UpRight

AB46 Electric & Bi-Energy

WORK PLATFORMS

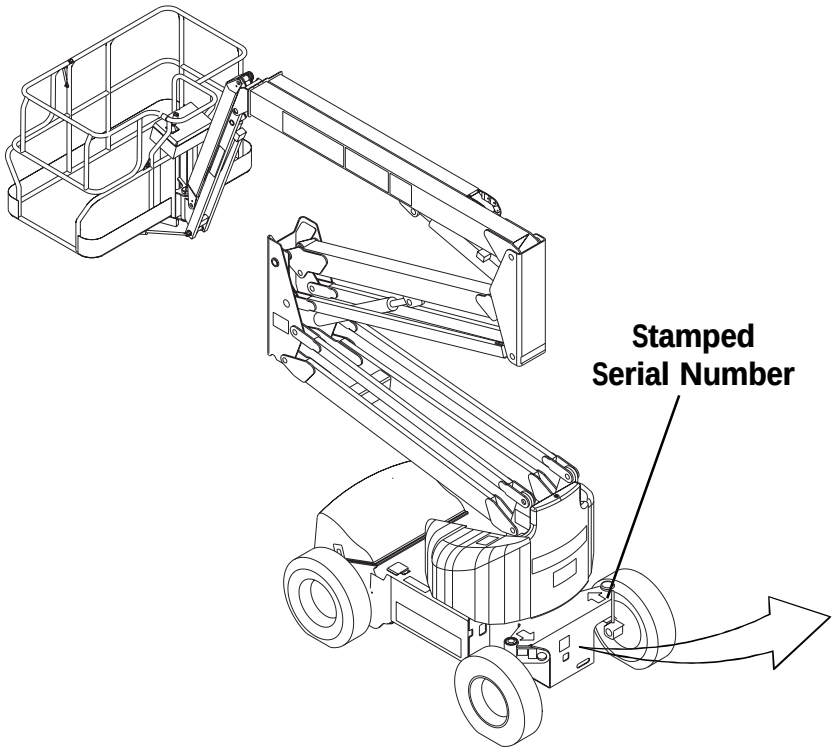
Service & Parts Manual

SERVICE & PARTS MANUAL

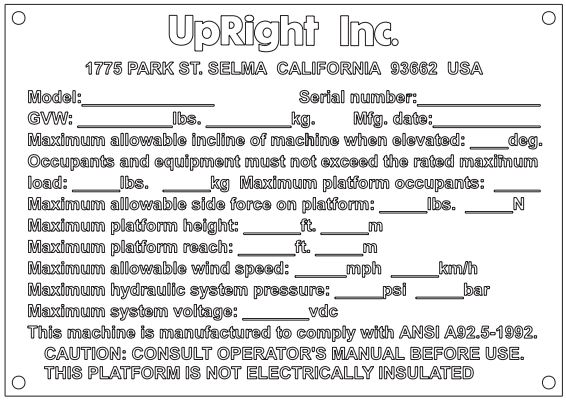
AB46

Electric and Bi Energy Models

Serial Numbers 1000 to current



When contacting UpRight for service or parts information, be sure to include the MODEL and SERIAL NUMBERS from the equipment nameplate. Should the nameplate be missing the SERIAL NUMBER is also stamped on top of the chassis above the front axle pivot.


UpRight Inc.
1775 PARK ST. SELMA CALIFORNIA 93662 USA
Model:_____ Serial number:_____
GVW: _____lbs. _____kg. Mfg. date:_____
Maximum allowable incline of machine when elevated: ____deg.
Occupants and equipment must not exceed the rated maximum load: _____lbs. _____kg Maximum platform occupants: _____
Maximum allowable side force on platform: _____lbs. _____N
Maximum platform height: _____ft. _____m
Maximum platform reach: _____ft. _____m
Maximum allowable wind speed: _____mph _____km/h
Maximum hydraulic system pressure: _____psi _____bar
Maximum system voltage: _____vdc
This machine is manufactured to comply with ANSI A92.5-1992.
CAUTION: CONSULT OPERATOR'S MANUAL BEFORE USE.
THIS PLATFORM IS NOT ELECTRICALLY INSULATED

UpRight

Call Toll Free in U.S.A.

1-800-926-LIFT

UpRight, Inc.
1775 Park Street
Selma, California 93662
TEL: 209/891-5200
FAX: 209/896-9012
PARTS: 1-888-UR-PARTS
PARTSFAX: 209/896-9244

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Foreword

Introduction

HOW TO USE THIS MANUAL

This manual is divided into 6 sections. The right hand pages of each section is marked with a black tab that lines up with one of the thumb index tabs on the right side of this page. You can quickly find each section without looking through the table of contents which follows this page. The section number printed at the top corner of each page can also be used as a quick reference guide.

SPECIAL INFORMATION

⚠ DANGER ⚠

Indicates the hazard or unsafe practice ***will*** result in severe injury or death.

⚠ WARNING ⚠

Indicates the hazard or unsafe practice ***could*** result in severe injury or death.

⚠ CAUTION ⚠

Indicates the hazard or unsafe practice could result in ***minor*** injury or property damage.

NOTES: Give helpful information.

WORKSHOP PROCEDURES

CAUTION: Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this manual does contain warnings and cautions against some specific service methods which could cause personal injury, or could damage a machine or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by UpRight, Inc., might be done, or of the possible hazardous consequences of each conceivable way, nor could UpRight Inc. investigate all such ways. Anyone using service procedures or tools, whether or not recommended by UpRight Inc., must satisfy themselves thoroughly that neither personal safety nor machine safety will be jeopardized.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at any time without notice.

Foreword

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1.0 Introduction

PURPOSE

The purpose of this service and parts manual is to provide instructions and illustrations for the operation and maintenance of the AB 46 Work Platform manufactured by UpRight, Inc. of Selma, California.

SCOPE

The manual includes procedures for proper operation, maintenance, adjustment, and repair of this product as well as recommended maintenance schedules and troubleshooting.

1.1 General Description

The AB46 Work Platform consists of the platform, controller, elevating assembly, power module, control module, and chassis.

Platform

The platform has a reinforced steel floor, 43.5 inch (1.11 m) high guardrails with midrail, 6 inch (152 mm) toeboards and an entrance gate at the side of the platform.

⚠ WARNING ⚠

DO NOT use the maintenance platform without guardrails properly assembled and in place.

Platform Controller

The platform controller contains the controls to operate the machine. It is located at the front of the platform cage. The foot switch must be depressed to operate any function from the platform. A complete explanation of control functions can be found in *Section 2*.

Elevating Assembly

The platform is raised and lowered by the elevating assembly; an articulated boom powered by two single stage lift cylinders. The hydraulic pump, driven by the batteries, powers the cylinders. Solenoid operated valves control raising and lowering.

Chassis

The chassis is a structural frame that supports all the components of the AB46 Work Platform. It contains the engine (BiEnergy models), batteries, hydraulic power unit, and electric drive motors.

PURPOSE OF EQUIPMENT

The objective of the AB46 Work Platform is to provide a quickly deployable, self propelled, variable height work platform to elevate personnel and materials to overhead work areas.

SPECIAL LIMITATIONS

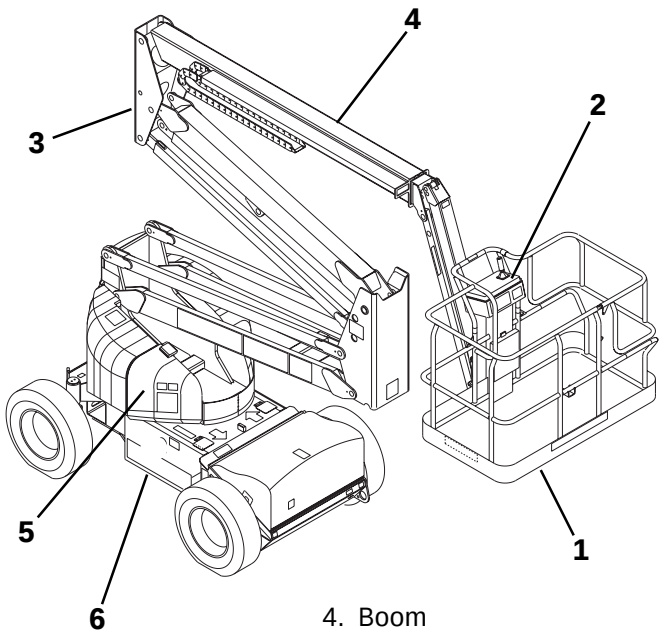
Travel with the platform raised is limited to a creep speed range.

Elevating of the Work Platform is limited to firm, level surfaces **only**. Any degree of slope greater than 5° will sound a warning alarm when machine is elevated. If machine is lowered, a light will illuminate on platform control box.

⚠ DANGER ⚠

The elevating function shall ONLY be used when the work platform is level and on a firm surface. The work platform is NOT intended to be driven over uneven, rough or soft terrain when elevated.

1. Platform
2. Platform Controller Assembly
3. Elevating Assembly



4. Boom
5. Chassis Control Module
6. Chassis

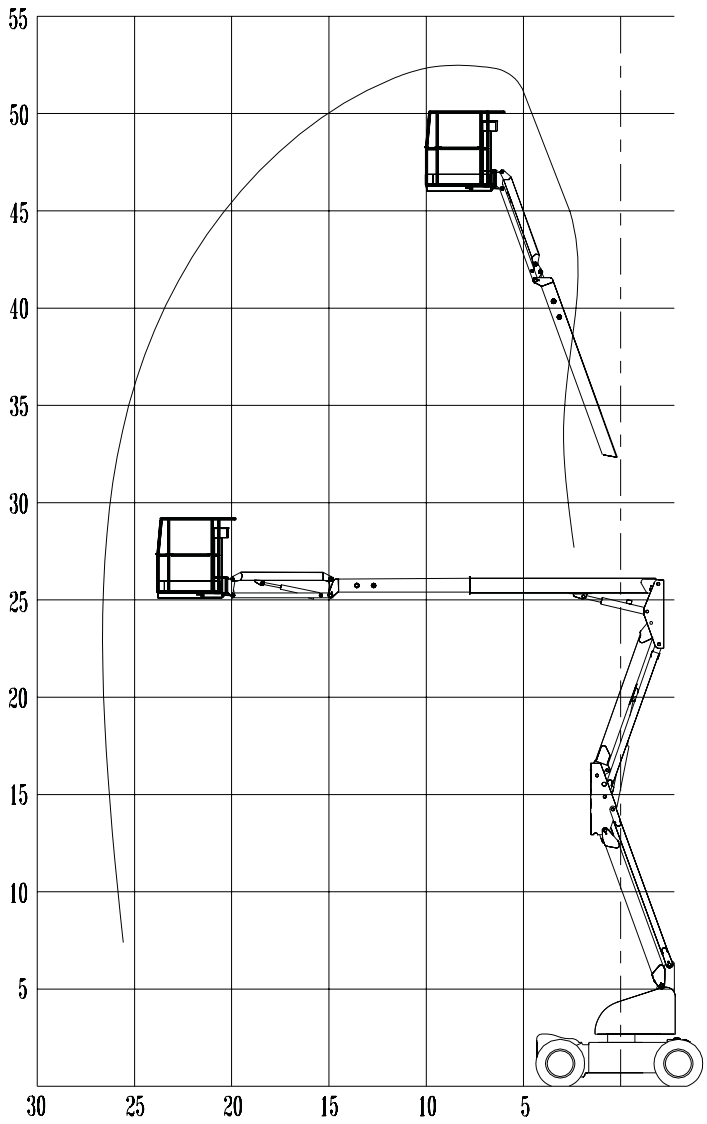
Figure 1-1: AB46 Work Platform

1.2 Specifications

Table 1-1: Specifications

ITEM	SPECIFICATION
Height	
Working height maximum	52 ft. [15.8 m]
Platform height maximum	46 ft. [13.98 m]
Platform step in height	9 in. [22.86 cm]
Up and over height	25 ft. [7.6 m]
Drivable height	46 ft. [13.98 m]
Horizontal outreach	24 ft. 6 in. [7.44 m]
Turret rotation	360 deg. non-continuous
Platform rotation	160 deg.
Tail swing	None
Jib length	5 ft. [1.52 m]
Jib arc	140 deg.
Inside turning radius	2 ft. [.61 m]
Outside turning radius	9 ft. 10 in. [2.98 m]
Drive speed (lowered)	3.5 mph [5.63 kph]
Drive speed (elevated)	.34 mph [.55 kph]
Gradeability	30%
Dimensions (boom stowed)	
Platform Size	69 in. x 39 in. [1.75 m x .99 m]
Guardrail height	43 1/2 in. [1.10 m]
Toeboards	6 in. [15.24 cm]
Maximum platform capacity	500 lbs. [226.8 kg]
Maximum no. of occupants	2
Weight	14,300 lbs. [6486.4 kg]
Overall height	6 ft 6 in. [1.97 m]
Overall length	17 ft. 10 in. [5.41 m]
Overall width	5 ft. 9 in. [1.75 m]
Wheel base	73 in. [1.85 m]
Wheel track	59 in. [1.5 m]
Ground Clearance	6 in. [15.24 cm]
Power source	Eight 6V, 350 AH Batteries One Kubota12 HP Diesel (BiEnergy models)
System voltage	48VDC
Maximum Hyd. Pressure	2500 psi [172.4 bar]
Controls	Electric Proportional
Tires	9.5x16.5 10 ply highway tread
Fuel tank - BiEnergy model	8 gal. [30 l]
Generator output	85 amps
Charger output	40 amps
Hydraulic tank	6 gal [22.7 l]

REACH ENVELOPE DIAGRAM



DIMENSIONS IN FEET

*** Specifications subject to change without notice.**
Meets or exceeds all applicable requirements of OSHA and ANSI A92.5-1992

Safety Rules and Operating Instructions

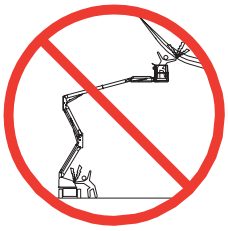
AB-46 Electric & Bi-Energy

WARNING

All personnel shall carefully read, understand and follow all safety rules, operating instructions, and the Scaffold Industry Association's MANUAL OF RESPONSIBILITIES (ANSI A92.5) before operating or performing maintenance on any UpRight boom supported aerial work platform.

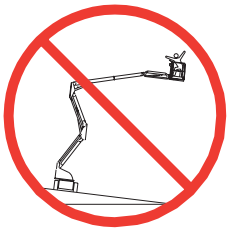
SAFETY RULES

Electrocution Hazard



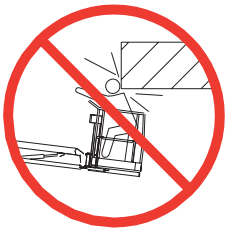
NEVER operate the machine within ten (10) feet of power lines. **THIS MACHINE IS NOT INSULATED.**

Tip Over Hazard



NEVER operate the boom or drive with platform elevated unless on firm level surface.

Collision Hazard



NEVER position the platform without first checking for overhead obstructions or other hazards.

Fall Hazard

NEVER climb, stand or sit on platform guardrails or midrail.

ALL occupants must wear an approved fall restraint properly attached to designated platform anchorage point. Attach only one fall restraint to each anchorage point.

NEVER exceed maximum platform load of 500 lbs. (225 kg) and two (2) occupants.

NEVER exceed 45 lbs. (200 N) of side force per occupant.

DISTRIBUTE all platform loads evenly on the platform.

NEVER operate the machine without first surveying the work area for surface hazards such as holes, drop-offs, bumps, curbs, or debris; and avoiding them.

OPERATE machine only on surfaces capable of supporting wheel loads.

NEVER elevate the machine when wind speeds exceed 28 mph (12.5 m/sec.).

IN CASE OF EMERGENCY push emergency stop button to cut power to all machine functions.

ALWAYS close and secure gate after entering platform.

NEVER exit or enter platform while elevated.

NEVER use ladders, scaffolding, or other items to gain height; work only from the platform floor.

NEVER climb down elevating assembly while platform is elevated.

INSPECT the machine thoroughly for cracked welds, loose or missing hardware, hydraulic leaks, loose wire connections, and damaged cables or hoses before using.

VERIFY that all labels are in place and legible before using. Refer to page 10 & 11 for label identification.

NEVER use a machine that is damaged, not functioning properly, or has damaged or missing labels.

IF ALARM SOUNDS while boom is elevated, STOP, carefully retract boom and lower platform without rotating. Move machine to a firm, level surface.

NEVER attach overhanging loads or use boom as a crane.

NEVER alter operating or safety systems without manufacturers written consent.

NEVER charge battery near sparks or open flame. Charging batteries emit explosive hydrogen gas.

NEVER replace any component or part with anything other than original UpRight replacement parts without the manufacturer's written consent.

NEVER tow the machine. Transport by truck or trailer only.

AFTER USE, secure the work platform from unauthorized use by turning both keyswitches off and removing all keys.

Safety Rules and Operating Instructions

Operation

Introduction

This section covers the operation of Electric and Bi-Energy powered models of the AB-46.

Pre-Operation and Safety Inspection

Carefully read, understand and follow all safety rules, labels, and operating instructions, then perform the following steps each day before use.

Perform a complete visual inspection of the entire unit prior to operating. Check the following areas for discrepancies:

1. Open panels and check hydraulic components / hoses for damage or leaks. Check electrical components / wiring for damage or loose connections.
2. Inspect chassis, axles, hubs, and steering linkage for damage, deformation, buckled paint, loose or missing hardware, and cracked welds.
3. Check tires for damage, punctures, and inflation; tire pressure must be 75 psi.
4. Check all hoses / cables for wear.
5. Inspect elevating assembly for damage, deformation, buckled paint, loose or missing hardware, and cracked welds.
6. Inspect platform and guardrails for damage, deformation, buckled paint, loose or missing hardware, and cracked welds. Insure that gate operates freely and latches securely.
7. Check Hydraulic fluid level with platform fully lowered.
8. Check battery fluid level (see battery maintenance, page 2-8).
9. Check fuel level, add fuel if necessary.
10. Ensure that radiator is cold, check coolant level. Add if necessary.

⚠ WARNING ⚠

NEVER remove the cap from a hot radiator. Hot coolant can cause severe burns.

⚠ WARNING ⚠

DO NOT use a machine that is damaged or malfunctioning. Tag and remove the unit from service until it is repaired.

SYSTEM FUNCTION INSPECTION

Note: Refer to figures 1 and 2 for chassis and platform control locations.

1. Before performing the following tests, check area around machine and overhead for obstructions, holes, drop-offs, and debris.
2. Turn chassis key switch to chassis, and turn on (rotate clockwise) emergency stop switches at the chassis control panel and at the platform control panel.

Note: Bi-Energy machines may be powered by batteries or by engine. To power the machine by engine, press engine start button to crank engine; release when engine starts. If engine is cold: press the preheat button and hold for six seconds prior to starting diesel models.

3. Push in the chassis emergency stop button and operate any function switch at the chassis control panel, function should NOT activate. Repeat for platform emergency stop button, operating chassis controls. Return both emergency stop switches to the on position.
4. Operate each function switch to raise / lower, extend / retract, rotate left / right, each section of the elevating assembly and observe the operation of the machine. All functions should operate through full cycle smoothly.
5. Turn chassis key switch to platform.
6. Mount the platform, close and latch the gate, and attach approved fall restraint to designated platform anchorage point. Attach only one fall restraint to each point.
7. Without depressing the foot switch, move the drive control handle, machine should not function.
8. Depress the foot switch and move the drive control handle forward and reverse. Observe that proportional functions operate smoothly, and that brakes apply quickly after control is released.
9. While depressing foot switch, operate steer switch to left and right. Observe that steering wheels turn properly.
10. While depressing foot switch, turn function speed control knob to desired setting, and operate boom controls. Observe that boom operates smoothly, and that upper boom, jib, turret rotation, platform level, and platform rotation controls operate proportionally in conjunction with function speed control knob. Observe that platform maintains level when boom is elevated.
11. With the upper boom elevated one foot, operate drive control handle. Observe that drive speed is limited to creep (1/2 foot [.15m] per second). Lower upper boom to stowed position.
12. Press the service horn button. Observe that horn is audible.

Bi-Energy Model Controls and Indicators

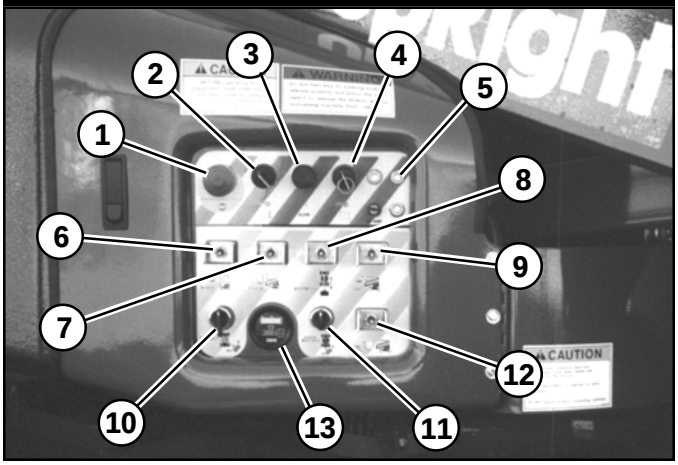


Figure 2-1A: Chassis Controls

Note: The following list corresponds to the numbered items in figures 1A and 2A.

1. Emergency stop.
2. Diesel Engine start.
3. Glow Plug button.
4. Keyswitch
5. Control fuses.
6. Riser control.
7. Upper boom control.
8. Boom extension control.
9. Jib control.
10. Turret rotation control.
11. Platform rotation control.
12. Platform level control.
13. Battery condition indicator & Hourmeter.
14. Service horn button.
15. Drive control handle.
16. Function speed control.
17. Foot switch (located on platform floor).
18. Out of level indicator.
19. Low Voltage indicator.

Electric Model Controls and Indicators

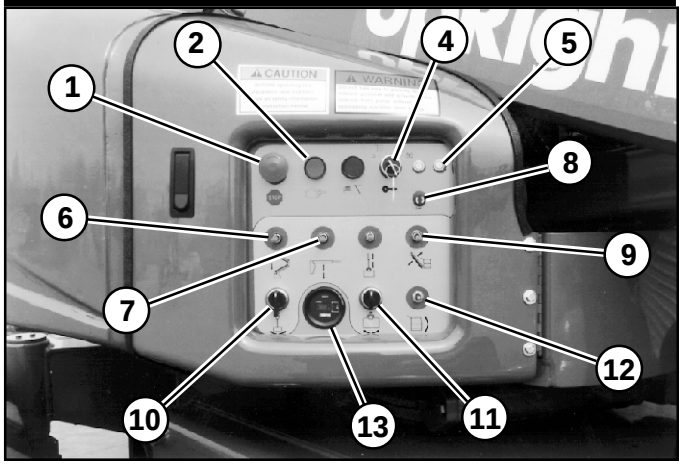


Figure 2-1B: Chassis Controls

Note: The following list corresponds to the numbered items in figures 1A and 2A.

1. Emergency stop.
2. Electric motor start.
3. Low Voltage Indicator.
4. Keyswitch
5. Control fuses.
6. Riser control.
7. Upper boom control.
8. Boom extension control.
9. Jib control.
10. Turret rotation control.
11. Platform rotation control.
12. Platform level control.
13. Hourmeter.
14. Service horn button.
15. Drive control handle.
16. Function speed control.
17. Foot switch (located on platform floor).
18. Out of level indicator.

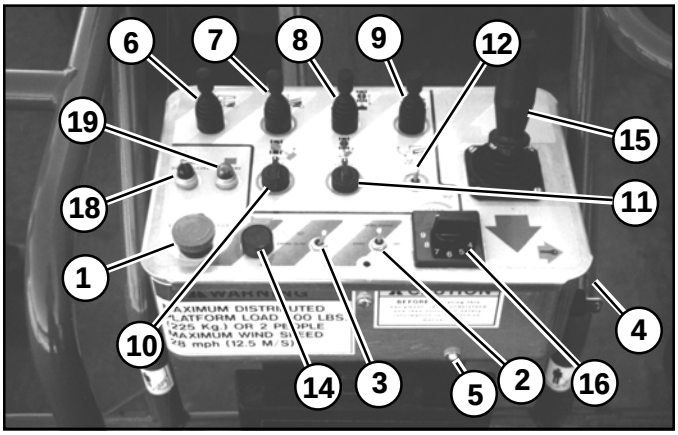


Figure 2-2A: Platform Controls

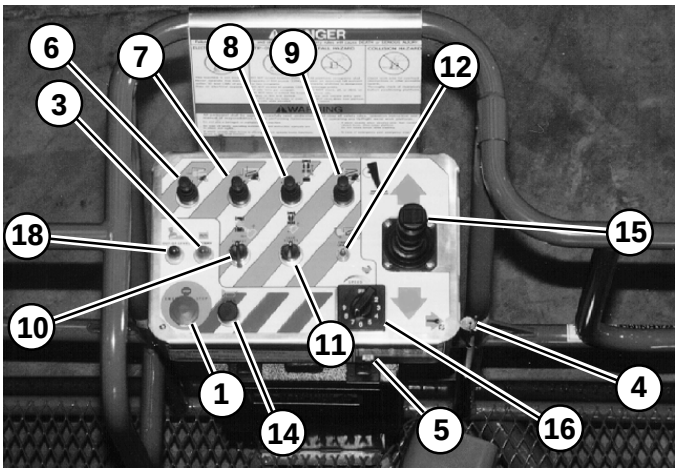


Figure 2-2B: Platform Controls

Operation

Before operating work platform insure that:

Pre-operation and safety inspection has been completed, and any discrepancies have been corrected.

The operator has been thoroughly trained on the operation of the machine.

The work area is clear of all obstructions, holes, drop-offs, or persons in the route of travel.

The surface is capable of supporting wheel loads.

Refer to figures one and two for control locations.

Emergency Stop

At any time during operation, press the emergency stop button to stop all functions in an emergency.

Service Horn

At any time during operation, press service horn button to sound an audible warning if necessary.

⚠ WARNING ⚠

Always wear an approved fall restraint properly attached to designated platform anchorage point when driving or elevating the machine (see Figure 2-3).

Attach only one fall restraint to each anchorage point.

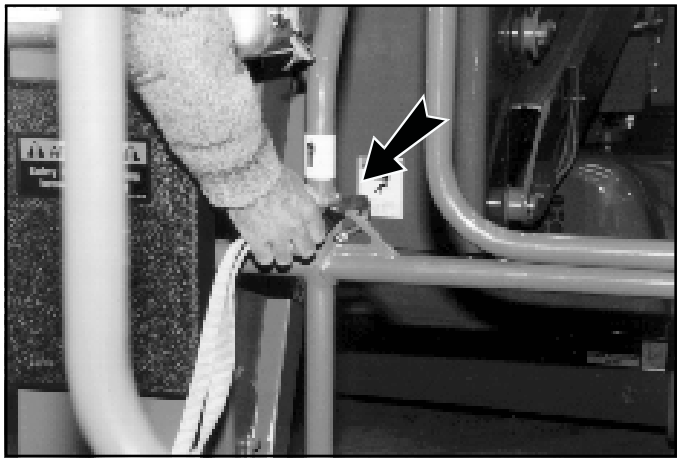


Figure 2-3: Typical Fall Restraint Anchorage Point

Driving

With Boom Lowered

1. Turn chassis key switch to platform, and turn on (turn clockwise) the chassis emergency stop switch.
2. Mount the platform, close and latch the gate.
3. Attach approved fall restraint to designated platform anchorage point. Attach only one fall restraint to each point.
4. Check that the area around and above the work platform is clear of obstructions, holes, drop-offs, persons in the route of travel, and the surface is capable of supporting wheel loads.
5. Depress the foot switch and move the drive control handle forward to travel forward and reverse to travel in the reverse direction.

Note: When the boom is rotated to the front of the chassis (steering wheels aft) directions of travel and steering will be reversed. Observe the color coded arrows on the control panel near the drive control handle, and on the chassis. They will indicate the direction of travel when the drive control handle is moved.

With Boom Elevated

Travel with boom elevated is restricted to firm level surfaces only.

When driving elevated, the machine will travel at creep speed (1/2 foot [.15 m] per second).

Steering

1. While depressing the foot switch, push the steering switch (located on top of the control handle) to the left to turn left, and right to turn right.

Note: Steering is not self centering. Wheels must be returned to the straight ahead position by operating the steering switch.

POSITIONING THE PLATFORM

Positioning the platform as close as possible to the work area requires some planning. First, you must survey the work site to find a suitable place to park the machine. This must be a firm level area as close as possible to the work area. Take into consideration all obstructions on the ground and overhead and avoid them.

Once you have moved the machine to a firm level surface as near as possible to the work area, follow the instructions on page 5 to position the platform.

Always, before operating any function, check the area around and overhead for any obstructions or electrical conductors.

Multifunction Controls

The UpRight AB-46 employs the use of multifunction controls. This means that riser or boom extension will function at full speed while simultaneously operating upper boom, jib, turret, or rotating the platform.

The turret may be rotated while driving if necessary to make turns in tight areas. All other boom functions will not operate while driving.

Lower Control Operation

All boom functions will operate at fixed speed.

1. Turn chassis keyswitch to chassis controls.
2. Operate boom control switches to position the platform.

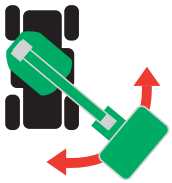
Leveling the Platform

⚠ WARNING ⚠

DO NOT operate the machine if the platform does not maintain level when elevated.

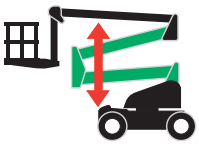
Note: Platform leveling can be performed only with the boom stowed and should be done only to calibrate the automatic leveling system.

1. Set the function speed control dial to the desired setting. Rotate the dial clockwise to increase speed, counterclockwise to decrease. If you are not sure what speed to use, start out slow; the speed can be varied while operating the function.
2. While depressing the foot switch, push the platform level control switch forward to swing the platform upward, rearward to swing the platform downward. Release the switch to stop leveling.



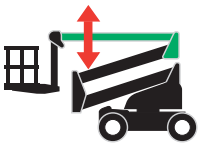
Rotating the Turret

1. Set the function speed control dial to the desired setting. Rotate the dial clockwise to increase speed, counterclockwise to decrease. If you are not sure what speed to use, start out slow; the speed can be varied while operating the function.
2. While depressing the foot switch, turn the turret rotation control switch counterclockwise to rotate left, clockwise to rotate right. Release the switch to stop rotation. Observe the area around the boom when rotating the turret to avoid any obstructions.



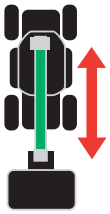
Elevating the Riser

1. While depressing the foot switch, push the riser control lever forward to elevate the riser, rearward to lower the riser. Release the control lever to stop elevating / lowering. The riser will function at a constant speed, function speed control setting is not necessary.



Elevating the Upper Boom

1. Set the function speed control dial to the desired setting. Rotate the dial clockwise to increase speed, counterclockwise to decrease. If you are not sure what speed to use, start out slow; the speed can be varied while operating the function.
2. While depressing the foot switch, push the upper boom control lever forward to elevate the upper boom, rearward to lower the upper boom. Release the control lever to stop elevating / lowering.



Extending the Upper Boom

1. While depressing the foot switch, push the boom extension control lever rearward to extend the boom, forward to retract the boom. Release the control lever to stop extending / retracting. The boom extension will function at a constant speed, function speed control setting is not necessary.

Elevating the Jib

1. Set the function speed control dial to the desired setting. Rotate the dial clockwise to increase speed, counterclockwise to decrease. If you are not sure what speed to use, start out slow; the speed can be varied while operating the function.
2. While depressing the foot switch, push the jib control lever forward to elevate the jib, rearward to lower the jib. Release the control lever to stop elevating / lowering.

Rotating the Platform

1. Set the function speed control dial to the desired setting. Rotate the dial clockwise to increase speed, counterclockwise to decrease. If you are not sure what speed to use, start out slow; the speed can be varied while operating the function.
2. While depressing the foot switch, turn the platform rotation control switch counterclockwise to rotate left, clockwise to rotate right. Release the switch to stop rotation.

EMERGENCY OPERATION

In the event of powered function failure, the elevating assembly may be lowered manually by the following procedure.

> **⚠ WARNING ⚠**
>
> **NEVER** climb down the elevating assembly. If controls do not respond, ask someone on the ground to lower the boom manually.

Lowering Elevating Assembly

1. Open the cover on the hydraulic module (opposite side of the turret from the chassis control panel).
2. Remove the wire loop retainer from the hand pump lever, and extend the handle upward to gain leverage.
3. Operate the manual override (knurled knob) on the appropriate valve (see figure 4). Push in to lower / extend, pull out to raise / retract as required.
4. While holding the appropriate valve in position, pump the handle in and out until that section of the elevating assembly is lowered / retracted.
5. Repeat as necessary operating each valve until the elevating assembly is fully lowered.

Rotating Turret

1. Obtain a 7/8 inch ratcheting wrench.
2. Place the socket of the wrench onto the hex shaft stub of the turret rotation gearbox.
3. Turn the wrench clockwise to rotate the turret counterclockwise, turn counterclockwise to rotate the turret clockwise.

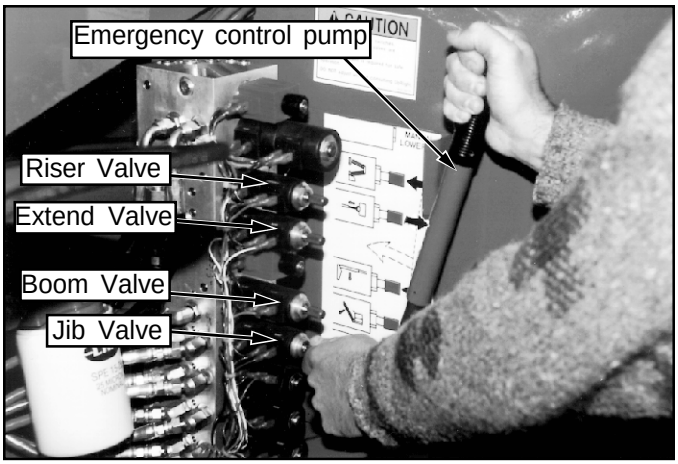


Figure 2-4: Emergency Control Operation

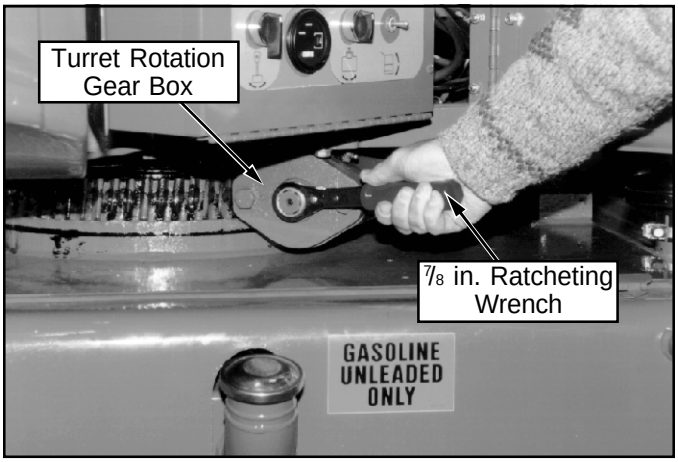


Figure 2-5: Manual Turret Rotation

EMERGENCY TOWING

Perform the following only when the machine will not operate under its own power and it is necessary to move the machine or when winching onto a trailer for transportation.

1. Insure that the platform is fully lowered, and that the turret is rotated so the platform is to the rear of the machine.
2. Attach chain / cable of sufficient strength for towing the machine to front or rear tie down lugs.
3. Turn the keyswitch to the parking brake release position. Alarm will sound.
4. Operate the emergency control pump four full strokes to release brakes.
5. After moving the machine, return the keyswitch to the off position and remove the key to prevent unauthorized operation. Brakes are now reset. Alarm will stop.

> **⚠ CAUTION ⚠**
>
> DO NOT move the machine faster than 3 mph. Faster speeds will damage drive components and void warranty.

AFTER USE EACH DAY

1. Ensure that the platform is fully lowered.
2. Park the machine on level ground, preferably under cover, secure against vandals, children or unauthorized operation.
3. Turn the key switch to **OFF** and remove all keys to prevent unauthorized operation.

BATTERY CHARGING

See *Maintenance,* page 2-9.

Transportation

BY CRANE

⚠ WARNING ⚠

Stand clear of machine when lifting.

Check specifications on back page, insure that crane and slings are of correct capacity to lift weight of unit.

1. Insure that boom is fully lowered and retracted.
2. Attach straps to chassis lifting lugs only. Insure that straps are adjusted properly to keep unit level when lifting.

BY TRUCK OR TRAILER

1. Insure that boom is fully lowered and retracted.
2. Maneuver the machine onto bed of truck / trailer.
3. When winching, follow instructions for emergency towing on page 2-7. Attach winch cable to front tie down lugs.

⚠ CAUTION ⚠

Do not winch machine faster than 3 mph.

4. After winching, insure that brakes are set.
5. Secure the machine to the transport vehicle using chains / straps of adequate load capacity (refer to specifications, back page) attached to chassis tie down lugs (see Figure 2-6).
6. Place a wooden block (7.5" x 4" x 28") under platform support braces as shown (see Figure 2-6).
7. Attach ratchet strap; under platform floor grating, over support braces (see Figure 2-6). Tighten securely, do not overtighten.

⚠ WARNING ⚠

NEVER elevate the machine while on a truck or trailer.

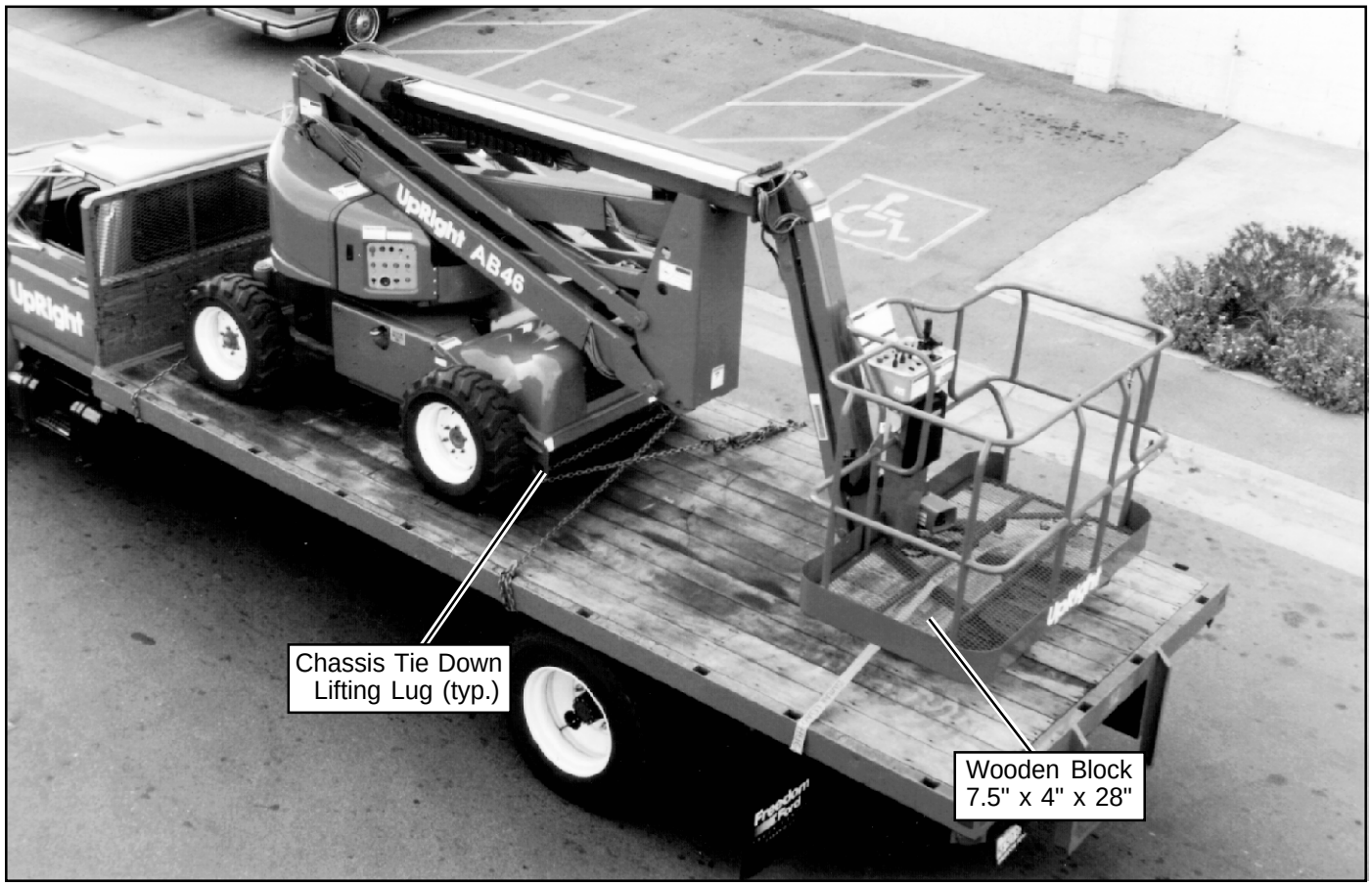


Figure 2-6: Securing the Machine for Transportation

TIRES

Tire selection can affect the stability of the machine. Use only tires supplied by UpRight unless approved by the manufacturer in writing.

BATTERY CHARGING

⚠ WARNING ⚠

Charge batteries only in a well ventilated area.

Hazard of explosive gas mixture. Keep sparks, flame and smoking materials away from batteries.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Rinse away any spilled fluid thoroughly with clean water.

Always replace batteries with UpRight batteries or manufacturer approved replacements weighing 120 lbs. each.

Charge batteries as follows:

1. Check the batteries fluid level. If the electrolyte level is lower than 3/8 in. (10 mm) above the plates, add clean, distilled water only.
2. Verify charger voltage switch is set to the correct voltage.
3. Connect extension cord (minimum 12 gauge (1.5 mm) conductor and maximum 50 ft. (15 m) in length) to charger plug located through the opening in front of the chassis (Figure 2-7). Connect extension cord to properly grounded outlet of proper voltage and frequency.
3. The charger will turn on automatically.
4. When the batteries are fully charged, the charger will turn off automatically .

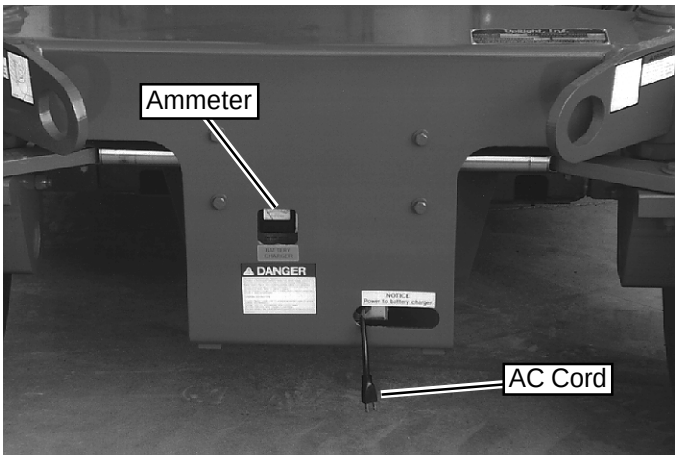


Figure 2-7: Battery Charger

BATTERY MAINTENANCE

Check battery fluid level daily, especially if work platform is being used in a warm, dry climate.

If electrolyte level is lower than 3/8 in. (10 mm) above plates add distilled water only. DO NOT use tap water it will shorten battery life.

Keep terminals and top of battery clean.

HYDRAULIC OIL

1. Check oil level at dipstick and/or sight gauge inside engine compartment left hand side with the platform fully lowered.
2. Lift flap located on top of chassis left side (see Figure 2-9).
3. Open filler / breather cap.
4. If necessary, fill to capacity with clean ISO 46 compatible hydraulic oil.
5. Replace cap.

LUBRICATION

Refer to service manual for lubrication chart and guidelines.

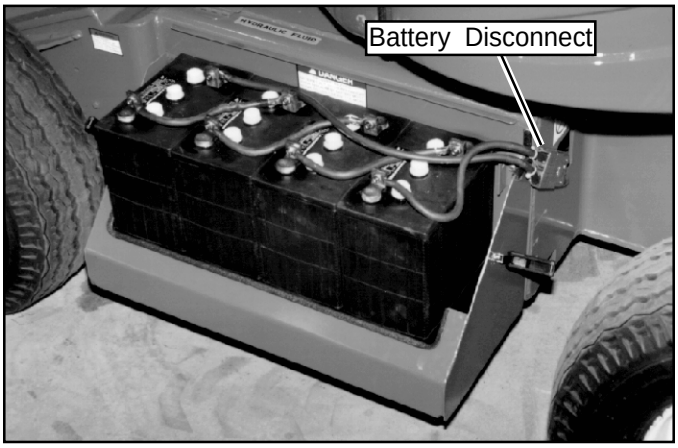


Figure 2-8: Batteries (Typical Both Sides)

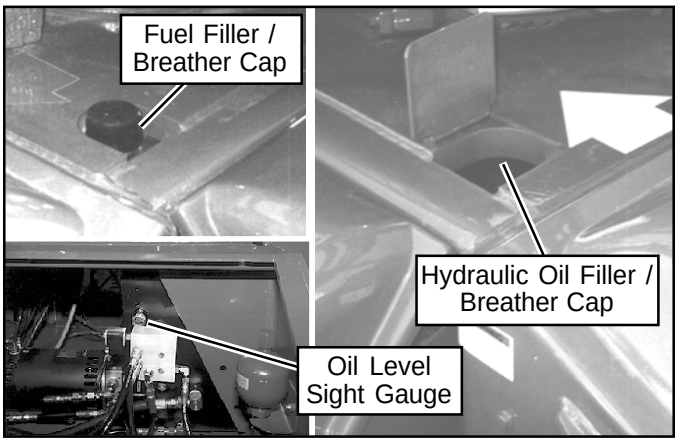


Figure 2-9: Hydraulic Oil Filler / Breather Cap, Fuel Filler / Breather Cap, and Oil Level Sight Gauge

NOTES:

3.0 Introduction

⚠ WARNING ⚠

Be sure to read, understand and follow all information in the *Operation Section* of this manual before attempting to operate or perform service on any AB46 Work Platform.

NOTE: Bi-Energy models - For service Information on the engine, refer to your engine manual.

This section contains procedures for the operation inspection, adjustment, scheduled maintenance, and repair/removal of the AB46.

Section 2.0 will aid in understanding the operation and function of the various components and systems of the AB46 and help in diagnosing and repair of the machine.

Refer to Table 3-1, Preventative Maintenance Checklist, for recommended maintenance intervals.

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

TERMINOLOGY

TERMINAL BLOCKS: Located in upper and lower control boxes. Designated by **TB##**. (##) designates the number of the block which is written on the terminal block. "R" right or "L" may follow the number.

WIRE COLOR: Indicated by **color/color**. First color refers to insulation color and second color indicates stripe. If second color is not given there is no stripe.

FORWARD: Front of machine indicated by yellow arrows on chassis.

AFT: Rear of machine indicated by orange arrows on machine.

GENERAL PROCEDURES

CONTACT BLOCKS: Removed by inserting a flat screwdriver into the slot at either end of block and prying outward. Installed by pressing into an empty slot.

SWITCH MOUNT BASE: Assembled to back of switch actuator. Removed by rotating the small black lever counterclockwise and lifting off base.

TERMINAL BLOCKS: Remove wires by inserting a small flat bladed screwdriver into square beside wire. Install wires by stripping 1/2" of insulation, inserting screwdriver in square and inserting wire. Be sure no strands are bend backwards. Replace wires with same rating and type.

LOWER CONTROL BOX

Disconnect battery connectors at front of each battery box. Bi-Energy machines, disconnect negative lead from starter battery in chassis. With left battery cover in place to prevent shorting, remove hardware which secures control box cover and rest on battery cover.

SPECIAL TOOLS

The following is a list of special tools which may be required to perform certain maintenance procedures on the AB46 work platform.

0-1000 PSI Hydraulic Pressure Gauge with Adapter Fittings (UpRight P/N 014124-010)

0-3000 PSI Hydraulic Pressure Gauge with Adapter Fittings (UpRight P/N 014124-030)

0-30 Gallon Hydraulic Flow Meter With 0-3000 P.S.I. Simulated Load and Adapter Fittings (UpRight P/N 67040-000)

Adapter Fitting (UpRight P/N 063965-002)

Inclinometer (UpRight P/N 010119-000)

MOS90 Calibrator (UpRight P/N 057128-000)

Crimping Tool (UpRight P/N 028800-009

Terminal Removal Tool (P/N 028800-006)

3.1 Preventative Maintenance (Table 3-1)

The complete inspection consists of periodic visual and operational checks, together with all necessary minor adjustments to assure proper performance. Daily inspection will prevent abnormal wear and prolong the life of all systems. The inspection and maintenance schedule is to be performed at regular intervals. Inspection and maintenance shall be performed by personnel who are trained and familiar with mechanical and electrical procedures.

⚠ WARNING ⚠

Before performing preventative maintenance, familiarize yourself with the operation of the machine.

Always block the elevating assembly whenever it is necessary to perform maintenance while the platform is elevated.

Maintenance

The preventative maintenance table has been designed to be used primarily for machine service and maintenance repair. Please photocopy this page and use the table as a checklist when inspecting the machine for service.

Preventative Maintenance Table Key

Interval

Daily = each shift or every day
50h/30d = every 50 hours or 30 days
250h/6m = every 250 hours or 6 months
1000h/2y = every 1000 hours or 2 years

Y = Yes/Acceptable
N = No/Not Acceptable
R = Repaired/Acceptable

Preventative Maintenance Report

Date: _____
Owner: _____
Model No: _____
Serial No: _____
Serviced By: _____
Service Interval: _____

Table 3-1: Preventative Maintenance Checklist

COMPONENT	INSPECTION OR SERVICES	INTERVAL	Y	N	R
Battery	Check electrolyte level	6M			
	Check specific gravity	6M			
	Clean exterior	6M			
	Check battery cable condition	Daily			
	Clean terminals	6M			
Engine Oil and Filter	Check level and condition	Daily			
	Check for leaks	Daily			
	Change oil and filter	100H			
Engine Fuel System	Check fuel level	Daily			
	Check for leaks	Daily			
	Replace fuel filter	6M			
	Check air cleaner	Daily			
Engine Coolant	Check coolant level (with engine cold)	Daily			
	Replace coolant	400H			
Hydraulic Oil	Check oil level	Daily			
	Change filter	6M			
	Drain and replace oil	2Y			
Hydraulic System	Check for leaks	Daily			
	Check hose connections	30D			
	Check hoses for exterior wear	30D			
Emergency Hydraulic System	Operate the emergency lowering valve and check for serviceability	Daily			
Controller	Check switch operation	Daily			
Control Cable	Check the exterior of the cable for pinching, binding or wear	Daily			
Platform Deck and Rails	Check fasteners for proper torque	Daily			
	Check welds for cracks	Daily			
	Check condition of deck	Daily			
Tires	Check for damage	Daily			
	Check air pressure (75 psi [5.2 bar])	Daily			

Table 3-1: Preventative Maintenance Checklist (cont'd.)

	Check lug nuts (torque to 80 ft. lbs. [109 Nm])	30D			
COMPONENT	INSPECTION OR SERVICES	INTERVAL	Y	N	R
Hydraulic Pump	Check for leaks at mating surfaces	30D			
	Check for hose fitting leaks	Daily			
	Check mounting bolts for proper torque	30D			
Drive Motors	Check for operation	Daily			
Torque Hubs	Check for leaks	Daily			
	Check Oil level	250H/6M			
	Change Oil after break-in	50H/30D			
	Change Oil	1000h/2y			
Steering System	Check hardware & fittings for proper torque	6M			
	Grease pivot pins	30D			
	Oil king pins	30D			
	Check steering cylinder for leaks	30D			
Elevating Assembly	Inspect for structural cracks	Daily			
	Check pivot points for wear	30D			
	Check mounting pin pivot bolts for proper torque	30D			
	Check elevating arms for bending	6M			
	Grease linkage pins	30D			
Chassis	Check hoses for pinch or rubbing points	Daily			
	Check component mounting for proper torque	6M			
	Check welds for cracks	Daily			
Lift Cylinder	Check the cylinder rod for wear	30D			
	Check mounting pin pivot bolts for proper torque	30D			
	Check seals for leaks	30D			
	Inspect pivot points for wear	30D			
	Check fittings for proper torque	30D			
Steering Cylinder	Check the cylinder rod for wear	30D			
	Check mounting pin pivot bolts for proper torque	30D			
	Check seals for leaks	30D			
	Inspect pivot points for wear	30D			
	Check fittings for proper torque	30D			
Entire Unit	Check for and repair collision damage	Daily			
	Check fasteners for proper torque	3M			
	Check for corrosion-remove and repaint	6M			
	Lubricate	30D			
Labels	Check for peeling, missing, or unreadable labels & replace	Daily			
Turret	Lubricate teeth	30D			
	CHECK BOLTS FOR TORQUE	150HR			
	GREASE GEARBOX	150HR			

3.2 Blocking Elevating Assembly (Figure 3-1)

⚠ WARNING ⚠

Never perform service on the work platform in the elevating assembly area while platform is elevated without first blocking the elevating assembly.

DO NOT stand in elevating assembly area while deploying or storing brace.

Installation

1. Park the work platform on firm level ground.
2. Fully retract upper boom.
3. Verify platform emergency stop switch is ON.
4. Turn platform/chassis switch to **CHASSIS**.
5. Using the raise button, elevate platform 8-12 inches.
6. Connect a crane or overhead hoist capable of supporting elevating assembly to front of elevating assembly.
7. Install brace capable of supporting elevating assembly under upper boom as shown.
8. Push lower button and gradually lower platform until brace is supporting the platform.
9. Push electric motor start button to stop electric motor.

Removal

1. Using chassis controls, gradually raise platform until upper boom is off brace.
2. Remove brace and unhook chain from front of upper boom.
3. Push lower button to completely lower platform.

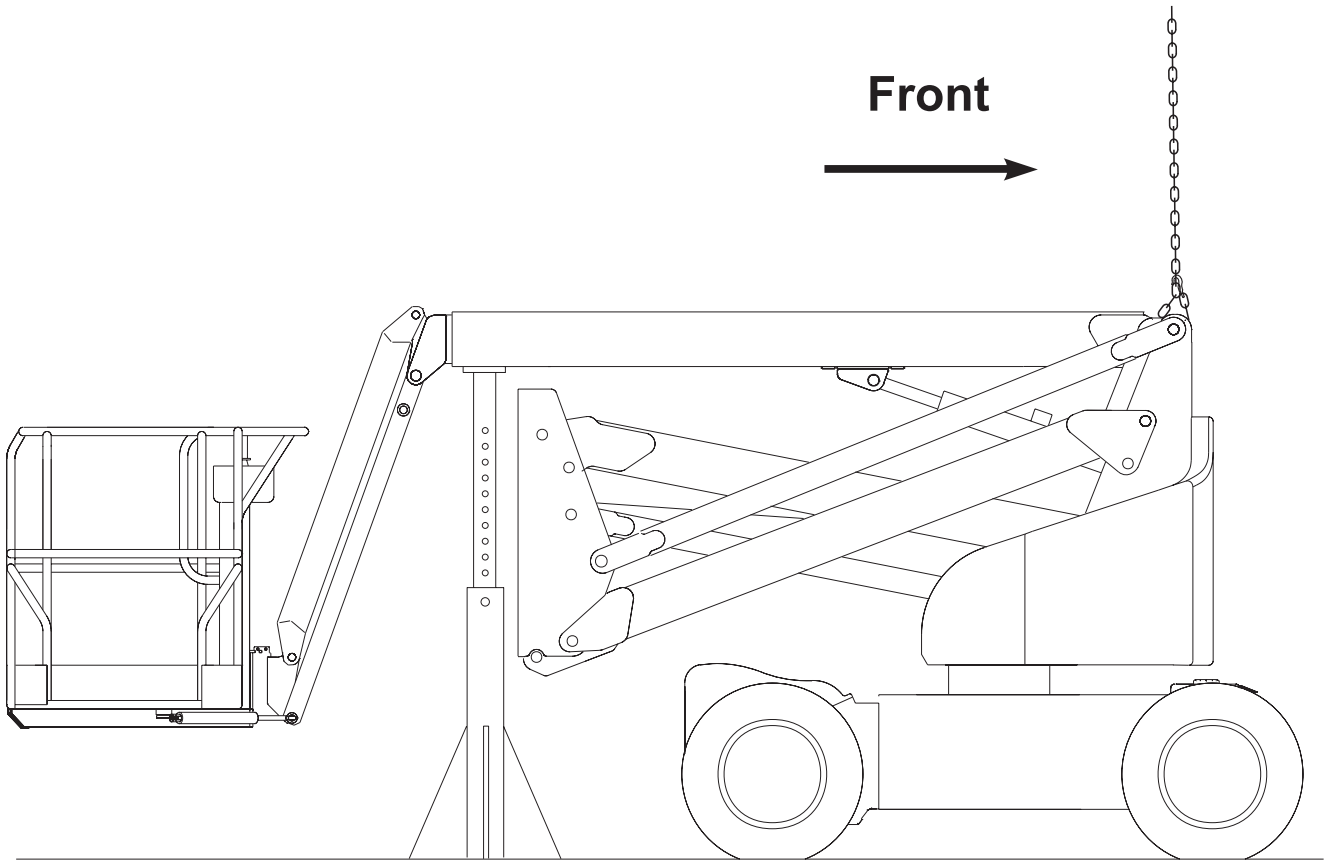


Figure 3-1: Blocking Elevating Assembly

3.3 Battery Maintenance

⚠ WARNING ⚠

Hazard of explosive gas mixture. Keep sparks, flame, and smoking material away from battery.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Thoroughly rinse away any spilled fluid with clean water.

BATTERY INSPECTION AND CLEANING

Check battery fluid level daily, especially if work platform is being used in a warm, dry climate. If required, add distilled water ONLY. Use of tap water will shorten battery life.

The batteries should be inspected regularly for signs of cracks in the case, electrolyte leakage and corrosion of the terminals. Inspect cables for worn spots or breaks in the insulation and for broken cable terminals.

Clean the batteries when they show signs of corrosion at the terminals or when electrolyte has overflowed during charging. Use a baking soda solution to clean the batteries, taking care not to get the solution inside the cells. Rinse thoroughly with clean water. Clean battery and cable contact surfaces to a bright metal finish whenever a cable is removed.

⚠ WARNING ⚠

Hazard of explosive gas mixture. Keep sparks, flame, and smoking material away from battery.

Always wear safety glasses when working with batteries.

Battery fluid is highly corrosive. Thoroughly rinse away any spilled fluid with clean water.

BATTERY CHARGING

Charge batteries at the end of each work shift or sooner if the batteries have been discharged.

⚠ WARNING ⚠

Charge the batteries only in a well ventilated area.

Do not charge the batteries when the work platform is in an area containing sparks or flames.

Permanent damage will result if the batteries are not immediately recharged after discharging.

Never leave the charger unattended for more than two days.

Never disconnect the cables from the batteries when the charger is operating.

Keep the charger dry.

Charge batteries as follows:

1. Check the fluid level. If the electrolyte level is lower than 3/8 in. (10mm) above the plates, add clean, distilled water only.
2. Connect the charger plug to a properly grounded outlet of the proper voltage and frequency.
3. The charger turns on automatically after a short delay.
4. The charger turns off automatically when the batteries are fully charged.

3.4 Lubrication

Refer to Table 3-1 for the lubrication intervals and Figure 3-2 for location of items that require lubrication service. Refer to the appropriate sections for lubrication information on the Steering Linkage, Torque hubs, Hydraulic Oil, Filter, and Engine Oil and Filter.

GREASE FITTINGS

Wipe each grease fitting before and after greasing. Using multipurpose grease in a grease gun, pump the grease into the fitting until grease just begins to appear at the edges of the pivot, wipe off any excess grease.

HYDRAULIC OIL AND FILTER

Fluid Level

With the platform fully lowered, check oil level on dipstick (sight gauge - Electric models). If the oil is NOT in operating range, add hydraulic fluid until oil is visible in operating range on dipstick or visible in sight gauge. DO NOT fill above operating range or when the platform is elevated.

Oil and Filter Replacement

1. Operate the platform for 10-15 minutes to bring the hydraulic oil up to normal operating temperature.

⚠ CAUTION ⚠

The hydraulic oil may be hot enough to cause burns. Wear safety gloves and safety glasses when handling hot oil.

2. Provide a suitable container to catch the drained oil. The hydraulic tank has a capacity of 5.0 gallons (19 l).
3. Remove the drain plug and allow all oil to drain into the container. Be sure to dispose of oil properly.
4. Reinstall the drain plug.
5. Remove filter element from filter head (located beside valve block).
6. Apply a thin film of clean hydraulic oil (ISO No. 46) to the gasket of the replacement filter.
7. Thread replacement filter onto the filter head until the gasket makes contact then rotate 3/4 of a turn further.
8. Fill the hydraulic oil tank to operating level on dipstick (sight gauge -Electric model) with ISO #46 hydraulic oil.

NOTE: Bi-Energy models - For service Information on the engine refer to your engine manual.

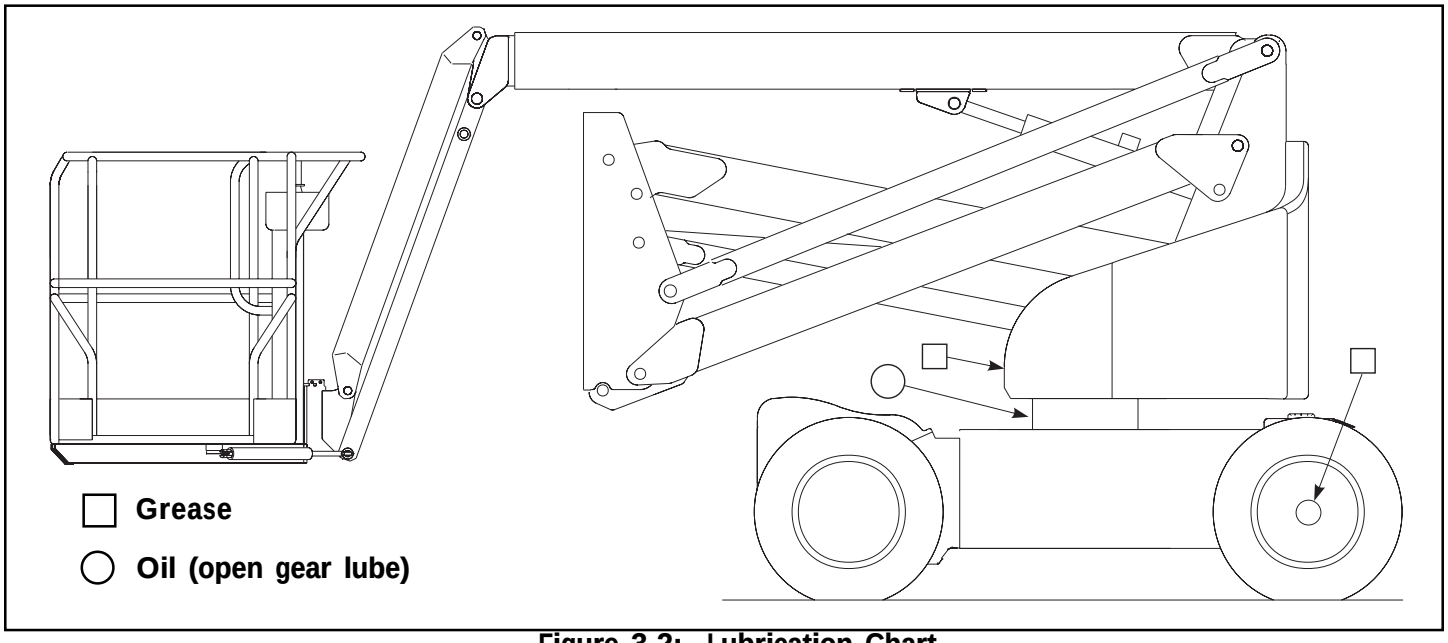


Figure 3-2: Lubrication Chart

TORQUE HUBS

Note: Change oil in torque hubs after the first 50 hours of operation. Change every 2000 hours thereafter.

1. Remove torque hub from drive assembly (refer to section 3-12).
2. Remove drain plug from underside of torque hub and drain oil from unit.
3. Replace drain plug.
4. Remove fill plug from top side of torque hub.
5. Remove fill level plug from side of hub.
6. Fill unit with 90 wt. gear oil until oil comes out fill level plug opening(1/2 full).
7. Replace fill level plug. Replace fill plug.

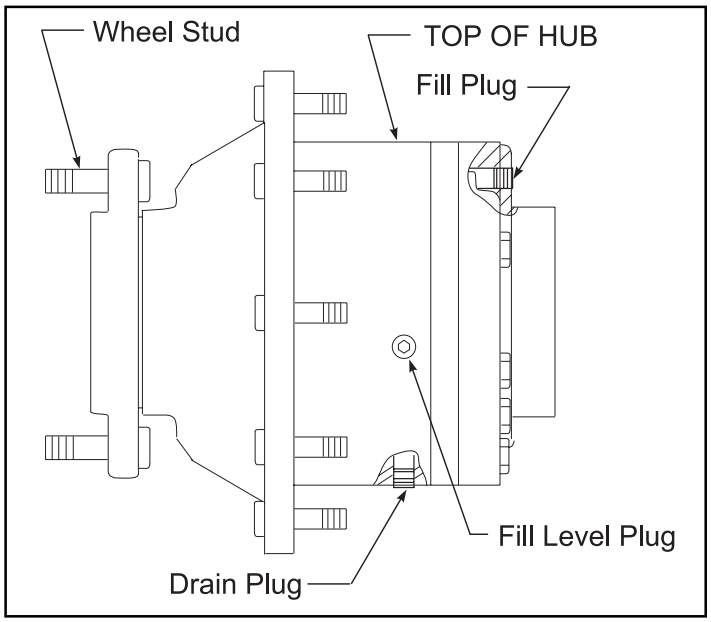


Figure 3-3: Torque Hub

3.5 Setting Hydraulic Pressures

Figure (3-9) shows complete hydraulic manifold assembly.

Note: Check hydraulic pressures whenever the pump, manifold or any relief valve has been serviced or replaced.

HIGH RELIEF VALVE (Figure 3-4)

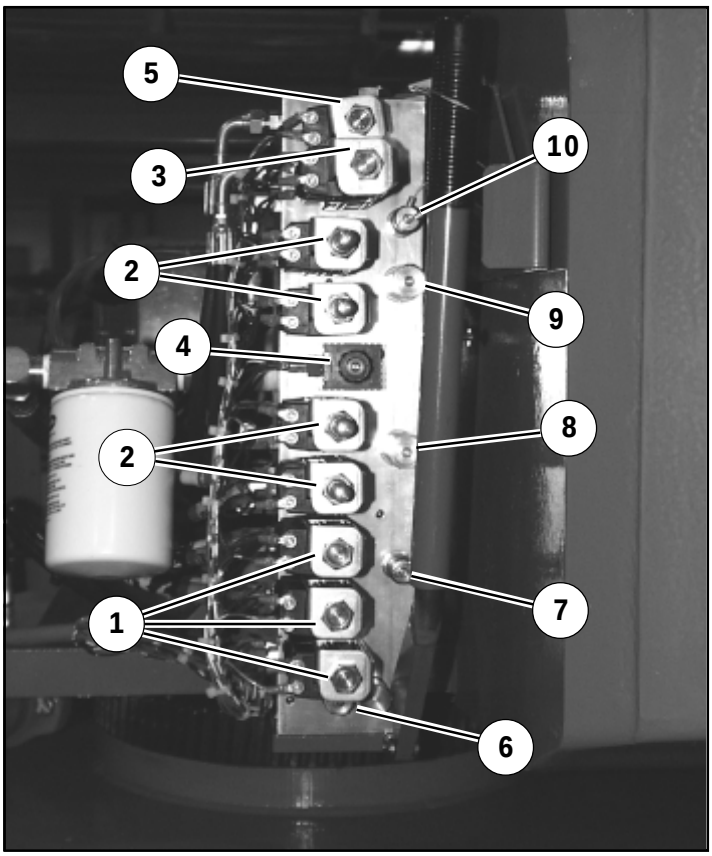
1. Operate the hydraulic system 10-15 minutes to warm the oil.
2. Remove the high relief port plug and install a 0-3000 PSI pressure gauge assembly.
3. Remove the plug in the end of the high relief valve to expose the adjusting screw.
4. Operate Jib raise function until jib is completely raised.
5. While activating the jib raise switch, set the pressure to 2500 PSI (173 bar) maximum by slowly turning the adjusting screw. Turning the adjusting screw clockwise increases pressure and counterclockwise decreases pressure.
6. Remove the pressure gauge and reinstall all plugs.

LOW RELIEF VALVE

1. Operate the hydraulic system 10 - 15 minutes to warm the oil.
2. Remove the low relief port plug and install a 0-3000 PSI pressure gauge assembly.
3. Remove the plug in the end of the low relief valve to expose the adjusting screw.
4. Turn the low relief valve adjustment screw counterclockwise two full turns.
5. Operate jib lower function until jib is completely lowered.
6. While activating the jib lower switch, set the pressure to 1500 PSI (104 bar) maximum by slowly turning the adjusting screw. Turning the adjusting screw clockwise increases pressure and counterclockwise decreases pressure.
7. Remove the pressure gauge and reinstall all plugs.

COUNTERBALANCE RELIEF VALVES

1. If any counterbalance relief valve is faulty, completely lower the jib, boom and elevating assembly and remove the remove counterbalance valve.
2. Replace or recalibrate (bench set) the counterbalance valve.
3. Slowly cycle function related to replaced counterbalance valve several times to remove air from system.



1. Motor Spool 4 way Valve, 3 position
2. Closed Center 4 way Valve, 3 position
3. Tandem Center 4 way, 3 position Valve
4. Low Flow Valve
5. High Flow Valve
6. Counterbalance Valve
7. Low Relief Gage Port Plug
8. Low Relief 1500 PSI
9. High Relief 2500 PSI
10. High Relief Gage Port Plug

Figure 3-4: Valve Manifold

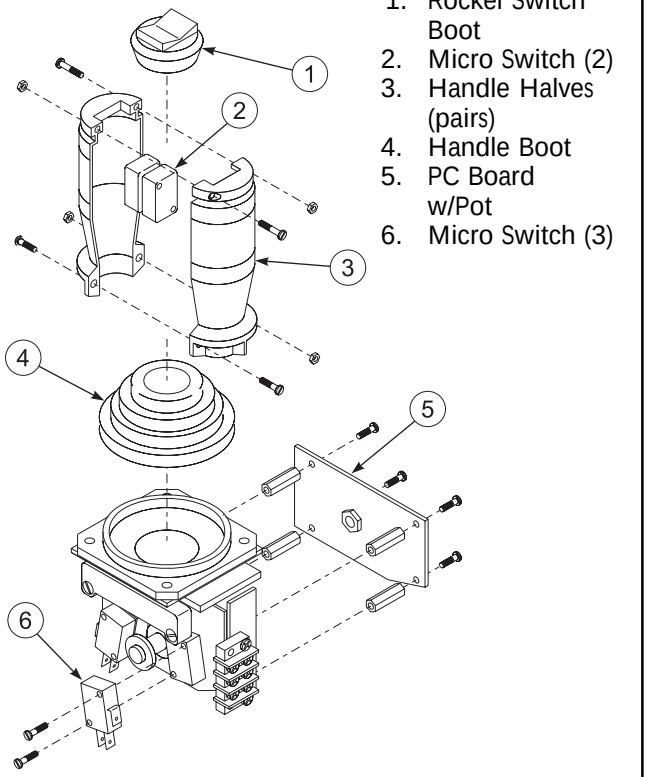


Figure 3-5: Proportional Controller

3.6 Proportional Controller

JOYSTICK HANDLE (FIGURE 3-5)

1. If necessary, remove handle assembly from controller box.
2. Remove and replace defective parts.
3. If replacing PC board with resistor, note resistor adjustment (number of turns) and adjust new resistor to match old resistor setting.

NOTE: Check that pot operates correctly when handle is pushed completely forward and reverse.

Refer to pages 6-8 (Electric) and 6-20 (Bi-Energy) for repair part numbers.

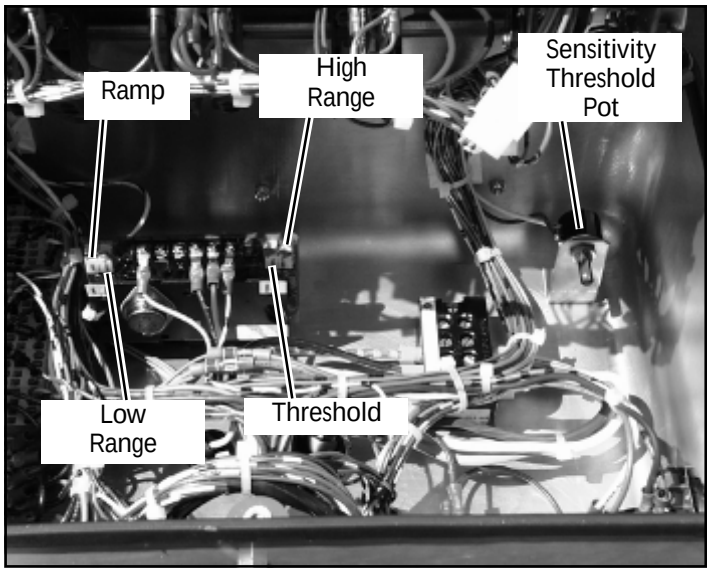


Figure 3-6: Upper Control Box

PROPORTIONAL CONTROL ADJUSTMENT (Figure 3-6)

NOTE: Refer to "TROUBLESHOOTING" section for detailed MOS90 pin configuration.

Potentiometers are sealed to protect sensitive adjustments from vibrations, or from tampering. Remove sealant prior to adjustment, and replace after.

NOTE: Do not use silicone sealer; it will damage pots.

Use a small screwdriver or special adjustment tool to set adjustment pots. Pots can be easily damaged.

Pots have 15 turns of adjustment, more than one turn will often be required to complete the adjustment. If pots have been previously set, reset by turning no more than 1 turn at a time. If they have not been previously set, preset to about mid range and start from there.

Turn pot clockwise (CW) to increase settings.

Turn pot counterclockwise (CCW) to decrease settings.

Adjust pots only in sequence as outlined in this procedure.

Rotary Control for Boom Functions

IMPORTANT: Back out ramp trimpot 10 turns (counter clockwise) before making any adjustments.

1. Verify that batteries are fully charged.
2. Connect ammeter in series at "A" terminal.
3. Set threshold so upper boom elevates with rotary speed adjustment set on 2 and raise function switch actuated.

4. Set high range at .44 amps or so upper boom functions operate with speed adjustment on 9 or highest speed position. Check for proportional valve vibration. Valve is fully closed when it does not vibrate when energized. Do not over adjust.
5. Set low range so machine slews 180 degrees in 45 seconds with speed control set at position 9 or full speed.
6. Turn ramp trimpot back in 10 turns. Set ramp trimpot until machine has a smooth start or upper boom delays 2 seconds with raiseswitch actuvated and speed control set at position 9 or full speed.

Drive Control

1. Adjust sensitivity threshold pot (located in upper control box) to obtain an equal threshold between forward and reverse directions (Figure 3-6).
2. Set Servcon motor values. Drive adjustments are made through the motor control calibrator.

PLATFORM DOWN LIMIT SWITCH (Figure 3-7)

The Platform Down Switch bypasses the Tilt Sensor when the platform is fully lowered and closes the circuit to the Platform Down Relay, which allows high speed travel, cage trim function and turret rotation.

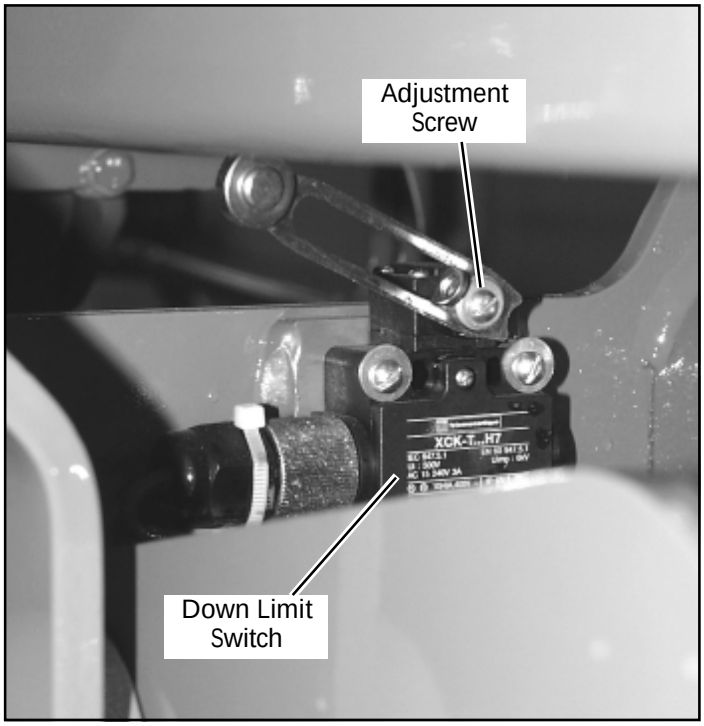


Figure 3-7: Platform Down Limit Switch

⚠ WARNING ⚠

DO NOT attempt to adjust Limit Switches without first blocking the elevating assembly (see section 3.1).

1. Lower the Platform completely.
2. With the Platform / Chassis switch on Chassis, push the Tilt Sensor base to test the alarm circuit.
3. If the alarm sounds, elevate the platform and adjust the position of the switch arm by loosening the adjustment screw and repositioning the arm. Lower the platform and retest. If down limit switch is properly adjusted, the tilt alarm will not sound.
4. With platform elevated, repeat step 2. When switch is properly adjusted, alarm will sound.

TILT SENSOR (FIGURE 3-8)

The Tilt Sensor has four wires; red-power (12v in), black-ground, white-output (12v out) and green (to controller). To verify the sensor is working properly there are two LED's under the sensor; green indicates the sensor is on (has power), red indicates the sensor is level and the white wire is 'hot' (12v out).

1. Check tires for proper pressure.
2. Place machine on firm level surface ± ¼°.
3. Use Inclinometer to ensure that the front and rear of the chassis are level within ± ¼°.
4. Adjust the three leveling locknuts until the bubble is centered in the circle on the attached bubble level.
5. Elevate the platform until down limit switch opens and push the tilt sensor base to test the alarm circuit. Alarm should sound.

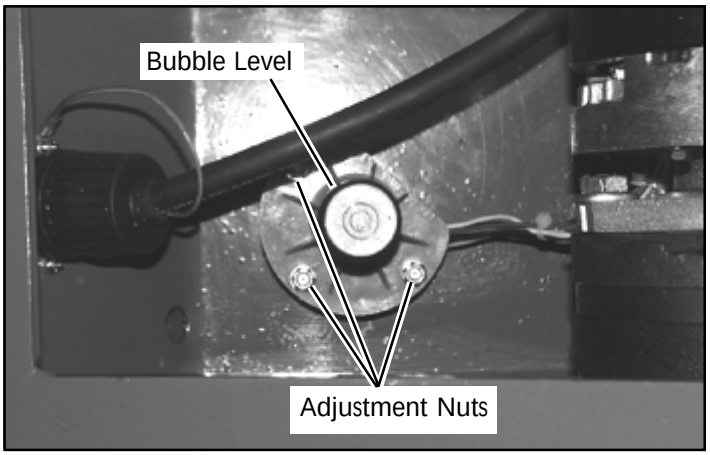


Figure 3-8: Tilt Sensor

3.7 Hydraulic Manifold (Figure 3-9)

It is not necessary to remove the manifold to perform all maintenance procedures. Prior to performing maintenance, determination if the manifold needs to be removed.

REMOVAL

1. Unplug the batteries.
2. Tag and disconnect the solenoid valve leads from the terminal strip.
3. Tag, disconnect and plug hydraulic hoses.
4. Remove the bolts that hold the manifold to the mounting bracket.
5. Remove manifold block.

DISASSEMBLY

NOTE: Mark all components as they are removed so as not to confuse their location during assembly. Refer to Figure 3-9 often to aid in disassembly and assembly.

1. Remove coils from solenoid valves.
2. Remove spool valve cover and spool valve.
3. Remove solenoid valves, lift relief valve, counterbalance valves and divider combiner valve.
4. Remove fittings, plugs, springs, balls and orifices.

CLEANING AND INSPECTION

1. Wash the manifold in cleaning solvent to remove built up contaminants and then blow out all passages with clean compressed air.
2. Inspect the manifold for cracks, thread damage and scoring where O-rings seal against internal and external surfaces.
3. Wash and dry each component and check for thread damage, torn or cracked O-rings and proper operation.
4. Replace parts and O-rings found unserviceable.

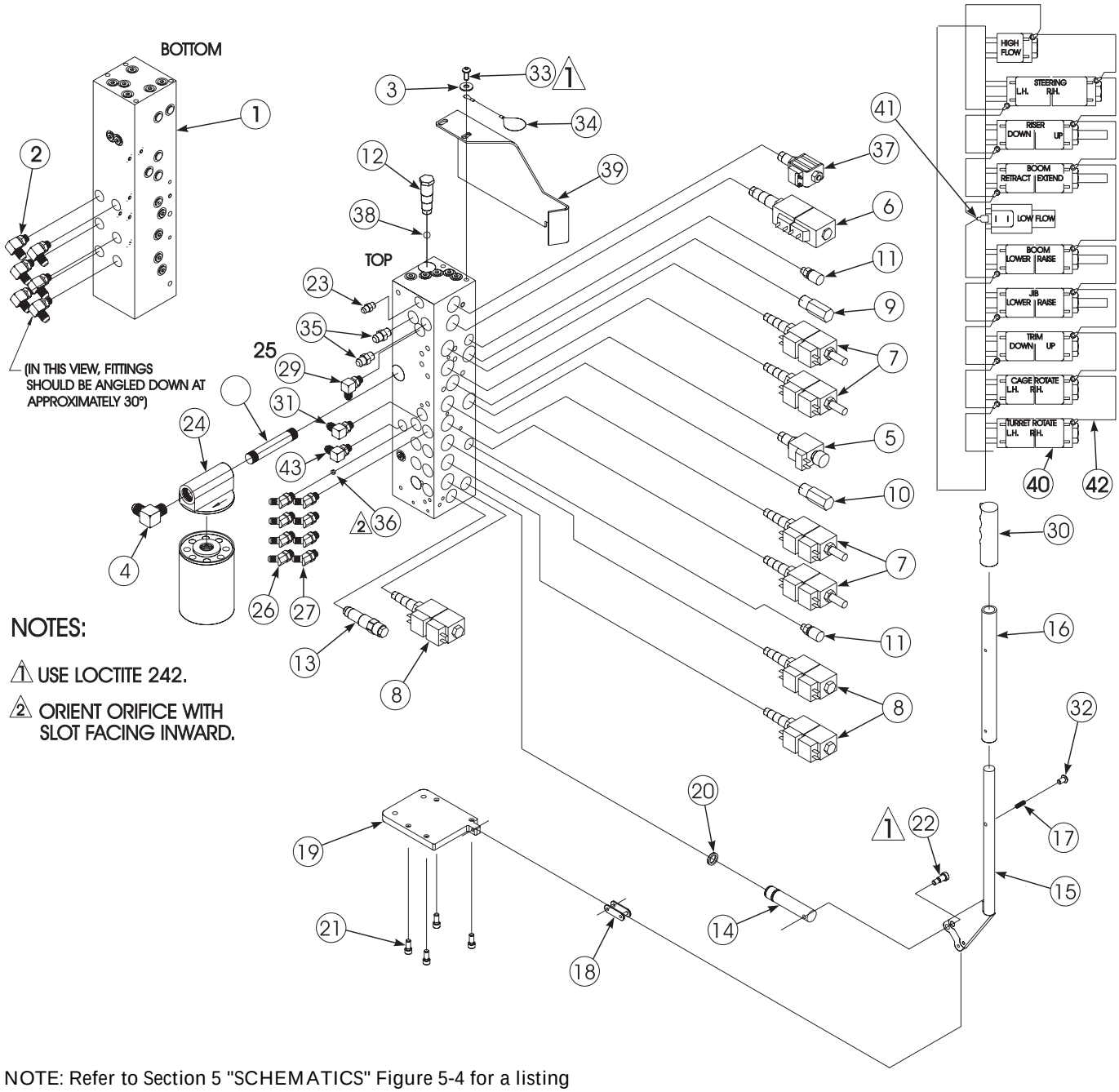
ASSEMBLY

NOTE: Lubricate all O-rings before installation to prevent damage to O-rings. Seat all balls in manifold block by lightly tapping on the ball with a brass drift punch.

1. Install fittings, plugs, springs, balls and orifices. Use one drop of Locktite #242 on each screw-in orifice.
2. Install solenoid valves, lift relief valve, counter balance valves, divider combiner valve, and spool valve.
3. Install coils on solenoid valves.

INSTALLATION

1. Attach manifold assembly to mounting plate with bolts.
2. Connect Solenoid leads to terminal strip (as previously tagged).
3. Connect hydraulic hoses. Be certain to tighten hoses to manifold.
4. Plug in batteries.
5. Operate each hydraulic function and check for proper operation and leaks.
6. Adjust lift relief and counterbalance valve pressures according to instructions in Section 3-5.



NOTE: Refer to Section 5 "SCHEMATICS" Figure 5-4 for a listing of hydraulic valve ports.

1. Valve Block
2. Fitting
3. Washer, 5/16 Flat
4. Fitting, Elbow
5. Low Flow Valve
6. Steering Valve
7. 4-Way Closed Center
8. 4-Way Motor Spool
9. Relief Valve
10. Relief Valve
11. Plug
12. Diverter Valve
13. Counterbalance
14. Piston
15. Lever
16. Extension
17. Detent
18. Pivot Link
19. Mounting Plate
20. Seal
21. Screw, 5/16-18
22. Screw, 3/8 x 5/8
23. Fitting
24. Filter Assembly
25. Nipple
26. Fitting Elbow
27. Fitting, Elbow
28. Fitting, Elbow
29. Fitting Elbow
30. Grip
31. Fitting Elbow
32. Screw, 10-20
33. Screw, 5/16-18
34. Lanyard
35. Fitting Adapter
36. Orifice
37. High Flow Valve
38. Steel Ball, 7/16
39. Bracket
40. Connector Ring
41. Connector Female
42. Wire
43. Fitting, Elbow

Figure 3-9: Hydraulic Manifold, Exploded View

3.8 Hydraulic Power Unit (Figure 3-10)

NOTE: Brushes on the electric motor can be replaced without removing the hydraulic power unit from the chassis by raising and securely blocking the chassis and work from underneath the chassis.

NOTE: Power unit may be removed through the front of the chassis by moving the relay panel out of the way or through the bottom of the chassis by raising and securely blocking the chassis. Drain the hydraulic tank before removing power unit.

REMOVAL

1. Mark, disconnect and plug the hose assemblies.
2. Mark and disconnect the electric cables.
3. Remove hardware which secures power unit and remove from chassis.

INSTALLATION

1. Install power unit using hardware previously removed.
2. Unplug and reconnect the hydraulic hoses.
3. Reconnect the electric cables.
4. Fill the tank with clean hydraulic fluid.
5. Check the oil level in the hydraulic tank before operating the work platform.
6. Operate the pump and check for leaks and proper operation.
7. Replenish hydraulic fluid if necessary.

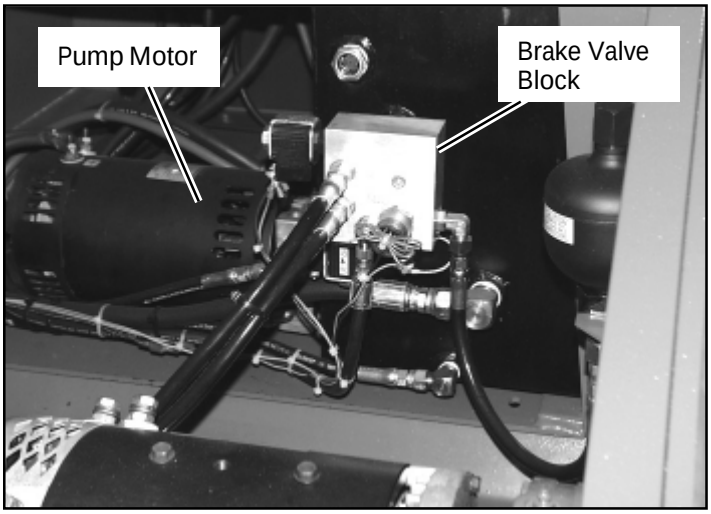


Figure 3-10: Hydraulic Power Unit (Electric Model Shown)

3.9 Hydraulic Brakes

Removal

1. Park the work platform on firm level ground and block the wheels to prevent the work platform from rolling.
2. Disconnect the hydraulic brake lines.
3. Tag and disconnect electric cables from drive motors.

⚠ CAUTION ⚠

Clean all fittings before disconnecting the hose assemblies.

Plug all port holes and hose assemblies IMMEDIATELY to prevent contamination from dust and debris.

4. Remove capscrews and washers holding the motor and brake to torque hub.
5. Remove the motor.
5. Remove the brake.

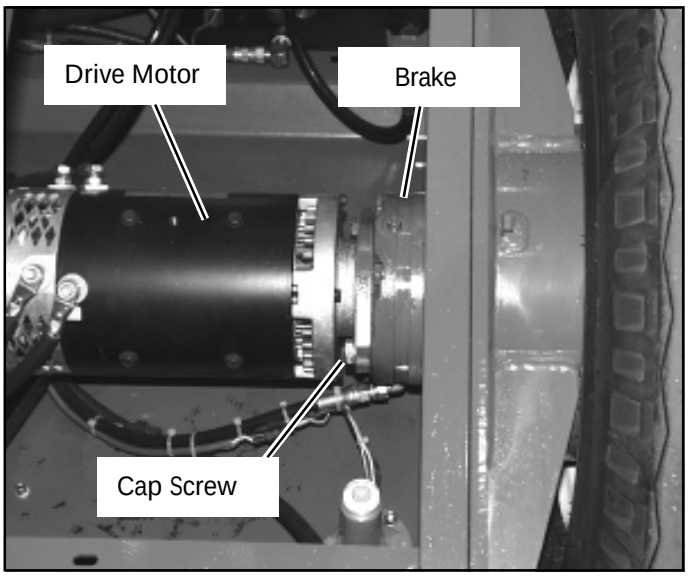


Figure 3-11: Rear Axle Assembly

NOTE: Torque all hardware to torques listed on page 3-32 unless otherwise specified.

Brake Seal Replacement(Figure 3-12)

1. With shaft protrusion downward remove capscrews (21) and washers (20) from brake assembly.
2. Remove power plate (19) from housing (1). Remove the gasket (2).
3. Remove piston (14) from power plate (19) by introducing low pressure air (15 psi) into the hydraulic inlet. Make sure piston is not pointed at anyone.
4. Remove o-rings (16 & 18) and backup rings (15 & 17) from inner and outer diameter grooves of piston.
5. Clean piston (14) and power plate (19) assemblies with solvent. Inspect the sealing surfaces of the piston (14) and power plate (19). Inspect seal grooves in the piston. Replace brake assembly if they are damaged or scratched deeply. Lubricate piston (14), power plate (19), and seals (15, 16, 17, & 18) with clean hydraulic oil prior to assembly.
6. Install the backup rings (15 & 17) and o-rings (16 & 18) into the seal grooves in the piston.
7. Install piston into power plate using a shop press. Be careful not to damage the seals during assembly. Center cutouts in piston with torque pin holes in the power plate. Press piston to a depth no less than flush, but not exceeding 0.120 in. below the surface of the power plate at cutouts in piston. This depth is critical. The brake will not hold if it is exceeded.
8. Install gasket (2).
9. Install power plate/piston assembly (14 & 19) to housing (1) using capscrews (21) and washers (20). Tighten sequentially, one turn at a time, to press the two assemblies together. Torque capscrews 50 - 60 ft.-lbs.

Installation

1. Coat output shafts of brake and drive motor with high pressure molybdenum grease and install gasket (22) and brake onto torque hub.
2. Install gasket (22) and drive motor. Align holes and install the two cap screws and lock washers.
3. Reinstall cables to drive motor and hoses to the brake.
4. Install the wheel. Torque the wheel nuts to 90 ft. lbs. (122 N-m).
5. Remove the jack stands and lower chassis to the ground.
6. Position chassis switch to parking brake release position. Alarm will sound.
7. Depress the electric motor start switch to energize brake hydraulic system.

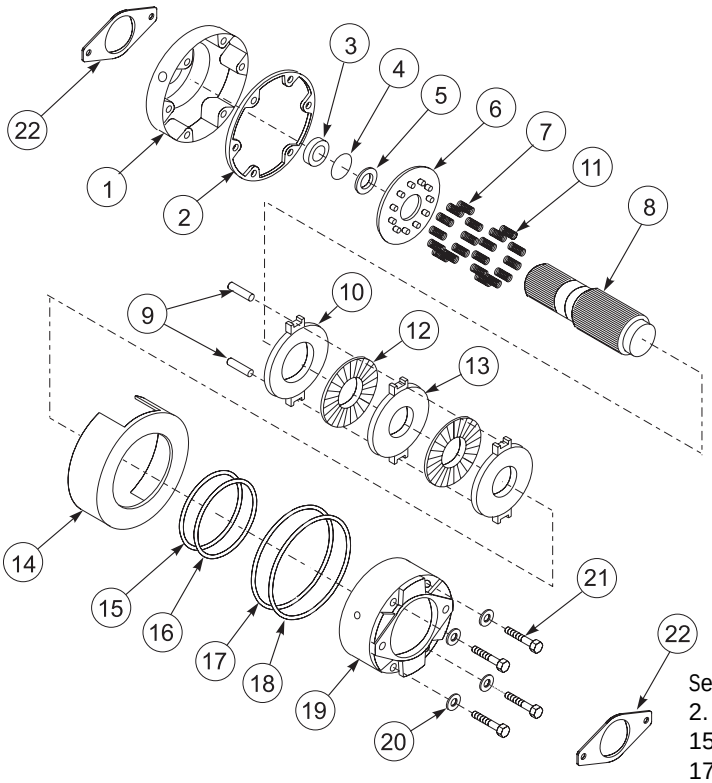


Figure 3-12: Brake Assembly

8. Check for leaks and bleed air out of brake hydraulic system using bleed valve located on brake housing.

3.10 Drive Motors

Removal

1. Disconnect battery negative terminals or Anderson connectors (both sides on electric model).
2. Tag and disconnect electric cables from motor.
3. Remove and save hardware which secures drive motor to torque hub.

Installation

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Install drive motor to torque hub using original hardware.
2. Connect electric cables to motor.
3. Connect Anderson connectors or negative terminals on batteries.

PUMP MOTOR

Removal

1. Disconnect battery negative terminals or Anderson connectors (both sides on electric model).
2. Tag and disconnect electric cables from motor.
3. Remove and save hardware which secures pump motor to pump assembly.

Installation

NOTE: Torque all hardware to torques listed on page 3-32 unless otherwise specified.

1. Install motor using original hardware.
2. Connect electric cables to motor.
3. Connect Anderson connectors or negative terminals on batteries.

DRIVE MOTOR BRUSHES (Figure 3-13)

1. If necessary, remove electric motor (Refer to previous section).
2. Release latch and remove headband.
3. Pull back brush spring and latch on hook.
4. Remove screw and set aside.

IMPORTANT: Be sure screw does not fall inside motor.

5. Remove old brush and replace with new brush.

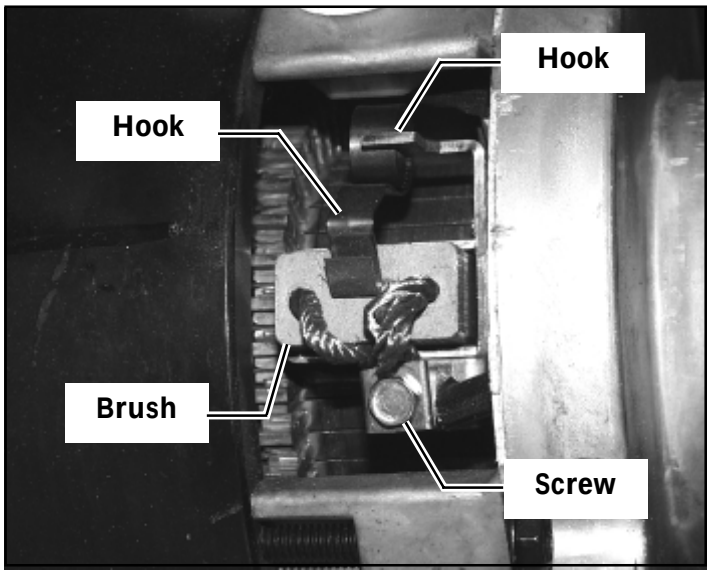


Figure 3-13: Replacing Drive Motor Brushes (P/N 068573-010)

3.11 FRONT WHEEL BEARINGS

Removal

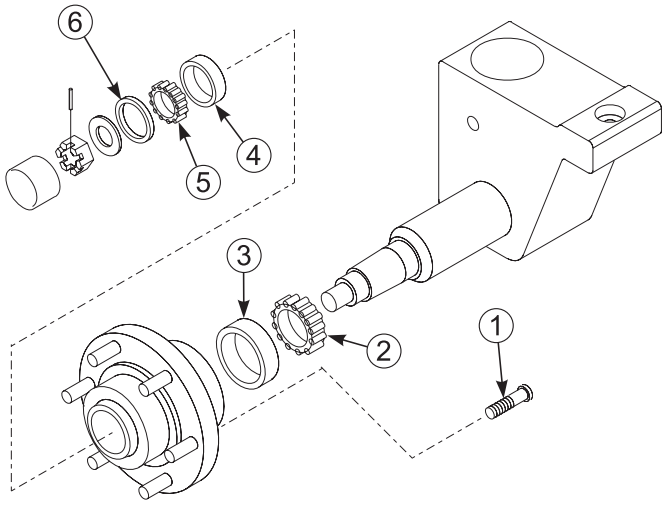
1. Disconnect battery negative terminals and/or Anderson connectors (both sides on electric model).
2. Loosen wheel lug nuts.
3. Raise front axle using 2-ton jack. Support front axle using two 2-ton jack stands.
4. Remove wheel lug nuts and remove wheel.
5. Remove axle dust cap.
6. Remove cotter pin, hub nut, and washer.
7. Remove hub assembly.
8. Clean all parts using a suitable solvent.
9. Inspect bearings, cones and cups for wear and replace if necessary.

NOTE: Cups do not need to be replaced if they are not damaged.

Installation

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Apply a liberal coating of grease to each cup.
2. Pack the inside bearing with a liberal amount of multi purpose grease and position it in the hub. Install new grease seal.
3. Apply a thin coating of grease to the spindle and slide the hub onto the spindle.
4. Pack the outside bearing cone with multi purpose grease and slide it onto the spindle until it seats in the outer bearing cup.



Repair kit (068577-010) includes:

1. Stud
2. Rear Bearing Cone
3. Rear Cup
4. Front Bearing Cone
5. Front Cup
6. Grease Seal

Figure 3-14: Front Axle Assembly

5. Install the washer and hub nut. While rotating the hub, tighten the hub nut until the hub drags. Then back the nut off until a slot lines up with the hole in the spindle.
6. Install a new cotter pin and bend the end up over the nut.
7. Install the dust cap and wheel. Torque the lug nuts to 90 ft. lbs. (123 N-m).
8. Remove jack stands and lower the axle to the ground.
9. Connect battery negative terminals and/or Anderson connectors.

6. Replace screw, unhook brush spring and return to original position.
7. Install and relatch headband.

3.12 TORQUE HUB

Removal

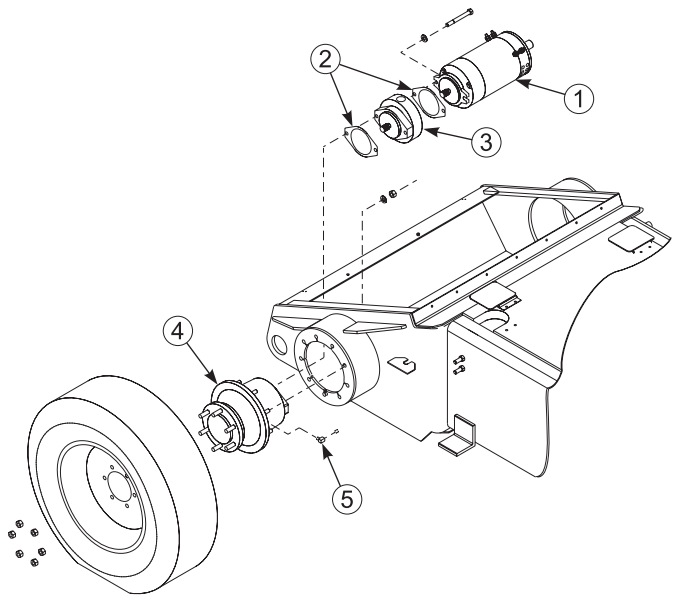
1. Park the work platform on firm level ground and block the wheels to prevent the work platform from rolling.
2. Disconnect battery negative terminals or Anderson connectors (both sides on electric model).
3. Loosen the wheel lug nuts on the torque hub to be removed.
4. Raise the rear of the work platform using a 2-ton jack.
5. Position two 2-ton jack stands under the rear axle to prevent the work platform from falling if the jack fails.
6. Remove the wheel nuts and wheel.
7. Disconnect hydraulic brake line from brake.

⚠ CAUTION ⚠

Clean all fittings before disconnecting the hose assemblies.

Plug all port holes and hose assemblies IMMEDIATELY to prevent contamination from dust and debris.

8. Remove 90° fitting from side of torque hub.
9. Tag and remove electric cables from drive motors.
10. Remove mounting bolts from electric motor.
11. Separate electric motor from brake. Discard gasket.
12. Separate brake from torque hub. Discard gasket.
13. Remove 1/2-20 nuts and washers from torque hub.
14. Remove torque hub.



1. Motor
2. Gasket
3. Brake
4. Torque Hub
5. 90° Fitting

Figure 3-15: Torque Hub Assembly

IMPORTANT: Note position of 90° fitting on torque hub body. Hub must be installed with fitting in same position.

Installation

IMPORTANT: Hub must be installed with 90° fitting in same position as when it was removed.

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Install torque hub using 1/2-20 nuts and 1/2 washers.
2. Remove plug from 90° fitting and install fitting in side of torque hub. Point fitting towards rear of hub.
3. Using 90 weight gear lube with EP additive, fill torque hub through top plug hole in rear cover until oil comes out of 90° fitting in side. Plug 90° fitting and top of rear cover.
4. Install new gasket and brake.
5. Install new gasket and electric motor.
6. Secure assembly using washers and bolts.
7. Connect hydraulic brake lines.
8. Connect electric cables.
9. Install wheels. Torque lug nuts to 90ft. lbs. (123 Nm).
10. Bleed brake lines if necessary.
11. Remove jack stands and lower rear end.
12. Connect battery terminals or Anderson connectors.

3.12 Seal Replacement Torque Hubs

ROLL AND LEAK TESTING

IMPORTANT: Torque hubs should always be roll and leak tested before disassembly and after assembly to make sure gears and sealants are working properly.

ROLL TEST

Gears should be able to rotate by applying a constant force to the axle. Some gear packages roll with more difficulty than others. Do not be concerned if gears seem to roll hard as long as they roll with consistency. If you feel more drag only at certain points the gears are not rolling freely and should be checked for improper installation or defects.

LEAK TEST

The purpose of a leak test is to make sure the unit is air tight. Pressurize hub to 5 PSI. Torque hub has a leak if the air pressure starts to fall after hub has been pressurized. Use soap and water on hub to detect location of leaks. If a leak is detected, seal or "O" ring must be replaced.

PRESSING TOOLS

The seal, cup and cone pressing tools are illustrated on pages 20, 21 and 23. Use pressing tools identical in size or fabricate them using the dimensions shown.

DISASSEMBLY (Figure 3-16)

CAUTION: Safety glasses should be used during disassembly of hub.

1. Remove two pipe plugs in cover and drain the oil from the unit.
2. Loosen and remove shoulder bolts and cap screws from cover. Remove cover from hub.
3. Remove "O" ring. Remove thrust washer from counterbore in cover.
4. Remove input gear from planet gears.
5. Using a punch, remove retaining ring from groove around inside of input gear.
6. Lift carrier sub-assembly from hub. Lift ring gear from hub. Remove "O" ring from counterbore in hub.
7. Remove pipe plugs from side of hub body.
8. Apply a preload to output shaft to remove retaining ring. Follow steps a & b.
   a. Place bearing cone pressing tool on retaining ring.
   b. Apply pressure to fixture using a hydraulic ram or by striking the fixture with a soft face ham mer. Pressure should be applied until hub rotates with difficulty.
9. Using retaining ring pliers remove retaining ring. Remove spacer from output shaft.
10. Place spacer under hub so output shaft will fall through bottom when pressed out.
11. Press output shaft out of hub. Output shaft may come out with bearing cone and seal attached. Remove seal and discard. Use a punch and hammer to remove bearing cone. Be careful not to strike shaft with punch.
12. If seal and cone remain in hub, press them out using a pressing tool.
13. Lift bearing cone out of hub.
14. Stand hub on its small end. Using a punch and hammer, remove bearing cup from counterbore of hub. Be careful not to strike counterbore with punch.
15. Turn hub over on larger end. Using a punch and hammer, remove bearing cup from counterbore of hub. Be careful not to strike counterbore.

NOTE: Carrier sub-assembly does not need to be disassembled to replace seals.

ASSMEBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Oil output shaft and bearing cone. Using cone press, press bearing cone onto end of output shaft with retaining ring groove.
3. Stand hub on its small end. Using bearing cup pressing tool press bearing cup down into hub.

NOTE: Make sure cup sits square with counterbore.

4. Turn hub over so it sit on large end. Using bearing cup pressing tool press bearing cup into small end of hub.

NOTE: Make sure cup sits square with counterbore.

5. Place output shaft into hub so end of shaft with retaining ring groove points down.
6. Oil output shaft. Using seal pressing tool press seal into counterbore in small end of hub. The closed face of the seal should be up.

3.12 Seal Replacement Torque Hubs (Continued)

7. Turn hub over so small end points down. Using bearing cone pressing tool, press bearing cone onto output shaft. Rotate hub while pressing bearing. Stop pressing when hub starts to resist rotating.
8. Place spacer onto output shaft so it rests on top of bearing cone. Using retaining ring pliers, place retaining ring to make sure it is seated.
9. Hit the end of output shaft once or twice with a soft face hammer. Turn the shaft in both clockwise and counter clockwise directions while hitting. This will seat the bearing cone against the spacer and retaining ring allowing necessary endplay in the hub-shaft sub-assembly.
10. Turn hub over so it rests on large end. Measure endplay in hub-shaft sub-assembly. Follow steps a-c.
    a. Mount a dial indicator on hub . Locate the dial rod on top of output shaft.
    b. Lift up on output shaft until the needle on the dial stops moving.

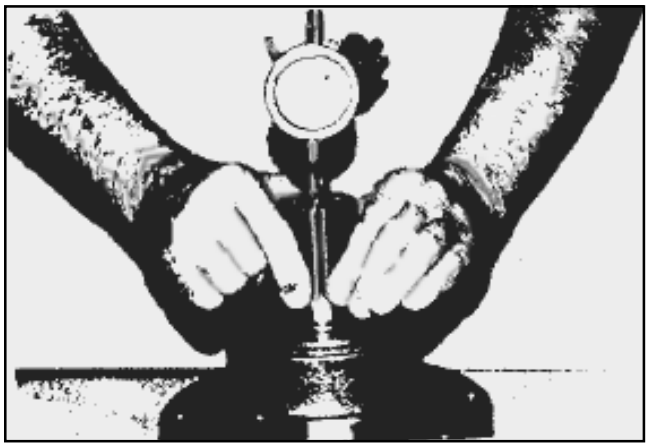


Figure 3-16: Measuring Hub End Play

    c. Read the dial. Reading should be no greater than .008 in.

- If dial reads less than .008 in. continue on to step 11.
- If dial reads more than .008 in. repeat step 8-15 of "DISASSEMBLY" section.

    d. Remove spacer and replace it with thicker spacer (SK91 068570-011).
    e. Repeat steps 7-10 and remeasure end play.

11. Apply a light coat of "Never Seize" to the pipe plugs and install into pipe plug holes in hub.

NOTE: Leave hole for 90° fitting open.

MAIN ASSEMBLY

1. Position hub on its output shaft so that hubs small diameter end points down.
2. Using a marker, mark the four shoulder bolt holes in hub.
3. Grease "O" ring and place in counterbore in hub.

NOTE: "O" rings may be stretched or squeezed together in order to fit exactly in counterbore.

4. Oil all exposed surfaces inside hub. Oil carrier sub-assembly.
5. Place carrier sub-assembly, with spline connections down, into mesh with output shaft.
6. Place ring gear, with squared shoulder down, into mesh with the planet gears of the carrier sub-assembly. Make sure that marked shoulder bolt hole on ring gear aligns with any of the marked shoulder bolt holes on the hub. "X" mark should be on the cover side of ring gear.
7. Start one half of retaining ring into groove inside input gear. Use a soft punch to press the remaining half of the retaining ring into the groove.
8. Insert input gear, with large diameter end down, into mesh with planet gears.
9. Place large thrust washer over input gear so it rests on carrier housing. Oil all exposed surfaces inside hub.
10. Grease "O" ring and place into counterbore of cover.

NOTE: "O" rings may be stretched or squeezed together in order to fit exactly in counterbore.

11. Place cover on top of ring gear so the fill hole will be at top of hub when it is installed.
12. Install four shoulder bolts into shoulder bolt holes and tighten.
13. Install eight cap screws in remaining holes and tighten.
14. Apply 23-27 ft. lbs. of torque to all bolts.
15. Apply a light coat of "Never Seize" to both pipe plugs and install into the two holes in cover.
16. Roll test the unit in both clockwise and counter-clockwise directions. Turn hub nine full revolutions in each direction.
17. Leak test the hub at Five PSI for two to three minutes.

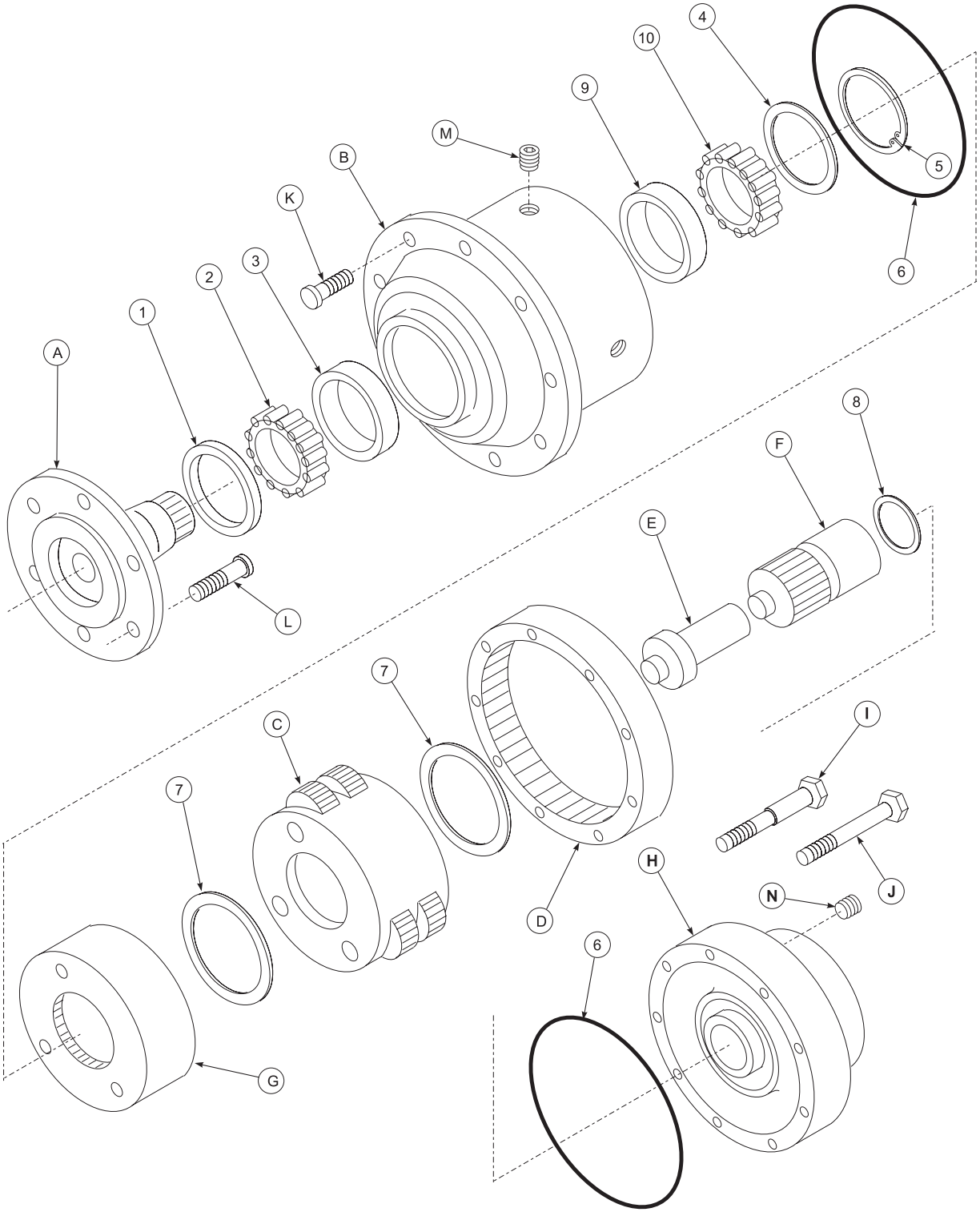


Figure 3-17: Torque Hub

A. Spindle
B. Housing
C. Carrier Assy
D. Gear Ring
E. Spacer, Input
F. Sun Gear
G. Gear, Internal
H. Cover
I. Shoulder Bolt
J. Bolt
K. Stud
L. Stud
M. Pipe Plug
N. Pipe Plug

Repair Kit (068570-010) contains:

1. Lip Seal
2. Bearing, Cone
3. Bearing, Cup
4. Thrust Washer
5. Retaining Ring
6. O-Ring (2)
7. Thrust Washer (2)
8. Thrust Washer - SK91 (068570-011)
9. Bearing, Cup
10. Bearing, Cone

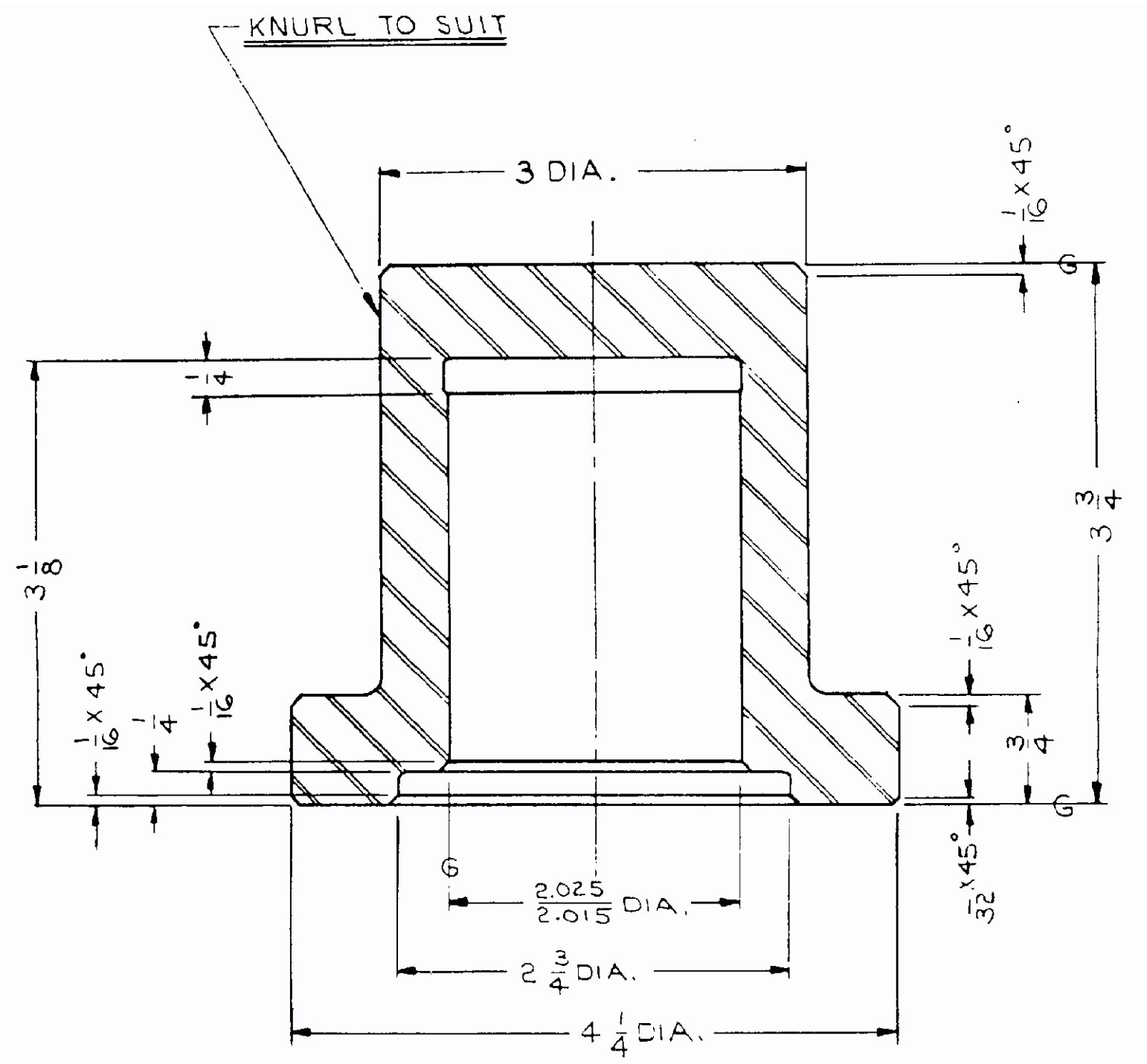


Figure 3-18: Seal Pressing Tool

SEAL PRESSING FIXTURE
Used with seal

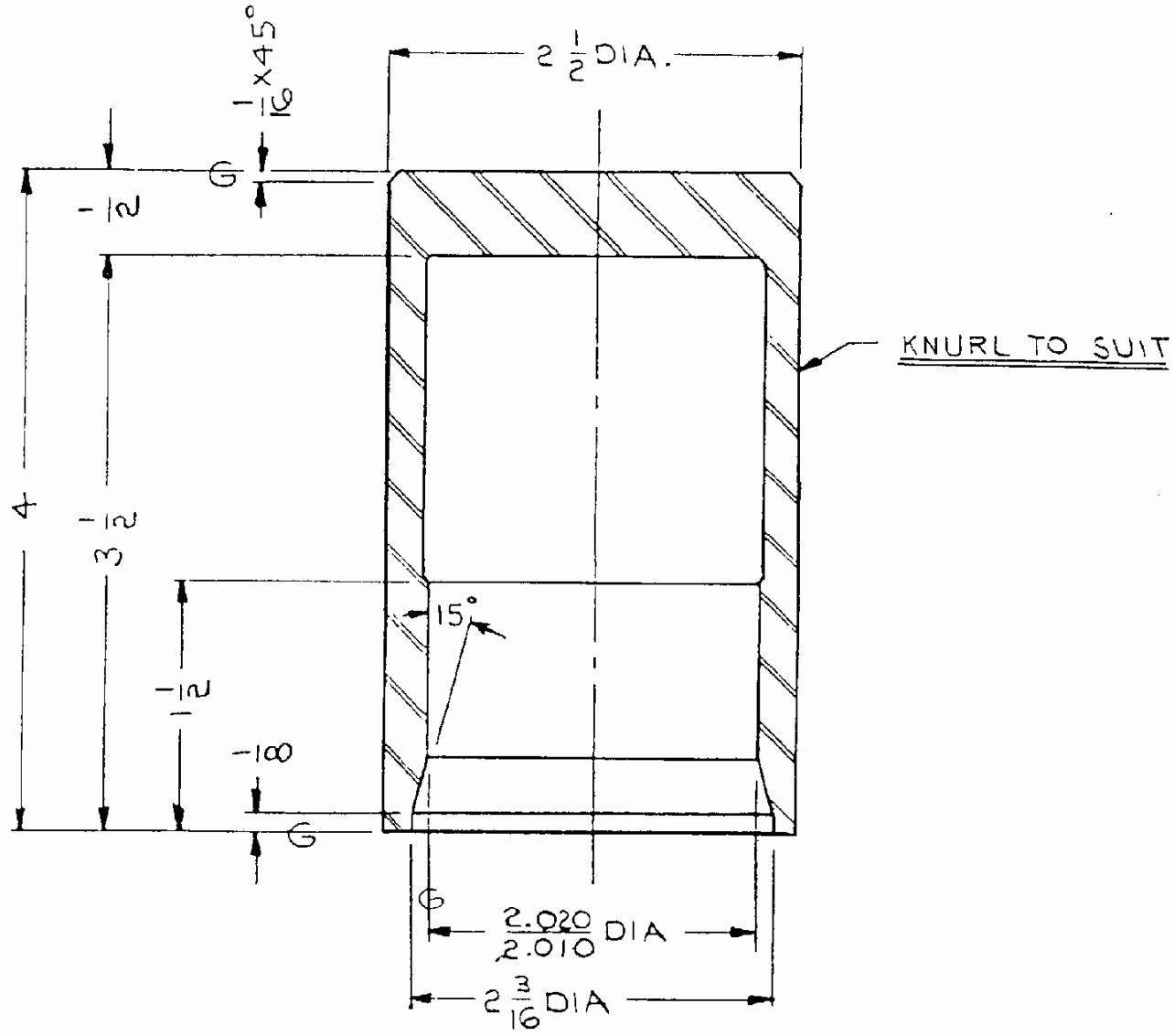


Figure 3-19: Bearing Cone Pressing Tool

BEARING CONE PRESSING FIXTURE
Used with bearing cones

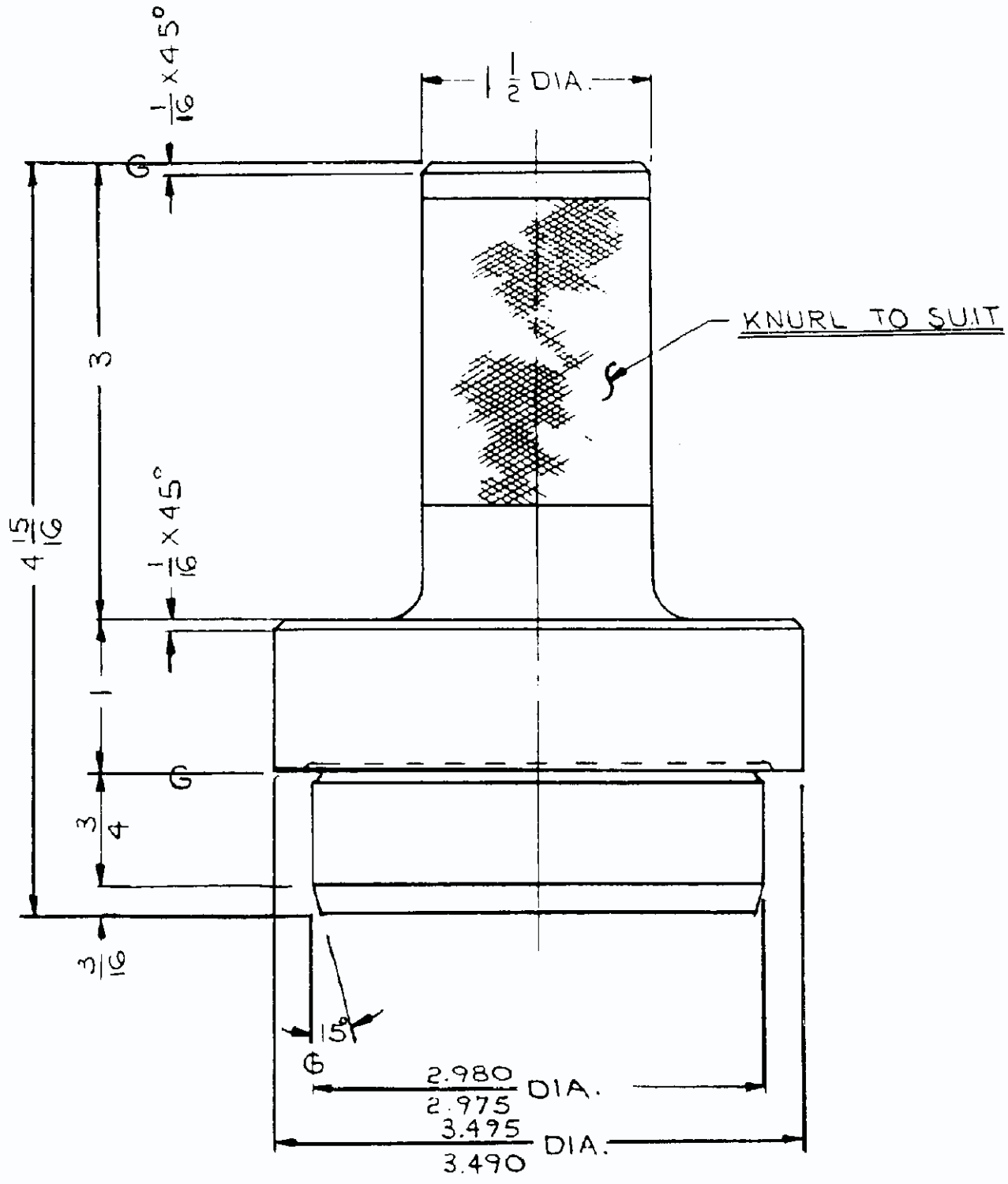


Figure 3-20: Bearing Cup Pressing Tool

BEARING CUP PRESSING FIXTURE
Used with bearing cups

3.13 Master Cylinder

REMOVAL

1. Raise elevating assembly until master cylinder pins are accessible.
2. Support the cage assembly (refer to Figure 3-1).
3. Remove rod end retaining bolt and rod end pin.
4. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
5. Using a metal drift, remove rod end pin.
6. Remove base end pin retaining bolt and pin.
7. Carefully remove master cylinder.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Remove set screw from cylinder tube and unscrew head from cylinder.
2. Carefully pull rod assembly from cylinder.
3. Clamp rod end in vise and turn piston off of rod.

NOTE: Piston is loctited (Loctite #277) onto rod.

4. Slide the head off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect the rod, head, piston, and tube for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

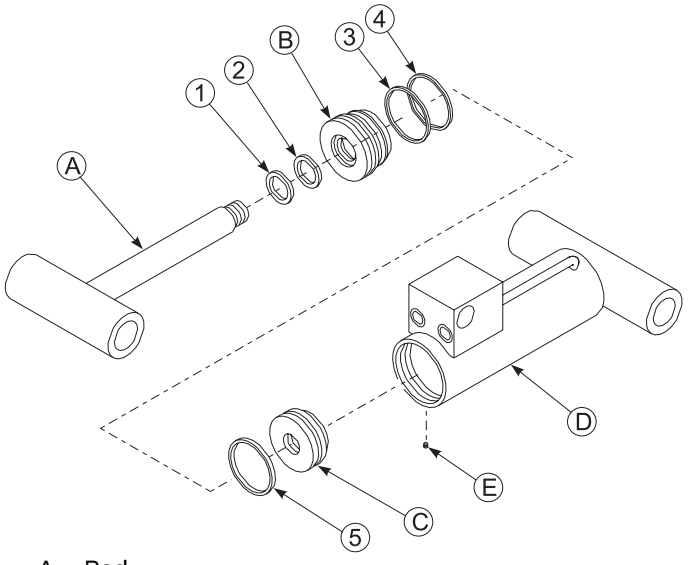
1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit to piston and head.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Clean threaded end of rod using loctite primer.
5. Using loctite #277, install piston onto rod.
6. Lubricate seals on piston and head with hydraulic oil.
7. Carefully slide rod assembly into cylinder.
8. Thread head into cylinder. Be sure hole for set screw aligns with hole in cylinder tube.
9. Clean set screw in loctite primer. Install set screw using loctite #242.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Remove boom support.
3. Slowly raise and lower boom several times. Check hydraulic connections for leaks. Check for proper slave cylinder operation.



A. Rod
B. Head
C. Piston
D. Cylinder
E. Set Screw

Seal kit (068454-010) includes:

1. Rod Wiper
2. Rod Seal
3. Backup
4. Static Seal
5. Piston Seal

Figure 3-21: Master Cylinder

3.14 Slave Cylinder

REMOVAL

1. Extend boom until slave cylinder trunion pins are accessible. Support the cage assembly.
2. Remove rod end pin retaining bolt.
3. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
4. Using a metal drift, remove rod end pin.
5. Remove trunion pin retaining bolts and using a pin puller, remove trunion pins.
6. Carefully remove slave cylinder.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Remove set screw from cylinder tube and unscrew head from cylinder.
2. Carefully pull rod assembly from cylinder.
3. Clamp rod end in vise and turn off rod extension. Slide piston off of rod.

NOTE: Rod extension is loctited (Loctite #262) onto rod.

4. Slide the head off of the rod.
5. Remove 1/4 inch socket head cap screws from rod end of cylinder and remove internal seal block from cylinder.
6. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head, piston and seal block.
7. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
8. Inspect parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable; replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

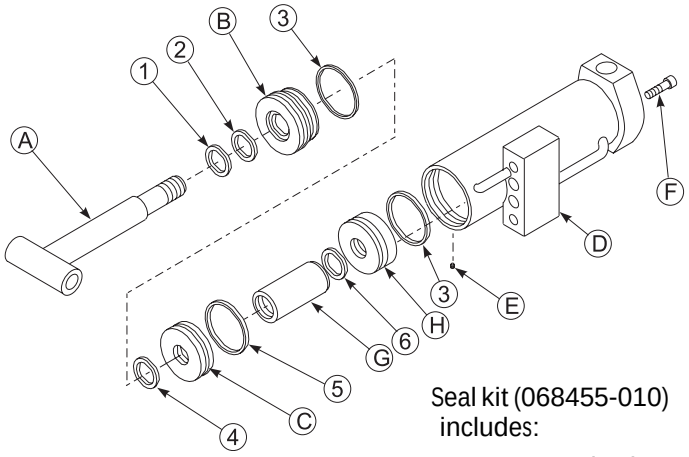
1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston, head and internal block.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Clean threaded end of rod and rod extension using loctite primer.
5. Using loctite #262, install rod extension onto rod.
6. lubricate seal block static seal and carefully push seal block into cylinder. Secure seal block using 1/4 socket head cap screws.
7. Lubricate seals on piston, head and seal block with hydraulic oil.
8. Carefully slide rod assembly into cylinder.
9. Thread head into cylinder. Be sure hole for set screw aligns with hole in cylinder tube.
10. Clean set screw in loctite primer. Install set screw using loctite #242.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Remove boom support.
3. Slowly raise and lower boom several times. Check hydraulic connections for leaks. Check for proper slave cylinder operation.



Seal kit (068455-010) includes:

1. Rod Wiper
2. Rod Seal
3. Static Seal
4. Static Seal
5. Piston Seal
6. Rod Seal

A. Rod
B. Head
C. Piston
D. Cylinder
E. Set Screw
F. Cap Screw
G. Rod Extension

Figure 3-22: Slave Cylinder

3.15 Cage Rotate Cylinder

REMOVAL

1. Support the cage assembly at a convenient working height.
2. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
3. Remove hardware which secures cage rotate cylinder. Remove cage rotate cylinder.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Unscrew head from cylinder
2. Carefully pull shaft assembly from cylinder.
3. Secure rod end and turn piston off of rod.

NOTE: Piston is loctited (Loctite #262) onto rod.

4. Slide the head off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect cylinder parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

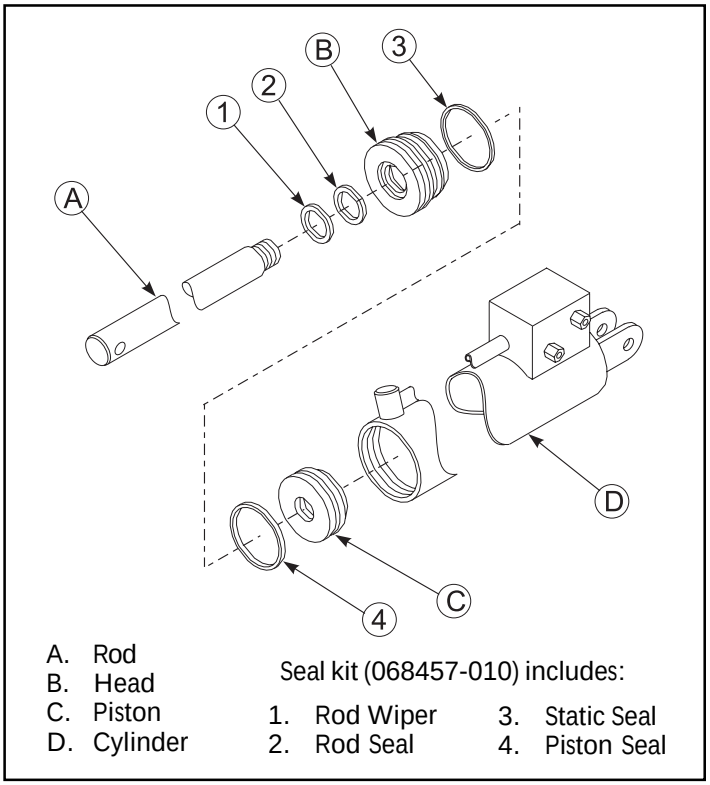
1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston and head.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Clean threaded end of rod using loctite primer.
5. Using loctite #262, install piston onto rod.
6. Lubricate seals on piston and head with hydraulic oil.
7. Carefully slide rod assembly into cylinder.
8. Thread head into cylinder.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Slowly cycle cage rotate cylinder several times. Check hydraulic connections for leaks. Check for proper cylinder operation.



A. Rod
B. Head
C. Piston
D. Cylinder

Seal kit (068457-010) includes:

1. Rod Wiper
2. Rod Seal
3. Static Seal
4. Piston Seal

Figure 3-23: Cage Rotate Cylinder

3.16 Steering Cylinder

REMOVAL

1. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
2. Remove hardware which secures the steering arms to the spindles.
3. Remove hardware which secures steering cylinder to the chassis. Remove steering cylinder.
4. Mark steering arms for position on cylinder. Remove hardware which secures steering arms to rod ends. Using a hammer and drift, remove the roll pins which secure the steering arms to the rod ends.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Mark heads for position on cylinder. Unscrew heads from cylinder.

IMPORTANT: Heads must be installed onto same end of cylinder as they were removed from.

2. Carefully pull rod assembly from cylinder.
3. Remove one snap ring and piston lock.
4. Slide the piston off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from heads and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect cylinder parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

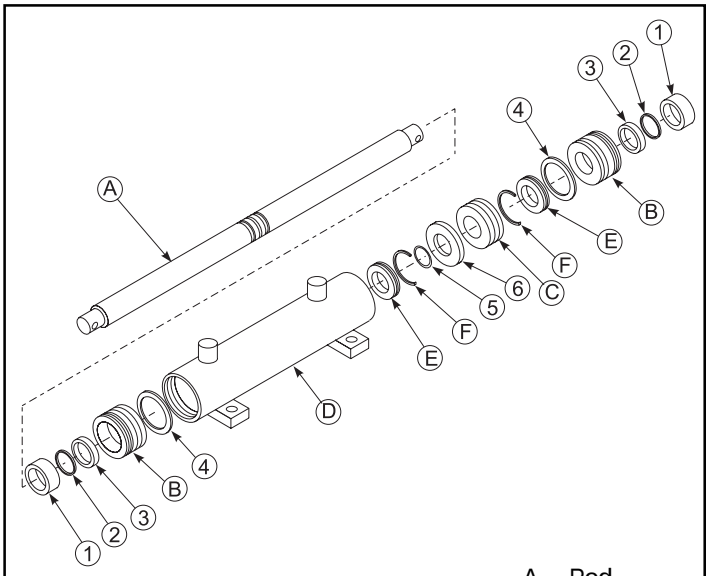
Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston and heads.
3. Lubricate seals on piston. Slide piston on rod and secure using piston lock and snap ring.
4. Carefully slide rod assembly into cylinder.
5. Thread heads into cylinder.

IMPORTANT: Heads must be installed onto same end of cylinder as they were removed from.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Slowly steering cylinder several times. Check hydraulic connections for leaks. Check for proper cylinder operation.



Seal kit (068456-010) includes:

1. Journal Bearing (2)
2. Rod Wiper (2)
3. Rod Seal (2)
4. Static Seal (2)
5. Static Seal
6. Piston Seal

A. Rod
B. Head (2)
C. Piston
D. Cylinder
E. Piston Lock
F. Snap Ring

Figure 3-24: Steering Cylinder

3.17 Jib Cylinder

REMOVAL

1. Using an overhead hoist or crane, support the cage assembly at a convenient working height.
2. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
3. Remove hardware which secures jib cylinder pins.

NOTE: Jib cylinder is heavy. Take appropriate measures to support cylinder.

4. Remove jib cylinder pins. Remove jib cylinder.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not even be visible to the naked eye.

1. Remove counterbalance valve from cylinder.
2. Unscrew head from cylinder.
3. Carefully pull shaft assembly from cylinder.
4. Secure rod end and turn piston off of rod.

NOTE: Piston is loctited (Loctite #277) onto rod.

4. Slide the head off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect cylinder parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

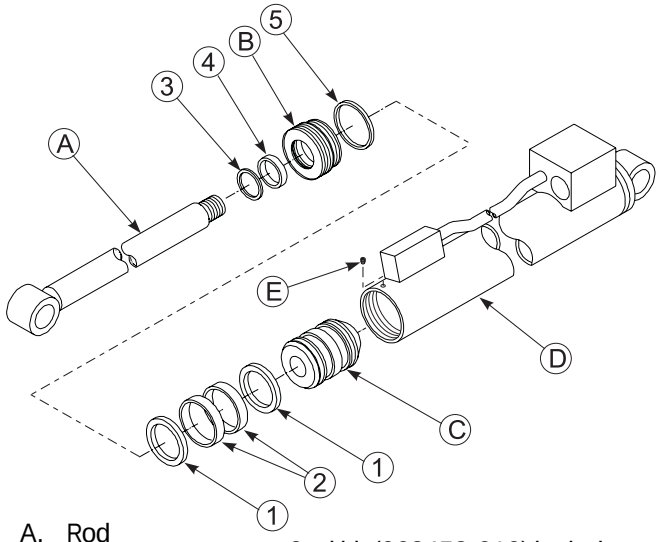
1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston and head.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Clean threaded end of rod using loctite primer.
5. Using loctite #277, install piston onto rod.
6. Lubricate seals on piston and head with hydraulic oil.
7. Carefully slide rod assembly into cylinder.
8. Thread head into cylinder.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Slowly cycle jib cylinder several times. Check hydraulic connections for leaks. Check for proper cylinder operation.



A. Rod
B. Head
C. Piston
D. Cylinder
E. Set Screw

Seal kit (068453-010) includes:

1. Piston Seal
2. Wear Ring
3. Rod Wiper
4. Rod Seal
5. Static Seal

Figure 3-25: Jib Cylinder

3.18 Boom Raise & Boom Riser Cylinders

REMOVAL

1. Raise elevating assembly until cylinder pins are accessible.
1. Support the elevating assembly(refer to Figure 3-1).
2. Mark and disconnect hoses and immediately cap the openings to prevent contamination.
3. Remove hardware which secures cylinder. Remove cylinder.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Remove set screw from cylinder tube and unscrew head from cylinder.
2. Unscrew head from cylinder
3. Carefully pull shaft assembly from cylinder.
4. Remove 3/16 set screw which secures piston to rod.

NOTE: Set screw is loctited (Loctite #242) into piston.

2. Secure end of rod and turn piston off of rod.
4. Slide stop tube and head off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect cylinder parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

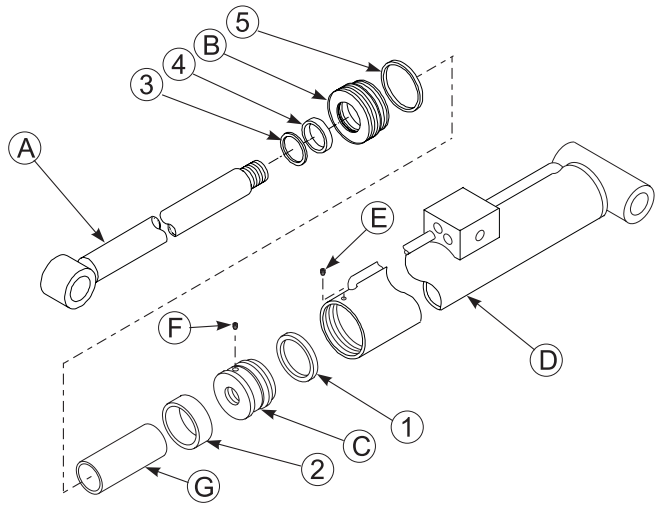
1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston and head.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Slide stop tube onto rod.
5. Thread piston onto rod. Be sure set screw hole lines up with hole on end of rod.
6. Using loctite #242, secure piston to rod with 3/16 set screw.
7. Lubricate seals on piston and head with hydraulic oil.
8. Carefully slide rod assembly into cylinder.
9. Thread head into cylinder. Be sure hole for setscrew aligns with hole in cylinder tube.
10. Clean set screw in loctite primer. Install set screw using loctite #242.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.
2. Slowly cycle cylinder several times. Check hydraulic connections for leaks. Check for proper cylinder operation.



Boom Raise Seal kit (068451-010) includes:
Boom Riser Seal kit (068450-010) includes:

A. Rod	E. Set Screw	1. Piston Seal
B. Head	F Set Screw	2. Wear Ring
C. Piston	G. Stop Tube	3. Rod Wiper
D. Cylinder		4. Rod Seal
		5. Static Seal

Figure 3-26: Boom Riser Cylinder (shown)

3.19 Boom Extend Cylinder

REMOVAL

1. Lower boom completely. Extend boom until front boom extend cylinder pin is accessable.
1. Use an overhead hoist or crane to support the rear of the boom (Figure 3-27).
2. Remove rear boom pivot pin.
3. Remove clips which secure front boom extend cylinder pin. Remove pin.
4. Mark and disconnect boom extend cylinder hoses and immediately cap the openings to prevent contamination.
5. Using overhead hoist, slightly raise rear of boom.

NOTE: This will extend master cylinder and allow room to remove boom extend cylinder. It may be necessary to remove a counterbalance valve to allow master cylinder to expand.

6. Remove rear boom extend cylinder pin. Carefully remove boom extend cylinder. Measure length of expanded boom cylinder.

IMPORTANT: Boom extend cylinder must be expanded to the same length when it is reinstalled.

DISASSEMBLY

Note: Provide a clean work area for this operation, and observe clean assembly practices. Seals and hydraulic cylinder components are highly sensitive to contamination that may not be visible to the naked eye.

1. Remove set screw and unscrew head from cylinder.
3. Carefully pull shaft assembly from cylinder.
4. Secure rod end and turn piston off of shaft.

NOTE: Piston is loctited (Loctite #277) onto rod.

4. Slide the head off of the rod.
5. Remove seal kit components (wipers, rod seals, o-rings and backup rings) from head and piston.
6. Thoroughly clean all parts with solvent. Rinse the inside of the tube and allow to drain. A high pressure rinse and wipe with a lint free rag is preferable.
7. Inspect cylinder parts for scratches, pits, or polishing. Check seal groves and sealing surfaces. Scratches or pits deep enough to catch the fingernail are unacceptable, replace the cylinder. Polishing is a sign of uneven loading. When this occurs, the surface should be checked for roundness. Cylinders not round within .007" should be replaced.

ASSEMBLY

NOTE: Torque all hardware to torques listed on page 3-31 unless otherwise specified.

1. Lubricate all components and seals with clean hydraulic oil prior to assembly.

Note: To avoid cutting the seals, do not use sharp edged tools during seal replacement. After installing seals allow at least one hour for the seals to elastically restore to their original shape before assembling cylinder.

2. Install new seal kit items to piston and head.
3. Lubricate rod wiper and seal with hydraulic oil and slide head onto rod.
4. Clean threaded end of rod using loctite primer.
5. Using loctite #277, install piston onto rod.
6. Lubricate seals on piston and head with hydraulic oil.
7. Carefully slide rod assembly into cylinder.

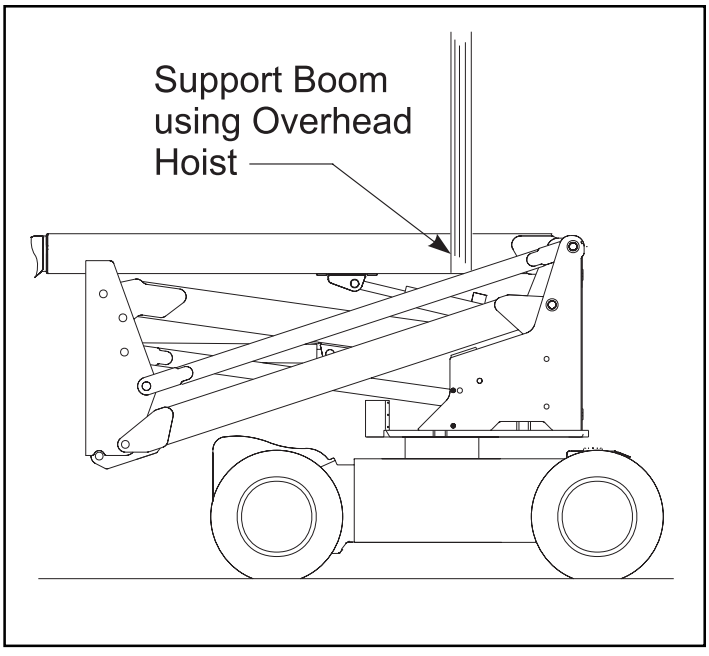


Figure 3-27: Removing Boom Extend Cylinder

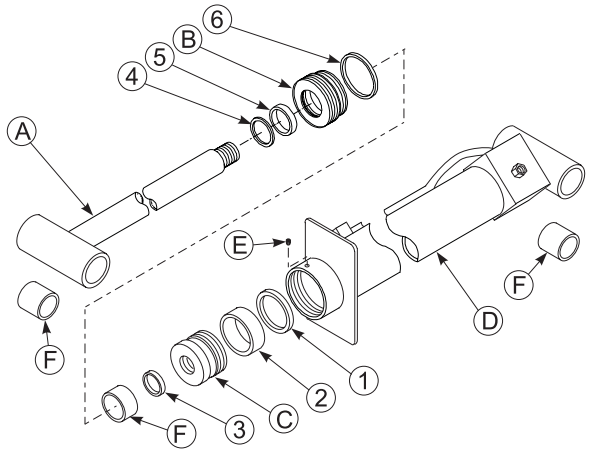
8. Thread head into cylinder.Using loctite #242, install set screw.

INSTALLATION

1. Follow steps from "REMOVAL" section in reverse order to install cylinder.

IMPORTANT: Boom extend cylinder must be expanded to the same length it was when it was removed.

2. Slowly cycle cylinder several times. Check hydraulic connections for leaks. Check for proper cylinder operation.



A. Rod
B. Head
C. Piston
D. Cylinder
E. Set Screw
F. Bushing

Seal kit (068452-010) includes:

1. Piston Seal
2. Wear Ring
3. Static Seal
4. Rod Wiper
5. Rod Seal
6. Static Seal

Figure 3-28: Boom Extend Cylinder

3.20 LONG TERM STORAGE

If the work platform is to be placed in long term storage (dead storage) follow these recommended preservation procedures.

PRESERVATION

1. Clean painted surfaces. If paint is damaged, repaint.
2. Fill the hydraulic tank to operating level. Fluid will be visible at the sight gauge (BiEnergy models) or on dipstick (Electric models).

IMPORTANT: Do not fill the hydraulic tank while the platform is elevated.

NOTE: Do not drain the hydraulic system prior to long term storage.

3. Coat exposed portions of cylinder rods with a preservative such as multipurpose grease and wrap with a barrier material.
4. Coat all exposed unpainted metal surfaces with preservative.
5. Service the engine according to the manufacturers recommendations.
6. Remove the batteries and place in alternative service.

3.21 Torque Specifications (Tables 3-3 & 3-4)

FASTENERS

Use the following values to torque fasteners used on UpRight Work Platforms unless a specific torque value is called out for the part being installed.

Table 3-3: Bolt Torque

THREAD SIZE American National Std.-UNC (course) Grade 5	WIDTH ACROSS FLATS	TORQUE VALUE ENGLISH	TORQUE VALUE METRIC
1/4	7/16	110 In/Lbs	12 N·m
5/16	1/2	190 In/Lbs	22 N·m
3/8	9/16	30 Ft/Lbs	41 N·m
7/16	5/8	50 Ft/Lbs	68 N·m
1/2	3/4	75 Ft/Lbs	102 N·m
5/8	1 5/16	150 Ft/Lbs	203 N·m
3/4	1 1/8	250 Ft/Lbs	339 N·m
7/8	1 15/16	400 Ft/Lbs	542 N·m
1	1 1/2	600 Ft/Lbs	813 N·m

HYDRAULIC COMPONENTS

Use the following values to torque hydraulic components used on UpRight Work Platforms.

Note: Always lubricate threads with clean hydraulic oil prior to installation.

Table 3-4: Hydraulic Component Torque

TYPE: SAEPART SERIES	CARTRIDGE POPPET (Ft/Lbs)	CARTRIDGE POPPET Nm)	FITTINGS (Ft/Lbs	FITTINGS Nm)	HOSES (In/Lbs	HOSES Nm)
#4	N/A	N/A	N/A	N/A	135-145	15-16
#6	N/A	N/A	10-20	14-27	215-245	24-28
#8	25-30	34-41	25-30	34-41	430-470	49-53
#10	35-40	47-54	35-40	47-54	680-750	77-85
#12	85-90	115-122	85-90	115-122	950-1050	107-131
#16	130-140	176-190	130-140	176-190	1300-1368	147-155

Coil nuts: 30 IN/Lbs (3 Nm)

NOTES:

4.0 Introduction

The following section on troubleshooting provides guidelines on the types of problems users may encounter in the field, helps determine the cause of problems, and suggests proper corrective action.

Careful inspection and accurate analysis of the symptoms listed in the Troubleshooting Guide will localize the trouble more quickly than any other method. This manual cannot cover all possible problems that may occur. If a specific problem is not covered in this manual, call our toll free number for service assistance.

Referring to *Section 2.0* and *5.0* will aid in understanding the operation and function of the various components and systems of the AB46 and help in diagnosing and repair of the machine.

GENERAL PROCEDURE

Use the charts on the following pages to help determine the cause of a fault in your UpRight AB46.

1. Verify your problem.

   Do a full function test from both platform controls and chassis controls and note all functions that are not operating correctly.

2. Narrow the possible causes of the malfunction.

   Use the troubleshooting guide to determine which components are common to all circuits that are not functioning correctly.

3. Identify the problem component.

   Test components that are common to all circuits that are not functioning correctly. Remember to check wires and terminals between suspect components. Be sure to check connections to battery negative.

4. Repair or replace component found to be faulty.

5. Verify that repair is complete.

   Do a full function test from both platform and chassis controls to verify that all functions are operating correctly and machine is performing to specified values.

Follow the fault finding charts to diagnose problems with the MOS90 drive system.

NOTE: Spike protection diodes at components have been left out of the charts to eliminate confusion.

⚠ WARNING ⚠

When troubleshooting, ensure that the work platform is resting on a firm, level surface.

When performing any service which requires the platform to be raised, the Elevating Assembly must be blocked.

Disconnect the battery ground cable when replacing or testing the continuity of any electrical component.

FOR SERVICE ASSISTANCE, IN THE U.S.A., CALL:

1-800-926-5438

FROM OUTSIDE THE USA, CALL 1-209-896-5150

4.1 OPERATIONAL THEORY

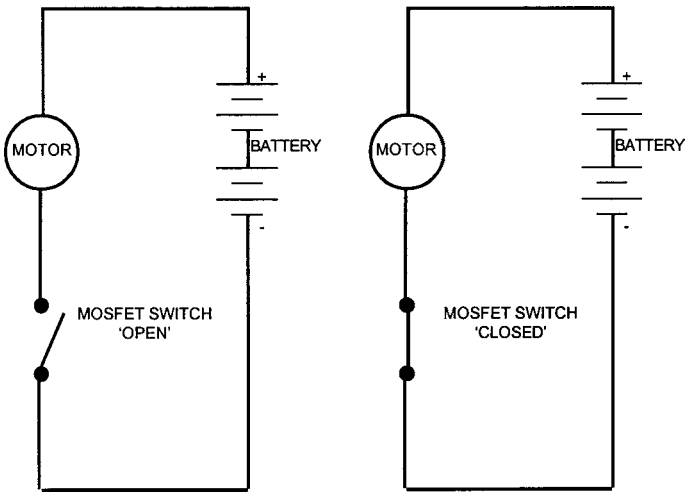
The DC motor controller has four connections: Positive (B+), Battery Negative (B-), Motor Field Negative and Field Negative (S).

The electric motor has continuous battery positive (B+) over the main fuse. Inside the controller are high current MOSFET transistors and capacitors and the control circuitry.

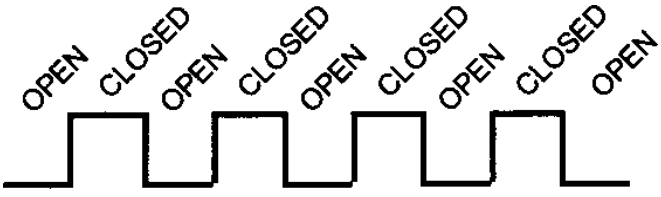
The controller acts as a switch. The amount of time Battery Negative (B-) and Motor Field Negative (A) are "connected" controls the RPM of the electric motor.

- If (B-) and (A) are connected all the time the motor will turn at 100%.
- If (B-) and (A) are not connected the motor will turn at 0%.
- The percentage of connection controls the speed of the motor.

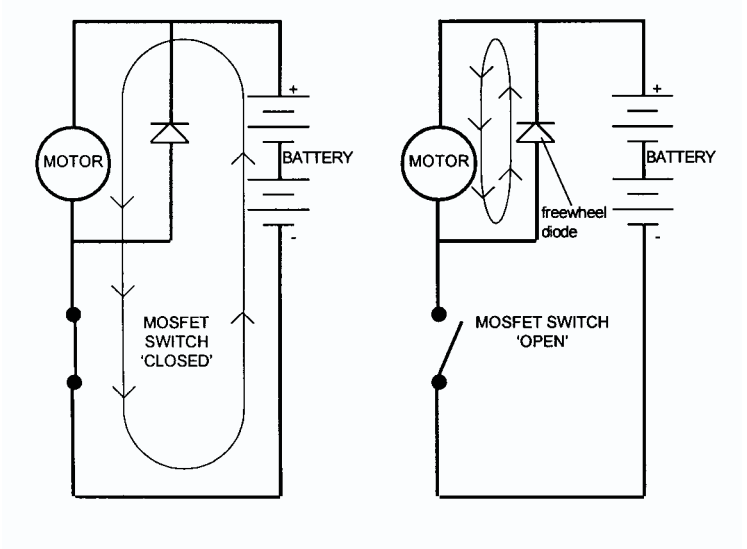
The controller acts as a switch which has the ability to open and close (pulse) very rapidly.



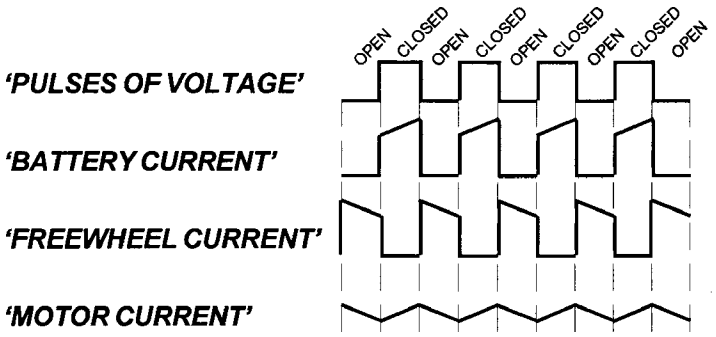
The number of pulses determines the voltage to the motor.



The motor is equipped with a "freewheel diode". During open cycle of MOS90 a current is produced by the motor. The freewheel diode collects this current and sends it back through the motor.



Equal pulses of open and closed drive the motor at half speed.

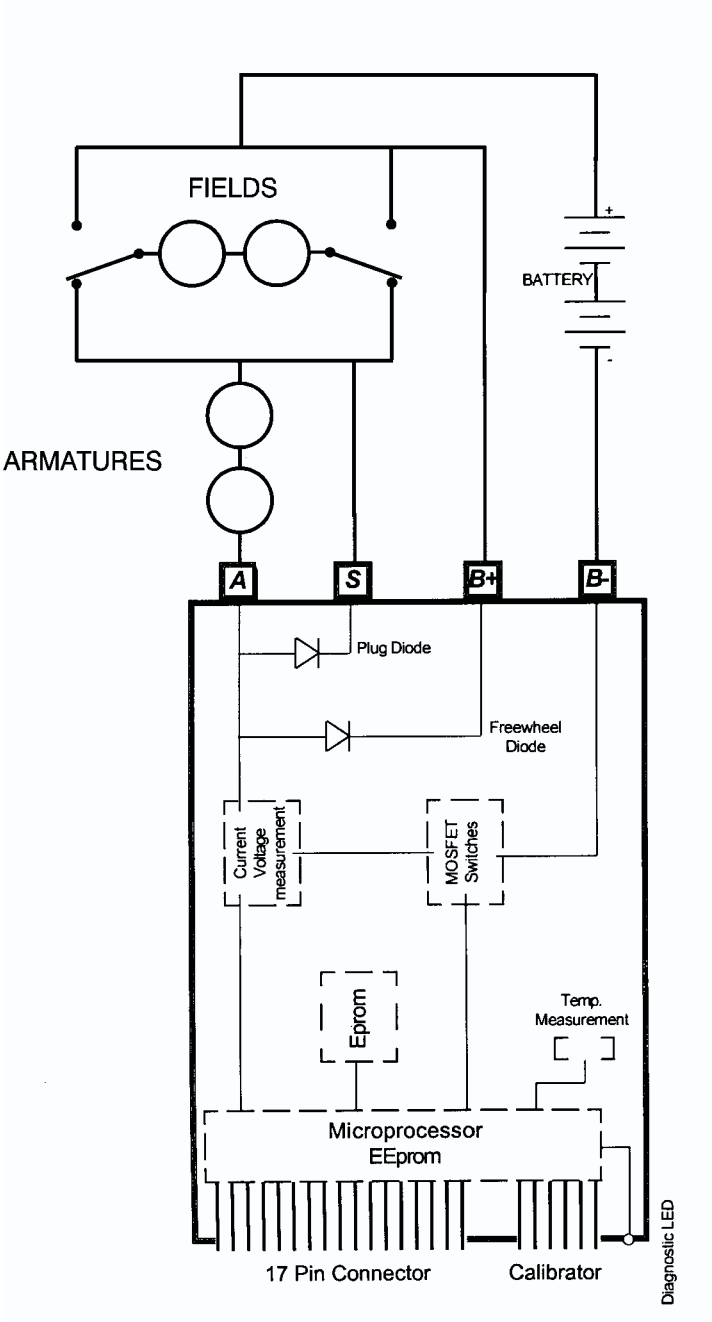


At low speed the MOSFET is mostly open and most of the current is from freewheel. At high speed the mosfet is mostly closed and most of the current is from the battery.

The motor armatures and fields are in series.

Forward and reverse are achieved by using directional contactors to control the direction of current in the drive motors.

Terminal (S) connects the "Drive Motor Armatures" to a diode inside the MOS90. When the machine stops, a signal is given to apply the brakes.



The illustration below shows a block diagram of the machines electrical system.

Refer to section 5 "SCHEMATICS" for a detailed electrical schematic.

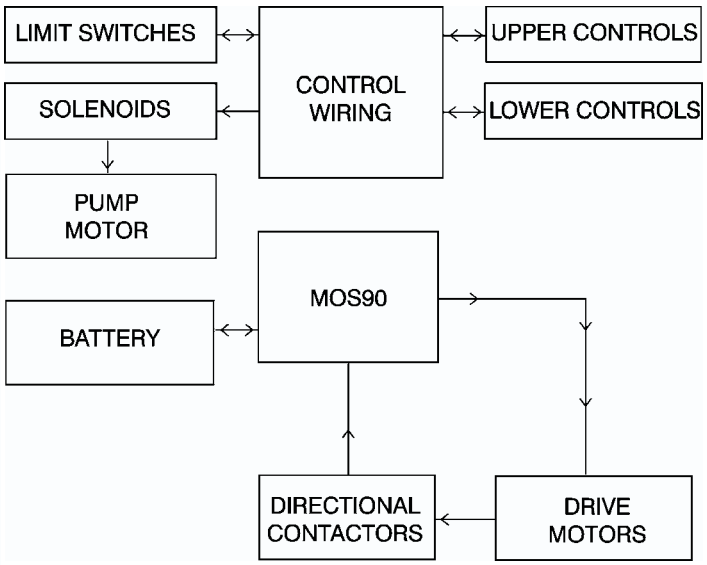


Table 4-1 Troubleshooting Guide - Hydraulic Schematic

Component / Function	Steer	Riser	Boom Extend	Boom Raise	Jib	Cage Level	Cage Rotate	Slew	Drive	Brake Release	Parking Brake Release
Pump	X	X	X	X	X	X	X	X			
Steer Valve	X										
Steer Cylinder	X										
High Relief	X	X	X	X	X	X	X	X			
Relief Check Valves	X	X	X	X	X	X	X	X			
High Dump	1	X	X								
Diverter Valve	2	2	2	2	2	2	2	2			
Riser Valve		X									
Riser Cylinder		X									
Riser C/B Valve		X									
Riser CK Valve		X									
Boom Extend Valve			X								
Boom Extend Cylinder			X								
Boom Extend C/B Valve			X								
Boom Extend CK Valve			X								
Boom Raise Valve				X							
Boom Raise Cylinder				X							
Boom Raise C/B Valve				X							
Boom Raise CK Valve				X							
Proportional Valve				X	X	X	X	X			
Jib Valve					X						
Jib Orifice					X						
Jib Cylinder					X						
Jib C/B Valve					X						
Jib CK Valve					X						
Master Cylinder						X					
Master Cylinder C/B Valves						X					
Master Cylinder CK Valves						X					
Slave Cylinder						X					
Slave Cylinder CB Valves						X					
Trim Level Valve						X					
Low Relief Valve		X	X	X	X	X	X	X			
Cage Rotate Cylinder							X				
Cage Rotate Valve							X				
Cage Rotate C/B Valve							X				
Cage Rotate CK Valve							X				
Slew Motor								X			
Turret Rotate Valve								X			
Turret Rotate CK Valve								X			
1000 PSI Relief								X			
Brake Valve									X	X	X
Brake Orifices									X	X	X
Brakes									X	X	X
1. High dump is not activated by steering. It will close for other functions while steering.											
2. Diverter valve is not activated during normal operation. Only for hand pump operation.											
3. Bypass valve is not energized during normal operation.											

Table 4-2 Troubleshooting Guide - Electrical Schematics

Component / Function	Upper Control Functions	Lower Control Functions	Steer Right	Steer Left	Riser Elevate	Riser Descend	Boom Extend	Boom Retract	Boom Raise	Boom Lower	Jib Up	Jib Down	Cage Level Up	Cage Level Down	Cage Rotate CCW	Cage Rotate CW	Slew CCW	Slew CW	Drive Forward	Drive Reverse	Parking Brake Release	Tilt Alarm	Tilt Light	Battery Charger
Battery	X	X																						X
Battery Disconnect	X	X																						X
Battery Charger																								X
Main Power Relay Coil	X	X																						
Main Power Relay Contacts NC																								X
Main Power Relay Contacts NO	X	X																						
25 A Fuse	X	X																						
Chassis EM Stop Switch	X	X																						
Chassis Key Switch	X	X																			X			
10 Amp Circuit Breaker CB1	X	X																						
10 Amp Circuit Breaker CB3																			X	X				
10 Amp Circuit Breaker CB2	X	X																						
Platform EM Stop Switch	X	X																						
10 Amp Control Box Fuse	X																							
Control Box Key Switch	X																							
Diode DB20	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Diode DB19		X			X	X	X	X																
Diode DB18			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Diode DB14	X																							
Diode DB13	X																							
Diode DB25																					X			
Diode DB9		X									X	X			X	X	X	X						
Diode DB10		X			X	X	X	X					X	X										
Diode DB11		X							X	X														
Diode DB3				X																				
Diode DB2			X																					
Diode DB5	X				X	X	X	X																
Diode DB6		X			X	X	X	X																
Diode 1	X												X											
Diode 2	X													X										
Diode 3	X										X													
Diode 4	X											X												
Diode 5	X								X															
Diode 6	X									X														
Diode 7	X						X																	
Diode 8	X							X																
Diode 9	X				X																			
Diode 10	X					X																		
Diode 11	X															X								
Diode 12	X														X									
Diode 13	X																	X						
Diode 14	X																X							
Diode 1		X											X											
Diode 2		X												X										
Diode 3		X									X													
Diode 4		X										X												
Diode 5		X							X															
Diode 6		X								X														
Diode 7		X					X																	
Diode 8		X						X																
Diode 9		X			X																			
Diode 10		X				X																		
Diode 11		X														X								
Diode 12		X													X									
Diode 13		X																X						
Diode 14		X															X							
Diode DB16	X								X	X														
Diode DB17	X										X	X	X	X	X	X	X	X						
Diode DB18	X				X	X	X	X																
Diode DB18B	X				X	X	X	X																
Diode DB9	X								X	X														
Diode DB10	X										X	X	X	X	X	X	X	X						
Diode DB11		X							X	X														
Diode DB12		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Diode DB12B		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Diode DB14	X										X	X	X	X	X	X	X	X						
Low Tilt Relay *Coil*	X	X																				X	X	
Low Tilt Relay *Contacts*	X	X																				X	X	

Troubleshooting

Table 4-2 Troubleshooting Guide - Electrical Schematics (continued)

Component ↓ / Function →	Upper Control Functions	Lower Control Functions	Steer Right	Steer Left	Riser Elevate	Riser Descend	Boom Extend	Boom Retract	Boom Raise	Boom Lower	Jib Up	Jib Down	Cage Level Up	Cage Level Down	Cage Rotate CCW	Cage Rotate CW	Slew CCW	Slew CW	Drive Forward	Drive Reverse	Parking Brake Release	Tilt Alarm	Tilt Light	Battery Charger
Tilt Light *off for normal functions*	X	X																						
Tilt Alarm off f*or normal operation*	X	X																						
Brake Relay *contacts*	X	X																						
Tilt Sensor *(red wire)*	X	X																						
Tilt Sensor *(white wire)*	X	X																				X	X	
Tilt Sensor *(green wire)*	X	X																	X	X				
Horn Relay *contacts*	X	X																						
Down Limit Switch	X	X																						
Down Relay *coil*	X	X																						
Chassis Control Power Relay *coil*	X	X																						
Chassis Control Power Relay *contacts*	X	X																						
Lower Turret Rotate Switch																	X	X						
Lower Cage Rotate Switch															X	X								
Lower Trim Switch													X	X										
Lower Jib Switch											X	X												
Lower Boom Elevate Switch									X	X														
Lower Boom Extend Switch							X	X																
Lower Riser Switch					X	X																		
Diode DB16											X	X	X	X	X	X	X	X						
Diode DB8											X	X	X	X	X	X	X	X						
Diode DB8.1											X	X	X	X	X	X	X	X						
Boom Speed Relay *coil*											X	X	X	X	X	X	X	X						
Boom Speed Relay *contacts*											X	X	X	X	X	X	X	X						
Turtle / Rabbit Knob											X	X	X	X	X	X	X	X						
Diode DB17					X	X	X	X																
Diode DB18									X	X														
Foot Switch			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Upper Turret Rotate Switch																	X	X						
Upper Cage rotate Switch															X	X								
Upper Trim Switch													X	X										
Upper Jib Switch											X	X												
Lower Boom Elevate Switch									X	X														
Upper Boom Extend Switch							X	X																
Upper Riser Switch					X	X																		
Turret Drive Relay *contacts*															X	X	X	X						
Boom Disconnect Relay *contacts*					X	X	X	X	X	X	X	X												
Diode DB7											X	X	X	X	X	X	X	X						
Diode DB6									X	X														
Diode DB11											X	X	X	X	X	X								
Diode DB3					X	X	X	X																
Diode DB2					X	X	X	X																
Diode DB9									X	X														
Diode DB23L			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Diode DB23R																			X					
Diode DB24																						X		
Speed Control Knob									X	X	X	X	X	X	X	X	X	X						
Boom Speed Relay *contacts*									X	X	X	X	X	X	X	X	X	X						
Boom Speed Relay *coil*											X	X	X	X										
Drive Enable Relay *coil*																			X					
Drive Enable Relay *contacts*																			X					
Steer Right Switch			X																					
Steer Left Switch				X																				
Down Relay *contacts*													X	X										
Down Relay *contacts*																						X		
Down Relay *contacts*																			X	X				
Boom Extend Drive Interlock Switch																			X	X				
Boom Disconnect Relay *coil*																			X	X				
Turret Drive Relay *coil*																			X	X				
Drive Joystick																			X	X				
Right Drive motor																			X	X				
Left Drive Motor																			X	X				
Mos 90 Motor Controller																			X	X				
Forward Contactor																			X					
Reverse Contactor																				X				
Power Unit			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Boom Pump Relay *coil*			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Boom Pump Relay *contacts*			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Brake Pressure Switch																			X	X				

Table 4.2 Troubleshooting Guide - Electrical Schematics (continued)

Component / Function	Upper Control Functions	Lower Control Functions	Steer Right	Steer Left	Riser Elevate	Riser Descend	Boom Extend	Boom Retract	Boom Raise	Boom Lower	Jib Up	Jib Down	Cage Level Up	Cage Level Down	Cage Rotate CCW	Cage Rotate CW	Slew CCW	Slew CW	Drive Forward	Drive Reverse	Parking Brake Release	Tilt Alarm	Tilt Light	Battery Charger
Brake Release Pressure Switch																					X			
Tach Card																			X	X				
Resistor Pack																			X	X				
Tach-Gen (2)																			X	X				
Brake Valve NO																			X	X	X			
Brake Valve NC																			X	X				
Controller Off Switch																			X	X				
Forward Switch																			X	X				
Reverse Switch																			X	X				
5K Resistor																			X	X				
Trim Up Solenoid Valve													X											
Trim Down Solenoid Valve														X										
Trim Up Upper Control Diode													X											
Trim Up Relay Lower Control Diode													X											
Trim Down Upper Control Diode														X										
Trim Down Lower Control Diode														X										
Jib Up Solenoid Valve											X													
Jib Down Solenoid Valve												X												
Jib Up Upper Control Diode											X													
Jib Up Relay Lower Control Diode											X													
Jib Down Upper Control Diode												X												
Jib Down Relay Lower Control Diode												X												
Boom Up Solenoid Valve									X															
Boom Down Solenoid Valve										X														
Boom Up Upper Control Diode									X															
Boom Up Lower Control Diode									X															
Boom Down Upper Control Diode										X														
Boom Down Lower Control Diode										X														
Boom Extend Solenoid Valve							X																	
Boom Retract Solenoid Valve								X																
Boom Extend Upper Control Diode							X																	
Boom Extend Lower Control Diode							X																	
Boom Retract Upper Control Diode								X																
Boom Retract Lower Control Diode								X																
Riser Up Solenoid Valve					X																			
Riser Down Solenoid Valve						X																		
Riser Up Upper Control Diode					X																			
Riser Up Lower Control Diode					X																			
Riser Down Upper Control Diode						X																		
Riser Down Lower Control Diode						X																		
Cage Right Solenoid Valve																X								
Cage Left Solenoid Valve															X									
Cage Right Upper Control Diode																X								
Cage Right Lower Control Diode																X								
Cage Left Upper Control Diode															X									
Cage Left Lower Control Diode															X									
Turret Right Solenoid Valve																		X						
Turret Left Solenoid Valve																	X							
Turret Right Upper Control Diode																		X						
Turret Right Lower Control Diode																		X						
Turret Left Upper Control Diode																	X							
Turret Left Lower Control Diode																	X							
Steer Right Solenoid Valve			X																					
Steer Right Diode			X																					
Steer Left Solenoid Valve				X																				
Steer Left Diode				X																				
Proportional Valve									X	X	X	X	X	X	X	X	X	X						
High Flow Valve					X	X	X	X																
Diode DB21																					X			
Bypass Solenoid Valve																					X			
Diode DB25																					X	X		

4.3 Troubleshooting the MOS90

Important basics applicable to the motor control unit.

- The MOS90 has a green diagnostics L.E.D. in the front panel.
- The green L.E.D. will turn on and shine continuously when the MOS90 is powered up and working correctly.
- The green L.E.D. will be off if no power is supplied to the MOS90.
- The green L.E.D. will flash a sequence of flashes if the MOS90 is damaged or is receiving an improper signal. An explanation of the flash sequences "flash faults" is shown on the following pages.
- The MOS90 is high temperature protected by "thermal cutback". The cutback operates between 80°C (176°F) and 90°C (194°F). Powered functions will gradually operate slower and slower until 90°C (194°F). The MOS90 will shut down at 90°C (160°F). Continued operation at high temperature will damage the MOS90.
- The MOS90 is low voltage protected by "low voltage cutout". The MOS90 shuts down at 14.0 VDC. Powered functions suddenly stop. When input voltage goes above 14.0 VDC turns back on.

WHEN A FLASH ERROR OCCURS

Step 1.

Disconnect the 17 pin connector from the MOS90. Wait Five (5) seconds and plug it back in again. If the flash error repeats go to step Two (2). If the green L.E.D. lights up and stays on continuously - operate machine. Note which functions are being used when problem repeats itself.

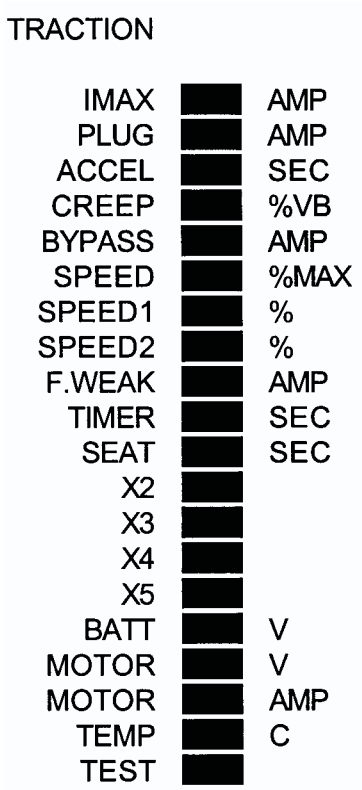
Step 2.

Disconnect the 17 pin connector from the MOS90. Connect pin Six (6) to a fused battery supply (14.0 VDC minimum) and observe the green L.E.D. If flash error stays, replace MOS90. If green L.E.D. lights up and remains on continuously, check wiring.

NOTE: Troubleshoot the possible cause of the flash error before replacing the MOS90, for example an Eight (8) flash error will cure itself when the MOS90 cools down.

4.4 Using the Calibrator

The calibrator has 20 L.E.D. segments marked as shown.



The values which should be expected when checking the machine are shown on the following page.

There are three buttons on the calibrator:

increment, marked +

decrement, marked -

select

When select is pressed, each L.E.D. will light in sequence until the select button is released. Each personality can be incremented or decremented using the + or - buttons when the adjacent L.E.D. is lit.

When "Test" L.E.D. is lit, the state of the MOS90 inputs is displayed. The first input displayed is the accelerator which can vary from 0-100%. When the + button is pressed once the switch Input 1 is displayed. This will be seen as "10P" until the switch Input voltage changes. "1CL" will then be displayed. This is repeated for all the switch inputs.

When BATTV, MOTORV, MOTORA and TEMPC are selected, the controller shows their values. When BATTV is selected and the "+" button is held in, the highest voltage that the MOS90 has recorded will be displayed. When TEMPC is selected and the "+" button is held in, the highest temperature that the MOS90 has recorded will be displayed. The "-" button will display the lowest values.

When the MOS90 is first powered up, the recorded minutes of run time is displayed. The "+" button displays thousands of hours and the "-" button displays hundreds of hours. When the MOS90 is pulsing (being used) run time is being incremented and stored.

4.5 Calibrator Settings

Table 4-3 Calibrator Settings

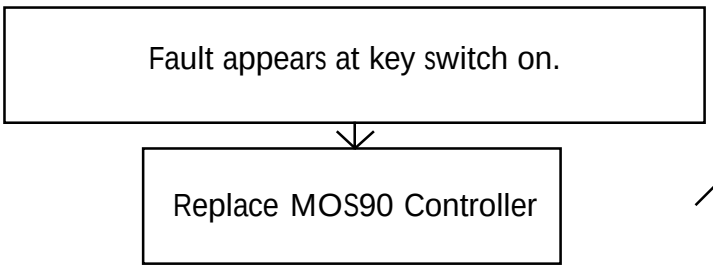
LED	Function	Unit	Setting	Comments
IMAX	MOS90 Maximum Amp. Capacity	Amps	600	
PLUG	Acceleration Delay	Seconds	2.0	
ACCEL	Deceleration Delay	Seconds	0.1	
CREEP	Not Used	%	0	
BYPASS	Stowed Max. Drive Soeed, Level	%	100	
SPEED	Elevated Drive Speed, Level	5	20	Elevated Drive Speed, Off-Level => Alarm On. No Drive
SPEED1	Stowed Max. Drive Speed, Off-Level First Tilt Setting	%	75	Drive Speed is reduced when Off-Level in Stowed Position
SPEED2	Stowed Max. Drive Speed, Off-Level	%	25	Drive Speed is reduced when Off-Level in Stowed Position
F.WEAK	Max. Plugging Current	Amps	750	
TIMER	Not Used			
SEAT	Not Used			
X3	Not Used			
X4	Not Used			
X5	Not Used			
BATT	Battery Voltage at pin #6 on MOS90	Volts	Real Time	
MOTOR	Voltage across Motor Contacts	Volt	Real Time	
MOTOR	Amperage Across Motor Contacts	Amp	Real Time	
TEMP	Internal Temp of Controller	Celsius	Real Time	
TEST	Switch Activation and Status	OP/CL %		Open=Unactivated Closed=Activated %=Percentage

4.6 MOS90 Fault Finding Flow Charts

At battery connection, the LED should not illuminate. At key ON, the LED should illuminate steadily. If the LED illuminates and remains steady, but no drive can be selected, the calibrator can be used to test the wiring harness.

1 Flash

- *Power up/Fail-safe Fault*
- *EEPROM data corrupted on key*

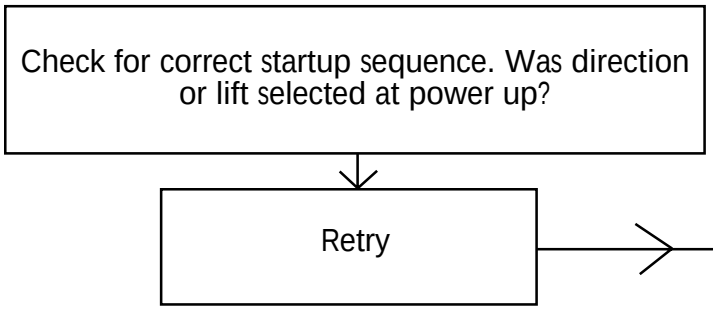


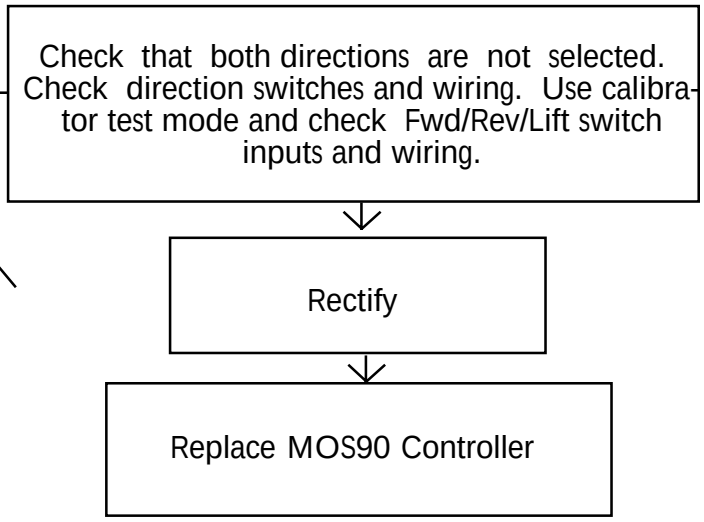
2 Flashes

- *Procedure Fault*
- *Illegal Startup Sequence.*

Two directions selected together, direction and lift selected together or lift and ground selected together

- *Drive inhibited*
- *Flashes until fault is cleared*

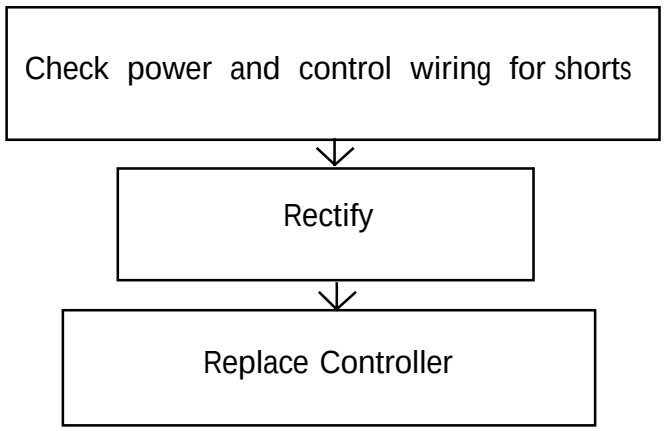




3 Flashes

- *Point "A" less than 7V in neutral, or less than 7V for 15mS in drive, or contactor coil short circuit.*
- *Drive inhibited.*
- *Recycle to neutral to clear.*

NOTE: If recycling to neutral does not clear the fault, then the fail-safe is due to a S/C contactor coil and the keyswitch must be recycled (and the coil replaced).



4 Flashes

- *Direction contactor welded. Point "A" within 6V of B+ve in neutral)*
- *Leakage between motor armature and field.*
- *Drive inhibited.*
- *Flashes in neutral until fault is cleared*

Check direction contactor tips

↓

Free/change tips

↓

Check power wiring for shorts

↓

Rectify

↓

Check motor for armature to field shorts or leakage

↓

Rectify

↓

Check for shorts to frame and battery leakage

↓

Rectify

↓

Replace MOS90 Controller

5 Flashes

- *Direction contactors (or line contactor) did not close.*
- *Motor armature or field open circuit.*
- *Point "A" not within 6V of B+ve within one second of selecting direction.*
- *Drive inhibited.*
- *Flashes until fault is cleared, when contactor closes.*

Check contactor tips

↓

Repair/replace

↓

Check contactor for mechanical operation and coil O.K.

↓

Repair/replace

↓

Check power and control wiring

↓

Rectify

↓

Check for open circuit motor

↓

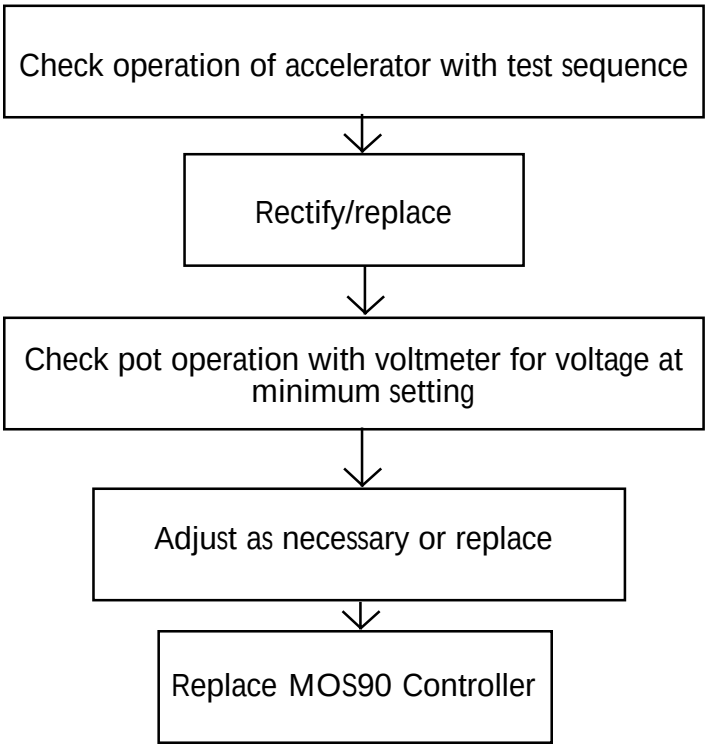
Rectify

↓

Replace controller

6 Flashes

- *Accelerator faults*
- *3.5 Volts to 0 Volts = Min. to Max. Speed on accelerator input (pin 14). Greater than 4.5 volts can mean an open accelerator pot. Less than 2.5 Volts on power up, indicates more than 30% demand*
- *Controller pulses at creep setting*
- *Flashes until fault cleared*



7 Flashes

- *Battery voltage dipped below 13 volts*
- *Drive inhibited*
- *Recycle to neutral to clear flash*

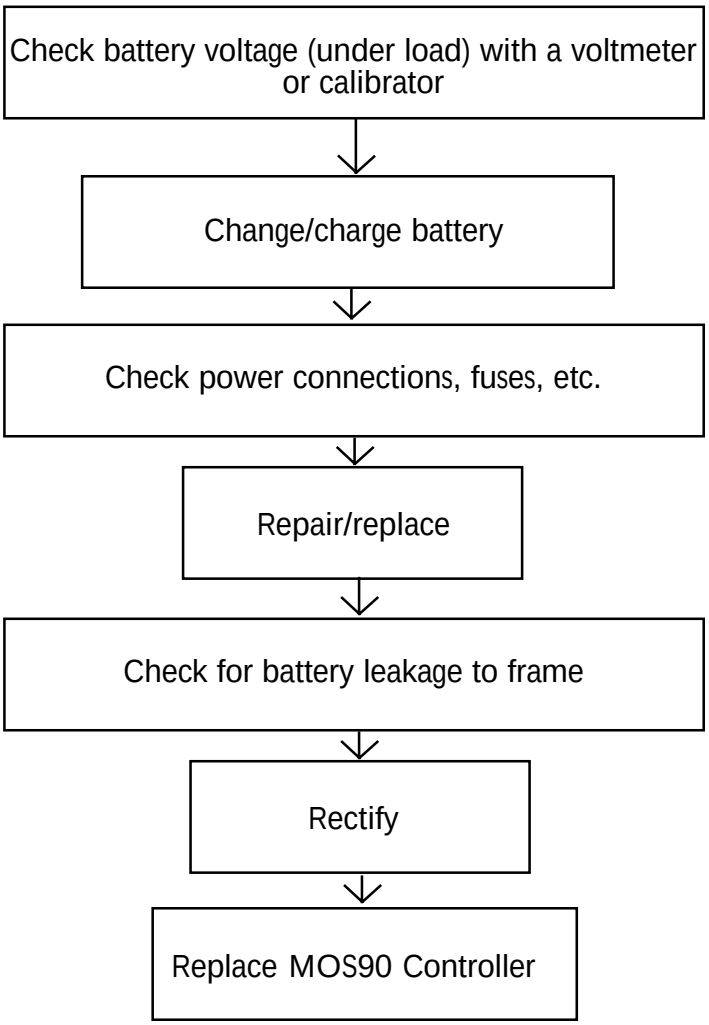
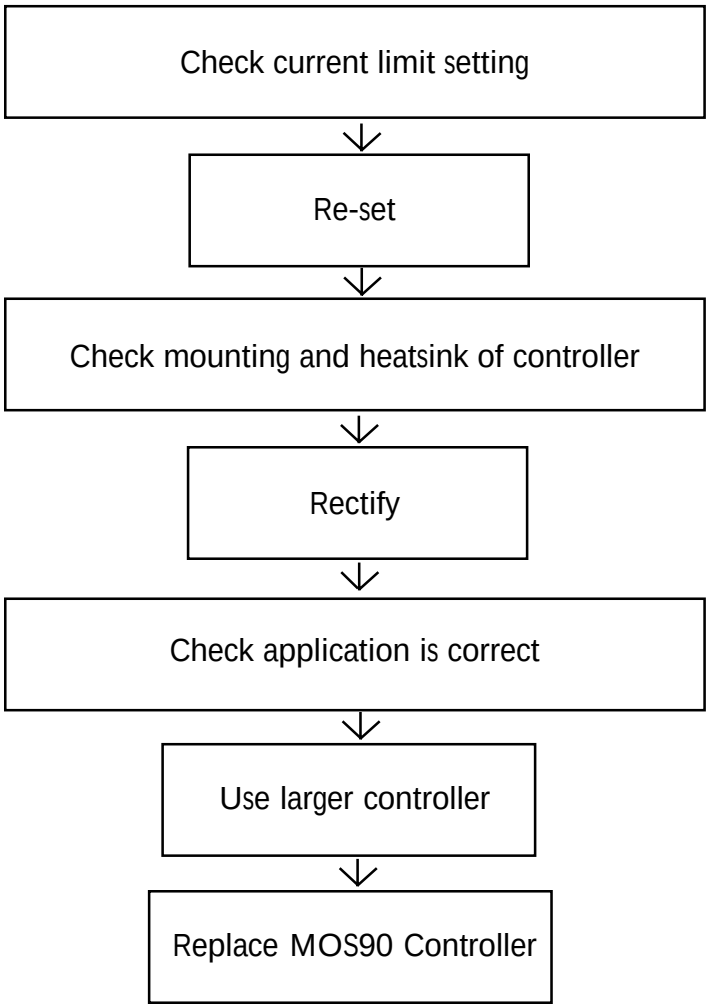


Figure 4-1: Blocking Elevating Assembly

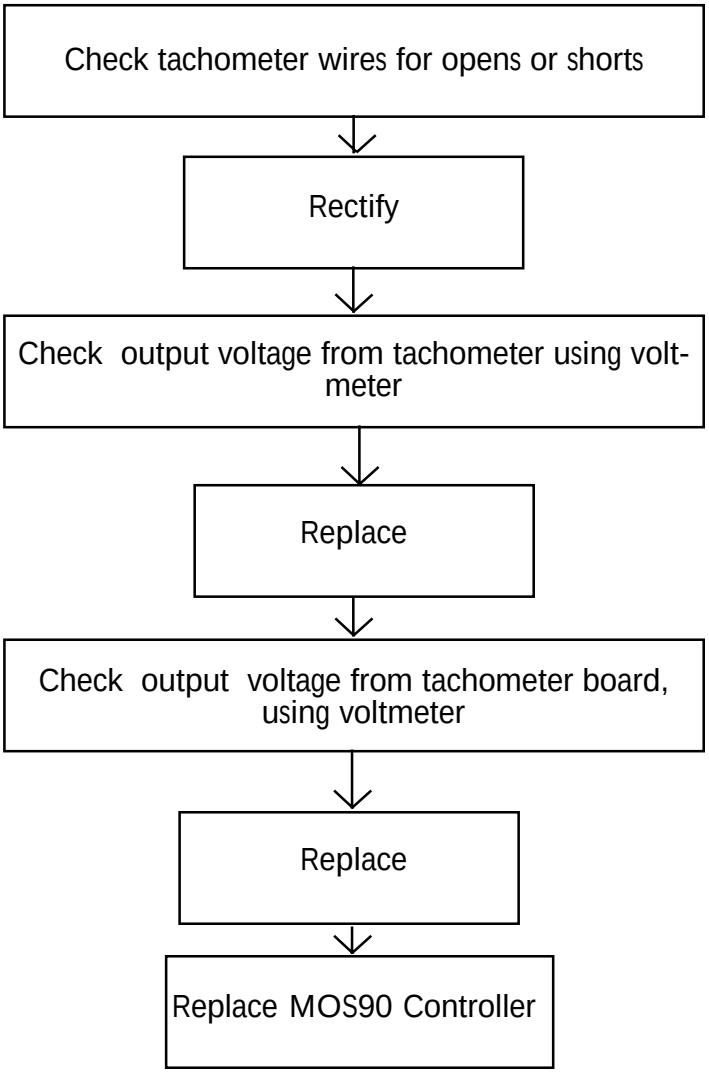
8 Flashes

- *Thermal cutback*
- *Heatsink temperature less than 80ºC (176ºF) (Current limit will be zero at 90ºC (194ºF)*
- *Allow unit to cool down, to clear flashing*



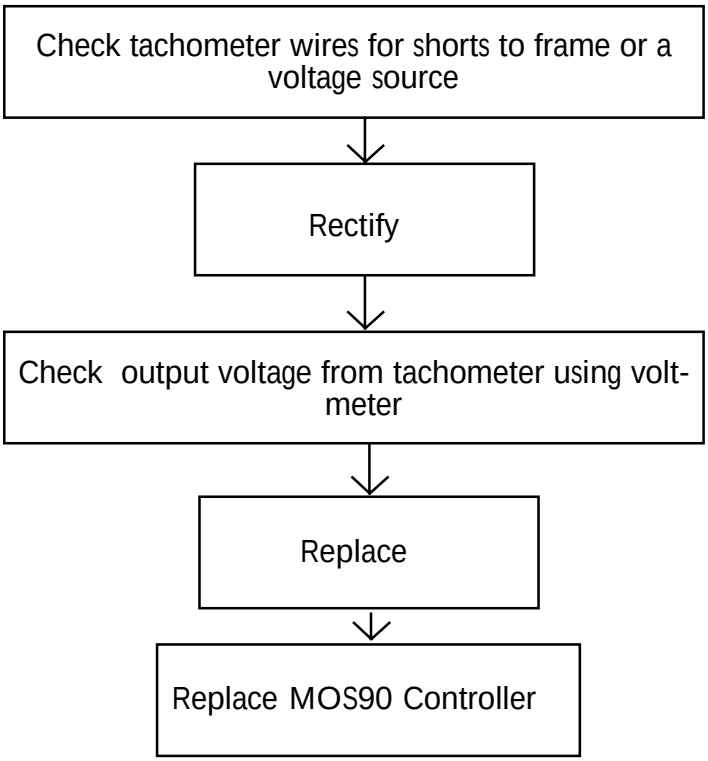
10 Flashes

- *Tachometer fault*
- *Drive inhibited*
- *Recycle key to clear fault*



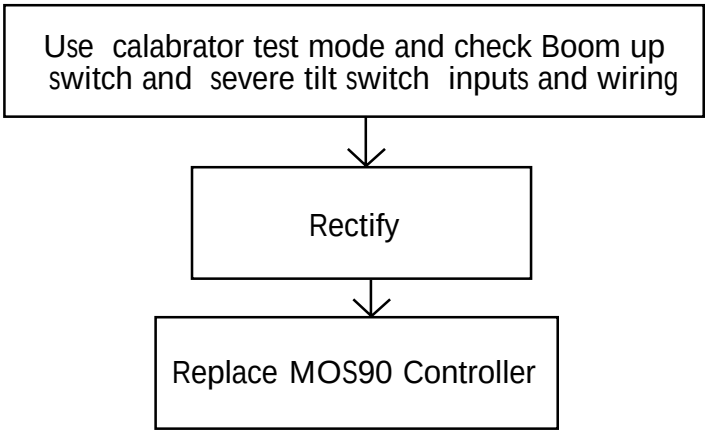
11 Flashes

- *Tachometer signal out of range*
- *Drive inhibited*
- *Flashes until fault cleared*



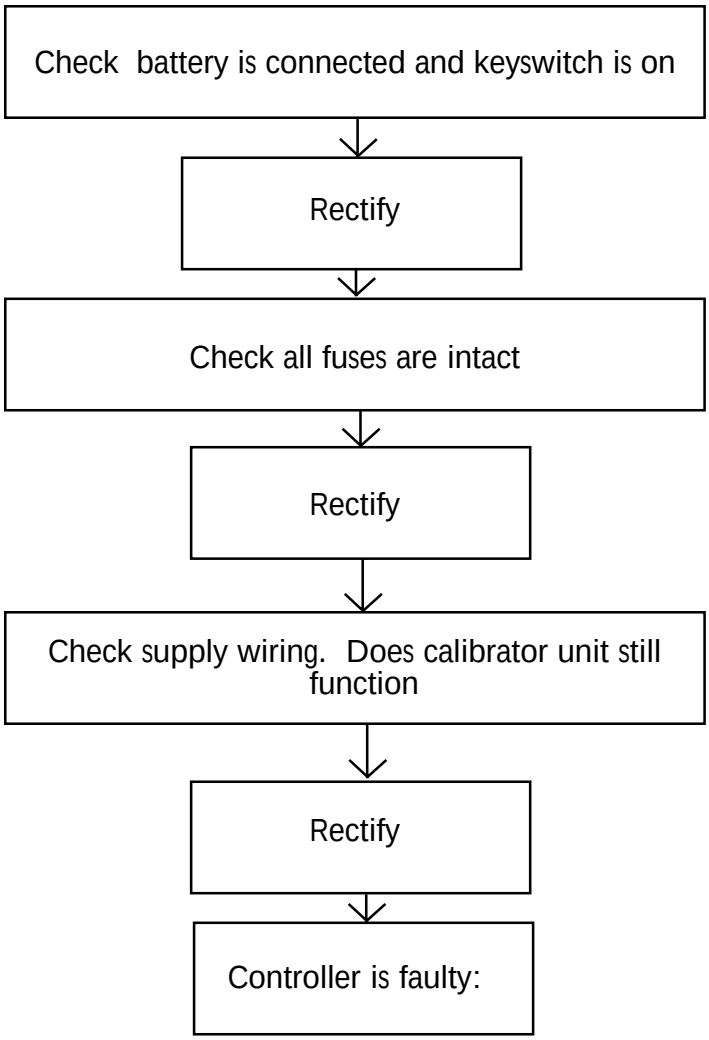
12 Flashes

- *Boom up and vehicle in severe tilt condition*
- *"Boom up" and "severe tilt" switches both opened (N.C. switches*
- *Vehicle goes into emergency stop (forced neutral state) and plug brakes to a stop*
- *Lower boom and recycle key to clear fault*



LED off

- Unit not powered up or controller faulty, or LED faulty



a) Auto fail-safe check failed. LED turns off when a direction is first selected after power up. Recycle keyswitch.
b) Contactor drive S/C. LED resets itself if short circuit clears.
c) Mosfets did not turn on. Recycle direction to neutral to clear fault indication.

Replace controller

ACTIVATING "TEST"

Position red LED at TEST. Press "+" or "-" to select the switch to be viewed.

The zero position input "-" should read zero and is set by adjusting the trim pot in the upper control box. Step on the foot switch and keeping the joystick centered, adjust the pot to give a readout of 1 or 2. Slowly back the pot down until the reading has just dropped to zero.

If set at an extremely high value MOS90 will read as fault and shut down.

Properly set the AB46 should start to move slowly with a small movement of the joystick after a very small "deadband" zone.

Table 4-4 Upright Traction Controller Calibratior Diagnostics

Sequence No.	Test	Display	Input #
-	Acc. Input	0-100%	14
1	Reverse	CL/OP	8
2	Forward	CL/OP	11
3	Tach Input	0-100%	12
4	Hvy Tlt Input	CL=Level	7
	Speed3 Sw	OP=Tilt	
5	Minor Tlt Input	CL=Level	16
	Speed2 Sw	OP=Tilt	
6	Brake Applied	CL= Brk On	16
7	Act. Direction	OP=FWD	2
	Tacho Output	CL=REV	2
8	Boom Up Sw Speed1 Sw	CL=Lowered OP=Raised	13

NOTE: CL = Switch Closed
OP = Switch Open

** If both tilt and boom-up condition, then FWD. and REV. is cleared

Figure 4-1 MOS90 17 WAY CONNECTOR PIN OUT DESIGNATION

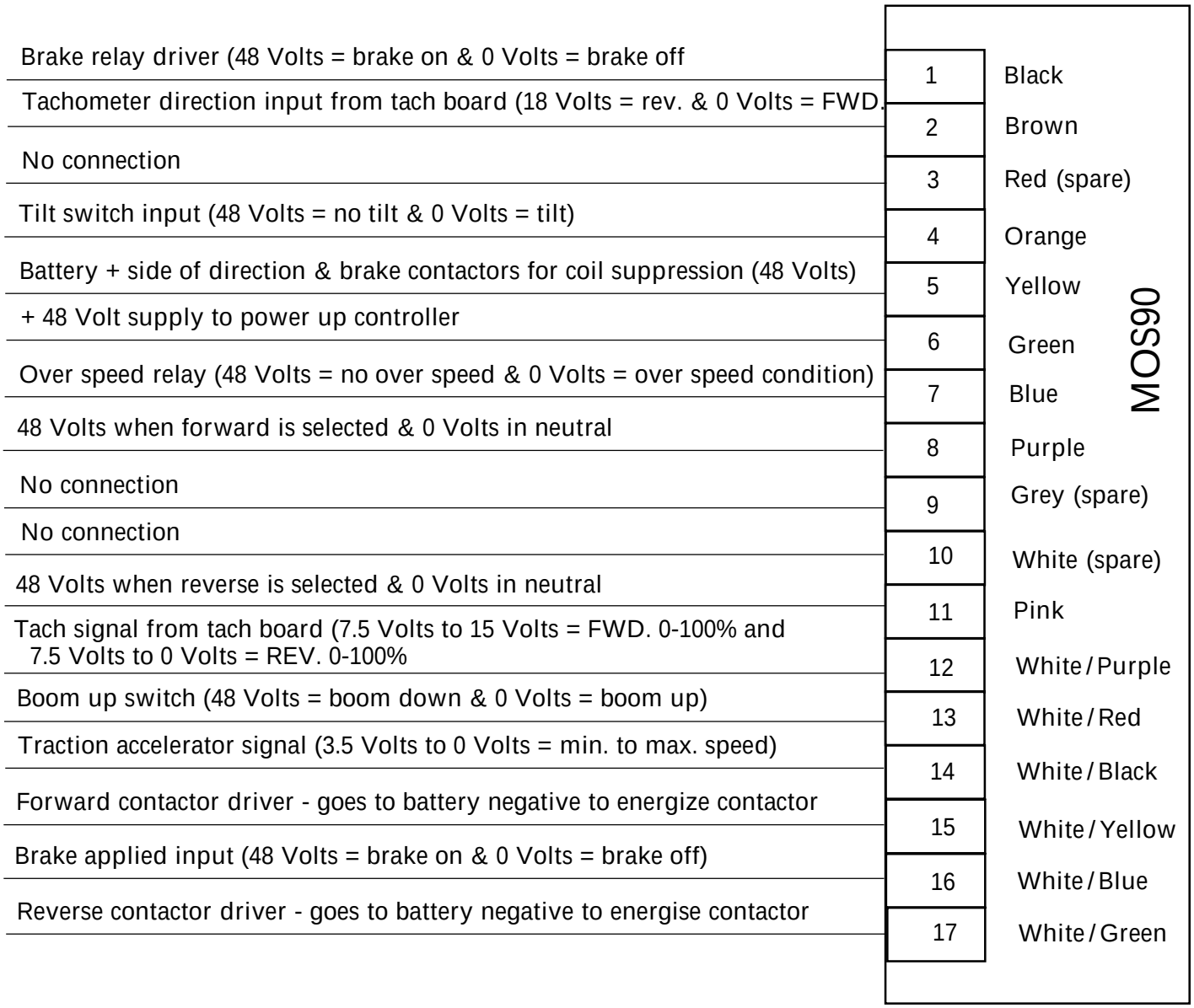
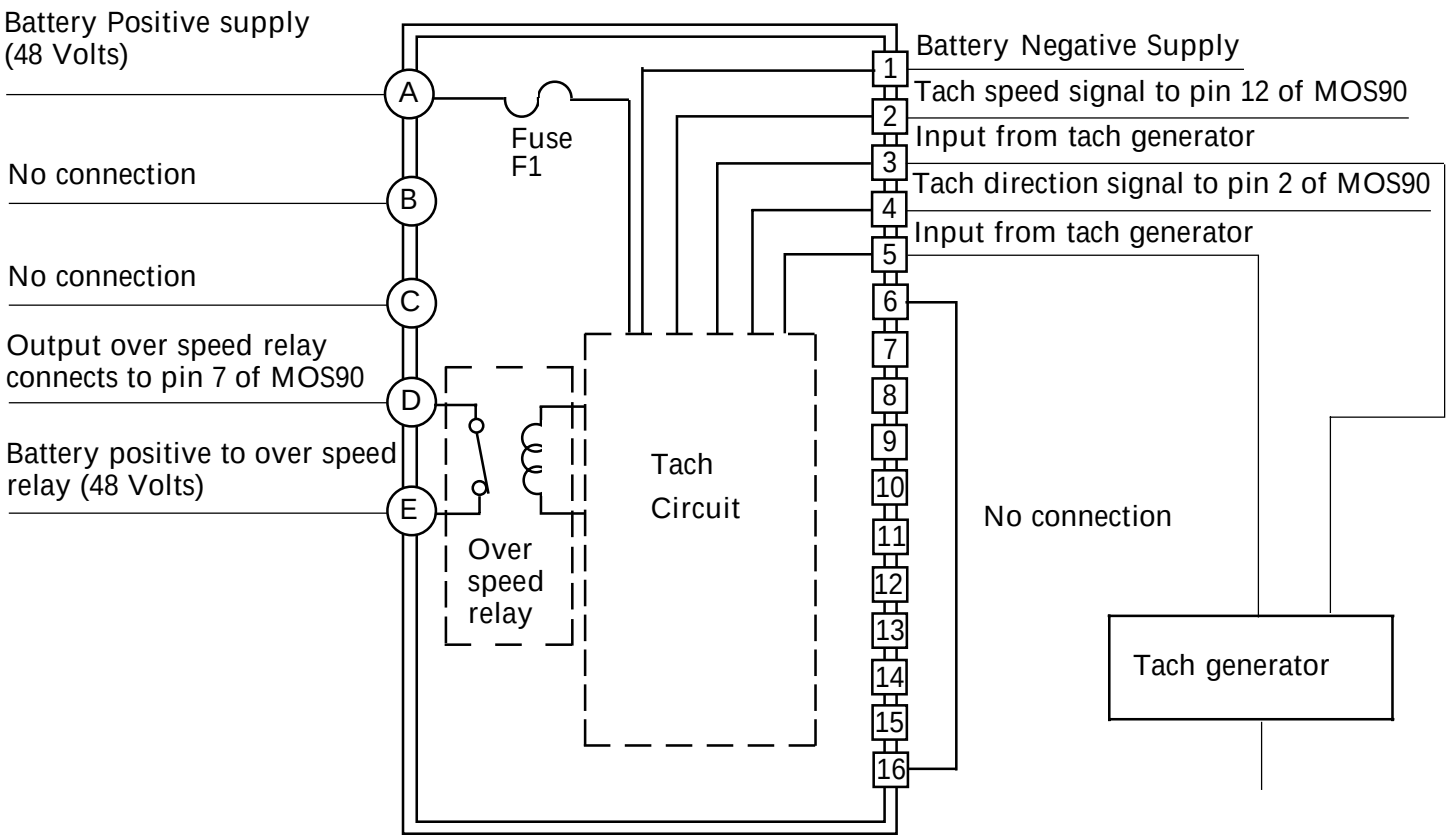


Figure 4-2 UPRIGHT TACHOMETER BOARD



(D) 48 Volts = no over speed condition
0 Volts = over speed condition

[2] Tach speed signal from tach board
7.5 Volts to 15 volts = 0-100% speed in FWD.
7.5 Volts to 0 volts = 0-100% speed in REV.

[4] Tach direction signal
18 Volts = REV.
0 Volts = FWD.

[3]

[5] Output of tach generator
0 to +50 Volts = 0-100% speed in FWD.
0 to -50 Volts = 0-100% speed in REV.

NOTES:

5.0 Introduction

This section contains electrical and hydraulic power schematics, and associated information for maintenance purposes.

The diagrams are to be used in conjunction with Section 4 *"Troubleshooting"*. They allow understanding of the makeup and functions of the systems for checking, tracing, and faultfinding during trouble analysis.

The components that comprise the electrical and hydraulic systems are given a reference designation and are explained as to function and location in the following tables.

5.1 Electrical Schematic Electrical Model

Table 5-1: Electrical Schematic Legend, Electric Model

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ALM 1	Horn	Warning sound	Front of chassis
ALM 2	Alarm, Tilt	Provides warning sound when slope of machine excedes 3° side to side, or fore and aft.	Upper control box, exterior upper left side.
CONT1	Controller	Controls operating speed of various functions	Upper control box
CRD1	Tach Card	Supplies speed information to controller	Relay Panel
D1	Diode (Block)	Supplies power to up trim solenoid.	Lower Controller
D2	Diode (Block)	Supplies power to down trim solenoid.	Lower Controller
D3	Diode (Block)	Supplies power to up jib solenoid.	Lower Controller
D4	Diode (Block)	Supplies power to down jib solenoid.	Lower Controller
D5	Diode (Block)	Supplies power to up boom solenoid.	Lower Controller
D6	Diode (Block)	Supplies power to down boom solenoid.	Lower Controller
D7	Diode (Block)	Supplies power to extend boom solenoid.	Lower Controller
D8	Diode (Block)	Supplies Power to retract boom solenoid.	Lower Controller
D9	Diode (Block)	Supplies power to up riser solenoid.	Lower Controller
D10	Diode (Block)	Supplies power to down riser solenoid.	Lower Controller
D11	Diode (Block)	Supplies power to cage right solenoid.	Lower Controller
D12	Diode (Block)	Supplies power to cage left solenoid.	Lower Controller
D13	Diode (Block)	Provides power to turret right solenoid.	Lower Controller
D14	Diode (Block)	Provides power to turret left solenoid.	Lower Controller
D15	Diode	Provides power to steer right solenoid	Lower Controller
D16	Diode	Provides power to steer left solenoid	Lower Controller
D17	Diode	Power to high flow solenoid from platform	Lower Controller
D18	Diode	Power to high flow solenoid from chassis	Lower Controller
D19	Diode	Power to brake release relay R7	Lower Controller
D20	Diode	Power to power relay R6 from foot switch	Lower Controller
D21	Diode	Power to	Lower Controller
D22	Doide	Power to tilt alarm ALM1	Lower Controller
D23	Diode	Power to brake solenoids	Lower Controller
D24	Diode	Power to tilt alarm ALM1	Lower Controller
D25	Diode	Power to boom pump	Lower Controller
D26	Diode	Power to boom pump	Lower Controller
D27	Diode	Power to high flow solenoid	Lower Controller
D28	Diode	Power to brake relay	Lower Controller
D29	Diode	Power to hour meter	Lower Controller
D30	Diode	Power to hour meter	Lower Controller
D31	Diode	Power to boom elevate speed relay R10	Upper Controller
D32	Diode	Power to speed controller CONT1	Upper Controller
D33	Diode	Power to speed controller CONT1	Upper Controller
D34	Diode	Power to speed controller CONT1	Upper Controller
D35	Diode	Power to speed controller CONT1	Upper Controller
D36	Diode	Power to high flow solenoid SOL18	Upper Controller
D37	Diode	Power to hour meter MTR	Upper Controller
D38	Diode	Power to hour meter MTR	Upper Controller
D39	Diode	Power to hour meter MTR	Upper Controller
D40	Diode	Power to boom elevate relay R10	Upper Controller
D41	Diode	Power to high flow solenoid	Lower Controller
D42	Diode	Power to high flow solenoid	Lower Controller
D43	Diode	Power to high flow solenoid	Lower Controller
FU1	Fuse	Lift Circuit 125 AMP	Relay Panel
FU2	Fuse	Main Fuse 350 AMP	Relay Panel
FU3	Fuse	Brake Ciruit 10 AMP	Lower Controller
FU4	Fuse	Platform Controls 10 AMP	Upper Controller
FU5	Fuse	Power Relay 10 AMP	Lower Controller
FU6	Fuse	Emergency Stop 25 AMP	Lower Controller
FU7	Fuse	Chassis Controls 10 AMP	Lower Controller

Table 5-1: (cont.)

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
MOT1	Motor, Electric	Left Drive Motor	Rear of Chassis
MOT2	Motor, Electric	Right Drive Motor	Rear of Chassis
MOT3	Motor, Electric	Powers Hydraulic Pump	Hydraulic Power Unit
MTR1	Meter, Hour	Displays number of hours Machine is turned on.	Chassis Control Panel, Bottom
R1	Main Power Relay	Isolates Batteries for Charging	Relay Panel
R2	Boom Pump Relay	Power to Hydraulic Pump	Lower Control box
R3	Brake Relay	Power to Brake controls	Lower Control box
R4	Horn Relay	Power to Horn	Lower Control box
R5	Low Tilt Relay	Disenables Drive Functions	Lower Control box
R6	Power Relay	Power to Controller	Lower Control box
R7	Brake Release Relay	Releases Brake for towing	Lower Control box
R8	Down Relay	Power to Hydraulic Pump	Lower Control box
R9	Boom Disconnect Relay	Power to Upper Controller	Upper Control box
R10	Boom Elevate Speed Relay	Power to Speed Controller	Upper Control box
R11	Turret Drive Relay	Power to Turret Rotate Solenoid	Upper Control box
R12	Drive Enable Relay	Power to Upper Control box	Upper Control box
R13	Forward Relay	Powers Drive Motors Forward	Relay Panel
R14	Reverse Relay	Powers Drive Motors Backward	Relay Panel
RES1	Resistor	Trim resistor	Upper control box.
RES2	Resistor	Speed control	Joystick control
S1	Trim Switch, (two)	Power to Trim Solenoid	Lower Control box Upper Control box
S2	Jib Switch, (two)	Power to Jib Solenoid	Lower Control box Upper Control box
S3	Boom Switch (two)	Power to Boom Lift Solenoid	Lower Control box Upper Control box
S4	Boom Extend Switch (two)	Power to Boom Extend Solenoid	Lower Control box Upper Control box
S5	Riser Switch (two)	Power to Riser Solenoid	Lower Control box Upper Control box
S6	Cage Switch (two)	Power to Cage Rotate Solenoid	Lower Control box Upper Control box
S7	Turret Switch (two)	Power to Turret Rotate Solenoid	Lower Conrtol box Upper Control box
S8	Control Switch	Control Handle	Control Handle
S9	Forward-Reverse Switch	FWD-Reverse	Upper control box
S10	Steer Switch	Power to left steer and right steer relays	Upper control box, top of joystick.
S11	Brake Switch	Power to MOS90, brakes released.	Relay Panel
S12	Pressure Stop Switch	Cuts power to hydraulic pump if low pressure	Relay Panel
S13	Platform/Chassis Switch	Supplies power to Platform/Chassis	Lower control box
S14	Down Limit Switch	Controls travel speed Slow/Fast	Turret at boom attachment
S15	Chassis Emergency Stop Switch	Emergency Stop	Lower control box,
S16	Brake Release Switch	Release Brakes for Towing	Lower Controller
S17	Foot Switch	Enables operation from platform	Floor of platform
S18	Platform Emergency Stop Switch	Emergency Stop	Platform control box
S19	Platform Key Switch	Enables operation from platform	Platform control box
S20	Horn Switch	Sounds horn	Platform control Box
S21	Boom Extend Drive Interlock	Controls travel speed Slow/Fast	On Boom
SNSR	Level Sensor	Provides power to cutout relay when machine is level.	Control module.
SOL1	Trim UP Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL2	Trim Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL3	Jib Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL4	Jib Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL5	Boom Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL6	Boom Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL7	Boom Extend Solenoid	Controls reverse valve.	Right s
SOL8	Boom Retract Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL9	Riser Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL10	Riser Down Solenoid	Controls series / parallel valves.	Front side of manifold, ports marked 'Q' & 'R'.
SOL11	Cage Right Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL12	Cage LeftSolenoid	Controls down valve.	Lift cylinder, lower end.
SOL13	TurretRight Solenoid	Controls steer valve when steering right.	Top of manifold, on steer valve.
SOL14	TurretLeft Solenoid	Controls steer valve when steering left.	Top of manifold, on steer valve.
SOL15	Steer Right Solenoid	Controls engine throttle.	Power module, engine, right side.
SOL16	Steer LeftSolenoid	Controls engine choke.	Power module, engine, right side.
SOL17	Low Flow	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL18	High Flow	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL19	Brake N.O.	Controls Brakes	Relay Panel
SOL20	Brake N.C.	Controls Brakes	Relay Panel
TG1	Tach generator - left	Generates speed signal	Left drive motor
TG2	Tach generator - right	Generates speed signal	Right drive motor

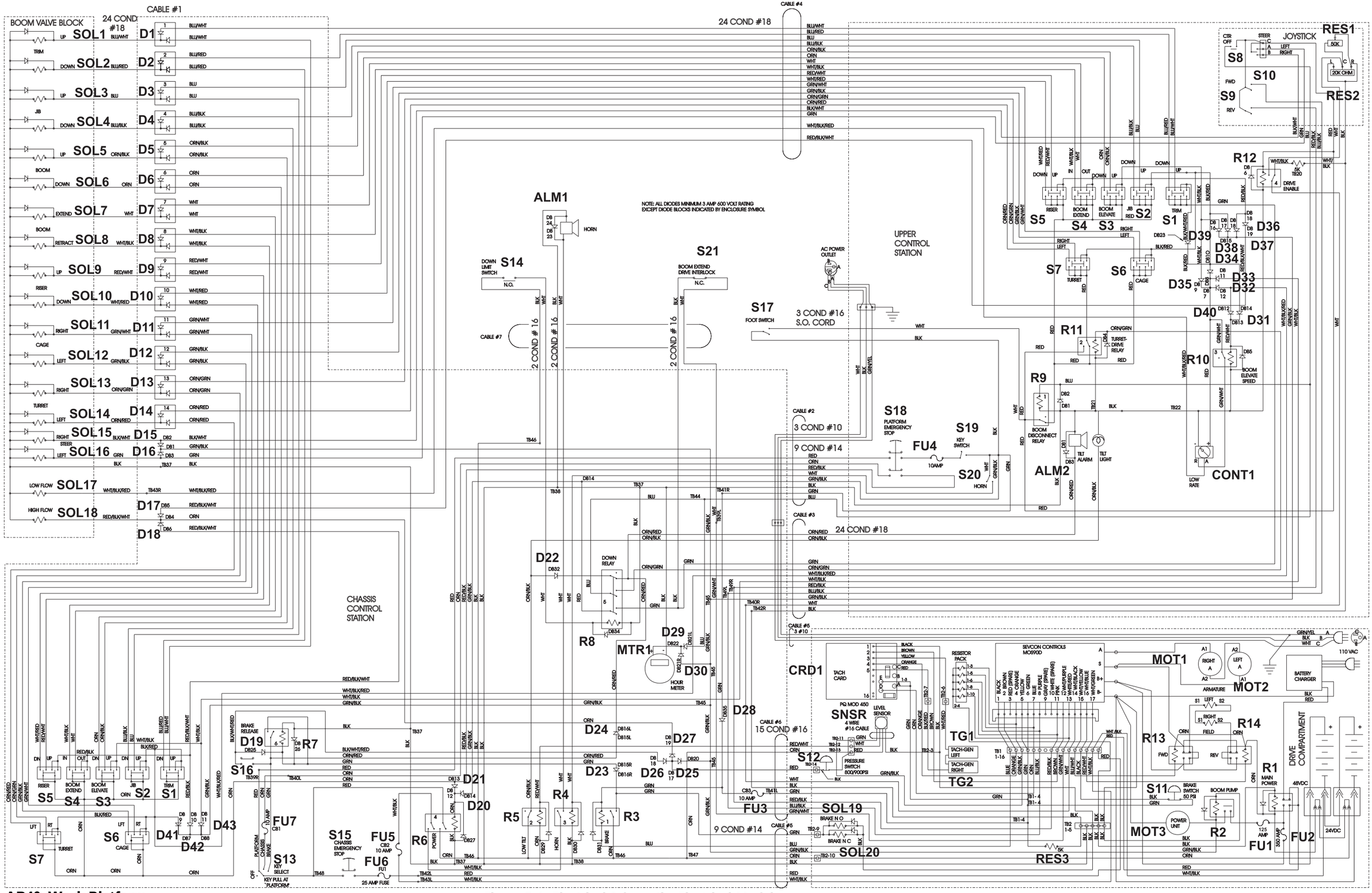


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Figure 5-1: Electrical Schematic, Electrical Model

5.1 Electrical Schematics

Table 5-2: Electrical Schematic Legend, BiEnergy Model

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ALM 1	Alarm, Tilt	Provides warning sound when slope of machine excedes 3º side to side, or fore and aft.	Upper control box, exterior upper left side.
CONT1	Controller	Controls operating speed of various functions	Upper control box
D1	Diode (Block)	Supplies power to up trim solenoid.	Lower Control box
D2	Diode (Block)	Supplies power to down trim solenoid.	Lower Control box
D3	Diode (Block)	Supplies power to up jib solenoid.	Lower Control box
D4	Diode (Block)	Supplies power to down jib solenoid.	Lower Control box
D5	Diode (Block)	Supplies power to up boom solenoid.	Lower Control box
D6	Diode (Block)	Supplies power to down boom solenoid.	Lower Control box
D7	Diode (Block)	Supplies power to extend boom solenoid.	Lower Control box
D8	Diode (Block)	Supplies Power to retract boom solenoid.	Lower Control box
D9	Diode (Block)	Supplies power to up riser solenoid.	Lower Control box
D10	Diode (Block)	Supplies power to down riser solenoid.	Lower Control box
D11	Diode (Block)	Supplies power to cage right solenoid.	Lower Control box
D12	Diode (Block)	Supplies power to cage left solenoid.	Lower Control box
D13	Diode (Block)	Provides power to turret right solenoid.	Lower Control box
D14	Diode (Block)	Provides power to turret left solenoid.	Lower Control box
D15	Diode	Provides power to steer right solenoid	Lower Control box
D16	Diode	Provides power to steer left solenoid	Lower Control box
D17	Diode	Power to high flow solenoid from platform	Lower Control box
D18	Diode	Power to high flow solenoid from chassis	Lower Control box
D19	Diode	Power to brake release relay R7	Lower Control box
D20	Diode	Power to power relay R6 from foot switch	Lower Control box
D21	Diode	Power to	Lower Control box
D22	Doide	Power to tilt alarm ALM1	Lower Control box
D23	Diode	Power to brake solenoids	Lower Control box
D24	Diode	Power to tilt alarm ALM1	Lower Control box
D25	Diode	Power to boom pump	Lower Control box
D26	Diode	Power to boom pump	Lower Control box
D27	Diode	Power to high flow solenoid	Lower Control box
D28	Diode	Power to brake relay	Lower Control box
D29	Diode	Power to hour meter	Lower Control box
D30	Diode	Power to hour meter	Lower Control box
D31	Diode	Power to boom elevate relay R10	Upper Control box
D32	Diode	Power to speed controller CONT1	Upper Control box
D33	Diode	Power to speed controller CONT1	Upper Control box
D34	Diode	Power to speed controller CONT1	Upper Control box
D35	Diode	Power to speed controller CONT1	Upper Control box
D36	Diode	Power to high flow solenoid SOL18	Upper Control box
D37	Diode	Power to hour meter MTR	Upper Control box
D38	Diode	Power to hour meter MTR	Upper Control box
D39	Diode	Power to hour meter MTR	Upper Control box
D40	Diode	Power to boom elevate relay R10	Upper Control box
D41	Diode	Power to high flow solenoid	Lower Control box
D42	Diode	Power to high flow solenoid	Lower Control box
D43	Diode	Power to high flow solenoid	Lower Control box
FU1	Fuse	Lift Circuit	Relay Panel
FU2	Fuse	Main Fuse	Relay Panel
FU3	Fuse	Brake Ciruit	Lower Control box
FU4	Fuse	Platform Controls	Upper Control box
FU5	Fuse	Power Relay	Lower Control box
FU6	Fuse	Emergency Stop	Lower Control Box
FU7	Fuse	Chassis Controls	Lower Control Box
MOT1	Motor, Electric	Left Drive Motor	Rear of Chassis
MOT2	Motor, Electric	Right Drive Motor	Rear of Chassis
MOT3	Motor, Electric	Powers Hydraulic Pump	Hydraulic Power Unit

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Table 5-2: (cont.)

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
MTR	Meter, Hour	Displays number of hours Machine is turned on.	Chassis Control Panel, Bottom
R1	Main Power Relay	Isolates Batteries for Charging	Relay Panel
R2	Boom Pump Relay	Power to Hydraulic Pump	Lower Control Box
R3	Brake Relay	Power to Brake controls	Lower Control Box
R4	Horn Relay	Power to Horn	Lower Control Box
R5	Low Tilt Relay	Disenables Drive Functions	Lower Control Box
R6	Power Relay	Power to Controller	Lower Control Box
R7	Brake Release Relay	Releases Brake for towing	Lower Control Box
R8	Down Relay	Power to Hydraulic Pump	Lower Control Box
R9	Boom Disconnect Relay	Power to Upper Control Box	Upper Control Box
R10	Boom Elevate Speed Relay	Power to Speed Controller	Upper Control Box
R11	Turret Drive Relay	Power to Turret Rotate Solenoid	Upper Control Box
R12	Drive Enable Relay	Power to Upper Control Box	Upper Control Box
R13	Forward Relay	Powers Drive Motors Forward	Relay Panel
R14	Reverse Relay	Powers Drive Motors Backward	Relay Panel
R15 *not used after S/N 1331	Start Engine Relay	Power to Start Engine	Relay Panel
RES1	Resistor	Trim Resistor	Upper Control Box
RES2	Resistor	Speed Control	Joystick Controller
S1	Trim Switch, (two)	Power to Trim Solenoid	Lower Control Box Upper Control Box
S2	Jib Switch, (two)	Power to Jib Solenoid	Lower Control Box Upper Control Box
S3	Boom Switch (two)	Power to Boom Lift Solenoid	Lower Control Box Upper Control Box
S4	Boom Extend Switch (two)	Power to Boom Extend Solenoid	Lower Control Box Upper Control Box
S5	Riser Switch (two)	Power to Riser Solenoid	Lower Control Box Upper Control Box
S6	Cage Switch (two)	Power to Cage Rotate Solenoid	Lower Control Box Upper Control Box
S7	Turret Switch (two)	Power to Turret Rotate Solenoid	Lower Control Box Upper Control Box
S8	Control Switch	Enables Joystick Functions	Joystick Handle
S9	FWD/REV Switch	FWD/REV Switch	Upper Control Box
S10	Steer Switch	Power to left steer and right steer relays	Upper control box, top of joystick.
S11	Brake Switch	Power to MOS90, brakes released.	Relay Panel
S12	Pressure Stop Switch	Cuts power to hydraulic pump if low pressure	Relay Panel
S13	Platform/Chassis Switch	Supplies power to Platform/Chassis	Lower control box,
S14	Down Limit Switch Switch	Controls travel speed Slow/Fast	Turret at boom attachment
S15	Chassis Emergency Stop Switch	Emergency Stop	Lower control box,
S16	Brake Release Switch	Release Brakes for Towing	Lower Controller
S17	Foot Switch	Enables operation from platform	Floor of platform
S18	Platform Emergency Stop Switch	Emergency Stop	Platform control box,
S19	Throttle Switch	Supplies power to throttle relay.	Lower control box, in panel, top, first from right.
S20	Platform Key Switch	Enables Operation from Platform	Platform Control Box
S21	Boom Extend Drive Interlock	Controls travel speed Slow/Fast	On Boom
SEN1	Level Sensor	Provides power to cutout relay when machine is level.	Control module.
SOL1	Trim UP Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL2	Trim Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL3	Jib Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL4	Jib Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL5	Boom Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL6	Boom Down Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL7	Boom Extend Solenoid	Controls reverse valve.	Right s
SOL8	Boom Retract Solenoid	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL9	Riser Up Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL10	Riser Down Solenoid	Controls series / parallel valves.	Front side of manifold, ports marked 'Q' & 'R'.
SOL11	Cage Right Solenoid.	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL12	Cage LeftSolenoid	Controls down valve.	Lift cylinder, lower end.
SOL13	TurretRight Solenoid	Controls steer valve when steering right.	Top of manifold, on steer valve.
SOL14	TurretLeft Solenoid	Controls steer valve when steering left.	Top of manifold, on steer valve.
SOL15	Steer Right Solenoid	Controls engine throttle.	Power module, engine, right side.
SOL16	Steer LeftSolenoid	Controls engine choke.	Power module, engine, right side.
SOL17	Low Flow	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL18	High Flow	Controls lift valve.	Right side of manifold, port marked 'J'.
SOL19	Brake N.O.	Controls Brakes	Relay Panel
SOL20	Brake N.C.	Controls Brakes	Relay Panel
TG1	Tach Generator - left	Generates speed signal	Left drive motor
TG2	Tach generator - right	Generates speed signal	Right drive motor

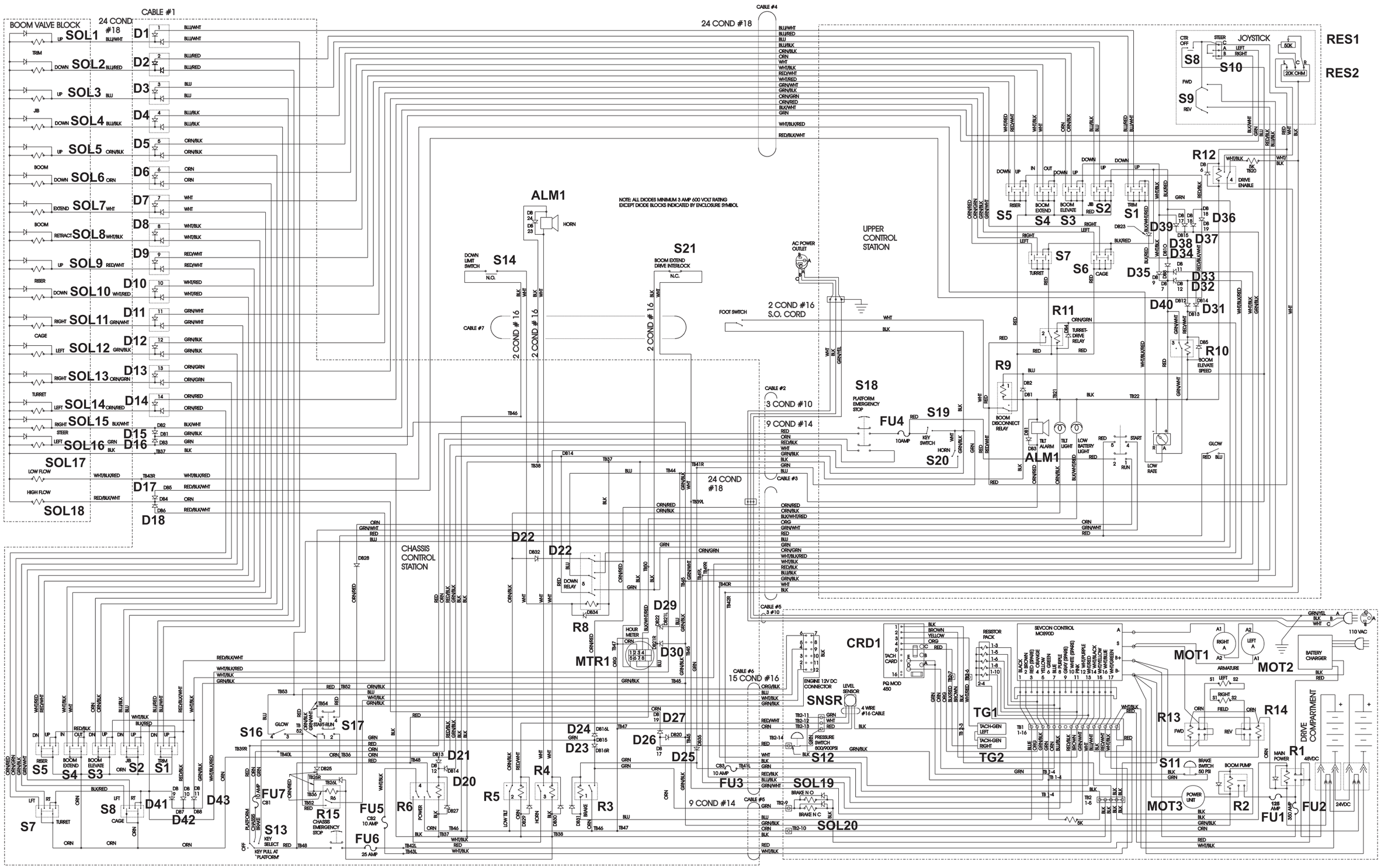

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Figure 5-2: (068341-005) Electrical Schematic, BiEnergy Model [S/N 1000 -1331]

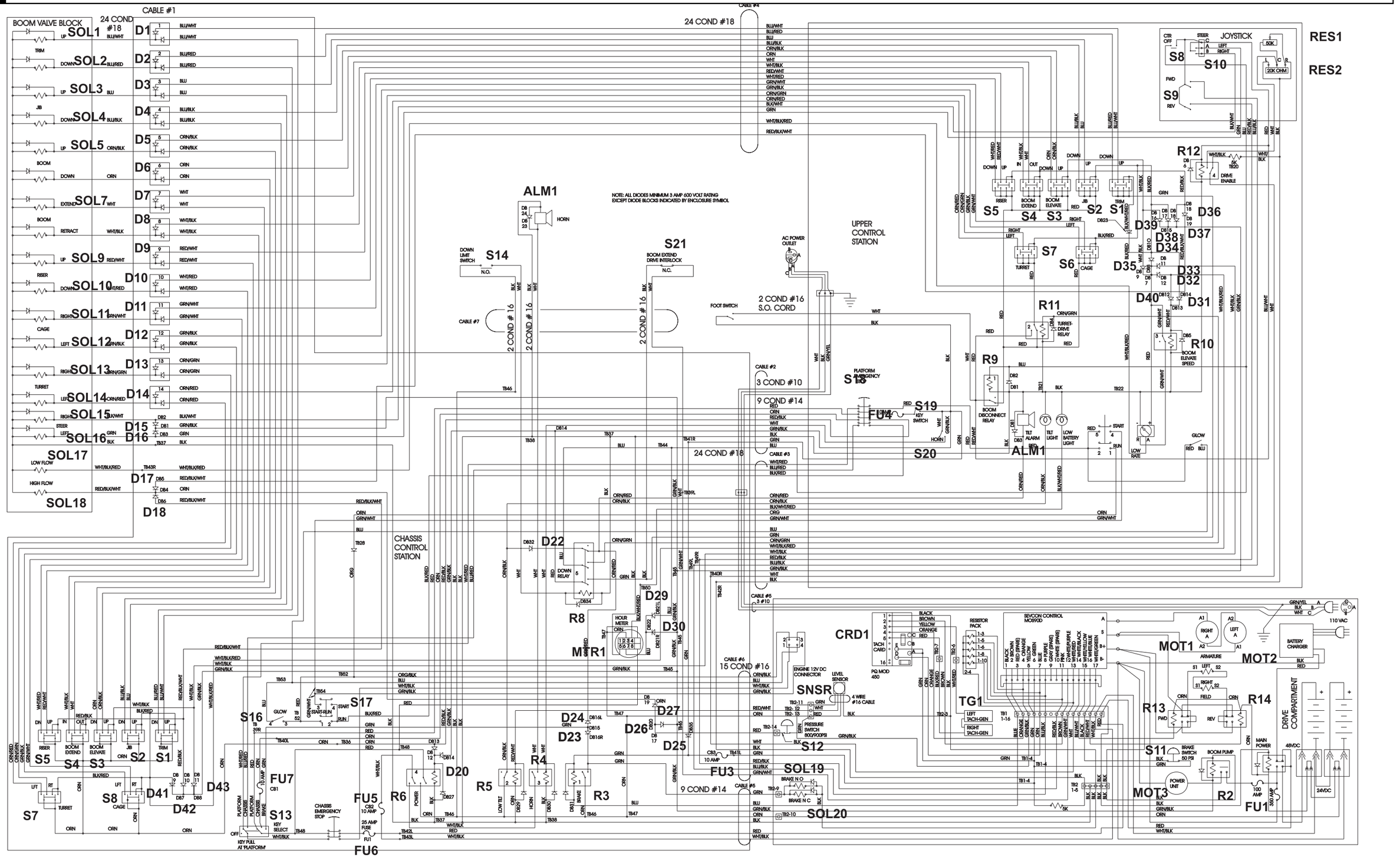


Figure 5-3: (068341-005) Electrical Schematic, BiEnergy Model [After S/N -1331]

NOTE:
1. RED WIRES FROM RECTIFIER MAY BE REVERSED WITHOUT EFFECT.

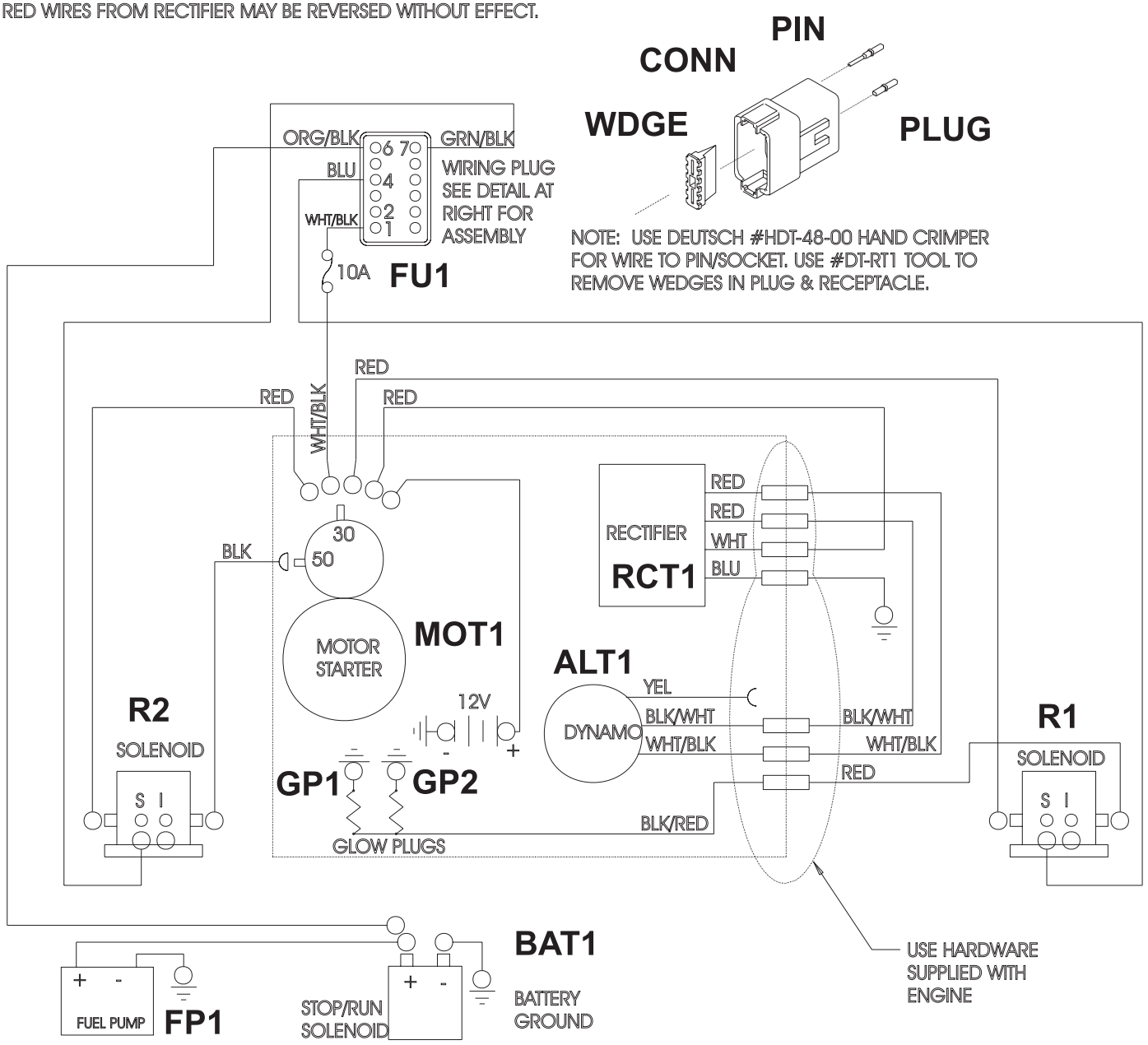


Figure 5-4: Kubota Engine Diagram - S/N 1000-1331

Table 5-3: Engine Assembly - Kubota ZB600C - S/N 1000-1331

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ALT1	Alternator	Power to charge battery BAT1	Side of engine
BAT1	Battery	Powers starter motor	Side of engine
CONN	Connector	Connects engine assembly to machine	On wire harness between engine and machine
FP1	Fuel Pump	Provides fuel to the Engine	Side of engine
FU1	Fuse	Overload protection for starter solenoid	Wiring harness between connector and engine
GP1	Glow Plug	Provide heat for engine startup	Top of engine
GP2	Glow Plug	Provide heat for engine startup	Top of engine
MOT1	Starter Motor	Starts Engine	Side of engine
PIN	Pin	Connection between engine and machine	Inside connector
PLUG	Plug	Seals connector	Inside connector
RCT1	Rectifier	Controls charging of battery	Side of engine
R1	Relay	Glow plug relay	Side of engine
R2	Relay	Starter Relay	On starter motor
WDG	Wedge	Secures connector pins	Inside connector

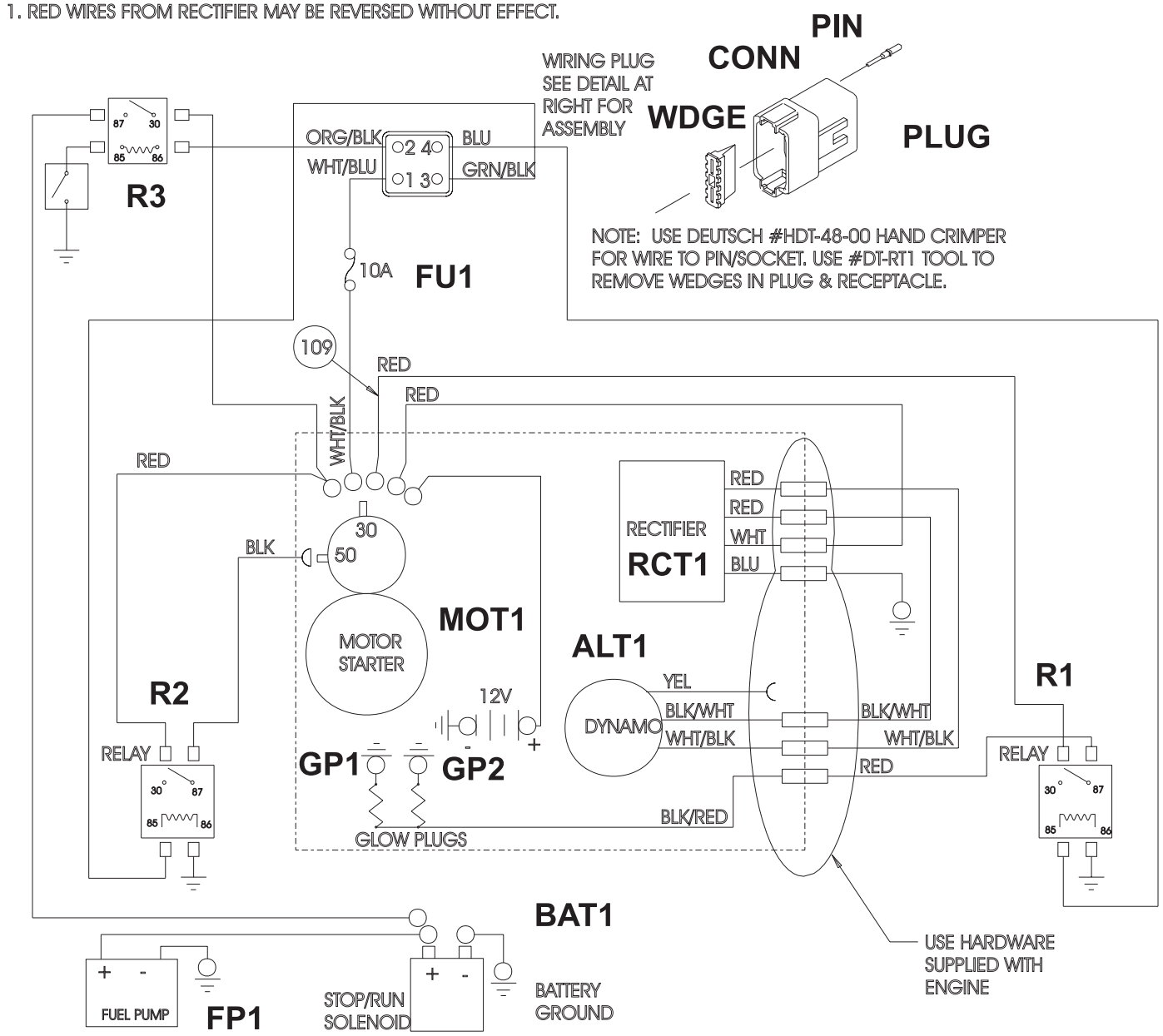


Figure 5-5: Kubota Engine Diagram - S/N 1331-current

Table 5-4: Engine Assembly - Kubota ZB600C - S/N 1331-current

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
ALT1	Alternator	Power to charge battery BAT1	Side of engine
BAT1	Battery	Powers starter motor	Side of engine
CONN	Connector	Connects engine assembly to machine	On wire harness between engine and machine
FP1	Fuel Pump	Provides fuel to the Engine	Side of engine
FU1	Fuse	Overload protection for starter solenoid	Wiring harness between connector and engine
GP1	Glow Plug	Provide heat for engine startup	Top of engine
GP2	Glow Plug	Provide heat for engine startup	Top of engine
MOT1	Starter Motor	Starts Engine	Side of engine
PIN	Pin	Connection between engine and machine	Inside connector
PLUG	Plug	Seals connector	Inside connector
RCT1	Rectifier	Controls charging of battery	Side of engine
R1	Relay	Glow plug relay	Side of engine
R2	Relay	Starter Relay	On starter motor
R3	Relay	Starter Rrelay	Side of engine
WDG	Wedge	Secures connector pins	Inside connector

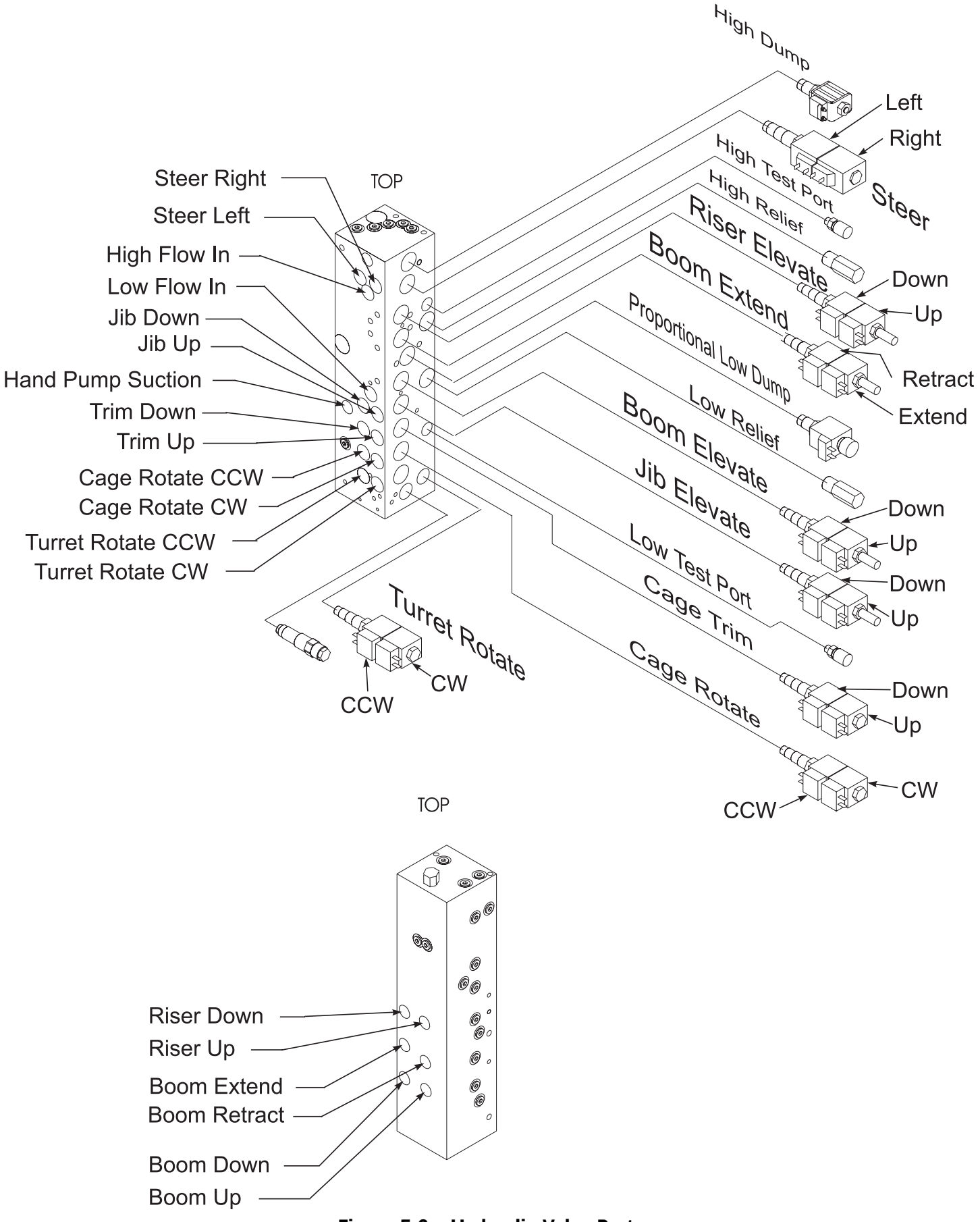


Figure 5-6: Hydraulic Valve Ports

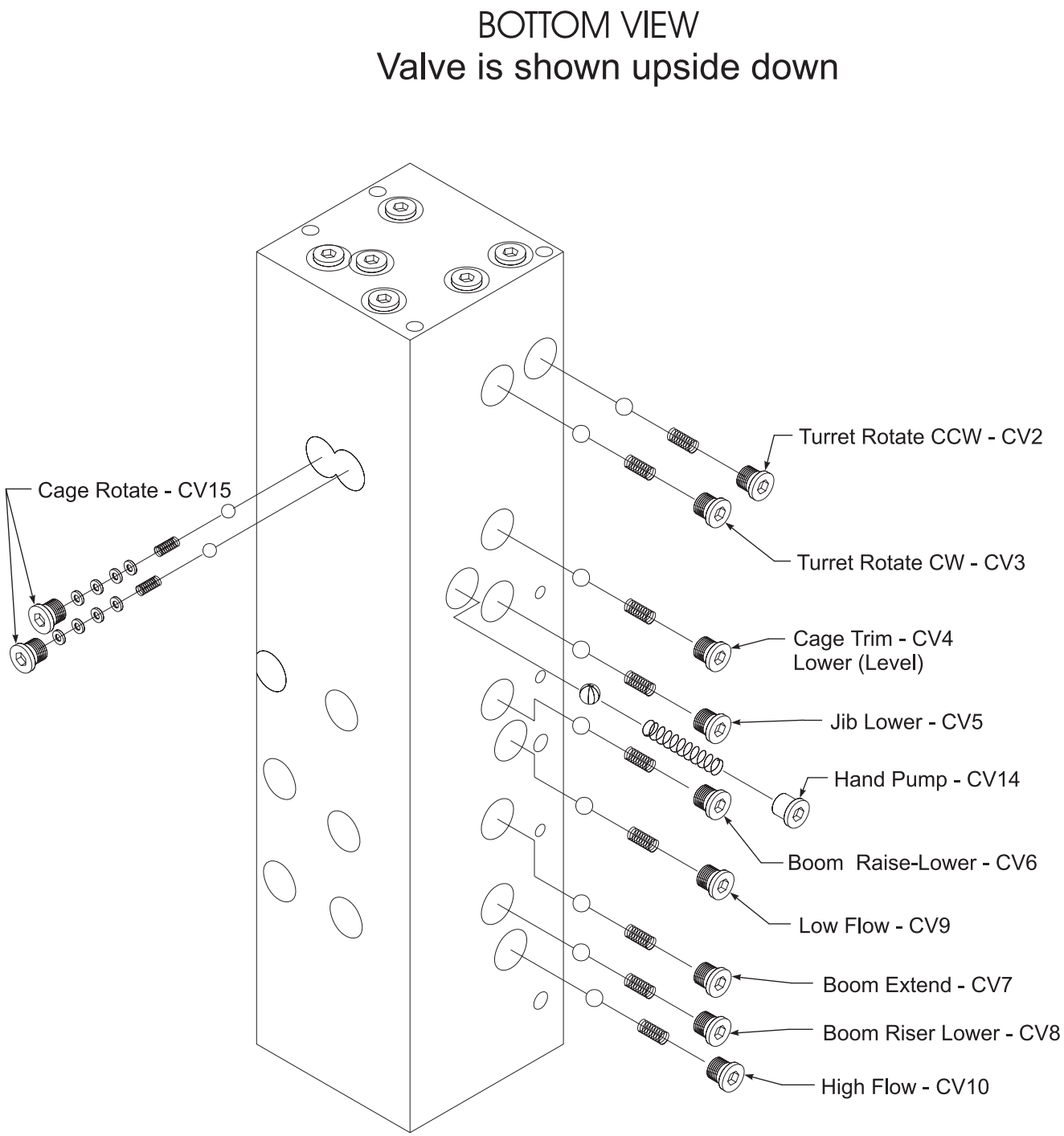


Figure 5-7: Check Ports

NOTES:

Table 5-5: Hydraulic Schematic Legend

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
BA1 (Electric Model only)		Brake Accumulator	Stores pressure to keep brakes released
CV1 & CV2	Check Valve, Brake	Allows free flow from brakes around pressure reducing valve	Rear of Chassis
CV3	Check Valve, Turret Rotate	Flow Check	Hydraulic Manifold
CV4	Check Valve, Trim	Flow Check	Hydraulic Manifold
CV5	Check Valve, Jib	Flow Check	Hydraulic Manifold
CV6	Check Valve, Boom Raise	Flow Check	Hydraulic Manifold
CV7	Check Valve, Boom Extend	Flow Check	Hydraulic Manifold
CV8	Check Valve, Riser	Flow Check	Hydraulic Manifold
CV9	Check Valve, High Relief	Flow Check	Hydraulic Manifold
CV10	Check Valve, High Relief	Flow Check	Hydraulic Manifold
CV11	Check Valve, Brake Release	Flow Check	Hydraulic Manifold
CV12	Check Valve, Pump 1	Flow Check	Hydraulic Manifold
CV13	Check Valve, Pump 2	Flow Check	Hydraulic Manifold
CV14 (2)	Check Valve, Hand Pump	Stops flow from hand pump through diverter valve	Hydraulic Manifold
CV15 (2)	Check Valve,	Reduces pressure for smooth cage rotate operation	Hydraulic Manifold
CV16	Check Valve, Jib Lower	Sends oil through OR2 to slow jib lowering	Hydraulic Manifold
CYL1	Steering Cylinder	Actuates steering linkage to steer front wheels.	Front axle assembly
CYL2	Riser Cylinder	Raise Elevating Assembly	Elevating Assembly
CYL3	Boom Extend Cylinder	Extend Boom	Inside Boom
CYL4	Boom Raise Cylinder	Raise Elevating Assembly	Elevating Assembly
CYL5	Jib Cylinder	Raise Jib	Jib
CYL6	Master Cylinder	Maintain cage level	Rear of Boom
CYL7	Slave Cylinder	Maintain cage level	Front of Boom
CYL8	Cage Rotate Cylinder	Rotate cage	Between cage and Jib
CYL9	Left Brake Cylinder	Release left brake	Left brake
CYL10	Right Brake Cylinder	Release right brake	Right brake
FL1	Filter, Return	Keep oil clean	Hydraulic tank
Fl2	Filter, Suction Strainer	Keep oil clean	Pump
MOT1	Motor, Slew	Turns Turret	Bottom of turret
ORF1	Brake Orifice	Allows brakes to release quickly and apply slowly.	Left side top of manifold under fitting in port 12.
ORF2	Jib Down Orifice	Limits the descent speed of the jib.	
PMP1	Hydraulic Pump High Flow	Provides fluid power for hydraulic system.	Power module
PMP2	Hydraulic Pump Low Flow	Provides fluid power for hydraulic system.	Power module
PMP3	Hand Pump	Pump up brakes for towing	Hydraulic manifold
PS1	Pressure Switch	Measure brake hydraulic pressure	Right brake
PS2	Pressure Switch	Provides overpressure protection for steering components.	Front of manifold, port marked 'A'.

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
RV1	High Pressure Relief Valve	Limits maximum pressure	Hydraulic manifold
RV2	Low Pressure Relief Valve	Limits minimum pressure	Hydraulic manifold
RV3	Turret Rotate Relief Valve	Limit pressure to turret rotate motor	Hydraulic manifold
RV4	Riser Relief Valve	Limit pressure to riser cylinder	Riser cylinder
RV5	Boom Extend Relief Valve	Limit pressure to boom extend cylinder	Boom extend cylinder
RV6	Boom Raise Relief Valve	Limit pressure to boom raise cylinder	Boom raise cylinder
RV7	Jib Relief Valve	Limit pressure to jib cylinder	Jib cylinder
RV8 (2)	Master Relief Valve	Limit pressure to master cylinder	Master cylinder
RV9 (2)	Slave Relief Valve	Limit pressure to slave cylinder	Slave cylinder
RV10 (2)	Cage Rotate Relief Valve	Limit pressure to cage rotate cylinder	Cage rotate cylinder
V1	Steering Valve	Controls oil flow to steering cylinder	Top of manifold, ports marked 'D'.
V2	Riser Valve	Controls oil flow to Riser Cylinder	Front of manifold, port
V3	Boom Extend Valve	Controls oil flow to Boom Extend Cylinder	Hydraulic manifold
V4	Boom Raise Valve	Controls oil flow to Boom Raise Cylinder	Hydraulic manifold
V5	Jib Valve	Controls oil flow to Jib Cylinder	Hydraulic manifold
V6	Trim/Level Valve	Controls oil flow to Master Cylinder	Hydraulic manifold
V7	Cage Rotate Valve	Controls loi flow to Cage Rotate Cylinder	Hydraulic manifold
V8	Turret Rotate Valve	Controls oil flow to Slew Motor (MOT1)	Hydraulic manifold
V9	Brake Apply Valve	Apply brakes	Brake valve block
V10	Brake Release Valve	Release brakes	Brake valve block
V11	Low Rate Valve	Flow control	Hydraulic manifold
V12	High Dump Rate	Power to riser and boom extend cylinders	Hydraulic manifold
V13	Diverter Valve	Allows hand pump to function	Hydraulic manifold

Note: See figure 5-6 for hydraulic valve locations.

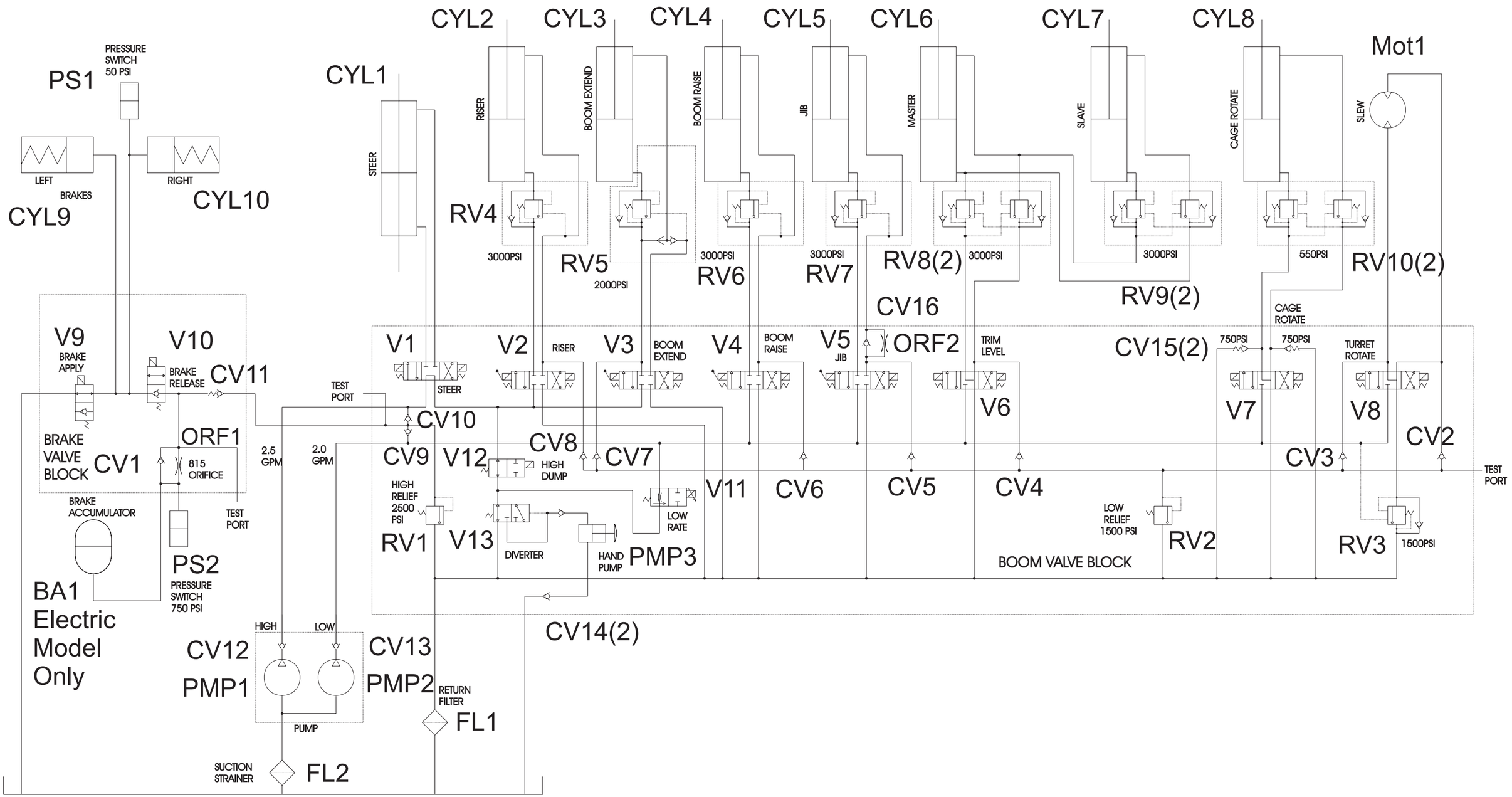


Figure 5-8: Hydraulic Schematic AB46

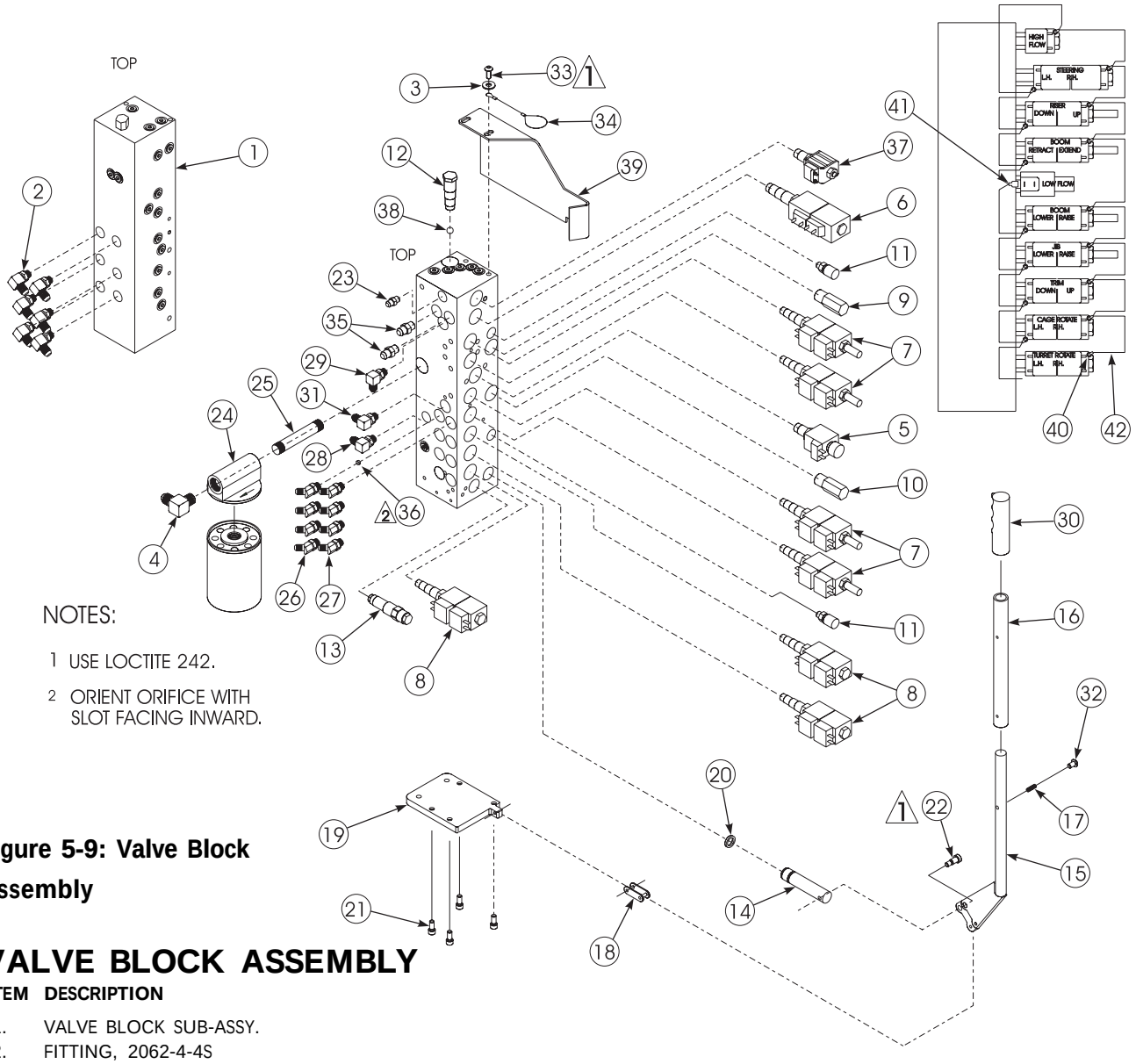


Figure 5-9: Valve Block Assembly

VALVE BLOCK ASSEMBLY

ITEM	DESCRIPTION
1.	VALVE BLOCK SUB-ASSY.
2.	FITTING, 2062-4-4S
3.	WASHER, 5/16 FLAT
4.	90° ELBOW 3/4 NPT X 3/4 JIC
5.	FLOW CNTRL, WATERMAN
6.	3 POS, 4 WAY, TANDEM CENTER
7.	4 WAY, CLOSED CENTER
8.	4 WAY, MOTOR SPOOL
9.	RELIEF VALVE, 2540 PSI
10.	RELIEF VALVE, 1450 PSI
11.	PLUG, GAUGE PORT
12.	DIVERTER VALVE
13.	COUNTERBALANCE VALVE, TURRET ROTATE
14.	PISTON, HAND PUMP
15.	LEVER WELDMENT, HAND PUMP
16.	LEVER EXTENSION, HAND PUMP
17.	DETENT BALL / SPRING
18.	PIVOT LINK
19.	MOUNTING PLATE, VALVE BLOCK
20.	SEAL, POLY PACK #12500625
21.	SCREW, SOC.HD. 5/16-18 UNC X 1/2
22.	SCREW, SHOULDER, 3/8 X 5/8
23.	FITTING 202702-4-6S

ITEM	DESCRIPTION
24.	FILTER ASSEMBLY
25.	PIPE NIPPLE, 3/4 SCHD 40 X 4
26.	FITTING, 45° 6MB-4MJ
27.	FITTING, 45° SWIVEL EL. 4MB-4MJ
28.	FITTING, 90° 4MB-6MJ
29.	FITTING, 90° EL. 6MB-6MJ
30.	HAND GRIP, VINYL
31.	FITTING, 2062-6-4S
32.	SCREW BUTT HEAD 1/4-20 UNC X 1/2
33.	SCREW BUTT HEAD, 5/16-18 UNC X 3/4
34.	LANYARD ASSEMBLY
35.	FITTING 202702-6-6S
36.	ORFICE
37.	VALVE
38.	STEEL BALL 7/16 DIA
39.	BRACKET
40.	CONNECTOR RING, 18-14 GA. #8
41.	CONNECTOR, FEMALE, PUSH, .25
42.	WIRE, 16 GA. BLACK

5.3 Upper Control Box Component Location

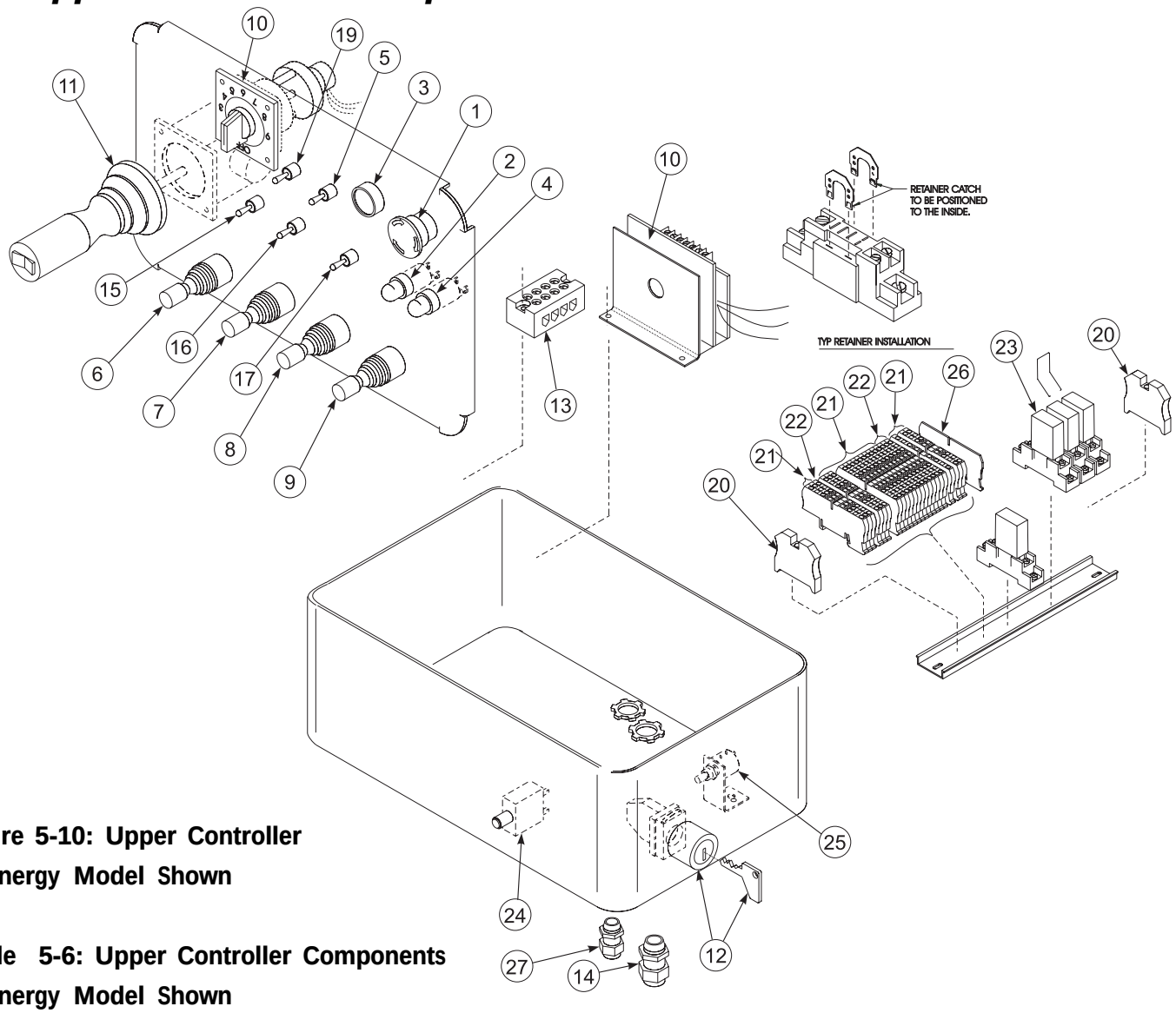


Figure 5-10: Upper Controller
Bi-Energy Model Shown

Table 5-6: Upper Controller Components
Bi-Energy Model Shown

	Electric Model	BiEnergy Model
1. Emergency Stop Button	X	X
2. Lamp	X	X
3. Horn		X
4. Lamp	X	X
5. Switch, Glow Plug		X
Switch, Motor Start	X	
6. Switch, Jib Control	X	X
7. Switch, Boom Extend	X	X
8. Switch, Upper Boom	X	X
9. Switch, Riser Control	X	X
10. Rheostat, Controller	X	X
11. Joystick	X	X
12. Key Switch	X	X
13. Terminal Strip	X	X
14. Cable Connector, 3/4	X	X

	Electric Model	BiEnergy Model
15. Switch, Platform Level	X	X
16. Switch, Platform Rotate	X	X
17. Switch, Turret Rotate		X
18. Cable Connector, 1/2	X	X
19. Switch, Engine Start		X
20. Terminal End	X	X
21. Terminal Block, Tan	X	X
22. Terminal Block, Blue	X	X
23. Relay, SPDT, 48 Volt	X	X
24. Circuit Breaker, 10 amp	X	X
25. Potentiometer, 10 turn	X	X
26. End Cap, Contact Block	X	X
27. Cable Connector, 1/2	X	X

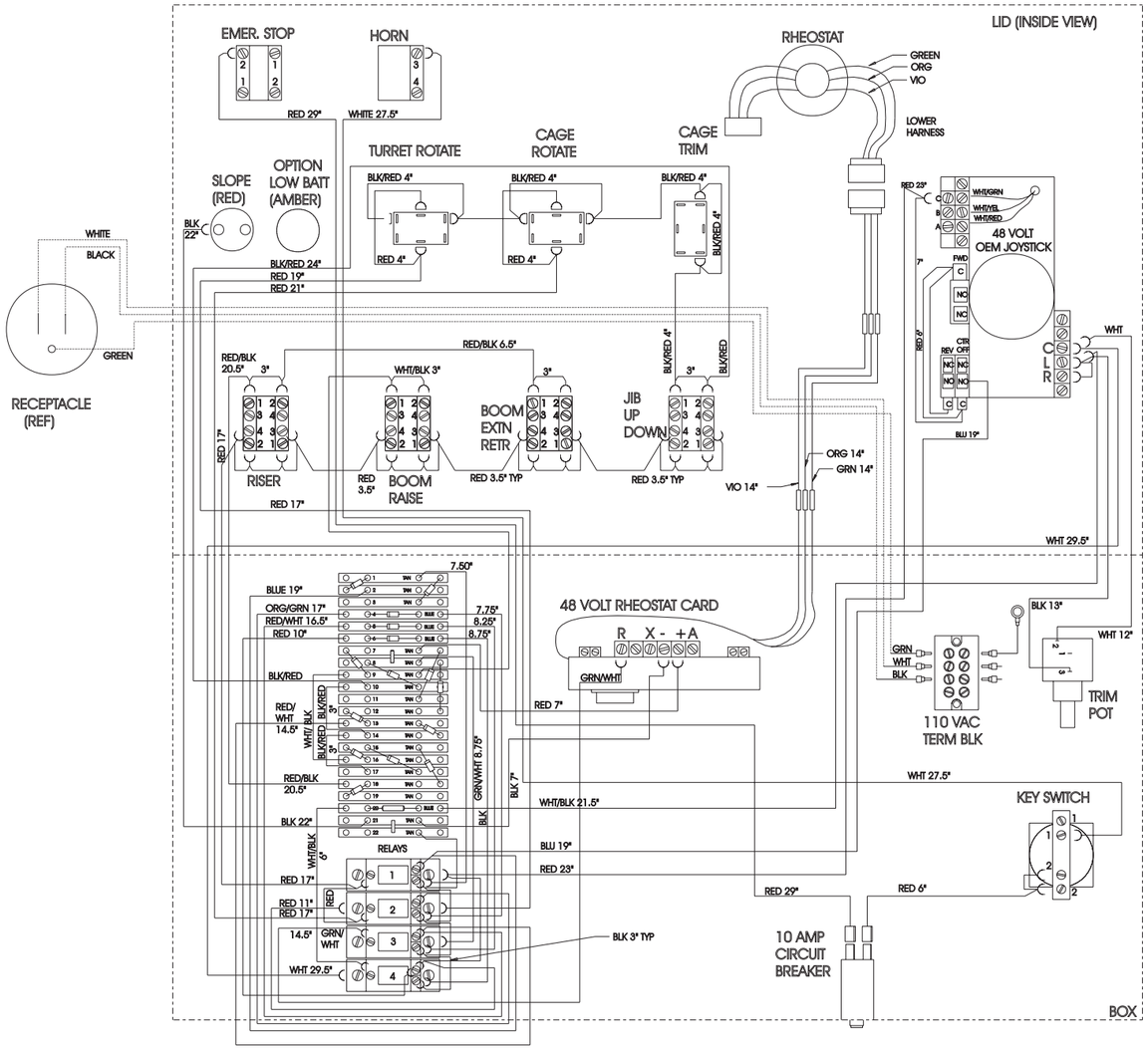


Figure 5-11: Electrical Diagram - Upper Control Box - Electric Model

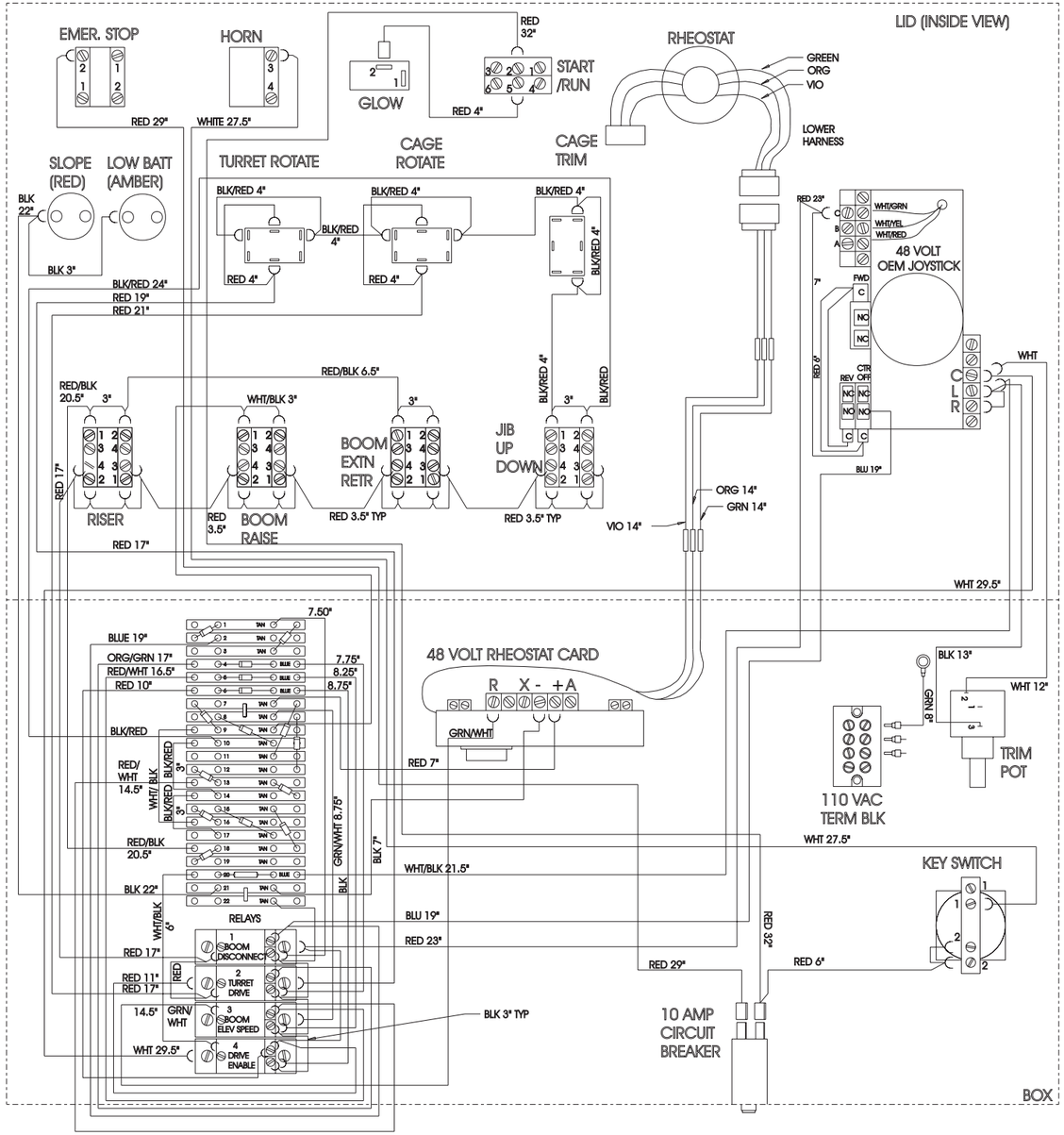


Figure 5-12: Electrical Diagram - Upper Control Box - BiEnergy Model

5.4 Lower Control Box Component Location

Table 5-7: Upper Controller Components

	Electric Model	BiEnergy Model
1. Emergency Stop Button	X	X
2. Operator Switch	X	X
3. Glow Plug Button		X
Motor Start Button	X	X
4. Engine Start Switch		X
5. Circuit Breakers	X	X
6. Jib Extend Switch	X	X
7. Cage Level Switch	X	X
8. Cage Rotate Switch	X	X
9. Hour Meter	X	X
10. Fuse	X	X
11. Boom Extend Switch	X	X
12. Boom Raise Switch	X	X
13. Riser Switch	X	X

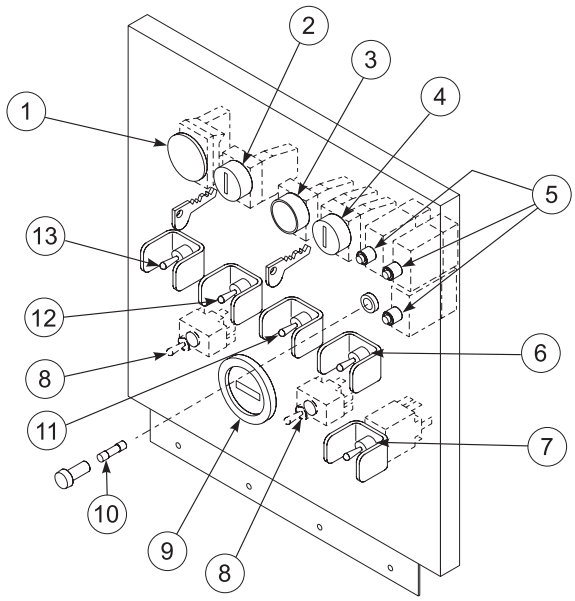
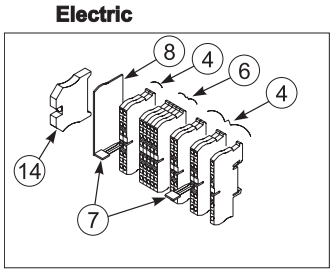
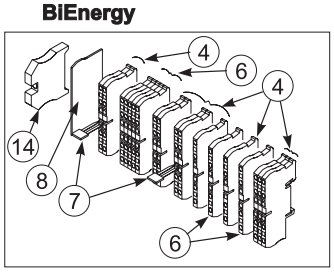
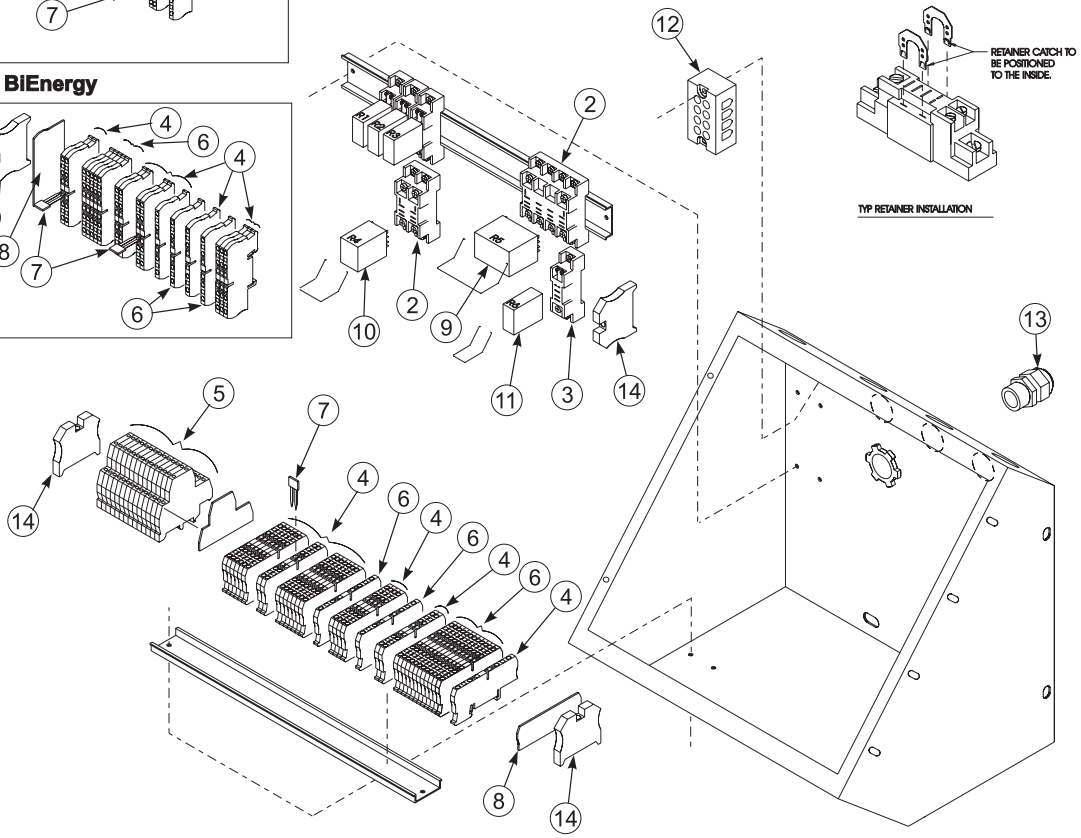


Figure 5-13: Lower Control Box Cover







1. Relay Socket
2. Relay Socket
3. Relay Socket
4. Terminal Block (tan)
5. Diode Block
6. Terminal Block (blue)
7. Jumper
8. Section End
9. Relay, 4 Pole
10. Relay, 2 Pole
11. Relay, 1 Pole(*)
12. Terminal Block (120V)
13. Cable Connector
14. End Block
15. Section End

*** NOTE: Relay 11 not used after serial number (1331).**

Figure 5-14: Terminal Strip, Relay Identification

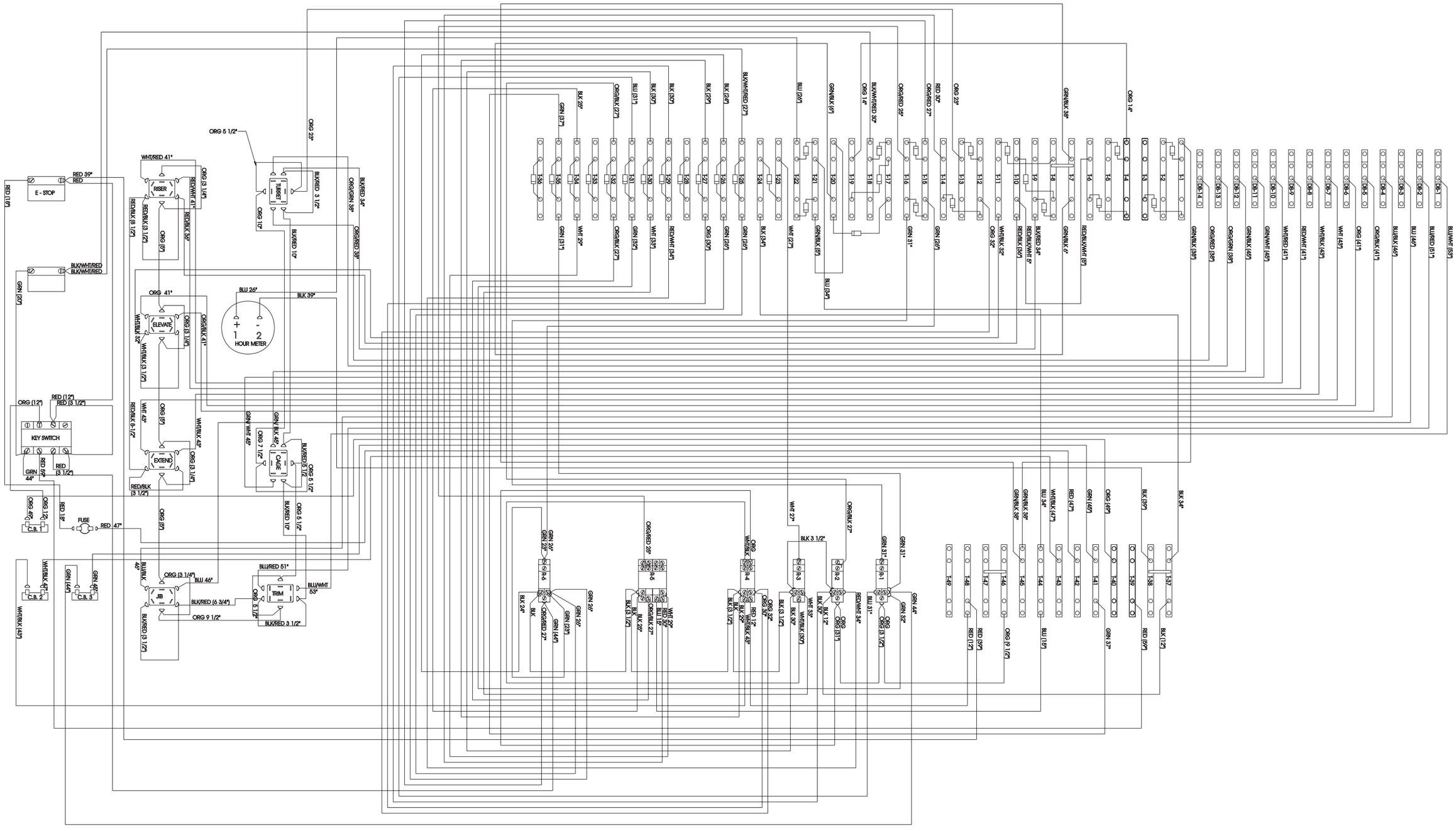


Figure 5-15: Electrical Diagram - Lower Control Box - Electric Model

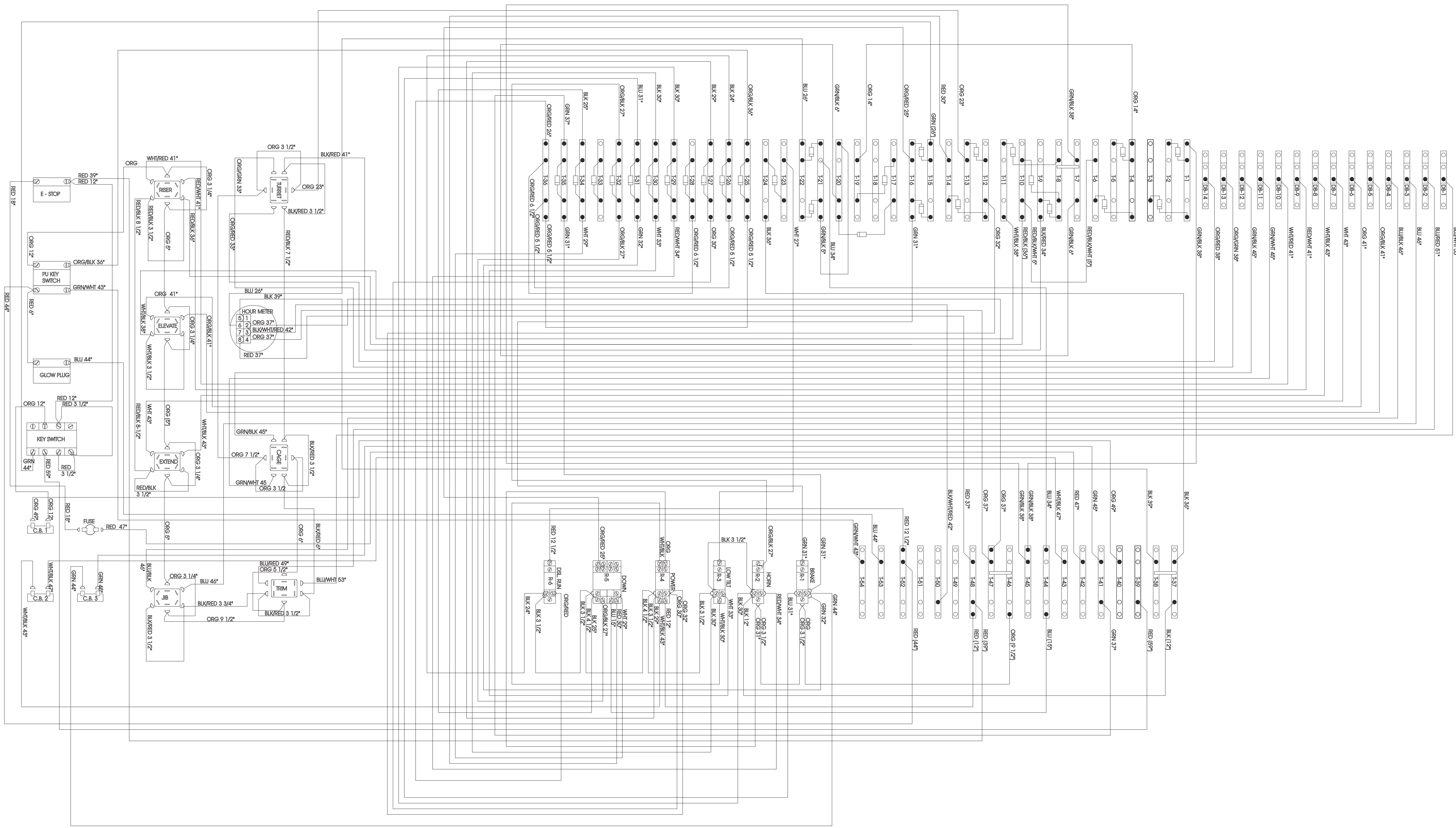


Figure 5-16: Electrical Diagram - Lower Control Box - BiEnergy Model - Serial Numbers 1000-1331

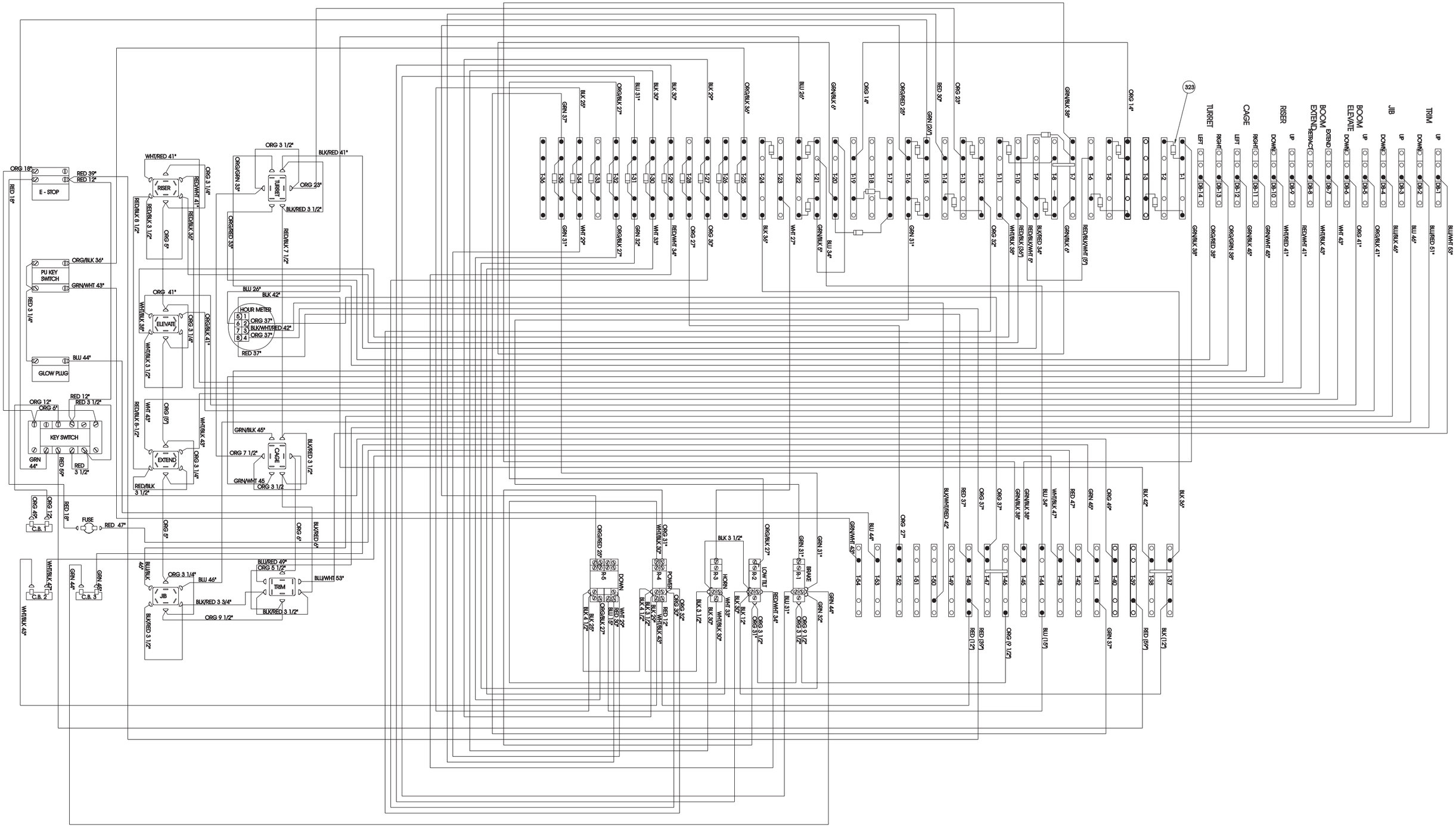
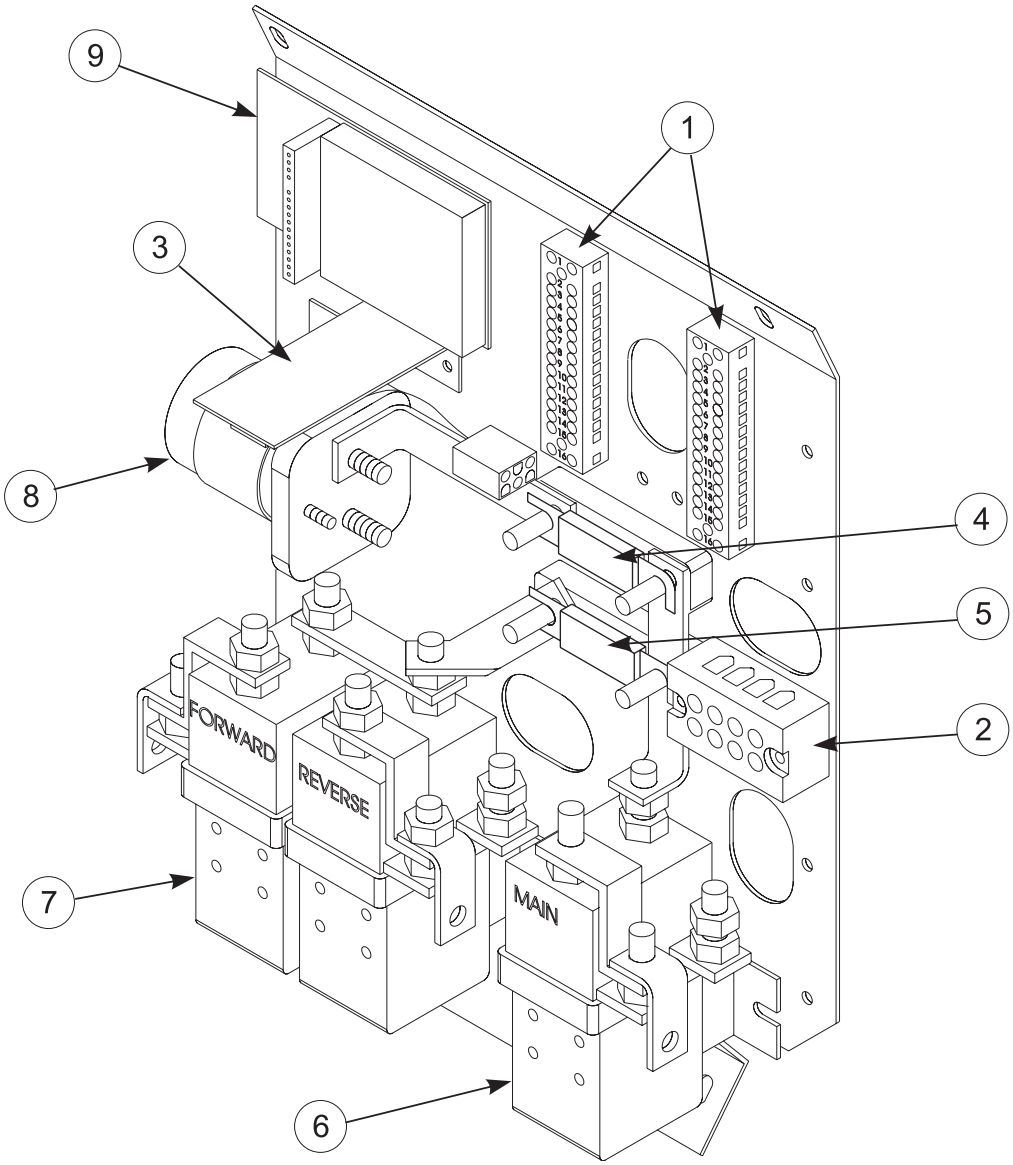


Figure 5-17: Electrical Diagram - Lower Control Box - Bi-Energy Model - After Serial Number - 1331



1. Terminal Block
2. Terminal Block
3. Resistor Bracket Assembly
4. Fuse (Buss ANN-125)
5. Fuse (Buss ANN-350)
6. Relay, 48 VDC (Single Contact)
7. Relay, 48 VDC (Double Contact)
8. Relay, 48 VDC
9. Tach Board Assembly

Figure 5-18: Relay Panel (Electric model shown)

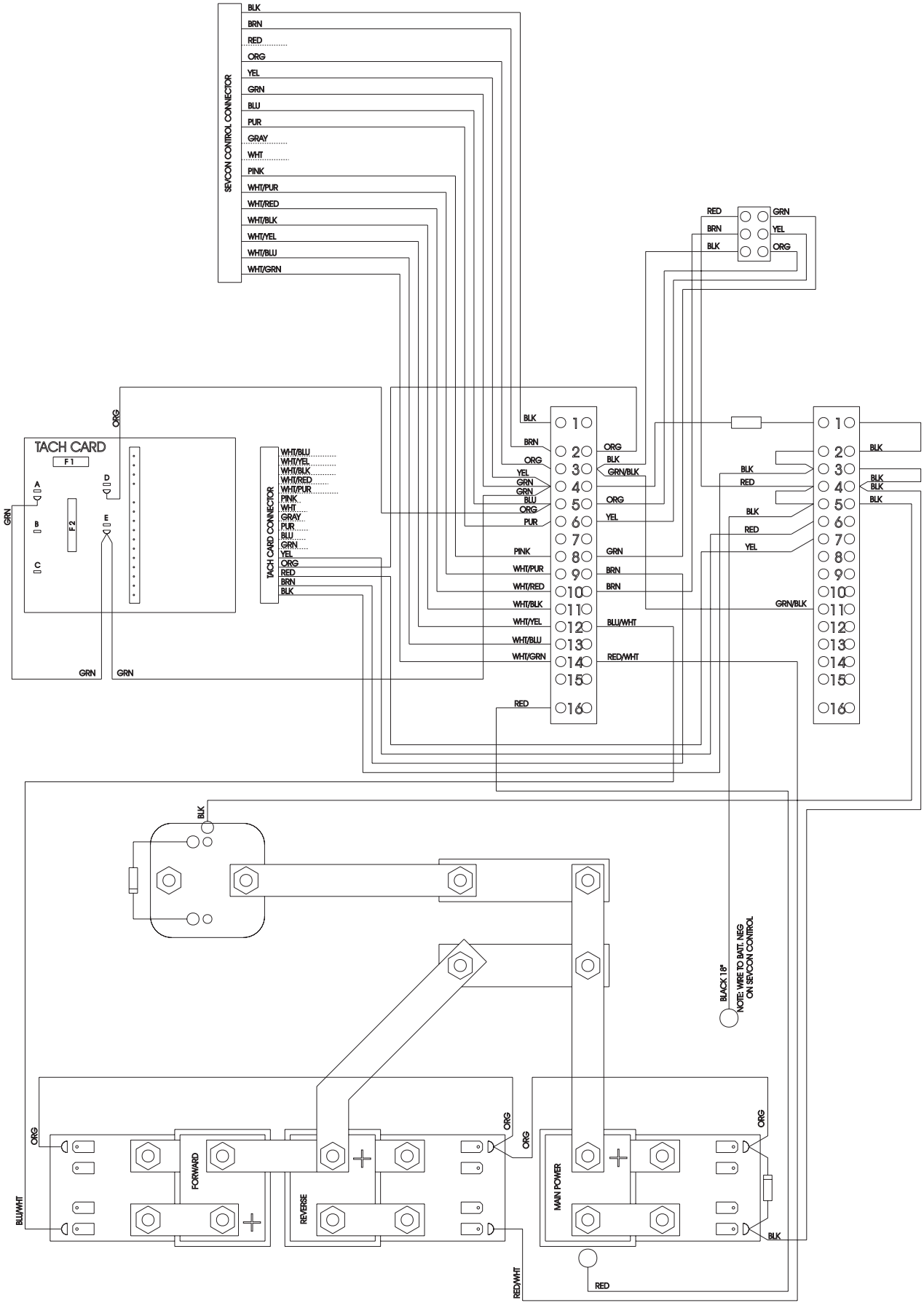


Figure 5-19: Relay Panel Schematic

6.0 Introduction

This section lists and illustrates the replaceable assemblies and parts of the AB46 Work Platform, as manufactured by UpRight, Inc.

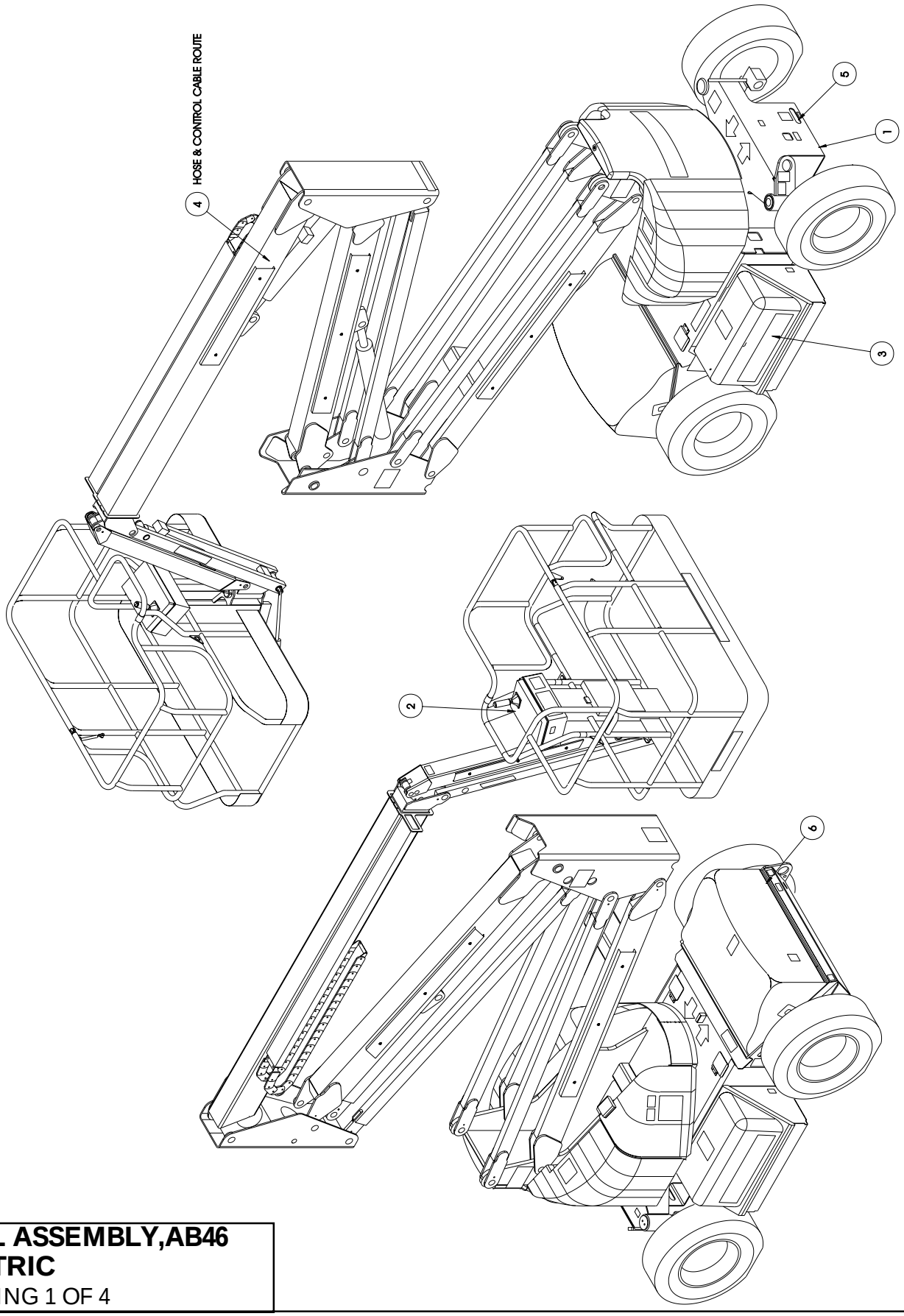
Each parts list contains the component parts for that assembly indented to show relationship where applicable.

6.1 Index

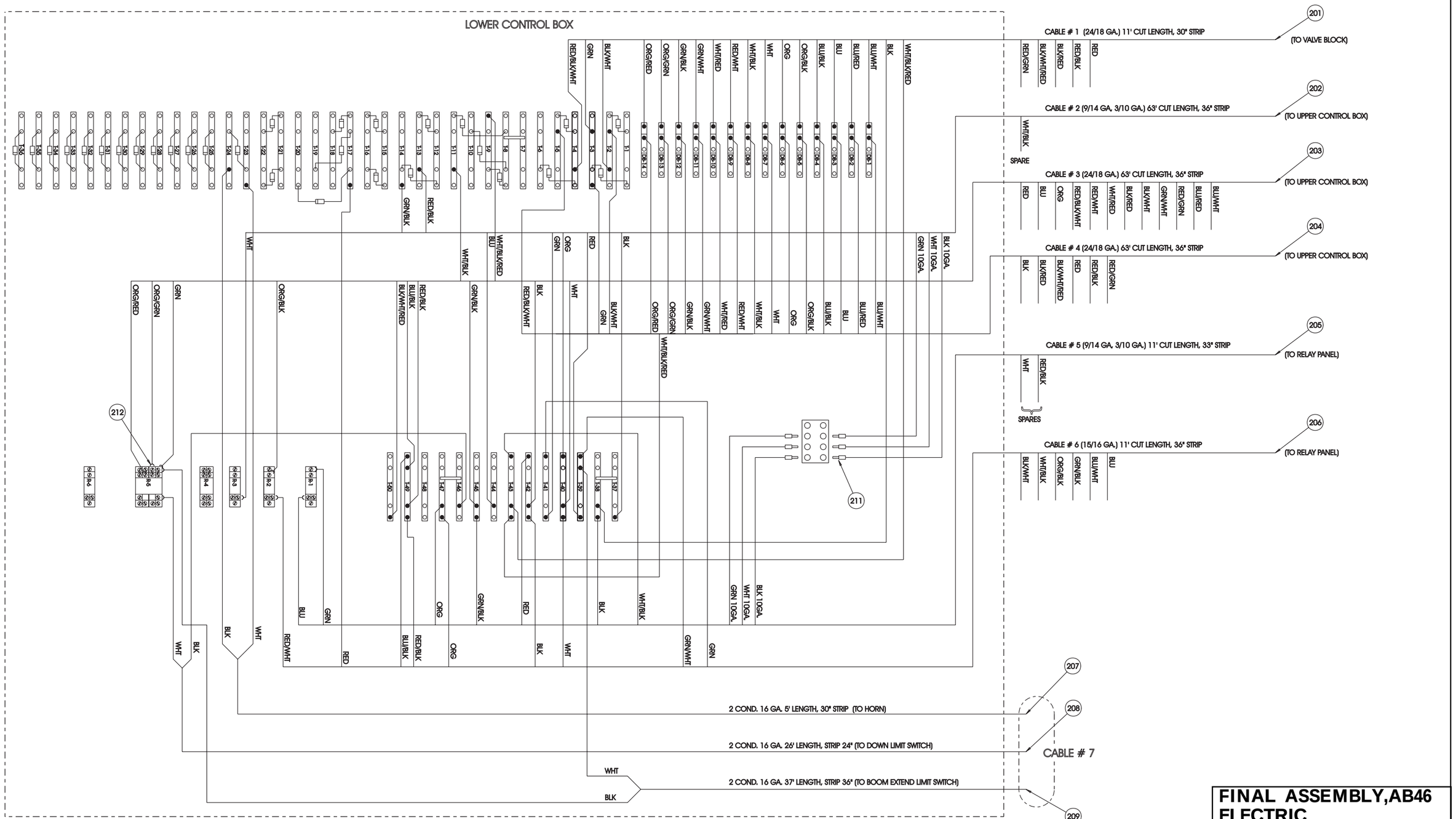
FINAL ASSEMBLY, AB46 ELECTRIC

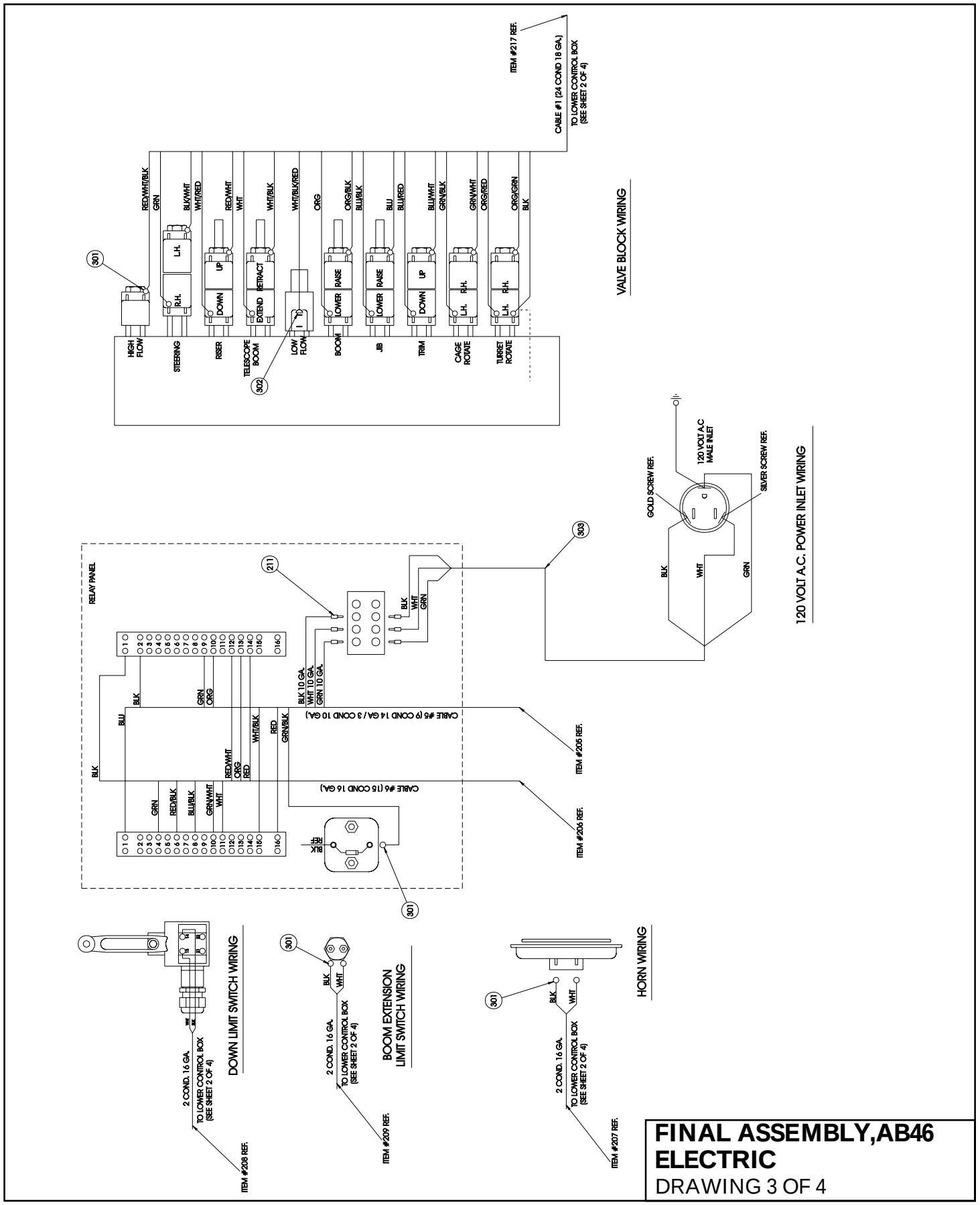
68300-000

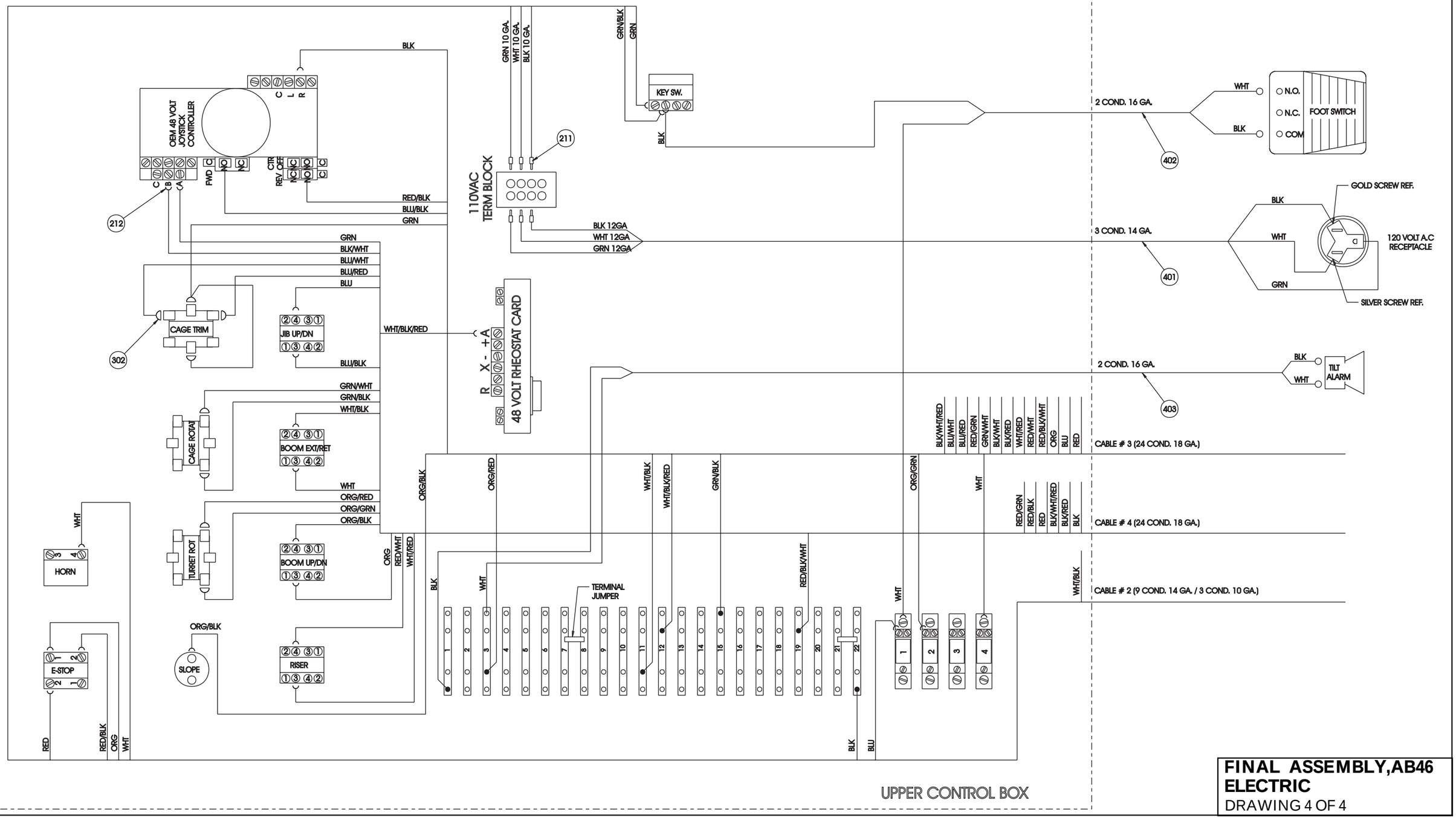
ITEM	PART	DESCRIPTION	QTY.
1	68303-000	BASIC ASSY. AB46-E	1
2	68339-001	CONTROLLER INSTL-ELEC. DOM.	1
3	68335-000	LABEL KIT/INSTL-ELEC. DOM.	1
4	68336-000	HOSE KIT/INSTL-ELEC NOT SHOWN	1
5	68338-000	CHARGER-DOM. NOT SHOWN	1
6	29945-015	LEVEL SENS P-Q DOM.EL NOT SHOWN	1
201	29433-099	CABLE, 24 COND. 18 GA.	11 FT
202	29434-099	CABLE, 3-10 GA. / 9-14 GA.	63 FT
203	29433-099	CABLE, 24 COND. 18 GA.	63 FT
204	29433-099	CABLE, 24 COND. 18 GA.	63 FT
205	29434-099	CABLE, 3-10 GA. / 9-14 GA.	11 FT
206	60214-099	CABLE, 15 COND. 16 GA.	11 FT
207	29496-099	WIRE, 2 COND. 16 GA.	5 FT
208	29496-099	WIRE, 2 COND. 16 GA.	26 FT
209	29496-099	WIRE, 2 COND. 16 GA.	37 FT
211	68814-000	TERMINAL, PIN	18
212	29610-006	TERMINAL, FORK 18-16 GA. #6	38
301	29601-005	TERMINAL, RING 18-22 GA. #10	23
302	29931-003	TERMINAL, FEM. PUSH 16-14 GA.	9
303	29495-099	WIRE, 3 COND. 14 GA.	6 FT
401	29495-099	WIRE, 3 COND. 14 GA.	2 FT
402	29496-099	WIRE, 2 COND. 16 GA.	8 FT
403	29496-099	WIRE, 2 COND. 16 GA.	2 FT



FINAL ASSEMBLY,AB46 ELECTRIC
DRAWING 1 OF 4


LOWER CONTROL BOX
CABLE # 1 (24/18 GA.) 11' CUT LENGTH, 30" STRIP
201
(TO VALVE BLOCK)
CABLE # 2 (9/14 GA, 3/10 GA.) 63' CUT LENGTH, 36" STRIP
202
(TO UPPER CONTROL BOX)
SPARE
CABLE # 3 (24/18 GA.) 63' CUT LENGTH, 36" STRIP
203
(TO UPPER CONTROL BOX)
CABLE # 4 (24/18 GA.) 63' CUT LENGTH, 36" STRIP
204
(TO UPPER CONTROL BOX)
CABLE # 5 (9/14 GA, 3/10 GA.) 11' CUT LENGTH, 33" STRIP
205
(TO RELAY PANEL)
SPARES
CABLE # 6 (15/16 GA.) 11' CUT LENGTH, 36" STRIP
206
(TO RELAY PANEL)
211
212
2 COND. 16 GA. 5' LENGTH, 30" STRIP (TO HORN)
207
208
2 COND. 16 GA. 26' LENGTH, STRIP 24" (TO DOWN LIMIT SWITCH)
CABLE # 7
2 COND. 16 GA. 37' LENGTH, STRIP 36" (TO BOOM EXTEND LIMIT SWITCH)
209
FINAL ASSEMBLY,AB46 ELECTRIC
DRAWING 2 OF 4


ITEM #217 REF.
CABLE #1 (24 COND 18 GA.)
TO LOWER CONTROL BOX
(SEE SHEET 2 OF 4)
VALVE BLOCK WIRING
HIGH FLOW
STEERING
RISER
TELESCOPE BOOM
LOW FLOW
BOOM
JIB
TRIM
CAGE ROTATE
TURRET ROTATE
120 VOLT A.C. POWER INLET WIRING
120 VOLT A.C MALE INLET
GOLD SCREW REF.
SILVER SCREW REF.
RELAY PANEL
CABLE #5 (9 COND 14 GA / 3 COND 10 GA.)
CABLE #6 (15 COND 16 GA.)
ITEM #205 REF.
ITEM #206 REF.
DOWN LIMIT SWITCH WIRING
2 COND. 16 GA.
TO LOWER CONTROL BOX
(SEE SHEET 2 OF 4)
ITEM #208 REF.
BOOM EXTENSION
LIMIT SWITCH WIRING
ITEM #209 REF.
HORN WIRING
ITEM #207 REF.
FINAL ASSEMBLY,AB46
ELECTRIC
DRAWING 3 OF 4



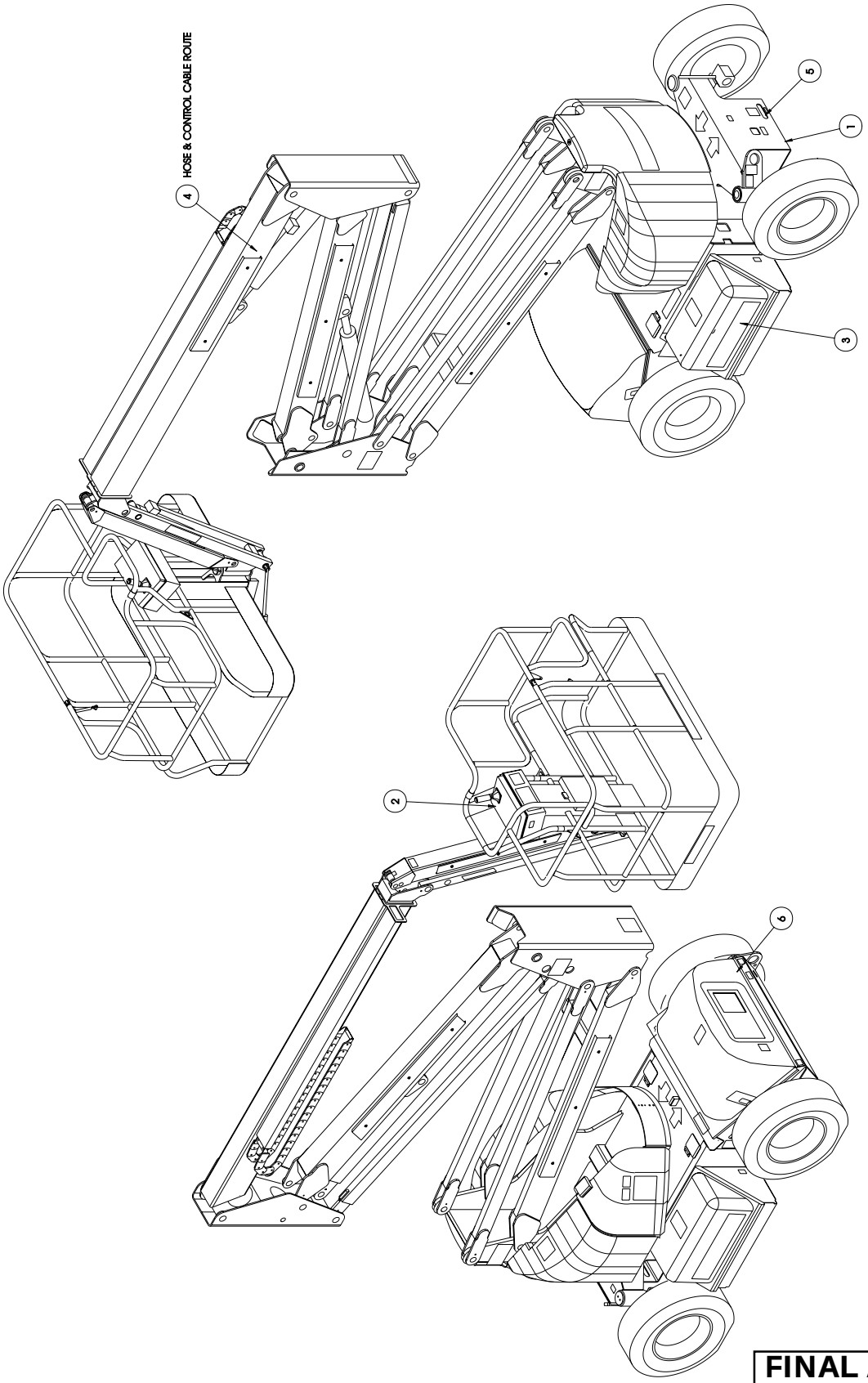
FINAL ASSEMBLY,AB46 ELECTRIC
DRAWING 4 OF 4

NOTES:

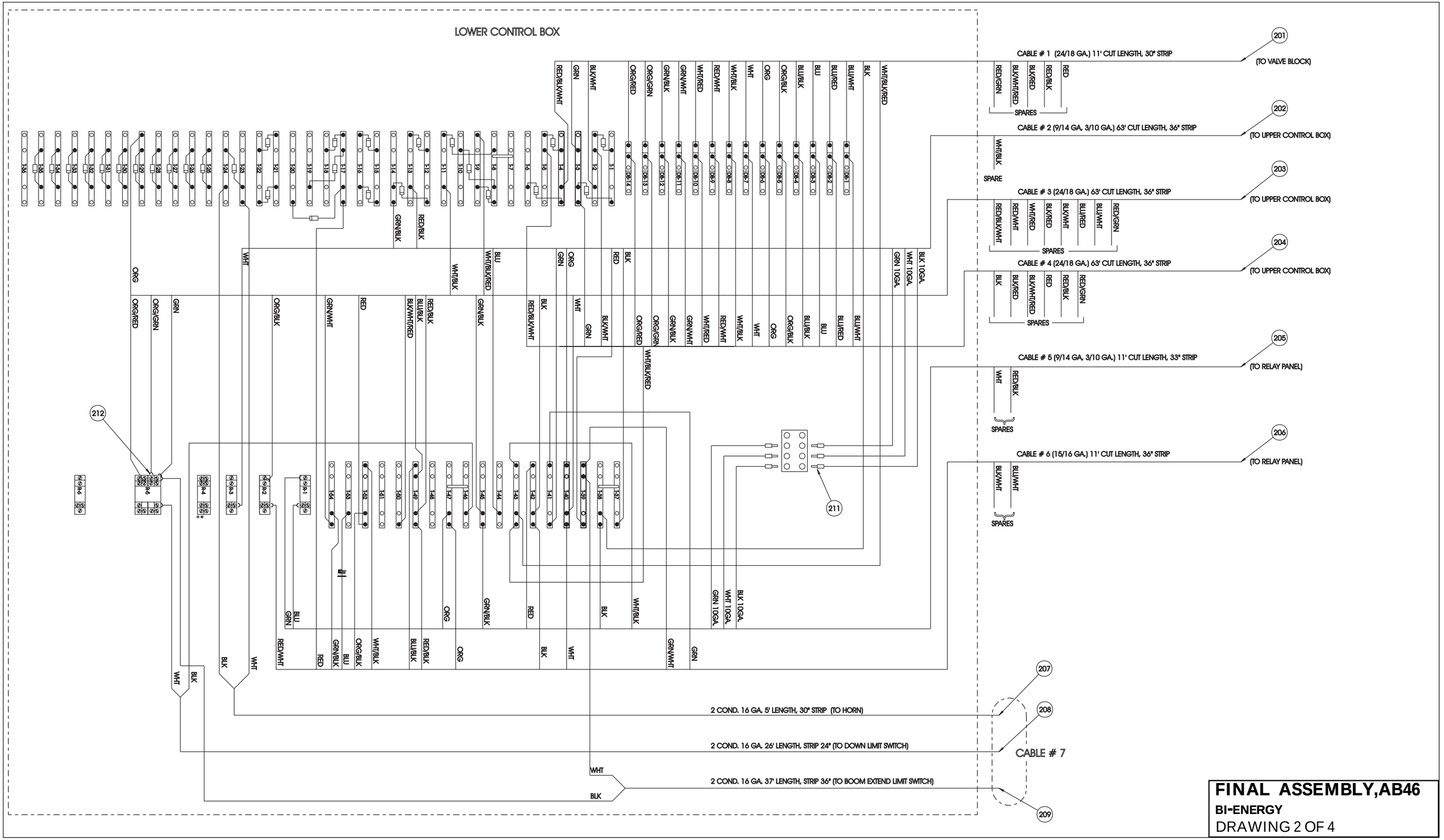
FINAL ASSEMBLY, AB46 BI-ENERGY

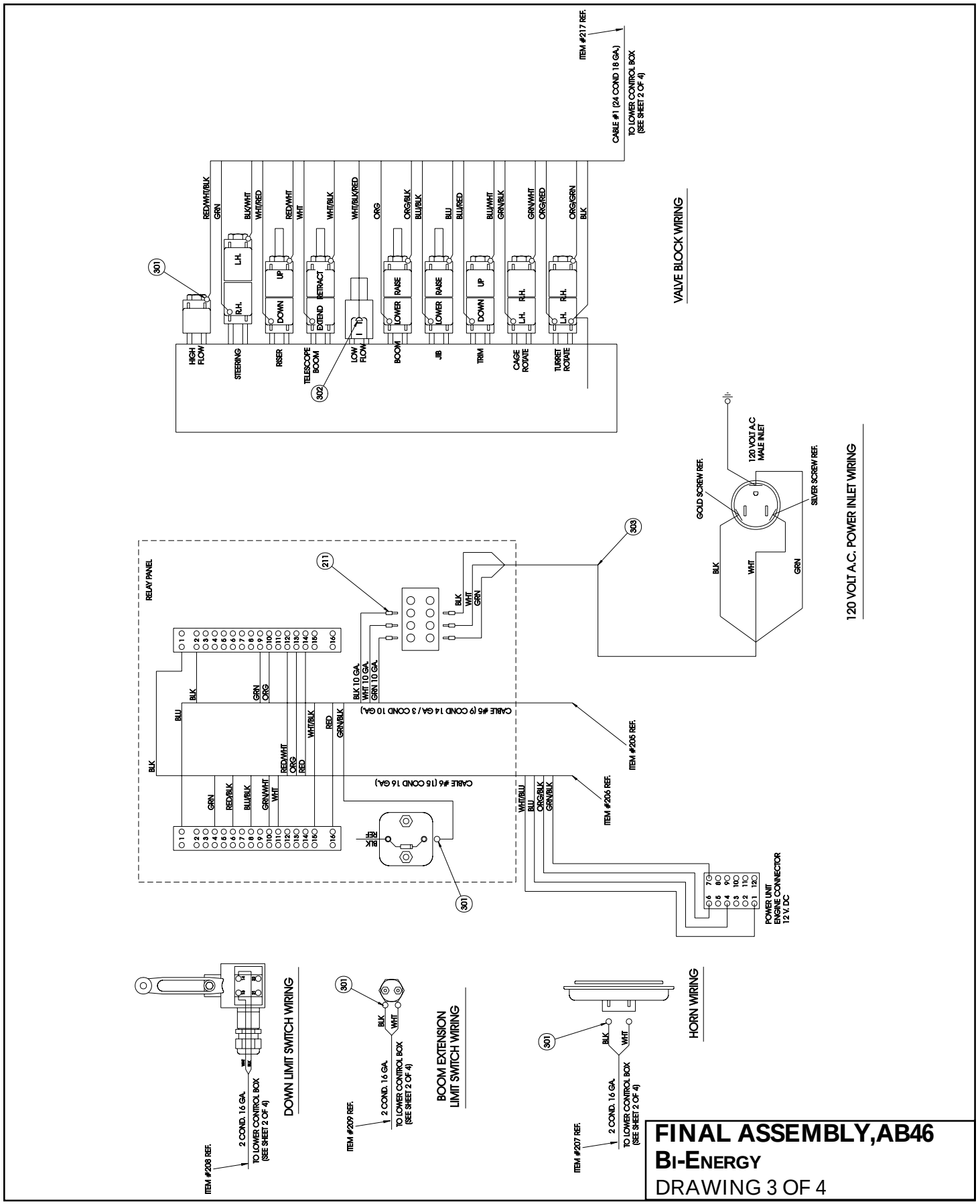
68310-000

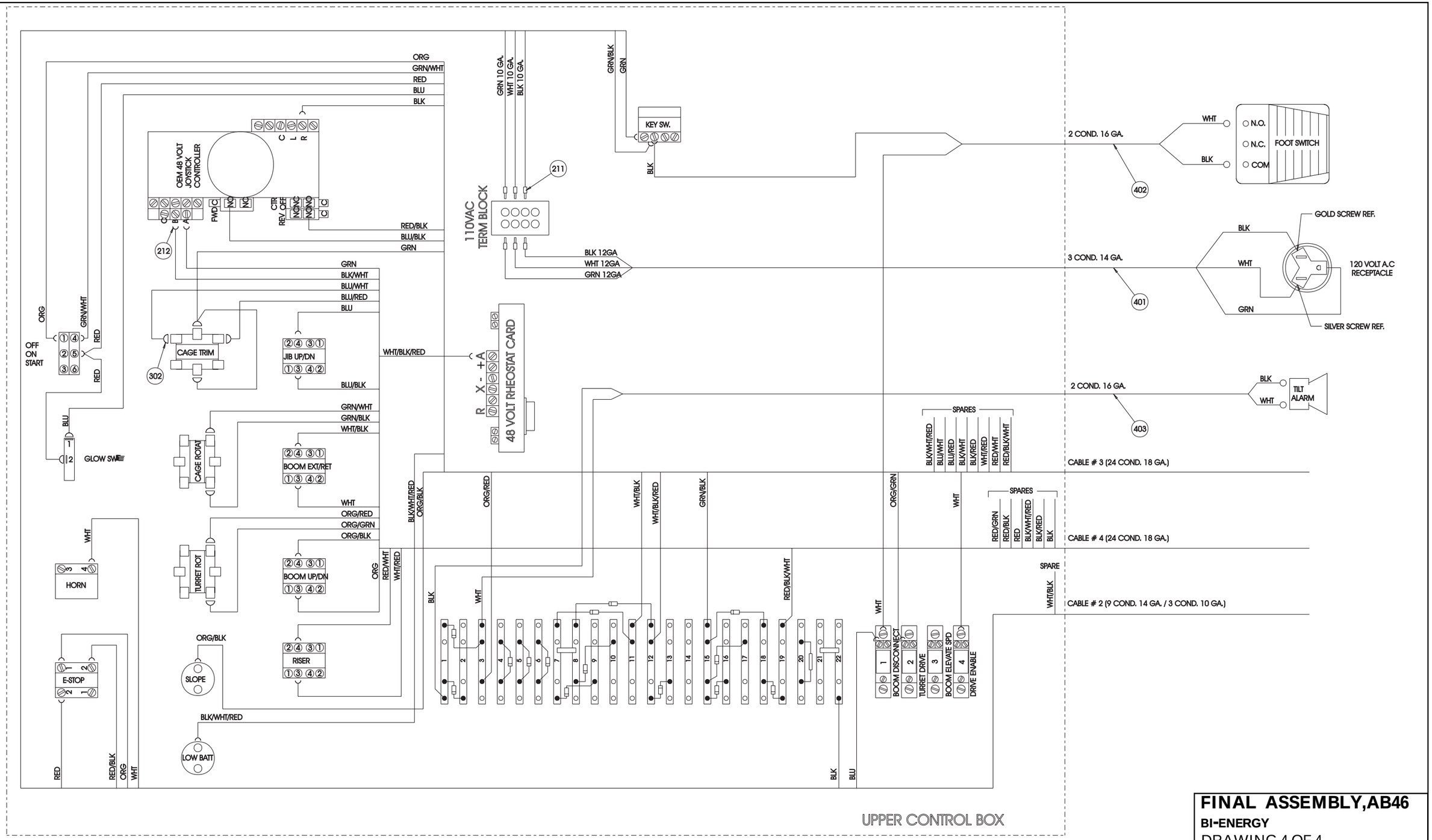
ITEM	PART	DESCRIPTION	QTY.
1	68313-000	BASIC ASSY. AB46 BI-ENERGY	1
2	68339-011	CONTROLLER INSTL, BI-ENERGY DOM.	1
3	68335-003	LABEL KIT/INSTL BI-ENG DOM.	1
4	68336-002	HOSE KIT/INSTL-ELEC NOT SHOWN	1
5	68338-000	CHARGER-DOM. NOT SHOWN	1
6	29945-015	LEVEL SENS P-Q DOM.EL NOT SHOWN	1
201	29433-099	CABLE, 24 COND. 18 GA.	11 FT
202	29434-099	CABLE, 3-10 GA. / 9-14 GA.	63 FT
203	29433-099	CABLE, 24 COND. 18 GA.	63 FT
204	29433-099	CABLE, 24 COND. 18 GA.	63 FT
205	29434-099	CABLE, 3-10 GA. / 9-14 GA.	11 FT
206	60214-099	CABLE, 15 COND. 16 GA.	11 FT
207	29496-099	WIRE, 2 COND. 16 GA.	5 FT
208	29496-099	WIRE, 2 COND. 16 GA.	26 FT
209	29496-099	WIRE, 2 COND. 16 GA.	37 FT
211	68814-000	TERMINAL, PIN	18
212	29610-006	TERMINAL, FORK 18-16 GA. #6	38
301	29601-005	TERMINAL, RING 18-22 GA. #10	23
302	29931-003	TERMINAL, FEM. PUSH 16-14	9
303	29495-099	WIRE, 3 COND. 14 GA.	6 FT
401	29495-099	WIRE, 3 COND. 14 GA.	2 FT
402	29496-099	WIRE, 2 COND. 16 GA.	8 FT
403	29496-099	WIRE, 2 COND. 16 GA.	2 FT



FINAL ASSEMBLY,AB46
BI-ENERGY
DRAWING 1 OF 4


LOWER CONTROL BOX
CABLE # 1 (24/18 GA.) 11' CUT LENGTH, 30" STRIP
(TO VALVE BLOCK)
SPARES
CABLE # 2 (9/14 GA, 3/10 GA.) 63' CUT LENGTH, 36" STRIP
(TO UPPER CONTROL BOX)
SPARE
CABLE # 3 (24/18 GA.) 63' CUT LENGTH, 36" STRIP
(TO UPPER CONTROL BOX)
SPARES
CABLE # 4 (24/18 GA.) 63' CUT LENGTH, 36" STRIP
(TO UPPER CONTROL BOX)
SPARES
CABLE # 5 (9/14 GA, 3/10 GA.) 11' CUT LENGTH, 33" STRIP
(TO RELAY PANEL)
SPARES
CABLE # 6 (15/16 GA.) 11' CUT LENGTH, 36" STRIP
(TO RELAY PANEL)
SPARES
2 COND. 16 GA. 5' LENGTH, 30" STRIP (TO HORN)
2 COND. 16 GA. 26' LENGTH, STRIP 24" (TO DOWN LIMIT SWITCH)
2 COND. 16 GA. 37' LENGTH, STRIP 36" (TO BOOM EXTEND LIMIT SWITCH)
CABLE # 7
FINAL ASSEMBLY,AB46
BI-ENERGY
DRAWING 2 OF 4


ITEM #217 REF.
CABLE #1 (24 COND 18 GA.)
TO LOWER CONTROL BOX (SEE SHEET 2 OF 4)
VALVE BLOCK WIRING
HIGH FLOW
STEERING
RISER
TELESCOPE BOOM
LOW FLOW
BOOM
JIB
TRIM
CAGE ROTATE
TURRET ROTATE
120 VOLT A.C. POWER INLET WIRING
120 VOLT A.C MALE INLET
GOLD SCREW REF.
SILVER SCREW REF.
RELAY PANEL
CABLE #5 (9 COND 14 GA / 3 COND 10 GA.)
CABLE #6 (15 COND 16 GA.)
ITEM #205 REF.
ITEM #206 REF.
POWER UNIT ENGINE CONNECTOR 12 V. DC
DOWN LIMIT SWITCH WIRING
2 COND. 16 GA.
TO LOWER CONTROL BOX (SEE SHEET 2 OF 4)
ITEM #208 REF.
BOOM EXTENSION LIMIT SWITCH WIRING
ITEM #209 REF.
HORN WIRING
ITEM #207 REF.
FINAL ASSEMBLY,AB46
BI-ENERGY
DRAWING 3 OF 4



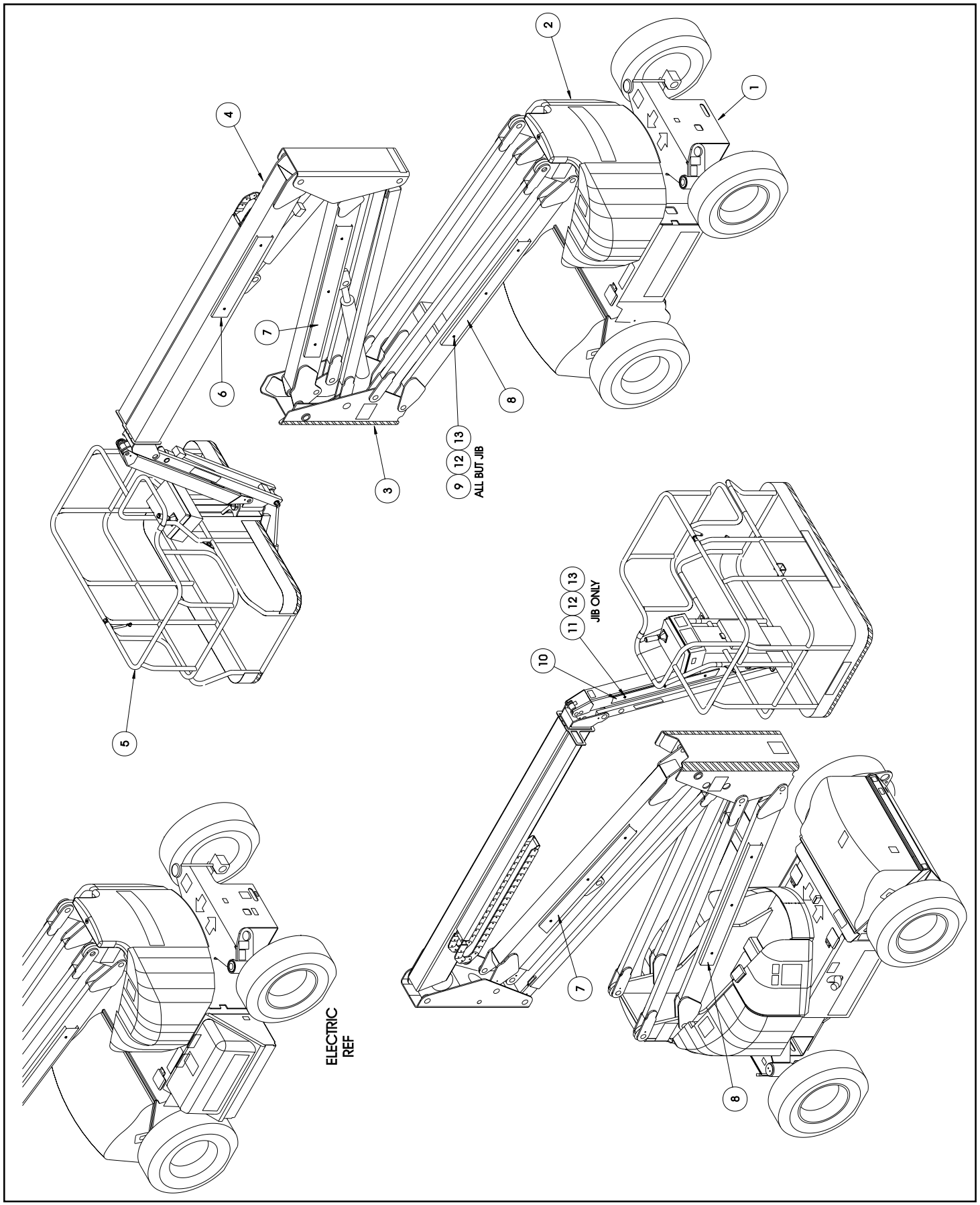
FINAL ASSEMBLY,AB46
BI-ENERGY
DRAWING 4 OF 4

NOTES:

BASIC ASSEMBLY, AB46 ELECTRIC

68303-000

ITEM	PART	DESCRIPTION	QTY.
1	68320-000	CHASSIS ASSY. AB46-ELEC	1
2	68330-000	TURRET ASSY-ELEC	1
3	68323-000	LOWER LINKAGE ASSY	1
4	68322-000	UPPER LINKAGE ASSY	1
5	68325-001	CAGE “B” ASSY	1
6	68703-000	HOSE GUARD	1
7	68704-000	HOSE GUARD (58")	2
8	68705-000	HOSE GUARD (68")	2
9	68706-000	HOSE CLAMP	14
10	68731-000	HOSE GUARD-JIB	1
11	68732-000	HOSE CLAMP-JIB	3
12	11248-004	NUT HEX ESNA 1/4-20 UNC	17
13	11240-004	WASHER 1/4 STD FLAT	17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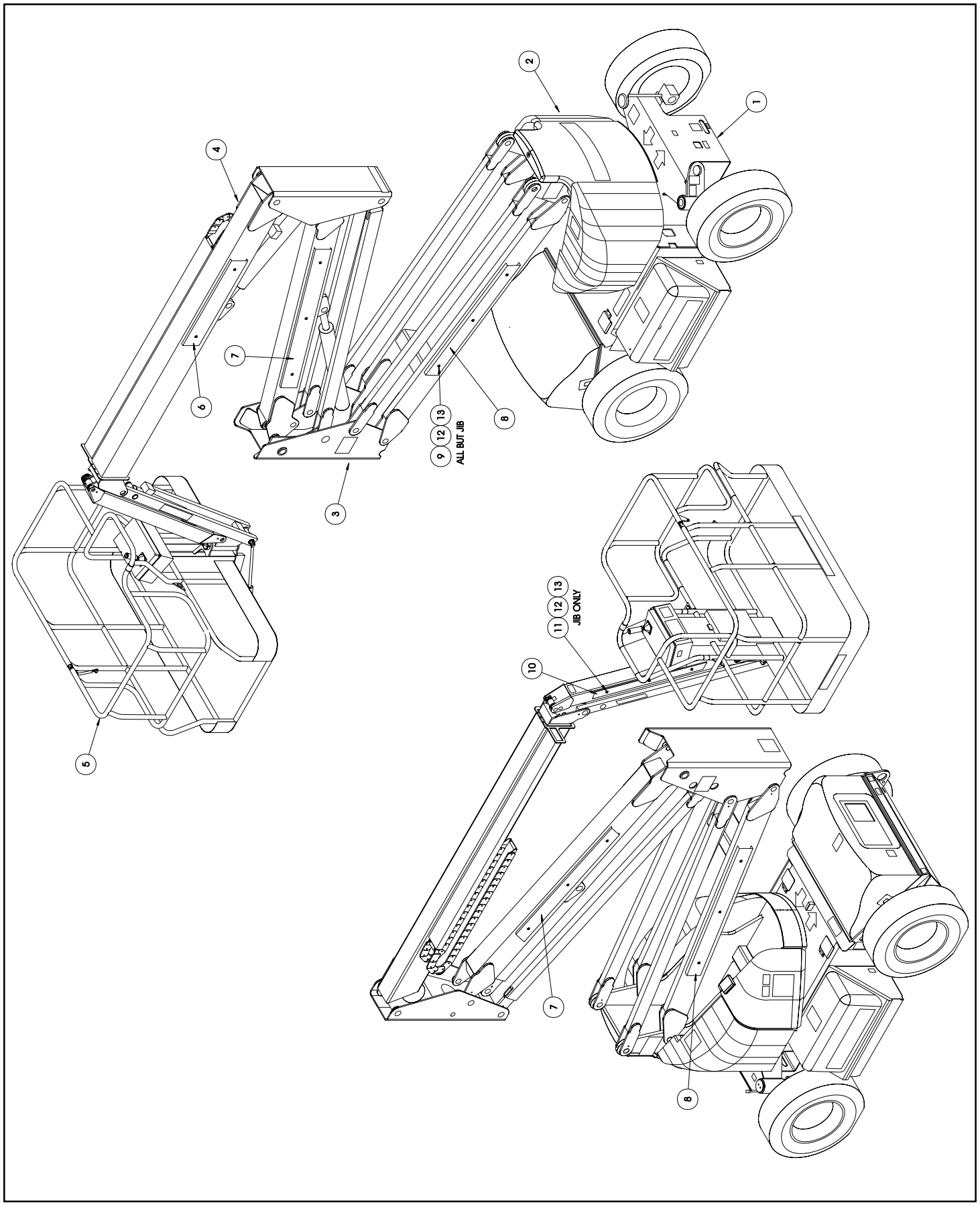
ALL BUT JIB
JIB ONLY
ELECTRIC
REF

BASIC ASSEMBLY, AB46 BI-ENERGY

68313-000

ITEM	PART	DESCRIPTION	QTY.
1	68317-000	CHASSIS ASSY. AB46 BI-ENERGY	1
2	68330-003	TURRET ASSY BI-ENERGY	1
3	68323-000	LOWER LINKAGE ASSY	1
4	68322-000	UPPER LINKAGE ASSY	1
5	68325-001	CAGE “B” ASSY	1
6	68703-000	HOSE GUARD	1
7	68704-000	HOSE GUARD (58")	2
8	68705-000	HOSE GUARD (68")	2
9	68706-000	HOSE CLAMP	14
10	68731-000	HOSE GUARD-JIB	1
11	68732-000	HOSE CLAMP-JIB	3
12	11248-004	NUT HEX ESNA 1/4-20 UNC	17
13	11240-004	WASHER 1/4 STD FLAT	17
13	11240-004	WASHER 1/4 STD FLAT	17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CHASSIS ASSEMBLY, AB46 ELECTRIC

68320-000

ITEM	PART	DESCRIPTION	QTY.
1	68381-001	CHASSIS WELDMENT (ELECTRIC)	1
2	11256-012	SCR, HHC 1/2-13 UNC X 1 1/2	2
3	11238-008	LOCKWASHER, SPLIT RING 1/2"	2
4	11240-008	WASHER, FLAT 1/2"	2
5	68370-000	SPINDLE WELDMENT (L.H.)	1
6	68370-001	SPINDLE WELDMENT (R.H.)	1
7	68368-000	STEERING PIVOT SHAFT	2
8	11257-040	SCR, HHC. 5/8-11 UNC X 5	2
9	11248-010	LOCKNUT, 5/8-11 UNC. (ESNA)	2
10	68456-000	STEERING CYLINDER	1
11	68702-000	BOLT, “SPECIAL LENGTH” 5/16-18	2
12	11239-005	WASHER, 5/16" ASTM A-325	4
13	11740-014	ROLL PIN Ø 1/2 X 1 3/4 LG.	2
14	11248-005	LOCKNUT, 5/16-18 UNC. (ESNA)	2
15	68372-000	STEERING ARM	2
16	11239-008	WASHER, 1/2" ASTM A-325	24
17	62642-033	BUSHING, Ø 1.25 X 1.00 (20DU16)	4
18	68380-000	STEERING PIN (SHORT)	2
19	68378-000	STEERING PIN (LONG)	2
20	14996-008	WASHER, FLAT 1/2" S.A.E.	8
21	11256-030	SCR, HHC. 1/2-13 UNC X 3 3/4	2
22	68338-000	BATTERY CHARGER,	1
23	10092-014	THRUST WASHER, GARLOCK G 28 DU	2
24	68576-001	BUSHING, GARLOCK #GF4852-40	4
25	11788-001	SEAL, GARLOCK #71 X 6308	2
26	13888-224	O-RING, 1.75 I.D. X .125 SECT	2
27	68373-000	CAP, STEERING PIN	2
28	11253-006	SCR, HHC. 5/16-18 UNC X 3/4	4
29	68577-000	FRONT HUB ASSY.	2
*	68577-010	FRONT HUB REPAIR KIT	1
*	68577-008	STUD BOLTS	1
*	68577-007	WHEEL NUTS	1
30	11979-008	O-RING	1
31	11297-010	BELLEVILLE WASHER, 5/8 DIA.	18
32	11469-005	LUG NUT 90° 9/16-18 UNF	24
33	68570-000	PLANETARY DRIVE	2
*	68570-010	TORQUE HUB REPAIR KIT	1
*	68570-011	THRUST WASHER	1
34	68569-000	BRAKE, “OSCO”	2
*	68569-010	SEAL KIT	1
35	68573-000	MOTOR, ELECTRIC 24 VOLT D.C.	2
36	68757-001	LATCH, DRAW	2
37	**	GASKET	4
38	10150-005	FITTING, BULKHEAD 8MJ-8MJ	1
40	68565-000	ACCUMULATOR	1
41	29945-VAR	LEVEL SENSOR, (SEE FINAL ASSY)	1
42	13969-002	FITTING, 4MJ-8FJ	1
44	68388-000	COVER PLATE	1
45	68575-000	MOTOR, HYDRAULIC	1
46	68571-000	DRIVE, WORM GEAR	1
47	14576-026	SCR, HHC. GR8 5/8-18UNF X 3 1/4	18
48	11941-038	FITTING, STR 10MB-4MJ	2
49	68326-000	HYDRAULIC POWER UNIT ASSY.	1
50	68346-000	RELAY PANEL ASSY.	1
51	68333-000	CABLE ASSY.	1

ITEM	PART	DESCRIPTION	QTY.
52	68727-000	ANGLE, BATTERY TRAY MOUNT	4
53	68331-001	BATTERY MODULE ASSY	1
54	68331-002	BATTERY MODULE ASSY	1
55	61692-099	GROMET MATERIAL	7 FT
56	11252-014	SCR. HHC 1/4-20 UNC X 1 3/4	4
57	11254-010	SCR. HHC 3/8-16 UNC X 1 1/4	10
58	11248-008	LOCKNUT, HEX 1/2-13 UNC ESNA	10
59	11240-006	WASHER, FLAT 3/8"	8
60	11248-006	LOCKNUT, HEX. 3/8-16 UNC ESNA	9
61	11256-036	SCR, HHC. 1/2-13 UNC X 4 1/4	4
62	**	WASHER, FLAT 7/8"	2
63	**	NUT, HEX CASTLE 7/8-14 UNF.	2
64	**	COTTER PIN 1/8" DIA. X 2 LG.	2
65	11934-026	FITTING, 90° ELBOW 4MB-6MJ	1
67	11715-004	SCREW, #6-32 X 1/2	4
68	11240-001	WASHER, FLAT #6	4
69	11248-047	LOCKNUT, #6-32 ESNA	6
70	11252-006	SCREW HHC 1/4-20 X 3/4	12
71	11240-004	WASHER 1/4 FLAT STD	10
72	11248-004	LOCKNUT, 1/4-20 ESNA	14
73	14252-004	NUT-SERT 1/4 - 20 UNC	6
74	11256-014	SCR, HHC 1/2-13 UNC X 1 3/4	4
75	11252-016	SCRW HHC GR5 1/4-20 X 2	4
76	11238-004	WASHER SPLIT LOCK 1/4	6
77	11249-008	LOCKNUT, 1/2-20 UNF. ESNA	18
78	68658-001	COVER, ENGINE COMPARTMENT	1
79	68327-000	TIRE & WHEEL ASSY.	4
81	68321-000	SPEED CONTROL PANEL ASSY.	1
82	68551-001	TACH ASSY. KIT (ITEMS 82-87)	2
84	**	MOUNTING PLATE	2
85	**	SCREW R.H. #2-56 X 1/4	6
86	**	WASHER	6
87	**	COUPLING	2
88	68680-007	FITTING, 90° ELBOW	2
94	11254-006	SCREW HHC 3/8-16 X 3/4	1
95	11238-006	WASHER, SPLIT LOCK 3/8	5
96	11240-006	WASHER, FLAT STD 3/8	1
97	03495-000	90° ELBOW STREET 6MB - 6FJ	2
98	29961-000	INLET FLANGE, MALE	1
99	68386-000	COVER PLATE (L.H.)	1
100	68386-001	COVER PLATE (R.H.)	1
101	68788-000	COVER, ELECTRICAL	1
102	11936-001	FITTING, TEE 4MJ-4MJ-4MB	1
103	14048-010	FITTING, ADAPT 4FP-4FJ	1
104	63921-007	PRESSURE SWITCH	1
105	68783-000	PRESSURE SNUBBER	1
106	29961-001	SEAL, HUBBELL #6017	1

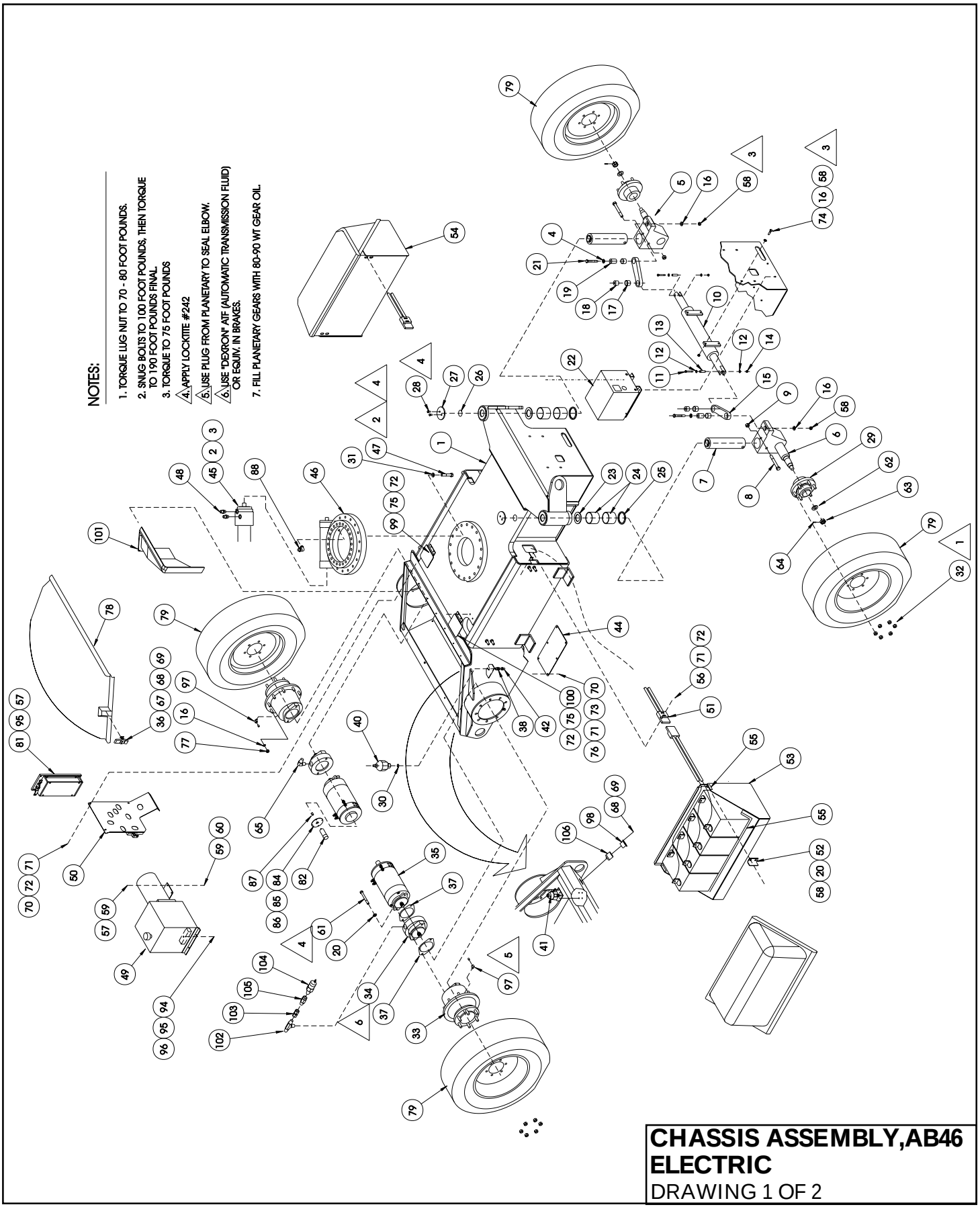
CHASSIS ASSEMBLY, AB46
ELECTRIC (CONT.)
68320-000

ITEM	PART	DESCRIPTION	QTY.
201	68776-001	CABLE ASSY. X 20" (3/8 X 3/8 LUG)	1
202	68776-002	CABLE ASSY. X 35" (3/8 X 3/8 LUG)	1
203	68776-003	CABLE ASSY. X 24" (3/8 X 3/8 LUG)	1
204	68776-004	CABLE ASSY. X 30" (3/8 X 3/8 LUG)	1
205	68777-001	CABLE ASSY. X 41" (5/16 X 3/8 LUG)	1
206	68777-002	CABLE ASSY. X 47" (5/16 X 3/8 LUG)	1
207	68777-003	CABLE ASSY. X 25" (5/16 X 3/8 LUG)	1
208	68777-004	CABLE ASSY. X 20" (5/16 X 3/8 LUG)	1
209	68334-003	CABLE ASSY. X 27" (5/16 X 5/16 LUG)	1
210	68334-004	CABLE ASSY. X 24" (5/16 X 5/16 LUG)	1
211	29452-099	WIRE, 16 GA. BLACK	5 FT
212	29451-099	WIRE, 16 GA. WHITE	5 FT
213	29454-099	WIRE, 16 GA. RED	5 FT
214	29457-099	WIRE, 16 GA. GREEN	5 FT
215	29453-099	WIRE, 16 GA. ORANGE	5 FT
216	29355-099	WIRE, 16 GA. BLACK / RED	5 FT
217	29356-099	WIRE, 16 GA. WHITE / RED	5 FT
218	14914-001	CONN. MALE PUSH, 14-16 .25	1
219	29931-003	CONN. FEM. PUSH, 14-16 .25	2
220	29601-012	CONN. RING, 14-16 #8	8
221	29601-015	CONN. RING, 14-16 Ø 3/8	1
222	29825-002	DIODE, 3 AMP, 400 VOLT	2
223	29440-099	CABLE, 12 GA. 3 COND. S.O	6 FT
224	68814-00	TERMINAL, PIN	3
225	29361-099	WIRE 16GA WHT/BLK	5 FT

***Not Shown**

****Items 62 - 64, included with item 6.**
Items 84 - 87 included with item 82.
Item 37 included with item 34.

See page 3-15 for detail of Front Hub Repair Kit



CHASSIS ASSEMBLY,AB46 ELECTRIC
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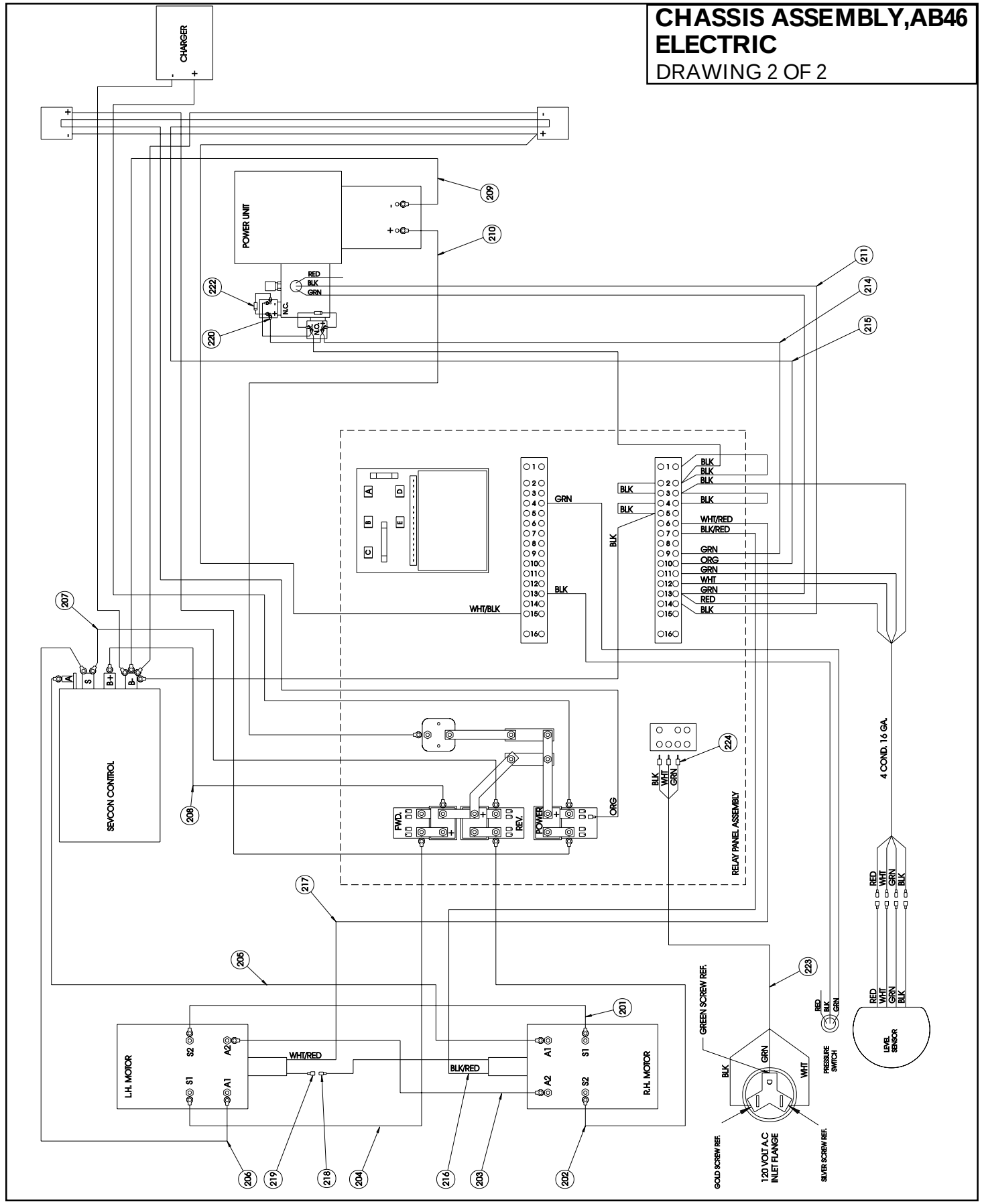
CHASSIS ASSEMBLY,AB46 ELECTRIC
DRAWING 2 OF 2



CHASSIS ASSEMBLY, AB46
BI-ENERGY
68317-000

ITEM	PART	DESCRIPTION	QTY.
1	68929-000	CHASSIS WELDMENT BI-ENERGY	1
2	11256-012	SCR, HHC 1/2-13 UNC X 1 1/2	2
3	11238-008	LOCKWASHER, SPLIT RING 1/2"	2
4	11240-008	WASHER, FLAT 1/2"	2
5	68370-000	SPINDLE WELDMENT (L.H.)	1
6	68370-001	SPINDLE WELDMENT (R.H.)	1
7	68368-000	STEERING PIVOT SHAFT	2
8	11257-040	SCR, HHC. 5/8-11 UNC X 5	2
9	11248-010	LOCKNUT, 5/8-11 UNC. (ESNA)	2
10	68456-000	STEERING CYLINDER	1
11	68702-000	BOLT, "SPECIAL LENGTH" 5/16-18	2
12	11239-005	WASHER, 5/16" ASTM A-325	4
13	11740-014	ROLL PIN Ø 1/2 X 1 3/4 LG.	2
14	11248-005	LOCKNUT, 5/16-18 UNC. (ESNA)	2
15	68372-000	STEERING ARM	2
16	11239-008	WASHER, 1/2" ASTM A-325	24
17	62642-033	BUSHING, Ø 1.25 X 1.00 (20DU16)	4
18	68380-000	STEERING PIN (SHORT)	2
19	68378-000	STEERING PIN (LONG)	2
20	14996-008	WASHER, FLAT 1/2" S.A.E.	8
21	11256-030	SCR, HHC. 1/2-13 UNC X 3 3/4	2
22	68338-000	BATTERY CHARGER,	1
23	10092-014	THRUST WASHER, GARLOCK G 28 DU	2
24	68576-001	BUSHING, GARLOCK #GF4852-40	4
25	11788-001	SEAL, GARLOCK #71 X 6308	2
26	13888-224	O-RING, 1.75 I.D. X .125 SECT	2
27	68373-000	CAP, STEERING PIN	2
28	11253-006	SCR, HHC. 5/16-18 UNC X 3/4	4
29	68577-000	FRONT HUB ASSY.	2
*	68577-010	FRONT HUB REPAIR KIT	1
*	68577-008	STUD BOLTS	1
*	68577-007	WHEEL NUTS	1
31	11297-010	BELLEVILLE WASHER, 5/8 DIA.	18
32	11469-005	LUG NUT 90° 9/16-18 UNF	24
34	68575-000	MOTOR, HYDRAULIC	1
35	68571-000	DRIVE, WORM GEAR	1
36	14576-026	SCR, HHC. GR8 5/8-18UNF X 3 1/4	18
37	11941-038	FITTING, STR 10MB-4MJ	2
38	68333-000	CABLE ASSY.	1
39	68727-000	ANGLE, BATTERY TRAY MOUNT	4
40	68331-001	BATTERY MODULE ASSY	1
41	68331-002	BATTERY MODULE ASSY	1
42	61692-099	GROMMET MATERIAL	7 FT
43	11252-014	SCR. HHC 1/4-20 UNC X 1 3/4	4
44	11248-008	LOCKNUT, HEX 1/2-13 UNC ESNA	10
45	**	WASHER, FLAT 7/8"	2
46	**	NUT, HEX CASTLE 7/8-14 UNF.	2
47	**	COTTER PIN 1/8" DIA. X 2 LG.	2
53	11248-004	NUT HEX ESNA 1/4-20	12
55	11256-014	SCR, HHC 1/2-13 UNC X 1 3/4	4
56	11252-016	SCRW HHC GR5 1/4-20 X 2	2
58	68327-000	TIRE & WHEEL ASSY	4
59	68680-007	FITTING 90° ELBOW	2
60	68386-000	COVER PLATE (L.H.)	1
62	68788-000	COVER ELECTRICAL	1

*** Not Shown**

**** Item 45,46,47 included with item 6.**

See page 3-15 for detail of Front Hub Repair Kit

ITEM	PART	DESCRIPTION	QTY.
201	68929-000	CHASSIS WELDMENT BI-ENERGY	1
202	68951-000	ENGINE ASSY KUBOTA 2 CYL	1
203	68326-001	HYD. POWER UNIT ASSY, BI-ENERGY	1
204	68346-001	RELAY PANEL ASSY BI-ENERGY	1
205	68321-000	SPEED CONTROL PANEL ASSY	1
206	68658-002	COVER, ENGINE COMPART.	1
208	68570-000	PLANETARY DRIVE	2
*	68570-010	TORQUE HUB REPAIR KIT	1
*	68570-011	THRUST WASHER	1
209	68569-000	BRAKE, AUSCO	2
*	68569-010	SEAL KIT	1
210	68573-000	MOTOR, ELECTRIC 24 VOLT D.C.	2
*	68573-010	BRUSHES, (PAIR)	1
211	**	COUPLING	2
212	**	MOUNTING PLATE	2
213	**	SCREW R.H. #2-56 X 1/4	6
214	**	WASHER	6
215	68551-001	TACH ASSY KIT (ITEMS 211 - 214)	2
216	**	GASKET	4
217	10070-099	SEAL STRIP, GASKET	2.13 FT
218	03495-000	90° ELBOW, STREET 6MB-6FJ	2
219	11936-001	FITTING, TEE 4MJ-4MJ-4MB	1
220	14048-010	FITTING ADAPT 4FP-4FJ	1
221	68783-000	PRESSURE SNUBBER	1
222	63921-007	PRESSURE SWITCH	1
223	11715-004	SCREW RD HD #6-32 X 1/2	2
224	11248-047	NUT #6-32 HEX	2
225	29961-000	INLET	1
226	29961-001	SEAL	1
227	29945-VAR	LEVEL SENSOR (SEE FINAL ASSY)	REF
229	68982-000	FUEL CAP, DIESEL	1
230	68969-000	FUEL TANK, BI-ENERGY PLASTIC	1
232	68940-000	AIR INLET DUCT WELDMENT	1
233	63674-012	SCREW HHC M6 X 1.0 X 12 MM	6
234	20541-013	HOSE CLAMP, GEAR TYPE #28	2
235	20331-000	FUEL FILTER	1
236	68946-000	OIL FILL TUBE	1
237	11238-006	WASHER, SPLIT LOCK 3/8	5
238	11254-010	SCREW, HHC 3/8-16 UNC X 1 1/4	14
239	68757-001	LATCH, DRAW	2
240	11715-004	SCREW, #6-32 X 1/2	4
241	11240-001	WASHER, FLAT #6	4
242	11248-047	LOCK NUT, #6-32 ESNA	6
243	11240-005	WASHER, 5/16 FLAT	6
244	11250-005	NUT, HEX 5/16-18 UNC	2
245	68549-000	BATTERY HOLD-DOWN BAR	1
246	12039-000	ROD, BATTERY HOLD-DOWN	2
247	64275-048	BATTERY CABLE	2
248	62299-002	BATTERY 12V DC	1
249	11240-004	WASHER, 1/4 FLAT STD	29

***Not Shown**

****Item 211 - 214 included with item 215.**

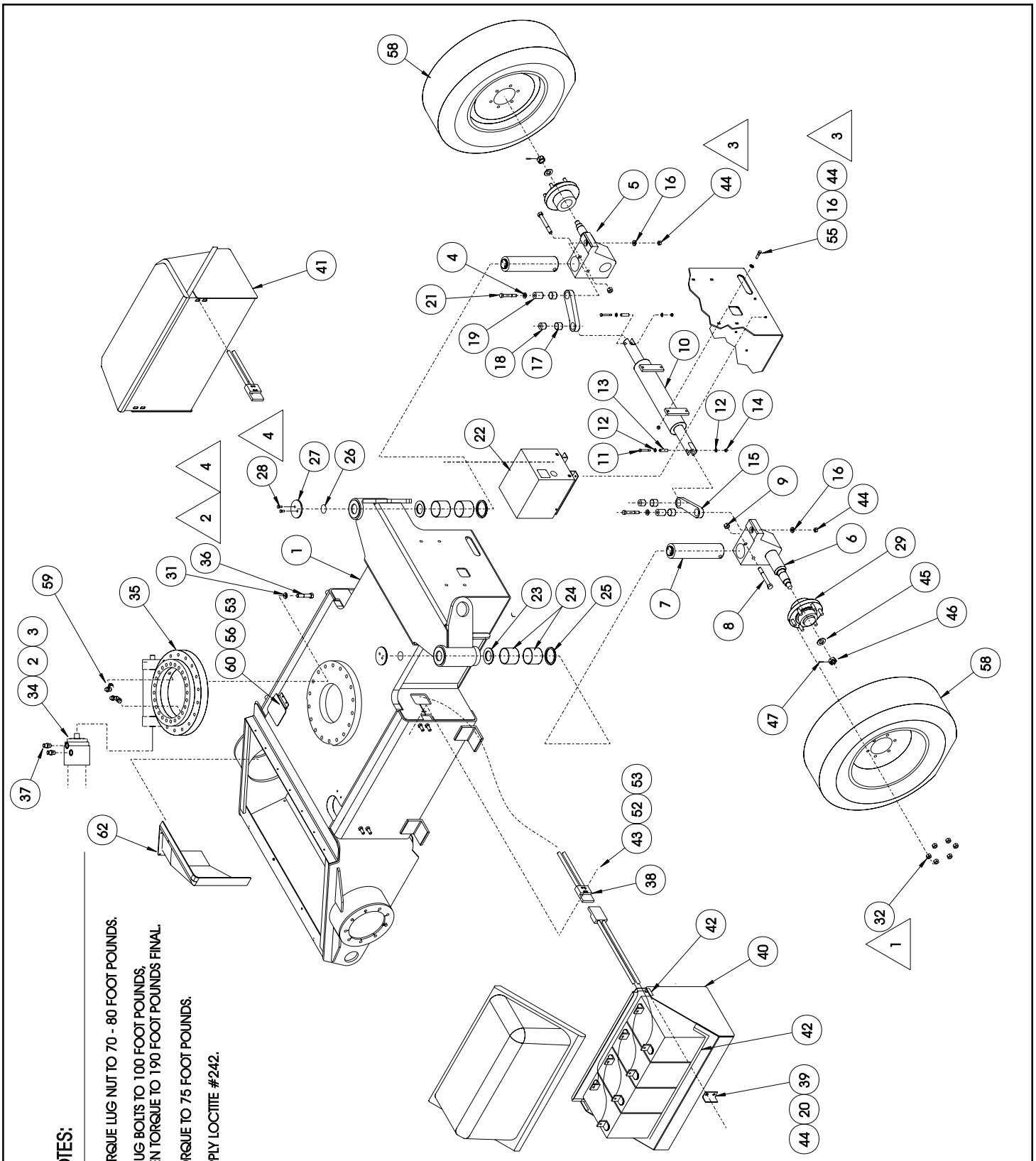
Item 216 included with item 210.

Item 274 - 277 included with item 254.

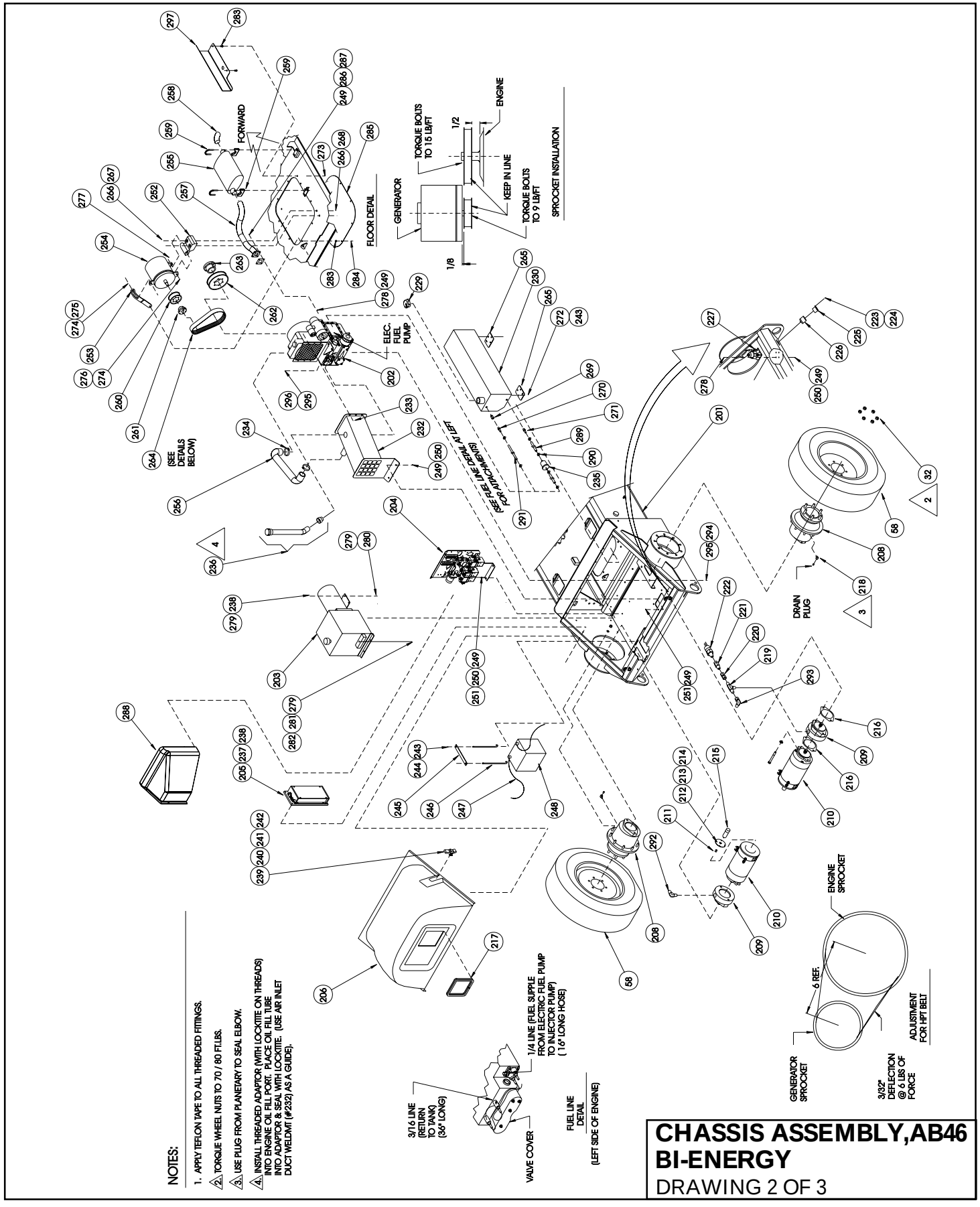
CHASSIS ASSEMBLY, AB46
BI-ENERGY (CONT.)
68317-000

ITEM	PART	DESCRIPTION	QTY.
250	11248-004	LOCKNUT, 1/4-20 ESNA	17
251	11252-006	SCREW, HHC 1/4-20 X 3/4	4
252	68933-001	GENERATOR BRACKET	1
253	68933-002	GENERATOR ADJUSTING STRAP	1
254	68933-000	GENERATOR	1
255	68967-001	MUFFLER	1
256	68971-000	AIR FILTER INLET HOSE	1
257	68974-000	WELDMENT, EXHAUST PIPE BI-ENER.	1
258	68973-000	EXHAUST TAIL PIPE	1
259	13259-006	1-1/2 MUFFLER CLAMP	2
260	68947-001	SPROCKET - 38 TOOTH	1
261	14806-008	BUSHING 7/8" "SH"	1
262	68947-000	SPROCKET - 64 TOOTH	1
263	14806-009	BUSHING 1-7/16" "SK"	1
264	68948-000	BELT, HTD DRIVE	1
265	68968-000	FUEL TANK BRACKET	2
266	11240-007	WASHER, FLAT STD 7/16	4
267	11255-020	SCREW HHC 7/16-14 X 2 1/2 LG	2
268	11248-007	NUT, 7/16-14 HEX	2
269	11923-001	REDUCER, PIPE 1/4 - 1/8	1
270	10178-001	FITTING, BARB 1/8NPT X 3/16 HOSE	1
271	10178-003	FITTING, BARB 1/4NPT X 1/4 HOSE	1
272	11253-006	SCREW HHC 5/16-18 X 3/4	4
273	11252-006	SCREW HHC 1/4-20 X 3/4	2
274	**	WASHER, FLAT STD 1/2	1
275	**	SCREW HHC 1/2-13 X 1 1/2	1
276	**	SCREW HHC 1/2-13 X 5 1/2	1
277	**	NUT, HEX 1/2-13	1
278	11252-008	SCREW HHC 1/4-20 X 1	7
279	11240-006	WASHER, FLAT STD 3/8	8
280	11248-006	LOCKNUT 3/8-16 ESNA	1
281	11238-006	LOCKWASHER 3/8"	1
282	11254-006	SCREW 3/8-16 X 3/4	1
283	14252-004	NUT SERT, 1/4-20UNC	10
284	11252-004	SCREW, 1/4-20 X 1/2	8
285	68981-000	COVER PLATE (BOTTOM)	1
286	11238-004	WASHER, 1/4 SPLIT LOCK	4
287	11250-004	NUT, HEX 1/4-20 UNC	4
288	68788-000	COVER, ELECTRICAL	1
289	12739-099	HOSE, 1/4" I.D. FUEL	2.13 FT
290	20541-001	HOSE CLAMP #1	6
291	12736-099	HOSE, 3/16" I.D.	3 FT
292	11934-026	FITTING, 4MJ-4MJ 90°	1
293	11937-001	FITTING, 4MJ-4FJ 90°	1
294	11256-010	SCREW HHC 1/2-13 X 1 1/4	4
295	11240-008	WASHER, FLAT STD 1/2	8
296	11248-008	NUT, HEX 1/2-13 ESNA	4
297	69206-000	HEAT SHIELD (BI-ENERGY)	1

ITEM	PART	DESCRIPTION	QTY.
301	068776-001	CABLE ASSY. X 20" 3/8	1
302	068776-002	CABLE ASSY. X 35" 3/8	1
303	068776-003	CABLE ASSY. X 24" 3/8	1
304	068776-004	CABLE ASSY. X 30" 3/8	1
305	068777-001	CABLE ASSY. X 41" 5/16 X 3/8	1
306	068777-002	CABLE ASSY. X 47" 5/16 X 3/8	1
307	068777-003	CABLE ASSY. X 25" 5/16 X 3/8	1
308	068777-004	CABLE ASSY. X 20" 5/16 X 3/8	1
309	068334-005	CABLE ASSY. X 60" 5/16	1
310	068334-006	CABLE ASSY. X 48" 5/16	1
311	029452-099	WIRE, 16 GA. BLACK	5 FT
312	029451-099	WIRE, 16 GA. WHITE	5 FT
213	029454-099	WIRE, 16 GA. RED	5 FT
314	029457-099	WIRE, 16 GA. GREEN	5 FT
315	029453-099	WIRE, 16 GA. ORANGE	5 FT
316	029355-099	WIRE, 16 GA. BLACK / RED	5 FT
317	029356-099	WIRE, 16 GA. WHITE / RED	5 FT
318	014914-001	CONN. MALE PUSH, 14-16 .25	1
319	029931-003	CONN. FEM. PUSH, 14-16 .25	2
320	029601-012	CONN. RING, 14-16 #8	8
321	029601-015	CONN. RING, 14-16 Ø 3/8	1
322	029825-002	DIODE, 3 AMP, 400 VOLT	2
323	029440-099	CABLE, 12 GA. 3 COND. S.O	6 FT
324	068814-000	TERMINAL, PIN	3
325	029361-099	WIRE 16GA WHT/BLK	5 FT
326	068334-007	CABLE ASSY X 35" 5/16	2



CHASSIS ASSEMBLY,AB46 BI-ENERGY
DRAWING 1 OF 3



NOTES:

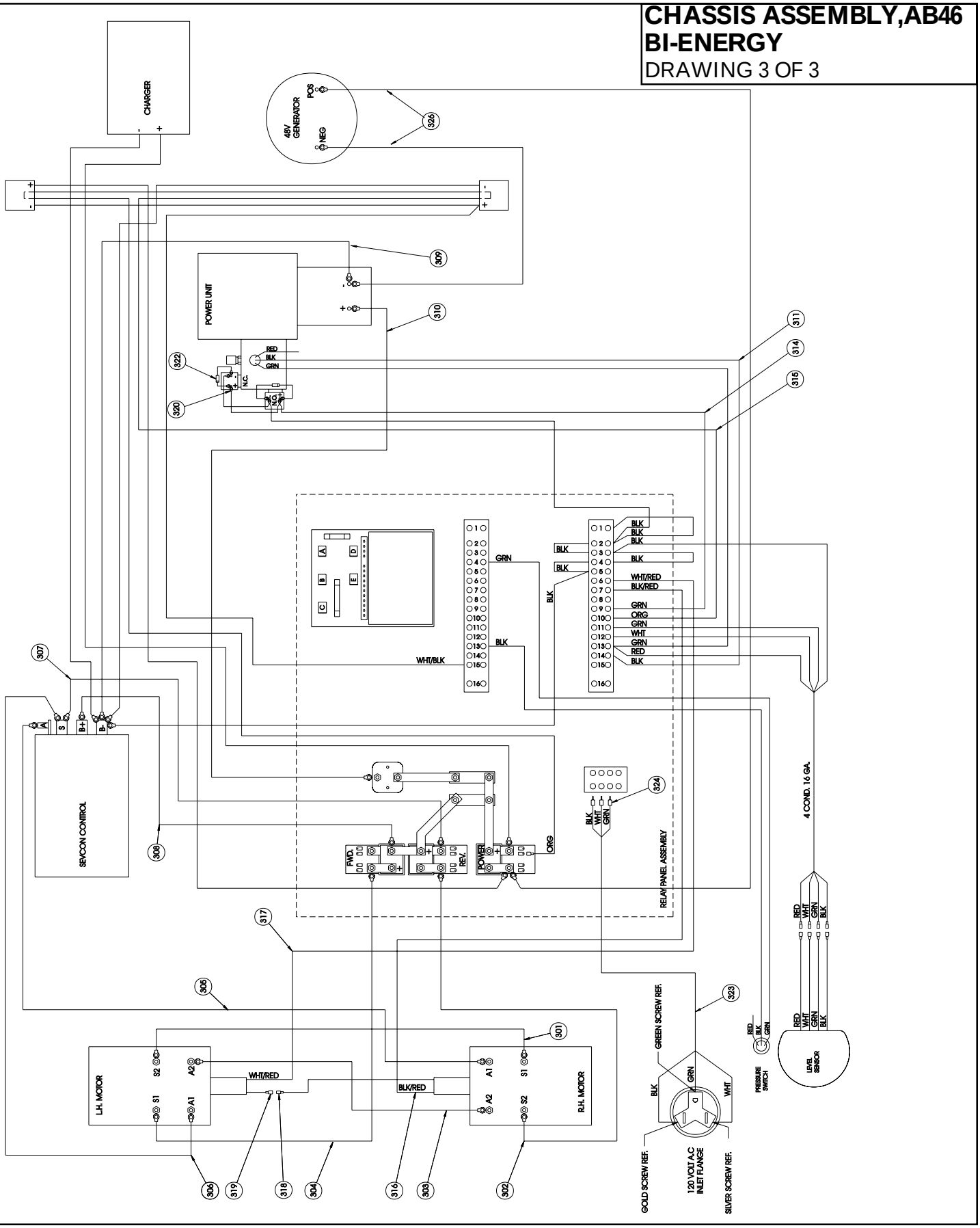
1. APPLY TEFLON TAPE TO ALL THREADED FITTINGS.
2. TORQUE WHEEL NUTS TO 70 / 80 FT.LBS.
3. USE PLUG FROM PLANETARY TO SEAL ELBOW.
4. INSTALL THREADED ADAPTOR (WITH LOCKTITE ON THREADS) INTO ENGINE OIL FILL PORT. PLACE OIL FILL TUBE INTO ADAPTOR & SEAL WITH LOCKTITE. (USE AIR INLET DUCT WELDMT (#232) AS A GUIDE).

CHASSIS ASSEMBLY,AB46 BI-ENERGY

DRAWING 2 OF 3

CHASSIS ASSEMBLY,AB46 BI-ENERGY

DRAWING 3 OF 3

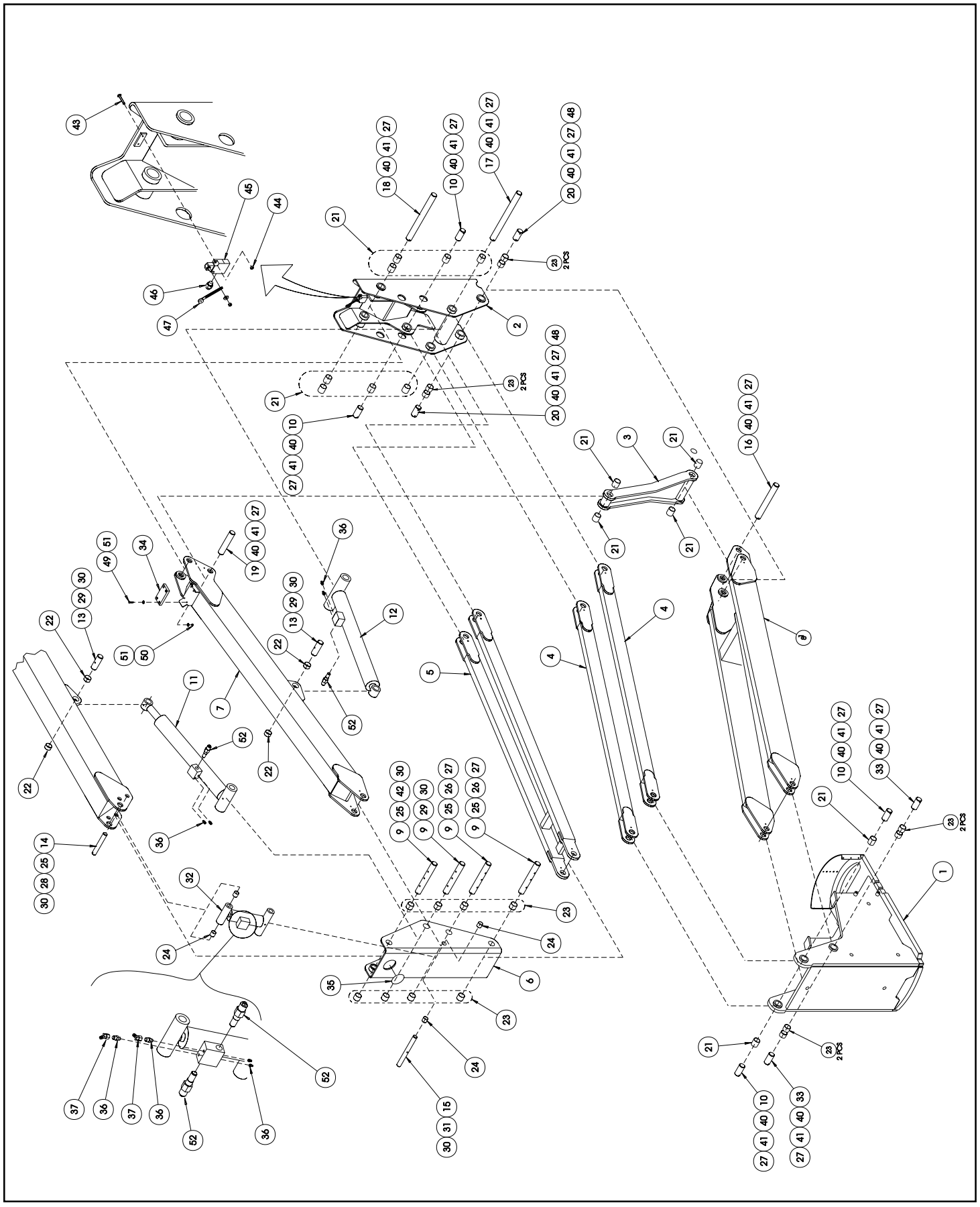


NOTES:

LOWER BOOM LINKAGE ASSEMBLY
AB46
68323-000

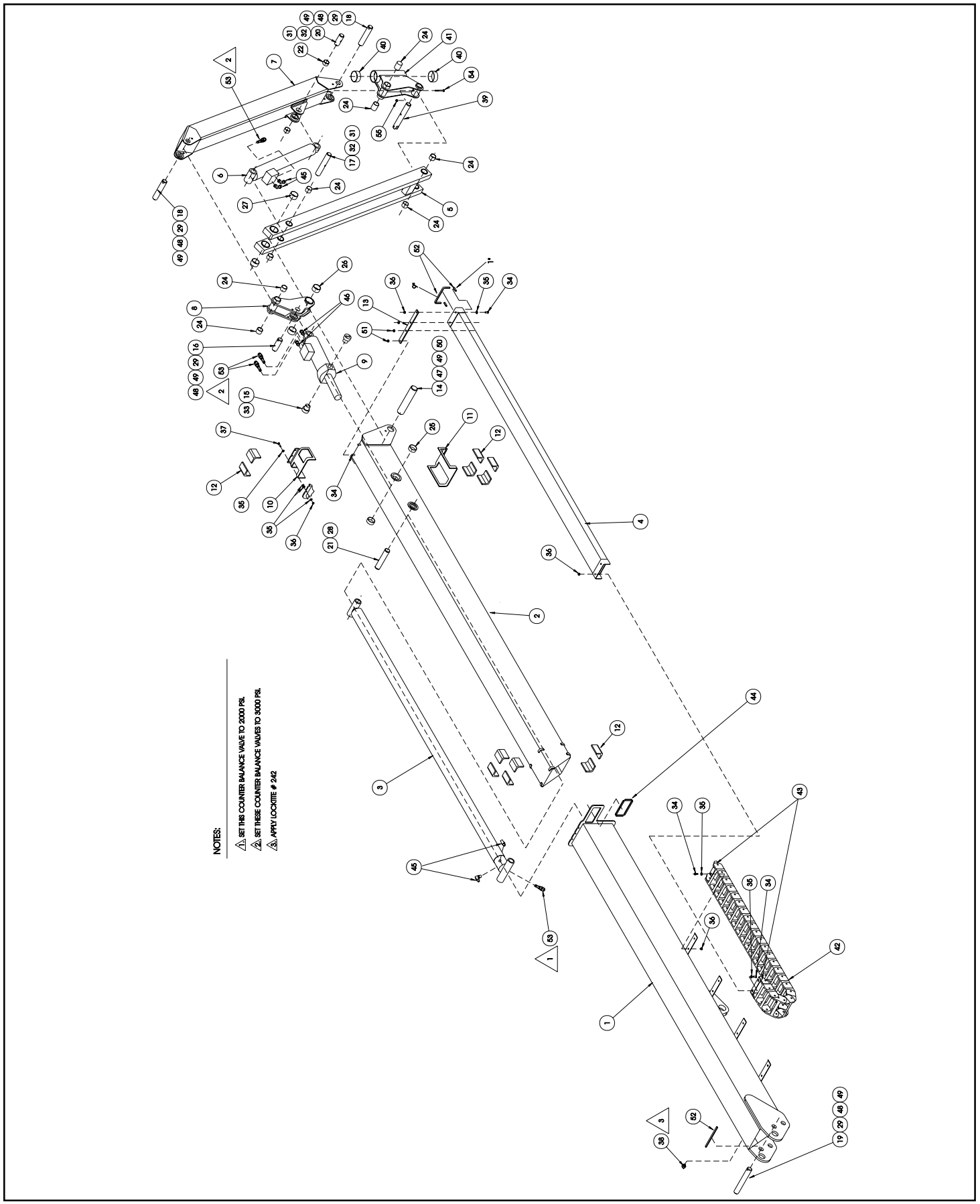
ITEM	PART	DESCRIPTION	QTY.
1	68330-000	TURRET ASSEMBLY	REF
2	68397-000	RISER POST WELDMENT	1
3	68399-000	TENSION LINK WELDMENT	1
4	68400-000	1ST. TENSION RAIL WELDMENT	2
5	68543-000	2ND. TENSION RAIL WELDMENT	1
6	68412-000	FRONT RISER WELDMENT	1
7	68415-000	2ND. RISER BOOM WELDMENT	1
8	68417-000	1ST. RISER BOOM WELDMENT	1
9	68475-000	PIN, 1.75 DIA. X 12.25 LG.	4
10	68477-001	PIN, 1.75 DIA. X 3.75 LG.	4
11	68451-000	CYLINDER, BOOM RAISE	1
*	68451-010	SEAL KIT, BOOM	1
12	68450-000	CYLINDER, BOOM RISER	1
*	68450-010	SEAL KIT, RISER	1
13	68477-007	PIN, 1.75 DIA. X 5.00 LG.	2
14	68796-002	PIN, 1.50 DIA. X 8.50 LG.	1
15	68796-001	PIN, 1.50 DIA. X 12.25 LG.	1
16	68477-005	PIN, 1.75 DIA. X 13.75 LG.	1
17	68477-003	PIN, 1.75 DIA. X 19.50 LG.	1
18	68477-002	PIN, 1.75 DIA. X 16.50 LG.	1
19	68477-006	PIN, 1.75 DIA. X 8.63 LG.	1
20	68794-000	PIN, 1.75 DIA. X 5.88 LG.	2
21	62642-034	BUSHING, Ø 1.75 X 2 (28DU32)	14
22	62642-028	BUSHING, Ø 1.75 X 1 (28DU16)	4
23	62642-031	BUSHING, Ø 1.75 X 1.50 (28DU24)	16
24	62642-036	BUSHING, Ø 1.50 X 1.25 (24DU20)	4
25	65214-000	ROD END (PIN RETAINER) 3/8"	4
26	11254-006	SCR, HHC 3/8-16UNC X 3/4	14
27	11238-006	LOCKWASHER, SPLIT RING 3/8	14
28	11254-012	SCR, HHC 3/8-16UNC X 1 1/2	2
29	11254-028	SCR, HHC 3/8-16UNC X 3 1/2	3
30	11248-006	LOCKNUT, HEX 3/8-16UNC (ESNA)	6
31	11254-024	SCR, HHC 3/8-16UNC X 3	1
32	68454-000	MASTER CYLINDER	1
*	68454-010	SEAL KIT, MASTER	1
33	68477-008	PIN, 1.75 DIA X 4.75 LG.	2
34	68660-000	REST PAD	1
35	66516-004	CAP, 4"	1
36	11941-004	FITTING, STR 6MB-4MJ	6
37	11932-001	FITTING, 45° 4FJX-4MJ	2
40	65214-001	ROD END (PIN RETAINER) 1/2"	12
41	11254-010	SCREW HHC 3/8-16UNC X 1-1/4"	12
42	11254-014	SCREW HHC 3/8-16UNC X 1-3/4"	1
43	11709-014	SCREW RD HD 10-24 X 1-3/4"	2
44	11248-003	NUT, 10-24 ESNA	2
45	68556-000	SWITCH	1
46	29925-000	STRAIN RELIEF	1
47	68556-001	LEVER	1
48	11739-020	ROLL PIN 3/8 X 2-1/2	2
49	11253-010	SCREW HHC 5/16-18 UNC X 1 1/4	4
50	11248-005	LOCKNUT HEX 5/16-18 UNC ESNA	4
51	14996-005	WASHER 5/16 SAE FLAT	8
52	68778-000	VALVE, COUNTERBALANCE	4

*** Not Shown**



UPPER BOOM LINKAGE ASSEMBLY
AB46
68322-000

ITEM	PART	DESCRIPTION	QTY.
1	68497-000	TOP (OUTER) BOOM WELDMENT	1
2	68496-000	TOP (INNER) BOOM WELDMENT	1
3	68452-000	BOOM EXTEND CYLINDER	1
*	68452-010	SEAL KIT, EXTEND	1
4	68479-000	EXTENSION TUBE WELDMENT	1
5	68447-000	LEVELING TUBE WELDMENT	1
6	68453-000	JIB CYLINDER	1
*	68453-010	SEAL KIT, JIB CY.	1
7	68439-000	JIB BOOM WELDMENT	1
8	68438-000	SWINGING FRAME WELDMENT	1
9	68455-000	SLAVE CYLINDER	1
*	68455-010	SEAL KIT, SLAVE	1
10	68436-000	UPPER BEARING PAD CASSETTE	1
11	68435-000	LOWER BEARING PAD CASSETTE	1
12	68423-000	WEAR PAD	12
13	68492-000	EXT. TUBE MTG. BRACKET	1
14	68477-006	PIN, JIB ASSY. PIVOT	1
15	68473-000	PIN, SLAVE CYL. TRUNNION	2
16	68476-005	PIN, SLAVE CYL. ROD END	1
17	68476-006	PIN, JIB CYL. BASE	1
18	68476-003	PIN, BOOM PIVOT	2
19	68476-002	PIN, TELESCOPIC CYL. BASE	1
20	68476-004	PIN, JIB CYL. ROD END	1
21	68474-000	PIN, TELESCOPIC CYL. ROD END	1
22	62642-024	BUSHING, Ø 1.25 X.75 (20DU12)	2
24	62642-025	BUSHING, Ø 1.25 X 1.75 (20DU28)	8
25	62642-027	BUSHING, Ø 1.75 X .75 (28DU12)	2
26	62642-031	BUSHING, Ø 1.75 X 1.50 (28DU24)	2
27	62642-029	BUSHING, Ø 1.75 X 1.75 (28DU28)	2
28	11764-120	RETAINING RING, TRUARC #5100-125	2
29	65214-000	ROD END (PIN RETAINER)	4
31	11248-006	LOCKNUT, HEX. 3/8-16 UNC (ESNA)	2
32	11254-020	SCR, HHC 3/8-16 UNC X 2 1/2	2
33	12553-014	SCR, SOC HD. 1/4-20 UNC X 1 3/4	4
34	11822-006	SCR, BUTT. HD. 5/16-18 UNC X 3/4	8
35	14996-005	WASHER, FLAT 5/16 S.A.E.	30
36	11248-005	LOCKNUT, HEX. 5/16-18 UNC (ESNA)	12
37	11253-010	SCR, HHC. 5/16-18 X 1 1/4	6
38	62881-000	SWITCH, BALL DETENT	1
39	68508-000	PIN, LOWER	1
40	62642-040	BUSHING, Ø 2.50 X 1.00 (40DU16)	2
41	68470-000	PIVOT BRACKET WELDMENT	1
42	68691-022	CAT TRACK (22 LINKS)	1
43	REF.	MOUNTING BRACKET (SET)	1
44	68701-099	WEAR STRIP, POLYETHYLENE	1.33 FT
45	11934-003	FITTING 6-4	4
46	11941-001	FITTING 6-4	2
47	65214-001	ROD END	1
48	11254-010	SCREW HHC 3/8-16UNC X 1 1/4	4
49	11238-006	WASHER, 3/8 SPLIT LOCK	5
50	11254-008	SCREW, HHC 3/8-16UNC X 1	1
51	11246-005	NUT, HEX ESNA 5/16-18UNC	2
52	61692-099	GROMMET (EDGE COVER)	1.5 FT
53	68778-000	VALVE, COUNTER BALANCE	4
54	11253-020	SCREW HHC 5/16-18 X 2 1/2	1
55	11248-005	NUT HEX ESNA 5/16-18UNC	1


NOTES:
1. SET THIS COUNTER BALANCE VALVE TO 2000 PSI.
2. SET THESE COUNTER BALANCE VALVES TO 3000 PSI.
3. APPLY LOCKTITE # 242

TURRET ASSEMBLY, AB46 ELECTRIC

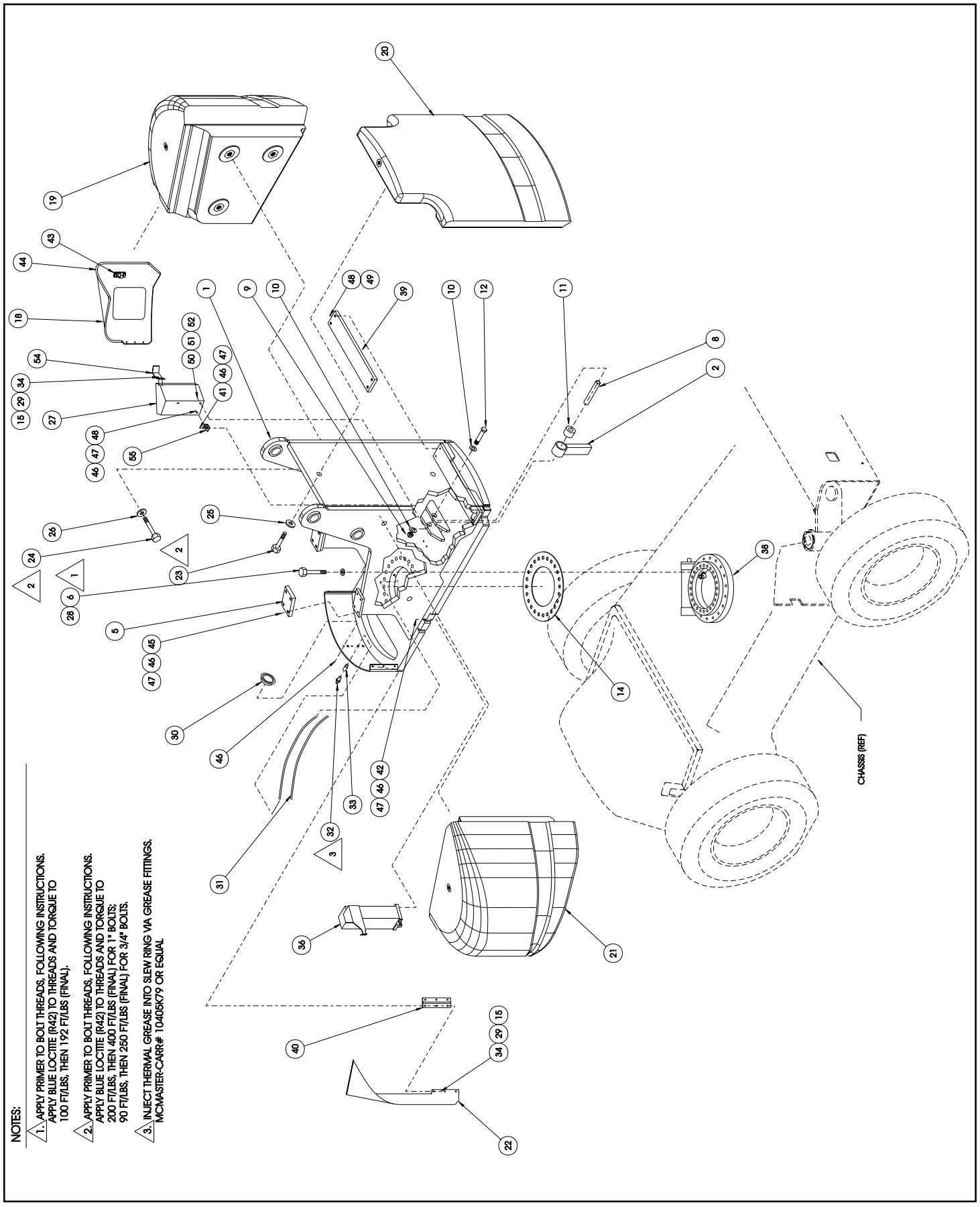
68330-000

ITEM	PART	DESCRIPTION	QTY.
1	68392-000	TURRET POST WELDMENT	1
2	68485-000	STOP WELDMENT	1
5	68660-000	REST PAD	2
6	11291-032	SCREW, HHC 5/8-11 X 4 GR 8	24
8	68478-000	TUBE, STL 1"O.D. X .120W X 3.10" LG	1
9	11248-012	NUT, HEX ESNA 3/4-10 ESNA	1
10	11240-012	WASHER 3/4 STL	2
11	68720-002	NEOPRENE SPRING CYLINDER POLY.	1
12	14099-036	SCREW, HHC 3/4-10 X 4-1/2	1
14	68472-000	SHIM RING	1
15	11248-004	NUT, HEX ESNA 1/4-20	16
18	68656-000	COVER TRIM, GROUND CONTROL	1
19	68653-000	COUNTER WEIGHT, LEFT SIDE	1
20	68652-000	COUNTER WEIGHT, REAR	1
21	68654-000	COUNTER WEIGHT, RIGHT SIDE	1
22	68657-000	COVER TRIM, VALVE BLOCK	1
23	14099-012	SCREW HHC, 3/4-10UNC X 1-1/2	2
24	14918-020	SCREW HHC, 1-8UNC X 2-1/2	6
25	11239-012	WASHER FLAT ASTM 3/4" A325	2
26	11240-016	WASHER FLAT 1" STD	6
27	68328-000	LOWER CONTROL BOX-ELEC	1
28	11297-010	BELLEVILLE WASHER 5/8 DIA	24
29	11240-004	WASHER, 1/4 FLAT STD	30
30	29958-000	HORN, 24 VOLT	1
31	68678-024	TUBING, POLYURETHANE 24"	2
32	13336-001	FITTING, GREASE	2
33	68679-003	FITTING, BULKHEAD	2
34	11252-006	SCREW, HHC 1/4-20 X 3/4	14
36	68348-000	VALVE BLOCK ASSY-ELEC	1
38	68571-000	DRIVE WORM GEAR	REF
39	68660-001	REST PAD	1
40	68759-000	HINGE,TURRET COVER	2
41	11253-018	SCRW HHC GR5 5/16-18 X 1-1/2	1
42	11253-022	SCRW HHC GR5 5/16-18 X 2-3/4	2
43	68757-002	LATCH, SOUTHCO	2
44	61692-099	GROMMET MATERIAL	10FT
45	11253-012	SCRW HHC GR5 5/16-18 X 1-1/2	8
46	11248-005	NUT HEX 5/16-18 ESNA	13
47	14996-005	WASHER 5/16 FLAT SAE	22
48	11253-006	SCRW HHC GR5 5/16-18 X 3/4	5
49	11238-005	WASHER, SPLIT LOCK 5/16	4
50	11254-006	SCRW HHC GR5 3/8-16 UNC X 3/4	6
51	11238-006	WASHER, SPLIT LOCK 3/8	6
52	14996-006	WASHER, 3/8 FLAT SAE	6
54	68792-000	BRACKET	1
55	68793-000	BRACKET	1

TURRET ASSEMBLY, AB46 BI-ENERGY

68330-003

ITEM	PART	DESCRIPTION	QTY.
1	68392-000	TURRET POST WELDMENT	1
2	68485-000	STOP WELDMENT	1
5	68660-000	REST PAD	2
6	11291-032	SCREW, HHC 5/8-11 X 4 GR 8	24
8	68478-000	TUBE, STL 1"O.D. X .120W X 3.10" LG	1
9	11248-012	NUT, HEX ESNA 3/4-10 ESNA	1
10	11240-012	WASHER 3/4 STL	2
11	68720-002	NEOPRENE SPRING CYLINDER-POLY.	1
12	14099-036	SCREW, HHC 3/4-10 X 4-1/2	1
14	68472-000	SHIM RING	1
15	11248-004	NUT, HEX ESNA 1/4-20	16
18	68656-000	COVER TRIM, GROUND CONTROL	1
19	68653-000	COUNTER WEIGHT, LEFT SIDE	1
20	68652-000	COUNTER WEIGHT, REAR	1
21	68654-000	COUNTER WEIGHT, RIGHT SIDE	1
22	68657-000	COVER TRIM, VALVE BLOCK	1
23	14099-012	SCREW HHC, 3/4-10UNC X 1-1/2	2
24	14918-020	SCREW HHC, 1-8UNC X 2-1/2	6
25	11239-012	WASHER FLAT ASTM 3/4" A325	2
26	11240-016	WASHER FLAT 1" STD	6
27	68328-003	LOWER CONTROL BOX BI-ENERGY	1
28	11297-010	BELLEVILLE WASHER 5/8 DIA	24
29	11240-004	WASHER, 1/4 FLAT STD	30
30	29958-000	HORN, 24 VOLT	1
31	68678-024	TUBING, POLYURETHANE 24"	2
32	13336-001	FITTING, GREASE	2
33	68679-003	FITTING, BULKHEAD	2
34	11252-006	SCREW, HHC 1/4-20 X 3/4	14
36	68348-000	VALVE BLOCK ASSY-ELEC	1
38	68571-000	DRIVE WORM GEAR	REF
39	68660-001	REST PAD	1
40	68759-000	HINGE,TURRET COVER	2
41	11253-018	SCRW HHC GR5 5/16-18 X 1-1/2	1
42	11253-022	SCRW HHC GR5 5/16-18 X 2-3/4	2
43	68757-002	LATCH, SOUTHCO	2
44	61692-099	GROMMET MATERIAL	10FT
45	11253-012	SCRW HHC GR5 5/16-18 X 1-1/2	8
46	11248-005	NUT HEX 5/16-18 ESNA	13
47	14996-005	WASHER 5/16 FLAT SAE	22
48	11253-006	SCRW HHC GR5 5/16-18 X 3/4	5
49	11238-005	WASHER, SPLIT LOCK 5/16	4
50	11254-006	SCRW HHC GR5 3/8-16 UNC X 3/4	6
51	11238-006	WASHER, SPLIT LOCK 3/8	6
52	14996-006	WASHER, 3/8 FLAT SAE	6
54	68792-000	BRACKET	1
55	68793-000	BRACKET	1

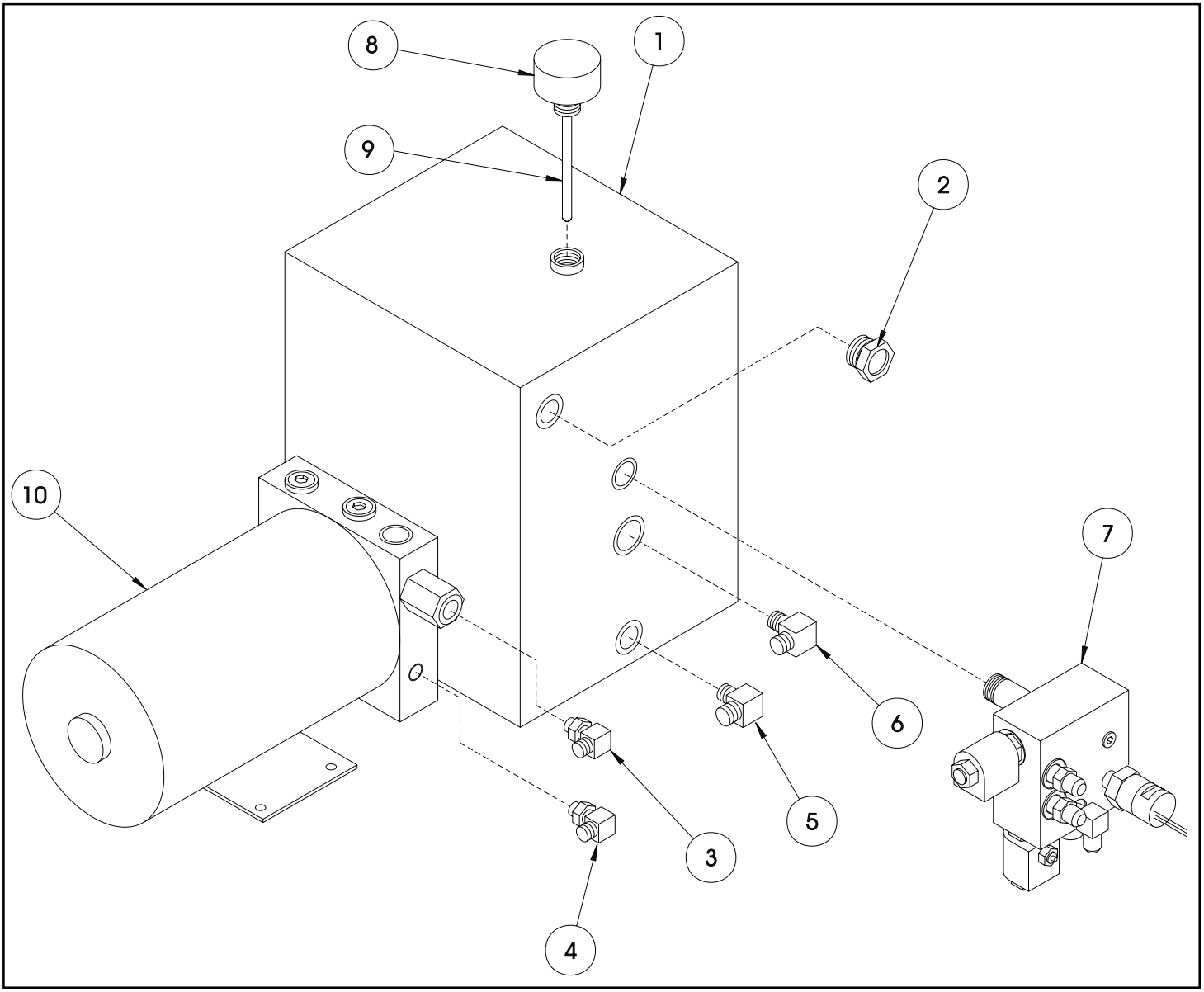

NOTES:
1. APPLY PRIMER TO BOLT THREADS, FOLLOWING INSTRUCTIONS.
APPLY BLUE LOCTITE (R42) TO THREADS AND TORQUE TO
100 FT/LBS, THEN 192 FT/LBS (FINAL).
2. APPLY PRIMER TO BOLT THREADS, FOLLOWING INSTRUCTIONS.
APPLY BLUE LOCTITE (R42) TO THREADS AND TORQUE TO
200 FT/LBS, THEN 400 FT/LBS (FINAL) FOR 1" BOLTS;
90 FT/LBS, THEN 250 FT/LBS (FINAL) FOR 3/4" BOLTS.
3. INJECT THERMAL GREASE INTO SLEW RING VIA GREASE FITTINGS.
MCMASTER-CARR# 10405K79 OR EQUAL
CHASSIS (REF)

POWER UNIT ASSEMBLY, AB46 ELECTRIC

68326-000

ITEM	PART	DESCRIPTION	QTY.
1	68554-000	POWER UNIT & TANK	1
*	68554-012	PUMP	1
2	63979-006	GAGE, LUBE SIGHT	1
3	11934-003	FITTING 90° 6MB - 4MJ	1
4	11934-004	FITTING 90° 6MB - 6MJ	1
5	11940-010	FITTING 90° 6MP - 6MJ	1
6	11940-019	FITTING 90° 12MP - 10MJ	1
7	68324-000	BRAKE VALVE BLOCK ASSY	1
8	68554-019	BREATHER	1
9	68554-018	DIPSTICK	1
10	68554-010	ELECTRIC MOTOR	1
*	68554-011	BRUSHES	1

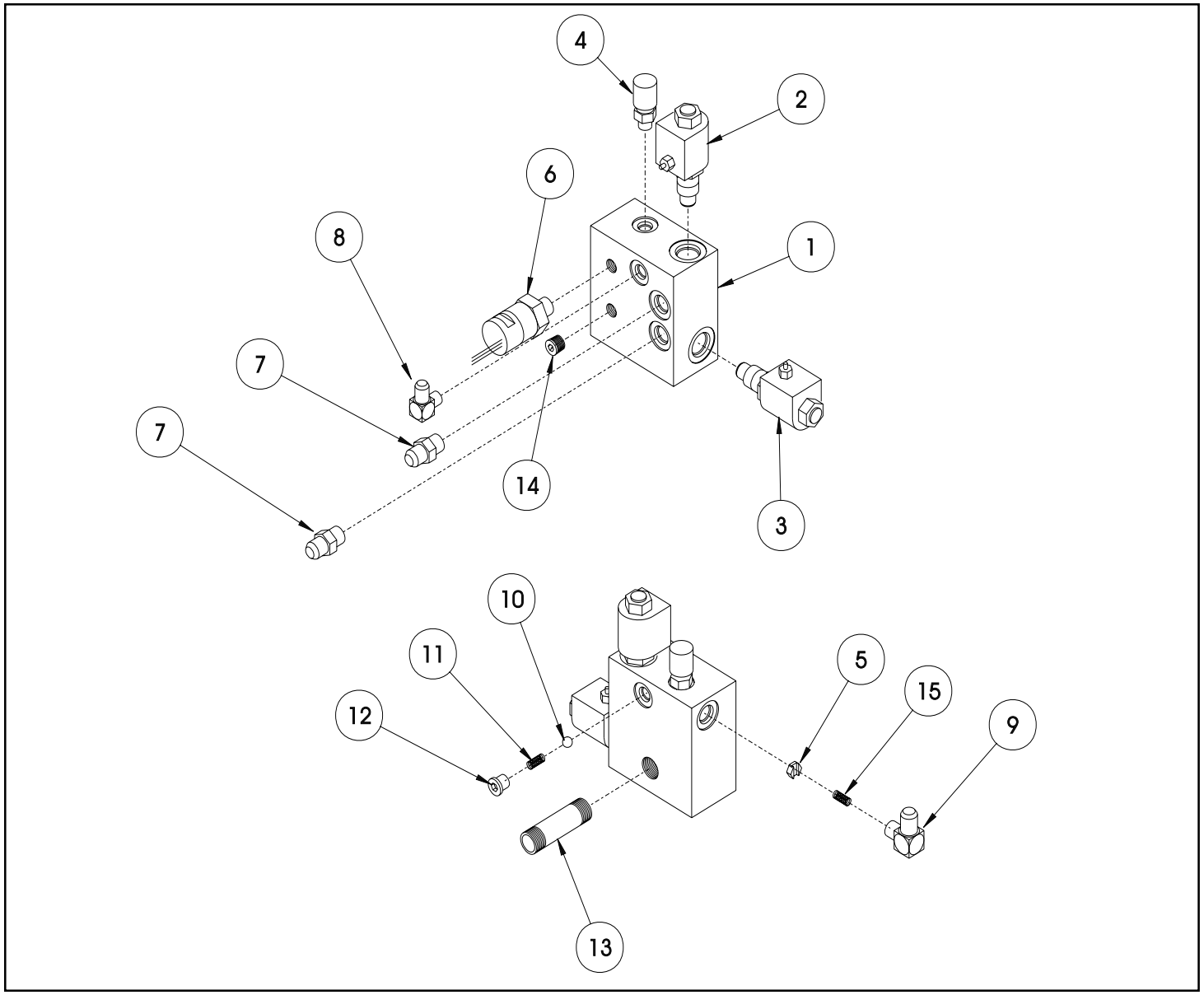
*** Not Shown**



BRAKE VALVE BLOCK ASSEMBLY
AB46, ELECTRIC

68324-000

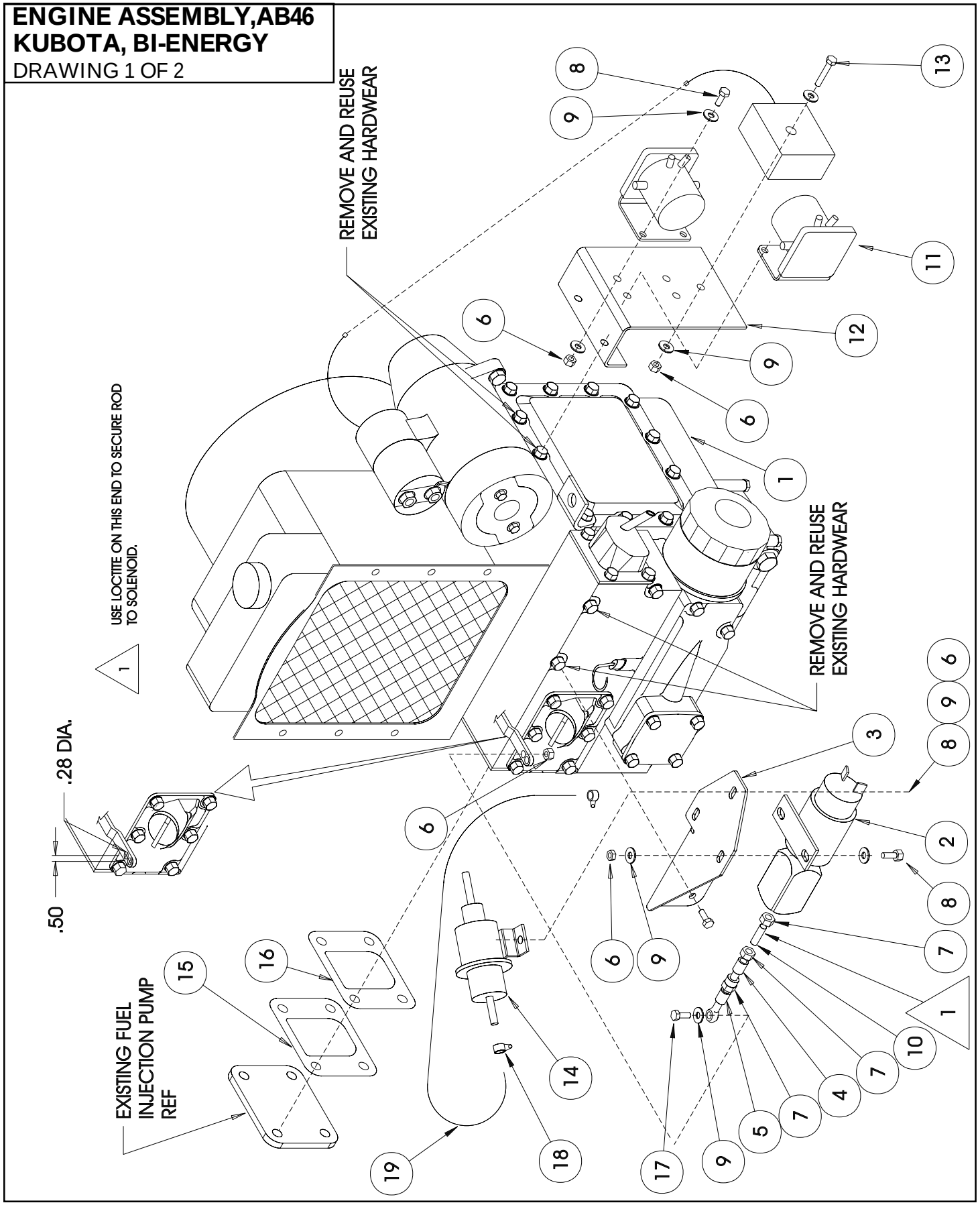
ITEM	PART	DESCRIPTION	QTY.
1	68481-000	VALVE BLOCK, BRAKE	1
2	68553-000	VALVE, POPPET N.C. 48VDC	1
3	68674-000	VALVE, POPPET N.O. 48VDC	1
4	63965-001	PLUG, GUAGE PORT	1
5	15919-002	ORIFICE, CESSNA 815	1
6	63921-010	PRESSURE SWITCH,	1
7	11941-005	STR. ADAPTER #6 SAE - #6 JIC	2
8	11934-001	ELBOW 90° #4 SAE - #4 JIC	1
9	11934-004	ELBOW 90° #6 SAE - #6 JIC	1
10	05135-000	STEEL BALL, 5/16" DIA.	1
11	13987-009	SPRING, 1/4 DIA. X 19/32 LG.	1
12	12004-004	PLUG, #4 SAE	1
13	14021-005	PIPE NIPPLE 1/2" SCH 40 X 2 1/2" LG.	1
14	11920-002	PLUG,PIPE SOC HD 1/4-18 NPTF	1
15	68798-001	SPRING 3/8 OD .035WIRE X 1 1/4 LG	1

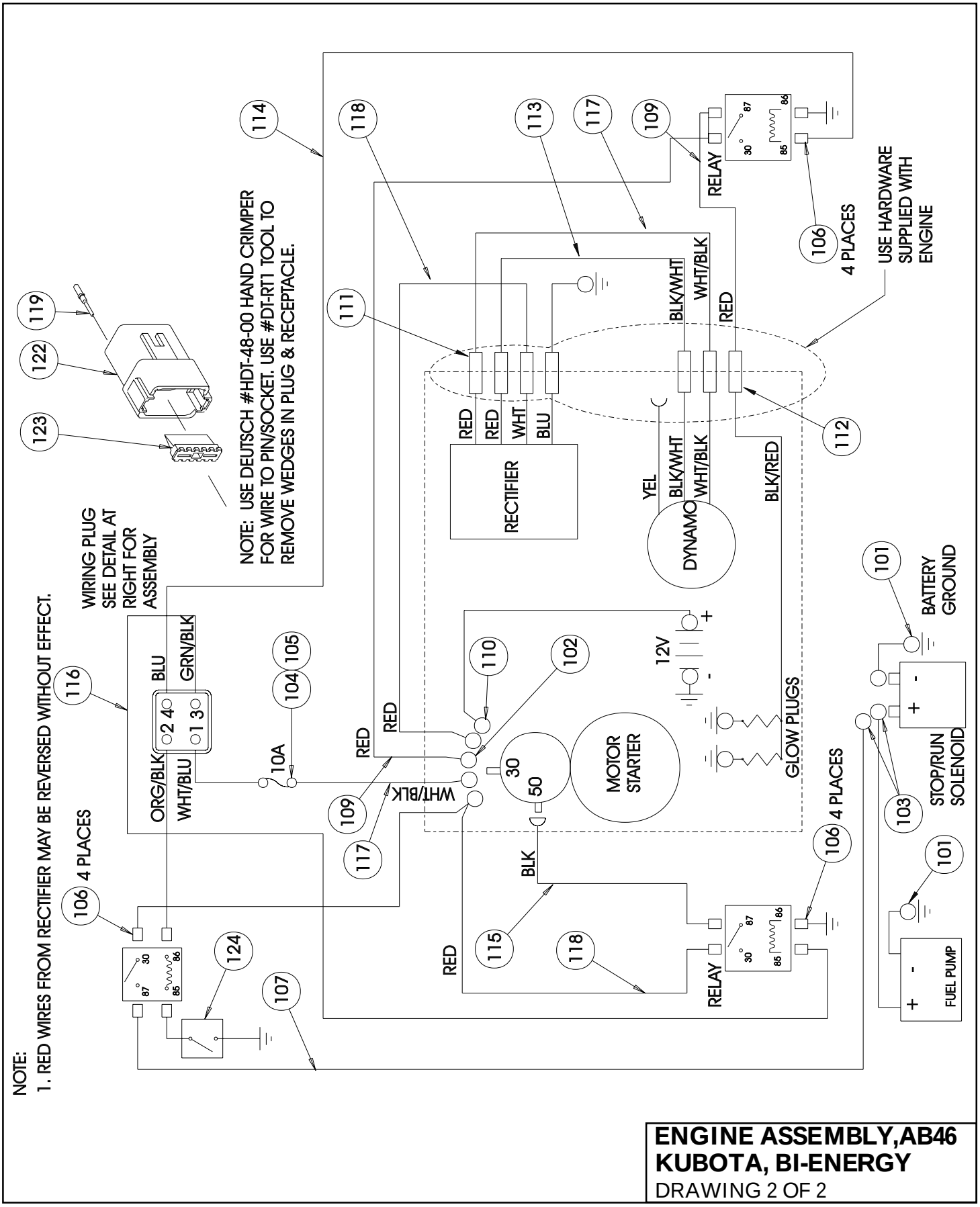


ENGINE ASSEMBLY, KUBOTA
AB46, BI-ENERGY
68951-000

ITEM	PART	DESCRIPTION	QTY.
1	068932-000	ENGINE	1
*	68951-006	AIR CLEANER ELEMENT	1
*	68951-007	FUEL FILTER	1
*	68951-008	OIL FILTER ELEMENT	1
*	68951-009	FAN BELT	1
2	063941-011	SOLENOID WITH INTERNAL THREADS	1
3	068936-000	SOLENOID BRACKET	1
4	064423-000	INLINE SWIVEL	1
5	011760-004	ROD END BEARING	1
6	011248-004	NUT HEX ESNA 1/4-20UNC	9
7	020495-004	NUT HEX JAM 1/4-28UNF	3
8	011252-006	SCREW HHC 1/4-20UNC X 3/4	7
9	011240-004	WASHER 1/4 STD FLAT	17
10	016776-003	ROD,THREADED 1/4-24UNF X 3-3/4"LG	1
11	027972-000	STARTER SOLENOID	2
12	068978-000	STARTER SOLENOID BRACKET	1
13	011252-012	SCREW HHC 1/4-20UNC X 1-1/2	1
101	029602-026	CONN RING #2 3/8 DIA	6
102	029601-039	CONN RING 12-10 GA. 5/16	2
103	029601-013	CONN RING 16-14 GA. # 10	7
104	029702-000	FUSE HOLDER	1
105	029704-010	FUSE 10 AMP	1
107	029477-099	WIRE 16 AWG ORG/BLK	6 FT
109	029480-099	WIRE 10 AWG RED	2 FT
110	029601-008	CONN RING 18-22 GA 5/16	6
111	029620-002	CONN BUTT 16-14 GA	6
112	029620-003	CONN BUTT 12-10 GA	1
113	029351-099	WIRE 16 AWG BLK/WHT	6 FT
114	029450-099	WIRE 16 AWG BLU	6 FT
115	029452-099	WIRE 16 AWG BLK	5 FT
116	005491-099	WIRE 16 AWG GRN/BLK	6 FT
117	029479-099	WIRE 16 AWG WHT/BLK	6 FT
118	029454-099	WIRE 16 AWG RED	5 FT
119	68762-000	PIN - CONTACT	5
121	68764-000	PLUG - SEALING 12-14 GA.	7
122	068760-001	CONNECTOR	1
123	68761-000	LOCK WEDGE - RECEPTACLE	1

ENGINE ASSEMBLY,AB46 KUBOTA, BI-ENERGY
DRAWING 1 OF 2





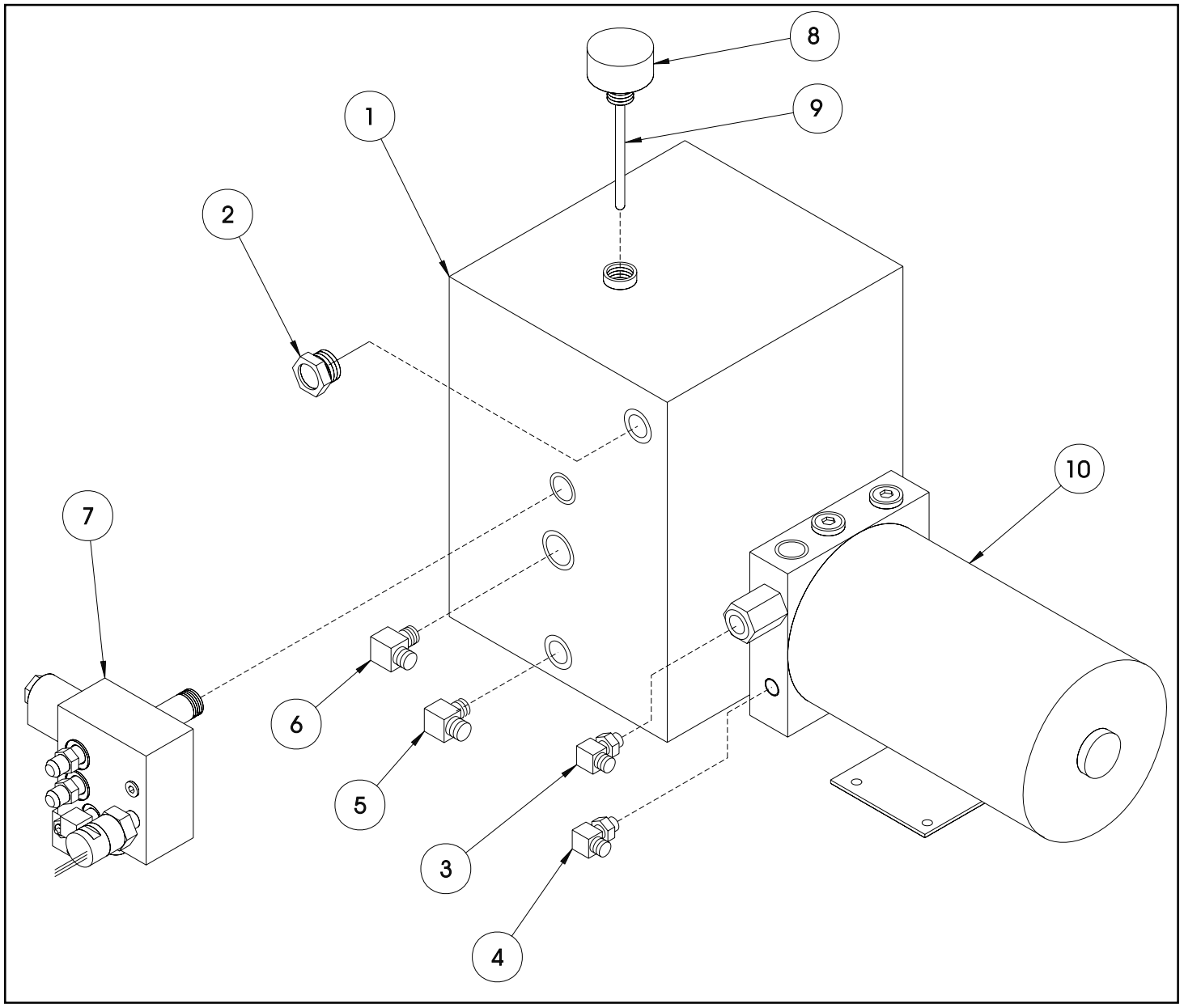
ENGINE ASSEMBLY,AB46 KUBOTA, BI-ENERGY
DRAWING 2 OF 2

POWER UNIT ASSEMBLY, AB46 BI-ENERGY

68326-001

ITEM	PART	DESCRIPTION	QTY.
1	68931-000	POWER UNIT & TANK BI-ENERGY	1
*	68554-012	PUMP	1
2	63979-006	GAGE, LUBE SIGHT	1
3	11934-003	FITTING 90° 6MB - 4MJ	1
4	11934-004	FITTING 90° 6MB - 6MJ	1
5	11940-010	FITTING 90° 6MP - 6MJ	1
6	11940-019	FITTING 90° 12MP - 10MJ	1
7	68324-001	BRAKE VALVE BLOCK ASSY BI-ENERGY	1
8	68554-019	BREATHER	1
9	68554-018	DIPSTICK	1
10	68554-010	ELECTRIC MOTOR	1
*	68554-011	BRUSHES	1

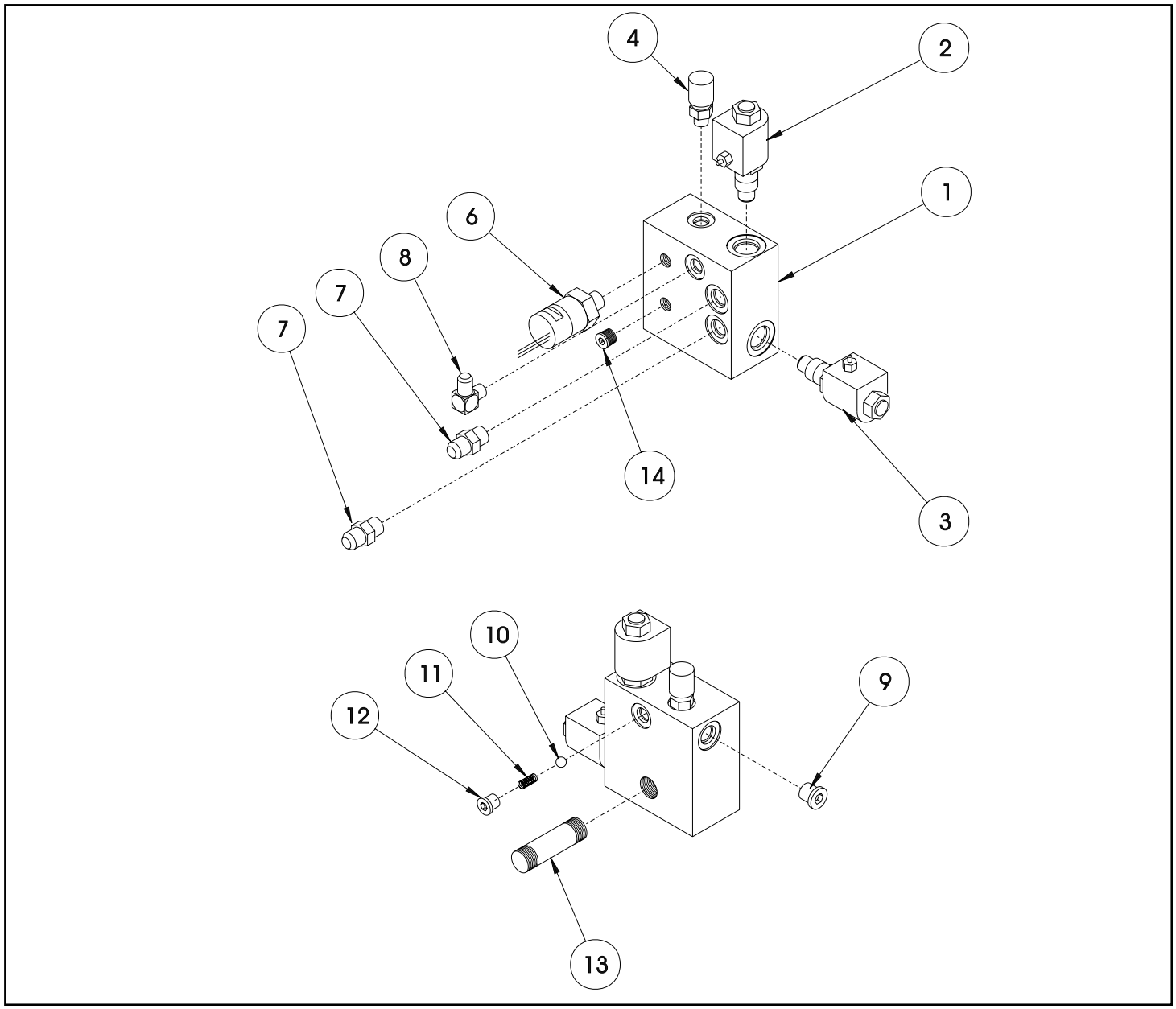
*** Not Shown**



BRAKE VALVE BLOCK ASSEMBLY
AB46 BI-ENERGY

68324-001

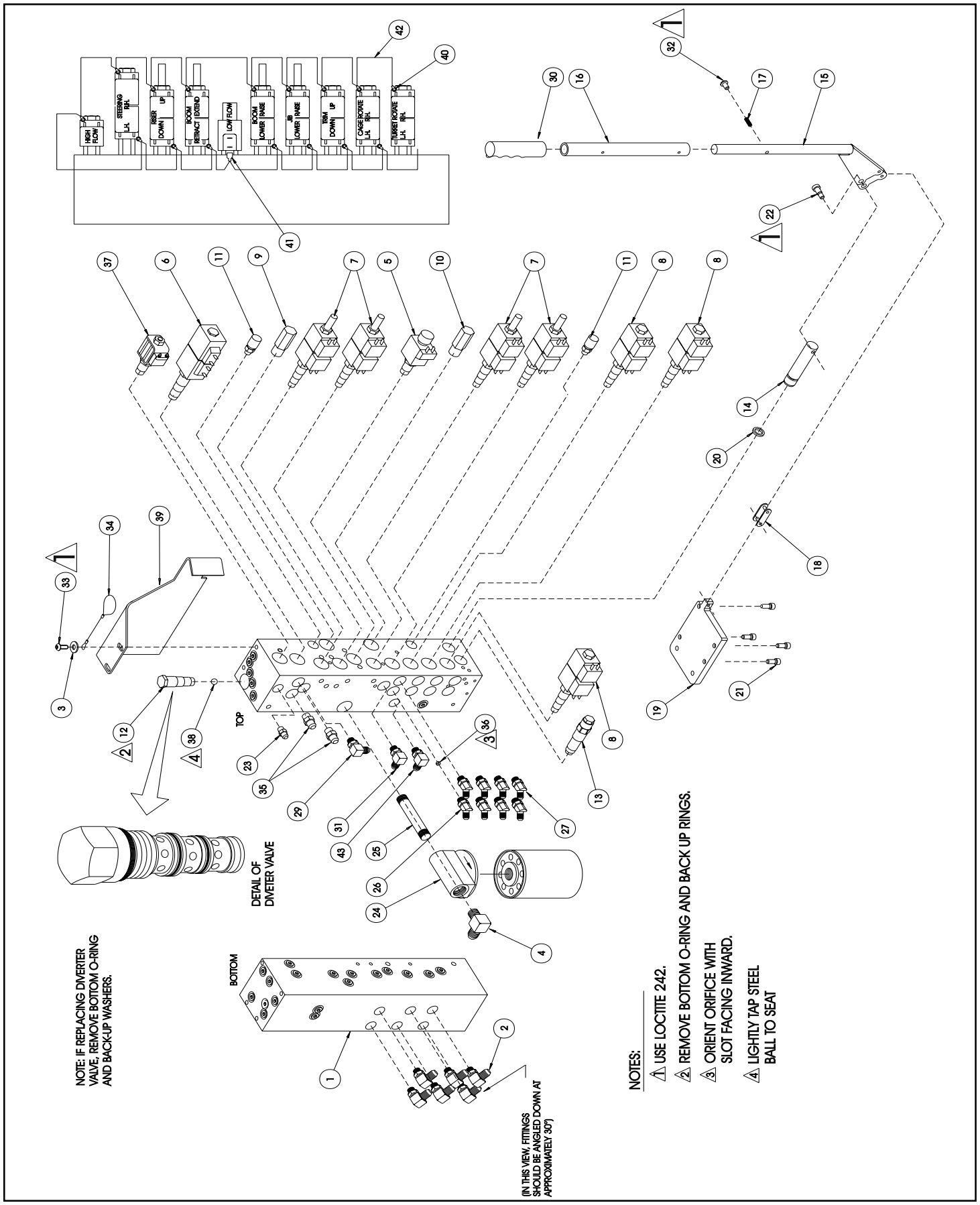
ITEM	PART	DESCRIPTION	QTY.
1	68481-000	VALVE BLOCK, BRAKE	1
2	68553-000	VALVE, POPPET N.C. 48VDC	1
3	68674-000	VALVE, POPPET N.O. 48VDC	1
4	63965-001	PLUG, GUAGE PORT	1
6	63921-010	PRESSURE SWITCH,	1
7	11941-005	STR. ADAPTER #6 SAE - #6 JIC	2
8	11934-001	ELBOW 90° #4 SAE-#4 JIC	1
9	12004-006	PLUG #6 SAE	1
10	05135-000	STEEL BALL, 5/16" DIA.	1
11	13987-009	SPRING, 1/4 DIA. X 19/32 LG.	1
12	12004-004	PLUG, #4 SAE	1
13	14021-005	PIPE NIPPLE 1/2" SCH 40 X 2 1/2" LG.	1
14	11920-002	PLUG,PIPE SOC HD 1/4-18 NPTF	1



NOTES:

VALVE BLOCK ASSEMBLY
AB46
68348-000

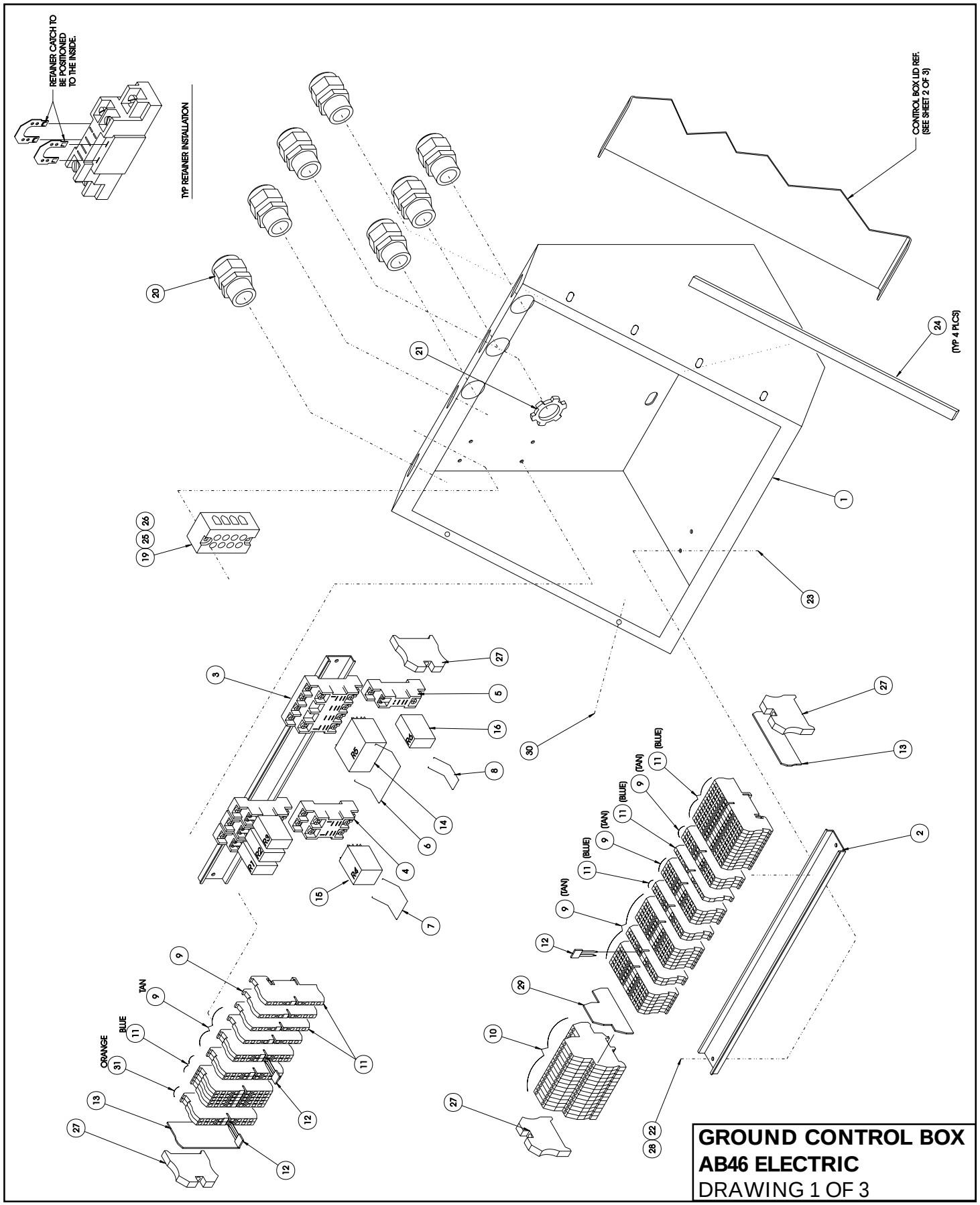
ITEM	PART	DESCRIPTION	QTY.
1	68349-000	VALVE BLOCK SUB-ASSY.	1
2	11934-001	FITTING, 2062-4-4S	6
3	11240-005	WASHER 5/16 FLAT	2
4	11940-019	90° ELBOW 3/4NPT X 3/4 JIC	1
5	63986-003	FLOW CNTRL,WATERMAN	1
6	68559-000	3 POS, 4 WAY, TANDEM CENTER	1
7	68560-000	4 WAY, CLOSED CENTER	4
8	68561-000	4 WAY,MOTOR SPOOL	3
9	60390-020	RELIEF VALVE, 2540 PSI	1
10	60390-021	RELIEF VALVE, 1450 PSI	1
11	63965-001	PLUG, GAGE PORT	2
12	68558-000	DIVERTER VALVE	1
13	68778-000	COUNTERBALANCE VALVE	1
14	68430-000	PISTON, HAND PUMP	1
15	68428-000	LEVER WELDMENT, HAND PUMP	1
16	68429-000	LEVER EXTENSION, HAND PUMP	1
17	68564-001	DETENT BALL / SPRING	1
18	68566-000	PIVOT LINK	1
19	68425-000	MOUNTING PLATE, VALVE BLOCK	1
20	12499-016	SEAL, POLYPAK #12500625	1
21	14334-004	SCREW. SOC. HD. 5/16-18 UNC X 1/2	4
22	15936-005	SCREW, SHOULDER Ø 3/8 X 5/8 LG	1
23	11941-002	FITTING 202702-4-6S	1
24	05154-001	FILTER ASSY.	1
25	14028-008	PIPE NIPPLE, 3/4 SCHD 40 X 4	1
26	11935-013	FITTING 45° 6MB-4MJ	1
27	11935-001	FITTING, 45° SWIVEL EL. 4MB-4MJ	7
29	11934-004	FITTING 90° EL. 6MB-6MJ	1
30	68700-000	HAND GRIP, VINYL	1
31	11934-003	FITTING 2062-6-4S	1
32	11821-004	SCRW BUTT HEAD 1/4-20UNC X 1/2	1
33	11822-006	SCRW BUTT HEAD 5/16-18 UNC X 3/4	2
34	63783-002	LANYARD ASSY	1
35	11941-005	FITTING 202702-6-6S	2
36	15919-000	ORFICE	1
37	68781-000	VALVE	1
38	61827-000	STEEL BALL 7/16 DIA	1
39	68791-000	BRACKET	1
40	29601-012	CONN. RING, 18-14 GA. #8	16
41	29616-002	CONN. FEM. PUSH, .25	1
42	29452-099	WIRE, 16 GA. BLACK	3 FT
43	11934-026	FITTING 90° 4MB-6MJ	1


HIGH FLOW
STEERING LH.
STEERING RH.
RIBER DOWN
RIBER UP
BOOM RETRACT
BOOM EXTEND
LOW FLOW
BOOM LOWER
BOOM RAISE
JIB LOWER
JIB RAISE
TRIM DOWN
TRIM UP
CAGE ROTATE LH.
CAGE ROTATE RH.
TURRET ROTATE LH.
TURRET ROTATE RH.
TOP
BOTTOM
DETAIL OF DIVETER VALVE
NOTE: IF REPLACING DIVERTER VALVE, REMOVE BOTTOM O-RING AND BACK-UP WASHERS.
(IN THIS VIEW, FITTINGS SHOULD BE ANGLED DOWN AT APPROXIMATELY 30°)
NOTES:
1 USE LOCTITE 242.
2 REMOVE BOTTOM O-RING AND BACK UP RINGS.
3 ORIENT ORIFICE WITH SLOT FACING INWARD.
4 LIGHTLY TAP STEEL BALL TO SEAT

GROUND CONTROL BOX ASSEMBLY
AB46 ELECTRIC
68328-000

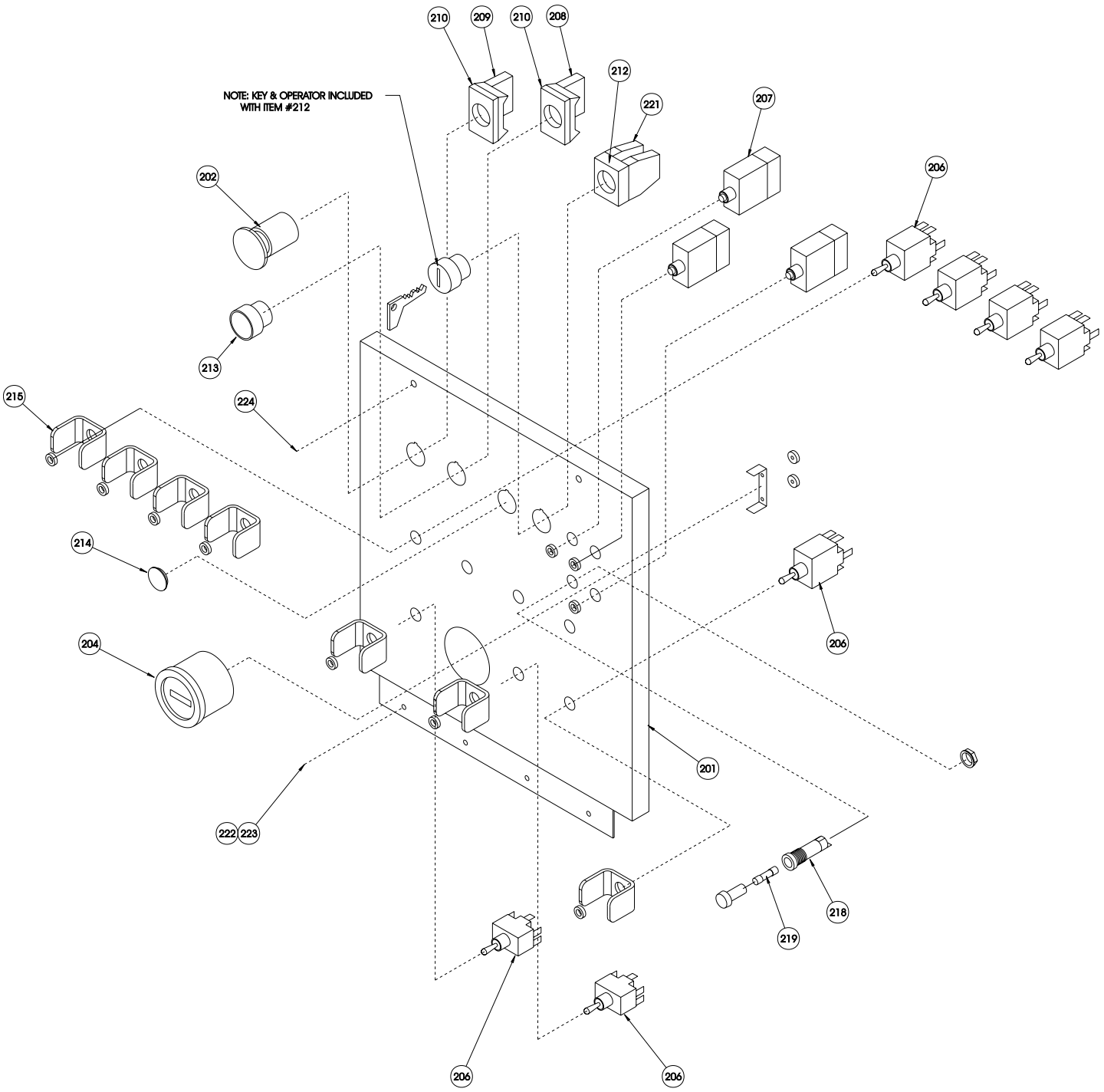
ITEM	PART	DESCRIPTION	QTY.
1	68717-000	BOX, GROUND CONTROL	1
2	67893-002	DIN RAIL, 14" LONG	2
3	67662-004	SOCKET, RELAY	1
4	67662-002	SOCKET, RELAY	1
5	67662-001	SOCKET, RELAY	4
6	67662-007	RETAINER CLIP,	1
7	67662-006	RETAINER CLIP,	1
8	67662-005	RETAINER CLIP,	4
9	68698-001	TERMINAL BLOCK (TAN)	27
10	68733-000	DIODE BLOCK	14
11	68698-002	TERMINAL BLOCK (BLUE)	22
12	68773-002	JUMPER 2 PIN	3
13	68698-004	END SECTION	2
14	68756-004	RELAY, 4 POLE (48V DC)	1
15	68756-002	RELAY, 2 POLE (48V DC)	1
16	68756-001	RELAY, 1 POLE (48V DC)	4
19	68734-004	TERMINAL BLOCK (120 V)	1
20	29925-001	CONNECTOR, CABLE	7
21	29939-003	LOCKNUT, 3/4 NPT	7
22	11715-003	SCR, RD. HD. 6-32 X 3/8	4
23	11248-047	LOCKNUT, 6-32 ESNA	4
24	68889-099	WEATHERSTRIP 1/2" X 3/16" FOAM	4.5 FT
25	11248-003	LOCKNUT, 10-24 ESNA	2
26	11709-010	SCR, RD. HD. 10-24 X 1 1/4	2
27	67660-006	END BLOCK, TERMINAL	4
28	11240-001	WASHER, FLAT #6	4
29	68733-001	END SECTION	1
30	14252-004	NUT SERT 1/4-20UNC	2
31	68648-000	TERMINAL BLOCK (ORANGE)	2
201	68719-000	CONTROL BOX LID	1
202	64446-003	EMERGENCY STOP BUTTON	1
204	15752-000	HOUR METER,	1
206	12798-004	SWITCH, TOGGLE DPDT MOM.	7
207	68582-010	CIRCUIT BREAKER, 10 AMP	3
208	64443-001	CONTACT BLOCK, N.O.	1
209	64443-002	CONTACT BLOCK, N.C.	1
210	64417-001	FLANGE, 3 CONTACT	2
212	68588-001	SWITCH, KEY OPERATED	1

ITEM	PART	DESCRIPTION	QTY.
213	67652-000	PUSH BUTTON ORERATOR, GREEN	1
214	66516-006	HOLE PLUG 7/8" DIA.	1
215	08721-001	GUARD, TOGGLE SWITCH	7
218	29701-000	FUSE HOLDER	1
219	29704-025	FUSE, 25AMP	1
221	66805-012	CONTACT BLOCK, N.O./N.C.	2
222	11709-004	SCRW MACH RD HD 10-24UNC X 1/2	4
223	11248-003	NUT HEX ESNA 10-24 UNC	4
224	11821-005	SCRW,BUTT.HD SOC.1/4-20 X 5/8 LG	2
301	29452-099	WIRE, 16 GA. BLACK	23 FT
302	29451-099	WIRE, 16 GA. WHITE	14 FT
303	29454-099	WIRE, 16 GA. RED	22 FT
304	29457-099	WIRE, 16 GA. GREEN	33 FT
305	29453-099	WIRE, 16 GA. ORANGE	27 FT
306	29450-099	WIRE, 16 GA. BLUE	13 FT
307	29479-099	WIRE, 16 GA. WHITE/BLACK	17 FT
308	29478-099	WIRE, 16 GA. RED/BLACK	5 FT
309	05491-099	WIRE, 16 GA. GREEN/BLACK	8 FT
310	29477-099	WIRE, 16 GA. ORANGE/BLACK	8 FT
311	29475-099	WIRE, 16 GA. BLUE/BLACK	4 FT
312	29362-099	WIRE, 16 GA. RED/BLK/WHT	1 FT
313	29483-099	WIRE, 16 GA. RED/WHITE	7 FT
314	29482-099	WIRE, 16 GA. GREEN/WHITE	5 FT
315	29459-099	WIRE, 16 GA. BLUE/WHITE	5 FT
316	29355-099	WIRE, 16 GA. BLACK/RED	6 FT
317	29356-099	WIRE, 16 GA. WHITE/RED	4 FT
318	29357-099	WIRE, 16 GA. ORANGE/RED	8 FT
319	29358-099	WIRE, 16 GA. BLUE/RED	5 FT
321	29360-099	WIRE, 16 GA. ORANGE/GREEN	4 FT
322	29361-099	WIRE, 16 GA. BLACK/WHITE/RED	5 FT
323	29825-002	DIODE, 3 AMP. 400 VOLT	29
324	13283-002	CABLE MOUNT	9
325	29610-002	CONN FORK TERM 16-14 (#8 STUD) LOCKING	10
326	29931-003	CONN FEM PUSH TERM 16-14 (1/4")	50
327	29616-001	CONN FEM PUSH TERM 16-14 (3/16)	4
328	29610-006	CONN FORK TERM 16-14 (#6 STUD) LOCKING	57

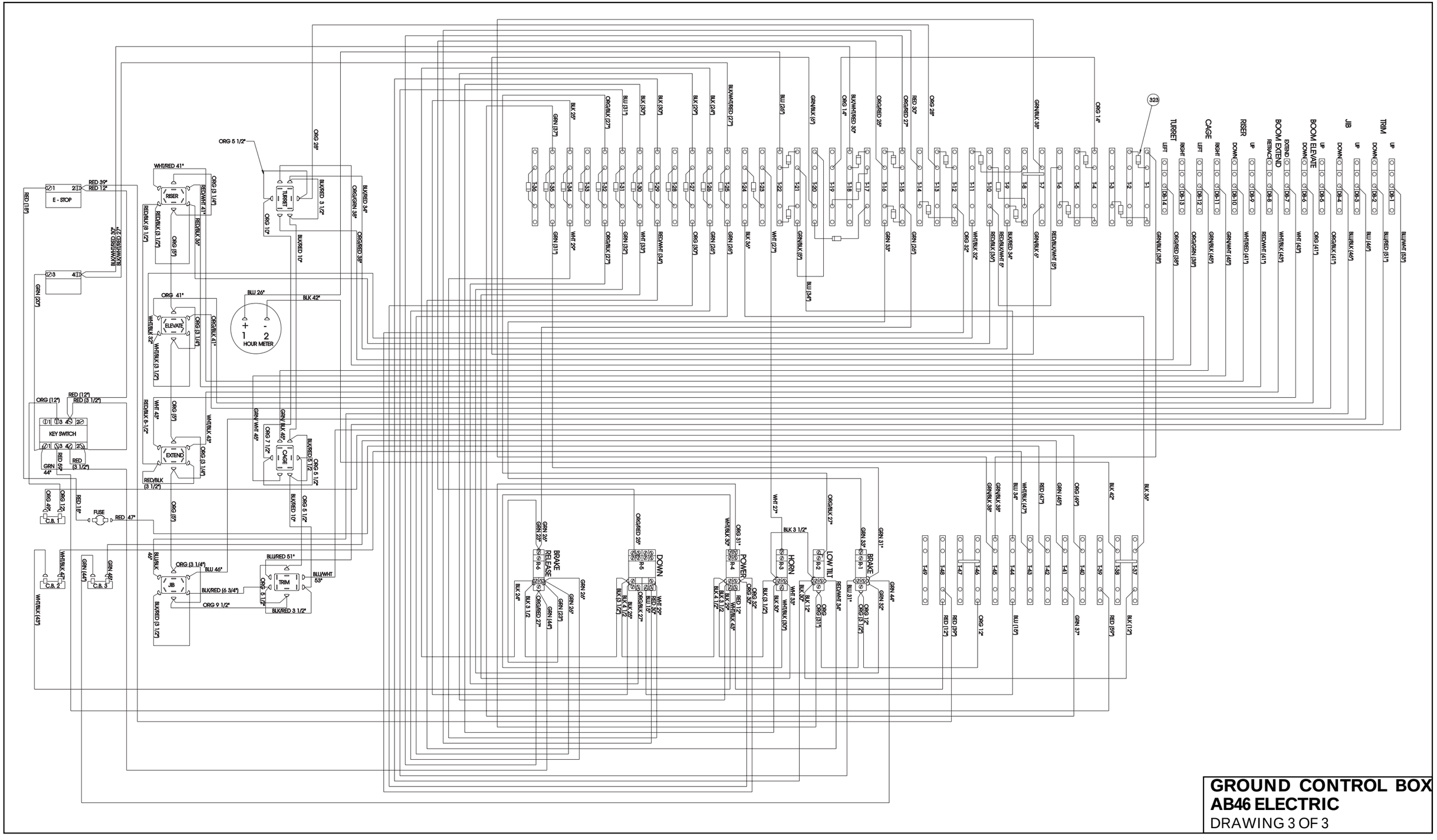


GROUND CONTROL BOX
AB46 ELECTRIC
DRAWING 1 OF 3

Illustrated Parts Breakdown



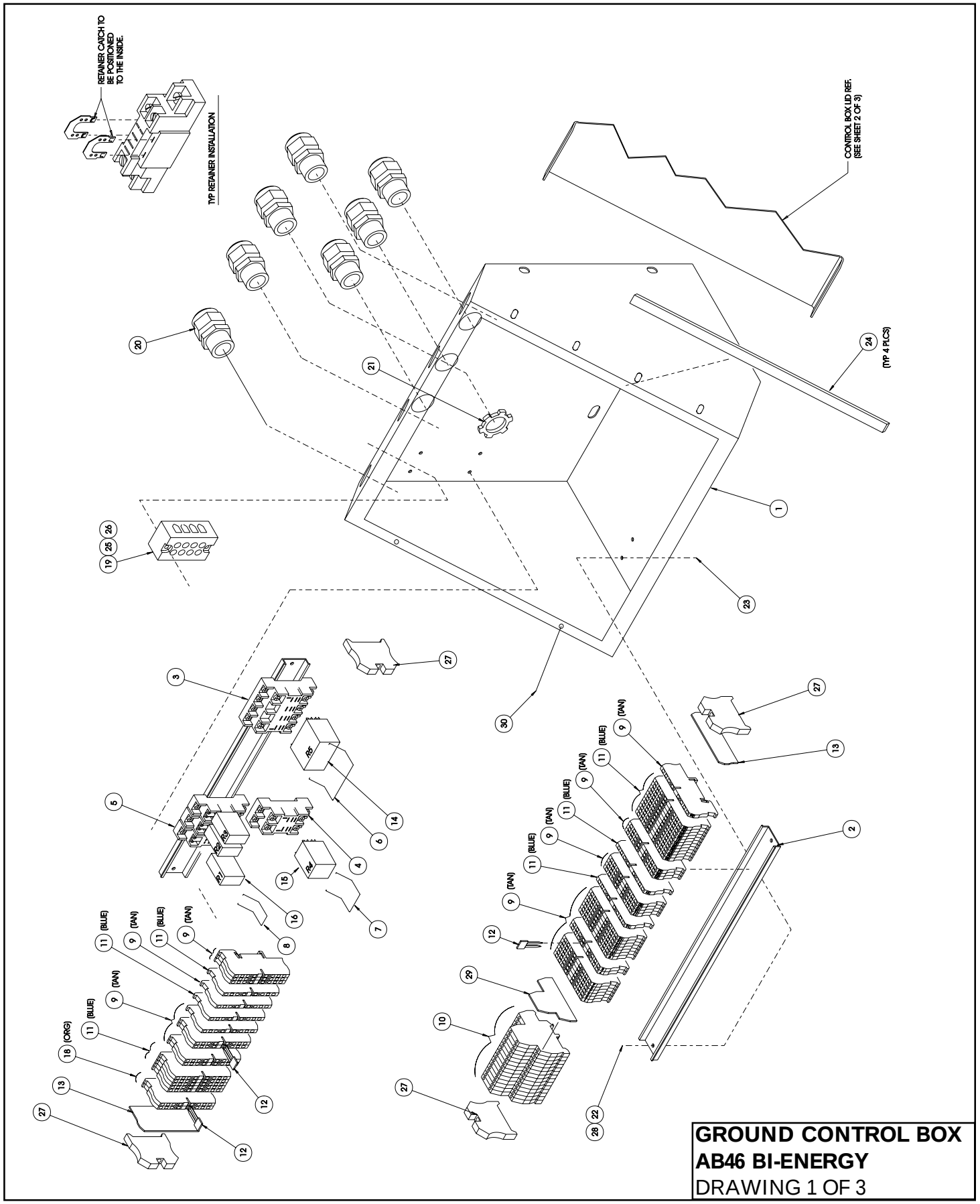
GROUND CONTROL BOX
AB46 ELECTRIC
DRAWING 2 OF 3


TRIM
UP
DOWN
JIB
UP
DOWN
BOOM ELEVATE
UP
DOWN
BOOM EXTEND
EXTEND
RETRACT
RISER
UP
DOWN
CAGE
RIGHT
LEFT
TURRET
RIGHT
LEFT
323
E - STOP
KEY SWITCH
FUSE
C.B. 1
C.B. 2
C.B. 3
RISER
ELEVATE
EXTEND
CAGE
JIB
TRIM
TURRET
HOUR METER
BRAKE RELEASE
DOWN
POWER
HORN
LOW TILT
BRAKE
GROUND CONTROL BOX
AB46 ELECTRIC
DRAWING 3 OF 3

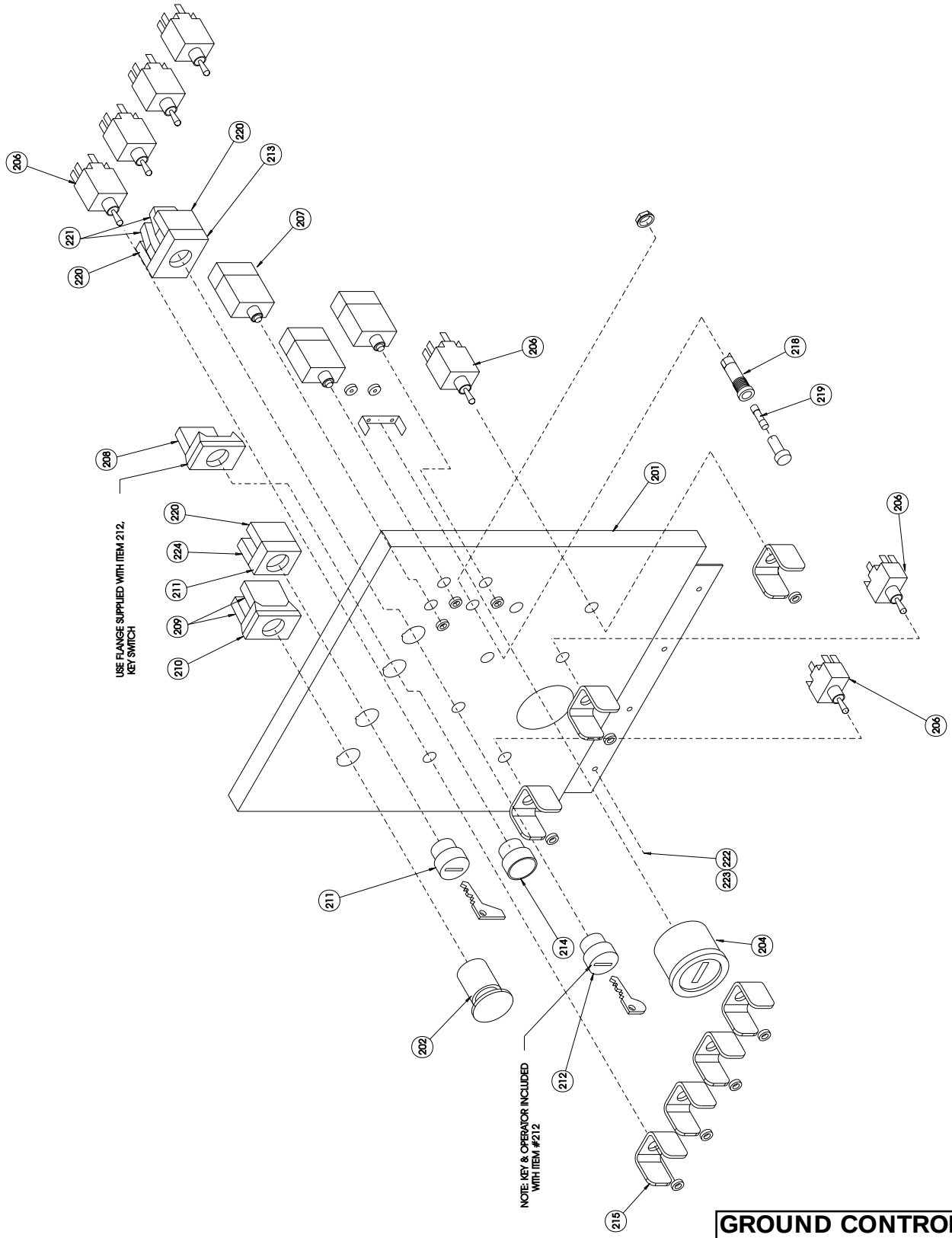
GROUND CONTROL BOX ASSEMBLY
AB46 BI-ENERGY
68328-003

ITEM	PART	DESCRIPTION	QTY.
1	68717-000	BOX, GROUND CONTROL	1
2	67893-002	DIN RAIL, 14" LONG	2
3	67662-004	SOCKET, RELAY	1
4	67662-002	SOCKET, RELAY	1
5	67662-001	SOCKET, RELAY	3
6	67662-007	RETAINER CLIP,	1
7	67662-006	RETAINER CLIP,	1
8	67662-005	RETAINER CLIP,	3
9	68698-001	TERMINAL BLOCK (TAN)	32
10	68733-000	DIODE BLOCK	14
11	68698-002	TERMINAL BLOCK (BLUE)	20
12	68773-002	JUMPER 2 PIN	3
13	68698-004	END SECTION	2
14	68756-004	RELAY, 4 POLE 48VDC	1
15	68756-002	RELAY, 2 POLE 48VDC	1
16	68756-001	RELAY, 1 POLE 48VDC	3
18	68698-000	TERMINAL BLOCK (ORANGE)	2
19	68734-004	TERMINAL BLOCK (120 V)	1
20	29925-001	CONNECTOR, CABLE	7
21	29939-003	LOCKNUT, 3/4 NPT	7
22	11715-003	SCR, RD. HD. 6-32 X 3/8	4
23	11248-047	LOCKNUT, 6-32 ESNA	4
24	68889-099	WEATHERSTRIP 1/2" X 3/16" FOAM	4.5 FT
25	11248-003	LOCKNUT, 10-24 ESNA	2
26	11709-010	SCR, RD. HD. 10-24 X 1 1/4	2
27	67660-006	END BLOCK, TERMINAL	4
28	11240-001	WASHER, FLAT #6	4
29	68733-001	END SECTION	1
30	14252-004	NUT-SERT 1/4-20 UNC	2
201	68719-000	CONTROL BOX LID	1
202	64446-003	EMERGENCY STOP BUTTON	1
204	68581-001	HOUR METER/BATTERY LEVEL IND.	1
206	12798-004	SWITCH, TOGGLE DPDT MOM.	7
207	68582-010	CIRCUIT BREAKER, 10 AMP	3
208	64443-001	CONTACT BLOCK, N.O.	1
209	64443-002	CONTACT BLOCK, N.C.	2
210	64417-001	FLANGE, 3 CONTACT	1
211	68819-000	SWITCH KEY OPERATOR	1
212	68588-001	SWITCH, KEY OPERATED	1

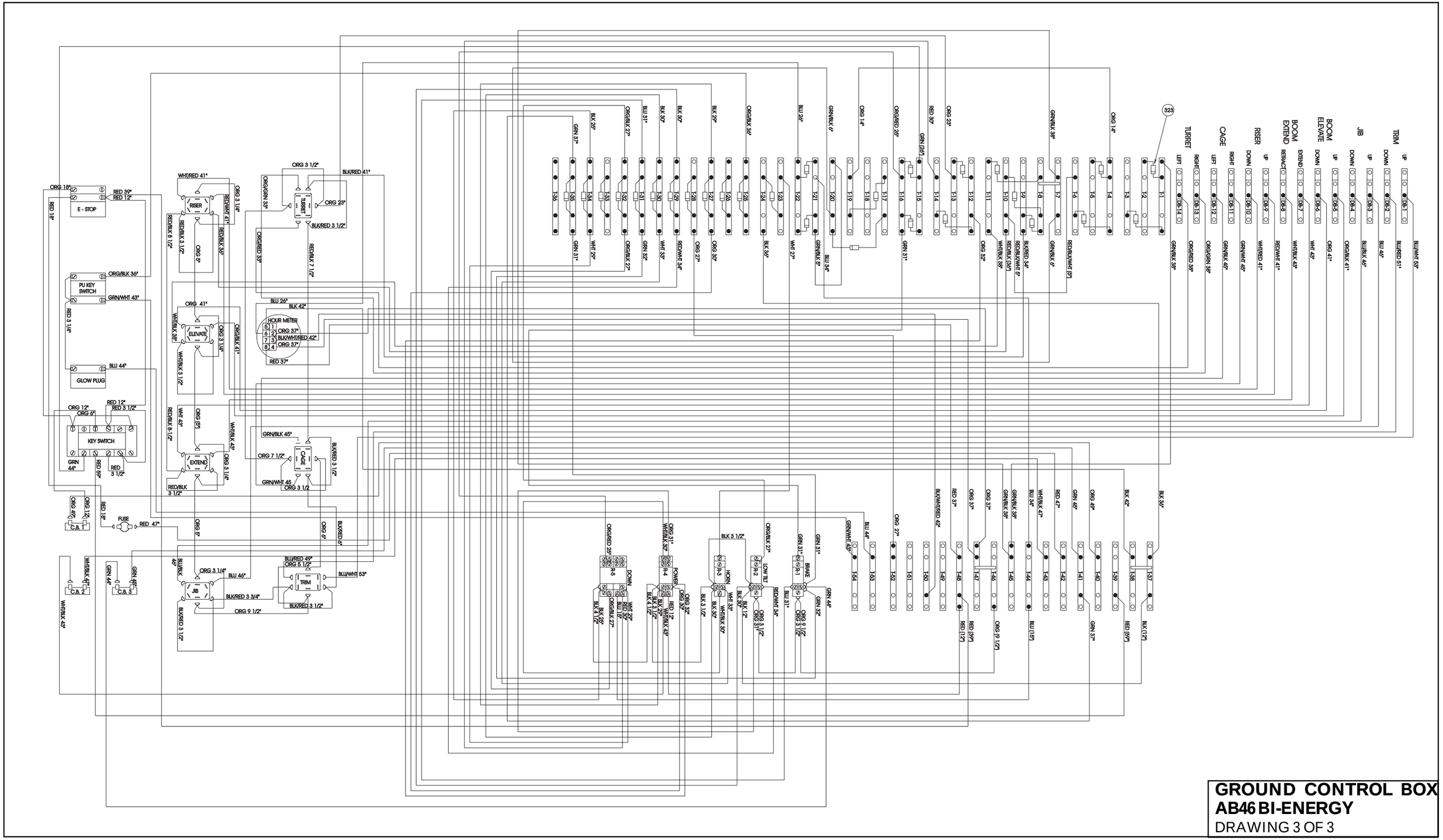
ITEM	PART	DESCRIPTION	QTY.
213	68585-000	FLANGE, 5 CONTACT	1
214	67654-000	PUSH BUTTON, BLACK	1
215	08271-001	GUARD, TOGGLE SWITCH	7
218	29701-000	FUSE HOLDER	1
219	29704-025	FUSE, 25AMP	1
220	66805-010	CONTACT BLOCK, N.O.	3
221	66805-012	CONTACT BLOCK, N.O./N.C.	2
222	11709-004	SCRW MACH RD HD 10-24UNC X 1/2	4
223	11248-003	NUT HEX ESNA 10-24 UNC	4
224	66805-011	CONTACT BLOCK 1 N.C.	1
301	29452-099	WIRE, 16 GA. BLACK	23 FT
302	29451-099	WIRE, 16 GA. WHITE	14 FT
303	29454-099	WIRE, 16 GA. RED	22 FT
304	29457-099	WIRE, 16 GA. GREEN	33 FT
305	29453-099	WIRE, 16 GA. ORANGE	27 FT
306	29450-099	WIRE, 16 GA. BLUE	13 FT
307	29479-099	WIRE, 16 GA. WHITE/BLACK	17 FT
308	29478-099	WIRE, 16 GA. RED/BLACK	5 FT
309	05491-099	WIRE, 16 GA. GREEN/BLACK	8 FT
310	29477-099	WIRE, 16 GA. ORANGE/BLACK	8 FT
311	29475-099	WIRE, 16 GA. BLUE/BLACK	4 FT
312	29362-099	WIRE, 16 GA. RED/BLK/WHT	1 FT
313	29483-099	WIRE, 16 GA. RED/WHITE	7 FT
314	29482-099	WIRE, 16 GA. GREEN/WHITE	5 FT
315	29459-099	WIRE, 16 GA. BLUE/WHITE	5 FT
316	29355-099	WIRE, 16 GA. BLACK/RED	6 FT
317	29356-099	WIRE, 16 GA. WHITE/RED	4 FT
318	29357-099	WIRE, 16 GA. ORANGE/RED	8 FT
319	29358-099	WIRE, 16 GA. BLUE/RED	5 FT
321	29360-099	WIRE, 16 GA. ORANGE/GREEN	4 FT
322	29361-099	WIRE, 16 GA. BLACK/WHITE/RED	5 FT
323	29825-002	DIODE, 3 AMP. 400 VOLT	27 FT
324	13283-002	CABLE MOUNT	9
325	29610-002	CONN FORK TERM 16-14 (#8 STUD) LOCKING	10
326	29931-003	CONN FEM PUSH TERM 16-14 (1/4")	50
327	29616-001	CONN FEM PUSH TERM 16-14 (3/16)	4
328	29610-006	CONN FORK TERM 16-14 (#6 STUD) LOCKING	57



GROUND CONTROL BOX
AB46 BI-ENERGY
DRAWING 1 OF 3



GROUND CONTROL BOX
AB46 BI-ENERGY
DRAWING 2 OF 3

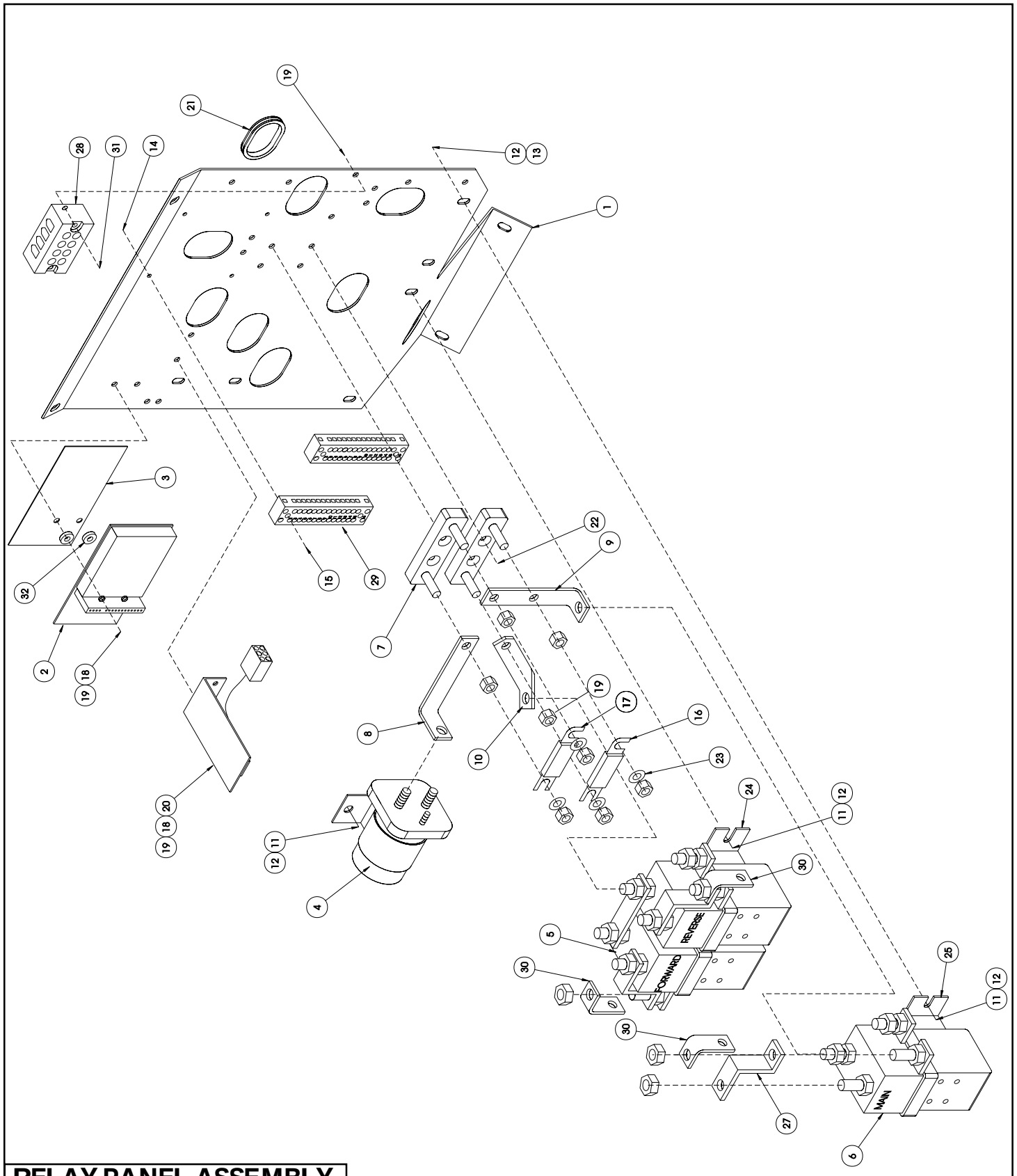


GROUND CONTROL BOX
AB46 BI-ENERGY
DRAWING 3 OF 3

RELAY PANEL ASSEMBLY, AB46 ELECTRIC

68346-000

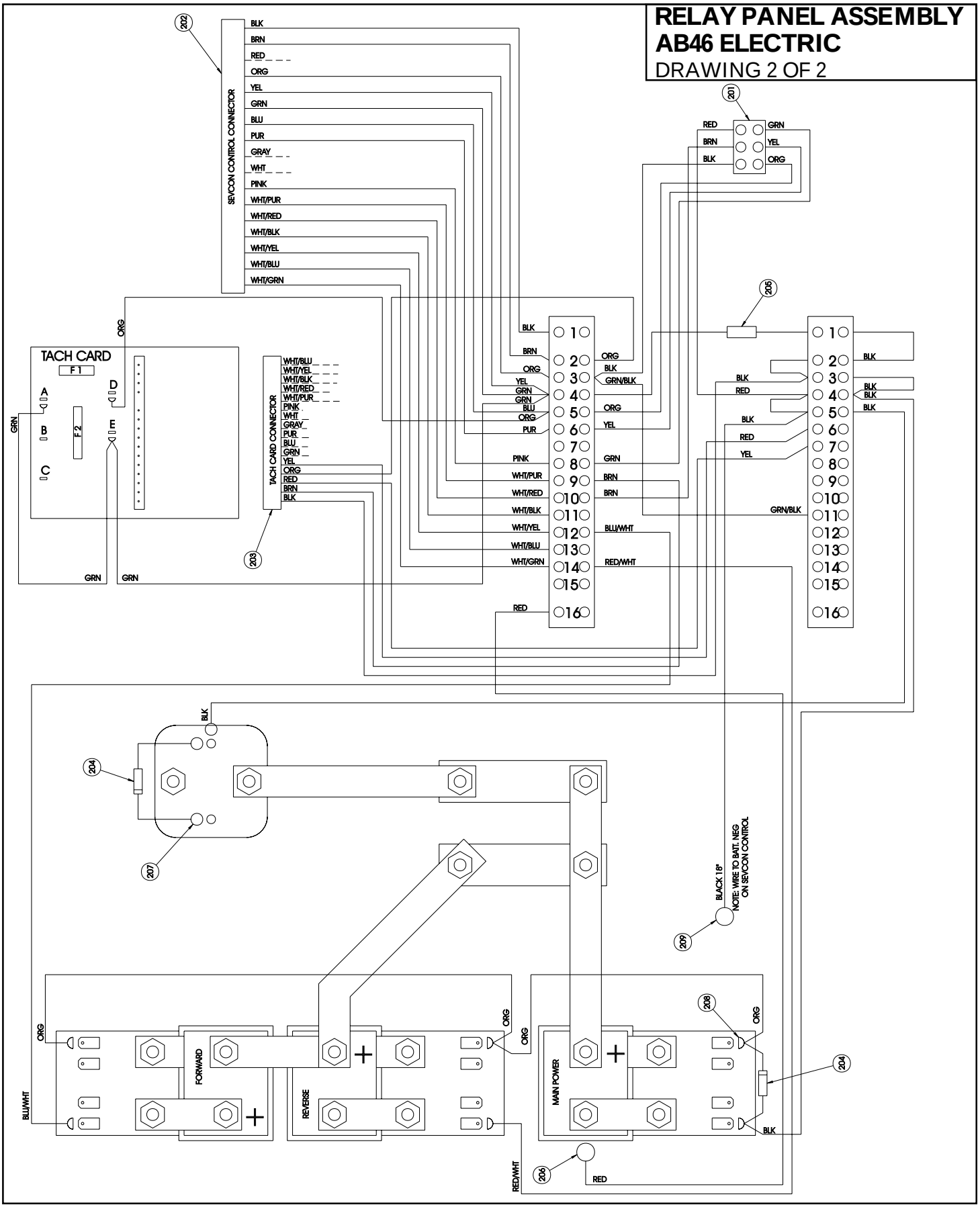
ITEM	PART	DESCRIPTION	QTY.
1	68490-000	RELAY MOUNT	1
2	68550-016	TACH BOARD ASSY.	1
3	68550-017	INSULATION SHEET	1
4	10122-002	RELAY, 48 VDC	1
5	68552-001	RELAY, 48 VDC DOUBLE CONTACT	1
6	68552-000	RELAY, 48 VDC SINGLE CONTACT	1
7	10149-000	FUSE BLOCK	2
8	68626-003	BUSS BAR	1
9	68626-004	BUSS BAR	1
10	68626-005	BUSS BAR	1
11	11252-006	SCREW, HHC 1/4-20 UNC X 3/4	6
12	11240-004	WASHER, FLAT STD. 1/4"	12
13	11248-004	LOCKNUT, HEX 1/4-20 UNC ESNA	6
14	11248-047	LOCKNUT, HEX #6-32 UNC ESNA	4
15	11715-008	SCREW, RD HD #6-32 UNC X 1	4
16	10148-003	FUSE,BUSS ANN-350	1
17	10148-002	FUSE,BUSS 125 AMP	1
18	11709-004	SCREW FLT HD #10-24 UNC X 1/2	4
19	11248-003	LOCKNUT, HEX #10-24 UNC ESNA	10
20	68550-018	RESISTOR BRACKET ASSY.	1
21	12956-002	GROMMET	8
22	11709-006	SCRW RD HD MACH 10-24 UNC X 3/4	4
23	11240-005	WASHER, FLAT STD 5/16	4
24	68550-015	BRACKET, SIDE MOUNT	1
25	68550-014	BRACKET, VERT. MOUNT	1
27	68550-013	TERMINAL LINK	1
28	68734-004	TERMINAL BLOCK	1
29	68818-000	TERMINAL BLOCK	2
30	68626-002	BUSS BAR	3
31	11709-010	SCR. RD. HD. #10 - 24 UNC X 1 1/4	2
32	20328-001	WASHER, NYLON	2
201	68550-021	CONNECTOR, RESISTOR PACK	1
202	68550-019	CONNECTOR, SEVCON CONTROL	1
203	68550-020	CONNECTOR, TACH CARD	1
204	29825-002	DIODE	1
205	68758-000	5K RESISTOR	1
206	29601-015	CONN. RING, 16-14 Ø 3/8	1
207	29601-013	CONN. RING, 16-14 #10	3
208	29931-003	CONN. FEM. PUSH, 16-14 .25	8
209	29601-040	CONN. RING, 16-14 Ø 5/16	1
210	29452-099	WIRE, 16 GA. BLK.	6 FT
211	29454-099	WIRE, 16 GA. RED	2 FT
212	29457-099	WIRE, 16 GA. GRN.	1 FT
213	29453-099	WIRE, 16 GA. ORG.	3 FT
214	29352-099	WIRE, 16 GA. RED/WHT	1.5 FT
215	29454-099	WIRE, 16 GA. BLU/WHT	2.2 FT



RELAY PANEL ASSEMBLY
AB46 ELECTRIC
DRAWING 1 OF 2

RELAY PANEL ASSEMBLY AB46 ELECTRIC

DRAWING 2 OF 2

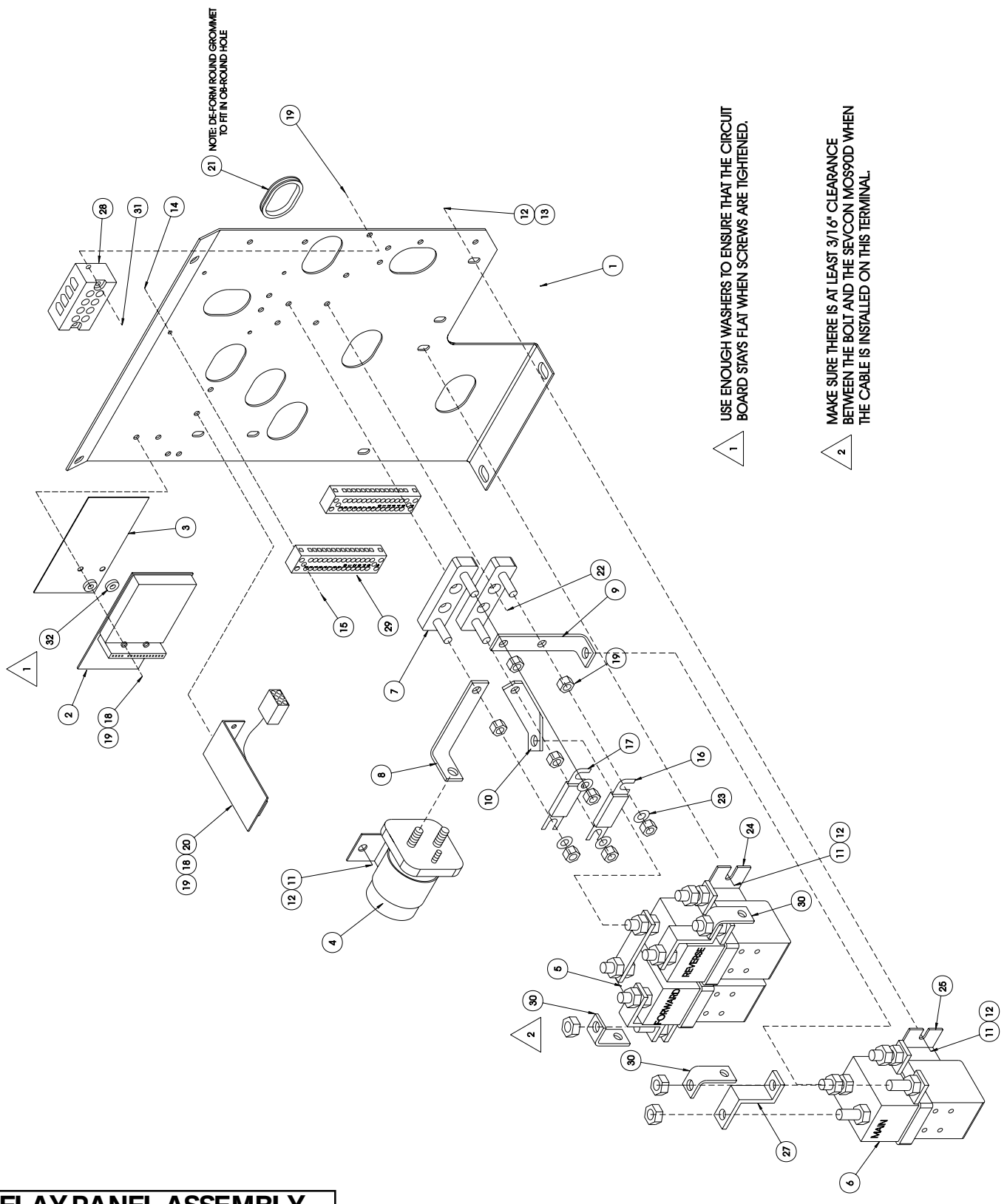


NOTES:

RELAY PANEL ASSEMBLY, AB46 BI-ENERGY

68346-001

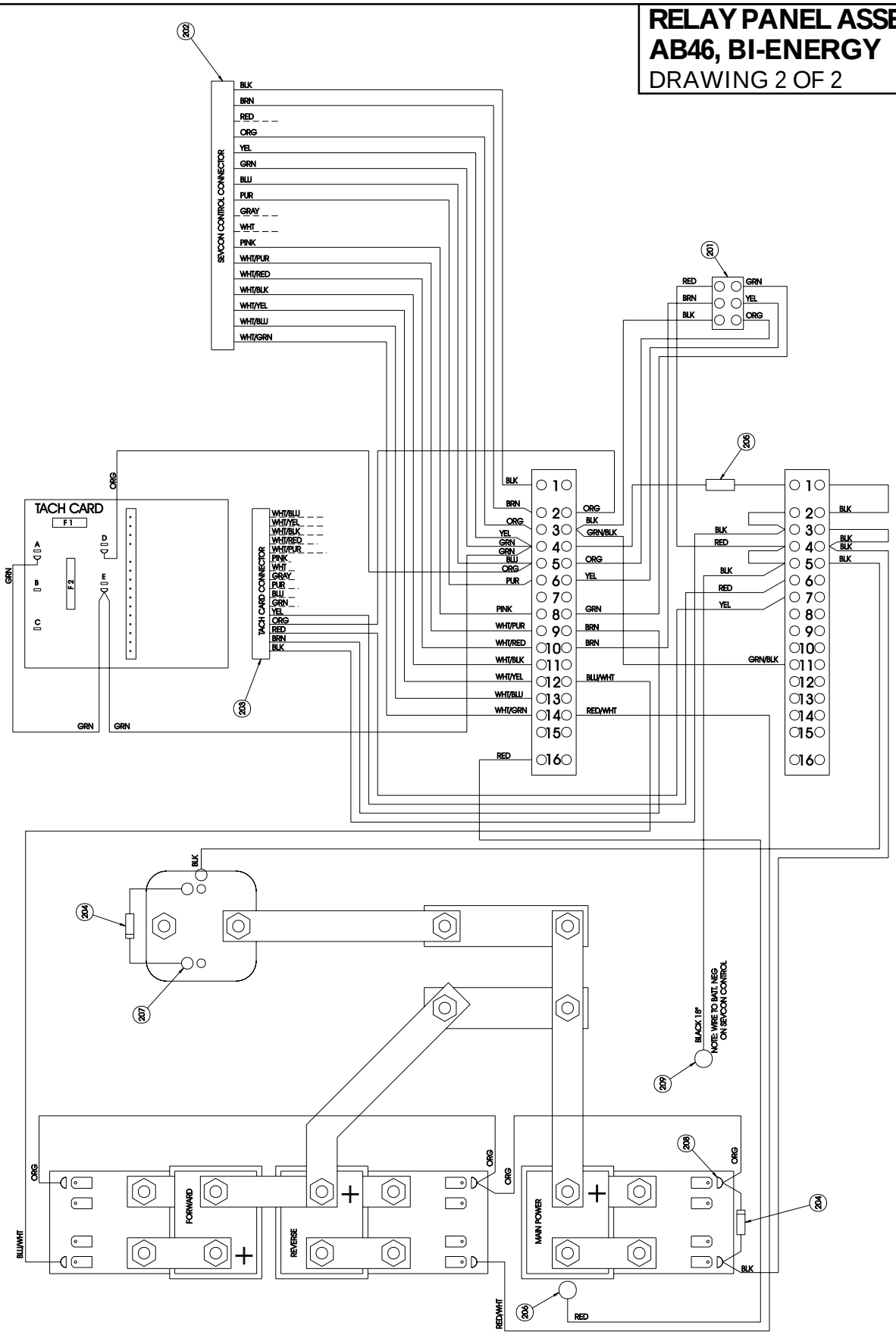
ITEM	PART	DESCRIPTION	QTY.
1	68921-000	RELAY MOUNT, BI-ENERGY	1
2	68550-016	TACH BOARD ASSY.	1
3	68550-017	INSULATION SHEET	1
4	10122-002	RELAY, 48 VDC	1
5	68552-001	RELAY, 48 VDC DOUBLE CONTACT	1
6	68552-000	RELAY, 48 VDC SINGLE CONTACT	1
7	10149-000	FUSE BLOCK	2
8	68626-003	BUSS BAR	1
9	68626-004	BUSS BAR	1
10	68626-005	BUSS BAR	1
11	11252-006	SCREW, HHC 1/4-20 UNC X 3/4	6
12	11240-004	WASHER, FLAT STD. 1/4"	12
13	11248-004	LOCKNUT, HEX 1/4-20 UNC ESNA	6
14	11248-047	LOCKNUT, HEX #6-32 UNC ESNA	4
15	11715-008	SCREW, RD HD #6-32 UNC X 1	4
16	10148-003	FUSE,BUSS ANN-350	1
17	10148-004	FUSE,BUSS 125 AMP	1
18	11709-004	SCREW FLT HD #10-24 UNC X 1/2	4
19	11248-003	LOCKNUT, HEX #10-24 UNC ESNA	10
20	68550-018	RESISTOR BRACKET ASSY.	1
21	12956-002	GROMMET	8
22	11709-006	SCRW RD HD MACH 10-24 UNC X 3/4	4
23	11240-005	WASHER, FLAT STD 5/16	4
24	68550-015	BRACKET, SIDE MOUNT	1
25	68550-014	BRACKET, VERT. MOUNT	1
27	68550-013	TERMINAL LINK	1
28	68734-004	TERMINAL BLOCK	1
29	68818-000	TERMINAL BLOCK	2
30	68626-002	BUSS BAR	3
31	11709-010	SCR. RD. HD. #10 - 24 UNC X 1 1/4	2
32	20328-001	WASHER, NYLON	2
201	68550-021	CONNECTOR, RESISTOR PACK	1
202	68550-019	CONNECTOR, SEVCON CONTROL	1
203	68550-020	CONNECTOR, TACH CARD	1
204	29825-002	DIODE	1
205	68758-000	5K RESISTOR	1
206	29601-015	CONN. RING, 16-14 Ø 3/8	1
207	29601-013	CONN. RING, 16-14 #10	3
208	29931-003	CONN. FEM. PUSH, 16-14 .25	8
209	29601-040	CONN. RING, 16-14 Ø 5/16	1
210	29452-099	WIRE, 16 GA. BLK.	6 FT
211	29454-099	WIRE, 16 GA. RED	2 FT
212	29457-099	WIRE, 16 GA. GRN.	1 FT
213	29453-099	WIRE, 16 GA. ORG.	3 FT
214	29352-099	WIRE, 16 GA. RED/WHT	1.5 FT
215	29459-099	WIRE, 16 GA. BLU/WHT	2.2 FT



RELAY PANEL ASSEMBLY
AB46, BI-ENERGY
DRAWING 1 OF 2

RELAY PANEL ASSEMBLY AB46, BI-ENERGY

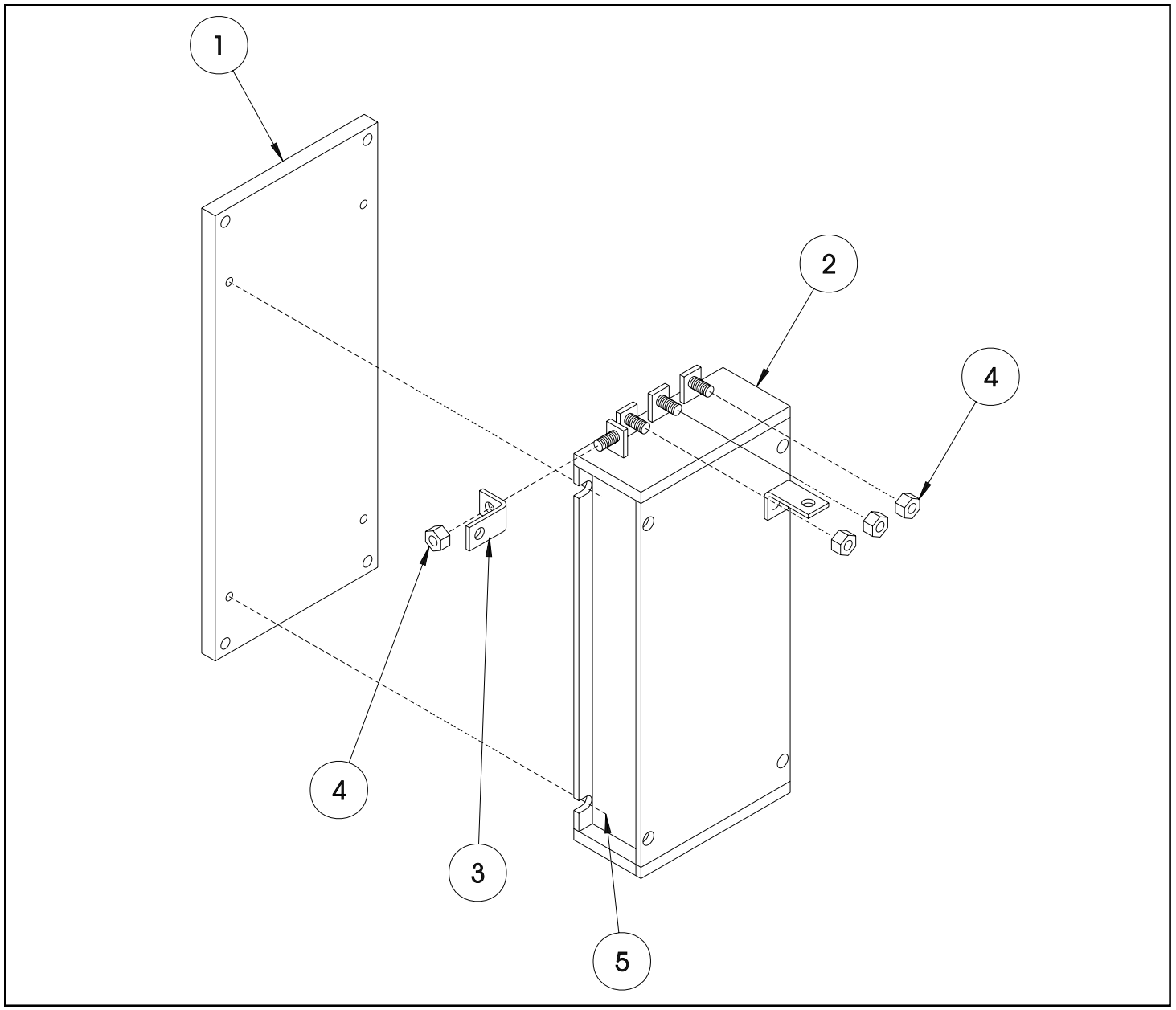
DRAWING 2 OF 2



SPEED CONTROL PANEL ASSEMBLY
AB46, BI-ENERGY

68321-000

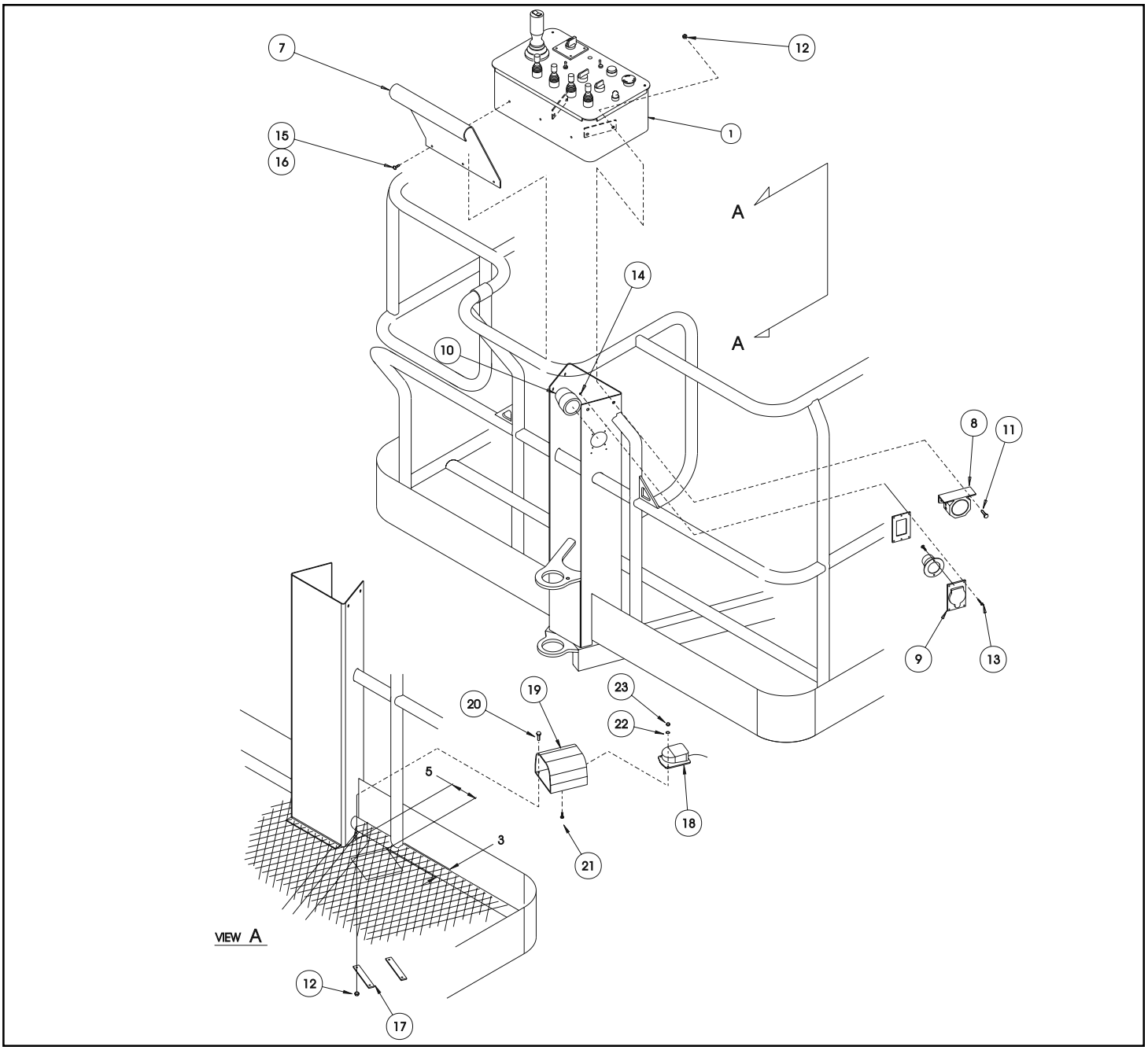
ITEM	PART	DESCRIPTION	QTY.
1	68489-001	CONTROL MOUNT	1
2	68550-000	MOTION CONTROL, SEVCON	1
3	68626-002	BUSS BAR	2
4	63947-008	NUT, HEX. REG. M8 X 1.25	4
5	11821-004	SCREW, BTN HD. 1/4-20 UNC X 1/2	4



CONTROLLER INSTALLATION
AB46 ELECTRIC
68339-001

ITEM	PART	DESCRIPTION	QTY.
1	68329-000	CONTROLLER ASSY - DOM. (ELEC)	1
7	68750-000	DECAL MOUNT	1
8	63778-001	ALARM	1
9	08942-001	FEMALE RECEPTACLE	1
10	29961-001	SEAL	1
11	11252-008	SCREW HHC 1/4-20 UNC X 1	4
12	11248-004	NUT HEX 1/4-20 UNC ESNA	8
13	11715-006	SCREW RD HD 6-32 UNC X 3/4	4
14	11248-047	NUT HEX 6-32 UNC ESNA	4
15	11709-006	SCREW RD HD 10-24 UNC X 3/4	3

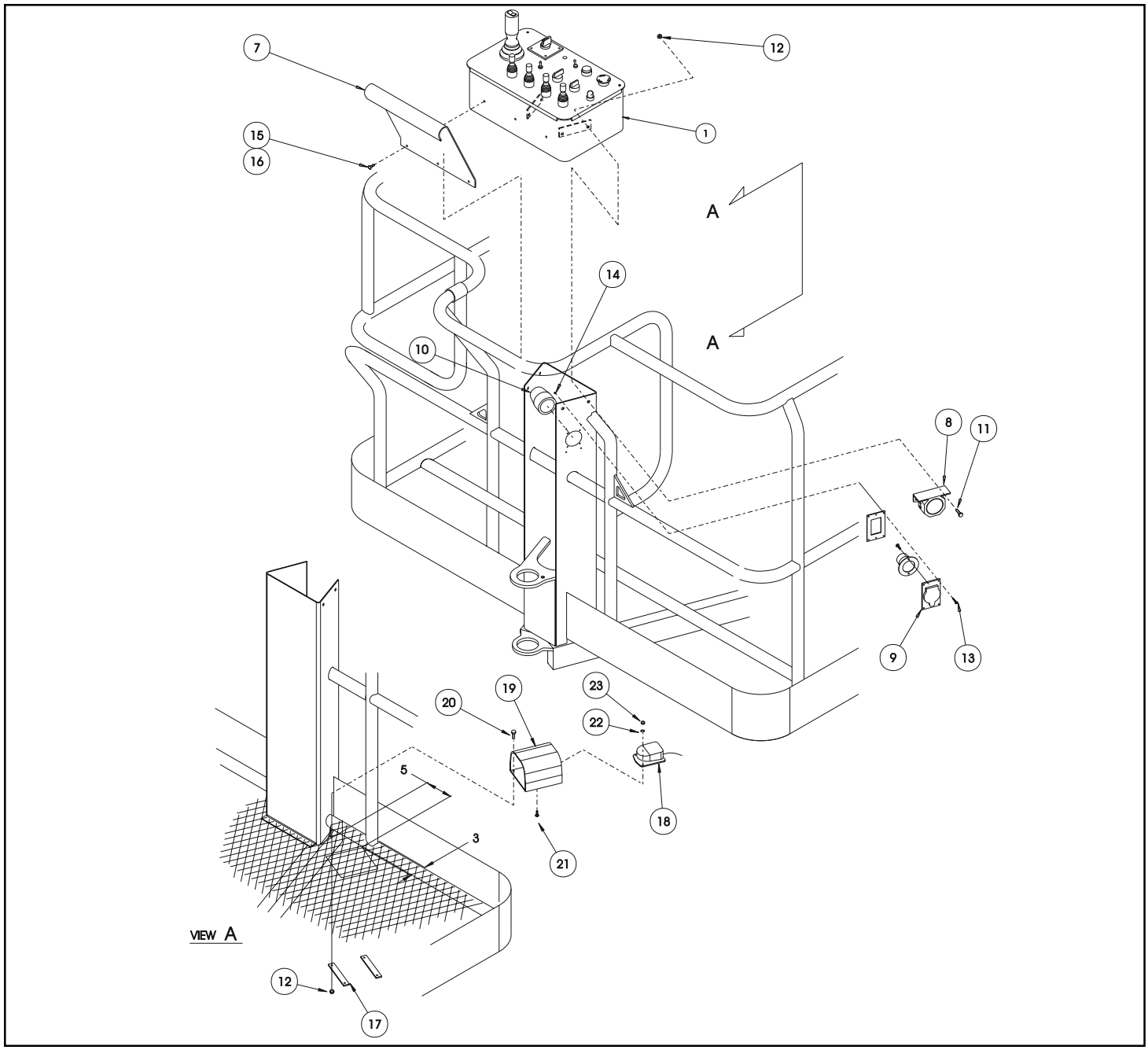
ITEM	PART	DESCRIPTION	QTY.
16	11248-003	NUT HEX 10-24 UNC ESNA	3
17	68820-000	RETAINING STRAP-FOOTSWITCH	2
18	63906-000	FOOT SWITCH CLPR	1
19	64479-000	SWITCH GUARD, FOOT	1
20	11252-012	SCREW HHC 1/4-20 UNC X 1 1/2	4
21	66695-006	SCREW FLAT HD 10-24 UNC X 3/4	2
22	13949-003	WASHER, #10 STAR, EXTERNAL TOOTH	2
23	11250-003	HEX NUT 10-24 UNC	2



CONTROLLER INSTALLATION
AB46 BI-ENERGY
68339-011

ITEM	PART	DESCRIPTION	QTY.
1	68329-010	CONTROLLER ASSY - DOM. (BI-ENERGY)	1
7	68750-000	DECAL MOUNT	1
8	63778-001	ALARM	1
9	08942-001	FEMALE RECEPTACLE	1
10	29961-001	SEAL	1
11	11252-008	SCREW HHC 1/4-20 UNC X 1	4
13	11715-006	SCREW RD HD 6-32 UNC X 3/4	4
12	11248-004	NUT HEX 1/4-20 UNC ESNA	8
14	11248-047	NUT HEX 6-32 UNC ESNA	4
15	11709-006	SCREW RD HD 10-24 UNC X 3/4	3

ITEM	PART	DESCRIPTION	QTY.
16	11248-003	NUT HEX 10-24 UNC ESNA	3
17	68820-000	RETAINING STRAP-FOOTSWITCH	2
18	63906-000	FOOT SWITCH CLPR	1
19	64479-000	SWITCH GUARD, FOOT	1
20	11252-012	SCREW HHC 1/4-20 UNC X 1 1/2	4
21	66695-006	SCREW FLAT HD 10-24 UNC X 3/4	2
22	13949-003	WASHER, #10 STAR, EXTERNAL TOOTH	2
23	11250-003	HEX NUT 10-24 UNC	2



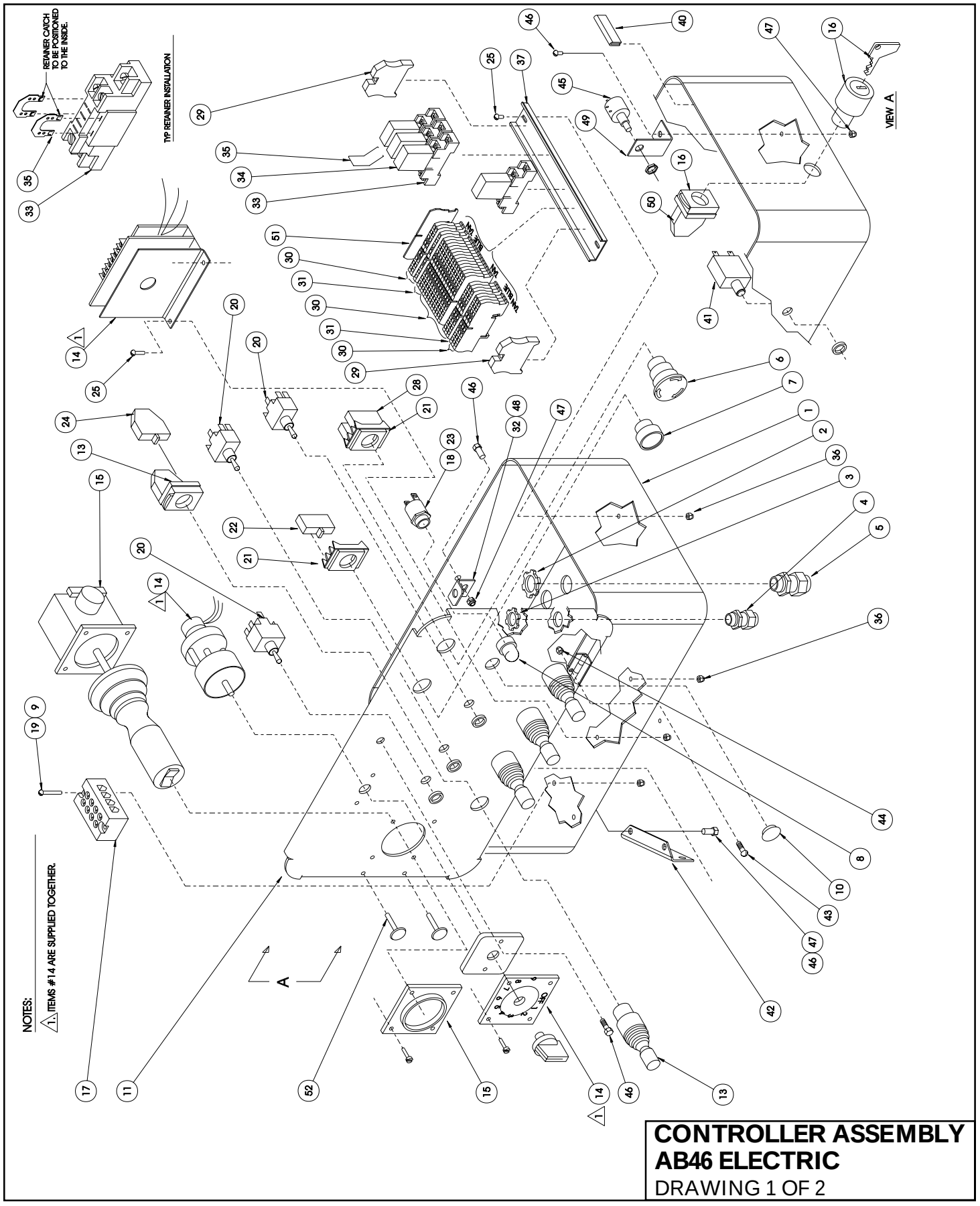
CONTROLLER ASSEMBLY-PLATFORM AB46 ELECTRIC

68329-000

ITEM	PART	DESCRIPTION	QTY.
1	68589-001	BOX, ENCLOSURE	1
2	29939-003	LOCKNUT 3/4" NPT	4
3	29939-002	LOCKNUT 1/2" NPT	1
4	29925-000	CONNECTOR CABLE 1/2" NPT	1
5	29925-001	CONNECTOR CABLE 3/4" NPT	4
6	64446-003	EMERGENCY STOP BUTTON	1
7	67654-000	PUSH BUTTON FLUSH (BLACK)	1
8	68595-001	LENS, RED	1
9	11249-003	NUT, HEX 10-32 ESNA	2
10	66516-005	HOLE PLUG ›11/16	1
11	68800-001	LID WELDMENT, CONTROLLER-ELEC.	1
13	68594-000	JOYSTICK - OPERATOR	4
14	68593-000	RHEOSTAT - CONTROLLER (48VOLT)	1
15	68592-000	JOYSTICK OEM/SEVCON (48V)	1
*	68592-005	ROCKER SWITCH BOOT	1
*	68592-006	MICRO SWITCH	2
*	63913-005	HANDLE HALVES (PAIR)	1
*	63913-001	HANDLE BOOT	1
*	68592-007	PC BOARD W/POT	1
*	68592-008	MICRO SWITCH	3
16	68807-000	KEYSWITCH & KEY	1
*	68807-010	KEY	1
17	68734-004	TERMINAL STRIP, 120V AC	1
18	68590-000	BASE INDICATOR (LAMP)	1
19	11826-012	SCREW RD HD 10-32 X 1-1/2	2
20	12798-004	TOGGLE SWITCH, MOMENTARY	3
21	64417-001	FLANGE MOUNT	2
22	64443-001	CONTACT BLOCK, N.O.	1
23	68591-000	LAMP T-2-1/2	1
24	66805-012	CONTACT BLOCK, N.O./N.C.	8
25	11715-003	SCREW RD HD 6-32 X 3/8	4
28	64443-002	CONTACT BLOCK N.C.	2
29	67660-006	TERMINAL END	2
30	68698-001	TERMINAL BLOCK (TAN)	18
31	68698-002	TERMINAL BLOCK (BLUE)	4
32	68799-000	ANGLE, CONTROLLER	1
33	67662-001	RELAY SOCKET	4
34	68756-001	RELAY, SPDT 48 VOLT	4
35	67662-005	RETAINING CLIP & WIRE	4
36	11250-001	NUT HEX 6-32	4

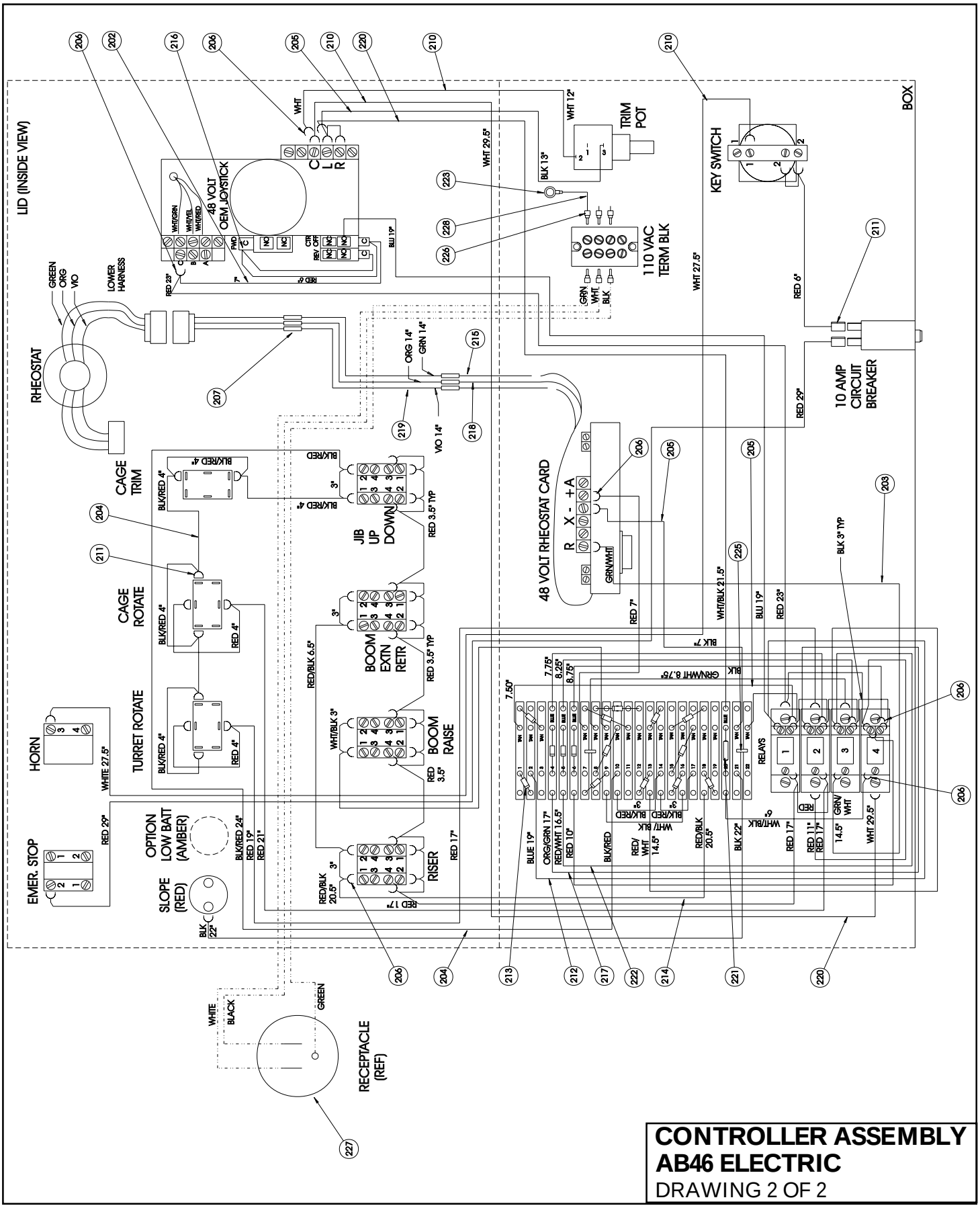
ITEM	PART	DESCRIPTION	QTY.
37	67893-003	MOUNTING RAIL, DIN 8-1/4"	1
40	68897-099	GASKET,BLACK RUBBER	3.25 FT
41	68582-010	CIRCUIT BREAKER 10 AMP	1
42	68767-000	BRACKET, UPPER CONTROLLER	2
43	11708-004	SCREW 8-32 X 1/2	2
44	11248-002	NUT, HEX ESNA 8-32 UNC	2
45	68769-000	POTENTIOMETER 10 TURN	1
46	11252-005	SCREW HHC GR5 1/4-20UNC X 5/8	6
47	11246-004	NUT HEX ESNA 1/4-20UNC	6
48	14252-004	NUT SERT 1/4-20	1
49	68804-000	BRACKET, POT MOUNT	1
50	068860-001	DOUBLE CONTACT BLOCK GE 2 N.C.	1
51	68698-004	END CAP, CONTACT BLOCK	1
202	29454-099	WIRE 16GA RED	21 FT
203	29482-099	WIRE 16GA GREEN/WHT	3 FT
204	68735-099	WIRE 16GA BLACK/RED	5 FT
205	29452-099	WIRE 16GA BLACK	9.3 FT
206	29610-006	TERM FORK 18-14GA #6	60
207	29620-002	BUTT CONNECTOR 18-14GA	6
210	29451-099	WIRE 16GA WHITE	5.8 FT
211	29931-003	CONN FEMALE PUSH .25 (16-14GA)	12
212	29450-099	WIRE 16GA BLFT4.1	
213	29825-002	DIODE 3 AMP 400V	15
214	29478-099	WIRE 16GA RED/BLACK	3.5 FT
215	29457-099	WIRE 16GA GREEN	1.5 FT
216	29616-001	CONN FEMALE PUSH .187 (16-14GA)	3
217	29360-099	WIRE 16GA ORANGE/GREEN	2 FT
218	29453-099	WIRE 16GA ORANGE	1.2 FT
219	29458-099	WIRE 16GA PURPLE	1.2 FT
220	29479-099	WIRE 16GA WHITE/BLACK	4 FT
221	68758-000	RESISTOR 5000 OHM	1
222	29483-099	WIRE 16GA RED/WHITE	2.5 FT
223	29601-039	RING TERM	1
225	68773-000	JUMPER	2
226	68814-000	PIN TERMINAL	6
227	REF	RECEPTACLE	1
228	29464-099	WIRE 14GA GREEN	.5 FT

*** Not Shown**



CONTROLLER ASSEMBLY
AB46 ELECTRIC
DRAWING 1 OF 2

Illustrated Parts Breakdown



CONTROLLER ASSEMBLY
AB46 ELECTRIC
DRAWING 2 OF 2

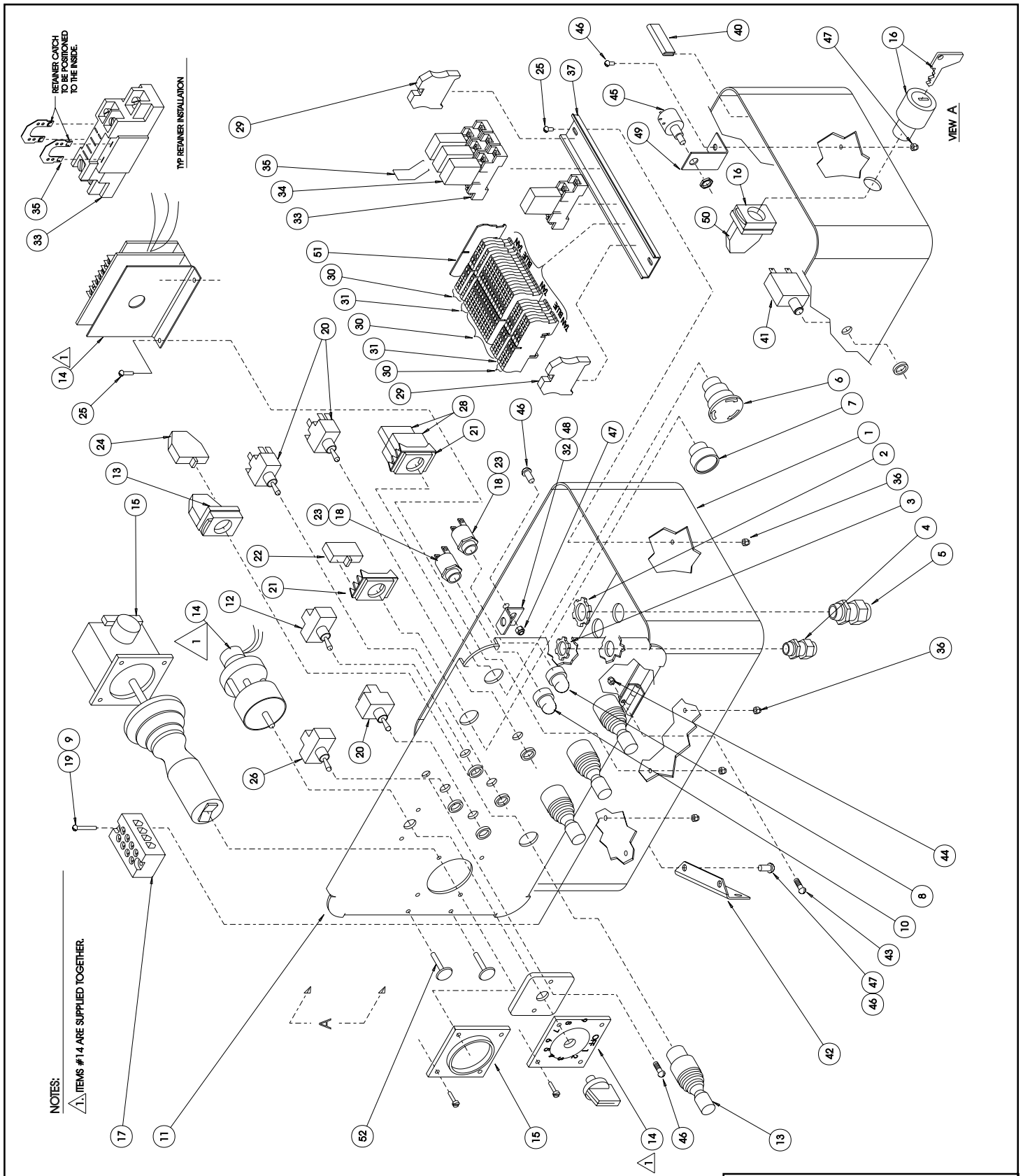
NOTES:

CONTROLLER ASSEMBLY - PLATFORM
AB46 BI-ENERGY
68329-010

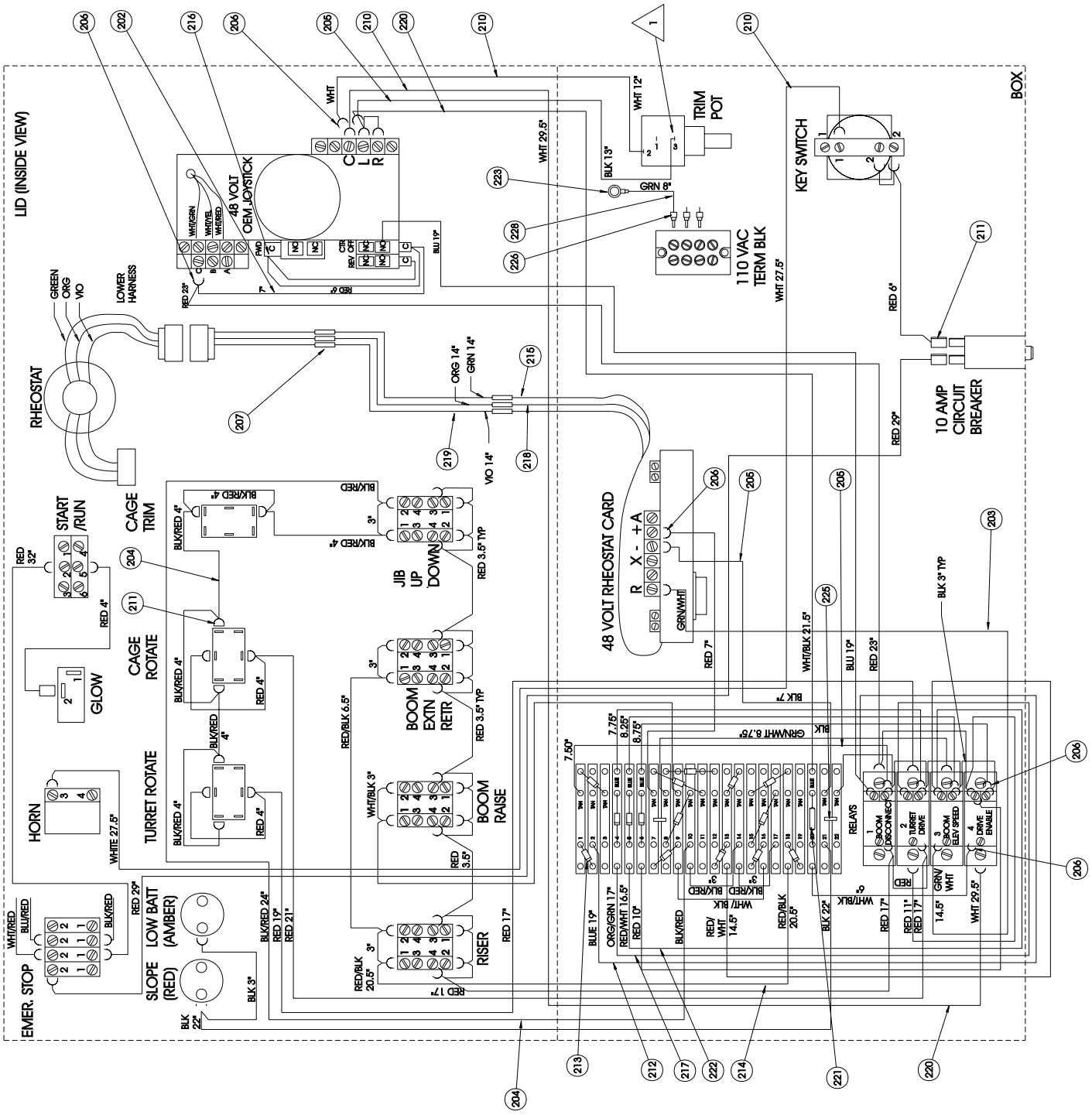
ITEM	PART	DESCRIPTION	QTY.
1	68589-001	BOX, ENCLOSURE	1
2	29939-003	LOCKNUT 3/4" NPT	4
3	29939-002	LOCKNUT 1/2" NPT	1
4	29925-000	CONNECTOR CABLE 1/2" NPT	1
5	29925-001	CONNECTOR CABLE 3/4" NPT	4
6	64446-003	EMERGENCY STOP BUTTON	1
7	67654-000	PUSH BUTTON FLUSH (BLACK)	1
8	68595-001	LENS, RED	1
9	11249-003	NUT, HEX 10-32 ESNA	2
10	68595-002	LENS, AMBER	1
11	68800-000	LID ASSY, CONTROLLER	1
12	12798-003	TOGGLE SWITCH, 2 POS, MOM	1
13	68594-000	JOYSTICK - OPERATOR	4
14	68593-000	RHEOSTAT - CONTROLLER (48VOLT)	1
15	68592-000	JOYSTICK OEM/SEVCON (48V)	1
*	68592-005	ROCKER SWITCH BOOT	1
*	68592-006	MICRO SWITCH	2
*	63913-005	HANDLE HALVES (PAIR)	1
*	63913-001	HANDLE BOOT	1
*	68592-007	PC BOARD W/POT	1
16	68807-000	KEYSWITCH & KEY	1
*	68807-010	KEY	1
17	68734-004	TERMINAL STRIP, 120V AC	1
18	68590-000	BASE INDICATOR (LAMP)	2
19	11826-012	SCREW RD HD 10-32 X 1-1/2	2
20	12798-004	TOGGLE SWITCH, MOMENTARY	3
21	64417-001	FLANGE MOUNT	2
22	64443-001	CONTACT BLOCK, N.O.	1
23	68591-000	LAMP T-2-1/2	2
24	66805-012	CONTACT BLOCK, N.O./N.C.	8
25	11715-003	SCREW RD HD 6-32 X 3/8	4
26	68986-000	TOGLE SWCH, 3 POS (HOLD, HOLD, MOM)	1
28	64443-002	CONTACT BLOCK N.C.	2
29	67660-006	TERMINAL END	2
30	68698-001	TERMINAL BLOCK (TAN)	18
31	68698-002	TERMINAL BLOCK (BLUE)	4
32	68799-000	ANGLE, CONTROLLER	1
33	67662-001	RELAY SOCKET	4
34	68756-001	RELAY, SPDT 48 VOLT	4
35	67662-005	RETAINING CLIP & WIRE	4
36	11250-001	NUT HEX 6-32	4

ITEM	PART	DESCRIPTION	QTY.
37	67893-003	MOUNTING RAIL, DIN 8-1/4"	1
40	68897-099	GASKET,BLACK RUBBER	3.25 FT
41	68582-010	CIRCUIT BREAKER 10 AMP	1
42	68767-000	BRACKET, UPPER CONTROLLER	2
43	11708-004	SCREW 8-32 X 1/2	2
44	11248-002	NUT, HEX ESNA 8-32 UNC	2
45	68769-000	POTENTIOMETER 10 TURN	1
46	11825-006	SCREW RD HD 1/4-20UNC X 3/4	6
47	11246-004	NUT HEX ESNA 1/4-20UNC	6
48	14252-004	NUT SERT 1/4-20	1
49	68804-000	BRACKET, POT MOUNT	1
50	068860-001	DOUBLE CONTACT BLOCK GE 2 N.C.	1
51	68698-004	END CAP, CONTACT BLOCK	1
52	10080-006	CLIP, TREE	2
202	29454-099	WIRE 16GA RED | FT	21
203	29482-099	WIRE 16GA GREEN/WHT	3 FT
204	68735-099	WIRE 16GA BLACK/RED	5 FT
205	29452-099	WIRE 16GA BLACK	9.3 FT
206	29610-006	TERM FORK 18-14GA #6	63
207	29620-002	BUTT CONNECTOR 18-14GA	6
210	29451-099	WIRE 16GA WHITE	5.8 FT
211	29931-003	CONN FEMALE PUSH .25 (16-14GA)	13
212	29450-099	WIRE 16GA BLUE	4.1 FT
213	29825-002	DIODE 3 AMP 400V	15
214	29478-099	WIRE 16GA RED/BLACK	3.5 FT
215	29457-099	WIRE 16GA GREEN	1.5 FT
216	29616-001	CONN FEMALE PUSH .187 (16-14GA)	3
217	29360-099	WIRE 16GA ORANGE/GREEN	2 FT
218	29453-099	WIRE 16GA ORANGE	1.2 FT
219	29458-099	WIRE 16GA PURPLE	1.2 FT
220	29479-099	WIRE 16GA WHITE/BLACK	4 FT
221	68758-000	RESISTOR 5000 OHM	1
222	29483-099	WIRE 16GA RED/WHITE	2.5 FT
223	29601-039	RING TERM	1
225	68773-000	JUMPER	2
226	68814-000	PIN TERMINAL	6
228	29464-099	WIRE 14GA GREEN	.5 FT

*** Not Shown**



CONTROLLER ASSEMBLY
AB46 BI-ENERGY
DRAWING 1 OF 2

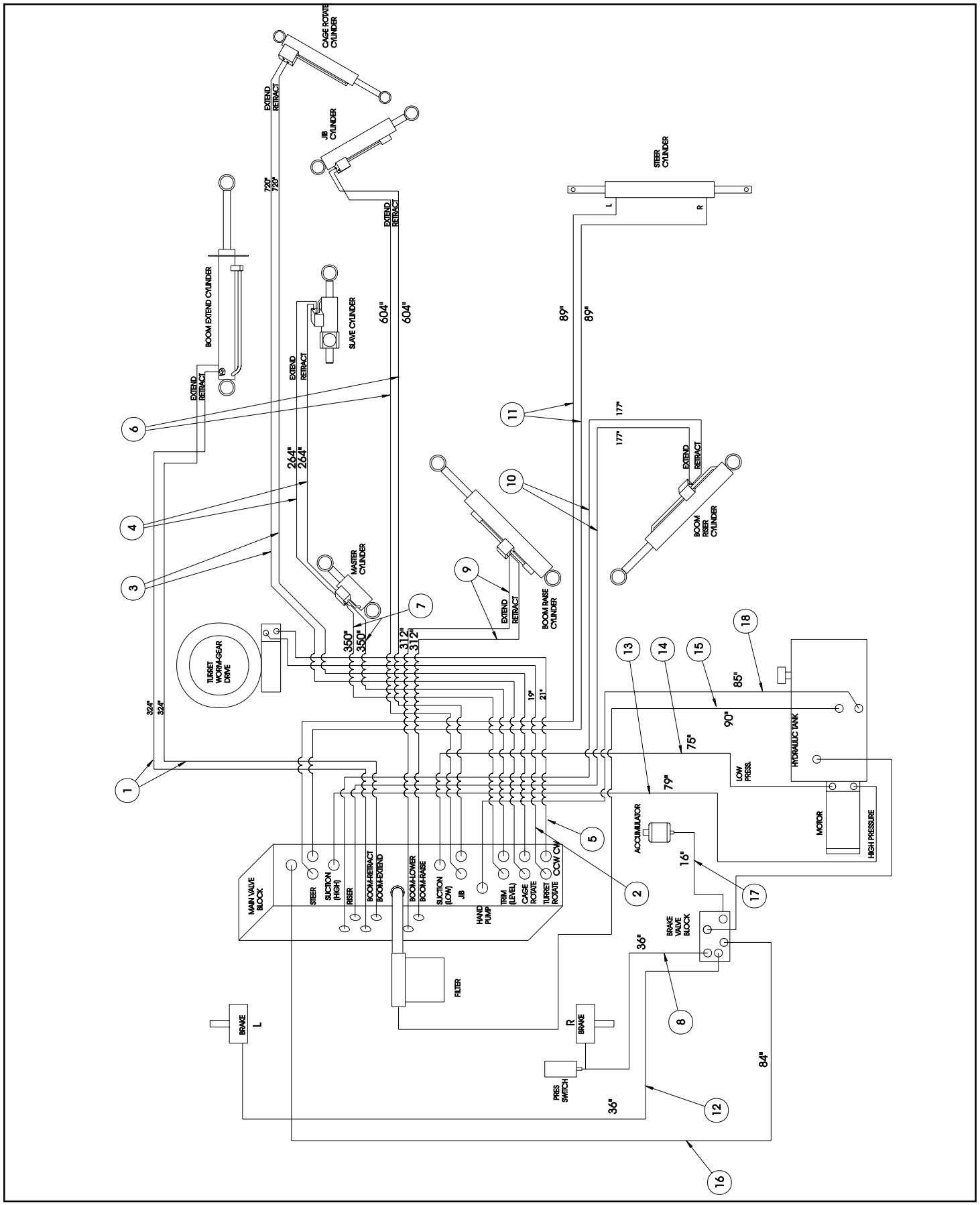


CONTROLLER ASSEMBLY
AB46 BI-ENERGY
DRAWING 2 OF 2

NOTES:

HOSE KIT
AB46 ELECTRIC
68336-000

ITEM	PART	DESCRIPTION	QTY.
1	68737-324	1/4 HOSE ASSY X 324" 4FJX-4FJX	2
2	68736-019	3/16 HOSE ASSY X 19" 4FJX-4FJX	1
3	68737-720	1/4 HOSE ASSY X 720" 4FJX-4FJX	2
4	68809-264	1/4 HOSE ASSY X 264" 4FJX-4FJX	2
5	68736-021	3/16 HOSE ASSY X 21" 4FJX-4FJX	1
6	68736-604	3/16 HOSE ASSY X 604" 4FJX-4FJX	2
7	68736-350	3/16 HOSE ASSY X 350" 4FJX-4FJX	2
8	68763-036	1/4 HOSE ASSY X 36" 6FJX-4FJX	1
9	68737-312	1/4 HOSE ASSY X 312" 4FJX-4FJX	2
10	68737-177	1/4 HOSE ASSY X 177" 4FJX-4FJX	2
11	68753-089	1/4 HOSE ASSY X 89" 4FJX-6FJX 90°	2
12	68741-036	1/4 HOSE ASSY X 36" 6FJX-6FJX	1
13	68741-079	1/4 HOSE ASSY X 79" 6FJX-6FJX	1
14	68737-075	1/4 HOSE ASSY X 75" 4FJX-4FJX	1
15	68740-090	1/2 HOSE ASSY X 90" 10FJX-10FJX	1
16	68753-084	1/4 HOSE ASSY X 84" 4FJX-6FJX 90°	1
17	68763-016	1/4 HOSE ASSY X 16" 6FJX-4FJX	1
18	68741-085	1/4 HOSE ASSY X 85" 6FJX-6FJX	1


CAGE ROTATE CYLINDER
EXTEND
RETRACT
JIB CYLINDER
720"
720"
EXTEND
RETRACT
STEER CYLINDER
L
R
BOOM EXTEND CYLINDER
EXTEND
RETRACT
SLAVE CYLINDER
604"
604"
89"
89"
EXTEND
RETRACT
264"
264"
177"
177"
EXTEND
RETRACT
BOOM RISER CYLINDER
MASTER CYLINDER
EXTEND
RETRACT
BOOM RAISE CYLINDER
350"
350"
312"
312"
TURRET WORM-GEAR DRIVE
324"
324"
19"
21"
85"
90"
75"
79"
HYDRAULIC TANK
LOW PRESS.
MOTOR
HIGH PRESSURE
ACCUMULATOR
16"
MAIN VALVE BLOCK
STEER
SUCTION (HIGH)
RISER
BOOM-RETRACT
BOOM-EXTEND
BOOM-LOWER
BOOM-RAISE
SUCTION (LOW)
JIB
HAND PUMP
TRIM (LEVEL)
CAGE ROTATE
TURRET ROTATE
CCW
CW
BRAKE VALVE BLOCK
36"
FILTER
BRAKE
L
R
BRAKE
PRES SWITCH
36"
84"
1
2
3
4
5
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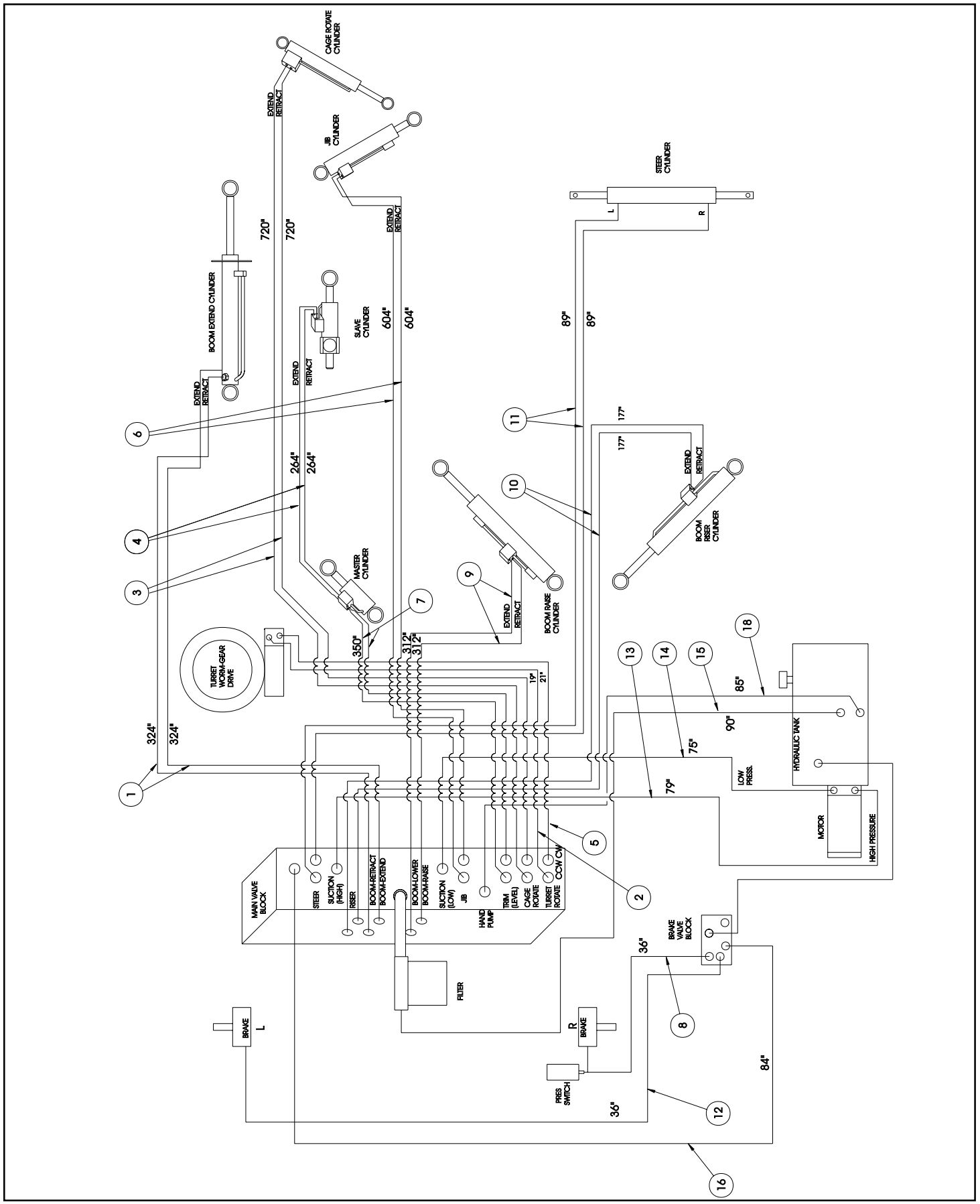
18

HOSE KIT
AB46 BI-ENERGY
68336-002

ITEM	PART	DESCRIPTION	QTY.
1	68737-324	1/4 HOSE ASSY X 324" 4FJX-4FJX	2
2	68736-019	3/16 HOSE ASSY X 19" 4FJX-4FJX	1
3	68737-720	1/4 HOSE ASSY X 720" 4FJX-4FJX	2
4	68809-264	1/4 HOSE ASSY X 264" 4FJX-4FJX	2
5	68736-021	3/16 HOSE ASSY X 21" 4FJX-4FJX	1
6	68736-604	3/16 HOSE ASSY X 604" 4FJX-4FJX	2
7	68736-350	3/16 HOSE ASSY X 350" 4FJX-4FJX	2
8	68763-036	1/4 HOSE ASSY X 36" 6FJX-4FJX	1
9	68737-312	1/4 HOSE ASSY X 312" 4FJX-4FJX	2
10	68737-177	1/4 HOSE ASSY X 177" 4FJX-4FJX	2
11	68753-089	1/4 HOSE ASSY X 89" 4FJX-6FJX 90°	2
12	68741-036	1/4 HOSE ASSY X 36" 6FJX-6FJX	1
13	68741-079	1/4 HOSE ASSY X 79" 6FJX-6FJX	1
14	68737-075	1/4 HOSE ASSY X 75" 4FJX-4FJX	1
15	68740-090	1/2 HOSE ASSY X 90" 10FJX-10FJX	1
16	68753-084	1/4 HOSE ASSY X 84" 4FJX-6FJX 90°	1
18	68741-085	1/4 HOSE ASSY X 85" 6FJX-6FJX	1


CAGE ROTATE CYLINDER
EXTEND
RETRACT
JIB CYLINDER
STEER CYLINDER
L
R
720"
720"
89"
89"
BOOM EXTEND CYLINDER
SLAVE CYLINDER
604"
604"
264"
264"
177"
177"
MASTER CYLINDER
BOOM RISER CYLINDER
BOOM RAISE CYLINDER
350"
312"
312"
19"
21"
85"
90"
75"
79"
324"
324"
TURRET WORM-GEAR DRIVE
HYDRAULIC TANK
LOW PRESS.
MOTOR
HIGH PRESSURE
MAIN VALVE BLOCK
STEER
SUCTION (HIGH)
RISER
BOOM-RETRACT
BOOM-EXTEND
BOOM-LOWER
BOOM-RAISE
SUCTION (LOW)
JIB
HAND PUMP
TRIM (LEVEL)
CAGE ROTATE
TURRET ROTATE
CCW
CW
BRAKE VALVE BLOCK
FILTER
BRAKE
L
R
PRES SWITCH
36"
36"
84"
1
2
3
4
5
6
7
8
9
10
11
12
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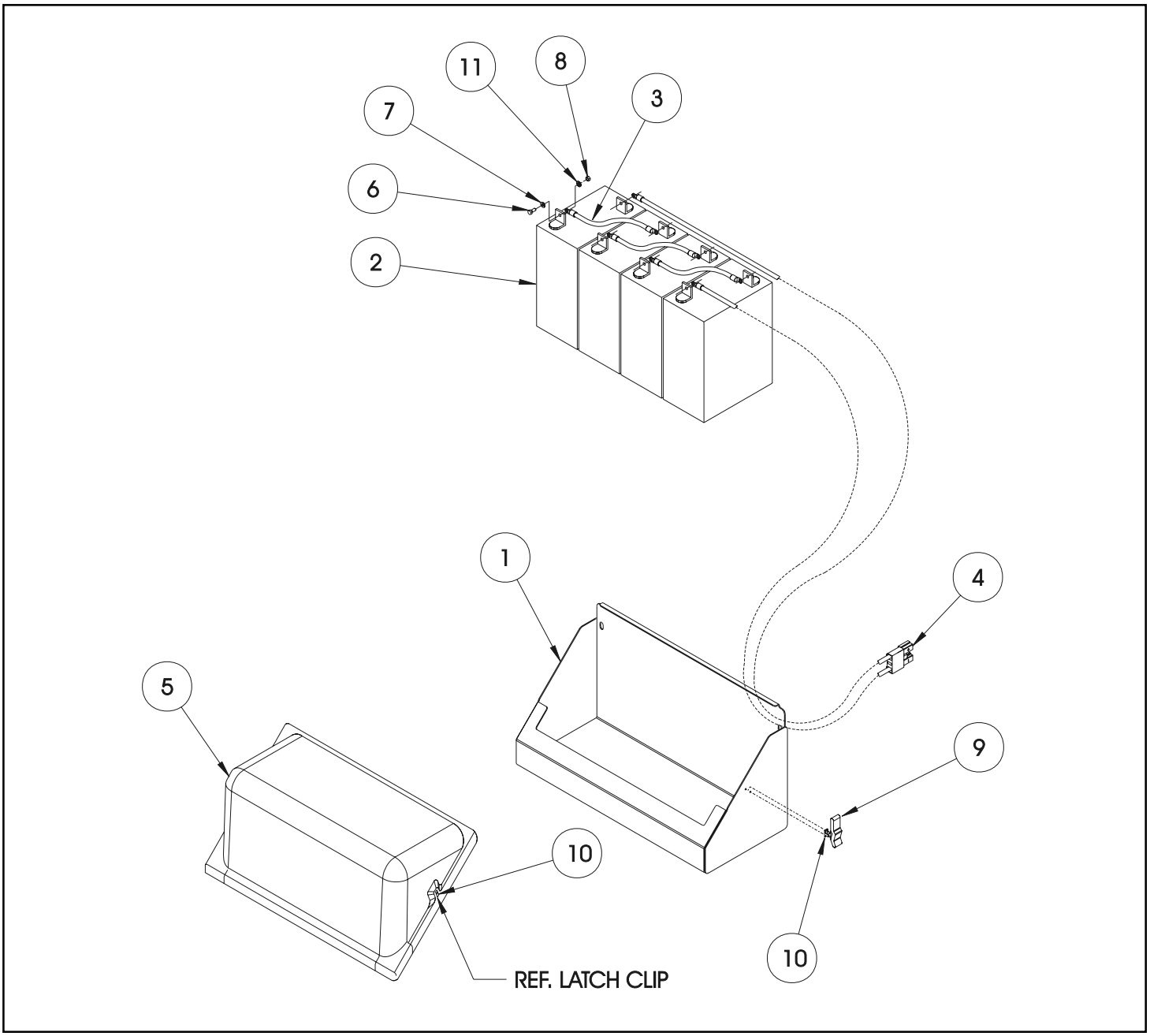
14
15
16
18

BATTERY MODULE ASSEMBLY
AB46

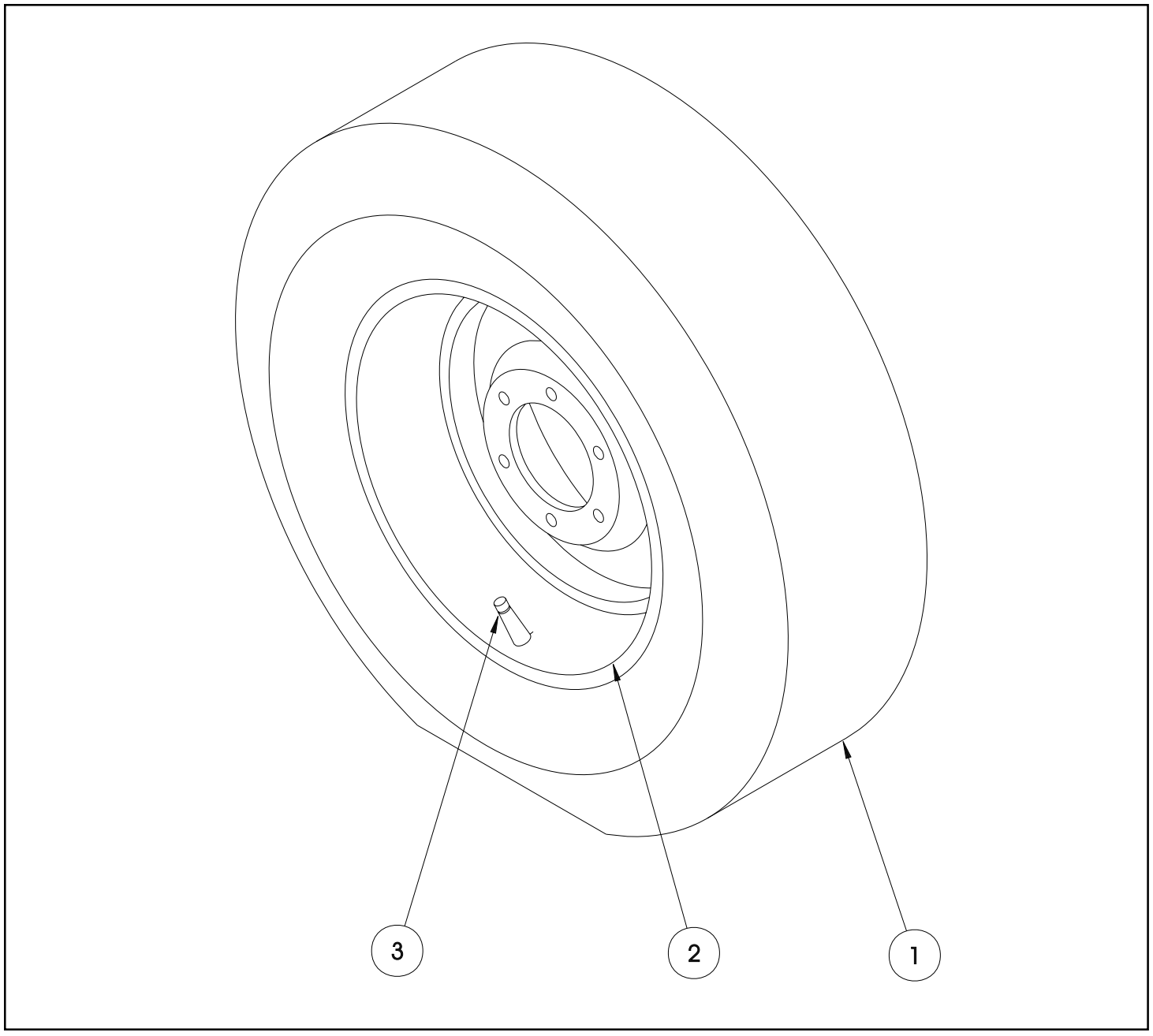
68331-001,002

ITEM	PART	DESCRIPTION	QTY.
1	68726-000	BATTERY TRAY WELDMENT	1
2	68568-000	BATTERY, 6 VOLT 350 AMP HR.	4
3	68334-001	CABLE ASSEMBLY	3
4	68332-002	CABLE ASSEMBLY	1
5	68659-000	COVER, BATTERY TRAY	1
6	11253-007	SCREW, HHC 5/16-18 UNC X 7/8	8
7	14996-005	WASHER, 5/16 DIA. S.A.E.	8
8	11250-005	NUT,HEX 5/16-18 UNC	8
9	68757-000	LATCH, SOUTHCO	2
10	26552-005	POP RIVET,	8
11	11238-005	WASHER, SPLIT LOCK 5/16	8



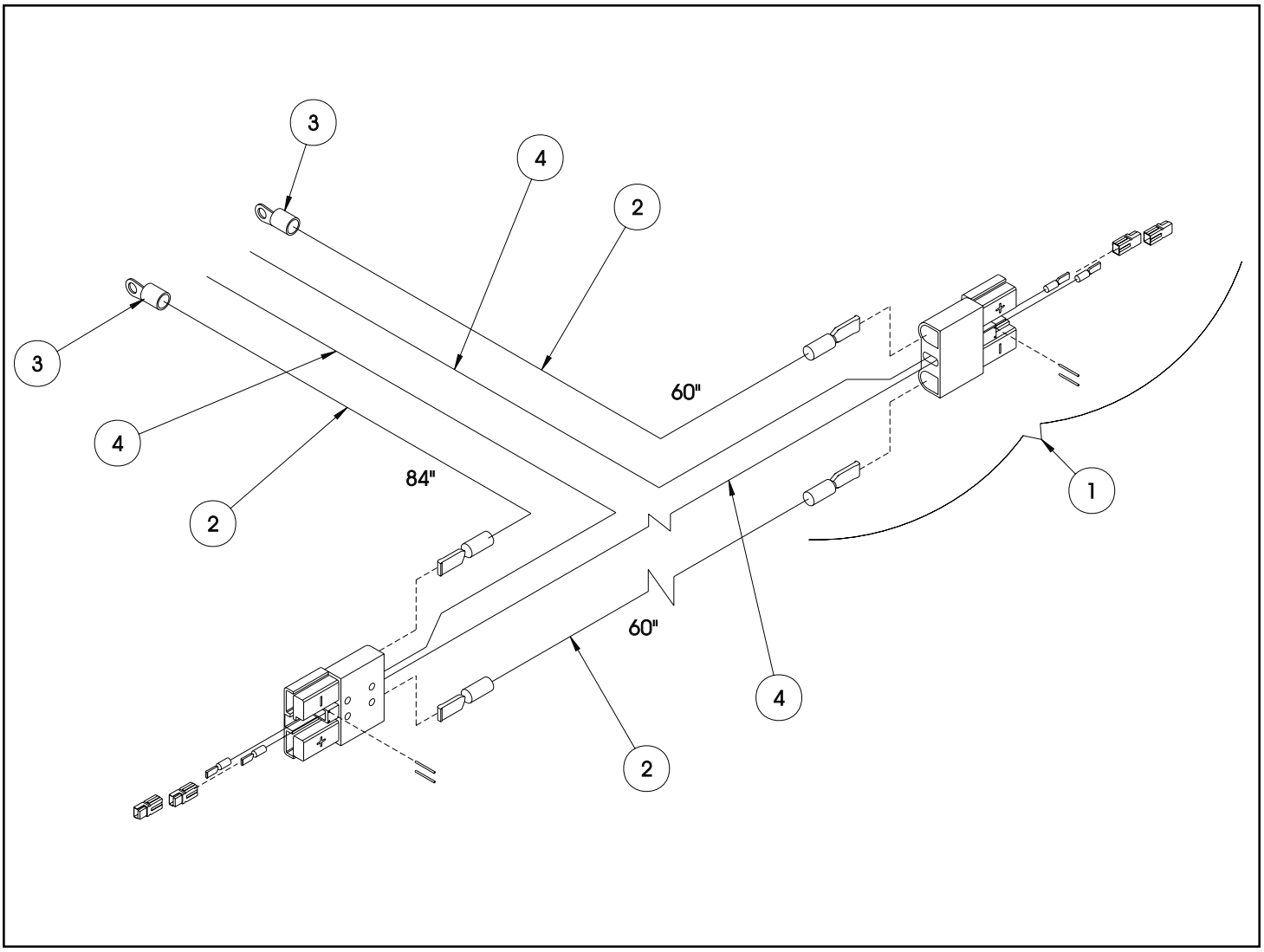
TIRE & WHEEL ASSEMBLY
AB46
68327-000

ITEM	PART	DESCRIPTION	QTY.
1	68555-000	TIRE 16.5 X 9.50 10 PLY	1
2	67609-000	WHEEL 16.5 X 8.25, 6 HOLE ON 6" B.C.	1
3	12282-001	VALVE STEM	1



CABLE ASSEMBLY
AB46
68333-000

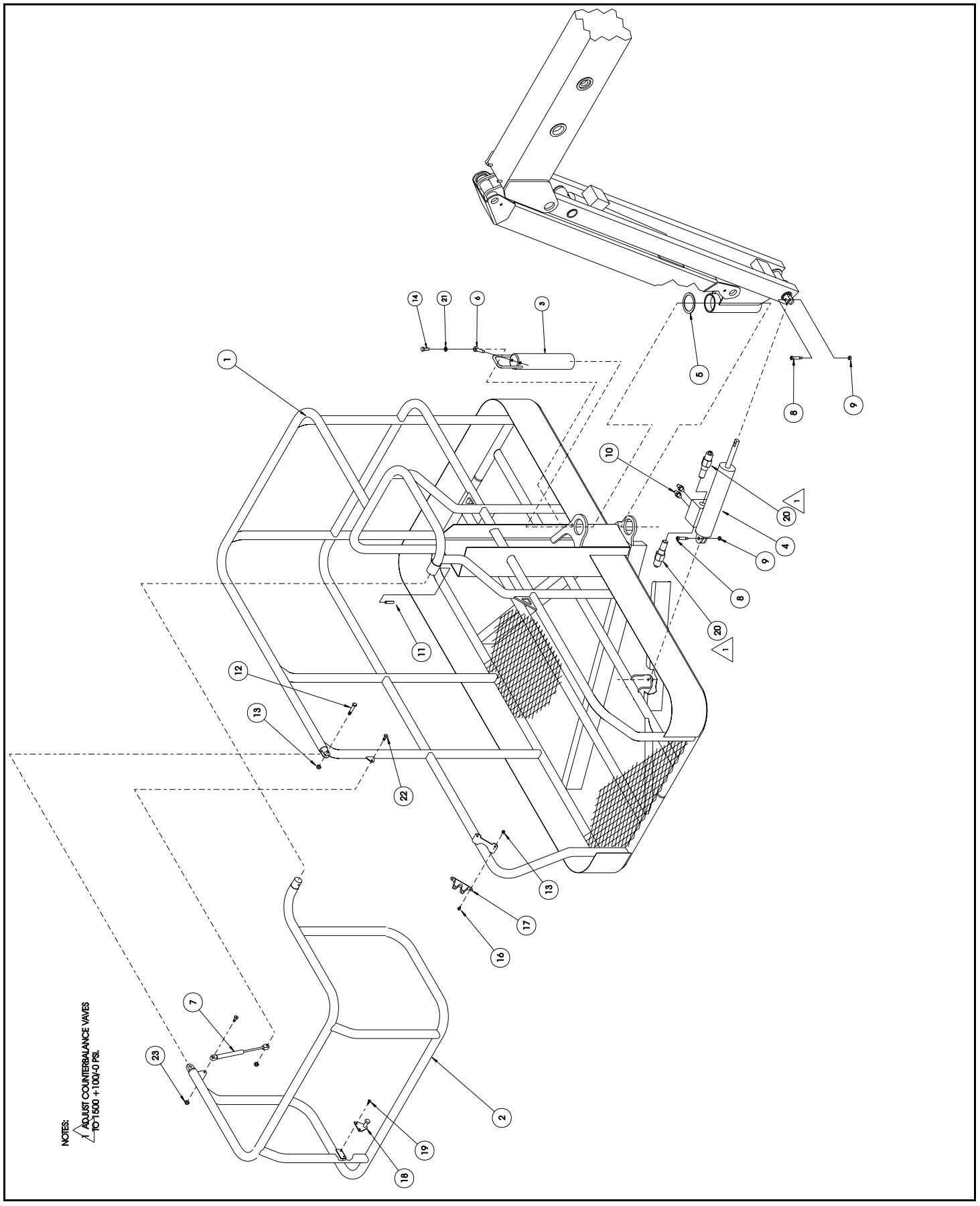
ITEM	PART	DESCRIPTION	QTY.
1	29902-001	CONNECTOR, ANDERSON (SBX175AMP)	2
2	68580-099	CABLE, 1/0 A.W.G. WELDING	17 FT
3	29602-024	CONNECTOR, RING 1/0 A.W.G. X Ø 5/16	2
4	29453-099	WIRE, 16 GA. ORANGE	18 FT



NOTES:

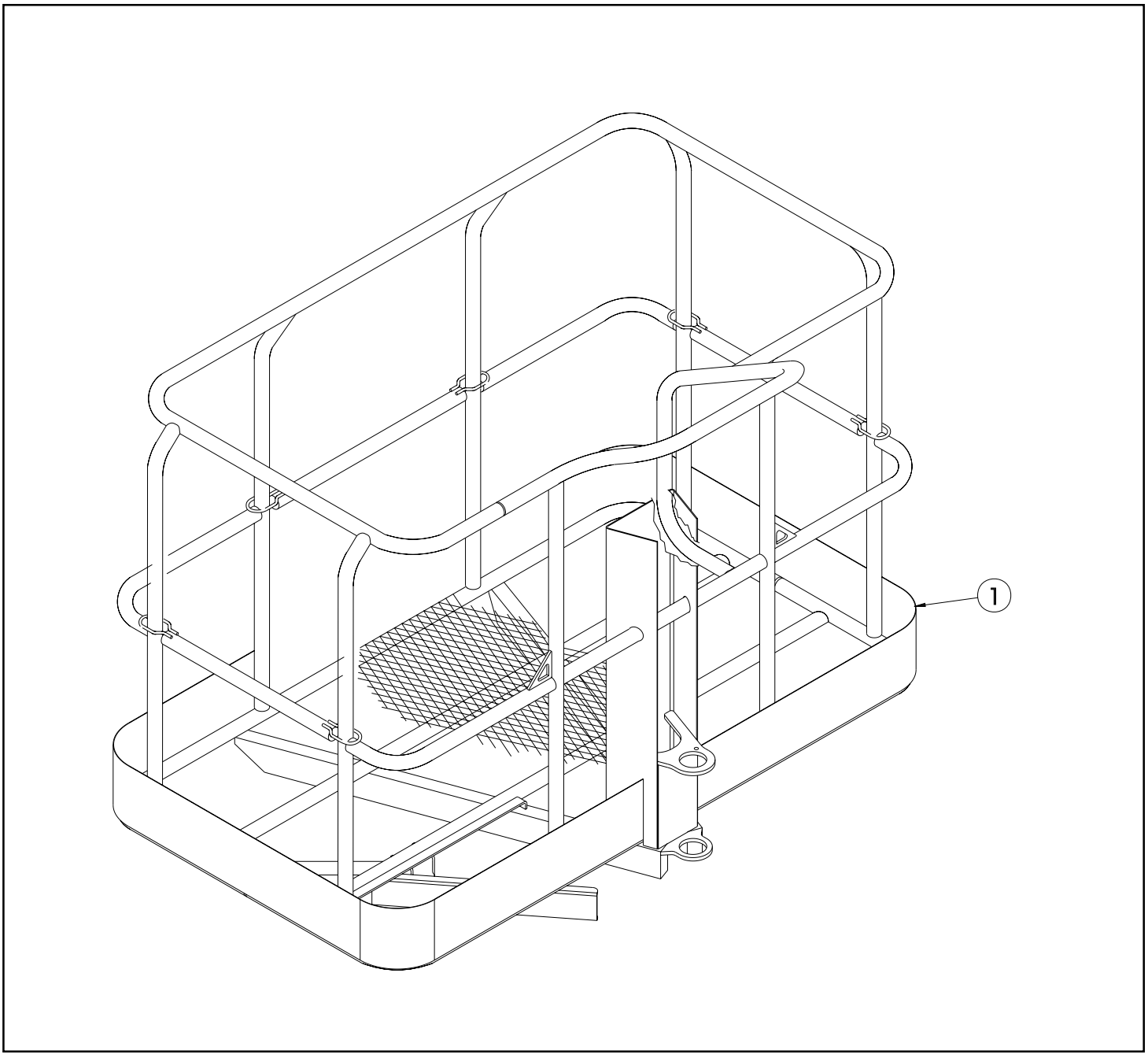
CAGE "B" ASSEMBLY
AB46
68325-001

ITEM	PART	DESCRIPTION	QTY.
1	68500-001	CAGE “B” WELDMENT	1
2	68532-000	LIFT-UP GATE WELDMENT	1
3	68775-000	BASKET PIN WELDMENT	1
4	68457-000	CYLINDER, CAGE ROTATION	1
*	68457-010	SEAL KIT, CAGE ROTATE	1
5	68651-000	THRUST WASHER G32DU (MODIFIED)	1
6	65214-000	PIN RETAINER	1
7	63650-012	GAS SPRING	1
8	15936-010	SHOULDER BOLT	2
9	11248-005	LOCKNUT	2
10	11939-004	FITTING, 4MP-4MJ	2
11	11737-012	ROLLPIN 1/4" X 1-1/2"	1
12	11703-008	SCREW, HHC 1/4-20 X 1-1/2	1
13	11248-004	NUT HEX 1/4-20	3
14	11254-008	SCREW HHC 3/8-16 X 1	1
16	11821-005	SCREW BUTTON HD 1/4-20 UNC X 5/8	2
17	68277-000	LATCH ROTARY	1
18	68806-000	STRIKER WELDMENT	1
19	11709-004	SCREW RND HD 10-24 UNC X 1/2	2
20	68778-000	VALVE COUNTERBALANCE (550 PSI)	2
21	11238-006	LOCKWASHER 3/8 SPLIT	1
22	15936-005	SHOULDER BOLT 3/8 X 5/8 LG	2
23	11248-005	NUT, ESNA 5/16-18	2


NOTES:
1 ADJUST COUNTERBALANCE VAVES TO 1500 +100/-0 PSI.

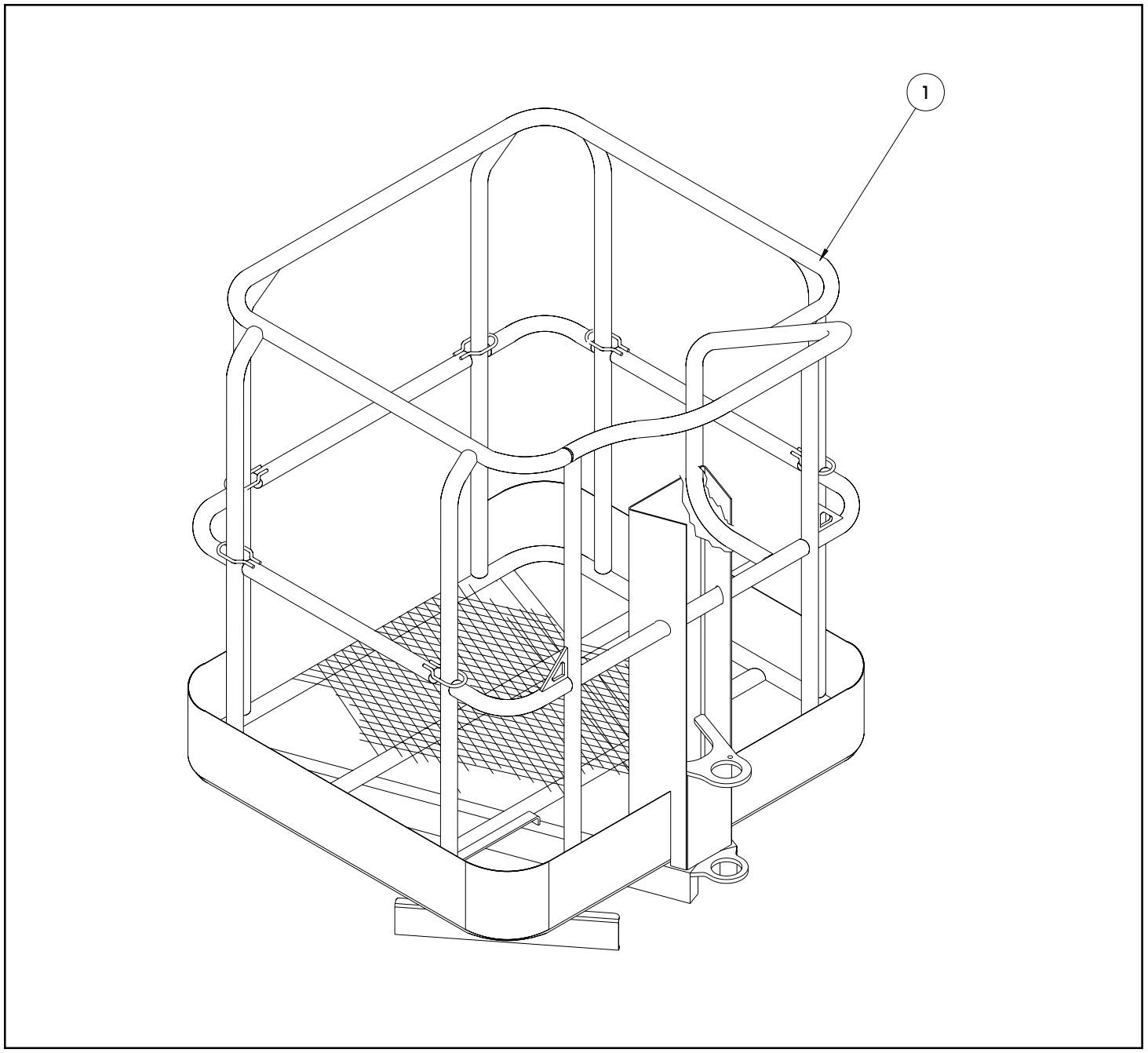
CAGE "A"
AB46
68500-000

ITEM	PART	DESCRIPTION	QTY.
1	68500-000	CAGE “A” WELDMENT	1



4 FT. CAGE
AB46
68500-003

ITEM	PART	DESCRIPTION	QTY.
1	68500-003	CAGE WELDMENT 4 FT	1



LABEL KIT, AB46 ELECTRIC

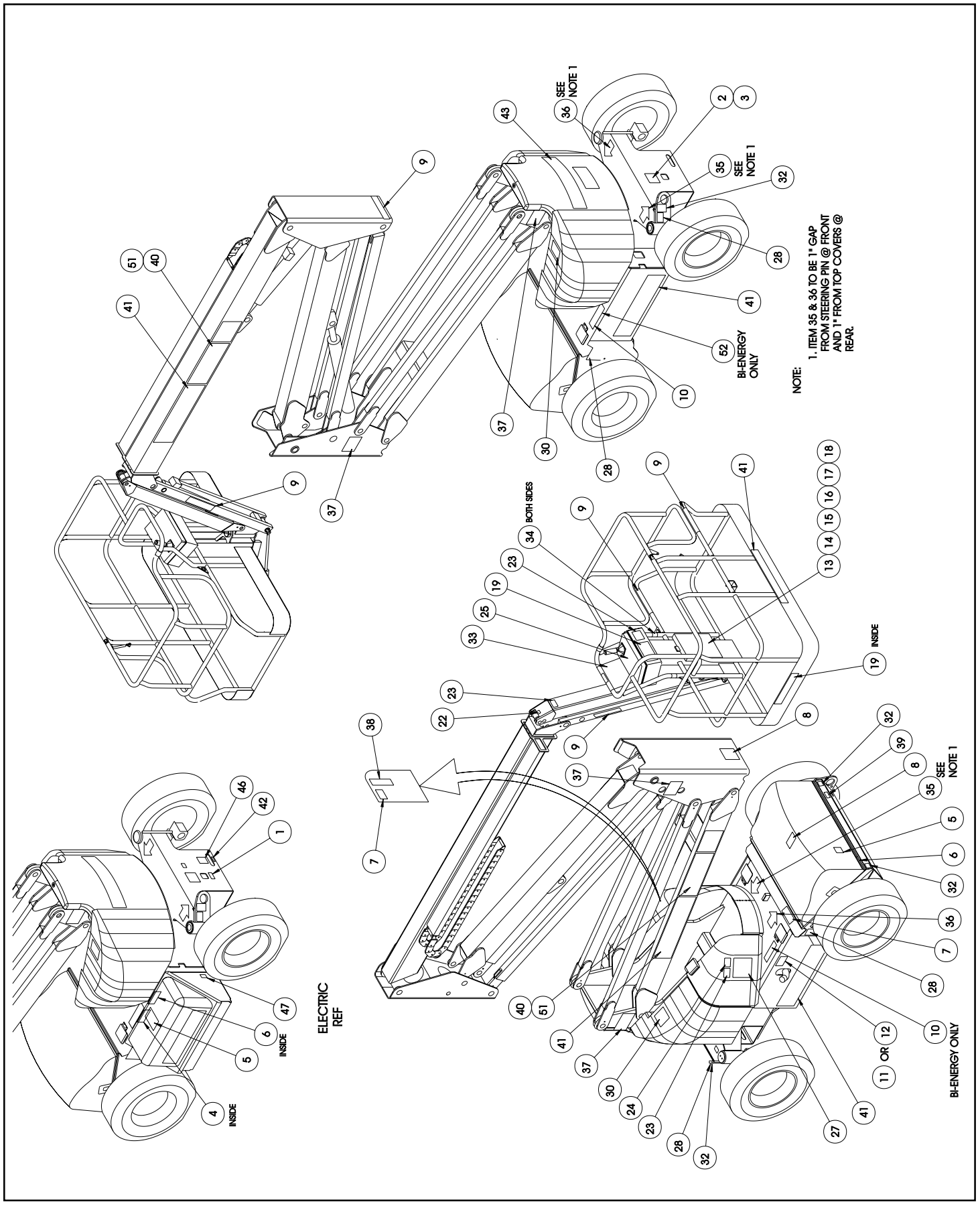
68335-000

ITEM	PART	DESCRIPTION	QTY.
1	066522-000	LABEL BATTERY CHARGER	1
2	061205-002	NAME PLATE / BOOM	1
3	065368-000	TACK	4
4	062562-002	LABEL BATTERY 120LBS EA	2
5	066552-000	LABEL EXPLOSIVE GAS	2
6	005221-000	LABEL BATTERY LEVEL	2
7	066555-000	LABEL LIMIT SWITCH	2
8	066556-000	LABEL PINCH POINT	2
9	066553-001	LABEL PINCH POINT	5
10	060197-000	LABEL HYDRAULIC FLUID	1
13	010076-000	MANUAL CASE	1
14	010076-001	LABEL ATTENTION	1
15	068342-000	USER MANUAL DOM ELEC	1
16	060565-000	ANSI MANUAL	1
17	011248-004	NUT HEX ESNA 1/4-20UNC	4
18	011252-008	SCREW HHC X 1/4-20 X 1	4
19	062557-012	MAX LOAD 500 Lb / 225 Kg	2
22	064444-000	LABEL USA	1
23	066554-000	LABEL BEFORE OPERATION	3
24	068641-001	LABEL WARNING BRAKE RELEASE-ELEC	1
25	068586-011	LABEL UPPER CONTROLS ELEC.	1
27	068587-010	LABEL LOWER CONTROLS	1
28	066562-001	TIRE PSI	4
30	066568-000	LABEL CRUSHING HAZARD	2
32	068632-000	LABEL HOLD DOWN	4
33	068633-000	LABEL READ & UNDERSTAND	1
34	068635-000	LABEL HARNESS POINT	2
35	068637-000	LABEL ARROW YELLOW	2
36	068637-001	LABEL ARROW ORANGE	2
37	066553-004	LABEL PINCH POINT	4
38	068638-000	LABEL EMERGENCY LOWER	1
39	068639-000	LABEL POWER TO PLATFORM	1
40	068634-001	LABEL AB46	2
41	061683-005	LABEL UPRIGHT	5
42	068640-000	LABEL POWER TO CHARGER	1
43	061683-007	LABEL UPRIGHT	1
46	068636-000	LABEL EXPLOSIVE GAS/CHARGER INSTL	1
47	068631-000	LABEL BATTERY DISCONNECT	2
48	068649-000	LABEL, CAUTION - RAISE JIB BOOM	1

LABEL KIT, AB46 BI-ENERGY

68335-003

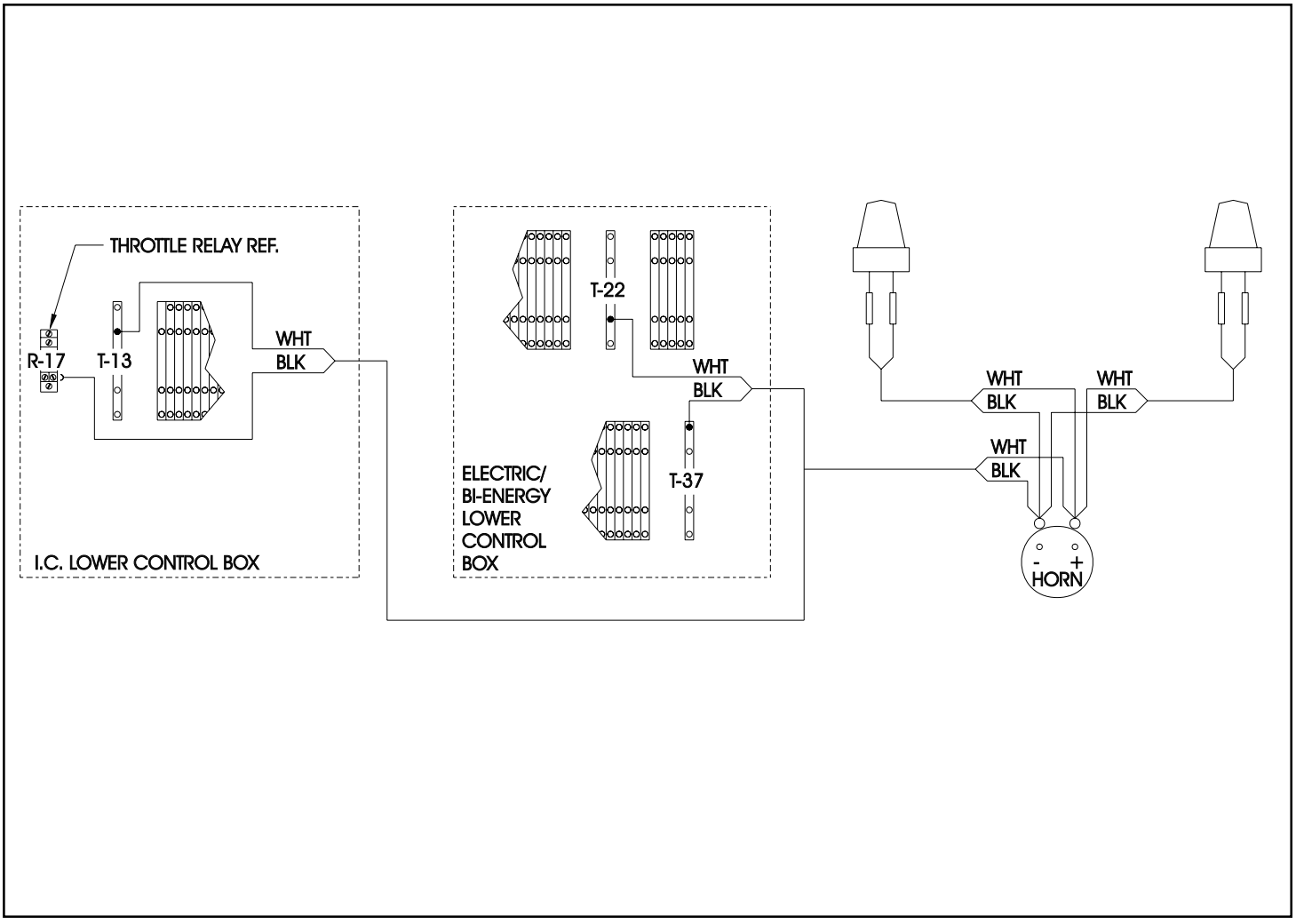
ITEM	PART	DESCRIPTION	QTY.
1	066522-000	LABEL BATTERY CHARGER	1
2	061205-002	NAME PLATE / BOOM	1
3	065368-000	TACK	4
4	062562-002	LABEL BATTERY 120LBS EA	2
5	066552-000	LABEL EXPLOSIVE GAS	3
6	005221-000	LABEL BATTERY LEVEL	3
7	066555-000	LABEL LIMIT SWITCH	2
8	066556-000	LABEL PINCH POINT	2
9	066553-001	LABEL PINCH POINT	5
10	060197-000	LABEL HYDRAULIC FLUID	1
13	010076-000	MANUAL CASE	1
14	010076-001	LABEL ATTENTION	1
15	068342-002	USER MANUAL DOM BI	1
16	060565-000	ANSI MANUAL	1
17	011248-004	NUT HEX ESNA 1/4-20UNC	4
18	011252-008	SCREW HHC X 1/4-20 X 1	4
19	062557-012	MAX LOAD 500 Lb / 225 Kg	2
22	064444-000	LABEL USA	1
23	066554-000	LABEL BEFORE OPERATION	3
24	068641-000	LABEL WARNING BRAKE RELEASE-I/C	1
25	068586-012	LABEL UPPER CONTROLS BI	1
27	068587-011	LABEL LOWER CONTROLS	1
28	066562-001	TIRE PSI	4
30	066568-000	LABEL CRUSHING HAZARD	2
32	068632-000	LABEL HOLD DOWN	4
33	068633-000	LABEL READ & UNDERSTAND	1
34	068635-000	LABEL HARNESS POINT	2
35	068637-000	LABEL ARROW YELLOW	2
36	068637-001	LABEL ARROW ORANGE	2
37	066553-004	LABEL PINCH POINT	4
38	068638-000	LABEL EMERGENCY LOWER	1
39	068639-000	LABEL POWER TO PLATFORM	1
40	068634-001	LABEL AB46	2
41	061683-005	LABEL UPRIGHT	5
42	068640-000	LABEL POWER TO CHARGER	1
43	061683-007	LABEL UPRIGHT	1
46	068636-000	LABEL EXPLOSIVE GAS/CHARGER INSTL	1
47	068631-000	LABEL BATTERY DISCONNECT	2
48	068649-000	LABEL, CAUTION - RAISE JIB BOOM	1
51	068983-000	LABEL BI-ENERGY	2
52	27898-001	LABEL DIESEL FUEL	1

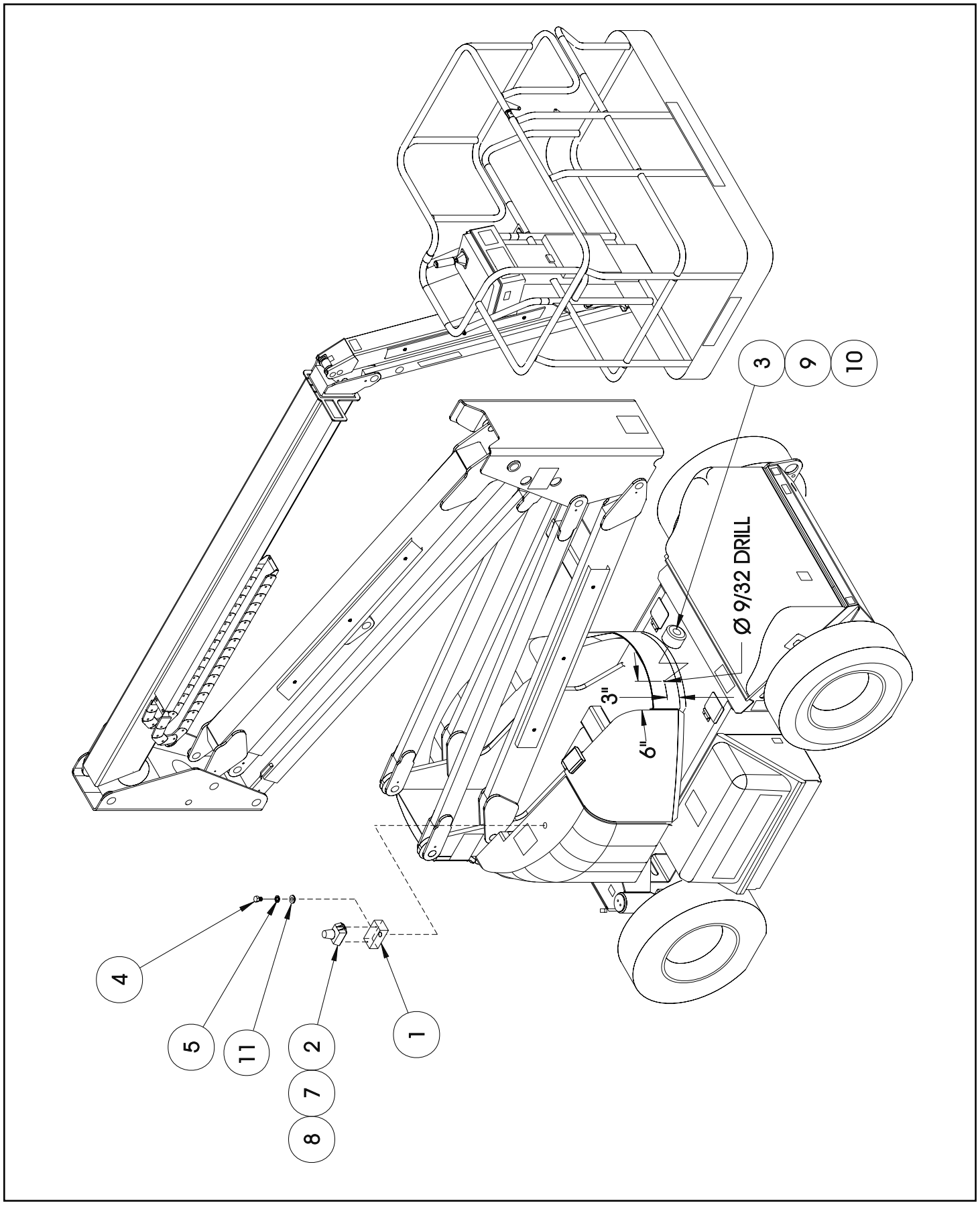

NOTE:
1. ITEM 35 & 36 TO BE 1" GAP FROM STEERING PIN @ FRONT AND 1" FROM TOP COVERS @ REAR.
SEE NOTE 1
BI-ENERGY ONLY
BOTH SIDES
INSIDE
ELECTRIC REF
OR
BI-ENERGY ONLY

MOTION ALARM/FLASHING BEACON OPTION - AB46

68294-000

ITEM	PART	DESCRIPTION	QTY.
1	66817-000	STROBE MOUNT WELDMENT	2
2	12848-004	FLASHING STROBE LIGHT	2
3	66807-000	HORN	1
4	11258-008	SCR. HHC 3/4-10 UNC X 1	1
5	11238-016	WASHER, SPLIT LOCK	1
6	29496-099	WIRE, C COND. 16 GA.	8 FT
7	11709-004	SCREW # 10-24 UNC X 1/2" LG	4
8	11248-003	LOCKNUT # 10-24 UNC ESNA	4
9	11252-006	SCREW, HHC 1/4-20UNC X 3/4" LG.	1
10	11239-004	LOCKWASHER, 1/4" SPLIT RING	1
11	11240-012	FLATWASHER STD 3/4"	2

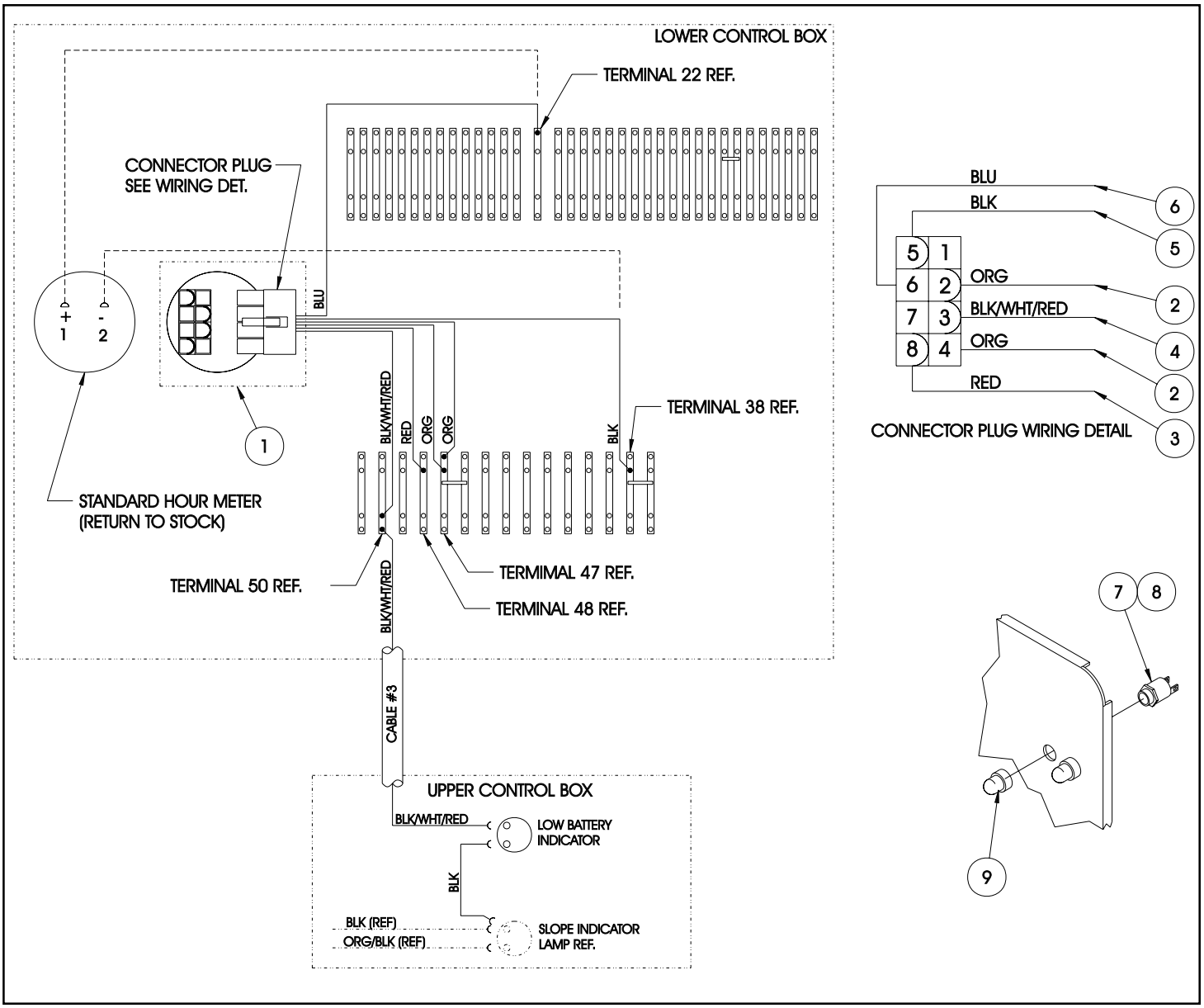



3
9
10
Ø 9/32 DRILL
3"
6"
4
5
11
2
7
8
1

BATTERY CHARGE INDICATOR OPTION - AB46 (ELECTRIC ONLY)

68297-000

ITEM	PART	DESCRIPTION	QTY.
1	68581-001	BATTERY FUEL / HOUR METER	1
2	29453-099	WIRE, 16 GA. ORANGE (2 PCS. @ 3')	6 FT
3	29454-099	WIRE, 16 GA. RED	3 FT
4	29361-099	WIRE, 16 GA. BLACK/WHITE/RED	3 FT
5	29452-099	WIRE, 16 GA. BLACK	3 FT
6	29450-099	WIRE, 16 GA. BLUE	3 FT
7	68590-000	BASE, INDICATOR LIGHT	1
8	68591-000	LAMP, 48 VOLT	1
9	68595-002	LENS, AMBER	1



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68343-000
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