

Dear Customer

Thank you for choosing a SAM Forward Control Hydrostatic Crop Sprayer for your future spraying needs.

We urge you to read and fully understand this manual and keep it handy at all times as it could avoid mistakes, frustration and excessive down time.

The Manual is divided into several sections. It is intended to cater for the Farm Maintenance Engineer as well as the Spray Operator and these people must decide which sections of the manual are relevant to them. It commences with General Safety Precautions and then goes on to explain the Traction, Spraying, Hydraulic and Air Systems on the machine, with a brief description of each individual component, their location and function.

Calibration, filling, spraying and cleaning are of particular importance to the spray operator as is the faultfinding section at the rear of this book. Sprayer lubrication and spares may also be found in this manual.

SAM Serial No: Cab No:

Commissioning Date:

Sands Agricultural Machinery Ltd may be contacted as follows:

Telephone:	01692 580522	Fax:	01692 580961
Email:	sales@samltd.co.uk	Web Site:	www.samltd.co.uk

Please ensure that the above details are completed when the machine is commissioned, as this information will be required when ordering spare parts.

A small selection of sprayer parts is enclosed.

DELIVERY

Upon receipt of the sprayer, please check for transport damage. Check all major fixings at this time and at frequent periodic intervals thereafter.

CONDITIONS OF SUPPLY

Sands Agricultural Machinery Ltd cannot be held responsible for injury or damage arising from incorrect handling, usage or storage of this sprayer.

The Customer will become wholly responsible for items or build specifications outside our normal conditions of supply.

WARRANTY

Sands Agricultural Machinery Ltd warrants all its products for a period of 1 year or 800 hours from the date of delivery. Free of charge replacement by post will only be accepted if the failed component(s) are returned, adequately packed and protected, in a representative condition. Any damage not attributed to the failure will be charged.

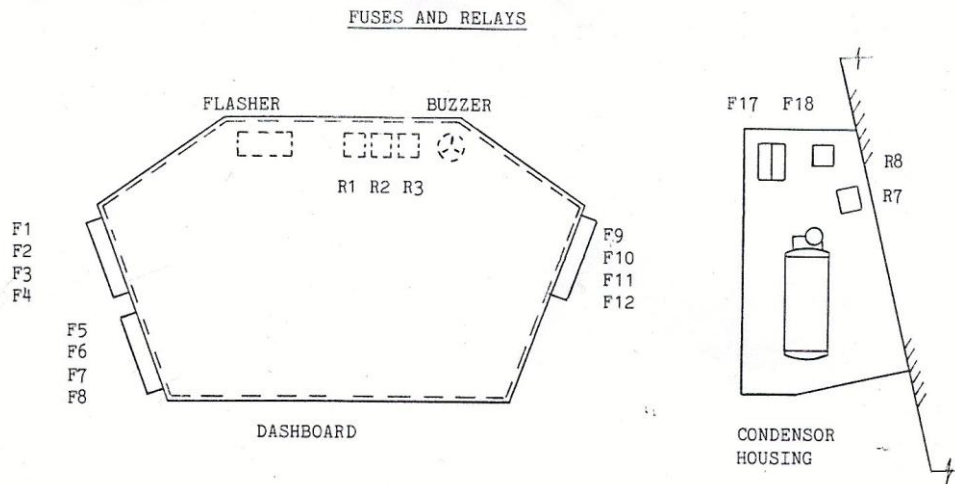
SAM Ltd reserves the right to charge for fair 'wear and tear' on selected items. Unusual working practices should also be avoided as these often contribute to a shorter working life on associated components.

It is the Company's policy to continually improve and update our products and SAM Ltd, therefore, reserve the right to alter specifications and design without notice.

GENERAL SAFETY

1. This machine must only be used for the purpose for which it was intended i.e. crop spraying.
2. It is illegal for anybody to operate a machine which they do not understand. Please read this handbook carefully before attempting to operate the sprayer.
3. In order to comply with the Health and Safety at Work Act, the sprayer must be thoroughly washed and decontaminated before any person may be permitted to carry out repairs or adjustments.
4. Be aware of the COSHH Regulations and comply with them at all times.
5. Always wear protective clothing when working with chemicals.
6. Always read the label on the chemical container very carefully.
7. The machine must not be used for spraying sulphuric acid unless it has been modified for this purpose.
8. Never operate the sprayer until all guards are in place.
9. Never start the machine until all personnel are clear.
10. Never perform maintenance or repair work while the machine is running. If you are working on a part of the machine not visible from the cab, remove the ignition key.
11. Never work under the machine when it is standing on a jack unless the axle is propped.
12. Extra care should be taken when working on steep hills, as is normal practice with any high clearance tractor. Beware of 'soft spots' and 'pot holes'. Never spray across a dangerously steep hill and never spray across a steep hill with the uppermost boom folded. Wider wheel settings aid stability.
13. Ensure that any replaced component, hose or fitting is of the same specification as that originally fitted. All hydraulic hoses carry an identification number inscribed on the ferrule.
14. If frost is expected, anti-freeze should be pumped through the complete spraying system and/or drain down.
15. Before going onto the road, check brakes, lights, indicators and tyre pressures. Lock out 4WS with the isolator switch
16. Extra care should be taken when servicing the battery. The sulphuric acid contained within the battery cannot only cause severe burns; it can also produce explosive gases. Keep cigarettes and sparks away.
17. This machine contains an air reservoir with a maximum pressure rating of 10 bar. The reservoir should be checked on an annual basis by a recognised inspector.

FUSES AND RELAYS



REF	TYPE		FUNCTION
F1	20A	Orange	RDS computer, engine warning devices
F2	35A	Black	Ignition, instrument panel lights
F3	35A	Black	Air conditioning, screen wipe and wash
F4	35A	Black	Cab blower fan
F5	5A	Red	Radio, interior light (CB socket)
F6	35A	Black	Hazards, horn, beacon, headlight flash
F7	35A	Black	Rear work lights
F8	35A	Black	Front work lights
F9	Spare		Do <u>not</u> exceed 20A rating
F10	35A	Black	Driving lights
F11	20A	Orange	Left-hand side, rear and turn lights
F12	20A	Orange	Right-hand side, rear and turn lights
F17	16A	Red	Condenser fan and air conditioning clutch
F18	5A	Yellow	Air conditioning, temperature and pressure switches
R1	30A	12V	Ignition on/off
R2	30A	12V	Safety circuits on/off
R3	30A	12V	Engine hours clock - changeover
R7	30A	12V	Condenser fan and air conditioning clutch on/off
R8	30A	12V	Air conditioning over pressure - on/off (NB not fitted with R143A trinary switched system).

IMPORTANT DO NOT EXCEED ABOVE RATINGS OR ADD EXTRA DEVICES WITHOUT SAM APPROVAL

MAJOR SAFETY CRITICAL ITEMS

The braking and steering systems fitted on the sprayer are both safety critical services. These services should be thoroughly inspected at least every 200 hours and should coincide with the hydraulic filter changes.

The two braking systems fitted (primary and parking) require only a visual inspection around the wheel motors. The multi-disc parking brake fitted to each rear wheel motor should be inspected for back plate spring integrity and oil leaks from this area.

The steering system consists of several components, all of which should be checked for tightness, in particular the fixings of the ball joint tapers plus the split pin, the ball joint, track rod, lock nut and the steering ram.

In the case of adjustable axles, the track rod-adjusting bolt should be checked. Axle adjustment is covered in the following pages of this instruction book but we should emphasise that both front and rear axle fixings should be re-checked for tightness after a few hours work. A weekly visual inspection should also be initiated.

Finally, it would be prudent at this time to check for fatigue marking in the highly stressed corners and associated components, especially on older machines. Should any item give cause for concern then contact SAM Ltd immediately.

SAFETY FIRST

All agricultural equipment can be hazardous. When a SAM sprayer is correctly operated and properly maintained, it is a safe machine to work with, but when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

In this handbook and on the machine you will find warning messages. Read and understand them. They tell you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or SAM Ltd to explain them.

However, safety is not just a matter of responding to the warnings. All the time you are working on or with the machine, you must be thinking what hazards there might be and how to avoid them.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

**BE CAREFUL
BE ALERT
BE SAFE**

SAFETY - CHECK LIST

As well as the warnings in this chapter, specific warnings are given throughout the book. This section is designed to give a safety code for use of the machine generally and for operation and maintenance practices.

General Safety

! WARNING Handbook

You and others can be injured if you operate or maintain the machine without first studying this handbook. Read the safety instructions before operating the machine. If you do not understand anything, ask your employer or SAM Ltd to explain it. Keep this handbook clean and in good condition. Do not operate the machine without a handbook in the cab, or if there is anything on the machine you do not understand.

! CAUTION Regulations

Obey all laws and local regulations that affect you and your machine.

! WARNING Decals

You can be injured if you do not obey the decal safety instructions. Keep decals clean. Replace unreadable or missing decals with new ones before operating the machine. Make sure replacement parts include warning decals where necessary.

! WARNING Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or whilst operating the machine or attachments. Be aware of medicines that can cause drowsiness.

! WARNING Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

! WARNING Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job.

! DANGER
Parking

Do not leave the driving seat under any circumstances unless the parking brake is on.

! WARNING
Roll Over Protection Structure

The machine is fitted with a Roll Over Protection Structure (ROPS). You could be killed or seriously injured if you operate the machine with a damaged or missing ROPS. If the ROPS has been in an accident, do not use the machine until the structure has been renewed. Modifications and repairs that are not approved by the manufacturer may be dangerous and will invalidate the ROPS certification.

! WARNING
Machine Condition

A defective machine can injure you or others. Do not operate a machine that is defective or has missing parts. Make sure the maintenance procedures in this handbook are completed before using the machine.

! WARNING
Controls

Keep the machine controls clean and dry. Your hands and feet could slide off slippery controls. If that happens you will lose control of the machine.

! WARNING
Seat Belt

Operating the machine without a seat belt can be dangerous. Before starting the engine, make sure your seat belt is fastened. Check the tightness and condition of the seat belt securing bolts regularly.

! WARNING
Machine Limits

Operating the machine beyond its design limits can damage the machine and can also be dangerous. Do not operate the machine outside its limits. Do not try to upgrade the machine performance with unapproved modifications.

! WARNING
Visibility

Accidents can be caused by working in poor visibility. Keep windows clean and use your lights to improve visibility.

! WARNING
Exhaust Gases

Breathing the machine exhaust gases can harm and possibly kill you. Do not operate the machine in closed spaces without making sure there is good ventilation. If you begin to feel drowsy, stop the machine at once. Get out of the cab into fresh air.

! WARNING
Noise Level in Cab

With cab door open, the sound pressure level measured at the driver's ear does not exceed 83.5 dB(A). At working speeds with the door closed this level drops to 78 dB(A) at the drivers ear.

! WARNING
Repairs

Do not try to do repairs or any other type of maintenance work you do not understand. Contact SAM Ltd or get the work done by a specialist engineer.

! WARNING
Communications

Bad communications can cause accidents. If two or more people are working on the machine, make sure each is aware of what the others are doing. Before starting the engine, make sure the others are clear of the danger areas; examples of danger areas are: the rotating shafts and belts on the engine, the booms, and anywhere beneath or behind the machine. People can be killed or injured if these precautions are not taken.

! WARNING
Soft Ground

A machine can sink into soft ground. Never work under a machine on soft ground.

! WARNING
Jacking

A machine can roll off jacks and crush you unless the wheels have been chocked. Always chock the wheels at the opposite end of the machine to that which is to be jacked. Do not work underneath a machine supported only by jacks. Always support a jacked-up machine on axle stands before working underneath it.

! WARNING
Electrical Circuits

Understand the electrical circuit before connecting or disconnecting any electrical component. A wrong connection can cause injury and/or damage.

! WARNING **Hydraulic Fluid**

Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs hydraulic fluid. If hydraulic fluid penetrates your skin, get medical help quickly.

! WARNING **Hydraulic Hoses**

Damaged hoses can cause fatal accidents. Inspect the hoses regularly for:

- Damaged end fittings
- Chafed outer covers
- Ballooned outer covers
- Kinked or crushed hoses
- Embedded armouring in outer covers
- Displaced end fittings.

! WARNING **Rams**

The efficiency of the rams will be affected if they are not kept free of solidified dirt. Clean dirt from around the rams regularly. When leaving or parking the machine, close all rams if possible to reduce the risk of weather corrosion.

! WARNING **Fires**

If your machine is equipped with a fire extinguisher, make sure it is checked regularly. Keep it in the operator's cab until you need to use it.

Do not use water to put out a machine fire, you could spread an oil fire or get a shock from an electrical fire. Use carbon dioxide, dry chemical or foam extinguishers. Contact your nearest fire department as quickly as possible.

Firefighters should use self-contained breathing apparatus.

! WARNING **Modifications and Welding**

Non-approved modifications can cause injury and damage. Parts of the machine are made from cast iron; welds on cast iron can weaken the structure and break. Do not weld cast iron. On no account weld or drill the chassis structure. Contact SAM Ltd before modifying the machine.

! WARNING **Metal Splinters**

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft-faced hammer or drift to remove and fit metal pins. Always wear safety glasses.

! WARNING **Cleaning**

Cleaning metal parts with incorrect solvents can cause corrosion. Use only recommended cleaning agents and solvents.

! WARNING **'O' rings, Seals and Gaskets**

Badly fitted, damaged or rotted 'O' rings, seals and gaskets can cause leakages and possible accidents. Renew whenever disturbed unless otherwise instructed. Do not use Trichloroethane or paint thinners near 'O' rings and seals.

! WARNING **Fluoroelastomeric Materials**

Certain seals and gaskets (e.g. crankshaft oil seal) on SAM machines contain fluoroelastomeric materials such as Viton, Fluorel and Technoflon. Fluoroelastomeric materials subject to high temperatures can produce highly corrosive hydrofluoric acid. **THIS ACID CAN SEVERELY BURN.**

New fluoroelastomeric components at ambient temperature require no special safety precautions.

Used fluoroelastomeric components whose temperatures have not exceeded 300°C require no special safety precautions. If evidence of decomposition (e.g. charring) is found, refer to the next paragraph for safety instructions. **DO NOT TOUCH COMPONENT OR SURROUNDING AREA.**

Used fluoroelastomeric components subjected to temperatures greater than 300°C (e.g. engine fire) must be treated using the following safety procedure. Make sure that heavy-duty gloves and special safety glasses are worn:

- Ensure that components have cooled then remove and place material in plastic bags.
- Thoroughly wash contaminated area with 10% calcium hydroxide or other suitable alkali solution, if necessary use wire wool to remove burnt remains.
- Thoroughly wash contaminated area with detergent and water.
- Contain all removed material, gloves etc used in this operation in sealed plastic bags and dispose of in accordance with Local Authority Regulations.

DO NOT BURN FLUOROELASTOMERIC MATERIALS.

If contamination of skin or eyes occurs, wash the affected area with a continuous supply of clean water or with calcium hydroxide solution for 16-60 minutes. Get medical attention immediately.

SAFETY DECALS

! WARNING

Decals on the machine warn you of particular hazards. Each decal is attached close to a part of the machine where there is a possible hazard. Read and make sure you understand the safety message before you work with or on that part of the machine.

Keep all decals clean and readable. Replace lost or damaged decals.

! WARNING

If you need eyeglasses for reading, make sure you wear them when reading the safety decals. Decals are strategically placed around the machine to remind you of possible hazards. Do not over-stretch or place yourself in dangerous positions to read the decals.

WARNING – POWER LINES!!

DANGER OF DEATH – Stay away from power lines while folding booms

In the unlikely event of any part of the machine touching a power line:

**STAY IN THE CAB
DON'T PANIC
TRY TO DRIVE CLEAR
WARN OTHERS TO STAY WELL CLEAR**

If this is not possible or the machine catches fire

JUMP WELL CLEAR – DON'T CLIMB DOWN – the metalwork of the machine may be alive

NEVER TOUCH THE MACHINE ONCE YOU ARE ON THE GROUND

RUN WELL CLEAR WITH LEAPING STRIDES

STAY WELL CLEAR, WIRES MAY RE-ENERGISE WITHOUT WARNING

KEEP EVERYONE AWAY AND CALL YOUR LOCAL ELECTRICITY SUPPLIER ON:

Tel:

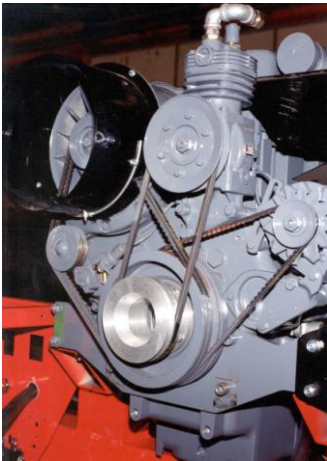
ENGINE

All Sands machines are powered by Deutz air-cooled industrial diesel engines. The various engine ratings are listed below:

2000 Lowline	BF4L913	79kw	105hp	At	2500 rpm
2500 Lowline	F6L912	89kw	120hp	At	2500 rpm
3000 Lowline	BF6L913	99kw	131hp	At	2500 rpm
3600 Lowline	BF6L913	109kw	148hp	At	2500 rpm
4000 Lowline	BF6L913	119kw	161hp	At	2500 rpm

The first oil and filter change is due at 50 hours, the second at 250 and thereafter every 500 hours, or annually, whichever comes first.

When a turbo charger is fitted it is essential that this engine be allowed to idle for 2 minutes prior to shut down. Failure to comply with this Deutz recommendation will cause premature failure of the turbo charger.



Your attention is drawn to the Manufacturer's Handbook. Study this carefully and refer to it for service and spares information.

Access to the front of the engine is gained by removing the air intake mesh on the offside of the machine.

Behind this mesh are various 'V' belts which drive the cooling air blower, alternator, compressor and, if fitted, the air conditioning compressor. The condition and tension of the belts should be checked at least every 100 hours. If a belt slips, it becomes glazed and will fail to drive correctly, even after it has been correctly re-tensioned. Should this occur then the belt and possibly the pulley will have to be replaced.

By removing the centre guard, access is gained to the top and side of the engine. From this position the dipstick, oil filler cap, oil and fuel filters and water trap are available for service in accordance with the recommendations.

By removing the cooling air cowling the individual cylinders, sump oil cooler and, in some cases, the hydraulic oil cooler become accessible. These should be blown out regularly with compressed air. An airline socket is provided on the off side of the air reservoir for such use.



Particular attention should be paid to the hydraulic oil cooler sited on the far left-hand side of the cowling. Not only should it be cleaned thoroughly from inside the cowling but it should also be 'back blown' from the outside into the cowling. The removal of the small inspection plate to the left-hand side of the removable cowling will aid inspection.

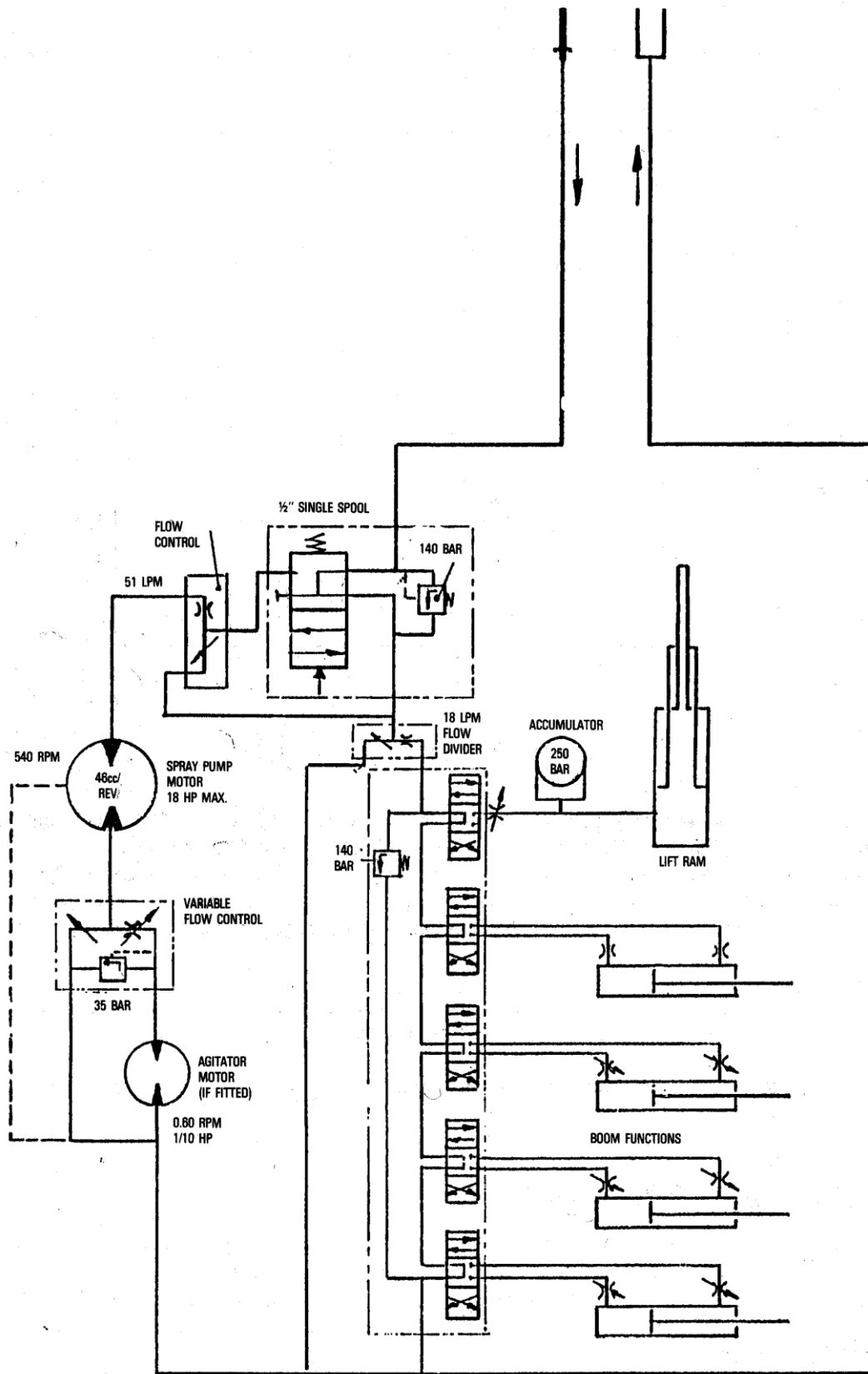
It should be noted that hot oil in excess of 80 deg C would severely damage the hydrostatic system causing unnecessary expense. The regularity at which the engine/oil cooler is cleaned will

depend entirely on the working conditions. When working in oil seed rape for instance it may need cleaning more than once daily. Only the operator can decide.

A visual inspection should be carried out daily.

Warning sensors are fitted to the cylinder head, oil pump and cooling air 'V' belts. At the first indication of an over heating engine, the vehicle horn will sound. The vehicle must be stopped **immediately** and the cause found and rectified before moving off.

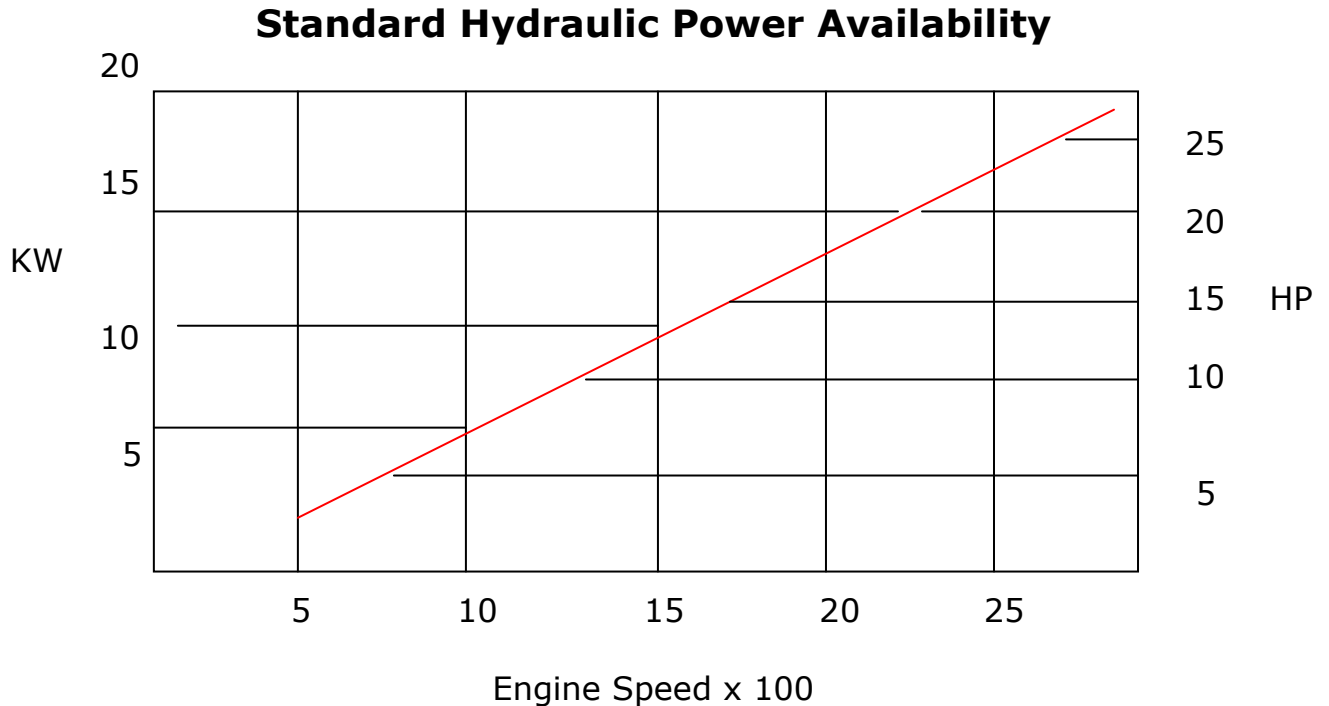
Spray Pack Hydraulic Circuit



2 x 5 SPOOL BANKS ARE FITTED TO SOME MACHINES

AUXILIARY HYDRAULICS

A small 8cc hydraulic pump is mounted on the side of the engine, driven by the timing gears, to provide hydraulic power for the steering system only. The PR valve mounted in the steering unit is pre-set to 140 bar (2000 psi). A larger 28cc hydraulic pump is mounted on the end of the main transmission pump. The total capacity of this pump can be used to power rear end implements up to powers shown on the graph below.



Maximum continuous working pressure must not exceed 140 bar (2000 psi) and is governed on the sprayer by the numerous PR valves within the system.

A 'last chance' PR valve rated at 170 bar (2500 psi) is mounted directly onto the pump outlet. Costly damage could result if the ratings of these valves change. They should, therefore, be checked on a regular basis, at least every 1500 hours.

Any additional rear end equipment provided by the customer must be fitted with a PR valve of 140 bar (2000 psi) in the primary drive system.

Separate details will be provided upon request of 'uprated' or 'non-standard' hydraulic systems.

SPLITTER BOX (SAM 3600 and 4000 Lowline)



On the SAM 3600 and 4000 Lowline, a twin transmission pump system is employed. The drive to these pumps is via a Splitter Box, close coupled to the rear of the engine. This Unit is filled with approximately 1 litre of a good quality EP90 gear oil. This oil should be changed after the first 50 hours and thereafter every 500 hours or 6 months.

TRANSMISSION SYSTEM

The drive system used on this machine is pure hydrostatic. Its function is extremely simple and consists of the following:

HYDROSTATIC PUMP

A single pump, in the case of the SAM 2000, 2500 and 3000 Lowline, is mounted directly onto the flywheel end of the engine. Twin pumps for the SAM 3600 and 4000 Lowline are mounted onto the splitter box. The pumps in all cases turn at engine speed. A mechanical cable, operated from the cab, alters the angle of the 'swash' plate inside the pump(s), which in turn alters the stroke of the pistons within the pump(s), and the result is an infinitely variable oil output from a fixed engine speed.

A smaller 'charge' or 'boost' pump is mounted on the end of the main pump; its function is to replace oil to the main pump, which is constantly being lost internally through leakage. It also supplies oil at 35 bar (500 psi) maximum pressure to operate brakes and 2-speed control. Its final duty is to pump the excess oil, which is not used for the aforementioned functions, back to the oil tank via the oil cooler.

The main circuit pressure cut off valve is also contained within the pump(s) and is pre-set at 420 bar (6100 psi).

HYDROSTATIC WHEEL MOTOR

A slow speed wheel motor is mounted into each driving wheel of the machine. Each motor has numerous pistons operating on numerous cam faces. As such, up to eighty piston strokes are therefore required to turn the wheel once, making slow speed operation extremely smooth and efficient. In 'road' or 'low torque' half the pistons are neutralised, therefore, for the same amount of oil the wheel will turn twice as fast but with half the power.

The speed of operation depends entirely upon the flow from the pump. Maximum field speed is approximately 17 km/h (11 mph) but like any tractor the slower it travels, the more power it has.

The hydrostatic pump carries out the 'primary' braking function. It will produce braking torque equal to the driving torque, since no freewheel action can occur within a hydrostatic wheel motor.

A mechanical disc brake is an integral part of the rear drive wheels. This 'secondary' mechanical braking system is for **parking/emergency use ONLY**.

These brakes are failsafe in their operation, spring on - pressure off, and are held off with 'boost pump' pressure, as such, they will be automatically applied when the engine is stopped or when 'boost' pressure fails i.e. if a hydraulic hose fails or from lack of oil in the tank.

The permanent 4WD system employed on all SAM sprayers maximises high tractive effort with more than adequate braking ability.

A 'diff lock' effect by controlling oil flow to the front and rear axles is a standard feature of the twin pumped SAM 3600 and 4000.

This can only be achieved on the smaller SAM machines by fitting the optional 'diff lock' valve. This valve, if fitted, will automatically engage when 'high torque' is selected.

VEHICLE SUSPENSION

On all machines, a maintenance free rubber sandwich suspension system is employed on the front axle. This system will not only absorb vertical shock loads but will also enable the axle to articulate.

The front tripod bearing and fixing screws should be inspected on a regular basis and at least every 250 hours along with the Panhard rod.

A rear suspension system on the SAM 3600 and 4000 Lowline, again, uses the same rubber sandwich blocks but in a swinging arm configuration.

The only maintenance on the rear being the regular greasing of the swinging arm bushes and the removal of the mud and stones, which accumulate on top of the swinging arm frame. Should this accumulation be allowed to dry then the rear suspension system will become inoperative.

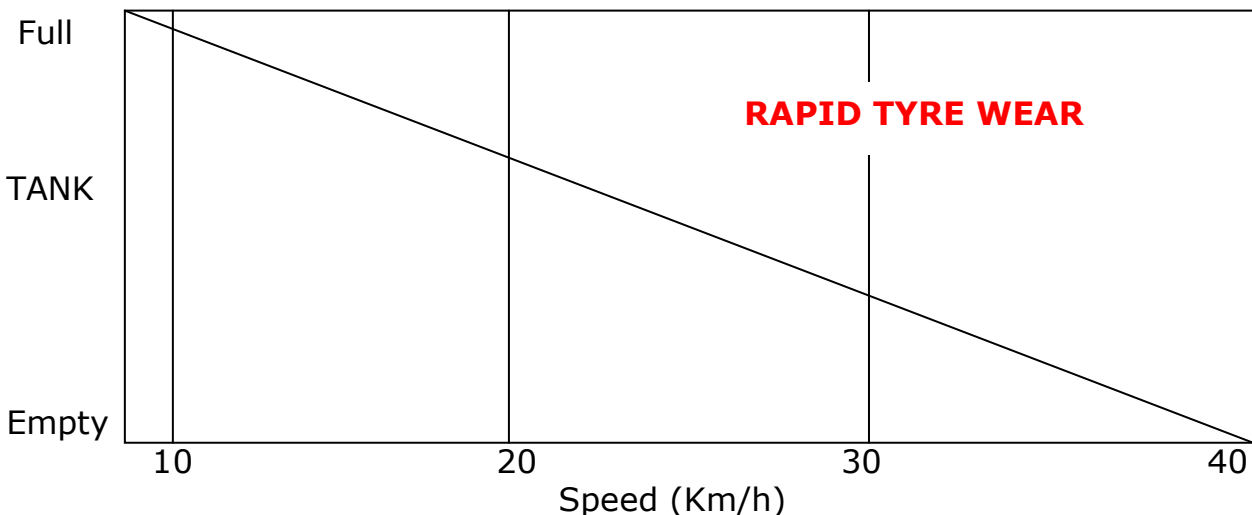
TYRES

The tyres on a crop sprayer are probably the most abused item on the machine. Because of the 'ever decreasing weight' nature of a crop sprayer, the tyres attract a 50% loading bonus, however, this bonus refers to low speed operations only.

Ensure tyre size i.e. contact area, is suitable for the prevailing conditions. Narrow wheels, very steep slopes and lush green foliage just **DO NOT MIX.**

High loads and high speeds can cause premature tyre wear not only to the tyre tread but also within the tyre carcass.

Your attention is therefore drawn to the load/speed graph below.



The various size tyres and pressures for the machines are listed below.



TYRE PRESSURES SHOULD BE CHECKED DAILY.

2000 Lowline

9.5 x 32	10 PR Radial	55 psi	This tyre is not speed rated above 30 km/h
12.4 x 28	Bib.x. m18	30 psi	
48 x 25 x 20	Terra Tyre	7 psi field	15 psi road

2500, 3000, 3600,4000 Lowline

9.5 x 36	10 PR Radial	55 psi	This tyre is not speed rated above 30 km/h (not on 3600 and 4000)
12.4 x 32	Bib.x. m18	30 psi	
700/50x 26.5	Trelleborg	7 psi field	15 psi road
54 x 31 x 26	Terra Tyre	7 psi field	15 psi road
48 x 25 x 20	Terra Tyre	7 psi field	15 psi road
14.9 x 28	BIBX M18	28 psi field	28 psi road

FLOTATION WHEELS

It is imperative that the tyre pressures in flotation wheels are increased to 15 psi before any roadwork is undertaken, even if only for a few miles. (An air line socket is provided on the offside of the air reservoir for such use.)

Flotation wheels impose extremely high stresses on all associated components i.e. bearings, axles, kingpins and steering components. A shorter life expectancy on these wearing parts must therefore be expected, especially in the case of bushes.

Any help the operator can give the machine in reducing the stresses caused by flotation wheels: - by not driving on kerbs; by not driving at excessive speeds on ploughed land; by not using excessive acceleration or braking, will extend components' life substantially.

Warranty on component failure, associated with flotation wheels, is severely limited and will only be accepted for a manufacturing defect.

Wheels wider than those listed are not acceptable.

TRACK ADJUSTMENT

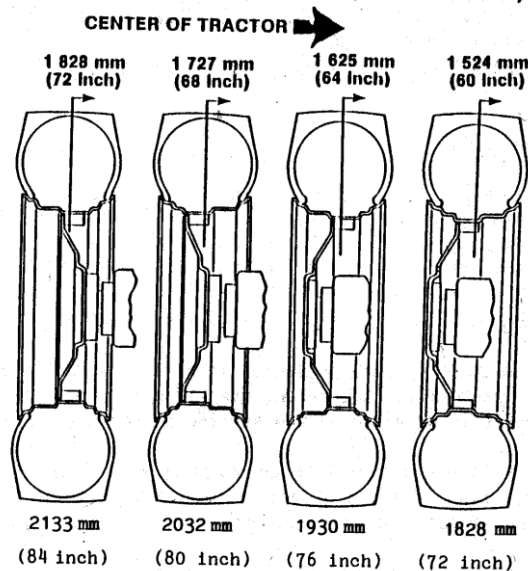
All standard machines have the same track capability. 60" (1524) to 72" (1829) in 4" (102) increments (2" per wheel)

A wide axle version is also available, 72" (1829) to 84" (2134) in 4" (102) increments (2" per wheel).

2000, 2500, 3000 Lowline

Track adjustment on this machine is by dish and pan. A drawing of the dish/pan orientation is shown.

Tighten rim to wheel center nuts 176 to 217 Nm (130 to 160lb ft)
Tighten the wheel to hub nuts 270 to 325 Nm (200 to 240 lb ft)



2500, 3000 & 4000 Lowline (optional)

Both front and rear axles can be of the sliding type. The track can be adjusted on both axles in 4" (102mm) increments from 60" (1524mm) to 72" (1828mm), or from 72" (1828mm) to 84" (2134mm) on the wide axle option. The wheels should never be reversed to increase track width as this induces excessive loads on the axle assembly.

FRONT AXLE ADJUSTMENT

Jack up one side of the front axle. Remove from the axle the two M20 clamp bolts and two M20 draw bolts plus one M10 nut and bolt from the track rod. Slide the axle leg to the required position. Re-fit the two top draw bolts and gradually tighten these, thus lifting the axle leg to the top of the beam. **DO NOT OVERTIGHTEN.** Fit the two clamp bolts and tighten these securely to approximately 150 Nm (111 lb.ft). Re-fit the track rod nut and bolt.

RE-CHECK THE BOLT TENSION AFTER THE FIRST HOURS WORK.

REAR AXLE ADJUSTMENT

Jack up one side of the machine on the rear cross member, not the axle leg, and loosen the four cast clamps on the side to be adjusted. Crank the leg to the required position with the ratchet assembly fitted between the legs. The suspension frame is marked in 2" (51mm) graduations to aid setting. Re-tighten the clamps.

OIL TANK

The oil tank is actually mounted inside the cab with only a small section protruding from the rear of the cab.

This fully baffled tank contains approximately 200 litres (45 gallons) of oil, (see lubrication section).

It is this oil, which is the lifeblood of the machine, and, because of this, it must be kept exceptionally clean. Two 125 µm suction strainers filter the oil before it leaves the tank.

On the 2000, 2500 and 3000 Lowline two 10 µm 'Maxiflow' filters - UC-MX1591-4-10, filter the oil before it enters the 'boost' pump.

On the 3600 and 4000 Lowline, 'boost' oil is filtered after the pump via the medium pressure 'Magnaflow' filters - MGR.2160.



All return oil, except wheel motor drainage, passes through two 10 µ 'Top Flow' filters - UC-2418 before re-entering the tank. Wheel motor drain oil returns to tank via an internal magnetic filter, and finally a 40 µm strainer is fitted into the filler cap, primarily to filter air entering the reservoir and secondly to ensure clean oil only enters the reservoir.

A level gauge is fitted to the near side of the tank, and contains a thermometer.

The oil level must always be between the min/max lines on this level gauge. The oil tank temperature should stabilise between 50°C - 80°C.

When topping up the tank, use a clean container and the correct grade of oil - **NOT UNIVERSAL TRACTOR OIL.**

A float switch is fitted to the offside of the tank. If the oil level drops dangerously low, then the vehicle horn will sound. **STOP IMMEDIATELY** - and investigate. Also, see section on engine.

Two outlet taps are fitted to the tank and, if closed, will isolate the oil in the tank from the pumps.

The taps must be fully open at all times except when changing filters.

All filters must be changed after the first 10 hours and, thereafter, every 200 hours or when the clogging indicator shows a blockage, whichever comes first. **SAM Ltd ONLY RECOMMENDS THE USE OF UCC FILTERS.**

A sample of hydraulic oil should be analysed at the beginning of each season to ascertain as to whether the oil should be changed or not. Your oil supplier can usually carry this out.

Water is the usual cause of contamination in hydraulic oil and can normally be traced back to condensation in the oil tank.

If emulsified oil is present, it is instantly recognisable as a milky yellow translucent material in the sight gauge. The oil must be changed **IMMEDIATELY**.

Every time the tank is emptied, the opportunity should be taken to clean the strainers within the tank.

Only 'lint free' cleaning material should be used inside the hydraulic tank.

THE CAB

The cab fitted to all Sands machines is a full R.O.P.S. safety cab, tested at Silsoe to exacting O.E.C.D. standards. Likewise, the filtration system complies to the latest H.S.E. forced air filtration recommendations. This means the air in the cab is changed at least 60 times per hour and a positive pressure is held within the cab of at least 1mm water gauge at all times. The window and door must obviously be closed. Finally, a high capacity carbon filter is fitted within the cab roof space.



The carbon filter must be changed every 500 hours or annually – whichever is the sooner. Access to the filter element is gained by removing the roof cover held with 4 quarter turn fasteners. A washable blue/white pre-filter is fitted over the carbon package and may be washed when necessary. The

frequency of washing will depend on working conditions. A 50 hour visual inspection is therefore recommended.

Protective clothing is necessary when handling the filter as it will be contaminated.

The heating system fitted in the cabs uses hot engine oil, not water. The oil is transferred to the heater by lifting the heater control on the transmission console. **Do not use heating and air conditioning at the same time.**

Within the cab on the 2000, 2500 and 3000 can be found 3 filter gauges numbered 1, 2 and 3. The oil tank filters are also correspondingly numbered.

Filter gauge 1 is for the hydrostatic suction filters (yellow). The maximum permissible suction is 20 cm.Hg at normal working temperature. If the suction figures exceed this then the filters need changing. **FAILING TO DO SO COULD CAUSE EXTENSIVE DAMAGE TO THE TRANSMISSION SYSTEM.**

Gauges 2 and 3 are for the tank top filters (yellow/blue line). The needle should remain in the green sections at all times when the oil is warm. If it enters the red then the filter by-pass is open and oil is returning to the tank unfiltered. Change the relevant filter **immediately**.

On the SAM 3600 and 4000 the twin boost filters have an electric contamination indicator light fitted into the dash panel alongside the return filter gauge. It should be treated the same as the red section in the gauge. Both the return tank top filters (yellow/blue line) are linked via a common manifold and, as such, only one gauge is fitted in the cab. If it enters the red then the bypass is open and oil is returning to the tank unfiltered. Change both filters **immediately**.

The front console will indicate:



Oil filter condition

Turn indicators

Engine air filter blocked - it is a Deutz recommendation that the air filter NOT be touched until this light illuminates.

Main beam

Generator inoperative

Lack of oil pressure

Hazard lights

Parking/emergency brake applied

Amber flashing beacon

An engine rev counter with an integral hour metre is fitted.

A matching pod, housing a further 4 instruments will indicate:

Fuel capacity - 0-170 litres (37 imperial gallons)

Air pressure - 9 bar maximum

Engine oil temperature - 125°C absolute maximum

Hydraulic oil tank temperature - 80°C

Lights, horn, indicators and hazard light switches are incorporated into the front panel, as is the main fuse box.

On the driver's right-hand side is the transmission control lever. This lever is locked in neutral until unlocked by lifting the 'T' bar below the handgrip. This control lever is connected by cable to the pump 'swash plate' control system.

Pushing the lever forward will drive the machine forward. The further forward the lever is pushed, the faster the machine will travel.

If the lever is returned to neutral then the machine will stop. The quicker the lever is moved, the quicker the response, whether it be acceleration or braking. Care must be taken not to induce skidding by moving the lever too rapidly.

Moving the lever backwards drives the machine backwards and the same rules apply.

A hand throttle control is situated on the same transmission control column behind the control lever. By pressing the centre button, the throttle may be raised or lowered for coarse adjustment. By revolving the throttle, the engine speed may be finely trimmed to suit.

The engine stop control is alongside the throttle.

TRANSMISSION SELECTOR SWITCHES



2000, 2500 and 3000 Lowline

Two selector switches are used on this machine and they each control the displacement on either the front or rear wheel motors. For road work 'Road'/'Low Torque' should be used. For field work 'Field'/'Low Torque' is normal, although 'Field'/'High Torque' is available when the going gets tough.

'ROAD/HIGH TORQUE' SHOULD ONLY BE USED FOR STEEP DOWNHILL WORK.

If a diff lock is fitted, it will automatically engage when high torque is selected.

SAM 3600 and 4000 Lowline

The first of the two selector switches is entitled Field and Road. The second is entitled Axle Free or Axle Locked. This will engage or disengage the diflock.

A small audible warning device is fitted inside the cab, which warns of high 'closed loop' transmission oil temperature.

Should this item ever sound off **DO NOT STOP**, as this will entrap the excessively hot oil within the 'closed loop' circuit, simply reduce speed by approximately 25% by pulling back the hydrostatic lever slightly. The device will stop sounding after approximately 3-4 minutes.

When this happens, stop and check the cleanliness of the hydraulic oil cooler.

PNEUMATIC CONTROL PANEL

The one-piece pneumatic control panel fitted on the driver's right-hand side contains all the boom control and sprayline function switches in an ergonomic layout. The top row of rotary switches control the boom folding – OUT to fold out and IN to fold in. To the left of these switches is the boom height switch.



Sprayline section switches (2 rows for the twin spraylines) are positioned in the centre section of the panel along with the contour lever.

The ladder, spray pump and tank wash switches are across the bottom of the panel along with any additional services.

The only spray control not on this panel is a foot operated pneumatic main spray ON/OFF control. Not only does this foot pedal control the main ON/OFF valve at the rear of the machine; it also cuts the air supply to the boom valves when

the spray is turned 'off'.

When the machine is being calibrated in the yard, this control must be 'on' to generate spray pressure but the boom valves may be turned 'off' to prevent loss of chemical.

AIR SYSTEM

An air compressor mounted directly on the engine provides the air for the machine.

Please refer to the Deutz handbook concerning the compressor drive belt tension.



An unloader valve is mounted on the air tank inlet port. This is preset to maintain the air pressure at approximately 9 bar (130 psi). Absolute minimum working pressure is 7.5 bar (110 psi).

The air reservoir, mounted below the engine, should be drained daily.

NOTE - water is present in compressed air even on the hottest days.

THIS AIR RESERVOIR MUST BE CHECKED ANNUALLY BY A RECOGNISED INSPECTOR.

Air is fed to the operators pneumatic control panel via a filter/lubricator assembly and copies of the manufacturer's service instructions follow.



SAM Ltd recommends the use of 'Tellus 37' lubricant in the lubricator bowl.

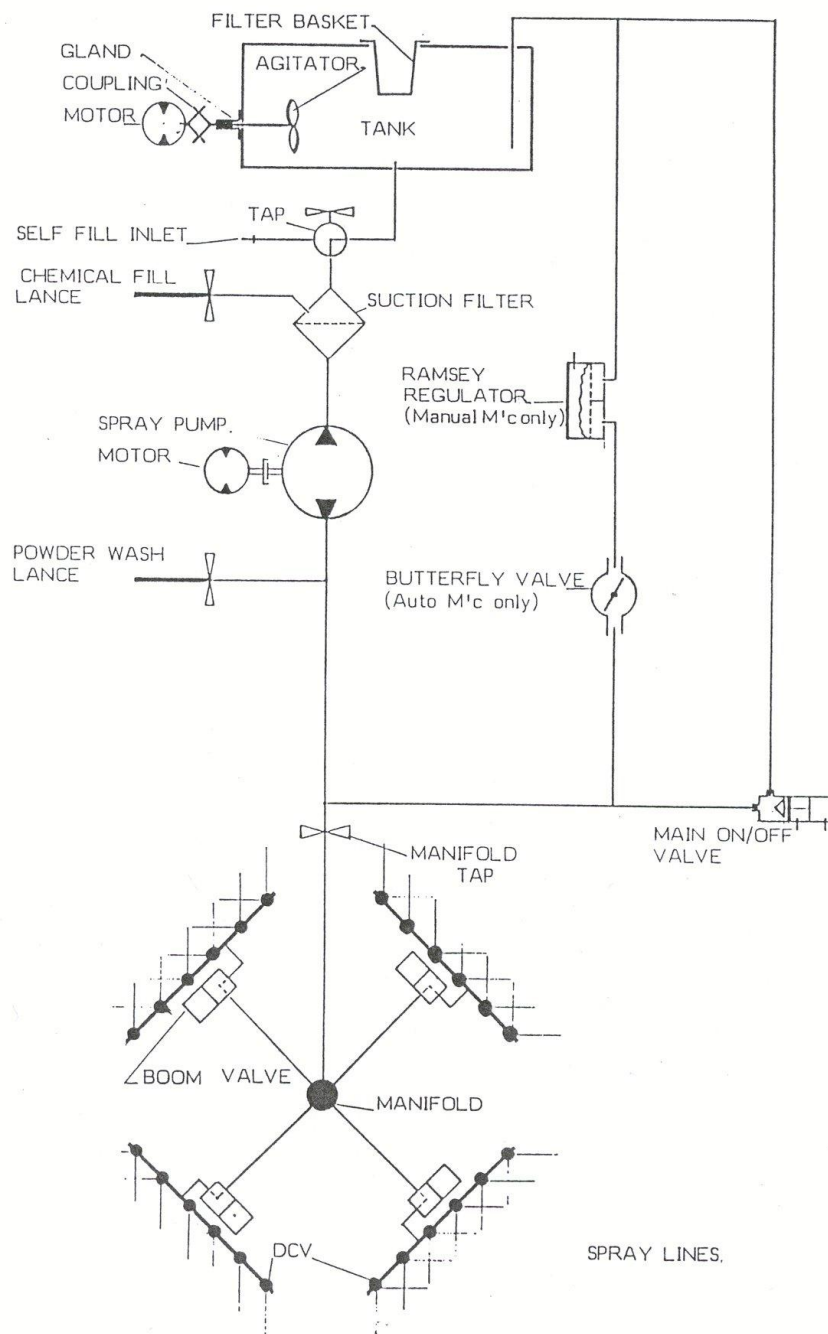
It is impossible for SAM Ltd to satisfactorily adjust the lubrication rate. The customer must regulate this himself over several weeks.

Oil usage should be in the region of one bowl every 500 to 600 hours.

A schematic diagram of the spraying system is shown for both manual and automatic machines.

Each component is described in the following pages.

THE SPRAYING SYSTEM



TANK

The heavy-duty fully baffled fibreglass tank has a nominal capacity of either 2000 litres (440 gallons), 2500 litres (550 gallons), 3000 litres (660 gallons), 3600 litres (793 gallons) or 4000 litres (881 gallons) and is suitable for all agrochemicals. It is glass smooth on the inside to prevent any residual chemical being held in rough crevices and so eliminates the cross-contamination of chemicals.

The charging hole in the top of the tank holds a large capacity filter basket.

The tank lid is fitted with a breather but if filling is being carried out with a high capacity pump, it is advisable to remove this lid to prevent excessive pressure build up in the tank.

Ensure sight gauge tube is kept clear at all times.

FILTER



A large capacity suction filter is fitted on the left-hand side of the machine behind the wheels. The 30-mesh element should be cleaned frequently to eliminate pump cavitation and loss of spraying pressure. The tap fitted to the side of the filter enables water to be fed to the filter either from the tank or, after turning the tap half a turn, from the self-fill inlet.

CHEMICAL INDUCTION HOPPER

This hopper is normally stowed at the rear of the machine alongside the spray pump and is of the Venturi type.



The booms should be lifted slightly to enable the hopper to swing out and down to a working position.

Select Venturi position on 3-way tap on top of spray pump. Select wash down ring on front left hand side of hopper, add chemical. Suction is controlled by 2-way tap mounted at the end of the hopper suction pipe on the main filter cluster. The two-way tap should be closed after each induction process. Failure to close this tap will cause severe frothing within the spraytank as air is inducted through the Venturi.

To wash out chemical containers, select can wash position with 3-way tap on front left-hand side of hopper. Wash out containers. Please ensure correct disposal of containers.

NB: Ensure suction tap is fully closed and 3-way tap on top of pump is in spray position after use.

PUMP



The machine is fitted with a hydraulically driven 6-diaphragm pump of approximately 235 lpm (51gpm) capacity. Providing the engine revs are at 1000 rpm or above, the spray pump will turn at the correct speed. This speed is automatically maintained irrespective of engine speed above 1000 rpm. Fitted directly to the pump outlet is a three-way tap. In its normal position water is pumped directly to the spraying system. On turning the tap 180 degrees the liquid may be pumped to the Venturi or back via a hose and quick release coupling into a holding tank.

LINE STRAINER



This extra fine mesh filter is fitted directly before the boom manifold and is particularly useful for low volume work where crystallising chemical presents a problem.

Two elements are supplied - blue 50 mesh for conventional 200l/ha outputs. A finer red 80-mesh element for low volume work. Finally, the element may be removed for high output rates.

The tap fitted to the strainer bowl is used for flushing the filter clean. It should be used at least daily and before every change of chemical.

Please dispose of the flashings in an environmentally friendly manner

BOOM VALVES



These valves are to an exclusive failsafe design. Air pressure at a minimum 7 bar (100 psi) is required to open the valves and so allow water to pass to the spray lines. When the air pressure is released, the valves, acting under very strong spring pressure, will close instantly. NB. See 'Main ON/OFF Valve'.

These valves are fitted with a dual O-ring sealing system. If one of these O-rings should fail liquid will be seen to leak out of the valve body from the drain hole. A seal kit is available. It is advisable that these valves be serviced prior to each spraying season simply by stripping them and lubricating the shafts and seals with petroleum jelly.

SPRAY LINES

The spray lines are manufactured from class 7 PVC tubing. Fitted to one end of each line is a removable end cap to enable the spray line to be flushed through.



Fitted at 1/2 metre spacing along the spray lines are diaphragm check valves (DCV's). The valves eliminate dripping when the spray is turned off. If drips are present, it usually indicates dirt under the diaphragm. The spray tips fitted into the quick-fit bayonet caps usually of the ceramic type. These tips are very hard wearing and have a longer life expectancy than conventional tips.

A 'top hat' filter is fitted above every tip. Please ensure the flow rate through the 'top hat' filter is adequate for the tip size. Twin spray lines are fitted to the boom, each line containing up to 7 sections and a boom valve controls each section. This gives the operator a choice of low volume application on one line with a medium volume application on the other, with both lines operating together, a high volume application is obtained.

A tap is fitted to the rear manifold so that the spray lines may be isolated.

MAIN ON/OFF VALVE



Situated at the rear of the tank on top of the manifold assembly, this valve is probably the most important item on the machine. It is pneumatically operated in two directions and controls the flow of water to the tank.

When the valve is open (spray off) the water being pumped to the manifold chooses the simplest route through the valve and back to the tank. Air is also prevented from operating the boom valves, and so these remain closed, thus preventing the water from entering the spray lines.

When the valve is closed (spray on), the water is pressurised and so travels to the booms and to those spray lines where the boom valve is open.

These valves are fitted with a dual O-ring sealing system. If one of these O-rings should fail liquid will be seen to leak out of the valve body from the drain hole. A seal kit is available. It is advisable that these valves be serviced prior to each spraying season simply by stripping them and lubricating the shafts and seals with petroleum jelly.

BOOM

The boom is of a triangulated space frame construction. The last 2m (6'6") incorporates a breakback section for safety.

The breakback mechanism is responsible for protecting the boom from contact damage so maintenance time on this area is time well spent.

The first section is of 12m width and on 24m booms; the second is at 18m so that various standard widths are available on one boom.



The boom can be used at these various widths but care should be taken, as the breakback section becomes inoperative when the end section is folded.

Two flow control valves mounted near the hinge point control the up and over folding mechanism. These valves should not necessarily need adjusting. However, if the need to adjust them does arise, please note that, with one valve mounted on each of the hydraulic flow and return lines, it is essential that both these valves be adjusted exactly the same amount.

The side folding 12m sections are also controlled by these flow control valves but in conjunction with P.O. check valves, which prevents oil surging from the rams when the boom tends to fold forward during heavy breaking.



It is an advantage to boom integrity to pre-load these rams periodically via the boom control levers.



Screw stops are situated where the booms fold and these should be regularly checked for tightness and boom alignment.

The hydraulic rams pushing the boom against these stops must never be fully extended; otherwise, the rod ends may break during acceleration or boom/ground contact due to the rams trying to overstroke.

The SAM boom suspension system is one of the finest in production with a hydraulic accumulator eliminating vertical shock loads. A short pendulum with gimbal capability stops tractor roll being transmitted to the boom.

Damping is provided with conventional shock absorbers. Anti-yaw is a standard fitment.

The boom can be contoured; raised and folded hydraulically all from the driver's seat by pneumatic pilot control.

A needle valve control unit is fitted on the spool bank at the lift/lower section. This valve will control the speed of **descent** of the booms; it will not affect the lifting speed. This valve is pre-set during manufacture and should not normally need adjusting. However, if adjustment is felt to be necessary, then the following precautions should be taken:

1. Never attempt to adjust the valve from the back of the machine, either under the boom back frame or through the framework.
2. Open the booms fully prior to adjustment.
3. Stand on top of spray tank.

Adjustment may be made from this position ONLY in complete safety.

Please Note: the valve should be easily adjustable by finger pressure after the locking grub screw has been loosened.

It is extremely difficult to remove every trace of air from a hydraulic ram circuit. Every effort is made during manufacture to remove this air from the hydraulic system but with up to 15 rams on a 24-metre boom, it is inevitable that air will become entrapped occasionally.

The cure is simple and as follows:

Start engine and run at 1000 rpm.

Simply loosening the hydraulic fittings and pressurising the appropriate circuit may accomplish the bleeding of the boom fold rams.

It may be necessary to bleed the boom circuits more than once during the first few weeks of use.

CAUTION! The 'Up and Over' boom folding mechanism produces a far stronger boom joint than other folding systems. However, great care should be taken when folding the second and third boom sections so that the booms do not interfere with high voltage cables. The operator should initiate a method of working where the boom is **always** lowered to the bottom of the mast prior to the operation of the 2nd and 3rd sections. Not only does this ensure that the boom folds well below the minimum safe height for high voltage cables, but also minimized the free boom movement which could add to boom height.

Never fold any boom section until the mating section has fully completed its total movement.

CIRCUIT INTERLOCKING ENSURES THAT BOOMS CAN ONLY BE FOLDED IN THE METHOD DESCRIBED I.E. IN THEIR LOWEST POSSIBLE POSITION.

AN AUDIBLE 'IN-CAB' WARNING IS GIVEN DURING ANY BOOM FOLDING OPERATION.

Never raise the boom when any boom section is raised.

Note! Booms folded as above will achieve a maximum height of 4.57 metres.

The General Safety section at the front of this handbook contains advice on what action to take in the case of boom/cable contact.

On all SAM machines it is possible to operate with only one boom folded out but there are limitations to this method of working:

1. It would impose less stress on the machine if the boom were only opened to the first stage (6m).

2. The machine speed should be kept low.
3. There will be no boom suspension because there will be no balance. As such, wear on associated components will be extremely high due to the high stresses involved, in particular the roger rails will tend to bow outwards.

Warranty on components associated with single boom working in these cases will be limited to manufacturing defects.

An adjustable boom rest may be necessary for extended periods of single boom working.

Sands Agricultural Machinery are pleased to announce the introduction of an 'all new' Gullwing folding boom of up to 24 metres in width based on its well-proven space frame construction.

The folding mechanism is in-cab controlled with two rotary switches.

After lifting the boom clear of its rest, both main sections may be opened to 12m. Both end sections may then be opened to their maximum. Folding 'in' is the reverse.

A 2-way breakback of 2 metres in length is incorporated at each boom end. Maintenance spent in this area is time well spent.

Single boom working is not possible with this boom although it may be used quite happily at 12 metres.

This boom normally has a 5 section shut off. Hydraulic, mechanical and pneumatic locking mechanisms are used to ensure boom integrity and safety.

The anti-yaw mechanism on this boom is based on rubber buffers which have been pre-loaded prior to delivery. No adjustments are necessary in this area.

Boom straightness affects boom ride and as such boom straightness should be checked weekly. Adjustment is simple – with the main sections fully open, loosen the hydraulic ram end and turn the ram shaft in the appropriate direction. Tighten the ram end.

AUTOMATIC MACHINES – SAM AIR CONTROL

The SAC system consists of several components. The functions of which are listed below.

THE CONTROL PANEL



The control panel is mounted inside the cab in front of the pneumatic panel and houses all the controls necessary for operating the system.

It also contains all the elements to make the system work. This is a type of mini-computer operating entirely on air. All units have been calibrated at our works and require no further adjustment. We suggest you do not open this panel.

WHEEL MAGNETS

Attached to the offside front wheel. A sensor measures the speed of the revolution of the wheel and shows a forward speed subject to the correct wheel circumference being keyed into the control box.

The method of calibration is accurately described in the RDS operating instructions.

BUTTERFLY VALVE

When the butterfly is fully closed, the spraying system is producing its maximum pressure. As the butterfly opens, more and more water is allowed to return to the tank and so the spray pressure drops. An air operated diaphragm cylinder operates the butterfly, which opens or closes automatically as the forward speed of the machine changes. An air operated spray pressure gauge is fitted inside the cab.

THE SPRAY PRESSURE TRANSDUCER

It is a small component at the back of the machine, which measures the water pressure and converts it to a proportional air pressure. This item will continually bleed air to atmosphere. The small pipe feeding the transducer from the spray manifold should be cleaned periodically to remove any congealed chemical.

THE CONTROLS

The control panel has two gauges fitted, the largest is glycerine filled and will indicate the spray pressure measured at the distribution manifold.

The smallest gauge will indicate the approximate contents of the spraytank. The outer scale is for water whilst the inner is for liquid fertilizer. Note – the air switch must be “on” for this to operate.

The electronic meter is manufactured to an exclusive SAM design by RDS Technology Ltd. Not only does it indicate speed in analogue and digital format, it will also accumulate sprayed area and consumed liquid in part and total quantities. Pre-determined limits will warn of blocked or lost nozzles and also of incorrect droplet size. Finally, it will hold a minimum spray pressure so that the spray pattern is never lost. All this is fully explained in the RDS Instruction Manual. If a printer or computer downloading facility is incorporated a further instruction book is supplied.

Along the bottom of the panel are the operating switches. On the right is the ‘Air On’ switch. This switch will activate the pneumatic computer and also the tank level gauge. As the system bleeds air continuously this switch can also be used to prevent air loss while the machine is stationary.

Next is the AUTO-9K/man switch. ‘Auto’ should always be selected during normal field spraying.

When 9K/man is selected, a false speed signal is transmitted to the system which enables calibration to take place in the yard with the machine stationary and without any loss of chemical. 'Auto' should be selected prior to any field spraying.

If the switch is left in '9K/man', then the system will act exactly like a manual machine and hold a constant spray pressure irrespective of the number of boom sections selected.

A pneumatic tell-tale indicator is fitted and this operates when the butterfly valve is fully closed. If the red tell-tale comes 'on', then either the forward speed of the machine is too great or nozzle tips with too large an orifice size for the pressure required are fitted.

Finally, a spray pressure regulator is fitted in the form of a very fine needle valve.

DEMOUNTING



2000, 2500, 3000, 3600, 4000 Lowline

One man in a matter of minutes may easily demount the spray/spreader packs normally carried on the rear end of the vehicle.

With the engine stopped, release the two clamps at the front of the spray pack and turn them to clear the pack. Release the rear-locking pins and withdraw them as far as possible. Uncouple the two pneumatic plugs on the offside of the machine behind the engine and also the two hydraulic lines.

THESE TWO HYDRAULIC PIPES MUST BE RE-CONNECTED TO EACH OTHER.

With the four jacking legs positioned at each corner of the spray pack, lift the pack approximately 25 mm (1"). Drive forward slowly until the spray/spreader pack is left free standing.

Remounting is the reverse of the above.

NOTE: The support legs are not intended to take end thrust. If the machine and the spray/spreader pack are not correctly aligned when remounting, damage could occur to the legs.

BEWARE! When the spray pack is removed from the SAM 2000 Lowline, in particular, but also the SAM 2500, 3000, 3600 and 4000 Lowline the power unit will become extremely front heavy.

The power unit must never be driven in a demounted state except to manoeuvre to the next implement pack, which should be parked alongside.

For safety and to prevent both rear wheels lifting:

1. Only demount on a flat hard pad.
2. Never leave the power unit in a demounted state.
3. Never exceed 5 km/h (3 mph) when demounted.
4. Be extremely careful when stopping and reversing.
5. Never take the power unit on the public highway in a demounted state.

Any rear end equipment fitted by the customer **MUST** conform to the normal axle weight distribution. You are strongly advised to contact Sands Agricultural Machinery Ltd prior to any rear end implement adaptations.

In order for customers to conform with weight distribution requirements on additional rear end equipment, all additional demount chassis supplied by SAM Ltd have the capability of accepting up to 18 large (50kg) Fort front end weights.

FILLING THE SPRAYER

WITHOUT SELF FILL ATTACHMENT

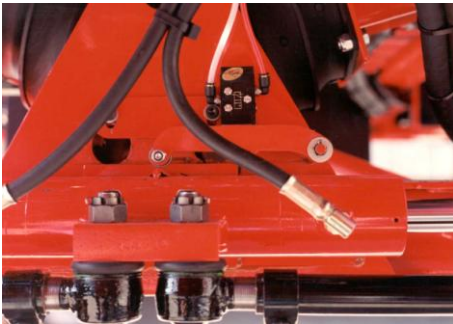
1. Fill the tank with a minimum of 100 litres (20 gallons) of clean water through the charging hole filter basket.
2. Ensure the main filter tap is turned for a 'tank to filter' flow and turn off the manifold tap at the rear of the machine.
3. With the engine running at 1000 rpm, engage the spray pump, if fitted, but with all other controls in the 'off' position.
4. Pour in the recommended quantity of chemical after relating the area to be sprayed with the tank size. The addition of chemical may be through the top charging hole or into the induction hopper.
5. Top up the tank with clean water, washing surplus chemical through the filter basket.
6. Allow the solution to circulate for a few minutes before attempting to spray.
7. Turn the rear manifold tap 'on'.

WITH SELF FILL ATTACHMENT

1. Connect the suction hose, complete with foot valve and strainer, to the 'self fill' inlet on the main filter tap. The strainer end of the hose should be placed in a suitable water supply.
2. With the engine running at 1000 rpm, engage the spray pump and agitator, if fitted, but with all other controls in the 'off' position.

3. Turn the main filter tap for 'self fill to filter' flow.
4. When there is at least 100 litres (20 gallons) of water in the tank, pour in the recommended quantity of chemical after relating the area to be sprayed with the tank size. The addition of chemical may be through the top charging hole or into the induction hopper.
5. Continue filling with water until the tank is full, then:
6. Turn the main filter tap to the 'tank to filter' position and disconnect the suction fill hose.
7. Allow the solution to circulate a few minutes before attempting to spray.

ALL WHEEL STEER



The 'All Wheel Steer' (AWS) system employed on SAM sprayers is designed with efficiency, safety and simplicity in mind.

It uses no electronics only compressed air to sense the relative positions of each axle.

It is self-aligning and requires no bleeding or re-setting.

The AWS system is for part-time operation only and is used to produce tight turns with the least crop damage, when required.

The system may be selected at any time by depressing the left foot pedal and holding it depressed. However, the rear axle will not engage until the front axle is perfectly straight. This may be when travelling straight in a tramline or when the front axle is being steered and passes through centre. When the rear wheels begin to steer a visual indication is displayed on the driver's console.

The foot switch may be released when the rear axle begins to steer, and the axle will continue to steer, until it once again hits centre.

In short, the rear axle will only engage when the front axle is straight, and will only disengage when it is itself straight.

Leakage within the steering system is corrected every time the rear axle disengages.

BEWARE: There are a number of situations in which AWS should **NOT** be used. They are as follows:

1. On side slopes when any 'crabbing' will be amplified by the steering rear axle.
2. When turning on steep hills where the rear end inertia could turn the machine over.
3. In potato rows where the rear wheels will try and climb the banks.
4. On any field spraying where rear axle movement is amplified by the boom thus causing an overlap/underlap situation at the boom tips.
5. Never engage AWS at speeds over 15 km/h especially on the Public Highway. Not only is it illegal, but it could cause an accident by the machine running out of control.

A rear axle isolator switch is positioned on the driver's console and should be used for all road journeys or anytime AWS is not anticipated.

If the Air System fails, the machine will automatically revert to two-wheel steer. If the machine is parked with AWS engaged, and air pressure is lost, the machine will 'crab' on start-up, until air pressure is re-instated.

To re-set the rear wheels, the rear axle should be locked with the isolator switch. The front wheels should then be turned to a similar, opposite angle (as in 4WS).

After releasing the rear axle isolator switch, the rear wheels may be turned in conjunction with the front wheels back to the centreline where the system will re-align itself.

Please only engage and use AWS while the machine is moving.

FIELD SPRAYING

It is assumed the operator has fitted the correct tips to the spray lines filled the tank with chemical and knows at what speed he has to drive. Then:

MANUAL SPRAYING

1. All switches off.
2. Increase engine revs.
3. Flick switches to 'air on' – '9km/h ON'.
4. Engage pump.
5. Turn on main ON/OFF control.
6. Set spraying pressure with the needle valve regulator – allow pressure to settle after any adjustment.
7. Leave 9km/h switch 'ON'.
8. Turn 'off' main ON/OFF control.
9. Turn on boom sections.
10. Move off and drive at desired speed.
11. Turn on main ON/OFF control at start of field.
12. Turn off main ON/OFF control at end of the field.

AUTOMATIC SPRAYING (SAM AIR CONTROL)

1. All switches off.
2. Increase engine revs.
3. Flick switches to 'air on' - '9 km/h ON'.
4. Engage pump.

5. Turn on main ON/OFF control.
6. Set spraying pressure at a speed of 9 km/h with the needle valve regulator - allow pressure to settle after any adjustment.
7. Turn 9-km/h switch to automatic (pressure will drop).
8. Turn 'off' main ON/OFF control.
9. Turn on boom sections.
10. Move off.
11. Turn on main ON/OFF control at start of field.
12. Turn off main ON/OFF control at end of the field.

NOTES

It is not necessary to drive at 9 km/h although it is advantageous to drive at a constant speed, this way the droplet sizes remain constant.

Maximum spraying speed in automatic is 14 km/h unless red indicator comes on at a lower speed. If the 'automatic' system fails, it is still possible to use the machine by turning on the 9-km/h switch. This will automatically hold a constant spray pressure, even when boom sections are turned off.

It will also be necessary to drive at a constant speed, not necessarily 9 km/h, but the pressure must be correct for the speed, which is chosen, exactly like a manual machine.

WASHING OUT THE SPRAYER

On all machines a tank washing facility is installed which enables the tank and booms to be flushed with clean water prior to removing the machine from the field. Approximately 100 litres of clean water, held in the tank bonded within the spray tank, is released into the spraytank by activating the wash control within the cab.



With the spraylines turned off and 'Tank Wash' selected the machine should be operated as for 'calibrating' the spraying system i.e. 9k/man 'ON' and main On/Off 'ON'. This will generate spray pressure and flush the water through an 'intank' cleaning nozzle. After 2-3 minutes of tank cleaning the 'tank wash' may be turned 'off' and the spraylines turned 'on'.

The cleaning water will now be flushed from the tank through the spraylines onto the headland. **Remember: both spraylines require flushing even though only one has been used.**

The spraying system can now be considered 98% clean and will require only a quick flush through on returning to the yard.

It is possible to flush the spraylines only by closing the SAC butterfly, opening the 'boom flush' tap on the main filter manifold and flushing the clean water through both spraylines.

Clean and replace the suction filter element.

LUBRICATION

GREASE - the following items should be regularly lubricated with a lithium based gun grease. A sodium-based grease is water-soluble and could be washed away by rain, whereas a lithium-based grease is not.

- Boom pendulum
- Boom hinges
- Rear axle
- Ram clevis pin
- Hardi spray pump
- Boom adjusters
- Butterfly valve
- Front axle tripod bearing
- Front axle
- Breakback pawl and catch
- All sliding areas of the back frame
- Breakback hinges
- Cylinder ball ends

LUBRICATING OIL - An SAE 30-grade mineral oil should be used to lubricate:

- Air system (also see section on Air System)

A good quality EP 90 gear oil should be used in the Splitter Box (SAM 3600 and 4000 only).

ENGINE - Please refer to the Deutz Operating Manual for lubrication information.

HYDRAULIC OIL - Only a good quality hydraulic oil type HV46 that conforms to AFNOR NF 48600 or ISO 3448 - CETOP RP 75 is suitable. **ANY OTHER GRADE OR SPECIFICATION OF OIL WILL CAUSE SERIOUS DAMAGE TO THE TRANSMISSION SYSTEM.**

A Universal oil is **NOT ACCEPTABLE**.

Modern agricultural machinery is required to perform efficiently under constant arduous conditions and extremes of ambient temperature. Machinery breakdown, particularly during peak periods, can mean a vital loss of production time and completely disrupt the operator's schedule.

The comprehensive range of proprietary products for agricultural equipment operators is designed to meet every lubricant need. However, whilst there is a product for each application, multipurpose products, which will allow stock rationalisation, are available.

SAM Ltd cannot emphasise enough how important it is to use the correct grade of hydraulic oil (HV46) in the machine.

Many oil companies now run a regular testing service for their customers and we, as a company, would advocate its use. We would recommend an oil sample be taken from the tank – not drain oil from the filters during the filter change operation – analysed and the findings noted. Potential failures could then be identified at an early stage.

Sands Agricultural Machinery Ltd recommend the use of:

**SANDS AGRICULTURAL MACHINERY
OPERATING INSTRUCTION MANUAL**

'Poclain Hydraulic Fluid' in the hydraulic system, plus the manufacturer's recommendations as follows:

Mobil

Lubrication Schedule

Order Free - Phone 0800 616595

Free-Fax 0800 122211

Technical - Free Phone 0800 800011

Sands Agricultural Machinery Ltd

Machine: HYDROSTATIC CROP SPRAYER

ITEM	LUBRICANT
Engine	Refer to Engine Manufacturers Instructions
Hydraulic System	Mobil DTE 15M
Splitter Gearbox (When Fitted)	Mobilube HD 90

LUBRICANT SPECIALISTS

CENTURY

CENTURY RECOMMENDED LUBRICANTS FOR
SANDS AGRICULTURAL MACHINERY LTD.,
SANDS HYDROSTATIC CROP SPRAYER

Engine: Deutz F5L912, F6L912, F6L913 Naturally aspirated and turbo charged	CENTURY SUPERB 15W/40 or AGRICENT SUPER TRACTOR OIL
Hydraulic System, Hydrostatic Transmission	NEVIS 10 SPECIAL
Grease Points	AGRICENT HP GREASE



SANDS AGRICULTURAL MACHINERY LIMITED

LUBRICANTS FOR HYDROSTATIC CROP SPRAYERS

ENGINE:-

Deutz F5L912 F6L912 F6L913 N/A & T/C Air Cooled

	ELF RECOMMENDED GRADES
Engine Lubricant	Safeguard EO 15W/40
Hydrostatic Drive	Hydrolif 46
Grease Points	Multi 2 Grease

MAY 1988



LUBRICANTS RECOMMENDATION CHART

Name SANDS AGRICULTURAL MACHINERY LTD Date 9/89
Address BRUNSTAD, STALHAM, NORWICH
NR12 9RR

EQUIPMENT DESCRIPTION AND ITEM TO BE LUBRICATED	*Recommended Shell Lubricant
HYDROSTATIC CROP SPRAYER	
MODEL FCH	
ENGINE : DEUTZ F5 L912, F6 L912, F6 L913	RIMULA X 15W/40
HYDROSTATIC DRIVE	TELLUS T46
GREASE POINTS	RETINAX A

January 2000

DO'S AND DON'T'S

DON'T'S

1. Do not put chemical in a dry tank.
2. Do not leave water or chemical solution in the tank overnight.
3. Do not weld on the machine without first disconnecting the battery.
4. Do not drive the machine with unsupported folded booms.
5. Do not spray in high winds
6. Do not use incorrect or dirty oil in the machine.

DO'S



1. Do study the chemical manufacturer's recommendations.
2. Do check nozzle output and pattern frequently.
3. Do take adequate precautions when frost is expected.
4. Do check forward speed at regular intervals
5. Do wear protective clothing (**THIS IS LAW**).
6. Do check for boom 'overlap'.
7. Do check for correct boom height, especially in crops of varying heights.
8. Do study this manual carefully - preventative maintenance is cheaper than compulsory maintenance.
9. Do contact SAM Ltd if there is any query on the control or operation of the machine.
10. Do have your machine regularly checked by our Service Engineers, especially at the end of every season.
11. Do STOP immediately the horn sounds and remove the cause.

PESTICIDE SPRAYING AND THE ENVIRONMENT

Used correctly, pesticides do not pose any more of a threat than many other modern inventions. Used incorrectly or thoughtlessly then problems may occur.

As commercial users of pesticides, the following points should be observed as guidelines on the safe use of pesticides.

- People living close to the intended area of pesticide operation should be advised so that they can take necessary action to prevent pets and livestock from straying into treated areas.
- Where there are risks to grazing animals, the period over which they must be kept away from the treated area, as indicated on the product label, should be observed.
- Do not spray hedge bottoms.
- Do not spray pesticides near ditches, rivers, lakes or other watercourses.
- Never empty tank or spray container washings, surplus diluted tank contents or concentrated product into any waterway or drained area.
- Never dispose of empty containers in ponds or other watercourses.
- Do not fill spray tanks from watercourses without a suction fill non-return valve, which will prevent siphoning back of pesticide into the watercourse.
- Select products which are specific to the pest or weed to be controlled.
- Consider not treating boom width or part of boom width closest to boundary.

SPRAY DRIFT is the most common culprit in reported incidents of pesticides misuse. Drift is related to:

- Spray quality
- Wind velocity at spray nozzle height
- Boom height
- Stability of local atmospheric conditions

The following actions should be observed:

- Listen to the weather forecast particularly wind speed and direction. The Met Office gives this as 'force' measured at 10m from the ground. Wind speed at boom height, the critical drift figure, will be roughly half this.
- The safest conditions in which to spray is a steady force 2 light breeze blowing away from susceptible crops, open water or neighbours land.
- Keep spray boom as low as possible consistent with an even spray pattern.
- Match spray quality to conditions - small drops are more likely to be caught by the wind.
- If conditions are unsuitable or unpredictable, do not spray.

The Food and Environment Protection Act 1985 stipulates that users shall take all reasonable precautions to protect the health of human beings, creatures and plants, to safeguard the environment and, in particular, to avoid pollution to water.

FIELD CRAFT (Operation)

Before any spraying takes place, check the following:

- Is the pesticide the correct one for the crop?
- Is the dose, volume or both correct?
- Is the weather suitable at present and going to remain so? (You do not want half a tank of pesticide left should it rain.)
- Ensure the wind speed and direction will not blow any drift to other crops, waterways, private gardens or members of the public.

If the above criteria are satisfactory, the following should be observed:

- Always use acceptable methods of swathe matching (tramlines, marker pegs etc.)
- Before starting to spray, correctly calibrate the machine.
- Set the boom to the correct height. Spray fans or cones from alternate nozzles should just overlap above the target.
- Spray twice round the headlands and reverse into the corners.
- Spray the longest side first, if possible. If not, spray so that the wind takes the spray away from your spraying direction.
- Whilst spraying keep a constant look out for blocked nozzles and a change in wind speed, direction etc.

USEFUL PUBLICATIONS

The following publications are recommended as useful references in the field of pesticides use.

Health and Safety Executive Booklets

Crop Spraying AS6: Poisonous Chemicals on the Farm HS(G)2

Prevention of Accidents AS12: Storage of Pesticides on the Farm AS18

Ministry of Agriculture, Fisheries and Food: Guidelines for Applying Crop Protection Chemicals - Booklet 2272 published by HMSO

Ministry of Agriculture, Fisheries and food: Guidelines for the Disposal of Unwanted Pesticides and Containers on Farms and Holdings published by MAFF

The UK Pesticide Guide (Annual) published by CAB/BCPC

Revised Draft Code of Practice for the Agricultural & Commercial Horticultural Use of Pesticides published by MAFF

Agricultural Training Board (ATB) Leaflets

Controlling Weeds, Pests and Diseases in Crops

Crop Spraying - Trainee Guide 3000-7/80 M9D2

Preparing Field Crop Sprayers - Trainee Guide 1000-7/87 M9D1

Control of Substances Hazardous to Health Regulations 1988 Leaflets

Introducing Assessment IND(G)64(L)

Introducing COSHH IND(G)65(L)

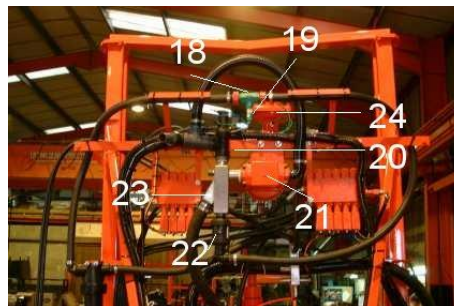
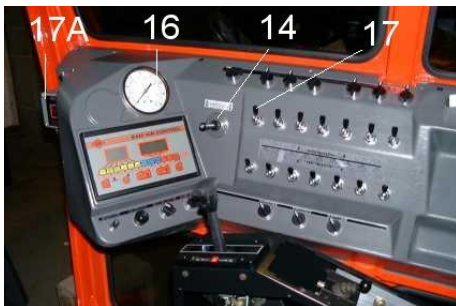
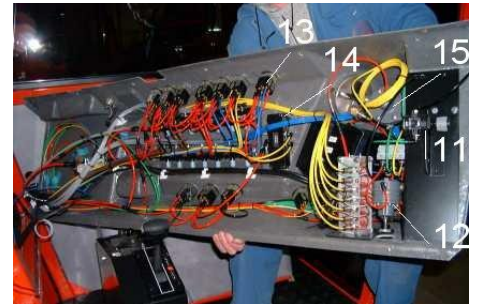
Hazard and Risk Explained IND(G)67(L)

FAULT FINDING

Listed below are a number of common sprayer faults with their 'causes' and 'cures'. We hope these cures will assist you in maintaining your sprayer in a good working condition.

FAULT	CAUSE	CURE
'Loss of' or 'no' spray pressure	Blocked filter	Clean
Red indicator comes on	Pump not turning or turning slowly	Check oil level
	Spool valve stuck	Free off manually after oiling air pilots
	Main ON/OFF valve stuck open	Clean valve
	Hole in Ramsey Diaphragm	Replace diaphragm
	Faulty control panel regulator	Clean
Spray pressure will not regulate	Worn pumps, valves or diaphragms	Check and replace
	Blocked filter	Clean
	Tips too big	Check/change tips
	Butterfly valve not revolving	Check/lubricate
Chemical in pneumatic panel	9 kph switch turned on	Turn off
	Leaking boom valve	Repair or replace
Fine foam in tank	Air leak in suction side	Locate and repair
Coarse foam in tank	Too much agitation during filling	Reduce agitation
Streaks in spray fan or cones	Partially blocked or worn nozzles	Check/clean/replace
Narrow spray fans or cones	Pressure too low	Increase pressure
Hydraulics will not function	Low air pressure	Check air system for leaks
	Low oil level	Replenish
	Dirty hydraulic filter	Change filter
	Pressure relief valve stuck open	Consult SAM Ltd
Booms will not fold	Dirt in regulators	Clean and re-adjust
Speed/area inaccurate		See operating instructions
Filtration fan will not operate	Tripped out	Check trip
Fluctuating speed / pressure (SAC II)	Wheel magnets	Check magnets

SPARES LIST

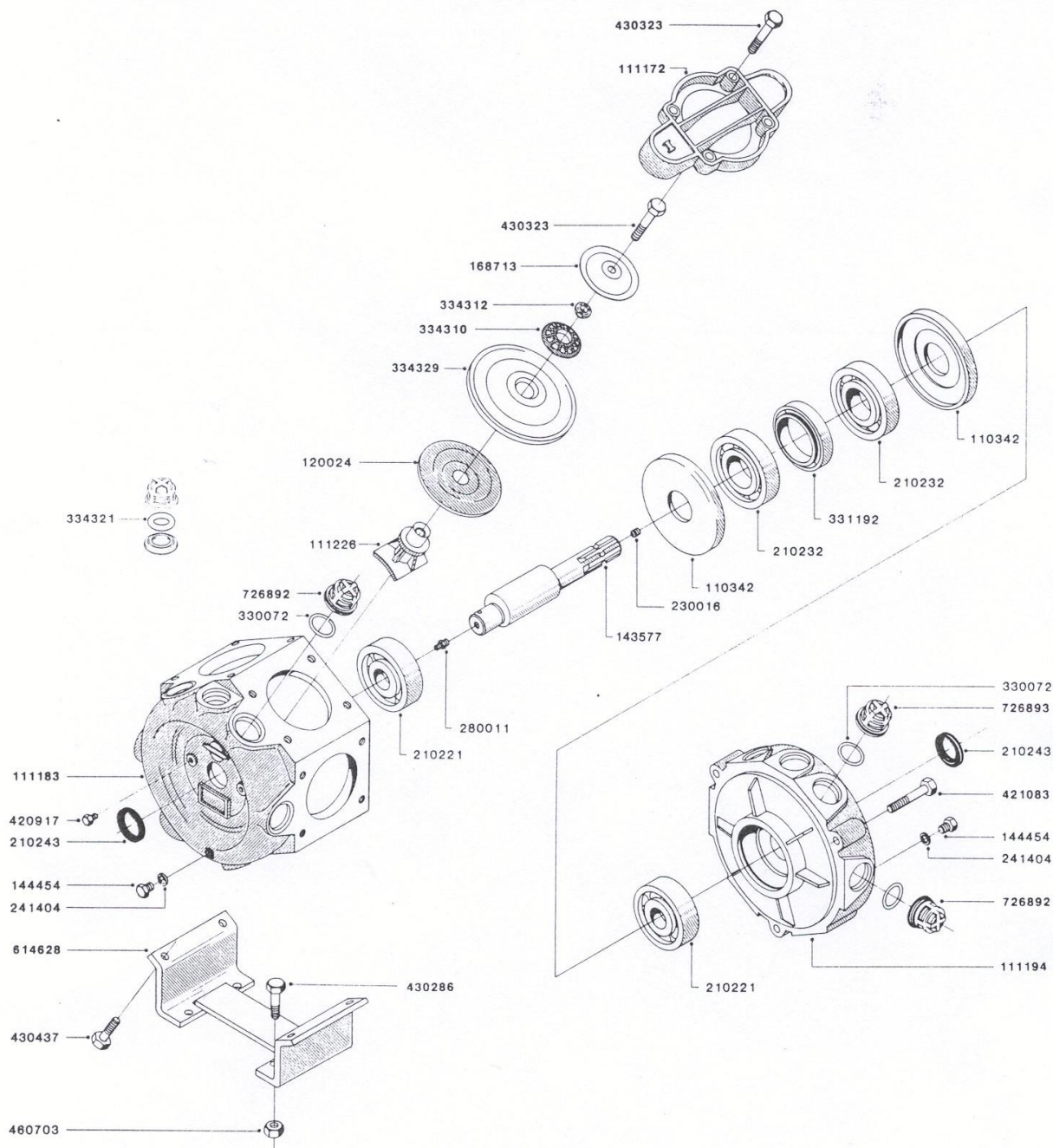


	DESCRIPTION	PART NO
1	Filter Element	49A637BK
2	80 Mesh Red	21A63180
3	50 Mesh Blue	21A63150
4	½" 3-way Tap	56003000
5	½" Elbow Male/Female	SL050-90
6	½" Male Adaptor	02050F12
7	Camlever Quick Release Coupling	02050C12
8	Spring 922/21	S1162

**SANDS AGRICULTURAL MACHINERY
OPERATING INSTRUCTION MANUAL**

9	Can Wash Nozzle	L1374-00
10	½" PVC Elbow – Threaded	35825012
11	Regulator	P3A-RA12BLP
12	Pressure Regulator	4130
13	Valve	9207000
	DESCRIPTION	PART NO
14	Valve	B53004LY
15	Relay 16-66	66BA6
16	Pressure Gauge 0-160 Bar Rear Con ½"	1819
17	Valve	B43603L
17A	E P Converter	778
18	1" Flow Turbine	S/SNR/FLOW/004
19	Flow Meter Sensor	S/SR/500-2-005
20	Main On/Off Valve	43SAM112
21	Air Pam Valve Body	1401
22	1" Safi 2-way Valve	56100302
23	Stainless Steel Manifold – Large	L1168
24	Diaphragm Cylinder	82041322-37
25	Lever End Base	401292MSZN
26	Half Multi Connector	3375 042001
27	¾" Carrier	2129
28	¾" Probe	2130
29	Unloader Valve Set at 9 Bar	DR3550
30	Pressure Sender 1/8 0-10 Bar	360081029012
31	Water Filter	P3EFA00WEN
32	Lubricator	P3ELA00TFN

HARDI INTERNATIONAL A/S



HARDI Pumpenmodell 460 mit
1^{3/8}" Welle

HARDI pump model 462 with
1^{3/8}" shaft

HARDI pumpe model 460 med
1^{3/8}" aksel

Bomba HARDI modelo 460 con
eje 1^{3/8}"

Pompe HARDI modèle 460 avec
arbre 1^{3/8}"

5-1-90

A21

DRAWBARS

With the advent of permanent 4WD on the SAM range of machines, it is now possible to tow water bowsters within the weight limits listed below:

SAM 2000	3000Kg gross
SAM 2500/3000	5000Kg gross
SAM 4000	5000Kg gross

This generally means that the sprayer water capacity may be doubled (ONE load in the machine and ONE in the bowser).

In addition, maximum nose weight must not exceed 100Kg, thus dictating a 4-wheel bowser.

A 50mm ball hitch is only suitable for loads up to 3500Kg.

Trailer braking must comply with RVCU (1986) regulations.

On a hydrostatic machine, this generally means a hydraulic over-run system of at least 35% efficiency. Maximum speed with an agricultural trailer is 20 mph.

WARNING – POWER LINES!!

DANGER OF DEATH – Stay away from power lines while folding booms

In the unlikely event of any part of the machine touching a power line:

STAY IN THE CAB
DON'T PANIC
TRY TO DRIVE CLEAR
WARN OTHERS TO STAY WELL CLEAR

If this is not possible or the machine catches fire

JUMP WELL CLEAR – DON'T CLIMB DOWN – the metalwork of the machine may be alive

NEVER TOUCH THE MACHINE ONCE YOU ARE ON THE GROUND

RUN WELL CLEAR WITH LEAPING STRIDES

STAY WELL CLEAR, WIRES MAY RE-ENERGISE WITHOUT WARNING

KEEP EVERYONE AWAY AND CALL YOUR LOCAL ELECTRICITY SUPPLIER ON:

Tel:

CAUTION! The 'Up and Over' boom folding mechanism produces a far stronger boom joint than other folding systems. However, great care should be taken when folding the second and third boom sections so that the booms do not interfere with high voltage cables. The operator should initiate a method of working where the boom is always lowered to the bottom of the mast prior to the operation of the 2nd and 3rd sections. Not only does this ensure that the boom folds well below the minimum safe height for high voltage cables, but also minimized the free boom movement which could add to boom height.

Never fold any boom section until the mating section has fully completed its total movement.

CIRCUIT INTERLOCKING ENSURES THAT BOOMS CAN ONLY BE FOLDED IN THE METHOD DESCRIBED I.E. IN THEIR LOWEST POSSIBLE POSITION.

AN AUDIBLE 'IN-CAB' WARNING IS GIVEN DURING ANY BOOM FOLDING OPERATION.

Never raise the boom when any boom section is raised.

Note! Booms folded as above will achieve a maximum height of 4.52 metres.