Operation Manual

Bucyrus - UN-A-TRAC®
Models - 488L and 488-6

Doc. No.: A6474X235

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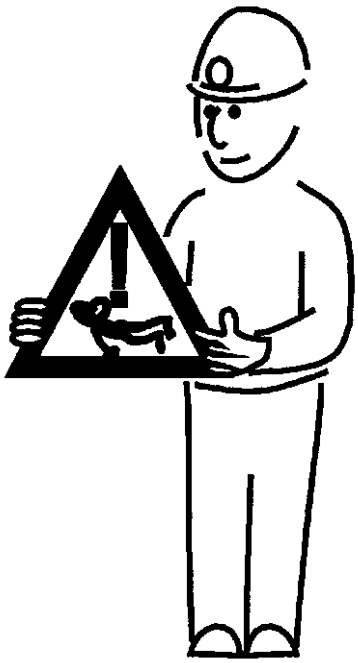
2 Your safety



maintenance, repair

Only persons who have and can demonstrate a special knowledge of hydraulics are allowed to work on the hydraulic system.

Avoid, whenever possible, servicing, cleaning or examining the machine in congested areas.

Avoid, whenever possible, servicing or providing maintenance to the unit unless the wheels are chocked and steering lockout device is connected to prevent accidental movement of the unit.

Do not alter the electrical or hydraulic settings from that indicated in this manual or as set at the factory.

Always replace damaged or lost decals and metal instruction plates.

Disconnect the battery when working with the electrical system, or when welding on the unit to prevent electrical shock.

Be sure the battery area is well ventilated (clear of fumes) when it is necessary to connect battery charger. Fumes from the battery could ignite from a spark and explode.

Always follow all safety procedures of each particular mine when performing maintenance.

It is important that any procedure not specifically recommended in this guide be thoroughly evaluated from the standpoint of safety before it is implemented.

Some illustrations in this manual show guards or cover panels removed for purposes of clarity. Never operate unit without guards or cover panels in place.

Carry out a visual inspection of all the hydraulic components at regular intervals. In particular check that:

- the hoses are not pinched or trapped,
- the hoses have no bubbles or blisters,
- the hose or outer sheathes of the hose are not abnormally rigid or hard,
- the outer sheath of the hoses is not damaged,
- the connectors are securely inserted into the sockets, and
- the connections are leak-tight.

Ensure that no dirt enters the hydraulic system during repair work. Dirt in the hydraulic system can cause serious damage in the whole system! Flush out the hydraulic lines thoroughly before connecting.

WARNING!
Power must be removed by unplugging the battery plugs before servicing the motor.

WARNING!
Mixing parts of different designs or from a variety of sources for wheels with pneumatic tires could cause severe injury or death.

Chapter 6: Technical data

IMPORTANT!
Due to the application of fasteners being subject to great stresses and heavy or extreme vibration, it is imperative that all bolts be applied with an adequate amount of torque. For this reason this list of recommended torque settings for different types and sizes of fasteners used has been compiled. The tightening torques stated in the spare parts lists have to be observed, as well, for installation and maintenance.

NOTICE!
Use only lubrication fluids and greases approved by Bucyrus America, Inc. ! These fluids and greases have been tested at Bucyrus America, Inc. and guarantee reliable operation of the mechanical and hydraulic functions of the machine.

IMPORTANT!
The lubrication fluids and greases listed in the same table can be mixed. Other products may only be used if the supplier can guarantee that they are equivalent. Differently composed fluids and greases must not be mixed as this may change the consistency, i.e. the mixture can become thinner so that the lubrication effect is not sufficient. It may also be dangerous to use lubricating greases and fluids having the same specification base but different origins. In case of doubt, the manufacturer of the lubrication to be used should be contacted as to the compatibility of the lubrication in question.

IMPORTANT!
Bucyrus America, Inc. expressly point out that the approval of the listed products relates only to the pure technical use in our mechanical and hydraulic systems. The responsibility for the constituents used in the hydraulic concentrates lies solely with the respective manufacturer.

NOTICE!
When performing maintenance on the machine, all used oil and lubricants should be disposed of per your local EPA standards.

Installation

Points to observe prior to installation

Who is allowed to carry out installation?

Installation is only allowed to be carried out by personnel having received adequate training to perform this task.

Work on:

the safety components (pressure relief valves, fire extinguishing equipment etc.),

the electrical equipment (control units, signaling devices, etc.), and

the hydraulic equipment (cylinders, directional control valves, hoses etc.)

should only be carried out by Bucyrus America, Inc. service engineers or by specially trained personnel.

Which tools are required for installation?

tool box

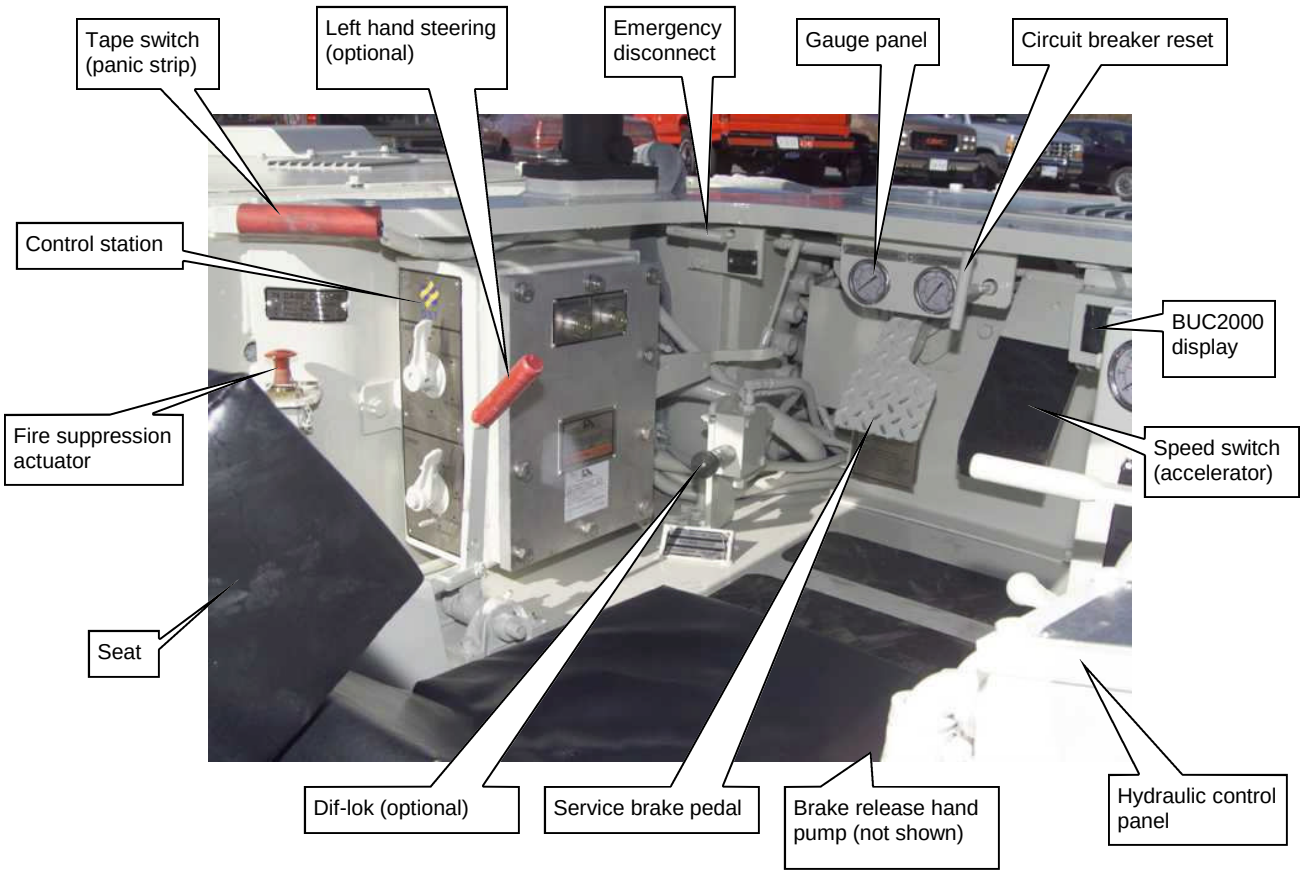
No special tools are required to put the UN-A-TRAC® into service.

The battery plugs and receptacles come with a special wrench for connecting and disconnecting battery plugs and receptacles.

Various items of auxiliary equipment and machines may be required at the point of installation. These include:

- hoists with adequate lifting capacity
- means of attachment with adequate lifting capacity
- unloading dock
- jacks with adequate lifting capacity

Fig. 9: Operator's compartment with control station



Note:
Typical operator's compartment shown, location of controls may vary.

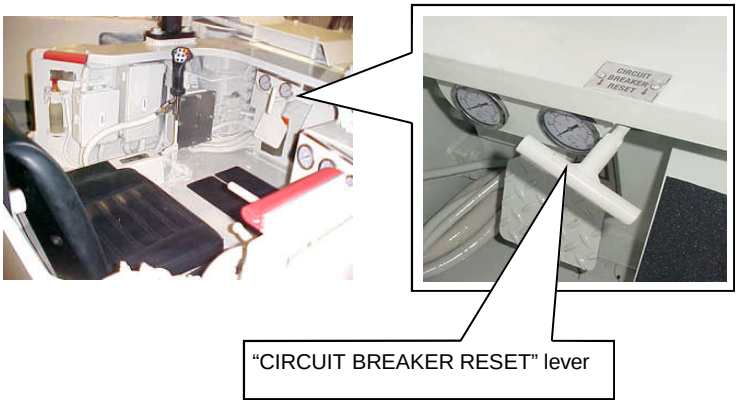
WARNING!
Before operating any levers or pedals on the UN-A-TRAC® always make sure no one is in the hazard zone (see Hazard zone in this chapter). Do not operate any levers or pedals from outside the operator's compartment.

Operator's compartment - control handle model only

"CIRCUIT BREAKER RESET" lever

The "CIRCUIT BREAKER RESET" lever (Fig. 18), located in front of and to the right of the operator, is used to reset the connection box (batteries) breaker when it has tripped. This circuit breaker is located in the connection box in the rear section of the UN-A-TRAC®. If the breaker has tripped, the reset lever must be pulled all the way out to the "RESET" position first and then pushed in to the "ON" position.

Fig. 18: "CIRCUIT BREAKER RESET" lever



WARNING!
The circuit breaker de-energizes the electrical controller and motors. However, electrical power is still present inside the connection box to the circuit breaker. If the circuit breaker inside the connection box requires service, the battery plugs must be disconnected from the batteries.

The circuit breaker is not intended as an "ON-OFF" switch for normal operation. Except in an emergency, the UN-A-TRAC® should be SHUTDOWN by first moving the master switch to the "OFF" position and then moving the circuit breaker to the "OFF" position.

WARNING!
The circuit breaker should be in the "OFF" position and the parking brake set before the operator leaves the operator's seat. In an emergency, the operator can stop the UN-A-TRAC® by striking the tape switch (panic bar), which trips the circuit breaker. The machine can also be stopped by moving the circuit breaker lever to the "OFF" position.

Control handle

IMPORTANT!
For more detailed control handle operating instructions, see Starting procedures in this chapter.

The control handle (Fig. 19) located to the left of the operator has a group of switches that control the following:

"TRACTION ASSIST"

Press down for Traction Assist.

Shutdown procedure with control handle

Tram the UN-A-TRAC® to its designated parking place.

Stop the UN-A-TRAC® by releasing the speed-switch foot pedal and depressing the foot brake pedal. When the speed-switch foot pedal is released, the tram (traveling) motors will stop. Applying the foot brake will stop forward (or reverse) motion. The hydraulic pump's electric motor will still be running, making a whining sound.

☞ 1. If equipped with optional quick attach bucket, ensure that the bucket (or other attachment) is lowered to the surface and ejector blade is returned to the back of the bucket. There should be no obstructions between the back of the bucket and ejector blade.

WARNING!
If equipped with optional quick attach bucket or other attachment, ensure that the bucket or attachment is lowered to the surface and ejector blade is returned to the back of the bucket. Always check before moving the ejector blade control lever to make sure no one has any part of their body between the ejector blade and the back of the bucket.

Note: Refer to Fig. 24 for illustration of control handle.

☞ 2. Before leaving the operator's compartment, press J3" to turn "OFF" the machine.

☞ 3. Turn "OFF" the machine circuit breaker.

☞ 4. Turn "OFF" battery circuit breaker and/or disconnect switch (if equipped) before leaving the machine area.

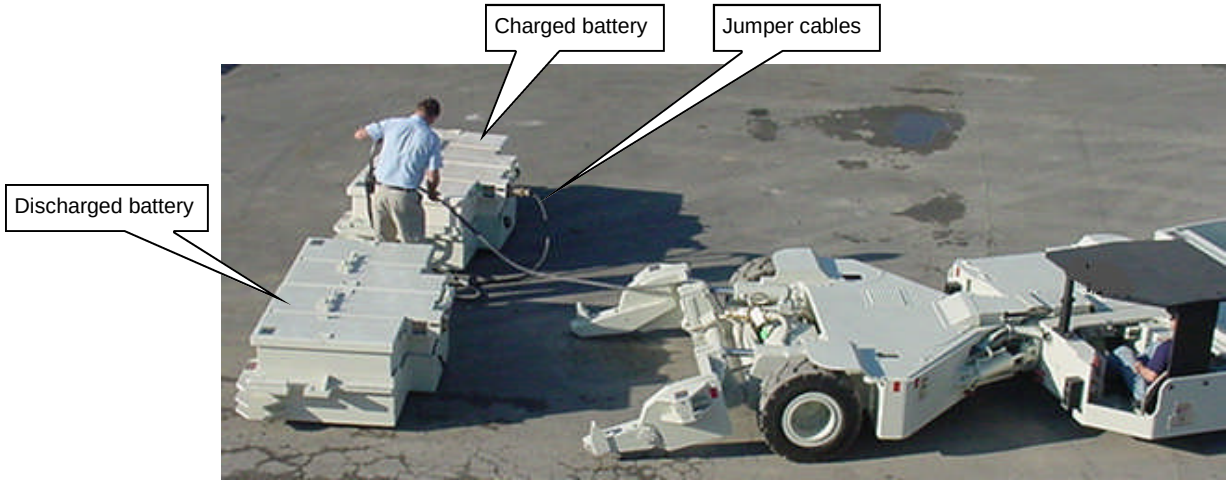
☞ 5. Connect the steering lockout device (Fig. 25):

- remove the steering lockout device from its storage lugs
- remove the hitch pin from the end farthest from the center section
- adjust turnbuckle until holes line up between the turnbuckle lug and the front section lug
- insert the hitch pin into the front section lug through the turnbuckle

WARNING!
Never enter the articulation area while the machine is running. Completely shutdown the machine as outlined before connecting the steering lockout device. Failure to observe this precaution may result in injury or death.

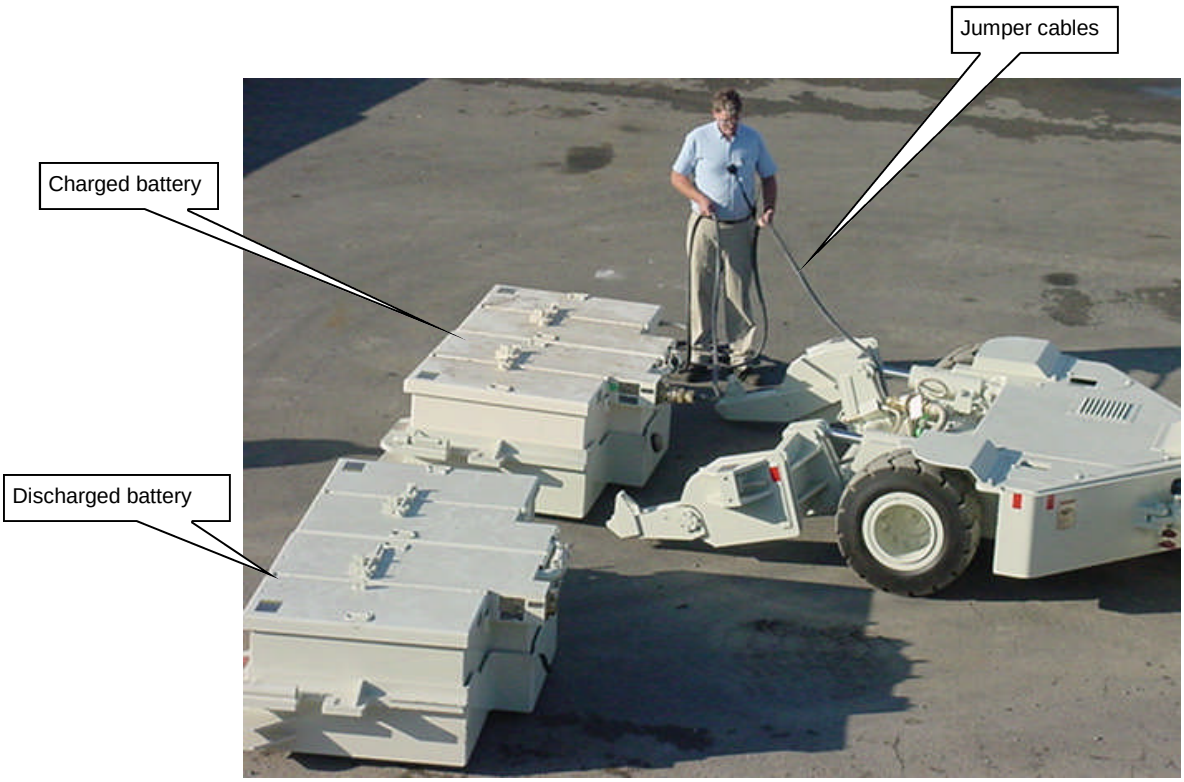
☞ Start the UN-A-TRAC® (see Starting Procedure in this manual). Gently pull away from the discharged battery while the second person holds the jumper cable away from possible damage (Fig. 30).

Fig 30: Battery changing procedure (ground level)



☞ Line the UN-A-TRAC® up with the fully charged battery. Move the machine back until the lift arms are aligned with the sides of the battery (Fig. 30 and 31).

Fig. 31: Battery changing procedure (ground level)



Instructions on the maintenance

Maintenance at regular intervals increases the operational safety and prolongs the service life of the machine. In particular, observe the safety instructions in chapter 2 “Your safety”.

Important notes

Please observe the following:

- In order to avoid individual components not being serviced or being only inadequately serviced during maintenance work on the machine as a whole, we recommend that a general maintenance plan be drawn up. You can, for example, draw up a checklist using this operation manual and the manuals of the other components.
- Inadequate maintenance can result in machine damage which leads to considerable costs.
- Use only suitable and approved tools for maintenance work.
- Use only original Bucyrus spare parts when replacing components.
- All electrical work must be supervised and inspected by a certified electrician.
- Anyone performing maintenance on this equipment must be trained to operate it and be familiar with this Bucyrus America, Inc. guide.

Before maintenance

Please observe the following:

- Shutdown the machine on level ground.
- Disconnect the electrical power. Either the battery circuit breaker or the emergency manual power disconnect (if equipped) must be in the "OFF" position. If work is to be done inside the electrical controller, the battery should be disconnected. Also make sure the capacitor discharge module indicates that the capacitors are discharged before working inside the controller.

WARNING!
Before performing maintenance on the machine, disconnect the electrical power. Either the battery circuit breaker or the emergency manual power disconnect (if equipped) must be in the "OFF" position. If work is to be done inside the electrical controller, the battery should be disconnected. Also make sure the capacitor discharge module indicates that the capacitors are discharged before working inside the controller. Electrical shock and accidental machine movement can cause serious injuries or even death to you or the maintenance person.

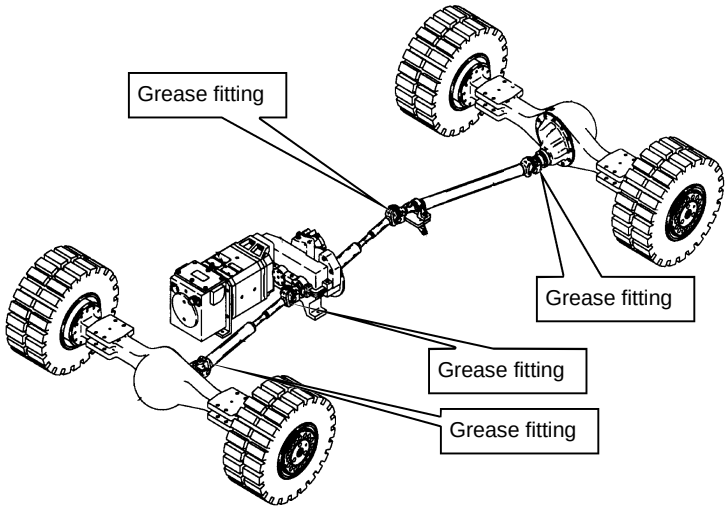
winch guide rollers (if equipped)

Lubricate the winch guide rollers (if equipped) (6 places) with Spec. 100-3 through the grease fittings located on each roller. Pump grease into the fittings until new grease can be observed coming out of the roller.

front and rear drive lines

Lubricate the front and rear drive lines (4 places) with Spec. 100-3 through the grease fittings located on each cross bearing (Fig. 54). Pump grease into the fittings until new grease can be observed coming out of the bearing.

Fig. 54: Front and rear drive line lubrication points



fasteners (nuts, bolts and screws)

Loose fasteners will cause premature wear and failure to machine and components. Visually inspect for loose fasteners and tighten as required.

tire/wheel mounting bolts

Check the wheel mounting nuts (Fig. 55). The mounting nuts should be torqued to 300 ft-lbs lubricated for a John Deere axle, 217 ft-lbs lubricated for a Kessler axle, 120 ft-lbs lubricated for an Axle Tech axle. Use Loctite 242 on wheel mounting bolts.

Fig. 55: Tire/wheel mounting nuts

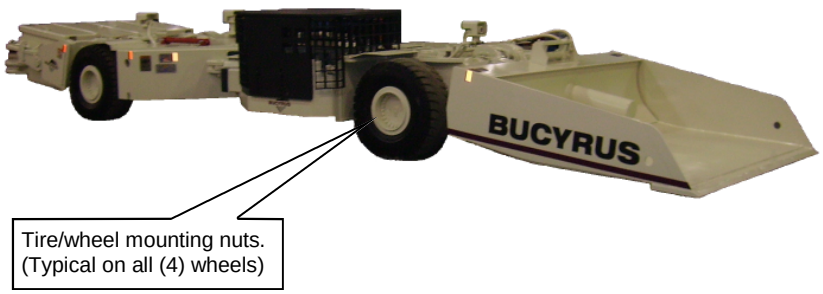


Fig. 69: Axle and wet disc brake oil level (Kessler)

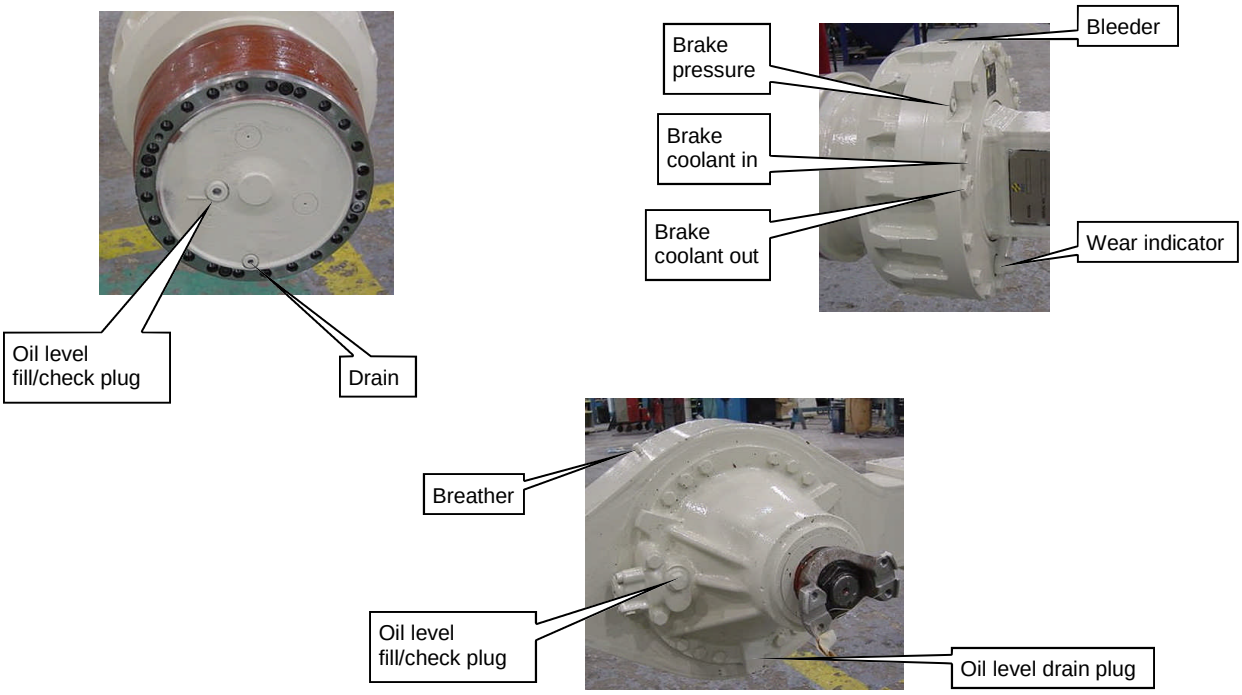


Fig. 70: Axle oil level (John Deere)

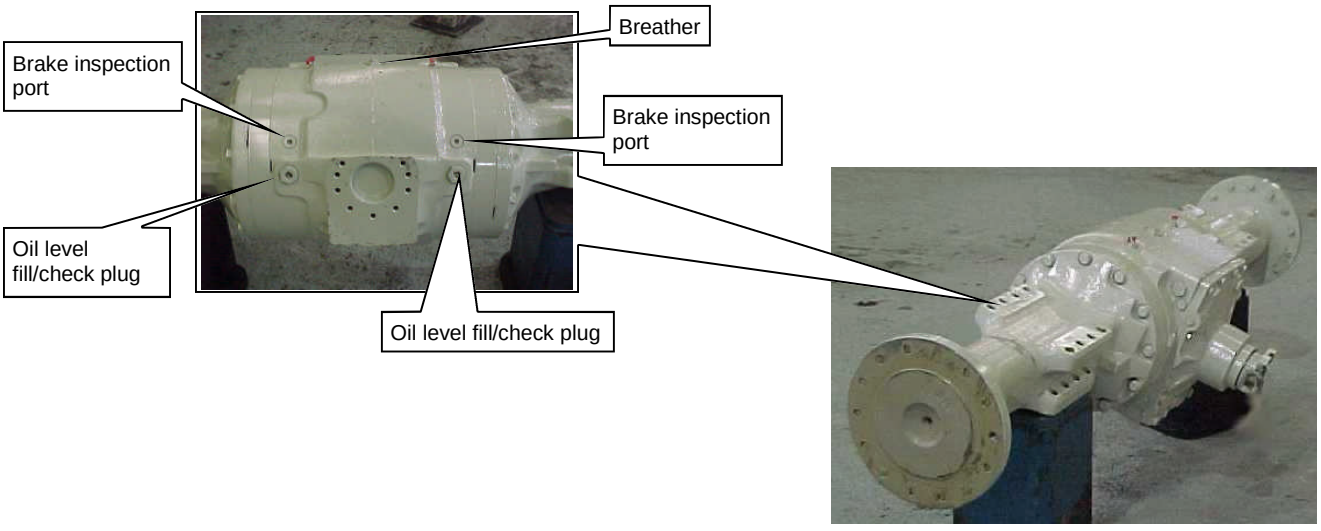
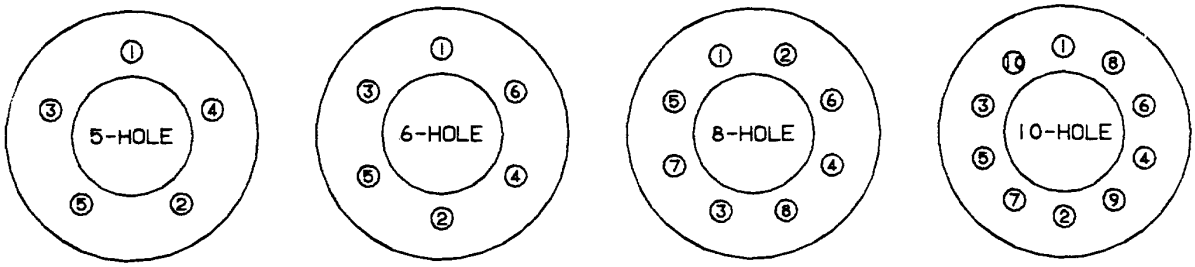


Fig. 79: Torque patterns



Recommended wheel mounting procedures

- ☞ All steel mating surfaces must be free and clean of any dirt, corrosion, paint, etc. These areas include wheel/hub tapers and disc faces. **NO PAINT** should be present under bolt heads or nuts.
- ☞ Fasteners should be in proper condition. Any fastener with damage, such as corrosion, bending or worn threads, should be replaced. Replace all broken wheel studs.
- ☞ After positioning the wheel on the hub, tighten nuts down evenly. Triangulate the bolt pattern tightening sequence as shown in the diagrams.
- ☞ After operating the machine for a short period of time, check the wheel-mounting bolts or nuts for proper torque.

NOTE: Wheel bolts or nuts “seat in” during normal vehicle operation. Therefore, it is necessary to repeat torquing procedures as necessary to seat the wheel to the hub. Planned periodic checks will help maintain correct torque values. All bolts and nuts, regardless of type, should be regularly checked for tightness.

Precautions

- ■ Do not install or remove tire/wheel assemblies from a machine without proper training.
- ■ Check wheel components periodically for cracks or broken parts. Replace all cracked, badly worn, damaged, or severely rusted components. When in doubt, replace.
- ■ Do not, under any circumstances, attempt to rework, weld, heat, or braze any wheel components that are cracked, broken or damaged. Replace such components with new OEM parts of the correct size and type.
- ■ Mixing wheel parts of different designs or from a variety of sources is potentially dangerous.
- ■ Replace broken studs and each unbroken stud next to the broken one.
- ■ Replace all damaged wheel studs or bolts.

Table 8 (continued): Hydraulic pump troubleshooting

Trouble, symptom or cause	Probable cause	Test, check and/or remedy
seal leak (continued)	☞ Oil viscosity too high or operating temperature too low.	☞ Replace with recommended oil.
	☞ Air leak in suction line or fittings.	☞ Replace lines or fittings if badly worn.
	☞ Loose or worn pump parts.	☞ Replace worn pump parts.
	☞ Air leak at pump shaft seal.	☞ Replace pump shaft seals.
	☞ Oil level too low and drawing air in through inlet pipe opening.	☞ Check oil level.
	☞ Air bubbles in intake oil.	☞ Check oil level and tighten any loose fittings.
	☞ Pump housing bolts loose or not properly torqued.	☞ Tighten the housing bolts and re-torque bolts.
pump failure to deliver oil	☞ Low oil level in reservoir.	☞ Fill to proper level.
	☞ Oil intake hose suction strainer plugged.	☞ Clean or replace strainer.
	☞ Air leak in suction line and preventing priming.	☞ Tighten or replace suction lines.
	☞ Pump shaft turning too slowly.	☞ Gears are worn and need replacing.
	☞ Oil viscosity too high.	☞ Replace with recommended oil.
	☞ Wrong shaft rotation.	☞ Check pump motor wiring.
	☞ Pump shaft or parts broken.	☞ Replace shaft or broken parts.
	☞ Dirt in pump.	☞ Clean pump .
oil leakage around pump	☞ Shaft seal worn.	☞ Replace seals.
	☞ Head of oil on suction hose connection leaking.	☞ Tighten bolts. Tighten or replace connections.
	☞ Pump housing bolts loose or improperly torqued.	☞ Tighten bolts.

Table 16: Electrically zinc plated (Coarse thread)

Property class	Torque	Recommended torque setting	Nominal diameter					
	Ma	M33	M4	M5	M6	M7	M8	M10
5.6	Nm	0.56	1.28	2.50	4.3	7.1	10.5	21
	Ft-lbs	0.41	0.94	1.84	3.1	5.2	7.7	15
8.8	Nm	1.28	2.90	5.75	9.9	16.5	24	48
	Ft-lbs	0.94	2.14	4.24	7.3	12.1	17.7	35
10.9	Nm	1.80	4.10	8.10	14	23	34	67
	Ft-lbs	1.33	3.02	5.97	10.3	16.9	25	49
12.9	Nm	2.15	4.95	9.70	16.5	27	40	81
	Ft-lbs	1.59	3.65	7.15	12.1	19.9	29	59

Table 16: Electrically zinc plated (Coarse thread, continued)

Property class	Torque	Recommended torque setting	Nominal diameter				
	Ma	M12	M14	M16	M18	M20	M22
5.6	Nm	36	58	88	121	171	230
	Ft-lbs	26	42	54	89	126	169
8.8	Nm	83	132	200	275	390	530
	Ft-lbs	61	97	147	202	287	390
10.9	Nm	117	185	285	390	550	745
	Ft-lbs	86.2	136	210	287	405	549
12.9	Nm	140	220	340	470	660	890
	Ft-lbs	103	162	250	346	486	656

Table 16: Electrically zinc plated (Coarse thread, continued)

Property class	Torque	Recommended torque setting	Nominal diameter				
	Ma	M24	M27	M30			
5.6	Nm	295	435	590	800	1030	1340
	Ft-lbs	217	320	435	590	759	988
8.8	Nm	675	995	1350	1830	2360	3050
	Ft-lbs	497	733	995	1349	1740	2249
10.9	Nm	960	1400	1900	2680	3310	4290
	Ft-lbs	708	1032	1401	1902	2441	3163
12.9	Nm	1140	1680	2280	3090	3980	5150
	Ft-lbs	840	1239	1661	2278	2935	3798

Table 27: Light gear oil, SAE 40 motor oil (Spec. 100-10)

	Supplier	Brand name
1	Amoco Oil Company	Amoco 300 SAE 40
2	Gulf Oil	Super Duty 40
3	Mobil Oil Corporation	Delvac 1340
4	Chevron U.S.A.	Chevron RPM Heavy Duty Motor Oil 15W-40
5	Sun Oil Company	Sunoco Super C 40
6	Unocal 76	Guardol Motor Oil SAE 40
7	Shell Oil Vompany	Rotella Oil 40 (Automotive) Turbo Oil 150 (Industrial) Rimula CT40 (Foreign) Rotela SX40 (Foreign)
8	Century	Flexe SAE 40
9	Texaco Lubricants Company	Ursa Super Plus SAE 40
10	Exxon	XD-3 Extra SAE 40 or XD-3 SAE 40
11	Pennzoil	Long Life SAE 40 Motor Oil
12	Lubricating Engineers	8440 Monolex GFS Engine Oil
13	Conoco Inc.	Fleet Heavy Duty Motor Oil SAE 40
14	Hydrotex	Hyfilm SAE 40
15	Phillips	Super HD II Motor Oil SAE 15W-40

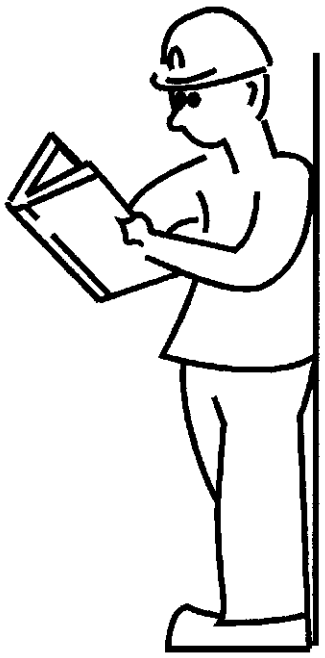
Table 28: Synthetic EP gear lubricants (Spec. 100-11)

	Supplier	Brand name
1	Century Lubricants Company	Synthetic EP Gear Lubricants

Table 29: Multi-purpose tractor hydraulic fluid (Spec. 100-12)

	Supplier	Brand name
1	Exxon / Mobil	Mobilfluid 424
2	Century / Fuchs	Multitran
3	Shell	Donax TD
4	Chevron	Tractor Hydraulic Fluid
5	BP Lubricants	Tractran UTH
6	Quaker State	Quaker State FCI HD
7	Conoco	Powertran Fluid

1 About this manual



cordon off working area

Cordon off your working area widely for the machine.

moving parts

Never allow parts of your body to come between parts which could move, such as e.g.:

- false bottoms
- pivot points
- battery lifts

steering lockout

Connect the steering lockout device before performing maintenance or repairs on the machine.

Storage and transport

Maintain the prescribed storage periods and observe the instructions for storage.

Do not store materials or parts in the travel way or in your working area.

Inform the persons involved about the intended transport route and the anticipated duration of the transport.

transport safety device

Ensure that the transport safety devices are correctly fitted.

Fix all moving parts with transport locks.

Never stand under unsupported parts or suspended loads.

means of attachment

Connect the lifting equipment only to the points of attachment provided for that purpose. Observe the different load limits of the attachment points. Also observe the instructions on the transport sheet.

Only use means of attachment which are in good condition and have been designed for the loads to be handled.

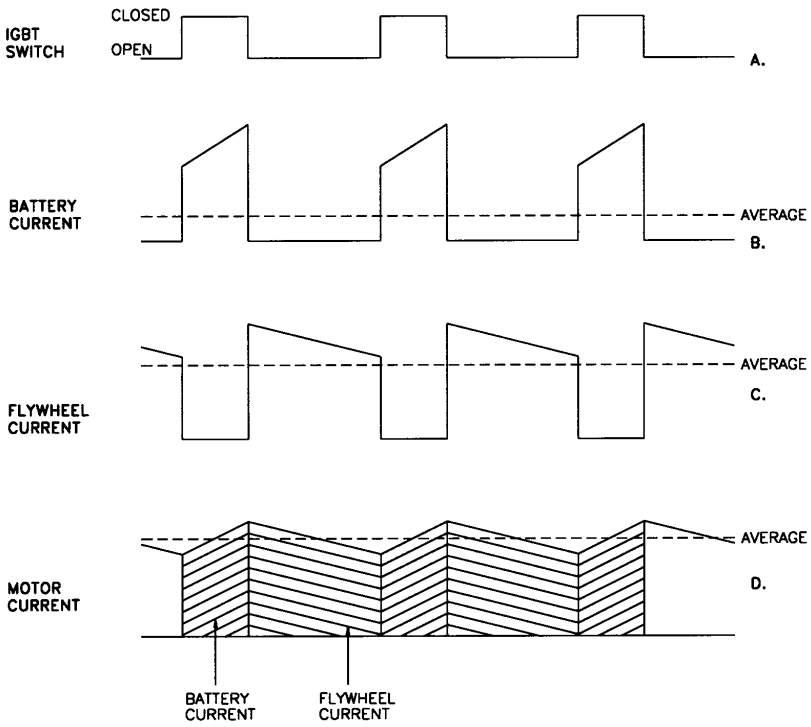
For round components use transport straps, only. Never use chains or steel cables for this purpose.

Do not damage the treated or polished surfaces of shafts, sealing surfaces, etc.

mobile handling equipment

When using mobile handling systems for transport make sure that the center of gravity is as low as possible.

Fig. 6: Flywheel current (low speed)



To summarize, the motor current is made up of a combination of battery current and "flywheel" current so that under all conditions the average motor current is always greater than the average battery current.

At low speeds the motor current can be several times greater than the battery current.

At high speeds, when the IGBT switch is open only for short periods before closing, the motor current is made up almost entirely of battery current.

Fig. 7: Flywheel current (high speed)

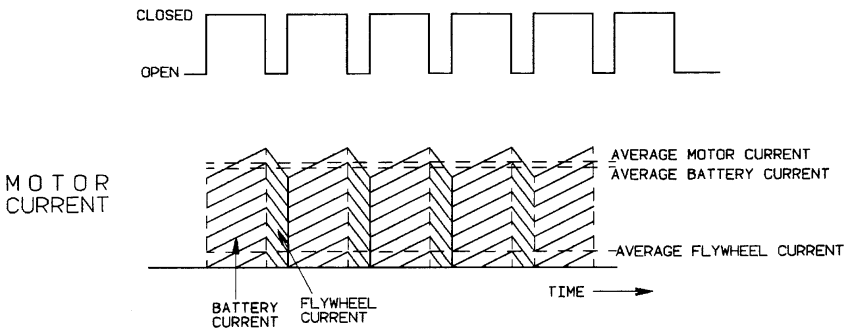


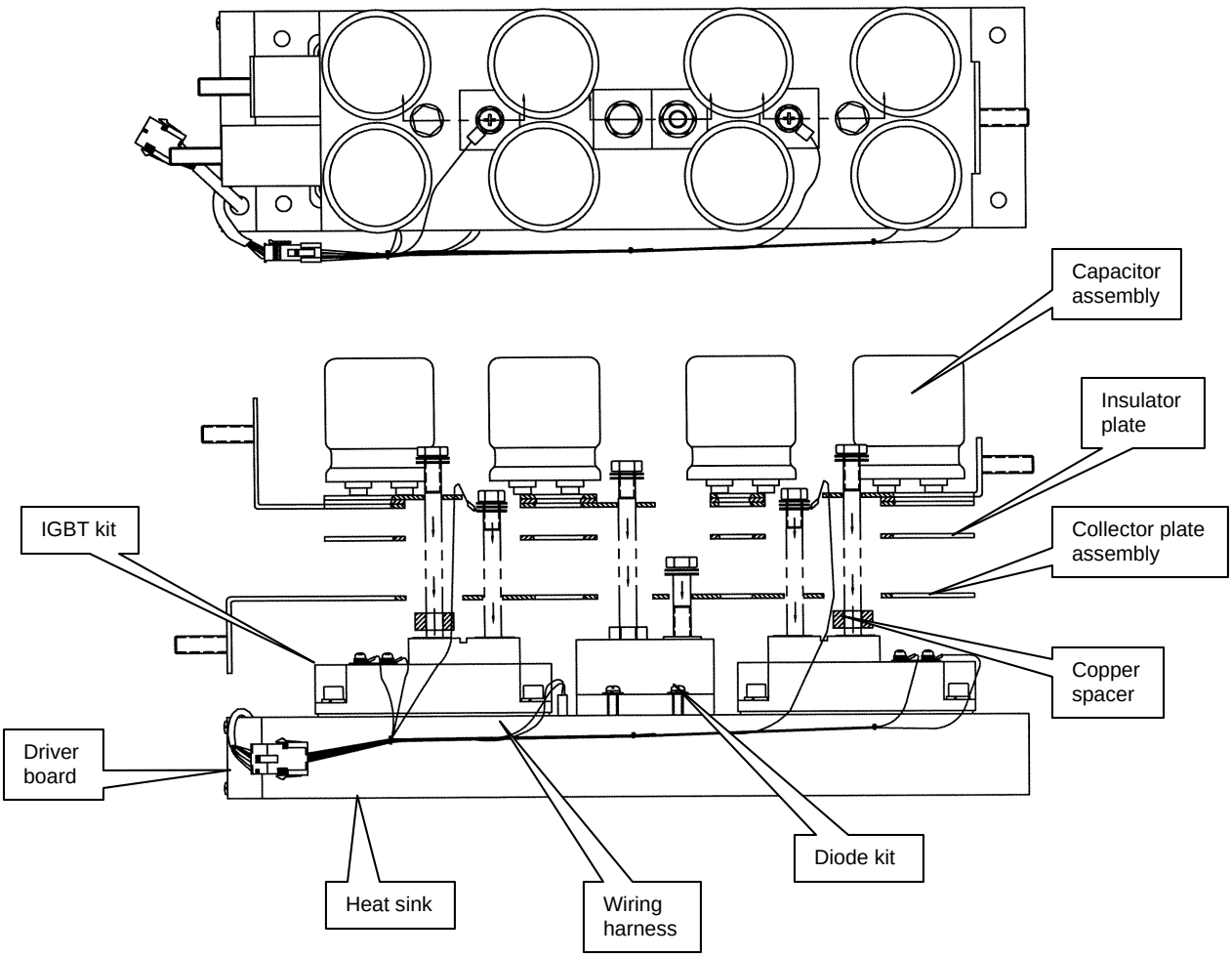
Table 2: Fault message chart (cont.)

Dashboard display	Calibrator display	Description	Possible causes/checks
"I. D. FAULT"	"VEHICLE ID FLT."	Vehicle Configuration ID invalid	
"L FWD OFF"	"TRACT L. FWD OFF"	Diagnostic LEFT FWD point "A" trip failed to disable PWM1.	Faulty logic board or driver board.
"L FWD ON"	"TRACT L. FWD ON"	Diagnostic LEFT FWD point "A" trip failed to be disabled.	Faulty logic board, shorted motor to ground or shorted IGBT.
"LPTA SHORT"	"P. UP L. PTA SHORT"	Dual motor Block 0 point "A" short (Note: Block 0 is right, point A (PTA) is any point between battery positive and battery negative.)	Motor short to ground or LEFT IGBT shorted Other electrical component shorted or grounded not allowing voltage to come up to or above 64VDC on IGBT panel. Some examples (list is not all inclusive) are: - Shorted solenoid - Confirm diodes and transistors are not shorted. - Pump drive shorted or grounded. - Pump motor grounded. - DC-DC converter for IS relays shorted. - DC-DC converter for PLC shorted. - Grounded tram motor. - Any grounded control wiring.
"L REV OFF"	"TRACT L. REV OFF"	Diagnostic LEFT REV point "A" trip failed to disable PWM1.	Faulty logic board or driver board.
"L REV ON"	"TRACT L. REV ON"	Diagnostic LEFT REV point "A" trip failed to be disabled.	Faulty logic board, shorted motor to ground or shorted IGBT.
"PTA SHORT"	"P. UP PTA SHORT"	Single motor Block 0 point "A" short (Note: Point A (PTA) is any point between battery positive and battery negative.)	Motor short to ground or IGBT shorted Other electrical component shorted or grounded not allowing voltage to come up to or above 64VDC on IGBT panel. Some examples (list is not all inclusive) are: - Shorted solenoid - Confirm diodes and transistors are not shorted. - Pump drive shorted or grounded. - Pump motor grounded. - DC-DC converter for IS relays shorted. - DC-DC converter for PLC shorted. - Grounded tram motor. - Any grounded control wiring.
"REV OFF"	"TRACT REV OFF"	Single motor Diagnostic REV point "A" trip failed to disable PWM0.	Faulty logic board or driver board.
"REV ON"	"TRACT REV ON"	Single motor Diagnostic REV point "A" trip failed to be disabled.	Faulty logic board, shorted motor to ground or shorted IGBT.
"R FWD OFF"	"TRACT R. FWD OFF"	Diagnostic RIGHT FWD point "A" trip failed to disable PWM0.	Faulty logic board or driver board.
"R FWD ON"	"TRACT R. FWD ON"	Diagnostic RIGHT FWD point "A" trip failed to be disabled.	Faulty logic board, shorted motor to ground or shorted IGBT.
"RPTA SHORT"	"P. UP R. PTA SHORT"	Dual motor Block 0 point "A" short (Note: Block 0 is right, point A (PTA) is any point between battery positive and battery negative.)	Motor short to ground or RIGHT IGBT shorted Other electrical component shorted or grounded not allowing voltage to come up to or above 64VDC on IGBT panel. Some examples (list is not all inclusive) are: - Shorted solenoid - Confirm diodes and transistors are not shorted. - Pump drive shorted or grounded. - Pump motor grounded. - DC-DC converter for IS relays shorted. - DC-DC converter for PLC shorted. - Grounded tram motor. - Any grounded control wiring.
"R REV OFF"	"TRACT R. REV OFF"	Diagnostic RIGHT REV point "A" trip failed to disable PWM0.	Faulty logic board or driver board.
"R REV ON"	"TRACT R. REV ON"	Diagnostic RIGHT REV point "A" trip failed to be disabled.	Faulty logic board, shorted motor to ground or shorted IGBT.

Fig. 18: IGBT heat sink assembly

X1 CONNECTOR

PIN #	COLOR	LENGTH	DESTINATION
1	WHITE	8.0”	THERMISTOR
2	WHITE	8.0”	THERMISTOR
3	ORANGE	6.0”	IGBT LEFT “C”
4	ORANGE	14.5”	IGBT RIGHT “C”
5	GREEN	4.0”	IGBT LEFT “G”
6	GREEN	13.5”	IGBT RIGHT “G”
7	GREY	4.75”	IGBT LEFT “E”
8	GREY	12.5”	IGBT RIGHT “E”



Troubleshooting

This section provides troubleshooting information. This guide assumes you have a working knowledge of IGBT controller servicing and that you have the following equipment.

- volt/ohm meter or digital meter with diode check function
- appropriate leads for meter
- insulated basic hand tools

WARNING!
Follow all Mine, State, and Federal lockout/tagout regulations.

WARNING!
When working inside the controller, use insulated gloves and tools where possible.

WARNING!
All connections must be tight and care must be taken to prevent bolts, nuts, washers and other small metal fasteners from being dropped or lost inside the controller.

WARNING!
Before starting any power-related performance tests, the machine must be securely blocked clear of the ground with all four (4) wheels free to turn.

NOTICE!
Refer to the parts manual for your particular machine wiring diagrams and schematics.

NOTICE!
The logic unit contains no user-serviceable parts. Opening this sealed device will void the warranty.

WARNING!
Never power up logic without the 32 pin connector connected to the logic. Powering up the logic without the 32 pin connector will result in damage.