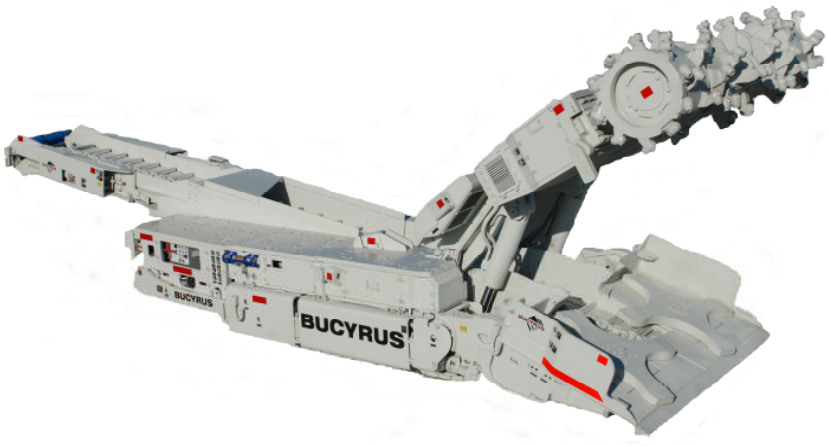
Operation Manual

Bucyrus - Continuous Miner
Model - 25M3 with Simpson Radio Controls

Doc. No.: A6474X274



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Characters and symbols used

The following characters and symbols are used for safety instructions and important information in the operating manual.

Try to memorize the symbols and their meanings.

DANGER!
Points in the text marked with this symbol draw your attention to immediately impending danger. Possible consequences are: very serious injury or even death.

WARNING!
These points contain information on dangerous situations. Possible consequences are: very serious injury or even death.

CAUTION!
This symbol draws attention to dangerous situations. Possible consequences are: light to moderately serious injuries and machine damage.

NOTICE!
Points in the text marked with this symbol draw attention to harmful situations. Possible consequences are: damage to the machine or damage in the immediate vicinity.

IMPORTANT!
Points in the text marked with this symbol contain useful tips and information intended to facilitate work for you. They do not warn about harmful or dangerous situations.

- Items in lists are marked with bullets.
  - Points in sub-lists are marked with a long dash at the start of the line.

☞ Points in text marked in this way describe individual operations. Follow these instructions step by step. They will help you carry out your work faster and more importantly, safer.

Installation and start-up

inclined face

On inclined faces secure all component parts by chains, e.g. to the support.

environmental acceptability

When working with oils, greases and other chemical substances, observe the safety regulations applicable to the product. Safety regulations can be found on the container or on the Material Safety Data Sheet (MSDS) for the product.

Dispose of cleaning rags, etc. which have been soiled with oil, grease or other chemical substances in an environmentally safe manner.

controls

When starting up machine, do not operate any controls located inside the operator's compartment (optional) from outside the compartment.

starting procedures

Follow the starting procedure instructions in the operations manual.

red zone

Do not operate any levers, pedals or controls if anyone is in the red zone. (See Red Zone in Chapter 5 of this manual)

Operation

training

Operate the machine only if you have a profound knowledge of the control elements and their functions. It is necessary that you have been task trained on the respective Continuous Miner.

before start-up

Before start-up, ensure that there are no persons or obstructions in your line of travel or in the articulation area when steering the unit.

protective devices

Check that all protective devices are installed on the machine and function properly.

operator's compartment (optional)

Clean the operator's compartment at regular intervals. Ensure that the operating symbols are legible in order to avoid any operator errors and resulting accidents.

Never climb onto, or climb out of the machine while it is in motion.

Do not operate the machine with any part of your body outside of the operator's compartment in order to prevent body parts from being crushed between the machine and outside objects .

traveling

Use extreme caution when traveling in close quarters or in congested or blind-travel areas.

passengers

Never carry passengers. Passengers may be thrown off the machine or crushed between the machine and outside objects.

safety rules

Always follow all safety rules of each particular mine when operating the machine.

problems and malfunctions

If problems or malfunctions are encountered while operating the unit, it must be properly shutdown and the problem corrected immediately.

WARNING!
Warn “ALL CLEAR” before starting the conveyor. Failure to do so may result in serious injury or death.

IMPORTANT!
The “CONV ON” key must be released before “SHIFT”. If “SHIFT” is released first, the conveyor motors will shut off.

IMPORTANT!
The “FAN ON” key must be released before “SHIFT”. If “SHIFT” is released first, the fan motor will shut off.

CAUTION!
Always ensure operator safety while operating the machine.

CAUTION!
Always be alert to hazardous conditions and take corrective action as necessary.

IMPORTANT!
Care should be taken not to stall cutters or conveyor during cutting operations. Severe damage to motors and gear boxes could occur if cutters or conveyor are repeatedly stalled.

IMPORTANT!
Tram is limited in the forward direction while the cutters are running with the cutter head feedback circuit. As the cutters begin to cut the material from the face the sump speed will automatically slow the tram to prevent over sumping the machine.

IMPORTANT!
Inspection of the bits and bit blocks before the start of each shift will reduce later problems. Mining with dull, bent or broken bits and bit blocks increases dust and noise levels, as well as putting excessive strain on both cutter motors and tram components.

WARNING!
Failure to maintain the hydraulic system will result in damage to its hydraulic components which will result in increased wear and premature failure.

IMPORTANT!
Schematics may vary from one unit to the next. Consult the Bucyrus America, Inc. parts book for the schematic for your machine.

IMPORTANT!
During disassembly of control valves, give particular attention to identification of parts for reassembly. Spools are selectively fitted to valve bodies and must be returned to the same bodies from which they were removed. Spools are NOT interchangeable between valve bodies.

WARNING!
Each stabilizer cylinder is extremely heavy. The next steps will remove the cylinder from its tractor frame mounting. Be prepared to support the weight from its tractor frame mounting. Be prepared to support the weight of the cylinder when it becomes free from the mounting.

IMPORTANT!
To obtain maximum performance, the duocone seals must be installed accurately to insure uniform loading at the mating faces and achieve a stable running position. Misalignment or cocking of seal rings during assembly can produce non-uniform loading and wobbling of the seals in their housings resulting in leakage due to scoring and/or pumping of debris past the toric rings. Improper installation can also result in breakage of the metal seal rings.

NOTICE!
Improper care and installation of duocone seals can result in immediate leakage or reduced service life.

IMPORTANT!
The toric must lie uniformly in the seal with the sealing ring and parallel to the seat face. Be sure that the toric is not twisted and that it rests uniformly against the retaining lip or not deeper in one side of the seat than the other.

IMPORTANT!
Do not get any oil onto the rubber torics!

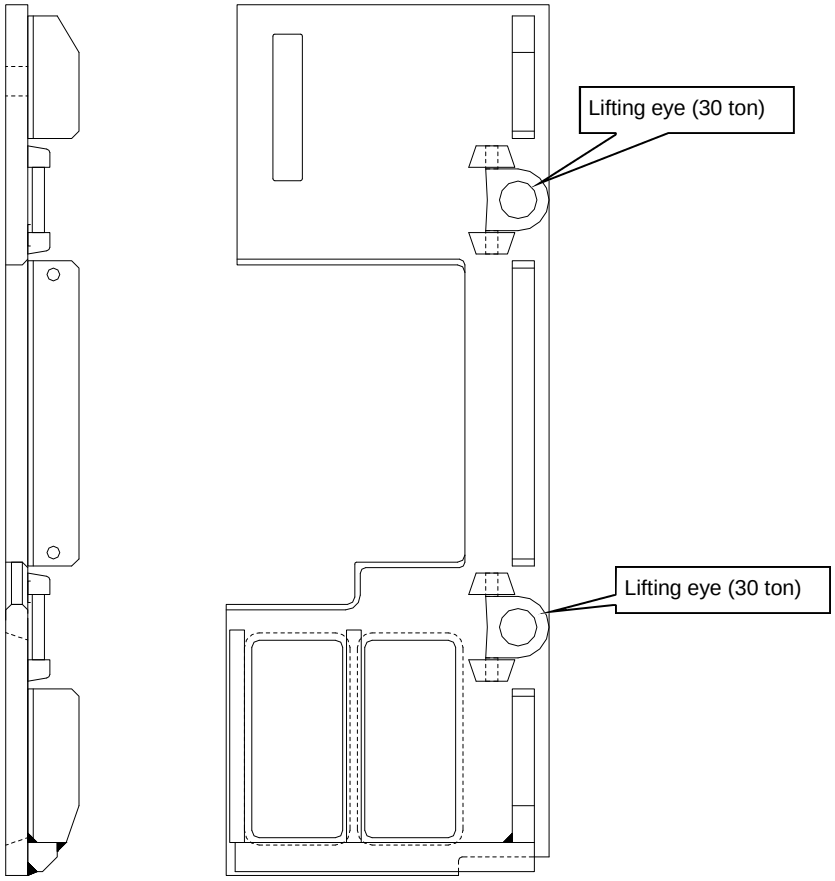
IMPORTANT!
Even a small piece of lint can hold the faces apart and cause leakage!

IMPORTANT!
A mixture of marking compound and spindle oil is good lube for the gears under light loads for 2-3 revolutions only. Check tooth patterns all round to make sure the pattern/markings are uniform.

CAUTION!
Be careful not to set fire to any grease or lubricant when heating bearings!

IMPORTANT!
Observe all applicable fire and safety regulations when heating bearings!

Fig. 5 (continued): Lifting points



Bumper

Fig. 6 (continued): Safety features on the Continuous Miner

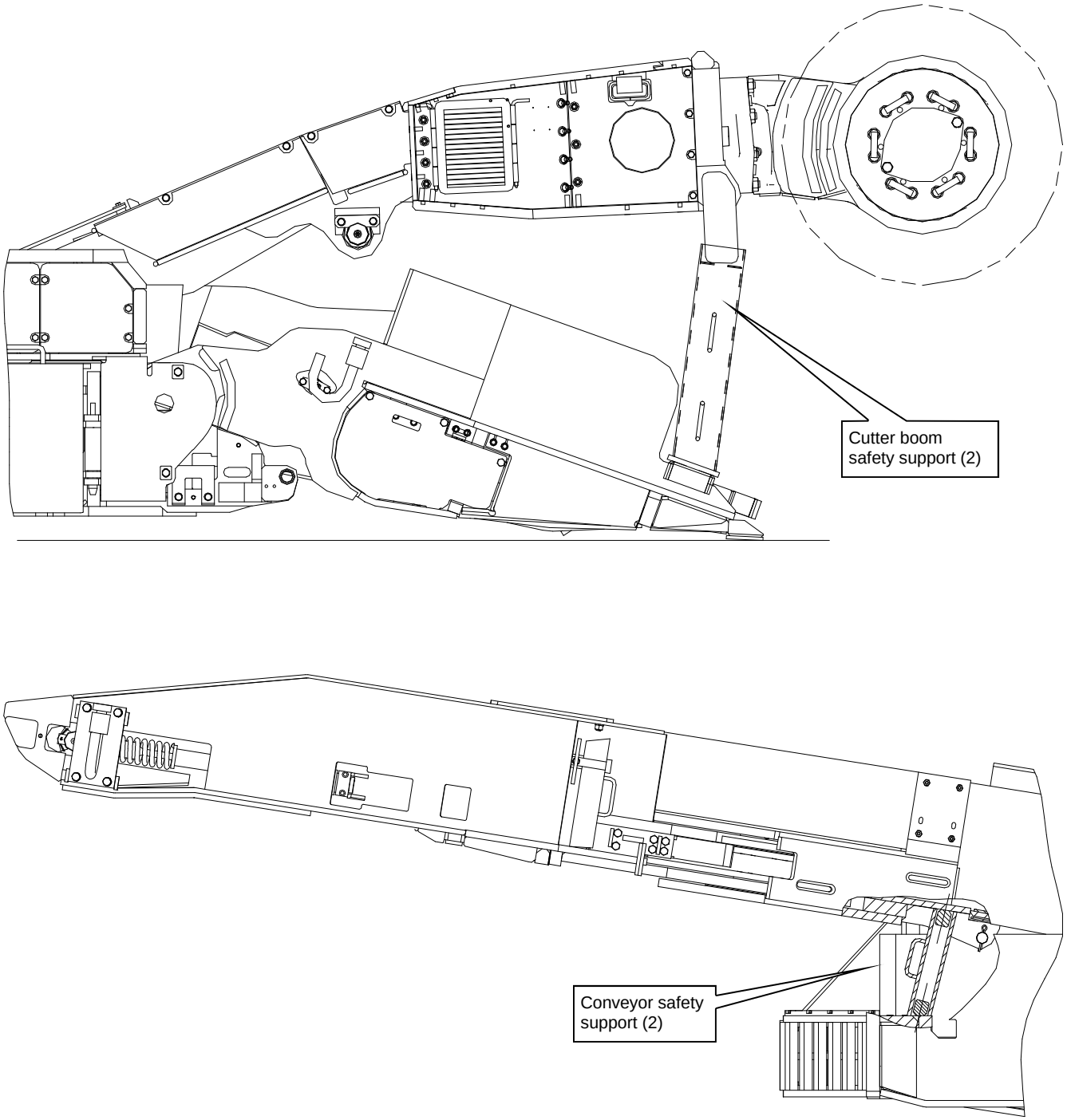
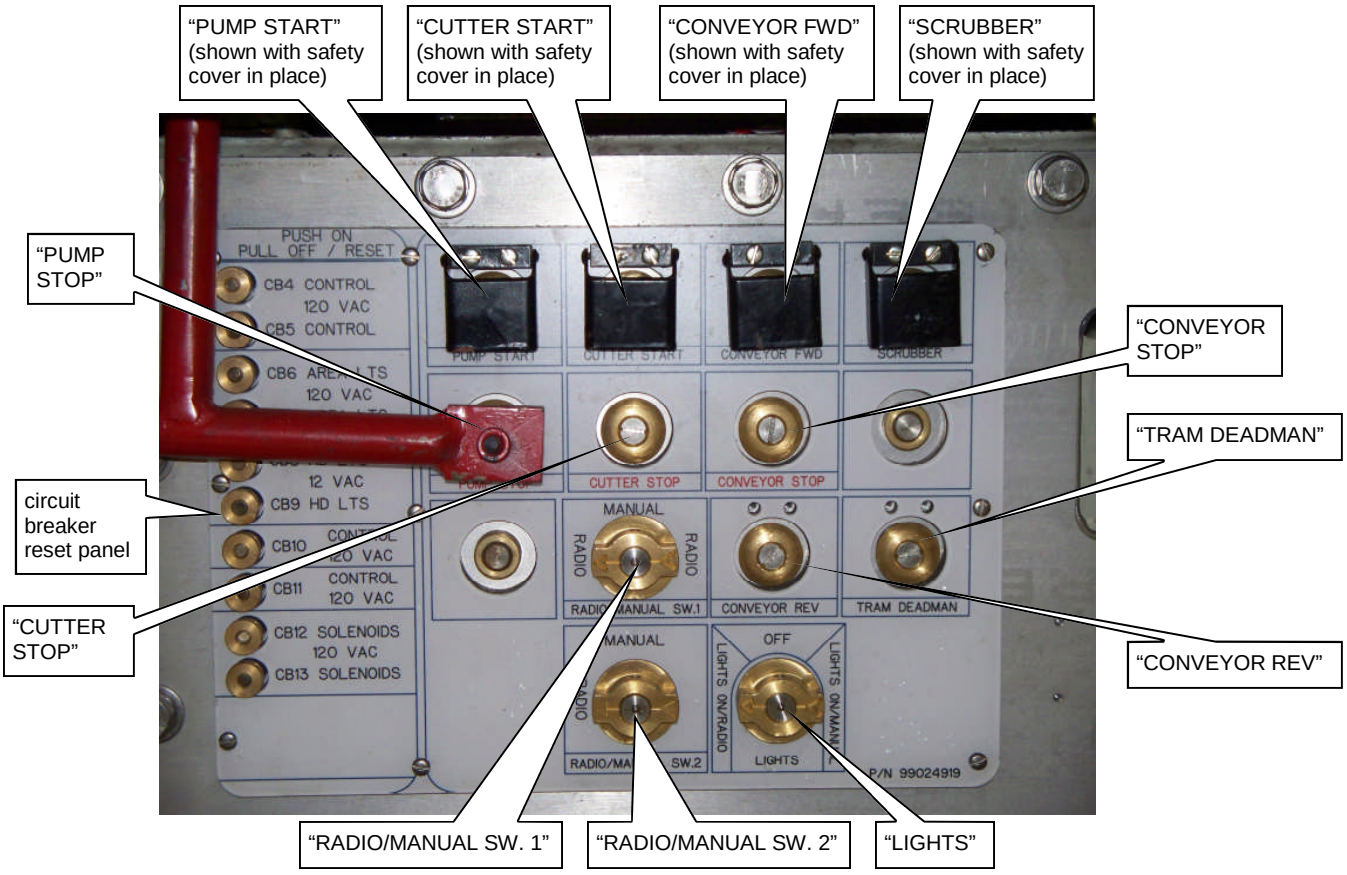


Fig. 11: Electrical control switch (s)



Red zone

Remote controlled continuous miners

The remote control of miners introduces certain potential safety hazards which the miner operator must watch for and be aware of. While the operator is now free to position himself for convenient visibility of mining operations at the face, he can easily expose himself to the danger of being near mobile heavy equipment.

Most significantly, the operator's greatest danger is from his Continuous Miner, especially when he is maneuvering it during mining operations. The miner is capable of slewing when turning, especially when the crawlers are split. The discharge conveyor can also swing. In each of these cases, the miner operator is in danger of being hit, or worse yet, run over by his own machine. Equally dangerous is the possibility of the operator being pinned against the rib by his own miner.

Miner operator danger areas, or Red zones

Some typical situations dangerous to the miner operator are illustrated on the following pages. The danger area, or red zone (Fig. 22) is indicated by alternating red and white diagonal stripes.

Fig. 22: Red zone

Remote console - tram speed control:

The system allows the tramming to be driven in three discrete speeds (SPEED 1, SPEED 2, and SPEED 3). SPEED 1 is the default tramming speed.

To advance a speed:

☞ Press the tram levers and “TRAM 2-3” keys together to move from SPEED 1 to SPEED 2.

☞ Once in SPEED 2, press the tram levers and “TRAM 2-3” together to move from SPEED 2 to SPEED 3.

The following tramming configurations are enforced by the control system for safety reasons:

- Spilt track tramming is limited to SPEED 1.
- Single track tramming is normally limited to SPEED 1.
- It is possible to speed up a single track from SPEED 1 to SPEED 2 providing that tramming is started in SPEED 1.
- Tramming is limited to SPEED 1 while the cutters are on.
- While the cutters are running, reverse speed can be incremented even while the forward tram keys are being pressed. Note that this option is used when the miner is retreating or pillar mining.

- To maintain smooth level floor conditions, it may be necessary to tram the machine backward approximately 36 in., thus trimming ridges and smoothing the floor. This may or may not be necessary each cut sequence depending on mine conditions.
- Repeat this procedure to desired depth of cut.
- Turning crosscuts is accomplished by making a series of partial] cuts (sumps) until the machine can be turned to the desired angle.

Relocating the miner

- Ensure rear stabilizer is raised from the floor.
- Position cutter boom so as to prevent it from hitting roof, ribs, or floor.
- Raise gathering head.
- Lower conveyor boom down and position so it will not hit roof, ribs, floor or any other equipment or obstacles.
- Ensure that trailing cable out of the path of travel.
- Ensure there is enough clearance when relocating to avoid damage to machine and ensure operator safety.
- Be alert to any people, obstacles, or other machines.
- Know the position of fellow workers.
- Engage tram in desired direction.

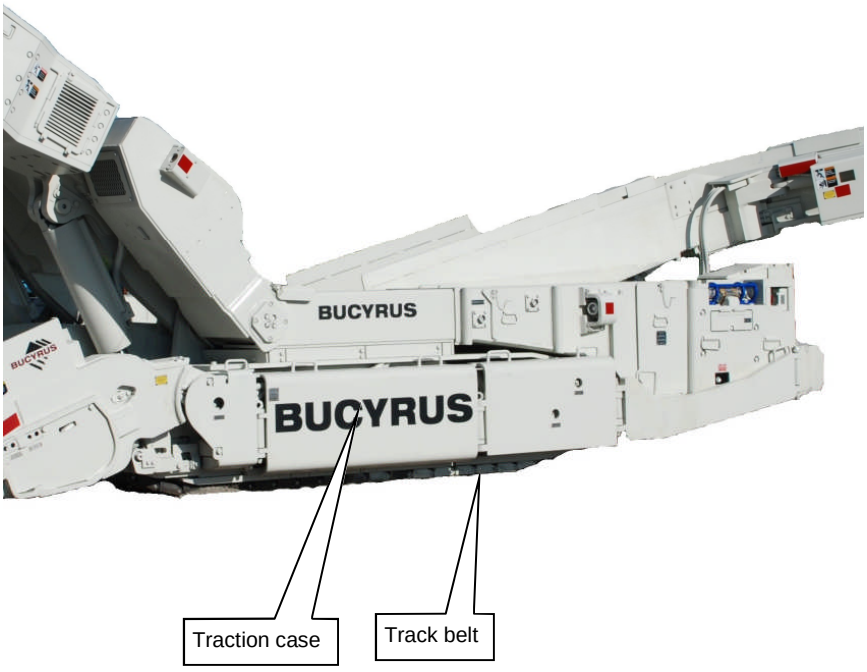
Traction system

The Continuous Miner is trammed by two individually controlled traction systems (Fig. 36). Each traction assembly has an electric motor connected to a tram drive gear case. The gear case encloses a bevel gear that drives a planetary sun gear. The gear case reduces the rotation speed, increases torque, and provides a right-angle drive to the drive sprocket.

The drive sprocket is directly connected to a tram drive planetary gear case. This gear case reduces the rotation speed, increases torque, and drives the track belt. (See the Maintenance section in this chapter for track belt adjustment procedures and Traction assembly maintenance procedures.)

There are three (3) tram speeds: 1st, 2nd, and 3rd. The speeds are selected from the radio transmitter.

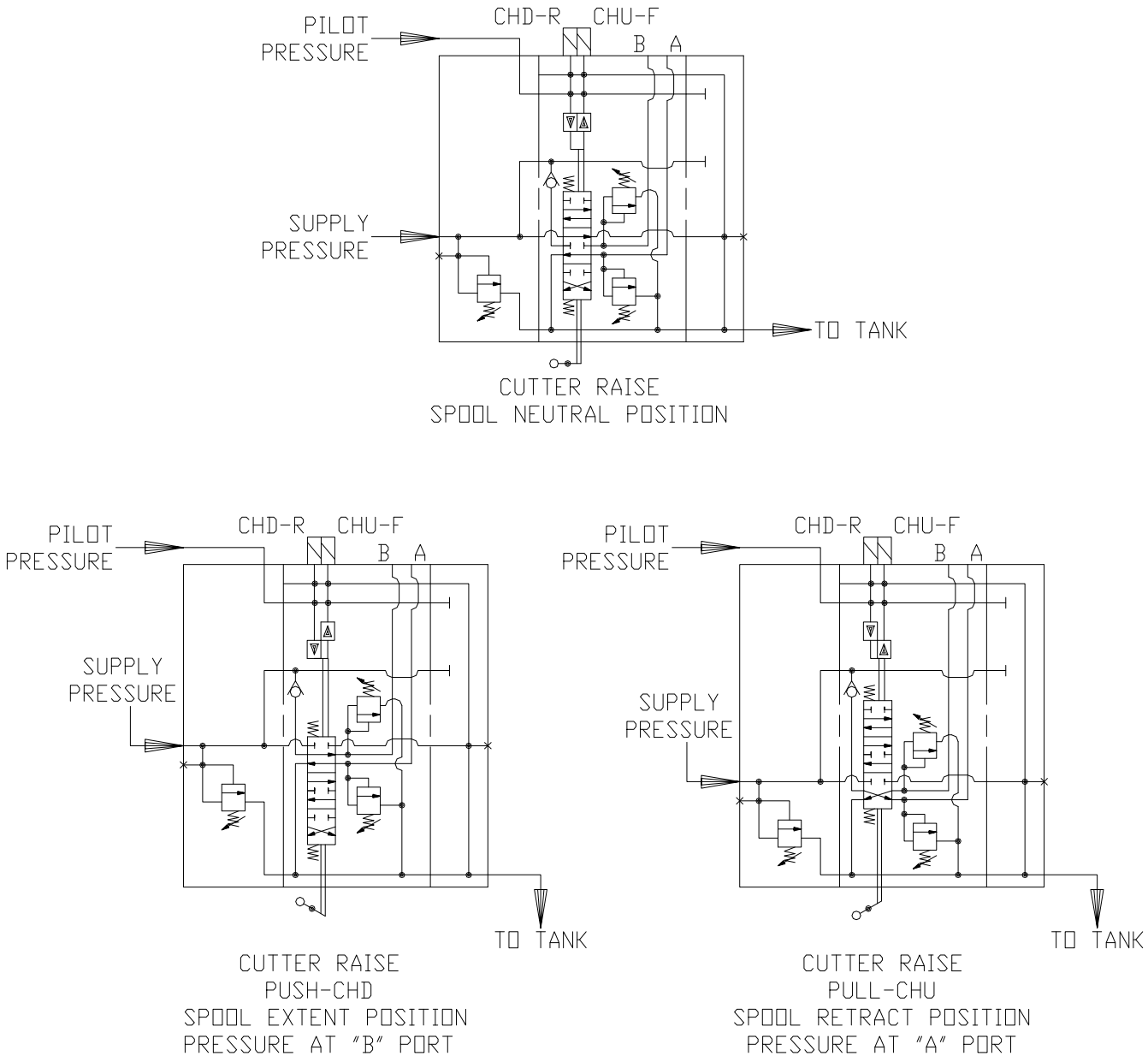
Fig. 36: Traction system



How to read a hydraulic schematic

All valves are shown in the neutral position on the hydraulic schematics. To follow oil flow through a system, visually imagine the valve spool shifting as shown in Fig. 44.

Fig. 44: Oil flow through a spool

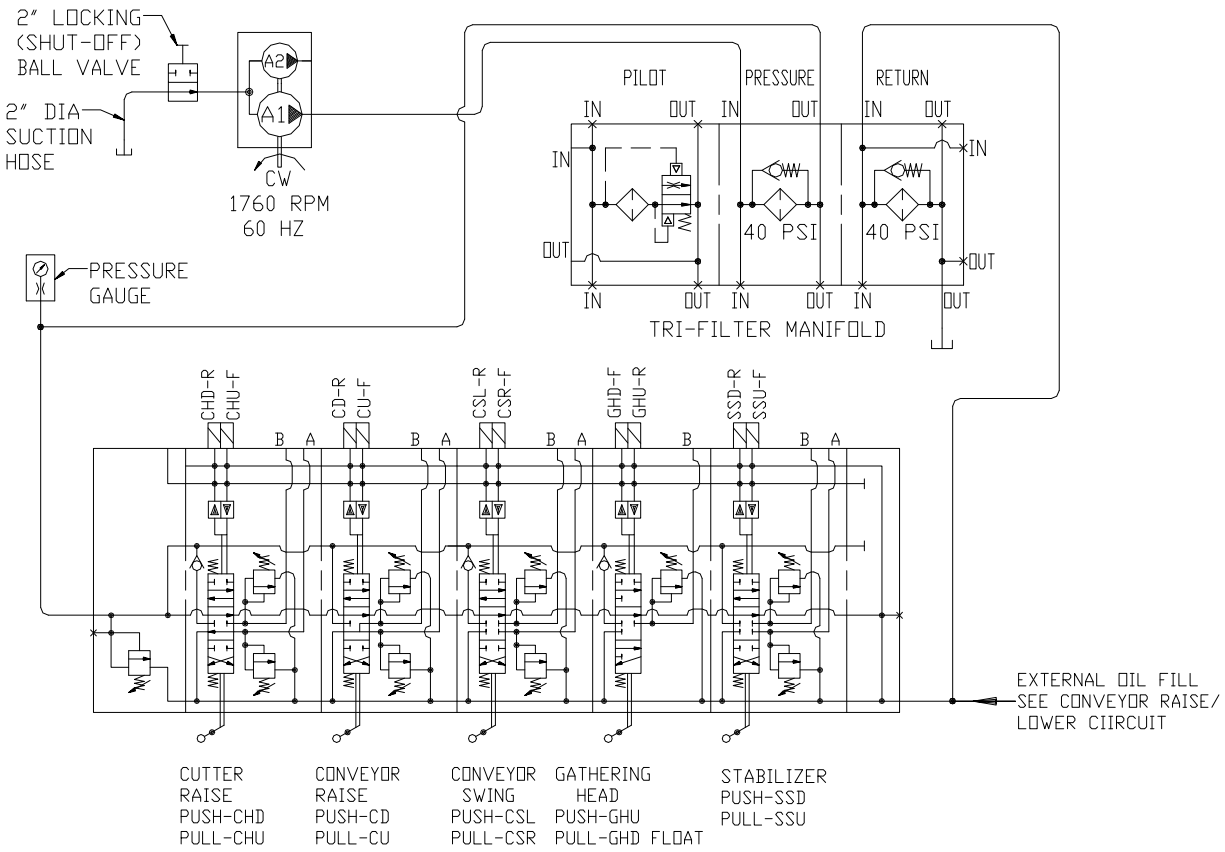


Main flow - primary pressure circuit

The main flow-primary pressure circuit is powered by hydraulic pump gear section A1. The A1 gear section is rated at 30 GPM at a pressure of 3,000 psi. The system is an open-center circuit and it supplies oil flow to the main control valve. The main control valve operates the cutter head, conveyor raise and swing, gathering head, and stabilizer shoe cylinders, along with oil tank fill. After passing through the 2" locking ball valve and pump gear section A1, oil enters a 10 micron by-passing pressure filter (tri-filter manifold) and continues to the main control valve, whose relief is set at 3,000 psi. On the return side of the system, oil exits the main control valve. There is a tee to allow external filling of the reservoir (see conveyor raise/lower circuit). Oil enters a 10 micron by-passing return filter (tri-filter manifold) before entering the oil reservoir. Once in the reservoir, the oil is forced to flow through and around baffle plates for cooling and de-aerating before re-entering the suction line. Also, located in the reservoir are floor magnets which will trap ferrous metal particles.

The schematic shown in Fig. 51 is a typical primary pressure circuit. Always refer to the schematic in your Bucyrus America, Inc. Parts Book for your machine.

Fig. 51: Main flow-primary pressure circuit



Stabilizer shoe cylinders circuit

Oil is supplied by hydraulic pump section A1 through a 10-micron by-passing pressure filter (tri-filter) to the stabilizer shoe working section on the main control valve. By manual or remote solenoid control, the spool allows oil to enter the stabilizer shoe circuit. The stabilizer shoe cylinder is a double-acting cylinder. There are two stabilizer shoe cylinders.

There are two port reliefs in the working section on the main control valve. Port relief to lower the stabilizer shoe is set at 2500 PSI. Port relief to raise the stabilizer shoe is sat at 1200 PSI. Push the handle it extends the cylinders and lowers the stabilizer shoe. Pull the handle it retracts the cylinders and raise the stabilizer shoe. Solenoid designations are SSU-F (stabilizer shoe up – front solenoid and SSD-R stabilizer shoe down – rear solenoid).

The schematic shown is Fig. 58 is a typical stabilizer shoe cylinder circuit. Always refer to the schematic in your Bucyrus America, Inc. Parts Book for your machine.

Fig. 58: Stabilizer shoe circuit

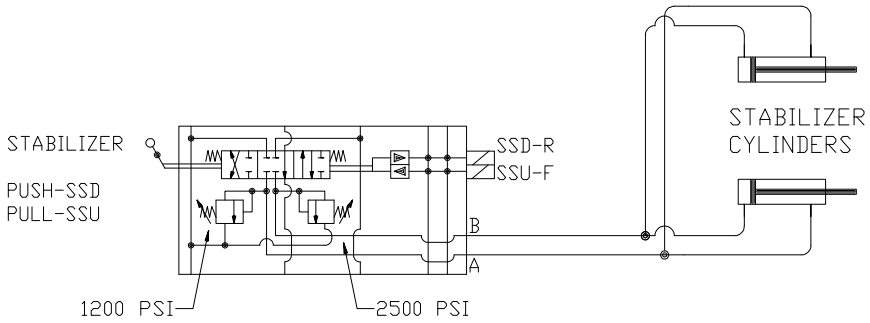
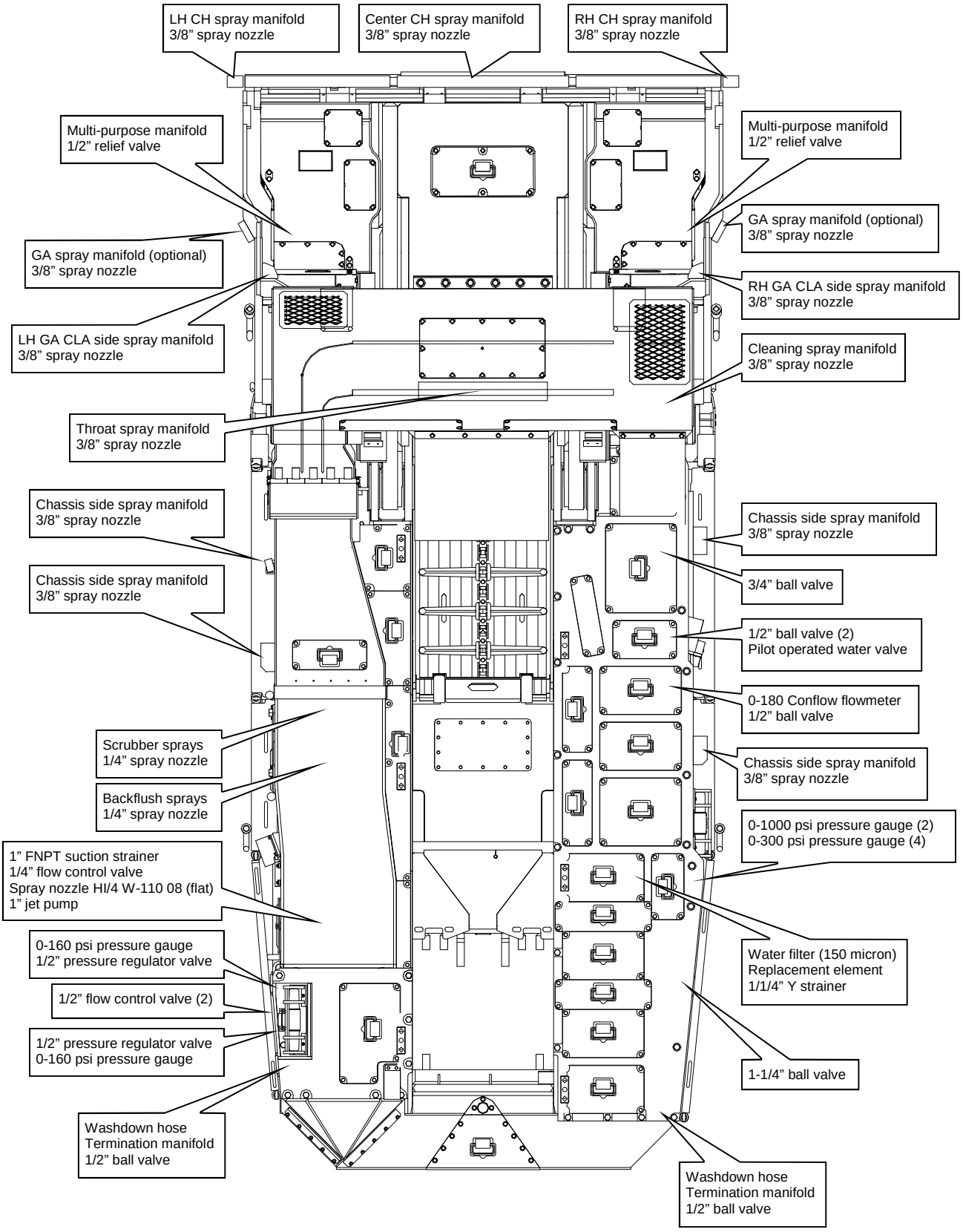


Fig. 64: Scrubber and dust-cooling component locations

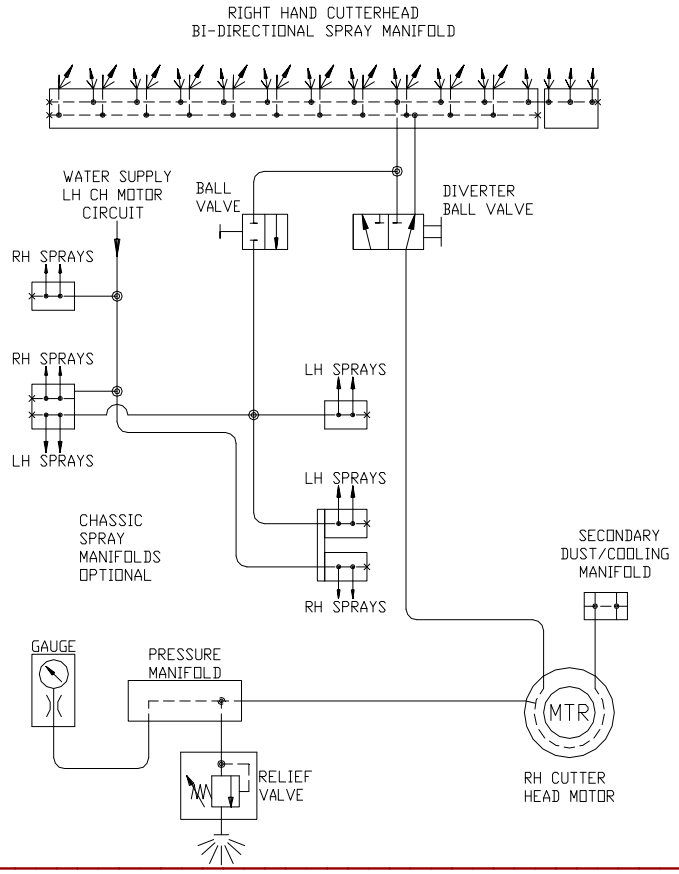


Dust-cooling right hand cutter head motor circuit

The dust-cooling right hand cutter head motor circuit (Fig. 72) continues from the dust cooling water supply circuit. Water from the secondary dust-cooling pressure manifold cools the right hand cutter motor. Water flows from the side port of the cutter head motor to an atmospheric relief mounted on a pressure manifold. The atmospheric relief is in place in the event that the pressure builds up from clogged spray nozzles. A pressure gauge (optional), typically mounted with the gauge package on the right side of the machine, is used to monitor nozzle pressure. The water continues from the right hand cutter motor to a (optional) diverter valve, then to the right hand bi-directional spray manifold. There are two supply lines going to the manifold, one each for the left and right hand sprays.

Bucyrus America, Inc. has an optional spray package available for chassis spray. In this package, a tee is added between the diverter valve and the supply port for the left hand spray of the cutter head manifold. From this tee, water flows to a ball valve, used to turn off or on the chassis side sprays for the left hand spray. With the ball valve open, water supplies three manifolds: two mounted on the right hand side of the machine (with four sprays total spraying towards the front of the machine) and one mounted on the left hand side of the machine (with two sprays total spraying towards the rear of the machine). The side sprays assist airflow direction and dust control.

Fig. 72: Dust-cooling left hand cutter motor circuit



radio system diagnostics

The radio system has a diagnostic display on the miner in an explosion proof enclosure, which can be seen at the right rear of the miner. Refer to the separate radio manual that came with your machine for complete use of the diagnostic display.

radio system battery

The radio transmitter has a rechargeable battery, which has a recharge socket for connection to the out-by battery charger. The complete transmitter unit is changed out each shift. The transmitter panel has switches, or keys, for all of the miner functions.

The complete system includes a battery charger which is used to re-charge the transmitter battery. This unit is usually located above ground. Four transmitter units can be recharged at the same time. A built-in radio receiver and screen will allow the transmitter to be tested before use underground and to change channels on the transmitter.

Permissibility

The 25M3 Continuous Miner for use in the United States is designed and built to be MSHA (Mine Safety and Health Administration) permissible: that is, the electrical system uses MSHA certified explosion proof enclosures and MSHA approved intrinsically safe circuits.

All of the electrical circuit components are located within explosion proof enclosures except the radio remote control transmitter, the radio receiving antenna, the manual tram control switches, the low oil level float switch, and the methane monitor.

A permissible explosion proof enclosure will prevent an explosion inside the enclosure from causing ignition of a methane-air atmosphere or a coal dust layer outside the enclosure.

The electrical circuit components not located within an explosion proof enclosure are intrinsically safe circuits.

A permissible intrinsically safe circuit (ISC) is incapable of producing a spark or thermal effect, under the approval criteria, which would cause an ignition of a methane-air atmosphere or a coal dust layer.

Insuring the miner is permissible and safe is the most important maintenance job. Operating equipment must be maintained by a “Qualified Person” as defined in Part 75, Title 30, of the Federal Code of Regulations.

Cutter motor power circuit with control

The pump motor must be running before the cutter motors will start. The cutter motor is a two-hand start. To start: push the pump start and the cutter motor start momentary switch at the same time. The cutter motor can be started in manual by depressing the pump and the cutter momentary switch. This completes the circuit across coil “A” and starts the left cutter motor, as well as starting the TD2 timer for the “B” contactor right cutter motor. Both cutter motors do not start at the same time. When the Time Delay 2 (TD2) timer times out, this completes the circuit across coil “B” and starts the right cutter motor. The holding circuit interlock “A” and “B” must be closed. There are two (2) thermal overloads and two (2) instantaneous overloads; one (1) for each motor Overload (OL)1, 2, 3 and 4. To stop the cutter motor, depress the momentary cutter stop switch.

When in radio mode, the cutter motors can be started from the radio as follows:

- ☞ Ensure that the pump motor is running normally.
- ☞ Press and hold “SHIFT” and wait 1/4 second.
- ☞ Press “CUTTER ON” while holding “SHIFT”.
- ☞ Hold both keys until the cutter motors start.
- ☞ Release “CUTTER ON” first. If “SHIFT” is release first, the cutter motors will shutdown.
- ☞ Release “SHIFT”. The cutter motors should be running.

To shutdown the cutter motors while in radio model

- ☞ Press and hold “CUTTER OFF” and the cutter motors should shutdown immediately.
- ☞ Release “CUTTER OFF”.

See the operation manual for the radio remote that shipped with your machine for options.

The schematic shown in Fig. 79 is a typical cutter motor power circuit. Always refer to the schematic in your Bucyrus America, Inc. parts book for your machine.

Conveyor left/right in radio remote

The pump motor must be running in order to control the conveyor raise, lower, and swing left/right.

To control the conveyor from the radio remote:

- ☞ Press the “CONVEYOR LEFT” key to the left to swing the conveyor tail to the left. The solenoid controlling the left conveyor swing will remain energized until the key is released.
- ☞ Press the “CONVEYOR RIGHT” key to the right to swing the conveyor tail to the left. The solenoid controlling the right conveyor swing will remain energized until the key is released.
- ☞ Press the “CONVEYOR DWN” key to lower the conveyor boom. The solenoid controlling the conveyor lower function will remain energized until the key is released.
- ☞ Press the “CONVEYOR UP” key to raise the conveyor boom. The solenoid controlling the conveyor raise function will remain energized until the key is released.

See the operation manual for the radio remote that shipped with your machine for options.

The schematic shown in Fig. 86 is a typical conveyor left/right in radio remote circuit. Always refer to the schematic in your Bucyrus America, Inc. parts book for your machine.

Torque values

When installing bolts, refer to the torque values on the drawings in the Bucyrus America, Inc. part book for your machine. If a torque value is not listed, refer to Chapter 6 of this manual

Lubricants and fluid capacities

Table 1: Lubricants and fluid capacities

Location	Specification	Approximate capacity	Notes
Hydraulic oil tank	Spec. 100-1	75 gals. (284 L)	
GH Assembly CLA Primary	Spec. 100-15	1 gal (3.79 L)	
GH Assembly CLA POT	Spec. 100-15	2.5 gal (9.46 L)	
Tram Drive Assembly	Spec. 100-15	3 gal (11.36 L)	
Drum Drive Assembly, high speed (back)	Spec. 100-15	0.5 gallon (1.89 L)	
Drum Drive Assembly, low speed (front)	Spec. 100-15	5 gal (18.93 L)	
Motor Lube Hoses	Spec. 100-14	variable	1

Notes:

1. All motor lube hoses are to be filled with high temperature electric motor grease (Spec. 100-14) before assembling them to the electric motor to ensure that there are no air gaps between the grease nipple and the point where the grease enters the motor.

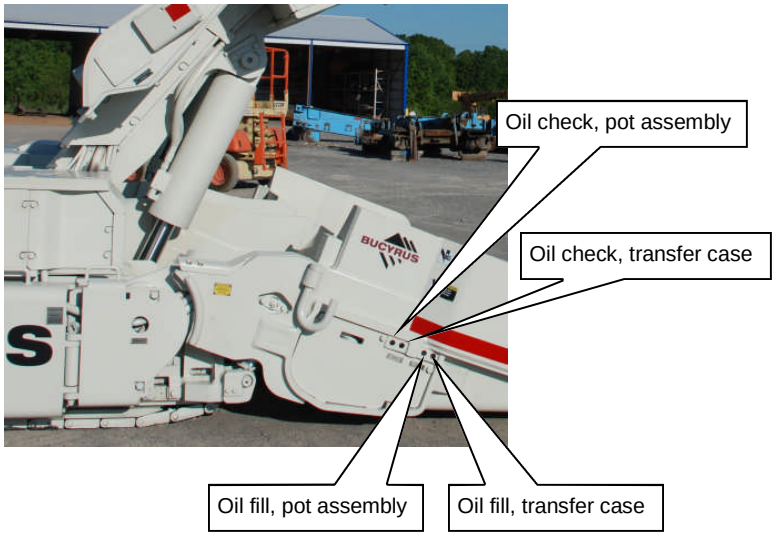
CLA head pot assembly (right and left)

Level the miner and place the gathering head on grade before checking or adding lubricant. Check the oil level in the pot assembly (Fig. 103). If oil is needed, add oil through the fill hole until oil comes out the breather.

CLA head transfer case (right and left)

Level the miner and place the gathering head on grade before checking or adding lubricant. Check the oil level in the hydraulic transfer case (Fig. 103). If oil is needed, add oil through the fill hole until oil comes out the breather.

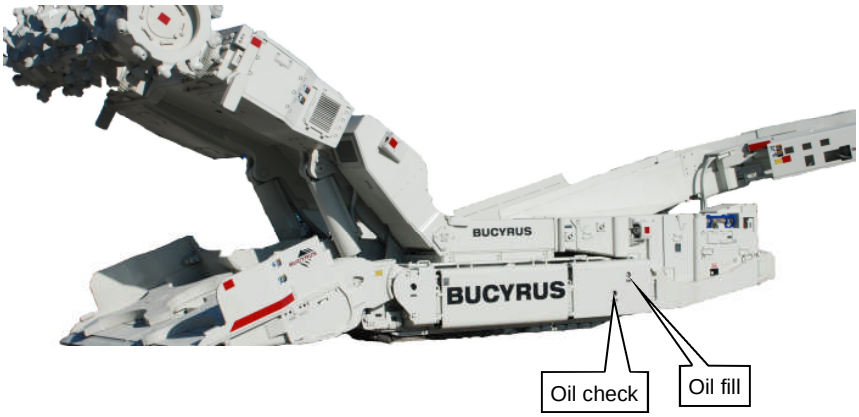
Fig. 103: CLA head pot assembly and transfer case lubrication



tram gear case (right and left)

With the miner in a level position, check the oil level in both tram gear cases by looking at the sight glass located on the side of each gear case (Fig. 104). Oil should be visible in each sight glass. If oil level is low, add oil through the fill plug hole.

Fig. 104: Tram gear case oil level



Every three months

IMPORTANT!
For motor bearings that require high temperature lithium complex grease (Spec. 100-15), Bucyrus provides a special “button” style lubrication fitting (Fig. 114) to prevent the accidental use of multi-purpose lithium complex grease at these locations.

cutter motor bearings

Lubricate the left and right cutter head motor bearings (Fig. 114) with high temperature lithium complex grease through the grease fittings located on each side of the cutter head assembly . To lubricate the motors:

- ☞ Remove the cover to access the motor.
- ☞ Inspect the grease fittings on the exit side of the front and rear motor bearing.
- ☞ If the exit side motor bearing ports are equipped with spring loaded relief fittings (Fig. 114):
  - ☞ Lubricate both motor bearings using the button type fittings (Fig. 114) until new grease appears out of the relief port on the exit side of the bearing.
  - ☞ Operate the motor for five minutes.
  - ☞ Inspect for any grease leakage in the area around the bearing.
- ☞ If the grease fitting on the exit side of the motor bearing is fitted with a plug:
  - ☞ Remove the plug.
  - ☞ Lubricate both motor bearings using the button fitting until new grease appears out of the exit side of the bearing.
  - ☞ Operate motor (s) for five (5) minutes.
  - ☞ Inspect for any grease leakage in the area around the bearing.
  - ☞ Replace grease plug (s) in all port (s).

NOTICE!
Incorrect grease or over greasing of the electric motor may cause serious damage to the motor. Follow the greasing procedure outlined above.

Setting hydraulic pressures

- Always refer to the hydraulic schematic in the Bucyrus America, Inc. parts book supplied with your miner.
- Most relief valves are set to factory specifications and should require no further adjustment. If a problem occurs which requires the reliefs to be adjusted, make certain the correct procedures are followed and all work is performed by a qualified person.
- Remember when adjusting relief valves that turning the adjusting screw in (clockwise) will increase the pressure setting.

WARNING!
Use extreme caution when performing test procedures and making adjustments. Unless noted in the procedures, all controls are to be in the neutral position.

The miner is equipped with seven pressure gauges, typically mounted in a gauge panel, to aid in setting relief pressures. The gauges are for:

- main flow - primary pressure circuit (all functions of the main control valve can be read from this gauge),
- pilot/auxiliary pressure circuit,
- accumulator,
- conveyor chain take-up,
- anti-chatter/maintenance (shear down) valve for cutter head,
- gathering head float valve, and
- the reduce pilot pressure circuits.

There will be occasions when relief valves, or other pressure control valves, must be set or adjusted. Setting relief valve pressure is necessary when a relief valve is replaced with a new unit or when an existing relief valve needs to be adjusted, for example, during the course of troubleshooting a hydraulic system fault. This section describes the proper procedure for setting the relief valves.

15. If the tram track tension is still too loose when the entire 5” shim set is inserted into the idler slide channel, re-adjust the idler position after removing a tram track link using the following steps:

    - Pump grease into the take-up jack to extend the cylinder and remove the pusher plate pressure on the idler shims.
    - Remove all of the idler adjustment shims from the idler slide channel.
    - Open the pressure release valve for the front idler take-up jack and allow the cylinder to contract.
    - The tram track tension should now be reduced and separation of the tram track will be easier.
    - Locate a tram track link near the tram idler.
    - Using the hammer and punch, remove the four roll pins of the two tram track pins (Fig. 129) that secure the tram track link to the track.
    - Using the hammer and punch, remove the tram track pins to disconnect the link from the track. Remove the disconnected link.
    - Store the tram track link, one of the tram track pins and two of the roll pins in a safe place.
    - Connect the two ends of the tram track and using the hammer and punch, secure the two end links together with the remaining tram track pin.
    - Using the hammer and punch, secure the tram track pin between the two links with the remaining two roll pins.
    - Pump grease into the idler take-up jack to extend the cylinder, move the idler assembly forward and tighten the tram track until it is at the correct tension. The tram track is at the proper tension when it hangs approximately 2 1/1” to 3 1/2” from the bottom wear shoes when the tractor frame is blocked off the floor.
    - Insert shims into the idler slide channel until the space between the tractor frame and the pusher plate is filled.
    - Open the pressure release valve for the front idler take-up jack and allow the cylinder to contract. The idler adjustment shims will keep the idler stationary and the track tensioned.
    - The idler adjustment shims will keep the idler stationary and the track tensioned.
    - Evaluate the resulting track tension and repeat until the

Cutter motor feedback adjustment

The tram motor speed voltages are limited in the forward direction when the cutter motors are running. How much the tram speed is limited is controlled by the load on the cutter motors. When the load is light, as in a clean-up operation, the tram speed is less limited that when there is high cutter motor loading, as in a sumping operation. The cutter motor loading is monitored by using a current transformer, CT3, in a phase lead.

This cutter motor feedback is connected to the tram interface to control the tram motor speed voltages. The “clean-up” and “sump” tram voltages are factory set. It may be necessary to adjust these voltages to suit the actual mining conditions.

Reference Fig. 137:Tram interface and Fig. 138: SCR tram drive.

☞ Open the tram case and access the traction case.

Note: Machine power must be disconnected during installation of the current generator. Cutter motor feedback adjustment is normally set with the crawler tracks off the mine floor, stabilizer and cutter head down.

WARNING!
You could be seriously injured or killed by falling loads. Observe the safe working limits of all lifting and blocking devices.

☞ **Current Generator:** Bucyrus America, Inc. has a current generator which can be used to simulate the secondary current in the feedback current transformer, CT3. The current generator needs to be connected to 120 vac. This can be tapped at terminal numbers 14 and 79 on the tram interface terminal strip (Fig. 197).

Remove the feedback wires number 196 and 197 from the tram interface terminal strip and connect the output of the current generator (flat cable) to the tram interface terminals 196 and 197. Be sure the power switch is off and the adjustable dial is set at zero.

☞ **Volt-Ohm Meter**:

- ☞ To check the left tram reference voltage connect VOM to tram interface terminal 41 pos. and D42 neg.
- ☞ To check the right tram reference voltage connect VOM to tram interface terminal 51 pos. and D52 neg.
- ☞ To check left armature voltage connect VOM to left SCR drive terminals A1 pos. and A2 neg.
- ☞ To check right armature voltage connect VOM to right SCR drive terminals A1 pos. and A2 neg.

To remove the tapered (McSweeney) boom pivot pin:

☞ 9. Remove the hex head bolts and nuts that secure the inside cap then remove the cap.

☞ 10. Remove the hex head bolts and nuts that secure the outside cap then remove the cap.

☞ 11. Remove the pin.

boom pivot pin installation

To install the straight boom pivot pin:

☞ 1. Position the boom pivot pin so that the end with the two flats (the end without the adapter) is inserted first. The single flat of the pin's opposite end must face the four retaining plate holes.

IMPORTANT!
On the back of the tractor frame clevis there is a welded strap that keeps the boom pivot pin from rotating. One of the flats of the boom pivot pin must parallel this strap or the pin cannot be completely inserted.

☞ 2. Use the hammer to insert the boom pivot pin through the aligned tractor frame clevis and boom pivot bushings.

IMPORTANT!
If it is extremely difficult to insert the boom pivot pin through the aligned tractor frame clevis and boom pivot bushings, extend or contract the shear cylinders to improve the alignment between the clevis and boom.

CAUTION!
Use extreme caution when adjusting the clevis and boom alignment with the shear cylinders.

☞ 3. Replace the support block over the four threaded holes in the tractor frame.

☞ 4. Place the retaining plate onto the support block. The end of the retaining plate L-extension should be positioned against the flat of the boom pivot pin.

☞ 5. Insert and tighten the hex head capscrews lockwashers to secure the boom pivot pin retaining plate to the tractor frame.

☞ 12. Use the chain falls to lift the upper half of the center drum off the cutter head assembly. The cutter head and the lower half of the center drum should remain on the floor.

WARNING!
Serious injury or death can result from falling loads. Observe the safe working load limits of lifting devices and keep a safe distance from suspended loads.

☞ 13. Remove the ten center drum alignment keys from the keyway slots around the edge of the bottom half of the center drum and store the keys in a safe place.

☞ 14. Connect trailing cable energize the miner.

☞ 15. Slowly raise the cutter head assembly until it is completely clear of the lower half of the center drum.

☞ 16. Slowly tram the miner backwards away from the suspended upper half and the resting lower half of the center until the cutter head assembly is completely clear of both of these pieces.

center cutter drum installation

To install the center cutter drum (Fig. 144):

☞ 1. Place the ten center drum alignment keys into the keyway slots around the edge of the bottom half of the center drum.

☞ 2. Slowly rotate the cutter head until the center drum drive keys are positioned directly on the top and on the bottom of the cutter head assembly.

WARNING!
You could be seriously injured or killed by falling loads. Observe the safe working load limits of lifting devices and keep a safe distance from suspended loads.

☞ 3. Slowly lower the cutter head assembly into the bottom half of the center drum. The bottom drum drive keys should fit into the interior of the lower half of the center drum.

WARNING!
Stand clear of the cutter head assembly and the unsecured upper half of the center drum while lowering it.

☞ 4. Using the chain falls, slowly lower the upper half of the center drum onto the cutter head assembly. The top drum drive keys should fit into the underside interior of the upper half of the center drum.

☞ 5. Disconnect the chains that supported the upper half of the center drum from the chain falls.

☞ 6. Remove the chains from the upper half of the center drum.

drum drive motor installation

To install the drum drive motor:

WARNING!
Federal law requires that mining equipment electrical connections must be inspected by a certified electrician before the equipment can be operated.

WARNING!
This procedure involves attaching an electrical power cable to the cutter head drum drive motor. The trailing cable must be disconnected to safely perform this operation or serious injury or death will result.

☞ 1. Block up cutter head drum drive motor into position against the rear of the boom so that the motor's mounting holes align with the boom's threaded motor mounting holes.

WARNING!
You can be seriously injured or killed by a falling load. Follow the safe working load limits of all blocking devices.

☞ 2. Insert the four Superbolts through the motor mounting holes (Fig. 153) and hand tighten them into the boom's threaded motor mounting holes

☞ 3. Torque the four Superbolts to approximately 1,800 ft-lbs (see Superbolt installation procedure in this chapter) to secure the drive motor to the boom.

☞ 4. Attach rear support mount to motor with bolts and lock washers (Fig. 153). Torque bolts to proper setting (see Torque tables in Chapter 6).

☞ 5. Install the two motor cooling water fittings into the front and rear cooling water ports of the motor.

☞ 6. Attach the two motor cooling water hoses to the fittings (Fig. 153).

☞ 7. Using a socket wrench, remove the four hex head capscrews and lock washers that secure the junction box cover.

☞ 8. Remove the cover and O-ring.

☞ 3. Mark the holes on the exterior of the gear case mounting brace that corresponds to the positions of the guides on the boom face.

WARNING!
The cutter drum gear case is extremely heavy. Keep body parts and other objects from underneath it until it is completely secured.

☞ 4. Apply RTV silicon sealer to the gear case center alignment key and install the key into the boom face. Also install the gear case's two larger side alignment keys into the boom face.

WARNING!
Use extreme caution when tramming the miner forward to position the boom face against the gear case.

☞ 5. Connect the trailing cable to energize the miner.

☞ 6. Using the boom face alignment keys and the guide pins to direct placement, tram the miner forward until the gear case is positioned against the cutter boom face. The guide pins should come out of the marked holes in the mounting brace.

☞ 7. Disconnect the trailing cable to de-energize the miner. Follow all Federal and mine lockout/tagout regulations.

WARNING!
Follow all federal and mine lockout/tagout regulations. Failure to do so could result in machine damage or serious injury or death to personnel.

☞ 8. Insert the hex head capscrews into the open holes (those not blocked by the guides) in the cutter drum drive gear case mounting brace.

☞ 9. Tighten the capscrews into the threaded holes in the cutter boom face.

☞ 10. Remove the alignment guides and insert and tighten the remaining four hex head capscrews through the gear case mounting brace and into the threaded holes in the cutter boom face.

☞ 11. Using a torque wrench with 20 to 1 multiplier, tighten all twenty-one hex head capscrews to 1,850 ft-lb.

☞ 12. Double check capscrew torque.

☞ 13. Strap the hex head capscrews into sets of two and three and tack weld.

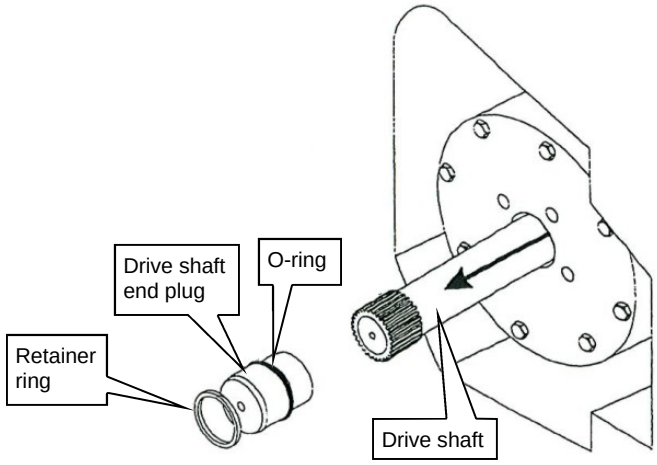
☞ 9. Remove the square-headed pipe plug on the end of the gathering head motor.

☞ 10. Remove the retaining ring that secures the shaft end plug inside the motor housing (Fig. 168).

☞ 11. Using a slide hammer, pull the drive shaft end plug out.

☞ 12. Pull the drive shaft from the motor and store in safe place.

Fig. 168: Drive shaft and end plug removal



☞ 13. Use the adjustable wrench to replace the pipe plug into the end of the motor.

☞ 14. Remove the hex head capscrews and lock washers that secure the motor junction box cover.

☞ 15. Remove the cover and its o-ring.

☞ 16. Locate the three taped power connections inside the junction box and strip the tap covering each lug connection.

☞ 17. Tag each connection and remove the hex head capscrew, flat washer, lock washer, and hex head nut that secures each of the power cable lugs.

☞ 18. Remove the socket head capscrews and lock washers that secure the stuffing box's half-moon clamp to the junction box.

☞ 19. Remove the clamp and slide the stuffing box out of the junction box. The power cable should be completely disconnected from the motor.

WARNING!
While the power cable is detached from the motor, the trailing cable should not be reconnected to the miner. Damage to the machine or injury or death to personnel could result.

Gathering head foot shaft removal and installation

gathering head foot shaft removal

To remove the gathering head foot shaft:

☞ 1. Lower the gathering head until it touches the floor.

☞ 2. Position the conveyor tail section directly behind the miner so that it is level with the floor.

☞ 3. Raise the cutter head assembly to its highest position. Place blocking underneath the cutter head assembly and lower the cutter head assembly onto the blocking.

WARNING!
You could be seriously injured or killed by falling loads. Observe the safe working load limits of blocking devices.

☞ 4. Slowly advance the conveyor chain until a connecting link appears on the gathering head entrance pan.

☞ 5. Disconnect the trailing cable to de-energize the miner. Follow all Federal and mine regulations for lockout/tagout.

WARNING!
Follow all federal and mine lockout/tagout regulations. Failure to do so could result in machine damage or serious injury or death to personnel.

☞ 6. Loosen tension on the conveyor chain as much as possible (see Conveyor chain adjustment procedure in the Adjustment procedures section of this chapter).

☞ 7. With conveyor chain tension removed, remove the connecting link pins and the connecting link.

☞ 8. The conveyor chain should now be separated. Move the two pieces of the conveyor chain out of the way to allow for easier removal of the gathering head foot shaft.

☞ 9. Remove the hex head capscrews and lock washers that secure the foot shaft cover to the gathering head and remove the foot shaft cover.

☞ 10. Locate the two collars on the foot shaft and remove the hex head capscrews that secure each of the collars to the foot shaft. When the capscrews are removed, the flex lock nuts will fall free from the other side of the collar. Retrieve these nut and hand tighten them onto their capscrews for safe keeping. Remove both collars from the foot shaft.

Tram motor removal and installation

tram motor removal

To remove the tram motor:

☞ 1. Lower the conveyor tail section until it is level with the floor.

☞ 2. Lower the gathering head and cutter head assemblies until they touch the floor.

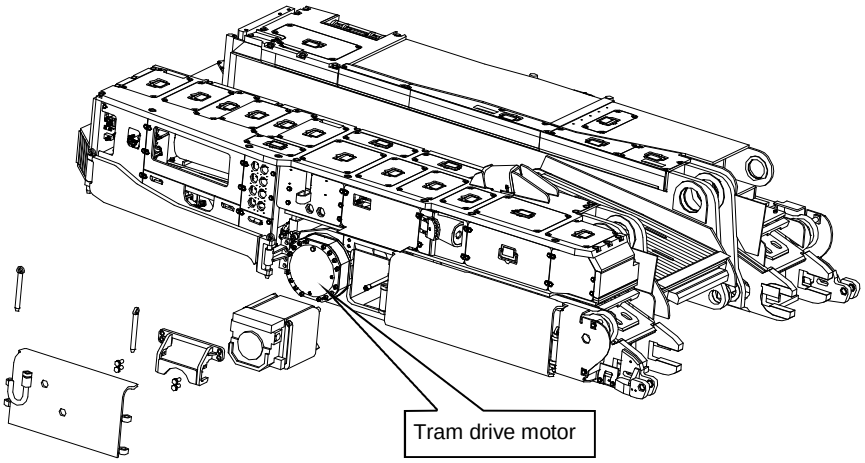
☞ 3. Disconnect the trailing cable to de-energize the miner. Follow all Federal and mine regulations for lockout/tagout.

WARNING!
Follow all federal and mine lockout/tagout regulations. Failure to do so could result in machine damage or serious injury or death to personnel.

☞ 4. Remove the two rub ail pins that secure the tram rub rail to the two rub rail sections adjacent to it.

☞ 5. Remove the tram rub rail to expose the tram gear case and locate the tram drive motor inside the gear case (Fig. 183).

Fig. 183: Tram drive motor location



☞ 6. Remove the hex head capscrews and hi-collar lock washers that secure the input shaft access cover to the motor housing. Note that the cooling water hose support clamp is secured by one of the capscrews. Remove the tram motor cooling water bypass hose when the clamp capscrew is removed.

☞ 7. Remove the input shaft access cover and its o-ring.

☞ 8. Remove the retaining ring that secures the shaft plug in position.

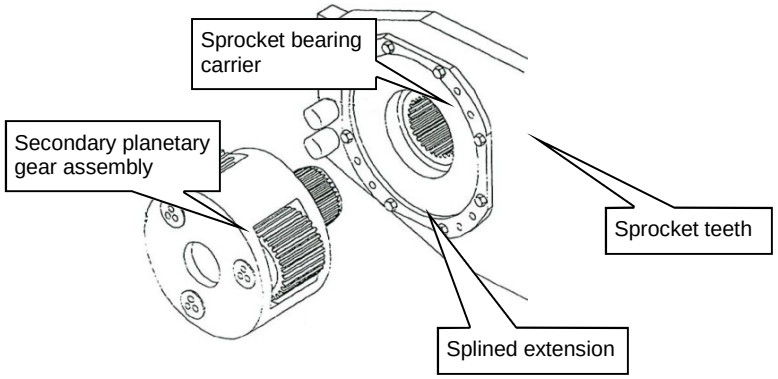
☞ 9. Remove the shaft plug with o-ring that secures the input shaft in the motor (Fig. 184).

secondary planetary gear removal

To install the tram secondary planetary gear:

☞ 1. Carefully insert the secondary planetary gear assembly into the sprocket bearing carrier (Fig. 191), ensuring that the splined extension of the planetary carrier seats securely in the interior teeth of the sprocket.

Fig. 191: Planetary carrier installation



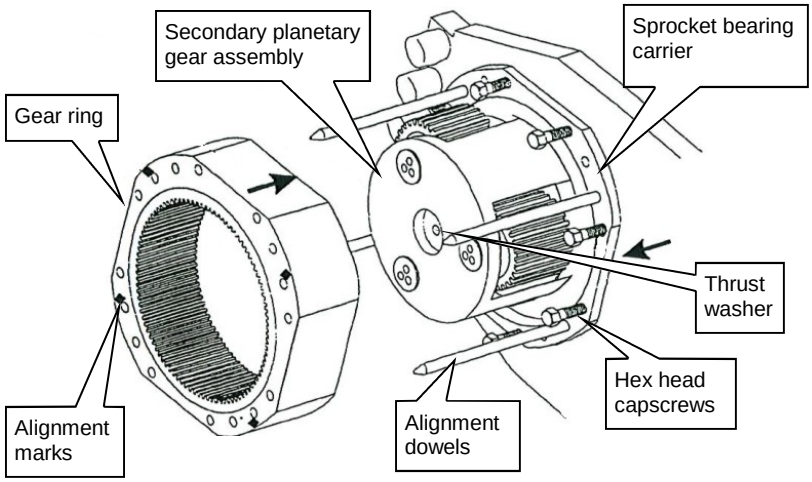
☞ 2. Slide the secondary tram drive shaft through the secondary planetary gear assembly and into the tram drive sprocket and reach gear set (the drive shaft end without the threaded hole should be inserted first). The shaft may require some adjustment so that the end fits into the reach gears.

☞ 3. Insert four alignment dowels into the holes in the sprocket bearing carrier not blocked by the eight hex head capscrews (Fig. 192).

☞ 4. To facilitate gear ring insertion, mark the mounting holes of the secondary planetary gear ring that corresponds to the holes in which the dowels were placed.

☞ 5. Remove the eight hex head capscrews that secure the sprocket bearing carrier to the tram.

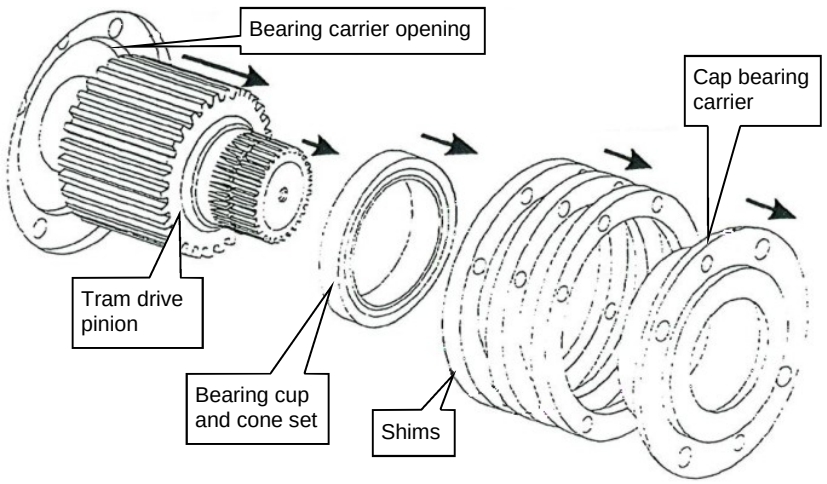
Fig. 192: Gear ring installation



☞ 20. Remove the three steel shims and the bearing found under the shims (Fig. 198).

☞ 21. Carefully pull the tram drive pinion out of the reach gear case through the cap bearing carrier opening.

Fig. 198: Tram drive pinion removal



☞ 22. Cut and remove the wire securing the idler shaft capscrews in position.

☞ 23. Remove the drilled hex head capscrews that secure the idler shaft cap to the tram case and remove the idler shaft and three steel shims located under the cap.

☞ 24. Carefully slide the idler shaft out of the reach gear case through the idler shaft cap opening.

☞ 25. Remove the idler reach gear through the top opening of the reach gear case (Fig. 199).

☞ 26. Remove the bearing cup and cone sets from the center indentions of the idler reach gear.

tram sprocket installation

To install the tram sprocket:

NOTICE!
Bucyrus recommends the installation of a pre-assembled sprocket. If a pre-assembled sprocket is not used, the following sprocket assembly procedure should be followed.

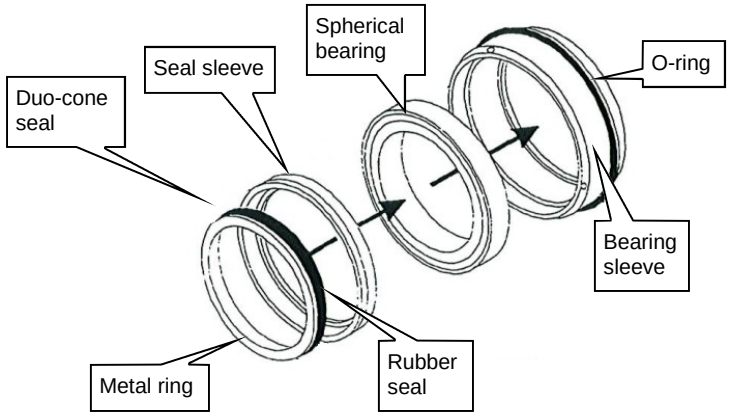
☞ 1. Install a spherical bearing into one of the bearing sleeves (Fig. 210).

☞ 2. Install the o-ring into the outside channel of the bearing sleeve.

IMPORTANT!
When the bearing sleeve is inserted into position, the o-ring forms a seal between the sleeve and the piece that holds it.

☞ 3. Install a Duo-Cone seal into the seal sleeve (see Duo-cone seal installation notes in this chapter). The rubber side of the seal should face toward the sleeve; the metal ring of the seal should face outward.

Fig. 210: Bearing/seal sleeve assembly



☞ 5. Insert and tighten the three set screw into the bearing sleeve to secure the seal sleeve in the bearing sleeve.

☞ 6. Insert the bearing/seal sleeve assembly into position at the rear of the sprocket bay of the tram case.

☞ 7. Install the two Duo-Cone seals into the channel in each end of the sprocket. The rubber side of the seals should face into the sprocket channel; the metal rings of the Duo-Cone seals should face outward.

☞ 8. Insert the end of the sprocket into the seal sleeve so that it seats into the spherical bearing. Push the sprocket until the metal rings of the Duo-Cone seals are securely against each other.

☞ 9. Install the other spherical bearing into the remaining bearing sleeve.

☞ 8. Remove the hose fittings from the pump and store in a safe place.

☞ 9. Remove the two hex head capscrews and lockwashers that secure the pump assembly to the motor assembly.

☞ 10. Carefully remove the pump assembly by sliding it out of the pump motor.

When located behind the operator's case:

☞ 4. Locate the rub rail directly behind the tram case on the operator's side of the miner. Remove the two rub rail pins that secure the rub rail to the two rub rail sections adjacent to it and remove the rub rail.

☞ 5. Swing the operator's case outward and locate the hydraulic pump and motor assembly.

☞ 6. Using the adjustable wrench, disconnect the inlet hose from the pump. Plug the hose end to keep it clean.

☞ 7. Using the adjustable wrench, disconnect the pilot and valve hoses from the pump fittings. Plug the hose ends to keep them clean.

☞ 17. Locate the bearing pin that secures the stabilizer cylinder to its tractor frame mounting.

☞ 18. Remove the two cotter pins that secure the bearing pin inside the stabilizer cylinder's piston bearing and tractor frame mounting.

☞ 19. Slide the washers off both ends of the pin and Remove the pin from the cylinder's piston end bearing and tractor frame mounting. The cylinder is now free and can be removed.

seal test

After the entire unit is reassembled, it may be a good practice to test the seals. A vacuum test is more sensitive than a pressure test and can be performed during a vacuum fill operation.

- ☞ Carefully fill the compartment to the correct fluid level.
- ☞ Slowly rotate the assembly several revolutions to seat the seals.
- ☞ A vacuum test will catch severe seal damage such as broken seal rings or cut torics that may be damaged in the last phases of assembly. The torics are not designed to seal air. Some leakage can be expected using such a procedure.

Fig. 229:Installation issues

Toric sliding on retainer ramp.

Toric caught on housing retainer lip.

Toric sliding on seal ramp.

installation process

With the lower half of the rubber toric seal still wet, use the installation tool to position the seal ring and the rubber toric squarely against the housing (Fig. 230). For smaller diameter seals, use sudden and even pressure to push the rubber toric under the retaining lip of the housing.

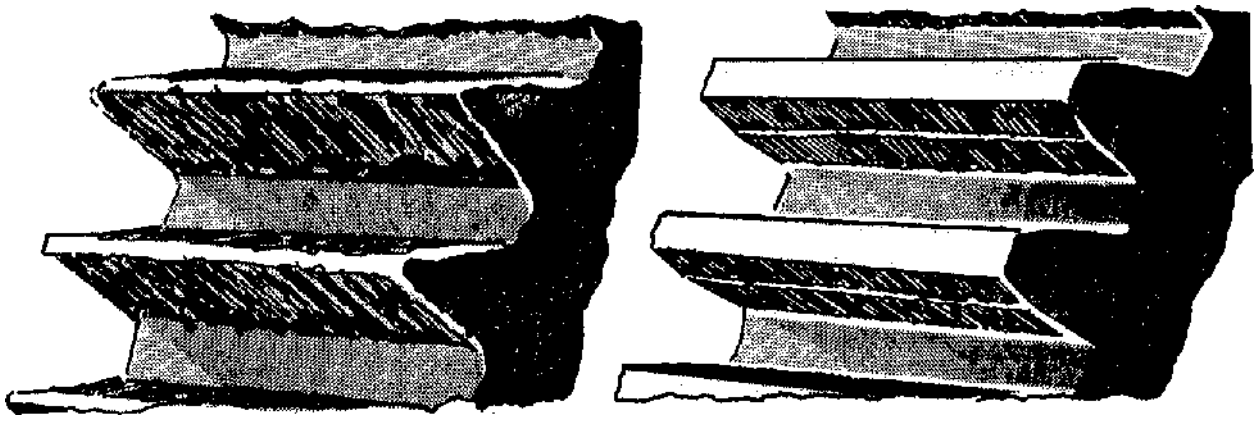
For larger diameter seals which will not press in with sudden and even pressure, it is acceptable to work the toric past the retaining lip by starting on one side and tapping the opposite side of the installation tool with a rubber mallet until it is engaged past the retaining lip of the housing.

Check the assembled height (height “A”, Fig. 231) in at least four places, 90° apart, using a caliper, tool makers' rule or any other calibrated measuring device. The difference in height around the ring must not be more than 1mm. If small adjustments are necessary, do not push or pull directly on the seal ring. Use the installation tool to push down and your fingers to pull up uniformly on the rubber toric and seal ring.

The rubber toric can twist if it is not wet all around during installation or if there are burrs or fins on the retaining lip of the housing. Twists, misalignment, and bulges of the toric will result in seal failure. If correct installation is not obvious, remove the seal from the housing and repeat the process.

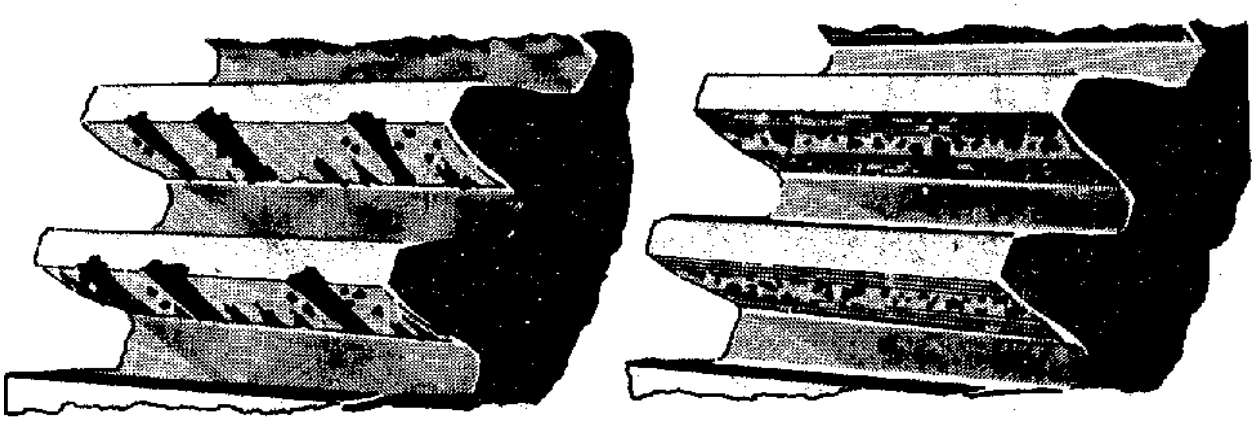
The rubber torics must never slip on the ramps of either the seal ring or the housing. To prevent slippage, allow adequate evaporation time for the lubricant before proceeding with further assembly. Once correctly in place, the rubber toric must roll on the ramp only.

Fig. 234: Examples of worn gear teeth



Shock Loading

Improper type of lubricant



Bent or broken teeth

Contaminated lubricant

The ability to recognize trouble indicators in a specific system is usually acquired with experience. the gaining of this experience can be greatly enhanced by developing a logical sequence for determining the cause of a hydraulic problem and implementing the proper remedy. Refer to the general troubleshooting charts in this section that illustrate the logical sequence for shutdown, troubleshooting, and restarting the machine. The charts cover:

- General safety procedure for shutting down the machine
- Troubleshooting excessive noise
- Troubleshooting excessive heat
- Troubleshooting incorrect flow
- Troubleshooting incorrect pressure
- Troubleshooting faulty movement/operation
- General restart checklist and procedure

This general information is intended to enhance the understanding of basic hydraulic principles which will lead to the development of a logical troubleshooting procedure. Specific troubleshooting checklists for each hydraulic circuit are given directly after the very important "Contaminants in hydraulic systems" section.

Contaminants in hydraulic systems

The primary cause of hydraulic component failure is SYSTEM CONTAMINATION! Cleanliness must be a high priority when servicing the hydraulic system. Even very small particles can damage system components by scoring valves, clogging orifices, and wearing seals prematurely. It is not the intent of this operation manual to outline a contamination control program but some of the most effective steps that have been identified in successful programs are given below:

1. Ensure that bulk oils are at acceptable cleanliness levels.

   Areas where Bucyrus America, Inc. customers have made improvements in the past include:

   - implement ISO Cleanliness Code standards for bulk hydraulic oils
   - evaluate bulk oil shipments for cleanliness by conducting particle counts and maintain records
   - minimize drum usage by utilizing tote tanks and five gallon pails
   - utilize plastic versus steel storage tanks, if possible

Table 7: Flow chart V for troubleshooting faulty operation

No Movement		Slow Movement		Erratic Movement		Excessive Speed or Movement	
Cause	**Remedy**	**Cause**	**Remedy**	**Cause**	**Remedy**	**Cause**	**Remedy**
No flow or pressure	See Table 5	Low flow	See Table 5	Erratic pressure	See Table 6	Excessive flow	See Table 5
Limit or sequence device (mechanical, electrical, or hydraulic) inoperative or misadjusted	E	Fluid viscosity too high	A	Air in fluid	See Table 3	Feedback transducer malfunctioning	E
Mechanical bind	B	Insufficient control pressure for valves	See Table 6	No lubrication of machine ways or linkage	G	Misadjusted or malfunctioning valve amplifier	C
No command signal to valve or amplifier	F	No lubrication of machine ways or linkage	G	Erratic command signal	F	Overriding work load	H
Inoperative or misadjusted valve amplifier	C	Misadjusted or malfunctioning valve amplifier	C	Misadjusted or malfunctioning valve amplifier	C		
Inoperative solenoid or proportional valve	E	Sticking valve	D	Malfunctioning feedback transducer	E		
Worn or damaged cylinder or motor	E	Worn or damaged cylinder or motor	E	Sticking valve	D		
		Pilot filter clogged	See Table 5	Worn or damaged cylinder or motor	E		

Remedies

A. ☞ check fluid temperature
☞ check system fluid viscosity; change if necessary

B. ☞ locate bind and repair

C. ☞ adjust, repair, or replace part

D. ☞ clean and adjust or replace part
☞ check condition of system fluid and filters

E. ☞ overhaul or replace part

F. ☞ repair command console or interconnecting wires

G. ☞ lubricate

H. ☞ adjust, repair, or replace counterbalance valve

6 Technical data

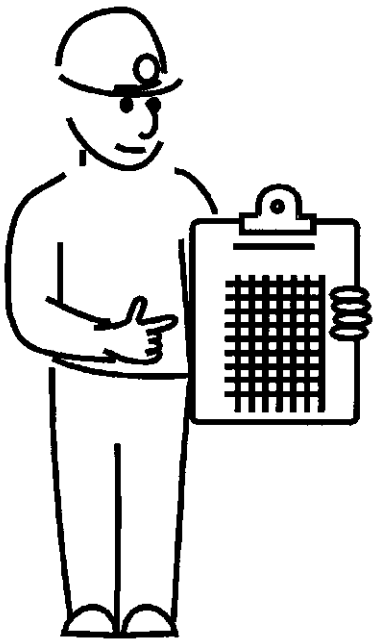


Table 17: Invert emulsion hydraulic fluid (Spec. 100-5)

	Supplier	Brand name
1	Unocal 76	FR Fluid
2	Conoco Inc.	FR Hydraulic Fluid
3	Atlantic Richfield Company	Duro FR-HD
4	Brooks Oil Company	Brooks fire Resistant Hydraulic Fluid B
5	Cincinnati – Vulcon Company	Vulcon FR Fluid #1
6	Cities Service Oil company	Citgo Pacemaker Invert FR Fluid
7	Century Oils limited	Aquacent Light
8	Fiske Bros. Refining Com-pany	Lubriplate HO-Retard
9	Getty Oil company (Veedol, Tidewater)	Veedol Auburn FRH
10	Gulf Oil Company	FR Fluid
11	E.F. Houghton	Houghto-Safe 5046 Houghto-Safe 5046W
12	Century Lubricating Oils	Hulsafe 600
13	Imperial Oil and Grease	Astrol 587
14	Mobil Oil Corporation	Pyrogard D
15	National Oil and chemical Co.	Erifon 1, 2, and 3
16	Pennzoil	Maxmul FRP/G
17	Quaker Chemical Company	Quintolubric 958 Series Quintolubric 958 Series
18	Henery E. Sanson and Sons MFGE Company	Hydra-Mul Premium Emulsion Fluid
19	Southwest Grease and Oil Company, Inc.	Invert Emulsion fire resistant Hydraulic Fluid
20	Southwest Petroleum Corp.	Swepco Fire Resistant Hydrau-lic oil #718
21	Standard Oil Company of Ohio (Boron Sohio)	Staysol FR
22	Sun Oil company	Sunsafe F
23	Tower Oil Company	Safoil Anti-Wear Hydraulic Fluid
24	Wynn Oil company	Hydra-Safe heavy Medium
25	Lubrication Engineers	6455 Monolec Fire Resistant hydraulic Fluid
26	Hydrotex	HY-Guard