OPERATION, PREVENTIVE MAINTENANCE, TROUBLESHOOTING AND SERVICE GUIDE

CHINA

MODEL 488 WITH CONTROL HANDLE

NOTICE

THIS GUIDE CONTAINS IMPORTANT OPERATION AND SAFETY INFORMATION AND SHOULD BE KEPT AVAILABLE TO THOSE PERSONNEL INSTALLING AND OPERATING THIS EQUIPMENT.

P/N A6474X260
Revision 0, March 2008

SAFETY PRECAUTIONS AND GUIDELINES

OVERVIEW

Before you operate, maintain or in any other way, use this unit -

READ and STUDY this guide. KNOW how to safely use the unit's controls and 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

PRE-START INSPECTION

Read this entire guide BEFORE attempting to operate this unit. You should be familiar with the controls and their functions before the unit is energized.

INSPECT your machine by doing a pre-operational inspection. Have any malfunctioning, broken or missing parts corrected or replaced before use.

VERIFY that all maintenance has been performed.

VERIFY that all the instruction and safety labels are in place and readable. These are as important as any other equipment on the machine.

CLEAN any foreign material from the operator's compartment.

THIS Model 488 Series UN-A-TRAC® was shipped from the factory equipped with a protective canopy. This canopy MUST be securely in place before operating the unit.

STARTING

DO NOT operate any levers or pedals from outside the operator's compartment to keep the machine from hitting you or other personnel.

FOLLOW the instructions in the STARTING PROCEDURES section of this guide (page 23).

DO NOT operate any levers or pedals if anyone is in the Hazard Zone (page 21).

BE familiar with the operation of the tape switches and be prepared for the sudden stop when the tape switches are struck.

OPERATING

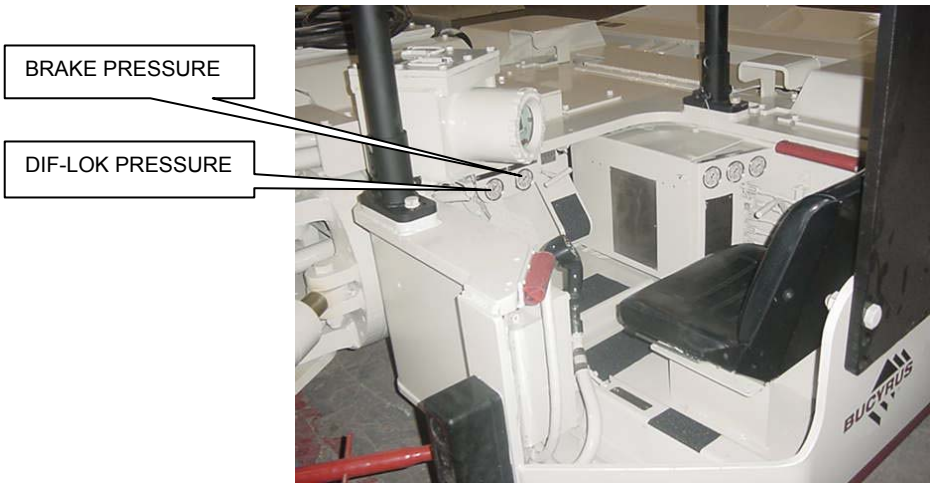
ALWAYS make sure that no person or obstruction is in your line of travel BEFORE starting the unit into motion or in the articulation area when steering the unit.

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

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

USE extreme caution and be observant when working in close quarters or in congested or blind-travel areas. The warning gong should be sounded to alert personnel of your movement.

FIGURE 8 – GAUGE PANEL



GENERAL HYDRAULIC CONTROL SYSTEM INFORMATION

In the operator's compartment located to the right of the operator's seat is a group of control levers and gauges (Figure 9). These levers control the steering, bucket position, 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 (Figure 9) read more than 2250 psi (155 bar), SHUTDOWN the Model 488 and call a maintenance person (see page 29 for Shutdown Procedure).

HYDRAULIC CONTROL PANEL GAUGES	
GAUGE	**PRESSURE READING**
Emergency Brake	1500 – 1800 psi (103 –124 bar)
Accumulator	1500 – 1875 psi (103 – 129 bar)
System Pressure	2250 psi (155 bar)

WARNING

SHOULD EITHER GAUGE SHOW ABOVE OR BELOW THE PRESSURES LISTED ABOVE, SHUTDOWN THE UN-A-TRAC® AND CALL A MAINTENANCE PERSON (SEE PAGE 29 FOR SHUTDOWN PROCEDURE).

TOWING A DISABLED MACHINE

IT IS NOT POSSIBLE, WITHIN THE SCOPE OF THIS GUIDE, TO ANTICIPATE ALL POSSIBLE ARRANGEMENTS FOR TOWING A DISABLED UNIT. BEFORE ATTEMPTING TO TOW ANY VEHICLE, YOU MUST TAKE ALL POSSIBLE PRECAUTIONS TO PROTECT THE OPERATORS AND ANY ONE AROUND BOTH VEHICLES FROM BEING INJURED BY EITHER THE TOWING VEHICLE, THE TOWING DEVICES OR THE VEHICLE BEING TOWED. THE PRIMARY 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.

1. Couple the towing vehicle securely to the disabled vehicle.

2. Close the valve to tank circuit that is on the hand pump. This isolates the park brake solenoid from the circuit.

3. Begin pumping the hand pump. The building pressure moves the shuttle valve and allows the Automatic (Park) Brake system to be pressurized.

4. The Automatic (Park) Brake is "released" as indicated by the Brake Release gauge.

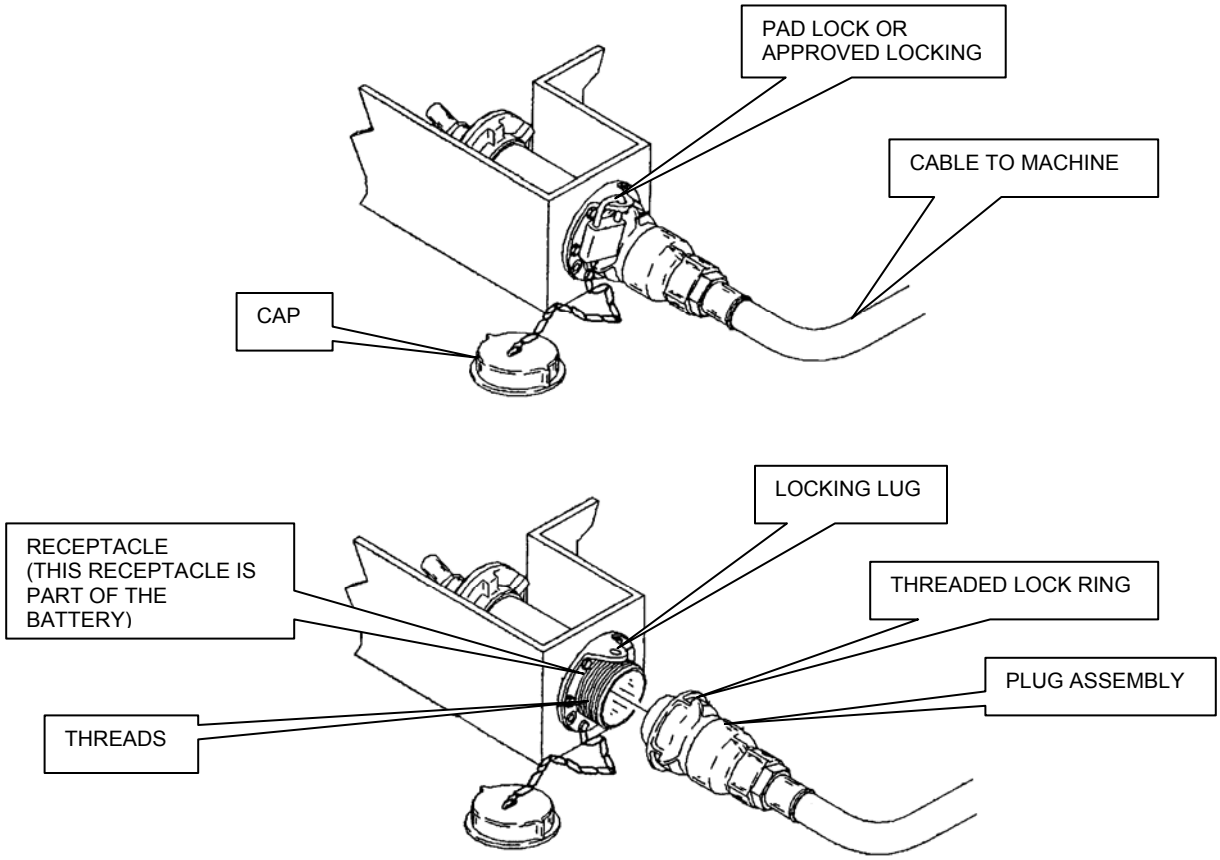
AT NO TIME DURING TOWING SHOULD ANYONE RIDE IN OR ON THE VEHICLE BEING TOWED OR STAND IN BETWEEN THE TOWING VEHICLE AND THE DISABLED VEHICLE.

5. Begin towing the vehicle.

6. 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 directions at all four wheels for additional stability. The brake is "set' by opening the valve on the hand-pump.

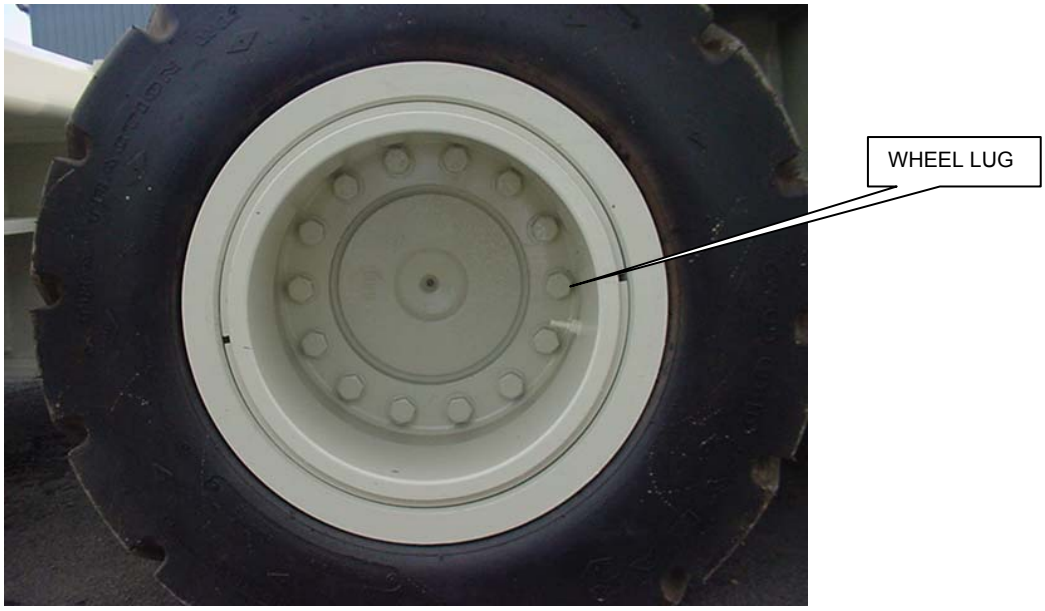
FAILURE TO SET THE PARKING BRAKE ON THE DISABLED VEHICLE BEFORE REMOVING THE TOWING DEVICE COULD ALLOW THE DISABLED VEHICLE TO ROLL AWAY UNCONTROLLED.

FIGURE 23 – BATTERY PLUG AND RECEPTACLE ASSEMBLY (TYPICAL)



4. Check the wheel mounting bolts (Figure 26). The mounting bolts should be torqued daily for the first two days of operation and weekly afterwards (See page 41 for Torque Values). Also, if equipped with pneumatic tires, check tire pressure. The tires should be inflated to 130 psi (9 bar).

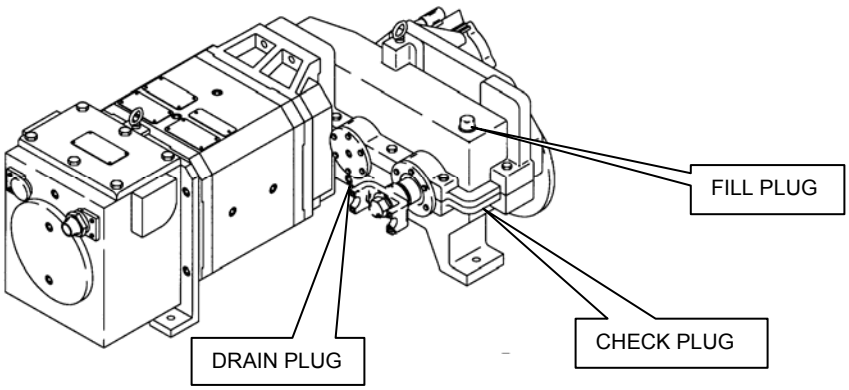
FIGURE 26 – WHEEL MOUNTING BOLTS (John Deere Axle Shown)



5. Check the oil level in the speed reducer (gearbox).

   A. Remove the check plug from the speed reducer (gearbox) (Figure 27). The oil level should be kept at the level of the check plug.
   B. Should it be necessary to add oil, add oil (Spec. 100-6) through the fill plug hole slowly until oil flows from the check plug hole. Do not overfill the speed reducer.
   C. Replace the check and fill plug.

FIGURE 27 – SPEED REDUCER (GEARBOX) OIL LEVEL



The following lubricants are recommended for use in the UN-A-TRAC®. Other lubricants with equivalent specifications may be used.

	Recommended Lubricant	Specification
Hydraulic Oil (John Deere or Meritor)	Texaco Rando HD68	Spec 100-1
Hydraulic Oil (Kessler)	Mobilfluid 424	Spec 100-12
Heavy-Duty, Multi-Purpose Grease	Texaco EP 1	Spec 100-3
Speed Reducer (Gearbox) Oil	Texaco EP-90 Gear Oil	Spec 100-6
Axle Oil (Meritor or Kessler)	Texaco EP-90 Gear Oil	Spec 100-6
Axle Oil (John Deere)	John Deere Hy-Gard Oil	--------
Wet Disc Brakes (Meritor or Kessler)	Mobilfluid 424	Spec 100-12
SROIB Park Brake	SROIB Oil	--------

LUBRICATION CHART

CLEAN ALL EXCESS OIL AND GREASE FROM THE UN-A-TRAC® AFTER COMPLETING MAINTENANCE PROCEDURES.

ONCE PER WEEK

The following points should be lubricated at the grease fittings with heavy-duty, multi purpose grease.

SYMBOL	LOCATION
•	1. Bucket Pivot Pins (2 Places)
•	2. Bucket Lift Cylinders (Rod End)
•	3. Bucket Lift Cylinders (Base End)
•	4. Steering Cylinders (Rod End)
•	5. Steering Cylinders (Base End)
•	6. Automatic (Park) brake Caliper
•	7. Drive Line Universal Joints
•	8. Drive Line Slip Joints
•	9. Control Levers
•	10. Foot Pedals
•	11. Central Lubrication Fitting Block
•	12. Center Section Assembly
•	13. Winch

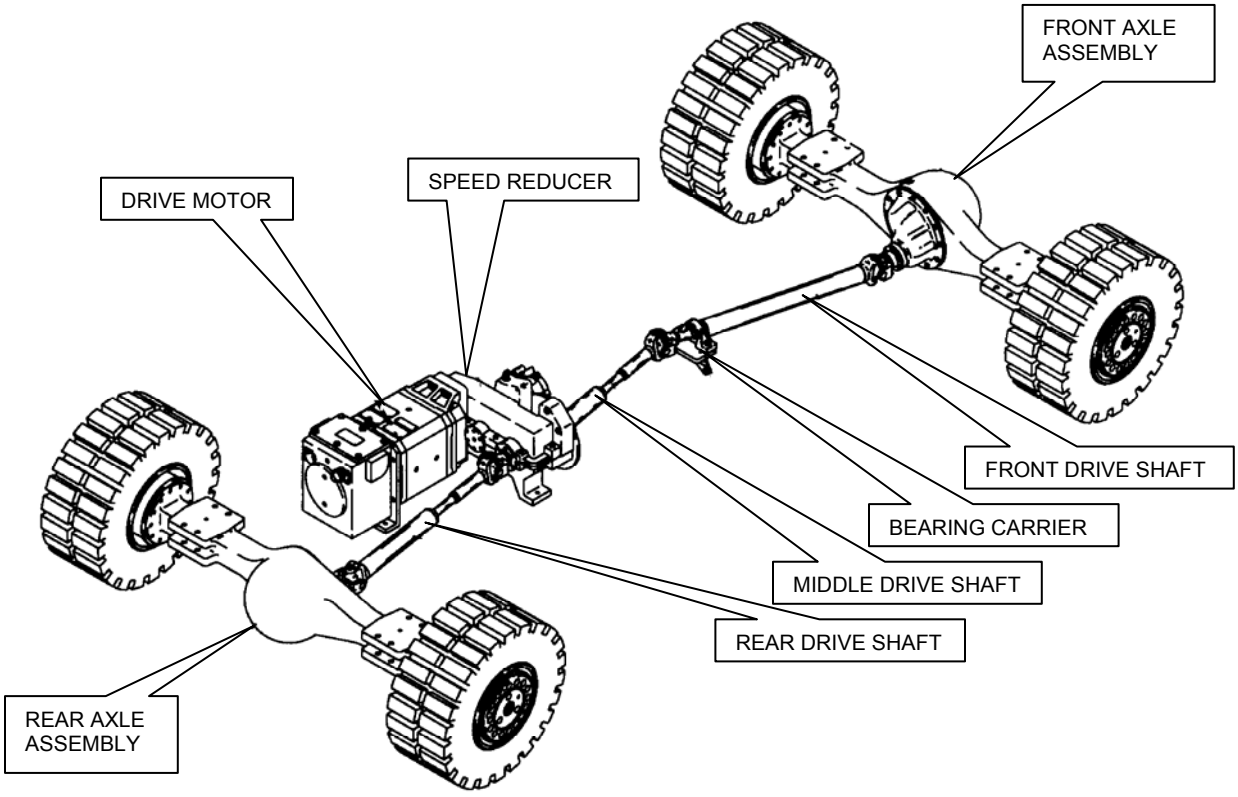
MAJOR MAINTENANCE PROCEDURES

DRIVE MOTOR/GEARBOX (SPEED REDUCER) REMOVAL AND REPLACEMENT

WARNING

POWER MUST BE REMOVED BY UNPLUGGING THE BATTERY PLUGS BEFORE SERVICING THE MOTORS.

FIGURE 38 – DRIVE TRAIN COMPONENTS



1. Drive Motor:

   A. Remove the motor inspection cover (Figure 38) and disconnect the power cables to the motor. Unpack the motor gland and completely remove the wiring and conduit from the motor.
   B. Attach a crane or hoist, capable of lifting the motor, to the eyebolt (Figure 38) on top of the motor and take up any slack in hoist chain.
   C. Remove the four (4) bolts that attach the motor to the gearbox.
   D. Lift the motor out of the unit.
   E. Cover the reducer opening to prevent foreign matter from entering the gearbox.

2. Drive Motor Replacement:

Verify that motor pinion gear is installed.
   B. Clean all mating surfaces (motor and gearbox.)
   C. Lower motor into unit and align bolt holes.

DANGER

ONLY TRAINED AND/OR AUTHORIZED PERSONNEL SHOULD PERFORM MAINTENANCE ON THE CONTROLLER.

FAILURE TO ADHERE TO DANGERS, WARNINGS AND CAUTIONS, NOTED IN THIS MANUAL, COULD RESULT IN SERIOUS INJURY OR DEATH.

FAILURE TO MAINTAIN THIS CONTROLLER IN STRICT ADHERENCE TO THESE INSTRUCTIONS AND WARNINGS IN THIS MANUAL COULD VOID THE WARRANTY.

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

- **LED on** Controller operational
- **LED off** Power-up fault – check display or calibrator. If all is blank, then replace logic.
- **1 Flash** **Personality CRC EEPROM Error.**
  Using the hand-held calibrator, change a password to any number then recycle power – should clear, otherwise replace logic.
- **2 Flash** **Procedure FAULT**
  FS1 closed before power on ,2 Directional Fault or Current imbalance fault. Recycle through NEUTRAL to clear.
- **3 Flash** **IGBT permanently low (IGBT Short Circuit FAULT).**
  This includes IGBT short circuit or IGBT open circuit. This fault shuts down all modes. Recycle through NEUTRAL to clear.
- **4 Flash** **Motor neither low nor high (Breaker Open FAULT).**
  This includes breaker open circuit or IGBT open circuit. This fault shuts down all modes. Recycle through NEUTRAL to clear.
- **5 Flash** **Motor permanently high.**
  This includes breaker welded. This fault shuts down all modes. Recycle "KEY" to clear.
- **6 Flash** **Faulty TRACTION accelerator.**
  This includes the accelerator greater than 15% at power on and wire-off. If wire-off occurs during active function then the motor speed will set to zero. This fault auto-clears.
- **7 Flash** **Battery voltage FAULT.**
  This includes battery below a predetermined value. Recycle through NEUTRAL to clear.
- **8 Flash** **Thermal cut-back (Over-Temperature FAULT).**
  This includes Heatsink temperature above 95° centigrade.

AS TEMPERATURE RISES ABOVE 95° CENTIGRADE, THE CONTROLLER WILL LIMIT THE CURRENT TO 300 AMPS REGARDLESS OF DEMAND.

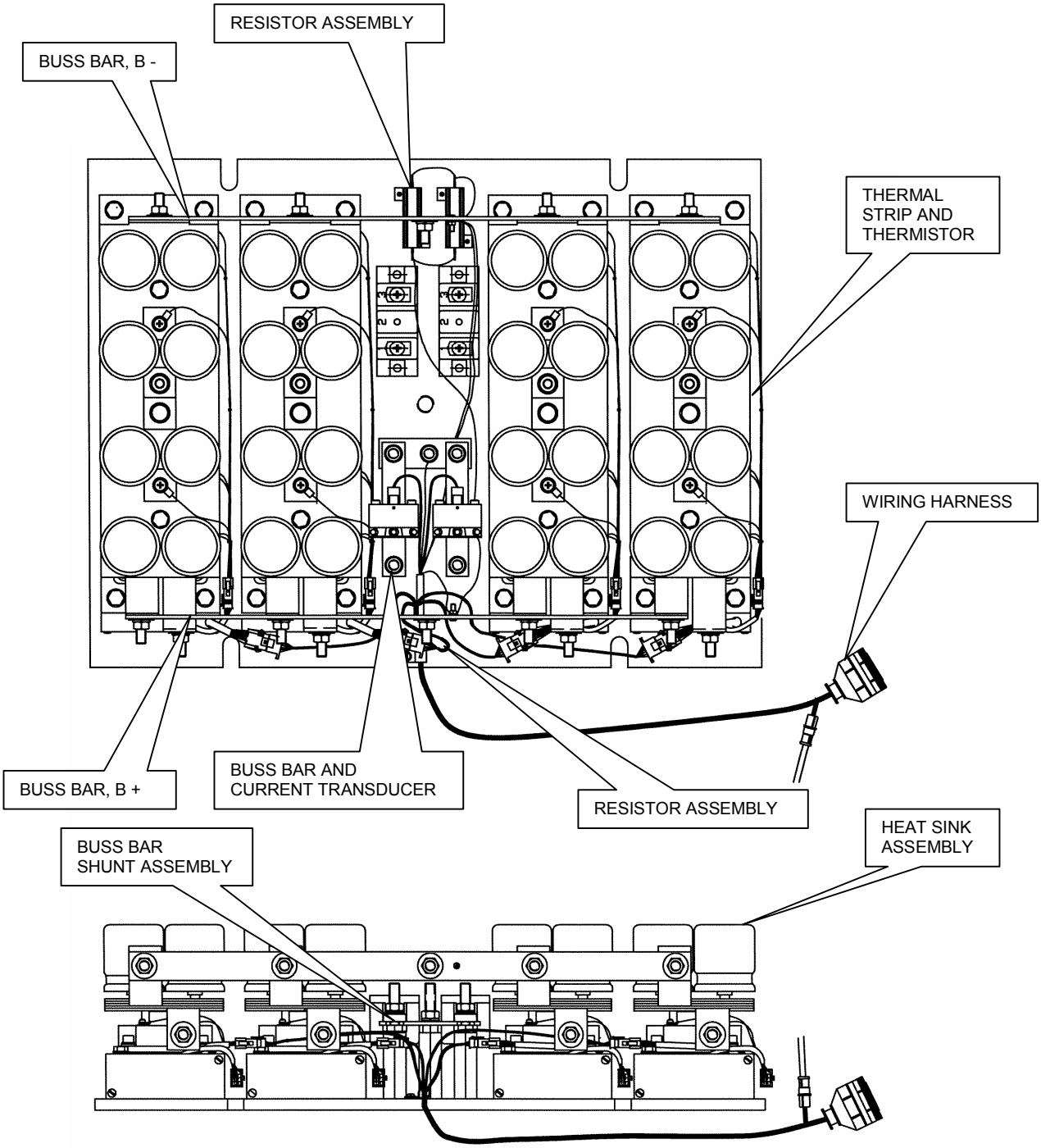
- **9 Flash** **UVR coil over-current FAULT (Coil short circuit FAULT).**
  Cleared with "KEY" recycled.
- **10 Flash** **Brake on FAULT**
  Will trip Directional and FS1 are energized without releasing brake. Recycle through NEUTRAL to clear.
- **15 Flash** **Current Transducer FAULT.**
  Occurs when current output is read during power-up or if no current is read during drive above 50% demand. "KEY" recycle to clear.

Traction BDI Display

Display Name	Range / Notes	Security Level Displayed	Security Level Adjustable
% CHANGE LEFT	0 - 100%	ENGINEERING	ENGINEERING
BDI CELLS	35 - 80 (64)	ENGINEERING	ENGINEERING
RESET CELL LEVEL	1.85V - 2.50V (2.04V)	SERVICE ADVANCED ENGINEERING	SERVICE ADVANCED ENGINEERING
EMPTY CELL LEVEL	1.00V - 1.99V (1.70V)	SERVICE ADVANCED ENGINEERING	SERVICE ADVANCED ENGINEERING
WARNING LEVEL	0% - 90% (20%)	SERVICE ADVANCED ENGINEERING	SERVICE ADVANCED ENGINEERING
CUTOUT LEVEL	0% - 90% (0%)	ENGINEERING	ENGINEERING
BATTERY CALLIBRATION VOLTAGE	1.00V – 10.0V (5-VOLTS)	ENGINEERING	ENGINEERING
BDI SAMPLE TIMER	1.0 - 255 SECONDS 2.0 (20 SECONDS)	ENGINEERING	ENGINEERING
DISPLAY WORKING	OK	ADVANCED ENGINEERING	ADVANCED ENGINEERING
DISPLAY STATUS	LOCK / ROTATE (ROTATE)	ALL	ALL
SELECT DASHBOARD DISPLAY STATUS	0 - 4 (BATTERY VOLTAGE, PUMP CURRENT AND MOTOR CURRENT) BATTERY VOLTAGE (1)	ALL	ALL
DISPLAY CONTRAST	0 - 127 1 (33)	ALL	ALL

IGBT Dual Motor Panel

FIGURE 16



OPERATION, PREVENTIVE MAINTENANCE, TROUBLESHOOTING, AND SERVICE GUIDE

MODEL LA10C BATTERY CHARGER CHINA

NOTICE

THIS GUIDE CONTAINS IMPORTANT OPERATION AND SAFETY INFORMATION AND SHOULD BE KEPT AVAILABLE TO THOSE PERSONNEL INSTALLING AND OPERATING THIS EQUIPMENT.

A6474X95MC

THEORY OF OPERATION FERRORESONANT DESIGN

The transformer in a ferroresonant design is non-linear. Its secondary is operated in saturation while the primary is operated in the linear region of the B-H curve.

A magnetic shunt is used to separate the primary and secondary fluxes, which are at different levels. This non-linear operation means that the transformer no longer obeys the turns ratio laws of the linear transformer. That is, the secondary voltage is no longer a function of the turns ratio times the primary voltage. This means that changes in the primary voltage do not directly affect the secondary voltage value.

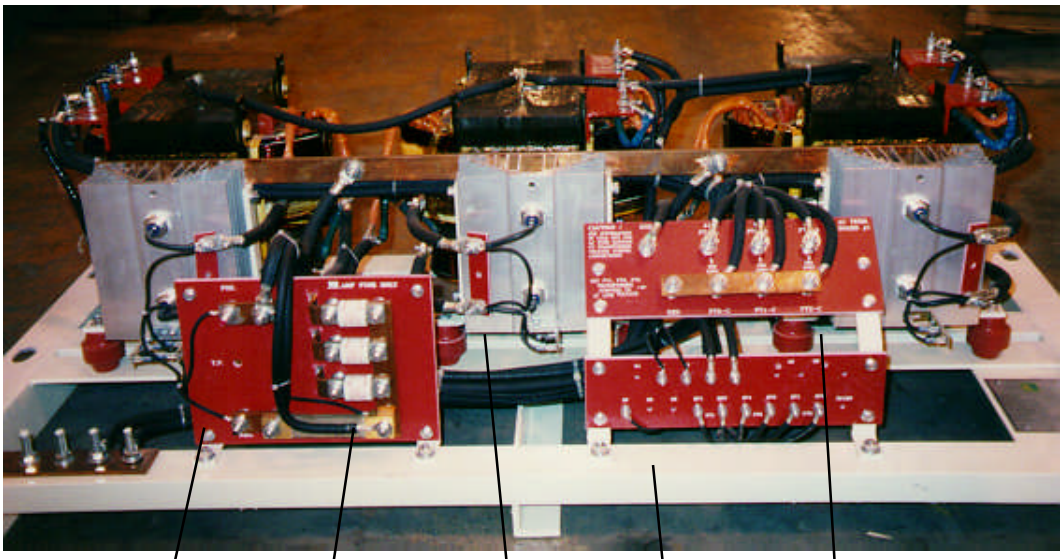
The secondary voltage is proportional to the voltage across the resonating winding only. The voltage of the resonating winding is affected by the amount of magnetic coupling to the primary, and by careful selection of magnetic shunts and capacitor values. Thus a battery charging curve can be established. The charging curve is essentially fixed and can only be altered by changes in the transformer design. Under short circuit conditions, the amount of primary to secondary magnetic coupling determines the value of the output current limit.

Rectifiers are added to convert the output of this A.C. regulator into D.C.

The ferroresonant circuit requires a good grade of capacitor in the resonating circuit to improve
reliability and a careful design of the transformer. That is the principle of the ferroresonant design.

NOTICE

THIS UNIT IS EQUIPPED WITH AN EMERGENCY STOP SWITCH WHICH TRIPS THE MAIN POWER CENTER WHEN PROPERLY INSTALLED, THUS REMOVING AC POWER FROM THE UNIT.



LA10C HOT BOX COMPONENTS
FIGURE 5

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.*

Section IV. Principles of Operation

1-6. Fundamentals of Cycling

A cycle is a discharge followed by a charge. During the charge, the electrical energy supplied by the charger causes an electromechanical reaction within the battery. This restores the active materials to a fully charged condition.

a. **The Fully Charged Cell or Battery -** The positive and negative plates (electrodes) are separated from each other and immersed in electrolyte. In the fully charged condition, the active material of the positive plate is lead dioxide and that of the negative plate is sponge lead. The electrolyte is a solution of sulfuric acid and water that normally varies in a specific gravity from 1.280 to 1.295. The combination produces a voltage of approximately 2 volts on open circuit. This voltage potential results from the fundamental characteristic of a storage battery which dictates that when two electrodes of dissimilar metals are immersed in suitable electrolyte, and a circuit is closed between the two, electrons begin to flow. A fully charged cell should normally have an on-charge voltage of from 2.45 to 2.70 volts when charging at the finish rate.

b. **The Discharging Cell or Battery -** While a battery is being discharged or used, lead dioxide and sponge lead combine with sulfuric acid to form lead sulfate within both plates. This action causes the specific gravity of the electrolyte to decrease. As the discharge progresses, individual cell and battery voltages decline, generally in direct proportion to the rate of discharge.

c. **The Discharged Cell or Battery -** As the depth of discharge increases, more sulphuric acid is removed from the electrolyte so the specific gravity decreases and may drop below 1.100 as it approaches the specific gravity of water. Almost all of the active material of both positive and negative plates is converted to lead sulfate, and an effective electromechanical reaction is no longer possible. At this point the battery has reached its discharge limit.

d. **The Charging Cell or Battery -** The charging action begins when the terminals of the battery are connected to an external source of direct current. The electromechanical reaction is reversed and the positive plates, negative plates, and electrolyte start returning to their original charged condition. Charging causes the battery voltage to rise as active materials are restored. A cell being charged may have a voltage of from 2.12 to 2.70 volts depending upon charging rate and time.

e. **General -** Storage batteries do not actually store electrical energy; instead, they accept the electrical energy delivered to them during charging and convert it into chemical energy. During discharging, this chemical energy is reconverted into electrical energy to be used as needed.

To obtain the best performance and life from a mine power storage battery, it should usually be charged after each shift of use or whenever the specific gravity of the electrolyte falls below 1.240. It is very important that proper ventilation be provided during charging to make certain that (1) the hydrogen gas, given off toward the end of the charging process is dissipated (see Chapter 4), and (2) that individual cell electrolyte temperatures, during normal operations, do not exceed 110 degrees F.

1-7. Ampere-Hour Capacity

The electrical capability of a storage battery is usually expressed in ampere-hours. The ampere-hour capacity is the number of ampere-hours which can be delivered under specified conditions of temperature, rate of discharge, and final voltage. Basically, ampere-hours are determined by multiplying the number of amperes which the battery will deliver by the number of hours during which the current is flowing. Total cell or battery capacity then is determined by the size and number of plates which make up

FIGURE 3 – TAKING HYDROMETER READINGS

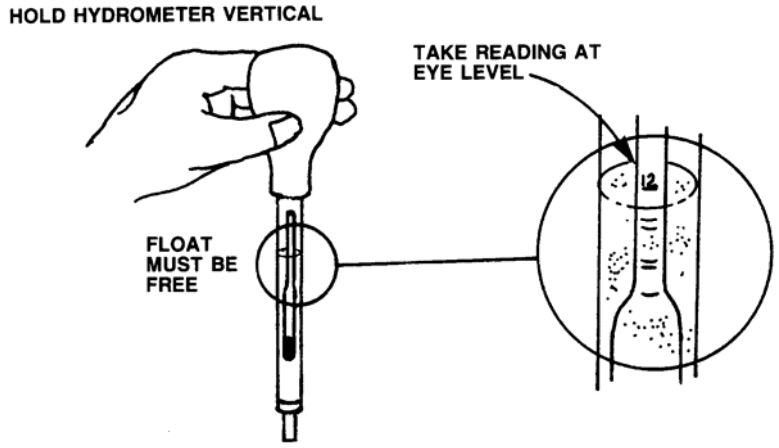


TABLE 3		
SPECIFIC GRAVITY TEMPERATURE CORRECTION CHART		
Electrolyte Temperature (Degrees Centigrade)	**Electrolyte Temperature (Degrees Fahrenheit)**	**Point Correction**
110	230	+11
107	221	+10
104	218	+9
101	212	+8
98	209	+7
95	203	+6
92	198	+5
89	194	+4
86	185	+3
83	180	+2
80	176	+1
77	171	No Correction
74	167	-1
71	158	-2
68	152	-3
65	149	-4
62	140	-5
59	135	-6
56	131	-7
53	128	-8
50	122	-9
47	118	-10
44	113	-11
41	104	-12
38	99	-13
35	95	-14
32	86	-15

Therefore a cell or battery should first be given an equalizing charge as described in Paragraph 2-10c. **Never make a gravity adjustment on a cell which does not gas vigorously while on charge.**

If, after the equalizing charge, the specific gravity of any cell, corrected for temperature, is lower than normal, it should be adjusted in the following manner:

1. Put battery back on charge at the finish rate until cells are actively gassing to provide proper mixing.

2. Remove electrolyte from the low reading cells until level reaches separator protector.

3. Slowly add 1.400 specific gravity sulfuric acid to the cell while it is still gassing.

4. Wait 15 to 20 minutes for the added acid to become thoroughly mixed, then read the specific gravity. If it is still low, repeat the process until gravity is normal. As a guide, every 1/4" of electrolyte that has been removed and replaced by 1.400 acid will cause the specific gravity to rise 4 to 5 points (.004 to .005).

If the corrected specific gravity of any cell is higher than normal, proceed as follows:

1. While the battery is gassing on charge, withdraw from the cell a small amount of electrolyte and replace with approved water.

2. Repeat, if necessary, at 20 to 30 minute intervals until the desired reading is obtained. Every 1/4" of electrolyte which is replaced with water will cause the specific gravity of the cell electrolyte to drop 4 to 5 points (.004 to .005).

NEVER ADD ACID WITH A SPECIFIC GRAVITY HIGHER THAN 1.400. STRONGER ACID COULD PERMANENTLY DAMAGE THE CELL. WHEN MIXING OR CUTTING ACID, ALWAYS ADD THE ACID TO THE WATER. NEVER POUR WATER INTO ACID. A VIOLENT REACTION COULD RESULT WHICH MIGHT CAUSE PERSONAL INJURY. WHEN WORKING WITH ACID, ALWAYS USE A FACE SHIELD OR GOGGLES, RUBBER GLOVES, AND AN ACID RESISTANT APRON.