Operation Manual

Bucyrus - **Battery Charger with Digital Display**

Models **5, 6, 8, 10, 12, 14, and 16**

Doc. No.: **A6474X230**

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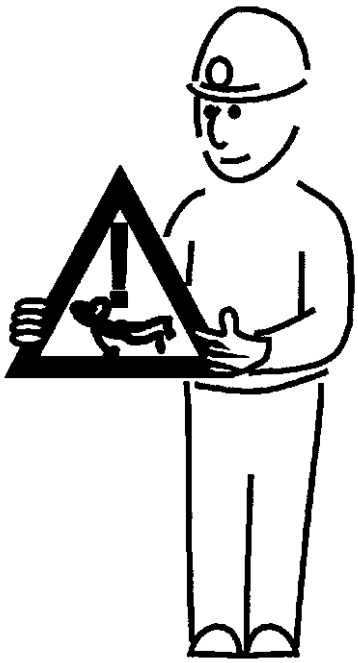
2 Your safety



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.

mobile handling equipment

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

Pre-start inspection

operation

Read this entire guide before attempting to operate this unit.

inspection

Inspect the unit and have any malfunctioning, broken, or missing parts corrected or replaced before use.

maintenance

Verify that all maintenance has been performed.

instruction and safety tags

Verify that all instruction and safety tags are in place and are readable.

operating area

Clean any foreign material from the work area.

4 Installation

Electrical Connections and Field Wiring

AC input

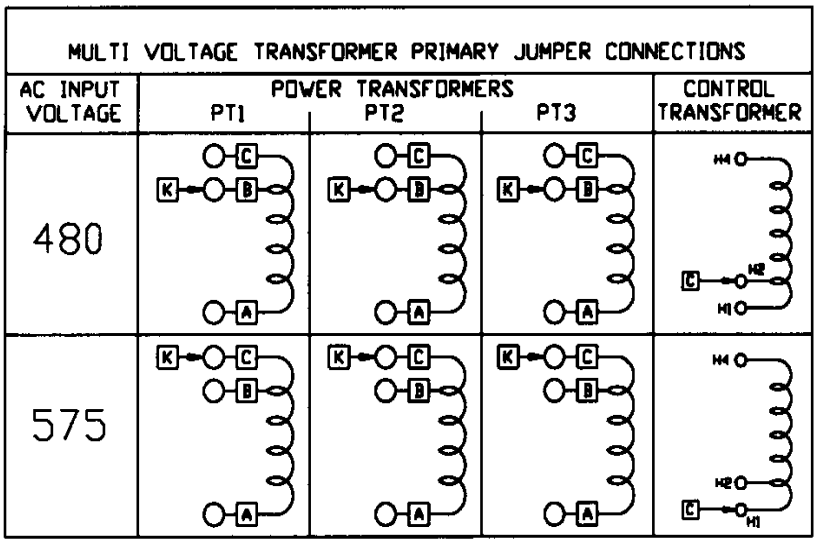
Make sure that the input source is the same voltage and frequency as that which is marked on the nameplate of the rectifier.

The AC input current, specified on the nameplate, is for (nominal) output. AC line fuses or breakers must be sized for the overload or current limit point of the charger, which is 130% of the nameplate value.

An adequate earth ground lead should be connected to the terminal marked "GROUND" or "GND" on the rectifier terminal board or case.

Be sure the transformer taps are set for the correct AC input (see Fig. 2 for standard chargers and Fig. 6 for PA models).

Fig. 2: Transformer tap connections (standard)



DC output

Make sure that the battery which is being connected to the rectifier matches the cell type and number of cells that is marked on the rectifier nameplate.

Polarity

The negative wire from the battery must be connected to the terminal marked “NEGATIVE” or “NEG” and the positive wire from the battery must be connected to the terminal marked “POSITIVE” or “POS” on the rectifier.

Adjustments

The Bucyrus Series Battery Charger is a completely automatic constant voltage charger. Each battery charger is designed to operate on a specific type of battery with a specified number of cells. **The unit is factory set at 2.5 volts per cell (V.p.c.).**

Circuit operation

The Bucyrus Series Ferroresonant Mine battery charger has three basic components; a ferroresonant step down transformer, silicon rectifiers (diodes) and electronic timer.

The regulating action of the unit is caused by the current developed in the resonant winding of the power transformer. The resonating capacitor along with the resonant winding of the transformer form a tuned circuit which establishes the correct core saturation point and in turn regulates the unit's output.

The transformer also steps down the AC input voltage to the proper voltage to charge the battery. It also provides isolation from the input to the output.

The silicon diodes convert the AC output from the secondary of the transformer to the DC voltage needed to charge the battery.

The automatic timer senses the connection of the battery and turns the unit on (green start button must be pushed in with the Ground Integrity option), the timer will allow the charger to charge the battery for a period of time (maximum 12 hours), then turns the charger off. It will also turn the charger off when the battery is disconnected.

Ground and short circuit test

A simple ohmmeter check can be performed to check the unit for a short to ground, primary to secondary breakdown, AC-DC short, or DC ground. Before installation of a new unit, the above checks should be made before installing. If a short of this type is suspected on a unit in service, check as follows:

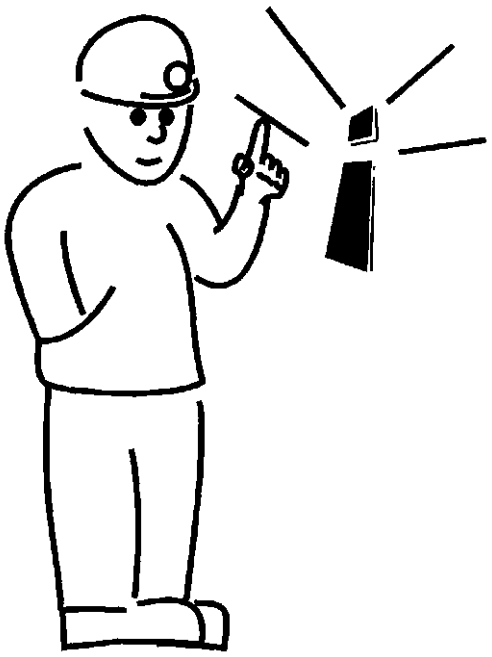
- ☞ Disconnect AC input power to the unit. Disconnect the DC battery and loads from the rectifier.
- ☞ Set ohmmeter scale on ohms scale RX100.
- ☞ Measure from one terminal of the input to one terminal of the output. Meter should not indicate. If the meter reads full scale deflection, this indicates an AC-DC short. During shipping, an AC wire may rub against the DC lugs, terminals, etc. and cause a short. These problems may be eliminated by very carefully inspecting the wiring to make certain the AC wires are not touching the DC wiring. If no wires are touching, then it is possible that the primary and secondary of the transformer is shorted. Disconnect the secondary of the transformer from the diodes. Measure with ohmmeter from input terminal to one of the isolated secondary leads. If there is an ohmmeter indication, there is an insulation breakdown between primary and secondary windings. The transformer should be replaced.
- ☞ Check the input terminals to ground and check the output terminals ground. If the meter indicates full scale deflection, a wire is touching a metal part of the unit. Look for wires that are near any metal part and inspect for possible breakdown caused by shipping. The heat sink of the diodes and the control unit are insulated from ground through the mounting legs.

Troubleshooting and replacing power silicon diodes

If a portable multimeter is used, set the switches on "ohms", "DC", and " RX1 " scale.

- ☞ Isolate one end of the diode by disconnecting the wires attached to the nipple (or pigtail) end of the diode (only one end of the diode must be disconnected).
- ☞ Clip one lead of the ohmmeter to the anode lead of the diode. Clip the other ohmmeter lead to the cathode.
- ☞ Note the ohmmeter reading, then reverse the leads to the diode. Again, note the ohmmeter reading. If the diode is good, the meter will indicate a high resistance in one direction, and a low resistance with the leads reversed. If the diode is shorted, the meter will read full scale, or zero ("0") resistance with the leads in either direction. If the diode is "open", the ohmmeter needle will not indicate or it will show infinite resistance in either direction, indicating an open circuit.

7 For your information



About this manual

This chapter provides important information making it easier for you to use this manual. You will also be given information on the structure of the manual and the symbols and characters used.

Before starting to work

applicable operating manual

Take care to ensure that the operating manual available to you is applicable for the type of equipment or machine used.

machine type

This operating manual is intended for:

Bucyrus America, Inc. – Model 488-6DM UN-A-TRAC ®
Serial No.: N/A

and is only permitted to be used for equipment of this type.

new operation manual

The operating manual must be accessible at all times to all persons working on or with the machine.
It should, if possible, always be available at the place of operation.

Send for a new operation manual immediately if the present manual is no longer complete or has become illegible.

Who is this operating manual intended for?

This operating manual is intended for those persons who work with or on the machine.
Every person working on the face or in the intersection between face and entry or in the entry must read this operating manual.

This includes persons who:

- are in charge of transport
- prepare the rise heading
- perform assembly / disassembly work
- operate the machine
- eliminate faults
- perform daily routine work on the face or in the entry
- perform maintenance work
- perform repair work

supervisory personnel who:

- initiate and/or
- supervise the activities just indicated.

Safety instructions

General rules:

general

Always work with full concentration.

Familiarize yourself with your working environment.

noise emissions

Always wear your personal protective equipment. This also includes ear protectors as the noise emitted by other equipment in the area may at times exceed 85 db(A).

Inform your colleagues of:

- your exact location.
- the work you are performing.
- the time that you will probably require.

safety equipment

Start the machine only when it is in a good and safe operating condition and all protective devices, e.g. EMERGENCY STOP devices, cover plates, etc. are correctly installed.

Observe the acoustic and optical start-up warnings of the machine.

symbol plates

Observe the symbol plates on the machine.

emergency stop (panic strip)

Press the EMERGENCY STOP switch immediately in the event of fault or irregularities in operation. Report any peculiarity to your superior so that necessary measures can be taken immediately.

disconnect battery

Disconnect the battery while performing:

- maintenance work
- inspection work
- repair work

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.:

- bucket/fork lifts
- pivot points
- battery lifts

steering lockout

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

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.

WARNING!
Should the dif-lok or brake pressure exceed the maximum readings, shutdown the machine and call a maintenance person.

WARNING!
The machine must be chocked at all four (4) wheels before releasing the automatic emergency/park brakes with the hand pump. The machine could run away out of control and cause damage to the machine or injury or death the operator or other persons.

WARNING!
Holding the "BUCKET" control lever in the down position can raise the front end of the machine off the ground and could cause the top of the machine to strike the roof of the mine, crushing persons or body parts in between. Make sure that no one is in the Hazard zone (see Hazard zone in chapter 5) before moving any levers or pedals.

WARNING!
When the unit is to be shutdown, the bucket should be lowered to the ground to prevent accidental movement of the bucket. If the "BUCKET" control lever is moved when the unit is shutdown, the bucket could drop, even if all other levers and pedals are in the "OFF" position.

WARNING!
Before moving the "EJECTOR" control lever, verify that no one has any part of their body between the ejector blade and the back of the bucket. Also keep any obstructions from behind the ejector blade so it can return completely to the back of the bucket.

WARNING!
The "BATTERY" changer lever should only be operated at a battery change station. The battery may be damaged if accidentally raised in a low roof area. For more information on how to change the batteries see the Battery change procedure in this chapter.

WARNING!
Never attempt to disconnect a hydraulic hose from the battery lifting cylinders with the battery in the "UP" position. This would allow the battery to fall and could result in injury.

Before transport

temperatures below freezing

Before transporting the equipment at temperatures below freezing, all hydraulic components operated with emulsion (HFAE or HFAS) must be completely drained and then filled with a corrosion inhibitor/frost-proofing fluid (e.g. CV 50).

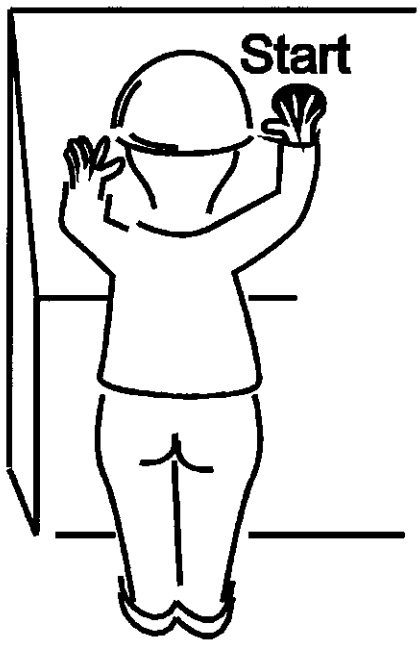
Transport of equipment at temperatures between -6° F (-21° C) and 40° F (-40° C) is only permissible when certain measures were taken to meet these conditions at the design and manufacture stages. Nevertheless, the individual parts and devices of this equipment must not be subjected to sudden impact loads at such low temperatures and may only be loaded statically or quasi-statically.

During transport of this equipment with floor-mounted vehicles at such low temperatures, measures must also be taken to ensure that the parts and devices are not subjected to sudden impact loads. At very low temperatures and on poor roads, the transport vehicle speed must therefore be limited to a maximum of 15 mph (25 kph) for truck transport.

electronic components

Electrical and electronic components must be removed for overseas transport or prolonged storage outdoors unless these components or the complete equipment is protected against harmful environmental influences by a suitable packaging.
The electrical cables remain in the equipment. They must be carefully protected against transport damage and soiling of the connections.

5 Operation



Operator’s compartment - control station model only

light switch lever

The light switch lever (Fig. 12), located to the left of the operator's seat, turns on either pair of the machine's headlights. One pair is located on the battery (rear) end and the other pair is located on the bucket (front) end of the machine.

master switch lever

The master switch lever (Fig. 12), located to the left of the operator's seat, has four (4) positions: "OFF," "PARK," "FORWARD," and "REVERSE." If the battery (connection box) circuit breaker is in the "ON" position and the master switch lever is in "PARK," "FORWARD" or "REVERSE" position, the hydraulic pump's electric motor can be started by pressing the pump start button and holding it for approximately one (1) second and release. At this point the pump motor will be operating making a whining sound. This is normal. "PARK" position of the master switch allow the unit's pump motor to run without being able to tram in either direction. "FORWARD" position of the master switch means that the machine is ready to tram forward in the direction of the bucket. "REVERSE" position of the master switch means that the machine is ready to tram backwards in the direction of the batteries. The speed switch foot pedal must be depressed before the machne will move in either direction.

To change the direction of travel:

1. Release the speed switch foot pedal and stop the UN-A-TRAC® by depressing the service brake pedal.

2. Change the position of the master switch lever.

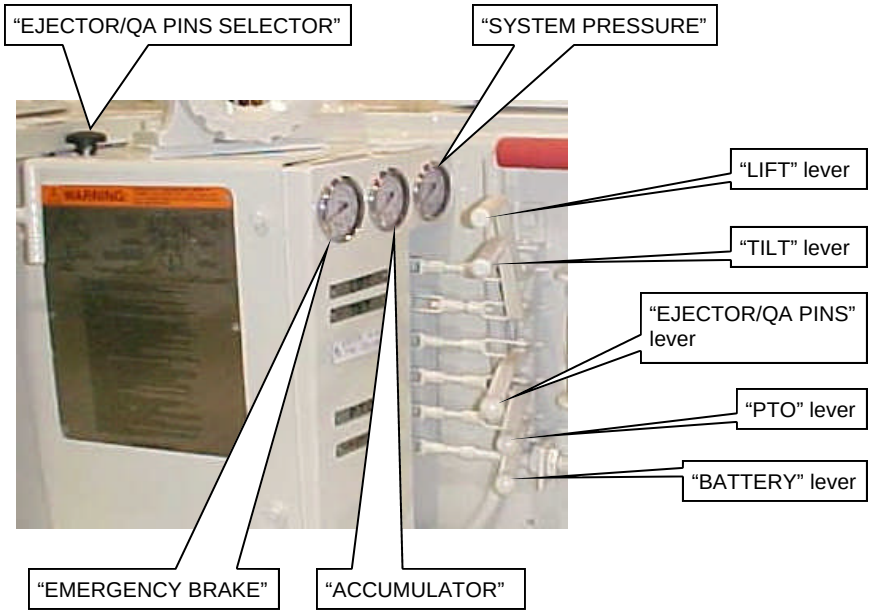
3. Release the service brake pedal and depress the speed switch foot pedal.

CAUTION!
NEVER CHANGE THE MASTER SWITCH LEVER FROM “FORWARD" TO "REVERSE" OR FROM "REVERSE" TO "FORWARD" WHILE THE UN-A-TRAC® IS IN MOTION OR WHILE THE SPEED SWITCH FOOT PEDAL IS DEPRESSED.

pump start switch

The pump start switch is a push button located on the front cover panel of the control station enclosure (Fig. 12). If the emergency manual “POWER DISCONNECT” switch is in the "ON” position (pulled out), the master switch is in "PARK” position, and the pump start switch is pushed, the hydraulic pump's electric motor will operate, making a whining sound. This is normal.

Fig. 17: Hydraulic control panel (optional QDS machines)



“TILT” control lever

The "TILT” control lever (Fig. 17) is used to controls the forks and or the quick attach bucket. This control lever allows the operator to tilt the forks or bucket either forward or back. To tilt the attachment down, push the lever away from the operator. To tilt the attachment up, pull the lever towards the operator.

“LIFT” control lever

The "LIFT” control lever (Fig. 17) is used to raise or lower the forks and or the quick attach bucket. To lower the attachment, push the lever away from the operator. To raise the attachment, pull the lever towards the operator.

WARNING!
Holding the “TILT” or "LIFT" control levers in the down position can raise the front end of the machine off the ground and could cause the top of the machine to strike the roof of the mine, crushing persons or body parts in between. Make sure that no one is in the hazard zone before moving any levers or pedals.

WARNING!
When the unit is to be shutdown, the forks or bucket should be lowered to the ground to prevent accidental movement of the attachment. If the "LIFT" control lever is moved when the unit is shutdown, the attachment could drop, even if all other levers and pedals are in the "OFF" position.

Shutdown procedure

Tram the machine to its designated parking place.

Stop the machine 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. 20 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. 21):

- 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.

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 America, Inc. 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:

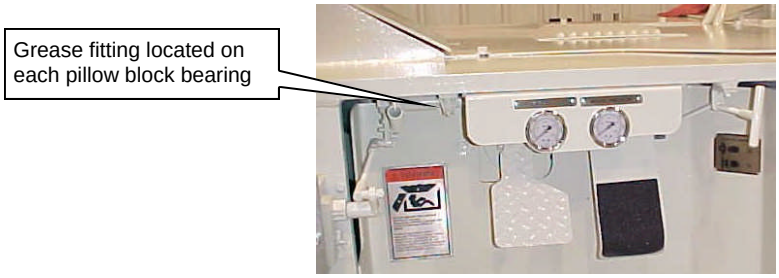
- Shutdown the machine on level ground.
- Disconnect the electrical power. Either the battery circuit breaker or the emergency manual power disconnect (if equipped) must be in the "OFF" position. If work is to be done inside the electrical controller, the battery should be disconnected. Also make sure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

accelerator pedal

Lubricate the accelerator pedal (2 places) with Spec. 100-3 through the grease fittings located on each pillow block bearing (Fig. 41). Pump grease into the fittings until new grease can be observed coming out of the bearings.

Fig. 41: Accelerator lubrication points



winch

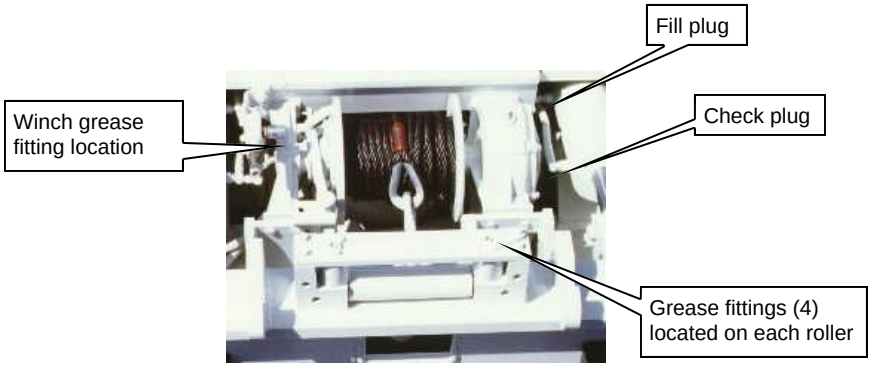
Lubricate the winch (1 place) with Spec. 100-3 through the grease fitting located on the top right side (Fig. 42). Pump grease into the fitting until new grease can be observed coming out of the shaft.

Check the oil level in the winch (Fig. 42). Clean dirt and debris from around the check plug and remove plug. Oil level should be kept at the level of the of the plug. If oil is required, add oil through the fill plug hole until oil begins to flow from the check plug hole and replace plugs. Do not overfill the winch. (Refer to the winch operation and maintenance manual included in your parts manual)

winch guide rollers

Lubricate the winch guide rollers (4 places) with Spec. 100-3 through the grease fittings located on the outside of the guide rollers (Fig. 42). Pump grease into the fittings until new grease can be observed coming out of the rollers.

Fig. 42: Winch and winch guide rollers lubrication points



wet disc brake oil

- ☞ Clean dirt and debris from around the check and fill plug and remove the plugs.
- ☞ Add oil (Spec. 100-12) through the fill plug hole slowly, just until it starts to flow back out of the check plug hole. Allow sufficient time for the oil to travel throughout the brake when filling.
- ☞ Clean and reinstall check and fill plugs.

Fig. 52: Axle and wet disc brake oil level (Kessler)

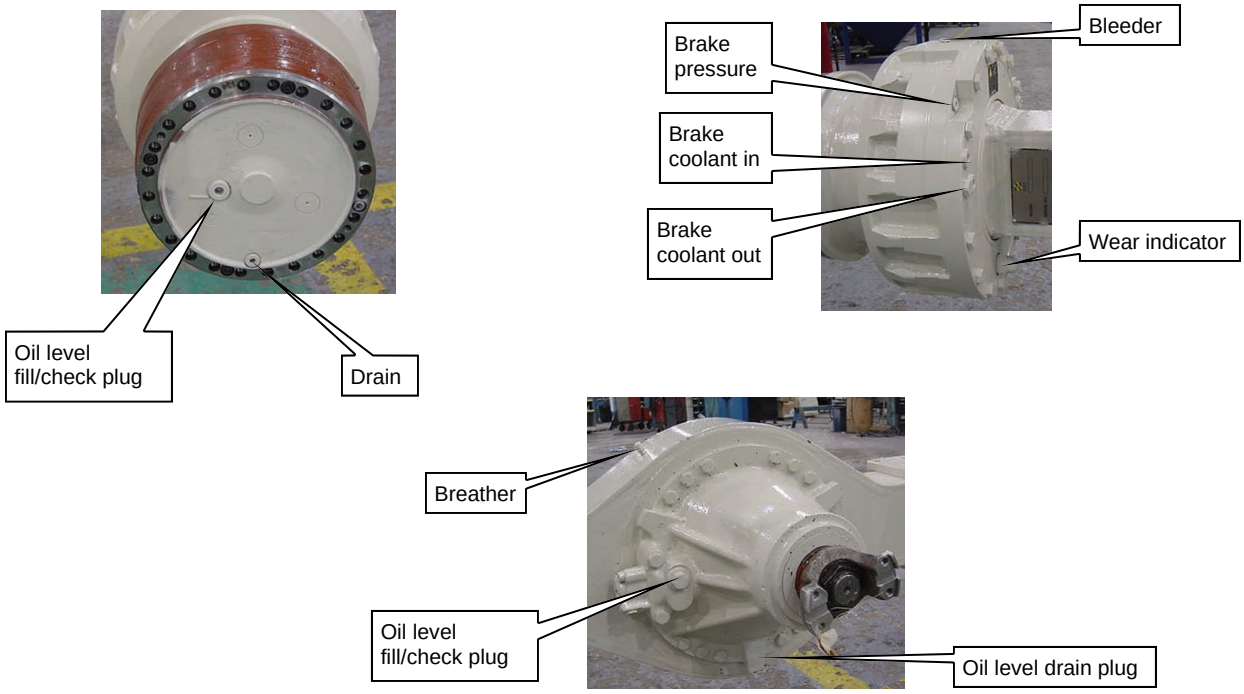
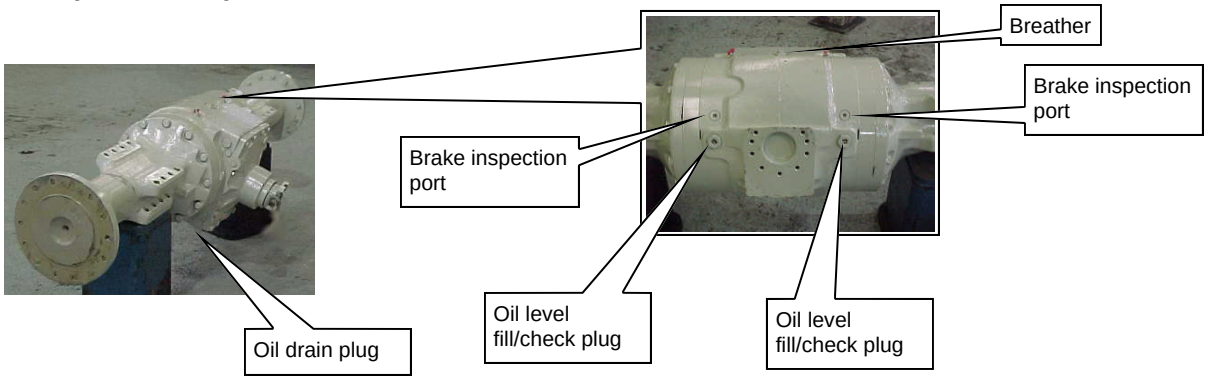


Fig. 58: Axle oil (John Deere)



Troubleshooting procedures

The following section lists possible problems encountered when servicing the UN-A-TRAC® and can aid in locating and correcting these problems.

This section covers basic hydraulic components, with each listed in a trouble-cause-remedy format.

For electrical instructions, troubleshooting, and maintenance procedures, refer to the BUCYRUS AMERICA, INC. “Dual Motor Controller Troubleshooting Guide”, part number A6474X226.

WARNING!
Some procedures must be carried out with the cover of the electrical controller removed and some procedures require the controller to be energized during the tests. It is extremely important that you take all necessary precautions to prevent accidental electrical shock while working within the controller. An MSHA-certified electrician must supervise and inspect all work performed.

For maintenance procedures and tests that DO NOT require the controller to be energized, these precautions include:

- ☞ Before removing the controller cover, remove power from the system by unplugging the battery.
- ☞ When the cover is removed, wait one minute for the capacitors to discharge before working inside the controller. To insure that the capacitors are discharged, connect an insulated 100-ohm, 10-watt resistor between the center buss bar and the outer buss bar of the capacitor bank and hold for 30 seconds.
- ☞ Use insulated gloves and tools where possible.
- ☞ 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. These lost fasteners could cause electrical shorts inside the controller.

For procedures that DO require that the controller be energized while the cover is off:

- ☞ At no time should you reach inside the controller while it is energized. If it becomes necessary to make adjustments or to replace parts inside the controller, the machine circuit breaker must be turned to the “OFF” position and the capacitor bank discharged (see above). Once the circuit breaker is in the “OFF” position and the capacitor bank discharged, adjustments or parts replacements can be made.
- ☞ Use insulated gloves and tools where possible.

6 Technical data

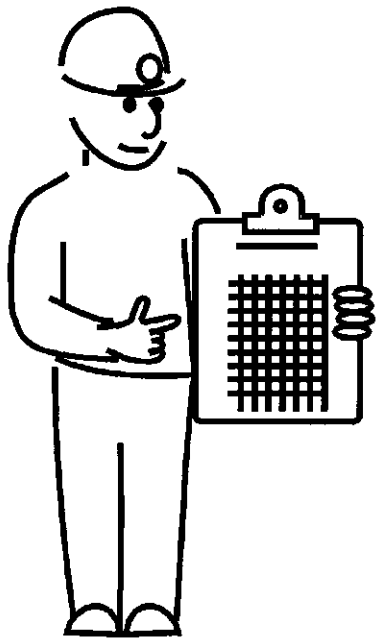


Table 22: Electrically zinc plated (Coarse thread)

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 23: 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 24: 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 37: 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 company	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 38: Synthetic EP gear lubricants (Spec. 100-11)

	Supplier	Brand name
1	Century Lubricants Company	Synthetic EP Gear Lubricants

Table 39: 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

6. Technical data

7. For your information

Your safety

This chapter provides vital information for your safety.
Pay special attention to this chapter. The safety instructions and rules of procedure will help you to avoid hazardous situations and to perform the necessary work as safely as possible.

state of the art

This battery has been manufactured in accordance with the state of the art and generally recognized safety standards and regulations.
You and others can nevertheless be exposed to dangerous situations e.g. as a result of environmental influences or battery damage.

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Use only original spare parts from Bucyrus America, Inc. Note that the use of parts from other manufacturers will void the guarantee.

In addition to this operating manual be sure to also observe the respective legal provisions and regulations in your country.

Observe the safety and accident prevention regulations:

- of the mine,
- of the Mine Inspector, and
- of the mining supervisory authorities.

while handling acids

- **The splashing of acid Into the eyes is the most dangerous condition encountered while handling sulfuric acid or electrolyte.** If this should happen, the eyes should immediately be gently flooded with clean, fresh, running water for at least 15 minutes, followed as quickly as possible with a physician's examination. If the person is wearing contact lenses, they should be removed before rinsing the eyes.

WARNING!
Do not use a buffering or neutralizing agent in the eyes without medical approval.

- Acid or electrolyte splashed onto the skin should be washed off under running water. Battery electrolyte will usually only cause irritation of the skin; if a burn develops, it should be treated medically.

- When electrolyte is splashed on clothing, use a weak solution of bicarbonate of soda, as soon as possible, to neutralize the acid.

- A carboy tilter or safety siphon should be provided for handling acid from a carboy container. Use the protective box when moving a carboy. Store acid in a cool place out of the direct rays of the sun. Use only glass, rubber, lead, or acid-resistant plastic containers when storing acid or electrolyte.

- When mixing acid to prepare electrolyte, always pour the acid slowly into the water and stir constantly to mix well. Never pour water Into acid. Never use sulfuric acid solutions which are over 1.400 specific gravity when adjusting battery acid. If acid adjustment becomes necessary, contact Bucyrus.

- Apply a neutralizing solution, such as bicarbonate of soda and water, when acid is spilled on floor. Clean up affected area promptly. A mixture of one pound of soda to one gallon of water is recommended.

Unpacking upon receipt

Upon receipt of a mine power storage battery, perform the following:

- ☞ It is important first to examine the exterior of the packing for wet spots on bottom or sides which may indicate leaking jars. Inspect also for physical damage to battery package because the battery could be affected as well. Report any damage to your supervisor.
- ☞ Make certain that the package is right side up, with skid mounts resting firmly on floor.
- ☞ Use a forklift truck or crane of sufficient capacity to remove the packaged battery from the truck or freight car. If a crane is employed, be sure the sling is secured against the bottom of the skid and not around the skid mounts.

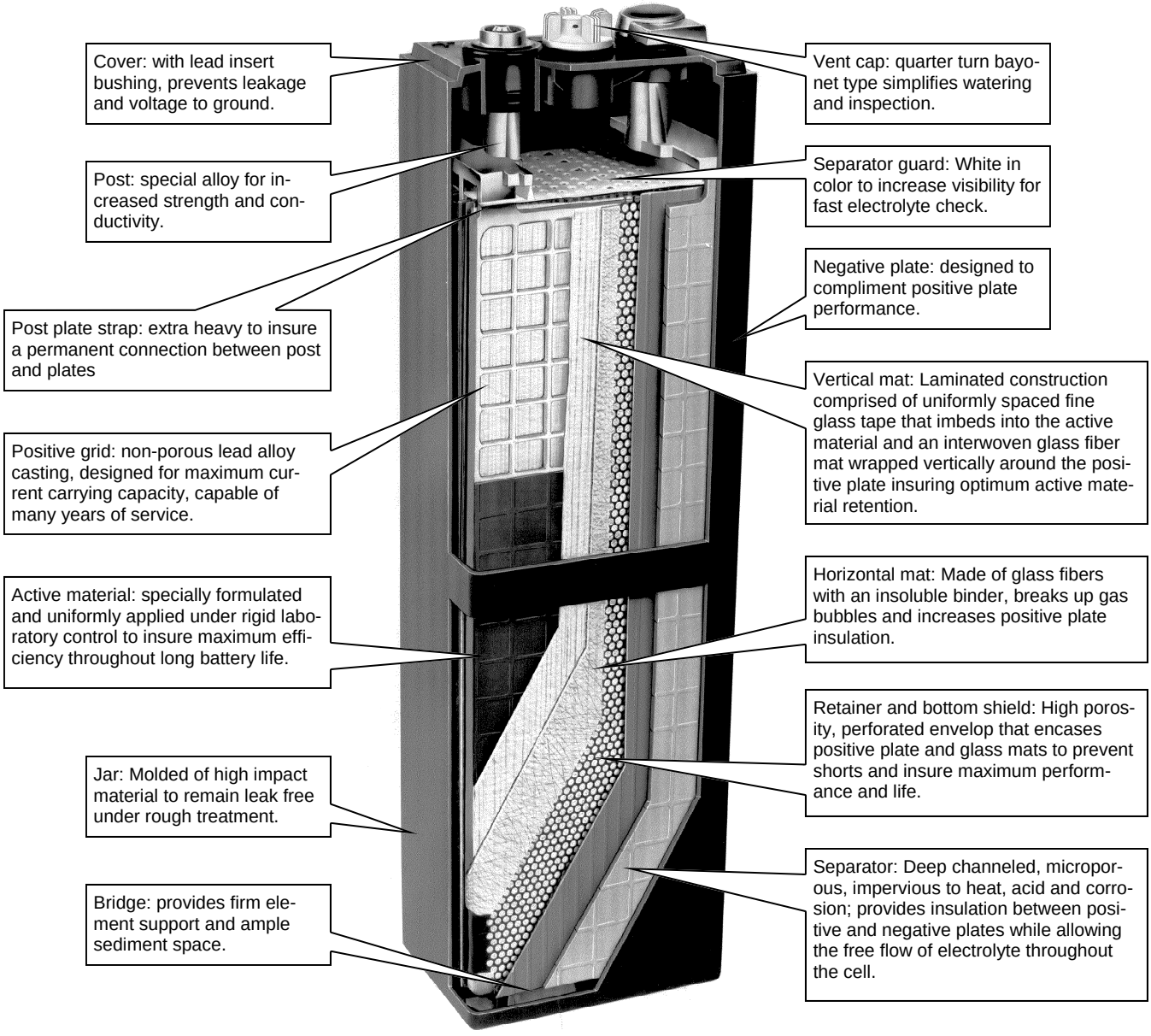
WARNING!
Lifting devices used to move batteries must be capable of carrying the weight stamped on the battery case. Keep all persons and body parts from under the batteries when they are lifted.

- ☞ Move the crated battery to the uncrating area and remove packaging, including any wrapping or other protection provided to the battery terminal cable connectors.
- ☞ Inspect battery and report any damage to your supervisor.
- ☞ Use a properly insulated lifting beam of adequate capacity to lift the battery, by means of an overhead hoist, from the battery skid.

When lifting batteries, always use a device which exerts a vertical pull on the lifting eye or tab. If a chain must be used, it should be in combination with a lifting beam with provision for adjusting lifting hook centers to the exact length of the tray. Any method of lifting which tends to squeeze or stretch the battery tray may distort it and could damage jars or disturb cell seals.

A piece of rubber sheet or other insulating material, temporarily laid on the battery while lifting, will prevent any possible short circuits from chains or hooks. As an additional precaution against accidental shorting, the lifting beam hooks should be electrically insulated from each other.

Fig. 1: Cell



Bucyrus America, Inc. mine batteries incorporate every feature required by today's mines. They are designed by engineering technology and built by master battery craftsmen according to strict quality control guidelines. Bucyrus America Inc. batteries are the finest available to meet today's mining requirements, and our precision construction provides new equipment performance throughout a long life.

Preparation for Use

Establishing battery requirements

The number of batteries required for service depends primarily upon the number of 8-hour shifts in effect. Normally, for operation on a single-shift basis, the minimum number of batteries required will be the same as the number of operating machines and the batteries need not be removed from the unit for charging. For operation on a 2- or 3-shift basis, the minimum number of batteries required will be twice the number of operating machines and it will, therefore, be necessary to exchange discharged batteries for charged batteries at the end of each work shift. Whenever possible, it is recommended that more than the minimum number of batteries be available for multiple-shift operation, providing at least an 8-hour cooling period after charging. In an emergency, any one battery can be used for two 8-hour shifts during a 24-hour period, but this procedure, repeated regularly, will cause high electrolyte temperatures and could seriously affect service life. Therefore, where 3-shift operation is normal, 3 batteries will be required per machine.

Acid to water proportions

Sulfuric acid to water proportions required to make electrolyte are given in Table 3.

Charged and wet batteries

Charged and wet batteries are shipped with cells filled and fully charged. Prepare these batteries for use as follows:

WARNING!
Proper eye and body protection must be worn at all times when servicing batteries to prevent electrical shock and contact with battery acid. Clean and neutralize any acid spill immediately.

- ☞ Examine battery to see if electrolyte has been accidentally spilled. If so, clean and neutralize any spillage with a cloth that has been dipped in a bicarbonate of soda solution. Rinse area with clear water.

- ☞ Remove vent caps and check the electrolyte level in each cell. Measure and record the specific gravity, electrolyte temperature, and individual open circuit voltage of each cell. Note any irregularities.

- ☞ Check to make sure that all cells are properly connected and that terminal connections are tight. If there are irregularities in the electrolyte levels or specific gravity readings, or if the battery has been in storage for more than 30 days, it should be given a freshening charge to assure that every cell is at a fully charged state.

- ☞ Recheck electrolyte levels after charging and after gassing has stopped. Again, measure and record specific gravity and electrolyte temperatures. If irregularities in electrolyte specific gravity readings still exist, call Bucyrus.

Troubleshooting

In addition to the required routine maintenance, storage batteries may, at some time during their service life, require more extensive or unusual care. Such care should be given as soon as it has been determined that a problem exists or that trouble may be developing. This section deals with the means of identifying existing or impending problems and offers possible solutions.

The Troubleshooting Chart, Table 6, defines the most common problems which could occur during a battery's lifetime. If the suggested operational remedies are ineffective, it may be assumed that there is an internal problem and it will be necessary to disassemble the cell or cells to inspect the elements and sediment well. If the cause of the problem can only be corrected by completely replacing cells or the battery, this information should be reported to the person in authority.

Table 6: Storage battery troubleshooting chart

Symptoms	Probable Cause	Possible Remedy
battery overheats during charge	☞ 1. Malfunctioning charging equipment.	☞ 1. Replace or repair defective charger parts (timer, voltage sensitive relay, control board, etc.)
	☞ 2. Charging equipment out of adjustment.	☞ 2. Adjust start or finish charging rates.
	☞ 3. Defective or weak cell(s).	☞ 3. Replace/repair problem cells.
	☞ 4. Battery worn out and beyond economical repair.	☞ 4. Replace battery.
	☞ 5. High resistance connection within battery.	☞ 5. Check for hot wires, cells, intercell connectors, charging plugs, etc. Repair or replace defective component(s).
	☞ 6. Low electrolyte level.	☞ 6. Add water to just cover separator protector when discharged.
	☞ 7. Battery charge in the vehicle with battery compartment closed or the tray cover closed.	☞ 7. Open compartment during charge or charge battery of the unit with the tray cover opened.
	☞ 8. Battery of 100° F when placed on charge.	☞ 8. Allow battery to cool below 90° F before charging.

- Raise the element to clear the top of the jar. Do not, unless absolutely necessary, expose an element to air longer than five minutes. Oxygen in the air combines with the active material in the negative plates, causing them to oxidize and heat. If the exposure persists, negative plates will discharge.

  - While the element is out of the jar, check the sediment well in the bottom of the jar. If it is full of shed material, the cell will probably have to be replaced.

  - Inspect plate and separator edges while the element is suspended. A more thorough inspection of separators, plate insulation, grids, and active materials may be indicated. If so, proceed as follows:

    - Remove the element from the jar.

    - Lay the element on its side on a clean non-metallic surface with the plates at right angles to the table surface so the element can be fanned slightly to permit the removal of separators, always on negative side.

    To reinstall the separator:

    - Make certain that the flat side of the separator is against the negative plate and the ribbed side is facing the positive.

    - Push up until they are flush with the bottom of the element and they project equally on each side of the plates.

- Before installing an element in a previously used jar, wash out any sediment which may have accumulated in the bottom of the jar and clean all compound from around the inside of the top edge.

- Clamp the element, if necessary, when reinstalling it in the jar. Make certain that the element is entering the jar properly and that the plates are at right angles to the plate support ribs in the bottom. When installing an element with a cell cover attached, use a putty knife to guide the lip of the cover past the top edges of the jar.

Table 13: Untreated screw, black finish (Fine thread)

Property class	Torque	Recommended torque setting	Nominal diameter	
	Ma	M8 X 1	M10 X 1.25	M12 X 1.25
8.8	Nm	27	52	95
	Ft-lbs	19	38	70
10.9	Nm	38	73	135
	Ft-lbs	28	53	99
12.9	Nm	45	88	160
	Ft-lbs	33	64	118

Table 13: Untreated screw, black finish (Fine thread, continued)

Property class	Torque	Recommended torque setting	Nominal diameter	
	Ma	M14 X 1.5	M16 X 1.5	M18 X 1.5
8.8	Nm	150	225	325
	Ft-lbs	110	165	239
10.9	Nm	210	315	460
	Ft-lbs	154	232	339
12.9	Nm	260	380	550
	Ft-lbs	184	280	405

Table 13: Untreated screw, black finish (Fine thread, continued)

Property class	Torque	Recommended torque setting	Nominal diameter	
	Ma	M20 X 1.5	M22 X 1.5	M24 X 2
8.8	Nm	399	610	780
	Ft-lbs		449	575
10.9	Nm	640	860	1100
	Ft-lbs	472	634	811
12.9	Nm	770	1050	1300
	Ft-lbs	567	774	958

Table of contents

1. About this manual

2. Your safety

3. Operation

Your safety

This chapter provides vital information for your safety. Pay special attention to this chapter. The safety instructions and rules of procedure will help you to avoid hazardous situations and to perform the necessary work as safely as possible.

state of the art

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Do not make any alterations or modifications which could impair the safety of the machine. All modifications and changes must be approved by Bucyrus America, Inc.

Use only original spare parts from Bucyrus America, Inc. Note that the use of parts from other manufacturers will void the guarantees.

In addition to this operating manual be sure to also observe the respective legal provisions and regulations in your country.

Observe the safety and accident prevention regulations:

- of the mine,
- of the Mine Inspector, and
- of the mining supervisory authorities.

Personnel

Repair

As a fundamental rule, repair work may only be carried out by personnel who have been adequately trained for these particular requirements.

Electrical repair work may only be carried out by Service Engineers from Bucyrus America, Inc. or by specially qualified personnel of the mine. All electrical work is to be done by qualified persons, in accordance with all MSHA, Federal, State, and Local regulations.

Except where allowed by MSHA, Federal, State, and Local regulations, before conducting electrical work on this machine:

- the machine circuit breaker shall be turned off.
- the battery circuit breaker shall be turned off.
- the battery plug shall be disengaged/removed, and tagged out.

Since the windings of the motor are inductive, the current in the motor cannot change quickly. When the IGBT switch is closed, the current builds up slowly and when the switch opens, the inductance wants to keep the current flowing. For this reason, the "flywheel" diode is provided. Fig. 3 and 4 illustrate the current paths with the switch closed in both forward (Fig. 3) and reverse (Fig. 4) modes.

Fig. 3: Flywheel diode motor current (forward mode)

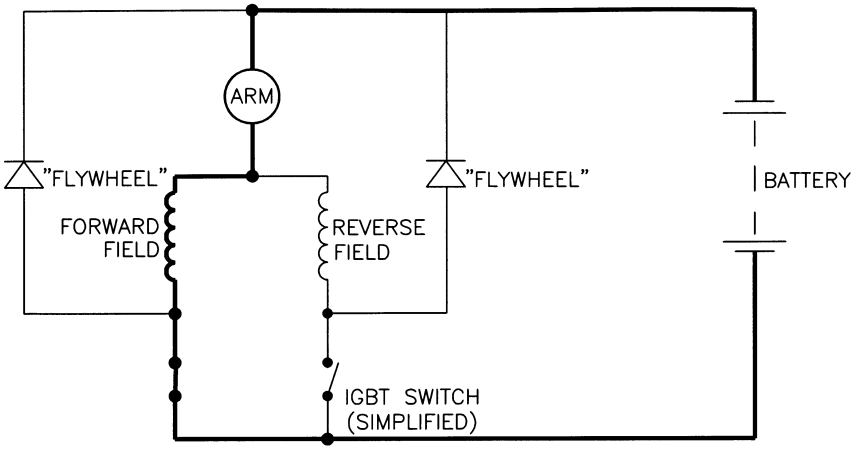
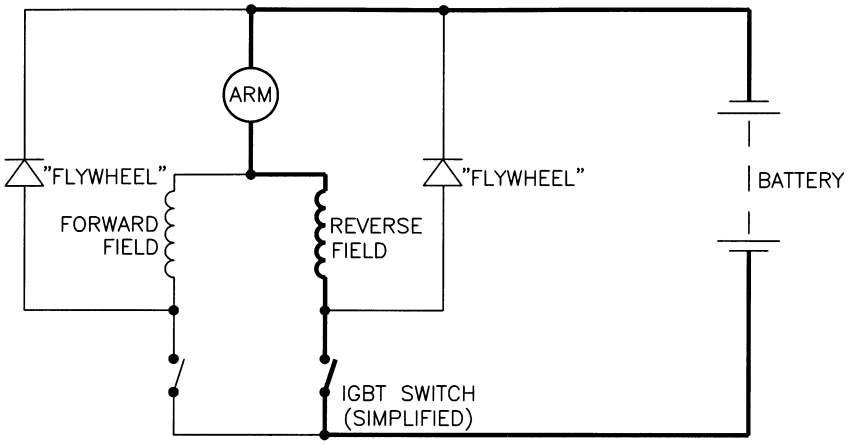


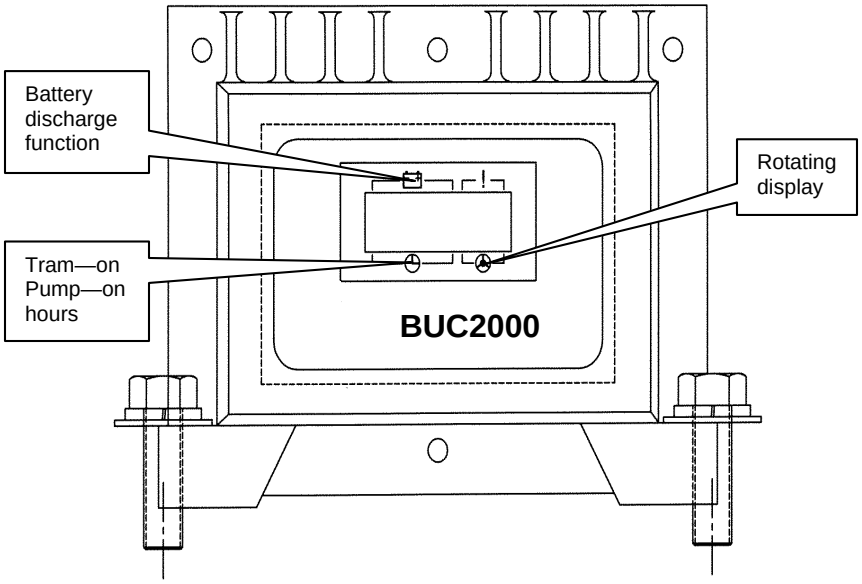
Fig. 4: Flywheel diode motor current (reverse mode)



Optional dashboard display features (See Fig. 9)

- a battery discharge indicator
- an hour meter displaying tram-on hours
- an hour meter displaying pump-on hours
- a rotating display showing:
  - battery voltage
  - pump motor current
  - diagnostic fault status, when applicable. Rotating display will lock on one of the following fault messages: (See Fault Message Chart)

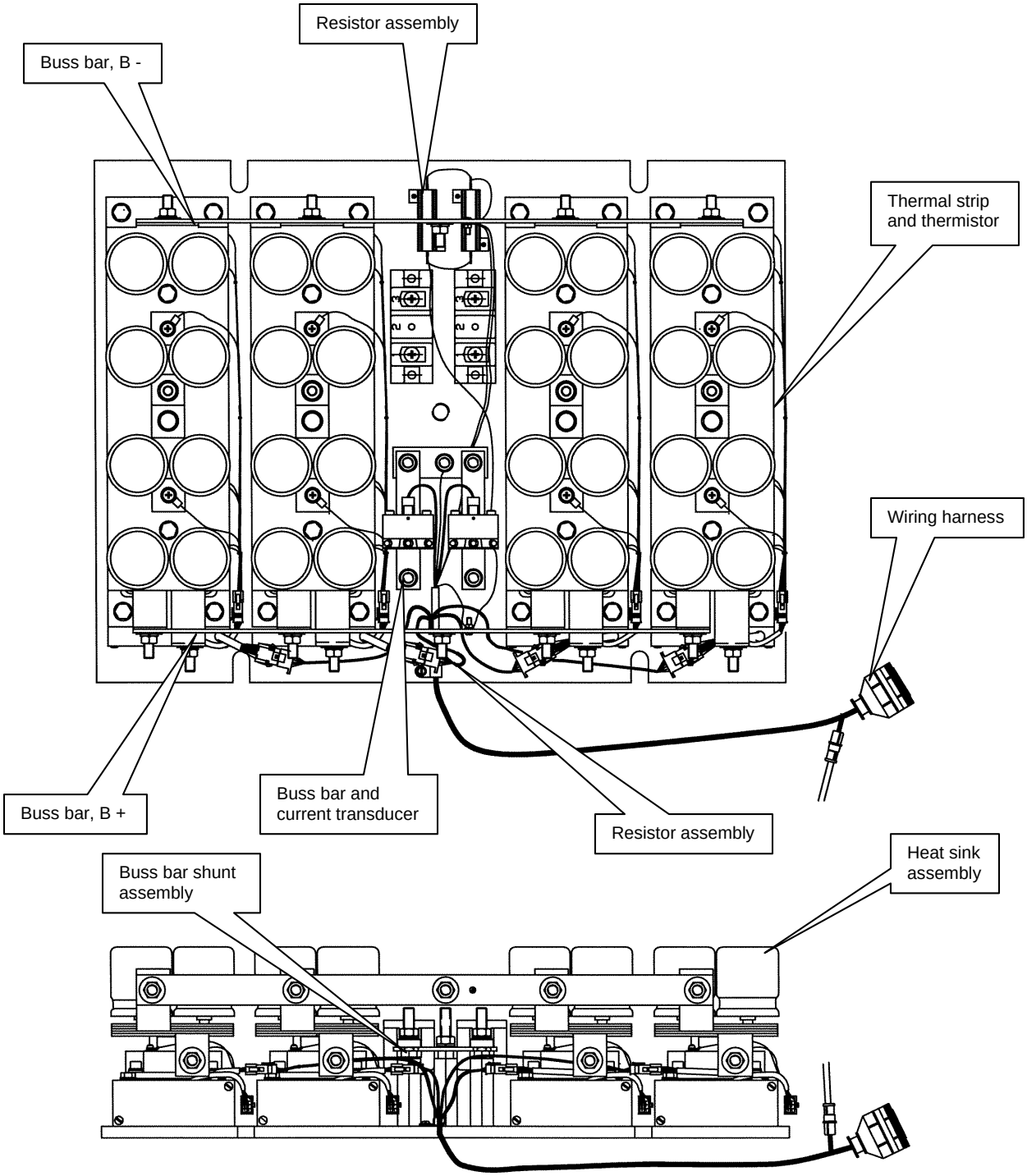
Fig. 9: Optional dashboard display



IMPORTANT!
The display hours will be different than the hours stored in the logic (as read on the hand held) if the logic card has been replaced. The display holds its hour count and, if the logic is replaced, will retain its original hour count. the display and logic card hour meters are independent from each other. the hours are not resettable.

IGBT panels

Fig. 16: IGBT dual motor panel components

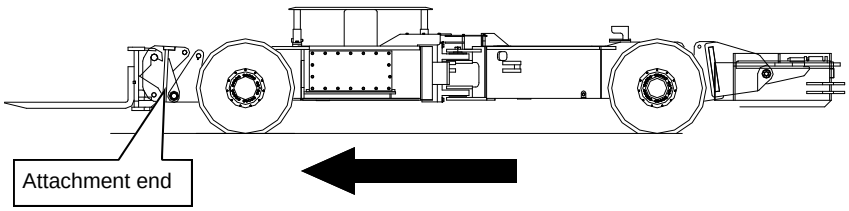


Vehicle direction of travel

Fig. 27 shows the direction of travel for typical vehicles. The forward direction for both scoops and shield haulers is in the direction of the bucket (or other attachment (ex. lifting forks)). The forward direction for a coal hauler is in the direction of the batteries.

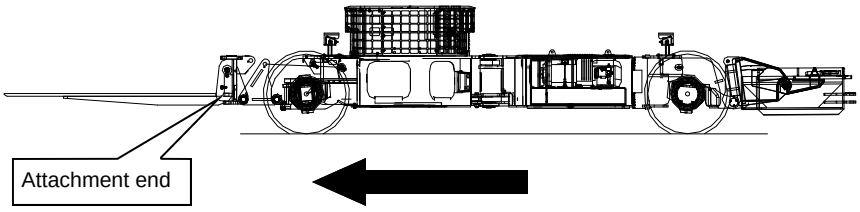
Fig. 27: Vehicle direction

Scoop



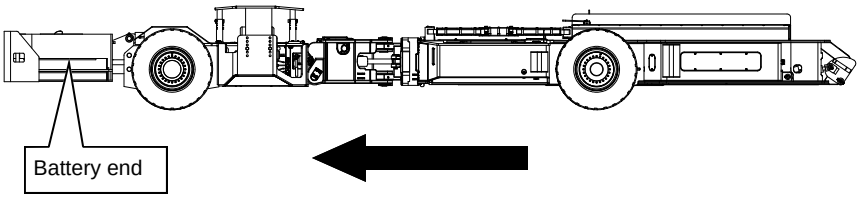
Forward direction of travel

Shield hauler



Forward direction of travel

Coal hauler



Forward direction of travel

Schematics

NOTICE!
For replacement parts and machine wiring diagrams, please refer to your spare parts manual.