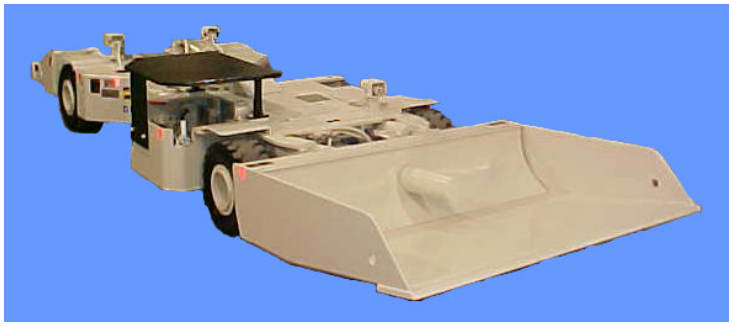
Operation Manual

Bucyrus - UN-A-TRAC ®
Model - 488-6DM

Doc. No.: A6474X245



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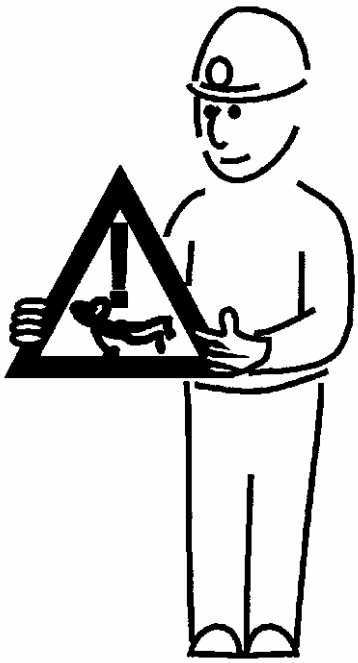
2 Your safety



maintenance, repair

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

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

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

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

Always replace damaged or lost decals and metal instruction plates.

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

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

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

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

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

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

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

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

IMPORTANT!
The drive and pump motors do not require periodic lubrication. The pump motor bearings are sealed. The drive motors have one bearing sealed and the other bearing receives lubrication from the gear case oil.

WARNING!
In order to check and adjust the steering system relief pressure, it is necessary to steer the machine to the turning limit in both directions. Care must be taken to avoid having anyone or any part of your body in the articulation area while the unit is being steered. All adjustments to the steering relief pressure must be made from inside the operator's compartment and not from outside the unit.

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

Chapter 6: Technical data

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

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

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

Installation

Points to observe prior to installation

Who is allowed to carry out installation?

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

Work on:

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

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

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

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

Which tools are required for installation?

tool box

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

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

In addition, various items of auxiliary equipment and machines may be required at the point of installation.

These include i.e.:

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

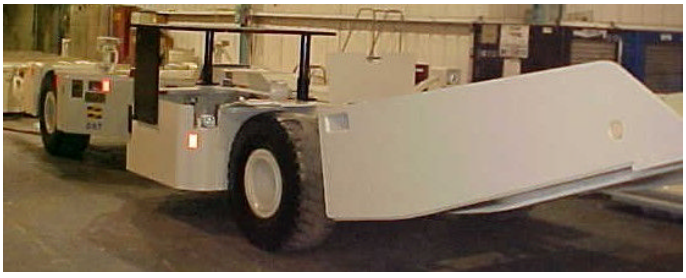
accelerator pedal

This pedal (Fig. 9), operated by the right foot, is used to start the tram (traveling) motors and regulate the speed of the machine.

CAUTION!
The speed switch foot pedal should not be depressed at the same time as the foot brake pedal or when the parking brakes are set. To do so may overload the tram motors and could shorten their usefulness. The UN-A-TRAC ® is provided with overload protection, but continued abuse can shorten motor life.

The machine is equipped with two (2) fire suppression (remote) actuators (Fig. 10). One is located to the operator's right inside the operator's compartment and the other is located next to the controller enclosure on the opposite side of the machine. This particular suppression system is pneumatically actuated and extinguishes with dry chemicals. To actuate the system from either of the two (2) actuators, pull the safety pin and strike downward on the plunger. Immediately after the plunger is struck, dry chemical will be dispensed throughout the machine. The fire suppression system must be completely recharged with dry chemicals and expellants after it has been actuated.

WARNING!
If either of the fire suppression actuators is actuated, the system must be completely recharged with dry chemicals and expellants.



“BATTERY” control lever

The "BATTERY" lever (Fig. 17) controls the battery changing system, which is made up of two hydraulic cylinders (battery lifting cylinders), one on each side of the batteries. When the "BATTERY” control lever is pulled toward the operator, the battery-lifting cylinders will raise the batteries. Pushing the handle away from the operator will lower the batteries.

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

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

General hydraulic control system information (machines equipped with optional QDS bellcrank)

In the operator's compartment located to the right of the operator’s seat is a group of control levers and gauges (Fig. 18). These levers control the bucket position, lift, tilt, QA pins, ejector blade position, winch operation and battery changer system by means of a hydraulic valve bank located behind the panel to the operator's right. The gauges include emergency brake, accumulator, and system pressure. The hydraulic system pressure relief valve is set at the factory at 2000 psi (138 bar), and should not be changed. Should the "SYSTEM PRESSURE" gauge (Fig. 16) read more than 2250 psi (155 bar), shutdown the machine and call a maintenance person (see Shutdown procedure in this chapter).

Table 3: Hydraulic control panel gauge readings (optional QDS)

Towing a disabled machine

WARNING!
It is not possible, within the scope of this guide, to anticipate all possible arrangements for towing a disabled vehicle, you must take all possible precautions to protect the operators and anyone around both vehicles from being injured by either the towing vehicle, the towing device used (cables, bars, etc.) and the towing vehicle (scoop, tractor, etc.) must be strong and heavy enough to maintain control of both vehicles through all bottom conditions to be encountered at all times. Safety chains or other safety devices must be used in case of failure of the primary towing device. All operators must be alert at all times to prevent either unit from running away or running out of control during towing. The vehicle to be towed must be securely coupled to the towing vehicle before the brakes are released on the disabled unit. The operator of the towing vehicle must be in place in the towing vehicle with the brakes applied before the brakes of the disabled vehicle are released.

- ☞ Couple the towing vehicle securely to the disabled vehicle.
- ☞ Turn the valve selector handle to “PUMP TO RELEASE” on the Emergency/Park Brake Release Hand Pump located inside the operator’s compartment (this isolates the park brake solenoid from the circuit).
- ☞ Begin pumping the hand pump. The building pressure moves the shuttle valve and allows the Automatic (Park) Brake system to be pressurized.
- ☞ The Automatic (Park) Brake is released when a minimum of 1500 psi is indicated by the Brake Release gauge.

CAUTION!
For long distance towing, disconnect and remove front and rear drive lines.

WARNING!
At no time during towing should anyone ride in or on the vehicle being towed or stand in between the towing vehicle and the disabled vehicle.

- ☞ Begin towing the vehicle.
- ☞ Once the destination is reached, stop both vehicles and set the parking brake on the disabled vehicle before removing the towing devices. The disabled vehicle should be choked in both direction at all four wheels for additional stability. The brake is set by turning the valve handle on the hand pump to “NORMAL RE-APPLY”.

WARNING!
Failure to set the parking brake on the disabled vehicle before removing the towing device could allow the disabled vehicle to roll away uncontrolled.

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 4: Critical torque values

Location	Bolt size	Grade	Dry	Lubricated
Steering cylinder pins	7/8 NC	8	N/A	460
Tire-Wheel mounting bolts	3/4” X 2 1/4”	8	N/A	300
Oscillating bearing	1 1/4” X 9”	8	N/A	1840
Drive motor-to-gear case mounting bolts	3/4” X 2 3/4”	8	N/A	280 - 320
Axle mounting bolts	7/8” X 9”	8	N/A	455
Center section mounting bolts	7/8” X 9”	8	N/A	620

Lubricants, fluids and capacities

Table 5: Lubricants, fluids and capacities

Location	Specification	Approximate capacity	Notes
Hydraulic oil tank	Spec. 100-1 (John Deere or Meritor) Spec. 100-12 (Meritor or Kessler)		1
Gear box (reducer)	Spec. 100-6	2.75 quarts. or as required	
Lubrication points	Spec. 100-3	As Required	3
Winch	API GL4 (140) Gear oil Peragma Grade 8	5 pints	
Axle housing (Meritor) (Kessler)	Spec. 100-6	As required	2
Planetary wheel ends (Meritor) (Kessler)	Spec. 100-6	As required	2
Wet disc brakes (Meritor) (Kessler)	Spec. 100-12	As required	
Axle (John Deere)	John Deere Hy-Gard oil	20 quarts	2
Wet disc brake (PT Tech)	Spec. 100-1	As required	
Wet disc brake (SROIB)	SROIB brake cooling fluid	1.9 quarts	

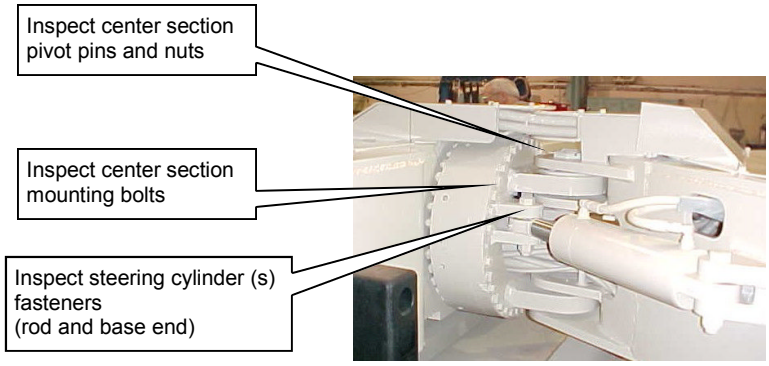
Notes:

1. With ejector blade completely retracted (if equipped with bucket).
2. The axle housing and planetary wheel end assemblies do not have a common oil source. Each assembly must be filled separately.

   Make sure the level and fill hole in the planetary wheel end cover is in the proper position. Rotate the wheel end as required to bring the fill hole to either the 3 o'clock or 9 o'clock position.

   When filling the axle housing and planetary wheel ends, allow enough time for the lubricant to fill the various cavities and around component parts in each assembly. Continue adding oil into each assembly until the required oil level is reached.
3. Pump grease into fitting until old grease can be observed coming out of component.

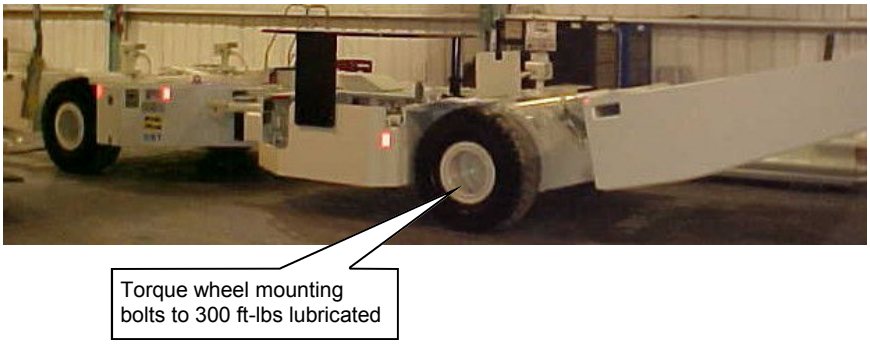
Fig. 45: Center section and steering cylinder pins and nuts



tire/wheel mounting bolts

Check the wheel mounting bolts (Fig. 46). The mounting bolts should be torqued to 300 ft-lbs lubricated. Use Loctite 242 on wheel mounting bolts.

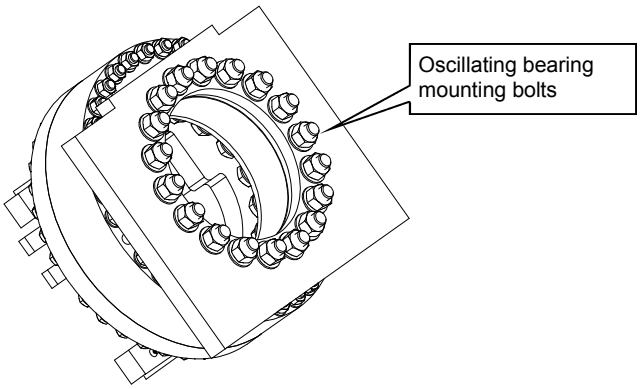
Fig. 46: Tire/wheel mounting bolts



oscillating bearing mounting bolts

Check the oscillating bearing mounting bolts (Fig. 47). The mounting bolts should be torqued to 1840 ft-lbs lubricated. Use Loctite 242 on mounting bolts.

Fig. 47: Oscillating bearing mounting bolts



hydraulic oil tank (s) and strainer (s)

Change oil and clean or change the suction strainer in the hydraulic oil tank (s) (Fig. 63).

- ☞ Park the UN-A-TRAC ® on solid level ground, clean dirt and debris from around the drain plug (s) located on each side tank.
- ☞ Remove drain plug (s) and allow oil to completely drain from the tanks. The two (2) drain plugs will allow oil to drain from all three (3) tanks.
- ☞ Clean and reinstall drain plug (s).
- ☞ Clean dirt and debris from around fill cap and cover on the right and left tanks.
- ☞ Remove the bolts that secure the fill cap and cover.
- ☞ Reaching down into each tank, unscrew the suction strainer (s) and remove from tank.
- ☞ If the strainer (s) is not torn or damaged, it can be cleaned using kerosene and a soft brush and dried thoroughly. If strainer (s) is damaged, it must be replaced.
- ☞ Replace the strainer (s) in the tank (s) and hand tighten.
- ☞ Replace the fill cap and cover on both tanks.
- ☞ Refill the tank to the proper level:
  (Spec. 100-1, if equipped with Meritor or John Deere axles)
  (Spec 100-12, if equipped with Kessler axles)
- ☞ Start the machine and allow the hydraulic pump to run in order to purge air from the system.
- ☞ Shutdown the machine and recheck the oil level. Add oil if necessary.

Fig. 63: Hydraulic oil and suction strainer

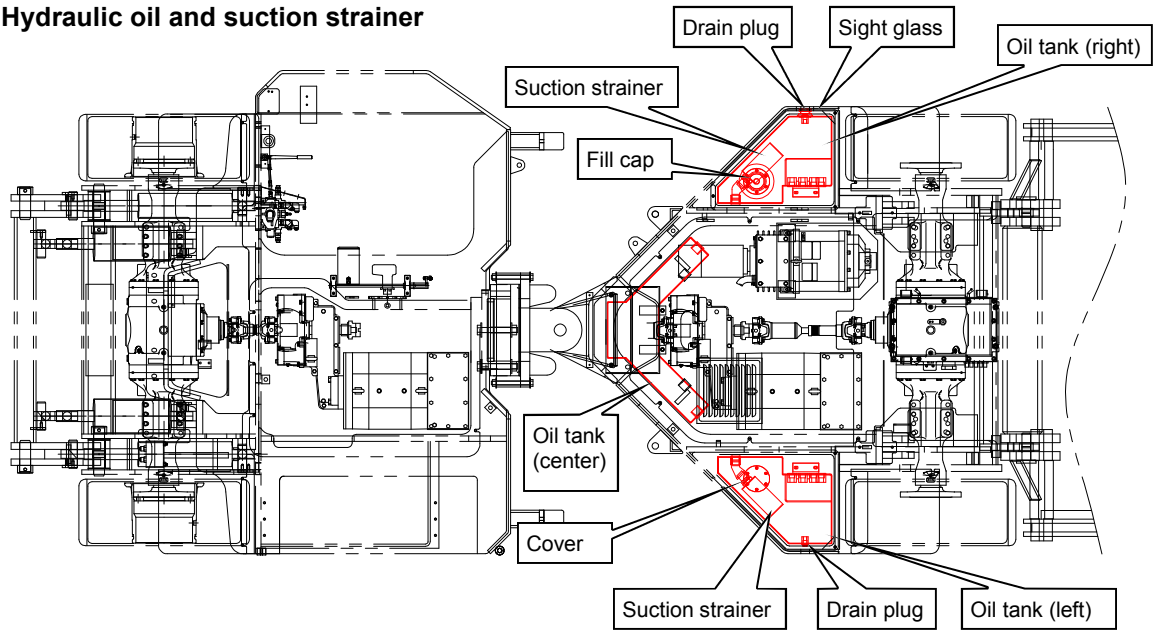


Table 7 (continued): Hydraulic system (general) troubleshooting

Trouble, symptom or cause	Probable cause	Test, check and/or remedy
overheating of system (continued)	☞ Improper air circulation around reservoir.	☞ Check to see if the area around the reservoir is clear.
	☞ System relief valve set too high or too low.	☞ Reset the relief valve to specifications.
foreign matter sources in the circuit	☞ Sealing compound (pipe dope, Teflon tape).	☞ Clean or replace seals.
	☞ Burrs inside piping components.	☞ Disassemble piping components and remove any burrs.
	☞ Tag ends of packing coming loose.	☞ Remove old packing and replace with new.
	☞ Lines left unprotected and dirty, repaired components.	☞ Drain and replace oil.
	☞ Repair parts not properly protected while stored.	☞ Clean parts thoroughly before installation.
Accumulator charging cycle repeats frequently when accumulator is not normally being discharged in service	☞ Leaking accumulator lines or fittings.	☞ Check lines and fittings for leaks and correct.
	☞ Accumulator gas charge too low.	☞ Check accumulator gas charge.
	☞ Accumulator gas charge too high.	☞ Check accumulator.
	☞ Line to accumulator plugged.	☞ Replace line.
Accumulator starts to charge but doesn't reach high limit	☞ No oil or low oil in tank.	☞ Check oil level.
	☞ Defective or worn pump (pump doesn't deliver full flow or pressure).	☞ Check pump pressure and flow.
	☞ Defective system relief valve (valve leaking or has low setting so full flow and pressure are not available).	☞ Check relief valve.
	☞ Defective charging valve.	☞ Replace valve.
No steering or inadequate steering when accumulator is charging but steering satisfactory when accumulator is not charging	☞ Pump worn (not delivering full flow or pressure).	☞ Check pump pressure and flow.
	☞ Relief valve defective (valve leaking so that full flow and pressure not available).	☞ Check relief valve.
	☞ Defective charging valve.	☞ Replace charging valve .

Technical data

This chapter contains the most important technical data on the 488-6DM UN-A-TRAC ®. 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 488-6DM UN-A-TRAC ®

Technical data sheet

general	Length (overall):	approx. 31’ 4.5”
	Bucket:	approx. 9’ 7”
	Outside operator’s compartment:	approx. 9’ 9.5”
	Wheelbase:	approx. 14’ 2”
	Ground clearance (w/35x15-15 tires):	approx. 11”
	Ground clearance (w/38x16-15 tires):	approx. 12”
	Chassis height (w/38x16-15 tires):	approx. 3’
	Weight (empty less battery):	approx. 36,700 lbs
	Weight (w/64-SS125-21 battery):	approx. 49,000 lbs
performance	Inside turning radius:	approx. 12’ 6.5”
	Outside turning radius:	approx. 24” 2”
	Steering articulation:	90 degrees total
	Tram speed:	4 to 5 mph
	Lift capacity (36” from the face of lift plate):	approx. 16 tons

axles Front and rear rigid mounted planetary axles (John Deere 1200 Series or Meritor). Axles are equipped with a wet disc service brake mounted at each planetary

drive lines Heavy duty off-highway type drive shafts and slip joints.

reducer Foot mounted gearbox.

brakes (service) Left foot-pedal actuated wet disc brakes at all four wheels. Hydraulic power is supplied through a one gallon accumulator which continues to provide stopping power in the event of a power loss and is monitored by a charging/unloading valve.
Accumulator is not permitted to fall below a certain residual pressure to assure this continued availability. A dash mounted monitoring gauge keeps the operator constantly informed of the accumulator’s status.

automatic emergency/park brake release hand pump Wall mounted hand pump located to the right of operator. Activating this pump enables the operator to release the brake without power on the unit for towing a disabled vehicle.

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.

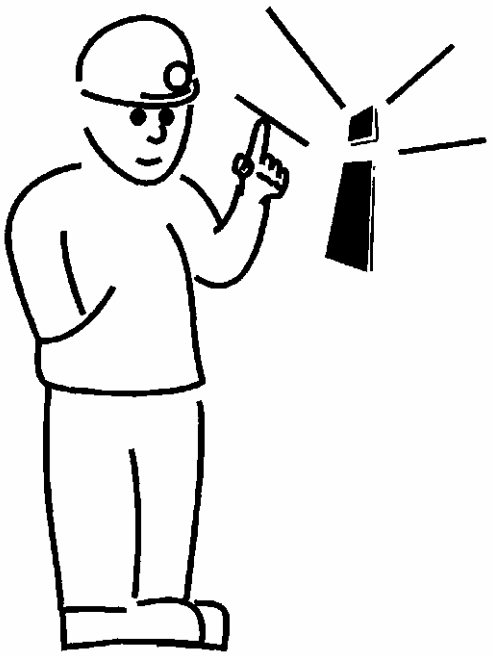
IMPORTANT!
The lubrication fluids and greases listed in the same table can be mixed. Other products may only be used if the supplier can guarantee that they are equivalent.
Differently composed fluids and greases must not be mixed as this may change the consistency, i.e. the mixture can become thinner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

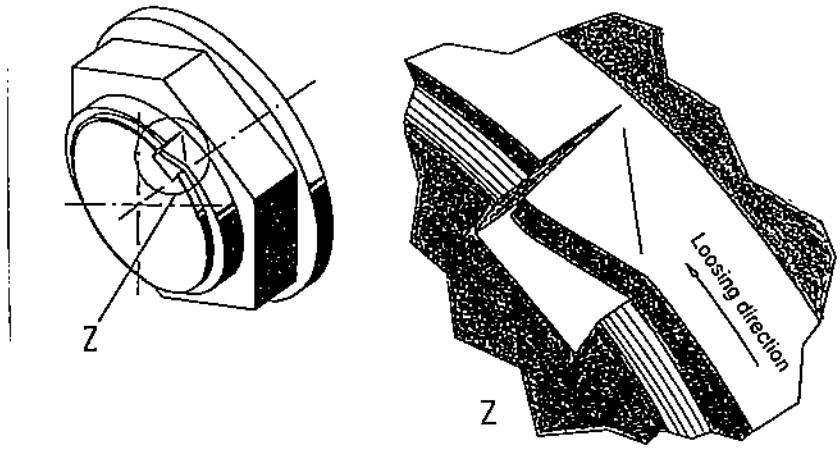


Lubrication intervals and maintenance instructions

Utilization of Loctite and operating supplies

Hub assembly			
Safety blocked parts	Joint	Loctite	Operating supplies
Spacer ring	Contact surface	572	-
Axle spindle	Screws	262	-
Axle spindle	Contact surface	270	-
Grommet	in planetary housing	270	-
Disk	in axle spindle	270	-
Adjusting screw with nut	in planetary housing	270	-
Support	Screw	262	-
Ring gear retainer	Screws	270	-
Pol wheel	Contact surface	638	-
Steering lever Track rod lever	Screws	262	-
Steering lever Track rod lever	Contact surface	270	-
Wheel hub cover	Thread	572	-
Radial seal rings Rubber casing	Contact surface	572	-
Radial seal rings Steel casing	Contact surface	270	-
Wheel safety nut → see chapter 5 → Adjustment of wheel bearings			

Securing of the striking nut



The brim of the striking nut has to be sheared only along the slot flank and the corner has to be bended on the slot ground .

Using of Loctite and other operating supplies

1.) Striking nut at drive flange

- In thread : assembly paste with MoS_2 (exception through drive pinion see point 2) .

- Front side contact surface : sealing compound (Epple 33 or equivalent) .

2.) Striking nut at through drive pinion

- In thread : Loctite 262 .

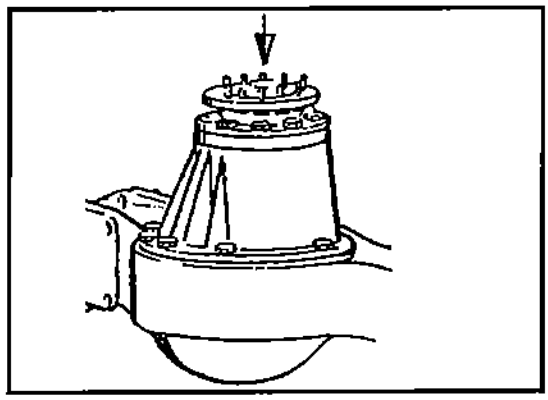
3.) Striking nut at gear wheels , bearings etc.

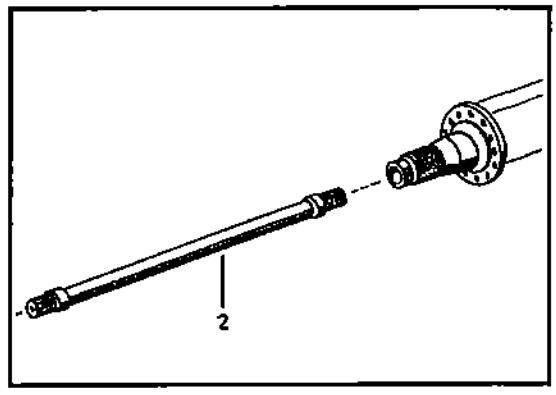
- In thread : assembly paste with MoS_2 .

Removing of the striking nut

Bend away the nose and screw off the nut .

Assembly of the drive assembly onto the axle housing





Coat the contact surface of the axle housing with Epple 33 (at version through drive with Loctite 510), and mount the complete drive assembly. The axle housing being placed in a horizontal position, secure the screws with Loctite 262. Mount the pol wheel (if present) onto the axle shaft (see 5.1.7).

Engage the axle shaft into the axle housing.

The axle shaft should be able to be moved easily (by hand) in the toothing of the differential side gear.

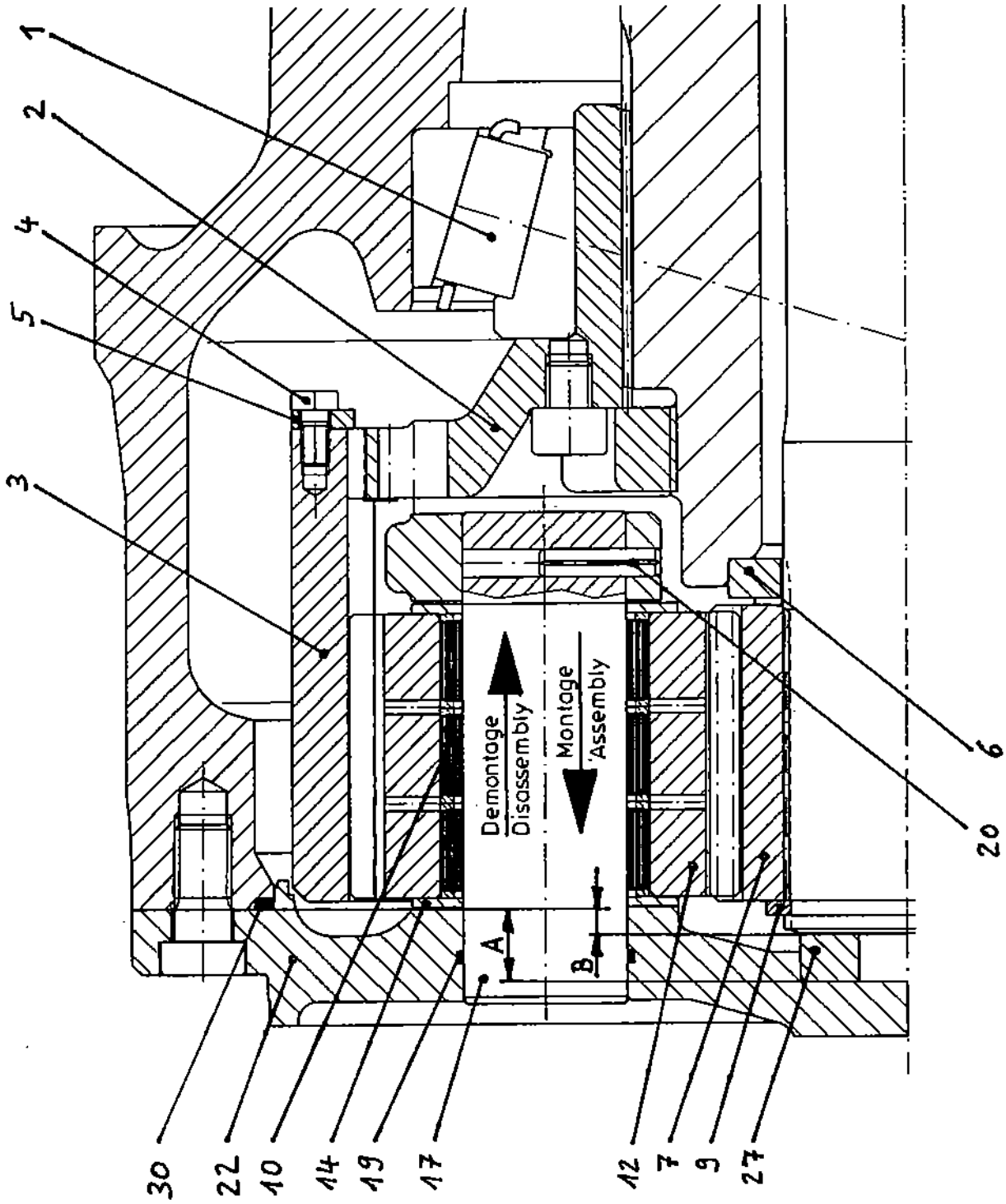
At version with differential lock on the outside (D 71 / D 109) the differential lock must always be actuated when assemble or disassemble the axle shaft.

Direction:

Actuating of the differential lock is necessary to prevent the sliding sleeve to drop out of the shifter fork into the axle housing when pulling out or sliding in the axle shaft. This would entail disassembly of the axle.

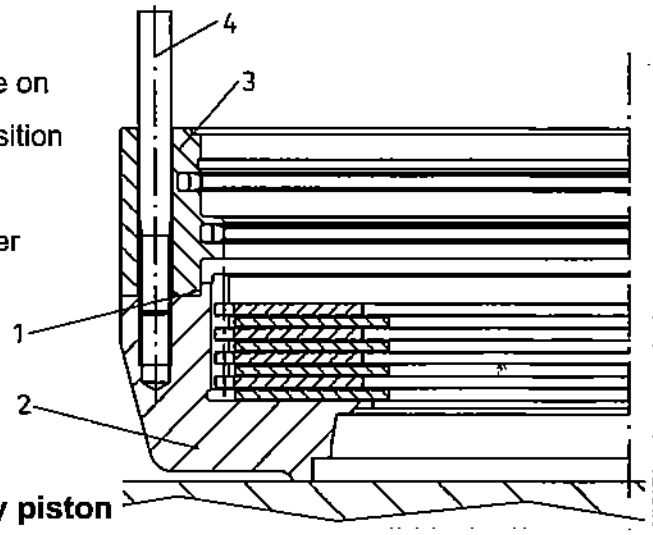
Planetengetriebe

Planetary gear drive



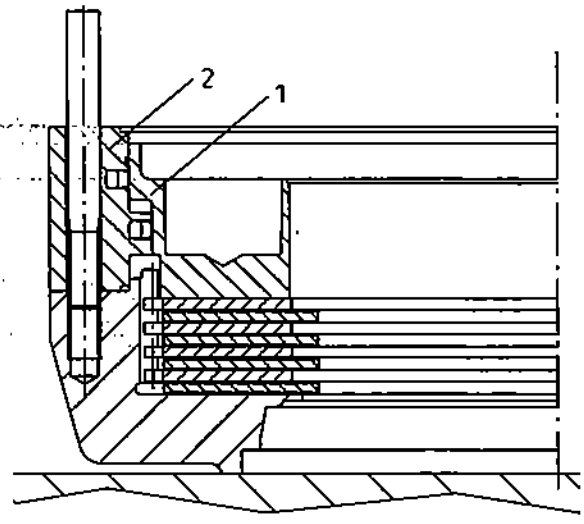
Assembly intermediate piece

Fit o - ring (1) onto the brake housing (2) and place on the intermediate piece (3) , take the screw holes position into consideration .
It is recommendable to use 2 thread bolts (4) (longer screws without screw head) for fixation .



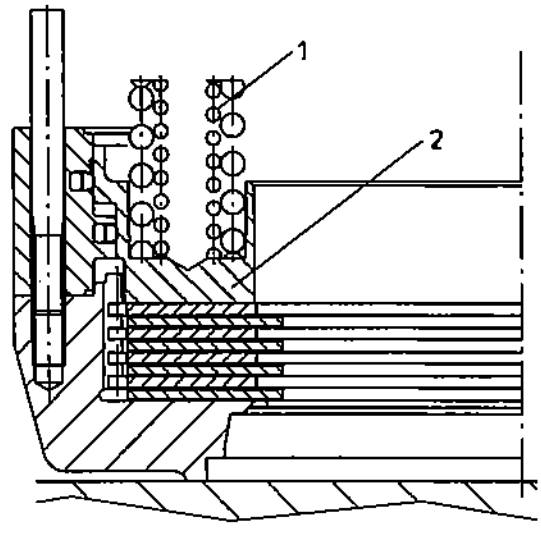
Assembly piston

Check the piston treads for intactness , wet the piston treads with oil . Install the piston (1) into the intermediate piece , take the position of the spring holes and screw holes into consideration .
Hint : The piston must not tilt (danger of seal tread damage !) .



Assembly springs

Place the spring sets (1) in corresponding quantity and in corresponding arrangement into the piston (2) .
Hint : If less spring sets than existing spring holes are assigned , pay attention for symmetrical spring distribution !



	spring arrangement
NLB x340	16 piec. 14 piec. 12 piec. 10 piec. 8 piec. 

TABLE OF CONTENTS

Section II. Definitions

1-3. Standards

Those 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.

Section III. Description and Construction

1-4. Battery

Mine power lead-acid batteries for electric vehicles typically consist of of: (1) a steel tray into which the cells are assembled; (2) a battery terminal connector; and (3) other components necessary to secure and protect the cells and provide the necessary electrical interconnections.

a. 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, such information can be obtained by contacting your nearest BUCYRUS AMERICA, INC. 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.

b. Cell Arrangement - The individual cells, which contain the energy generating components of the battery, may be arranged slightly differently for various types of equipment. The cells of all motive power batteries are, however, always connected in series to produce the required voltage. Cell and battery capacity, which is the available ampere-hours or watt-hours, is a function of the total number and size of plates within each cell. Voltage, though, is the same for all cells regardless of size. Each lead-acid cell yields a nominal 2 volts.

c. Connector Arrangement - Connections between cells are made by intercell connectors which may be lead-coated copper straps or be cast of solid lead. These connections are always welded, in proper sequence, by the application of heat to the terminals of the cells. Energy from the battery is drawn off by terminal cables which extend beyond the steel tray wall and are in turn permanently joined to the battery terminal connector.

1-5. Cell

2-7. Charging Rates

Proper charging means charging the battery sufficiently without overcharging, overheating, or excessive gassing. The charge is usually started at high amperage which is known as the starting rate. Later during the charge, this rate of current flow is reduced to what is called the finishing rate. It is suggested that this finishing rate should not exceed 5 amperes per 100 ampere-hours of rated battery capacity. The starting rate may be as much as four to five times higher than the finishing rate.

Lead-acid batteries should be charged for a sufficient length of time and at a rate which will put back into the battery the same number of ampere-hours removed on discharge, plus approximately 10% additional which is an acceptable, and in fact desirable, overcharge. The specific amount of overcharge depends upon the temperature, age, and history of the battery. In general, it is more harmful to excessively overcharge an older battery, or one which is operating at high temperature, than a new battery or one operating consistently at room temperature. Any charge rate is permissible which does not produce excessive gassing or cell temperatures greater than 110 degrees F.

2-8. Control of Gassing

Gassing is the evolution of gases from one or more of the electrodes during electrolysis. It is a natural phenomenon which takes place when a battery on charge can no longer accept all of the current being applied to it. Gassing is evidenced by bubbling of the electrolyte. The gases liberated are oxygen (evolved at the positive plates) and hydrogen (evolved at the negatives).

The point at which significant gassing begins is determined by voltage, but the amount of gas depends upon the portion of the charging current that is not being absorbed by the battery. Normally, noticeable gassing will begin when the voltage exceeds 2.30 volts per cell. At 2.40 volts per cell, gassing will be normal; at 2.50, it will be rapid. The amperage at which gassing becomes excessive depends primarily upon the state of charge and electrolyte temperatures. As the battery approaches full charge, it is necessary to reduce the charging rate to a point at which excessive gassing is prevented. This safe rate is the finishing rate or below. When proper charging equipment is used, the tapering of the charging current to the finishing rate is achieved automatically.

2-9. Charging Methods and Equipment

The modern storage battery, used with a properly designed, modern, automatic charger, needs only normal water additions, occasional cleaning, and regular checking of both charger adjustment and battery condition to provide long, dependable service.

There are two recommended methods for the normal charging of motive power batteries:

a. **Modified Constant Voltage (potential) Method -** The modified constant voltage method, in which the tapering of the charging rate is accomplished gradually, requires a source of direct current with a constant bus voltage of approximately 2.63 volts for each cell. This is for an 8-hour charge. Proper series resistance in the output circuit inherently provides the correct starting rate and assures that the rate will automatically be reduced, as the charge progresses, to the recommended finish rate. The constant voltage source may be either a motor-driven generator or rectifier.

b. **Taper Method -** The taper method can be used with either generator or rectifier type equipment. The charger is designed to provide the correct charge rate during a constantly tapering charge. This is accomplished by coordinating the rising battery voltage with the design characteristics of the charger. The shape of the current-taper curve will vary with different types of equipment, but the result is essentially the same. Solid state chargers are available which deliver as much current as the battery can accept, up to maximum charger output, and then taper the input sharply, when cells begin to gas, to keep finish rates low. These chargers do not require adjustment.

TABLE 5 (Continued)		
STORAGE BATTERY TROUBLESHOOTING CHART		
SYMPTOMS	**PROBABLE CAUSE**	**POSSIBLE REMEDY**
BATTERY NOT COMPLETING FULL WORK SHIFT	1. Battery not fully charged before placed into operation.	1. See that battery has reached full charge specific gravity before placing into operation.
	2. Weak, leaking, or defective cell(s) in battery.	2. Repair or replace cell(s) or battery.
	3. Grounds or shorts in the battery.	3. Remove grounds or shorts.
	4. Battery worn out and beyond economical repair.	4. Replace battery with equal or higher capacity battery.
	5. Battery too small for job.	5. a. Replace battery with one having higher capacity. b. Purchase extra batteries (with higher capacity if possible) and change them more frequently.
	6. Electrical or mechanical problem.	6. Troubleshoot vehicle and repair.
LOW ELECTROLYTE	1. Cracked or broken jar(s).	1. Replace jar(s) and adjust gravity.
	2. Cell missed when watered.	2. More careful attention when watering.
	3. Defective or weak cell(s).	3. Repair or replace cell(s)
	4. Frequent overcharge.	4. See items 1 and 2 in “Battery Overheats During Charge.”
	5. Battery not regularly watered.	5. Water battery regularly.

CHAPTER 5 – STORAGE AND SHIPMEMT

5-1. General

Follow these guidelines for those occasions when batteries must be stored, in either a wet or dry state, and for possible reshipment to other areas.

5-2. Storage Methods

a. 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 degrees F. or higher, the specific gravity of the electrolyte should be checked at least monthly. If below 80 degrees F., check gravities at least every two months. Whenever the specific gravity, corrected to 80 degrees F., falls to 1.240 or below, the battery should be given a freshening charge as described in Paragraph 2-10d. A freshening charge is also recommended just before returning a battery to service.

b. 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 degrees 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. Charged and dry batteries when removed from storage should be activated as described in Paragraph 2-4a.

5-3. Shipment

a. Charged and Wet Batteries - Depots or using organizations may make shipments of motive power batteries in a charged and wet condition if intended for use within a period of 90 days. The battery service weight is usually stamped into the steel tray near one of the lifting holes.

Before crating a wet battery for shipment, it should be given a freshening charge as described in Paragraph 2-10d. A tag should be attached to both the battery and the crate showing the date of the last charge and the specific gravity of the electrolyte at the completion of the charge. Make certain that the battery is properly protected when crated. The receiving organization should be alerted also to the need for a freshening charge before the battery is put into service.

b. Charged and Dry Batteries - Depots will normally make domestic and export shipments of new batteries which usually will be in a charged and dry condition. Batteries, and the accompanying electrolyte in separate carboys, which are intended for export shipment must be packaged in accordance with approved methods.

WHENEVER BATTERIES ARE SHIPPED BY COMMON CARRIER, ICC REGULATIONS WILL APPLY.

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 ATTACHED STATEMENT COULD RESULT IN A SERIOUS INJURY OR FATALITY.*

INTRODUCTION

The Bucyrus America, Inc.. Model LA Series Charger can be one of the most useful and safe machines found underground today, IF IT IS OPERATED CORRECTLY BY A PROPERLY TRAINED OPERATOR. Before operating the Model LA SERIES Charger, study the drawings to become familiar with the controls and read the description of each control.

General

The Model LA SERIES Mine Battery Charger combines reliable, rugged components with unmatched circuit simplicity. The ferroresonant design of the Model LA Series Charger eliminates the need for complicated control circuits and lowers the parts count.

Three major components make up the circuit of the LA Series; a ferroresonant step down transformer; silicon rectifiers, and timer.

The magnetics are designed with an extra margin of capacity and have a Class H (180 degrees C) rating. Cores and windings are insulated with Class H Nomex material. The DuPont Nomex system uses a modified polyester baking varnish for further protection. This assures continued operation under the most severe, damp and dirty conditions present in the mine. The full wave rectifier includes conservatively rated silicon diodes and surge suppressors to provide a reliable d.c. output.

The Model LA Series regulates the d.c. output voltage to produce the proper charging curves for the battery. Its charge rate is dependent on the state of charge of your battery. A.C. line voltage compensation prevents any drift from the d.c. charging curve because of surges or drops in voltage. Basic design eliminates the need for voltage sensitive relays.

The Model LA Series automatically limits the output of the charger to approximately 125% of its rating. This prevents battery overheating, fuse blowing and assures long life for both battery and charger.

The Model LA Series is a completely automatic constant voltage charger. Each LA Series is designed to operate on a specific type of battery with a specified number of cells.

TROUBLESHOOTING

Troubleshooting should be performed only by trained service personnel or experienced electricians.

HAZARDOUS A.C. AND D.C. VOLTAGES ARE PRESENT WITHIN THE RECTIFIER CABINET.

Equipment: The only equipment required is a multimeter (volt-ohm meter).

General Inspection

On servicing new equipment, before setting up any complicated testing or jumping to any conclusions, give the unit a general inspection. Check the following:

1. Check d.c. output cables, connections, battery type, and number of battery cells with rectifier rating.
2. Check unit specifications with customer order.
3. Check input connections, input voltage and a.c. line breaker size.
4. Check for shipping damage, loose connections, broken wires, etc.
5. Certain failures can be caused by defective batteries and customer loads; make sure batteries and loads are free from defects.
6. Check all safety switches.

IF THE PROBLEM IS FOUND TO BE LOCATED IN THE PRINTED CIRCUIT BOARDS, THE BOARD SHOULD BE REPLACED. NO ATTEMPT SHOULD BE MADE TO REPAIR CIRCUIT BOARDS IN THE FIELD.

Service Information

Information you should have when calling in for troubleshooting assistance:

1. Equipment model number and serial number.
2. The actual a.c. input voltage.
3. The d.c. output voltage with and without the battery.
4. Result of the check of a.c. input fuse and d.c. output fuse.
5. The actual d.c. output current and voltage when measured with battery connected to rectifier.

491868X10 LA-10 Battery Charger 480/575 Volt, 60 HZ

REFERENCE	QUANTITY	PART NUMBER	DESCRIPTION
1	2	491868X560	HEATSINK MTG. BRKT. (TOP LEFT)
2	2	491868X541	HEATSINK MTG. BRKT. (TOP RIGHT)
3	2	491868X559	HEATSINK MTG. BRKT. (BOTTOM)
4	1	491868X503	GLAND PLATE
5	1	491868X504	WIRE HARNESS, TIMER BOARD
6	1	491868X505	CONTROL TRANSFORMER (CT)
7	1	491868X506	AUTOMATIC TIMER BOARD
*8	6	491868X507	SPACER, 0.25-30 X 0.875 HEX
*9	1	491868X508	POS. DC OUTPUT TERM. (BLK)
10	3	491868X509	CAPACITOR, 660 VOLT - 25MFD (C1)
11	12	491868X510	CAPACITOR BRACKET, 5.75” HIGH
12	1	491868X511	SECONDARY FUSE BLOCK
*13	1	491868X512	TERMINATION BASE COMPONENT
*14	4	491868X513	THREADED INSULATOR
15	3	491868X568	POWER TRANSFORMER ASSY. LA10 (PT)
*16	4	491868X515	SURGE PROTECTOR ASSY. (SP)
17	1	491868X563	HEATSINK PLATE, 25 X 8 X 1/8
18	3	491868X564	EXTRUDED ALUM HEATSINK
19	1	491868X518	FUSE BLOCK, THREE POLE (AC)
20	1	491868X519	FUSE (C), 3 AMP - 600V (CTF)
21	3	491868X569	FUSE (B), 70 AMP - 600V (ACF)
22	3	491868X570	FUSE (AT), 130 AMP - 130V (DCF)
23	3	491868X566	CAPACITOR BRKT., 1.91 X 2.91
*24	1	491868X523	ACF BLACK MOUNT BRKT. 26F - AG
25	3	491868X524	CAPACITOR, 660V - 30MFD (C3)
26	3	491868X567	CAPACITOR, 660V - 6MFD (C2)
*27	1	491868X571	AMMETER SHUNT, 250 AMP - 100MV (S)
28	1	491868X572	DC AMMETER, 0 - 250 AMP (A)
29	6	491868X528	SILICONE DIODE, 150 AMP - 1KV (SD)
*30	1	491868X529	CONTACTOR, 3P - 115VAC (AK)
31	1	491868X530	COPPER BUSS, (DC FUSE BLOCK)
*32	1	491868X531	CONTACTOR COIL
33	1	491868X532	CHARGER BASE
34	1	491868X533	CHARGER DOOR LEFT
35	1	491868X534	CHARGER DOOR RIGHT
*36	1	491868X535	PLEXIGLASS
37	1	491868X536	DISPLAY GUARD
38	1	491868X537	GUARD BRACKET
39	1	491868X538	TOP COVER
40	1	491868X562	WIRING HARNESS

* INDICATES PARTS NOT SHOWN.

WIRING DIAGRAM 491736

NOTE: SEE FORM NO. E-004 FOR ASSEMBLY DRAWING.

FIGURE 3C – BATTERY CHARGER ASSEMBLY (FORM NO. E-004)

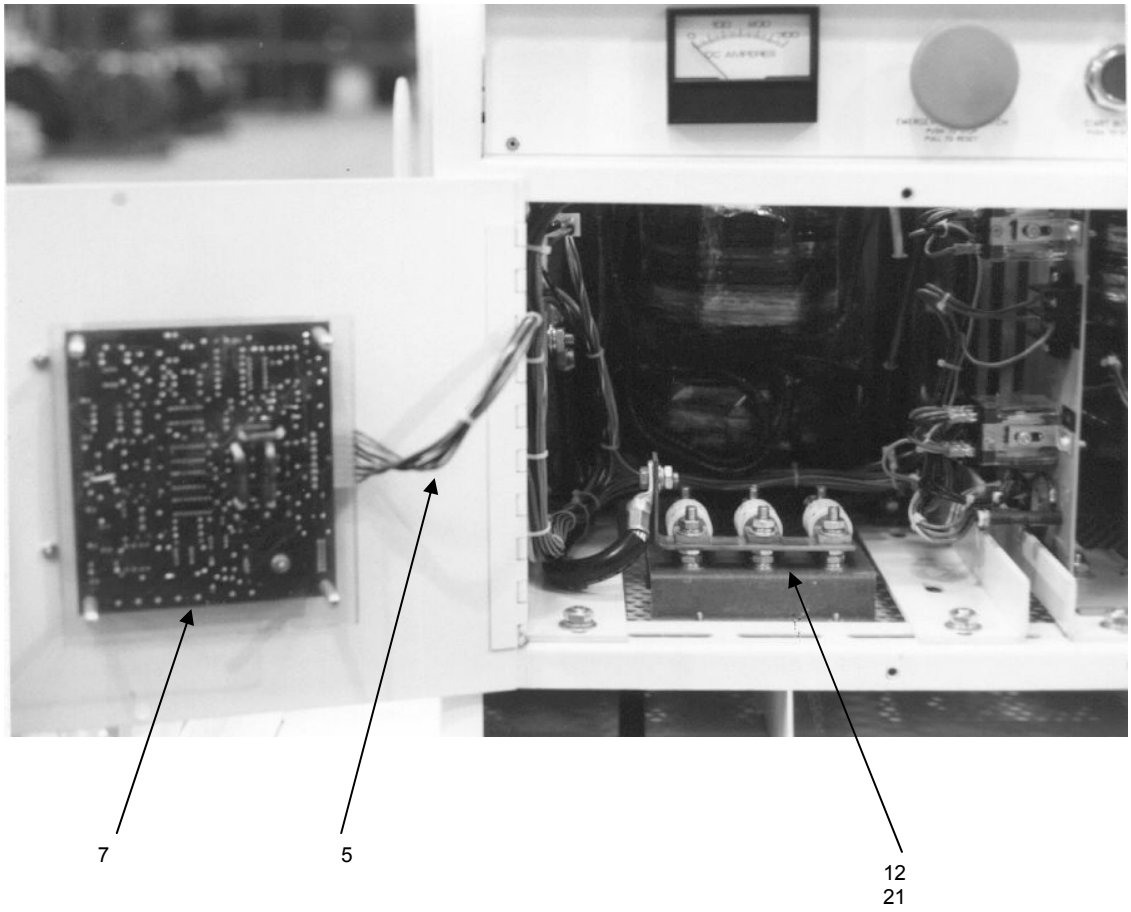
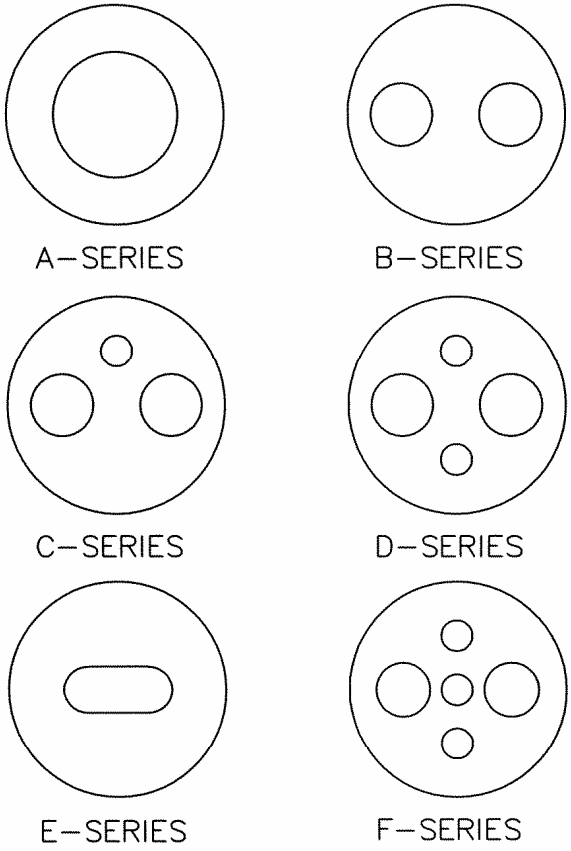


FIGURE 8B – 5-POLE BRASS RECEPTACLE ASSEMBLY (A14161 Sheet 2 of 2)

REF	PART NUMBER	DESCRIPTION	QTY
1	A14161	BRASS RECEPTACLE ASSEMBLY	1
2	A14161-1	BRASS RECEPTACLE HOUSING	1
3	A14161-2	BRASS CAP	1
4	A14161-3	INSULATOR (INCLUDES TIPS)	1
	A14161-4	INSULATOR (WITHOUT TIPS)	1
5	A14161-5	REPLACEMENT POWER TIP SET (2/0-4/0)	1
6	A14161-6	REPLACEMENT GROUND TIP	1
7	A14161-7	REPLACEMENT CONTROL TIP SET	1
8	A14163X2	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.80)(0.80)(0.62)(0.37)	1
	A14163X2A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.80)(0.80)(0.62)(0.37)	
	A14163X3	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.65)(0.65)(0.62)(0.37)	
	A14163X3A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.65)(0.65)(0.62)(0.37)	
	A14163X4	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (1.24 X 0.75 FLAT)	
	A14163X4A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (1.24 X 0.75 FLAT)	
	A14163X5	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (1.56)	
	A14163X5A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (1.56)	
	A14163X6	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.65)(0.65)(0.53)(0.597)	
	A14163X6A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.65)(0.65)(0.53)(0.597)	
	A14163X7	BRASS PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET I.D. (0.66)(0.66)(0.495)	
	A14163X7A	ALUM. PACKING GLAND ASSY. (WITHOUT HOSE TUBE) WITH GROMMET (0.66)(0.66)(0.495)	
9		PACKING GLAND GROMMETS (SEE FORM 2-288)	
10	A14161-8	ADAPTER	1
11	A14161-9	GLAND WITHOUT HOSE TUBE	1

FIGURE 18 – PACKING GROMMETS (A15058 Sheet 1 of 2)



DBT AMERICA INC. PART NO.	GROMMET SIZE				
	HOLE 1	HOLE 2	HOLE 3	HOLE 4	HOLE 5
A15058–A–1	1.230	–	–	–	–
A15058–A–2	1.450	–	–	–	–
A15058–A–3	1.570	–	–	–	–
A15058–A–4	1.720	–	–	–	–
A15058–A–5	1.060	–	–	–	–
A15058–A–6	1.000	–	–	–	–
A15058–A–7	0.930	–	–	–	–
A15058–A–8	1.800	–	–	–	–
A15058–A–9	1.750	–	–	–	–
A15058–A–10	1.668	–	–	–	–
A15058–A–11	2.590	FOR AUSTRALIA CONNECTORS ONLY			–
A15058–A–12	1.350	–	–	–	–
A15058–A–13	2.025	FOR AUSTRALIA CONNECTORS ONLY			–
A15058–A–14	0.740	–	–	–	–

SAFETY PRECAUTIONS AND GUIDELINES

Overview

Before you test, troubleshoot, service or in any other way, use this unit -

READ and **STUDY** this guide. **KNOW** what you must do for safe maintenance.

ALWAYS wear or use the proper safety items required for your personal protection.

If you have ANY QUESTIONS about the safe use or maintenance of this unit:
ASK YOUR SUPERVISOR - NEVER GUESS - ALWAYS CHECK

Maintenance

AVOID, whenever possible, servicing, cleaning or examining the unit in congested areas.

AVOID, whenever possible, servicing or providing maintenance to the unit unless the wheels are adequately choked. If the drive motor (s) is to be run, the unit must be jacked clear of the ground and all four (4) wheels must be free to turn.

DO NOT alter the electrical settings from that indicated in this guide or as set at the factory.

ALWAYS replace damaged or lost decals or metal instruction plates. Refer to the Parts Manual for the proper location and part number of decals and plates.

DISCONNECT the battery when working with electrical systems, or when welding on the unit to prevent electrical shock.

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

Some photographs and illustrations in this guide may show guards or covers removed for purposes of clarity. Never operate unit without all guards and covers in place.

NOTICE

SOME PHOTOGRAPHS OR ILLUSTRATIONS IN THIS GUIDE MAY SHOW PROTOTYPE UNITS OR UNITS WITH OPTIONAL EQUIPMENT INSTALLED THAT MAY OR MAY NOT BE ON YOUR PARTICULAR MACHINE. PRODUCTION MODELS MAY VARY IN SOME DETAIL. OPTIONAL EQUIPMENT MAY BE PURCHASED FROM BUCYRUS AMERICA, INC.

CONTINUING IMPROVEMENT AND ADVANCEMENT OF PRODUCT DESIGN MAY CAUSE CHANGES TO YOUR MACHINE WHICH MAY NOT BE INCLUDED IN THIS PUBLICATION. EACH PUBLICATION IS REVIEWED AND REVISED, AS REQUIRED, TO UPDATE AND INCLUDE THE CHANGES IN LATER ADDITIONS. BUCYRUS AMERICA, INC. RESERVES THE RIGHT TO MODIFY OR MAKE CHANGES WITHIN A SPECIFIC MODEL GROUP WITHOUT NOTICE AND WITHOUT INCURRING ANY LIABILITY TO RETROFIT UNITS PREVIOUSLY SHIPPED FROM THE FACTORY. CONTACT YOUR BUCYRUS DEALER FOR MAINTENANCE THAT IS NOT COVERED IN THIS PUBLICATION.

Fault Message Chart

DASHBOARD DISPLAY	CALIBRATOR DISPLAY	DESCRIPTION
“Rotating Disp.”	“OK”	No fault
“Testing”	“Testing”	Only visible when power-up diagnostics is running. Check connections if not clearing.
“System OK”	“System Okay”	Power-up check completed, waiting to closure of Circuit Breaker
“Over Temp.”	“Thermal Cutback”	Controller in thermal cut-back.
“Brkr Open”	“Breaker Open”	Circuit breaker failed to close. Faulty Circuit breaker, UVR, CB Auxiliary or faulty logic board.
“Brkr Weld”	“Breaker Weld”	Circuit breaker welded close. Faulty CB auxiliary switch or faulty logic will give this fault also.
“UVR Coil”	“UVR Coil”	UVR coil driver over-current sensed.
“Cap Fault”	“Capacitor Fault”	Caps failed to charge after power-up.
“Accel Flt.”	“Accel Flt.”	Accelerator fault sensed. Faulty accelerator (accelerator voltage 4.0v; accelerator voltage below 1.2v in NEUTRAL). Faulty FS1 or logic board.
“Seq. Fault”	“Sequence Fault”	FS1 closed at power-up. Possible circuit breaker auxiliary switch not closing
“2 Dir Fault”	“2 Dir Fault”	Both directional switches active.
“Tram Fault”	“Tram Fault”	Motor current imbalance sensed.
“Bat Low”	“Bat Low”	Battery fell below personality level.
“CRC Error”	“CRC Error”	During power-up a personality CRC error occurred. Try adjusting one of the passwords (1 or 2) then power recycle. If not cleared replace logic board.
“IGBT s/c”	“IGBT s/c”	An IGBT short has been detected – SM.
“IGBT s/c”	“IGBT s/c”	A left or right IGBT short has been detected – DM.
“Brake on”	“Brake on”	The vehicle BRAKES are on while there is a direction and demand selected.
“Cur Xducer”	“Cur Xducer Flt”	The controller reads current when it is first powered-up or does not read any current when demand for drive over 50%.
“Bad Logic”	“Bad Logic”	An internal errors has occurred in the software state machine. Faulty logic board.
“Bad Logic”	“Bad Logic”	Invalid status state encountered (internal error). Faulty logic board.
		*** * * * POWER UP TEST STATUS * * * ***
“Cap Fault”	“Cap Fault”	Caps failed to change after power-up.
“PTA Short”	“P. Up PTA Short”	Single motor Block 0 point “A” short Motor short to ground or IGBT shorted Other electrical component (coil/etc.) shorted or grounded not allowing voltage to come up to or above 64VDC on IGBT panel.
“RPTA Short”	“P. Up R. PTA Short”	Dual motor Block 0 point “A” short Motor shorted to ground or RIGHT IGBT shorted Other electrical component (coil/etc.) shorted or grounded not allowing voltage to come up to or above 64VDC on IGBT panel.

TROUBLESHOOTING

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

1. Volt/Ohm Meter with Leads

2. Insulated Basic Hand Tools

WHEN WORKING INSIDE THE CONTROLLER, USE INSULATED GLOVES AND TOOLS WHERE POSSIBLE.

ALL CONNECTIONS MUST BE TIGHT AND CARE MUST BE TAKEN TO PREVENT BOLTS, NUTS, WASHERS AND OTHER SMALL METAL FASTENERS FROM BEING DROPPED OR LOST INSIDE THE CONTROLLER.

BEFORE STARTING ANY POWER-RELATED PERFORMANCE TESTS, THE MACHINE MUST BE JACKED AND SECURELY BLOCKED CLEAR OF THE GROUND WITH ALL FOUR (4) WHEELS FREE TO TURN.

REFER TO THE PARTS MANUAL FOR YOUR PARTICULAR MACHINE WIRING DIAGRAMS AND SCHEMATICS.

THE LOGIC UNIT CONTAINS NO USER-SERVICEABLE PARTS. OPENING THIS SEALED DEVICE WILL VOID THE WARRANTY.