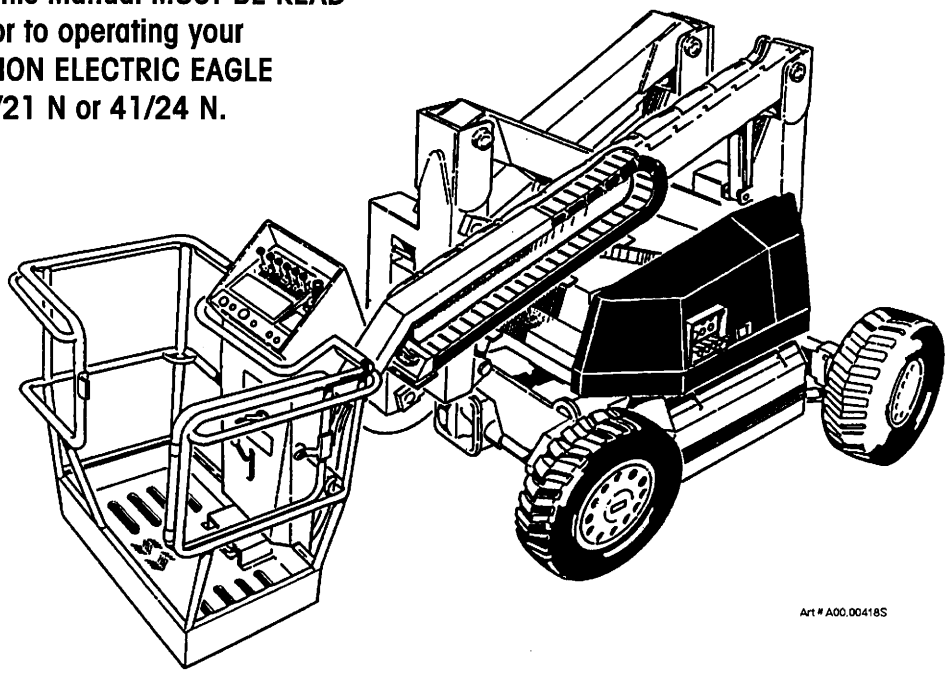
ELECTRIC EAGLE
32/21 N
41/24 N

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
SIMON ELECTRIC EAGLE
32/21 N or 41/24 N.



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AMENDMENTS

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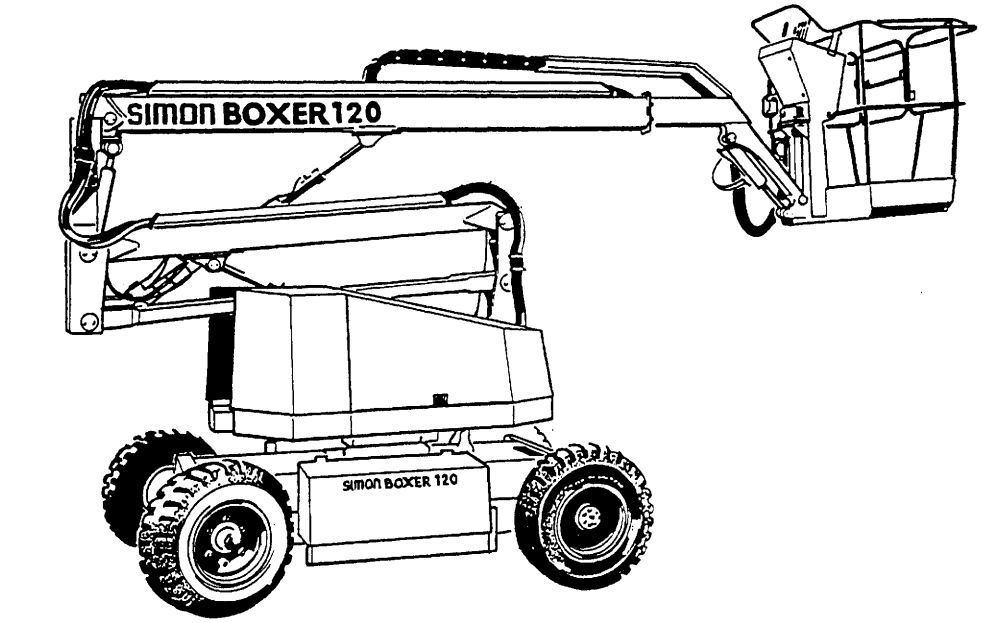
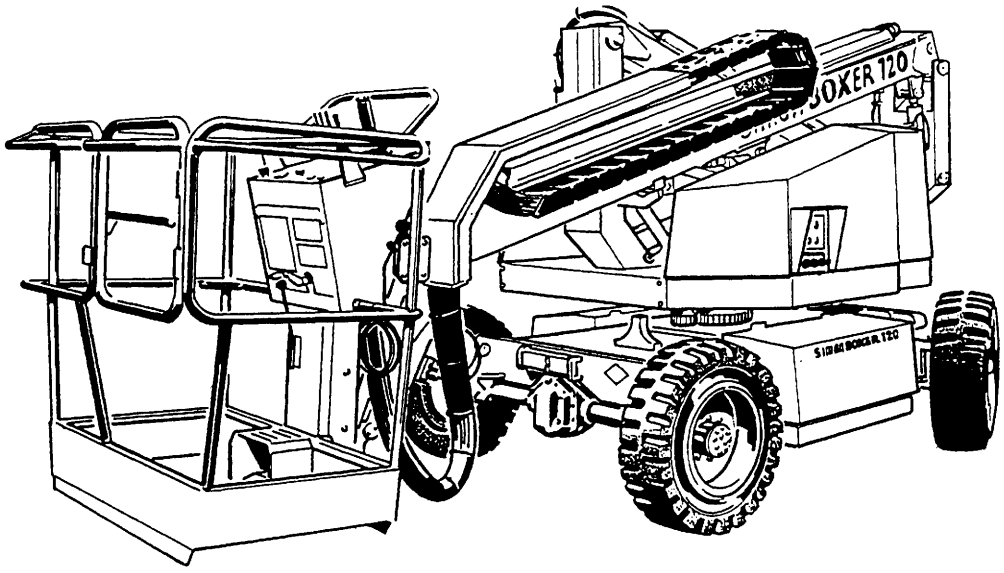




BOXER - GENERAL VIEW

INTRODUCTION

1. The electric powered Boxer Mk.3 (E) Access Platform is developed from the Boxer 2 and 3-Stage self-propelled models and is manufactured in the U.K. by **SIMON AERIALS LTD., of Thetford, Norfolk.**

2. The Boxer is available in five models, each with a different working height ability, and identified as the Boxer 120, 130, 140, 150 and 170. Narrow aisle versions are also available, and these models are identified by the letter 'N', which follows the height identification. The Boxer Access Platform can be powered by battery (E), Diesel (D), or gas (G).

3. The work platforms have sideways folding boom configurations that allow easy access through standard industrial doorways and can operate in narrow aisles and confined spaces with no knuckle or tailswing to restrict manoeuvrability. The unique up-and-over feature enables Boxer platforms to reach work positions that are frequently out of range of larger and more expensive machines.

4. All Boxer work platforms are engineered to high standards using the best quality materials and are tested and stable to twice working load in all positions.

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

6. Double-acting cylinder lock-valves prevent descent of booms 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.

7. 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 within the booms (Boxer 120, 130, 140 and 150), or by special covers (Boxer 170).

8. The electric powered Boxer (E) is powered by eight 6 volt Heavy Duty batteries. An advanced battery charger is incorporated in the electrical circuit, and batteries can be charged from either a 240 volts A.C. 50 Hz, or 110 volts A.C. 50 Hz supply. Optional battery packs are available.

9. The transmission system allows outstanding range and performance. The powerful motor and high ground clearance allow the Boxer to climb 1 in 4 slopes.

10. This manual refers to the Boxer 120, 130, 140, 150 and 170 Mk.3 Electric models.

SECTION 1

BOXER Mk.3 (E) SPECIFICATION

CLOSED DIMENSIONS AND WEIGHTS (CHART 1) (refer to page 1.9 for Narrow Aisle Machines):

	BOXER 120	BOXER 130	BOXER 140	BOXER 150	BOXER 170
Length (m)	4.50	4.50	4.74	4.74	5.64
Width (m) (standard)	1.80	1.80	1.80	1.80	1.85
Width (m) (narrow)	1.50	1.50	1.50	1.50	
Height (m)	2.00	2.00	2.00	2.00	2.20
Unladen Weight (kg)	4510	4540	5260	5290	6000

OPERATING DIMENSIONS (CHART 2):

	BOXER 120	BOXER 130	BOXER 140	BOXER 150	BOXER 170
Max. Cage Floor Height (m)	10.00	11.00	12.60	13.70	14.70
Max. Working Height (m)	11.80	12.80	14.50	15.50	16.50
Max. Working Outreach (m)	7.00	6.90	7.50	7.40	9.0
Cage Size (m) (LxB)	1.20x0.60	1.20x0.60	1.20x0.60	1.20x0.60	1.20x0.60
Outside Turning Circle (m)	3.90	3.90	3.90	3.90	4.00
Climbability (degrees)	14	14	12	12	11.3
Climbability (%)	25	25	21	21	20
Max. Speed (km/hr) (Booms Stowed)	5	5	5	5	5
Max. Speed (mph) (booms Stowed)	3	3	3	3	3
Max. Speed (Booms Elevated)	0.75	0.75	0.75	0.75	0.75
Max. Speed (mph) (Booms Elevated)	0.5	0.5	0.5	0.5	0.5
Ground Clearance (m)	0.14	0.14	0.14	0.14	0.20

DESIGN SPECIFICATION (CHART 3):

	BOXER 120	BOXER 130	BOXER 140	BOXER 150	BOXER 170
SWL (kg) *	225	225	225	225	225
SWL (lbs) *	496	496	496	496	496
Max. Horizontal Platform Pull (kg)	40	40	40	40	40
Max. Horizontal Platform Pull (lbs)	88	88	88	88	88
Max. Wind Speed (m/sec)	10	10	10	10	10
Max. Wind Speed (mph)	23	23	23	23	23
Max. Wind Speed (km/hr)	36	36	36	36	36
Max. Slope for Safe Operation (degrees) *	5	5	5	5	5
Full Range Time Up (secs)	70	70	90	90	100
Full Range Time Down (secs)	40	40	60	60	70
Swing Left/Right (secs)	60	60	60	60	60

* NOTE: THE INFORMATION DETAILED IN CHARTS 1 TO 3 IS FOR THE STANDARD BOXER MODEL.

REFER TO COUNTRY SPECIFICATION CHARTS 4 TO 6 FOR VARIATIONS OF SWL, MAX. SLOPE FOR SAFE OPERATION, BALLAST, DYNAMIC TESTING AND STABILITY AND STRUCTURE.

DESIGN SPECIFICATION (CHART 4):

MODEL	SPECIFICATION	SWL	ADDITIONAL BALLAST
120E/140E	ENGLISH / GERMAN	225 kg	NONE
130E	ENGLISH / GERMAN	225 kg	NONE
150E	ENGLISH / GERMAN	225 kg	1*PS381
120EN / 130EN	ENGLISH	225 kg	NONE
140EN / 150EN	ENGLISH	225 kg	NONE (PS381 INC)
120E / 130E	FRENCH	265 kg	NONE
140E	FRENCH	265 kg	1*PS381
150E	FRENCH	265 kg	1*PS381
120EN / 130EN	FRENCH	165 kg	NONE
140EN / 150EN	FRENCH	165 kg	NONE (PS381 INC)
120EN	GERMAN	225 kg	NONE
140EN	GERMAN	225 kg	NONE (PS381 INC)
120E	AUSTRALIAN	225 kg	NONE
130E	AUSTRALIAN	225 kg	NONE
140E	AUSTRALIAN	225 kg	1*PS381+1*PS400
150E	AUSTRALIAN	225 kg	1*PS381+1*PS400

NOTE: BOXER 170 (E) - NO ADDITIONAL BALLAST. ALL COUNTRY SPECIFICATIONS ARE COVERED IN ONE STANDARD MODEL.

DESIGN SPECIFICATION (CHART 5):

MODEL	SPECIFICATION	RATED SLOPE (DEGREES)	RATED WIND
120E/140E	ENGLISH / GERMAN	5 DEG	10 ms-1
130E	ENGLISH / GERMAN	5 DEG	10 ms-1
150E	ENGLISH / GERMAN	5 DEG	10 ms-1
170E	ENGLISH/GERMAN	5 DEG	10ms-1
120EN/130EN	ENGLISH	5 DEG	10 ms-1
140EN/150EN	ENGLISH	LEVEL GROUND	
120E/130E	FRENCH	5 DEG	10 ms-1
140E	FRENCH	5 DEG	10 ms-1
150E	FRENCH	5 DEG	10 ms-1
170E	FRENCH	5 DEG	10ms-1
120EN/130EN	FRENCH	5 DEG	10 ms-1
140EN/150EN	FRENCH	2 DEG	
120EN	GERMAN	2 DEG	10ms-1
140EN	GERMAN	LEVEL GROUND	
120E	AUSTRALIAN	5 DEG	10 ms-1
130E	AUSTRALIAN	5 DEG	10 ms-1
140E	AUSTRALIAN	5 DEG	10 ms-1
150E	AUSTRALIAN	5 DEG	10 ms-1
170E	AUSTRALIAN	5 DEG	10ms-1

MECHANICAL COMPONENTS:

Tyre Type:	High Traction Deep Lug (Solid Rubber), 26 cm wide, 73 cm dia.
Tyre Sise:	250 - 15
Axle (120, 130, 140, 150):	4.45 : 1 ratio
Axle (170 ONLY):	14.058 : 1 ratio
Gearbox (standard model):	20 : 1 ratio
Wheels (cms):	38.1
Brakes (120, 130, 140, 150):	Service - Spring applied, hydraulically released * Parking - Spring applied, hydraulically released * * Released when the footswitch is depressed and joystick is moved in a forward or reverse direction.
Brakes (170 ONLY):	Oil immersed discs integral inside axle housing.

HYDRAULIC COMPONENTS:

Lift Cylinders:	Double-acting, with overcentre valves
Hoses:	Thermoplastic
Filtration:	Pressure

ELECTRIC COMPONENTS:

Pump Motor:	48 volt, 3.7Kw, 1200 rpm. Flow rate 10 litres/min
Pump Pressure:	150 bar (2176 psi)
Drive Motor:	48 volt, series-wound reversible. Solid state controlled
Hand Controller:	Joystick type
Batteries (120, 130, 140, 150):	Standard - Eight 6 volt HD, 170 amp/hr rate Option 1 - Twenty-four 2 volt HD, 210 amp/hr rate Option 2- Twenty-four 2 volt HD, 252 amp/hr rate
Batteries (170 ONLY):	Option 1- Twenty-four 2 volt HD, 258 amp/hr rate Option 2- Twenty-four 2 volt HD, 300 amp/hr rate
Battery Charger Type:	FM-Traction, Dual Input Auto 240/110 volts switching for 30 amp 48 volt battery charging

HYDRAULIC OIL:

Type:	BP ENERGOL HLP 22
Capacity (Reservoir):	26 litres

EQUIVALENT HYDRAULIC OILS:

BRAND	TYPE
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

BOXER MK.3

(ELECTRIC SERIES)

WORKING ENVELOPES

BOXER MK.3 (E)

WORKING ENVELOPES

1. IDENTIFICATION OF MODEL:

The various Boxer machines are identified by their working height ability, i.e., Boxer 120 (12 metre working height), or Boxer 140 (14 metre working height). The electric powered Boxer machine is available in five models - Boxer 120, 130, 140, 150 and 170.

2. STRUCTURAL DIFFERENCE (STANDARD MACHINES):

The only structural difference between the Boxer 120 and 130, and the Boxer 140 and 150, is that the Boxer 130 and 150 machines have an extended cage support post fitted to increase the working height by one metre.

The Boxer 170 differs from all the other Boxer E's by having enlarged posts, a different axle assembly, a different differential lock system, a different braking system, a larger electric drive motor and a different slew ring assembly. The cage has a Differential Lock (Diff. Lock) engagement control added to the standard control layout.

3. STRUCTURAL DIFFERENCE (NARROW AISLE BOXERS):

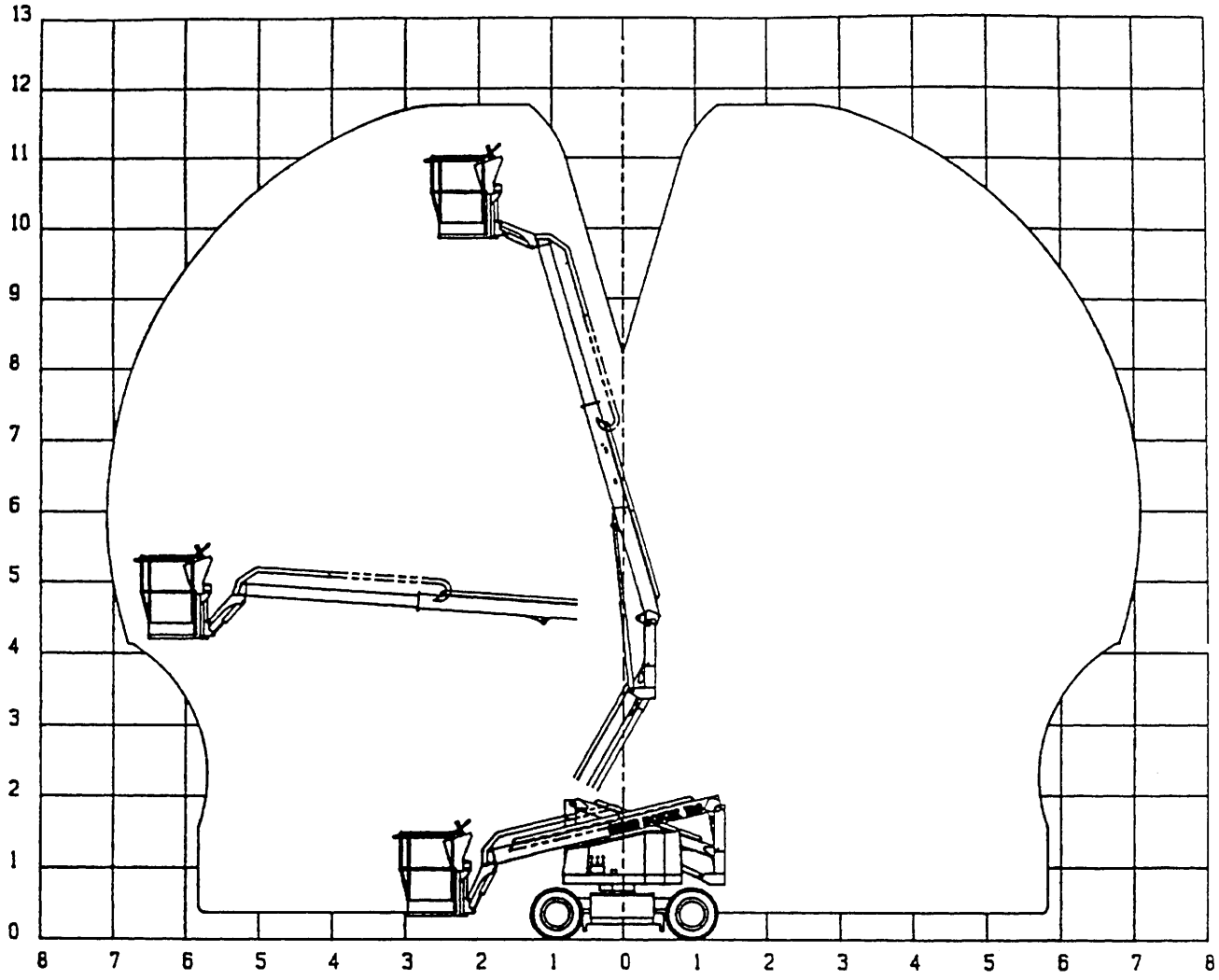
The working envelope configuration is the same as for the standard machines but the overall machine width is reduced from 1.8 metres to 1.5 metres. Due to the reduction in plinth area, some components differ in positioning from the standard machine. A G.K.N. (narrow width) axle and a Brevini gearbox are fitted in place of the G.K.N. (standard) drive axle and Brevini gearbox/ brake assembly.

4. WORKING ENVELOPES DIAGRAMS:

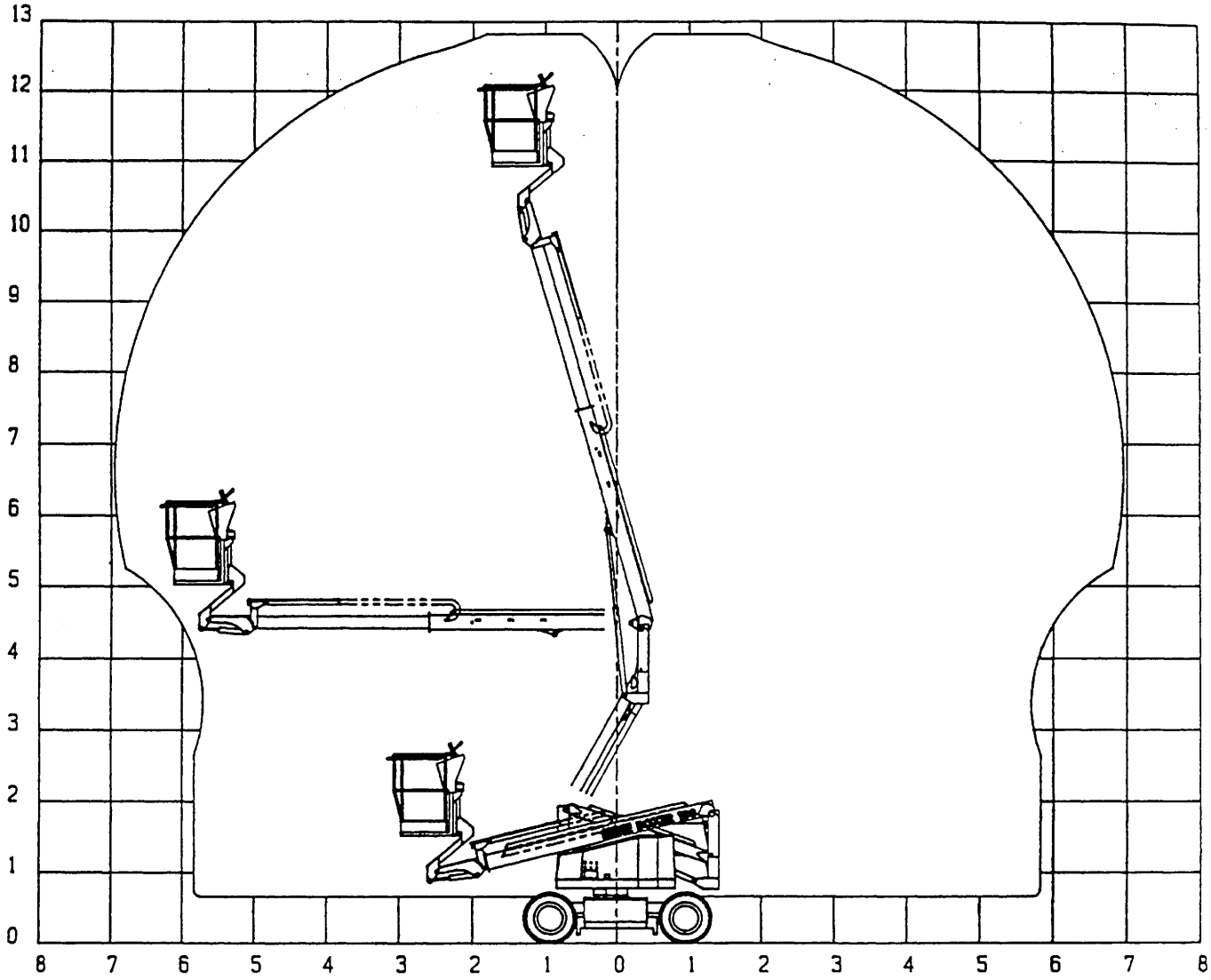
All measurements are shown in metres.

5. DIMENSIONS DIAGRAM (NARROW AISLE MACHINES):

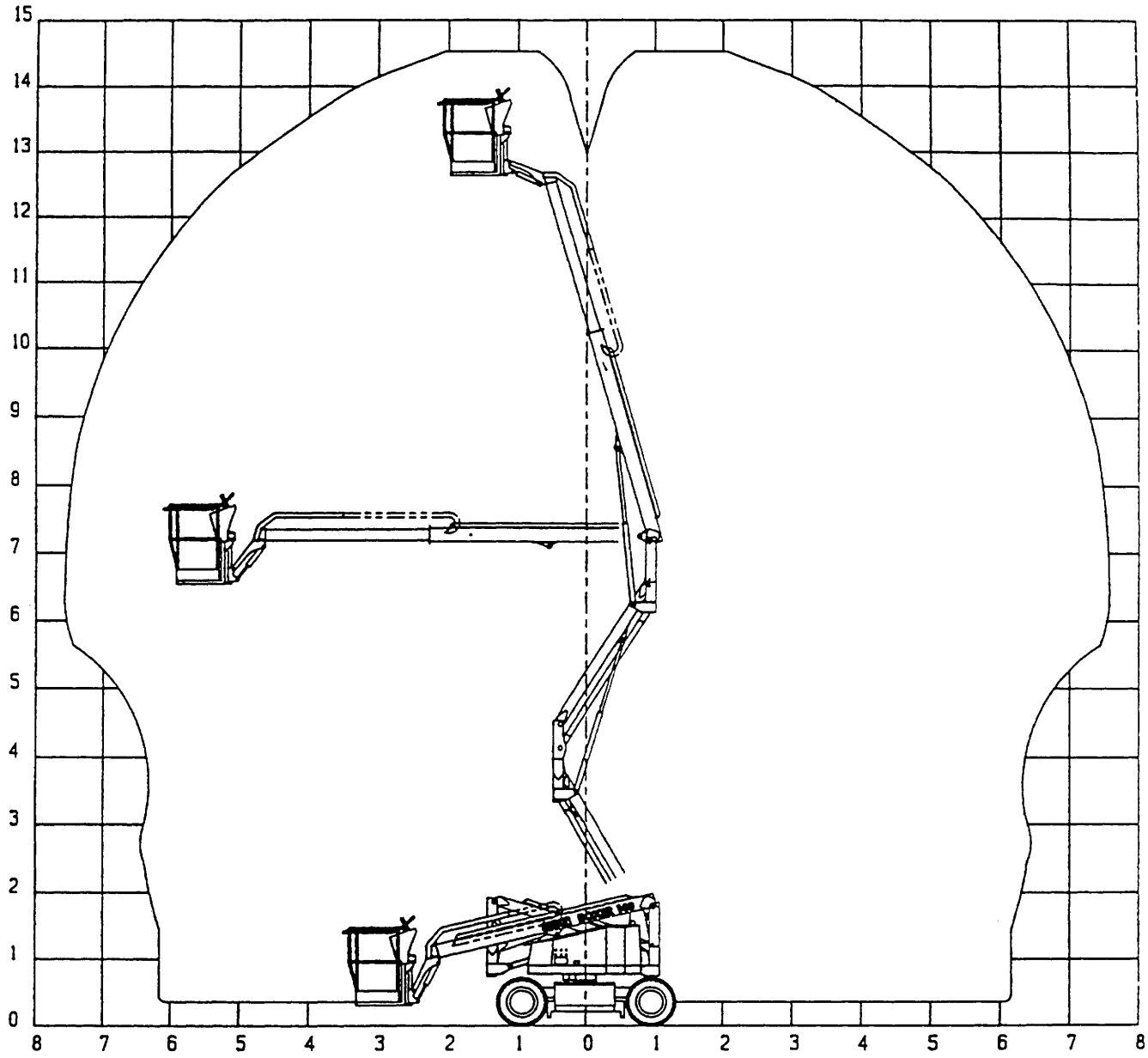
The height measurement noted in the specification (page 1.1) is a nominal two metres, but the Narrow Aisle Boxer 150's height measurement differs from the Boxer 120 and 140 machines, due to a larger cage support post. With this particular model, the cage assembly can be zoomed out to allow easy clearance of doorways and for cage entry. **See Narrow Aisle Dimensional diagrams for further details.**



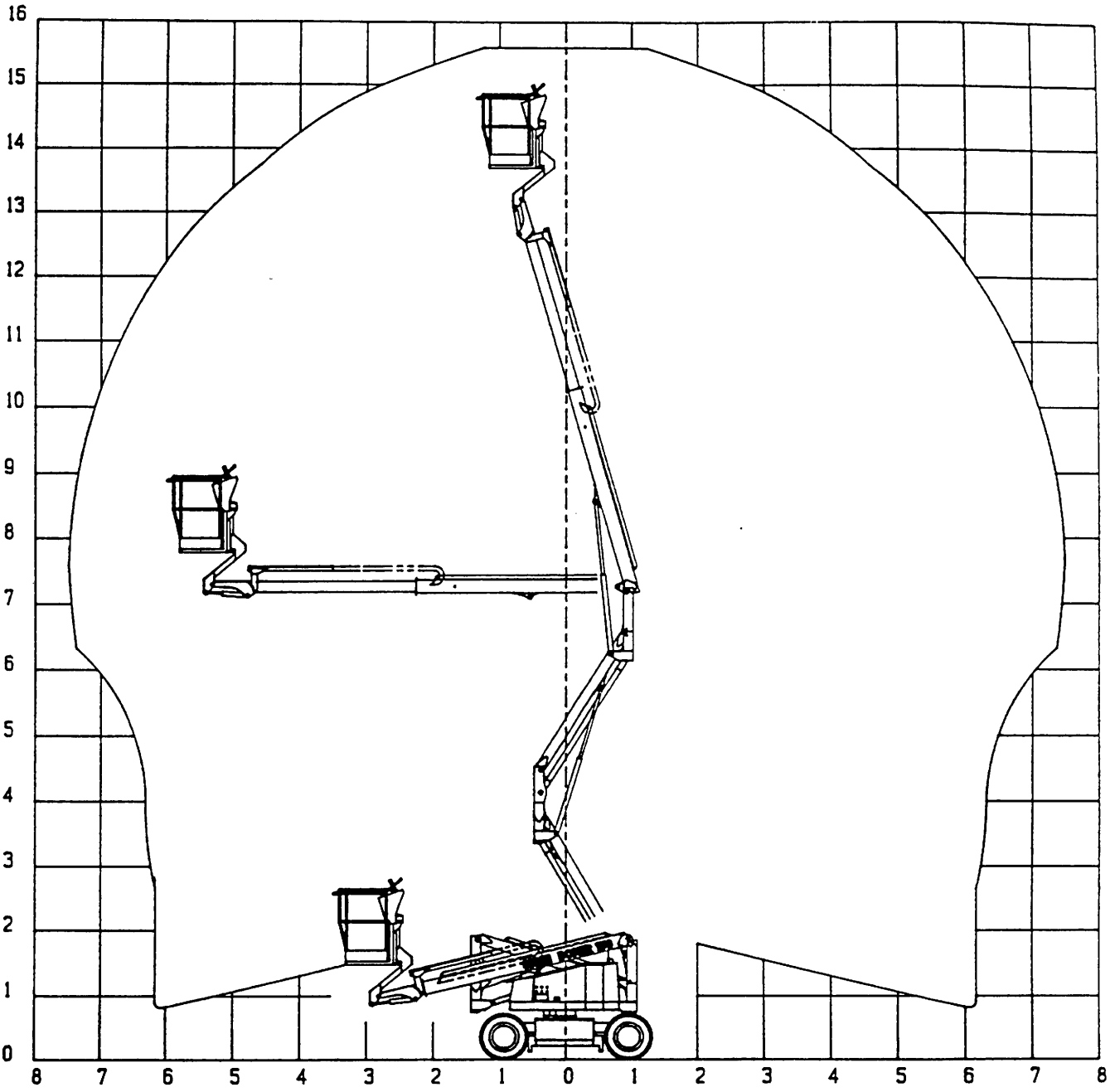
SIMON BOXER 120



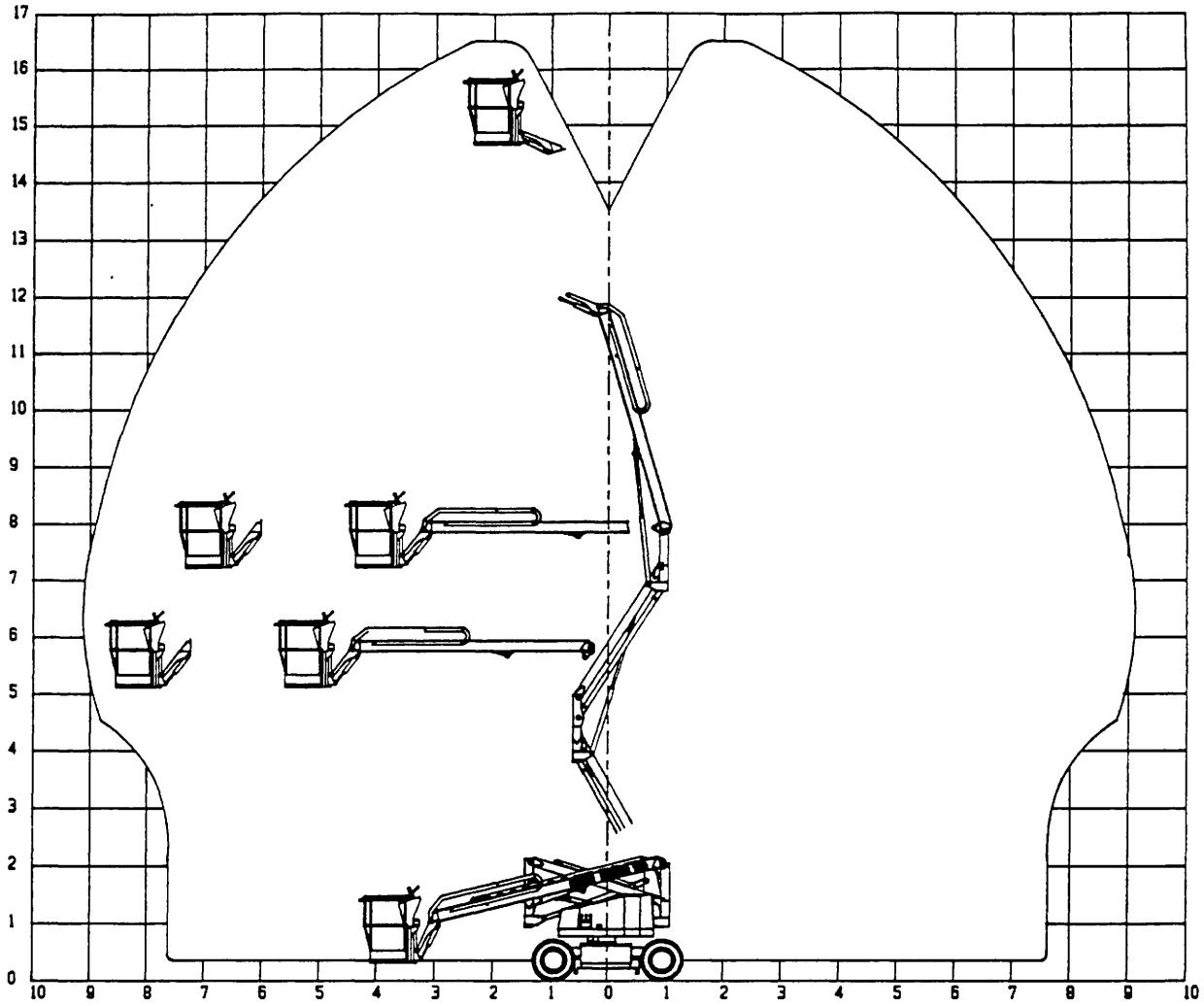
SIMON BOXER 130



SIMON BOXER 140



SIMON BOXER 150

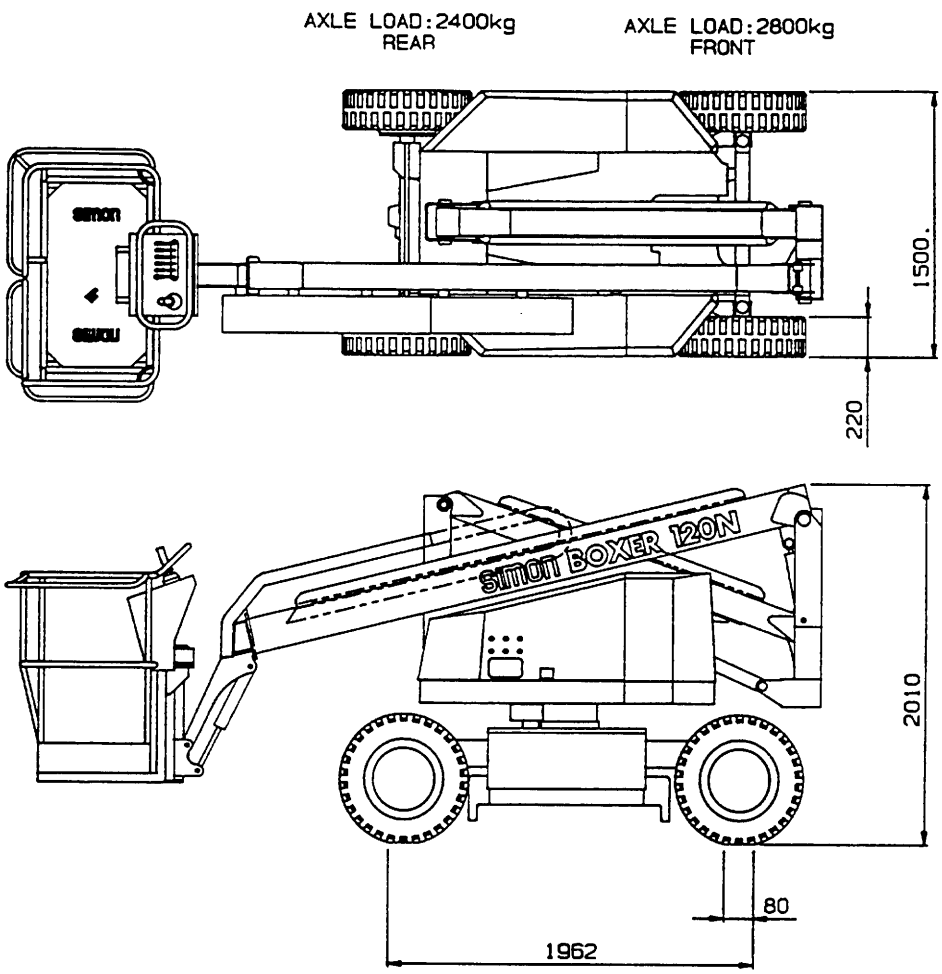


SIMON BOXER 170

BOXER MK.3

(ELECTRIC SERIES)

NARROW AISLE DIMENSIONS



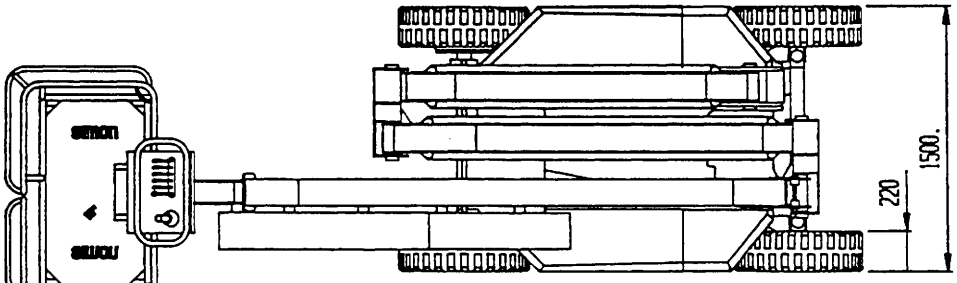
GROSS WEIGHT:5200kg

GROUND CONTACT:
TRAVELLING:180cm^2
WORKING :280cm^2

GROUND PRESSURE:
TRAVELLING:8kg/cm^2
WORKING :11kg/cm^2

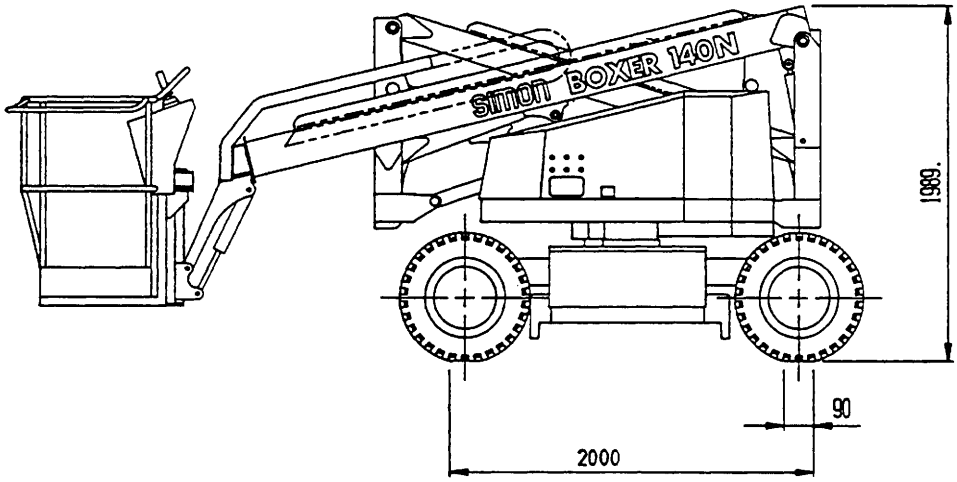
MAX TYRE LOAD:
TRAVELLING:1400kg
WORKING :3150kg

BOXER MK.3 120 N (NARROW AISLE MACHINE)



AXLE LOAD:2500kg
REAR

AXLE LOAD:3200kg
FRONT



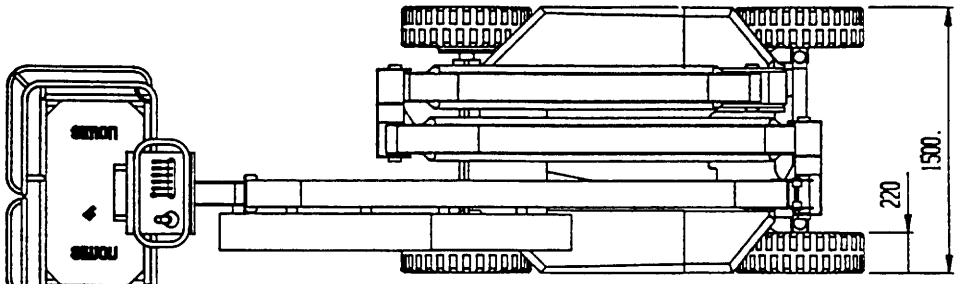
GROSS WEIGHT:5700kg

GROUND CONTACT:
TRAVELLING:200cm²
WORKING :300cm²

GROUND PRESSURE
TRAVELLING:8kg/cm²
WORKING :12kg/cm²

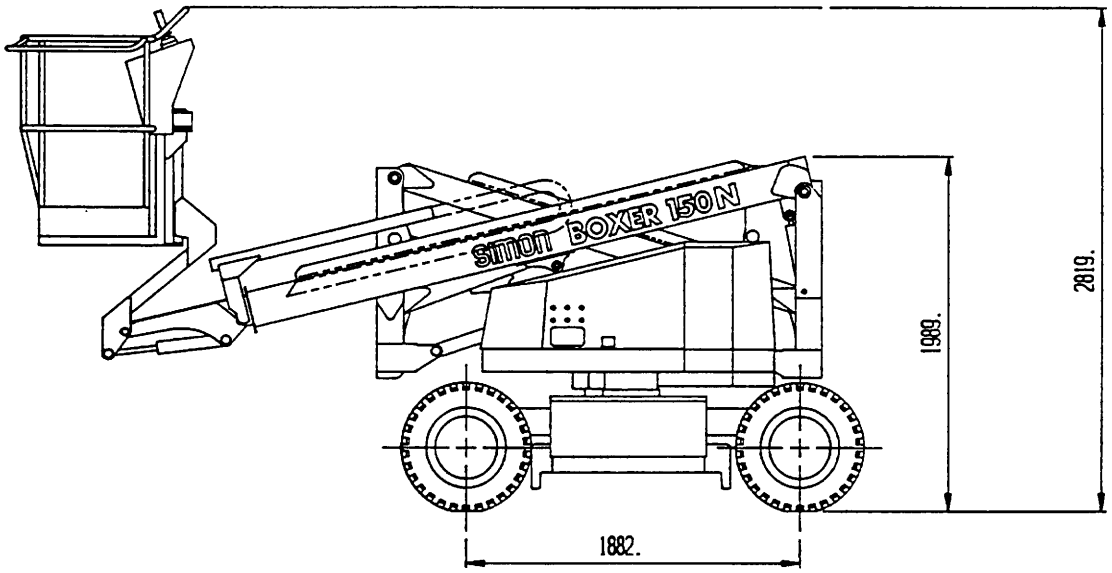
MAX TYRE LOAD
TRAVELLING:1600kg
WORKING :3580kg

BOXER MK.3 140 N (NARROW AISLE MACHINE)



AXLE LOAD:2500kg
REAR

AXLE LOAD:3200kg
FRONT



GROSS WEIGHT:5700kg

GROUND CONTACT:
TRAVELLING:200cm²
WORKING :300cm²

GROUND PRESSURE
TRAVELLING:8kg/cm²
WORKING :12kg/cm²

MAX TYRE LOAD
TRAVELLING:1600kg
WORKING :3580kg

BOXER MK.3 150 N (NARROW AISLE MACHINE)

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 SHOULD BE ALLOWED TO CONTROL THE MACHINE.**

   (c) **UNDER NO CIRCUMSTANCE SHOULD 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 SHOULD BE READ AND UNDERSTOOD:

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

   (b) "Specification for Mobile Elevating Work Platforms", Document B.S. 7171., by British Standard Institute, 1989.

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

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

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

3. HAZARDS:

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

   The following instructions are minimum requirements to be adapted for safe working practice with the Boxer Mk.3 machine:

   (a) The safe working load of 225 kgs (496 lbs) must not be exceeded (two persons only), unless specified otherwise in Chart 4 (Section 1 - Specification).

   (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 the 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 per 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 should be worn at all times, and the platform door/bar must be in position when the operator(s) 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 should be taken to avoid collision between the obstruction and the work platform, and to prevent the operator(s) from being trapped.

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

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

(i) When working in public or peopled areas, special care should be taken to prevent members of the public from approaching the work platform. The working area should be cordoned off and people prevented from walking or working underneath, where objects or the structure may descend onto them. Consideration should be given to the use of a warning hooter to signify motion of the machine where circumstances may prevent persons close to the machine being aware of its movement.

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

(k) Care must be exercised when working underneath the platform for maintenance or other purposes. The platform should be chocked up into position and the hydraulic cylinders must not be relied upon to hold position while parts of the body are in a position where they may become trapped by the superstructure.

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

(m) The operator should 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.

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

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

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 ELECTRICAL AUTHORITIES FOR ADVICE.

WARNING

SAFE WORKING LOAD: THE PLATFORM IS DESIGNED TO HOLD TWO PERSONS ONLY, AND THE SAFE WORKING LOAD OF 225 KGS MUST NOT BE EXCEEDED, UNLESS SPECIFIED OTHERWISE IN CHART 4 (SECTION 1 - SPECIFICATION).

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).

WARNING

SAFE WORKING PRACTICE: UNDER NO CIRCUMSTANCE SHOULD THIS MACHINE BE USED IN SUCH A MANNER AS TO CONTREVENE ANY INTERNATIONAL, NATIONAL OR LOCAL HEALTH AND SAFETY AT WORK REGULATIONS, OR FACTORIES ACTS AND SUBORDINATE REGULATIONS.

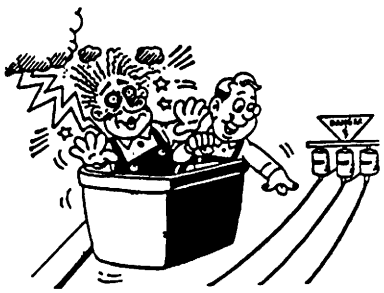
DANGER

All work carried out should be within the area bounded by the guard rails. Do not lean out.

DANGER

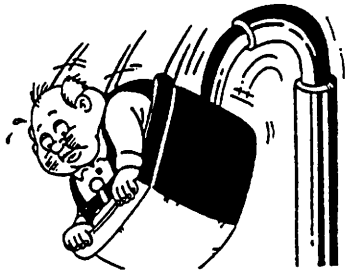
Don't ever use a work platform unless you have been selected, trained and authorised to do so.

DANGER



Keep clear of hazards such as live electrical conductors and overhead travelling cranes.

DANGER



Never exceed the safe working load recommended by the manufacturer.

DANGER

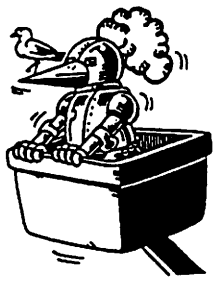
Always ensure that clearances are adequate and that there is no danger of collision with obstacles.

DANGER

DANGER

Always ensure that surfaces are level and firm and that outriggers (if fitted), sole plates and spreaders are used if necessary.

The manufacturers' instructions in inspection, maintenance and servicing should be closely followed.



Always ensure that the appropriate protective clothing is worn and that the safety harness is securely fastened when the platform is elevated.

DANGER

SECTION 3

OPERATING PROCEDURES

WARNING

READ THE SPECIAL PRECAUTIONS (PARAGRAPHS 19 TO 28) 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 must be carried out to ensure that the machine is safe and in good condition for use:-

(a) Check battery electrolyte level and connections.

(b) Check all labels are readable and secure.

(c) Check hydraulic oil level.

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

(e) Check tyres for damage.

(f) Check wheel bolts for security.

(g) Check Tilt Alarm (see SPECIAL PRECAUTIONS, paragraph 28 for details).

2. GROUND CONTROL CHECKS:

With the cage assembly empty:

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

(b) Check for:

(i) Uneven or jerky operation.

(ii) Hydraulic oil leaks.

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

WARNING

DO NOT OPERATE THE MACHINE IF THESE CHECKS REVEAL A DEFECT.

3. CAGE CONTROL CHECK:

WARNING

ENSURE THAT THE FOLLOWING CHECKS ARE CARRIED OUT ON A LEVEL SURFACE.

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

(b) Check drive and normal/emergency braking.

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

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

WARNING

DO NOT OPERATE THIS MACHINE IF THESE CHECKS REVEAL A DEFECT.

4. MACHINE USE (ON THE HIGHWAY):

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

5. DRIVE CONTROLS:

The drive controls are located in the cage assembly and consist of a joystick controller and a footswitch. The footswitch must be activated during all drive, lift and descent operations.

(a) Forward and Reverse Operation:

(i) Select "Cage" at the ground controls.

(ii) Select "Drive" at the cage controls.

(iii) Depress the footswitch. The footswitch MUST be fully depressed during all driving functions.

NOTE: To De-activate Brakes (Transmission and Wheel Brakes):

The footswitch must be depressed and the joystick control moved to give a forward or reverse motion.

6. SERVICE BRAKES (DRIVE MODE):

The Service 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 in the opposite direction to the direction of travel. It is recommended that this procedure is carried out with no pause at the "neutral" position, as this will allow smoother braking.

7. EMERGENCY BRAKING:

Emergency braking is achieved by depressing the "Emergency Stop" push-button control, by releasing the footswitch, or by returning the joystick control to neutral.

8. ACCESS CONTROLS:

The controls in the work cage are those normally used in operation. The ground controls are located on the turret and are intended for use in tests and emergencies only. Care should be exercised to avoid unauthorised interference from the ground station when the work cage is elevated.

9. ACCESS CONTROLS (CAGE ASSEMBLY):

The access controls consist of a function selector switch, function levers, rotation lever, "Emergency Stop" push-button control and a "Dead Man's" footswitch.

10. ACCESS OPERATION (CAGE ASSEMBLY):

Before Entering the Cage Assembly:

(a) Ensure that all pre-use checks are carried out.

(b) Switch on electrical power at the key-switch position.

(c) Release both "Emergency Stop" push-button controls (into the "out" position).

(d) Check that the blue "Power On" light is illuminated. If it is not, check that both "Emergency Stop" push-button controls are fully released (in the "out" position).

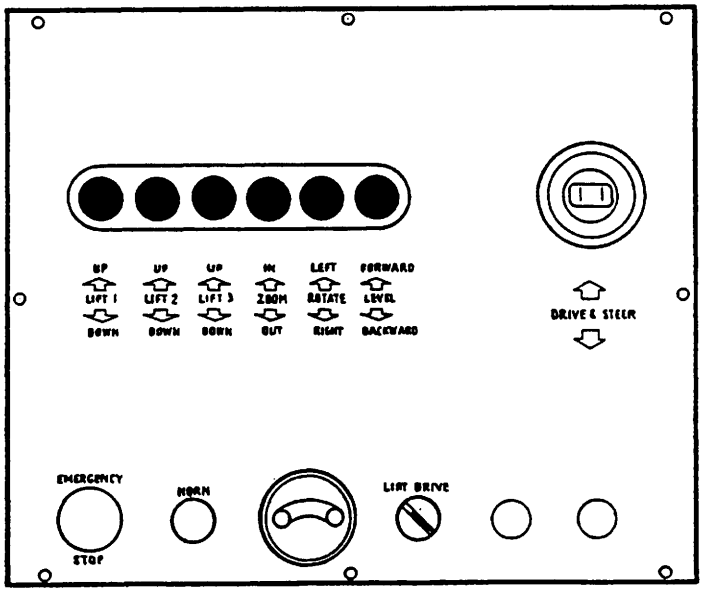
(e) Switch the station selector switch to "Cage".

After Entering the Cage Assembly:

(f) Select "Lift" mode.

(g) Depress the footswitch.

(h) Select the required function.



Available Control Functions:

-	**Lower Boom:**	Up	Down
-	**Middle Boom:**	Up	Down (Boxer 140/150 only)
-	**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.**

11. CAGE ROTATION:

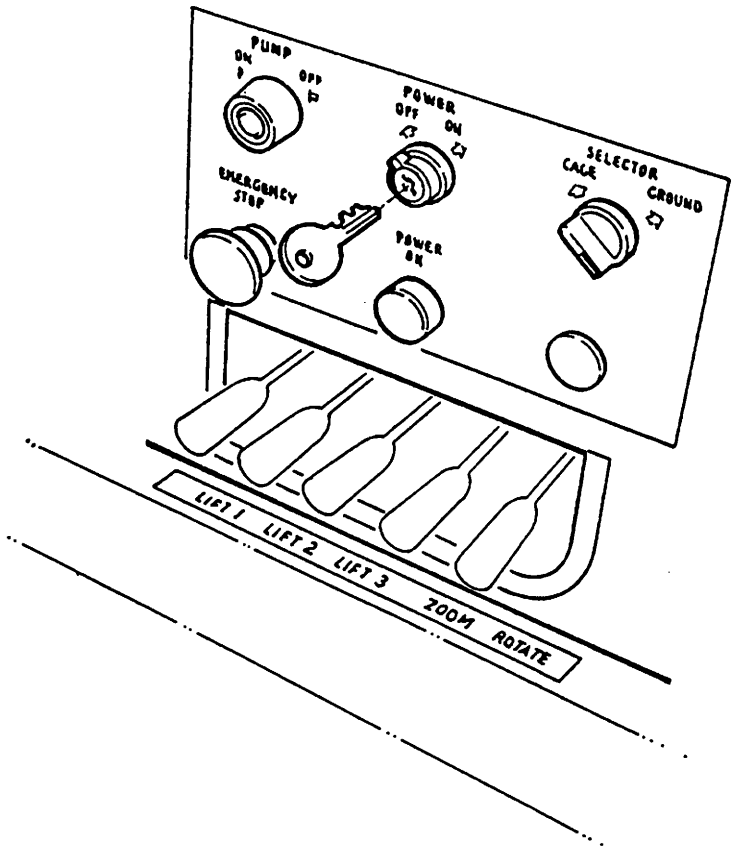
Rotation is achieved by operating a lever positioned below the cage rotation worm box. The lever releases the cage lock and allows the cage to be rotated by turning the handle on the rotation box.

12. CAGE LEVELLING:

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

13. GROUND CONTROLS:

The ground controls are located on the turret and consist of a key-activated "Power On/Off" switch, "Power On" light, "Pump On/Off" switch, "Emergency Stop" push-button control, "Lift 1", "Lift 2", "Lift 3" (Boxer 140/150 only), "Zoom" and "Rotate" levers. There is no cage levelling facility.



14. GROUND ACCESS CONTROL OPERATION:

The ground controls have identical functions to the cage controls and are for testing and emergency procedures. There are no cage levelling, footswitch or battery indicator facilities. Switch the selector switch to the "Ground" position for all ground functions.

15. COMPLEX CONTROL OPERATION:

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

16. AFTER USE:

When the machine is no longer required, switch the ignition switch to "Off" and depress the ground or cage "Emergency Stop" push-button control.

17. BATTERY CHARGING:

Battery charging is by a magnetically controlled FM-Traction charger. This charger will automatically switch to the required input voltage and will operate on 110 volts or 240 volts A.C. 50 Hz. (see Section 6 for further details).

(a) Connect charger plug to an appropriate Mains supply.

(b) Select the charge rate by inserting an insulated screwdriver into the small hole to the left of the LED display. The charge rate can be set to either a 13 hour charge or a 6.5 hour charge.

WARNING

DO NOT OPERATE THE CHARGE RATE SWITCH DURING CHARGING OPERATION.

(c) Switch "On" the charger. The "On/Off" switch is located on the charger front panel.

NOTE: **The yellow LED illuminates during the charging process. The green LED illuminates when charging is complete.**

(d) When charging is complete, switch the charger to "Off".

(e) Switch Mains power "Off" and disconnect the charger from the Mains supply point.

18. BATTERY INDICATOR:

IMPORTANT: **If the batteries have been disconnected, the battery indicator will read "Full" when the batteries are re-connected. Before disconnecting the batteries, note the state of discharge. The controller will settle to the correct level after a period of operation.**

The battery state indicator is located in the cage and is permanently displayed during machine operations. When the charge state falls to 75%, the red LED will flash as an indication that the charge rate has deteriorated to a low level.

If deterioration is allowed to continue, i.e., the battery state falls a further 5%, the battery condition will be such that no lift or descent capability will be available.

It is recommended that the machine is taken out of service as soon as the red warning LED flashes, and the batteries fully charged before any further machine operation takes place.

19. SPECIAL PRECAUTIONS - COLD WEATHER:

In very cold, "below zero" weather conditions, the hydraulic oil should be allowed to warm before full operation of the machine is carried out. Precautions must also be taken to ensure that the hydraulic oil is kept free from water contamination, by regular oil maintenance. 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 rotation drive teeth are not blocked by ice.

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

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

WARNING

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

20. SPECIAL PRECAUTIONS - OVERHEAD ELECTRICAL CABLES:

The working cage IS NOT INSULATED and extreme care must be taken when working in the vicinity of overhead electrical cables. Allowance must be made for movement of cables/machine, due to wind condition and the operator should read, "AVOIDANCE OF DANGER FROM OVERHEAD ELECTRIC LINES", Health and Safety Guidance Note GS6, by H.M.S.O. The local electricity authorities should be contacted for advice.

WARNING

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

REMEMBER - IF IN DOUBT - ASK

21. SPECIAL PRECAUTIONS - SAFE WORKING LOAD (SWL):

The maximum safe working load of the Boxer machine is 225 kgs (496 lbs) (two persons), unless otherwise stated in Chart 4 (Section 1 - Specification). When carrying out operations from the cage, the weight of tools and equipment must be taken into consideration and the safe working load MUST NOT BE EXCEEDED.

22. SPECIAL PRECAUTIONS - WIND CONDITIONS:

The machine should not be operated in wind speeds in excess of 10 metres/second (36 km/hr - 23 mph). During normal machine operations, consideration should be given to nearby objects, especially when working in the close vicinity of buildings and electrical cables, when sudden gusts of wind could cause the machine to sway and possibly trap the operator's arms/hands between the cage railing and the object. It is recommended that a reasonable safety distance is kept between close objects and the cage assembly during all machine operations.

23. SPECIAL PRECAUTIONS - TRANSPORTATION:

Care must be taken when preparing the machine for storage or transportation. The booms must be fully down and the zoom boom fully retracted.

WARNING

ENSURE ALL BOOMS ARE FULLY DOWN WITH THE TOP BOOM LOCATED WITHIN THE BOOM REST WITH THE ZOOM BOOM FULLY RETRACTED.

24. SPECIAL PRECAUTIONS - TOWING:

If a drive fault is associated with the electric drive motor or gearbox, the machine must be towed backwards (with the steering assembly to the rear). Towing speeds MUST NOT exceed 8 km/hr (5 mph), or the drive motor will be damaged. Before towing is attempted, the brakes must be disengaged and the steering lock pin removed. It is also recommeneded that the steering cylinder is safely secured to prevent accidental contact with the ground during the towing operation (see Section 4, for Emergency Procedures).

WARNING

BEFORE ATTEMPTING TO TOW THE MACHINE, ENSURE THE STEERING LOCK PIN IS REMOVED, THE BRAKES DISENGAGED AND THE STEERING CYLINDER SAFELY SECURED.

DO NOT TOW THE MACHINE AT SPEEDS EXCEEDING 8 KM/HR (5 MPH). IF THIS WARNING IS IGNORED, THE DRIVE MOTOR WILL BE DAMAGED.

25. SPECIAL PRECAUTIONS - OVERHEAD CRANE OPERATIONS:

The Boxer machine has four lifting points situated at the four corners of the chassis. The Boxer 120 and 130 (2-Stage models) weigh 4510 kgs and 4540 kgs respectively. The Boxer 140 and 150 (3-Stage models) weigh 5260 kgs and 5290 kgs respectively. During lifting operations, take all instructions from the crane operator.

26. SPECIAL PRECAUTIONS - DRIVING ON SLOPES:

There is a danger that the machine may "run away" when driving down an incline. The operator should ensure that speed is kept within the limits of 5 km/hr (3 mph) with booms stowed, and 0.75 km/hr (0.5 mph) with booms elevated.

27. SPECIAL PRECAUTIONS - BEDDING-IN NEW BRAKES (Models 120, 130, 140, and 150 ONLY):

When fitting replacement brake shoes, or re-adjusting the brakes, special attention must be taken to allow sufficient bedding-in of the brake shoes before fully operating the machine. See Section 7 for special instructions for brake adjustment.

CAUTION

BEFORE ALLOWING THE MACHINE TO BE USED FOR OPERATIONS, TEST DRIVE THE MACHINE AND OPERATE THE BRAKING SYSTEM FOR AT LEAST TEN TIMES TO ENSURE THAT THE BRAKES ARE BEDDED-IN.

28. SPECIAL PRECAUTIONS - TESTING THE TILT ALARM CIRCUIT:

The tilt alarm test is an essential safety test and must be carried out during pre-use checks (see paragraph 1.). Although the tilt alarm sensor circuit is self-checking and will sound for three seconds when the machine is switched on (to indicate that the circuit is serviceable), it is important to also carry out a manual test of the sensor by pressing down the sensor unit (located in the electrical module) to simulate a tilting movement. When this action is carried out, and provided that the amount of tilt is fully applied, the tilt warning alarm will sound.

If at any time during machine use a wire becomes disconnected in the tilt alarm circuit, the warning alarm will sound continuously, until the fault is rectified. If this should occur while the machine is in the elevated position, zoom in immediately and bring the cage down to the stowed position. **DO NOT USE THE MACHINE UNTIL THE FAULT IS FULLY RECTIFIED.**

WARNING

IF THE TILT ALARM IS ACTIVATED DURING MACHINE OPERATIONS, ZOOM IN AND LOWER THE PLATFORM INTO THE STOWED POSITION. ENSURE THAT THE FAULT IS FULLY INVESTIGATED AND RECTIFIED BEFORE THE MACHINE IS ALLOWED TO CONTINUE WITH OPERATIONS.

29. SPECIAL PRECAUTIONS - DIFFERENTIAL LOCK (DIFF. LOCK) OPERATION:

The diff. lock system fitted to the Model 170 is not an automatic type as fitted to the Boxer models 120 to 150. The system employed on the model 170 gives 100% engagement on selection and is hydraulically operated with a spring release. It is not designed for, or intended for continuous use but is fitted to give increased traction when driving on rough or undulating ground, or when in slippery conditions.

SECTION 4

EMERGENCY PROCEDURES

WARNING

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

1. PROCEDURE:

Before any emergency procedure is carried out:

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

(b) Switch ground control station selector to "Ground" and attempt to operate the ground controls.

2. CAGE OPERATOR INCAPACITY:

The cage should be lowered using the ground controls (see Section 3).

3. CAGE CONTROL FAILURE:

The cage should be lowered using the ground controls (see Section 3).

4. IMMOBILITY DUE TO LOSS OF DRIVE:

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

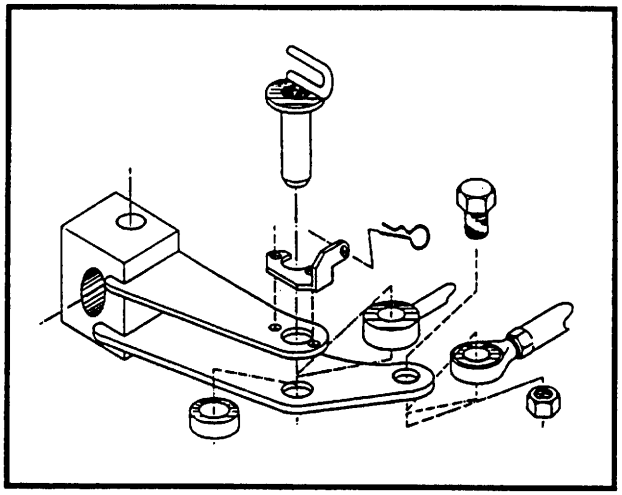
(a) Battery Failure:

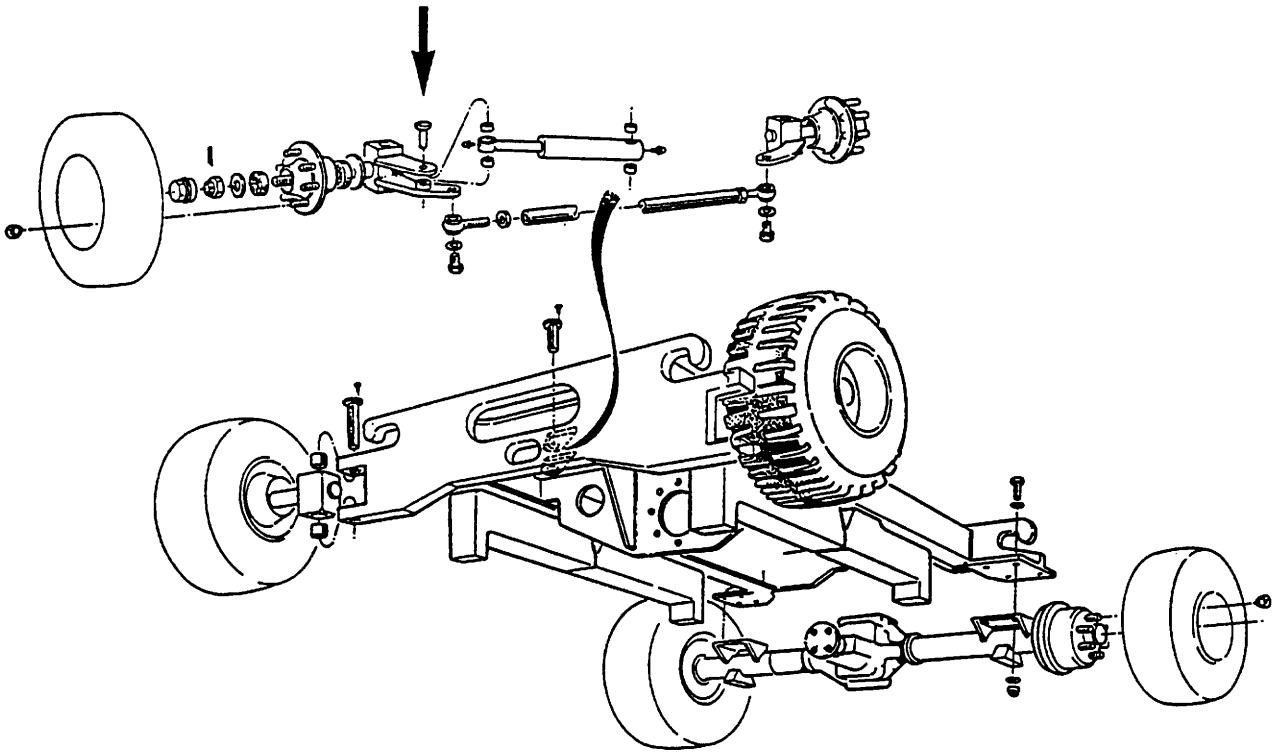
This condition will be displayed on the Battery State Indicator (cage control panel). If possible, replace weak or faulty batteries with fully charged batteries.

(b) Drive Motor/Gearbox Failure:

Towing Operations:

If a drive fault is associated with the electric drive motor or gearbox, the machine must be towed from the work site. The towing bracket is an optional fit (see page 4.2 for diagram).





THE LOCK PIN MUST BE REMOVED AND THE BRAKES DISENGAGED BEFORE TOWING OPERATIONS CAN BEGIN (REFER TO PARAGRAPH 4(b) AND 5 FOR DETAILS).

STEERING LOCK PIN LOCATION

If no towing bracket is fitted, the machine must be towed backwards (with the steering assembly to the rear). The turret must be turned 180 degrees to allow the cage to be kept clear during the towing operation (see instructions for manual rotation).

Care must be taken during the towing operation, as the cage assembly could make contact with the ground if the surface is uneven.

Towing speeds MUST NOT exceed 8 km/hr (5 mph), or the drive motor will be damaged.

Before towing is attempted, the brakes MUST be disengaged, the steering lock pin removed, and the steer cylinder safely secured to prevent accidental contact with the ground during the towing operation.

WARNING

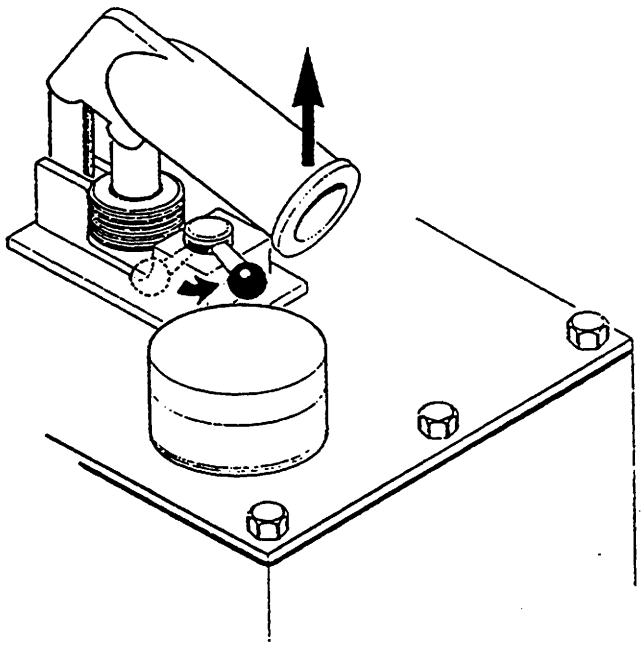
BEFORE ATTEMPTING TO TOW THE MACHINE, ENSURE THE STEERING LOCK PIN IS REMOVED, THE BRAKES DISENGAGED, AND THE STEERING CYLINDER SAFELY SECURED.

5. TO DISENGAGE BRAKES:

(a) Fully close the knurled knob on the valve block (located at the left-hand end of the module).

(b) Move the black hand pump lever (located on top of the hydraulic oil tank) to the right.

(c) Operate the hand pump (located on top of the hydraulic oil tank) until pressure has built up sufficiently to disengage the brakes.



BRAKE DISENGAGEMENT CONTROL

WARNING

DO NOT ATTEMPT TO TOW THE MACHINE WITH THE STEERING LOCK PIN IN POSITION OR WITH THE BRAKES APPLIED. ALWAYS SECURE THE STEER CYLINDER BEFORE TOWING TO PREVENT GROUND CONTACT AND POSSIBLE DAMAGE.

IF NO TOWING BRACKET IS FITTED, THE MACHINE MUST BE TOWED BACKWARDS WITH THE STEERING ASSEMBLY TO THE REAR. THE TURRET MUST BE MANUALLY TURNED 180 DEGREES, SO THAT THE CAGE IS KEPT CLEAR DURING THE TOWING OPERATION.

DO NOT EXCEED 8 KM/HR (5 MPH) WHEN TOWING. IF THIS WARNING IS IGNORED, THE DRIVE MOTOR WILL BE DAMAGED.

6. TO RE-ENGAGE BRAKES:

When the operations in Paragraph 5 are completed, fully open the knurled knob on the valve block (located at the left-hand end of the module), and move the black hand pump lever (located on top of the hydraulic oil tank) to the left.

7. OVERHEAD CRANE OPERATION:

If towing is impossible, due to terrain or the close proximity of buildings, it is recommended that the machine is removed from the site with the use of an overhead crane.

The Boxer has four lifting points situated at the four corners of the chassis. The Boxer 120 and 130 (2-Stage models) weigh 4510 kgs and 4540 kgs respectively. The Boxer 140 and 150 (3-Stage models) weigh 5260 kgs and 5290 kgs repectively. During lifting operations, take all instructions from the crane operator.

8. HYDRAULIC PUMP FAILURE:

All functions can be achieved by moving the black handpump lever to the left and operating the handpump (located on top of the hydraulic oil tank, in the left-hand module), then depressing the relevant ground control function lever and operating the handpump.

NOTE: **Zoom and Lift functions are difficult and will require some effort.**

Lowering All Booms:

The booms can be lowered by moving the black handpump lever to the left, then depressing the relevant ground control function lever and operating the handpump.

9. EMERGENCY ROTATION:

Rotation can be carried out hydraulically, using the handpump and function lever (U.K. and Swedish machines), or by manually turning the square shaft on the worm gearbox (located under the rotating turret) with a 17mm (5/8") socket. An extension bar will be required to reach the shaft.

10. EMERGENCY LOWERING FROM THE CAGE ASSEMBLY (OPTIONAL):

Certain Boxer models have Emergency Lowering facilities incorporated in the cage assembly. The lowering control is situated to the right of the main machine controls and consist of a selection lever, pump assembly, and handpump (handle stored at the bottom right-hand side of the cage).

To Lower Cage:

(a) Fit handpump handle to Emergency Lowering pump.

(b) Depress selection lever to the "down" position.

(c) Operate the handpump handle to lower the boom.

SECTION 5

THE HYDRAULIC CIRCUIT

1. THE PUMP MOTOR:

A 48 volt D.C. 3.7Kw motor/pump unit provides all hydraulic power. The pump is rated at 10 litres/min and pressure is 150 bar (2176 psi).

2. LIFT FUNCTION VALVE MANIFOLD BLOCK:

The valve block controls:

(a) Steer valve with cross-line relief, and brake release.

(b)

Up/Down	-	Lower Boom
Up/Down	-	Middle Boom (Boxer 140/150 only).
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 via a function switch at ground control.

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 CYLINDERS:

The lift cylinders are of the double-acting type with "Banjo" mounted over-centre valves at the cylinder base.

5. ZOOM CYLINDER:

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

6. CAGE LEVELLING CYLINDERS:

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.

7. HYDRAULIC OIL TANK:

The oil tank comprises of 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. BRAKING SYSTEM (Models 120, 130, 140 and 150 ONLY):

The machine has two braking systems - (a) Service Brakes, and (b) A Parking brake:

(a) Service Brakes:

The service brakes are situated at both drive wheels and are spring-applied when the machine is static. The brakes are hydraulically released whilst the machine is in motion.

(b) Parking Brake:

The parking brake is situated at the reduction gearbox and is spring-applied when the machine is static. The brake is hydraulically released whilst the machine is in motion.

The system has a delay device fitted to enable the service brakes to operate before the parking brake. Both braking systems are hydraulically released simultaneously when the footswitch is depressed and the joystick moved to a forward or reverse position.

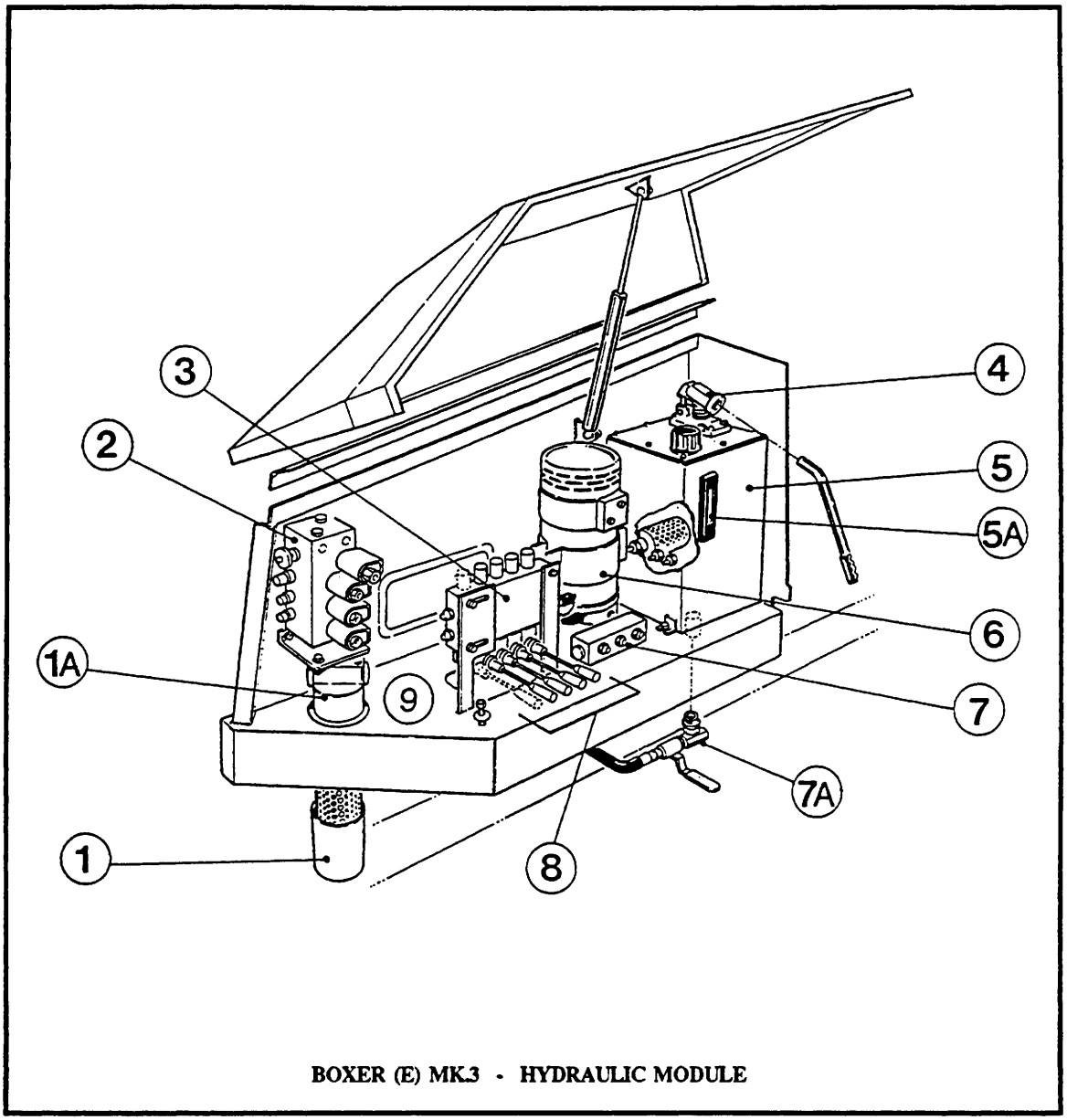
9. BRAKING SYSTEM (Model 170 ONLY):

The 170 machine has powerful oil immersed disc brakes which are integral within the axle housing.

The brakes are 'fail-safe' and are spring applied and hydraulically released. The brakes are hydraulically held in the release position when the machine is in motion.

10. THE HYDRAULIC MODULE:

The main hydraulic components are located within this module and are shown in the location diagram (page 5.3).



BOXER (E) MK.3 - HYDRAULIC MODULE

KEY:

1. PRESSURE FILTER ELEMENT
1A. PRESSURE FILTER
2. MANIFOLD BLOCK
3. FOUR OR FIVE PORT BANK VALVE
4. EMERGENCY HANDPUMP
5. HYDRAULIC OIL TANK
5A. OIL LEVEL GAUGE
6. HYDRAULIC PUMP MOTOR
7. RETURN MANIFOLD
7A. $^{3}/_{4}$" BALL VALVE
8. FUNCTION CONTROL LEVERS
9. DIFFERENTIAL LOCK ENGAGEMENT MANIFOLD (OPTIONAL)

SETTING-UP PROCEDURES

(BOXER 120, 130, 140, 150 and 170)

NOTE: **A pressure take-off test point is located at the pump input part of the ground control valve bank (not shown on diagram).**

1. RELIEF VALVES:

(a) Adjust the relief valve on the directional ground control valve bank to exceed 150 bar, i.e., turn fully clockwise. Connect a pressure gauge to the test point.

(b) Select "Ground Control" and switch the key-switch to "ON".

(c) Operate the "Zoom In" lever and the pump control. Note the pressure reading.

NOTE: **Pressure should be 150 bar. Adjustment is available at the front relief valve on the base of the Lift/Steer manifold (located on the back panel of the hydraulic module).**

If the pressure is too low, screw in the relief valve adjuster until 150 bar is obtained. Lock the adjuster.

(d) Continue to operate "Zoom In" while adjusting the relief valve on the ground control bank. Stop adjustment when the pressure gauge reading just drops below 150 bar. Re-adjust until reading is 150 bar.

Applicable to Boxer 120/130 Only:

(e) Select "Cage" and operate "Zoom In" from the cage controls (depress the footswitch to activate pressure).

(f) Monitor the pressure at the ground test point and adjust the cage relief valve until the pressure reading just drops below 150 bar. Re-adjust until the reading is 150 bar.

(g) Select "Cage" and "Drive" and operate "steer left" on the joystick. The pump should operate and the wheels should steer to the left.

(h) Switch the key-switch ignition to "OFF". Connect a pressure gauge to the high pressure test point on the Accummulator Block (located beneath the chassis).

(i) Switch the key-switch to "ON". Operate the steering to the left, until maximum steering is obtained. Note pressure reading.

NOTE: **Pressure should be 130 bar. If the pressure is too low, adjust the appropriate cross-line relief valve on the Lift/Steer manifold (the two valves behind the system relief valve).**

(j) Repeat the procedure for "Steer Right" by adjusting the remaining relief valve.

SECTION 6

THE ELECTRICAL CIRCUIT

1. INTRODUCTION:

The main electrical components are located in the Electrical Module (see diagram, page 6.5).

The electrical circuit has two distinct parts:

(a) The Access Circuit:

Controls Lift, Zoom, Rotate and Steering. This circuit is basically two duplicate circuits for cage and ground operation, individually controlled by the ground selector switch.

(b) The Drive Circuit:

Controls the drive motor, via a transistor control.

2. BATTERIES:

(a) Battery Charger:

Battery charging is by a FM-Traction Battery Charger. This charger differs from conven tional chargers by having a magnetically stabilized charging characteristic curve independ ent of mains voltage. Switching between 110 volts and 240 volts is carried out automatic- cally by a special voltage sensing circuit and full battery condition control is achieved by a 933/3 Battery Controller and Indicator (see paragraph 17 - Section 3, for information on charging procedures).

(b) Battery Controller:

The 933/3 battery controller ensures economical use of the machine's battery supply and displays this information on the Battery State Indicator (located on the cage control panel).

The controller provides full Lift lock-out to prevent damage to the batteries and machine. Lock-out is enabled by a silicon controlled rectifier (SCR) and reduces the chance of welded contacts from breaking high pump motor currents. The Lock-out point is pre-set for full scale termination at 80% depth of discharge and should not be adjusted without the advice of Simon Aerials Ltd.

(c) Battery State of Charge Indicator:

The 933/3 Indicator (located on the cage control panel) displays the batteries' state of charge and provides the operator with information on which to base his operational decisions. The indicator uses a needle that represents state of charge from full to empty and uses the internationally-recognised colour code of green for "Full/Go" and red for "Empty/Stop".

When the charge rate falls to 75% of full charge, the red LED (positioned at top centre of the indicator) flashes to indicate that the battery charge rate has deteriorated to a low level. If deterioration is allowed to continue and the battery state falls a further 5%, the battery condition will be such that no lift or descent capability will be available.

It is recommended that the machine is taken out of service as soon as the red warning LED flashes, and the batteries fully charged before any further machine operation takes place.

If the batteries are fully charged, but the red LED continues to flash, resetting of the battery cutout system is required. See Item 14, page 6.3 for procedure.

4. PUMP AND DRIVE MOTORS:

The pump motor is a 48 volt fixed speed motor, rated at 3.7kW at 1200 rpm. The flow rate is 10 ltrs/min and the pressure is 150 bar. The motor is started by a heavy duty contactor.

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

5. EMERGENCY STOP CONTROL SWITCHES:

Two "Emergency Stop" push-button switches - at the ground station and in the cage, act as power "On/Off" switches. **Both switches must be "On" to operate the machine.** When either of the switches is depressed, all functions stop immediately and the Parking Brake is automatically applied.

6. FOOTSWITCH:

The footswitch must be fully depressed before any machine operation can be carried out. When the footswitch is released, the electrical supply to the hydraulic pump and the drive function is terminated and all machine functions stop. The footswitch is located in the cage.

7. TILT ALARM:

Two types of Tilt Alarm can be fitted to the Boxer machines, depending upon the specification required. All standard Boxers are fitted with a 5° tilt alarm. The Boxer 120/130 Narrow Aisle machine is fitted with a 5° tilt alarm (coloured black) but the Boxer 140/150 Narrow Aisle machine is fitted with a 2° tilt alarm (coloured blue). The Tilt Alarm sensor is located in the Electric Module. Refer to Section 3, paragraph 1 and 28 for further details.

8. MOVEMENT ALARM:

The Movement Alarm is activated as soon as the machine is in the drive mode.

9. RELAYS - IDENTIFICATION AND FUNCTION:

The functions of the relays are (looking left to right):

1.	TILT ALARM	4.	OVER-CENTRE (BRAKE)
2	FORWARD/REVERSE	5.	LOCK-OUT (LIFT)
3.	WARNING HORN	6.	PRESSURE SWITCH (BRAKE)

10. D.C. CONTACTORS:

The "Forward/Reverse" SW 182 Contactor is a paired single-pole double-throw contactor. The "Traction and Pump" isolating SW 180 Contactors are single-pole single-throw (On/Off) contactors. Both contactors have silver cadmium oxide contacts. The contacts have been designed to operate with the the minimum of "bounce" and are extremely hardwearing.

The contactor coil connections use 6mm spade connectors. Power dissipation at 50% is 15-25 Watts. Power dissipation at 100% 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 has been attracted to the magnets, and it is recommended that periodic cleaning with the aid of a pressurised air-line is carried out.**

11. D.C. CONVERTER (48 VOLTS TO 12 VOLTS) (OPTIONAL):

The converter is fitted when a 12 volt supply is required for lights and warning beacons.

12. AUTOMATIC BEACON WARNING SYSTEM (OPTIONAL):

The beacon will activate when any function is operated. There are two types of beacon available - one has no moving parts and gives an intense light (Part No. 10834), the other has a rotating reflector with a less intense light (Part No. 10097).

13. FUSES:

Four low value fuses are situated in the electrical module and are located in front of the six relays. The fuses protect the main machine ancillary functions and are identified (looking left to right): F1 - 5 Amp; F2 - 10 Amp; F3 - 3 Amp; and F4 - 5 Amp.

Two 325 Amp fuses are fitted at the right-hand rear bulkhead of the module and protect the pump and drive circuits (refer to the electrical circuit diagram).

14. RESET PROCEDURE - BATTERY CUTOUT SYSTEM:

If the batteries are fully charged, but the red LED on the cage control panel battery charge indicator continues to flash, resetting of the battery cutout system is required.

To reset:

(a) Disconnect the batteries.

(b) Open the cover above the battery charger so you can see the terminal strip.

(c) Remove the cover from the battery controller.

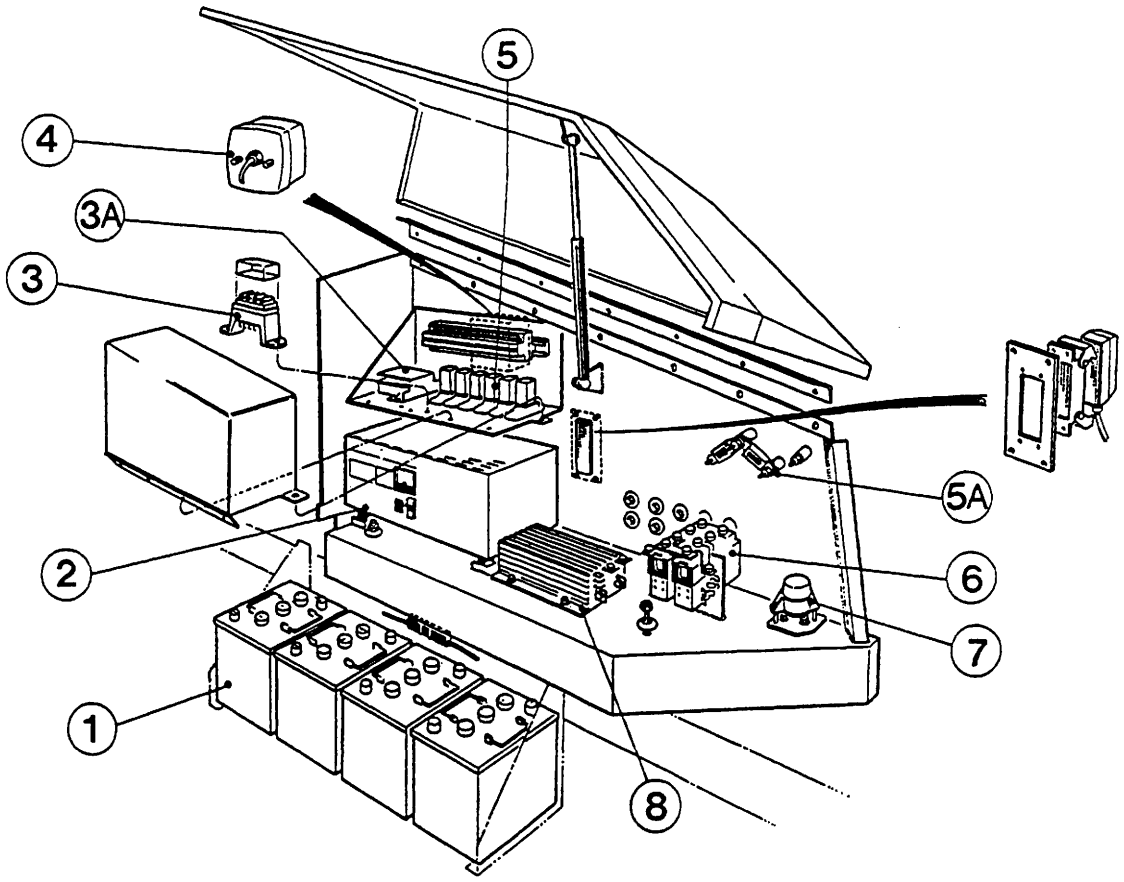
(d) Remove the jam nut from the left adjuster, and make a mark where the indicator is pointing.

(e) Rotate the adjustment knob fully counterclockwise. Leave the knob in that position for at least six (6) minutes.

(f) Reset the adjustment knob to its original position (at the mark made in step "d"). Replace the jam nut.

(g) Reconnect the batteries and test the unit.

1. 6v BATTERY
2. BATTERY CHARGER
3. FUSES (See para. 13)
3A. BATTERY CONTROLLER
4. HORN
5. RELAYS 1-6 (See para. 9)
5A. FUSE 325 AMP (TWO OFF)
6. CONTACTORS
7. TILT ALARM
8. D.C. CONVERTER



BOXER MK 3 - ELECTRIC MODULE AND BATTERIES

[redacted]

DRIVE MOTOR CONTROLLER

1. INTRODUCTION:

The controller is a sealed unit and no rectification is possible. The following notes are to assist in general fault-finding to determine if the fault lies within the controller, or some other part of the control circuit.

The controller has built-in features to protect against damage caused by low voltage. The power to the motor is reduced when the battery voltage falls below approximately 18 volts. The controller is also protected against damage from overheating by reducing the power to the motor if the internal temperature exceeds 71°C (160°F). Machine overloading may cause overheating and power output will be reduced for as long as the overheating condition remains. Full power will return when the unit cools.

WARNING

1. RUNAWAYS: SOME FAULT CONDITIONS CAN CAUSE THE MACHINE TO RUN UNCONTROLLABY. BEFORE ATTEMPTING TEST PROCEDURES ON THE MOTOR CONTROL CIRCUITRY, IT IS ADVISABLE THAT THE MACHINE IS JACKED UP AND THE WHEELS FREE OF CONTACT WITH THE GROUND.

2. HIGH CURRENT ARCS: ELECTRIC MACHINE BATTERIES CAN SUPPLY VERY HIGH POWER FOR SHORT PERIODS. IF BATTERIES ARE ACCIDENTLY SHORT-CIRCUITED, ARCS CAN OCCUR. DISCONNECT THE BATTERY CIRCUIT BEFORE ATTEMPTING WORK ON THE MOTOR CONTROL CIRCUIT. WEAR SAFETY GLASSES AND USE INSULATED TOOLS TO PREVENT ACCIDENTAL SHORT-CIRCUITS.

3. LEAD ACID BATTERY PRECAUTION: CHARGING OR DISCHARGING BATTERIES GENERATE HYDROGEN GAS. ALWAYS FOLLOW BATTERY MANUFACTURER'S RE-COMMENDATIONS WHEN WORKING AROUND BATTERIES. ALWAYS WEAR SAFETY GLASSES.

2. TROUBLE SHOOTING THE CURTIS 1205X SPEED CONTROLLER:

The following procedures are intended to assist users of the above controller to diagnose problems in the field. The controller is sealed and no field rectification is possible. If a controller fault is diagnosed, the faulty controller must be returned to Simon Aerials Ltd.

With this guide it should be possible to identify faults in other parts of the motor control system. It is important that the tests be carried out in the order they are written. If not, the conclusions reached may not be valid.

The controller has certain features designed to protect against low batteries. Power to the motor is reduced when the battery voltage falls below 18 volts. The batteries should not be allowed to discharge to this level and most battery manufacturer's recommend a maximum discharge level of 80%.

Other features protected with the controller include:-

(a) Over current protection.

(b) Over temperature protection.

(c) Safety protection circuits to conform to E.E.C. regulations, as a minimum requirement.

The tests are carried out with a VOLT-OHM-METER and a CLAMP-ON current meter. Current shunt and millivolt meter set-up can also be used in place of the clamp-on current meter.

WARNING

BEFORE WORKING ON AN ELECTRIC VEHICLE, THE DRIVE WHEELS MUST BE RAISED CLEAR OF THE GROUND. TAKE ALL PRECAUTIONS NECESSARY TO PROTECT YOURSELF AND OTHERS FROM THE POTENTIAL DANGERS OF WORKING WITH LEAD-ACID BATTERIES AND HIGH CURRENTS BEFORE ATTEMPTING TO CARRY OUT FAULT-FINDING ON THE MACHINE.

REFER TO THE MAIN ELECTRICAL SCHEMATIC DRAWING AND DRAWING No. DS463. ENSURE THAT THE CONTROLLER IS CONNECTED AS SHOWN.

3. SERVICING CHECKS - DRIVE MOTOR CONTROLLER:

Check for Power To the Controller:

(a) Check all connections are sound and there are no short circuits between connections or to chassis.

(b) Check that battery (-ve) connects to the B- terminal of the controller. Connect meter (-ve) lead to the B- terminal (Test Point A).

(c) Connect the voltmeter (+ve) lead to the controller B+ terminal (Test Point B). A reading of one to five volts less than full battery voltage should be obtained. If this voltage is zero or close to zero, the problem is either a faulty controller, a faulty 250 ohm resistor fitted across the LINE contactor, or a damaged cable from the contactor to the controller B+ terminal.

Check both the resistor and cable before reaching the conclusion that the controller is faulty.

If full battery voltage is observed, check that the LINE contactor contacts are not welded together. Rectify as necessary.

4. SERVICING CHECKS - CONTACTOR OPERATION AND KEYSWITCH INPUT:

(a) Turn the keyswitch to "On" and operate any other switches that are required to activate the LINE contactor. Refer to the machine wiring diagram.

NOTE: **The LINE contactor should make contact with an audible "click". The keyswitch input to the controller should also be active. This can be confirmed by connecting the voltmeter to B- (Test Point A) and the top pin of the 7-position connector of the controller (Test Point C). Battery voltage should be detected.**

(b) If the LINE contactor and the keyswitch are not powered, use the voltmeter to locate the fault. Connect the meter lead to B- (Test Point A), and check both sides of the control fuse (Test Point D and Test Point A) and the contactor coil (Test Point F).

(c) With the LINE contactor made, connect the meter across the main connections of the LINE contactor (Test Point H). There should be NO measurable voltage. If there is a significant voltage at this point, it will be necessary to investigate the contactor. Rectify any faults before continuing with the remainder of the checks.

(d) With the keyswitch to "On" and the LINE contactor made, operate the direction select lever. An audible "click" should be heard as the associated contactor switches. Check that the opposite direction contactor switches in the same manner.

If the direction contactors do not operate, the following checks should be carried out:

(e) With all the required switches made, to select a direction, connect the meter lead to B- (Test Point A) and check that the battery voltage is apparent on one of the lower two pins (Test Point I - Green wire and Test Point J - Yellow wire) of the 7-position connector of the controller. Carry out the same check with the opposite direction selected. Battery voltage should only appear on one of these pins in either direction.

NOTE: **If there is no voltage reading, check the associated wiring. These wires are part of the safety detection circuit. The controller will not operate if the appropriate signal is not detected.**

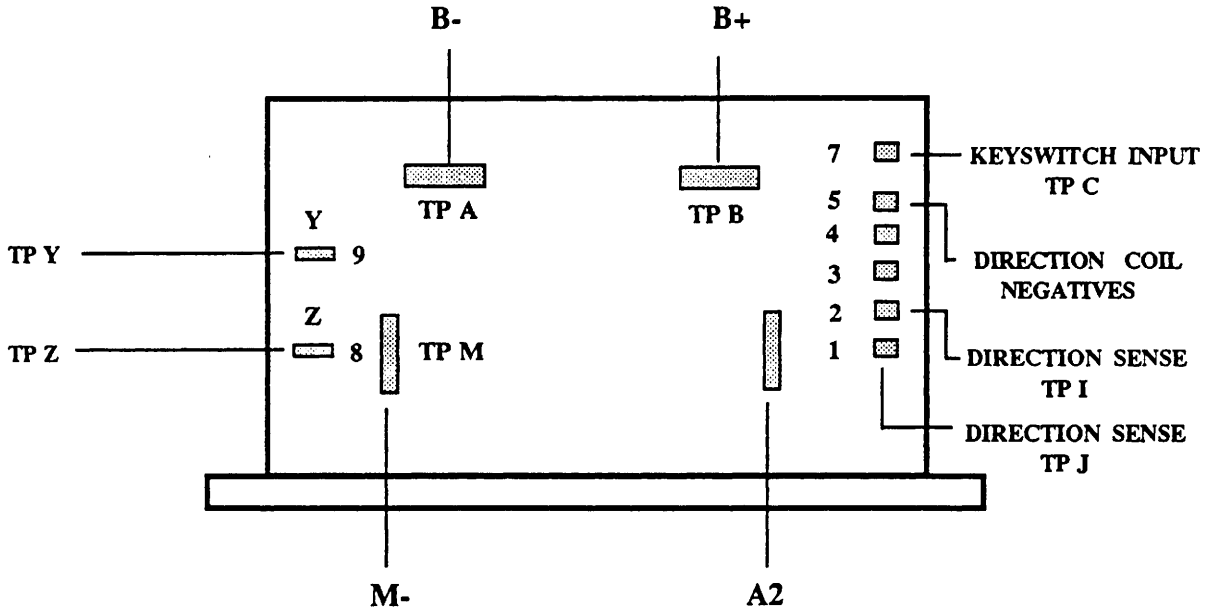
(f) Connect a jumper lead from B- to both contactor direction coil (-ve) terminals and check that the contactors will switch. If they do switch, there is either a fault with the controller or a poor connection associated with the white wire of the 7-position connector. Check the white wire is connected correctly.

NOTE: **The above checks could, at this point, suggest a faulty controller. However, the remaining checks must be made before finally coming to this conclusion.**

5. SERVICING CHECKS - JOYSTICK CONTROL CIRCUITRY:

Motor Operates but Joystick Control Incorrect:

If the problem is that the motor operates, but the control action of the joystick is wrong, switch the key switch to "On" and check for the following voltages at the Controller, with respect to the B- terminal:-



		NEUTRAL	FULL TRAVEL
	TP Y	10.1v + or -0.2v	10.1v + or -0.2v
	TP Z	2.9v + or -0.2v	7.2v + or -0.2v
ELEVATED	TP Z	2.9v + or -0.2v	4.1v + or -0.2v

NOTE: **If these voltages are incorrect, the fault is caused by the joystick, or because the supply voltages to the joystick are incorrect (+48v at terminal 15 or 81 with respect to terminal 33).**

(a) Remove joystick wires 3 and 19 from the controller and check for short circuits between them and the machine frame with an ohmeter. The correct resistance reading should be at least 1 megohm. If the reading is lower than 1 megohm, inspect the wiring for damaged insulation. If necessary, replace the joystick. Re-connect the wires on to the correct controller terminals.

(b) Carefully inspect the terminal area of the controller. Dirt or acid residue may cause electrical leakage between the joystick input terminals and the B- and/or M- terminals and cause faulty joystick operation.

(c) Carefully clean the terminal area of the controller with a Q-tip or clean rag moistened with water, and dry thoroughly. Re-test the controller to establish if the correct functions are available.

6. SERVICING CHECKS - CONTROLLER OUTPUT:

Connect the voltmeter (-ve) lead to the B- terminal (TP A).

Connect the voltmeter (+ve) lead to the M- terminal (TP M).

(a) With the keyswitch "On", and the joystick pushed slightly forward or in reverse so the contactor energizes, the battery voltage should be observed.

(b) As the joystick is moved towards maximum, the voltage should decrease towards zero.

(c) If the voltage decreases towards zero but the motor does not turn, check the motor brake is "Off" (if fitted). Check the motor cables for continuity, and for shorting to each other, or to the chassis. Check the motor for armature and field coil faults. Check the motor brushes are in a usable condition.

(d) If battery voltage is not observed but the motor operates at full speed, the controller is faulty. Check that all the required switches are made and able to pass current.

7. SERVICING CHECKS - CURRENT LIMIT SETTING:

These checks require the use of a CLAMP-ON ammeter or a current shunt (rated to suit maximum control current) and a millivolt meter. The clamp-on instrument is much easier to use and is clamped around the M- cable.

If the current shunt is to be used, it should be connected in series with the M- terminal and the appropriate cable. The millivolt meter is connected across the shunt.

The following checks are for the use of a CLAMP-ON meter:-

(a) Remove the blocks holding the drive wheels clear off the ground. Stall the drive motor and ensure that the drive wheel cannot turn.

CAUTION

DO NOT HOLD THE MOTOR STALLED FOR LONGER THAN NECESSARY.

(b) Fit the clamp-on meter around the M- cable (TP O - refer to Electric Drive Circuit Drawing Number DS 463).

(c) Operate the joystick to maximum (in forward or reverse) and read the meter. The reading obtained should be the maximum current for that particular motor.

If the current reading is very low, and adjustment of the controller current limit has no effect, the controller could be faulty.

8. SERVICING CHECKS - PLUG DIODE:

(a) Remove power by opening the battery circuit. Remove the cable off the controller A2 terminal.

(b) Check the resistance between the controller A2 and B+ terminals with an ohmeter. As the test is to establish the serviceability of the diode inside the controller, reverse the two meter leads and check for a low resistance one way and a high resistance the other way. If the diode is found to be short-circuited, the controller is faulty.

(c) Re-connect the A2 cable back onto the controller and re-connect the battery.

(d) If the plug diode is serviceable, there is a short circuit in the motor circuit. Because an ordinary ohmeter would be unreliable in detecting low resistance in a field winding, operate the controller in forward or reverse and check that the motor winding voltage level drops at the motor terminals.

9. COMPLETION OF SERVICING CHECKS:

When all servicing checks have been completed and the results suggest a faulty controller, replace the suspect unit with a new controller and return the faulty unit to Simon Aerials Ltd. for inspection.

DRIVE MOTOR CONTROLLER - BENCH TEST

1. EQUIPMENT NEEDED FOR BENCH TESTING (refer to diagram, page 6.17):

   (a) A Power Supply with the voltage equal to the rating of the controller. This can be a series of batteries or a regulated line-operated power supply. Since only low power tests are necessary, a 10 amp fuse should be inserted in series with the batteries to protect both operator and controller against accidental short-circuits.

> **WARNING**
>
> **DO NOT USE A BATTERY CHARGER AS A POWER SOURCE. WITHOUT A BATTERY LOAD THE OUTPUT VOLTAGE MAY EXCEED THE RATING OF THE CONTROLLER**

   (b) A control input source: A 5 Kilohm potentiometer used as a 2-wire rheostat (when 5 Kilohm = minimum speed, and 0 Kilohm = maximum speed).

   (c) A contactor with 250 ohm, 5 watt resistor across the contacts, and a toggle-switch for an "On/Off" control.

   (d) A test board consisting of an incandescent light bulb with the same voltage rating as the test set-up, or wire four 12 volt bulbs in series.

   (e) A general-purpose digital volt/ohmeter.

2. PROCEDURE:

   (a) Before connecting the controller into circuit, pick it up and shake it to check that nothing is loose internally. If a loose item can be detected, the controller must be considered defective.

   (b) Connect the controller as shown in the diagram (page 6.17) and connect the voltmeter leads to the controller B+ and B- terminals.

   (c) Switch the power source (not the contactor) to "On" and observe the voltmeter reading. The reading should gradually build-up over several seconds until it reaches the full battery voltage. If the voltage reading does not increase, the controller is defective.

   NOTE: **The lamp(s) should not illuminate during this part of the test. If any illumination is detected, the controller is defective.**

   (d) Switch the toggle-switch operating the controller to "On".

   (e) Switch the key-switch input to the controller to "On".

   (f) Adjust the control potentiometer from 5 Kilohms to 0 Kilohms and observe the brightness of the lamp(s). The lamp(s) should go from full "Off" to full "On" with the movement of the potentiometer.

(g) Test the controller's 'High Pedal Disable' function, as follows:-

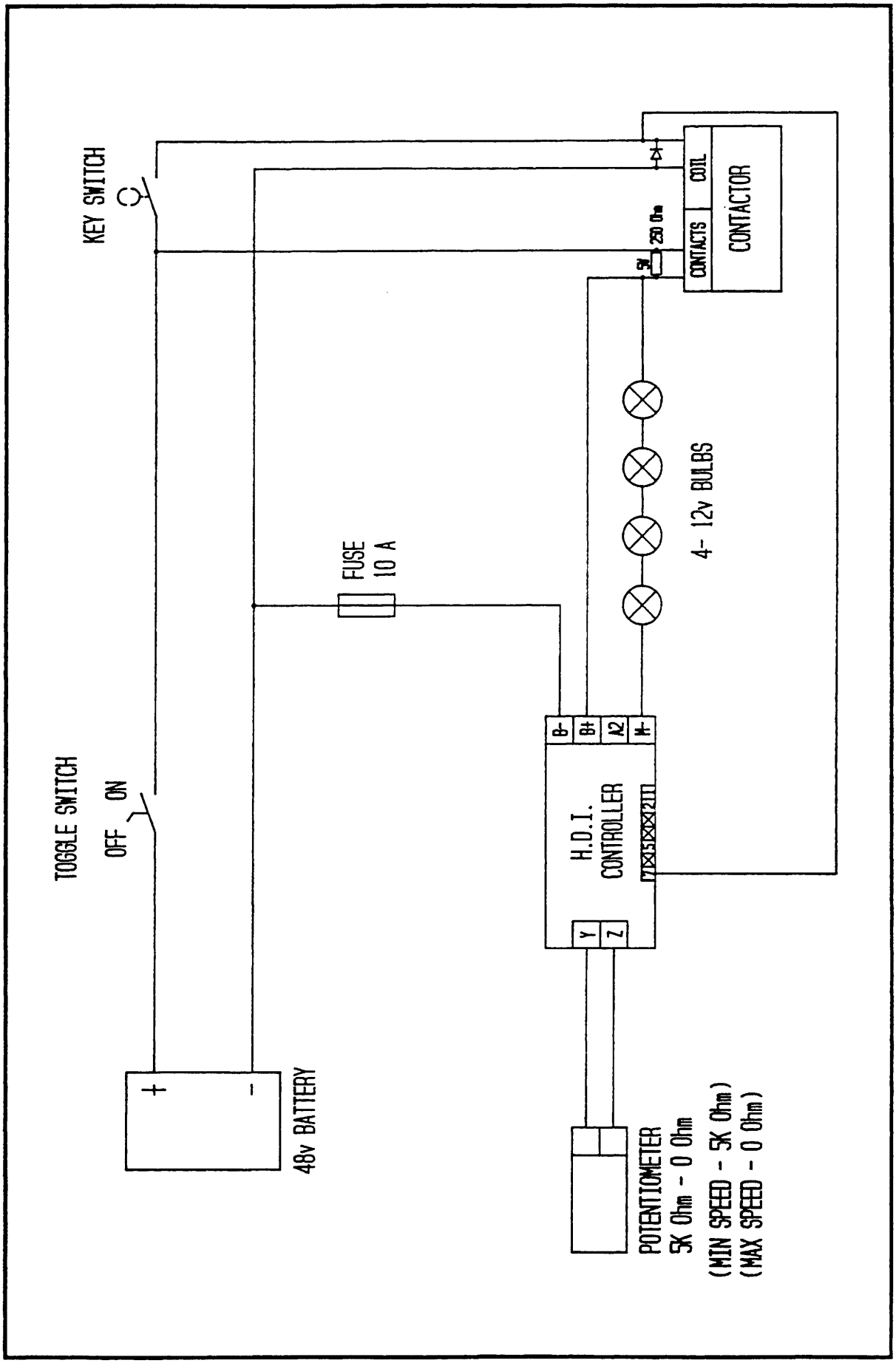
(i) Switch the switch to "Off".

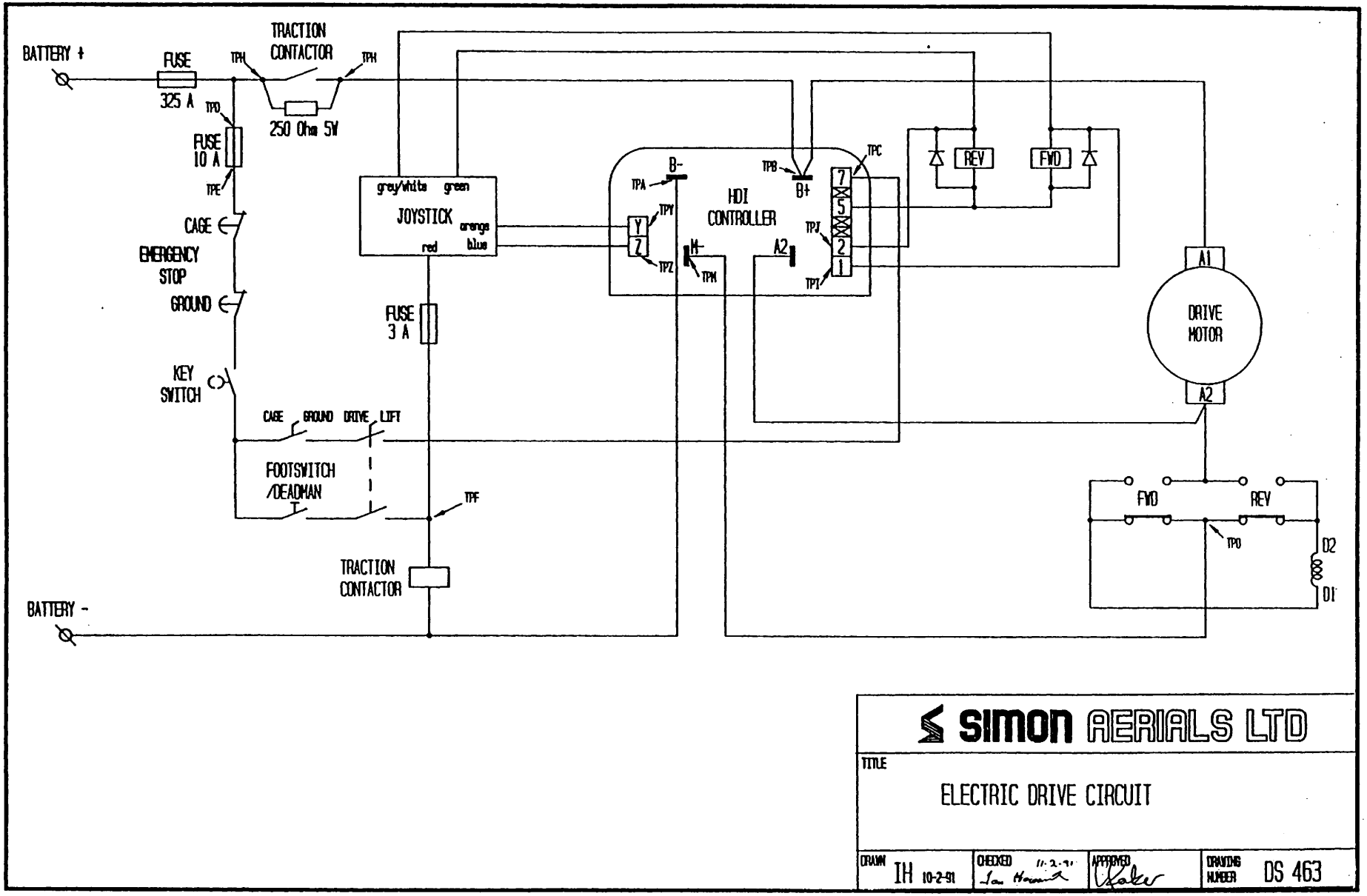
(ii) Turn the potentiometer up (towards 0 Kilohms)..

(iii) Switch the switch to "On" and check that the lamp(s) **DO NOT** illuminate until the potentiometer is turned almost fully down and then turned back up.

(h) Test the controller's joystick fault function, by removing one of the control potentiometer connections. The lamp(s) should **NOT** illuminate.

(i) Finally, remove the controller from the test set-up and check the internal plug diode, as described in paragraph 8 of the Servicing Checks.


KEY SWITCH
TOGGLE SWITCH
OFF ON
48v BATTERY
+
-
FUSE
10 A
4- 12v BULBS
CONTACTOR
COIL
CONTACTS
250 Ohm
B-
B+
A2
M-
H.D.I.
CONTROLLER
Y
Z
POTENTIOMETER
5K Ohm - 0 Ohm
(MIN SPEED - 5K Ohm)
(MAX SPEED - 0 Ohm)


BATTERY +
FUSE
325 A
TPH
TRACTION CONTACTOR
TPH
250 Ohm 5W
TPD
FUSE 10 A
TPE
CAGE
EMERGENCY STOP
GROUND
KEY SWITCH
CASE
GROUND
DRIVE
LIFT
FOOTSWITCH /DEADMAN
TPF
TRACTION CONTACTOR
BATTERY -
FUSE 3 A
grey/white
green
JOYSTICK
orange
red
blue
B-
TPA
TPB
B+
TPC
HDI CONTROLLER
Y
Z
TPY
TPZ
M-
TPM
A2
TPJ
TPI
7
5
2
1
REV
FWD
A1
DRIVE MOTOR
A2
FWD
REV
TPD
D2
D1
SIMON AERIALS LTD
TITLE
ELECTRIC DRIVE CIRCUIT
DRAWN
IH 10-2-91
CHECKED
11-2-91
APPROVED
DRAWING NUMBER
DS 463

SECTION 7

MAINTENANCE INSTRUCTIONS

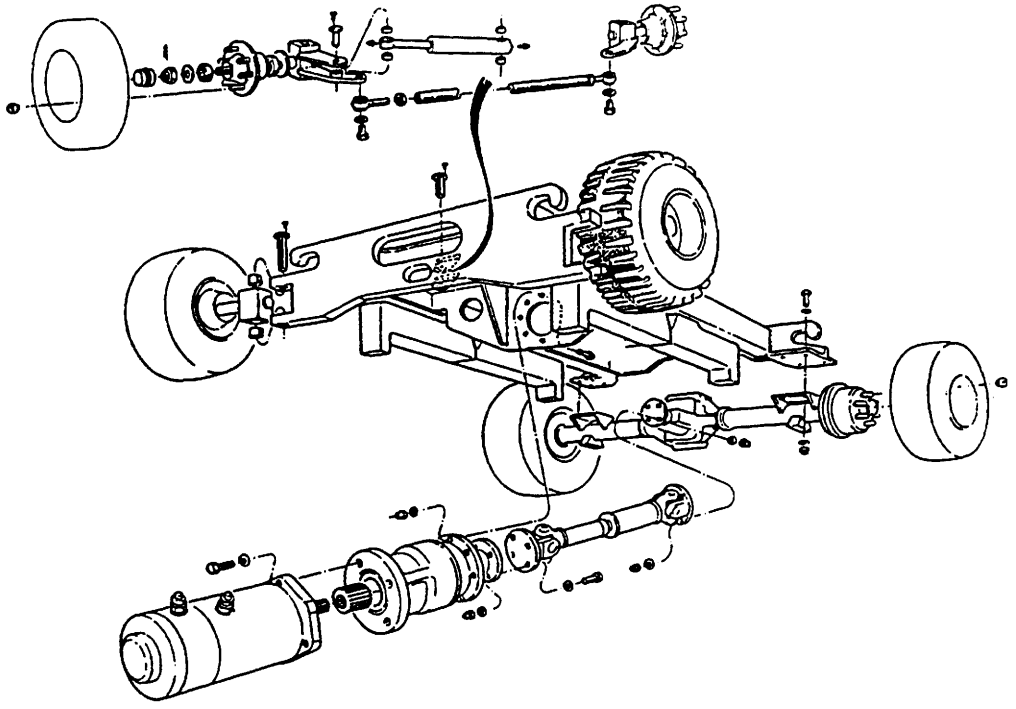
1. **TYRES:**

The tyres fitted to the Boxer machines are solid resilient urethane rubber. Any significant sidewall or other damage should be professionally examined and if necessary, the tyre must be replaced. Tyre type is high traction, deep lug (solid rubber). Tyre size is 250 - 15.

2. **WHEELNUT SECURITY:**

Check the security of the wheel nuts (Torque 140 Nm).

3. **DRIVE ASSEMBLY:**



BOXER MK.3 (E) - STEERING AND DRIVE ASSEMBLIES

(a) Drive Axle:

Check the securing bolts for tightness and the differential for oil leaks and oil level. Top-up with EP 90 oil, if necessary.

(b) Gearbox:

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

(c) Drive Motor:

Check the drive motor and relating cables for security. Check the cables for signs of chafing. Apply grease to the motor terminals.

(d) Drive Shaft and Coupling:

Check the drive shaft securing bolts (at axle end) for tightness. Check the coupling for cracks and damage.

4. SERVICE BRAKE (Driving Mode):

The Service Brakes are hydraulically controlled. Regular checks to the Master Brake Cylinder are necessary to ensure that the hydraulic oil is at the correct level. The brake shoes should require no maintenance until they show signs of wear. When wear is detected, the shoes should be renewed.

5. PARKING BRAKE:

The Parking Brakes are hydraulically controlled. The brakes can be manually disengaged to allow the machine to be towed.

(a) Check hose and connections for security.

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

6. STEERING ASSEMBLY:

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

Steering Cylinder:

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

7. CHASSIS AND PLINTH LABELS:

Ensure that all labels and instructions are readable and secure.

8. CHASSIS CABLES:

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

9. LIFT PUMP MOTOR ASSEMBLY:

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

10. BATTERIES AND BATTERY MOUNTINGS:

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

(b) Check battery terminals for corrosion. Ensure they are clean. Grease with Vaseline.

(c) Check battery electrolyte level. Top-up, if necessary.

11. D.C. CONTACTORS:

The contactors should be inspected for contamination and spark damage. The contacts are manufactured of silver cadmium oxide and are extremely hard-wearing. Any dirt or swarf should be cleaned out by blow-cleaning with an air-line.

12. MANIFOLD ASSEMBLY:

Operate the motor. Check:

(a) Security of block and solenoids.

(b) Security and condition of hoses and cables.

13. HYDRAULIC OIL TANK:

(a) Check the tank for security.

(b) Check the tank for leakage.

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

14. MINOR EQUIPMENT MOUNTING:

(a) Check all minor equipment for security.

(b) Check for oil leakage.

(c) Check all cables for security and damage.

15. PLINTH/SUPERSTRUCTURE HOSES/CABLES:

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

16. PIN BUSHES:

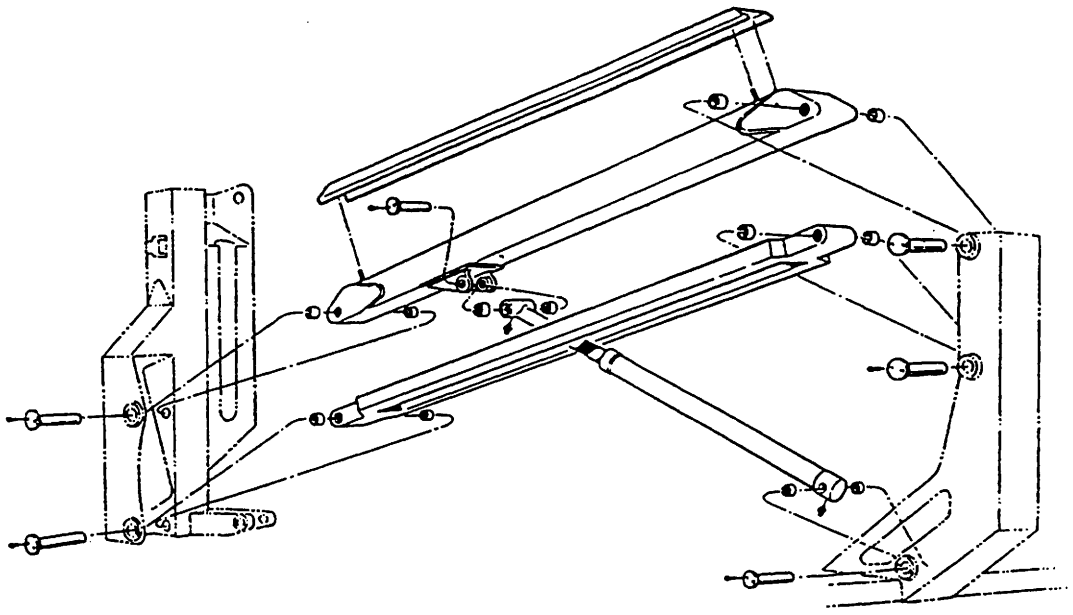
Check all bushes for wear. Elevate the booms and check each pin in turn for rotation or movement. If wear is detected, the bush may need to be replaced. Consult Simon Aerials Ltd. for advice.

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 (see Section 9 for details).

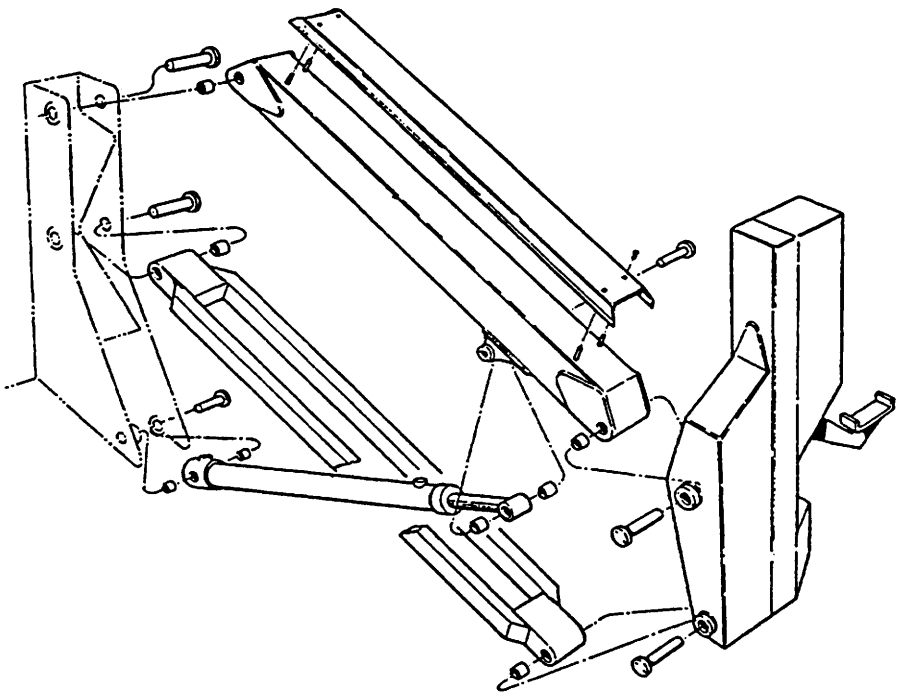
17. PIVOT PIN REPLACEMENT:

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 the pin locking bolts have not sheared.

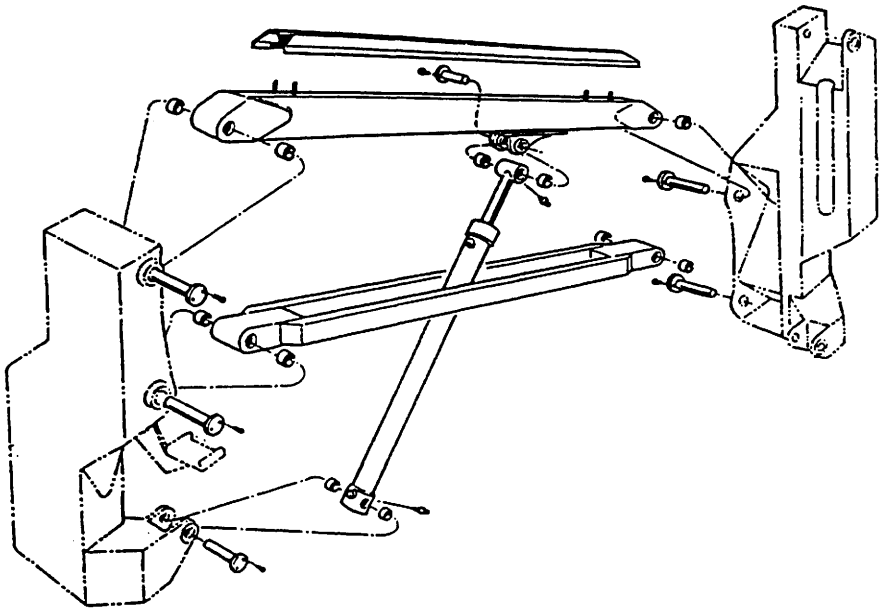
NOTE: See overleaf for diagrams showing boom configurations and pin/bush locations for the various Boxer models.



BOXER 120/130 - 1st LIFT STAGE



BOXER 140, 150 and 170 - 1st LIFT STAGE



BOXER 140, 150 and 170 - 2nd LIFT STAGE

(a) <u>To Fit New Boom Pins:</u>

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

(ii) Remove the pin locking bolts.

(iii) Drive out the Boom pin. Ensure that no damage occurs to the inside bore.

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

(v) Apply grease to pins.

<u>IMPORTANT</u>

It is important to maintain the correct mating position between the Boom and the side plates during this operation - any movement between the two parts will make pin fitting more difficult.

(b) To Fit New Tie-Rail Pins:

(i) Support the Boom.

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

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

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

(iv) Apply grease to pins.

(c) Cylinder Pins - Lift Cylinder:

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

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

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

(iv) Apply grease to pin.

(d) Cylinder Pins - Self-Levelling Cylinders:

(i) Support the cage assembly to ensure there is no load on the self-levelling cylinders (this also applies when changing pins on the rear levelling cylinder).

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

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

(iv) Apply grease to pin.

(e) Cylinder Pins - Zoom Boom Cylinder:

Remove the pin locking bolts, support the cylinder and remove the pin. When changing the Rod pin, it may be necessary to zoom out to reveal the pin location.

NOTE: **If the Zoom has been greased, the location recess may be filled and not visible.**

18. SLEW BEARING:

Generally, no user maintenance to the bearing is possible. The replacement of the slew bearing is a major operation and advice should be sought from Simon Aerials Ltd. Checks should be made to ensure that all securing bolts are tight, and any bolts found loose or sheared must be replaced by new bolts. 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.**

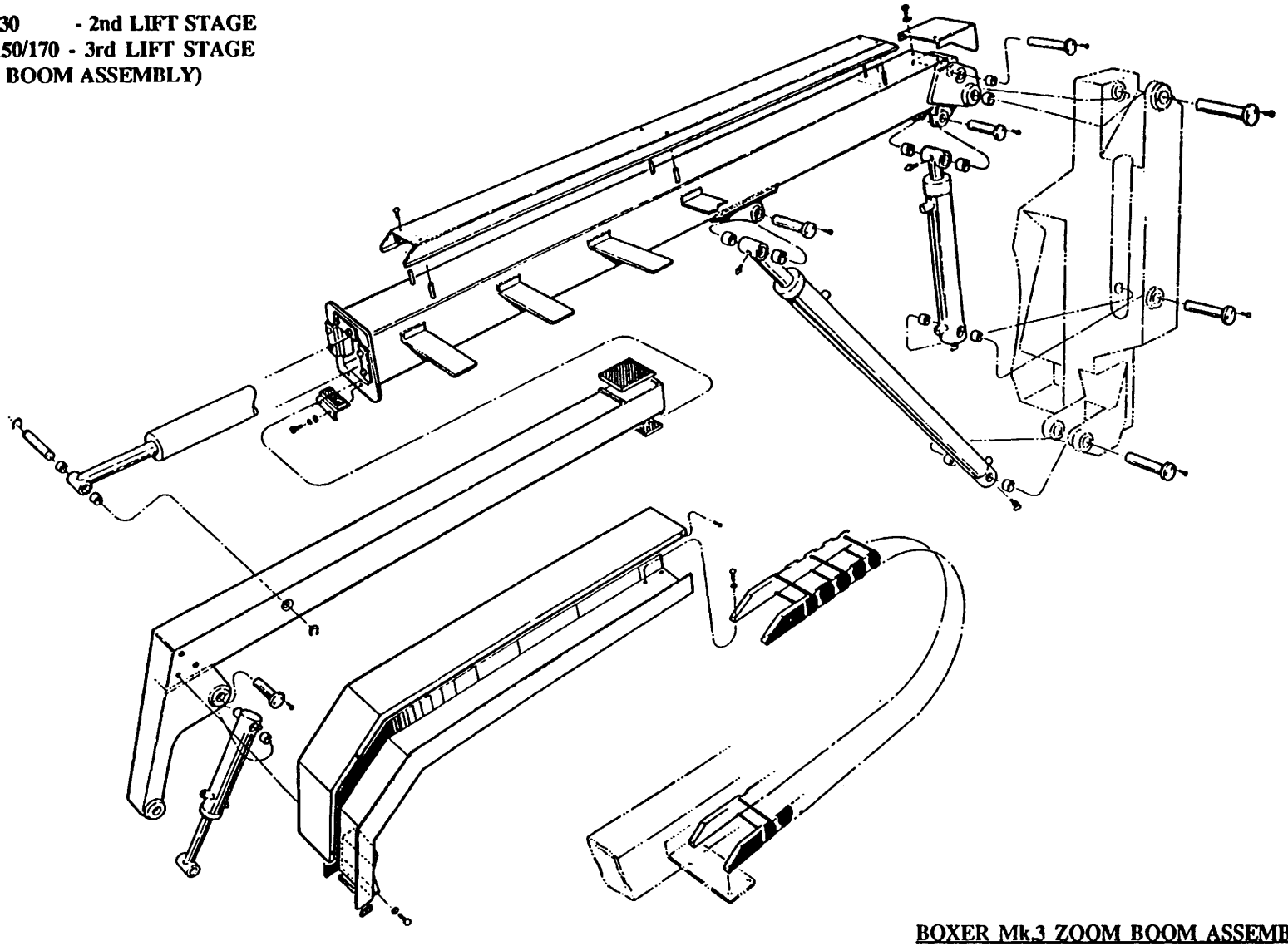
Torque Setting (all models):

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

Slew Ring Lubrication:

Refer to Section 9 for lubrication details.

BOXER 120/130 - 2nd LIFT STAGE
BOXER 140/150/170 - 3rd LIFT STAGE
(ZOOM BOOM ASSEMBLY)



BOXER Mk.3 ZOOM BOOM ASSEMBLY

19. SUPERSTRUCTURE:

(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). For pin replacement procedure - see paragraph 17.

20. 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.

To Remove The Cylinder:

(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. Care must be taken to prevent the zoom inner from sliding out without the constraint of the zoom cylinder. Secure the zoom boom fully in.

To Replace The Seals:

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

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

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

(g) Remove the seals and fit a new set of seals.

21. ZOOM PADS:

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.

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

NOTE: **The pads will need renewing if a gap of 5mm exists between pad and RHS (Roll Hollow Section).**

To Replace The Front Pads:

- Support the inner zoom boom. Unbolt the front pad keep plates, and replace pads as necessary.

- Replace the pad by hammering gently into place. Re-bolt the keep plates in to position.

To Replace The Rear Pads:

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

- Pull the inner zoom boom backwards and remove it from the outer boom assembly.

- Remove the pads and fit new pads. Re-assemble the zoom boom.

22. LIFT CYLINDERS:

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

To Replace Cylinder Seals:

(a) Support the boom and release 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. Ensure that no dirt enters the system.

(d) Replace the seals in the end cap and reverse the above procedure. Care should be taken during this procedure to ensure that no damage occurs to the rod surface. Bleed the cylinder by allowing air to escape around the end cap threads. Fully tighten the end cap.

Alternatively:

The cylinder can be removed from the machine and the seals changed on a work bench. It is recommended that the bearing ring at the base of the rod is replaced when seals are changed.

(e) Examine the rod for scoremarks and damage. This is most easily achieved by extending the cylinder and examining the protruding rod. Bleed the system, as decribed above.

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

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

To Check Over-centre Valves:

After completing the above procedure, raise the boom and stop the pump motor. 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.

23. 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 cylinders are serviced.

To Fit New Seals:

(a) Remove the cylinder 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 new seals.

Procedure for Cage Levelling and Bleeding Levelling System:

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 the system.**

WARNING

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

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

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

(iii) Operate the cage levelling lever so that the cage moves fully backwards and fully forwards, to expell any air that may be in the system. Repeat this action until all air is expelled.

(iv) Re-tighten the bleed nipple and top-up the hydraulic oil tank. Repeat this procedure until all air is expelled.

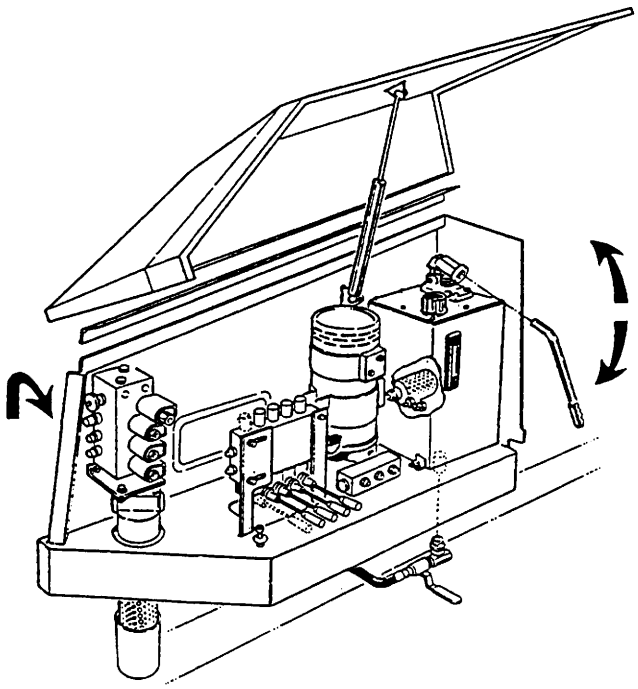
24. BRAKE ADJUSTMENT (AFTER REPLACING BRAKE LININGS) (Models 120, 130, 140 and 150 ONLY):

Brake adjustment is by tightening the black wheel on the brake manifold (located in the hydraulic module), pressurising the brake system with the handpump, then adjusting the small cogged wheel at the rear of the drive wheels.

(a) Jack the machine up to give sufficient clearance between the tyre and the ground.

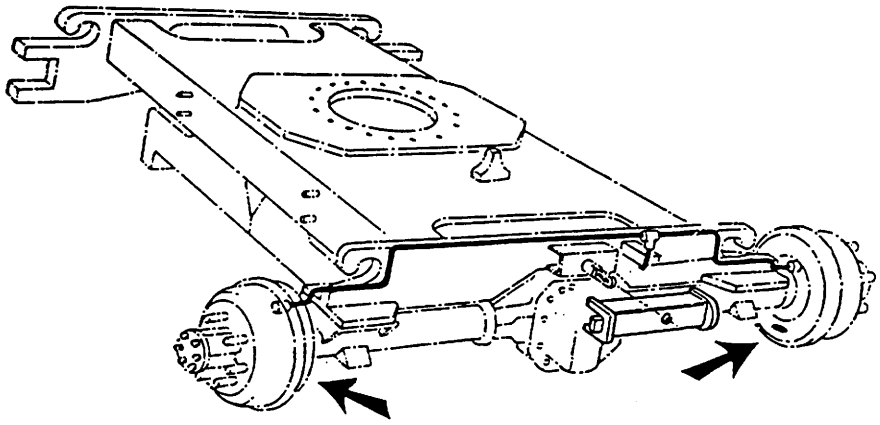
(b) In the hydraulic module, turn the small black wheel on the brake manifold fully clockwise.

(c) Operate the handpump until sufficient pressure is available in the system.



HYDRAULIC MODULE - BRAKE ADJUSTMENT PROCEDURE

(d) Remove the small plastic dustcover from the rear of the drive wheel to reveal the toothed brake adjustment wheel.



DRIVE WHEELS - ADJUSTMENT CONTROL

(e) Turn the toothed adjustment wheel upwards, by inserting a screwdriver between the teeth until the wheel hub locks.

(f) Bleed the brake system until it is free from trapped air.

(g) Back-off the toothed adjustment wheel until the brake shoes are just off the binding level.

(h) At the hydraulic module, turn the small black wheel on the brake manifold fully anti-clockwise. Check that the brakes are locked on.

(i) Lower the machine and remove the jack.

To Bed-in The Brakes:

(j) Test drive the machine and operate the braking system for at least ten times to ensure that the brakes are bedded-in.

(k) If the braking system is satisfactory, return the machine to service. If not, repeat steps (a) to (k).

25. BRAKES (Model 170 ONLY):

The brakes should require no maintenance except for periodical checks to the hoses and brake port connections (see Section 9 for maintenance schedules).

SECTION 8

FAULT-FINDING

1. INTRODUCTION:

Before any investigation into a malfunction is attempted:

(a) Ensure that the ignition is switched to "On".

(b) Ensure that both "Emergency Stop" buttons are released.

(c) Ensure the selector switch (at ground controls) is set to the correct function, i.e., "Ground" or "Cage".

(d) Ensure that the selector switch (at cage controls) is set to the correct function, i.e., "Lift" or "Drive".

(e) Ensure that the footswitch (in cage assembly) is depressed (for cage operations only).

(f) Ensure that the battery bank connections are secure.

(g) Ensure that the batteries have sufficient charge for operations.

(h) Ensure that the hydraulic oil is at the correct level.

2. FAULT-FINDING HINTS:

(a) PUMP MOTOR WILL NOT START:

(i) Operate the pump and check battery voltage.

(ii) Check voltage at the pump.

(iii) Inspect and check that the contactor is operating correctly.

(iv) Check the brushes in the pump motor.

(v) Check electrical circuit for loose connections.

(vi) Check the pump for mechanical defect.

(b) PUMP MOTOR WILL NOT STOP (WHEN MACHINE IS SWITCHED TO "DRIVE"):

(i) Check pressure switch relay for correct operation.

(ii) Check contactor contacts are not "welded".

NOTE: **Do not attempt to clean the contactors with abrasive material - Replace with new contactor.**

(iii) Check for electrical short-circuit.

NOTE: **If the fault cannot be determined immediately, disconnect the battery as a temporary remedy.**

(c) PUMP MOTOR OPERATES BUT NO HYDRAULIC POWER:

(i) Check for hydraulic oil leak.

(ii) Examine the pump assembly for mechanical defect.

(iii) Check pressure relief valve for correct pressure setting (pressure should be 150 bar - 2176 psi).

(iv) Check the 3-way 2-position valve on the "Brake/Lift/Steer" manifold for correct operation.

(d) PUMP MOTOR SLOW OPERATION:

(i) Check Safe Working Load is not exceeded (SWL must be 225 kg - 496 lbs).

(ii) Check pressure relief valve for correct pressure setting (pressure should be 150 bar - 2176 psi).

(iii) Check hydraulic system has correct grade of oil.

(iv) Check battery voltage for low charge.

(v) Check electrical circuit for bad or loose connections.

(e) BOOMS WILL NOT LOWER:

(i) Check battery voltage for low charge.

(ii) Check for hydraulic oil leak.

(iii) Check over-centre valves for defect (sticking or damaged directional spool, etc.).

(f) ZOOM BOOM WILL NOT OPERATE:

(i) Check pressure relief valve for correct pressure setting (pressure should be 150 bar - 2176 psi).

(ii) Check zoom boom assembly for possible damage or for obstruction between the inner/outer boom assembly.

(iii) Check zoom boom for lubrication (lubricate with WD 40).

(g) MACHINE WILL NOT ROTATE:

(i) Check for obstruction on slewing ring (grit in teeth, etc.).

(ii) Check hydraulic rotation motor and gearbox for operation.

(h) MACHINE WILL NOT STEER OR STEERING IS SLUGGISH:

(i) Check cross-line relief valves for correct pressure (pressure should be 130 bar - 1859 psi).

(ii) Check steer 4-way 3-position solenoid for correct operation.

(iii) Check steer cylinder for leaking seals.

(iv) Check joystick electrical contacts for correct operation.

NOTE: **The joystick cannot be customer serviced. The joystick must be renewed.**

(i) DRIVE MOTOR WILL NOT OPERATE:

(i) Check contactors for correct operation.

(ii) Check electrical circuit for loose or broken connection.

(j) NO FAST DRIVE FACILITY:

(i) Check limit-switches for correct operation.

(ii) Check foot-switch for correct operation.

(iii) Check that parking and service brakes are releasing.

(k) FAST DRIVE WITH UPPER STAGE ELEVATED:

(i) Check joystick for correct operation.

(ii) Check limit-switch for correct operation.

(l) NO "EMERGENCY STOP":

(i) Check "Emergency Stop" push-button for correct operation.

(ii) Check foot-switch for correct operation.

(m) **BATTERIES FULLY CHARGED, BUT RED L.E.D. STILL FLASHES:**

If the batteries are fully charged, but the red LED on the cage control panel battery charge indicator continues to flash, resetting of the battery cutout system is required.

To reset:

(i) Disconnect the batteries.

(ii) Open the cover above the battery charger so you can see the terminal strip.

(iii) Remove the cover from the battery controller.

(iv) Remove the jam nut from the left adjuster, and make a mark where the indicator is pointing.

(v) Rotate the adjustment knob fully counterclockwise. Leave the knob in that position for at least six (6) minutes.

(vi) Reset the adjustment knob to its original position (at the mark made in step "d"). Replace the jam nut.

(vii) Reconnect the batteries and test the unit.

SECTION 9

MAINTENANCE SCHEDULES

1. GENERAL INFORMATION:

The Boxer Mk.3 series 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". It is particularly important that inspection of all hydraulic components, hoses and pipe fittings for oil leaks, etc., should form part of the weekly service for the first three months operational use, and corrective action taken, as required.

2. HYDRAULIC OILS:

Hydraulic oils not shown on the Recommended Lubricants Chart (page 9.2) may be used, providing that the manufacturer is reputable and the oil complies 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**	**300cS**
TEMPERATE	**40°C**	**30cS**
TROPICAL	**0°C**	**700cS**
TROPICAL	**40°C**	**50cS**
TROPICAL	**100°C**	**8cS**

(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:

Mineral oils act as solvents on the natural oil in the skin and 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 should be sought.

WARNING

THE ATTENTION OF ALL PERSONS IN REGULAR CONTACT WITH MINERAL OILS SHOULD BE DRAWN TO THE NEED FOR THOROUGH HYGIENE AND THE CORRECT METHOD FOR HANDLING TO AVOID POTENTIAL HAZARDS TO HEALTH.

4. RECOMMENDED EQUIVALENT HYDRAULIC 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

WARNING (Models 120, 130, 140 and 150 ONLY)

BRAKE FLUID: DO NOT PUT HYDRAULIC OIL IN THE SERVICE BRAKE MASTER BRAKE CYLINDER. USE ONLY SAE J1703 UNIVERSAL GRADE BRAKE AND CLUTCH FLUID (U.S. SPECIFICATION: FMVSS 116 DOT 3).

5. 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 absorptive and corrosion resistant qualities.

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

Recommended lubricant is 'MOLYKOTE LONGTERM 2 PLUS' extreme pressure grease or equivalent.

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

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

SERVICING CHECK LIST

(BASIC MACHINE ONLY)

DAILY:

Check hydraulic oil level.
Check tyre condition.
Check cage door lock.

WEEKLY:

Check hydraulic system for leakage.
Check control valves for self-centre.
Check steering system for oil leakage and wear.
Check battery electrolyte levels.
Check pivot pin security.

MONTHLY:

Check hydraulic oil for contamination.
Check drive gearbox oil.
Check master brake cylinder oil level (models 120, 130, 140 and 150 ONLY).
Check chassis mounting bolts.
Check rotation gearbox oil level.
Check pivot pin security.
Lubricate slew ring teeth.
Lubricate all small pivots throughout the machine.

6 MONTHLY:

Check cage levelling.
Check cage pivots.
Check boom cylinders.
Check axle assembly.
Change pressure line filter.
Test all machine systems.

YEARLY:

Examine/change oil in rotation gearbox.
Examine/change hydraulic oil for contamination.
Examine inside of hydraulic oil tank for contamination.
Examine/change oil in transmission brake (models 120, 130, 140 and 150 ONLY).
Examine machine structure for damage, corrosion, etc.
Examine cage mounting security.

FOUR YEARLY:

Detailed inspection of all flexible hoses.
Detailed inspection of all pivot pins and bearings.

NOTE: **THIS CHECK LIST IS ONLY TO BE USED AS A REMINDER OF THE DETAILED INSTRUCTIONS GIVEN IN THIS MANUAL. ALL DETAILED SERVICING INSTRUCTIONS MUST BE IMPLEMENTED.**

DAILY ROUTINE SERVICING

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 2.54 cms (1 inch) below the top of the oil level gauge. Refer to the lubrication chart (page 9.17) for the correct grade of oil if the reservoir requires "topping-up".

2. **TYRE CONDITION:**

Check that machine tyres are in good condition.

3. **CAGE DOOR LOCK:**

Check the security of the cage door.

WEEKLY ROUTINE SERVICING.

1. CONTROL VALVES:

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

2. HYDRAULIC:

(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 levelling system to ensure that they are positively secured in position.

3. STEERING:

Check the steering cylinder for oil leakage and the steer linkage for wear.

4. BATTERIES:

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

5. PIVOT PINS:

Check all pivot pins for security.

MONTHLY ROUTINE SERVICING

1. HYDRAULIC OIL:

Allow the machine to stand overnight, or for at least 8 hours, without operating the pump. This will allow water and any 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.

2. CHASSIS BOLTS:

Check all chassis bolts for signs of looseness. Re-tighten, if necessary.

3. SLEW RING GEAR TEETH:

Remove any dirt or grit from between the gear teeth and re-lubricate (refer to Lubrication Chart, page 9.17 for details).

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

4. ROTATION GEARBOX OIL LEVEL:

Check the gearbox oil level. 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 (with the machine on level ground). Low oil level is usually due to seal failure on the wormshaft.

5. LUBRICATION:

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

6. PIVOT PIN SECURITY:

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

7. DRIVE GEARBOX:

Check oil level. Top-up with EP 90 grade oil.

8. MASTER BRAKE CYLINDER (models 120, 130, 140 and 150 ONLY):

Check oil level. Top-up with SAE J1703 UNIVERSAL Brake and Clutch Fluid.

SIX MONTHLY ROUTINE SERVICING

1. CAGE LEVELLING:

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

   (b) Check cylinders and hose fittings for leakage.

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 should show any defect, they should be replaced with the correct type. Consult Simon Aerials Ltd.

3. BOOM CYLINDERS:

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

   (b) Check all cylinders for oil leakage.

4. AXLE ASSEMBLY:

   Check oil level. Top-up with EP 90 oil.

5. PRESSURE LINE FILTER:

   Change the Pressure Line Filter element (S.A. No. 11357).

6. MACHINE TEST:

   Test the following systems:

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

   (b) Slew ring and rotation gearbox.

   (c) Cage rotation worm drive.

   (d) All machine functions.

YEARLY ROUTINE SERVICING

1. ROTATION GEARBOX:

   (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) Replace the drain plug, re-fill the gearbox with EP 90 (or equivalent) oil. Refit filler plug.

2. SLEW RING BEARINGS:

   Grease the slew ring by rotating the turntable, as necessary.

3. HYDRAULIC OIL:

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

   If the oil has a cloudy appearance, this indicates that water is present. If the oil has changed from clear amber to dark brown, accompanied by a strong "burnt" smell, this indicates over-heating of the oil. The cause should be investigated and rectified. The presence of either condition requires a complete oil change.

4. HYDRAULIC OIL TANK:

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

   To Re-fill the Tank Only:

   (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 attach 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 re-fill the tank to the correct level.

   Materials:

   Approximately 19 litres of BP Energol HLP 22 hydraulic oil.

5. TRANSMISSION BRAKE (models 120, 130, 140 and 150 ONLY):

   Check the condition of the oil and top-up with BP Energol HLP 22 hydraulic oil.

6. 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.

7. CAGE MOUNTING:

(a) Check that all mounting bolts are secure.

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

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 of use and type of work, environmental conditions, local safety regulations, etc.

1. FLEXIBLE HOSES:

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

2. PIVOT PINS AND BEARINGS:

(a) Remove the pivot pins for examination.

(b) Check the pivot pin bearings with the pivot pins removed. Renew the 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 should be fitted. Consult Simon Aerials Ltd.

LUBRICATION

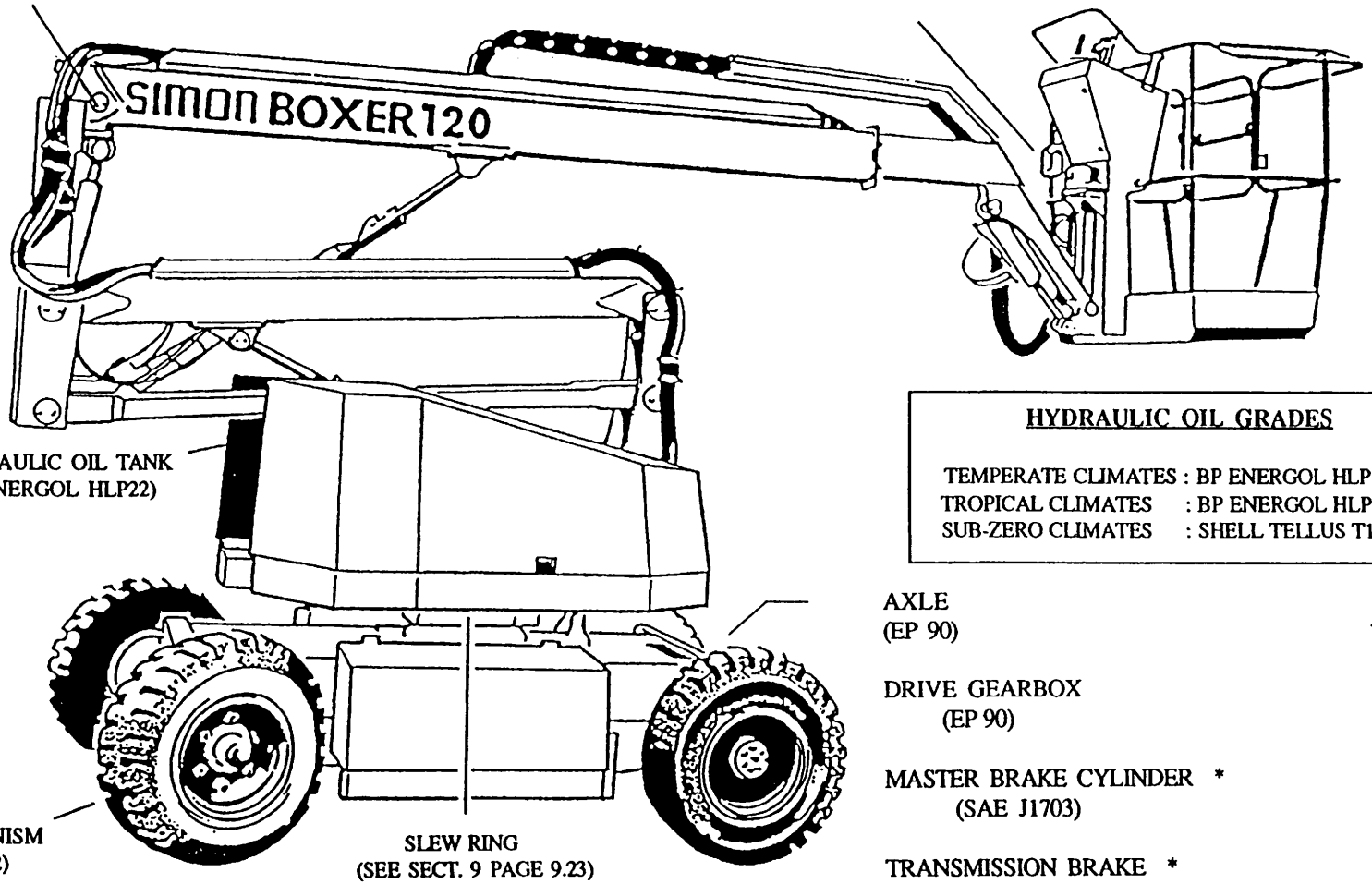
(SEE DIAGRAM, PAGE 9.19)

PART	GREASE/OIL	FREQUENCY	NOTE
Rotation Gearbox	EP 90	Check Monthly Change Yearly	-
Axle Assembly	EP 90	6 Monthly Change Yearly	-
Drive Gearbox	EP 90	Check Monthly Change Yearly	-
Lift/Pump Motor	Vaseline	6 Monthly (grease)	Smear electrical connections
Hydraulic Oil	BP HLP 22	Check Weekly Change Yearly	Fill to 2.54 cms from filler hole neck
Lift Cylinders	Molykote 2	Weekly (grease)	-
Pins/Bearings	Molykote 2	4 Yearly (grease)	More frequent in tropical climates
Wheel Bearings	LS 2	Yearly (grease)	-
Brake Mechanism	Molykote 2	Yearly (grease)	Smear all moving parts ***
Zoom Boom	Molykote 2	Monthly (grease)	Inner part
	WD 40	Monthly	Outer part
Master Brake	SAE J1703	Check Monthly	* and ***
Transmission Brake	BP HLP 22	Check Yearly	***
Slew Ring	-	-	**

* See diagram, page 9.19

** See Slew Bearing details, page 9.24

*** Models 120, 130, 140 and 150 ONLY



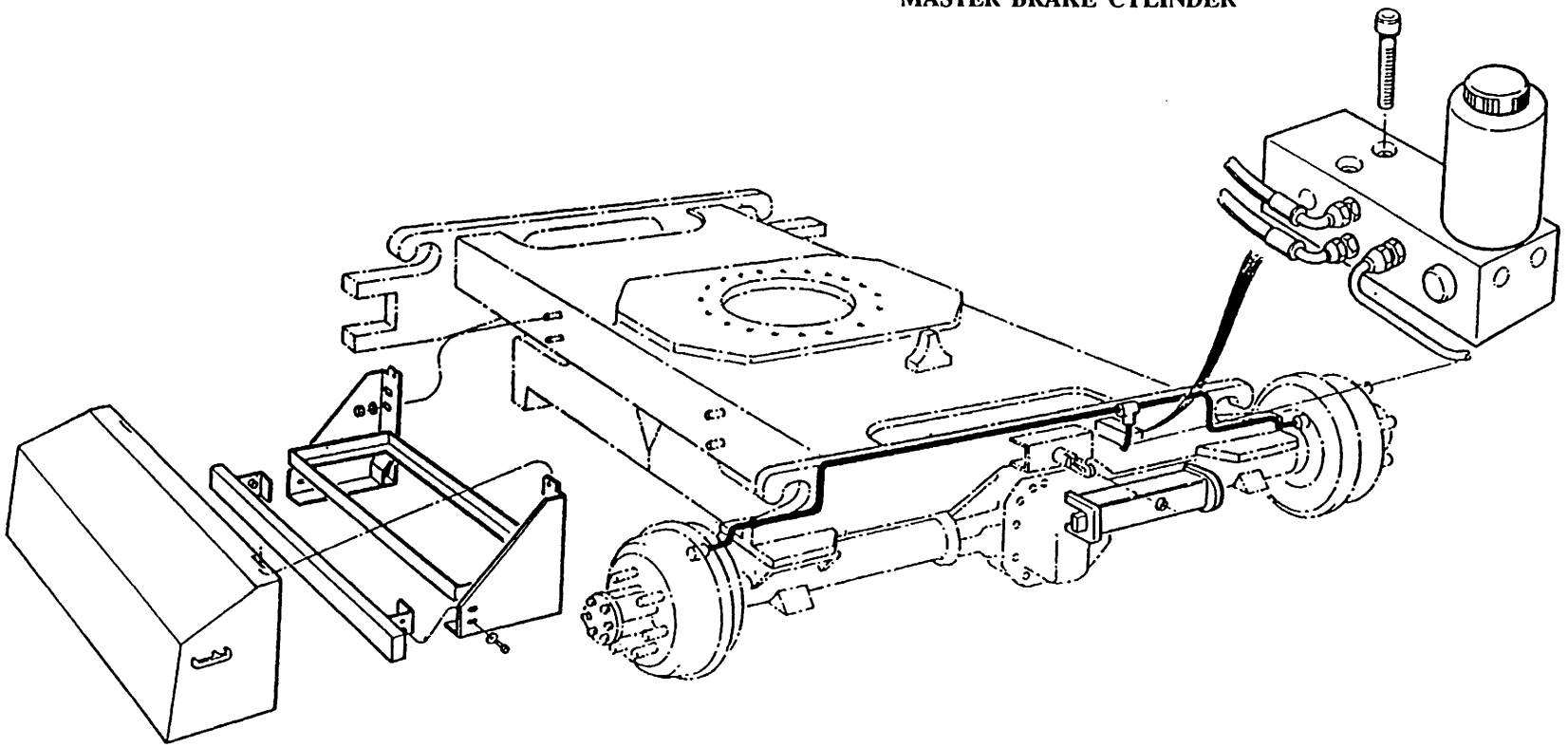
HYDRAULIC OIL GRADES

TEMPERATE CLIMATES	: BP ENERGOL HLP 22
TROPICAL CLIMATES	: BP ENERGOL HLP 100
SUB-ZERO CLIMATES	: SHELL TELLUS T15

LUBRICATION DIAGRAM

* models 120, 130, 140 and 150 ONLY

MASTER BRAKE CYLINDER *



* TOP-UP WITH SAE J1703 UNIVERSAL BRAKE AND CLUTCH FLUID

BOXER MK.3 - MASTER BRAKE CYLINDER LOCATION
(Models 120, 130, 140 and 150 ONLY)

SLEW BEARING LUBRICATION

1. GREASE CHARACTERISTICS:

The greases used for the Slew Bearing are of two different types, each having a particular function:-

(a) For The Bearing:

- Lithium soap and Lead soap greases
- Good stability
- Operating temperature: 30°C to 150°C
- ASTM penetration at 25°C (ASTM D217)
  - non-worked 269
  - worked (10,000 cycles) 284
- Drop point, as per ASTM D566 187
- Viscosity at 50°C (for base oil) 110
- Timken OK test load in lbs (min. requirements) 50

(b) For The Gears:

- Extreme pressure lubricant
- BTRA viscosity at 50°C (minimum) 100
- Engler viscosity at 50°C 1,65

2. ROLLIX-DEFONTAINE RECOMMENDATION:

According to the operating conditions, we recommend:

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

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 : approximately 150 hours.

Other brands of grease may be used, provided that they possess the same lubrication characteristics as those quoted.

(a) BEARING LUBRICATION:

For the bearing lubrication, the grease holes are tapped 10 x 100 (not fine) thread which is a European standard and suitable for this application.

- Centralized lubrication, this takes a number 6 or 8 tube (DIN 2391)
- Conventional lubrication, spherical head, straight or bent grease nipples are used (Standards AFNOR - NFR 165-21 - DIN 3410).

(b) LUBRICATION FREQUENCY:

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

NOTE : **The Slewing Ring should be rotated after the lubrication operation, then the lubricant should be topped-up.**

EQUIVALENT LUBRICATION

GREASE BRAND	BEARING	GEAR
Antar	Epexa 2	Pebron engrenage 1401
BP	Energrease EP2	GR 154 GS
Castrol	Spheerol	-
Elf	Elf EP2	Elfnera 4900 x fluid
Esso	Beacon EP2	Surret fluid 30F
Fina	Marson EPL2	-
Igol	Perfect	-
Labo	GS 2061	-
Mobil	Mobilplex 47	Dorcia 30
Shell	Alvania EP2	Cardium EP fluid H
Total	Multis EP2	-
Texaco	Multifak EP2	Crater 2 x fluid

SECTION 10

ILLUSTRATED SPARE PARTS

BOXER 120 EN

UPPER CHASSIS ASSEMBLY

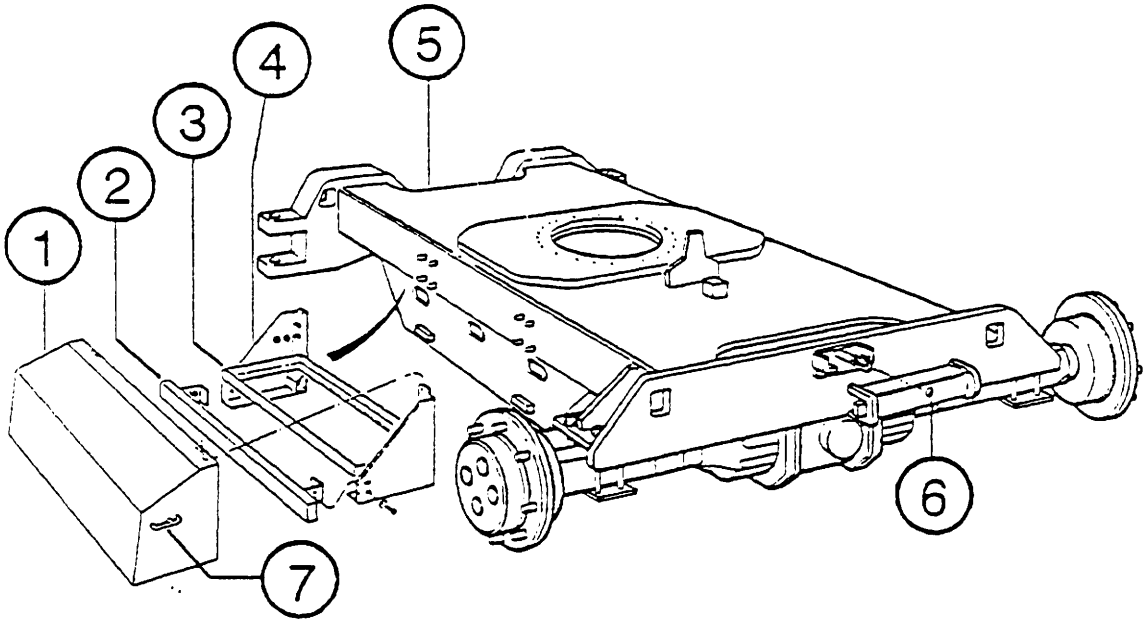


Figure 10.1 - Upper Chassis Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS347	BATTERY COVER	2
2	GS346	RETAINING BAR	2
3	GS004	BATTERY TRAY	2
4	GS345	SUPPORT BRACKET (LEFT HAND)	2
	GS617	SUPPORT BRACKET (RIGHT HAND)	2
5	GS616	CHASSIS ASSEMBLY	1
6	FSD001	SAFETY CHOCK	1
7	12285	HANDLE	2

BOXER 140 EN

UPPER CHASSIS ASSEMBLY

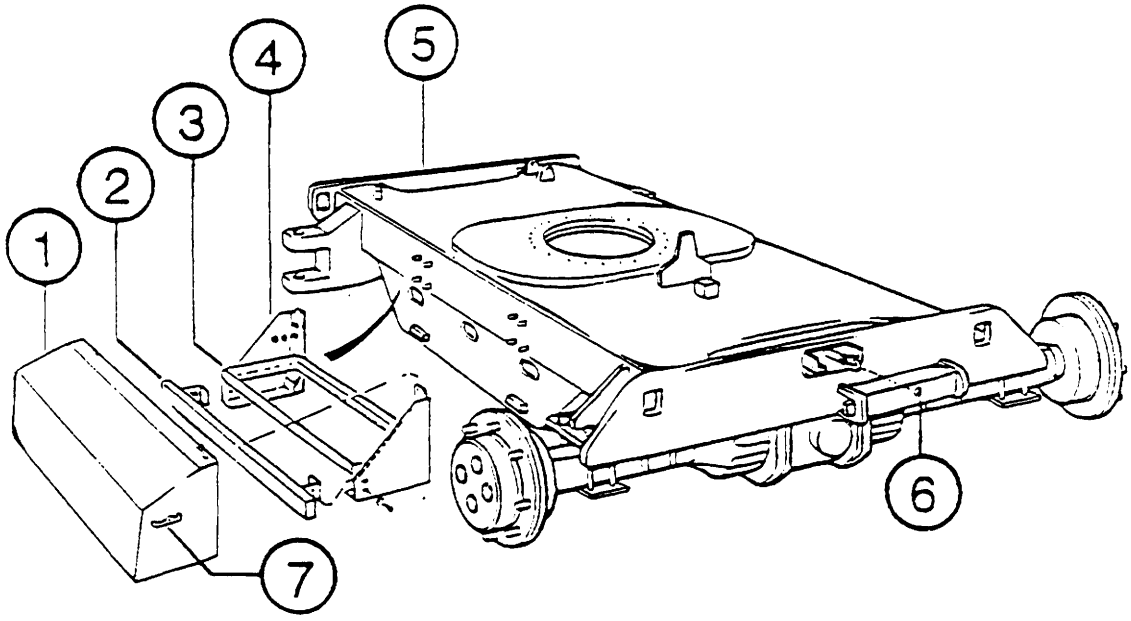


Figure 10.1 - Upper Chassis Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS347	BATTERY COVER	2
2	GS346	RETAINING BAR	2
3	GS004	BATTERY TRAY	2
4	GS345	SUPPORT BRACKET (LEFT HAND)	2
	GS617	SUPPORT BRACKET (RIGHT HAND)	2
5	GS616	CHASSIS ASSEMBLY	1
6	FSD001	SAFETY CHOCK	1
7	12285	HANDLE	2

BOXER 120 EN

LOWER CHASSIS ASSEMBLY

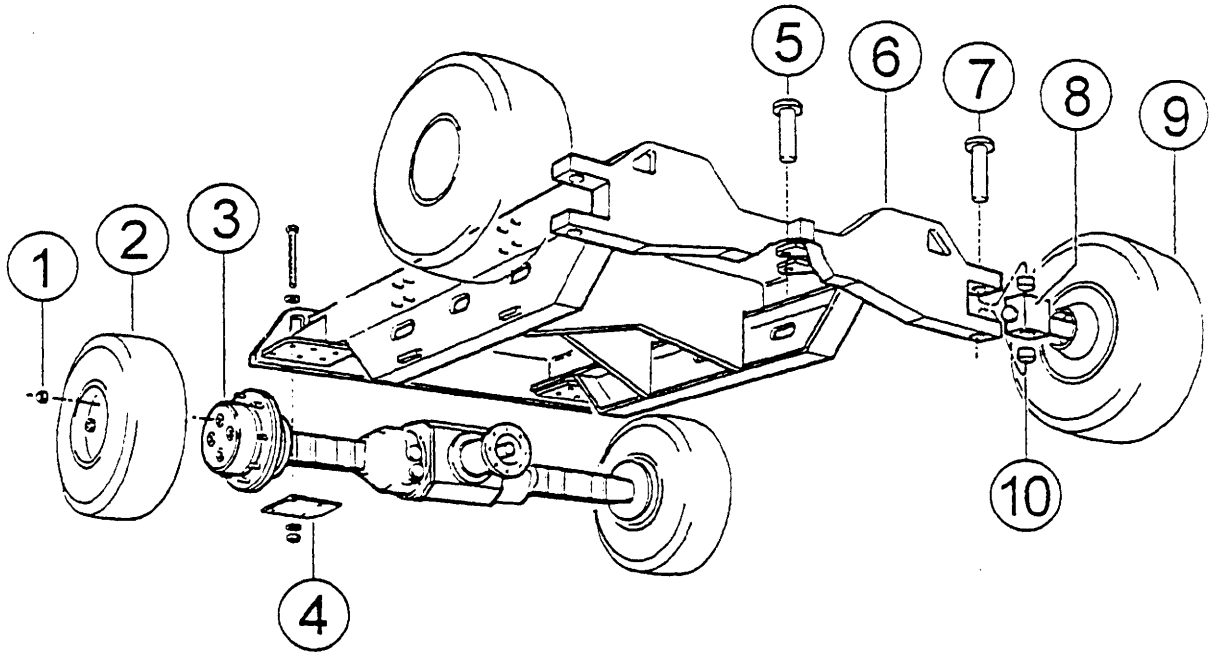


Figure 10.2 - Lower Chassis Assembly

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	18089	WHEEL ASSEMBLY (REAR) Complete with tyre, rim and nave.	2
3	18288	DRIVE AXLE	1
4	DS1067	AXLE MOUNTING ASSEMBLY (Complete)	2
	MS535	AXLE MOUNTING PLATE	2
	17543	M20 x 200LG HEX HEAD BOLT	8
	15138	M20 HEAVY-DUTY FLAT WASHER	8
	10990	M20 NYLOC NUT	8
5	GS505	PIN	2
6	GS600	CHASSIS ASSEMBLY	1
7	GS315	PIN (STEERING BLOCK)	2
8	GS236	STEERING ARM (LEFT HAND)	1
	GS237	STEERING ARM (RIGHT HAND)	1
9	14352	WHEEL ASSEMBLY (FRONT) Complete with tyre, rim and nave.	2
10	10288	PM 40 x 40 DX GLACIER BEARING	4
	11683	WC 40 DX GLACIER THRUST WASHER	4

BOXER 140 EN

LOWER CHASSIS ASSEMBLY

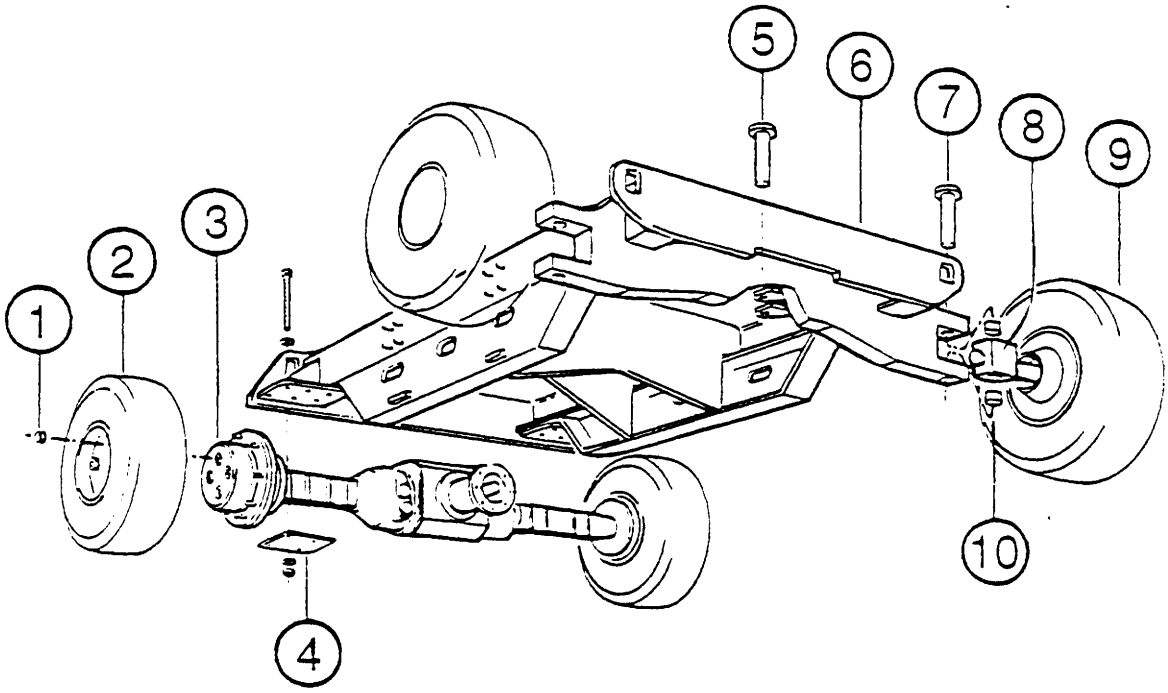


Figure 10.2 - Lower Chassis Assembly

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	18089	WHEEL ASSEMBLY (REAR) Complete with tyre, rim and nave.	2
3	18288	DRIVE AXLE	1
4	DS1056	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	GS600	CHASSIS ASSEMBLY	1
7	GH550	PIN (STEERING BLOCK)	2
8	GS236	STEERING ARM (LEFT HAND)	1
	GS237	STEERING ARM (RIGHT HAND)	1
9	14352	WHEEL ASSEMBLY (FRONT) Complete with tyre, rim and nave.	2
10	10288	PM 40 x 40 DX GLACIER BEARING	4
	11683	WC 40 DX GLACIER THRUST WASHER	4

BOXER 120 EN

STEERING ASSEMBLY

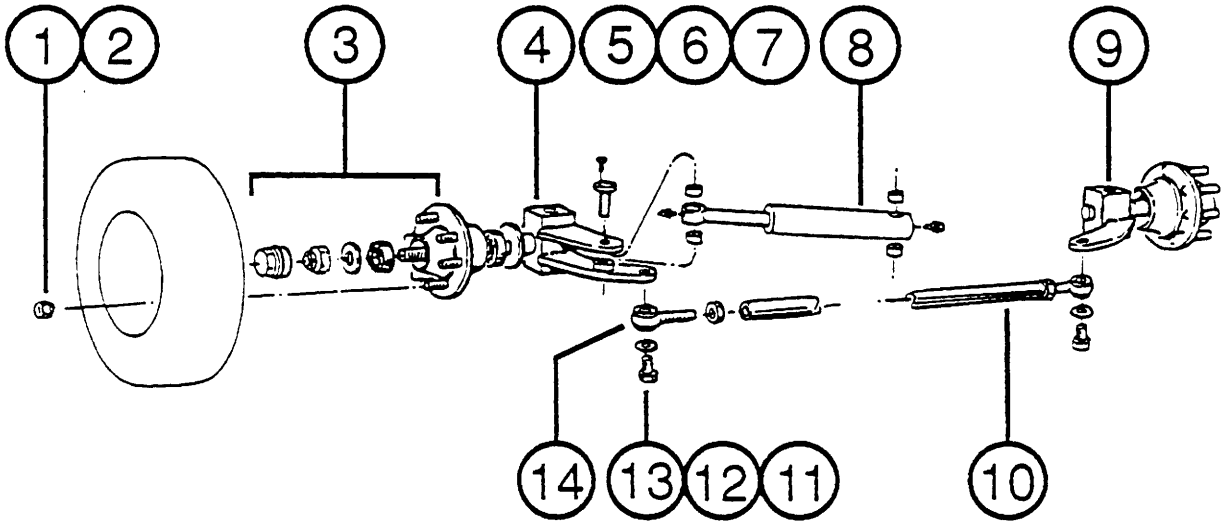


Figure 10.9 - Steering Assembly

Note: - If the towing package option is fitted, refer also to the diagrams and parts details on pages 28 and 29.

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	MS368	TRACK ROD	1
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 140 EN

STEERING ASSEMBLY

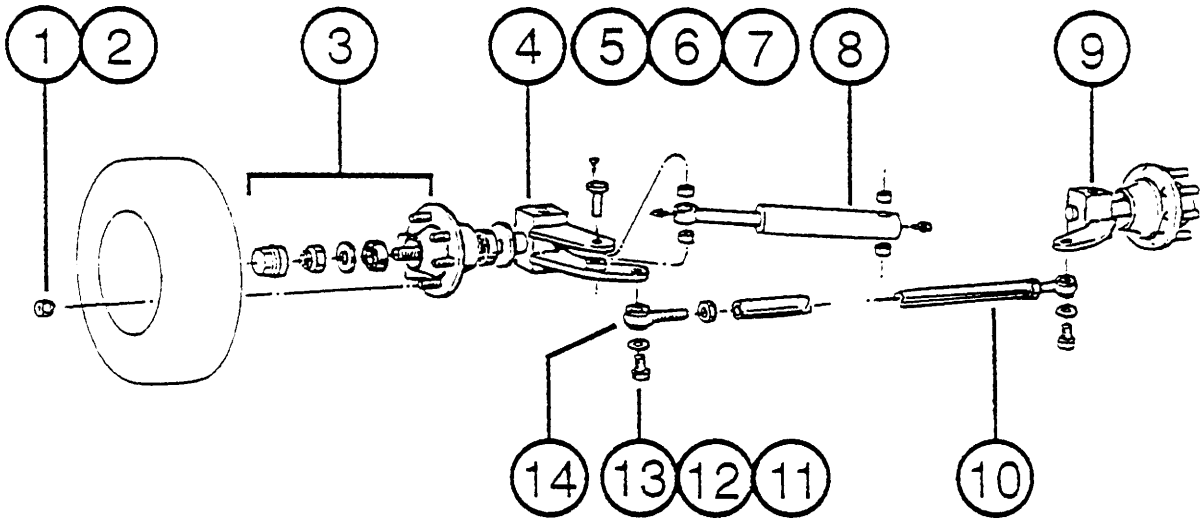


Figure 10.9 - Steering Assembly

Note: - If the towing package option is fitted, refer also to the diagrams and parts details on pages 29 and 30.

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	GH550	STEERING BLOCK PIVOT PIN	2
8	14368	STEERING CYLINDER	1
9	GS237	STEERING ARM (RIGHT HAND)	1
10	MS368	TRACK ROD	1
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 120 EN

PLINTH ASSEMBLY

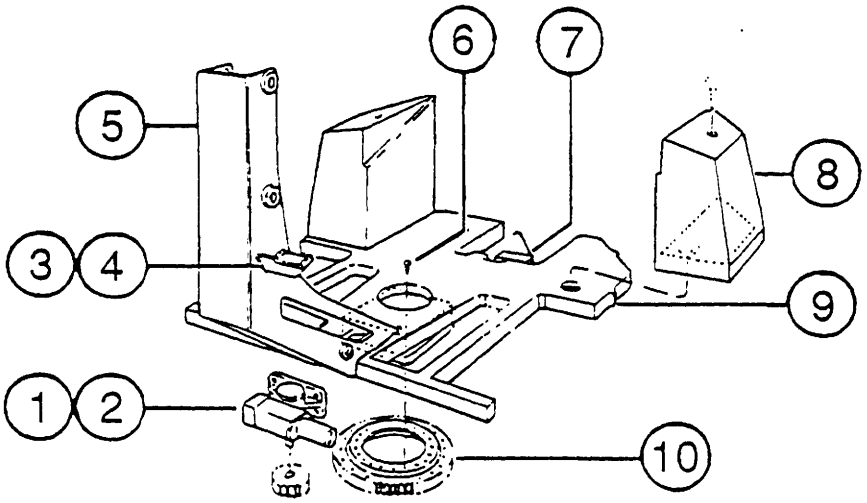


Figure 10.10 - Plinth Assembly

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	GS258	ZOOM BOOM REST	1
4	MS143	NYLON PAD (ZOOM BOOM REST)	1
5	GS132	FIRST POST	1
6	17647	M12 x 70 LG 10.9 GRADE CAP HEAD BOLT (SLEW RING/CHASSIS/PLINTH)	38
7	11110	LIMIT SWITCH BODY	1
	10308	LIMIT SWITCH HEAD	1
	DS1009	LIMIT SWITCH LEVER	1
8	PS358/360/362	BALLAST (LEFT HAND)	
	PS358/360/362	BALLAST (RIGHT HAND)	
	GS419	BALLAST RETAINING ASSEMBLY	2
	10542	M12 x 60 HEX HEAD SCREW	6
	11564	M12 HEX HEAD LOCK NUT	6
9	GS377	PLINTH ASSEMBLY	1
10	18247	SLEW RING	1
	16474	DIVERTER VALVE	1
	14613	HANDLE (DIVERTER VALVE)	1
	MS440	ROTATION STOP	2

(continued)

BOXER 120 E - PLINTH ASSEMBLY (continued)

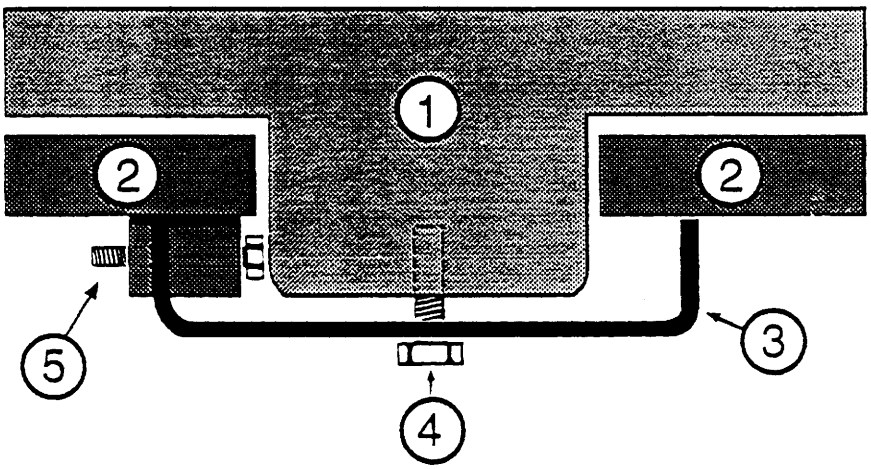


Figure 10.11 - Ballast Security

1) Ballast
2) Plinth
3) Ballast Retaining Assembly
4) Securing Bolt and Washers (M12)
5) Adjusting Bolt (M12)

BOXER 140 EN

PLINTH ASSEMBLY

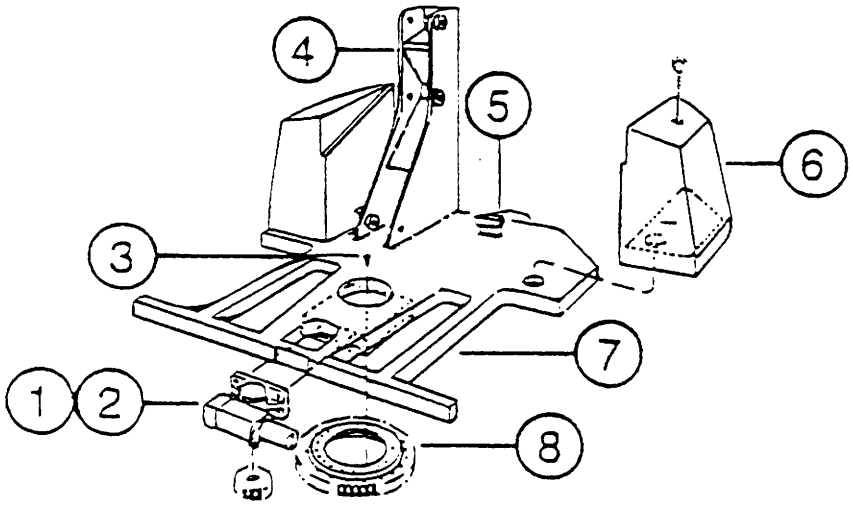


Figure 10.10 - Plinth Assembly

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	11369	M12 x 75 LG 10.9 GRADE CAP HEAD BOLT (SLEW RING/CHASSIS/PLINTH)	38
4	GS191	FIRST POST	1
5	11110	LIMIT SWITCH BODY	1
	10308	LIMIT SWITCH HEAD	1
	DS1009	LIMIT SWITCH LEVER	1
6	PS358/360/362	BALLAST (LEFT HAND)	1
	PS358/360/362	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	GS375	PLINTH ASSEMBLY	1
8	18247	SLEW RING	1
	16474	DIVERTER VALVE	1
	14613	HANDLE (DIVERTER VALVE)	1
	MS440	ROTATION STOP	2

(continued)

BOXER 140 E - PLINTH ASSEMBLY (continued)

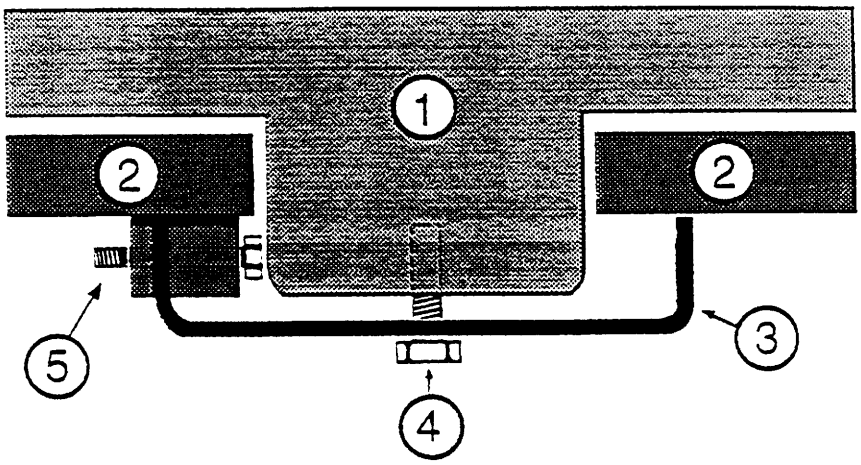


Figure 10.11 - Ballast Security

1) Ballast
2) Plinth
3) Ballast Retaining Assembly
4) Securing Bolt and Washers (M12)
5) Adjusting Bolt (M12)

BOXER 120 EN

1st LIFT STAGE

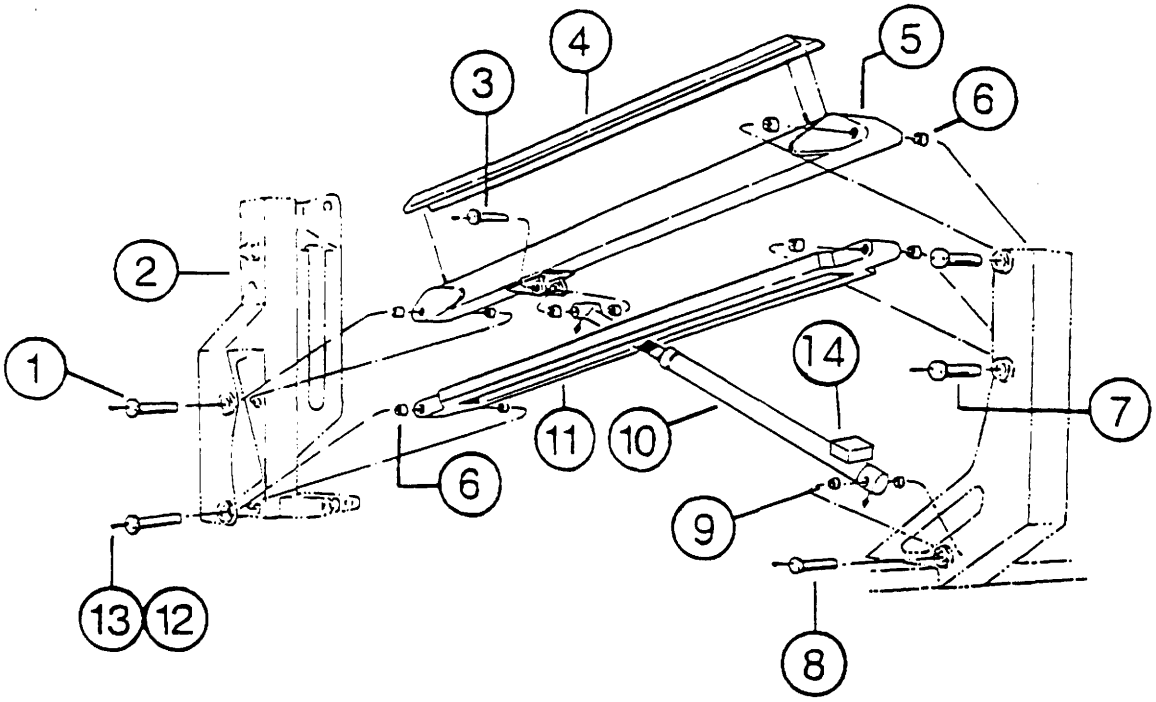


Figure 10.12 - 1st Lift Stage

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS472	PIN (OFFSET POST)	2
2	GS193	OFFSET POST	1
3	GS474	PIN (LIFT CYLINDER ROD END)	1
4	SS101	CABLE COVER	1
	MS128	CABLE COVER STUD	4
5	GS185	FIRST BOOM	1
6	10288	GLACIER PM 40 x 50 DX BEARING	8
7	GS315	PIN (FIRST POST)	2
8	GS473	PIN (LIFT CYLINDER BASE)	1
9	11844	GLACIER PM 25 x 25 DX BEARING (PART OF LIFT CYLINDER)	4
10	18242	LIFT CYLINDER	1
	17614	SEAL KIT, LIFT CYLINDER	1
11	GS178	FIRST TIE RAIL	1
12	11085	M8 x 25 GRADE 8.8 HEX HEAD SCREW	12
13	14541	M8 DISC LOCK WASHER	24
14	41031-0004	OVERCENTRE VALVE	1

BOXER 120 E N

ZOOM BOOM ASSEMBLY

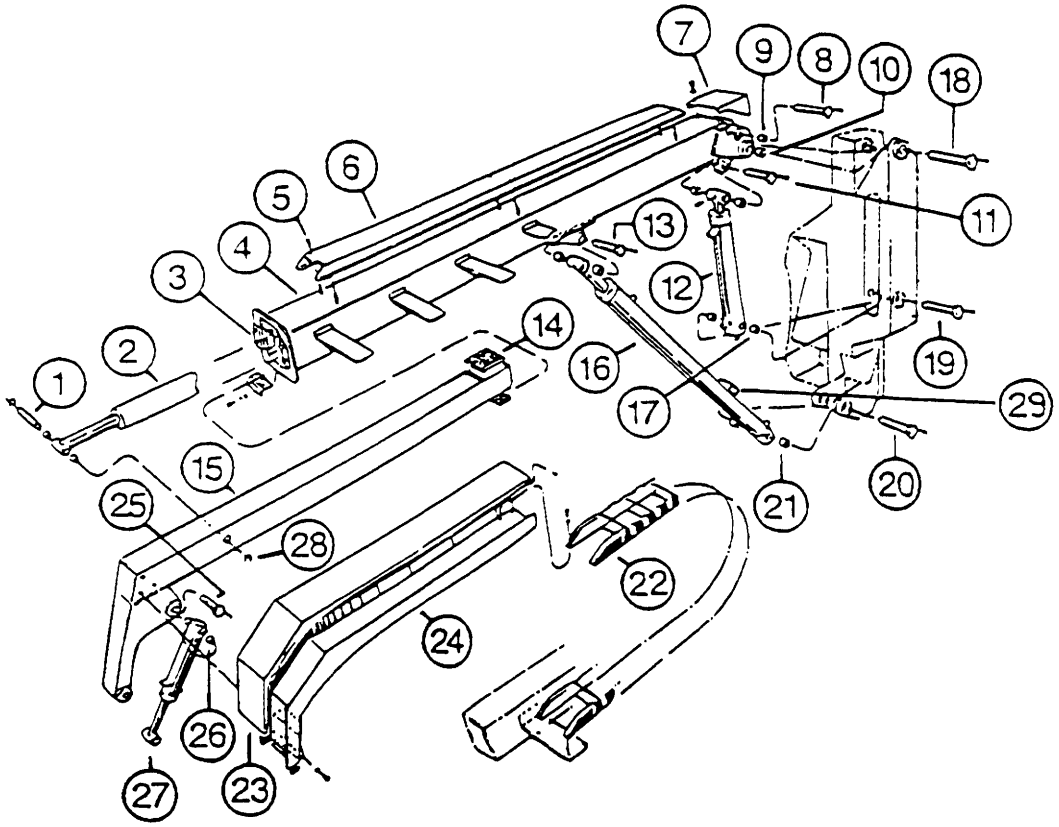


Figure 10.13 - Zoom Boom Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	LS103	PIN (ZOOM CYLINDER ROD END)	1
2	14371	ZOOM CYLINDER	1
	11853	SEAL KIT, ZOOM CYLINDER	1
3	MS179	WEAR PAD (SIDE)	4
4	GS621	ZOOM BOOM (OUTER)	1
5	MS128	CABLE COVER STUD	6
6	SS100	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	GS476	PIN (LEVEL CYLINDER ROD END)	1
12	18245	LEVEL CYLINDER (MASTER)	1
	10053	SEAL KIT, LEVEL CYLINDER (MASTER)	1
13	GS474	PIN (LIFT CYLINDER ROD END)	1

(continued)

BOXER 120 E - ZOOM BOOM ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
14	MS178	WEAR PAD (TOP/BOTTOM)	4
** 15	GS205	ZOOM BOOM (INNER) (SEE NOTE)	1
16	18242	LIFT CYLINDER	1
	17614	SEAL KIT, 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	14375	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
	10053	SEAL KIT, 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
	DS1080	ZOOM BOOM (COMPLETE ASSEMBLY)	1
29	44031-0004	OVERCENTRE VALVE	1

** **NOTE** : FOR THE BOXER 130 ONLY , USE SNOUT FORMING PART NO. GS344

BOXER 140 E N

1st LIFT STAGE

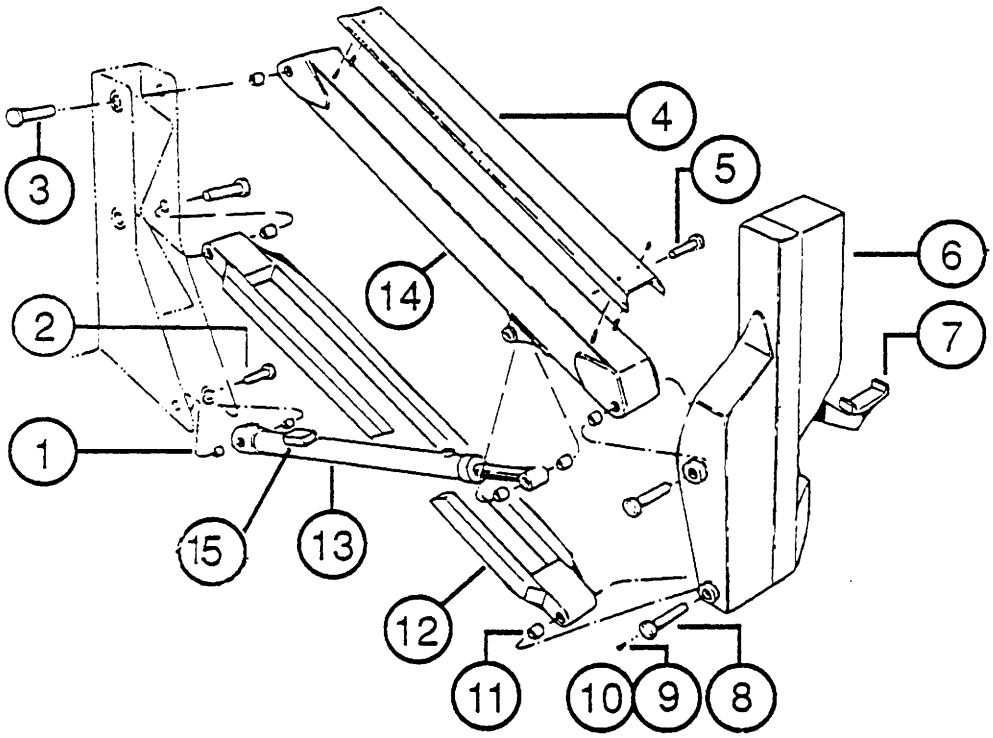


Figure 10.12 - 1st Lift Stage

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	SS101	CABLE COVER	1
	MS128	CABLE COVER STUD	4
5	GS474	PIN (LIFT CYLINDER ROD END)	1
6	GS147	OFFSET POST	1
7	GS262	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	GS178	FIRST TIE RAIL	1
13	18242	LIFT CYLINDER	1
	17614	SEAL KIT, LIFT CYLINDER	1
14	GS185	FIRST BOOM	1
15	44031-0004	OVERCENTRE VALVE	1

BOXER 140 EN

2nd LIFT STAGE

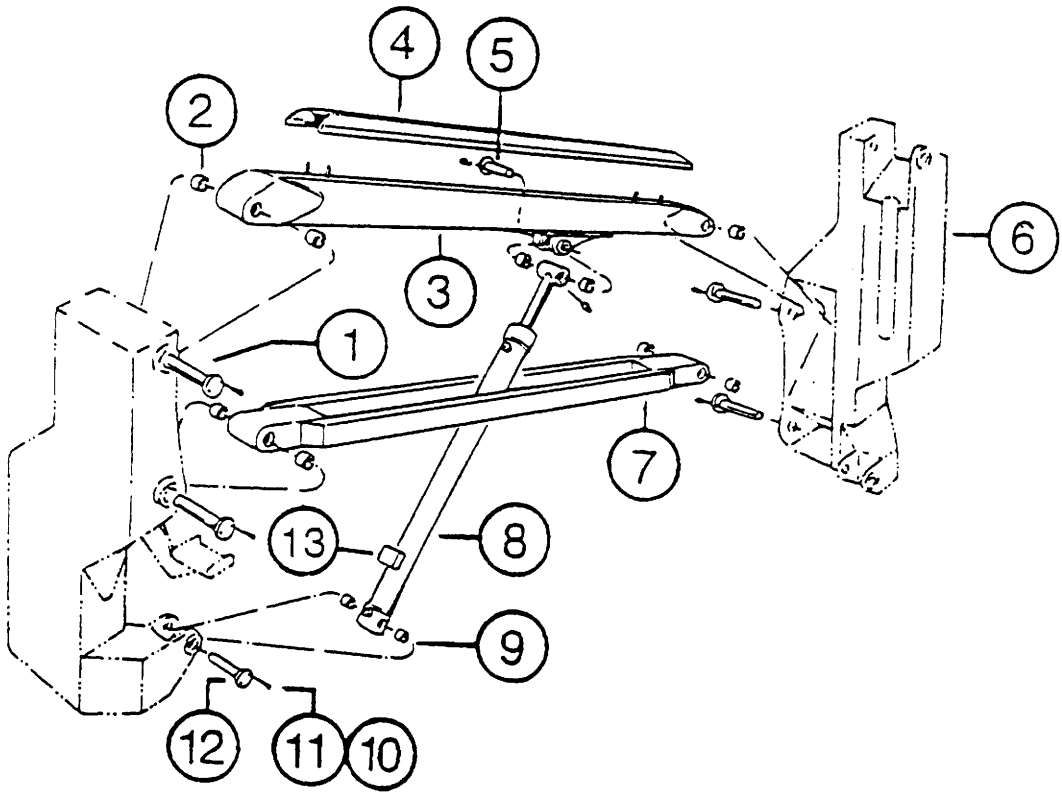


Figure 10.13 - 2nd Lift Stage

ITEM	PART NO.	DESCRIPTION	QTY.
1	GS472	PIN (FIRST AND SECOND OFFSET POSTS)	4
2	10288	GLACIER PM 40 x 40 DX BEARING	
3	GS620	SECOND BOOM	1
4	SS102	CABLE COVER	1
	MS128	CABLE COVER STUD	4
5	GS474	PIN (LIFT CYLINDER ROD END)	1
6	GS602	SECOND OFFSET POST	1
7	GS179	SECOND TIE RAIL	1
8	18242	LIFT CYLINDER	1
	17614	SEAL KIT, 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	44031-0004	OVERCENTRE VALVE	1

BOXER 140 EN

ZOOM BOOM ASSEMBLY

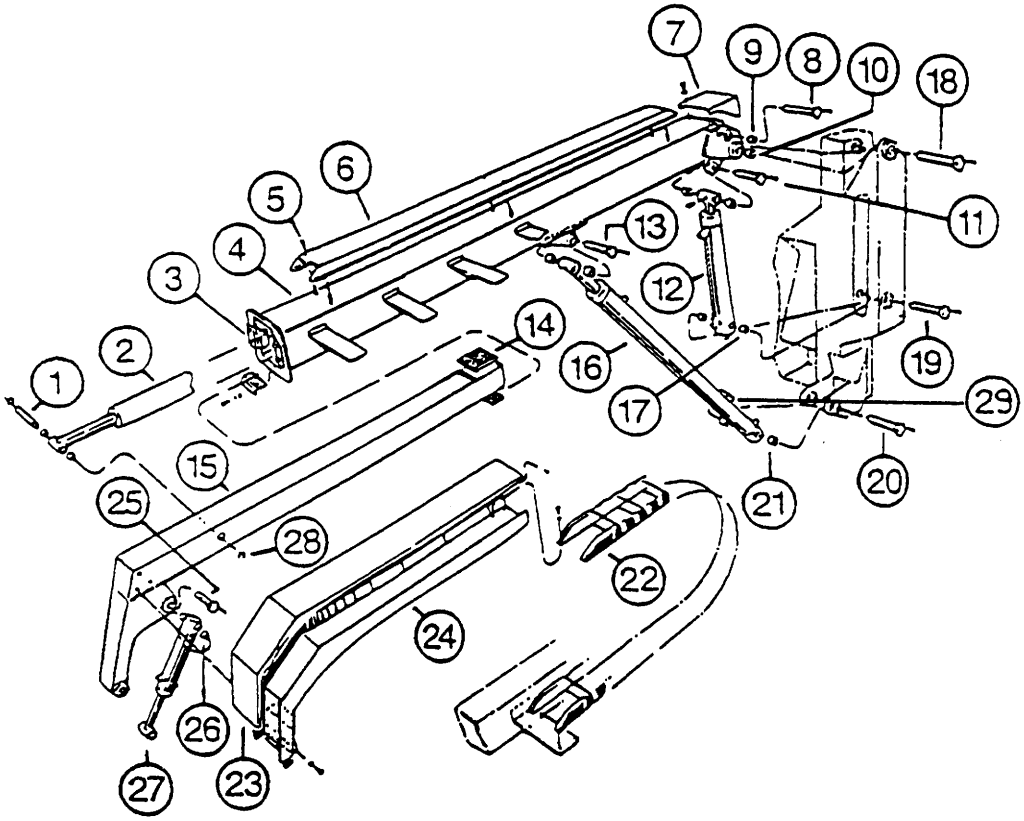


Figure 10.14 - Zoom Boom Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	LS103	PIN (ZOOM CYLINDER ROD END)	1
2	14371	ZOOM CYLINDER	1
	11853	SEAL KIT, ZOOM CYLINDER	1
3	MS179	WEAR PAD (SIDE)	4
4	GS621	ZOOM BOOM (OUTER)	1
5	MS128	CABLE COVER STUD	6
6	SS100	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	GS476	PIN (LEVEL CYLINDER ROD END)	1
12	18245	LEVEL CYLINDER (MASTER)	1
	10053	SEAL KIT, LEVEL CYLINDER (MASTER)	1
13	GS474	PIN (LIFT CYLINDER ROD END)	1

(continued)

BOXER 140 - ZOOM BOOM ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
14	MS178	WEAR PAD (TOP/BOTTOM)	4
15	GS205	ZOOM BOOM (INNER)	1
16	18242	LIFT CYLINDER	1
	17614	SEAL KIT, 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	14375	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
	10053	SEAL KIT, 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
	DS1080	ZOOM BOOM (COMPLETE ASSEMBLY)	1
29	44031-0004	OVERCENTRE VALVE	1

BOXER 120 E N

CAGE ASSEMBLY

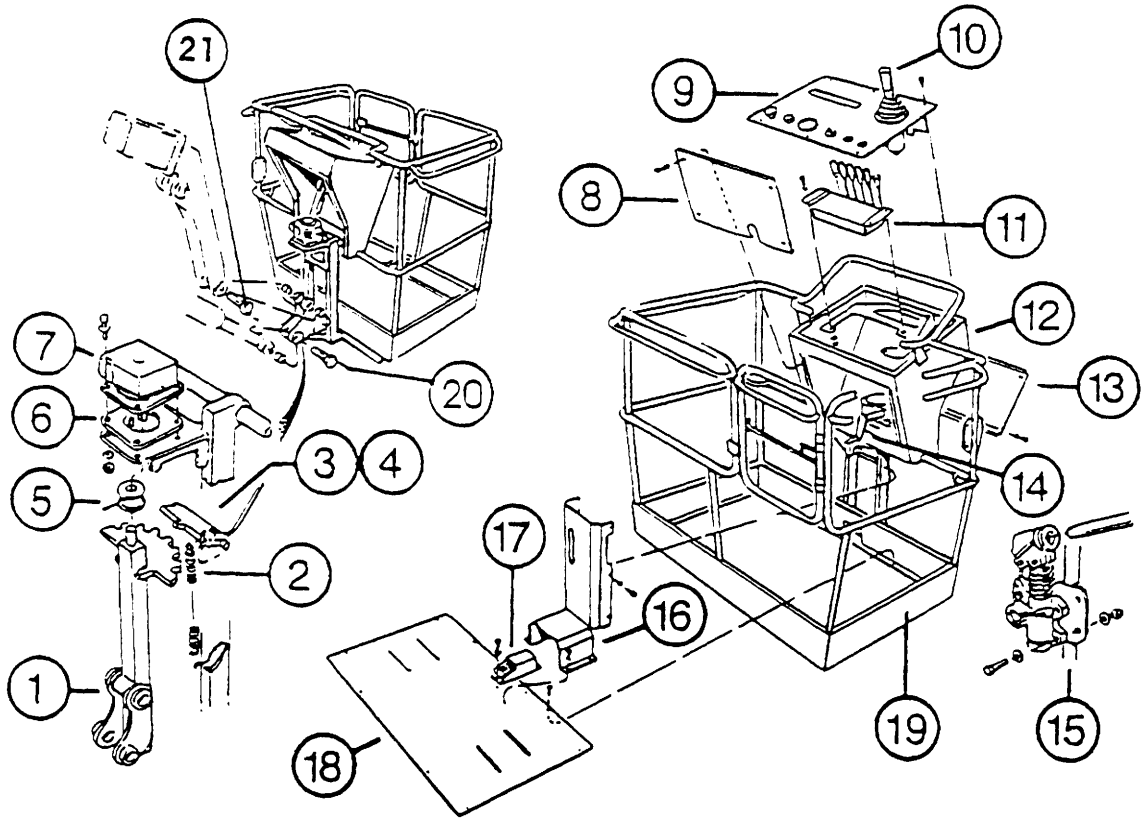


Figure 10.14 - Cage Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
** 1	DS336	SWIVEL POST (SEE NOTE)	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	PS261	FRONT COVER	1
9	PS263	FASCIA PLATE	1
10	11745	JOYSTICK CONTROLLER	1
11	14378	BANK VALVE	1
	14446	ROTATION HANDLEVER (COMPLETE WITH KNOB)	1
	14380	HANDLEVER (COMPLETE WITH KNOB)	4
12	PS260	CONTROL CONSOLE	1
13	PS473	REAR COVER	1

(continued)

BOXER 120 E - CAGE ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
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) **(SEE NOTE)**	1

** **NOTE :**

THE BOXER 130 E IS CONSTRUCTED AS PER THE BOXER 120 E , WITH THE ADDITION OF A SWIVEL POST ASSEMBLY , PART No.GS369 AND PIN No. GS498

BOXER 140 EN

CAGE ASSEMBLY

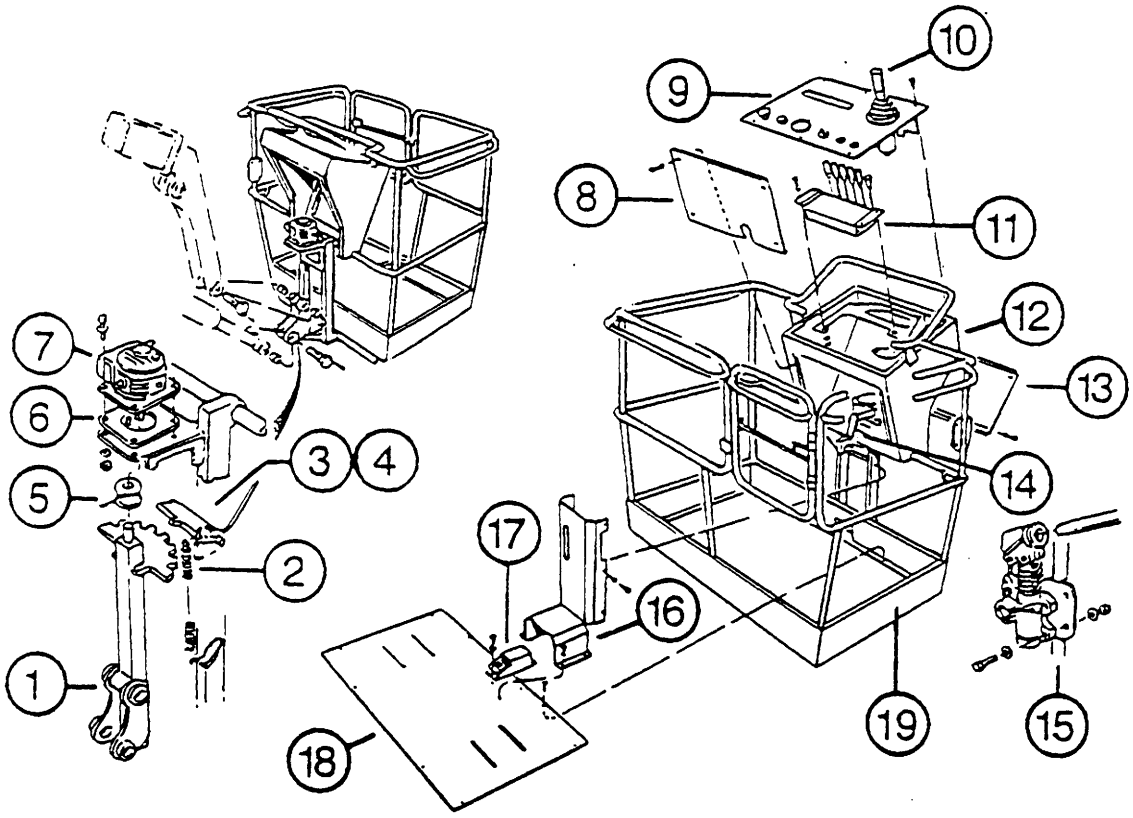


Figure 10.15 - Cage Assembly

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	P89/M88	MOUNTING PLATE	1
7	10468	ROTATION GEARBOX	1
8	PS261	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	PS260	CONTROL CONSOLE	1
13	PS262	REAR COVER	1

(continued)

BOXER 140 - CAGE ASSEMBLY (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
14	14451	ROTATION HANDLE	1
15	11964	EMERGENCY LOWER PUMP/VALVE (OPTIONAL)	1
16	PS269	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

BOXER 120 EN

ELECTRIC MODULE

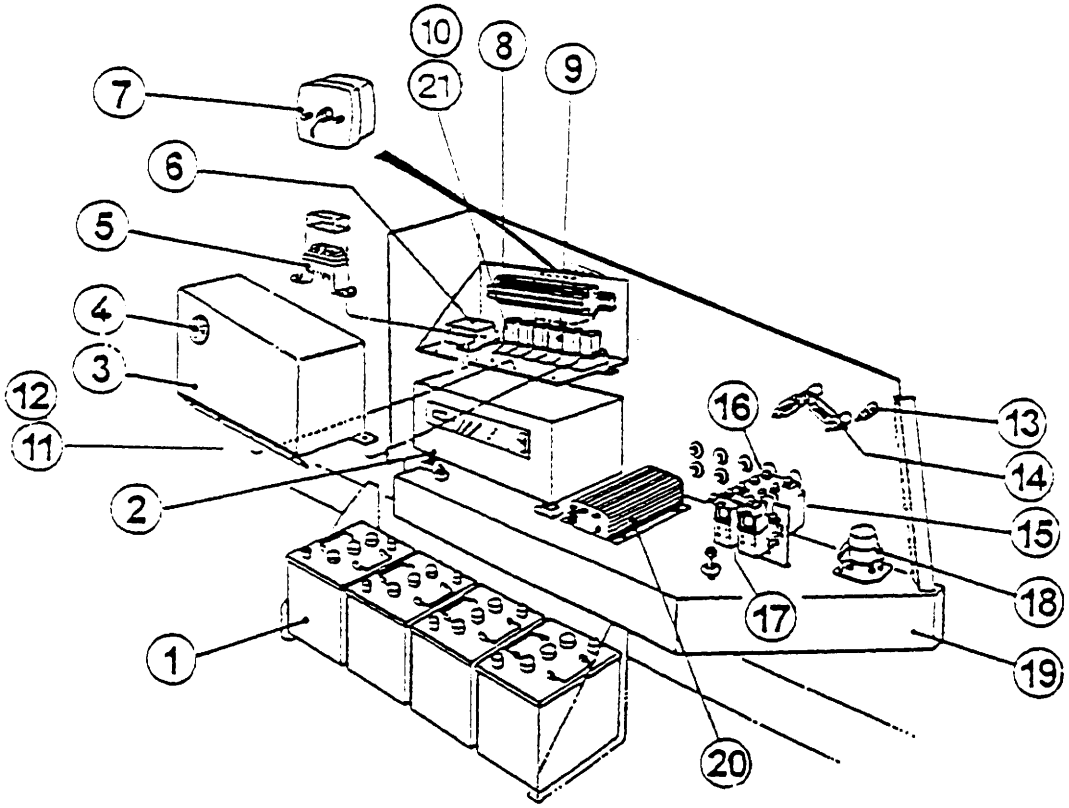


Figure 10.15 - Electric Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	11830	BATTERY, 6V, 175 AMP-HOUR (Standard)	8
	14605	BATTERY PACK, 2V, 258 AMP-HOUR (Optional)	2
	17041	BATTERY PACK, 2V, 300 AMP-HOUR (Optional)	2
2	17311	BATTERY CHARGER, 48V, 40A, SINGLE VOLTAGE (Standard)	1
	17305	BATTERY CHARGER, 48V, 35A, DUAL VOLTAGE (Optional)	1
	16976	PLUG, 2-POLE, BLUE	2
3	GS325	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

(continued)

BOXER 120 EN ELECTRIC MODULE (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
7	12423	KLAXON, 24V	1
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	5
	12349	8-PIN RELAY BASE	5
10	17715	11-PIN RELAY	1
11	13030-0042	COVER	1
12	16404	HINGE	1
	12274	LATCH	1
13	10823	M8 STAND-OFF	4
14	10862	FUSE, 300A	1
	18186	FUSE, 100A	1
15	11044	CONTACTOR (PUMP)	1
16	10150	CONTACTOR (TRACTION)	1
17	12426	CONTACTOR (FORWARD/REVERSE)	1
	11550	CONTACTOR BRACKET	2
18	42013-0287	TILT ALARM SENSOR	1
19	13030-0043	MODULE BASE	1
20	16443	DRIVE MOTOR CONTROLLER	1
	11976	RUBBER BOOT	18
	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	11729	11 PIN RELAY BASE	1

BOXER 140 EN

ELECTRIC MODULE

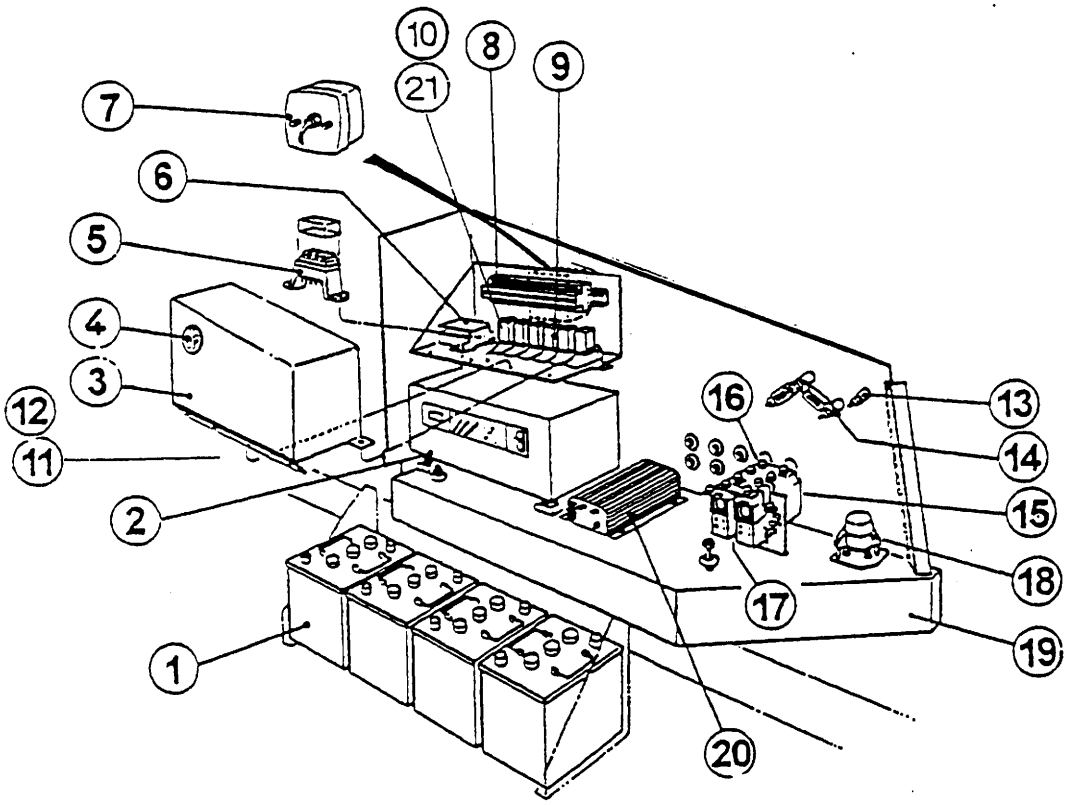


Figure 10.16 - Electric Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	11830	BATTERY, 6V, 175 AMP-HOUR (Standard)	8
	14605	BATTERY PACK, 2V, 258 AMP-HOUR (Optional)	2
	17041	BATTERY PACK, 2V, 300 AMP-HOUR (Optional)	2
2	17311	BATTERY CHARGER, 48V, 40A, SINGLE VOLTAGE (Standard)	1
	17305	BATTERY CHARGER, 48V, 35A, DUAL VOLTAGE (Optional)	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

(continued)

BOXER 140 EN ELECTRIC MODULE (continued)

ITEM	PART NO.	DESCRIPTION	QTY.
7	12423	KLAXON, 24V	1
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	6
	12349	8-PIN RELAY BASE	6
10	16138	GAS STRUT	1
11	13030-0042	COVER	1
12	GS325	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	2
18	42013-0285	TILT ALARM SENSOR	1
19	13030-0043	MODULE BASE	1
20	16443	DRIVE MOTOR CONTROLLER	1
	11976	RUBBER BOOT	18
	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

BOXER 120 EN

HYDRAULIC MODULE

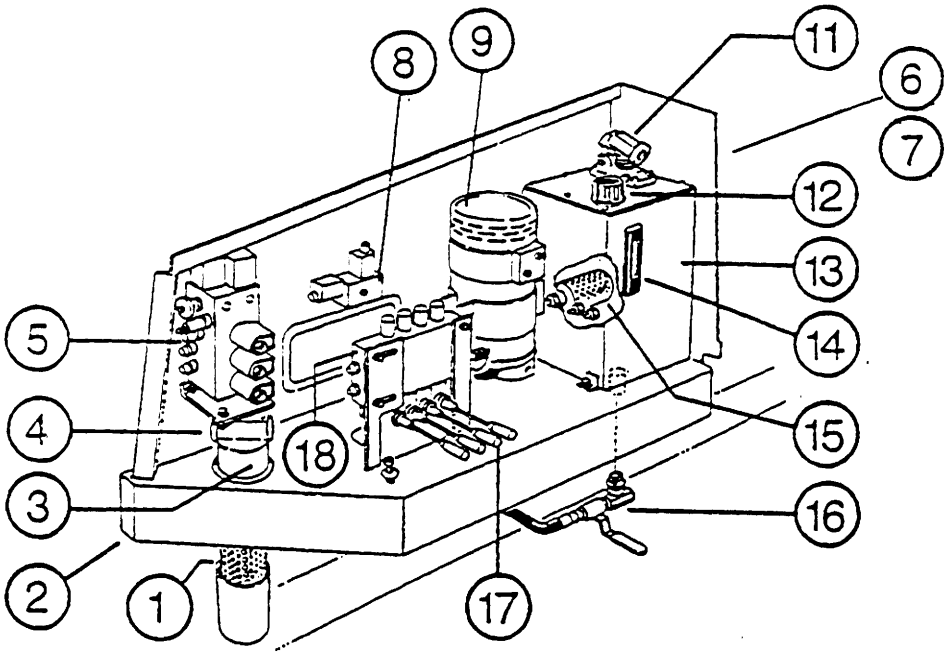


Figure 10.16 - Hydraulic Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	11357	PRESSURE FILTER ELEMENT	1
2	GS399	MODULE BASE	1
3	11389	PRESSURE FILTER	1
4	GS060	FILTER BRACKET	1
5	17244	BRAKE/LIFT/STEER MANIFOLD	1
6	-	HINGE,	1
7	13030-0041	COVER	1
8	17245	DIFF LOCK ENGAGEMENT MANIFOLD	1
9	10319	BOSCH PUMP	1
	MS041	MOTOR/PUMP CLAMP	1
10			
11	16160	HANDPUMP (COMPLETE WITH HANDLE)	1
12	11667	FILLER CAP	1
	11510	DIFFUSER	1

(continued)

BOXER 120EN 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)	4
18	14377	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)	
	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
	17713	RELIEF VALVE	1
	17541	PRESSURE SWITCH (25 BAR)	1
	17542	PRESSURE SWITCH (35 BAR)	1
	10639	PROTECTIVE COVER (PRESSURE SWITCH)	2
	11976	RUBBER BOOT	2

BOXER 140 EN

HYDRAULIC MODULE

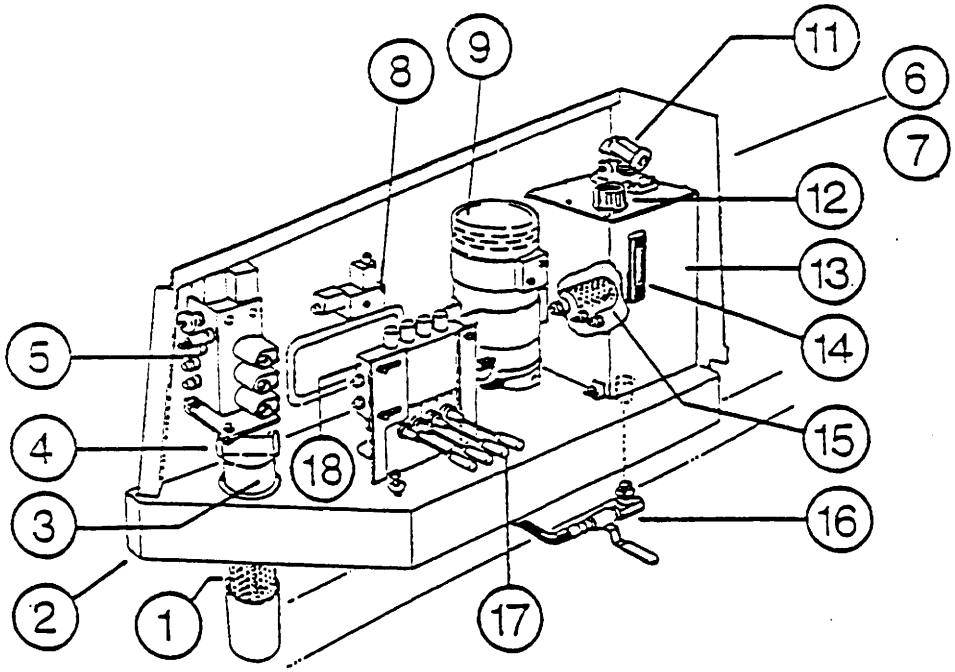


Figure 10.17 - Hydraulic Module

ITEM	PART NO.	DESCRIPTION	QTY.
1	11357	PRESSURE FILTER ELEMENT	1
2	GS399	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	13030-0041	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 140 EN 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)	4
18	14377	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
	17713	RELIEF VALVE	1
	17541	PRESSURE SWITCH (25 BAR)	1
	17542	PRESSURE SWITCH (35 BAR)	1
	10639	PROTECTIVE COVER (PRESSURE SWITCH)	2
	11976	RUBBER BOOT	2

BOXER 120 EN

GROUND CONTROLS

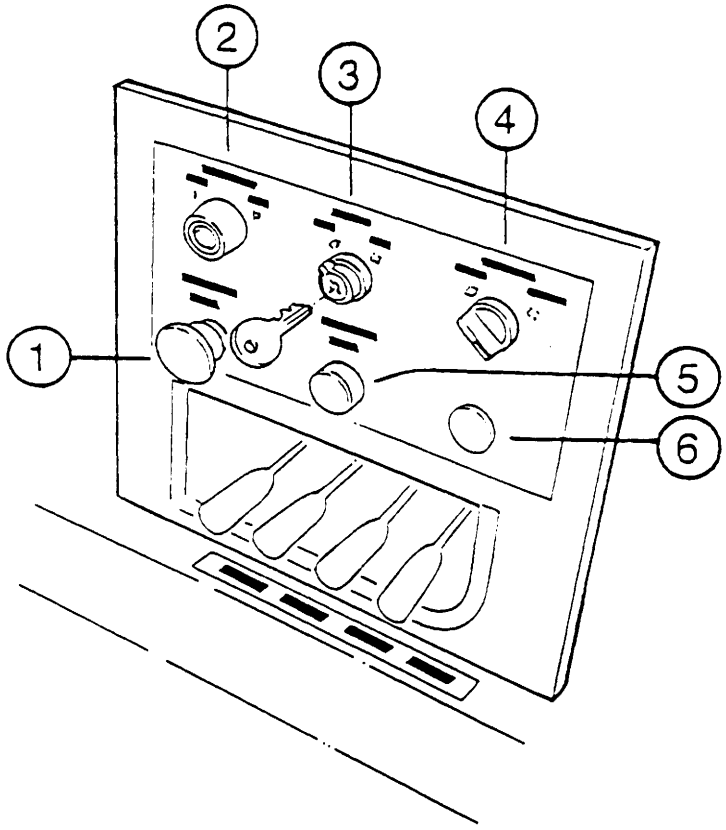


Figure 10.17 - Ground Controls

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 140 EN

GROUND CONTROLS

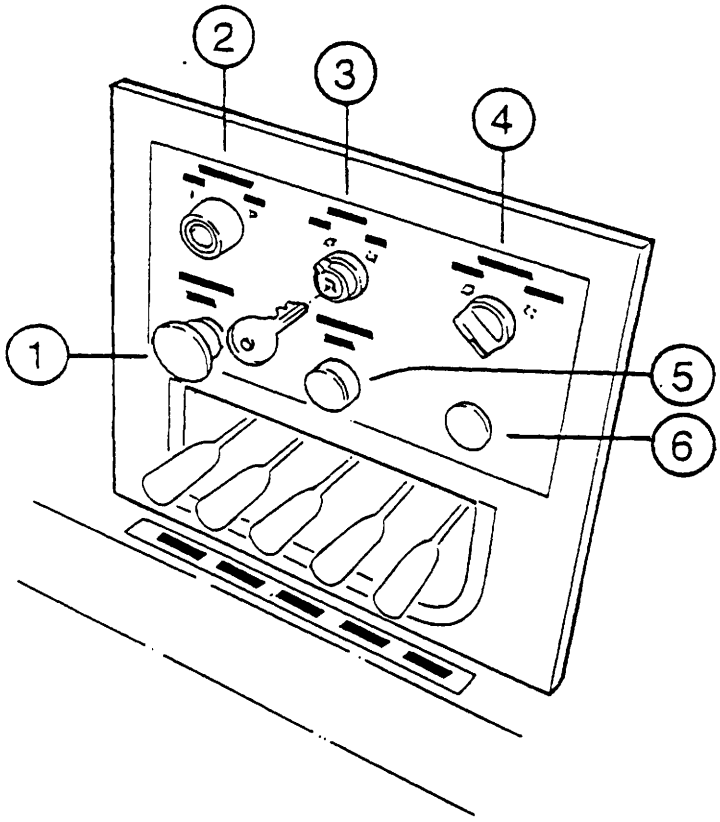


Figure 10.18 - Ground Controls

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 120 EN

CAGE CONTROLS

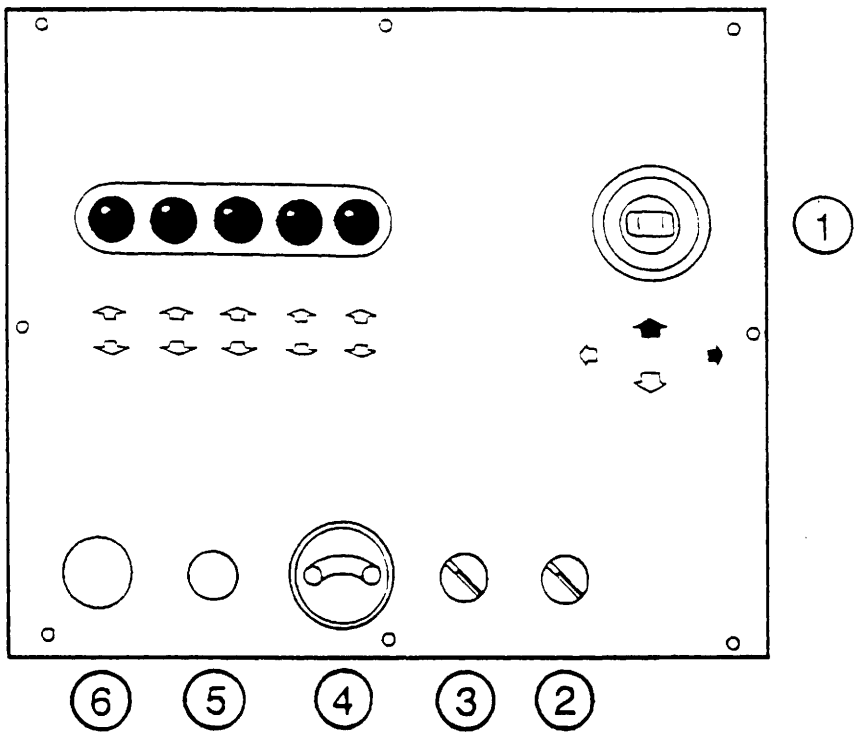


Figure 10.18 - Cage Controls

ITEM	PART NO.	DESCRIPTION	QTY.
1	11745	JOYSTICK CONTROLLER	1
2	11201	SELECTOR SWITCH (DIFF LOCK)	1
3	10954	SELECTOR SWITCH (LIFT/DRIVE)	1
	11527	CONTACT (NORMALLY CLOSED)	1
	12457	CONTACT (NORMALLY OPEN)	1
4	11958	BATTERY INDICATOR	1
5	11037	HORN PUSHBUTTON, GREEN	1
	11815	CONTACT (NORMALLY OPEN)	1
6	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 140 EN

CAGE CONTROLS

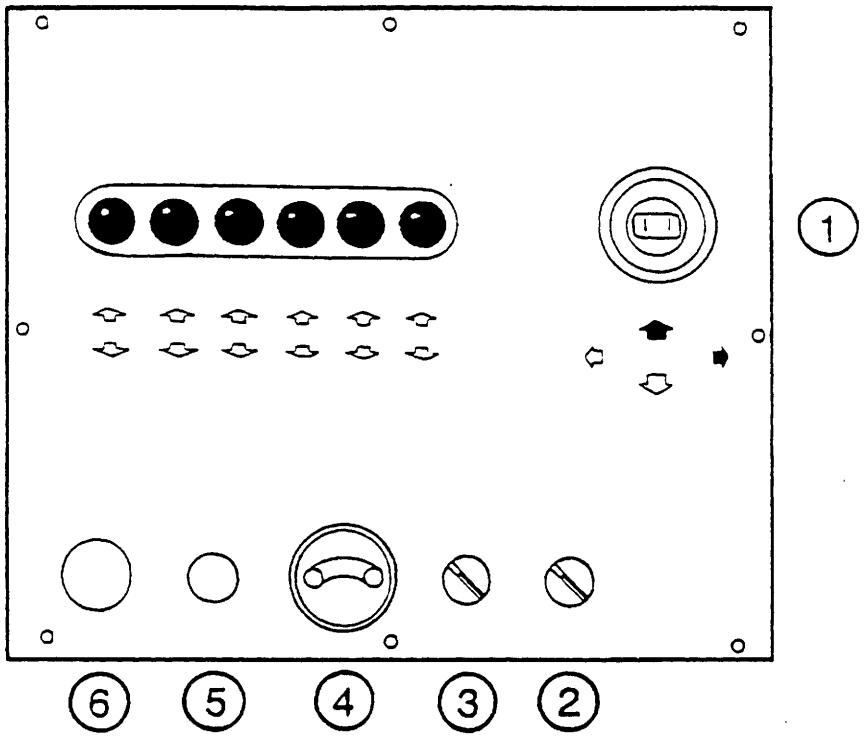


Figure 10.19 - Cage Controls

ITEM	PART NO.	DESCRIPTION	QTY.
1	11745	JOYSTICK CONTROLLER	1
2	11201	SELECTOR SWITCH (DIFF LOCK)	1
3	10954	SELECTOR SWITCH (LIFT/DRIVE)	1
	11527	CONTACT (NORMALLY CLOSED)	1
	12457	CONTACT (NORMALLY OPEN)	1
4	11958	BATTERY INDICATOR	1
5	11037	HORN PUSHBUTTON, GREEN	1
	11815	CONTACT (NORMALLY OPEN)	1
6	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 120 EN

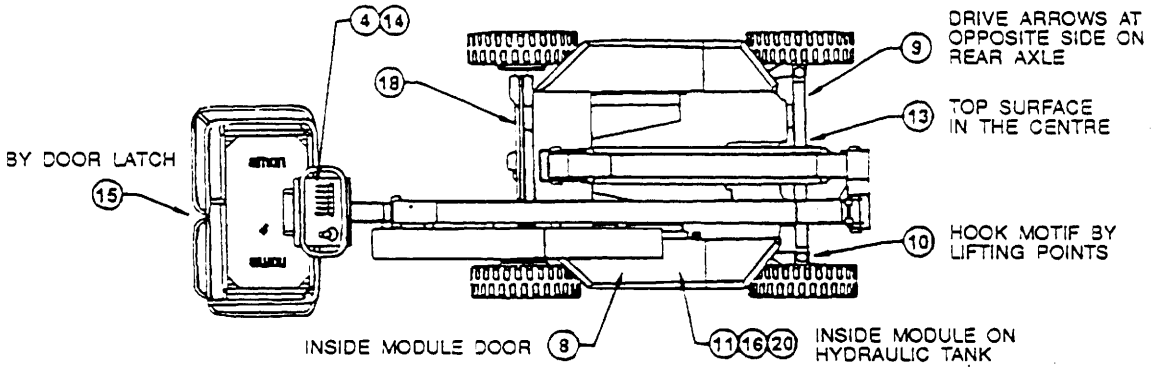
LABELS

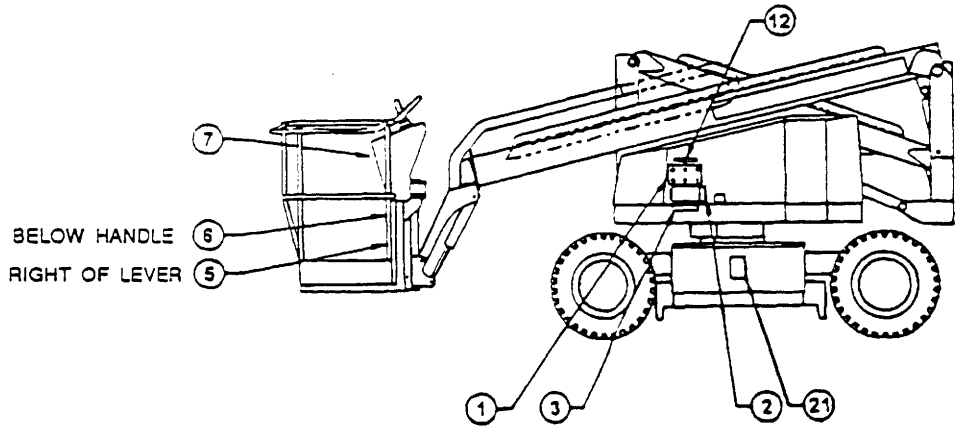
(Refer to Figure 10.19.)

ITEM	PART NO.	DESCRIPTION	QTY.
1	AS103	GROUND CONTROLS	1
2	AS104	GROUND CONTROL	1
3	AS106	GROUND CONTROL	1
4	A1129	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 - 120 mm PRE-SPACED	2
23	16616	BOXER - 120 mm BLACK	2
24	16608	120 - 120 mm BLACK	2
25	16603	E - 120 mm BLACK	2

(continued)

BOXER 120 E - LABELS (continued)





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

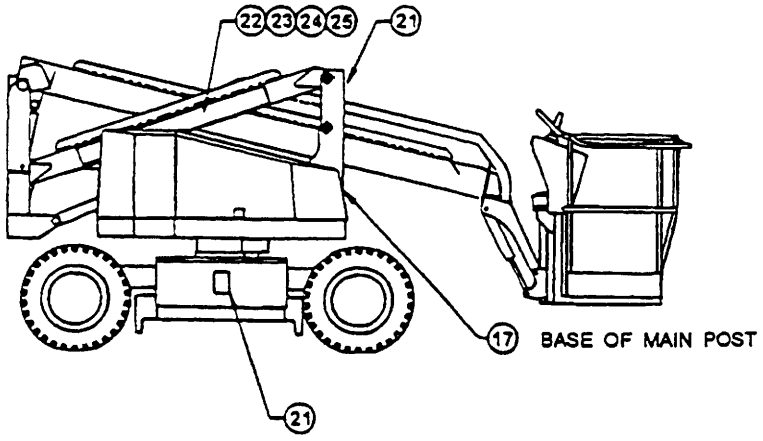


Figure 10.19 - Label Positions

BOXER 140 EN

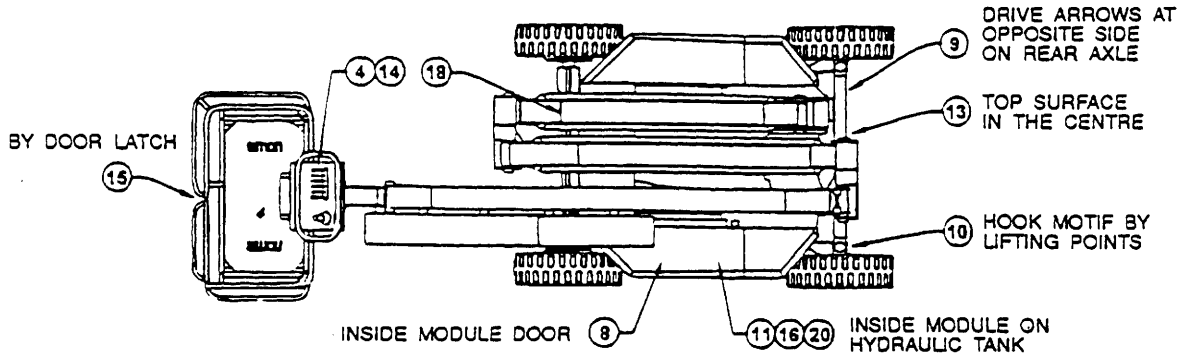
LABELS

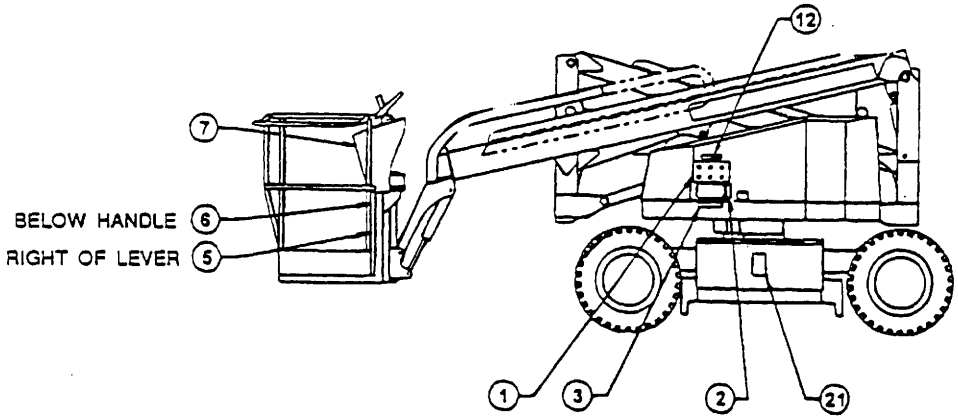
(Refer to Figure 10.20.)

ITEM	PART NO.	DESCRIPTION	QTY.
1	AS103	GROUND CONTROLS	1
2	AS104	GROUND CONTROL	1
3	AS105	GROUND CONTROL	1
4	A1128	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	37003-0022	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	16610	140 - 120mm BLACK	2
25	16603	E - 120mm BLACK	2
	16602	N-120 mm BLACK	2

(continued)

BOXER 140 M - LABELS (continued)





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

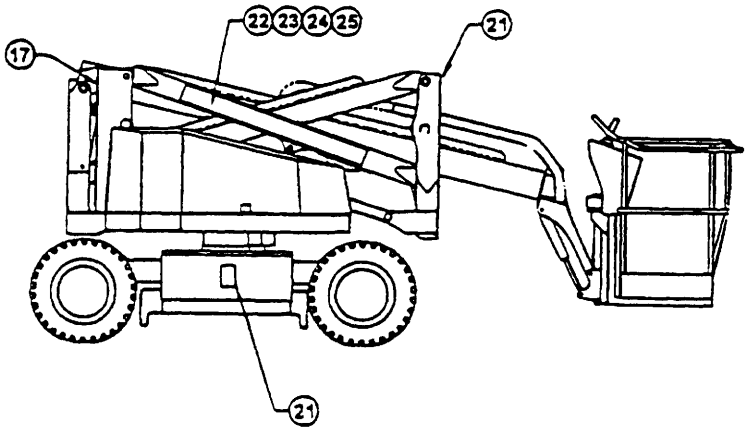


Figure 10.20 - Label Positions

BOXER 140 EN

HYDRAULIC COMPONENTS

(NOT LISTED OR SHOWN IN DIAGRAMS)

ITEM	PART NO.	DESCRIPTION	QTY.
	12513	RELIEF VALVE (1ST OFFSET POST)	2
	10761	OVERCENTRE VALVE (LIFT CYLINDERS)	3
	11837	BANJO BOLT (RELIEF VALVE)	3
	16137	COUNTER BALANCE VALVE (ZOOM SNOUT)	1
	11925	UNION SCREW $^1/_4$" UNF	3
	12118	BSP MALE STUD COUPLING - $^1/_4$" OD TUBE x $^3/_8$" BSP	1
	16192	BANJO COUPLING - TYPE R $^1/_4$" OD TUBE x $^1/_4$" BSP	1