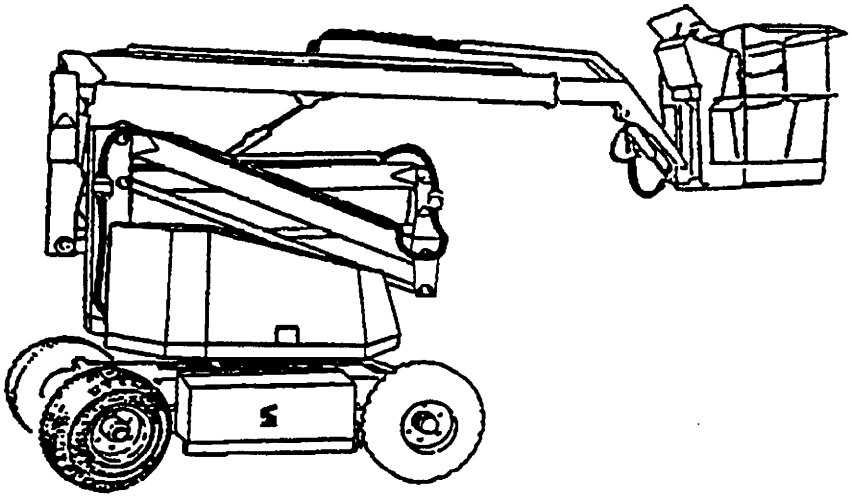
EAGLE 50/30

TECHNICAL MANUAL

Section 2: Safe Working Practice
Section 3: Operating Procedures
Special Precautions
Section 4: Emergency Procedures
of this Manual MUST BE READ
prior to operating your
EAGLE 50/30



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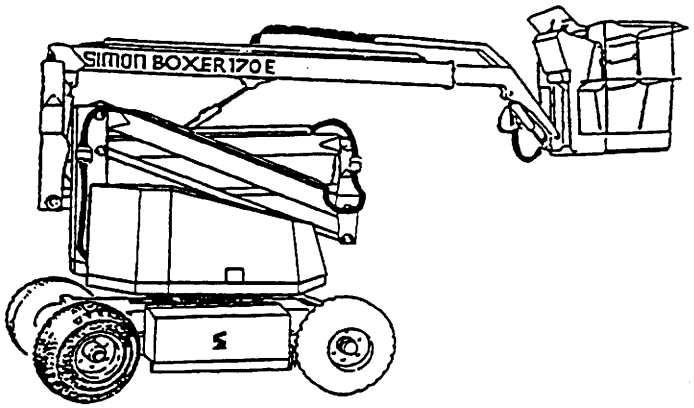
HYDRAULIC LIFT PLATFORM TECHNICAL MANUAL

BOXER 170 E



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INTRODUCTION

1. The Boxer 170 E is an electrically powered self-propelled hydraulic access platform manufactured in the U.K. by Simon Aerials Limited. The Boxer 170 machines have a working height ability of 17 metres.

2. The work platform has a sideways folding boom configuration with no knuckle or tailswing to restrict manoeuvrability. This allows easy access through standard industrial doorways and enables operation in narrow aisles and confined spaces. The unique up-and-over feature enables the Boxer 170 E platform to reach work positions that are frequently beyond the range of larger and more expensive machines.

3. The operator has full control from ground or cage positions. The machine can be driven accurately and safely from the cage, even when the booms are fully elevated.

4. Double-acting cylinder lock-valves prevent the booms from descending in the event of hydraulic hose failure and all emergency lowering valves are situated at ground level. Manual rotation is available in the event of an emergency with power loss.

5. The Boxer chassis is of welded steel and the booms are manufactured from square/rectangular hollow steel sections for optimum strength, lightness and durability. Hoses are abrasion resistant and are protected upon the booms.

6. The Boxer 170 E is powered by twenty-four 2V heavy duty batteries. Battery packs are available in either 258 Amp-hour or 300 Amp-hour options. The standard machine is fitted with an advanced battery charger which operates from 240V, 50Hz a.c. A dual input 110V/240V battery charger is available as an option.

7. The transmission system allows an outstanding range and performance. The powerful motor, high ground clearance and differential lock allow the Boxer 170 E to climb 1 in 5 slopes.

SECTION 1

BOXER 170 E SPECIFICATION

1. CLOSED DIMENSIONS AND WEIGHTS

Length	5.64 m
Width	1.85 m
Height	2.20 m
Unladen Weight	6500 kg

2. OPERATING DIMENSIONS

Maximum Cage Floor Height	14.70 m
Maximum Working Height	16.770 m
Maximum Working Outreach	9.00 m
Standard Platform Dimensions	1.20 m x 0.60 m
Large Platform Dimensions	1.50 m x 0.60 m
Outside Turning Circle	4.00 m
Gradeability	20% (11°)
Maximum Speed, Booms Stowed	5 km/hr (3 mph)
Maximum Speed, Booms Elevated	0.75 km/hr (0.5 mph)
Ground Clearance	0.20 m

3. DESIGN SPECIFICATION

Safe Working Load (2 persons)	225 kg (496 lbs)
Maximum Horizontal Platform Pull	40 kg (88 lbs)
Maximum Wind Speed	12.5 m/sec (28 mph - 45 km/hr)
Maximum Slope for Safe Operation	5°
Full Range Time Up	100 seconds
Full Range Time Down	70 seconds
Swing Left/Right	60 seconds

4. MECHANICAL COMPONENTS

Tyre Type . . . . . High Traction Deep Lug (Solid Rubber) 26 cm wide x 73 cm dia.

Tyre Size . . . . . 250 - 15

Axle . . . . . 14.058 : 1 ratio

Gearbox . . . . . 6 : 1 ratio

Wheel Diameter . . . . . 38.1 cms

Brakes . . . .Oil immersed discs integral inside the axle housing with failsafe operation serve as both parking and service brakes. The brakes are released when the footswitch is depressed and the joystick is moved to either forward or reverse motion.

5. HYDRAULIC COMPONENTS

Lift Cylinders . . . . . Double-acting with overcentre valves

Hoses . . . . . Thermoplastic

Filtration . . . . . Suction and pressure

6. OIL

Type . . . . . Shell Tellus 32.

Oil Reservoir Capacity . . . . . 26 litres

7. EQUIVALENT OILS

BP	ENERGOL HLP 22
SHELL	TELLUS 22
FINA	CIRKAN 22
TOTAL	AZOLLA 22
CASTROL	HYSPIN AWS 22
ESSO	NUTO HP 22
GULF	HYDRASIL 22 AW
CHEVRON	EP HYDRAULIC OIL 22

8. ELECTRIC COMPONENTS

Pump Motor . . . . . 48V, 3.7kW, 1200 rpm. Flow rate 10 l/min.

Pump Pressure . . . . . 180 bar (2611 psi)

Drive motor . . . . 48V, 5kW, series-wound reversible. Solid state controlled.

Hand Controller Type . . . . . Joystick

Batteries - Option 1 . . . . . Twenty-four 2V heavy duty, 300Amp-hour

Batteries - Option 2 . . . . . Twenty-four 2V heavy duty, 258Amp-hour

Battery Charger - Standard . . . . . FM-Traction. 48V, 40A charging. Single 240V, 50Hz input.

Battery Charger - Optional . . . . . FM-Traction. 48V, 35A charging. Dual 110V/240V, 50Hz input.

9. WORKING ENVELOPE

The Boxer 170 E has a working height ability of 16.770 mts. The following diagram shows the working envelope for the Boxer 170 E. All dimensions are in metres.

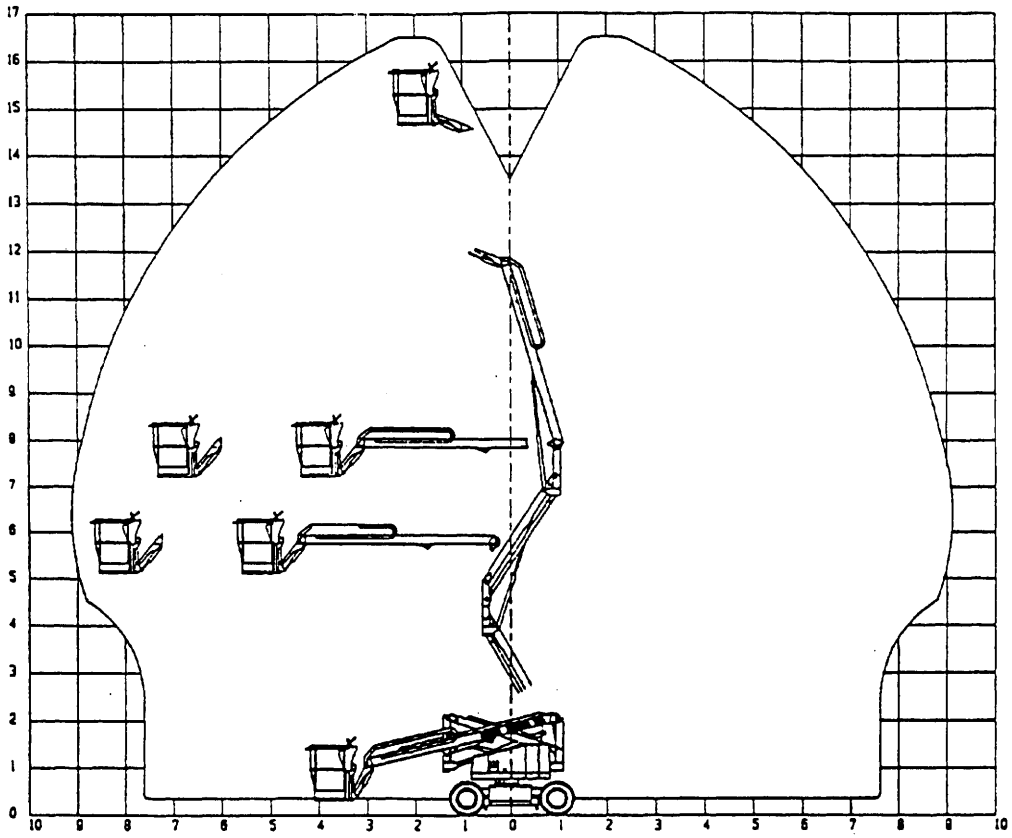


Figure 1.1 - Boxer 170 E Working Envelope

SECTION 2

SAFE WORKING PRACTICE

1. USE OF THE MACHINE

(a) **AT ALL TIMES, IT IS THE RESPONSIBILITY OF THE OPERATOR TO USE THE MACHINE IN A SAFE AND PROPER MANNER.**

(b) **ONLY TRAINED OPERATORS MUST BE ALLOWED TO CONTROL THE MACHINE.**

(c) **UNDER NO CIRCUMSTANCES MUST THIS MACHINE BE USED IN SUCH A MANNER AS TO CONTRAVENE ANY INTERNATIONAL, NATIONAL OR LOCAL HEALTH AND SAFETY AT WORK REGULATIONS OR FACTORIES ACTS AND SUBORDINATE REGULATIONS.**

2. INFORMATION SOURCES

THE FOLLOWING INFORMATION MUST BE READ AND UNDERSTOOD:

(a) "Mobile Elevating Work Platforms", Draft European Standard, Document No. 88/74145, published by the British Standards Institute, 1988.

(b) "Specification for Mobile Elevating Work Platforms", Document No. BS 7171, published by the British Standards Institute, 1989.

(c) "Safety in Work with Power Operated Mobile Work Platforms", Health and Safety Guidance Note HS(G) 19, published by H.M.S.O.

(d) "Avoidance of Danger from Overhead Electric Lines", Health and Safety Guidance Note GS6, published by H.M.S.O.

(e) "I.P.A.F. Guide to MEWPs (Mobile Elevating Work Platforms)", published by the International Powered Access Federation, 1987.

3. HAZARDS

ONLY TRAINED AND MEDICALLY FIT PERSONNEL MUST OPERATE THE MACHINE. IF UNTRAINED PERSONS ARE PRESENT IN THE PLATFORM FOR INSPECTION DUTIES THEY MUST NOT BE PERMITTED TO CONTROL THE MACHINE.

The following instructions are minimum requirements to be adopted for safe working practice with the Boxer 170 E machine:

(a) The safe working load of 225 kgs (496 lbs) must not be exceeded (two persons only).

(b) The machine must not be elevated on ground that is more than 5.0 degrees out of level. The ground must be well compacted and capable of taking weight transferred to the wheels in all stages of operation. In general, a road quality surface is required.

(c) The machine must not be used in wind speeds in excess of 10 metres/second, or 36 km/hr (23 mph) and the maximum platform horizontal pull of 40 kg (88.2 lbs) must not be exceeded.

(d) Safety belts and helmets must be worn at all times and the platform door/bar must be in position when the operators are in the cage.

(e) Care must be exercised when working in an area where there are live electric cables. The local electricity authorities should be contacted for advice.

(f) Where there are obstructions such as pillars, additional care must be taken to avoid collision between the obstruction and the work platform, and to prevent the operator from becoming trapped.

(g) The machine must not be used as a crane or hoist, nor must the platform be used as a jack or prop.

(h) When working in areas with other moving machines, special care must be taken to prevent collisions with objects that may enter the working envelope.

(j) When working in public areas, special care must be taken to prevent members of the public from approaching the work platform. The working area must be cordoned off and people prevented from working or walking underneath, where objects or the structure may descend onto them. In some circumstances, an audible signal may be necessary to warn that the machine is in motion.

(k) The platform must only be used where adequate visibility is available. The work area and the adjacent operating envelope may require illumination to prevent collision between the work platform and an obstruction. Additionally, it must be remembered that in darkness the shape or extent of the work platform may not be apparent to others. Consideration should be given to the location and extent of warning lights, etc.

(l) Care must be exercised when working underneath the platform for maintenance or other purposes. The hydraulic cylinders must not be relied upon to hold position. The platform must be securely chocked, using the chock provided with the machine, to prevent parts of the body becoming trapped by the superstructure.

(m) Use of the platform must be avoided in areas where rescue of the operator in an emergency would be difficult.

(n) The operator must not interfere with, or make adjustments to the hydraulic circuit in an attempt to increase the machine speeds outside the range given in the specification.

(p) The machine must not be used if it is not fully serviceable. This includes passing the pre-use checks.

4. WARNINGS

WARNING

SPECIAL PRECAUTIONS: BEFORE OPERATING THE MACHINE, READ THE SPECIAL PRECAUTIONS IN SECTION 3.

WARNING

SAFETY EQUIPMENT: WEAR HELMET AND SAFETY HARNESS AT ALL TIMES WHEN CARRYING OUT OPERATIONS FROM THE PLATFORM.

WARNING

PRE-USE CONTROL CHECKS: ALWAYS CARRY OUT PRE-USE CONTROL CHECKS ON AN EVEN AND LEVEL SURFACE

WARNING

ELECTRIC SHOCK: THE WORKING PLATFORM IS NOT INSULATED AND EXTREME CARE MUST BE TAKEN WHEN WORKING IN THE VICINITY OF OVERHEAD ELECTRIC CABLES. CONSULT THE LOCAL ELECTRICITY AUTHORITIES FOR ADVICE.

WARNING

SAFE WORKING LOAD: THE SAFE WORKING LOAD OF 225 KGS MUST NOT BE EXCEEDED THE PLATFORM IS DESIGNED TO HOLD TWO PERSONS ONLY.

WARNING

EMERGENCY PROCEDURES: DURING ALL EMERGENCY PROCEDURES, PERSONNEL MUST TAKE SPECIAL CARE TO AVOID BEING TRAPPED BY ANY SUDDEN DESCENT OF THE SUPERSTRUCTURE.

WARNING

WIND SPEED: DO NOT OPERATE THE MACHINE IN WIND SPEEDS IN EXCESS OF 36 KM/HR (23 MPH).

SECTION 3

OPERATING PROCEDURES

WARNING

READ THE SPECIAL PRECAUTIONS DETAILED IN PARAGRAPHS 17 TO 24 BEFORE ATTEMPTING TO OPERATE THE MACHINE.

1. PRE-USE CHECKS

Before the Boxer is used at the start of a day, or after an extended period without use, the following checks should be carried out to ensure that the machine is in good condition and is safe to use:

(a) Check all battery electrolyte levels and connections.

(b) Check that all labels are readable and secure.

(c) Check the hydraulic oil level.

(d) Check that the battery charger is disconnected from the mains supply.

(e) Check tyres for damage.

(f) Check wheel bolts for security.

(g) Check the tilt alarm. Refer to paragraph 24 for details.

2. GROUND CONTROL CHECKS

WARNING

DO NOT OPERATE THE MACHINE IF THE GROUND CONTROL CHECKS REVEAL A DEFECT.

Ensure that the following checks are carried out with the cage empty:

(a) Test all operations (lift, rotate, etc.)

(b) Check for the following:

(i) Uneven or jerky operation.

(ii) Hydraulic oil leaks.

(iii) Pivot pin security. Ensure that all securing bolts are in place on each locking point.

3. CAGE CONTROL CHECKS

WARNING

DO NOT OPERATE THE MACHINE IF THE CAGE CONTROL CHECKS REVEAL A DEFECT.

Ensure that the following checks are carried out on a level surface:

(a) Carry out the checks described in paragraph 2.

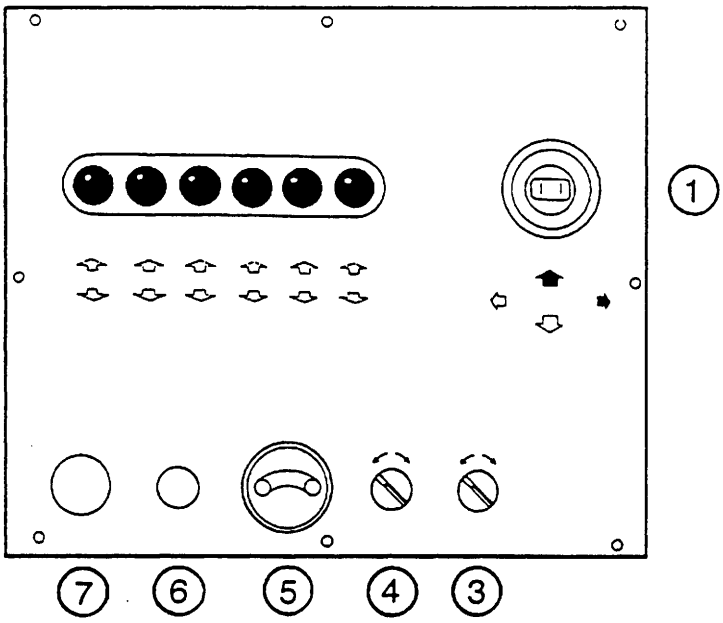
(b) Check the drive, normal and emergency braking.

(c) Check the slow drive speed with the upper boom slightly elevated.

(d) Check the fast drive speed with all the booms fully down.

4. USE ON THE HIGHWAY

The machine is not equipped for highway use and should only be driven on the public highway in compliance with any relevant statutory regulations.



KEY

1) Joystick.
3) DIFF LOCK selector switch.
4) LIFT/DRIVE selector switch.
5) Battery indicator.
6) HORN pushbutton.
7) EMERGENCY STOP pushbutton.

Figure 3.1 - Cage Controls

5. DRIVE CONTROLS

(Refer to Figure 3.1)

The drive controls are located in the cage and consist of a joystick controller and a footswitch. These controls operate as follows:

5.1 Forward and Reverse

(a) At the ground controls, set the CAGE/GROUND selector switch to CAGE.

(b) At the cage controls, set the LIFT/DRIVE selector switch to DRIVE.

(b) Operate the footswitch.

(c) With the footswitch depressed, push the joystick forward to drive the machine forward, or pull the joystick back to drive the machine in reverse.

Note: - To de-activate the brakes, the footswitch must be depressed and the joystick displaced simultaneously.

5.2 Drive Speed Control

The drive speed of the machine is proportionally controlled by the amount of movement made to the joystick.

Note: - When elevated, the drive speed of the machine is automatically reduced.

5.3 Steering Control

WARNING

THE WHEELS ARE NOT SELF-CENTREING AND MUST BE ALIGNED BY USING THE JOYSTICK ROCKER SWITCH

Steering is achieved by depressing the rocker switch on top of the joystick controller to the left or right, as required.

6. DRIVING

The drive controls are located in the cage and the machine can be driven with the cage positioned at either end of the machine. If driving is attempted from the 'steering' end of the machine, all directions given to the controls will be reversed so the operator may find driving easier with the cage positioned at the 'drive' end. Arrows on the chassis show the true control direction. Before driving the machine, check the following:

(a) The POWER ON/OFF keyswitch at the ground controls is set to ON.

(b) The CAGE/GROUND selector switch at the ground controls is set to CAGE.

(c) The route to be taken is clear.

(d) The differential lock is not engaged unless it is required.

7. DIFFERENTIAL LOCK

Caution 1: - To avoid mechanical damage, ensure that the machine is stationary before attempting to engage or disengage the differential lock

Caution 2: - Prolonged use of the differential lock impairs steering and causes excessive tyre wear. The differential lock must only be engaged momentarily.

The differential lock switch is located at the cage controls. The differential lock improves traction in slippery conditions and should only be engaged momentarily to reduce wheel spin.

7.1 Differential Lock

While driving on certain ground surfaces it may be necessary to engage the differential lock.

The procedure for the use of the diferential lock is explained below.

(a) Ensure that the machine is stationary.

(b) Select the differential " **Lock On** " position at the upper control station.

(c) Drive the machine to a position where areater wheel to ground traction is available and the lock is no longer required.

(d) Stop the machine and release the differential lock switch to " **Lock Off** " position.

Note : It is usual that the differential lock will not disengage immediatly, to reduce this delay it may be necessary to momentarily operate the drive control lever back and forth.

8. BRAKING SYSTEM

The Boxer 170 E has a single braking system which serves as a parking brake when the machine is static, and as service brakes when the machine is in drive mode. The brakes are spring applied and hydraulically released.

8.1 Brakes in Static Mode

For normal parking, the brakes are automatically applied when the joystick controller is positioned in the central (neutral) position. During lift operations, the brakes are automatically applied to the machine.

8.2 Brakes in Drive Mode

The brakes are spring applied when the joystick is in the centre (neutral) position and remain applied during lifting operations. Deceleration is achieved by moving the joystick controller to the central (neutral) position.

8.3 Emergency Braking

Emergency braking is achieved by operating the EMERGENCY STOP button, or by releasing the footswitch, or by returning the joystick controller to the central (neutral) position.

9. ACCESS OPERATIONS (CAGE CONTROL)

Before entering the cage:

(a) Ensure that the pre-use checks have been carried out.

(b) If necessary, release either or both EMERGENCY STOP buttons.

(c) At the ground controls, set the POWER ON/OFF keyswitch to ON.

(d) Check that the blue POWER ON lamp is lit. If the lamp is not lit, check that both EMERGENCY STOP pushbuttons are out.

(e) At the ground controls, set the CAGE/GROUND selector switch to CAGE.

After entering the cage:

(f) At the cage controls, set the LIFT/DRIVE selector switch to LIFT.

(g) Operate the footswitch.

(h) Select the required function.

Available Control Functions:

-	**Lower Boom:**	**Up**	**Down**
-	**Middle Boom:**	**Up**	**Down**
-	**Upper Boom:**	**Up**	**Down**
-	**Zoom:**	**Extend**	**Retract**
-	**Rotate:**	**Left**	**Right**
-	**Cage Level:**	**Front**	**Back**

Note: - The footswitch must be activated at all times during cage access functions.

10. CAGE ROTATION

Rotation is achieved by operating a lever positioned below the rotation worm box. This lever releases the cage lock and allows the cage to be rotated by turning the handle on the rotation box.

11. CAGE LEVELLING

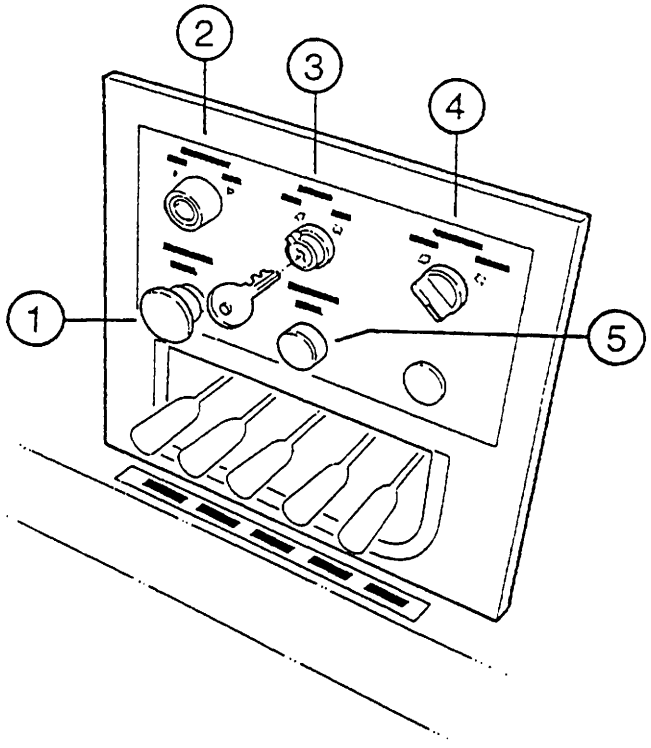
Cage levelling (forwards and backwards) is achieved by operating a lever on the main valve assembly block.

12. ACCESS OPERATIONS (GROUND CONTROL)

(Refer to Figure 3.2)

The ground controls are located on the turret and consist of a key-activated POWER ON/OFF switch; PUMP ON/OFF switch; EMERGENCY STOP pushbutton; CAGE/GROUND selector switch; LIFT 1; LIFT 2; LIFT 3; ZOOM and ROTATE levers. There is no cage levelling facility available from the ground controls.

The ground controls have identical functions to the cage controls and are for testing and emergency procedures only. There are no cage levelling, footswitch or battery indicator facilities at the ground controls. Set the CAGE/GROUND selector switch to GROUND to operate lift functions from the ground controls.



KEY

1) EMERGENCY STOP pushbutton.
2) PUMP ON/OFF pushbutton.
3) POWER ON/OFF keyswitch.
4) CAGE/GROUND selector switch.
5) POWER ON indicator lamp.

Figure 3.2 - Ground Controls

13. COMPLEX CONTROL OPERATION

Some complex control operation is available by using more than one lever. Response, however, will depend on the amount of pressure in the various components.

14. AFTER USE

When the machine is no longer required, set the POWER ON/OFF switch to OFF and operate the ground or cage EMERGENCY STOP pushbutton.

15. BATTERY CHARGING

The standard charger fitted accepts an input supply of 240 V,50Hz a.c.

A dual-input charger, which may be fitted as an option, automatically accepts inputs of 110V or 240V, 50Hz a.c.

To charge the batteries, proceed as follows:

(a) Plug the charger in to an appropriate mains supply.

(b) At the front of the charger, set the ON/OFF switch to ON.

(c) A series of LEDs (Light Emitting Diodes) indicate the state of the charging process as follows:

(i) The red LED at the top is lit when charging begins.
The digital anemeter will indicate the current flowing to the battery as a percentage of the full load rated output current of the charger.

(ii) The red LED in the middle is lit when charging is at an intermediate stage.

(iii) The green LED at the bottom left is lit when charging is complete.
(Note : The digital anemeter will now read approximately 30 per cent.)

(iv) The yellow LED at the bottom right (labelled *t max*) is lit if the charger has been operating for too long.

If the *t max* LED is lit, switch the charger off.
If charging is not complete when the *t max* LED is lit, switch the charger off and leave the machine for a minimum of four hours before switching the charger back on.

Note: - Batteries in good condition should be fully charged before the *t max* LED is lit. If the *t max* LED is lit before charging is complete, the condition of the batteries is deteriorating.

(d) When the green LED is lit, set the charger ON/OFF switch to OFF.

(e) Disconnect the charger from the mains supply.

(f) The timing basis of the charging switch is interrupted by the failure of the mains electricity suply.The position of the charging programme is then stored. All indicators go off and show the original stage of the process when current is restored.

16. BATTERY INDICATOR

Important: - If the batteries are disconnected, the battery indicator will read FULL when the batteries are re-connected. Before disconnecting the batteries, note the state of discharge. The indicator will settle to the correct level after a period of operation.

The battery indicator, located at the cage controls, shows the state of charge during machine operations. The indicator uses the colour coding of green, representing FULL/GO and red, representing EMPTY/STOP.

Caution: - When the red LED on the battery indicator is flashing, continued machine operations may reduce the battery charge until no lift or descent capacity is available.

The red LED at the top centre of the indicator flashes when the charge state falls to 75% below fully charged. If the battery charge is reduced a further 5%, the Battery Controller lock-out function disables all lift and descent operations to prevent battery damage.

It is recommended that the machine is taken out of service as soon as the red LED flashes and that the batteries are fully charged before any further machine operations take place.

17. SPECIAL PRECAUTIONS - COLD WEATHER

WARNING

BRAKING IN ICY CONDITIONS: WHEN THE GROUND SURFACE IS ICY, CARE MUST BE TAKEN TO AVOID SUDDEN BRAKING. IT IS RECOMMENDED THAT ALL DRIVING OPERATIONS ARE CARRIED OUT SLOWLY AND A SAFE MARGIN IS ALLOWED FOR MANOEUVRING AROUND OBSTACLES.

In very cold weather conditions, the hydraulic oil must be allowed to warm before full operation of the machine is attempted. Regular oil maintenance must be carried out to ensure that the hydraulic oil is kept free from water contamination. Emulsified water can freeze out of the oil as ice crystals, completely blocking the suction strainer and causing hydraulic pump damage.

(a) Ensure that all control valves operate smoothly and return freely to the neutral position without sticking.

(b) Ensure that the rotation drive teeth are not blocked by ice.

(c) Ensure that the steering linkages are free from ice and that the steering operates smoothly.

(d) Ensure that the cage floor is free from ice to allow a firm foot-hold without danger of slipping.

18. SPECIAL PRECAUTIONS - SAFE WORKING LOAD

The maximum safe working load of the Boxer 170 E is 225 kgs (496 lbs) (two persons). THE SAFE WORKING LOAD MUST NOT BE EXCEEDED. When carrying out operations from the cage, the weight of tools and equipment must be taken into consideration.

19. SPECIAL PRECAUTIONS - OVERHEAD ELECTRICAL CABLES

WARNING

THE WORKING CAGE IS NOT INSULATED. EXTREME CARE MUST BE TAKEN WHEN WORKING IN THE VICINITY OF OVERHEAD ELECTRICAL CABLES. CONSULT THE LOCAL ELECTRICITY AUTHORITIES FOR ADVICE.

REMEMBER

IF IN DOUBT - ASK

The working cage is NOT insulated. Extreme care must be taken when working in the vicinity of overhead cables. Allowance must be made for the relative movement of cables and machine due to wind conditions. The operator should read "Avoidance of Danger from Overhead Electric Lines", Health and Safety Guidance Note GS6, published by H.M.S.O. The local electricity authorities should be contacted for advice.

20. SPECIAL PRECAUTIONS - TOWING

WARNING

BEFORE ATTEMPTING TO TOW THE MACHINE ENSURE THAT TOWING NEEDLE VALVE IS OPENED (ITEM 12 PAGE 10.3) (This allows free movement of steering cylinder) proceed to disengage the drive disengage clutch on underside of chassis (Ref.____page____).

Towing From the Front

Disengage brace using handpump (see operations instructions page 4.2). Remove towing arm from stowed position and attached to front axle towing assembly (Ref.____ item____page____). **Do not exceed 15 km/hr.**

Towing from the Rear

Towing from rear should only be attempted in an emergency if unit is inaccessable from the front. Once unit is out of danger and accessable from the front then it should be towed from front. Remove towing arm (item____ page____) and connect to rear towing bracket **do not exceed 5km/hr** as wheels may not camber correctly.

21. SPECIAL PRECAUTIONS - WIND CONDITIONS

The Boxer must not be operated in wind speeds in excess of12.5metres/second (28 mph - 45 km/hr) During normal machine operations, considerations should be given to nearby objects, especially when working in the close vicinity of buildings and electrical cables. Sudden gusts of wind could cause the machine to sway and trap the operator's, arms/hands between the cage railing and an object. It is recommended that a reasonable safety distance is kept between close objects and the cage assembly during all machine operations.

22. SPECIAL PRECAUTIONS - CRANE OPERATIONS

The Boxer is fitted with four lifting points in the form of eyes at each corner of the chassis. The Boxer 170 E weighs 6000 kgs. During lifting operations, take all instructions from the crane operator.

23. SPECIAL PRECAUTIONS - DRIVING ON SLOPES

Caution: - To prevent damage to the drive motor, do not exceed the specified speeds when driving on slopes.

The operator must ensure that speeds are kept within the limits of 5 km/hr (3 mph) with booms stowed and 0.75 km/hr (0.5 mph) with booms elevated.

24. SPECIAL PRECAUTIONS - TESTING THE TILT ALARM CIRCUIT

WARNING

IF THE TILT ALARM SOUNDS WHEN THE MACHINE IS OPERATING, ZOOM IN IMMEDIATELY AND LOWER THE CAGE TO THE STOWED POSITION. DO NOT OPERATE THE MACHINE FURTHER UNTIL THE FAULT HAS BEEN RECTIFIED.

The tilt alarm test is an essential safety test which must be carried out during the pre-use checks described in paragraph 1. The tilt alarm sounds for three seconds when the machine is switched on to indicate that the circuit is operating correctly. The tilt sensor itself, located in the electric module, must be tested manually by pressing down on the sensor unit until the alarm sounds.

If a wire in the tilt alarm circuit becomes disconnected whilst the machine is in use, the alarm will sound continuously. If this occurs when the machine is elevated, zoom in immediately and lower the cage to the stowed position. DO NOT USE THE MACHINE UNTIL THE FAULT HAS BEEN RECTIFIED.

SECTION 4

EMERGENCY PROCEDURES

WARNING

DURING EMERGENCY LOWERING PROCEDURES, TAKE CARE NOT TO BE TRAPPED BY THE DESCENDING SUPERSTRUCTURE.

1. PROCEDURE

Before any emergency procedure is carried out,ensure the following

(a) If possible, take instructions from the cage operator.

(b) At the ground control panel, set the CAGE/GROUND selector switch to GROUND and attempt to operate the ground controls.

2. CAGE OPERATOR INCAPACITATION

In the event of the operator becoming incapacitated ,the cage should be lowered using the ground controls.Refer to Section 3.

3. CAGE CONTROL FAILURE

The cage should be lowered using the ground controls. Refer to Section 3.

4. IMMOBILITY DUE TO LOSS OF DRIVE

If the machine becomes immobile due to battery, gearbox or drive motor failure, the following options are available:

4.1 Battery Failure

Battery failure will be shown on the batterv state indicator at the cage controls. if necessary replace weak or faulty batteries with fully charged batteries,but normally it is sufficent to recharge them.

4.2 Drive Motor/Gearbox Failure

If a drive fault is associated with the drive motor or gearbox, the machine must be towed away from the work site.

Caution 1: Before attempting to tow the machine,ensure that the brakes are disengaged and that the steering locking valve is open.

Caution 2: To prevent damage to the drive motor, Do not tow the machine at speeds exceeding 8 km/hr (5 mph).

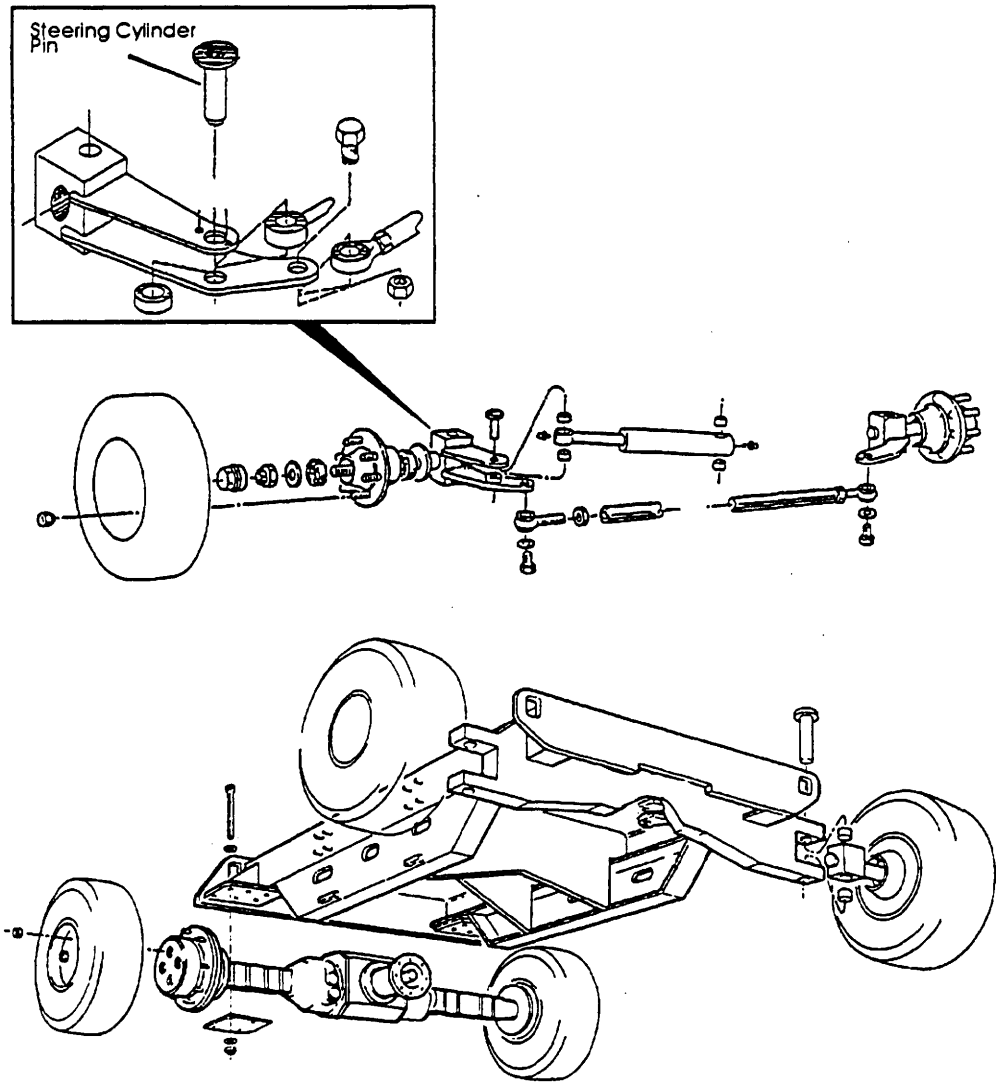


Figure 4.1 - Steering Cylinder Pin / Location

4.2.1 Towing Operations -

Before towing is attempted, the brakes must be disengaged and the needle valve opened to allow the steering cylinder to move freely with the wheels .Remove the tow arm and connect to pivot assembly at front of chassis.

Caution : Do not tow in excess of 15km/h.

4.2.2 Towing Operations - Towing Package Not Fitted

When towing from the rear ensure that the unit is slewed thtough 180 degrees to prevent damage while towing,Do not exceed **8km/h (5mph)**.as this may cause damage to gearbox.

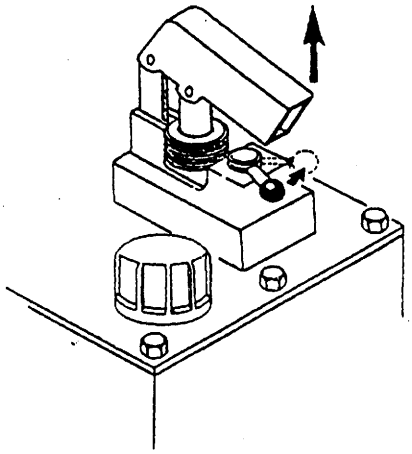
5. DISENGAGE THE BRAKES

(Refer to figure 4.2)

(a) At the brake/steer/lift manifold, located at the left hand side of the hydraulic module, turn the black knurled knob fully clockwise. (**See Fig. 4.3 item no.1**)

(b) At the handpump, located on top of the hydraulic tank, move the Emergency brake/lift selector to the right.

(c) Operate the handpump until sufficient pressure has built up to release the brakes.



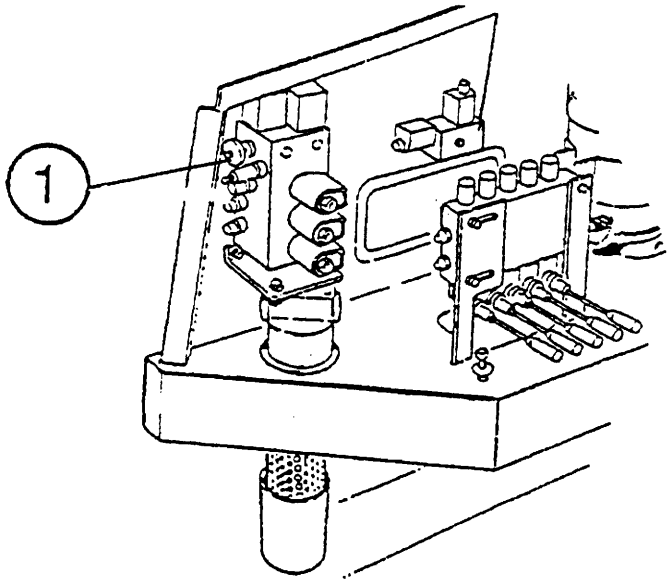


Figure 4.2 - Handpump

..ake / Steer manifold

6. RE-ENGAGE THE BRAKES (**See Fig. 4.3 item no.1**)

When the operation in paragraph 5 is completed, turn the knurled knob on the brake/steer/lift manifold fully anti-clockwise.

7. CRANE OPERATIONS

If towing is not possible, it is recommended that a crane is used to remove the machine from the site.

The Boxer is fitted with four lifting points in the form of eyes at each corner of the chassis. The Boxer 170 E weighs 6500 kgs. During lifting operations, take all instructions from the crane operator.

8. HYDRAULIC PUMP FAILURE

If the hydraulic pump fails, all functions can be achieved by moving the Brake/Lift selector (located on top of the hydraulic tank)to the left.Then depressing the appropriate ground control function lever and operating the handpump.

Note: - Zoom and Lift functions are difficult and may require some effort. It will probably be necessary to use both hands for pumping.

8.1 Lowering All Booms

The booms can be lowered by moving the brake/lift selector (located on top of the hydraulic tank) to the left, then depressing the appropriate ground control function lever and operating the handpump simultaneously.

9. EMERGENCY ROTATION

Emergency rotation can be carried out in two ways:

(a) Hydraulically, using the handpump and function lever.

(b) Mechanically, by manually turning the square shaft on the Worm Gearbox (located under the rotating turret) using a 17mm (5/8") socket. An extension bar will be required to reach the shaft.

SECTION 5

THE HYDRAULIC CIRCUIT

1. PUMP MOTOR

All hydraulic power is provided by a 48V d.c., 3.7kW motor/pump unit. The pump is rated at 10 litres/min and the pressure is 180 bar (2611 psi).

2. LIFT FUNCTION VALVE MANIFOLD BLOCK

The valve block controls the following functions:

(a) Steer valve with cross line relief.

(b)
- Up/Down — Lower Boom
- Up/Down — Middle Boom
- Up/Down — Upper Boom
- Zoom — Extend/Retract
- Rotate — Left/Right

3. HYDRAULIC STEERING SYSTEM

The steering function is provided by a double-acting cylinder and a dual valve system. The valve system controls lift and drive.

When DRIVE is selected, hydraulic flow is directed to a directional solenoid valve assembly. When steer is initiated, the valve opens to allow directional steering.

4. HYDRAULIC LIFT CYLINDER

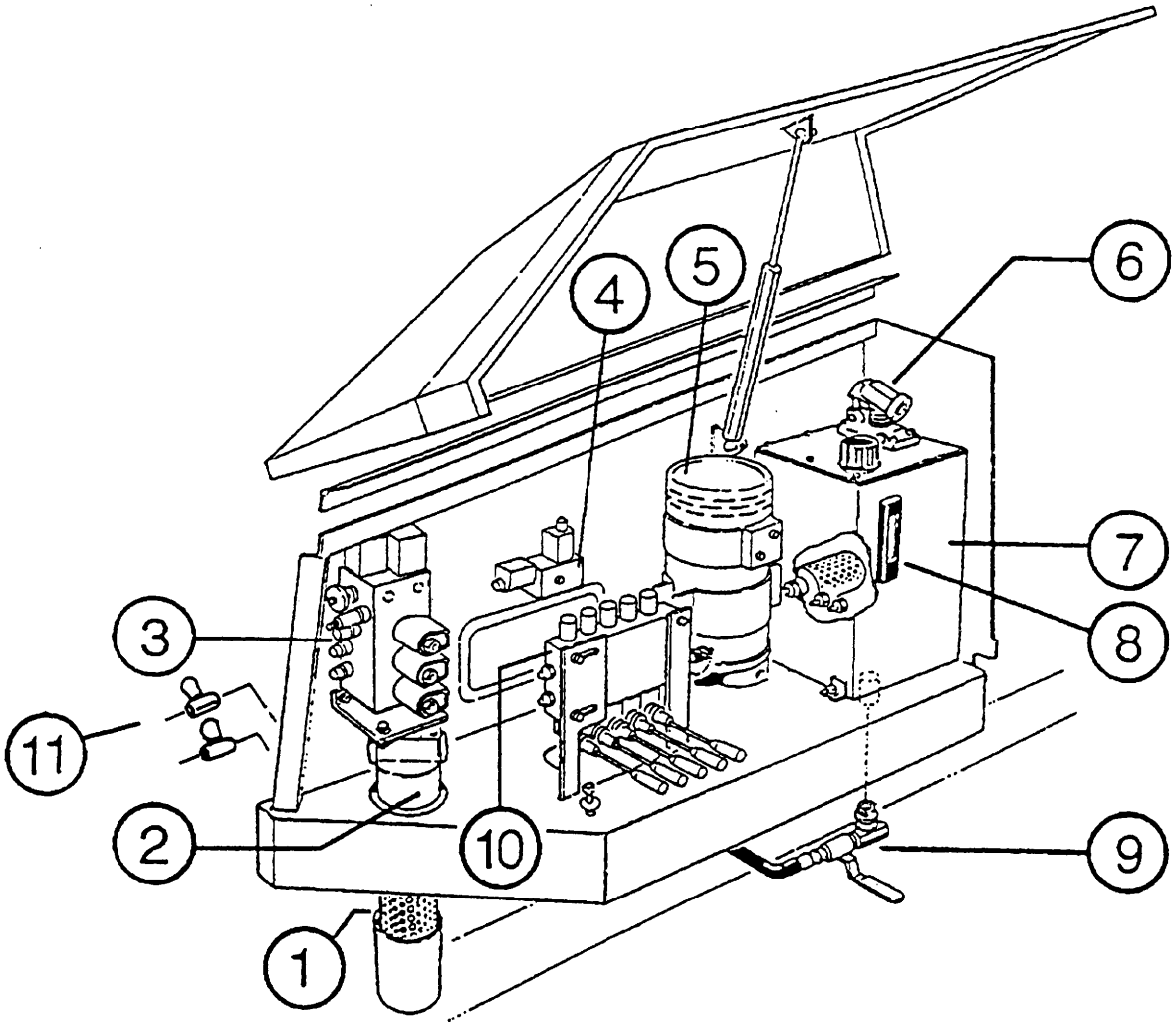
The lift cylinders are of the double-acting type with a banjo-mounted over-centre valve at the base.

5. ZOOM CYLINDER

The zoom cylinder is a double-acting cylinder with integral double pilot-operated check valves at the base end.

6. CAGE LEVELLING CYLINDER

Cage levelling facilities are provided by two double-acting cylinders. The cage end cylinder has a banjo-mounted check valve fixed to the full bore side. The cylinders are connected in a master/slave configuration.



KEY

1)	Pressure filter element.	6)	Emergency handpump.
2)	Pressure filter.	7)	Hydraulic oil tank.
3)	Brake/lift/steer manifold.	8)	Oil level gauge.
4)	Diff. lock manifold.	9)	$^3/_4$" Ball valve.
5)	Hydraulic pump motor.	10)	Bank valve.
		11)	Needle Valves (Towing package)

Figure 5.1 - Hydraulic Module and Hydraulic Manifold

7. HYDRAULIC OIL TANK

The oil tank comprises a filler cap with built-in strainer, a return line diffuser, a suction filter and an emergency handpump. The handpump is permanently connected into the hydraulic circuit for emergency use.

8. BRAKES

The braking system serves as both parking and service brakes. The brakes are spring applied when the machine is static and hydraulically released when the machine is in motion. The brakes are released when the footswitch is depressed and the joystick moved to a forward or reverse position.

9. HYDRAULIC MODULE

The main hydraulic components are located within the hydraulic module, shown in Figure 5.1.

SECTION 6

THE ELECTRICAL CIRCUIT

1. INTRODUCTION

(Refer to Figure 6.1)

The main electrical components are located in the electric module. The electric circuit has two distinct parts:

1.1 Access Circuit

The access circuit both controls and limits lift,zoom,rotate, levelling and steering functions.The CAGE/GROUND switch at the ground controls selects one or two duplicate access circuits for cage ground operations.

1.2 Drive Circuit

The drive circuit controls the electric drive motor, via the transistorised Drive Motor Controller.

2. BATTERIES

The unit is powered by twenty-four 2V heavy duty batteries.Battery packs are 301 amp-hour.

2.1 Battery Charger

The batteries are charged via a Benning battery charger located in the electric module. The charger has a magnetically stabilized charging characteristic curve.

The charger fitted as standard accepts an input supply of 240V, 50Hz a.c. A dual-input charger, which may be fitted as an option, automatically accepts inputs of 110V or 240V, 50Hz a.c.

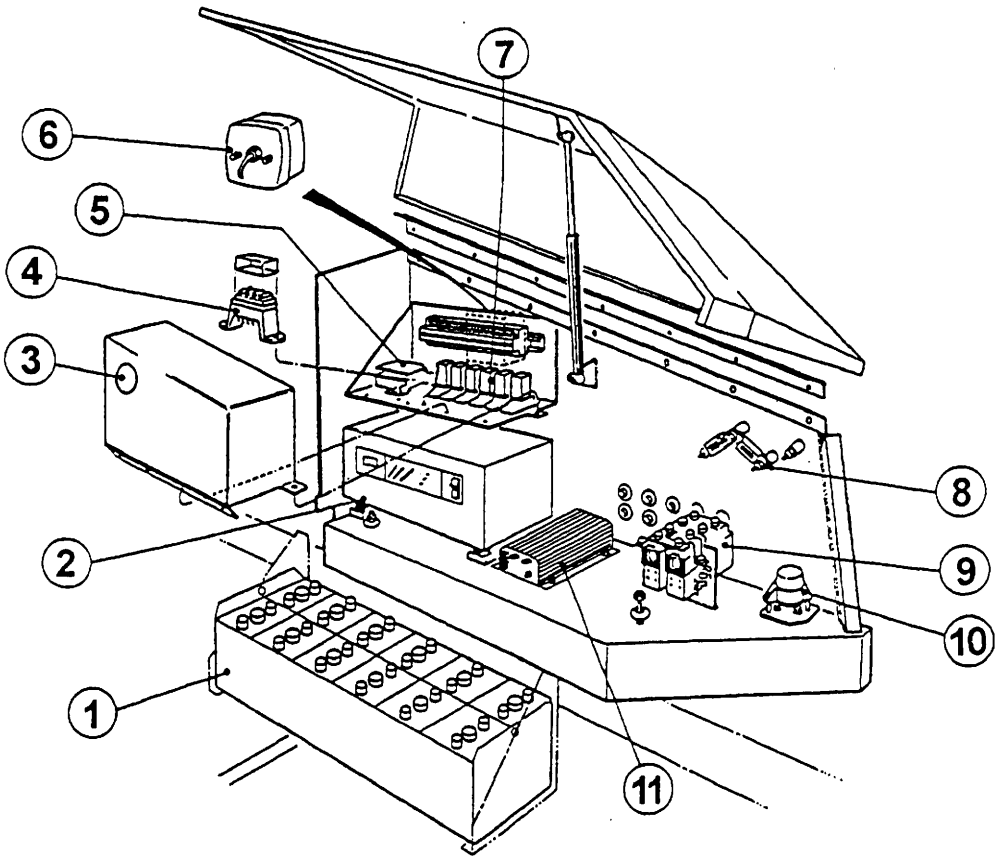
Refer to Section 3, paragraph 15 for details of battery charging procedures.

Battery condition control is achieved by the battery controler located in the module and the indicatir in the basket.

2.2 Battery Controller

The battery controller, located to the left of the relays, ensures economical use of the battery supply and displays the state of charge on the battery indicator at the cage controls.

The controller provides a lift lock-out function to prevent damage to the batteries and the machine. The lock-out function disables all lift and descent operations when the battery state falls to 80% below charge. The lock-out point must not be adjusted without the advice of Simon Aerials Limited.



KEY

1)	Battery pack.	7)	Relays.
2)	Battery charger.	8)	325A/100A Fuses.
3)	Hour meter.	9)	Contactors.
4)	Fuses.	10)	Tilt alarm sensor.
5)	Battery controller.	11)	Drive motor controller.
6)	Horn.		

Figure 6.1 - Electric Module and Batteries

2.3 Battery Indicator

The battery indicator, located at the cage controls, shows the state of charge during machine operations. The indicator uses the colour coding of green, representing FULL/GO and red, representing EMPTY/STOP.

The red LED at the top centre of the indicator flashes when the charge state falls to 75% below fully charged. If the battery charge is reduced a further 5%, the battery controller lock-out function disables all lift and descent operations to prevent battery damage.

It is recommended that the machine is taken out of service as soon as the red LED flashes and that the batteries are fully charged before any further machine operations take place.

3. PUMP AND DRIVE MOTORS

The pump motor is a 48V fixed speed motor, rated at 3.7kW at 1200 rpm. The flow rate is 10 litres/min and the pressure is 180 bar (2611 psi). The motor is started by a heavy duty contactor.

The drive motor is a 48V, 5kW series-wound reversible motor, controlled by a transistor circuit.

4. EMERGENCY STOP PUSHBUTTONS

Two EMERGENCY STOP pushbuttons, one at the ground station and one in the cage, act as power on/off switches. Both switches must be ON to operate the machine. When either of the buttons is depressed, all functions stop immediately and the parking brake is automatically applied.

5. FOOTSWITCH CONTROL

The footswitch must be fully depressed before any machine operation can be carried out from the cage.

When the footswitch control is released, the electric supply to the hydraulic pump and the drive function is terminated and all machine functions stop.

6. TILT ALARM

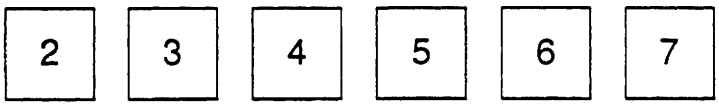
The tilt alarm gives an audible warning when the machine is 4.5^{o} or more out of level.

7. MOVEMENT ALARM

The movement alarm is activated as soon as the machine is in the drive mode.

8. RELAYS - IDENTIFICATION AND FUNCTIONS

The functions of the relays are as follows:



1. Not fitted.
2. Tilt alarm.
3. Motion alarm.
4. Horn.
5. Brake relay.
6. Lock-out (Lift/descent).
7. Pressure switch (Brake).

9. D.C. CONTACTORS

The forward/reverse contactor is a paired single-pole double-throw contactor. The traction and pump isolating contactors are single-pole single-throw (on/off) contactors. Both types of contactor have silver cadmium oxide contacts. The contacts have been designed to operate with the minimum of "bounce" and are extremely hardwearing.

The contactor coils use 6mm spade connectors. Power dissipation at 50 per cent battery level is 15-25 Watts. Power dissipation at 100 per cent battery level is 7-12 Watts.

Note: - The contactors are fitted with magnetic "blow-outs" to extend their working life. It is important to ensure that no ferrous metal is attracted to the magnets. Periodic cleaning with a pressurised air-line is recommended.

10. D.C. CONVERTER (OPTIONAL)

A 48V to 12V dc. converter is fitted for the 12V supply which is required for lights and warning beacons.

11. AUTOMATIC BEACON WARNING SYSTEM (OPTIONAL)

A beacon may be fitted which activates when any function is operated. Two types of beacon are available:

Part No. 10834 has no moving parts and an intense flashing light.

Part No. 10079 has a rotating reflector and a less intense light.

12. FUSES

Four low value fuses, located in the fuse box in front of the relays, protect the main machine ancillary functions. The fuse values are as follows (looking from left to right):

F1 - 5 Amp. F2 - 10 Amp. F3 - 3 Amp. F4 - 5 Amp.

Two high value fuses are fitted at the right-hand rear bulkhead of the module.

A 325 Amp fuse protects the drive circuit.

A 100 Amp fuse protects the pump circuit.

13. DRIVE MOTOR CONTROLLER

The Drive Motor Controller is located in the electric module to the right of the battery charger. The drive motor controller is a sealed transistorised unit which contains no user serviceable parts.

14. HOUR METER

The hour meter is fitted to the relay cover in the electric module. The meter records the total time that the pump and drive motors are in operation to provide an indication of machine wear.

SECTION 7

MAINTENANCE INSTRUCTIONS

1. TYRES

The standard tyres fitted to the Boxer 170 E are solid rubber. Any significant sidewall or other damage must be professionally examined and if necessary, the tyre must be replaced. The tyre size is 250-15.

2. WHEEL NUTS

Check the security of the wheel nuts and examine the rims for damage. Wheel nuts must be torqued to 180 Nm (135 lbf ft). The mating faces of wheels, nuts, and axles must not be painted.

Caution: **Overtightening of wheel nuts can strip the thread. Always use the correct torque setting. Do not secure the wheel nuts without using a torque spanner set to the correct specification.**

3. DRIVE ASSEMBLY

(Refer to Figure 7.1)

3.1 Back Axle

Check the securing bolts for tightness and the differential for oil leaks and oil level. Oil should be level with the filler hole. Top-up with EP 90 oil if necessary.

3.2 Gearbox

Check the assembly for security and oil leakage. Check the gearbox oil level. Top-up with EP 90 oil if necessary.

3.3 Drive Motor

Check the drive motor and associated cables for security and signs of chafing.

4. BRAKES

A single braking system is fitted which serves as both service and parking brakes. The brakes are hydraulically controlled and comprise oil immersed disks integral inside the axle housing with fail-safe operation. The brakes in parking mode can be manually disengaged to allow the machine to be towed. Refer to Section 4 for details of parking brake disengagement.

(a) Check hoses and connections for security.

(b) Check all retaining bolts, pins and grubscrews for security.

5. STEERING ASSEMBLY

(Refer to Figure 7.1.)

Check all pins for excess play and ensure that all circlips are in place and secure. Lubricate the steering linkage if necessary.

5.1 Steering Cylinder

Check pins for excess play. Check cylinder hoses for oil leakage and security.

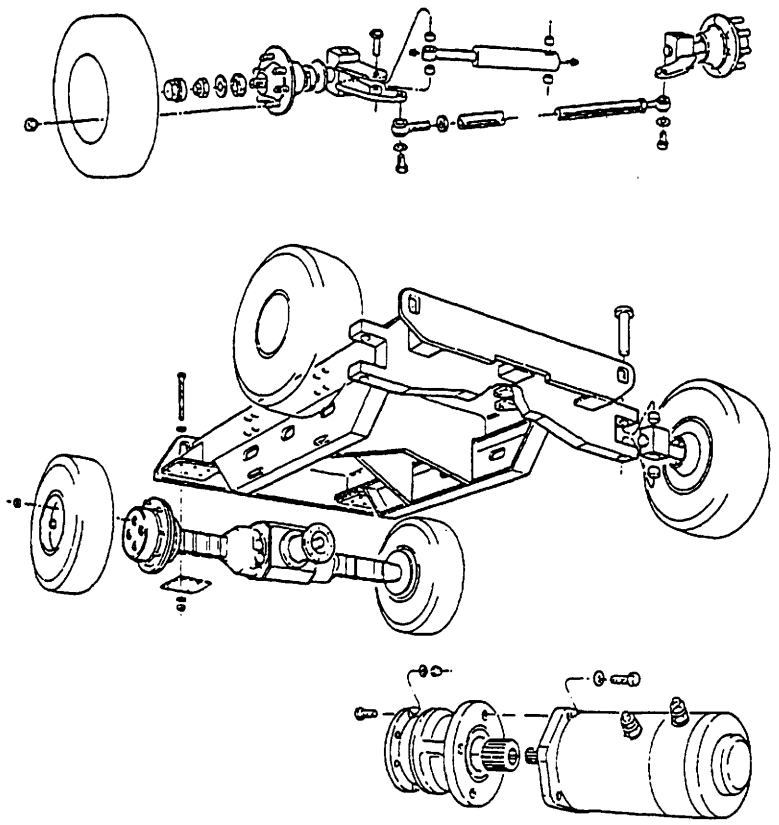


Figure 7.1 - Steering and Drive Assemblies

6. CHASSIS AND PLINTH LABELS

Ensure that all labels and instructions are readable and secure.

7. CHASSIS CABLES

The chassis cables should be examined for chafing, especially in the area of rotation.

8. LIFT PUMP MOTOR ASSEMBLY

Operate the motor. Check the securing bolts and all cables and hoses for security and oil leakage.

9. BATTERIES AND BATTERY MOUNTINGS

Check the batteries and mountings as follows:

(a) Check the batteries and mounting frame for signs of damage.

(b) Check battery terminals for corrosion. Clean the terminals and apply petroleum jelly (E.g. Vaseline) if necessary.

(c) Check the battery electrolyte levels and top-up if necessary.

10. MANIFOLD ASSEMBLY

To check the manifold assembly, operate the motor and carry out the following checks:

(a) Check the security of blocks and solenoids.

(b) Check the security and condition of hoses and cables.

11. D.C. CONTACTORS

WARNING

EYE PROTECTION MUST BE WORN WHEN USING AN AIR-LINE TO CLEAN THE CONTACTORS.

The contactors should be inspected for contamination and spark damage. Periodic cleaning with a pressurised air-line is recommended to keep the contactors free from dirt and ferrous metal.

12. HYDRAULIC OIL TANK

Check the hydraulic oil tank as follows:

(a) Check the tank for security.

(b) Check the tank for leakage.

(c) Check the handpump by depressing one of the function levers and pumping the handle.

13. MINOR EQUIPMENT MOUNTING

Check the minor equipment as follows:

(a) Check all minor equipment for security.

(b) Check for oil leakage.

(c) Check all cables for security and damage.

14. PLINTH/SUPERSTRUCTURE HOSES/CABLES

Inspect all hoses and cables for security and damage. Check for leaks at fittings. Any damaged hoses or cables must be renewed.

15. PIN BUSHES

Check all bushes for wear. Elevate the booms and check each pin in turn for rotation or movement. If wear is detected, the bush may need to be replaced. Consult Simon Aerials Ltd.

The pins and bushes have been specially treated and should only require lubrication at 4 yearly intervals. Under certain conditions, lubrication may be required more frequently. Refer to Section 9 for details of lubrication requirements.

16. PIN REPLACEMENT

Check all pins for wear. Elevate the booms and observe each pin individually. The pins should be retained in the column and should not rotate. If any pins rotate, check that pin locking bolts have not sheared.

Figures 7.2 to 7.4 show the boom configuration, pin bush and pivot pin locations for the Boxer 170 E.

16.1 Boom Pin Replacement

To replace a boom pin, proceed as follows:

(a) Support the boom and upper structure securely on a fork-lift, or similar rigid platform.

(b) Remove the pin locking bolts.

(c) Drive out the boom pin. Take care to ensure that the inside bore is not damaged during this procedure.

(d) Fit new pin and locking bolts. Lubricate the bolts before fitting.

Note: It is very important to maintain the correct mating position between the boom and side plates during this operation. Any movement between the two parts will make pin fitting more difficult.

(e) Apply grease to pins.

16.2 Tie-Rail Pin Replacement

To replace a tie-rail pin, proceed as follows:

(a) Support the Boom.

(b) Remove the pin locking bolts and pivot pin.

Note: On removal of the pin, the tie-rail will fall from position if not held. Since the tie-rail is a relatively light component, it can be held in position manually while the new pin is fitted.

(c) Fit new pin and locking bolts. Lubricate bolts before fitting.

(d) Apply grease to the pin.

16.3 Lift Cylinder Pin Replacement

To replace a lift cylinder pin, proceed as follows:

(a) Support the Boom. Release the oil pressure to ensure there is no load on the cylinder.

(b) Remove the pin locking bolts, support the cylinder and remove the pin.

(c) Fit new pin and pin locking bolts. Lubricate the bolts before fitting.

(d) Apply grease to the pin.

16.4 Self Levelling Cylinder Pin Replacement

To replace a self-levelling cylinder pin, proceed as follows:

(a) Support the cage to ensure that there is no load on the self levelling cylinders. This also applies when changing pins on the rear levelling cylinder.

(b) Remove the pin locking bolts and remove the pin.

(c) Fit new pin and new pin locking bolts. Lubricate the bolts before fitting

(d) Apply grease to the pin.

16.5 Zoom Boom Cylinder Pin Replacement

To replace a zoom boom cylinder pin, proceed as follows:

Note: If the zoom has been greased, the location recess may be filled and not visible.

(a) Remove the pin locking bolts.

(b) Support the cylinder and remove the pin. When changing the rod pin, it may be necessary to zoom out to reveal the pin location.

(c) Fit new pin and new pin locking bolts. Lubricate the bolts before fitting

(d) Apply grease to the pin.

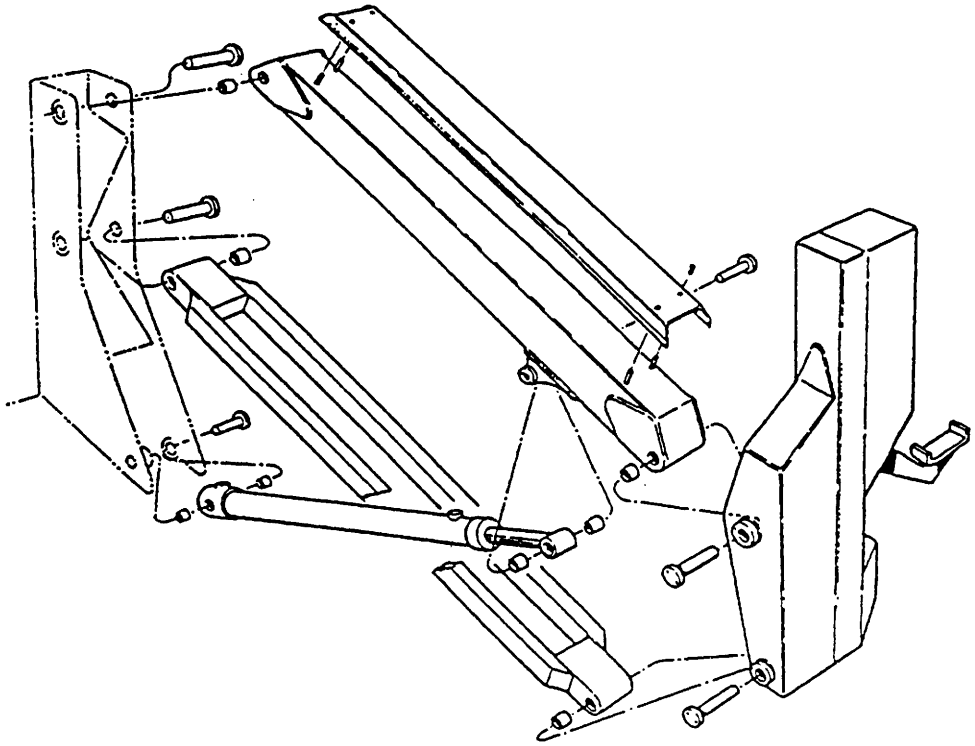


Figure 7.2 - 1st Lift Stage

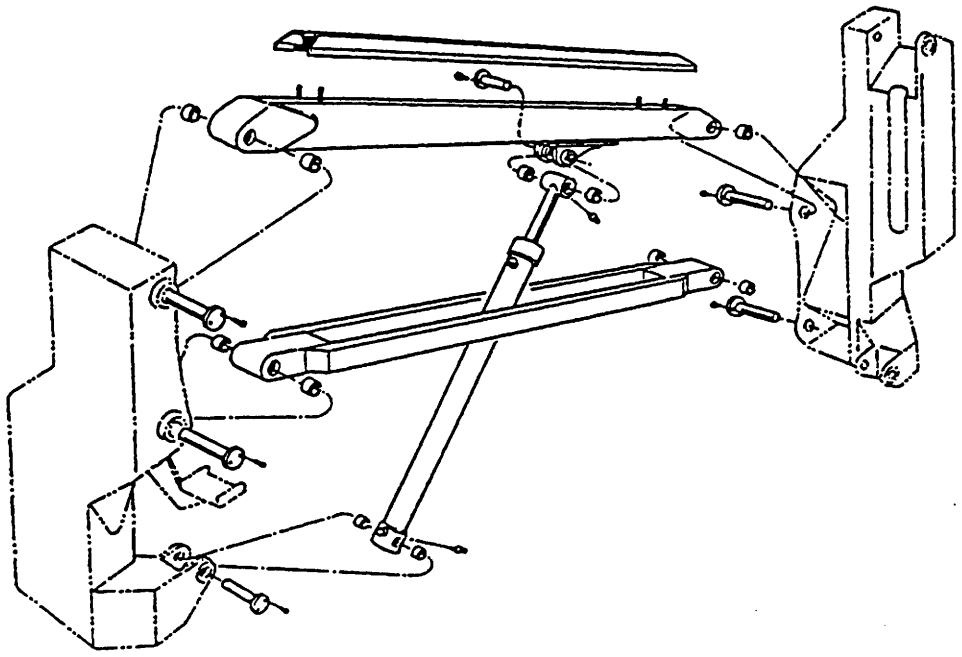


Figure 7.3 - 2nd Lift Stage

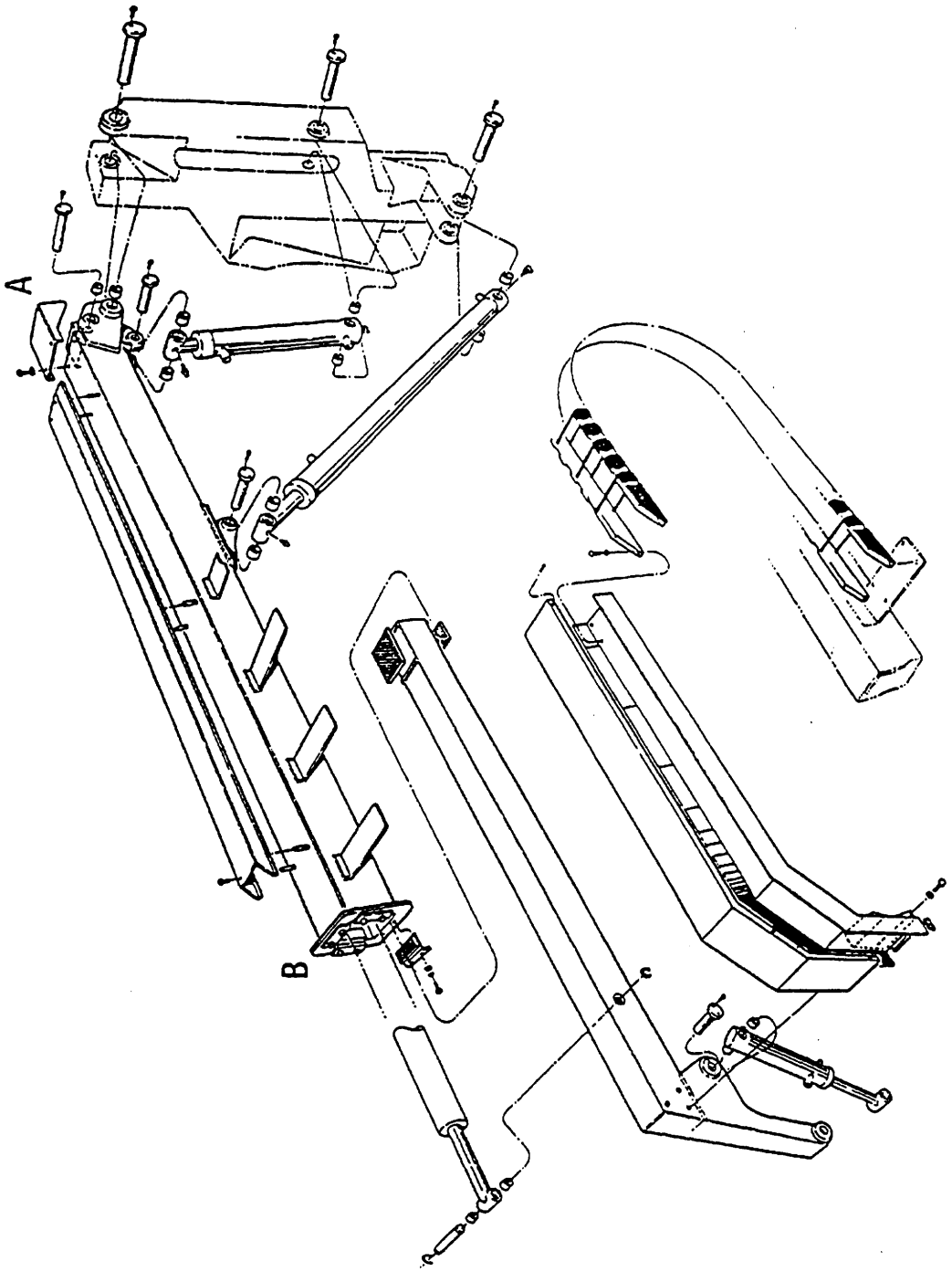


Figure 7.4 - Zoom Boom Assembly

17. SLEW BEARING

Generally, no user maintenance to the slew bearing is possible. The replacement of the slew bearing is a major operation and advice should be sought from Simon Aerials Ltd.

Checks must be made to ensure that all securing bolts are tight. Any bolts found loose or sheared must be replaced. The replacement bolts must be un-plated, clean and lightly oiled before assembly. The tightening process must be progressive and at 180°. On no account must flat washers, Grower, Belleville or serrated lock washers be used.

17.1 Slew Bearing Torque Setting

Bolt size is M12 and grade is 10.9. Torque is 120 Nm.

17.2 Slew Ring Lubrication

For lubrication details, refer to Section 9.

18. SUPERSTRUCTURE

Check and maintain the superstructure as follows:

(a) Steam clean the superstructure and inspect all welds and brackets.

(b) Check for pins turning in their mountings. This will indicate sheared pin lock bolts. Refer to paragraph 15 for pin replacement procedures.

19. ZOOM CYLINDER

The zoom cylinder is a double-acting type and must be removed from the machine before any thorough check can be carried out.

19.1 Zoom Cylinder Removal

To remove the zoom cylinder, proceed as follows:

(a) Remove the pins and hoses.

(b) Withdraw the cylinder backwards out of the zoom boom.

(c) Elevate the zoom boom to the horizontal position.

Note: The zoom boom must be secured fully in to prevent the zoom inner from sliding out without the constraint of the zoom cylinder.

19.2 Zoom Cylinder Seals Replacement

To replace the zoom cylinder seals, proceed as follows:

(a) Remove the end cap from the cylinder. Pull the cap and rod straight out of the cylinder barrel.

(b) Remove the split-pin and nut from the end of the rod. Slip off the collar.

(c) Examine the seals and the rod for signs of damage or wear.

(d) Remove the seals and fit a new set.

20. ZOOM PADS

(Refer to Figure 7.4.)

The nylon zoom pads should be checked for wear as follows:

(a) Fully zoom in and check the gap at the top of the zoom boom telescope, between the inner and the outer, at the rear of the zoom boom (Position A).

(b) Fully zoom out and check the same gap at the top of the telescope, at the front of the zoom outer (Position B).

(c) Renew the pads if the gap between the pad and the zoom outer is 5mm or more.

20.1 Front Zoom Pad Replacement

To replace the front zoom pads, proceed as follows:

(a) Support the inner zoom boom. Unbolt the front pad keep plates, and remove pads as necessary.

(b) Replace the pads by hammering gently into place.

(c) Replace and secure the keep plates.

(d) Repeat this procedure for the side and top pads if replacement is required.

20.2 Rear Zoom Pad Replacement

To replace the rear zoom pads, proceed as follows:

(a) Remove the rear zoom cylinder pins, cage and cage levelling brackets that are bolted to the front of the zoom boom inner.

(b) Pull the inner boom backwards, until the pads are accessible at the rear of the zoom boom.

(c) Replace the pads and re-assemble the zoom boom.

21. LIFT CYLINDERS

The lift cylinders are the double-acting type. During operation, the cylinders should not leak, although a slight dampness from out of the rod seal is acceptable. The pivot pins should be checked for wear and the pivot locking bolts checked for security. The cylinder and over-centre valve should be checked and inspected for oil leakage, damage and security.

21.1 Lift Cylinder Seal Replacement

The lift cylinder seals can be replaced with the cylinder mounted on the machine, or by removing the cylinder before removing the seals.

21.1.1 Seal Replacement - Cylinder In-place

To replace the lift cylinder seals without removing the cylinder from the machine, proceed as follows:

(a) Support the boom and release the cylinder pressure.

(b) Clean the cylinder end and loosen the cylinder end cap. Undo the end cap several turns.

(c) Remove the rod end pin and support the cylinder barrel. Undo the end cap and withdraw it carefully over the piston rod. Take care to ensure that no dirt enters the system.

Note: It is recommended that the bearing ring at the base of the piston rod is replaced when seals are replaced. Examine the rod for scoremarks and damage. This is most easily achieved by extending the cylinder and examining the protruding rod.

(d) Replace the seals in the end cap and replace the end cap. Care should be taken during this procedure to ensure that no damage occurs to the rod surface.

(e) Bleed the cylinder by allowing air to escape around the end cap threads.

(f) Fully tighten the end cap.

(g) Clean the over-centre valves and examine for signs of leakage.

(h) Check for efficiency, by extending the cylinder and selecting descent, via the spool valves at either cage or ground.

21.1.2 Seal Replacement - Cylinder Removed

The cylinder can be removed from the machine before replacing the seals. The replacement procedure is the same as that detailed in paragraph 19.1.1.

21.2 Over-centre Valve Checks

(a) Extend the cylinder and select descent, via the spool valves at either cage or ground.

(b) Stop the motor and activate the control levers a few times to dissipate residual pressure. If the cylinder begins to move, the valve is faulty and the cartridge should be replaced.

Note: The over-centre valve is pre-set on issue from the manufacturer.

22. LEVELLING CYLINDERS

The levelling cylinders are of the double-acting type with seals at both ends. It is recommended that the seals are renewed whenever the unit is serviced.

22.1 Levelling Cylinder Seal Replacement

To replace levelling cylinder seals, proceed as follows:

(a) Remove the cylinders from the machine. Lower the last boom and support the cage. Remove the pins.

(b) Remove the end cap from the cylinder. Pull the cap and rod straight out of the cylinder barrel.

(c) Remove the split-pin and nut from the end of the rod. Slip off the collar.

(d) Examine the seals and the rod for signs of damage or wear.

(e) Remove the seals and fit a new set.

22.2 Bleeding the Levelling System and Cage Levelling

WARNING

CARE MUST BE TAKEN DURING BLEEDING PROCEDURES, AS OIL WILL BE EJECTED AT FORCE FROM THE BLEED NIPPLE. RELEASE THE BLEED NIPPLE SLOWLY.

If a cylinder has been replaced, or the cage has come out of level, the following procedure should be carried out:

Note: Assistance will be required to complete the bleeding procedure - one person to operate the cage levelling control and one to bleed system.

(a) Check the hydraulic oil level with the machine in the closed position.

(b) Slacken the bleed nipple at the base of the levelling cylinder with a 4mm Allen key.

(c) Operate the cage levelling lever so that the cage moves fully backwards and fully forwards to expel air from the system. Repeat this action until all air is expelled from the system.

(d) Re-tighten the bleed nipple and top-up the hydraulic tank.

SECTION 8

FAULT FINDING

1. INTRODUCTION

Before any investigation into a malfunction is attempted, check the following:

(a) The hydraulic oil level is correct.

(b) Both EMERGENCY STOP buttons are released.

(c) The battery connections are secure.

(d) The batteries have sufficient charge.

(e) The POWER ON/OFF keyswitch at the ground controls is set to ON.

(f) The CAGE/GROUND selector switch at the ground controls is set to the appropriate function.

(g) The LIFT/DRIVE selector switch at the cage controls is set to the appropriate function.

(h) The footswitch in the cage assembly is depressed when operating cage control levers.

2. FAULT-FINDING PROCEDURES

2.1 Pump Motor Faults

2.1.1 Pump Motor Will Not Start

If the pump motor will not start, check:

(a) The battery voltage whilst operating the pump.

(b) The voltage at the pump.

(c) That the pump contactor operates correctly.

(d) The brushes in the pump motor.

(e) The electrical circuit for loose connections.

(f) The pump for mechanical defects.

2.1.2 Pump Motor Will Not Stop (When Machine is Switched to DRIVE)

If the pump motor will not stop when the LIFT/DRIVE selector switch is set to DRIVE, check:

(a) The pressure switch relay for correct operation.

(b) That the contacts in the pump contactor are not welded together.

Note: Do not attempt to clean the contacts with abrasive material. A faulty contactor must be renewed.

(c) For an electrical short circuit.

If the fault can not be determined immediately, disconnect the batteries to stop the pump until the fault is rectified.

2.1.3 Pump Motor Operates, but No Hydraulic Power

If the pump motor operates, but hydraulic power is not available in the lift circuit, check:

(a) For a hydraulic oil leak.

(b) The pump assembly for mechanical defects.

(c) The pressure relief valve for the correct pressure (170 bar - 2466 psi).

(d) Check the 3-way 2-position valve on the brake/lift/steer manifold for correct operation.

2.1.4 Pump Motor Operation is Too Slow

If the pump motor operates too slowly, check:

(a) That the Safe Working Load of 225 kg (496 lbs) has not been exceeded.

(b) The pressure relief valve for the correct pressure (170 bar - 2466 psi).

(c) That the hydraulic system has the correct grade of oil.

(d) That the battery indicator shows sufficient charge.

(e) The electrical circuit for poor or loose connections.

2.2 Boom Faults

2.2.1 Booms Lowering Fault

If the booms will not lower, check:

(a) That the battery indicator shows sufficient charge.

(b) For hydraulic oil leaks.

(c) The over-centre valves for defects such as sticking or damaged directional spool.

2.2.2 Zoom Boom Operation Fault

If the zoom boom will not operate, check:

(a) That the pressure relief valve is set at 180 bar (2611 psi).

(b) The zoom boom assembly for possible damage and for obstruction between the inner and outer boom assembly.

(c) The zoom boom for adequate lubrication. Lubricate with penetrating oil (E.g. WD40) if necessary.

2.3 Rotation Fault

If the machine will not rotate, check:

(a) For any obstruction in the slewing ring, ie. grit in the teeth.

(b) The hydraulic rotation motor and gearbox for correct operation.

2.4 Steering Fault

If the machine will not steer or if the steering is sluggish, check:

(a) That the cross-line relief valve is set at the correct pressure of 120 bar (1741 psi).

(b) The steer 4-way 3-position solenoid for correct operation.

(c) The steer cylinder for leaking seals.

(d) The joystick electrical contacts for correct operation.

Note: The joystick cannot be customer serviced. A faulty joystick must be renewed.

2.5 Drive Faults

2.5.1 Drive Motor Will Not Operate

If the drive motor will not operate, check:

(a) The contactors for correct operation.

(b) The electrical circuit for poor or broken connections.

2.5.2 Fast Drive Fault

If the machine will not operate in fast drive when the upper stage is lowered, check:

(a) The limit switches for correct operation.

(b) The footswitch for correct operation.

(c) That the brakes are releasing correctly.

2.5.3 Fast Drive Fault - Upper Stage Elevated

If the machine continues to operate in fast drive when the upper stage is elevated, check:

(a) The limit switches for correct operation.

(b) The joystick for correct operation.

2.6 Emergency Stop Fault

If the emergency stop facility does not operate correctly, check:

(a) The EMERGENCY STOP pushbuttons for correct operation.

(b) The footswitch for correct operation.

2.7 Drive Motor Controller Fault

The drive motor controller has built-in protection against low voltage and overheating.

The power to the motor is reduced when the battery charge falls below 50 per cent. The batteries should be maintained above this level by regular recharging.

Power to the motor is also reduced if the controller temperature exceeds 71°C due to machine overloading. Full power returns when the unit cools.

The drive motor controller is a sealed unit with no user-serviceable parts. A faulty controller must be returned to Simon Aerials Limited.

SECTION 9

MAINTENANCE SCHEDULES

1. GENERAL INFORMATION

The Boxer 170 E has been specially designed to reduce maintenance to a minimum. It is essential that the specified servicing instructions are followed to ensure safety and reliability.

The hydraulic pump, motor, cylinders and pressure valves are self-lubricating internally. The turntable slewing ring is grease packed and the corrosion-resistant pivot pins and bearings are pre-lubricated and require attention only at six monthly intervals.

Note: During the guarantee period, minor oil leaks may occur until the various hydraulic components and pipe fittings are "bedded-in". During the first three months of operational use, all hydraulic components, hoses and pipe fittings must be inspected weekly for oil leaks etc. Corrective action should be taken as required.

2. HYDRAULIC OILS

The following table lists the recommended equivalent hydraulic oils for the Boxer 170 E.

BP	ENERGOL HLP 22
SHELL	TELLUS 22
FINA	CIRKAN 22
TOTAL	AZOLLA 22
CASTROL	HYSPIN AWS 22
ESSO	NUTO HP 22
GULF	HYDRASIL 22 AW
CHEVRON	EP HYDRAULIC OIL 22

If a lubricant not listed in the table is to be used, the oil must comply with the following requirements:-

(a) Highly refined mineral oil incorporating anti-oxidant, anti-rust, anti-foam, and anti-wear additives.

(b) The oil must have good demulsibility, so that water is not circulated in the system.

(c) The optimum viscosity range at operating temperature is 16/40 centiStokes.

(d) The viscosity index should preferably be 100, and not less than 90.

(e) The viscosity range will usually be:

Temperate	0°C	-	300cSt
Temperate	40°C	-	30cSt
Tropical	0°C	-	700cSt
Tropical	40°C	-	50cSt
Tropical	100°C	-	8cSt

(f) Mineral hydraulic oils produced by different companies will usually mix with each other satisfactorily. However the oil producers should be consulted in case of doubt.

(g) For sub-zero temperatures, the use of Shell Tellus T15 or equivalent hydraulic fluid with viscosity index of 151E and pour point MINUS 50°C is recommended.

(h) For tropical temperatures, the use of BP Energol HLP 100 or equivalent is recommended.

3. HEALTH WARNING WHEN HANDLING HYDRAULIC OILS

WARNING

REGULAR CONTACT WITH MINERAL OILS POSES A POTENTIAL HAZARD TO HEALTH. ALL PERSONS MUST BE AWARE OF THE CORRECT METHODS OF HANDLING THE OIL AND THE NEED FOR THOROUGH HYGIENE.

Mineral oils act as solvents on the natural oil in the skin. Frequent and prolonged skin contact can cause dermatitis or severe irritation. Normally, mineral hydraulic oils present no health hazard when used intelligently and it is recommended that protective clothing and proper washing facilities should be provided or be accessible.

If oil is splashed into the eyes, it must be washed out thoroughly using copious quantities of water. If irritation persists, medical advice must be sought.

4. PIVOT PINS AND BEARINGS

All pivot pins have been Parco Lubrite 2 treated and only require lubrication checks at 4-yearly intervals. The Parco Lubrite 2 treatment converts the metallic surface of the pin to a manganese/iron phosphate coating, giving high oil absorption and corrosion resistant qualities.

All pivot pin bearings are steel-backed, acetal co-polymer lined and only require lubrication checks at 4-yearly intervals.

Note: In tropical climates, pins and bearings may require more frequent lubrication.

The recommended lubricant for pivot pin bearings is 'MOLYKOTE LONGTERM 2 PLUS' extreme pressure grease or equivalent.

Note: There are no grease nipples for pin or bearing lubrication. The pins must be removed and lubricated by hand.

5. SERVICING CHECK LIST (BASIC MACHINE ONLY)

The following check list is included as a reminder for the instructions given in paragraphs 6 to 11. All detailed servicing instructions must be implemented.

5.1 Daily

(a) Check hydraulic oil level.

(b) Check tyre condition.

(c) Check cage door lock.

5.2 Weekly

In addition to the daily checks, carry out the following:

(a) Check control valves for self-centre.

(b) Inspect hydraulic system for leakage.

(c) Check steering system for oil leakage and wear.

(d) Check battery electrolyte levels.

(e) Check pivot pin security.

5.3 Monthly

In addition to the weekly checks, carry out the following:

(a) Check for hydraulic oil contamination.

(b) Check chassis mounting bolts.

(c) Grease slewing ring teeth.

(d) Check rotation gearbox oil level.

(e) Lubricate all small pivots throughout the machine.

(f) Ensure all boom/cylinder pins are positively secured in position.

(g) Check drive gearbox oil level.

5.4 Six Monthly

In addition to the monthly checks, carry out the following:

(a) Check cage levelling.

(b) Check cage pivots.

(c) Check boom cylinders.

(d) Check axle.

(e) Replace pressure line filter element.

(f) Test all machine systems.

5.5 Yearly

In addition to the 6 monthly checks, carry out the following:

(a) Change oil in rotation gearbox.

(b) Grease slewing ring bearing.

(c) Examine the hydraulic oil. Change if necessary.

(d) Check hydraulic oil tank.

(e) Examine machine structure for defects.

(f) Examine cage mountings and structure.

5.6 Four Yearly

In addition to the yearly checks, carry out the following:

(a) Detailed examination of flexible hoses.

(b) Detailed examination all pivot pins and bearings.

6. DAILY ROUTINE SERVICING

6.1 Hydraulic Oil Level

Before checking the oil level, ensure that the machine booms are stowed in the travelling position and the machine is standing on level ground. The oil level must be 1" (2.5 cms) below the top of the oil level gauge. Refer to the lubrication chart for the correct grade of oil if the reservoir requires topping up.

After checking the oil level, ensure the oil filler cap is fully secure to prevent the entry of water or other impurities into the tank.

6.2 Tyre Condition

Check the condition of all four tyres.

6.3 Cage Door Lock

Check the security of the cage door.

7. WEEKLY ROUTINE SERVICING

7.1 Control Valves

Cage control valves must be checked for correct operation. Check that the cage control valve handles automatically return to the centre (neutral) position.

7.2 Hydraulic System

Inspect the hydraulic system as follows:

(a) Pressurise the hydraulic circuit and inspect the system for any signs of oil leakage, particularly at flexible hoses, connections and hydraulic components.

(b) Examine all pivot pins on booms, cylinders and the levelling system to ensure that they are positively secured in position.

7.3 Steering

Check the steering cylinder for oil leakage and the linkage for signs of wear.

7.4 Batteries

Check the battery electrolyte levels. Replenish the electrolyte with distilled water if necessary.

7.5 Pivot Pins

Check all pivot pins for security.

8. MONTHLY ROUTINE SERVICING

8.1 Hydraulic Oil

Allow the machine to stand for at least 8 hours without operating the pump. This will allow water and other impurities to separate out of the oil and settle to the bottom of the tank.

Disconnect the $^{3}/_{4}$" pipe from the pump side of the ball valve and block off to prevent oil leakage from the system.

Open the ball valve at the bottom of the tank just enough to allow a gradual trickle of oil and drain fluid from the tank into a transparent container, until clean oil flows. Under normal operating conditions, a maximum of 0.25 litres ($^{1}/_{2}$ pint) is usually sufficient to remove all impurities.

If the oil does not flow clear but has a cloudy appearance, it is usually an indication that water is present. If this condition occurs, a complete oil change will be necessary.

8.2 Chassis Bolts

Check all bolts for tightness.

8.3 Slewing Ring Gear Teeth

Remove any dirt from between the gear teeth and lubricate.

Note: If solvents or a high-pressure washer are used for cleaning, re-grease the slewing ring bearings.

8.4 Rotation Gearbox Oil Level

Check the gearbox oil level with the machine on level ground and, if necessary, top-up with EP 90. The filler plug is located at the top of the gearbox and the drain plug is located at the bottom of the gearbox housing. The oil level should reach the filler plug hole. Low oil level is usually due to seal failure on the wormshaft.

8.5 Lubrication

Lubricate all small pivots throughout the machine with any good quality medium grade oil. Special attention should be given to the cage control lever pivots. DO NOT lubricate the main pin pivots.

8.6 Pivot Pin Security

Examine all pivot pins on booms, cylinders and levelling system and ensure that they are all positively secured in position.

8.7 Drive Gearbox Oil Level

Check the gearbox oil level with the machine on level ground and, if necessary, top-up with EP 90.

9. SIX MONTHLY ROUTINE SERVICING

9.1 Cage Levelling

Check the cage levelling system as follows:

(a) Examine both levelling cylinders, particularly at the pivot points, for any signs of wear or damage. Ensure that the end fittings are secure.

(b) Check cylinders and hose fittings for leaks.

9.2 Cage Pivots

The main pivots on the booms, cylinders and levelling system are fitted with corrosion-resistant pins and pre-lubricated bearings. Check the bearings with the pivot pins removed.

The bearings are steel-backed, acetal co-polymer lined. If the bearings show any defect, they should be replaced with the correct type. Consult Simon Aerials Ltd.

9.3 Boom Cylinders

Check the boom cylinders as follows:

(a) Hydraulically test the cylinders at fully retracted and extended positions. Check that there is no movement between rod and bearing housing, or between cap and tube.

(b) Check all cylinders for oil leakage.

9.4 Axle

Check the oil levels in the axle with the machine on level ground and, if necessary, top up with EP 90 oil.

9.5. Pressure Line Filter

Change the Pressure Line Filter element (Part No. 11357).

9.6 Machine Systems Tests

Test the following systems:

(a) Drive assembly, including drive shaft, axle, couplings, drive motor and gearbox.

(b) Slewing ring and rotation gearbox.

(c) Cage rotation worm drive.

(d) All machine functions.

10. YEARLY ROUTINE SERVICING

10.1 Rotation Gear Box

(a) Remove the drain plug and drain the oil from the rotation gearbox housing. The oil will flow more easily and hold any impurities in suspension if the turntable is rotated for a short period to warm the oil before draining.

(b) Refill with EP 90 (or equivalent) oil. Refit filler plug.

10.2 Slewing Ring Bearings

Grease the slewing ring by rotating the turntable as necessary.

10.3 Hydraulic Oil

Providing the hydraulic oil has been regularly maintained, it should only require to be changed at approximately two-yearly intervals This is dependant on maintenance, amount of use, application, temperature, atmospheric conditions and other factors.

A cloudy appearance in the hydraulic oil indicates that water is present. A change from clear amber to dark brown, accompanied by a strong "burnt" smell, indicates overheating of the oil. The cause should be investigated and rectified. The presence of either condition requires a complete oil change.

10.4 Hydraulic Oil Tank

Carefully check the condition of the oil inside the tank to ensure that it flows easily and is a clear amber colour. In cases of gross contamination, it will be necessary to completely drain and refill the entire hydraulic system.

10.4.1 Hydraulic Tank Refill Procedure

Refilling the hydraulic oil tank requires approximately 19 litres of Shell Tellus 32.

To refill the hydraulic tank, proceed as follows:

(a) Ensure that the oil temperature is sufficiently high to allow the oil to flow freely.

(b) Place a suitable container under the drain tap or attached to a suitable hose to lead from the drain tap to the waste oil container.

(c) Open the drain tap and drain off all the oil from the tank.

(d) Remove the tank top plate for internal inspection and cleaning.

(e) Renew or clean the suction hose and close the drain tap.

(f) Replace the cover plate, renew the gasket if necessary and refill the reservoir to the correct level.

10.5 Structural Examination

A thorough examination of the complete machine should be carried out for any signs of damage, corrosion, misalignment, material fractures, etc. Particular attention must be given to the condition of all welded joints.

10.6 Cage Mounting

Check the cage mounting as follows:

(a) Check that all mounting bolts are secure.

(b) Check cage frame members are in good condition.

11. FOUR YEARLY ROUTINE SERVICING

Note: The following recommendations are based on the advice of suppliers and the requirements of various national safety regulations. They should be applied with discretion, depending on such factors as the amount and type of use, environmental conditions, local safety regulations etc.

11.1 Flexible Hoses

Inspect all flexible hoses over their complete length. Renew any hoses showing looseness or corrosion at the end fittings, cracking, blistering or excessive wear of outer protective covering.

11.2 Pivot Pins And Bearings

Check the pivot pins as follows:

(a) Remove all pivot pins for examination.

(b) Check the pivot pin bearings with the pivot pins removed and renew defective bearings as necessary. The pivot pins are Parco Lubrite 2 treated and the pivot pin bearings are steel-backed, acetal co-polymer lined. The correct type of pin and bearing must be fitted. Consult Simon Aerials Limited.

12. LUBRICATION

12.1 General Lubrication

The following table lists the recommended lubricants for the Boxer 170 E.

COMPONENT	LUBRICANT	FREQUENCY	REMARKS
Rotation Gearbox	EP 90	Check monthly Change yearly	-
Axle	EP 90	Check 6 monthly Change yearly	-
Drive Gearbox	EP 90	Check monthly Change yearly	-
Battery Terminals	Vaseline	Grease 6 monthly	Smear electrical connections.
Hydraulic Oil	BP HLP 22 (or equivalent - refer to para. 2)	Check weekly Change yearly	Fill to 1 inch (2.5 cms) below the top of oil level gauge.
Pins/Bearings	Molykote 2	Grease 4 yearly	Grease more frequently in tropical climates.
Wheel Bearings	LS 2	Grease Yearly	-
Zoom Boom (Inner)	Molykote 2	Grease monthly	-
Zoom Boom (Outer)	WD 40	Monthly	-
Slew Ring	Refer to para. 13.2.	Refer to para. 13.2.	-

12.2 Slew Bearing/Gear Lubricants

The following table lists the recommended equivalent lubricants suitable for the slew bearing and the slew gears.

GREASE	BEARING	GEARS
Antar	Epaxa EP2	Pebron gear 1401
BP	Energrease LS-EP2	GR 154 GS
Castrol	Spheerol EP2	-
Elf	Elf EP2	Elfnera 4900 x fluid
Esso	Beacon EP2	Surrett fluid 30F
Fina	Marson EPL2	-
Igol	Perfect	-
Kluber	Centoplex EP2	Grafloscon CG 901 Grafloscon AC SG 40
Labo	GS 2061	-
Mobil	Mobilux EP2	Dorcia 30
Shell	Alvania EP2	Cardium EP fluid H
Texaco	Multifak EP2	Crater 2 x fluid
Total	Multis EP22	-
Trilob	Molub-Alloy	-

12.2.1 Slew Bearing Lubrication

The slewing rings are equipped with greasing holes tapped to the European standard and suitable for:

- Centralized greasing.
- Standard greasing: straight or angled spherical head grease nipples (AFNOR norms NFR 165-21 - DIN 3410).

Lubrication Frequency - Slew Bearing

- Regular Operation: . . . . . every 100 hours.
- Intensive Operation: . . . . . every 50 hours.

Note: The slewing ring should be rotated after the lubrication operation and the lubricant should then be topped up.

Grease Characteristics - Slew Bearing

The grease used on the slew bearing must comply with the following characteristics:

- Lithium soap or lead soap grease.
- High stability.
- Normal service temperature: -30 degrees C to +120 degrees C.
- Penetration at 25 degrees C according to ASTM D 217.

  Uworked (UW) . . . . . 269.

  Worked (W) 10,000 cycles . . . . . 284.
- Drop point according to ASTM D 566 . . . . . 187.
- Viscosity at 50 degrees C (for the basic oil) . . . . . 110.
- Timken test OK load in lbs, greater than . . . . . 50.

12.2.2 Slew Gear Lubrication

The teeth must be thoroughly cleaned, particularly within the gaps between the teeth, before lubrication. For this operation we recommend a proprietary solvent.

Lubrication Frequency - Slew Gear

- Approximately 150 hours.

Grease Characteristics - Slew Gear

The grease used on the slew gears must comply with the following characteristics:

- Extreme pressure grease.
- BTRA viscosity at 25 degrees C (minimum) . . . . . 100.
- Engler viscosity at 50 degrees C . . . . . 1.65.

According to the operating conditions, we recommend the following greases for the slew gear:

- ESSO SURRET FLUID 30F for normal operation.
- MOBIL DORCIA 30 when subject to shock loading.

It is possible to use other brands of grease provided that they offer greasing characteristics similar to the types listed above. Refer to the table for equivalent greases.

SECTION 10

ILLUSTRATED SPARE PARTS

BOXER 170 E

UPPER CHASSIS ASSEMBLY

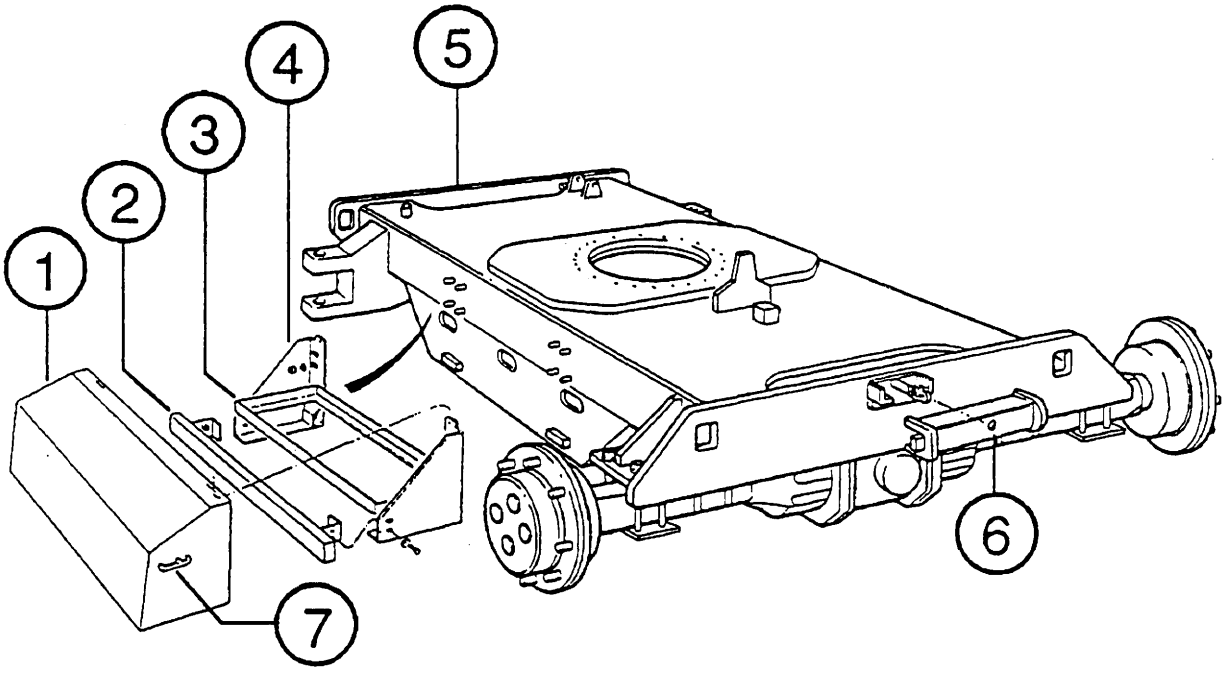


Figure 10.1 - Upper Chassis Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS347	BATTERY COVER	2
2	SS273	RETAINING BAR	2
3	GS004	BATTERY TRAY	2
4	GS345	SUPPORT BRACKET (LEFT HAND)	2
		SUPPORT BRACKET (RIGHT HAND)	2
5	GS582	CHASSIS ASSEMBLY	1
6	-	SAFETY CHOCK	1
7	12285	HANDLE	1

BOXER 170 E

LOWER CHASSIS ASSEMBLY

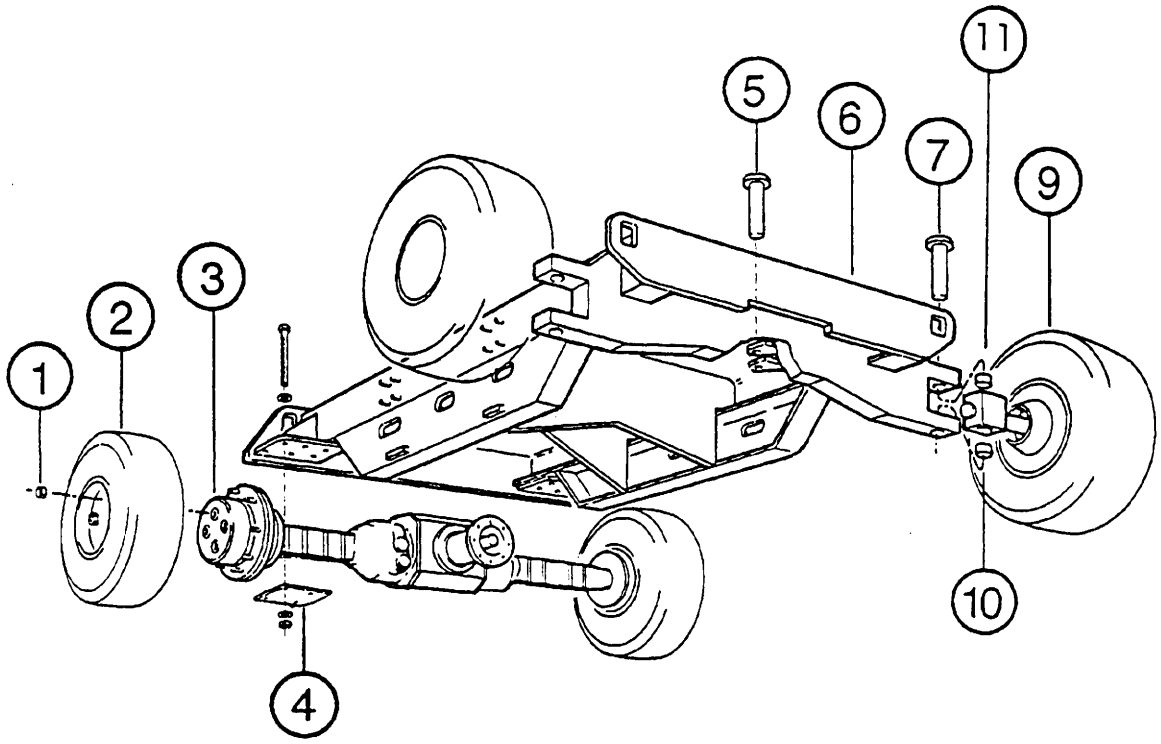


Figure 10.2 - Lower Chassis Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	13169	M18 x 1.5p HEX NUT (REAR ASSEMBLY)	12
	11824	M18 x 2 HEX NUT (FRONT ASSEMBLY)	12
	15169	M18 SPHERICAL WASHER	24
2	17315	WHEEL ASSEMBLY (REAR) Complete with Watts tyre, rim and nave.	2
3	18276	DRIVE AXLE	1
4	DS906	AXLE MOUNTING ASSEMBLY (Complete)	2
	MS479	AXLE MOUNTING PLATE	2
	17543	M20 x 200LG HEX HEAD BOLT	8
	15138	M20 HEAVY-DUTY FLAT WASHER	8
	15291	M20 NYLOC NUT	8
5	GS505	PIN	2
6	GS582	CHASSIS ASSEMBLY	1
7	GS315	PIN (STEERING BLOCK)	2

(continued)

BOXER 170 E - LOWER CHASSIS ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
8	GS236	STEERING ARM (LEFT HAND)	1
	GS237	STEERING ARM (RIGHT HAND)	1
9	14352	WHEEL ASSEMBLY (FRONT) Complete with Watts tyre, rim and nave.	2
10	10288	PM 40 x 40 DX GLACIER BEARING	4
	11683	WC 40 DX GLACIER THRUST WASHER	4
11	GS497	STEER PIVOT BLOCK & STUB AXLE ASSEMBLY	2

BOXER 170 E

DRIVE ASSEMBLY

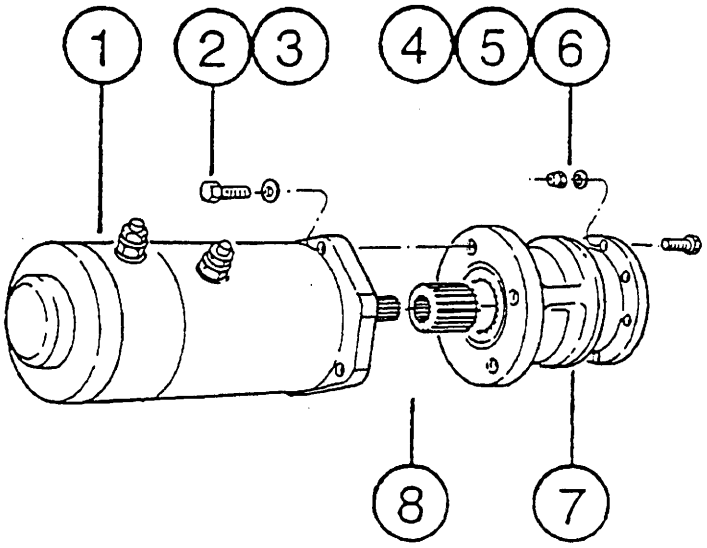


Figure 10.3 - Drive Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	18499	ELECTRIC MOTOR (5 kW)	1
	10935	SPEED CONTROLLER	1
2	12283	M10 x 50 x 10.9 GRADE SOCKET HEAD CAP BOLT	4
3	11589	SPRING WASHER	4
4	15097	M8 NYLOC NUT	8
5	15124	M8 PLAIN WASHER	16
6	15032	M8 x 50 x 10.9 SOCKET HEAD CAP BOLT	8
7	18062	GEARBOX (See note below)	1
	DS1079	MOTOR RETENTION ASSEMBLY	1
8	MS423	ADAPTOR PLATE (Not shown on diagram)	1
	M706	SPLINE	1
	10171	OIL SEAL 85 OD, 65 ID, 10 WIDE	1

Note: On early Boxer 170 E machines, a flanged coupling is fitted between the gearbox and the Sige axle. Where a coupling is fitted, the part numbers are as follows.

ITEM	PART NO.	DESCRIPTION	QTY.
	MS463	FLANGED COUPLING	1
	MS464	ADAPTOR HOUSING	1
	17316	GEARBOX	1
	DS907	GEARBOX SUPPORT ASSEMBLY	1

BOXER 170 E

SIGE AXLE ASSEMBLY

(Refer to Figure 10.4)

ITEM	PART NO.	DESCRIPTION	QTY.
		AXLE AND BRAKES	
1	17893	BELL SPRINGS, FAIL-SAFE SPRINGS BRAKE	36
	17894	PISTON, FAIL-SAFE SPRINGS BRAKE	2
2	17861	SEAL SPRING FOR BRAKE	2
	17862	SNAP RING FOR SEAL SPRING	2
	17859	BACK SPRING BRAKE PISTON	2
	17860	BALL	4
	17866	CLAMP FOR BRAKE RUBBER PIECE	2
	17867	BRAKE COVER	1
	17874	SNAP RING FOR BELL SPRINGS	2
	17886	O-RING FOR BUSH, FAIL-SAFE SPRINGS BRAKE	2
	17887	O-RING FOR BUSH, FAIL-SAFE SPRINGS BRAKE	2
	17888	CAP SCREW, FAIL-SAFE SPRINGS BRAKE	8
3	17889	LEVER, INSIDE FAIL-SAFE SPRINGS BRAKE	2
	17890	FLANGE, FAIL-SAFE SPRINGS BRAKE	2
	17891	PIN, FAIL-SAFE SPRINGS BRAKE	2
	17892	BUSH, FAIL-SAFE SPRINGS BRAKE	2
	17851	CENTRAL BOX	1
	17852	FLANGE FOR HUB (RH)	1
	17853	FLANGE FOR HUB (LH)	1
	17854	CAP SCREW	1
	17855	BRAKE HOLES PLUG	1
	17856	OIL PLUG WASHER	5
	17857	OIL PLUG	3
	17858	OIL PLUG	2
	17863	ACTUATOR	2
	17864	BRAKE DISK	10
	17865	COUNTER BRAKE	6
	17868	SNAP RING FOR PULL PIN	2
	17869	BRAKE PULL PIN	2
	17870	BRAKE FORK (COMPLETE)	2
4	17871	CAP SCREW FOR BRAKE COVER	4
	17872	SPHERICAL WASHER	2
5	17873	NUT SET-UP BRAKE	2
6	17875	BRAKE INSPECTION PLUG	2
	17876	WASHER	2
7	17877	CAPSCREW FOR BRAKE COVER	4
	17878	COUNTER PLATES PIN LOCK	6
	17879	AXLE HOUSING (RH)	1
	17880	AXLE HOUSING (LH)	1
	17881	STUD BOLT, AXLE HOUSING	24
	17882	STUD BOLT NUT	24
	17883	SPRING WASHER	24
	17884	CAP SCREW, BRAKE	4
	17885	CAP SCREW, CROWN DELOCK BRAKE	2

(continued)

BOXER 170 E - SIGE AXLE ASSEMBLY (continued)

(Refer to Figure 10.4)

ITEM	PART NO.	DESCRIPTION	QTY.
		DIFFERENTIAL AND HALF SHAFT	
8	17924	BEVEL DRIVE	1
	17925	WASHER, DIFF. CASE SCREW	12
	17926	CAP SCREW, CROWN WHEEL	12
	17927	BEARING, DIFF. CASE	2
	17928	SHIM, DIFF. BEARING	4
	17929	SHIM, DIFF. BEARING	4
	17930	HALF SHAFT	2
	17931	HALF SHAFT SLEEVE	2
	17932	ROLLPIN SHAFT CONNECTION	2
	17933	DIFFERENTIAL (COMPLETE)	1
	17934	DIFF. CASE	1
	17935	DIFF. GEAR (COMPLETE)	1
	17936	DIFF. GEAR (COMPLETE)	1
	17937	DIFF. GEAR	1
	17938	THRUST WASHER	2
	17939	THRUST WASHER	4
	17940	DIFF. PINION GEAR	2
	17941	DIFF. CASE	1
	17942	DIFF. GEARS	1
	17943	THRUST WASHER	2
	17944	THRUST WASHER	4
	17945	DIFF. PINION GEAR PIN	2
	17946	PINION BEARING	1
	17947	SHIM, PINION BEARING	3
	17948	SHIM, PINION BEARING	3
	17949	OIL SEAL, PINION	1
9	17950	CAP SCREW, PLANETARY BOX	10
	17952	PLANETARY BOX	1
	17953	O-RING, PLANETARY BOX	1
	17954	CIRCLIP	1
	17955	PINION SPACER	1
	17956	PINION RINGNUT	1
	17957	PINION BEARING	1
	17958	SHIM, PINION BEARING 0.15	2
	17959	SHIM, PINION BEARING 0.20	2
	17960	SHIM, PINION BEARING 0.50	2
	17961	DIFF. PIN	1
		DIFFERENTIAL LOCK	
	17962	SNAP RING	1
	17963	DIFF. LOCK SPRING	1
	17964	FORK PIN	1
	17965	SPRING WASHER, DIFF. LOCK	1
	17966	SNAP RING	2
	17967	DIFF. LOCK FORK	1
	17968	DIFF. LOCK SPRING	1
	17969	DIFF. LOCK PISTON	1
	17970	O-RING, DIFF. LOCK PISTON	1
	17971	DIFF. LOCK SLEEVE	1

(continued)

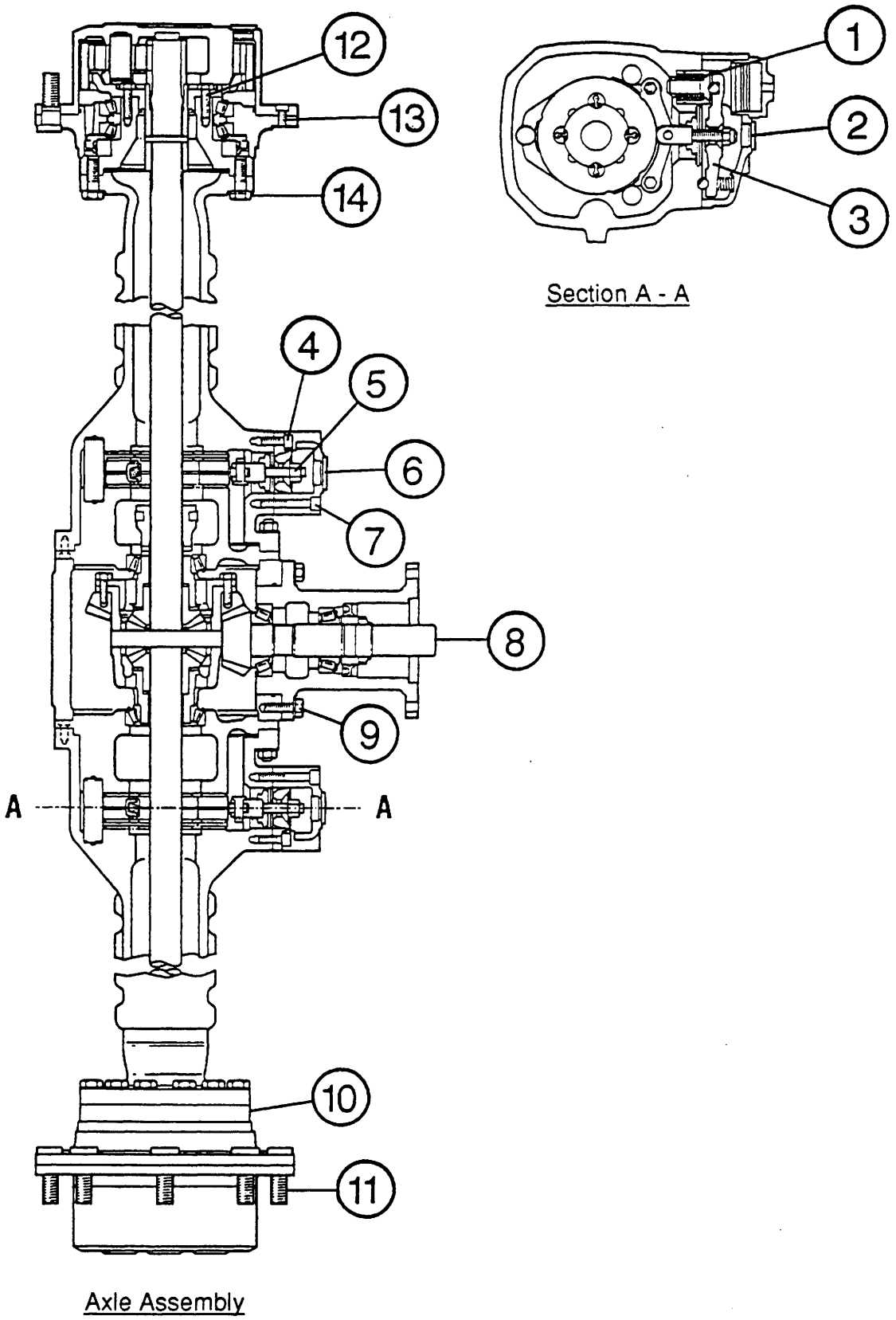
BOXER 170 E - SIGE AXLE ASSEMBLY (continued)

(Refer to Figure 10.4)

ITEM	PART NO.	DESCRIPTION	QTY.
		WHEEL HUB	
	17895	OIL SEAL, HUB	2
	17896	BEARING, WHEEL HUB	4
10	17897	WHEEL HUB (COMPLETE)	2
	17898	WHEEL HUB	1
11	17899	WHEEL BOLT	8
	17900	WHEEL BOLT	16
	17901	O-RING, WHEEL HUB	2
	17902	RING	2
	17903	RING GEAR CARRIER FLANGE	2
12	17904	CAP SCREW, CROWN DELOCK BRAKE	24
	17905	PLANETARY RING GEAR	2
	17906	SNAP RING	6
	17907	PLANET SET	2
	17908	PLANET PIN	6
	17909	ROLLER BEARING (COMPLETE)	6
	17910	PLANETARY REDUCTION GEAR	2
	17911	SHIM, BUTTON SHAFT STOP	2
	17912	BUTTON SHAFT STOP	2
	17913	PLANETARY CARRIER	2
	17914	WHEEL HUB SUPPORT (COMPLETE)	2
	17915	WHEEL HUB SUPPORT	1
13	17922	CAP SCREW, WHEEL HUB	4
	17916	HUB WEAR RING	1
	17917	DUST COVER, WHEEL HUB	1
	17918	HUB WEAR RING	2
	17919	DUST COVER, WHEEL HUB	2
14	17920	CAP SCREW, PLANETARY	24
	17921	SPRING WASHER	24
	17923	WASHER, PLANETARY GEAR	12

(continued)

BOXER 170 E - SIGE AXLE ASSEMBLY (continued)



Section A - A

Axle Assembly

Figure 10.4 - Sige Axle Assembly

BOXER 170 E

STEERING ASSEMBLY

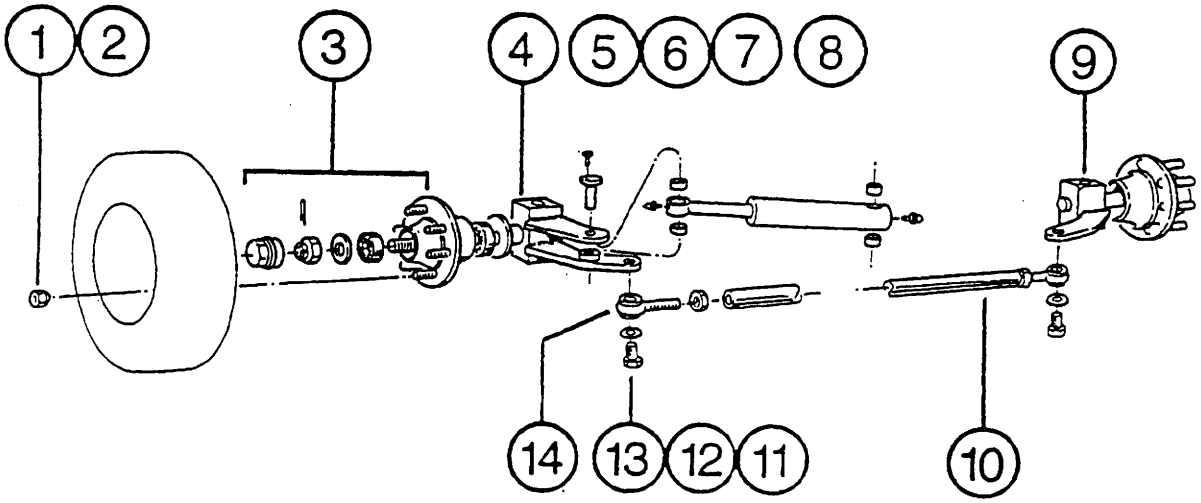


Figure 10.5 - Steering Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	11824	M18 x 2p HEX NUT (FRONT)	12
2	15169	M18 SPHERICAL WASHER	12
3	-	PART OF AXLE ASSEMBLY	-
4	GS236	STEERING ARM (LEFT HAND)	1
5	10890	M8 x 20 LG HEX HEAD SCREW	2
6	15125	M8 SPRING WASHER	2
7	GS315	STEERING BLOCK PIVOT PIN	2
8	14368	STEERING CYLINDER	1
9	GS237	STEERING ARM (RIGHT HAND)	1
10	MS484	TRACK ROD	1
-	MS~~485~~ 584	TRACK ROD WITH TOWING PACKAGE	2
11	10989	M20 x 50 LG x 2.5p HEX HEAD BOLT	2
12	11631	M20 SPRING WASHER	2
13	11637	M20 x 1.5p HALF NUT	2
14	13170	SHERICAL (ROSE) JOINT (MMC 20)	2

BOXER 170 E

PLINTH ASSEMBLY

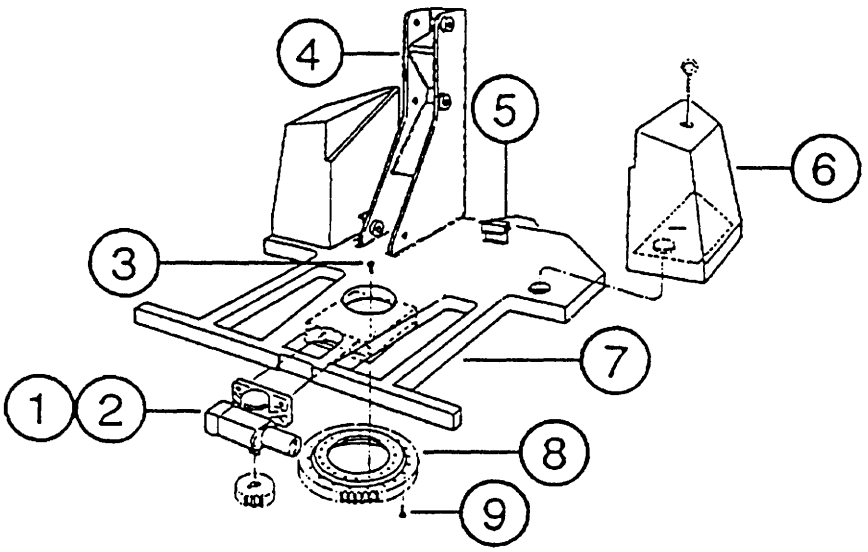


Figure 10.6 - Plinth Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	14315	SLEW GEAR BOX	1
	15068	M12 x 40 x 10.9 GRADE HEX HEAD BOLT	2
	11564	M12 NYLOC NUT	4
2	10854	ROTATION MOTOR	1
3	17647	M12 x 70 LG 10.9 GRADE CAP HEAD BOLT (SLEW RING/CHASSIS/PLINTH)	27
4	GS510	FIRST POST	1
5	11110	LIMIT SWITCH BODY	1
	10308	LIMIT SWITCH HEAD	1
	DS1009	LIMIT SWITCH LEVER	1
6	TS140	BALLAST (LEFT HAND)	1
	TS141	BALLAST (RIGHT HAND)	1
	GS419	BALLAST RETAINING ASSEMBLY	2
	10542	M12 x 60 HEX HEAD SCREW	6
	11564	M12 HEX HEAD LOCK NUT	6
7	G584	PLINTH ASSEMBLY	1
8	18247	SLEW RING	1
9	-	M12 x 60 x 10.9 GRADE HEX HEAD BOLT	15
	16474	DIVERTER VALVE	1
	14613	HANDLE (DIVERTER VALVE)	1
	MS440	ROTATION STOP	2

(continued)

BOXER 170 E - PLINTH ASSEMBLY (continued)

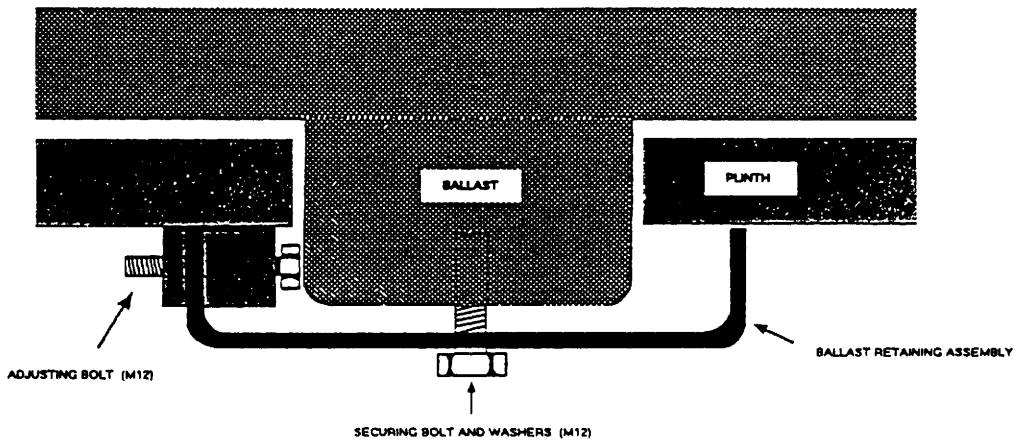


Figure 10.7 - Ballast Security

BOXER 170 E

1ST LIFT STAGE

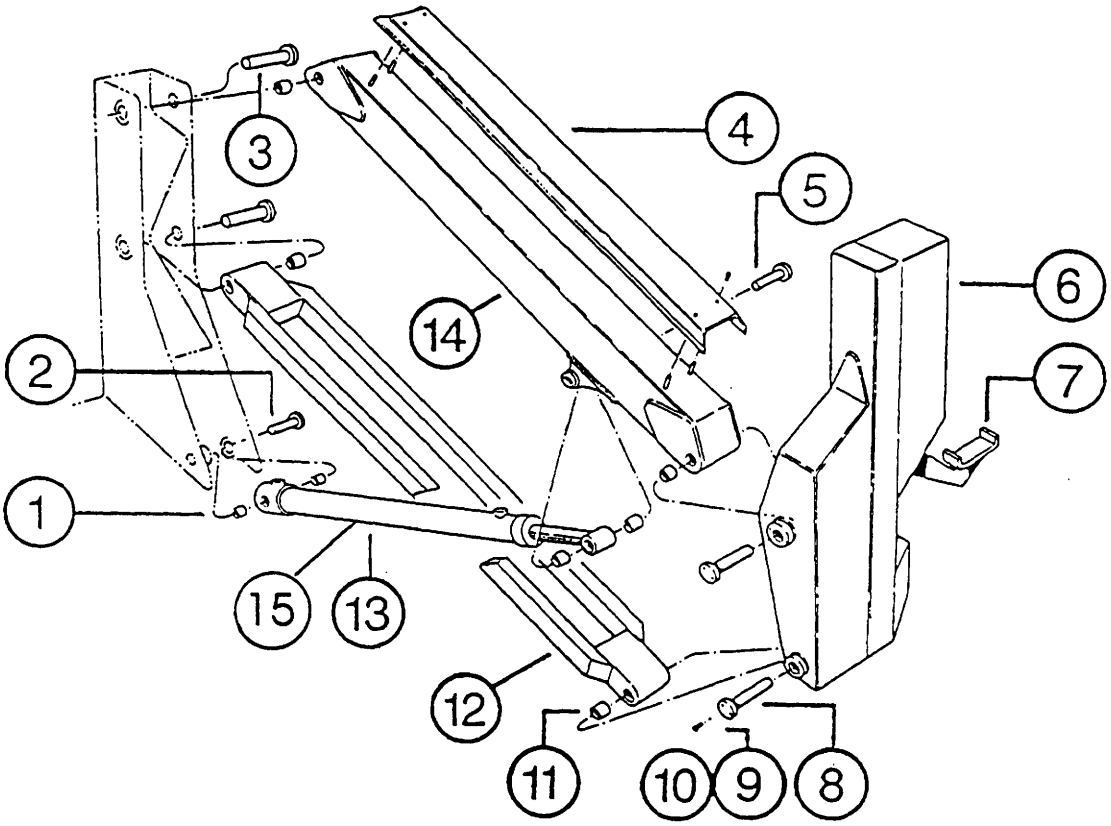


Figure 10.8 - 1st Lift Stage

ITEM	PART NO.	DESCRIPTION	QTY.
1	11844	GLACIER PM 25 x 25 DX BEARING (PART OF LIFT CYLINDER)	4
2	GS473	PIN (LIFT CYLINDER BASE)	1
3	GS315	PIN (FIRST POST)	2
4	SS102	CABLE COVER	1
	MS128	CABLE COVER STUD	4
5	GS474	PIN (LIFT CYLINDER ROD END)	1
6	GS541	OFFSET POST	1
7	GS527	ZOOM BOOM REST	1
	MS143	NYLON PAD (ZOOM BOOM REST)	1
8	GS472	PIN (OFFSET POST)	2
9	11085	M8 x 25 GRADE 8.8 HEX HEAD SCREW	12
10	14541	M8 DISC LOCK WASHER	24
11	10288	GLACIER PM 40 x 40 DX BEARING	8
12	GS179	FIRST TIE RAIL	1
13	18242	LIFT CYLINDER	1
14	GS620	FIRST BOOM	1
15	41031-0004	OVERCENTRE VALVE	1

BOXER 170 E

SECOND LIFT STAGE

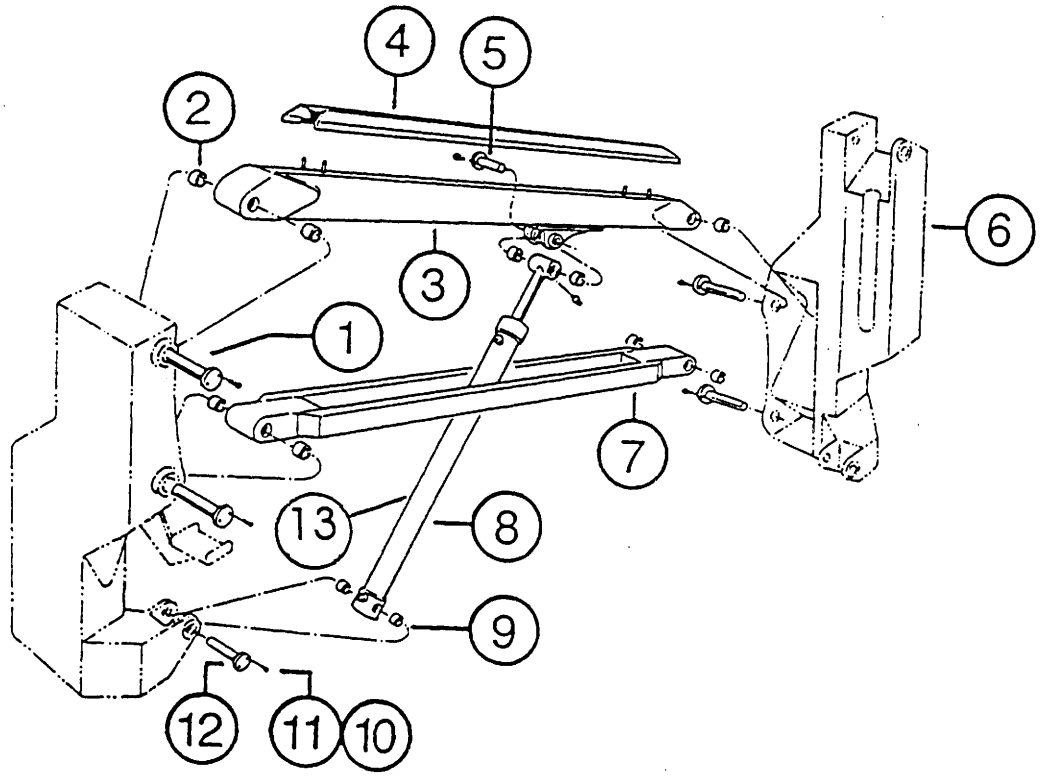


Figure 10.9 - 2nd Lift Stage

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS472	PIN (FIRST AND SECOND OFFSET POSTS)	4
2	10288	GLACIER PM 40 x 40 DX BEARING	
3	GS619	SECOND BOOM	1
4	SS331	CABLE COVER	1
	MS128	CABLE COVER STUD	4
5	GS474	PIN (LIFT CYLINDER ROD END)	1
6	GS602	SECOND OFFSET POST	1
7	GS308	SECOND TIE RAIL	1
8	18242	LIFT CYLINDER	1
9	11844.	GLACIER PM 25 x 25 DX BEARING (PART OF LIFT CYLINDER)	4
10	11085	M8 x 25 GRADE 8.8 HEX HEAD SCREW	12
11	14541	M8 DISC LOCK WASHER	24
12	GS475	PIN (LIFT CYLINDER BASE)	1
13	41031-0004	OVERCENTRE VALVE	1

BOXER 170 E

ZOOM BOOM ASSEMBLY

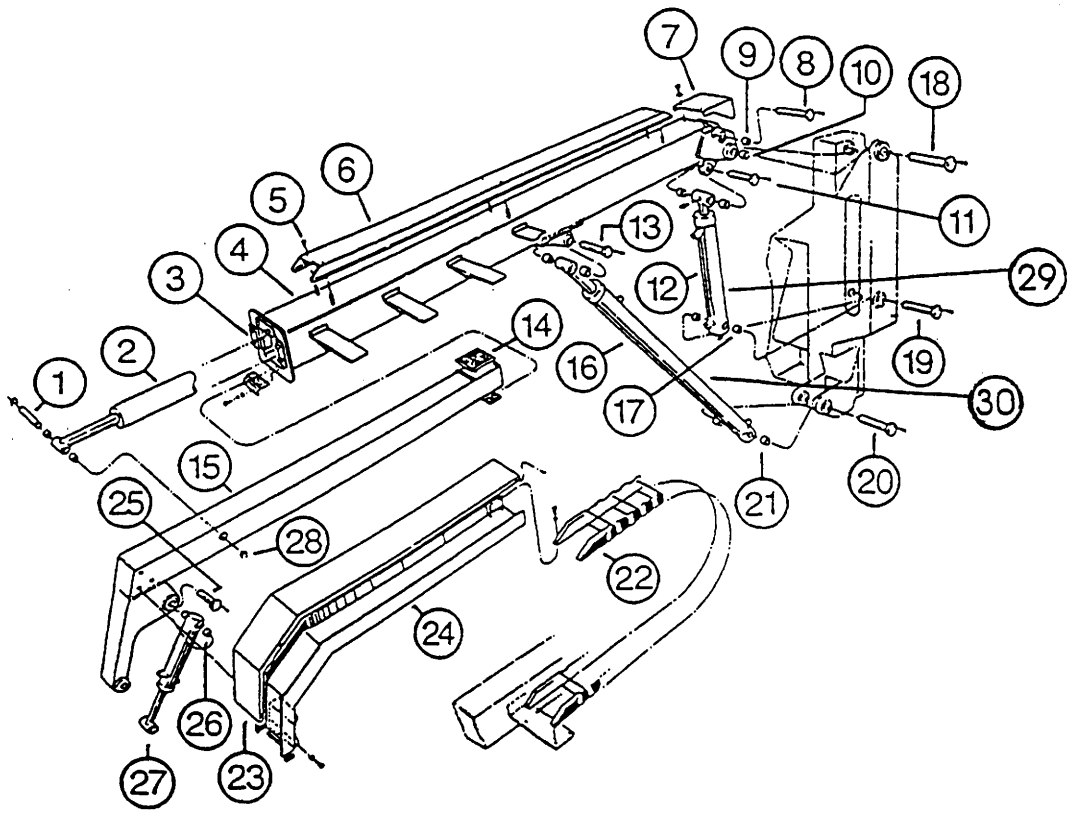


Figure 10.10 - Zoom Boom Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	LS118	PIN (ZOOM CYLINDER ROD END)	1
2	18127	ZOOM CYLINDER	1
3	MS530	WEAR PAD (SIDE)	4
4	GS613	ZOOM BOOM (OUTER)	1
5	MS128	CABLE COVER STUD	6
6	SS329	CABLE COVER	1
7	SS271	END COVER	1
8	GS476	PIN (ZOOM CYLINDER BASE)	1
9	14265	GLACIER PM 20 x 20 DX BEARING	2
10	10288	GLACIER PM 40 x 40 DX BUSH	2
11	GS505	PIN (LEVEL CYLINDER ROD END)	1
12	14368	LEVEL CYLINDER (MASTER)	1
13	GS474	PIN (LIFT CYLINDER ROD END)	1
14	MS531	WEAR PAD (TOP/BOTTOM)	4
15	GS608	ZOOM BOOM (INNER)	1

(continued)

BOXER 170 E - ZOOM BOOM ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
16	18265	LIFT CYLINDER	1
17	14265	GLACIER PM 20 x 20 DX BEARING (PART OF MASTER LEVEL CYLINDER)	4
18	GS472	PIN (STRUCTURE)	1
19	GS476	PIN (LEVEL CYLINDER BASE)	1
20	GS475	PIN (LIFT CYLINDER BASE)	1
21	11844	GLACIER PM 25 x 25 DX BEARING (PART OF LIFT CYLINDER)	4
22	17093	CAT-TRACK	1
23	PS214	CABLE TRAY LID	1
24	GS235	CABLE BOX WELDMENT	1
25	GS477	PIN (LEVEL CYLINDER BASE)	1
26	14265	GLACIER PM 20 x 20 DX BEARING (PART OF SLAVE LEVEL CYLINDER)	4
27	18244	LEVEL CYLINDER (SLAVE)	1
28	11758	CIRCLIP	2
	11564	M12 HEX HEAD NUT	3
	11597	M12 SPRING WASHER	3
	12028	M10 x 25 LG HEX HEAD SCREW	8
	15126	M10 PLAIN WASHER	8
	11589	M10 SPRING WASHER	8
	10890	M8 x 20 LG HEX HEAD SCREW	12
	10589	M8 HEX HEAD NUT	8
	15125	M8 SPRING WASHER	8
	15018	M6 x 20 LG SOCKET BUTTON HEAD SCREW	8
	10146	M6 PLAIN WASHER	8
	14541	M8 DISC LOCK WASHER	24
	DS1047	ZOOM BOOM (COMPLETE ASSEMBLY)	1
29	18246	DOUBLE RELIEF VALVE	1
30	41031-0004	OVERCENTRE VALVE	1

BOXER 170 E

CAGE ASSEMBLY

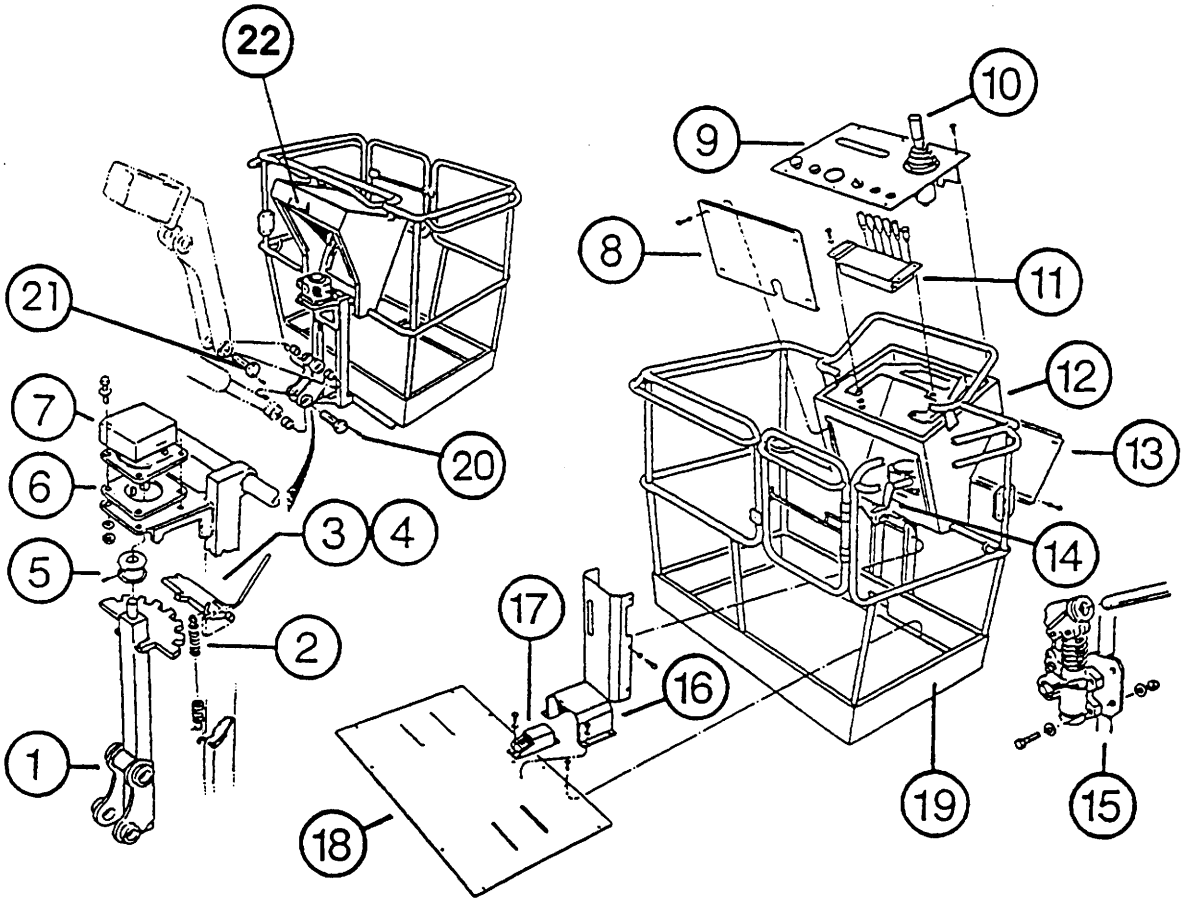


Figure 10.11 - Cage Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	DS336	SWIVEL POST	1
2	10564	TENSION SPRING	2
3	MS253	ROTATION LEVER ARM	1
4	GS267	TONGUE PLATE ASSEMBLY	1
5	-	COLLAR (PART OF MOUNTING PLATE)	1
6	49011-0146	MOUNTING PLATE	1
7	44023-0113	ROTATION GEARBOX	1
8	PS474	FRONT COVER	1
9	PS263	FASCIA PLATE	1
10	11745	JOYSTICK CONTROLLER	1
11	14379	BANK VALVE	1
	14446	ROTATION HANDLEVER (COMPLETE WITH KNOB)	1
	14380	HANDLEVER (COMPLETE WITH KNOB)	5
12	PS470	CONTROL CONSOLE	1

(continued)

BOXER 170 E - CAGE ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
13	PS473	REAR COVER	1
14	18622	ROTATION HANDLE	1
15	11964	EMERGENCY LOWER PUMP/VALVE (OPTIONAL)	1
16	GS032	FOOTSWITCH GUARD	1
17	14269	FOOTSWITCH	1
18	PS297	CAGE FLOOR	1
19	DS1018	CAGE ASSEMBLY (COMPLETE WITH POST)	1
	17716	AUDIBLE ALARM (TILT ALARM)	1
	PS288	DOOR CATCH PLATE	1
	GS297	DOOR LATCH PIVOT PLATE	1
	MS251	DOOR LATCH BAR	1
	14450	DOOR CLOSER	1
	-	M10 x 50 HEX HEAD BOLT (ROTATE GEAR BOX)	4
	10419	M6 x 16 HEX HEAD SET SCREW (FOOTSWITCH)	7
	-	M5 x 10 GRUB SCREW (ROTATE HANDLE)	1
	-	M10 NYLOC NUT (ROTATE GEARBOX)	4
	-	M10 PLAIN WASHER (ROTATE GEARBOX)	8
	-	M5 'P' CLIP (CONSOLE)	16
	15007	M5 x 16 SKT BUTTON HEAD SET SCREW	16
	15119	M5 PLAIN WASHER (CONSOLE)	16
	-	M8 HANK BUSH (CONSOLE)	3
	-	M8 x 55 HEX HEAD BOLT (VALVE MOUNTING)	3
	10142	M10 x 40 HEX HEAD BOLT (CATCH LATCH)	2
	-	M6 SKT BUTTON HEAD SET SCREW (CONSOLE)	6
	-	M6 NYLOC NUT (CONSOLE)	10
	-	M6 x 20 SKT BUTTON HEAD SET SCREW (JOYSTICK)	4
	-	M6 PLAIN WASHER	4
	15096	M6 NYLOC NUT (JOYSTICK)	4
	11844	GLACIER PM 25 x 25 DX BUSH	3
	10288	GLACIER PM 40 x 50 DX BUSH	1
20	GS505	PIN (LEVELLING CYLINDER ROD END)	1
21	GS475	PIN (CAGE MOUNTING PIVOT)	1
22	41009-0020	P.O. CHECK VALVE (ITALY ONLY)	1

BOXER 170 E

ELECTRIC MODULE

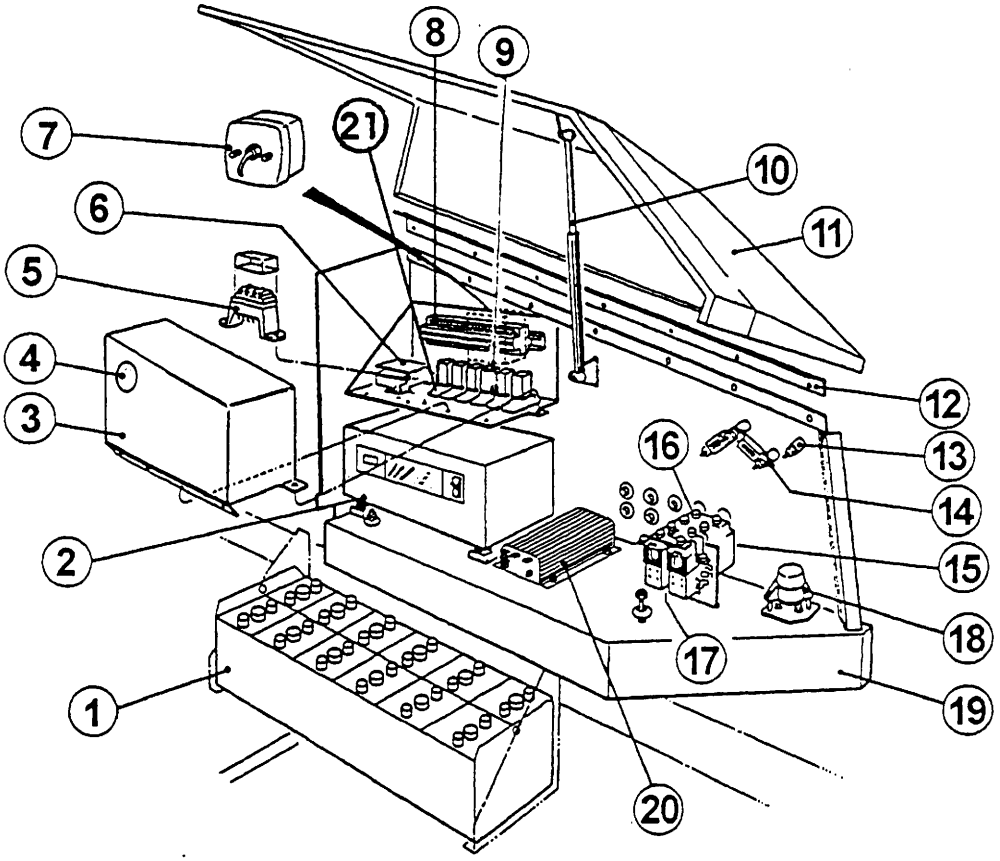


Figure 10.12 - Electric Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	14605	BATTERY PACK, 2V, 258 AMP-HOUR	1
	17041	BATTERY PACK, 2V, 300 AMP-HOUR	1
2	17311	BATTERY CHARGER, 48V, 40A, SINGLE VOLTAGE	1
	17305	BATTERY CHARGER, 48V, 35A, DUAL VOLTAGE	1
	16976	PLUG, 2-POLE, BLUE	2
3	-	COVER (INTERNAL ELECTRICS)	1
4	17185	HOUR METER	1
5	11893	FUSE HOLDER	1
	10026	SPADE FUSE, 10A, DURITE	1
	11563	SPADE FUSE, 5A, DURITE	2
	14615	SPADE FUSE, 3A, DURITE	1
6	11791	BATTERY CONTROLLER	1
	GS053	BATTERY CONTROLLER COVER	1
7	12423	KLAXON, 24V	1

(continued)

BOXER 170 E - ELECTRIC MODULE (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
8	14355	TERMINAL	48
	10250	TERMINAL RAIL (G SECTION)	1
	14652	TERMINAL RAIL (TOP-HAT SECTION)	1
	14356	END SECTION	1
	10203	STOP SECTION	2
9	12197	8-PIN RELAY	
	12349	8-PIN RELAY BASE	1
10	16138	GAS STRUT	1
11	GS299	COVER	1
12		HINGE	1
	12274	LATCH	1
13	10823	M8 STAND-OFF	4
14	10862	FUSE, 325A	1
	18186	FUSE, 100A	1
15	11044	CONTACTOR (PUMP)	1
16	10150	CONTACTOR (TRACTION)	1
17	12426	CONTACTOR (FORWARD/REVERSE)	1
	11550	CONTACTOR BRACKET	1
18	42013-0287	TILT ALARM SENSOR	1
19	GS298	MODULE BASE	1
20	16443	DRIVE MOTOR CONTROLLER	1
	11976	RUBBER BOOT	1
	10059	RUBBER PLUG	1
	11490	M8 x 16 HEX HEAD SCREW (STAND OFFS)	4
	15019	M6 x 20 HEX HEAD SCREW (CONTACTS/ALARM)	4
	10419	M6 x 16 HEX HEAD SCREW (COVER/LATCH)	3
	11625	M6 x 16 SOCKET BUTTON HEAD SCREW (HINGE)	8
	15003	M4 x 16 PAN HEAD SLOT SCREW (PLUG/SOCKET)	4
	10434	M3 x 20 PAN HEAD SLOT SCREW (RELAYS)	12
	15098	M10 NYLOC NUT (MODULE)	3
	15096	M6 NYLOC NUT (COVER/ALARM CONTACTS)	7
	15095	M5 NYLOC NUT (STUDS)	16
	15182	M4 NYLOC NUT (PLUG/SOCKET)	4
	15209	M4 NYLOC NUT (RELAYS)	12
	11078	M8 PLAIN WASHER (STAND OFFS)	6
	15121	M6 PLAIN WASHER (HINGE/LATCH)	15
	15119	M5 PLAIN WASHER (STUDS)	16
	15117	M4 PLAIN WASHER (PLUG/SOCKET)	4
	15125	M8 SPRING WASHER	4
	15127	M10 DISHED WASHER	4
	16196	DIODE, 3A, 1000V	19
21	17715	11 PIN RELAY	1
	11729	BASE FOR 11 PIN RELAY	1

BOXER 170 E

HYDRAULIC MODULE

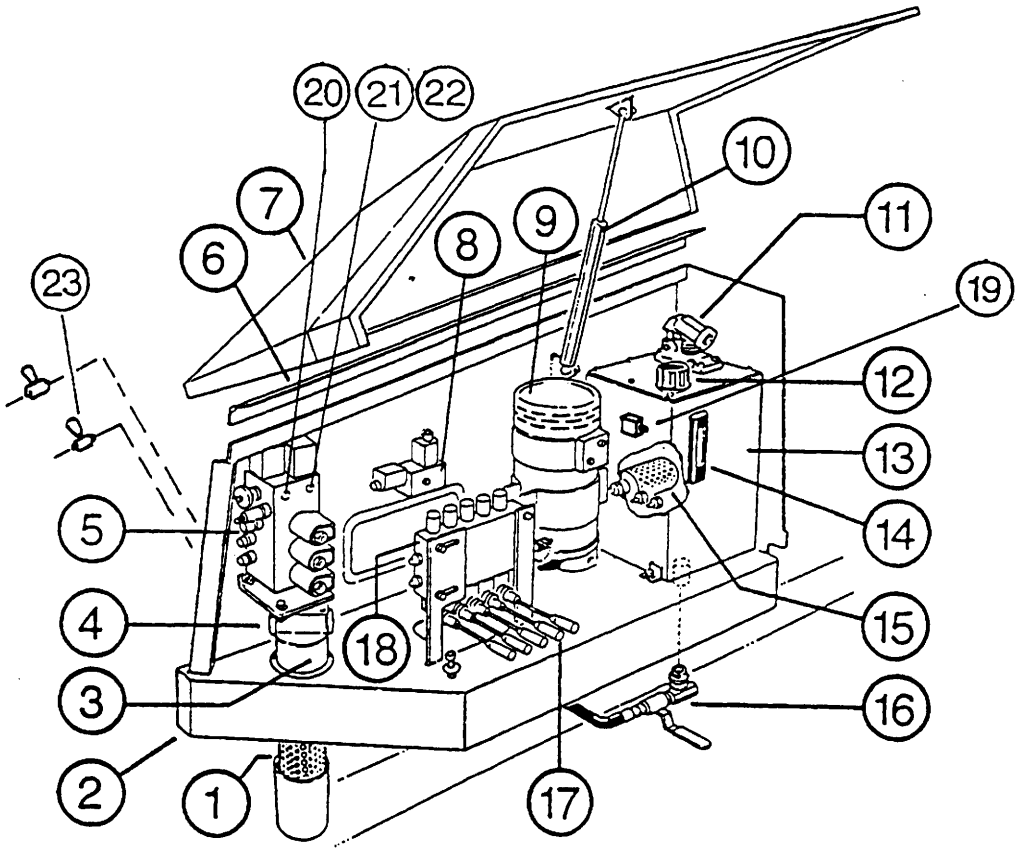


Figure 10.13 - Hydraulic Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	11357	PRESSURE FILTER ELEMENT	1
2	GS305	MODULE BASE	1
3	11389	PRESSURE FILTER	1
4	GS060	FILTER BRACKET	1
5	17244	BRAKE/LIFT/STEER MANIFOLD	1
6	-	HINGE, $1^1/_2$" x 1068 mm LONG	1
7	GS306	COVER	1
8	17245	DIFF LOCK ENGAGEMENT MANIFOLD	1
9	10319	BOSCH PUMP	1
	MS041	MOTOR/PUMP CLAMP	1
10	16138	GAS STRUT	1
11	16160	HANDPUMP (COMPLETE WITH HANDLE)	1
12	11667	FILLER CAP	1
	11510	DIFFUSER	1

(continued)

BOXER 170 E - HYDRAULIC MODULE (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
13	GS309	HYDRAULIC RESERVOIR	1
14	12398	OIL LEVEL INDICATOR	1
15	12424	SUCTION FILTER	1
16	11141	$^3/_4$" BALL VALVE	1
17	14606	HANDLEVER (COMPLETE WITH KNOB)	5
18	14378	VALVE BANK (GROUND)	1
	14447	CARRY OVER VALVE	1
	11235	CHECK VALVE	1
	12260	CHECK VALVE	1
	12274	PADDLE LATCH	1
	-	M12 x 100 HEX HEAD BOLT (MOTOR BRACKET)	2
	12290	M6 x 40 HEX HEAD BOLT (BRAKE RELEASE)	2
	15036	M10 x 20 HEX HEAD SET SCREW (FILTER)	2
	-	M8 x 75 HEX HEAD BOLT (BANK VALVE)	3
	15017	M6 x 16 HEX HEAD SET SCREW (FILTER BRACKET)	2
	15007	M5 x 16 SOCKET BUTTON HEAD SCREW (HINGE)	7
	15003	M4 x 16 PAN HEAD SET SCREW (PUMP HANDLE CLIP)	2
	11564	M12 NYLOC NUT (PUMP)	2
	15098	M10 NYLOC NUT (MODULE)	4
	15089	M8 NYLOC NUT (BANK VALVE)	3
	15096	M6 NYLOC NUT (FILTER BRACKET)	4
	15095	M5 NYLOC NUT (HINGE/RESERVOIR)	10
	15182	M4 NYLOC NUT (PUMP HANDLE CLIP)	2
	12236	M12 PLAIN WASHER (PUMP)	2
	15126	M10 PLAIN WASHER (FILTER)	2
	15124	M8 PLAIN WASHER (BANK VALVE/STRUT)	5
	15121	M6 PLAIN WASHER	4
	15119	M5 PLAIN WASHER (HINGE/RESERVOIR)	10
	15117	M4 PLAIN WASHER (PUMP HANDLE CLIP)	2
	11589	M10 SPRING WASHER (FILTER)	2
	15127	M35 x 10 x 16 SWG (MODULE)	4
	14530	SWEPT ELBOW 90° $^3/_4$" x $^3/_4$" BSP MALE/MALE CONNECTOR	1
19	17713	RELIEF VALVE	1
20	17541	PRESSURE SWITCH (35 BAR)	1
21	17542	PRESSURE SWITCH (25 BAR)	1
22	10639	PROTECTIVE COVER (PRESSURE SWITCH)	2
23	11488	NEEDLE VALVE (FITTED WITH TOWING PACKAGE ONLY)	2

BOXER 170 E

GROUND CONTROLS

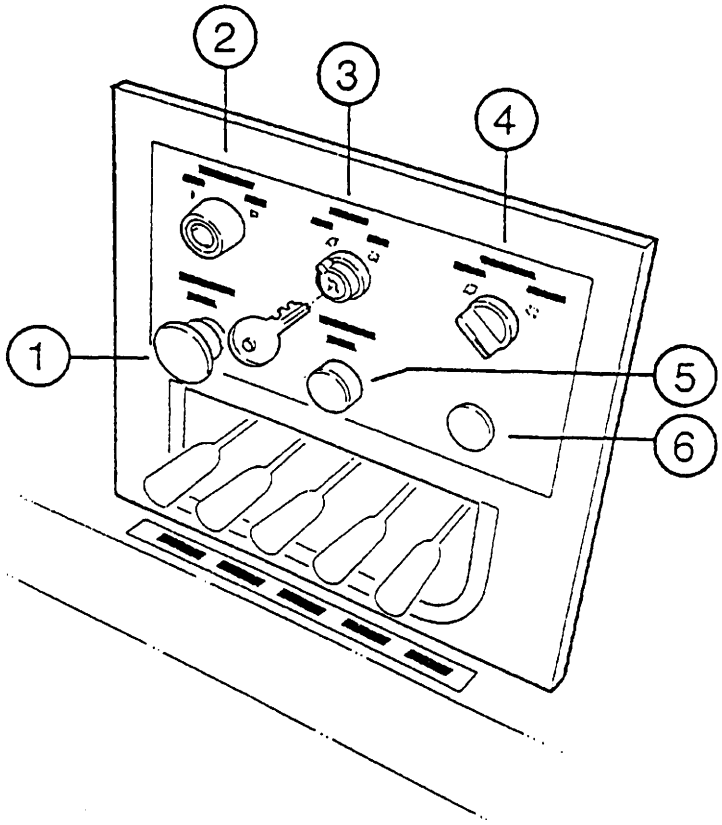


Figure 10.14 - Ground Controls

ITEM	PART NO.	DESCRIPTION	QTY.
1	10104	EMERGENCY STOP BUTTON	1
	11527	CONTACT (NORMALLY CLOSED)	1
2	11037	PUSHBUTTON, GREEN (PUMP ON/OFF)	1
	11815	CONTACT (NORMALLY OPEN)	1
3	12345	KEYSWITCH (POWER ON/OFF)	1
4	10954	SELECTOR SWITCH (CAGE/GROUND)	1
	11815	CONTACT (NORMALLY OPEN)	1
	11527	CONTACT (NORMALLY CLOSED)	1
5	10576	LENS ASSEMBLY (POWER ON)	1
	11289	BULB, 24 V, 3 W	1
6	11730	BLANK	1

BOXER 170 E

CAGE CONTROLS

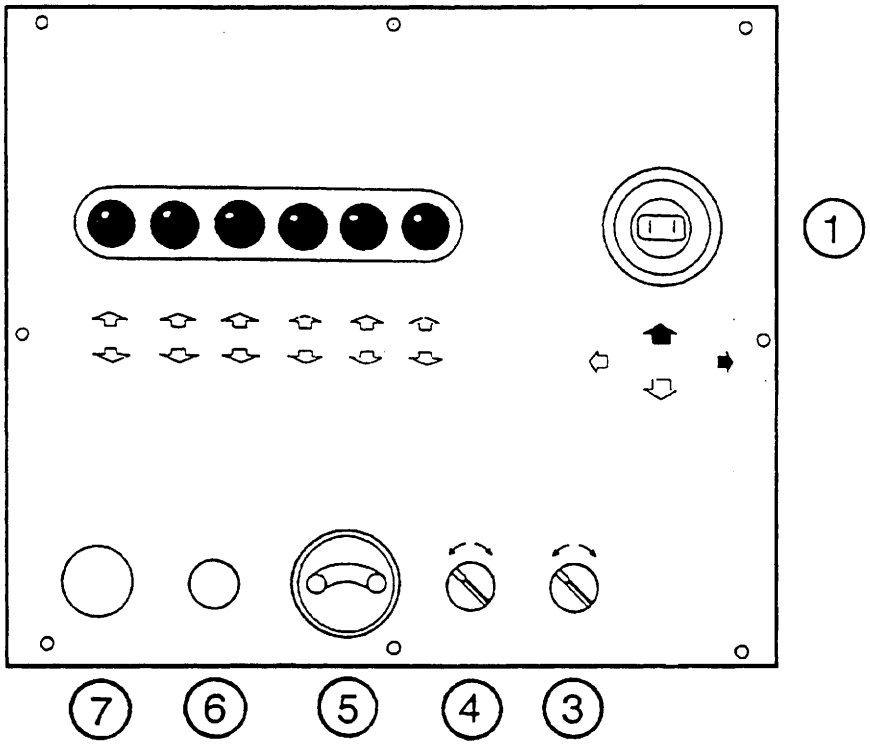


Figure 10.15 - Cage Controls

ITEM	PART NO.	DESCRIPTION	QTY.
1	11745	JOYSTICK CONTROLLER	1
3	10954	SELECTOR SWITCH (DIFF LOCK)	1
4	10954	SELECTOR SWITCH (LIFT/DRIVE)	1
	11527	CONTACT (NORMALLY CLOSED)	1
	12457	CONTACT (NORMALLY OPEN)	1
5	11958	BATTERY INDICATOR	1
6	11037	HORN PUSHBUTTON, GREEN	1
	11815	CONTACT (NORMALLY OPEN)	1
7	10104	EMERGENCY STOP BUTTON	1
	11527	CONTACT (NORMALLY CLOSED)	1
	12085	CAPACITOR	1
	12197	RELAY	1
	12349	RELAY BASE	1
	14354	RELAY CLIP	1

BOXER 170 E

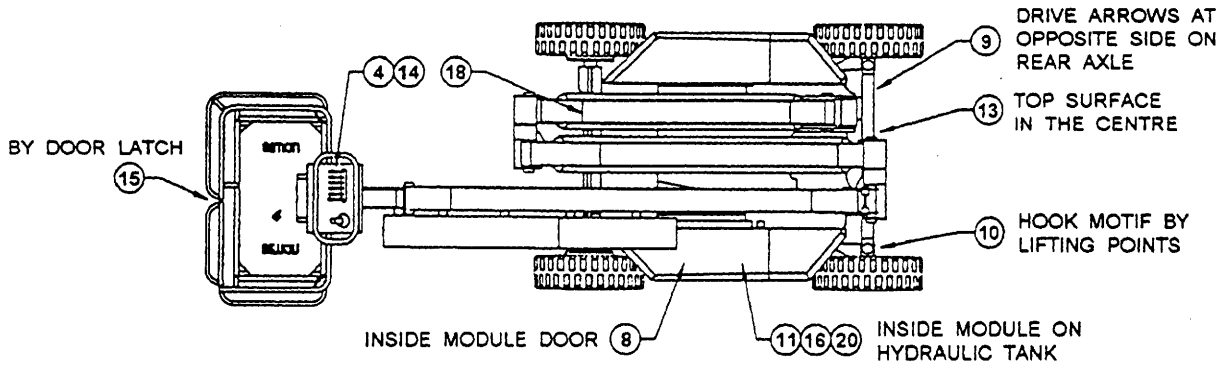
LABELS

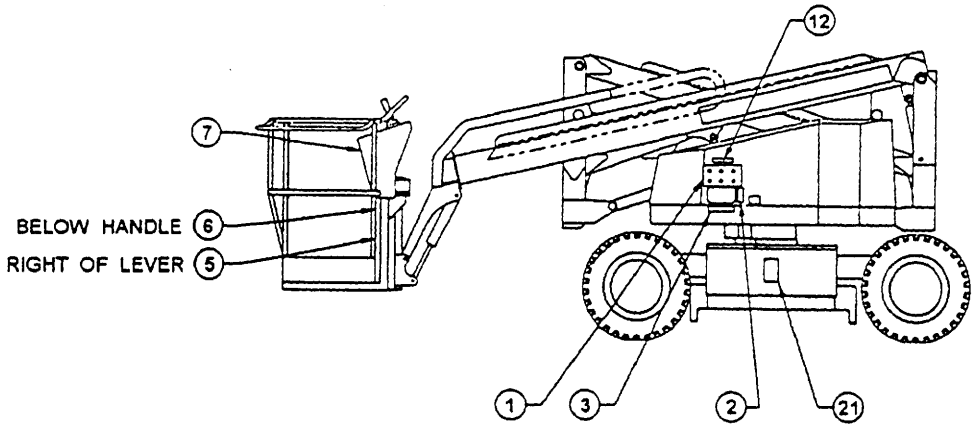
(Refer to Figure 10.16.)

ITEM	PART NO.	DESCRIPTION	QTY.
1	AS103	GROUND CONTROLS	1
2	AS104	GROUND CONTROL	1
3	AS105	GROUND CONTROL	1
4	A1491	CAGE CONTROL	1
5	AS101	ROTATION LOCK	1
6	AS100	ROTATION ARROWS	1
7	A581	SWL & WARNING	1
8	A1240	TOWING INFORMATION	1
9	A583	DRIVE ARROWS	2
10	A582	HOOK MOTIF	4
11	A580	HYDRAULIC OIL ONLY	1
12	A577	EMERGENCY LOWERING	1
13	A578	TOWING REFERENCE	1
14	A1373	TOWING REMINDER	1
15	A22	PINCH POINT	7
16	A584	MAINTENANCE	1
17	A147	I P A F	1
18	A146	IDENTIFICATION PLATE	1
20	A1042	CIRCUIT IDENTIFICATION	1
21	A1417	SIMON LOGO	3
22	16617	SIMON - 120mm PRE-SPACED	2
23	16616	BOXER - 120mm BLACK	2
24	16891	170 - 120mm BLACK	2
25	16603	E - 120mm BLACK	2

(continued)

BOXER 170 E - LABELS (continued)





PINCH POINT POSITIONS:
1) PLINTH CUTOUT FOR BOOMS
2) ZOOM BOOM REST
3) ZOOM BOOM SNOUT
4) ROTATION STOP

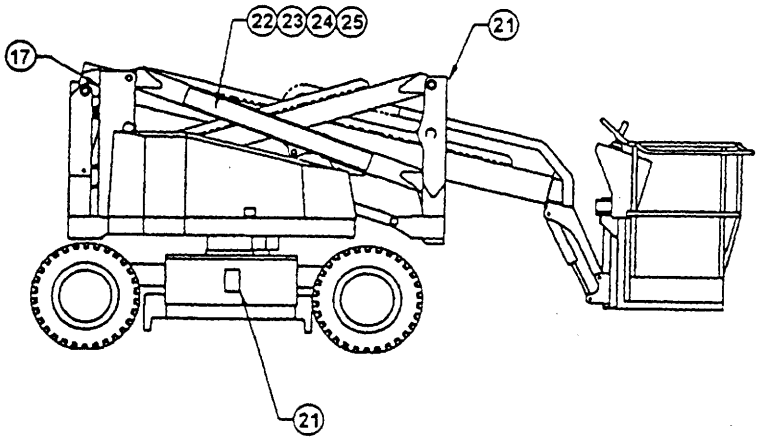
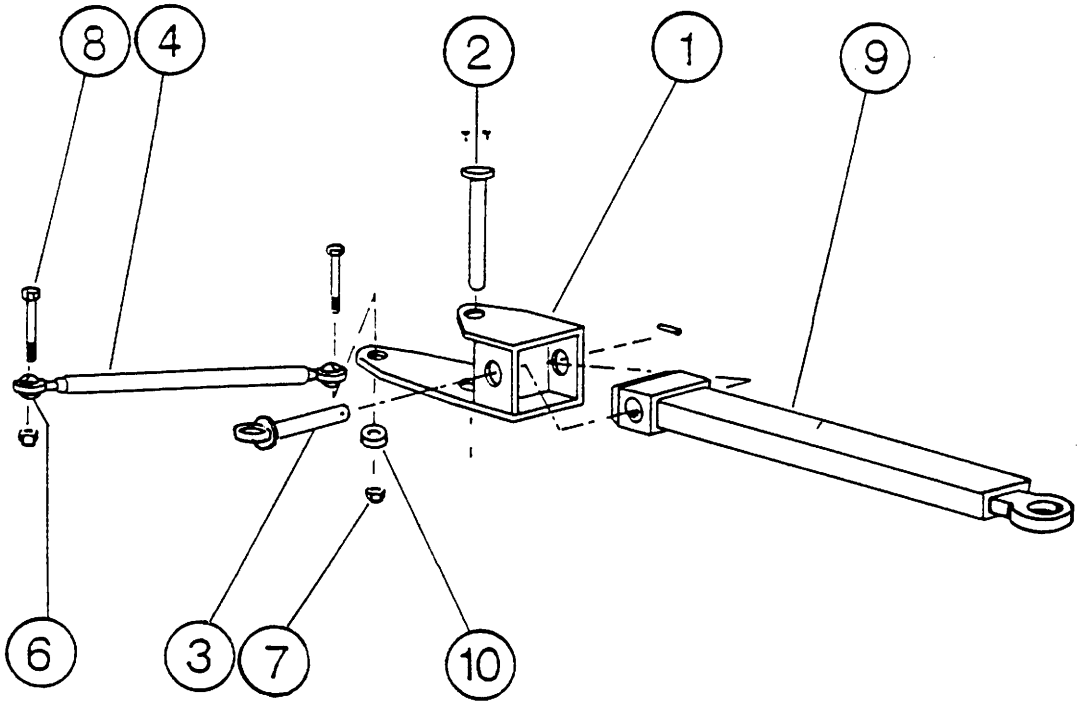


Figure 10.16 - Label Positions

TOWING ARM ASSEMBLY



Towing Arm Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS605	STEERING TOW BRACKET ASSEMBLY	1
2	GS499	PIN	1
3	GS498	PIN	1
4	MS584	TOWING TRACK ROD	1
-	-	-	-
6	13170	BEARING	2
7	10990	M20 NYLOC NUT	2
8	16397	M20 X 70 HEX. HEAD BOLT	2
9	GS034	TOWING ARM	1
10	MS586	TOW SPACER	1
-	-	-	-

BOXER 170 E

CONVERSION TABLE

UNITS OF LENGTH

30.48 cm	=	1 Foot
0.9144 m	=	1 Yard

UNITS OF AERA

6.4516 cm^2	=	1 Square inch
929.03 cm^2	=	1 Square foot
0.83613 m^2	=	1 Square yard

UNITS OF VOLUME

0.56826 Lts	=	1 Pint (GBR)
0.47318 Lts	=	1 Pint (USA)
4.54609 Lts	=	1 Gallon (GBR)
3.78543 Lts	=	1 Gallon (USA)

UNIT OF MASS

0.453592 kg	=	1 Pound (16 ounces)
12.7006 kg	=	1 Quarter (28 Lbs)
50.8024 kg	=	1 Hundredweight (112 Lbs.)
1.016047 t	=	1 Ton (1 Long ton)

UNITS OF FORCE

4.448221 N	=	1 Pound force (lbf)
9.80665 N	=	1 Kilogramme-force (kgf)

UNITS OF PRESSURE

1N/mm^2	=	145.3 Psi (10 Bar)

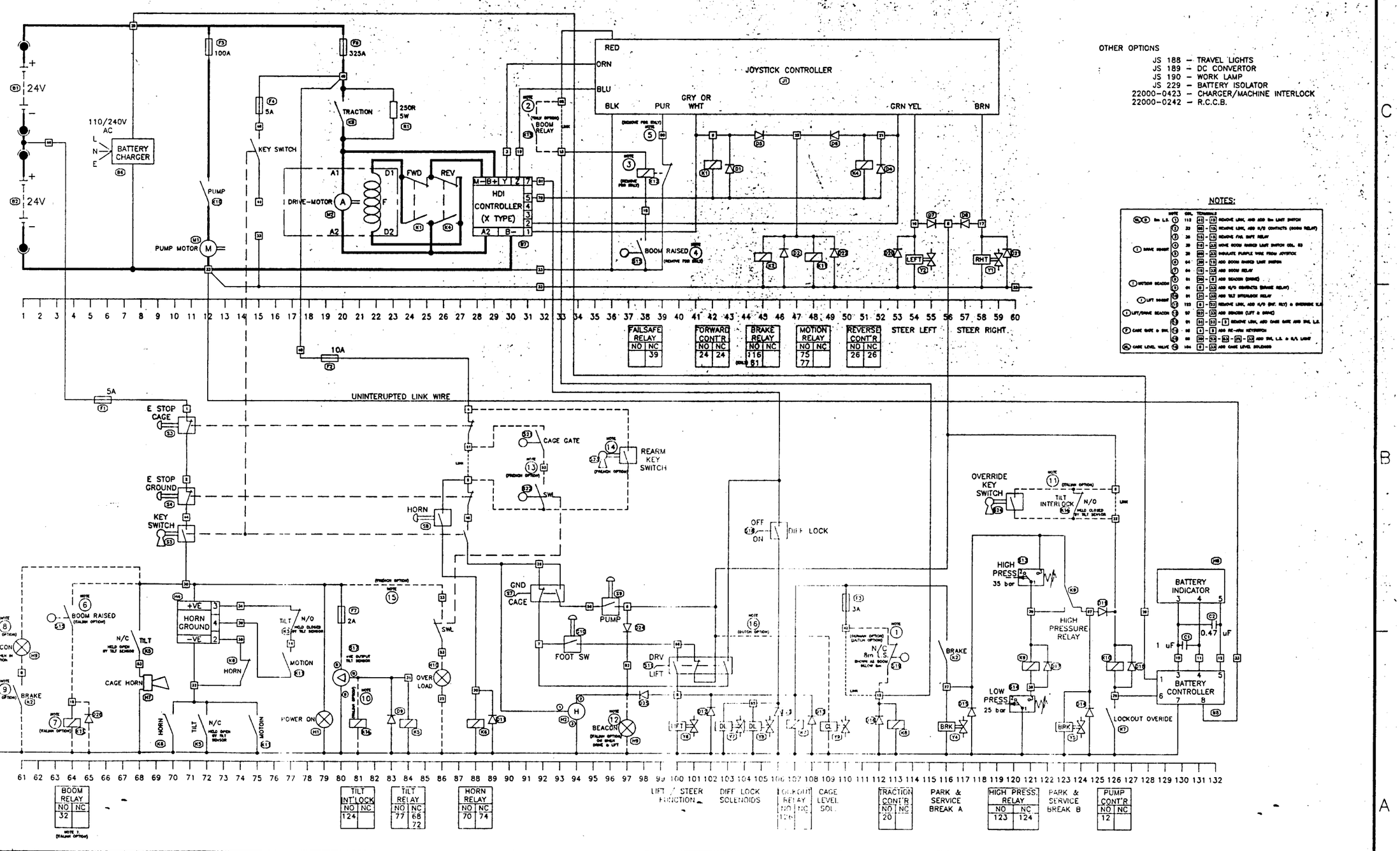
UNITS OF POWER (Work / Time)

0.74570 kw	=	1 Horse-power

REMOVE ALL BURRS AND SHARP EDGES

IF IN DOUBT–ASK DO NOT SCALE

ALL DIMENSIONS IN MM



OTHER OPTIONS

JS 188 – TRAVEL LIGHTS
JS 189 – DC CONVERTOR
JS 190 – WORK LAMP
JS 229 – BATTERY ISOLATOR
22000-0423 – CHARGER/MACHINE INTERLOCK
22000-0242 – R.C.C.B.

NOTES:

REV. No.	MOD. No.	DATE
D	11621	JAN94
E	11910	MAR94

TOLERANCES ±0.5mm UNLESS OTHERWISE SPECIFIED.

SIMON-AERIALS LTD.

TITLE: LINE DIAGRAM ELECTRIC BOXER

DRAWN: D JEFFERIES | APPROVED | DATE: NOV 93

MATERIAL SPEC.

DRG. No. JS237

PROJECTION | SCALE | MODEL | WEIGHT | DIVISION | REV. E

IF IN DOUBT - ASK | DO NOT SCALE | REMOVE ALL BURRS AND SHARP EDGES

CAGE CONTROLS

LIFT 1 | LIFT 2 | LIFT 3 | ZOOM | ROTATE | CAGE SELF-LEVEL

190 bar

14379

ITALIAN OPTION
41009-0020
V2 V1
C2 C1

11964
12260
SWEDISH OPTION

10865 1/32" | 10865 1/32"

DUTCH OP.
17458
P T A B Y9

SLAVE 18244
MASTER 18245
CAGE LEVEL
18246

ROTATE
16646 1.1mm
10854
1.1mm 16646

170E: 18127
140/150E: 14371
ZOOM

18242
LIFT 3
18243

170E: 18265
140/150E: 18242
LIFT 2
18243

18242
LIFT 1
18243

LIFT INHIBIT (SWISS) OPTION

4.5 bar SWEDISH OPTION

DIVERTER VALVE SLEW STOP
B A P T
16474

TANK RETURN LINE
USE 1/2" HOSE.

BALL VALVE 10568
Y3
10047
12260
10223

MCH

STEER RIGHT Y1
STEER LEFT Y2
SR
SL
120 bar
120 bar

LIFT/DRIVE Y6
180 bar
P1
T
40 bar
P2
Y5

BRAKES ON/OFF Y4
B

UCC 1700
10935

PSL 25 bar
PSH 35 bar
17542 FAILSAFE BRAKE

17244
17541

3/4" BALL VALVE
11141

M
10319
11235
11357
11389
41009-0007
40 bar
17713
16160
LIFT/BRAKES OFF

11510
12424

T
Y8
P
Y7
DIFF. LOCK
17245

190 bar
LIFT 1 | LIFT 2 | LIFT 3 | ZOOM | ROTATE
14378
GROUND CONTROLS

14368
STEER

REV.	MODIFICATION	E.C.N.	BY	DATE	CHECKED	APPROVED
G	DUTCH OPTION ADDED	11491	DJ	6.12.93		
F	SLEW STOP ADDED	12374	DJ	25.8.93		
E	PART NoS ADDED, PRV INCREASED, OPTIONS ADDED	11511	DJ	25.06.93		
D	F/BORE & AN. ON ZOOM FN. SWITCHED ON UPPER BLOCK	11273	DJ	25.05.93		
C	PRESSURES CHANGED	1877	RJP	13.11.92		
B	WAS BOXER 170E NOW ALSO SUITS BOXER 140E/150E.		R.W.W	20/3/92		
A	HAND PUMP RELIEF VALVE ADDED. DIFF LOCK	1499	R.W.W	5/9/91		
	CHANGED FROM N.C TO N.O					

TOLERANCE

FINISH

MATERIAL | C.O.G. POSITION INDICATED BY

COMPONENT WEIGHT | SCALE KGS

DERIVED FROM | E.R.N.

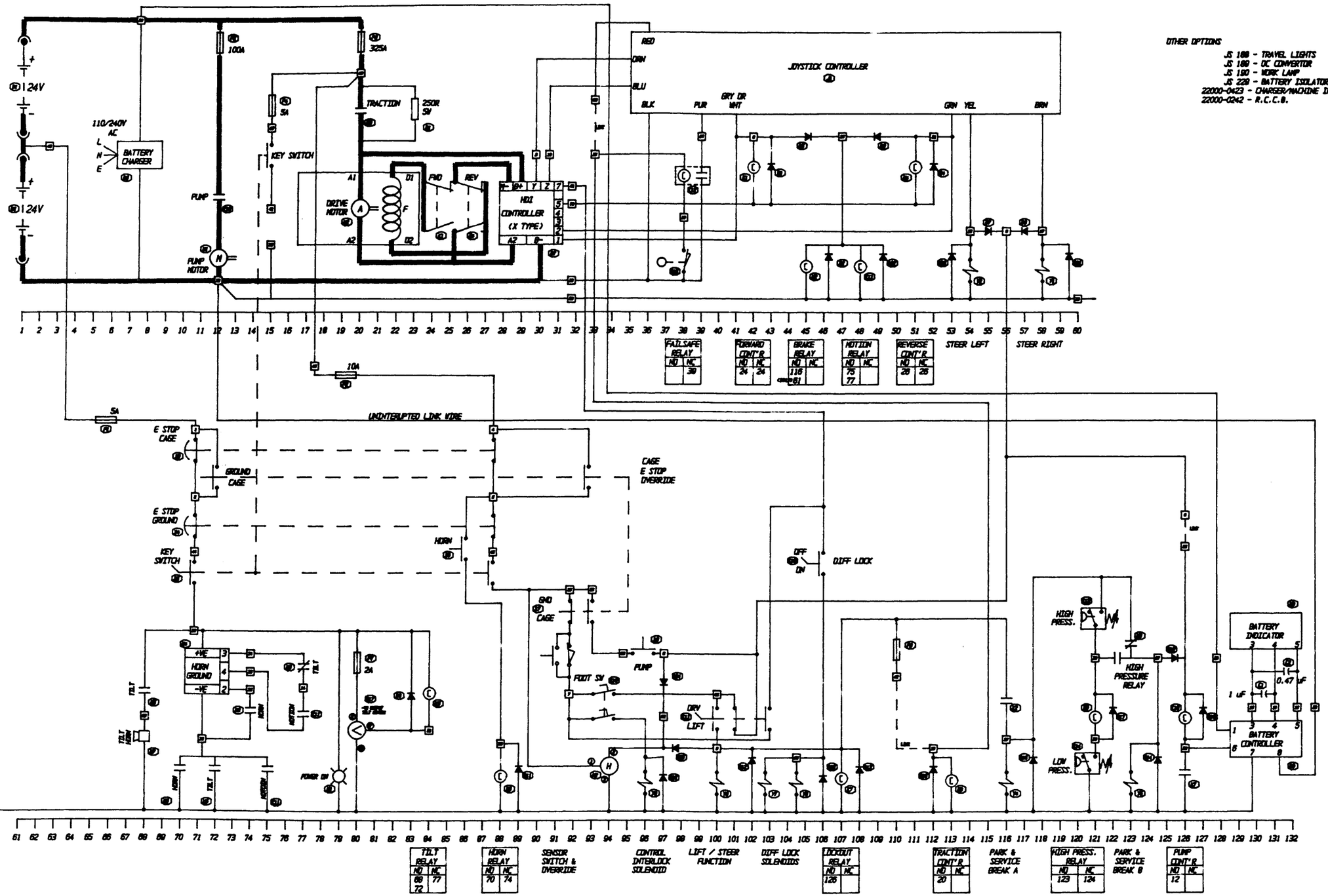
SIMON AERIALS LTD

TITLE: HYDRAULIC CIRCUIT. BOXER MK3 140E/150E/170E

DRAWN R.W.W 4/9/91 | CHECKED | APPROVED | DRAWING NUMBER HS 148/G

SIZE A2 420mm X 594mm

ZT 185



OTHER OPTIONS

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JS 189 - DC CONVERTOR
JS 190 - WORK LAMP
JS 229 - BATTERY ISOLATOR
22000-0423 - CHARGER/MACHINE INTERLOCK
22000-0242 - R.C.C.B.

REF:50/30 EAGLE ATLANTIC COMPRESSED AIR w/ PLATFORM SENSOR RING

SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE: ELECTRICAL SCHEMATIC

REVISION: REL

DRWG. NO.: D-2349140