A6474X268
August 2012

Operation and Maintenance Manual

Face Haulage

FH110 (CH810C)
FH120 (CH816C)
FH120 (CH816CL)

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.

Installation and start-up

inclined face

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

environmental acceptability

When working with oils, greases and other chemical substances, observe the safety regulations applicable to the product.

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

controls

When starting up machine, do not operate any controls located inside the operator's compartment 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 machine.

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

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

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

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

traveling

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

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

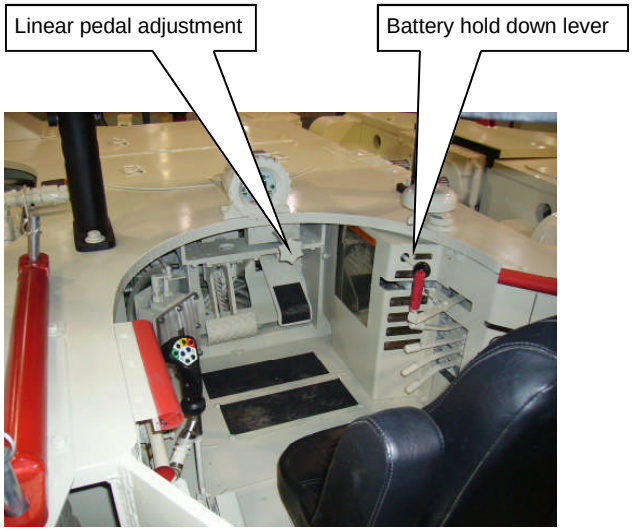
The battery hold down (Fig. 17), available on Models CH816C and CH816CL, is located directly in front of the operator's seat. It is used to secure the battery in position during tramming operations. To engage the hold down, push the handle away from the operator and to unlock, pull the handle towards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

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:

1. 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:

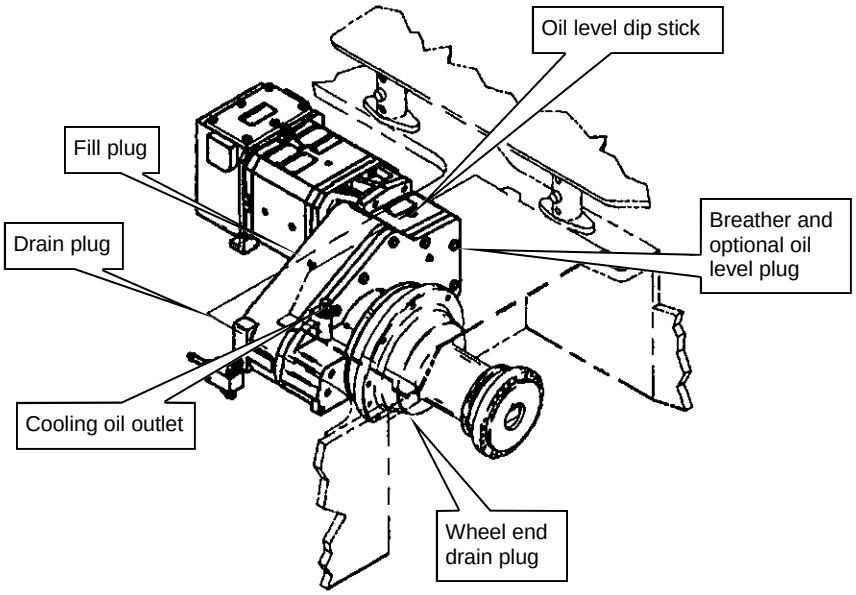
1. With false bottom/ejector blade completely retracted.
2. 4 gallons of oil to completely fill dry system. Actual level should be checked after running unit to fill cooling system. Use dipsticks (one in each drive gear case) to check oil level.
3. Drain gear case and wheel end separately. Fill gear case only to proper level on dipstick.
4. 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.

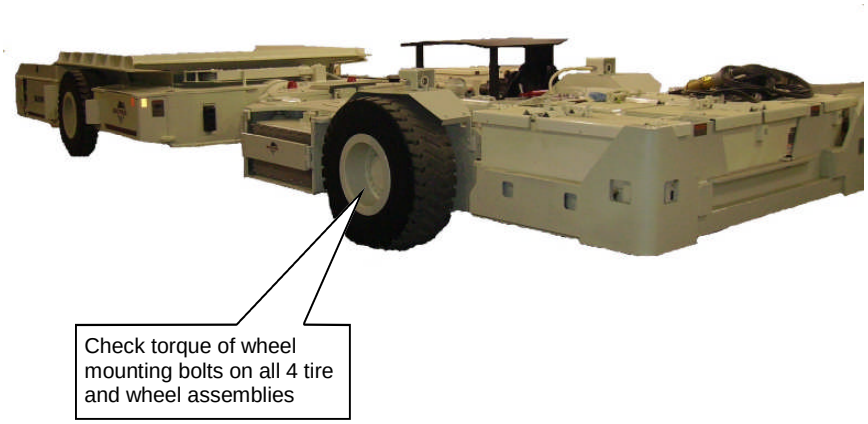
Fig. 42: Gear case and planetary wheel end lubrication



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

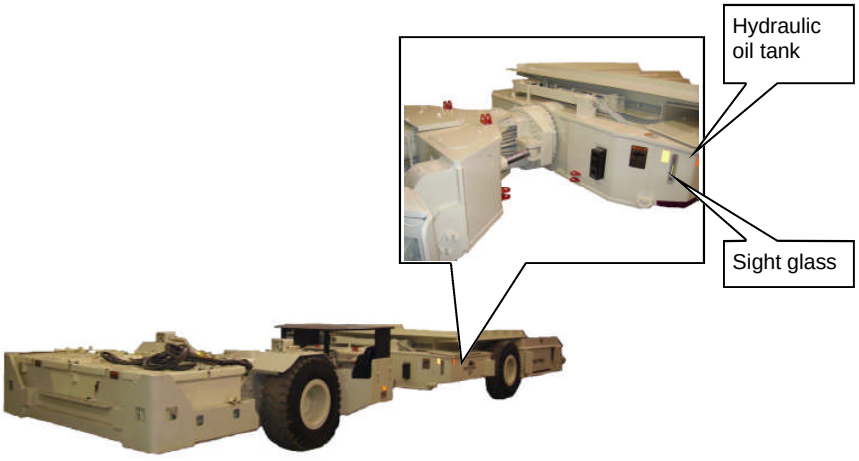


hydraulic oil suction strainer

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



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.

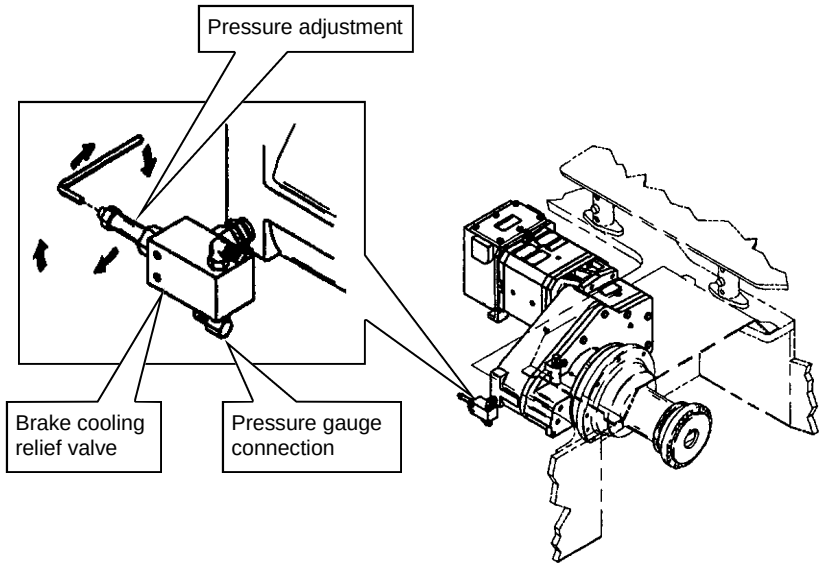
☞ Remove the cap that covers the pressure adjustment screw.

☞ 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.

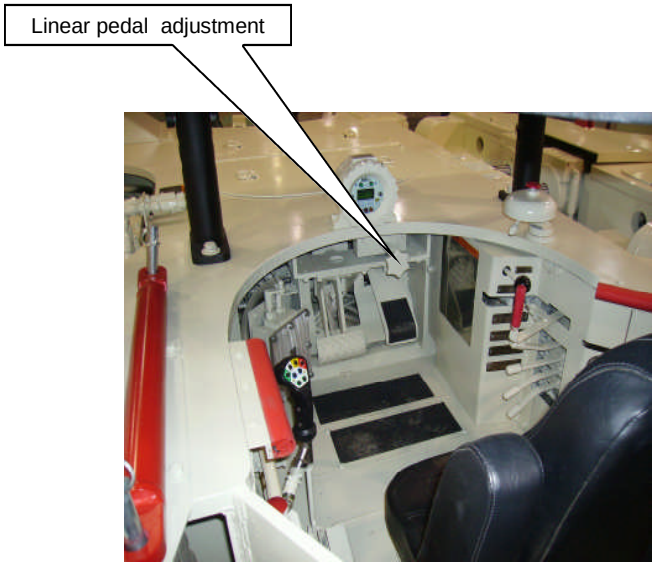
Linear pedal adjustment (if equipped)

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



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 machine 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 there 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 machine. 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

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

machine type

This operating manual is intended for:

BUC - Models 5, 6, 8, 10, 12, 14, and 16 Battery Chargers
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 battery charger.
.
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 battery charger
- 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, and
- the time that you will probably require.

safety equipment

Start the battery charger only when it is in a good and safe operating condition and all protective devices, e.g. EMERGENCY STOP devices, covers, 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

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.

lock-out

Lock-out and disconnect the power system while performing:

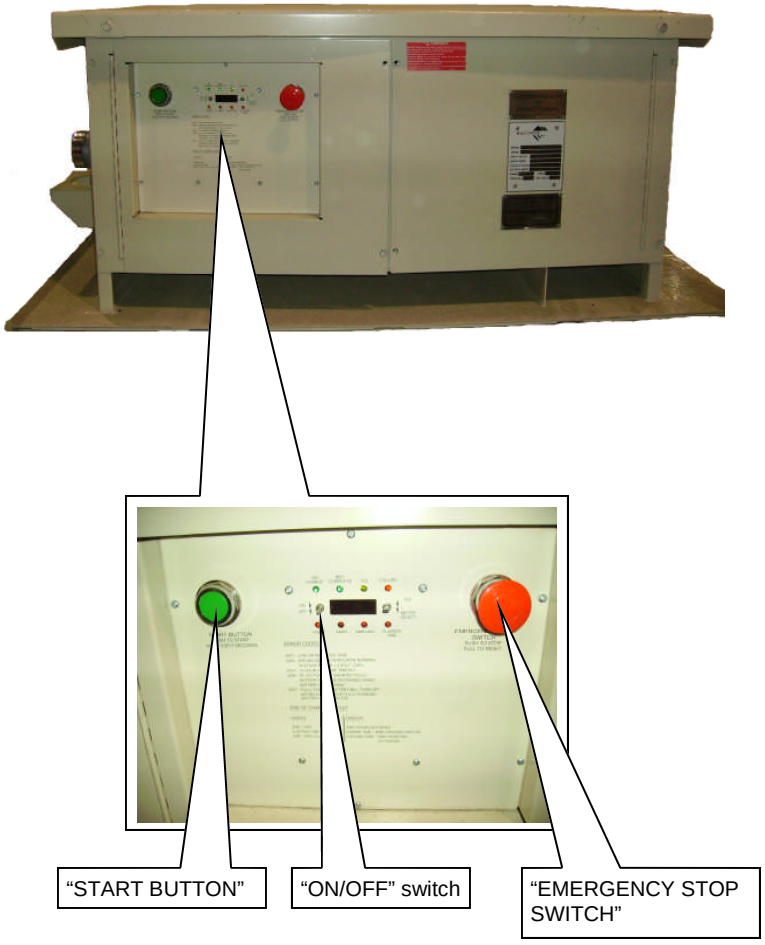
- maintenance work,
- inspection work, and
- repair work.

cordon off working area

Cordon off your working area widely for the unit.

3 Storage and transport

Fig. 1: Safety features of the battery charger



Operation

This chapter contains important information on the operation and maintenance of the battery charger. Read this chapter carefully and thoroughly. In particular, observe the safety instructions in Chapter 2 “Your safety”.

How to operate the battery charger

DANGER!
Incorrect operation endangers yourself and others!
Incorrect operation of the battery charger is often the cause of very serious accidents!
Operate the unit only when you have been sufficiently trained on the machine and have read and understood this operating manual. Should anything be unclear, please contact your immediate supervisor.

Who is allowed to operate the battery charger?

The battery charger is only allowed to be operated by persons with adequate knowledge of the complete unit.

This also includes:

- what safety devices are installed on the unit,
- where these safety devices are located, and
- how these safety devices are to be operated.

When can charging be started?

Charging must not be started until the safe condition and proper function of the complete unit has been checked and the daily maintenance operations have been carried out.

Instructions on the maintenance

Maintenance at regular intervals increases operational safety and prolongs the service life of the battery charger. 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 unit as a whole, it is recommended that a general maintenance plan be developed. For example, compile a checklist using this operation manual.
- Inadequate maintenance can result in battery charger damage, which leads to considerable cost.
- Use only suitable and approved tools for maintenance work.
- Use only original spare parts when replacing components.
- All electrical work must be supervised and inspected by a certified electrician.
- Anyone performing maintenance on this unit must be trained to operate it and must be familiar with this guide.

Before maintenance

Please observe the following:

- Shutdown the unit.
- Disconnect the electrical power. The power should be disconnected at the main power source.

WARNING!
Before performing maintenance on the battery charger, disconnect the electrical power. Electrical shock can cause serious injury or even death to you or the maintenance person.

- Do not perform maintenance in a congested area. This could endanger the maintenance person or others in the vicinity.
- Whenever a potential problem is uncovered during a periodic maintenance check, it is imperative that it be corrected immediately by a qualified maintenance technician.
- Cleanliness can not be overemphasized as the essential ingredient of a good maintenance program. Battery chargers should be kept as free as possible of dirt and debris which could impede performance and cause premature failure.

Part number:	**242167**
Model:	BUC-10S
Output:	Single
Voltage/HZ:	480/575Volt/60 HZ
Battery size:	900 AH thru 1020 AH
PA kit:	No
AC 110 VAC outlets:	No

Part number:	**334134**
Model:	BUC-10S
Output:	Single
Voltage/HZ:	480/575Volt/60 HZ
Battery size:	900 AH thru 1020 AH
PA kit:	No
AC 110 VAC outlets:	Yes

Part number:	**247630**
Model:	BUC-10S
Output:	Single
Voltage/HZ:	480/575Volt/60 HZ
Battery size:	900 AH thru 1020 AH
PA kit:	Yes
AC 110 VAC outlets:	No

Part number:	**216848**
Model:	BUC-12S
Output:	Single
Voltage/HZ:	480/575Volt/60 HZ
Battery size:	1100 AH thru 1200 AH
PA kit:	No
AC 110 VAC outlets:	No

Part number:	**334133**
Model:	BUC-12S
Output:	Single
Voltage/HZ:	480/575Volt/60 HZ
Battery size:	1100 AH thru 1200 AH
PA kit:	No
AC 110 VAC outlets:	Yes

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3. Storage and transport

2 Your safety

Safety procedures

federal standards

Congress passed the Occupational Safety and Health Act (OSHA) in 1970. This act established the minimal acceptable standards for safe and healthful working conditions. The safety procedures suggested in this manual have been compiled from standards developed over the years by professional and technical organizations and by battery manufacturers and users. Experience has shown them to be the most effective safety standards. In all cases, they exceed the minimum standards of OSHA for personal safety and include procedures for safeguarding equipment as well.

The safety procedures have been grouped by functional area of most logical application or need.

while handling batteries

- Lift batteries with mechanical equipment, such as an overhead hoist, crane or lift truck. A properly insulated lifting beam, of adequate capacity, should always be used with overhead lifting equipment. Do not use chains attached to a hoist at a single central point forming a triangle. This procedure is unsafe and could damage the steel tray.
- Always wear safety shoes and safety glasses.
- Tools, chains, and other metallic objects should be kept away from the top of uncovered batteries to prevent possible short circuits.
- Battery operated equipment should be properly positioned with switch off, brake set, and battery unplugged when changing batteries or charging them while in the equipment.
- Personnel who work around batteries should not wear jewelry made from a conductive material. Metal items can short circuit a battery and could cause severe burns.
- Only trained and authorized personnel should be permitted to change or charge batteries.
- Reinstalled batteries should be properly positioned and secured in the unit. Before installing a new or different battery, check both the unit nameplate and battery service weight to make sure that the proper weight battery is being used. A battery of the wrong weight could change the center of gravity and cause equipment to upset.

Storage and transport

This chapter contains important information on the correct storage and transport of the mine power storage battery.

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Observance of the instructions and tips will increase the service life and availability of the battery. You will also be able to carry out the transport work quicker and more safely. Careful attention to the points in this chapter will help you to simplify your day-to-day work.

Storage

Storage methods

charged and wet batteries

Lead acid batteries may be stored in a charged and wet (filled with electrolyte) condition when necessary for periods of up to several months. During such periods they should be stored in a clean, cool, dry, and well ventilated location away from radiators, hot air ducts, or other sources of heat, and protected from exposure to direct sunlight.

Before being stored, the battery should be fully charged and the electrolyte brought to the proper level. Any leads should be disconnected or insulated to prevent accidental discharge. The top of the battery should be protected from dust, foreign matter, and moisture. **Do not attempt to dismantle the battery.**

If the average storage temperature is 80° F or higher, the specific gravity of the electrolyte should be checked at least monthly. If the temperature is below 80° F, check the specific gravity at least every two months. Whenever the specific gravity, corrected to 80° F, falls to 1.240 or below, the battery should be given a freshening charge as described in Chapter 5 of this manual. A freshening charge is also recommended just before returning a battery to service.

charged and dry batteries

New batteries are often supplied charged and dry (without electrolyte). Batteries in this condition can remain in storage, unattended, for a period of at least two years. They should be stored in a cool, dry place with vent caps tightly closed. Average temperatures should not exceed 80° F.

Batteries should not be stored near radiators, hot air ducts, or other sources of heat, and should be protected from exposure to direct sunlight. The top of the battery should be protected from dust, foreign matter, and moisture.

When removed from storage, charged and dry batteries should be activated as described in Chapter 5 of this manual.

Operation

This chapter contains important information on the operation and maintenance of the battery. Read this chapter carefully and thoroughly. In particular, observe the safety instructions in chapter 2, “Your safety”.

Definitions

The definitions referenced throughout this manual generally agree with accepted industry standards. For a more complete listing of "Definitions for Lead-Acid Industrial Storage Batteries", see NEMA Standards publication No. 1B 1-1971.

Copies of NEMA standards may be obtained at nominal cost by writing to: National Electrical Manufacturers Association, Department of Engineering and Safety Regulations, 2101 L Street, N.W. Washington, D.C. 20037.

Description and construction

Battery

Mine power lead-acid batteries for electric vehicles typically consist of a steel tray into which the cells are assembled, a battery terminal connector, and various other components necessary to secure and protect the cells and provide the necessary electrical interconnections.

battery identification and data

The essential information necessary for proper care of an industrial motive power battery appears on the battery, either stamped into one of the intercell connectors or on a name plate affixed to the tray. This information usually includes the manufacturer's name and model, number of plates per cell, battery capacity, battery voltage, serial number, suggested charging rate, and fully charged specific gravity of electrolyte.

If vital information is missing or is no longer legible, the information can be obtained by contacting your nearest representative.

Some manufacturers list, as a part of the model or type designation, the rated ampere-hour capacity of a single positive plate, such as "SS75". As an alternate means of determining rated battery capacity, this number should be multiplied by the total number of positive plates in one cell. To find the number of positive plates in a cell, subtract one from the total number of plates and divide by two. To find the capacity of a battery designated "SS75-19," therefore: 19 - 1 = 18; 18 divided by 2 = 9; 9 x 75 = 675 Ah battery capacity.

Sulfation

Sulfation occurs when conditions within the cell cause sufficient accumulation of abnormal lead sulfate at both the positive and negative plates, permanently affecting the normal chemical reactions. Habitual over discharging below final voltage, prolonged operation in an undercharged condition, and extended stand periods while in a discharged state are major causes of sulfation. A servicing schedule should be followed to provide frequent monitoring and adequate charging. See the maintenance section in this chapter for methods of restoring a sulfated battery.

Operating cycle

An operating cycle of a storage battery consists of the discharge, subsequent charge cycle to restore its initial condition, and an eight hour cooling, or rest, period following the charge.

Service life

The service life of a storage battery is the period during which it provides useful power while being discharged. It is usually expressed as the time period, or number of cycles, which elapses before the ampere-hour capacity falls below 80% of its rated value. To obtain maximum service life, it is recommended that a battery be restricted to one full cycle per 24 hour day or fewer than 300 cycles per year. Other factors which most often adversely influence service life are:

- Abnormally high or low electrolyte temperatures.
- Frequent over discharging.
- Failure to add water regularly.
- Frequent overcharging.
- Poor, or high, resistance, connections or contacts.
- Overfilling with water, which causes electrolyte loss.

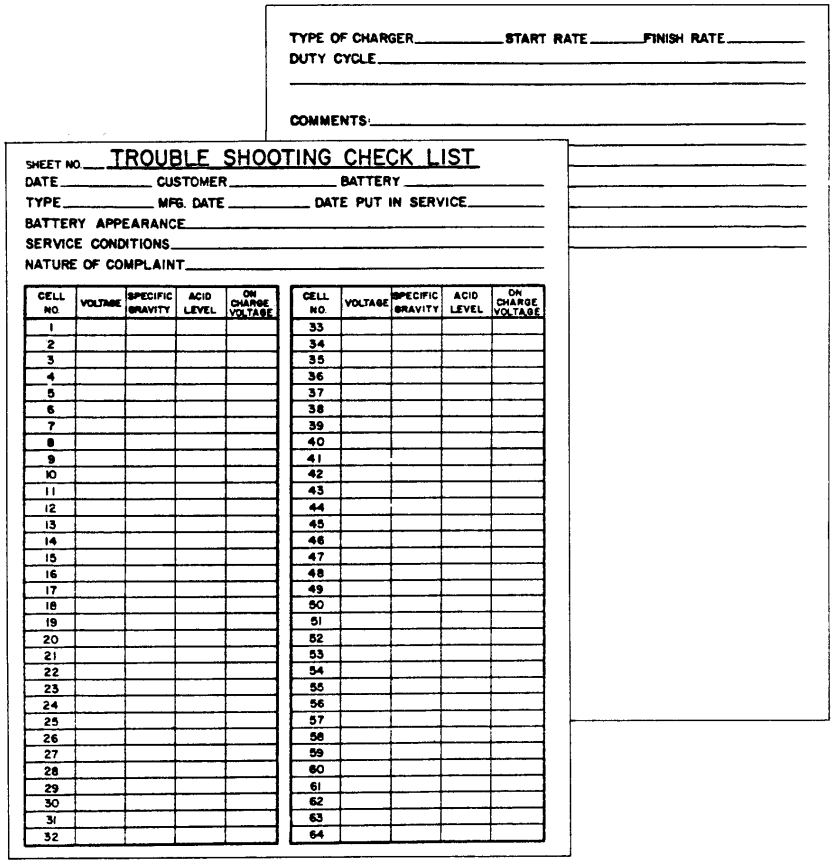
Temperature

The normal operating characteristics of a storage battery are effectedby unusually low or high cell temperatures.

low temperature

Available battery power is reduced by low temperature because electrolyte viscosity and resistance is increased and diffusion throughout the pores of the active material is retarded. For example, a fully charged battery (1.280 to 1.295 specific gravity at 77° F.), when its electrolyte temperature is about 32° F, will deliver only 75% of the capacity which would be available at normal room temperature (see Table 1). This drops to 40% at 0° F. The electrolyte could freeze if a discharged battery were exposed to very cold temperatures for several hours. (See Table 2 for freezing points of various electrolyte concentrations.)

Fig. 3: 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	ON CHARGE VOLTAGE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				

CELL NO.	VOLTAGE	SPECIFIC GRAVITY	ACID LEVEL	ON CHARGE VOLTAGE
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
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Repairing batteries

Storage batteries which have been damaged or which contain defective cells may, if the rebuilding cost and time are justified, be restored to a serviceable condition.

It is important to check a battery thoroughly if it has been involved in an accident or if it is believed to be defective. A neglected battery will continue to deteriorate even when not in use. **Usually, rebuilding is justified if the majority of the cells are in good condition.**

This section explains how to remove cells from a battery and how to repair them if they are to be salvaged. Some special tools and parts will be required, depending upon the work to be done. Reference will be made to the use of such special devices but they will not be further identified in this manual. Each manufacturer identifies all tools, accessories, and replacement parts by an appropriate part number. Use this number when making reference to them.

Purging gas

- ☞ Before starting any repairs, remove all vent caps from cells to be repaired as well as from all surrounding cells.

- ☞ The space above the electrolyte must be cleared of hydrogen gas before proceeding with repairs. Introduce a low volume air stream (volume and force equal to that produced by fanning each cell with a stiff piece of cardboard or other suitable nonconducting material) into each cell for at least 30 seconds. Be very careful when using air so that the electrolyte is not splashed out of the cell.

CAUTION!
Do not blow breath into cells. Wear protective face shield or goggles, rubber gloves, and apron.

- ☞ After cells have been purged, cover all vent openings with several layers of water-dampened cloth before starting repairs.

Removing intercell connectors

Special intercell connector drills, available in different sizes, are designed to cut the bond between the cell post and the connector while permitting the post to remain for later rebuilding.

- ☞ Make certain vent plugs are in place.

- ☞ Cut the bond between the cell post and the connector. Be careful to cut only as deep as necessary, usually 1/4" to 3/8". During drilling, try to center on the cover bushing and make sure any lead curl produced does not short across other connectors.

- ☞ Lift the intercell connectors off with a pair of pliers.

Table 11: FSR hex bolts (SAE 5 and 325 steel)

Nominal diameter	Recommended torque setting
¼”	9 ft-lbs
5/16”	18 ft-lbs
3/8”	31 ft-lbs
7/16”	50 ft-lbs
½”	75 ft-lbs
9/16”	110 ft-lbs
5/8”	150 ft-lbs
¾”	250 ft-lbs
7/8”	378 ft-lbs
1”	583 ft-lbs
1 1/8”	782 ft-lbs
1 ¼”	1,097 ft-lbs
1 3/8”	1,461 ft-lbs
1 ½”	1,748 ft-lbs
1 ¾”	3,114 ft-lbs
2”	4,504 ft-lbs
2 ¼”	6,497 ft-lbs
2 ½”	7,144 ft-lbs
2 ¾”	12,092 ft-lbs
3”	15,744 ft-lbs

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Operation and Troubleshooting Manual

Model BUC2000
Dual and Single Motor Solid State Controller

2 Your safety

Operation

This chapter contains important information on the operation and troubleshooting of the model BUC2000 Dual and Single Motor Controller.

Read this chapter carefully and thoroughly. In particular, observe the safety instructions in Chapter 2 “Your safety”.

History

In the early 1970's, the introduction of solid state speed controls for battery-powered underground mining equipment led the way in mining innovation. Solid state controls increased the range and reliability of the battery powered vehicles along with providing smooth, stepless acceleration. Even with solid state speed control, direction change was achieved with the use of electromechanical contactors. These contactors provided an endless source of maintenance problems and consumed excessive amounts of valuable controller-box space. Also, most solid state controllers of the past utilized an electromechanical "bypass" contactor to connect the motor directly to the batteries which caused more contactor problems.

In the 1980’s, contactorless motor controller (X90) was developed to be used exclusively on Cat underground mining equipment. The X90 system used a dual-field motor in combination with SCRs (Silicone Controlled Rectifier) to achieve solid state direction change.

Today, a BUC2000 motor controller has been developed. The BUC2000 system uses IGBTs (Insulated Gate Bipolar Transistors) to achieve motor control and direction change. Unlike an SCR, an IGBT is turned ON and OFF via a gating electronic signal. This eliminated commutating capacitor banks and coils. The microprocessor based BUC2000 Logic Card provides complete motor control and drives both a Diagnostic Dashboard Display along with a hand held Calibrator/ Diagnostic Unit.

The IGBT switch operates so fast that it can connect and disconnect the motor in less than 1/1700 second. This is such a short time period that the dual-field motor does not have time to move. Each time the IGBT switch closes and reopens, the full battery voltage is applied to the motor terminals for about 1/1700 second. This is commonly referred to as a "pulse." (Fig. 1)

The IGBT speed control works by feeding to the motor a rapid series of pulses. The number of pulses per second determines the average voltage at the motor terminals. (Fig. 2)

There is an LED on the logic card which serves as an indicator of the status of the controller. The following diagnostics shall apply:

LED on Controller operational

LED off Power-up fault – check display or calibrator. If all is blank, then replace logic. Check control wiring. possible shorted driver board, UVR, or "W" relay.

1 Flash **Personality CRC EEPROM Error.**
Using the hand-held calibrator, change a password to any number then recycle power – should clear, otherwise replace logic.

2 Flash **Procedure FAULT**
FS1 closed before power on or 2 Directional Fault. Recycle FS1 through neutral to clear.

3 Flash **IGBT permanently low (IGBT Short Circuit FAULT).**
This includes IGBT short circuit or IGBT open circuit. This fault shuts down all modes. Recycle FS1 through neutral to clear.

4 Flash **Motor neither low nor high (Breaker Open FAULT).**
This includes breaker open circuit or IGBT open circuit. This fault shuts down all modes. Recycle FS1 through neutral to clear.

5 Flash **Motor permanently high. (Breaker welded FAULT)**
This includes breaker welded. This fault shuts down all modes. Recycle "KEY" to clear.

6 Flash **Faulty TRACTION accelerator.**
Includes the accelerator greater than 15% at power on and wire-off. If wire-off occurs during active function then the motor speed will set to zero. This fault auto clears.

7 Flash **Battery voltage FAULT.**
This includes battery below a predetermined value. Recycle FS1 through neutral to clear.

8 Flash **Thermal cut-back (Over-Temperature FAULT).**
This includes heat sink temperature above 95° C.

NOTICE!
As temperature rises above 95° C, the controller will limit the current to 300 amps (maximum), regardless of demand.

9 Flash **UVR coil over-current FAULT (Coil short circuit FAULT).**
Cleared with "KEY" recycled.

10 Flash **Brake on FAULT**
Fault will occur when directional and FS1 are energized without releasing brake. Recycle FS1 through neutral to clear.

12 Flash **Current Transducer FAULT.**
Occurs when current output is read during power-up or if no current is read during drive above 50% demand. "KEY" recycle to clear.

15 Flash **Current Transducer FAULT.**
Occurs when current output is read during power-up or if no current is read during drive above 50% demand. "KEY" recycle to clear.

Table 5: Traction test display

Display name	Calibrator display	Range/Notes
"ACCELERATOR PERCENT DEMAND"	"ACCELERATOR x%"	0-100%
"ACCELERATOR VOLTAGE"	"ACCELERATOR xV"	0.0 V-5.0 V
"FORWARD SWITCH"	"FORWARD OPEN"	OPEN/CLOSED
"REVERSE SWITCH"	"REVERSE OPEN"	OPEN/CLOSED
"FS1 SWITCH"	"FS1 OPEN"	OPEN/CLOSED
"CONFIGURATION JUMPER 1"	"CONFIG 1"	OPEN/CLOSED
"CONFIGURATION JUMPER 2"	"CONFIG 2"	OPEN/CLOSED
"BRAKE INPUT"	"BRAKE ON"	OPEN/CLOSED
	"PTA LEVEL"	HIGH/LOW
"CIRCUIT BREAKER INPUT"	"CB AUX SW"	OPEN/CLOSED
	"I MAX SW"	
"SOFTWARE VERSION"	"SOFTWARE X.XXX"	VX.XXX
"DISPLAY STATUS"	"STATUS LOCK (or ROTATE)"	LOCK / ROTATE (ROTATE)
"SELECT DASHBOARD DISPLAY STATUS"	"STATUS #"	0-4 (Battery voltage, pump current, motor current, battery voltage) (0)
"DISPLAY CONTRAST"		0-127 (33)

Table 6: Traction BDI display

Display name	Calibrator display	Range/ Notes	Adjustable with password
"RESET CELL LEVEL"	"RESET xV CELL"	1.85V-2.50V (2.04V)	X
"EMPTY CELL LEVEL"	"EMPTY xV CELL"	1.00V-1.99V (1.70V)	X
"WARNING LEVEL"	"WARNING X%"	0%-90% (20%)	X

Note 1: Values in parentheses are default values.
Note 2: When the last status (Traction test or Traction BDI) is displayed, the display will go back to the first status and scroll through again.

Fig. 24: Calibrator unit

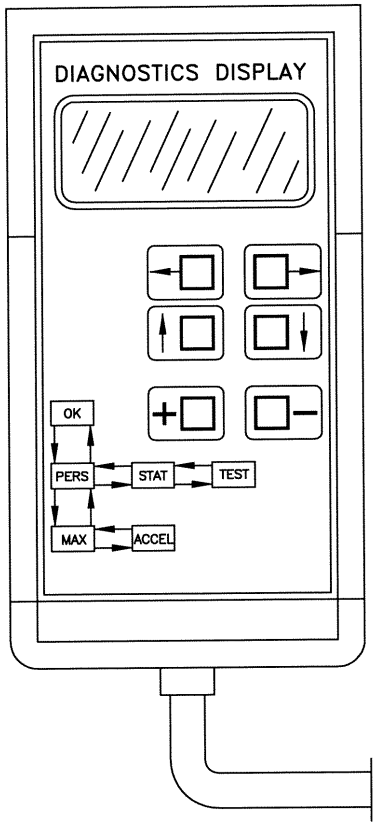
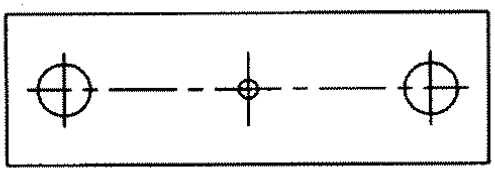


Fig. 25: BUC2000 pump motor shunt



Panel measurements

Before taking readings, the meter should be in DC volts (and appropriate range) and the following system conditions must be met:

- All connections attached, and power applied.
- Main circuit breaker on.
- Master switch or control handle in the “PARK” or “PARK BRAKE APPLIED” position.
- Accelerator NOT depressed (FS1 open).

B+ to B-: Battery Voltage
B- to AA: Battery Voltage
B- to S1L, S4L, S1R, & S4R: Battery Voltage

If the breaker is off and the diagnostics button has been pushed, the readings should be:

B+ to B-: > 35 VDC
B- to AA: > 35 VDC
B- to S1L, S4L, S1R, & S4R: > 35 VDC