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Operator's Manual

GOLDACRES

Australia's World Class Sprayers

For further information about any of the products shown please visit - www.goldacres.com.au

All information in this operator's manual is based on the latest product information available at the time of printing. The policy of Goldacres is one of continuous improvement and as such, Goldacres reserve the right to alter any specifications and designs without notice and without incurring any obligation regarding such changes.

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Revision number: 01
18-08-2016
Part Number: GA8700312

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Chapter 1

INTRODUCTION

Welcome

Congratulations on your purchase of a Goldacres sprayer. For more than a quarter of a century Goldacres has supplied Australian farmers with quality, innovative and technologically advanced spraying solutions - equipment designed in Australia for Australian conditions.

Goldacres not only produce Australia's finest range of spraying equipment - we also keenly value the unique relationship we enjoy with owners of our equipment. We are pleased to welcome you as a Goldacres owner and look forward to making your spray applications as efficient as possible.

Please use this comprehensive resource to gain a full understanding of your equipment, and don't hesitate to contact your Goldacres Dealer or Goldacres for further information.

Roger Richards
General Manager

GOLDACRES - RESELLER TERMS AND CONDITIONS OF SALE

Goldacres Goods are only available for purchase upon the terms and conditions set out below.

Interpretation

1. In terms and conditions:
(1) "Goldacres" means Goldacres Trading Pty. Ltd. A.C.N. 061 306 732 trading as Goldacres Agricultural Equipment (its successors and assigns) which is the seller of the Goods;
(2) "Purchaser" means the purchaser of the Goods;
(3) "Goods" means the products and, if any, the services sold or provided by Goldacres to the Purchaser;
(4) "GST Act" and "GST" are given the meanings referred to in a New Tax System (Goods and Services Tax) Act 1999.
(5) "PPSA" means the Personal Property Securities Act 2009 (Clth) (as amended);
(6) Nothing in these terms and conditions shall be read or applied so as to exclude, restrict or modify or have the effect of excluding, restricting or modifying, any condition, warranty, guarantee, right or remedy implied by law (including the Competition and Consumer Act 2010) and which by law cannot be excluded, restricted or modified.

General

2. (1) The Goods and all other products or services provided by Goldacres are provided subject to these terms and conditions. These terms and conditions and any terms and conditions incorporated herein by virtue of clause 3 hereto shall prevail over all other terms and conditions of the Purchaser or otherwise to the extent of any inconsistency.
(2) These terms and conditions may not be modified or amended without the expressed written consent of Goldacres endorsed by the Managing Director of Goldacres Trading P/L.

Additional Terms and Conditions

3. From time to time Goldacres may provide additional or extended warranties in respect of certain goods and/or services. Where such additional or extended warranties are provided to a Purchaser in writing they will be incorporated into these terms and conditions provided that in the event of any inconsistency between these terms and conditions and the terms of any additional or extended warranty, the provisions of the additional or extended warranty shall prevail.

Goldacres quotations.

4. Unless previously withdrawn, Goldacres quotations are open for acceptance within the period stated therein or, when no period is stated, with 14 days only of the quotation date. Goldacres reserves the right to refuse any order based on any quotation within 7 days of receipt of the order.

Packing

5. The cost of any special packing and packing materials used in relation to the Goods shall be at the Purchaser's expense notwithstanding that such cost may have been omitted from any quotation.

Shortage

6. The Purchaser waives any claim for shortage of any Goods delivered if a claim in respect thereof has not been lodged with Goldacres within (7) seven days from the date of receipt of the Goods by the Purchaser.

Specifications, etc: Catalogues, etc: Quantities

7. All specifications, (including but not limited to: drawings, particulars of weights, volumes, capacities, dimensions, load factors) are approximate only and any deviation shall not be taken to vitiate any contract with Goldacres or form any claim against Goldacres. The descriptions, illustrations, and performances contained in catalogues, price lists and other advertising matter do not form part of the contract of sale of the Goods. Where specifications, drawings or other particulars are supplied by the Purchaser, Goldacres' price is made on estimates of quantities required. Should there be any adjustments in quantities above or below the quantities estimated by Goldacres and set out in a quotation, then any such increase or decrease shall be adjusted on a unit rate basis according to unit prices set out in the quotation.

Performance, Capacities, Chemicals, Liquids, Application Methods, Environmental Effects

8. Any performance, volumes, and/or capacity figures given by Goldacres are estimates only. Goldacres shall be under no liability for damages for failure to obtain such figures unless specifically guaranteed in writing and any such written guarantee shall be subject to the recognised tolerances applicable to such figures. The suitability of chemicals and other liquids for any application and the application methods and the environmental effects shall be the sole decision and responsibility of the Purchaser and the user of the Goods. Goldacres gives no warranty as to the suitability of any chemicals or other liquids for any application, nor the application methods nor the environmental effects, which may result from the use of the Goods. Goldacres shall be under no liability for damages arising out of the use of any chemicals, liquids, or mixtures in the Goods nor for any application, nor for the application methods nor for the environmental effects, which may result from the use of the Goods.

Delivery/Service Times

9. The delivery times and service times made known to the Purchaser are estimates only and Goldacres shall not be liable for late delivery, non-delivery or delay and under no circumstances shall Goldacres be liable for any loss, damage or delay occasioned by the Purchaser or its customers arising from the late or non-delivery or late installation of the Goods.

Loss or damage in transit

10. Goldacres is not responsible for any loss or damage to Goods in transit. Goldacres shall render the Purchaser such assistance as may be necessary to press claims on carriers provided that the Purchaser shall have notified Goldacres and the carriers immediately the loss or damage is discovered on receipt of Goods and shall lodge a claim on the carrier within three days of the date of receipt of the Goods. Insurance of Goods in transit is the responsibility of the Purchaser.

Limit of Liability

11. (1) Goldacres liability for Goods manufactured by it is limited to:
(a) where the law implies consumer guarantees into these terms and conditions pursuant to Part 3.2 Division 1 of Schedule 2 to the Competition and Consumer Act 2010 (C'th") ("consumer guarantees") which cannot be excluded and Goldacres breaches a consumer guarantee, the loss and damage the Purchaser is entitled to at law which cannot be excluded by these terms and conditions;

and, in all other cases

(b) making good any defects by repairing the same or at Goldacres option by replacement within a period not exceeding either 1000 hours or twelve calendar months, whichever comes first, after the Goods have been dispatched provided that:
(i) the defects have arisen solely from faulty materials or workmanship;
(ii) the Goods have not received maltreatment inattention or interference;
(iii) accessories of any kind used by the Purchaser are manufactured or approved by Goldacres;
(iv) where applicable, the seals on the Goods remain unbroken;
(v) there has been no improper adjustment, calibration or operation;
(vi) the use of accessories including consumables, hardware or software (not manufactured by Goldacres) has been approved in writing by Goldacres;
(vii) no contamination or leakage has been caused or induced;
(viii) any modification to the Goods have been authorised in writing by Goldacres;
(ix) there has been no inadequate or incorrect use, storage, handling or application of the Goods;
(x) there has been no use or operation of the Goods outside of the physical, electrical or environmental specifications of the Goods;
(xi) there has been no inadequate or incorrect site preparations;
(xii) there has been no inadequate or improper maintenance of the Goods;
(xiii) it has not been caused by fair wear and tear; and
(xiv) firstly the Goods have been thoroughly inspected and any damage (from whatever cause) to the Goods (and in particular – the structure, welding, seams, bolts, booms) has been repaired prior to the Goods being operated, used driven or moved and on each occasion the tanks are filled; and
(xv) there has been no failure to comply with the requirements of all present or future laws or regulations relating to the Goods and/or the use and/or the operation of the Goods; and
(xvi) there has been no failure to maintain a record of hours of operation (which record shall contain full details of all inspections, repairs and maintenance) and produce same to Goldacres at the time of the claim;
(xvii) the defective Goods or any damaged part of the Goods are promptly returned free of cost to Goldacres or a representative of Goldacres;
(xviii) all warranty related repairs have been carried out with the prior authorisation of Goldacres;
(2) If Goods or any part thereof are not manufactured by Goldacres, in particular engines, engine accessories, transmissions, transfer cases, differentials, tyres, tubes, batteries, radios and UHFs, the guarantee of the manufacturer thereof shall be accepted by the Purchaser and is the only guarantee given to the Purchaser in respect of the Goods or that part provided always that this clause does not seek to exclude the consumer guarantees;
(3) In the case of hydraulic systems, Goldacres shall replace defective parts in accordance with clause 11(1) of these conditions, provided that the failure of the part was not related to contamination within the system, Goldacres shall not be liable for labour in the case of repairing hydraulic system defects;
(4) Goldacres will not accept liability for damage attributed to fair wear and tear including but not limited to fair wear and tear to nozzles, chains, belts, filters, brake pads, polyethylene bushes and liquid pump valves, valve O-rings, diaphragms and seals;
(5) Goldacres shall not be liable for and the Purchaser releases Goldacres from any claims in respect of faulty or defective design of any Goods supplied unless such a design has been wholly prepared by Goldacres and the responsibility for any claim has been specifically accepted by Goldacres in writing and in any event Goldacres liability hereunder shall be strictly limited to the replacement of defective parts in accordance with paragraph 11(1) of these conditions provided always that this clause does not seek to exclude the consumer guarantees;
(6) Except as provided herein, all express and implied warranties, guarantees and conditions under statute or general law as to the merchantability, description, quality, suitability or fitness of the Goods for any purpose or as to design, assembly, installation, materials or workmanship or otherwise are hereby expressly excluded and Goldacres shall not be liable for physical or financial injury, loss or damage or for consequential loss or damage of any kind arising out of the supply, layout, assembly, installation or operation of the Goods or arising out of Goldacres negligence or in any other way whatsoever;
(7) The benefit of any warranty provided under these terms and conditions shall only be available to the Purchaser and shall not be transferable by the Purchaser;
(8) The warranties provided under these terms and conditions do not extend to second hand or used Goods that may be sold by Goldacres.

12. Goldacres liability for breach of a consumer guarantee is hereby limited (in the case of goods and services not used for personal, domestic or household purposes) to:
(1) in the case of Goods, any one or more of the following:
(a) the replacement of the Goods or the supply of equivalent Goods;
(b) the repair of the Goods;
(c) the payment of the cost of replacing the Goods or acquiring the equivalent Goods;
(d) the payment of having the Goods repaired; or
(2) in the case of services;
(a) the supplying of the services again; or
(b) the payment of the cost of having the services supplied again.

Prices

13. (1) Unless otherwise stated in writing by Goldacres, all prices quoted by Goldacres are inclusive of GST for supplies within Australia and exclusive of GST for exports outside of Australia. Prices quoted are those ruling at the time of quotation or the date the price is given and are based on rates of freight, insurance, customs, duties, taxes, exchange, shipping expenses, sorting and stacking charges, cartage, cost of materials and other charges affecting the cost of production ruling on that date and any alterations thereto either before acceptance of or during currency of the contract shall be to the Purchaser's account.
(2) For the purpose of 38-185 of the GST Act, the day upon which the seller gives the invoice for the supply shall be the date of the invoice.

Payment

14. (1) The purchase price in relation to the Goods and the cost of the service shall be payable without deduction and or set off and payment thereof shall be made on or before the thirteenth day of the month following the delivery of the Goods or performance of the services unless other terms of payment are expressly stated in writing.
(2) A decreasing or increasing adjustment and or the issuing of an adjustment note, pursuant to Division 21 and Division 29-C of the GST Act, shall not, in any way, constitute a release, waiver, and or forgiveness of the debt incurred by the Purchaser.

Interest on overdue payments

15. If Goldacres is not paid for any Goods or services on the due date specified in this agreement without prejudice to any other right or remedy, all outstanding money shall bear interest at the rate set, pursuant to the Penalty Interest Rates Act, Victoria, 1986, as such money, together with interest shall be recoverable forthwith from the Purchaser.

Rights in relation to Goods.

16. (1) Title to the Goods supplied by Goldacres to the Purchaser shall remain with Goldacres until the total amount due in respect of the Goods and all monies owing to Goldacres have been paid in full (the "Debts"). Risk in the Goods shall pass to the Purchaser upon delivery.
(2) The Purchaser shall have the right to resell Goods but only as fiduciary agent and trustee for Goldacres by way of bona fide sale at full market value and in the ordinary course of its business.
(3) Until all the Debts have been paid in full:
(a) the Purchaser shall take custody of the Goods as trustee, fiduciary agent and bailee for Goldacres;
(b) the Purchaser shall keep the Goods separate from any other goods and properly marked, stored, protected and insured;
(c) the Purchaser must hold all of the money it receives ("Proceeds"):
(i) from the sale of any property into which Goods supplied have been incorporated; and
(ii) from the sale of Goods or provision of services including the Goods supplied by the Goldacres as bailee, fiduciary agent and trustee for Goldacres, but the Purchaser need not hold on trust any money exceeding the amount of the Debts at the time the money is received.
(d) The Purchaser expressly acknowledges that it is bound by the fiduciary obligation created in the preceding paragraph and acknowledges that:
(i) it must hold the Proceeds on trust for Goldacres;
(ii) it must place the whole of the Proceeds in an account separate from its own moneys (the "Proceeds Account");
(iii) it must maintain the Proceeds Account separate from its own moneys at all times.
(iv) it must maintain proper records for the Proceeds Account.
(v) it must not assign or encumber any book debts arising from sales made in circumstances set out in clauses 16(c)(i) and (ii) or do any other act in derogation of Goldacres' legal or beneficial interests; and
(vi) it must account to Goldacres on demand for all moneys standing to the credit of such account.
(e) For the purposes of identification of different consignments of Goods purchased from Goldacres and receipt of Proceeds, the Purchaser agrees that the principle of "Last In, First Out" shall be applied to any items that cannot be distinguished.
(f) Goldacres may trace the Proceeds in equity.
(4) Goldacres may at any time, without notice to the Purchaser and without prejudice to any other rights which it may have against the Purchaser, terminate any contract connected with the Goods and the bailment referred to in clause 16(3) and enter upon any premises owned or occupied by the Purchaser where Goldacres reasonably believes the Goods may be stored, and repossess the Goods without liability for any damaged caused, and subsequently dispose of the Goods at Goldacres' discretion if:
(a) the Debts are not paid in accordance with these terms and conditions or any other contract or arrangement between Goldacres and the Purchaser; or
(b) Goldacres receives notice of or reasonably believes that:
(i) a third person may attempt to levy execution against the Goods; or
(ii) the Purchaser is insolvent (within the meaning of the Corporations Act 2001) or bankrupt; or
(iii) the Purchaser has entered into any arrangement or composition with its creditors, gone into liquidation, or has appointed a receiver, a receiver and manager or administrator.
(5) If after repossession under clause 16(4) Goldacres sells the Goods, Goldacres shall account to the Purchaser for any proceeds of sale (less expenses of repossession and sale) that exceeds the amount of the outstanding Debts.
(6) If any Goods belonging to Goldacres are disposed of by the Purchaser or an insurance claim is made in respect of them, Goldacres shall be entitled to trace the sale or insurance proceeds, which proceeds shall be held by the Purchaser in a separate bank account on trust for Goldacres.
(7) The Purchaser agrees and acknowledges that in the event it sells Goods to a third party on account, it will include in its terms and conditions of sale a provision under which the Purchaser retains title to the Goods until such time that the total amount due in respect of the Goods and all monies owing to the Purchaser have been paid in full by that third party debtor. The Purchaser also agrees and acknowledges that in these instances, it will register its PMSI in accordance with the PPSA in respect of its security interest in the Goods.

PPSA provisions

17. (1) The Purchaser acknowledges that these terms and conditions constitute a security agreement for the purposes of section 20 of the PPSA and that a security interest exists in all Goods (and any associated Proceeds from their sale) previously supplied by Goldacres to the Purchaser (if any) and in all in future Goods (and any associated Proceeds from their sale) that may be supplied to the Purchaser by Goldacres.
(2) The Purchaser acknowledges that Goldacres has a first ranking purchase money security interest ("PMSI") (as defined in section 14 of the PPSA) in the Goods and the Purchaser must not jeopardise such ranking (whether by act or omission).
(3) The Purchaser acknowledges that it has received value as at the date of first delivery of the Goods and has not agreed to postpone the time for attachment of the security interest (as defined in the PPSA) granted to Goldacres under these terms and conditions.
(4) The Purchaser will execute documents and do such further acts as may be required by Goldacres to register the security interest granted to Goldacres under these terms and conditions under the PPSA.
(5) Until ownership of the Goods passes, the Purchaser must not give to Goldacres a written demand or allow any other person to give Goldacres a written demand requiring Goldacres to register a financing change statement under the PPSA in respect of Goldacres' interest in the Goods.
(6) The Purchaser must indemnify Goldacres and on demand reimburse Goldacres for all costs and expenses incurred by Goldacres in respect of these terms and conditions including but not limited to Goldacres registering its security interest in the Goods, lodging, discharging or amending any financing statement or financing change statement, or otherwise complying with the PPSA.
(7) The Purchaser agrees (other than as provided in these terms and conditions) not to sell, lease, mortgage, deal with, dispose of or create or attempt to create any other security interest in or affecting the Goods unless and until the Purchaser's Debts have been satisfied.
(8) The Purchaser waives its rights under the following provisions of Chapter 4 of the PPSA:
(a) to receive a notice on enforcement action against liquid assets (section 121(4),
(b) to receive a notice to seize collateral (section 123);
(c) to receive a notice of disposal of Goods by Goldacres purchasing the Goods (section 129);
(d) to receive a notice to dispose of Goods (section 130);
(e) to receive a statement of account following disposal of Goods (section 132(2));
(f) to receive a statement of account if no disposal of Goods for each 6 month period (section 132(4));
(g) to receive notice of any proposal of Goldacres to retain Goods (section 135(2));
(h) to object to any proposal of Goldacres to either retain or dispose of Goods (section 137(2));
(i) to redeem the Goods (section 142);
(j) to reinstate the security agreement (section 143);
(k) to receive a notice of any verification statement (section 157(1) and section 157(3);
(9) The rights Goldacres may have under the PPSA are supplementary and in addition to those set out in these terms and conditions and do not derogate from the rights and remedies of Goldacres under these terms and conditions or under any other statute or under general law.
(10) The Purchaser must give 10 business days prior written notice of any proposed change in the Purchaser's name or other identifying characteristics and details.

Purchasers property

18. Any property of the Purchaser under Goldacres' custody or control shall be entirely at the Purchaser's risk as regards loss or damage caused to the property or by it.

Storage

19. Goldacres reserves the right to make a reasonable charge for storage if delivery instructions are not provided by the Purchaser within (14) fourteen days of a request by Goldacres for such information.

Returned Goods

20. Goldacres shall not be under any obligation to accept Goods returned by the Purchaser and will do so only on terms to be agreed in writing in each individual case.

Goods sold

21. All Goods to be supplied by Goldacres shall be described on the purchase order agreed by Goldacres and the Purchaser and the description on such purchase order modified as so agreed shall prevail over other descriptions including any Purchaser's specification or enquiry.

Cancellation

22. No order may be cancelled except with the consent in writing and on terms, which will indemnify Goldacres against all losses.

No waiver

23. The failure of any party to enforce the provisions of these terms and conditions or to exercise any rights expressed in these terms and conditions shall not be a waiver of such provisions or rights and shall not affect the enforcement of this agreement. The exercise by any party of any of its rights expressed in this agreement shall not preclude or prejudice such party from exercising the same or any other rights it may have irrespective of any previous action taken by that party.

Force Majeure

24. If by reason of any fact, circumstance, matter or thing beyond the reasonable control of Goldacres is unable to perform in whole or in part any obligation under these terms and conditions then Goldacres shall be relieved of that obligation under these terms and conditions to the extent and for the period that it is so unable to perform and shall not be liable to the Purchaser in respect of such inability.

Passing of risk

25. Risk in the Goods shall pass to the Purchaser upon delivery of the Goods to the Purchaser or collection of the Goods by the Purchaser's agent or carrier as the case may be.

Exclusion of liability

26. To the extent permitted by law Goldacres shall not be liable to the Purchaser in contract or in tort arising out of, or in connection with, or relating to, the performance of the Goods or any breach of these conditions or any fact, matter or thing relating to the Goods or error (whether or not it is negligent or a breach of contract) in information supplied to the Purchaser or a user before or after the date of the Purchaser's or user's use of the Goods and Goldacres shall be under no liability for damages arising out of the use of any chemicals, liquids, or mixtures in the Goods, nor for any application, not for the application methods nor for the environmental effects, which may result therefrom or from the use of the Goods.

Exclusion of representations and arrangements

27. To the extent permitted by law the terms and conditions supersede and exclude all prior and other discussions, representations (contractual or otherwise) and arrangements relating to the supply of the Goods or any part thereof including, but without limiting the generality of the foregoing, those relating to the performance of the Goods or any part thereof or the results that ought to be expected from using the Goods.

Place of contract

28. The contract for sale of the Goods and the provision of the services is made in the State of Victoria and the Purchaser agrees to submit all disputes arising with Goldacres to the courts of such State and any court competent to hear appeals therefrom.

Chapter 2

SAFETY

General

The following pages outline important safety information. At Goldacres safety is a high priority. These safety and warning instructions MUST be followed to ensure the safe operation of your Goldacres equipment.

Explanation of key terms used in this operator's manual are:

DANGER:

You will be killed or seriously hurt if you don't follow instructions

WARNING:

You can be seriously hurt if you don't follow instructions

CAUTION:

You can be hurt if you don't follow instructions

NOTE:

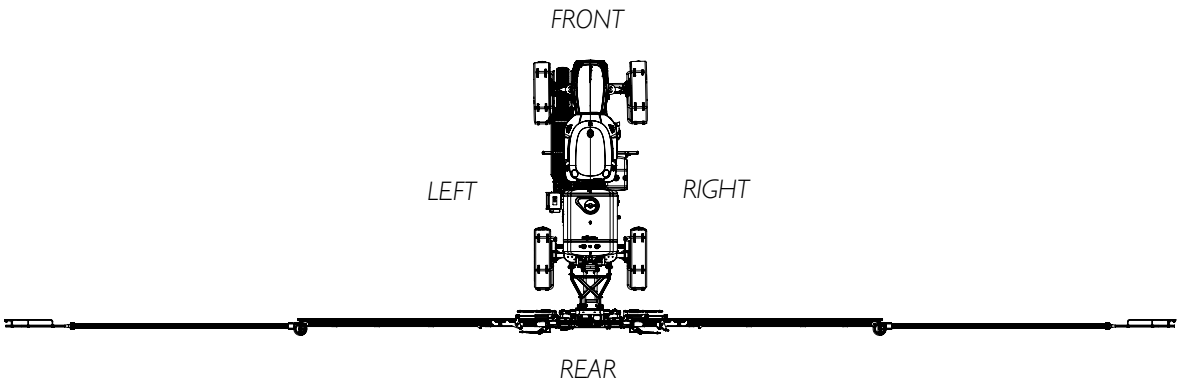
Is used to notify people of installation, operation or maintenance information that is important but not hazard related.

The Operator

All operators of this equipment should be adequately trained in the safe operation of this equipment. It is important that all operator's have read and fully understand the operators manual prior to using this equipment.

All new operators should be trained in an area without bystanders or obstructions and become familiar with the sprayer prior to operation.

Machine Orientation



Safety Precautions

Notes

- Goldacres Crop Cruiser's mechanical drive system delivers efficient, positive power to the ground for superior traction.

  However, should your Crop Cruiser become bogged and the wheels subsequently locked, do not engage first gear and maximise engine revs.

  With the wheel 'locked' in a bog situation, transmitting full power WILL DAMAGE the driveline.

  Goldacres recommends that bog situations are addressed prudently by using the assistance of a tow vehicle. Doing otherwise can cause significant driveline damage and VOID WARRANTY

- Always read, and understand, the operator's manual prior to operation of this equipment.
- It is the responsibility of the operator to ensure that there are no decals missing from the equipment and that any damaged, or missing, decals are replaced prior to operation.
- Goldacres equipment ordered, or operated, outside the guideline limitations may not be warranted by Goldacres for successful performance. Operators working outside these limitations do so at their own risk, unless specific advice has been sought from, and provided by, Goldacres in writing.
- Always read and follow the chemical manufacturer's guidelines for safe application as per the chemical label. Particular attention should be given to the recommended target application rate of the chemical being applied as per the chemical label.
- Inspect the equipment thoroughly for damage and wear before operation.
- Lubricate the equipment as per recommended requirements before operating.
- Flush chemicals from equipment immediately after use.
- Certain chemicals may be unsuitable for use with Goldacres standard plumbing designs. Consult your Goldacres dealer if in doubt.
- Do not operate the equipment while under the influence of any drugs, alcohol or if excessively tired.
- Make sure that the equipment complies with all relevant road regulations when transporting.
- Goldacres equipment uses several materials that may be harmful to the environment. Potentially harmful waste used with Goldacres equipment includes such items as oil, fuel, coolant, brake fluid and batteries. If these items are disposed of incorrectly the waste can threaten the surrounding environment and ecology. The waste products can leech into surrounding water sources and contaminate the area.
- When draining fluids from the equipment use appropriate, leak proof containers. Do not use food or beverage containers because someone may consume the contents by mistake.

Cautions

- A supply of fresh water should be with the equipment at all times.
- Water tanks are not designed for use with diesel fuel or any flammable liquid.
- Do not use this machine in ambient temperatures exceeding 40 degrees Celsius.
- Each individual boom section has a maximum delivery of 35 litres per minute with clean filters fitted.
- The maximum combined flow of all boom sections is limited to 140 litres per minute, or 50% of the pump flow whichever is the lesser amount, with clean filters.
- Do not exceed the maximum spraying pressure of 8 Bar.
- Ensure that all bolts are tightened and secured before operation.
- Where fitted, care should be taken to never overfill the diaphragm pump with oil or operate at speeds exceeding 540 rpm.
- Always ensure that the boom is securely supported when travelling.

- Do not travel at excessive speeds over rough terrain. The superior ride characteristics of this machine can disguise the impact of rough terrain, on the driveline and suspension system on the machine. After impact with gutters, sinkholes, rocks etc. stop the machine and inspect for damage.
- Violent speed change WILL CAUSE boom damage. The high power to weight ratio and braking capacity (especially when empty) enables very high acceleration and decelerations of the machine. It is important during accelerating and braking that the effect on the spray boom in the open position is taken into account.
- When leaving the sprayer always isolate the batteries by turning the isolator key off and removing it.

Towing and Transporting the Sprayer

- A disabled sprayer is best transported on a drop deck trailer. Use chains to secure the sprayer via the tie down attachment point located under the front and rear axles.
- The machine must not be towed unless the engine is running (as the steering and brakes require engine power to operate). Before towing, the rear tail shaft should be disconnected, due to the risk of damage to the transmission. While towing do not travel at a speed greater than 10 km/h.
- An operator must steer and brake the sprayer under tow.
- Check the wheel nut tension on a regular basis. The torque and inspection frequency is outlined in the maintenance section.
- Brake pads should be inspected for wear regularly. The inspection frequency is outlined in the maintenance section.

Service Cooling System Safely

- At operating temperature the fluids in the cooling system are under pressure. Only remove the radiator cap when the engine is turned off and has cooled down.
- Loosen off the cap slowly to relieve the pressure, and then remove the cap completely.
- Coolant can be added when the engine is cool and turned off.

Maintaining Batteries

The machine is supplied with sealed, non service batteries. The battery electrolyte contains sulfuric acid; this is a highly dangerous liquid and should be handled with the greatest degree of care.

The acid can cause blindness, burn skin and dissolve clothing. Batteries also produce hydrogen gas (especially when charging), so do not place flames or sparks near the batteries.

A vigilant operator can avoid these hazards by:

1. Wearing the correct personal protective equipment.
2. Avoid spilling or dripping electrolyte.
3. If the case is damaged, place into a plastic collection tray ready for disposal.

Emergency Measures:

- If the electrolyte gets in your eyes, flush your eyes with clean water for at least 15 minutes, then get immediate medical assistance.
- Also thoroughly wash all other affected areas on your body with water and remove all clothing.
- If you swallow any electrolyte seek medical attention immediately.

Support Machine Safely

Before raising the machine off the ground;

✓ Ensure that the boom is in its closed position.

✓ Park on a flat level, firm area and engage the park brake.

✓ Where possible before lifting the machine, empty the spray tank.

✓ Chock all wheels that remain on the ground.

✓ Securely lift the machine using a jack and support the machine on work stands.

× Do not rely solely on the jack before working under the machine.

× Do not support the sprayer using materials that may crumble.

× Do not work under the machine when supported solely by a jack.

Changing Wheels and Tyres

Changing
An experienced person with the correct equipment should mount the wheels on the sprayer.

When changing a wheel on the sprayer ensure that the sprayer is on firm level ground and the wheels are chocked.

Tyre maintenance
Maintain correct tyre pressure at all times. Inflation of tyres above or below the recommended pressure exerts additional pressure on the tyre, which may result in tyre damage.

Extreme caution is required during the inflation of tyres. If the tyre is inflated at a rapid rate separation and/or explosion of the rim can occur. This event can inflict serious or fatal injuries to the operator.

✓ Always use a tyre inflation gauge.

× Do not weld, heat or modify the rim.

✓ Be proactive and continually check the condition of your tyres.

Maintenance Warning (Crush Hazard)
Never attempt to maintain axles, wheels or components within the vicinity of the wheels with the engine running.

Burn Risk

- Ensure safety around the entire exhaust system on the sprayer
- Ensure safety around the hydraulic tank and all hydraulic lines when at operating temperature.

Warnings

- Any unauthorised modifications to this equipment may affect its function and create a serious safety risk.
- Keep clear of overhead obstructions – especially power lines as contact can be fatal.
- Never attempt to clean parts, or nozzles, by blowing with mouth.
- Never attempt to siphon chemicals, or substances, by sucking.
- It is imperative that the vehicle manufacturer's specifications be checked and all instructions for use when transporting, or towing, be adhered to at all times.
- Care should be taken when transferring liquid into the tank to ensure that the gross weight of the equipment does not exceed the carrying and braking capacity of the vehicle to which as specified by the vehicle manufacturer.

Note: 1 Litre water = 1 Kg.

- Water weighs 1kg per litre, however conversion factors must be used when spraying liquids that are heavier or lighter than water. Example: liquid nitrogen has a density of 1.28 kg/L and will therefore be significantly heavier than water if the tank is filled completely. The total weight of a tank full of chemical, should not exceed that of a full tank of water. Machine damage can result if the machine is over weight. (See filling instructions in the Operations chapter for more information.)
- Suitable care should be taken when driving the vehicle. Consideration should be given to both the carrying capacity of the vehicle and the gradient of the terrain when determining the speed at which the vehicle can be driven safely.
- Ensure that the maximum speed of the vehicle, when loaded, is within the vehicle manufacturer's limitations.
- Ensure equipment is securely fastened, or attached, to vehicle at all times.
- Never stand within the radius of boom wings.
- Never work under any hydraulically raised boom.

Personal Protective Equipment (PPE)

Always wear close fitting clothing and safety equipment designed for the job.

- Exposure to loud noise over an extended period can cause impairment or loss of hearing. Be active in the conservation of your hearing and wear appropriate hearing protection at all times.

- Chemicals can be harmful to humans, appropriate PPE should be used when handling chemicals. Always refer to the chemical manufacturers label for guidelines on the appropriate PPE to use with the chemical/s you are using.

Goldacres also suggest that you read and understand the following Australian standards:

- Australian Standard for Chemical protective clothing AS3765
- Australian Standard for Respiratory protection devices AS1715

Airborne Particles

- Always stand well clear of equipment during operation.
- Any spray drift is dangerous and may be hazardous to humans.
- When heating and welding components, ensure that all paint and other such materials are removed. Often hazardous airborne particles and fumes are generated from welding and heating.

Do Not Heat Pressurized Fluid Lines

When conducting any process on the machine that involves heat; be aware of pressurized fluid lines in the vicinity of your work area.

Pressurized lines can be easily cut when the heat over shoots the target object.

Do Not Carry Passengers

Do not stand or carry passengers on the steps or platform when the equipment is in motion or when the booms are being folded or unfolded.

Fluids Under Pressure

Fluids escaping from high pressure lines can cause serious injury to skin. Hydraulic oil can easily penetrate human skin. This hazard can be avoided by relieving the pressure in the system.

Do not disconnect any hoses, nozzles or filters while equipment is operating. Disconnecting these components while under pressure may result in uncontrolled fluid discharge which may be hazardous.

When the repair is complete ensure that all fittings and lines are secured before re-applying pressure.

Machine Operation

- High speed turning places severe stresses on the wheels and axles and should be avoided. It is essential to observe the effects of turning on the open spray boom. Excessive turning speeds transmit great stresses to the spray boom and WILL CAUSE boom damage.
- Modification of the machine to increase maximum speed is STRICTLY PROHIBITED. This machine is designed for a maximum speed of 50 km/h. This speed must only be used on suitable terrain conditions. All components i.e. tyres, brakes, suspension, steering and chassis are designed and built to this maximum speed.
- MAXIMUM SPEED WHEN CORNERING, TURNING AT AN ANGLE GREATER THAN 45° OR DRIVING ON A SLOPE OR UNEVEN TERRAIN IS 5KM/H. When fitted with narrow wheel track and with high centre of gravity, the Goldacres Crop Cruiser self-propelled sprayer may become unstable when turning at excessive speed or when operating on excessively steep terrain.
- To minimize the risk of injury in the event of an accident, the operator must be wear seat belt at all times.
- Before leaving the sprayer the engine must be shut off, the transmission placed in neutral and the park brake engaged. NEVER ENGAGE THE PARK BRAKE WHILE THE SPRAYER IS MOVING. DAMAGE TO THE TRANSMISSION MAY RESULT.

Re-Fuelling safety

- Handle fuel with extreme caution. Do not refuel the machine while smoking or near open flames or sparks.
- Always stop the engine before refueling the machine.
- To prevent fires always keep the machine clean of grease, debris and dirt.
- Do not use current emitting devices when re-fuelling.

Collision prevention and warning lights

- Before operating the machine check with the

relevant road management authorities for information regarding safe and legal transport on public roads in the state where the machine is being operated.

- To assist in the prevention of collisions with other road users the Goldacres Crop Cruiser self propelled sprayers, are fitted with warning lights and signs in accordance with Vic Roads regulations.
- Crop Cruisers are fitted with a reverse warning beeper when the machine is put into reverse.
- The Crop Cruiser can only be driven on public roads during daylight hours.
- Keep lighting and signs in good order and replace any damaged or faulty fixtures.

Working at Heights

Please contact your local government on the restrictions and safety requirements needed to operate at heights.

- There is a risk a falling if a person has "climbed" onto the machine.
- Do not "climb" on machine to get access.
- Use ladder or work platform to get access to parts or areas of the machine above local government restrictions.

Slippery Surfaces

- The surface of the platform has raised portions to stop slipping.
- The platform surface needs to be kept clean of mud and other material to help stop slipping.

Dangers

- Check area to be sprayed for overhead powerlines. Contact between the machine and powerlines can result in serious injury or death. If there are powerlines in the spray area, exercise extreme caution when tilting boom wings.
- Do NOT walk on machine platform when near power lines.
- NEVER start the engine when standing on the ground. Only start the engine from the operator's seat, with the transmission in neutral. Possible injury or death can occur by starting the machine through other methods.
- Never exit the cabin while the machine is in motion.
- Diesel engine exhaust fumes are harmful and can cause severe sickness or death. If it is necessary to run the engine in an enclosed area use an exhaust pipe extension. If an exhaust pipe extension is unavailable ensure that all doors are fully open and the room is well ventilated.

Entanglement in Rotating Drive Lines

- Rotating drives can cause serious injury or even death when entanglement occurs. Keep hands, feet, hair and clothing away from all moving parts to prevent injury. Never operate this machine with covers, shrouds, or guards removed.

Main Tank

- Danger - Confined space do not enter.
- Do not enter the tank for any purpose.

Safe Use of Chemicals

The safe use of Ag chemicals with this equipment is the responsibility of the owner/operators. All operators should be trained in the safe use of Ag chemicals. Goldacres suggest that a relevant course is completed by owners/operators prior to operation of this equipment as a spray unit.

Personal Protective Equipment (PPE)

Always wear close fitting clothing and safety equipment designed for the job.

Chemicals can be harmful to humans, appropriate PPE should be used when handling chemicals. Always refer to the chemical manufacturers label for guidelines on the appropriate PPE to use with the chemicals you are using.

Goldacres also suggest that you read and understand the following Australian standards:

- Australian Standard for Chemical protective clothing AS3765
- Australian Standard for Respiratory protection devices AS1715

Airborne particles

Always stand well clear of equipment during operation. Any spray drift is dangerous and may be hazardous to humans and animals.

Fluids under pressure

DO NOT disconnect any hoses, nozzles or filters while equipment is operating. Disconnecting these components while under pressure may result in uncontrolled fluid discharge which may be hazardous.

When the repair is complete ensure that all fittings and lines are secured before re-applying pressure.

Safety Decals

Understanding safety decals and their purpose assists in the safe operation of your sprayer. Safety decals are there for your protection and it is the responsibility of the owner operator to replace damaged and/or missing safety decals.

Regularly review safety decals with operators. It is very important to ensure that all new machine components and replacement parts include current hazard identification decals.

Replacement safety decals can be ordered from your Goldacres dealer or directly from Goldacres. Part numbers and descriptions of the decals on this machine can be found in the parts manual supplied.

Parts Ordering

When ordering parts from your Goldacres dealer, please quote:

- Serial No.
- Part No. required
- Part description
- Quantity required

The parts manual supplied with this machine includes all the relevant information that you need when ordering parts from your dealer or Goldacres. When returning parts to Goldacres, or to a Goldacres dealer, for service or repair all parts MUST be cleaned thoroughly before sending them. Goldacres cannot expose technicians to the many potentially hazardous pesticides and substances that are in use.

Note: Please ensure that all parts are clearly labelled with the owner's details, and a brief description of the fault. Goldacres are not liable for the return of any goods to Goldacres or a Goldacres Dealer. The goods must be returned to the point of sale. The customer will be responsible for any cost incurred by a Goldacres appointed person travelling to any site outside the point of sale.

Genuine Goldacres parts only should be used on Goldacres equipment.

Fire Extinguisher

It is recommended that a fire extinguisher be fitted to your machine.

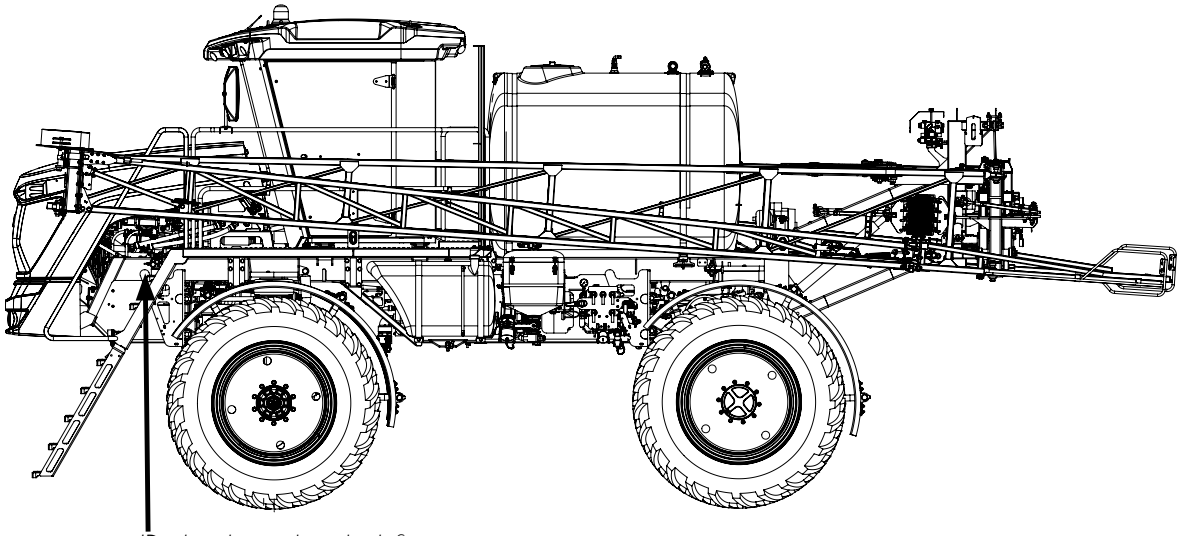
A dry chemical fire extinguisher ABE approved for wood, paper, flammable liquid and live electrical equipment fires.

First Aid kit

It is recommended that a first aid kit be added to your machine.

Identification

When ordering parts or requesting service information for your sprayer it is important to quote the serial number of your machine, and the purchase date, in order to receive accurate information. The location of the serial number plate on your machine is shown in the picture.



ID plate located on the left hand chassis rail near steps.

Chapter 3

GENERAL INFORMATION AND SPECIFICATIONS

General

Chassis
The chassis is an all steel construction, that is fully welded for superior strength. The chassis is grit blasted, primed and then protected by the Goldacres paint process for excellent chemical resistance and durability.

Paint Colours

Wheels: N23 Neutral Grey
Steel work: G13 Dark Green
Steel work: N61 Black

Australian Standards AS2700

Tank
All tanks are constructed from UV resistant polyethylene. Polyethylene tanks have a very high chemical resistance. Due to the rotomoulding process, there can be a variance in the overall dimensions of the tank which in turn results in variations to the tank capacity. For this reason, calibration markings should be used as a guide only.

Cabin
The cabin features panoramic views surrounding the sprayer and is customised to suit spraying applications. The rate controller and all key spraying functions are within easy reach of the operator

Further information on the cabin can be found in the 'Cabin' chapter.

Agitation
The Supermix agitator is located at the back of the tank and is used to generate increased agitation within the tank. The pressure line to the Supermix agitator from the control manifold passes through a nozzle and then through the barrel into the tank. This causes extra agitation as flow around the agitator is sucked into the barrel and is then passed back into the tank. To increase this venturi effect, the bypass flow from the electric regulating valve also passes through the barrel, multiplying the agitation effect. For further information refer to the 'Operation' chapter.

Boom Valves
Motorised boom valves, for control of boom section on/off, are fitted as standard. These are mounted on the boom centre section at the rear of the sprayer. The number fitted is dependent on the number of boom sections and number of boom lines.

Controller
G3 G4 sprayers are supplied with either a Raven SCS450, SCS4400 automatic rate controller or a ISOBUS connector. Automatic rate controllers will maintain a user defined application rate automatically as the vehicle speed changes. In order to function, the automatic rate controller relies on a flow meter, speed sensor and control valve. For specific information on the Raven controller please refer to Raven operator's manual supplied and 'Calibration' section of this manual.

Filtration
Filtration is a critical part of the sprayer's performance.

As standard on all sprayers, they are fitted with:

- 1 x Suction filter (32 mesh)
- 2 x Pressure filters (1 x 80 & 1 x 100 mesh)
- Nozzle strainers (50 mesh)

Pump
Udor positive displacement, oil backed diaphragm pumps are fitted as standard on Goldacres equipment. The normal operating range is from 1 - 8 bar which is sufficient for efficient nozzle performance.

Chemical Induction

The method of chemical induction into your sprayer is dependent on the optional chemical induction equipment fitted to your sprayer.

Goldacres chemical induction equipment available includes:

- Chemical Probe
- Chemical Induction Hopper
- 12 volt Chemical Transfer Pumps

Booms

The Crop Cruiser can be fitted with a variety of boom sizes from 18 metres up to 36 metres in width. All booms feature hydraulic lift and fold, with control from the cabin. Individual wing tilt is available as an option.

Goldacres booms feature: pitch, roll and yaw suspension in order to provide a superior boom ride and assist in the efficient application of chemical to your target.

Nozzles

As information regarding nozzles is specific to those being used in your application, no specific reference is made to nozzle application rates or nozzle types in this operator's manual. Goldacres suggest the use of a current TeeJet or Lechler nozzle selection catalogue for reference to nozzle sizes, outputs, spray patterns and general spraying information. For more technical information on the function of spray nozzles and factors affecting their performance you can also use the TeeJet 'User's Guide to Spray Nozzles'.

The TeeJet & Lechler nozzle selection catalogue and Users guides to spray nozzles are available from your Goldacres dealer, or as a free download from the TeeJet web site: www.teejet.com
Lechler web site: www.lechler.de

Machine Limitations

All Goldacres equipment is subject to operating limitations, it is the operator's responsibility to ensure that this equipment is being operated within these limitations and appropriately to the operating conditions at hand.

Goldacres do not endorse use of this machine for spraying at speeds greater than 20 km/hr and should not be used in ambient temperatures exceeding 40 degrees celsius or below 5 degrees celsius.

Each individual boom section has a maximum delivery of 35 litres per minute with clean filters fitted. With clean filters fitted, the maximum combined flow of all boom sections is limited to 140 litres per minute, or 50% of the pump flow, whichever is the lesser amount.

Goldacres Crop Cruiser mechanical drive system delivers efficient, positive power to the ground for superior traction.

However, should your Crop Cruiser become bogged and the wheels subsequently locked, do not engage first gear and maximise engine revs.

With the wheel 'locked' in a bog situation, transmitting full power WILL DAMAGE the driveline.

Goldacres recommends that bog situations are addressed prudently by using the assistance of a tow vehicle. Doing otherwise can cause significant driveline damage and VOID WARRANTY

Custom Built Equipment

Where the owner of this sprayer has requested that custom built equipment or options be fitted to this sprayer it is necessary to understand that custom fabrication and engineering is subject to many variables. Goldacres cannot fully field test all custom built options prior to despatch, and owners of new sprayers fitted with custom built equipment or options need to understand that the functionality of these items may require refining in order to operate as desired.

Suspension

The Crop Cruiser is fitted with 5 link airbag axle suspension to provide excellent ride and comfort.

Further information on the suspension can be found in the 'Lubrication and Maintenance' chapter.

Air Conditioning

The cabin is climate controlled and a carbon filter is installed to ensure operator safety.

Further information can be found in the 'Lubrication and Maintenance' chapter.

Hydraulics

Electric over hydraulic valves are standard on all models. The hydraulic functions are then controlled from electric switches in the cabin. The valve block is located at the rear of the sprayer above the boom valves.

Hand Wash Tank

A fresh water hand wash tank is located on the right hand side of the machine near the bonnet. It has a bottle with a hand pump that can be filled with a liquid hand cleaner. The hand wash tank can be filled with fresh water for the use of the operator.

Ladder

The Ladder is to be used as access to the platform and cabin by the operator. Always face the ladder and retain three points of contact with the ladder at all times when ascending and descending.

The ladder is only lifted to the raised position when the key is turned on and the handbrake is released. The operator must take care when operating the handbrake when there is a person close to the ladder as it may move unexpectedly. In an emergency the ladder can be lowered by either, Applying the handbrake, turning off the ignition or removing the air supply hose from the air cylinder.

Wheels and Tyres

The tyre pressure needs to be checked regularly (check every 8 to 12 hours of operation) and maintained at the required tyre pressure.

There are many factors concerning the appropriate tyre pressure for a particular tyre and load. For example, the tyre size, rim type, tyre status (driven or free rolling), load, speed, haul length and ply rating all need to be considered when determining the tyre pressure.

The rated pressure and capacity applicable when the machine is stationary. The cyclic loading pressure & km/hr is applicable for machines that are loaded and moving.

To determine the Correct Tyre Pressure:

- Determine the maximum weight of the sprayer when loaded (do not forget to add the weight of any other tanks on the sprayer when filled).
- Allow for each tyre to carry a quarter of the maximum loaded weight of the sprayer.
- Determine what tyre size and ply is on the sprayer.
- Determine what appropriate tyre pressure will provide the load capacity required by the respective tyre as indicated in the following table.

For further information on wheels & tyres please refer to the 'Lubrication and Maintenance' chapter.

Weight

G3 - Tare 7820 Kg (24M boom Delta centre)

G4 - Tare 9380 Kg (36m boom TriTech centre)

Dimensions

The following information is provided as a guide only.

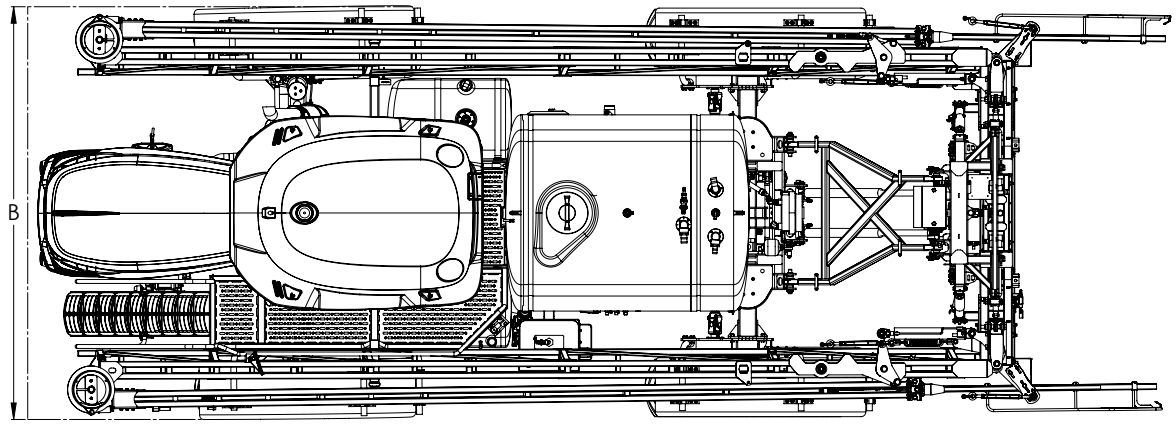
Variations in dimensions may occur without notification. To ensure that the dimensions are accurate for your sprayer it is recommended that you measure your sprayer individually.

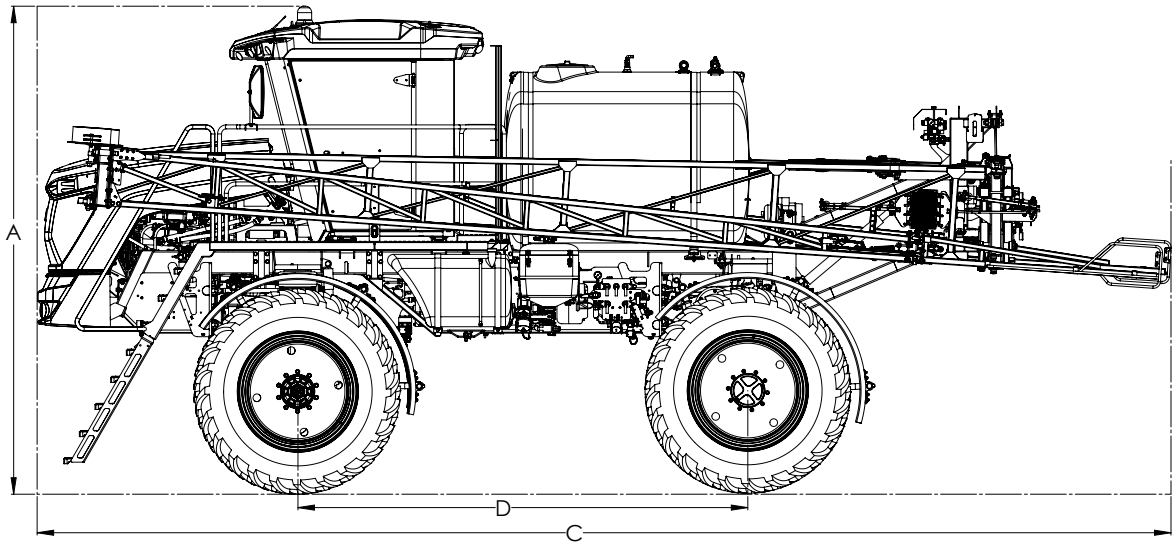
Note: The Crop Cruiser sprayer is approx 4.22m in height and with aerials on the roof, can be much higher. Check the regulations in your state for maximum vehicle height restrictions. When driving the Crop Cruiser on roads it may be necessary to remove aerials to meet the required height restrictions.

Aerials on the roof may also need to be removed to meet clearance requirements for over head power lines, while on the road and also in some paddocks.

Sizing is on the following page.

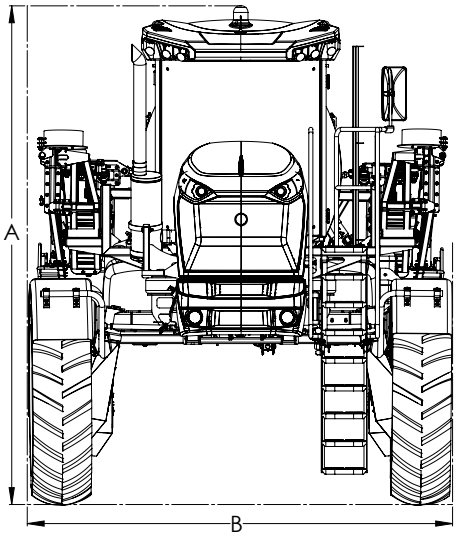
Dimensions





Boom size	A Front Height	B Width	C Total Length	D Wheelbase
18m	4.12m	3.5m	8.2m	3.820m
24m	4.12m	3.5m	8.5m	3.820m
30m	4.12m	3.5m	8.5m	3.820m
33m	4.12m	3.5m	8.5m	3.820m
36m	4.12m	3.5m	9.48m	3.820m

Spray height is based on 380/90 R46 Harvest tyres fitted & with air bags deflated



Chapter 4

CABIN

Key Features - Up to SN 201605

Number	Feature
1.	Over Head Console
2.	Side Arm Rest Console
3.	Operators Seat
4.	Steering Wheels And Controls
5.	Power Distribution Box
6.	Storage Area (under operators seat)
7.	Operator Seat Belt
8.	Hand brake
9.	Gauges (Boom)

Key Features - SN 201683 Onwards

Number	Feature
1.	Over Head Console
2.	Side Arm Rest Console
3.	Operators Seat
4.	Steering Wheels And Controls
5.	Power Distribution Box
6.	Storage Area (under operators seat)
7.	Operator Seat Belt
8.	Hand brake
9.	Gauges (Boom)

Arm Rest Controls

SCS450 Controller

ISOBUS with Raven

Number	Feature
1.	Auto Rate Controller - SCS450 or SCS4400 or ISO BUS
2.	Tilt Left Up & Down
3.	Boom Up/Down
4.	Tilt Right Up & Down
5.	Blank
6.	Cruise Control Resume+/Set-
7.	Fence Jets On/Off Left and Right
8.	Cruise - RPM Raise
9.	Boom Recirc
10.	Spray Pump On/Off

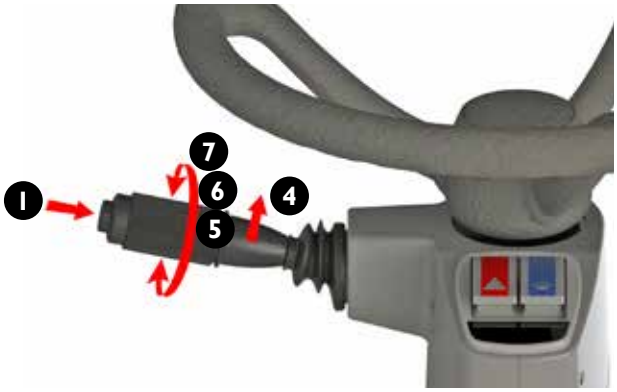
Number	Feature
11.	Transmission Gear Selector
12.	Boom Fold In/Out
13.	Boom Bi-Fold In/Out
14.	Blank
15.	Spray Mode/Road Mode
16.	Diff Lock On/Off
17.	Blank
18.	Fuel Gauge
19.	Aux USB Power Supply
20.	Engine Monitor CAN

Steering Column - Up to SN 201605

Number	Feature	Instructions
1.	Steering column tilt adjust	• Hold the steering wheel with your hand • Press the lever at the rear end with your foot. With the lever pressed down, set the steering column to the desired position with your hand • Release lever to lock in final position
2.	Steering wheel angle adjust	• Hold the steering wheel with your hand • Push lever to the top With the lever pushed up, tilt the steering wheel to the desired position with your hand • Release lever to lock in final position
3.	Steering column height adjust	• Hold the steering wheel with your hand • Lift the lever that is at the rear of the column • Set the steering wheel to the desired position by hand • Release lever to lock in final position

Multifunction Switch

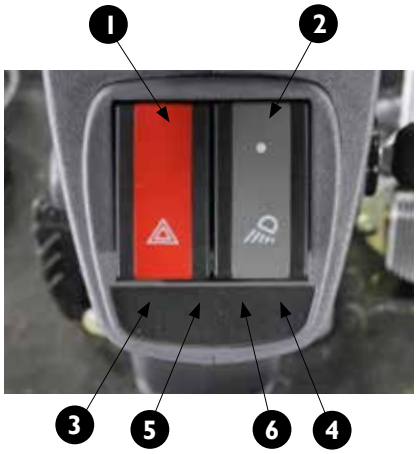
The multifunction switch is located on the left hand side of the steering column.



Number	Feature
1.	Horn
2.	Right turn signal indicator
3.	Left turn signal indicator
4.	High beam / low beam toggle
5.	Low beam off
6.	Park lights on
7.	Low beam on

Vehicle Information Unit

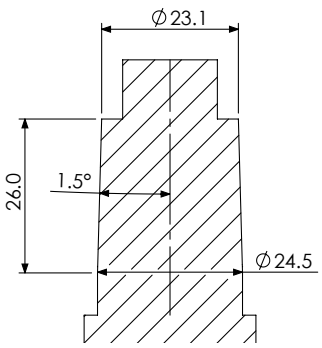
The vehicle information unit is located on the front of the steering column., although other icons may be visible, only blinkers and high beam are used.



Number	Feature
1.	Hazard lights on / off
2.	Park / head lights (not used)
3.	Left turn signal indicator
4.	Right turn signal indicator
5.	Low beam on indicator
6.	High beam on indicator

Steering Column Shaft for Autosteer

This drawing is a guide for an adaptor to suit the steering shaft for the fitment of an Autosteer unit.



Steering Column - SN 201683 Onwards

Number	Feature	Instructions
1.	Steering column tilt adjust	• Hold the steering wheel with your hand • Press the lever at the base of the column with your foot. With the lever pressed down, set the steering column to the desired position with your hand • Release lever to lock in final position
2.	Steering column height adjust	• Hold the steering wheel with your hand • Pull the lever out that is on the right side of the column • Set the steering wheel to the desired position by hand • Push the lever back in to lock in final position

Multifunction Switch (Lights)

The multifunction switch is located on the left hand side of the steering column.

Number	Function
1.	High beam flash (Pull up)
2.	Low beam (Center position)
3.	High beam (Push down)
4.	Right turn signal (Push forward)
5.	Left turn signal (Pull back)

Multifunction Switch (Horn and wipers)

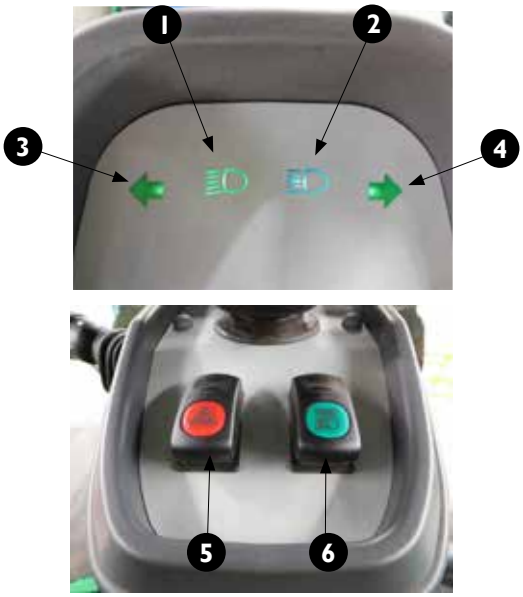
The multifunction switch is located on the left hand side of the steering column.

Number	Function
1.	Not used
2.	Not used
3.	Not used
4.	Not used
5.	Not used
6.	Horn (Press)

Note: Wiper functions are controlled by overhead buttons detailed in the 'Overhead Components' section of this chapter.

Vehicle Information Unit

The vehicle information unit is located on the top front of the steering column.



Number	Feature
1.	Low beam indicator
2.	High beam indicator
3.	Left turn signal indicator
4.	Right turn signal indicator
5.	Hazard light switch
6.	Park light and low beam switch

Operator Seat

Number	Feature	Function
1.	Fore / Aft adjustment	By lifting this lever the seat can be slid backwards or forward to the desired position.
2.	Height adjustment	By lifting this lever air will be pumped in to the airbag suspension. By lowering this lever air is exhausted from the air bag
3.	Seat pan angle adjustment	To adjust the angle of the seat pan, pull the handle upwards. By exerting pressure on or off the front or rear part of the seat pan it can be moved to the desired position.
4.	Absorber	The cushioning effect can be adjusted for on and off-road driving conditions. 1-Soft, 2-Medium, 3-Hard.
5.	Seat Depth adjustment	To adjust the depth of the seat cushion, pull the handle upwards. By moving the seat cushion backwards the desired seating position can be reached.
6.	Tilt	The lever on the right hand side of the seat allows the back rest to be tilted forward or rearward. Pulling the lever upwards releases the back rest so it can be repositioned. Release to lock.
7.	Arm Rest Adjust	By turning this knob the arm rest can be angled to suit. The cover on the side can be removed and loosen the nut, and adjust the armrest up/down to desired position.
8.	Fore/Aft isolator	Shock impacts in the driving direction can be better absorbed by the driving seat. Position 1 Off / Position 2 On
9.	Seat Belt	Operator lap seat belt must be fitted when ever the operator is seated in the cabin.

Overhead Components

Number	Feature
1.	Cooler bottle storage
2.	Air conditioning control
3.	Lights & wiper switches (See next section below)
4.	12V outlet
5.	AM/FM Radio/CD player
6.	Bluetooth microphone

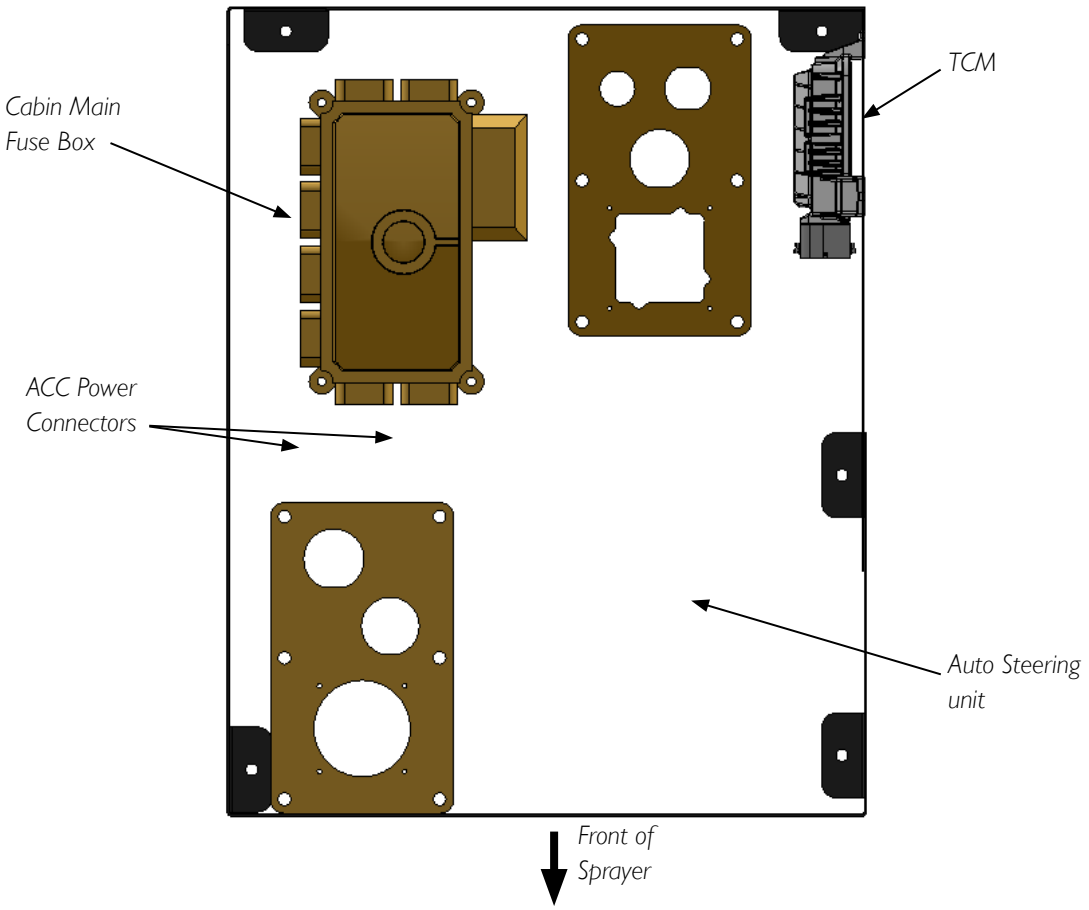
Lights & Wiper Switches

Number	Feature
1.	Outer front work lights
2.	Inner front work lights
3.	Wipers
4.	Windscreen washers
5.	Rotating beacon
6.	Rear cabin work lights

Note: All switches are ON\OFF toggle.

Power Distribution Box

The power distribution box is located on the floor to the right of the operators seat. The box contains fuses and relays, to gain access to these the top cover needs to be removed. To do this, pull the lever upwards on the 4 clamps and then lift the cover upwards. The location of the fuses and relays are shown below.



Air Conditioning

Overview of Controls

The air conditioner regulates the temperature and humidity of the air in the cabin.

1. Selection knob

2. Display

Switching the Air Conditioner On

- Switch on the ignition and start the engine.
- To start the air conditioner press the selection knob and hold it for two seconds. The display will light up and the screen will be as follows.

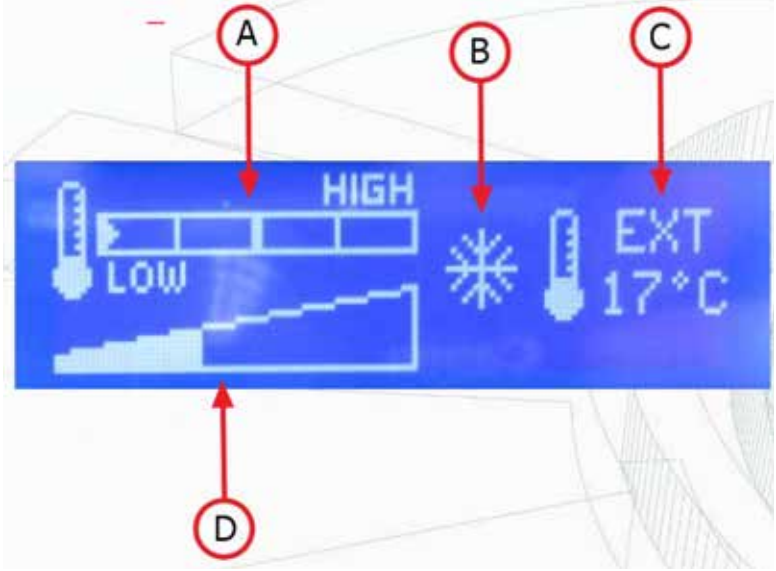
After switching on, the operating mode and the display are always identical with the settings before switching off the last time.

A. LOW / HIGH temperature

B. Air Conditioning ON/ OFF

C. External temperature

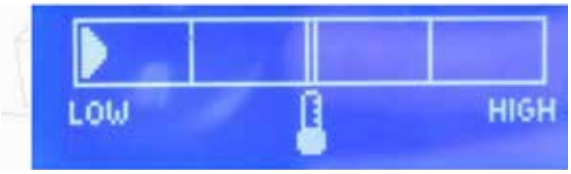
D. Ventilation speed indicator



Setting the Air Conditioner

- To set the Ventilation speed, press the selection knob until this screen is displayed. To set the speed turn the selection knob clockwise will increase the speed and turn anti-clockwise will decrease the speed.

- To set the Temperature, press the selection knob until this screen is displayed. To set the temperature, turning the selection knob clockwise will increase the temperature and turning anti-clockwise will decrease the temperature.



- To turn the Compressor ON/ OFF double press the selection knob, the display will change to show COMPRESSOR: at the top and the state of the compressor ON or OFF. To change the setting turn the selection knob to switch from the current selection.

To indicate the effective operation of the air conditioning compressor there will be a "click" sound emitted from the control panel and an icon of a snowflake (B) will be located in the leading position in the display.

- To turn the unit OFF press and hold the selection knob down for more than 2 seconds.

Adjusting the Air Conditioner Air Flow

The air flow is distributed inside the cab by fully adjustable nozzles. Each nozzle can be adjusted directionally or turned on/off to suit the individual needs of the user.

AM/FM Radio

The entertainment radio is fitted to the panel to the right of the operator on the roof. It consists of a radio tuner as well as single compact disc player. A blue tooth compatible phone system is installed in the unit.

Operational instructions can be found in the entertainment radio manual supplied with this manual.

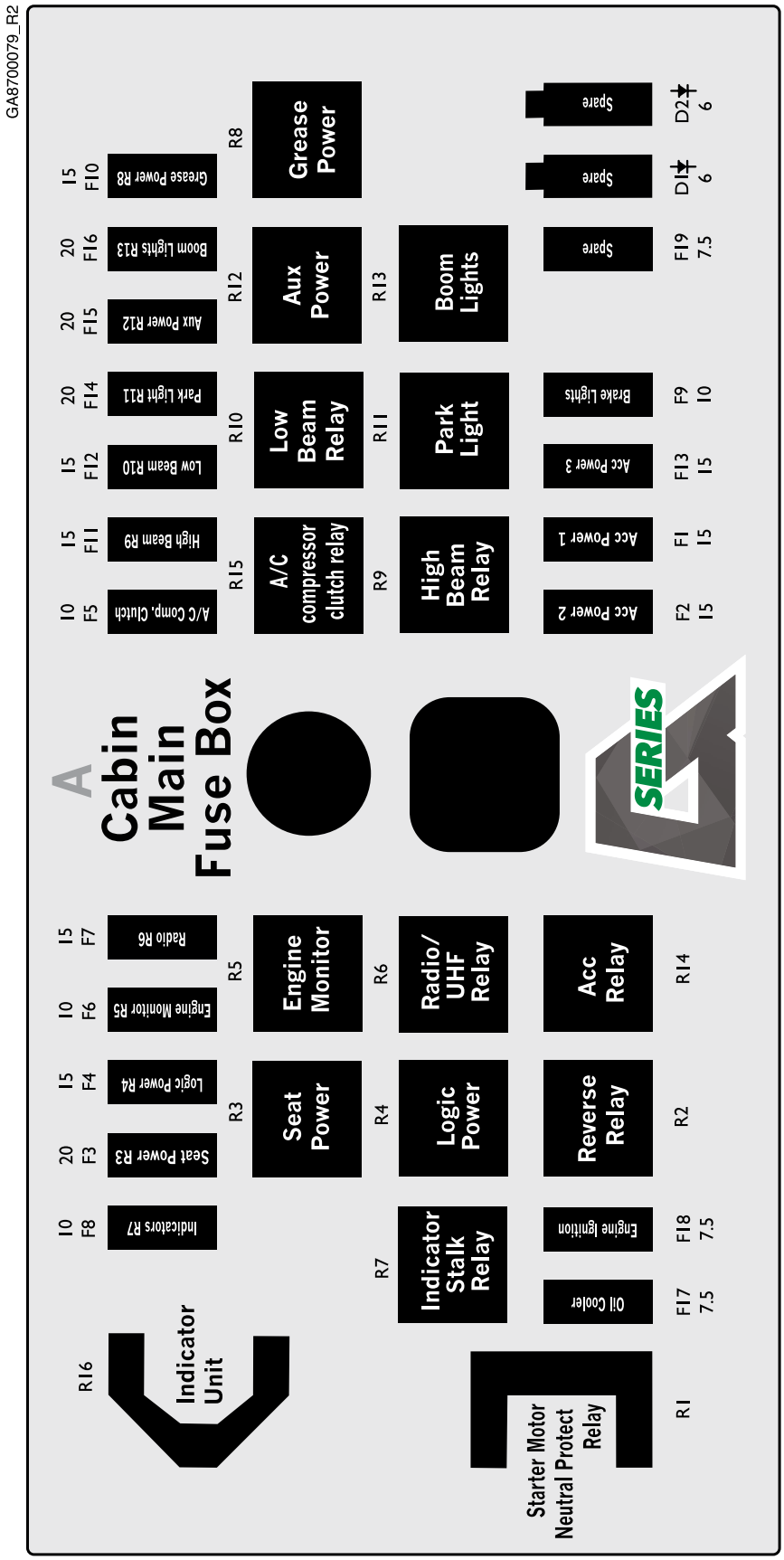
Overhead Light

There is 2 overhead lights. They can be operated individually.

Both switches turn on by pressing the front or the rear of the light lens. These lights are fixed and cannot be aimed.

Note: The overhead lights wont operate unless the ignition key is in the 'accessories' or 'run' position.

Cabin Main Fuse Box



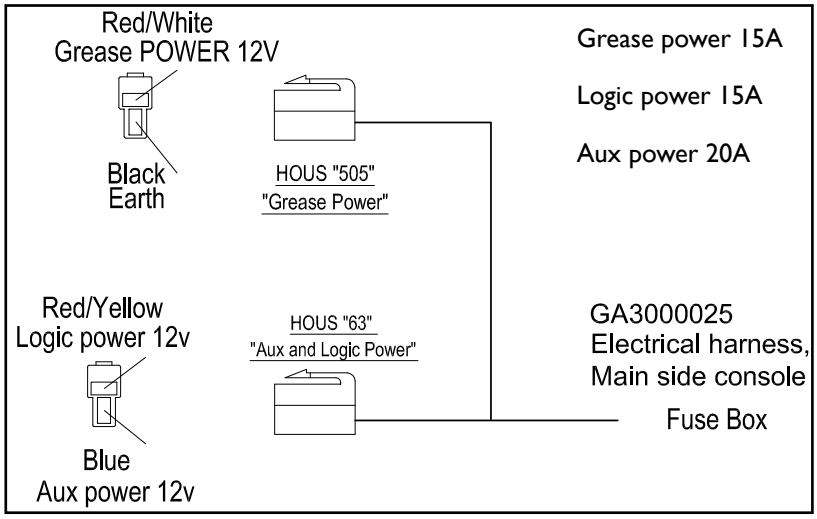
Cabin Main Fuse Box

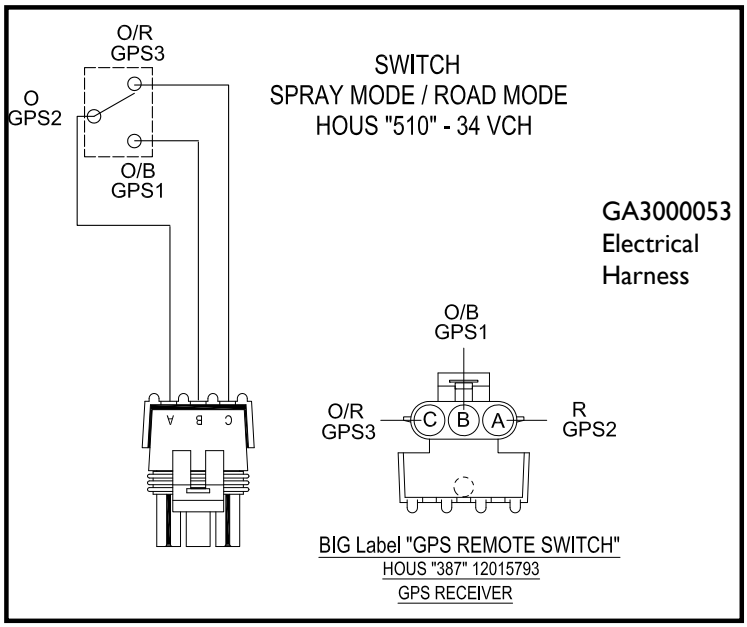
In the power distribution box there are three electric connector points. These have been provided for the connection of optional equipment.

HOUS"505" is for connection of the auto greasing system that is an option from Goldacres.

HOUS"63" is for the connection of an external controller like the Raven Smart Boom or auto steer system.

"GPS REMOTE SWITCH" is for the connection to an auto steer system via the 3-pin weatherpack connector.

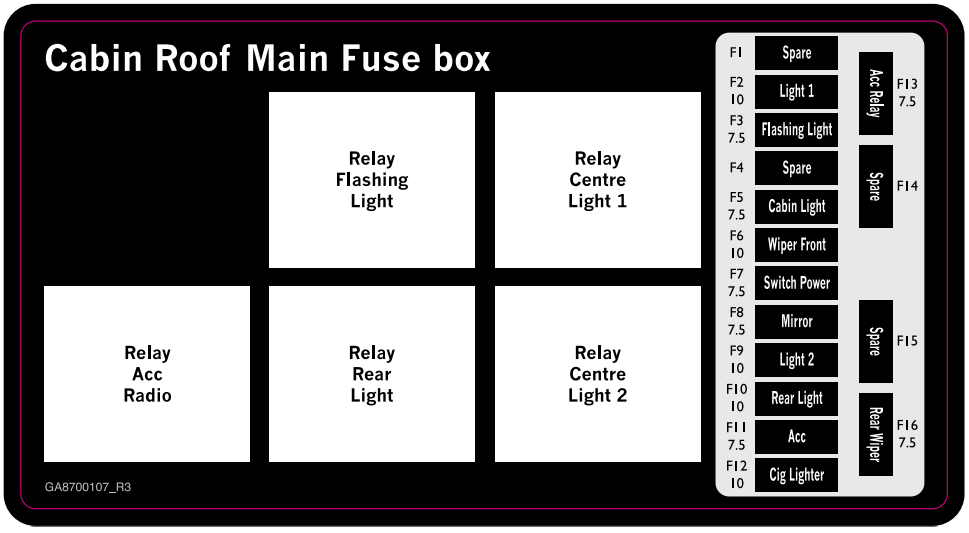




Cabin Roof Fuse Box - Up to SN 201683

There is also a fuse box under the roof of the cabin that contains the fuses for the cabin functions. There is an access hatch in the rear of the roof held in by four thumb screws. When removed, the fuse panel can be accessed without lifting the roof.

If the entire internal roof area needs to be accessed, the four eye bolts must first be removed. The roof cover can then be tilted open. Use the roof support bracket inside to hold it open for easy access to the fuse box and other components.

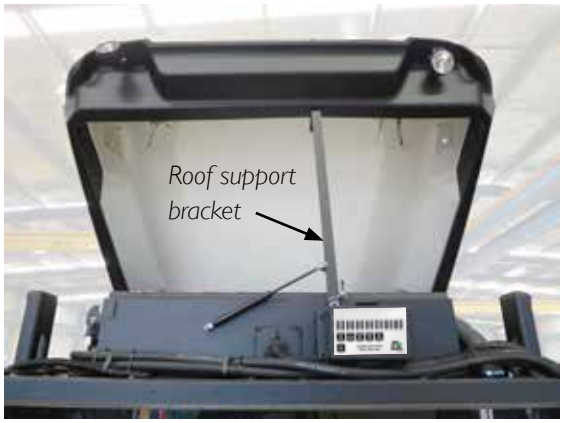


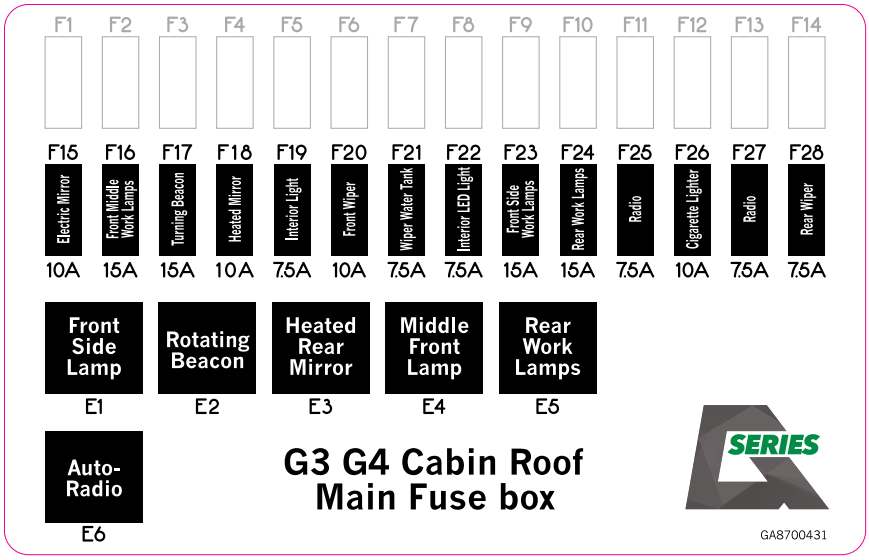
Decal location: Cabin roof main fuse box decal is found under the main roof structure to the left of the roof support bracket.

Cabin Roof Fuse Box - SN 201686 Onwards

There is also a fuse box under the roof of the cabin that contains the fuses for the cabin functions. There is an access hatch in the rear of the roof held in by four thumb screws. When removed, the fuse panel can be accessed without lifting the roof.

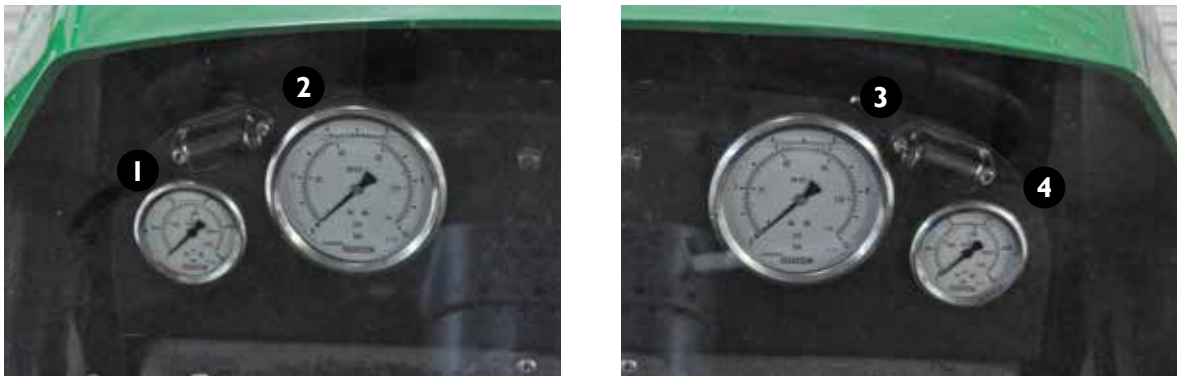
If the entire internal roof area needs to be accessed, the four eye bolts must first be removed. The roof cover can then be tilted open. Use the roof support bracket inside to hold it open for easy access to the fuse box and other components.





Decal location:
Cabin roof main fuse box decal is found on the main fuse box lid. It is accessed through the rear access port cover plate by removing the four thumbscrews.

Pressure Gauges



Number	Feature
1.	Bi-Fold hydraulic pressure - Left side (if optioned)
2.	Second line spray pressure (if optioned)
3.	Standard main spray pressure
4.	Bi-Fold hydraulic pressure - Right side (if optioned)

Note: Some gauges may not be present depending on options fitted

CANtrak System (Generic Engine Monitor)

Understanding Gem

GEM software runs on a CANtrak display with five soft keys, providing a flexible and intuitive Human-Machine Interface (HMI). The 5 soft keys access a graphical menu structure that uses standard and easily-understood icons to indicate the key's current function. This enables the operator to select the required engine and transmission data and display it in the following formats:

- Analogue gauges
- Digital values
- Multi-gauge/data (a combination of above)
- Historical trend graphs
- Current or stored alarm messages

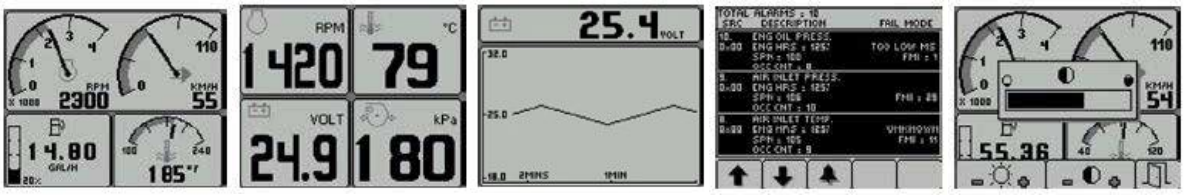
Additionally, various diagnostic screens are available, allowing detailed investigation of the engine and transmission data stream. By accessing the Configuration menu, users can customise some of the displayed data to show, for example, metric or imperial units, and various parameters such as the full-scale reading of gauges.

Pressing any of the first 4 keys (GEM keys are numbered 1 to 5, from left to right) brings up the top level 'button bar' (navigation menu).

GEM presents a context dependent 'button bar' above the push buttons if any key from 1 to 4 is pressed - it disappears after 5 seconds of inactivity. This 'top level' button bar shows the basic structure of GEM:

Key	Feature	Function
1.	Tri Display, or Main Engine Display	Repeat presses cycle the fuel computer through various modes.
2.	Quad Display	(User configurable). Repeat presses cycle the display around 3 different quad view options..
3.	Uni Display	Showing data history (configurable). Repeat presses cycle display through available parametres.
4.	Active alarm display	holding the button brings up stored alarms..
5	Contrast and Lighting Adjustment	Or - if held for 3 seconds - the configuration menu..

Left to right: Key 1-5, examples of screen images after keys are pushed.



Getting Started

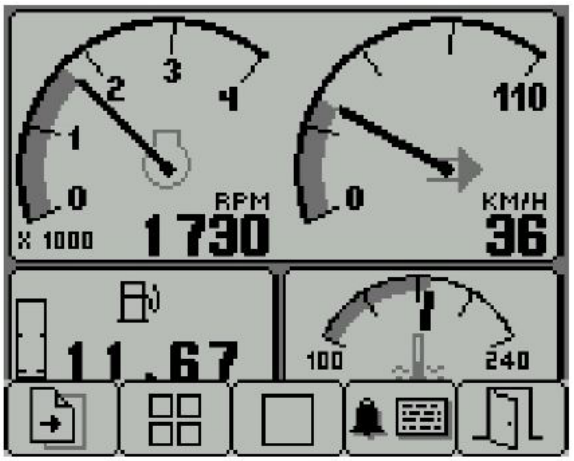
When power is applied to the display, a start-up screen displays for approximately 7 seconds while the unit performs a self test . If the unit makes a long 'beeping' sound, self-test has failed. Users can attempt to rectify the fault by restoring factory defaults (see Configuration section); if the fault persists, contact your supplier for guidance.

The 'Splash Screen' is displayed on boot up.

After the start up screen disappears, GEM starts displaying readings on its virtual gauges if it is connected to an active source of data. GEM displays the 'main engine display' or tri-screen on initial start up, but note that after use this changes to the screen that was last displayed (see Preferred Screen Store section for details). GEM display modes are detailed in the following sections.

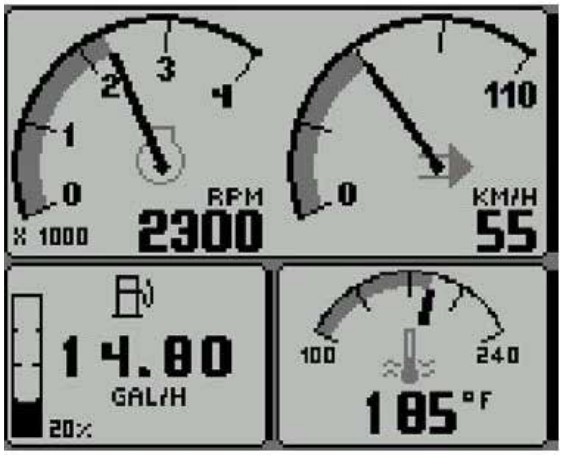
Gem's Soft Keys

GEM's soft keys simplify the operator interface. In use, GEM displays a 'button bar' directly above the soft keys when any of the first 4 keys (keys 1 to 4, starting from the left) are pressed - with icons representing the current function of each key. The picture at the top of the page shows the main button bar, with icons 1 to 4 representing the gauges and alarms available, and icon 5 an 'exit door'. Repeat presses of these buttons toggles around the display options available. The button bar will disappear after approximately 5 seconds if no further keys are pressed.



- Key 1: Pages icon indicating that further presses cycle through options for the screen being viewed (in this instance fuel computer modes for the main engine display)
- Key 2: Quad display mode
- Key 3: Uni display mode
- Key 4: Alarm display mode
- Key 5: Exit door

Tri Display or Main Engine Display (Key 1)



Tri Display or main engine display, accessed via key 1. **Note:** Metric units are shown by default but others may be selected via the configuration menu.

This GEM display mode provides three independent windows, and is intended to show the most frequently-accessed vehicle data (RPM, speed, temperature and fuel). To select Tri Display, press any of the first 4 keys to show the top-level button bar, and then key 1 (the left-hand key). The parameters displayed on this page cannot be changed, apart from the fuel computer window which is explained below. However, attributes such as units and scales may be changed - see the Configuration menu section for details (note that user -defined views of vehicle data are available in the next GEM mode: Quad Display).

Tri Display - Fuel Computer Modes

An example of a fuel computer mode

- Instantaneous Fuel Rate: (volume/hour)
- Average Trip Fuel Rate: If Total Fuel and Engine Hours are available it is calculated since last trip fuel/hours reset using: trip fuel/trip hours [volume/hour]
- Average Distance Per Volume: If Vehicle Speed or Vehicle Distance and the Total Fuel is available then it is calculated since last trip fuel/distance reset using: distance/volume
- Total Engine Hours: If Total Engine Hours is available
- Trip Engine Hours: Since last trip hours reset
- Trip Fuel: Since last trip fuel reset
- Total Distance: If Total Distance is available
- Trip Distance: If Total Distance is available then it is calculated since last trip distance reset. If Total Distance is not available, but Trip Distance is, then this is displayed.
- Fuel Remaining: If Tank Capacity is entered, Tank Full is reset, and Total Fuel Used is available, then Fuel Remaining is calculated using: Tank Capacity – (Total Fuel Used – Trip Fuel). Evaluation assumes Engine Fuel Used is cumulative and not zeroed on power up.

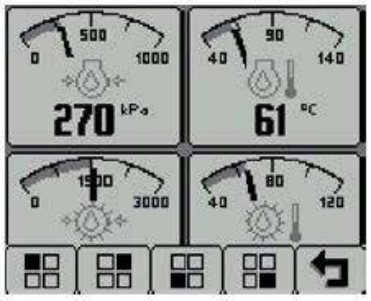
Distance Remaining: If the data required for Fuel Remaining and Average Distance Per Volume is available, it is calculated using: Average Distance Per Volume x Fuel Remaining

Note: Reset - which affects all resettable fuel computer parameters - is performed by allowing the button bar to disappear and pressing and holding key 1 for at least 3 seconds. If the button bar is visible then the display will move to the next parameter before the Reset. Setting Fuel Tank Reset and Total Fuel Tank Data is performed via the Configuration menu.

The Quad Display (Key 2)

Quad display mode provides 4 gauges. To select it, press any of the keys 1 to 4 to show the top-level button bar and then key 2. Repeat presses of key 2 cycle the display around 3 separate quad screens: as a default these screens show 4 digital gauges (RPM, temperature, battery voltage, oil pressure), 4 analogue gauges (same as digital), and 4 alternative analogue gauges. All 12 gauges may be selected and configured by users, providing a simple means of creating application-specific views of engine data. Gauges are selected via quad display's 'adjust mode', by pressing key 5 (noted by an arrow icon) when GEM is running quad display and the button bar is visible. In adjust mode, corresponding key presses cycle the display through available parameters. The selected configuration is stored even when power is removed; adjust mode is exited by pressing key 5.

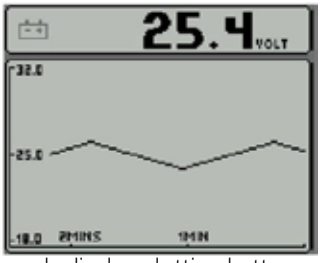
The 3 default displays available in quad-display



Adjust mode, which allows users to select the gauges displayed.

The Uni Display (Key 3)

GEM's Uni display mode plots data history in one large window - in an X-Y graph format similar to a pen plotter. This mode is selected by pressing any of the first 4 keys to show the top-level button bar and then key 3. Data is shown in graph form, with the most recent data scrolling from right to left. The viewed time range may be adjusted in the Configuration menu from 2 minutes to 8 hours in six steps. Maximum and minimum values of the Y axis (the reading span) are adjusted automatically to give an optimum view of data. The parameter displayed is selectable by repeatedly pressing key 3 while in the graph display mode. The parameters that may be displayed are listed in the next section.



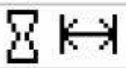
Example graph display plotting battery voltage.

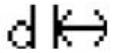
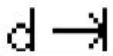
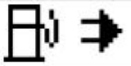
Engine And Transmission Parameters Monitored

This table lists the engine and transmission parameters that can be displayed by GEM and which may be shown in user-configurable Quad Display and Uni Display modes (a tick indicates the parameter may be selected). DB is an abbreviation for GEM's internal database, which stores all data transmitted from the engine/transmission. It can be accessed via the Configuration menu. (Note that this list is current at the time of going to press, new parameters are continually being added - the latest list may be found in the latest GEM data sheet available at <http://www.cantrak-int.com>).

Abbreviations: The units 'MPG' and 'Gal' denote US gallons. For non-US Imperial gallons (UK, Canada, etc) units, these units are denoted as IMPG or IGal. N = nautical. KTS = Knots.

Note: If a parameter is not available, it will not be possible to select it. If the parameter becomes unavailable while in view, '- - -' is displayed.

Icon	Parameter	Tri	Quad	Uni	DB
	MISCELLANEOUS				
None	Torque converter lock-up				√
	Current gear		√		√
	Selected gear		√		√
	Accelerator position (%)		√		√
None	Transmission output shaft speed (RPM)				√
None	Transmission input shaft speed (RPM)				√
	Engine speed (RPM)	√	√	√	√
	Engine torque (%)		√		√
	Engine oil level (%)		√		√
	Coolant level (%)		√		√
	Fan speed (%)		√		√
	Vehicle speed (km/h, MPH or KTS)	√			√
	Engine hours (h)	√			√
	Trip engine hours (h)	√			√

Icon	Parameter	Tri	Quad	Uni	DB
	FUEL & DISTANCE				
	Trip distance (km, Miles, NMiles)	√			√
	Distance remaining (km, Miles, NMiles)	√			√
	Total distance (km, Miles, NMiles)	√			√
	Fuel rate (L/h, Gal/h or IGal/h)	√		√	√
	Average trip fuel rate (L/h, Gal/h or IGal/h)	√			√
	Fuel level (%)	√			√
	Fuel remaining (L, Gal or IGal)	√			√
	Trip fuel (L, Gal, IGal)	√			√
None	Total fuel used (L, Gal, IGal)				√
	Instantaneous fuel economy (Km/L, MPG or IMPG)	√			√
	Average fuel economy (Km/L, MPG or IMPG)	√			√

Icon	Parameter	Tri	Quad	Uni	DB
	PRESSURE (can be kPa, PSI or bar)				
	Fuel pressure		√	√	√
	Barometric pressure		√		√
	Auxiliary pressure		√		√
	Turbo pressure		√	√	√
	Air inlet pressure		√	√	√
	Air filter differential pressure		√		√
None	Injector metering rail 1 pressure				√
None	Injector metering rail 2 pressure				√
	Coolant pressure		√	√	√
	Engine oil pressure	√	√	√	√
	Transmission oil pressure		√	√	√

Icon	Parameter	Tri	Quad	Uni	DB
	ELECTRICAL				
	Internal voltage (V)		√	√	√
	Battery voltage (V)		√	√	√
	Battery current (A)		√		√
	Alternator current (A)		√		√
	TEMPERATURE (can be °C or °F)				
	Coolant temperature	√	√	√	√
	Engine intercooler temperature		√		√
	Engine oil temperature		√	√	√
	Transmission oil temperature		√	√	√
	Turbo oil temperature		√		√
	Fuel temperature		√		√
	Inlet manifold temperature		√	√	√
	Air inlet temperature		√		√
	Exhaust temperature		√	√	√
	Auxiliary temperature		√		√

Active and Stored Alarm Lists

Active alarms. When an active/current alarm is received, a flashing pop-up window appears overlaid on the current screen in use, showing details of the current alarm. If the alarm is 'red/ stop' category (this is J1939 terminology for a serious problem, e.g. low oil pressure), GEM activates its internal sounder (beeping noise), and the External Alarm Output or Pin 11 (if available on the CANtrak you have chosen)

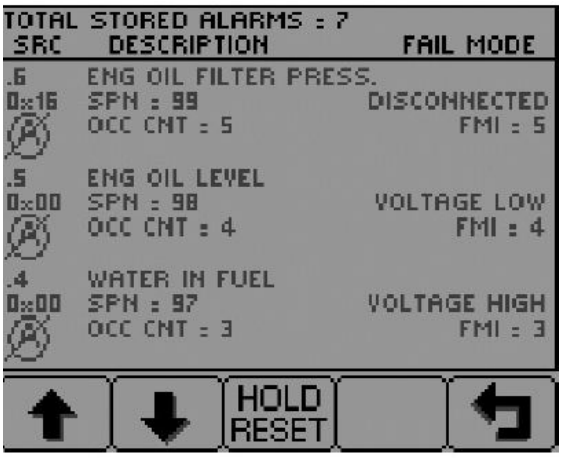
.

Example alarm message, plus alarm list screens showing unacknowledged conditions (black background) and acknowledged alarms (grey background). After acknowledgement, the exit key (open door icon) becomes active. J1939 - standard abbreviations are used wherever possible.

Note: 'MS' = "Most Severe, "MOD"= Moderately Severe and "LS" = Least Severe.

The alarm list is accessed by pressing any key while an alarm pop-up is displayed, or by pressing any of the first 4 keys to show the button bar, and then key 4. This screen displays all current active alarms; when entered, Pin 11 External Alarm Output is deactivated (if the function is available). Alarms not yet acknowledged are shown in grey on black. Alarms already acknowledged are shown in black on grey. If engine Hours data is available, the list indicates when the alarm was initiated. When first entering the screen, the list automatically displays the most recent alarm. The list can be scrolled using keys 1 and 2. This screen cannot be exited until all alarms have been acknowledged by pressing key 3. Alarm messages are automatically cleared from the list when no longer received by GEM.

Stored alarms. Alarms stored by engine/transmission ECU's (i.e. not active or current but old/historical alarms) may be viewed by pressing and holding key 4 while the active alarm list screen is visible. On entry to this page, GEM sends a data request to the engine/transmission. The engine/transmission sends the stored alarm data to GEM, which is decoded and displayed in a similar fashion to active alarms. GEM displays an error message if there is no response from the engine/transmission. If the engine/ transmission supports the erasure of stored alarms, they may now be erased by holding key 3.



Example of stored alarms list

Engine Fault Codes

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
111	629	12	Red	Controller #1	Engine Control Module Critical internal failure - Bad intelligent Device or Component
115	612	2	Red	System Diagnostic Code # 2	Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor - Data Erratic, Intermittent, or incorrect
122	102	3	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
123	102	4	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
124	102	16	Amber	Boost Pressure	Intake Manifold 1 Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
131	91	3	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
132	91	4	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
133	974	3	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Above Normal, or Shorted to High Source
134	974	4	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
135	100	3	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
141	100	4	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
143	100	18	Amber	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
144	110	3	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
145	110	4	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
146	110	16	Amber	Engine Coolant Temperature	Coolant Temperature High - Data Valid but Above Normal Operational Range - Moderately Severe Level
147	91	1	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period
148	91	0	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period
151	110	0	Red	Engine Coolant Temperature	Coolant Temperature Low - Data Valid but Above Normal Operational Range - Most Severe Level
153	105	3	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
154	105	4	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
155	105	0	Red	Intake Manifold #1 Temp	Intake Manifold Air Temperature High – Data Valid but Above Normal Operational Range - Most Severe Level
187	3510	4	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Below Normal, or Shorted to Low Source

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
193	520199	3	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Above Normal, or Shorted to High Source
194	520199	4	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Below Normal, or Shorted to Low Source
195	111	3	Amber	Coolant Level	Coolant Level Sensor Circuit - Voltage Above Normal, or Shorted to High Source
196	111	4	Amber	Coolant Level	Coolant Level Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
197	111	18	Amber	Coolant Level	Coolant Level - Data Valid but Below Normal Operational Range - Moderately Severe Level
199	1661	4	Amber	Engine Automatic Start Lamp	Engine Automatic Start Lamp Driver Circuit - Voltage Above Normal, or Shorted to High Source
211	1484	31	None	J1939 Error	Additional Auxiliary Diagnostic Codes logged - Condition Exists
212	175	3	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
213	175	4	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
214	175	0	Red	Oil Temperature	Engine Oil Temperature - Data Valid but Above Normal Operational Range - Most Severe Level
221	108	3	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
222	108	4	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
227	3510	3	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Above Normal, or Shorted to High Source
231	109	3	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
232	109	4	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
233	109	18	Amber	Coolant Pressure	Coolant Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
234	190	0	Red	Engine Speed	Engine Speed High - Data Valid but Above Normal Operational Range - Most Severe Level
235	111	1	Red	Coolant Level	Coolant Level Low - Data Valid but Below Normal Operational Range - Most Severe Level
237	644	2	Amber	External Speed Input	External Speed Input (Multiple Unit Synchronization) - Data Erratic, Intermittent, or Incorrect
238	3511	4	Amber	System Diagnostic code # 1	Sensor Supply Voltage #3 Circuit – Voltage Below Normal, or Shorted to Low Source
239	3511	3	Amber	System Diagnostic code #2	Sensor Supply Voltage #3 Circuit - Voltage Above Normal, or Shorted to High Source
241	84	2	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit - Data Erratic, Intermittent, or Incorrect
242	84	10	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit tampering has been detected – Abnormal Rate of Change
244	623	4	Amber	Red Stop Lamp	Red Stop Lamp Driver Circuit - Voltage Below Normal, or Shorted to Low Source
245	647	4	Amber	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Below Normal, or Shorted to Low Source
249	171	3	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
256	171	4	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
261	174	16	Amber	Fuel Temperature	Engine Fuel Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
263	174	3	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit - Voltage Above Normal, or Shorted to High Source
265	174	4	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit - Voltage Below Normal, or Shorted to Low Source
268	94	2	Amber	Fuel Delivery Pressure	Fuel Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
271	1347	4	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Below Normal, or Shorted to Low Source
272	1347	3	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Above Normal, or Shorted to High Source
281	1347	7	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve #1 – Mechanical System Not Responding Properly or Out of Adjustment
284	1043	4	Amber	Internal Sensor Voltage Supply	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit - Voltage Below Normal, or Shorted to Low Source
285	639	9	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing PGN Timeout Error - Abnormal Update Rate
286	639	13	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing Configuration Error – Out of Calibration
287	91	19	Red	Accelerator Pedal Position	SAE J1939 Multiplexing Accelerator Pedal or Lever Sensor System Error - Received Network Data In Error
288	974	19	Red	Remote Accelerator	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Data Error - Received Network Data In Error
292	441	14	Red	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
293	441	3	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit - Voltage Above Normal, or Shorted to High Source
294	441	4	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit - Voltage Below Normal, or Shorted to Low Source
295	108	2	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
296	1388	14	Red	Auxiliary Pressure	Auxiliary Pressure Sensor Input 1 - Special Instructions
297	1388	3	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit - Voltage Above Normal, or Shorted to High Source
298	1388	4	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit - Voltage Below Normal, or Shorted to Low Source
319	251	2	Maint	Real Time Clock Power	Real Time Clock Power Interrupt - Data Erratic, Intermittent, or Incorrect
322	651	5	Amber	Injector Cylinder #01	Injector Solenoid Cylinder #1 Circuit – Current Below Normal, or Open Circuit
323	655	5	Amber	Injector Cylinder #05	Injector Solenoid Cylinder #5 Circuit – Current Below Normal, or Open Circuit
324	653	5	Amber	Injector Cylinder #03	Injector Solenoid Cylinder #3 Circuit – Current Below Normal, or Open Circuit
325	656	5	Amber	Injector Cylinder #06	Injector Solenoid Cylinder #6 Circuit – Current Below Normal, or Open Circuit
331	652	5	Amber	Injector Cylinder #02	Injector Solenoid Cylinder #2 Circuit – Current Below Normal, or Open Circuit
332	654	5	Amber	Injector Cylinder #04	Injector Solenoid Cylinder #4 Circuit – Current Below Normal, or Open Circuit
334	110	2	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Data Erratic, Intermittent, or Incorrect

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
338	1267	3	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Above Normal, or Shorted to High Source
339	1267	4	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Below Normal, or Shorted to Low Source
341	630	2	Amber	Calibration Memory	Engine Control Module data lost - Data Erratic, Intermittent, or Incorrect
342	630	13	Red	Calibration Memory	Electronic Calibration Code Incompatibility - Out of Calibration
343	629	12	Amber	Controller #1	Engine Control Module Warning internal hardware failure - Bad Intelligent Device or Component
349	191	16	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Above Normal Operational Range - Moderately Severe Level
351	627	12	Amber	Controller #1	Injector Power Supply - Bad Intelligent Device or Component
352	3509	4	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Below Normal, or Shorted to Low Source
386	3509	3	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Above Normal, or Shorted to High Source
415	100	1	Red	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range - Most Severe Level
418	97	15	Maint.	Water in Fuel Indicator	Water in Fuel Indicator High - Data Valid but Above Normal Operational Range – Least Severe Level
422	111	2	Amber	Coolant Level	Coolant Level - Data Erratic, Intermittent, or Incorrect
425	175	2	Amber	Oil Temperature	Engine Oil Temperature - Data Erratic, Intermittent, or Incorrect
428	97	3	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Above Normal, or Shorted to High Source
429	97	4	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
431	558	2	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Data Erratic, Intermittent, or Incorrect
432	558	13	Red	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Out of Calibration
435	100	2	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
441	168	18	Amber	Electrical Potential (Voltage)	Battery #1 Voltage Low - Data Valid but Below Normal Operational Range – Moderately Severe Level
442	168	16	Amber	Electrical Potential (Voltage)	Battery #1 Voltage High - Data Valid but Above Normal Operational Range – Moderately Severe Level
449	157	0	Red	Injector Metering Rail 1 Pressure	Fuel Pressure High - Data Valid but Above Normal Operational Range – Moderately Severe Level
451	157	3	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
452	157	4	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
488	105	16	Amber	Intake Manifold	Intake Manifold 1 Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
489	191	18	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Below Normal Operational Range - Moderately Severe Level

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
497	1377	2	Amber	Switch Circuit	Multiple Unit Synchronization Switch Circuit - Data Erratic, Intermittent, or Incorrect
523	611	2	Amber	System Diagnostic code # 1	OEM Intermediate (PTO) Speed switch Validation - Data Erratic, Intermittent, or Incorrect
527	702	3	Amber	Circuit - Voltage	Auxiliary Input/Output 2 Circuit - Voltage Above Normal, or Shorted to High Source
528	93	2	Amber	Switch - Data	Auxiliary Alternate Torque Validation Switch - Data Erratic, Intermittent, or Incorrect
529	703	3	Amber	Circuit - Voltage	Auxiliary Input/Output 3 Circuit - Voltage Above Normal, or Shorted to High Source
546	94	3	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
547	94	4	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
551	558	4	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Voltage Below Normal, or Shorted to Low Source
553	157	16	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure High – Data Valid but Above Normal Operational Range - Moderately Severe Level
554	157	2	Amber	Injector Metering Rail 1 Pressure	Fuel Pressure Sensor Error - Data Erratic, Intermittent, or Incorrect
559	157	18	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
584	677	3	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Above Normal, or Shorted to High Source
585	677	4	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Below Normal, or Shorted to Low Source
595	103	16	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed High - Data Valid but Above Normal Operational Range – Moderately Severe Level
596	167	16	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage High – Data Valid but Above Normal Operational Range - Moderately Severe Level
597	167	18	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range - Moderately Severe Level
598	167	1	Red	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range - Most Severe Level
599	640	14	Red	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
649	1378	31	Maint	Engine Oil Change Interval	Change Lubricating Oil and Filter – Condition Exists
687	103	18	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed Low - Data Valid but Below Normal Operational Range – Moderately Severe Level
689	190	2	Amber	Engine Speed	Primary Engine Speed Sensor Error – Data Erratic, Intermittent, or Incorrect
691	1172	3	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
692	1172	4	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
697	1136	3	Amber	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
698	1136	4	Amber	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source

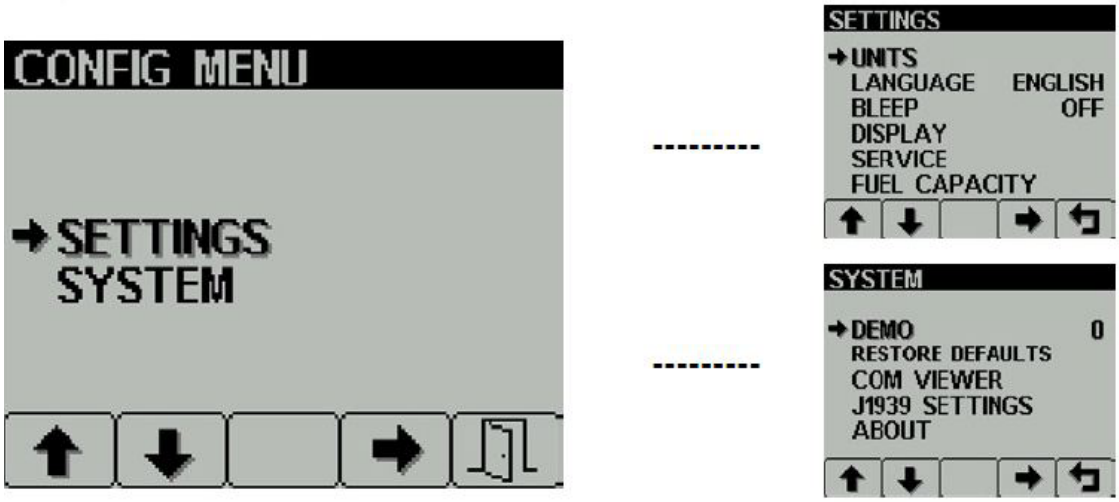
Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
719	22	3	Amber	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Above Normal, or Shorted to High Source
729	22	4	Amber	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Below Normal, or Shorted to Low Source
731	723	7	Amber	Engine Speed Sensor #2	Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
757	2802	31	Amber	Electronic Control Module	Electronic Control Module data lost - Condition Exists
778	723	2	Amber	Engine Speed Sensor #2	Engine Speed Sensor (Camshaft) Error – Data Erratic, Intermittent, or Incorrect
779	703	11	Amber	Auxiliary Equipment Sensor Input	Warning Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Root Cause Not Known
951	166	2	None	Cylinder Power	Cylinder Power Imbalance Between Cylinders - Data Erratic, Intermittent, or Incorrect
1117	627	2	None	Power Supply	Power Lost With Ignition On - Data Erratic, Intermittent, or Incorrect
1139	651	7	Amber	Injector Cylinder # 01	Injector Cylinder #1 - Mechanical System Not Responding Properly or Out of Adjustment
1141	652	7	Amber	Injector Cylinder # 02	Injector Cylinder #2 - Mechanical System Not Responding Properly or Out of Adjustment
1142	653	7	Amber	Injector Cylinder # 03	Injector Cylinder #3 - Mechanical System Not Responding Properly or Out of Adjustment
1143	654	7	Amber	Injector Cylinder # 04	Injector Cylinder #4 - Mechanical System Not Responding Properly or Out of Adjustment
1144	655	7	Amber	Injector Cylinder # 05	Injector Cylinder #5 - Mechanical System Not Responding Properly or Out of Adjustment
1145	656	7	Amber	Injector Cylinder # 06	Injector Cylinder #6 - Mechanical System Not Responding Properly or Out of Adjustment
1239	2623	3	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Above Normal, or Shorted to High Source
1241	2623	4	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Below Normal, or Shorted to Low Source
1242	91	2	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 1 and 2 - Data Erratic, Intermittent, or Incorrect
1256	1563	2	Amber	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1257	1563	2	Red	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1852	97	16	Amber	Water in Fuel Indicator	Water in Fuel Indicator - Data Valid but Above Normal Operational Range - Moderately Severe Level
1911	157	0	Amber	Injector Metering Rail	Injector Metering Rail 1 Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
2111	52	3	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2112	52	4	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2113	52	16	Amber	Coolant Temperature	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Moderately Severe Level
2114	52	0	Red	Coolant Temperature	Coolant Temperature 2 - Data Valid but Above Normal Operational Range - Most Severe Level

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
2115	2981	3	Amber	Coolant Pressure	Coolant Pressure 2 Circuit - Voltage Above Normal, or Shorted to High Source
2116	2981	4	Amber	Coolant Pressure	Coolant Pressure 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2117	2981	18	Amber	Coolant Pressure	Coolant Pressure 2 - Data Valid but Below Normal Operational Range - Moderately Severe Level
2182	1072	3	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit - Voltage Above Normal, or Shorted to High Source
2183	1072	4	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal, or Shorted to Low Source
2185	3512	3	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Above Normal, or Shorted to High Source
2186	3512	4	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Below Normal, or Shorted to Low Source
2195	703	14	Red	Auxiliary Equipment Sensor	Auxiliary Equipment Sensor Input 3 Engine Protection Critical - Special Instructions
2215	94	18	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
2216	94	1	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range – Moderately Severe Level
2217	630	31	Amber	Calibration Memory	ECM Program Memory (RAM) Corruption - Condition Exists
2249	157	1	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level
2261	94	15	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Least Severe Level
2262	94	17	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Least Severe Level
2263	1800	16	Amber	Battery Temperature	Battery Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
2264	1800	18	Amber	Battery Temperature	Battery Temperature - Data Valid but Below Normal Operational Range - Moderately Severe Level
2265	1075	3	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Above Normal, or Shorted to High Source
2266	1075	4	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Below Normal, or Shorted to Low Source
2292	611	16	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level
2293	611	18	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device flow demand lower than expected - Data Valid but Below Normal Operational Range - Moderately Severe Level
2311	633	31	Amber	Fuel Control Valve #1	Fueling Actuator #1 Circuit Error – Condition Exists
2321	190	2	None	Engine Speed	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect
2322	723	2	None	Engine Speed Sensor #2	Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect
2345	103	10	Amber	Turbocharger 1 Speed	Turbocharger speed invalid rate of change detected - Abnormal Rate of Change
2346	2789	15	None	System Diagnostic Code #1	Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level

Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
2347	2790	15	None	System Diagnostic Code #1	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level
2363	1073	4	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Below Normal, or Shorted to Low Source
2365	1112	4	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver Output 3 Circuit - Voltage Below Normal, or Shorted to Low Source
2367	1073	3	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Above Normal, or Shorted to High Source
2368	1112	3	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver 3 Circuit - Voltage Above Normal, or Shorted to High Source
2372	95	16	Amber	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
2373	1209	3	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2374	1209	4	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2375	412	3	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2376	412	4	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2377	647	3	Amber	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Above Normal, or Shorted to High Source
2425	730	4		Intake Air Heater # 2	Intake Air Heater 2 Circuit - Voltage Below Normal, or Shorted to Low Source
2426	730	3		Intake Air Heater # 2	Intake Air Heater 2 Circuit - Voltage Above Normal, or Shorted to High Source
2555	729	3	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Above Normal, or Shorted to High Source
2556	729	4	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Below Normal, or Shorted to Low Source
2557	697	3	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Above Normal, or Shorted to High Source
2558	697	4	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Below Normal, or Shorted to Low Source
2963	110	15	None	Engine Coolant Temperature	Engine Coolant Temperature High - Data Valid but Above Normal Operational Range - Least Severe Level
2973	102	2	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

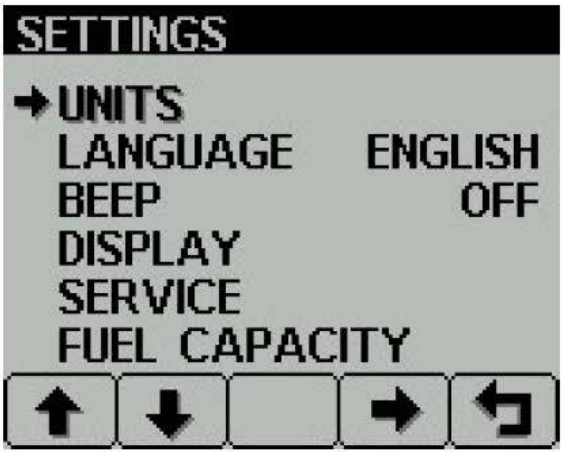
Configuration Menu

This mode allows users to set various GEM operating parameters such as imperial or metric units, scale limits for the speedometer, engine service interval, etc. The configuration menu is entered by pressing and holding key 5 (the right hand key) for at least 3 seconds while GEM is in normal operating mode. The top-level configuration menu will be displayed as shown. Keys 1 and 2 then allow you to choose either SETTINGS or SYSTEM sub-menus (the chosen item is highlighted in bold with an arrow pointing to it). Pressing key 4 enters the selected/ highlighted sub-menu. SETTINGS allows GEM to be configured according to user preferences. SYSTEM accesses maintenance and low-level system configuration settings. These sub-menus are described overleaf. Key 5 exits the current menu/sub menu. Settings are automatically stored on exit.



The top-level Configuration menu and it's two choices of SETTINGS and SYSTEM sub-menus. Pressing Key 4 enters the menu highlighted. The right hand button (Key 5 'exit door') returns you to the previous menu..

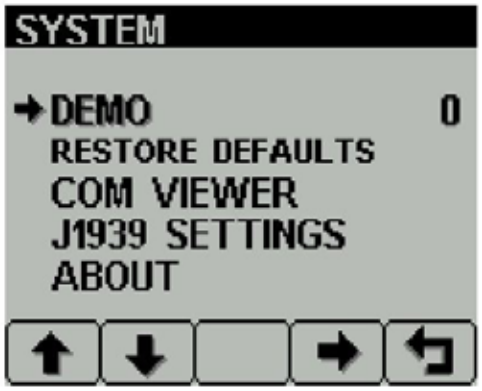
Settings Sub-Menu (2nd Level Configuration Menu)



The settings menu allows the user to enter sub-level screens to configure:

- UNITS: speed, distance, pressure, volume, etc.
- LANGUAGE: choose from various language options
- BEEP: keys "beep" when pressed (toggles on or off); note that an audible beep still sounds if an alarm occurs
- DISPLAY: select ranges for max. RPM, max. speed, and graph X axis
- SERVICE: set service interval in hours, and reset interval counter
- FUEL CAPACITY: adjust tank capacity and reset tank level to full

System Sub-Menu (2nd Level Configuration Menu)



The system menu allows the user to configure or view: DEMO: Switches between GEM's demonstration mode and the normal mode of displaying live engine/ transmission data. Demo allows GEM to operate without live data and provides 3 levels of simulated data: 1 = Speed On; 2 = Speed Off; 3 = Alarms On. Demo is automatically set to OFF if live data is received. DEMO mode can be selected, allowing you to evaluate GEM without connecting an engine/ transmission (it is accessed via the Configuration menu described above). If the unit is in DEMO mode and live data from the engine/ transmission becomes active, DEMO mode will automatically be switched off.

RESTORE DEFAULTS:

Allows you to reset all configuration information to default metric or imperial values. The default settings are:

Setting	Metric	Imperial
Language	ENGLISH	
Max. RPM	4000	
Max. speed	110 KM/H	70 MPH
Graph range	2 minutes	
Speed	KM/H	MPH
Distance	KM	MILES
Pressure	kPa	PSI
Volume	L	Gallon (US)
Temperature	°C	°F

COM VIEWER: Displays last messages received on J1939 (CAN) and NMEA 0183 (GPS - derived speed over ground data) ports. You can also view GEM's database (DB) which stores all data transmitted from the engine/transmission.

Note: this is a diagnostic feature that may be helpful for OEMs/users diagnosing faults.

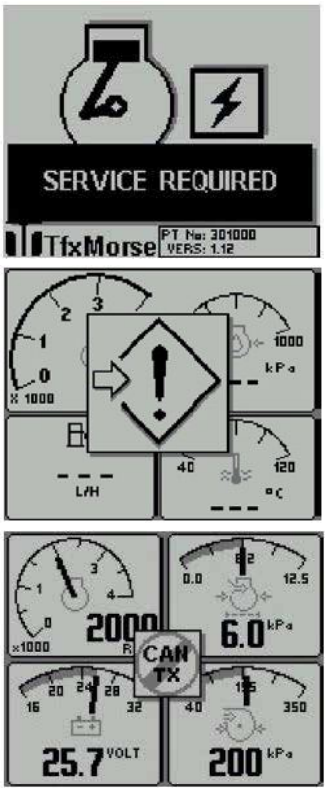
J1939 SETTINGS: J1939 configuration screen for engine and transmission source: 1 = engine 1 (port), 2 = engine 2 (Starboard); alarm filter (GLB (Global) = all alarm sources, SRC = selected engine/ transmission only); SPN version (4 is default but older engines will need to be set to 1, 2 or 3 as appropriate). Note. Consult your engine or vehicle supplier to establish which SPN version is appropriate if you have problems reading alarm data.

ABOUT: Displays the following product information:

- ID NO: Unique number of the display
- EEPROM: Number of write cycles
- PART No: Software part number
- VERS: Software version number
- CHK: Flash memory checksum
- SOURCE: The source of received data
- LIB1: Low level system library version
- LIB2: Low-level graphical display interface library version (if used).

Pop Up Messages and Warnings

- Engine service warning. In the Configuration menu, users can set the engine service interval in hours. When GEM determines an engine service is due, it displays SERVICE REQUIRED on the splash screen that appears at power-up.
- Data communications failure. If GEM cannot detect engine/ transmission data broadcasts , a pop-up window with a data communications failure warning icon will appear and flash. Once engine/transmission data is detected the warning disappears and normal data display resumes.
- CAN TX disable. If CAN TX (transmission) is disabled, then the status will be displayed, with a pop-up window flashing with a period of approximately 1 second on, 10 seconds off. Note that this function is a requirement of the J1939 specification and is not normally of importance for GEM applications.
- Data not supported. If the required data parameter is not available, the gauge will display " - - - " near the units and parameter icon (see centre picture for example)



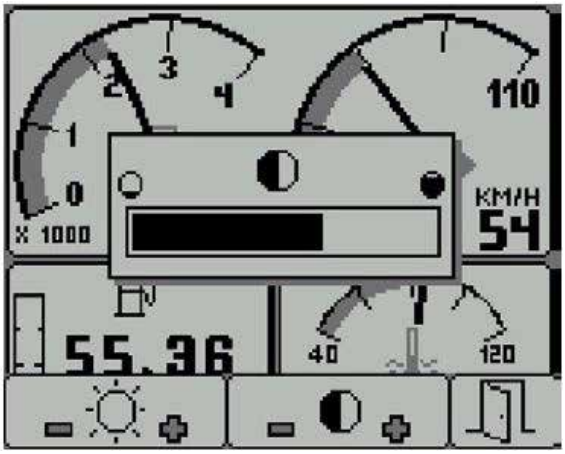
From top to bottom., pop up warnings of: Engine service required, a data communications failure and CANTX is disabled.

Setting LCD Lighting And Contrast

Pressing key 5 (the right-hand key) when the menu icons are not being displayed brings up the lighting and contrast menu. The LCD has a number of back-lighting levels that allow the display to be read in the dark. The appropriate level is selected by pressing keys 1 or 2 to decrease or increase illumination. Contrast is adjusted in the same manner, using keys 3 and 4 (Figure 12.1). Note that GEM monitors the temperature of the LCD and automatically adjusts display contrast as required, therefore it is not likely that a user will need to make a manual contrast adjustment unless extreme climate changes occur. The menu is exited by pressing key 5. The lighting and contrast settings are retained after the unit is switched off.

Note: resetting contrast. If the contrast has been adjusted poorly, you may restore the factory setting (a central value) by pressing keys 1 to 4 simultaneously. This action does not change other user-configured settings.

Note: The backlight can be set to Auto or ON.



The lighting and adjust screen, showing a contrast level adjustment in progress.

Preferred Screen Storage

GEM automatically stores the current screen as a user's preferred page, after a delay of approximately 15 seconds (if no buttons are pushed). On next power-up the display will start with the splash screen, and then go to the last stored screen.

Note: selecting Restore Defaults on the Systems sub-menu of Configuration will set the main engine screen as the default display.

Key Pad Lock

GEM's five keys can be locked, such that an operator cannot change any settings or access any other display mode. (in a similar manner to the key lock functions on a mobile phone). This is achieved by pressing and holding keys 1 and 5 simultaneously for four seconds. Repeating this operation resets GEM/ CANtrak back to normal operation.

Maintenance and Troubleshooting

No regular maintenance is required, except for cleaning the GEM lens as required using a soft, damp cloth. Do not use abrasive materials or solvents. Should any further attention be necessary, please contact your supplier.

If you are experiencing problems with GEM, check these diagnostics:

Problem	Possible solution
Unit does not power up	Ensure connections to unit are correct. Ensure power source is present.
Display is blank or black	Adjust/ reset lighting and contrast settings. Ensure temperature is within operating range of the unit.
Unit fails self-test	Perform Restore Factory Defaults procedure.
Unit fails to display any data	Ensure connections to unit are correct. Ensure data source supports J1939 message protocol.
Unit fails to display certain parameter(s)/unable to select certain parameter(s)	Ensure GEM supports required parameter(s). Ensure data source provides required parameter(s).
Active alarm messages are not displayed	Ensure data source provides alarm message data in the following format: J1939 Active Diagnostic Trouble Codes- Diagnostic Message 1 (DM1).
Stored alarm messages are not displayed	Ensure data source provides alarm message data in the following format: J1939 Active Diagnostic Trouble Codes- Diagnostic Message 2 (DM2).

Glossary

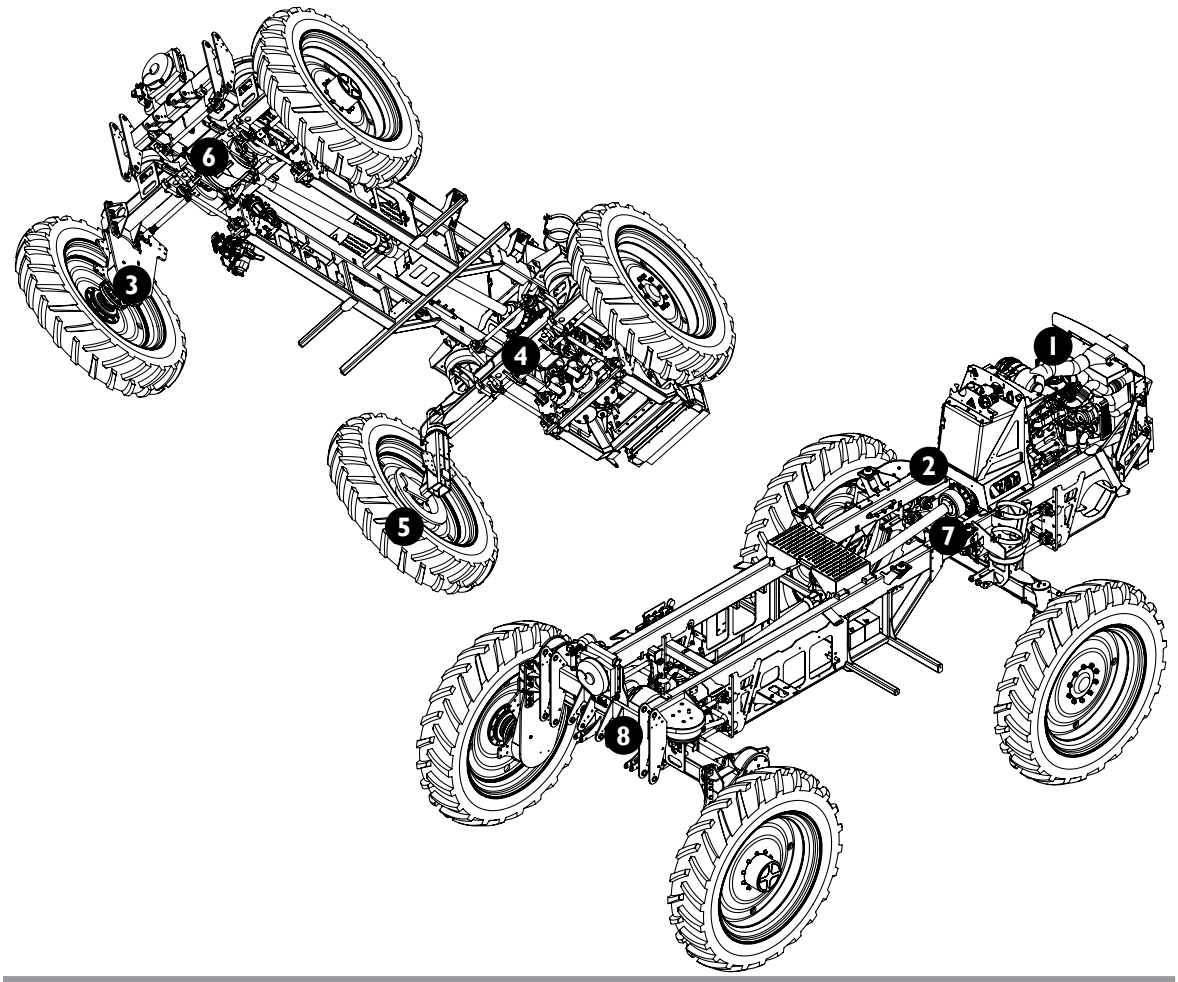
- CAN: Controller Area Network (also referred to as CANbus); serial communications protocol for automotive use
- CANtrak: Intelligent CAN-compatible LCD display module
- GEM: Generic Engine Monitor
- GPS: Global Positioning System
- HMI: Human-Machine Interface
- ISO: International Standard Organisation
- J1939: SAE engine data protocol using CAN 2.0B
- LCD: Liquid Crystal Display
- NMEA: National Marine Electronics Association; serial communications protocol for marine use
- PID: Parameter Identifier
- RS-232: Standard electrical interface for serial communications
- RS-485: Standard differential electrical interface for serial communications
- SAE: Society of Automotive Engineers Inc.
- SID: Subsystem Identifier
- Soft keys: Push-button keys whose function changes according to use
- SPN: Suspect Parameter Number: J1939-specific fault code ID number

Note: The messages, icons, error codes etc displayed by GEM conform to J1939 standards wherever possible.

Chapter 5

DRIVETRAIN

Key Features

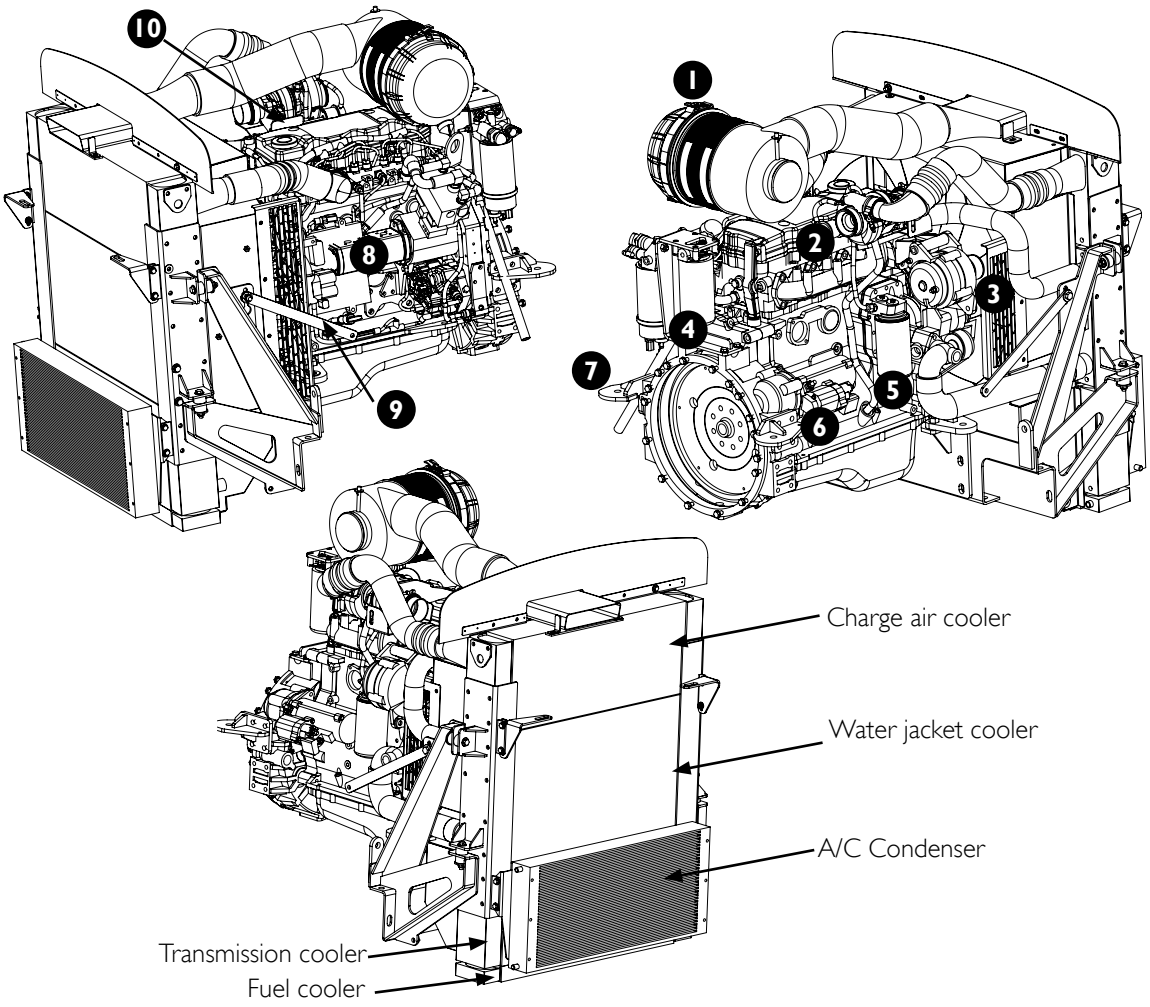


Number	Feature
1.	Engine
2.	Transmission
3.	Chain Drive Drop Legs
4.	Steering
5.	Brakes
6.	Differential
7.	Drive Shafts
8.	Suspension

Engine

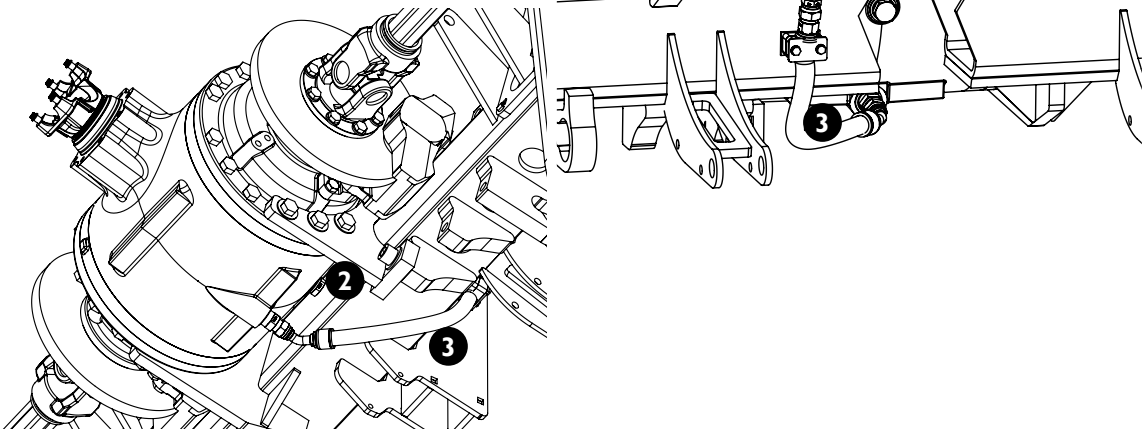
Key Features

The Crop Cruiser is fitted with a 123Kw (165 hp) 4.5 litre Cummins engine, some of its components are shown below.



Number	Feature
1.	Air cleaner
2.	Turbo
3.	Alternator
4.	Fuel Filter (secondary)
5.	Oil Filter
6.	Starter Motor
7.	Engine Mounts
8.	Hydraulic Pump - Machine Hydraulics
9.	Dip Stick
10.	Oil Filler

Differential



Number	Feature
1.	Differential Centre
2.	Oil Level Plug
3.	Oil Drain / Fill Hose

The differential runs in an oil bath sump. The oil level can be checked by removing the level plug on the rear of the differential housing. The oil should be replaced as per the service intervals specified in the maintenance chapter.

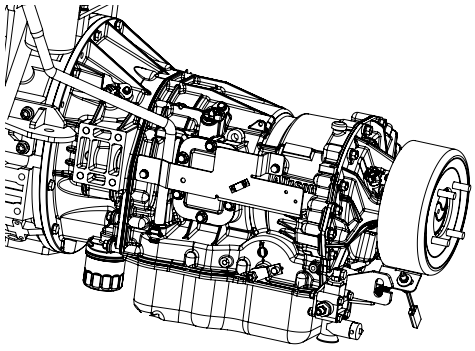
Note: The lubricant specification can be found in the "Recommended Lubricants" section of this manual.

Note: This differential does not need a breather fitted.

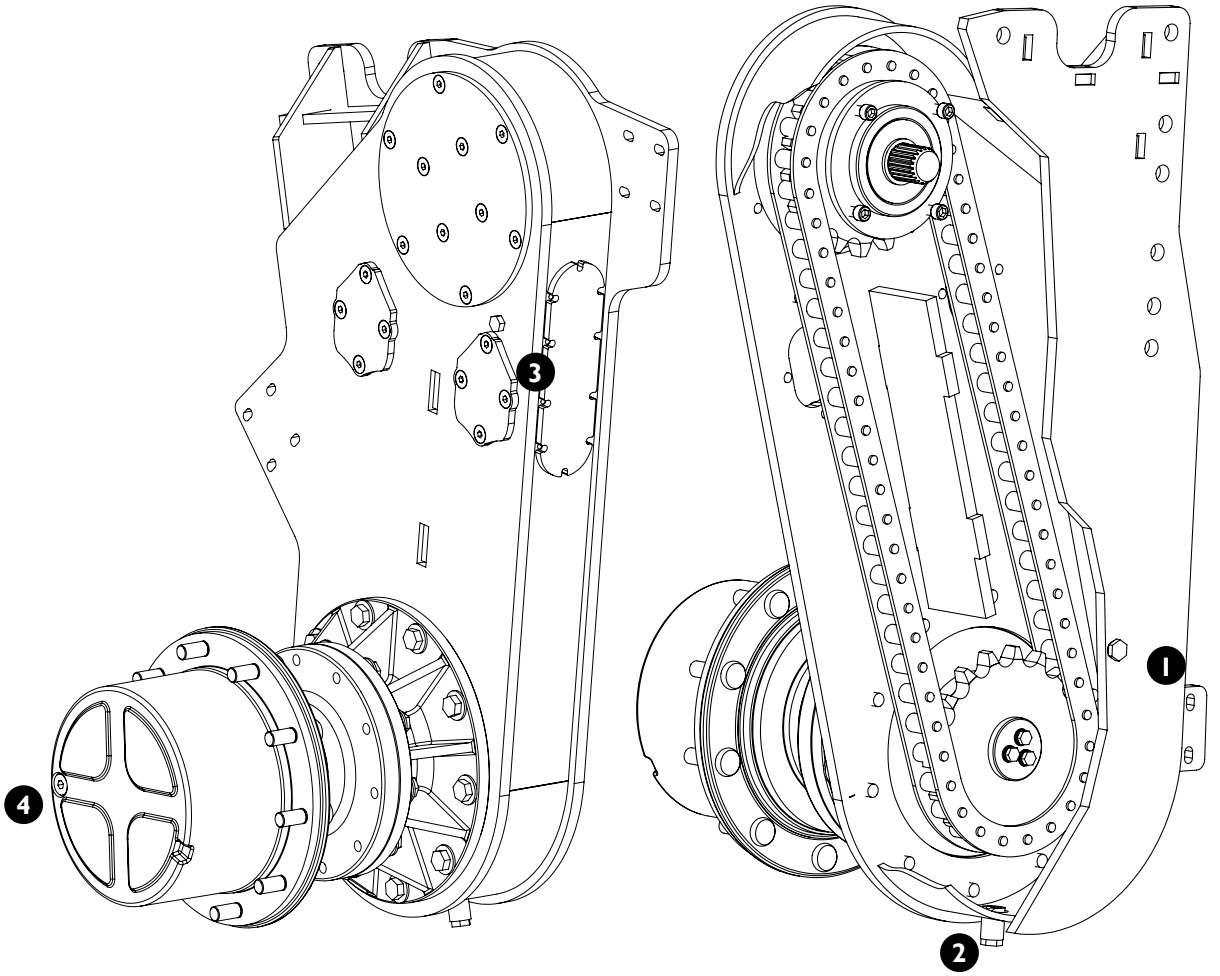
Transmission

Refer to the Allison Transmission operation and codes manual (supplied) for any information on operation or trouble shooting the Allison transmission.

You can also refer to the Operation chapter of this manual for information on using the Allison transmission



Chain Drive and Droplegs



Number	Feature
1.	Oil Level Plug
2.	Oil Drain
3.	Chain Inspection Cover
4.	Planetary fill/drain plug

The Crop Cruiser run chain driven drop legs. Drive is transferred from the differential through drive shafts to the input shaft of the drop leg. A 120 Super HT 1"1/2 drive chain is between the input shaft and the bottom output axle shaft with a 1:1 ratio which drives into a planetary hub.

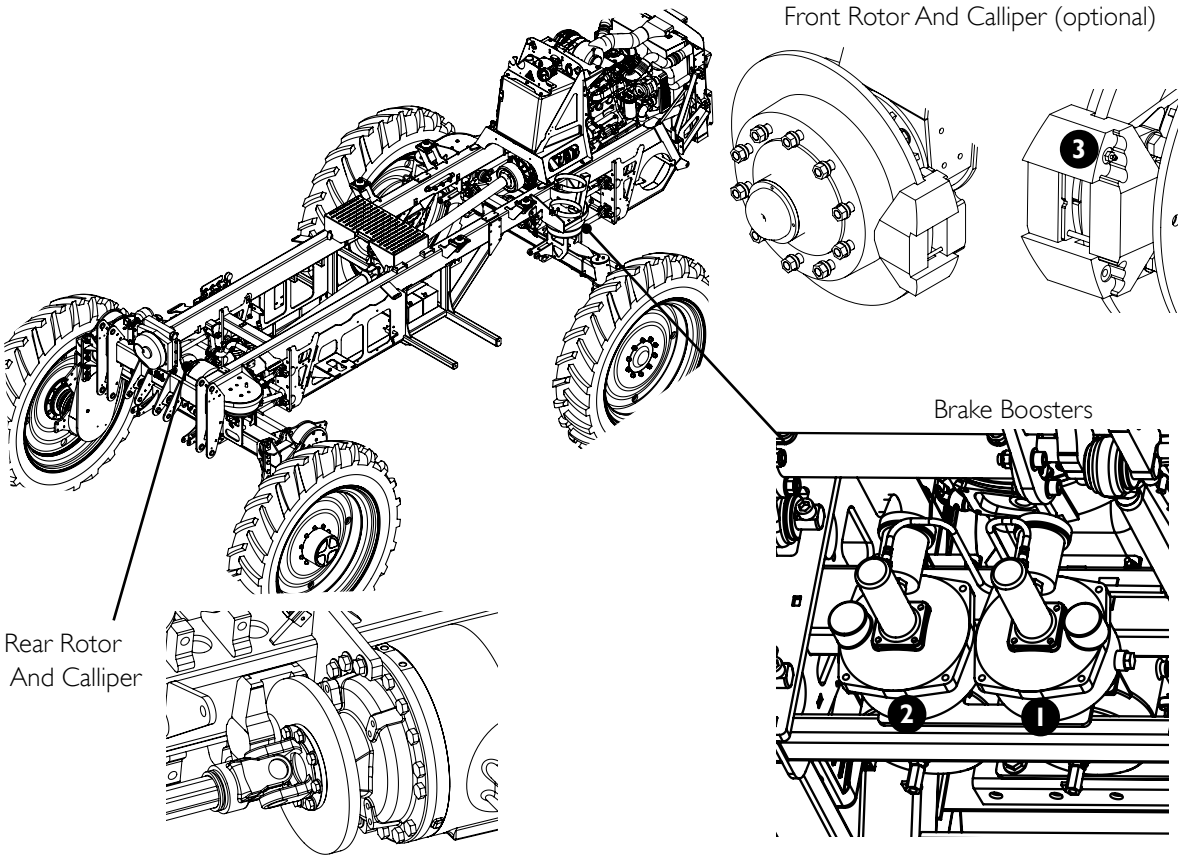
The drop legs have an oil bath sump which the chains run in and carry the oil to the bearings. The planet hubs run in oil and have a separate oil fill/drain plug.

The oil level can be checked by removing the level plugs.

The chain will stretch over time and become loose. When this occurs the chains must be replaced. There is no tensioning mechanism for the drive chains as stretched chains will damage the drive sprockets and therefore must be replaced.

For all service intervals and maintenance requirements for the Drop Leg, refer to the Maintenance chapter of this manual.

Braking System



Number	Feature
1.	Master Cylinder (rear brakes)
2.	Master Cylinder (front brakes)
3.	Bleed Nipple (one located at each calliper)

The braking system used on the G4 machine is a split system consisting of four rotors with one calliper per rotor. These callipers are powered by an air over hydraulic system. The front two callipers are powered off one master cylinder and the rear callipers are powered off a second master cylinder. The G3 only runs the rear braking system with the callipers on the diff centre.

ROTORS

The rotor used on the front of the sprayers are a customized construction and are a 600mm diameter rotor that is fitted to the hub on the inside of the wheel. The rear are a 310mm diameter steel rotor and are mounted on the differential.

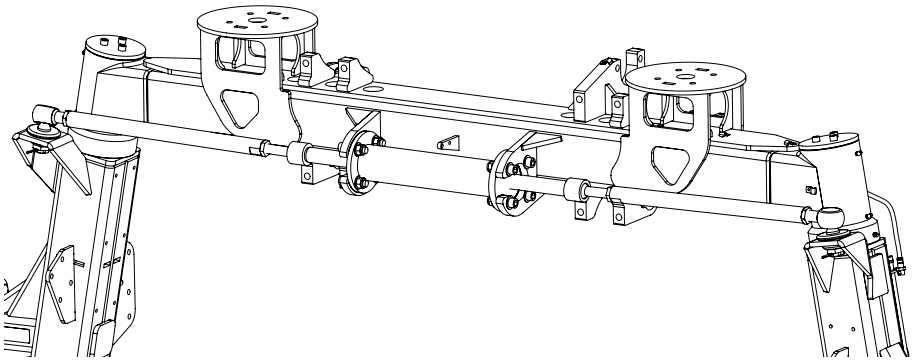
CALLIPERS & PADS

The callipers used on the sprayers have two brake pads with kevlar anti-squeal liners, which clamp on to the rotor when the brakes are applied. These pads must be inspected regularly for wear. When the pads wear down to the indicator groove they must be replaced. Build up of mud and debris will cause the brake pads to wear prematurely. For this reason the brake callipers must be kept clean at all times.

BRAKE BOOSTERS

Both brake boosters are located under the transmission on the chassis on the sprayer. The booster on the right is used to power the rear brakes and the left booster powers the front brakes. To maintain sufficient brake fluid in the system, each brake booster reservoir must be checked regularly.

Steering System



CAMBER

The wheel camber is a factory set parameter and cannot be adjusted

STEERING TOE IN

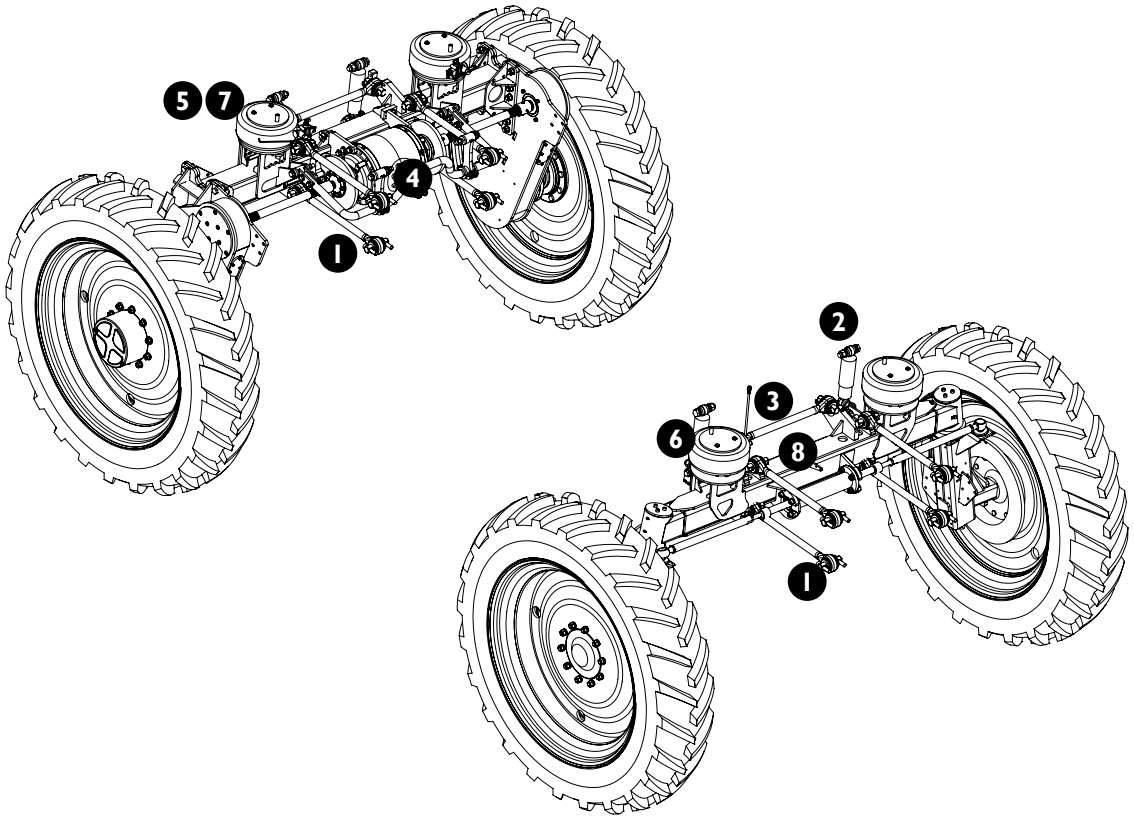
The wheels of the sprayer should toe in 0-5mm.

Note: information on checking toe can be found in the Maintenance chapter.

STEERING KING PINS

The king pins need to be greased as per the maintenance schedule

Suspension System



Number	Feature
1.	Parallel Link
2.	Shock Absorber
3.	Panhard Rod
4.	Sway Bar (Rear only)
5.	Air Bag - Rear
6.	Air Bag - Front
7.	Ride Height Valve - Right Rear
8.	Ride Height Valve - Front Centre

SUSPENSION

The Five Point Suspension system used on the Crop Cruiser Sprayer consists of four parallel links, one panhard rod and 2 air bags on each axle. The rear axle of the machine is also fitted with an anti roll sway bar.

Parallelogram links hold the axle in place on the chassis. Panhard rods hold the axle centred in the chassis. The parallelogram arms allow the drop legs to distort or twist forward and backwards when the wheels come in contact with an obstruction such as a pot hole, log or embankment. This oscillation is absorbed by polyurethane bushes in each end of the links. The life time of these bushes is subject to the conditions the sprayer operates in and the style of operation that it receives. The polyurethane bushes should be checked at regular service intervals as stated in this manual.

Air Bags mounted on to each side of the axle allow the axle to oscillate and dampen.

Chapter 6

PRE-OPERATION

Preparing the Sprayer for Use

Warning:

If spraying is to be done at night, ensure that adequate lighting is available around the sprayer and the area to be sprayed.

- The amount of lighting around the sprayer needs to be sufficient for all labels and warnings on the sprayer to be clearly visible to the operator.
- The amount of lighting in the area to be sprayed needs to be sufficient for obstacles in the path of the sprayer to be clearly visible to the operator.

Before Starting the Sprayer in Cold Conditions

- If the sprayer has been in a cold environment, always check components to make sure that they have not been damaged and that there is no ice in the system before starting spraying. If the water has frozen in the pump and/or in the lines, wait until it has completely thawed before use.
- Inspect the sprayer to ensure there is no damage or wear which could lead to injury, further damage or reduced performance.
- Check all hoses and fittings for leaks or damage. Check the sprayer to ensure frosts and/or vermin have not damaged the machine, and that the tyres are correctly inflated.
- Check the engine oil, water and fuel.
- Check that all of the lights are working correctly.
- Check all bolts and nuts to make sure they are tight and secure.
- Complete the scheduled lubrication.

NOTE: Proper greasing is essential for the sprayer to operate with maximum effectiveness and life-expectancy. It is important to keep the lubricant and lubricant applicator clean. Wipe all dirt from the fittings before use. Goldacres recommends that multi-purpose grease should be used for all lubrications. Make sure all open-end bearings are lubricated their full length by forcing lubricant into them until it begins to appear at the sides.

- Be sure to adequately clean and flush all chemical handling equipment.
- All spray equipment should be cleaned at the start and end of each spray season including all filters and nozzles.
- Test the pump with clean water. Switch on the pump at the lowest revs possible and then gradually increase revs until the pump reaches its operating speed. Do not exceed 540 R.P.M.
- Check nozzle patterns for irregularities. If there are irregularities, clean the nozzles and refit. If the problem persists they could be worn so remove and replace.
- Make sure there is a sufficient quantity of clean water in the rinse water tank in case of a chemical accident.
- Arrange communication with someone who can come to your aid if need be.

Sprayer in Transit

The Crop Cruiser sprayer is approx 4.2m in height and with aerials on the roof, can be much higher. Check the regulations in your state for maximum vehicle height restrictions. When driving the Crop Cruiser on roads it may be necessary to remove aerials to meet the required height restrictions.

Aerials on the roof may also need to be removed to meet clearance requirements for over head power lines, while on the road and also in some paddocks.

Over Head Power Lines

Check any areas to be sprayed for over head power lines. If there are any in the area, contact the relevant energy provider for information on safe use of machinery near live lines.

DANGER: Check area to be sprayed for over head power lines. Contact between the machine and power lines can result in serious injury or death.
If there are powerlines in the spray area, exercise extreme caution when tilting boom wings.
Do NOT walk on machine platform when near power lines.

Spray Calibration

Flow meter and spray nozzle calibration should be checked regularly to ensure that correct application rates are maintained. Refer to the "Calibration" chapter for procedures to check and alter calibration if required. Also refer to the Spray Controller manual.

Maintenance

Correct servicing and maintenance of the Goldacres Crop Cruiser Sprayer will ensure the efficient safe operation of the sprayer. Servicing and maintenance should be carried out according to the schedule in the Lubrication & Maintenance section of this manual (Chapter 10)

During the First 8 Hours of Operation

Torque Settings

- Check the torque on retaining nuts frequently.
- The wheel nuts should be checked to ensure that 350 lbft is maintained.

Engine

- If the engine has been running, take extra care around hot engine parts such as the exhaust.
- Check the engine oil level frequently. Due to the "bedding in" of the engine components and additional friction between connecting parts, expect the oil usage to be higher than normal.
- Avoid excess engine idling.
- Inspect the air intake system and check for leaks.

Lubricating and Hydraulic Fluids

- Maintain correct hydraulic oil levels and monitor the oil temperature on a regular basis.

Check the transmission oil level and ensure that grease points are lubricated effectively. Crush Hazard Warning (Refer to Chapter 2, Safety)

- Inspect for leaks in the hydraulic system

Tank Retaining Strap Bolts

- The tank retaining strap bolts should be checked to ensure that they have not become loose.

Pump Mounting Bolts

- The pump mounting bolts should be checked to ensure that they are not loose.

Suspension Bolts

- There are numerous suspension bolts located at each end of the parallel links and at each end of the pan hard rods and sway bars. These bolts should be checked to ensure that they have not become loose.

Lights

- Check each light around the vehicle for correct operation.

Starting

Before operating the sprayer, all fluid levels must be checked in accordance to this manual.

The isolator switch must be engaged to provide power to the machine systems.

To start the engine, the transmission must be in neutral.

Insert the ignition key and turn clockwise. The ignition key is located on the steering console.

The key has 5 positions, however only 3 of these are in use on this sprayer:

P - Off.

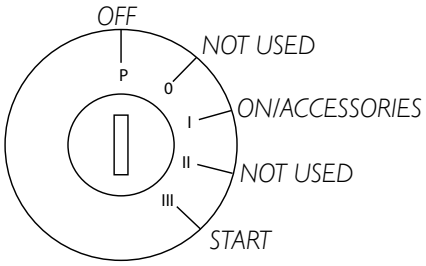
0 - Not used.

I - On/accessories; in this position all cabin components will be energised.

II - Not used.

III - Start; this is a momentary position which can only be achieved by holding the key hard in this position, the engine will be cranking if the transmission is in neutral. Once released the key will return to the 'On/Accessories' position.

To shut down the engine rotate the ignition key counter clockwise to the 'Off' position.



Shut Down

When turning off the engine of the Crop Cruiser.

Ensure the gear selector is in Neutral.

Then pull the hand brake on. The ladder will go down.

Turn the key to the 'Off' position.

Wait for a minimum of 30 seconds before turning the isolator switch to 'Off' . This allows time for the engine data to be saved back to the ECM.

Chapter 7

CALIBRATION

General

Spraying is a complex task, that is affected by many variables. It is the responsibility of the operator to be familiar with spraying variables and to understand the spraying process prior to operation.

In general, the operator should know:

- The target application rate.
- The required operating (spray) pressure.
- The speed of travel.
- The desired droplet size.

To make the spray application as accurate as possible, it is critical that your spray equipment is regularly calibrated.

The Raven automatic controller is designed to improve the uniformity of spray applications. Raven controllers will monitor and control the determined application volume, but prior calculations will be required to ensure spraying pressures do not exceed operating parameters. The Raven system comprises a console, flow meter, speed sensor and liquid flow control valve.

As the sprayer is moving, the console records ground speed and then calculates the amount of flow required to maintain the respective application rate at that speed. The console monitors the amount of flow being used via the flow meter and then determines if the flow is correct for that speed. Flow adjustments are made by the control valve which varies the amount (volume) of by-pass and thus the volume being applied via the boom is controlled.

When the console is in the automatic mode, as the ground speed increases, the flow to the booms required to maintain the application volume will be increased. This will result in the pressure (as displayed on the gauge) increasing. Conversely, as the ground speed decreases, the required flow to the booms, as well as the pressure, decreases.

When the console is in the manual mode, as the ground speed increases, the pressure and flow will remain constant and the application volume will decrease. Similarly, as the ground speed decreases, again the pressure and flow will remain constant and the application rate will increase.

Record your console calibration information in the table below for future reference:

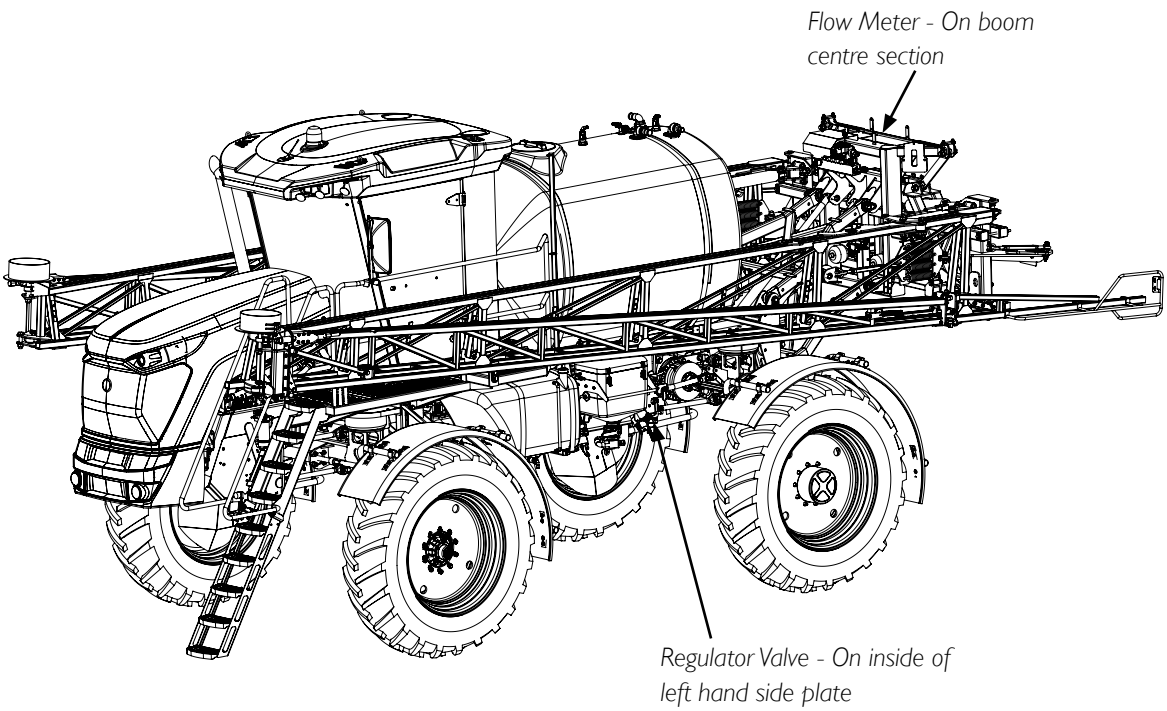
	SCS4400	Unit	SCS450
Boom Cal 1		cm	
Boom Cal 2		cm	
Boom Cal 3		cm	
Boom Cal 4		cm	
Boom Cal 5		cm	
Boom Cal 6		cm	
Boom Cal 7		cm	
Speed Cal			
Meter Cal			
Valve Cal			
Rate 1		L/Ha	
Rate 2		L/Ha	
Tier 1		L/min.	
Tier 2		L/min.	
Pump Cal (1)		RPM	

$$\text{L/min. (per nozzle)} = \frac{\text{L/ha x km/hr x W}}{60{,}000}$$

$$\text{L/ha} = \frac{60000 \times \text{L/min. (per nozzle)}}{\text{Km/hr x W (metres)}}$$

$$\text{Km/hr} = \frac{\text{Metres x 3.6}}{\text{Time (seconds)}}$$

Regulator Valve, Speed Sensor and Flow Meter



Regulator Valve

The Crop Cruiser uses 2 types of regulator valves depending on the rate controller used. The regulator valves control the flow going to the boom sections directed via the console. It controls the flow to the boom by regulating the amount of liquid that bypasses back to tank.

The fast close valve is a positive ball valve which means it can control flow infinitely to the boom from 0 L/min. to the maximum pump output, dependant on system pressure.

If a SCS450 Controller is used then the regulator is a Teejet 3 way valve. The Teejet is classed as a Standard Valve and uses a 2123 control constant

If a SCS4400 controller is used then the regulator is a Raven Fast Close Valve. The Fast Close Valve uses a 743 control constant.

Each valve is treated differently in terms of the rate controller.

Flowmeter Calibration (Raven)

If the sprayed volume from the controller does not match the tank volume that was output, then the flowmeter will need to be checked and a new figure input in to the Meter Cal in the Raven controller.

- On the flow meter on the sprayer, there will be a calibration number attached to it on a white sticker. The number that is applicable is the one in square brackets, i.e. [185]. Note this number down as this is the number that should be entered as the Meter Cal. number.
- The Flow meter should be checked at the start of every spraying season and periodically during the season.
- The simplest way to check the accuracy of the flow meter is to fill the tank to a previously determined volume mark (usually top fill marking). Make sure the tank is level.
- On the Raven controller, make sure the Total Volume reads "0".

- Perform a self test, choose a high speed and high rate so that the tank will empty relatively quickly but make sure the pressure does not exceed 60 psi.
- When the tank is empty, on the Raven controller press [TOTAL VOLUME] to read what the Raven flow meter has output to the boom. Record the reading.
- Check the volume of the tank to see what has been sprayed out to the boom. Record the reading.
- Compare the reading from the controller with the known volume from the tank. If there is a relatively large discrepancy (i.e. more than 50 litres out of a 3000 litre tank), the flow meter should be removed from the sprayer, disassembled and the condition of the turbine checked and cleaned (make sure it spins freely).
- The flow meter should then be reassembled and replaced on the sprayer. Perform the volume check again and if there is still a discrepancy, the Meter Cal No. can be changed.

e.g. If volume from the controller reads 3100 litres instead of 3000 litres and the original Meter Cal value is 185

New Meter Cal value $\frac{185 \times 3100}{3000}$

Every sprayer should be calibrated regularly to ensure minimal error in the application rate. A nozzle selection chart indicates what application rates are to be expected but variations due to nozzle wear, ground speed error and pressure irregularities can result in large application rate errors.

Nozzle Calibration

As part of your daily sprayer calibration, Goldacres recommends you carry out a simple "JUG TEST" to ensure the spray nozzles you are using are delivering the correct amount of chemical, as stated in your Nozzle Supplier's "Rate Chart".

The method of carrying out the "JUG TEST" is as follows;

1. You will need:

a. A calibrated measuring container that can measure the medium in litres, in 10 ml increments. e.g. 0.45 L.

b. A timing device showing seconds.

c. A pressure gauge mounted at the nozzle tip to verify the system pressure being delivered at the nozzle. Goldacres part numbers QJ4676-1/4-NYR will mount a suitable gauge to the nozzle body bayonet fitting. (Not including gauge).

Procedure:

2. Check the plumbing system for kinked or obstructed hoses and repair or replace any hoses that restrict the normal flow of the liquid.
3. Start your sprayer

- Initiate a 'self test' procedure and set the application rate and speed to the settings depicted in your "Rate Chart" at which you expect to spray.

4. Then place the jug under one of the nozzles, for 1minute (exactly) and record the volume of liquid collected.
5. Repeat the test over a representative sample of the jets in each boom section.
6. Compare the volume collected from each nozzle to the stated volume in your "Rate Chart". It should be no more than plus or minus 10% of the volume stated in your Nozzle Supplier's "Rate Chart".

7. In the event that any of your nozzles do not deliver the required volume, a further investigation is required which may include, but not be limited to:

- Cleaning the nozzles - using the method recommended by the nozzle supplier.
- Replacing the nozzles.
- TeeJet advise that nozzles that flow greater than +10% of their stated volume are 'worn out' and should be replaced.
- Cleaning nozzle filters.

UNEVEN VOLUMES FROM INDIVIDUAL NOZZLES WILL RESULT IN VARIATIONS IN THE APPLICATION RATE ACROSS THE WIDTH OF THE BOOM. SPRAY EFFICIENCY WILL BE REDUCED. CROP DAMAGE MAY RESULT.

If you have any further questions, Goldacres recommends you contact your nozzle supplier or your Goldacres dealer for additional information.

Download your free copy of 'A user's guide to spray nozzles' from the TeeJet website. Also Lechler nozzle selection catalogue and Users guides to spray nozzles are available from your Goldacres dealer, or as a free download from the TeeJet web site: www.teejet.com or Lechler web site: www.lechler.de

Speed Sensors

Raven automatic rate controllers can utilise a speed reading from:

- Transmission Output
- GPS receiver

Transmission Output

When the transmission output is used for speed the system must be set as if it were reading a radar sensor (SP2)

GPS receiver

If a GPS unit is fitted, GPS ground speed can be obtained and used in place of the transmission output.

To receive a speed reading from the GPS unit a **pulsed niema** string must be connected to the speed cable of the console. The console must then be set up to accept GPS speed. This is called radar in the console calibration settings. When using GPS the console speed cal figure is 200 initially and then can be fine tuned from this figure. See 'Calibration' chapter for further information on console setup.

SCS450 Console Calibration

The following information is a condensed version of the Raven installation and service manual. It is designed to provide sufficient basic information to enable the new unit to be calibrated before spraying is commenced. For more detailed information about console features, consult the Raven installation and operational manual.

It is imperative that the Raven console is correctly programmed, as the system will only work as accurately as the programmed information entered.

The following information is applicable for the Raven SCS 450 consoles:

Initially displaying "SP 1" and "CAL"

STEP 1: For Radar Speed Sensor, toggle to "SP 2" by pressing [CE] then [ENTER]

STEP 2: Press [ENTER] to lock in "C-SD" (Standard Valve)

Note: These 2 steps are very important because the system will appear to function properly but if the units are incorrect the quantities will be very inaccurate. If an error has been made whilst calibrating these 2 steps, turn the console off then turn back on again with [CE] pressed and all information will be cleared. To see what has been programmed, depress [SELF TEST] for about 5 seconds and the programmed information should be displayed (flashing and toggling)

STEP 3:

Press [BOOM CAL] then [ENTER]

Enter Boom Section 1 in Centimeters, Press [ENTER]

(For example 6m = 600 cm. Press [6] then [0] then [0])

The Raven 450 console has provisions for handling up to 5 boom sections. To measure the boom width for each boom section, count the number of nozzles in each section and multiply by the nozzle spacing e.g. 12 nozzles in one section at 50 cm (½ metre) spacings = 12 x 0.5m = 6 metres.

STEP 4: Press [1] to select boom section 2 (b-02) Key in Boom Section 2, then press [ENTER]

STEP 5: Insert remaining boom sections by using toggle [☐] & [☐] buttons [1] or [2]. If a boom section is not needed, enter a "0" for the length.

STEP 6:

Press [SPEED CAL] then [ENTER]

Enter Speed Cal in Decimeters (1 metre = 10 decimeters) (e.g. 477)

Press [ENTER]

Speed Cal is the distance measured by 10 revolutions of the Speed Sensor Wheel. This is best done with the tank half full of water (best simulates average between full and empty) and measured on ground that is typical to what will be encountered when spraying. Also note the tyre pressure when this procedure is performed. This tyre pressure needs to be maintained for the speed cal to be accurate. The speed cal should be checked at the start of every spraying season as the speed cal may need to be altered to compensate for tyre wear, etc.

Note: For the Crop Cruiser, the output is taken from the transmission.

STEP 7: Press [METER CAL] then [ENTER]
Enter Meter Cal for litres. Press [ENTER] (e.g. 185)
Meter Cal is the Calibration number on the Flow Meter white tag. The required number for litres is the number in square brackets.

STEP 8:
Press [VALVE CAL] then [ENTER]
Enter "2123"
Press [ENTER]

STEP 9:

Press [RATE 1] then [ENTER]
Enter Rate 1 (litres per hectare)
Press [ENTER] (e.g. 60)

STEP 10:

Press [RATE 2] then [ENTER]
Enter Rate 2 (litres per hectare)
Press [ENTER] (e.g. 75)

Note: Rate 2 can be the same as Rate 1 if only the one rate is to be used.

STEP 11: OPTIONAL
Press [VOL/TANK] then [ENTER]
Enter the Volume in Tank at start of spraying
Press [ENTER] (e.g. 3000)

STEP 12: OPTIONAL
Press [TIME] then [ENTER]
Enter the time of the day. Press [ENTER]
(e.g. 10:30)

STEP 13: (WHERE HYDRAULIC DRIVE IS FITTED TO SPRAYER PUMP)

Press [SPEED] and hold down for 5 seconds until speed value begins to flash. When the pump is fitted with hydraulic drive, the flashing 'speed' figure represents the pump's RPM.

To Zero Information When Entering New Field

When entering a new field, the previous data in the console can be changed to zero so that the new data is current for that field only.

Note: Write down all necessary data before removing data from console memory

To zero out data in Area and Volume:

Step 1: Write down the previous information for Area and Volume

Step 2: Press Area or Volume (Total or Field for 450 consoles)

Step 3: Press [ENTER]

Step 4: Enter "0"

Step 5: Press [ENTER]

The Area and Volume will now count from zero for the new field.

Self-Test Simulation

By simulating speed, the Raven controller can be tested without having to move. The Raven works in rate (i.e. litres per hectare) and a speed is required in order to calculate a rate. The self-test simulation provides the console with a simulated speed even though the sprayer is stationary and thus the console will be able to display a rate.

This self-test should be performed when first testing the system so that the operator can become familiar with the working system.

Step 1: Press [SELF TEST] then [ENTER]
Enter speed (i.e. 12.0 for 12 km/h)
Press [ENTER]
Press [SPEED] to verify speed

The sprayer will now operate so that it can be tested. Switch the boom sections on and off to see that the system compensates and the applied rate returns to the required rate. The self-test will cancel when motion from the vehicle is detected by the speed sensor. For radar speed sensor, disconnect the speed cable going into the back of the console in order to do a self-test.

Raven SCS4400 Console Calibration

It is imperative that the Raven console is correctly programmed, as the system will only work as accurately as the programmed information entered. For specific information please refer to the Raven operator's manual supplied with the machine.

Note: While proceeding through the initial console programming write down all relevant calibration values for future reference.

The following steps are very important because the system will appear to function properly but be very inaccurate if values are incorrectly entered.

Step 1: Turning The Console On

1. Turn the console 'ON' by momentarily depressing the [POWER] key.
2. Instruction for adjusting the contrast should now be displayed

Note: If this is not displayed or if an incorrect entry is made during programming turn the console power switch 'OFF' depress and hold the [CE] key while turning the power switch back "ON". This procedure resets the console.

3. Adjust the screen contrast as directed by depressing and holding the or keys.
4. When the desired contrast is achieved depress the [ENTER] key.
5. The display should now flash the word "CAL" and prompt for a "UNIT OF MEASURE" to be selected.

Step 2: Units of Measure

1. Momentarily depressing the [CE] key repeatable at this stage toggles the console through the "UNITS OF MEASURE" selection.
2. To operate in litres/hectare ensure "UNITS SI METRIC HECTARES" is display.
3. Then depress the [ENTER] key to lock it in.
4. The console will now prompt for a "PRODUCT TYPE" to be selected.

Step 3: Product Type

1. Momentarily depressing the [CE] key repeatedly at this stage toggles the console between "LIQUID" and "GRANULAR" control selections.
2. Sprayers require the selection of "LIQUID CONTROL" to function correctly. (Granular control would be selected when using a fertilizer spreader or air seeders).
3. Ensure "LIQUID CONTROL" is displayed then depress the [ENTER] key to lock it in.
4. The console will now prompt for a "VALVE TYPE" to be selected.

Step 4: Valve Type

To select the correct valve type:
Labelling on the side of the flow control valves provides information on the "VALVE TYPE" ("VALVE CAL" information is also on the label and will be required in step 6 below).

Momentarily depressing the [CE] key repeatedly at this stage toggles the console through the various valve types. "FCV" is for SCS4400 (fast close valve).

1. Ensure correct "VALVE TYPE" is displayed as labelled on the valve then depress the [ENTER] key to lock it in.
2. The console will now prompt for a "METER CAL" value to be entered.

Step 5: Meter Cal

All Raven flow meters are pre-calibrated. The calibration tag is attached to the transducer wire directly adjacent to the flow meter. The metric calibration number is the number in [square brackets] i.e. [185].

To enter the meter calibration figure first:

1. Depress the [ENTER] key.
2. The console will now display "E" enter symbol on the bottom right hand side of the calibration screen.
3. Key in the correct calibration number (i.e. 185).
4. Depress the [ENTER] key again to lock it in.
5. The console will now prompt for a "VALVE CAL" value to be entered.

Note: When entering any calibration figures during the calibration process the [ENTER] key must first be depressed momentarily to display the "E" enter symbol. The "E" indicates the console is ready to accept a calibration figure. After keying in a figure the [ENTER] key must be depressed again to lock the new value in before moving on to the next step.

Step 6: Valve Cal
The [VALVE CAL] value is located on the side of the flow control valve together with the "VALVE TYPE" "FAST CLOSE VALVES" have a value of [743].

To enter the value calibration figure:

1. Depress the [ENTER] key to display the "E" enter symbol.
2. Key in the appropriate [VALVE CAL] calibration number as printed on the side of the flow control valve.
3. After keying in the appropriate valve calibration number depress the [ENTER] key again to lock it in.
4. The console will now prompt for a [RATE CAL] number to be entered.

Step 7: Application Rate
[RATE CAL] is the rate (litres/hectare) desired for the particular application

Note: Before entering an application rate consult the nozzle application chart (in the operators manual or the Tee Jet catalogue) to ensure the rate is within the speed and pressure capabilities of the nozzles fitted to the boom.

To enter a [RATE CAL]:

1. Depress the [ENTER] key to display the "E" enter symbol.
2. Key in the desired application rate (i.e. 50 Lt/ha).
3. Depress [ENTER] again to lock it in.
4. The console will now prompt for a "SPEED SENSOR TYPE" to be entered

Note: If the console detects the presence of a 2nd product it will automatically interrupt the programming procedure at this point and request values be entered for PRODUCT TYPE, VALVE TYPE, METER CAL, VALVE CAL, and RATE for this 2nd product. The console will then revert back to STEP 8 if a 3rd product is not detected. If a 3rd is detected the console will automatically request the information be entered for this product before continuing no to STEP 8 below.

For SCS 4400 console connected to a chemical injection pump(s) see separate section on SCS 4400 chemical injection pump programming, in the "DCI" chapter for further details.

Step 8: Speed Sensor Type
Before proceeding in this step first identify which type of speed sensor the console is connected to.

Transmission output or Raven GPS:

1. Momentarily depress the [CE] key repeatedly to toggle through the selection of "SPEED SENSOR TYPES" until "SPEED SENSOR RADAR SP-2" is displayed.
2. Depress the [ENTER] key to lock it in and the console will now prompt for a "SPEED CAL" number to be entered.

Step 9: Speed Cal
Before a [SPEED CAL] figure can be entered a speed calibration value must first be ascertained. The method for calculating a speed calibration figure varies depending on the type of speed sensor the console is connected to

For consoles connected to a transmission output:
Use an arbitrary [SPEED CAL] value of [200]

To enter this value:

1. Depress the [ENTER] key to display the "E" enter symbol.
2. Key in the appropriate [SPEED CAL] number.
3. Depress the [ENTER] key again to lock it in.
4. The console will now prompt for a "BOOM CAL 1" number to be entered.

Note: This is an arbitrary value only and will require correcting; using the following procedure, once the remainder of the programming procedure is completed.

To recalibrate a [SPEED CAL] value once initial console programming is complete:

1. Accurately mark and measure 100 metres.

2. With the power switch "on" and all other switches "Off"

3. Depress the [DISTANCE] key.

4. Depress the [ENTER] key to display the "E" enter symbol.

5. Key in a "0" value.

6. Then depress the [ENTER] key again to lock it in.

7. Drive the 100 metres, being careful not to accelerate or decelerate too suddenly.

8. Record the distance that the console displays once the 100 metres has been travelled.

9. The distance should read 100. If it reads between 99 or 101 this calibration value will be correct. If the distance reads any other valve perform the following procedure.

NEW [SPEED CAL] VALUE = OLD [SPEED CAL] VALUE x 100

RECORDED DISTANCE

Note: Redo the distance check again to confirm the new [SPEED CAL] value is correct.

For consoles connected to a Raven GPS:

Use a Speed Cal figure of [785] (standard speed cal figure for all Raven GPS units).

To enter this value:

1. Depress the [ENTER] key to display the "E" enter symbol.

2. Key in the appropriate [SPEED CAL] number.

3. Depress [ENTER] again to lock it in.

4. The console will now prompt of a "BOOM CAL 1" value to be entered.

This value can be checked once initial console programming is complete by using the same procedure for recalibrating a [SPEED CAL] value for a radar speed sensor above.

Step 10: Boom Sections
The console needs to know the width of each section so it can calculate;

1. The total flow rate required.

2. The area applied.

As boom sections are turned on or off the console increases or decreases the theoretical width of the boom accordingly in order to calculate the correct flow rate (total L/min. to the boom) and the total area sprayed.

To measure the width for each boom section, count the number of nozzles in each section and multiply by the nozzle spacing e.g. 12 nozzles in one section at 50cm (½ metre) spacings = 12 x 0.5m = 6m

All Boom Sections must be entered in Centimeters (for example 6m = 600cm) so the correct Boom Cal in this example would be 600.

To enter a [BOOM CAL] figure for boom 1:

1. Ensure boom 1 is displayed.

2. Depress the [ENTER] key to display the "E" enter symbol.

3. Key in the boom width in centimeters for boom 1.

4. Depress the [ENTER] key to lock it in.

Note: At this point the console does not proceed automatically to boom 2.

5. To proceed to Boom 2 depress the [UP] key momentarily.

6. Depress [ENTER] and key in the calibration figure for boom 2.

7. Depress the [ENTER] key again to lock it in.

Depress the key and continue entering the [BOOM CAL]'s in the remaining boom sections. If a boom section is not utilised ensure "0" is entered in that section or the console will fail to function correctly.

INITIAL PROGRAMMING IS NOW COMPLETE.

If the sprayer is fitted with the 3TS option see the separate section on Raven SCS 4400 3TS dual boom operation and programming.

Note: Each time the console power switch is turned "on" the products automatically default to the "OFF" mode. Before commencing spraying the product must be changed to the "AUTO" mode.

To change to the "AUTO" mode:

1. Momentarily depress the [PRODUCT ON/OFF] key to turn the product "ON". At this point the console should read "AUTO NOBM" (auto no boom).

2. If it reads "MAN NOBM" (manual no boom) momentarily depress the [AUTO/MANUAL] key to switch to the product to the auto mode.

The "NOBM" (no boom) component automatically disappears when the console senses the switching "on" of a boom section.

If you wish to change a calibration figure for Boom Cal, Speed Cal, Meter Cal, Valve Cal or Rate Cal (application rate) at any time simply depress the appropriate key i.e. [BOOM CAL], then the [ENTER] key to display the "E" enter symbol, key in the new calibration number and depress the [ENTER] key again to lock it in.

If you wish to view the Units of Measure, Product Type, Valve Type or Speed Sensor Type depress and hold down the [SELF TEST] key and the console will flash through the various values entered.

If you wish to change the Units of Measure, Product Type, Valve Type or Speed Sensor Type continue holding down the [SELF TEST] key for 20 seconds until the console stops on "UNITS OF MEASURE" and flashes "CAL". Once "CAL" is displayed release the [SELF TEST] key.

At this point repeatedly depressing the [CE] key momentarily will toggle the console through the various options in each step and depressing the [ENTER] key will lock it in and/or move on to the next step. To exit this function at any time continue momentarily depressing the [ENTER] key until the console reverts back to "SELF TEST" and discontinues flashing "CAL".

Step 11: Pump RPM

To activate the pump RPM display on the console screen:

1. Depress the [DATA MENU] key to display the data sub menu at the bottom of the screen. The word "SERIAL" will be highlighted.

2. Depress [DATA MENU] key again and the highlight will move down to "PRODUCT".

3. Momentarily depress the [DOWN] key repeatedly to move the curser down until page 2 is displayed.

4. Continue momentarily depressing the [DOWN] key repeatedly until the curser is adjacent to "PUMP CAL".

5. Depress the [ENTER] key to display the to display the "E" (enter symbol).

6. Key in a value of pulses per revolution (normally one) _____

7. RPM should now be displayed in the top right hand corner of the screen.

8. Depress a volume or area key to exit the data sub menu and return to the operational screen.

Step 12: Low Flow Limit

This feature, when activated, stops the console controlling the flow rate below an assigned limit to prevent boom line pressure falling too low resulting in fan angle collapse or nozzle check valve closure.

This feature is particularly useful in row crop situations to prevent 'under- application' at the start and end of a row.

In this mode the console effectively defaults to an 'over-application' mode during periods when the sprayer is unable to maintain the minimum speed required for a particular application rate.

Note: This feature must not be used with chemicals that have poor crop selectivity and will cause damage to the crop if 'over-applied'. Check with your chemical supplier for more details on chemical/crop selectivity before using this feature.

The SCS 4400 also has the added ability to control to this minimum flow rate value. To activate this feature a minimum flow rate value must be calculated and entered into the console.

To calculate a minimum flow rate refer to the relevant nozzle chart for the nozzle type/size fitted to the sprayer. Nozzle charts can be found in the operator's manual or the TeeJet catalogue.

From the nozzle chart determine the flow rate of the nozzle used at the minimum recommended operating pressure. Multiply this figure by the total number of nozzles fitted to the entire boom line to obtain the "LOW FLOW LIMIT" value.

Note: This minimum flow rate value is automatically proportioned as boom sections are turned on and off. Thus a minimum pressure will be maintained

regardless of boom section status.

Entering a Low Flow Limit value:

1. Depress the [DATA] key to bring up the data submenu at the bottom of the screen. The word "SERIAL" will be highlighted.
2. Depress the [DATA] key again to highlight "PRODUCT".
3. Momentarily depress the key repeatedly to move the curser adjacent to "LOW LIMIT".
4. Depress the [ENTER] key to display the "E" (enter symbol).
5. Enter the "LOW FLOW LIMIT" value calculated.
6. Depress the [ENTER] key again to lock it in.
7. Depress a volume or area key to exit the data sub menu and return to the operational screen.

Step 13: To Zero Information When Starting A New Load

When starting a new load, the previous Area and Volume data in the console can be reset using the following procedure;

"TANK VOLUME" gives the operator a reference as to the number of litres left in the tank as the load is progressively applied to the field. For this feature to function correctly the estimated volume in the tank must be entered before application of the new load is commenced.

WARNING: The [self test] feature should never be used with chemical in the tank used to more accurately determine tank volume particularly if using partial tank loads

1. Depress the [VOLUME TANK] key.
2. Depress the [ENTER] key to display the "E" enter symbol.
3. Enter the volume of liquid actually in the tank at the start of the load.
4. Depress [ENTER] again to lock it in.

Note: The console will subtract the litres used (count down) from this value as the load is applied to the field giving the operator a reference as to the number of litres left in the tank.

TO ZERO OUT DATA IN AREA AND VOLUME:

Note: Before resetting the Area and Volume functions record any previous data in the console that maybe applicable for future use.

To reset an Area or Volume value:

1. Depress the relevant key relating to the value to be reset. For example [TOTAL AREA], [TOTAL VOLUME], [FIELD AREA] or [FIELD VOLUME].
2. Depress the [ENTER] key to display the "E" enter symbol.
3. Enter a value of "0" to reset the particular function.
4. Depress the [ENTER] key again to lock it in.

The Area and Volume will now count up from zero for the new field.

[FIELD AREA] and [FIELD VOLUME] are generally use as sub-totals for [TOTAL AREA] and [TOTAL VOLUME].

For example if applying several tank loads to the one area [FIELD AREA] and [FIELD VOLUME] can be use to record data for the current tank load while the [TOTAL AREA] and [TOTAL VOLUME] can be used to record accumulative data for the whole area. If [TOTAL AREA] and [TOTAL VOLUME] are used to accumulate data do not reset them until starting a new area.

WARNING: The [self test] feature should never be used with chemical in the tank.

WARNING: Do not use the self test function with the booms in the transport position.

To simulate a speed:

1. Depress the [SELF TEST] key momentarily.
2. Depress [ENTER] key to display the "E" enter symbol.
3. Key in a desired test speed. Note this feature has a decimal point so a "0" needs to be added when entering a whole figure. For example 1, 6 and 0 for 16 Kph.
4. Depress the [ENTER] key again to lock it in.

A desired test speed should now be displayed in the speed window at the lower left corner of the display

Spraying can now be simulated by simply turning on

the boom switches.

The [SELF TEST] feature will automatically clear itself when motion is detected from the speed sensor.

Note: Some radar and GPS units may sense motion when the sprayer is stationary thus continually clear this function. To counteract this simply unplug the speed sensor connection in the fuse box area whilst using this function.

Using the flow meter to calibrate the tank:

1. Enter in the Meter Cal value as given on the white Calibration sticker on the Flow meter.
2. Enter all the other calibration information needed to enable the console to work.
3. Fill the tank to the top mark with water (i.e. 2500 or 3000 etc.). Make sure the tank is level.
4. Make sure the Total Volume reads "0"

Press [TOTAL VOLUME] then [ENTER] Enter "0" then [ENTER]

5. Perform a self-test. (Choose a relatively high speed and high rate so that the tank will empty relatively quickly but make sure the pressure does not exceed 60 psi).
6. When the tank is empty press [TOTAL VOLUME] to read what the Raven Flow meter has output to the booms.
7. If there is a large discrepancy (i.e. the difference between theoretical tank volume and Flow meter volume is greater than 100 litres), alter the Meter Cal value accordingly. For example: If volume reads 3100 litres instead of 3000 litres and the original Meter Cal value is 185.

New Meter Cal value = 185 x 3100 ÷ 3000 = 191

8. Enter in new Meter Cal value and repeat procedure (Step 3 to Step 6). Continue to re-iterate the Meter Cal value until the desired volume accuracy is achieved
9. Write down the appropriate Speed Cal value for future reference.
10. Re-fill the tank to the top mark and perform the self test again. Stop the self test after every 200 litres has been pumped out (read by pressing [TOTAL VOLUME] and check how the water level compares with the appropriate tank calibration mark.

(e.g. After 200 litres has been pumped out there is 2800 litres left in a 3000 litre tank). There may need to be extra marks put on the tank to indicate where the actual tank calibration levels are.

3TS (Boom Tier Programming)

Note: 3TS boom tier programming can only be carried out if initial console programming has been completed (see SCS 4400 console programming).

For boom tiering to operate flow rate values (L/min.) have to be entered into the console. The console automatically starts on the first tier when the boom master switch is turned "on" but it needs reference points entered to be able to determine when it should change to the second and third tiers. Thus to achieve the three tiers two flow rate value have to be entered.

Before these figures can be entered the maximum flow rate (L/min. in total to the boom) for each tier must be calculated.

Using a nozzle chart determine the flow rates (for a single nozzle) at which point you wish the console to change tiers. These points are best determined by ascertaining the minimum pressure and thus the corresponding flow rates at which point you wish the next nozzle to cut in. Care must be taken to ensure these minimum pressure/flow rate settings do not exceed the maximum recommended operating pressure of the preceding nozzle.

For example: If you had XR110015 and XR110025 nozzles fitted to the sprayer the minimum pressure that the XR110025's can cut in at is 1.0 bar. The flow rate for an XR110025 nozzle at 1.0 bar is 0.57 L/min. The maximum operating pressure for an XR110015 is 4.0 bars at which point the flow rate is 0.68 L/min. so this combination of nozzles overlaps nicely. In actual fact the XR110025 would cut in at slightly less than 3 bars if the first set point was programmed at the 0.57 L/min.

To determine the second set point of the 3rd tier, first ascertaining the minimum pressure you wish the combination of the two nozzles to operate at. Then add the corresponding flow rates at this pressure for the two nozzles together to form the second set point.

For example: If you wanted the 3rd tier to cut in at one bar you would add the flow rates for the XR110015 and XR110025 at one bar together (0.34 + 0.57 = 0.91 L/min.) Again care must be taken to ensure this minimum pressure/flow rate setting does not exceed the maximum recommended operating pressure/flow rate of the preceding nozzle. At 0.91 L/min. the preceding XR110025 nozzle would be operating at slightly over 2.5 bars before the 3rd tier would cut in. Again a nice overlap.

Note: The flow rate values entered into the console for the tier interchange points must be the sum total of all the nozzles on one entire boom line.

For example: A 30 metre boom with 50 cm nozzle spacings has 60 nozzles on one boom line, therefore 60 nozzles x 0.57 L/min. = 34.2 L/min. which would be the tier 1 max rate value for the example above.

The tier 2 max rate would be 60 x 0.91 L/min. = 54.6 L/min.

Note: The above example is based on a 30 metre broad acre boom. Some booms may have different nozzle spacings or layout (i.e. row crop) so it's important to count the total number of nozzles on the first line to ensure the correct Tier Value is calculated and entered.

The pressure figure of one bar is an example only. Other trigger point pressures may be selected.

Note: Care must be taken to ensure there is sufficient pressure overlap between the tiers otherwise spray drift or poor efficacy may result.

Note: The consoles won't accept tier values containing decimal points so values calculated with decimal points require rounding off to the nearest whole figure before entering.

To Enter The Tier Values:

1. Depress and hold down the [BOOM CAL] key for 5 seconds until "TIER 1 HIGH VOL PER MIN" is displayed.
2. Depress the [ENTER] key to display the "E" (enter symbol).
3. Key in the first tier interchange value and depress [ENTER] again to lock it in.
4. To enter the second tier interchange point depress the ↑ key and "TIER 2 HIGH VOL PER MIN" will be displayed.
5. Depress the [ENTER] key again to display the "E" (enter symbol).
6. Key in the second tier interchange value and

depress [ENTER] again to lock it in.

7. Depress the ↑ key again and "PERCENTAGE TIER DISABLE" will be displayed.

The default setting for this function is "10" which means the tiers will overlap 10% above the entered tier values on the 'up-change' and 10% below on the 'down-change'.

This function is useful if the sprayer is operated at a speed and/or rate that coincides with a tier change point. If this scenario occurs the console will tend to hunt between tiers unless a percentage overlap figure is entered. Maintaining the 10% tier disable value at this point will reduce this 'hunting' tendency.

Keep in mind that the pressures will rise over and fall under the set tier value by the percentage entered. For example if a value of 10% is entered the pressure will rise 10% above the set tier interchange point before a tier 'up-change' will occur and correspondingly fall 10% below the value before 'down- changing'. If using this function ensure the tier interchange points are calculated with this expanded pressure range in mind otherwise the sprayer may operate outside the recommended operating pressure range of the nozzle.

If the nozzles or tier values selected allow for very little or no pressure overlap a "PERCENT TIER DISABLE" value of "0" must be selected:

1. To enter a "PERCENT TIER DISABLE" value depress the [ENTER] key to display the "E" (enter symbol).
2. Key in the desired percentage overlap and depress the [ENTER] again to lock it in.
3. Press a volume or area key to exit this function and return to the operational screen.

SCS 4400 and 2TS

The SCS 4400 3TS system can be set up to operate in a 2TS mode if the operator wishes to use the same size nozzles in both boom lines.

In the 2TS mode the console will start the sprayer on one line then turn the second line on in conjunction with the first at a predetermined point. It effectively does away with the first tier interchange point of the 3TS system where one boom line is turned "on" whilst the other is turned "off" (obviously this step is superfluous if the same size nozzles are fitted to both boom lines).

To set the console up in the 2TS mode:

1. Depress and hold down the [BOOM CAL] key for 5 seconds until "TIER 1 HIGH VOL PER MIN" is displayed.
2. Depress the [ENTER] key to display the "E" (enter symbol).
3. Key in a value of "1".
4. Depress the [ENTER] key again to lock it in.

By entering a value of "1" the console will automatically proceed and start on the second tier.

To calculate the second tier interchange value: From the nozzle chart in the operator's manual or the TeeJet catalogue locate the minimum recommended operating pressure and corresponding flow rate (Lt/min) for the nozzle size and type fitted to the sprayer.

Note: If operating the sprayer in the 2TS mode the same size and type of nozzles should be fitted to both boom lines.

Multiply this value by 2 then by the total number nozzle on one entire boom line.

For example: Using a 30 Mt broad acre boom fitted with XR11002 nozzles.

The minimum recommended pressure for an XR nozzle is 1 bar. The flow rate for an XR11002 nozzle at 1 bar is 0.46 L/min. Thus the second tier interchange value will be 0.46 X 2 X 60 (2 nozzles/ meter) = 55.2.

Note: The console will not except tier values containing decimal points so round any values calculated with decimal points off to the nearest whole number before entering.

So the value entered in this example would be 55.

Continuing on from above to enter the second tier interchange point:

1. Depress the ↑ key and "TIER 2 HIGH VOL PER MIN" will be displayed.
2. Depress the [ENTER] key again to display the "E" (enter symbol).
3. Key in the second tier interchange value and

depress [ENTER] again to lock it in.

4. Depressing the again will display "PERCENT TIER DISABLE" (see instruction above on setting this value).

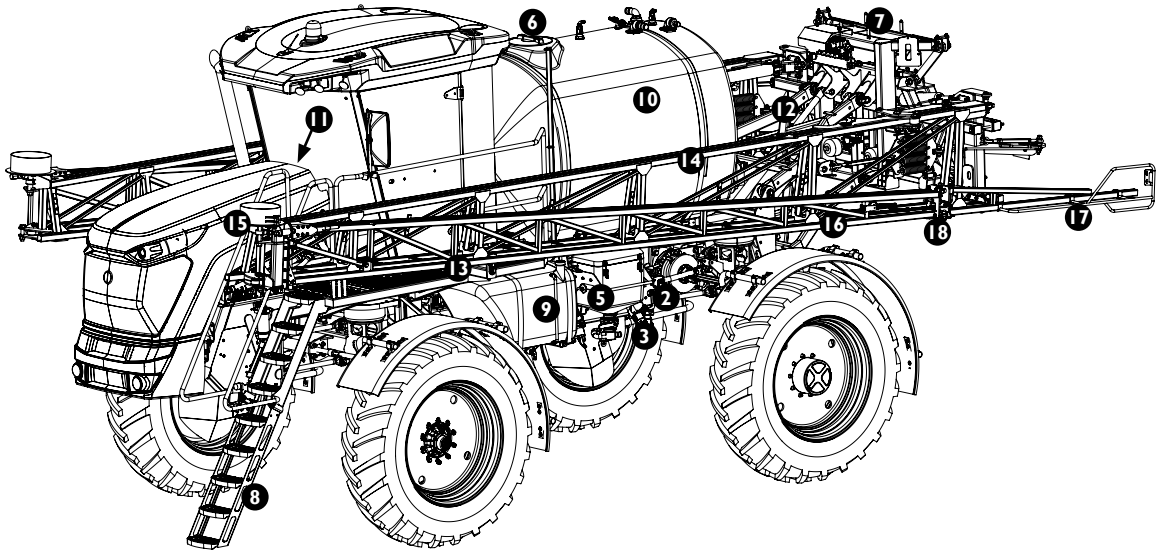
5. Depress and volume or area key to exit this function and return to the operational screen

Note: That if either tier value is set to zero then the boom valves will not open.

Chapter 8

OPERATION

Machine Key Features



Number	Feature	Number	Feature
1.	Diaphragm Pump (on right side)	10.	Main Tank
2.	EZ Control	11.	Pressure Gauges (view from inside cab)
3.	Fill Point	12.	Boom Para Lift
4.	Hand Wash Tank (on right side)	13.	Boom Rest
5.	Induction Hopper	14.	Boom Inner Wing
6.	Main Tank Lid	15.	Boom Cable Drum
7.	Flow Meter	16.	Boom Outer Wing
8.	Access Steps	17.	Boom Tip
9.	Flush Water Tank	18.	3-D Breakaway

EZ Control

Number	Feature	Number	Feature
1.	Main Suction Control	8.	Spray Pump (Switch)
2.	Manifold Pressure gauge	9.	Fill Pump (Switch)(Optional)
3.	Vortex Induction Hopper	10.	RPM Raise (Switch)
4.	Chemical Probe Venturi	11.	POD Light (Switch)(Optional)
5.	Main Tank Agitation	12.	Bypass
6.	Rinse Tank Fill	13.	Fresh Water Cam Lock
7.	Main Tank Rinse	14.	Chemical Probe Venturi Cam Lock

EZ Control Key Functions

External water delivery functions. *These functions are only available when external water is being pumped into the system.*	**Use**
Main tank fill	Used to direct external water delivery, coming from quick fill, to main tank. When main tank fill is ON the other functions of the external water delivery station can be used, however they will not be under pressure as only a small amount of flow will be directed to the external water delivery station.
Main tank rinse (external water source)	Turning on this function allows the use of the tank rinse nozzles with larger quantities of fresh water making it useful for a more thorough flushing/decontamination.
Rinse tank fill	Used to fill the rinse water tank.

Pressure delivery *These functions only available when the main spray pump is operating - pressuring the system.*	
Vortex induction hopper	Turn ON to use vortex induction hopper
Chemical probe Venturi	Turn ON to use chemical probe
Main tank agitator	Turn ON to activate main tank agitator
Bypass	Turn ON bypass when in spray mode
Pressure regulator	The pressure regulator allows the operator to set the relief pressure of the pressure manifold (max 110-130 psi) All other taps must be off.
Manifold pressure gauge	Indicates the manifold pressure

Arm Rest Controls

BOOM FOLD IN by pressing and holding the momentary switch, this will fold the left and right booms in at the same time. The switch must be held until the booms contact the boom rest uppers. Holding the switch for an extra 20-30 seconds phases the fold cylinders. If Bi-fold is fitted the boom outers must first be folded. The boom must be at full height before folding. Stopping while the booms are folding will stress the boom.

BOOM FOLD OUT by pressing and holding the momentary switch, this will fold the left and right booms out at the same time to a working position. The switch must be held until the booms fold all the way out and come to a stop, holding the switch for an extra 20-30 seconds phases the fold cylinders. If Bi-fold is fitted the booms must be folded out before BiFolding the outers. The boom must be at full height before folding

BI-FOLD IN by pressing and holding the momentary switch, this will fold the booms outers in and saddle them onto the inner booms. The switch must not be released until the booms are folded all the way in or boom stress can occur. This function must be activated before the inner booms are folded.

BI-FOLD OUT by pressing and holding the momentary switch, this will fold the booms outers out in to the working position. The switch must not be released until the booms are folded all the way out or boom stress can occur. When the booms are all the way out hold the switch down until the bi-fold pressure gauges read 1500-1700 psi. This pressure maintains boom alignment while moving. This function must only be activated once the inner booms have been unfolded.

FENCE LINE JETS "R" by pressing the on /off/ on switch at the top the fence line nozzles on the right hand end of the boom are activated. This switch will remain in the on position until it is centred by the operator to OFF.

FENCE LINE JETS "L" by pressing the on /off/ on switch at the bottom the fence line nozzles on the left hand end of the boom are activated. This switch will remain in the on position until it is centred by the operator to OFF.

SPRAY PUMP ON/OFF by pressing the top of the switch activates the product pump. The pump will remain operating until the switch is returned to the SPRAY PUMP OFF location.

TILT LEFT UP/DOWN This raises and lowers the left hand side boom only, when the tilt function is fitted to the sprayer. When the switch is released it returns to neutral centre. When ultra glide is connected to the sprayer the left side will be disabled from automatic mode when this switch is activated in this direction.

TILT RIGHT UP/DOWN This raises and lowers the right hand side boom only, when the tilt function is fitted to the sprayer. When the switch is released it returns to neutral centre. When ultra glide is connected to the sprayer the right side will be disabled from automatic mode when this switch is activated in this direction.

BOOM UP/DOWN Pushing the switch at the top will activate the boom raise circuit. Releasing the switch will return the switch to the neutral, centre position. Pushing the bottom of the switch will lower the boom until the lower height switch, which is mounted on the parallelogram, is tripped. When the switch is released it returns to neutral, centre position.

BOOM RECIRC ON/OFF by pressing the switch to the on position allows an agitated chemical mix to be run through the boom lines prior to spraying - pre-charging them and eliminating waste. It takes approx 1 minute to flush 60L through the boom lines. The boom recirc must be in the OFF position to begin spraying.

RPM Raise: Pressing this button will raise the engine

revs to 1500 RPM. The cruise control +- can still alter the engine RPM idle while this button is depressed. Pushing the button again will return the engine to idle. Before pressing the RPM Raise, ensure that Cruise Control is turned OFF.

Note: The transmission will not engage any gear if the engine speed is over 900 RPM.

DIFF LOCK ON/OFF by pressing the switch forward, this will engage the diff lock. The Diff Lock should only be used when needed and never to be left engaged for long periods. For use in poor ground conditions, do not engage during wheel spin, and disengaged when not needed, not to be used at road speed. The Diff Lock needs to be disengaged when cornering as it will put more load on the tyres and driveline.

FIELD MODE / ROAD MODE by pressing this switch forward it will engage the field mode in which the highest gear that can be obtained is 4th. Pressing the bottom of the switch, will engage road mode and over drive will be able to be selected by the transmission.

Cruise control

CRUISE ON / OFF this on / off switch activates the cruise control circuit.

CRUISE ON When the switch is in this position the cruise control can be set, resume, increased or decreased by using the switch CRUISE RESUME(+) / SET(-). To disable cruise control this switch can be cycled to the off position or the foot brake can be engaged.

CRUISE OFF When it is pressed down to this position the cruise control is OFF. The switch will remain in this position until the operator moves to another position. When the switch is in this position the cruise control CAN NOT be set, resume, increased or decreased.

SET(-) when the momentary switch is depressed the ground speed that is currently maintained will be set as the cruise control speed. The CRUISE ON switch must be depressed for this to engage and the foot brake must be released. Once cruise control is set pressing this button will increase ground speed. To disable cruise control the Cruise OFF switch can be cycled or the foot brake can be engaged.

CRUISE RESUME(+) when the momentary switch is depressed the cruise control will resume the ground speed that was previously set before the system was disabled by the foot brake. The cruise switch must be in the ON position for this to engage and the foot brake must be released. If the engine ignition has been cycled a new cruise speed will have to be set. Once the cruise speed is engaged pressing this switch will decrease the ground speed. To disable cruise control the Cruise OFF switch can be cycled or the foot brake can be engaged.

CRUISE RESUME(+)/SET(-) This switch also can be used to set a higher idle speed. When cruise is not engaged pressing Cruise Resume + will increase the idle speed above the set idle of the electronic control module (ECM). Set - will bring the RPM down to the set idle of the ECM.

Raven SCS4400 (Standard)

The Raven SCS 4400 Auto Section Controller
Multiable product capability with 7 boom switches.
Rate bump feature.
Low-limit function.
Digital boom pressure read-out.
Self test function.

For more information please see your Raven Operation Manual.

ISOBUS - Raven Sprayer Control (Optional)

The Raven ISOBUS single product control node is designed to add liquid speed compensated product control capabilities plus 3TS, UltraGlide, DCI and pump rpm information to ISOBUS virtual terminals.

Raven ISOBUS product control node will allow a machine operator to monitor and control a Raven product control system directly from a virtual terminal (VT) screen. A VT screen removes the need for multiple screens as the implements computer communicates directly with the Virtual terminal, telling it what it is connected to and what information to display to the operator.

This is useful when the steering controller has VT capabilities such as the John Deere 2630, Trimble FMX 1000, Case Pro 700 or Ag leader VT displays.

Check with supplier of console to determine if an unlock code is required for additional features such as Auto section control as an unlock code may be required. ISOBUS is an international standard communication system which links tractors and implements together, enabling data to be transferred quickly and simply.

The name ISOBUS is derived from 'CAN-BUS', which is the system by which electronic devices talk to each other.

The ISOBUS system is optional with a programmable 6 section switch box. Each section switch can be setup to control multiple boom sections. This box mounts to the VT for easy operation

A pressure transducer is fitted as standard to provide the operator with the current spray pressure in the cabin. The controller Foot switch for master on/off is fitted next to LHS foot rest. The operation of this can be turned on and off via the switch box.

Before using the ISOBUS system the following calibration values are required to accurately control product application:

ISOBUS with Raven

- Total Width of Implement
- Number of Sections and Section Widths
- Control Type
- Meter Cal or Spreader Constant and Product Density
- Valve Type and Cal
- Rate Cal

The Raven ISO Bus product node is mounted to the right hand chassis rail under the cabin.

Please see the Raven ISOBUS operators manual for further information on calibration and setup.

Transmission

The operator must wear the "Operator Safety Belt" at all times when seated in the cabin or when the machine is in motion. To engage a gear, first apply the foot service brake located on the right of the console, release the park brake, push the lock button on the gear selector inward and move the gear selector to the desired position.

R	Reverse
N	Neutral, the gear selector must be in this position for ignition.
OD	Over drive, in this position all the forward gears are available and will be selected by the electronic control module (ECM) when required. The over drive disable switch can be used to lock out Over Drive.
D	Drive, in this position 1st- 3rd gears are available and will be selected by the ECM when required. Overdrive gear not be engaged.
2	In this position 1st and 2nd gears are available and will be selected by the ECM when required. 2nd gear is the highest gear obtained.
1	In this position 1st gear is the highest gear that can be obtained.

When the lever is in the OD position and the switch is in FIELD MODE, the highest gear that can be obtained is 4th. When the switch is in position for ROAD MODE, over drive will be able to be selected by the transmission.

Once the desired gear is selected release the foot service brake. If OD is selected the transmission electric control module will select the required gear as the engine revs are increased.

If the gear selector is moved to D while the park brake is still engaged, no gear will be engaged by the transmission. The gear selector needs to be moved back into N then the park brake released and then a gear can be selected.

Note: The transmission must be in neutral before pressing RPM raise and Cruise Control must be off.

Note: The transmission will not engage any gear if the engine is over 900 RPM.

Spray Mode / Road Mode

Diff Lock ON / OFF

Filling

When filling the sprayer it is necessary to connect to an external water source.

The main tank should always be filled through the quick fill. This line fills through the top of the tank and then through a hose inside the tank so that the water is deposited in the centre of the tank. Water can then be pumped into the system from an external pump, or via a hydraulically driven fill pump mounted on the sprayer (for hydraulic fill pump information refer to chapter at the rear of this manual). If a fill flow meter has been fitted, refer to the operation chapter at the rear of this manual for further information.

The following steps should be used as a guide to filling the machine:

WARNING: Water weighs 1kg per litre. Conversion factors must be used when spraying liquids that are heavier than water. The total weight of the liquid being sprayed should not exceed the equivalent weight of a full tank of water. Exceeding this weight, can lead to sprayer damage.
ie: Liquid nitrogen has a density of 1.28kg per litre. Tank size is 6000L

4000L / 1.28kg = 3125L

This means that the total volume of liquid Nitrogen allowed in a 4000L tank is 3125L.

This rule applies for all tanks sizes. If unsure about the density/weight of the chemicals being applied, contact your agronomist or chemical supplier.

Main Tank Fill:

1. Connect the fill hose (not supplied) to the quick fill cam lock coupling.
2. Make sure that the "main tank fill" handle on the side of the EZ control is in the OFF position (so that there can be no flow coming out of the tank if it is not already empty) & that other fill functions are OFF.
3. Turn the fresh water pumping system on (make sure the pressure does not exceed 75psi, to protect plumbing components)
4. Turn "main tank fill" handle on the side of the EZ control to ON. The main tank should now be filling.
5. When the required amount of water has been transferred into the main tank, stop the flow by turning the "main tank fill" to OFF.

EZ Control

External Water Delivery Station:

The external water delivery station allows several filling functions of the sprayer to be performed simultaneously.

1. With fresh water coming into the system as per "Main tank fill" instructions, ensure that all flip valves, including the "main tank fill" ball valve, on the external water delivery station are turned to OFF.
2. Turn the desired function ON by selecting the appropriate flip valve as labelled.
3. When the required amount of water has been transferred, turn the appropriate valve to OFF.
4. When all functions have been performed, turn the fresh water pumping system OFF.

Adding Chemical To The Main Tank:
Where chemical induction equipment (chemical probe, induction hopper) has been fitted, please refer to the instructions on operating this equipment at the rear of this manual.

Rinse Water Tank Fill:

The standard size rinse water tank holds approximately 300 litres.

To fill the rinse water tank from the fresh water supply via the quick-fill and fill station:

1. Start by ensuring that all flip valves on the fill station are turned off.
2. Connect the fresh water fill hose to the quick-fill coupling.
3. The tank lid may need to be loosened to help air escape.
4. Operate the fresh water pumping system. (Make sure pressure does not exceed 75psi)
5. Flip the rinse water tank fill valve. (There should now be flow transferring to the rinse water tank)

6. When the required amount of water has been transferred to the rinse water tank, shut the rinse water tank fill valve and stop the flow by turning off the external water supply.

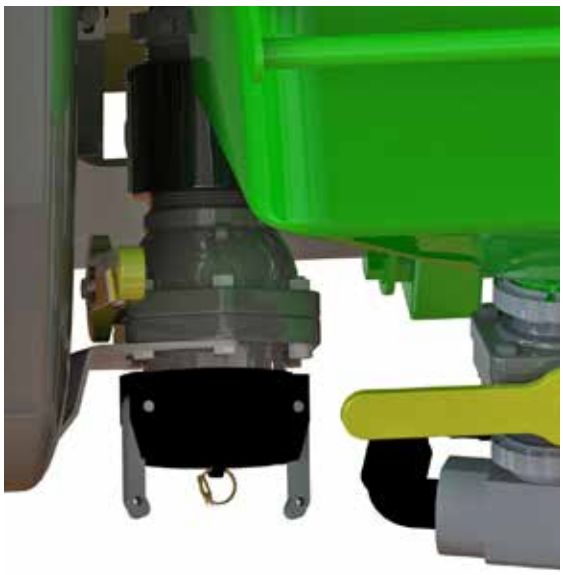
7. Tighten tank lid.

3" Fill Points

There is two options for the 3" Remote Fill Points. One is located on the front right hand side of the chassis just in front of the front axle. The other is located on the left hand side of the chassis and is mounted beside the fresh water rinse tank.

These fill points go straight into the main tank, bypassing the control POD, in doing so, the tank rinse and or rinse tank filling can not be operated when filling from these points.

The fill times are faster and can also be remote filled from a Goldacres BatchMate unit with pre-mixed chemical straight into the main tank.



Agitation

To achieve satisfactory agitation, the following guidelines are recommended.

1. Add 20 percent of the tank volume of fresh water to the main tank.
2. Add all chemicals.
3. Add the remaining quantity of water required.
4. Turn the agitator on with the pump at operating speed. (may need RPM Raise ON)

Note: Check to ensure that the Supermix agitator is working (there should be a visible circulation of water near the rear of the tank near the agitator).

5. If the tank has been filled and the spray mixture has been allowed to settle, agitate for as long as it takes the pump to pump the quantity of water in the tank. For example: with 4000 litres in the tank with a 260l/min pump agitate for 4000/260 = 16 minutes.

To agitate while spraying: Have the bypass ball valve and agitator flip valves OPEN.

Note: The bypass ball valve must be open while spraying.

Spray Application

After completing the filling process, you are now ready to start spraying. While travelling from the fill station to the field, the pump should be running at 400 - 540 rpm with the agitator running in order to ensure that the chemical mix is adequately agitated prior to spraying.

Note: The following information is provided as a guide only. It is the responsibility of the operator to assess the conditions in the field where the spray application is taking place

Note: The main pressure station ball valve must be in the bypass (spray mode) position.

1. Enter the field, unfold boom and set the boom to desired height above the target and have pump running.
2. Switch on the console and set to run in self test mode (while stationary). Information on running in self test mode can be found in the spray controller operators manual supplied.
3. Turn on all boom sections
4. Purge all boom lines with product from the main tank. (If RapidFlow is fitted, then switch on for approx 2 minutes)
5. Switch off all boom sections.
6. Commence travel on primary swath and engage boom master switch. Auto rate controller will now control application based on the calibration information entered by the operator.
7. To avoid overlap it is recommended that individual boom section switches are used to turn on/off sections as needed.
8. When you have completed the task at hand, please follow the flushing instructions to ensure that all plumbing is flushed.

Flushing

The following information is provided as a general guide for flushing your sprayer following a spray application.

For more specific information regarding flushing, and decontamination, specific to the products that you are applying, it is recommended that you consult the chemical label or your chemical supplier.

To use the flush water tank to flush pump & boom only:

1. Turn pump off
2. Turn 3 way ball valve to draw from flush water tank rather than main product tank.
3. Set spray controller console into manual mode.
4. Switch all boom sections to ON
5. Hold increase button for 15-20 secs. This will ensure that fast close valve is fully open to direct all flow to booms (This will eliminate bypass from the booms to main tank).
6. Turn pump ON. The pump will now draw water from the flush water tank and direct all flow to the booms.
7. Keep boom switches on until the contents of the flush water tank has been run through the booms.

Note: If the pressure gauge increases dramatically, hold decrease to reduce.

Note: To rinse out a system with RapidFlow go to Chapter 12 - RapidFlow

This will allow rinse water back into the main spray tank.

To flush entire system (pump, boom & tank):

1. Drain the main tank.
2. Connect to external water source (to provide fresh water supply).
3. Turn main tank fill tap OFF to direct external water supply to the fill manifold under pressure.
4. Engage tank rinse nozzles with the flip valve on EZ control (if fitted) and allow rinsate to drain out through the main tank drain.
6. Add a quantity of fresh water (a minimum of approximately twice the pumps capacity) to the rinse water tank (as per instructions under filling).
7. Turn on pump with agitator and bypass open to allow fresh water to circulate.
8. Turn off all taps to allow the pressure relief valve to blow off and purge the "relief to tank" line.
9. Operate induction equipment (if fitted), with a quantity of fresh water in order to flush venturi system. If fitted lower the induction hopper and open drain valve while the agitation jet is running.
10. Now follow the instructions for boom flushing as above - keep ball valve drawing from rinse water tank.

Removing Suction Filter

Always wear the recommended personal protective equipment and use caution while working with chemicals.

To remove the suction filter bowl, follow the steps below. A quantity of fresh water will need to be in the flush water tank.

1. Ensure Main Suction tap is in the OFF position.
2. Loosen the nut holding the filter bowl, only undo it halfway. Take care as some chemical may dribble out.
3. Stand clear of the filter and turn the 3 way suction tap to fresh water for 2 seconds, then turn the valve off again. Allow the chemical in the filter to dribble out. Be sure to catch any chemical coming out in a suitable container.
4. Once chemical has stopped coming out of the filter, unscrew the nut fully to remove the filter bowl. Be careful when removing the bowl as there may still be some chemical in it.
5. Clean the screen and the o'rings, then refit and ensure that o'rings are in place.

Decontamination

Decontamination of your spraying equipment is important when changing chemicals or application methods.
Information specific to your circumstances, the spraying equipment being used and the chemicals being applied should be provided by your agronomist or chemical supplier.
Always wear the recommended personal protective equipment and use caution while working with chemicals.

Basic decontamination;

1. Fill the main spray tank with approx 1000L of fresh water.

2. Lower the induction hopper and put the appropriate amount of decontaminating agent into it.

3. Turn on the agitation jet on the hopper and allow it to fill the hopper to the top. Once full, turn the jet off and leave the hopper to sit for a few minutes. This is to ensure that the decontaminating agent fully neutralises any of the chemicals that were in the hopper.

4. Use the venturi to induct the contents of the hopper into the main spray tank.

5. Turn off all taps to allow the pressure relief valve to blow off and purge the "relief to tank" line.

6. Operate induction equipment (if fitted), with a quantity of fresh water in order to flush venturi system.

7. Once complete, drain chemical induction hopper delivery hose externally.

Note: Lower the hopper and open the lid to allow it to drain completely

8. Open the boom section drain valves and empty the contents of the main tank through the boom.

DO NOT open the boom section drain valves while there is pressure in the boom lines.

9. Once the main tank has emptied, flush the system again using fresh water to ensure the decontaminating agent is removed from the system.

10. Once the main tank is empty, the hose between the tank and the 3 way suction valve also needs to be drained. The valve is located on the EZ Control. Turn the 3 way valve off.

11. Remove the filter bowl. As per filter removal instructions.

12. Turn 3 way valve to main chemical tank. Stand clear of the filter when turning the valve to main chemical tank as chemical will be coming out. Catch all of the chemical in a suitable container so it can be disposed of in the correct manner.

End of day

At the end of the spraying day: Follow the flushing and decontamination procedure as per previous instructions.

1. Unfold the boom in an area convenient to dispose of residual chemical (an area where chemical can not run-off into above ground or sub surface water courses).

2. Clean all filters.

3. Clean all nozzles.

4. Wash down unit

5. Drain main tank

Note: Store the sprayer in a suitable location to prevent freezing. If the sprayer is to be left where freezing may occur, cover the pump and flow meter with a material bag and empty pump and flow meter of all water (run the pump dry for 15-20 seconds). It is also suggested that a small quantity of anti freeze be added to the main tank and circulated through the sprayer to minimise the chance of freezing.

Note: Make sure any ice has thawed before using sprayer.

End Spray of program

If the sprayer is to be stored for a long period of time without use, there are several tasks that need to be performed.

- Clean the sprayer thoroughly as described under 'End of Day' tasks.
- Carry out a thorough observation to determine if there is any damage to the sprayer.
- Park the sprayer in a position where it will not be affected by frosts, and preferably out of direct sunlight.
- Ensure the main tank and any other tanks fitted are empty.

If necessary, remove consoles from cabin and store in a safe and secure location. Protect hydraulic hoses and electrical connections.

Chapter 9

BOOM

General

All booms present a number of safety hazards due to their operation - the operator should read and fully understand the safety instructions in this manual prior to operation.

Goldacres TriTech (24-36M) and Delta (18-24M) booms have been designed and built to ensure many years of trouble free service. Aluminium outer boom sections reduce the overall weight of the boom and aid in providing a superior boom ride and longevity.

CAUTION: Goldacres do not endorse use of this machine for spraying at speeds greater than 20 km/hr.

CAUTION: Before adjusting the boom alignment, the hydraulic fold circuit must be free of air. Hydraulic circuits that contain air can make the boom appear that it is too far forward. Adjustment of the boom without "bleeding" the hydraulic circuit first will result in a boom that quickly reverts to hanging out of alignment to the back.

CAUTION: All chemicals have corrosive properties to some degree. Prevent damage to the machine by always consulting the chemical MSDS or the chemical supplier for advice concerning the corrosive properties of the chemical. It is the responsibility of the operator to carry out preventative and ongoing maintenance to the machine, particularly while applying chemicals with highly corrosive properties. Machine components should be coated with a suitable protectant prior to use, and then washed down, thoroughly, immediately after every application. Consult the supplier of the substance if you require specific advice about the effectiveness of any particular protectant to prevent premature degradation of machine components.

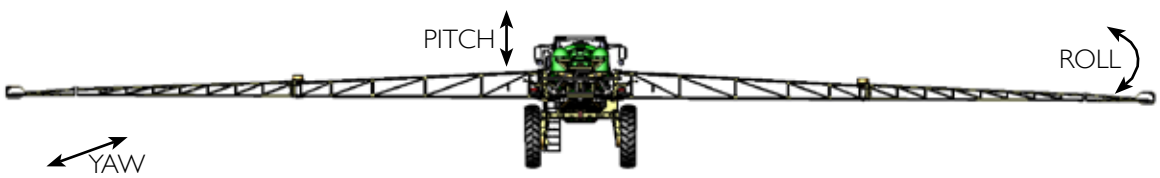
TriTech booms feature a unique (patented) boom suspension system.

This system provides suspension in three directions:

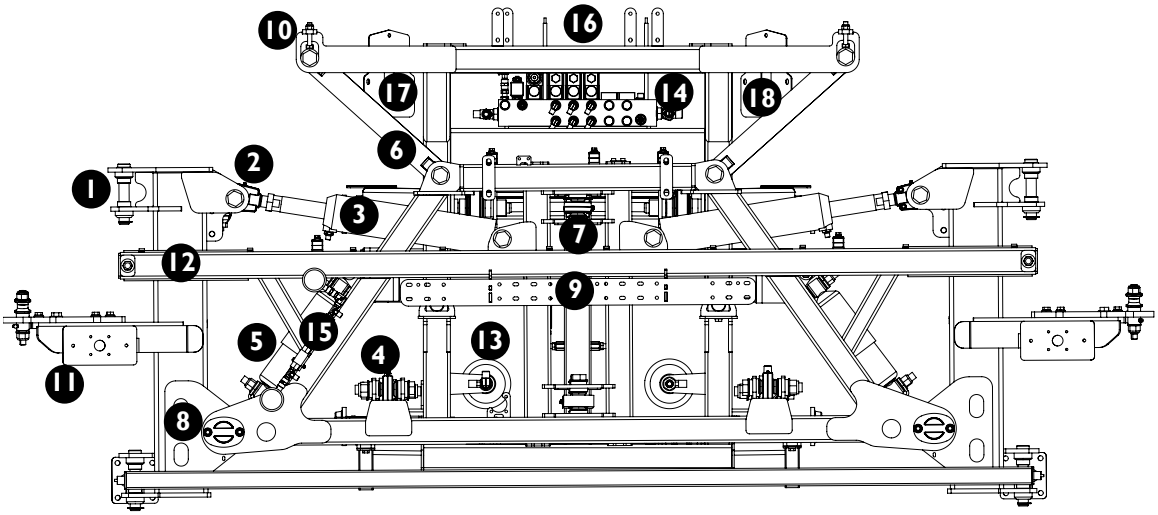
Pitch: Hydraulic cylinders and accumulators dampen the vertical boom movement encountered over rough ground conditions.

Roll: Shock absorbers help maintain constant boom height over sloping and uneven ground.

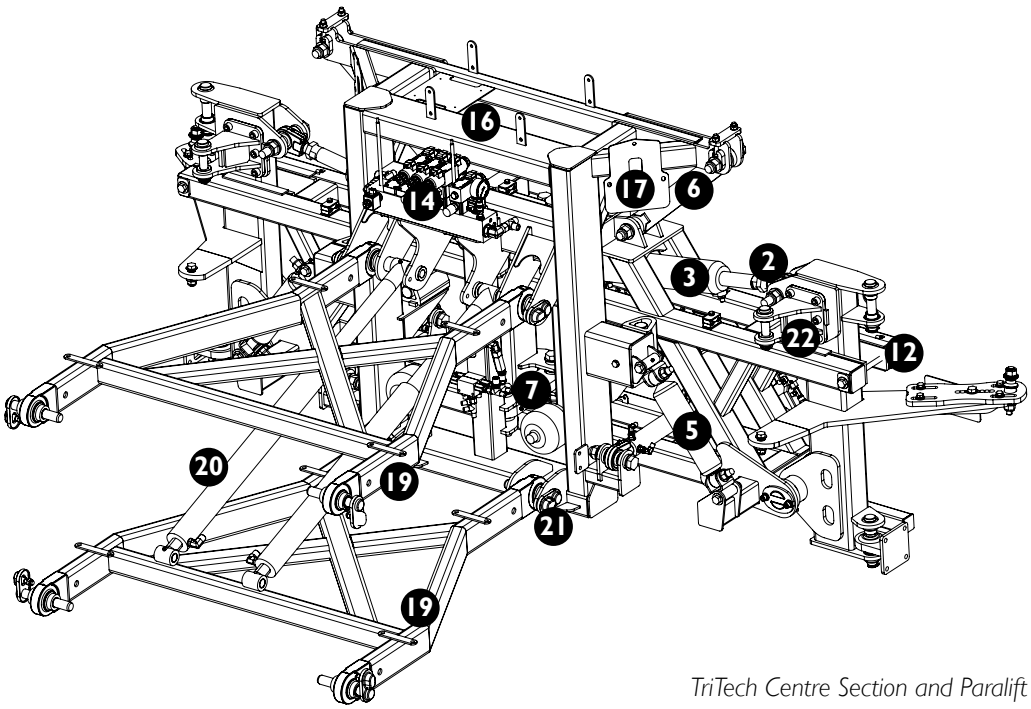
Yaw: Shock absorbers and springs, over come the erratic whipping movement, which creates undue stress on the boom frame and uneven spray application. (Hydraulic Yaw suspension is an option)



TriTech Boom Key Features

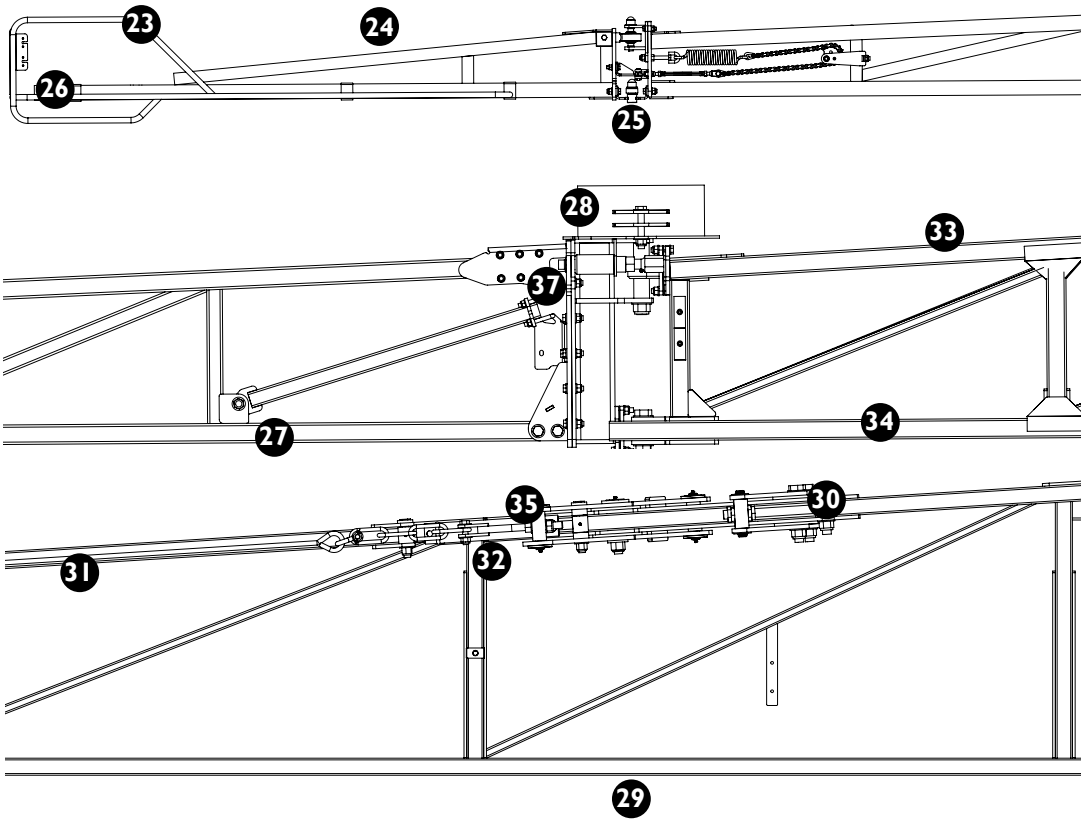


TriTech Centre Section



TriTech Centre Section and Paralift

Boom Key Features



Number	Feature
1	Boom rose end
2	Tilt arm adjuster
3	Tilt cylinder (option)
4	Yaw spring (or cylinder) mount
5	Roll shocker
6	Diagonal delta links
7	Lineal delta links
8	Tilt pin (60mm)
9	Boom section controls
10	Boom alignment adjuster
11	Tail light mounting plate
12	Tilt arm wear strips
13	Hydraulic yaw accumulators (option)
14	Electric Over Hydraulic valves (option)
15	Hydraulic yaw controls
16	Flow meter
17	Accuboom node (option)
18	Autoboom node (option)
19	Paralift arms

Number	Feature
20	Lift cylinders
21	Boom lower limit switch
22	Bolt on fold cylinder mount
23	Boom end protector
24	Boom wing tip
25	3D breakaway
26	Fence line jet
27	Boom aluminium outer
28	Boom cable drum
29	Boom steel inner
30	Adjuster for fold ram
31	Boom cable
32	Hydraulic cylinder - for Bi-fold
33	Boom top chord (R.H.S)
34	Boom bottom chord (R.H.S)
35	Cable adjuster
36	Centre Leveling system
37	Boom stopper bolt

Boom Overview

Centre Section

The TriTech centre section is made up of two components, the paralift rear and the boom centre section. The two are held together by delta 4 links. These links allow the boom to be suspended in order to provide roll and yaw suspension.

Roll suspension is when the boom pitches up and down at the tips. Yaw suspension is when the boom moves fore and aft at the tips. If the boom did not feature yaw suspension there would be excessive stresses exerted on the booms and centre section when cornering or corrections of line are made. The yaw suspension allows the chassis of the sprayer to move left and right without any movement being transferred to the boom. The paralift rear will move with the centre of the sprayer but the boom centre section will remain static or level as it rotates around the delta links connecting it to the paralift rear.

The boom yaw is dampened by 2 large springs (1 each side) and 2 dampener shockers to limit the recoil of the yaw springs(optional is hydraulic yaw). These springs must be tensioned all the way. If the springs are not tensioned correctly the boom will be able to yaw excessively and the springs may be damaged. If a spring is damaged, both opposing springs must be replaced at the same time.

The overall yaw travel is limited by rubber bumpers mounted to the paralift rear. If the boom centre section yaws excessively the centre section will contact these and cushion the travel by collapsing the block. If the block collapses totally the yaw travel will be stopped. If the boom is continually yawed excessively this block will wear out and require replacement.

As an option, a hydraulic yaw system may be fitted, each hydraulic cylinder has a nitrogen charged accumulator which also assists in lessening the amount the boom yaw.

Hydraulic Raise and Lower

The paralift enables the boom to be raised and lowered to maintain a consistent boom height above the target.

The Crop Cruiser features a paralift rear which uses two hydraulic cylinders to perform the lift, while also acting as a component providing the vertical suspension. Each hydraulic cylinder has a nitrogen charged accumulator which also assists in improving the boom ride. The "boom limit" height switch allows the operator to adjust the minimum ride height of the boom.

The hydraulic lift also enables the boom to be raised prior to folding and then used to lower the boom onto the boom rests.

Hydraulic Fold

The Crop Cruiser booms have a hydraulic fold feature, allows the boom to opened and closed from within the cabin.

Hydraulic phasing cylinders are used in the folding operation of the boom. This ensures that both sides of the boom are synchronised and open and close together so that the weight distribution is the same for both sides of the boom.

As hydraulic fluid enters one hydraulic cylinder, it acts upon the first ram and causes it to move. This motion results in an amount of fluid entering the second hydraulic cylinder which causes it to move an equivalent distance. There is also a flow restrictor for each cylinder so that the hydraulic fluid will enter and leave the respective cylinders at a controlled rate. This has the effect of slowing down the rate of fluid transfer and thus causes the boom to open and close more slowly - protecting the boom from damage. If the phasing cylinders do not fold together, information on re-phasing the rams can be found in the 'Troubleshooting' chapter.

Boom Balance

The Crop Cruiser boom suspension system causes the boom to adopt the same plane as the spray tanker. If one side is heavier than the other, the boom will tend to hang lower on the heavy side, so both sides need to be balanced for the boom ends to be of the same height.

To achieve this, a boom drum weight can be included on the boom and placed strategically so that it compensates and balances the boom. The boom drum can have more weight added and/or be moved to balance the boom correctly.

Before adding any boom weights, it is advised that the boom is adjusted correctly. As per the

instructions following in this chapter.

Boom Cables

Boom cables are a critical part of the Crop Cruiser booms and it is important to ensure that boom cables are correctly adjusted prior to operation.

Loose boom cables can cause boom damage by allowing the outer boom section to hang out of alignment or to 'break away' too easily. This can shorten the sprayers life by placing unnecessary stresses on the boom, lift and chassis.

The cable tension can be checked by inspecting the cable springs, Further information on boom adjustment and alignment can be found later in this chapter.

Boom Valves

Motorised boom valves are fitted as standard and are mounted on the boom centre section at the rear of the sprayer. Motorised boom valves feature a 12 volt motor that opens or closes a stainless steel plunger and thus opening or closing flow to the boom sections as required.

In the event of a valve failure, unscrew the top cap of valve then check that the fuse (3 amp) is ok.

Nozzles

The standard nozzle spacing on Goldacres booms is 500mm. Nozzles are mounted on brackets that are adjustable for different nozzle types. Nozzles are mounted so that they are protected from strikes should the boom make contact with the ground, obstructions or crop.

As information regarding nozzles is specific to those being used in your application, no specific reference is made to nozzle application rates or types in this operator's manual. Goldacres suggest the use of a current TeeJet or Lechler nozzle selection catalogue for reference to nozzle sizes, outputs, spray patterns and general spraying information. For more technical information on the function of spray nozzles and factors affecting their performance you can also use the TeeJet 'User's guide to spray nozzles'.

The TeeJet & Lechler nozzle selection catalogue and Users guides to spray nozzles are available from your Goldacres dealer, or as a free download from the TeeJet web site: www.teejet.com
Lechler web site: www.lechler.de

Three Dimensional Breakaway

TriTech booms feature the unique three dimensional breakaway hinge which allows the tip to "break" forward, backward and upward if an obstruction is hit. The 3D Breakaway hinge aims to eliminate any further damage to the remainder of the boom should an obstruction be hit.

It is important that the 3D Breakaway hinge is properly adjusted when in operation. Just tightening the spring will not help with the function of the breakaway. Instructions on how to properly adjust the breakaway can be found later in this chapter.

Boom Protection Brackets

Stainless steel boom protectors are fitted on the boom to protect the boom when resting on the boom rests for transport. It is important to ensure that the boom protection brackets are fitted correctly.

Boom End Protector

Boom end protectors are fitted to the breakaway tips to help prevent damage to the boom from ground strike or from hitting an obstruction. They also help to keep the boom from becoming entangled when spraying close to fence lines.

Boom Options

Fence Line Jets

Goldacres offer manually and electrically operated fence line jets. The 'fenceline' jet is designed to enable the operator to spray right up to the boundary fence without having the boom too close to the fence.

This should prevent operators from putting the boom into the fence, especially important when the boom is relatively new and the operator is not familiar with the width of the boom. The fenceline jet should be turned off after the end of the first lap and this can be done either manually via a tap or remotely via an optional electric solenoid (controlled in the cabin).

Hydraulic Yaw Suspension

(Optional on TriTech)
Hydraulic yaw suspension is designed to control the yaw movement of the boom centre section. In place of the conventional system, which uses 2 springs and 2 dampers, the hydraulic yaw option uses 2 hydraulic cylinders and nitrogen filled accumulators to centre and dampen the yaw movement.

The two hydraulic cylinders and accumulators are charged with hydraulic pressure and then closed off to create a separate circuit which acts as the yaw suspension.

For further information, refer to the hydraulic yaw suspension section in this chapter.

Bi-fold

(Optional on TriTech)

TriTech booms can incorporate a hydraulic bi-fold option which allows the boom outer sections to be folded in to make the entire boom smaller.

For example a 36 metre TriTech boom fitted with the bi-fold option would fold back into 18 metres swath width for easier spraying in tight situations.

A centre leveling system is fitted as standard on machines with bi-fold. The centre leveling system holds the centre section level with the sprayer chassis when fold or bi-fold functions are activated. This helps with the even folding of the wings.

See the section at the end of this chapter for information on adjusting booms fitted with bi-fold.

UltraGlide

(Optional on TriTech)

The Goldacres ultrasonic boom height levelling system allows you to spray more precisely by automatically adjusting the height of your boom as you travel across the paddock. The operator sets a desired height above the target

This means that you spend less time watching your booms and trying to prevent them from hitting the ground or crop. UltraGlide detects changes in target height and adjusts your boom accordingly.

The ultrasonic sensor detects the height of the target and adjusts the boom height with the hydraulic tilt cylinders to suit the preset height.

Further information on ultrasonic boom height levelling can be found in the 'Optional Accessories' chapter at the rear of this manual.

Hydraulic Boom Wing Tilts

TriTech and Delta booms can incorporate a hydraulic tilt option, which allows the individual boom sides to be raised independently when in the working position. This serves to provide greater variability of boom height control to compensate for undulating ground conditions. Boom tilts are operated from switches in the cabin.

Where hydraulic tilts are not fitted, a manually adjustable link is placed in substitute for the tilt cylinder.

Three Tier System (3TS)

Three Tier System (3TS) consists of two complete and totally separate boom lines on the same boom frame. As an example a conventional 30 metre boom has one boom line with 60 nozzle outlets (2 per metre) across its width. A 3TS boom replicates this first line with a second line also consisting of 60 nozzles giving a total of 120 nozzles for both lines.

In simple language, 3TS gives you the capacity to vary application rates and speeds by switching extra nozzles on and off.

3TS allows a range of speed changes without the spray quality being compromised – the correct droplet size is maintained.

Importantly you can use the nozzles you want to use - including air induction nozzles. That's higher speed spraying without the limitations of large droplet size.

Typically nozzles on the first line may flow at 015 flow rate and the nozzles on 3TS's second line at 025. When spraying, the first nozzles automatically switch off when they reach full operating pressure allowing the second line nozzles to commence spraying. As speed increases again and the second line nozzles reach their maximum operating pressure, the first line nozzles will switch on again.

Thus, the flow rates of 015, 025 and 040 can be achieved while maintaining the optimum droplet size and spraying pressure.

We could make it out to be more than that and charge an exorbitant price for it, but the reality is that 3TS delivers everything needed for precision application at variable speeds.

The 3TS system can be fitted to single boom lines, while a further option allows Goldacres' RapidFire air operated nozzles to be fitted which eliminates the need for boom valves.

RapidFire

The RapidFire system provides rapid, individual nozzle shut off that is controlled by air operated solenoids at each nozzle. This system replaces the boom valves and standard check valves that shut off the boom sections and nozzles. This provides greater flexibility in changing boom section widths and faster shut off at the nozzle.

The RapidFire system reduces the amount of plumbing on the sprayer and allows for the fitting of a boom recirculation system. The ability to have more boom sections also works perfectly in conjunction with autoboom shut off systems.

Boom Recirculation (RapidFlow)

In order to ensure that boom lines are charged and ready to spray, a standard sprayer plumbing system will require the boom lines to be purged with chemical mix prior to spraying. RapidFlow allows an agitated chemical mix to be run through the boom lines prior to spraying - pre-charging them and eliminating waste.

This option is included when RapidFire is fitted.

Boom Operation

Boom Operation Folding

The boom fold sequence is as below:

1. Starting with the boom in the working position, use the switch in cabin to raise the boom fully.
2. Use the switch to Tilt the wings down.
3. Use the switch to fold the boom completely in.
4. Lower the boom until the boom just touches the rests
5. Then continue to lower the boom a further 100mm so as to put sufficient weight onto the rests.
6. Finally, press the boom fold switch momentarily to fold the booms tight on the rest.

Note: Booms must not be folded, or unfolded, while the sprayer is moving. When the boom is between fully open and fully closed , there can be large stresses placed on many boom components. If the sprayer is moving and hits a bump, severe damage to the boom can occur.

Note: The booms must be folded continuously without stopping and starting during the sequence. Take care not to fold/unfold booms too fast, as damage can be caused.

CAUTION: Always check for power lines while folding and unfolding the boom, also when using wing tilts, as contact with lines can be fatal.

Un-folding

The boom unfold sequence is as below:

1. Raise the boom fully to clear the boom rests.

2. Use the switch in the cabin to unfold the boom so that the boom is aligned with the centre section.

3. Lower the boom to the desired height above the target.

Note: The booms must be folded continuously without stopping and starting during the sequence.

Note: To re-phase the fold cylinders, continue holding the boom out button once the boom has fully unfolded.

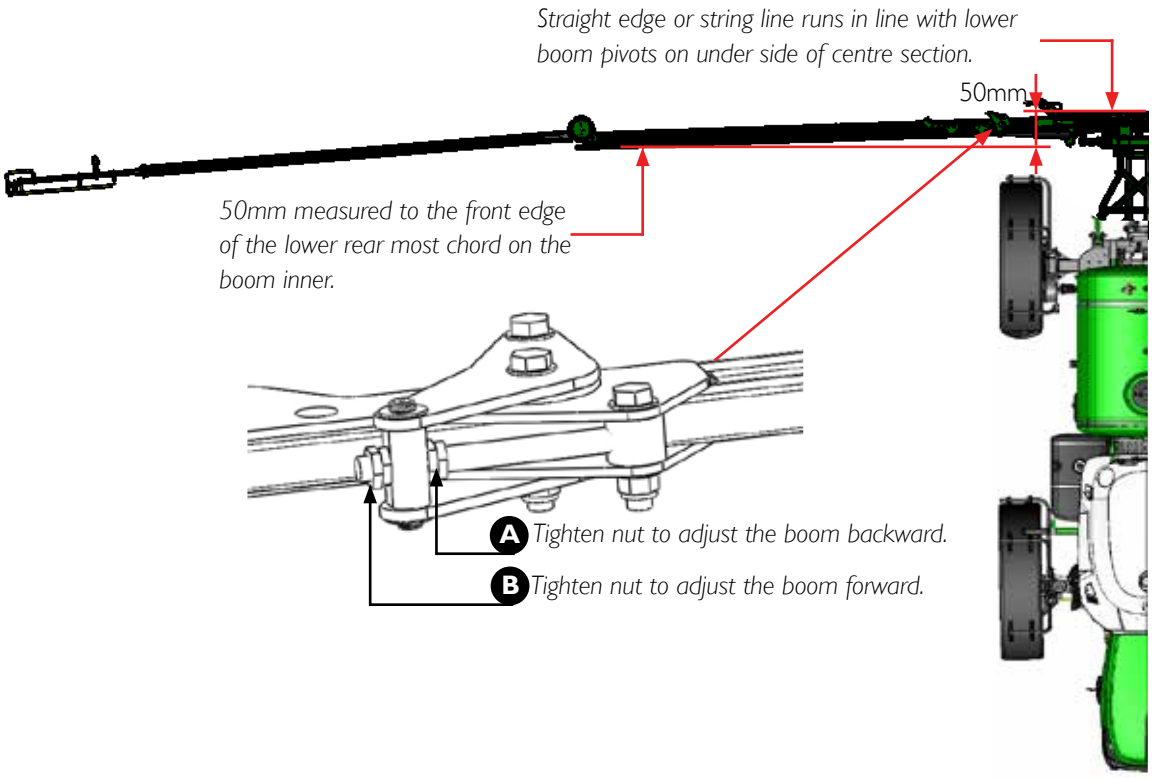
Boom adjustment

Inner Steel Boom Alignment - Working Position

1. Open the boom fully into the working position.
2. Continue to press the unfold button or hold the hydraulic remote open to ensure the fold cylinders are phased completely. They must be at the same length.
3. Look along the inner booms between the cable drums to assess the alignment.

   All booms must be 50mm forward of the centre section at the cable drums. A string line can also be used for measuring the lead of the inner boom (see below).
4. If adjustment is required, loosen the two lock-nuts on the boom fold adjuster bolt at the rear of the boom.
5. To adjust the boom forward, tighten the outer adjuster nut. To adjust the boom rearward, tighten the inner adjuster nut
6. When the boom is in the required position tighten both locknuts to hold in place.
7. Follow this process for both inner booms.

Note: It is important that both wings are adjusted the same. If one wing is adjusted further forward or back than the other, the boom may not sit level.



Outer Boom Wing Alignment - Working Position

1. When adjustment of the inner booms is complete the outer booms can now be aligned.

2. 24-30m TriTech booms must be 30-50mm and 33-36m booms must be 50mm forward of the inner booms. Use a string line to assist with achieving the correct measurements.

3. To align the outer booms, the cable adjusters and boom stopper bolt are used. To pull the outer boom forward, wind in the boom stopper bolt. The turnbuckle that is connected to the cable damper springs at the front of the boom must also be shortened to maintain cable tension. At the same time the rear turnbuckle must be lengthened.

4. To adjust the outer boom rearward, wind out the boom stopper bolt. The rear turnbuckle must be shortened and the turnbuckle at the front lengthened.

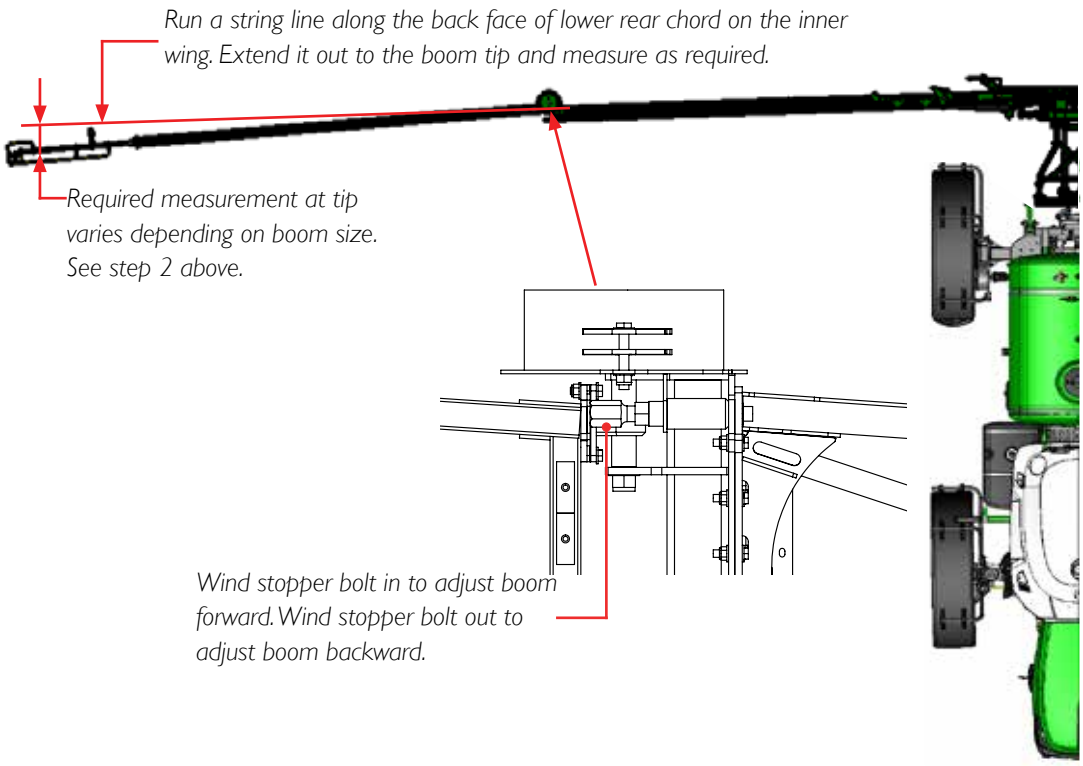
5. Once correct alignment has been achieved the cable spring tension must be set so there is a **3mm gap** between the coils.

Note: It is advised that all threads are lubricated prior to making adjustments.

Note: If cable adjustments run out on the turnbuckles, it is advised that you should contact your dealer and purchase new cables.

Note: It is important that both wings are adjusted the same. If one wing is adjusted further forward or back than the other, the boom may not sit level.

Note: The rear cable is used for folding only, and must not be tight when the boom is unfolded.

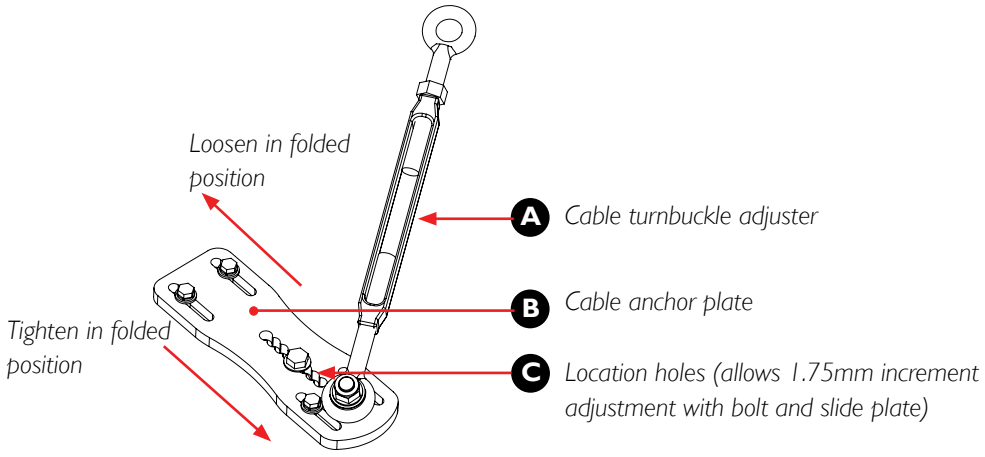


Outer Boom Wing Alignment - Folded Position

Alignment of Outer Aluminium Boom - Folded Position:

- The eyebolt cable adjuster aligns the outer boom arm in the working position; the adjustment plate is designed to adjust the outer boom arm in the folded position.
- The eyebolt adjuster will follow the same orientation as the boom when folding and unfolding. For example, when the boom is in the operating position the eyebolt adjuster should be horizontal in line with the boom. With the boom folded, the eyebolt adjuster should be pointing forward in a raised position, again following the line of the boom.
- Fold in the boom. If the outer boom arm does not come in all the way against the inner boom arm and contact the bump stop then the adjustment plate will need to be moved out. If the outer boom arm contacts the bump stop too early and places too much tension on the cable then the adjustment plate needs to be moved inwards.
- To adjust the plate the boom has to be in the working position. Have someone pull back on the outer boom arm to release the tension on the cable whilst you make adjustments to the plate. When adjustment is completed ensure the outer boom arm is released carefully so it does not spring forward dangerously. Re-adjust the cable eyebolt to realign the outer boom arm whilst still in the working position before folding the boom and re-checking the alignment in the folded position.
- Repeat the procedure if necessary until the outer boom arm assumes the correct alignment in both the working and folded positions. When this has been achieved install the bolts (C) and tighten.
- Spring tension may be altered slightly when this plate is moved. Check there is a 3mm gap in the spring coils and adjust if required.

Note: If the outer boom arm contacts the bump stop too early and too much tension is placed on the cable, then the hydraulic cylinder may fail to bring both arms all the way in, or damage the boom arms and cable.



TriTech Vertical Boom Alignment - Working Position

When the boom is in the working position, the inner and outer boom should be level or slightly increasing in height from the centre section to give a consistent and even spray application height. A new boom may be susceptible to stretching or sagging as the components are worn in. Several adjustment may be required in the first 12months of operation until the boom settles.

Inner Booms

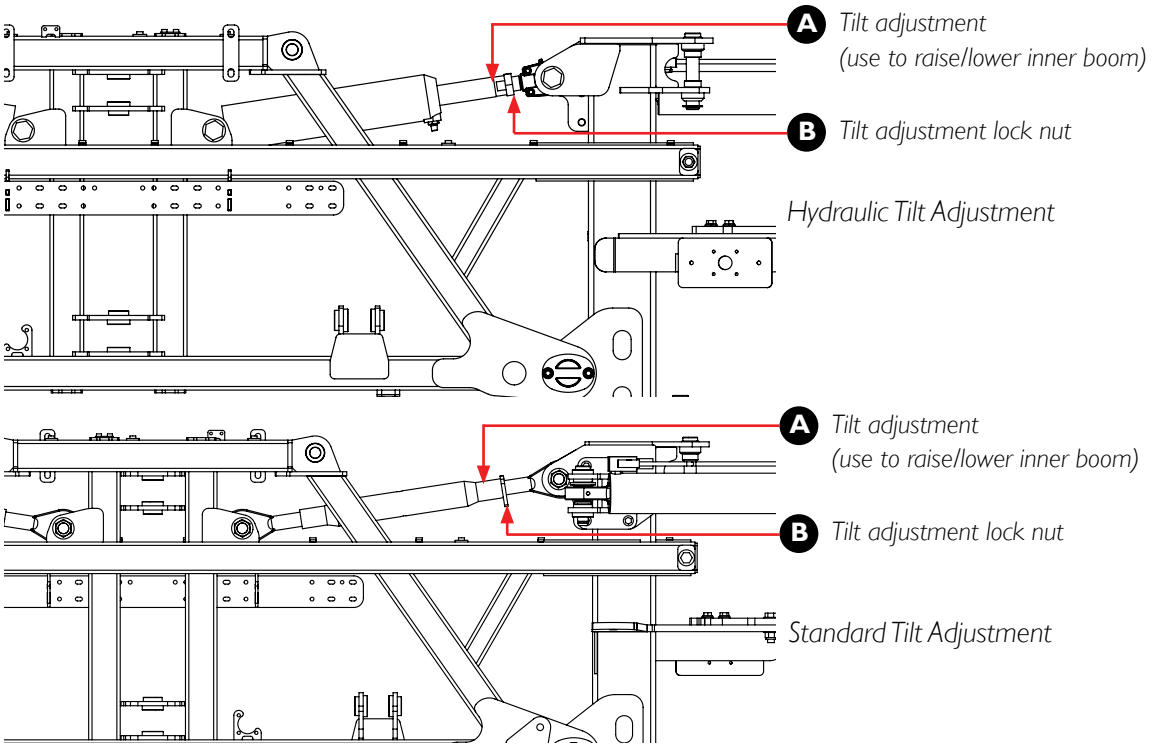
- The boom centre section must be level with the chassis before any boom adjustments are made. The centre of the centre section should line up with the centre of the paralift when look from the rear. This can be done by either shortening or lengthening the centre section adjuster bolt at the top delta links, or by adding weight discs to the cable drums.
- The inner booms must be adjusted first so they are the same height as the centre section or slightly increasing in height from the centre section (to allow for boom stretch) .These adjustments are made by lengthening or shortening the tilt adjusters on the tilt cylinder..
- To lengthen or shorten the tilt adjusters, the weight of both the booms will need to be supported.
- When any adjustments are completed. Ensure the lock nuts are tight.

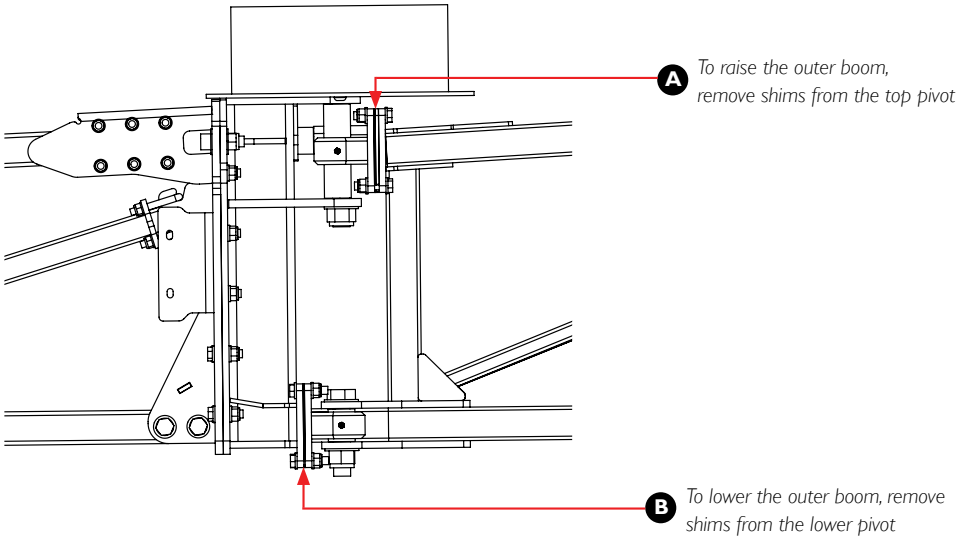
Outer Booms

- The height of the outer booms in the working position are adjusted by adding or removing shims at the cable drum.
- The cable drum mounts are assembled in manufacturing with 6-7 shims at the upper and lower bearing blocks.
- If the outer boom hangs lower than the inner boom, remove shims from the upper mount until the booms are level. If the outer boom is too high remove shims from the lower bearing block. Retension the retaining bolts to 65Nm when all adjustments are complete.
- The boom cables may need to be loosened to enable easier removal of the shims.

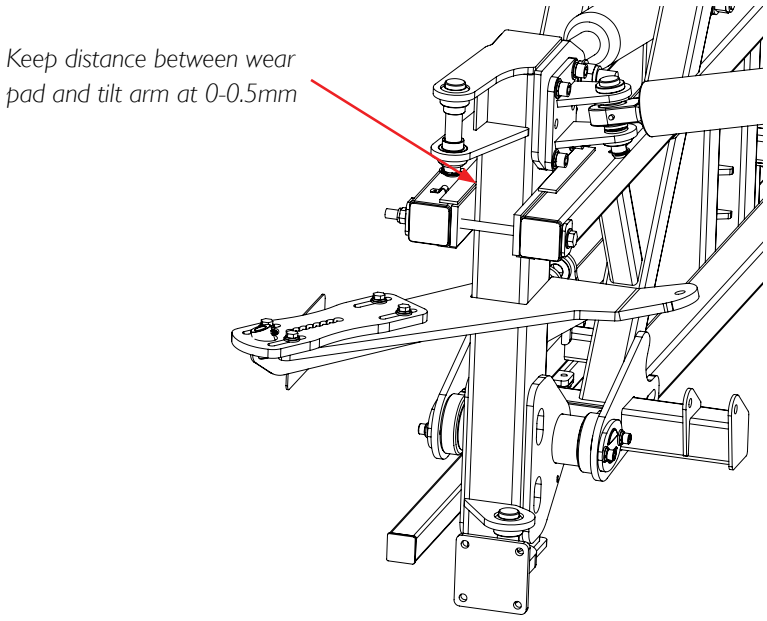
24-30m booms:
1 shim added = 10-20mm @ boom end

33-36m booms:
1 shim added = 20-30mm @ boom end





The tilt arm guide arms are fitted with wear strips. It is important that these strips are maintained and that the gap between them and the tilt arm is kept between 0-0.5mm either side. This ensures the tilt arm cannot twist, prolonging the life of the product.



Vertical Boom Alignment - Folded Position

When the booms are folded up in the transport position, the full weight of the booms must be supported by the inner boom. The outer aluminium boom may sit on the boom rest rubber but must not support any weight.

Inner Booms

- If the boom sits level in the working position but when folded up, one side is lower than the other, there is one adjustment that can be made.
- Shims can be placed at the bottom boom mount of the lowest boom - refer to diagram A. This will lift the boom in the open position.
- If the boom is not level in the working position, the most likely cause if this is an out of balance boom. Refer to previous boom adjust information.

Note: This process should not be required as once they are set in manufacturing, they should not change

When the booms are folded up in the transport position, the outer boom must saddle onto the inner boom. If this alignment of out the outer boom will not saddle correctly and will not be supported in transport.

The boom support saddle is bolted to the outer boom and when folded, couples to the inner boom. This saddle must slide onto the inner boom freely to prevent damage to the booms.

Note: This process will be require in the first 6 months of operation as the booms stretch an ware in.

Outer Booms

- If the outer boom hangs too low in the folded position shims must be added to the cable drum pivots. To raise the outer boom, add shims to both the upper and lower pivots. This adjusts the angle of the pivot axis causing the outer boom to fold up higher. By adding shims to both the upper and lower pivots, the outer boom height is not affected in the working position.
- To lower the outer boom in the folded position, remove shims from both the upper and lower pivots.
- 1 x 1mm shim at the upper and lower pivots equals approximately 15mm change in height.

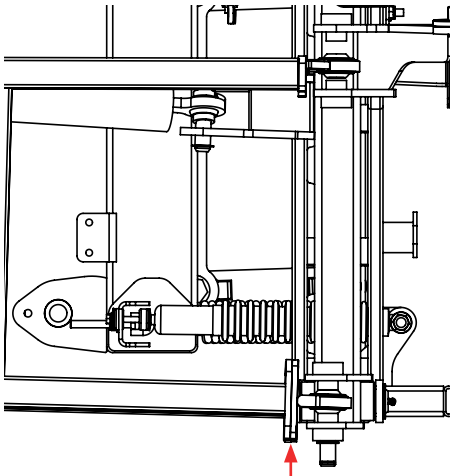


Diagram A

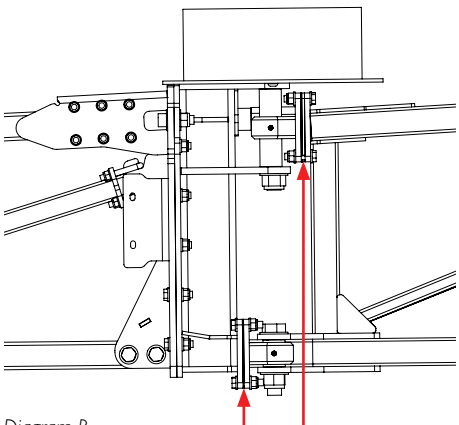


Diagram B

36m & 42m Aluminium Outer Boom

Initial Setup

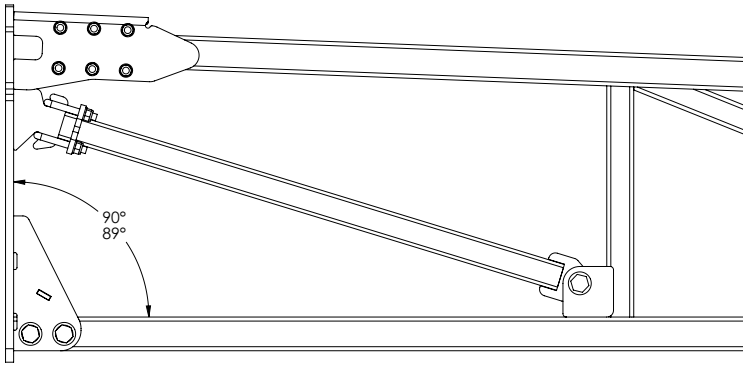
When the booms are fitted at the factory, they are made level or slightly increasing in height from the centre section. Under working conditions the aluminium outer booms will need to be checked at every 50 hour intervals as per the Maintenance Schedule.

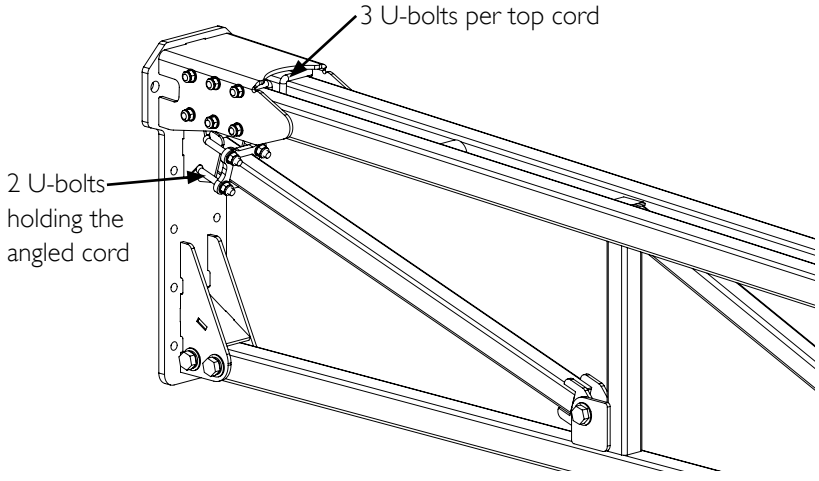
If the aluminium outer boom is not level in the working position, then a likely cause of this may be sagging or stretching.

Shims may need to be placed or removed at the cable drum bearing blocks to get the booms level. Refer to Vertical boom alignment - working position.

If the aluminium around the u-bolts shows any signs of movement, then the u-bolts will need to be tightened.

Ensure the boom is level in the working position, and that the end plate to cords are at 89-90 degree, then tighten all the u-bolts up to 30 ft/lbs.





Three Dimensional Breakaway - Delta & TriTech

Initial Setup

1. Open the boom fully into the working position and lower to a good working height.

2. Close the ball valves on the two hydraulic lift cylinders for safety purposes.

3. The lower pivot plates need to be in line with each other. (fig A)

4. If the rose end is removed for any reason, anti seize should be applied to the thread before it is screwed into the boom tip. The rose end should be screwed into the breakaway tip so that it measures 52mm from the boom tip face plate to the centre of the rose end (fig B).

5. The small hole in the sprocket must align with the hole in the side of the pivot plate. This is adjusted by tightening or loosening the turnbuckle (fig C). To adjust the turnbuckle;
   A) Pull the boom tip back until the large hole in the sprocket aligns with the hole in the pivot side plate, put a pin through the holes and release the tip.
   B) Make adjustments to turnbuckle.
   C) Pull tip back and remove the pin. Release the tip and check alignment of small hole in sprocket with pivot plate.
   D) Repeat steps A-C until the small hole in the sprocket and hole in the side plate align.

6. The spring tension must be adjusted so there is a 1-2mm gap between the coils. This applies the ideal amount of resistance when breaking away. The spring tension can be adjusted by tightening or loosening the eye bolt.

Maintenance

There are several things that need to be done to ensure that the breakaway will be functioning properly.

1. There are two main things that are critical to the breakaway functioning correctly. The small hole in the sprocket needs to align with the hole in the side of the pivot plate (see step 5) and the spring tension. Check these on a regular basis and adjust as required.

2. The spring will stretch over time and will loose tension. A spring is worn and should be replaced when there is no tension on the spring and it doesn't fully retract.

3. To ensure the smooth and longlasting operation of the breakaway mechanism, they must be lubricated on a regular basis. The sprocket pivot, chain and lower rose joints should be oiled with a wet lubricant every 8 hours. The upper rose joint should be greased every 8 hours.

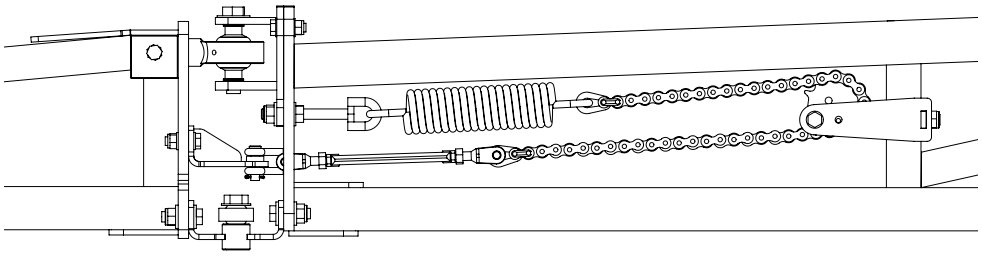


Figure A

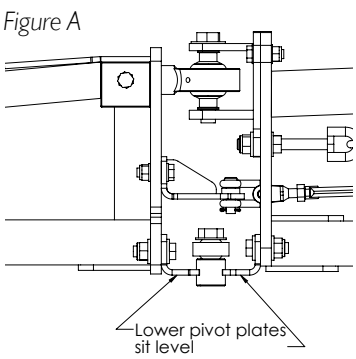


Figure B

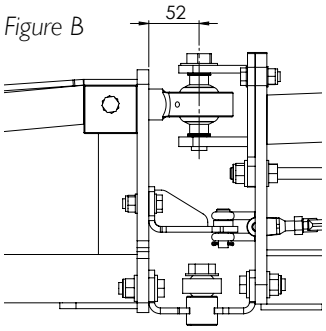
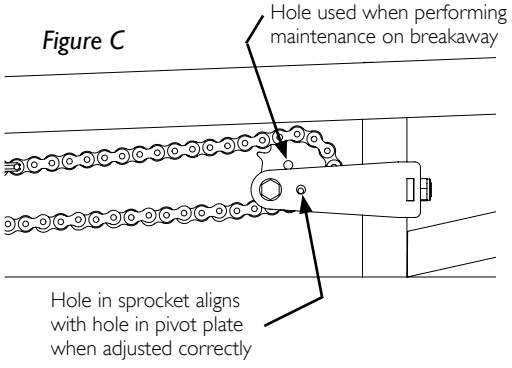


Figure C



Hydraulic Yaw Suspension - TriTech Only

About

Large booms, and booms fitted with Weedseeker sensors, may have hydraulic yaw suspension fitted. This is a system that replaces the yaw springs and dampers with hydraulic cylinders and nitrogen filled accumulators. This system maintains a more rigid ride in the centre section therefore limiting small variations in the yaw on heavier booms.

The hydraulic yaw system is a closed hydraulic circuit. The base of the right hand yaw cylinder is connected via hydraulic hoses to the rod end of the left hand cylinder with a nitrogen charged (70 bar) accumulator which is connected via a t-piece into the cross over hose. The base of the left hand cylinder is connected via hydraulic hose to the rod end of the right hand cylinder with a nitrogen charged (70 bar) accumulator which is connected via a t-piece into the cross over hose.

If the boom yaws to the left, the right hand cylinder will try to compress. This will push oil out of the base of the right hand cylinder into the rod end of the left hand cylinder also into the accumulator against the 70 bar precharge pressure. Because the hydraulic yaw is a closed circuit the oil movement is restricted by the precharge pressure in the accumulator. This precharge pressure is what restricts the boom yaw movement trying to hold the boom centralised. If the boom yaws to the right the opposite action occurs.

The circuit precharge needs to be monitored and maintained. Gauges on the centre section display the closed loop hydraulic yaw pressure. This pressure should be maintained at 100 bar.

Note: When the hydraulic yaw system is installed or any components are replaced, the closed loop hydraulic circuit needs to be bled of any air. The maximum pressure needs to be set, the system charged and the booms aligned.

Bleeding the Circuit

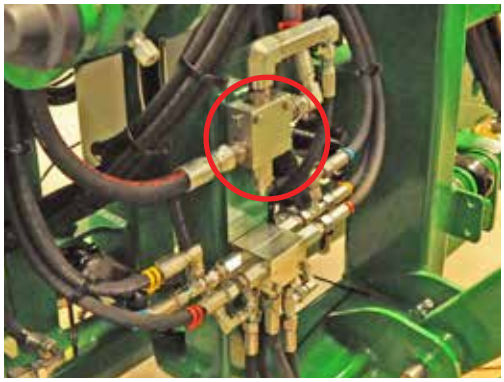
1. Park the machine on a flat level surface, engage the parking brake and chock the sprayer wheels.
2. Open the boom into the working position and lower to the minimum working height. (Ensure there is ample room in front and behind the boom as it will be required to oscillate.)
3. Isolate the boom lift cylinders by rotating the paralift cylinder ball valves to the OFF position.
4. Remove the pressure gauges from the quick connect port on the accumulators.
5. Connect the bleed hose (supplied in the sprayer kit) to quick connect ports on the accumulators.
6. Couple the pioneer connectors to an external hydraulic source, such as a tractor.
7. Using the external hydraulic source, oscillate the boom back and forth ensuring to hold the boom at its extremities for approximately 30 seconds. Start by activating the hydraulic source in one direction. The boom will oscillate forward and stop when the hydraulic cylinder is fully extended. Hold the hydraulic supply in position for at least 30 seconds to ensure that the hydraulic cylinder is fully extended. Move the hydraulic source in the opposite direction until the opposite cylinder is fully extended, again hold in position for 30 seconds to ensure the cylinder is fully extended. Repeat this at least 15-20 times to bleed any air from the system.
8. When oscillations are complete move the boom into a perfect centred position.

Setting the Pressure Reducing Valve

1. Park the machine on a flat level surface, engage the parking brake and chock the sprayer wheels.
2. Open the boom into the working position and lower to the minimum working height.
3. Isolate the boom lift cylinders by rotating the paralift cylinder valves to the off position.

4. Open the hydraulic yaw "charge" ball valves.

5. Identify the pressure reducing valve.



6. Loosen the adjustment lock nut and turn the set screw counter clockwise 3 rotations.

7. This will generate minimum hydraulic oil pressure in the sprayer hydraulic circuit.

8. With the hydraulic circuit engaged turn the set screw IN (clockwise) until the hydraulic yaw pressure gauges indicate 100 bar (1500 psi). If the pressure is exceeded the closed loop circuit must be "cracked" to bleed off any excess pressure. The Tilt Out can be used to generate pressure in the hydraulic system.

CAUTION: Take care when working with hydraulic oil under pressure. Ensure that excess oil is drained into a container.

9. Once the set screw is set to the correct pressure, tighten the lock nut. Ensure that the set screw is held firmly in position to prevent the pressure fluctuating.

10. When the pressure is correctly set, charge the circuit as per the instructions following.

Charging the System

1. Park the machine on a flat level surface, engage the park brake and chock the sprayer wheels.

2. Open the boom into the working position and lower to the minimum working height.

3. Isolate the boom lift cylinders by rotating the paralift cylinder valves to the off position.

4. Open the hydraulic yaw "charge" ball valves.

5. Activate the boom lift circuit and maintain constant pressure for 30-60 seconds. This will generate maximum hydraulic oil pressure in the sprayer hydraulic circuit.

Note: The pressure reducing valve in the circuit limits the main hydraulic pressure to 100 bar (1500 psi) entering the hydraulic circuit.

6. After 30-60 seconds release the lift circuit and isolate the hydraulic yaw "charge" ball valves by rotating them to OFF position. The pressure gauges in the hydraulic yaw circuit should be reading 100 bar (1500 psi).

7. Ensure that the boom is sitting level or aligned correctly. If one side of the yaw is sitting forward of the other "open" the "charge" ball valve and push the boom around to align it and even the cylinders out, once aligned "close" the "charge" ball valves. Check the pressure gauges are still at 100 bar (1500 psi).

Bi-fold - TriTech Boom Only

The following are boom adjustments that are specific to Bi-fold booms. All other adjustments on a bi-fold boom can be made as stated above for a regular boom.

Alignment of Outer Aluminium Boom - Working Position

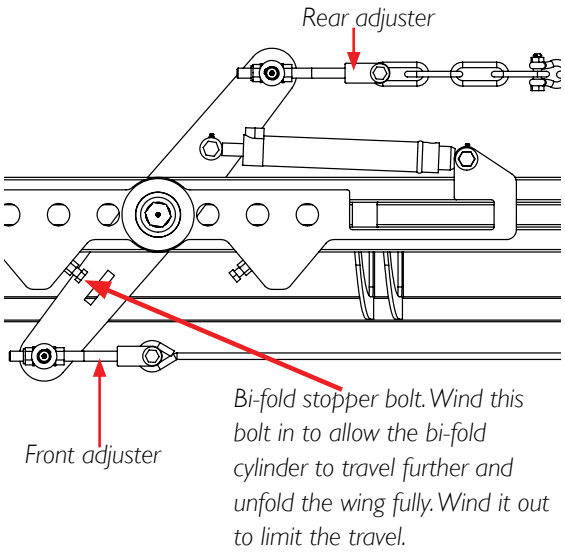
1. When adjustment of the inner booms is complete the outer booms can now be aligned.
2. 24-30m TriTech booms must be 30-50mm and 33-36m booms must be 50mm forward of the inner booms.
3. To align the outer booms, the cables must be adjusted. To move the boom forward the front adjuster bolt must be shortened. At the same time the rear cable adjuster bolt must be lengthened.
4. To adjust the outer boom rearward the rear cable adjuster must be shortened and the front adjuster bolt lengthened.
5. If the there is insufficient travel in the Bi-fold cylinder to completely unfold the outer boom, the Bi-fold stopper bolt will require adjustment. Wind the bolt in to allow the cylinder to travel more and fold out the wing further. Make small adjustments when winding the bolt and fold the outer wing each time to check the adjustments made.

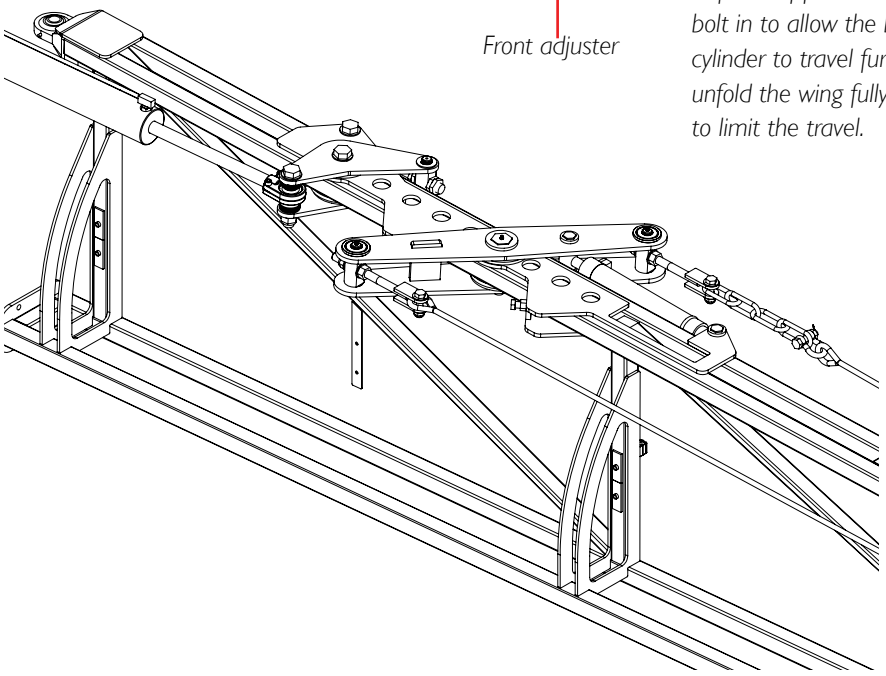
   The bolt must be in contact with the fold pivot plate stop when the wing is in the working position.

Note: The cable should be tensioned so that there is a 50mm deflection in the cable when a force of 15kg is applied to it.

Note: It is advised that all threads are lubricated prior to making adjustments

Note: If cable adjustments run out, a new cable should be purchased as the old one has stretched beyond specification.





Alignment of Outer Aluminium Boom - Folded Position (With Bi-fold)

1. When the outer boom folds up into the transport position it must saddle firmly against the inner boom. If it is too loose, the outer boom may be damaged in transport.

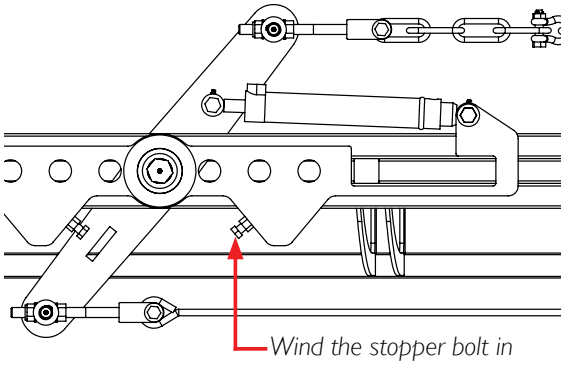
2. To increase to fold pressure of the outer boom, the Bi-fold stopper bolt must be shortened. This will increase the travel of the bi-fold cylinder allowing the outer boom to fold around tighter.

3. If the outer boom folds up too tight damage can also be caused to be boom.

4. To loosen the fold pressure, the Bi-fold arm stopper bolt must be screwed out, reducing fold travel of the outer boom.

Note: It is advised that all threads are lubricated prior to making adjustments

Note: If cable adjustments run out, a new cable should be purchased as the old one has stretched beyond specification.



Wind the stopper bolt in to make the outer boom fold in tighter. Wind it out to decrease the fold travel of the outer boom.

Hydraulic Adjustments

The pressure in the Bi-fold circuit will vary depending on what size boom is fitted, up to a maximum pressure of 1700 psi.

Boom Size	Bi-fold pressure
24m	1500 psi
28m	1550 psi
30m	1600 psi
33m	1650 psi
36m	1700 psi

The Bi-fold pressure is shown on the gauges located on the Dash Panel in front of the cabin.

The Bi-fold pressure is adjusted at the spool block (for more information on the spool block, see the lubrication and maintenance chapter).

Bi-fold pressure reducing valve

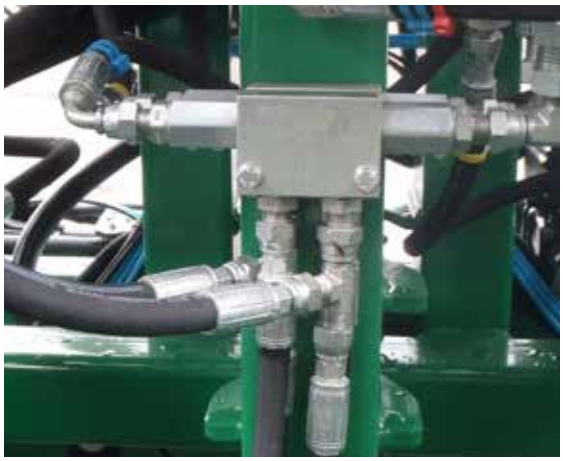
With the boom fully folded out, check the Bi-fold pressure on the gauges on the dash panel. Note if the pressure needs to be increased or decreased. Bi-fold the boom so that the outers only are folded in. The Bi-fold pressure should now be reading zero.

To adjust, the Bi-fold pressure reducing valve located on the spool block should be wound in or out. Winding the knob in will increase the pressure, winding it out will decrease pressure. When adjusting the pressure, make only small changes. Fold the boom out and check the pressure reading on the gauges. If not reading correct, Bi-fold the boom in again and make another adjustment. Always make adjustments while the boom is Bi-folded in and re-check when the boom is fully folded out. When the correct pressure is reached, tighten the lock nut on the pressure adjusting screw on the spool block.

WARNING: Working with hydraulics can be very dangerous. While operating the boom, all people and objects should be clear of the boom wing fold radius. Nobody should be on or near the centre section, while hydraulic functions are operated.

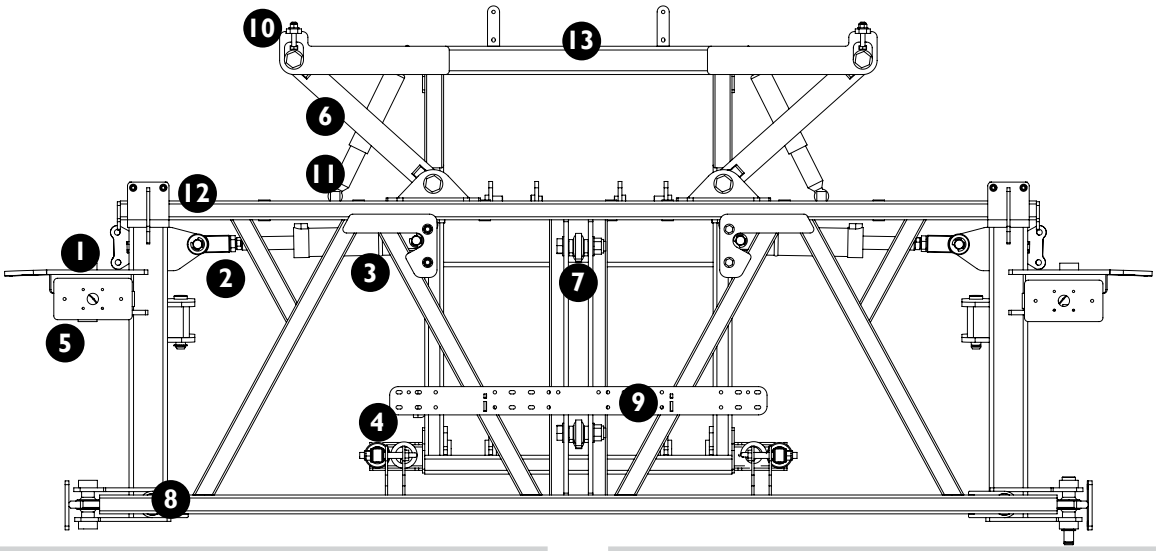
If the Bi-fold losses pressure while operating, the check valves may be leaking. If they are leaking, they should be replaced. (Check valves shown below).

The check valve for the right hand side is located closest to the paralift, with the left side check valve on top of it.



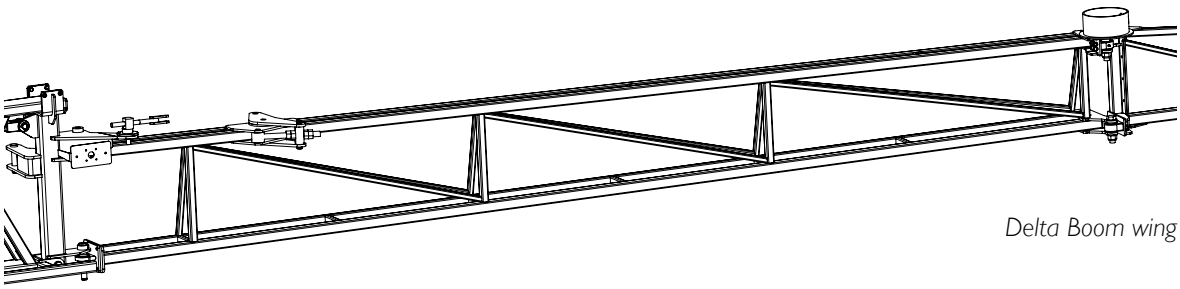
Boom centre section

Delta Boom

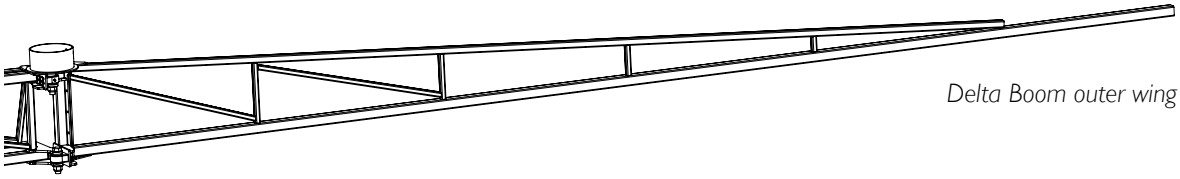


Number	Feature
1	Boom rose end
2	Tilt arm adjuster
3	Tilt cylinder (option)
4	Yaw spring (or cylinder) mount
5	Tail light mounting plate
6	Diagonal delta links
7	Lineal delta links
8	Tilt pin (40mm)

Number	Feature
9	Boom section controls
10	Boom alignment adjuster
11	Roll Shocker
12	Tilt arm wear strips
13	Flow Meter
-	Electric Over Hydraulic valves (option)



Delta Boom wing



Delta Boom outer wing

Delta Boom overview

Centre Section

The Delta centre section is made up of two components, the paralift rear and the boom centre section. The two are held together by 4 delta links. These links allow the boom to be suspended in order to provide roll and yaw suspension.

Roll suspension is when the boom pitches up and down at the tips. Yaw suspension is when the boom moves fore and aft at the tips. If the boom did not feature yaw suspension there would be excessive stresses exerted on the booms and centre section when cornering or corrections of line are made. The yaw suspension allows the chassis of the sprayer to move left and right without any movement being transferred to the boom. The paralift rear will move with the centre of the sprayer but the boom centre section will remain static or level as it rotates around the delta links connecting it to the paralift rear.

The boom yaw is dampened by springs and dampener shockers to limit the recoil of the yaw springs. If the springs are not tensioned correctly the boom will be able to yaw excessively and the springs may be damaged. If a spring is damaged, both opposing springs must be replaced at the same time.

Hydraulic Raise and Lower

The paralift on a Delta boom enables the boom to be raised and lowered to maintain a consistent boom height above the target.

Delta booms feature a paralift rear which uses two hydraulic cylinders to perform the lift, while also acting as a component providing the vertical suspension. Each hydraulic cylinder has a nitrogen charged accumulator which also assists in improving the boom ride. The "boom limit" height switch allows the operator to adjust the minimum ride height of the boom.

The hydraulic lift also enables the boom to be raised prior to folding and then used to lower the boom onto the boom rests.

Hydraulic Fold

The Delta booms hydraulic fold feature, allows the boom to be opened and closed from within the cabin.

Hydraulic phasing cylinders are used in the folding operation of the boom. This ensures that both sides of the boom are synchronised and open and close together so that the weight distribution is the same for both sides of the boom.

As hydraulic fluid enters one hydraulic cylinder, it acts upon the first ram and causes it to move. This motion results in an amount of fluid entering the second hydraulic cylinder which causes it to move an equivalent distance. There is also a flow restrictor for each cylinder so that the hydraulic fluid will enter and leave the respective cylinders at a controlled rate. This has the effect of slowing down the rate of fluid transfer and thus causes the boom to open and close more slowly - protecting the boom from damage. If the phasing cylinders do not fold together, information on re-phasing the rams can be found in the 'Troubleshooting' chapter.

Boom Balance

The Delta boom suspension system causes the boom to adopt the same plane as the spray tanker. If one side is heavier than the other, the boom will tend to hang lower on the heavy side, so both sides need to be balanced for the boom ends to be of the same height.

To achieve this, a boom counterweight can be included on the boom and placed strategically so that it compensates and balances the boom. The counterweight can have more weight added and/or be moved to balance the boom correctly.

Boom Cables

Boom cables are a critical part of the Delta boom and it is important to ensure that boom cables are correctly adjusted prior to operation.

Loose boom cables can cause boom damage by allowing the outer boom section to hang out of alignment or to 'break away' too easily. This can shorten the sprayers life by placing unnecessary stresses on the boom, lift and chassis.

The cable tension can be checked by inspecting the cable springs, Further information on boom adjustment and alignment can be found in the 'Boom adjustment' section.

Boom Valves

Motorised boom valves are fitted as standard and are mounted on the boom centre section at the rear of the sprayer. Motorised boom valves feature a 12 volt motor that opens or closes a stainless steel plunger and thus opening or closing flow to the boom sections as required.

In the event of a valve failure, unscrew the top cap of valve then check that the fuse (3 amp) is ok.

Nozzles

The standard nozzle spacing on Goldacres booms is 500mm. Nozzles are mounted on brackets that are adjustable for different nozzle types. Nozzles are mounted so that they are protected from ground hits should the boom make contact with the ground, obstructions or crop.

Three Dimensional Breakaway

24 metre Delta booms and all TriTech booms feature the unique three dimensional breakaway hinge which allows the tip to "break" forward, backward and upward if an obstruction is hit. The 3D Breakaway hinge aims to eliminate any further damage to the remainder of the boom should an obstruction be hit.

It is important that the 3D Breakaway hinge is properly adjusted when in operation. Adjustment instructions can be found in the 'Three Dimensional Breakaway - Delta and TriTech' section of this chapter.

Boom Protection Brackets

Stainless steel boom protectors are fitted on the boom to protect the boom when resting on the boom rests for transport. It is important to ensure that the boom protection brackets are fitted correctly.

Boom End Protector

Boom end protectors are fitted to the 24 metre breakaway tips to help prevent damage to the boom from ground strike or from hitting an obstruction. They also help to keep the boom from becoming entangled when spraying close to fence lines.

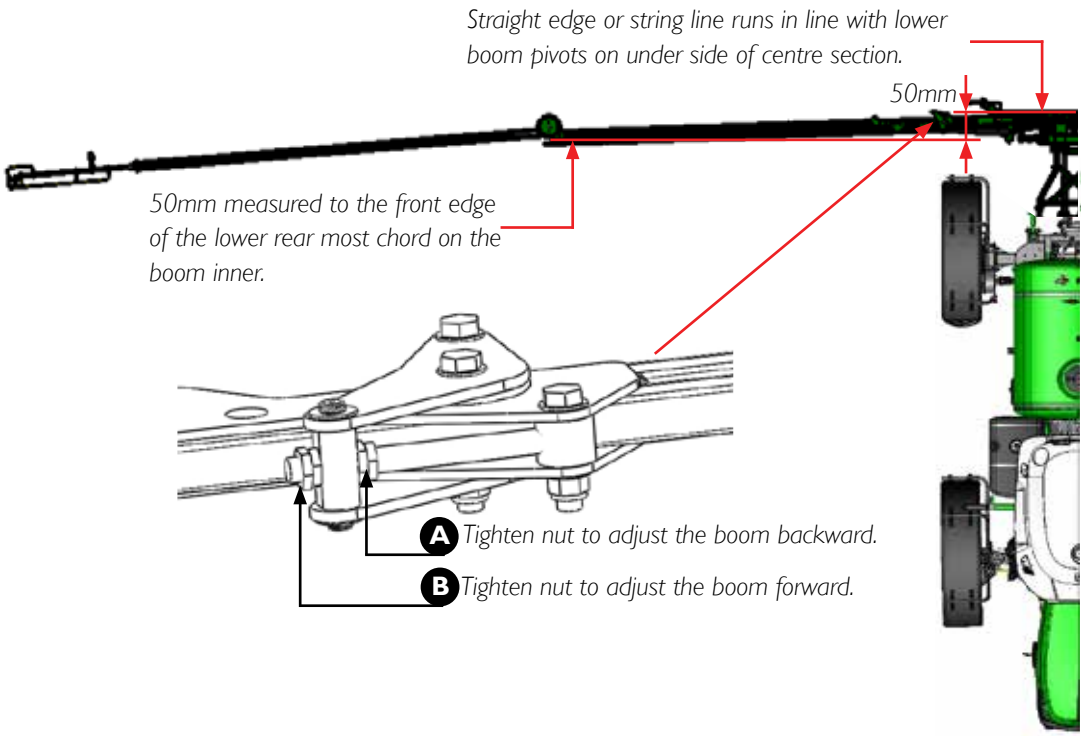
Delta Boom adjustment

Inner Steel Boom Alignment - Working Position

1. Open the boom fully into the working position.
2. Continue to press the unfold button or hold the hydraulic remote open to ensure the fold cylinders are phased completely. They must be at the same length.
3. Look along the inner booms between the cable drums to assess the alignment.

   All booms must be 50mm forward of the centre section at the cable drums. A string line can also be used for measuring the lead of the inner boom (see below).
4. If adjustment is required, loosen the two lock-nuts on the boom fold adjuster bolt at the rear of the boom.
5. To adjust the boom forward, tighten the outer adjuster nut. To adjust the boom rearward, tighten the inner adjuster nut
6. When the boom is in the required position tighten both locknuts to hold in place.
7. Follow this process for both inner booms.

Note: It is important that both wings are adjusted the same. If one wing is adjusted further forward or back than the other, the boom may not sit level.



Outer Boom Wing Alignment - Working Position

1. When adjustment of the inner booms is complete the outer booms can now be aligned.

2. 24-30m TriTech booms must be 30-50mm and 33-36m booms must be 50mm forward of the inner booms. Use a string line to assist with achieving the correct measurements.

3. To align the outer booms, the cable adjusters and boom stopper bolt are used. To pull the outer boom forward, wind in the boom stopper bolt. The turnbuckle that is connected to the cable damper springs at the front of the boom must also be shortened to maintain cable tension. At the same time the rear turnbuckle must be lengthened.

4. To adjust the outer boom rearward, wind out the boom stopper bolt. The rear turnbuckle must be shortened and the turnbuckle at the front lengthened.

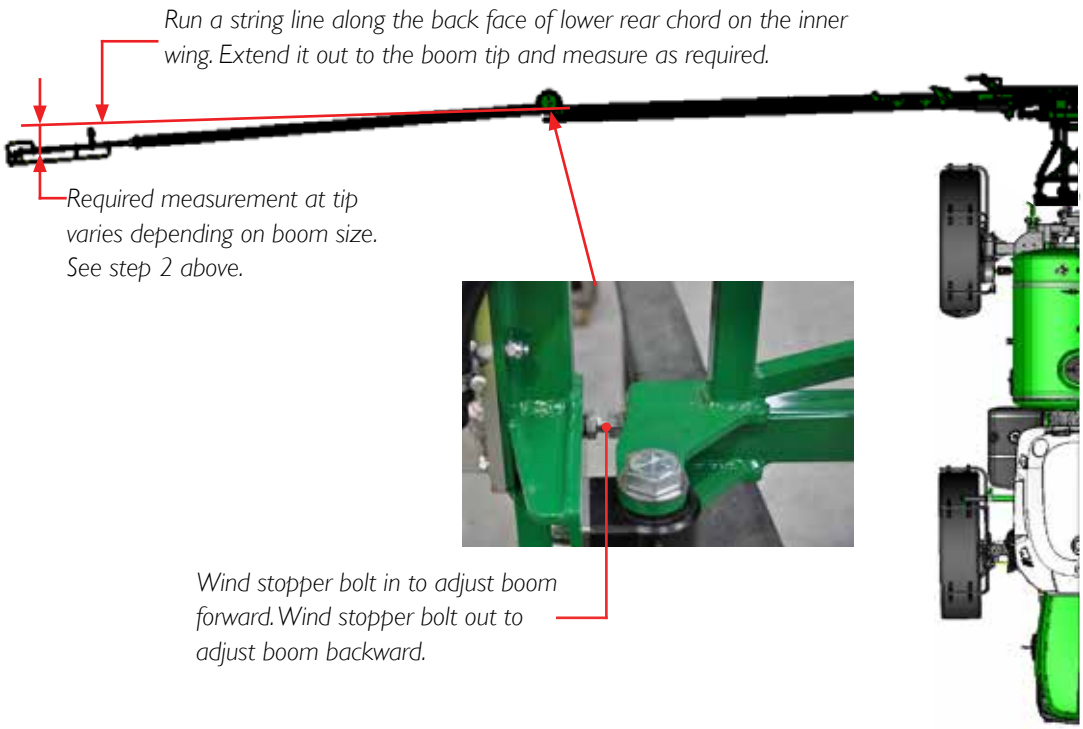
5. Once correct alignment has been achieved the cable spring tension must be set so there is a **3mm gap** between the coils.

Note: It is advised that all threads are lubricated prior to making adjustments.

Note: If cable adjustments run out on the turnbuckles, it is advised that you should contact your dealer and purchase new cables.

Note: It is important that both wings are adjusted the same. If one wing is adjusted further forward or back than the other, the boom may not sit level.

Note: The rear cable should be under tension.

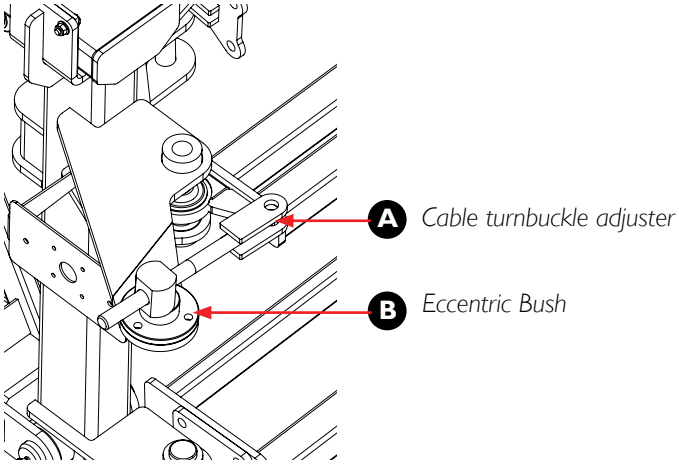


Outer Boom Wing Alignment - Folded Position

Alignment of outer aluminium boom - folded position

- The eyebolt cable adjuster aligns the outer boom arm in the working position; the adjustment plate is designed to adjust the outer boom arm in the folded position.
- The eyebolt adjuster will follow the same orientation as the boom when folding and unfolding. For example, when the boom is in the operating position the eyebolt adjuster should be horizontal in line with the boom. With the boom folded, the eyebolt adjuster should be pointing forward in a raised position, again following the line of the boom.
- Fold in the boom. If the outer boom arm does not come in all the way against the inner boom arm and contact the bump stop then the adjustment plate will need to be moved out. If the outer boom arm contacts the bump stop too early and places too much tension on the cable then the Eccentric Bush needs to be rotated to suit.
- To adjust the Eccentric Bush the boom has to be in the working position. Have someone pull back on the outer boom arm to release the tension on the cable whilst you make adjustments to the bush. Rotate the Eccentric Bush one set of holes for small adjustments. When adjustment is completed ensure the outer boom arm is released carefully so it does not spring forward dangerously. Re-adjust the cable eyebolt to realign the outer boom arm whilst still in the working position before folding the boom and re-checking the alignment in the folded position.
- Repeat the procedure if necessary until the outer boom arm assumes the correct alignment in both the working and folded positions. When this has been achieved tighten all bolts.
- Spring tension may be altered slightly when this bush is rotated. Check there is a 3mm gap in the spring coils and adjust if required.

Note: If the outer boom arm contacts the bump stop too early and too much tension is placed on the cable, then the hydraulic cylinder may fail to bring both arms all the way in, or damage the boom arms and cable



TriTech Vertical Boom Alignment - Working Position

When the boom is in the working position, the inner and outer boom should be level or slightly increasing in height from the centre section to give a consistent and even spray application height. A new boom may be susceptible to stretching or sagging as the components are worn in. Several adjustment may be required in the first 12months of operation until the boom settles.

Inner Booms

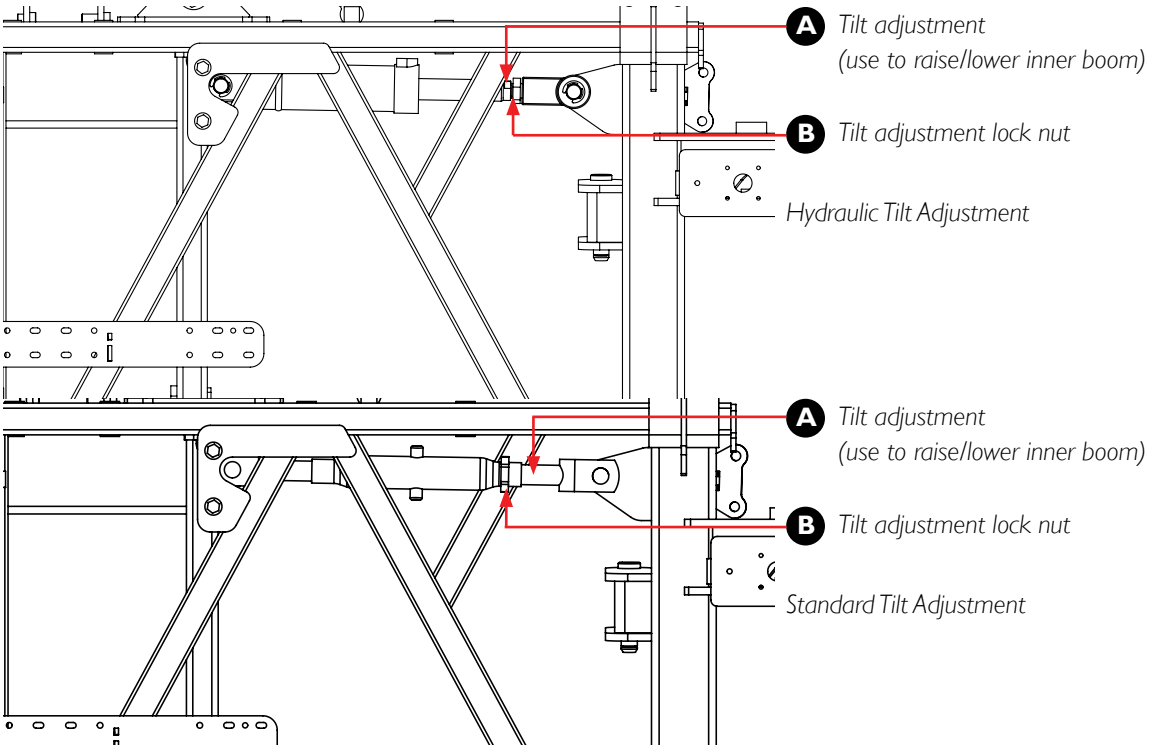
- The boom centre section must be level with the chassis before any boom adjustments are made. The centre of the centre section should line up with the centre of the paralift when look from the rear. This can be done by either shortening or lengthening the centre section adjuster bolt at the top delta links, or by adding weight discs to the cable drums.
- The inner booms must be adjusted first so they are the same height as the centre section or slightly increasing in height from the centre section (to allow for boom stretch) .These adjustments are made by lengthening or shortening the tilt adjusters on the tilt cylinder..
- To lengthen or shorten the tilt adjusters, the weight of both the booms will need to be supported.
- When any adjustments are completed. Ensure the lock nuts are tight.

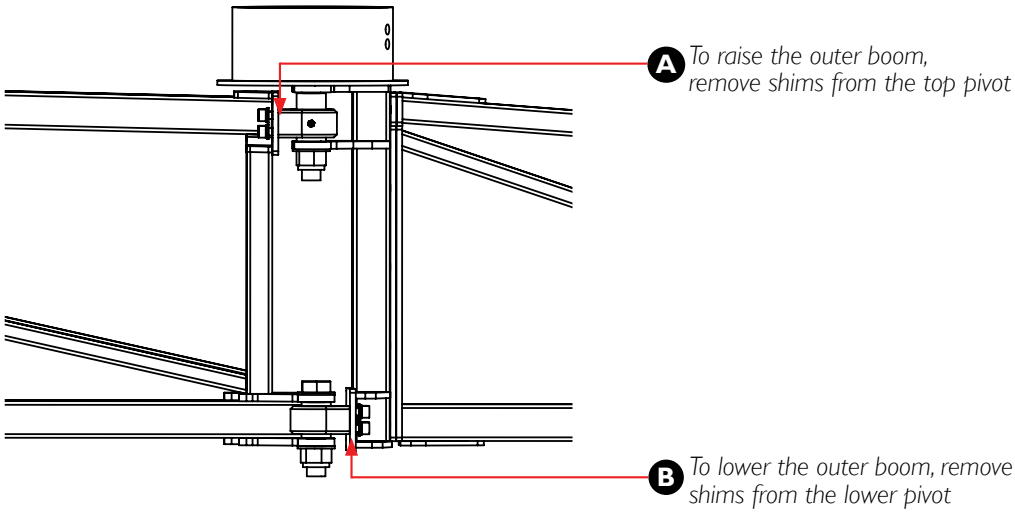
Outer Booms

- The height of the outer booms in the working position are adjusted by adding or removing shims at the cable drum.
- The cable drum mounts are assembled in manufacturing with 6-7 shims at the upper and lower bearing blocks.
- If the outer boom hangs lower than the inner boom, remove shims from the upper mount until the booms are level. If the outer boom is too high remove shims from the lower bearing block. Retension the retaining bolts to 65Nm when all adjustments are complete.
- The boom cables may need to be loosened to enable easier removal of the shims.

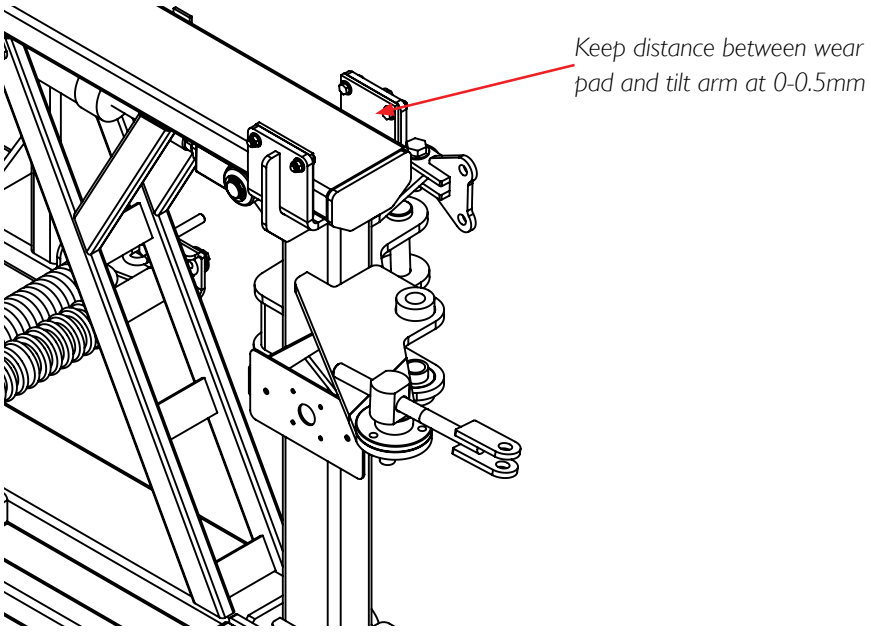
24-30m booms:
1 shim added = 10-20mm @ boom end

33-36m booms:
1 shim added = 20-30mm @ boom end





The tilt arm guide arms are fitted with wear strips. It is important that these strips are maintained and that the gap between them and the tilt arm is kept between 0-0.5mm either side. This ensures the tilt arm cannot twist, prolonging the life of the product.



Vertical Boom Alignment - Folded Position

When the booms are folded up in the transport position, the full weight of the booms must be supported by the inner boom. The outer aluminium boom may sit on the boom rest rubber but must not support any weight.

Inner Booms

- If the boom sits level in the working position but when folded up, one side is lower than the other, there is one adjustment that can be made.
- Shims can be placed at the bottom boom mount of the lowest boom - refer to diagram A. This will lift the boom in the open position.
- If the boom is not level in the working position, the most likely cause if this is an out of balance boom. Refer to previous boom adjust information.

Note: This process should not be required as once they are set in manufacturing, they should not change.

When the booms are folded up in the transport position, the outer boom must saddle onto the inner boom. If this alignment of out the outer boom will not saddle correctly and will not be supported in transport.

The boom support saddle is bolted to the outer boom and when folded, couples to the inner boom. This saddle must slide onto the inner boom freely to prevent damage to the booms.

Note: This process will be require in the first 6 months of operation as the booms stretch an ware in.

Outer Booms

- If the outer boom hangs too low in the folded position shims must be added to the cable drum pivots. To raise the outer boom, add shims to both the upper and lower pivots. This adjusts the angle of the pivot axis causing the outer boom to fold up higher. By adding shims to both the upper and lower pivots, the outer boom height is not affected in the working position.
- To lower the outer boom in the folded position, remove shims from both the upper and lower pivots.
- 1 x 1mm shim at the upper and lower pivots equals approximately 15mm change in height.

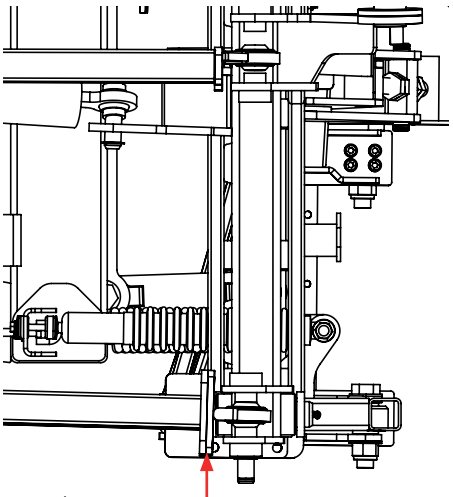


Diagram A

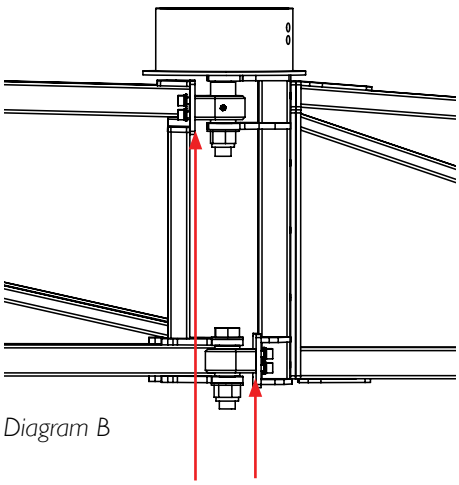


Diagram B

Chapter 10

LUBRICATION AND MAINTENANCE

Recommended Lubricants

- For differing weather conditions consult your Cummins operator's manual to choose the suitable oil grade.
- Ensure that lubricants are stored in a place where the lubricants are protected from contamination (such as dirt and moisture). Always use clean containers when handling lubricants.
- Do not mix lubricants. Proper lubrication may be affected by differences in chemical composition.
- Seek advice from your petroleum dealer on the correct use of lubricants and additives.

LOCATION	TYPE OF LUBRICANT	CAPACITY (L)
ENGINE OIL	SAE 15W-40 Heavy Duty Engine Oil that meets Cummins standard CES20078 API1 & C14	11L
HYDRAULIC OIL	46 WEIGHT, DEDICATED HYDRAULIC OIL e.g. TOTAL EQUIVIS ZS 46	90L
TRANSMISSION 2000 SERIES 5 SPEED	CASTROL ALLISON TRANSYND GA5006959	20L approx (dry)
DIFFERENTIAL	80W90 EP GEAR OIL	9L (fill to level hole)
DRIVE LEGS	SAE 80W90 GEAR OIL	10L (per leg)
PLANET HUBS	SAE 80W90 GEAR OIL	5L approx
GENERAL GREASE POINTS	MULTI-PURPOSE GREASE	-
STEERING PIVOT POINTS	MOLYBDENUM BASED GREASE	-
COOLANT	TEC PG XL CUMMINS	36L approx
BRAKE FLUID	DOT 4 SYNTHETIC	approx. 0.5L per Booster
DIAPHRAGM SPRAY PUMP	SAE 15W40	2.68L for Zeta 260
		1.28L for Zeta 170
AIR CONDITIONING	OIL, SANDEN SP20	571ml dry
	GAS R134a	2kg
AUTO GREASER	EP0	4 L
RAPIDFIRE OILER	Air Tool Oil	50ml

Goldacres are applying G15 anti corrosion spray to all fasteners (bolts, washers and nuts) and zinc plated components at the time of manufacture.
G15 should also be applied to the sprayer pre and post season.
The following is a guide, application to these areas is recommended but not limited to: Towing eye bolts, pump mounting bolts, boom rests, left hand pod, right hand pod, mudguard mounting bolts, induction hopper bolts & latches, hydraulic manifold, cable drum bolts, airbag hose fittings, hydraulic hose crimp fittings etc.

Replacement Filters

LOCATION	Goldacres P/#	Generic Numbers
Hydraulic Return Filter	GA5069056	
A/C Carbon Filter	GA5075310	102.01
Air Cleaner Primary Element	GA5071700	AF26120
Air Cleaner Secondary Element	GA5071705	AF26121
Engine Oil Filters	GA5051755	LF3970
Transmission Oil Filters	GA5048281 spin on	Series 2000 = 29539579 or HF35296
	GA5048285 internal	Series 2000 = 29537966 internal kit
Fuel filter (primary)	GA5051760	FS1242
Fuel filter on engine	GA5051765	FF5612 , FF5421
Fuel Filter inline	GA5069895	W2153 3/8 tails

Tyre Pressures

GA8700538 applies 2016

G3 & G4 MAX SPEED FULLY LOADED IS 25 KM/H		RECOMMENDED TYRE PRESSURE	
TYRE BRAND	TYRE SIZE	KPA	PSI
HARVEST	380/90R46 (14.9R46) HR45 159A8	275	40
HARVEST	460/85R38 (18.4x38) 159A8 Cross Ply(16)	200	29
HARVEST	460/85R38 (18.4R38) HR45 149A8/146B	158	23
HARVEST	480/80R46 (18.4R46) HR45 158A8/155B	240	35
HARVEST	480/80R46 (18.4R46) HR45 166A8/159D	172	25
HARVEST	520/85R38 (20.8R38) HR45 155A8/152B	262	38

Note: PSI = Kpa x 0.145
Example: 240Kpa x 0.145 = 34.8 PSI

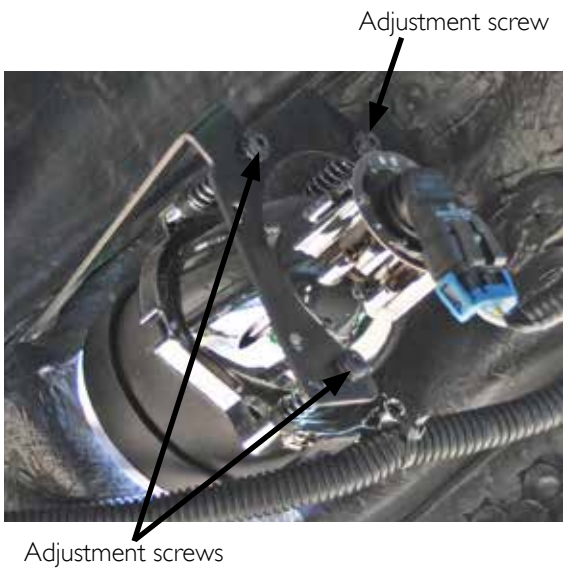
Replacement Globes

LOCATION	Goldacres P/#	Generic Numbers
Headlight - Low Beam	GA3000082	HB3 12V 60w

Headlight Adjustment

The headlights on the Crop Cruiser have a HB3 globe for replacement. To replace the globe, the bonnet will need to be unclipped on both sides and rolled forward, do not let the bonnet roll forward under it's own weight, lean over the cold engine and unclip the loom from the globe and then unclip the globe from the headlight housing and remove. Replace with new globe and follow the instuction in reverse. Ensure bonnet has been re-clipped before driving.

Headlight alignment can be made by adjusting the 3 screws located around the headlight body. Make a change and then check to see the movement was in the correct direction.



Wheels

Tyre Changing

- Only an experienced person working with the correct equipment should change the wheels.
- When changing a wheel ensure that the sprayer is on hard, level ground and the wheels at the opposite end are chocked.
- Remove the isolator and the key from the ignition.
- Before raising the machine off the ground ensure that the boom is at its fully closed position.
- Where possible empty the spray tank before lifting the machine.
- Place the jack securely under the jacking point and gently raise the machine until the weight has been removed from the wheel.
- Do not support the sprayer using materials that may crumble.
- Do not work under the machine when supported solely by a jack.

Note: When the tank is fully loaded each wheel supports a weight up to 4 tonnes. Always ensure that the jack is designed to operate under this pressure.

Tyre Maintenance

- Maintain the correct tyre pressure at all times. Inflation above the recommended pressures may cause damage to the tyres.
- Extreme caution is required during the inflation of tyres. If tyres are inflated at a rapid rate then the tyre and rim combination may explode. This can result in serious or fatal injuries.
- When inflating a tyre regularly check the tyre pressure with an inflation gauge
- Do not weld, heat or modify the rim, as this is likely to weaken the rim.

Be proactive and regularly check the condition of your tyres.

Tyre Pressures

The tyres on the Crop Cruiser operate under harsh conditions, high road speeds and high loads can cause tyres to wear prematurely. It is very important that tyres are maintained and operated correctly. Tyre pressures are the most integral item to maintaining correct load rating of the tyre.

It is advisable to protect the tyres as much as possible to reduce deterioration.

Chemical sprays and insecticides are harmful to the rubber in the tyres and should be washed off after use.

Tyre Pressures must be checked daily to maintain a satisfactory working life.

Wheel Nut Tension

Wheel nuts must be tensioned daily when the machine is new or when the wheel nuts have been removed and refitted.

Once the wheel nuts hold their tension inspection can be lengthened to approximately 50 hrs. Wheel nut tension on the Crop Cruiser front wheels is 350 lbft and rear wheels is 300 lbft

Suspension

The Five Point Suspension system used on the Crop Cruiser Sprayer consists of four parallel links, one panhard rod and 2 air bags on each axle. The rear axle of the machine is also fitted with an anti roll sway bar.

Parallelogram links hold the axle in place on the chassis. Panhard rods hold the axle centred in the chassis. The parallelogram arms allow the drop legs to distort or twist forward and backwards when the wheels come in contact with an obstruction such as a pot hole, log or embankment. This oscillation is absorbed by polyurethane bushes in each end of the links. The life time of these bushes is subject to the conditions the sprayer operates in and the style of operation that it receives. The polyurethane bushes should be checked at regular service intervals as stated in this manual.

Polyurethane Bushes

There are two sized polyurethane bushes used in the suspension system on this machine. The first bushes are located in the Para Link and Pan Hard Rods. There are 20 of these bushes used in the machine and they can be purchased from your Goldacres dealer.

The second bushes are located on the sway bar.

Polyurethane bushes wear gradually over time and should be checked for movement during servicing. If there is any play in these bushes they should be replaced.

Parallel Link

Each end of the parallel link is attached to the chassis and differential with polyurethane bushes and 3/4 inch high tensile bolts. These links hold the axle in place while the bushes allow deflection when the drop leg comes in contact with an impact such as wash out or embankment. The bolts and bushes should be checked each time that the vehicle is serviced. If the axle is tending to twist or rock the bushes must be replaced.

Shock Absorbers

There are four shock absorbers fitted to the machine one fitted to each side of the front and rear axle. The shockers dampen the movement of the air bags to prevent recoil. These should be check for damaged rubbers or oil leaks.

Panhard Rods

The panhard rods fitted to the Crop Cruiser are designed to prevent any sideways movement of the axles and hold the axles central to the chassis. These rods are attached to the top of the axle and bottom of the chassis with two polyurethane bushes and 3/4" high tensile bolts. These bolts and bushes should be checked each time that the vehicle is serviced. If the axle is tending to twist or rock the bushes must be replaced.

Sway Bar

The sway bar is attached to the chassis and top of the rear axle with polyurethane bushes. This bar is designed to prevent excessive roll in the vehicle. The bushes should be checked each time that the vehicle is serviced.

Air Bags

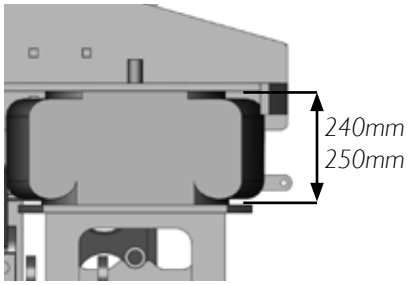
The four air bags use compressed air to inflate them. They have ride height valves attached to the chassis and axle. As a load is exerted on the chassis the air bags will compress lowering the ride height valve arm. The ride height valve will then let air into the air bag causing it to inflate. As load is lessened on the axle the air bags will expand raising the arm of the ride height valve. The ride height valve will exhaust letting air flow out of the air bag causing it to deflate until the ride height arm becomes level again.

The air bags have internal rubber bumps that prevent the air bag bottoming out and jarring when the axle contacts large obstacles.

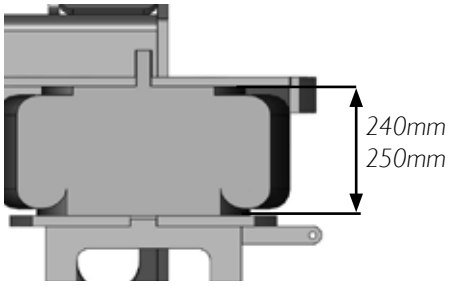
The rear axle has 2 ride height valves which level the sprayer, the front axle has 1 ride height valve in the middle of the axle which maintains the required height and allows it to pivot freely.

Airbag Height Settings

The distance between the two Air Bag mounting faces should be between 245mm and 250mm with both sides being the same. If this distance is not maintained the angle of the drive shaft changes causing a vibration and possible damage to the drive train.



The front air bag is measured from the inside of the top mount to the top of the bottom mount



The rear air bag is measured from the inside of the top mount to the top of the small arms protruding from the bottom mount.

Airbag Evacuation Procedure for Transport on Trailers

Loosen the two drain taps on the air tanks and drain the air. Loosen the fitting on the top of the Air Bag mount and release the air in the Air Bags. The Air Bags will lower on to the bump stops. Once the machine is on the bump stops tighten up the air tank valves and the fittings to the Air Bags. Don't alter or change the Height Control Valve linkages to release the air.

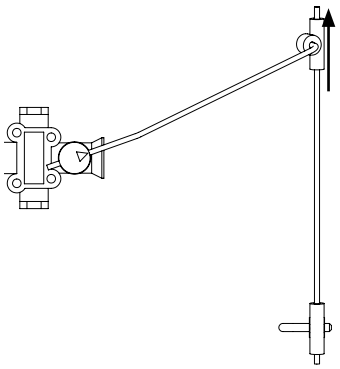
Ride Height Valve Adjustment

The ride height valves are used to adjust the air pressure within the air bags to maintain the correct ride height. There are two ride height valves located on each side of the rear axle and one located in the centre of the front axle.

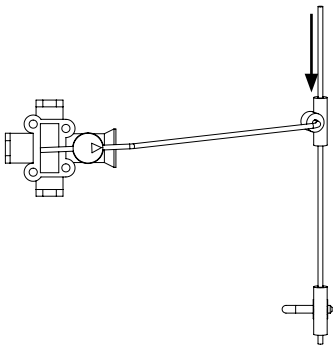
The ride height can be adjusted by loosening the hose clamp attached to the vertical rod on the end of the ride height valve and then moving the valve arm in the required direction.

When the sprayer has been unused for a period of time, the air bags may deflate, which is normal. They will refill when the machine is started.

To raise the machine this arm should be moved up the vertical rod.



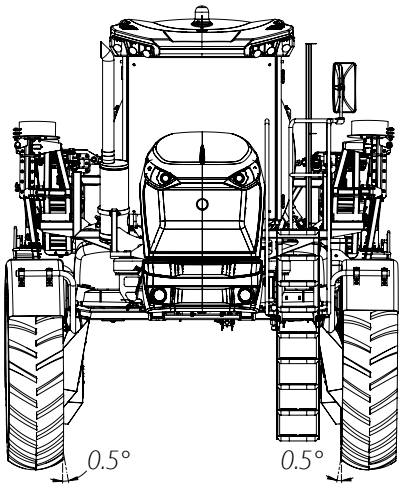
To lower the machine, move the arm down the vertical rod.



Steering

Camber

The wheel camber is a factory set parameter and cannot be adjusted. At the time of manufacture the wheel camber is set to +0.5°.



Steering Toe In

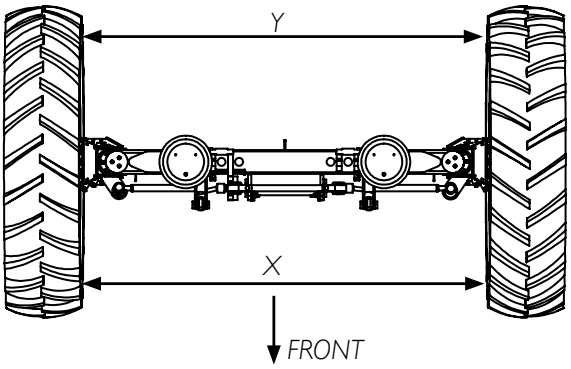
The steering wheels of the sprayer should "toe in" 0-5mm to check this measurement follow these steps.

1. Park the machine on a flat level surface.
2. Apply the parking brake and remove the keys from the ignition
3. Measure up from the ground 900mm on the front of the steer tyre and mark.
4. Repeat for the rear of the steer tyre.
5. Measure between the front of the left and right steer tyres at the mark previously made and record.
6. Measure between the rear of the left and right steer tyres at the mark and record.
7. The front measurement must be 0-5mm less than the rear measurement.

8. If it is not the tie rod lengths must be varied.

9. Loosen the tie rod lock nuts and loosen or tighten until the "toe in" measurement is correct.

Measurement X should be 0-5mm less than measurement Y.



Pneumatic System

The pneumatic system on this machine is used to actuate the brakes, operate the air bags, control the cabin access ladder and RapidFire if optioned.

Air Tanks

The air system fitted to this machine incorporates two air tanks all located on the cross rail under the engine. The tank 1 (left) collects the air from the compressor and feeds air to the rear brakes and then to the second tank through a one way valve. These valves are designed to prevent de-pressurisation of tank 2 if a fault develops above these points in the system. The second tank (right) is used as reservoir for the front brakes and supply air for the front and rear air bags and ladder.

Due to condensation in the tanks, they must be drained daily. Tank 1 is the first tank in the system after the compressor and receives the majority of the fluid entering the system. To drain fluid from both tanks a drain tap has been placed into the bottom of these tanks. They must be drained on a 10 hour or daily basis.

To drain the air, open the manual drain taps on each tank and allow the condensation and air to escape from the tank.

CAUTION: Beware of high-speed particles leaving the tank. Also be aware that due to the expansion of the air the valve may become cold.

Compressor

The compressor used on this system is attached to the timing gear case on the rear of the engine. The output of the compressor is connected to the input into tank number 1. To regulate the amount of air being generated by the compressor a governor is attached to the side of the compressor. This governor is connected with a sense line back to tank 1.

The governor enables the compressor to continue pumping until the required tank pressure is achieved. Once this pressure is reached the governor stops the compressor pumping air. The governor is set to stop the compressor when a pressure of 120 psi is reached.

Pressure Relief Valve

To prevent the pressure within the air system exceeding acceptable limits, tank 1 has a pressure relief valve built onto the top of the tank. This valve is set to operate when a pressure of 150 psi is reached and vents the air to atmosphere.

Pressure Protection Valve

The pressure protection valve is attached to the outlet line of tank 2, before the air is supplied to the air bags and valves. This valve supplies air to the air bags and valves only if the pressure within tank 2 is at least 75 psi. If an air bag blows then this valve will only supply air to the bags until the pressure within the tank drops below 75 psi. This valve is used to ensure that there is always sufficient air pressure in the tanks to supply the brake boosters.

Pneumatic Cylinders

There is a pneumatic cylinder used on the cabin access ladder. This cylinder gets air flow from the micro switch on the park brake lever. There is a flow control needle valve, on the inlet of the cylinder, to control the speed of the ladder when raising and falling. To increase or decrease the speed of the ladder going down, the needle valve on the flow control can be screwed in to decrease the speed and screwed out to increase the speed.

Note: The speed of the ladder is set at the factory and if adjustments need to be made, ensure the safety precautions are followed.

Braking system

The braking system used on a G4 machine is a split system consisting of four rotors with one calliper per rotor. These callipers are powered by an air over hydraulic system. The front two callipers are powered of one master cylinder and the rear callipers are powered of a second master cylinder. The G3 only runs the rear braking system with the callipers on the differential centre.

Rotors

The rotor used on the front of the sprayers are a customized construction and are a 600mm diameter rotor that is fitted to the hub on the inside of the wheel. The rear are a 310mm diameter steel rotor and are mounted on the differential.

Callipers and Pads

The callipers used on the Crop Cruiser sprayers have two brake pads which clamp on to the rotor when the brakes are applied. These pads must be inspected regularly for wear. When the pads wear down to the indicator grove they must be replaced. Build up of mud and debris will cause the brake pads to wear prematurely for this reason the brake callipers must be kept clean at all times.

Brake Boosters

Both brake boosters are located under the transmission in the centre of the chassis. The right hand side booster is used to power the rear brakes and the left hand side booster is used to power the front brakes. To maintain sufficient brake fluid in the system, each brake booster reservoir must be checked regularly.

Bleeding the Brakes

The braking system is an air over hydraulic configuration. The front and rear brakes are operated from two separate brake boosters and reservoirs. The boosters are located under the transmission in the centre of the chassis. If there has been a brake pad change, a leak in the lines or any reason the brake lines or calipers have been removed then the system need to be bled.

To bleed the brakes, there must be sufficient air pressure. Each brake calliper must then be bled separately.

The method used to bleed the callipers manually is to

1. Connect a clear plastic tube to the bleed screw on the caliper and place the opposite end of the tube into a container.

Front Caliper

Important Notes:

- Fill the container with approximately 30mm of brake fluid and then submerge the end of the plastic tube in the fluid. (This will stop air being drawn back through the system)
- The system should be bled until no more air bubbles appear in the container.
- It is recommended that during this process the person bleeding the brakes wear suitable eye protection.

2. With an assistant, loosen the bleed screw and then slowly depress the brake pedal. When the brake pedal reaches its full travel re-tighten the bleed screw before allowing the pedal to return to its released position. Continue this process until the air in the system stops bubbling up in the container and a continuous stream of fluid can be seen leaving the bleed screw.

3. Repeat this procedure for each of the other brake assemblies.

Rear Caliper

Note: Ensure that at all times the fluid level in the reservoirs remain above the minimum mark.

If the desired result is not achieved after completing this process then the brake system must be pressure bled.

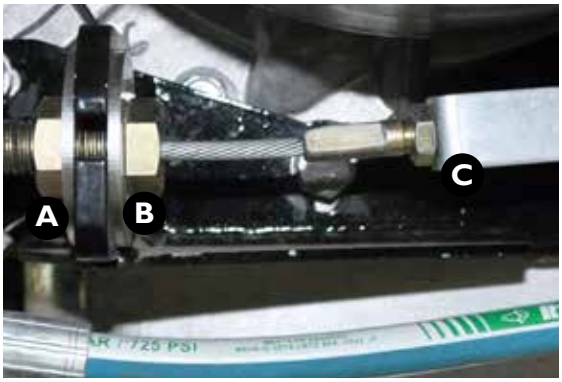
Park Brake

The park brake is mounted at the rear of the transmission. It is a drum brake that is applied using a cable mounted to a hand operated lever at the left hand side of the driver seat.

To adjust the Park brake:

- Park the sprayer on even level ground. Leave the park brake on so the cabin access ladder remains down.
- Turn engine OFF.
- Chock all wheels of the sprayer, ensuring it cannot roll while it is being worked on.
- Once the hand brake has been overridden, the condition of the park brake pads must be inspected before adjustment of the cable at the transmission.
- In the cabin, release the hand brake. Undo the screw that is in the head of the lever.

- Rotate the top knurled section of the lever to adjust the tension on the cable.
- Test the tension by pulling the hand brake ON. If the lever comes up into the ON position with small amount of effort, the adjustment has made the cable looser. If the lever comes into the ON position with more effort than before then the cable has been tightened.
- If there is no more adjustment in the lever in the cabin then the adjuster at the park brake on the transmission can be used.
- Use locking nuts (A,B) to adjust the cable tension at the rear of the transmission. The cable should be tensioned just enough so the clevis pin (C) can not be spun by hand.
- Once adjustments have been made, tighten lock nuts A & B.



- To test the park brake, start the machine and drive to a small embankment or hill, stop and put the machine in neutral, apply the park brake with your foot brakes on. Slowly release your foot from the foot brake and see if the machine starts to roll backwards. If the machine does start to roll apply the foot brakes to stop, the cable still needs to be adjusted more until it can hold the machine.

  There is also a switch fitted to the park brake in the cabin. This switch controls the position of the cabin access ladder. When the park brake is engaged the switch dumps air from the ladder cylinder allowing the ladder to lower, when the park brake is disengaged the switch supplies air to the cylinder positioning the ladder up in the transport position. The switch is also used to ensure that the transmission is in neutral.

Drop Legs

The Crop Cruiser run a 1:1 chain driven drop leg. Drive is transferred from the differential through drive shafts to the input shaft of the drop leg. A 120 Super HT 1"1/2 drive chain is between the input shaft and the bottom axle shaft.

The drop legs have an oil bath sump which the chains run in and carry the oil to the bearings.

The oil level can be checked by removing the level plug.

The chain will stretch over time and become loose. When this occurs the chains must be replaced. There is no tensioning mechanism for the drive chains as stretched chains will damage the drive sprockets and therefore must be replaced.

Drive Chain Testing Procedure

The Crop Cruisers are fitted with quality drive chains to transmit power to the wheels. These chains are of the highest quality and are designed for a long trouble free life, however, proper care and maintenance of the drive system must be adhered to for maximum chain and sprocket life. The chain is 120 Super HT chain.

The chains service life is gauged by total stretch. When a chain stretches it does not align correctly with the drive sprockets and therefore should be replaced, not tensioned, to prevent excessive wear on the teeth of the drive sprockets.

The maximum allowable chain stretch is 1.5%. The amount of chain stretch can be measured with the chain stretch tool supplied with the sprayer.

To check the chains:

1. Apply hand brake and chock all wheels
2. Remove rear drive leg inspection cover.
3. Place a suitable strength jack under the drive leg and lift up until the wheel is just off the ground.
4. Rotate wheel so that the chain is tensioned on the inspection cover side.
5. Fit the outside of the chain gauge onto a chain roller and tilt the top up trying to slide it under the roller. If fits under easily the chain is stretched.
6. Using the supplied chain gauges, (0.5, 1.0 & 1.5%). Start with the 0.5% gauge and work up until the next largest gauge does not fit in. If the 1.5% chain gauge fits then the chain is outside the allowable limit and must be replaced. Always try the chain in at least three places. Gauge set GA5068320.

Bottom Sprocket Inspection

On the inside of the rear drop legs, there is an inspection cover to check the 3 bolts retaining the bottom sprocket.

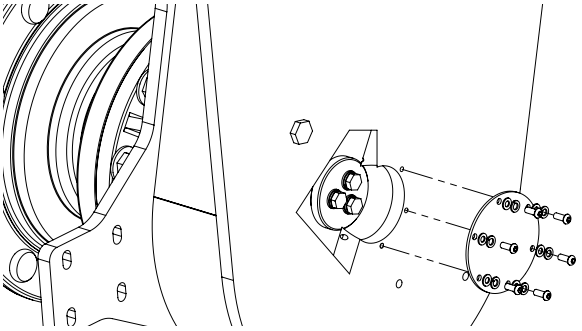
First, the oil will need to be drained to below the inspection port into a suitable container.

Next remove the 6 socket head cap screws and remove the cover from the drop leg.

Then check that the M10 bolts are still torqued up to 46 ft/lbs and then clean the surface around the inspection port and clean the cover plate also.

Apply a suitable sealant or gasket to the surface and screw the cover plate back into place. Tighten the socket head cap screws up to 9 ft/lbs.

Refill the drop leg up to the level hole using the recommended oil as listed at the start of this chapter.



Transmission

The Allison 5 speed automatic transmission oil level can be checked by using the dipstick located in front of the cabin on the left hand side.

The oil level must be checked with the engine running. If the oil is cold (less than 70 degrees) the oil level must be in the lower range.

If the oil temperature is warm (above 70 degrees) the oil level must be in the upper range.

Transmission Oil Cooler

The transmission oil cooler is integrated into the cooling package.

Refer to the maintenance schedules and the Lubricants and Filters charts for servicing requirements.

Refer to the Allison Transmission operator's manual (supplied) for oil filter change and any information on operation or trouble shooting the Allison transmission.

Drive Shafts

Fixed drive shafts are used to transmit drive between the transmission and the differential. These drive shafts have greasable universal joints at each end, and centre bearings on the shafts. The rear shaft has a telescopic spline which also requires greasing. These drive shafts should be inspected for wear and greased at regular service intervals.

Differential

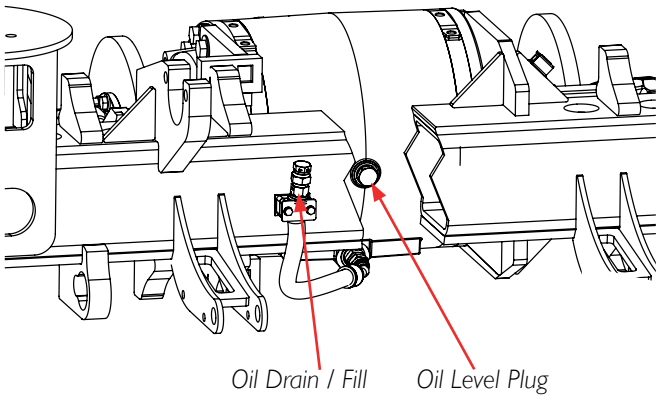
The differential runs in an oil bath sump. The oil level can be checked by removing the level plug on the rear of the differential housing.

The oil should be replaced at the first service to remove manufacturing contamination.

To drain the oil, remove the hose from the clamp, remove the cap and point down into collection container.

There is no breather for the differential.

Note: The lubricant specification can be found in the 'Lubrication and Maintenance' chapter of this manual.



Hydraulics

Crop Cruiser sprayers are fitted with two hydraulic systems. The first is used to operate the steering & hydraulic cylinders on the boom. The second system is used to operate the liquid spray pump.
These systems operate from a common hydraulic reservoir. The reservoir has a sight tube mounted on the side with a temperature gauge fitted. The oil level must always be visible in top third of the tube. The oil temperature will normally run at 60-80 degrees Celsius. The oil should be checked as per the maintenance schedule.

WARNING: Working with hydraulics is dangerous. Ensure the machine is switched of and the ignition source is isolated before working near the centre section.

Note: The lubricant specification can be found in the 'Lubrication and Maintenance' chapter of this manual.

Main Hydraulic Systems

The two hydraulic systems are used to provide liquid for the steering, hydraulic cylinders and liquid pump. The first hydraulic system is a priority system, driven by a hydraulic pump attached directly to the engine. This system has two priority levels. The highest priority components on the system are the steering. The second priority components are the boom hydraulics as well as the fill pump. The second system drives and maintains the liquid pump speed.

Return Filter

The hydraulic return filter is located in the oil tank in front of the cabin. This filter should be checked as per the maintenance schedule The return filter filters all of the return oil to the reservoir. There is a red indicator located on the top of the filter. If the indicator pops out then the filter must be replaced because it is blocked and causing back pressure through the system. This filter should be checked once the oil has reached operating temperature as cold oil can cause a false reading on the indicator.

Oil Cooler

The oil cooler is located on the rear of the chassis above the rear differential. This cooler uses an electric fan and a thermo switch to keep the oil at the optimum temperature. The cooler will switch on when the oil flowing through reaches 55°C. Ensure that the fins on the cooler are kept clear of debris.

Electric / hydraulic controls

The boom and fill pump functions are controlled by electric over hydraulics solenoids. These solenoids are energised by functions on the side arm rest console in the cabin and switches on the work station cover.

The boom functions are controlled by the solenoid block mounted at the top of the boom centre section. This hydraulic block is plumbed as an open centre circuit. The oil from the priority valve flows through the block continuously. When a hydraulic function is activated the unloader solenoid closes providing flow and pressure to the function on demand. There is a gauge mounted at the left end of the block for diagnosis.

See end of section for boom hydraulic block layout.

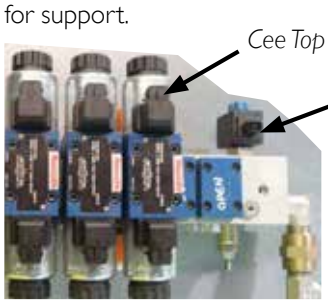
The directional valve controls oil flow to the desired circuit.

Each particular circuit can be identified by the tag on the wires attached to the solenoids.

Unloader Solenoid

The unloader solenoid is located at the rear of the sprayer on a hydraulic bank that contains Cee top 3 solenoids. The unloader solenoid can be identified as the cartridge solenoid on the front face of the manifold. It is in a different plain than the Cee top 3 solenoids.

When the boom hydraulics are de-energised this solenoid allows fluid to return back to the hydraulic tank. As soon as one of the hydraulic circuit solenoids is activated the unloader solenoid will also activate and prevent the fluid returning directly back to the tank, therefore increasing the pressure in the system to main relief pressure and allow the hydraulic function to be performed. When the system performs a function, the gauge on the left hand end of the block should read 2500 Psi. If the reading is lower, contact your local Goldacres dealer for support.

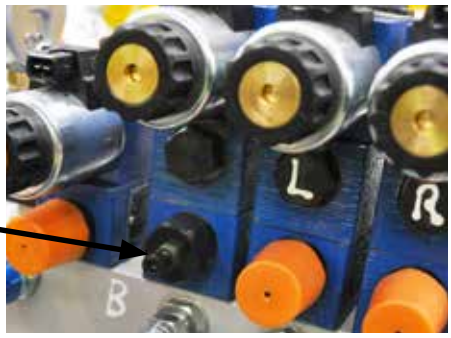


Raise/Lower Boom Solenoid and Cylinders

The raise/lower boom solenoids are separate solenoids. The raise solenoid is a single acting Cee top 3 solenoid. The lower solenoid is a cartridge solenoid that has a one way check in its spool.

When the lift solenoid is energised oil flows from the pressure port in the cee top manifold through the lower solenoids one way check out to the lift cylinders. The oil flow can be controlled by the flow control spool under the lift cee top 3 solenoid.

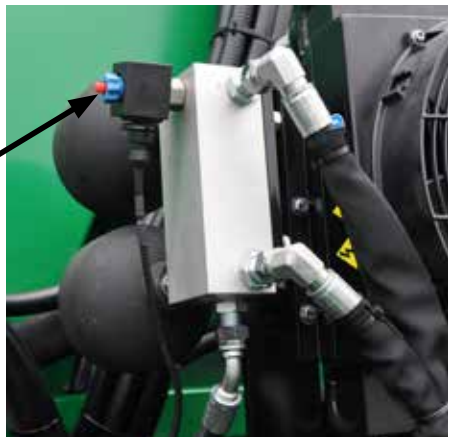
Flow control spool



There are also a lift lockout solenoid in the circuit, located on the accumulator manifold, at the rear of the machine. This is in the system to eliminate boom bounce when in transport. (wings folded and boom rests in)

This solenoid can be overridden in the event that they become non operational. To do this, locate the solenoid, there is a red knob on top of it. Wind the knob all the way in. This will allow the flow of hydraulic oil to the lift cylinders.

Red knob



This is a temporary solution to allow the boom to move up and down. It is recommended to troubleshoot the system to find the fault. If the problem cant be diagnosed, contact your dealer.

Note: When lowering the boom the unloader solenoid will not be activated.

Boom Open/Close Solenoid and Cylinder

The boom open/close solenoid is located in the bank of solenoids at the rear of the sprayer. This solenoid is a double acting solenoid.

To open and close the boom, two hydraulic phasing cylinders are used.

Tilt Left And Tilt Right Solenoid and Cylinder

The tilt left and tilt right solenoids are located in the bank of solenoids at the rear of the sprayer. This solenoid is a double acting solenoid.

Bi-fold Circuit

The Bi-fold solenoid is located in the bank of solenoids at the rear of the sprayer. This solenoid is a double acting solenoid.

There is a pressure reducing valve mounted under the solenoid. This prevents the circuit being over pressurised so that the outer booms retain suspension. This pressure can be monitored on the pressure gauges at the front of the cabin. The Bi-fold circuit has 2 double operated check valves in the system to maintain the pressure in the boom lines when it is folded out in the working position.

Double operated check valves

Pressure reducing valve

Hydraulic Yaw

Hydraulic yaw cylinders that are fitted to the centre section get there oil supply from the lift circuit. When charging the yaw system the yaw ball valves are opened and the lift circuit is dead headed. Oil flows through the yaw pressure reducing valve, which limits the maximum pressure to 1500 PSI, charges the yaw cylinders and accumulators. The yaw ball valves must then be isolated as the hydraulic yaw circuit is

closed loop. The pressure gauges on the hydraulic yaw accumulators must be inspected to maintain the correct operating pressure.

Rear Hydraulic System

Liquid Spray Pump Control Manifold

The liquid spray pump control manifold is located on the inside of the chassis, on the left-hand side of the sprayer. It is a pressure flow compensated valve. This means that the oil flow to the product pump can be maintained even if the pressure of the oil is increased or decreased. This allows the product spray pump RPM to remain constant even if engine RPM changes.

The valve has a built in pressure relief valve. This valve prevents excessive pressures within the hydraulic system. (This valve operates when a pressure of 2250 PSI is reached) During normal operation this will prevent any fluid bypassing the system. If a fault develops in the system, this valve will enable fluid to return to the tank, without causing damage to the system.

Liquid Spray Pump Solenoid

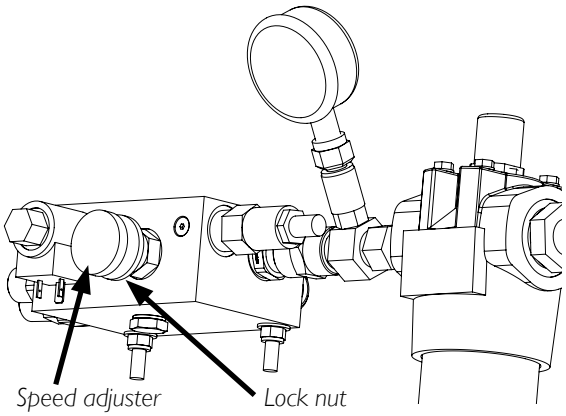
The liquid spray pump solenoid is a single acting spring return solenoid and is built into the liquid pump control manifold. When this solenoid is activated, fluid is forced to travel to the needle valve before travelling to the hydraulic drive for the liquid spray pump.

Liquid Pump Needle Valve

The liquid spray pump needle valve is built into the liquid spray pump control manifold. This valve enables the speed of the pump drive to be adjusted. Pump speed must never exceed 540 rpm.

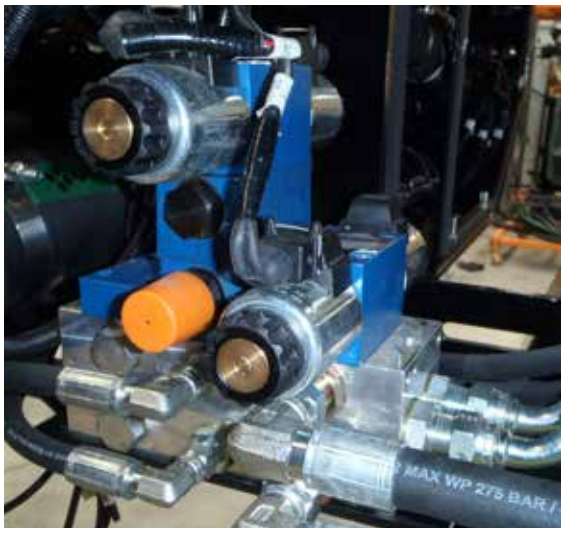
To Set the Liquid Spray Pump RPM

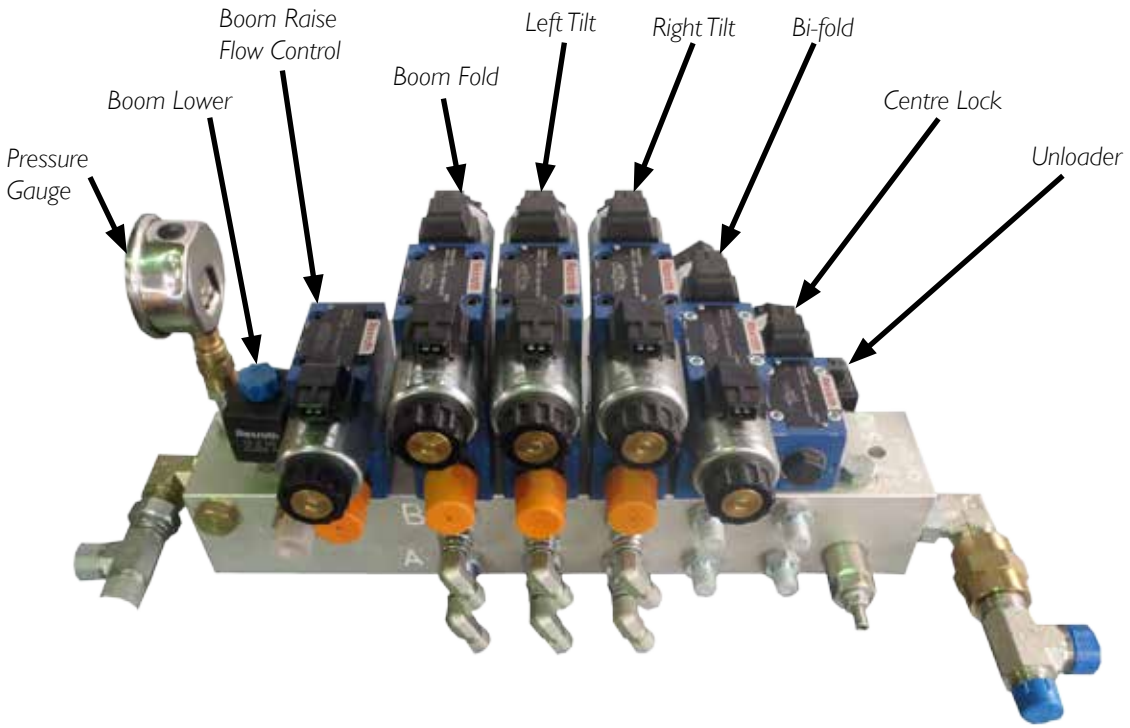
1. Park the sprayer on even level ground. Leave the park brake on so the cabin access ladder remains down.
2. Chock all wheels of the sprayer, ensuring it cannot roll while it is being worked on.
3. Ensure the hydraulic oil in the system is up to temp.
4. Set engine speed to around 2000 rpm
5. Switch spray pump on.
6. Hold the outer adjuster and loosen the locknut behind it.
7. Rotate clockwise to increase the speed, rotate anti-clockwise to decrease the spray pump speed, set to 540 rpm.
8. Hold adjuster and tighten the lock nut.



Hydraulic fill pump (Optional)

Fill pump is controlled by the valve block mounted on the cross member of the chassis under the cabin.





Engine

Opening the Bonnet

The bonnet is fastened down by 2 latches.

Once open, the bonnet is supported by over centre weight.

Do not drive the machine with the bonnet open.

CAUTION: If the engine has been running, take extra care around hot engine parts such as the exhaust.

CAUTION: When the bonnet is closed, ensure that the latches are tight before driving machine.

Fuel Filters

There are three fuel filters mounted at the rear of the engine.

The first filter is the first point from the fuel tank, is an inline filter that is located on top of the fuel tank near the right hand chassis rail.

The water separator or primary filter is mounted on the left hand side chassis near the ladder. It separates any water from the fuel and also filters contaminants.

This filter has a sensor in the base of it which will alarm when excessive amounts of water is detected in the fuel.

This filter should be replaced with in the first 50 hours of use and then every 250 hours of engine operation. Refer to maintenance schedule.

The water trap at the base of the cylinder should be drained daily.

The Secondary filter is mounted on the rear of the engine. This filter is finer than the primary filter.

Note: Filter specifications in the 'Lubrication and Maintenance' chapter of this manual.

Engine Oil and Filter

Check the engine oil level daily. The engine oil must be checked with the engine stopped. The engine oil dipstick must be removed from the engine tube, cleaned and then re-dipped to verify the correct engine oil level. The oil level must be between the "ADD" and "FULL" marks on the dipstick. If the oil level is below the "ADD" mark top up the engine with the appropriate fluid. The lubricant specification can be found in the 'Lubrication and Maintenance' chapter of this manual.

The engine oil must be drained within the first

50 hours of engine use and then as per the maintenance schedule after that. To drain the engine oil place a container, at least 30 litre capacity, under the drain plug, located on the front on the left hand chassis rail, and then remove the plug. The engine oil filler cap can be loosened to allow the oil to drain easier.

Once drained refit the oil drain plug and fill though the rocker cover on the top of the engine. The oil level can be checked via the dipstick on the left of the engine.

When the engine oil is changed the engine oil filter must be replaced. The engine oil filter is located on the right side of the engine. The filter is a spin on element.

Note: Filter specifications can be found in the 'Lubrication and Maintenance' chapter of this manual.

Coolant

The Crop Cruiser radiators are fitted with a expansion header tank. This allows for expansion of the coolant when the engine warms up. The radiator cap allows excess fluid to drain out of the over flow if the coolant expands too much. The coolant level must be visible from the lid of the header tank. The level will be 50mm below the lid when the engine is cool.

Coolant level must be checked DAILY.

Note: Never remove the radiator cap when the engine is hot.

The expansion header tank is fitted with a level sensor. If the coolant drops below this sensor the engine controller will send an alarm through to the CanTrak console and shut the engine down.

Coolant must be checked at regular service intervals. Refer to maintenance schedule. Test kits are available from Cummins to check this.

The coolant must be replaced every 2000 hours. Quantity and type can be found in the 'Lubrication and Maintenance' chapter of this manual.

There are ball valves located on the heater hoses at the rear of the engine and also at the header tank. These ball valves can be isolated during hotter periods to allow the air conditioning system to operate more efficiently. When replacing the entire coolant system these ball valves must be opened so that all the air is bled from the coolant lines.

Engine Drive Belt

The engine drive belt is a serpentine belt that has a self tensioner on it. The belt requires inspection at regular service intervals. If the belt begins to slip the belt may require replacement as it can become laminated or slippery. If the tensioner looses its tension it can also cause the belt to slip and must be replaced. Refer to maintenance schedule.

To replace the engine drive belt insert a ½" drive into the tensioner arm and pull upwards.

Pull the belt off the pulleys and off the fan.

Fit the new belt in reverse, ensure all pulleys are aligned correctly with the belt before releasing the tensioner.

Air Conditioner Belt

The air conditioner compressor belt has a manual adjuster. To tension the belt the compressor mounting bolt and adjuster bolt must be loosened. To tighten the belt, use the lock nuts on the adjuster to pivot the compressor and pull the belt tight. When the belt is correctly tensioned tighten the retaining hardware.

There should be no more than 12mm deflection in the belt when it is tensioned correctly. Refer to maintenance schedule.

Engine Air Cleaner

The air cleaner is mounted above the engine near the expansion header tank. Mounted on the right hand side of the air cleaner is a vacuum gauge. This is used to detect a blocked air filter. The gauge will operate in the middle range when in normal working conditions, and in the "RED" zone when blocked. This indicates it is time to remove the primary filter and replace it.

It is recommended to inspect the filters when the machine is new. Inspection of the primary filter should be carried out at service intervals or when the vacuum gauge indicates. NEVER clean the secondary filter, this filter should be replaced if it is contaminated or damaged.

Refer to maintenance schedule.

Note: Filter specifications can be found in the 'Lubrication and Maintenance' chapter of this manual.

Air Conditioning System

General Operation

The air conditioning circuit operates by the pressuriser fan drawing clean air into the cabin through the carbon filter. This fan pressurises the cabin with clean air and forces air out any holes or leaking seals in the cabin ensuring no impurities can be drawn into the operator's clean environment.

The blower fan then pulls air through the air conditioning evaporator and heating coils and pushes it to the demist and roof vents. If the air conditioning compressor is engaged the air conditioner evaporator will cool the air as it is drawn though it. If the heater thermostat is turned to heat, the air will warm again as it passes through. If the heater is off, the cool air passes through to the vents.

Compressor

The air conditioning compressor is located on the front side of the engine. This compressor is connected to the engine by a "V" belt. The compressor is engaged when ever the cabin blower fan switch is energised. The thermostat will cycle the air compressor if the evaporator gets to cold.

Condensor

The air conditioning system condenser is located in front of the engine radiator. The condenser is cooled by air being drawn through from the engine fan. The condenser requires regular cleaning of dust and any debris.

Note: Take care not to damage the condenser coils or fins when the condenser is cleaned.

Receiver Dryer

The air conditioning receiver dryer is fitted to the right hand chassis rail under the cabin. This component captures any moisture that is circulating in the air condition system. Moisture in the air conditioning system freezes and causes blockages. The component must be replaced any time the air conditioning system is opened or serviced.

Heating System

The heating core is warmed with hot water from the engine. The volume of the water travelling through the system (and therefore the heat supplied) may be adjusted by setting the temperature on the AC head unit.

To enable the heating core to be isolated from the engine two taps have been installed. The first tap is located on the right hand side of the engine behind the radiator. The second tap is located at the header tank.

Note: If the heating is not working ensure that the isolating taps are on.

Cabin Air Cleaner

A carbon air cleaner is located in the right hand side of cabin under the roof. This filter cleans the impurities from the air being drawn into the cabin. The air is drawn in through the carbon filter by a fan and pressurises the cabin to prevent impure air entering the cab from any holes or seal leaks.

To access the area under the roof, remove the 2 screws at the rear of the roof, lift the rear of the roof and place the support bracket in the locator. Remove the 4 thumb screws and remove cover, remove the old filter. Remove the new filter from the plastic bag. Place new filter in with the seal face to the inside. Replace the outer cover and refix the thumb screws. Lower roof and refix the 2 screws to hold roof.

Refer to maintenance schedule.

Note: Filter specifications can be found in the 'Lubrication and Maintenance' chapter of this manual.

Electrical System

Batteries

The electrical system operates on 12 volts. To provide a 12V supply with sufficient current two 12 volt batteries have been used in parallel. This means that the like polarity terminals have been joined.

- Before carrying out any repairs to the electrical system turn the battery isolator switch to the 'off' position. The battery isolator is located on the right hand chassis rail behind the fuel tank.
- When welding connect the ground terminal directly to the part being welded and ensure that the batteries are disconnected. Disconnect any electronic controls such as the engine controller, transmission controller and the spray controller. **Ensure the TCM is disconnected.**
- When welding on the sprayer ensure, If Fitted, that all weed seeker controllers are totally removed from the sprayer.

Battery Isolator

The battery isolator switches power flow from the batteries to the sprayer. The isolator switch cuts all power to the sprayer except for the radio back up power. The isolator switch must be isolated when the sprayer is not in use to prevent battery leakage or power faults. The isolator switch is located on the right hand chassis rail behind the fuel tank.

After engine shutdown, wait for a min of 30 seconds before turning OFF the isolator switch. This allows the engine data to be saved back to the ECM.

CAUTION: Not to be used as emergency stop.

Electrical Components

The Electrical control panels are located in the side console on the right of the operator's seat. These panels contain fuses and relays to activate the sprayer circuitry. To gain access to the panels the console lining must be removed by releasing the latches on top of the cover and pulling it upwards.

These boxes control various relays, diodes and fuses to operate a number of electrical circuits through out the sprayer. The layout of the fuse boxes can be seen in the 'Cabin' chapter.

When a fault occurs, the fuses will blow and disconnect the circuit. If a fuse has been blown identify the corresponding device and investigate the cause before reconnecting the new fuse.

The fuses have been placed in the system to protect the system against electrical faults. When a fuse is replaced it is important that the fuse is replaced with another fuse of the same rating.

Maintenance Schedules

After the first service, replace or inspect the items at the intervals indicated.

See end of chapter for 50 hour service check list.

Engine

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Engine oil	Inspect	Inspect	Replace	Replace	Replace	Replace
Engine oil filter	Inspect	Inspect	Replace	Replace	Replace	Replace
Fuel filter - engine	Inspect	Inspect	Replace	Replace	Replace	Replace
Fuel filter - (separator filter)	Drain	Drain	Replace	Replace	Replace	Replace
Fuel Filter - (in line)		Inspect	Replace	Replace	Replace	Replace
Fuel level	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Antifreeze/Coolant	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Fan	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Drive belt	Inspect	Inspect	Inspect	Inspect	Inspect	Replace
Cooling system	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Mounting bolts and vibromounts		Inspect	Inspect	Inspect	Inspect	Inspect
Hoses, lines and clamps		Inspect	Inspect	Inspect	Inspect	Inspect
Exhaust system		Inspect	Inspect	Inspect	Inspect	Inspect
Air cleaner (primary filter)		Inspect	Inspect	Inspect	Inspect	Replace
Air cleaner (safety filter)		Inspect	Inspect	Inspect	Inspect	Replace
Air cleaner fittings		Inspect	Inspect Tension	Inspect Tension	Inspect Tension	Inspect Tension
Intake system		Inspect	Inspect Tension	Inspect Tension	Inspect Tension	Inspect Tension
Belt tensioner bearing		Inspect	Inspect	Inspect	Inspect	Replace
Belt tension		Inspect	Inspect	Inspect	Inspect	Inspect
Turbocharger		Inspect	Inspect	Inspect	Inspect	Inspect
Air compressor		Inspect	Inspect	Inspect	Inspect	Inspect
Harmonic balancer		Inspect	Inspect	Inspect	Inspect	Inspect

Engine coolant to be replaced at 2000 hours

Transmission

Service Interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Oil	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Internal Filter	Replace on transmission rebuild					
External Spin-on Filter		Inspect	Inspect	Replace	Inspect	Replace
Selector Linkage		Inspect	Inspect	Inspect	Inspect	Inspect
Bolts		Inspect	Inspect Tension	Inspect Tension	Inspect Tension	Inspect Tension
Oil Lines		Inspect	Inspect	Inspect	Inspect	Inspect
Electrical Harnesses		Inspect	Inspect	Inspect	Inspect	Inspect
Cooling System		Inspect	Inspect	Inspect	Inspect	Inspect

Tail Shafts

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Transmission, Axle Input &, Centre Bearing		Inspect	Inspect	Inspect	Inspect	Inspect
Universal Joints		Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Slip Splines		Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Centre Bearing		Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect

Axles and Drop Leg

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Differential Oil		Inspect	Inspect	Replace	Inspect	Replace
Drop leg Oil		Inspect	Inspect	Replace	Inspect	Replace
Planet hub Oil		Inspect	Replace	Replace	Replace	Replace
Drive Chains			Inspect Measure	Inspect Measure	Inspect Measure	Inspect Measure
Steering Pins		Lubricate	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Universal Joints		Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Bearings		Inspect	Inspect	Inspect	Inspect	Replace
Axles		Inspect	Inspect	Inspect	Inspect	Inspect
Toe In (1-5mm)			Measure	Measure	Measure	Measure

Hydraulic System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Hydraulic oil		Inspect	Sample	Sample	Sample	Replace
Hydraulic oil return filter		Inspect	Inspect	Replace	Inspect	Replace
Hydraulic lines and hoses		Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic cylinders		Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic pumps		Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic pump mountings		Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic valves		Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic relief pressures		Inspect	Adjust	Adjust	Adjust	Adjust

Pneumatic System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Air tanks	Drain	Drain	Drain	Drain	Drain	Drain
Air lines and fittings	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect

Braking System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Brake fluid		Inspect	Inspect	Inspect	Inspect	Replace
Brake pads		Inspect	Inspect	Inspect	Inspect	Replace
Hydraulic brake lines/hoses		Inspect	Inspect	Inspect	Inspect	Inspect
Brake discs		Inspect	Inspect	Inspect	Inspect	Inspect
Seals		Inspect	Inspect	Inspect	Inspect	Inspect
Brake operation	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake cables		Adjust	Adjust	Adjust	Adjust	Adjust
Parking brake drum		Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake pads		Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake operation	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake switch		Inspect	Inspect	Inspect	Inspect	Inspect
Calliper mountings		Inspect	Inspect	Inspect	Inspect	Inspect
Calliper and Rotor	Inspect	Clean	Clean	Clean	Clean	Clean

Suspension System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Polyurethane bushes		Inspect	Inspect	Inspect	Inspect	Replace
Bolts and nuts *		Inspect	Tension	Tension	Tension	Tension
Shock absorbers		Inspect	Inspect	Inspect	Inspect	Replace
Ride height valve		Inspect	Inspect	Inspect	Inspect	Inspect
Sway Bar Bushes		Inspect	Inspect	Inspect	Inspect	Replace

*__Note:__ Parallel link bolts are to be torqued to 350 ft/lb

Wheels and Tyres

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Rims			Inspect	Inspect	Inspect	Inspect
Wheel nuts	Tension	Tension	Tension	Tension	Tension	Tension
Tyre pressure	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Tyres	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect

Air Conditioning System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Condenser	Inspect Clean	Inspect Clean	Inspect Clean	Inspect Clean	Inspect Clean	Inspect Clean
Air conditioner lines			Inspect	Inspect	Inspect	Inspect
Refrigerant and dryer			Inspect	Inspect	Inspect	Replace
HVAC box			Inspect	Inspect	Inspect	Inspect
Compressor drive belt		Inspect	Inspect	Adjust	Adjust	Adjust
Carbon filter inlet		Inspect	Inspect	Inspect	Inspect	Inspect

Service interval	200hrs/ 2 months	400hrs/ 4 months	600hrs/ 6 months	800hrs/ 8 months	1000hrs/ 10months	12000hrs/ 1 year
Carbon filter	Replace	Replace	Replace	Replace	Replace	Replace

Chassis

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Ladder Folding Mechanism		Lubricate	Lubricate	Lubricate	Lubricate	Lubricate
Ladder Mounting Bolts		Inspect	Inspect	Inspect	Inspect	Inspect
Pump Mounting Bolts	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Cab mount bolts and bushes		Inspect	Tighten Inspect	Tighten Inspect	Tighten Inspect	Tighten Inspect
Cabin Seals			Inspect	Inspect	Inspect	Inspect
Cabin Interior	Clean	Clean	Clean	Clean	Clean	Clean
Tank Retaining Strap Bolts		Tighten	Tighten	Tighten	Tighten	Tighten
Para lift Link Bushes	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate	Replace
Chassis Frame		Inspect	Inspect	Inspect	Inspect	Inspect
Induction Hopper Arms		Lubricate	Lubricate	Lubricate	Lubricate	Lubricate
Boom Support Mounting Bolts		Tighten	Tighten	Tighten	Tighten	Tighten
Machine Exterior		Clean	Clean	Clean	Clean	Clean
Windscreen Wiper Fluid		Inspect	Inspect	Inspect	Inspect	Inspect

Electrical System

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Battery condition indicator		Inspect	Inspect	Inspect	Inspect	Inspect
Lights	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Leads and wires			Inspect	Inspect	Inspect	Inspect
Earth Leads			Inspect	Inspect	Inspect	Inspect
Wires near moving parts			Inspect	Inspect	Inspect	Inspect
Boom limit switch	Inspect Adjust	Inspect Adjust	Inspect Adjust	Inspect Adjust	Inspect Adjust	Inspect Adjust
Park brake position switch			Inspect	Inspect	Inspect	Inspect
Battery Terminal			Clean & Protect	Clean & Protect	Clean & Protect	Clean & Protect

Spraying Equipment

Service interval	Daily (10hrs)	Weekly (50hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Sprayer boom	Inspect	Adjust Inspect	Adjust Inspect	Adjust Inspect	Adjust Inspect	Adjust Inspect
Nuts and bolts	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Hinge bushes	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate
Tilt bushes	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate
Tilt wear pads		Inspect	Inspect	Inspect	Inspect	Inspect
Sprayer calibration	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Filters (suction filter, pressure filter, flush filter, compressor air filter)	Inspect	Inspect	Inspect or replace	Inspect or replace	Inspect or replace	Inspect or replace
Nozzles	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Pump (pre-spray test)	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Pump oil condition and level	Inspect	Inspect	Replace	Replace	Replace	Replace
Pump diaphragms				Replace		Replace
Pump seals				Replace		Replace
Pump valve o-rings				Replace		Replace
Pump valve springs and cages				Replace		Replace
Hoses and fittings	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Boom secure in boom rests	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Sprayer pump and lines	Flush	Flush	Flush	Flush	Flush	Flush
Ball valves	Open & inspect	Open & inspect	Open & inspect	Open & inspect	Open & inspect	Open & inspect

First Service @ 50 Hrs

Service location	Type of service required		
Engine		Goldacres #	Generic #
Engine oil	Drain and Replace		
Engine oil filter	Replace	GA5051755	LF3970
Fuel filter - engine	Replace	GA5051765	FF5612, FF5421
Fuel filter - (Primary)	Replace	GA5051760	FS1242
Fuel Filter - (in line)	Replace	GA5069895	W2153 3/8 tails
Transmission			
Oil	Drain and Replace		
External Spin-on Filter	Replace	GA5048281	29539579 or HF35296
Parking brake cables	Inspect and adjust		
Rear Axle			
Differential Oil	Drain and Replace		
Drop Leg Oil	Drain and Replace		
Planet Hub Oil	Drain and Replace		
Drive Chains	Inspect and measure		
Front Axle			
Front Wheel Bearings	Check tension and inspect		
Toe In (1-5mm)	Measure		
Hydraulic Oil Tank			
Hydraulic oil return filter	Replace	GA5069056	
Air Conditioning			
Compressor drive belt	Check and re-tension		

Chapter 11

TROUBLESHOOTING

General

The following troubleshooting information is provided as a reference when your sprayer is not functioning correctly.

To ensure that you receive the best possible service, it is recommended that you exhaust all applicable troubleshooting solutions shown in this chapter prior to calling your dealer for service advice.

Parts information and schematics can be found in the parts manual supplied.

Diaphragm Pump

Problem	Common Causes	Common Solution
Pressure and flow rate are too low	Pump	Check suction line for air leaks
		Suction filter may be blocked
		Check pump speed. 400 - 540 RPM
		Check oil for colour change. If the oil appears milky, a diaphragm will be damaged and needs to be replaced
		Check valves in pump
		Turn the pressure station ball valve to off, if the pressure increases on the pump gauge there is a problem with the control valve
		Measure the flow per minute coming out of one nozzle and check the nozzle chart for the corresponding flow
		Check the regulator valve is rotating the full 90 degrees when the boom valves are switched off
		Check tank sump and suction line blockages
	Excessive bypass on pressure manifold	Verify console calibration settings
	Supply to pump is restricted	Check the pressure relief valve setting on pressure manifold
Pressure and flow rate are too high	Bypass line is restricted or blocked	Verify console calibration settings Check for restriction in bypass line Check pump speed is not too fast
The pressure on my gauge is higher than the nozzle flow indicates	Blocked filters of nozzles	Check and clean all pressure and nozzle filters
	Flow loss due to resistance in lines, valves and filters	Re-calibrate console to allow for pressure loss

Problem	Common Causes	Common Solution
The flow rate is correct but my pressure is too low or high	Nozzles	Check nozzle chart for correct nozzle size
Pressure fluctuation	Air leak on suction side of pump	Check suction pump for air leaks
	Incorrect pump speed	Adjust pump speed so it is between 400 -540rpm
	Faulty pump valves	Replace pump valves
Pump pressure pulsating	Air accumulator pressure is incorrect (if fitted)	Reset the pressure in air accumulator
	Air accumulator diaphragm has a leak (if fitted)	Replace air accumulator diaphragm
	Incorrect pump speed	Adjust pump speed so it is between 400 - 540rpm
	Air leak on suction side of pump	Check pump suction for air leaks
Pump oil is becoming milky	Cracked diaphragm	Replace all diaphragms.
Pump is noisy	Low oil level	Refill or replace oil
	Damaged pump valves	Replace pump valves
	Pump suction line has air leak or is restricted	Clean suction filter and check for leaks in suction lines
Pump housing or mounting cracked	Extremely cold weather can cause liquid in the pump to freeze	Check for ice in the pump and let defrost if required

Flow Meter and Controller

Problem	Common Causes	Common Solution
Application rate is inaccurate, unstable or zero	Incorrect console calibration	Re-calibrate console
	Inconsistent ground speed reading	Check cabling
	Inconsistent spraying volume	Replace flow meter
	Faulty control valve. Check by using manual inc/dec flow control	Replace control valve
Speed sensor display is inaccurate, unstable or zero	Incorrect speed calibration	Re-calibrate console speed
	Faulty cable	Test cable as per instructions following
Volume display is inaccurate, unstable, zero or not changing	Meter calibration is incorrect	Reset meter calibration
	Flow meter cable pins are corroded	Replace flow meter plugs & pins
	Flow meter is pointing the wrong way	Disconnect flow meter and reinstall in the correct orientation
	Faulty cable	Manually test the cable
Flow meter appears not to be working	Flow meter is seized or blocked	Remove and clean any foreign materials so the turbine spins freely
Application rate or pressure will not alter	Faulty control valve	Test valve manually and replace if required
Control valve has failed	Replace control valve Faulty cable Faulty valve	Replace control valve : Temporary solutions: Remove the motor from the 3 way ball valve and manually adjust the flow by turning the shaft with a spanner

If the flow meter fails to give accurate readings, the following procedures should occur:

- Adjust the spraying pressure by putting the flow control switch into manual and using the increase decrease switch to adjust to the desired pressure as shown on the pressure gauge on the sprayer.
- Drive the sprayer at a constant speed in order to apply the required application volume as determined by the nozzle selection chart.
- The sprayer should then be operated to empty the tank. Once the sprayer is empty of chemical, partially fill the tank with fresh water so that test can be performed in order to correct the problem. Repair or replace the flow meter as soon as possible.

If the Raven console fails so that it is not able to control the boom valves, and control valve, the following procedures should be adhered to:
Boom Valves

1. Disconnect console from console cable.
2. Remove Cap from boom valves.
3. Remove Shaft locking Screw.
4. Wind plunger shaft anti-clockwise to open valve.

To start and stop spraying through the nozzles, start and stop the pump.

Note: If the sprayer is fitted with Rapid fire, then the air valves located on the centre section can be operated by turning the small screw on the top of the solenoid (circled). The nozzles will now turn on. For more information on overriding the rapid fire solenoids, see the 'Optional Accessories' chapter 'Rapid Fire' section.

Note: Care should be taken because there is no agitation while the nozzles are not spraying.

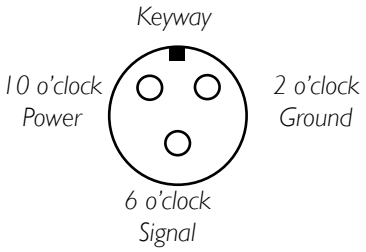
Control Valve

- Remove electric motor from three way fast close valve, and manually rotate valve until desired spraying pressure is achieved.
- Drive the sprayer at a constant speed in order to apply the required application volume as determined by the nozzle selection chart.

The sprayer should then be able to be operated in order to empty the tank. Once the sprayer is empty of chemical, partially fill the tank with fresh water (no chemical) so that testing can be performed in order to correct the problem. Repair or replace the console as soon as possible.

Instructions for Testing Flow Meter Cable

1. Change meter cal number to 1 with the [Meter Cal] key
2. Press [total volume] key and place boom switches ON
3. With a jumper wire (ie: paper clip) short between 6 o'clock and 2 o'clock sockets with a "short" then "no short" motion. Each time contact is made the [total volume] should move up in increments of 1 or more.
4. If total volume does not count up, perform test at the next connector closer to the console. If this next test works, the previous section of cable must be faulty and should be replaced.
5. Perform above voltage checks
6. Change [meter cal] number back to previous number



Voltage readings

2 o'clock to 6 o'clock (+5v DC)

2 o'clock to 10 o'clock (+5v DC)

Chemical Probe

Problem	Common Causes	Common Solution
Chem probe is not working or is working too slow	Air leak in the vacuum system	Check all hose clamps and fittings are tight.
	The volume of water supplied to the venturi probe is not sufficient	Check there are no kinked hoses and the water pressure is about 100psi

To isolate the area of possible air leak:
Step 1: Check the operation of the chemical probe.
If this will transfer water at a minimum of 30L/min. then this part of the system is okay.
If not check for air leaks at:

- Cam lever fitting at the probe
- Hose fittings
- Venturi – the venturi can suck air (less vacuum) where the black drop-pipe connects to the orange venturi.
- The venturi may also suck air where the 'lay flat' hose joins the bottom of the black PVC drop pipe.

Step 2: If probe works correctly but envirodrum will not operate, check for air leaks in envirodrum fitting (this must be thoroughly cleaned after each use) and check interior pipes in the envirodrum for air leaks or damage.

IN SUMMARY:
First: Check the flow of water into venturi.

Then:
1. Check the probe only.
3. Check probe and envirodrum section.

- Tests must be done with water because the speed of the transfer is affected by the increased viscosity of the chemical.

Spray Nozzles

Problem	Common Causes	Common Solution
Streaky pattern coming from nozzle	Nozzle tip blockages	Check for blockages by removing the nozzle, rinsing thoroughly with water and cleaning with compressed air DO NOT clean by blowing into nozzle with mouth
	Nozzle worn or damaged	Visually inspect nozzle for damage or wear, conduct a jug test if necessary
No spray coming from nozzle	Nozzle tip blockages	Check for blockages by removing the nozzle, rinsing thoroughly with water and cleaning with compressed air
	Check valve blockages	Remove the check valve and clean as required

TriTech and Delta Boom

Problem	Common Causes	Common Solution
Inner and outer wing are not inline with each other when the boom is unfolded	Boom cables are not adjusted correctly	Adjust boom cables to realign booms
Booms will not fully fold to the boom rests	Insufficient lubrication	Lubricate all boom pivots
	Fold cylinder mounts have moved	Adjust fold cylinder mounts
Boom unfold unevenly	Air trapped in the phasing cylinders	Unfold booms completely and hold switch for a few seconds - this will purge any air out of the phasing cylinder
Outer boom does not line up with the inner wing when unfolded	Incorrect boom adjustment	Fold the boom out and note the position the outer boom is in Fold the boom in to transport position and note position outer boom is in Follow the table below to adjust boom so it sits level in the out (work) position and to have the bottom chords sitting parallel in the folded (transport) position
Booms are showing signs of bending components and welds cracking	Folding or unfolding of booms is too fast	Reduce the hydraulic flow to the folding cylinders
	Folding or unfolding of booms while the sprayer is still moving	Do not fold or unfold the boom while the sprayer is still moving
	Tilt operation	Tilt operation should be kept to a minimum If the tilt operation is too fast, reduce the oil flow

The shim adjustment at the cable drum will affect the position of the outer boom when un-folded and when in the folded position. Use the table below to add or remove shims.

The table below shows the position of the boom and the adjustment necessary to get them level:

Outer wing position (Out)	**Outer wing position (Folded)**	**Top pivot shim adjustment**	**Bottom pivot shim adjustment**
UP	UP	NIL	REMOVE SHIMS
UP	DOWN	ADD SHIMS	NIL
LEVEL	UP	REMOVE SHIMS	REMOVE SHIMS
DOWN	DOWN	NIL	ADD SHIMS
DOWN	UP	REMOVE SHIMS	NIL
LEVEL	DOWN	ADD SHIMS	ADD

Plumbing

Problem	Common Causes	Common Solution
Boom valves fail to open	Insufficient power	Check all wiring and connections to ensure there is 12 volts at the valves
	System pressure greater than 150 PSI	Reduce the system pressure
Boom valves fail to close	Insufficient power	Check all wiring and connections to ensure there is 12 volts at the valves
	Foreign objects blocking plunger from seating	Clean the inside of the boom valves
No water at boom	No Tier valve entered or is at 0	

Induction Hopper

Problem	Common Causes	Common Solution
Induction hopper is not performing as well as it should	Insufficient flow to venturi in the hopper bottom	Check the pressure supplied to the hopper bottom is around 550kpa (80psi)
	Air leaks on induction system	Check all hoses, clamps, and cam lever fittings are sealed

Brakes

Problem	Common Causes	Common Solution
Brakes are spongy	Air in brake lines	Bleed brakes as outlined in maintenance chapter
Sprayer is stopping inconsistently	Grease or oil on the brake discs	Clean the discs with a clean cloth and methylated spirits
	Warped brake discs	Inspect the discs to ensure they are straight. If warped, they must be replaced
The brakes are screeching or squealing	Insufficient friction material on brake pads	Inspect brake pads and replace immediately if worn beyond wear indicators

Hydraulic and Pneumatic

Problem	Common Causes	Common Solution
No hydraulic pressure	Low hydraulic oil level	Check the oil level in the hydraulic reservoir and top up if necessary
	Fill pump is engaged	Switch the hydraulic fill pump off
The air bags are not inflating	Low system pressure	The bags will not inflate until the pressure in the system is above 75 PSI, check system pressure
	Compressor not working properly	Check that the compressor is working correctly
Vehicle sits unevenly	Incorrectly adjusted ride height valves	Adjust the ride height valves as per the instructions in the 'Lubrication and Maintenance' chapter

Air Conditioning

Problem	Common Causes	Common Solution
Air conditioning not cooling effectively	Condenser Blocked	Check the condenser for a build up of dirt and plant matter, clean if required
	Compressor belt loose	Inspect the belt to see if it is tensioned correctly If belt is showing signs of wear, replace
	A/C system needs re-gassing	If this is the case, only allow a qualified air conditioning technician to work on the system R134a refrigerant must not be allowed to escape to the atmosphere
	Evaporator blocked	Build up of dirt and plant matter, clean if required Be careful not to damage any of the components

Chapter 12

OPTIONAL ACCESSORIES

General Information

The following pages provide information on Goldacres optional accessories available on this equipment.

Please note: These options may not be fitted to your equipment unless ordered.

Chemical Induction Probe

Overview

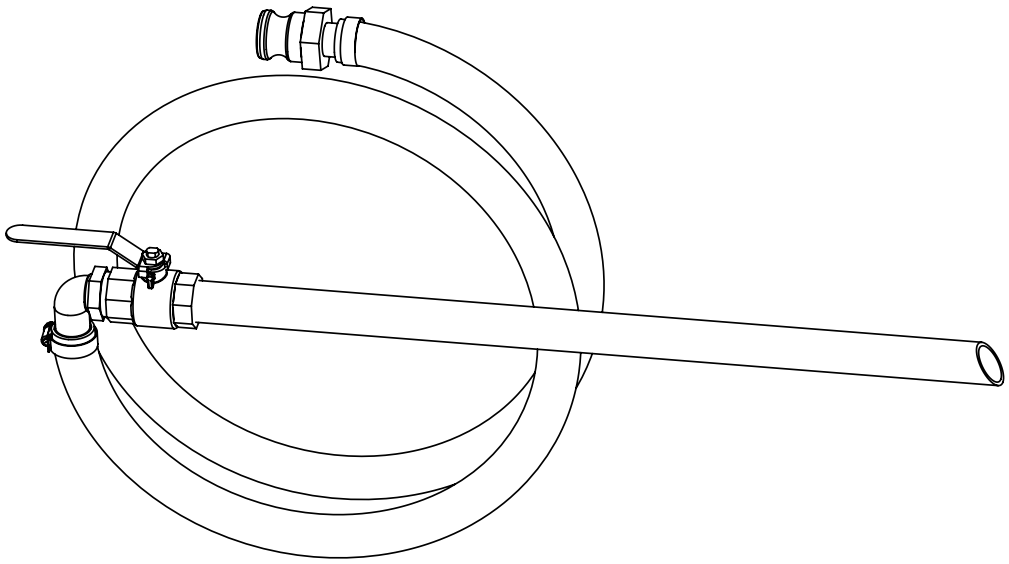
A simple method of transferring chemical into the sprayer tank is via the chemical probe. The chemical probe enables the chemicals to be transferred with minimal exposure to the operator. The probe is used in conjunction with the Venturi filler (located on the top of the tank) which creates the required suction on the pressure side of the pump.

The viscosity of the chemical being transferred will affect the rate of suction flow and hence the amount of time required to transfer the chemical. Water and air have low viscosities whereas molasses is an example of a highly viscous liquid. The higher the viscosity of the liquid, the longer it takes to transfer via the chemical probe. If the viscosity of a chemical is such that it takes too long to transfer, dilute the chemical with water, which will reduce the viscosity, and then transfer the solution.

The chemical should be transferred after about 20% to 50% of the required water quantity has been added to the sprayer tank. This will ensure that agitation takes place when the remaining water is added.

The end of the probe is not flat so that the probe, when placed flat against the bottom of the container, will not restrict the flow of chemical.

Key Features



Operation

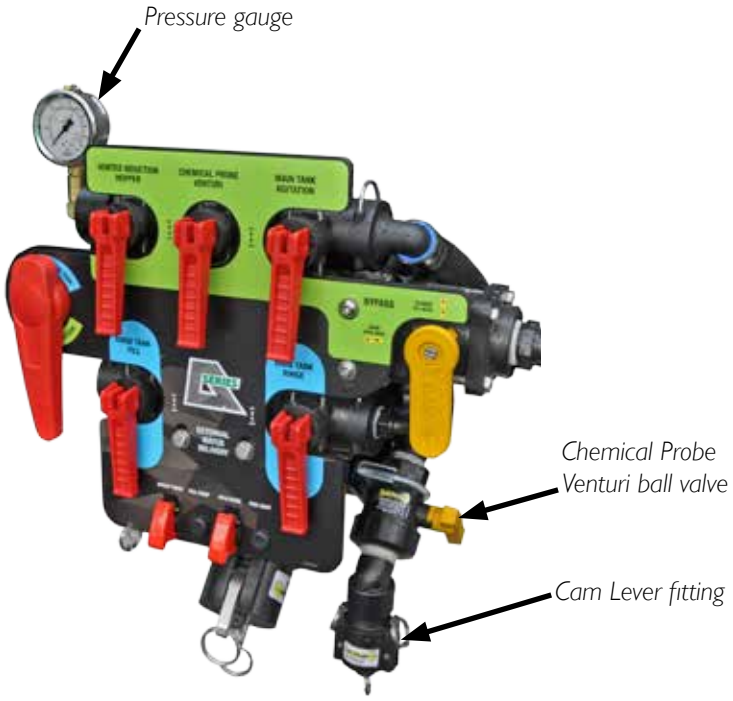
WARNING: It is critical that the chemical probe venturi continues to operate for a minimum of 30 seconds following use. This will ensure that no chemical is left in the line prior to the probe being disconnected.

Note: This item is intended for the induction of liquid chemicals only.

To operate the chemical probe:

1. Add 20 percent of the tank's volume of clean water to the main spray tank. Initially there needs to be a sufficient amount of water in the tank in order for the pump delivery to create the venturi effect via the venturi filler.
2. Ensure that the red handle on the suction valve is pointing towards the Suction From Main Tank.
3. Connect probe via cam lever fitting.
4. Open the ball valve above the cam lever fitting
5. Close all flip valves and Bypass valve to CLOSED.
6. 'OPEN' the Chemical Probe Venturi flip valve.
7. Turn on the SPRAY PUMP, turn on the RPM RAISE to generate the speed necessary to generate at least 100 psi delivery pressure. Do not run the pump faster than 540 RPM. The higher the pump delivery pressure, the greater the venturi suction and the quicker the probe will transfer the chemical. The delivery pressure should not exceed 120 psi as determined by the pressure relief valve setting.
7. Place probe in chemical.
8. 'OPEN' the valve on the probe.
9. The chemical should be now transferring to the sprayer tank via the venturi filler.
10. When all of the chemical has been transferred, rinse the chemical container with water and transfer the rinsate to the sprayer tank via the probe. This should ensure that the entire chemical is transferred and that the probe, venturi filler and connecting suction hose are cleaned. Induct clean water to rinse probe vacuum hose.
11. When finished, rotate the Bypass valve to OPEN/ Spray mode, flip open the Main Tank Agitator valve and flip OFF the Chemical Probe Venturi.
12 Close the ball valve above the cam lever fitting, and disconnect the probe from the cam lever.

Note: Once chemical has been transferred into the main spray tank the sprayer should always be agitating until spraying begins.



Superflow Chemical Induction Hopper

Overview

The Superflow Chemical Induction Hopper is an alternative method of transferring chemical into the main spray tank. The hopper can be lowered to a more convenient height for adding chemicals. The chemical can either be in liquid form or granular form and once in the hopper the chemical can then be easily transferred into the main spray tank. The hopper facilitates drum rinsing with fresh water and the hopper itself can be rinsed and all rinsate then transferred into the tank.

The hopper transfers the chemical via venturi effect. Water from the main spray tank is pumped under the bottom of the hopper where it passes through a venturi fitting under the hopper. This causes a suction effect and when the bottom of the hopper is open (via the hopper tank valve) the tank contents are drawn into the flow from the pump passing under the hopper and then transferred into the middle of the main spray tank.

Note: The level indicator should be used as a guide only.

Note: Never let the hopper run empty or suck air, this may cause foaming in the main tank.

Key Features

Reference Number	Function
1	Rinse tap
2	Tank rinse nozzle
3	Level indicator 60L
4	Drain tap

Reference Number	Function
5	Hopper tank ball valve
6	Drum rinse nozzle
7	Pressure water mixing jet valve

To operate the induction hopper:

1. Add at least 500 litres of clean water to the main spray tank. Initially there needs to be a sufficient amount of water in the tank in order for the pump delivery to create the venturi effect via the venturi fitting. This will also ensure that agitation takes place when the remaining water is added.
2. Lower the hopper for convenience. (Check that the delivery hose to the hopper is not restricted or kinked).
3. Ensure that the red handle on the suction valve is pointing towards the Suction From Main Tank.
4. Open the vortex induction hopper flip valve and (if required) the main tank agitator flip valve.
5. Ensure the bypass line ball valve and the chemical probe venturi flip valves are closed.
6. Operate the pump at the lowest speed necessary to generate at least 70-80 psi delivery pressure (as displayed on the sprayer pressure gauge). Do not run faster than 540 RPM.

Note: The higher the pump delivery pressure, the greater the venturi suction and the quicker the hopper will transfer the chemical. The delivery pressure should not exceed 110 psi as determined by the pressure relief valve setting.

7. Put the required amount of chemical into the hopper (liquid or granular). Wear the necessary protective clothing and use the required safety equipment to avoid exposure to chemicals.
8. Open the hopper tank ball valve at the bottom of the hopper by turning the large yellow handle down. The chemical should be now transferring to the main spray tank.
9. Rinse all chemical drums and the hopper as per the rinsing instructions.

When finished using the hopper:

- Close the hopper tank ball valve at the bottom of the hopper by turning the yellow handle so that it is horizontal.
- Turn the bypass valve 'OPEN'.
- Flip the induction hopper valve 'OFF'.
- Ensure that the agitator valve is 'ON'. The sprayer should always be agitating until spraying begins.
- Raise the hopper to its transport position and replace the retaining pin in the mechanism.
- Turn OFF the RPM RAISE and the SPRAY PUMP switches.

Rinsing

To rinse the Induction Hopper and chemical drums with fresh water from the external water delivery station: (Not with hydraulic fill pump)

1. Lower the hopper. (Check that the delivery hose to the hopper is not restricted or kinked).
2. Make sure that all valves on the EZ control external water delivery station are 'OFF'.
3. Make sure that the Hopper Rinse valve on the top of the hopper is 'OFF'.
4. Connect the fresh water fill hose to the quick-fill coupling.
5. Turn on the SPRAY PUMP and the RPM RAISE so the fresh water pumping system is between 70 and 100 psi.
6. Flip the vortex Induction Hopper valve to 'ON'.
7. Open the hopper tank ball valve at the bottom of the hopper by turning the yellow handle down.
8. Ensure that the hopper drain tap, also located at the bottom of the hopper, remains 'CLOSED'.
9. To rinse a drum, push the drum over the rinsing nozzle located in the hopper.
10. To rinse the hopper, close the lid, and turn the Hopper Rinse valve on the top of the hopper 'ON'. Close this valve when the hopper has been rinsed.

When the hopper is empty:

- Remove any chemical drums that have been rinsed from the hopper.
- Turn the hopper tank valve at the bottom of the hopper 'OFF' by turning the yellow handle horizontal.
- Flip the vortex Induction hopper valve on the EZ control station 'OFF'.

- Drain the hopper of any remaining liquid using the hopper drain tap at the bottom of the hopper.
- Raise the hopper to its transport position and replace the retaining pin in the mechanism.

The hopper can be rinsed and the rinsate emptied through the hopper drain ball valve rather than transferred into the main spray tank.

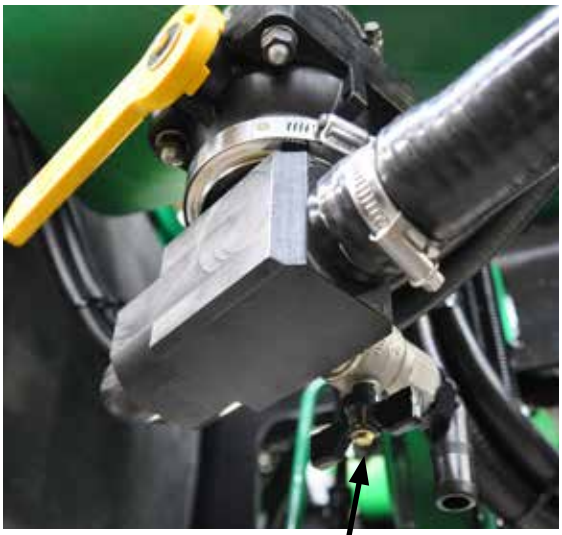
CAUTION: Do not have the sprayer pump operating.

To do this:

1. Ensure the fresh water filling supply pump system is operating.
2. Open the hopper rinse valve on the top of the hopper.
3. 'OPEN' the hopper tank ball valve at the bottom of the hopper by turning down the yellow handle so that it is vertical, removing the rinsate from the hopper.
4. Open the hopper drain valve.
5. Once the tank is clean, stop the fresh water supply to the machine.
6. Close the hopper rinse valve on the top of the hopper.
7. Turn the hopper tank valve at the bottom of the hopper 'OFF' by turning the yellow handle horizontal.
8. Close the hopper drain valve.
9. Raise the hopper to its transport position and replace the retaining pin in the mechanism.

Note:

- Take proper safety precautions to avoid any contact with rinsate when draining, as it may contain chemical residue.
- Be careful as to where the rinsate is being deposited as it may contain chemical residue.
- This procedure will not rinse the hose from the bottom of the hopper to the main tank.



Hopper Drain Tap - Photo look up from underneath the hopper

Chemical Transfer Pump

Overview

The Transfer Pump is used to transfer chemical to the main tank, in place of the venturi chemical probe. Combined with an FM-1100 flow meter, its an accurate way of measuring chemical being transferred into the main tank.

Pump Specifications:

- Flow rate - Up to 29 L/min.
- Head - Up to 3.6 m
- Pressure - Up to 1.0 bar

Note: The polypropylene pump housing is designed to pump chemicals with a low pH. However, ensure chemical compatibility between liquids pumped and the pumps wetted parts before using.

Note: Do not use the pump to transfer flammable petroleum products.

Operation

CAUTION: Exposure to chemical can cause serious injuries, always wear proper protective clothing and devices when transferring chemical. Refer to and follow chemical manufacturers instructions.

1. Connect chemical probe to cam lock fitting on sprayer.
2. Put other end of probe into the chemical to be transferred.
3. Turn Chemical Induction handle to PUMP.
4. Turn on pump and open valve on chemical probe and valve behind cam lock fitting.
5. Transfer desired amount of chemical. Pull probe out of chemical and let the pump run until all chemical has been sucked from lines.
6. When all of the chemical has been transferred, rinse the chemical container with water and transfer the rinsate to the sprayer tank via the probe. This should ensure that the entire chemical is transferred and that the probe, pump and connecting suction hose are cleaned. Induct clean water to rinse probe vacuum hose.
7. Turn pump off, close both valves and disconnect chemical probe.

Note: Do not use the pump with fluids that have a flash point lower than 37 degrees C (100 degrees F).

Maintenance

CAUTION: Exposure to chemicals can cause bodily harm. Thoroughly flush pump with water before disassembling. Gloves and proper eye protection should be worn.

Pump Disassembly:

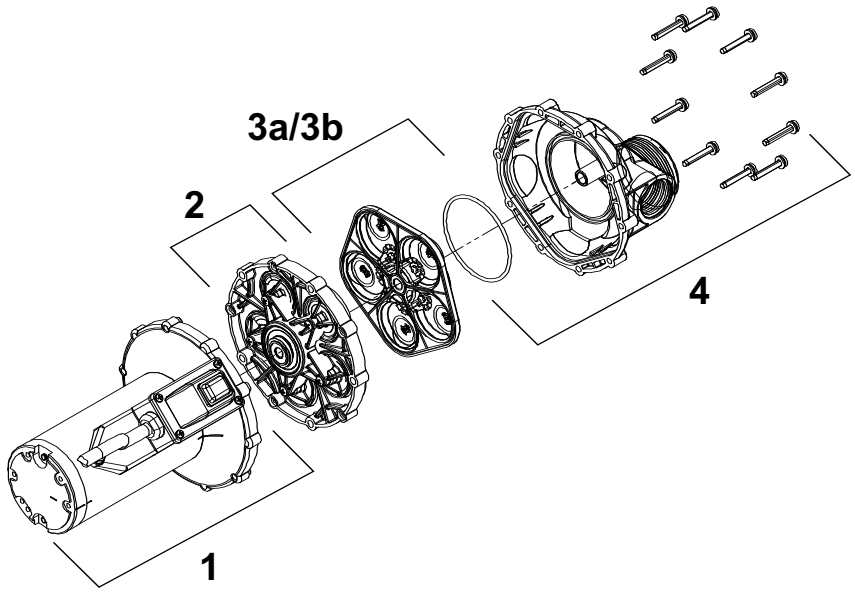
1. Purge pump with clean water.
2. Disconnect 12-volt power source.
3. Remove motor by removing the 10 screws from the pump assembly.
4. Remove the Diaphragm Lower Housing Assembly from the Upper housing. DO NOT pry the Diaphragm Housing from the Upper housing, damage to the O-ring or Valve Housing Assembly can occur.
4. Remove the Valve Housing Assembly from the Diaphragm Lower Housing.

Pump Assembly

1. Reverse the disassembly procedure and ensure that the O-ring seats in the correct groove..
5. Secure the 6 screws connecting the motor and pump housing to 2.5 ft/lbs.

CAUTION: do not over tighten plastic connections, breakage can occur resulting in fluid exposure.

Note: On all pipe connections, teflon tape is the recommended pipe thread sealant.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	94-718-00	Motor Assembly Kit	1
2	94-719-00	Diaphragm / Lower Housing / Drive Assembly Kit	1
3a	94-720-00	Valve Housing Assembly Kit (EPDM)	1
3b	GA2000034	Valve Housing Assembly Kit (Viton)	1
4	94-721-00	Upper Housing Assembly Kit	4

FM-1100 Flow meter

The SEM-10 Flow Meter is a positive displacement fluid metering unit.

- Accuracy: +-0.5%
- Flow Range: 9-136 L/min
- Maximum Pressure: 410 kPa (60 PSI)
- Maximum Total: 9999
- Auto Shut Off: 3 minute
- Auto Wake Up: With Flow

Operation

CAUTION: Exposure to chemical can cause serious injuries, always wear proper protective clothing and devices when transferring chemical. Refer to and follow chemical manufacturers instructions.

The FM-1100 flow meter will start working automatically when flow is detected.

The LCD display will show the following:
- LOW - Low battery indicator
- CUR - Current Total indicator
- CUM - Cumulative total indicator
- GAL - Gallons indicator
- LTR - Litre indicator
- CNT - counts indicator
- CAL - Calibration indicator

The meter displays and stores:

- A resettable CURRENT TOTAL (CUR)
- A non-resettable CUMULATIVE TOTAL (CUM)
- A COUNTS calibration value (CNT)

The FM-1100 Series Flow Meter has three push buttons:

1 MODE or "ON" button

2 INCREASE (up arrow) button

3 DECREASE (down arrow) or "ZERO" button

FM-1100 Flow meter

The MODE button performs the following functions:

1. If the display is off, press MODE button to display current total (CUR).
2. Use MODE button to cycle between CURRENT TOTAL (CUR) and CUMULATIVE TOTAL (CUM).

Note: After approximately 30 seconds, display will automatically switch from CUMULATIVE TOTAL (CUM) back to CURRENT TOTAL (CUR).

3. Press and hold MODE button for 3–5 seconds to show Volume Unit Selection. Press INCREASE or DECREASE buttons to cycle through volume units. When desired units are flashing, press MODE button to save selection and return to CURRENT TOTAL (CUR).

Volume Unit Selection choices are: GALLONS (GAL), LITERS (LTR), or COUNTS (CNT).

Note: To reset CURRENT TOTAL (CUR) to Zero, press and hold DECREASE button for 2 seconds or more while CURRENT TOTAL (CUR) is displayed.

Note: Meter will not enter Volume Unit Selection mode if pump is running.

CUMULATIVE TOTAL CANNOT BE RESET - EVEN BY REMOVING THE BATTERY.

- The flow meter display will turn on whenever flow is detected.
- The flow meter will turn off and blank the display after a 3-minute period of button or flow inactivity. Any unsaved changes will not be saved.

Calibration Procedures

- Calibration procedures are the same for both the 90° and inline meters.
- To ensure accuracy, purge all air from pump/meter system before calibrating.

To CALIBRATE (CAL) meter:

1. Press MODE button to turn meter on.
2. Press and hold MODE button for 3–5 seconds to show Volume Unit Selection. Press INCREASE or DECREASE buttons to select desired Volume Units.
3. Press and hold MODE button again for 3–5 seconds to enter Calibration Mode (CAL).
4. CAL and chosen Volume Unit (GAL or LTR) will blink together. Numeric Display will show default values as listed below.

Flashing Indicators	Numeric Display
Calibrate Litres (LTR)	20.00
Calibrate Gallons (GAL)	5.00
Calibrate Counts (CNT)	XXXX

Note: XXXX represents the present COUNTS (CNT) value stored in flow meter's memory. To Calibrate using COUNTS (CNT), please see next section.

Note: To use a calibrated container with a volume other than the default values, press INCREASE or DECREASE buttons to change value shown on Numeric Display.

5. To complete CALIBRATION for GALLONS (GAL) or LITERS (LTR), pump the exact amount shown on Numeric Display.
6. Press MODE button for 3–5 seconds to SAVE the CALIBRATION. Display will show CAL if CALIBRATION was successful.

Note: If MODE button is pressed for less than 3 seconds, CALIBRATION will be aborted and display will show Err (Error) to indicate the CALIBRATION was not successful. Display will return to CURRENT TOTAL (CUR) without making any changes.

To CALIBRATE (CAL) meter using COUNTS (CNT) value:

Note: No pumping is required to complete CALIBRATION (CAL) for COUNTS (CNT).

1. Press MODE button to turn meter on.
2. Press and hold MODE button for 3–5 seconds to show Volume Unit Selection. Press INCREASE or DECREASE buttons to select COUNTS (CNT).
3. Press and hold MODE button again for 3–5 seconds to enter Calibration Mode (CAL).
4. CALIBRATE (CAL) and COUNTS (CNT) indicators will both blink together. Numeric Display will also show a value (XXXX), which represents the present value stored in flow meter's memory.
5. Press INCREASE or DECREASE buttons to change the value shown in Numeric Display to

FM-1100 Flow meter

desired value.

6. To complete CALIBRATION for COUNTS (CNT), press MODE button for 3–5 seconds. CALIBRATE (CAL) and COUNTS (CNT) indicators will turn off and display will show CAL if CALIBRATION was successful.

Note: If MODE button is pressed for less than 3 seconds, CALIBRATION will be aborted and display will show Err (Error) to indicate the CALIBRATION was not successful. Display will return to CURRENT TOTAL (CUR) without making any changes.

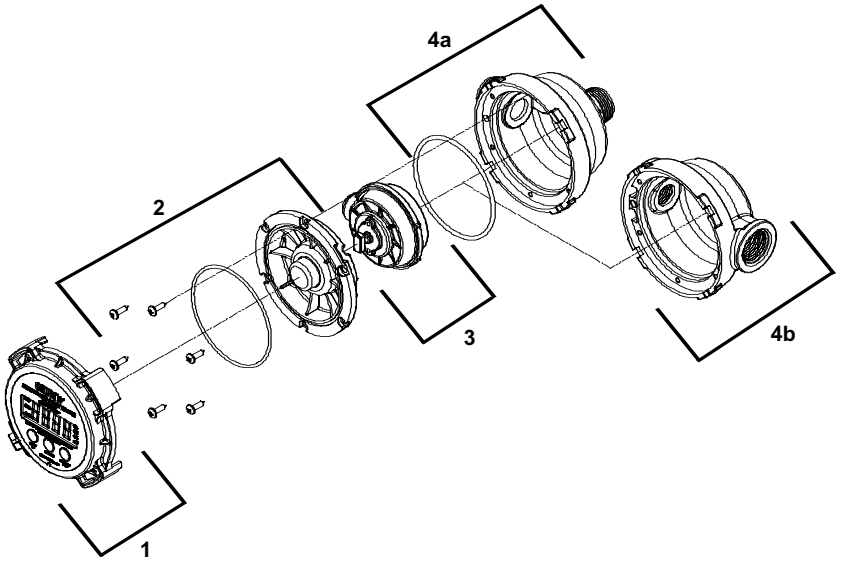
To Display Software Revision Number

1. Press MODE button to turn meter on.

2. Press MODE button again to display CUMULATIVE TOTAL (CUM).

3. While display is showing CUMULATIVE TOTAL (CUM), press and hold DECREASE button to display flow meter's software revision number (e.g. r1.00).

CUMULATIVE TOTAL CANNOT BE RESET - EVEN BY REMOVING THE BATTERIES.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	94-732-00	Electronic Assembly Kit	1
2	94-733-00	Meter Housing Seal Cover Kit	1
3	94-734-00	Nutating Chamber Assembly Kit	1
4a	94-735-00	90 Degree Meter Housing Kit	1
4b	94-736-00	Inline Meter Housing Kit	1

Troubleshooting Flowmeter and Pump

Pump is noisy?	
Common causes	Common solutions
Meter display will not turn on:	Check for dead battery.
	Check electronics chamber for moisture.
	Check o-ring seal for damage.
	Check to see that PCB assembly is properly seated.
	Check to see that battery is properly seated / no corrosion.
	Check for damaged magnetic switch/PCB.
Meter shows no flow: (pump runs)	Check low battery indicator.
	Check for damaged magnetic switch/PCB.
	Check magnetic wheel assembly.
	Check nutating chamber for debris.
	Check to see if outlet tube is severely restricted (kinked).
	Check for missing magnet wheel assembly.
	Check to see if out of product.
Flow low/high/inconsistent:	Check for air in system.
	Check for calibration error (Err).
	Check for particulates in fluid.
	Check for damaged nutating chamber.
Meter leaks:	Check for damaged o-ring.
	Check for loose screws.
	Check inlet/outlet fittings for proper seal.
	Check meter housing for cracks.
Noisy / rough operation:	Check nutating chamber for debris.
	Check for loose magnetic wheel assembly.

UltraGlide

Overview

UltraGlide uses boom mounted ultrasonic sensors to measure the height of the boom above the ground and maintain the boom at a pre-set level.

The UltraGlide system comes in 3 configurations:

- 3 sensor (standard), one centre sensor and two outer sensors on the boom wing
- 5 sensor, one centre sensor, two inner boom senors and two outer boom wing sensors.
- 5 sensor severe terrain, five sensors and touch down wheels fitted to each outer wing.

Touch down wheels are fitted for severe terrain because they provide instant feed back to the UltraGlide hydraulics and provide a quicker reaction time than the sensors alone.

Terrain conditions and the machines hydraulic system dictate the actual speeds that can be achieved during application with an engaged UltraGlide system. Typically rougher and more varied terrain require slower speeds when UltraGlide is activated.

Note: Always refer to the Raven operators manual for more detailed instructions.

Key Features

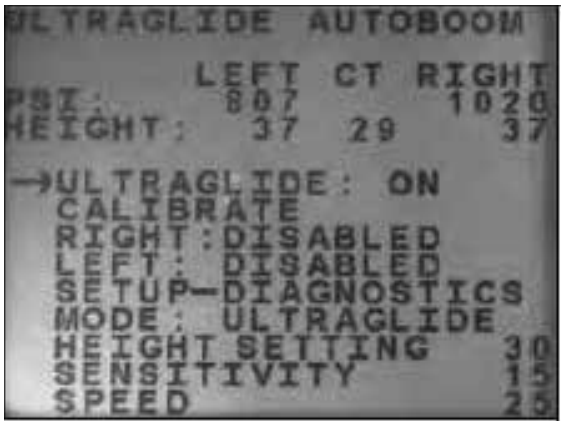
Operation - Calibration

AutoBoom calibration requires pressure in the machine's cylinders and enough boom travel to allow the boom to travel 10" up or down without reaching the top or bottom of the cylinder stop.

During calibration and operation, it is important to keep the machine running at a sufficient engine RPM so that the hydraulic pump is able to supply a full flow of oil at operating temperature to the hydraulic system.

Note: Calibration procedures should be performed with the machine operating at the normal operating engine RPM with oil at normal operating temperatures.

1. Move the machine to a flat area.
2. Verify that the booms are unfolded, and lower the center rack.
3. Press the DATA MENU button on the SCS console keypad until the AutoBoom Main Menu is displayed.



4. Press the CE button to toggle UltraGlide to ON.
5. Verify that the booms are unfolded, and lower the center rack so that the wheels are approximately six inches from the ground.

Note: If the booms do not go over center or are travel-limited, raise the booms so that the boom tips are approximately 25cm above the horizontal position and lower the center section slightly below the normal spraying height.

6. Using a tape measure the distance from the bottom of the sensor to the spray nozzle tip.

7. In the setup screen adjust the vertical sensor height offset settings in the SCS console to sensor position as measured in step 4.

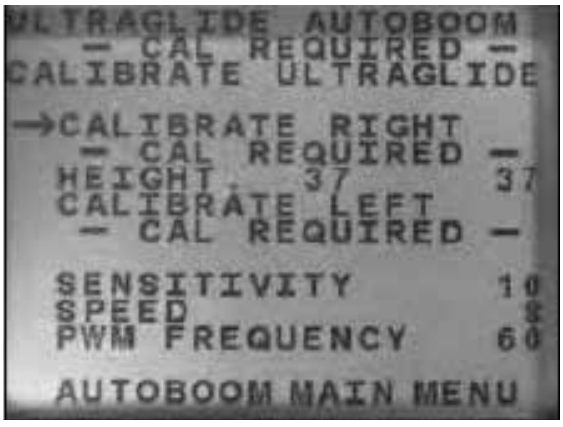
- Positive offsets indicate the sensor surface is located above the nearest spray tips.
- Negative offsets indicate the sensor surface is located below the nearest spray tips.
- Inner, outer, and center offsets are not required to be the same across the width of the machine, but they must be correctly measured relative to the spray tips.

Note: If the machine is equipped with a center sensor, the center rack height can be verified through the main menu or diagnostics screen in AutoBoom section of the SCS console.

8. Raise the boom tips to approximately the target height.

Note: The default target height is 50cm. Verify that the booms are not fully raised to the boom stops. If gauge wheels are installed, the setting must be adjusted to 60 - 65 cm to prevent the wheels from touching the ground during system calibration.

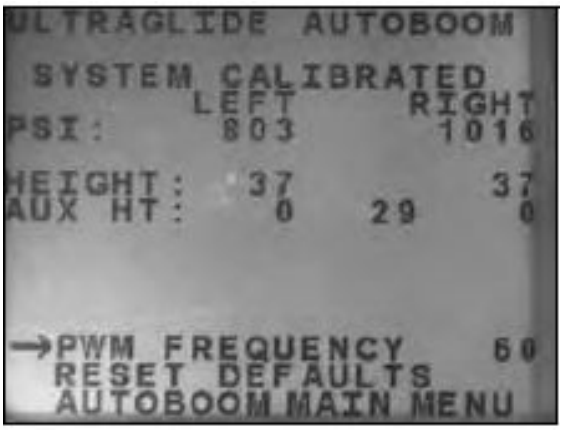
9. Press the arrow down button to move the cursor to CALIBRATE RH and select ENTER.



10. Press the ENTER button on the SCS console to begin calibration.

11. Repeat steps 9 and 10 to calibrate the left hand boom as well.

The calibration process may take up to a minute to complete. "Calibration" will flash, indicating that calibration is in progress. If the boom fails to calibrate, press enter to stop the calibration process. Once the calibration is complete the following screen will appear:



Note: The PWM Frequency will display 250 for all machines from 2009 onwards.

12. Press the arrow down button twice to return to the AutoBoom Main Menu.

Centre Rack Control Calibration

There are many different valve configurations used to control the machine's center rack functions. The AutoBoom system must "learn" which of the machine's solenoids are used to raise and lower the booms.

Complete the following steps to calibrate the center rack control feature after the individual booms have been calibrated.

1. Press and hold the center rack raise button on the machine's control panel or joystick for six seconds so that the center rack raises.

Note: The center rack may reach the upper limit of travel during this time, but continue holding the button until the full six seconds has passed.

2. Press and hold the center rack lower button on the machine's control panel or joystick for six seconds so that the center rack lowers.

Note: The center rack may reach the lower limit of travel during this time, but continue holding the button until the full six seconds has passed.

Routine Operation

Joystick Functions

- When AutoBoom control is on, control of each boom can be enabled or disabled via the SCS console or by tapping the sprayer's switch functions (if equipped).

Note: Pressing the down function for longer than 1/2 a second will switch the function to manual control.

The operator must tap the down function to enable AutoBoom.

A single up-tap on the sprayer's switch functions disables AutoBoom on that boom.

A single down-tap on the sprayer's switch functions enables AutoBoom on that boom.

Enabling AutoBoom via the SCS Console

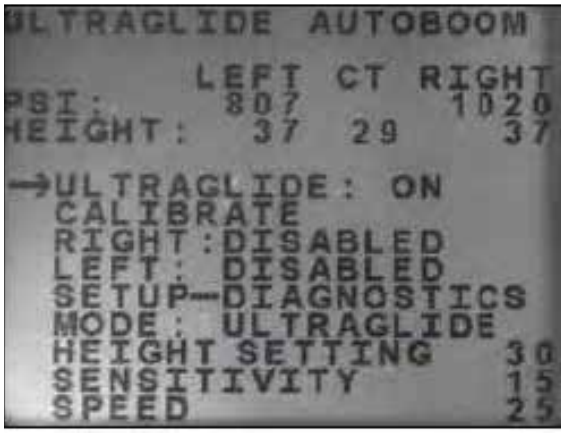
The status of the AutoBoom system is displayed in the lower-right corner of the SCS console display. The status details displayed are:

• The type of AutoBoom system installed and whether it is powered on or off.

• The status of the AutoBoom system (enabled or disabled).

• Center rack height (if equipped with center sensor).

1. Press the DATA MENU button to navigate to the AutoBoom Main Menu.



2. Select ULTRAGLIDE and use the CE button to toggle the setting to ON.

Note: The AutoBoom system is now powered on, but the booms are disabled.

3. Press the down arrow to navigate to the RIGHT boom setting.
4. Press the ENTER button to select the RIGHT boom setting.
5. Press the down arrow to enable the RIGHT boom setting.
6. Repeat the steps above to enable the LEFT boom setting.

Note: AutoBoom can be disabled by selecting the boom settings and pressing the up arrow.

Boom Adjustments when Approaching Headlands (If Equipped with Gauge Wheels)

When approaching the headlands to make a turn, the gauge wheel must be raised approximately six inches from the ground to prevent it from sliding sideways or backward, causing damage to the gauge wheel assembly.

Center Rack Control (AutoBoom Enabled and Center Rack Control On)

Note: The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.

Note: Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.

Note: Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.

- Center Down Switch - A double down-tap will lower the center rack to the desired spray height, enable the center rack, and enable both booms.
- Center Up Switch - A single up-tap will disable the center rack and both booms. Two consecutive up-taps will raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height, turn AutoBoom off, and preserve the new transport height as the maximum height.

Set a lower transport height - While the center rack is returning to transport, down- tap once on the center switch when the new transport height is reached.

Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

Center Rack Control (AutoBoom Enabled and Center Rack Control Off)

Note: The machine may require the activation of a boom valve and/or master spray switch for the center rack control feature to engage.

Note: Consecutive up-taps or down-taps must be performed within 1.5 seconds of each other.

Note: Return to height and return to transport heights are measurements relative to the crop canopy, not necessarily ground level.

- Center Down Switch - Two consecutive down-taps will lower the center rack to the desired spray height and enable both booms.

Note: Center rack control will not be enabled since center rack control is off.

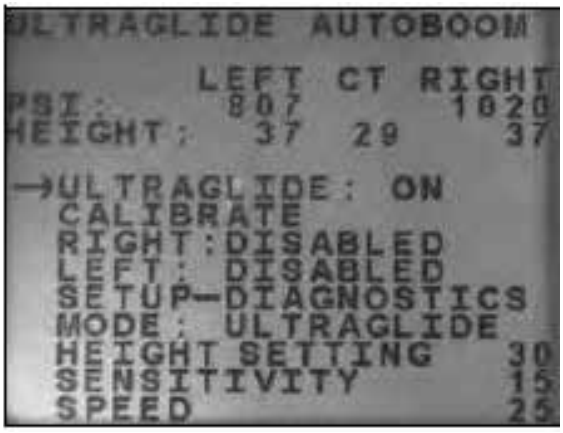
- Center Up Switch - Two consecutive up-taps will disable both booms and raise the center rack to the desired transport height. Four consecutive up-taps will raise the center rack to the maximum height and turn AutoBoom off, preserving the new transport position as the maximum height.

Set a lower transport height - While the center rack is returning to transport, down-tap once on the center switch when the new transport height is reached.

Set the transport height to the maximum height - With the center rack positioned higher than the current transport height and with the AutoBoom not currently returning to the transport height, up-tap twice on the center switch to move the center rack to the maximum height.

System Adjustments

Note: AutoBoom must be enabled after both booms have been calibrated in order to make system adjustments.



Sensitivity

1. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second) to within 12 inches of the sensor surface.

Note: The boom should react immediately and raise at approximately the same speed as your hand.

2. Adjust the Sensitivity setting as needed to make the boom more or less reactive to hand motions.

Note: The default setting is 15. If the Sensitivity is too high, the boom will appear unstable and jittery, reacting to slight changes in target height or crop movement. The typical Sensitivity setting that works best for most machines is 13 - 17. During routine operation, AutoBoom should be unresponsive to changes in height of 2" - 3", but should react quickly to changes of 5" or more. For row-crop situations, or when crop conditions are sparse and not fully covering the ground, it may be beneficial to decrease the sensitivity so the boom is less reactive to sudden changes in crop height, and less likely to cause sudden movements that diminish performance.

Speed

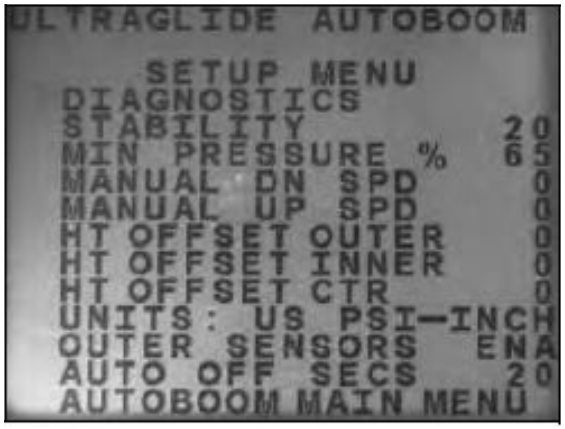
The Speed setting controls how fast the boom will move away from an obstacle, and how much the boom overshoots the target height. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. Adjust the Speed setting as needed so that boom raise rates match hand movement rates, but so that the booms don't overreact and become unstable.

1. Place one hand at ground level below one boom sensor and raise it quickly (about 2 feet per second) to within 12 inches of the sensor surface.

Note: The boom should react immediately and adjust at a raise speed matching the hand movement, overshooting the new target height by one foot or less.

2. Adjust the Speed setting as needed.

Note: The default setting is 25. The Speed setting should be set so that the boom motion is smooth and the machine does not oscillate. The typical Speed setting that works best for most machines is 22 - 27, but can be much higher depending on the static pressures of the boom, boom geometry, and the Sensitivity settings.



Stability

1. Place one hand at ground level below one boom sensor and raise it quickly (about two feet per second) to within 12 inches of the sensor surface, while observing the movement of the opposite boom.

Note: The opposite boom should raise slightly (usually no more than six inches) simultaneously.

2. Adjust the Stability setting to minimize movement of the opposite boom.

Note: Lower the Stability value to make the opposite boom more rigid, but keep the number high enough to allow for natural movement of the boom without affecting the chassis roll.

Min Press %

Note: On machines with travel-limited booms, operate the AutoBoom system with center rack control enabled, or with the center sensor at or slightly below the target height to prevent the booms from continuously entering the Min Press % mode. This mode is for boom emergency protection only, and AutoBoom system should not be run in this mode during routine operation.

1 Raise the center rack section to the target height, so that the booms and center rack are horizontal.

2. Enable the AutoBoom system.

3. Locate the Min Press % setting in the AutoBoom control menus.

Note: The default setting is 65.

4. Increase the Min Press % value to approximately 80.

5. Place one hand at ground level below one boom sensor and raise it slowly (about one foot per second)to within 12 inches of the sensor surface, or until the boom travels up approximately three feet higher than the original target.

6. Pull hand away, and verify that the booms lower slowly after a slight delay.

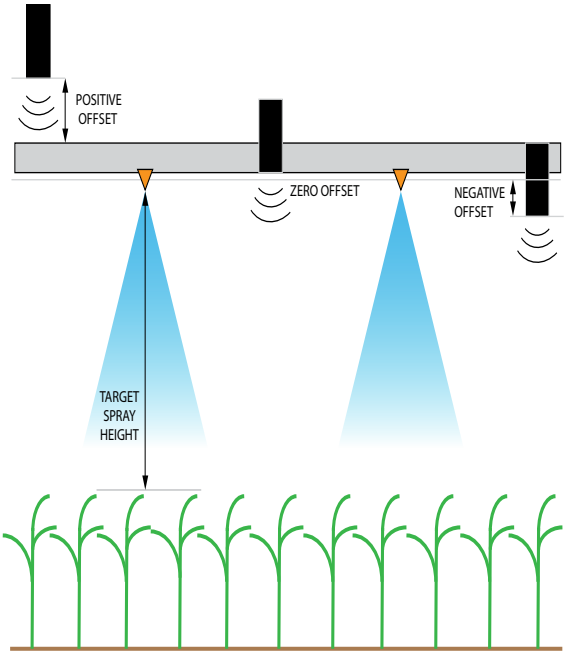
Note: If the booms do not lower, decrease the Min Press % setting value by one and repeat the steps above. Continue performing the Min Press % test until the booms begin to lower.

Ultrasonic Sensor Height Offsets

Ultrasonic sensor height offset adjustments are used to compensate for the difference between the height of the sensor surface and the height of the spray tip. The offset height is calculated by measuring the distance from the bottom of the sensor to the height of the crop, measuring the distance between the spray tip to the height of the crop, and then subtracting the spray tip distance from the sensor distance. Refer to the diagram below to determine whether the offset value should be positive or negative.

Note: The maximum offset height value is 20 inches.

Note: Ultrasonic sensors will react to the first object that reflects an echo, whether it is the ground or the crop. For row-crop situations, it may be beneficial to adjust the sensor positions to directly over a row, or add additional boom sensors.



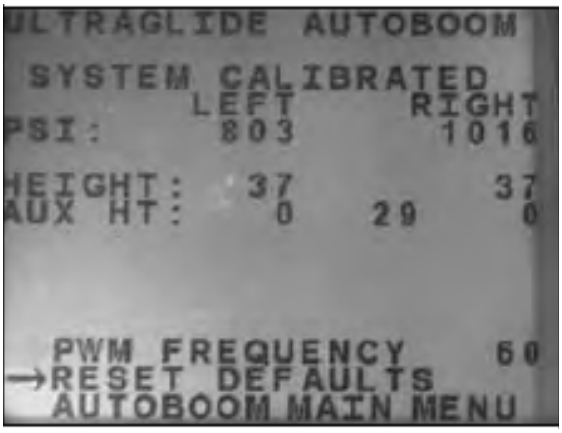
- Touch the up arrow in the Sensor Height section to increase the value representing the distance between the sensor and the ground.

- Touch the down arrow in the Sensor Height section to decrease the value representing the distance between the sensor and the ground.

Note: On machines with travel-limited booms, center sensor height offsets may need to be entered as less than the measured value from the sensor to the ground to ensure the boom cylinders have sufficient pressure during operation.

Resetting Defaults

Although it is not normally necessary, there may be circumstances under which it may be necessary to reset the system defaults. Resetting the defaults erases all AutoBoom system settings and adjustments that have been performed. System calibration will be required after the defaults have been reset.



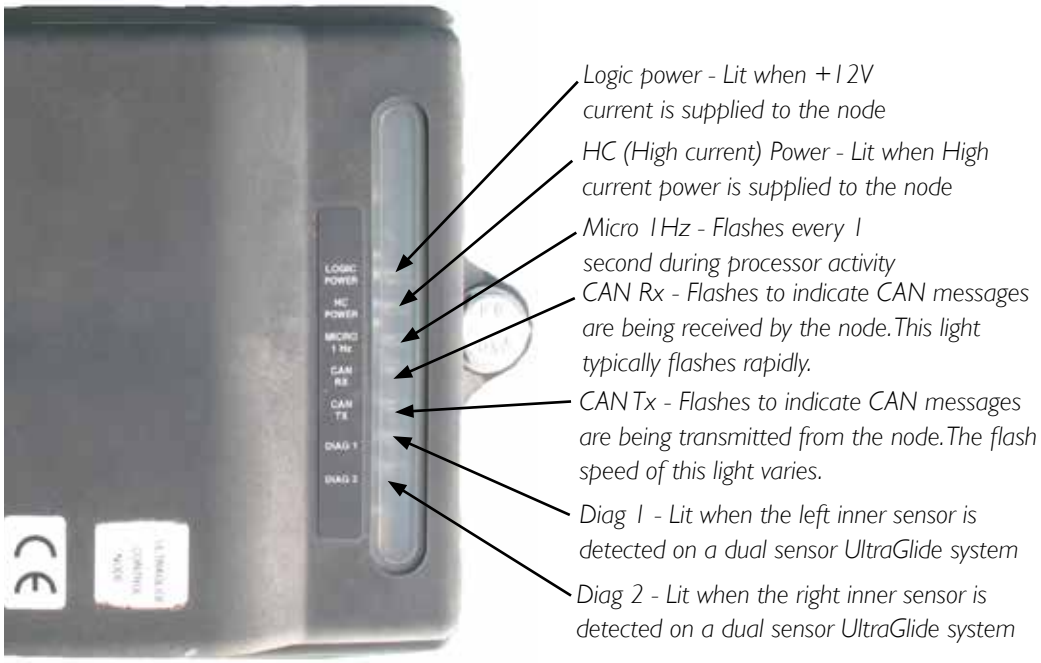
1. From the Calibration menu, use the arrow buttons to navigate to RESET DEFAULTS.

2. Press the ENTER button on the SCS console to reset the AutoBoom settings.

Node Troubleshooting

The AutoBoom CAN control node features several green light-emitting diodes (LEDs) which may be used to diagnose issues within the AutoBoom system.

Note: If the LEDs are not displayed as outlined in the picture below or are all on continuously, check the CAN connections and the control cable connections on the node. If the issue persists, contact your local Raven dealer for additional technical support.



Logic power - Lit when +12V current is supplied to the node

HC (High current) Power - Lit when High current power is supplied to the node

Micro 1Hz - Flashes every 1 second during processor activity

CAN Rx - Flashes to indicate CAN messages are being received by the node. This light typically flashes rapidly.

CAN Tx - Flashes to indicate CAN messages are being transmitted from the node. The flash speed of this light varies.

Diag 1 - Lit when the left inner sensor is detected on a dual sensor UltraGlide system

Diag 2 - Lit when the right inner sensor is detected on a dual sensor UltraGlide system

Pre Calibration Troubleshooting

Problem	Possible Cause	Corrective Action
Booms and centre section will not raise/lower properly through the Raven controller	The proportional blocker coil connections from the AutoBoom harness cable are incorrect on the AutoBoom valve.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The hydraulic connections are reversed.	Reverse the left and right hydraulic connections.
	The electrical connections are reversed.	Reverse the left and right electrical connections (proportional, blocker, and possibly pressure transducers).
	Improper high current voltage electrical connection or blown fuse.	Check the electrical connections and fuses.
	The center sense/control cables are improperly connected.	Check the center rack section control cabling (connections to center control valve(s), directional valve, load sense valve, and open center valve - if applicable).

Problem	Possible Cause	Corrective Action
Pressures/heights are not being displayed in the correct units of measure.	The units of measure are set incorrectly in the AutoBoom system.	Change the units of measure in the controller being used in the AutoBoom system.
Pressures for the left and right boom are not displayed on the correct side.	The left and right pressure transducer connections are reversed.	Reverse the left and right transducer connections.
	The left and right hose connections are reversed.	Reverse the left and right cylinder connections on the AutoBoom valve.
Ultrasonic sensor heights are displaying incorrect locations.	The left and right sensor connections are reversed.	Reverse the left and right outer sensor connections on the AutoBoom harness cable.
	The outer sensors are connected to the inner sensor connectors.	Disconnect the sensors from the AutoBoom harness cable and connect the outer sensor connectors to the sensors.
Left, right, and center raise/lower functions are not sensed correctly when the machine's functions are used.	The boom sense cables/connections are connected to the incorrect machine coils.	Check the connections to the machine's coils and trace the wiring to ensure the connections are made to the correct cylinders.
Center section will not raise/lower manually with the machine's functions.	The center rack boom sense cables are not connected to the correct center sense/control function.	Check the connections to the machine's coils and trace the wiring to ensure the connections are made to the correct coils.
	The AutoBoom node hardware does not support the center rack control function.	The node must be revision B or higher to support the center rack control function. Contact your Raven dealer.
Fold/unfold status does not change when booms are folded/unfolded (if equipped).	The fold/unfold sensors are not connected.	Check the electrical connections to the fold/unfold sensors.

Calibration Troubleshooting

Problem	Possible Cause	Corrective Action
Left and right booms do not move during calibration.	The proportional/blocker connections are reversed or improperly connected.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The hydraulic connections are improperly connected.	Check the hydraulic connections.
	Booms are resting on their stops or the cylinders are fully extended.	Raise the booms and lower the center rack to ensure the pressure is sufficient in the booms for calibration.
	The pressure transducer or connection is faulty.	Check the transducer connections to the AutoBoom harness cable.
	There is insufficient high current power.	Check the power and ground connections at the battery and the connections to the node.
The booms over react or oscillate during calibration	There are objects beneath the sensors causing faulty readings.	Attempt to calibrate the system over open ground or consistent crop canopy.
	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse if necessary.
	Faulty ultrasonic sensor readings.	Check the sensors and cabling and replace if necessary.
	The Speed setting is too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	The hydraulic flow is too high (pull type sprayers only).	Decrease the hydraulic flow the AutoBoom circuit remote.
	The orifices are missing from the AutoBoom valve.	Reinstall orifices into the AutoBoom valve.

Problem	Possible Cause	Corrective Action
The booms fully raise during calibration and do not lower	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	The ultrasonic sensors are giving poor readings.	• Check the cabling to the sensors. • Verify the sensor surface is clean. • Verify no obstructions or boom components are interfering with sensor readings.
	The hydraulic connections are improperly connected.	• Check the hydraulic connections. • Reverse the direction of the hydraulic lever on pull-type sprayers.
	The electrical connections to the AutoBoom valve are reversed.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The Speed setting is too high.	Decrease the Speed setting.
	The Sensitivity setting is too high.	Decrease the Sensitivity setting.
	The hydraulic flow is too high (pull type sprayers only).	Decrease the hydraulic flow the AutoBoom circuit remote.
The booms fall to the ground during calibration	The proportional valve connections are reversed on the AutoBoom valve.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The hydraulic connections are improperly connected.	• Check the hydraulic connections. • Reverse the direction of the hydraulic lever on pull-type sprayers.
	Malfunctioning proportional valve.	Turn the set screws in on the proportional valve to verify the booms raise during calibration. • If the booms raise, troubleshoot the electrical system and/or AutoBoom node. • If the booms do not raise, troubleshoot the hydraulic system and/or AutoBoom valve.
	The hydraulics are not activated (pull type sprayers only).	• Verify the hydraulics are activated. • Ensure hydraulic flow going to the AutoBoom valve.

Operation Troubleshooting

Problem	Possible Cause	Corrective Action
Booms raise but will not lower when starting the machine or engaging the hydraulics (pull-type sprayers) with AutoBoom engaged.	The PWM base is too high.	Engage the AutoBoom hydraulics and allow the PWM base to decrease and the booms to lower automatically.
	The system is out of calibration.	Re-calibrate the AutoBoom system.
	(Pull-Type only) The flow is turned up too high on the remote.	Reduce flow on the sprayer to 3 - 5 gallons per minute.
	(Pull-Type only) There is a restriction in the tank line hose.	• Check the quick couplers on the sprayer. • If the sprayer is equipped with a case drain line (non-restricted), connect the tank line to this hose.
The booms will not enable with the down-tap of the machine's functions.	The boom sense adapter cables are damaged or not connected.	• Check the cabling. • Use the Diagnostics menu to determine the proper wiring setup.
	There is inadequate voltage to the system.	Use a multi-meter to verify +12V is provided to the machine's coils when the function is activated.
	The AutoBoom system is not calibrated.	Calibrate the AutoBoom system.
	The AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	The AutoBoom node is faulty.	Replace the AutoBoom node.
The pressure alarm is always on.	The pressure alarm setting in the PowerGlide Plus mode is set too low.	Increase the pressure alarm setting.
	The pressure and tank hoses are reversed.	Check the hoses and reverse if necessary.
	The pressure transducer is faulty	• Inspect the transducer and verify the pressure reading on the Diagnostic screen. • Replace the pressure transducer if necessary.
	The AutoBoom harness cable is damaged.	Inspect the cable for damage and repair or replace as needed.
	Booms are resting on their stops or the cylinders are fully extended.	Raise the booms, lower the center section, and re-engage AutoBoom.

Problem	Possible Cause	Corrective Action
Objects under one boom makes the opposite side react.	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	The proportional valve connections are reversed or one side is not connected.	Check the connections on the AutoBoom valve to ensure the harness cable connections are connected to the correct ports.
	The Stability setting is too low.	Increase the Stability setting incrementally until the opposite side barely raises.
	The proportional valve is faulty.	• Inspect the proportional valve. • Clean and/or replace if necessary.
The booms oscillate or overreact when the machine is stationary.	The Sensitivity setting is too high.	Decrease the Sensitivity setting by one increments until the boom oscillation stops.
	The wind is affecting the sensor readings.	Decrease the Sensitivity setting by one increments until the boom oscillation stops.
	The Speed setting is too high.	Decrease the Speed setting by one until the boom oscillation stops.
	The center section is unstable.	Decrease the Stability setting to balance the movement of the booms on both sides of the center section.
	Sporadic ultrasonic sensor readings.	Inspect the sensor cabling for damage and repair or replace as needed.
The booms raise but will not lower or lower too slowly during operation.	The incorrect PWM frequency was entered.	Verify the PWM frequency setting in the Raven console/field computer. (60 Hz for square coil valves, 250 Hz for round coil valves)
	The Speed setting is too low	Increase the Speed setting.
	The Minimum Pressure % setting is too high.	Decrease the minimum pressure % setting by one until the booms lower at the desired rate.
	The inner and outer sensor connections are reversed.	Check the inner and outer sensor connections and reverse them if necessary.
	Faulty ultrasonic sensor readings	Check the sensors and cabling and replace if necessary.
	The orifices or circuit restrictions are restricting the return flow from the tilt cylinders.	Inspect the AutoBoom hydraulics and remove orifices or restrictions in the circuit if necessary.

Problem	Possible Cause	Corrective Action
The booms are slow to raise or are unresponsive to height changes.	The Speed setting is too low.	Increase the Speed setting.
	The Sensitivity setting is too low.	Increase the Sensitivity setting.
	Excessive ground speed.	Decrease the ground speed.
	The incorrect sensor height offsets were entered.	Verify the proper height offset and adjust the settings as needed. Refer to the appropriate chapter in this manual for the Raven controller/field computer being used to determine the height offset settings calculation.
	The orifices or circuit restrictions are restricting the return flow from the tilt cylinders.	Inspect the AutoBoom hydraulics and remove orifices or restrictions in the circuit if necessary.

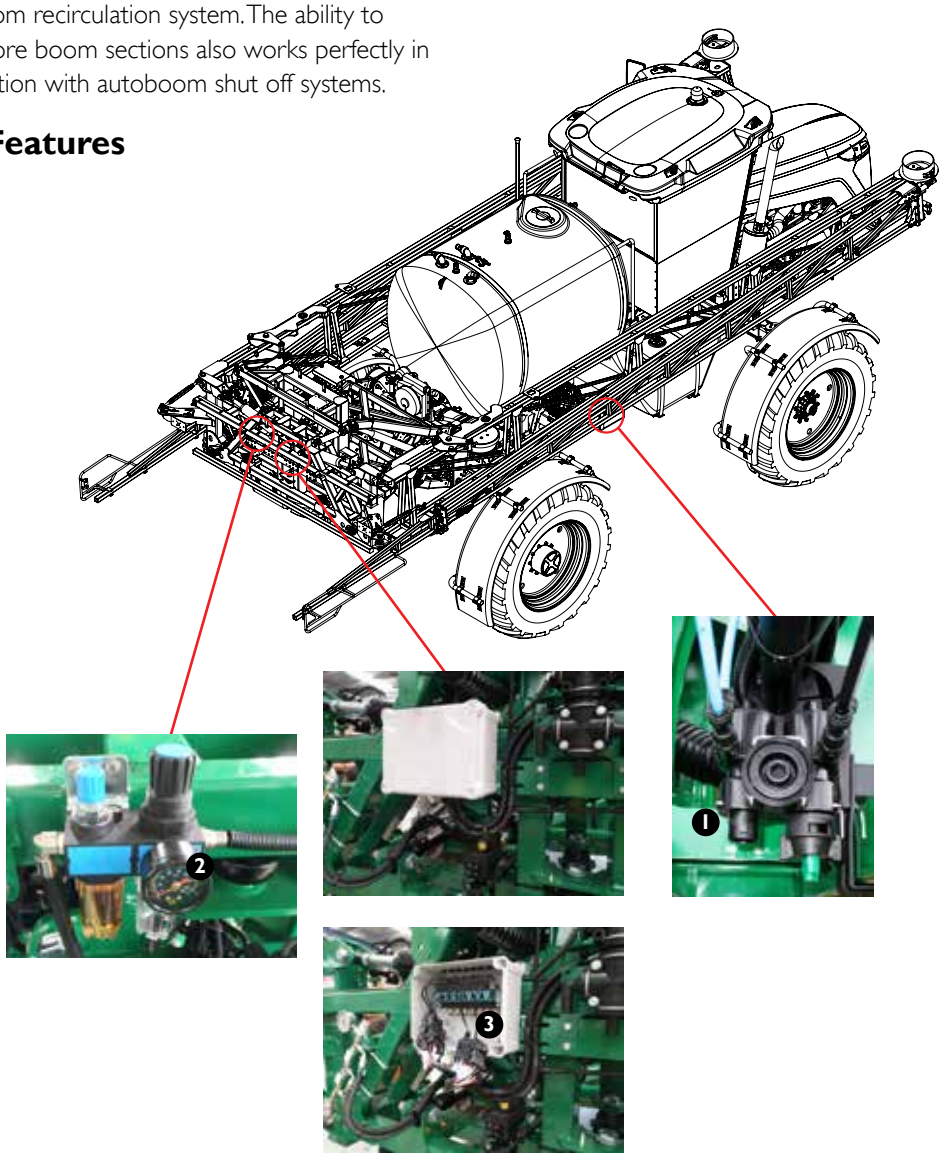
RapidFire

Overview

The RapidFire system provides instantaneous, individual nozzle shut off that is controlled by air operated solenoids at each nozzle. This system replaces the boom valves and standard check valves that shut off the boom sections and nozzles. This provides greater flexibility in changing boom section widths and faster shut off at the nozzle.

The RapidFire system reduces the amount of plumbing on the sprayer and allows for the fitting of a boom recirculation system. The ability to have more boom sections also works perfectly in conjunction with autoboom shut off systems.

Key Features



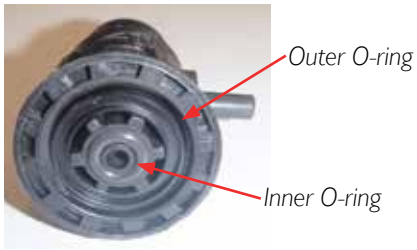
Number	Feature
1.	Air Check Nozzle Body
2.	Air Dryer/Oiler
3.	Air Solenoids

Nozzle and Air Check

The air check nozzles allow for instantaneous response at the nozzle tip. The lines can be at spraying pressure and when switched on or off, the nozzle responds quickly with no dribbling, as pressure builds up or subsides.

The air checks close under a spring tension of 140psi pressure. This traps the liquid in the spray line at the same pressure that it was being applied. When the booms are turned on, air pressure acts against the 140psi springs instantly opening flow to the nozzle allowing the trapped boom line pressure to apply the liquid at the rated pressure and droplet size with a full fan angle.

The air check valve is located on the side of the nozzle, it has 2 O-rings in it. Over time, the o'ring may swell or be damaged. This may result in the nozzle dripping or being slow to shut when it has been turned off. If the nozzle leaks the outer o'ring requires replacement. If the air shut off has poor or delayed response the inner o'ring requires replacement.



To remove the air check from the nozzle, the air supply must be removed. Ensure that all the air pressure is vented from the system. Ensure that all liquid pressure has been removed from the boom lines.

To remove the air hose from the check valve, push down on the release ring on the air fitting and at the same time, pull the hose.

Unscrew the air check valve from the main body. Replace the O-rings that are in the air check valve.

Screw the air check valve back onto the main nozzle body.

When re-fitting the hose, simply push it into the fitting.

On dual or quad nozzle bodies, the body is a fixed unit and the multi spray nozzle body will need to be removed from the clamp around the pipe. See the parts book for more detail.

Air Dryer and Oiler

The air supply to the RapidFire system has a dryer, oiler and pressure regulator fitted in the circuit.

The dryer removes all the moisture from the air supply and traps it in a clear bowl. This must be drained daily to prevent moisture entering the rapid fire system.

The oil lubricates the air as it passes through to the rapid fire system. In turn, this lubricates the RapidFire seals and o'rings. The oiler must be checked weekly and serviced at approximately 250 hours or when required. The amount of lubricant drawn into the air supply can be increased or decreased depending on requirements.

The pressure regulator is used to set the maximum pressure available to the rapid fire system. This should be set to 80 PSI.

The black knob located above the water trap is used to set the air pressure. To unlock it, lift the black knob. Looking from above, turning the knob clockwise will increase pressure. Turning anti-clockwise will decrease pressure.

To release air from the system for maintenance, turn the knob anti-clockwise until the pressure on the gauge reads zero. Drain the water trap to release any residual pressure.

Once adjustments have been made or maintenance carried out, reset the pressure as above and push the black knob down to lock it in place.

(see pictures on next page)

Lock *Unlock*

Increase pressure

Decrease pressure

The moisture trap should be checked on a daily basis while the sprayer is in use. It must not be allowed to fill up totally. If it does, moisture will be sent through the lines to the nozzle check valve and this may cause problems with its operation.

To drain the trap, turn the black knob at the bottom of the clear bowl and push it up. Air and moisture will be expelled from the bowl. Keep the knob pressed up until all the moisture has been released. Once finished, release the knob and turn it back until it stops. Ensure correct safety equipment is worn and in place as air will be displaced at high pressure.

The oiler slowly releases oil into the air to keep the check valves, seals & O-rings lubricated.

Fill the oil to within 5 mm of the top of the oil bowl. Use an air tool oil or equivalent.

To ensure the correct flow of oil into the air, the oil flow adjustment screw may need to be adjusted to suit the conditions.

The screw can be adjusted by turning the blue regulator knob shown below. Turning the knob clockwise and in will reduce the amount of oil being supplied to the RapidFire. Turning the screw counter clockwise and out will increase amount of oil. To set the oil flow, wind the knob all the way in, then turn the knob anti-clockwise half a turn. A full bowl of oil should last about 250 hours. The oiler requires regular inspection and topping up every 250 hours or when required.

Moisture trap drain (Right chamber)

Full oil level

Oil flow adjustment screw knob (Blue)

Solenoid Valves

The solenoid valves are, electrically, turned on and off to control the flow of air to the nozzles.

For troubleshooting purposes or in the event of an electrical problem, the solenoid valve can be manually overridden.

Remove the black plug from the white box in the position above the valve that is to be overridden. Insert a flat head screw driver in through the top of the box and find the screw in the top of the solenoid valve. Push down on the screw driver and turn the screw a 1/4 turn in either direction.

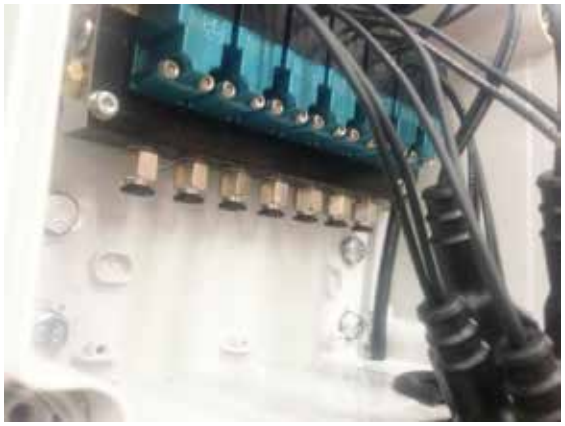
The valve should now be allowing air to flow out to the nozzle and if there is fluid in the lines, it should be coming out of the nozzle.

To shut off the valve , turn the screw driver 1/4 turn in the opposite direction to when it was overridden. The screw in the top of the solenoid is spring loaded, it will pop up when returned to its original position and shut off the flow of air.

On the solenoid bank there are two exhaust ports. These must be kept clean so that the air can expel from these when the RapidFire nozzles are turned off. If these ports are blocked the air can not release from the air checks, through the solenoids to atmosphere and the nozzles will continue to spray. The ports can become blocked when working in dusty environments. To clean the exhaust ports, remove them from the air solenoid manifold and rinse them in solvent. Blow out with compressed air and refit.

Exhaust port, one located on each end of the manifold.

If a section of the boom will not turn on, it may be because that section has a large air leak, in the supply air to the check valves on the nozzles. To find the air leak, spray soapy water on each of the connections along that section. Replace any component that is leaking air. If the air leak can not be found on the section of the boom line, check to see if the air is leaking out of the air solenoid manifold exhaust port. These should not leak air when the boom sections are turned ON. If they do then a solenoid is stuck. To find the stuck solenoid turn all the boom sections OFF. Remove the hoses from the under side of the air solenoid manifold.



If there is air coming out from any of the ports then that is the solenoid that is stuck and it should be replaced.

The air solenoids have two wires going to them, one power and one earth. The wire in pin B of the plug is the earth and pin C is the power. The solenoids operate on 12 volts supplied from the section switches on the console

RapidFlow (Boom Recirculation)

Key Features

In order to ensure that boom lines are charged and ready to spray, a standard sprayer plumbing system will require the boom lines to be purged with chemical mix prior to spraying. RapidFlow allows an agitated chemical mix to be run through the boom lines prior to spraying - pre-charging them and eliminating waste.

This option is not available unless RapidFire is also fitted.

Operation

Note: It is important that boom recirculation is turned off before spraying. If it is left on while spraying, the flow meter will read incorrectly leading to the wrong amount of chemical being applied.

Before Spraying (Charging the lines)

1. Turn off all boom sections on the console.
2. Have the pump running agitating the tank mix.
3. Turn on boom recirculation switch.

NOTE: The lines will require at least 80L of fluid to fill them.

4. When ready to spray turn off boom recirculation and turn on the required boom sections.

After Spraying (Rinsing)

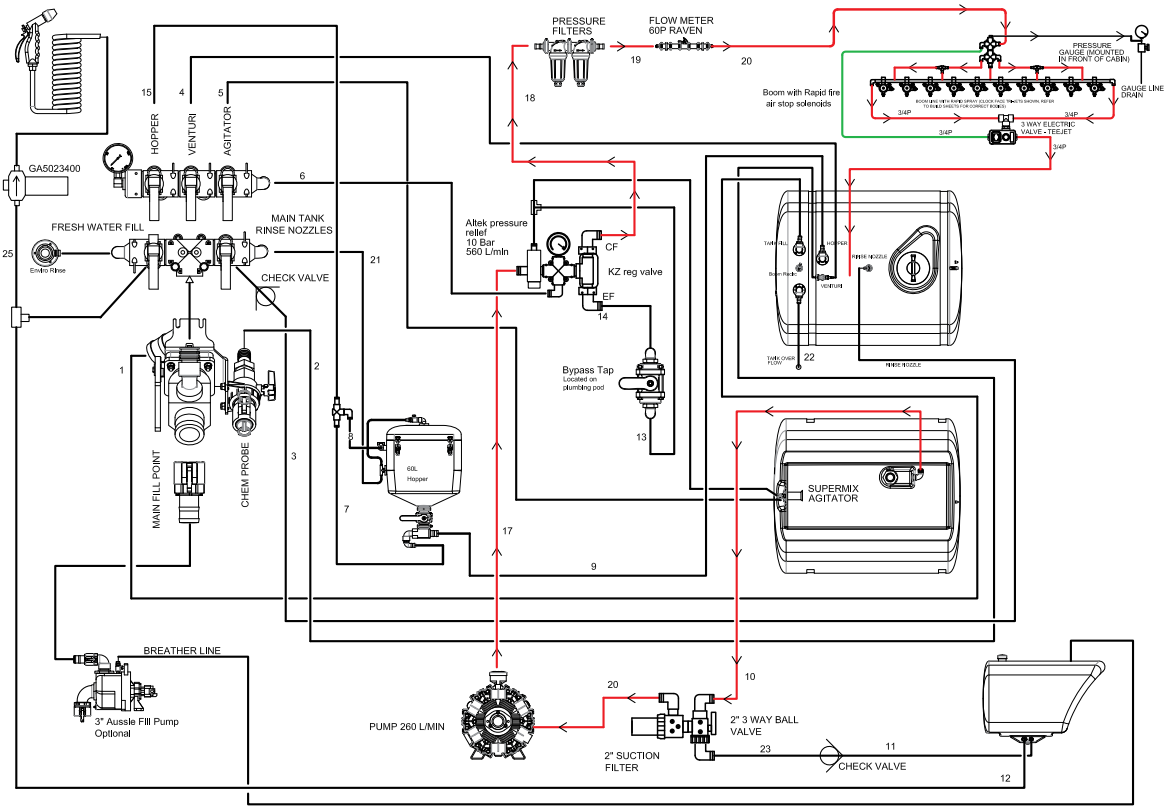
1. Turn off all boom sections on the console.
2. Turn the pump suction to "Draw From Flush Tank"
3. Turn pump on.
4. Turn on boom recirculation switch.

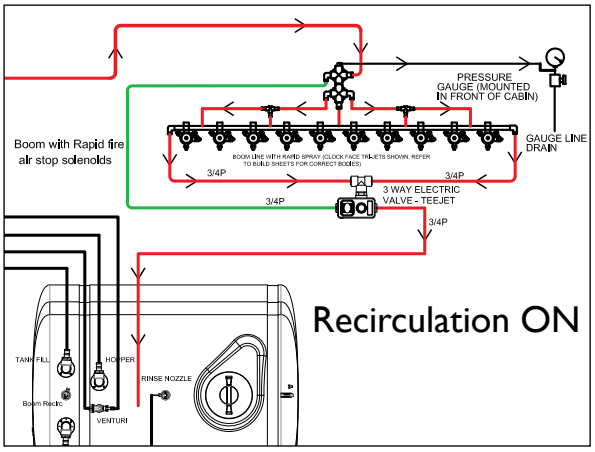
Note: The boom sections can be pulsed on/off to flush/rinse the tips and nozzle bodies.

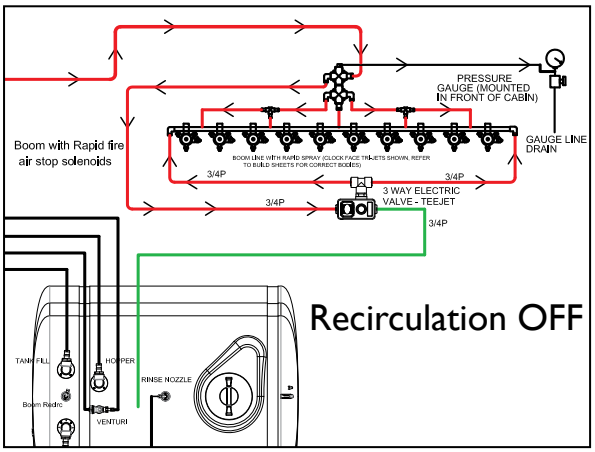
5. Turn off boom recirculation switch.
6. Return pump suction to "Draw From Main Tank".

Pressure delivery with RapidFire and Boom Recirculation with Raven controller

Charging Lines

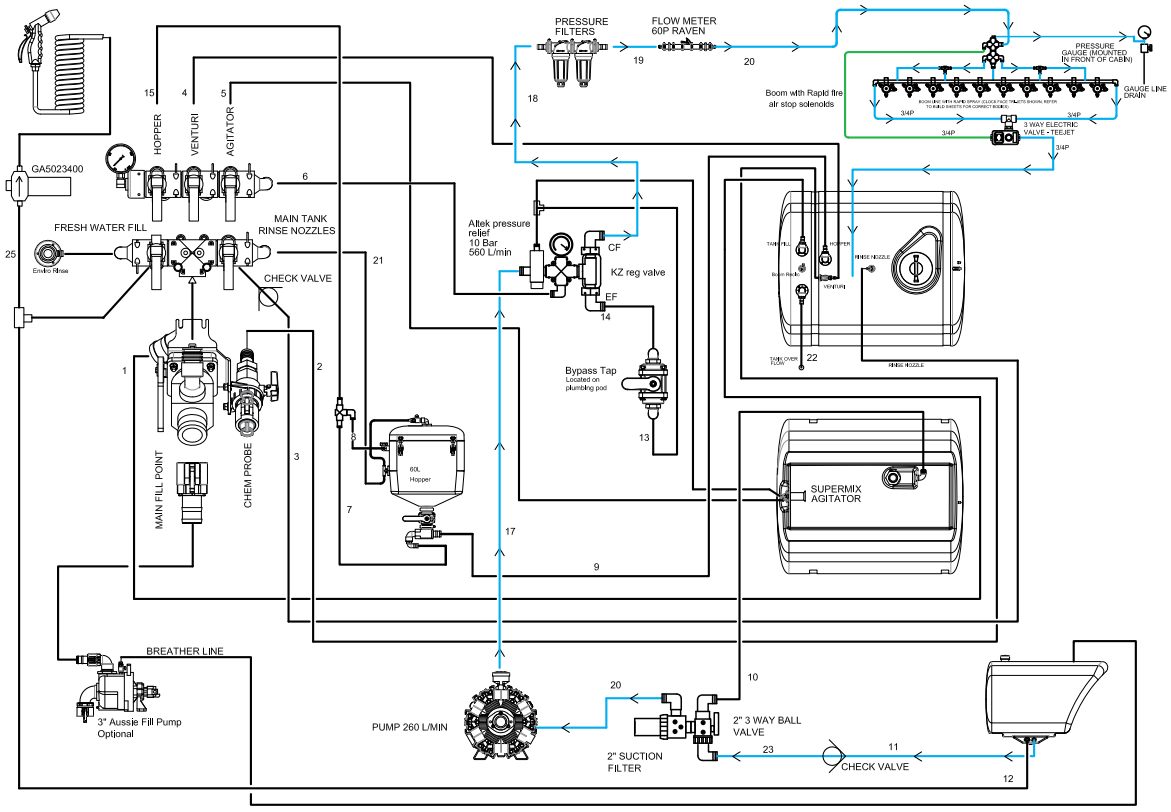


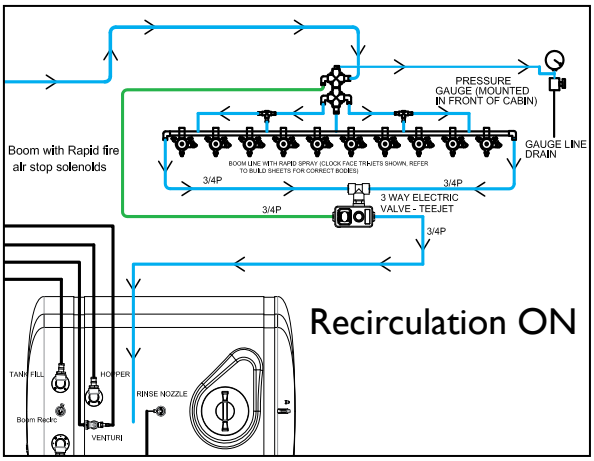


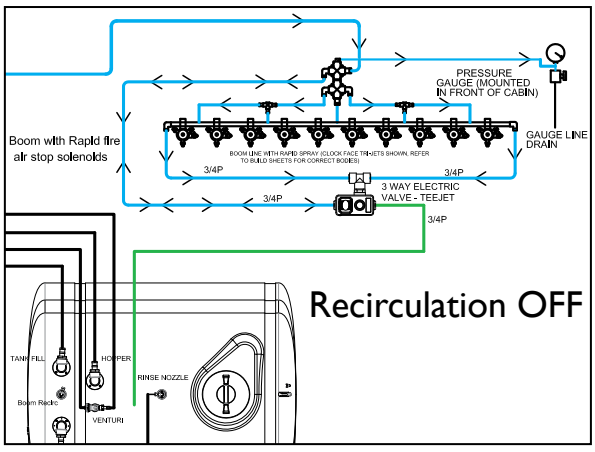


Pressure delivery with RapidFire and Boom Recirculation with Raven controller

Rinsing System







Hydraulic Fill Pump

Key Features

Suction and Delivery Lines

- Use good quality suction hose and fittings that will not collapse or leak air under suction.
- If pumping water from structures other than storage tanks, we recommend the use of an appropriate sized floating filter equipped with a check valve.
- It is essential the suction line to the pump is the same size as the suction port (3")

A smaller size delivery line can be used but will reduce pump output.

3" Fill Pump - Operation

Set the external RPM raise switch on so the engine is at 1500 RPM. Once engine is at 1500 RPM switch the fill pump on.

When done filling, turn off the fill pump before closing any valves.

CAUTION: Always turn off the delivery ball valve slowly as pump damage can occur if its turned off too quickly.

Setting Hydraulic Fill Pump RPM

The 3" fill pump speed can be altered by adjusting the screw and lock on the rear of the hydraulic motor. The hydraulic system has been sized so that the fill pump can not be over revved, so the speed control should be wound all the way out.

Groeneveld Auto Greaser

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Townsville, QLD 4810
Tel: 07 4774 3056
Fax: 07 4774 3824

Please Note:

The Groeneveld auto greaser system is supplied and fitted by Groeneveld. Any service problems that should arise or spare parts must be directed through Groeneveld.

Preface

The Groeneveld Automatic Greasing System is cutting edge design encompassing robust components and precision engineering to bring the owner operator not only ease in operation and maintenance but also peace of mind that all moving systems are able to work at their peak.

To this end, Goldacres acknowledges that while we hold a high degree of knowledge in their product, we would always recommend that owners and dealers contact their local Groeneveld dealer for technical advice and assistance. We also advise that you use only genuine Groeneveld parts and lubricants. After all, this system is your investment in your machines serviceability and longevity!

The information following, has been produced by using excerpts from the Groeneveld EG0101 Zero General Manual. Utilising text, tables and diagrams as well as text and photographs supplied by Goldacres.

The following information about the auto greaser system has been approved by Groeneveld.

Introduction

GROENEVELD Automatic Greasing Systems ensure the daily maintenance of the moving parts attached to the system. They avoid unnecessary machinery wear and down-time and thus save cost and prevent exasperation.

GROENEVELD greasing systems are used by production companies, machinery used in service industries, agriculture, shipping, the offshore industry and the transport industry.

In the following list are the most important advantages:

- Increase of the service intervals, thus less unnecessary down-time;
- Less wear of the lubricated parts because of accurate and constant lubricating;
- Reduced repair and replacement costs;
- Reduced unexpected down-time;
- Fewer production losses.

With a Singleline Automatic Greasing System, all attached lubrication points of a vehicle or machine are automatically lubricated at the correct time with the correct dose. Moreover, optimum grease or lube-oil distribution over the whole lubricating surface is achieved, because the lubrication takes place while the machinery or vehicle is in operation. Every action is automatically carried out by the system. The user needs only to refill the reservoir periodically.

Definitions

Note: Is used to notify people of installation, operation or maintenance information that is important but not hazard related.

CAUTION: Instructions that if ignored will cause damage to the system or machine.

WARNING: Instructions that if ignored will cause personal injury or death to the operator or bystanders.

Groeneveld Auto Greaser - System Overview

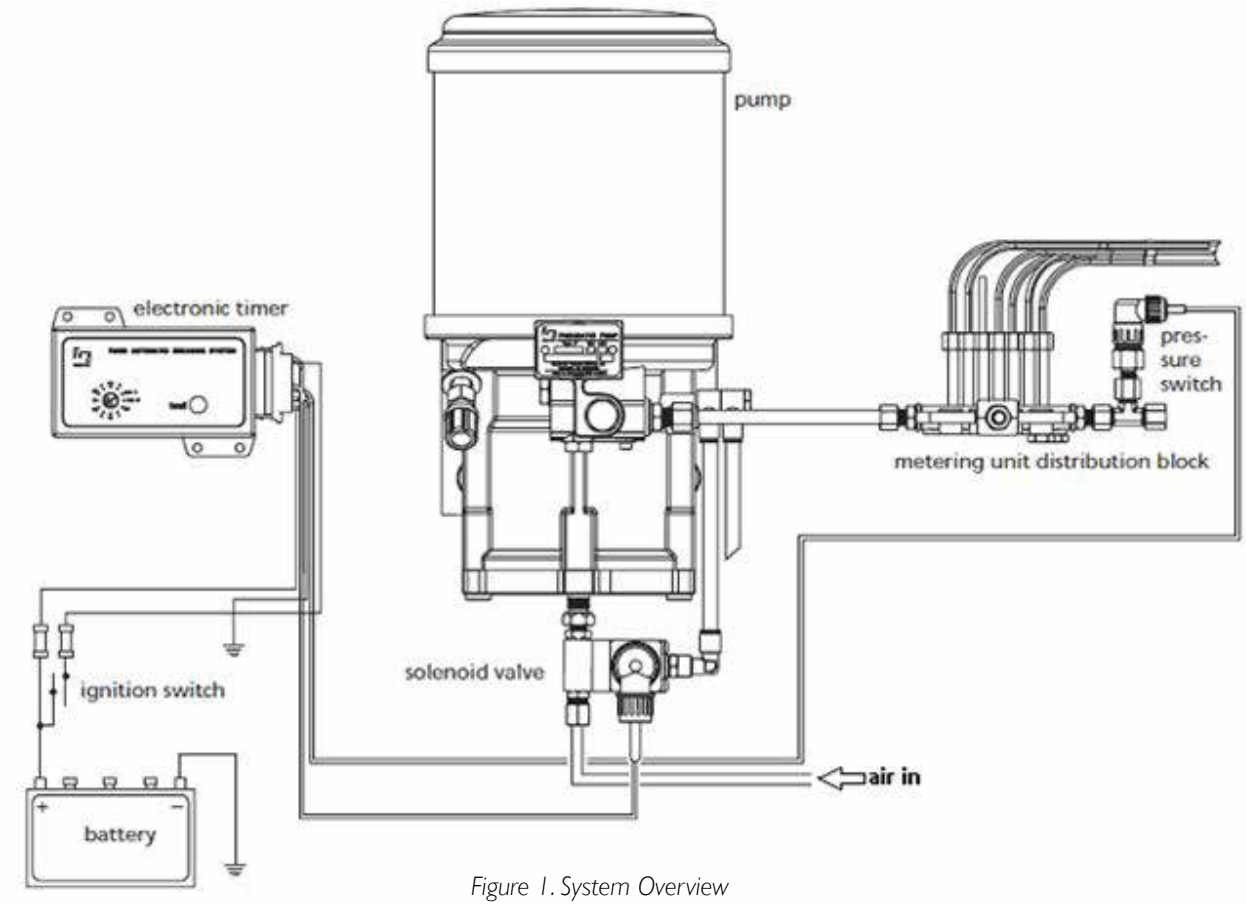


Figure 1. System Overview

Groeneveld Auto Greaser - Distribution Block Map

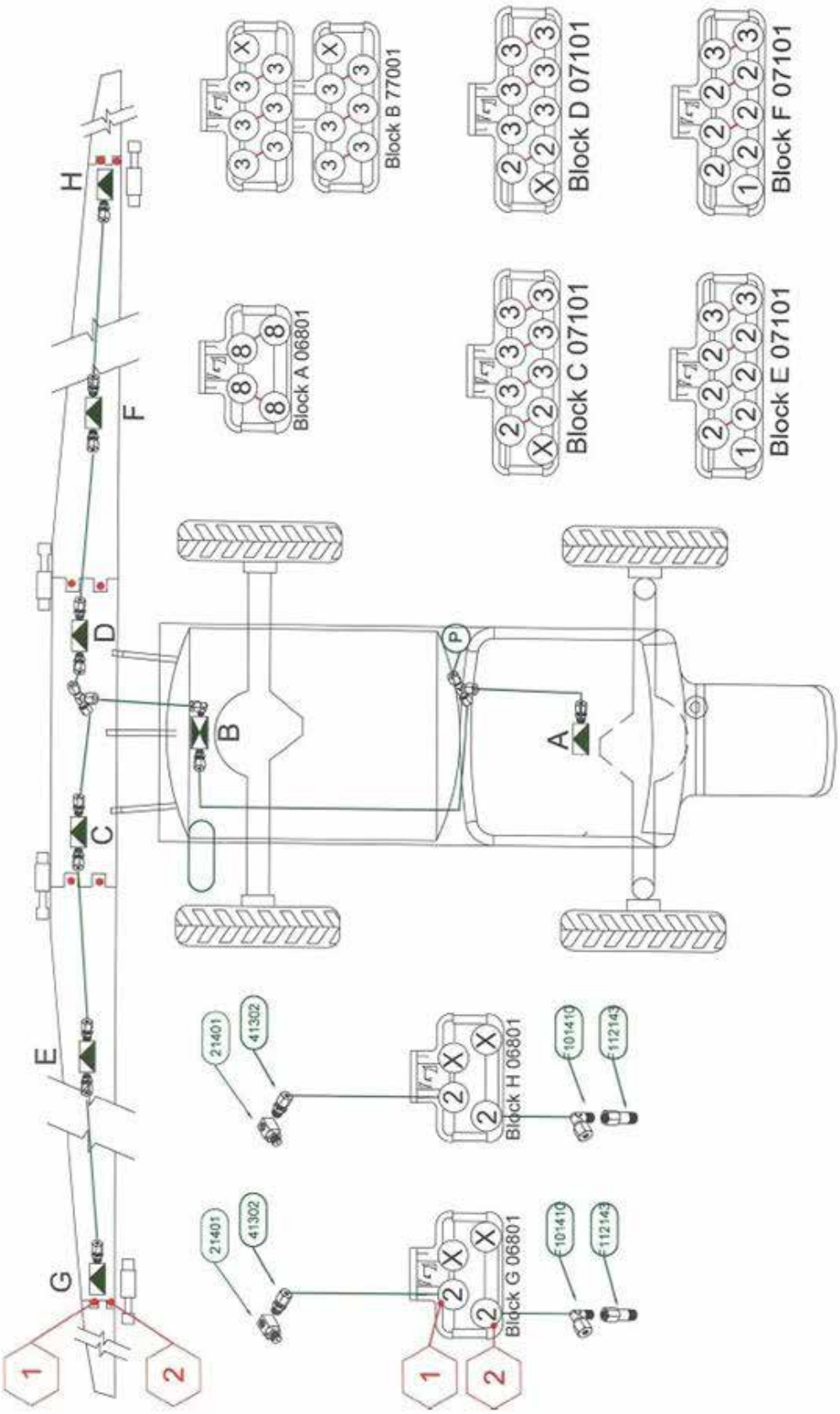


Figure 2. System layout for crop cruiser

Groeneveld Auto Greaser - Components

The COMPONENTS section will give you a basic run down of the components, their location and their purpose. A full operational description of the system is in the OPERATION section. Some settings, tips and words of advice and caution are also listed where applicable at each component's section. Please familiarise yourself with this area thoroughly.

Pump Unit

The Pump Unit is made up of the following parts – the main storage area, the metered reservoir where the next grease dose is held, main piston, follower plate, compressed air inlet, fill point and return / non return valves. The purpose and operation of these will be explained in the manual.
The filling point is on the left side of the pump unit and should be covered with a protective cap.

Before filling, ensure you read and understand the following note and cautions:

CAUTION: When you take delivery of your sprayer, ensure you check the right hand side of the pump unit and look for a red tag or an over flow hole. If the red tag is still fitted, REMOVE IT now. If it is left in place, the reservoir may fail on refilling due to pressure build up.

Figure 3. Pump Unit

Figure 4. Fill Point

Figure 5. Red tagged bung in place.

Figure 6. Unplugged over flow hole

Note: The fill point requires a Groeneveld female fill pump adaptor. You can purchase these via your local Groeneveld dealer or contact your Goldacres dealer to order.

CAUTION: Do not overfill the main reservoir. Fill only to about 2cm from the top. You will see this instruction on the reservoir tank. Over filling will cause the reservoir to fracture.

CAUTION: Use ONLY HP0 or NLGI0 rated grease. It needs to be Lithium based and contain NO Teflon or Graphite as they stick to the meters and eventually jam them. The grease must NOT contain Aluminium or Copper compounds as they are abrasive to the seals and lines.

If you should happen to slightly overfill the reservoir, grease will overflow from the hole on the right of the pump unit as indicated in Figure 6. This will continue for about 3 days until the overflow channel is clear.

Main Air Supply

The air supply that operates the auto greasing system is the red air line running from the pneumatic manifold behind the right hand pod, to the bottom of the pump unit.

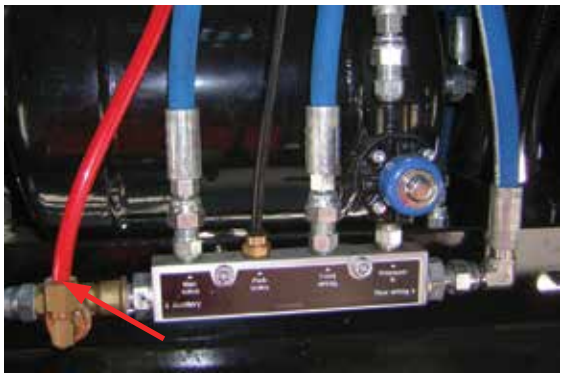


Figure 7. Main Air Supply

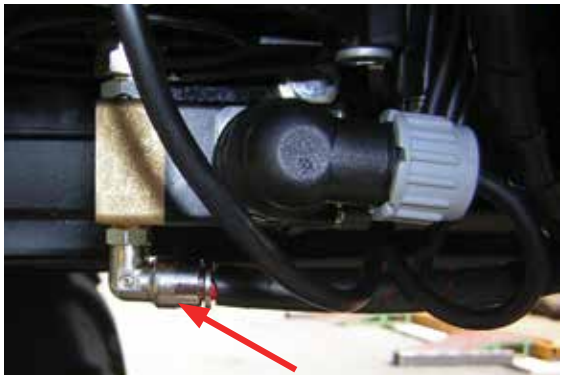


Figure 8. Main Air Supply

Electronic Timer

The electronic timer sets the intervals for operation of the greasing system. This can be set at 30 minute intervals. The timer is located in the main cabin in the main fuse compartment to the right of the operators' seat. The timer is wired into the red covered ignition bus or via the 180A Relay. Power is applied when the ignition key is turned on.

Figure 9. Electronic Timer

Figure 10. Electronic timer in main fuse compartment

The timer is protected by a 10 Amp fuse and is the clear orange covered fuse indicated in Figure 10.

CAUTION: The timer should be preset to 90 minutes. This has been tested as the optimum time interval for greasing the main moving parts of your machine. Setting the timer to a longer interval will mean that the components on your sprayer will not be properly lubricated.

While this may seem to be a short time interval, do not forget that the auto greaser applies only small, metered amounts of grease at a time. Keeping that particular area topped up and in optimum condition.

Solenoid

The solenoid at the bottom of the grease dispenser opens the valve, allowing air pressure to enter through the compressed air connection and push against the main piston. The inwards airline can be seen at the bottom of Figure 12.

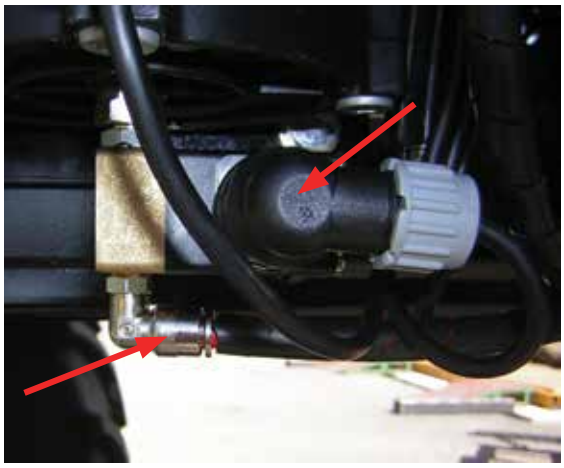


Figure 11 & 12. Solenoid

Second Grease Outlet

A second grease outlet is on the pump unit and shown in the photograph below, in this case it is covered by the brass blank indicated. The main grease line is indicated by the arrow to the right of the blank.

Note: If you decide you want to run a second grease outlet line, please contact your Groeneveld dealer directly for technical advice.

Figure 13. Second Grease Outlet

Return Valve

The return valve indicated in the photograph below allows grease to return to the reservoir from the grease line when pressure is released at the end of the lubrication cycle.

Figure 14. Return Valve

Note: Removing this blank is not advised. There is a check ball held in under spring tension that will come out at some speed. If this is lost, the return valve and non return valve will not work and the system will pump the grease back to the reservoir. If you believe there is a problem with this part of the system, contact your Groeneveld dealer direct.

WARNING: Removing this blank is not advised. There is a check ball held in under spring tension that will come out at some speed. Eye injury may result from the ball bearing if the blank is removed. If you believe there is a problem with this part of the system, contact your Groeneveld dealer directly.

Pressure Switch

The pressure switch is easily seen at the front of the unit. This monitors the system pressure during operation. Should pressure drop below a set point (due to brake in a main grease line), the switch will close and sound a low pressure alarm in the cabin.

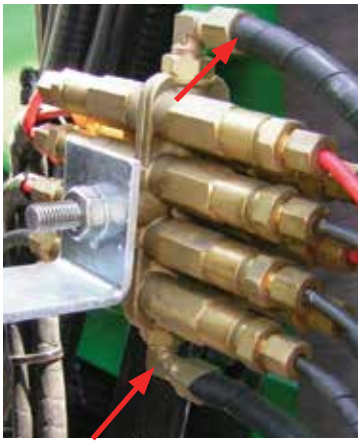
Figure 15. Pressure Switch

The air pressure supplied to the auto greaser is 110 – 120 PSI (7.6 Bar). The minimum required for effective operation of the auto greaser is 90 PSI (6.1Bar). Below this, grease pressure will likely be inadequate to effectively protect the components.

The pressure switch operates at 40 PSI (2.7 Bar) grease pressure. Should a main grease line become broken (see next heading on this page), the pressure will drop below 40 PSI and the alarm in the cabin will sound.

Main Grease Lines

The main grease lines leave the pump unit and terminate at either a bank of metering units or a single metering unit. On your system, a single line leaves the pump unit and to a 'T' joint which branches off to the front and rear of the machine.



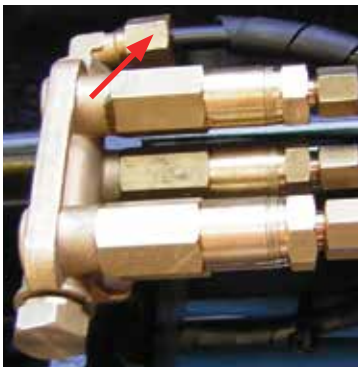


Figure 16, 17 & 18. Main Grease Lines

CAUTION: The main lines from the pump unit to the banks of metering units or single metering unit are monitored for pressure. Should one of these lines brake or leak, there will be a notable pressure drop in the system and a buzzer will sound in the cabin to alert you. The system will no longer be operating effectively and some or all areas may not be lubricated.

Grease Nipple Lines

The grease nipple lines are the smaller lines that run from the meter units and deliver the metered dose of grease to the grease nipple. These are Black, Red or Blue.

The 3 hose colours can be used if there are 3 different sized metering units in a bank. These make it easier to trace the lines to their terminating points.

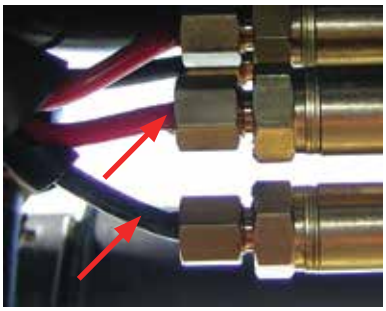


Figure 19, 20 & 21. Grease Nipple Lines

Black is used to denote the lines out of the largest meter unit/s (based on the shims or spacers).
Red is used to denote the lines out of the smallest meter unit/s (based on the shims or spacers).
Blue is used to denote the lines out of the intermediate meter unit/s (based on the shims or spacers).

CAUTION: These lines do not have their pressure monitored. Should a line after its meter unit be broken, the system will not sound the alarm buzzer. The grease will flow out of the point of least resistance, which is the hole or brake in the hose. It is important to make regular inspections of these lines to ensure they are not damaged. Also inspect the grease point for evidence of lubrication.

Meter Distribution Block

The meter unit distribution block is a brass fitting that holds multiple meter units. It has a port to attach the main grease line in and a main grease line out if there are further banks to feed off that line. If there are no further banks, one of the 2 main grease line ports can be closed with a screw in blank.

Any unused meter points will be terminated with a blanking plug.

CAUTION: Do not open any of the blanked ports or meter units. This can allow contaminants into the lines and thus be a potential cause of faults or failures.

Figure 22 & 23. Meter Distribution Block. (no meter units fitted)

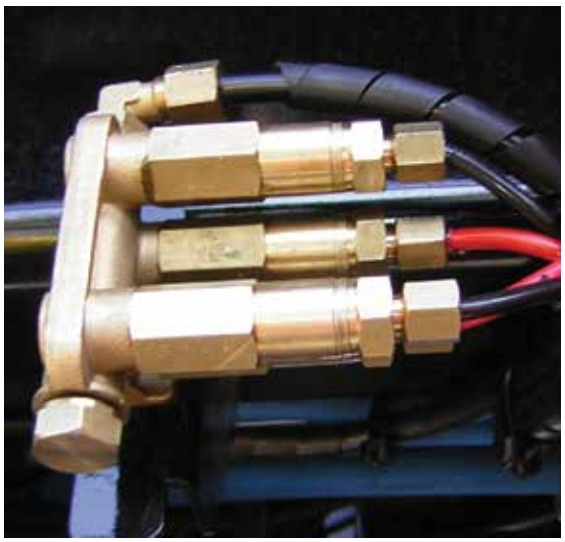


Figure 24 & 25. Meter Distribution Block. (meter units fitted)

Meter Units

The meter units measure the dose of grease to the grease nipple. The metered dose is varied by a number of shims or spacers. If you look closely at your machine, you will see each meter will have 1, 2 or 3 shims. After that, it moves up to a spacer (equivalent to 4 shims). Then 1 spacer with 1, 2 or 3 shims, followed by 2 spacers, then 2 spacers and 1 shim (9 shim spacing).

Figure 26. Meter Unit fitted with spacer

This has been set by the technician when fitted at the factory and has been tested to ensure each component gets the grease it requires. This will allow enough grease to be pushed into the moving parts, lubricating them as well as keeping dirt and abrasives out. If you believe that any points are not getting enough grease, check the lines for damage. If none is evident, contact your dealer or Groeneveld direct and ask about increasing the meter dose for that particular area.

CAUTION: It is not advisable to open the metering units as this allows the entry of dirt, and thus is a potential cause of faults and failures.

Figure 27. Meter components showing shim

Operation

1. Reservoir with follower plate
2. Air venting channel
3. Grease channel
4. Return channel to reservoir
5. Main line connection
6. Pressure channel
7. Return valve
8. Non-return valve
9. Compressed air connection
10. Main air piston
11. Spring
12. Filler connector
13. Small grease piston
14. Grease chamber
15. Flapper valve
16. Connection to reservoir

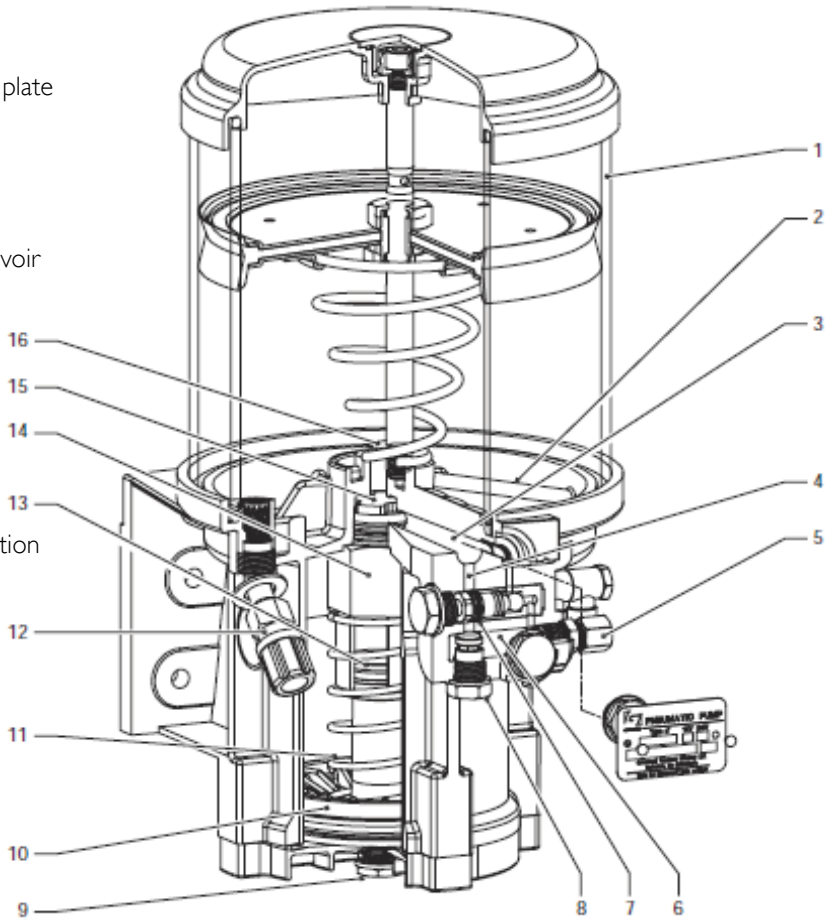


Figure 28. Pump unit exploded view

The timer counts down the preset interval and then closes the circuit applying power to the solenoid, opening it and allowing air pressure to enter through the bottom of the pump unit.

The air pressure is applied via the compressed air connection (9) the main piston (10) will be forced upwards applying pressure to the lubricant in chamber (14).

The pressure in chamber (14) forces valve (15) against the seat. The connection (16) to the reservoir (1) is closed so the grease does not pump straight back into the reservoir.

The lubricant leaves the chamber (14) via a channel (3) through the non-return valve (8) into the main or primary line. It moves along the main lines under pressure and acts on the plungers in the metering units.

The metering units are brought under full pump pressure passing their metered quantities of lubricant into the lubrication points. As a result of the pressure differential at the return valve (7) the return channel (4) remains closed.

At the end of the complete lubrication cycle, which takes 3 minutes, the air pressure under the main piston (10) falls, allowing the piston to be pushed downward by the spring (11). At the same time flapper valve (15) is released and, because of the reduced pressure in the chamber (14), lubricant is drawn from the reservoir. This primes the system for the next cycle.

The non-return valve (8) prevents grease from the system piping and metering units from flowing back into the chamber (14).

The pressure in the main pipe opens the return valve (7) via the channel (6). This allows the pressure of the lubricant to flow via the channel (4) to the reservoir.

The metering units, with this pressure drop can now automatically refill themselves. The springs inside the meter units push the plunger back and the reservoir in front of the plunger fills, priming it for the next cycle.

There is NO pressure relief valve for the grease. Once the system has expended all the grease in the meter units, the system hydraulically locks until the end of the cycle time.

Meter Unit

There are 11 metering unit types (1) available for the Singleline system, each with a differing metered lubricant quantity. By careful selection of the type of metering unit each lubrication point can be provided with the right quantity of lubricant.

The metering units are fitted in groups on distribution blocks (2); this is a cast brass distribution block to which the primary (main) line (3) is connected. The blocks are available with several ports or outlets to which metering units can be connected. The unused outlets should be blanked-off. The metering units are also made of brass and are, because of their enclosed design, exceptionally suitable for use in dirty and dusty conditions.

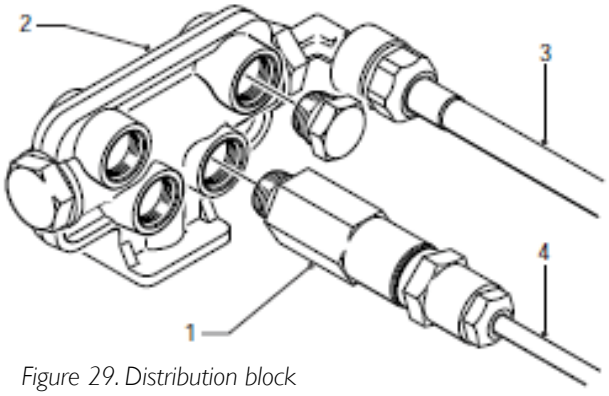


Figure 29. Distribution block

CAUTION: Do not open any of the blanked ports or meter units. This can allow contaminants into the lines and thus be a potential cause of faults or failures.

Figure 30 illustrates a new metering unit, one that has not yet been filled with grease. Item (1) in this figure is the spacer, which determines the delivery of the metering unit.

The metering units that are used in your greasing system may differ externally, or even internally, from the one illustrated here. However, the operating principle is always the same.

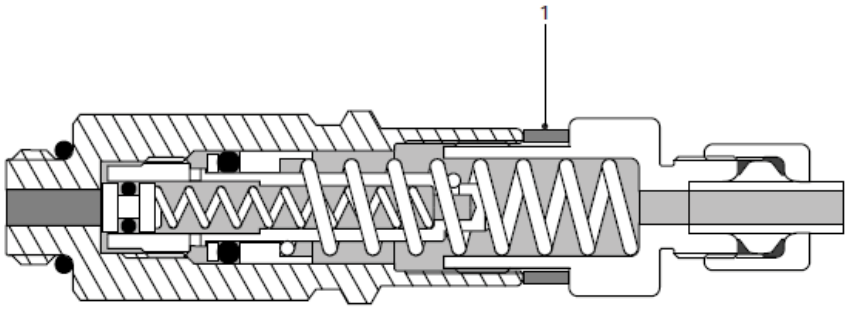


Figure 30. Meter unit & Spacer

PHASE A. The pump presses the grease into grease channel (1). The grease pushes plunger (4) past channel (2). The grease now fills chamber (3) and pushes plunger (5) to the right. The stroke length of plunger (5) will determine the amount of grease that will be pressed through the secondary grease line to the grease point. This stroke length - hence the capacity of chamber (3) – is determined by the number and thickness of the spacers as shown above.

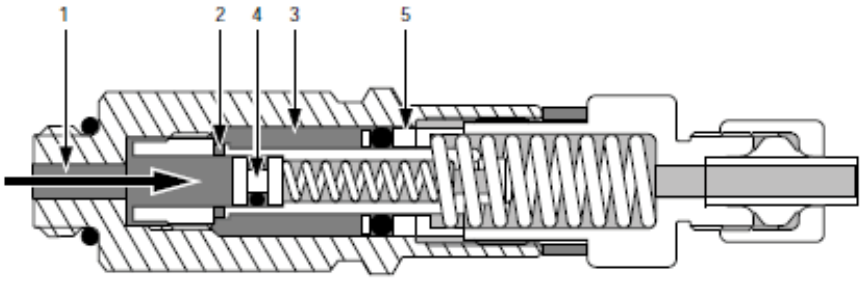


Figure 31. Meter unit in phase A

PHASE B. When the pump stops and as the grease pressure drops, spring (7) (fig. 7.4) will push plunger (4) back to the left, closing off channel (1). O-ring (9) prevents grease from being sucked back from chamber (6). Plunger (5) is pushed back by spring (10) and presses the grease in chamber (3), via channel (2), to chamber (8).

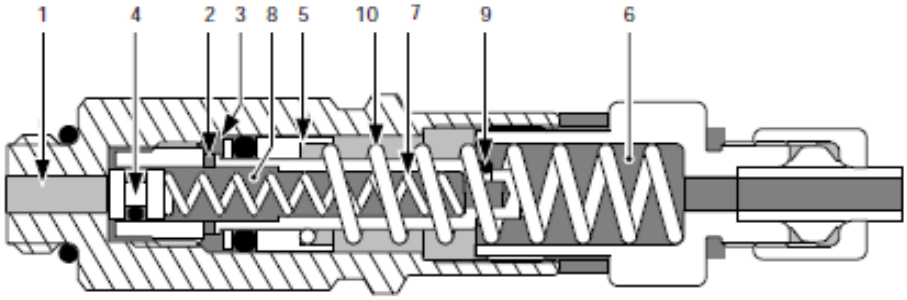


Figure 32. Meter unit in phase B

PHASE C. During the next lubrication cycle, the same happens as in phase A. Chamber (8) however, is now filled with grease. As plunger (4) moves right under influence of the grease pressure, the grease in chamber (8) is pressed, via chamber (6) and the secondary grease line, to the grease point. During all this, O-ring (9) is pressed outward to allow the grease to leave chamber (8).

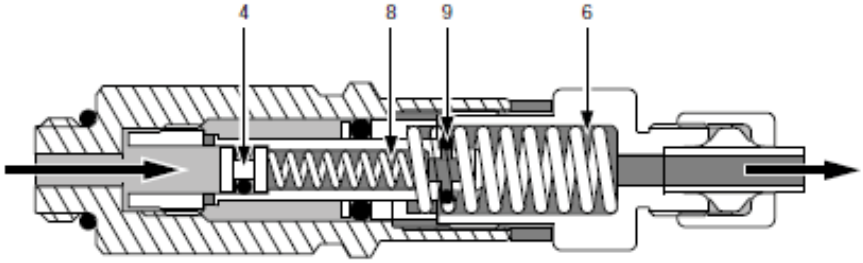


Figure 33. Meter unit in phase C

CAUTION: It is not advisable to open the metering units as this allows the entry of dirt, and thus is a potential cause of faults and failures.

Solenoid

The solenoid valve between the air tank and the pneumatically operated pump (usually fitted to the pump) is a normally closed, free venting type. The valve is connected electrically by an M24 screw connector.

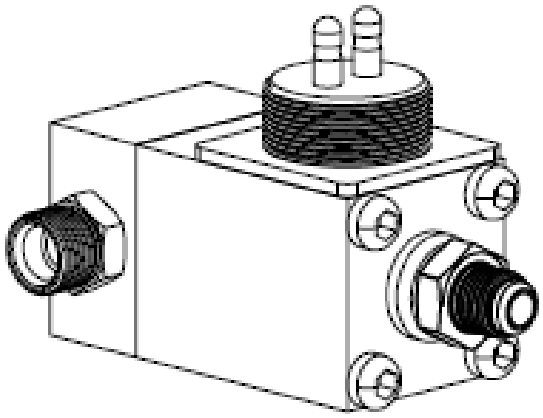


Figure 34. Solenoid

Pressure Switch

A pressure switch is included in the lubrication system (in the main pipe) to provide an alarm for too low a pressure in the system during the lubrication cycle.

This switch closes at a pressure of 40 bar, making a connection to earth. If this does not happen during the lubrication cycle, because insufficient or no grease pressure is generated, an alarm will be given. During the remaining cycle time there will be an intermittent alarm signal. This alarm will be repeated after a preset time if the problem is not corrected.

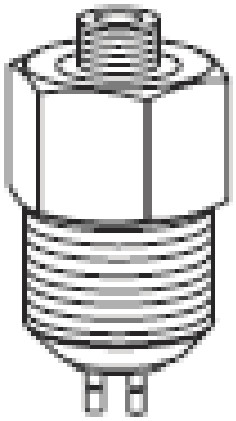


Figure 35. Pressure Switch

An M24 screw connector connects the switch electrically.

For a system with a pneumatically operated pump the pressure switch is fitted to a distribution block. The electrically operated pump is provided with a built-in pressure switch.

Reservoir

The reservoir (2) is made from impact-resistant plastic that can withstand the influences of fluctuating temperatures. The reservoir can hold a quantity of lubricant that in most cases is sufficient for about 4 months, depending on the number of grease points.

The minimum level (5 cm) is marked by a label (3) on the reservoir.

There is NO maximum level mark

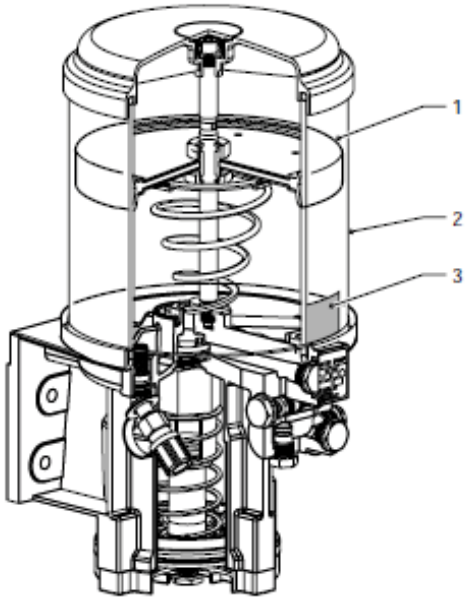


Figure 36. Reservoir

In the standard reservoir a follower plate is placed above the level of the lubricant. This plate follows the level of the lubricant; as the level falls the follower plate falls with it under the action of a tension spring. The follower plate prevents the increase of air into the lubricant and any consequent soaping of the lubricant. Funnelling of grease as the level falls is also prevented. The follower plate also wipes the reservoir wall clean. This allows the level of the lubricant to be checked easily at a glance.

Electronic Timer

The greasing system is controlled by an electronic timer. The timer produces, at set time intervals impulses lasting 3 minutes. These impulses energize the solenoid valve in the air supply to start the lubrication cycle. The interval between successive lubrication cycles is adjusted on the electronic timer.

If during a cycle the power supply is switched off, a complete new lubrication cycle will restart when the power supply is again switched on.

1. Pump cycle rotary switch

2. Diagnostic (Groeneveld only)

3. Grease interval rotary switch

4. Test button

5. Connector

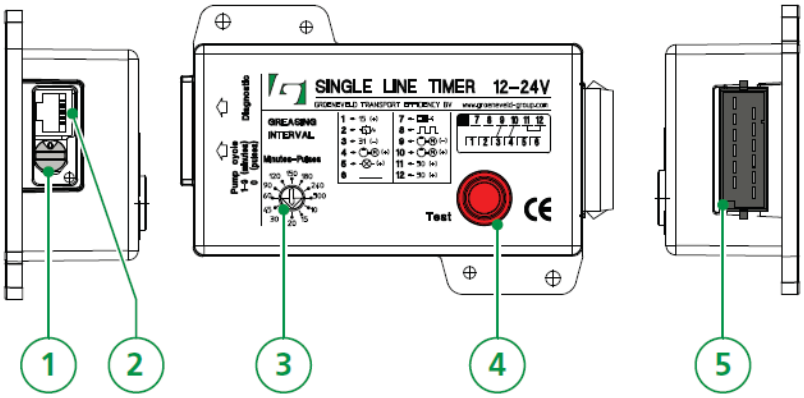


Figure 37. Electronic Timer

Adjusting the Timer

Your electronic timer should be set to 90 minutes to ensure your sprayer components are adequately lubricated.

CAUTION: At Goldacres, we strongly advise that you do not increase your timer setting past 90 minutes. This could mean your sprayer grease points are not being adequately lubricated.

The interval time between two successive lubrication cycles can be adjusted using the step switch. One of ten time intervals can be selected. The standard version has time intervals increasing by 0.5 hr steps (0.5 hr, 1 hr, 1.5 hr etc. to 5 hr). If the power supply is switched off during a cycle the cycle will be ended. When the power supply is switched on again a complete new cycle will be started.

Timer Alarms

Alarm signals can be generated by the electronic timer in various circumstances.

The standard version uses a built-in buzzer. In other versions another (external) alarm indicator can be fitted, for example a lamp. The alarm signal is generated in the following situations:

- After reaching 70% of the cycle time (70% of 3 minutes = 2 minutes) the pressure switch should have connected to earth. If this is not the case - because insufficient pressure has been built up - then a continuous alarm signal is generated.
- The electronic timer runs a self-test after the power supply is switched on; if there is a fault condition an intermittent alarm is generated. This can occur if no interval is selected by the step switch.

If the electronic timer sounds an alarm to indicate that the timer or greasing system is not functioning properly, it is strongly advised to examine (or have examined) the greasing system and if necessary to make repairs. If this is left too long, damage can be caused to either the sprayer or the greasing system.

Maintenance, Filling and Testing

Periodic Maintenance

CAUTION: All maintenance points must be carefully followed. Failure to do so can cause failure of your auto greasing system or your machine to be under lubricated.

The following maintenance is required to ensure a long and reliable lifespan of the auto greasing system:

1. Do not overfill the main reservoir. Fill only to about 2 cm from the top. You will see this instruction on the reservoir tank. Over filling will cause the reservoir to fracture.
2. Check the lubricant levels daily.
3. Use ONLY HP0 or NLGI0 rated grease. It needs to be Lithium based and contain NO Teflon or Graphite as they stick to the meters and eventually jam them and NO Aluminium or Copper compounds as they are abrasive to the seals and lines.
4. Your electronic timer should be set to 90 minutes to properly lubricate the connected points on your machine.
5. Inspect grease points daily. If there is no indication of grease at the components, there may be a break in the line between the meter and the grease nipple.
6. Inspect pump unit and airlines / power cables for external damage.
7. Inspect all grease lines weekly for damage. If a brake or puncture occurs between the tank and meter units, there will be a buzzing alarm in the cabin. Your system may not be able to lubricate the machine effectively. However, if a brake occurs between a meter unit and a grease nipple, there will be no alarm. Grease will be lost at the break and the component will not be lubricated.
8. Do not make alterations to your system. Call your local Groeneveld dealer for technical advice.
9. Do not use high pressure or steam cleaners on the pump unit as it may force water into the system.
10. Drain the pneumatic system regularly to prevent water build up. Water entering under the piston CAN NOT drain away. Eventually this will fill the area under the piston and the amount of lubricant delivered will reduce and eventually cease.
11. Do not forget that the auto grease doesn't cover every grease point on the machine. Ensure you check and grease those parts that are not connected to the auto greaser as per your operators' manual.

Filling

CAUTION: Do not overfill the main reservoir. Fill only to about 2cm from the top. You will see this instruction on the reservoir tank. Over filling will cause the reservoir to fracture.

CAUTION: Use ONLY HP0 or NLGI0 rated grease. It needs to be Lithium based and contain NO Teflon or Graphite as they stick to the meters and eventually jam them. The grease must NOT contain Aluminium or Copper compounds as they are abrasive to the seals and lines.

When the lubricant in the reservoir has fallen to the minimum level it must be re-filled. Generally a filler pump is used for this purpose. The procedure is as follows:

1. Ensure there grease drain hole on the right of the pump unit is not blocked.
2. With a new filler pump (or filling hose) the hose should first be primed with lubricant. This avoids the pumping of air into the reservoir. For this the ball (1) in the snap-on connector on the filler hose should be depressed while pumping lubricant through the hose until it is filled with the lubricant.
3. Remove the dust cap from the filler connector.
4. Carefully clean the filler connector and the connector on the filler hose.
5. Secure the filler hose to the filler connector.
6. Fill the reservoir to not more than the maximum level (2 cm below the top of the reservoir) or until the follower plate meets its stop. If you slightly overfill, you will see grease flow from the drain hole on the right of the pump unit. This will take about 3 days to complete draining.

7. Replace the dust cap on the filler connector.

8. There is a filter within the filler connector in the reservoir. If pumping is very difficult, the filter could be blocked. In this case, dismantle and clean the filter.

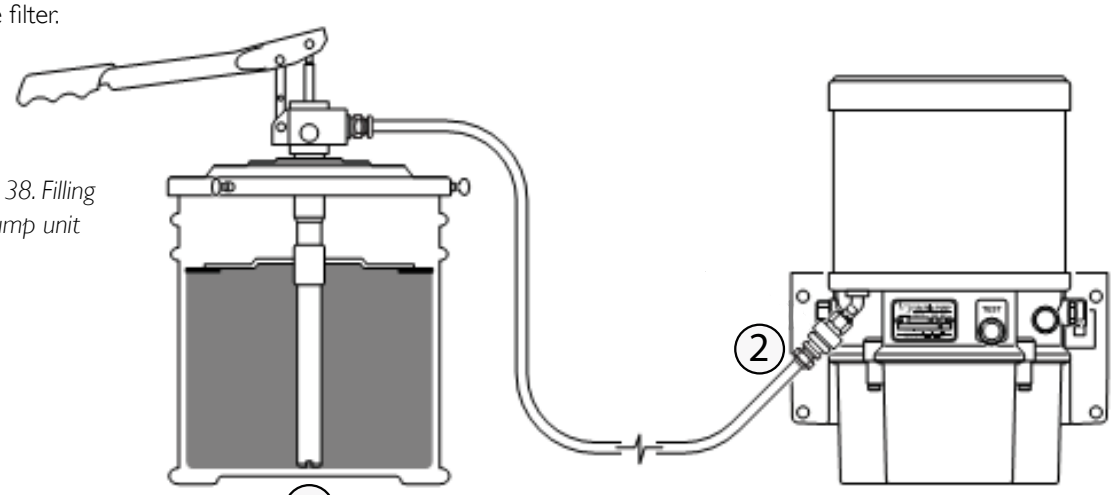


Figure 38. Filling the pump unit

Testing the Electronic Timer

STEP SWITCH TEST.

This checks the step switch contacts in all positions.

1. Set the step switch to position 'test A'.

2. Activate the electronic timer by switching on the ignition.

3. Press the 'test' button.

4. Wait for the audible alarm signal then release the 'test' button.

5. Within 5 seconds turn the step switch to the required interval time position. Each position produces a number of signals: position 1 gives one signal, position 2 two signals etc.

6. The switch can be set to all positions; positions 'test A' and 'test B' will not produce an alarm signal.

7. End the test by switching off the ignition.

ACCELERATED CYCLE TEST.

This allows you to test a timing cycle without waiting the full set time interval. It sets the time interval at 1/20 of its duration.

1. Set the step switch to position 'test A'.

2. Press and hold the 'test' button.

3. Switch the ignition on while still keeping the 'test' button pressed in.

4. The alarm signal buzzer will now sound. The 'test' button must be pressed as long as the alarm signal continues.

5. Within 5 seconds of the end of the alarm signal turn the step switch to the required position.

6. The electronic timer is now fully operational; the time intervals are now 1/20 of their usual times.

7. End the test by switching off the power supply.

NORMAL SYSTEM TEST.

1. Switch the ignition on.

2. Press the 'test' button; a normal lubrication cycle will then follow. The switch can be set in any position except 'test A' or 'test B'.

After this test the electronic timer will work at the interval set.

The 'test B' position is only for use with the test or read-out unit.

Warnings and Cautions Summary

Note: Instructions given to the operator to better enhance the system.

CAUTION: Instructions that if ignored will cause damage to the system or machine.

WARNING: Instructions that if ignored will cause personal injury or death to the operator or bystanders.

WARNING: Removing this blank is not advised. There is a check ball held in under spring tension that will come out at some speed. Eye injury may result from the ball bearing if the blank is removed. If you believe there is a problem with this part of the system, contact your Groeneveld dealer direct.

CAUTION: Do not overfill the main reservoir. Fill only to about 2 cm from the top. You will see this instruction on the reservoir tank. Over filling will cause the reservoir to fracture.

CAUTION: When you take delivery of your sprayer, ensure you check the right hand side of the pump unit and look for a red tag or an over flow hole. If the red tag is still fitted, REMOVE IT now. If it is left in place, the reservoir may fail on refilling.

CAUTION: Use ONLY HP0 or NLGI0 rated grease. It needs to be Lithium based and contain NO Teflon or Graphite as they stick to the meters and eventually jam them. The grease must NOT contain Aluminium or Copper compounds as they are abrasive to the seals and lines.

CAUTION: The timer should be preset to 90 minutes. This has been tested as the optimum time interval for greasing the main moving parts of your machine. Setting the timer to a longer interval will mean that the components on your sprayer will not be properly lubricated.

CAUTION: The main lines from the pump unit to the banks of metering units or single metering unit are monitored for pressure. Should one of these lines brake or leak, there will be a notable pressure drop in the system and a buzzer will sound in the cabin to alert you. The system will no longer be operating effectively and some or all areas may not be lubricated.

CAUTION: These lines do not have their pressure monitored. Should a line after its meter unit be broken, the system will not sound the alarm buzzer. The grease will flow out of the point of least resistance, which is the hole or brake in the hose. It is important to make regular inspections of these lines to ensure they are not damaged and the grease point for evidence of lubrication.

CAUTION: Do not open any of the blanked ports on meter distribution blocks or the meter units. This can allow contaminants into the lines and thus be a potential cause of faults or failures.

CAUTION: It is not advisable to open the metering units as this allows the entry of dirt, and thus is a potential cause of faults and failures.

CAUTION: At Goldacres, we strongly advise that you do not increase your timer setting past 90 minutes. This could mean your sprayer grease points are not being adequately lubricated.

CAUTION: All maintenance points must be carefully followed. Failure to do so will can failure of your auto greasing system or your machine to be under lubricated.

Note: The fill point requires a Groeneveld female fill pump adaptor. You can purchase these via your local Groeneveld dealer or contact you Goldacres dealer to order.

Note: If you decide you want to run a second grease outlet line, please contact your Groeneveld outlet directly on technical advice.

Note: Removing this blank is not advised. There is a check ball held in under spring tension that will come out at some speed. If this is lost, the return valve and non return valve will not work and the system will pump the grease back to the reservoir. If you believe there is a problem with this part of the system, contact your Groeneveld dealer direct.

Technical Data

Pump Unit

Your sprayer is fitted with model part number 36201 on this table.

	part number			
	36201	35501	37101	43001
reservoir capacity	4 liters	8 liters	4 liters	8 liters
delivery	42 cc / stroke		60 cc / stroke	
ratio	9:1			
grease pressure	72 bar (for an air pressure of 8 bar)			
maximum grease pressure	100 bar			
temperature range	-25 °C to +80 °C (NLGI 0 grease)			
weight	6.3 kg	7.2 kg	7.52 kg	8.42 kg

Electronic Timer

Your sprayer is fitted with part number 0099.01 on this table.

	part number					
	099.01 (12 V)	032.01 (24 V)	676.02 (12V)	675.02 (24V)	678.02 (12V)	677.02 (24V)
cycle time	3 minutes		2 minutes		3 minutes	
cycle intervals	steps of 30 minutes (0.5 - 5 h)		steps of 5 minutes		steps of 30 minutes	
alarm	built-in buzzer		internal relais (16A)		internal relais (16A)	

Solenoid

Your sprayer is fitted with part number 184.08 on this table.

	part number	
	184.08 (12 V)	183.08 (24 V)
type	normally-closed with open venting	normally-closed with open venting
operating pressure	maximum 10 bar	maximum 10 bar
power requirement	maximum 8 W	maximum 8 W
screw thread	M24	M24

Pressure Switch

Your sprayer is fitted with part number 184.08 on this table.

	part number
	225.01
type	normally-open
switching pressure	40 bar
connection	2-wire
screw thread	M24

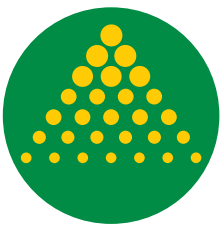
Meter Units

The metering units as mentioned are altered using combinations of shims and spacers (a spacer being equivalent to 4 shims) to a maximum of 9 shims (2 spacers and 1 shim).

Metering unit nr.	*Delivery [cc]*
0	0.025
1	0.050
2	0.1
3	0.15
4	0.2
5	0.25
6	0.3
7	0.35
8	0.4
8,5	0.7
9	1.0

Fault Finding

Fault	Cause	Action
1. All points to be lubricated are dry.	a. Pump reservoir is empty.	a. Fill the reservoir (see section 9).
	b. Reservoir filled with grease that is too thick and unsuitable for the system.	b. Remove and clean the reservoir. Refit and fill the reservoir with the correct grease. Remove the end plugs from the distribution blocks and pump the old grease out of the system.
	c. Main pipe leaking.	c. Repair the line and bleed the system if a new piece of piping has been fitted.
	d. Electronic timer, PLC or pneumatic impulse counter not set correctly.	d. Reset the electronic timer, PLC or brake impulse counter.
	If there is another cause, please consult your dealer.	
2. Pump does not work or does not reach working pressure.	a. Pneumatically operated pump: No or too-low air pressure.	a. Ensure there is an air pressure of 6 to 8 bar.
	b. Piston does not rise.	b. Dismantle the cover of the pump casing and clean the piston.
	If there is another cause, please consult your dealer.	
3. One or more lubrication points are dry while the others receive sufficient grease.	a. Break in the secondary piping.	a. Repair or replace the line.
	b. Inoperative metering unit.	b. Remove the metering unit and fit a new unit.
4. A lubrication point receives too much grease.	a. Internal leak in the metering unit.	a. Remove and clean the metering unit or fit a new unit.
5. Pneumatically operated pump: Solenoid valve fails to operate or does not operate correctly.	a. Bad or open electrical connections.	a. Check the electrical circuit and connections to the solenoid valve. Check the valve with direct current bypassing the electronic timer. Watch out for short-circuits!
	b. Solenoid valve internally fouled with water and/or rust from the vehicle air system.	b. Dismantle, clean and refit the valve or fit a new valve. Clean the vehicle air system.
6. Continuous buzzing from the electronic timer.	a. Short circuit.	a. Check wiring and test solenoid.
7. Electronic timer does not operate.	a. Fuse blown.	a. Fit new fuse.
8. Too much grease at all lubrication points.	a. System greasing frequency does not correspond with vehicle operating conditions.	b. Reduce the greasing frequency. Do not be too sparing, it is better to grease too much than too little.
9. Alarm buzzer in electronic timer sounds intermittently.	a. Grease level in the reservoir below the minimum.	a. Fill the reservoir (see section 9).
	a. System not reaching working pressure.	a. Top up the reservoir with grease and/or repair the main pipe, check the pump pressure with a manometer.
	c. No cycle time interval selected on the electronic timer.	c. Set a cycle time interval on the electronic timer.



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