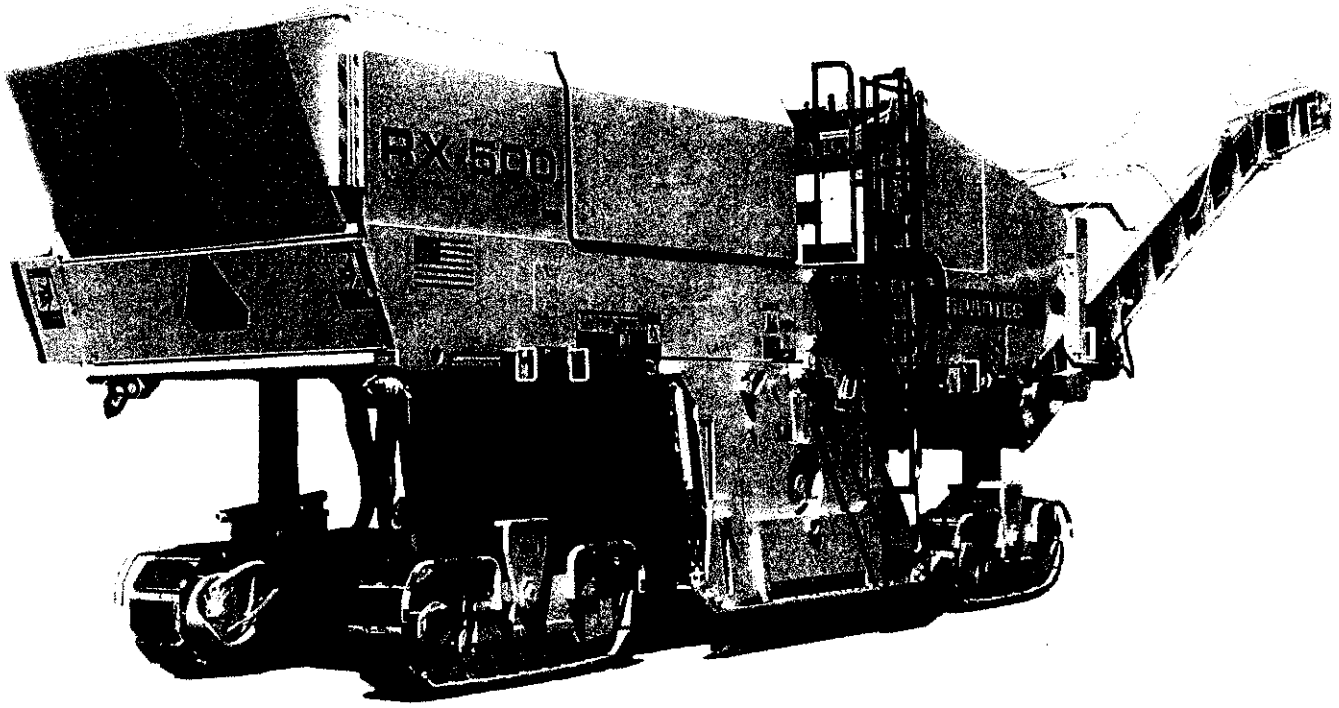
# ROADTEC RX-500
# MILLING MACHINE




## OPERATION, SERVICE
## &
## MAINTENANCE

P.N. 204924-E
SN 204-208


ROADTEC
an Astec Industries Company

# HOW TO ORDER PARTS

THE **ROADTEC** PARTS DEPARTMENT NEEDS THE FOLLOWING INFORMATION TO PROCESS YOUR ORDER PROPERLY AND ACCURATELY.

1. YOUR COMPANY'S NAME AND PURCHASE ORDER NUMBER.
2. NAME AND ADDRESS OF PERSON OR PLACE TO WHOM PARTS ARE TO BE SHIPPED.
3. METHOD OF SHIPMENT (MOTOR FREIGHT, AIR, UPS, etc.)
4. MODEL AND SERIAL NUMBER OF THE MACHINE FOR WHICH PARTS ARE BEING ORDERED.
5. PART NUMBER, DESCRIPTION AND QUANTITY OF PARTS.
6. THE LOCATION OF PART(S) IN THE ROADTEC PARTS MANUAL.

ONCE THE ABOVE INFORMATION HAS BEEN OBTAINED, CONTACT THE ROADTEC PARTS DEPARTMENT AT:


**ROADTEC INC. PARTS DEPARTMENT**
**800 MANUFACTURERS ROAD**
**CHATTANOOGA, TN. 37405**

**PHONE: 1-423-265-0600**
**TOLL FREE: 1-800-272-7100**
**SERVICE / PARTS FAX: 1-423-267-8686**


## RECEIPT OF PARTS:

RESPONSIBILITY FOR BREAKAGE, LOSS OR DAMAGED GOODS, CEASES UPON DELIVERY OF THE MERCHANDISE TO THE TRANSPORTATION COMPANY FOR WHICH A RECEIPT IS RECEIVED SHOWING THAT THE SHIPMENT WAS ACCEPTED BY THEM IN GOOD CONDITION. IF ANY OF THE MATERIAL LISTED ON THE BILL OF LADING OR EXPRESS RECEIPT IS SHORT, BROKEN, OR DAMAGED, DO NOT ACCEPT THE SHIPMENT UNTIL THE CARRIER'S AGENT MAKES A NOTATION OF THE SHORTAGE OR DAMAGED ON THE EXPENSE BILL. NOTIFY THE TRANSPORTATION COMPANY'S AGENT AT ONCE AND REQUEST AN INSPECTION.

## THIS IS ABSOLUTLEY NECESSARY:

IF THE AGENT DOES NOT MAKE AN INSPECTION, THEN AN AFFIDAVIT SHOULD BE MADE THAT THEY WERE NOTIFIED (ON A CERTAIN DATE) AND FAILED TO DO SO. THIS AFFIDAVIT WITH OTHER PAPERS WILL PROPERLY SUPPORT YOUR CLAIM.

# WARRANTY

Manufacturer (Roadtec, Inc.) warrants, commencing with the date of shipment to first end-user and for a period of 12 months thereafter or 1,000 hours of operation, whichever occurs first, all machinery and parts manufactured by Roadtec, Inc. to be free from defects in workmanship and material. **Warranty remains in force for the above time period only if all Manufacturer's operational procedures are followed and recommended maintenance is performed.** If, within such warranty period, any machinery or parts shall be proved to Manufacturer's satisfaction to be defective, it shall be repaired or replaced, at the Manufacturer's option, F.O.B. Manufacturer's warehouse. All failed parts or components must be returned to Manufacturer prepaid for inspection before credit will be issued for new parts or components. Manufacturer's obligation hereunder shall be confined to such repair or replacement and does not include any charges, direct or indirect, for removing or replacing defective machinery or parts.

Wear parts such as: conveyor lines, screed plates, cutter teeth, tooth holders, scraper blades, track pads, tires and conveyor belts are warranted only if found to be defective at time of shipment, but are not warranted for the warranty period as far as wear or abuse.

No warranty shall apply to machinery, or parts or accessories which have been furnished, repaired or altered by others so as, in Manufacturer's judgement, to affect the same adversely or which shall have been subject to negligence, accident or improper care, installation, maintenance, storage or other than normal use or service, during or after shipment. With respect to machinery, parts or accessories to Manufacturer's products which are furnished but not manufactured by Manufacturer, Manufacturer's warranty obligation shall in all respects conform and be limited to the warranty extended to Manufacturer by its supplier or, if none, to the warranties expressed herein.

**The foregoing warranties are in lieu of all other warranties expressed or implied including but not limited to any warranty or merchantability of fitness for a particular purpose, and Manufacturer shall not be subject to any other obligations or liabilities whatsoever with respect to machinery, parts, accessories or services manufactured or furnished by it or any undertakings, acts or omissions relating thereto. Under no circumstances shall Manufacturer be liable for any consequential or other damages, expenses, losses or delays howsoever caused. There are no warranties that extend beyond the description on the face hereof.**

ROADTEC
an Astec Industries Company

**ROADTEC, INC.**
**Chattanooga, Tennessee**

# INTRODUCTION

SECTION PAGE

## 1.1 ABOUT THIS MANUAL

The information provided in this manual should be used as a guide for the safe operation and maintenance of the Roadtec RX-500 milling machine. As in all cases, when dealing with heavy equipment and high pressure hydraulic systems, the potential for disabling injury and/or death is ever present and must be respected at all times.

Safety information has been incorporated throughout this manual and should be read and followed exactly.

Always refer to the machine serial number when ordering parts or writing for information. Space is provided below to record important information concerning your machine.

**SERIAL NUMBER:**_____
**DATE PURCHASED:**_____
**ENGINE MAKE:**_____
**ENGINE MODEL:**_____
**ENGINE SERIAL NUMBER:**_____

**FOR INFORMATION AND/OR ASSISTANCE:**

**ROADTEC, INC.**
**800 MANUFACTURERS ROAD**
**CHATTANOOGA, TN 37405-7515**

**PHONE: 423-265-0600 OR**
**1-800-272-7100**
**FAX: 423-267-7104**

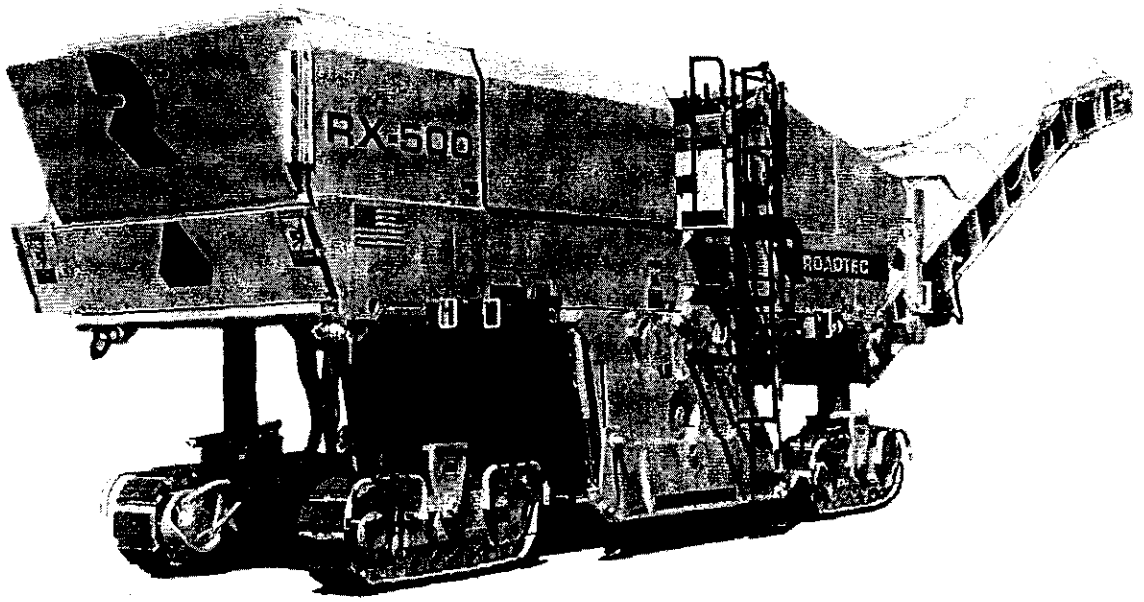
**VISIT US ONLINE AT: www.roadtec.com**

## 1.2 MACHINE DESCRIPTION

The Roadtec RX-500 is a reliable quality milling machine designed for ease of operation and service. The RX-500 mills and planes any pavement material in cutting widths of 6'3" (1905 mm), 6'7" (2006.6 mm), or 7'2"(2184.4 mm) with the use of bolt in style cutter housings.

The standard 630 h.p. (469 kw) diesel engine powers the belt-driven cutter drum that can cut up to 13 inches (305 mm) deep. The cutter loads material onto a 32" wide (863 mm) primary conveyor which transfers the material to a 32" wide (863 mm) secondary conveyor. The secondary conveyor is capable of pivoting 60 degrees left and right of center to more readily load material into a waiting dump truck.

**COMPLETE SYSTEMS DESCRIPTIONS ARE AS FOLLOWS:**




### A. ENGINE

RX-500 is equipped with the Cummins QSX-15 diesel engine. This engine is electronically controlled and is capable of producing 630 hp (469 kw) @ 2,100 rpm. An emergency shutdown feature prevents any unnecessary damage that may be caused by high operating temperatures or incorrect operating pressures. This engine comes standard with a one year limited warranty from the engine manufacturer. This is a tier III rated engine.

### B. DRIVE SYSTEM

A mechanical v-belt drive powers the cutter drum planetary gearbox. The propulsion, conveyor, and auxiliary systems are all hydrostatically driven.

### C. SUSPENSION

The machine is built with either a three or four point suspension system. Hydraulic cylinders inside each leg tube adjust by electric controls on the console. The leg tubes can also be adjusted automatically with the use of automatic grade controls.

## 1.2 MACHINE DESCRIPTION (CONTINUED)

### D. STEERING

An advanced coordinated steering system allows for the selection between several different navigational settings on demand by the operator. These settings include: front steering, rear steering, coordinated steering, and crab steering.

6'-8" (2.0 m) TURNING RADIUS WITH FOUR TRACK STEERING

5'-8" (1.7 m) TURNING RADIUS WITH THREE TRACK STEERING

### E. WATER SYSTEM

Spraybars are located on the front and rear of the cutter housing and on both primary and secondary conveyors. These spray bars provide cooling water to the cutter drum and conveyors while the machine is in operation. Water is provided for the washdown procedure through the use of a washdown hose. The washdown hose is stored on a hose reel, which is located at the front of the machine. All of these systems are supplied water from a water tank that stores up to 600 gallons (2271 l) of water.

### F. CONVEYOR SYSTEM

This unit uses a two-stage front discharge conveyor system, which delivers the milled material to a waiting dump truck. This two-stage system consists of a 32" (863 mm) wide pick-up or "primary" conveyor and 32" (863 mm) loadout or "secondary" conveyor. The material is carried through the conveyors by way of endless cleated belts. The loadout conveyor is capable of swinging 60 degrees right or left to help facilitate the loading of dump trucks.

### G. GRADE CONTROLS

Hydraulic or sonic grade control systems on each side of the machine can be used to automatically maintain the desired depth of cut of up to 13" (305 mm). Ground control boxes found on either side of the machine allow the grade controls to be activated from ground level.

### H. CUTTER DRUM

The RX-500 is fitted with a bolt-in style cutter housing. The advantage of a bolt-in cutter housing is that it can be readily changed out with a different size cutter housing to meet various job requirements. The cutter housing sizes that are available for this machine are: 6'3" (1905 mm), 6'7" (2006.6 mm), or 7'2" (2184.4 mm).

The cutter drum is powered by a clutch-driven belt system. This system rotates the cutter drum at a speed of up to 94.7 rpm (when the engine is at full throttle). The cutter drum is fitted with bolt on tooth holders that make changing damaged or worn cutting teeth a simple task.

## 1.2 MACHINE DESCRIPTION (CONTINUED)

### I. SAFETY FEATURES

- Engine will start only when certain prestart conditions are met. Refer to "Starting The Engine" article 3.5, section 3 of this manual.
- Engine will not start with the machine in an unsafe condition.
- Engine will not run when coolant overheats or engine oil pressure is low.
- Cutter drum stops when a hard, unmillable object, such as a manhole cover, is encountered.
- Legtube safety bars provide support for the machine when maintenance or repairs are being performed.
- Emergency shut down buttons will immediately shut down the engine when one is pushed. These buttons are located on the operator's console as well as on all the ground control boxes. The engine will not start until all the emergency shutdown buttons have been reset (figure 1).

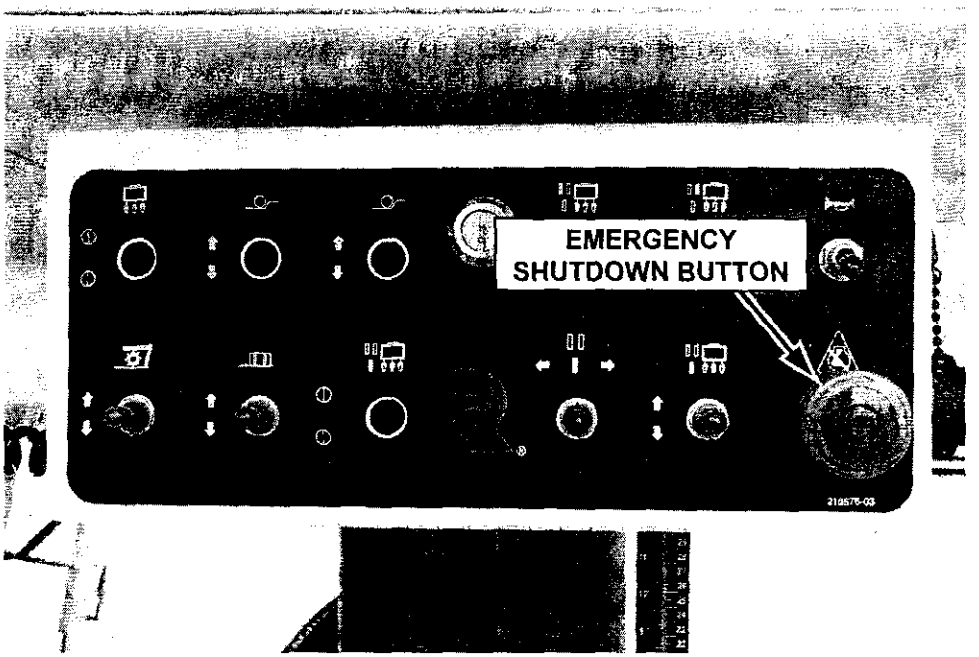


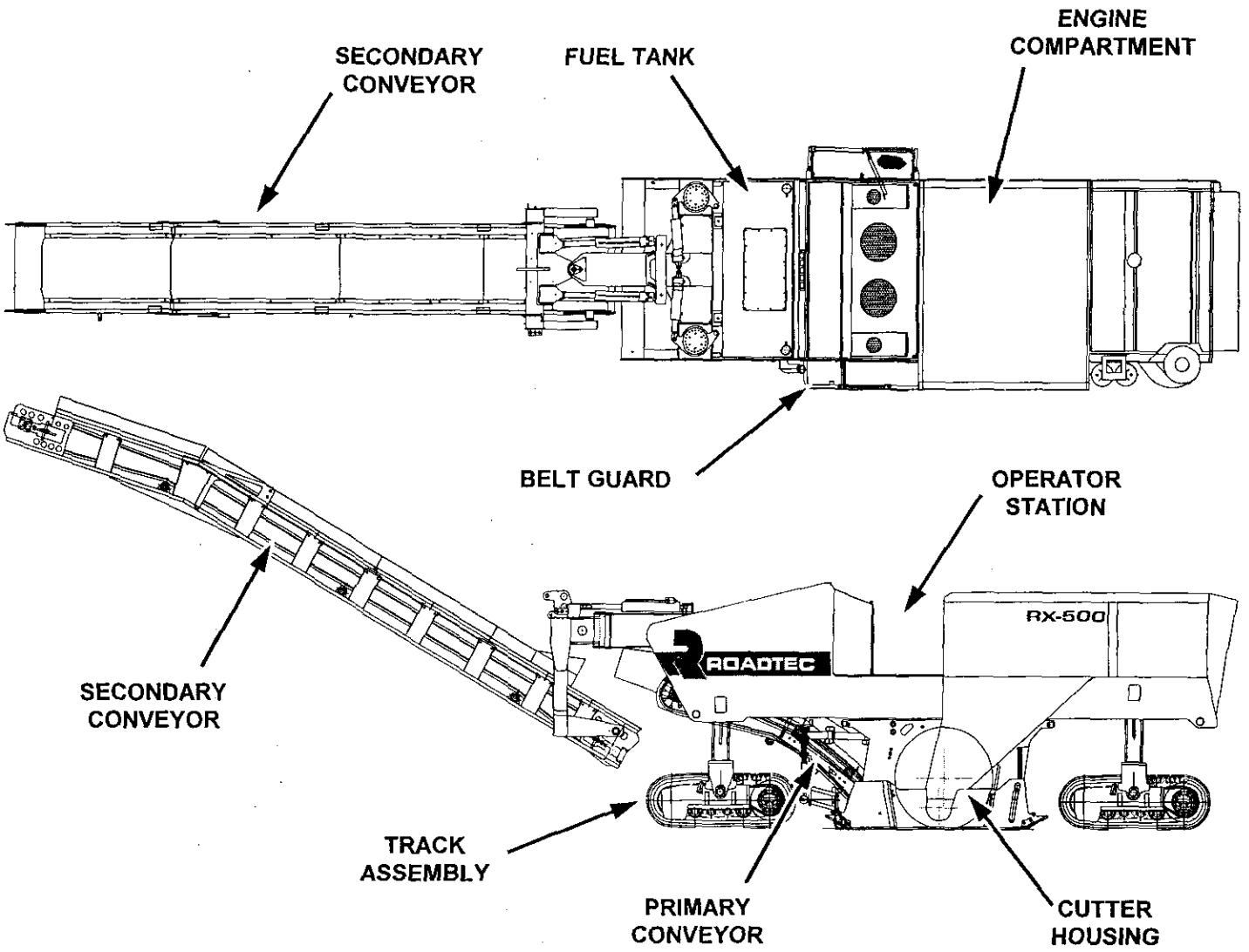

**FIGURE 1**

### J. OPTIONAL EQUIPMENT

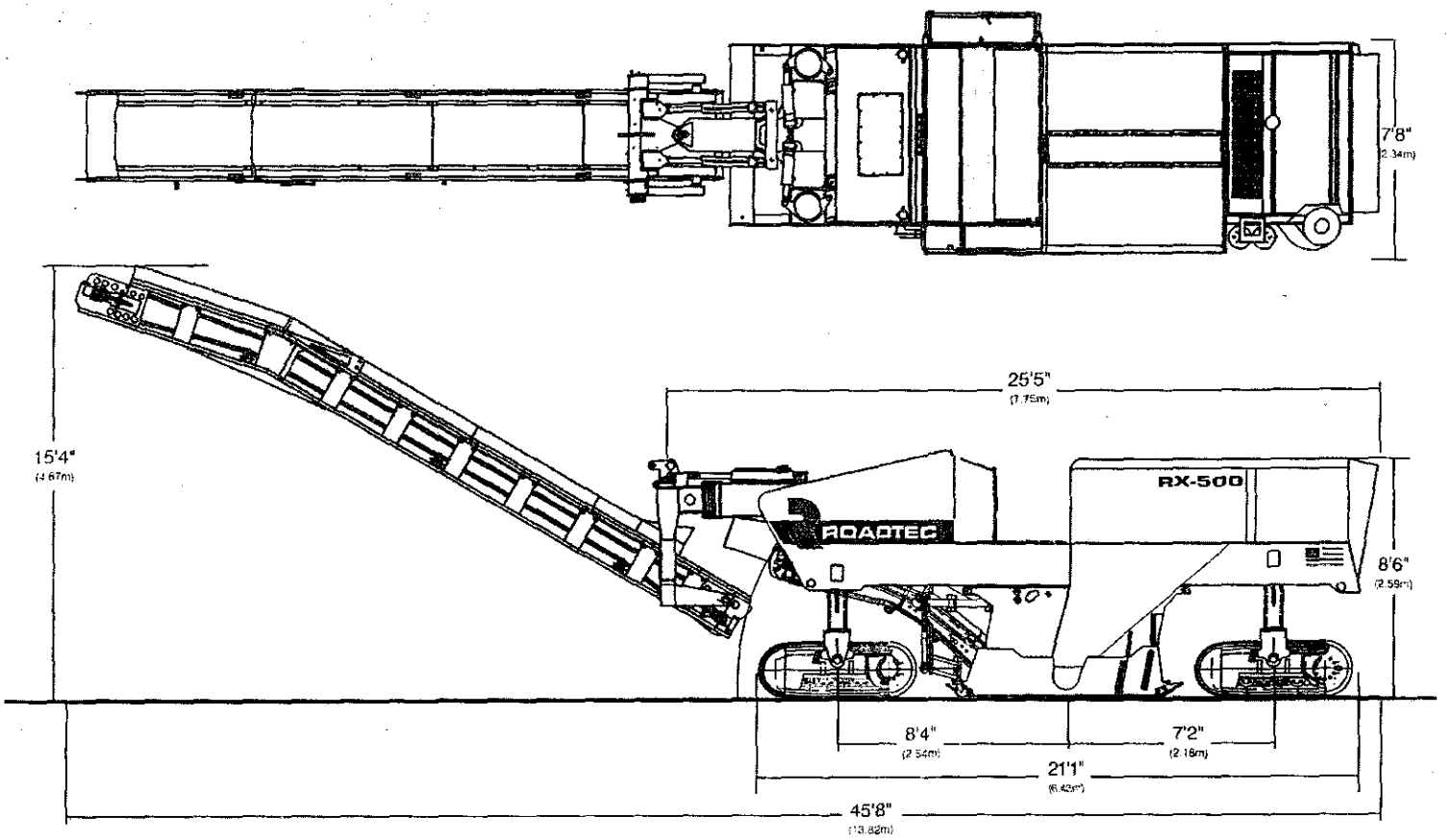
- Electric grade jacks
- Automatic grade controls
- 4 kw – 120 volt hydraulic generator
- Work lights
- Center console Topcon bracket
- Exhaust/air tank cover
- Operator's canopy
- 30 ft. Sonic ski

## 1.2 MACHINE DESCRIPTION (CONTINUED)

# UNIT NOMENCLATURE



## 1.3 MACHINE SPECIFICATIONS




### A. DIMENSIONS

1. OVERALL LENGTH..... 45' – 8" (13.9 m)
2. OVERALL HEIGHT..... 15' - 4" (4.6 m)
3. WHEEL BASE..... 15' - 6" (4.72 m)
4. OUTSIDE TO OUTSIDE TRACK

    FOUR TRACK MACHINE..... 21' - 1" (6.42 m)

    THREE TRACK MACHINE..... 21' - 8" (6.6 m)

5. WIDTH (WITH STANDARD 6' 3" CUTTER DRUM)..... 7' - 8" (1.9 m)
6. LENGTH WITHOUT SECONDARY CONVEYOR..... 25' - 8" (2.34 m)
7. SHIPPING HEIGHT..... 8' - 6" (2.59 m)

## 1.3 MACHINE SPECIFICATIONS (CONTINUED)

### B. ENGINE

1. TYPE: CUMMINS QSX-15
2. FUEL: DIESEL
3. HORSEPOWER: 630 H.P. (469 kW) @ 2100rpm
4. RATING: TIER III

### C. MAIN DRIVE SYSTEM

THREE SPEED HYDROSTATIC MOTOR

### D. SPEED RANGES

1. OPERATING RANGE: **FOUR TRACK**: 0 - 102 FEET/MIN
   0 - 1.17 MPH
   **THREE TRACK**: 0 - 100 FEET/MIN
   0 - 1.13 MPH

2. HIGH OPERATING RANGE: **FOUR TRACK**: 0 - 150 FEET/MIN
   0 - 1.7 MPH
   **THREE TRACK**: 0 - 127 FEET/MIN
   0 – 1.44 MPH

3. TRAVEL RANGE: **FOUR TRACK**: 0 - 285 FEET/MIN
   0 – 3.2 MPH
   **THREE TRACK**: 0 - 285 FEET/MIN
   0 – 3.2 MPH

### E. WEIGHTS

1. BASIC MACHINE WITH 6'3" CUTTER DRUM
   4 TRACK MACHINE – 50,000lbs.
   3 TRACK MACHINE – 48,700lbs.

2. MAXIMUM OPERATING WEIGHT WITH 6'3" CUTTER DRUM
   4 TRACK MACHINE – 58,000lbs.
   3 TRACK MACHINE – 56,700lbs.

### F. SERVICE CAPACITY

1. FUEL CAPACITY - 290 GALLONS (1,100 LITERS)

2. WATER TANK CAPACITY - 600 GALLONS (2,271 LITERS)

3. HYDRAULIC CAPACITY - 84 GALLONS (317 LITERS) - **100% CAPACITY ***
   75 GALLONS (283 LITERS) - **90% CAPACITY ***

4. ENGINE COOLING FLUID CAPACITY – 14.6 GALLONS (55 LITERS)

* It is recommended that the hydraulic tank be filled to only 90% capacity. If the tank were to be filled to 100% capacity, the tank would overflow due to fluid expansion when the hydraulic oil becomes hot.

## 1.4 SAFETY

You will observe the "attention" symbols below and throughout this manual. These symbols are meant to draw your attention to important information that could affect safe unit operation, or the safety of people. They mean:

**ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

These symbols will be accompanied by the following:

**DANGER** This word indicates the most serious hazard.

**WARNING** This word indicates an intermediate hazard.

**CAUTION** This word indicates the least serious hazard and is usually used in conjunction with those operating and maintenance instructions that affect safe practice.

**PRELIMINARY SAFETY AND OPERATING INSTRUCTIONS:**

1. Read and study the milling machine safety manual provided in the literature package furnished with the machine. **"FOLLOW ALL SAFETY PRECAUTIONS."**

2. Read and study the operation and operational safety sections of this manual thoroughly.

3. Read and study the service and maintenance safety sections of this manual thoroughly.

4. Operator's platform is for properly trained and qualified personnel only. There should be only one operator on the platform during operation. **"NO RIDERS!"**

5. Never fuel the unit with the engine running, when smoking or near an open flame.

6. Perform a walk-around visual inspection for signs of fluid leakage, damaged components or component wear.

7. Before starting unit or when stopping unit, always set parking brake, put travel and conveyor controls in neutral and disengage cutter drum clutch.

## 1.4 SAFETY

Personal safety equipment can be used to preemptively prevent personal injury or harm. There are several different types of personal safety equipment and they are each used to protect a person in a specific way. You should consult your supervisor for specific instructions on a job, and the personal safety equipment required.

For instance, you may be required to use any of the following:

### 1. HARD HAT

Hard hats must be worn to protect a person's head. Getting hit in the head by objects and hitting your head on objects can cause serious injury.

**WARNING** Any maintenance or service being performed at the engine or any high locations around or on the machine requires the use of a hard hat!

### 2. SAFETY SHOES

Steel toe safety boots must be worn to protect a person's feet from injury.

### 3. EYE PROTECTION

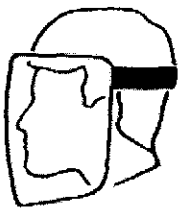
Eye protection must be worn to protect one's eyes from injury. Substances and debris can get into the eyes and cause serious injury or blindness so always wear eye protection.

## 1.4 SAFETY

#### 4. HEARING PROTECTION

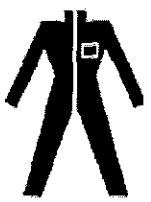
Hearing protection must be worn to protect one's hearing from loud noises. Loud noises can cause permanent hearing loss so always wear hearing protection.

#### 5. FACE PROTECTION



Face protection should be used to protect one's face from injury. Flying objects and substances can cause serious injury.

#### 6. SAFETY CLOTHING



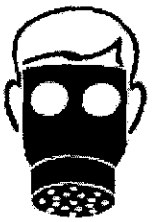
Safety clothing should be worn to protect one from exposure and to maintain visibility to others around them. A reflective safety vest should be worn to help keep a person visible to others around them and to traffic. Snug fitting work attire should be worn to protect one from physical exposure.

#### 7. HEAVY GLOVES

Heavy work gloves should be worn to protect one's hands from injury. When working around heavy construction equipment there are many ways that your hands could become burned, cut or injured. Always be sure to wear protective heavy gloves.

## 1.4 SAFETY

### 8. RESPIRATORS



Respirators should be worn to protect one from inhalation of dangerous substances. Air born substances can be inhaled and cause severe personal injury.

## FIRE EXTINGUISHER

A fire extinguisher is mounted inside the right hand operator's console door (figure 1).


**FIGURE 1**

**EXTINGUISHER PROPERTIES**

TYPE: A-B-C DRY CHEMICAL

FIRE RATING: 1-A:10-B:C

EXTINGUISHANT: AMMONIUM PHOSPHATE BASE

NOMINAL FACTORY CHARGE: 2 LB 8 OZ (1.13 KG)

NOMINAL OPERATING PRESSURE: 195 PSI

NOZZLE ORIFACE: .136

## 1.4 SAFETY

The sound power levels measured at the operator's station and around the machine while it is in operation can reach levels of up to 126 db(a). Due to this fact it is absolutely necessary that anyone operating the machine wear proper hearing protection. Also, anyone around the machine while it is in operation must wear the proper hearing protection.

The following decal, found at the operator's station, indicates the need to use hearing protection.


**FIGURE 2**

## 1.4 SAFETY

### OPERATIONAL CHECKS

1. Pretest the steering, brakes and all other controls.

2. Before starting the machine check all fluid levels (hydraulic fluid, engine oil, water level, engine coolant, etc.)

3. Be sure that the area you plan to mill is on a slope of less than 10 degrees. Always use caution when operating on uneven surfaces and rough terrain.

4. Never climb on or off the unit when the unit is moving and always use proper steps and rails when climbing on or off the unit.

5. Look in all directions before reversing the unit.

6. Be aware of all potential clearance and ground obstacles.

### EMERGENCY STOP SYSTEM

All Roadtec milling machines are equipped with an emergency stop system. This system is designed to shut the machine down in the event of an emergency.

The emergency stop system is made up of a number of red buttons mounted to the operator's console and the ground control boxes (figure 3). When any of these buttons are pressed the machine's engine will shut down. The machine's engine will not start until all the emergency stop buttons are reset to the run position. If lights inside the buttons illuminate when the main power is turned on, then that means one or more of the buttons is not reset.

To reset an emergency stop button, simply twist it clockwise and the button will pop out to the "run" position (figure 3).

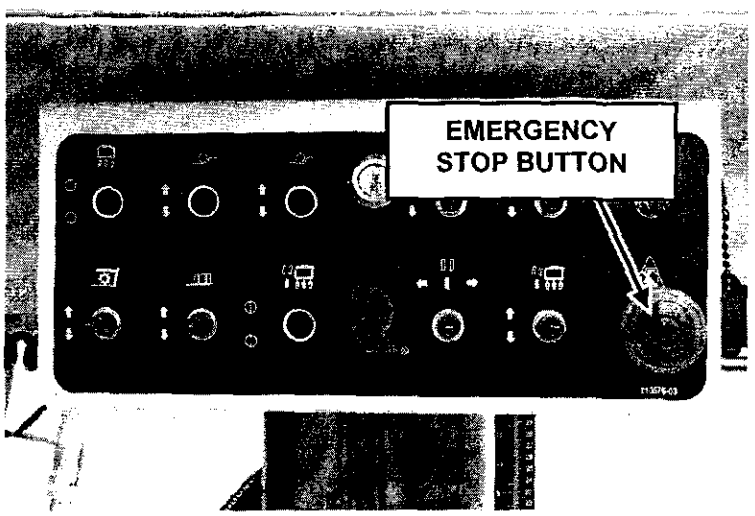



FIGURE 3

## 1.4 SAFETY

### BEACON LIGHT

All Roadtec cold planers are equipped with a beacon light mounted to the top of the machine. This beacon light is designed to get the attention of individuals around the machine indicating the machine is in operation (figure 4).

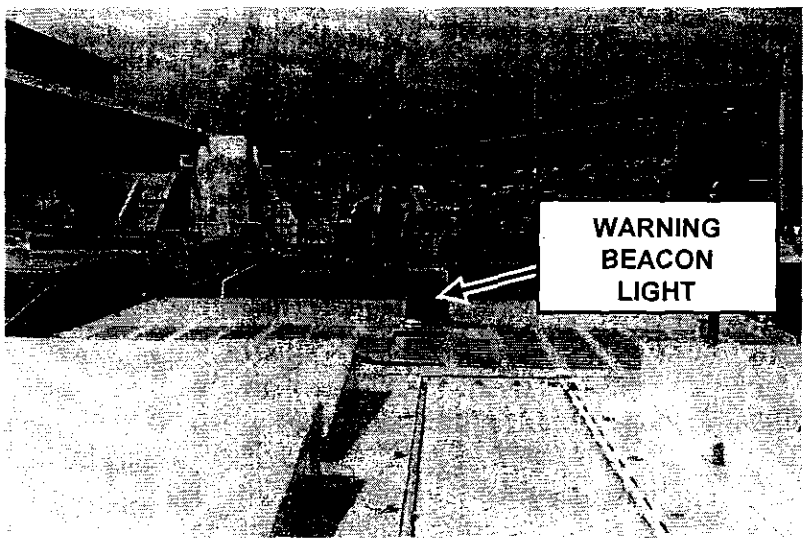



FIGURE 4

The beacon light should be activated every time the machine is started and remain activated until the machine is shut down. The activation switch can be found at the operator's console (figure 5).

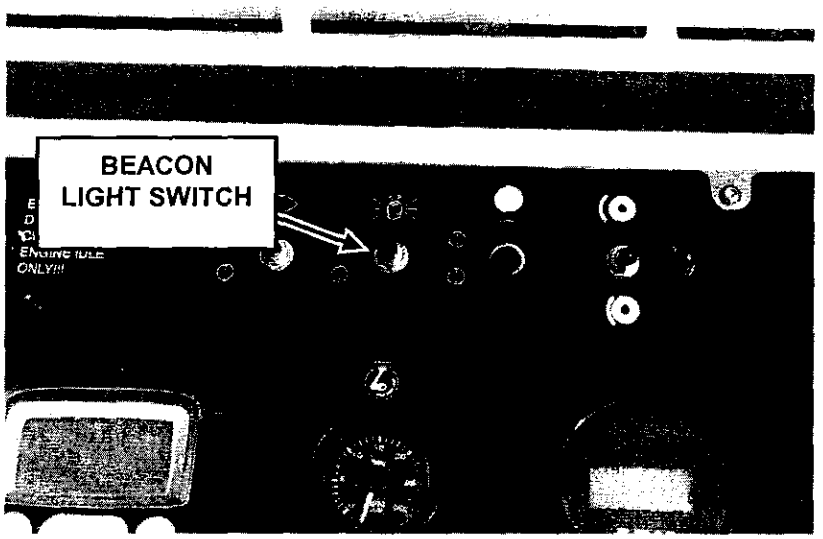



FIGURE 5

## 1.4 SAFETY

### PROPER MACHINE USE

The RX-500 is designed to mill and plane road surfaces in depths of up to 13 inches (330 mm) in widths of 6'3" (1900mm), 6'7" (2000mm) or 7'2" (2184mm). It is equipped with a 42" (1.04m) front load out conveyor, which can swing 60° to either the left or right side of the machine. The conveyors are designed to convey the milled material away from the cutter housing and into a waiting dump truck. Do not use this machine for any other use than what it is designed to do.

**WARNING** **This machine is not specifically designed for towing. Do not attempt to tow anything with this machine without consulting with the manufacturer.**

**WARNING** **The conveyor is not designed to be used as a lifting boom. Do not attempt to lift anything with the conveyor.**

#### WORK LIMITATIONS

There are certain limitations that must be understood when operating this machine. Knowing these limitations will help provide a safer working environment. Read and understand each of the following:

1. Never lower the machine into the cut too quickly. This can result in the machine riding on the cutter drum causing the machine to "jump backwards" quickly. This can also damage the cutting teeth and expose bystanders to ejecting parts.

2. Do not mill at a speed greater than 128 fpm (39 mpm) or faster than conditions allow.

3. Do not travel at a speed greater than 3.2 mph (5.15 kph) or faster than conditions allow.

4. Do not mill or travel on a slope greater than 10° to the left or right.

5. Mill and travel only on suitable terrain. Do not operate on rocky, ice covered, slick or muddy areas as this may compromise safety. Do not operate on bridges not rated to support the machine's weight. Do not operate on wooden bridges.

6. This machine has a clearance height of 16 feet (4.87 meters). Do not attempt to drive the machine under overpasses with clearances lower than 16 feet (4.87 meters).

7. Operational ambient temperature range: 125°f (51.6°c) — -10°f (-23.3°c)

8. Operational fluid temperature range: 221°f (105°c) — -10°f (-23.3°c)

## 1.4 SAFETY

### MACHINE SHUTDOWN

Proper machine shutdown is an important safety measure. Please follow these guidelines when shutting the machine down after use.

1. Stop the machine by placing the travel control in the center or "neutral" position.

2. Deactivate the grade controls and raise the machine out of the cut.

3. Decrease engine speed to idle.

4. Disengage the cutter drum.

5. Disengage the conveyors.

6. Turn off the water pump.

7. Choose a suitable area to park the machine that is out of the way of traffic and other equipment. Select a place where the parked machine will not pose any kind of hazard.

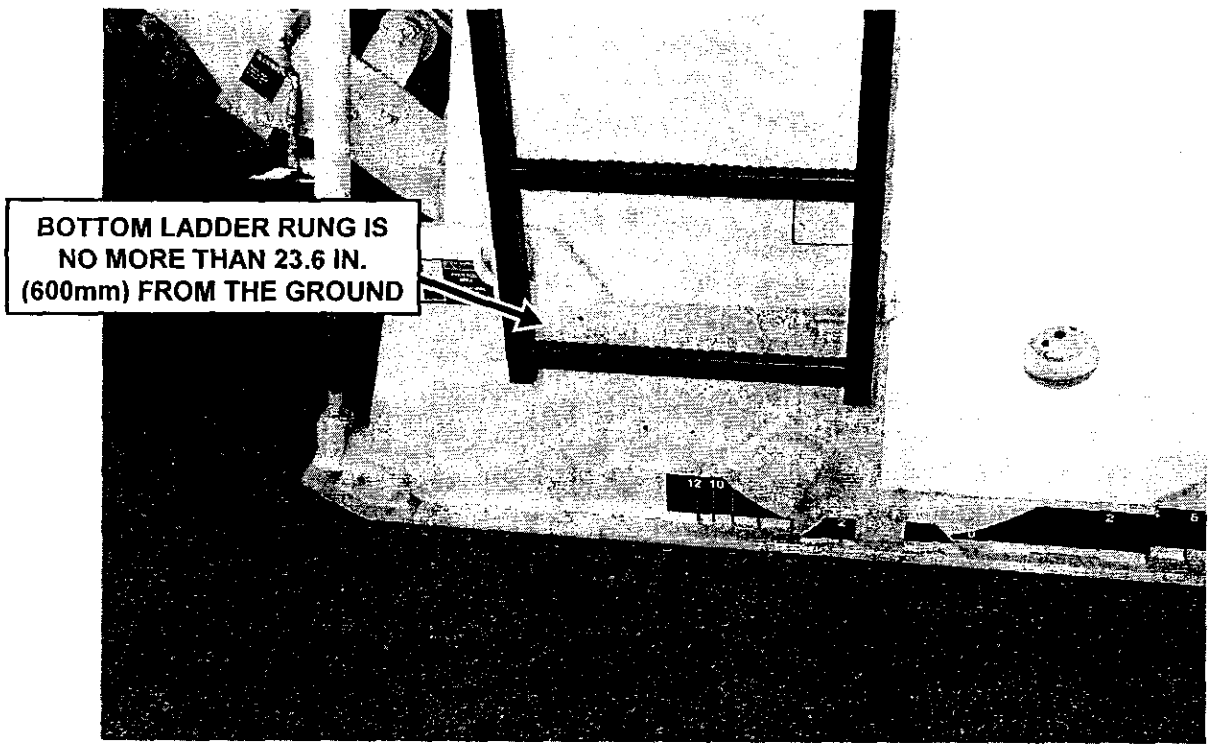



**FIGURE 6**

## 1.4 SAFETY

### MACHINE SHUTDOWN

8. Increase the engine speed to full rpm and travel the machine to the pre-selected parking location.

9. Position the machine on a level and stable surface.

10. After positioning the machine in a suitable area be sure to put the travel joystick in the center or "neutral" position.

11. Using the front and rear elevation controls, lower the machine elevation until the bottom ladder rung is no more than 23.6 in. (600 mm) from the ground (figure 5).

12. Activate the machine's parking brakes.

13. Decrease engine speed to idle then shut off the engine.

14. Turn both of the battery disconnect switches to the **"OFF"** position.

## 1.4 SAFETY

### MAINTENANCE SAFETY

1. Always set the parking brakes, shut off the engine and raise the moldboard with the power pack before performing any maintenance to the machine.

2. Keep control plates on console clean and replace lost or damaged decals immediately.

3. Turn the battery disconnects to "off" and insert "lockout locks & tags" before performing maintenance, servicing or doing any welding on the machine (figures 7 & 8).

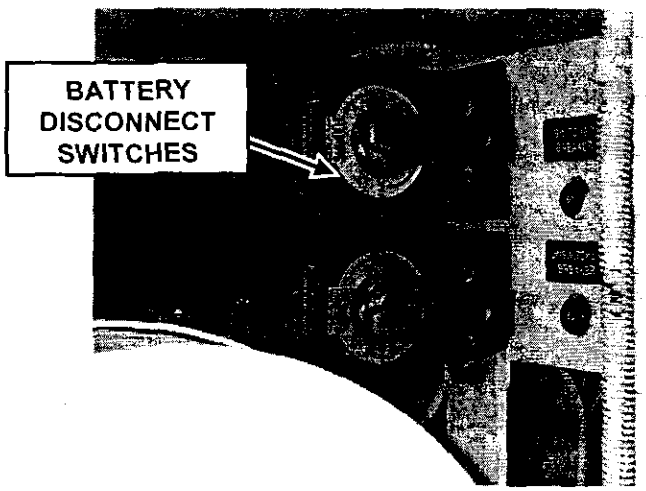



FIGURE 7

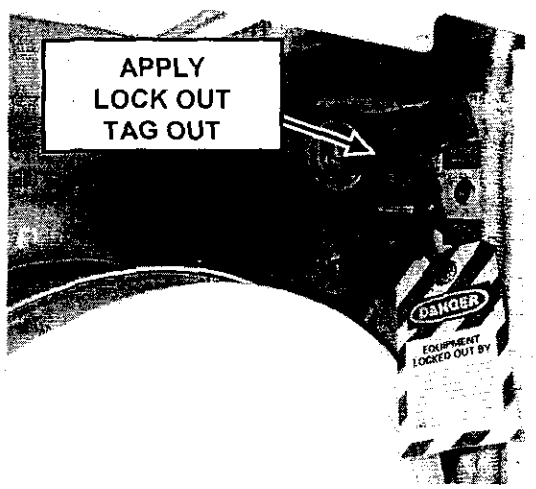



FIGURE 8

4. Use only approved or recommended fluids and filters.

5. Do not modify this machine in any way that will compromise safety.

## 1.4 SAFETY

### MAINTENANCE SAFETY

6. Always set the legtube support bars in the support positions when working under the machine (figures 9 & 10).


FIGURE 9

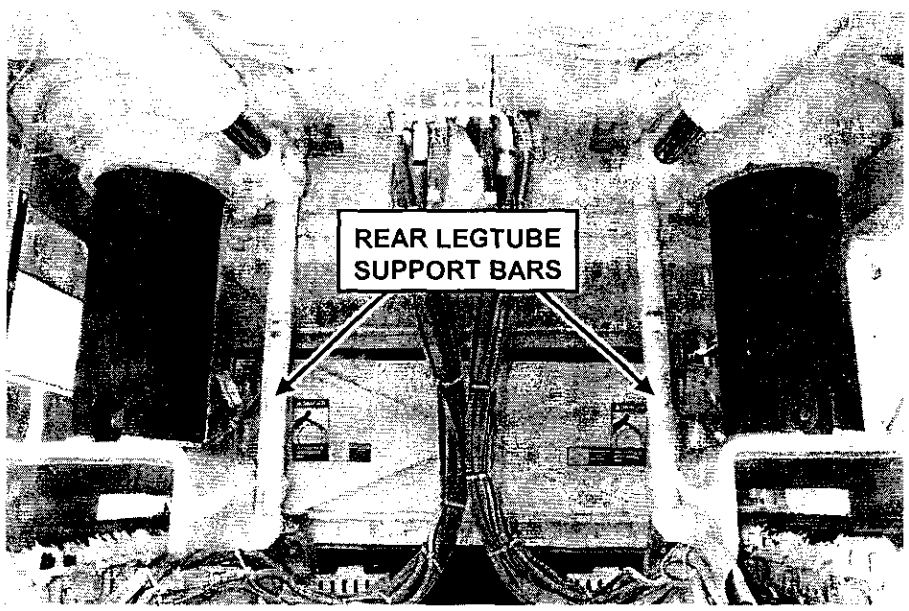



FIGURE 10

## 1.4 SAFETY

### HYDRAULIC SYSTEM

Hydraulic power is accomplished by utilizing high-pressure fluids to transfer energy and do work. Hoses, fittings and hose assemblies all contribute to this by transmitting fluids at high pressures. Fluids under pressure can be dangerous and potentially lethal. Extreme caution must be exercised when working with fluids under pressure and handling the hoses that transport the fluids

When hydraulic hoses fail, generally the high pressure fluids inside escape in a high pressure stream which may or may not be visible to the user.

**WARNING** **UNDER NO CIRCUMSTANCES SHOULD THE USER ATTEMPT TO LOCATE A HYDRAULIC LEAK BY "FEELING" WITH THEIR HANDS OR ANY OTHER PART OF THEIR BODY!**

High pressure fluids can and will penetrate the skin and cause severe tissue damage and possibly loss of limb!

**WARNING** **ALL HYDRAULIC FLUID INJURIES MUST BE TREATED IMMEDIATELY BY A PHYSICIAN WITH KNOWLEDGE OF THE TISSUE DAMAGING PROPERTIES OF HYDRAULIC FLUID!**

If a failure does occur, immediately shut down the machine and leave the area until pressure has been completely released from the hose assembly. Most of the time hydraulic valves are employed in a hydraulic system. These valves can cause pressure to remain in a hose assembly after the machine has been shut down. It may take several hours for the pressure to be relieved before the hose can be examined safely.

**WARNING** **HYDRAULIC PRESSURE MUST BE REDUCED TO ZERO BEFORE OPENING ANY LINES OR FITTINGS!**

The following hydraulic circuits may retain residual pressure after the machine has been shut down. The pressure in these systems will have to be relieved before performing any kind of maintenance or repair to them.

1. **Front steering**: To relieve retained pressure after shutdown, wrap a rag around the fitting at the cylinder and slightly crack the fitting open to drain off the pressure.

2. **Rear Steering**: To relieve retained pressure after shutdown, wrap a rag around the fitting at the cylinder and slightly crack the fitting open to drain off the pressure.

3. **Front Moldboard**: To prevent retained pressure after shutdown, lower the front moldboard until it is resting on the ground before shutting the machine off.

4. **Rear Moldboard**: To prevent retained pressure after shutdown, lower the rear moldboard until it is resting on the ground before shutting the machine off. Then wrap a rag around the fitting at the cylinder and slightly crack the fitting open to drain off the hydraulic fluid to reduce pressure.

## 1.4 SAFETY

### HYDRAULIC SYSTEM

5. **Belt Tension**: to prevent retained hydraulic pressure in this circuit, hold the belt tension release switch while shutting the machine down (figure 11).

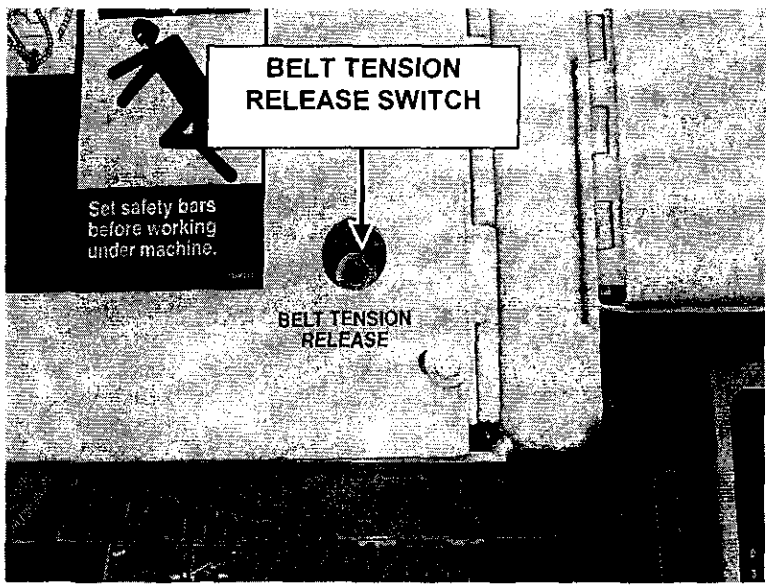



FIGURE 11

6. **Left and Right Hood Raise**: To prevent retained hydraulic pressure, completely raise the hood wing, apply the hood wing safety pin. Then lower the hood wing slightly until it is resting on the safety bar. Then shut off the machine (figure 12).

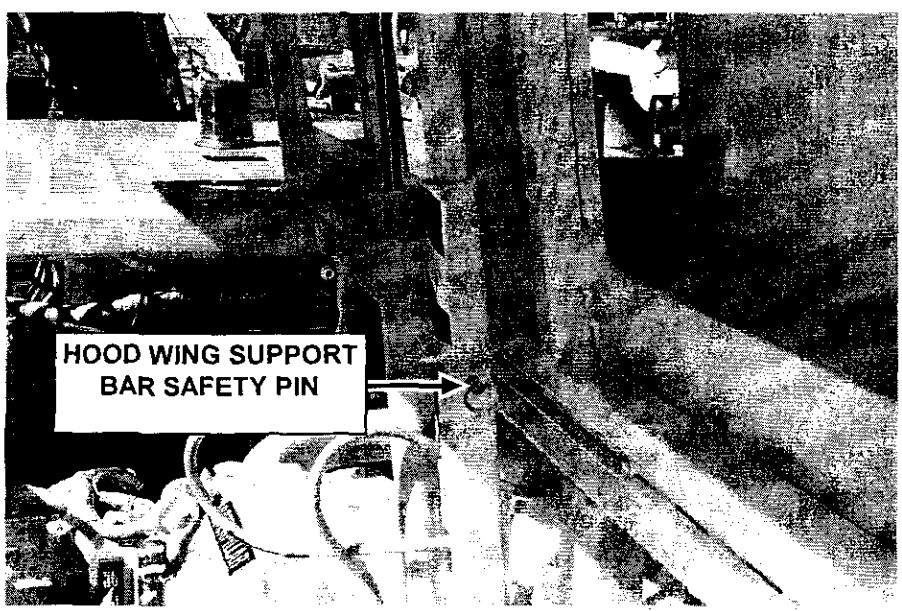



FIGURE 12

## 1.4 SAFETY

### HYDRAULIC SYSTEM

7. **Left and Right Endgates**: To prevent retained hydraulic pressure, lower the endgates to the ground before shutting the machine off. Another way would be to hang the endgates on the endgate support hangers and then shut the machine off (figure 13).

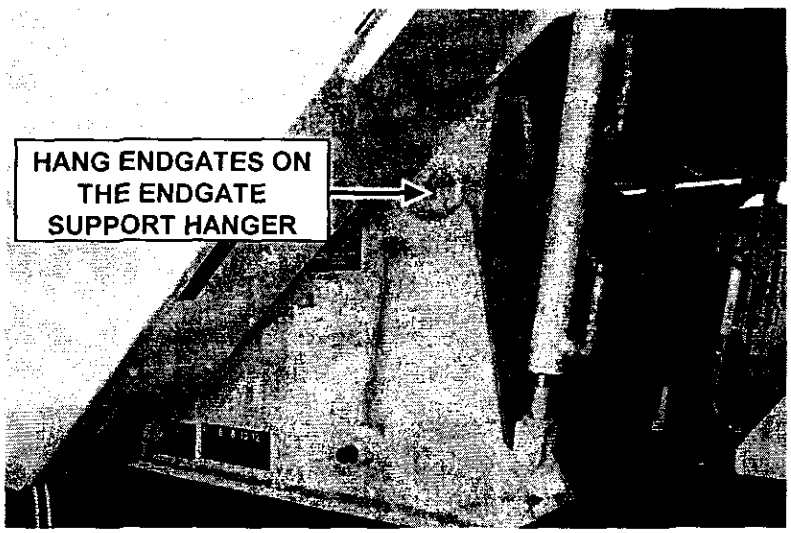



**FIGURE 13**

8. **Legtubes**: To prevent any retained pressure in the legtube cylinders, lower the machine until it is resting on the engaged legtube safety bars. Then shut off the engine.

### PARKER DATE CODE

THE PARKER DATE CODE IS ESTABLISHED TO INDICATE THE DATE THAT A HOSE ASSEMBLY WAS MADE.

PS_ _ _ EXAMPLE: PS20A6

PS = PARKER / CONYERS

20 = DAY OF THE MONTH

A = MONTH OF THE YEAR, EXAMPLE: A = JANUARY, B = FEBRUARY, ETC.

6 = 2006

### HOSE REPLACEMENT INTERVALS

Hose assemblies and elastomeric seals used on hose fittings and adapters will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Hose assemblies and elastomeric seals should be inspected and replaced at specific replacement intervals, based on previous service life, government or industry recommendations, when failures could result in unacceptable downtime, damage or injury risk.

## 1.4 SAFETY

### HAZARDOUS RESIDUAL TEMPERATURES

After the machine is shut down the engine compartment will remain extremely hot for several hours or longer.

**WARNING** Before performing maintenance around or inside the engine compartment always allow a cool down time of at least 4 hours after operating the machine.

### PRESSURE LIMIT VALVES

Special pressure limit valves protect all 5 hydraulic circuits. The pressure limit ratings for these valves are as follows:

TRAVEL – 5070 PSI (350 BAR)

PRIMARY CONVEYOR – 4640 PSI (320 BAR)

SECONDARY CONVEYOR – 4640 PSI (320 BAR)

FAN – 2500 PSI (171 BAR)

AUXILIARY – 2800 PSI (192 BAR)

### STORED ENERGY

After the machine has been shut down there are still many areas of stored energy that remain and they must be noted. These areas could pose a potential safety hazard when performing maintenance or repair. Be aware and cautious of the following areas of stored energy:

**Track Springs:** The track springs are under a tremendous amount of pressure. Do not try to disassemble them.

**Air Tanks:** The air tanks contain highly pressurized air. Do not damage or disassemble them.

**Radiator:** The radiator contains engine coolant that is extremely hot and pressurized both during and after engine operation. Allow a minimum of 4 hours cool down time, after engine shut down, before removing the radiator cap.

**Batteries:** The batteries pose the risk of electrical shock. Always disconnect the batteries before performing any maintenance or repair to the electrical system. Do not damage or disassemble the batteries.

## 1.4 SAFETY

### DECOMMISSIONING

The day will come when this machine will out live its usefulness and will have to be decommissioned or taken out of service. But before the machine can be decommissioned, there are several precautionary measures that must be taken to help provide environmental and personal safety.

1. Completely drain and properly dispose of all fluids. These fluids include:

    A. Engine oil

    B. Fuel

    C. Hydraulic fluid

    D. Radiator coolant

    E. All planetary gear oil

    F. Cutter drum coolant

    G. Water

    H. Release agent (if applicable)

2. Remove the batteries. If the batteries are no good, then have them recycled.

3. Dispose of machine in a legal and safe manner.

## 1.4 SAFETY

### SAFETY FEATURE MAINTENANCE PROCEDURE

Safety features incorporated on this machine will require routine inspection and functionality testing. Please refer to the following checklist when inspecting and testing safety features.

The following safety features need to be inspected and tested **before starting up a brand new machine and after every 250 hours of operation:**

### 1) EMERGENCY STOP BUTTONS:

Inspect each emergency stop button for damage. If any emergency stop button appears to be damaged have it replaced immediately.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF ANY EMERGENCY STOP BUTTON.**

Check the functionality of each emergency stop button. Do this by checking each emergency stop individually.

**Checking an emergency stop button:**

1. Shut the machine engine "OFF".
2. Select only one emergency stop button and press it.
3. Try to restart the machine. If the machine does not start, then the emergency stop button is working properly. If the machine starts, then the emergency stop button is faulty and must be replaced immediately.

**DANGER** **IF ANY EMERGENCY STOP IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

4. Reset the emergency stop button by pulling on it slightly until it "Pops" back out into the "Run" position.

   **NOTE**: Some emergency stop buttons can be reset by twisting them clockwise until they "pop" out into the "run" position.

5. Perform the same process to each individual emergency stop button.

   **NOTE:** Be sure to reset each button after it is tested before moving on to the next one.

## 1.4 SAFETY

### 2) BATTERY DISCONNECT SWITCHES

Inspect each battery disconnect switch for damage. If any battery disconnect switch appears to be damaged have it replaced immediately.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF ANY BATTERY DISCONNECT SWITCH.**

Check the functionality of each battery disconnect switch. Do this by testing each battery disconnect switch.

**Checking a battery disconnect switch:**

1. Shut the machine engine "OFF".
2. Select one of the two battery disconnect switches and turn it to the "OFF" position.
3. Try to restart the machine. If the machine does not start, then the battery disconnect switch is working properly. If the machine starts, then the battery disconnect switch is faulty and must be replaced immediately.

**DANGER** **IF ANY BATTERY DISCONNECT SWITCH IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

4. Reset the battery disconnect switch by turning it back to the "ON" position.
5. Perform the same process to the other battery disconnect switch.

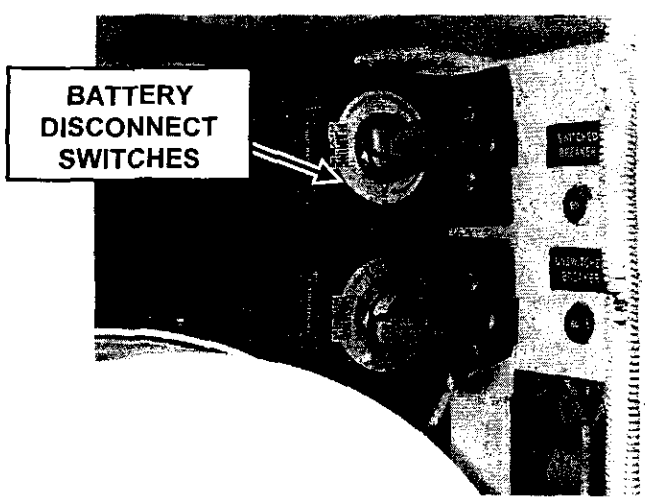



**FIGURE 14**

## 1.4 SAFETY

### 3) REAR MOLDBOARD PROXIMITY SWITCH

The rear moldboard proximity switch is designed to shut down the machine's engine if the rear moldboard is raised to an unsafe height. This switch will not allow the machine's engine to start until the rear moldboard is lowered to a safe height.

Inspect rear moldboard proximity switch for damage. If it appears to be damaged have it replaced immediately.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE REAR MOLDBOARD PROXIMITY SWITCH.**

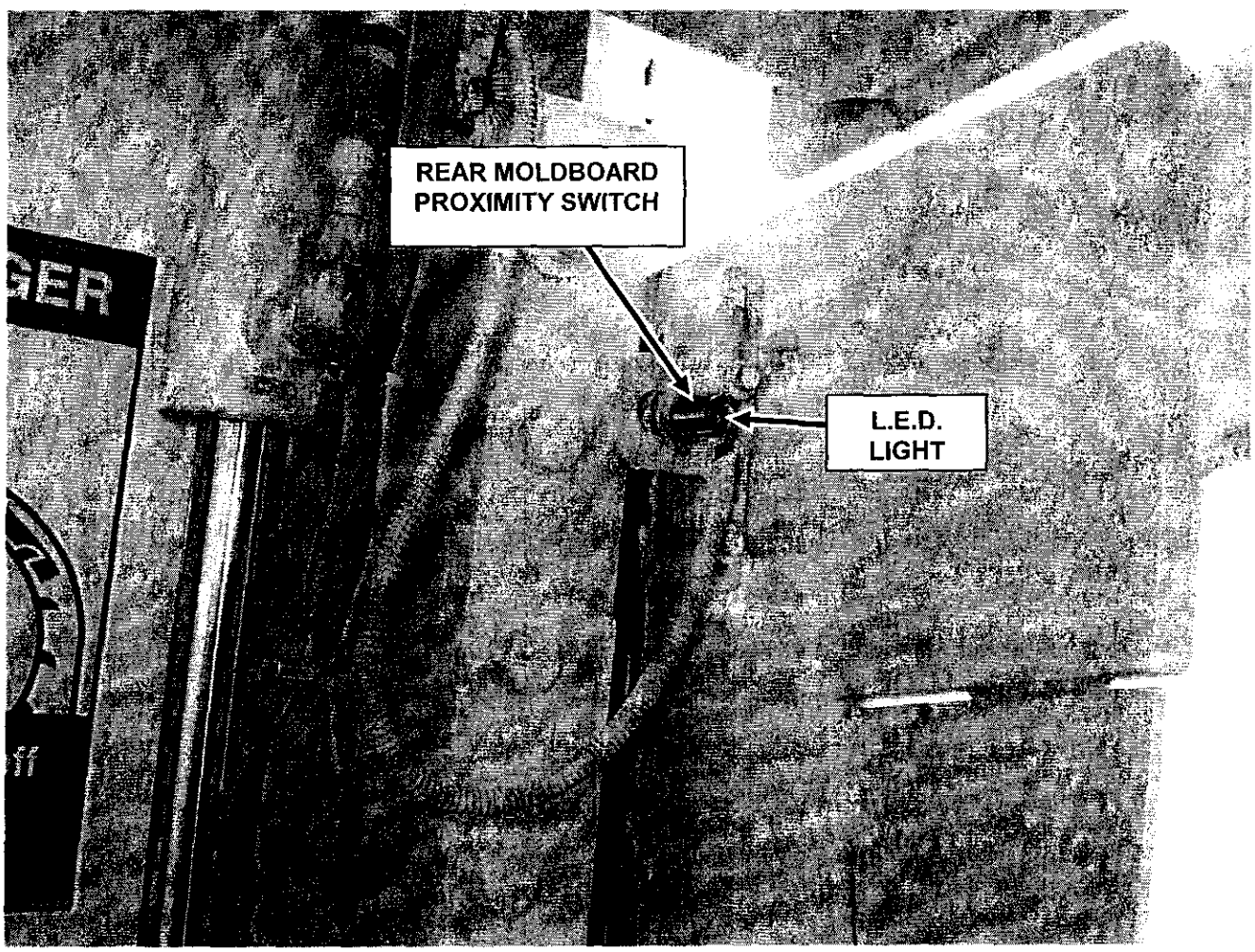



**FIGURE 15**

## 1.4 SAFETY

### 3) REAR MOLDBOARD PROXIMITY SWITCH

**Checking the rear moldboard proximity switch:**

1. Shut the machine's engine "OFF".
2. Use the rear moldboard raise/lower switch, located under the belt guard, to fully raise the rear moldboard.
3. Once the moldboard is raised, try to start the machine's engine.
4. If the machine does not start, then the rear moldboard proximity switch is working properly. If the machine starts, then the rear moldboard proximity switch is faulty and must be replaced immediately.
5. Once a new rear moldboard proximity switch is installed, it must be adjusted for proper operation.

**DANGER** **IF THE REAR MOLDBOARD PROXIMITY SWITCH IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

6. The rear moldboard must be completely lowered before the machine's engine can be started.

**Adjusting the rear moldboard proximity switch:**

1. Completely raise the rear moldboard with the power pack and apply the moldboard safety pin.
2. Turn the ignition switch to the power "on" position **only**. **DO NOT TRY TO START THE ENGINE.**
3. Turn the adjustment nuts on the proximity switch until the L.E.D. light, located on the back of the switch, comes "ON" (Figure 15).
4. Once the L.E.D. light comes on, tighten the adjustment nuts so that the proximity switch is held securely in that position.
5. Lower the rear moldboard and complete the procedure for checking the rear moldboard proximity switch to be sure it is functioning properly.

## 1.4 SAFETY

### 4) PRE-START SAFETY FEATURES

This machine is equipped with several safety feature requirements that need to be met before the engine can be started.

Before the engine will start the following pre-start safety feature requirements must be met:

1. The clutch switch has to be in the "OFF" position.
2. The conveyor switch has to be in the "OFF" position.
3. The travel control has to be in "NEUTRAL".
4. The brake switch has to be in the "ENGAGED" position.
5. The rear moldboard has to be completely lowered.
6. All emergency stop buttons have to be in the "RUN" position.
7. The battery disconnect switches have to be in the "ON' position,

**Checking the pre-start safety features:**

1. Check each of the above features individually by **not** placing each one in its necessary state for starting the machine's engine.
2. Then try to start the engine. If the engine does not start, then that feature is functioning properly. If the engine does start, then that feature is not functioning properly and must be replaced immediately.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE PRE-START SAFETY FEATURES.**

**DANGER** **IF ANY OF THE PRE-START SAFETY FEATURES ARE FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

3. Repeat the same process to each of the above mentioned pre-start safety features.

## 1.4 SAFETY

### 5) LEGTUBE SUPPORT BARS

This machine is equipped with leg tube support bars. These support bars can be used to help keep the machine leg tubes raised at a certain height. It is required that these leg tube support bars be used anytime maintenance or repairs are being performed under the machine.

Check to be sure all leg tube support bars are in good operating condition and are functioning properly.

**Checking the leg tube support bars:**

1. Start the engine, and completely raise the machine's elevation.
2. Place all the leg tube support bars into their raised support positions.
3. Lower the machine's elevation until the weight of the machine is resting on the leg tube support bars.

**NOTE:** Be sure to watch for proper alignment of the support bars as the machine is lowered onto them.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE LEGTUBE SUPPORT BARS.**

**DANGER** **IF ANY OF THE LEG TUBE SUPPORT BARS ARE FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**


FIGURE 16

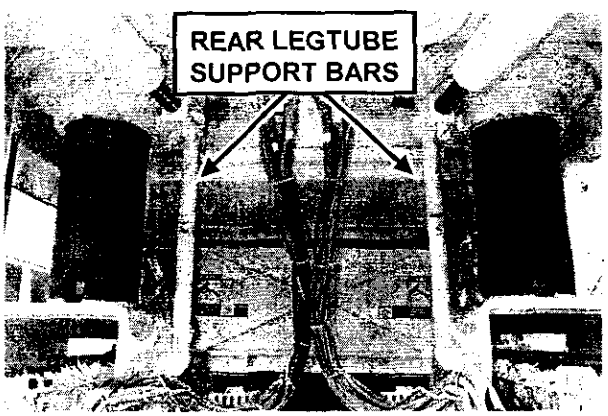



FIGURE 17

## 1.4 SAFETY

### 6) REAR MOLDBOARD SAFETY PIN

This machine is equipped with a rear moldboard safety pin. This pin is used to hold the rear moldboard in a completely raised position.

Check to be sure the rear moldboard safety pin is in good operating condition and is functioning correctly.

**Checking the rear moldboard safety pin:**

1. Shut the machine's engine off.
2. Use the rear moldboard raise/lower switch, located under the belt guard, to completely raise the rear moldboard
3. The rear moldboard safety pin is spring loaded, so as the rear moldboard safety pin bracket approaches, the safety pin will have to be pulled out to allow for clearance of the bracket.
4. Once the support pin and bracket are properly aligned, release the pin and it will spring into the support bracket.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE REAR MOLDBOARD SAFETY PIN**

**DANGER** **IF THE REAR MOLDBOARD SAFETY PIN IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

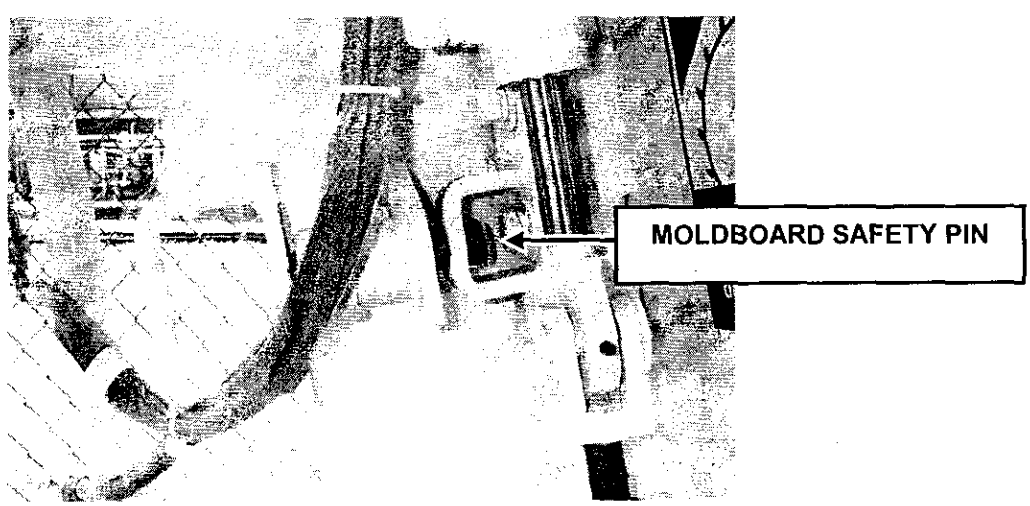



**FIGURE 18**

## 1.4 SAFETY

### 7) HOOD WING SUPPORT BARS AND SAFETY PINS

This machine is equipped with hood wing support bars and safety pins. These bars and pins are designed to help prevent the hood wings from being lowered while performing repairs or maintenance in the engine compartment.

Check to be sure the hood wing support bars and safety pins are in good operating condition and are functioning correctly.

**Checking the hood wing support bars and safety pins:**

1. Raise the engine compartment hood wings.
2. Shut the machine's engine off.
3. There is a specific hole drilled through each of the support bars to receive the safety pins.
4. Insert the safety pins.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE HOOD WING SUPPORT BARS OR SAFETY PINS.**

**DANGER** **IF THE HOOD WING SUPPORT BARS OR SAFETY PINS ARE FOUND TO BE FAULTY, THEN THEY MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**


**FIGURE 19**

## 1.4 SAFETY

### 8) OPERATOR'S STATION GATES

The operator's station is equipped with gates on both sides. These gates are designed to enclose the operator inside the operator's station. They should be closed every time the operator enters the operator's station.

Check to be sure the operator's station gates are in good operating condition and are functioning correctly by opening and closing them several times.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE OPERATOR'S STATION GATES.**

**DANGER** **IF THE OPERATOR'S STATION GATES ARE FOUND TO BE FAULTY, THEN THEY MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

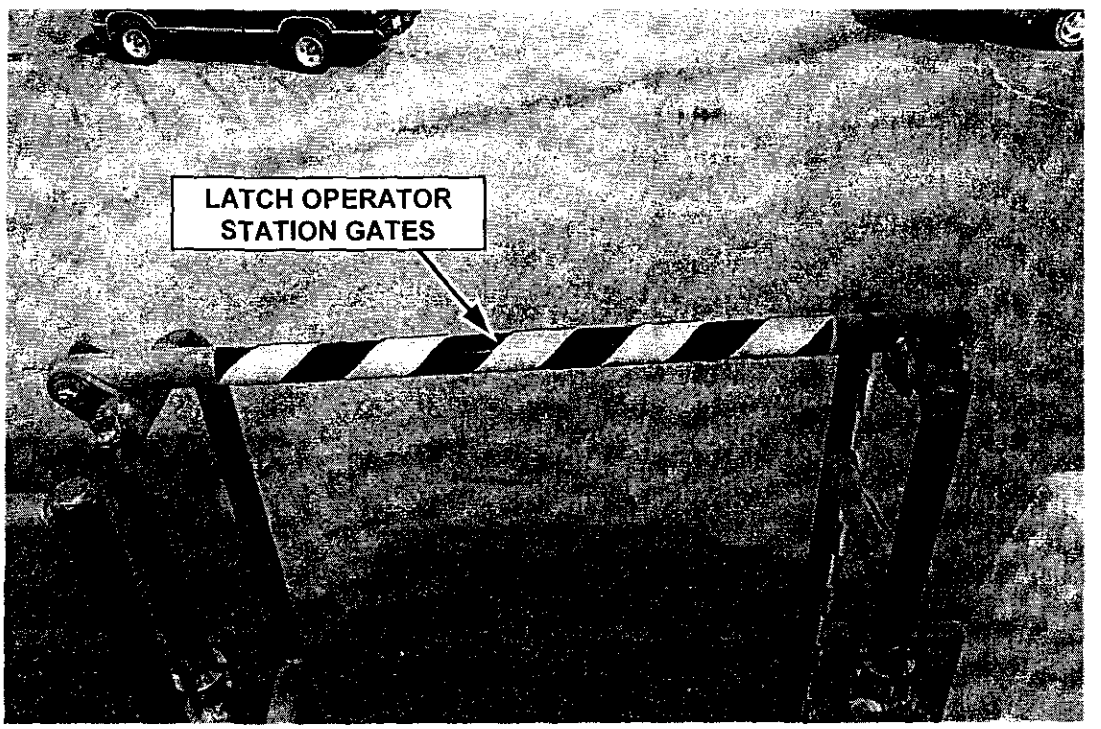



**FIGURE 20**

## 1.4 SAFETY

### 9) WARNING BEACON LIGHT

This machine is equipped with a flashing warning beacon light. This light is designed to get the attention of anyone around, letting them know that the machine is in operation. This warning beacon light must be activated every time the machine is in operation.

Check to be sure the warning beacon light is in good operating condition and is functioning correctly.

**Checking the warning beacon light:**

1. Start the machine's engine.
2. Activate the warning beacon light by flipping the activation switch, found on the operator's console, to the "ON" position.
3. The light should be very noticeably bright and flashing.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE WARNING BEACON LIGHT.**

**DANGER** **IF THE WARNING BEACON LIGHT IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**


**FIGURE 21**

## 1.4 SAFETY

### 10) REVERSE ALARM

This machine is equipped with a reverse alarm. This alarm is designed to get the attention anyone around, letting them know that the machine is traveling in reverse.

Check to be sure the reverse alarm is in good operating condition and is functioning correctly.

**Checking the reverse alarm:**

1. Start the machine's engine.
2. Place the machine travel joystick in the reverse position.
3. You should be able to notice a loud "beeping" sound coming from the rear of the machine.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE REVERSE ALARM.**

**DANGER** **IF THE REVERSE ALARM IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**


**FIGURE 22**

## 1.4 SAFETY

### 11) SLOPE SCALE

This machine is equipped with a slope scale. This scale is designed to indicate the slope of the machine. Do not for any reason place this machine in a position that is at a slope greater than 10° to the left or right.

Check to be sure the slope scale is in good operating condition and is functioning correctly.

**DANGER** **DO NOT MODIFY THIS MACHINE IN ANY WAY THAT WOULD COMPROMISE THE PROPER FUNCTION OF THE SLOPE SCALE.**

**DANGER** **IF THE SLOPE SCALE IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**

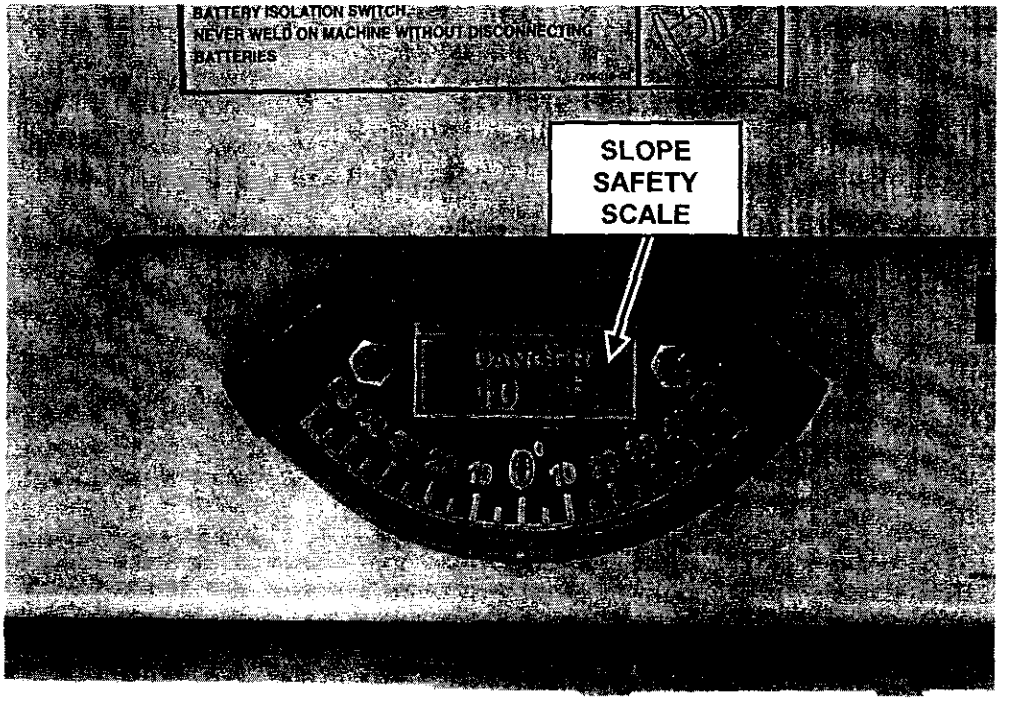



**FIGURE 23**

## 1.4 SAFETY

### 12) FIRE EXTINGUISHER

This machine is equipped with a fire extinguisher located inside the operator's console.

Check to be sure the fire extinguisher is in good operating condition and is functioning correctly.

**Checking the fire extinguisher:**

You can perform routine quick checks on the fire extinguisher yourself, but a professional portable fire extinguisher servicing company (certified by your local fire department) must come in at least once a year and perform maintenance, recharging and testing.

The quick checks you can perform include:

1. Checking to be sure the fire extinguisher is in the proper location.
2. Inspecting the fire extinguisher for any visible damage.
3. If the fire extinguisher appears to be damaged in any way, then immediately have it replaced.

**DANGER** **DO NOT MODIFY THE FIRE EXTINGUISHER IN ANY WAY THAT WOULD COMPROMISE ITS PROPER FUNCTION.**

**DANGER** **IF THE FIRE EXTINGUISHER IS FOUND TO BE FAULTY, THEN IT MUST BE REPLACED IMMEDIATELY. DO NOT ATTEMPT TO OPERATE THE MACHINE UNTIL IT HAS BEEN REPAIRED.**


**FIGURE 24**

## 1.4 SAFETY

### 13) REAR LEGTUBE PRESSURE SWITCH

Roadtec milling machines are equipped with a safety mechanism called the cutter drum clutch interlock. What this mechanism is designed to do is to automatically disengage the cutter drum when dangerous milling conditions or practices are present. Any abrupt change in the rear leg tube down pressure will cause the clutch interlock to disengage the cutter drum. A pressure switch attached to the rear leg tube detects this change in pressure and sends a signal to the clutch interlock telling it to disengage the cutter drum clutch. It is recommended that this pressure switch be checked every time the clutch interlock is activated. On occasion the pressure switch will have to be readjusted. The following instructions will explain how to check and adjust the rear leg tube pressure switch.

1. If the cutter drum interlock has been activated, the interlock indicator light, located on the operator's console, will be illuminated (figure 25).

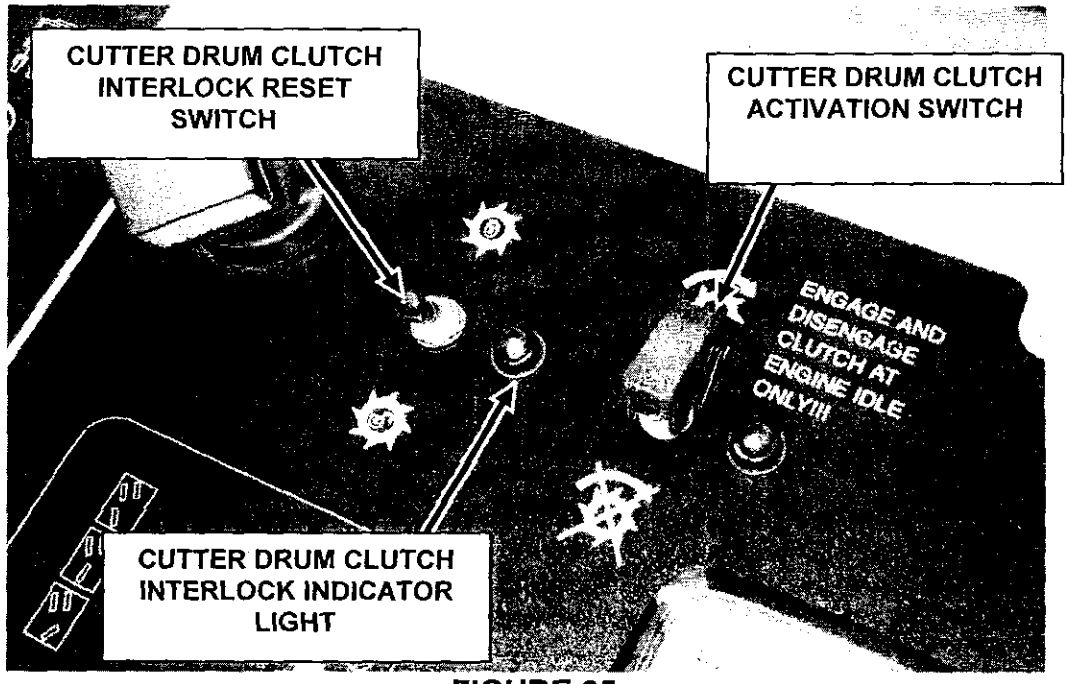



**FIGURE 25**

2. Raise the machine up out of the cut and disengage the cutter drum.

3. Reset the clutch safety interlock switch. This will cause the indicator light to go out

4. Drive the machine forward until both the front and rear tracks are completely up onto the un-milled surface.

5. Lower the machine until the cutter drum just makes contact with the ground.

6. Fully raise the rear leg tube(s) by raising the rear of the machine until the rear leg cylinders are completely extended. Once the switch is released, the rear leg tube(s) will naturally start to lower back down to a resting position.

## 1.4 SAFETY

7. When the rear leg tube(s) stops lowering, use a pencil or marker and mark the point on the inner leg tube where it intersects the outer leg tube. On a four track machine, this can be done on either one of the rear leg tubes (figure 26).

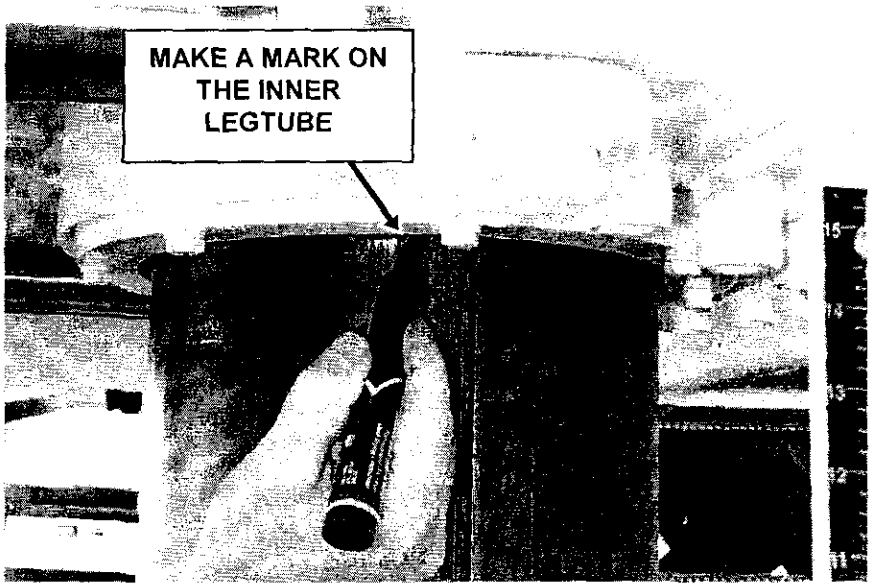



FIGURE 26

8. Start lowering the front leg tubes so that the machine seems to teeter-totter on the drum. Continue to lower the front leg tubes until the interlock indicator light comes on (figure 26).

9. Go back to the rear leg tube(s). Since you lowered the front leg tubes the rear leg tube(s) will have automatically adjusted by rising slightly.

10. The mark you made will now be slightly below where the inner leg tube now intersects with the outer leg tube. Mark the spot on the inner leg tube where it now intersects with the outer leg tube.

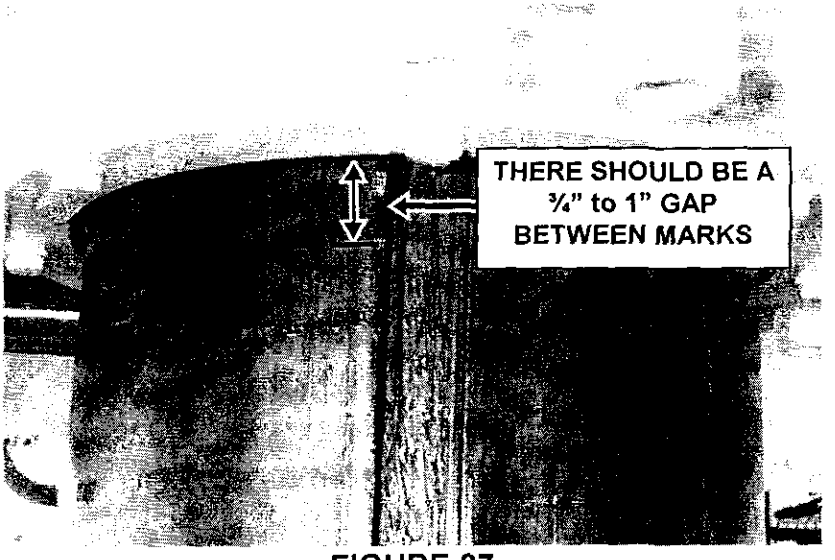



FIGURE 27

## 1.4 SAFETY

11. It is ideal for there to be between 3/4" to 1" gap between the two marks. If there is any larger or smaller gap then the rear leg tube pressure switch will have to be adjusted accordingly (figure 27).

12. The rear leg tube pressure switch is located at the top of the rear leg tube. The hood wings will have to be raised to access it (figure 28).

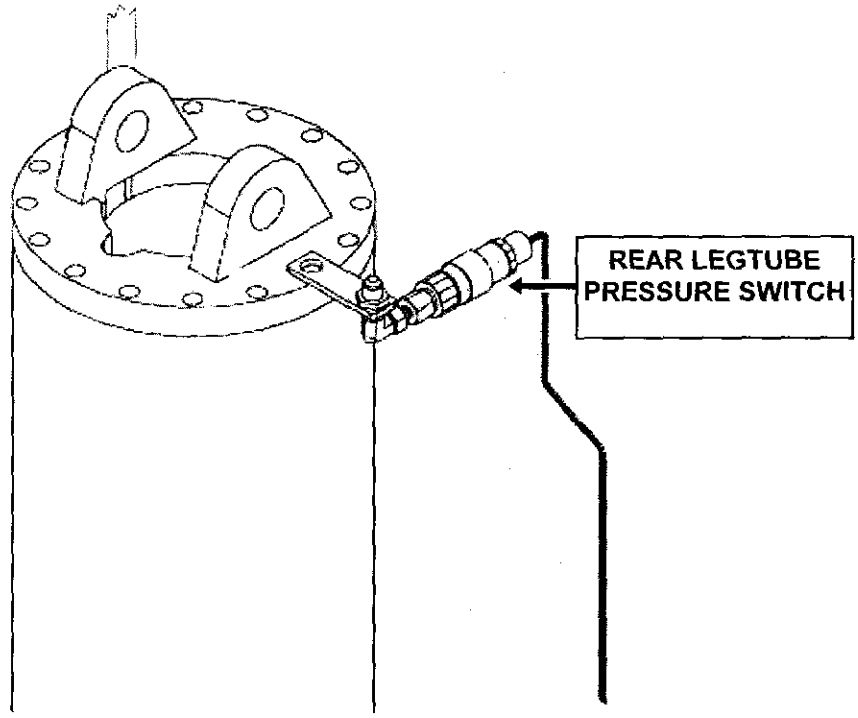



**FIGURE 28**

13. The rear leg tube pressure switch is fitted with a slide collar. Slide the collar down to expose the sensitivity adjustment dial.

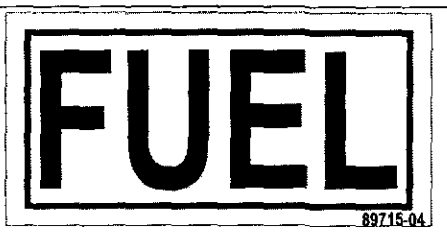
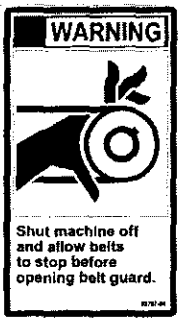
14. Using a small flat head screwdriver, rotate the sensitivity adjustment dial to the right to increase the sensitivity and to the left to decrease the sensitivity. If the gap between the marks is smaller than ¾" the sensitivity should be decreased. If the gap between the marks is greater than 1" the sensitivity should be increased.

15. Adjust the sensitivity dial and repeat steps 5 though 14 until the cutter drum interlock light comes on so that there is only a 3/4" to 1" gap between the two marks you make on the inner leg tube.

## 1.4 SAFETY

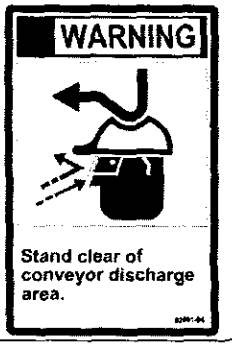
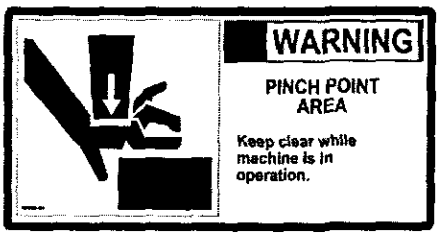
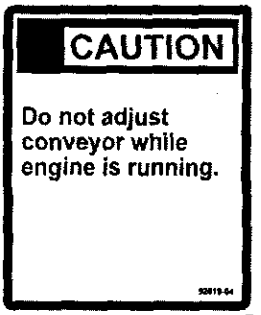
### 14) DECALS

This machine is equipped with many decals which indicate proper and safe operating practices. It is critical that these decals stay in good condition on the machine. If for any reason a decal should become damaged or removed from the machine, then it must be replaced immediately.

| SAFETY LABEL | DESCRIPTION |
|---|---|
|   | **FUEL (89715-04)** –This decal can be found at the fuel fill ports. Refill the fuel tank using only a high grade of diesel fuel. |
|  | **SLOW MOVING SAFETY (89716-04)** – This decal can be found on the rear of the machine. It indicates that this is a slow moving vehicle. |
|   | **WARNING: BELT GUARD WARNING (92787-04)** – This decal is located on the belt guard. It is warning to shut the machine off and allow the cutter drive belts to completely stop turning before opening the belt guard door. |
|   | **CAUTION: CLEAN WALKWAY (92798-04)** – This decal can be found on the rear operator's station wall. It is cautioning that walkways must be cleaned. |

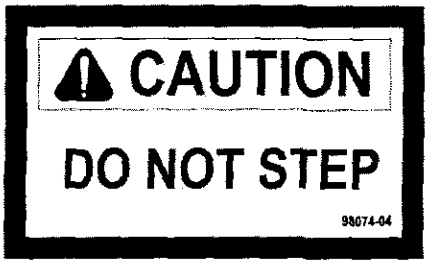
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **CAUTION: NO SMOKING (92800-04-2)** – This decal can be found at various locations around the operator's station. It is cautioning to not smoke within 50 feet of the machine. |
|  | **WARNING: STAND CLEAR (92801-04)** – This decal can be found on the secondary conveyor cradle. It is warning to stand clear of the of conveyor discharge areas. |
|  | **WARNING: PINCH POINT AREA (92803-04)** – This decal can be found at various locations on the machine such as the secondary conveyor cradle, rear operator's station wall and on the cutter housing. It is warning of the possibility of getting pinched by moving components. |
|  | **CAUTION: CONVEYOR ADJUSTMENT (92819-04)** – This decal can be found at the secondary conveyor head shaft area. It is cautioning not to adjust the conveyor while the engine is running. |

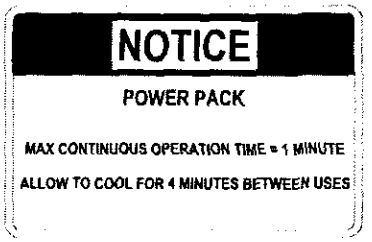
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **DANGER: STAND CLEAR (92820-04)** – This decal can be found on the primary conveyor. It is indicating that everyone should stand clear of that area while the engine is running. |
|  | **DANGER: PINCH POINT AREA (93192-04)** – This decal can be found on the secondary conveyor cradle. It is warning of the possibility of getting pinched by moving components. |
|  | **DIESEL FUEL ONLY (95885-04)** – This decal can be found at the operator's station. It is indicating that this machine must only be fueled with diesel fuel. |
|  | **CAUTION: DO NOT STEP (98074-04)** - This decal can be found at various locations around the machine. It is cautioning that to not step on certain areas of the machine. |

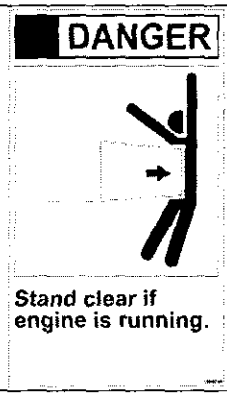
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **WARNING: COMPRESSED AIR (120827-04)** – This decal can be found on the air tanks. It is warning that the air tanks contain compressed air. |
|  | **FIRE EXTINGUISHER (122129-04)** – This decal can be found at the operator's station. It is indicating the location of the fire extinguisher. |
|  | **NOTICE: POWER PACK OPERATION (134598-04)** – This decal can be found at the operator's console. It is indicating that the power pack must not be operated for more than 1 minute continuously before allowing it to cool for 4 minutes. |
|  | **CAUTION: INSTALL HANDRAIL SAFETY BARS (139455-04)** – This decal can be found at the operator's station. It is cautioning that the handrail safety bars must be installed to help prevent someone from falling. |

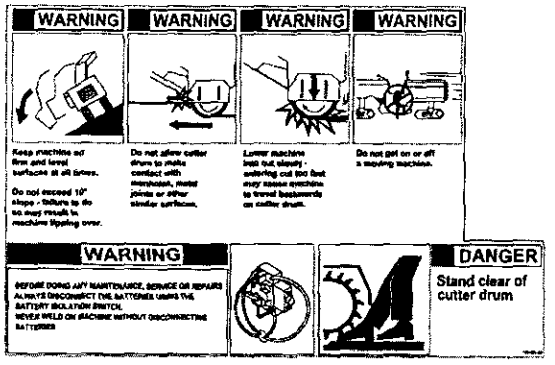
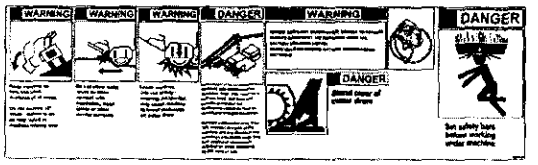
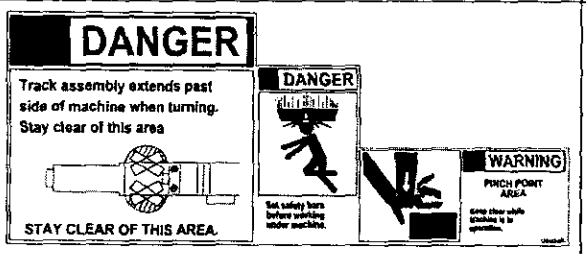
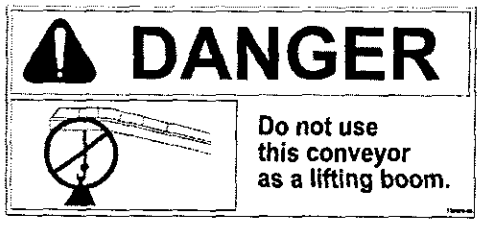
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|   | **HEARING PROTECTION (139456-04)** – This decal can be found at the operator's station. It is indicating that hearing protection must be worn when operating this machine. |
|   | **DANGER: STAND CLEAR (139457-04)** – This decal can be found on the rear of the machine. It is indicating that everyone should stand clear of that area while the engine is running. |
|   | **DANGER: NO SMOKING / DO NOT OPERATE WITHOUT ENDGATES (139458-04)** - This decal can be found on the side of the machine. It is warning not to smoke within 50 feet of the machine and to never operate the machine with the endgates removed or raised. |
|   | **WARNING: IMPOTABLE WATER (202475-04)** – This decal can be found around the water tank fill area. It is warning that the water used in the water tank is **not** suitable for any use other than in this machine. |

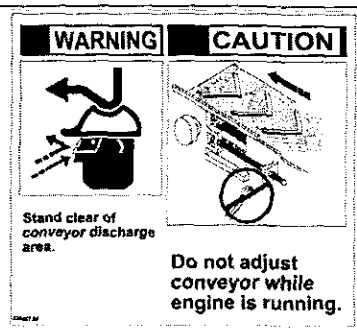
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **WARNING/DANGER DECAL (139461-02)** – This decal can be located on both sides of the machine. It is warning of tipping hazards and cutter drum hazards. It is warning to never get on or off a moving machine. It is also indicating that the batteries must be disconnected using the battery disconnect switches before any welding can be done on the machine. |
|  | **WARNING/DANGER DECAL (139462-02)** - This decal can be located on both sides of the machine. It is warning of tipping hazards and cutter drum hazards. It is warning of electrical line clearances. It is warning that the batteries must be disconnected using the battery disconnect switches before any welding can be done on the machine. It is also warning that the leg tube support bars must be used when working under the machine. |
|  | **WARNING/DANGER DECAL (139463-03L & R)** - This decal can be located on both sides of the machine. It is describing the danger of the track are. It is telling one to apply the leg tube support bars when working under the machine. Also, it is indicating that there is a pinch point area. |
|  | **DANGER: DO NOT USE CONVEYOR AS LIFTING BOOM (139465-03)** – This decal can be found on both sides of the secondary conveyor. It is informing that the secondary conveyor is to never be used as a lifting boom. |

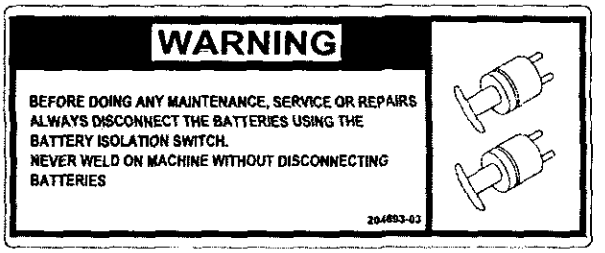
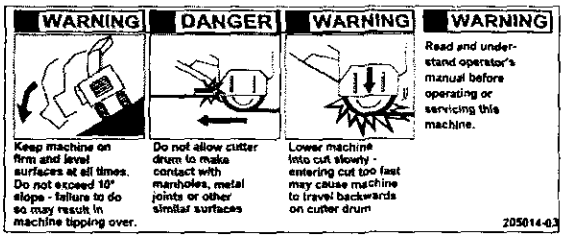
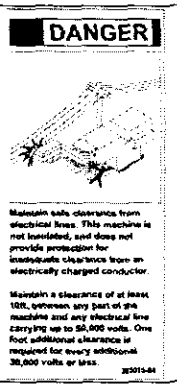
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **CAUTION/WARNING DECAL (139467-04)** – This decal can be located on both sides of the secondary conveyor. It is warning that everyone must stand clear of the conveyor discharge area. It is also cautioning to not adjust the conveyor while the engine is running. |
|  | **DANGER: STAY CLEAR OF TRACK ASSEMBLIES (139630-04)** – This decal is located at the track assembly. It is warning to stay away from the track assemblies. |
|  | **HYDRAULIC OIL ONLY (139659-04A)** – This decal is located on the hydraulic tank. It specifies what kind of hydraulic is to be used in this machine. |
|  | **CAUTION: DO NOT WELD ON WATER TANK (202476-04)** – This decal is located on both sides of the machine. It is informing one to not weld on the water tank because the water tank has a special liner that will be destroyed by welding. |

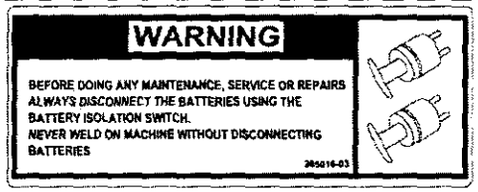
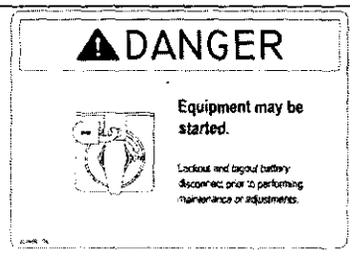
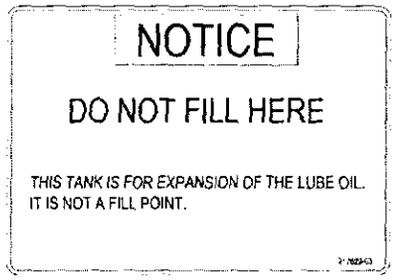
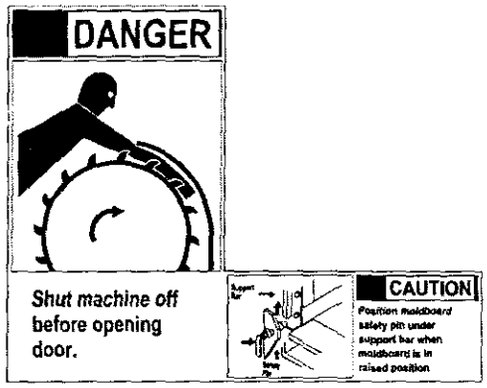
## 1.4 SAFETY

## 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **WARNING: BATTERY DISCONNECT (204693-03)** – This decal can be located on the rear operator station wall. It is warning that the battery disconnects must be turned off before performing any maintenance or repairs on the machine and especially before welding on the machine. |
|  | **WARNING/DANGER DECAL (205014-03)** – This decal can be found at the operator's console. It is warning about tipping dangers and cutter drum dangers. It is also instructing one to read and understand the operator' manual before operating this machine. |
|  | **DANGER: ELECTRICAL LINE CLEARANCE (205015-04)** – This decal is warning of the need to maintain at least a 10 foot distance between the machine and any electrical lines. |

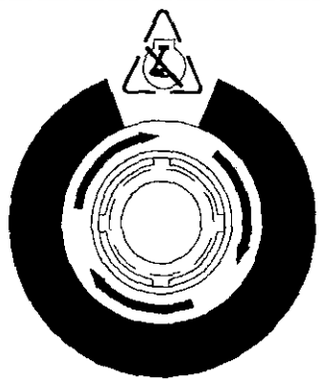
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **WARNING: BATTERY DISCONNECT (205016-03)** – This decal can be located on the operator station instrument panel. It is warning that the battery disconnects must be turned off before performing any maintenance or repairs on the machine and especially before welding on the machine. |
|  | **DANGER: APPLY LOCKOUT, TAGOUT (207966-04)** – This decal can be located on the operator station instrument panel. It is warning that a lockout, tagout system must be used before performing any maintenance or repairs on this machine. |
|  | **NOTICE: DO NOT FILL HERE (217829-03)** – This decal is located inside the cutter belt guard next to the input adaptor overflow tank. It is informing one to not fill the input adaptor here. This tank is for overflow only. |
|  | **DANGER/CAUTION (139464-01L & R):** These decals are located on the rear moldboard. They are warning that the machine must be shut down before lifting the rear moldboard. They are also advising to apply the rear moldboard safety pin when moldboard is in the raised position. |

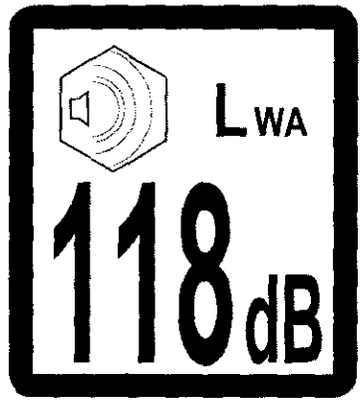
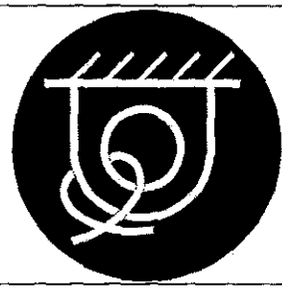
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **CONSULT SERVICE MANUAL (216270-04)** – This decal can be located on both the left and right hand sides of the machine as well as on the service manual enclosure box. It is advising one to consult the service manual before performing any repairs of maintenance on the machine. |
|  | **CONSULT OPERATOR'S MANUAL (216271-04)** – This decal can be located on both the left and right hand sides of the machine as well as on the service manual enclosure box. It is advising one to consult the operator's manual before attempting to operate the machine.. |
|  | **HARD HAT REQUIRED (216284-04)** - This Decal can be found on both the left and right hand sides of the machine as well as on the operator's console. It is indicating that one must wear a hard hat while in the vicinity of the machine. |
|  | **YELLOW E-STOP BACKGROUND (216301-04)** – This decal can be located around emergency stop buttons on the machine. It is designed to help bring attention to the location of the emergency stop buttons. |

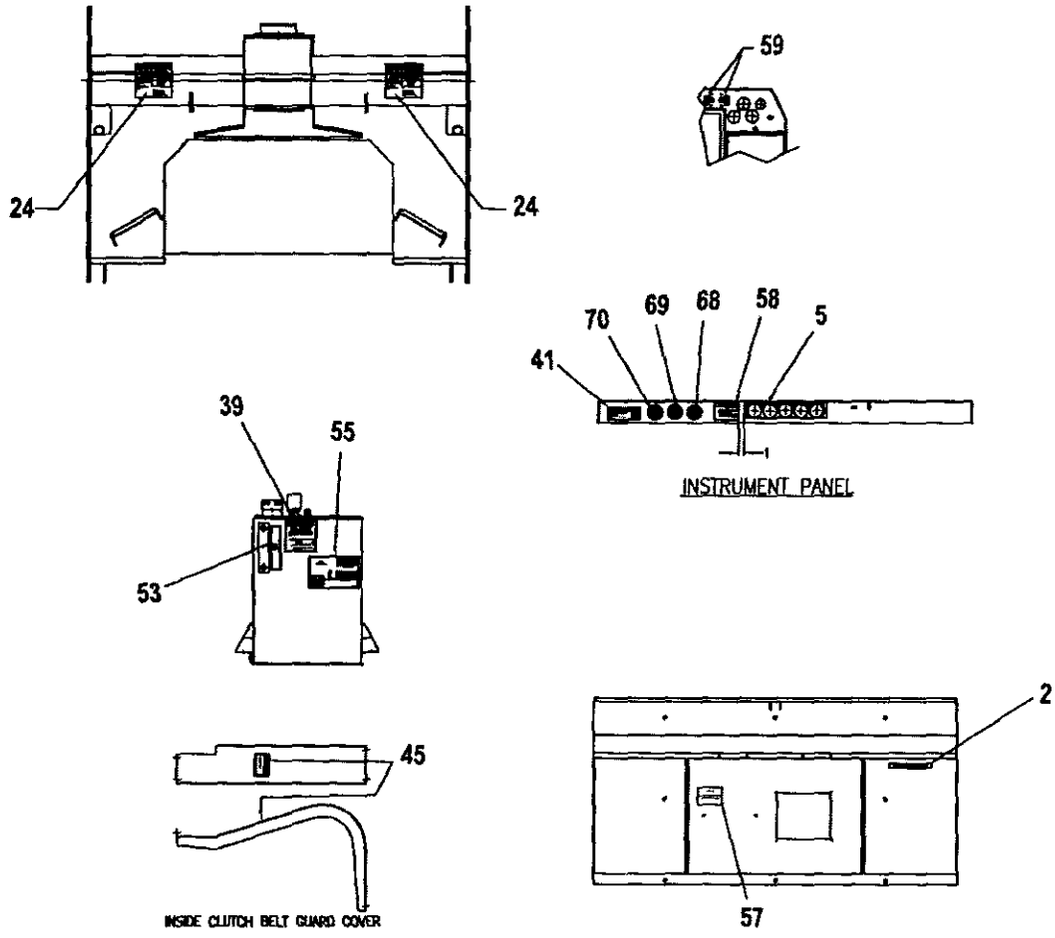
## 1.4 SAFETY

### 14) DECALS

| SAFETY LABEL | DESCRIPTION |
|---|---|
|  | **SOUND POWER LEVEL (215952-04)** – This decal can be located on both the left and right hand sides of the machine as well as at the operator's console. It is advising that sounds around the machine can reach 126dB or louder. One should always wear hearing protection while the machine is in operation. |
|  | **DANGER ENTANGLEMENT HAZARD (211268-04)** – This decal can be located on both the left and right hand sides of the machine. It is advising one to stay clear of these areas because of the danger of entanglement. |
|  | **TIE DOWN POINT (211275-04)** - This Decal can be found at all four corners of the machine. It is indicating the location of tie down points. |
|  | **LIFT POINT (211274-04)** – This Decal can be found at all four corners of the machine. It is indicating the location of lift points. |

## 1.4 SAFETY

### 14) DECALS




NOTE 1: HANDRAILS, FLOOR PLATES & EXPOSED EXHAUST COMPONENTS TO BE PAINTED BLACK

NOTE 2: DRUM HEIGHT INDICATOR TIPS, REAR TRACK INDICATOR TIP, & STEERING GUIDES TO BE PAINTED RED

NOTE 3: ITEM 53 TO BE APPLIED TO TRACK SAFETY BARS, HANDRAIL SAFETY BARS, THE CATWALK EDGES, AND THE REAR EDGES OF THE MACHINE

NOTE 4: MIRROR BRACKETS TO BE PAINTED WHITE

NOTE 5: APPLY ITEM 63 INSIDE BELT GUARD NEXT TO OVERFLOW TANK.

VENDOR NOTES:

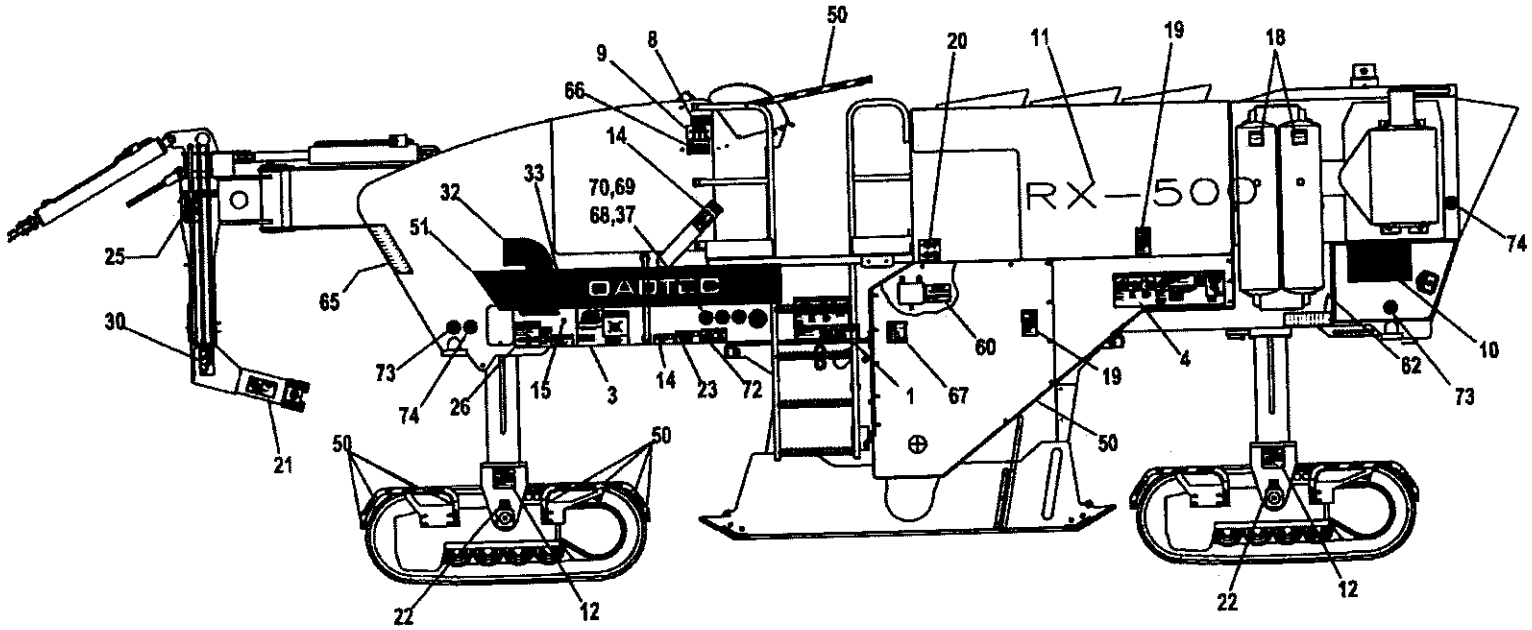
NOTE 1: KIT TO BE ARRANGED SEQUENTIALLY BY ITEM NUMBERS LISTED ABOVE.

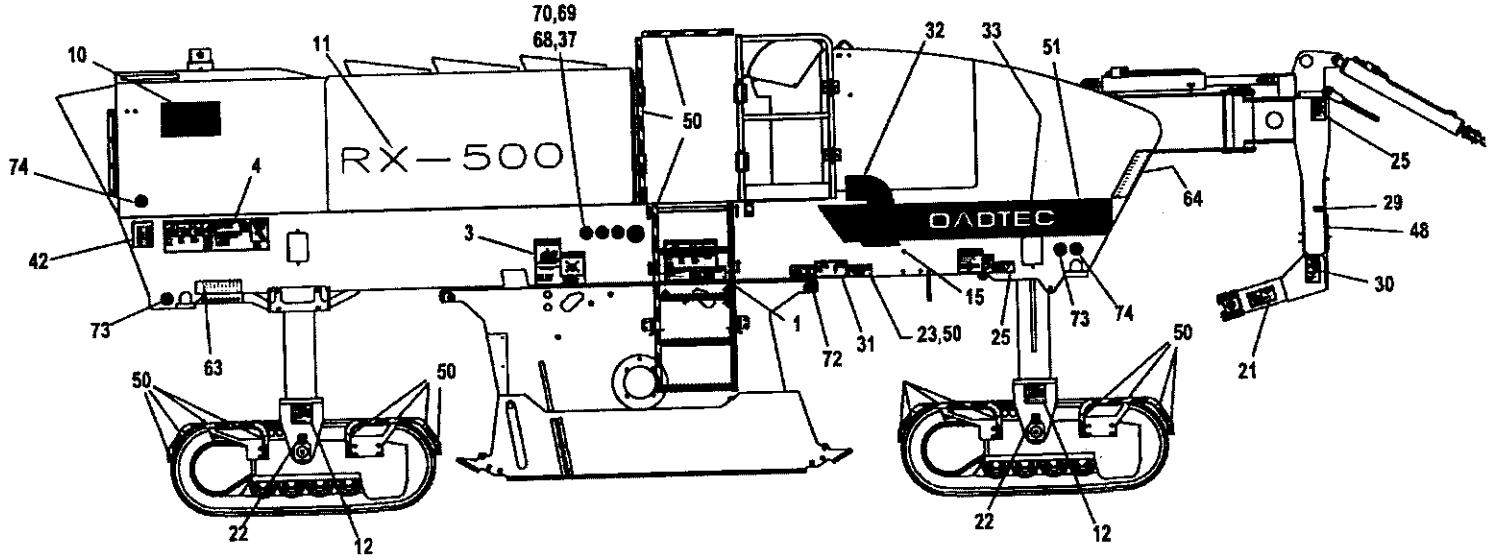
NOTE 2: ONE COPY OF THIS DRAWING TO BE INCLUDED IN KIT.

NOTE 3: ITEMS 8, 53 THRU 54 NOT NOT INCLUDED IN KIT.

## 1.4 SAFETY

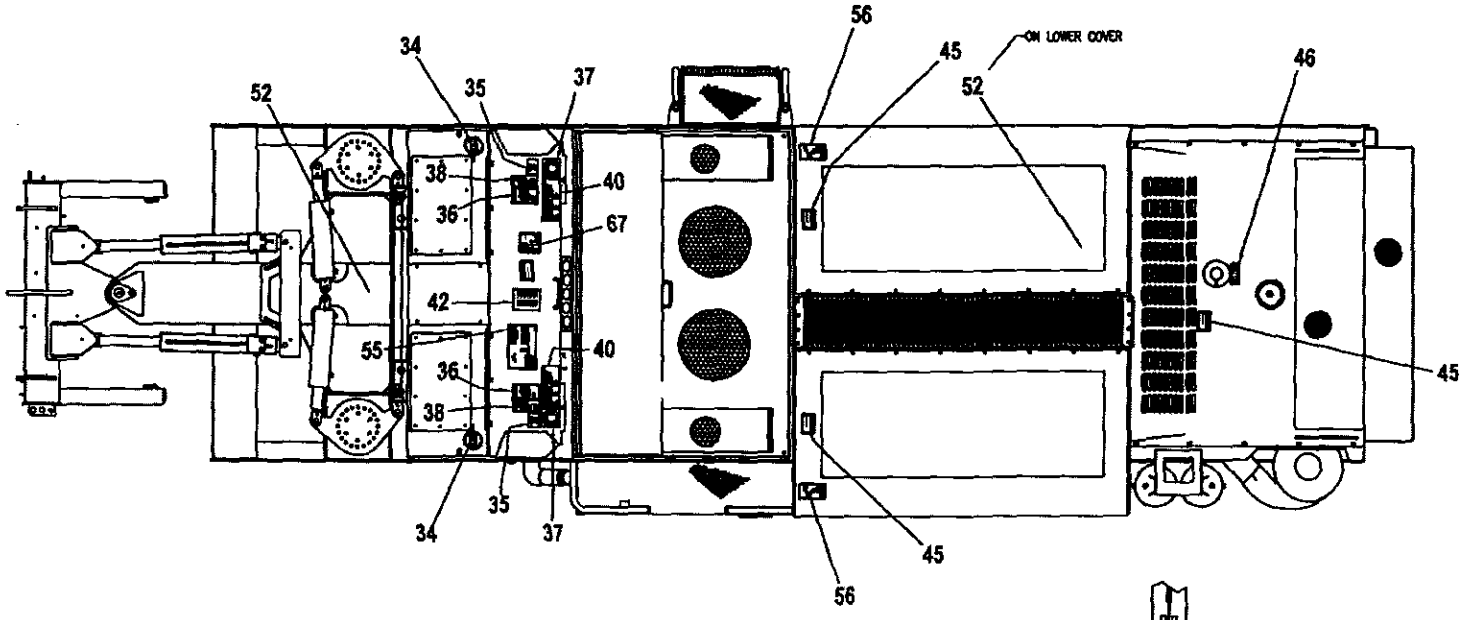
### 14) DECALS

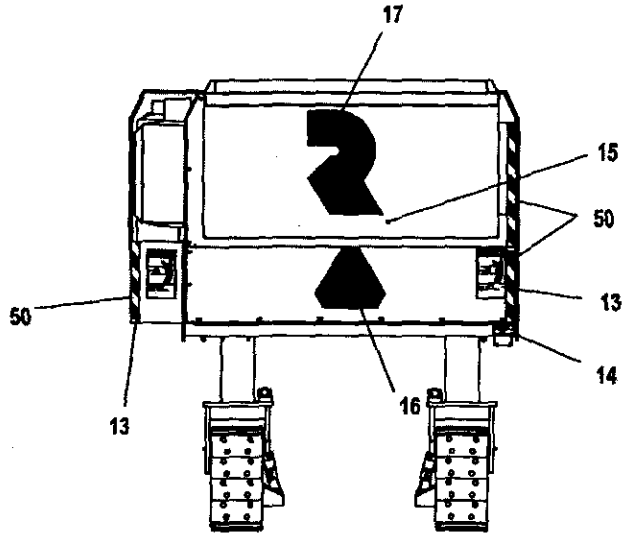


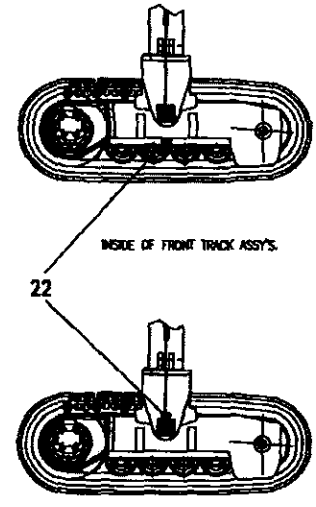



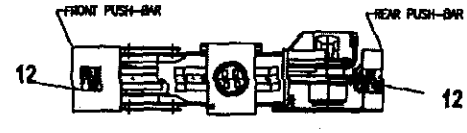
## 1.4 SAFETY

### 14) DECALS



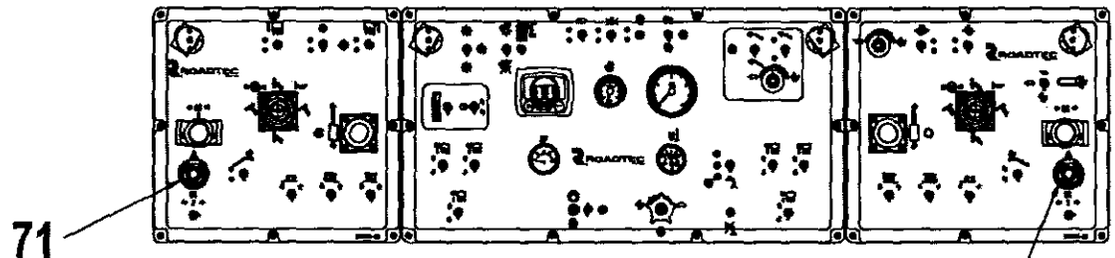



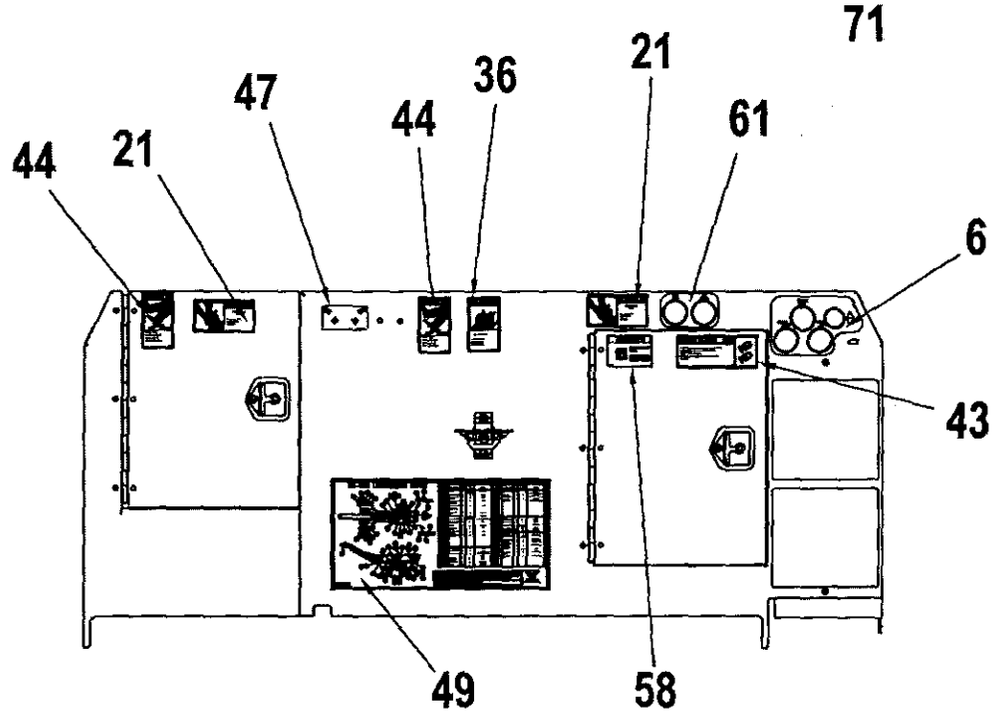



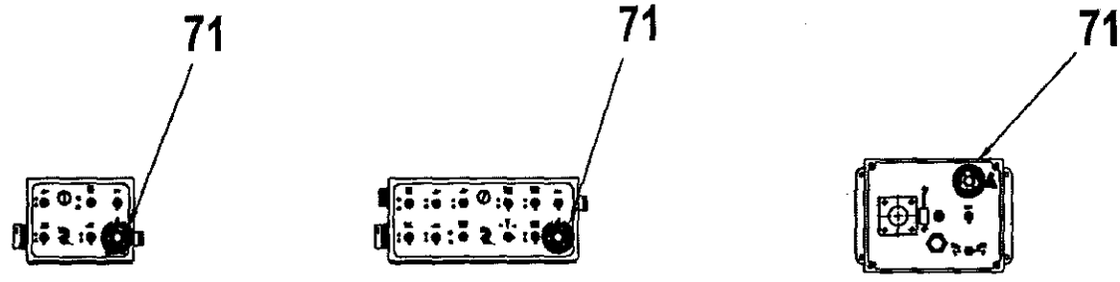

PUSH BAR SAFETY DECAL DETAIL (TYPICAL)
LEFT FRONT TRACK TOP VIEW SHOWN

## 1.4 SAFETY

### 14) DECALS



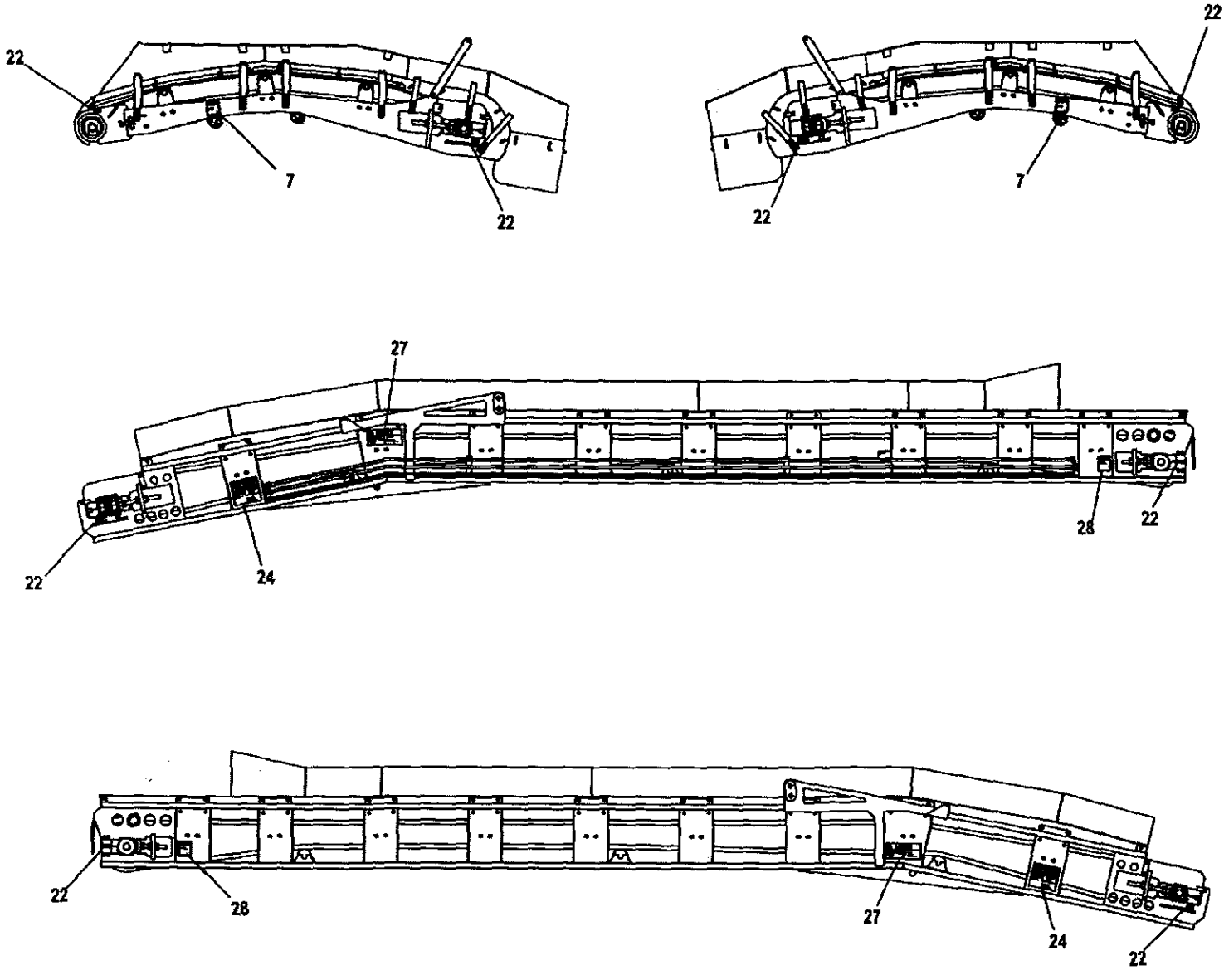




FRONT GROUND BOX REAR GROUND BOX ELECTRICAL BOX–OPTIONAL

## 1.4 SAFETY

### 14) DECALS



## 1.4 SAFETY

### 14) DECALS

| ITEM # | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 139461-02 | DECAL - WARNING | 2 |
| 2 | 122129-04 | DECAL - FIRE EXTINGUISHER | 1 |
| 3 | 139458-04 | DECAL - FIRE & CUTTER DRUM | 2 |
| 4 | 139462-02 | DECAL - WARNING | 2 |
| 5 | 204523-02 | DATA PLATE - GAUGE | 1 |
| 6 | 211304-04 | CHARGE PRESSURE GAUGE DATA PLATE | 1 |
| 7 | 92820-04 | DECAL - STAND CLEAR | 2 |
| 8 | 92870-04 | MACHINE SERIAL NUMBER PLATE | REF |
| 9 | 131690-04 | UNIVERSAL PATENT PLATE | 1 |
| 10 | 95906-03 | DECAL - AMERICAN FLAG 8 1/4" X 15" | 2 |
| 11 | 201677-04 | DECAL - RX-500 - 6" | 1 |
| 12 | 139630-04 | DECAL - TRACK (SMALL) | 12 |
| 13 | 139457-04 | DECAL - DANGER MOTION | 2 |
| 14 | 202475-04 | DECAL - IMPOTABLE WATER | 3 |
| 15 | 131841-04 | DECAL - CIRCLED BLUE R (3/4" HIGH) | 3 |
| 16 | 89716-04 | DECAL - SLOW MOVING SAFETY | 1 |
| 17 | 141104-04 | DECAL - "R" 24" TALL RED | 1 |
| 18 | 120827-04 | DECAL - COMPRESSED AIR | 2 |
| 19 | 92787-04 | DECAL - BELT GUARD | 2 |
| 20 | 146360-04 | DECAL - BATTERY (INT. SYM) | 1 |
| 21 | 92803-04 | DECAL - PINCH POINT AREA | 5 |
| 22 | 96088-04 | DECAL - GREASE HERE 1" X 2" | 5 |
| 23 | 202476-04 | DECAL - WATER TANK WELD CAUTION | 2 |
| 24 | 139467-04 | DECAL - SECONDARY CONV. | 4 |
| 25 | 139463-04R | DECAL - RH STEERING | 1 |
| 26 | 139463-02L | DECAL - LH STEERING | 1 |
| 27 | 139465-03 | DECAL - SECONDARY CONV. LIFT | 2 |
| 28 | 92819-04 | DECAL - CONVEYOR ADJUST | 2 |
| 29 | 99535-04 | DECAL - WASH DOWN | 1 |
| 30 | 93192-04 | DECAL - PINCH POINT | 2 |
| 31 | 144931-04 | DECAL - WATER FLOW CONTROL | 1 |
| 32 | 141102-04 | DECAL - "R" LOGO (RED) | 2 |
| 33 | 141103-03 | "ROADTEC" STRIPE (BLUE) | 2 |
| 34 | 89715-04 | DECAL - FUEL | 2 |
| 35 | 95885-04 | DECAL - DIESEL FUEL ONLY | 2 |
| 36 | 92800-04-2 | DECAL - NO SMOKING | 3 |
| 37 | 139456-04 | DECAL - EAR PROTECTION | 4 |
| 38 | 205015-04 | DECAL - ELECTRICAL LINES | 2 |
| 39 | 139659-04 | HYDRAULIC RESERVOIR | 1 |
| 40 | 205014-03 | DECAL - CONSOLE | 2 |
| 41 | 205016-04 | DECAL - BATTERY ISOLATION SWITCH | 1 |
| 42 | 124898-04 | SLOPE CONVERSION ON CHART | 2 |
| 43 | 204693-03 | DECAL - BATTERY ISOLATION SWITCH | 1 |
| 44 | 92798-04 | DECAL - CLEAN WALKWAYS | 2 |
| 45 | 98074-04 | DECAL - NO STEP | 4 |

## 1.4 SAFETY

### 14) DECALS

| ITEM # | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 46 | 89725-04 | DECAL - WATER | 1 |
| 47 | 211925-04 | DECAL - HOOD RAISE & LOWER | 1 |
| 48 | 218918-04 | DECAL - CRADLE GREASE POINT FUNCTION | 1 |
| 49 | 205024-01 | DECAL - RX-500 LUBRICATION CHART | 1 |
| 50 | 129611 | DECAL - REFL. SAFETY TAPE BLACK/YELLOW | REF |
| 51 | 143063 | DECAL - 1" YELLOW STRIPING | REF |
| 52 | 216882-04 | DECAL - ANTI-SPIN VALVE | 2 |
| 53 | 207432 | DECAL - COLD OIL LEVEL | 1 |
| 54 | 205044-03 | DECAL - AMPHENOL PLUG | 1 |
| 55 | 210860-02 | DECAL - VALVE | 2 |
| 56 | 139455-04 | DECAL - INSTALL HANDRAIL SAFETY BARS | 2 |
| 57 | 134598-04 | DECAL - MAX OPERATING TIME | 1 |
| 58 | 207966-04 | DECAL - LOCKOUT/TAGOUT | 2 |
| 59 | 211937-04 | DECAL KIT - 60 AMP BREAKER | 1 |
| 60 | 217829-03 | DECAL - DO NOT FILL | 1 |
| 61 | 218391-04 | PRESSURE GAUGE DATA PLATE | 1 |
| 62 | 218916-03 | DECAL - LH REAR GREASE POINT FUNCTION | 1 |
| 63 | 218917-03 | DECAL - RH REAR GREASE POINT FUNCTION | 1 |
| 64 | 218914-04 | DECAL - RH FRONT GREASE POINT FUNCTION | 1 |
| 65 | 218915-04 | DECAL - LH FRONT GREASE POINT FUNCTION | 1 |
| 66 | 215948-04 | CE MACHINE PLATE | 1 |
| 67 | 219454-04 | DECAL - SOUND POWER LEVEL | 1 |
| 68 | 216270-04 | CONSULT SERVICE MANUAL | 2 |
| 69 | 216271-04 | CONSULT OPERATOR'S MANUAL | 2 |
| 70 | 216284-04 | HARD HAT REQUIRED | 2 |
| 71 | 216301-04 | E-STOP YELLOW BACKGROUND | 5 |
| 72 | 211268-04 | DECAL - DANGER! ENTANGLEMENT HAZARD | 1 |
| 73 | 211275-04 | DECAL - TIE DOWN POINT | 3 |
| 74 | 211274-04 | DECAL - TOW TIE DOWN POINT | 3 |
| 75 | 216633-04 | NUMBER TAGS FOR HYDRAULIC HOSES | 2 |

## 1.4 SAFETY

### MATERIAL SAFETY DATA SHEETS

The RX-500 contains various substances that are required for proper operation of the machine. These substances include; 80w-90 gear lube, 15w-40 engine oil, antifreeze & coolant, anti-wear 46 hydraulic oil, cerulean #2 grease and low sulfur diesel fuel.

These materials may pose a health hazard if one were to be exposed to them. The following pages contain the actual material safety data sheets (MSDS) for these substances.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL



The Valvoline Company

Date Prepared: 01/14/02

MSDS No: 505.0171784-012.002I

ALL-FLEET PLUS 15W40 12/1 QT

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: ALL-FLEET PLUS 15W40 12/1 QT
General or Generic ID: PETROLEUM BASED-LUBRICATING OIL

| Company | Telephone Numbers | |
|---|---|---|
| The Valvoline Company | Emergency: | 1-800-274-5263 |
| P.O. Box 14000 | | |
| Lexington, KY 40512 | Information: | 1-859-357-7206 |

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2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredient(s) | CAS Number | % (by weight) |
|---|---|---|
| ALIPHATIC PETROLEUM DISTILLATES | 64742-65-0 | 80.0- 90.0 |
| DETERGENT/DISPERSANT ENGINE OIL PACKAGE | | 10.0- 20.0 |
| PETROLEUM DISTILLATE | 64741-88-4 | 1.0- 10.0 |
| ZINC DIALKYLDITHIOPHOSPHATE | 68649-42-3 | 2.2- 2.2 |

---

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
May cause mild eye irritation.

Skin
May cause mild skin irritation. Prolonged or repeated contact may dry and crack the skin.

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful. This material can get into the lungs during swallowing or vomiting. This results in lung inflammation and other lung injury.

Inhalation
It is possible to breathe this material under certain conditions of handling and use (for example, during heating, spraying, or stirring). Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Symptoms usually occur at air concentrations higher than the recommended exposure limits (See Section 8).

Symptoms of Exposure
Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



include: stomach or intestinal upset (nausea, vomiting, diarrhea) irritation (nose, throat, airways), pain in the abdomen.

Target Organ Effects
No data

Developmental Information
No data

Cancer Information
Used motor oil has been shown to cause skin cancer in laboratory animals continually exposed by repeated applications. Avoid prolonged or repeated skin contact.

Other Health Effects
No data

Primary Route(s) of Entry
No data

---

4. FIRST AID MEASURES

Eyes
If symptoms develop, immediately move individual away from exposure and into fresh air. Flush eyes gently with water for at least 15 minutes while holding eyelids apart; seek immediate medical attention.

Skin
Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing
Seek medical attention. If individual is drowsy or unconscious, do not give anything by mouth; place individual on the left side with the head down. Contact a physician, medical facility, or poison control center for advice about whether to induce vomiting. If possible, do not leave individual unattended.

*Inhalation*
If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention. If breathing is difficult, administer oxygen. Keep person warm and quiet; seek immediate medical attention.

Note to Physicians
This material is an aspiration hazard. Potential danger from aspiration must be weighed against possible oral toxicity (See Section 3 - Swallowing) when deciding whether to induce vomiting. Preexisting disorders of the following organs ( or organ systems) may be aggravated by exposure to this material: skin.

---

5. FIRE FIGHTING MEASURES

Flash Point

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



> 425.0 F (218.3 C) COC

Explosive Limit
No data

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: boric oxide, calcium oxide, carbon dioxide and carbon monoxide, magnesium oxide, oxides of sulfur, nitrogen and phosphorus, various hydrocarbons, zinc oxide.

Fire and Explosion Hazards
Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. Dense smoke may be generated while burning.

Extinguishing Media
regular foam, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating
Health - 1, Flammability - 1, Reactivity - 0

---

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill
Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify proper authorities as required, that a spill has occured. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area of spill to prevent spreading, pump liquid to salvage tank. Remaining liquid may be taken up on sand, clay, earth, floor absorbent, or other absorbent material and shoveled into containers.

---

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



Storage
Not applicable

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Not required under normal conditions of use. However, if misting or splashing conditions exist, then safety glasses or chemical splash goggles are advised.

Skin Protection
Not normally required. However, wear resistant gloves such as nitrile rubber to prevent irritation which may result from prolonged or repeated skin contact with product., Wear normal work clothing covering arms and legs..

Respiratory Protections
Not required under normal conditions of use. However, if oil mists are generated above recommended PEL/TLV of 5 mg/m3, then a NIOSH/MSHA approved respirator is advised in absence of proper environmental control. (See your industrial hygienist.)

Engineering Controls
Not required under normal conditions of use. However, if unusual operating conditions exist, then provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below PEL/TLV (s).

Exposure Guidelines
Component
---

ALIPHATIC PETROLEUM DISTILLATES (64742-65-0)
OSHA VPEL 5.000 mg/m3 - TWA Oil Mist
ACGIH TLV 5.000 mg/m3 - TWA Oil Mist

DETERGENT/DISPERSANT ENGINE OIL PACKAGE
No exposure limits established

PETROLEUM DISTILLATE (64741-88-4)
OSHA VPEL 5.000 mg/m3 - TWA
ACGIH TLV 5.000 mg/m3 - TWA

ZINC DIALKYLDITHIOPHOSPHATE (68649-42-3)
No exposure limits established

---

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
No data

Vapor Pressure
No data

Specific Vapor Density
No data

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



Specific Gravity
.890 @ 60.00 F

Liquid Density
7.400 lbs/gal @ 60.00 F
.890 kg/l @ 15.60 C

Percent Volatiles (Including Water)
No data

Evaporation Rate
No data

Appearance
No data

State
LIQUID

Physical Form
No data

Color
AMBER

Odor
PETROLEUM

pH
Not applicable

Viscosity
<= 7000.0 cps @ -20 C
14.5 - 15.5 cst @ 100 C

---

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: boric oxide, calcium oxide, carbon dioxide and carbon monoxide, magnesium oxide, oxides of sulfur, nitrogen and phosphorus, various hydrocarbons, zinc oxide.

Chemical Stability
Stable.

Incompatibility
Avoid contact with: strong acids, strong oxidizing agents.

---

11. TOXICOLOGICAL INFORMATION

No data

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



12. ECOLOGICAL INFORMATION

No data

13. DISPOSAL CONSIDERATION

Waste Management Information
Dispose of in accordance with all applicable local, state and federal regulations.

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101
DOT Description:
Not Regulated

Container/Mode:
*CASES/SURFACE - NO EXCEPTIONS*

NOS Component:
None

RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

15. *REGULATORY INFORMATION*

US Federal Regulations
TSCA (Toxic Substances Control Act) Status
TSCA (UNITED STATES) The intentional ingredients of this product are listed.

CERCLA RQ - 40 CFR 302.4
None

*SARA 302 Components* - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire( ) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65

| Section 313 Component(s) | CAS Number |
|---|---|
| *ZINC C1-C14 ALKYLDITHIOPHOSPHATE* | 68649-42-3 |

International Regulations
Inventory Status
DSL (CANADA) The intentional ingredients of this product are listed.
EINECS (EUROPE) The intentional ingredients of this product are

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 15W40 ENGINE OIL (CONTINUED)



listed.

State and Local Regulations
California Proposition 65
None

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

Last Page

## 1.4 SAFETY

## MATERAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL



The Valvoline Company Date Prepared: 01/14/02

MSDS No: 505.0067073-008.010I
ANTI-WEAR 46 HYDRAULIC OIL BULK

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: ANTI-WEAR 46 HYDRAULIC OIL BULK
General or Generic ID: PETROLEUM BASED-LUBRICATING OIL

| Company | Telephone Numbers |
|---|---|
| The Valvoline Company | Emergency: 1-800-274-5263 |
| P.O. Box 14000 | |
| Lexington, KY 40512 | Information: 1-859-357-7206 |

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredient(s) | CAS Number | % (by volume) |
|---|---|---|
| ALIPHATIC PETROLEUM DISTILLATES | 64742-65-0 | 94.0-100.0 |

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Unlikely to cause eye irritation or injury.

Skin
May cause mild skin irritation. Prolonged or repeated contact may dry and crack the skin.

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful.

Inhalation
It is possible to breathe this material under certain conditions of handling and use (for example, during heating, spraying, or stirring). Symptoms usually occur at air concentrations higher than the recommended exposure limits (See Section 8).

Symptoms of Exposure
stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways), pain in the abdomen.

Target Organ Effects
No data

Developmental Information
No data

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL (CONTINUED)

MSDS: ANTI-WEAR 46 HYDRAULIC OIL BULK Page 2 of 6

Cancer Information
No data

Other Health Effects
No data

Primary Route(s) of Entry
No data

---

4. FIRST AID MEASURES

Eyes
If symptoms develop, move individual away from exposure and into fresh air. Flush eyes gently with water while holding eyelids apart. If symptoms persist or there is any visual difficulty, seek medical attention.

Skin
Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing
Do not induce vomiting. Give one glass of milk or water, and get medical attention immediately. If possible, do not leave victim unattended.

Inhalation
If symptoms develop, immediately move individual away from exposure and into fresh air. Seek immediate medical attention; keep person warm and quiet. If person is not breathing, begin artificial respiration. If breathing is difficult, administer oxygen.

Note to Physicians
Preexisting disorders of the following organs ( or organ systems) may be aggravated by exposure to this material: skin.

---

5. FIRE FIGHTING MEASURES

Flash Point
405.0 F (207.2 C)

Explosive Limit
No data

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide, oxides of sulfur, nitrogen and phosphorus.

Fire and Explosion Hazards
Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. Dense

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL (CONTINUED)



smoke may be generated while burning.

Extinguishing Media
regular foam, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating
Health - 1, Flammability - 1, Reactivity - 0

---

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill
Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify proper authorities as required, that a spill has occured. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area of spill to prevent spreading, pump liquid to salvage tank. Remaining liquid may be taken up on sand, clay, earth, floor absorbent, or other absorbent material and shoveled into containers.

---

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed.

Storage
Not applicable

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Not required under normal conditions of use. However, if misting or splashing conditions exist, then safety glasses or chemical splash goggles are advised.

Skin Protection
Not normally required. However, wear resistant gloves such as nitrile rubber to prevent irritation which may result from prolonged or repeated skin contact with product., Wear normal work

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL (CONTINUED)

MSDS: ANTI-WEAR 46 HYDRAULIC OIL BULK — Page 4 of 6

clothing covering arms and legs..

Respiratory Protections
Not required under normal conditions of use. However, if oil mists are generated above recommended PEL/TLV of 5 mg/m3, then a NIOSH/MSHA approved respirator is advised in absence of proper environmental control. (See your industrial hygienist.)

Engineering Controls
Not required under normal conditions of use. However, if unusual operating conditions exist, then provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below PEL/TLV (s).

Exposure Guidelines
Component
---

ALIPHATIC PETROLEUM DISTILLATES (64742-65-0)
OSHA VPEL 5.000 mg/m3 - TWA Oil Mist
ACGIH TLV 5.000 mg/m3 - TWA Oil Mist

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9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
(for product) > 425.0 F (218.3 C) @ 760.00 mmHg

Vapor Pressure
(for component) < .100 mmHg

Specific Vapor Density
No data

Specific Gravity
.879 @ 60.00 F

Liquid Density
7.320 lbs/gal @ 60.00 F
.879 kg/l @ 15.60 C

Percent Volatiles (Including Water)
No data

Evaporation Rate
SLOWER THAN ETHYL ETHER

Appearance
DRY, CLEAR & BRIGHT

State
LIQUID

Physical Form
No data

Color
No data

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL (CONTINUED)



Odor
No data

pH
Not applicable

Viscosity
42.0 - 50.0 cst @ 40 C

---

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: carbon dioxide and carbon monoxide, oxides of sulfur, nitrogen and phosphorus.

Chemical Stability
Stable.

Incompatibility
Avoid contact with: strong oxidizing agents.

---

11. TOXICOLOGICAL INFORMATION

No data

---

12. ECOLOGICAL INFORMATION

No data

---

13. DISPOSAL CONSIDERATION

Waste Management Information
Dispose of in accordance with all applicable local, state and federal regulations.

---

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101
DOT Description:
Not Regulated

Container/Mode:
CASES/SURFACE - NO EXCEPTIONS

NOS Component:
None

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTI-WEAR GRADE 46 HYDRAULIC OIL (CONTINUED)



RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

---

15. REGULATORY INFORMATION

US Federal Regulations
TSCA (Toxic Substances Control Act) Status
TSCA (UNITED STATES) The intentional ingredients of this product are listed.

CERCLA RQ - 40 CFR 302.4
None

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire( ) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

International Regulations
Inventory Status
DSL (CANADA) The intentional ingredients of this product are listed.

State and Local Regulations
California Proposition 65
None

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16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

Last Page

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE



The Valvoline Company

Date Prepared: 01/14/02

MSDS No: 999.0290465-001.010I

CERULEAN #2 GREASE 1/35 LB

---

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: CERULEAN #2 GREASE 1/35 LB
General or Generic ID: PETROLEUM GREASE

| Company | Telephone Numbers |
|---|---|
| The Valvoline Company | Emergency: 1-800-274-5263 |
| P.O. Box 14000 | |
| Lexington, KY 40512 | Information: 1-859-357-7206 |

---

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredient(s) | CAS Number | % (by weight) |
|---|---|---|
| GREASE | Trade Secret | 100.0 |

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3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
May cause mild eye irritation.

Skin
Can cause skin irritation.

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful.

Inhalation
It is possible to breathe this material under certain conditions of handling and use (for example, during heating, spraying, or stirring). Symptoms usually occur at air concentrations higher than the recommended exposure limits (See Section 8).

Symptoms of Exposure
stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways).

Target Organ Effects
No data

Developmental Information
No data

Cancer Information

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE (CONTINUED)



No data

Other Health Effects
No data

Primary Route(s) of Entry
Skin contact.

---

4. FIRST AID MEASURES

Eyes
If symptoms develop, move individual away from exposure and into fresh air. Flush eyes gently with water while holding eyelids apart. If symptoms persist or there is any visual difficulty, seek medical attention.

Skin
Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing
Do not induce vomiting. Give one glass of milk or water, and get medical attention immediately. If possible, do not leave victim unattended.

Inhalation
If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention. If breathing is difficult, administer oxygen. Keep person warm and quiet; seek immediate medical attention.

Note to Physicians
Preexisting disorders of the following organs ( or organ systems) may be aggravated by exposure to this material: skin.

---

5. FIRE FIGHTING MEASURES

Flash Point
460.0 F (237.7 C) COC

Explosive Limit
No data

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Fire and Explosion Hazards
Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively.

Extinguishing Media

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE (CONTINUED)



regular foam, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating
Health - 1, Flammability - 1, Reactivity - 0

---

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Sweep up material for disposal or recovery.

Large Spill
Shovel material into containers. Thoroughly sweep area of spill to clean up any residual material.

---

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed.

Storage
Not applicable

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Wear safety glasses in compliance with OSHA regulations. (Consult your safety representative.)

Skin Protection
Wear resistant gloves such as: neoprene, Wear normal work clothing covering arms and legs..

Respiratory Protections
Not required under normal conditions of use.

Engineering Controls
Not required under normal conditions of use.

Exposure Guidelines
Component
---

GREASE

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE (CONTINUED)



No exposure limits established

---

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
Not applicable

Vapor Pressure
(for product) < .100 mmHg @ 68.00 F

Specific Vapor Density
< 1.000 @ AIR=1

Specific Gravity
< 1.000

Liquid Density
No data

Percent Volatiles (Including Water)
No data

Evaporation Rate
< .01

Appearance
No data

State
SEMISOLID

Physical Form
GEL

Color
BLUE, MILD PETROLEUM ODOR

Odor
No data

pH
Not applicable

---

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Chemical Stability
Stable.

Incompatibility

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE (CONTINUED)



Avoid contact with: *strong oxidizing agents.*

---

11. TOXICOLOGICAL INFORMATION

No data

---

12. ECOLOGICAL INFORMATION

No data

---

13. *DISPOSAL CONSIDERATION*

Waste Management Information
*Dispose of in accordance* with all applicable local, state and federal regulations.

---

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101
DOT Description:
Not Regulated

Container/Mode:
CASES/SURFACE - NO EXCEPTIONS

NOS Component:
None

RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

---

15. REGULATORY INFORMATION

US Federal Regulations
CERCLA RQ - 40 CFR 302.4
None

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire( ) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

International Regulations
Inventory Status
Not determined

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### CERULEAN GRADE 2 GREASE (CONTINUED)



State and Local Regulations
California Proposition 65
None

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL



The Valvoline Company Date Prepared: 01/14/02

MSDS No: 505.0091437-009.011I
HP GEAR OIL 80W-90 1/16 GA

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: HP GEAR OIL 80W-90 1/16 GA
General or Generic ID: PETROLEUM BASED-LUBRICATING OIL

Company
The Valvoline Company
P.O. Box 14000
Lexington, KY 40512

Telephone Numbers
Emergency: 1-800-274-5263
Information: 1-859-357-7206

---

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Ingredient(s) | CAS Number | % (by weight) |
|---|---|---|
| ALIPHATIC PETROLEUM DISTILLATE | | 87.0- 97.0 |
| GEAR OIL ADDITIVE | | 3.6- 14.0 |

---

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Unlikely to cause eye irritation or injury.

Skin
Prolonged or repeated contact may dry and crack the skin.

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful.

Inhalation
Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Breathing large amounts may be harmful.

Symptoms of Exposure
Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea)

Target Organ Effects
No data

Developmental Information
No data

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL (CONTINUED)



Cancer Information
This material is not listed as a carcinogen by the International Agency for Research on Cancer, the National Toxicology Program, or the Occupational Safety and Health Administration.

Other Health Effects
No data

Primary Route(s) of Entry
Skin contact.

---

4. FIRST AID MEASURES

Eyes
If eye contact with liquid occurs, hold eyelids apart and flush eyes gently with lukewarm water. Seek immediate medical attention.

Skin
Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing
Do not induce vomiting. Give one glass of milk or water, and get medical attention immediately. If possible, do not leave victim unattended.

Inhalation
First aid is not normally required. If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention.

Note to Physicians
Preexisting disorders of the following organs ( or organ systems) may be aggravated by exposure to this material: skin.

---

5. FIRE FIGHTING MEASURES

Flash Point
300.0 F (148.8 C) COC

Explosive Limit
Not applicable

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Fire and Explosion Hazards
Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. Dense smoke may be generated while burning.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL (CONTINUED)



Extinguishing Media
regular foam, water fog, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter.

NFPA Rating
Health - 1, Flammability - 1, Reactivity - 0

---

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill
Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify proper authorities as required, that a spill has occured. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area of spill to prevent spreading, pump liquid to salvage tank. Remaining liquid may be taken up on sand, clay, earth, floor absorbent, or other absorbent material and shoveled into containers.

---

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed. Avoid prolonged or repeated contact.

Storage
Keep containers closed when not in use.

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Not required under normal conditions of use. However, if misting or splashing conditions exist, then safety glasses or chemical splash goggles are advised.

Skin Protection
Not normally required. However, wear resistant gloves such as nitrile rubber to prevent irritation which may result from prolonged or repeated skin contact with product.

Respiratory Protections
Not required under normal conditions of use. However, if oil mists are generated above recommended PEL/TLV of 5 mg/m3, then a NIOSH/MSHA approved respirator is advised in absence of proper

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL (CONTINUED)



environmental control. (See your industrial hygienist.)

Engineering Controls
Not required under normal conditions of use. However, if unusual operating conditions exist, then provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below PEL/TLV (s).

Exposure Guidelines
Component
---

ALIPHATIC PETROLEUM DISTILLATE
No exposure limits established

GEAR OIL ADDITIVE
No exposure limits established

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9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
(for component) > 425.0 F (218.3 C)

Vapor Pressure
Not applicable

Specific Vapor Density
No data

Specific Gravity
..890 @ 60.00 F

Liquid Density
7.480 lbs/gal @ 60.00 F
.890 kg/l @ 15.60 C

Percent Volatiles (Including Water)
No data

Evaporation Rate

Appearance

State
LIQUID

Physical Form
No data

Color
AMBER

Odor
PETROLEUM

pH
Not applicable

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL (CONTINUED)



| Viscosity | | | | |
|---|---|---|---|---|
| 14.0 | - 15.0 | cst | @ | 100 C |

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Chemical Stability
Stable. Avoid heat, open flame, and prolonged storage at elevated temperatures.

Incompatibility
Avoid contact with: strong oxidizing agents.

11. TOXICOLOGICAL INFORMATION

No data

12. ECOLOGICAL INFORMATION

No data

13. DISPOSAL CONSIDERATION

Waste Management Information
Dispose of in accordance with all applicable local, state and federal regulations.

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101
DOT Description:
Not Regulated

Container/Mode:
CASES/SURFACE - NO EXCEPTIONS

NOS Component:
None

RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### 80W90 HIGH PERFORMANCE GEAR OIL (CONTINUED)



15. REGULATORY INFORMATION

US Federal Regulations
TSCA (Toxic Substances Control Act) Status
TSCA (UNITED STATES) The intentional ingredients of this product are listed.

CERCLA RQ - 40 CFR 302.4
None

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire( ) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

International Regulations
Inventory Status
AICS (AUSTRALIA) The intentional ingredients of this product are listed.
DSL (CANADA) The intentional ingredients of this product are listed.
ECL (SOUTH KOREA) The intentional ingredients of this product are listed.
ENCS (JAPAN) The intentional ingredients of this product are listed.
PICCS (PHILIPPINES) The intentional ingredients of this product are listed.

State and Local Regulations
California Proposition 65
None

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16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT

*Initial Preparation Date:* *7/3/1997*
*Last Revision Date:* *9/18/2003*
*Effective Date:* *10/4/2004*

**MATERIAL SAFETY DATA SHEET**

**PRODUCT IDENTITY: SERVICE PRO ANTIFREEZE & COOLANT**

***1. CHEMICAL PRODUCT & COMPANY INFORMATION***

*OLD WORLD INDUSTRIES, INC.*
*4065 COMMERCIAL AVENUE*
*NORTHBROOK, ILLINOIS 60062*
*PHONE: 847-559-2000*
*EMERGENCY PHONE: 1-800-424-9300 (CHEMTREC)*

***2. COMPOSITION/INFORMATION ON INGREDIENTS***

| *Material* | *CAS#* | *% by Wt* | *PEL (OSHA)* | *TLV (ACGIH)* |
|---|---|---|---|---|
| Ethylene Glycol | 107-21-1 | 90 - 95 | 50 ppm | 50 ppm |
| Diethylene Glycol | 111-46-6 | 0 - 5 | None | None |
| Dipotassium Phosphate | 7758-11-4 | 1 - 2 | None | None |

***3. HAZARDS IDENTIFICATION***

*EMERGENCY OVERVIEW*

***Slight odor.*** ***May be fatal if swallowed.*** ***Vapors can cause eye irritation.***

| | | |
|---|---|---|
| Lowest Known LD50 (Oral) | 107-21-1 | 5840 mg/kg (Rats) |
| Lowest Known LD50 (Skin) | 107-21-1 | 9530 mg/kg (Rabbits) |

**HAZARD RATING SYSTEM**

| | | |
|---|---|---|
| **NFPA: HEALTH: 1** | **FLAMMABILITY: 1** | **REACTIVITY: 0** |
| **HMIS: HEALTH: 2** | **FLAMMABILITY: 1** | **REACTIVITY: 0** |

KEY: 0 – Minimal 1 – Slight 2 - Moderate 3 - Serious 4 - Severe

SERVICE PRO Antifreeze 1

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

*POTENTIAL HEALTH EFFECTS*

**Routes of Exposure: Inhalation, Ingestion, Skin Contact/Absorption, Eye Contact**

**Eye:** May cause slight transient (temporary) eye irritation. Corneal injury is unlikely. Vapors or mists may cause eye irritation.

**Skin:** Prolonged or repeated exposure not likely to cause significant skin irritation. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Repeated skin exposure may result in absorption of harmful amounts. Massive contact with damaged skin or of material sufficiently hot to burn skin may result in absorption of potential lethal amounts.

**Ingestion:** Single dose oral toxicity is considered to be moderate. Excessive exposure may cause central nervous system effects, cardiopulmonary effects (metabolic acidosis), and kidney failure. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing amounts larger than that may cause serious injury, even death.

**Inhalation:** At room temperature, exposures to vapors are minimal due to physical properties; higher temperatures may generate vapor levels sufficient to cause adverse effects.

**Systemic (Other Target Organ) Effects:** Repeated excessive exposures may cause severe kidney and also liver and gastrointestinal effects. Signs and symptoms of excessive exposure may be central nervous system effects. Signs and symptoms of excessive exposure may be nausea and/or vomiting. Signs and symptoms of excessive exposure may be anesthetic or narcotic effects. Observations in animals include formation of bladder stones after repeated oral doses of ethylene glycol. Reports of kidney failure and death in burn patients suggest the ethylene glycol may have been a factor. The use of topical applications containing this material may not be appropriate in severely burned patients or individuals with impaired renal function.

**Cancer Information:** Based on data from long-term animal studies, ethylene glycol is not believed to pose a carcinogenic risk to man.

**Teratology (Birth Defects):** Exposure to ethylene glycol has caused birth defects in laboratory animals only at doses toxic to the mother.

**Reproductive Effects:** Ethylene glycol has not interfered with reproduction in animal studies except at very high doses.

*CHRONIC, PROLONGED OR REPEATED OVEREXPOSURE*

**Effects of Repeated Overexposure**: Repeated inhalation of ethylene glycol mist may produce signs of central nervous system involvement, particularly dizziness and nystagmus.

**Other Effects of Overexposure**: repeated skin contact with ethylene glycol may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

SERVICE PRO Antifreeze 2

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

*4. FIRST AID MEASURES*

***Ensure physician has access to this MSDS.***

*TREATMENT*

**Eyes:** Immediately flush eyes with large amounts of water for 15 minutes, lifting lower and upper lids. Get medical attention as soon as possible. Contact lenses should never be worn when working with this chemical.

**Skin:** Flush area of skin contact immediately with large amounts of water for at least 15 minutes while removing contaminated clothing. If irritation persists after flushing, get medical attention promptly. Wash clothing before re-use.

**Inhalation:** If inhaled, immediately remove victim to fresh air and call ***emergency medical care.*** If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Ingestion:** Obtain medical attention immediately. If patient is fully conscious, give two glasses of water. Do not induce vomiting. If medical advice is delayed, and if the person has swallowed a moderate volume of material (a few ounces), then give three to four ounces of hard liquor, such as whisky. For children, give proportionally less liquor, according to weight.

**Notes to Physician:**
It is estimated that the lethal oral dose to adults is of the order of 1.0 ml/kg. Ethylene glycol is metabolized by alcohol dehydrogenate to various metabolites including glyceraldehydes, glycolic acid and oxalic acid which cause an elevated anion-gap metabolic acidosis and renal tubular injury. The signs and symptoms in ethylene glycol poisoning are those of metabolic acidosis, CNS depression, and kidney injury. Urinalysis may show albuminuria, hematuria and oxaluria. Clinical chemistry may reveal anion-gap metabolic acidosis and uremia. The currently recommended medical management of ethylene glycol poisoning includes elimination of ethylene glycol and metabolites, correction of metabolic acidosis and prevention of kidney injury. It is essential to have immediate and follow up urinalysis and clinical chemistry. There should be particular emphasis on acid-base balance and renal function tests. A continuous infusion of 5% sodium bicarbonate with frequent monitoring of electrolytes and fluid balance is used to achieve correction of metabolic acidosis and forced diuresis. As a competitive substrate for alcohol dehydrogenase, ethanol is antidotal. Given in the early stages of intoxication, it blocks the formulation of nephrotoxic metabolites. A therapeutically effective blood concentration of ethanol is in the range 100-150 mg/dl, and should be achieved by a rapid loading dose and maintained by intravenous infusion. For severe and/or deteriorating cases, hemodialysis may be required. Dialysis should be considered for patients who are symptomatic, have severe metabolic acidosis, a blood ethylene glycol concentration greater than 25 md/dl, or compromise of renal functions.

A more effective intravenous antidote for physician use is 4-methylpyrazole, a potent inhibitor of alcohol dehydrogenases, which effectively blocks the formation of toxic metabolites of ethylene glycol. It has been used to decrease the metabolic consequences of ethylene glycol poisoning before metabolic acidosis coma, seizures, and renal failure have occurred. A generally recommended protocol is a loading dose of 15 mg/kg followed by 10 mg/kg every 12 hours for 4 doses and then 15 mg/kg every 12 hours until ethylene glycol concentrations are below 20 mg/100 ml. Slow intravenous infusion is required. Since 4-methyplyrozole is dialyzable, increased dosage may be necessary during hemodialysis. Additional therapeutic measures may include the administration of cofactors involved in the metabolism of ethylene glycol. Thiamine (100 mg) and pyridoxine (50 mg) should be given every six hours.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

Pulmonary edema with hypoxemia has been described in a number of patients following poisoning with ethylene glycol. The mechanism of production has not been elucidated, but it appears to be non-cardiogenic in origin in several cases. Respiratory support with mechanical ventilation and positive end expiratory pressure may be required. There may be cranial nerve involvement in the late stages of toxicity from swallowed ethylene glycol. In particular, effects have been reported involving the seventh, eighth and ninth cranial nerves, presenting with bilateral facial paralysis, diminished hearing and dysphasia.

#### *5. FIRE FIGHTING MEASURES*

**Flammable Properties**
Flash Point: 119°C (247°F)
Method Used: Setaflash
Autoignition Temperature: Autoignition temperature for ethylene glycol is 398°C (748°F).

**Flammability Limits** - % of vapor concentration at which product can ignite in presence of spark.
Lower Flammability Limit: 3.2%
Upper Flammability Limit: 15.3%

**Hazardous Combustion Products**: Hazardous combustion products may include and are not limited to carbon monoxide, carbon dioxide and trace amounts of aldehydes and organic acids. When available oxygen is limited, as in a fire or when heated to very high temperatures by a hot wire or plate, carbon monoxide and other hazardous compounds such as aldehydes might be generated.

**Extinguishing Media**: Water fog or fine spray. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Carbon dioxide. Dry chemical. Do not use direct water stream. May spread fire.

**Fire Fighting Instructions**: No fire and explosion hazards expected under normal storage and handling conditions (i.e. ambient temperatures). However, ethylene glycol or solutions of ethylene glycol and water can form flammable vapors with air if heated sufficiently. Keep people away. Isolate fire area and deny unnecessary entry.

**Protective Equipment for Fire Fighters**: Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire-fighting helmet, coat, pants, boots and gloves).

#### *6. ACCIDENTAL RELEASE MEASURES*

**Protect People**: Material is moderately toxic when ingested. Take adequate precautions to keep people, especially children away from spill site. PVC-coated rubber gloves and monogoggles or face shield can be used during cleanup of spill site. Product on surfaces can cause slippery conditions. Practice reasonable care and cleanliness. Avoid breathing spray mists if generated. Keep out of reach of children. Product may become a solid at temperatures below -18°C (0°F). Do not store near food, foodstuffs, drugs or potable water supplies.

**Protect the Environment**: Do not dump used product or diluted material into sewers, on the ground, or into any body of water.

**Cleanup**: Small spills: Soak up with absorbent material. Large spills: Dike and pump into suitable containers for disposal. Ensure compliance with all applicable statues that require notification of appropriate government officials.

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

### *7. HANDLING AND STORAGE*

**Steps to be Taken in Case Material is Released or Spilled:** Eliminate all sources of ignition in vicinity of the spilled or released fluid.

**Other Precautions:** Use normal precautions in handling any combustible liquid. Keep container closed when not in use. Store away from heat or open flame. Product on surfaces can cause slippery conditions. Practice reasonable care and cleanliness. Avoid breathing spray mists if generated. Keep out of reach of children. Product may become a solid at temperatures below -18°C (0°F). Do not store near food, foodstuffs, drugs or potable water supplies.

### *8. EXPOSURE CONTROLS / PERSONAL PROTECTION*

**Respiratory Protection:** Respiratory protection is required if airborne concentration exceeds TLV. At any detectable concentration any self-contained breathing apparatus with a full face piece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full face piece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

**Escape:** Any air-purifying full face piece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister or any appropriate escape-type self-contained breathing apparatus.

**Skin Protection:** Protective gloves recommended when prolonged skin contact cannot be avoided. Polyethylene; Neoprene; Nitrile; Polyvinyl alcohol; Natural Rubber, Butyl Rubber. Safety shower should be available.

**Eye Protection:** Safety goggles and face shield. Emergency eyewash should be available. Contact lenses should not be worn when working with this chemical.

**Engineering Controls:** Use general or local exhaust ventilation to meet TLV requirements.

**EXPOSURE LIMITS**

| Component | Exposure Limits | Skin Form |
|---|---|---|
| Ethylene glycol | 100 mg/m3 CEILING ACGIH | Aerosol |
| Ethylene glycol | 125 mg/m3 CEILING OSHA-vacated | |
| | 50 ppm CEILING OSHA – vacated | |
| | 100 mg/m3 CEILING UCC | Aerosol and Vapor |
| Diethylene glycol | 50 ppm TWA8 AIHA WEEL | Aerosol and Vapor |
| Diethylene glycol | 10 mg/m3 TWA8 AIHA WEEL | Aerosol |

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

A "blank" in the Skin column indicates that exposure by the cutaneous (skin) route is not a potential significant contributor to overall exposure.

SERVICE PRO Antifreeze 5

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

*9. PHYSICAL / CHEMICAL PROPERTIES*

| | |
|---|---|
| **Boiling Range:** | 171 - 175°C (339 - 348°F) |
| **Freeze Point:** | -18°C (0°F) |
| **Specific Gravity (Water =1):** | 1.12 |
| **Pounds/Gallons:** | *9.3* |
| **Vapor Pressure (mm of Hg) @ 20C:** | <0.1 |
| **Vapor Density (air=1):** | 2.1 |
| **Water Solubility:** | Complete |
| **Evaporation Rate (BuAc = 1):** | Nil |
| **% Volatile By Volume:** | 97.0 |
| **Appearance:** | Green |
| **Odor:** | Mild |
| **pH (50% Water Solution):** | 10.5-11.0 |

*10. STABILITY & REACTIVITY DATA*

| | |
|---|---|
| **Stability:** | Stable |
| **Conditions to Avoid:** | Keep away from flame |
| **Incompatibility (Materials to Avoid):** | Strong acid or oxidizing agents |
| **Hazardous Decomposition Products:** | Incomplete combustion may produce CO gas |
| **Hazardous Polymerization:** | Will not occur |

*11. TOXICOLOGICAL INFORMATION*

**Skin:** The dermal LD50 has not been determined.

**Ingestion:** The lethal dose in humans is estimated to be 100 ml (3 ozs.). The oral LD50 for rats is in the 6000-13,000-mg/kg range.

**Mutagenicity (The Effects on Genetic Material):** In vitro mutagenicity studies were negative. Animal mutagenicity studies were negative.

**Significant Data with Possible Relevance to Humans:** Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect doses for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also, in a preliminary study to asses the effects of exposure of pregnant rats and made to aerosis at concentrations of 150, 1000 and 25000 mg/m3 for 6 hours a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the *developmental toxicity was mediated by inhalation of aerosol percutaneous absorption of ethylene glycol from* contaminated skin, or swallowing ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 25000 mg/m3) and developmental toxicity with minimal evidence of teratogenicity (2500 mg/m3). The no-effects concentration (based on maternal toxicity) was 500 mg/m3. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen. There is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

toxicity. Exposure to high aerosol concentrations is only minimally effective in producing developmental toxicity. The major route for producing developmental toxicity is perorally. Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence or a different pattern of tumors compared with untreated controls. The absence of carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

A chronic dietary feeding study of diethylene glycol with rats showed mild kidney injury at 1%, while concentrations of 2% and 4% caused more marked kidney injury. In addition, at 2% and 4% of diethylene glycol in the diet, some rats developed benign papillary tumors in the urinary bladder. These have been attributed to the presence of urinary bladder calcium oxalate stones. No evidence for carcinogenicity was found with a chronic skin-painting study with diethylene glycol in mice. The absence of a direct chemical carcinogenic effect addords with the results in vitro genotoxicity studies that show that it does not produce mutagenic or clastogenic effects. A feeding study employing up to 5.0% diethylene glycol in the diet failed to produce any teratogenic effects. In a mouse continuous breeding study with large doses of diethylene glycol in drinking water, there was evidence for reproductive toxicity at 3.5% (equivalent to 6.1 g/kg/day) as reduced number of litter, live pups per litter and live pup weight. No such effects were seen at 1.75% (approximately 3.05 g/kg/day). The relevance of these very high dosages to human health is uncertain. Pregnant rats receiving undiluted diethylene glycol by gavage over the period of organogenesis had toxic effects at 4.0 and 8.0 ml/kg/day as mortality, decreased body weight, decreased food consumption increased water consumption and increased liver and kidney weights. Fetotoxicity was seen only at these maternally toxic dosages. Decreased fetal body weight occurred at 8.0 ml/kg/day, and increased skeletal variants at 4.0 and 8.0 ml/kg/day. No embryotixic or teratogenic effects were seen. Neither maternal toxicity nor fetotoxicity occurred at 1.0 ml/kg/day. In a study with mice also receiving undiluted diethylene glycol over the period of organogenesis, maternal toxicity occurred at 2.5 and 10.0 ml/kg/day, but not at 0.5 ml/kg/day. Definitive developmental toxicity was not seen in this species.

*ACUTE TOXICITY*

**Peroral:** The lethal dose in humans is estimated to be 3 oz. or 100 ml.
Rat: LD50 (6000 – 13000) mg/kg

**Percutaneous:**
Rabbit: LD50 = >22270 mg/kg; 24 h occluded

**Inhalation:**
Rat: 8-hour exposure, substantially saturated vapor studies, dynamic generation method

**Mortality:** 0/6

**Inhalation:** Mist/vapor study, rat, at 170°C, 8-hour exposure = 2.2 mg/l

**Mortality:** 0/6

**Inhalation:**
Rat: 8-hour exposure, fog = 10000 ppm; 65° - 70°C

**Mortality:** 0/6

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

*IRRITATION*

**Skin:**

Rabbit: 24-hour occluded contact, 0.5 ml
Results: Minor erythema and edema

**Skin:**

Human: Primary irritation patch test, 48-hour occluded, 0.2 ml
Results: Evidence of irritation

**Eye:**

Rabbit: 0.1 ml
Results: Minor transient iritis, conjunctival irritation with discharge

*REPEATED EXPOSURE*

In a 7-day dietary study with rats, a significant increase in kidney weights in females was observed at 5.0 gm/kg. The NOEL was 2.5 gm/kg.

In a 24-month dietary study with rats, increased mortality in males was observed at the highest dose, 1.0 gm/kg/day. There were multiple signs: mineralization of several organs, including the cardiac vessels, cardiac muscle, vas deferens, stomach and pulmonary vessels; cellular hyperplasia of the parathyroids, hemosiderosis of the spleen, myocardial fibrosis, portal fibrosis of the liver, bile duct hyperplasia and hydronephrosis and oxylate nephrosis of the kidneys. Ethylene glycol was not oncogenic.

In a 90-day dietary study with dogs, repeated exposures to 2.5 gm/kg resulted in acute renal failure and deaths. The NOAEL was 1.0 gm/kg.

*SENSITIZATION (ANIMAL AND HUMAN STUDIES)*

Repeated skin contact with ethylene glycol may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

*REPRODUCTIVE TOXICITY*

A three-generation study indicated that ethylene glycol did not affect reproductive parameters at dietary concentrations up to 1.0 gm/kg/day in any generation.

*CHRONIC TOXICITY AND CARCINOGENICITY*

Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence or a different pattern of tumors compared with untreated controls. The absence of a carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

*GENETIC TOXICOLOGY*

**In Vitro:** Ethylene glycol was devoid of genotoxic activity in an Ames test, forward gene mutation and sister chromatid exchange (SCE) studies in Chinese Hamster Ovary (CHO) cells and an in vitro cytogenetics study.

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

**In Vivo:** Ethylene glycol by three different routes (intravenous, peroral and percutaneous) demonstrates apparent first-order pharmacokinetic behavior for the disposition in and the elimination from the plasma. Dose-dependent changes occur for the elimination of metabolites in the urine and as $14CO^2$ after single doses for the intravenous and peroral, but not the percutaneous route. The hypothesis from literature sources exists that developmental toxicity is caused by a metabolite of ethylene glycol, called glycolic acid, and not parent ethylene glycol. Under most conditions of ethylene glycol exposure, the glycolic acid metabolite is present in the blood in very low levels. However, it can become the major metabolite following large doses of ethylene glycol due to saturation of glycolic acid oxidation and/or elimination. When levels of this acidic metabolite exceed the capacity of maternal blood buffers to neutralize it, a maternal metabolic acidosis ensues, which has been hypothesized to be the true agent responsible for ethylene glycol induced developmental toxicity. Research suggests that ethylene glycol developmental toxicity is due to a dose-rate dependent toxicokinetic shift leading to glycolate accumulation and metabolic acidosis.

*ADDITIONAL STUDIES*

Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect doses for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also, in a preliminary study to assess the effects of exposure of pregnant rats and mice to aerosols at concentrations of 150, 1000 and 2500 $mg/m^3$ for 6 hours a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the developmental toxicity was mediated by inhalation of aerosol, percutaneous absorption of ethylene glycol from contaminated skin, or swallowing of ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 2500 $mg/m^3$) and developmental toxicity with minimal evidence of teratogenicity (2500 $mg/m^3$). The no-effects concentration (based on maternal toxicity) was 500 $mg/m^3$. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to the skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen. There is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental toxicity. Exposure to high aerosol concentrations is only minimally effective in producing developmental toxicity.

## *12. ECOLOGICAL INFORMATION*

*ENVIRONMENTAL FATE*

**Movement & Partitioning:** Bioconcentration potential is low (BCF less than 100 or Log Kow less than 3). Log octanol/water partition coefficient (log Kow) is -1.36. Henry's Law Constant (H) is 6.0E-08 atm-m3/mol. Bioconcentration factor (BCF) is 10 in golden orfe.

**Degradation & Transformation:** Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD greater than 40%). 5-Day biochemical oxygen demand (BOD5) is 0.78 p/p. 10-Day biochemical oxygen demand (BOD10) is 1.06 p/p. 20-Day biochemical oxygen demand (BOD20) is 1.15 p/p. Theoretical oxygen demand (THOD) is calculated to be 1.29 p/p. Biodegradation may occur under both aerobic and anaerobic conditions (in either the presence or absence of oxygen). Inhibitory concentration (IC50) in OECD "Activated Sludge, Respiration Inhibition Test" (Guideline # 209) is < 1000 mg/L. Degradation is expected in the atmospheric environment within days to weeks.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

**Ecotoxicology:** Material is practically non-toxic to aquatic organisms on an acute basis (LC50 greater than 100 mg/L in most sensitive species). Acute LC50 for fathead minnow (Pimephales promelas) is 51000 mg/L. Acute LC50 for bluegill (Lepomis macrochirus) is 27549 mg/L. Acute LC50 for rainbow trout (Oncorhynchus mykiss) is about 18000-46000 mg/L. Acute LC50 for guppy (Poecilia reticulata) is 49300 mg/L. Acute LC50 for water flea (Daphnia magna) is 46300-51100 mg/L. Acute LC50 for the cladoceran Ceriodaphnia dubia is 10000-25800 mg/L. Acute LC50 for crayfish is 91430 mg/L. Acute LC50 for brine shrimp (Artemia salina) is 20000 mg/L. Acute LC50 for golden orfe (Leuciscus idus) is greater than 10000 mg/L. Acute LC50 for goldfish (Carassius auratus) is greater than 5000 mg/L. Growth inhibition EC50 for green alga Selenastrum capricornutum is 9500-13000 mg/L.

**BOD (% Oxygen Consumption):**

| Day 5 | Day 10 | Day 15 | Day 20 | Day 30 |
|---|---|---|---|---|
| 51% | 80% | | 97% | |

*ECOTOXICITY*

**Toxicity to Micro-organisms:**
Bacterial / NA: 16 h; IC50
Result Value: >10000 mg/l

**Toxicity to Aquatic Invertebrates:**
Daphnia: 48 h; LC50
Result Value: >100000 mg/l

**Toxicity to Fish**
Fathead Minnow: 94 h; LC50
Result Value: 70000 mg/l

*FURTHER INFORMATION*

Chemical Oxygen Demand (COD) – Measured: 1.29 mg/mg
Theoretical Oxygen Demand (THOD) – Calculated: 1.30 mg/mg

Octanol/Water Partition Coefficient – Measured: -1.36

### *13. DISPOSAL CONSIDERATIONS*

***DO NOT*** discharge to sewer. Wear appropriate personal protection. Take up with sand, vermiculite, or similar inert material. Dispose in accordance with federal, state and local regulations.

### *14. TRANSPORT INFORMATION*

**U.S. DEPARTMENT OF TRANSPORTATION**
**Non-Bulk**
Not regulated by the US D.O.T. (in quantities under 5,000 lbs in any one inner package)

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

**Bulk**

| | |
|---|---|
| Proper Shipping Name: | Environmentally Hazardous Substance, LIQUID N.O.S. (ETHYLENE GLYCOL) |
| Technical Name: | ETHYLENE GLYCOL |
| ID Number: | UN 3082 |
| Hazard Class: | 9 |
| Packing Group: | PG III |
| Reportable Quantity: | 5,000 lb. |

**IATA**
**Non-Bulk**
Not Regulated by IATA

**IMDG**
**Non-Bulk**
Not regulated by IMDG (in quantities under 5,000 lbs in any one inner package)

### *15. REGULATORY INFORMATION*

*THIS PRODUCT CONTAINS COMPONENT(S) CITED ON THE FOLLOWING REGULATIONS.*

| | *Chemical Name* | *Cas Number* |
|---|---|---|
| | Ethylene Glycol | 107-21-1 |

**United States - TSCA Inventory:** Listed

**Water Standards:** No data available

**Atmospheric Standards:** Clean Air Act (1990) - List of Hazardous Air Contaminants: listed

**CERCLA:** Reportable Quantity (RQ): 5,000 pounds (532 gallons)

**OSHA Hazard Communication Standard:** This product is a "hazardous chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

**SARA Title III:**

Section 311/312 - Categories: Acute hazard; chronic hazard

Section 312 - Inventory Reporting: Ethylene glycol is subject to Tier I and/or Tier II annual inventory reporting.

Section 313 - Emission Reporting: Ethylene glycol is subject to Form R reporting requirements.

Section 302 - Extremely Hazardous Substances: Ethylene glycol is not listed.

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### ANTIFREEZE AND COOLANT (CONTINUED)

**State Right-To-Know:**

| | |
|---|---|
| California - Exposure Limits - Ceilings: | vapor-50 ppm ceiling; 125 mg/m3 ceiling |
| Director's List of Hazardous Substances: | listed |
| Florida - Hazardous Substances List: | listed |
| Massachusetts - Right-to-Know List: | listed |
| Minnesota - Haz. Subs. List: | listed (particulate and vapor) |
| New Jersey - Right-to-Know List (Total): | Present greater than 1.0% |
| Pennsylvania Right-to-Know List: | environmental hazard |

**Canadian Regulations:** This product has been classified in accordance with the hazard criteria of the Controlled *Products Regulations* (CPR) and the MSDS contains all the information required.

**WHMIS Information:** **D2A** - material has potential toxic effects. Refer elsewhere in the MSDS for specific warnings and safe handling information. Refer to the employer's workplace education program.

**California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986):** The normal consumer use of this product does not result in exposure to chemicals known to the state of California to cause Cancer and/or reproductive harm above the significant risk level for carcinogens or the maximum allowable dose levels for reproductive toxins. Warnings are not required for consumer packaging. However, industrial or other occupational use of this product at higher frequency and using larger quantities of this product may result in exposures exceeding these levels and are labeled accordingly.

**California SCAQMD Rule 443.1 (South Coast Air Quality Management District Rule 443.1, Labeling of Materials Containing Organic Solvents):**

VOC: Vapor pressure 0.06 mmHg at 20°C
1113.38 g/l

***16. OTHER INFORMATION***

**Contact:** Thomas Cholke Phone: (847) 559-2225

**Old World Industries, Inc. makes no warranty, representation or guarantee as to the accuracy, sufficiency or completeness of the material set forth herein. It is the user's responsibility to determine the safety, toxicity and suitability of his own use, handling and disposal of this product. Since actual use by others is beyond our control, no warranty, expressed or implied, is made by Old World Industries, Inc. as to the effects of such use, the results to be obtained or the safety and toxicity of this product, nor does Old World Industries, Inc. assume liability arising out of the use by others of this product referred to herein. The data in this MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.**

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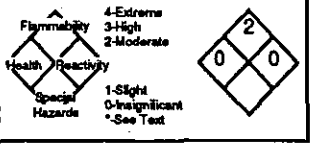
## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL

**BP OIL**

# MATERIAL SAFETY DATA SHEET

| 24-HOUR EMERGENCY ASSISTANCE | GENERAL ASSISTANCE | NFPA FIRE HAZARD SYMBOL* |
|---|---|---|
| BP America: 800-321-8642<br>CHEMTREC Assist: 800-424-9300 | 216-441-8106 (Technical)<br>216-586-8023 (MSDS) |  |
| MSDS Number > 1354 | Version #: 5 | |



**MANUFACTURER/SUPPLIER:** BP Oil Company
**ADDRESS:** 200 Public Square, Cleveland, OH 44114-2375

## PRODUCT IDENTIFICATION

**TRADE NAME:**
## LOW SULFUR NO. 2 DIESEL

**CAS NUMBER:** 68476-34-6
**SYNONYM(S):** PROCESS STREAM; NO. 2 DIESEL FUEL; FUEL OIL; MIDDLE DISTILLATE; AB0/AA9-1; AG7; AG8
**CHEMICAL FAMILY:** PETROLEUM HYDROCARBONS
**MOLECULAR FORMULA:** MIXTURE
**MOLECULAR WEIGHT:** NA
**PRODUCT CODE:** NA **HIERARCHY:** 040.020

## PRODUCT HAZARD SUMMARY

**HEALTH**
DANGER!
HARMFUL OR FATAL IF SWALLOWED
ASPIRATION HAZARD IF SWALLOWED--CAN ENTER LUNGS AND CAUSE DAMAGE
MAY BE IRRITATING TO THE SKIN, EYES AND RESPIRATORY TRACT
VAPORS MAY BE HARMFUL
POSSIBLE CANCER HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA

**FLAMMABILITY**
CAUTION!
COMBUSTIBLE LIQUID & VAPOR

**REACTIVITY**
STABLE

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

**PRODUCT HEALTH HAZARD INFORMATION**

**INGESTION:**
MODERATELY TOXIC (ACUTE EXPOSURE). Human oral LDLo = ~10 mls. Aspiration into lungs may cause pneumonitis. May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea. May cause harmful central nervous system effects. Effects may include excitation, euphoria, headache, dizziness, drowsiness, blurred vision, fatigue, tremors, convulsions, loss of consciousness, coma, respiratory arrest and death.

**SKIN:**
PRACTICALLY NON-TOXIC (ACUTE EXPOSURE). Rabbit dermal LD50 = >5 ml/kg. MODERATELY IRRITATING. Repeated or prolonged contact may result in defatting, redness, itching, inflammation, cracking and possible secondary infection. May cause allergic reactions in some individuals. Absorption from prolonged or massive skin contact may cause poisoning. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Injury may not appear serious at first; within a few hours, tissue will become swollen, discolored and extremely painful (see Notes to Physician section).

**EYE:**
SLIGHTLY IRRITATING. Exposure to vapors, fumes or mists may cause irritation.

**INHALATION:**
May cause respiratory tract irritation. Exposure may cause central nervous system symptoms similar to those listed under "Ingestion" (see Ingestion section). Degenerative changes in the liver, kidneys and bone marrow may occur with prolonged, high concentrations. Repeated or prolonged exposures may cause behavioral changes.

**SPECIAL TOXIC EFFECTS:**
Products of similar composition have produced skin cancer in laboratory animals and have been positive in mutagenic test systems.

IARC has determined that diesel engine exhaust is probably carcinogenic to humans. (IARC Class--2A). Lifetime exposure to whole diesel exhaust has been shown to cause cancer in laboratory animals. NIOSH recommends that whole diesel exhaust be regarded as a potential occupational carcinogen.

WARNING: The use of any hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of combustion products and inadequate oxygen levels. IARC has determined that occupational exposures in petroleum refining are probably carcinogenic to humans.

**FIRST AID**

**INGESTION:**
DO NOT INDUCE VOMITING BECAUSE OF DANGER OF ASPIRATING LIQUID INTO LUNGS. Get immediate medical attention. If spontaneous vomiting occurs, monitor for breathing difficulty.

**SKIN CONTACT:**
Remove contaminated clothing immediately. Wash area of contact thoroughly with soap and water. Get medical attention if irritation persists. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Get immediate medical attention.

**EYE CONTACT:**
Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be

ND = No Data
NA = Not Applicable

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation persists.

**INHALATION:**
Remove affected person from source of exposure. If not breathing, ensure clear airway and institute cardiopulmonary resuscitation (CPR). If breathing is difficult, administer oxygen if available. Get medical attention.

**NOTES TO PHYSICIAN**

In case of ingestion, gastric lavage with activated charcoal can be used promptly to prevent absorption. Consideration should be given to the use of an intratracheal tube, to prevent aspiration. Individuals intoxicated by Diesel Fuel No. 2 should be hospitalized immediately, with acute and continuing attention to neurologic and cardiopulmonary function. Positive pressure ventilation may be necessary. After the initial episode, individuals should be followed for changes in blood variables and the delayed appearance of pulmonary edema and chemical pneumonitis. Such patients should be followed for several days or weeks for delayed effects, including bone marrow toxicity, hepatic and renal impairment. Individuals with chronic pulmonary disease will be more seriously impaired, and recovery from inhalation exposure may be complicated. In case of skin injection, prompt debridement of the wound is necessary to minimize necrosis and tissue loss.

**PERSONAL PROTECTION INFORMATION**

**EYE PROTECTION:**
Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye washing facilities readily available where eye contact can occur.

**SKIN PROTECTION:**
Wear impervious gloves and protective clothing to prevent skin contact.

**RESPIRATORY PROTECTION:**
NIOSH/MSHA approved breathing equipment must be available for non-routine and emergency use. Ventilation may be used to control or reduce airborne concentrations.

**PHYSICAL PROPERTIES**

**BOILING POINT:** 160 C (320 F)
**SPECIFIC GRAVITY:** 0.84 - 0.88 @ 60 F
**MELTING POINT:** NA
**% VOLATILE:** NEGLIGIBLE
**VAPOR PRESSURE:** 0.4 MM HG @ 68 F
**EVAPORATION RATE (WATER=1):** SLOWER
**VAPOR DENSITY (AIR=1):** 4.7
**VISCOSITY:** 1.2 - 4.6 CST @ 100 F
**% SOLUBILITY IN WATER:** NEGLIGIBLE
**OCTANOL/WATER PARTITION COEFFICIENT:** ND
**POUR POINT:** -12.22 C (10 F)
**pH:** NEUTRAL
**APPEARANCE/ODOR:** CLEAR LIQUID WITH HYDROCARBON ODOR. MAY BE DYED FOR IDENTIFICATION.

ND = No Data
NA = Not Applicable

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

#### FIRE AND EXPLOSION DATA

FLASH POINT: 51.700 C (125 F)
AUTOIGNITION TEMPERATURE: ND
FLAMMABILITY LIMITS IN AIR (% BY VOL.) LOWER: 0.700
FLAMMABILITY LIMITS IN AIR (% BY VOL.) UPPER: 5.000

BASIC FIREFIGHTING PROCEDURES:
Use water spray, dry chemical, foam or carbon dioxide to extinguish fire. Use water spray to cool fire-exposed containers, structures and to protect personnel. If leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers or other drainage systems. Exposed firefighters must wear MSHA/NIOSH approved positive pressure self-contained breathing apparatus with full face mask and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Irritating or toxic substances may be emitted upon thermal decomposition. Dangerous when exposed to heat or flame. Runoff to sewer may cause fire or explosion hazard. Containers may explode in heat of fire.

#### REACTIVITY DATA

STABILITY/INCOMPATIBILTY:
Stable. Avoid contact with strong oxidizers.

HAZARDOUS REACTIONS/DECOMPOSITION PRODUCTS:
Combustion may produce CO, CO2 and reactive hydrocarbons.

#### ENVIRONMENTAL INFORMATION

SPILL OR RELEASE TO THE ENVIRONMENT:
If your facility or operation has an "Oil or Hazardous Substance Contingency Plan", activate its procedures.

-- Take immediate steps to stop and contain the spill. Caution should be exercised regarding personnel safety and exposure to the spilled material.

-- For technical advice and assistance related to chemicals, contact CHEMTREC (800/424-9300) and your local fire department.

-- Notify the National Response Center, if required. Also notify appropriate state and local regulatory agencies, the LEPC and the SERC. Contact the local Coast Guard if the release is into a waterway.

When reporting a spill to the National Response Center or the Coast Guard, you may need to supply the Coast Guard Chemical Hazard Response Information System (CHRIS) code:

Group Number: 33 CHRIS Code: OTD

Additional spill related information may be found in the U.S. Coast Guard Chemical Hazard Response Information System (CHRIS) Manual.

Emergency Action:
Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out

ND = No Data
NA = Not Applicable

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

of low areas. (Also see Personal Protection Information section.)

**Spill or Leak Procedure:**
Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces. Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Large Spills: Dike far ahead of liquid spill for later disposal.

**Notification:**
Any spill or release, or substantial threat of release, of this material to navigable water (virtually any surface water) sufficient to cause a visible sheen upon the water must be reported immediately to the National Response Center (800/424-8802), as required by U.S. Federal Law. Failure to report may result in substantial civil and criminal penalties. Also contact the Coast Guard and appropriate state and local regulatory agencies.

**WASTE DISPOSAL:**
This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however it could be characteristically hazardous if it is considered toxic, corrosive, ignitable, or reactive according to Federal definitions (40 CFR 261). Additionally, it could be designated as hazardous according to state regulations. This substance could also become a hazardous waste if it is mixed with or comes in contact with a hazardous waste. Check 40 CFR 261 to determine whether it is a hazardous waste. If it is a hazardous waste, regulations at 40 CFR 262, 263, 264, 268 and 270 apply. Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate or otherwise inappropriate.

The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, state, and local regulations.

**SARA TITLE III INFORMATION:**
Listed below are the hazard categories for the Superfund Amendments and Reauthorization Act (SARA) Section 311/312 (40 CFR 370):

Immediate Hazard: X Delayed Hazard: X Fire Hazard: X Pressure Hazard: - Reactivity Hazard: -

**ADDITIONAL ENVIRONMENTAL REGULATORY INFORMATION:**
There may be specific regulations at the local, regional or state level that pertain to this material.

**REGULATORY INFORMATION**

All components of this product are listed on the TSCA inventory.

The following Canadian Workplace Hazardous Materials Information System (WHMIS) categories apply to this product:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Compressed Gas | - | Flammable/Combustible | X | Oxidizer | - | Acutely Toxic | - |
| Other Toxic Effects | X | BioHazardous | - | Corrosive | - | Dangerously Reactive | - |

ND = No Data
NA = Not Applicable

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

**SPECIAL PRECAUTIONS/SUPPLEMENTAL INFORMATION**

**HANDLING/STORAGE:**
Store in tightly closed containers in cool, dry, isolated, well-ventilated area away from heat, sources of ignition and incompatibles. Use non-sparking tools. Ground lines and equipment used during transfer to reduce the possibility of static spark-initiated fire or explosion.

**EMPTY CONTAINERS:**
Empty containers may contain toxic, flammable/combustible or explosive residue or vapors. Do not cut, grind, drill, weld, reuse or dispose containers unless adequate precautions are taken against these hazards.

**TRANSPORTATION REQUIREMENTS (DOMESTIC LAND)**

| | |
|---|---|
| D.O.T. PROPER SHIPPING NAME (49 CFR 172.101): | FUEL OIL (NO. 2) |
| D.O.T. HAZARD CLASS (49 CFR 172.101): | 3 |
| UN/NA CODE (49 CFR 172.101): | NA 1993 |
| PACKING GROUP (49 CFR 172.101): | PG III |
| BILL OF LADING DESCRIPTION (49 CFR 172.202): | FUEL OIL (NO.2), 3, NA 1993, PG III |
| D.O.T. LABELS REQUIRED (49 CFR 172.101): | NOT REGULATED |
| D.O.T. PLACARDS REQUIRED (49 CFR 172.504): | COMBUSTIBLE |

**INGREDIENTS/HEALTH HAZARD INFORMATION**

| COMPONENT | CAS NO. | % | EXPOSURE LIMITS - REF. |
|---|---|---|---|
| A distillate having a minimum viscosity of 32.6 SUS at 100 degrees F to a maximum of 40.1 SUS at 100 degrees F | 68476-34-6 | 99.90-100 | None established |

REVISION DATE: 17-feb-1995 REPLACES SHEET DATED: 02-feb-1994
COMPLETED BY: BP OIL HSEQ DEPARTMENT



ND = No Data
NA = Not Applicable

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## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

DIESEL FUEL (CONTINUED)

**BP OIL** **RECOMMENDED LABEL DATA**

# LOW SULFUR NO. 2 DIESEL

**DANGER!**

HARMFUL OR FATAL IF SWALLOWED
ASPIRATION HAZARD IF SWALLOWED--CAN ENTER LUNGS AND CAUSE DAMAGE
MAY BE IRRITATING TO THE SKIN, EYES AND RESPIRATORY TRACT
VAPORS MAY BE HARMFUL
POSSIBLE CANCER HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA
COMBUSTIBLE LIQUID & VAPOR

**Before using this product, read the MSDS which contains more detailed precautionary measures, handling instructions and emergency procedures.**

### PRECAUTIONARY STATEMENTS

Avoid contact with skin, eyes and clothing. If contact is unavoidable, wear protective clothing, face protection and gloves. Use with adequate ventilation. After handling, wash thoroughly with soap and water. Keep away from heat, sparks and open flame. Keep container closed.

### FIRST AID

INGESTION:
DO NOT INDUCE VOMITING BECAUSE OF DANGER OF ASPIRATING LIQUID INTO LUNGS. Get immediate medical attention. If spontaneous vomiting occurs, monitor for breathing difficulty.

SKIN CONTACT:
Remove contaminated clothing immediately. Wash area of contact thoroughly with soap and water. Get medical attention if irritation persists. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Get immediate medical attention.

EYE CONTACT:
Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation persists.

INHALATION:
Remove affected person from source of exposure. If not breathing, ensure clear airway and institute cardiopulmonary resuscitation (CPR). If breathing is difficult, administer oxygen if available. Get medical attention.

### BASIC FIRE FIGHTING PROCEDURES

Use water spray, dry chemical, foam or carbon dioxide to extinguish fire. Use water spray to cool fire-exposed containers, structures and to protect personnel. If leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers or other drainage systems. Exposed firefighters must wear MSHA/NIOSH approved positive pressure self-contained breathing

## 1.4 SAFETY

## MATERIAL SAFETY DATA SHEETS

### DIESEL FUEL (CONTINUED)

apparatus with full face mask and full protective clothing.

**SPILL OR LEAK PROCEDURE**

Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces. Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Large Spills: Dike far ahead of liquid spill for later disposal.

**REGULATORY INFORMATION**

The following Canadian Workplace Hazardous Materials Information System (WHMIS) categories apply to this product:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Compressed Gas | - | Flammable/Combustible | x | Oxidizer | - | Acutely Toxic | - |
| Other Toxic Effects | x | BioHazardous | - | Corrosive | - | Dangerously Reactive | - |

**TRANSPORTATION REQUIREMENTS (DOMESTIC LAND)**

| | |
|---|---|
| BILL OF LADING DESCRIPTION (49 CFR 172.202): | FUEL OIL (NO.2), 3, NA 1993, PG III |
| D.O.T. LABELS REQUIRED (49 CFR 172.101): | NOT REGULATED |

**EMPTY CONTAINERS**

ATTENTION!

Empty containers may contain toxic, flammable/combustible or explosive residue or vapors. Do not cut, grind, drill, weld, reuse or dispose containers unless adequate precautions are taken against these hazards.
OBSERVE ALL PRECAUTIONARY LABELING.

**INGREDIENTS INFORMATION**

The following component(s) of this product are listed in accordance with right-to-know laws:

| Component(s): | CAS Number: |
|---|---|
| A distillate having a minimum viscosity of 32.6 SUS at 100 degrees F to a maximum of 40.1 SUS at 100 degrees F | 68476-34-6 |

**MANUFACTURER DETAILS**

BP Oil Company
200 Public Square, Cleveland, OH 44114-2375
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General Assistance: 216-441-8106 (Technical)
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Issue Date: 17-feb-1995

ND = No Data
NA = Not Applicable

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# SYSTEMS DESCRIPTION

SECTION PAGE

## SYSTEM DESCRIPTION

### 2.1 ENGINE

The RX-500 milling machine is powered by the Cummins QSX-15 diesel engine. The Cummins QSX-15 is a 915 cubic inch (15 liter) in-line turbocharged and after-cooled diesel, which is capable of producing 630 horsepower (469 kw) at 2100 rpm.

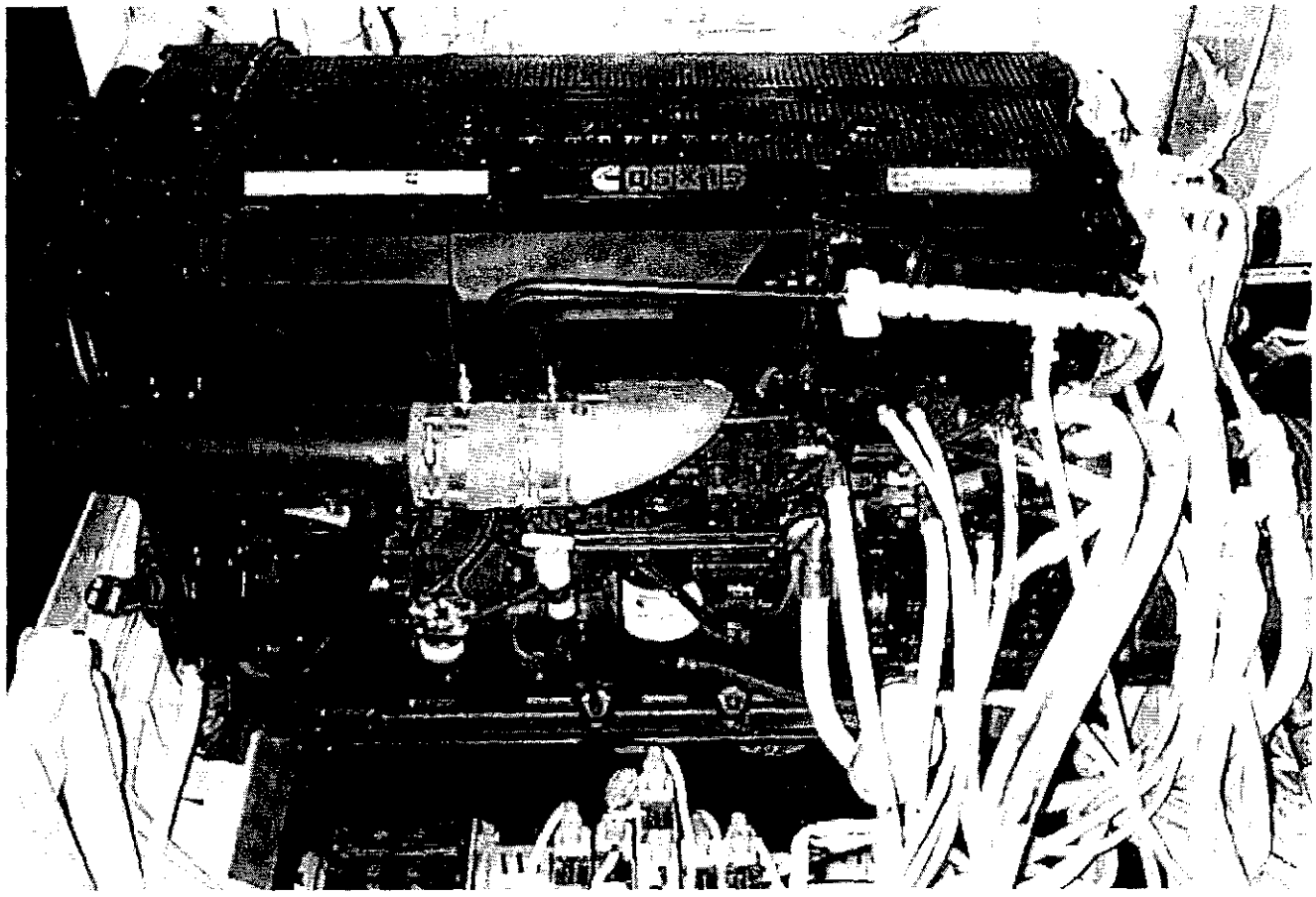



**FIGURE 1**

A turbocharger uses exhaust gas energy to pack more air into the engine cylinders. Efficient fuel combustion, improved fuel consumption and reduced heat are a few of the benefits that can be attained from a turbocharged engine. It will also compensate to maintain combustion air density for operating in higher altitudes. These engines will deliver full rated power up to 8500 feet (2590 meters) above sea level.

The after cooler cools the pressurized intake air from the turbocharger, permitting greater air density for more complete combustion of fuel.

The engine is also equipped with an oil cooler as well as a fuel cooler, both of which support optimal engine performance through lower operating temperatures.

## 2.1 ENGINE

The engine is equipped with an electronic control module (ECM), which is connected to many sensors on the engine. These sensors relay vital information to the ECM for monitoring engine functions. High coolant temperature or low oil pressure will activate sensors that open the circuit to the fuel injector solenoid, shutting off the fuel supply to the engine.

The engine data plate shows specific information about your engine: (1) the engine serial number (ESN), (2) control parts list (CPL), (3) model, (4) horsepower and rpm rating provide information for ordering parts and service needs (figure 2).

The engine data plate must not be changed unless approved by the engine manufacturer.

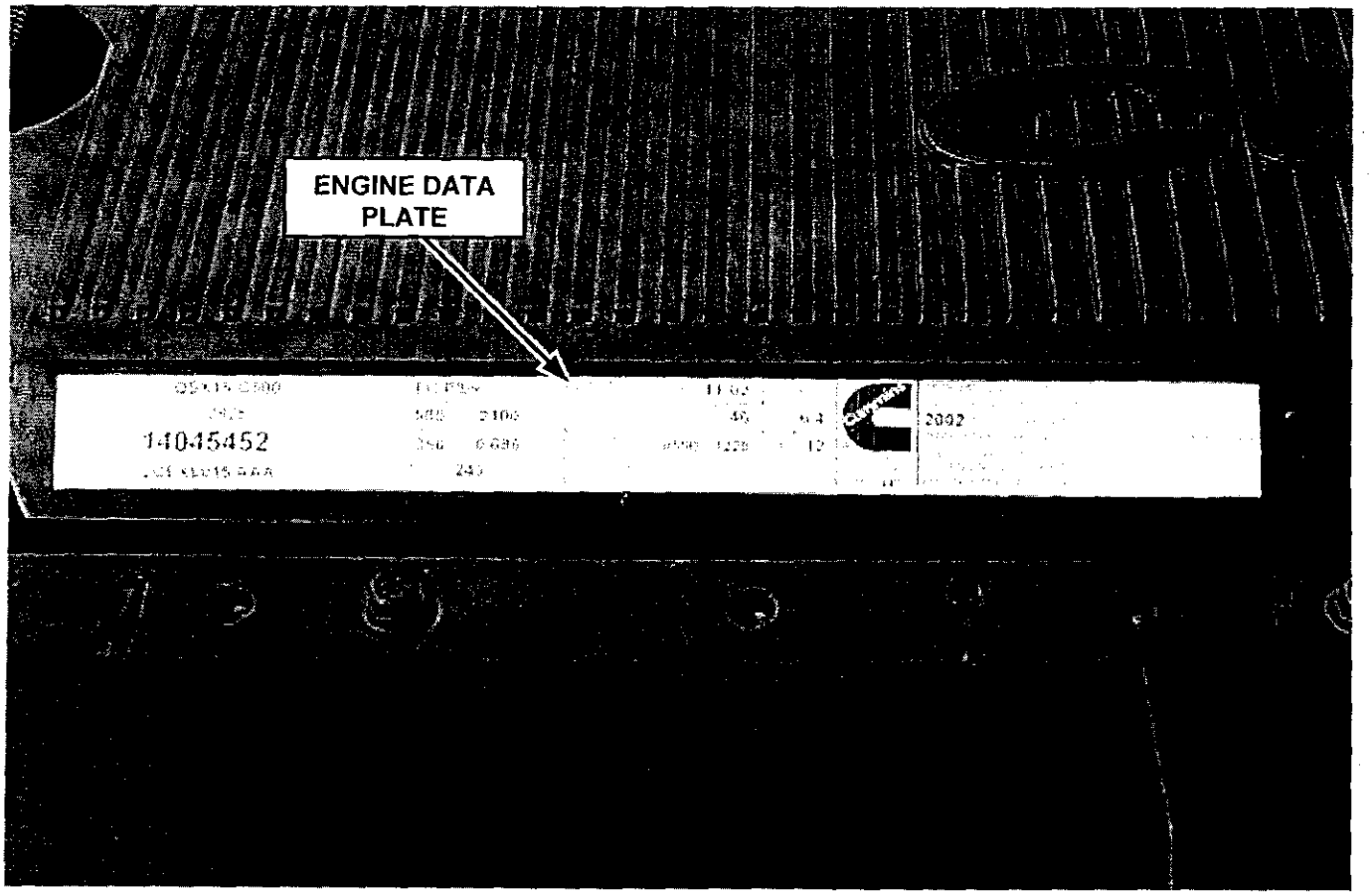



**FIGURE 2**

## FUEL

Always use a reputable grade of diesel fuel, the sulfur content of which should be below 0.5%. Higher sulfur contents affect oil change intervals. Observe strict cleanliness when filling tank. At low ambient temperatures, use winter-grade fuel only. The fuel must be replenished promptly to prevent the tank from running dry: otherwise the fuel filters and injection lines will have to be air-vented.

## 2.2 ELECTRICAL SYSTEM

The RX-500 is equipped with two 12-volt batteries that are connected in a series that provide power to the 24 volt electrical system (figure 3). The batteries are the center of the electrical system and with proper care will ensure trouble-free operation. A 60 amp alternator supplies the current that is necessary to maintain battery charge.

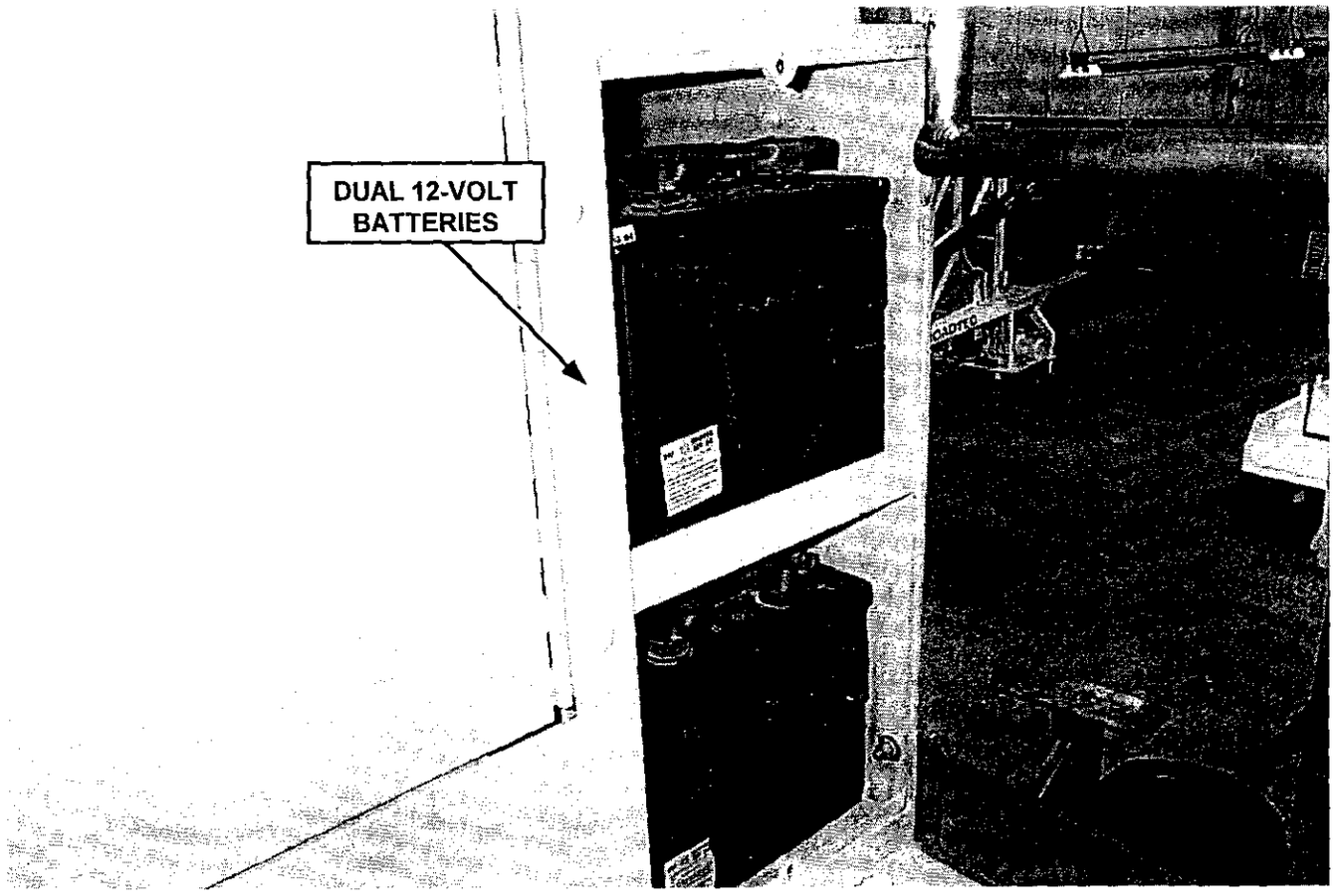



FIGURE 3

## 2.3 HYDRAULIC SYSTEMS

The RX-500's hydraulic system is comprised of five engine driven hydraulic pumps that provide hydraulic power to the various system motors and valves. These pumps are: the main drive pump, primary conveyor pump, secondary conveyor pump, auxiliary pump and radiator fan pump. The hydraulic power supplied by these pumps drive the following hydraulic circuits: main drive, steering, leg tubes, primary conveyor, secondary conveyor, secondary conveyor swing, brake, hood raise, moldboard raise, endgate raise, belt tensioning, spraybar / washdown and radiator fan. The main drive, primary conveyor, secondary conveyor, clutch and auxiliary pump pressures can be monitored from the operators console instrument panel.

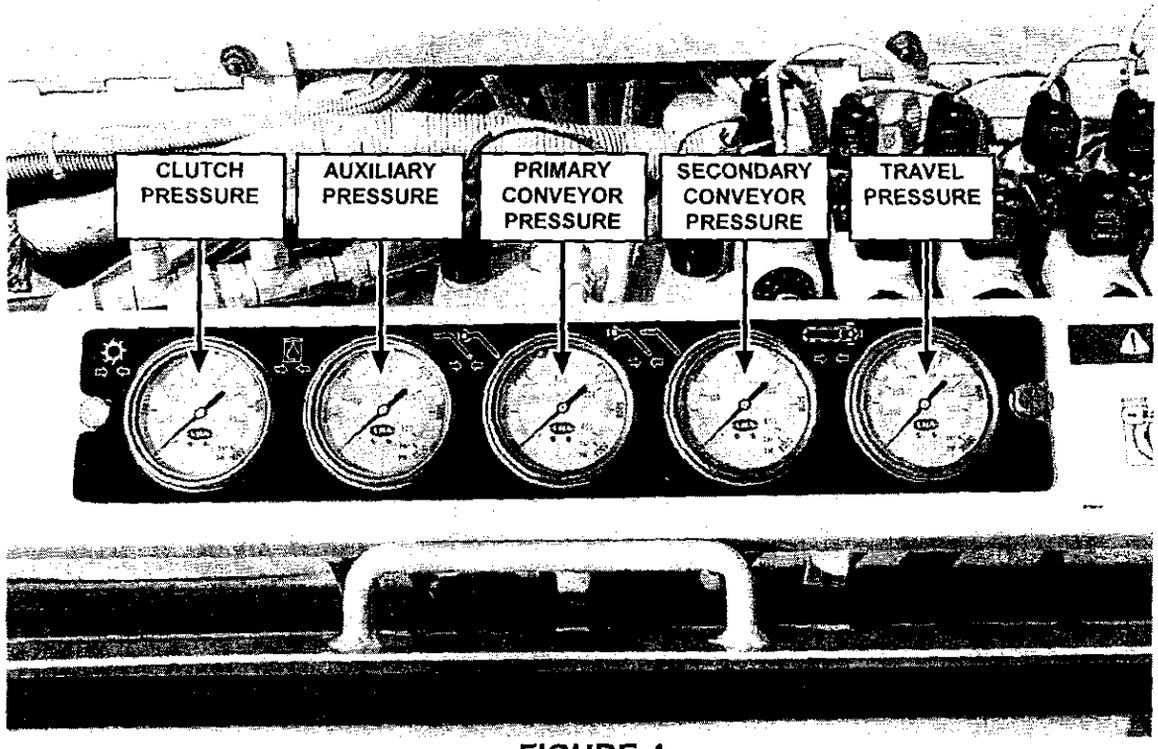



**FIGURE 4**

All hydraulic circuits are supplied hydraulic oil from a 84 gallon (317 liter) hydraulic oil tank. It is recommended that the hydraulic tank only be filled to 90% capacity, 75.6 gallons (286 liters), to prevent overflow due to heat expansion of the hydraulic oil during operation.

# OPERATING PROCEDURES

## 3.1 BEFORE STARTING THE MACHINE

Before operating the RX-500 for the first time, carefully read and understand this manual. Familiarize yourself with the machine, its systems and controls. Read and study the milling machine safety manual provided in the literature package.

**FOLLOW ALL SAFETY PRECAUTIONS!**

**NOTE** **FOLLOW ALL MAINTENANCE AND SERVICE INSTRUCTIONS CAREFULLY.FAILURE TO DO SO MAY VOID THE WARRANTY.**

## 3.2 PRE-START CONDITIONS

1. Operator's platform is for properly trained and qualified personnel only. There is to be only one operator on the platform at a time. **"NO RIDERS!"**

2. Check machine fluid levels: engine oil, hydraulic fluid, radiator coolant and water tank level. Be sure that all theses fluids are filled to their proper operational level. Be sure to fill the hydraulic tank to only 90 % capacity to allow for fluid expansion.

3. Inspect water filter and spray bar nozzles. A clogged sparybar nozzle will not allow the much needed cooling water to spray the cutter drum or spray bars.

4. Perform a "walk around" visual inspection for signs of fluid leaks or component wear. Visually inspect high-wear components such as cutter teeth, engine belts, conveyor belts and track pads.

5. Observe and abide by all safety decals that have been placed on the machine.

6. After boarding the machine, always latch the operator station gates located on both sides of the operator's station.

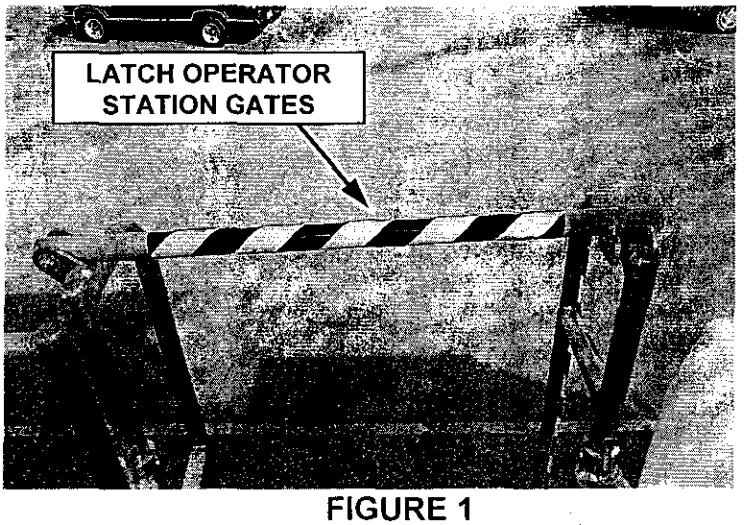



**FIGURE 1**

## OPERATING PROCEDURES

## 3.2 PRE-START CONDITIONS

### MIRRORS

Before traveling or operating this machine mirrors must be mounted to the appropriate locations on the machine. These mirrors are intended to increase the operator's visibility around the machine.

1. This machine is equipped with mounting brackets for mirrors at each corner of the machine.

2. The spare parts kit that came with the machine contains four mirrors. Two of these mirrors are round and two of them are square.

3. Mount the round mirrors to the rear mounting brackets using the supplied hardware (figure 2).

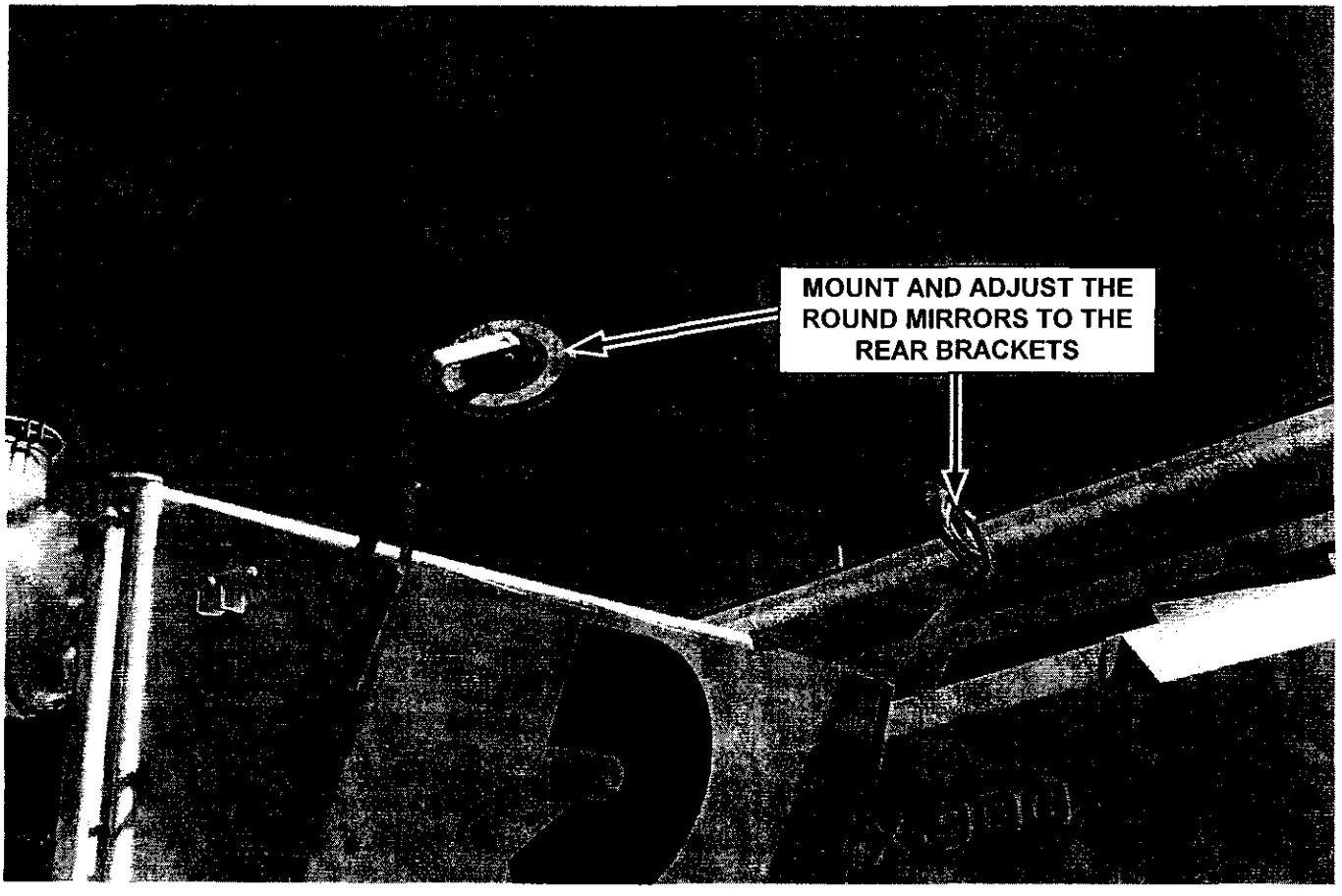



**FIGURE 2**

## OPERATING PROCEDURES

### 3.2 PRE-START CONDITIONS

### MIRRORS

4. Mount the square mirrors to the front mounting brackets using the supplied hardware (figure 3).

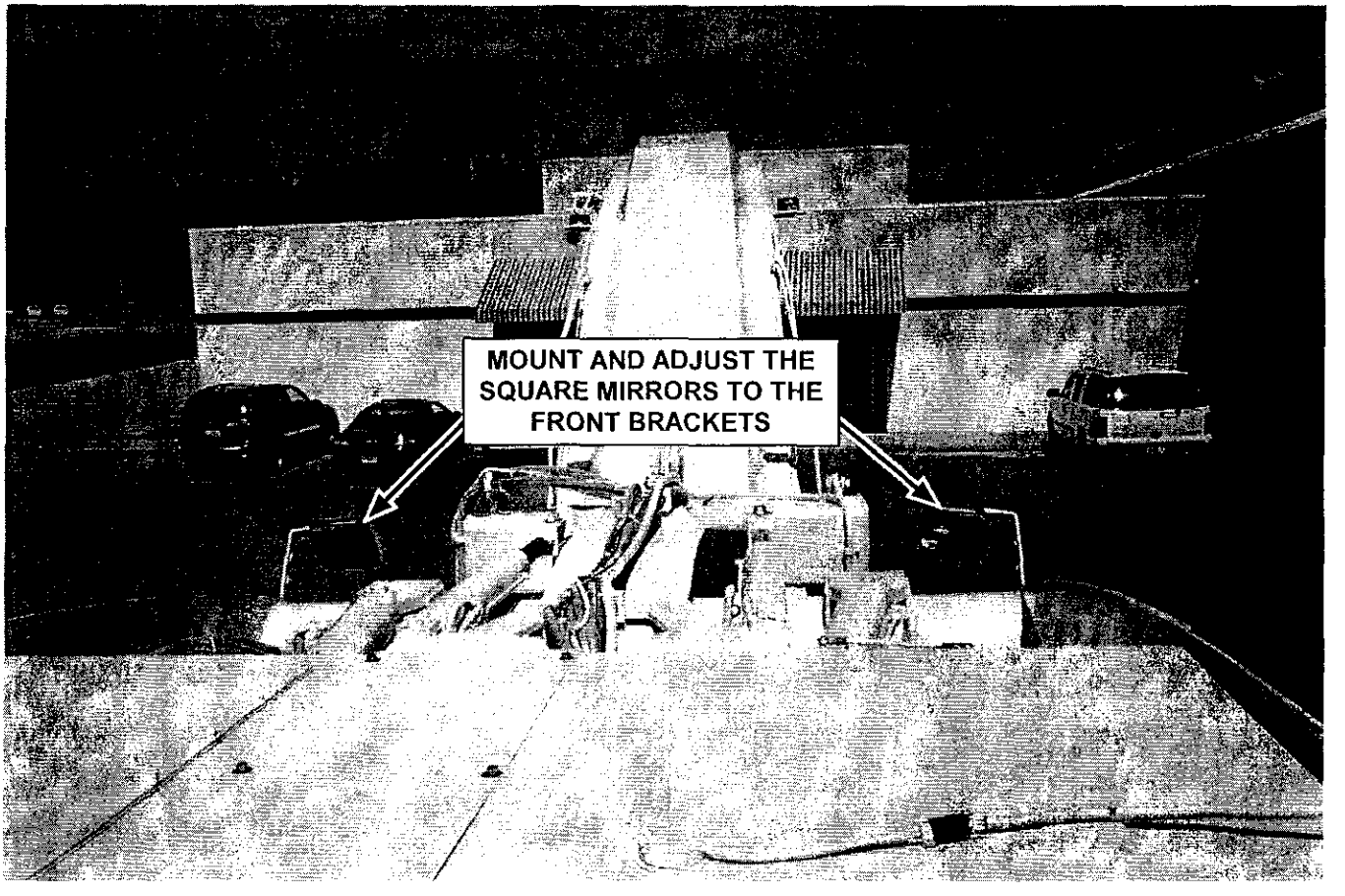



**FIGURE 3**

5. ADJUST THE MIRRORS SO THE OPERATOR CAN CLEARLY SEE THEM AND ATTAIN THE BEST POSSIBLE VISIBILITY AROUND THE MACHINE.

## 3.3 OPERATORS CONSOLE

The RX-500 operators console is simple and easy to access. A user friendly array of controls and gauges simplifies operation of the RX-500. The console is broken down into three sections: left console, center console and right console. The center console contains a wide variety of general functions and gauges. The left and right consoles are made up of the same basic controls so that the machine can be piloted from either side of the operator's station depending on the need of the operator and the requirements of the job being performed. Console lights provide illumination for night time operation.

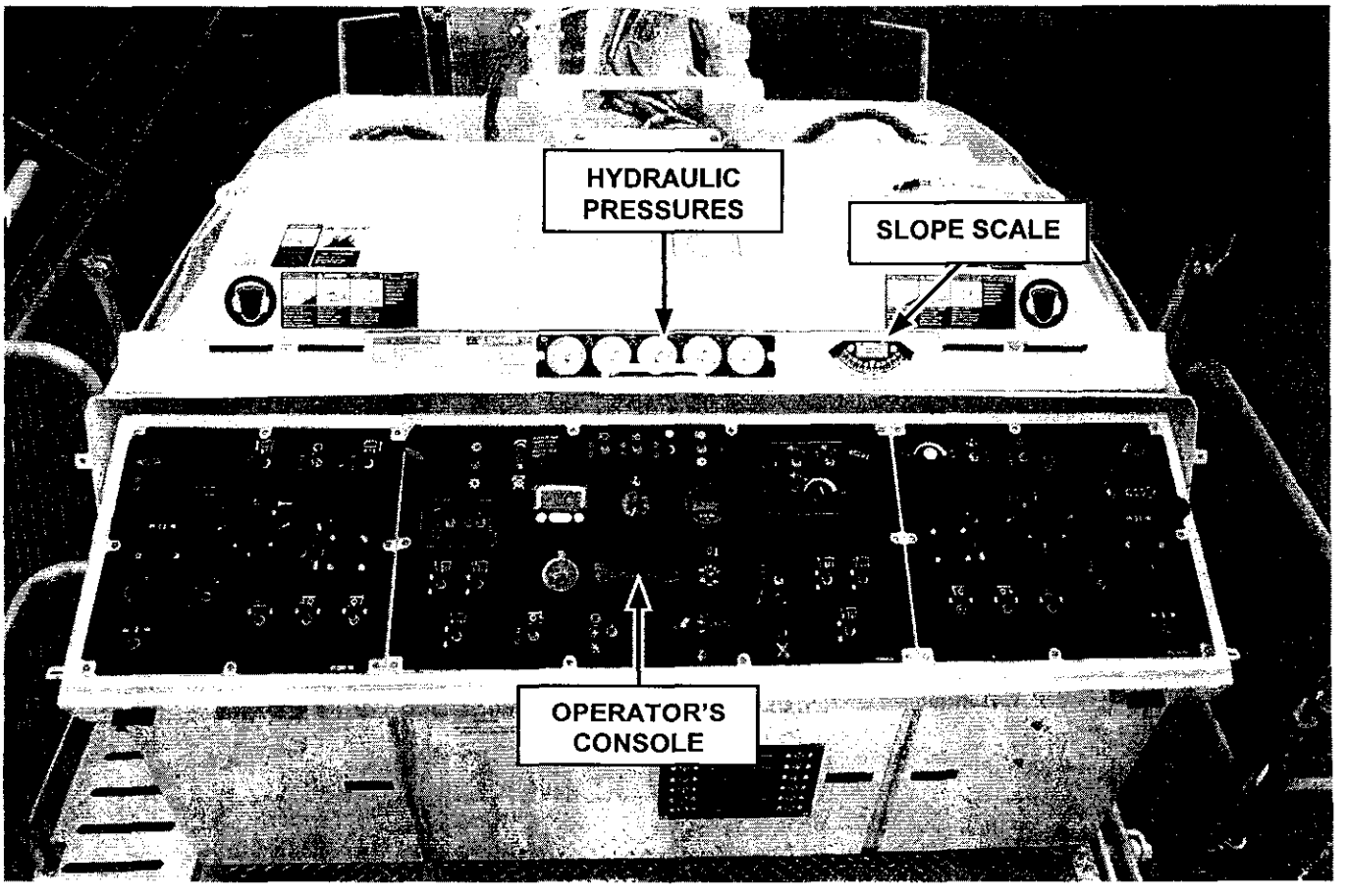



**FIGURE 4**

## 3.3 OPERATORS CONSOLE (CONTINUED)

### LEFT HAND OPERATORS CONSOLE

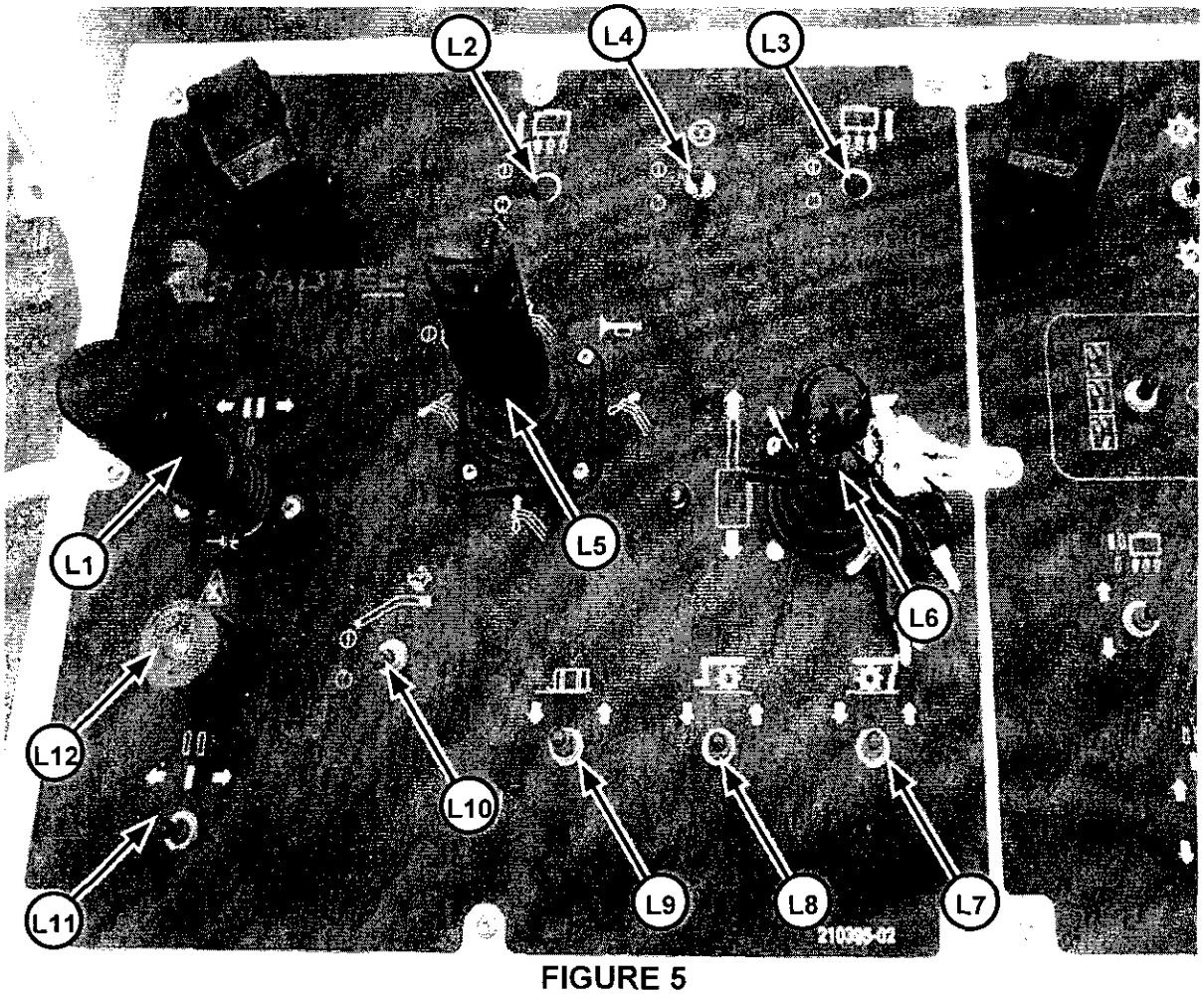



FIGURE 5

USE THE FOLLOWING CHART WHEN REFERENCING THE LEFT HAND OPERATORS CONSOLE.

| |
|---|
| **L1 – STEERING JOYSTICK-** *This Joystick Controls the Machine's Steering While Using Any* Standard Or Coordinated Steering Option. |
| **L2 – LEFT GRADE JACK ON/OFF (OPTIONAL)-** When this switch is activated, left hand grade is maintained automatically through a grade jack that is mounted on the left hand side of the machine. Grade is maintained according to the left grade jack setting. |
| **L3 – RIGHT GRADE JACK ON/OFF (OPTIONAL)-** When this switch is activated, right hand grade is maintained automatically through a grade jack that is mounted on the right hand side of the machine. Grade is maintained according to the right grade jack setting. |
| **L4 – AUTOMATIC GRADE CONROL**- This switch activates the automatic grade control system (Topcon, Moba, etc.) If so equipped. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

**USE THE FOLLOWING CHART WHEN REFERENCING THE LEFT HAND OPERATORS CONSOLE.**

| |
|---|
| **L5 – CONVEYOR JOYSTICK-** Controls the vertical and horizontal position of the secondary conveyor. A thumb switch can be used to temporarily stop the conveyors to allow trucks to be changed out. Also mounted with a fingertip switch that sounds the horn **(ALWAYS SOUND HORN BEFORE STARTING ENGINE).** |
| **L6 – TRAVEL JOYSTICK-** Use this joystick to engage the forward or reverse travel of the machine. The further this joystick is engaged, the faster the machine will travel. Set the joystick in the middle and the machine will stop. |
| **L7 – REAR MOLDBOARD SWITCH-** This switch is used to raise or lower the rear moldboard. Completely lower the rear moldboard before starting the engine. |
| **L8 – FRONT MOLDBOARD SWITCH-** This switch is used to raise or lower the front moldboard. |
| **L9 – ENDGATE SWITCH-** This switch is used to raise and lower right endgate. |
| **L10 – CONVEYOR BOOST-** Temporarily boosts the speed of the secondary conveyor. Use this function in times when the secondary conveyor is being overloaded. |
| **L11 – REAR STEER-** This joystick is used to control the rear steering. |
| **L12 – EMERGENCY STOP-** When this button is pressed the machine's engine will shutdown. In order for the machine to be restarted, all emergency stops must be reset by simply pulling them back to the run position. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

### CENTER CONSOLE

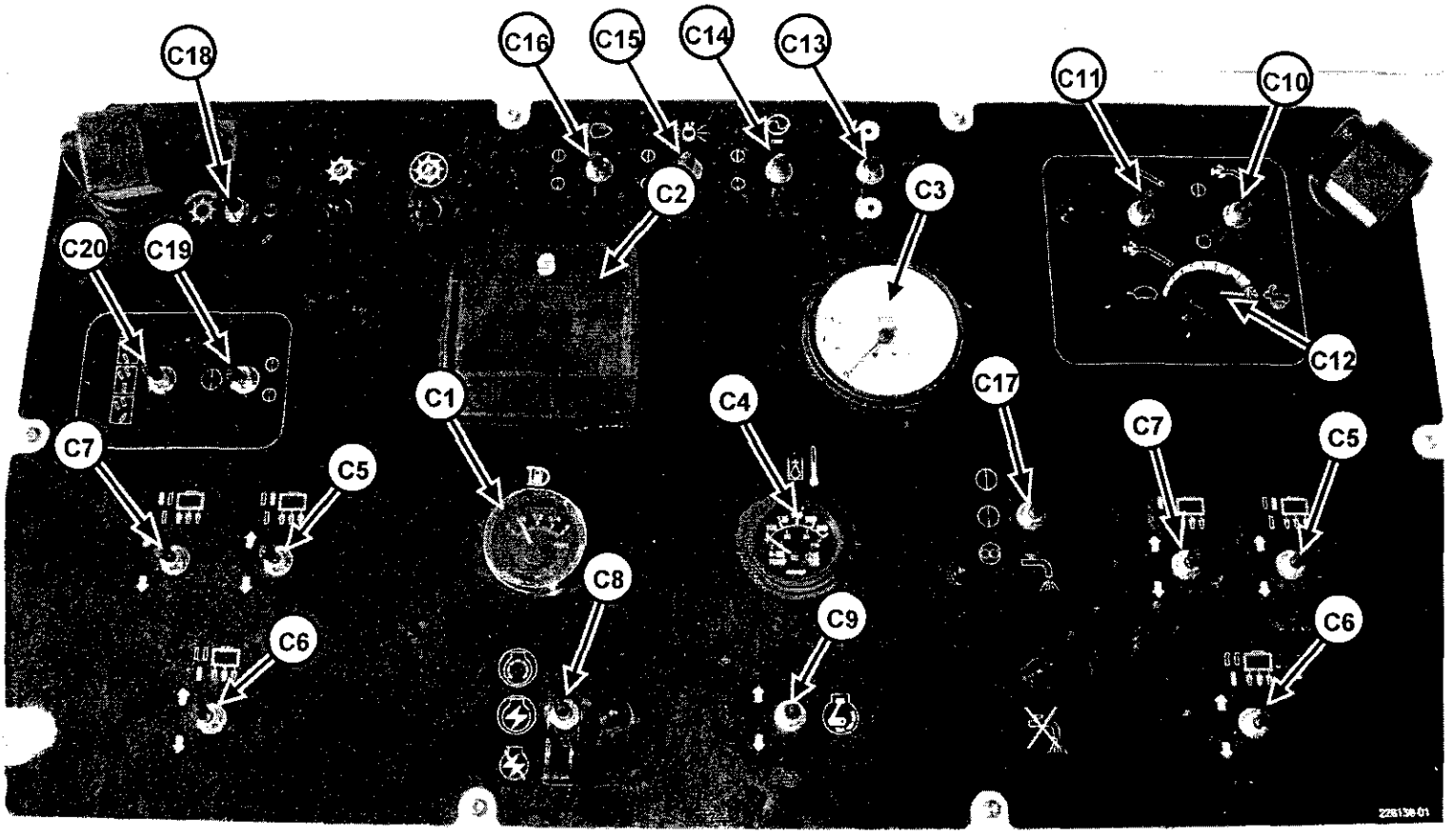



**FIGURE 6**

**USE THE FOLLOWING CHART WHEN REFERENCING THE CENTER CONSOLE.**

| |
|---|
| **C1 – FUEL GAUGE** – Indicates The Amount Of Fuel That Is In The Fuel Tank. |
| **C2 – ENGINE DIAGNOSTIC GAUGE** – This digital gauge is used to monitor engine performance and diagnose problems if they should occur. If the engine were to malfunction the diagnostic gauge would display a fault code that can be used to pinpoint the problem. |
| **C3 – FOOT PER MINUTE GAUGE** – Indicates the working speed in feet per minute. This is very useful when working the machine. |
| **C4 – HYDRAULIC OIL TEMPERATURE GAUGE** – Indicates the hydraulic oil temperature while in operation. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

| |
|---|
| **C5 – RIGHT FRONT ELEVATION** – This joystick raises and lowers the right front legtube of the machine. |
| **C6 – REAR ELEVATION** – This joystick raises and lowers the rear legtube or legtubes of the machine. |
| **C7 – LEFT FRONT ELEVATION** – This joystick raises and lowers the left front legtube of the machine. |
| **C8 – POWER UP / IGNITION SWITCH** – Place this switch in the center position for about 5 seconds before starting the engine in order to activate the machine's prestart processes. Once the system is activated, push and hold this switch in the up position to start the machine's engine. After the engine is started release the switch so that it falls back to the center position. Flip the switch to the down position to shut the engine off. |
| **C9 – ENGINE THROTTLE** – Use this switch to raise or lower the engine speed (RPM). |
| **C10 – CONVEYOR ON/OFF** – Activates And Deactivates The Conveyor System. |
| **C11 – CONVEYOR REVERSE** – This switch can be used to reverse the secondary conveyor. Be sure that the conveyors are stopped before switching to reverse. |
| **C12 – CONVEYOR SPEED** – Turn This Dial To Either Increase Or Decrease The Speed At Which The Conveyors Are Operating. |
| **C13 – PARKING BRAKE SWITCH** – This switch is used to engage and disengage the parking brake. Be sure to always engage the parking brake before shutting the machine down. |
| **C14 – GENERATOR ON/OFF** – Activates and deactivates the electric generator whenever ac power is required. |
| **C15 – BEACON LIGHT SWITCH** – This switch activates the work beacon light. Always activate this beacon when moving or working the machine. |
| **C16 – WORK LIGHT SWITCH** – Activates and deactivates the work lights. Use these lights when operating in low light or at night. |
| **C17 – WATER SYSTEM CONTROL** – Controls the water system by activating the water pump. Auto selection allows the water pump to be activated only when the machine is moving forward. All necessary water valves must be open for the spraybars to actually spray water. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

**USE THIS CHART WHEN REFERENCING THE CENTER CONSOLE.**

| |
|---|
| **C18 – CUTTER DRUM ON/OFF & INTERLOCK SAFETY RESET –** This switch will activate and deactivate the cutter drum. Be sure to activate cutter drum when engine is at idle speed only. Push this switch in the down position to reset the clutch interlock if it has been triggered. Cutter drum will not turn until this is reset. |
| **C19 – COORDINATED STEERING ON/OFF:** This switch will activate or deactivate the coordinated steering system. When not activated only the front tracks will steer the machine. When activated the machine's steering system will respond according to the steering mode that is selected. |
| **C20 – COORDINATED STEERING MODE SELECTOR:** When the coordinated steering switch is activated this switch can be used to select between crab steering, front steering and coordinated steering. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

### RIGHT HAND OPERATORS CONSOLE

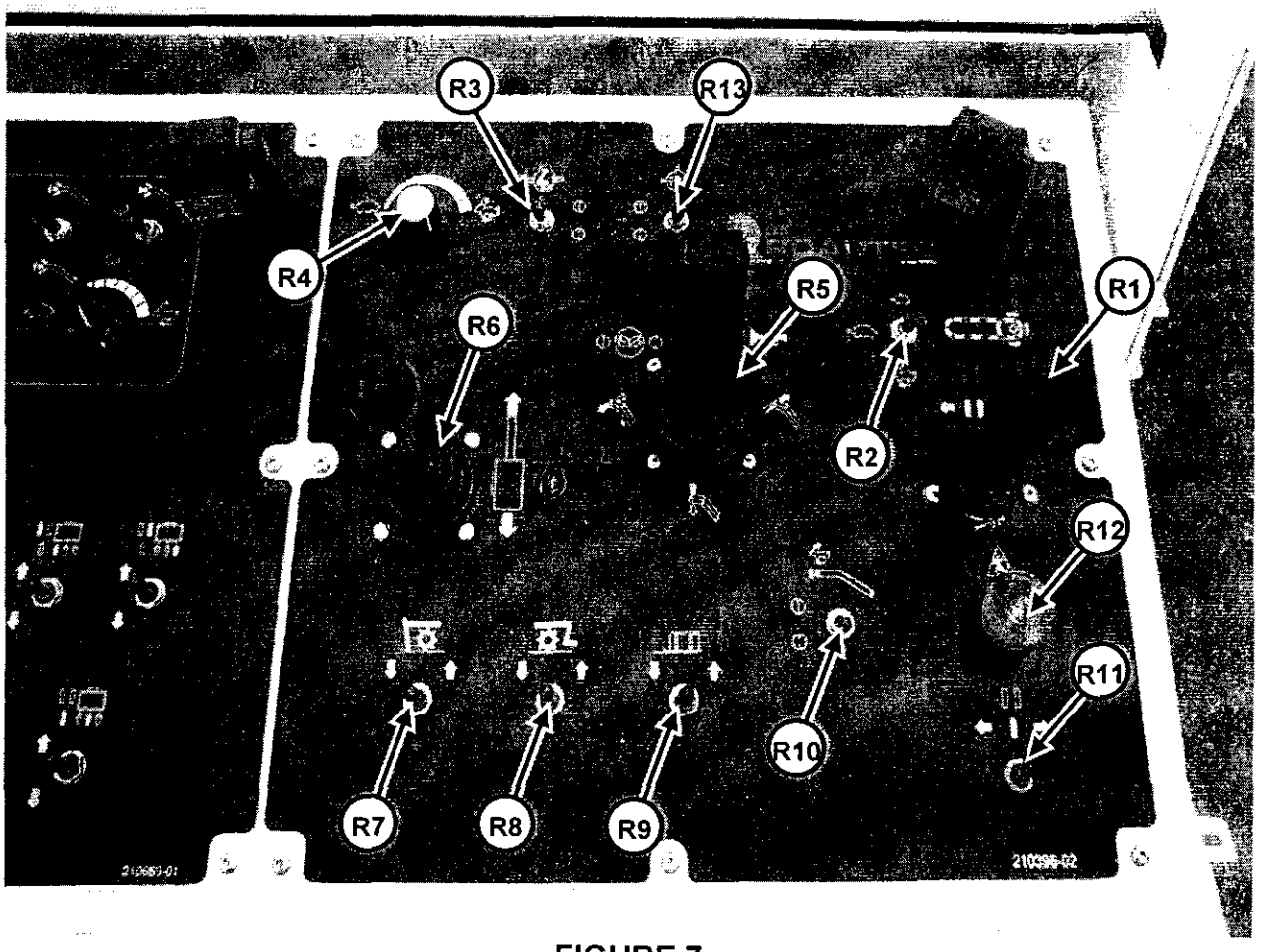



FIGURE 7

**USE THE FOLLOWING CHART WHEN REFERENCING THE RIGHT HAND OPERATORS CONSOLE.**

| |
|---|
| **R1 – STEERING JOYSTICK-** This joystick controls the machine steering while using any standard or coordinated steering option. |
| **R2 – TRAVEL SWITCH-** Used to alternate between travel range and the two working ranges. Be sure the machine is completely stopped before changing the travel range. |
| **R3 – LOAD CONTROL ACTIVATION SWITCH-** This switch will activate and deactivate the load control function which automatically coordinates travel with cutter work to achieve the best possible performance. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

| |
|---|
| **R4 – LOAD CONTROL SPEED DIAL**- *This dial adjusts the speed at which the machine is* milling and traveling when the load control function is activated. |
| ***R5 – CONVEYOR JOYSTICK-*** *Controls the vertical and horizontal position of the secondary* conveyor. A thumb switch can be used to temporarily stop the conveyors to allow trucks to be changed out. Also mounted with a fingertip switch that sounds the horn **(ALWAYS SOUND HORN BEFORE STARTING ENGINE)**. |
| **R6 – TRAVEL JOYSTICK**- Use this joystick to engage the forward or reverse travel of the machine. The further this joystick is engaged, the faster the machine will travel. Set the joystick in the middle and the machine will stop. |
| **R7 – REAR MOLDBOARD SWITCH-** This switch is used to raise or lower the rear moldboard. Completely lower the rear moldboard before starting the engine. |
| **R8 – FRONT MOLDBOARD SWITCH-** This switch is used to raise or lower the front moldboard. |
| **R9 – ENDGATE SWITCH**- This switch is used to raise and lower the right endgate. |
| **R10 – CONVEYOR BOOST-** Temporarily boosts the speed of the secondary conveyor. Use this function in times when the secondary conveyor is being overloaded. |
| **R11 – REAR STEER-** This joystick is used to control the rear track steering. |
| **R12 – EMERGENCY STOP-** When this button is pressed the machine's engine will shutdown. In order for the machine to be restarted, all emergency stops must be reset by simply pulling them back to the run position. |
| **R13 – ANTI-SLIP**- Activates a traction control system the automatically adjusts travel speed as to prevent the machine's tracks from slipping when traveling over questionable terrain. |

## 3.3 OPERATORS CONSOLE (CONTINUED)

### SLOPE SCALE

The slope scale can be found on the upper left hand side of the operator's console.

**THE MACHINE SHOULD NEVER BE OPERATED, TRAVELED, PARKED OR FOR ANY REASON PLACED IN A POSITION THAT IS AT A SLOPE OF MORE THAN 10 DEGREES ON EITHER SIDE.**

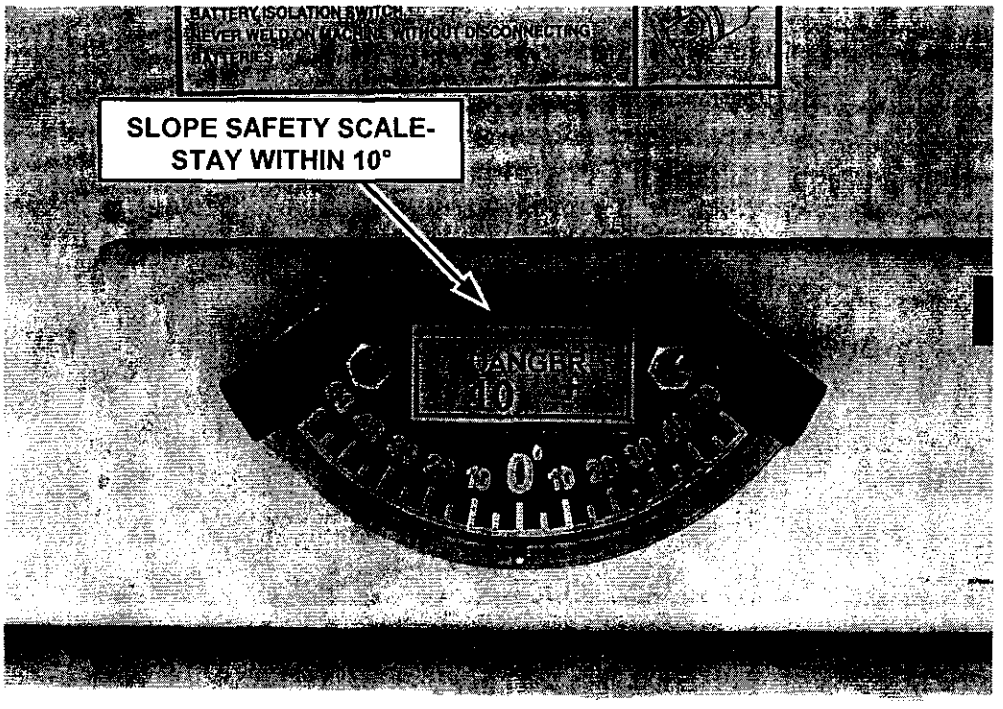



**FIGURE 8**

## 3.3 OPERATORS CONSOLE (CONTINUED)

The hood wings can be raised with the left and right hood wing raise switches. These switches are found at the rear of the operator's station (figure 9).

**CAUTION! – KEEP AWAY FROM MOVING HOOD WINGS!**

Additionally there are two work light receptacles that can be found next to the hood raise switches.

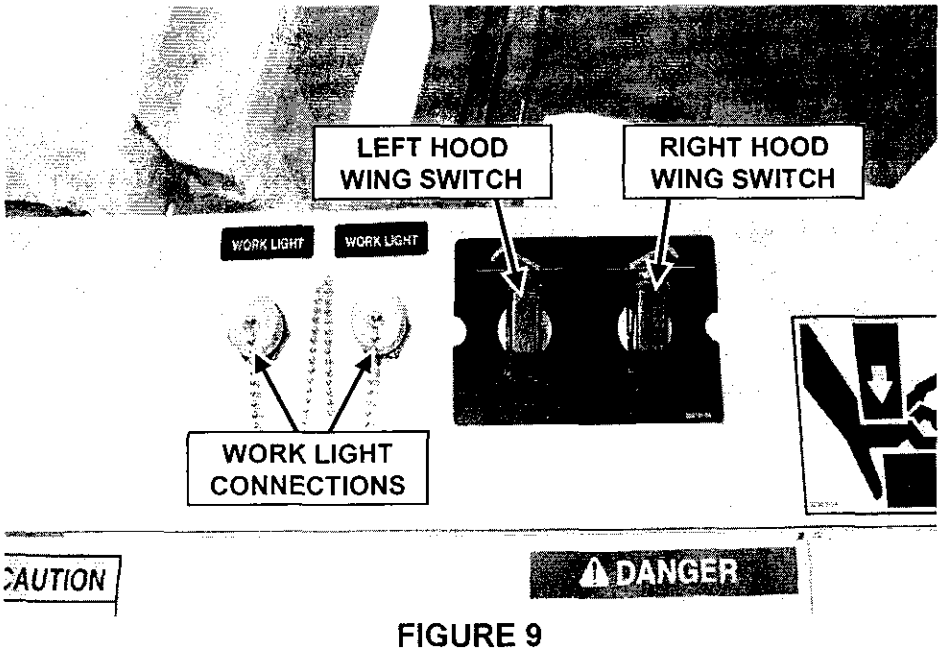



FIGURE 9

An array of gauges can be found on the rear operator's station wall (figure 10). These gauges indicate charge pressure for various hydraulic systems while the machine is in operation.

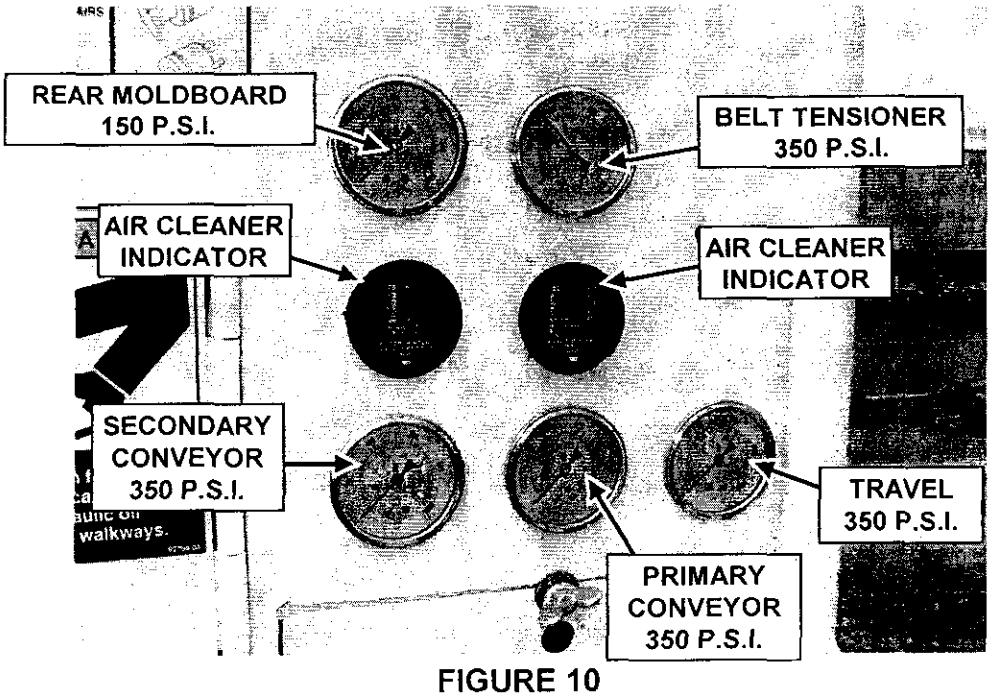



FIGURE 10

## 3.4 GROUND LEVEL CONTROLS

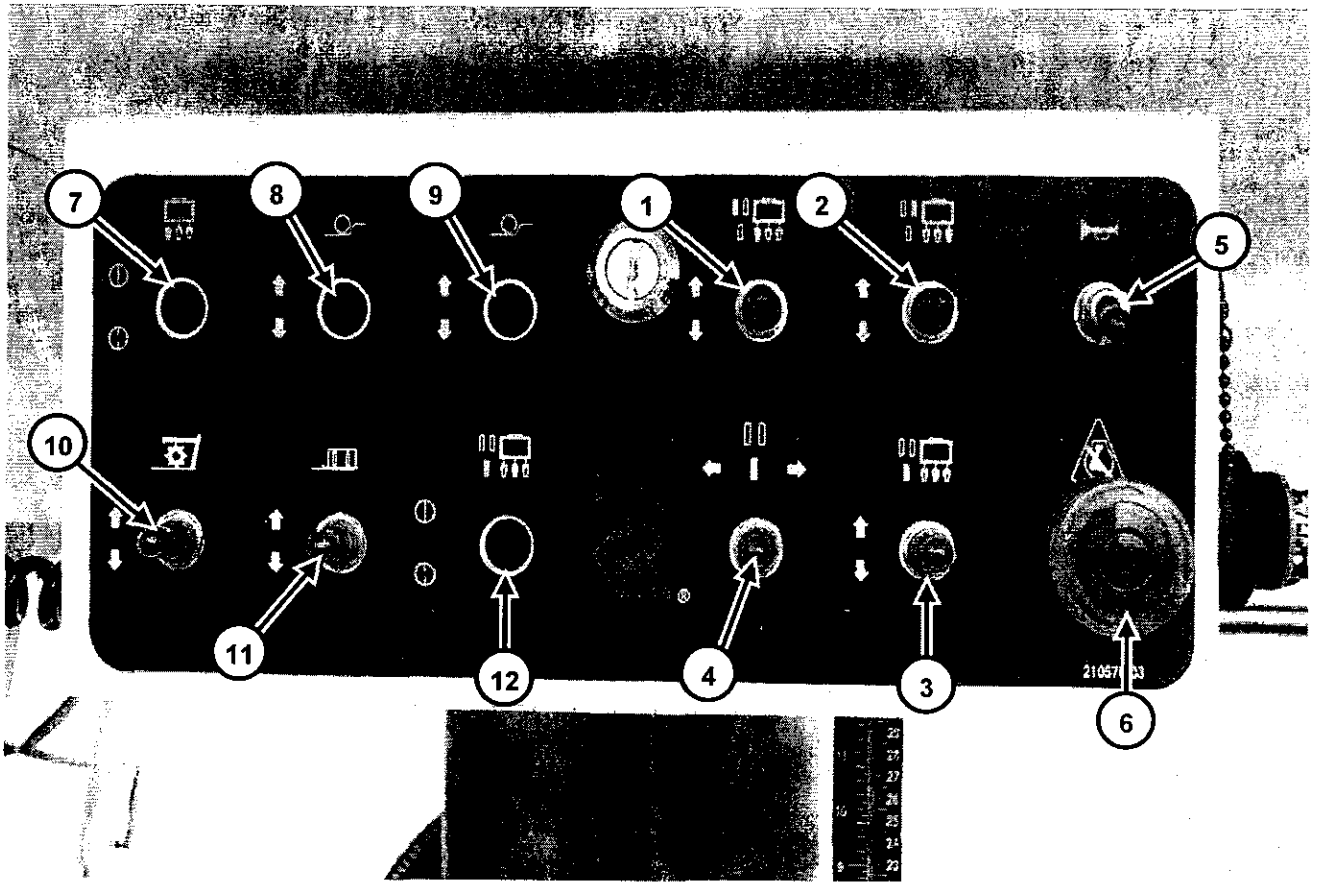



FIGURE 11

There are rear ground controls located on both sides of the machine. Use the following chart to identify the front ground controls.

| |
|---|
| **1. LEFT FRONT ELEVATION**- Raises and lowers the left front legtube. |
| **2. RIGHT FRONT ELEVATION**- Raises and lowers the right front legtube. |
| **3. REAR ELEVATION**- Raises and lowers the rear legtube or legtubes. |
| **4. REAR STEER**- Use this to control the left and right steering of the rear tracks. |

## 3.4 GROUND LEVEL CONTROLS (CONTINUED)

**USE THE FOLLOWING CHART WHEN REFERENCING THE REAR GROUND CONTROLS.**

| |
|---|
| **5. HORN**- Sounds the horn. *Always remember to sound the horn before starting the engine so* that everyone around the machine will be alerted that the engine is about to be started. |
| **6. EMERGENCY STOP**- When pressed, this button will shut the machine down. The machine will not start until all the emergency stops have been pulled out the run position. |
| **7. GRADE JACK ON/OFF (OPTIONAL)**- After the electric grade jacks have been set to the desired position, this switch can be used to activate them. There is a grade jack for each side of the machine and a seperate control for each. Note: All three grade on/off switches (found on the console, front ground box and rear ground box) have to be activated in order for the grade jacks to work. |
| **8. LEFT GRADE JACK CONROL (OPTIONAL)**- Raises and lowers the left electric grade jack. |
| **9. RIGHT GRADE JACK CONTROL (OPTIONAL)**- Raises and lowers the right electric grade jack. |
| **10. REAR MOLDBOARD RAISE AND LOWER**- Raises and lowers the rear moldboard cylinders. Safety features will not allow the machine to start unless the rear moldboard is completely lowered. |
| **11. ENDGATE SWITCH**- Raises and lowers the endgate on that same side of the machine. |
| **12. Rear Automatic Grade Control Switch (Optional)**- This switch activates the rear grade control if the machine is equipped with this option. |

## 3.4 GROUND LEVEL CONTROLS (CONTINUED)

### FRONT GROUND CONTROLS

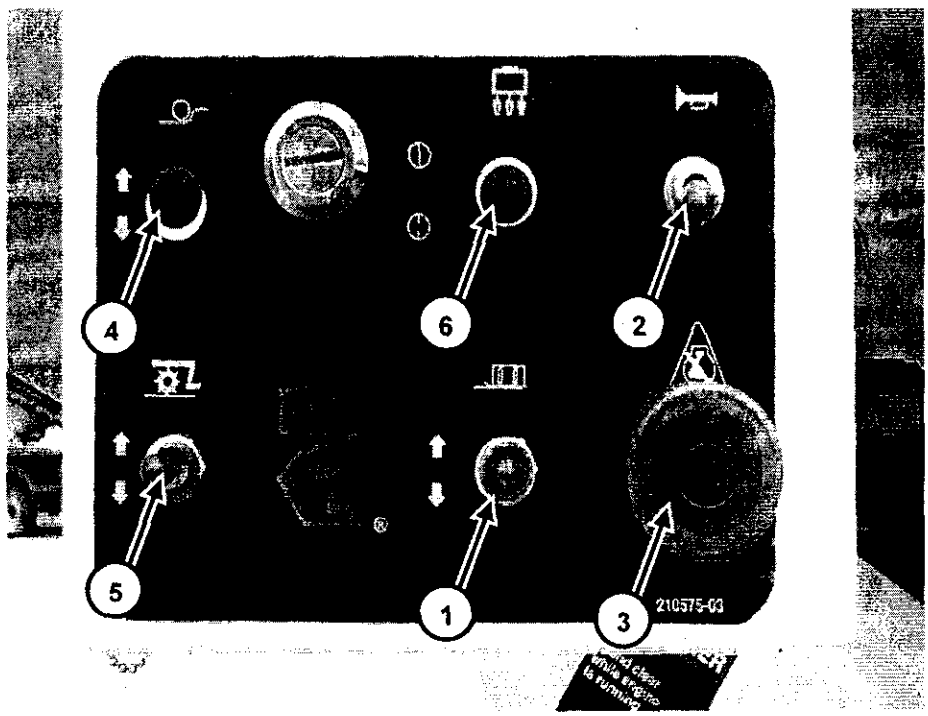



FIGURE 12

There are front ground controls located on both sides of the machine. Use the following chart to identify the front ground controls.

| |
|---|
| **1. ENDGATE SWITCH**- Raises and lowers the endgates. |
| **2. HORN**- Sounds the horn. Always remember to sound the horn before starting the engine so that everyone around the machine will be alerted that the engine is about to be started. |
| **3. EMERGENCY STOP**- When pressed, this button will shut the machine down. The machine will not start until all the emergency stops have been pulled out to the run position. |
| **4. GRADE JACK CONTROL (OPTIONAL)**- Raises and lowers the electric grade jack mounted to that particular side of the machine. |
| **5. FRONT MOLDBOARD RAISE AND LOWER**- Raises and lowers the front moldboard cylinders. Safety features will not allow the machine to start unless the rear moldboard is completely lowered. |
| **6. GRADE JACK ON/OFF (OPTIONAL)**- After the electric grade jacks have been set to the desired position, this switch can be used to activate them. There is a grade jack for each side of the machine and a separate control for each. NOTE: All three grade on/off switches (found on the console, front ground box and rear ground box) have to be activated in order for the grade jacks to work. |

## 3.5 STARTING THE ENGINE

Refer to operator's console figures and descriptions in section 3.3.

**A.** Place throttle control at low idle.

**B.** Place the travel control in neutral.

**C.** Position the conveyor selector switch to off.

**D.** Be sure that the clutch has been disengaged and that the brake is applied.

**E.** Be sure the left and right grade sensors should be off.

**F.** Rear moldboard will have to be in the down position.

**NOTE** Neutral safety switches will prevent the engine from starting unless the travel is in neutral, conveyors off, clutch off and Moldboard is in the down position.

**G.** Place the ignition switch in the system power up position for a few moments. Once the system is powered up, push the ignition to the engine start position until the engine starts. Then allow the switch to fall back into the system power up position.

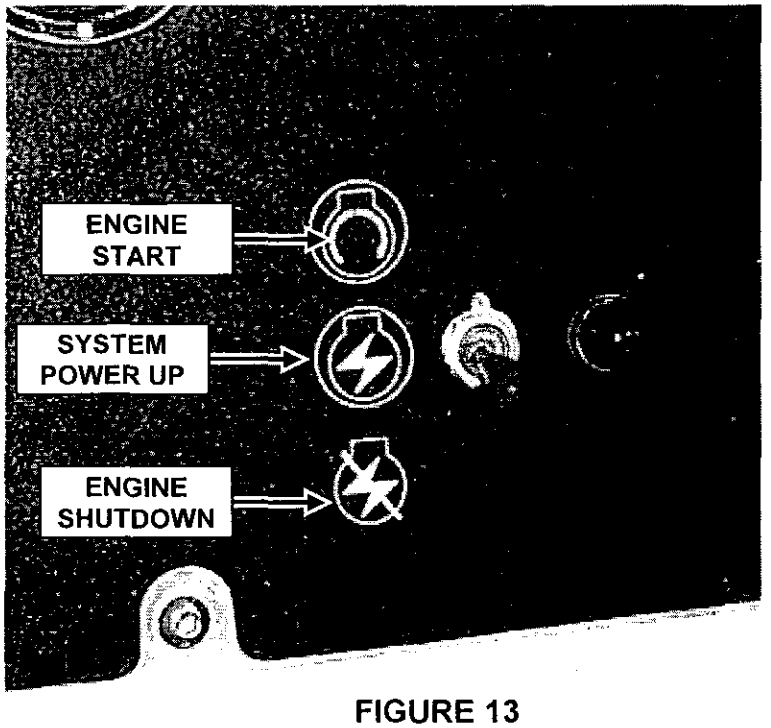



**FIGURE 13**

**NOTE** For cold weather start-up, refer to the specifications section in the engine manufacturer's handbook.

## 3.6 OPERATION OF THE MACHINE

**A**. After the engine has had sufficient time to warm-up (15 to 20 min. unless colder than 30° f then allow 30 min.) Increase throttle to full speed - 2,100 rpm.

**B**. Check all controls and pressures (figure 14) at full engine rpm. Then return the throttle to low and allow the engine to idle.

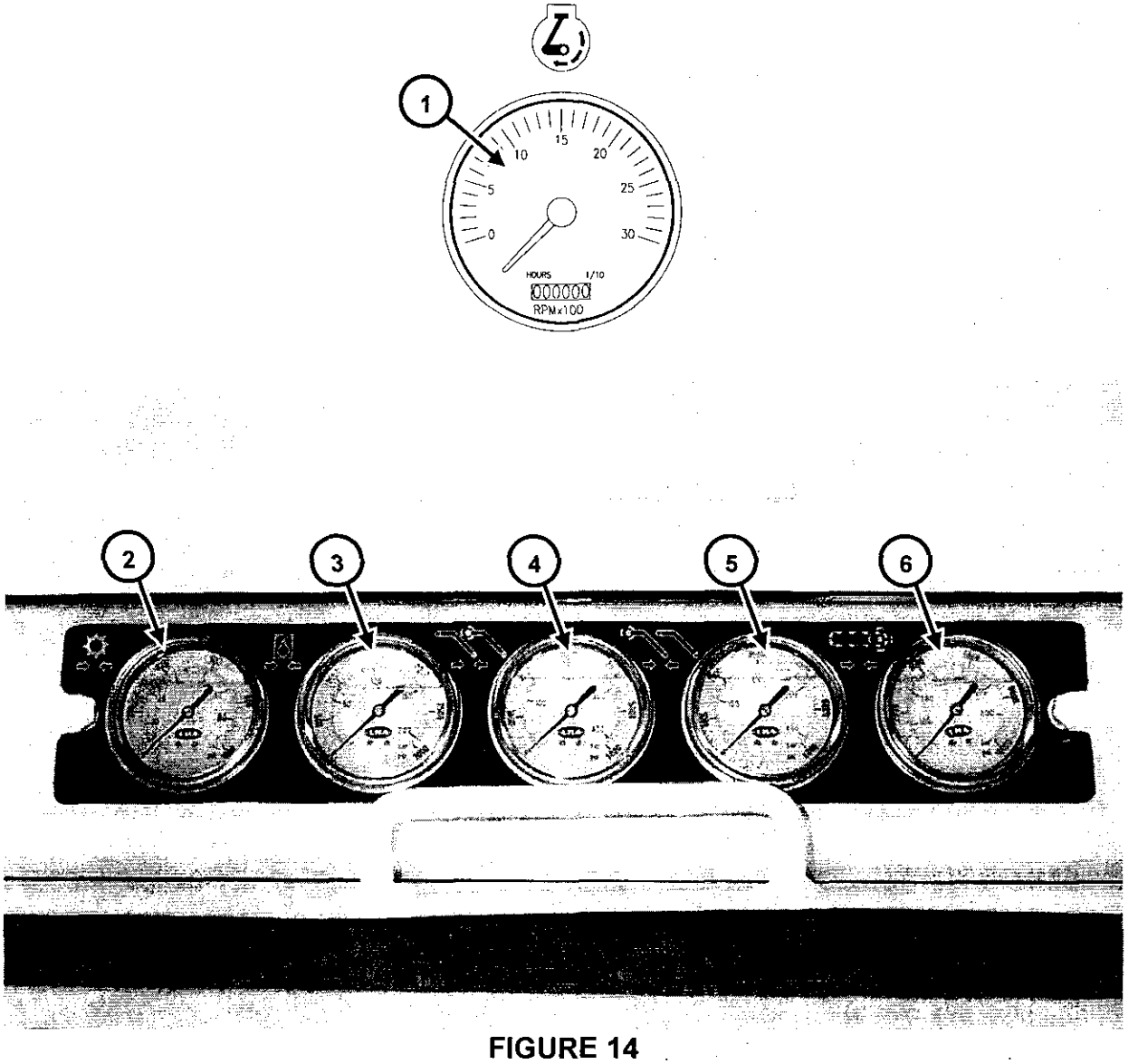



**FIGURE 14**

(1) **TACHOMETER** – 800 RPM AT IDLE AND 2,100 RPM WHILE WORKING
(2) **CLUTCH PRESSURE** - 350 PSI
(3) **AUXILIARY SYSTEM PRESSURE** – 2,800 PSI
(4) **PRIMARY CONVEYOR PRESSURE**- 4,640 PSI
(5) **SECONDARY CONVEYOR PRESSURE** - 4,640 PSI
(6) **TRAVEL PRESSURE** - THREE TRACK - 5,070 PSI

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

**c**. Zero out the grade controls using the following procedure.

**1**. Completely raise the front legtubes and lower the rear of the machine using the rear elevation controls to the desired cutting depth. Use the rear depth indicator scale (figure 13) to accurately judge depth.

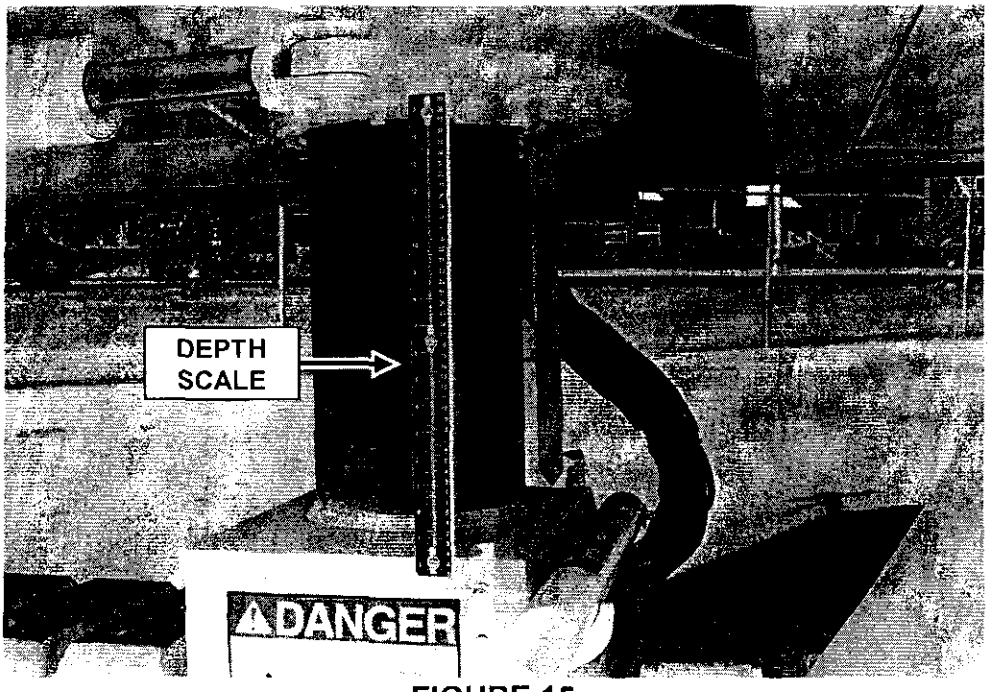



**FIGURE 15**

**2**. Lower the front of the machine using the left and right front elevation controls until the cutter teeth just barely make contact with the ground (figure 14). Do not allow machine to rest on the cutter drum

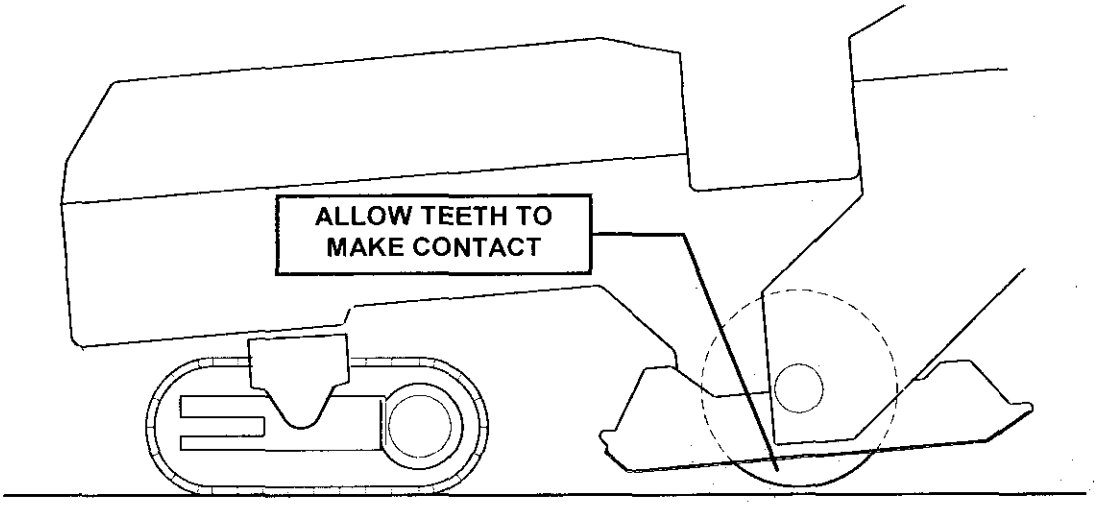



**FIGURE 16**

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

**3**. Whether the machine is equipped with automatic grade controls (figures 17 & 18) or if it uses grade jacks, now is the time to zero out the grade reference point. Refer to the automatic grade control's operation manual to learn how to zero out the reference point for that particular system.

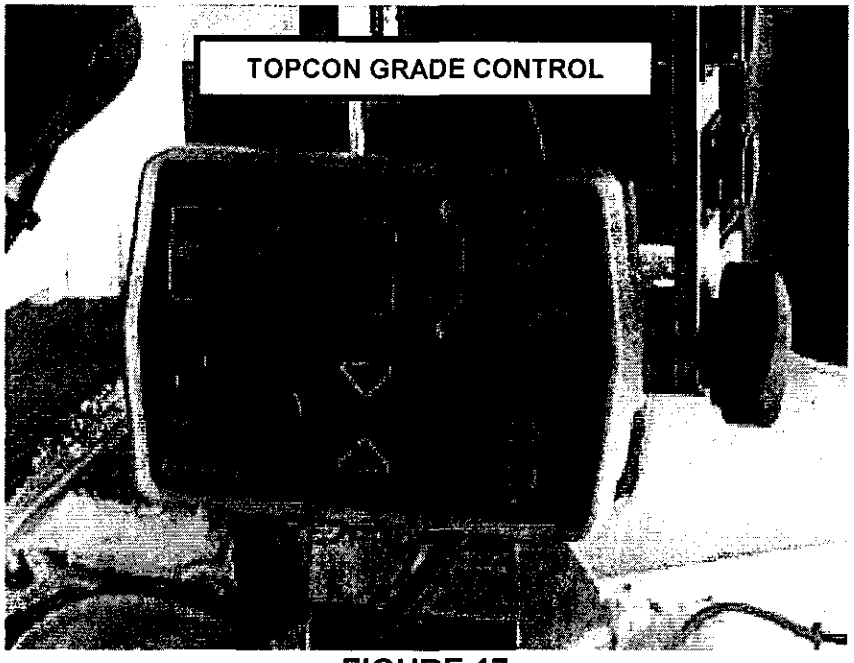



**FIGURE 17**

**4**. Perform the same operations on both grade control boxes for either side of the machine and the grade will be set with a zero reference point.

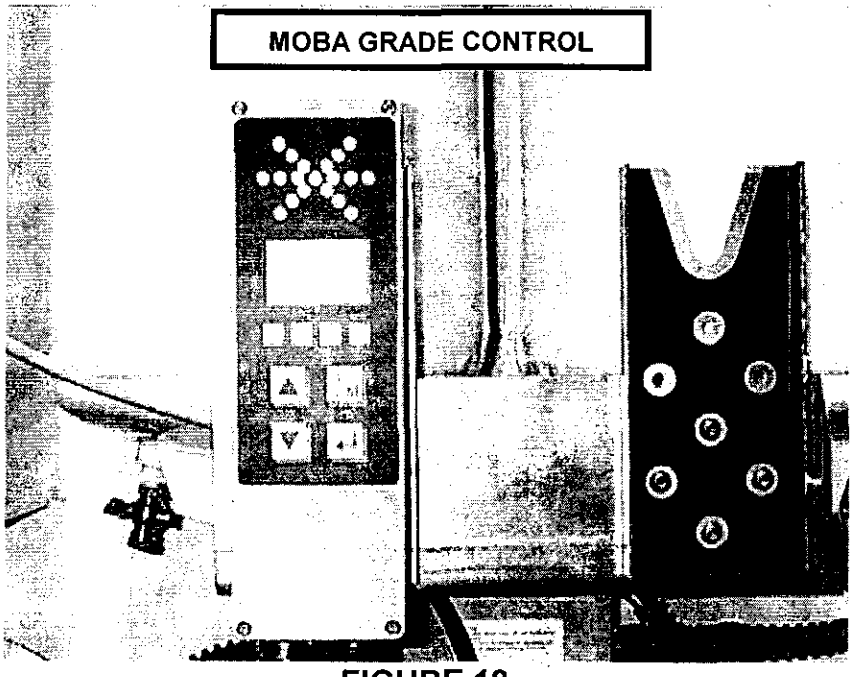



**FIGURE 18**

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

**D.** Set the depth that you intend for the machine to mill and hold grade. Refer to the automatic grade control operation manual for how to do this see figure 12.

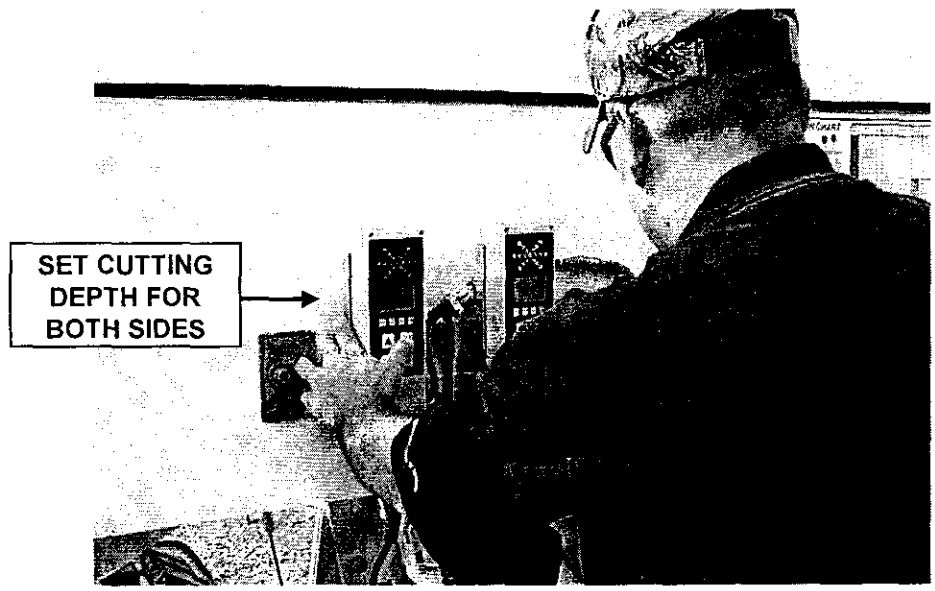



**FIGURE 19**

**E.** Using the front elevation controls, raise the front of the machine until the cutter drum is approximately 6" off of the ground.

**F.** Open the valve between the water tank and the water pump (figure 20). Open all the valves between the pump and spray bars (figures 21 & 22). Water flow pressure can be adjusted by turning the flow control valve located just above the cutter drum spraybar valves.

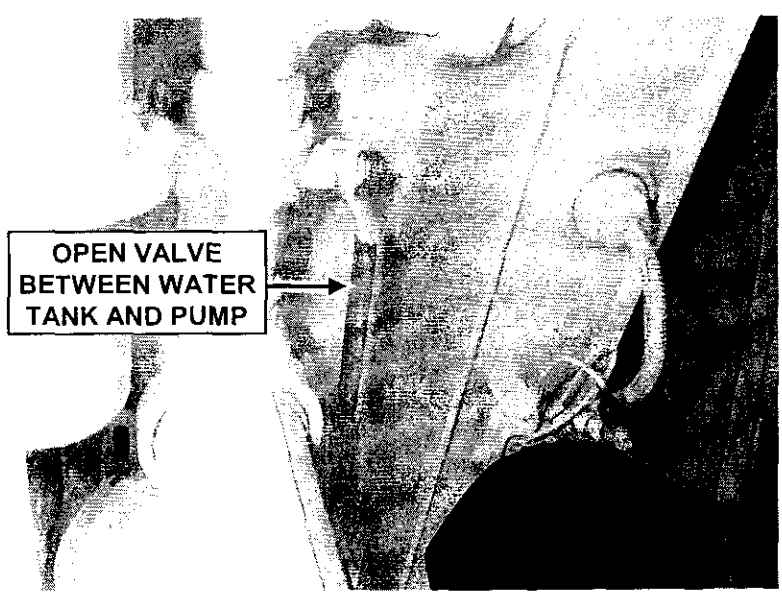



**FIGURE 20**

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

Cutter drum spraybar valves must be open so that the cutter drum can receive cooling water while in operation.

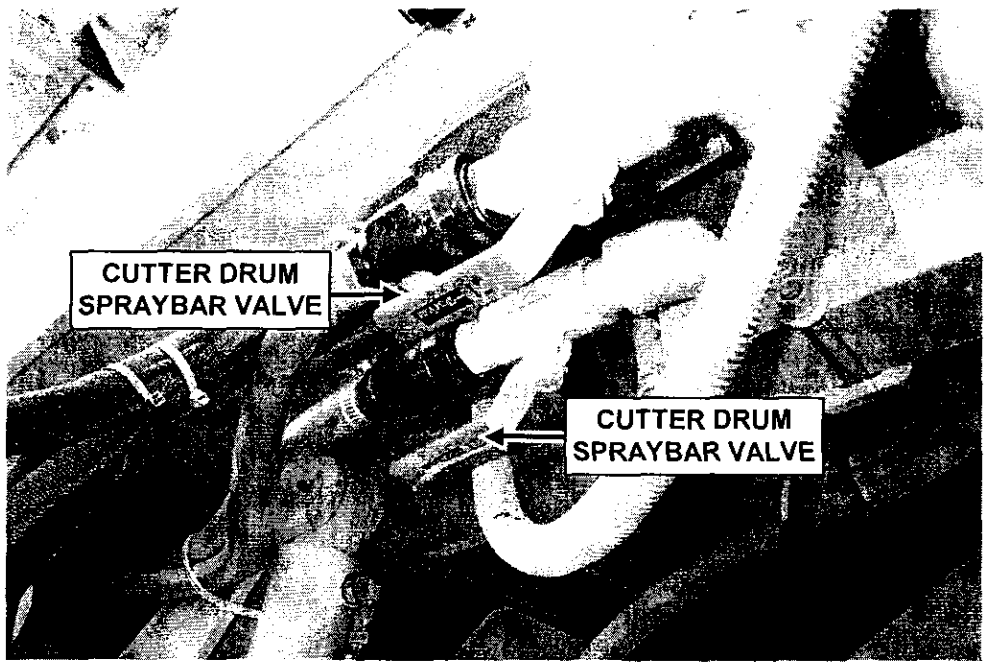



FIGURE 21

The primary conveyor spraybar valve must be open to allow water to cool the primary conveyor while the machine is in operation.

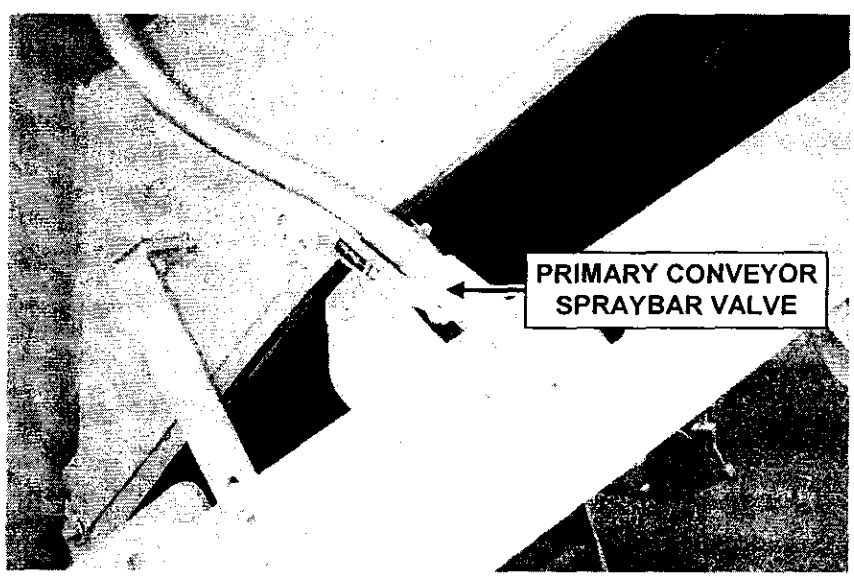



FIGURE 22

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

There is only one secondary conveyor sparybar. Be sure to open the secondary conveyor spraybar valve so that water may be allowed to cool the secondary conveyor while the machine is in operation.

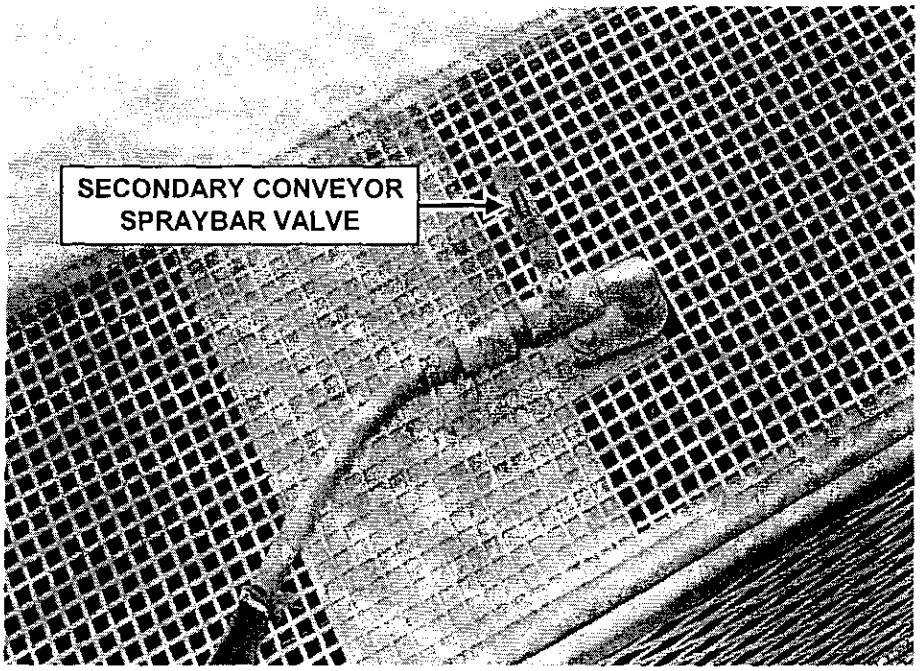



FIGURE 23

Water pressure can be controlled with the water pressure control valve (figure 24).

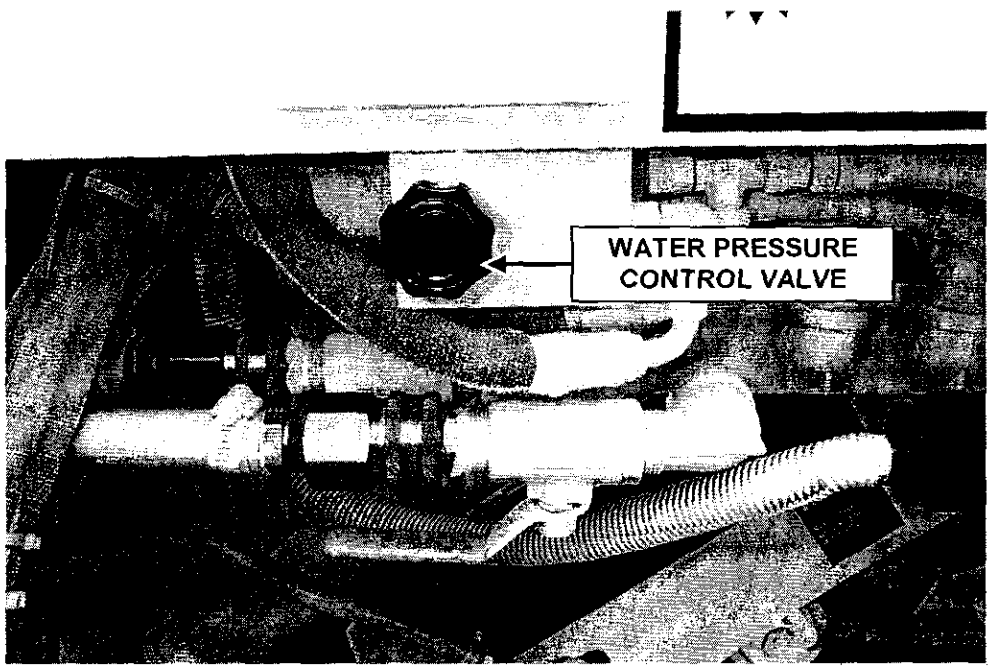



FIGURE 24

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

**G.** Activate the water pump by placing the water control switch in auto mode. This means that the spraybars will only spray water when the machine is moving forward.

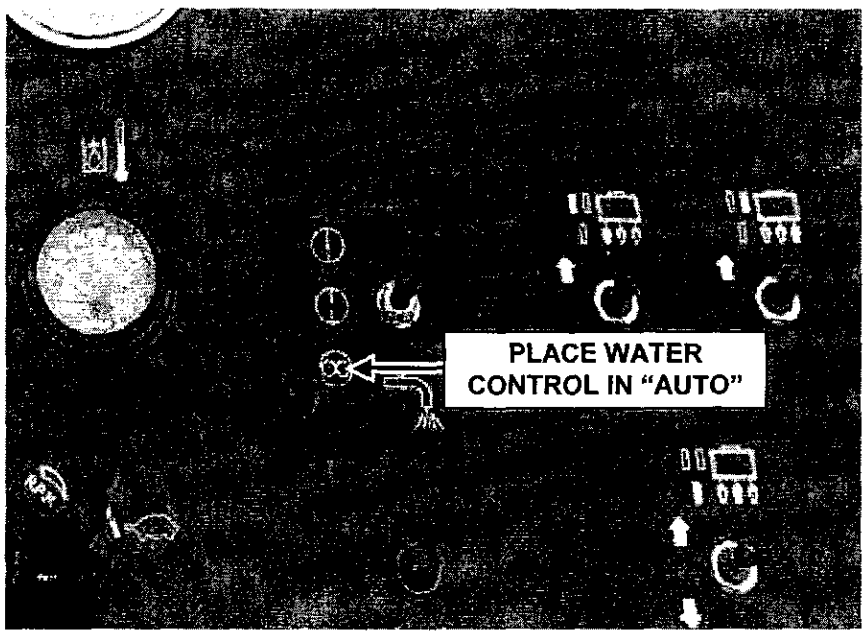



**FIGURE 25**

**H.** Start the conveyors by selecting forward on the conveyor switch and turning the conveyor speed control clockwise to the required speed. Be sure to have a dump truck ready to receive the milled material (figure 26).

**FIGURE 26**

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

I. Be sure that the rear moldboard is lowered (figure 27). Rear moldboard down pressure can be adjusted at the pressure reducing valves located inside the engine compartment just behind the hydraulic tank (figure 28). The normal operating pressure of the rear moldboard is 150 psi.

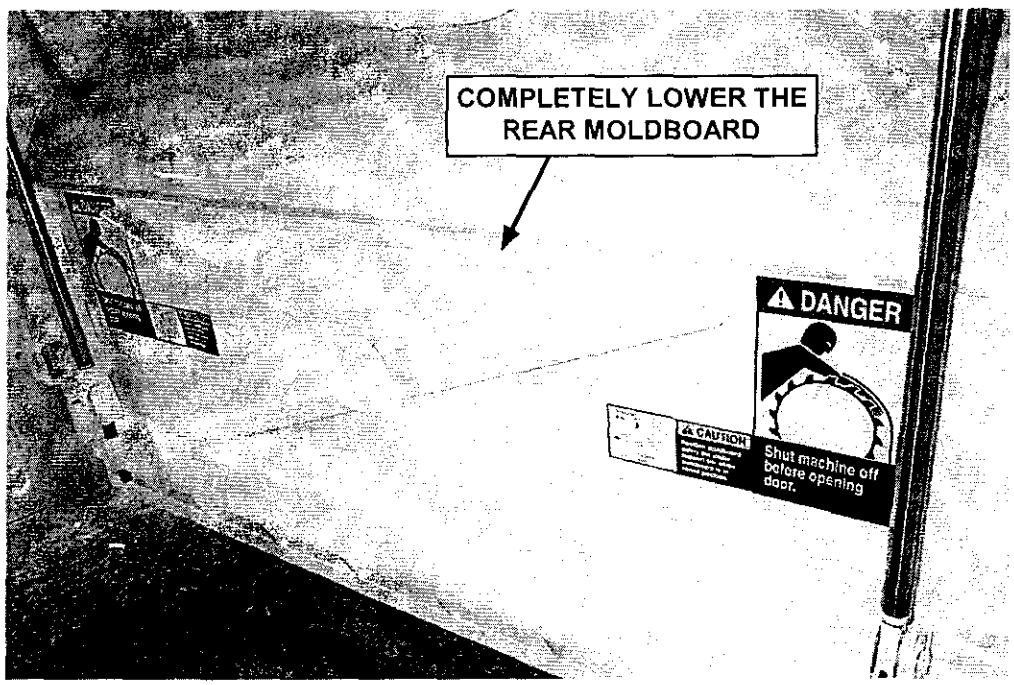



FIGURE 27

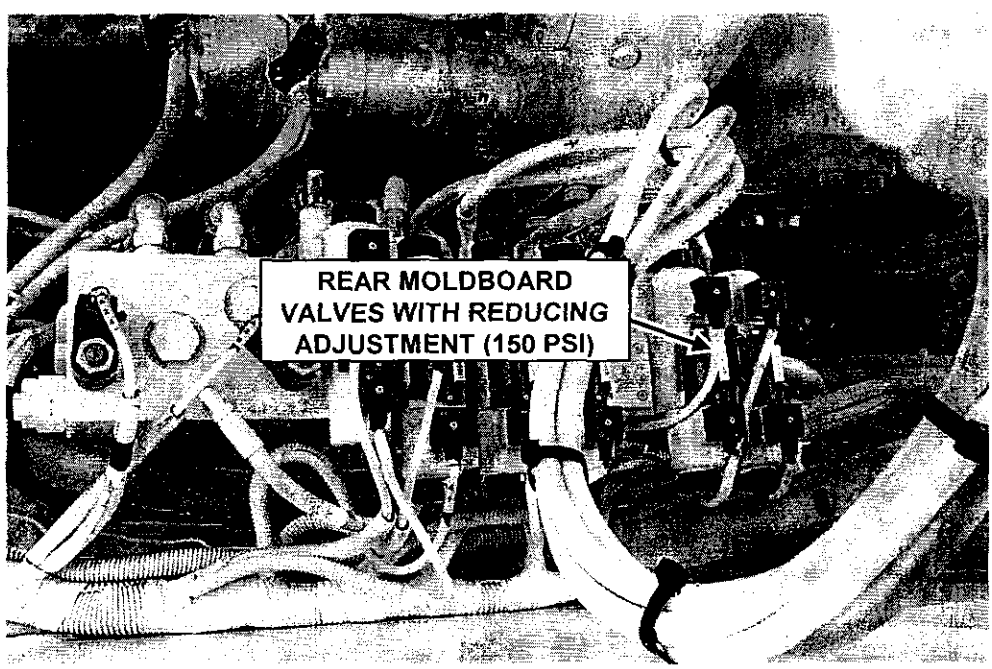



FIGURE 28

## 3.6 OPERATION OF THE MACHINE (CONTINUED)

**BE SURE NO ONE IS NEAR THE MACHINE WHEN ENGAGING THE CUTTER DRUM!**

**J.** With the engine at low idle, engage the clutch by pressing the clutch control switch found on the operators console (figure 29). Clutch pressure is set at 350 psi. Clutch pressure can be modified by adjusting the clutch pressure reducing valve (figure 30) located underneath the right hand engine compartment hood.

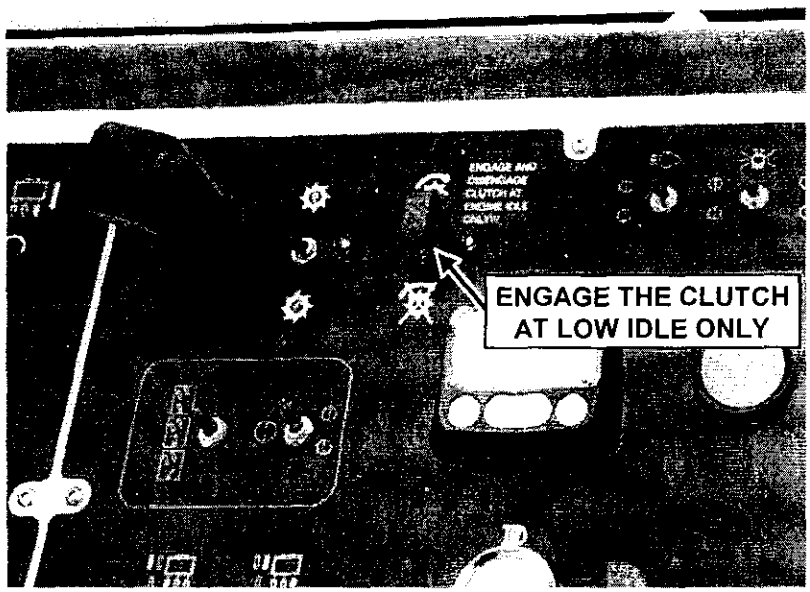



FIGURE 29

**CAUTION** **Engage the clutch at low engine idle only!**
**Failure to do so will result in premature clutch failure.**

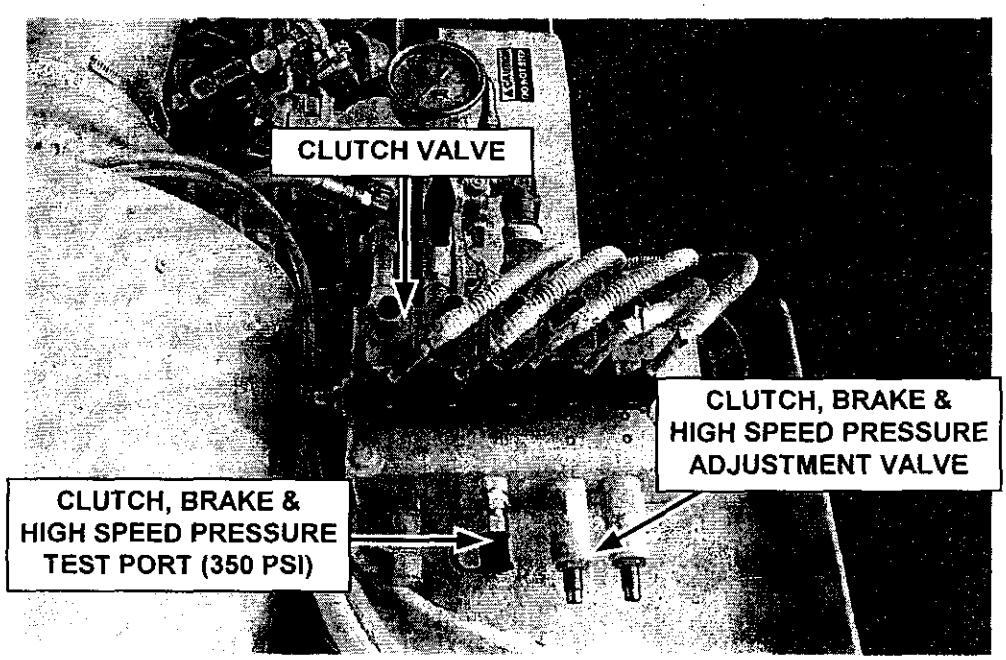



FIGURE 30

## 3.6 OPERATION OF THE MACHINE

**K.** Increase engine speed to full throttle by turning the throttle control to "high".

**L.** Be sure all personnel are at least 25 feet (7.6m) away from the machine before lowering into the cut.

**M.** Using the front elevation controls, slowly lower the machine into the cut. Alternate each side down as you slowly lower the machine.

**DANGER! LOWERING TOO QUICKLY CAN CAUSE THE MACHINE TO RIDE UP ON THE CUTTER DRUM THUS FORCING THE MACHINE TO JUMP BACKWARDS VERY QUICKLY.**

**N**. Once the machine has been lowered, activate the automatic grade control system. The machine should start to adjust itself into the proper grade.

**0**. Release the brake.

**P**. Place the travel control switch into one of the two working ranges. Move the travel speed joystick slowly forward until the required working speed is obtained.

## 3.7 STOPPING AND SHUTDOWN

Proper machine shutdown is an important safety measure. Please follow these guidelines when shutting the machine down after use.

1. Stop the machine by placing the travel control in the center or "neutral" position.

2. Deactivate the grade controls and raise the machine out of the cut.

3. Decrease engine speed to idle.

4. Disengage the cutter drum.

5. Disengage the conveyors.

6. Turn off the water pump.

7. Choose a suitable area to park the machine that is out of the way of traffic and other equipment. Select a place where the parked machine will not pose any kind of hazard.

8. Increase the engine speed to full rpm and travel the machine to the pre-selected parking location.

9. Position the machine on a level and stable surface.

10. After positioning the machine in a suitable area, be sure to put the travel joystick in the center or "neutral" position.

11. Using the front and rear elevation controls, lower the machine elevation until the bottom ladder rung is no more than 23.6 in. (600 mm) from the ground.

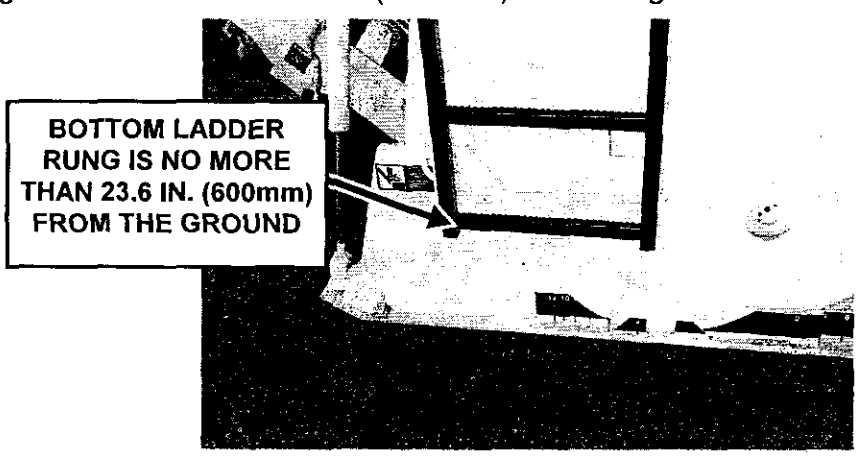



**FIGURE 31**

12. Activate the machine's parking brakes.

13. Decrease engine speed to idle then shut off the engine.

14. Turn both of the battery disconnect switches to the **off** position.

## 3.8 POWER PACK – AUXILIARY FUNCTIONS

In the event that engine failure should occur, the power pack system can be used to release the brake system and operate other auxiliary functions (figure 32). The power pack operates directly off of the batteries. Be sure that the batteries are charged before attempting to use the power pack.

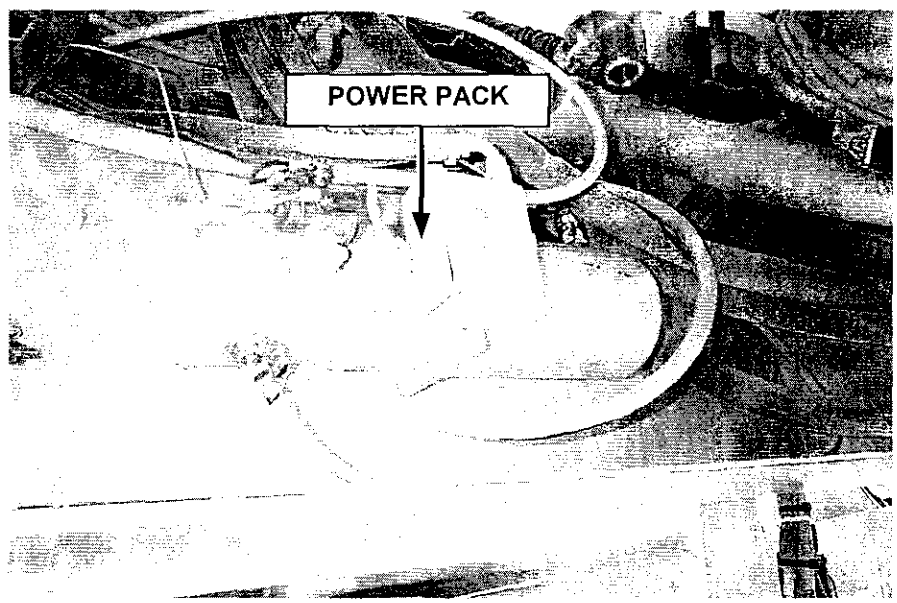



FIGURE 32

### MOLDBOARD CONTROL

The rear moldboard is the only power pack driven function that can be activated independently with its own operator control. This operator control can be found mounted to the underside of the beltguard (figure 33).

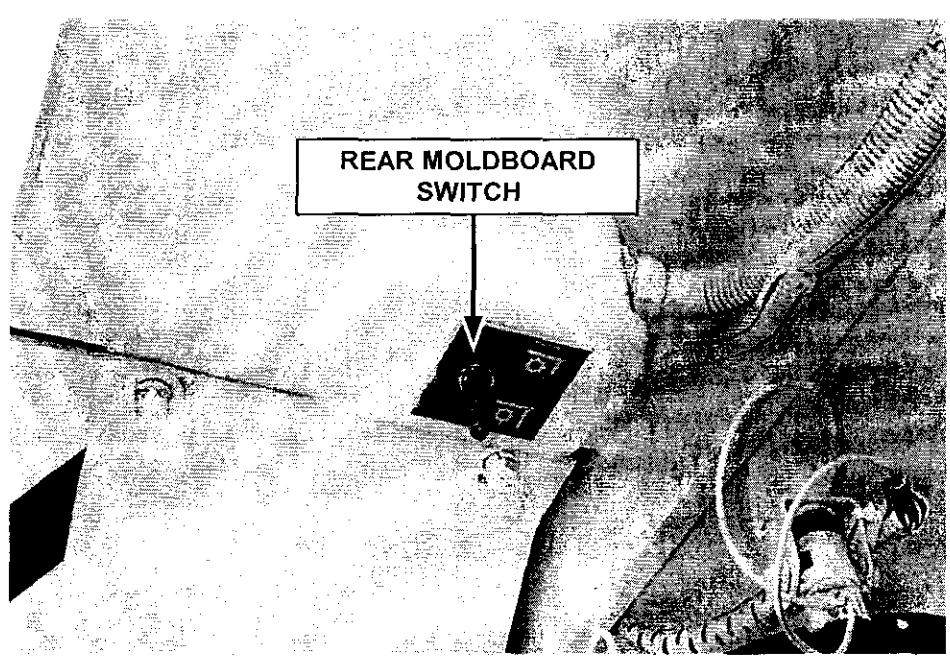



FIGURE 33

## 3.8 POWER PACK – AUXILIARY FUNCTIONS

Use the moldboard switch to raise and lower the rear moldboard anytime the machine is not in operation. ***CAUTION*** **do not operate continuously for more than one minute at a time.** Allow the power pack to cool for four minutes for every one minute of operation. Not doing so may cause severe damage.

In the event that engine or machine failure should occur, the power pack system can be used to operate all auxiliary functions and to release the brakes if the machine requires towing. Please read the following procedure before attempting to operate the power pack.

**DANGER** Before using the power pack be sure the machine is completely Shut down.

1. The ignition switch must be "on" to operate the power pack.

2. The power pack can be used to operate auxiliary functions such as the secondary conveyor swing, hood wing raise, legtube elevation, endgates and moldboards. First locate the left hand operators console door and open it (figure 34).

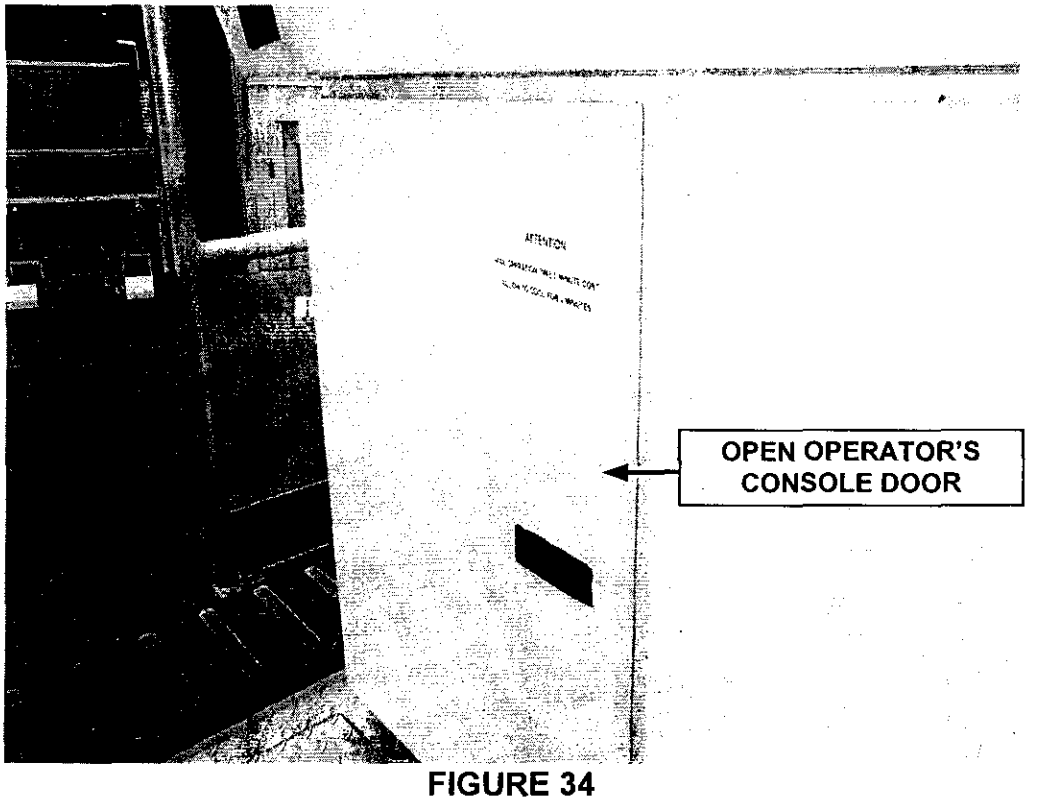



**FIGURE 34**

## 3.8 POWER PACK – AUXILIARY FUNCTIONS

3. Locate the power pack switch inside the operator's console, just behind the panel door (figure 35).

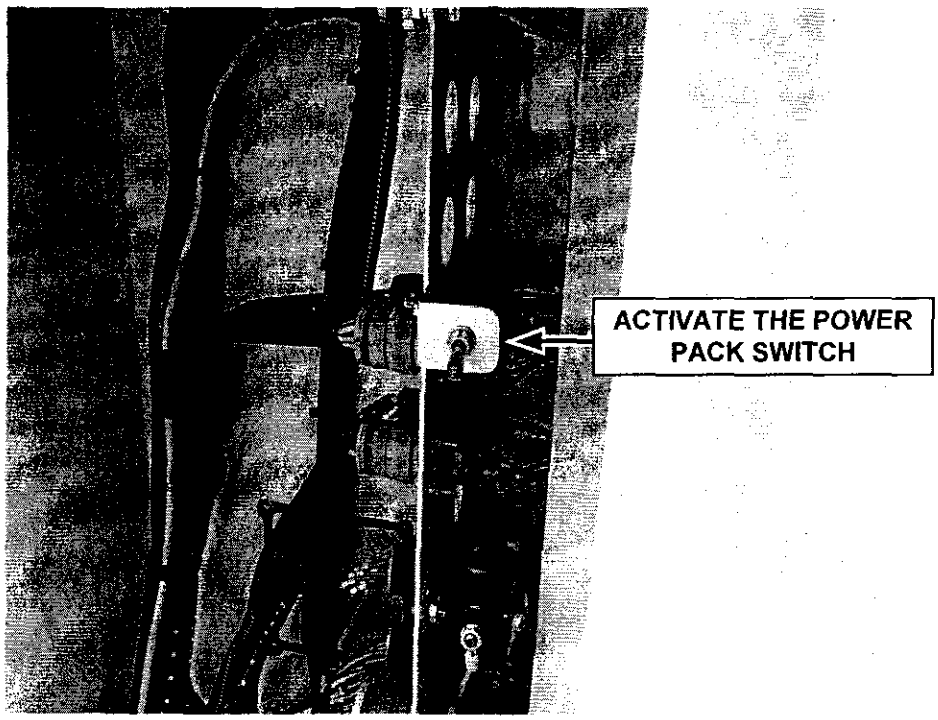



**FIGURE 35**

4. Hold the switch and the power pack will begin to raise hydraulic pressure to the auxiliary system. While holding the power pack switch, activate any auxiliary function. This feature comes in handy when needing to raise the legtubes and lift the machine out of a cut, reposition the secondary conveyor or raise the engine compartment hood wings.

**DO NOT OPERATE THE POWER PACK CONTINUOUSLY FOR MORE THAN ONE MINUTE AT A TIME. AFTER OPERATING THE POWER PACK FOR ONE MINUTE, ALLOW IT TO COOL FOR FOUR MINUTES BEFORE ACTIVATING IT AGAIN!**

## 3.9 POWER PACK – BRAKE RELEASE AND TOWING

### BRAKE RELEASE

1. In the event that the machine will not start and requires towing, the power pack can be used to release the brakes.

2. The ignition switch must be in the "on" position to operate the power pack.

3. Raise the right hand hood wing and locate the brake valve found in the valve stack that is mounted above the belt guard.

4. Activate the brake valve override by pushing the red override button in and twisting counter clockwise until the button pops up slightly.

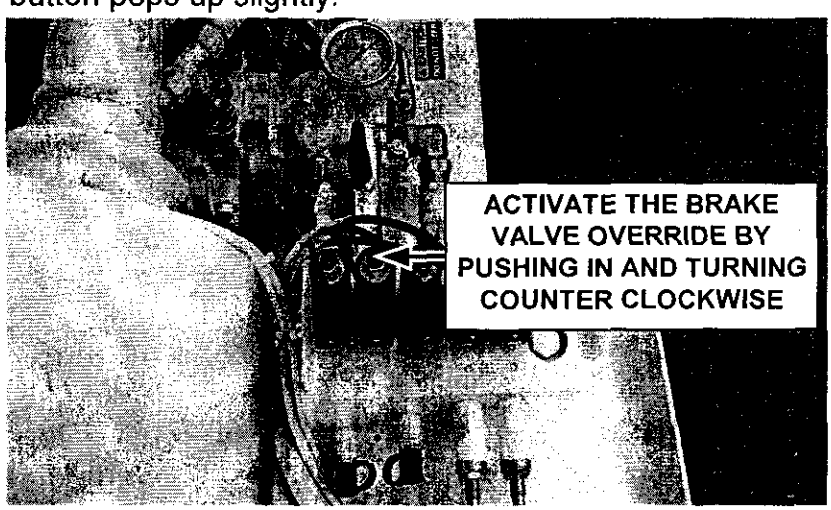



FIGURE 36

5. Activate the power pack switch to raise brake pressure. When the brake pressure gauge reads 350 psi., close the brake circuit ball valve and the brakes will be released.

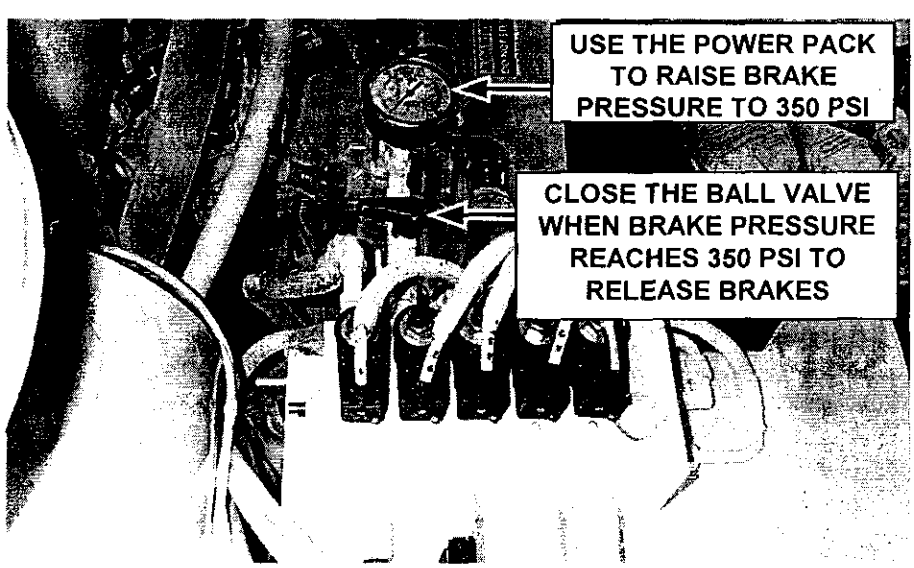



FIGURE 37

## 3.9 POWER PACK – BRAKE RELEASE AND TOWING

### TOWING

6. In order to tow the machine, the brakes will have to be released and the travel pump will have to be put in bypass mode. When the travel pump is put in bypass mode, it will allow the tracks to roll freely.

7. Locate the Sauer Danfoss series 90 travel pump inside the engine compartment (figure 38).

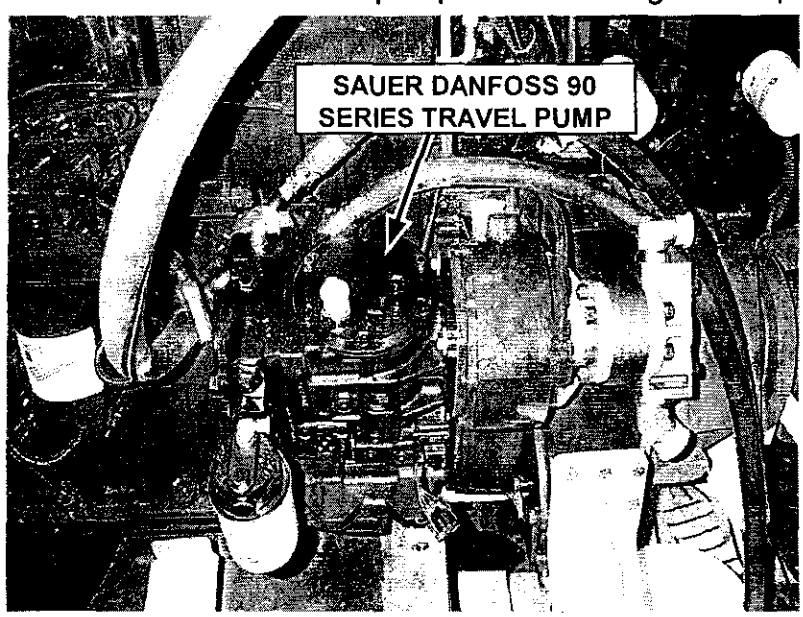



FIGURE 38

8. On the travel pump, open the bypass on both multifunction valves by rotating the middle hex nut while at the same time securing the bottom hex nut. Rotate the middle hex nut 3 rotations counter clockwise. this will put the pump in bypass mode and will allow the tracks to roll freely (figure 39).

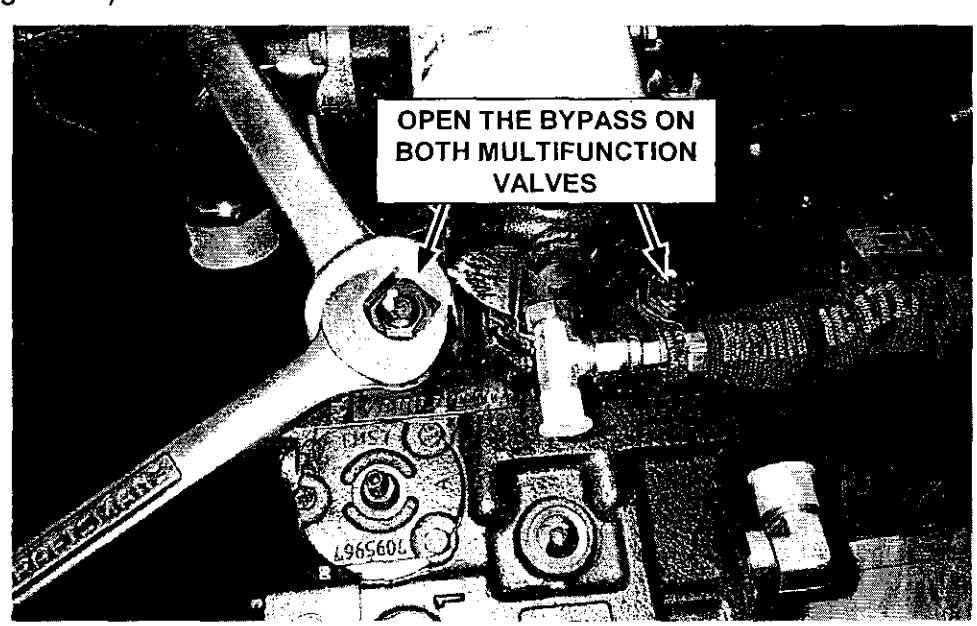



FIGURE 39

## 3.9 POWER PACK – BRAKE RELEASE AND TOWING

### TOWING

9. The machine is equipped with tie down points located on the front and rear corners of the machine. Use these tie down points as places to connect the towing chains as needed (figures 40 & 41).

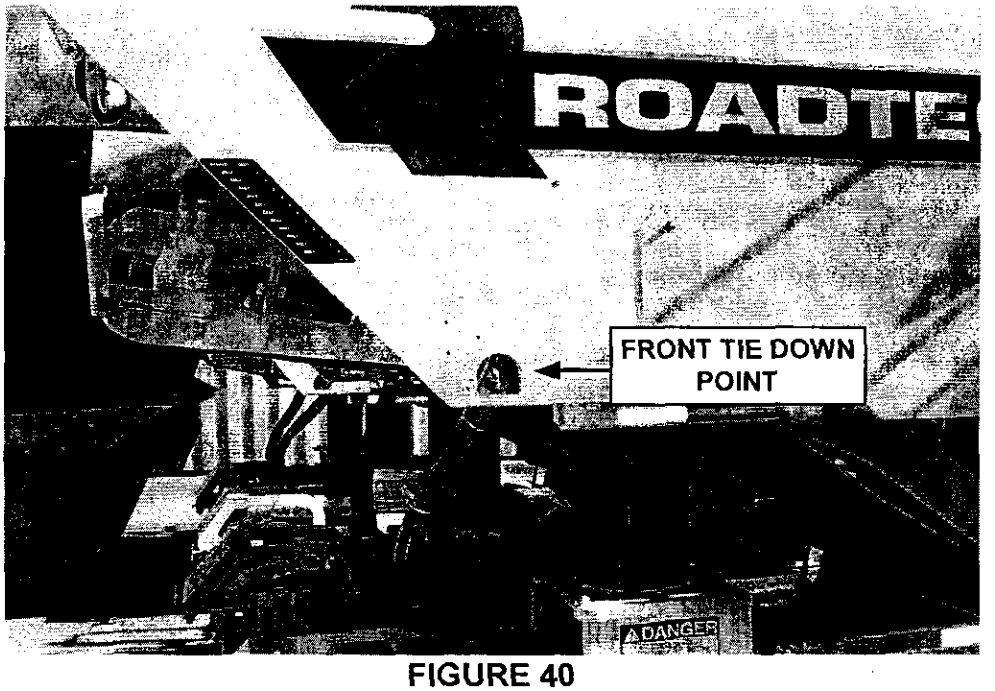



FIGURE 40

**DANGER** **TOW ONLY AT LOW SPEED AND ON LEVEL GROUND TO PREVENT RUNAWAY. EXTREME CAUTION MUST BE TAKEN TO PREVENT ANY UNCONTROLLED MOVEMENT.**

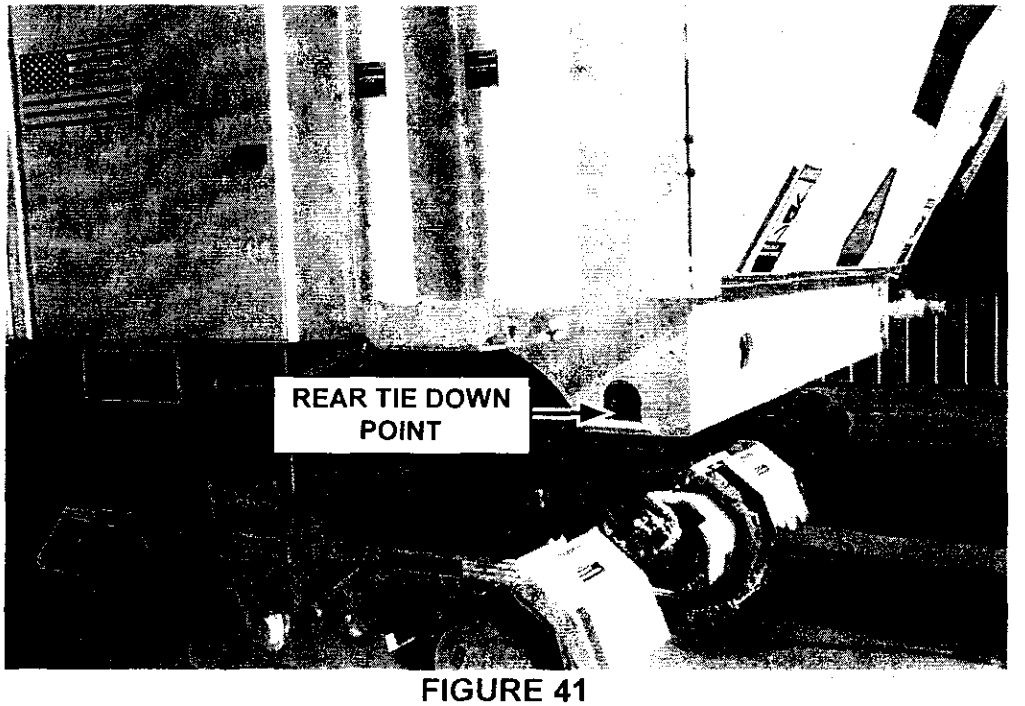



FIGURE 41

## 3.9 POWER PACK – BRAKE RELEASE AND TOWING

### TOWING

10. Once the machine has been towed out of the roadway and into the desired location the brakes should now be reset. Do this by simply opening the brake pressure ball valve and then closing the brake valve override. This will reapply the brakes (*figure 42*).

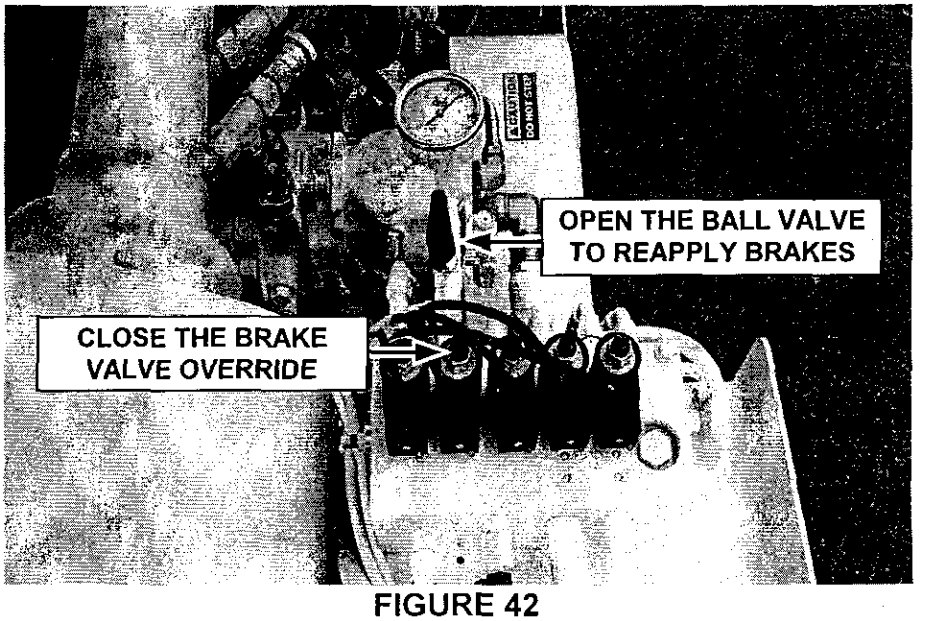



FIGURE 42

10. After the machine has been repaired pressure will have to be restored to the travel circuit. Retighten the bypass on each multi function valve of the travel pump. This will take the pump out of bypass mode and restore track pressure for normal operation.

## 3.10 HIGH PRESSURE WASHDOWN

Removal of asphalt and concrete from the machine is accomplished by utilizing the machine's high pressure washdown system. A daily routine of machine washdown should be completed at the end of each milling day and prior to any greasing. A daily routine of machine washdown increases the reliability and safety of your machine. The high pressure washdown hose can be accessed from the hose reel, which is located on the right hand side of the front of the secondary conveyor. The high pressure washdown wand is located in the toolbox. The high pressure washdown system is activated from the washdown lever located on the right hand side of the machine (figure 22).

**The steps to activate the washdown system is as follows:**

1. Select a suitable location where washdown water will not effect milling operation or the environment.

2. Verify that the parking brake is on.

3. Start the engine.

4. Open the toolbox and remove the washdown wand.

5. Pull the hose out from the hose reel.

6. Connect washdown wand to hose.

7. Open the valve between the water tank and the water pump (figure 43).

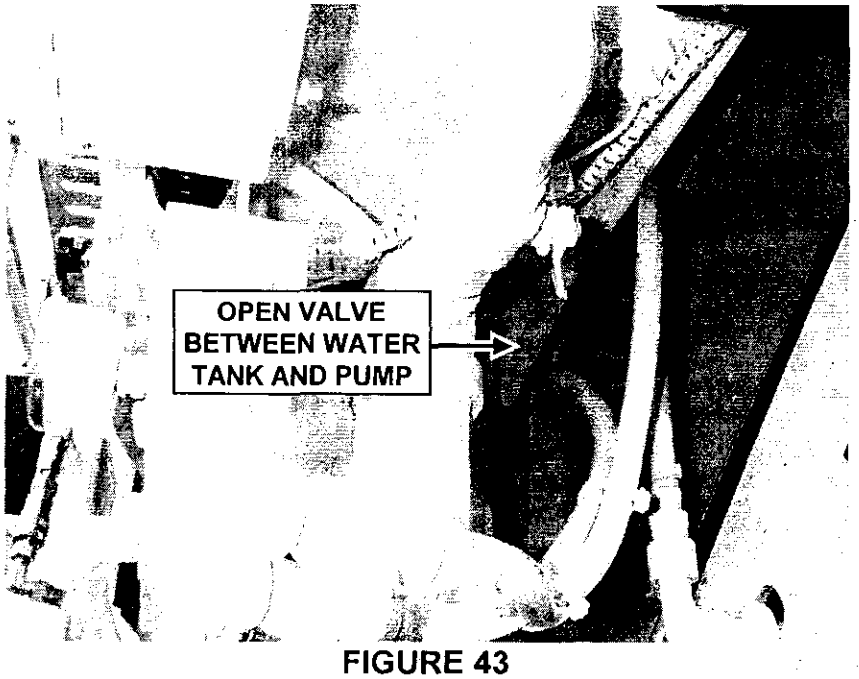



**FIGURE 43**

8. Move the engine throttle control to the "high" rpm range.

## 3.10 HIGH PRESSURE WASHDOWN

9. Activate the water pump by positioning the water pump switch on the operators console to the *manual (always on) position.*

10. Turn the washdown on/off lever to the on position (figure 44). By doing this all auxiliary system pressure will be diverted to the washdown pump so that the washdown system may be able to produce the maximum amount of water pressure.

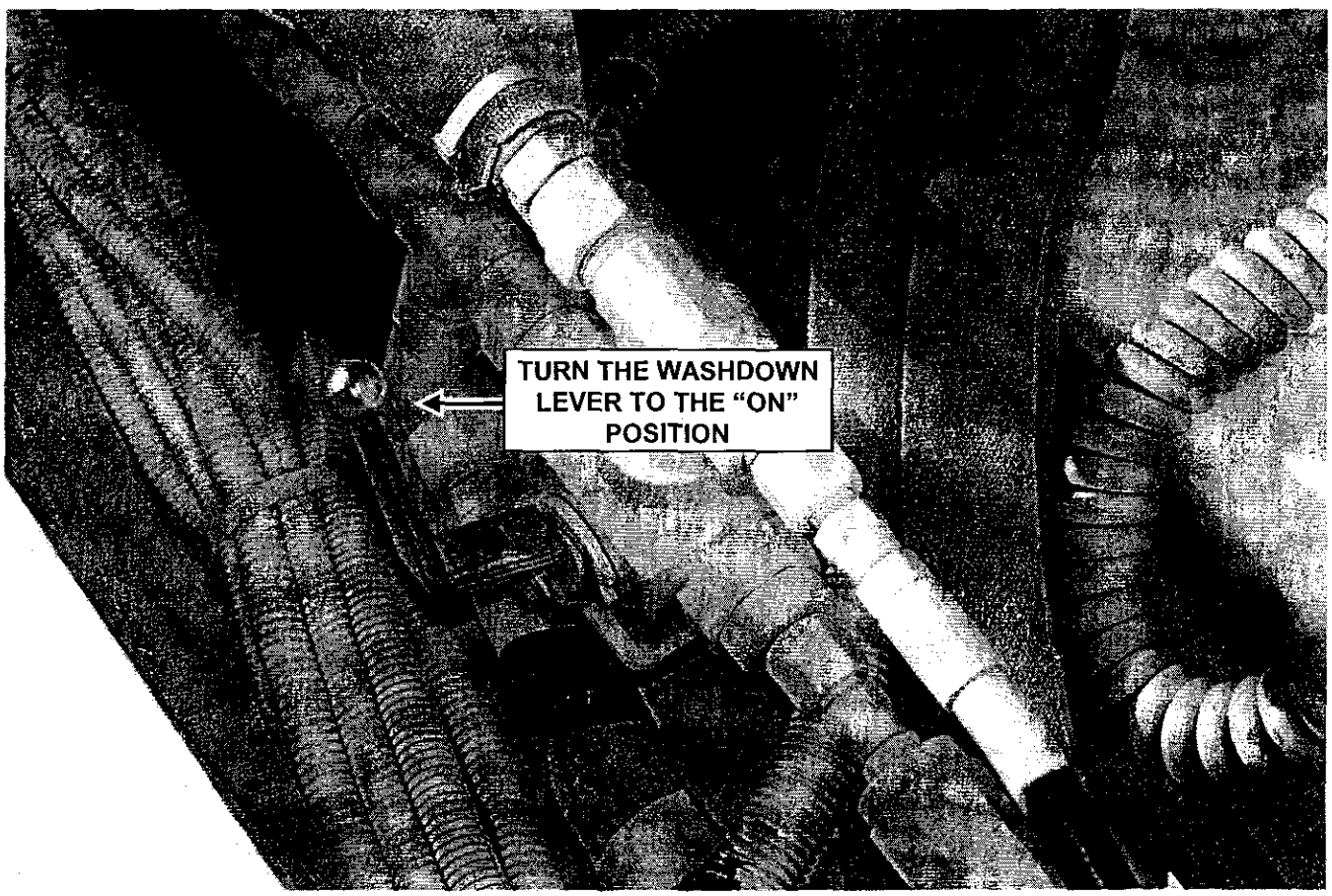



**FIGURE 44**

## 3.10 HIGH PRESSURE WASHDOWN

11. Hold washdown wand in one hand and open the hose reel on/off valve (figure 45).

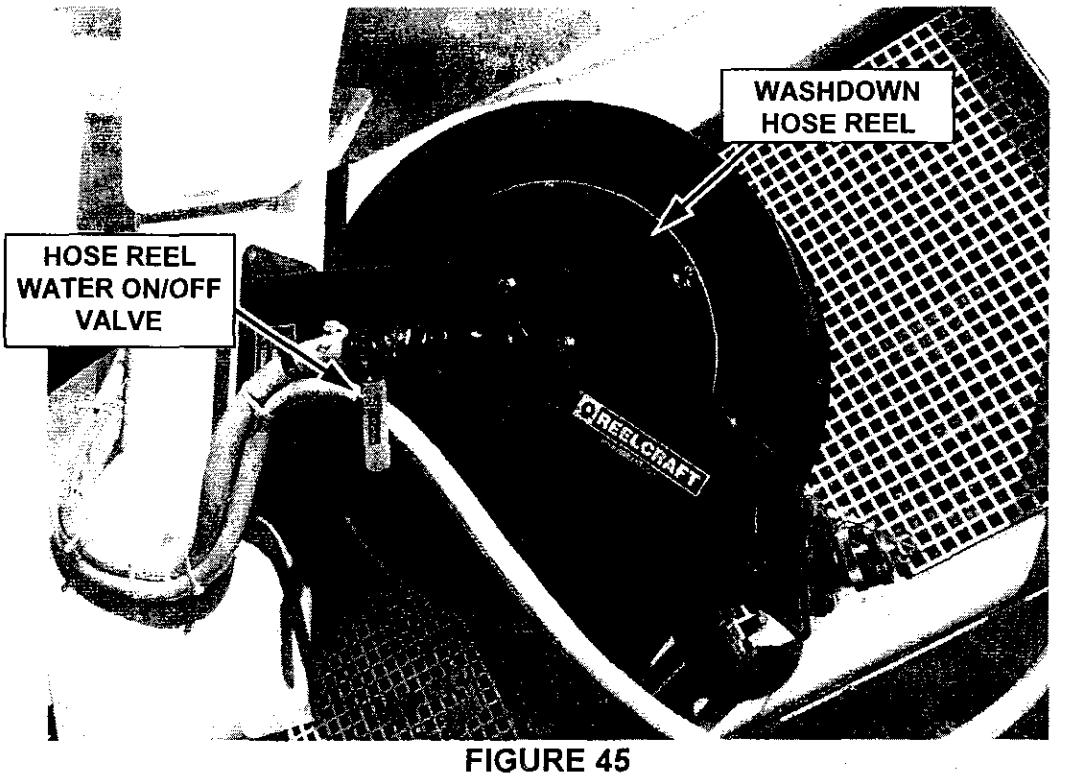



**FIGURE 45**

12. Wash all areas of the machine such as the primary and secondary conveyors, cutter drum and housing, moldboard, track assemblies, drive motors and torque hubs, engine and housing, mainframe, operator's station and ladders.

13. Turn off the hose reel on/off valve.

14. Turn the washdown on/off lever to the original off position.

15. Turn the water pump switch to the off position.

16. Return the engine throttle control to the "low" rpm.

17. Close the valve between the water tank and the water pump.

18. Remove the washdown wand from the washdown hose.

19. Return the washdown wand to the toolbox.

20. Return the washdown hose to the hose reel.

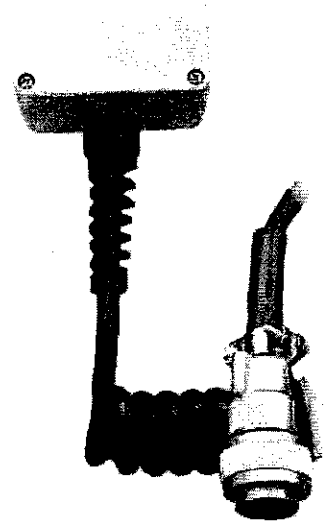
21. Shut off engine.

## 3.11 MOBA-matic GRADE AND SLOPE CONTROL SYSTEM

The moba-matic grade and slope system has a wide range sensors used for distance and slope measurement. Its ease of operation and reliability make the moba-matic a flexible and efficient control system for milling machines like the RX-500.

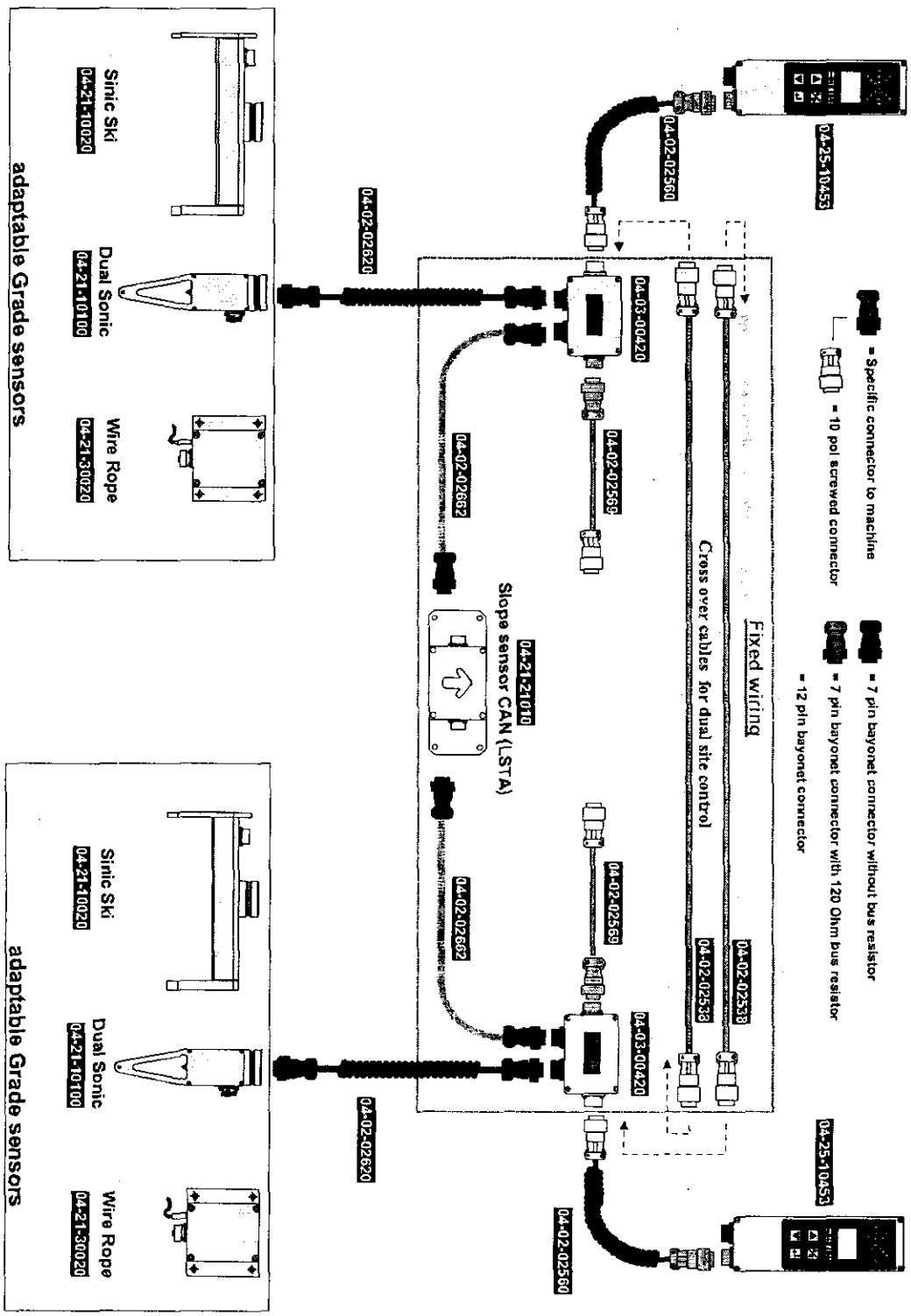
The system is based upon ultra-modern micro-processor technology and is designed around the **c**ontroller-**a**rea-**n**etwork vehicle communications system. This **can**-bus represents the latest technology for the mobile equipment on-board communications and therefore guarantees maximum system safety. The **can**-bus permits a more centralized point of operation and due to its design allows for the addition of future sensor attachments without a total redesign of the entire system. The main component of the entire system, the digital controller, will automatically identify all the connected sensors as soon as the system is powered on.

For complete instruction on the operation and calibration of the Moba-matic grade and slope control system, please see the *Moba-matic operating instructions manual.*



## 3.11 MOBA-matic GRADE AND SLOPE CONTROL SYSTEM

### MOBA-matic COMPONENT DIAGRAM



## 3.11 MOBA-matic GRADE AND SLOPE CONTROL SYSTEM

### MOBA SONIC CONTROL ASSEMBLY

The *moba sonic grade control* system control boxes are mounted to either side of the machine as seen in the following illustrations. Next to the control boxes you will find the system junction boxes (figure 46).

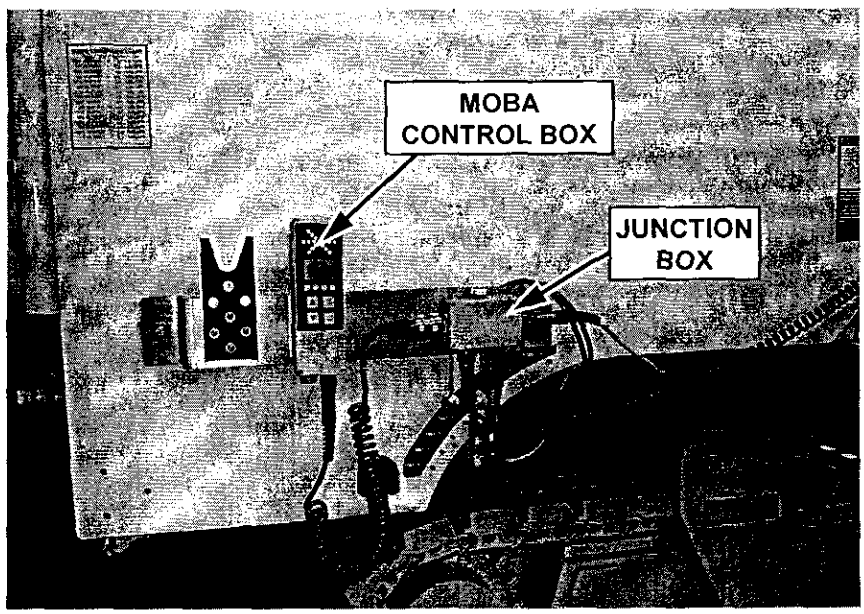



FIGURE 46

Sonic ground sensors can be mounted at various locations on the machine to provide the best possible readings for various jobs. *Yo-yo type sensors can be mounted to each endgate.*

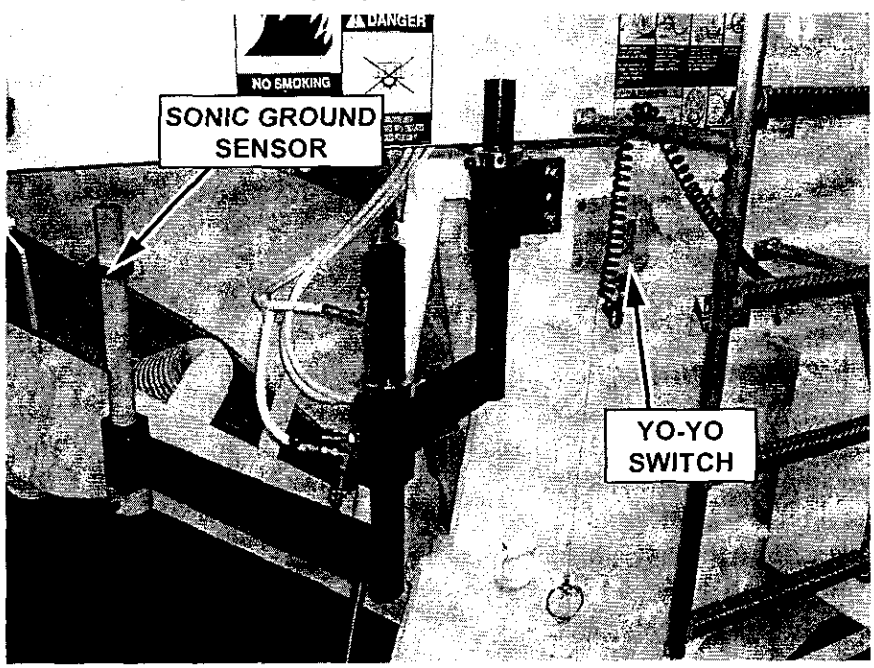



FIGURE 47

## 3.11 MOBA-matic GRADE AND SLOPE CONTROL SYSTEM

### MOBA SONIC CONTROL ASSEMBLY

The slope box is mounted to the floorplate inside the operators console (figure 48).

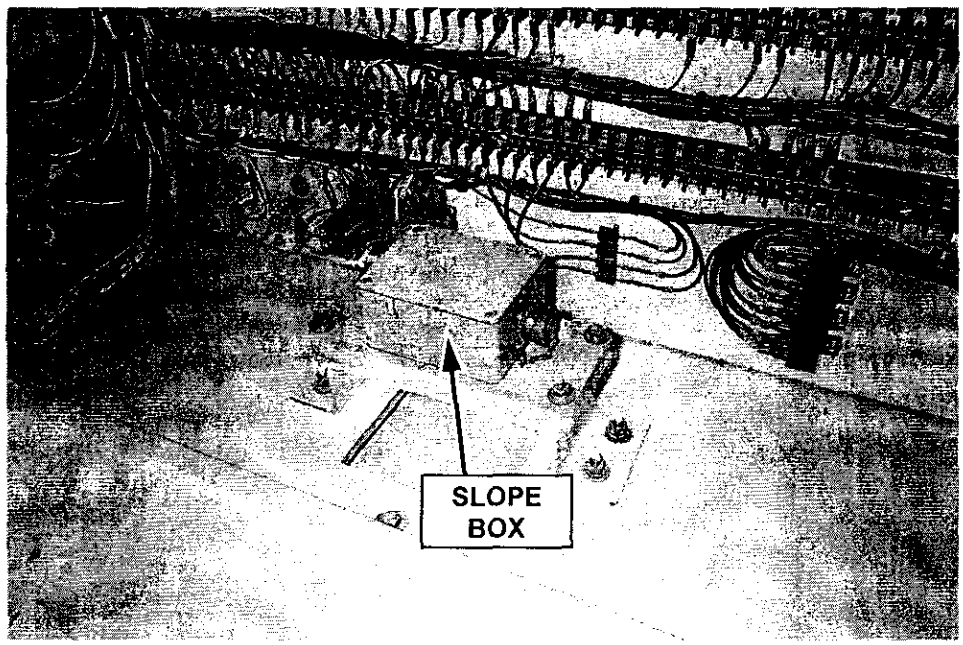



FIGURE 48

## 3.12 GRAD-LINE SLOPE CONTROL SYSTEM

The Grad-line slope control system is a complete, non-contacting slope control system. The Grad-line slope system includes the following hardware: one control module, one handset and a carrying case. The control module and handset are mounted and removed each working day and stored in the Grad-line carrying case in order to prevent damaging moisture exposure and to protect against vandalism. When setting up the Grad-line system for daily operation, mount the control module to the mounting frame assembly on top of the milling machine by the instrument panel.

Daily calibration of the Grad-line slope control system is required by the machine operator in order to set the machine up for slope control. These settings determine how precise and accurate the Grad-line system stays on slope during milling operation. The features, which must be entered in order for the control box to function properly are: "zeroing" or "nulling" of the control module and sensitivity.

**NOTE:** In order for the Grad-line slope control system to be calibrated properly the hydraulic system must be at normal operating temperature.

## 3.12 GRAD-LINE SLOPE CONTROL SYSTEM

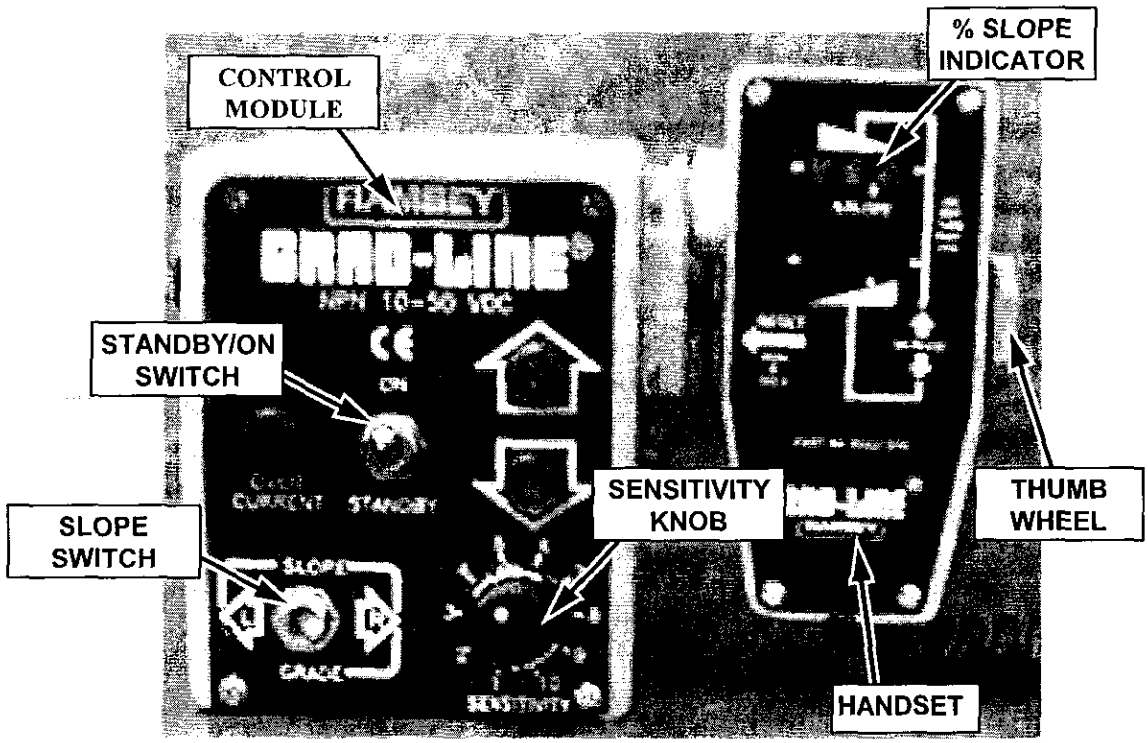



FIGURE 49

## 3.13 GRAD-LINE INSTALLATION AND CALIBRATION

1. Level machine transversely and longitudely by raising or lowering the leg tube cylinders.

2. Place the control module onto the mounting plate on the milling machine and latch the locking clips onto the side of the control module.

3. Connect the control module electrical cable to the slope / grade amphenol connector on the left side milling machine instrument panel.

4. Turn the grade / slope toggle switch to the "on" position on the left or right side milling machine instrument panel.

5. Turn the control module slope switch to the left or right direction (the side of the machine that slope is controlled by).

6. Switch the control module to the standby setting.

7. Adjust the handset % slope to 00.0% by turning the thumbwheel on the side of the handset.

8. Turn the thumbwheel until both up and down arrow lights are out

## 3.13 GRAD-LINE INSTALLATION AND CALIBRATION

9. Push and hold the reset button on the side of the handset. Turn the thumbwheel until the % slope indicator reads 00.0%. release the reset button.

10. The control module is now calibrated; both lights on the arrow up and down should be off. if a light is on or blinking then repeat steps 3 - 9.

11. With the power to the control module "on" turn the sensitivity knob to 6.

12. Turn the control module standby switch to on.

13. Turn the sensitivity switch clockwise until the milling machine left or right side leg tube begins to oscillate. Move the direction of the blinking light.

14. Turn the sensitivity switch counterclockwise until the milling machine left side leg tube becomes stable again.

15. Turn off the grade / slope switch on the milling machine instrument panel.

16. Disconnect the control module electrical cable from the left side slope / grade amphenol connector and connect to the right side slope / grade amphenol connector on the milling machine instrument panel.

17. Turn the grade / slope toggle switch to the "on" position on the right side milling machine instrument panel.

18. Turn the control module slope switch to the right side direction

19. Switch the control module to the standby setting.

20. Adjust the handset % slope to 00.0% by turning the thumbwheel on the side of the handset.

21. Turn the thumbwheel on the handset until the milling machine right side leg tube stops rising in elevation. The arrow up light on the control module should be off.

22. Push and hold the reset button on the side of the handset. turn the thumbwheel until the % slope indicator reads 00.0%. Release the reset button.

23. The control module is now calibrated; both lights on the arrow up and down should be off. if a light is on or blinking then repeat steps 16 - 22.

24. With the power to the control module "on", turn the sensitivity knob to 6.

25. Turn the control module standby switch to "on".

## 3.13 GRAD-LINE INSTALLATION AND CALIBRATION (CONTINUED)

26. Turn the sensitivity switch clockwise until the milling machine right side leg tube begins to oscillate.

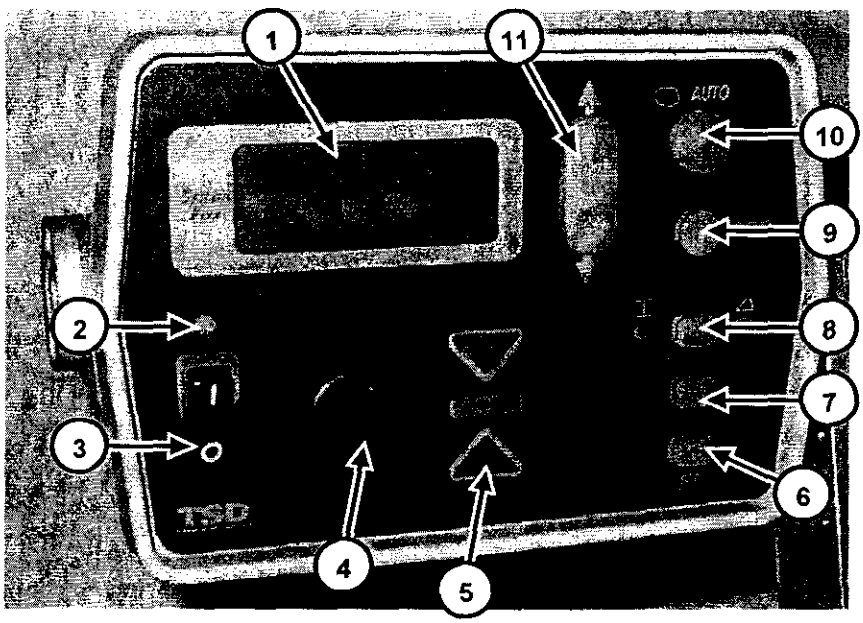
27. Turn the sensitivity switch counter clockwise until the milling machine right side leg tube becomes stable again.

28. Turn off the grade / slope switch on the milling machine instrument panel.

## 3.14 TOPCON GRADE / SLOPE SYSTEMS

The Topcon grade/slope system is a complete, non-contacting control system, which combines both elevation control and slope control into one package. The Topcon grade/slope system includes the following hardware: two control boxes, two sonic trackers, two remote jog switches, two junction boxes and a single slope sensor. The control boxes and sonic trackers are mounted and removed each working day and stored in the Topcon carrying case in order to prevent damaging moisture exposure and to protect against vandalism. The slope sensor, jog switches and junction boxes are mounted on the machine and are not removed once installed. When setting up the Topcon system for daily operation, mount the sonic trackers to the mounting frame assembly at the side of the machine and the control boxes to the top left and right side of the machine. Mount the control box with the "l" marked on the side of the control box to the left side of the machine and mount the control box with the "r" marked on the side of the control box to the right side of the machine. Reversing the left and right control boxes with the left and right side of the machine will cause the Topcon system to function improperly.

For complete instruction on the operation and calibration of the Topcon grade and slope control system, please see the Topcon operating instructions manual




1. LCD DISPLAY
2. LIGHT SENSOR FOR LED DISPLAY
3. POWER SWITCH
4. ADJUSTMENT KNOB
5. GRADE ADJUSTMENT LED
6. SET (MENU) BUTTON
7. CROSS COMMUNICATION BUTTON
8. SLOPE/ELEVATION BUTTON
9. SURVEY(SET)BUTTON
10. AUTO/MANUAL BUTTON
11. JOG BUTTON

## 3.14 TOPCON GRADE / SLOPE SYSTEMS

### 1. THE LCD (LIQUID CRYSTAL DISPLAY)

The LCD allows the operator to view text and graphic symbols that represent elevation or slope settings that system five is currently maintaining for the machine.

### 2. LIGHT SENSOR FOR LED DISPLAY

Automatically adjusts the brightness of the display for better visibility.

### 3. POWER SWITCH

Activates the power for system five.

### 4. GRADE ADJUSTMENT KNOB

This knob is used to make measured adjustments to the cross slope or elevation settings and allows the operator to cycle through the menu options.

**Grade adjustment direction arrows**: These red arrows light up around the grade adjustment knob to indicate the direction the knob should be rotated to reach on grade.

### 5. GRADE CORRECTION ADJUSTMENT CHART

| LED-ACTION | ELEVATION | SLOPE |
|---|---|---|
| SLOW BLINKING, YELLOW DOWN ARROW | OUT OF RANGE, BEYOND .2' ABOVE GRADE | BEYOND 2% ABOVE GRADE |
| SOLID YELLOW DOWN ARROW | ABOVE GRADE, BETWEEN .05' & .2' | ABOVE GRADE, BETWEEN 1% & 2% |
| BLINKING, YELLOW DOWN ARROW | ABOVE GRADE, BETWEEN .02' & .05' | ABOVE GRADE, BETWEEN .5% & 1% |
| BLINKING YELLOW DOWN ARROW/ GREEN BAR | WITHIN .02' OF GRADE | WITHIN .5% OF GRADE |
| BLINKING GREEN BAR | ON GRADE | ON GRADE |
| BLINKING RED UP ARROW/ GREEN BAR | WITHIN .02' OF GRADE | WITHIN .5% OF GRADE |
| BLINKING RED UP ARROW | BELOW GRADE, BETWEEN .02' & .05' | BELOW GRADE, BETWEEN .5% & 1% |
| SOLID RED UP ARROW | BELOW GRADE, BETWEEN .05' & .2' | BELOW GRADE, BETWEEN 1% & 2% |
| SLOW BLINKING RED UP ARROW | OUT OF RANGE, BEYOND .2' BELOW GRADE | BEYOND 2% BELOW GRADE |

## 3.14 TOPCON GRADE / SLOPE SYSTEMS

### 6. SET/MENU BUTTON

**SET MODE**- Set is used to change the reference number viewed on the display to a desired value. Press and hold the set/menu button and dial in desired value using the grade adjustment knob. Both the grade correction indicator lights and double arrows will be lit. Release the set/menu button and the value will be saved

**MENU MODE**- System five performance menu settings are a series of features that allow system five to be modified for operator ease of use, or performance enhancement (please refer to the profiler system five performance manual for an in-depth analysis).

### 7. CROSS COMMUNICATION BUTTON

The cross communication button enables the LCD to display the current operation of the other control boxes. The two red arrows on either side of this button will illuminate when in cross communication mode.

### 8. SLOPE/ELEVATION BUTTON

The slope/elevation button is used to select system five for slope or elevation control.

**SLOPE MODE**- Press the button and the yellow led next to the cross slope symbol will illuminate.

**ELEVATION MODE**- Press the button again and the green led next to the elevation symbol will illuminate.

### 9. SURVEY/INDICATE BUTTON

**SURVEY**- Survey is used to quickly "NULL OUT", or set the sensor to on-grade. Push the button for 1 second until box beeps and the green on-grade correction display bar is illuminated. ***NOTE*** By entering survey function, system five will be taken out of automatic mode.

**INDICATE**- Indicate mode allows the operator to continuously monitor the grade or slope setting on the LCD. Continue pressing on the button until there is a second beep. "IND" will be shown in the LCD display. There will be no on-grade lights. To exit out of indicate mode push either the survey button or the auto button.

## 3.14 TOPCON GRADE / SLOPE SYSTEMS

### 10. AUTO/MANUAL BUTTOM

**AUTOMATIC MODE**- The tow leg tube cylinders are automatically adjusted up or down to maintain proper grade. Press the red button. The red led will light up showing that the control box is in auto mode.

**MANUAL MODE**- System five will display grade corrections, but the leg tube cylinders will not be adjusted. Press the red button. The red led light will not be lit, showing that the box is in manual mode.

### 11. JOG SWITCH

Manually moves the leg tube cylinders up or down. The jog switch is always active when the control box is turned on. To raise the cylinders push the switch up. To lower the cylinders push the switch down.

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

**CAUTION** **ALWAYS SHUT OFF THE ENGINE, RAISE THE MOLDBOARD WITH THE POWER PACK AND SET THE ELEVATION SUPPORT BARS WHEN WORKING ON THE CUTTER DRUM, CONVEYOR OR OTHERWISE SERVICING THE MACHINE.**

The RX-500 gives the user the option of several different cutting widths. These optional cutter widths require a removable cutter housing, which can be exchanged from under the machine to facilitate the required width. Read and understand the following procedure when changing cutter housings on your mill.

### A. ATTACHMENT REMOVAL

Remove all necessary external attachments such as: the ladders, grade and slope devices (if equipped), endgate jacks (if equipped), endgate cylinders and the endgates being careful to note the direction of fittings on cylinders and micro torque valve for reassembly later. (figure 50)

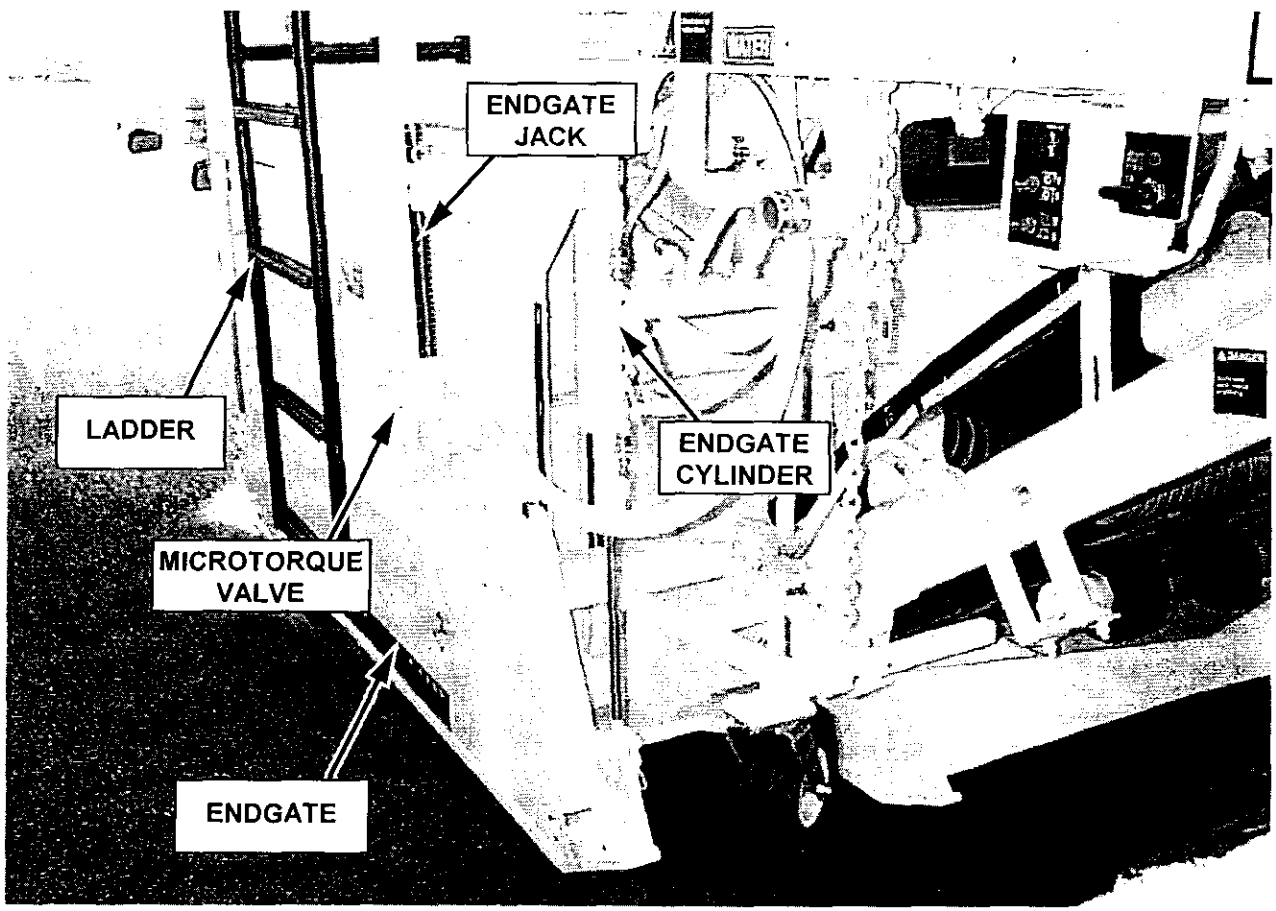



**FIGURE 50**

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### B. ENDGATE REMOVAL

Before removing the endgate bolt, nut and washer, place a support block under the endgate. Remove the endgates even if replacement cutter housing is equipped with endgates (figure 51).

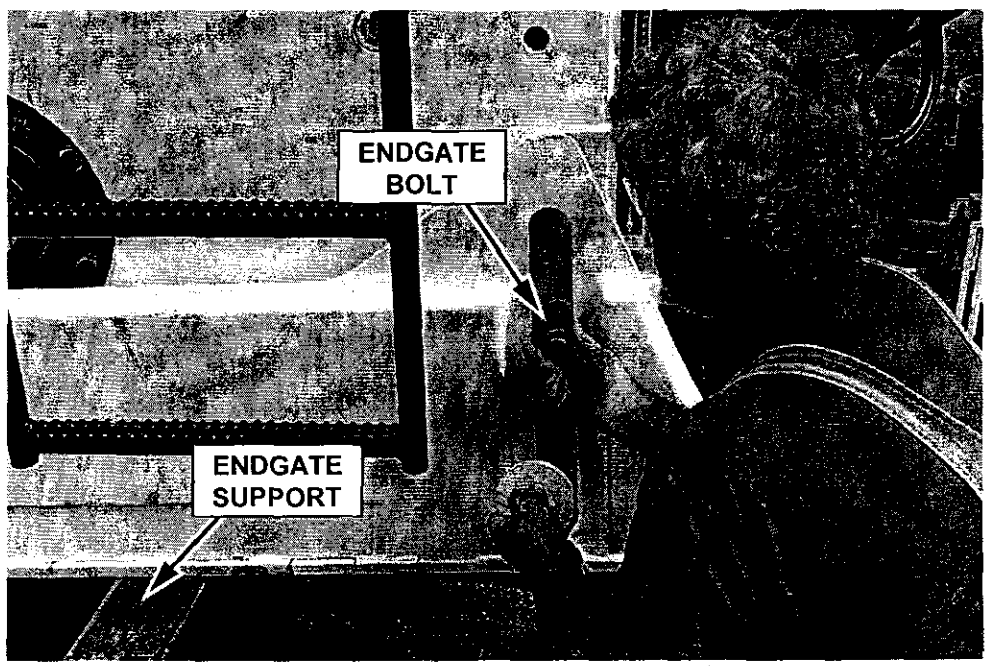



FIGURE 51

### C. CUTTER BELT REMOVAL

1. Remove beltguard housing doors and panels to gain access to the belt tension cylinder and pulley (figure 47).

**CAUTION**

2. Be sure all personnel have been removed from under and around the machine and release the cutter belt tension (engine will have to be started to release the cutter belt).

3. Remove the cutter belt and disconnect any hydraulic hoses that are connected to the belt tension cylinder. Then, support the belt tension pulley with a strap (figure 52).

4. Remove the belt tension cylinder, and the belt tension pulley (figure 53). Be sure that all loose hydraulic hoses are placed in a safe position as to not be pinched when changing cutter housing.

**5. Apply never seize and some form of wrapping to the belt tension pulley shaft. This stops rust from forming and prevents future problems.**

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### C. CUTTER BELT REMOVAL (CONTINUED)

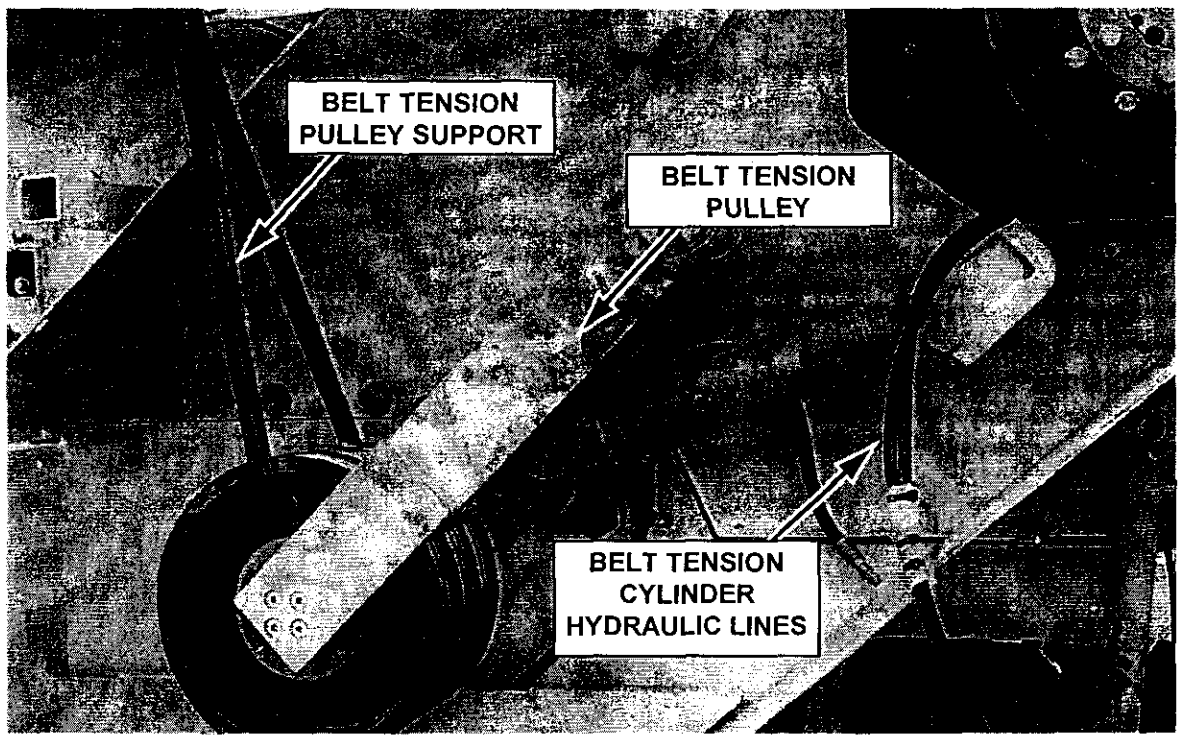



FIGURE 52

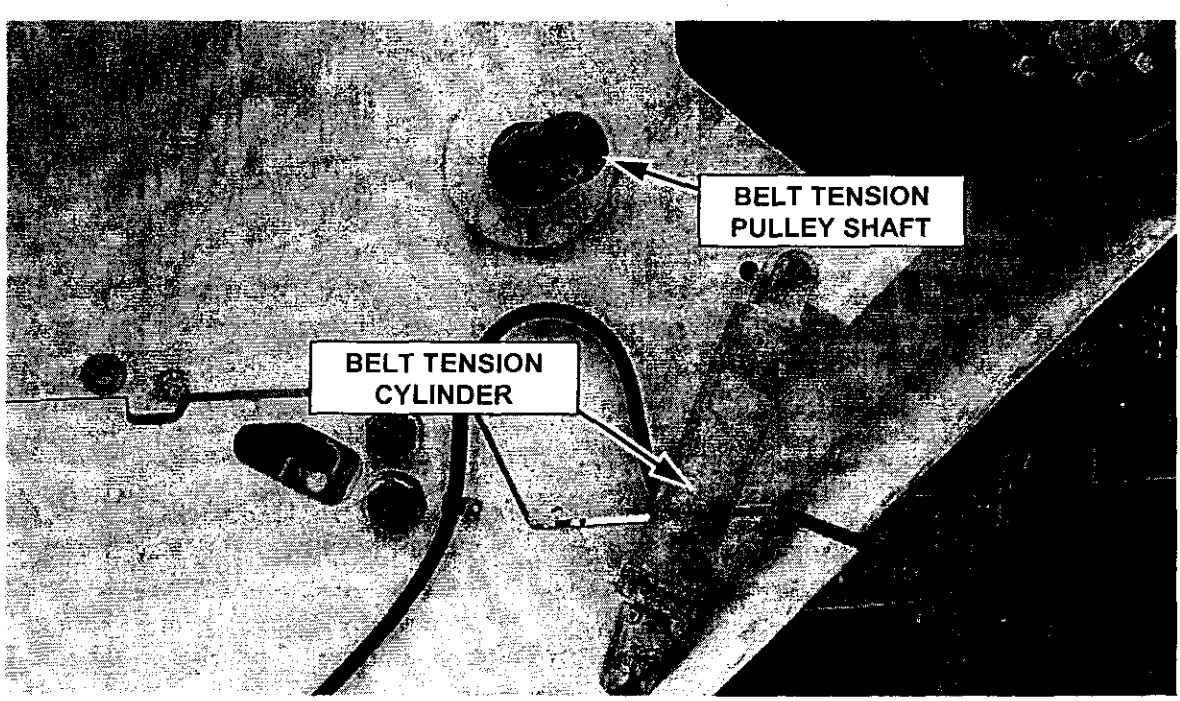



FIGURE 53

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### D. REAR MOLDBOARD CYLINDER

Completely lower the front and rear moldboards. Then remove the cylinder pins from the rear moldboard cylinders. Now, carefully (with all personnel out from under and away from the machine) retract cylinders to keep them from interfering with the cutter housing removal (figure 54).

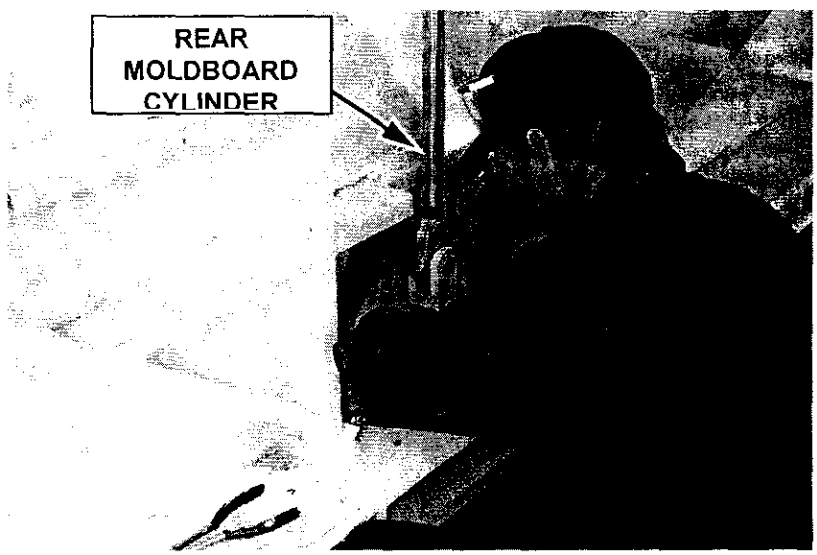



FIGURE 54

### E. PRIMARY CONVEYOR

1. Using some type of lift equipment (i.e. turnbuckle or come-along), slightly raise and suspend the primary conveyor using the side hooks and chains (figure 55 & 56). *Use **caution** and be sure that chains are secured tightly.*

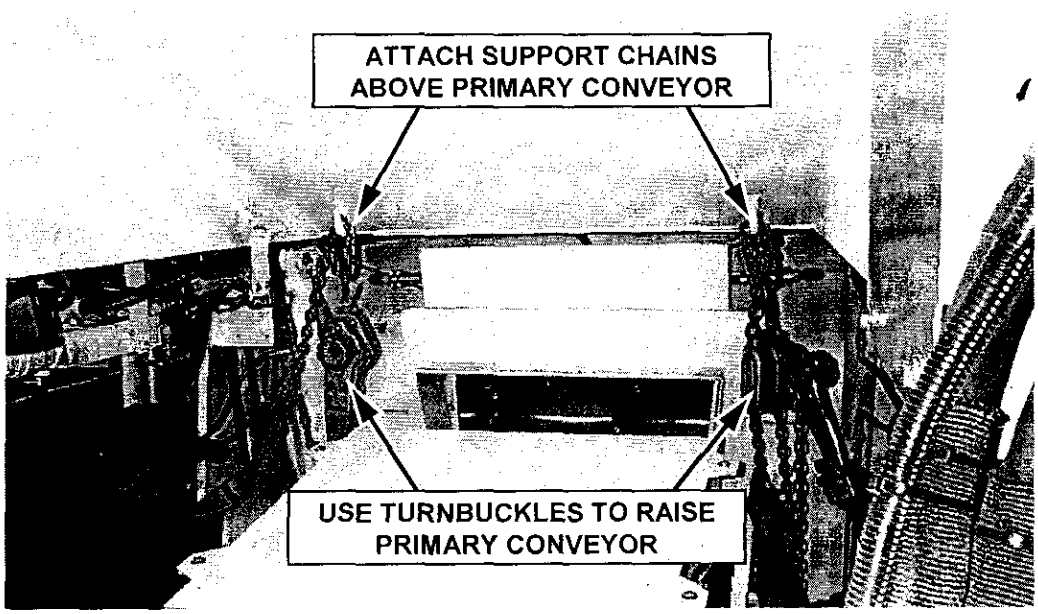



FIGURE 55

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### E. PRIMARY CONVEYOR

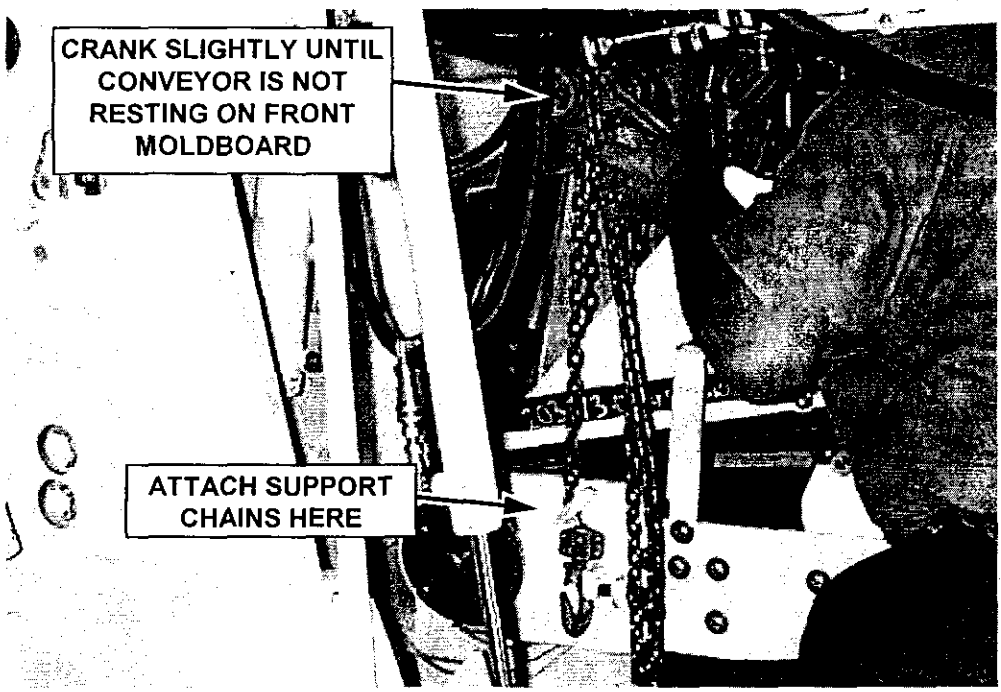



FIGURE 56

### F. SPRAY BAR DISCONNECTS

1. Disconnect the front and rear spray bars using the quick disconnects (figure 57).

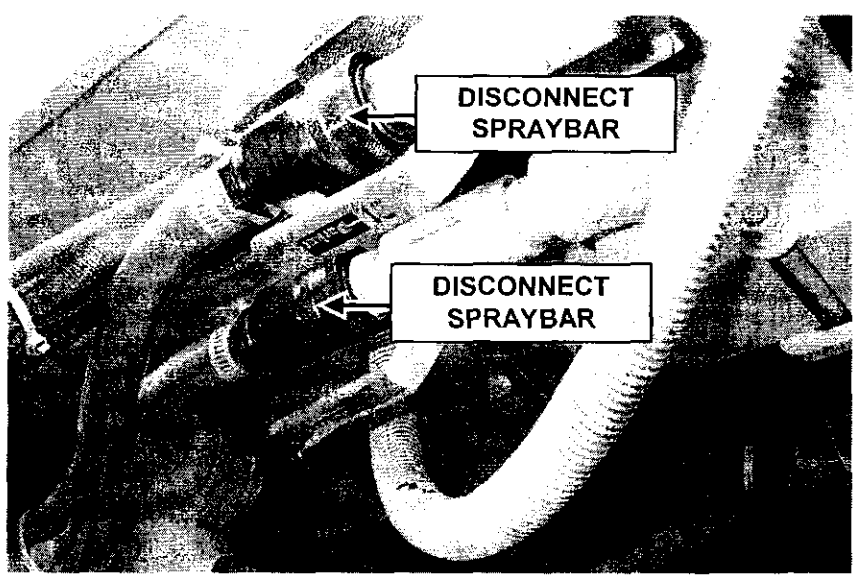



FIGURE 57

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### G. ENDGATE/MOLDBOARD CYLINDER QUICK DISCONNECTS

Disconnect all endgate cylinder quick disconnects (each cylinder has two disconnects) (figure 58).

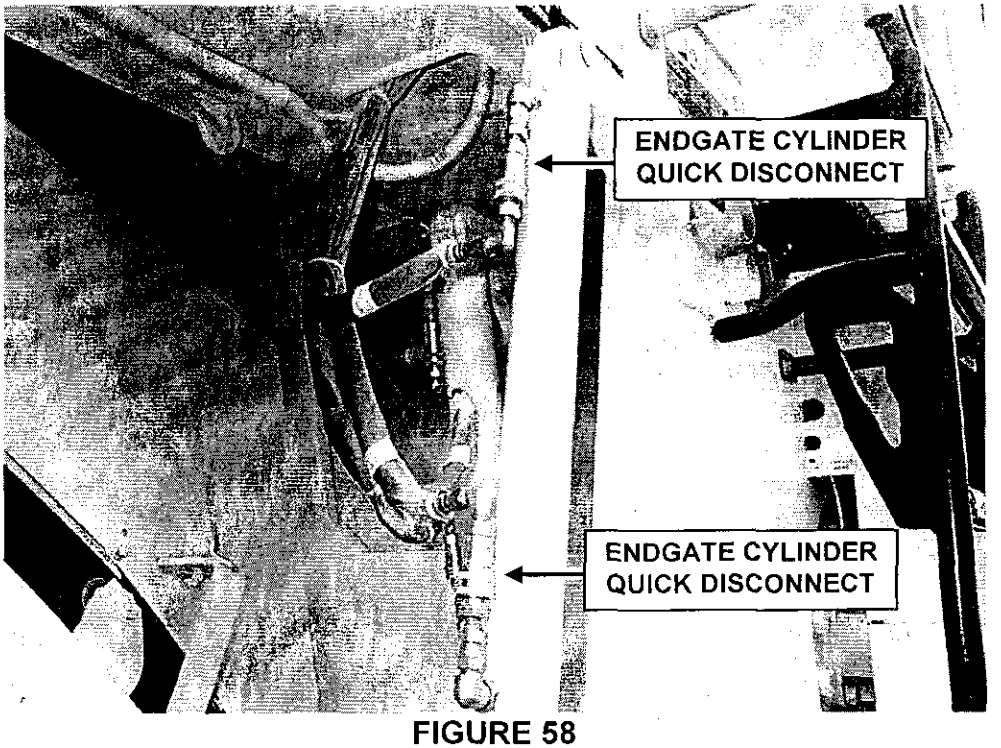



FIGURE 58

Disconnect front moldboard cylinder quick disconnects (two cylinders with two disconnects each) (figure 59).

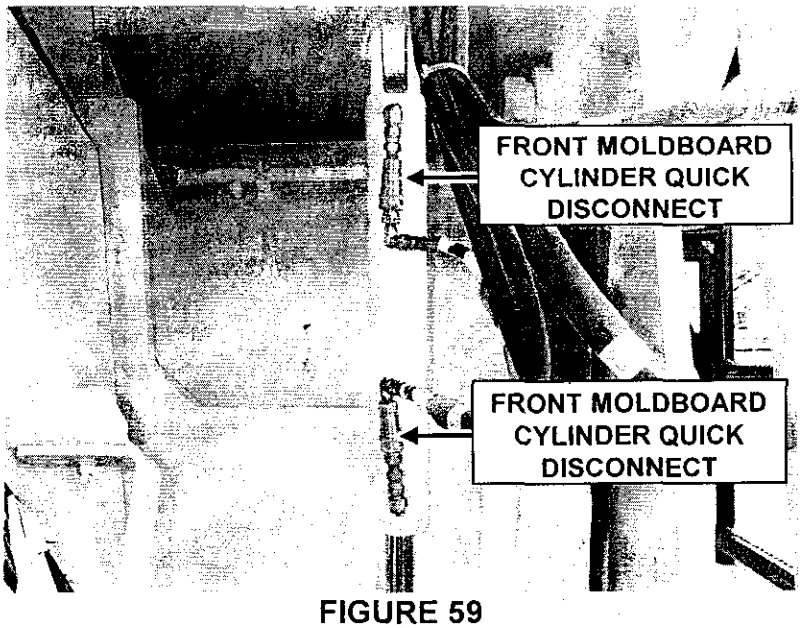



FIGURE 59

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### H. HOUSING BOLTS & HOUSING SKI

**CAUTION** Make sure the area around and under the machine is clear of personnel.

1. Using the elevation switches raise the machine so that a cutter housing ski (provided) can be placed under the cutter housing (figure 60).

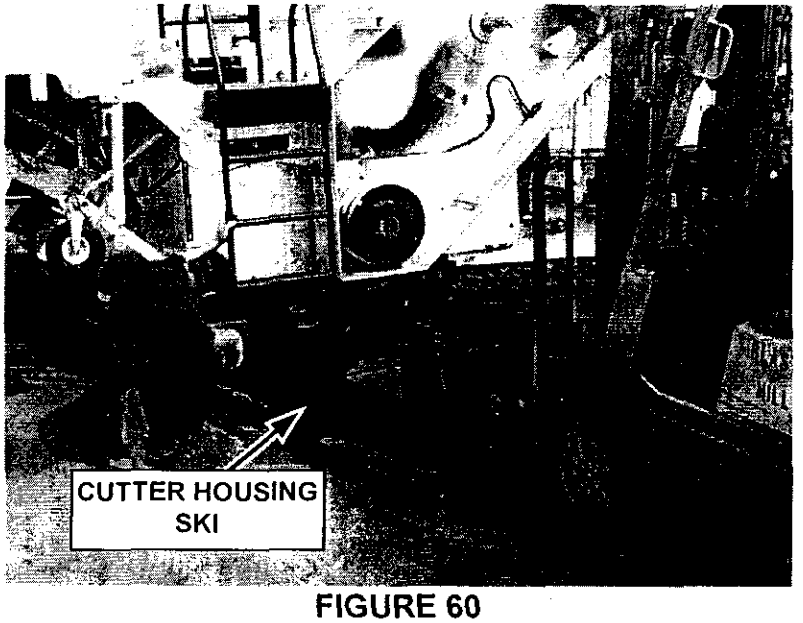



**FIGURE 60**

2. Once the ski is in position, safely lower the machine allowing the ski to line up directly under the cutter housing. bolt the ski to the cutter housing securely, there are eight bolts, four per side (figure 61).

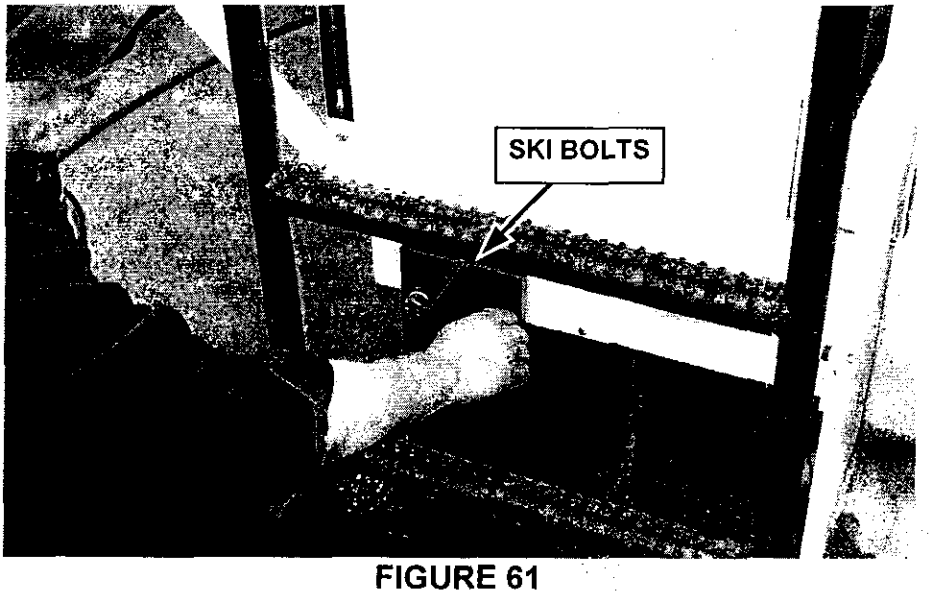



**FIGURE 61**

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### H. HOUSING BOLTS & HOUSING SKI (CONTINUED)

3. With the ski bolted into place safely raise the machine and ski to allow any type of roller to be placed under the ski. the illustration in figure 62 shows solid metal bars being used. The rollers allow the cutter housing and ski to be removed more easily.

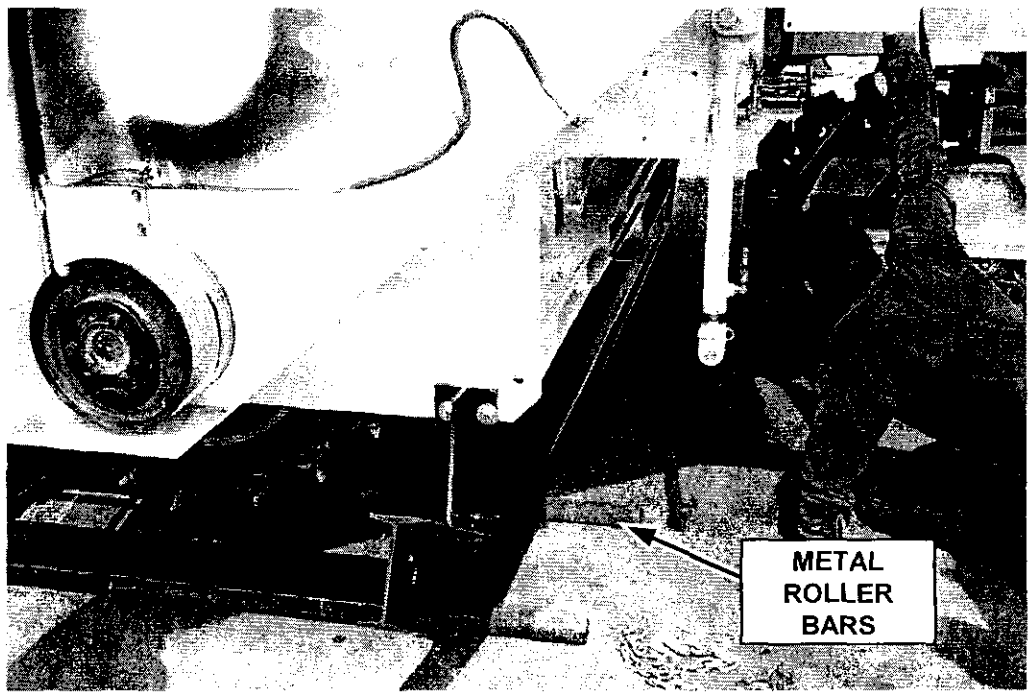



**FIGURE 62**

4. Once the bars are placed, safely lower machine, this allows the weight of the cutter housing to be supported on the ground. Remove the cutter housing bolts, four per side (figure 63).


**FIGURE 63**

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### I. REMOVING THE CUTTER HOUSING

1. Some type of vehicle will have to be used to pull the cutter housing from under the machine. Slowly and carefully, (being aware of personnel in the area) pull the cutter housing from the belt guard side of the machine. The machine will have to be raised and lowered during the process (to clear the primary conveyor and the moldboards) at different points in the path of the housing as it is pulled from under the machine (figure 64).

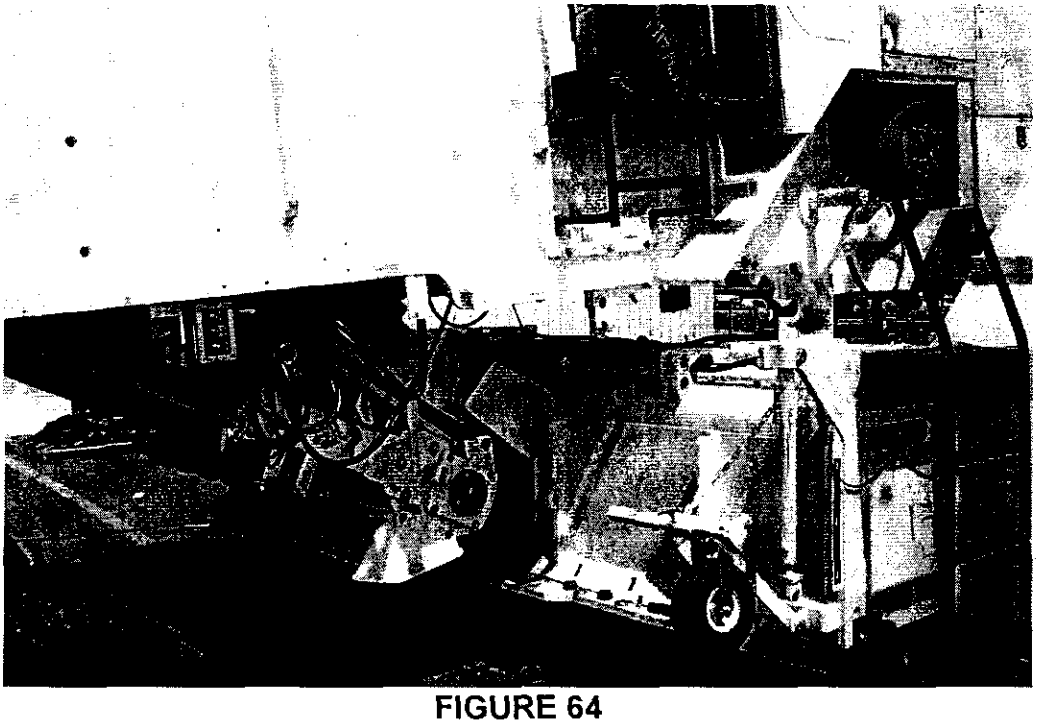


**FIGURE 64**

### J. REPLACING THE CUTTER HOUSING

1. Reverse the procedures in section **F** & **G** to insert a new cutter housing.

2. If the new cutter housing is a wider version such as a 12' 6" then there are a few adjustments in the reinstallation of this cutter housing. We will illustrate and discuss this beginning with section **I.**

## 3.15 INTERCHANGEABLE CUTTER HOUSING PROCEDURE

### K. WIDER CUTTER HOUSINGS

1. Once the new cutter housing is in place under the machine and bolted in using cutter housing bolts. Reconnect the primary conveyor (this may also require some maneuvering of the machine to line up the flashing and conveyor pins). Unbolt the ski and safely raise machine to remove the ski.

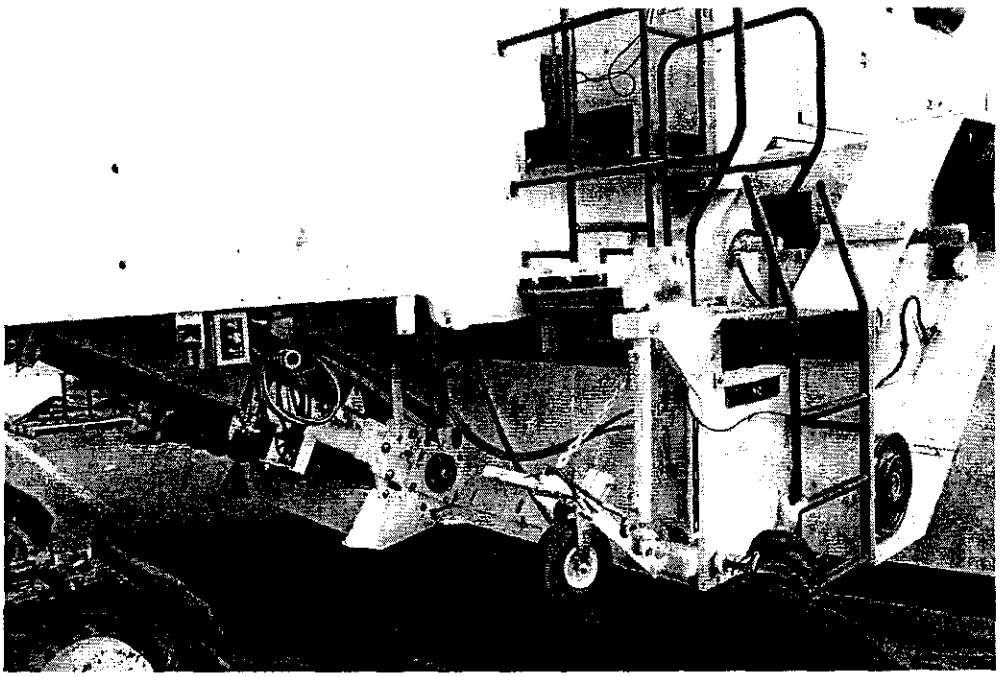


**FIGURE 65**

2. Once the braces and covers are in place, it is just a matter of reconnecting the hydraulics and various components. Reasemble the belt tension system and belt guard being sure to route the hydraulic lines to their appropriate location. Reinstall the moldboard cylinders and reconnect all the Spraybar quick disconnect fittings. Mount the endgates (if there are not any) and reattach the endgate cylinders. Reconnet the endgate cylinder quick disconnects as well as the front moldboard quick disconnects. Mount all the necessary attachments such as: endgate jacks, microtorque valves and ladders. Be sure all the components have been securely attached before attempting to use the machine.

## 3.16 TRANSPORTING THE MACHINE

### A. LOADING THE MACHINE

When loading this machine for transport, there are certain steps that must be taken to help provide a safer process and working environment. Please read and understand the following procedure when loading a machine for transport.

**WARNING** Be sure that no one could be endangered if the machine were to slip or tip over. The loading supervisor must have continuous visual contact with the machine operator and be outside the danger zone.

1. When transporting this machine it is absolutely necessary to be sure that it is securely attached to the transportation vehicle with chains and tensioning devices.

2. Close and lock all compartments and doors.

3. Use only sturdy and secure loading ramps that are sufficiently wide enough for loading this machine.

4. Be sure that the loading ramps are clean of any kind of contaminant or debris that could compromise traction when loading the machine.

5. Loading ramps should be equipped with a non-skid surface (figure 66).

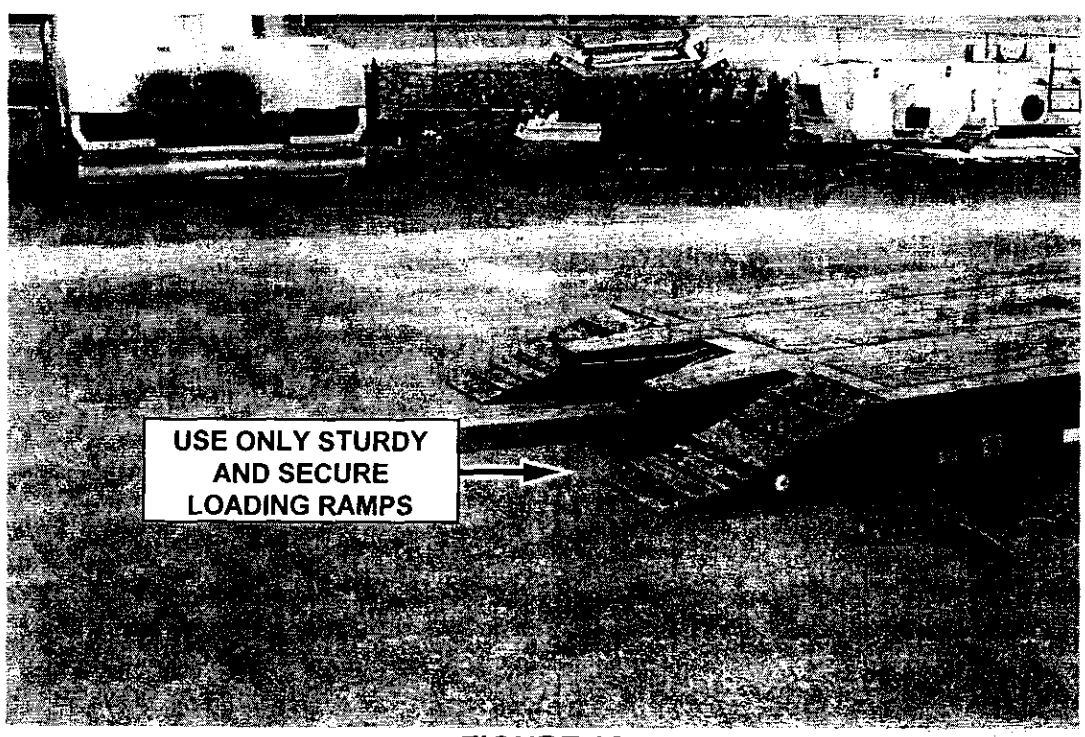



**FIGURE 66**

## 3.16 TRANSPORTING THE MACHINE

### A. LOADING THE MACHINE

6. The machine should be cleaned before it is transported.

7. If the machine is equipped with caster wheels, be sure they have been raised and secured.

8. Be sure all of the emergency shut down buttons have been disengaged (figure 67).

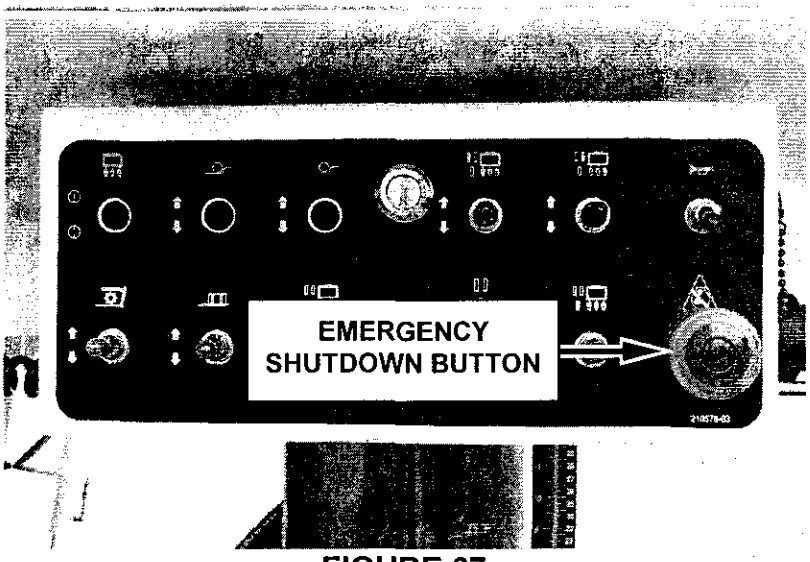



**FIGURE 67**

9. Place the travel control joystick in the center or neutral position.

10. Be sure the parking brake is applied.

11. Be sure the cutter drum has been disengaged.

12. Start the machine's engine and allow it to warm up for about 10 minutes if you haven't already done so.

13. Increase engine speed to full rpm (2100 rpm).

14. Completely raise the machine elevation.

15. Completely raise the front moldboard.

16. Raise the rear moldboard about halfway.

17. Place the travel selection switch in the low working range.

18. Disengage the parking brake.

## 3.16 TRANSPORTING THE MACHINE

### A. LOADING THE MACHINE

19. Using the travel controls, travel the machine slowly onto the transportation vehicle until its final position is reached. Make sure that the machine has plenty of clearance when loading (figure 68).


**FIGURE 68**

20. Lower the machine elevation evenly, until there is a couple of inches of gap between the cutter drum and the transport vehicle. Do not allow the cutter drum to rest on the transport vehicle as this may damage the transport vehicle.

21. Apply the parking brake.

22. Lower the secondary conveyor as low as possible.

23. Shut the machine down and turn the battery disconnect switches to the "off" positions.

## 3.16 TRANSPORTING THE MACHINE

### A. LOADING THE MACHINE

24. Securely tie the machine down to the transport vehicle. Each corner of the machine is equipped with a tie down point. Secure the machine to the transport vehicle with chains and tensioners at all four of the tie down points (figure 69).

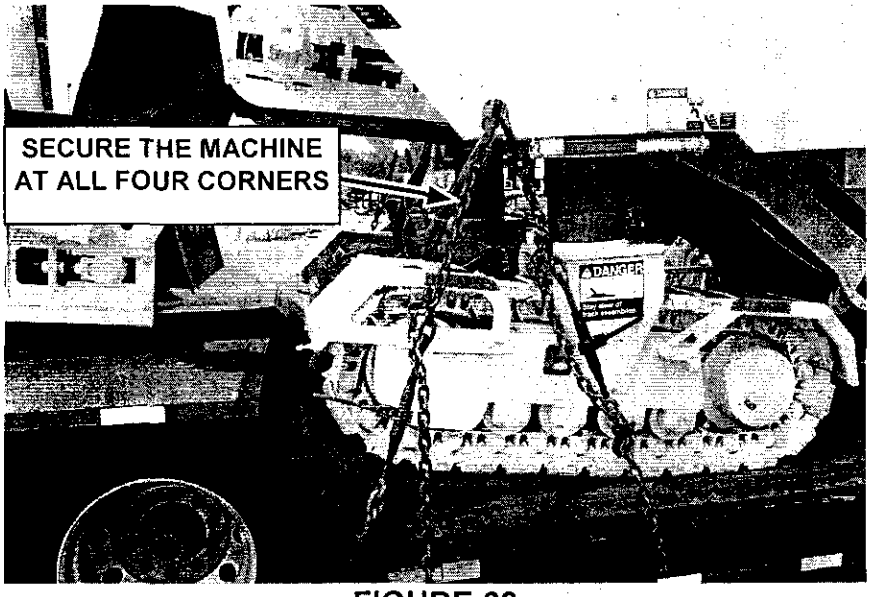



FIGURE 69

25. Use chains and tensioners to secure the secondary conveyor from swinging during transport (figure 70).

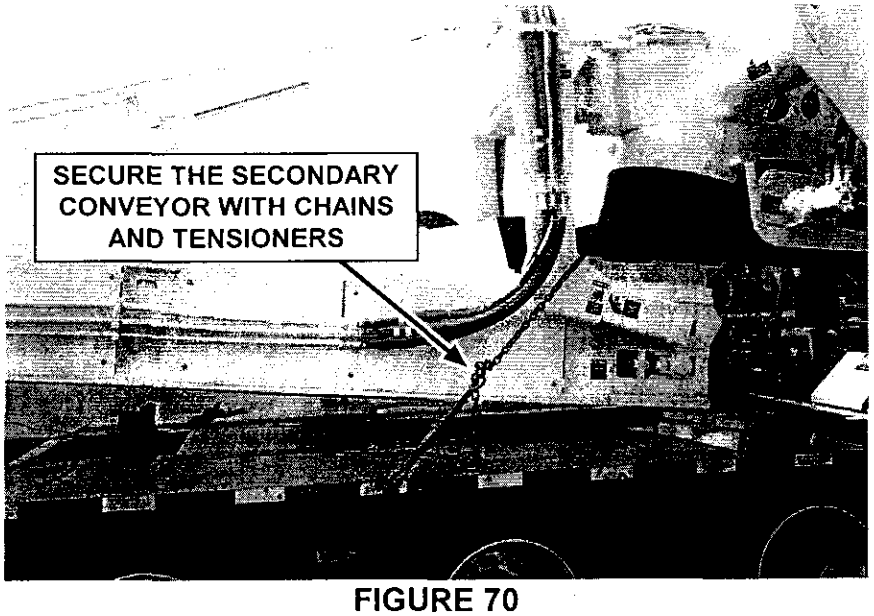



FIGURE 70

## 3.16 TRANSPORTING THE MACHINE

### A. LOADING THE MACHINE

26. Check the machine's transportation height to be sure of clearance.

27. Add safety flags and flashers to areas of the machine that may protrude beyond the transport vehicle such as the secondary conveyor and the sides of the cutter housing (figure 71).

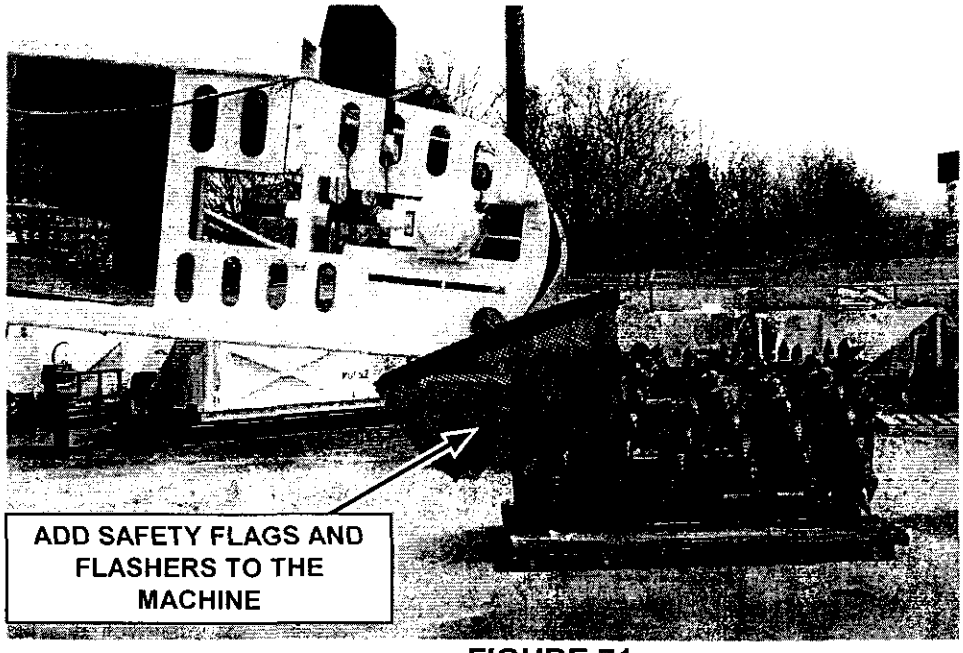



**FIGURE 71**

28. Remove all mirrors in order to prevent them from being damaged during transport.

## 3.16 TRANSPORTING THE MACHINE

### B. UNLOADING THE MACHINE

When unloading this machine after transport, there are certain steps that must be taken to help provide a safer process and working environment. Please read and understand the following procedure when unloading a machine.

**WARNING** Be sure that no one could be endangered if the machine were to slip or tip over. The loading supervisor must have continuous visual contact with the machine operator and be outside the danger zone.

1. Mount all the mirrors to their appropriate locations. The two square mirrors are mounted to the front brackets and the two round mirrors are mounted to the rear brackets (figures 72 & 73).

2. Adjust all the mirrors so that the operator achieves the best possible visibility around the machine (figures 72 & 73).

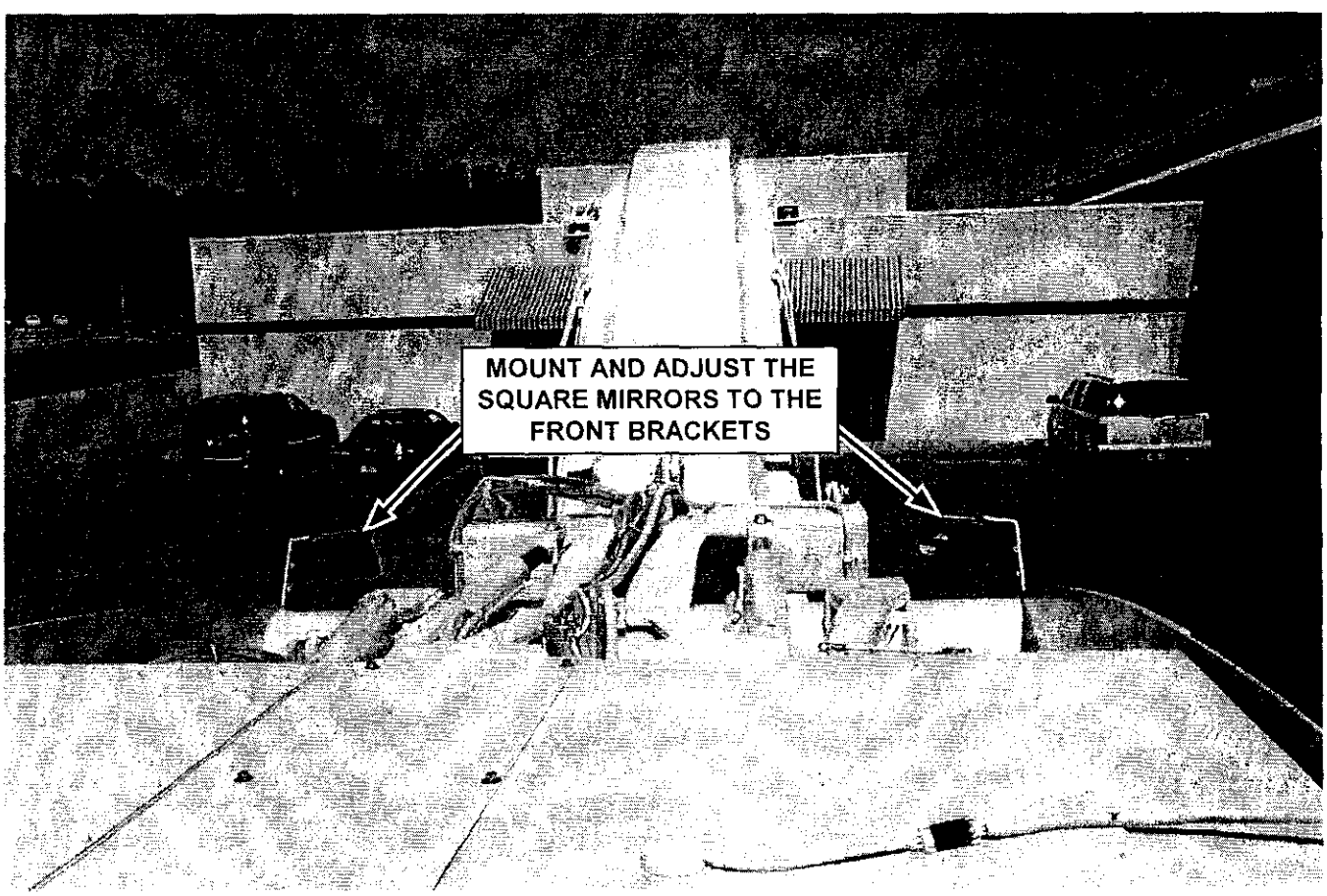



**FIGURE 72**

## 3.16 TRANSPORTING THE MACHINE

### B. UNLOADING THE MACHINE

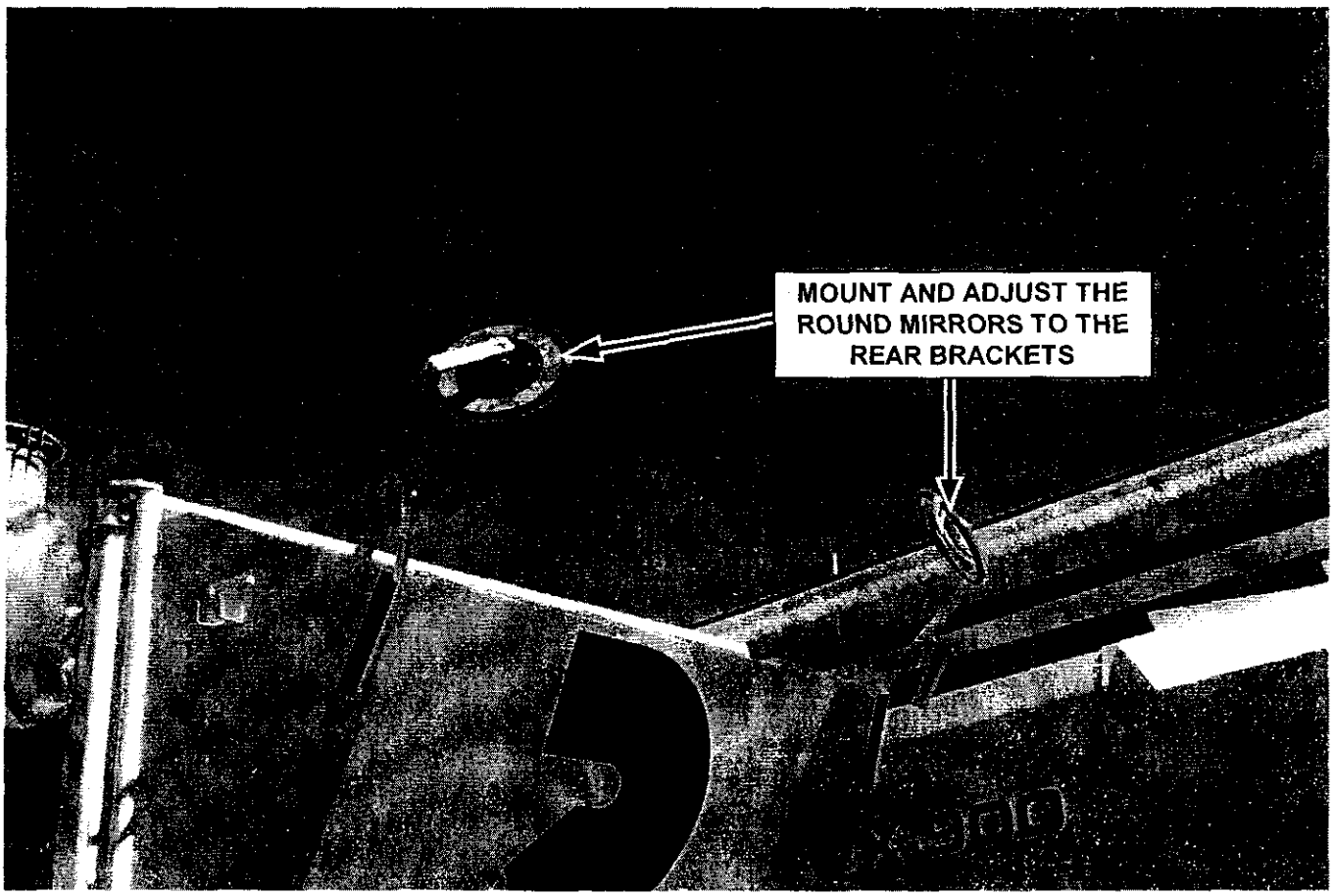



**FIGURE 73**

3. Remove all safety flags and flashers that may have been attached to the machine for transport.

4. Remove all tie down chains from the machine.

5. Remove all tie down chains from the secondary conveyor.

## 3.16 TRANSPORTING THE MACHINE

### B. UNLOADING THE MACHINE

6. Use only sturdy and secure loading ramps that are sufficiently wide enough for unloading this machine.

7. Be sure that the loading ramps are clean of any kind of contaminant or debris that could compromise traction when unloading the machine.

8. Loading ramps should be equipped with a non-skid surface.

9 Turn the battery disconnect switches to the "on" position.

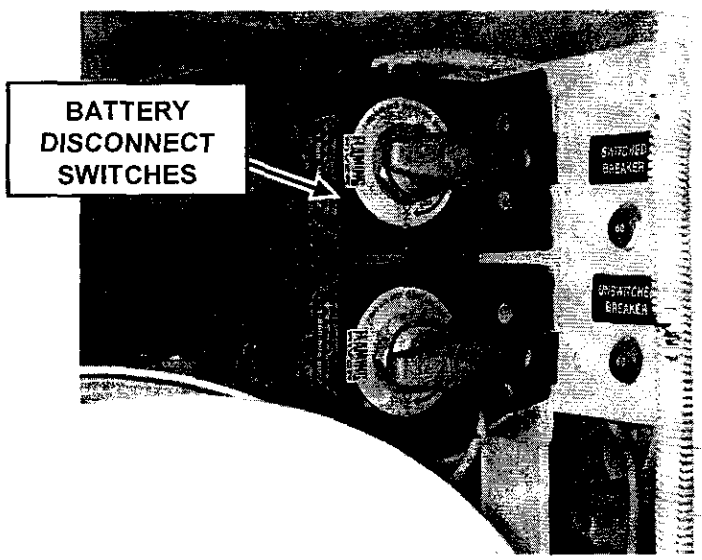



FIGURE 74

10. Be sure all the emergency stop buttons have been disengaged.


FIGURE 75

## 3.16 TRANSPORTING THE MACHINE

## B. UNLOADING THE MACHINE

11. Be sure the cutter drum switch is not engaged.

12. Place the travel control lever in the center or neutral position.

13. Start the machine's engine and allow it to warm up for about 10 minutes.

14. After warming up the engine, increase the engine rpm's to full speed (2100 rpm).

15. Completely raise the machine's elevation.

16. Completely raise the front moldboard.

17. Raise the rear moldboard about halfway to allow for proper clearance when unloading.

18. Raise the secondary conveyor as necessary to allow for clearance when unloading the machine.

19. Place the travel selector switch in the low working range (figure 76).

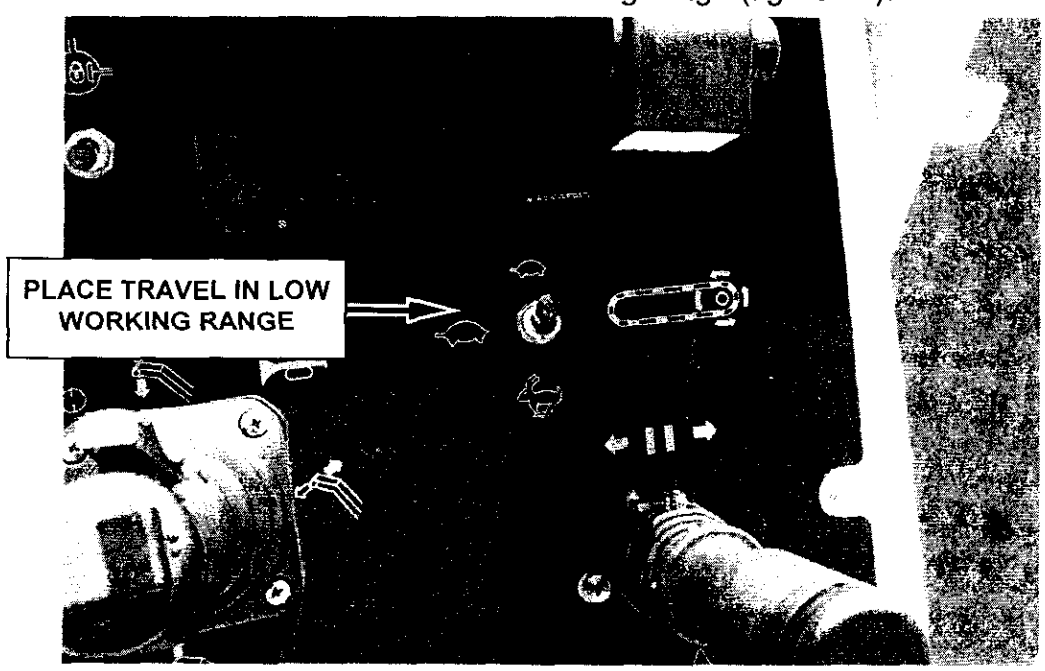



**FIGURE 76**

20. Disengage the parking brakes.

21. Use the travel controls to slowly drive the machine off of the transport vehicle.

22. After machine has been driven to the required location, apply the parking brakes and shut off the engine.

# LUBRICATION AND MAINTENANCE

## 4.1 SUMMARY

The life and reliability of a milling machine is greatly affected by the type, frequency and care of lubrication. Dirt particles that are difficult to see with the human eye can cause many thousands of dollars worth of damage to a mechanical or hydraulic system. Lubricants must be properly stored in clean, covered containers that are properly marked to identify their use. If containers are used to carry lubricants from bulk storage tanks, they should be thoroughly cleaned and provided with covers.

Before removing caps and plugs, thoroughly clean the area around them. Grease fittings and grease gun adapters must be cleaned before injecting grease . Funnels should be washed with solvents and thoroughly dried before and after use. Re-clean all grease fittings and wipe up spilled oils to avoid accumulation and hazardous walkways.

Lubrication should be performed at the end of the day right after the machine has been washed down. Lubricants and debris are most easily flushed while they are warm. This is particularly true in the material handling areas of the machine.

A lubrication schedule is provided with suggested service intervals. If operating conditions are severe, shorter intervals may be required. Only quality lubricants should be used which conform to the lubricant specifications. Fluid levels should be checked when the machine is parked on a level surface.

Over lubrication on non-sealed fittings will not harm the fittings or components, but under lubrication will definitely lead to a shorter life.

All grease fittings are sae standard unless otherwise indicated. Grease non-sealed fittings until grease can be seen extruding from the fitting. One ounce of EP-MPG equals one pump on a standard grease gun.

Clean fuel, lubricants and hydraulic oil from walkways, or loss of footing may easily occur resulting in serious injury or even death.

Use caution when working with hot, pressurized system. You can be burned by hot fluid.

Never fill the fuel tank while the engine is running, near an open flame or when smoking. Always wipe up any spilled fuel.

## 4.1 SUMMARY

Unless otherwise indicated, items not equipped with grease fittings such as linkages, pins and levers should be lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An anti-seize compound may be used if rust has not formed, otherwise the part must be cleaned first.

Lubricants must be at operating temperature when draining.

Visually check the entire unit in regard to cap screws, nuts and pins being properly secured. Check several cap screws and nuts for proper torque. If any are found loose, a more through investigation must be made.

## HYDRAULIC FLUID REQUIREMENTS

Ratings and data for Sauer Danfoss products are based on operating with premium hydraulic fluids containing premium oxidation, rust and foam inhibitors. These include premium turbine oils, API CS engine oils pre SAE j 183, m2c33f or g transmission fluids (type f), power shift transmission fluids meeting Allison c-3 or caterpillar to-2, and certain specialty agricultural fluids. Fire resistant fluids are also suitable at modified operating conditions.

While fluids containing anti-wear additives are not necessary for the satisfactory performance of Sundstrand piston units, they are often required for associated equipment. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion and corrosion of the internal components.

## TEMPERATURE

The operating temperature of the system should not exceed 180 degrees Fahrenheit (82 degrees Celsius) continuous and 220 degrees Fahrenheit (104 degrees Celsius) intermittent at the case drain.

## VISCOSITY

Under operating conditions, the fluid viscosity must be above 55 SUS (9 CST) continuously and never less than 47 SUS (6.4 CST).

## 4.1 SUMMARY

## FLUID LEVELS

| RX-500 FLUID CAPACITIES | | | | |
|---|---|---|---|---|
| COMPONENT | FLUID TYPE | INTERVALS | UNIT OF MEASURE | |
| FUEL TANK | DIESEL FUEL | FILL DAILY | 290 GALLONS | 1100 LITERS |
| HYDRAULIC TANK | ISO VIS. GRADE 46 HYDRAULIC OIL | CHECK DAILY | 75.6 GALLONS (90% FULL) | 286 LITERS (90% FULL) |
| | | DRAIN, FLUSH & REFILL EVERY 1000 HOURS | | |
| ENGINE OIL | 15W40 ENGINE OIL | CHECK DAILY | 11 GALLONS | 41 LITERS |
| | | DRAIN, FLUSH & REFILL EVERY 250 HRS | | |
| WATER TANK | WATER | AS NEEDED-MAINTAIN FULL | 600 GALLONS | 2,271 LITERS |
| RADIATOR | 50/50 MIX HIGH PERFORMANCE ANTIFREEZE & WATER | CHECK DAILY, DRAIN/REFILL- 1000 HOURS | 14.6 GALLONS | 55 LITERS |
| CUTTER DRUM COOLANT | 50/50 MIX HIGH PERFORMANCE ANTIFREEZE & WATER | AS NEEDED-MAINTAIN AT 75% FULL | 75% CAPACITY | |
| TRACK DRIVE PLANETARY | SAE 80W90 HIGH PERFORMANCE GEAR OIL | DRAIN, FLUSH & REFILL FIRST 50 HOURS | 1.2 QUARTS | 1.1 LITERS |
| | | THEN EVERY 1000 HOURS THEREAFTER | | |
| CUTTER DRUM PLANETARY | SAE 80W90 HIGH PERFORMANCE GEAR OIL | DRAIN, FLUSH & REFILL FIRST 50 HOURS | 3.8 GALLONS | 14.4 LITERS |
| | | THEN EVERY 1000 HOURS THEREAFTER | | |
| BELT TENSIONER PULLEY | SAE 80W90 HIGH PERFORMANCE GEAR OIL | DRAIN, FLUSH & REFILL EVERY 250 HRS | 8 OUNCES | .23 LITERS |

* Tank fluid capacity of 90% is the recommended amount of hydraulic oil to refill the hydraulic oil tank. A hydraulic tank that is filled to 100% capacity would overflow when hydraulic fluid expands due to heat.

## 4.2 MAINTENANCE


**Do not work under this machine with the engine running or without the safety bars being in place. This could result in serious injury or death.**


**Before doing any maintenance, service or repairs, read and understand section I - safety precautions and guidelines of this manual to avoid personal injury.**

**Never** service, clean or examine the unit with the engine running.

**Never** service or perform maintenance to the unit unless the track safety bars are in place.

**Never** fill the fuel tank with the engine running, while near an open flame or when smoking. Always wipe up spilled fuel.

**Never** remove the pressurized radiator cap until the engine's cooling system has cooled.

**Do not** alter the engine governor settings from that indicated in the engine manual and engine option plate.

**Never** change cutter drum teeth while the engine is running.

**Always** replace damaged or lost decals. Refer to the parts manual for the proper location and part number of all decals.

**Disconnect** the battery from the electrical system by turning the electrical disconnect switch located inside the belt guard / toolbox; whenever working on the electrical system or whenever welding on the machine.

**Be sure** the battery area is well ventilated should it become necessary to connect a jump battery or battery cable. Fumes can ignite by a spark and explode.

## 4.2 MAINTENANCE

## I. THE FOLLOWING ITEMS ARE ROUTINE ADJUSTMENTS:

### CUTTER DRUM TEETH

**DANGER** DO NOT LOWER THE CUTTER DRUM WHEN THE CUTTER IS NOT TURNING. THE WEIGHT OF THE CUTTER DRUM CAN BREAK THE TEETH.

*ALWAYS USE EYE PROTECTION WHEN REPLACING CUTTER DRUM TEETH.*

SHUT THE ENGINE OFF, RAISE THE REAR MOLDBOARD AND LOCK REAR MOLDBOARD PINS IN PLACE BEFORE REPLACING CUTTER TEETH.

PLACE THE LEGTUBE SAFETY BARS IN THE SUPPORT POSITION BEFORE REPLACEING CUTTER TEETH.

### REPLACING CUTTER DRUM TEETH

The life of the cutter drum teeth will vary with the type of material being cut, the temperature and the span of operation. Check the length of the teeth periodically during the day and be sure they are replaced before the carbide insert is worn completely. If the teeth are not replaced when needed, the holders will start hitting and be severely damaged or even torn from the cutter drum. It is much easier to replace a tooth than to replace a holder and tooth. The teeth can be removed by using an air hammer, straight punch and a drive pin. To change a tooth without the use of an air hammer, insert the tip of the drive pin into the opening in the rear of the tooth holder and strike the drive pin sharply with a hammer to dislodge the tooth. Insert a new tooth into the holder so that the keeper spring is engaged with the holder.

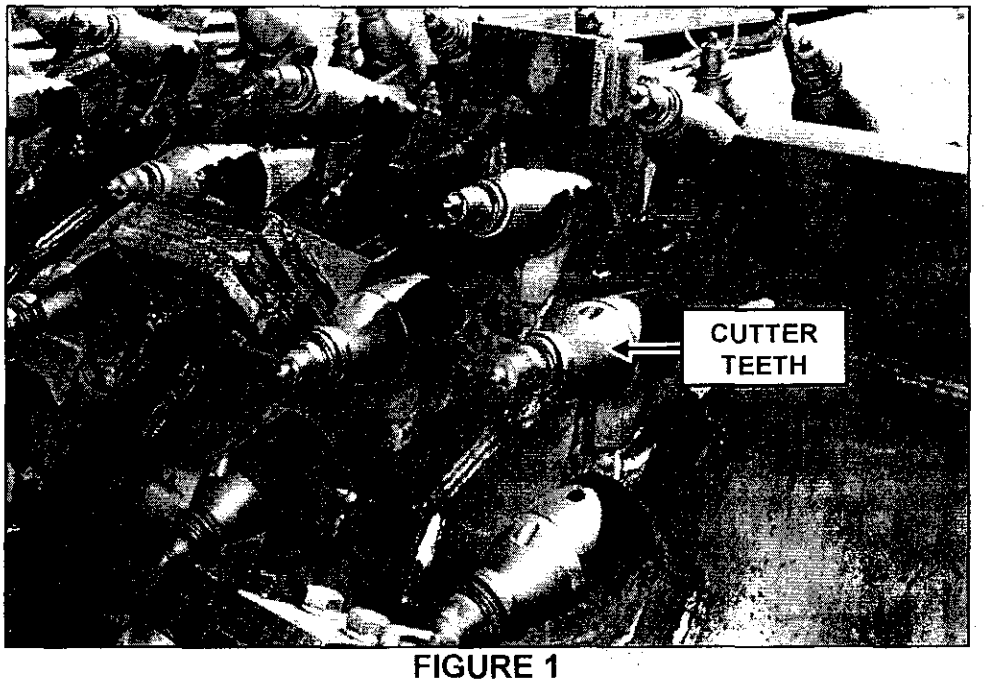



**FIGURE 1**

## 4.2 MAINTENANCE

### AIR CLEANER ELEMENT INSPECTION AND REPLACEMENT

Air cleaner elements should be inspected every 50 hours of operation. They should be replaced with new filters every 250 hours of operation.

**CAUTION** **HOLES, LOOSE END SEALS, DENTED SEALING SURFACES AND OTHER FORMS OF DAMAGE RENDER THE CLEANER INOPERATIVE AND REQUIRE IMMEDIATE ELEMENT REPLACEMENT.**

1. Remove the wing nut that secures the cover to the cleaner housing.
2. Remove the cover.
3. Pull the element out from the center bolt.
4. Remove the gasket from the outlet end of the housing.

**CAUTION** Pull the cover and the element straight out when removing them from the housing to avoid damage to the element.

### ELEMENT CLEANING:

**NOTE!** CLEANING PAPER AIR CLEANER ELEMENTS IS NOT RECOMMENDED. THEY SHOULD BE REPLACED WITH NEW ELEMENTS.

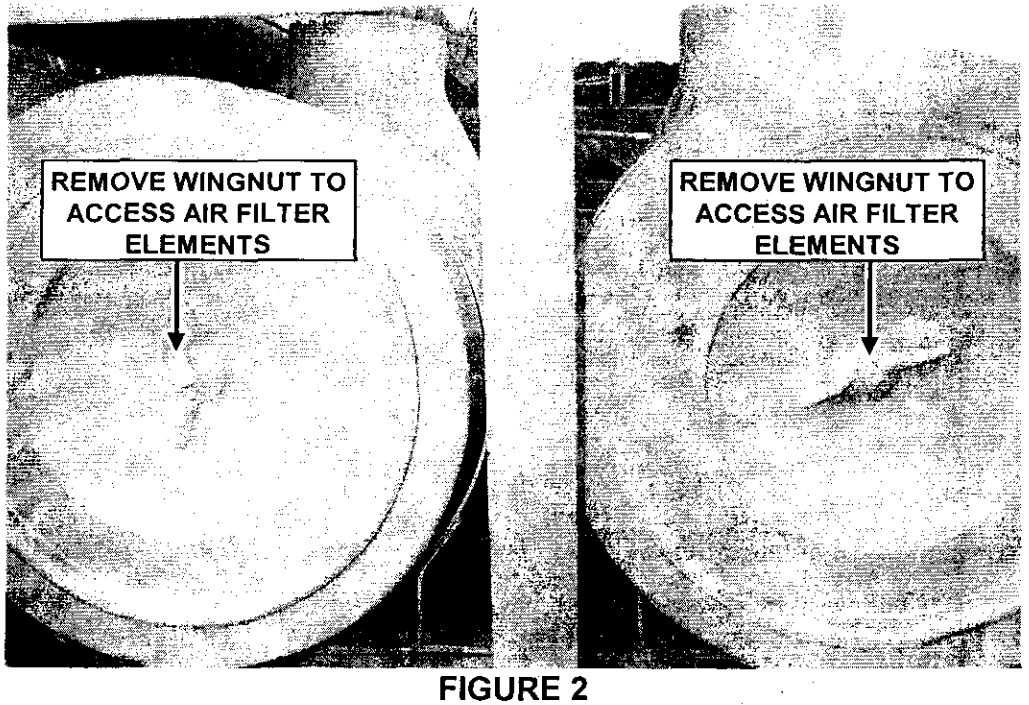



**FIGURE 2**

## 4.2 MAINTENANCE

Cleaning a an element with compressed air

Cleaning elements with Compressed air is recommended when an element will be reused immediately.

**CAUTION** WHEN CLEANING ELEMENTS WITH COMPRESSED AIR, CARE MUST BE TAKEN TO PREVENT THE REMOVED DIRT FROM GETTING REDEPOSITED ON THE CLEAN SIDE OF THE FILTER.

Replace elements every 250 hours of operation or annually, whichever comes first.

- Do not remove plastic fin assembly. Back flowing with compressed air will remove dust from beneath the fin assembly.
- Direct air through the element in the direction opposite of the normal airflow. Keep nozzle at least one inch from the pleated paper.
- Air pressure above 100 psi will damage the element.

### INSPECTION

Place bright light inside element and rotate element slowly. If any rupture, holes or damaged gaskets are discovered, replace element.

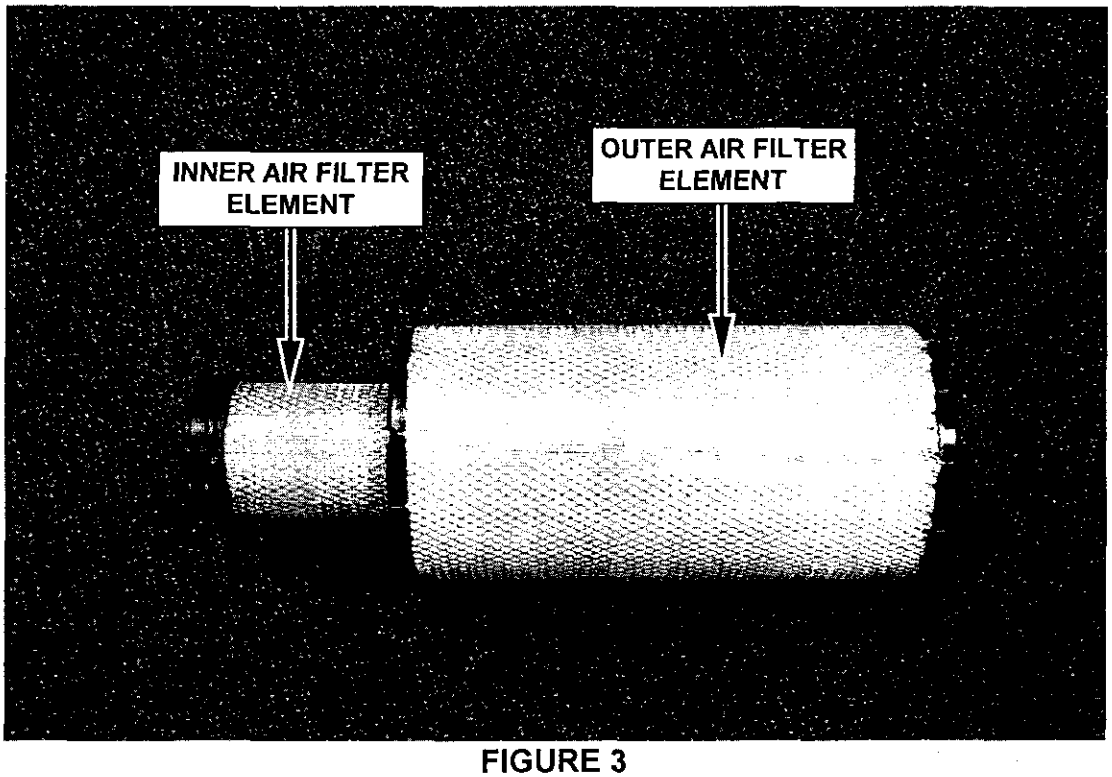



**FIGURE 3**

## 4.2 MAINTENANCE

### CONVEYOR BELTS

**CAUTION** **Do not service the machine with the conveyor safety cables disconnected or the engine running.**

Belt tension adjustments are made at the head pulley. Loosen the jam nut at the take-up bearing adjustment and tighten the take-up bearing adjustment nut to remove top surface belt slack and then tighten an additional 1/2". Equalize both take-up bearing adjustment screws. This procedure is for both the primary and secondary conveyors.

Belt tracking at the head pulley can be corrected by adjusting the tracking from the right and left head pulley take-up bearing adjustment screws (figure 4). Tightening the right take-up bearing adjustment screw will correct the tracking to the left. Tightening the left take-up bearing adjustment screw will correct the tracking to the right.

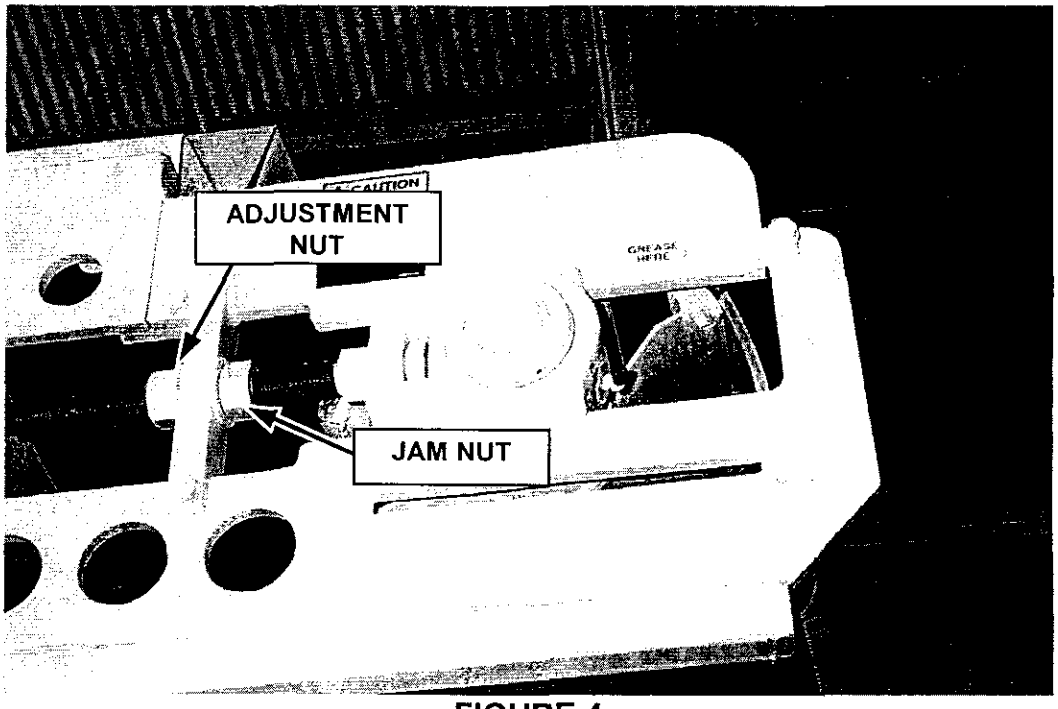



**FIGURE 4**

## 4.2 MAINTENANCE

### CONVEYOR BELTS

Belt tracking at the tail pulley can be corrected by adjusting the tail pulley take-up bearing adjustment screw (figure 5 & 6). Tightening the right take-up bearing adjustment screw will correct tracking to the left and tightening the left take-up bearing adjustment screw will correct tracking to the right.

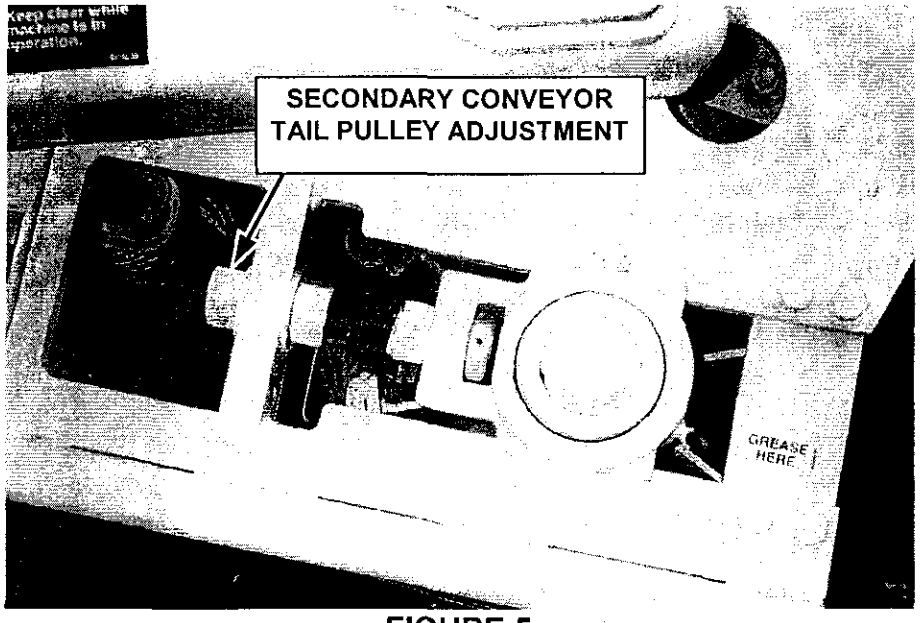



FIGURE 5

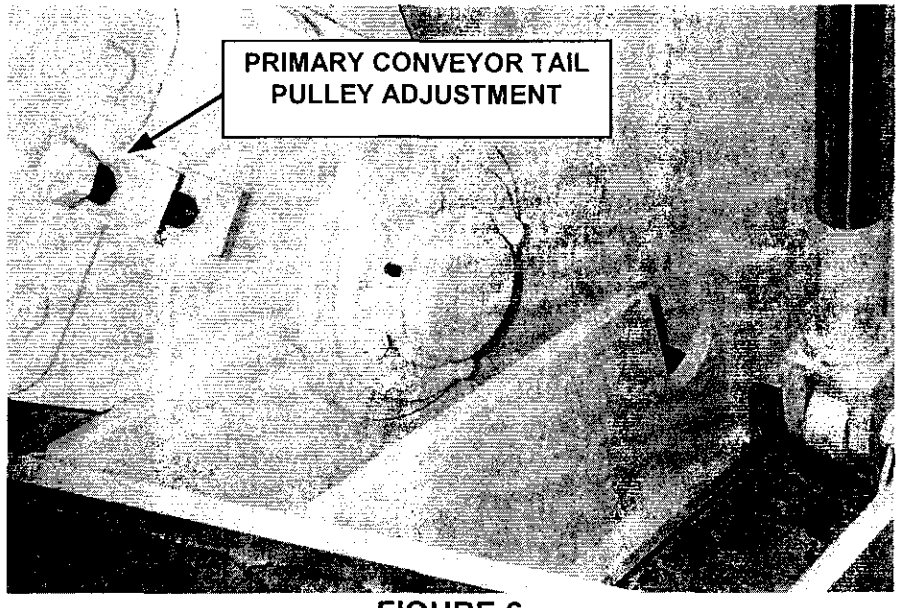



FIGURE 6

## 4.2 MAINTENANCE

### CUTTER DRUM BELTS

Prior to changing belts be sure that:

- The engine is shutdown.
- The parking brake is engaged.
- All elevation locking bars are locked in the safety position.
- Be sure the clutch has been disengaged.

The cutter drum belt tension is maintained automatically by use of the hydraulic belt tensioner.

**Do not** mix new and used belts.

**Do** check sheave adjustment - misaligned sheaves can shorten belt life by up to 50%.

**Do** clean sheaves before replacing belts - dirty or rusty sheaves impair drive efficiency and may result in premature failure.

In order to change out the cutter drum belts, the pressure must be released on the belts. Pressure is released on the cutter drum belts by pressing the belt tension release switch found in the lower right corner of the beltguard (figure 7).

The procedure for the replacement of cutter drum belts is as follows:

1. Check to be sure that the parking brake is applied.

2. Start the engine.

3. Hold the belt tension release switch and the belt tensioner will release pressure from the cutter drum drive belt.

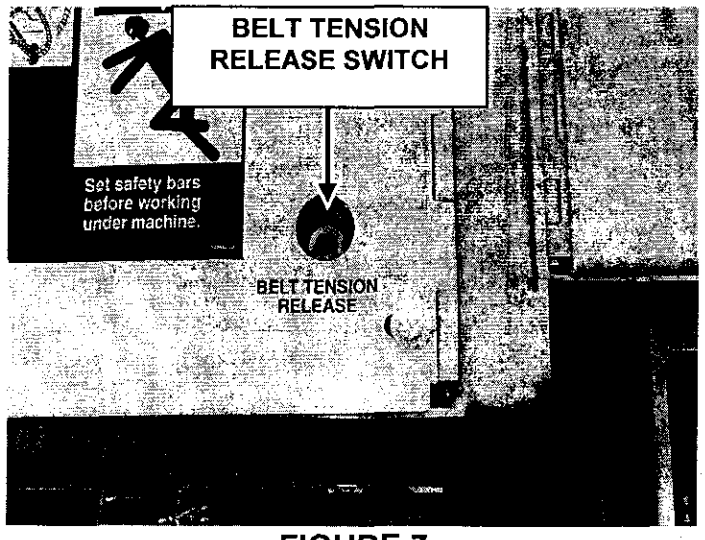



FIGURE 7

## 4.2 MAINTENANCE

### CUTTER DRUM BELTS

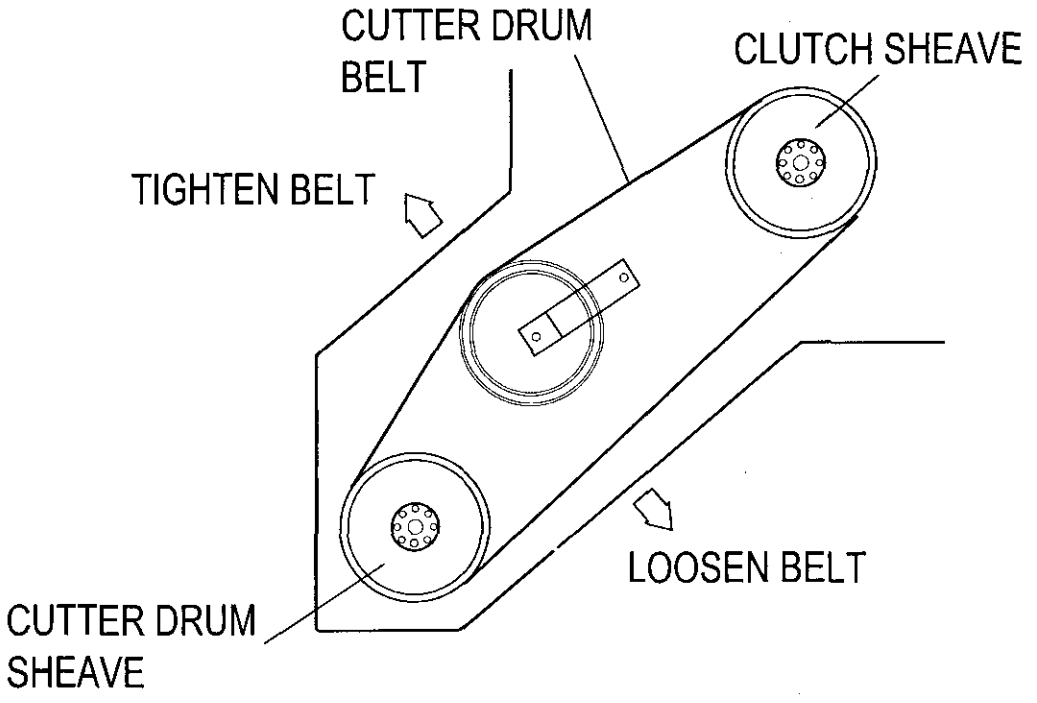



**FIGURE 8**

4. Shut down the engine.

5. For safety be sure to raise the rear moldboard and activate an emergency stop button.

6. The belt guard can now be removed to replace the belts.

**WARNING** **Do not restart the engine while working on the belts. starting the engine will cause the tensioner to automatically tension the belts.**

7. Remove all old belts from the sheave.

8. Replace with new belts onto the sheave.

9. Replace the belt guard.

10. Lower the moldboard and reset any emergency stop buttons that may be activated.

11. Start the engine and the belts will automatically be adjusted to the proper belt tension.

## 4.2 MAINTENANCE

### TRACK TENSION CHECK

The front and rear tracks require track tension adjustment routinely. In order to determine if the track needs to be adjusted, the following check must be completed. Check that the machine is level. Pull a string or place a level or straight edge across the top of the tracks. Use a ruler to measure the distance from the top of the tracks to the string or straight edge (figure 9). If the distance from the top of the tracks to the string or straight edge is greater than ½", the track tension is too loose and tightening of the track must be performed. Check the track tension adjustment for the other tracks.

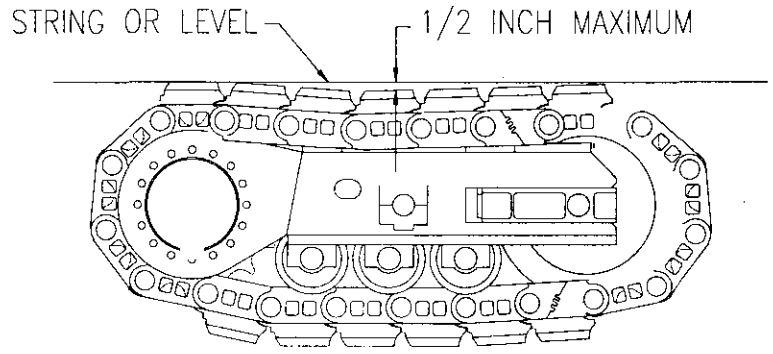



**FIGURE 9**

**Track tension adjustment**

Track tension adjustment is performed by applying grease to the track tensioner grease fitting (figure 10). After a few shots of high temperature grease has been applied, re-check the distance from the top of the tracks to the bottom of the string or straight edge. If the distance is still greater than ½", then apply more grease to the fitting and re-check distance. Repeat this process until the tracks are properly tensioned.

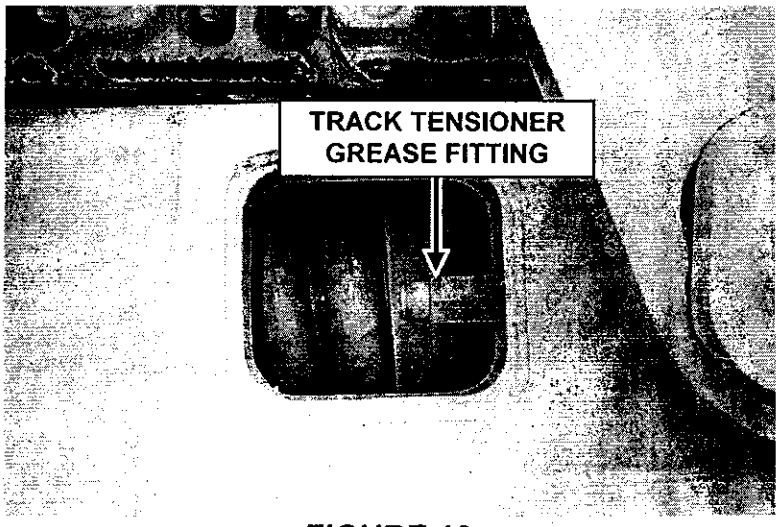



**FIGURE 10**

## 4.2 MAINTENANCE

### TRACK TENSION ADJUSTMENT

If too much grease is applied to the track tensioner or if tracks are to be removed for replacement purposes, tension must be decreased. Relieving track tension is performed by turning the grease fitting counter clockwise with a socket about 5 turns. Grease will be released from the track tension cylinder and track tension will be relieved on the tracks.

**The following items should be completed every 10 hours or daily:**

**Shut down engine and apply the parking brake before working on the machine. Failure to do so can cause serious injury or even death.**

### ENGINE OIL LEVEL

Check the engine oil level before starting the machine each day and maintain it to the full mark on the dipstick. Replace engine oil only with oil recommended by the engine manufacturer (figure 11).

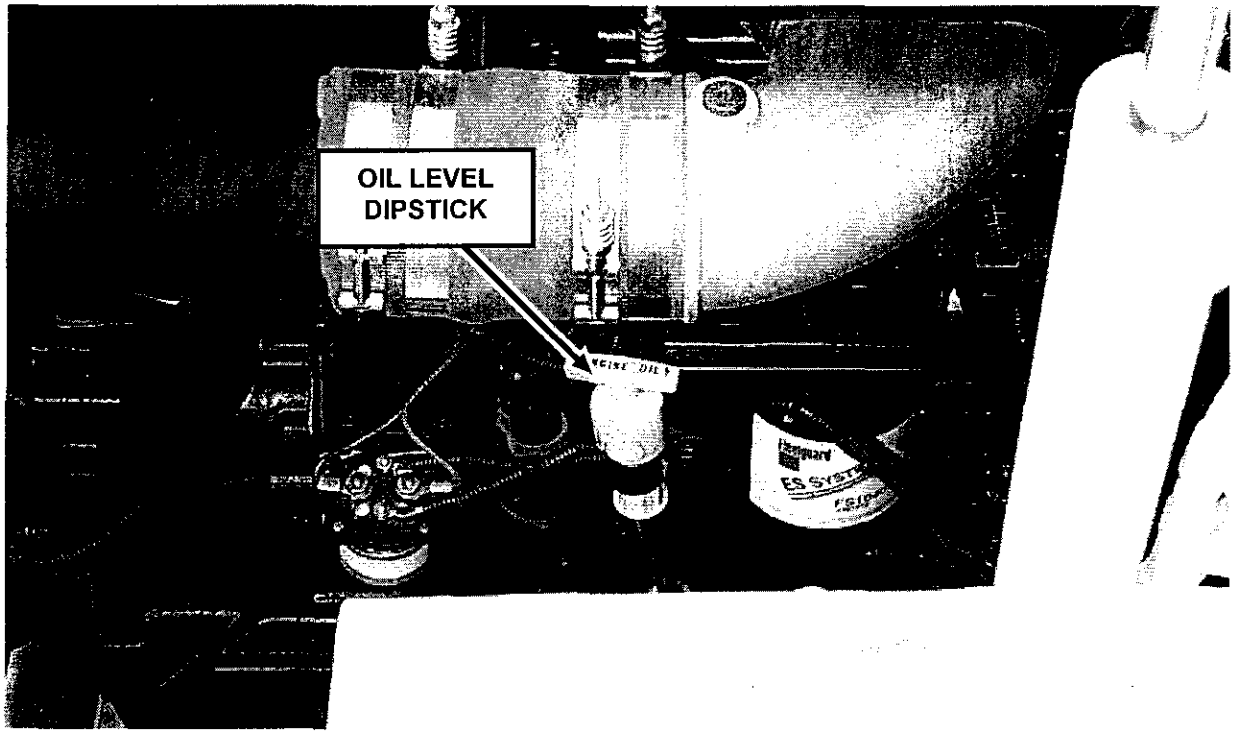



**FIGURE 11**

## 4.2 MAINTENANCE

### ENGINE COOLANT

The coolant level and mix should be checked daily. Maintain the engine coolant to 4" from the bottom of the radiator cap. Use a 50/50 anti-freeze and water mixture (figure 12).

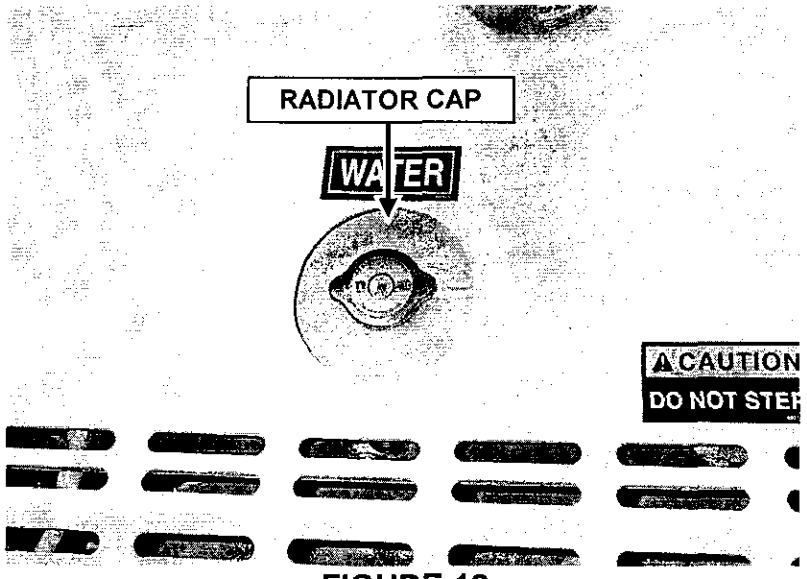



FIGURE 12

### HYDRAULIC OIL LEVEL

Check hydraulic oil level by viewing the sight glass on the left side of the hydraulic tank. The oil level (when hot) should always be visible in the upper levels of the viewing gauge. The level of oil should never be out of the sight on gauge even when oil is cold (figure 13).

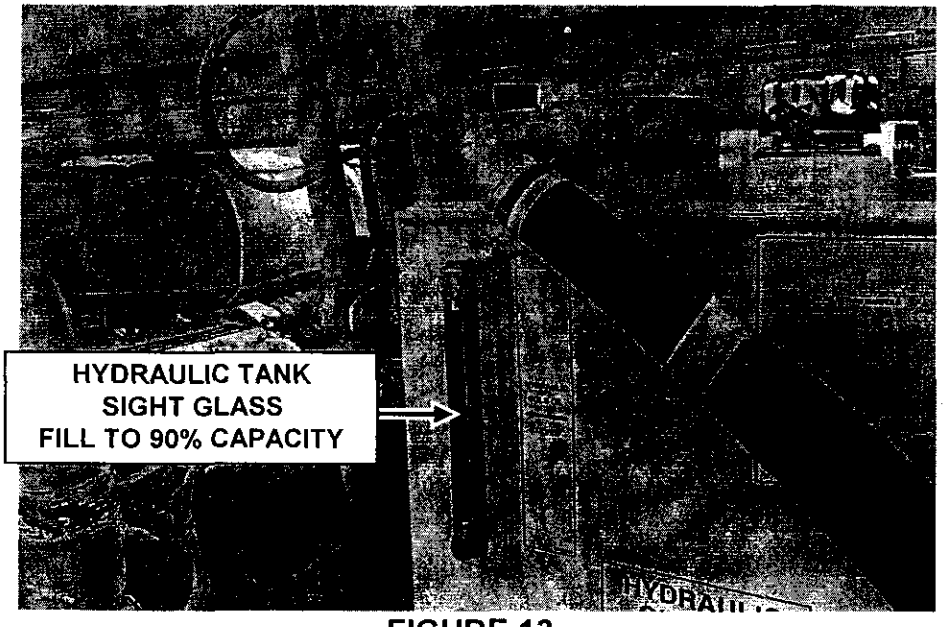



FIGURE 13

## 4.2 MAINTENANCE

### AIR CLEANER INDICATOR

Check the air cleaner filter indicator. Clean or replace the air cleaner filter elements when necessary (figure 14).

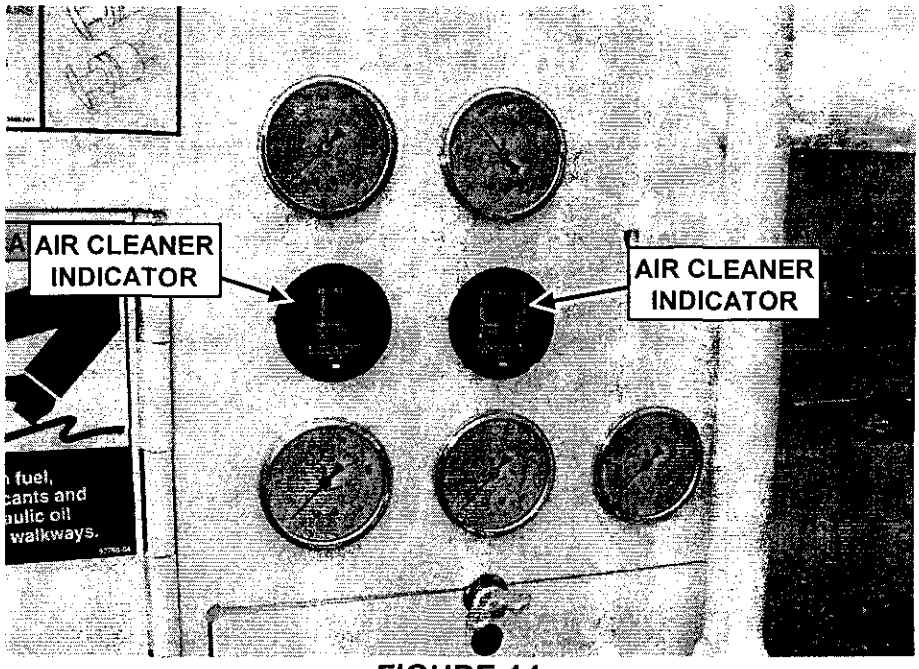



FIGURE 14

### FUEL TANK

Fill the fuel tank at the end of the day in order to reduce water condensation in the fuel. Fill ports are located on either side of the machine, just in front of the operator's console (figure 15).

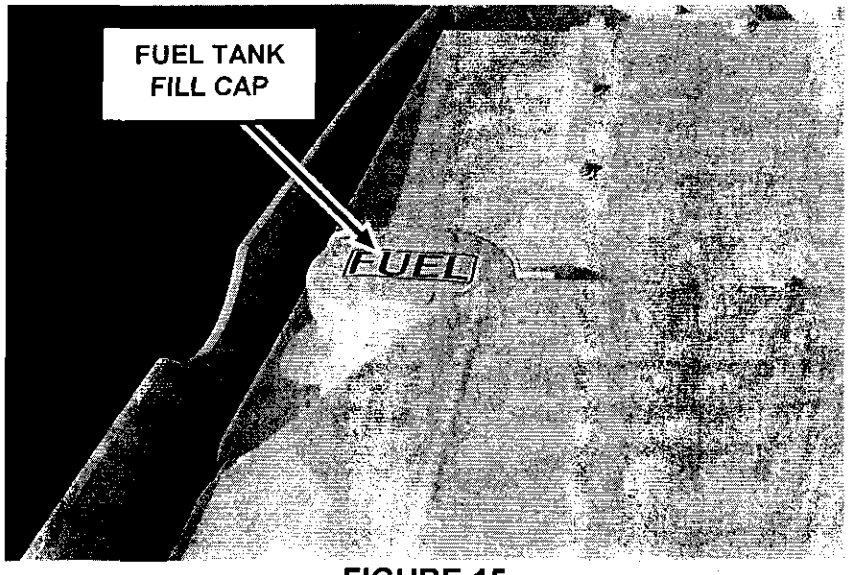



FIGURE 15

## 4.2 MAINTENANCE

### WATER TANK

Fill the water tank through the top water fill port, rear port, or side ports with clean water. Check the water level throughout the day when machine is in operation and replenish when needed. The level gauge is located on the left side of the machine. When the chance of water freezing could occur, drain the water tank at night through the side water drain valve and leave all water valves open (figures 17 and 18).

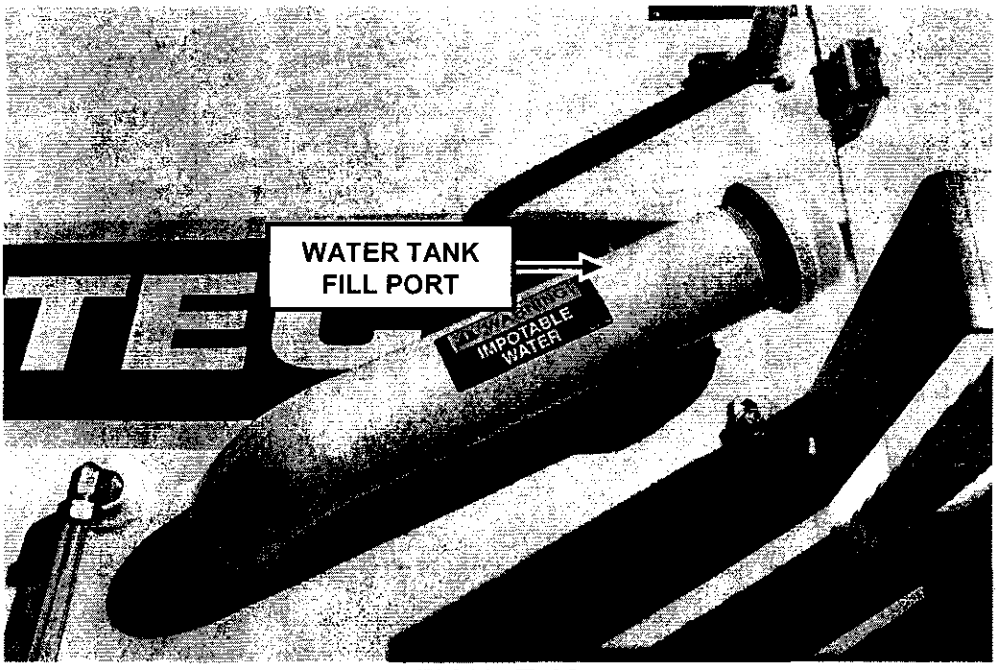



FIGURE 16

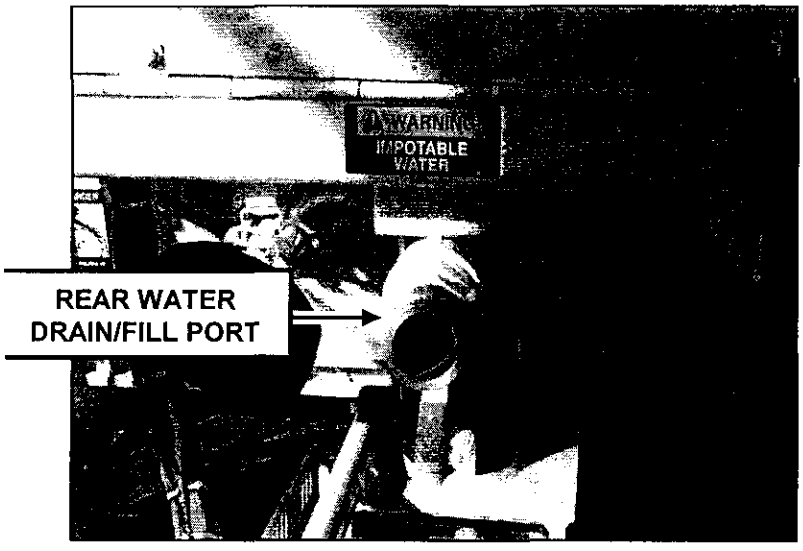



FIGURE 17

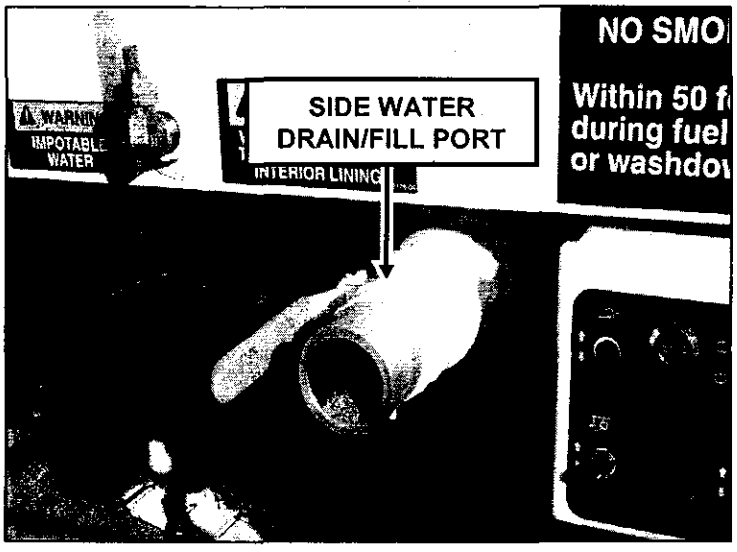



FIGURE 18

## 4.2 MAINTENANCE

### CUTTER DRUM SPRAY BAR AND WASHDOWN FILTER

Clean water filter daily (figure 19) to ensure proper water flow and to keep water nozzles as clear as possible of obstructions. The cutter drum spray nozzles are used to cool the cutter drum teeth. If nozzles become clogged, remove nozzles and clean orifices with a small diameter wire.

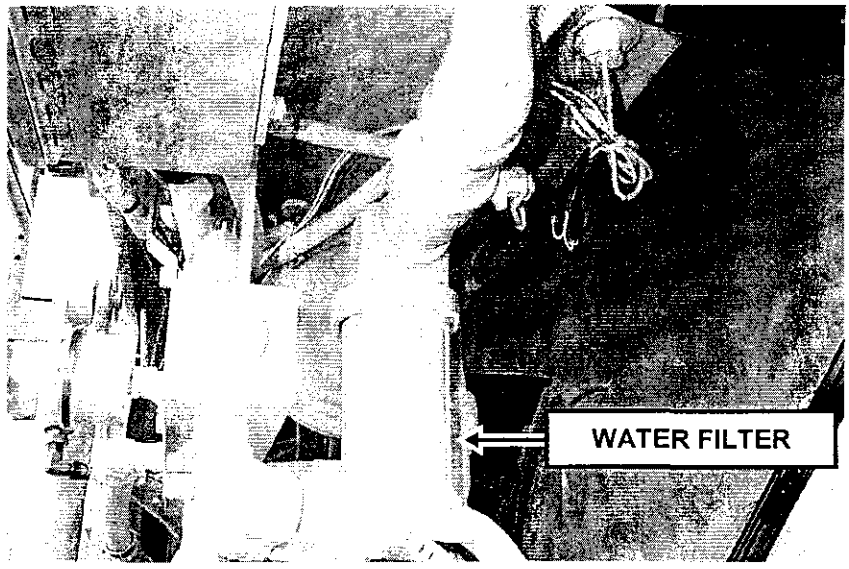



FIGURE 19

### AIR TANKS

Condensation will cause water to accumulate in the air tanks. Be sure to drain any accumulated water at the end of the day by opening the drain valves located at the bottom of the tanks (figure 20).

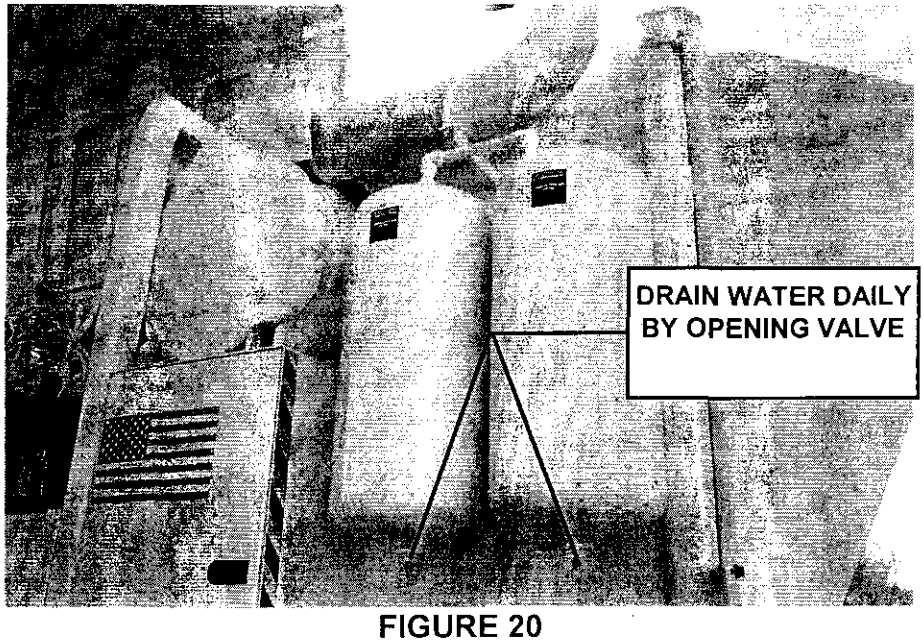



FIGURE 20

## 4.3 LUBRICATION

### FRONT GREASE FITTING BANKS

The grease fitting banks are designed to ease in the greasing of hard to reach areas through remote grease lines. The front grease fitting banks are located at the conveyor pivot area on the left and right mainframe walls (figure 21).

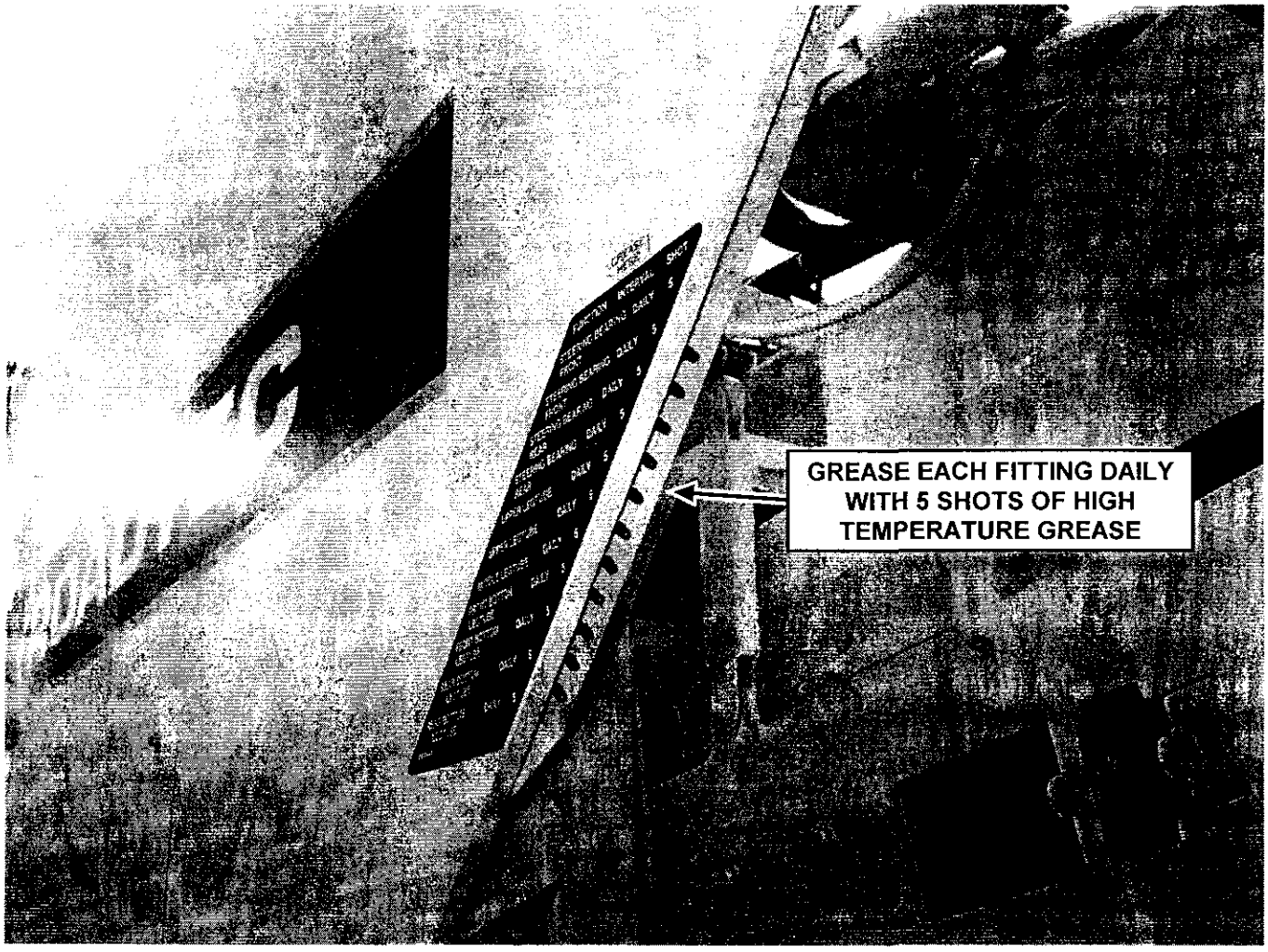



**FIGURE 21**

**Note:** There is a left hand and a right hand front grease fitting bank. Which are in relation to that operational side of the machine. The left hand lubrication bank lubricates components on the left hand side of the machine. And the right hand lubrication bank lubricates components of right hand side of the machine.

## 4.3 LUBRICATION

### REAR GREASE FITTING BANKS

The rear grease fitting banks are located at the rear of the machine on the right and left hand side mainframe walls (figure 22).

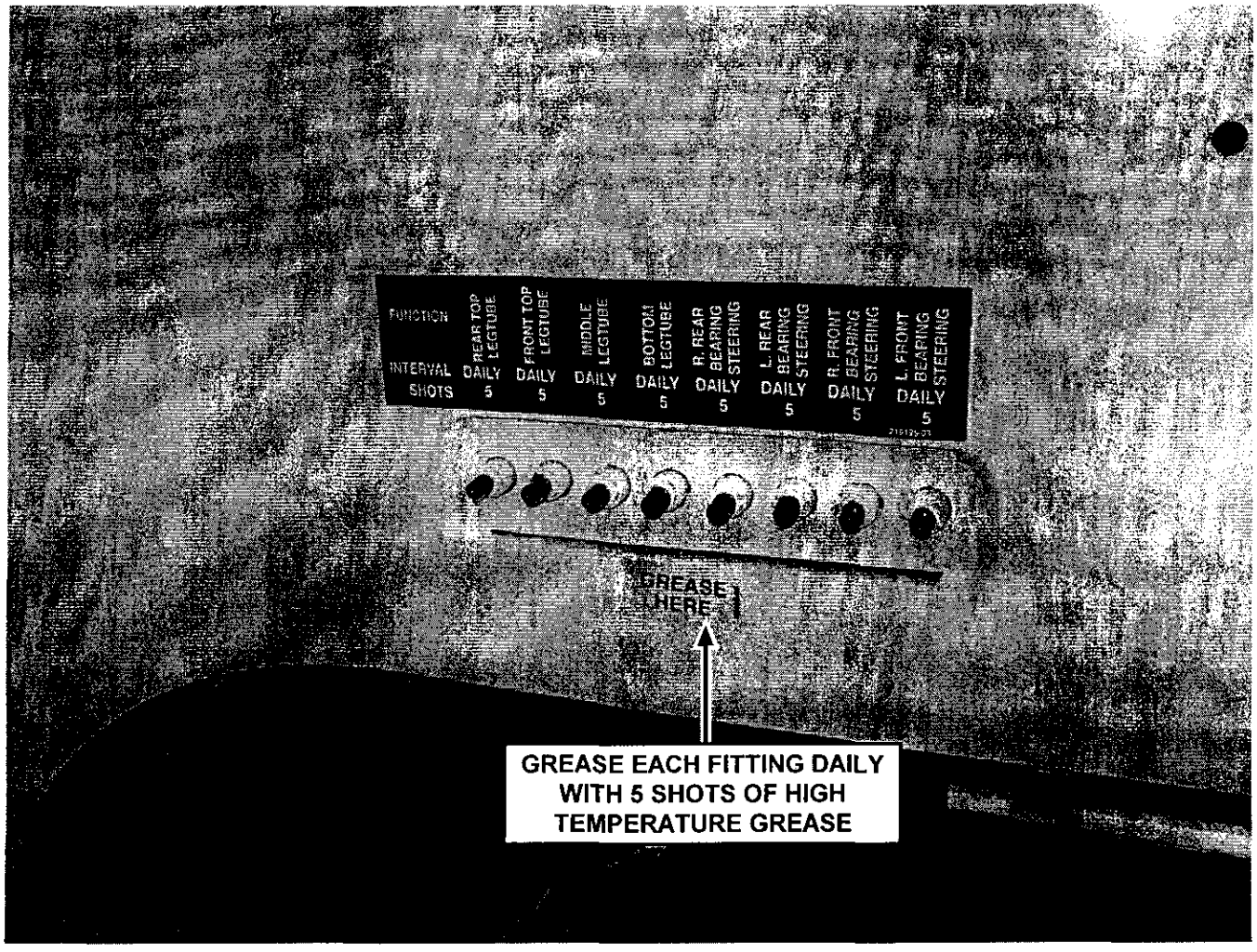



**FIGURE 22**

**Note:** There is a left hand and a right hand rear grease fitting bank, which are in relation to the rear leg tube assembly on that side of the machine. What this means is that the left hand lubrication bank lubricates components on the left hand side of the machine. And the right hand lubrication bank lubricates components of right hand side of the machine. Three track machines will have only one rear grease fitting bank that lubricates the rear legtube.

## 4.3 LUBRICATION

### PRIMARY AND SECONDARY CONVEYOR HEAD PULLEY BEARINGS

Clean any dirt from the fittings on left and right conveyor head pulley grease nipples. Lubricate the primary and secondary conveyor head pulley bearings daily with 5 shots of high temperature grease at each lubrication nipple (figure 23 & 24).

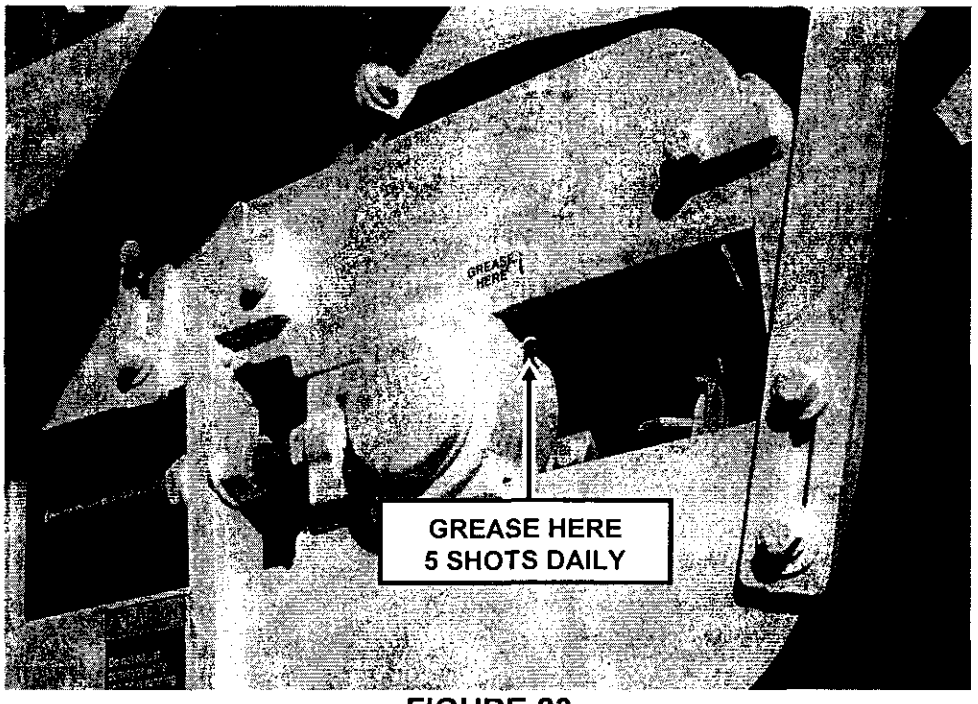



FIGURE 23

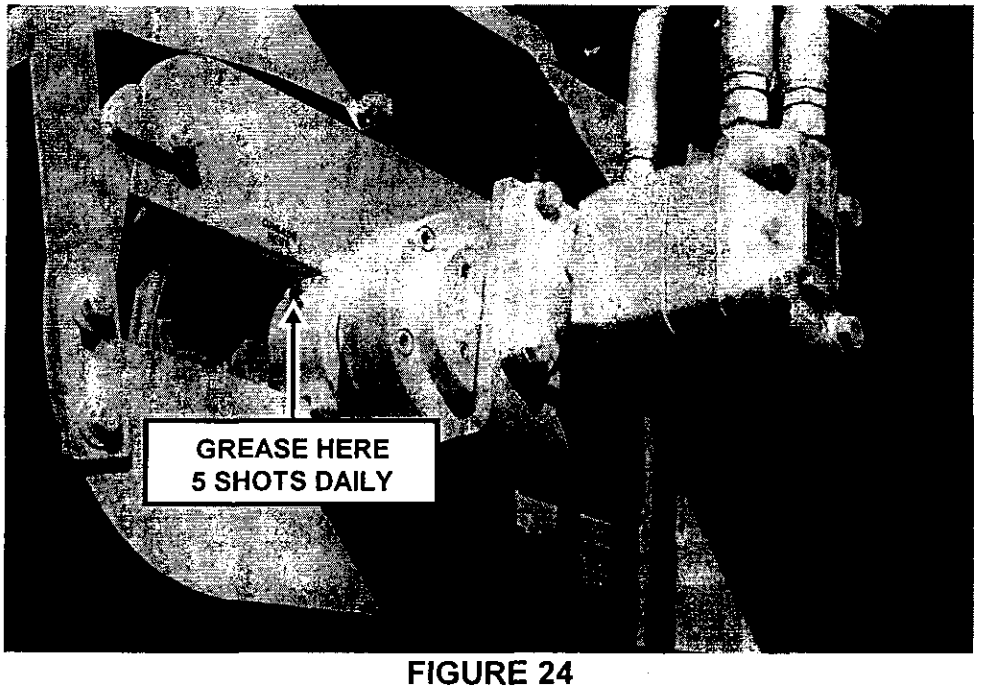



FIGURE 24

## 4.3 LUBRICATION

### PRIMARY AND SECONDARY CONVEYOR TAIL PULLEY BEARINGS

Clean any dirt from the fittings. Lubricate both sides of the primary and secondary conveyor tail pulleys with high temperature grease (figures 25 and 26).

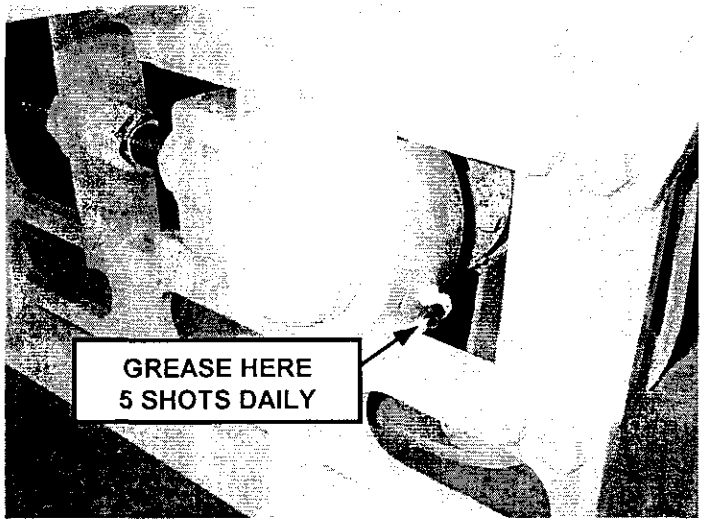



FIGURE 25

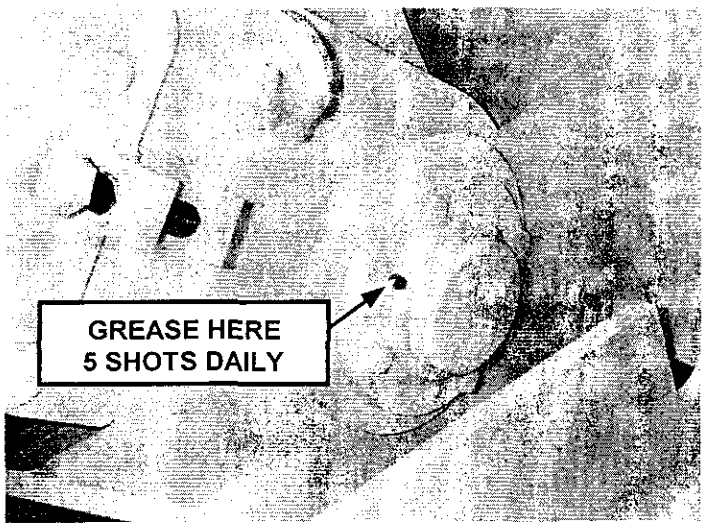



FIGURE 26

### CUTTER DRUM BEARINGS

Clean any dirt and grease from the fittings. Lubricate the cutter drum bearing with high temperature grease 10 shots a day when milling full time. Lubricate the center bearing once daily (figure 27).

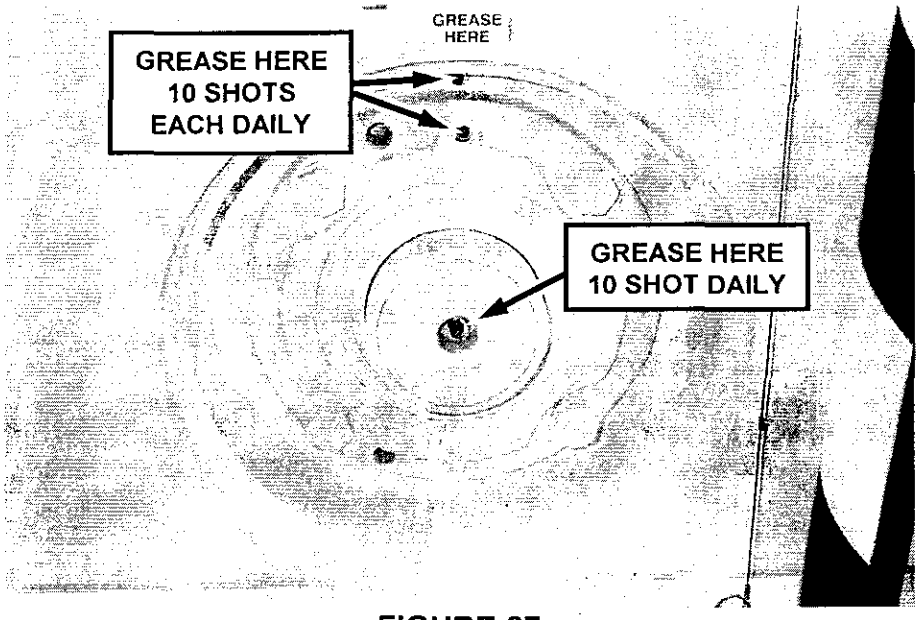



FIGURE 27

## 4.3 LUBRICATION

### CUTTER PLANETARY DRIVE SEAL

Clean any grease and dirt from the grease fitting. Lubricate the cutter planetary drive seal with 15 shots of high temperature grease daily (figure 28).

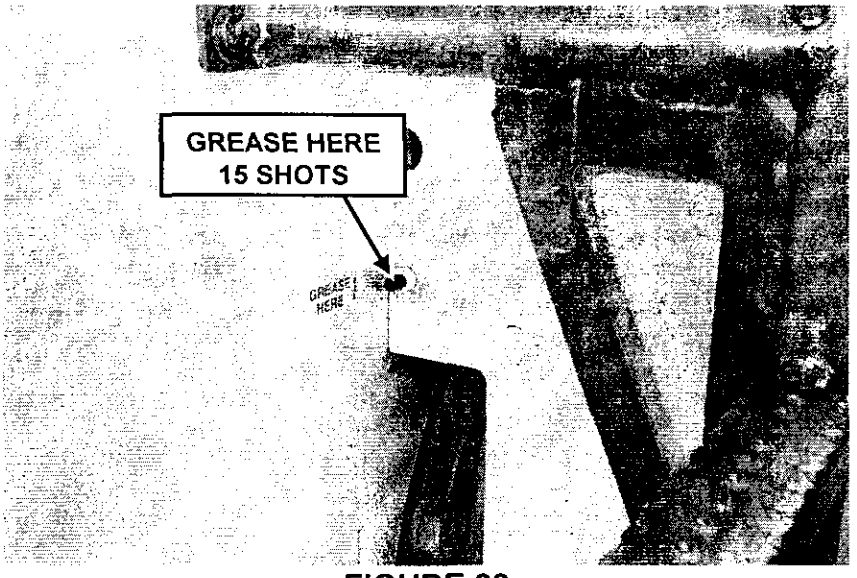



FIGURE 28

### BATTERIES

Open battery cover plate and check each battery for electrolyte level. If a battery should need to have electrolyte added, fill to the base of the vent well. Use only distilled, clean water or iron free water (figure 29).

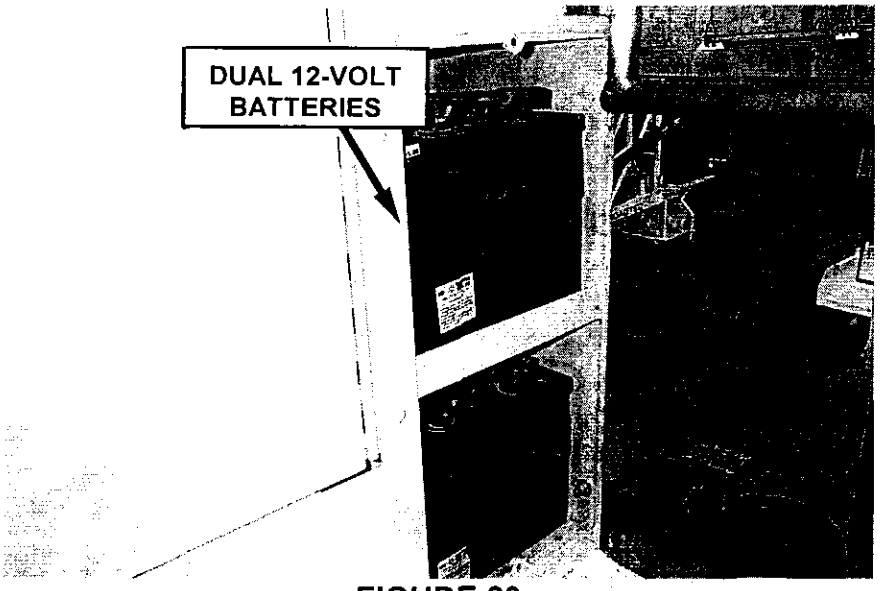



FIGURE 29

## 4.3 LUBRICATION

### CRAWLER TORQUE HUBS

Position the machine in a level area. Clean any dirt and grease from the fill and level port areas. Move machine in order for the fill port to be in the 9 o'clock position, and the drain port to be in the 6 o'clock position. Remove the fill port cap. Refill the hub with ep-90 oil through the fill port until oil slightly flows out of the fill port. (Drain and replace fluid after the first 50 hours of operation then every 250 hours there after) complete the same process on the other torque hubs (figure 30).

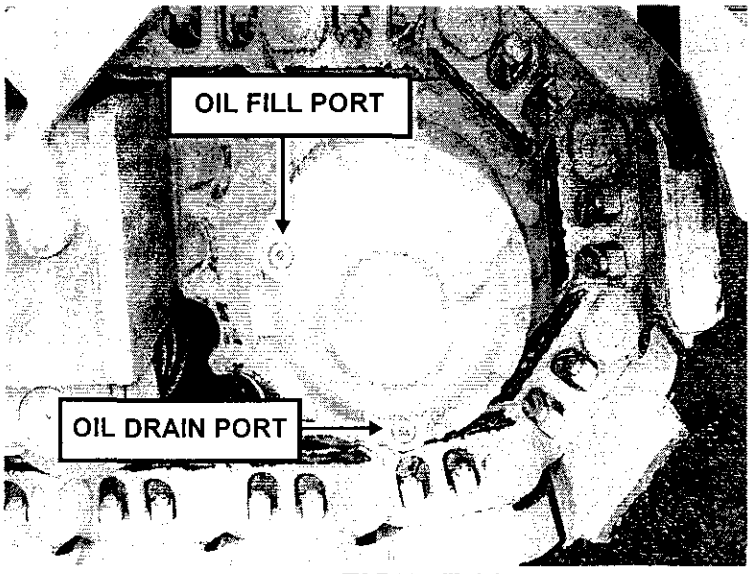



FIGURE 30

### REAR MOLDBOARD LOWER CYLINER PINS

Be sure to keep rear moldboard lower cylinder pins lubricated every 50 hours of operation with 3 shots of high temperature grease (figure 31).

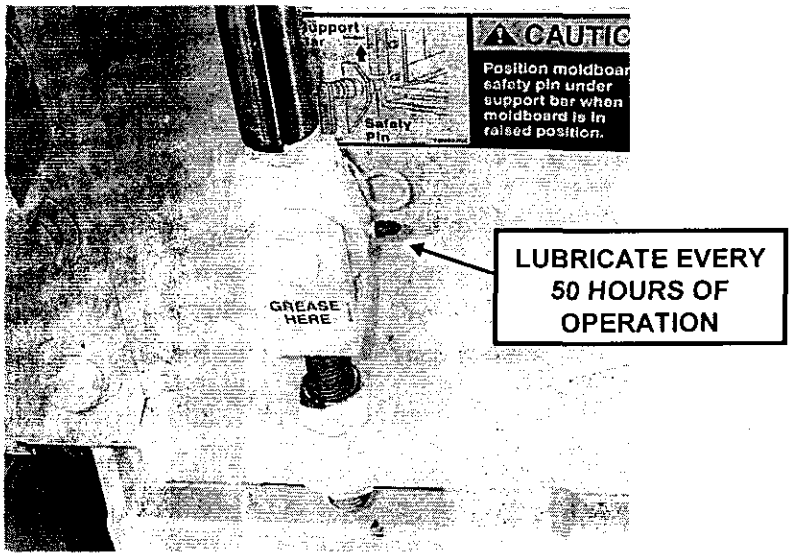



FIGURE 31

## 4.3 LUBRICATION

### CUTTER INPUT ADAPTER

Position the machine on completely level ground. To check the cutter input adapter oil level, the cutter drum belt guard door must be opened to gain access to the level plug. Clean any dirt and grease from the cutter input adapter level plug area located at the 3 o'clock position. Remove the level plug. Check the oil level, which should be at the bottom the level port. Fill the cutter input adapter with ep-90 oil until oil flows out of the level port. Clean and replace the plug. Close the cutter drum belt guard door (figure 32).

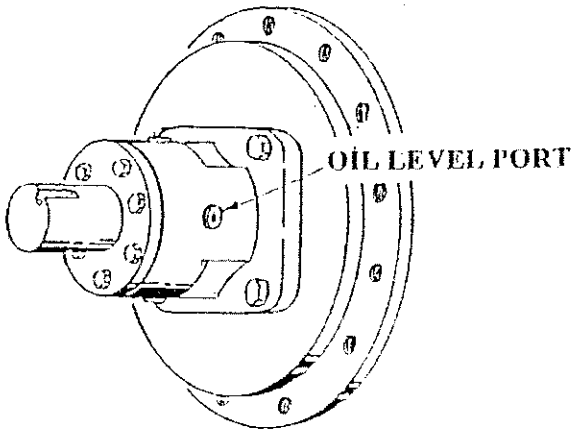



**FIGURE 32**

### CUTTER PLANETARY HUB

Position the machine on completely level ground. To check the level of the cutter planetary hub, remove the access plate to provide access to the level plug. Turn the drum to position the level plug at the 9 o'clock position. Clean any dirt and grease from the cutter planetary hub plug area. Remove the level plug and check that the ep-90 oil should be at the bottom of the level port. If needed, fill the cutter hub at the level port with ep-90 oil until the oil comes out of the level port. Replace the level plug of the cutter planetary hub and replace the access plate (figure 33).

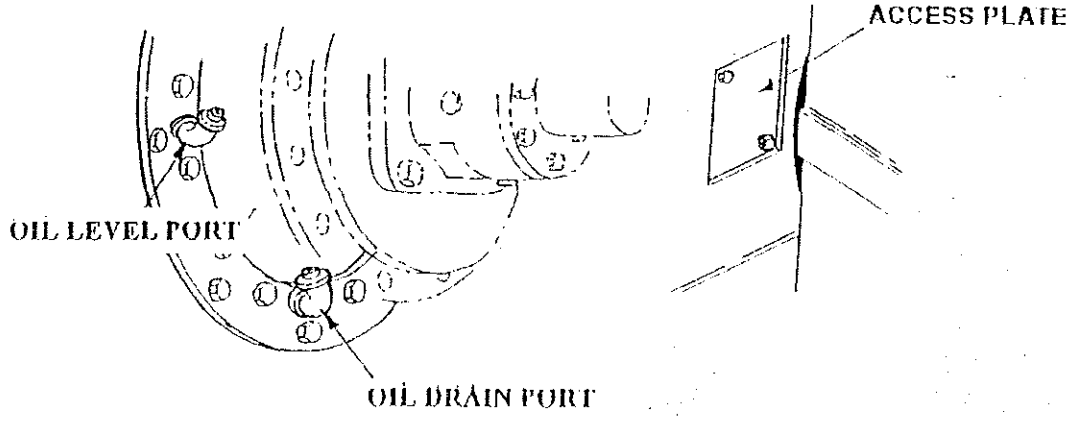



**FIGURE 33**

## 4.3 LUBRICATION

### IV. THE FOLLOWING ITEMS SHOULD BE COMPLETED EVERY 250 HOURS:

### ENGINE OIL AND FILTERS

When changing the oil and filters be sure that the engine is warm but use extreme caution when working around a warm engine to avoid burns. After the engine has warmed up let the engine sit for 10 minutes before draining the oil to allow all the oil to drain down into the engine oil pan.

The procedure for changing the engine oil and filters is as follows:

1. Open the bottom engine compartment access door.

2. Open the engine oil drain valve that is mounted to the engine oil pan.

3. Clean around the filter heads, remove the filters and clean the gasket surface.

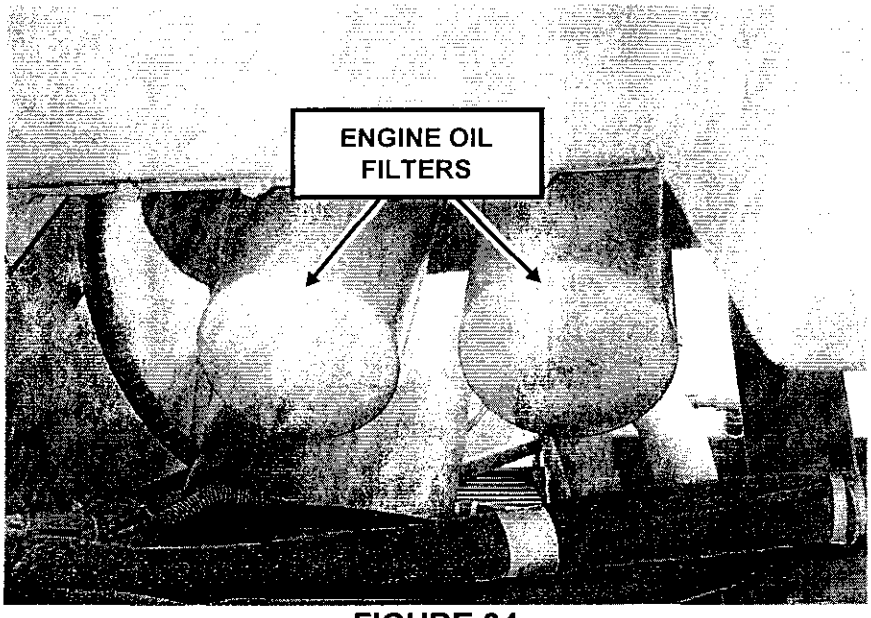



**FIGURE 34**

4. Fill the new filters with clean lubricating oil.

5. Apply a light film of lubricating oil to the gasket and sealing surfaces before installing the filters.

6. Install the filter as specified by the filter manufacturer. Do not over-tighten to avoid distorting the threads or damaging the filter element seal.

7. Install the oil drain plug. **NOTE:** DO NOT OVERTIGHTEN THE OIL DRAIN PLUG.

## 4.3 LUBRICATION

8. Fill the engine with clean lubricating oil (see engine operator's manual).

9. Operate the engine at idle and inspect for leaks at the filter and drain plug.

10. Shut the engine off, wait 10 minutes, and check the oil level on the oil dipstick.

11. Close all console doors that were opened and lower hood.

### ENGINE FUEL FILTER

Remove the old fuel filters. Fill the new fuel filter with clean fuel and lubricate the seals with a little clean oil. Install the filter as specified by the filter manufacturer. After installing the new filter, use the fuel system priming pump to manually pump pressure into the fuel line before attempting to start the engine. Check for leaks after starting the engine (figure 35).

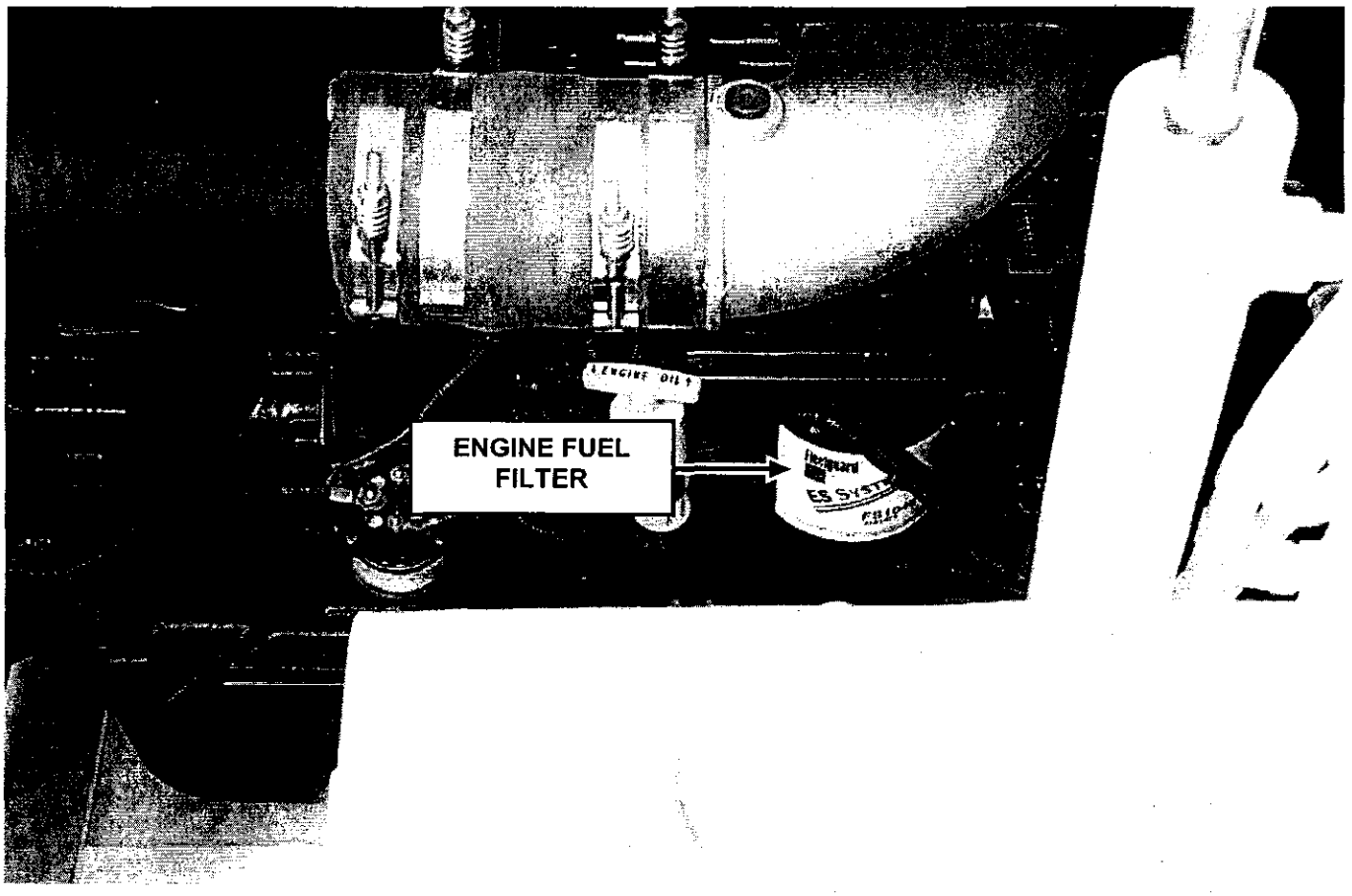



**FIGURE 35**

## 4.3 LUBRICATION

### HYDRAULIC OIL FILTERS

Change all hydraulic oil filters after the first 50 hours of operation then every 250 hours of operaion there after (figure 36).

The following steps should be followed when changing hydraulic oil filters:

1. Clean any dirt and grease away from the filter heads.
2. Remove filters. A filter that is below fluid level will require a suction device.
3. Fill the new filters with clean hydraulic oil that has been filtered through a 10-micron element.
4. Lubricate the filter gaskets with clean oil.
5. Install the filters as specified by the filter manufacturer.
6. Start the engine and check for leaks.

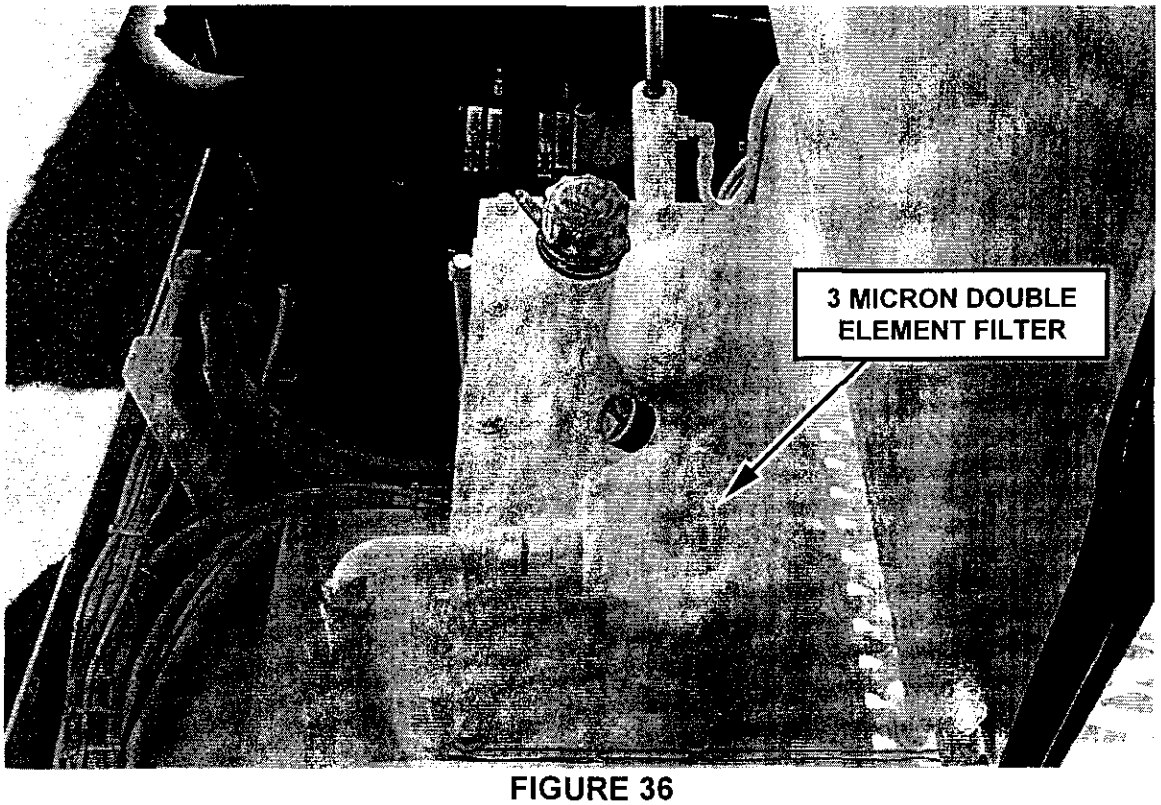



**FIGURE 36**

## 4.3 LUBRICATION

The auxiliary system is equipped with a 10 micron in line high pressure filter. Change this filter after every 250 hours of operation (figure 37).

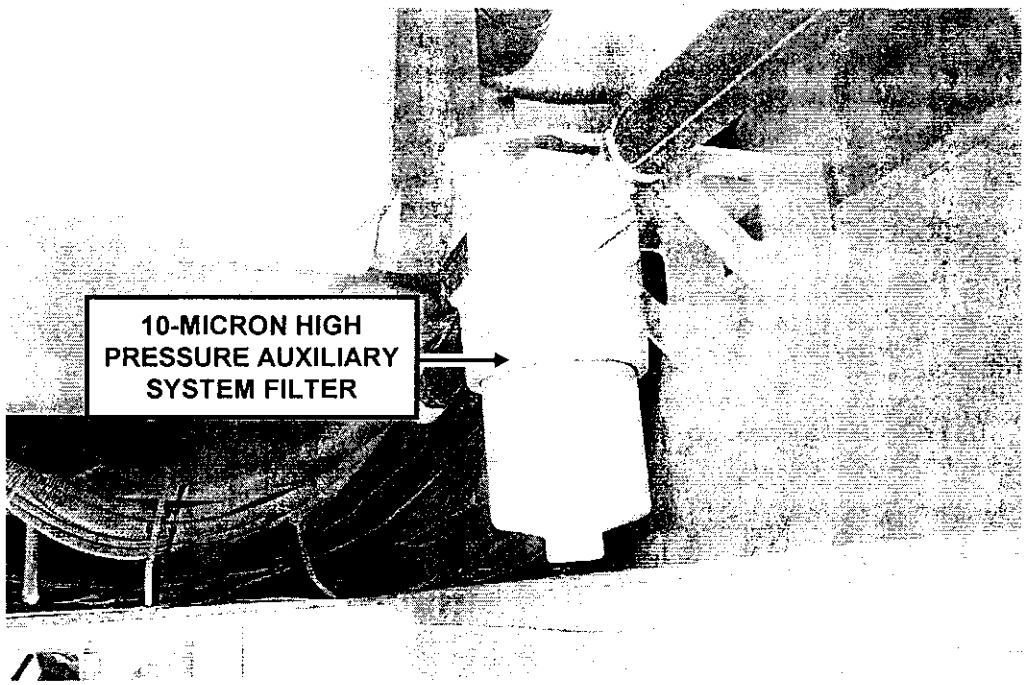



FIGURE 37

The primary conveyor, secondary conveyor and travel pumps are all fitted with 5 micron high pressure charge filters. Change these filters after the first 50 hours of operation then after every 250 hours of operation (figure 38).

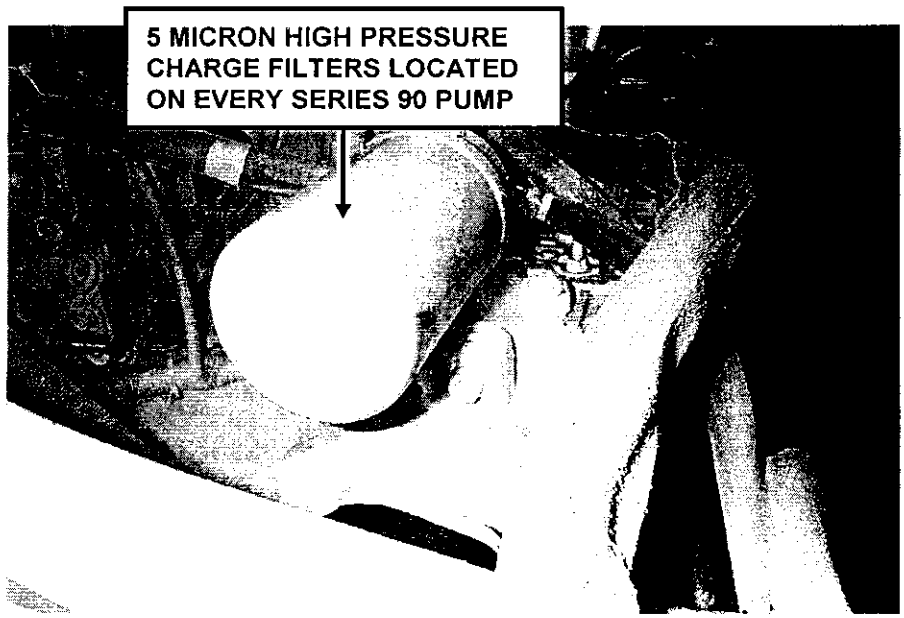



FIGURE 38

## 4.3 LUBRICATION

***The following items should be completed every 500 hours of operation or semi-annually:***

### PTO CLUTCH

Clean any dirt and grease from the grease fittings. Lubricate the PTO clutch with Unirex N3 grease - 5 shots per grease fitting every 500 hrs (figure 39).

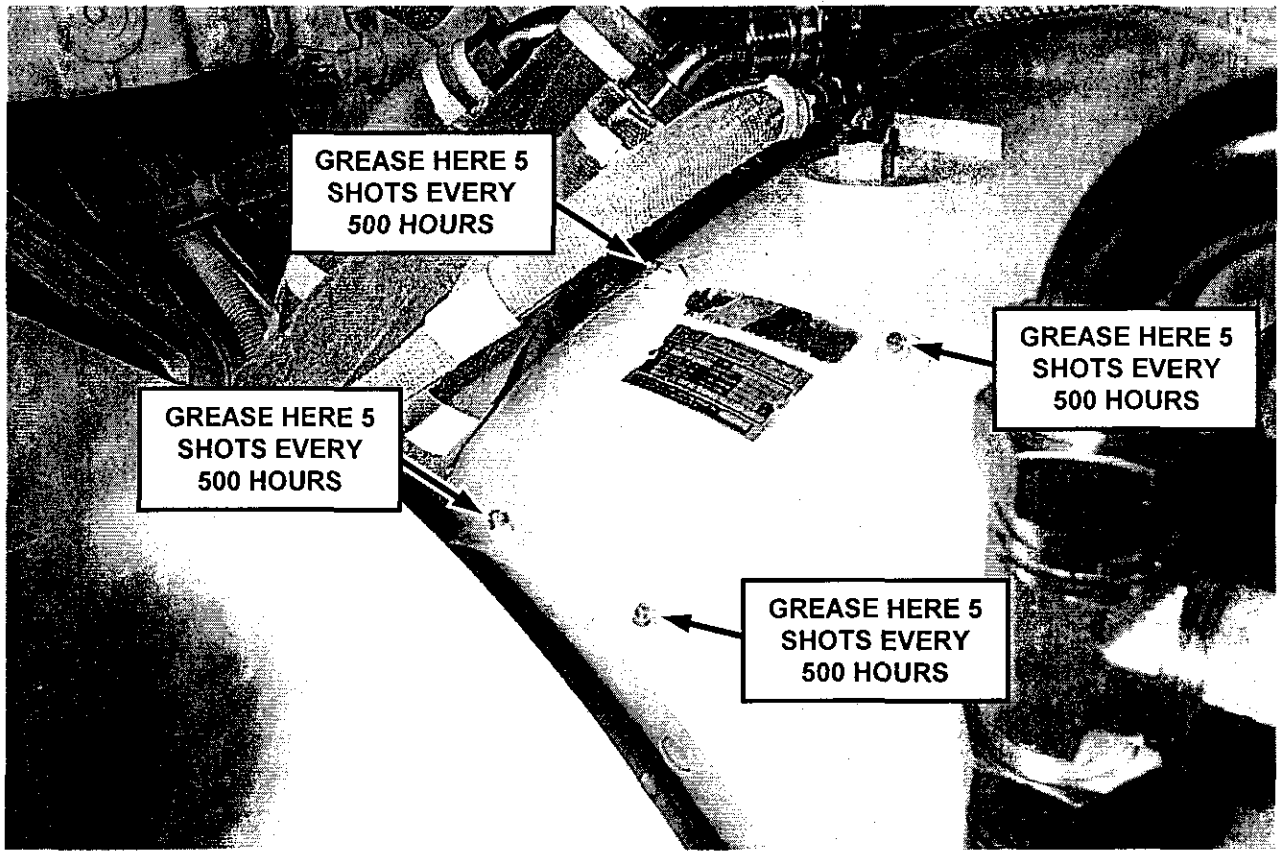



FIGURE 39

## 4.3 LUBRICATION

**The following items should be completed every 1,000 hours:**

**DANGER** **Be sure the machine is completely shut down with an emergency stop activated before performing any of the following maintenance procedures.**

### CRAWLER TORQUE HUBS

The oil in the crawler torque hubs will have to be changed after every 1000 hours of operation. Be sure to refill the hubs with SAE 80w90 Valvoline high performance gear oil or equivalent.

Position the machine on completely level ground. Clean any dirt or grease away from the torque hub drain and fill port areas. Move machine in order for drain plug to be in the 6 o'clock position. Remove the drain plug and the fill level plug and allow oil to drain into a safe container. Follow all local laws and ordinances when disposing of used oil. Clean the plugs and torque hub area. Replace the drain plug and fill the torque hub with SAE 80w90 gear oil through the oil fill port. Fill slowly until the oil starts to seep out of the fill port. Replace the fill plug. Repeat this process with all the other torque hubs as well.

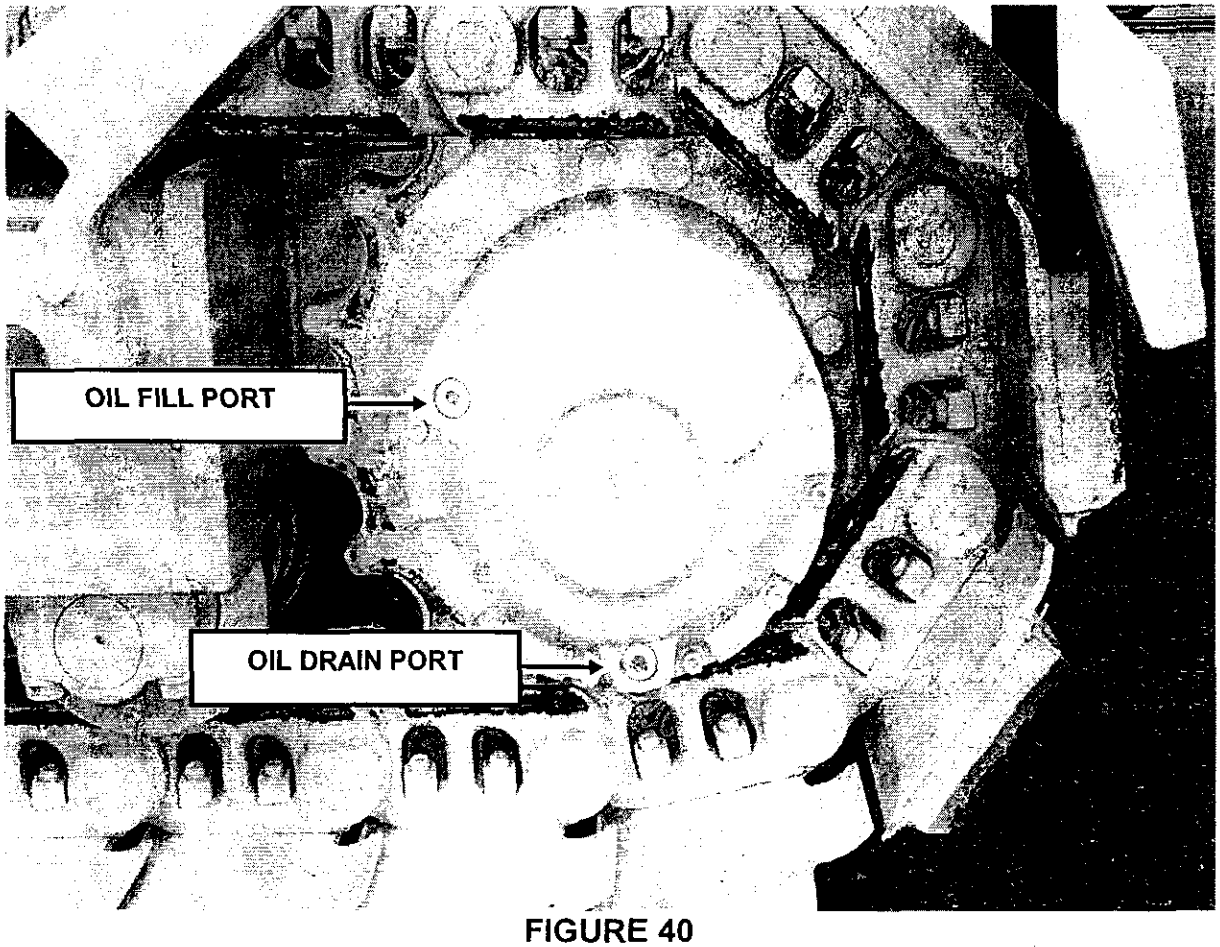



**FIGURE 40**

## 4.3 LUBRICATION

### CUTTER PLANETARY HUB

Position the machine on completely level ground. To drain oil from the cutter planetary hub, remove the access plate to provide access to the level and drain plugs. Turn the drum to position the drain and level plug at the 6 and 9 o'clock position, respectively. Clean any dirt and grease from the cutter planetary hub plug area. Remove the drain and level plug and allow oil to drain. After all the oil has drained, replace the drain plug. Refill the cutter hub at the level plug (9 o'clock position) with ep-90 oil until the oil starts to seep out of the level port. Replace the level plug and replace the access plate (figure 41).

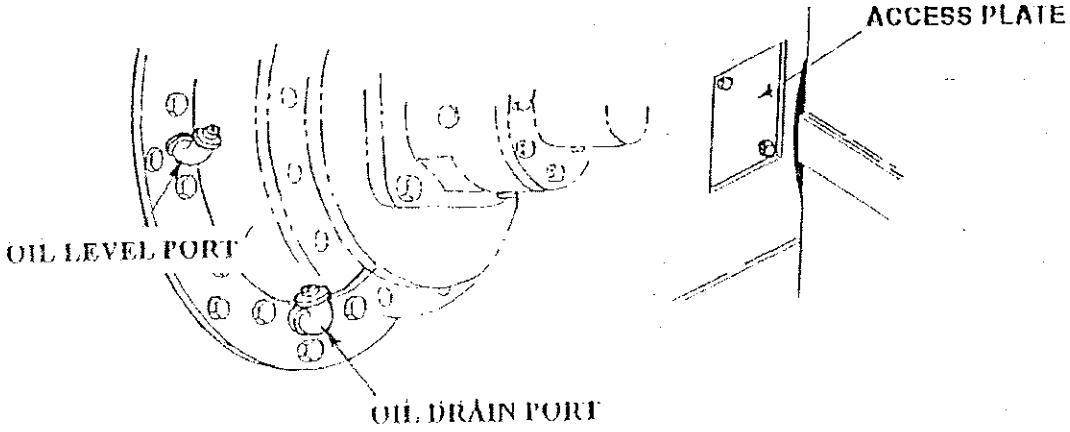



**FIGURE 41**

### CUTTER INPUT ADAPTER

Position the machine on completely level ground. To drain oil from the cutter input adapter, the cutter drum belt guard door must be opened to gain access to the level plug. Clean any dirt and grease from the input adapter plug areas. Remove the drain and level plugs at the 3 and 6 o'clock position, respectively and allow the oil to drain. After the oil has drained, replace the drain plug at the 6 o'clock position. Refill the cutter input adapter at the level plug (3 o'clock position) with ep-90 oil until the oil starts to seep out of the level port. Replace the level plug. Close the cutter drum belt guard door (figure 42).

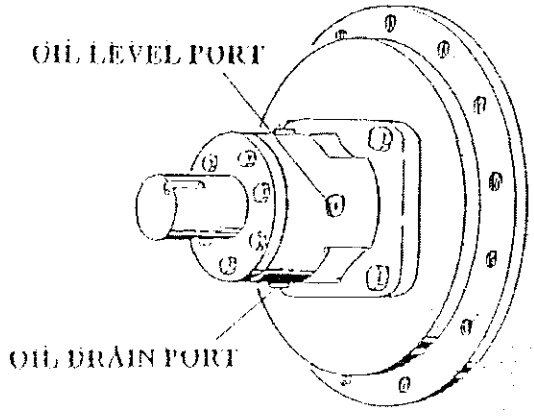



**FIGURE 42**

## 4.3 LUBRICATION

The hydraulic system depends on good clean hydraulic oil to function properly. This is why proper maintenance is so important. In order to insure peak performance the hydraulic system should be drained, cleaned and refilled every 1,000 hours of operation. Following this maintenance requirement will increase the life of the pumps, motors, valves and cylinders as well a helping to maintain an efficient hydraulic system.

### HYDRAULIC OIL

1. Clean any dirt and grease from the plug and tank lid areas of the hydraulic tank.

2. Open the bottom engine access door and open the hydraulic tank drain valve to allow the hydraulic oil to drain. Be sure to drain the oil into an appropriate container. Follow all local laws and ordinances when disposing of the used oil.

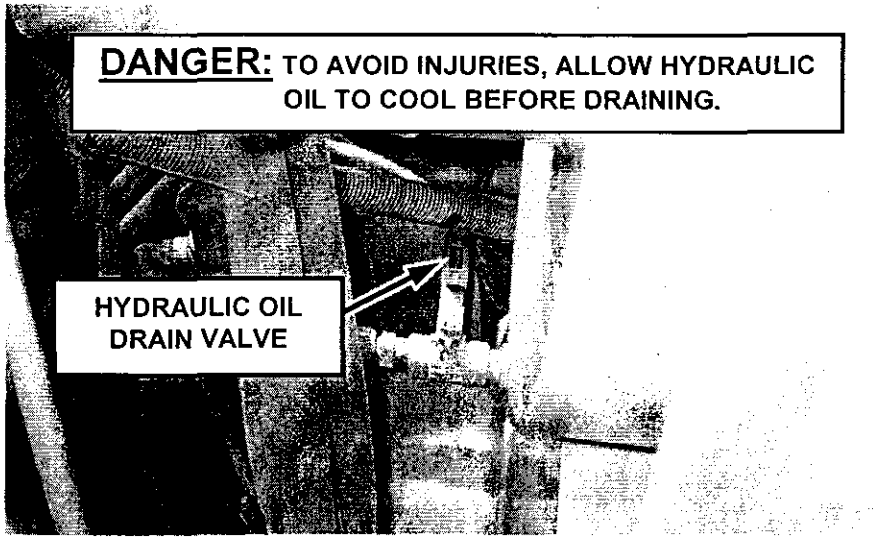



**FIGURE 43**

3. Remove the lid of the tank and clean the inside of the tank thoroughly (figure 44).

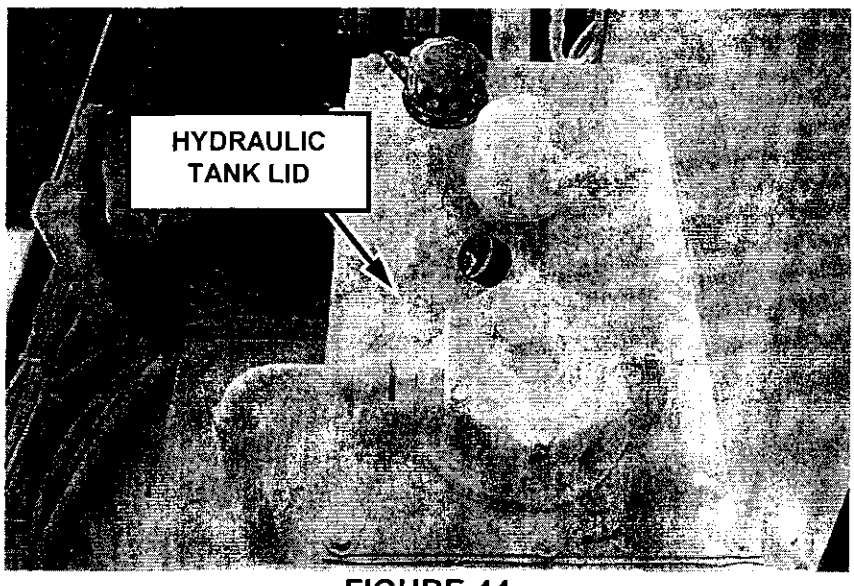



**FIGURE 44**

## 4.3 LUBRICATION

4. *Vacuum any particles out of the bottom of the tank with a shop vacuum.*

5. Clean any dirt and grease from around the tank strainers before attempting to clean or replace them. Remove the hydraulic tank strainers, clean and replace (figure 45).

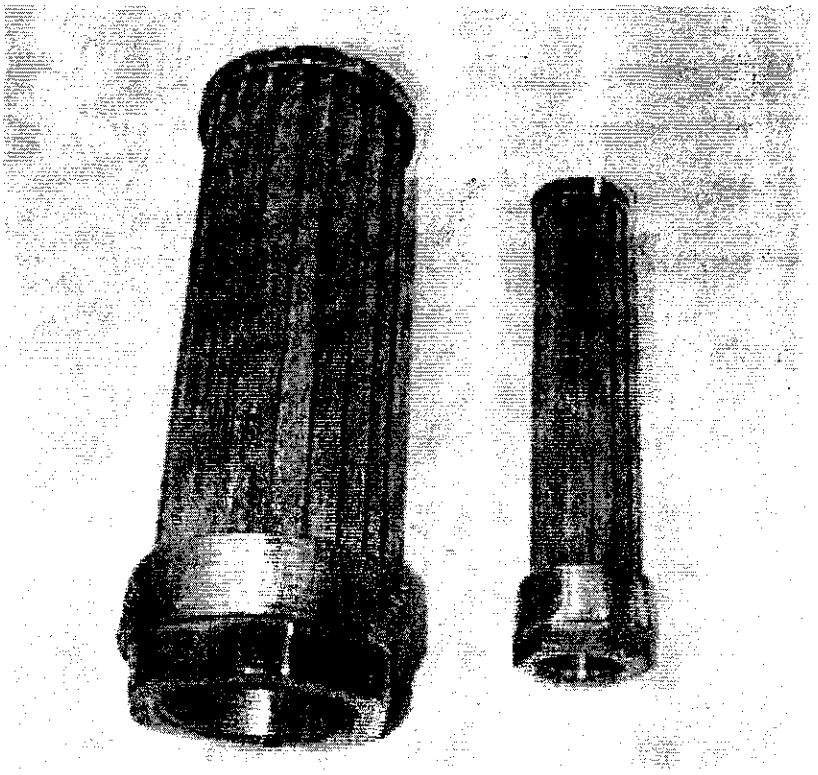


**FIGURE 45**

6. Replace all hydraulic filters. See hydrauic oil filters discussed earlier in this section.

7. Replace the hydraulic tank lid and be sure the tank drain valve is completely off.

8. Refill the tank to 90% capacity with **iso vis. Grade 46-valvoline anti-wear hydraulic oil** or equivalent.

## 4.3 LUBRICATION

### RADIATOR COOLANT

Open the drain valve at the base of the radiator and allow the coolant to drain. Check the radiator for mineral build-up, rust or oil. If any contaminants are found, use radiator cleaner to flush the system. Afterwards, flush the radiator with clean water. Then refill the radiator with a 50/50 mix of water and antifreeze. Start the engine and check for leaks (figure 46).

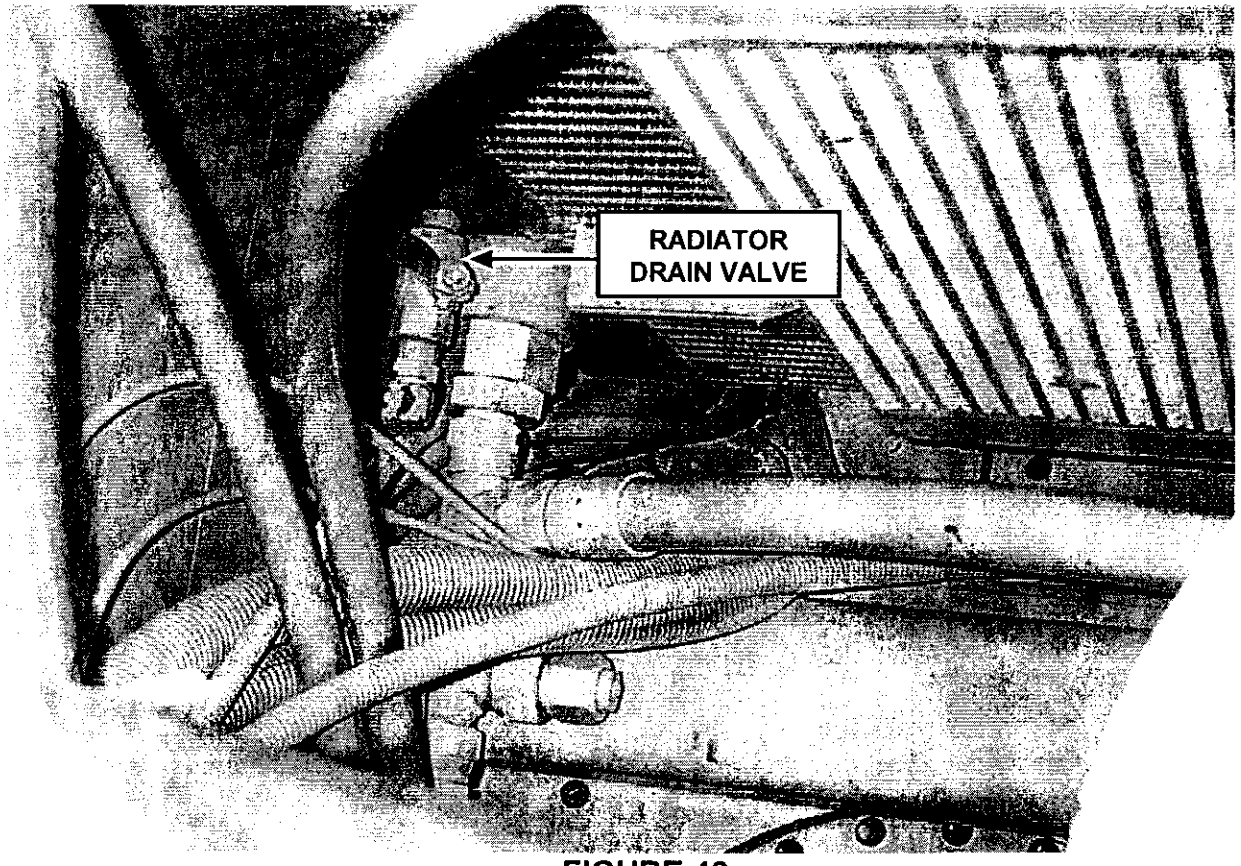



**FIGURE 46**

## 4.3 LUBRICATION

### BELT TENSIONER PULLEY

The cutter drum belt tensioner pulley should be drained and refilled with sae 80w90 valvoline high performance gear oil or equivalent every 1,000 hours of operation.

**DANGER** **Be sure the machine is completely shut down and that the belt tension has been released before attempting to work on the cutter drum belt. Be sure to disconnect the batteries and attach safety locks and tags to the battery disconnect switches.**

1. Rotate the pulley until the fill/drain port is in the 6 o'clock position. Remove the drain port plug and drain the oil (figure 47).

2. Rotate the pulley until the fill/drain port is in the 3 o'clock or 9 oclock position. Refill pulley with 80w-90 high performance gear oil until oil just starts to seep out of the fill/drain port. Re-install the fill/drain port plug (figure 48
3. ).

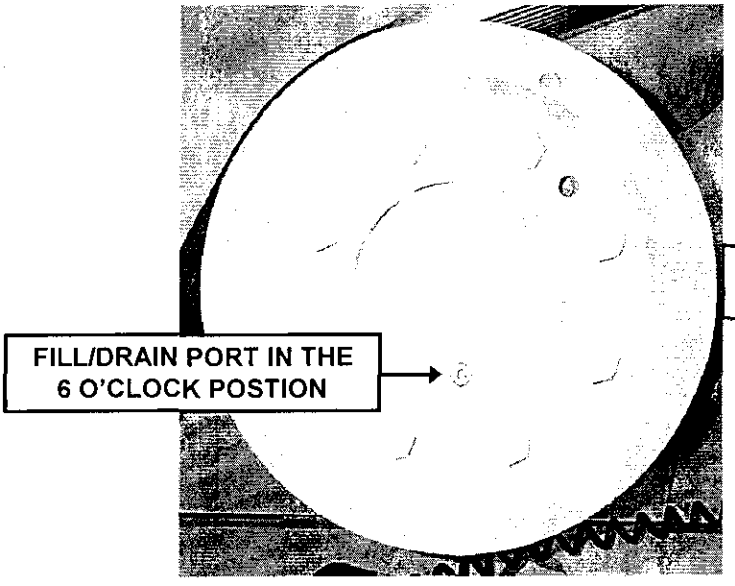



FIGURE 47

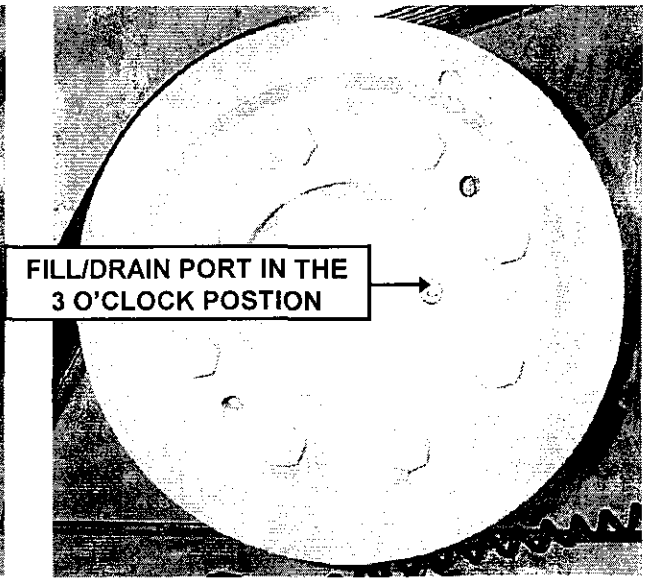
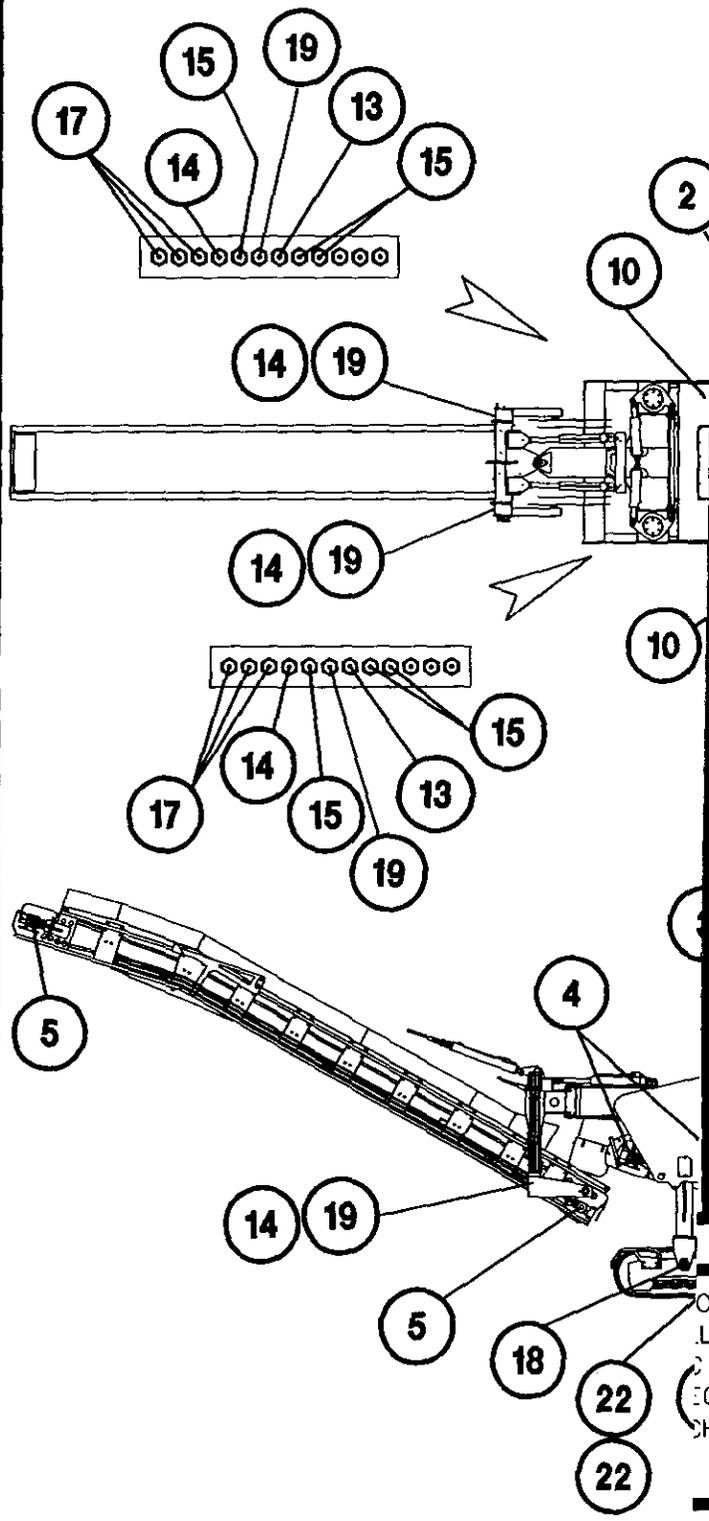



FIGURE 48

# RX-500 LUBRIC




| IDENTIFICATION | NO. OF POINTS | TYPE OF LUBRICATION | REMARKS |
|---|---|---|---|
| CRAWLER GEARBOX | 3\4 | GO | CHECK LEVEL (DRAIN & REFILL 1ST 50 HRS.) |
| CUTTER DRUM PLANETARY DRIVE | 1 | GO | CHECK LEVEL (DRAIN & REFILL 1ST 50 HRS.) |
| CUTTER DRUM INPUT ADAPTER | 1 | GO | CHECK LEVEL (DRAIN & REFILL 1ST 50 HRS.) |
| ENGINE AIR CLEANER | 1 | QSX15 ENG. | REPLACE |
| HYDRAULIC FILTERS | 4 | N/A | REPLACE |
| ENGINE WATER FILTER | 1 | N/A | REPLACE |
| ENGINE OIL & FILTER | 1 | REFER TO ENGINE MANUAL | DRAIN & REPLACE |
| ENGINE FUEL FILTER | 1 | N/A | REPLACE |
| COOLING ADDITIVE | 1 | CA | TOP OFF (1 LITER) |
| PTO CLUTCH | 2 | UNIREX-N3 | 5-SHOTS |
| HYDRAULIC TANK | 1 | HO | DRAIN, FLUSH, & REFILL |
| RADIATOR COOLANT | 1 | 50/50 ANTIFREEZE | DRAIN, CLEAN, & REFILL |
| CRAWLER GEARBOX | 3\4 | GO | DRAIN, FLUSH, & REFILL |
| CUTTER DRUM PLANETARY DRIVE | 1 | GO | DRAIN, FLUSH, & REFILL |
| CUTTER DRUM INPUT ADAPTER | 1 | GO | DRAIN, FLUSH, & REFILL |
| HYDRAULIC TANK STRAINER | 4 | N/A | CLEAN OR REPLACE |
| BELT TENSIONER PULLEY | 1 | GO | DRAIN, FLUSH, & REFILL |

OR EQUIVALENT
LADIUM, OR EQUIVALENT
OIL OR EQUIVALENT
EQUIVALENT
H 460 OR EQUIVALENT

Valvoline

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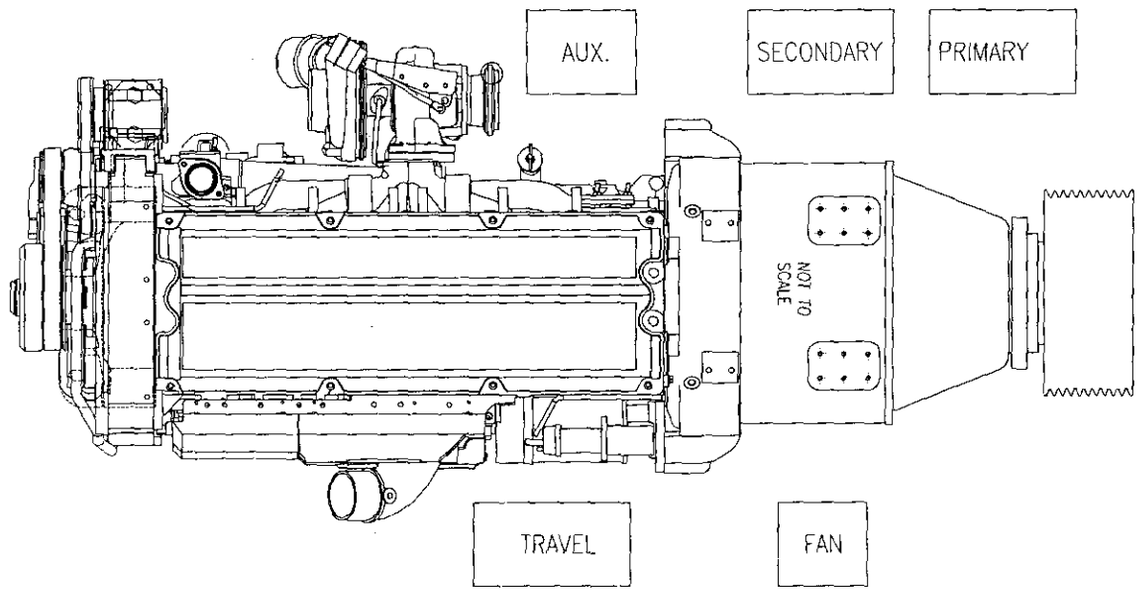
# PUMPS, MOTORS AND VALVES

SECTION PAGE

## 5.1 PUMPS, MOTORS AND VALVES

The RX-500 milling machine utilizes a hydrostatic propulsion, conveyor and auxiliary system. This system is comprised of a series of hydraulic pumps, motors and valves. The following section describes each one of these components and their function.

## 5.2 PUMPS




PUMP ARRANGEMENT

**FIGURE 1**

### 1. AUXILIARY PUMP

The system auxiliary pump is a Sauer Danfoss 45 series pump. Auxiliary pressure is 2,750 psi.

### 1. ENGINE FAN PUMP

The engine fan pump is a Sauer Danfoss CPB 180 series pump. Fan pressure is 2,500 psi.

### 2. PRIMARY AND SECONDARY CONVEYOR PUMPS

The primary and secondary system pumps are Sauer Danfoss series 90 pumps. Both pumps are set with a relief pressure of 4,640 psi. And charge pressure of 350 psi.

### 3. MAIN DRIVE PUMP

The main drive pump is a Sauer Danfoss series 90 pump. The pump relief pressure is set at 5,070 psi. And charge pressure at 350 psi.

## 5.2 PUMPS

### 90 SERIES HYDRAULIC PUMPS

The 90 series variable displacement pump receives input torque from the machine's engine and converts it into hydraulic power. The input shaft turns the pump cylinder, which contains a ring of pistons. The pistons run against a tilted plate, called the swashplate. This causes the pistons to compress the hydraulic fluid. The high pressure fluid is then ported out to provide power to functions like the primary conveyor, secondary conveyor, and travel.

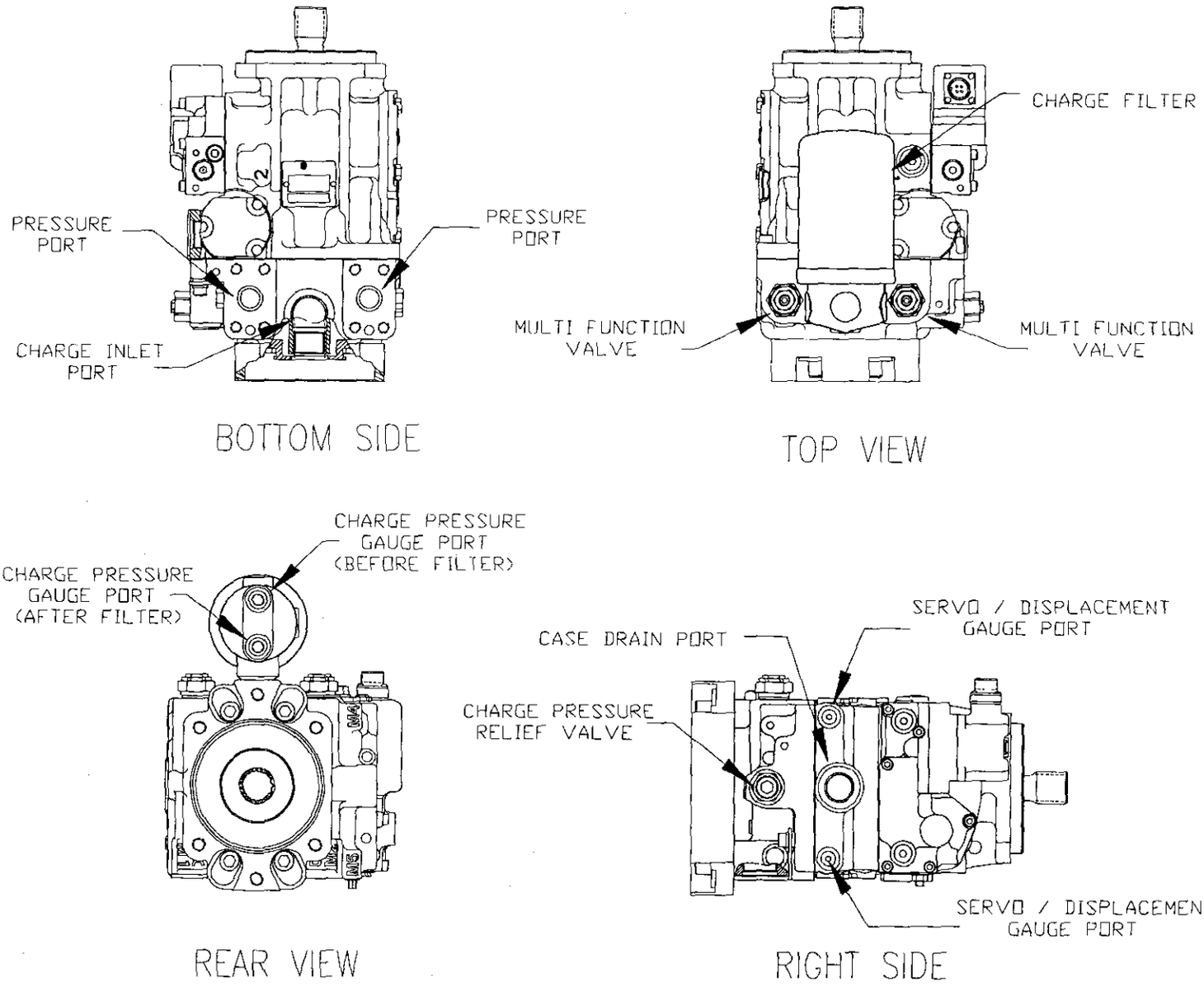



**FIGURE 2**

## 5.2 PUMPS

### SAUER DANFOSS CPB 180 SERIES HYDRAULIC PUMP

The radiator fan motor pump is a Sauer Danfoss CPB 180 series pump. This 3.4 cu.in/rev (55.7 cc/rev) pump operates at a system pressure of 2,500 psi.

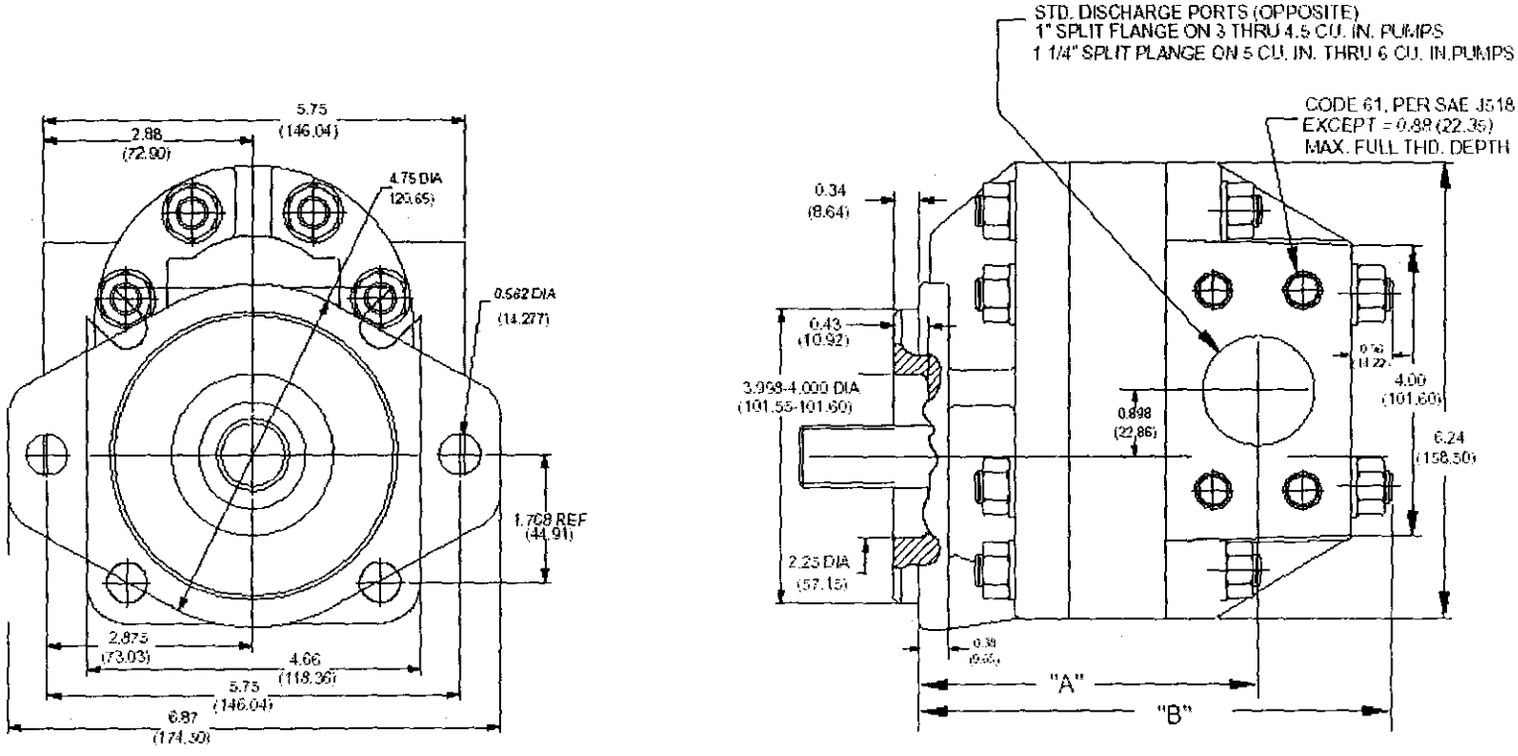
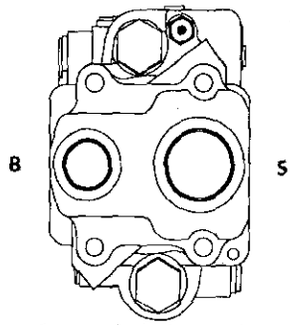



**FIGURE 3**

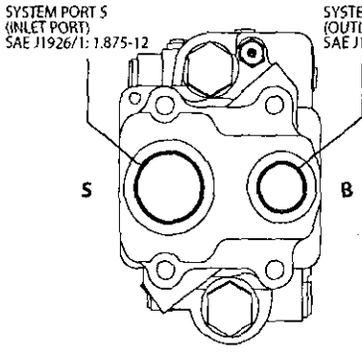
## 5.2 PUMPS

## SAUER DANFOSS SERIES 45 H FRAME PUMP

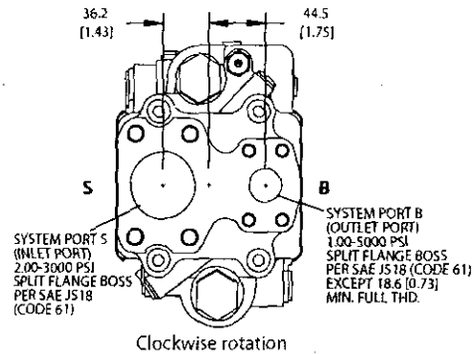
The auxiliary system pump is a Sauer Danfoss series 45 h frame pump. This is 57cc/rev (3.48 cu in/rev) pump that is set to operate at 2,750 psi.



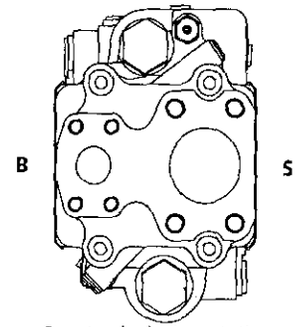

Counterclockwise rotation



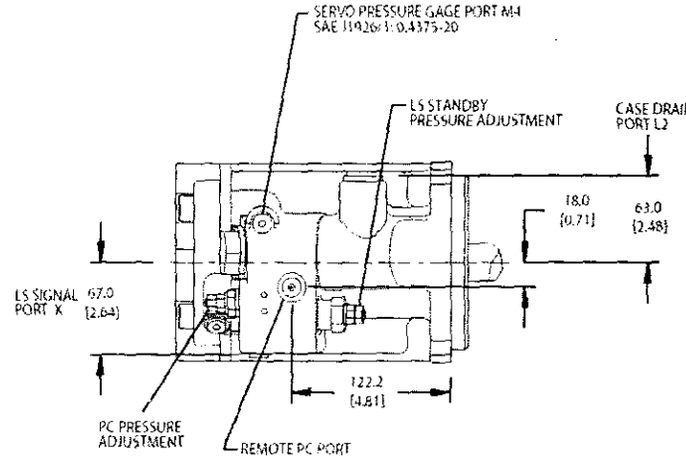

Clockwise rotation

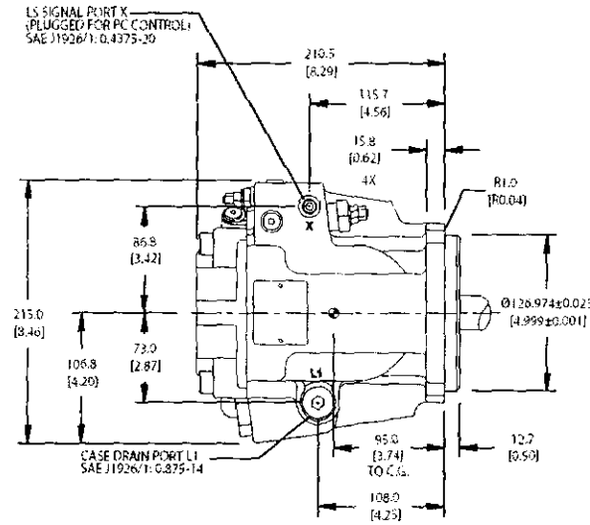


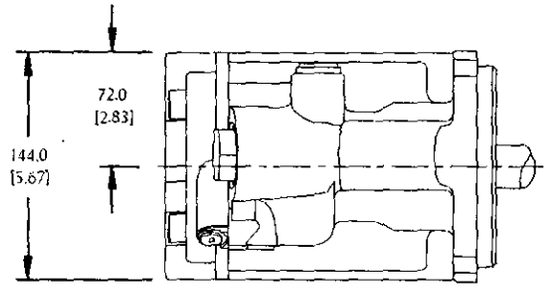

Clockwise rotation




Counterclockwise rotation



## 5.2 PUMPS

### CHARGE PRESSURE GAUGES

System charge pressures can be monitored from the charge pressure gauges mounted to the rear of the operator's station (figure 4).

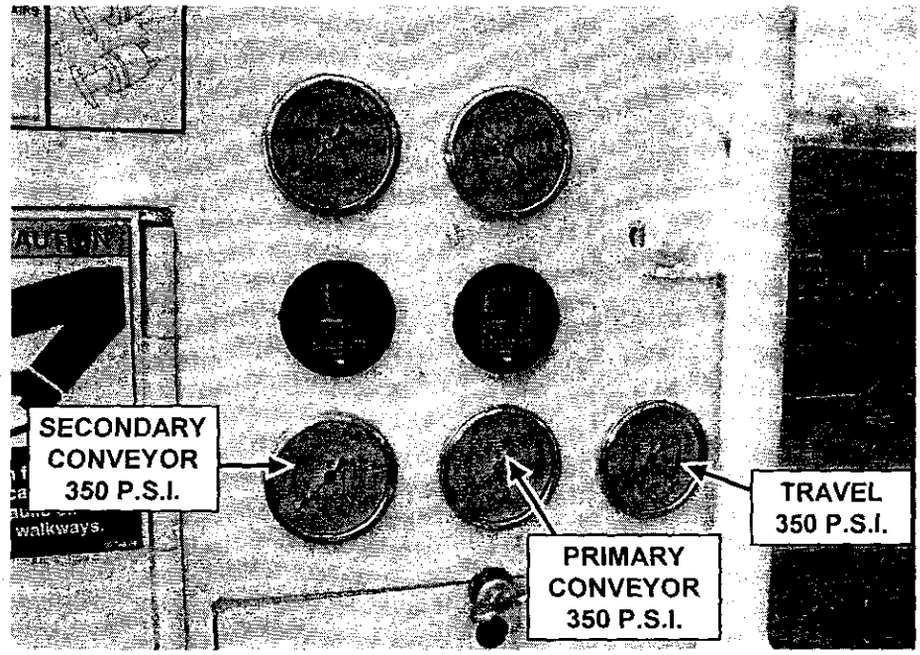



FIGURE 4

### WATER PUMP

The water pump provides pressurized water for the washdown and spraybar systems.

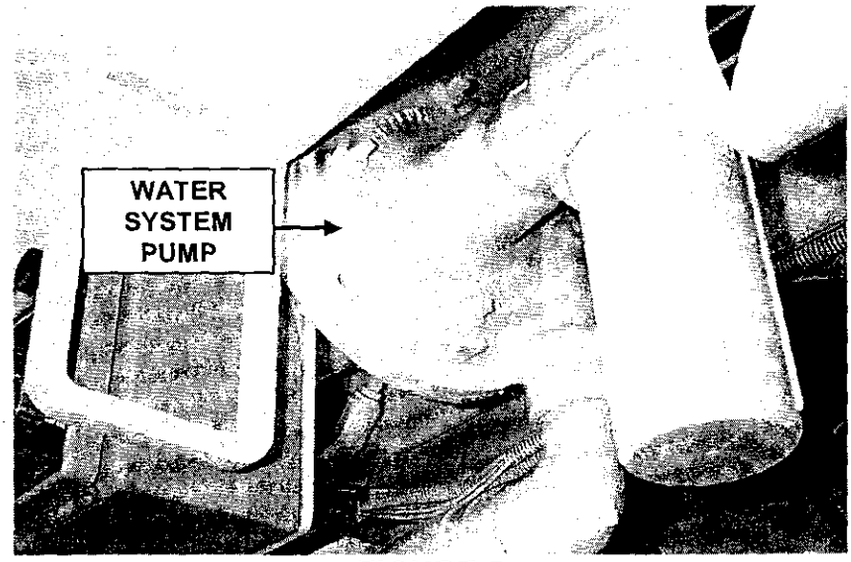



FIGURE 5

## 5.3 MOTORS

**TRACK DRIVE MOTORS** – The track drive motors are Rexroth A6VE bent axis motors with a max displacement of 28cc and a minimum displacement of 10cc (figure 6).

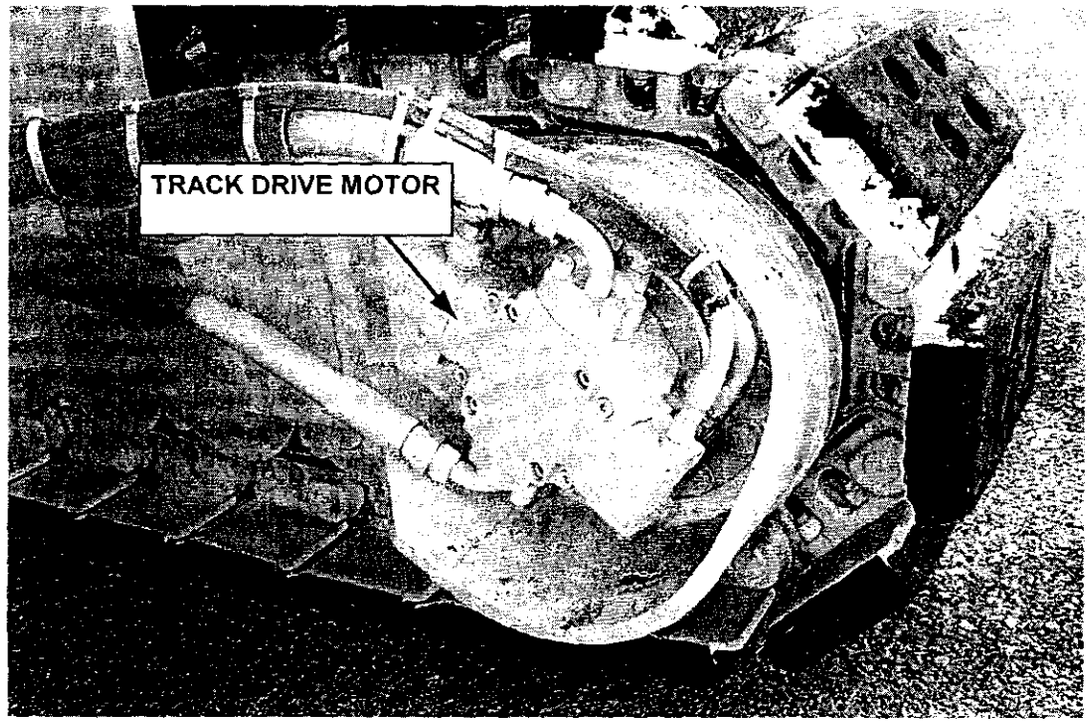



**FIGURE 6**

**PRIMARY CONVEYOR MOTOR** – The primary conveyor motor is a 19.9 cubic inch Sauer Danfoss OMT 315 (figure 7).

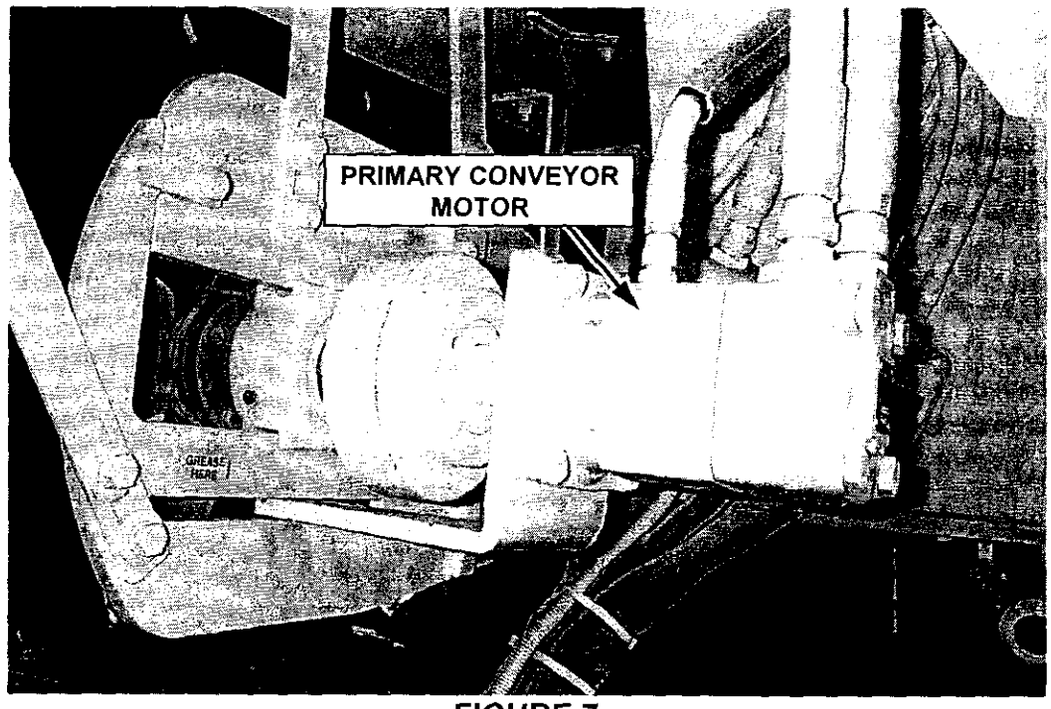



**FIGURE 7**

## 5.3 MOTORS

**SECONDARY CONVEYOR MOTOR** – The secondary conveyor motor is a 19.9 cubic inch Sauer Danfoss OMT 315 (figure 8).

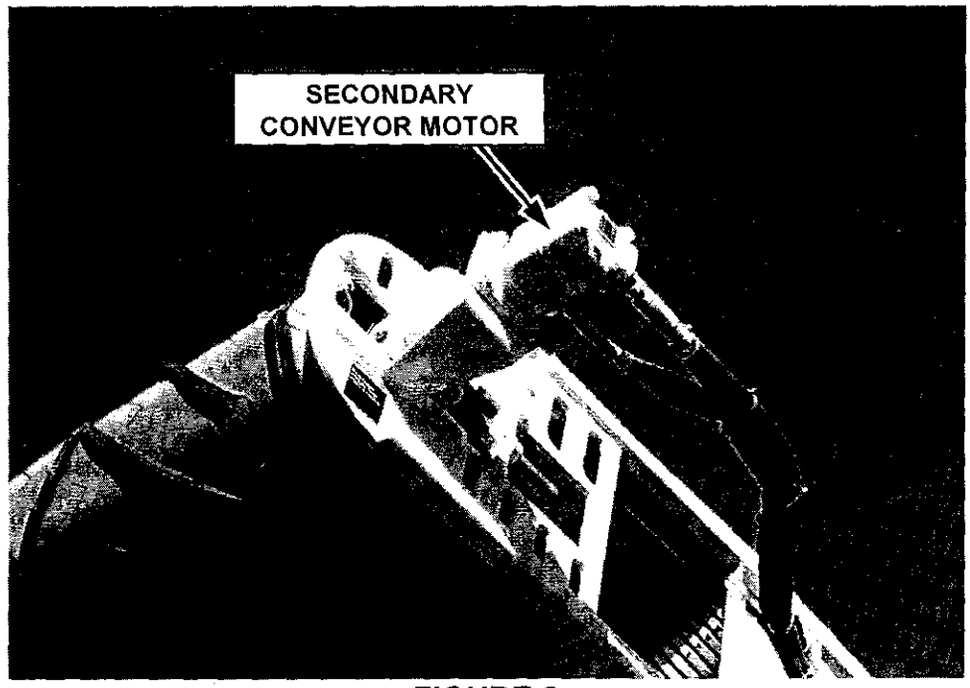



FIGURE 8

**RADIATOR FAN MOTOR** - The radiator fan motor comes premounted from the radiator manufacturer. Replacement motors for this application are available through Roadtec parts (figure 9).

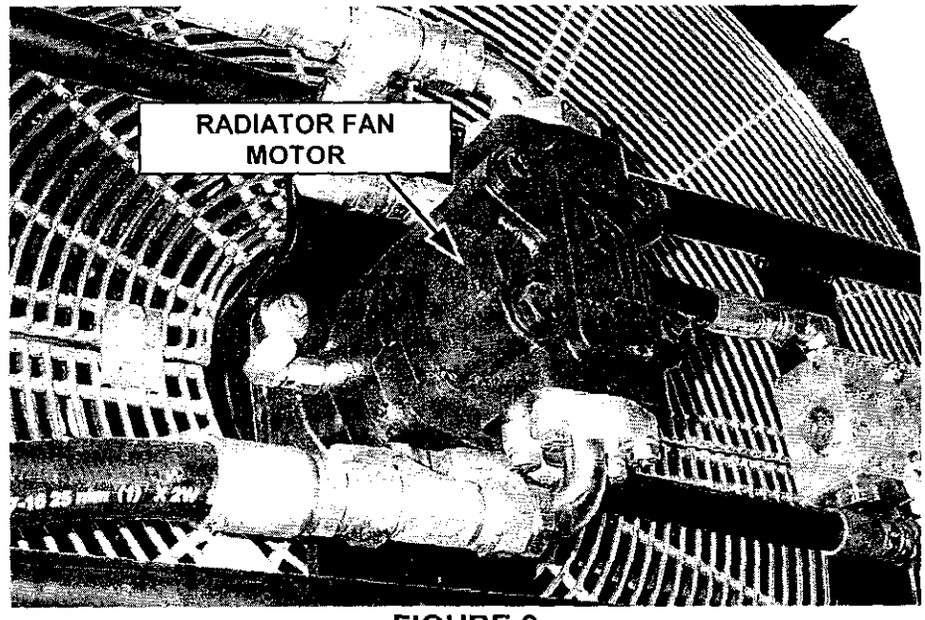
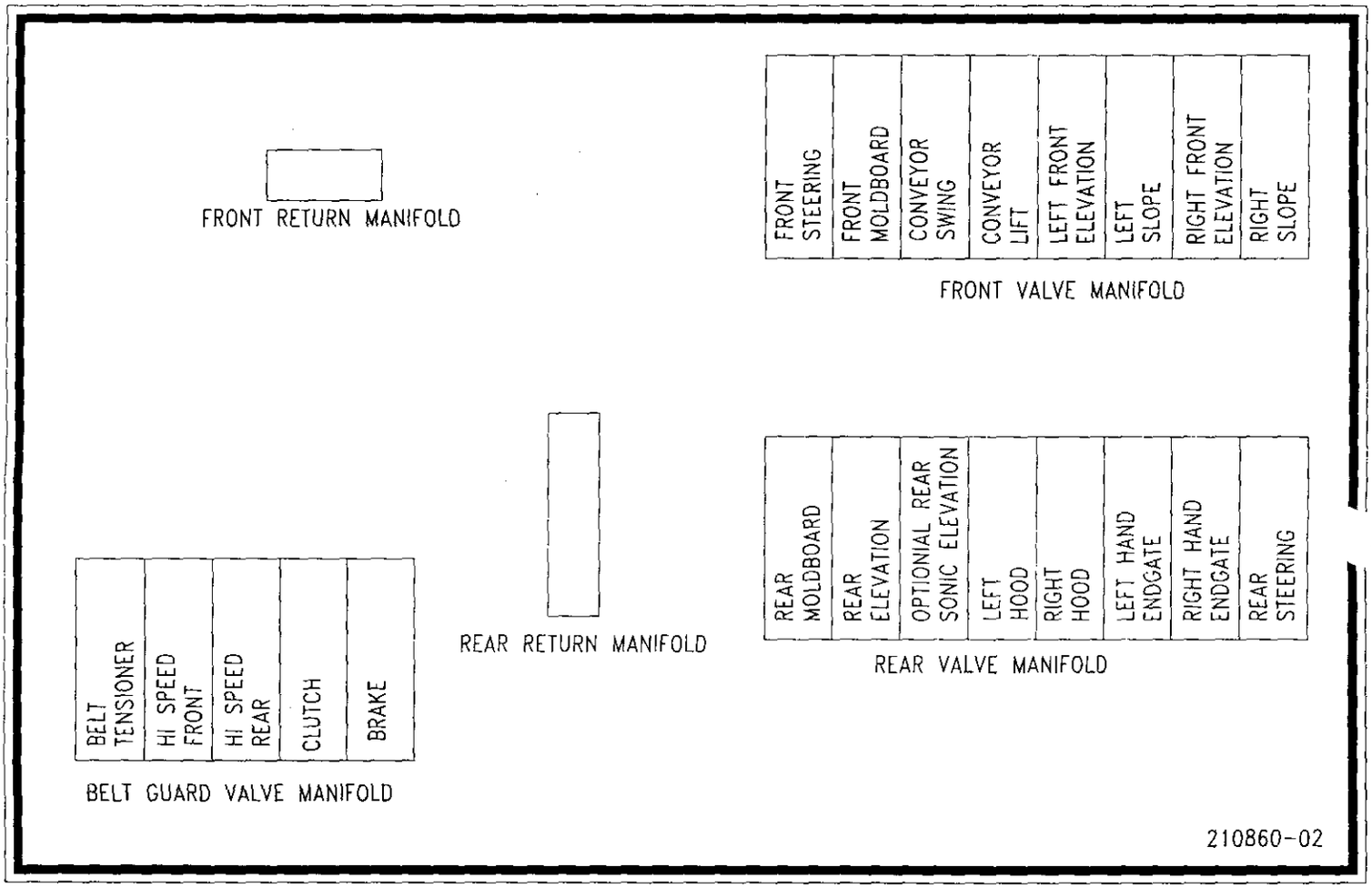



FIGURE 9

## 5.4 VALVES

The compact valves used in the hydraulic system of the RX-500 serve the purpose of condensing a multi stage hydraulic circuit into one simple unit. Each unit provides hydraulic flow, pressure reduction, a valve stack, pressure relief and pressure check.

## VALVE BANK DIAGRAM



## 5.4 VALVES

### FRONT VALVE MANIFOLD.

The front valve manifold is located just in front of the operator's console and is covered by a special protective lid. This lid will have to be raised in order to gain access to the valve bank. Front moldboard down pressure can be adjusted at this manifold in order to meet any special job requirements.

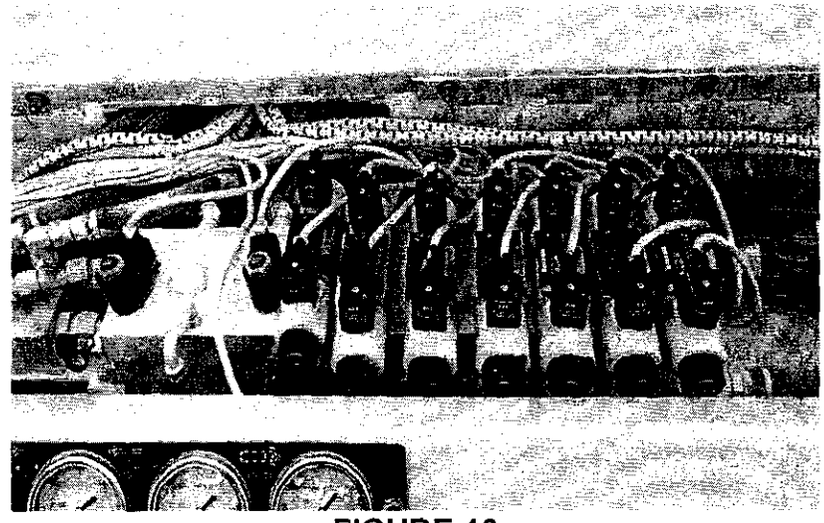


FIGURE 10

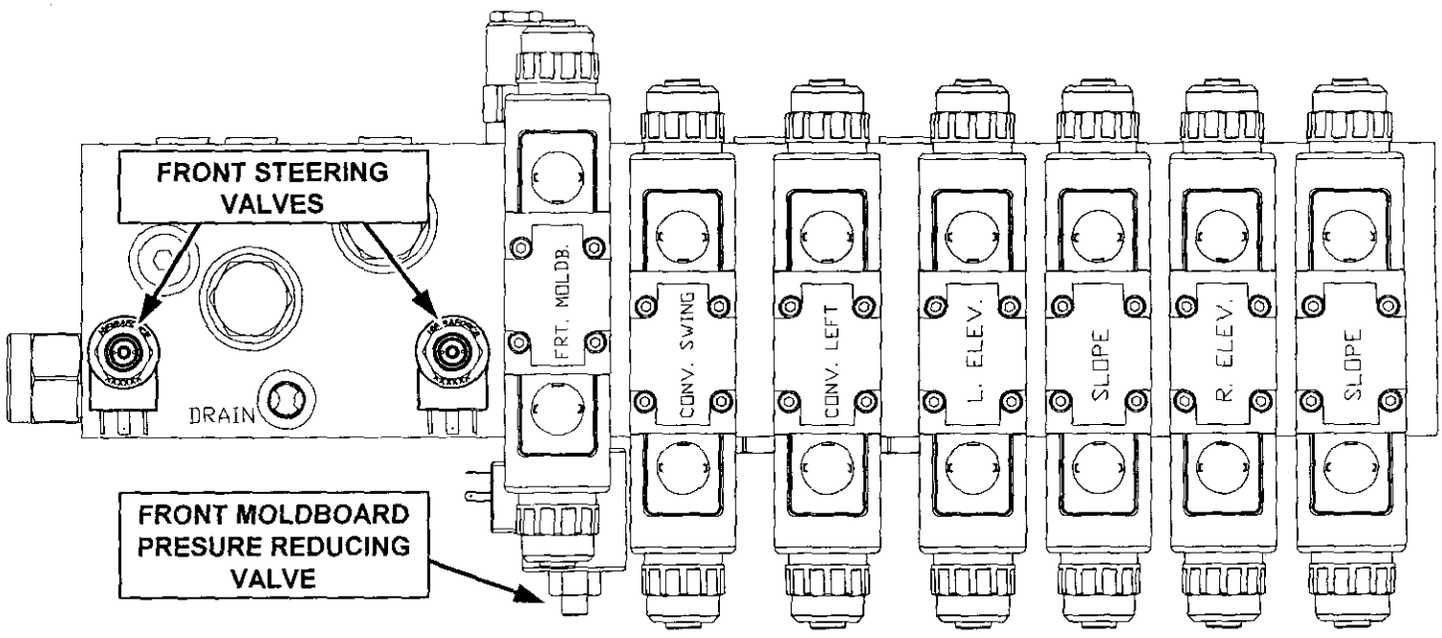



FIGURE 11

## 5.4 VALVES

### BELTGAURD VALVE MANIFOLD

These valves are found mounted to the top of the battery box under the right hand hood wing. These valves regulate pressure to the following hydraulic circuits: brake, clutch, rear two-speed, cutter belt tensioner and front two-speed.

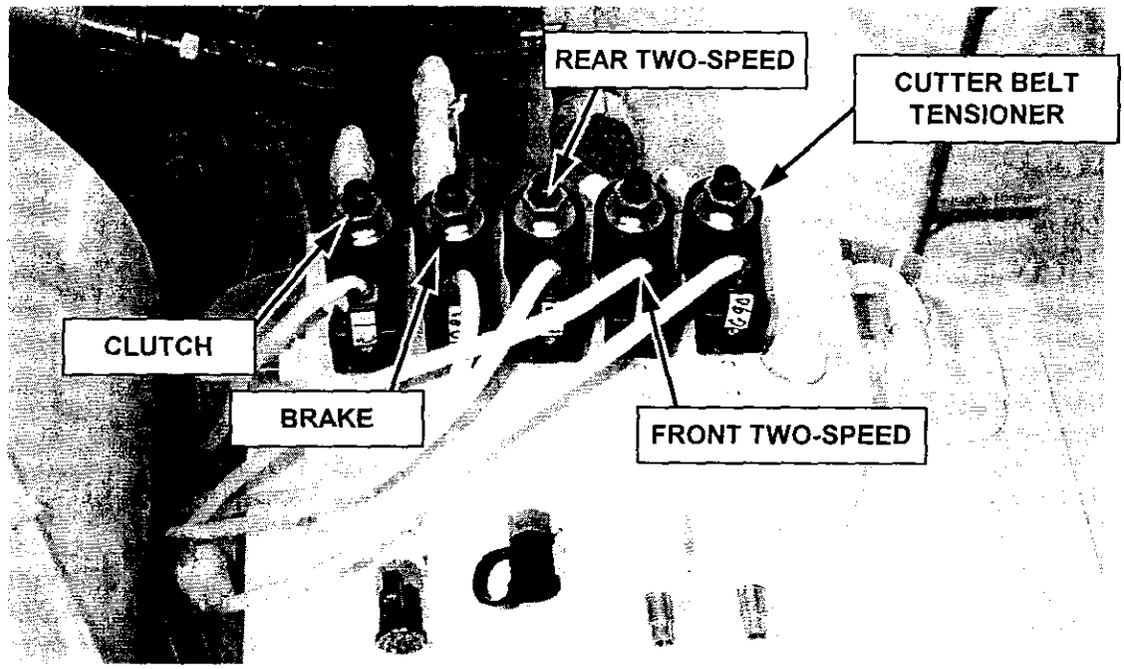



FIGURE 12

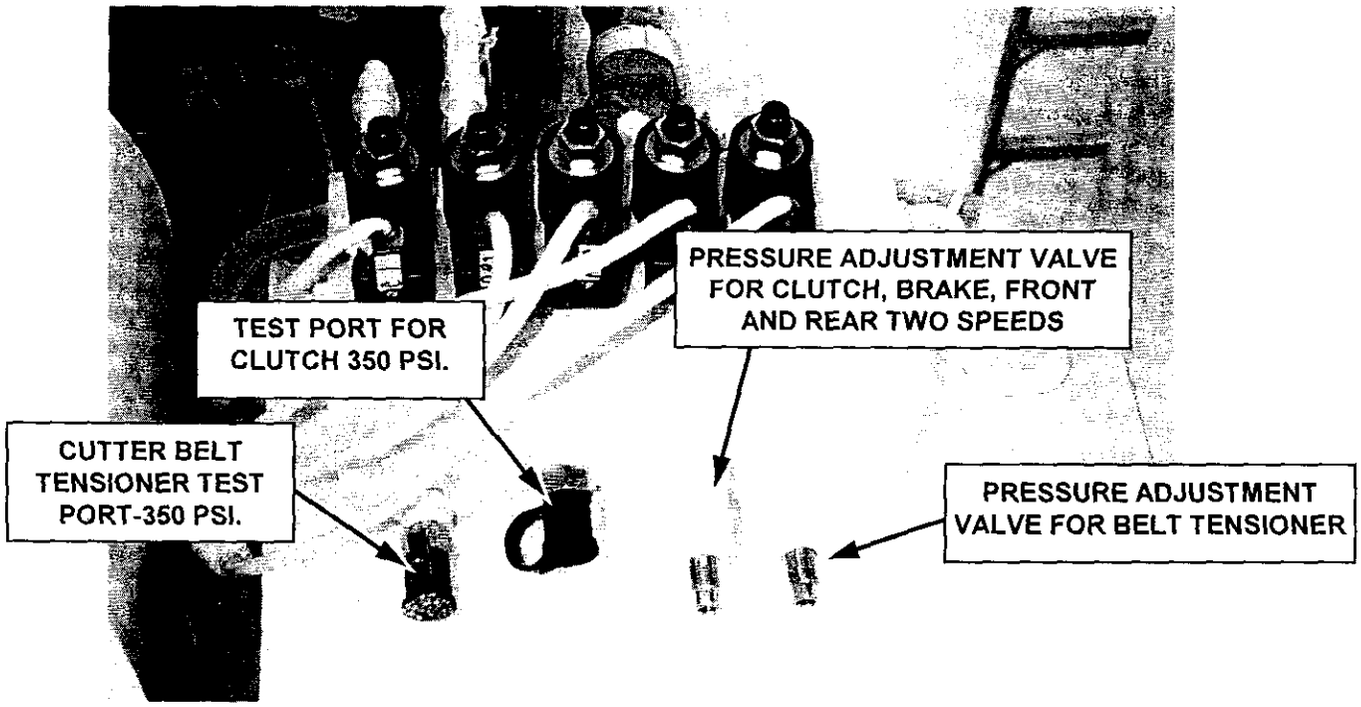



FIGURE 13

## 5.4 VALVES

### REAR VALVE MANIFOLD

The following valves are located just behind the hydraulic tank. The rear moldboard and endgates are equipped with pressure reducing valves, to meet special job requirements (figures 14 and 15).

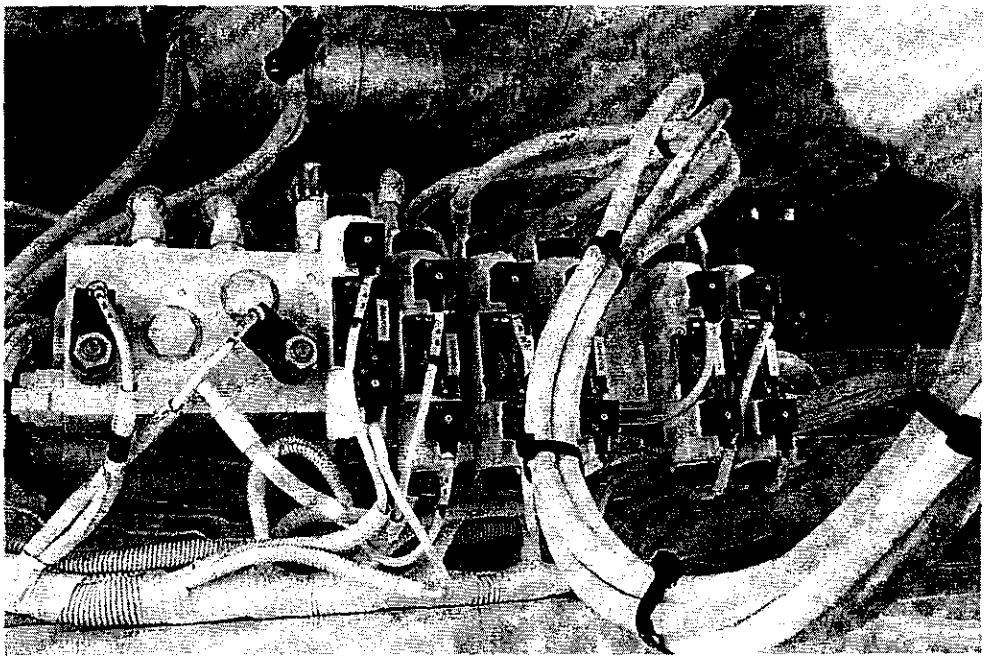


FIGURE 14

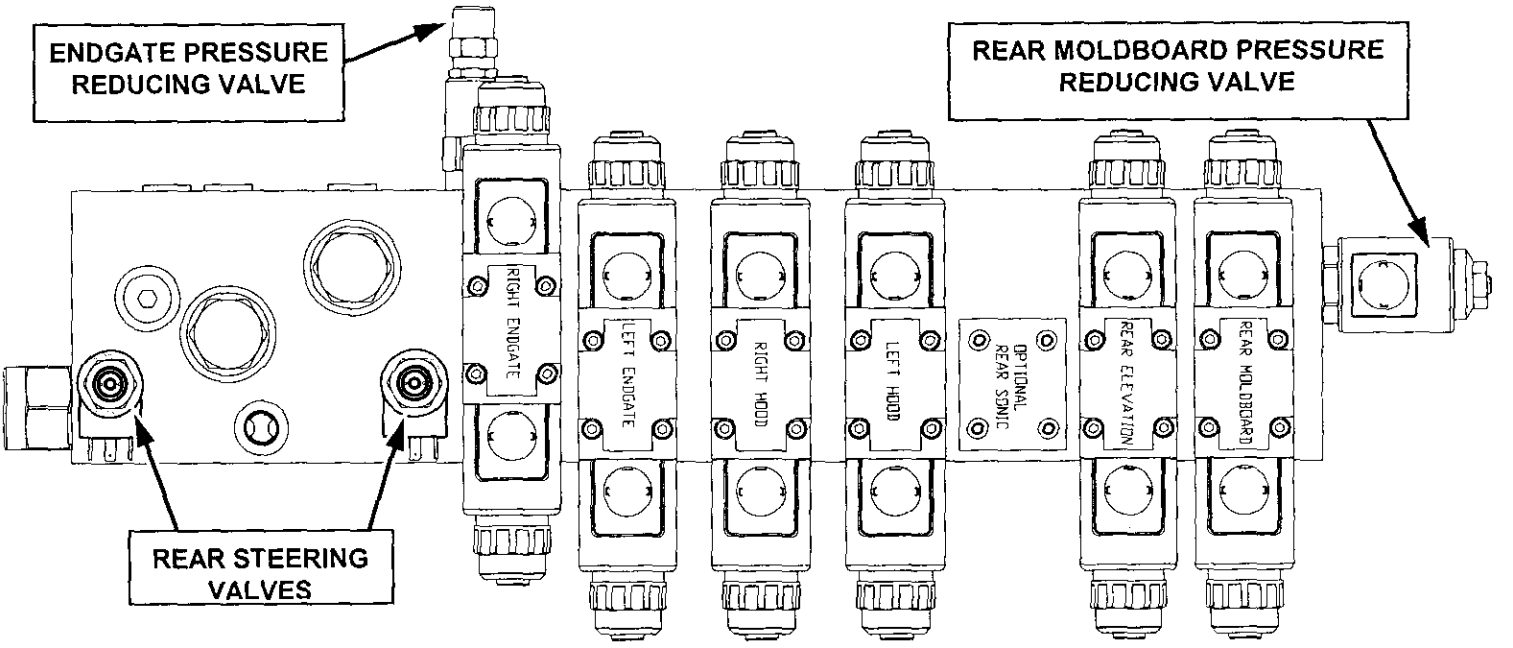
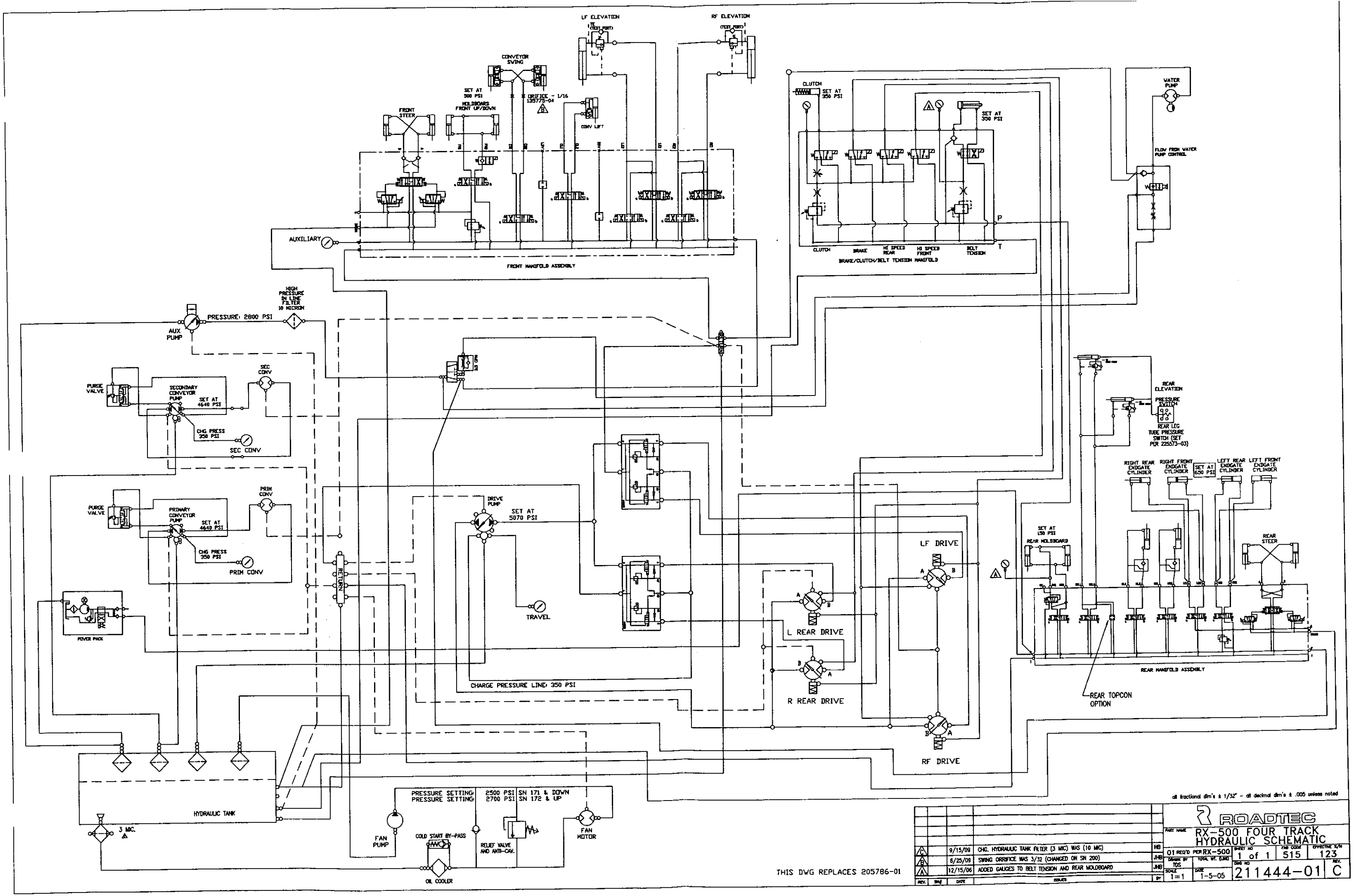



FIGURE 15

# SCHEMATICS




THIS DWG REPLACES 205786-01

all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

| REV. | SHT | DATE | ISSUES | BY |
|---|---|---|---|---|
| C | | 9/15/09 | CHG. HYDRAULIC TANK FILTER (3 MIC) WAS (10 MIC) | MB |
| B | | 6/25/09 | SWING ORRIFICE WAS 3/32 (CHANGED ON SN 200) | JHB |
| A | | 12/15/06 | ADDED GAUGES TO BELT TENSION AND REAR MOLDBOARD | JHB |

ROADTEC

PART NAME: RX-500 FOUR TRACK HYDRAULIC SCHEMATIC

01 REQ'D PER RX-500 | SHEET NO: 1 of 1 | FAB CODE: 515 | EFFECTIVE S/N: 123

DRAWN BY: TDS | TOTAL WT. (LBS) | DWG NO: 211444-01 | REV: C

SCALE: 1=1 | DATE: 1-5-05

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SOLENOID | TEMPERATURE SWITCH | (RY #) = RELAY | TERMINAL STRIP | NORMALLY OPEN SWITCH (N.O.) | ELEV = ELEVATION | PRESSURE SWITCH | RESISTOR | RED LIGHT | CIRCUIT BREAKER (CB #) | FRT = FRONT | FUSIBLE LINK |
| LIGHT SWITCH | PUSH BUTTON | WHITE LIGHT | WIRE NUMBER & WIRE DIRECTION | MTLK = INTERLOCK | | LIMIT SWITCH | NORMALLY CLOSED SWITCH (N.C.) | ORANGE LIGHT | BATTERY | GROUND | PROXIMITY SWITCH |
| | | | | | | | | | | | DIODE |

LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 2 ROADTEC | PART NAME ELECTRICAL SCHEMATIC RX-500 | 1 RECD FOR RX500 | SHEET NO 1 OF 10 | DWG NO 503 | REVISION 201 |
| | | ISSUE BY TOOL W/ QUAD | SCALE 1=1 | DATE 10-14-08 | REV 0 |

2263O2-01

all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

| MK | BY | DATE | REMARKS |
|---|---|---|---|
| | | | |

HYD. POWER PACK

STARTER

ALTERNATOR

STARTING

BRAKE

E-STOP

CLUTCH

SECONDARY CONVEYOR LIFT

SECONDARY CONVEYOR SWING

WOLDBOARD CIRCUIT SHEET 3

POWER PACK SWITCH CENTER CONSOLE

HYDRAULIC POWER PACK

STARTER RELAY

STARTER ASSIST

ALTERNATOR

STARTER ASSIST

CLUTCH ON/OFF

SLIDECUTTER JUMPER

BRAKE OFF/ON

BRAKE REF. TRAVEL CONTROL CIRCUIT SHT 2

REF. CONVEYOR SWITCH SHT 2 (SHOWN IN OFF)

"POWER ON" LIGHT

NEUTRAL JOYSTICK LEFT

RADIATOR DOOR PROX SW

REAR MOLDBOARD PROX SW

TRAVEL NEUTRAL (TRAVEL JOYSTICK) RIGHT

IGNITION/POWER SWITCH

EFFECTIVE SN 150

CONSOLE RIGHT N.C. EMERGENCY STOP

CONSOLE LEFT N.C. EMERGENCY STOP

RIGHT REAR GROUND BOX N.C. EMERGENCY STOP

LEFT REAR GROUND BOX N.C. EMERGENCY STOP

RIGHT FRONT GROUND BOX N.C. EMERGENCY STOP

LEFT FRONT GROUND BOX N.C. EMERGENCY STOP

RY2

RY3

CB-RECM

CB-BECM

BATTERY DISCONNECT

60 A

40 A

15 A

150 Ω

100 Ω

NEW CLUTCH INTERLOCK CIRCUIT EFFECTIVE SN 176 AND LATER

TO CONTROLLER PIN 46

TO CONTROLLER PIN 29

CLUTCH

CLUTCH OVERRIDE LIGHT

CLUTCH ON

LATCHING RELAY (IN TERMINAL BOX)

TO CONTROLLER PIN 5

TO CONTROLLER PIN 31

TO CONTROLLER PIN 14

RESET LIGHT

N.C. / N.O. REAR LEG TUBE PRESSURE SWITCH

CLUTCH OVERRIDE SWITCH LOCATED INSIDE CENTER CONSOLE

RIGHT JOYSTICK

LEFT JOYSTICK

RIGHT JOYSTICK

LEFT JOYSTICK

TRAVEL SPEED VALVES

SPEED SHIFT

TRAVEL SPEED SWITCH SHOWN IN LOW RANGE

ANTI-SPIN ON/OFF

NEUTRAL

LH CONTROL LEVER

IGNITION SWITCH LOGIC (ON-ON-ON SWITCH)

TRAVEL SPEED SWITCH LOGIC (ON-ON-ON SWITCH)

UP LOW RANGE MAINTAINED

CENTER MEDIUM RANGE MAINTAINED

DOWN HIGH RANGE MAINTAINED

all fractional dim's ± 1/32" – all decimal dim's ± .005 unless noted

| REV. | BY | DATE | REMARKS |
|---|---|---|---|
| | | | |

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

| | | | |
|---|---|---|---|
| 1 RECD'D PER RX500 | SHEET NO 2 OF 10 | PAR CODE 503 | EFFECTIVE S/N 201 |
| DRAWN BY KDM | TOTAL NO. (Desc) | DWG NO 2263O2-01 | REV. 0 |
| SCALE 1=1 | DATE 10-14-08 | | |

CONVEYOR CONTROL

CONVEYOR FORWARD

CONVEYOR REVERSE

WATER VALVE

WATER PUMP POWER OFF LIGHT

REVERSE ALARM

TRAVEL JOYSTICK

PRIMARY FORWARD

SECONDARY FORWARD

PRIMARY REVERSE

SECONDARY REVERSE

FACTORY SET TO 460 OHMS

FACTORY SET TO 360 OHMS

1K OHM 25 WATT

250 OHM 10 WATT

50 OHM 10 WATT

LEFT SECONDARY CONVEYOR BOOST

RIGHT SECONDARY CONVEYOR BOOST

CONVEYOR SWITCH (SHOWN IN OFF POSITION)

SEC CONV SWITCH IN (LH) JOYSTICK

SEC CONV SWITCH IN (RH) JOYSTICK

LATCHING RELAY (IN TERMINAL BOX)

CONVEYOR SPEED CONTROL

100 OHM 25 WATT

SECONDARY REVERSE ON / OFF

CONVEYOR SWITCH LOGIC (ON-ON-ON SWITCH)

KEYWAY REVERSE MOMENTARY

CENTER OFF MAINTAINED

UP FORWARD MAINTAINED

LEFT JOYSTICK SWITCH

+24v MOTION FORWARD

WATER SWITCH

AUTO

ON

SPST N.O. (RRY)

RY7

LOAD CONTROL ON/OFF

GREEN

A4 (SAUER)

A5 (SAUER)

REF. BRAKE SW NEUTRAL START CIRCUIT SHT 1

BRAKE

PROPEL PUMP EDC

RIGHT

all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

| REV. | BY | DESCRIPTION | DATE | APP'D |
|---|---|---|---|---|
| | | | | |

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

1 REQ'D PER RX500 | SHEET NO 3 OF 10 | FILE CODE 503 | DRAWING NO 201

DRAWN BY: KDM | ISSUE PER CUST. | DATE 10-14-08 | SCALE 1 = 1

DRWG NO 226302-01 | REV. 0

FRONT MOLDBOARD FLOAT REMOVED SN 132

FRONT MOLDBOARD

REAR MOLDBOARD

FRONT M'BOARD CYL

RAISE

LOWER

REAR M'BOARD CYL

REAR M'BOARD PRESSURE REDUCING VALVE

REFERENCE POWER PACK CIRCUIT - SHEET 1

AGND

POWER PACK

111

110

39

38

GROUND BOX (RH) FRONT MOLDBOARD RAISE/LOWER

GROUND BOX (LH) FRONT MOLDBOARD RAISE/LOWER

CENTER CONSOLE FRONT MOLDBOARD RAISE/LOWER

FRONT MOLDBOARD RAISE/LOWER

(UNDERNEATH) REAR MOLDBOARD RAISE/LOWER LH CYLINDER

CENTER CONSOLE REAR MOLDBOARD RAISE/LOWER

GROUND BOX (LH) REAR MOLDBOARD RAISE/LOWER

GROUND BOX (RH) REAR MOLDBOARD RAISE/LOWER

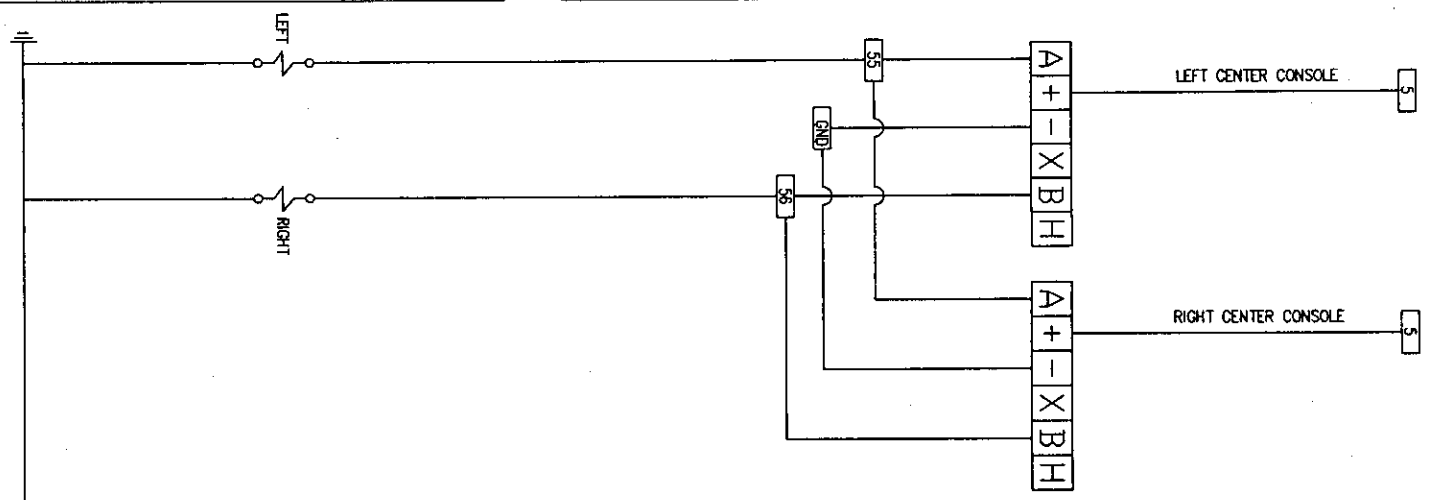
C89

C88

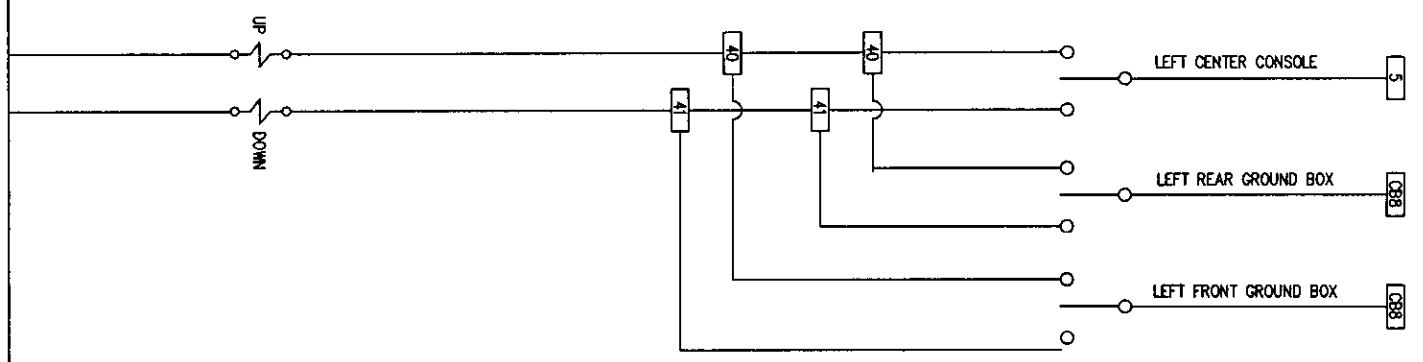
C82

5

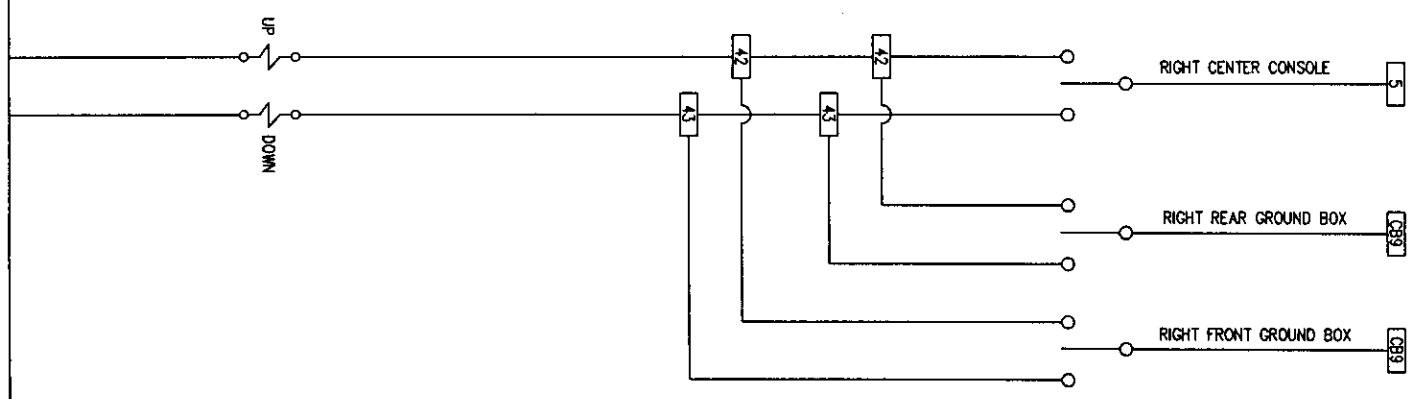
JOYSTICK STEERING



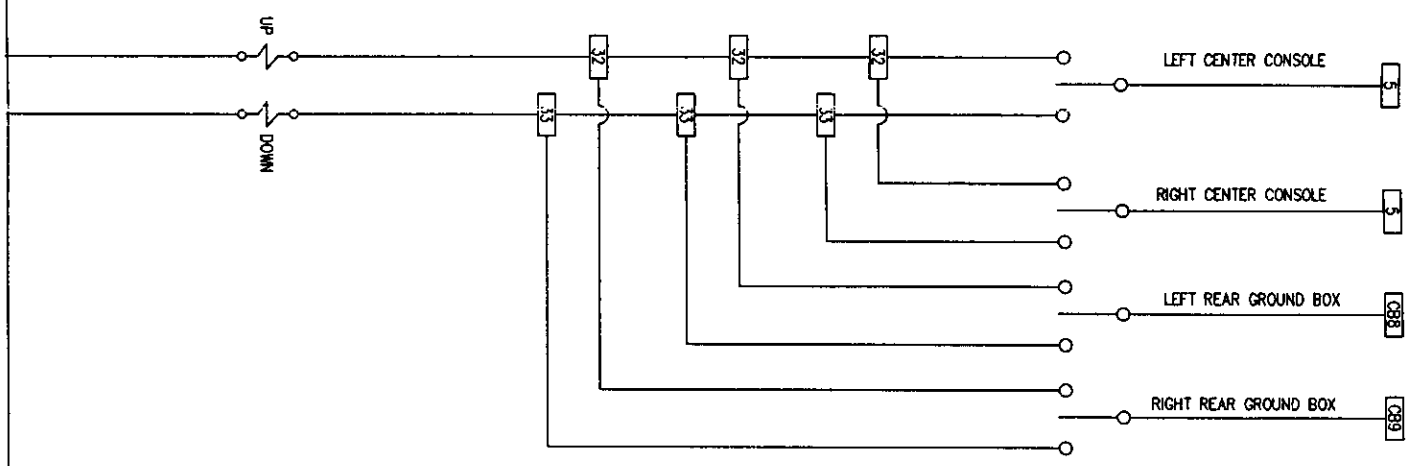

LEFT END GATE



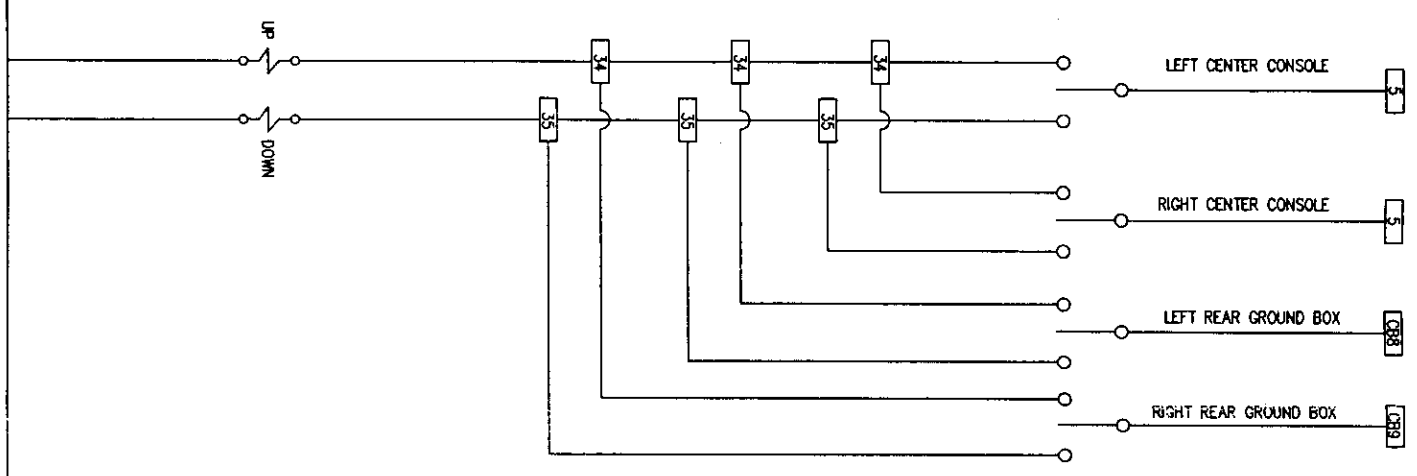

RIGHT END GATE



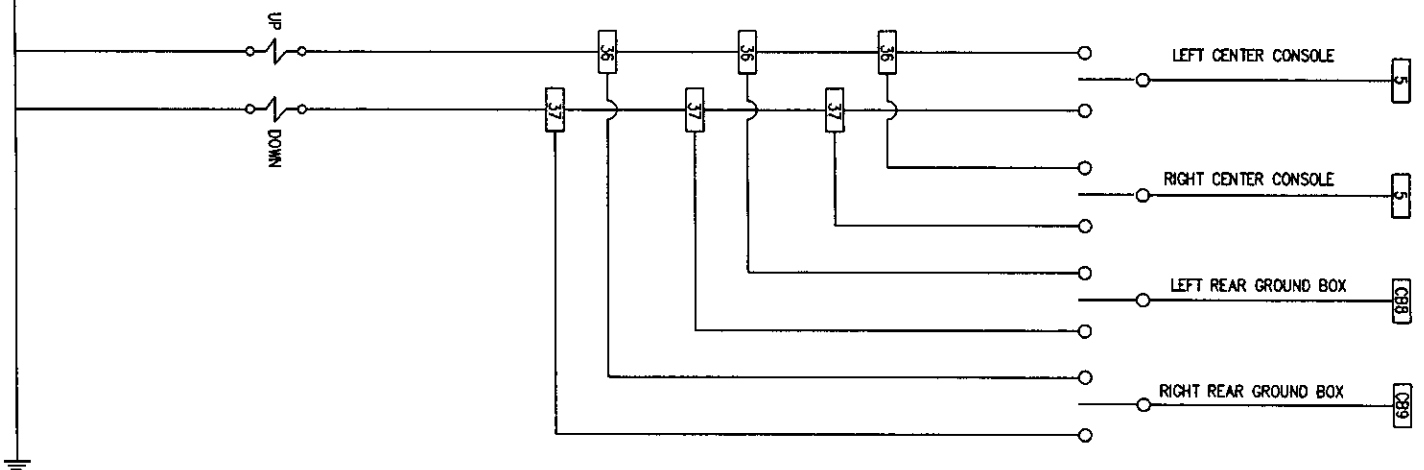

LEFT FRONT ELEVATION




RIGHT FRONT ELEVATION




REAR




all fractional dim's ± 1/32" – all decimal dim's ± .005 unless noted

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

| | |
|---|---|
| SCALE: 1=1 | 1 RECD'D PER RX500 |
| DRAWN BY: KDM | TOTAL WT. (LBS) |
| DATE: 10-14-08 | SHEET NO: 4 OF 10 |
| DWG NO: 226302-01 | FAB CODE: 503 |
| | EFFECTIVE S/N: 201 |
| | REV.: 0 |

| REV. | BY | DATE | ISSUED |
|---|---|---|---|

GRADE/SLOPE CONTROL (LEFT)

MOBA GRADE/SLOPE CONTROL

GRADE/SLOPE CONTROL (RIGHT)

TOPCON/RAMSEY GRADE/SLOPE CONTROL

REAR TOPCON GRADE CONTROL

REAR MOBA GRADE CONTROL

all fractional dim's ± 1/32" – all decimal dim's ± .005 unless noted

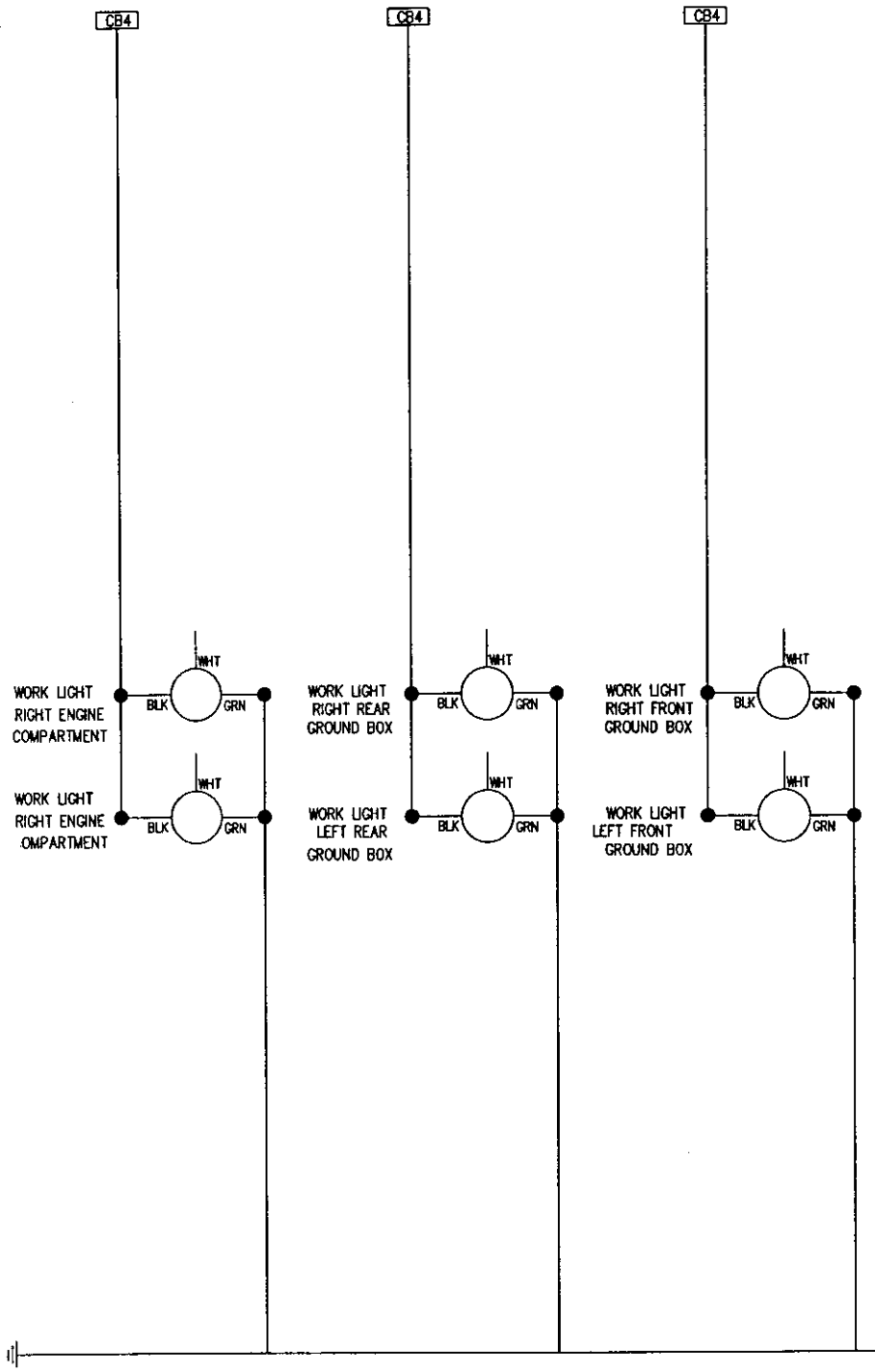
ROADTEC

PRINT NAME

ELECTRICAL SCHEMATIC RX-500

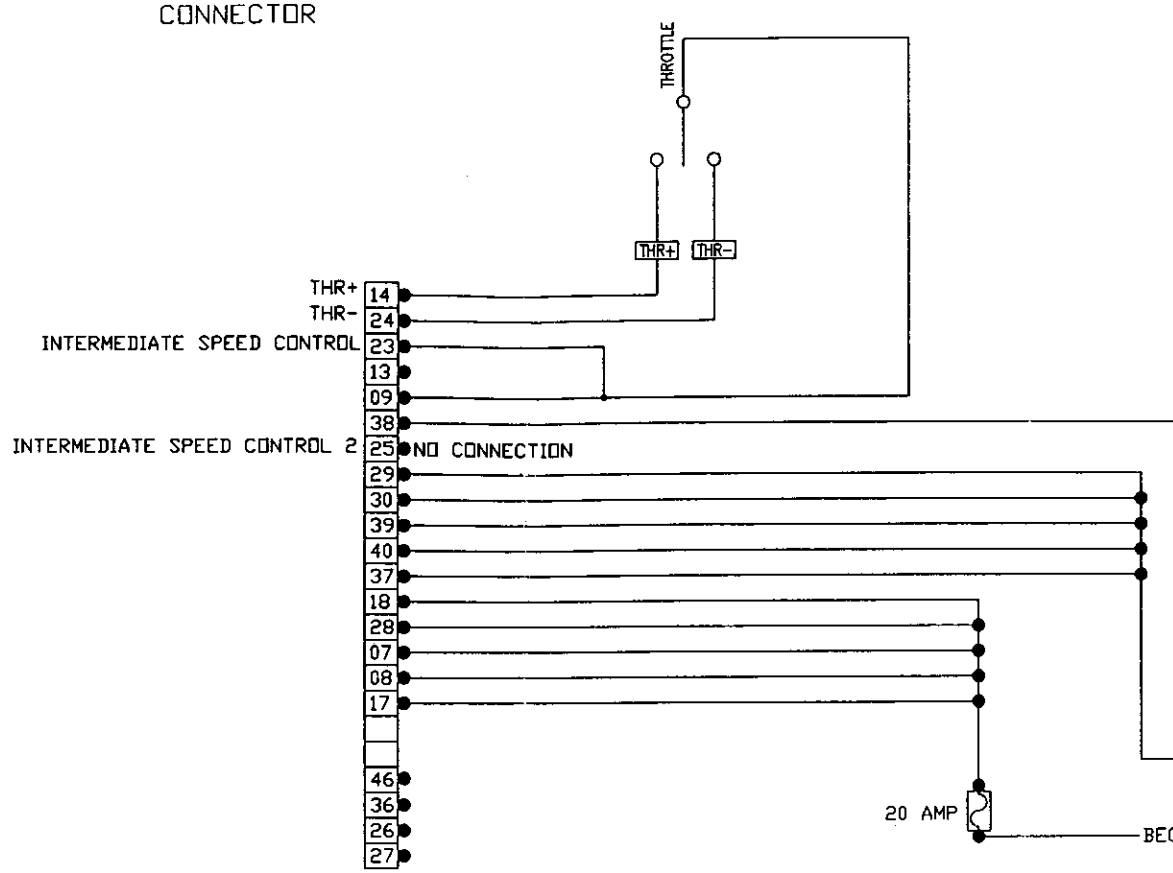
| | |
|---|---|
| DRAWN BY | KDM |
| REQ'D PER | RX500 |
| TOTAL QT. (UNIT) | 6 |
| SHEET NO | 6 OF 10 |
| PART CODE | 503 |
| EFFECTIVE S/N | 201 |
| SCALE | 1=1 |
| DATE | 10-14-08 |
| DWG NO | 226302-01 |
| REV. | 0 |

| REV. | PAM | DATE | DESCRIPTION | BY |
|---|---|---|---|---|
| | | | | |

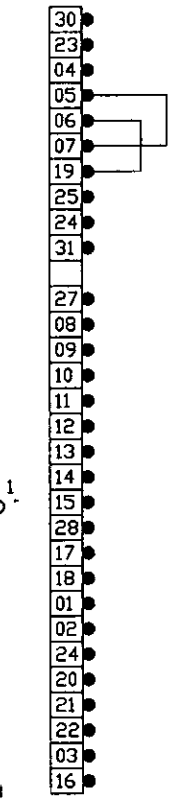



WORK LIGHTS

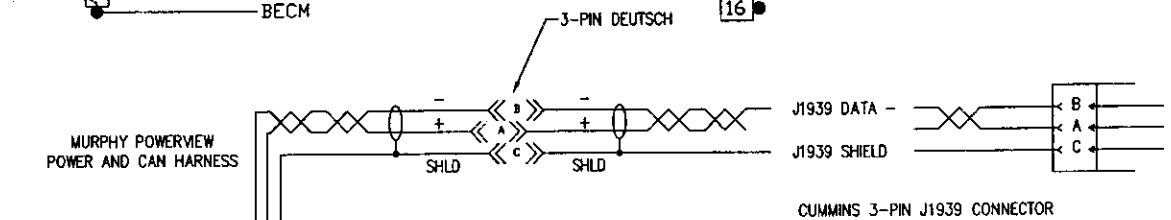
47 PIN OEM CONNECTOR



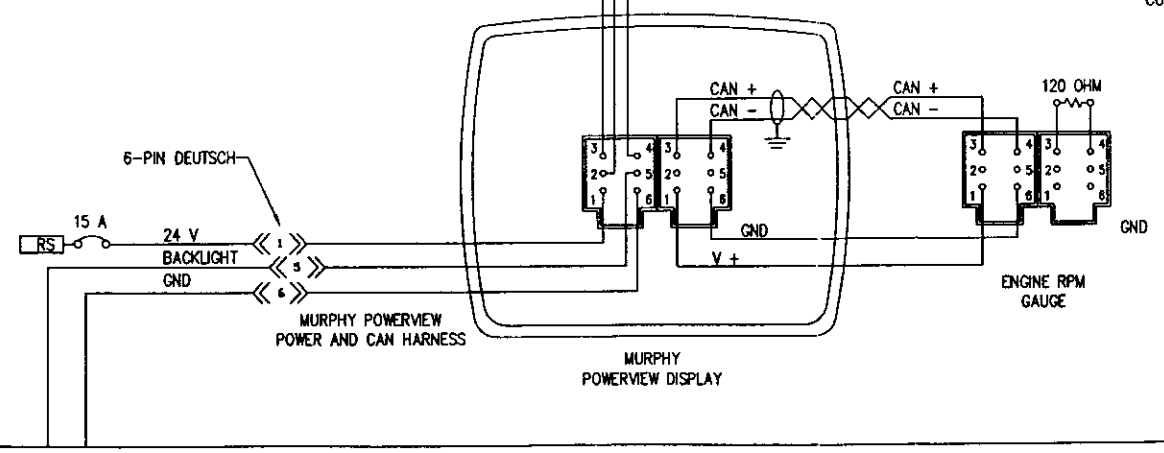

31 PIN OEM CONNECTOR




COOLANT LEVEL SENSOR SHORTING JUMPERS




CUMMINS 3-PIN J1939 CONNECTOR




CUMMINS ENGINE WIRING

MURPHY POWERVIEW WIRING

all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

1 REQ'D PER RX500 | SHEET NO: 7 OF 10 | FAB CODE: 503 | EFFECTIVE 3/94: 201

DRAWN BY: KDM | TOTAL WT. (LBS): | DWG NO: 226302-01 | REV: 0

SCALE: 1=1 | DATE: 10-14-08

| REV. | SHT | DATE | ISSUED | BY |
|---|---|---|---|---|

## MC050-10

| | | |
|---|---|---|
| POWER GROUND | 1 | GND |
| +24 VOLTS | 2 | C86 |
| CAN1 HIGH | 3 | PIN A (CAN +) |
| CAN1 LOW | 4 | PIN B (CAN -) |
| +24V IN CLUTCH RESET | 5 | L8 FROM LATCHING RELAY PIN 8 |
| DIGITAL IN - STEERING ON (A2) | 6 | A2 |
| DIGITAL IN - CRAB STEERING (B10) | 7 | B10 |
| 5V SENSOR POWER (B3) | 8 | B3 TO STEERING POTS AND RPM SETPOINT |
| SENSOR GROUND (B22) | 9 | B22 TO STEERING POTS AND RPM SETPOINT |
| DIGITAL IN - COORDINATED STEERING (B11) | 10 | B11 |
| DIGITAL IN - TRAC CNTRL OFF W/GND (A3) | 11 | A3 FROM TRAVEL SPEED SWITCH (SHEET 1) |
| DIGITAL IN - LOAD CNTRL ON W/GND (A4) | 12 | A4 FROM LOAD CONTROL SWITCH (SHEET 2) |
| DIGITAL IN - CALIBRATE SENSORS W/GND | 13 | C13 |
| DIGITAL IN - CLUTCH SWITCH ON | 14 | L7 FROM CLUTCH SWITCH (SHEET 1) |
| ANIN - FRONT SENSOR (B15) | 15 | B15 |
| ANIN - REAR SENSOR (B16) | 16 | B16 |
| ANALOG/DIGITAL IN | 17 | |
| +24V IN - REVERSE | 18 | 26 +24V IN REVERSE |
| SPARE 3 - MULTI INPUT | 19 | |
| J1939+ | 20 | YELLOW (PIN A) |
| J1939- | 21 | GREEN (PIN B) |
| +24V IN - CLUTCH OVERRIDE SWITCH | 22 | C1P22 +24V IN FROM CLUTCH OVERRIDE SWITCH |
| FREQ IN - LF_SPEED_PPU (B14) | 23 | B14 |
| FREQ IN - RF_SPEED_PPU (B19) | 24 | B19 |
| FREQ IN - LR_SPEED_PPU (B20) | 25 | B20 INSTALL JUMPER |
| FREQ IN - RR_SPEED_PPU (B21) | 26 | B21 3 TRACK MACHINE |
| ANIN RPM SETPOINT POT (B18) | 27 | B18 |
| ANALOG IN - NO CONNECTION RX-500 | 28 | |
| +24V CLUTCH ON | 29 | 1A FROM LATCHING RELAY SHEET 1 |
| SPARE 7 - ANIN | 30 | |
| +24V OUT - SET CLUTCH LATCHING RELAY | 31 | CLUTCH LATCHING RELAY |
| +24V OUT - CLUTCH OVERRIDE LIGHT | 32 | CLUTCH OVERRIDE LIGHT SEE SHEET 1 |
| +24V OUT - CLUTCH ON LIGHT | 33 | CLUTCH ON LIGHT SEE SHEET 1 |
| SPARE 11 - DIGOUT | 34 | |
| SPARE 12 - DIGOUT | 35 | |
| SPARE 13 - DIGOUT | 36 | |
| REAR STEER LEFT OUT | 37 | A24 |
| REAR STEER RIGHT OUT | 38 | A20 |
| THROTTLE + | 39 | THR+ |
| NO CONNECTION SPARE OUTPUT | 40 | SPARE |
| LOAD CONTROL OUT (A5) | 41 | A5 OUTPUT VOLTAGE TO LOAD CONTROL SWITCH (SEE PAGE 2) |
| LF TRAC CNTRL VLV (A8) | 42 | A8 |
| RF TRAC CNTRL VLV (A11) | 43 | A11 |
| LR TRAC CNTRL VLV (A12) | 44 | A12 |
| RR TRAC CNTRL VLV (A17) | 45 | A17 |
| CLUTCH VOLTAGE OUT | 46 | 1 |
| +24 VOLTS | 47 | C811 |
| +24 VOLTS | 48 | C812 |
| +24 VOLTS | 49 | C813 |
| +24 VOLTS | 50 | C814 |

AUTO STEER ON/OFF

STEERING MODE CRAB/FRONT/COORDINATE

CALIBRATION SWITCH

MURPHY DIAGNOSTIC GAUGE DEUTSCH RECEPTACLE TO

FRONT STEER SENSOR 1K

REAR / REAR LEFT STEER SENSOR 1K

RPM SET POINT POT 1K

REAR STEER OVERRIDE L CONSOLE

REAR STEER OVERRIDE R CONSOLE

REAR STEER OVERRIDE L GROUND BOX

REAR STEER OVERRIDE R GROUND BOX

LEFT FRONT MOTOR SPEED PICKUP

RIGHT FRONT MOTOR SPEED PICKUP

LEFT REAR MOTOR SPEED PICKUP

(NOT USED WITH 3-TRACK MACHINE)

RIGHT REAR MOTOR SPEED PICKUP

1 CLUTCH

A17 RR TRAC CNTRL VLV

A12 LR TRAC CNTRL VLV

A11 RF TRAC CNTRL VLV

A8 LF TRAC CNTRL VLV

A20 REAR STEER RIGHT

A24 REAR STEER LEFT

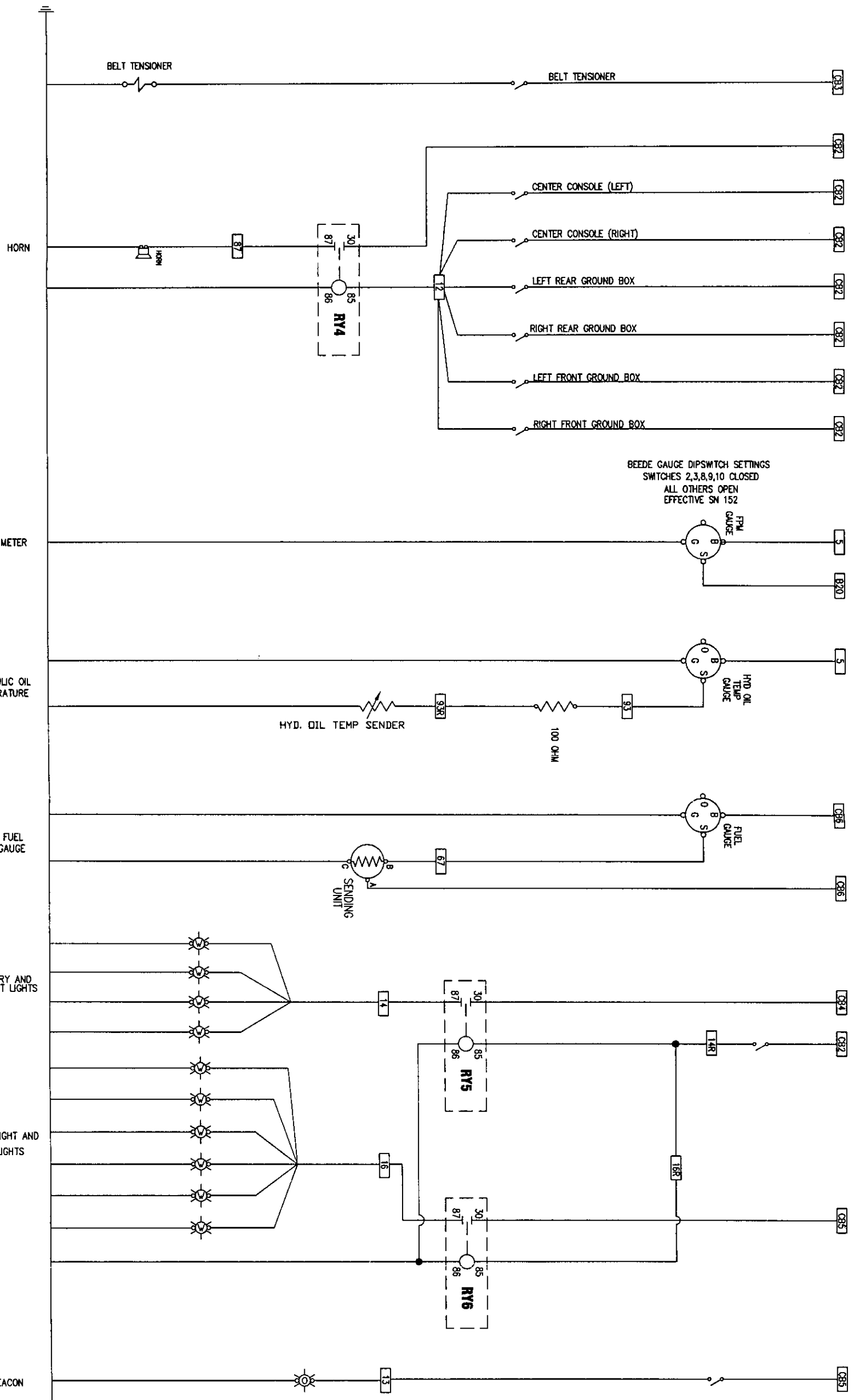
all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500 (CAT ENGINE)

| | | | |
|---|---|---|---|
| 1 REQ'D PER RX-500 | SHEET NO 8 OF 10 | FMI CODE 503 | EFFECTIVE S/N 202 |
| DRAWN BY KDM | TOTAL WT. (LBS) | DWG NO 226302-01 | REV 0 |
| SCALE 1=1 | DATE 10-23-08 | | |

| REV. | BY | DATE | ISSUES | BY |
|---|---|---|---|---|




| REV. | BY | DATE | ISSUED |
|---|---|---|---|

all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

1 REQ'D PER: RX500 | SHEET NO: 9 OF 10 | TYPE CODE: 503 | EFFECTIVE S/N: 201

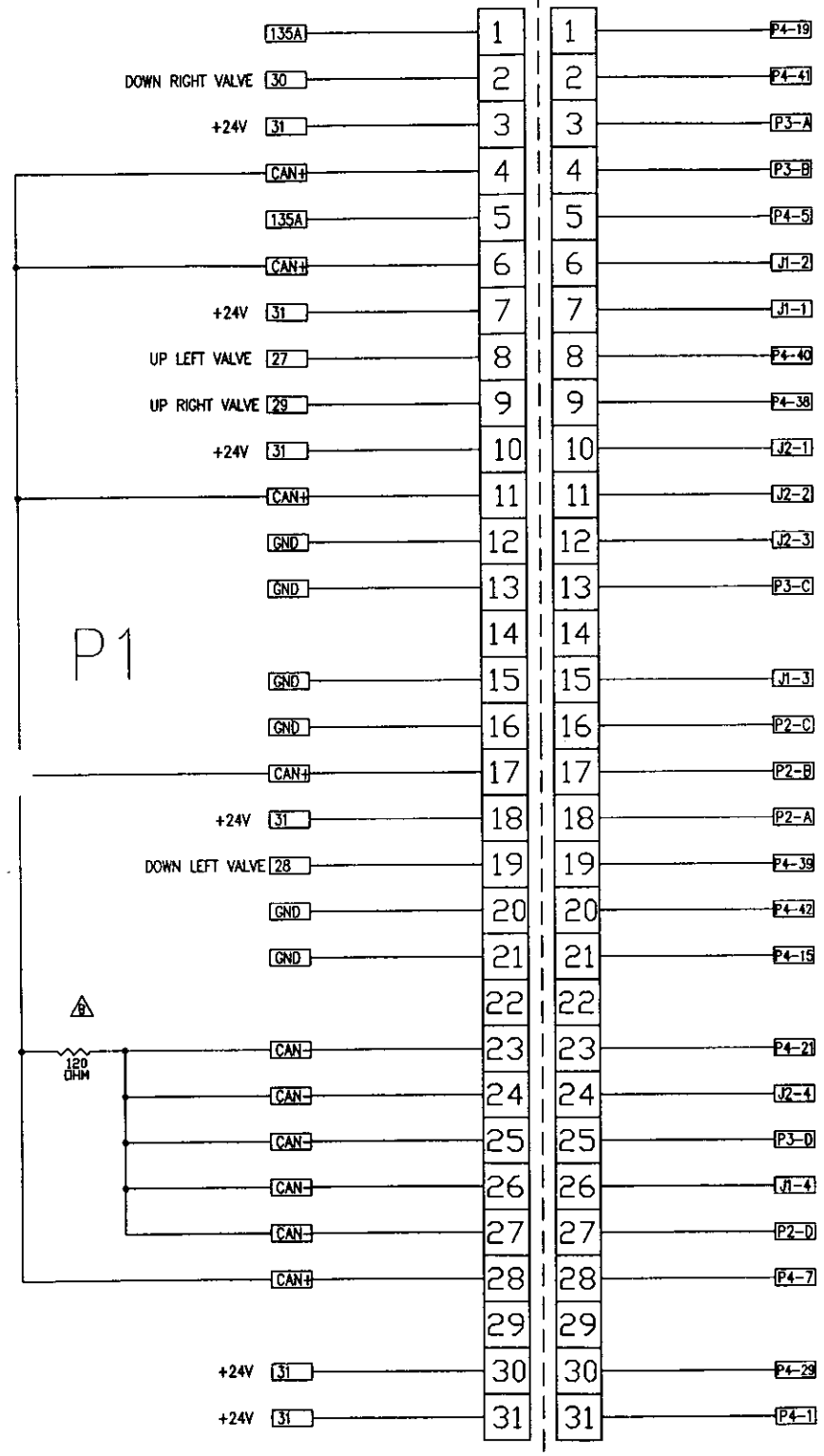
DRAWN BY: TOTAL WT. (LBS): | DWG. NO: 226302-01 | REV: 0

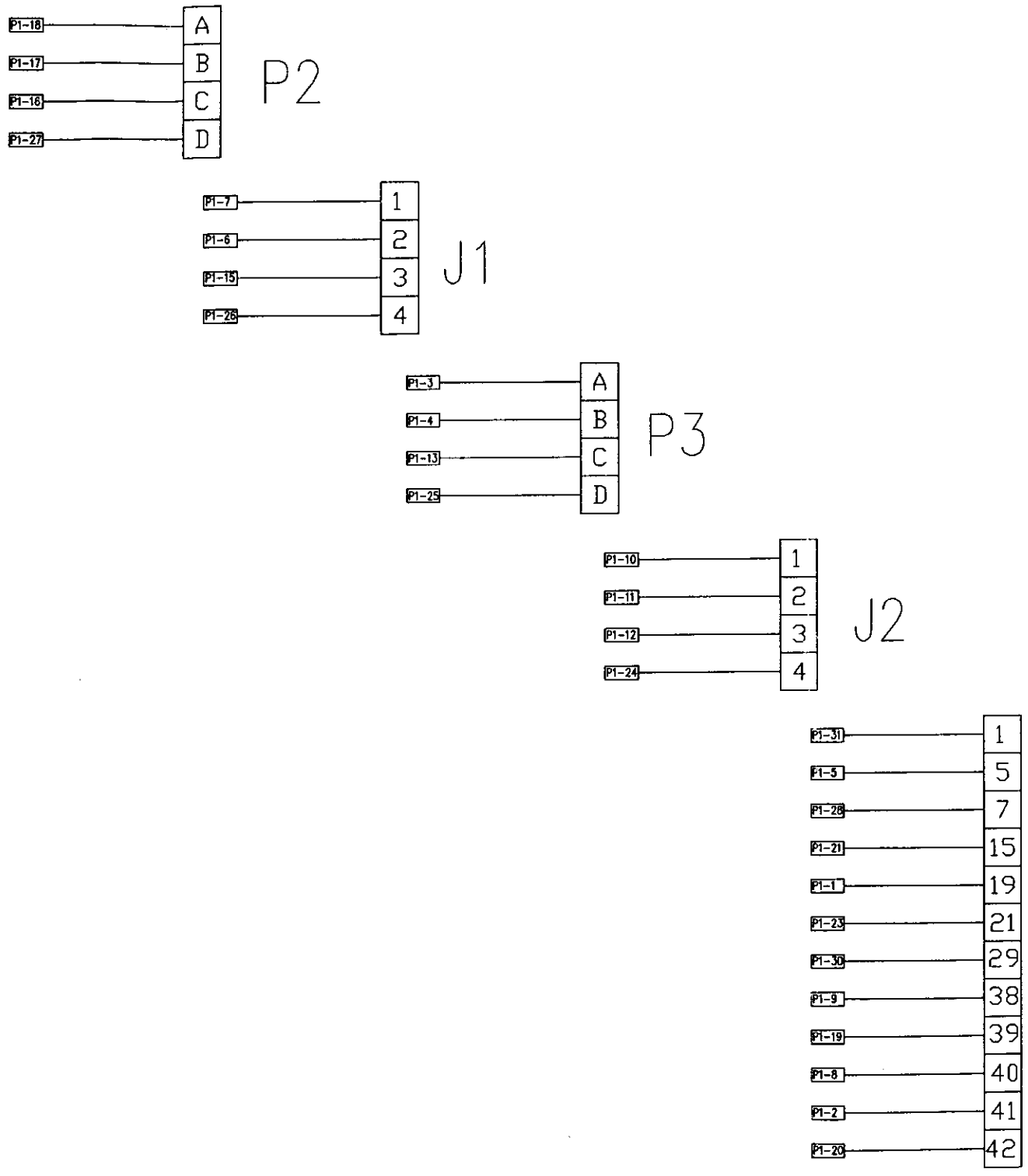
DATE: 10-14-08

SCALE: 1=1

# MOBA HARNESS ~ COMP-SLOPE-BOX CABLE

## MOBA~MAIN PIGTAIL




all fractional dim's ± 1/32" - all decimal dim's ± .005 unless noted

| REV. | BY | DATE | ISSUES |
|---|---|---|---|
| | | | |

ROADTEC

PART NAME: ELECTRICAL SCHEMATIC RX-500

| 1 REQ'D PER RX500 | SHEET NO: 0 OF 10 | FAB CODE: 503 | EFFECTIVE S/N: 201 |
|---|---|---|---|
| DRAWN BY: KDM | TOTAL WT. (LBS): | | |
| SCALE: 1=1 | DATE: 10-14-08 | DWG NO: 226302-01 | REV: 0 |

# TROUBLESHOOTING

SECTION PAGE

## 7.1 CUMMINS ENGINE FAULT CODES

In the event of an engine malfunction the engine's ECM will detect the source of the malfunction and display a certain code on the engine diagnostic gauge (figure 1). Each code will have an "SPN" number and an "FMI" number. In order to correctly identify the exact malfunction both the "SPN" and the "FMI" are required.

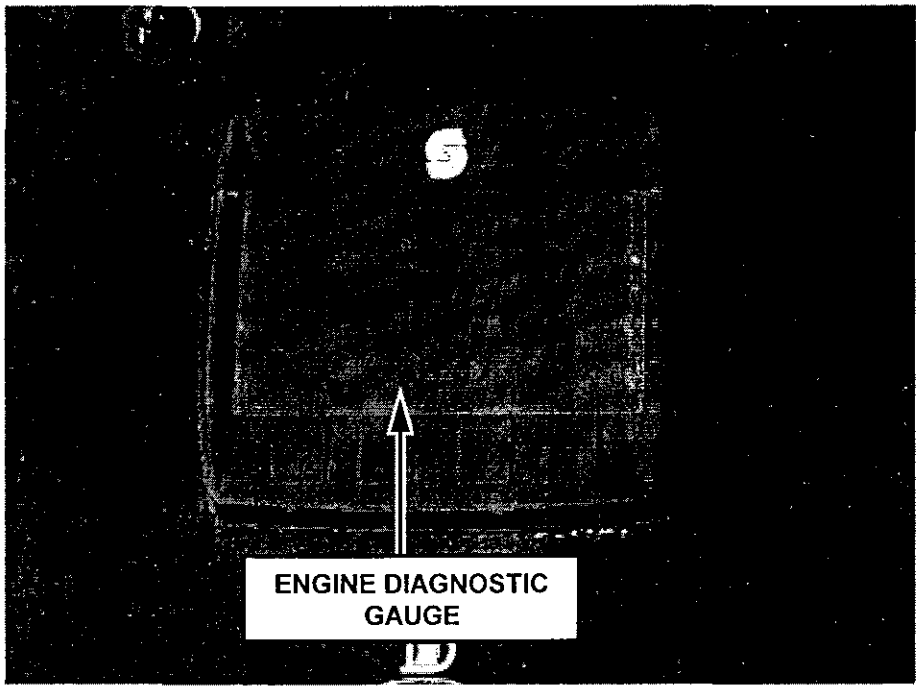



FIGURE 1

The "**SPN**" number, which stands for **suspect parameter number**, identifies the system or the component that is causing the failure. An example of this would be an spn of 110, which represents a failure of the engine coolant temperature circuit.

The "**FMI**" number, which stands for **failure mode identifier**, represents the type of failure that has occurred. An example of this would be an FMI of 03. This is indicating an above average value.

When the SPN of 110 and the FMI of 03 are combined, a conclusion can be made that the engine coolant temperature input voltage is too high.

The society of automotive engineers has established a listing of SPN and FMI codes that are universally used by all engine manufacturers. The following pages contain the listings that pertain specifically to Cummins engines.

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| SPN | FMI | DESCRIPTION |
| 29 | 3 | REMOTE ACCELERATOR PEDAL POSITION SENSOR-SHORTED HIGH |
| 29 | 4 | REMOTE ACCELERATOR PEDAL POSITION SENSOR-SHORTED LOW |
| 84 | 2 | VEHICLE SPEED SENSOR CIRCUIT-DATA INCORRECT |
| 84 | 10 | VEHICLE SPEED SENSOR CIRCUIT-TAMPERING HAS BEEN DETECTED |
| 91 | 3 | ACCELERATOR PEDAL POSITION SENSOR CIRCUIT-SHORTED HIGH |
| 91 | 4 | ACCELERATOR PEDAL POSITION SENSOR CIRCUIT-SHORTED LOW |
| 91 | 8 | ACCELERATOR PEDAL POSITION SENSOR CIRCUIT-LOW FREQUENCY |
| 91 | 8 | ACCELERATOR PEDAL POSITION SENSOR CIRCUIT-HIGH FREQUENCY |
| 91 | 19 | SAE J1939 MULTIPLEXING ACCELERATOR PEDAL SENSOR SYSTEM ERROR |
| 91 | 2 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT - DATA INCORRECT |
| 91 | 13 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT-OUT OF CALIBRATION |
| 91 | 4 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT - SHORTED LOW |
| 93 | 2 | OEM ALTERNATE TORQUE VALIDATION SWITCH-DATA INCORRECT |
| 94 | 16 | FUEL PRESSURE HIGH - WARNING |
| 94 | 18 | FUEL PRESSURE LOW - WARNING |
| 94 | 3 | FUEL DELIVERY PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 94 | 4 | FUEL DELIVERY PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 97 | 15 | WATER IN FUEL INDICATOR HIGH - MAINTENANCE |
| 97 | 3 | WATER IN FUEL SENSOR CIRCUIT - SHORTED HIGH |
| 97 | 4 | WATER IN FUEL SENSOR CIRCUIT - SHORTED LOW |
| 100 | 3 | ENGINE OIL PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 100 | 4 | ENGINE OIL PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 100 | 18 | ENGINE OIL PRESSURE LOW-WARNING |
| 100 | 1 | ENGINE OIL PRESSURE LOW-WARNING |
| 100 | 1 | ENGINE OIL PRESSURE LOW - CRITICAL |
| 100 | 2 | ENGINE OIL PRESSURE SENSOR CIRCUIT - DATA INCORRECT |
| 102 | 3 | INTAKE MANIFOLD PRESSURE SENSOR #1 CIRCUIT-SHORTED HIGH |
| 102 | 4 | INTAKE MANIFOLD PRESSURE SENSOR #1 CIRCUIT-SHORTED LOW |

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| SPN | FMI | DESCRIPTION |
| 102 | 2 | INTAKE MANIFOLD PRESSURE SENSOR CIRCUIT-DATA INCORRECT |
| 103 | 16 | TURBO CHARGER #1 SPEED HIGH - WARNING LEVEL |
| 105 | 3 | INTAKE MANIFOLD TEMPERATURE SENSOR #1-SHORTED HIGH |
| 105 | 4 | INTAKE MANIFOLD TEMPERATURE SENSOR #1-SHORTED LOW |
| 105 | 0 | INTAKE MANIFOLD TEMPERATURE #1 HIGH-CRITICAL |
| 108 | 3 | AMBIENT AIR PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 108 | 4 | AMBIENT AIR PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 108 | 2 | AMBIENT AIR PRESSURE SENSOR CIRCUIT-DATA INCORRECT |
| 109 | 3 | ENGINE COOLANT PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 109 | 4 | ENGINE COOLANT PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 109 | 1 | ENGINE COOLANT PRESSURE LOW-WARNING |
| 110 | 3 | ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT-SHORTED HIGH |
| 110 | 4 | ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT-SHORTED LOW |
| 110 | 0 | ENGINE COOLANT TEMPERATURE HIGH-CRITICAL |
| 111 | 1 | ENGINE COOLANT LEVEL LOW-CRITICAL |
| 111 | 2 | ENGINE COOLANT LEVEL SENSOR CIRCUIT-DATA INCORRECT |
| 135 | 3 | FUEL PUMP DELIVERY PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 135 | 4 | FUEL PUMP DELIVERY PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 156 | 3 | FUEL TIMING PRESSURE SENSOR CIRCUIT -SHORTED HIGH |
| 156 | 4 | FUEL TIMING PRESSURE SENSOR CIRCUIT -SHORTED LOW |
| 156 | 2 | FUEL TIMING PRESSURE OR TIMING ACTUATOR STUCK |
| 157 | 3 | INJECTOR METERING RAIL #1 PRESSURE SENSOR CIRCUIT - SHORTED HIGH |
| 157 | 4 | INJECTOR METERING RAIL #1 PRESSURE SENSOR CIRCUIT - SHORTED LOW |
| 157 | 16 | INJECTOR METERING RAIL #1 PRESSURE HIGH-WARNING LEVEL |
| 157 | 0 | INJECTOR METERING RAIL #1 PRESSURE HIGH-WARNING LEVEL |
| 157 | 2 | FUEL PRESSURE SENSOR ERROR |
| 166 | 2 | CYLINDER POWER IMBALANCE BETWEEN CYLINDERS |

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| **SPN** | **FMI** | **DESCRIPTION** |
| 167 | 16 | ELECTRICAL CHARGING SYSTEM VOLTAGE HIGH - WARNING LEVEL |
| 167 | 18 | ELECTRICAL CHARGING SYSTEM VOLTAGE LOW - WARNING LEVEL |
| 167 | 1 | ELECTRICAL CHARGING SYSTEM VOLTAGE LOW - CRITICAL LEVEL |
| 168 | 18 | BATTERY #1 VOLTAGE LOW - WARNING |
| 168 | 1 | BATTERY #1 VOLTAGE LOW - WARNING |
| 168 | 16 | BATTERY #1 VOLTAGE HIGH - WARNING |
| 168 | 0 | BATTERY #1 VOLTAGE HIGH - WARNING |
| 174 | 0 | FUEL TEMPERATURE HIGH-WARNING |
| 174 | 3 | FUEL TEMPERATURE SENSOR CIRCUIT-SHORTED HIGH |
| 174 | 4 | FUEL TEMPERATURE SENSOR CIRCUIT-SHORTED LOW |
| 175 | 3 | ENGINE OIL TEMPERATURE CIRCUIT-SHORTED HIGH |
| 175 | 4 | ENGINE OIL TEMPERATURE CIRCUIT-SHORTED LOW |
| 175 | 0 | ENGINE OIL TEMPERATURE HIGH-CRITICAL |
| 190 | 2 | ENGINE SPEED/POSITION SENSOR CIRCUIT LOST BOTH OF TWO SIGNALS FROM THE MAGNETIC PICKUP SENSOR |
| 190 | 10 | ENGINE SPEED/POSITION SENSOR CIRCUIT LOST BOTH OF TWO SIGNALS FROM THE MAGNETIC PICKUP SENSOR |
| 190 | 0 | ENGINE SPEED HIGH-CRITICAL |
| 191 | 16 | TRANSMISSION OUTPUT SHAFT (TAILSHAFT) SPEED HIGH-WARNING |
| 191 | 0 | TRANSMISSION OUTPUT SHAFT (TAILSHAFT) SPEED HIGH-WARNING |
| 191 | 18 | TRANSMISSION OUTPUT SHAFT (TAILSHAFT) SPEED LOW-WARNING |
| 191 | 1 | TRANSMISSION OUTPUT SHAFT (AUX GOV) SPEED LOW-WARNING |
| 251 | 2 | REAL TIME CLOCK-POWER INTERRUPT |
| 558 | 2 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT - DATA INCORRECT |
| 558 | 13 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT-OUT OF CALIBRATION |
| 558 | 4 | ACCELERATOR PEDAL IDLE VALIDATION CIRCUIT - SHORTED LOW |
| 620 | 4 | SENSOR SUPPLY VOLTAGE #2 CIRCUIT-SHORTED LOW |
| 620 | 3 | SENSOR SUPPLY VOLTAGE #2 CIRCUIT-SHORTED HIGH |
| 626 | 11 | START ASSIST DEVICE CONTROL CIRCUIT ERROR (ETHER INJECTION) |
| 626 | 1 | START ASSIST DEVICE-CANISTER EMPTY (ETHER INJECTION) |

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| SPN | FMI | DESCRIPTION |
| 627 | 2 | POWER LOST WITHOUT IGNITION OFF |
| 629 | 12 | ENGINE CONTROL MODULE-CRITICAL INTERNAL FAILURE |
| 629 | 12 | ENGINE CONTROL MODULE-WARNING INTERNAL HARDWARE FAILURE |
| 630 | 2 | ENGINE CONTROL MODULE-DATA LOST |
| 630 | 12 | ENGINE CONTROL MODULE-WARNING SOFTWARE ERROR |
| 632 | 4 | FUEL SHUTOFF VALVE CIRCUIT-SHORTED LOW |
| 632 | 3 | FUEL SHUTOFF VALVE CIRCUIT-SHORTED HIGH |
| 632 | 7 | FUEL SHUTOFF VALVE-STUCK OPEN |
| 633 | 5 | FUELING ACTUATOR #1 CIRCUIT-OPEN CIRCUIT |
| 633 | 6 | FUELING ACTUATOR #1 CIRCUIT-GROUNDED CIRCUIT |
| 633 | 3 | FUEL CONTROL VALVE CIRCUIT - SHORTED HIGH |
| 633 | 2 | FUEL RAIL ACTUATOR CIRCUIT - DATA INCORRECT |
| 633 | 7 | FUEL CONTROL VALVE - MECHANICALLY STUCK |
| 635 | 7 | ENGINE TIMING ACTUATOR IS NOT RESPONDING TO **ECM** COMMANDS |
| 635 | 3 | ENGINE TIMING ACTUATOR CIRCUIT-SHORTED HIGH |
| 635 | 5 | TIMING ACTUATOR #1 CIRCUIT - OPEN CIRCUIT |
| 635 | 6 | TIMING ACTUATOR #1 CIRCUIT - GROUNDED CIRCUIT |
| 635 | 2 | TIMING ACTUATOR CIRCUIT - DATA INCORRECT |
| 639 | 9 | SAE J1939 MULTIPLEXING PGN TIMEOUT ERROR |
| 639 | 13 | SAE J1939 MULTIPLEXING CONFIGURATION ERROR |
| 639 | 2 | SAE J1939 DATALINK - CANNOT TRANSMIT |
| 639 | 9 | SAE J1939 NOT FAST ENOUGH |
| 644 | 2 | EXTERNAL SPEED INPUT (MULTIPLE UNIT SYNCRONIZATION) - DATA INCORRECT |
| 647 | 4 | FAN CLUTCH CIRCUIT-SHORTED LOW |
| 651 | 6 | INJECTOR SOLENOID VALVE CYLINDER #1 CIRCUIT-GROUNDED CIRCUIT |
| 652 | 6 | INJECTOR SOLENOID VALVE CYLINDER #2 CIRCUIT-GROUNDED CIRCUIT |
| 653 | 6 | INJECTOR SOLENOID VALVE CYLINDER #3 CIRCUIT-GROUNDED CIRCUIT |
| 655 | 6 | INJECTOR SOLENOID VALVE CYLINDER #5 CIRCUIT-GROUNDED CIRCUIT |

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| SPN | FMI | DESCRIPTION |
| 656 | 6 | INJECTOR SOLENOID VALVE CYLINDER #6 CIRCUIT-GROUNDED CIRCUIT |
| 702 | 3 | AUXILIARY INPUT/OUTPUT #2 CIRCUIT - SHORTED HIGH |
| 703 | 3 | AUXILIARY INPUT/OUTPUT #3 CIRCUIT - SHORTED HIGH |
| 723 | 2 | ENGINE SPEED/POSITION #2 - CAM SYNC ERROR |
| 931 | 3 | FUEL SUPPLY PUMP ACTUATOR CIRCUIT-SHORTED HIGH |
| 931 | 7 | FUEL SUPPLY PUMP ACTUATOR-MECHANICALLY STUCK |
| 974 | 3 | REMOTE ACCELERATOR PEDAL POSITION SENSOR-SHORTED HIGH |
| 974 | 4 | REMOTE ACCELERATOR PEDAL POSITION SENSOR-SHORTED LOW |
| 974 | 19 | SAE J1939 MULTIPLEXING REMOTE THROTTLE DATA ERROR |
| 1043 | 4 | ENGINE SPEED/POSITION SENSOR #1 (CRANKSHAFT) SUPPLY VOLTAGE CIRCUIT-SHORTED LOW |
| 1043 | 3 | ACCELERATOR PEDAL POSITION SENSOR SUPPLY VOLTAGE CIRCUIT - SHORTED HIGH |
| 1043 | 4 | ACCELERATOR PEDAL POSITION SENSOR SUPPLY VOLTAGE CIRCUIT - SHORTED LOW |
| 1043 | 11 | ENGINE SPEED/POSITION SENSOR #2 (CAMSHAFT) VOLTAGE SUPPLY |
| 1079 | 4 | SENSOR SUPPLY VOLTAGE #1 CIRCUIT-SHORTED LOW |
| 1079 | 3 | SENSOR SUPPLY VOLTAGE #1 CIRCUIT-SHORTED HIGH |
| 1083 | 14 | AUXILIARY TEMPERATURE SENSOR INPUT #1 ENGINE PROTECTION-CRITICAL |
| 1083 | 3 | AUXILIARY TEMPERATURE SENSOR INPUT #1 CIRCUIT-SHORTED HIGH |
| 1083 | 4 | AUXILIARY TEMPERATURE SENSOR INPUT #1 CIRCUIT-SHORTED LOW |
| 1084 | 14 | AUXILIARY PRESSURE SENSOR INPUT #2 ENGINE PROTECTION-CRITICAL |
| 1084 | 3 | AUXILIARY PRESSURE SENSOR INPUT #2 CIRCUIT-SHORTED HIGH |
| 1084 | 4 | AUXILIARY PRESSURE SENSOR INPUT #2 CIRCUIT-SHORTED LOW |
| 1188 | 4 | TURBO CHARGER #1 WASTEGATE CONTROL CIRCUIT-SHORTED LOW |
| 1244 | 5 | FUELING ACTUATOR #2 CIRCUIT - OPEN CIRCUIT |
| 1244 | 6 | FUELING ACTUATOR #2 CIRCUIT - GROUNDED CIRCUIT |
| 1245 | 5 | TIMING ACTUATOR #2 CIRCUIT - OPEN CIRCUIT |

## 7.1 CUMMINS ENGINE FAULT CODES

| CUMMINS ENGINE FAULT CODES | | |
|---|---|---|
| **SPN** | **FMI** | **DESCRIPTION** |
| 1245 | 6 | TIMING ACTUATOR #2 CIRCUIT - GROUNDED CIRCUIT |
| 1264 | 0 | ENGINE BLOWBY - WARNING LEVEL |
| 1264 | 3 | CRANKCASE BLOWBY PRESSURE SENSOR CIRCUIT - SHORTED HIGH |
| 1264 | 4 | CRANKCASE BLOWBY PRESSURE SENSOR CIRCUIT - SHORTED LOW |
| 1265 | 4 | ENGINE OIL BURN VALVE SOLENOID CIRCUIT-SHORTED LOW |
| 1266 | 4 | ENGINE OIL REPLACEMENT VALVE SOLENOID CIRCUIT-SHORTED LOW |
| 1349 | 3 | INJECTOR METERING RAIL #2 PRESSURE SENSOR CIRCUIT-SHORTED HIGH |
| 1349 | 4 | INJECTOR METERING RAIL #2 PRESSURE SENSOR CIRCUIT-SHORTED LOW |
| 1349 | 16 | INJECTOR METERING RAIL #2 PRESSURE HIGH-WARNING |
| 1349 | 18 | INJECTOR METERING RAIL #2 PRESSURE LOW-WARNING |
| 1349 | 7 | INJECTOR METERING RAIL #2 PRESSURE MALFUNCTION |
| 1377 | 2 | MULTIPLE UNIT SYNCHRONIZATION SWITCH CIRCUIT - DATA INCORRECT |
| 1378 | 0 | CHANGE LUBRICATING OIL AND FILTER |
| 1380 | 17 | LOW OIL LEVEL IN THE CENTINEL MAKEUP OIL TANK |
| 1380 | 1 | LOW OIL LEVEL IN THE CENTINEL MAKEUP OIL TANK |
| 1381 | 3 | FUEL SUPPLY PUMP INLET PRESSURE SENSOR CIRCUIT - SHORTED HIGH |
| 1381 | 4 | FUEL SUPPLY PUMP INLET PRESSURE SENSOR CIRCUIT - SHORTED LOW |
| 1381 | 18 | FUEL SUPPLY PUMP INLET PRESSURE LOW - WARNING LEVEL |
| 1383 | 31 | ENGINE HOT SHUTDOWN |
| 1384 | 31 | ENGINE SHUTDOWN COMMANDED BY J1939 |
| 1484 | 31 | ADDITIONAL OEM/VEHICLE DIAGNOSTIC CODES HAVE BEEN LOGGED |

# MAINTENANCE SCHEDULE

## DAILY MAINTENANCE

| IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|
| ENGINE OIL | CHECK LEVEL | REFER TO ENGINE MANUAL FOR LUBE SPECS |
| CUTTER DRUM BEARING | LUBRICATE WITH HIGH TEMP. GREASE | 20 SHOTS AT GREASE FITTING |
| CUTTER PLANETARY DRIVE SEAL | LUBRICATE WITH HIGH TEMP. GREASE | 10 SHOTS AT GREASE FITTING |
| PRIMARY CONVEYOR HEAD AND TAIL SHAFT BEARINGS | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| SECONDARY CONVEYOR HEAD AND TAIL SHAFT BEARINGS | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| HYDRAULIC TANK | CHECK OIL LEVEL-REFILL IF NECESSARY | REFILL TO 90% CAPACITY WITH GRADE 46 HYDRAULIC OIL |
| RADIATOR | CHECK LEVEL | REFILL WITH A 50/50 MIX OF ANTIFREEZE AND WATER |
| ENGINE AIR CLEANER | CHECK OR REPLACE | DAMAGED OR DIRTY AIR CLEANERS SHOULD BE REPLACED |
| WATER FILTER AND CUTTER SPRAY BAR | CLEAN | CHECK FOR LEAKS OR DAMAGED COMPONENTS |
| AIR TANKS | DRAIN WATER | OPEN DRAIN VALVE AT BOTTOM OF TANKS TO DRAIN |
| STEERING SWIVEL BEARINGS | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| SECONDARY CONVEYOR SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| STEERING CYLINDER TIE ROD PINS | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |

## 50 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | HYDRAULIC FILTERS | CHANGE | CHANGE AFTER THE FIRST 50 HOURS OF SERVICE ON NEW MANCHINE. |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | DRAIN FLUSH REFILL AFTER FIRST 50 HOURS | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | DRAIN FLUSH REFILL AFTER FIRST 50 HOURS | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | DRAIN FLUSH REFILL AFTER FIRST 50 HOURS | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 100 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 150 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 200 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 250 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | REPLACE | REPLACE WITH NEW FILTERS |
| | ENGINE OIL & FILTER | CHANGE | REFER TO ENGINE MANUAL FOR OIL SPECIFICATIONS |
| | ENGINE FUEL FILTERS | REPLACE | REPLACE WITH NEW FILTERS |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | ENGINE WATER FILTER | REPLACE | REPLACE WITH NEW FILTER |
| | COOLANT ADDITIVE (CAT ENGINES ONLY) | TOP OFF WITH CAT COOLINT ADDITIVE #3P2044 | TOP OFF RADIATOR WITH ONE LITER OF COOLANT ADDITIVE |
| | HYDRAULIC FILTERS | CHANGE | CHANGE ALL FILTERS |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 300 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | *MOLDBOARD* CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 350 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## *400 HOUR MAINTENANCE*

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 450 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## *500 HOUR MAINTENANCE*

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | REPLACE | REPLACE WITH NEW FILTERS |
| | ENGINE OIL & FILTER | CHANGE | REFER TO ENGINE MANUAL FOR OIL SPECIFICATIONS |
| | ENGINE FUEL FILTERS | REPLACE | REPLACE WITH NEW FILTERS |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | ENGINE WATER FILTER | REPLACE | REPLACE WITH NEW FILTER |
| | COOLANT ADDITIVE (CAT ENGINES ONLY) | TOP OFF WITH CAT COOLANT ADDITIVE #3P2044 | TOP OFF RADIATOR WITH ONE LITER OF COOLANT ADDITIVE |
| | HYDRAULIC FILTERS | CHANGE | CHANGE ALL FILTERS |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | PTO CLUTCH | LUBRICATE WITH UNIREX-N3 | 5 SHOTS AT EACH GREASE FITTING |

## 550 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 600 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 650 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 700 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 750 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | REPLACE | REPLACE WITH NEW FILTERS |
| | ENGINE OIL & FILTER | CHANGE | REFER TO ENGINE MANUAL FOR OIL SPECIFICATIONS |
| | ENGINE FUEL FILTERS | REPLACE | REPLACE WITH NEW FILTERS |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | ENGINE WATER FILTER | REPLACE | REPLACE WITH NEW FILTER |
| | COOLANT ADDITIVE (CAT ENGINES ONLY) | TOP OFF WITH CAT COOLANT ADDITIVE #3P2044 | TOP OFF RADIATOR WITH ONE LITER OF COOLANT ADDITIVE |
| | HYDRAULIC FILTERS | CHANGE | CHANGE ALL FILTERS |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 800 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | *MOLDBOARD* CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 850 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 900 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 950 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | CHECK | REPLACE IF DIRTY OR IN BAD REPAIR |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | CHECK LEVEL-REFILL IF NECESSARY | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |

## 1000 HOUR MAINTENANCE

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | ENGINE AIR FILTER | REPLACE | REPLACE WITH NEW FILTERS |
| | ENGINE OIL & FILTER | CHANGE | REFER TO ENGINE MANUAL FOR OIL SPECIFICATIONS |
| | ENGINE FUEL FILTERS | REPLACE | REPLACE WITH NEW FILTERS |
| | BATTERIES | CHECK ELECTROLYTE LEVEL | REFILL IF NECESSARY |
| | ENGINE WATER FILTER | REPLACE | REPLACE WITH NEW FILTER |
| | RADIATOR COOLANT | DRAIN, FLUSH REFILL | REFILL WITH A 50/50 MIX OF WATER AND ANTIFREEZE |
| | COOLANT ADDITIVE (CAT ENGINES ONLY) | TOP OFF WITH CAT COOLANT ADDITIVE #3P2044 | TOP OFF RADIATOR WITH ONE LITER OF COOLANT ADDITIVE |
| | HYDRAULIC TANK, OIL, FILTERS AND STRAINERS | DRAIN, CLEAN AND CHANGE | DRAIN TANK AND CLEAN IT THROUGHLY. INSTALL NEW TANK STRAINERS. REFILL TANK WITH CLEAN HYDRAULIC OIL. INSTALL ALL NEW FILTERS |
| | MOLDBOARD CYLINDERS | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | VERTICAL SUSPENSION | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING: LEGTUBES MUST BE FULLY EXTENDED TO GREASE |
| | CRAWLER GEARBOX | DRAIN FLUSH REFILL | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM PLANETARY DRIVE | DRAIN FLUSH REFILL | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |
| | CUTTER DRUM INPUT ADAPTOR | DRAIN FLUSH REFILL | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |

## 1000 HOUR MAINTENANCE (CONTINUED)

| DATE WHEN COMPLETED | IDENTIFICATION | TYPE OF SERVICE | REMARKS |
|---|---|---|---|
| | TRACK YOKE PIN | LUBRICATE WITH HIGH TEMP. GREASE | 5 SHOTS AT EACH GREASE FITTING |
| | CONVEYOR SWING | LUBRICATE WITH HIGH TEMP. GREASE | 3 SHOTS AT EACH GREASE FITTING |
| | PTO CLUTCH | LUBRICATE WITH UNIREX-N3 | 5 SHOTS AT EACH GREASE FITTING |
| | BELT TENSIONER PULLEY | DRAIN, FLUSH & REFILL | REFILL WITH 80W90 HIGH PERFORMANCE GEAR OIL |

# Cold Planers

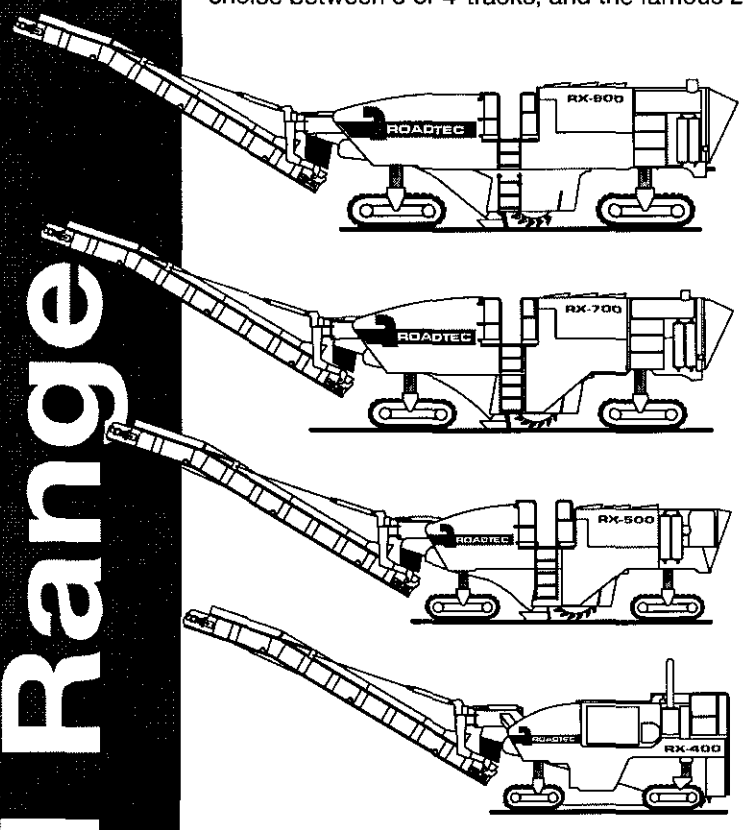
ROADTEC®

an Astec Industries Company

# Model Range

## Roadtec Cold Planers: High Productivity & Low Cost of Ownership

Powerful and well-balanced, Roadtec cold planers will outwork the competition. Designed and built in the U.S., Roadtec cold planers offer you solid design features, systems that are simple to troubleshoot, and parts that are non-proprietary and cost less. Plus you get exclusive features like our 60° conveyor swing to either side, choice between 3 or 4-tracks, and the famous 24-hour Roadtec customer support.




### Roadtec RX-900

Equipped with a 950 hp (708 kW) Caterpillar® engine, this machine cuts up to 14 ft. (411cm) wide and 14" (35.5cm) deep. The RX-900 is the best choice if you do lots of full-lane, high-production milling. Power's the name of the game here.

### Roadtec RX-700

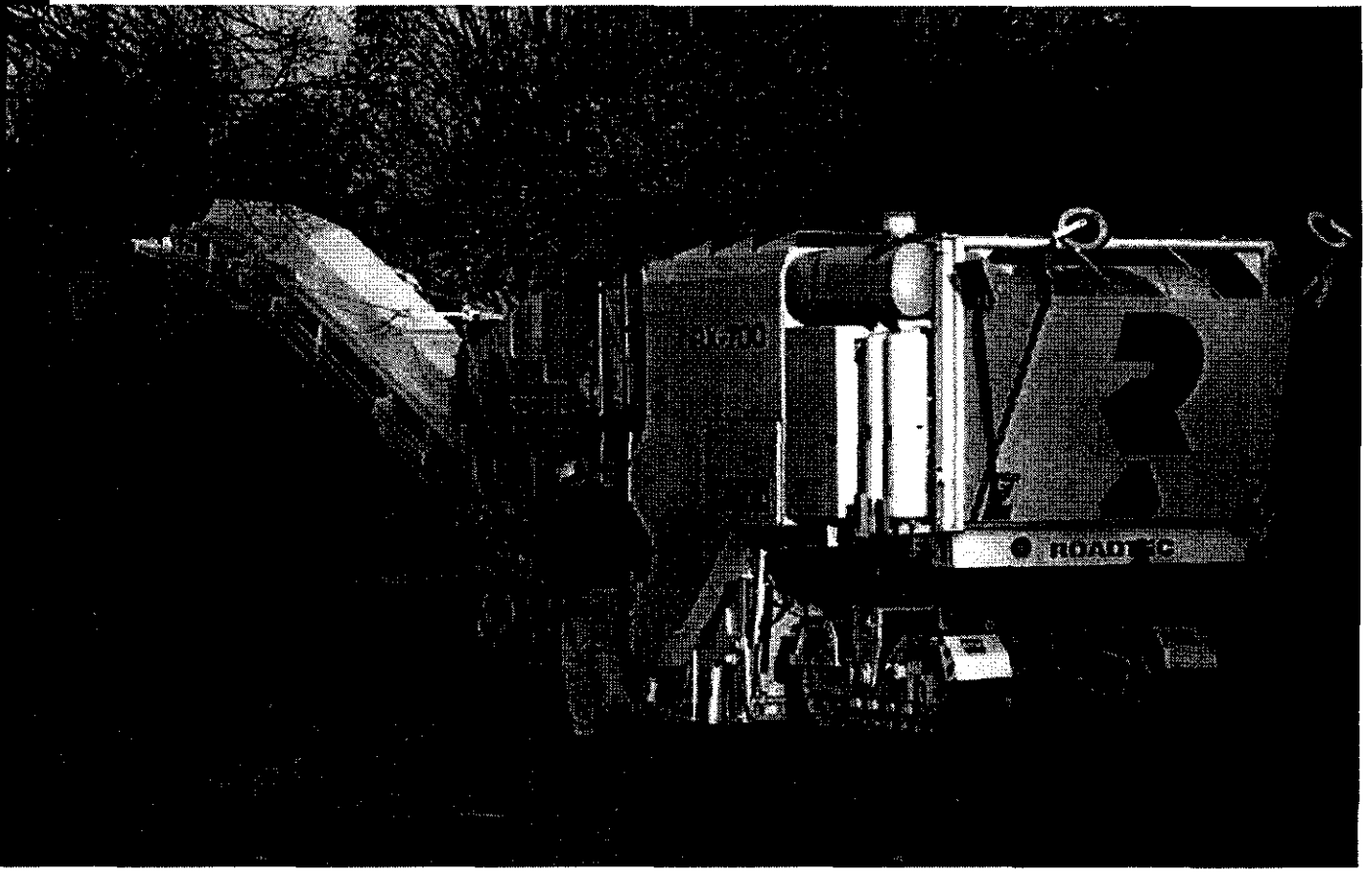
Featuring a 700 hp (522 kW) Caterpillar engine and capable of cuts up to 10ft (3 m) wide and 14" (35.6cm) deep the RX-700 is a good choice for the contractor who is looking for high output in a half-lane planer.

### Roadtec RX-500

If machine weight concerns and maneuverability are high on the agenda, the RX-500 is the machine for you. It comes with a 630 hp (470 kW) Cummins engine and can cut up to 7'2" (218cm) wide and 13" (33cm) deep.

### Roadtec RX-400

The most compact planer in the line up has a rear-mounted drum, four tracks, and right-hand flush cut. Tailor-made for commercial applications and narrow projects such as road shoulders, the RX-400 cuts up to 5' (152cm) wide and 12.5" (31cm) deep. It features a 325 hp (242 kW) Caterpillar engine.



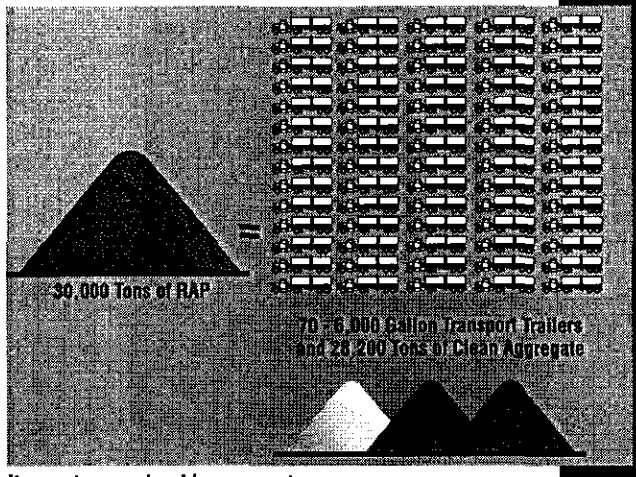
# Smoothness

## Advantages You Gain by Milling

Milling an uneven pavement before repaving will make resufacing easier and will assure you the best possible situation for achieving smoothness, especially if your cold planer is equipped with automated grade and slope controls. Plus, you can turn the removed material into money by recycling it in your own asphalt plant or selling it to an asphalt producer.

## Cold Planers as Mining Machines

A 30,000 ton pile of RAP with an average 6% liquid AC content is the equivalent of about 28,200 tons of clean aggregate plus 420,000 gallons of liquid asphalt! This material can replace virgin materials in new mix. The recycled materials are as good as virgin rock or AC. For more information on how to use RAP as a money maker see the Astec Technical Paper T-127. Go to astecinc.com and click on "Literature."

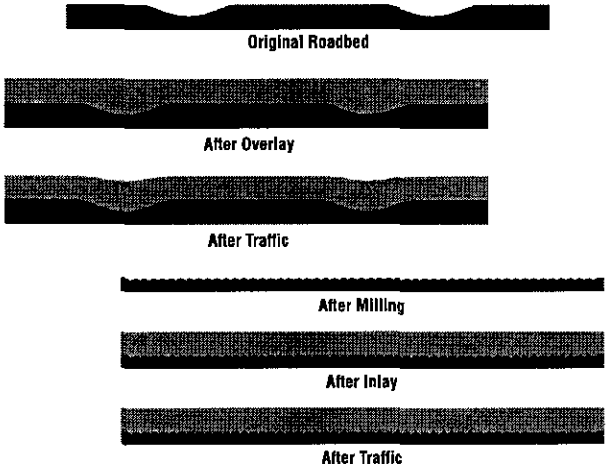



**It pays to recycle old pavement.**

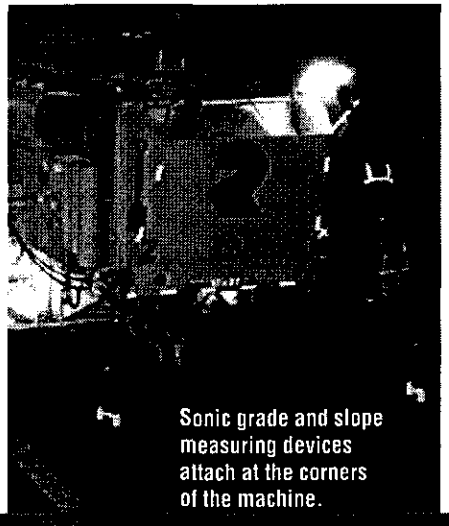
## Milling for Smoothness

When smoothness of the finished pavement is important, it's good to start with a level milled surface. Then the paver has every opportunity to get it right. Today's cold planers with their extremely accurate grade and slope controls can be used to level the road in longitudinal and transverse directions. Using current grade and slope control technology will result in a much smoother surface, and many states now require smoothness measurements on milled surfaces.

Roadtec offers both Moba™ and Topcon™ grade and slope technology. These devices scan the surface 40 times per second and produce a signal which automatically adjusts the leg tubes of the cold planer so the resulting milled surface will conform to your specification.




**Overlays can crack and re-rut but milling and then inlaying the pavement prevents re-rutting and also provides better density numbers.**



Sonic grade and slope measuring devices attach at the corners of the machine.

Milling with sonic ski

## Roadtec SmoothMill™ for Ease of Use

Optional Roadtec SmoothMill grade and slope control automation for RX-500, RX-700 and RX-900 cold planers is designed especially for milling. It features plug-in connections and internal cable routing, two dual control boxes for ground personnel, each capable of controlling both sides of the machine, and also provides the operator (driver) with a separate control box. Moba technology is standard, other systems can be supplied.

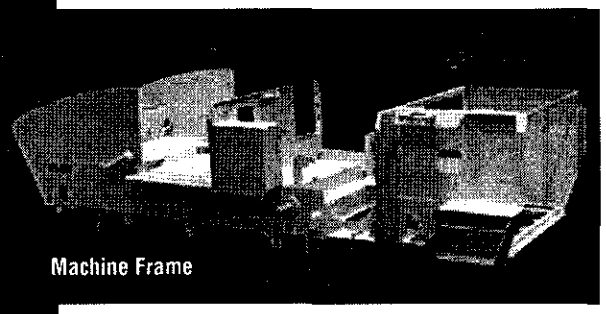
SmoothMill by Roadtec advanced milling automation

SmoothMill by ROADTEC

Features

## The Right Balance of Power, Maneuverability and Weight

A cold planer needs to be heavy enough to perform in the cut, yet easy to transport to the job site. The kind of work the machines have to do requires a powerful engine and the ability to follow trucks through tight turns or in adjacent lanes. Roadtec has worked to properly balance these requirements in its cold planer model line.



Machine Frame

## It Starts with a Strong Frame

One-piece side sheets running the entire length of the machine are made from extremely strong A656 grade 80 steel. *This steel has twice the yield strength as the mild steel used in other machines on the market.* Roadtec frames are very strong and rigid without adding unnecessary weight.

## Higher Horsepower Engines

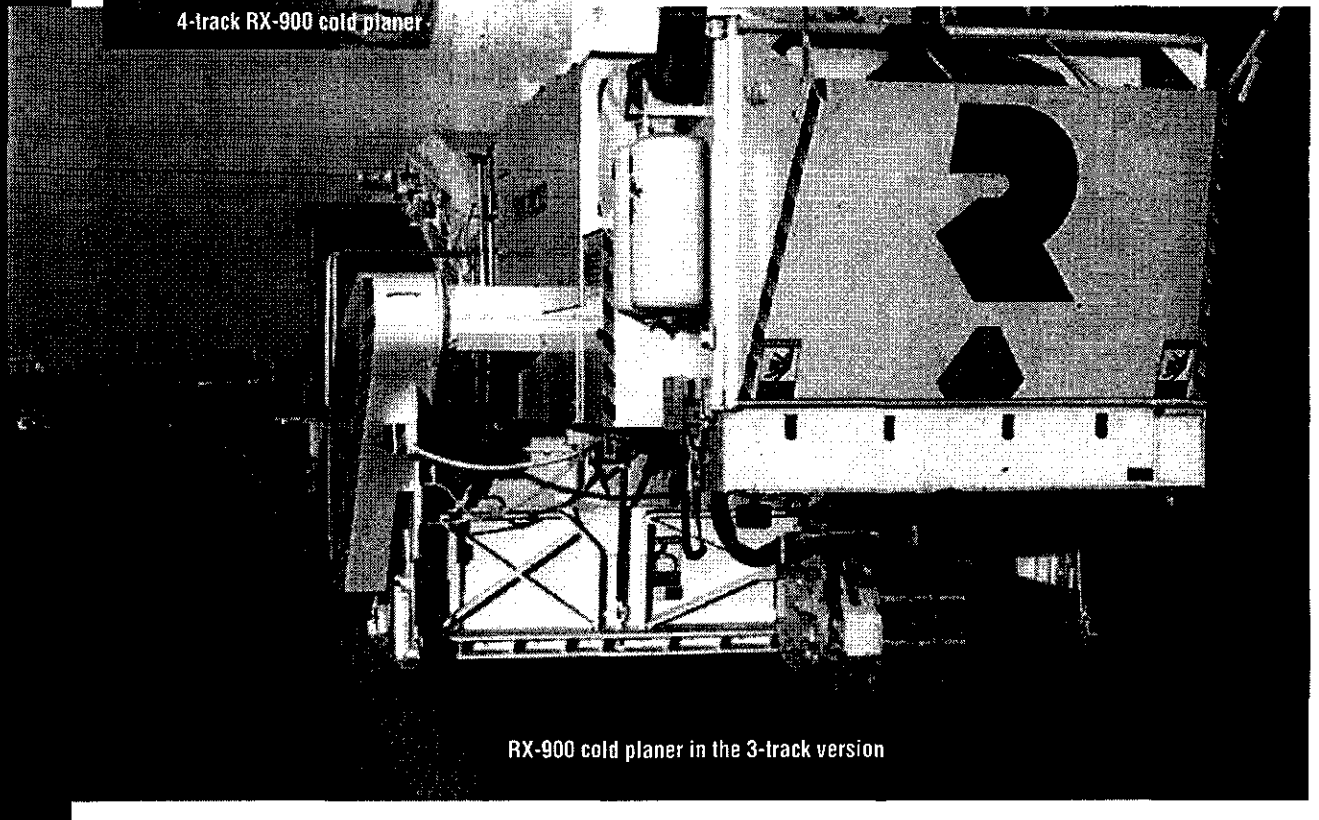
You'll find that Roadtec cold planers feature the highest horsepower in their class. We use Caterpillar® and Cummins® engines that have proven to be efficient and reliable. Please see spec sheets for the individual model engine specifications.

## Choose Either Three or Four Tracks

*With the RX-500, RX-700 and RX-900 you can select either* three or four tracks. Each type has its advantages.

Cold Planers with three-track suspensions are more maneuverable, lower in weight, and have slightly less mainentance, while four-tracks machines provide greater traction and flotation.

4-track RX-900 cold planer



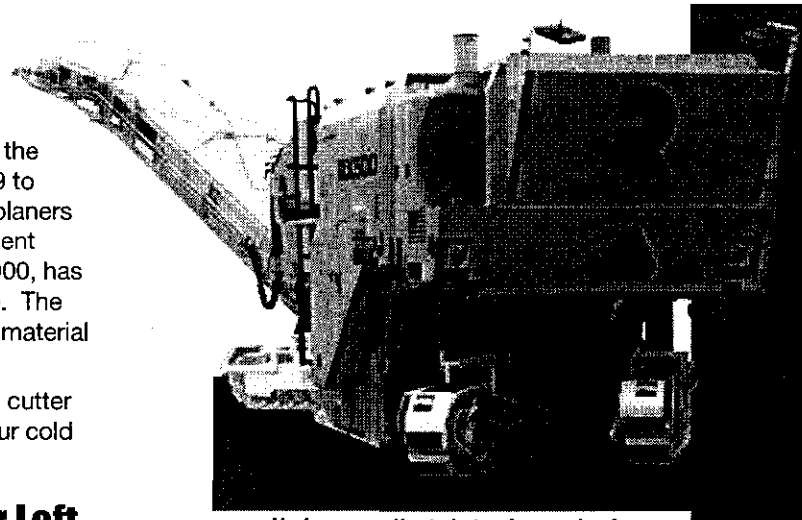
RX-900 cold planer in the 3-track version

# Features

## Strong, Agile & Productive

Rated working speeds for Roadtec cold planers are the fastest in the industry (128 to 172 feet per minute/39 to 52 meters per minute). What's more, Roadtec cold planers are among the most maneuverable, thanks to excellent turning capability. Even the biggest model, the RX-900, has a turning radius of only about 8 1/2 feet (2.6 meters). The cutter housing with its angled moldboards won't let material accumulate that could bog down the machine.

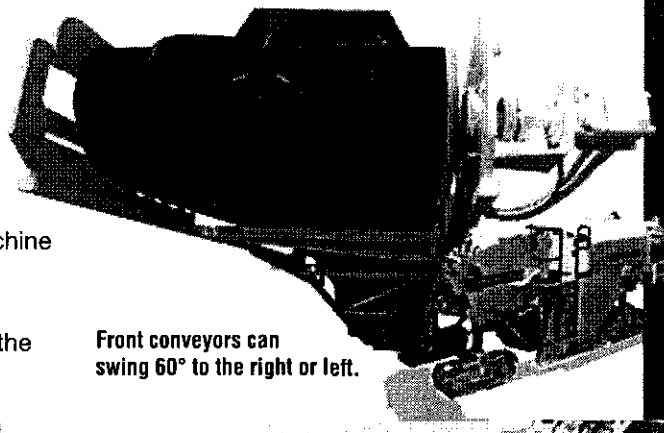
With their high degree of mobility, powerful engines, cutter housing design, and all the other Roadtec details, our cold planers are the most productive in the world.



Various coordinated steering modes for maximum maneuverability.

## Conveyor Swings to Load Right or Left

The front conveyor on Roadtec cold planers has the ability to swing left or right 60 degrees. This allows the machines to follow trucks through tight turns and to easily fill trucks in adjacent lanes. Conveyors feature infinitely variable speed and self-cleaning pulleys.



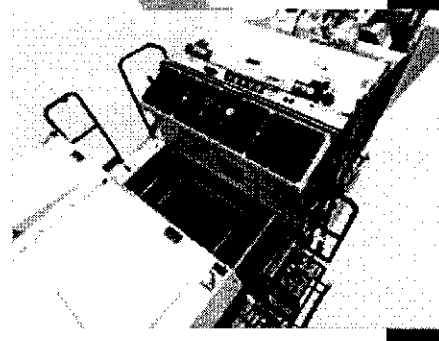
Front conveyors can swing 60° to the right or left.

## Safe & Functional Operator Platform

The operator platform is conveniently accessed from the right or the left side. Two control stations allow machine operation from either side.

A joystick controls both front and rear tracks.

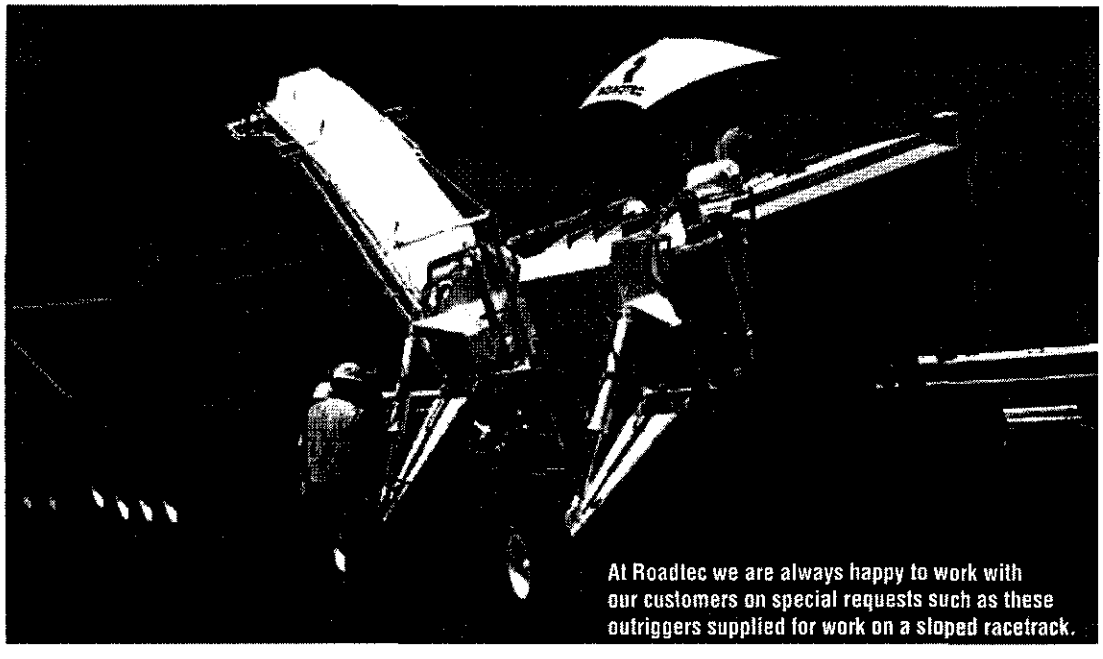
Optional bi-directional controls also allow operation in the rear-load mode.



Dual operator stations on a vibration-isolated platform.

## Auto Exchange: Easy Stop & Resume

RX-500, RX-700 and RX-900 cold planer have the Roadtec Auto Exchange function. You can pause for truck switch-out or other stops with the flip of a switch, easing down propulsion, conveyors and water systems to a stop. When you're ready to resume operation, simply flip the switch again and the machine will come up to the same speed as before.

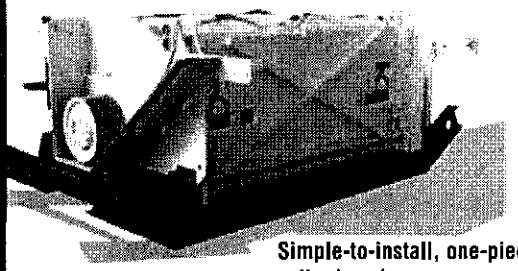


At Roadtec we are always happy to work with our customers on special requests such as these outriggers supplied for work on a sloped racetrack.

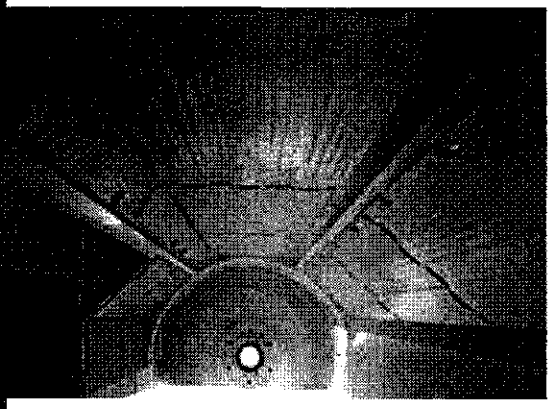
# Cutters

## Cutter Drum and Cutter Housing Features Maximize Productivity

Roadtec gives you choices. Our customers are able to choose from Kennemetal, Sollami, Keystone, or Sandvik cutting systems for their cold planers. Only Roadtec gives you the option of a machine that can upcut or downcut, so you can use your Roadtec cold planer for more than standard milling.



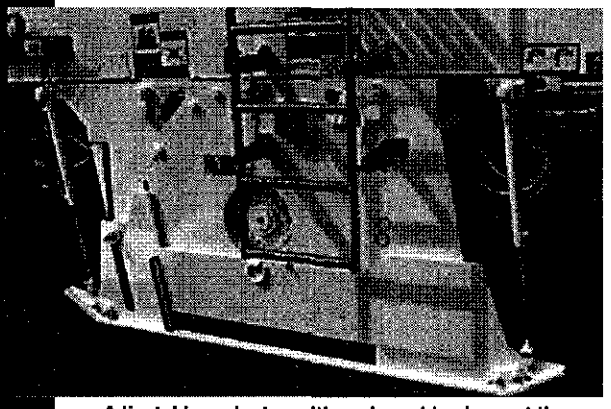
Simple-to-install, one-piece cutter housing



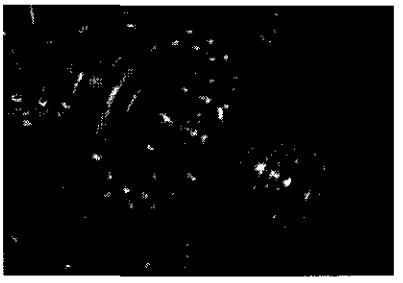
Replaceable, chromium-clad wear plate covers all *potential wear areas (shown shaded blue).*

Front and rear mold board are entirely made from abrasion-resistant steeel with a Brinell hardness of 500.

Bolt-on Tungsten Carbide scraper blades at the rear mold board add to the housing's toughness.



Adjustable endgates with replaceable shoes at the high-wearing front and rear corners.



Gear box has"break-away"shear coupling

## Cutter Drum Options

Cutter drums are balanced and concentrically machined for smooth machine operation. You can choose the tooth spacing pattern depending on your needs, including profiling patterns.

## Tough, Single Assembly Cutter Housing

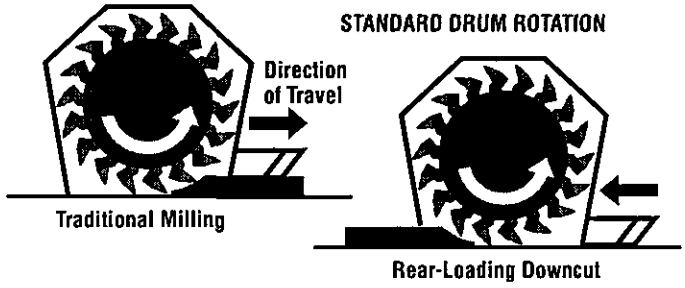
Constructed of T-1 steel and lined with replaceable, abrasion-resistant steel, Roadtec cutter housings are made to withstand abuse. The self-contained cutter housings attach to the frame with self-aligning bolts. When you change out the drum, the cutter housing comes off in one piece and easily re-installs.

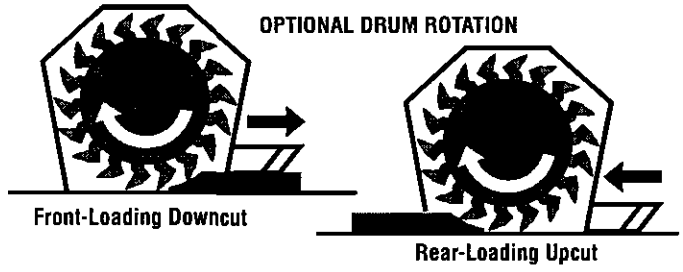
## Cutter Drum Gearbox Protects the Engine

Heavy-duty, high-torque gearboxes transfer power from the drive belts to the cutter drum. Shear couplings are also used. If the drum strikes a buried obstruction that would damage the engine, the shear coupling will separate the input shaft from the gear box to protect the engine.

## Bi-Directional Drum Can Do More

With the bi-directional option, you can use the machine as a downcut and upcut pulverizer, in addition to traditional milling work. A cold-in-place recycling package can be added.




**FOR MORE INFORMATION ON COLD-IN-PLACE RECYCLING OPTIONS, PLEASE SEE THE ROADTEC CIR BROCHURE.**

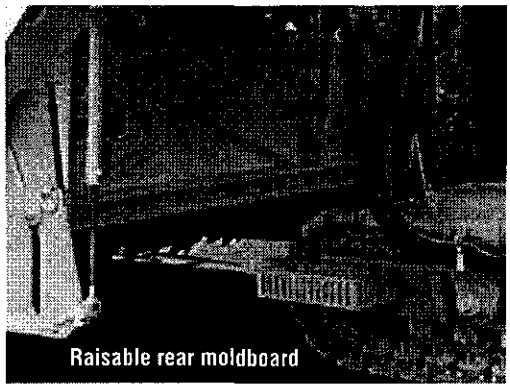
Emulsion package for cold-in-place recycling.

# Cutters

## Adjustable Moldboards Give You Options

The front moldboard can be set to float with the elevation, or in a fixed position. Height of the rear moldboard is fully adjustable. Raise the rear board completely to easily access the drum and cutter teeth. When the moldboard is fully raised the engine is shut down for safety.

Both the rear and front moldboard on Roadtec cold planers are angled in toward the drum by 10°. This allows less material to accumulate around the drum, which means increased component life, production rates, and efficiency.

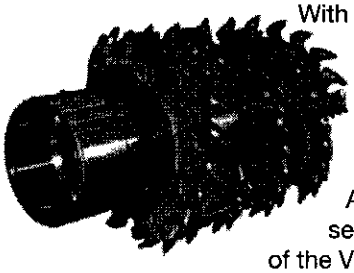


Raisable rear moldboard

## Roadtec's Exclusive VCS™ System

The Roadtec VCSTM Variable Cutter System allows the RX-500 and RX-700 models to cut at widths of 24", 36" and 48" (60cm, 91cm, and 121cm).

The VCS systems for the RX-400 supplies widths of 26", 36", and 48" (66cm, 91cm, and 121cm). You don't have to remove the cutter housing to change widths.



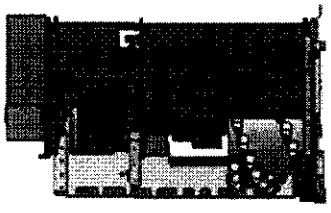
With the VCS the primary conveyor is shifted over 8 inches (20cm) so that even the narrowest drum has "visibility" of the discharge belt, making material removal much better.

A hydraulically adjustable, segmented rear moldboard is part of the VCS package. It easily adapts to any of the three cutting widths.

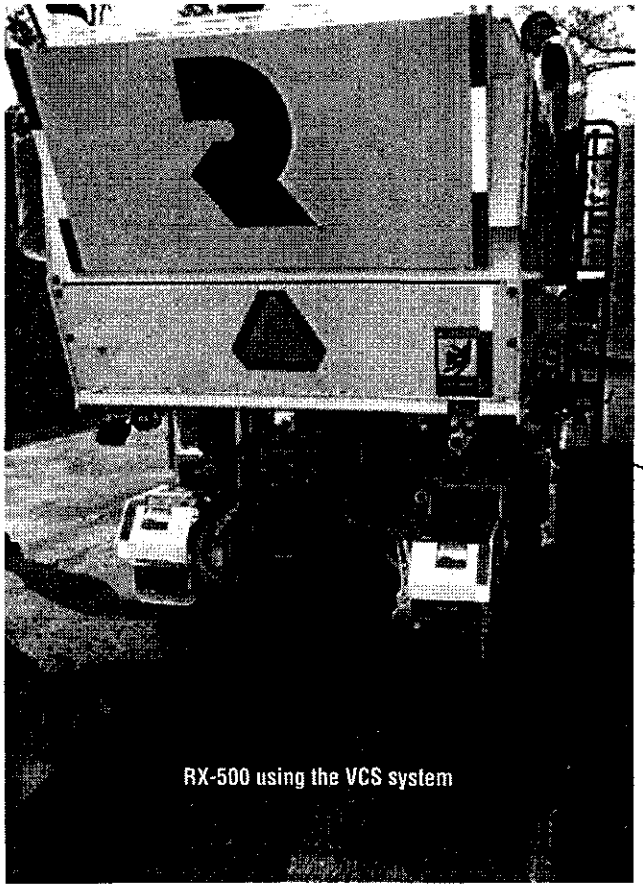
**A material brace on the front moldboard applies even pressure to the front edge of the cut for excellent material sizing.**

*TO SEE AVAILABLE CUTTER DRUM & HOUSING CHOICES FOR ALL MODELS, PLEASE TURN TO THE LAST PAGE.*

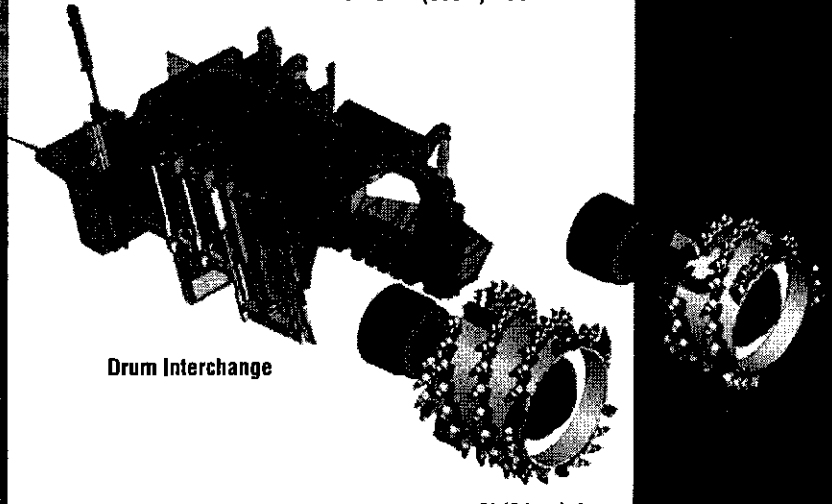
**Front view of 24" (60cm) VCS**



**Rear view of 2' (60cm) VCS**



RX-500 using the VCS system



**Drum Interchange**

**3' (91cm) drum**

# Extras

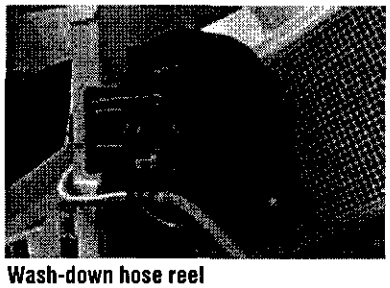
## Extra Features to Make the Work Go Smoother

You'll enjoy thoughtful features that can make the work day go better. From better dust control to better noise and vibration control, Roadtec strives to give you what you need so you have the best possible conditions for productivity and profitability. Please see the last page for all options.

Water system valve manifold

Vibration Isolator

Air tanks



Wash-down hose reel

## Front & Rear Spray Bars Instead of One

Two independent stainless steel spray bars in the cutter housing provide much better dust reduction and keep cutter tools cooler, thus extending the life of the cutting teeth. The system's water tank is completely lined and can be filled on the fly from three different fill positions.

## Vibration Isolators for Comfort

Rubber vibration isolators eliminate destructive vibration throughout the cold planer and also help to make the machine more quiet. Rubber mounts under the operator platform provide additional comfort.

## Easy Clean-Up with Wash Down Hose

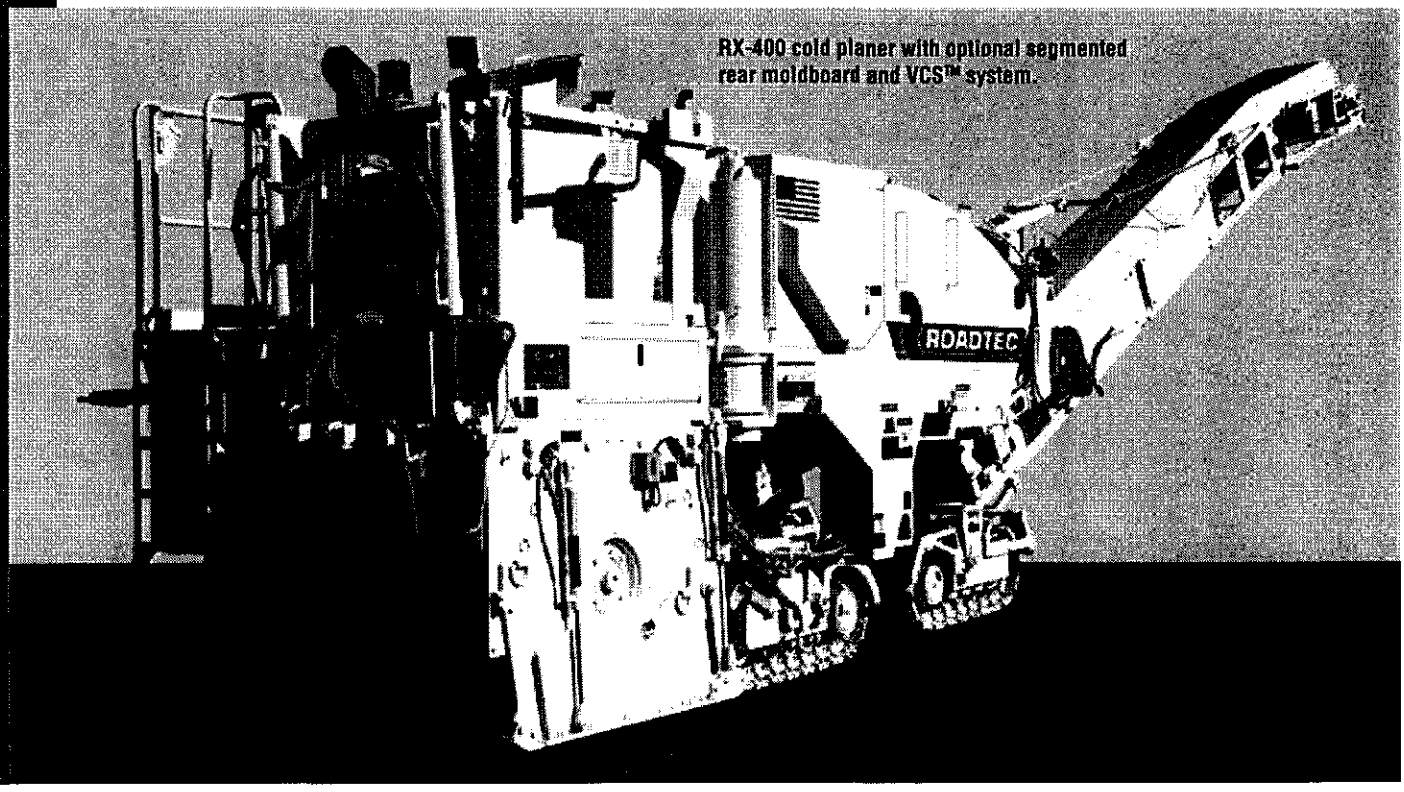
At the end of the day the standard high pressure washdown system helps to keep the machine looking and running like new. The system includes wash down bars at conveyors and plenty of hose to reach all points of the machine.

## On Board Air Compressor Included

RX-500, RX-700 and RX-900 models come with a standard compressed air system. Two storage tanks and a compressor let you use your air tools for service and maintenance tasks.

## Light Package Is Supplied

All models come with lights to illuminate key areas of the machine and two halogen magnetic work lights. Additional work lights are available.




RX-400 cold planer with optional segmented rear moldboard and VCS™ system.

# Serviceability

## Straight-Forward and Easy to Work on

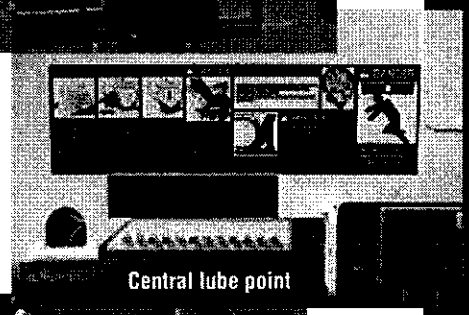
The design of Roadtec cold planers makes for easy trouble-shooting and maintenance and avoids costly downtime and expensive repairs. Often minor issues can be fixed right in the field because Roadtec machines don't require complicated computer diagnostics. You can buy many maintenance parts straight off the shelf.

## Engine Access Couldn't Be Easier

Roadtec cold planers offer the best engine access in the industry. Two gullwing style covers raise hydraulically for complete access. Additional access doors are found at each service point.

## Lube Quickly from Central Location

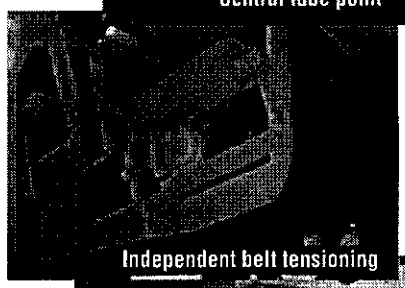
All lubrication points are centralized at the four corners of the machine. They are clearly marked with recommended applications, making routine maintenance even easier.



Central lube point

## Belt Tensioning Made Simple

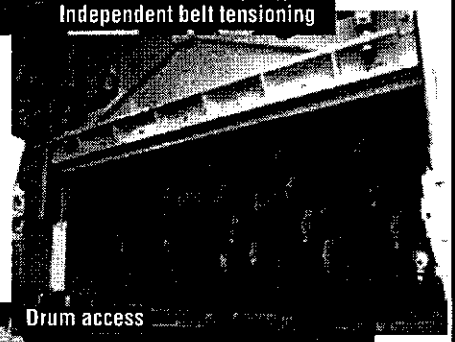
Each end of the belt on each conveyor can be independently tensioned. Keeping the belt tensioned correctly ensures proper belt tracking and greatly improves belt life.



Independent belt tensioning

## Easily Reach the Cutter Drum

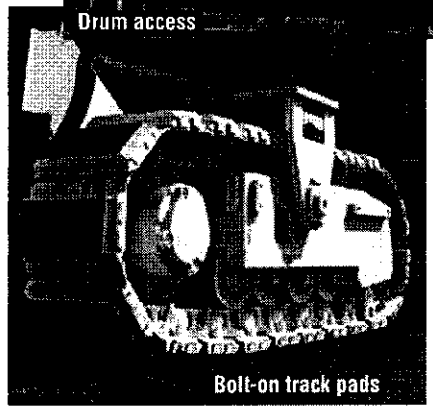
Simply raise the rear moldboard all the way to access the drum. When the moldboard is in the up position the drum is disengaged for safety.



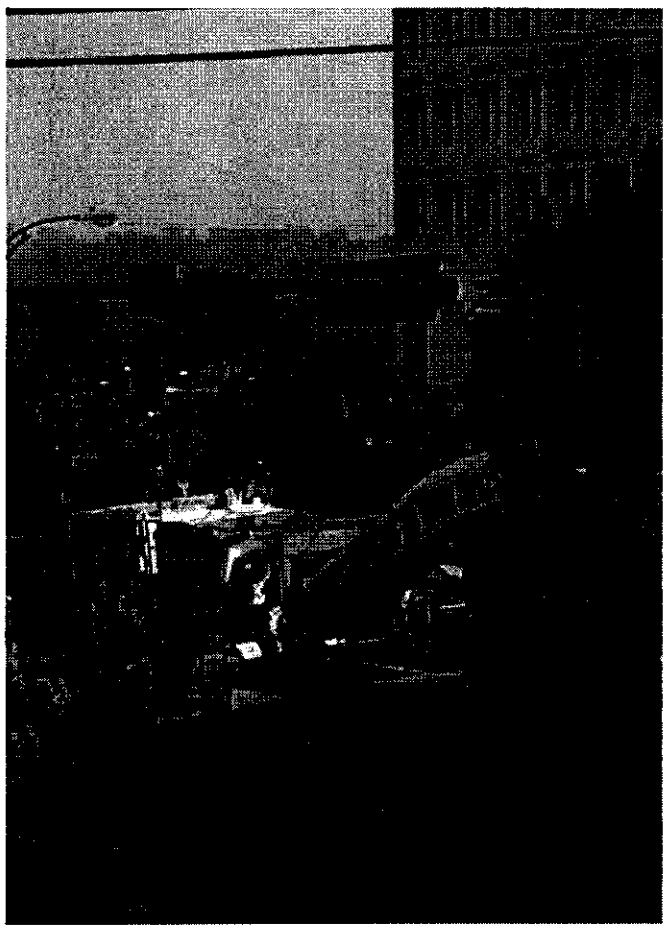
Drum access

## Bolt-On Track Pads

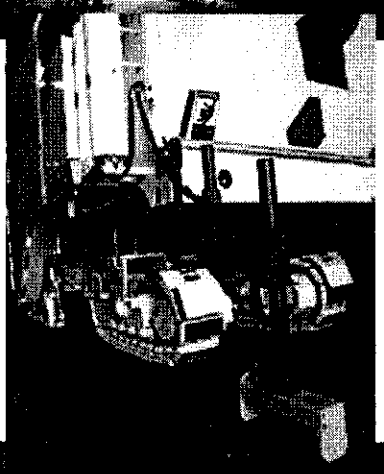
This standard feature allows quick and easy replacement of worn pads.



Bolt-on track pads



# Options



## Choose from these Options and More

In addition to the options below, we also offer specialized customization depending on your needs. Let us know the requirements of your special application, so we may propose a solution for you.

| Tracks |
|---|
| RX-500, RX-700, RX-900: 3-track or 4-track |
| **AUXILIARY POWER** |
| 4KW 60 Hz Continuous Duty Hydraulic Generator |
| 4KW 50 Hz Continuous Duty Hydraulic Generator |
| 15KW 60 Hz Continuous Duty Hydraulic Generator |
| 15KW 50 Hz Continuous Duty Hydraulic Generator |
| **ADDITIONAL LIGHTING (Generator Required)** |
| Night Work Package – Includes four 500W, 120V lights w/ brackets and mounting hardware |
| **GRADE AND SLOPE CONTROL** |
| Roadtec Hydro-Mechanical Grade Control. Dual Controls. |
| Roadtec SmoothMill™ Digital Grade and Slope Control System for operator and ground man (featuring MOBA components). |
| Digital Base System. Traditional Dual Control Boxes for ground man. Topcon Automation. |
| Sonic Averaging Ski Package with one or two skis. |
| Rear Leg Control System. Sonar Grade Control for rear elevation. |
| **CUTTER SYSTEMS** |
| Kennametal, Sollami, Keystone, and Sandvik Systems available. See table below. |
| Profiling or Micro-Milling Drums |
| VCS Variable Cutter Systems for RX-400, RX-500, RX-700 |
| **COLD-IN-PLACE RECYCLING** |
| Dual Control Package For Bi-Directional Operation (not available on RX-400) |
| Cutter Housing Bi-Directional Package |
| Emulsion Additive Sytem |
| Hydraulic Tow Hitch for RT-500 Cold Recycling Trailer |
| **MISCELLANEOUS** |
| Operator Station Canopy - Hydraulic or Manual |
| *Belt Scale Package with Optional Printer* |
| Hydraulically Folding Secondary Conveyor |
| Lincoln QuickLub Automated Lubrication System |

**STANDARD CUTTER DRUM WIDTHS OPTIONS (custom widths can be supplied)**

| | 26" 66cm | 36" 91cm | 48" 122cm | 6'3" 191cm | 6'7" 201cm | 7'2" 218cm | 8'2" 249cm | 10' 305cm | 12' 366cm | 12'6" 381cm | 13' 396cm | VCS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RX-400 | • | • | • | | | | | | | | | • |
| RX-500 | | | | • | • | • | | | | | | • |
| RX-700 | | | | | • | • | • | • | | | | • |
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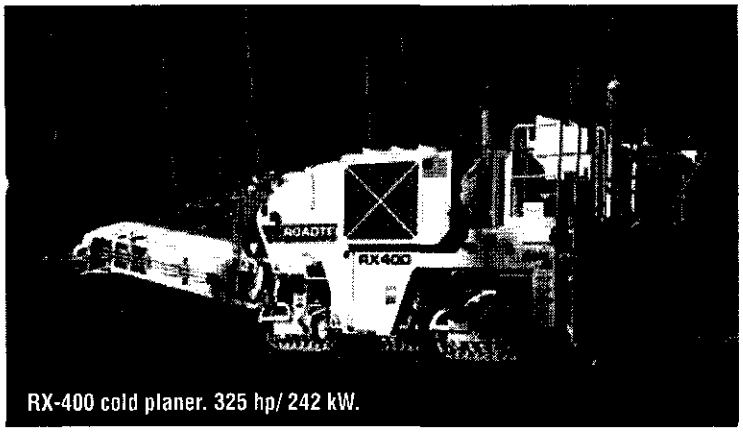
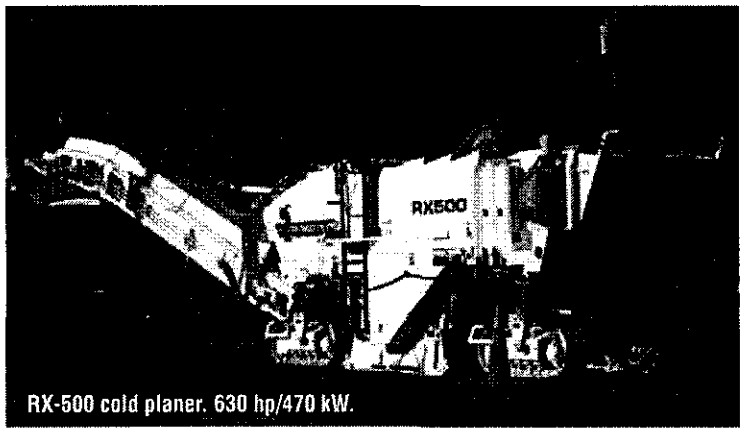
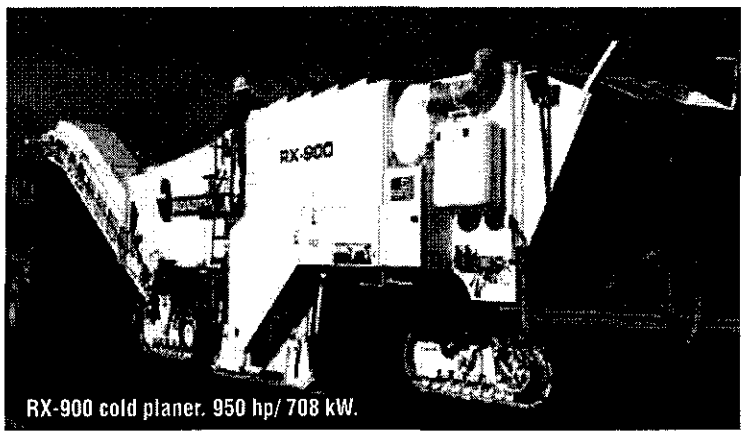


RX-400 cold planer. 325 hp/ 242 kW.



RX-500 cold planer. 630 hp/470 kW.

RX-700 cold planer. 700 hp/522 kW.



RX-900 cold planer. 950 hp/ 708 kW.

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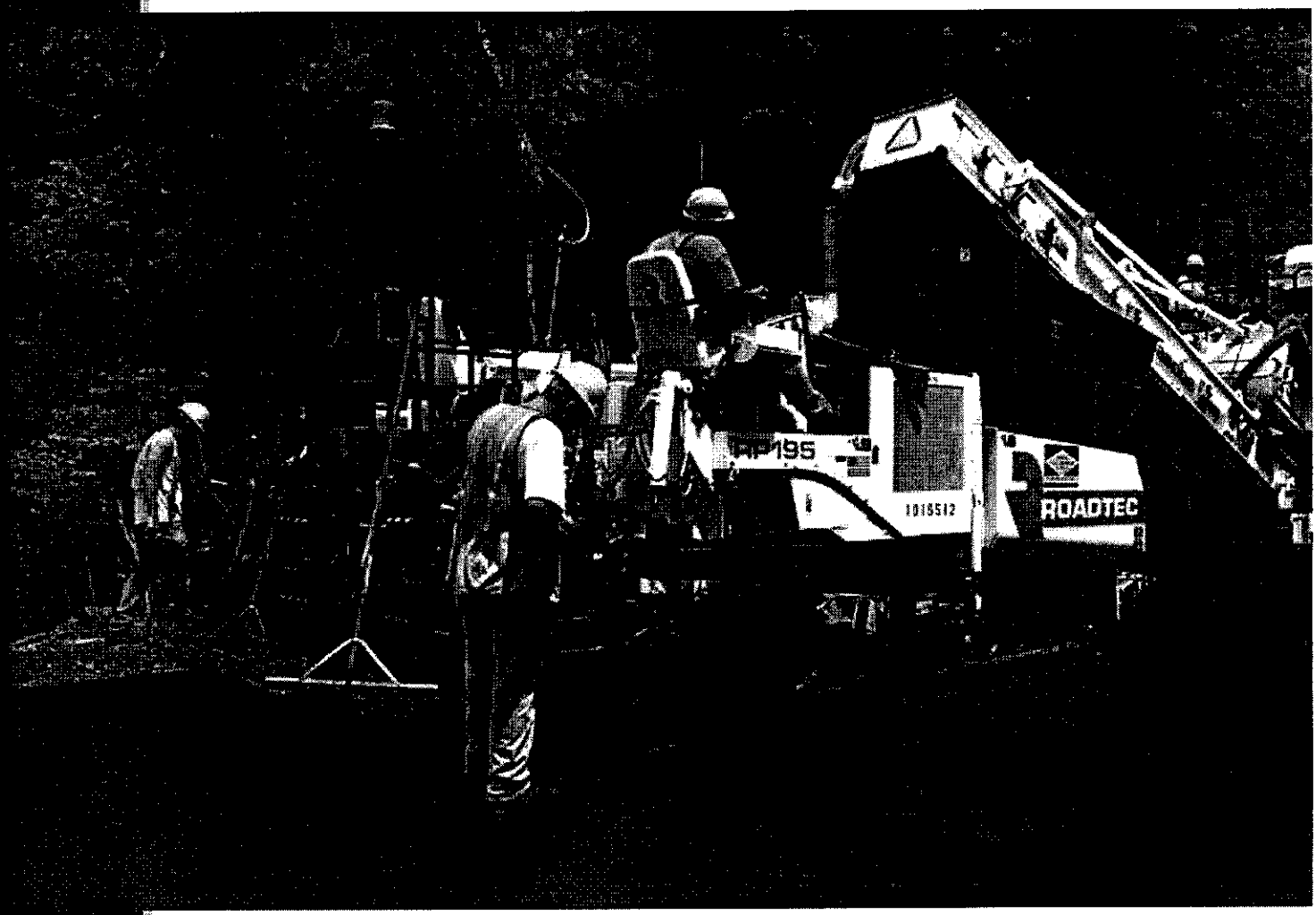
# Pavers
# 8 & 10 Ft.

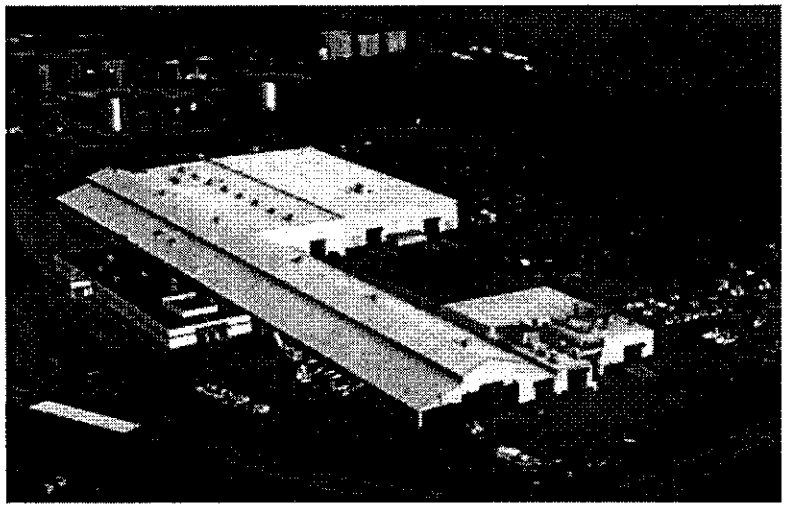



# ROADTEC®

an Astec Industries Company

# Company Overview

Roadtec, located in Chattanooga, Tennessee, manufactures and markets a complete line of cold planers, material transfer vehicles and asphalt pavers. These products are sold all over the world through an extensive combination of dealers and direct sales managers. All of our products are built to the highest standards, emphasizing simplicity, productivity, versatility and serviceability.



We are further committed to provide unequaled service and parts support to our customers. Our service men are all highly trained, experienced employees of Roadtec, not just field service representatives. They are committed solely to the Roadtec product line and will share their working knowledge to help you get the most out of your investment. Whether it's a new equipment start-up or a field repair, we will be on the job until it is finished.

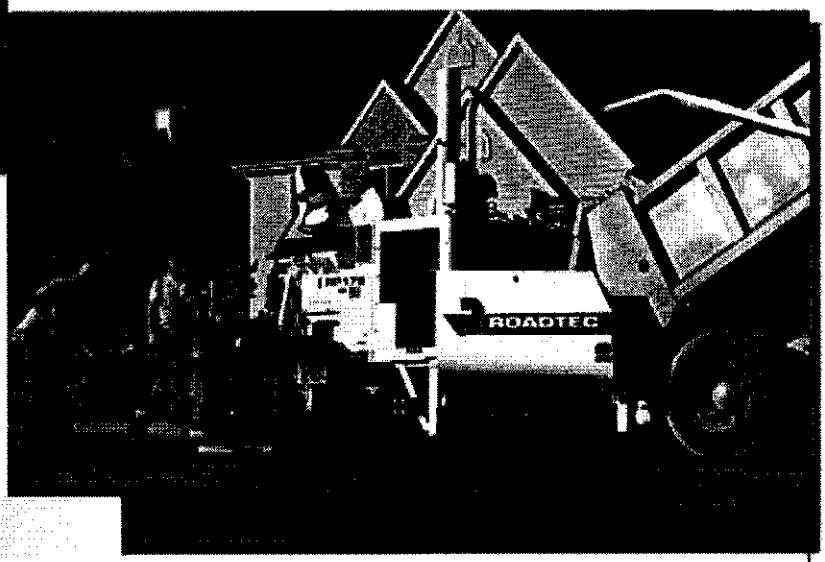
Service schools are held at the Roadtec manufacturing facility each winter. We also offer a training course called the Paving Professionals Workshop. Our team of industry professionals provide the most thorough hands-on and classroom instruction offered in the proper application of asphalt lay down handling, rolling and testing equipment.

Our parts department is staffed with experienced technicians who can quickly fulfill your needs from our factory inventory. By dealing directly with the manufacturer for your parts needs, you eliminate the middle man, significantly reducing costs and wasted time.

Our commitment is clear. We give our customers the highest level of quality, both in the equipment we produce and the service and parts support we provide.

## RP-170 8 Foot Rubber Tire Paver

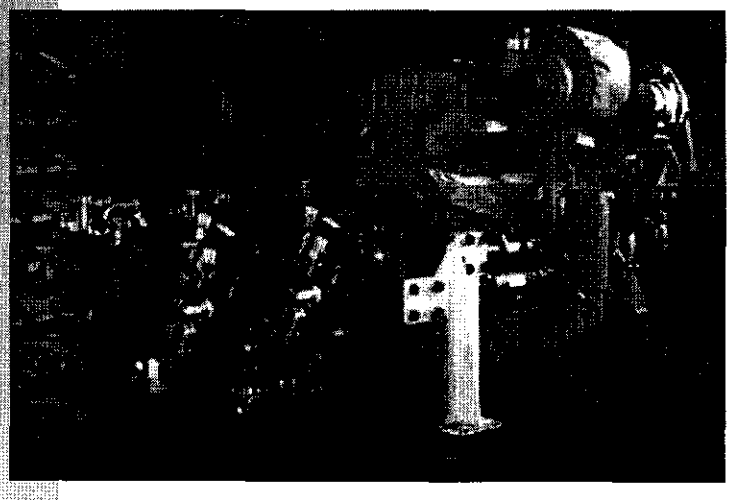
## RP-175 8 Foot Rubber Track Paver




## RP-190 10 Foot Rubber Tire Paver


## RP-195 10 Foot Rubber Track Paver

# Reliability

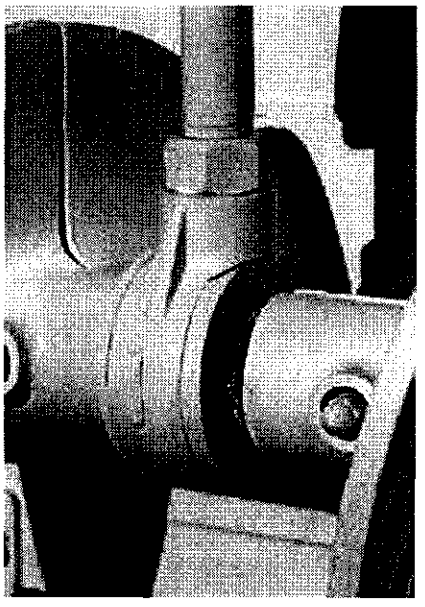


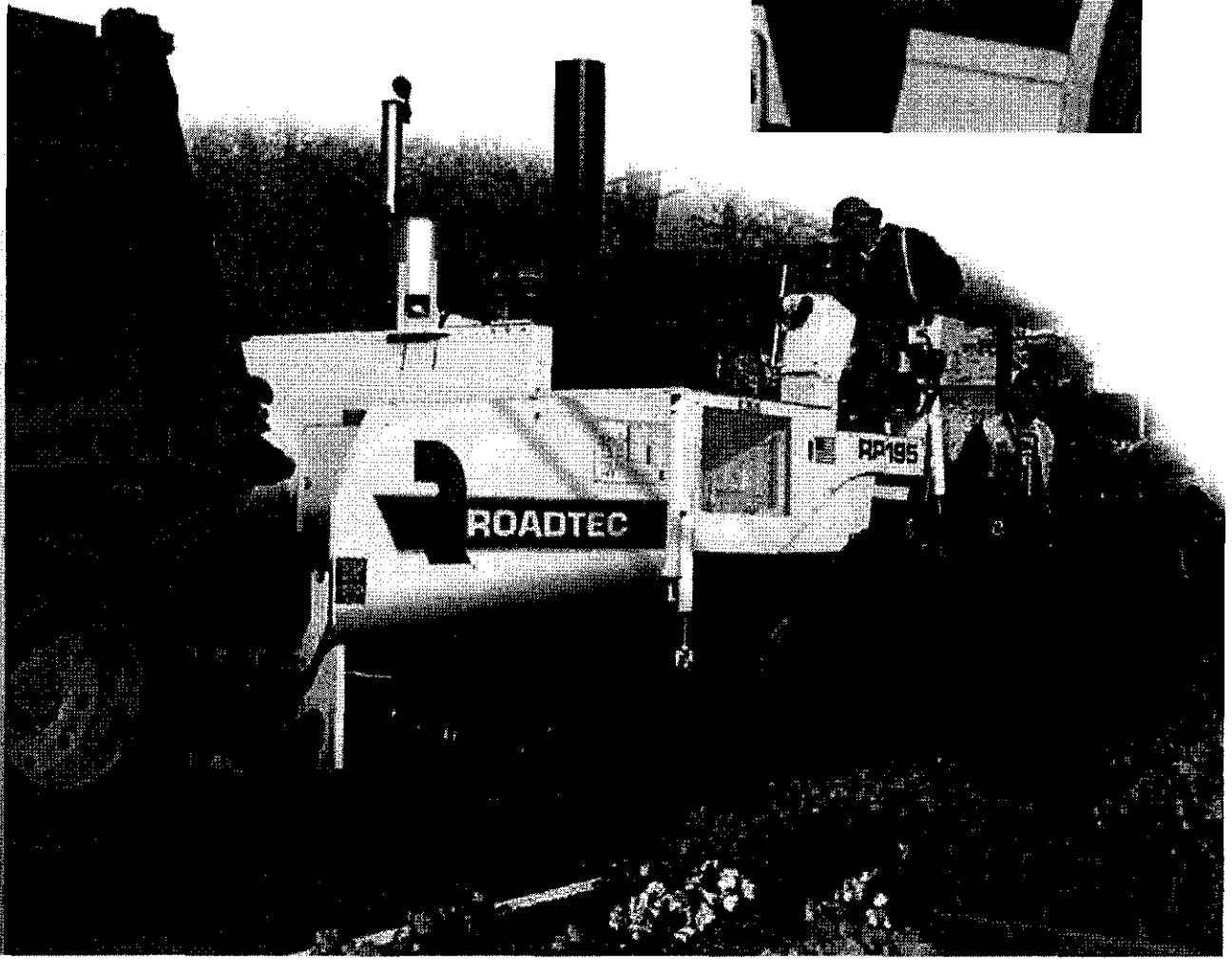
## Engine

All Roadtec Pavers feature CAT® engines. The name has long been synonymous with reliability. The RP-170 and RP-175 contain a 174 HP version and the RP-190 and RP-195 have a 225 HP version. The engine is transversely mounted which allows for better ground level access and cooling efficiency.

## Outboard Auger Bearings

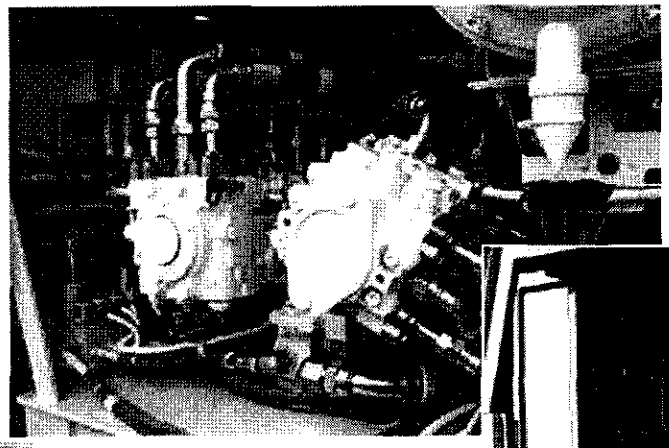
Roadtec's outboard auger bearing system incorporates a NOMEX™ washer and an AR400 steel plate on each side of the bearing. This prevents material from entering the bearing.

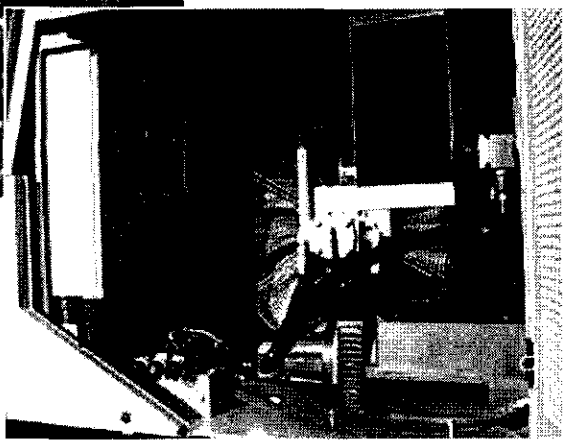


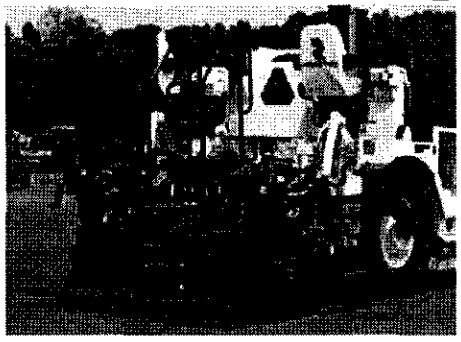


# Heavy Duty Hydraulic Pump

Sauer-Danfoss™ 90 series variable displacement pumps are used in all Roadtec pavers. These are the highest output pumps used in the industry. Roadtec uses 90 series pumps since the larger capacity enables them to run at a more optimal speed which permits them to run cooler and increases their life.







# Radiators

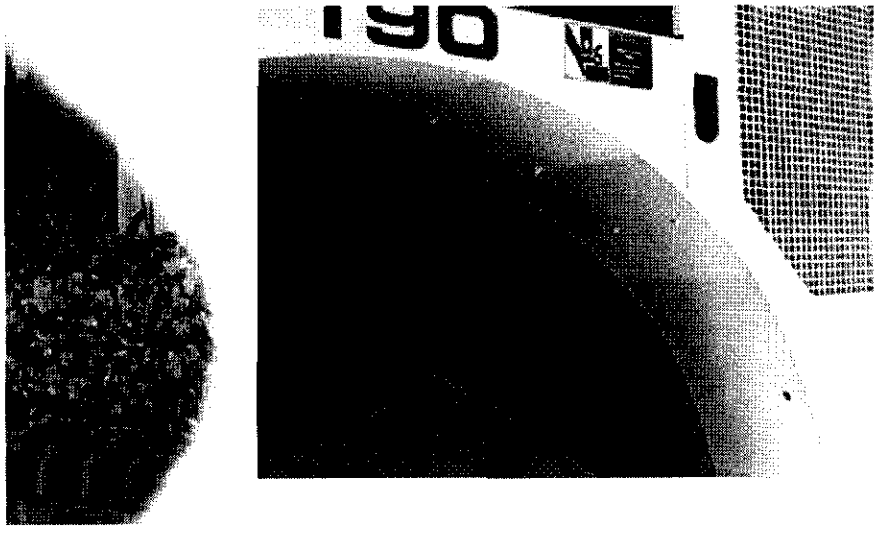
The cooling package on Roadtec pavers is mounted on the side of the paver where it can get the cleanest and coolest air. The radiators are also rated for higher horsepower engines and the fan is controlled hydraulically. The fan can run at the optimal speed depending on the load, which reduces noise levels emitted by the paver.

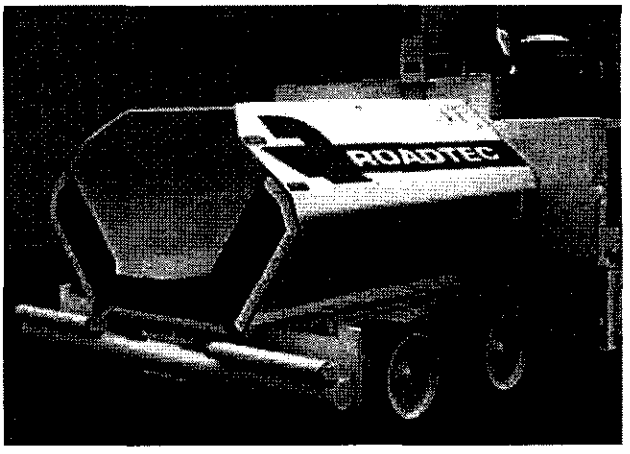
# Frame

Roadtec pavers feature the sturdiest frame in the industry. The frame starts with a 2 inch thick front cross member. Connected to this are two thick continuous side sheets which run the entire length of the paver and then wrap around to make up the rear. These side sheets are connected to each other with numerous cross members throughout the length of the paver. This frame allows Roadtec pavers to withstand all of the forces involved with asphalt paving for a much longer time period.

# Fenders

The fenders on the rubber tired Roadtec pavers are completely enclosed, which eliminates tack and debris from being thrown into the engine compartment.

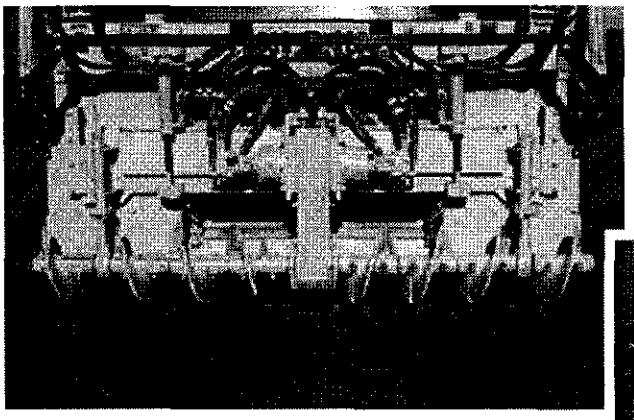





# Hopper Wings

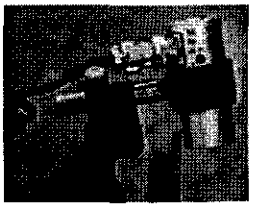
Thick continuous sheet construction makes Roadtec's paver hoppers incredibly durable. The rounded hopper wing construction helps to eliminate segregation.

Performance



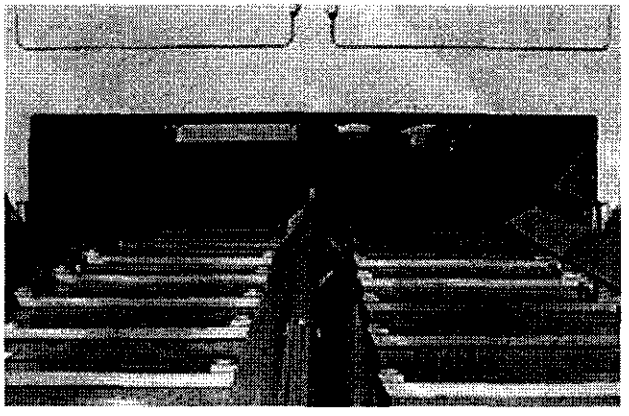
## Augers

The auger assembly on Roadtec pavers can be hydraulically raised and lowered. This feature can assist in eliminating segregation in certain mixes and is very helpful during the loading and unloading process. Standard sonic feed sensors control the augers. The auger chain case width has been kept to a minimum to further reduce segregation.

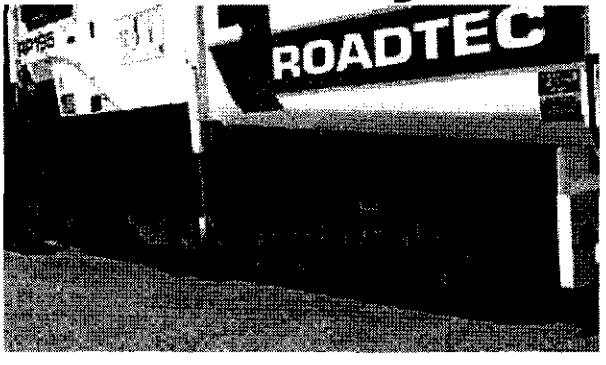


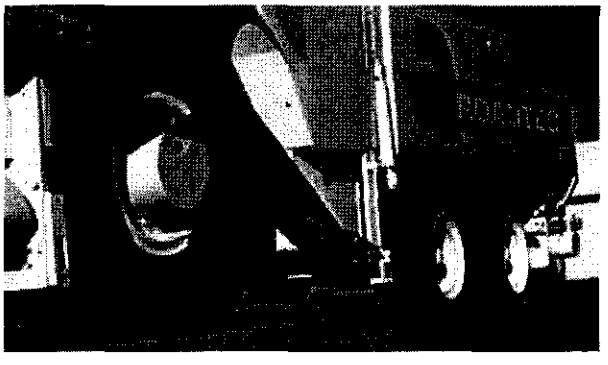
## Conveyors

The conveyers are designed to maximize throughput while maintaining durability. All Roadtec pavers feature a 13 inch high conveyer opening and extremely wear resistant replaceable liners. Each conveyer is independently driven so material delivery can be fine tuned for each side. Finer control over the material is achieved since the conveyers are outfitted with their own feeder.



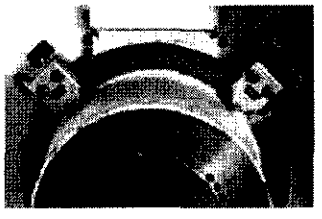
## Track and Tire System



The track system has been designed to give a smooth ride while giving greater weight displacement. The paver rides on a durable steel belted rubber track which utilizes a hydraulic tensioning system to insure constant band traction and increased maneuverability. Rubber coated oscillating bogies provide even pressure along the track footprint. The key to track pavers' excellent traction and flotation is its large footprint.

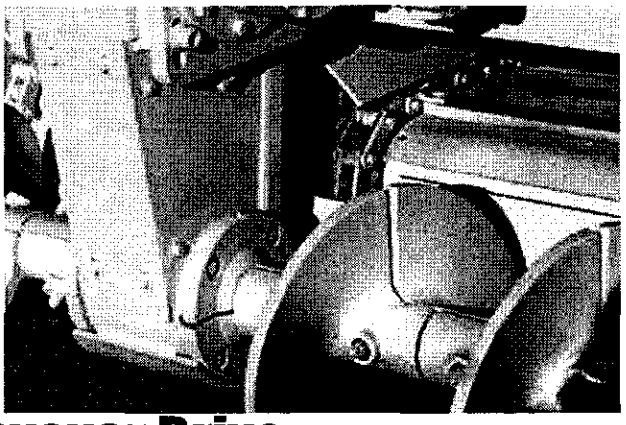
Our rubber tired pavers provide excellent maneuverability, ride quality and traction. The tire system is comprised of 2 large rear drive tires which are steered by two tandem bogie assemblies. In addition to hydraulic braking and the parking brake, both drive wheels are also equipped with dry disc brakes, giving you precise control during operation, a unique Roadtec feature. With the steer assist feature activated, even greater maneuverability can be achieved resulting in a turning radius of 2 feet 6 inches for the RP-170 and 4 feet 6 inches for the RP-190.

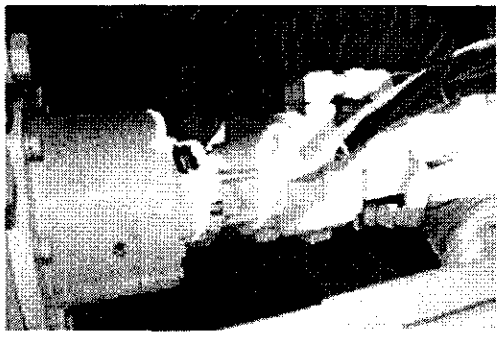


# Anti Segregation Elements

## Independent Auger Assembly

Each auger is driven by its own motor. This allows the conveyers to be much closer together compared to designs where the conveyers drive the augers by a chain. Minimizing the space between the conveyers allows mix to be conveyed out as one uniform flow, greatly reducing segregation.



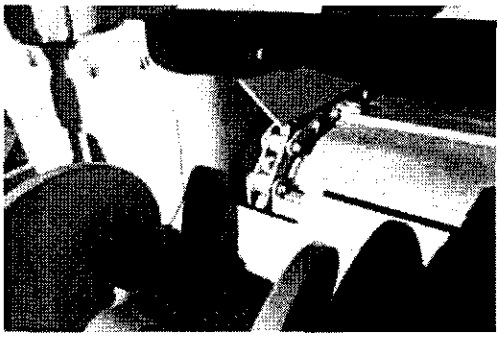


## Outboard Conveyor Drive

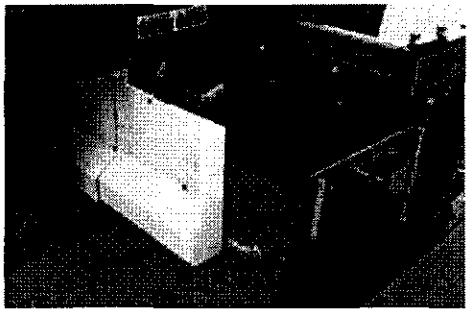
Hydraulic motors drive the conveyers by a chain which allows them to be located above the feed tunnel. This makes for easier access and allows for a wider conveyer tunnel. The conveyer tunnel disperses material over the augers more evenly, which prevents segregation. The motors can be controlled independent of the feeders by screed operators to decrease the pile at the end of each pull.

## Continuous Side Sheets

The use of continuous side sheets to construct the tunnel walls and rear of the paver not only greatly increase the rigidity of the frame but it also helps battle segregation. The rounded corner on the back of the tunnel as opposed to a sharp welded corner permits mix to freely flow out.



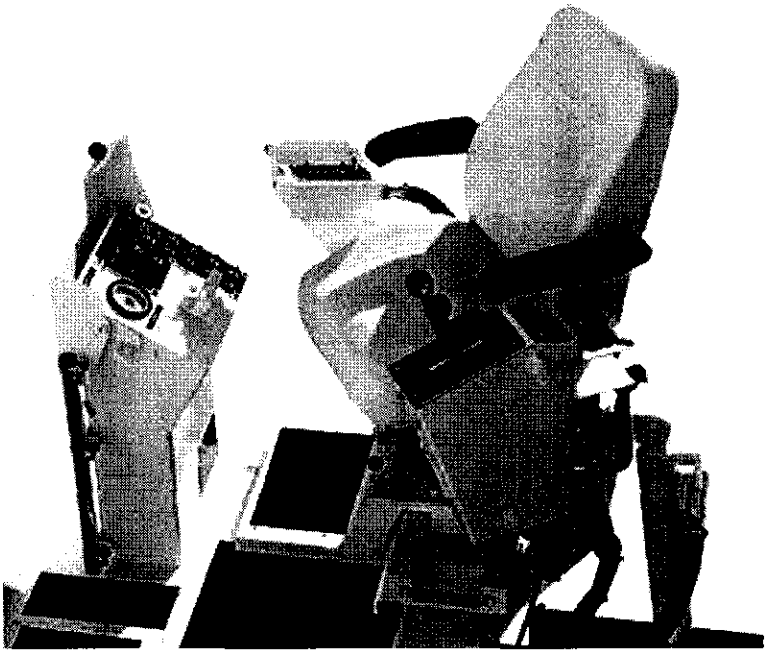
## Hydraulic Tunnel Extensions



Track-driven models RP-175 and RP-195 feature hydraulic tunnel extensions as standard to make it simpler than ever to keep mix away from the track assembly. On the tire-driven models, the hydraulic tunnel extensions are optional.

## Comfort Drive Operator System

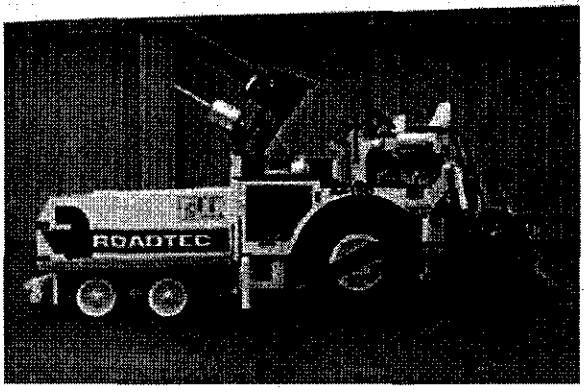
The Comfort Drive™ operator system is designed for maximum comfort and ease of operation. The stations feature duel operating control systems on left and right sides of the paver. The four way adjustable, swivel, ride control tension seat includes adjustable armrests and can also slide sideways. This positioning gives the operator greater range of visibility.

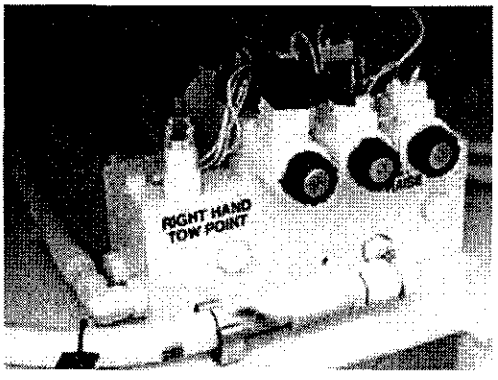


# Serviceability

## Access Panels

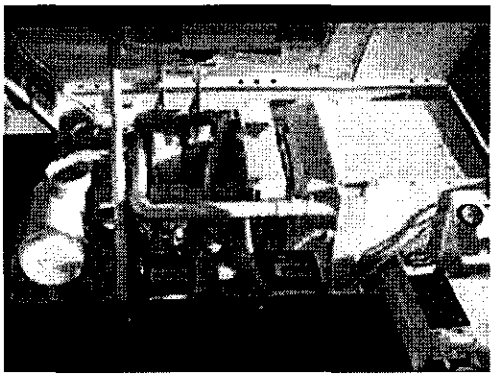
Routine maintenance areas are easily reached through numerous access panels to help keep your paver operating at peak performance levels. The left and right side access doors allow you to freely get to radiators, hydraulic pumps, filters and more.



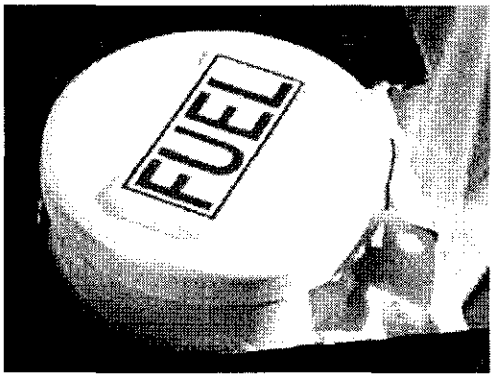

## Centralized Solenoids

Conveniently located solenoids simplify diagnostic testing.



## Engine Access

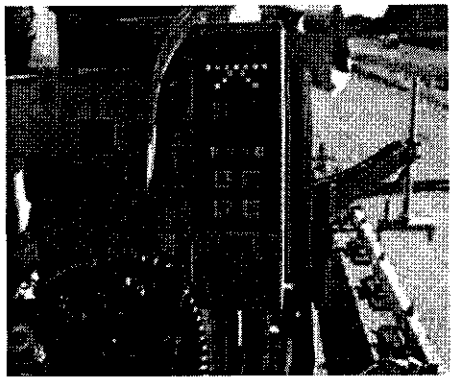
The hydraulically raised hood provides exceptional engine access.




## Dual Fuel Fills

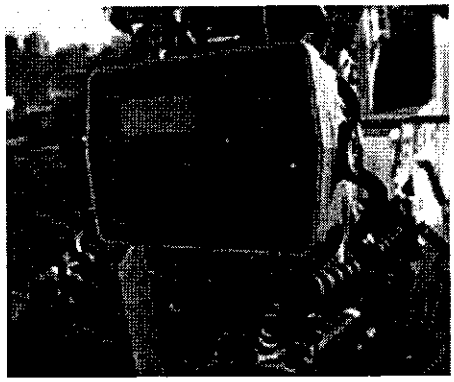
A fuel fill location on each side of the paver lets you refuel on the fly from either side of the machine.

# Options



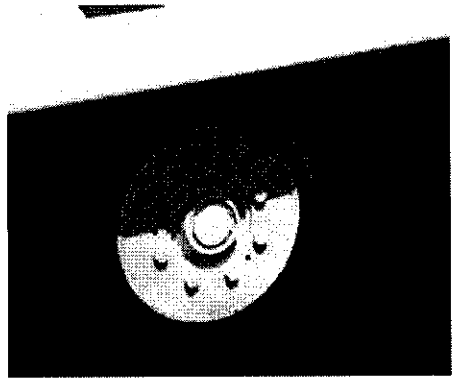
## MOBA-Matic™ System

The MOBA-Matic™ system comes in a dual grade and slope configuration or the optional Big-Sonic-Ski™ configuration. Each sensor head contains 5 ultrasonic ground sensors. In the Big-Sonic-Ski configuration three of the sensors are set up along a ski and their measurements are averaged together.



## Topcon® Paver System Five

The Topcon® Paver System Five comes in a dual grade and slope configuration or the optional Smoothtrac® configuration. Each sensor head contains an ultrasonic ground sensor. In the Smoothtrac® configuration four of the sensors are set up along a ski and their measurements are then averaged together.



## Front Wheel Assist

Provides extra pulling power to the rubber tired pavers by powering the front bogies with independent hydraulic motors.

## Other Available Options:

- **Release Agent Tank**
  Replaces the standard wash down system with a 20 gallon tank and pump which attaches to the standard 30' retractable hose reel.

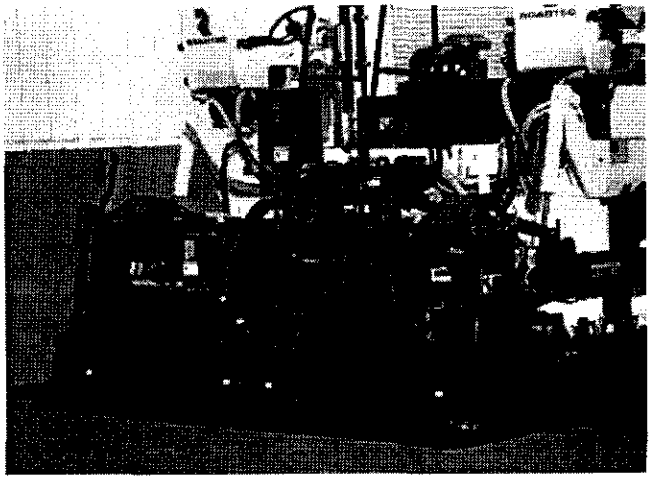
- **Screed Assist**
  Hydraulically controls the amount of down pressure applied by the screed.

- **Hydraulic Tunnel Extensions for Tire-Driven Models (standard on track pavers)**
  Hydraulically extendable tunnel extensions extend from 0 to 18 inches.

- **Road Light Package**
  Package includes six 12 volt lights, two for the hopper, two for the tunnel and two for the screed. It also includes one amber beacon.

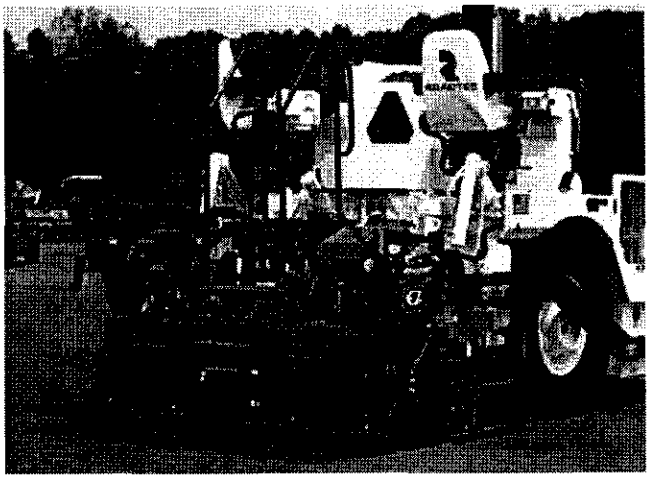
- **Premium Light Package**
  Package includes five 500W halogen lights, two 150W lights and four 120V outlets mounted to machine.

# Screeds



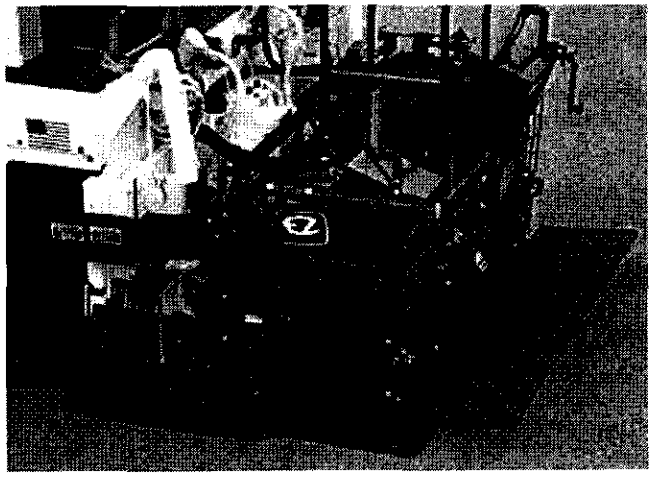
## S-8 & S-10

The Roadtec S series vibratory screeds are available in both 8' (2.5m) and 10' (3.0m) standard paving widths. Standard features include 3' hydraulic strike-offs with electric articulation, dual screed control consoles, power crown control and electrically heated screed plates.



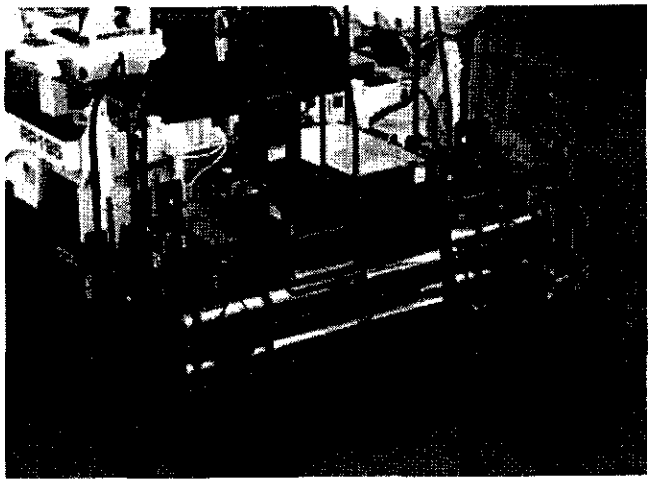
## Carlson EZ III

The Carlson EZ III hydraulic extendable screed comes in an 8' (2.4m) to 13'6" (4.1m) version or a 10' (3m) to 17' (5.2m) version. Both the main screed and the front mounted extensions are electrically heated by a 34kw generator. They also feature vibration, adjustable angle of attack, adjustable slide track, berm builder and spring loaded end gates with replaceable runners.



## Carlson EZ IV

The Carlson EZ IV hydraulic extendable screed comes in an 8 (2.4m) to 15' (4.5m) version or a 10' (3m) to 19' (5.8m) version. Both the main screed and the front mounted extensions are electrically heated by a 34kw generator. They also feature vibration, adjustable angle of attack, adjustable slide track, berm builder and spring loaded end gates with replaceable runners.



## Eagle 8 & Eagle 10

The Eagle 8 can hydraulically extend to 15'6" (4.7m) while the Eagle 10 can hydraulically extend to 19'6" (5.9m). Both have rear mounted extensions facilitating excellent material flow to the ends of the screed and are electrically heated by a 34kw generator. A unique feature of these screeds is being able to replace the electric heating elements without dropping the screed plates.

# Reliability
# Performance
# Serviceability

## "We've got you covered!"



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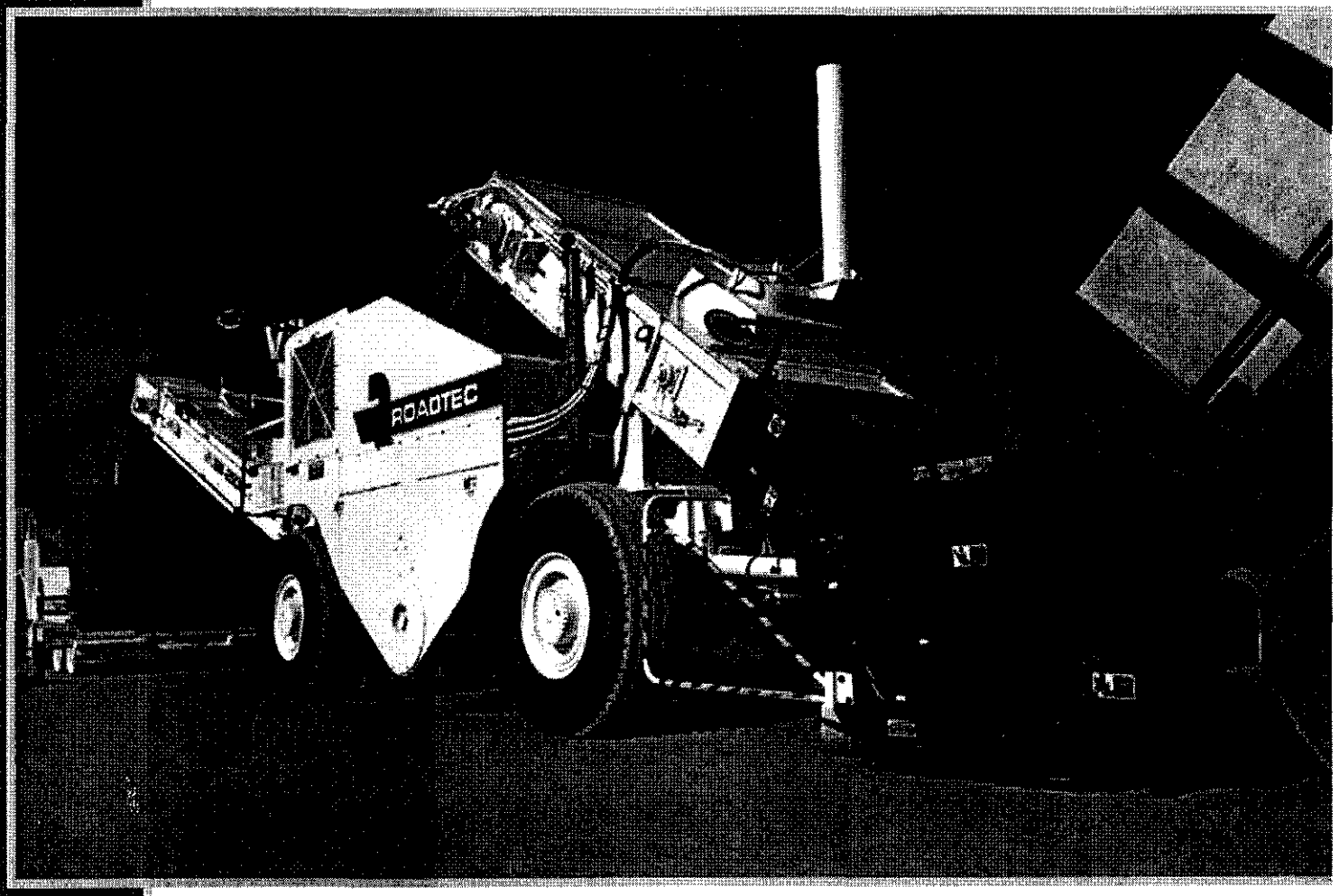
# Material Transfer Vehicles

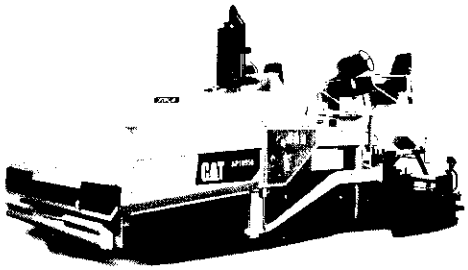



ROADTEC®

an Astec Industries Company

# Asphalt Paver Handbook

For Caterpillar®
AP655C, AP655D,
AP1000D and AP1055D
and Barber-Greene®
BG-260D and BG-2455D
Asphalt Pavers



CATERPILLAR®

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## Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules and precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

**Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.**

**Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.**

Safety precautions and warnings are provided in this presentation and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "WARNING" as shown below.

The meaning of this safety alert symbol is as follows:

**⚠ WARNING**

**Attention! Become Alert!**
**Your Safety is Involved.**

*(continued)*

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this presentation.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this presentation and on the product are therefore not all inclusive. If a tool, procedure,work method or operating technique not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this presentation are on the basis of information available at the time it was written. The specifications, illustrations and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information available.

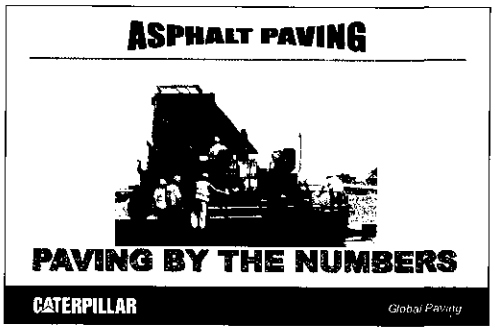
An asphalt paver is a machine that is used for road construction. The asphalt paver typically uses bulk material for the placement of paved surfaces. Most commonly, hot mix asphalt is supplied by vehicle delivery to the paver's front hopper.



The asphalt paver is a heavy duty machine that can place paving surfaces for many applications. The asphalt paver can be used for numerous applications such as roads, city streets, parking lots, highways and motorways. The asphalt paver accepts delivery of asphalt mix from a truck or transport vehicle at the front. The asphalt paver then contains the mix in a hopper. Slat conveyors transport the mix from the hopper to the rear of the machine. The mix flows onto the ground ahead of the screed. The screed shapes the mix to specified dimensions. The screed also levels the mix to specified dimensions. The slope and the grade of the asphalt surface is precisely controlled by sensors and references that are mounted on the paver. This system achieves a high degree of flatness. The paver can be configured with different types of screeds to satisfy common customer's requirements.

**⚠ WARNING**

Falling off of the machine could cause serious injury or death. No riders while machine is in travel mode. Refer to Operation and Maintenance Manual, "Roading the Machine" for proper roading procedures. Always wear a seatbelt.

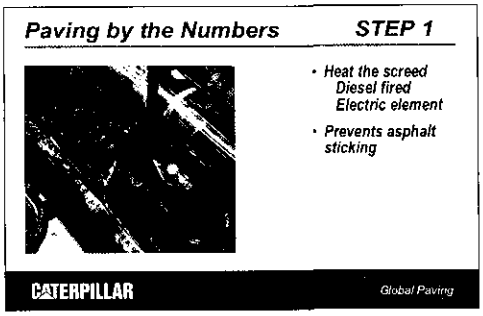



Producing a smooth asphalt surface with a tight finish is not as simple as saying "one...two...three". But a well-trained paver crew, which follows a set of established fundamental practices, will avoid many of the problems that affect mat quality. The purpose of this presentation is to review the steps you should follow each time you get ready to pull off the joint and start paving.

**⚠ WARNING**

Do not operate or work on a machine unless you have read and understand the instructions and warnings in the Operator and Maintenance Manuals. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Caterpillar® dealer for replacement manuals. Proper care is your responsibility.



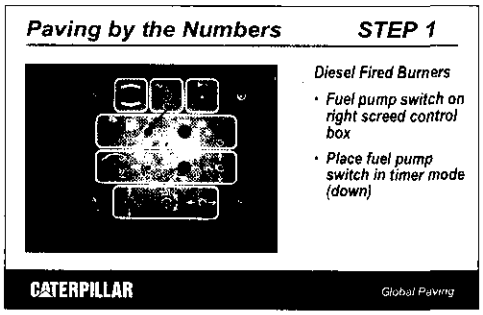



**Step 1** is lighting the screed heaters.

If the screed is cold, you have to heat it before beginning to pave to prevent asphalt sticking to the screed plate.

There are two types of screed heaters on Caterpillar screeds, diesel fired and electric element. In this presentation we will talk about both kinds.

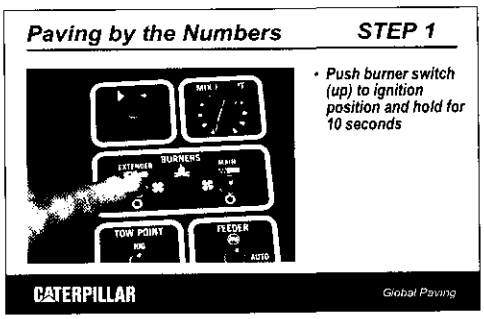
There are four screed heaters on Caterpillar extendable type screeds: one on each screed extender and two on the main screed.




**Diesel Fired Burners**

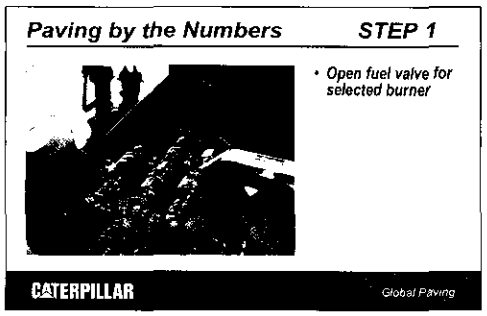
The right screed control box has the fuel pump switch for the heater system. Move the fuel switch down to the timer position. This system on Cat® and Barber-Greene® Pavers has a built-in fifteen minute timer and will shut off automatically to prevent overheating the screed plate. On other pavers, you'll need to shut the system off manually so watch your time when heating the screed. No more than fifteen minutes.



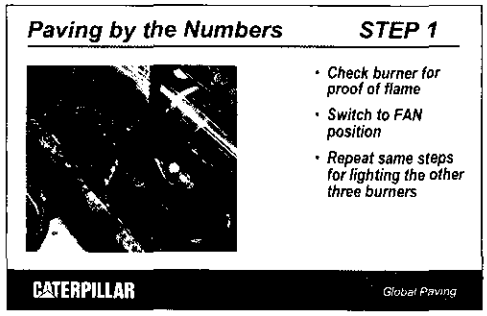



There are burner ignition switches on both the right and left screed control boxes. Each switch has three positions: OFF, Fan, and Ignition. Push up and hold one of the burner ignition switches to the ignition position. On newer screeds with 24-volt glow plugs, hold the switch in the ignition position no more than ten seconds. On older screeds with 12-volt glow plugs, you may need to hold the switch up a little longer in order to heat up the glow plug.

**NOTE:** Light only one burner at a time. Lighting more than one burner at a time will trip the circuit breaker for the burner ignition system.

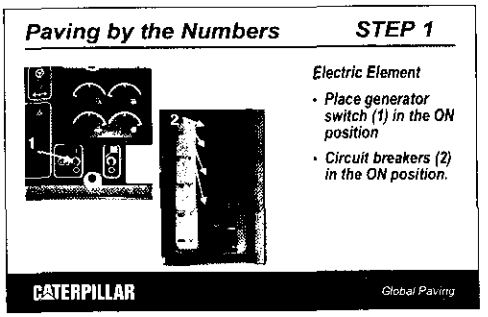



Then, open the fuel line to the selected burner. In this case, we're lighting the left extender burner.




Check that the burner has ignited. Then release the control box switch to the FAN position. Repeat the ignition steps for the other three burners.

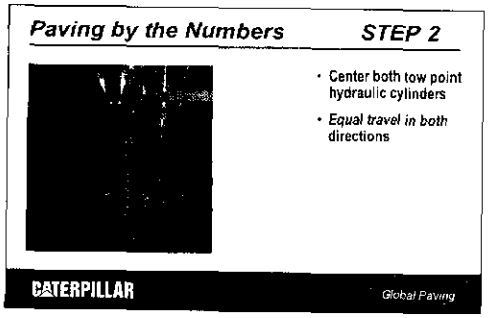





**Electric Element**

Locate the generator switch and move it to the on position. On "C and D" series pavers the switch is on the center console.

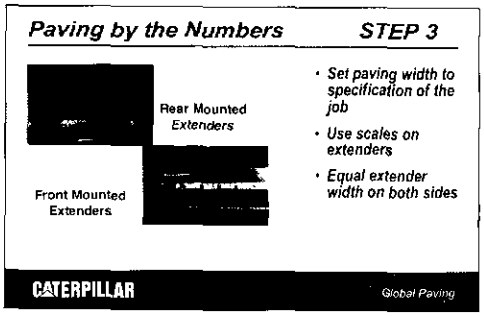
On top of the generator are the circuit breakers for each section of the screed. Move them all to the "ON" position.




**Step 2** is centering the tow points.

After the screed has warmed up, center the tow points on both sides. When automatic grade and slope is used, mat thickness corrections are created by tow point movement. That's why it is important to center the tow point for equal travel in both directions.

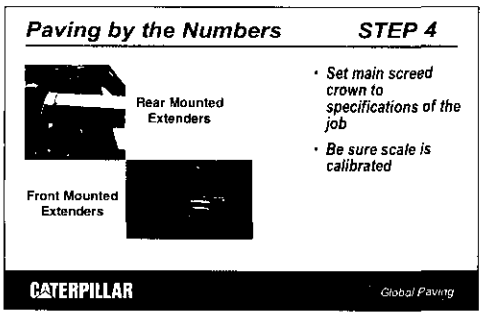





**Step 3** is setting the desired paving width.

With the screed still raised, move the extenders out to the specified paving width. Each extender has a scale which shows how far the extender is moved out from the main screed.

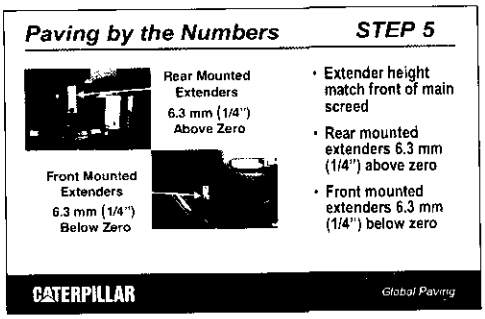
It's good paving practice to balance the extender width so the forces against each extender are equalized. For example, if you need a total of 1.2 m (4') of extender, move the left and right extenders out an equal amount – 0.6 m (2') on each side.




**Step 4** is setting the main screed crown to the specifications of the job.

Use the crown indicator scale located in the center of the screed to set the crown. Before using the indicator scale, be sure that it is properly calibrated to the screed.





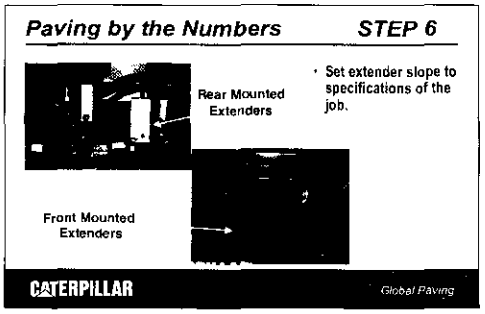

**Step 5** is setting the height of the extenders.

You want to set the height of the extenders so they match the height of the front of main screed. When the extender height is right, there are no transition marks in the mat.

Caterpillar Screeds normally run with a 6.3 mm (1/4") nose-up angle of attack. Therefore, on a screed with rear mounted extenders, set the extender height 6.3 mm (1/4") above the zero point on the scale. Do this for both left and right extenders.

If the screed has front mounted extenders, lower the extenders 6.3 mm (1/4") below the zero point on the scale.

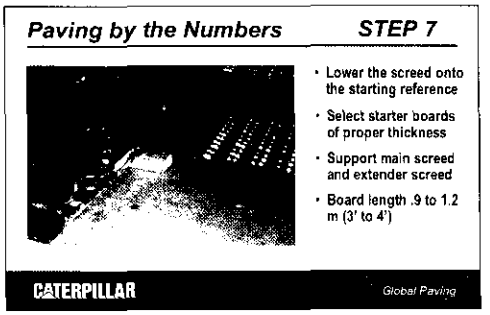
Again, make sure that the height indicators have been calibrated to the extenders.




**Step 6** is setting the slope of the extenders to the specifications of the job.

If there is no requirement for extender slope, set the indicator at zero on both sides.





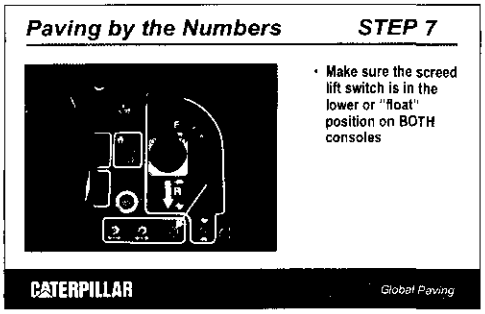

**Step 7** is positioning the starter boards under the screed.

Select starter boards whose thickness matches the mat depth and the rate of compaction. Normally, the mat will compact about 6.3 mm (1/4") per inch of mat depth. For example, to get a 50 mm (2") compacted mat, use starter boards which are 63 mm (2 1/2") thick.

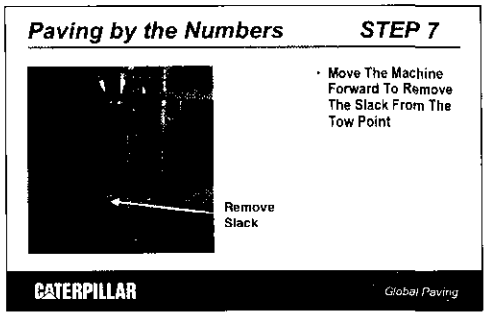
Use two boards. Position them so they completely support both the main screed and the screed extender from front to back. The normal length is between 0.9-1.2 m (3'-4').

When the boards are in position, lower the screed so it rests on both boards.

**NOTE:** When paving wider than 4.9 m (16'), it is good paving practice to also add starter boards underneath the extenders themselves.

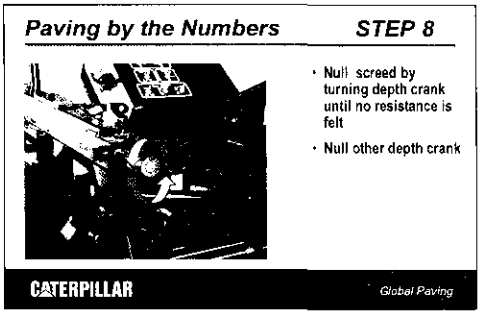



Remember to leave the screed RAISE/ LOWER switch in the lower or "float" position on both consoles.



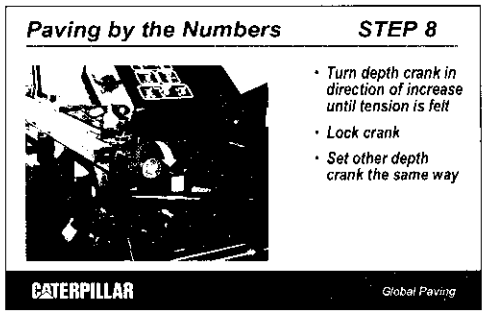

Step 7 also includes removing the slack from the tow point. Move the machine forward until the tow arm roller contacts the tow point frame.





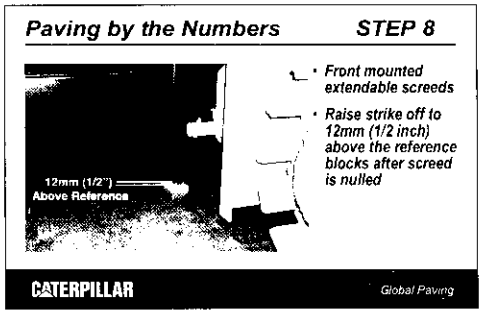

**Step 8** is nulling the screed.

Use the manual depth control cranks to null the screed. Turn the crank in either direction until no resistance is felt. This ensures that the full weight of the screed is supported by the starting reference. Move to the other side and follow the same nulling procedure. Be sure the crank turns freely. Then, go back to the other side. Make sure the crank still turns freely.



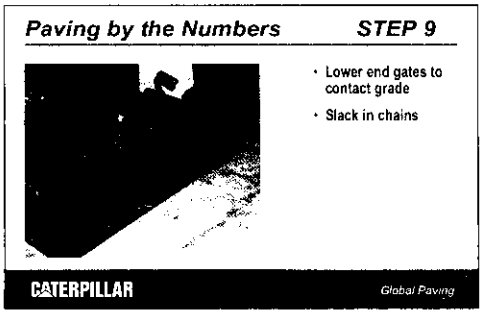

Then, turn the depth crank in the direction that increases mat thickness until resistance is felt. Lock the depth crank in this position. On the other side, turn the crank until you feel resistance and lock it. On other types of screeds, you may have to turn the depth cranks one or more revolutions to set the angle of attack. Follow the manufacturer's guidelines for the screed you're setting up.





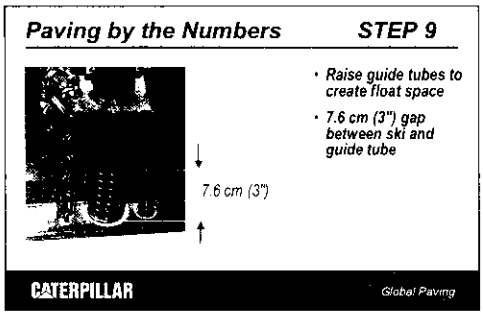

On a screed with front mounted extenders the strike off plate in front of the screed will need to be set. This plate controls the amount of material allowed in from of the main screed.

After the screed is nulled out and the initial angle of attack is applied, raise the strike off to 12 mm (1/2") above the reference.



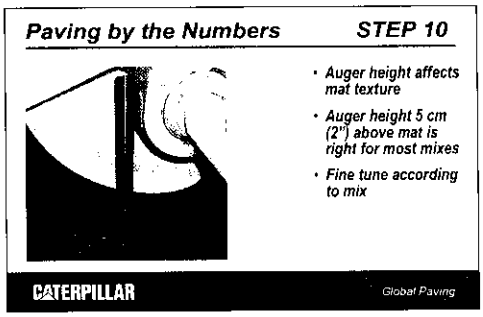

**Step 9** is positioning the end gates.

End gates on both ends of the screed retain material at the proper width. They float on the grade. First, lower the end gate until it touches the grade. Then, make sure there is slack in the locking chains.



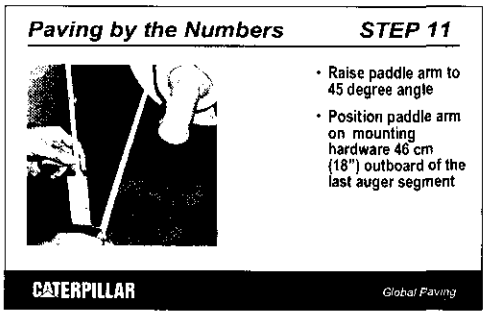

Next, raise the guide tubes to create space for the spring-loaded skis to move up and down over any grade irregularities. The space should be about 7.6 cm (3").






**Step 10** is setting the auger height.

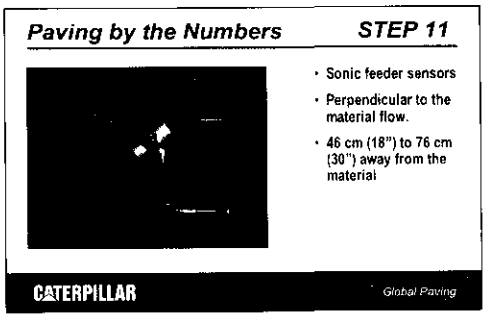
The height of the augers in relation to the depth of the uncompacted mat has an effect on the texture and finish of the mat. If the augers are too low, you'll probably see an open texture and maybe material segregation. If the augers are too high, the head of material will likely be too high which will cause the screed to climb. Different mixes react differently to auger height adjustment, but as a rule, set the auger height at least 5 cm (2") above the height of the uncompacted mat. Fine tune the auger height after paving starts if the mix is very coarse or very tender.



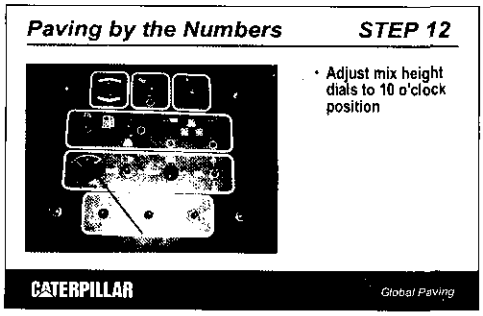

**Step 11** is setting the position of the feeder sensors.

You want to position the feeder sensors, either paddle-type or sonic, so they are sensing the active pile of material about 46 cm (18") away from the last auger segment. If you have a paddle-type sensor, the paddle arm should be at a 45° angle at the 46 cm (18") distance.



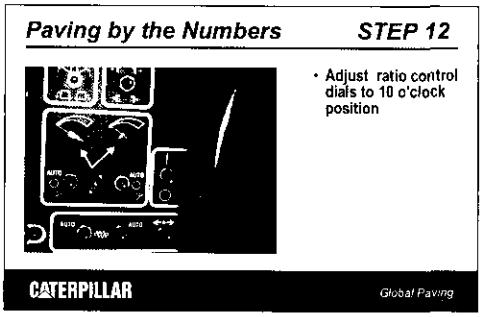



Sonic feeder sensors should be set perpendicular to the material flow 46 cm (18") to 76 cm (30") away from the material.



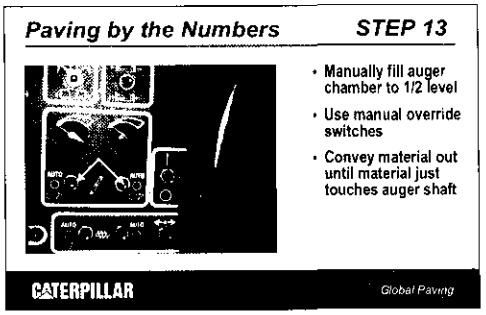

**Step 12** is adjusting feeder system controls.

When the feeder sensors are properly positioned, turn the mix height dials and ratio control dials clockwise about the ten o'clock position. The auger mix height dials are located on the screed control boxes.



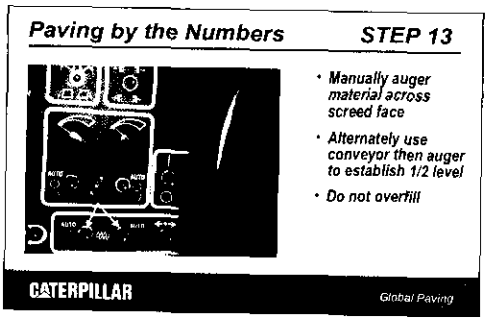

The conveyor ratio control dials are located on the left side of the operator's station. Turn the ratio control dials clockwise about the ten o'clock position. You can fine tune these dials when you start paving.





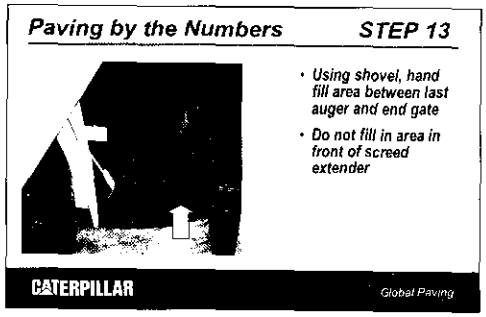

**Step 13** is filling the auger chamber in front of the screed until it is one half full.

Using the manual override switches on the operator's console, alternately convey and auger material to the auger chamber and out to the ends of the augers. Your goal is to fill the auger chamber evenly on both sides. Use one conveyor switch at a time to move material out until it just touches the auger shaft.

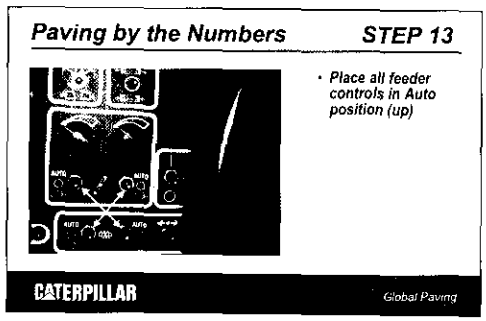



Then, use the manual auger switch to move material out to the end of the screed. The correct head of material is one that covers one half of the augers. Always fill the auger chamber using the manual mode and be careful not to overfill. Overfilling the auger chamber will result in a bump when starting off the transverse joint.

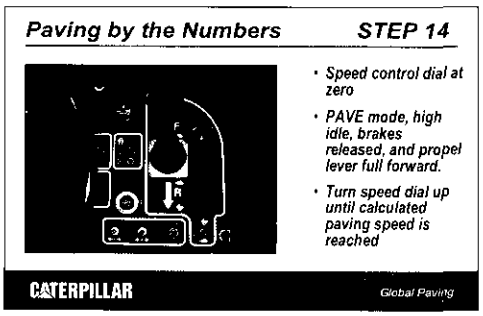





Don't force material out to the end gate. You'll probably overfill the chamber. Instead, move some material with a shovel to the area in front of the extender. Do not fill in the area adjacent to the main screed and directly in front of the extender. This area will be filled by material as the paver pulls forward off the starting reference.




With the auger chamber half full, put the conveyor and auger switches on the console in the auto mode.

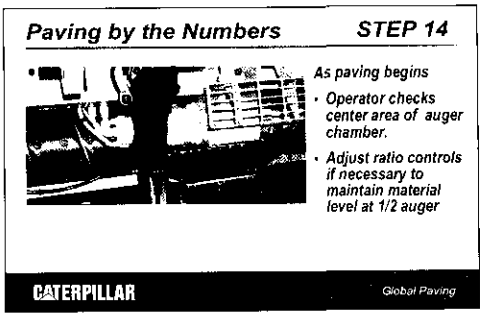



Now, we're ready for **Step 14** – pulling off the starting reference.

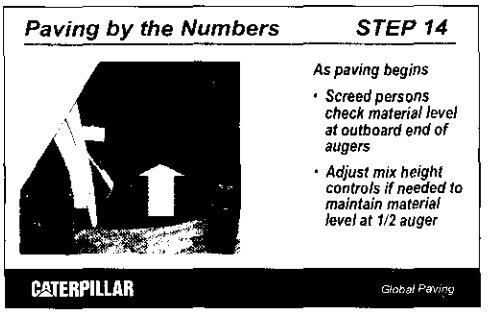
Start with the speed control dial set at zero – that's fully counterclockwise. Make sure the gear selector is in the PAVE mode, the engine throttle is set at high idle, the parking brakes are released, and the propel lever is moved all the way forward.

Then, turn the speed control dial clockwise until the desired paving speed is reached.



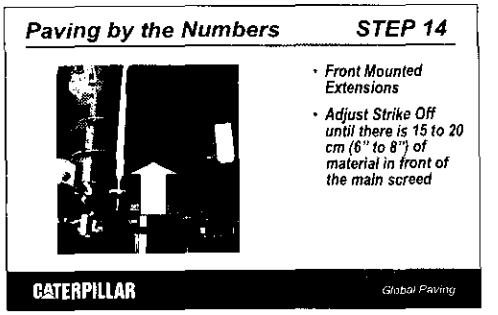



Screed personnel observe the level of material at the outboard ends of the auger shafts to see if the auger shafts are one half covered. There are individual material height dials on the screed control boxes which are adjusted to control the height of material at the outboard ends.

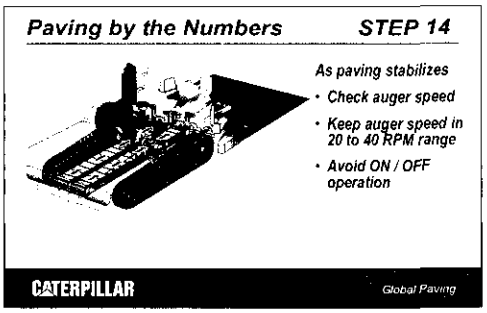



As the paver comes up to speed, the operator should look down at the area in the center of the auger chamber. The goal is to maintain the mix level so one half of the auger shaft is covered. Use the independent left and right feeder ratio controls to adjust the height of the mix in the center.






On screeds with front mounted extenders, adjust the strike off until there is 15-20 cm (6"-8") of material in front of the exposed main screed.

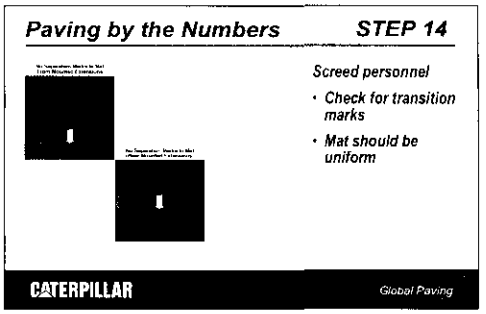



As the paving operation stabilizes, the operator should check the speed of auger rotation. The augers should be turning uniformly in the range of 20-40 rpm.

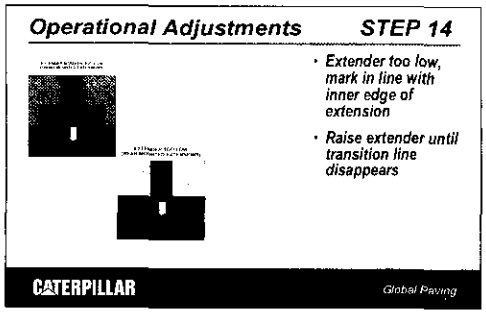
To slow down the augers, the operator turns the ratio control dials clockwise. This action sends more mix to the auger chamber. To increase auger speed, turn the ratio control dials counterclockwise.

By all means, avoid erratic or ON/OFF operation of the augers. These conditions tend to create material segregation stripes in the mat and loss of smoothness.



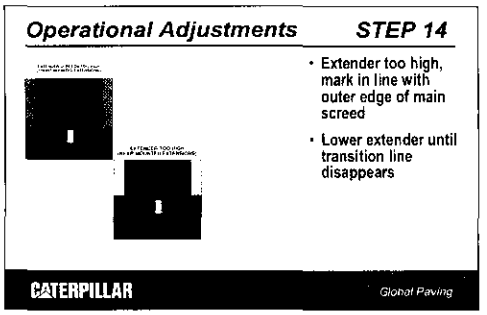



As paving speed and feeder system operation are stabilized, screed personnel look for transition marks between the main screed and screed extenders. If screed height, angle of attack and slope are correct, the mat should have a uniform texture across the full width of the mat and there should be no longitudinal lines present.

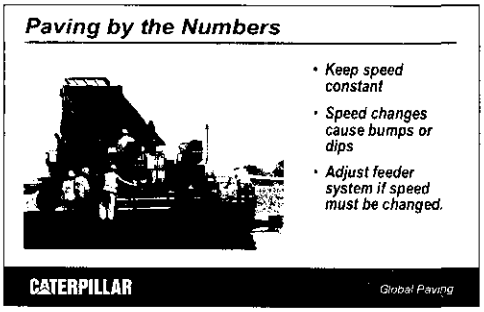



If an extender is set too low, there will be a longitudinal transition mark in line with the inner edge of the screed extender. The mat will be thinner behind the screed extender. Use the power height switch or manual height crank to raise the extender until no transition mark is present.






If an extender is set too high, there will be a longitudinal transition mark in line with the outer edge of the main screed. The mat will be thicker behind the screed extender. Use the power height switch or manual height crank to lower the extender until no transition mark is present.



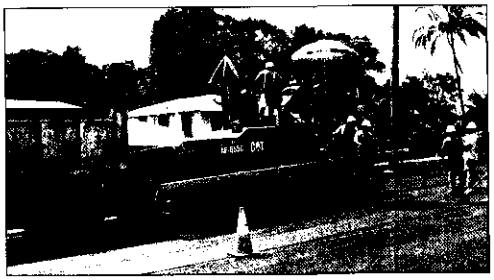

One of the most important fundamentals of smooth paving is maintaining a consistent paving speed. Normally, you can set up the paver to pave smoothly at any speed that matches the delivery of mix to the job site. The important thing is to keep the speed constant.

If the paving speed is changed drastically, the screed will either rise or fall and mat smoothness will suffer.

Also, if paving speed changes, the demands on the feeder system change. So the feeder system controls will have to be adjusted to match the new material demands.

For quality paving results, always follow the basic fundamentals of paver set-up and keep the operation consistent.





## Paving With Automation

Grade and/or slope automation is simply a measuring device much like a tape measure or a carpenter's level.

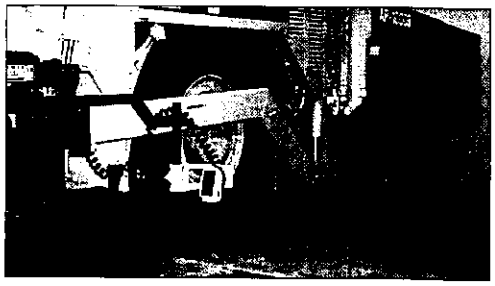
These systems are used on asphalt pavers to assist the paver crews in maintaining thickness and/or slope of the asphalt mat being placed.

Proper paving techniques must be employed when using grade and/or slope automation.

Grade and/or slope automation can not prevent mat defects that are caused by poor or bad paving techniques. It can only minimize the defect.

**⚠ WARNING**

Consult the Operation and Maintenance Manual before installing the grade and slope equipment onto the paver. Always connect power cables with the key in the OFF position.

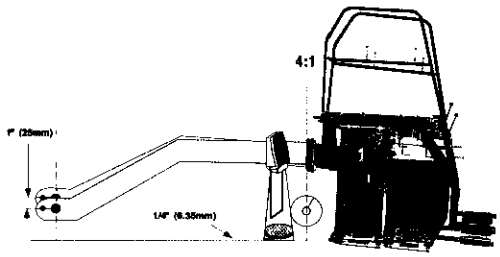


## Sensor Position

The position of the sensor on the tow arm 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 position that will produce the required results.

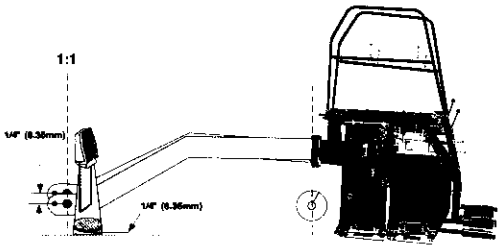
Automation sensors will always move the tow point up or down to maintain the sensor's null point. In effect, the location of the sensor becomes the control point. The tow point becomes the point from which we raise or lower the tow arm to reestablish the null point at the sensor. The effective length of tow arm becomes the distance between the control point (sensor) and the pivot point (trailing edge of the screed). Because the screed must travel five tow arm lengths to fully react to a correction, shortening the effective tow arm length shortens the distance the paver must travel to complete a correction.






Positioning the sensor to the rear or inline with the auger, will produce a quick change (or reaction) of the screed. This placement will have a 4 to 1 ratio. Meaning that for every 6 mm (1/4") of sensor movement up or down, the tow point will move up or down 35 mm (1"). This position is used to match existing surfaces or a curb line.

**RULE:** Sensor(s) positioned inline with the augers builds PROFILE.

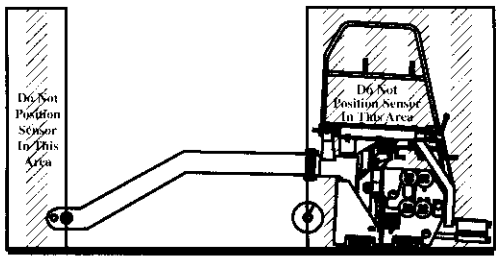



Positioning the sensor forward or near the tow point causes gradual changes in tow point movement. Again, because the screed must travel five tow arm lengths to fully react to a correction, increasing the effective tow arm length increases the distance the paver must travel to complete a correction.

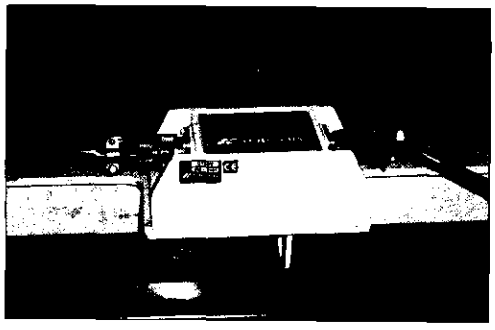
Positioning the sensor near the tow point decreases reaction time of the screed. This placement will have a 1 to 1 ratio. Meaning that for every 6 mm (1/4") of sensor movement up or down, the tow point will also move up or down 6 mm (1/4"). This position is used to build rideability.

**RULE:** Sensor(s) positioned near the tow point or 1/4 of the tow arm length back from the tow point builds RIDEABILITY.






Never position the sonic sensor or contacting sensor behind the centerline of the augers or in front of the tow point cylinders. This could cause severe over correction and result in an opposite reaction of the screed.

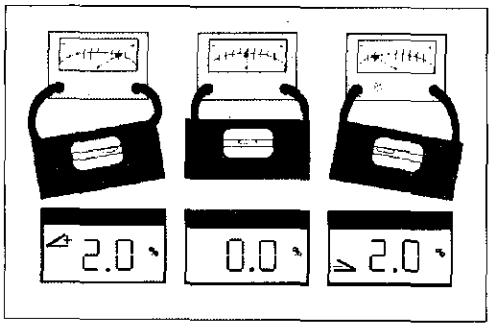


## Slope Sensor (Topcon shown)

The slope sensor may vary from manufacturer to manufacturer, but the purpose is the same. It is a precision electronic sensor which functions much like a carpenter's level that constantly measures the slope that the paver is operating on. It is a sealed unit that cannot be adjusted and contains no serviceable parts. The slope sensor can be selected to control either side of the paver. It is mounted to the cross beam with the arrow facing in the direction of travel.

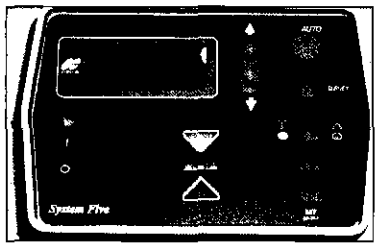
Using the control box, the slope sensor can be calibrated to a known slope. The operator can maintain a desired left hand or right hand slope from +20% to -20%.






The slope sensor "reads" slope using an internal precision level. It works by reading the lateral inclination (right side to left side tilt or left side to right side tilt) of the screed and sends a signal to the control box.

Once the desired slope has been set at the control box, the slope sensor measurements will be indicated on the control box LCD and LED displays. When the paver is at the correct slope, the control box will display the On Grade symbol.



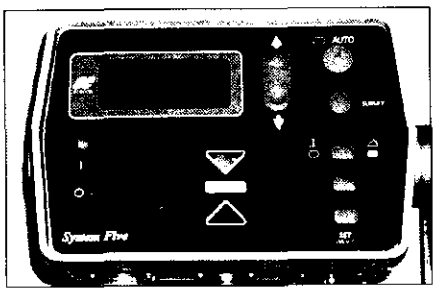
## Paving With Topcon System 5

Prepare the machine for paving using Paving by the Numbers.

### Grade Control

1. Position the grade sensor for smoothness or joint matching.
2. Make sure the sensor is between 36 and 60 cm (14" and 24") above target reference.
3. Turn the control box power on.
4. Put the control box in the grade mode.
5. To null the grade sensor, press and hold the survey button until you hear 2 beeps or until the green On Grade bar appears.
6. Press and hold the set button and turn the grade adjusting knob until the desired readout appears in the window. For example, after nulling, the readout shows 2.00 and the paving thickness is 3.00. Press and hold the set button and turn the grade adjusting knob until 3.00 shows in the window.
7. Push the auto button and the red auto light comes on.
8. Start paving using the grade adjusting knob to adjust thickness if necessary.



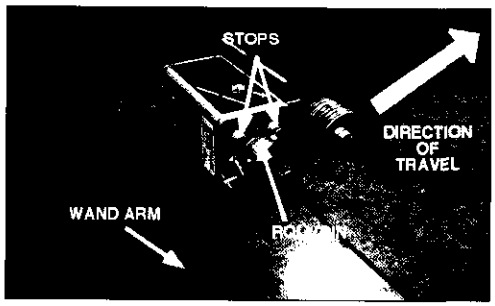


## Paving With Topcon System 5

Prepare the machine for paving using Paving by the Numbers.

### Slope Control

1. Turn the control box power on.
2. Put the control box in the slope mode.
3. Press and hold the survey button until you hear 2 beeps or until the green On Grade bar appears. This is called nulling the sensor.
4. Press and hold the set button and turn the grade adjusting knob until the desired readout appears in the window. For example, after nulling, the readout shows 2.0% slope left (<) and the actual slope is 2.0% slope right. Press and hold the set button and turn the grade adjusting knob until 2.0% slope right (>) shows in the window.
5. Push the auto button and the red auto light comes on.
6. Start paving using the grade adjusting knob to adjust slope if necessary.



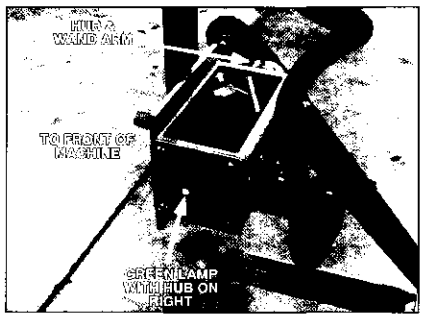

## Mechanical Sensor (Contacting Type)

When using the mechanical or contacting type sensor, mount the sensor to the jack. The sensor mounting bolt should be pointing to the front of the machine and the power cable should be pointing to the rear of the machine. Rotate the hub until the roll pin is centered between the stops. Hold the hub in this position and attach the wand arm to the hub at a 45° angle trailing the machine.

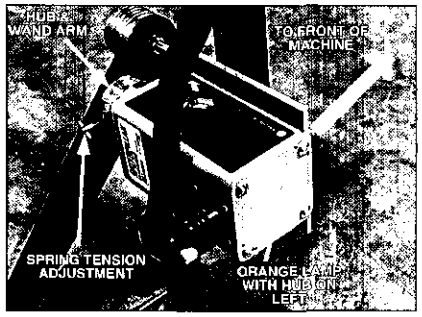
Lower the sensor until wand arm and skate or string line wand is in contact with the grade or reference. Continue to lower the sensor until the roll pin is centered between the stops.

Once the hub and wand are on the reference with the roll pin in the center of the stops, follow steps 5 through 7 on page 43.



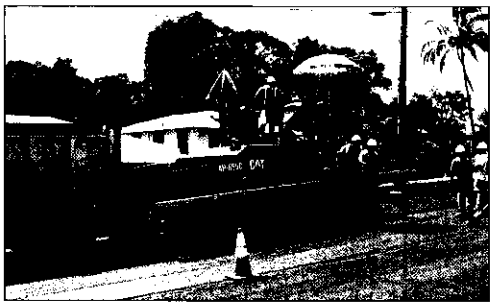



The sensor can be set with the hub and wand arm on the right side or the left side. If the hub and wand are on the right, the green lamp will be illuminated.




If you flip the sensor 180° so the hub and wand are on the left side, the orange lamp will illuminate.

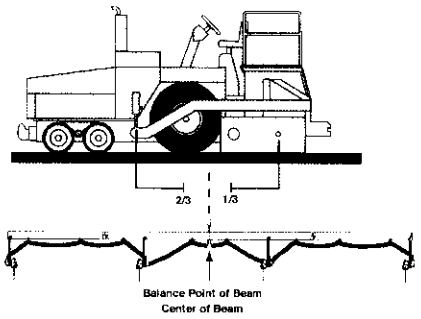
**NOTE:** Changes in wand and hub position have to be done with the power switch on the control box in the "OFF" position. When the controller is powered up the changes are picked up and the controller responds correctly.



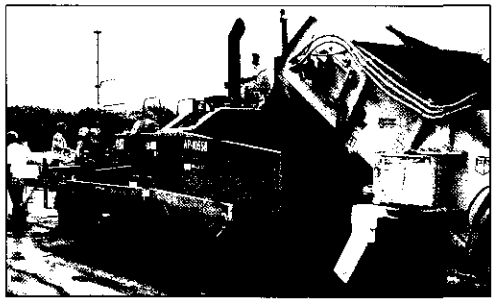
## SAS Set Up

1. Make sure all control boxes and Trackers are labeled with SAS stickers.
2. Position the ski for the paving application. Do not position the center line of the ski forward of the tow point. Placing the center line of the ski close to the tow point will slow the reaction time which is best for smoothness. When using the ski for smoothness and to match a joint, position the center line of the ski closer to the screed for a faster reaction. Do not place the center line of the ski less than 1/3 the distance from the pivot point of the screed to the tow point.
3. Turn the control box off.
4. Make sure all cables are connected. Connectors are marked 1-4. Connector 1 of the cable should be on the front sensor.
5. Make sure each Tracker has a temperature bail installed and the height of each sensor is a minimum 43 cm (17") above reference.





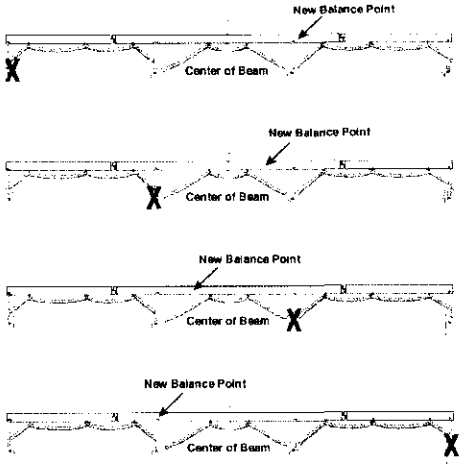

6. Follow Paving by the Numbers to prepare the screed for paving.
7. Turn the control box on. Once the control is turned on, it will automatically configure for SAS. The box will check to see how many Trackers are connected and average over that amount.
8. Setting up the control box for paving is the same as with one Tracker.
9. Once the system is nulled out and turned to automatic, inspect each Tracker to verify they all show an On Grade bar.



**NOTE: If the SAS is mounted on the right side of the machine and is pulled in close to the machine, air flow from the machine could interfere with the signal from the number 2 sensor. This issue can be resolved by going into the Technician's Menu (refer to page 56) and adjusting the Grade Gain to 30 (normal setting is 75) and the Averaging (AVG) to 50 (normal setting is 29).**

The SAS has been designed to discontinue operating when one of the Trackers fails. When a failure occurs, the control box will flash "ERR" preceded by a number "1-4". The number represents the Tracker which failed. 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. Resurvey the control box to lock SAS on grade.

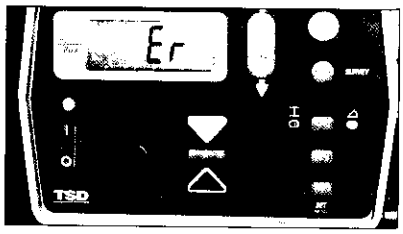





**X = Indicates Tracker has be removed.**

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 rear Tracker fails, to replace it with one of the Trackers from the middle of the beam. This will insure that the balance point is not outside of the 1/3 to 2/3 rule.

**NOTE: 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.**




## System 5 Errors

The Topcon System 5 has 6 possible error codes that may scroll across the display screen. Four are very common and two are rare. The four common error codes that you may see are:

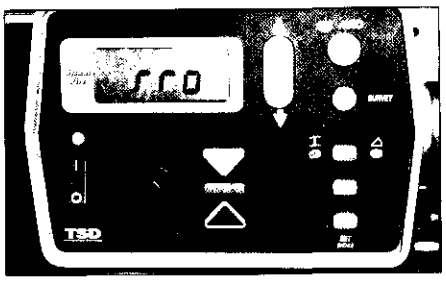
**1. SLOPE ERROR** - This error is caused by a loss of communication between the controller and the slope sensor. It will also display when one controller is in the slope mode and the other controller is also turned on in the slope mode.

**2. ELEV ERROR** - This is an elevation error. It is caused by a loss of communication between the controller and the sensor.

**3. SAS ERROR 1, 2, 3 or 4** - The error is caused when the controller is not communicating with one of the four sonic sensors that are paralleled on the Sonic Averaging Ski. The numbers 1, 2, 3, or 4 indicate which sensor is not communicating.

**4. NO SIGNAL** - The sensor is not delivering a valid measurement to the controller.






Two other error codes that may be seen but are rare are:

**1. EE Error** - This indicates that something in the controller has quit functioning. Take the controller to your Cat® dealer or an authorized Topcon service center.

**2. SENSOR SHORT** - This indicates that the sensor has short circuited. Take the sensor to your Cat® dealer or an authorized Topcon service center.

## Topcon System 5 Settings

**NOTE: The following settings are recommended for the models listed below.**

**AP1055D/BG-2455D** (PIN: FAC1-UP; AGP1-UP; BNW1-UP; BXW 1-UP)

**AP1000D/BG-260D** (PIN: EAD1-UP; BPW1-UP)

**AP655C** (PIN: CDG1-UP, AYP1-UP)

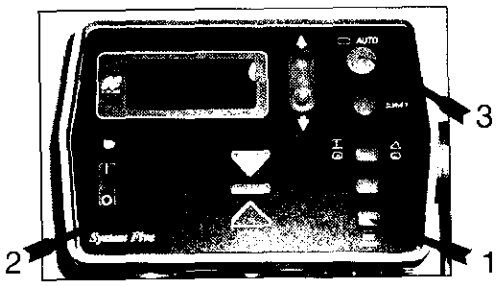
**AP655D** (PIN: GNZ1-UP; MAT1-UP)

## Accessing the Technician's Menu

**The following section explains how to access the Technician's Menu, select a desired Performance Setting, save the new Value and exit the Technician's Menu.**

Refer to Operation & Maintenance Manual KEBU7018 for more information on Topcon System 5.






## To Access the Performance and Technician's Menu:

1. Turn the Power off. While holding down the Set/Menu button (1) turn the box back on. The Auto LED light and grade adjustment Direction Arrows will flash. You are now in the Performance Menu (settings listed on page 55)
2. Rotate the Grade Adjustment knob (2) to scroll through the Performance Menu Selections until coming to the Beeper Selection.
3. Press the auto Button (3) and hold for approximately 15 seconds or until "CON" appears in the window. You are now in the Technician's Menu (settings listed on page 56).
4. Once the Control box has entered the Technician's Menu, the red arrows on the Grade Adjustment knob will flash. Turn the Grade Adjustment knob to display the Technician's Menu selections.

## Making the Selections

1. Once the desired selection is dialed in, press the auto button. The current operating value for that setting is displayed.
2. The values for the settings may now be changed by simply turning the Grade Adjustment knob until the desired value is displayed.
3. Some settings are simply ON or OFF while others involve numerical value ranges. See "Technician's Menu Performance Settings" (page 56) for the choices provided for each setting.
4. Once the setting is dialed in, press the "Auto" button and the setting is saved.
5. The LCD will display the menu selection that was just exited. Rotate the Grade Adjustment knob to a new selection or press the Set/Menu key to exit the menu.

## Performance Menu Settings

**TO ENTER THE PERFORMANCE MENU, PRESS AND HOLD THE MENU BUTTON WHILE TURNING THE POWER OFF AND THEN BACK ON.**

| | |
|---|---|
| BEP (Beeper) | ON |
| UNT (Units) | IN |
| TST (Valve Test) | PASS/OPEN |
| TST (Valve Test) | PASS/OPEN |



## Technician's Menu Settings

**ENTER THE PERFORMANCE MENU AND SELECT THE BEEPER MODE. WHILE IN THE BEEPER MODE, PUSH AND HOLD THE AUTO BUTTON UNTIL "CON" APPEARS IN THE DISPLAY.**

| | |
|---|---|
| CON (Configuration) | 15 |
| AVG (Averaging) | 29 |
| UA (Valve Type) | PROP |
| DR (Current Direction) | SRC |
| DA (Dither Amplitude) | 4 |
| DF (Dither Frequency) | 42 |
| FRE (Frequency) | 5 |
| CL (Current Limit) | 1.75 |
| HR (Hour Meter) | — |
| EA (External Auto) | OFF |
| AP (Auto Power Up) | ON |
| EE (E-Squared Reset) | NO |
| LOC (Lock Out) | ON 2 |
| 9AN (Grade Gain) | 75 |
| 9AN (Slope Gain) | 75 |
| OFS (Offsets RH/UP) | 256 |
| OFS (Offsets RH/DN) | 256 |
| OFS (Offsets LH/UP) | 256 |
| OFS (Offsets LH/DN) | 256 |
| db (Grade Dead Band) | 3 |
| db (Slope Dead Band) | .075% |
| ADJ (Adjust) | 20 |
| NET (Cross Talk) | OFF |

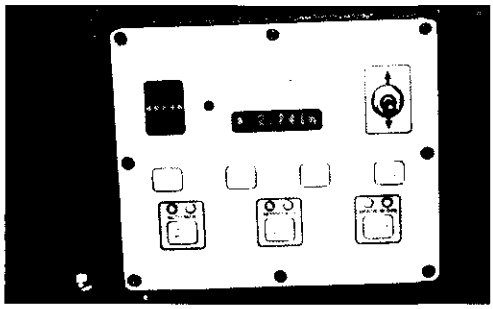
## Checking System Performance (Fine Tuning Offsets)

1. Move the machine to a flat surface. Lower the screed to the ground. Pull the machine slightly forward taking the slack out of the tow point.
2. Operate the tow point cylinders up and down full stroke to assure hot oil circulates through the valve and cylinder. Move the tow point cylinders to the center position.
3. Put the screed thickness controls to null.
4. The following conditions must be met during the performance check:
   - The park brake must be applied.
   - The machine must be in Pave mode.
   - The maximum speed potentiometer must be at the 50% position.
   - The propel control must be forward.
   - The hydraulic temperature must be a minimum of 38° C (100° F).
5. Put the control box for the system in the Slope mode. Null the control.
6. Place control in "AUTO" mode.
7. Turn the Grade Adjustment knob clockwise one click. Observe the downward movement of the tow point cylinder. If the cylinder does not make a complete change in 2 or 3 seconds, you should increase the offset of the valve. If the cylinder moves too fast, you should decrease the offset of the valve. If the cylinder overshoots the correct position and the cylinder then returns, you should decrease the offset of the valve.



**NOTE:** The valve offsets should always be set with the tow point cylinders at the center position or near the center position.

8. Access the Technician's Menu to change offset values. Make the changes that are required to the offsets until the criteria for the performance of the system is met.
9. Repeat the procedure for the upward direction. Turn the Grade Adjustment knob counter clockwise one click to test the up valve.
10. Repeat the procedure for the opposite side of the machine.



## Paving With Premier System

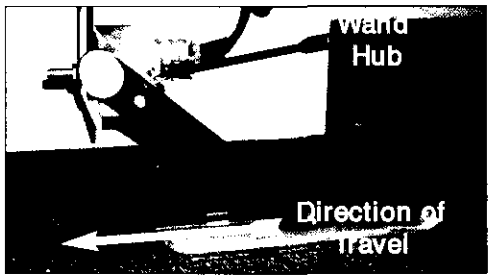
### Sonic Sensor

1. Prepare the machine for paving using Paving by the Numbers.
2. Position the grade sensor for matching or smoothness.
3. Make sure the grade sensor is 35-40 cm (14"-16") above the grade reference and the temperature bail in place.
4. Use the Sensor pad to select grade.
5. Press the Null Setpoint pad to get a flat bar in the error display.
6. Press the Control Mode pad to place the system in Auto.
7. If the number in the display does not match the mat thickness, press and hold the Display Offset pad and move the Toggle switch up or down until the display matches the mat thickness.

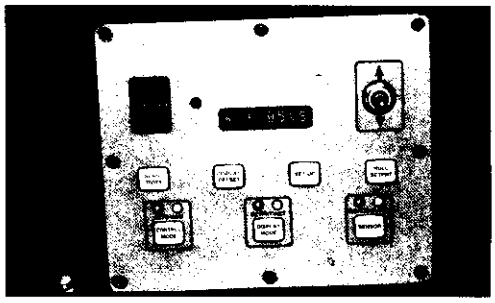
### Contacting Sensor

1. Prepare the machine for paving using Paving by the Numbers.






2. Position the grade sensor for matching or smoothness.
3. Position the grade sensor so it is facing the rear of the machine and the arm is at a 45° angle trailing the machine.
4. Access the Foreman's Menu (page 62) and scroll to the "wand hub" variable. Make sure the variable matches the actual position of the wand hub.
5. Use the Sensor pad to select grade.
6. Press the Setup pad, then raise or lower the sensor until you hear the beeping tone turn to a solid tone. Press the Setup pad again.
7. Press the Null Setpoint pad to get a flat bar in the error display.
8. Press the Control Mode pad to place the system in Auto.
9. If the number in the display does not match the mat thickness, press and hold the Display Offset pad and move the Toggle switch up or down until the display matches the mat thickness.



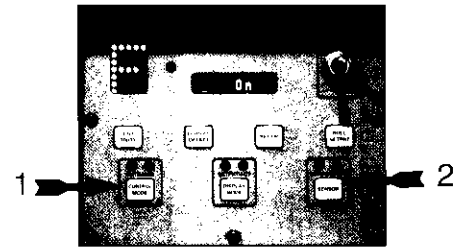
## Paving With Premier System

### Slope Sensor

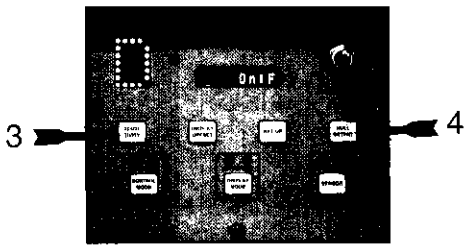
1. Prepare the machine for paving using Paving by the Numbers.
2. Use the Sensor pad to select slope.
3. Press the Setup pad twice.
4. Press the Null Setpoint pad to get a flat bar on the error display.
5. Press the Control Mode pad to place the system in Auto.
6. If the number in the display does not match the actual mat slope, press and hold the Display Offset pad and move the Toggle switch up or down until the display matches the mat slope.



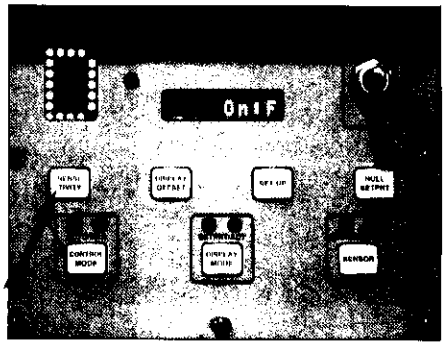
## Premier Grade Controls



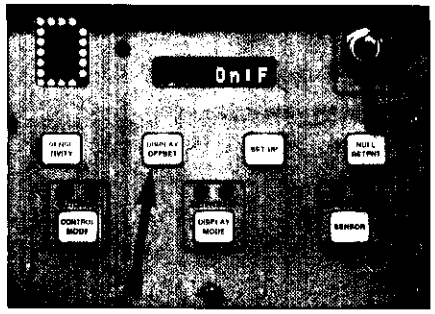

The Premier Grade and Slope System has two menus. The Foreman's Menu is accessed by pressing and holding the "Sensitivity" pad (1) and then pressing the "Null Setpnt" pad (2). "F" will appear in the error display.




All the configuration variables listed on page 65 can be accessed through the "Dealer" menu. To access, press and hold the Sensor pad (3) then press the Control Mode pad (4). "D" will appear in the error display.

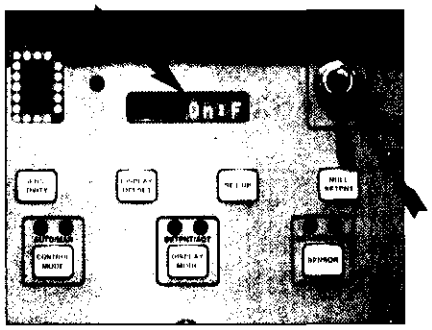



The sensitivity pad is used to scroll backwards through the different variables.

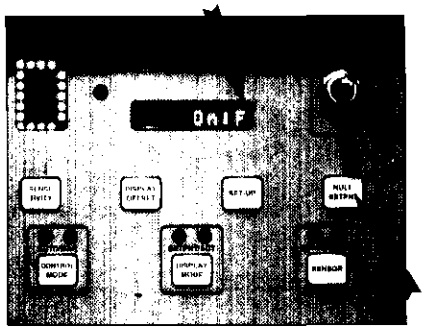



The Display Offset pad is used to scroll forward through the different variables.






The toggle switch is used to change the value in the LCD display for the selected variable.




The Null Setpnt pad is used to change the letter at the end of the selected variable. "D" means that this variable will only appear in the dealer menu. "F' means that the selected variable will appear in both the Dealer and the Foreman Menus.

## Premier Configuration Chart

(C & D Series Machines)

| *Configuration Variable* | *Instructions* | *Value* | *Menu* |
|---|---|---|---|
| Battery | | 24 VDC | D |
| Alarm | | ON or OFF | F |
| Display Units | | In or cm | F |
| Left Side Wand Hub | | LEFT | F |
| Right Side Wand Hub | | RIGHT | F |
| Valve Type | | PRPSOL | D |
| Coil/Drive Type | | DUALHI | D |
| Slope Error DeadBand | | .05% | D |
| Wand Error DeadBand | | .02 | D |
| Ultrasonic Error DeadBand | | .04 | D |
| Wand Error Limit | | 2.00 | D |
| Ultrasonic Error Limit | | 2.00 | D |
| Left Valve Frequency | | 150 | D |
| Right Valve Frequency | | 150 | D |
| Left Side Raise Valve Step | Adjust Valve Steps | | D |
| Left Side Lower Valve Step | Adjust Valve Steps | | D |
| Right Side Raise Valve Step | Adjust Valve Steps | | D |
| Right Side Lower Valve Step | Adjust Valve Steps | | D |
| Slope Filter | | 0.0 | D |
| Wand Offset | | 2.00 | D |



## Checking System Performance

**(Fine Tuning Valve Steps)**

1. Move the machine to a flat surface. Lower the screed to the ground. Pull the machine slightly forward taking the slack out of the tow point.
2. Move the tow point cylinders to the center position.
3. Put the screed thickness controls to null.
4. The following conditions must be met during the performance check:
   - The park brake must be applied.
   - The machine must be in pave.
   - The maximum speed potentiometer must be at the 50% position.
   - The propel control must be forward.
   - The hydraulic temperature must be at 38° C (100° F).
5. Put the control box for the system in the Slope position. Null the control and place the system in the Automatic mode.
6. Bump the toggle switch up two clicks. Observe the upward movement of the tow point cylinder. If the cylinder does not make a complete change in 2 or 3 seconds, you should increase the value of the valve step. If the cylinder moves too fast, you should decrease the value of the valve step. If the cylinder overshoots the correct position and the cylinder then returns, you should decrease the value of the valve step.

*(continued)*

**NOTE:** The valve steps should always be set with the tow point cylinders at the center position or near the center position.

7. Access the the Dealer Menu. Make the changes that are required to the Valve Steps until the criteria for the performance of the system is met.
8. Repeat the procedure for the downward direction. Bump the toggle switch down two clicks and observe towpoint cylinder movement.
9. Repeat the procedure for the opposite side of the machine.

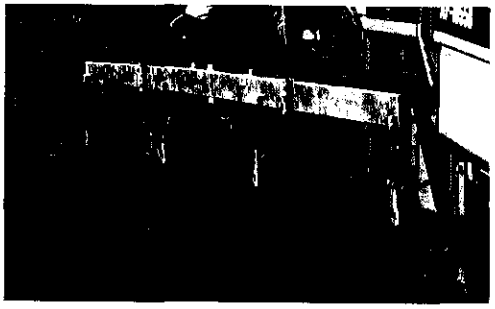
**For more information on Premier, refer to the Operation & Maintenance Manual KEBU7008.**

## SLOPE CONVERSION TABLE

| Percent | Inches Per Foot | Inches Per 12 Foot | Percent | Inches Per Foot | Inches Per 12 Foot |
|---|---|---|---|---|---|
| .17% | | 1/4 | 5.21% | 5/8 | 7 1/2 |
| .35% | | 1/2 | 5.38% | | 7 3/4 |
| .52% | 1/16 | 3/4 | 5.56% | | 8 |
| .70% | | 1 | 5.73% | 11/16 | 8 1/4 |
| .87% | | 1 1/4 | 5.90% | | 8 1/2 |
| 1.04% | 1/8 | 1 1/2 | 6.08% | | 8 3/4 |
| 1.22% | | 1 3/4 | 6.25% | 3/4 | 9 |
| 1.39% | | 2 | 6.42% | | 9 1/4 |
| 1.56% | 3/16 | 2 1/4 | 6.60% | | 9 1/2 |
| 1.74% | | 2 1/2 | 6.77% | 13/16 | 9 3/4 |
| 1.91% | | 2 3/4 | 6.94% | | 10 |
| 2.08% | 1/4 | 3 | 7.12% | | 10 1/4 |
| 2.26% | | 3 1/4 | 7.29% | 7/8 | 10 1/2 |
| 2.43% | | 3 1/2 | 7.47% | | 10 3/4 |
| 2.60% | 5/16 | 3 3/4 | 7.64% | | 11 |
| 2.78% | | 4 | 7.81% | 15/16 | 11 1/4 |
| 2.95% | | 4 1/4 | 7.99% | | 11 1/2 |
| 3.13% | 3/8 | 4 1/2 | 8.16% | | 11 3/4 |
| 3.30% | | 4 3/4 | 8.33% | 1 | 12 |
| 3.47% | | 5 | 8.51% | | 12 1/4 |
| 3.65% | 7/16 | 5 1/4 | 8.68% | | 12 1/2 |
| 3.82% | | 5 1/2 | 8.85% | 1 1/16 | 12 3/4 |
| 3.99% | | 5 3/4 | 9.03% | | 13 |
| 4.17% | 1/2 | 6 | 9.20% | | 13 1/4 |
| 4.34% | | 6 1/4 | 9.38% | 1 1/8 | 13 1/2 |
| 4.51% | | 6 1/2 | 9.55% | | 13 3/4 |
| 4.69% | 9/16 | 6 3/4 | 9.72% | | 14 |
| 4.86% | | 7 | 9.90% | 1 3/16 | 14 1/4 |
| 5.04% | | 7 1/4 | 10.07% | | 14 1/2 |

## FORMULA

$$\text{PERCENT} = \frac{\text{INCHES PER FOOT} \times 100}{12}$$



## Averaging Skis Are Key to Smoothness

The majority of state Departments of Transportation (DOT) now have payment incentives and penalties written into their specifications for pavement smoothness. Whether the specification is written around profilograph results or, more recently, around the International Roughness Index (IRI), project profitably may hinge on your ability to collect a significant amount of the available smoothness incentive.

It is now absolutely clear that proper use of averaging skis on ride incentive projects is the key to maximizing the amounts of incentives earned. While doing the fundamental things right, usually called best paving practices, is still very important, the inclusion of averaging skis into standard highway paving practice has become a requirement.

*(continued)*



Skis come in various lengths and configurations. Some reference a target outside the paving width. Some reference inside the paving width. Some even extend over the screed. When selecting the right ski (mobile grade reference), two factors should always be considered first: (1.) the longer the better and (2.) the more articulation points the better.

A variety of averaging devices are available from Caterpillar and other paver manufacturers. Following is a review of the Caterpillar averaging skis.

## Tips for Using Skis

1. Install any averaging device so the center of the string or beam is just behind the tow point cylinder. This is the ideal point for grade sensor location when ultimate smoothness is the goal. Remember, on a device like the Outboard Leveler, the center of the string will show the most reduction in grade deviation. The tow point reaction will be exactly the same amount as the sensed grade deviation and mat smoothness will be the best when the center of the string or beam is in this position.
2. Position the grade sensor (mechanical or sonic) in the middle of the string. Adjust the tension of a mechanical sensor arm so the arm maintains good contact with the string. Position sonic sensors 35-40 cm (14"-16") above the string.

*(continued)*

3. Adjust string tension so there is no slack or vibration. Use string that is at least 3 mm (1/8") in diameter to provide a good target for sonic sensors. String must be a minimum of 10 cm (4") above beam.
4. Do daily maintenance on towed skis. The feet that contact the grade can pick up tack. Excessive tack build-up can cause the towed ski to vibrate excessively. Clean the ski feet at the end of each shift.

## Using Two Skis

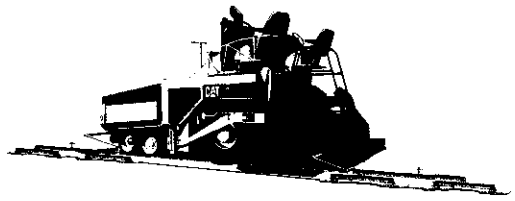
On any multi-lift project, install averaging skis on both sides of the paver for every lift after the bottom lift. On the bottom lift, it is common to operate with an averaging device on the centerline side of the paver and slope control for the shoulder side. This will build the correct profile as specified in the project plan. If the profile of the structure is already correct, as is the case on some overlay or mill/fill projects, operate with two skis on every lift.

On smoothness projects, once the correct profile is built, your main concern is mat smoothness. So, look at the grade reference possibilities. Determine whether you can sense a reference outside the paving width or if you have to sense inside the paving width. Then, select the type of averaging device that best matches the paving application. Remember, the longer the better and the more articulation points the better.



Do not hesitate to use an averaging ski when matching a longitudinal joint. In the past, the conventional practice was to use a single sensor directly referencing the adjacent mat for joint match. A single sensor without an averaging ski produces a fast reacting screed, good for exact joint match but bad for smoothness.

Ride incentive money is out there. You should be earning as much of it as possible on every project. Put averaging skis to work for you. You'll see better results.



## Outboard Leveler

The Outboard Leveler is towed by the paver and references the grade outside the paving width. It comes in two lengths: 9.15 m (30') or 12.2 m (40'). It has multiple feet and multiple articulation points. It has the ability to reduce the amount of sensed grade deviation by a factor of eight. In other words, if a ski foot runs over a 25 mm (1") deviation, the center of the string running between the ends of the ski will move only 3 mm (1/8"). The grade sensor (either sonic or mechanical) will send a signal to the control box signifying a 3 mm (1/8") correction is required. The screed will make a small, slow correction and the deviation will be spread out over a long portion of the mat.

The Outboard Leveler is judged the ultimate averaging device for smoothness. It is recommended for highway projects when long pulls are the norm. Its main drawback, when compared to non-contacting averaging skis, is that it is harder to transport because of its size and number of moving parts.



## Mobile Stringline

The mobile stringline is a two-section arrangement of beams and shoes that mount outboard of the paving width. A 2.44 m (8') articulated section attaches to the front of the paver and a 1.22 m (4') articulated section attaches to the screed end gate. A string runs between the two sections to provide a reference for the grade sensor.

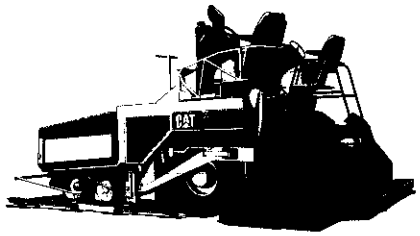
The Mobile Stringline provides about 50% of the averaging capability compared to the Outboard Leveler, so it is less suitable for optimum smoothness. It does a very good job for yield control and for joint matching, while providing an averaged reference. It is normally used on highway projects with long continuous pulls.

## Fore and Aft Leveler

The Fore and Aft Leveler mounts inboard of the paving width and bridges the screed extender to reference ahead of the screed and behind the screed. The front section is similar to the multi-articulated portion of the Outboard Leveler and the rear section is a wide foot that is towed by the screed and rides on the freshly laid mat. It also provides about 50% of the averaging capability compared to the Outboard Leveler. One significant benefit of the Fore and Aft Leveler is that the rear portion uses the smooth mat as a reference. This method is very popular when there is no suitable grade reference outside the paving width. It is often used on the shoulder side of the paver in conjunction with the Outboard Leveler used on the centerline side of the paver.

It is used mainly on highway jobs with long continuous pulls. The rear foot must be heated prior to use on the hot mat. The rear portion blocks access to the outside of the screed extender.





## Inboard Leveler

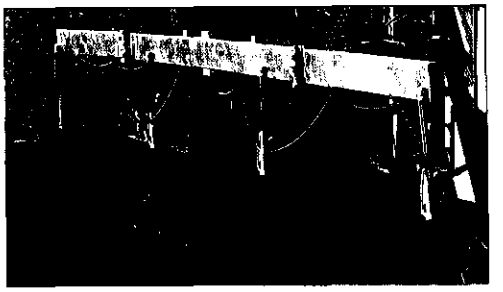
The Inboard Leveler is a shorter stringline with many features of the Mobile Stringline. The leveler consists of a 3.66 m (12') multi-footed and multi-articulated beam attached to the front of the paver, running inside the paving width. A stringline runs from the center of the beam to a rod that is mounted to the screed. Its short length reduces the averaging capability.

The Inboard Leveler is easy to set up and is economical. Because of its smaller size, it provides a good reference for confined areas like parking lots. It is very suitable for yield control and for joint matching.


## Rigid Ski

The Rigid Ski, 9.15 m (30') or 12.2 m (40'), was the first averaging device to be developed. It is a welded steel, triangular frame that rides on the grade reference outside the paving width. It will bridge low spots as long as the depression is shorter than the length of the ski. When it rides over high spots, it provides about 50% reduction in the size of the sensed deviation. Therefore, it provides the least amount of averaging compared to all other mobile grade references. The use of rigid skis has virtually disappeared because they are least suitable for projects with smoothness specifications tied to pay factors. It is recommended only for projects where a minimum amount of grade averaging is acceptable.





## Sonic Averaging Beam

The Sonic Averaging Beam is the most recently developed averaging device. It is an 8.5 m (28') long, four-section, hinged aluminum beam with four sonic sensors evenly spaced along the length of the beam. The beam is solidly attached to the paver and can be installed to sense the grade outboard or inboard of the paving width. The signals from the four sensors are combined and averaged by the automatic grade control box. Its averaging capabilities are somewhat less than the Outboard Leveler. It has become very popular for a variety of reasons. Because it is attached to the paver and does not contact the grade reference, it is easy to transport compared to "drag" skis. Because it can sense grade both outboard and inboard of the paving width, it has the most versatility and can be used for nearly any application. Since it is non-contacting, it does not pick up tack and requires less maintenance.

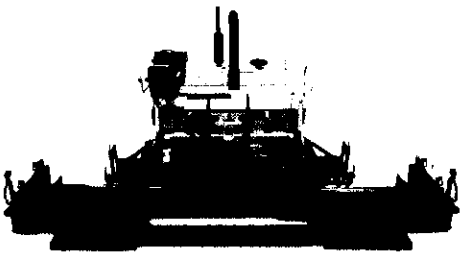
*(continued)*

There are some concerns about using the Sonic Averaging Beam. The beam is not independent of the paver and will be affected by vertical displacement of the paver. Sonic sensors can be affected by airflow from the paver's cooling system. Finally, when installed inboard of the paving width, sensor number three can be influenced by the head of material in front of the screed extender.

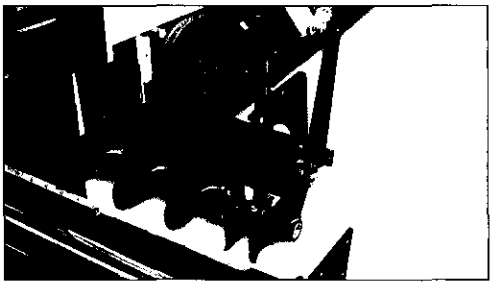


## Extended Width Paving

When paving wider than the standard main screed width, there is concern about the need for auger, mainframe and screed extenders. This information is a guide to help control head of material in the auger chamber. When the machine is set up correctly, a consistent head of material will flow to the end gates.



The picture above shows a machine set up for wide width paving. Auger, mainframe extenders, mainframe extender braces, bearing support brackets and screed extenders have all been added. This configuration will allow this machine to pave to a maximum width of 7.37 m (24' 2").



## Auger Extenders

The suggestions here are for paving a constant width with little or no variation. Having the right length augers will help control head of material and segregation.

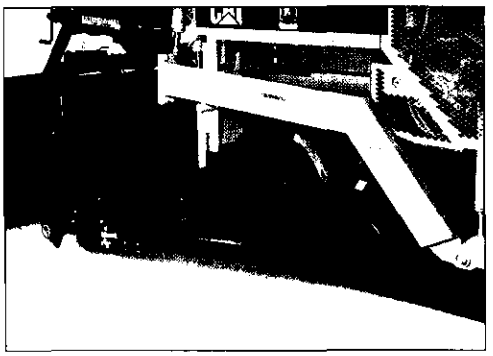
When paving variable widths, use as much auger as possible without interfering with minimum paving width.

Auger extenders on front mounted or fixed width screeds, needs to be kept within 30-61 cm (12"-24") of the end gate depending on how the material flows.

Auger extenders on rear mounted screeds are a little more forgiving. They need to be kept within 61-91 cm (2'-3') of gate end.

Auger extenders in excess of 61 cm (2') should use wide width auger bearing supports.

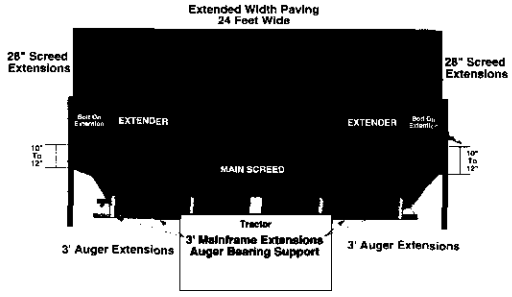




A good rule to remember when using auger extenders is, 30 cm (1') of auger extender equals 30 cm (1') of mainframe extender. This will always bring the mainframe out about 15.2 cm (6") beyond the last auger segment. No auger segments should be open towards the front of paver.

Mainframe extenders are very instrumental in maintaining proper head of material and helping to prevent segregation.

If an auger support bearing bracket is used, a brace from the tow point to the end of the main frame extender is needed.



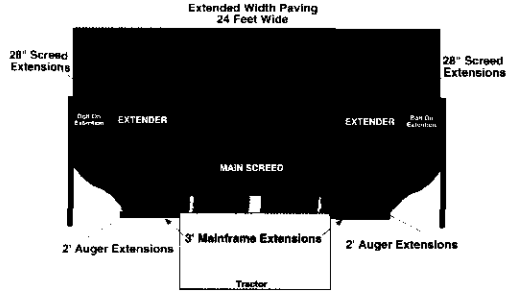

While a constant head of material is an important part of maintaining smoothness, it becomes even more critical when paving wide widths.

The material that is carried in front of the extenders has to be constant. Even the smallest variation will cause the screed to react.

The drawing shows an example of the material flow on a machine with a rear extendable screed set up correctly for wide width paving.

The material should come off the last section of auger and flow to the screed. The mainframe extender should contain the material and allow it to flow off the last auger segment to a point on the endgate about 25.4-30.5 cm (10"-12") in front of the screed.



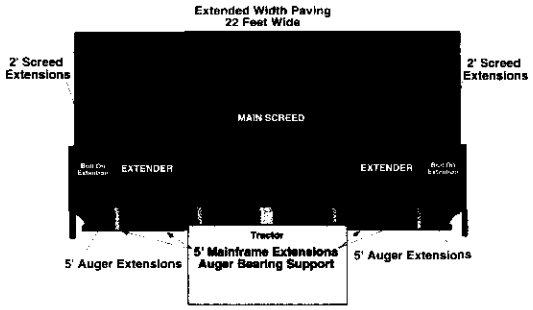



If you don't have an auger bearing support, the maximum amount of auger extenders recommended is 61 cm (2'). All the other rules still apply. Keep the mainframe extenders out past the last auger segment.

Set the flow so the material comes off the last auger segment and flows to a point on the endgate about 25.4-30.5 cm (10"-12") in front of the screed.

As you can see by the drawing, the material pushes past the last auger segment but is still contained by the mainframe extender. At this point the natural rearward flow takes over.

Regardless of how the material is reaching the screed, a constant head of material is crucial in holding grade and smoothness.




When paving extended widths with a screed that has front mounted extenders, try to keep as much auger and mainframe as you can. Try to bring the auger to within 30 cm (1') of the endgate. The same rules apply to mainframe extenders as on a screed with rear extenders.

If you add more than 61 cm (2') of auger, you have to add an auger bearing support.

Providing a smooth continuous flow of material to the end gates while providing sufficient flow to the main screed is the objective. Keeping the material moving without any fluctuation in the head is critical in wide width paving. Any change in head of material will effect mat smoothness.



## Conclusion

This book covers a lot of different things that hopefully will improve your paving operation.

Some of the key points to remember are:

**Follow Paving by the Numbers.**

**Constant paving speed** – Calculated at the beginning of every job.

**Constant head of material** – Keep the feed sensors adjusted properly and the head of material consistent.

**Screed adjustments** – Make minor adjustments giving the screed time to react. Remember the basics. It takes five tow arm lengths to complete a change made to the screed.

**Grade sensor position** – Know what you want to do and the type of reaction you need from the sensor.