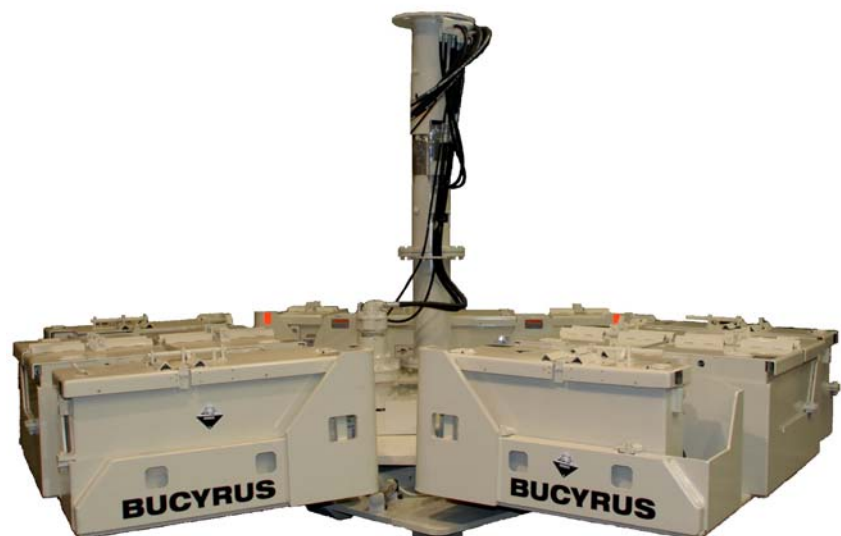




Operation Manual

Bucyrus - Battery Carousel

Doc. No.: A6474X267



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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.

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 power supply when working with the electrical system, or when welding on the unit to prevent electrical shock.

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.
- 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.



Storage and transport

This chapter contains important information on the correct storage and transport of the Battery Carousel.

Observance of the instructions and tips will increase the service life and availability of the machine. Careful attention to the points in this chapter will help you to simplify your day-to-day work.

Storage

corrosion protection

Components coated with temporary corrosion inhibitor are protected for approximately six months.

Before delivery, the hydraulically operated equipment is operated and all gear boxes, hydraulic oil tank, etc. are filled to their maximum fill point.

Storage of the machine and spare parts

no direct exposure to sunlight

Store the equipment indoors or cover with a tarpaulin to protect against direct exposure to sunlight. Store the electrical equipment, electronic components, spare parts of rubber or plastic – such as seals and hoses – and hydraulic fluids only in closed rooms at temperatures of 60° F (15° C) to 77° F (25°C).

dirt and moisture

Protect the equipment and all spare parts stored outdoors against moisture and dirt, e.g. using tarpaulins.

The mounting surfaces of hydraulic components must be protected against corrosion and sealed with blind plates. Protect the hydraulic plug connectors and the connectors of the electrical cables with the caps and plugs supplied.

short-term storage

During short-term storage (approximately 4 weeks) of equipment outdoors, but at temperatures above freezing, electrical components need not be removed. Such components must be particularly protected against excessive temperatures, dirt and moisture.

long-term storage

If the equipment is to be stored more than six months, the hydraulic components must be completely filled with a corrosion inhibiting/frost-proofing fluid such e.g. CV 50.

Fill the hollow areas of hydraulic components (e.g. the piston chambers) in horizontal position (ports facing upwards) until they start to overflow.

Then seal the ports with plastic or steel plugs.

The equipment must be stored in a well ventilated, dry room. Do not store outdoors.



Hydraulic hose connections

Refer to hydraulic schematic (Fig. 8) for correct connection of hydraulic hosing.

Fig. 8: Hydraulic schematic

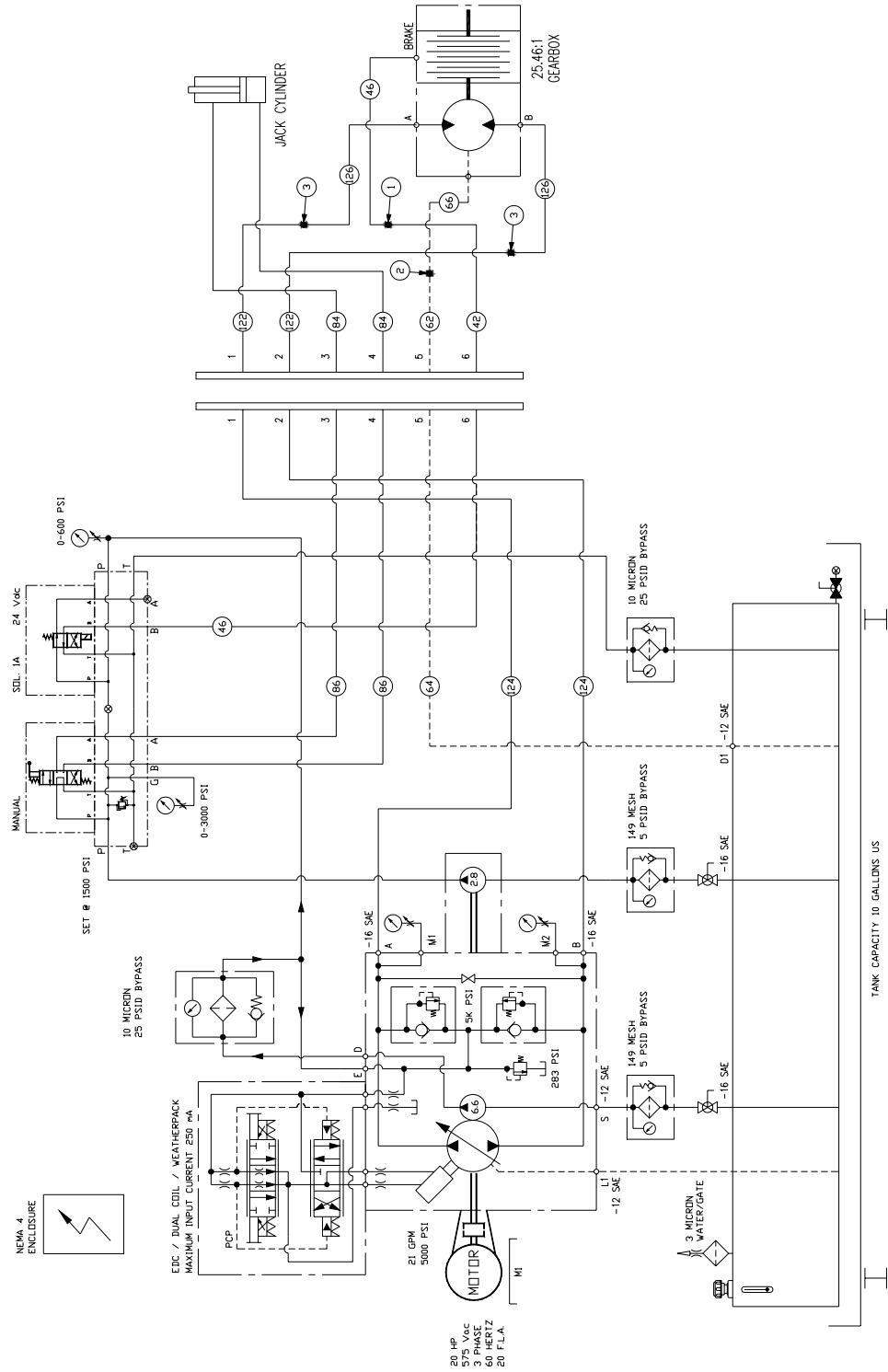




Fig.14: Pressure gauges



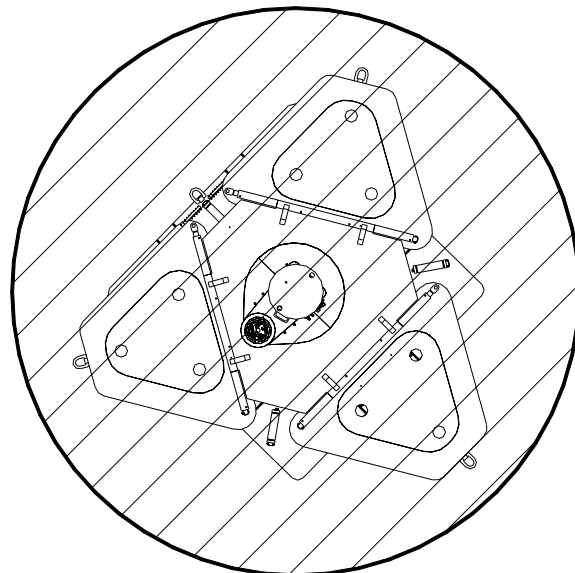
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Hazard zone

The hazard zone, five feet around the Battery Carousel (Fig.15) exists unless:

- The Battery Carousel is disconnected from the power unit, OR;
- The main power supply is disconnected, OR;
- The power unit fused disconnect switch is in the “OFF” position.

Fig. 15: Hazard zone





Specific lubrication and maintenance procedures

Every shift

electrical cables, conduits and glands

Visually inspect all electrical cables, conduits and glands for signs of wear or damage.

hydraulic hoses and connections

Visually inspect all hydraulic hoses and connections for signs of wear, damage or leakage.

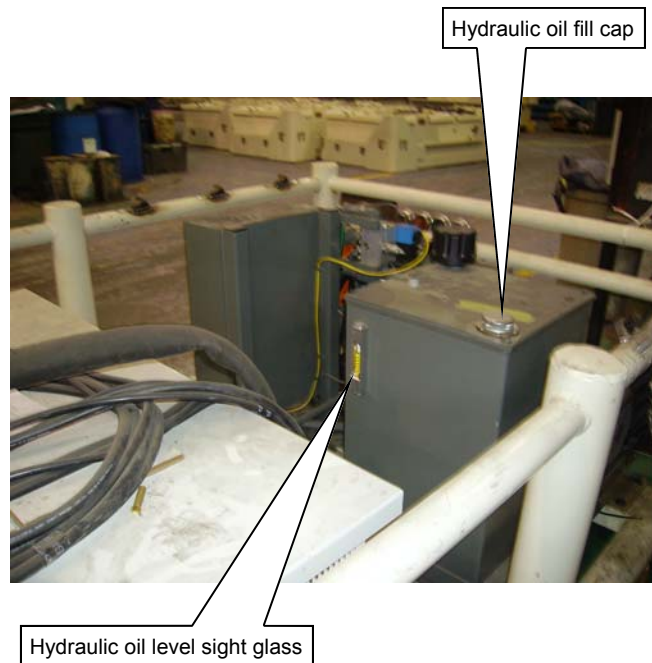
reflectors and warning plates

Visually inspect the condition and readability of all warning tags, labels and reflectors for signs of wear or damage. Replace any found missing or damaged.

hydraulic oil level

Check the hydraulic oil level by looking at the sight glass located on the side of the oil tank (Fig. 24). If the oil level is low, add oil: (Spec. 100-1) by removing the fill cap and adding oil until full level is reached on the sight glass.

Fig. 24: Hydraulic oil level





Technical data

This chapter contains the most important technical data on the Battery Carousel. Further data can be found in the spare parts lists. At the end of this chapter you will find information on the bolt tightening torques, HFA fluids, greases, etc. Read this chapter through carefully and pay particular attention in particular to the safety instructions.



The technical data listed in this chapter is for stock machines only. Customer specials may not be listed.

Components of the Battery Carousel

Technical data sheet

general

Width (with platforms raised):	approx. 9' 0"
Width (with platforms lowered):	approx. 13' 11"
Height with extension (stabilizer cyl fully collapsed):	approx. 8' 0"
Height w/out extension (stabilizer cyl fully collapsed):	approx. 6' 5"
Height with extension (stabilizer cyl fully extended):	approx. 10' 0"
Height w/out extension (stabilizer cyl fully extended):	approx. 7' 7"
Weight (empty):	approx. 18,000 lbs
Battery platform capacity (max):	approx. 90,000 lbs
Rotation speed:	1 rpm

hydraulics hoses and fittings

All main system hose two wire braid, heavy duty, MSHA 2G flame resistance approved; all fittings JIC. (Exceptions: Planetary drive motor case drain: 1/4" BSPP; Brake pressure port: 12mm X 1.5)

or

All main system hose four wire braid, heavy duty, MSHA 2G flame resistance approved; all fittings JIC. (Exceptions: Planetary drive motor case drain: 1/4" BSPP; Brake pressure port: 12mm X 1.5)

reservoir

20 gallon capacity. A sight glass is provide on the side of the oil tank for oil level monitoring.

Fill cap in top of reservoir tank.

power pack assembly

575 VAC 20 hp



Table 24: Extreme pressure motor bearing grease (Spec. 100-3)

	Supplier	Brand name
1	Amoco Oil Company	Amolith grease 2 EP Rykon Premium Grease 2 EP
2	Gulf oil	Gulfcrown grease EP#2
3	Mobil Oil Corporation	Mobilux EP-2
4	Chevron U.S.A.	Chevron Dura-Lith Grease EP-2 NLGI 2
5	Sun Oil Company	Sun Prestige 742EP
6	Unocal 76	Multiplex EP2
7	Shell Oil company	Alvania EP-2
8	Century Lubricating Oils, Inc.	Hullith EP2 Multipurpose Grease or Replex2 or Uniwrl 2 or Uniwrl EMB or Hullith GP 2 or Hullith EP 2
9	Texaco Lubricants Company	Texaco Multifak EP 2
10	Exxon	Lidok EP 2
11	Pennzoil	Pennlith EP 712 Grease
12	Lubricating Engineers	3752 Almagard Vari-Purpose Lubricant
13	Conoco Inc.	EP Conolith grease No. 2 or Super Sta Grease No. 2
14	Hydrotex	LC-65 Hplex
15	Phillips	Philube EP Grease
16	Atlantic Richfield	Litholine H EP-2 Grease

Table 25: Semi-fluid grease (Spec. 100-4)

	Supplier	Brand name
1	Texaco Lubricants Company	Novatex EP 000
2	Century oils Limited	Joy Loader Semi-Fluid grease
3	Hydrotex	MPD-60 Ultra E.P. 000
4	Pennzoil	Semi-Fluid 760 Grease
5	Unocal	MM Grease
6	Exxon	Lidok E.P. 000



Operation Manual

Bucyrus - UN-A-HAULER[®]
Model - CH810C, CH816C, and
CH816CL

Doc. No.: A6474X268



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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	<p>When working with oils, greases and other chemical substances, observe the safety regulations applicable to the product.</p> <p>Dispose of cleaning rags, etc. which have been soiled with oil, grease or other chemical substances in an environmentally safe manner.</p>
controls	When starting up machine, do not operate any controls located inside the operator's compartment from outside the compartment.
starting procedures	Follow the starting procedure instructions in chapter 5 of this manual.
hazard zone	Do not operate any levers, pedals or controls if anyone is in the hazard zone. (See Hazard 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 UN-A-HAULER ©.
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	<p>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.</p> <p>Never climb onto, or climb out of the machine while it is in motion.</p> <p>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 .</p>
traveling	Use extreme caution when traveling in close quarters or in congested or blind-travel areas. The warning gong should be sounded to alert personnel of your movement.
passengers	Never carry passengers to prevent the passengers from being thrown off 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!

In the event of an emergency, the UN-A-HAULER[®] may also be shutdown by striking the panic strip. When the panic strip is struck, the machine circuit breaker will trip. This disconnects the motors and applies the automatic emergency brake. Be prepared for the sudden stop when the panic strips are struck.

WARNING!

The "battery" change control lever should never be operated except at a battery change station or when it's necessary to adjust the battery's terrain clearance. If the "battery" change control lever is operated in a low roof area, the battery may be damaged.

WARNING!

Never attempt to disconnect a hydraulic hose from the battery lifting cylinders while the battery is in the up position. This could cause the battery to fall and could result in serious injury.

WARNING!

Before performing maintenance on the machine, disconnect the electrical power. Either the battery circuit breaker or the machine circuit breaker 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.

WARNING!

Do not move any hydraulic control lever unless you are certain that everyone is completely clear of any machine movement. Accidental machine movement can cause serious injuries or even death to you or the maintenance person.

WARNING!

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

WARNING!

Never disconnect a hydraulic hose if the circuit is pressurized or if there is a load on the circuit. If a hose is disconnected while the circuit is pressurized or a load is on the circuit, the load will fall causing damage to the machine or serious injury or death to you or other workers.

NOTICE!

If any welding is to be done to machine, the circuit breakers must be in the "OFF" position and the batteries disconnected. Failure to do so may cause electrical component damage.



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





battery hold down

The battery hold down (Fig. 17), available on Models CH816C and CH816CL, is located directly in front of the operator's seat. It is used to secure the battery in position during tramping operations. To engage the hold down, push the handle away from the operator and to unlock, pull the handle towards the operator.

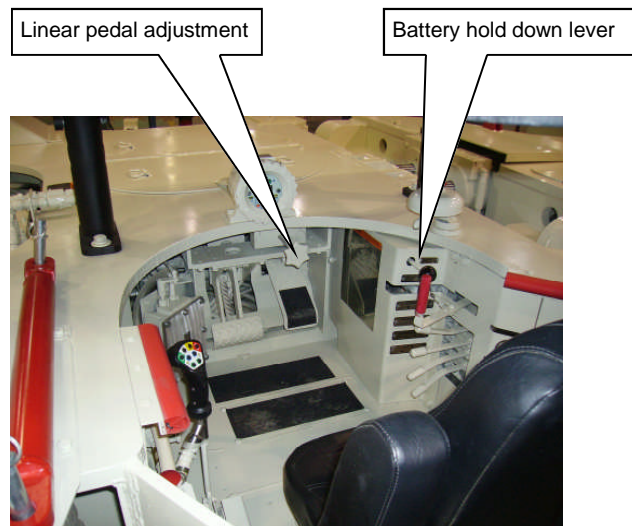
WARNING!

Always make sure the battery hold down is engaged after each battery change and disengaged prior to changing batteries. The batteries may be damaged if left unsecured during tramping operations.

linear pedal adjustment

The linear pedal adjustment (Fig. 17), available on Model CH816C, is located directly in front of the operator's seat. It is used to adjust the position of the pedals. See adjustment procedure in this chapter.

Fig. 17: Battery hold down lever and linear pedal adjustment lever location





Shutdown procedure

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

Stop the UN-A-HAULER ® 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.

WARNING!

Always check before moving the ejector blade and false bottom control lever to make sure no one has any part of their body between the ejector blade/false bottom and the front of the rear (payload) section.

- ☞ 1. Pull the ejector blade/false bottom control lever toward the operator to move the ejector blade/false bottom to the front of the rear (payload) section. There should be no obstructions behind the ejector blade/false bottom.

Note: Refer to Fig. 21 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. 22):
 - 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.



Critical torque values

Torque values are expressed in lubricated and dry thread values. Lubricated thread torque values should be used any time the bolt threads are covered with oil, grease, anti-seize or thread-locking compounds. Dry thread torque values should be used when threads are completely clean and dry.

Table 1: Critical torque values

Location	Bolt size	Grade	Dry	Lubricated
Steering cylinder pins			400	240
Tire-Wheel mounting bolts (Front)	3/4-16UNF X2-1/2	Grade 8	420	250
Tire-Wheel mounting bolts (Rear)	3/4-16UNF X2	Grade 8	420	250
Planetary wheel end-to-frame mounting bolts	3/4-NC 3-1/4	Grade 8	380	230
Gear case-to-frame mounting bolts	3/4-NC 2-1/4	Grade 8	380	230
Drive motor-to-gear case mounting bolts	3/4-NC 2-3/4	Grade 5	380	230
Center section (Outer ring) (810 & 816) * See note 1	7/8-NC 9	Grade 8	650	N/A
Center section (Inner ring) (810 & 816) * See note 1	1 1/4 NC 9	Grade 8	1886	

Notes:

- Retorque of these bolts should not be required due to the use of prevailing torque locknuts. If bolts require to be retorqued, new bolts and locknuts must be installed.

Lubricants, fluids and capacities

Table 2: Lubricants, fluids and capacities

Location	Specification	Approximate capacity	Notes
Hydraulic oil	Spec. 100-1	72 Gallons (816) 65 Gallons (810)	1
Drive sump (Gear case)	Spec. 100-8	4 Gallons Each	2, 3
Multi-Purpose grease	Spec. 100-3	As Required	4

Notes:

- With false bottom/ejector blade completely retracted.
- 4 gallons of oil to completely fill dry system. Actual level should be checked after running unit to fill cooling system. Use dipsticks (one in each drive gear case) to check oil level.
- Drain gear case and wheel end separately. Fill gear case only to proper level on dipstick.
- Pump grease into fitting until old grease can be observed coming out of component.

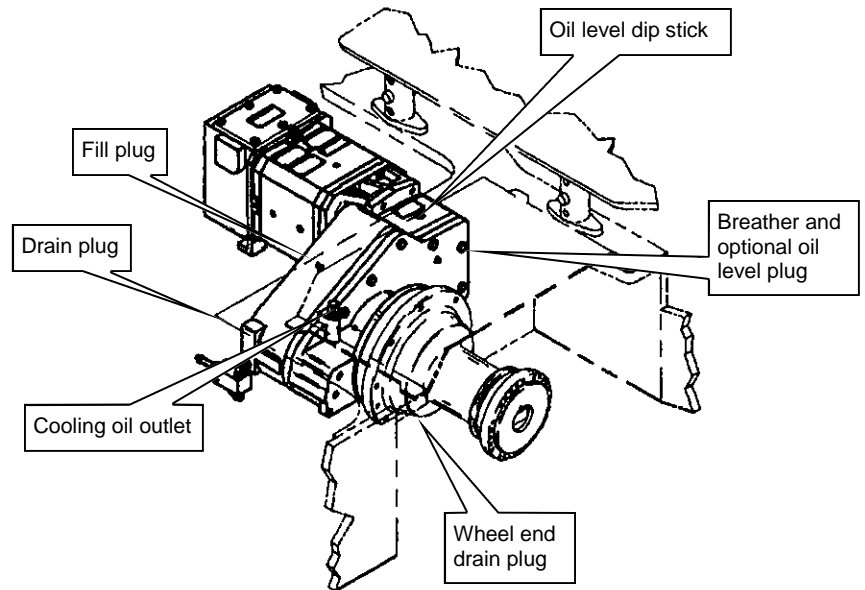


gear cases and planetary wheel ends

Change the oil in both gear cases and planetary wheel ends after the first week of service (Fig. 42).

- ☞ Remove the drain plug (or hose connection if equipped with rear tractive assist) from the gear case and from the planetary wheel end and allow the oil to completely drain.
- ☞ Replace the drain plugs and refill with oil to full level on dipstick or until oil begins to flow from check/level plug.

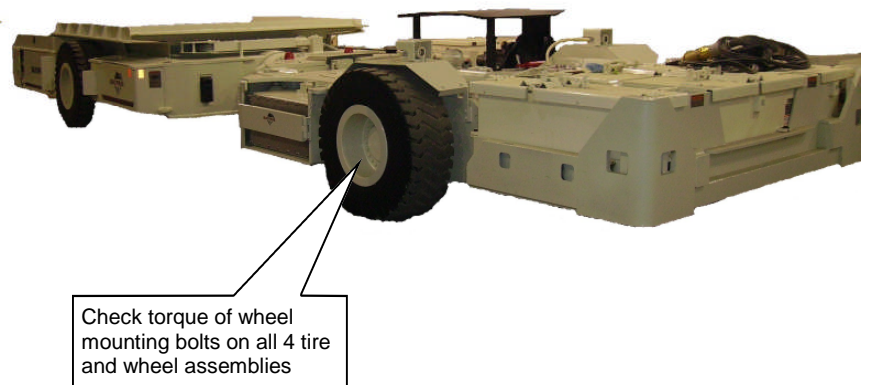
Fig. 42: Gear case and planetary wheel end lubrication



wheel mounting bolts

Check the wheel mounting bolts (Fig. 43). The mounting bolts should be torqued to 300 ft-lbs on Models CH810C, CH816CL and to 380 ft-lbs on Model CH816C. Use Loctite 242 on wheel mounting bolts.

Fig. 43: Wheel mounting bolts

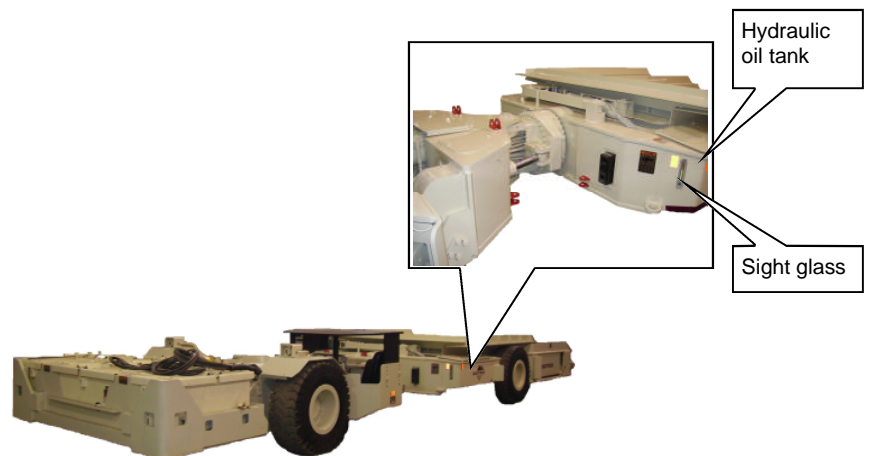


**hydraulic oil suction strainer**

Clean or replace the hydraulic suction strainer inside the hydraulic oil tank (Fig. 56).

- ☞ Remove the drain plug from the hydraulic oil tank to allow the oil to drain.
- ☞ Remove the oil tank cover and gasket.
- ☞ Reach through opening in tank and unscrew strainer from fitting.
- ☞ Replace the strainer with a new one or thoroughly clean the old one with kerosene and a soft brush. Dry the cleaned strainer with air before replacing in the tank.
- ☞ Replace the strainer in the tank and tighten hand-tight.
- ☞ Inspect cover gasket for damage and replace if necessary.
- ☞ Replace cover and gasket,
- ☞ Install drain plug.
- ☞ Refill tank to proper level with hydraulic oil (Spec. 100-1).
- ☞ Purge hydraulic system of air.

Fig. 56: Hydraulic oil suction strainer maintenance



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Brake cooling circuit relief pressure adjustment

To adjust the steering relief pressure proceed as follows (Fig. 65).

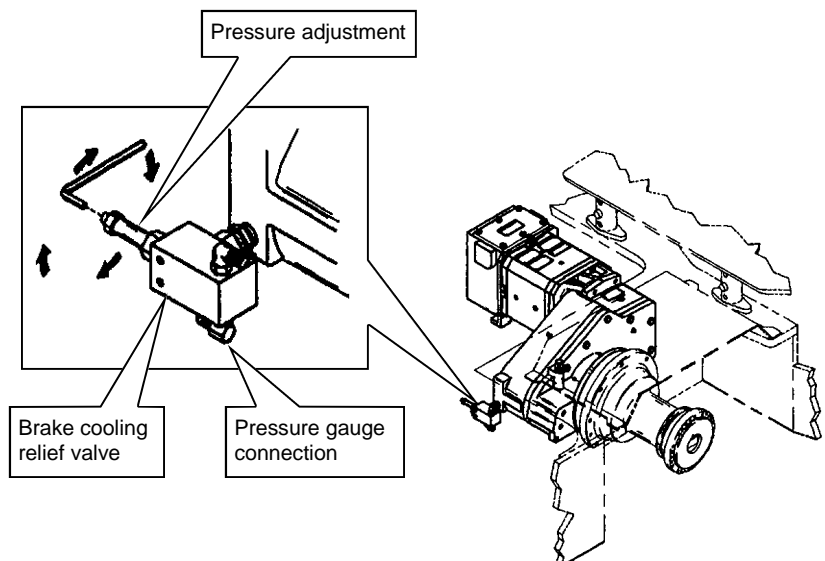
- ☞ Raise and securely block the machine off the ground so that all four (4) wheels are free to rotate.

DANGER!

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

- ☞ Remove the hose fittings from the top of the relief valve.
- ☞ With a gauge and suitable fittings, install the gauge onto the relief valve where the hose was disconnected.
- ☞ Start the machine, release the automatic brakes and slowly depress the accelerator pedal.
- ☞ As the drive wheels begin to turn, read the pressure indicated by the gauge. The pressure should be 50 psi. If the pressure is not 50 psi, continue to next step.
- ☞ Remove the cap that covers the pressure adjustment screw.
- ☞ Using an allen wrench, turn the screw until the correct pressure of 50 psi is indicated on the pressure gauge.
- ☞ Replace the cap on the relief valve.
- ☞ Remove the gauge and replace the hose in the relief valve.

Fig. 65: Brake cooling circuit relief pressure adjustment





Tailgate sequence valve adjustment (P/N LUP02119)

To adjust the tailgate sequence valve proceed as follows (Fig. 69 and 70).

WARNING!

Before moving the “EJECTOR” control lever, always check to make sure no one has any part of their body between the ejector blade/false bottom and the front of the rear (payload) section.



IMPORTANT!

Remember that counterbalance cartridges adjust opposite of relief cartridges. Turning the stem clockwise will reduce pressure.

The cartridges on the sequence valve are identified with numbers stenciled on the valve body beside the location of the respective cartridge.

- ☞ Ensure that the “SYSTEM PRESSURE” is set as specified on the hydraulic schematic supplied with your machine before beginning this procedure.

Extend cycle

Cartridges #3 and #4 should be minimized (Turn adjustment stem out in a counter-clockwise direction), prior to operating the Extend Cycle. These two cartridges control the sequential operation of the extend function and should prevent any movement of the false bottom or ejector, until the tailgate is fully open. Cartridge #3 controls oil flow to the false bottom cylinders extend ports and Cartridge #4 controls oil flow to the ejector extend port. If adjustment is required, proceed as follows:

- ☞ If the false bottom or ejector cylinders are extending while the tailgate is being opened, increase the setting of Cartridge #3 first, in full turn increments (Turn adjustment stem in clockwise), to inhibit any movement of the false bottom and ejector cylinders until the tailgate is fully opened. Once this is achieved, you may optimize the cartridge setting by decreasing the adjustment (Counter-clockwise direction) in fractional increments (e.g. 1/2hf; 1/4tr; 1/8th turns) to insure that the transition between functions is as smooth as possible. At this point, you may have to increase the adjustment of Cartridge #4 in like fashion to insure that the false bottom reaches full extension before the ejector will move. Again, you should optimize the cartridge setting for the ejector control to insure that the transition between functions is as smooth as possible.



IMPORTANT!

Insure that all the jam nuts have been locked down securely before returning the machine to service, to insure that the cartridge settings will be maintained.



Linear pedal adjustment (if equipped)

To adjust the linear position of the pedals proceed as follows (Fig. 73).

- ☞ Turn the handle counterclockwise to move the pedals away from the operator.
- ☞ Turn the handle clockwise to move the pedals toward the operator.

Fig. 73: Linear pedal adjustment

Linear pedal adjustment





Alternate gear case and planetary wheel end shim procedure number 3 (shimming procedure does not apply to Fairfield gearbox)

The purpose of the shim procedure is to set the axial end play between the gear case spacer (bronze) and the planet carrier/wheel end from 0.005" to 0.030" (loose).

NOTICE!

The following procedure is an alternate, easier procedure that can be used instead of Procedure 1 or 2.

DANGER!

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

- ☞ 1. To determine the correct number of shims required to fill the gap between the wheel end mounting surface and the brass sleeve: use a straight edge across the wheel end mounting surface on the wheel well plate on the Un-A-Hauler® tractor frame. Add the correct number of shims to fill gap between sleeve and appropriate straight edge being used.
- ☞ 2. Each shim is 0.025" thick. For example, if gap is 0.125" total, this will require five shims to fill this gap. Once you have determined the correct number of shims to fill gap, then remove the shims from the pinion shaft. Make certain during the process of determining the proper number of shims that the straight edge is resting against the mounting surface as you shim it outward. Do not have any gaps between the mounting surface and the straight edge during this process and make sure the sleeve is pushed back into the reducer until there is no slack present.
- ☞ 3. After removing the shims, record measurement. For example 0.125", equates to five shims total as shown in the example above.
- ☞ 4. Document the measurement that is stamped on the mounting face of the wheel end. For example, a measurement of 0.083" could be a typical measurement.
- ☞ 5. Subtract stamped wheel end measurement from the total number of shims recorded from the above process, establishing the gap to be filled. For example 0.083" subtracted from 0.125" equals 0.042". This means one shim needs to be added behind the sleeve. This will leave a clearance of 0.017". Proper clearance of 0.005" to 0.030" must be maintained .



Another mounting arrangement is based on holding a very close pilot fit where the tolerance between the wheel and hub is very tight, requiring a clamp-load force to hold the wheel securely in place. If the wheel studs or bolts are allowed to loosen, the load will be transmitted to them, resulting in sheared studs or bolts.

problem areas

Periodic wheel inspection is critical to the life cycle of a tire/wheel assembly. A fractured wheel, broken bolt pattern and missing or broken wheel studs are all contributors to tire/wheel failures. Problems in these areas occur as the result of repeated cyclical loading as the tire/wheel unit rotates during machine travel. Haulage vehicles loaded unevenly, downhill hauls with high speed turns, or operating a vehicle with one tire of a dual assembly damaged or flat are some examples of conditions that produce damaging high stresses in wheel assemblies. Also, the effects of corroding or poorly fitted mating parts can produce surface irregularities that result in cracks and ultimate failure of a wheel.

A most common problem with tire/wheel installations is the incorrect tightening of wheel bolts or studs. Threaded fasteners perform their function of holding things together better when torque control is used in their tightening. Using an accurate torque wrench correctly is the best and most practical way of securing fasteners. Although torque value charts are available as a reference guide to proper tightening, OEM specifications should always be followed when tightening fasteners. However, proper torque values are of little benefit if certain other factors are not considered.

wheel mounting tips

All fasteners should be examined before use. Any fastener that is worn, bent or has damaged threads should be replaced. Fastener threads should also be lightly coated with a protective substance, such as residual oils, wax or Loctite, because any oxidation or rust will upset the torque-to-tension relationship.

Mating surface conditions should also be considered. The tightening surface under the bolt or nut should be carefully inspected. A fastener, when tightened against a softer material, will gall under these conditions, and much of the applied torque may be lost through head friction. It is very important when using higher strength fasteners to have a smooth, even surface under the bolt head. In some cases, hard flat washers and most lockwashers will provide a good tightening surface.

An other area of concern is cleanliness. All mating surfaces should be free of rust, dirt, oil, paint, etc. Also no paint of any kind should exist between a fastener and wheel disc surface. Any form of contamination between these surfaces will most likely lead to serious wheel problems.

WARNING!

When torquing any wheel bolt pattern, always torque in a triangular pattern.



Technical data

This chapter contains the most important technical data on the UN-A-HAULER®. Further data can be found in the spare parts lists. At the end of this chapter you will find information on the bolt tightening torques, HFA fluids, greases, etc. Read this chapter through carefully and pay particular attention in particular to the safety instructions.



The technical data listed in this chapter is for stock machines only. Customer specials may not be listed.

Components of the CH810C UN-A-HAULER®

Technical data sheet

general

Overall length:	approx. 38' 4"
Overall width tractor (extended deck option):	approx. 11' 1"
Overall width w/ 10.00 dual tires on tractor and 14.50XR15 tires on trailer:	approx. 11' 3"
Overall width trailer:	approx. 10' 8"
Wheelbase:	approx. 19' 9"
Weight (empty less battery):	approx. 52,900 lbs
Weight (w/ 64-SS100-25 battery):	approx. 71,000 lbs
Weight (w/ 64-SS85-25 battery):	approx. 69,500 lbs
Design gross vehicle weight:	approx. 91,000 lbs
Material capacity (max.):	approx. 20,000 lbs
Component load capacity (max.):	approx. 24,000 lbs
Cubic feet capacity (max. payload—calculated) (w/no sideboards or tailgate) (heaped):	approx. 436 cu ft
(struck):	approx. 221 cu ft
Ground clearance (w/ 10.00R15 dual tires on tractor and 14.50XR15 tires on trailer):	approx. 8"
Ground clearance (w/ 400/80R15 tires):	approx. 10"
Min. canopy height (w/ 10.00R15 dual tires on tractor and 14.50XR15 tires on trailer):	approx. 40"
Min. canopy height (w/ 400/80R15 tires):	approx. 41"
Trailer height (w/ 10.00R15 dual tires on tractor and 14.50XR15 tires on trailer):	approx. 38"
Trailer height (w/ 400/80R15 tires):	approx. 41"
Trailer frame height (w/ 10.00R15 dual tires on tractor and 14.50XR15 tires on trailer):	approx. 36"
Trailer frame height (w/ 400/80R15 tires):	approx. 39"

performance

Inside turning radius:	approx. 11' 6"
Outside turning radius:	approx. 24' 4"
Minimum entry width:	approx. 15' 6"
Steering articulation:	120° total
Tram speed:	
(speed will vary depending gear box ratios):	approx: 0-5 mph
Discharge time:	approx: 30 seconds
Terrain compensation articulation:	approx: (+) 15° approx: (-) 10°



Permissible media

Lubrication fluids and greases

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.



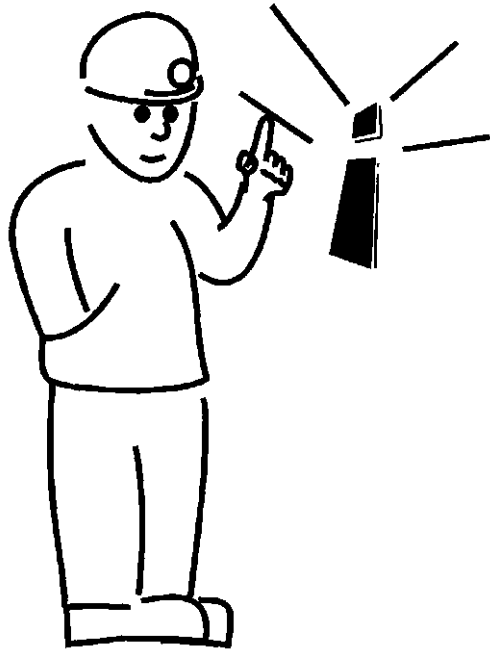
IMPORTANT!

Be sure to use the manufacturer's instructions for use.

NOTICE!

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

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 operation and troubleshooting manual available to you is applicable for the type of equipment or machine used.

machine type

This operation and troubleshooting manual is intended for:

BUCYRUS – Model BUC2000 Dual and Single Motor Controller

Serial No.: N/A

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

new operation manual

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

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

Who is this manual intended for?

This manual is intended for those persons who work with or on the controller. Every person working on the controller must read this operation and troubleshooting manual.

This includes persons who:

- 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.



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.



BUC2000 Motor Controller consist of:

- dual motor IGBT panel, single motor IGBT panel or two (2) single motor IGBT panels
- microprocessor based logic card
- optional dashboard display
- optional hand held diagnostics/calibrator unit
- “Y” connecting harness (used only with two (2) single motor panel systems)

BUC2000 motor IGBT panel (power connections)

- battery positive
- battery negative
- 4 motor connections for each motor (S1, S2, A1 and A2)

(For power circuit layout see machine wiring diagram and schematic)

Motor current imbalance feature (dual motor only)

There is a selectable motor current imbalance time-out feature that allows for a selectable time delay before the controller stops drive if current in one motor is less than 150A and current in the other motor is above 350A. This feature is enabled when the adjustable personality for the timer is set above 0.

Wire off detect

In the event of the accelerator input becoming detached, a 6-flash fault diagnostic will occur.



IMPORTANT!

An accelerator short will be detected when neutral is selected and it shall cause a 6-flash fault diagnostic.

Fail-safe operation

- In the event of a shorted IGBT, the circuit breaker will be opened, disconnecting power from the traction motors.
- Operation of the circuit breaker will always be sensed and, if faulty, drive will be inhibited.
- Whenever the vehicle is power-cycled, power-up diagnostics will be executed to test the tram drive circuitry. If faulty, drive will be inhibited.



Connecting for Operation

- ☞ Turn the machine “OFF”.
- ☞ Turn the main circuit breaker to the “OFF” position to deenergize power on machine.
- ☞ Remove the main controller cover.
- ☞ Connect the hand held diagnostics/calibrator unit to the CAN.
- ☞ Communication Input Port of the logic card.
- ☞ Turn the main circuit breaker to the “ON” position.
- ☞ Leave the “Park Brake Set”.

The hand held diagnostics/calibrator unit is now operational.

Operation

Upon power-up of the hand held diagnostics/calibrator unit, before pressing any buttons, a top level display is visible to provide diagnostic information as follows (see Table 3):

Personality Adjustment Procedure

- ☞ 1. Power-up calibrator. “PLEASE WAIT” message may appear. Note: If the “PLEASE WAIT” message appears but does not clear, the CAN link is not working. Disconnect the dashboard display, recycle power, and try calibrator only. Possible wire or display grounded or short.
- ☞ 2. If the top level display indicates “OK”, go to step (4). If not “OK”, go to step (3).
- ☞ 3. Consult above diagnostic information table to determine cause of fault.
- ☞ 4. Press the “DOWN” button two times to access the personalities table.
- ☞ 5. Use the “LEFT” or “RIGHT” buttons to locate the desired personality.
- ☞ 6. After locating the personality, use the “+” or “-” buttons to adjust the values accordingly.
- ☞ 7. To go back to the top level display, press the “UP” button two times.

The following features shall be customer adjustable personalities, accessible using the Calibrator.



Fig. 20: Dual motor panel harness assembly

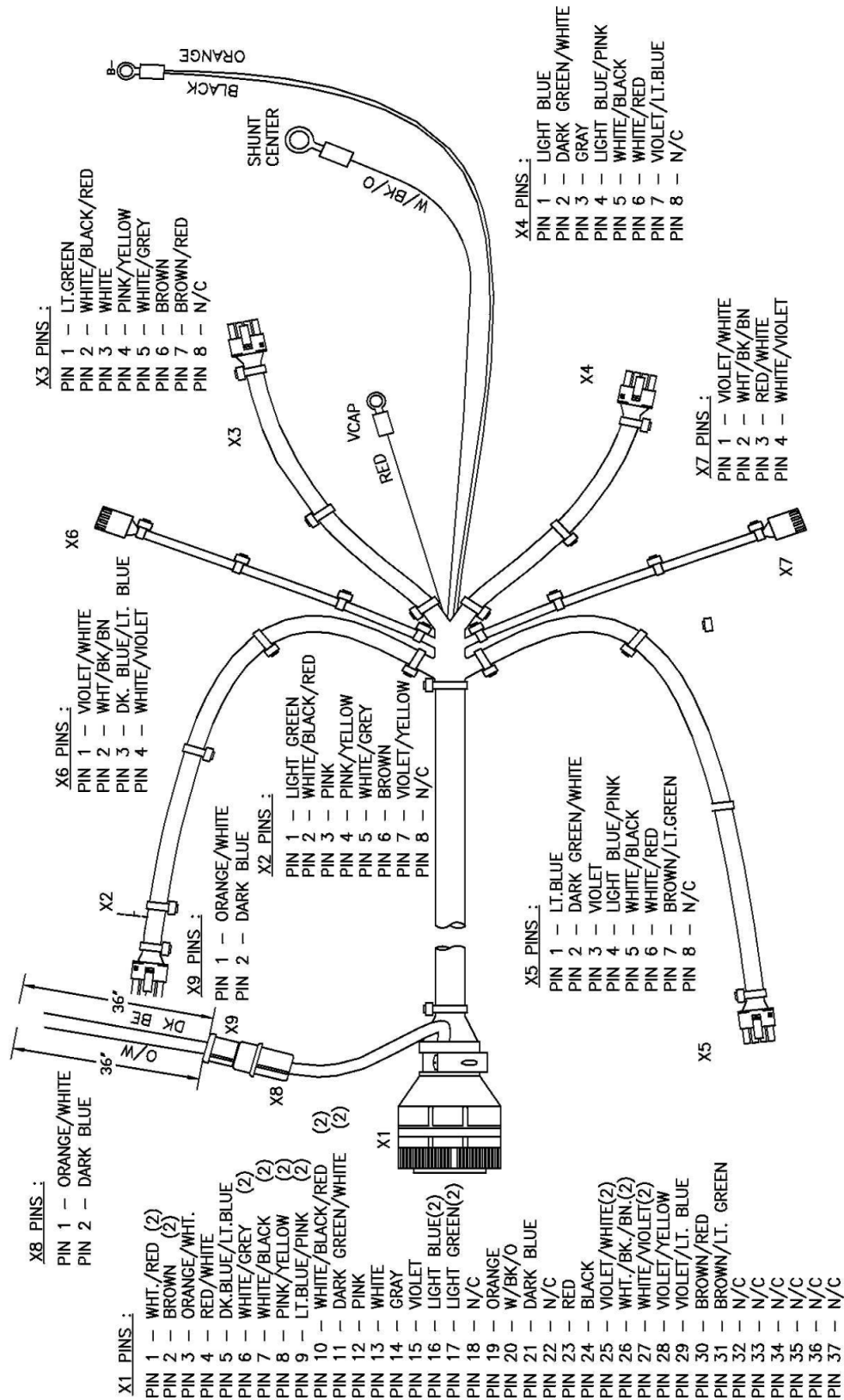
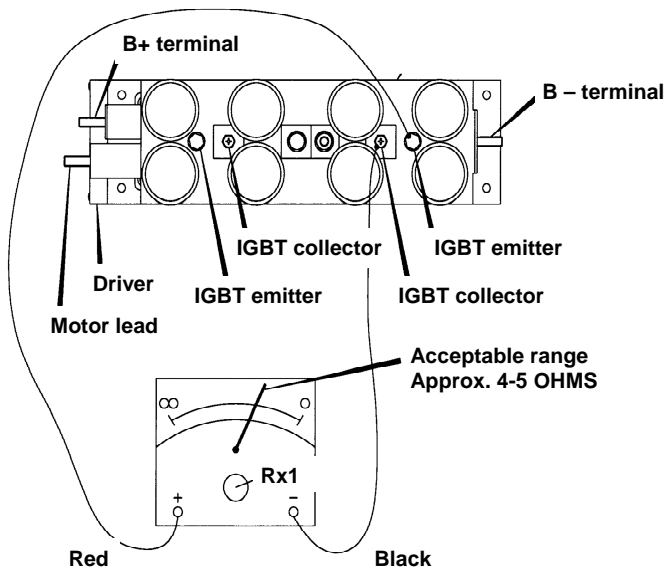




Fig. 28: IGBT measurements



Analog Volt-Ohm Meter (use RX1 scale)

Acceptable range: Approx. 4 - 5 ohms

Analog Volt - Ohm - Meter



Digital multimeter (use Diode check function)

Acceptable range: Approx. 0.30 - 0.35 Volts

Digital multimeter with diode check function

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Tightening torques

NOTICE!

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 the correct torque. The tightening torques stated in the spare parts lists have to be observed, as well, for installation and maintenance.

Controller terminal torque: 13.5Nm \pm 10% (9 ft-lb \pm 10%)

Controller mounting torque: 44 Nm \pm 10% (32 ft-lb \pm 10%)

SYMBOLS AND SPECIAL NOTATIONS

Throughout this manual there are specific notations that are either **UPPERCASE BOLD**, UNDERLINED or *ITALICIZED* for the primary purpose of emphasis. Please pay special attention to such statements as they regard safety or critical maintenance installation information.

You will also see the following:



NOTICE

NOTICE: *THIS NOTATION DENOTES A REFERENCE TO PREVIOUSLY STATED INSTRUCTIONS.*



IMPORTANT

IMPORTANT: *THIS SYMBOL DENOTES THAT SPECIAL ATTENTION MUST BE ADHERED TO IN THE ATTACHED STATEMENT.*



CAUTION

CAUTION: *THIS SYMBOL DENOTES THAT FAILURE TO COMPLY WITH THE ATTACHED STATEMENT COULD RESULT IN A CUT, BRUISE OR ABRASION.*



WARNING

WARNING: *THIS SYMBOL DENOTES THAT FAILURE TO COMPLY WITH THE ATTACHED STATEMENT COULD RESULT IN A LOST TIME ACCIDENT.*



DANGER

DANGER: *THIS SYMBOL DENOTES THAT FAILURE TO COMPLY WITH THE ATTACHED STATEMENT COULD RESULT IN A SERIOUS INJURY OR FATALITY.*

Standard Features

Input Protection

- A. A.C. fuses on each input leg.
- B. A.C. contactor to disconnect the unit from the a.c. line.
- C. A.C. fuse in one leg of control transformer.

Meters

Digital Volt/Amp Meter – Standard (See OPERATION section)

Output Protection

- A. D.C. output fuse.
- B. Current limiting automatically limits the d. c. output current of the charger to approximately 125% of its rating..

Electronic Timer

8 hour timer with auto start/stop feature on battery connection. (See OPERATION section)

Mounting

Low profile mine case with skids.

Optional Ground Integrity

The Automatic Mine Recharger is designed to operate on a specific type of battery with a specified number of cells. The nameplate on the charger indicates the type of battery, number of cells, and the a.c. input voltage.

To energize the unit with optional ground integrity, the following procedure should be used:

1. Check a. c. input voltage with that specified on the nameplate. i.e.: chargers furnished with 480 volt and 575 volt power lines, are dual input units. Taps within the unit must be set on the 480 volt setting for 480 volt power lines, and 575 volt taps for 575 volt power systems. A schematic is provided with the unit which indicates how the a.c. power connections must be wired. Connect the power lines to the a.c. input terminals, the ground wire to the ground terminal bonded to the case near the input terminals.
2. A ground check wire supplied from the power center must be connected to terminal 3R, near the input terminals.
3. The battery, with a 4 wire plug, must be connected to the unit's output in order to energize the unit.
4. Ground integrity must be made on all systems to energize the unit. If the case ground is more than 5 ohms, the unit will not energize.
5. The emergency stop switch must be pulled out.
6. Push in the green button. The unit should energize, and the charger will automatically start to charge the battery at some rate up to its maximum capacity, depending upon the state of charge of the battery, and charge the battery to full charge, then shutdown to a trickle charge-preserving-charge. The charger will continue the trickle rate until the timer turns the unit completely off.

CHAPTER 1 - INTRODUCTION

Section I. General

1-1. Scope

This guide contains information concerning the theory, construction, installation, use, maintenance, repair, and hazards of lead-acid storage batteries used to power mine tractors, scoops, locomotives, and coal haulers.

1-2. Forms, Records and Reports

The following form will be used by personnel responsible for the receipt, storage, operation, charging, and maintenance of lead-acid storage batteries.

- a. **Monthly Storage Battery Record** - The Monthly Storage Battery Record is to be used to record the services performed on motive power batteries. This record should be prepared and maintained by the using operator and should accompany the battery at all times. (See Figure 1 for a typical "Monthly Storage Battery Report" form.)

FIGURE 1 – MONTHLY STORAGE BATTERY RECORD

TYPE OF CHARGER _____ START RATE _____ FINISH RATE _____
 DUTY CYCLE _____

COMMENTS _____

SHEET NO. _____ **TROUBLE SHOOTING CHECK LIST**

DATE _____ CUSTOMER _____ BATTERY _____

TYPE _____ MFG. DATE _____ DATE PUT IN SERVICE _____

BATTERY APPEARANCE _____

SERVICE CONDITIONS _____

NATURE OF COMPLAINT _____

CELL NO.	VOLTAGE	SPECIFIC GRAVITY	ACID LEVEL	OH CHARGE VOLTAGE	CELL NO.	VOLTAGE	SPECIFIC GRAVITY	ACID LEVEL	OH CHARGE VOLTAGE
1					33				
2					34				
3					35				
4					36				
5					37				
6					38				
7					39				
8					40				
9					41				
10					42				
11					43				
12					44				
13					45				
14					46				
15					47				
16					48				
17					49				
18					50				
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22					54				
23					55				
24					56				
25					57				
26					58				
27					59				
28					60				
29					61				
30					62				
31					63				
32					64				



2. Remove vent caps and check the electrolyte level in each cell. Take and record the specific gravity reading, electrolyte temperature, and individual open circuit voltage of each cell. Note any irregularities.
3. 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 (see Paragraph 2-10d).
4. Recheck electrolyte levels after charging and after gassing has stopped. Again take and record specific gravity readings and electrolyte temperatures. If irregularities in electrolyte specific gravity readings still exist, they should be adjusted as described in Paragraph 3-12.

2-5. General

Economical and dependable performance from a storage battery depends, to a great extent, upon proper charging. Faulty charging causes a decrease in battery service life and dissatisfaction with its performance. The selection of suitable charging equipment and methods is as important as the application of the correct battery. A mine battery installation is completely satisfactory only when the unit, battery, and charger operate as a smoothly functioning team. **This text on chargers is for general information and guidance only.** If specific data is required on a particular type of charger, contact the nearest sales representative.

When preparing a battery to be charged, make certain that all points of contact between the charger and the battery are clean to assure good conductivity. Also make certain that the positive terminal of the battery is connected to the positive terminal of the charger and, correspondingly, negative of battery to negative of charger.



PERMANENT DAMAGE TO THE BATTERY OR CHARGER MAY RESULT IF THE BATTERY IS CONNECTED INCORRECTLY.

2-6. Charging Principles

Charging, as applied to a storage battery, is the conversion of electrical energy into chemical energy within the cell or battery. This restores the active materials and is accomplished by maintaining a unidirectional current to the battery in the opposite direction to that during discharge. When a cell or battery is said to be charged it is understood to mean fully charged. The type of battery, service condition, time available for charging, and the variation in battery voltages will strongly influence which charging method is best for a particular situation. Normally lead-acid batteries are recharged in 8 hours following a full discharge. However, they can be recharged within other time periods when desirable. A deeply discharged battery will absorb high current rates when the voltage is low. As the charge progresses, the voltage steadily increases until it reaches gassing voltage, approximately 2.37 volts per cell at 77 degrees F. At this point, battery chargers normally reduce charging rates automatically and taper to finishing rates which are used to complete the charge. The battery is fully charged when nearly all of the active material has been converted and when the specific gravity of the electrolyte and cell voltage have reached their maximum or constant values (corrected for temperature), as indicated by similar readings over a two or three hour period.

Batteries used in mine power applications are cycled - they are either being charged or discharged. In most circumstances, batteries are charged after each shift of use, so they are cycled many times during their lifetime. Incorrect charging for only a few cycles will do little harm, but if repeated day after day, the battery's service life will be seriously shortened.

TABLE 5		
STORAGE BATTERY TROUBLESHOOTING CHART		
SYMPTOMS	PROBABLE CAUSE	POSSIBLE REMEDY
BATTERY OVERHEATS DURING CHARGE	<ol style="list-style-type: none"> 1. Malfunctioning charging equipment. 2. Charging equipment out of adjustment. 3. Defective or weak cell(s). 4. Battery worn out and beyond economical repair. 5. High resistance connection within battery. 6. Low electrolyte level. 7. Battery charged in the vehicle with battery compartment closed or the tray cover closed. 8. Battery over 100 degrees F. when placed on charge. 	<ol style="list-style-type: none"> 1. Replace or repair defective charger parts (timer, voltage sensitive relay, control board, etc.) 2. Adjust start or finish charging rates. 3. Replace or repair problem cell(s). 4. Replace battery. 5. Check for hot wires, cells, intercell connectors, charging plugs, etc. Repair or replace defective component(s). 6. Add water; Just cover separator protector when discharged. 7. Open the compartment during charge or charge the battery out of the unit with the tray cover opened. 8. Allow battery to cool below 90 degrees F. before charging.
BATTERY OVERHEATS DURING DISCHARGE	<ol style="list-style-type: none"> 1. See causes 3 through 8 above. 2. Worn out bearings, brakes dragging, or other vehicle problem causing high current draw. 3. Over discharge of battery. 	<ol style="list-style-type: none"> 1. See remedies 3 through 8 above. 2. Repair or replace defective unit problems. 3. <ol style="list-style-type: none"> a. Require drivers to return battery for recharge when vehicle begins to slow down. b. Put more batteries into service.



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