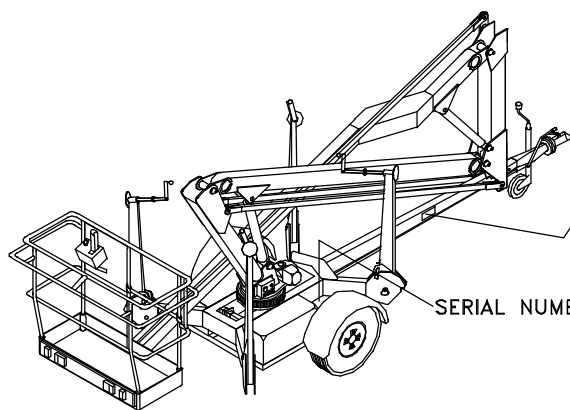


# SERVICE & PARTS MANUAL TL33 Aerial Work Platform Serial Numbers 1001 to current

When contacting UpRight for service or parts information, be sure to include the MODEL and SERIAL NUMBERS from the equipment nameplate. Should the name plate be missing the SERIAL NUMBER is also stamped on the axle mounting plate on the right hand side of the machine.



SERIAL NUMBER STAMPED HERE

UpRight		POTTERY ROAD, DUN LAOIRE, IRELAND.	CE
MODEL	TL33	SERIAL No.	199
MAX. PLATFORM HEIGHT	10.3m	UNLADEN WEIGHT	1250kg
MAX. PLATFORM LOAD	215kg 2 Persons + 55kg. Equipment		
MAX. LATERAL FORCE	400N	MAX. WIND SPEED	12.5m/s
MAX. CHASSIS INCLINATION	0°	BATTERY VOLTAGE	24V
NOMINAL POWER	3kW	CHARGER INPUT VOLTAGE	220/240V
CAUTION: ONLY TRAINED & AUTHORISED PERSONNEL MAY USE THIS MACHINE—CONSULT OPERATORS MANUAL BEFORE USE. THIS PLATFORM IS NOT ELECTRICALLY INSULATED			

Manual Part Number 57009-000 Rev 0 Dec.'96

## UpRight

UpRight Ireland Ltd.,  
Pottery Road,  
Dun Laoire,  
Ireland.

# Foreword

## SPECIAL INFORMATION



### WARNING



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



### CAUTION



Indicates the hazard or unsafe practice that 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 and make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by UpRight Ireland Ltd., might be done, or of the possible hazardous consequences of each conceivable way, nor could UpRight Ireland Ltd. investigate all such ways. Anyone using service procedures or tools, whether or not recommended by UpRight Ireland Ltd., must satisfy themselves thoroughly that neither personal safety nor machine safety will be jeopardised.

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. No part of this publication may be reproduced, stored in retrieval system, or transmitted, in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission of the publisher. This includes text, figures and tables.

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General description and machine specifications

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## Operation

Operating instructions and safety rules.

# 3.0

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Preventative maintenance and service information

# 4.0

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## Schematics

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# 6.0

## Illustrated Parts Breakdown

Schematics and valve block diagram with description and location of components

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# Foreword

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## 1.0 Introduction

### PURPOSE

This manual provides illustrations and instructions for the operation and maintenance of the TL33 Work Platform manufactured by Upright Ireland Ltd, Dun Laoire, Ireland. (See Figure 1-1).

### SCOPE

This manual includes both operation and maintenance responsibilities concerning the TL33 Work Platform's readiness. The Maintenance Section covers scheduled maintenance, trouble shooting, repair, adjustment and replacement.

## 1.1 General Information

### DESCRIPTION

The TL33 is a two-stage articulating boom lift platform, designed to raise two operators with hand tools to a work height of up to 12.3m. It is mounted on a trailer suitable for towing on public roads at speeds of up to 50 mph / 83Km/h (subject to local regulations). The boom assembly is operated by a hydraulic pump driven by a DC electric motor.

### Platform

The platform is large enough for two operators and has a free-draining perforated floor with 150mm toeboards. Hand rails are constructed from aluminium tubing and a safety drop-bar is provided at the entrance. Safety harness anchor points are fitted in the floor of the platform.

### Control Box

The control box is permanently fitted at the front of the platform, and features a joystick to provide proportional control of raising and lowering of each boom plus rotation. A safety 'Deadman' switch is provided which must be pressed at all times if operation is required. This is integral with the joystick handle allowing one-handed operation.

A complete explanation of control functions can be found in chapter 3.

### Elevating assembly

The platform is raised and lowered by two steel booms each of which are operated by a hydraulic cylinder actuated by hydraulic power from the motor driven pump. Each cylinder features an integral holding valve to prevent uncontrolled descent in the case of a hose burst.

### Rotation Gear

The booms can be rotated to provide up to 5m side outreach by means of a hydraulic motor driving a pinion gear around a large diameter slew gear via a gearbox.

### Power Pack

The power pack comprises four 6V batteries driving a 4HP electric motor which drives the hydraulic pump. The batteries, charger and motor/pump set are located under the fibreglass covers on either side of the chassis.

### Control system

The machine is provided with fully proportional controls by means of a motor control unit. This unit regulates the drive motor/pump speed and hence the flow of oil reaching the cylinders and slew motor via the solenoid valves located on the manifold block.

The motor control unit is located above the electric motor in the chassis module. The manifold block is located on the first post.

### Chassis

The chassis is designed for towing on public roads. It is fitted with suspension and full sized road wheels. Also fitted is a 50mm ball tow hitch, jockey wheel and overrun braking system with handbrake.

Four 'Quick set' fold down outriggers with screw jacks for level adjustment are provided. Interlocks prevent operation of the booms until all four outriggers are deployed. The hydraulic tank is integral with the chassis members, and a bubble level is fitted to aid levelling of the chassis before use.

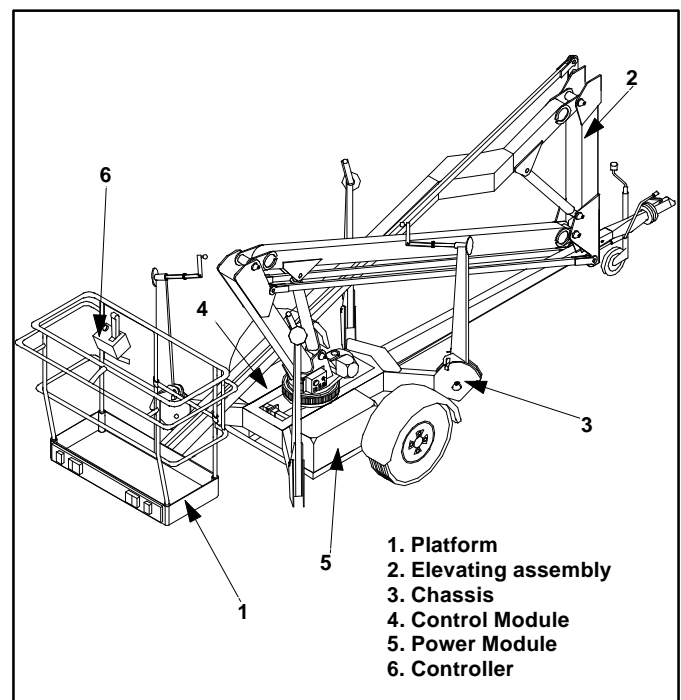


Figure 1-1: TL33 Work Platform

## Purpose and limitations

The purpose of the TL33 work platform is to provide a quickly deployable, trailer mounted, variable height work platform. It is capable of lifting two people with work tools up to an upper limit of 215kg in total. The unit will provide the ability to reach over obstacles and may be used on uneven firm ground provided the chassis is correctly levelled using the screw jack adjusters prior to elevating.



### CAUTION



The platform must **only** be used on firm level ground capable of supporting the maximum load generated under the outriggers. All outriggers **must** be correctly deployed and the chassis levelled before use. **Do not** use on soft or severely sloping ground.

## 1.2 Specifications\*

Table 1-1: Specifications

ITEM	METRIC	IMPERIAL
Duty Cycle	30% of 8hr cycle	
Platform Size	0.7m x 1.3m (inside guardrails)	2.3 ft x 4.3ft
Max. Platform Capacity	215Kg	473 lbs
Max. No. of occupants	2 People	
Max. Working Height	12.3m	40.3 ft
Max. Platform Floor Height	10.3m	33.8 ft
Max. Working Outreach	5 m	16.4 ft
Travelling Dimensions:		
Length	5.5 m	18 ft
Width	1.6 m	4.9 ft
Height	1.99m	6.5 ft
Stabiliser spread	3 m X 3m	10 ft x 10 ft
Rotation	360° non-continuous	
Gross weight	1209 Kg	2660 lbs
Max. Towable speed	83 Km/Hr. **	50 mph **
Energy source	24V DC 4HP, 4 x 6V 220 Ah batteries	
System Voltage	24V	
Battery Charger	24V 25A 220/110VAC 50/60 Hz	
Hydraulic Tank Capacity	8 Litres	2.1 Gallons
Max. Hydraulic System Pressure	140 Bar	2030 P.S.I
Hydraulic Fluid	ISO # 46	
Lift System	2 x Double acting lift cylinders with lock valves and manual emergency lower facility	
Control System	One-hand proportional joystick operating energy-efficient motor control system	
Tyres	6PLY R13	
Braking	Automatic reverse and overrun brakes plus handbrake.	

**\*Specifications subject to change without notice**

\*\* Max. speed is subject to traffic regulations in the country in question.

## 2.1 Preparation for use

Read and familiarise yourself with all operating instructions before attempting to operate machine.

1. Check Hydraulic oil level.
2. Check that batteries are charged.

## 2.2 Preparation for Shipment

1. Lubricate machine per lubrication instructions in Section 4.4, Maintenance.
2. Fully Lower the platform.
3. Stow all 4 outriggers.
4. Disconnect the negative (-) battery cable from the battery terminal.

## 2.3 Forklifting the Work Platform

**NOTE:** Lifting is for loading and unloading only.

**NOTE:** The TL33 is not designed to be forklifted, and does not have provision on the chassis to allow this method of lifting. Upright recommend the procedure below for handling the machine.



**CAUTION**



See specifications for weight of work platform and be certain that lifting apparatus is of adequate capacity to lift platform.

## 2.4 Lifting the Work Platform

The TL33 may be lifted by an overhead hoist/crane in the following manner:

Four lifting straps capable of safely supporting the total weight of the TL33 (1209Kg), and at least 220cm long are required. This minimum length is important to ensure the correct lifting angle.

The straps should be positioned as shown in Figure 2-1. The two rear lifting slings should be positioned inside the "quadrant" outrigger mounting plates. Care must be taken to ensure the slings do not damage the cable for the outrigger limit switches (Positions 1 & 2). the front lifting slings should be positioned under the towing beam, directly in front of the brake cable anchor plate. Note that two straps are essential at this point - one must pass each side of the lower boom and be positioned between the boom and the tension bars on either side. (Position 3 & 4).

Care must be taken to avoid damage to covers and other equipment on the machine.

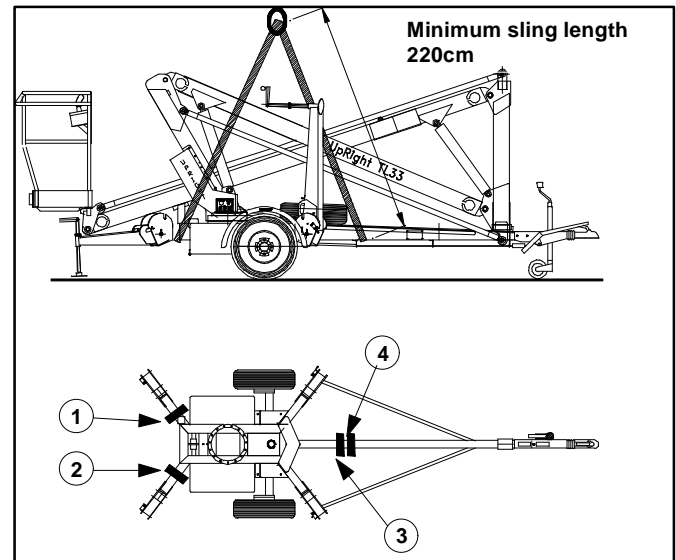


Figure 2-1: Lifting the TL33

## 2.5 Transport

The TL33 is a road approved vehicle and therefore may be transported behind a motor vehicle of suitable towing capacity.

If the TL33 is to be transported by other means then it must be securely tied down to the transporting unit at several points.

Recommended securing points are the four outrigger support members on the chassis and the towbar. Further securing points should be used if the terrain on which the unit is travelling is rough or uneven.

ALWAYS ensure that the handbrake is fully applied and that all the booms are FULLY stowed.

## 2.6 Storage

No preparation is required for normal storage. Regular maintenance per Table 4-1 should be performed. If The work platform is to be placed in long term storage (dead storage) use the following preservation procedure.

### PRESERVATION

1. Clean painted surfaces. If the painted surface is damaged, repaint.
2. Fill the hydraulic tank to operating level **with the platform fully lowered**. Fluid should be visible on the dip stick.
3. Coat exposed portions of cylinder rods with a preservative such as multipurpose grease and wrap with barrier material.
4. Coat all exposed unpainted metal surfaces with preservative.

### BATTERIES

1. Disconnect the battery ground cable and secure to the chassis.
2. Disconnect the remaining battery leads and secure to the chassis.
3. Remove the batteries and place in alternate service.



**NOTES**

## 3.0 Introduction

### General functioning

#### Refer to the Hydraulic and Electrical Schematics, Section 6

The battery powered electric motor directly drives a two section hydraulic pump. The low section of the pump is not used. The high section supplies oil under pressure to the various platform functions. The oil flow is directed to the different functions by electrically activated solenoid valves.

#### Setting up the machine for use

The TL33 must be set up on firm level ground. The outrigger set-up is critical for sound stability of the unit when elevated.

The outriggers are secured in the travel position by a spring-activated retaining pin. When the outrigger is lowered the pin locks the leg into the down position by means of another retaining slot at the bottom of the 'quadrant' plate. The screw jack at the end of the outrigger leg is then lowered until in contact with the ground surface. Further adjustment off the appropriate screw jack(s) are then made to level the machine using the bubble level on the chassis as a guide.

All outriggers are fitted with electrical interlock limit switches which prevent operation of any functions until all outriggers are secured in the lowered position and the outrigger foot is taking the machines weight. Should an outrigger become unloaded during operation of the booms an alarm sounds and further operation is impossible except by means of an emergency override switch on the cage control box, allowing the operator to descend and remedy the cause.

#### Operating the booms

**Only when the TL33 is set up according to the above procedure can raising and lowering of the booms commence.**

The keyswitch at the lower control box can be switched to platform or chassis controls.

Platform controls provide variable speeds for the boom functions through the use of a joystick.

This is achieved using a motor control unit which varies the speed of the motor/pump unit and increases or decreases the flow of oil to the different functions.

This control unit receives a control signal from the joystick on the upper controls.

The speed of the motor increases as the control lever is pushed further away from the neutral (stopped) position.

**Note:** A deadman trigger is an integral part of the joystick. This must be depressed for the functions to operate. (This safety feature prevents unwanted movement of the booms in the case of inadvertent movement of the joystick.)

Chassis controls provide a fixed speed for each of the boom functions.

### Design Features

The TL33 Series Work Platform has the following features:

- The interlock system on the outriggers ensure that the machine must be set up safely before use.
- The slew cut-out interlock ensures that the boom support structure is clear of the towbar before slewing can commence.
- The energy-efficient motor control units provides long battery life and smooth proportional control of the boom functions.
- All cylinders are fitted with hydraulic hose-burst protection interlocks.
- The on-board charger is fully automatic and charges the batteries efficiently and economically.
- If the work platform starts to become unstable and one of the outrigger interlocks becomes de-activated an alarm will sound in the upper control box. In this situation power is cut to the upper controls to prevent boom movement that might increase instability. An emergency override switch is fitted to allow the booms to be descend at a controlled speed to bring the machine back to a stable position.
- In the event of a power loss the two lift cylinders are fitted with emergency lowering valves which allow the booms to be lowered at a controlled speed by an operator on the ground.
- A manual rotation facility is fitted to allow rotation of the booms in the event of power loss.

### 3.1 Safety Rules and Precautions

#### Before using the TL33 Work Platform:

**NEVER** operate the machine unless you have been fully trained in its safe use, are medically fit and have read and fully understood these instructions.

**NEVER LEAVE A LIFT UNATTENDED WITH THE PLATFORM IN THE RAISED POSITION.**

**ALWAYS** position the machine on firm level ground with a minimum bearing capacity of 550KN/m<sup>2</sup>.

**CHECK** that no overhead obstructions exist within the machine's range of movement. **DO NOT** work within 8 metres of live overhead cables. Set up warning tape barrier at the safe distance. **( THIS MACHINE IS NOT INSULATED )**.

**DO NOT** operate unless all four outriggers are fully lowered, locked and screwed down to ground level taking the load of the machine.

**DO NOT** exceed the safe working load of 215kg (max. 2 persons plus 55kg equipment)

**NEVER** sit, stand or climb on guard rail or midrail.

**NEVER** use ladders or scaffolding on the platform.

**DO NOT** use the machine as a crane or for any other application involving additional loads or forces. The maximum side force **must not exceed 400N**.

**DO NOT** increase wind loadings by fitting items such as sign boards, flags etc. to the cage or boom.

**DISTRIBUTE** all loads evenly on the platform. See Table 1-1 for maximum platform load.

**NEVER** use damaged equipment. (Contact UpRight Ireland Ltd. for instructions).

**NEVER** attach overhanging loads or increase the size of the working platform.

**DO NOT** use in winds exceeding 12.5m/s (27mph - Beaufort Force 6)

**NEVER** change or modify operating or safety systems.

**INSPECT** the machine thoroughly for cracked welds, loose hardware, hydraulic leaks, damaged control cable, loose wire connections and wheel bolts.

**NEVER** climb down an elevating assembly with platform elevated.

**NEVER** perform service on or in the elevating assembly while the platform is elevated without first blocking the elevating assembly.

**NEVER** recharge batteries near sparks or open flame; batteries that are being charged emit highly explosive hydrogen gas.

**SECURE** the work platform against unauthorised use by turning keyswitch off and removing key from switch.

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

## 3.2 Controls and Indicators

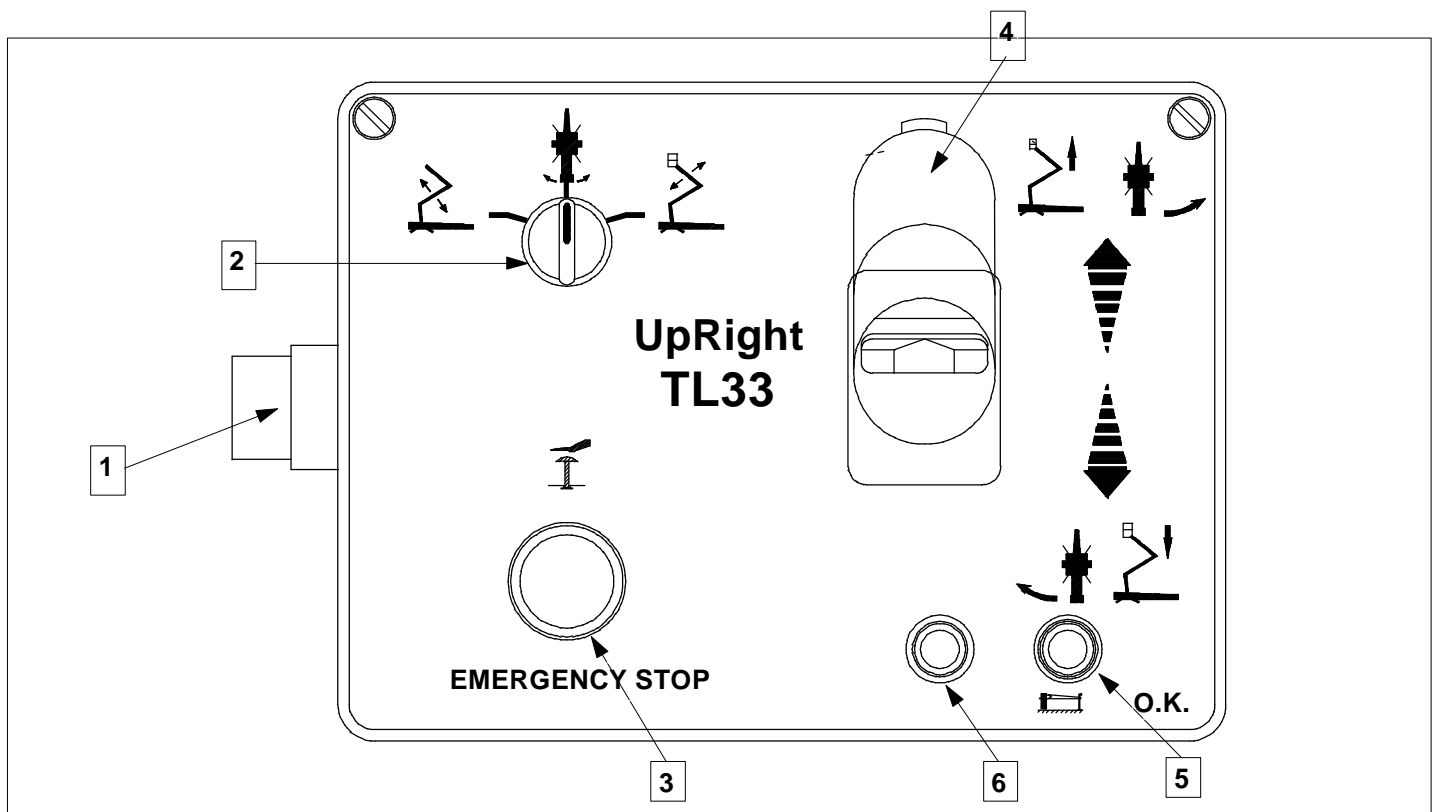
The controls and indicators for operation of the TL33 Work Platform are shown in Figures 3-1 & 3-2. The name and function of each control and indicator are listed in Tables 3-1 & 3-2. The index numbers in the figure correspond to the index numbers in the table. **The operator should know the location of each control and indicator and have a thorough knowledge of the function and operation of each before attempting to operate the unit.**

The controls and indicators for operation of the TL33 Work Platform are shown in Figure 3-1. The name and function of each control and indicator are listed in Table 3-1. The index numbers in Figure 3-1 correspond to the index numbers in Table 3-1. The operator should know the location of each control and indicator and have a thorough knowledge of the function and operation of each of these before attempting to operate the unit.

**Table 3-1: Platform Controls and indicators**

INDEX NO.	NAME	FUNCTION
1	SWITCH :- ON / OFF - EMERGENCY OVERRIDE	Turn clockwise for power 'ON', in centre position for power 'OFF' and anticlockwise for 'EMERGENCY OVERRIDE'. (Must be held against spring pressure in this position)
2	FUNCTION SELECTOR	Select function to be operated. SELECTOR: Left hand position for BOOM 1, centre for ROTATE and right for BOOM 2 operation. Left hand position for BOOM 1, centre for ROTATE and right for BOOM 2 operation.
3	EMERGENCY STOP SWITCH	Push red button to cut off power to all functions(OFF). Turn clockwise to release and restore power (ON).
4	JOYSTICK CONTROL LEVER	Squeeze to activate Deadman control and push forward to activate lift or rotate left function (dependent upon position of Function Selector2). Pull back for boom lower or rotate right. The speed each function operates is dependent on how far the lever is moved.

INDEX NO.	NAME	FUNCTION
5	SYSTEM OK INDICATOR	Illuminates to indicate outrigger interlocks are activated. If not illuminated check outrigger set-up
6	BATTERY CONDITION INDICATOR	This red L.E.D. indicates the condition of the batteries. It is constantly illuminated when the batteries are fully discharged. It flashes repeatedly when the batteries have begun to discharge. It remains off when the batteries are fully charged.



**Figure 3-1: Platform Controls**

## 3.2 Controls and Indicators

Table 3-2: Lower Controls

INDEX NO.	NAME	FUNCTION
1	KEYSWITCH	Turn key clockwise to select control from ground level, anticlockwise for platform control and to the centre position for power 'OFF'.
2	EMERGENCY STOP SWITCH	Push red button to cut off power to all functions(OFF). Turn clockwise to release and restore power (ON).
3	ROTATION CONTROL	Move switch to left for 'ROTATE LEFT'; to the right for ROTATE RIGHT; Switch must be held against spring pressure while operating. Note that control is not porportional, boom will move at a constant, slow speed.

NO.		
4	BOOM 1 CONTROL	Move switch up to raise boom no.1, down to lower. Note that control is not proportional, boom will move at a constant, slow speed.
5	BOOM 2 CONTROL	Move switch up to raise boom no.1, down to lower. Note that control is not proportional, boom will move at a constant, slow speed.

NOTE: ALL LOWER CONTROLS OPERATE AT SLOW, NON-PROPORTIONAL SPEED.

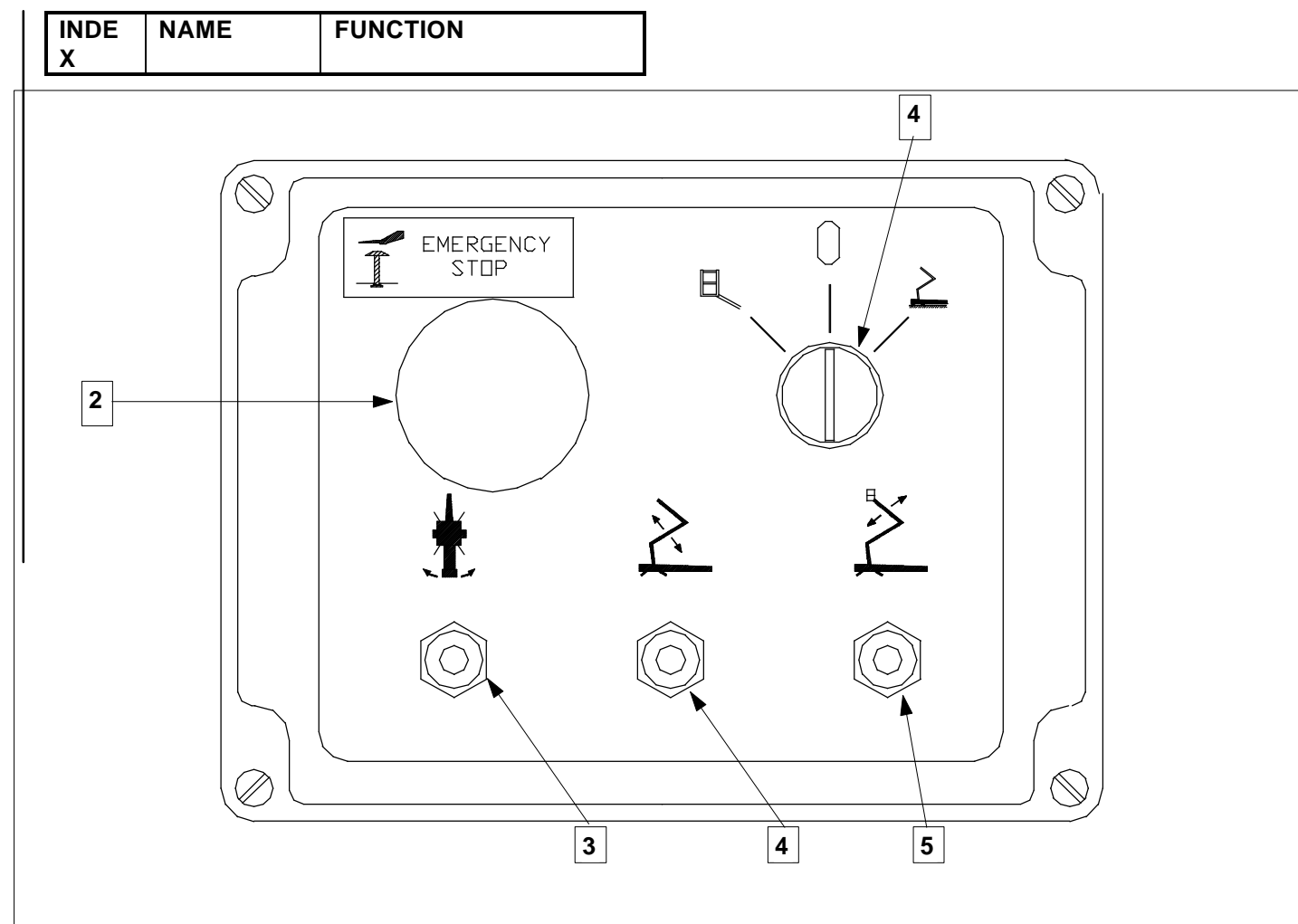


Figure 3-2: Lower Control Box

## 3.3 Pre-Operation Inspection

**NOTE:** Carefully read, understand and follow all safety rules and operating instructions. Perform the following steps each day before use.



### **WARNING**



**DO NOT** perform service on work platform with the platform elevated unless the elevating assembly is properly supported.

1. Remove module covers and inspect for damage, oil leaks or missing parts.
2. Check the level of the hydraulic oil with the platform fully lowered. Oil should reach the level of the filler cap dip stick. If necessary top-up using ISO no.46 hydraulic oil.
3. Check that the electrolyte level in the batteries is correct. (See Battery Maintenance, Section 4.3)
4. Verify batteries are charged.
5. Check that the A.C. extension cord has been disconnected from charger.
6. Carefully inspect the entire machine for damage such as cracked welds or structural members, loose or missing parts, oil leaks, damaged cables or hoses, loose connections and tyre damage.
7. Move machine, if necessary, to unobstructed area where machine can be fully elevated.
8. Check that the ground is capable of supporting the outrigger loads, and is generally level. Apply handbrake.
9. Taking each outrigger in turn, pull the locking pin release lever out while simultaneously lowering the outrigger leg. Ensure the locking pin snaps into position in the lower slot.  
(See Figure 3-3)
10. Lower all screw jacks until the load is just removed from the road wheels. Level the machine as necessary using the bubble level on the chassis to check in both longitudinal and lateral directions. Retract the jockey wheel until it is clear of the ground.
11. Turn both Chassis and Platform Emergency Stop switches ON (rotate clockwise).
12. Turn key switch on Ground Control box to the CHASSIS position (right-hand position).
13. Using the chassis control switches, fully elevate booms no 1 and 2.
14. Visually inspect the elevating assembly and cage mounting/structure, lift cylinders, cables and hoses for leaks, damage or erratic operation. Check for missing or loose parts such as nuts, bolts and circlips.
15. Check rotation left and right function.
16. Lower each boom until platform is returned to its rest.
17. Replace module covers.
18. Retract screw jack on one outrigger and check that warning alarm sounds.
19. Return chassis key switch to OFF (centre) position.
20. Lower jockey wheel until it is in contact with ground. Raise remaining screw jacks then return each outrigger leg in turn to vertical position, checking that locking pin snaps securely into upper slot on the quadrant.
21. Check tyre pressures and thread depth.

## 3.4 Operation

**NOTE:** Understand the functions of all the controls before operating the machine AND ensure that the Pre-Operation Inspection (Section 3.3) has been completed and any deficiencies corrected



### WARNING



Before Towing, ensure that all booms are properly stowed and secured and that outriggers are raised, retracted and locked into position.

Ensure tyres are free from damage, inflated to correct pressure and have sufficient thread depth.

Ensure breakaway cable is properly attached to towing vehicle before driving away.

### TOWING

1. Adjust Jockey wheel using screw handle until tow hitch is just above height of tow ball on towing vehicle.
2. Position tow vehicle and fit breakaway cable to a suitable attachment point on the towing vehicle (not the tow ball stem or towing pin).
3. Lower tow socket onto hitch using screw handle on Jockey wheel, until catch snaps into position. Adjust jockey wheel height until well clear of the ground.
4. Connect electrical lead to tow vehicle socket and check lighting functions.

**NOTE:** Exercise caution during brake "Running In" period (First 850Km or 500 miles). When parking on hills remember to fully tension handbrake, and in reverse, compress handbrake spring fully plus double check when vehicle has moved back. Chock wheels for safety.

### OUTRIGGER DEPLOYMENT



### DANGER



All outriggers **MUST** be correctly deployed on firm ground capable of withstanding the loads imposed. The chassis **MUST** be correctly levelled before elevating the platform.

1. Position machine on firm, level ground.
2. Pull out locking handle, lower outrigger until pin locks into position in the lower slot. Ensure pin is completely seated in this slot.
3. Repeat for remaining 3 outriggers
4. Screw down all four jacks until they contact firm surface.
5. Adjust jacks to ensure machine is level. Check using bubble level located at rear of chassis.
6. Ensure outriggers are taking machine's weight. Road wheels should be relieved of load, but remain just in contact with the ground.
7. Raise jockey wheel at tow hitch until it is well clear of the ground.

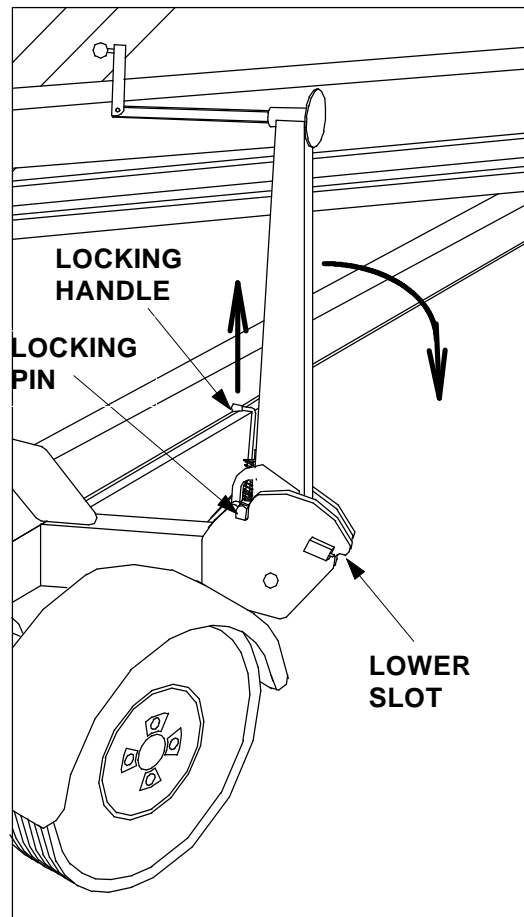


Figure 3-3: Releasing Outrigger Lock Pin  
TL33 Work Platform

## ELEVATING PLATFORM



### WARNING



**LOOK up and around for obstructions before performing the lift function.**

**DO NOT overload the platform**

**DO NOT operate within 8 metres of any electrical power cables.**

**THIS WORK PLATFORM IS NOT INSULATED.**

**Cordon off the area within the platform's working area to keep passers-by clear of boom.**

1. Ensure key switch is turned to "Cage" position and both emergency stop buttons are released (out).
2. Enter cage through gate and ensure drop bar is in position.
3. Wear safety helmets/harnesses in accordance with local requirements. Safety harness lanyards, not exceeding 1m in length, should be attached to anchor points in cage floor.
4. Check green "System OK" L.E.D. is illuminated. If not, and/or audible alarm sounds, check that outriggers are correctly deployed. Booms will not operate unless this is done.
5. Select "Boom 1" on function selector switch.
6. Check for overhead obstructions.
7. Squeeze "deadman" control on Joystick and slowly move Joystick forward to elevate boom. The further the joystick is moved, the faster the boom will move. Pressure must be applied to the "deadman" at all times operation is required.
8. Select "Boom 2" or "Rotate" as required and operate as described above. Note: Move joystick forward to rotate left, back to rotate right.
9. Before lowering, check under cage floor for obstructions, operate as described above, moving joystick back to perform 'lower' function.

10. In an emergency, hit the red "Emergency Stop" button for instant cut-out of all functions. Twist button clockwise to release before operating machine again.
11. If the Audible warning alarm sounds, control functions will cease to operate. This will be due to a loss of pressure on one or more of the outriggers. Do not attempt to elevate the booms with the alarm sounding, unless this action is required to move the boom away from an obstruction. In this event, movement should be kept to a minimum.  
Turn the cage "on/off" switch to the 'emergency' position, and hold it in this position while using the boom controls as normal to descend immediately to ground level. Do not rotate until close to the ground. After leaving the cage, check all outriggers and adjust to ensure each is correctly deployed. Note that during emergency operation, controls will operate only at a fixed, slow speed.



### WARNING



When operating this function, extreme care must be taken to ensure person carrying out the task does not become trapped by the structure

## EMERGENCY LOWERING

1. Should the machine become inoperable when elevated ask a person on the ground to lower the platform using the emergency lowering valves.
2. These are red knobs (twist or push type) mounted at the base of the hydraulic lift cylinders (See Figure 3-4). Operate the lower boom first by turning slightly in an pushed) - ensure rate of descent is kept slow and under control.  
Descent can be halted at any time by turning the red knob clockwise until the valve is closed.
3. Repeat the operation if necessary for the upper boom when cylinder is in reach of the ground.
4. Tighten valves clockwise before using the machine again.



## EMERGENCY ROTATION

The following procedure for rotation of the elevating assembly in an emergency situation should be carried out only by a qualified service engineer:

1. Ensure booms are lowered as far as possible using emergency lower valves.
2. Remove cap on rotation gearbox shaft cover.
3. Apply a 13 mm. socket wrench to shaft and turn to rotate elevating assembly.
4. Remove wrench.
5. Reinstall protective cap.

## CONTROL FROM GROUND LEVEL

1. Ground Controls are fitted at the base of the boom. These should only be used when no operator is in the platform (for maintenance/ service purposes), or if the operator has become incapacitated.

2. Turn key switch to **CHASSIS** (to the right).
3. Use the appropriate switch to raise/lower Boom 1, Boom 2 or rotate as required.

## 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 unauthorised operation. Apply handbrake.
3. Turn key switch to **OFF** and remove key to prevent unauthorised operation.
4. Recharge batteries in accordance with the instructions in section 4.3.

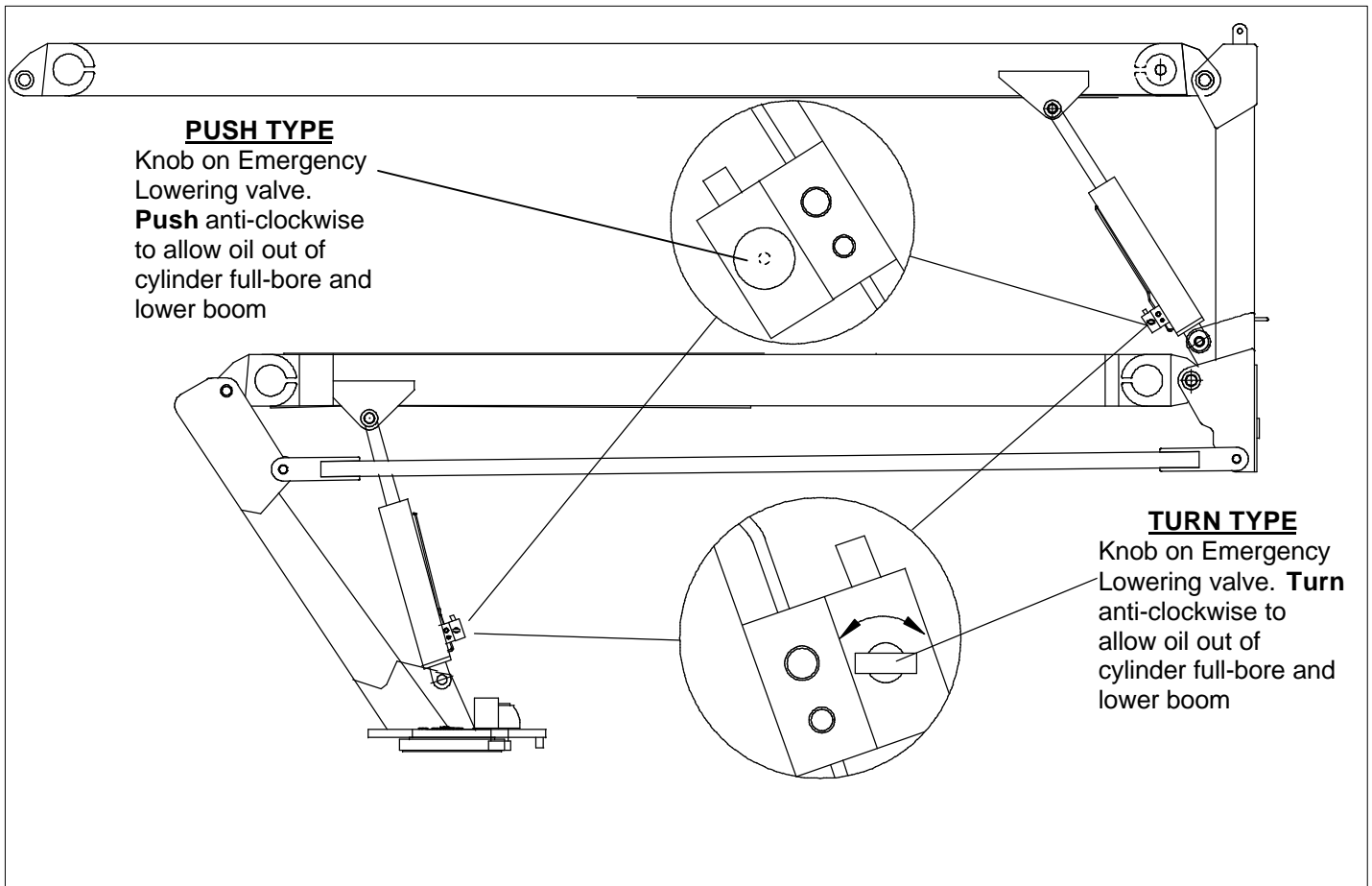


Figure 3-4: Emergency Lowering Valves

NOTES

## 4.0 Introduction

This section contains instructions for the maintenance of the TL33 Series Work Platform. Procedures for scheduled maintenance and repair/removal are included.

Referring to *Section 3 and Section 6* will aid in understanding the operation and function of the various components and systems of the TL33 Series Work Platform and help in diagnosing and repair of the machine.

### TOOLS REQUIRED

The following is a list of items that are required to perform certain maintenance & repair procedures.

- 1 x Multi-meter capable of reading Voltage, Ohms and Amps.
- 1 x Pressure Gauge - Range (0 - 1000 P.S.I)
- 1 x Pressure Gauge - Range (0 - 3000 P.S.I)

We recommend:



- 1 x 57128-000 Calibrator - A test and analysis instrument for the D.C. motor Control Unit.

## 4.1 Preventative Maintenance (Table 4-1)

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. Complete descriptions of the procedures are in the text following the table.

 <b>WARNING</b> 
<p>Before performing preventative maintenance familiarise yourself with the operation of the machine.</p> <p>Never perform maintenance on a machine when it is in the elevated position.</p>

The Preventative Maintenance table has been designed to be used for machine service and maintenance repair.

**Please copy the following page and use this table as a checklist when inspecting a machine for service.**

## 4.1 Preventative Maintenance Table Key

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

### Preventative Maintenance Report

Date:	
Owner:	
V.I.N No.:	Serial No.:
Serviced By:	
Service Interval:	

#### Daily, each shift or every 8 hours

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Battery System	Check electrolyte level Check battery cable condition Charge batteries			
Hydraulic Oil	Check oil level			
Hydraulic System	Check for leaks			
Emergency Hydraulic System	Open the emergency lowering valves and check for proper operation.			
Controller Control Cable	Check switch operation Check the exterior of cable for pinching, binding or wear.			
Tyres / Wheels	Check tyre pressures 3.25 bar Check thread depth Check for damage Check/torque nuts 100Nm			
Platform Deck and Handrails	Check welds for cracks Check that securing bolts are tightened Check condition of floor Check drop bar on cage entrance			
Hydraulic Pump	Check for hose fitting leaks			
Elevating Assembly	Inspect for structural cracks Check hoses for pinch or rubbing points			
Chassis Assembly	Inspect for structural cracks Check hoses for pinch or rubbing points			
Entire Unit	Function check Emergency stop switches at control boxes Perform pre-operation inspection Check for and repair collision damage			
Outriggers	Check all screw jacks Check interlock switch function			
Tow hitch	Check coupling for function and wear. Inspect breakaway cable for proper attachment.			
Road Lights	Check all trailer lights and connecting plug			
Brake System	Apply handbrake & check function			

#### Monthly, every 30 Days or 50 hours

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Battery System	Check specific gravity			
Hydraulic System	Check hose connections Check for exterior wear			
Hydraulic Pump	Wipe clean. Check for leaks at mating surfaces. Check mounting bolts for proper torque.			
Slew system	Grease slew gear. Check slew motor for leaks and mounting bolts for proper torque.			
Elevating Assembly	Check pivot pins for damage. Check pivot pin retaining rings.			
Lift Cylinders	Check cylinder rod for wear. Check pivot pin retaining rings. Grease all fittings as section 4.4			
Entire Unit	Lubricate. Grease all fittings.			
Outriggers	Lubricate. Grease all fittings.			
Brake System	Check brake shoes for wear. Test auto reverse function			
Tow Hitch	Grease all fittings as section 4.4			

#### 3 Monthly, every 3 months or 80 hours

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Slew system/ First Post	Check torque on all bolts, 15 outer ring and 20 inner ring. Retorque to 120 Nm			

#### 6 Monthly, every 6 months or 125 hours

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Battery System	Clean exterior. Clean terminals.			
Slew system	Check hardware and fittings for proper torque.			
Elevating Assembly	Check elevating assembly for bending. Check component mounting for proper torque. Check fasteners for proper torque.			
Entire Unit	Check for corrosion - Remove and repaint.			
Brakes	Adjust brake shoes. Check handbrake and adjust.			

#### Yearly, every 12 months or 250 hours

COMPONENT	INSPECTION OR SERVICES	Y	N	R
Hydraulic Oil	Drain and replace oil. (ISO No.46)			
Axle/ Hubs	Repack wheel bearings			
Hydraulic System	Change filter			

## 4.2 Battery Maintenance

Electrical energy for the motor is supplied by four 6 volt batteries wired in series for 24 volts DC. Proper care and maintenance of the batteries and motor will ensure maximum performance from the work platform.

### WARNING

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.

## 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 with a high mineral content will shorten battery life.

### WARNING

If battery water level is not maintained, batteries will not fully charge, creating a low discharge rate which will damage Motor/Pump unit and void warranty.

Batteries should be inspected periodically for signs of cracks in the cases, electrolyte leakage and corrosion of the terminals. Inspect cables for worn spots or breaks in the insulation and for broken cable terminals.

Clean batteries that show signs of corrosion at the terminals or onto which 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, warm water. Clean battery and cable contact surfaces to a bright metal finish whenever a cable is removed.

## BASIC RULE FOR MAX. DUTY CYCLE OF DEEP CYCLE TRACTION BATTERIES

- Use the machine until it shows signs of weak / slow performance.
- Allow the charger to charge the batteries until it automatically shuts off.
- Avoid intermittent charging as the batteries develop a memory effect similar to Nicad batteries.

## BATTERY CHARGING

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

### WARNING

Charge batteries in a well-ventilated area.

Do not charge batteries in the vicinity of sparks or flames.

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

Never leave charger operating unattended for more than two days.

Never disconnect cables from batteries when charger is operating.

Keep charger dry.

When ambient temperatures fall below 18°C (65°F) batteries in unheated areas should be placed on charge as soon after use as possible. Under such conditions a 4 hour equalize charge once a week in the early afternoon will improve state of charge and battery life.

1. Check battery fluid level. If electrolyte level is lower than 10mm(3/8in.) above plates add distilled water only.
2. Connect battery charger lead to properly earthed outlet
3. Charger turns on automatically after a short delay. The ammeter will indicate the rate of charging.
4. Charger turns off automatically when batteries are fully charged.

## BATTERY CELL EQUALIZATION

The specific gravity of the electrolyte in the battery cells should be equalized monthly. To do this, charge batteries as described above. After this initial charge, check the electrolyte level in all cells and add distilled water as necessary, and turn the charger on for an additional eight hours. During this time, the charging current will be low (four amps) as cells are equalizing. After equalization, the specific gravity of each cell should be checked with a hydrometer. The **temperature corrected** specific gravity in this state should be **1.280**. If any corrected readings are below **1.230**, the batteries containing such cells should be replaced.

Do not check the specific gravity in a cell to which water has just been added. If there is not enough electrolyte in a fully charged cell to obtain a sample for the hydrometer, add water and continue charging for one to two hours before checking again.

## 4.3 Temperature correction for Electrolyte readings

### SPECIFIC GRAVITY CONVERSION CHART

Electrolyte Temperature		Temperature Corrected Specific Gravity, Fully Charged	
Fahrenheit	Celsius	USA	Euro
120	48.9	1291	1.29
110	43.3	1287	1.29
100	37.8	1283	1.28
90	32.2	1275	1.28
80	26.7	1275	1.28
70	21.1	1275	1.28
60	15.6	1267	1.27
50	10.0	1263	1.26
40	4.4	1259	1.26
30	-1.1	1255	1.26
20	-6.7	1251	1.25
10	-12.2	1247	1.25
5	-15.0	1245	1.25
0	-17.8	1243	1.24
-5	-20.6	1241	1.24
-10	-23.3	1239	1.24
-15	-26.1	1237	1.24
-20	-28.9	1235	1.24
-25	-31.7	1233	1.23
-30	-34.4	1231	1.23

## 4.4 Lubrication

Refer to Figure 4-1 for location of items that require lubrication service. Refer to the appropriate sections for lubrication information on the Hydraulic Oil Tank and Filter.

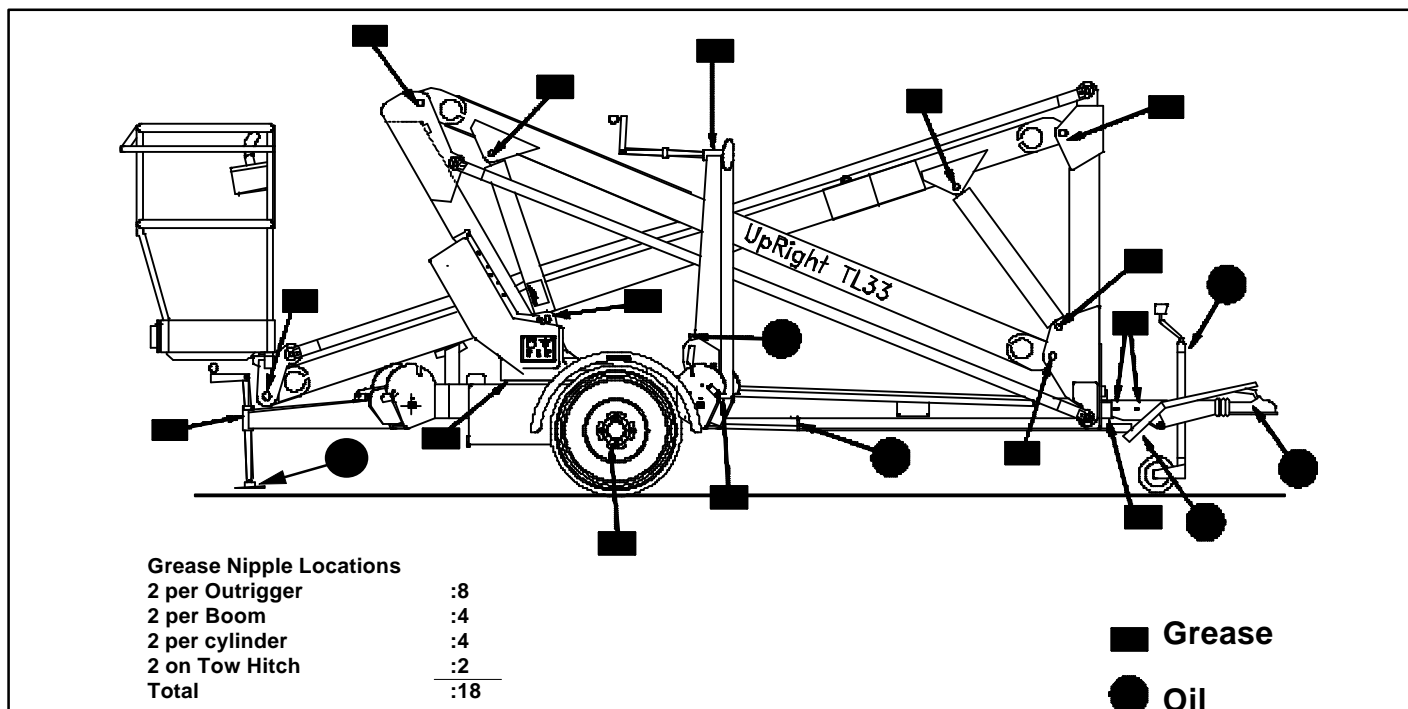


Figure 4-1: Lubrication Points

## HYDRAULIC OIL TANK AND FILTER

### Fluid Level

With platform fully lowered, oil should be visible on the dipstick, if not fill the tank until oil registers on the dipstick. **DO NOT** fill above the upper line or when the platform is elevated.

### Oil and Filter Replacement (Figure 4-2)

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



**CAUTION**

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

2. Provide a suitable container to catch the drained oil. Hydraulic tank has a capacity of 8 Litres.
3. Remove the drain plug under the tank and allow all oil to drain
4. Clean the magnetic drain plug and reinstall.
5. Unthread the the filter from the filter head.
6. Apply a thin film of clean hydraulic oil (ISO No. 46) to the gasket of the replacement filter.

7. Thread the replacement filter onto the filter head until the gasket makes contact then rotate the filter a further 3/4 of a turn.
8. Fill the hydraulic reservoir with hydraulic oil (see Section 1-2) checking level with dipstick.
9. Recycle used oil as per local environmental regulations.

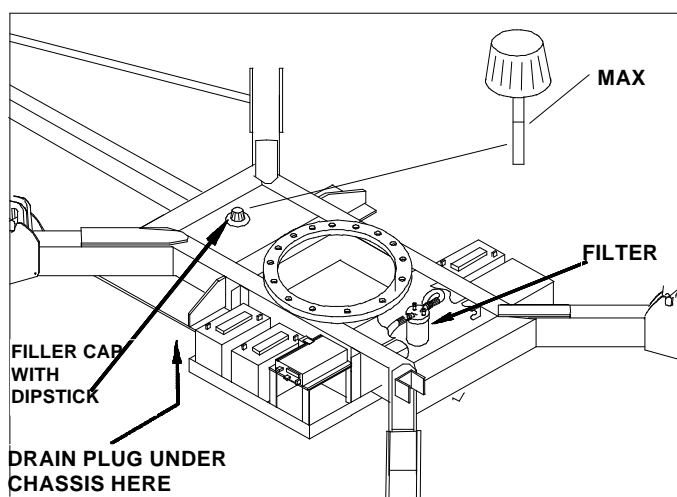


Figure 4-2: Oil and Filter Replacement

## 4.5 Setting Hydraulic Pressures (Figure 4-3)

Check the hydraulic pressures whenever the pump, manifold or relief valve have been serviced or replaced.



### WARNING

The hydraulic oil may be of sufficient temperature to cause burns. Wear safety gloves and safety glasses when handling hot oil.  
The oil in the hydraulic system is under very high pressure which can easily cause severe cuts. Obtain medical assistance immediately if cut by hydraulic oil.

## MAIN RELIEF VALVE (Figure 4-3)

1. Operate the hydraulic system for 10-15 minutes to warm the oil.
2. Remove the cover from the 1<sup>st</sup> post.
3. Insert pressure gauge into high pressure gauge port on top of front face of main manifold block.
4. Loosen locknut on main relief valve and turn adjusting screw counter clockwise two full turns.
5. Operate lower boom down function switch at lower controls and keep it activated.
6. Slowly turn the main relief valve adjusting screw clockwise until the pressure gauge reads 140 Bar (2030 p.s.i.) pressure.
7. Release the boom down switch.
8. Tighten locknut on main relief valve while holding the adjusting screw in position.

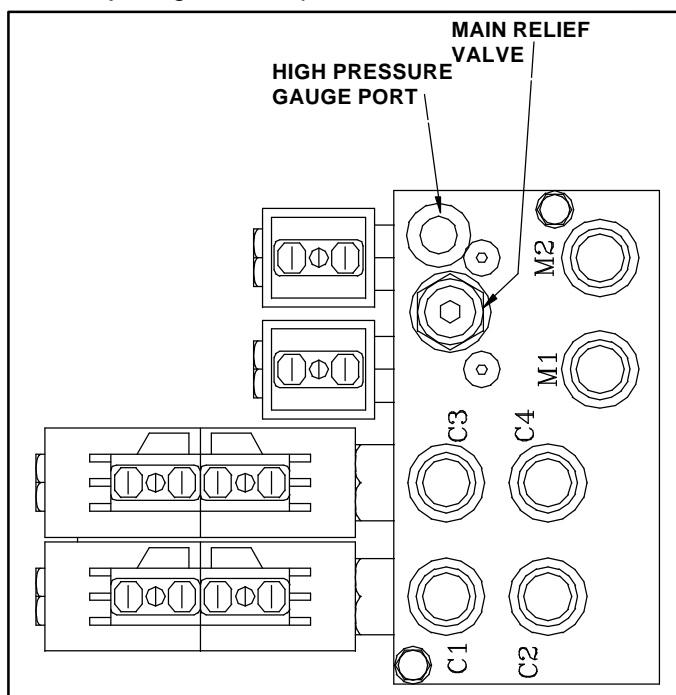


Figure 4-3: Main Manifold Block

## 4.6 Maintenance on Elevating Assembly (Figure 4-4)

The only time the Elevating Assembly needs to be elevated to allow service work to be carried out is when working on the Slew Limit Switch.

All other work (Bearings, Cylinders, Booms & Tension Bars) can and must be performed with the Elevating Assembly in the stowed position.

When working on the Slew Limit Switch follow the procedure detailed below.



### WARNING



**BEFORE** entering Elevating Assembly while performing maintenance on work platform while elevated, ensure that Elevating Assembly properly supported by suitable crange of adequate capacity. (Recommended 1 tonne capacity crane and sling.)

## INSTALLATION

1. Park the work platform on firm level ground.
2. Verify Platform Emergency Stop Switch is ON.
3. Turn Key Switch to "Ground Control" position.
4. Position Lower Control Boom 1 Switch to "UP" and elevate until the lower boom is 1600mm (63inches) above the tow bar.
5. Place a sling of 1000kg load capacity at the end of the lower boom and first post. Ensure sling is secured so that it will not slip up along the boom.
6. Push Lower Control Boom 1 Switch to "DOWN" and gradually lower the platform until Lower Boom is supported by the sling.

## REMOVAL

1. Push Lower Control Boom 1 Switch to "UP" position and gradually raise the platform until the sling can be removed.
2. Remove the sling.
3. Push Lower Control Boom 1 Switch to "DOWN" and completely lower platform.
4. Turn Key Switch to "OFF"

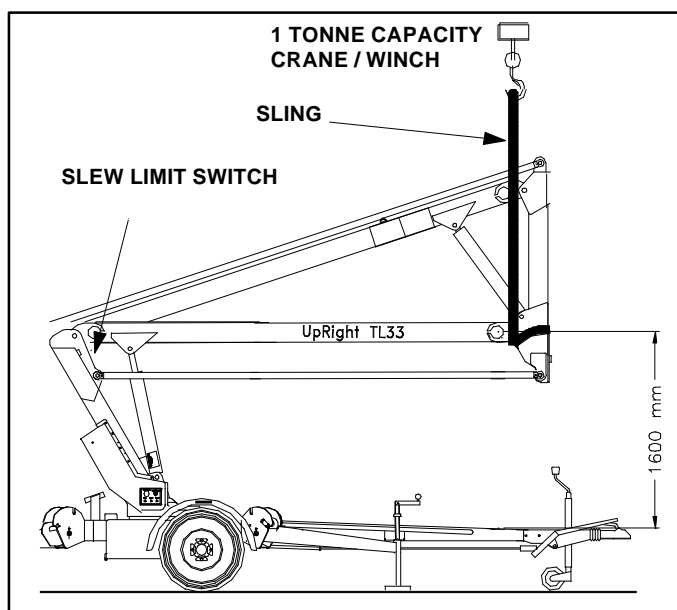


Figure 4-4: Supporting the Elevating Assembly



## OUTRIGGER LIMIT SWITCHES

**Function:** These four limit switches are wired in series. When the four outriggers are deployed these switches are activated and allow the booms functions to be operated. In addition, the switches also provide warning if one of the outriggers becomes 'light' or lifts off the ground. In this case power is cut to the upper controls and the alarm is activated.

**Location:** On the outrigger pivot plates.

### Adjustment:

The limit switch head is non-adjustable and should be depressed by the outrigger locking pin the outriggers are deployed and taking load. It should be checked for freedom of movement and kept clean from dirt or other contaminants. Ensure all moving parts on locking mechanism (springs, etc.) are in good working order and lubricated regularly.

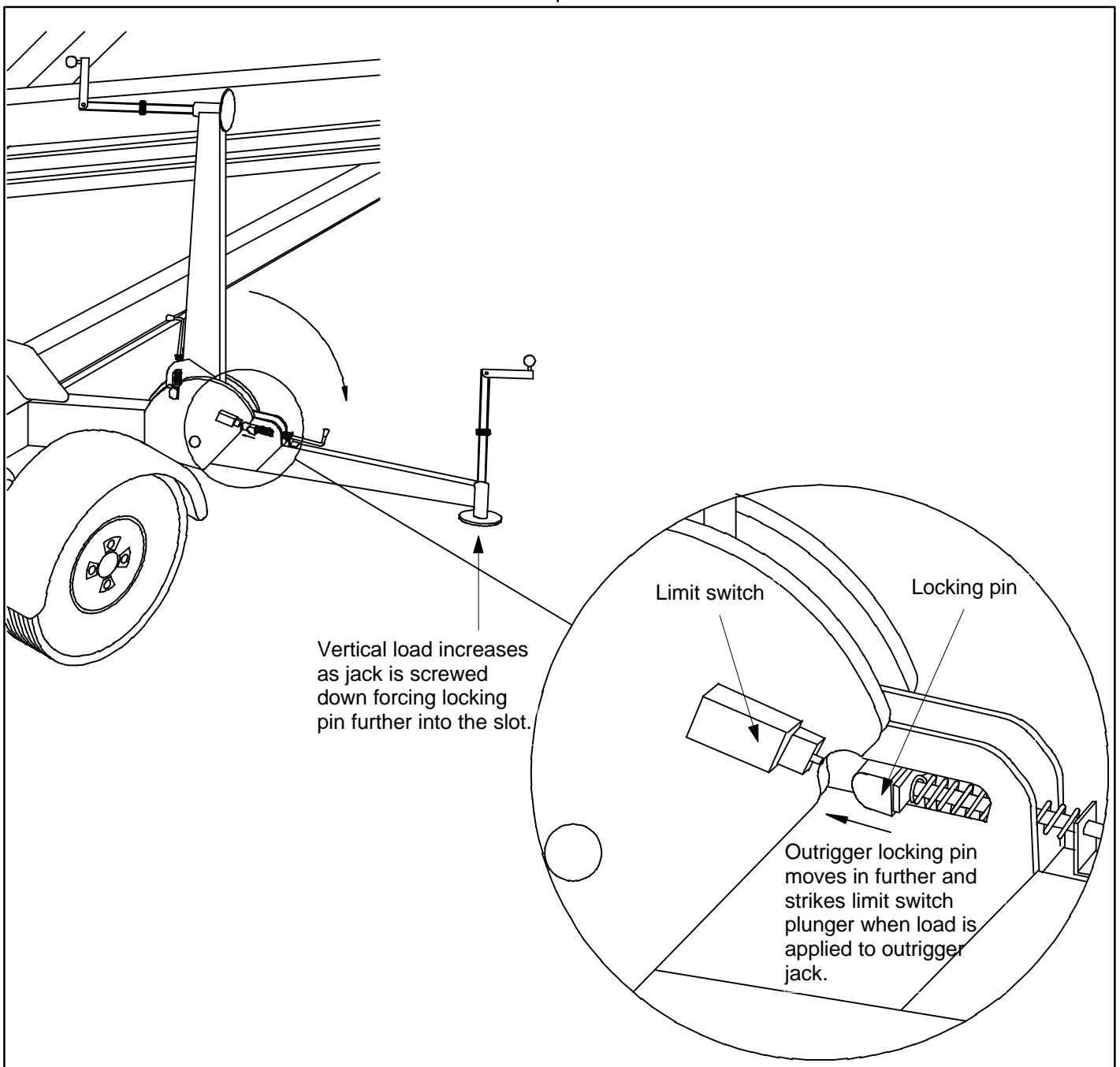


Figure 4-6: Outrigger Limit Switches

## 4.7 Hydraulic Manifold

Though it is not necessary to remove the manifold to perform all maintenance procedures, a determination should be made as to whether or not the manifold should be removed before maintenance procedures begin.

### REMOVAL

1. Remove battery ground cable.
2. Remove plastic cover from first post.
3. Tag and disconnect the solenoid valve leads from the solenoids.
4. Tag, disconnect and plug hydraulic hoses.
5. Remove securing bolts that hold manifold block to first post.
6. Remove manifold block.

### DISASSEMBLY

**NOTE:** Mark all components as they are removed so as not to confuse their location during assembly. Refer to Figure 4-9 often to aid in disassembly and assembly.

1. Remove coils from solenoid valves.
2. Remove solenoid valves and relief valves.
3. Remove fittings and bonded washers.
4. Remove spool housings and spools.

### 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.

1. Install fittings and bonded seals.
2. Install relief valves and solenoid valves.

Note: Torque cartridge relief valves to 45NM.  
Torque solenoid spool cartridges to 20NM  
Torque coil retaining nuts to 3.4NM

### INSTALLATION

1. Attach manifold assembly to first post with bolts and washers.
2. Connect hydraulic hoses to their destinations on the manifold block.
3. Connect solenoid leads to their correct coils.
4. Operate each hydraulic function and check for proper function and leaks.
5. Re-secure plastic cover to first post.

- |  |  |
|--|--|
| 1. Valve Block                               | 8. Fitting (Straight 3/8" Male/Male)         |
| 2. Spool Assembly, Large (including O-Rings) | 9. Bonded Seal (3/8")                        |
| 3. Coil, Large                               | 10. Relief Valve                             |
| 4. Spool Assembly, Small (including O-Rings) | 11. Pressure Test Point Fitting              |
| 5. Coil Locking Nut                          | 12. Fitting (Straight 3/8" Male - 1/2" Male) |
| 6. Coil, Large                               | 13. Fitting (Straight 3/8" Male - 1/4" Male) |
| 7. Fitting (Straight 3/8" Male/Male)         |  |

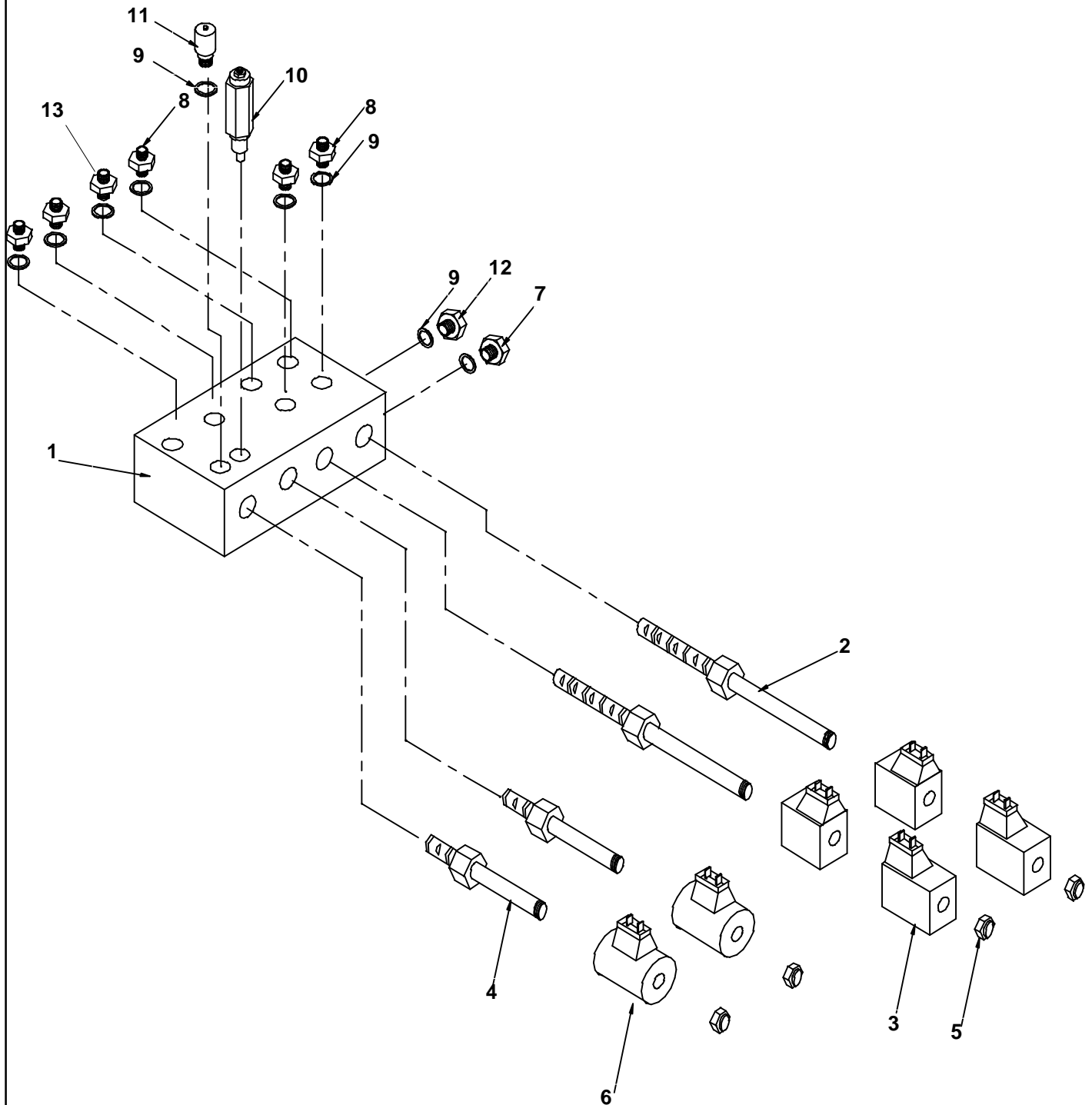


Figure 4-7: Main Manifold Block

## 4.8 Hydraulic Pump (Figure 4-8)

### REMOVAL

**NOTE:** If the hydraulic reservoir has not been drained, suitable means for plugging the hoses should be provided to prevent excessive fluid loss.

1. Mark, disconnect and plug hose assemblies.
2. Loosen the capscrews and remove the pump assembly from the motor.

### INSTALLATION

1. Lubricate the pump shaft with general purpose grease and attach the pump to the motor with the capscrews.
2. Using a criss-cross pattern torque each capscrew a little at a time until all the capscrews are torqued to 20 ft.lbs. (27 N-m).
3. Unplug and reconnect the hydraulic hoses.
4. Check the oil level in the hydraulic tank before operating the work platform.

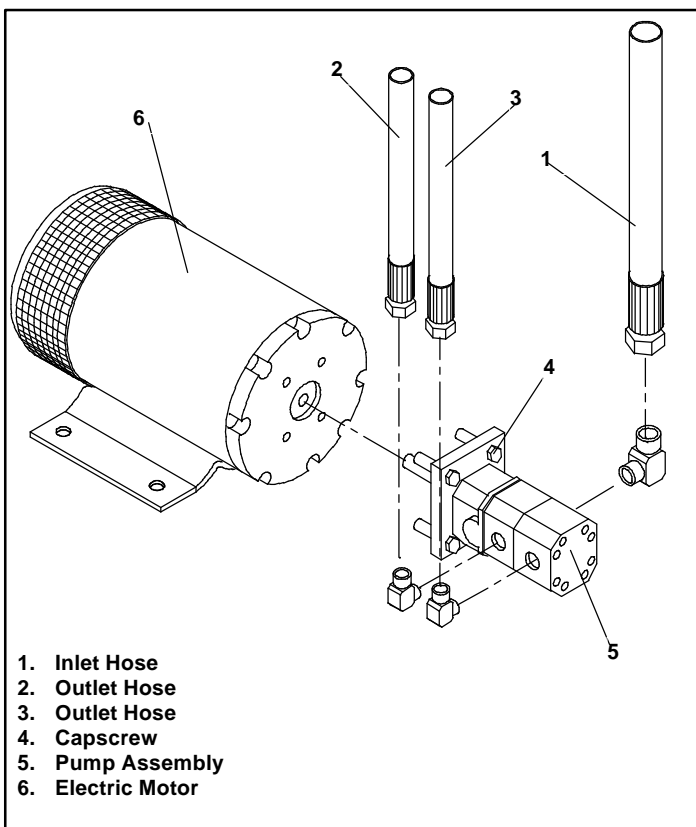


Figure 4-8: Hydraulic Pump

## 4.9 Wheel Hubs/Bearings

### MAINTENANCE & ADJUSTMENT

1. On level ground, jack up the TL33 with the outriggers so that the wheels are clear of the ground.
2. Slacken the brakes by turning the hexagon adjusting nut (Figure 4-11 item 1) anticlockwise.
3. If movement can be detected between the brake drum and brake backplate, adjust as follows:
  - a) With a screwdriver blade inserted between the flange of the grease cap and the hub, remove the cap. (See Figure 4-9.1).
  - b) Straighten and remove the split pin from the axle nut. (See Figure 4-9.2).
  - c) Tighten the axle nut clockwise until resistance is felt when rotating the hub by hand.
  - d) Slacken the nut one slot (30°) anticlockwise, and refit new split pin. Replace new grease cap.
  - e) Adjust brakes. (See section 4-10)

### REPLACING WORN BEARINGS/ HUB OIL SEAL

1. Remove hubs following procedure from 1 to 3.b above.
2. Remove oil seal and bearing cone (with rollers), remove bearing cup by using a 'drift' or bar through the hub bore, and tapping the cup and oil seal out with a hammer. (See Figure 4-9.3 )
3. Clean hub thoroughly with a cleaning fluid.
4. Using a suitable soft plug/jig, tap bearing into hub recess. Ensure that the tapered side of the bearing is facing outwards (See Figure 4-9.4) and bearing is fully located against shoulder in hub.
5. Pack bearings with good quality high melting point grease. Half fill hub cavity with grease.
6. Locate back bearing in hub with rollers facing inwards, tap oil seal into position.
7. Assemble hub and adjust as described in paragraphs 3c - 3e above.

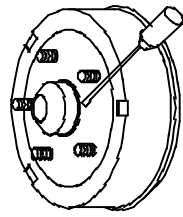


Figure: 4.9.1

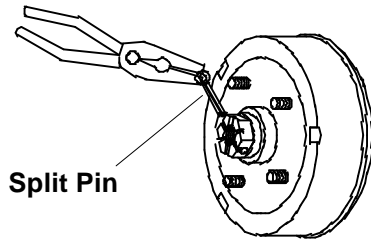


Figure: 4.9.2

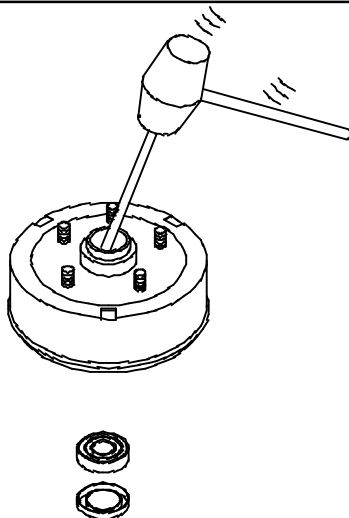


Figure: 4.9.3

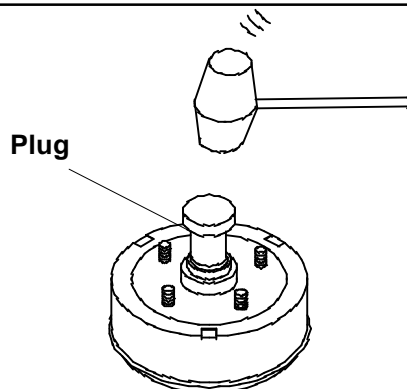
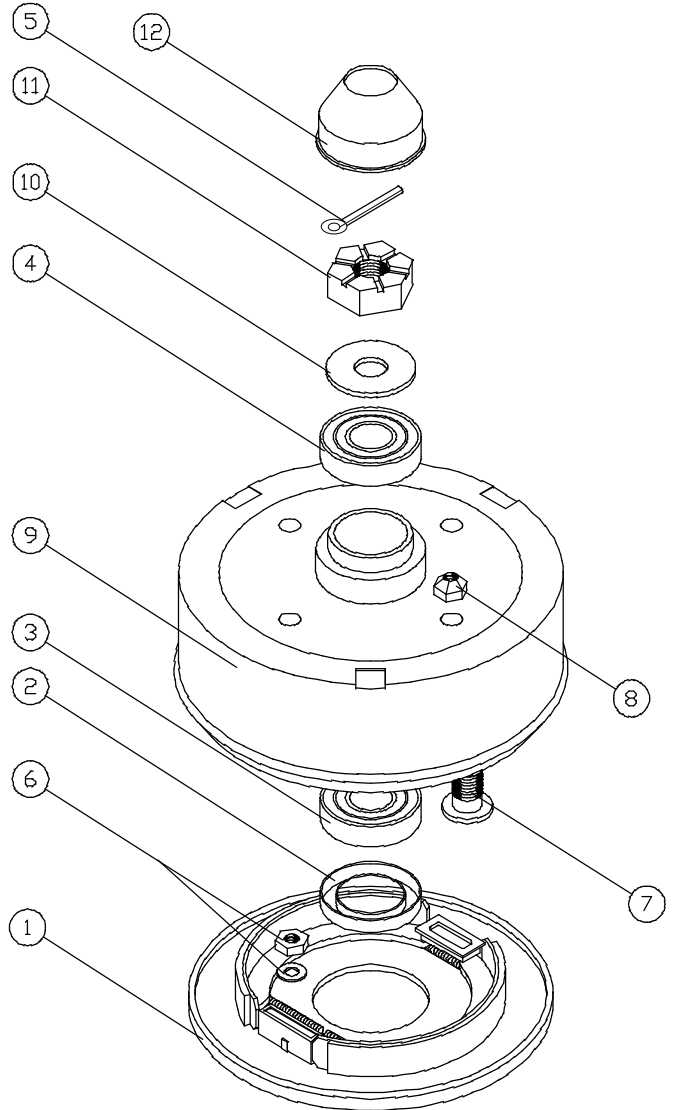


Figure: 4.9.4



ITEM	DESCRIPTION
1	Brake Assembly
2	Grease seal
3	Inner Bearing
4	Outer Bearing
5	Split Pin
6	Retaining Nut & Washer
7	Wheel Stud
8	Wheel Nut
9	Drum
10	Washer
11	Axle Nut
12	Hub Cap

Figure: 4.10 Wheel Hub Assembly

## 4.10 Braking System

### PRINCIPLES OF OPERATION

The Auto Reversing arrangement is fitted to each wheel brake. One 'Shoe' in each brake is fitted with a device that allows the shoe to slide down on cams or rollers when the brake drum is rotated in reverse, thus reducing the overall brake diameter and resistance to movement. In forward motion, the brake shoe is drawn back to its normal operating position for forward braking.

To overcome the tendency for the auto-reverse function to disengage the brakes when parked facing up-hill, an 'energy-store' in the form of a spring in the handbrake lever mechanism is fitted. This maintains sufficient pressure on the brakes in the reverse mode, preventing the TL33 from moving backwards.

**NOTE: The handbrake must be applied sufficiently to ensure that the spring energy store is fully compressed. Prior to the brakes being 'bedded in' (850 Km or 500 miles from new or from brake shoe change) care must be taken during normal braking, and when using the handbrake for parking it is advisable to chock the wheels for safety.**

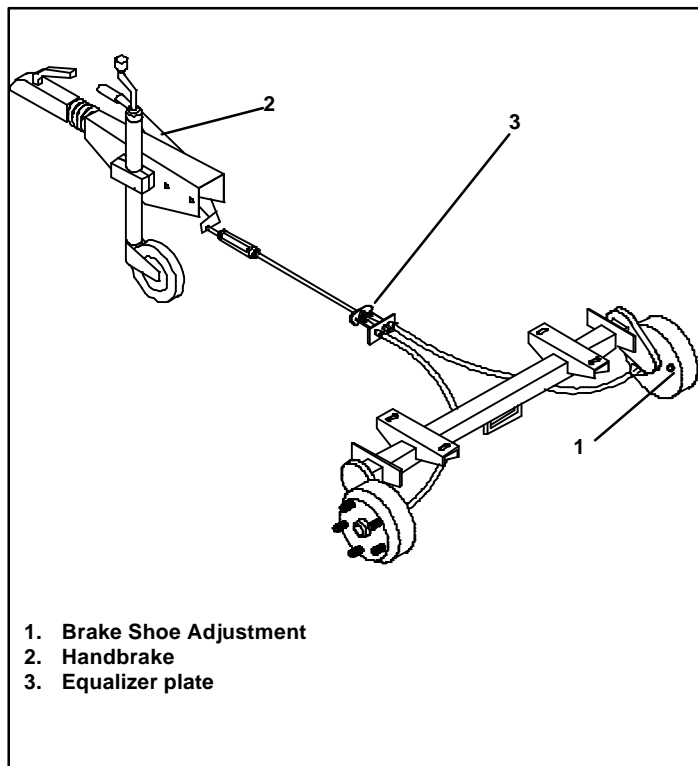


Figure 4-11: Braking Arrangement

### ADJUSTMENT OF WHEEL BRAKES

**⚠ WARNING ⚠**

Take care not to inhale brake dust when working on brakes. Wear a filter mask.

Position the machine on level ground. Ensure handbrake is in the fully OFF position.

1. Jack wheels clear of the ground.
2. Ensure that handbrake cables are slacked.
- 3.. Rotate wheels in the forward direction (clockwise on the right hand side of trailer, anti clockwise on the left hand side) and tighten adjustment nut (Fig. 4-11 item 1) in a clockwise direction until hubs will no longer rotate.
4. Slacken the adjustment nut until very slight resistance is felt between the brakes and brake drum.
5. When adjusting the brakes, ensure that the shoes only just touch the inside of the brake drums. In order for the system to work correctly in the reverse mode, the brake drums must rotate in reverse sufficiently to disconnect and collapse the auto reverse shoe. The moving tube inside the coupling must continue to stroke fully and rest on a "stop" without re-applying the brakes. If the brakes are adjusted too tightly to the drums then the coupling will again apply the brakes and prevent further reverse movement.
6. Re-adjust cables & test function.

### CHANGING WORN OR DAMAGED BRAKE CABLES

1. Check brake cable where it enters brake. If it ends in a collar that fits over the cable entry tube then the cables are of the detachable type.
2. To change the cable, slacken and drop cable end from the Equalizer plate (Fig. 4-11 item 3) and detach cables from drum as shown in Figure 4-12 (a) .
3. To refit, reverse the procedure.

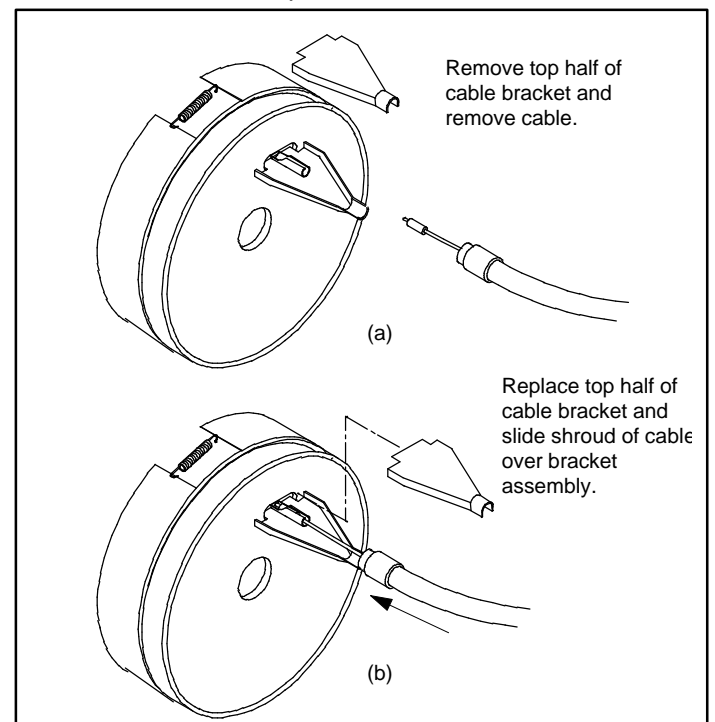


Figure 4-12: Replace Brake Cable

## 4.11 Upper Lift Cylinder (Figure 4-13)

### REMOVAL

1. Ensure Elevating Assembly is completely stowed.
2. Provide a suitable container to collect the hydraulic fluid, then disconnect the hydraulic hoses. Immediately plug hoses to prevent foreign material from entering.
3. Remove circlips and securing bolts from cylinder pins.
4. Support rod end of cylinder and remove rod end pivot pin. Let cylinder down to rest on the lower boom. Note: The cylinder is heavy, so utilise appropriate lifting tackle to support the unit before removing pins.
5. Support the cylinder so that the barrel end cylinder pin can be removed, then remove the cylinder from the machine.
6. Move the cylinder to a prepared work area.

### DISASSEMBLY (Refer to Figure 4-15)

1. Unscrew the headcap and withdraw the rod and piston assembly from the barrel tube.
2. Unscrew the piston nut and remove piston and headcap from the cylinder rod.
3. Remove the piston static O-ring from the cylinder rod.
4. Remove the piston seal from the piston.
5. Remove the rod seal, rod wiper and static seal from the headcap.
6. Remove the valve block from the cylinder barrel.
7. Care should be taken to save the O-ring for later use.

### CLEANING AND INSPECTION

1. Clean all metal parts in solvent and blow dry with filtered compressed air.
2. Check all threaded parts for stripped or damaged threads.
3. Check the bearing surfaces inside of the headcap, outer edge surface of the piston, inside of the cylinder barrel and the shaft for signs of scoring or excessive wear.
4. Replace any parts found to be unserviceable.

### REASSEMBLY

1. Lubricate and install new rod seal, rod wiper and static seal on the headcap.  
**NOTE:** Multi-purpose lubricant should be used.
2. Install a new piston seal on the piston.
3. Install the headcap on the cylinder from the piston end.  
**NOTE:** Installing the headcap over the pivot hole in the shaft could damage the seals.
4. Install a new piston static O-ring, the piston and piston nut on the cylinder rod. Screw nut to end of thread and secure with set screw.
5. Lubricate the piston seal and install the piston and rod assembly in the barrel tube.
6. Thread headcap onto barrel tube and hand tighten, then turn 1/4 turn further.
7. Install the upper cylinder valve block. Check O-rings.

### INSTALLATION

**NOTE:** Before installing Lift Cylinder check cylinder pins and bearings for wear and replace if necessary.

1. Install barrel end bearing (if removed)
2. Place the lift cylinder on the lower boom.
3. Lift the barrel end of the cylinder into place and push the cylinder pin in until approx. 38mm (1 1/2 in.) is still exposed.  
**NOTE:** Take care in aligning the holes so that the pin can be pushed in by hand. If holes are not properly aligned and the pin is forced in, the bearings will be damaged.
4. Align anti-rotation plate on cylinder pin with hole in the mast and push the cylinder pin completely in and secure the circlip. Lock anti-rotation plate with bolt.
5. Install rod end bearings (if removed).
6. Lift rod end of cylinder into place and insert pin until approx. 38mm (1 1/2 in.) is still exposed. Install anti-rotation pin.
7. Install circlip. Lock anti-rotation plate with bolt.
8. Test with weight at rated platform load to check system operation.

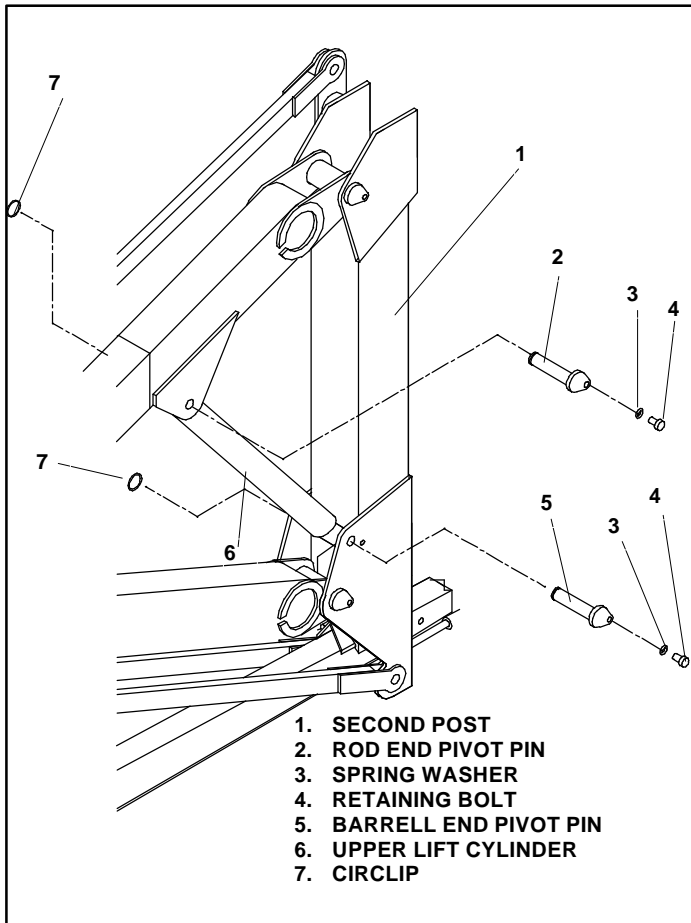


Figure 4-13: Upper Lift Cylinder

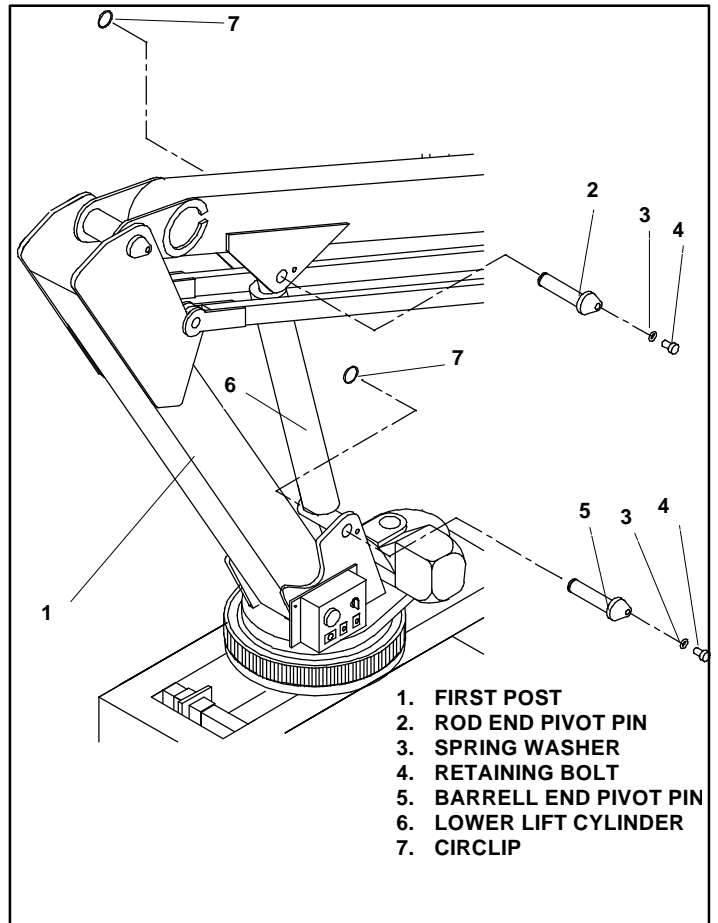


Figure 4-14: Lower Lift Cylinder

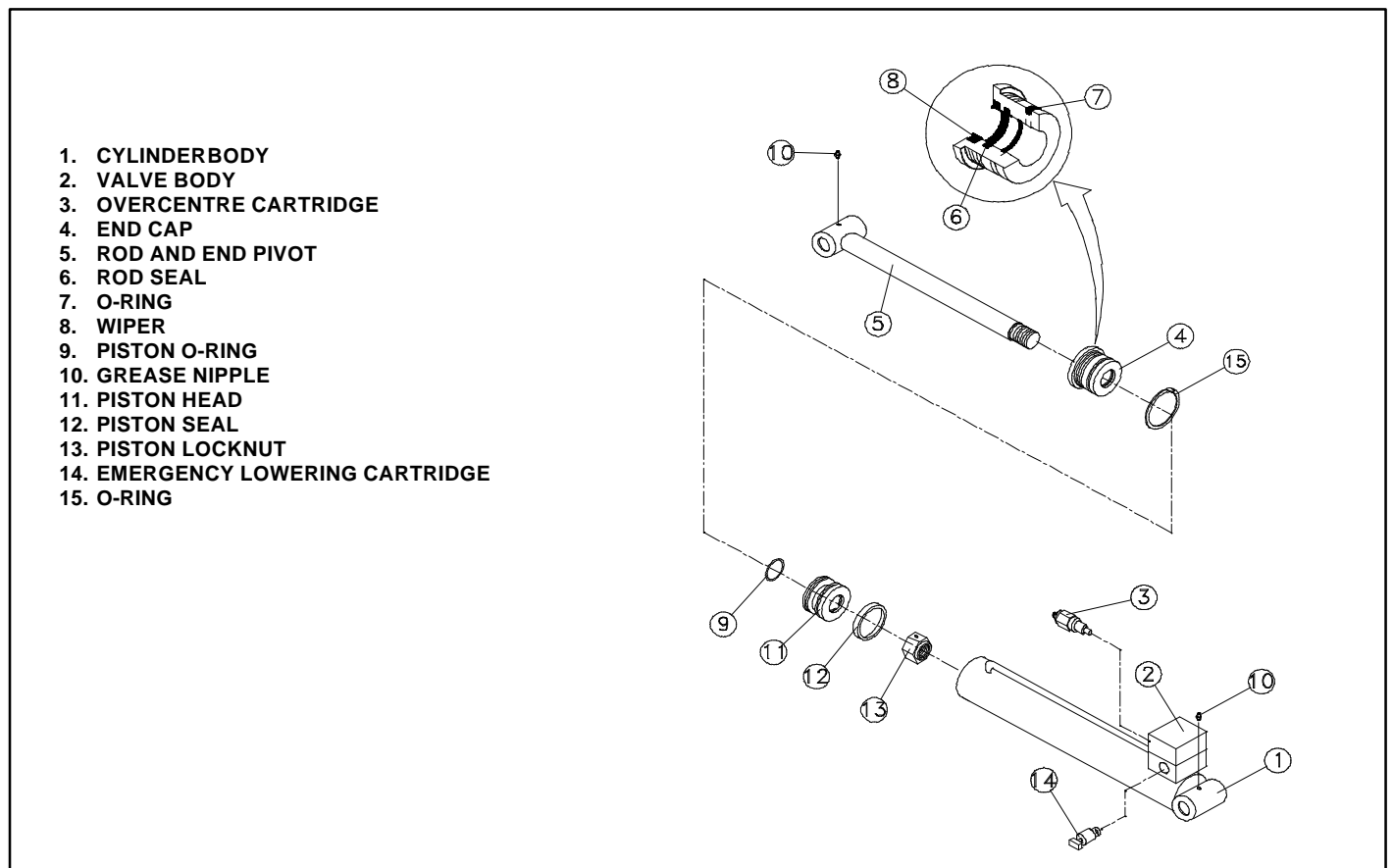


Figure 4-15: Hydraulic Cylinder Components



## 4.12 Lower Lift Cylinder (Figure 4-14)

### REMOVAL

1. Ensure Elevating Assembly is completely lowered and that the booms are in their rest position.
2. Provide a suitable container to collect the hydraulic fluid, then disconnect the hydraulic hoses. Immediately plug hoses to prevent foreign material from entering.
3. Remove circlips and securing bolts from cylinder pins.
4. Support rod end of cylinder and remove rod end pivot pin. Move cylinder backwards to rest against the first post. **Note:** The cylinder is heavy, so utilise appropriate lifting tackle to support the unit before removing pins.
5. Support the cylinder so that the barrel end cylinder pin can be removed, then remove the cylinder from the machine.
6. Move the cylinder to a prepared work area.

### DISASSEMBLY (Refer to Figure 4-15)

1. Unscrew the headcap and withdraw the rod and piston assembly from the barrel tube.
2. Unscrew the piston nut and remove piston and headcap from the cylinder rod.
3. Remove the piston static O-ring from the cylinder rod.
4. Remove the piston seal from the piston.
5. Remove the rod seal, rod wiper and static seal from the headcap.
6. Remove the valve block from the cylinder barrel.
7. Care should be taken to save the O-ring for later use.

### CLEANING AND INSPECTION

1. Clean all metal parts in solvent and blow dry with filtered compressed air.
2. Check all threaded parts for stripped or damaged threads.
3. Check the bearing surfaces inside of the headcap, outer edge surface of the piston, inside of the cylinder barrel and the shaft for signs of scoring or excessive wear.
4. Replace any parts found to be unserviceable.

### REASSEMBLY

1. Lubricate and install new rod seal, rod wiper and static seal on the headcap.  
**NOTE:** Multi-purpose lubricant should be used.
2. Install a new piston seal on the piston.
3. Install the headcap on the cylinder from the piston end.  
**NOTE:** Installing the headcap over the pivot hole in the shaft could damage the seals.
4. Install a new piston static O-ring, the piston and piston nut on the cylinder rod. Screw nut to end of thread and secure with set screw.
5. Lubricate the piston seal and install the piston and rod assembly in the barrel tube.
6. Thread headcap onto barrel tube and hand tighten, then turn 1/4 turn further.
7. Install the upper cylinder valve block. Check O-rings.

### INSTALLATION

**NOTE:** Before installing Lift Cylinder check cylinder pins and bearings for wear and replace if necessary.

1. Install barrel end bearing (if removed)
2. Rest the lift cylinder against the first post.
3. Lift the barrel end of the cylinder into place and push the cylinder pin in until approx. 38mm (1 1/2 in.) is still exposed.  
**NOTE:** Take care in aligning the holes so that the pin can be pushed in by hand. If holes are not properly aligned and the pin is forced in, the bearings will be damaged.
4. Install anti-rotation pin into cylinder pin aligning with hole in the mast and push the cylinder pin completely in and secure the circlip.
5. Install rod end bearings (if removed).
6. Lift rod end of cylinder into place and insert pin until approx. 38mm (1 1/2 in.) is still exposed. Install anti-rotation pin.
7. Install circlips and securing bolts.
8. Test with weight at rated platform load to check system operation.

## 4.13 Electric Motor(Figure 4-17)



### WARNING

Before carrying out any maintenance procedures on the electric motor ensure that the electric circuit is disconnected i.e. disconnect the batteries and unplug the charger!

## TROUBLESHOOTING

1. Read the nameplate to become familiar with the motor, especially the rated voltage.
2. Try to turn the shaft by hand. Keep motor leads separated while doing this. If the shaft turns freely go to step 3. If the shaft won't turn, proceed to step 2A.
- 2A. The shaft could be tight for a number of reasons, this check is to determine if the tightness is of a temporary nature only. Obtain power to produce the nameplate voltage. Do not make a permanent connection. First touch the motor leads quickly to the power supply just long enough to observe if the shaft runs. If it does turn, then hold the motor leads on the power supply for a longer time. If the motor sounds normal, go to step 3. If the motor is noisy it should be taken apart as described in the disassembly section.
3. If the motor turned freely, connect an ammeter in the circuit as shown in Figure 4-16. With rated voltage applied and the shaft running free, the ammeter should read less than 20% of the nameplate full load current. If the motor meets the above conditions then it can be assumed the original problem is external to the motor.

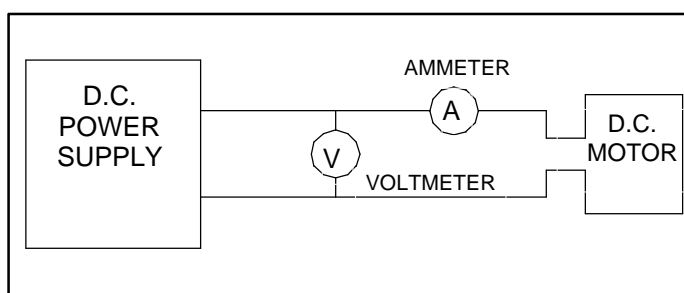


Figure 4-16: Electrical Test Circuit

## DISASSEMBLY

1. Remove through bolts.
2. Remove pulley end cover
3. Pull the armature out of the assembly in one swift motion.
4. Remove commutator end cover.

**NOTE:** Do not place the stator ring in any mechanical holding device during the disassembly or assembly operation. Permanent distortion or other damage will result.

## INSPECTION

Once the motor has been disassembled, go through the following check list steps to determine where the problem lies.

1. Bearings should spin smoothly and easily and have ample lubrication and be free of corrosion.
2. Armature should be checked for grounds and shorted turns. Refinish commutator surface if pitted or excessively worn.
3. Brushes should be checked for wear and to ensure that they are free in the brush holders.

**NOTE:** Observe how the brushes are assembled in brush holders and position of brush lead. New brushes must be installed in same manner. Brushes should be removed as follows:

- Remove brush spring clip from its mounting on brush assembly.
  - Lift brush assembly from the brush holder
  - Disconnect brush assembly lead.
  - New brush assembly to be installed by reversing the above procedure.
4. Inspect wire harness and all connections for signs of damage due to overheating.
  5. Check stator to see if it is securely mounted.

## REASSEMBLY

1. Install new brushes and be sure they are free in the holder. Install brush with the lead wires positioned as when received.
2. Place commutator cover on a work bench with brush assembly facing upward.
3. Place the bearing spring into the bearing bore.
4. Take a complete armature assembly, including bearings, and insert commutator end bearing into the bearing bore.  
Note: Do not re-use bearings which have been removed from armature shaft. Keep assembly in a vertical position. Use extreme care not to damage armature with bearing pullers. New bearings should be installed by pressing inner race of bearing onto proper position on armature shaft.
5. Set the brushes to final position and lock with springs.
6. Place the complete stator down over the vertical armature, and into position on the commutator cover.
7. The stator assembly must be placed in a definite relationship with the commutator covers in order to obtain a neutral brush setting. There is a match-mark on both items. These two marks must line up exactly. Rotate until they do.
8. Assemble the pulley end cover in the proper relationship. Insert mounting bolts and tighten alternately to ensure a good mechanical alignment.
9. Spin the shaft by hand to see if it is free. Be sure motor leads (if used) are not touching together. If the leads are touching, a generator action will give the effect of friction in the motor. A no-load test can now be performed. At rated voltage, observe the no-load current. It should be less than 20% of the nameplate full load current. Anything higher indicates:
  - Brushes are not on neutral setting (check matchmarks for exact alignment)
  - Faulty armature

Every **500** working hours

Brushes - Check the wear, the correct seating, and the regularity of the working surface.

Springs - They should not be burned or damaged, and they must apply a constant and equal pressure on the brushes.

Commutator - The surface must be clean and regular without grooving or burning.

Every **1000** working hours

Bearings- All the bearings are fitted with a double shield and lubricated with high temperature grease. Check for leaks, vibration and noise. If necessary replace with bearings of identical type.

Seals - Check that hydraulic seals are in perfect condition.

Screws - Check that all nuts, particularly the cable nuts and screws are tight.

General - Check that foreign bodies or dirt have not entered the motor. Check that the ventilation holes are clean and not obstructed.

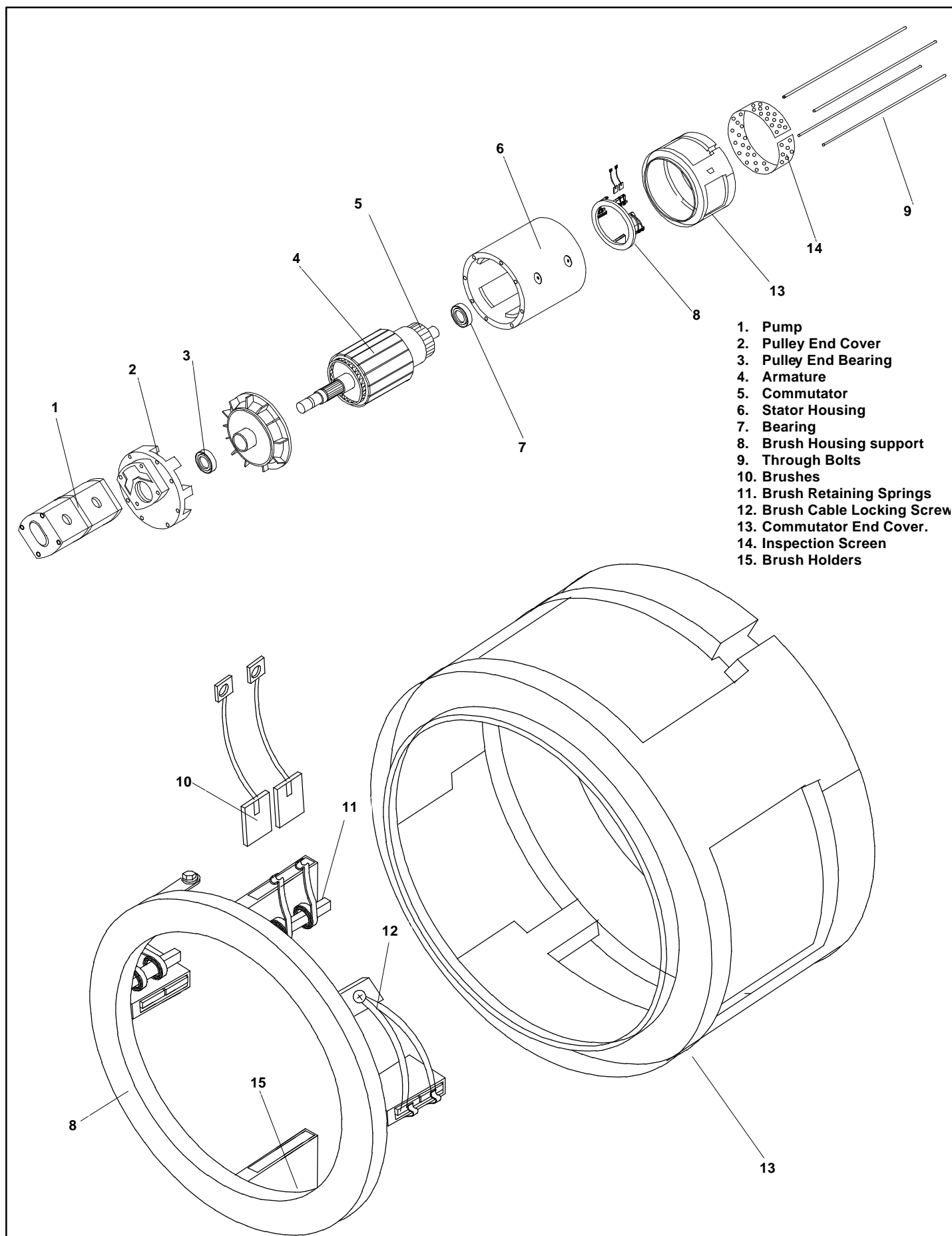


Figure 4-17: Electric Motor Assembly

## **4.14 Adjustment of Overcentre Valves on lift cylinders.**

The valve supplier delivers the overcentre valve pre-set to specification and **SHOULD NOT** be adjusted by the user. In the event of the valve having been tampered with the advisable course of action is to fit a replacement cartridge.

A **short term** solution is to temporarily adjust the valve as follows :-

- a) Place 215 kg. evenly distributed in the cage.
- b) Raise the boom to about 50mm stroke on the cylinder.
- c) Using a screw driver adjust the spring setting screw on the valve cartridge.  
Turning the screw clockwise increases the pressure setting. Turning the screw anticlockwise reduces the setting and allows the boom to creep downwards. Adjust the spring setting until the boom just begins to creep downwards.
- d) Screw the adjuster **1 (one)** further turn **clockwise** and secure locknut.

**This operation should only be carried out by suitably qualified and/or experienced personnel.**



### **CAUTION**



**An incorrectly adjusted valve may cause one of the following problems:-**

Cylinder creeps down under load less than the SWL.  
Jerky motion in cylinder & boom when lowering.

Pump under high load when lowering.

Valve does not hold load if hose connections are loosened or broken.

Damaged seals in cylinders due to high ambient temperature rise.

**NOTES**

## 5.0 Introduction

Table 5-1 provides a logical sequence of tests that are designed to isolate problems with TL33 machines. This table includes a list of probable causes and remedies.



### **WARNING**



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

When performing any service on or in the elevating assembly area, which requires the platform to be raised, the elevating assembly must be securely supported by overhead cranes of suitable capacity. Disconnect the batteries ground cable when replacing or testing the continuity of any electrical component.

## **GENERAL PROCEDURE**

Trouble shooting should be carried out in two steps. First, thoroughly study both the hydraulic and electric schematics to determine possible causes. Loose terminal connections and short circuits are always a potential cause when trouble shooting. Second, check suspect components electrically, hydraulically and mechanically to determine if they are at fault. Refer to Tables 6-1 and 6-2 for References used in Table 5-1

**Table 5-1: Troubleshooting**

TROUBLE	PROBABLE CAUSE	REMEDY
All functions inoperable, electric motor does not start.	1. Blown electric motor fuse FU2.	Check 160 amp electric motor fuse. Replace if blown.
	2. Faulty battery charger.	Check the voltage output of the battery charger. If less than 24 VDC, repair or replace.
	3. Faulty battery(ies).	After completely charging batteries, test each battery. Replace as required.
	4. Loose or broken battery lead.	Check continuity of all battery and motor leads. Replace if necessary.
	5. Emergency Stop switch(es) upper & lower failed open.	With emergency stop switch in the ON position, check continuity across contacts. If none, replace.
	6. Blown control fuse FU1.	Check 7A circuit control fuse. Replace if blown.
All functions inoperable. Electric motor starts when control is actuated.	1. Oil level in hydraulic reservoir is low.	Check hydraulic fluid level, top off as required.
	2. Faulty hydraulic pump.	Check pressure and delivery of the hydraulic pump. Replace if required.
	3. Faulty Controller	Check operation. Replace if required.
Platform will not elevate or elevates slowly.	1. Emergency Lowering valve open.	Close emergency down valve.
	2. Platform overloaded.	Observe maximum load rating. (See Table 1-1)
	3. Faulty controller at upper controls.	Check functionality of controller. Replace if faulty.
	4. Blown control fuse FU1.	Check 7A circuit control fuse. Replace if blown.
	5. Battery Voltage low. Check LED on motor control unit for 7 flash fault (LED will flash 7 times) due to battery voltage <14V.	Check Battery Voltage. Charge if necessary.

TROUBLE	PROBABLE CAUSE	REMEDY
Platform will not elevate or elevates slowly.	6. Check LED on motor control unit for 8 flash fault (LED will flash 8 times) due to thermal cutback.	Allow unit to cool down, to clear flashing.
	8. Outrigger limit switches LS1, LS2, LS3, LS4 not activated.	Ensure all four outriggers are deployed and the limit switch contacts are closed. Replace switch.
	9. Faulty lift valve solenoid.	Test Lift Solenoid, if proper voltage is present and coil is not magnetized - Replace.
Booms drift down after being elevated	1. Emergency lowering valve open.	Ensure that emergency lowering valve is completely closed. Replace the valve.
	2. Leaking piston seals in lift cylinders (CYL1, CYL2)	Check for leakage at cylinder return line, replace seals if necessary.
	3. Overcentre valve leaking internally.	Check for contamination and clean. Check that O-Rings are intact.
Machine will not slew when booms are elevated	1. Faulty slew cut-out limit switch.	Check that Normally Closed contacts of limit switch are closed when second post is approximately 1m above ground. Adjust switch lever arm or Replace switch.
	2. Faulty slew switch or controller	Test switch for continuity. Replace if defective.
	3. Faulty slew solenoid.	Test Slew Solenoid, if proper voltage is present and coil is not magnetized - Replace.
	4. Mechanical Damage	Inspect all slewing components. Replace damaged parts.
	5. Slew Valves stuck.	Inspect slew valves. If spool is sticking - Replace.
	6. Key on Slew Motor shaft sheared off.	Remove motor from gearbox and replace key if sheared.



# Troubleshooting

## Section 5.1

TROUBLE	PROBABLE CAUSE	REMEDY
Machine will not slew when booms are elevated (contd...).	7. Oil seals in slew motor are damaged.  8. Faulty function select switch.	Check and replace if necessary.  Replace switch.
Platform will not lower.	1. Faulty Down Valve Coil.  2. Faulty function select switch.  3. Faulty Controller  4. Down Valve stuck.	Test Down Valve Coil. If proper voltage is present and coil is not magnetised - Replace  Replace switch.  Replace if required.  Check and see if spool is stuck. - Replace if necessary.
Brakes overheating	Brake shoes adjusted too tight, wheels difficult to rotate.	Reset brakes according to reset procedure.
Trailer fails to auto-reverse	Hitch incorrectly adjusted.	Follow adjustment procedure.
Handbrake not working efficiently.	Brake shoes worn  or  handbrake out of adjustment.	Remove hubs, clean brakes and drums, replace brake shoes.  Adjust handbrake as per section 4-10 in maintenance section.
Brakes snatching	Damper failure in coupling.	Fit exchange coupling.
Brakes remaining on after handbrake release.	Cable linkage incorrectly adjusted/sticking.	Remove linkages, cables and rods. Clean and refit. Re-adjust linkage system.
Trailer failing to tow easily (Resistance)	Brake shoes adjusted to tight, wheels difficult to rotate.	Reset brakes according to reset procedure in chapter 4 of maintenance section.

## 5.2 GENERAL INFORMATION

The TL33/49 use a single DC Motor Control Unit to control the speed of the hydraulic pump electric drive motor. The SP 37 uses two Motor Control Units. One for the hydraulic pump electric drive motor and one for the two (2) electric traction drive motors.

The DC motor control units powers the electric motors at a speed that depends on (1) the signal from the lower or upper controls and (2) the pre-programmed software inside the MCU. Many names are in use for these DC motor controllers, the most common is **MOS90**. To separate the two we tend to call them **TRACTION MOS90 (MCU1)** and **PUMP MOS90 (MCU2)**.

The name MOS90 relates to the technology behind this system of providing variable, multi-directional, control of a DC motor. The basic principle of this system is to deal with a high current (resulting in a high temperature) in a compact and energy efficient manner. The main component in a MOS90 is a MOSFET transistor (micro osmosis field effect transistor). The MOSFET can deal with very high currents, quickly rid itself of high temperatures and in a very efficient way (95%). All this despite its small physical size.

The SP37 control circuit operates at 48 Volts whilst the TL33/49 operate at 24V. Both circuits are limited to 7A by the control fuse. The components used are relays, diodes, selector/limit switches, motor contactors, the joystick, horn and tilt sensor.

Between the components we generally use 0.75 sq.mm (AWG 20) cable and P.C.B's (Printed Circuit Boards). The P.C.B. connectors are of the MOLEX type.

### Terminology

The reference points used on the schematics e.g. JP1 (Junction Point #1) and Pin 1 (connection pin #1) have the following meanings:

- JP is a cable harness connector, e.g. between P.C.B. and multi-connector
- PIN is the pin number of the P.C.B. or on the MOS90.

The software of the MOS90 is related to the various functions as follows:

- e.g. Speed 5 is the #5 internal speed setting of the Pump MOS90.
- e.g. Switch 5 (sw5) is the logical switch in the software enabling Speed 5

## 5.3 D.C. Motor Control - General Information

### What is it ?

DC motor control is one way to achieve smooth proportional control of an electrically powered work platform.

Most of you are familiar with the “constant rpm electric motor” turning a hydraulic pump at a constant speed. The speed of the function is controlled by the proportional valve, allowing more or less hydraulic fluid to the e.g. lift cylinder depending on the angle of the joystick.

With DC motor control we are doing the opposite, but still achieving the same objective. By controlling the r.p.m. of the electric motor we are controlling the amount of hydraulic fluid the pump will deliver, or the speed at which the elevating assembly will e.g. lift.

On electric drive machines, i.e. SP37, the DC motor gives the operator the ability to drive at various speeds depending on the angle of the joystick.

### How is it done ?

The basic DC motor controller has three connections: Positive (B+), Battery Negative (B-) and Motor Field Negative (A). The electric motor has continuous battery positive (B+) over the main fuse. Inside the DC motor controller we have high current MOSFET transistors & capacitors and the low current control circuitry, made up of integrated circuits (IC's).

By controlling the amount of time when Battery Negative (B-) and Motor Field Negative (A) is “connected” - the electric motor will turn at an r.p.m. equal to the same. Or simply:

- If (B-) and (A) are connected all the time - then the motor will turn at 100%
- If (B) and (A) are not connected - then the motor will turn at 0%
- Anything in between will turn the motor at any speed between 0 to 100%.

Some of the benefits of this type of “proportional control” are:

- Energy efficient - preserves battery power.
- Smooth and Precise - allows safe and easy precision control.
- Quiet operation - the motor only “hums”, no high pitch scream.
- Compact - no bulky equipment.

### What is the difference ?

We are using two types of DC motor controllers: the PUMP controller and the TRACTION controller (Self propelled units only). Typically we call them: a **TRACTION MOS90** or a **PUMP MOS90**. They are not interchangeable and the fundamental differences are as follows:

#### **PUMP MOS90:**

- A Pump MOS90 only controls hydraulically powered functions.
- Can only control a “pump motor” (single direction)
- Has two (2) or three (3) proportional speeds.
- Has up to four (4) fixed speeds (non-proportional)
- Identified by three (3) big terminal connections at the front.
- Currently there are five (5) different models covering the TL33/49 and SP37.

#### **TRACTION MOS90:**

- A traction MOS90 only controls the electrical drive functions on the SP37
- Can only control a “traction motor” (bi-directional D.C. motor)
- Has three (3) proportional speeds
- Has an electric “plug-braking” system (similar to hydraulic counter balance valve)
- Identified by four (4) big terminals at the front.
- Currently there are two (2) different models covering all SP-37's.

## 5.4 Trouble shooting the motor control unit (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 being 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 from the machine circuit. An explanation of the flash sequences or "flash faults" is shown in the table below.
- The MOS90 is **high temperature protected** called "**thermal cut-back**". The high temperature cut-back starts at 80 degrees Celsius and the MOS90 will shut down at 90 degrees Celsius. This is a gradual feature and the symptom is: powered functions will gradually operate slower and slower. Continuing operation at high temperature will damage the MOS.
- The MOS90 is **low voltage protected** called "**low voltage cut-out**". The low voltage cut-out shuts the MOS90 down as soon as the input voltage is below 14.0VDC. This is an instant feature and the symptom is: powered functions suddenly stop. As soon as the input voltage goes above 14.0 VDC it will resume normal functions.
- All PUMP MOS90, except, part number 57300-000 (TL33 units before serial number 1133), have a B.D.I. system (Battery Discharge Indicator System), connected to the red L.E.D. on the upper control box. The B.D.I. system monitors the input voltage and will inform the operator when the batteries are discharged.

Normal operation: The red L.E.D. is off.

70% Discharge: The red L.E.D. will flash.

80% Discharge: The red L.E.D. will be continuously on.

- The B.D.I. will not show how much battery power is left, it only shows how much the batteries have been discharged from the starting time.

**Table 5-2 MOS90 Flash Faults**

L.E.D. Status	Manufacturers Technical Reason	Possible cause
No L.E.D	MOS90 did not turn on	MOS90 did not receive an input voltage on PIN # 6 (The power input pin)
1 Flash	EEPROM corruption	The MOS90 received a high voltage spike
2 Flash	not applicable	not applicable
3 Flash	(a) Internal short circuit (b) Motor circuit open	(a) Line contactor not activated (b) Motor burned / bad contact
4 Flash	not applicable	not applicable
5 Flash	not applicable	not applicable
6 Flash	(a) Accelerator input wrong (b) Accelerator input wrong	(a)Bad connection on PIN #14 (b) PIN #14 input >4.5V or < 2.4 V
7 Flash	Battery voltage <14.0V	Batteries low - need charging
8 Flash	Thermal cut-back	The MOS90 temp. is too high

### General guide lines when a flash error occurs

#### Step 1

Disconnect the 17 pin multi-connector from the MOS90. Wait 5 seconds and plug it back in again. If the flash error stays go to Step 2. If the green L.E.D. lights up and stays on continuously - test all functions, try to recreate the problem.

#### Step 2

Disconnect the 17 pin multi-connector from the MOS90. Connect pin #6 to fused battery supply (min 14VDC) and observe the green L.E.D. If flash error stays - replace MOS90. If the green L.E.D. lights up and remains on continuously - check wiring.

**NOTE:** Troubleshoot the flash error as per "possible cause" before replacing the MOS90, e.g. 8 flash fault will cure itself with time (as the MOS90 cools down).

## 6.0 Introduction

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

The diagrams are to be used in conjunction with Table 5-1: Troubleshooting Guide. They allow understanding of the makeup and functions of the systems for checking, tracing, and faultfinding during troubleshooting 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.

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## NOTES

# Schematics

## 6.1 Electrical Schematic SERIAL NUMBERS: 1001 TO 1132

Table 6-1: Electrical Schematic Legend

REFERENCE	NAME	FUNCTION	LOCATION
ALM1	Alarm,Tilt.	Provides warning sound until outriggers are deployed and the contacts on LS1, LS2, LS3 and LS4 are closed. If one of the switches opens during the operation of the machine then the alarm sounds and power is cut to the upper controls.	Upper Control Box.
BAT	Batteries x (4). 6 Volts each.	Power supply.	Chasis subframe
BC1	24V Battery Charger.	This chargers the 4 x 6v batteries when switched on and the line contactor is unergised.	Chasis Subframe.
D1	Diode	Feeds +24V to pin 6 on the controller from upper controls.	Lower control box PCB.
D2	Diode	Feeds +24V to pin 6 on the controller when the keyswitch is switched to lower controls.	Lower control box PCB.
D3 TO D8	Diode	Suppression diodes for coils of hydraulic solenoids.	Lower control box PCB.
D9	Diode	Prevents feedback to upper controls when slew cut out switch LS5 is activated	Lower control box PCB.
D10	Diode	Feeds a signal from lower lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D11	Diode	Feeds a signal from upper lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D12	Diode	Feeds power to slew left solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D13	Diode	Feeds power to slew left solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.
D14	Diode	Feeds power to the lower cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D15	Diode	Feeds power to the lower cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D16	Diode	Feeds power to the upper cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D17	Diode	Feeds power to the upper cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D18	Diode	Feeds power to slew right solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D19	Diode	Feeds power to slew right solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.

REFERENCE	NAME	FUNCTION	LOCATION
D20	Diode	Feeds power to the lower cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D21	Diode	Feeds power to the lower cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D22	Diode	Feeds power to the upper cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D23	Diode	Feeds power to the upper cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D24	Diode	Feeds power signal from joystick trigger to pin 4 on controller when emergency override is activated	Lower control box PCB.
D25,D26	Diode	Feed the signal which comes from the keyswitch (set at upper controls) to one of the alarm relay contacts and prevent power getting to upper controls when the alarm is activated from the lower controls.	Lower control box PCB.
D27	Diode	Suppression diode for the coil of direction relay 1 (RL1)	Upper Control Box P.C.B.
D28	Diode	Suppression diode for the coil of direction relay 2 (RL2)	Upper Control Box P.C.B.
D29	Diode	Feeds power to joystick at upper controls . It also prevents a feedback to normal upper controls when the emergency override is being operated.	Upper Control Box.
D30	Diode	Feeds a signal from lower lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D31 & D32	Diode.	Feeds a signal to pin 8 on the controller when the lower cylinder lift function is selected at the upper controls. It prevents backfeed to the lower lift solenoid when the upper lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D33 & D34	Diode.	Feeds a signal to pin 8 on the controller when the upper cylinder lift function is selected at the upper controls. It prevents backfeed to the upper lift solenoid when the lower lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D35, D36	Diode	Feed a signal to pin 4 on the controller when slew is energised from the lower controls. They prevent backfeed to the slew solenoids when a signal is fed through D24 to pin 4 on the controller	Lower control box PCB.
D37	Diode	Feeds a signal from upper lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
FU1	Fuse 7Amps	Overload protection for curcuit.	On MCU
FU2	Fuse 160Amps	Overload protection for Electric motor.	On MCU
KSW1	Keyswitch 3-position	Diverts power to either upper or lower control boxes.	Lower control box.

REFERENCE	NAME	FUNCTION	LOCATION
LED 1	Outrigger LED (Green)	This LED is illuminated when the outriggers are deployed and taking load. If an outrigger becomes "light" and comes off the ground this LED will go off and the alarm will sound.	Upper Control Box.
LS1,LS2,LS3 & LS4.	Outrigger Limit Switches.	activated when the outriggers are deployed and taking load. +24V supply from the batteries is routed through these four limit switches, which are wired in series, to the keyswitch and provides power to the upper and lower control boxes for operation of the boom functions.	On Outrigger supports.
LS5	Slew cut-out limit switch.	This prevents slewing until the second post is clear of the tow bar. The normally closed contact is open and the slew signal to pin 4 on the controller is broken until the second post is clear of the towbar.	On first post under lower boom.
MCU	Motor Control Unit.	This controls the speed of the electric motor. Using the upper controls the motor speed varies with the position of the control joystick. Using the lower controls the motor has different fixed speeds for the various functions which are programmed into the MCU using a special calibrator.	Chasis Subframe.
MOT	24V D.C. Electric Motor.	This motor is coupled to the hydraulic pump which provides the oil flow and pressure to operate the various machine functions.	Chasis Subframe.
RL1	Joystick direction relay.	This relay is energised when the joystick is pushed foward. The contacts close allowing +24V to be fed into only one half of the contacts on the selector switch. This then allows only one of the two solenoids on each function spool to be energised thus allowing only one direction of motion when the joystick is pushed forward.	Upper Control Box P.C.B.
RL2	Joystick direction relay.	This relay is energised when the joystick is pulled backwards. The contacts close and feed +24V to opposite set of contacts on the selector switch as RL1 does. This then energises the opposite solenoid for each function and provides motion in the opposite direction when the joystick is pulled back.	Upper Control Box P.C.B.
SOL1	Solenoid	Solenoid used for activating hydraulic valve to slew in the right direction	Back of first post.
SOL2	Solenoid	Solenoid used for activating hydraulic valve to raise the first boom.	Back of first post.
SOL3	Solenoid	Solenoid used for activating hydraulic valve to raise the second boom.	Back of first post.
SOL4	Solenoid	Solenoid used for activating hydraulic valve to slew in the left direction	Back of first post.
SOL5	Solenoid	Solenoid used for activating hydraulic valve to lower the first boom.	Back of first post.
SOL6	Solenoid	Solenoid used for activating hydraulic valve to lower the second boom.	Back of first post.

# Schematics

Section

## 6.1 Electrical Schematic SERIAL NUMBERS: 1133 TO 1330

Table 6-1: Electrical Schematic Legend

REFERENCE	NAME	FUNCTION	LOCATION
ALM1	Alarm,Tilt.	Provides warning sound until outriggers are deployed and the contacts on LS1, LS2, LS3 and LS4 are closed. If one of the switches opens during the operation of the machine then the alarm sounds and power is cut to the upper controls.	Upper Control Box.
BAT	Batteries x (4). 6 Volts each.	Power supply.	Chasis subframe
BC1	24V Battery Charger.	This chargers the 4 x 6v batteries when switched on and the line contactor is unergised.	Chasis Subframe.
D1	Diode	Feeds +24V to pin 6 on the controller from upper controls.	Lower control box PCB.
D2	Diode	Feeds +24V to pin 6 on the controller when the keyswitch is switched to lower controls.	Lower control box PCB.
D3 TO D8	Diode	Suppression diodes for coils of hydraulic solenoids.	Lower control box PCB.
D9	Diode	prevents feedback to alarm ALM1 whens relays k1 and k2 are energised	Lower control box PCB.
D10	Diode	Feeds a signal from lower lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D11	Diode	Feeds a signal from upper lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D12	Diode	Feeds power to slew left solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D13	Diode	Feeds power to slew left solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.
D14	Diode	Feeds power to the lower cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D15	Diode	Feeds power to the lower cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D16	Diode	Feeds power to the upper cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D17	Diode	Feeds power to the upper cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D18	Diode	Feeds power to slew right solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D19	Diode	Feeds power to slew right solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.

REFERENCE	NAME	FUNCTION	LOCATION
D20	Diode	Feeds power to the lower cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D21	Diode	Feeds power to the lower cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D22	Diode	Feeds power to the upper cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D23	Diode	Feeds power to the upper cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D24	Diode	Feeds power signal from joystick trigger to pin 4 on controller when emergency override is activated	Lower control box PCB.
D25,D26	Diode	Feed the signal which comes from the keyswitch (set at upper controls) to one of the alarm relay contacts and prevent power getting to upper controls when the alarm is activated from the lower controls.	Lower control box PCB.
D27	Diode	Prevents backfeed to pin 4 on the controller when the a signal is sent to the line contactor from the jostick trigger.	Lower control box PCB.
D28	Diode	Prevents backfeed to lower control contact of the keyswitch when the line contactor is energised.	Lower control box PCB.
D29	Diode	It prevents backfeed to the lower control switches when the alarm is activated from upper controls.	Lower control box PCB.
D30	Diode	Feeds a signal to the line contactor when the joystick trigger is depressed. It prevents backfeed to the upper controls when the line contactor is energised by the lower controls.	Lower control box PCB.
D31	Diode	Allows the feed to the alarm for continuous operation in tilt. Prevents the continuous alarm during intermittent outrigger operation	Lower control box PCB.
D32	Diode	Feeds the tilt alarm switch when the key switch is set to lower controls and prevents feedback when the keyswitch is set to upper controls.	Lower control box PCB.
D33	Diode	Feeds the tilt alarm switch when the key switch is set to upper controls and prevents feedback when the keyswitch is set to lower controls.	Lower control box PCB.
D34	Diode	Suppression diode for the coil of direction relay 1 (RL1)	Upper Control Box P.C.B.
D35	Diode	Suppression diode for the coil of direction relay 2 (RL2)	Upper Control Box P.C.B.
D36	Diode	Feeds power to joystick at upper controls . It also prevents a feedback to normal upper controls when the emergency override is being operated.	Upper Control Box.
D37	Diode	Feeds a signal from lower lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.

REFERENCE	NAME	FUNCTION	LOCATION
D79 & D81	Diode.	Feeds a signal to pin 8 on the controller when the lower cylinder lift function is selected at the upper controls. It prevents backfeed to the lower lift solenoid when the upper lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D80 & D82	Diode.	Feeds a signal to pin 8 on the controller when the upper cylinder lift function is selected at the upper controls. It prevents backfeed to the upper lift solenoid when the lower lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D83	Diode	Suppression diode for coil of line contactor.	LC1
D84, D85	Diode	Feed a signal to pin 4 on the controller when slew is energised from the lower controls. They prevent backfeed to the slew solenoids when a signal is fed through D24 to pin 4 on the controller	Lower control box PCB.
D9	Diode	Feeds a signal from upper lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
FU1	Fuse 7Amps	Overload protection for curcuit.	On MCU
FU2	Fuse 160Amps	Overload protection for Electric motor.	On MCU
K1	Alarm Relay.	This relay is energised when the four outrigger limit switches are activated the normally closed contacts which feed power to the alarm are opened and the alarm switches off. If an outrigger limit switch opens during operation of the booms the relay de-energises and the alarm sounds.	On lower control box PCB.
K2	Relay.	This Relay is constantly energised through the tilt alarm. The normally open contacts remain closed in this state and feed the upper controls with power when the keyswitch is turned to the upper controls.	On lower control box PCB.
KSW1	Keyswitch 3-position	Diverts power to either upper or lower control boxes.	Lower control box.
LC1	Line Contactor.	In the unergised state the normally closed contacts allow the charger +ve to the batteries. In the energised stete the normally open contacts contacts close and route the battery +ve to the pump motor.	On the motor control unit on the chasis subframe.
LED 1	Battery Indicator. (Red)	The LED remains off when the batteries are fully charged. The LED flashes when the batteries begin to discharge. The LED will remain on when the batteries are fully discharged.	Upper Control Box.
LED2	Outrigger LED (Green)	This LED is illuminated when the outriggers are deployed and taking load. If an outrigger becomes "light" and comes off the ground this LED will go off and the alarm will sound.	Upper Control Box.



# Schematics

Section  
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## 6.1 Electrical Schematic SERIAL NUMBERS: 1331 TO CURRENT

Table 6-1: Electrical Schematic Legend

REFERENCE	NAME	FUNCTION	LOCATION
ALM1	Alarm,Tilt.	Provides warning sound until outriggers are deployed and the contacts on LS1, LS2, LS3 and LS4 are closed. If one of the switches opens during the operation of the machine then the alarm sounds and power is cut to the upper controls.	Upper Control Box.
BAT	Batteries x (4). 6 Volts each.	Power supply.	Chasis subframe
BC1	24V Battery Charger.	This charges the 4 x 6v batteries when switched on and the line contactor is unenergised.	Chasis Subframe.
D1	Diode	Feeds +24V to pin 6 on the controller from upper controls.	Lower control box PCB.
D2	Diode	To eliminate any power spikes which may affect relay 1	On lower control box PCB.
D3	Diode	To eliminate any power spikes which may affect relay 2	On lower control box PCB.
D4	Diode	Feeds +24V to pin 6 on the controller when the keyswitch is switched to lower controls.	Lower control box PCB.
D5 TO D10	Diode	Suppression diodes for coils of hydraulic solenoids.	Lower control box PCB.
D11,D12	Diode	prevents feedback to alarm ALM1 when relays k1 and k2 are energised	Lower control box PCB.
D13	Diode	Feeds a signal from lower lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D14	Diode	Feeds a signal from upper lift cylinder (down) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
D15	Diode	Feeds power to slew left solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D16	Diode	Feeds power to slew left solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.
D17	Diode	Feeds power to the lower cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D18	Diode	Feeds power to the lower cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D19	Diode	Feeds power to the upper cylinder (up) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D20	Diode	Feeds power to the upper cylinder (up) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D21	Diode	Feeds power to slew right solenoid from upper controls and prevents feedback to upper controls from the lower controls	Lower control box PCB.
D22	Diode	Feeds power to slew right solenoid from lower controls and prevents feedback to lower controls from the upper controls	Lower control box PCB.

REFERENCE	NAME	FUNCTION	LOCATION
D23	Diode	Feeds power to the lower cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D24	Diode	Feeds power to the lower cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D25	Diode	Feeds power to the upper cylinder (down) solenoid from upper controls and prevents feedback to upper controls from lower controls.	Lower control box PCB.
D26	Diode	Feeds power to the upper cylinder (down) solenoid from lower controls and prevents feedback to lower controls from upper controls.	Lower control box PCB.
D27	Diode	Feeds power signal from joystick trigger to pin 4 on controller when emergency override is activated	Lower control box PCB.
D28,D29	Diode	Feed the signal which comes from the keyswitch (set at upper controls) to one of the alarm relay contacts and prevent power getting to upper controls when the alarm is activated from the lower controls.	Lower control box PCB.
D30	Diode	Prevents backfeed to pin 4 on the controller when the a signal is sent to the line contactor from the joystick trigger.	Lower control box PCB.
D31	Diode	Prevents backfeed to lower control contact of the keyswitch when the line contactor is energised.	Lower control box PCB.
D32	Diode	It prevents backfeed to the lower control switches when the alarm is activated from upper controls.	Lower control box PCB.
D33	Diode	Feeds a signal to the line contactor when the joystick trigger is depressed. It prevents backfeed to the upper controls when the line contactor is energised by the lower controls.	Lower control box PCB.
D34	Diode	Allows the feed to the alarm for continuous operation in tilt. Prevents the continuous alarm during intermittent outrigger operation	Lower control box PCB.
D35	Diode	Feeds the tilt alarm switch when the key switch is set to lower controls and prevents feedback when the keyswitch is set to upper controls.	Lower control box PCB.
D36	Diode	Feeds the tilt alarm switch when the key switch is set to upper controls and prevents feedback when the keyswitch is set to lower controls.	Lower control box PCB.
D37	Diode	Suppression diode for the coil of direction relay 1 (RL1)	Upper Control Box P.C.B.
D38	Diode	Suppression diode for the coil of direction relay 2 (RL2)	Upper Control Box P.C.B.
D39	Diode	Feeds power to joystick at upper controls . It also prevents a feedback to normal upper controls when the emergency override is being operated.	Upper Control Box.
D40	Diode	Feeds a signal from lower lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.

REFERENCE	NAME	FUNCTION	LOCATION
D41 & D42	Diode.	Feeds a signal to pin 8 on the controller when the lower cylinder lift function is selected at the upper controls. It prevents backfeed to the lower lift solenoid when the upper lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D43 & D44	Diode.	Feeds a signal to pin 8 on the controller when the upper cylinder lift function is selected at the upper controls. It prevents backfeed to the upper lift solenoid when the lower lift cylinder solenoid is energised.	Upper Control Box P.C.B.
D45	Diode	Suppression diode for coil of line contactor.	LC1
D46, D47	Diode	Feed a signal to pin 4 on the controller when slew is energised from the lower controls. They prevent backfeed to the slew solenoids when a signal is fed through D27 to pin 4 on the controller	Lower control box PCB.
D48	Diode	Feeds a signal from upper lift cylinder (up ) solenoid to pin 4 on the controller and prevents feedback to the lift solenoid when other functions are selected.	Lower control box PCB.
FU1	Fuse 7Amps	Overload protection for circuit.	On MCU
FU2	Fuse 160Amps	Overload protection for Electric motor.	On MCU
FU3	Fuse 7Amps	Overload protection for supply to motor control unit.	On MCU
K1	Alarm Relay.	This relay is energised when the four outrigger limit switches are activated the normally closed contacts which feed power to the alarm are opened and the alarm switches off. If an outrigger limit switch opens during operation of the booms the relay de-energises and the alarm sounds.	On lower control box PCB.
K2	Relay.	This Relay is constantly energised through the tilt alarm. The normally open contacts remain closed in this state and feed the upper controls with power when the keyswitch is turned to the upper controls.	On lower control box PCB.
KSW1	Keyswitch 3-position	Diverts power to either upper or lower control boxes.	Lower control box.
LC1	Line Contactor.	In the unenergised state the normally closed contacts allow the charger +ve to the batteries. In the energised state the normally open contacts close and route the battery +ve to the pump motor.	On the motor control unit on the chasis subframe.
LED 1	Battery Indicator. (Red)	The LED remains off when the batteries are fully charged. The LED flashes when the batteries begin to discharge. The LED will remain on when the batteries are fully discharged.	Upper Control Box.
LED2	Outrigger LED (Green)	This LED is illuminated when the outriggers are deployed and taking load. If an outrigger becomes "light" and comes off the ground this LED will go off and the alarm will sound.	Upper Control Box.

6.1 Electrical SchematicSERIAL NUMBERS: 1001 TO 1132

Table 6-1: Electrical Schematic Legend (Contd...)

REFERENCE	NAME	FUNCTION	LOCATION
SW 1	Function switch Lower Boom.	Sends power to the lower lift cylinder solenoid which diverts oil to full bore or annular side of lower lift cylinder.	Lower control box.
SW 2	Function switch Upper Boom.	Sends power to the upper lift cylinder solenoid which diverts oil to full bore or annular side of upper lift cylinder.	Lower control box.
SW 3	Function switch slew.	Sends power to the slew motor control solenoid which diverts oil to the left or right side of the slew motor.	Lower control box.
SW 4	Switch- 3 position selector	Sends power to selected solenoid valve (lower lift, upper lift, tele & slew). Only one function can be selected at any time.	Upper Control Box.
SW 5	Emergency stop button.	Control circuit shut off.	Upper Control Box.
SW 6	Switch, Emergency Override.	Provides emergency power when power is cut to the upper controls due to an outrigger limit switch de-activating.	Upper Control Box.
SW 7	Swith On/Off	Allows +24V supply to feed upper controls. Allows signals from tele and lift functions to pass down to the controller. Allows joystick trigger signal to pass down do the controller. (this switch is combined in the same housing as SW6)	Upper Control Box.
SW 8	Emergency stop button.	Control circuit shut off.	Lower Control Box.

MOTOR CONTROL UNIT (PIN LEGEND)	
PIN No.	DESCRIPTION
1	Battery Discharge Indicator (B.D.I.) output
2	Not used - sw8 - Switch 8
3	Not used - 10V supply
4	sw4 - Switch 4 (Speed 4: slew speed from lower controls - Factory set at 13%)
5	Not used - Not connected.
6	24V supply (Must be greater than 14V)
7	Not used - Not connected.
8	sw1 - Switch 1 (speed 1: Max. variable speed for upper and lower lift cylinders from upper controls - Factory set at 90%)
9	Not used - Not connected.
10	Not used - Not connected.
11	Not used - Not connected.
12	sw3 - Switch 3 (Speed 3: Boom speeds from lower controls - Factory set at 45%)
13	sw2 - Switch 2 (Speed 2: Max variable slewing speed from upper controls - Factory set at 40%)
14	Accelerator (3.5V - 0V) - Input from joystick to vary motor speed from upper controls.
15	Not used - Not connected.
16	Not used - Not connected.
17	Not used - Not connected.

## 6.1 Electrical Schematic SERIAL NUMBERS: 1133 TO 1330

Table 6-1: Electrical Schematic Legend (Contd...)

REFERENCE	NAME	FUNCTION	LOCATION
LS1,LS2,LS3 & LS4.	Outrigger Limit Switches.	Activated when the outriggers are deployed and taking load. +24V supply from the batteries is routed through these four limit switches, which are wired in series, to the keyswitch and provides power to the upper and lower control boxes for operation of the boom functions.	On Outrigger supports.
LS5	Slew cut-out limit switch.	This prevents slewing until the second post is clear of the tow bar. The normally closed contact is open and the slew signal to pin 4 on the controller is broken until the second post is clear of the towbar.	On first post under lower boom.
MCU	Motor Control Unit.	This controls the speed of the electric motor. Using the upper controls the motor speed varies with the position of the control joystick. Using the lower controls the motor has different fixed speeds for the various functions which are programmed into the MCU using a special calibrator.	Chasis Subframe.
MOT	24V D.C. Electric Motor.	This motor is coupled to the hydraulic pump which provides the oil flow and pressure to operate the various machine functions.	Chasis Subframe.
RL1	Joystick direction relay.	This relay is energised when the joystick is pushed forward. The contacts close allowing +24V to be fed into only one half of the contacts on the selector switch. This then allows only one of the two solenoids on each function spool to be energised thus allowing only one direction of motion when the joystick is pushed forward.	Upper Control Box P.C.B.
RL2	Joystick direction relay.	This relay is energised when the joystick is pulled backwards. The contacts close and feed +24V to opposite set of contacts on the selector switch as RL1 does. This then energises the opposite solenoid for each function and provides motion in the opposite direction when the joystick is pulled back.	Upper Control Box P.C.B.
SOL1	Solenoid	Solenoid used for activating hydraulic valve to slew in the right direction	Back of first post.
SOL2	Solenoid	Solenoid used for activating hydraulic valve to raise the first boom.	Back of first post.
SOL3	Solenoid	Solenoid used for activating hydraulic valve to raise the second boom.	Back of first post.
SOL4	Solenoid	Solenoid used for activating hydraulic valve to slew in the left direction	Back of first post.
SOL5	Solenoid	Solenoid used for activating hydraulic valve to lower the first boom.	Back of first post.
SOL6	Solenoid	Solenoid used for activating hydraulic valve to lower the second boom.	Back of first post.

REFERENCE	NAME	FUNCTION	LOCATION
SW 1	Function switch Lower Boom.	Sends power to the lower lift cylinder solenoid which diverts oil to full bore or annular side of lower lift cylinder.	Lower control box.
SW 2	Function switch Upper Boom.	Sends power to the upper lift cylinder solenoid which diverts oil to full bore or annular side of upper lift cylinder.	Lower control box.
SW 3	Function switch slew.	Sends power to the slew motor control solenoid which diverts oil to the left or right side of the slew motor.	Lower control box.
SW 4	Emergency stop button.	Control circuit shut off.	Lower Control Box.
SW 5	Switch-3 position selector	Sends power to selected solenoid valve (lower lift, upper lift, tele & slew). Only one function can be selected at any time.	Upper Control Box.
SW 6	Emergency stop button.	Control circuit shut off.	Upper Control Box.
SW 7	Switch, Emergency Override.	Provides emergency power when power is cut to the upper controls due to an outrigger limit switch de-activating.	Upper Control Box.
SW 8	Swith On/Off	Allows +24V supply to feed upper controls. Allows signals from tele and lift functions to pass down to the controller. Allows joystick trigger signal to pass down do the controller. (this switch is combined in the same housing as SW7)	Upper Control Box.
TS 1	Tilt Alarm. (option)	This is a warning device that will sound if the machine tilts at an angle greater than 3 degrees	Chasis Subframe.

MOTOR CONTROL UNIT (PIN LEGEND)

PIN No.	DESCRIPTION
1	Battery Discharge Indicator (B.D.I.) output
2	Not used - sw8 - Switch 8
3	Not used - 10V supply
4	sw4 - Switch 4 (Speed 4: slew speed from lower controls - Factory set at 13%)
5	Not used - Not connected.
6	24V supply (Must be greater than 14V)
7	Not used - Not connected.
8	sw1 - Switch 1 (speed 1: Max. variable speed for upper and lower lift cylinders from upper controls - Factory set at 90%)
9	Not used - Not connected.
10	Not used - Not connected.
11	Not used - Not connected.
12	sw3 - Switch 3 (Speed 3: Boom speeds from lower controls - Factory set at 45%)
13	sw2 - Switch 2 (Speed 2: Max variable slewing speed from upper controls - Factory set at 40%)
14	Accelerator (3.5V - 0V) - Input from joystick to vary motor speed from upper controls.
15	Not used - Not connected.
16	Not used - Not connected.
17	Not used - Not connected.

6.1 Electrical SchematicSERIAL NUMBERS: 1331 TO CURRENT  
Table 6-1: Electrical Schematic Legend (Contd...)

REFERENCE	NAME	FUNCTION	LOCATION
LS1,LS2,LS3 & LS4.	Outrigger Limit Switches.	activated when the outriggers are deployed and taking load. +24V supply from the batteries is routed through these four limit switches, which are wired in series, to the keyswitch and provides power to the upper and lower control boxes for operation of the boom functions.	On Outrigger supports.
LS5	Slew cut-out limit switch.	This prevents slewing until the second post is clear of the tow bar. The normally closed contact is open and the slew signal to pin 4 on the controller is broken until the second post is clear of the towbar.	On first post under lower boom.
MCU	Motor Control Unit.	This controls the speed of the electric motor. Using the upper controls the motor speed varies with the position of the control joystick. Using the lower controls the motor has different fixed speeds for the various functions which are programmed into the MCU using a special calibrator.	Chasis Subframe.
MOT	24V D.C. Electric Motor.	This motor is coupled to the hydraulic pump which provides the oil flow and pressure to operate the various machine functions.	Chasis Subframe.
RL1	Joystick direction relay.	This relay is energised when the joystick is pushed forward. The contacts close allowing +24V to be fed into only one half of the contacts on the selector switch. This then allows only one of the two solenoids on each function spool to be energised thus allowing only one direction of motion when the joystick is pushed forward.	Upper Control Box P.C.B.
RL2	Joystick direction relay.	This relay is energised when the joystick is pulled backwards. The contacts close and feed +24V to opposite set of contacts on the selector switch as RL1 does. This then energises the opposite solenoid for each function and provides motion in the opposite direction when the joystick is pulled back.	Upper Control Box P.C.B.
SOL1	Solenoid	Solenoid used for activating hydraulic valve to slew in the right direction	Back of first post.
SOL2	Solenoid	Solenoid used for activating hydraulic valve to raise the first boom.	Back of first post.
SOL3	Solenoid	Solenoid used for activating hydraulic valve to raise the second boom.	Back of first post.
SOL4	Solenoid	Solenoid used for activating hydraulic valve to slew in the left direction	Back of first post.
SOL5	Solenoid	Solenoid used for activating hydraulic valve to lower the first boom.	Back of first post.
SOL6	Solenoid	Solenoid used for activating hydraulic valve to lower the second boom.	Back of first post.
SW 1	Function switch Lower Boom.	Sends power to the lower lift cylinder solenoid which diverts oil to full bore or annular side of lower lift cylinder.	Lower control box.
SW 2	Function switch Upper Boom.	Sends power to the upper lift cylinder solenoid which diverts oil to full bore or annular side of upper lift cylinder.	Lower control box.
SW 3	Function switch slew.	Sends power to the slew motor control solenoid which diverts oil to the left or right side of the slew motor.	Lower control box.
SW 4	Switch-3 position selector	Sends power to selected solenoid valve (lower lift, upper lift, tele & slew). Only one function can be selected at any time.	Upper Control Box.

REFERENCE	NAME	FUNCTION	LOCATION
SW 5	Emergency stop button.	Control circuit shut off. In series with SW8.	Upper Control Box.
SW 6	Switch, Emergency Override.	Provides emergency power when power is cut to the upper controls due to an outrigger limit switch de-activating.	Upper Control Box.
SW 7	Swith On/Off	Allows +24V supply to feed upper controls. Allows signals from tele and lift functions to pass down to the controller. Allows joystick trigger signal to pass down do the controller. (this switch is combined in the same housing as SW13)	Upper Control Box.
SW 8	Emergency stop button.	Control circuit shut off. In series with SW5.	Lower Control Box.
TS 1	Tilt Sensor	This is a warning device that will sound if the machine tilts at an angle greater than 3 degrees	Chasis Subframe.

MOTOR CONTROL UNIT (PIN LEGEND)

PIN No.	DESCRIPTION
1	Battery Discharge Indicator (B.D.I.) output
2	Not used - sw8 - Switch 8
3	Not used - 10V supply
4	sw4 - Switch 4 (Speed 4: slew speed from lower controls - Factory set at 13%)
5	Not used - Not connected.
6	24V supply (Must be greater than 14V)
7	Not used - Not connected.
8	sw1 - Switch 1 (speed 1: Max. variable speed for upper and lower lift cylinders from upper controls - Factory set at 90%)
9	Not used - Not connected.
10	Not used - Not connected.
11	Not used - Not connected.
12	sw3 - Switch 3 (Speed 3: Boom speeds from lower controls - Factory set at 45%)
13	sw2 - Switch 2 (Speed 2: Max variable slewing speed from upper controls - Factory set at 40%)
14	Accelerator (3.5V - 0V) - Input from joystick to vary motor speed from upper controls.
15	Not used - Not connected.
16	Not used - Not connected.
17	Not used - Not connected.

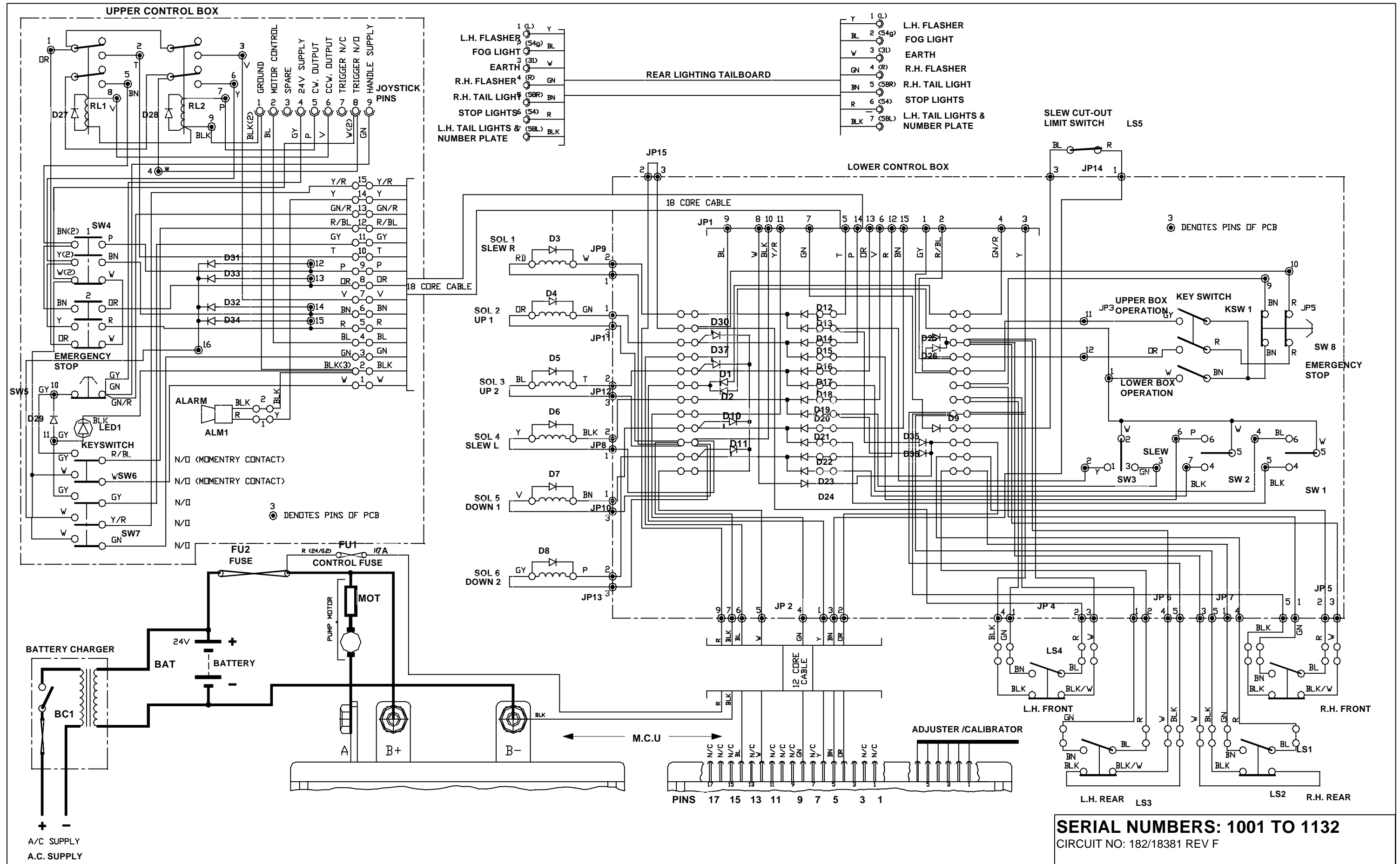


Figure 6-1: Electric Schematic

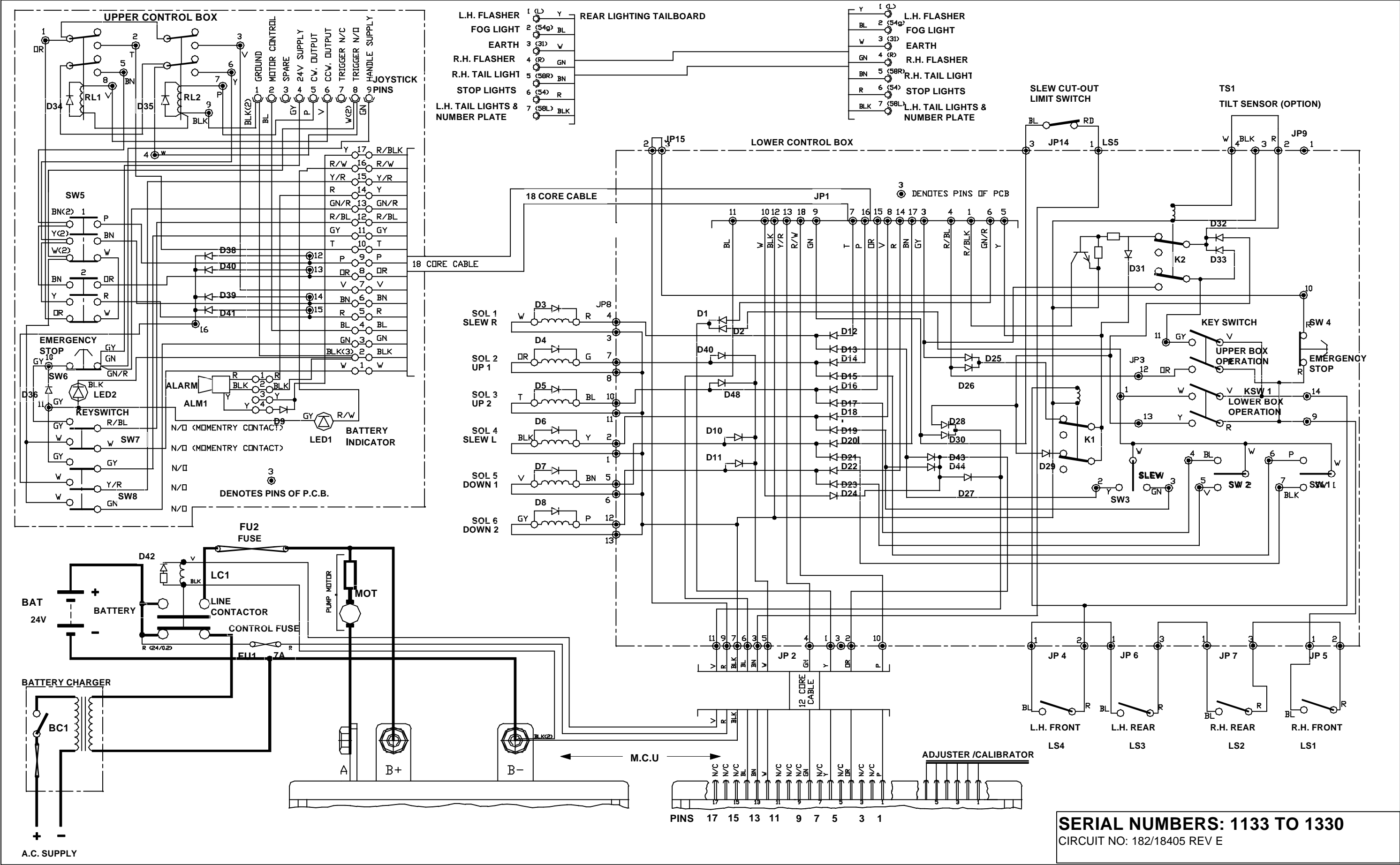
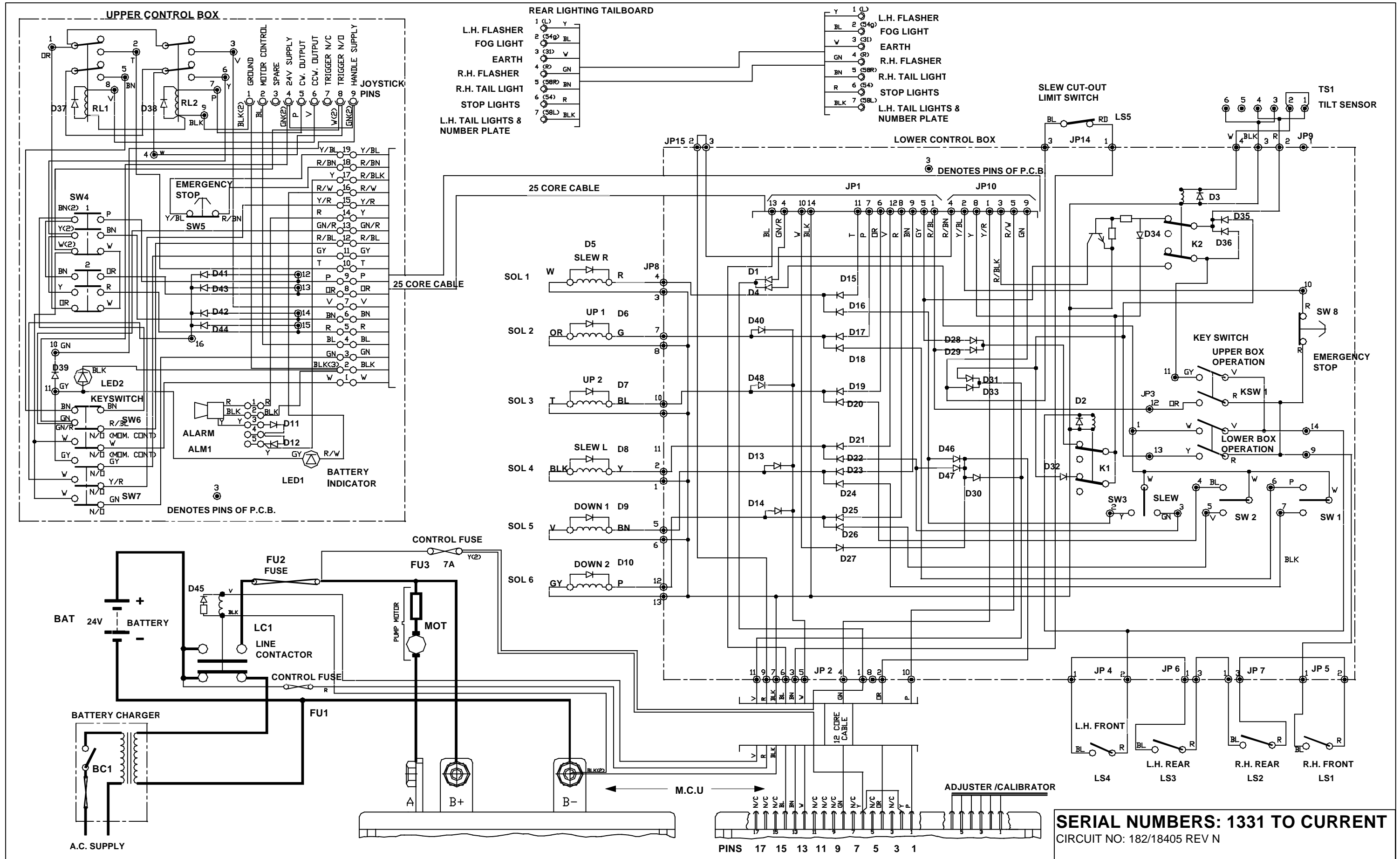


Figure 6-1: Electric Schematic



## NOTES



## 6.2 Hydraulic Schematic

Table 6-2: Hydraulic Schematic Legend

REFERENCE DESIGNATION	NAME	FUNCTION	LOCATION
CYL1	Lower boom lift cylinder	Provides the force to lift lower boom	Forward of first post
CYL2	Upper boom lift cylinder	Provide the force to lift upper boom	Behind second post
FL1	Return line filter (10 Micron)	Continuously filters hydraulic return oil. Contains integral bypass which operates when return line oil pressure exceeds 1.7 Bar.	Between chassis runners behind slew bearing.
MMB	Main manifold block	Contains the directional control valves and relief valves that distribute oil to the various functions and control the operating pressures,	On rear of first post under glass reinforced plastic cover.
MOT1	Slew Motor	Coupled to a gearbox it drives the slew bearing via a pinion gear.	Forward of first post on base plate
MP	Motor/Pump set	Gear pump close coupled to D.C electric motor. Provides pressurised oil flow for all hydraulic functions. One section of pump not used and pumps oil straight back to tank. The other section delivers approx. 13 L/min at 100% motor speed.	On chassis under motor control unit.
RV1	Main relief valve	Sets max system pressure to 155 Bar.	On main manifold block
V1	Single overcentre valve	Prevents back flow and provides hydraulic lock on cylinder	On base of upper, lower cylinders
V2	Emergency lowering valve	Allows upper and lower boom to be manually lowered	On base of upper and lower cylinders
V3,V4,V5,V6	Direction control valves	Sends oil to annular or full bore sides of the lift cylinders and to the left or right side of the slew motor.	On main manifold block.

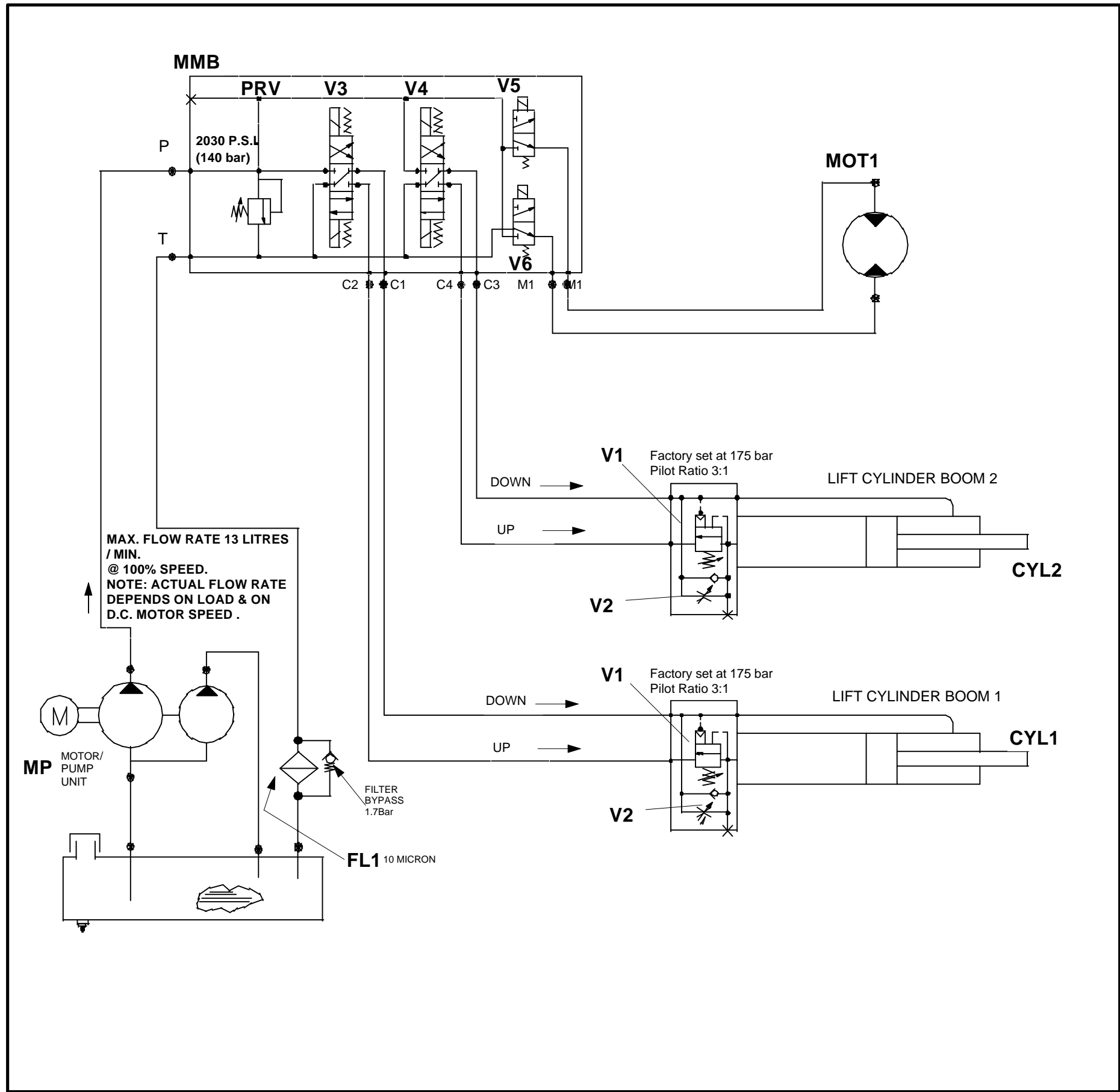


Figure 6-2: Hydraulic Schematic

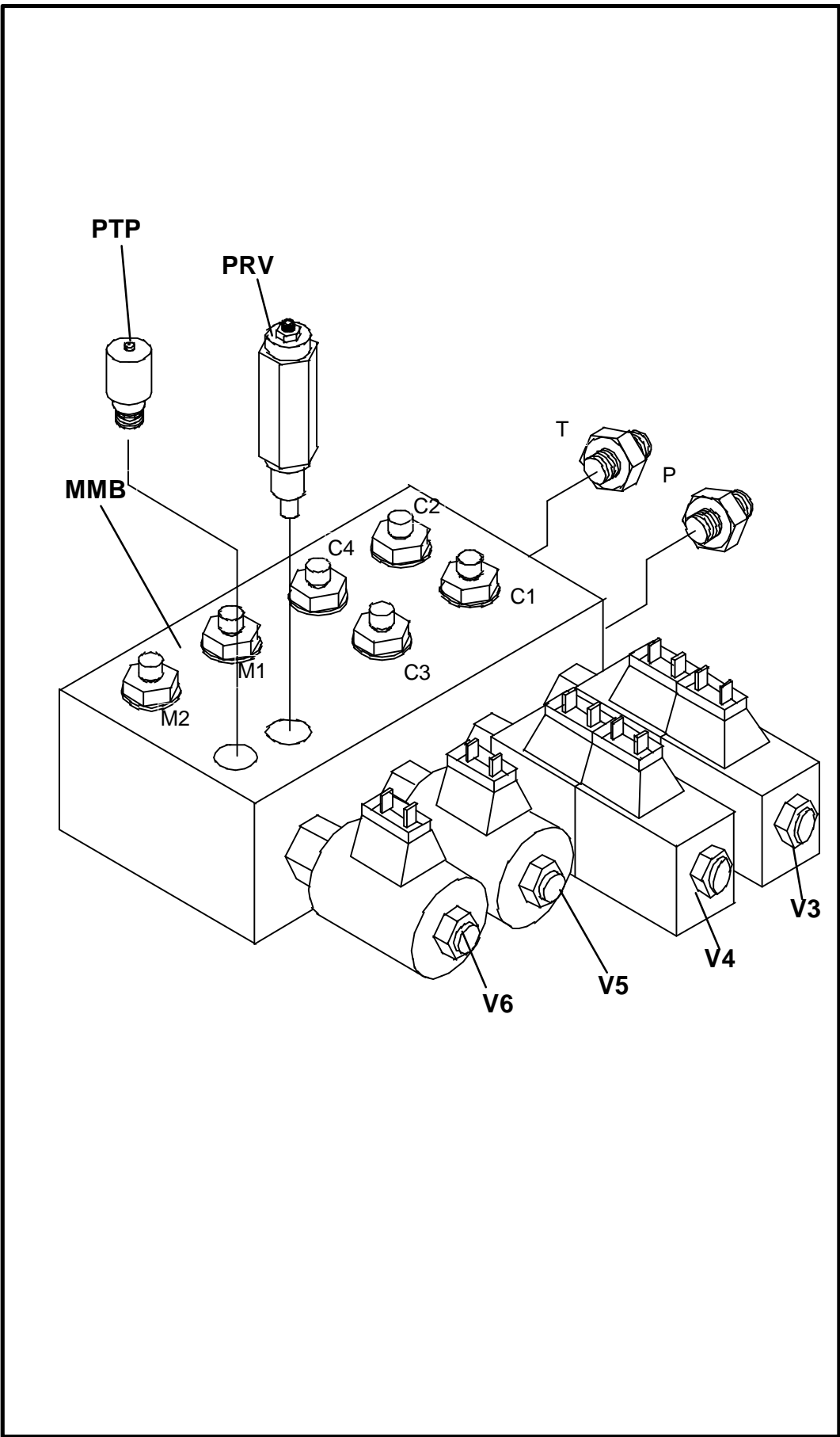


Figure 6-3: Main Hydraulic Manifold

NOTES

## 7.0 Introduction

This section lists and illustrates the replaceable assemblies and parts of the TL33 Work Platform as manufactured by UpRight Ireland Ltd.

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

**NOTE:** Part Numbers and descriptions in bold text have more detailed descriptions further on in this manual.

## 7.1 Index

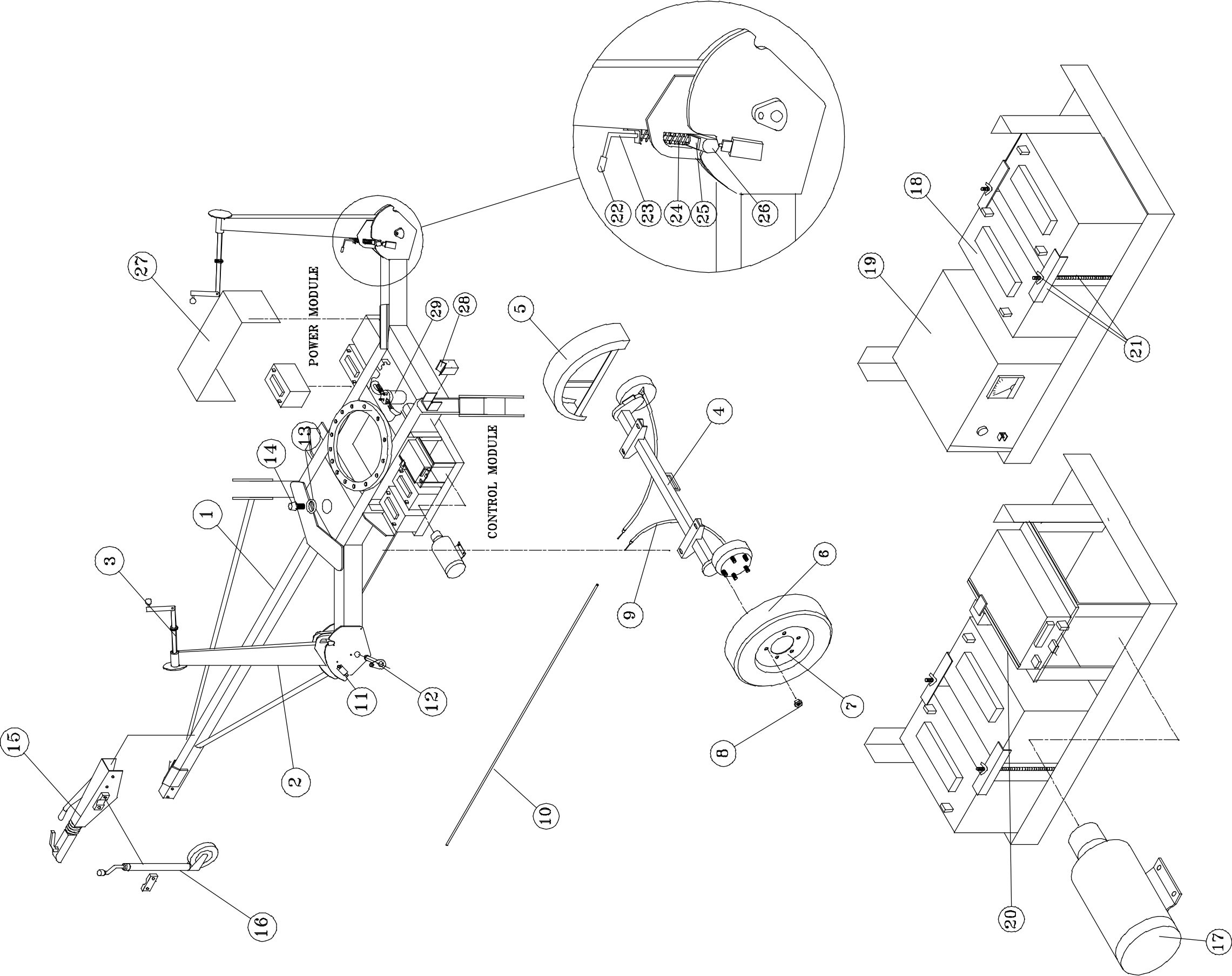
<b>Assembly</b>	<b>Page</b>
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Pump Motor Control Unit Assembly	7-30
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## CHASSIS ASSEMBLY

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57060-200	CHASSIS WELDMENT	1
2	57061-200	OUTRIGGER WELDMENT	4
3	57062-000	OUTRIGGER JACK ASSEMBLY	4
*	57062-001	JACK HANDLE (AND NUT AND BOLT)	4
*	57062-002	JACK SCREW (AND PIVOT PLATE)	4
4	<b>57069-300</b>	<b>BRAKED AXLE ASSEMBLY</b>	<b>1</b>
5	57099-300	MUDGUARD ASSEMBLY	2
6	57072-000	TYRE 6.7 - 13 6 PLY	2
7	57070-000	WHEEL RIM	2
8	57071-000	WHEEL NUT - 1/2" U.N.F. SERIAL NUMBERS 1001 TO 1069	8
8	57474-000	WHEEL NUT - M12 SERIAL NUMBERS 1070 TO CURRENT	8
9	57077-000	BRAKE CABLE ASSEMBLY	2
10	57078-300	BRAKE ROD	1
11	57182-400	OUTRIGGER LIMIT SWITCH	4
12	57030-400	OUTRIGGER PIVOT PIN	4
13	57379-000	GASKET FOR FILLER / BREATHER	1
14	57109-300	FILLER / BREATHER ASSEMBLY	1
15	<b>57081-300</b>	<b>COUPLING - SERIAL NUMBERS 1001 TO 1410</b>	<b>1</b>
15	<b>58240-300</b>	<b>COUPLING - SERIAL NUMBERS 1411 TO CURRENT</b>	<b>1</b>
16	57080-300	JOCKEY WHEEL ASSEMBLY SERIAL NUMBERS 1001 TO 1410	1
*		CLAMP SLEEVE ASSEMBLY FOR 57461-000	
16	58242-000	JOCKEY WHEEL ASSEMBLY SERIAL NUMBERS 1411 TO CURRENT	1
*		CLAMP SLEEVE ASSEMBLY FOR 58263-000	
17	<b>15797-000</b>	<b>MOTOR PUMP SET ASSEMBLY</b>	<b>1</b>
*	15797-010	PUMP	
*	15797-011	ELECTRIC MOTOR	
*	10145-001	BRUSH SET	
18	15796-001	BATTERY 6V 220 Ah, DRY	4
19	63948-011	BATTERY CHARGER - E.U. 220/110VAC 50/60HZ	1
19	63944-011	BATTERY CHARGER - U.S.A. 110VAC 60HZ	
19	63983-002	BATTERY CHARGER - JAPAN 100VAC 60HZ	
20	57300-400	PUMP MOTOR CONTROLLER - NO B.D.I. <b>SERIAL NUMBERS 1001 TO 1032</b>	1
20	57475-300	PUMP MOTOR CONTROLLER - WITH B.D.I. <b>SERIAL NUMBERS 1033 TO CURRENT</b>	1
21	57082-300	BATTERY CLAMP ASSEMBLY	4
22	57064-400	CAP	4
23	57063-400	LOCKING HANDLE	4
24	57065-400	SPRING	4
25	57066-400	GUIDE BLOCK	4
26	57067-400	LOCKING PIN	4
27	57025-300	COVER	2
*	57510-000	RUBBER LATCH	4
28	57291-300	BOOM REST	1
29	57375-000	FILTER ASSEMBLY (NO FITTINGS)	1
	57107-000	FILTER ASSEMBLY (WITH FITTINGS)	1

## OPTIONS

# 1	<b>57130-000</b>	<b>SPARE WHEEL OPTION</b>	<b>1</b>
*	57070-300	WHEEL RIM	1
*	57072-300	TYRE	1
*	57016-300	MOUNTING BRACKET	1
*	56060-100	BOLT	2
*	56064-000	NUT	2
*	56069-010	WASHER	2



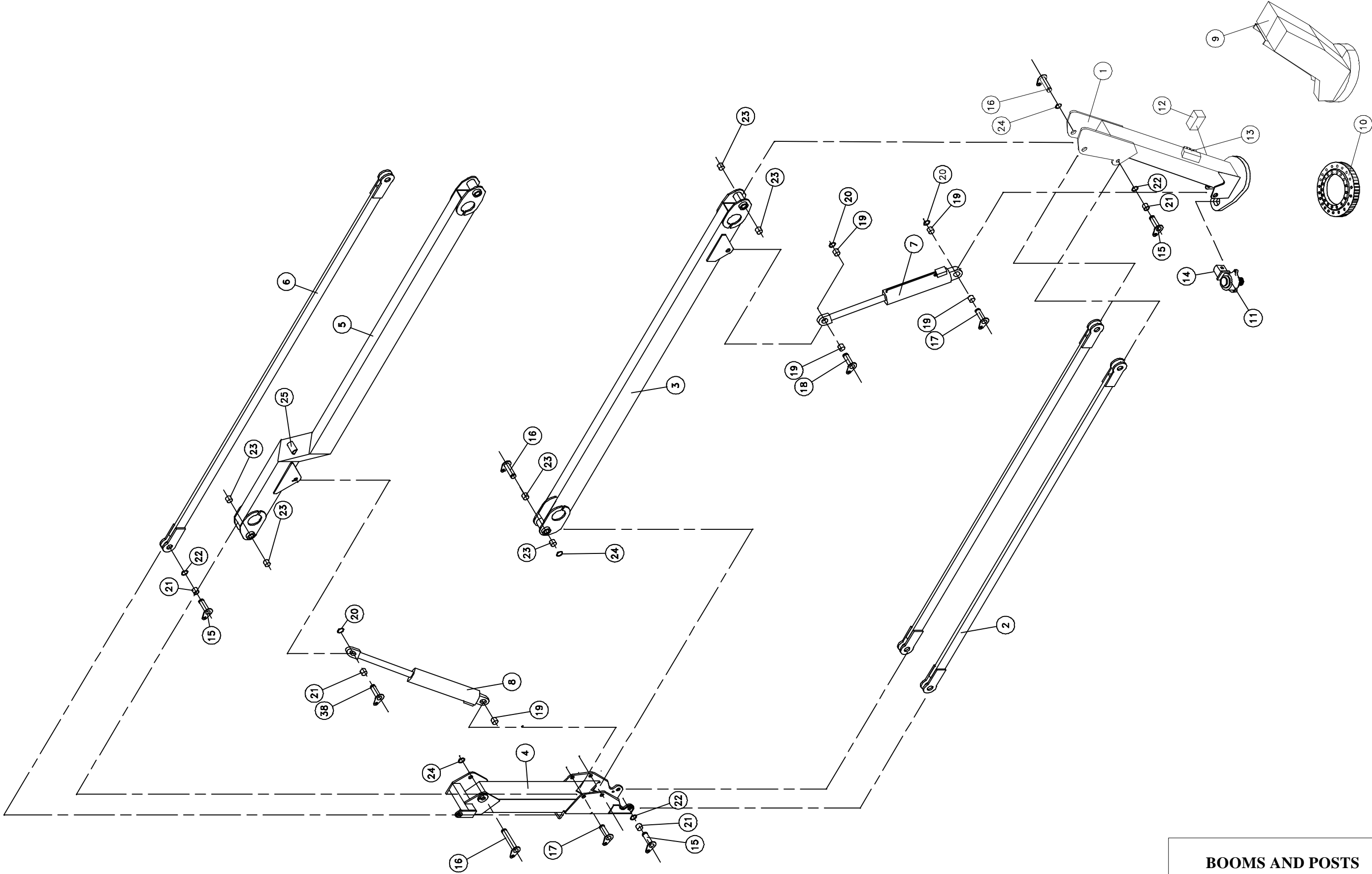
POWER MODULE

CONTROL MODULE

CHASSIS ASSEMBLY

## BOOMS AND POSTS ASSEMBLY

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57035-200	FIRST POST WELDMENT	1
2	57039--300	TENSION BAR WELDMENT	2
3	57037-300	LOWER BOOM WELDMENT	1
4	57036-300	SECOND POST WELDMENT	1
5	57038-300	UPPER BOOM WELDMENT	1
6	57040-300	LEVELLING ROD WELDMENT	1
7	<b>57104-300</b>	<b>1ST POST CYLINDER ASSY</b>	1
8	<b>57104-300</b>	<b>2ND POST CYLINDER ASSY</b>	1
9	57453-300	1ST POST COVER	1
10	57043-300	SLEWRING BEARING	1
11	<b>57041-300</b>	<b>SLEW GEARBOX AND PINION</b>	1
12	57180-300	LOWER CONTROL BOX ASSEMBLY	1
13	<b>57105-300</b>	<b>MANIFOLD BLOCK ASSEMBLY</b>	1
14	57350-300	SLEW MOTOR	1
*	57473-000	SEAL KIT	1
15	57027-400	TENSION BAR PIVOT PIN	5
16	57031-400	BOOM PIVOT PIN	3
17	57028-400	CYLINDER BODY PIVOT PIN	2
18	57029-400	CYLINDER ROD PIVOT PIN	2
19	57054-000	30MM I.D. FLANGED BUSH	8
20	57033-000	CIRCLIP	4
21	57047-000	25MM I.D. BUSHING	5
22	57032-000	CIRCLIP	5
23	57046-000	35MM I.D. BUSHING	6
24	57034-000	CIRCLIP	3
25	57049-300	BOOM REST BUFFER	1



**BOOMS AND POSTS  
ASSEMBLY**



CAGE ASSEMBLY Serial Numbers 1001 to 1429

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57091-300	CAGE RAIL ASSEMBLY	1
2	57090-300	CAGE FLOOR WELDMENT	1
3	58038-300	UPPER CONTROL BOX MOUNTING PLATE	1
4	57181-000	UPPER CONTROL BOX - SERIAL NUMBERS 1001 TO 1132	1
4	57181-001	UPPER CONTROL BOX - SERIAL NUMBERS 1132 TO CURRENT	1
5	57212-300	MOUNTING PANEL	1
6	03613-000	OPERATOR INSTRUCTIONS HOLDER	1
*	57008-000	OPERATORS INSTRUCTIONS	1
7	57190-400	TAILBOARD ASSEMBLY	1
8	57092-300	LADDER	1
9	57046-000	BUSHING	2
10	57034-000	CIRCLIP	1
11	57032-300	CIRCLIP	1
12	57027-400	LEVEL ROD PIVOT PIN	1
13	57031-400	BOOM PIVOT PIN	1
14	57047-000	BUSHING	1

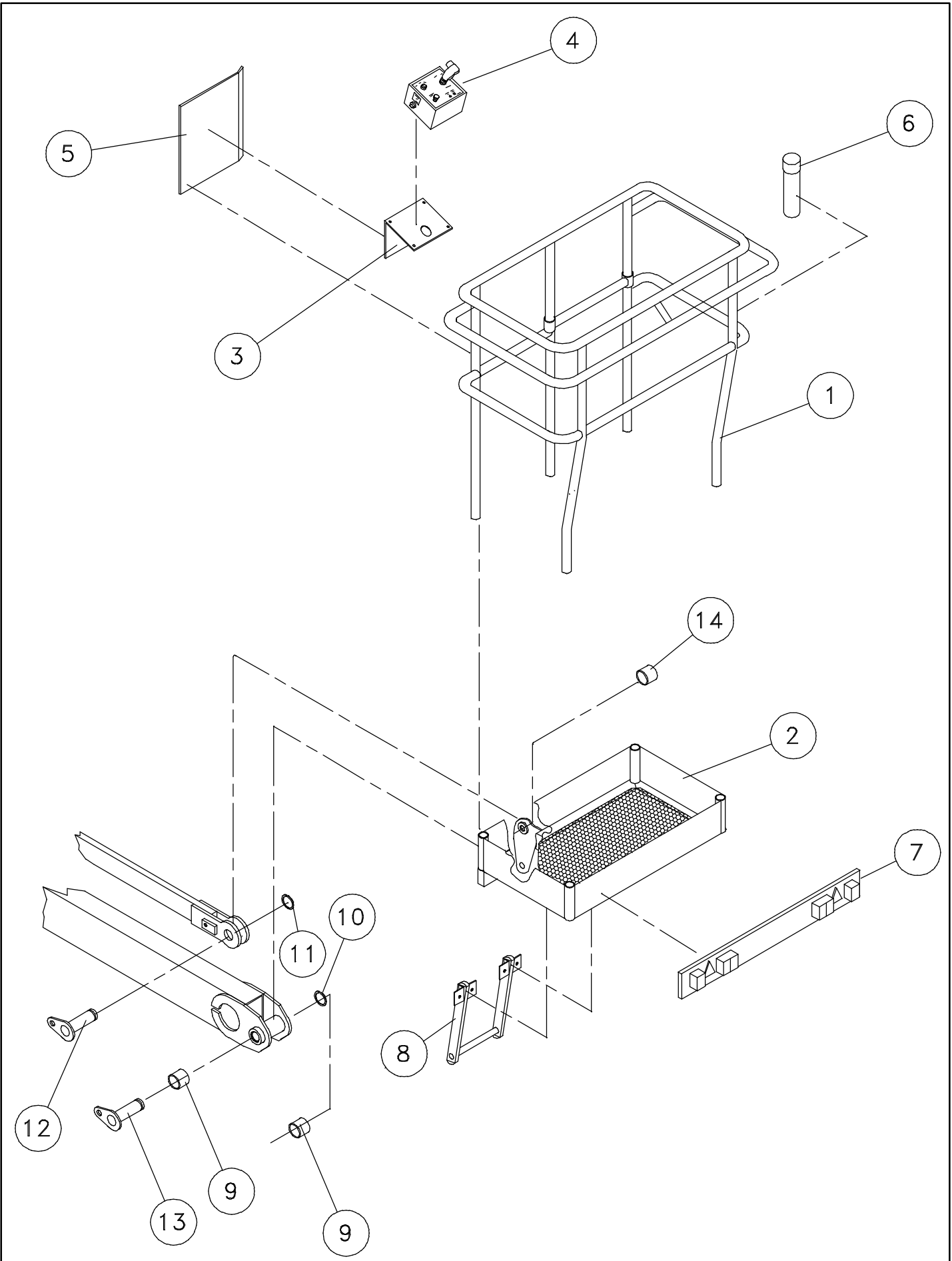
# Illustrated Parts Breakdown

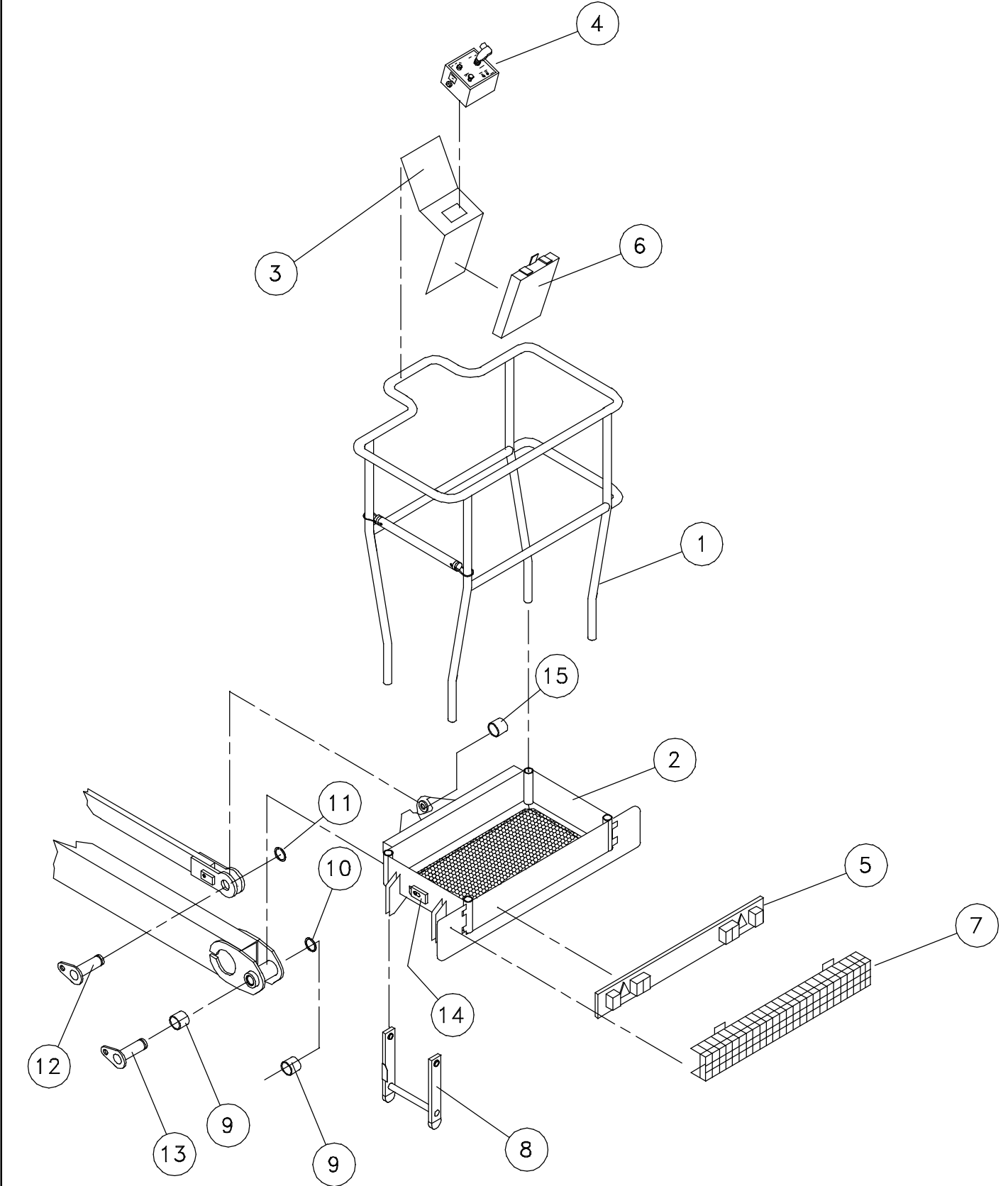
## CAGE ASSEMBLY Serial Numbers 1430 to current

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57521-300	CAGE RAIL ASSEMBLY	1
*	57524-300	DROP BAR ASSEMBLY	1
2	57344-300	CAGE FLOOR WELDMENT	1
3	57523-300	UPPER CONTROL BOX MOUNTING PLATE	1
4	<b>57181-000</b>	<b>UPPER CONTROL BOX - SERIAL NUMBERS 1001 TO 1132</b>	1
4	<b>57181-001</b>	<b>UPPER CONTROL BOX - SERIAL NUMBERS 1132 TO CURRENT</b>	1
5	57190-400	TAILBOARD ASSEMBLY	1
6	10076-000	SERVICE MANUAL / OPERATOR INSTRUCTIONS HOLDER	1
*	57009-000	SERVICE MANUAL (THIS MANUAL)	1
*	57008-000	OPERATORS INSTRUCTIONS	1
7	58244-300	TAILBOARD PROTECTOR	1
*	58245-300	TAILBOARD PROTECTOR SECURING LATCH	2
8	57348-300	LADDER	1
9	57046-000	BUSHING	2
10	57034-000	CIRCLIP	1
11	57032-300	CIRCLIP	1
12	57027-400	LEVEL ROD PIVOT PIN	1
13	57031-400	BOOM PIVOT PIN	1
14	58251-000	LADDER LOCKING LATCH	1
15	57047-000	BUSHING	1

# Illustrated Parts Breakdown

Section  
7.2





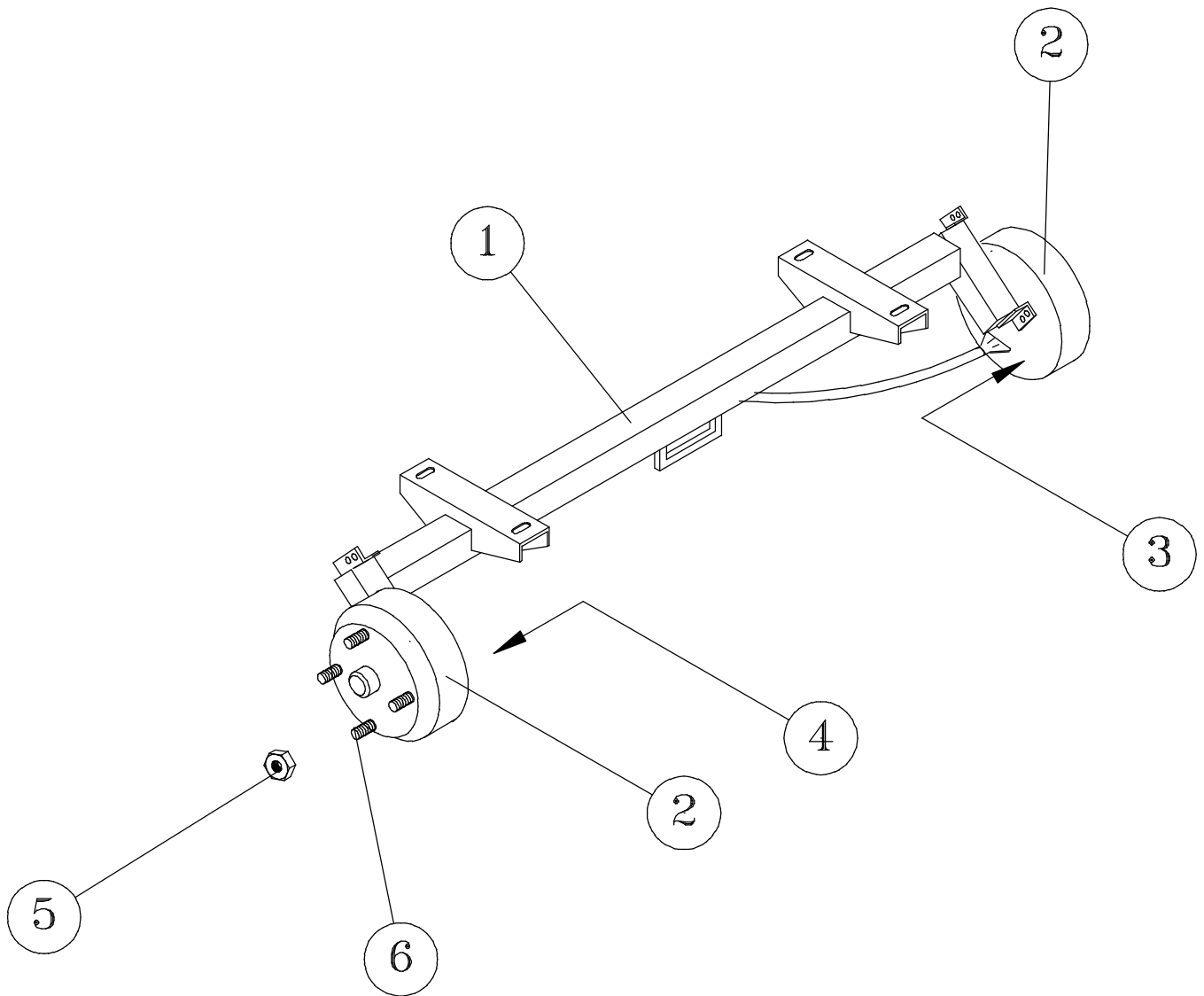
# Illustrated Parts Breakdown

## AXLE AND BRAKE HUB ASSEMBLY

57069-300

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57059-000	AXLE BEAM ASSEMBLY	1
2	57058-000	WHEEL HUB ASSEMBLY	2
3	57056-000	BRAKE ASSEMBLY (LEFT HAND)	1
4	57057-000	BRAKE ASSEMBLY (RIGHT HAND)	1
5	57071-000	WHEEL NUT - 1/2" UNF SERIAL NUMBERS 1001 TO 1069	8
5	57474-000	WHEEL NUT - M12 SERIAL NUMBERS 1070 TO CURRENT	8
6	57086-000	WHEEL STUD - 1/2" UNF SERIAL NUMBERS 1001 TO 1069	8
6	57471-000	WHEEL STUD - M12 SERIAL NUMBERS 1070 TO CURRENT	8

## AXLE AND BRAKE HUB ASSEMBLY



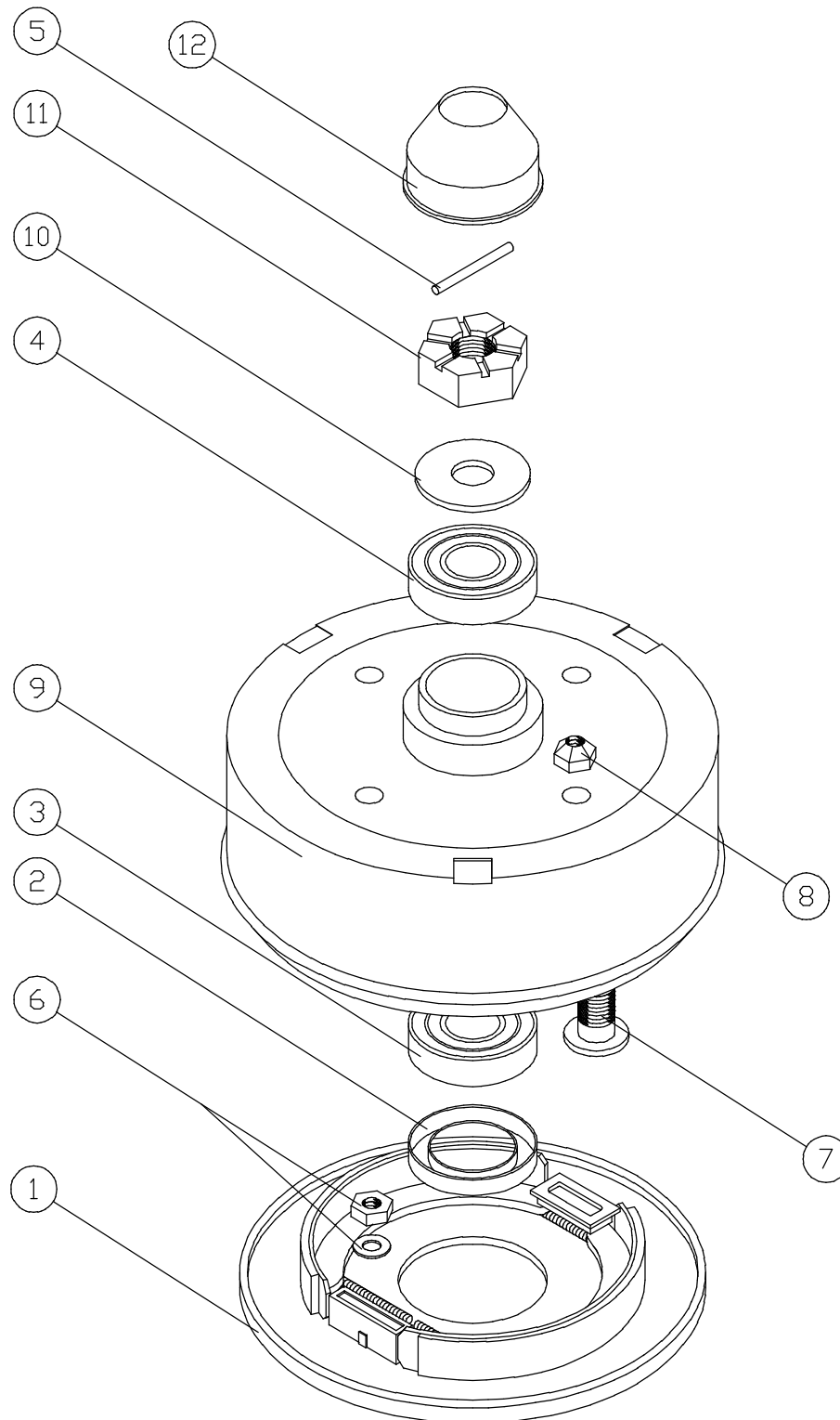
# Illustrated Parts Breakdown

## HUB ASSEMBLY

57058-000

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57056-000 57057-000	LEFT HAND BRAKE ASSEMBLY RIGHT HAND BRAKE ASSEMBLY	1
2	58871-000	GREASE SEAL	1
3	57083-000	INNER BEARING	1
4	57084-000	OUTER BEARING	1
5	-	SPLIT PIN	1
6	-	RETAINING NUT & WASHER	4
7	57086-000 57471-000	WHEEL STUD - 1/2" UNF SERIAL NUMBERS 1001 TO 1069 WHEEL STUD - M12 SERIAL NUMBERS 1070 TO CURRENT	8 8
8	57071-000 57474-000	WHEEL NUT - 1/2" UNF SERIAL NUMBERS 1001 TO 1069 WHEEL NUT - M12 SERIAL NUMBERS 1070 TO CURRENT	8 8
9	57087-000	DRUM	1
10	-	WASHER	1
11	-	AXLE NUT	1
12	58898-000	HUB CAP	1

## HUB ASSEMBLY



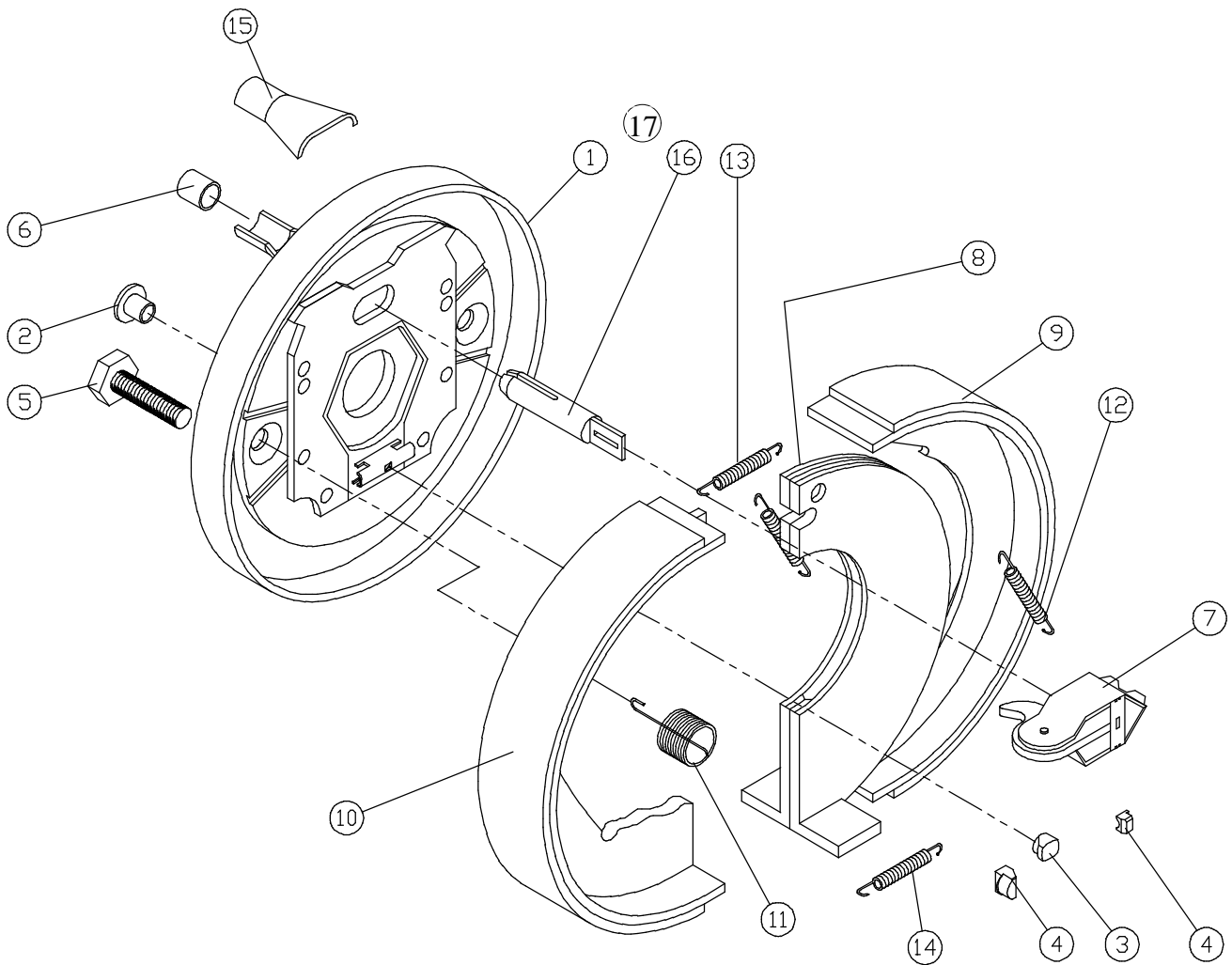


**BRAKE ASSEMBLY**

57056-000 (L.H.) / 57057-000 (R.H.)

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	-	BACK PLATE L.H.	1
2	-	BLANKING PLUG	2
3	-	ADJUSTING WEDGE NUT	1
4	-	SIDE WEDGE	2
5	-	BOLT	1
6	-	RETAINING CAP	1
7	-	EXPANDER ASSEMBLY	1
8	-	SHOE CARRIER	1
9	57138-000	REVERSING SHOE	1
10	57139-000	STANDARD SHOE	1
11	-	RETAINING SPRING	1
12	-	REVERSING SHOE SPRING	2
13	-	TOP SPRING	1
14	-	BOTTOM SPRING	1
15	-	CABLE BRACKET TOP HALF	1
16	-	EYELET	1
17	-	BACKPLATE RIGHT HAND	1

## BRAKE ASSEMBLY

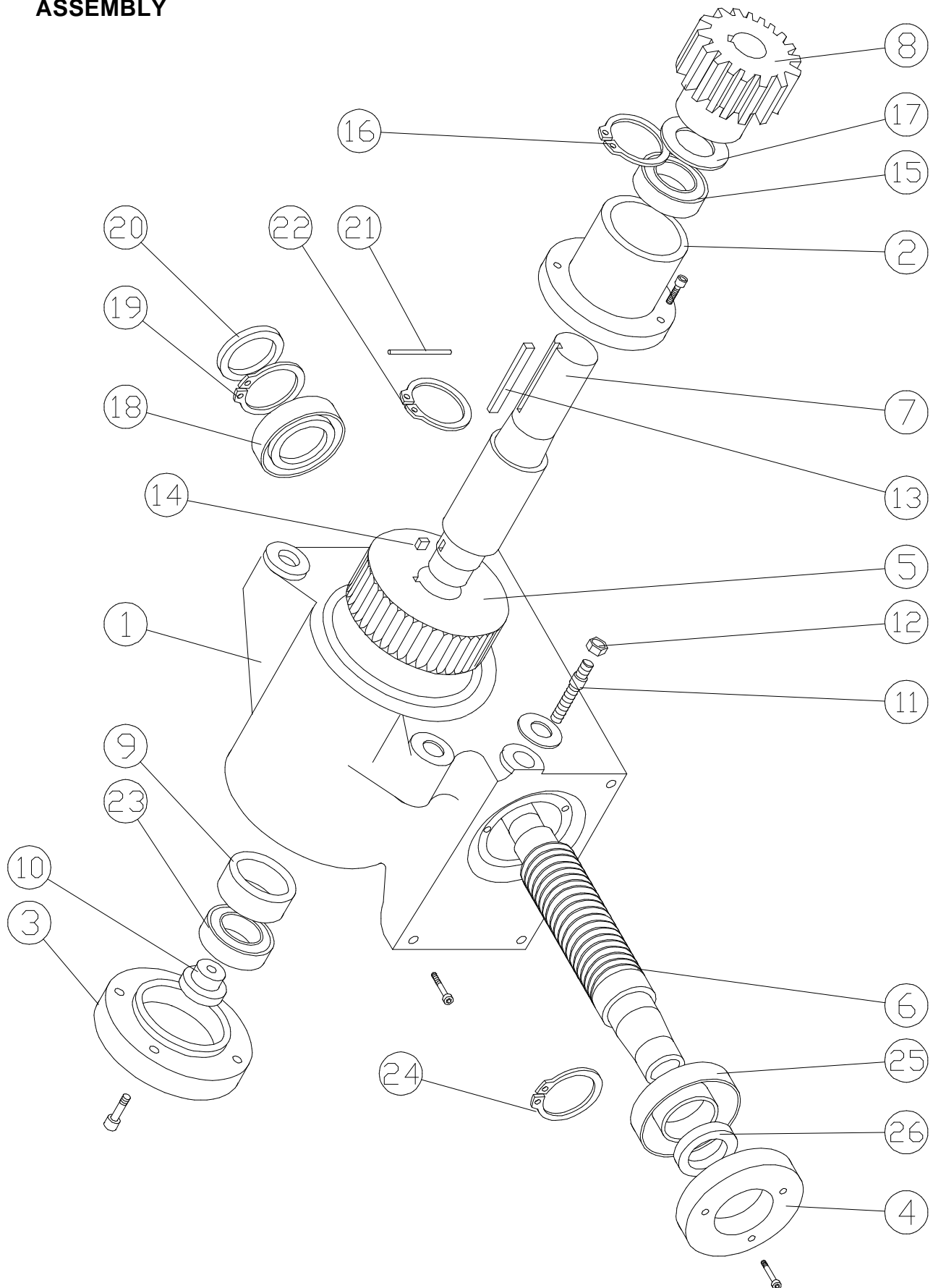


## SLEW GEARBOX ASSEMBLY

57041-300

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	-	GEARBOX HOUSING	1
2	-	BEARING HOUSING	1
3	-	TOP CAP	1
4	-	WORM CAP	1
5	-	GEAR WHEEL	1
6	-	WORM	1
7	-	MAIN SHAFT	1
8	-	SLEW PINION	1
9	-	BUSH	1
10	-	LOCKING CAP	1
11	-	STUD	1
12	-	SELF-LOCKING NUT	1
13	-	KEY	1
14	-	KEY	1
15	-	BEARING	1
16	-	CIRCLIP	1
17	-	SEAL	1
18	-	BEARING	1
19	-	CIRCLIP	1
20	-	SEAL	1
21	-	SEALOCK PIN	1
22	-	CIRCLIP	1
23	-	BEARING	1
24	-	CIRCLIP	1
25	-	BEARING	1
26	-	SEAL	1
27	-	CIRCLIP	1

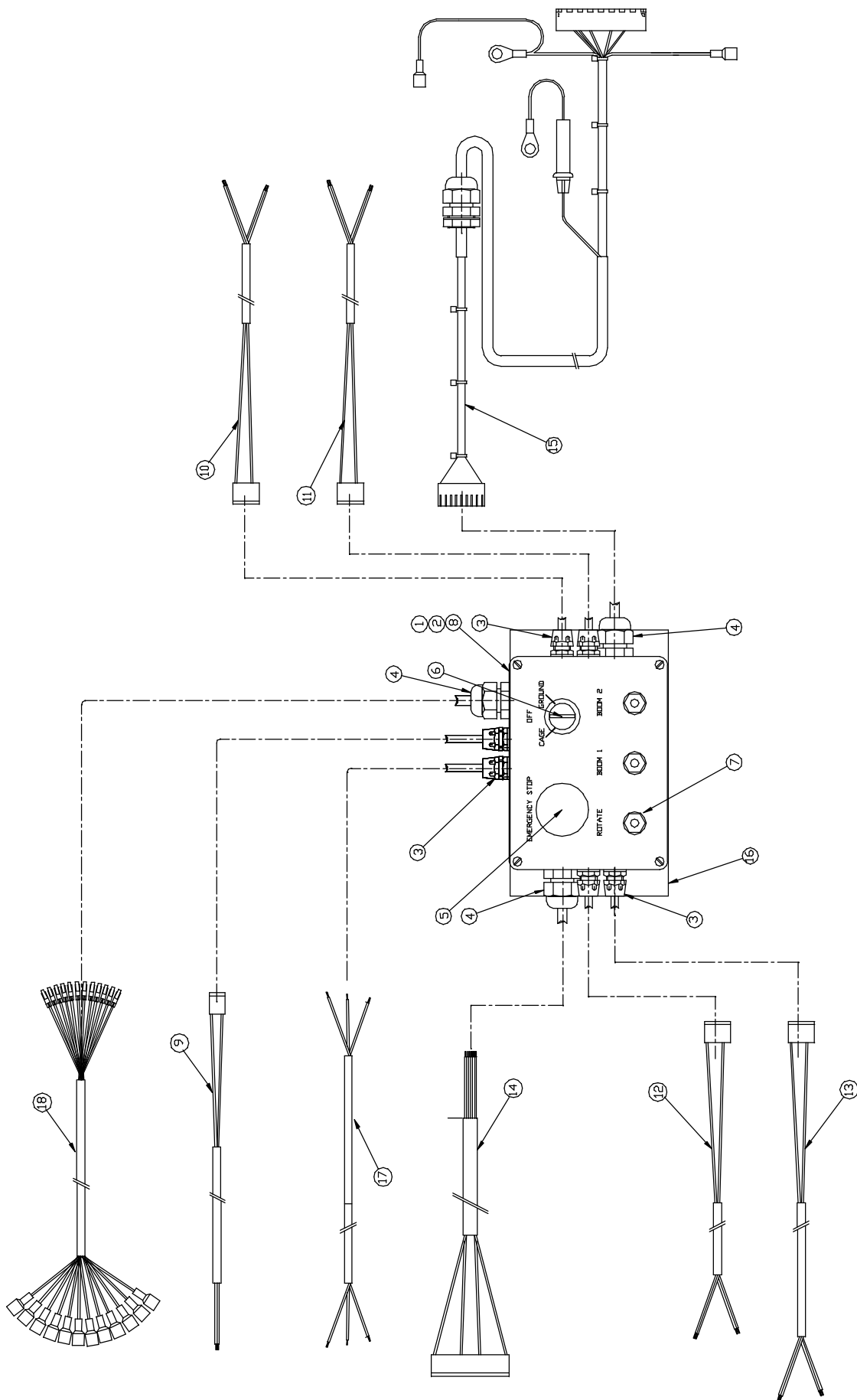
## SLEW GEARBOX ASSEMBLY



# Illustrated Parts Breakdown

## LOWER CONTROL BOX AND HARNESES

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57306-000	ENCLOSURE	1
2	57307-400	P.C.B. ASSEMBLY <b>SERIAL NUMBERS 1001 TO 1132</b>	1
	57476-000	P.C.B. ASSEMBLY <b>SERIAL NUMBERS 1133 TO 1330</b>	1
	58252-300	P.C.B. ASSEMBLY <b>SERIAL NUMBERS 1331 TO CURRENT</b>	1
3	57308-000	CABLE GLAND (SMALL)	11
4	57332-000	CABLE GLAND (LARGE)	2
5	57309-400	EMERGENCY STOP COMPLETE	1
6	57310-400	KEYSWITCH COMPLETE	1
7	57311-400	TOGGLE SWITCH	3
8	57313-400	HARNESS - INTERNAL	1
9	57317-400	HARNESS - TO SLEW CUT-OUT LIMIT SWITCH	1
10	57318-400	HARNESS - TO FRONT LEFT OUTRIGGER LIMIT SWITCH	1
11	57319-400	HARNESS - TO FRONT RIGHT OUTRIGGER LIMIT SWITCH	1
12	57320-400	HARNESS - TO REAR RIGHT OUTRIGGER LIMIT SWITCH	1
13	57321-400	HARNESS - TO REAR LEFT OUTRIGGER LIMIT SWITCH	1
14	57322-400	HARNESS - LOWER CONTROL BOX TO UPPER CONTROL BOX	1
15	57323-400	HARNESS - TO MOTOR CONTROL UNIT	1
16	57451-300	MOUNTING PLATE	1
17	57322-400	HARNESS - TO TILT ALARM	1
18	57292-400	HARNESS - TO SOLENOIDS	1



# Illustrated Parts Breakdown

## TAILBOARD ASSEMBLY

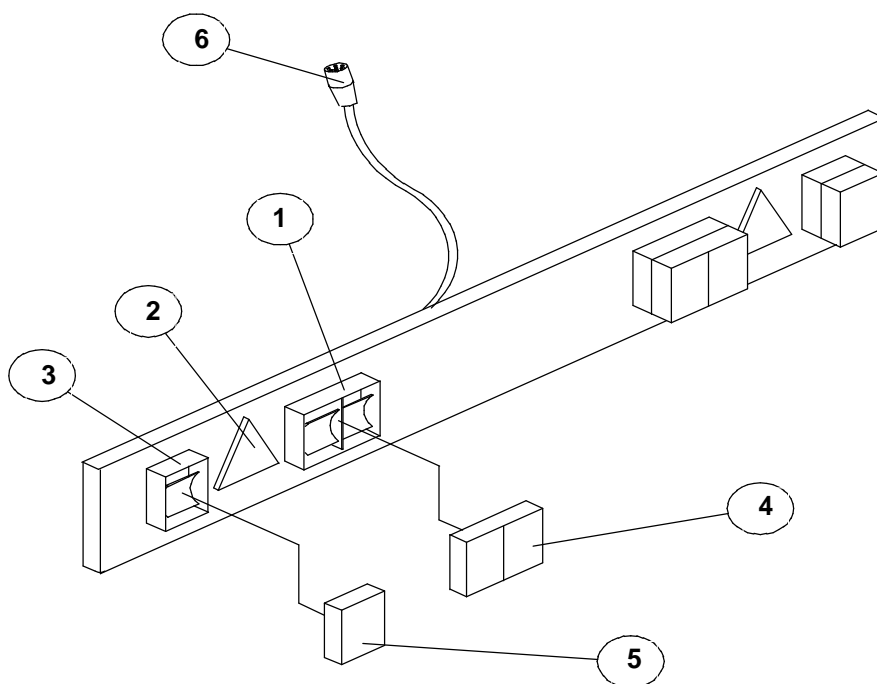
**57190-000 (SERIAL NUMBERS 1001 TO 1410)**

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	58736-000	BRAKE/INDICATOR ASSEMBLY COMPLETE	2
2	58739-000	REFLECTOR	2
3	58738-000	FOG LIGHT ASSEMBLY COMPLETE	2
4	57280-000	BRAKE/INDICATOR LENS	2
5	57237-000	FOG LIGHT LENS	2
6	57334-000	7-PIN PLUG	2
*	57335-000	7- PIN SOCKET	2

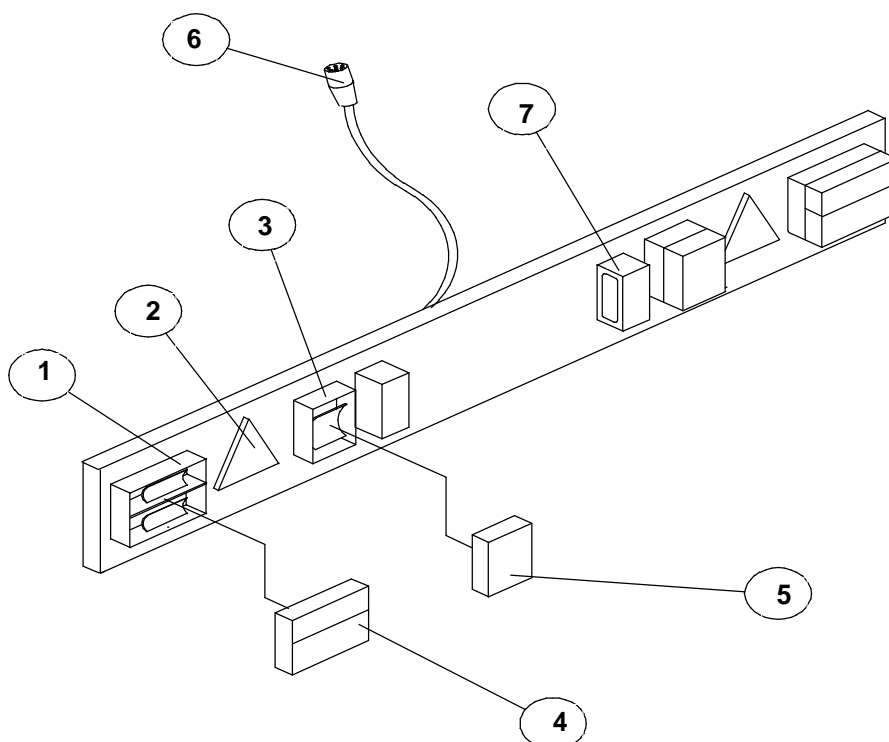
**57190-001 (SERIAL NUMBERS 1411 TO CURRENT)**

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	58260-000	BRAKE/INDICATOR ASSEMBLY COMPLETE	2
2	58739-000	REFLECTOR	2
3	58738-000	FOG LIGHT ASSEMBLY COMPLETE	2
4	58261-000	BRAKE/INDICATOR LENS	2
5	57237-000	FOG LIGHT LENS	2
6	57334-000	7-PIN PLUG	2
*	57335-000	7- PIN SOCKET	2
7	58262-000	NUMBER PLATE LIGHT ASSEMBLY COMPLETE	2

**Tail Board Assembly - 57190-000**  
**Serial Numbers 1001 to 1410**



**Tail Board Assembly - 57190-001**  
**Serial Numbers 1410 to Current**





**COUPLING ASSEMBLY****(a) 57081-300 SERIAL NUMBERS 1001 TO 1410**

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1(a)	57481-000	LEVER ASSEMBLY	1
2(a)	57486-000	BREAKAWAY SAFETY CABLE	1
4(a)	58789-000	GAITER	1
5(a)	57491-000	COUPLING HEAD (EUROPE)	1
	57490-000	COUPLING HEAD (USA)	1
**	57461-000	CLAMP SLEEVE ASSEMBLY FOR JOCKEYWHEEL	1

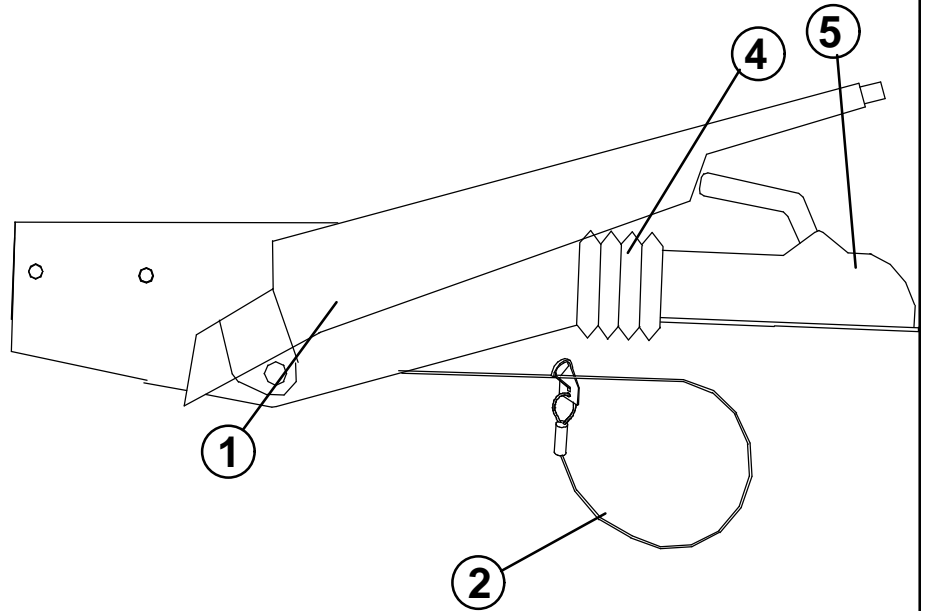
ITEM \*\* NOT SHOWN - USED TO CLAMP JOCKEY WHEEL TO COUPLING.

**(b) 58240-300 SERIAL NUMBERS 1411 TO CURRENT (EXCLUDING GERMAN MACHINES (TYPE (a) USED))**

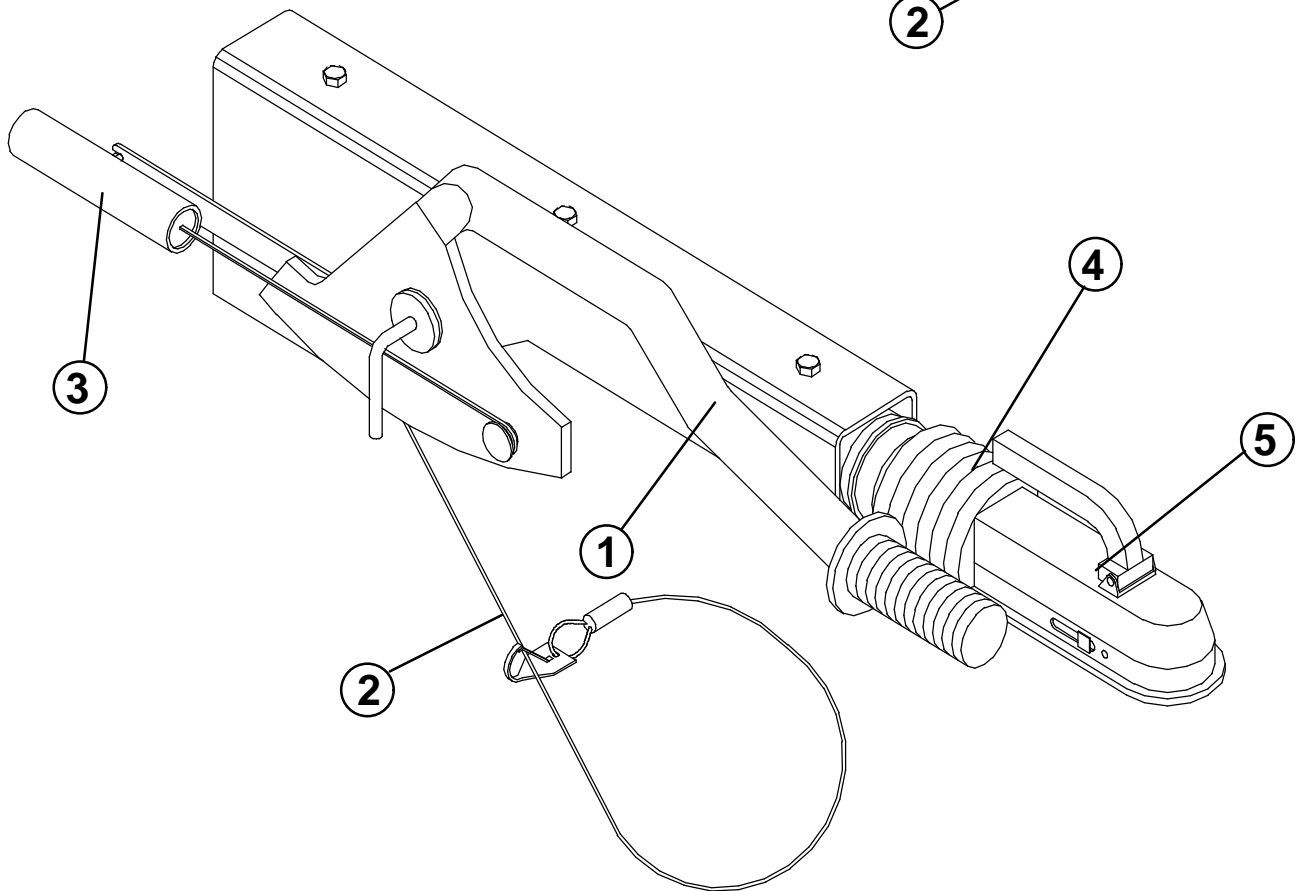
ITEM	PART-NUMBER	DESCRIPTION	QTY.
1(b)	58787-000	LEVER ASSEMBLY	1
2(b)	57486-000	BREAKAWAY SAFETY CABLE	1
3(b)	58794-000	SPRING PACK ASSEMBLY	1
4(b)	58790-000	GAITER	1
5(b)	58791-000	COUPLING HEAD (EUROPE)	1
	58792-000	COUPLING HEAD (USA)	1
**	58263-000	CLAMP PLATE ASSEMBLY FOR JOCKEY WHEEL	1

## Coupling Assembly

**A**



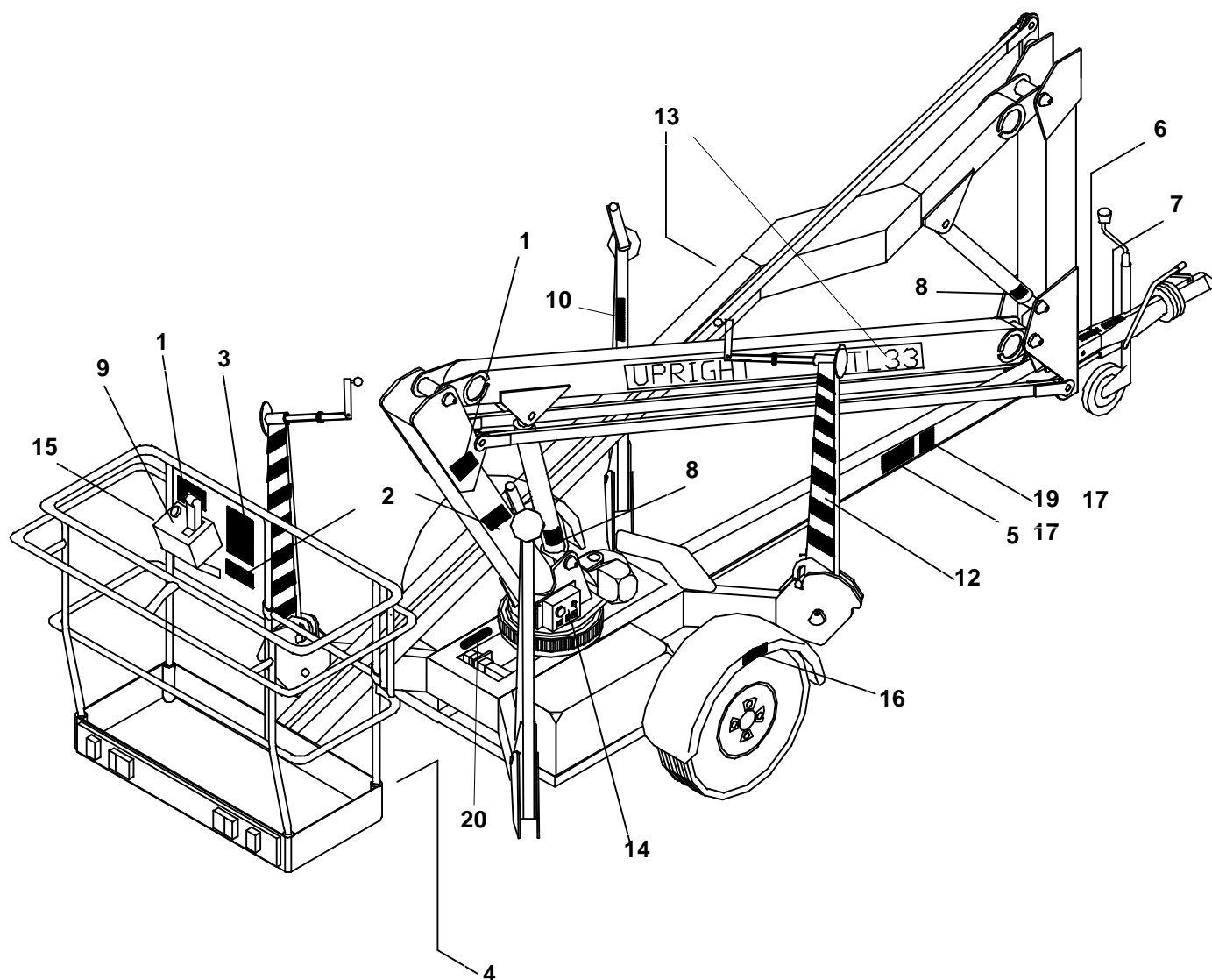
**B**





## LABEL KIT

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57507-016	DECAL - WARNING (NOT INSULATED)	2
2	57507-018	DECAL - ALARM ACTION	2
3	57507-013	DECAL - IMPORTANT INSTRUCTIONS	1
4	57507-014	DECAL - 215 kgs SWL	1
5	57397-400	DECAL - NAME PLATE	1
6	57507-020	DECAL - OUTRIGGER LOCKING	1
7	57507-017	DECAL - BEFORE TOWING	1
8	57507-015	DECAL - EMERGENCY LOWERING	2
9	57400-300	DECAL - UPPER CONTROL BOX	1
10	57507-019	DECAL - LOWERING OUTRIGGERS	4
11	57387-300	DECAL - QUADRAPOWER	1
12	57385-000	HAZARD TAPE - BL ACK / AMBER	1 roll
13	57389-300	DECAL - UPRIGHT LOGO	2
14	57399-300	DECAL - LOWER CONTROL BOX	1
15	57507-008	DECAL - ON/OFF UPPER CONTROLS	1
16	57507-009	DECAL - TYRE PRESSURE	2
17	57339-001	PLASTIC PUSH RIVET	2
18	57457-400	SECURITY VIN LABEL	1
19	57403-400	DECAL - V.I.N. PLATE	1
20	57507-010	DECAL - ARROW	2



## NOTES :

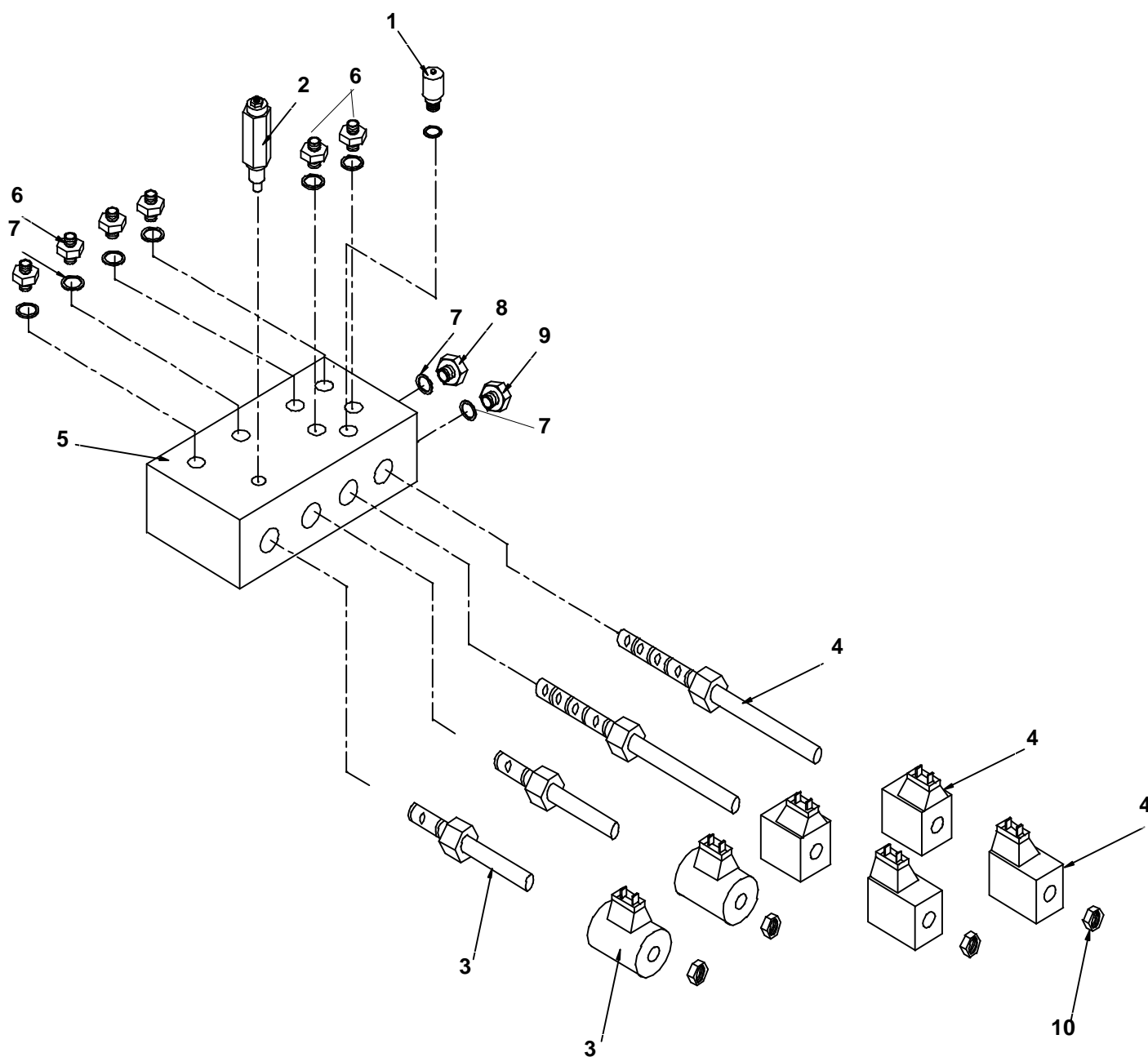
\* ITEM 18 PLACED ON UNDERSIDE OF CHASSIS IN SLEW RING AREA.

\* ITEM 11 LOCATED ON MOTOR CONTROL UNIT IN BATTERY COMPARTMENT.

# Illustrated Parts Breakdown

## MAIN MANIFOLD BLOCK

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57106-000	PRESSURE TEST POINT FITTING	1
2	57373-000	RELIEF VALVE	1
3	57371-000	SOLENOID VALVE CARTRIDGE INCLUDING COIL (SLEW)	2
4	57372-000	SOLENOID VALVE CARTRIDGE INCLUDING COIL (CYLINDERS)	2
5	57370-000	MANIFOLD BODY	1
6	57121-000	M/M ADAPTOR 3/8" - 1/4" B.S.P.	6
7	57125-000	BONDED SEAL - 3/8"	9
8	57123-000	M/M ADAPTOR 3/8" - 1/2" B.S.P	1
9	57122-000	M/M ADAPTOR 3/8" - 3/8" B.S.P	1
10	58255-000	LOCKNUT	4



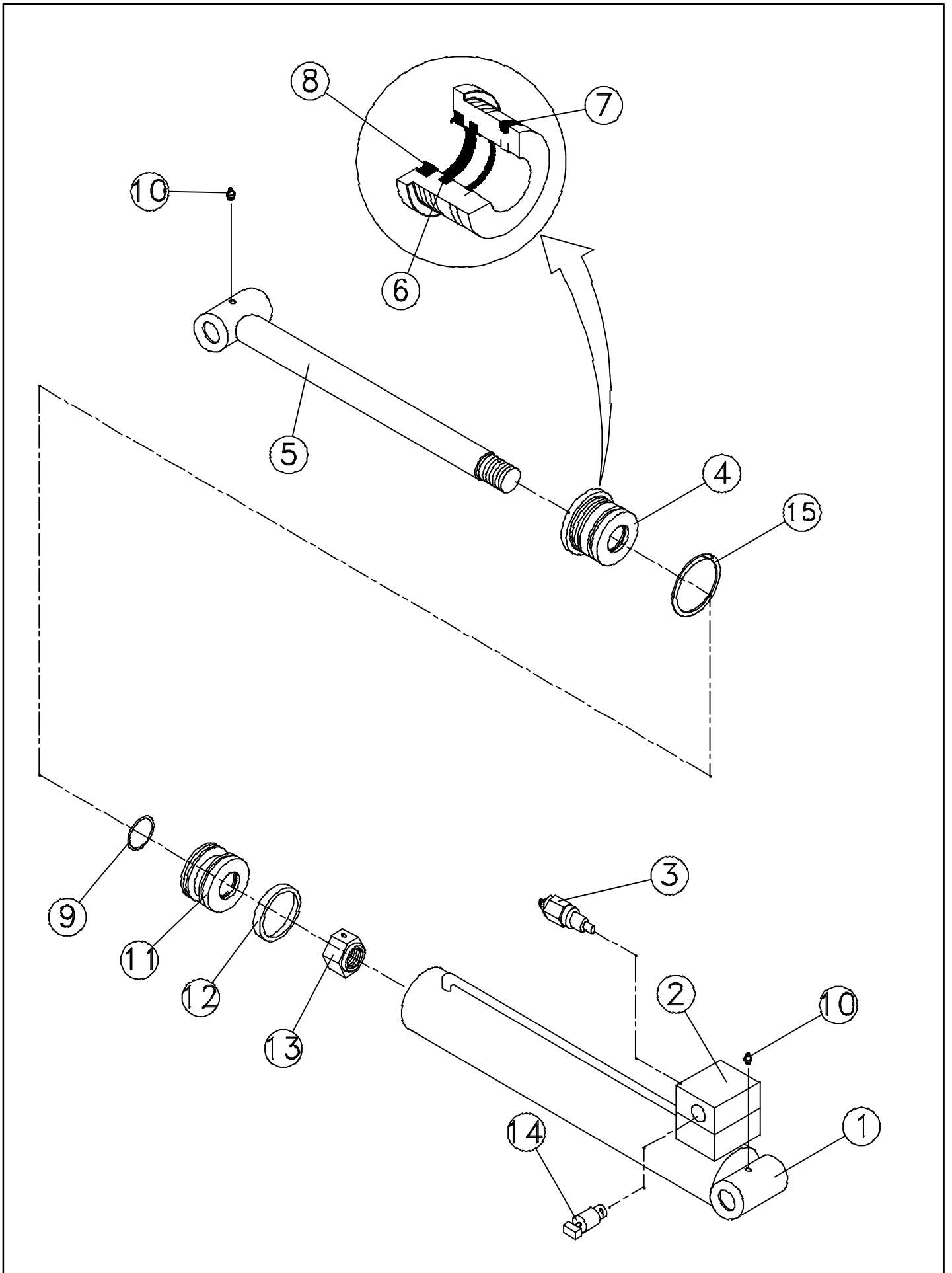
## UPPER & LOWER LIFT CYLINDER ASSEMBLY

57104-300

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	-	CYLINDER BODY	1
2	57368-000	VALVE BLOCK	1
3	57378-000	SINGLE OVERCENTRE CARTRIDGE - 175 BAR	1
4	-	END CAP	1
5	-	ROD AND END PIVOT	1
6	SEE NOTE	ROD SEAL	2
7	SEE NOTE	O-RING	1
8	SEE NOTE	WIPER	1
9	SEE NOTE	PISTON O-RING	1
10	58819-000	GREASE NIPPLE	2
11	-	PISTON HEAD	1
12	SEE NOTE	PISTON SEAL	1
13	SEE NOTE	PISTON LOCKNUT	1
14	57472-000	EMERGENCY LOWERING CARTRIDGE VALVE	1
15	-	O-RING	1

**NOTE:** ITEMS 6,7,8,9,12 & 13 ALL FORM THE SEAL KIT FOR THE CYLINDER.  
THE SEAL KIT IS 57360-300





## HYDRAULIC CIRCUIT ASSEMBLY

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	15797-000	HYDRAULIC PUMP/ ELECTRIC MOTOR UNIT	1
2	57100-000	PUMP SUCTION PORT ADAPTOR	1
3	57101-000	PUMP PRESSURE PORT ADAPTOR	1
4	57102-000	PUMP "IDLE PORT" ADAPTOR	1
5	57103-300	HYDRAULIC MOTOR ASSEMBLY	1
6	57104-300	HYDRAULIC CYLINDER ASSEMBLY C/W LET-DOWN VALVE	2
7	57105-300	MANIFOLD BLOCK ASSEMBLY	1
8	57106-000	TEST POINT FITTING	1
9	57107-300	RETURN LINE FILTER	1
10	57108-300	MAGNETIC DRAIN PLUG	1
11	57109-300	FILLER BREATHER CAP	1
12	57110-300	HOSE ASSEMBLY - TANK TO PUMP	1
13	57111-300	HOSE ASSEMBLY - PUMP TO MANIFOLD 'P'	1
14	57112-300	HOSE ASSEMBLY - PUMP IDLE PORT TO TANK	1
15	57113-300	HOSE ASSEMBLY - FILTER TO TANK	1
16	57114-300	HOSE ASSEMBLY- MANIFOLD TO FILTER	1
17	57115-300	HOSE ASSEMBLY - MANIFOLD TO SLEW MOTOR	1
18	57116-300	HOSE ASSEMBLY - MANIFOLD TO SLEW MOTOR	1
19	57117-300	HOSE ASSEMBLY - MANIFOLD TO LOWER CYLINDER	1
20	57118-300	HOSE ASSEMBLY - MANIFOLD TO LOWER CYLINDER	1
21	57119-300	HOSE ASSEMBLY - MANIFOLD TO UPPER CYLINDER	1
22	57120-300	HOSE ASSEMBLY - MANIFOLD TO UPPER CYLINDER	1
23	57121-000	M/M ADAPTOR - 1/4" BSP - 3/8" BSP	4
24	57122-000	M/M ADAPTOR - 3/8" BSP - 3/8" BSP	3
25	57123-000	M/M ADAPTOR - 3/8" BSP - 1/2" BSP	2
26	57124-000	BONDED SEAL 3/4"	1
27	57125-000	BONDED SEAL 3/8"	9
28	57126-000	HYDRAULIC OIL	1

## Section 7.2

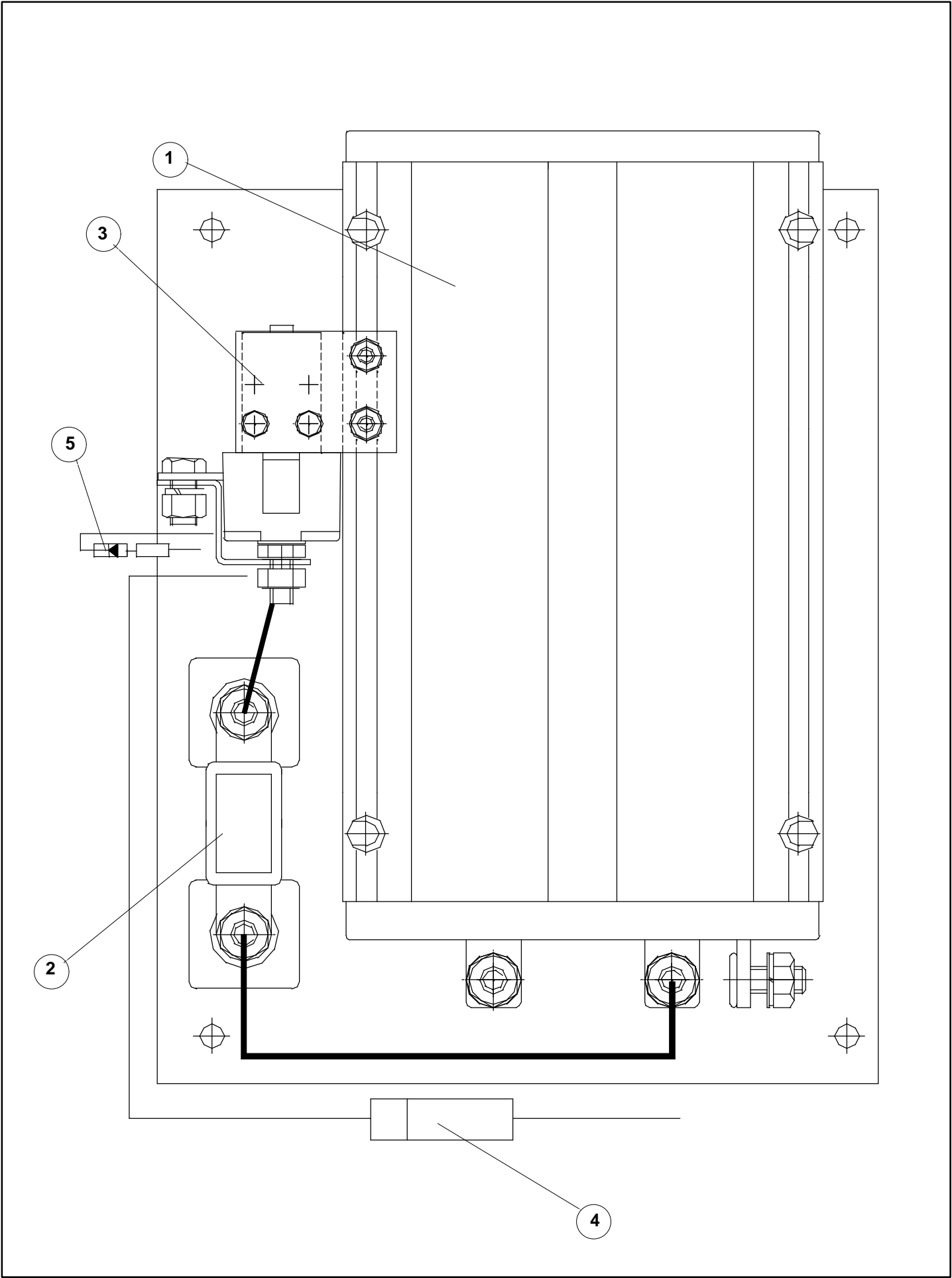


# Illustrated Parts Breakdown

## PUMP MOTOR CONTROL UNIT ASSEMBLY

57192-000 = COMPLETE ASSLEMBY (NO LINE CONTACTOR) SERIAL NUMBERS 1001 TO 1132  
57192-001 = COMPLETE ASSEMBLY - SERIAL NUMBERS 1133 TO CURRENT

ITEM	PART NUMBER	DESCRIPTION	QTY.
1 *	<b>57300-400</b> <b>57475-300</b>	CONTROLLER UNIT <b>SERIAL NUMBERS 1001 TO 1132</b> CONTROLLER UNIT <b>SERIAL NUMBERS 1133 TO CURRENT</b>	1
2	57304-000	FUSE 160A	1
3	57485-000	LINE CONTACTOR - <b>SERIAL NUMBERS 1133 TO CURRENT ONLY</b>	1
4	57470-000	FUSE 7A	1
5	58932-000	SUPRESSION DIODE ASSY.	1
6 * NOT SHOWN	57128-000	MOS 90 CALIBRATOR - TEST/PROGRAMMING INSTRUMENT	1



# Illustrated Parts Breakdown

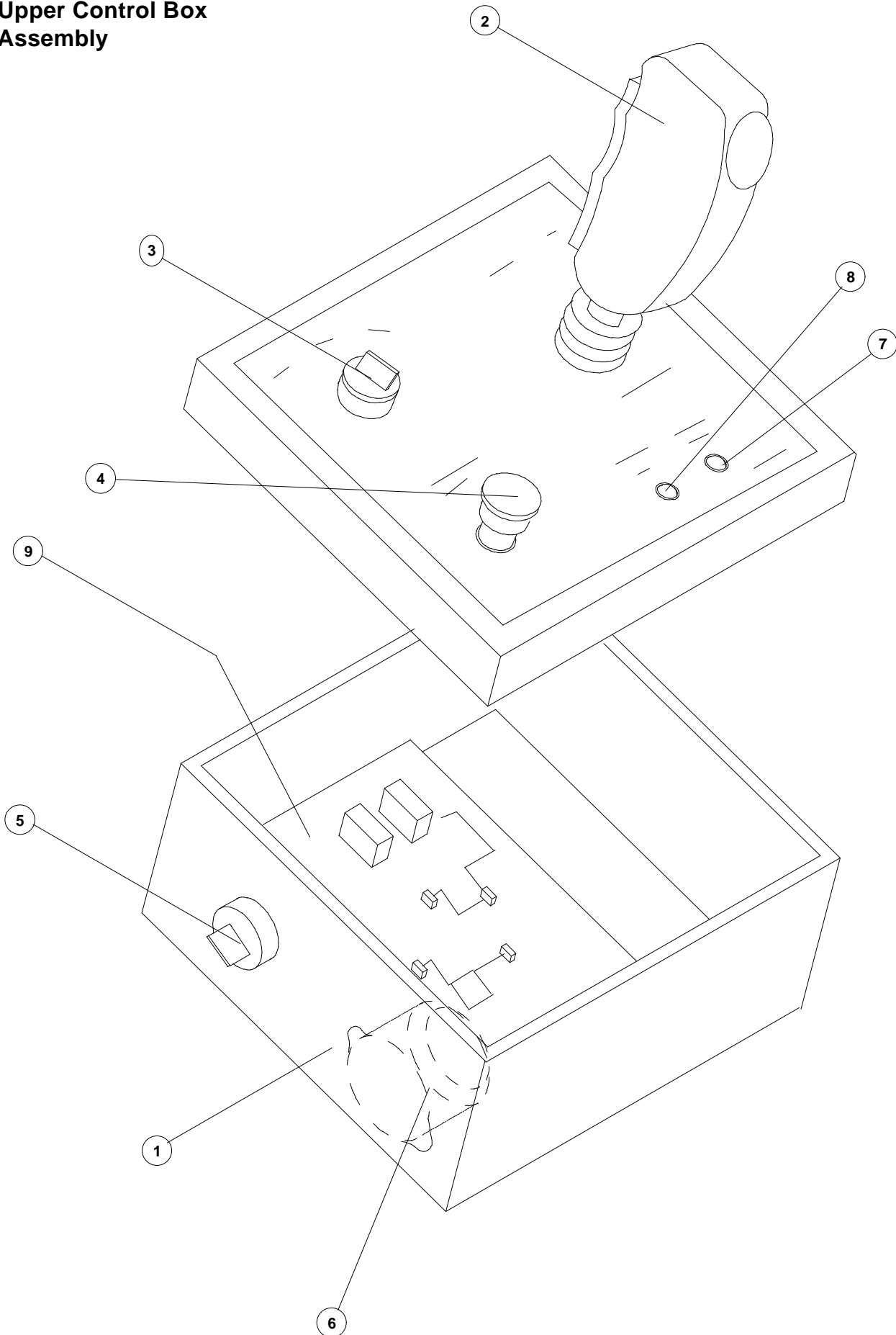
## UPPER CONTROL BOX ASSEMBLY

**57181-000 SERIAL NUMBERS 1001 TO 1132**

**57181-001 SERIAL NUMBERS 1133 TO CURRENT**

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57324-400	ENCLOSURE	1
2	57325-400	JOYSTICK	1
*	63975-004	POT ASSY	1
*	58984-000	RUBBER BOOT	1
*	58985-000	INTERNAL MICRO SWITCH	1
3	58152-000	3-POSITION SELECTOR SWITCH	1
*	58947-000	CONTACT BLOCK N/C	2
*	58946-000	CONTACT BLOCK N/O	2
4	57309-000	EMERGENCY STOP BUTTON	1
5	57327-400	ROTARY SWITCH	1
*	58947-000	CONTACT BLOCK N/C	1
*	58946-000	CONTACT BLOCK N/O	3
6	57328-400	ALARM	1
7	57329-000	GREEN LED (OUTRIGGERS PROPERLY DEPLOYED)	1
8	57330-000	RED LED (BATTERY WARNING)	1
9	57236-000	P.C.B., UPPER	1

## Upper Control Box Assembly



# Illustrated Parts Breakdown

## CABLES AND ELECTRICAL COMPONENTS

ITEM	PART-NUMBER	DESCRIPTION	QTY.
1	57192-000	MOTOR CONTROLLER ASSEMBLY SERIAL NUMBERS 1001 TO 1132	1
1	57192-001	MOTOR CONTROLLER ASSEMBLY SERIAL NUMBERS 1133 TO CURRENT	1
2	57180-300	LOWER CONTROL BOX ASSEMBLY	1
3	57181-000	UPPER CONTROL BOX ASSEMBLY SERIAL NUMBERS 1001 TO 1132	1
3	57181-001	UPPER CONTROL BOX ASSEMBLY SERIAL NUMBERS 1001 TO 1132	1
4	15796-001	BATTERY 6V 220 AH	4
5	63948-011	BATTERY CHARGER 24V/220V	1
6	57182-400	OUTRIGGER LIMIT SWITCH	4
7	57183-300	SLEW CUT-OUT LIMIT SWITCH	1
8	57184-400	CABLE ASSEMBLY - BATTERY TO BATTERY	1
9	57185-400	CABLE ASSEMBLY - BATTERY TO BATTERY	2
10	57186-400	CABLE ASSEMBLY - FUSE TO D.C. MOTOR	1
11	57187-400	CABLE ASSEMBLY - BATTERY TO MOTOR CONTROL UNIT	1
12	57188-400	CABLE ASSEMBLY - D.C. MOTOR TO MOTOR CONTROL UNIT	1
13	57189-400	CABLE ASSEMBLY - BATTERY TO CHARGER	1
14	57190-000	TAIL BOARD ASSEMBLY SERIAL NUMBERS 1001 TO 1410	1
14	57190-001	TAIL BOARD ASSEMBLY SERIAL NUMBERS 1411 TO CURRENT	1
15	57191-400	CABLE ASSEMBLY - TAIL'BOARD TO TOWHITCH	1
16	57470-000	7-AMP FUSE	1
17	10154-000	BATTERY TERMINAL COVER (NOT SHOWN)	8
18	57465-400	CABLE ASSEMBLY - CHARGER TO FUSE	1
19	57335-400	7-PIN TRAILER SOCKET	1
20	57334-000	7-PIN PLUG	1
21	57485-000	LINE CONTACTOR (SERIAL NUMBERS 1133 TO CURRENT)	1
22	58912-000	TILT SENSOR (OPTION)	1



