A6474X230
February 2012

Operation Manual

Battery Charger with Digital Display
Models 5, 6, 8, 10, 12, 14 and 16

2 Your safety

Storage and transport

Maintain the prescribed storage periods and observe the instructions for storage.

Do not store materials or parts in the travel way or in your working area.

Inform the persons involved about the intended transport route and the anticipated duration of the transport.

transport safety device

Ensure that the transport safety devices are correctly fitted.

Fix all moving parts with transport locks.

Never stand under unsupported parts or suspended loads.

means of attachment

Connect the lifting equipment only to the points of attachment provided for that purpose. Observe the different load limits of the attachment points. Also observe the instructions on the transport sheet.

Only use means of attachment which are in good condition and have been designed for the loads to be handled.

For round components use transport straps, only. Never use chains or steel cables for this purpose.

mobile handling equipment

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

Pre-start inspection

operation

Read this entire guide before attempting to operate this unit.

inspection

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

maintenance

Verify that all maintenance has been performed.

instruction and safety tags

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

operating area

Clean any foreign material from the work area.

4 Installation

Electrical Connections and Field Wiring

AC input

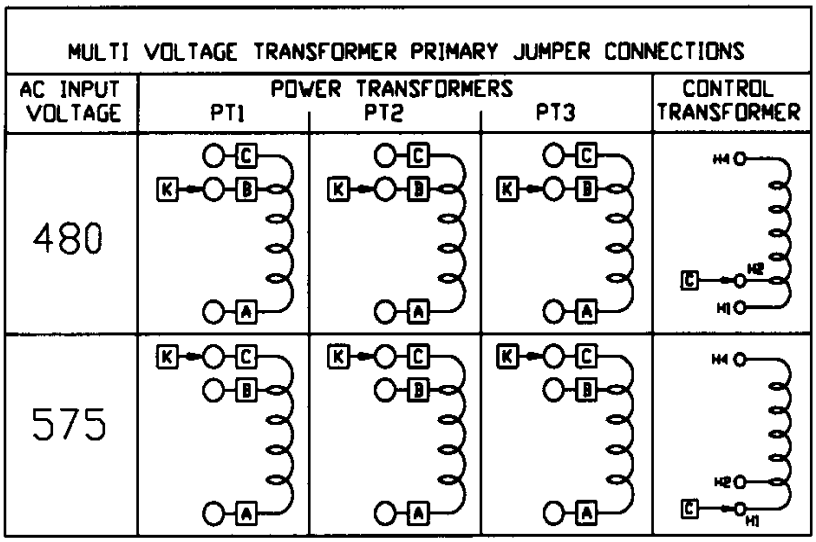
Make sure that the input source is the same voltage and frequency as that which is marked on the nameplate of the rectifier.

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

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

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

Fig. 2: Transformer tap connections (standard)



DC output

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

Polarity

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

Adjustments

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

Circuit operation

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

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

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

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

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

Ground and short circuit test

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

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

Troubleshooting and replacing power silicon diodes

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

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

7 For your information

About this manual

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

Before starting to work

applicable operating manual

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

machine type

This operation and troubleshooting manual is intended for the BUC2000 Dual and Single Motor Controller and is only permitted to be used for equipment of this type.

new operation manual

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

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

Who is this manual intended for?

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

This includes persons who:

- perform assembly / disassembly work
- operate the machine
- eliminate faults
- perform daily routine work on the face or in the entry
- perform maintenance work
- perform repair work

supervisory personnel who:

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

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

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

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

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

BUC2000 Motor Controller consist of:

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

BUC2000 motor IGBT panel (power connections)

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

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

Motor current imbalance feature (dual motor only)

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

Wire off detect

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

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

Fail-safe operation

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

Connecting for Operation

1. Turn the machine “OFF”.
2. Turn the main circuit breaker to the “OFF” position to
3. deenergize power on machine.
4. Remove the main controller cover.
5. Connect the hand held diagnostics/calibrator unit to the CAN.
6. Communication Input Port of the logic card.
7. Turn the main circuit breaker to the “ON” position.
8. Leave the “Park Brake Set”.

The hand held diagnostics/calibrator unit is now operational.

Operation

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

Personality Adjustment Procedure

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

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

Fig. 20: Dual motor panel harness assembly

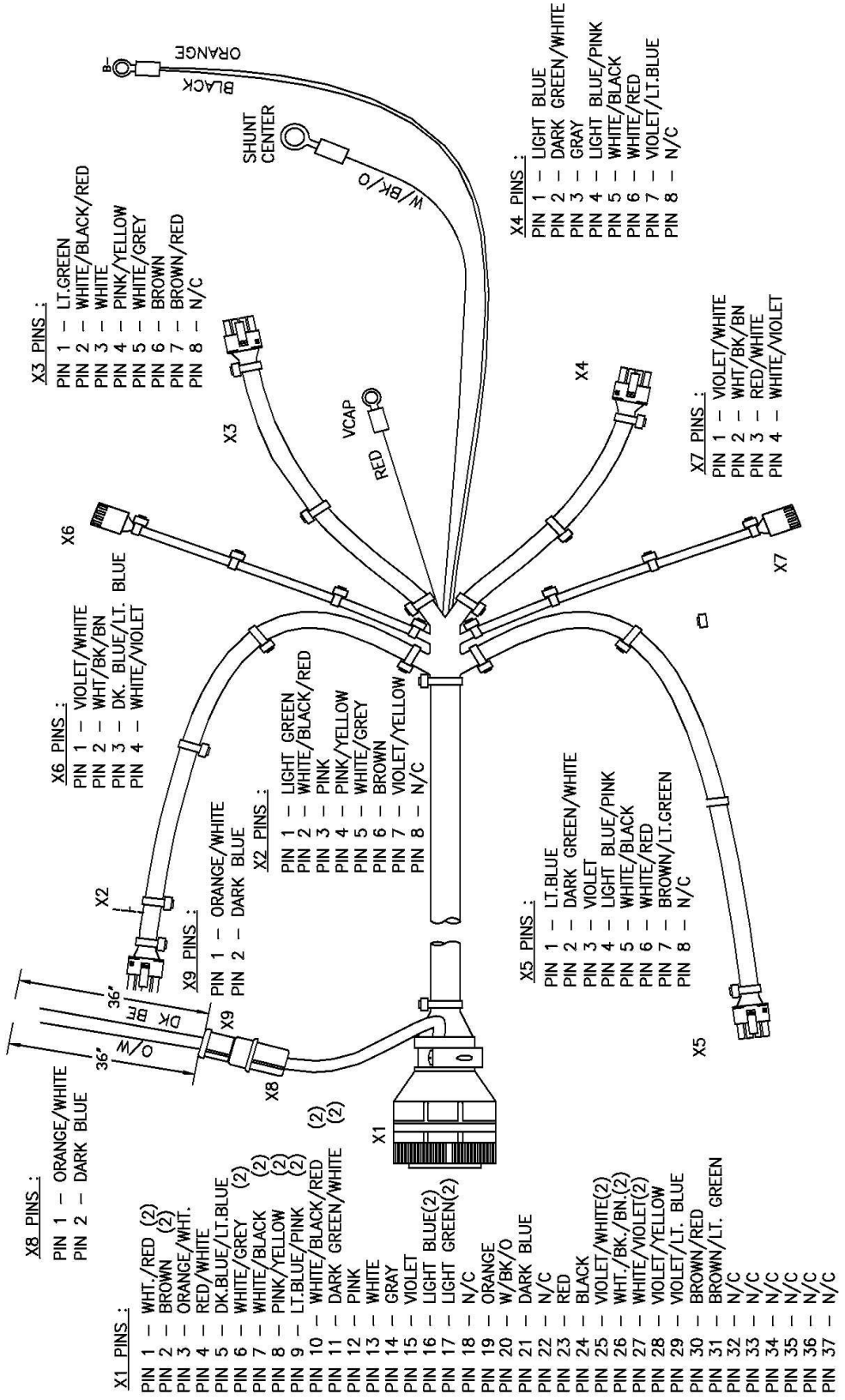
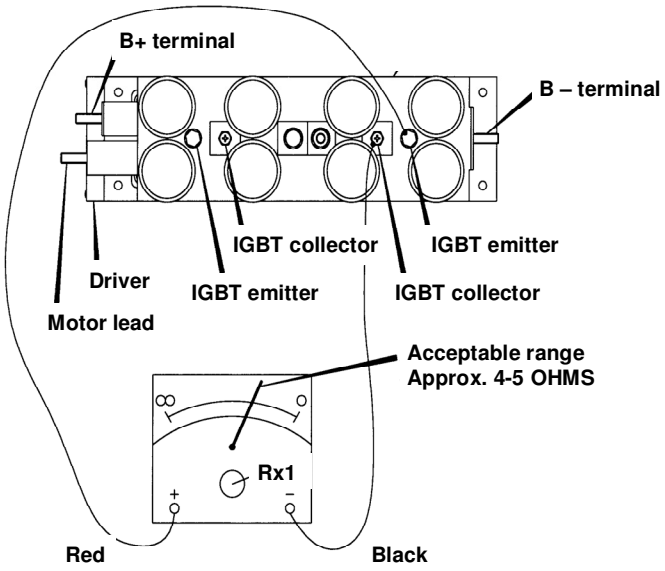


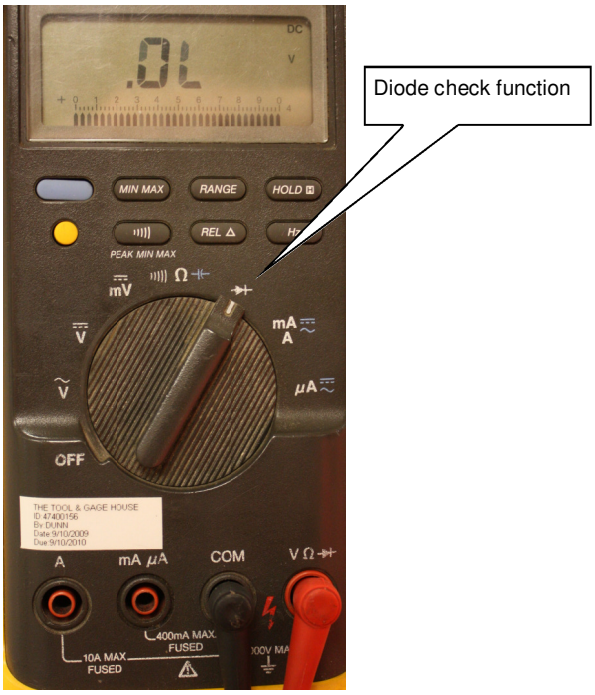
Fig. 28: IGBT measurements



Analog Volt - Ohm - Meter

Analog Volt-Ohm Meter (use RX1 scale)

Acceptable range: Approx. 4 - 5 ohms



Digital multimeter with diode check function

Digital multimeter (use Diode check function)

Acceptable range: Approx. 0.30 - 0.35 Volts

Tightening torques

NOTICE!
Due to the application of fasteners being subject to great stresses and heavy or extreme vibration, it is imperative that all bolts be applied with the correct torque. The tightening torques stated in the spare parts lists have to be observed, as well, for installation and maintenance.

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

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

6. Technical data

7. For your information

Your safety

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

state of the art

The machine has been manufactured in accordance with the state of the art and generally recognized safety standards and regulations. You and others can nevertheless be exposed to dangerous situations as a result of environmental influences, machine damage, or operator errors.

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

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

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

Observe the safety and accident prevention regulations

- of the mine,
- of the mines inspector, and
- of the mining supervisory authorities

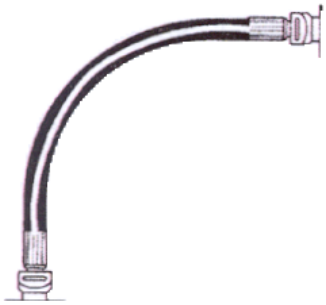
further operating manuals

Please read also the operating manuals of the components required for operation, e.g. of gearboxes, electric motors, etc., carefully and thoroughly. Clarify any questions **before** starting work.

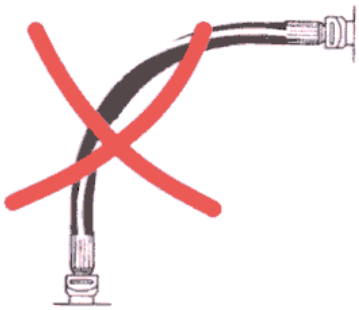
- are not twisted.

Fig. 2: Laying hydraulic hoses, twisting

Right



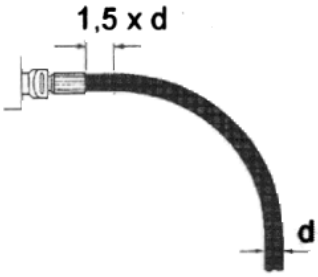
Wrong



- are not bent directly behind the connections. (distance min. 1.5 x nominal diameter).

Fig. 3: Laying hydraulic hoses, bending

Right

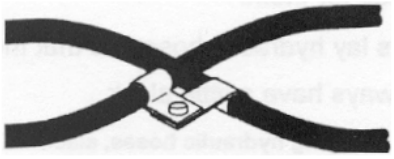


Wrong

- always have a little slack.

Fig. 4: Laying hydraulic hoses, crossing

Right



Wrong

WARNING!
Do not disconnect any hoses in the brake system until all pressure has been relieved and the “accumulator” gauge indicates "0” bar.

WARNING!
Failure to follow applicable guidelines described in Chapter 2, "Your Safety" before performing maintenance or service on this machine could result in severe personal injury or potential death.

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! These fluids and greases have been tested 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!
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.

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 service engineers or by specially trained personnel.

Which tools are required for installation?

tool box

No special tools are required to put the machine 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:

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

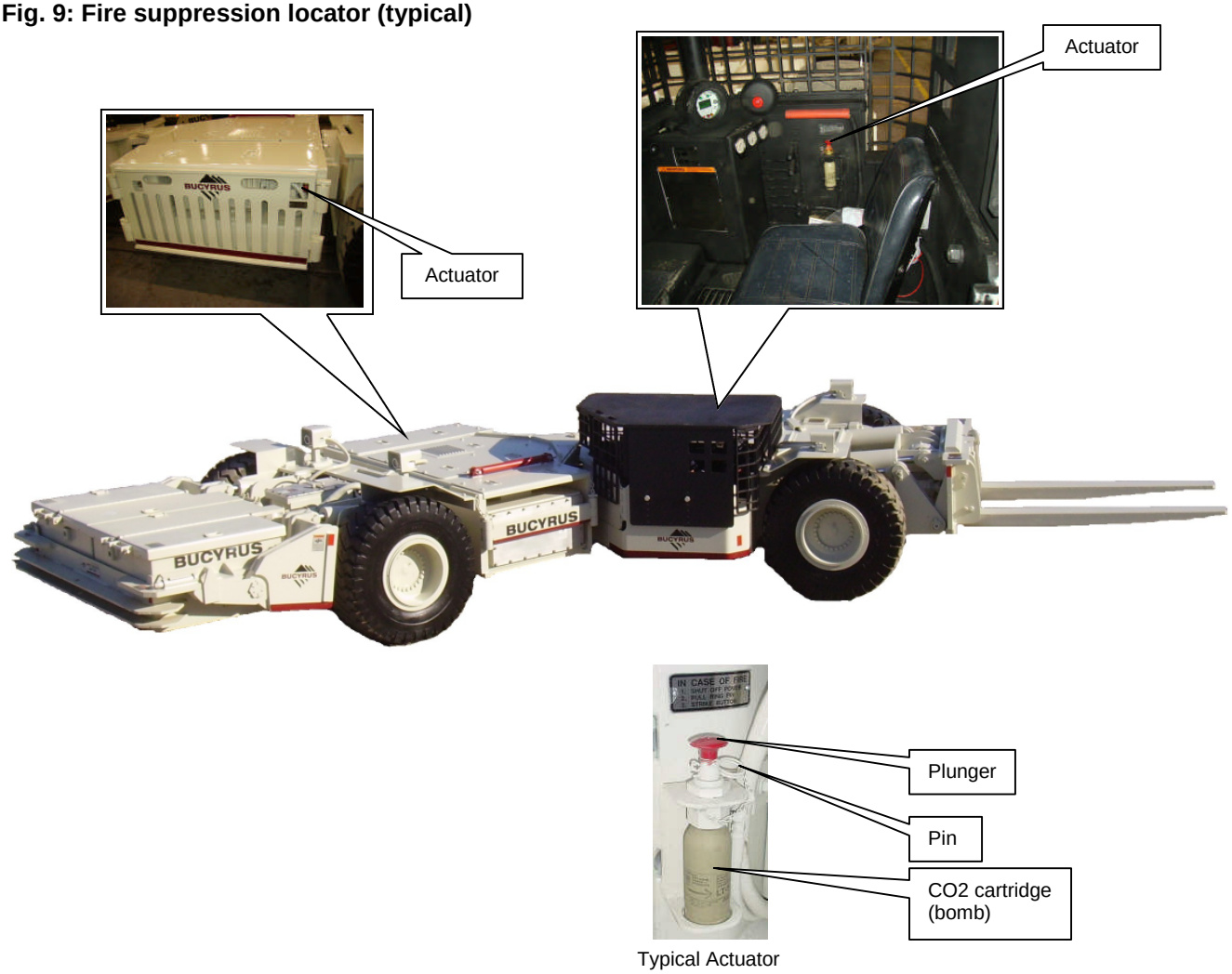
WARNING!
Before operating any levers or pedals on the machine always make sure no one is in the hazard zone (see Hazard zone in this chapter). Do not operate any levers or pedals from outside the operator's compartment.

fire suppression actuators

The machine is equipped with two (2) fire suppression (remote) actuators (Fig. 9). One is located to the operator's right inside the operator's compartment and the other is located on the middle frame next to the hydraulic oil tank opposite the operator. 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 actuator are actuated, the system must be completely recharged with dry chemicals and expellants.

Fig. 9: Fire suppression locator (typical)



Typical Actuator

gauge panel

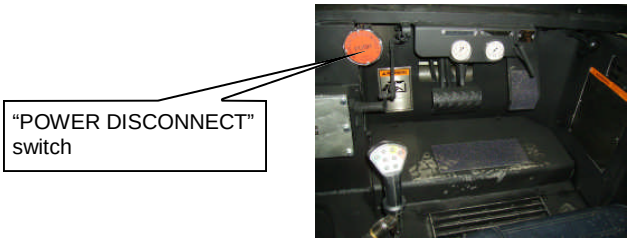
The gauge panel (Fig. 18) is located directly in front of the operator. It has two gauges on it: “DIF-LOK PRESSURE” (traction assist pressure) and “BRAKE PRESSURE”. During operation, the “DIF-LOK PRESSURE” reading should be a maximum of 150 psi (10 bar) and the “BRAKE PRESSURE” reading should be 1,850 ± 50 psi (128 ± 3 bar).

Fig. 18: Gauge panel location

“POWER DISCONNECT”

The “POWER DISCONNECT” switch (Fig. 19) is located in front and to the left of the operator. Push the button in to open the disconnect switch and trip the circuit breaker, shutting down the machine. Pull the switch out to close the disconnect switch and reset the circuit breaker.

Fig. 19: “POWER DISCONNECT” switch



speed monitor display (optional)

The speed monitor display (optional) displays the motor speed in percentage of maximum tram motor speed: 20% green LED, 40% green LED, 60% green LED, 80% green LED, 95% red LED, and 100% large red LED. Once the 100% LED is displayed, the tram motor has reached its maximum rated speed and the motor overspeed protection circuit is activated. This results in the energizing of the motor protection solenoid which will signal other controls to automatically apply the brakes of the machine and de-energizes the tram motor until the motor speed slows below the 90% level.

Unloading from the side of the shield

☞ Lower the lift attachment until the shield touches the surface or the chocks.

☞ Back the machine away from the shield until the lift attachment is completely clear of the shield.

NOTICE!
If the shield is not being placed on blocks, it may be necessary to lower the lift attachment slightly below grade before the shield will begin to slide away from it.

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	1 1/4” nut			1480 - 1500
Tire-Wheel mounting nuts				217
Oscillating bearing	1 1/4” X 7 1/2”	8		1340 - 1360
Drive motor-to-gear case mounting bolts	3/4” X 2 3/4”	8		280 - 320
Axle mounting bolts	7/8” X 9”	8		455
Center section retaining nuts				680 - 720

Lubricants, fluids and capacities

Table 2: Lubricants, fluids and capacities

Location	Specification	Approximate capacity	Notes
Hydraulic oil tank	Spec. 100-12	50 gallons	1
Gear box (reducer)	Spec. 100-6	2.75 qts. (2.6 liters) or as required	
Lubrication points	Spec. 100-3	As Required	3
Winch	API GL4 (140) Gear oil Peragma Grade 8	5 pints	
Axle housing	Spec. 100-6	As required	2
Planetary wheel ends	Spec. 100-6	As required	2
Wet disc brakes (SROIB)	SROIB cooling oil	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.

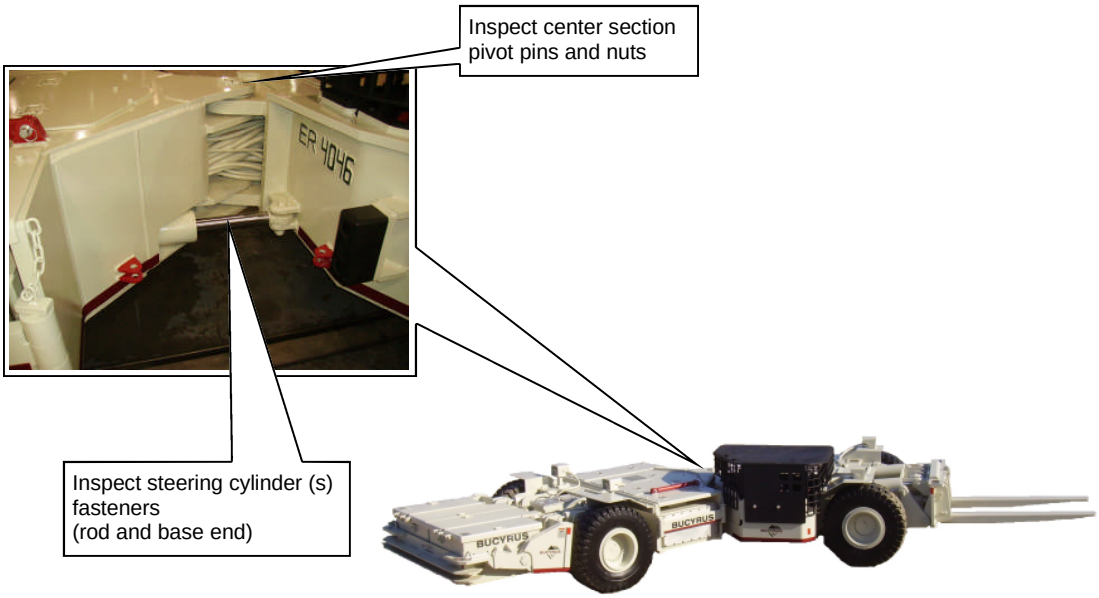
   When filling the axle housing and planetary wheel ends, allow enough time for the lubricant to fill the various cavities and around component parts in each assembly. Continue adding oil into each assembly until the required oil level is reached.
3. Pump grease into fitting until old grease can be observed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

Weekly

center section pins and nuts — Inspect the center section pins and nuts for looseness or wear (Fig. 46). Tighten (680 - 720 ft. lbs.) where necessary and replace any worn parts.

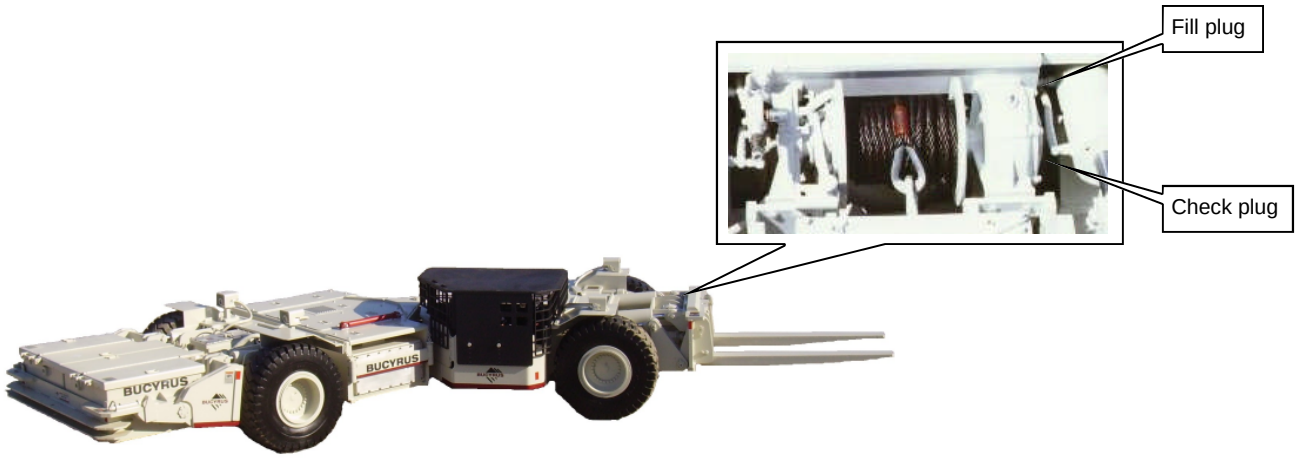
steering cylinder pins and nuts — Inspect the steering cylinder pins and nuts for looseness or wear (Fig. 46). Tighten (1480 - 1500 ft. lbs.) where necessary and replace any worn parts.

Fig. 46: Center section and steering cylinder pins and nuts



winch oil level — Check the oil level in the winch (Fig. 47). Clean dirt and debris from around the check plug and remove plug. Oil level should be kept at the level of the of the plug. If oil is required, add oil (SAE 140) through the fill plug hole until oil begins to flow from the check plug hole and re-place plug. Do not overfill the winch. (Refer to the winch operation and maintenance manual included in your parts manual)

Fig. 47: Winch oil level

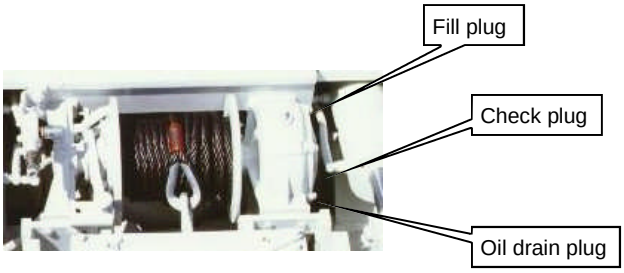


winch oil

Change oil in the winch (Fig. 59). (Refer to the winch operation and maintenance manual included in your parts manual)

- ☞ Park the machine on solid level ground, clean dirt and debris from around the drain plug.
- ☞ Remove drain plug and allow oil to completely drain from the winch.
- ☞ Clean and reinstall drain plug.
- ☞ Clean dirt and debris from around the check plug and remove plug.
- ☞ Clean dirt and debris from around the fill plug.
- ☞ Add oil (API GL4 (140) Gear oil Peragma Grade 8) through the fill hole slowly, just until it starts to flow out of the check plug hole. Allow sufficient time for the oil to travel throughout the winch when filling.
- ☞ Clean and reinstall fill and check plug.

Fig. 59: Winch oil change



Axle removal/installation

To remove either axle from the machine (reference Fig. 65):

axle removal

☞ Park the machine on level ground.

☞ Properly crib the machine using standard mine practices and following all applicable mine safety rules.

WARNING!
Make sure the machine is properly cribbed before removing the axle. Serious injury or death can occur from falling loads.

☞ Disconnect the power to the machine by turning the circuit breaker reset switch to the “OFF” or “RESET” position and disconnect power from the battery.

WARNING!
Before performing maintenance on the machine, the circuit breaker reset switch must be in the “OFF” or “RESET” position and the power should be disconnected from the battery. Electrical shock or accidental machine movement can cause serious injury or death.

☞ Test the controls to ensure that the unit will not move.

WARNING!
Do not test any control unless you are sure that everyone is completely clear of all machine movement. Accidental machine movement can cause serious injury or death.

☞ Remove wheels from each end of the axle by removing the wheel mounting nuts.

☞ Disconnect, tag, and cap the service brake lines.

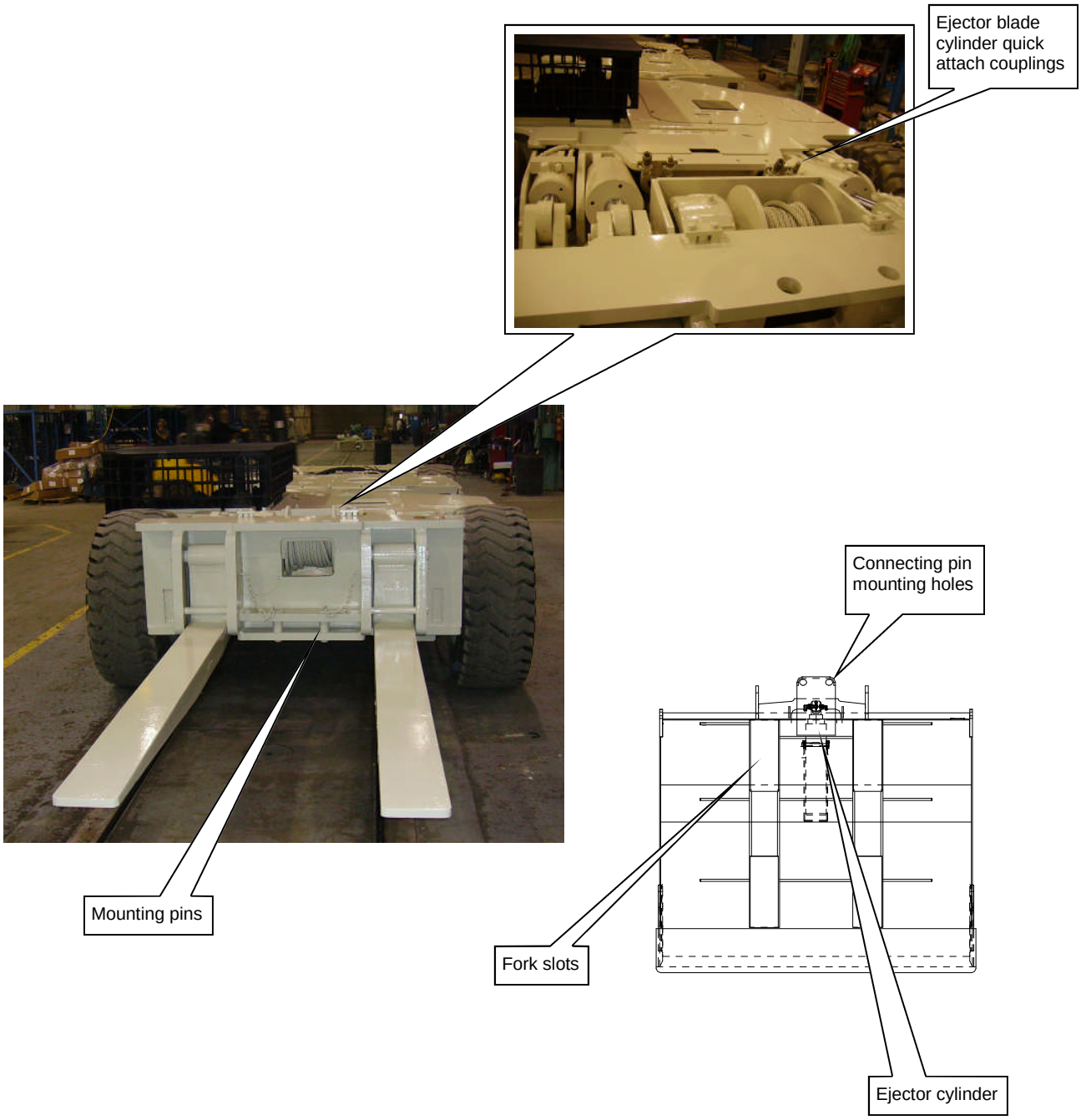
☞ Disconnect the drive shaft from the axle.

☞ Support the axle so that it will not fall when the axle mounting bolts are removed.

WARNING!
Before removing axle mounting bolts, make sure the axle is properly supported. Serious injury can resulting from falling loads.

☞ Remove the axle mounting bolts.

Fig. 68: Bucket assembly installation and removal



Battery lift cylinder removal and installation

battery lift cylinder removal

To remove a battery lift cylinder (Fig. 74):

☞ Properly crib the machine using standard mine practices and following all applicable mine safety rules.

WARNING!
Make sure the machine is properly cribbed before performing maintenance. Serious injury or death can occur from falling loads.

☞ Block the battery assembly using standard mine practices and following all applicable mine safety rules.

WARNING!
Make sure the battery assembly is properly blocked before removing a cylinder. Serious injury or death may occur from falling loads.

☞ Shutdown the machine.

WARNING!
Before performing maintenance on the machine, the circuit breaker reset switch must be in the "OFF" or "RESET" position and the power should be disconnected from the battery. Electrical shock or accidental machine movement can cause serious injury or death.

☞ Test the controls to ensure that the unit will not move.

WARNING!
Do not test any control unless you are sure that everyone is completely clear of all machine movement. Accidental machine movement can cause serious injury or death.

☞ Disconnect power to the battery.

☞ Remove the tire/wheel beside the battery lift cylinder.

☞ Slowly disconnect, tag, and cap hydraulic hoses going to the battery lift cylinder.

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 it, the load will fall, causing damage to the machine or serious injury or death to personnel.

☞ The cylinder eye is accessed through a hole cut in the side of the frame. Unpin the cylinder eye by removing the cotter pin from the pin and then knocking the pin out.

☞ Unpin the rod eye by removing the cotter pin from the pin and then knocking the pin out.

Table 4 (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.
	☞ Lines left unprotected and dirty, repaired components.	☞ Drain and replace oil.
	☞ Repair parts not properly protected while stored.	☞ Clean parts thoroughly before installation.
Accumulator unloading 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.
	☞ Brake valve leaking.	☞ Check leakage in valve, replace if necessary.
	☞ Dump valve not closed all the way.	☞ Close dump valve fully.
	☞ Defective unloading valve.	☞ Replace unloading valve.
Accumulator starts to charge but doesn't reach high limit	☞ Relief valve setting too low.	☞ Check valve setting.
	☞ 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 unloading valve.	☞ Replace valve.

Technical data

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

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

Components of the SH620

Technical data sheet

general	Overall length:	approx. 31’ 2”
	Overall width with forks:	approx. 9’ 4”
	Overall width with quick detach bucket:	approx. 10’ 1.5”
	Wheelbase:	approx. 14’ 2”
	Weight (empty less battery):	approx. 46,000 lbs
	Weight (w/64-125-21 battery):	approx. 62,000 lbs
	Main frame height (w/44 X 18L20 tires):	approx. 3’ 2””
	Main frame height (w/38 X 16-15 tires):	approx. 3’ 0”
	Ground clearance (w/44 X 18L20 tires):	approx. 12.5”
	Ground clearance (w/38 X 16-15 tires):	approx. 10”
performance	Inside turning radius:	approx. 12’ 6.5”
	Outside turning radius:	approx. 24’ 2”
	Steering articulation:	100 degrees total
	Tram speed:	approx. 4 - 5 mph
	Lift capacity (at 36” from the face of lift plate):	approx. 22 tons

Table 26: Extreme pressure gear oils (Spec. 100-2)

	Supplier	Brand name
1	Amoco Oil Company	Amoco Permagear EP 460
2	Gulf Oil	EP Lubricant HD 460
3	Mobil Oil Corporation	Mobil Gear 634 Mobil Gear 636
4	Chevron U.S.A.	Chevron Gear Compound EP ISO 460
5	Sun Oil Company	Sunep 460
6	Unocal 76	Extra Duty NL Gear Lube 7 EP Extra Duty NL Gear Lube 8 EP
7	Shell Oil Company	Shell Omala 680
8	Century Lubricating Oils, Inc.	Hulbest EP-7 Powergear 460
9	Texaco Lubricants Company	Meropa 680
10	Exxon	Spartan EP 460
11	Pennzoil	Super Maxol EP 460 Gear Lube Super Maxol EP 460 Gear Lube
12	Lubricating Engineers	608 Almosal Vari-Purpose Gear Lubricant
13	Conoco Inc.	Gear oil 460
14	Hydrotex	933 Industrial Gear Lubricant
15	Phillips	All Purpose Gear Oil 85W-90 5EP
16	Miners Oil	Gear Oil EP460

For your information

Our service

If you need to order spare parts or if technical problems occur, please contact our after-sales service personnel or contact us direct.

Service address

Beckley, WV
200 George Street, Suite 4
Beckley, WV 25801
Phone: (304) 256-5927
Fax: (304) 256-5928

Craig, CO
400 Mack Lane
Craig, CO 81625
Phone: (970) 824-3249
Fax: (970) 824-8851

Duffield, VA
P.O. Box 847
6808 Fraley Avenue
Duffield, VA 24244
Phone: (276) 431-7000
Fax: (276) 431-2464

Houston, PA
(Corporate Headquarters)
2045 West Pike Street
Houston, PA 15342
Phone: (724) 743-1200
Fax: (724) 743-1201

Carrier Mills, IL
9580 State Route 13 West
Carrier Mills, IL 62917
Phone: (618) 982-9000
Fax: (618) 982-9912

Oak Hill, WV
P.O. Box 60
Oak Hill, WV 25901

843 Lochgelly Road
Oak Hill, WV 25901
Phone: (304) 469-3302
Fax: (304) 465-0450

Paonia, CO
P.O. Box 566
Paonia, CO 81428

719 Second Street
Paonia, CO 81428
Phone: (970) 527-3151
Fax: (970) 527-6846

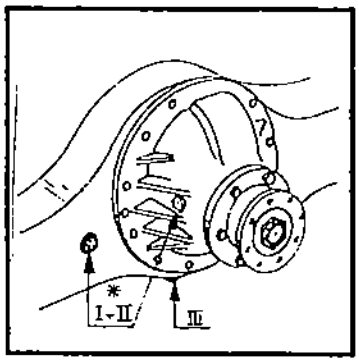
Price, UT
1814 North 1500 West
P.O. Box 1016
Price, UT 84501
Phone: (435) 637-3930
Fax: (435) 637-9754

Pulaski, VA
4041 Wurno Road
Pulaski, VA 24301
Phone: 540-980-4530
Fax: 540-980-6211

Washington, PA
255 Berry Road
Washington, PA 15301
Phone: (724) 743-1200
Fax: (724) 228-2177

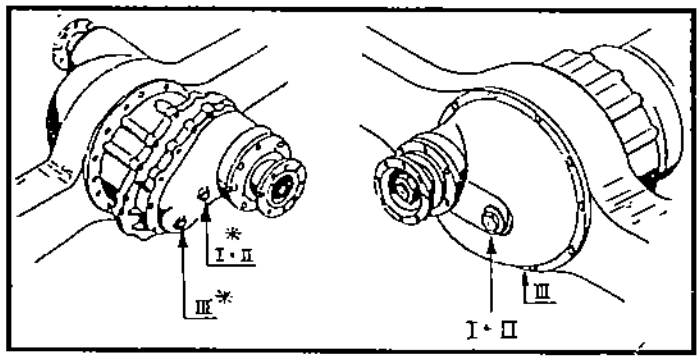
Lubrication points

The binding lubrication points has to be taken from the according installation drawing of the axle .



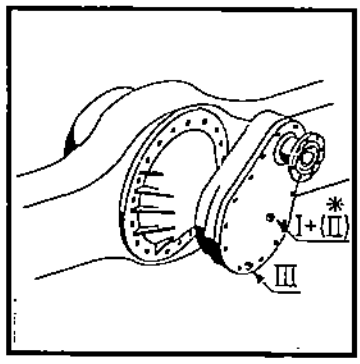
Single drive assembly

* The position is dependent from the respective axle version .



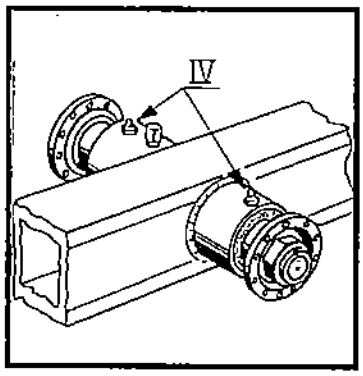
Drive assembly with throughdrive

* Version with interaxle differential
fill 1,5 litre oil at I + II * for first - time filling and for refilling !



Drop gear D 51 / D 108

* II only at version with separately oil space .



Cardan shaft intermediate bearing

I = Oil fitl plug
II = Oil level control plug
III = Oil drain plug
IV = Grease nipple

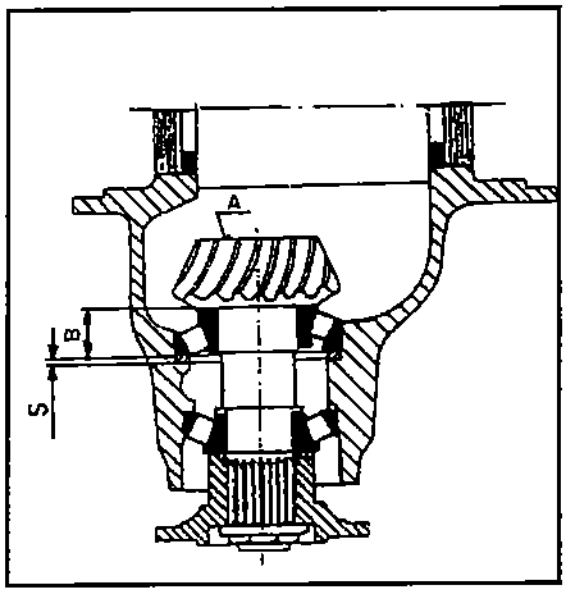
Tightening torques (Nm)

$\mu = 0{,}14$

Metric standard thread						
	Screw	Nut	Screw	Nut	Screw	Nut
Thread	8.8	8	10.9	10	12.9	12
M 4	3,0		4,4		5,1	
M 5	5,9		8,7		10	
M 6	10		15		18	
M 8	25		36		43	
M 10	49		72		84	
M 12	85		125		145	
M 14	135		200		235	
M 16	210		310		365	
M 18	300		430		500	
M 20	425		610		710	
M 22	580		830		970	
M 24	730		1050		1220	
M 27	1100		1550		1800	
M 30	1450		2100		2450	
Metric fine pitch thread						
	Screw	Nut	Screw	Nut	Screw	Nut
Thread	8.8	8	10.9	10	12.9	12
M 8 x 1	27		39		46	
M 10 x 1	55		81		95	
M 10 x 1,25	52		76		90	
M 12 x 1,25	93		135		160	
M 12 x 1,5	89		130		155	
M 14 x 1,5	145		215		255	
M 16 x 1,5	225		330		390	
M 18 x 1,5	340		485		570	
M 20 x 1,5	475		680		790	
M 22 x 1,5	650		920		1050	
Brake caliper dowel screws (greased !)						
M 20 x 1,5	400 + 100					
M 27 x 2	900 + 100					
Nut for steering stop = 300 Nm						

Regard reduced tightening torque for galvanized bolts and nuts !

Adjustment drive pinion distance



To obtain the proper tooth flank contact, adjust the axial position of the drive pinion with the thickness of the adjustment disk. The necessary thickness of the adjustment disk for first time assembly can be obtained by measurement (see calculation example). The final thickness of the adjustment disk can be fixed during the checking of gear meshing at the assembled drive assembly (see page „Adjustment of gear meshing of Gleason gears").

*) A = Set value for correct pinion support. This dimension is written on the end face of the pinion in millimetre. It indicates the deviation from the theoretic distance (setpoint dimension).

**) B = Measured width of the taper roller bearing.

Calculation example to ascertain the thickness S from the adjustment disk :

A = + 0,10 ; B = 37,95

S = 3,00 mm (theor.)
+ 0,05 mm → B = 0,05 mm smaller than B theor.
= 3,05 mm
- 0,10 mm → drive pinion value A
= **2,95 mm** → necessary thickness of the adjustment disk

Fit corresponding disk and outer rings of the taper roller bearings.

*) **Hint :** If value A is positive (f. e. + 0,1) the adjustment disk has to be 0,1 mm thinner than theor. S. If value A is negative (f. e. – 0,1) the adjustment disk has to be 0,1 mm thicker than theor. S.

) **Hint : If measure B is positive (f. e. 38,05) the adjustment disk has to be 0,05 mm thinner than theor. S. If measure B is negative (f. e. 37,95) the adjustment disk has to be 0,05 mm thicker than theor. S.

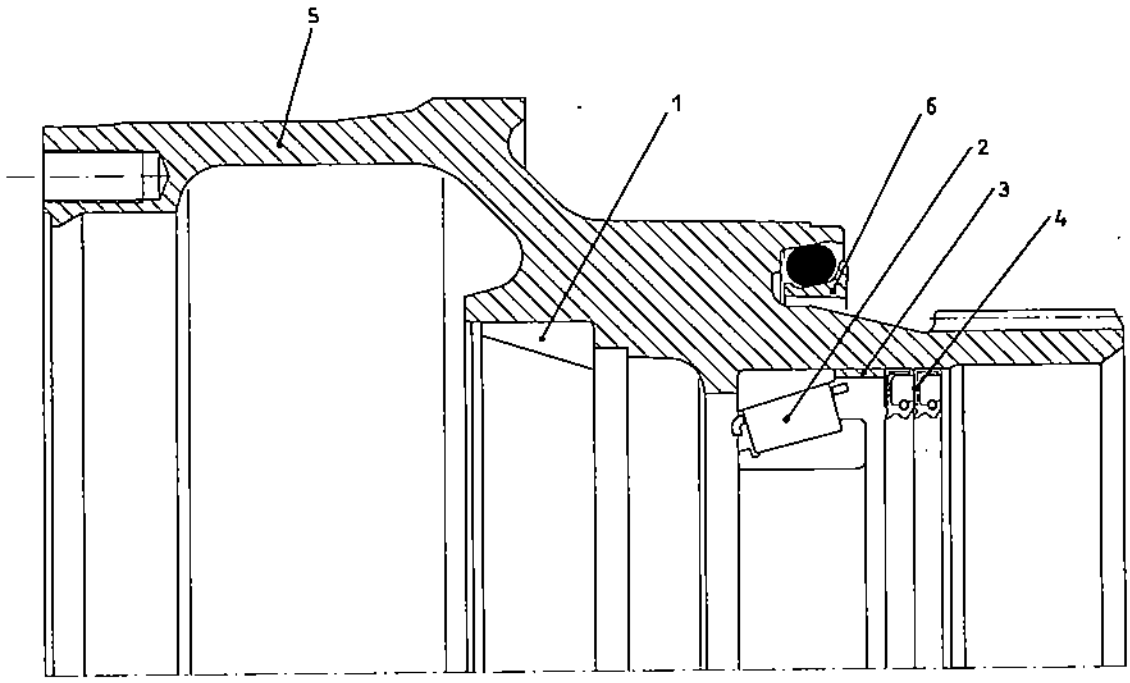
Prepare wheel hub

Press in outer rings of taper roller bearings (1 + 2), do not hammer them.
Install inner ring of taper roller bearing (2).
Install the distance ring (3).
Press the radial seal rings (4) with Loctite 572 (rubber cage) resp. Loctite 270 (steel cage) applied into the wheel hub (5). Fill the radial seal rings with bearing grease.
Install the face seal (6) into the wheel hub (5) (see 5.8).

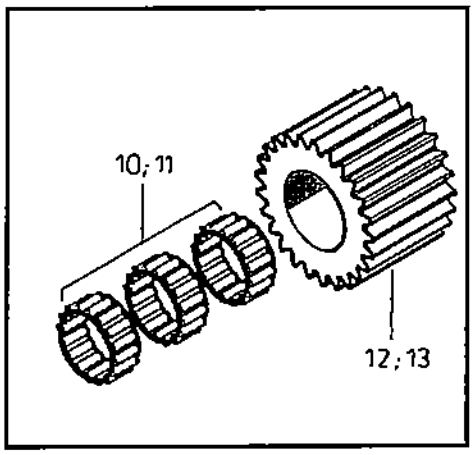
Mount wheel hub

Push the pre - assembled wheel hub (5) parallel onto the axle spindle resp. steering knuckle.

Attention: Be carefully do not damage the radial seal rings (4).

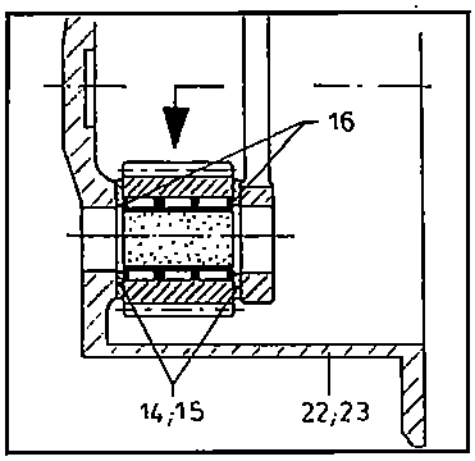


Assembly of planetary gear

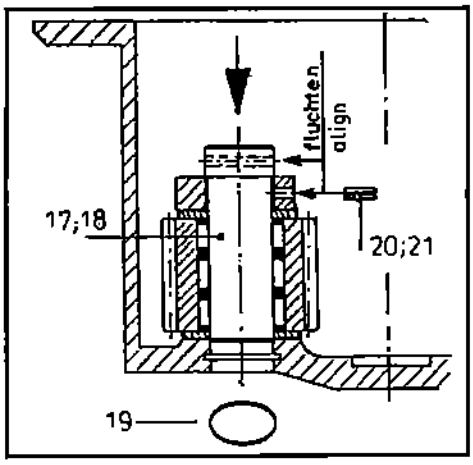


Prepare planetary gear:

Install the needle bearing (10 resp. 11) into the planetary gear (12 resp. 13).



Insert the preassembled planetary gears (12 resp. 13) with needle bearings (10 resp. 11), rings (16) (if present) and thrust disks (14 resp. 15) into the planetary housing (22 resp. 23) (planetary housing in horizontal position).



Place o - ring (19) into the slot of the planetary housing (22). Because of the difference of diameter of 0,1 mm press the planetary pin (17 resp. 18) in direction of arrow. Be sure, that the bore hole of the locking pin in the planetary pin and planetary housing are aligned. After inserting, secure the planetary pin with the locking pin (20 resp. 21).

Finish assembly

- Screw in the bleeder with connection piece and seal ring as well as the screw plugs with seal ring .
- Check brake hydraulic system for leaks (see sheet 7.11.7) .
- **Check the air gap (pressurized) :**

  Measure through the wear inspection hole the distance from the brake carrier to the piston end face , while non actuated brake (piston room pressurized) , actuate the brake (piston room non pressurized) and repeat the measure operation - the difference of the measured distances gives the air gap sL (pressurized) , rated size sL see table .

  Measure through the check hole the distance from brake carrier to the end face , while actuating the brake (piston room non pressurized) and stamp the now ascertained dimension into the brake carrier near by the wear inspection hole .

air gap and wear dimension		
brake type	air gap sL new (pressurized) [mm]	wear dimension [mm]
NLB 4340-FS	1,12 + 1,46	1,6
NLB 7340-FS	3,25 + 0,5 / - 0,5	2,8
NLB 5460-FS	2,4 + 1,0 / - 0,7	2,0
NLB 7460-FS	3 + 0,5 / - 0,1	2,8
NLB 7460-1FS	3 + 0,5 / - 0,1	2,1

  Hint : with increased disk wear and hence it resulting less spring tension the brake torque will be reduced .

- Install o - ring (brake carrier / axle spindle resp. steering knuckle) free of torsion and loops (inapplicable at one-piece design brake carrier) .
- Install the complete brake on the axle (coat the contact surface with Loctite 270) (inapplicable at one-piece design brake carrier) .
- Mount face seal see chapter 5.8 .
- **Centering of the discs :**

  The centering of the inner discs at wet disk brake dimension x340 has to be relized at wheel hub mounting by the wheel hub itself , to this the disc set has to be released by hydraulic pressure .

  The centering of the inner discs at wet disk brake dimension x460 has to be realized by using a center tool (see chapter 3.6) , to this the disc set has to be released by hydraulic pressure .

  After centering clamp the disc set by releasing the hydraulic pressure (spring load effect) .

  Hint : To safe the centering of the disc set in case of disassembly the wheel hub , the hydraulic pressure should be released , so the disc set will be clamped (spring load effect) .

6. Technical data

7. For your information

Your safety

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

state of the art

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

Do not make any alterations or modifications which could impair the safety of the battery. All modifications and changes must be approved.

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

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

Observe the safety and accident prevention regulations:

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

while handling acids

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

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

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

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

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

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

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

Unpacking upon receipt

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

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

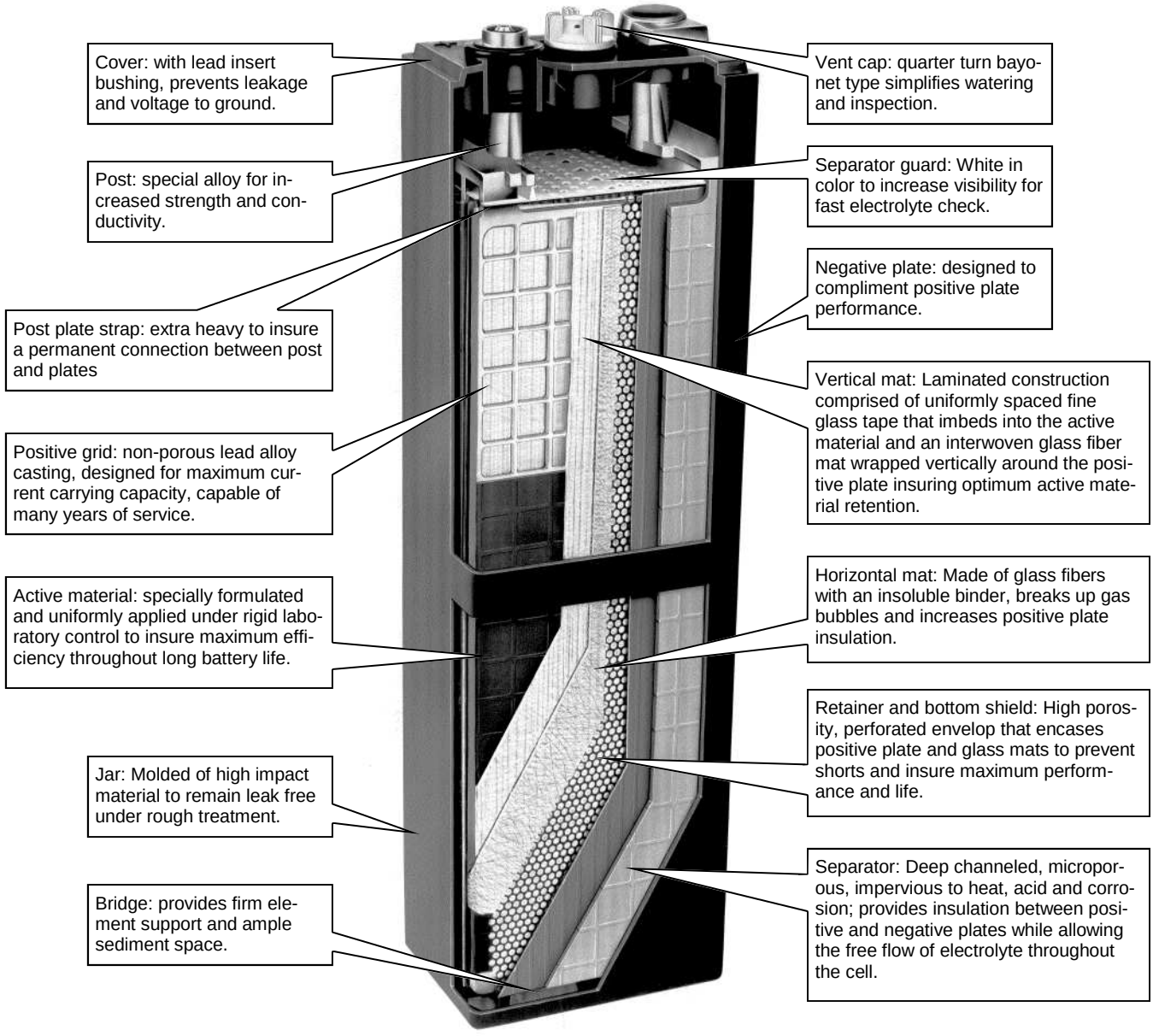
WARNING!
Lifting devices used to move batteries must be capable of carrying the weight stamped on the battery case. Keep all persons and body parts from under the batteries when they are lifted.

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

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

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

Fig. 1: Cell



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

Preparation for Use

Establishing battery requirements

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

Acid to water proportions

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

Charged and wet batteries

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

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

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

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

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

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

Troubleshooting

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

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

Table 6: Storage battery troubleshooting chart

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

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

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

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

    - ☞ Remove the element from the jar.

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

    To reinstall the separator:

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

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

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

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