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

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 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

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.

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).

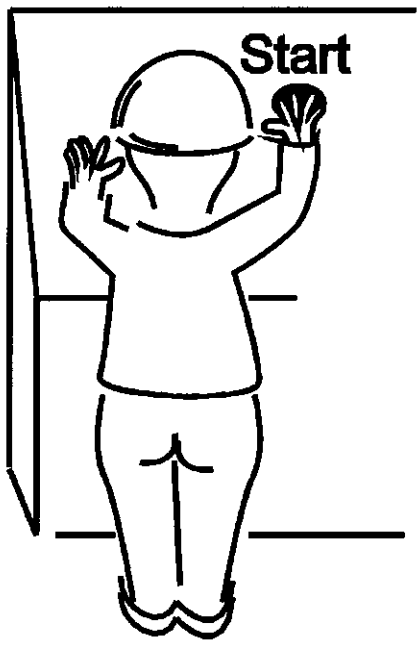
Transport of equipment at temperatures between -6° F (-21° C) and 40° F (-40° C) is only permissible when certain measures were taken to meet these conditions at the design and manufacture stages. Nevertheless, the individual parts and devices of this equipment must not be subjected to sudden impact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

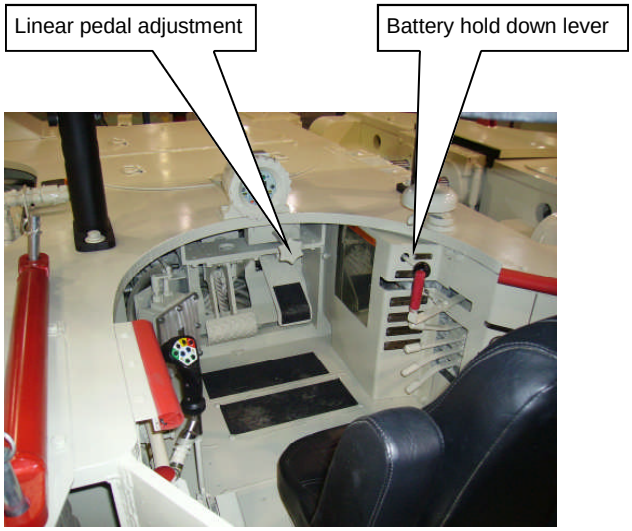
The battery hold down (Fig. 17), available on Models CH816C and CH816CL, is located directly in front of the operator's seat. It is used to secure the battery in position during tramming operations. To engage the hold down, push the handle away from the operator and to unlock, pull the handle towards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

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.

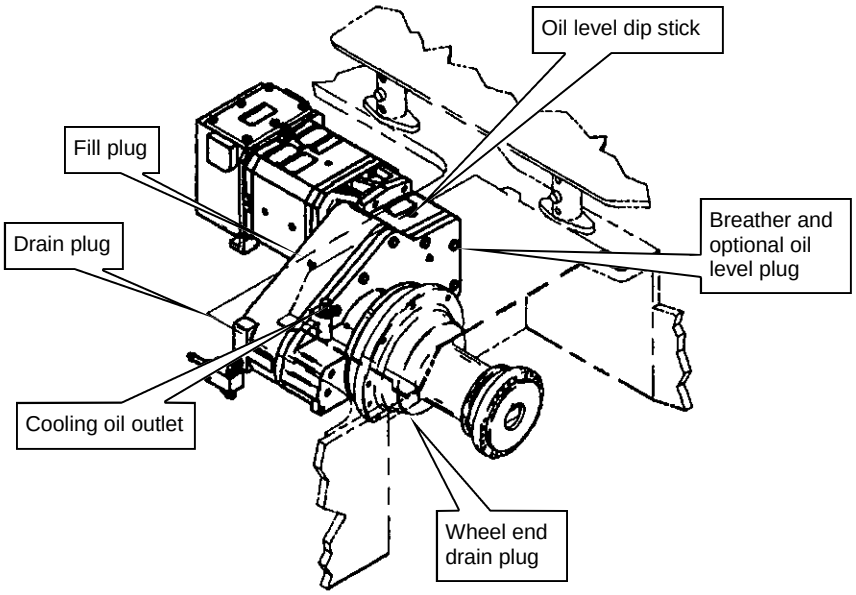
gear cases and planetary wheel ends

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.

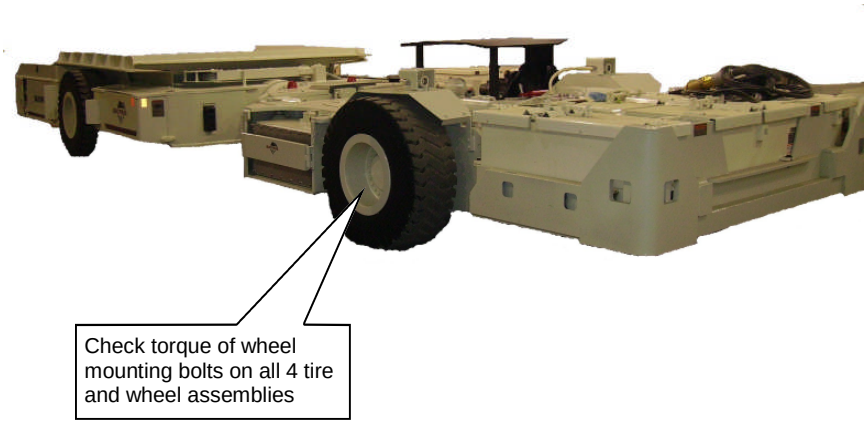
Fig. 42: Gear case and planetary wheel end lubrication



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

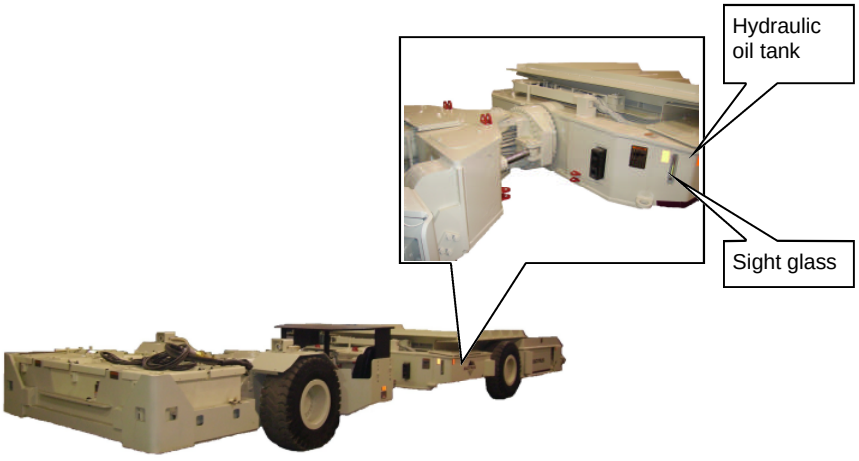


hydraulic oil suction strainer

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.

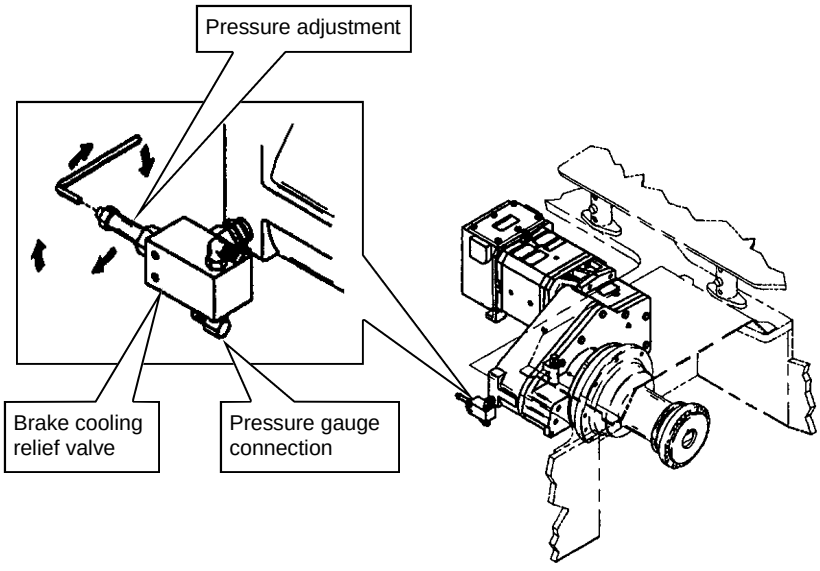
☞ Remove the cap that covers the pressure adjustment screw.

☞ 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.

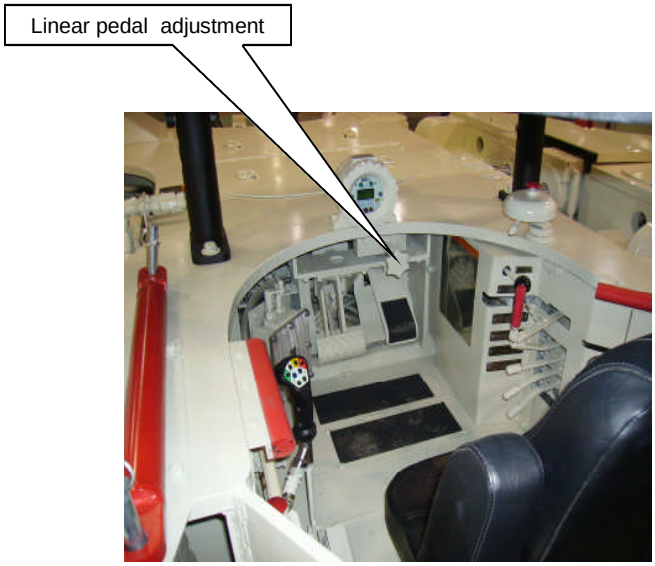
IMPORTANT!
Insure that all the jam nuts have been locked down securely before returning the machine to service, to insure that the cartridge settings will be maintained.

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 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 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 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.

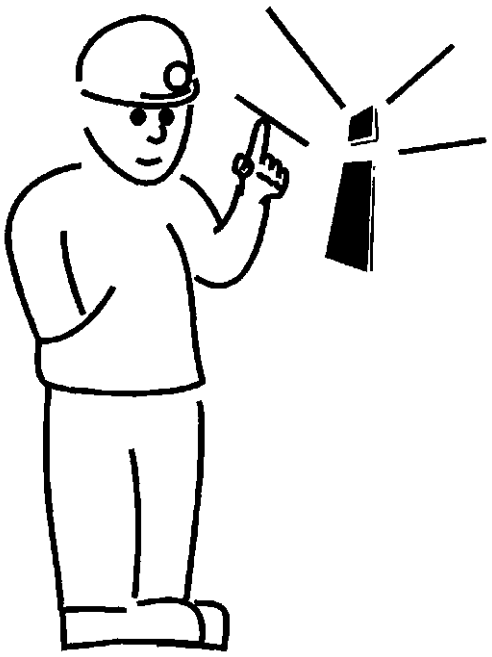
IMPORTANT!
The lubrication fluids and greases listed in the same table can be mixed. Other products may only be used if the supplier can guarantee that they are equivalent.
Differently composed fluids and greases must not be mixed as this may change the consistency, i.e. the mixture can become thinner 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



MAJOR HAZARDS

AREA WHERE HAZARD CAN OCCUR	HAZARD WHAT CAN HAPPEN IF PRECAUTIONS AND SAFEGUARDS ARE NOT OBEYED	SAFEGUARDS HOW TO AVOID THE HAZARD
ELECTRICAL (A.C. Input, Charger, Battery)	Electrical shock could cause irreparable injury or death.	All electrical systems should be maintained by certified electricians. The a.c. input and charger plug should be disconnected before servicing the charger.
	Charging a battery of a size different than that shown on the charger nameplate could cause the battery to burst, or cause damage to the battery or charger.	Chargers should be matched to the size batteries in use at each particular mine.
BATTERY	The battery produces lethal amounts of power whether connected to the machine or charger, or not.	The battery should be maintained by qualified personnel. (Refer to Bucyrus America, Inc. "INSTALLATION, USE, MAINTENANCE, AND REPAIR OF MINE POWER STORAGE BATTERIES," PART NUMBER A6474X26, for complete instructions).
	Battery covers could fall crushing hands or arms.	Be sure cover supports are in place when working on battery.
	Battery hold-down clamps could crush fingers.	Keep fingers away from hold-down clamps.
	Batteries produce explosive gases that could be ignited causing burns or explosions.	Batteries should be well vented before servicing particularly if welding or burning on the battery. Batteries should be maintained by qualified personnel.
	Batteries contain strong acid that could cause severe burns if spilled or splashed on body parts or in the eyes.	Protective clothing, gloves, and eyewear must be worn when working on batteries. Batteries should be maintained by qualified personnel.

INSTALLATION INFORMATION

Minimum Wire Sizes

Table 2 lists the a.c. input and the d.c. output minimum wire size requirements. At distances exceeding 10 ft., the d.c. wire size should be chosen to keep the voltage difference between the units d.c. output terminals and the battery at less than 1/2 volt when the unit is fully loaded.

FUSE SIZE	WIRE SIZE REQUIREMENT CUSTOMER CONNECTION	EQUIPMENT GROUNDING CONDUCTOR MINIMUM	FUSE SIZE	WIRE SIZE REQUIREMENT CUSTOMER CONNECTION	EQUIPMENT GROUNDING CONDUCTOR MINIMUM
1	#14	#14	150	#1	#6
3	#14	#14	175	#1/0	#6
4	#14	#14	200	#2/0	#6
5	#14	#14	225	#2/0	#4
6	#14	#14	250	#4/0	#4
10	#14	#14	300	250-MCM	#4
15	#12	#12	350	350-MCM	#2
20	#12	#12	400	400-MCM	#2
25	#10	#12	450	500-MCM	#2
30	#10	#10	500	600-MCM	#2
35	#8	#10	600	900-MCM	#1
40	#8	#10	700	1500-MCM	1/0
45	#8	#10	800	2/500-MCM	1/0
50	#8	#10	1000	2/800-MCM	4/0
60	#6	#10	1200	2/1000-MCM	4/0
70	#6	#8	1600	2/2000-MCM	4/0
80	#4	#8	2000		250-MCM
90	#4	#8	2500		350-MCM
100	#4	#8	3000		400-MCM
110	#2	#6	4000		500-MCM
125	#2	#6	5000		700-MCM
130	#2	#6	6000		800-MCM

TABLE 2

Electrical Connections & Field Wiring

Terminal blocks are provided for connecting the a.c. input and d.c. output. A ground wire must be connected to the unit's case ground.

A.C. Input

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

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

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

Be sure the transformer taps are set for the correct a.c. input.

(see Figure 1, page 15).

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

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

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

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

DANGER: *THIS SYMBOL DENOTES THAT FAILURE TO COMPLY WITH THE* POINTS IN THE TEXT MARKED WITH THIS SYMBOL DRAW YOUR ATTENTION TO IMMEDIATELY IMPENDING DANGER INCLUDING ELECTRICAL DANGERS. POSSIBLE CONSEQUENCES ARE: VERY SERIOUS INJURY, DEATH OR DEATH BY ELECTROCUTION.

DESCRIPTION OF FEATURES

The Bucyrus 2000 Solid State Controller incorporates a variety of independent protection systems. These improve reliability, shield the motors and controller from overload, protect the machine from inadvertent abuse by the operator, and help to protect workers from potential harm from malfunctioning equipment.

Bucyrus 2000 Motor Controller Consist of:

- Dual Motor IGBT Panel or single motor IGBT Panel or 2-single motor IGBT panels
- Microprocessor Based Logic Card
- Optional Dashboard Display
- Optional Hand held Diagnostics/Calibrator Unit
- "Y" connecting harness (used only with 2-single motor panel systems)

Bucyrus 2000 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)

Microprocessor Based Logic Card (Control Inputs)

- Input applies battery voltage to logic card (Pin 16)
- Proportional control accelerator, 5000 OHMS (Pins 1 and 2)
- Tram direction select (Pin 7)
- Tram direction select (Pin 8)
- Park brake condition (set / release) (Pin 14)
- Circuit breaker driver (Pin 6)
- Circuit breaker condition (Pin 11)
- Current limit default setting (Pin 12)
- Accelerator (FS1) input switch (Pin 4)
- CAN Communication Input Port for optional hand held diagnostics/calibrator unit
- CAN Communication Input Port for optional dashboard display
- Analog Input for connection to pump motor shunt to allow pump motor current measurement

The Bucyrus 2000 Microprocessor-Based Logic Card will control dual two-quadrant IGBT devices, controlled by PWM (PULSE WIDTH MODULATED) switching, providing forward and reverse direction control.

Traction Status Display (Continued)

Plugging Current Stored Duration Mid Bytes (S. M.) Left Channel Plugging Current Stored Duration Mid Bytes (S. M.)		ALL	N / A
Plugging Current Stored Duration Low Bytes (S. M.) Left Channel Plugging Current Stored Duration Low Bytes (S. M.)		ALL	N / A
SM FWD IGBT High Temperature		ALL	N / A
SM REV IGBT High Temperature		ALL	N / A
DM RIGHT IGBT High Temp.		ALL	N / A
DM LEFT IGBT High Temp.		ALL	N / A
SM FWD IGBT Low Temperature		ALL	N / A
SM REV IGBT Low Temperature		ALL	N / A
DM RIGHT IGBT Low Temp.		ALL	N / A
DM LEFT IGBT Low Temp.		ALL	N / A
Battery Voltage High		ALL	N / A
Battery Voltage Low		ALL	N / A

Traction Test Display

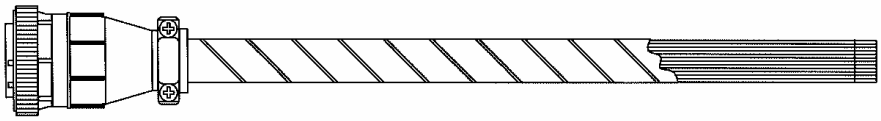
Display Name	Range / Notes	Security Level Displayed	Security Level Adjustable
Accel. Voltage	0.0 V - 5.0 V	ALL	N / A
Accel. Percent Demand	0 - 100%	ALL	N / A
Forward Switch	OPEN / CLOSED	ALL	N / A
Reverse Switch	OPEN / CLOSED	ALL	N / A
FS1 Switch	OPEN / CLOSED	ALL	N / A
Configuration Jumper 1	OPEN / CLOSED	ALL	N / A
Configuration Jumper 2	OPEN / CLOSED	ALL	N / A
Brake Input	OPEN / CLOSED	ALL	N / A
Circuit Breaker Input	OPEN / CLOSED	ALL	N / A
Oil Temperature	OK / HOT	ALL	N / A
Oil Level	OK / LOW	ALL	N / A
Software Version	VX.XXX	ALL	N / A

IGBT PANELS

FOR REPLACEMENT PARTS AND MACHINE WIRING DIAGRAMS, PLEASE REFER TO YOUR SPARE PARTS MANUAL.

Bucyrus 2000 Panel Wiring Harness

FIGURE 26



PIN NUMBER	WIRE COLOR CODE
1	ORANGE
2	RED
3	LT BLUE
4	BLACK
5	NOT USED
6	WHITE
7	BROWN
8	GRAY
9	NOT USED
10	NOT USED
11	VIOLET
12	YELLOW
13	NOT USED
14	GREEN
15	NOT USED
16	DARK BLUE

CHAPTER 2 – INSTALLATION, USE, AND MAINTENANCE

Section I. Preparation for Use

2-1. Establishing Requirements

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

2-2. Unpacking Upon Receipt

1. It is important first to examine the exterior of the packing for wet spots on bottom or sides which may indicate leaking jars. Inspect also for physical damage to battery package because the battery could be affected as well. Report any damage to your supervisor.

2. Make certain that the package is right side up, with skid mounts resting firmly on floor.

3. Use a forklift truck or crane of sufficient capacity to remove the packaged battery from the truck or freight car. If a crane is employed, be sure the sling is secured against the bottom of the skid and not around the skid mounts.

LIFTING DEVICES USED TO MOVE BATTERIES MUST BE CAPABLE OF CARRYING THE WEIGHT STAMPED ON THE BATTERY CASE. KEEP ALL PERSONS AND BODY PARTS FROM UNDER THE BATTERIES WHEN THEY ARE LIFTED.

4. Move the crated battery to the uncrating area and remove packaging, including any wrapping or other protection provided to the battery terminal cable connectors.

5. Inspect battery and report any damage to your supervisor.

6. Use a properly insulated lifting beam of adequate capacity to lift the battery, by means of an overhead hoist, from the battery skid.

2-3. Handling Batteries

When lifting batteries, always use a device which exerts a vertical pull on the lifting eye or tab. If a chain must be used, it should be in combination with a lifting beam with provision for adjusting lifting hook centers to the exact length of the tray. Any method of lifting which tends to "squeeze" or "stretch" the battery tray may distort it and could damage jars or disturb cell seals. A piece of rubber sheet or other insulating material, temporarily laid on the battery while lifting, will prevent any possible short circuits from chains or hooks. As an additional precaution against accidental shorting, the lifting beam hooks should be electrically insulated from each other.

3-3. Correcting Excessive Self-Discharge

While a storage battery is in a charged state, a local electrochemical reaction takes place within the cells, which causes very gradual discharging. This reaction is known as self-discharge. A small amount is quite normal in mine power batteries where grids are made from antimonial lead. The rate of self-discharge is temperature-related and increases significantly as temperatures rise. Table 4 shows the relationship between temperature and loss of specific gravity. The normal rate at 77 degrees F. to 80 degrees F. is a loss in specific gravity of about one point (.001) per day. This becomes of concern only when a wet battery is to be stored for weeks at a time. It can be ignored as a factor in normal battery operation.

It is possible, however, particularly during the latter stages of a battery's life, for the rate of discharge to become much greater and even limit the battery's duty cycle. Excessive self-discharge may be caused by defective separators or plates which have become shorted at the edges. Edge shorting is usually caused by loss of positive active material which can fill the sediment well or build up on the top or sides of the plates and eventually bridge the space between the positives and negatives. If a shorted condition seems likely, the element should be pulled for examination and the defective separator replaced, shorts cleared, or cells replaced. Usually, if the sediment well is full, salvage is impractical.

3-4. Test Discharge

A capacity test is sometimes desirable to determine a battery's actual discharge capability as compared to its 6-hour rated capacity.

This can be a significant diagnostic tool when equipment does not operate as expected and it can help determine when the battery should be replaced. When a battery consistently delivers less than 80% of its rated ampere-hour capacity, either some cells are substandard or the battery has reached the end of its useful life and should be replaced.

A test discharge is performed by discharging a fully charged battery at a fixed rate under carefully controlled test conditions.

Section II. Repairing Batteries

3-5. General

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.

3-6. Purging of Gas