

# G3V G4V

## Operator's Manual MY17



GA8700841 REV 4  
JAN 2019  
FROM SERIAL #202020



# GOLDACRES

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## INTRODUCTION

### Welcome

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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

- In terms and conditions;
- "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;
- "Purchaser" means the purchaser of the Goods;
- "Goods" means the products and, if any, the services sold or provided by Goldacres to the Purchaser;
- "GST Act" and "GST" are given the meanings referred to in a New Tax System (Goods and Services Tax) Act 1999.
- "PSA" means the Personal Property Securities Act 2009 (Cth) (as amended);
- 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

- (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.
- 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

- 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.

- 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

- 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

- 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

- 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

- 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

- 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 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

- 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

- (1) Goldacres liability for Goods manufactured by it is limited to:
  - 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 ("Cth") ("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
  - 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:
    - the defects have arisen solely from faulty materials or workmanship;
    - the Goods have not received maltreatment inattention or interference;
    - accessories of any kind used by the Purchaser are manufactured or approved by Goldacres;
    - where applicable, the seals on the Goods remain unbroken;
    - there has been no improper adjustment, calibration or operation;
    - the use of accessories including consumables, hardware or software (not manufactured by Goldacres) has been approved in writing by Goldacres;
    - no contamination or leakage has been caused or induced;
    - any modification to the Goods have been authorised in writing by Goldacres;
    - there has been no inadequate or incorrect use, storage, handling or application of the Goods;
    - there has been no use or operation of the Goods outside of the physical, electrical or environmental specifications of the Goods;
    - there has been no inadequate or incorrect site preparations;
    - there has been no inadequate or improper maintenance of the Goods;
    - it has not been caused by fair wear and tear; and
    - 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
    - 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
    - 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;
    - the defective Goods or any damaged part of the Goods are promptly returned free of cost to Goldacres or a representative of Goldacres;
    - all warranty related repairs have been carried out with the prior authorisation of Goldacres;
  - 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 UHF's, 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;
- 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;
- 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;
- 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;
- 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;
- 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;
- The warranties provided under these terms and conditions do not extend to second hand or used Goods that may be sold by Goldacres.
- 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:
  - in the case of Goods, any one or more of the following:
    - the replacement of the Goods or the supply of equivalent Goods;
    - the repair of the Goods;
    - the payment of the cost of replacing the Goods or acquiring the equivalent Goods;
    - the payment of having the Goods repaired; or
  - in the case of services;
    - the supplying of the services again; or
    - the payment of the cost of having the services supplied again.

### Prices

- (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.
- 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

- (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.

- 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

- 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.

- (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.
- 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.
- Until all the Debts have been paid in full:
  - the Purchaser shall take custody of the Goods as trustee, fiduciary agent and bailee for Goldacres;
  - the Purchaser shall keep the Goods separate from any other goods and properly marked, stored, protected and insured;
  - the Purchaser must hold all of the money it receives ("Proceeds");
  - from the sale of any property into which Goods supplied have been incorporated; and
  - 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.
- The Purchaser expressly acknowledges that it is bound by the fiduciary obligation created in the preceding paragraph and acknowledges that:
  - it must hold the Proceeds on trust for Goldacres;
  - it must place the whole of the Proceeds in an account separate from its own moneys (the "Proceeds Account");
  - it must maintain the Proceeds Account separate from its own moneys at all times.
- it must maintain proper records for the Proceeds Account.
- 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
- it must account to Goldacres on demand for all moneys standing to the credit of such account.
- 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.
- Goldacres may trace the Proceeds in equity.
- 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:
  - the Debts are not paid in accordance with these terms and conditions or any other contract or arrangement between Goldacres and the Purchaser; or
  - Goldacres receives notice of or reasonably believes that:
    - a third person may attempt to levy execution against the Goods; or
    - the Purchaser is insolvent (within the meaning of the Corporations Act 2001) or bankrupt; or
    - 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.
- 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.
- 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.
- 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

- (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.
- 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).
- 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.
- 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.
- 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 charge statement under the PPSA in respect of Goldacres' interest in the Goods.
- 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 charge statement, or otherwise complying with the PPSA.
- 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.
- The Purchaser waives its rights under the following provisions of Chapter 4 of the PPSA:
  - to receive a notice on enforcement action against liquid assets (section 121(4)),
  - to receive a notice to seize collateral (section 123);
  - to receive a notice of disposal of Goods by Goldacres purchasing the Goods (section 129);
  - to receive a notice to dispose of Goods (section 130);
  - to receive a statement of account following disposal of Goods (section 132(2));
  - to receive a statement of account if no disposal of Goods for each 6 month period (section 132(4));
  - to receive notice of any proposal of Goldacres to retain Goods (section 135(2));
  - to object to any proposal of Goldacres to either retain or dispose of Goods (section 137(2));
  - to redeem the Goods (section 142);
  - to reinstate the security agreement (section 143);
  - to receive a notice of any verification statement (section 157(1) and section 157(3));
- 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.
- 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

- 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

- 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

- 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

- 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

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

### No waiver

- 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

- 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

- 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

- 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, nor 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

- 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

- 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.

## SAFETY

### Safety Information

#### 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 operators have read and fully understand the operator's 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.

The machine is fitted with a roll-over protection structure incorporated into the frame of the cabin. To minimize the risk of injury in the event of an accident, the operator and anyone in the training seat must wear seat belts at all times.

#### Passengers

The machine is equipped with one training seat with a seatbelt. To minimize the risk of injury in the event of an accident, the operator and anyone in the training seat must wear seat belts at all times.

Any further passengers must be kept off the machine.

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

#### Warnings

- 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 damaged or missing decals on the equipment and that any damaged or missing decals are replaced prior to operation.
- Goldacres equipment either 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.
- Inspect the equipment thoroughly for damage and wear before operation.
- 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.
- 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 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.
- 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.
- Lubricate the equipment as per recommended requirements before operating.
- Make sure that the equipment complies with all relevant road regulations when transporting.
- Flush chemicals from equipment immediately after use.

*Continued over page*



# Safety Information

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- 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.
- 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 braking and carrying capacity of the vehicle as specified by the vehicle manufacturer.

**NOTE:** 1 Litre water = 1 Kg.

- Water weighs 1 kg 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 Chapter 8 'Operation' 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 the boom wings.
- Never work under any hydraulically raised boom.

## Cautions

- When leaving the sprayer always isolate the batteries by turning the isolator key off and removing it.

- 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.
- Ensure that all bolts are tightened and secured before operation.
- Always ensure that the boom is securely supported when travelling.
- Where fitted, care should be taken to never overfill the diaphragm pump with oil or operate at speeds exceeding 540 rpm.
- Do not exceed the maximum spraying pressure of 8 Bar.

## 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.

## Personal Protective Equipment (PPE)

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

- Exposure to loud noise over an extended period can cause permanent hearing impairment or loss. 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.

*Continued over page*

# Safety Information

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**CAUTION:** Always refer to the chemical manufacturers label for guidelines on the appropriate PPE to use with the chemical/s you are using.

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

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

Poisons Information Centres - Call 131 126 (AU)

## Cuts, Stabs & Punctures

When Servicing machine, be mindful of sharp edges on parts such as trimmed cable ties, hose clamps, cut reinforced hose and the edges of plates and brackets as they could cause cut, stab or puncture injuries.

## Crush Hazard

Never attempt to maintain axles, wheels or components within the vicinity of the wheels with the engine running.

## Pinch Hazard

When operating moving components such as the boom, access ladder, bonnet or other components, keep fingers and hands away from potential pinch points.

## Burn Hazard

- Avoid contact around the entire exhaust system of the sprayer when at operating temperature
- Avoid contact around the hydraulic tank and all hydraulic lines when at operating temperature

## Entanglement Hazard

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.

## Stored Energy Hazard

Even when the machine is not running, energy can be stored in components such as hydraulic accumulators, air tanks, tyres, A/C hoses, springs and boom cables. Hydraulically supported components such as the boom center are also a source of stored energy. Before working on the machine, ensure that these parts are relieved of their energy in a safe manner.

## Overhead Hazard

BOOM LIFT OR TILT AND RADIO ANTENNA COULD STRIKE POWER LINES. Keep clear of overhead obstructions – especially power lines as contact can be fatal.

Do NOT walk on machine platform when near power lines.

## Airborne Particles

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

## 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.

Be mindful of the location of pressurised lines in the vicinity of the work area when using equipment such as grinders, oxy torches and welders. The two main risks are that this equipment may easily cut through the lines or the local heat generated near the lines may cause them to rupture.

Ensure that all fittings and lines are fully/tightly secured before re-pressurizing after repairs.

## Norac System

If Norac height control system is fitted, keep clear of the boom as it could potentially move without notice.

## Cooling System

- 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 the radiator cap slowly to relieve the pressure before removing the cap completely.
- Coolant can be added when the engine is cool and turned off.

## Batteries

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

*Continued over page*

# Safety Information

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The acid can cause blindness, burn skin and dissolve clothing. Batteries also produce flammable hydrogen gas (especially when charging), so keep them separated from any sources of sparks and flames.

A vigilant operator can avoid these hazards by:

1. Wearing the correct personal protective equipment.
2. Avoid spilling or dripping electrolyte.
3. Place into a plastic collection tray ready for disposal if the case is found to be damaged.

## 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.

## Lifting Machine

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.
- ✓ Empty the spray tank where possible.
- ✓ Chock all wheels that remain on the ground.
- ✓ Securely lift the machine using a jack and support the machine on work stands.
- ✗ Do not work under the machine when supported solely by a jack.
- ✗ Do not support the sprayer using materials that may crumble.

## Changing Wheels & Tyres

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

- ✗ Do not weld, heat or modify the rim.

## 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 self-propelled sprayer may become unstable when turning at excessive speed or when operating on excessively steep terrain.
- 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.

## Refuelling

- 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 refuelling.

## Collision Prevention & 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 sprayers are fitted with warning lights and signs in accordance with national road regulations.

*Continued over page*

# Safety Information

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- The machine is fitted with a reverse warning beeper when the machine is put into reverse.
- The machine 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.

## Main Tank

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

## Safe Chemical Usage

The safe use of Agricultural (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.

## 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. Part numbers and descriptions of the decals on this machine can be found in the parts manual supplied.

## First Aid Kit

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

## Fire Extinguisher

A fire extinguisher is fitted under the training seat in the cabin of your machine.

It is a dry chemical ABE type fire extinguisher approved for wood, paper, flammable liquid and live electrical equipment fires.

## Four Wheel Steering system

Crush hazard. This machine is fitted with 4 wheel steering. Never work in the space between the wheels and the chassis while the engine is running. The wheels may steer quickly and without warning.

## Machine Recovery

- The mechanical drive system delivers efficient, positive power to the ground for superior traction. However, should your machine 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.

## Towing & Transporting 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 front & 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.
- The park brake needs to be manually released if engine is not able to run.
- Check the wheel nut tension on a regular basis. The torque and inspection frequency is outlined in the maintenance section.
- Brake performance should be checked regularly. The inspection frequency is outlined in the maintenance section.

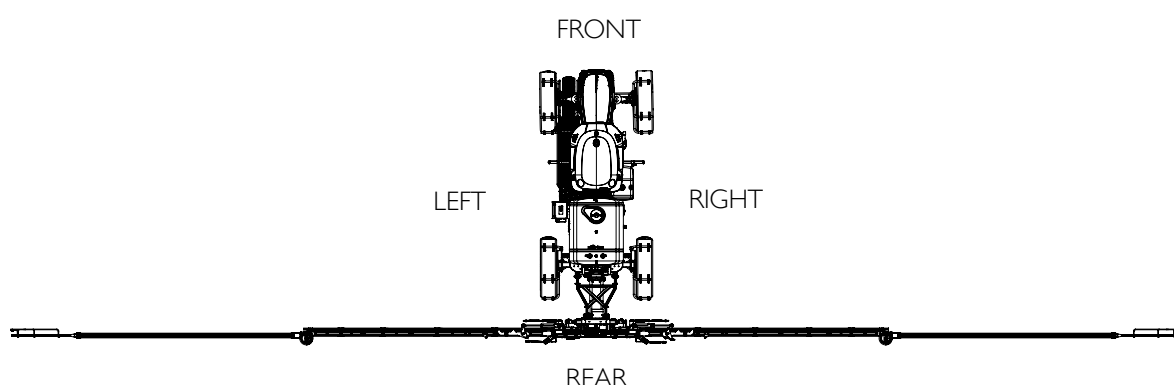




# Chapter 3

## GENERAL INFORMATION & SPECIFICATIONS

### Machine Orientation



### 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 Codes

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 rotational moulding process, there can be variance in the overall dimensions of the tank which in turn results in 5-10% variation in 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 Chapter 4 'Cabin'.

#### 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. The Supermix agitator has an approximate capacity of 300 - 1300 L/min depending of the pump size and operating pressure. For further information refer to Chapter 10 'Lubrication & Maintenance'.

#### Boom Nozzle Control

Nozzle control is achieved using the Rapid Fire with Rapid Flow system fitted as standard equipment. Electrically activated air-solenoids control individual boom nozzles and boom section on/off functions. The nozzles have a standard spacing of 500 mm, but 250 mm distances can also be optioned.

*Continued over page*

# General

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## Controller

These sprayers are supplied with either a Raven SCS4400 automatic rate controller or a ISOBUS connector with an optional Raven VT console. 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 Chapter 6 'Calibration' of this manual.

## Filtration

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

As standard, these sprayers 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

Fitted as standard on Goldacres equipment are Udor positive displacement and oil backed diaphragm pumps. 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
- 12V 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. The booms feature hydraulic lift, fold and optional individual wing tilt all controllable from the cabin.

Goldacres TriTech 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](http://www.teejet.com)

Lechler web site: [www.lechler.de](http://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.

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 of the machine. Stop the machine and inspect for damage after impact with gutters, sinkholes, rocks etc.

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.

The mechanical drive system delivers efficient, positive power to the ground for superior traction. However, should your machine 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.

*Continued over page*

# General

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## 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 Chapter 10 'Lubrication & Maintenance'.

## Air Conditioning

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

Further information can be found in Chapter 4 'Cabin'.

## Hydraulics

Electric over hydraulic valves are standard on these machines. The hydraulic functions are then controlled from electric switches in the cabin. The valve block is mounted on the boom centre section which is located at the rear of the sprayer.

## 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 - Cabin Access

The Ladder is to be used to 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 to ensure that no person is standing on or near the ladder at the time. In an emergency, the ladder can be lowered by either applying the park brake or turning off the ignition, or removing the air supply hose from the air cylinder.

## Ladder - Fuel Tank Access

For the convenience of the operator, a fold out ladder has been provided under the fuel tank to allow easier access to the fill point. Always face the ladder and retain three points of contact with the ladder at all times when ascending and descending.

To extend the ladder, give a sharp pull on the handle to release it from the rubber holders on the end. Then slide it forward as far as it will go before lowering it down.

To stow the ladder, lift it up until it is horizontal to the ground and then slide it all the way in. Give a sharp push on the handle to secure it in the rubber holders.

**NOTE:** Do not drive the machine or operate the steering wheel with the ladder extended.

*Continued over page*

## Wheels & Tyres

Tyre pressures need to be checked regularly - check every 8 to 12 hours of operation.

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.

**NOTE:** If a tyre is replaced with a different brand or size, please contact the supplier for correct air pressures to suit the load carrying capacity of this machine.

For further information on wheels and tyres please refer to Chapter 10 'Lubrication & Maintenance'.

GA8700822_R2 G3V & G4V MAX SPEED FULLY LOADED IS 25 KM/H		RECOMMENDED TYRE PRESSURE	
TYRE BRAND	TYRE SIZE	KPA	PSI
HARVEST	380/90R46 (14.9R46) HR45 159A8	240	35
HARVEST	AF380/90R46 (14.9R46) HR45 173D	180	26

## Dimensions & Weight

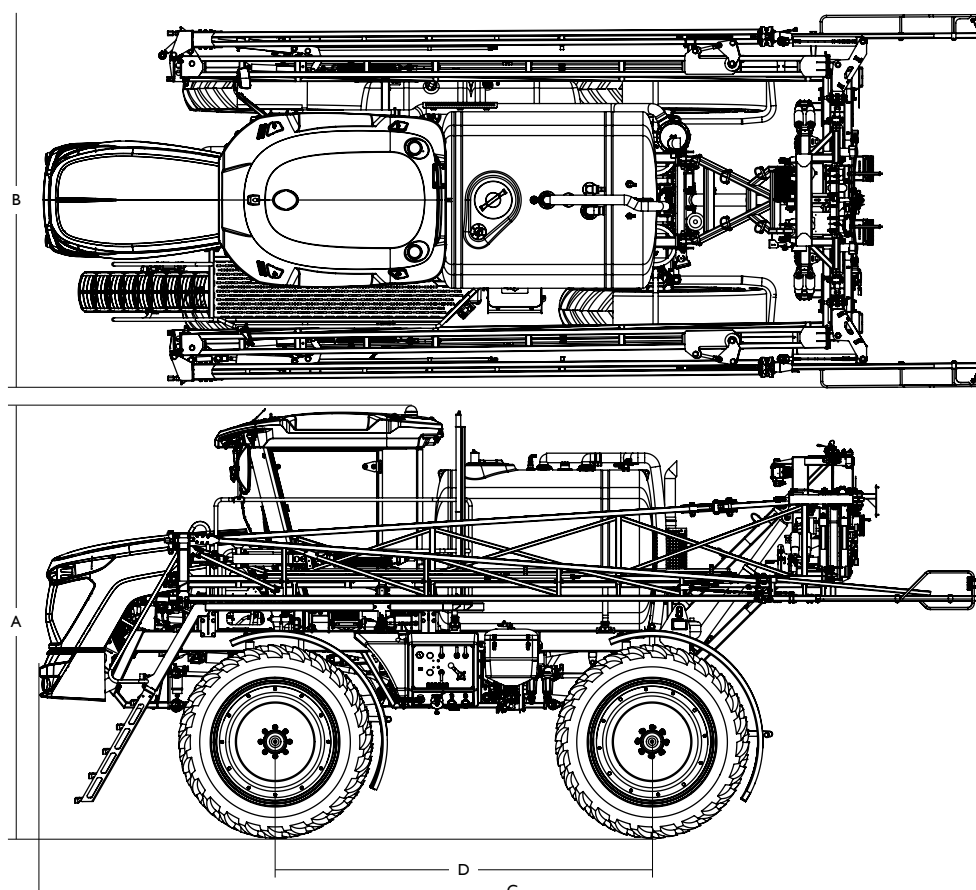
The following information is provided as a guide only.

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 sprayer is approximately 4 metres 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 on roads it may be necessary to remove aerials to meet the required height restrictions.

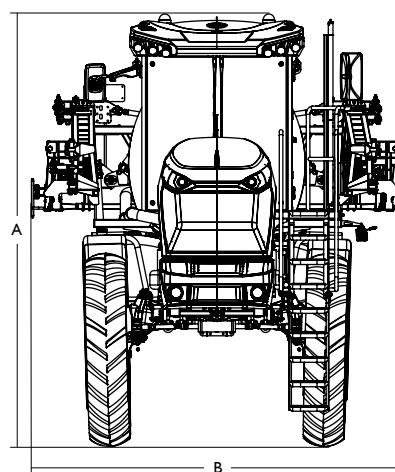
Aerials on the roof may also need to be removed to meet clearance requirements for over head power lines, while on the road and also in some paddocks.



BOOM SIZE	A FRONT HEIGHT	B WIDTH	C TOTAL LENGTH	D WHEEL-BASE
18 m	3.98 m	3.10 m	x m	3.55 m
24 m	3.98 m	3.10 m	x m	3.55 m
30 m	3.98 m	3.10 m	9.05 m	3.55 m
33 m	3.98 m	3.10 m	x m	3.55 m
36 m	3.98 m	3.10 m	x m	3.55 m

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

VARIANT	TARE MASS
G4V	9450 Kg (30 m boom, TriTech centre)



**NOTE:** Weight is approximate and subject to change and variation without notice.



## Identification & Parts Ordering

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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.

**NOTE:** To identify the exact options fitted to your particular machine, refer to the original quotation and/or build sheet. If needed, a copy of the buildsheet may be obtained by contacting your dealer and quoting your machine serial number as described above.

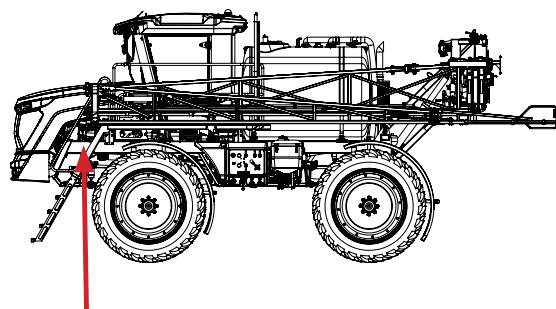
When ordering parts from your Goldacres dealer, please quote:

- Machine serial number
- Part number 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. When returning parts to a Goldacres dealer for service or repair, all parts **MUST** be cleaned thoroughly before sending them. Dealers 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. Dealers are not liable for the return of any goods to a Goldacres Dealer. The goods must be returned to the point of sale.

Genuine Goldacres parts only should be used on Goldacres equipment.



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

# Chapter 4

## CABIN

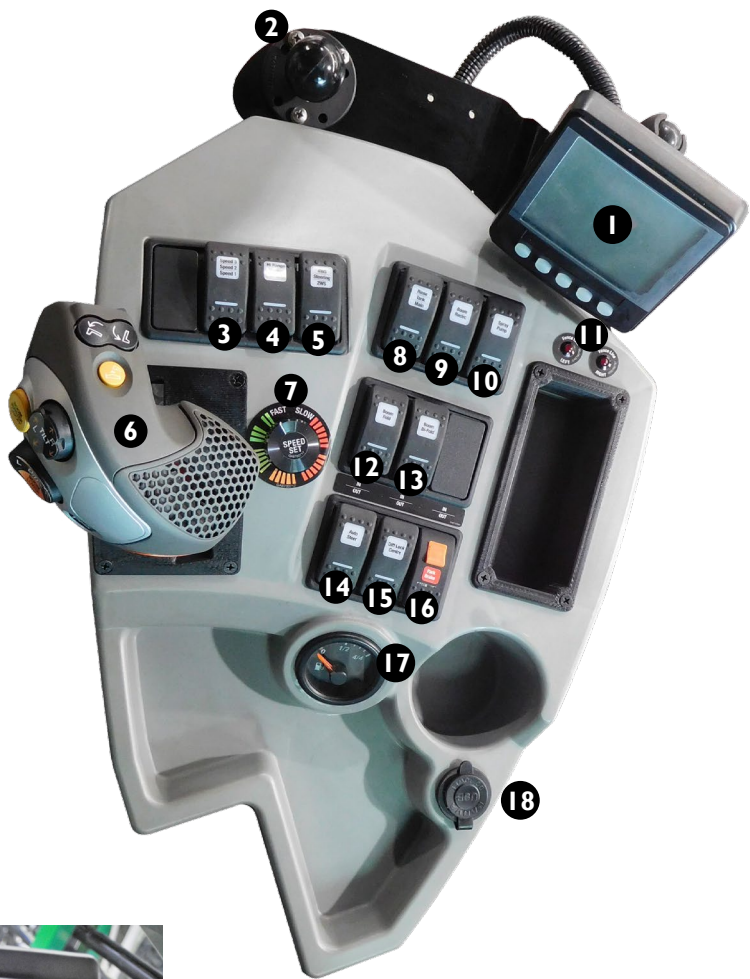
### Key Features



NUMBER	FEATURE
1.	Operator's seat
2.	Operator's seat belt
3.	Operator's seat storage area
4.	Training seat
5.	Steering wheel & controls
6.	Side arm rest console
7.	Power distribution box
8.	Boom gauges
9.	Emergency foot brake
10.	Buzzer warning codes guide sticker

# Arm Rest Controls

**Right:** A Raven SCS4400 spray controller console is standard equipment and mounts to the side dash console. An ISOBUS system can also be optioned, but with no included console.



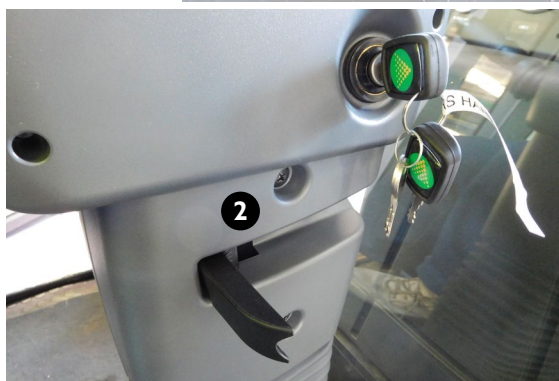
**Above:** Optional Raven VT spray controller console.

NUMBER	FEATURE
1.	Engine monitor CAN
2.	Rate controller mount
3.	Speed 1,2,3
4.	High-range, Neutral, Low-range
5.	4-Wheel steer, 2-Wheel steer
6.	Joystick/throttle
7.	Maximum speed setting dial
8.	Rinse tank, main tank
9.	Boom recirculation ON/OFF

NUMBER	FEATURE
10.	Spray pump ON/OFF
11.	Fence line jet indicator LEDs
12.	Boom fold IN/OUT
13.	Boom bi-fold IN/OUT
14.	Autosteer ON/OFF
15.	Differential lock centre ON/OFF
16.	Park brake ON/OFF
17.	Fuel gauge
18.	Powered USB connector



# Steering Column



NUMBER	FEATURE	INSTRUCTIONS
1.	Steering column tilt adjust	<ul style="list-style-type: none"> <li>• Hold the steering wheel with your hand</li> <li>• 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</li> <li>• Release lever to lock in final position</li> </ul>
2.	Steering column height adjust	<ul style="list-style-type: none"> <li>• Hold the steering wheel with your hand</li> <li>• Pull the lever out that is on the right side of the column</li> <li>• Set the steering wheel to the desired position by hand</li> <li>• Push the lever back in to lock in final position</li> </ul>

*Continued over page*

# Steering Column

## Multifunction Switch - Lights

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



NUMBER	FEATURE
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 & Wipers

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



NUMBER	FEATURE
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.

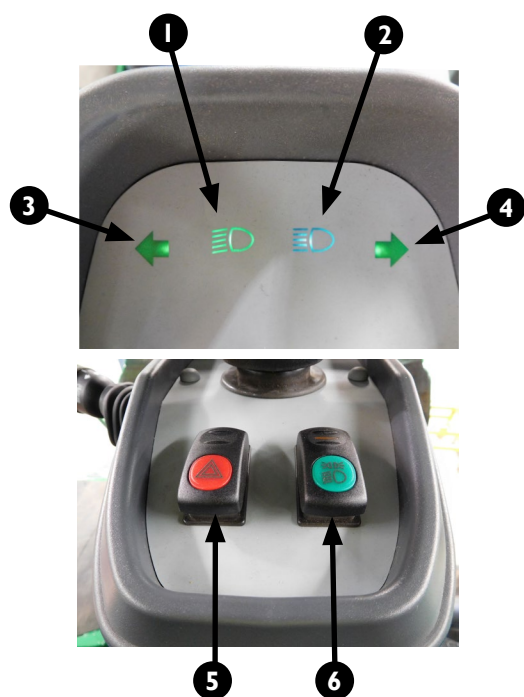
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# Steering Column

## Vehicle Information Unit

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



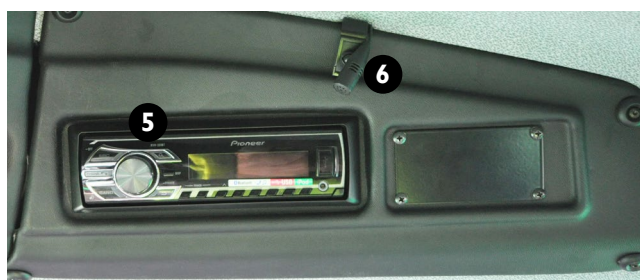
NUMBER	FEATURE
1.	Low beam indicator
2.	High beam indicator
3.	Left turn signal indicator
4.	Right turn signal indicator
5.	Hazard light switch
6.	Park light and low beam switch

## Operator Seat



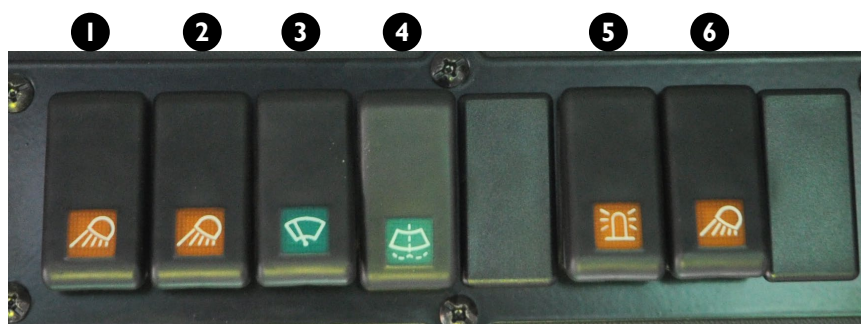
NUMBER	FEATURE	DESCRIPTION
1.	Seat Depth adjustment	To adjust the depth of the seat cushion, pull the handle upwards. By moving the seat cushion backwards the desired seating position can be reached.
2.	Seat pan angle adjustment	To adjust the angle of the seat pan, pull the handle upwards. By exerting pressure on or off the front or rear part of the seat pan it can be moved to the desired position.
3.	Absorber	The cushioning effect can be adjusted for on and off-road driving conditions. 1-Soft, 2-Medium, 3-Hard.
4.	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
5.	Lumbar adjustment	The top switch controls upper lumbar support. The lower switch controls the lower lumbar support.
6.	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.
7.	Seat Belt	Operator lap seat belt must be fitted when ever the operator is seated in the cabin.
8.	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.
9.	Fore / Aft adjustment	By lifting this lever the seat can be slid backwards or forward to the desired position.
10.	Fore/Aft isolator	Shock impacts in the driving direction can be better absorbed by the driving seat. Position 1 Off / Position 2 On

## 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.

# Air-conditioning

## Overview of Controls

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

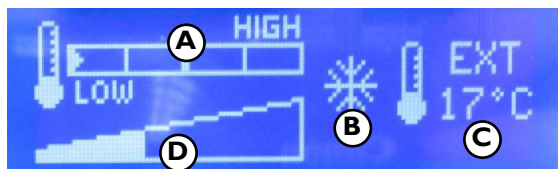
1. Selection knob
2. Display



## Switching 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.

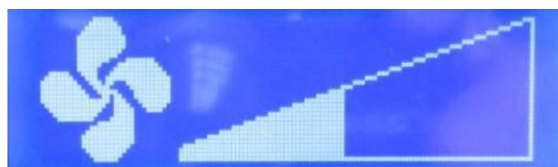
After switching on, the operating mode and the display are always identical with the settings before switching off the last time.



- A. Temperature LOW / HIGH
- B. Air-conditioning ON/ OFF
- C. External temperature
- D. Fan speed

## Setting 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: 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 Air Vents

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.



## Lighting

### Interior Lighting

There are two 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 won't operate unless the ignition key is in the 'accessories' or 'run' position.



Above: Cabin interior overhead lighting.

### Egress Lighting

These machines are fitted with egress lighting to assist with safely exiting the machine when parking in dark conditions. There is a timed relay that will keep the outside work lights on for 30 seconds after the machine has been shut down and the key removed. The amount of time that the relay keeps the lights on for can be adjusted. It is located in rear left hand side roof area of cabin.

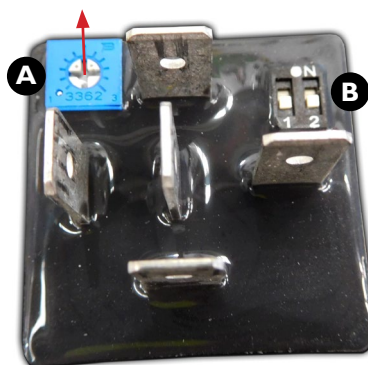
By default, the timer potentiometer is set to 30 seconds (A). It has a range between 0 and 60 seconds. Turning it clockwise increases the timer. Turning it anti-clockwise decreases the timer.

The two dimples in the white adjuster indicate the direction it is pointing in.

The two dip switches are set to the OFF position by default (B). If a lighting time longer than 60 seconds (1 minute) is required, then dip switch 2 can be set to the ON position. On this setting, each increment on the potentiometer represents 1 minute, for a maximum of range of 1 to 60 minutes.



Above: Egress lighting timer relay located in rear left hand side roof area of cabin.



Above: Timer relay potentiometer and dip switches.

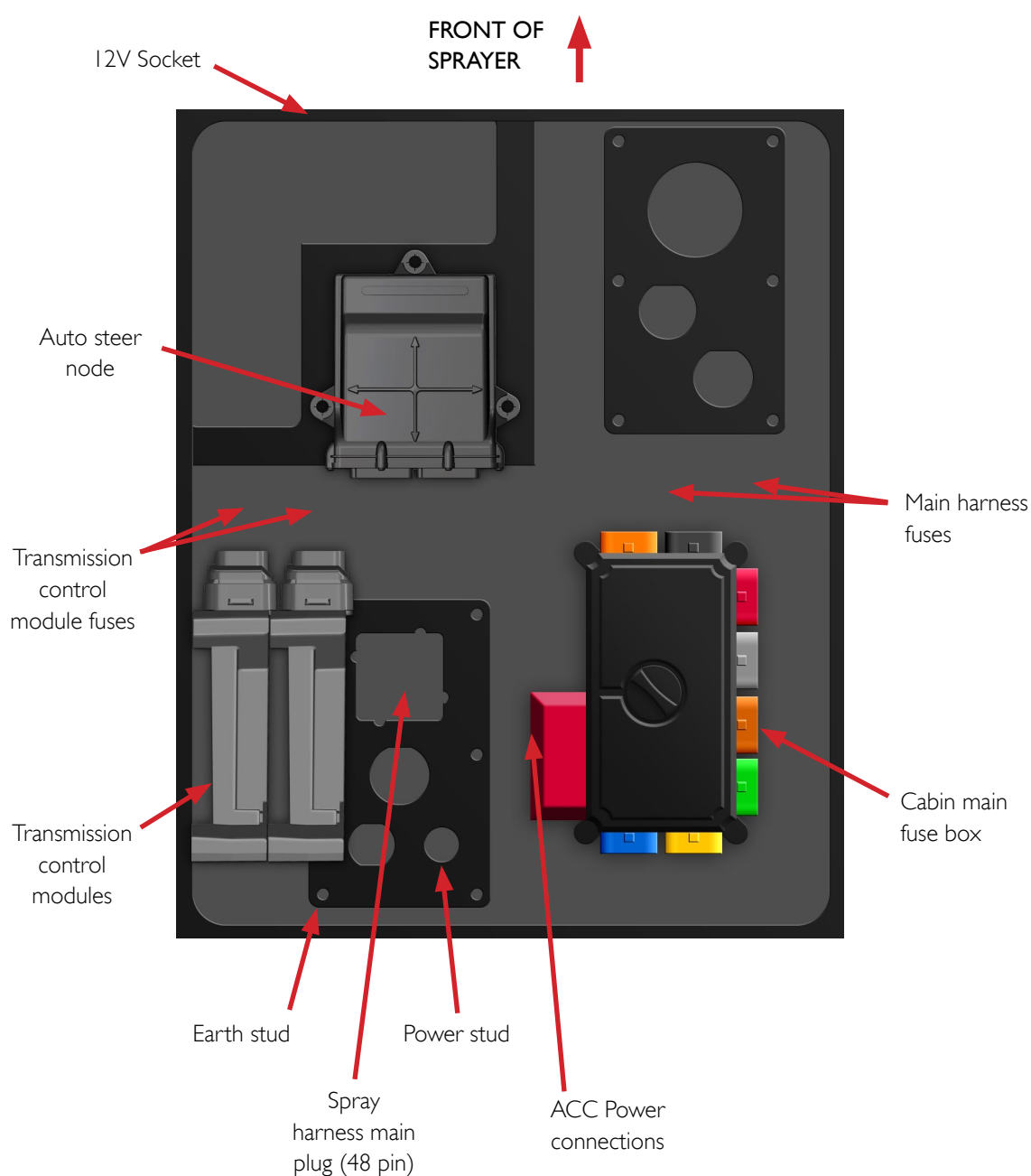
## Power Distribution Box

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.

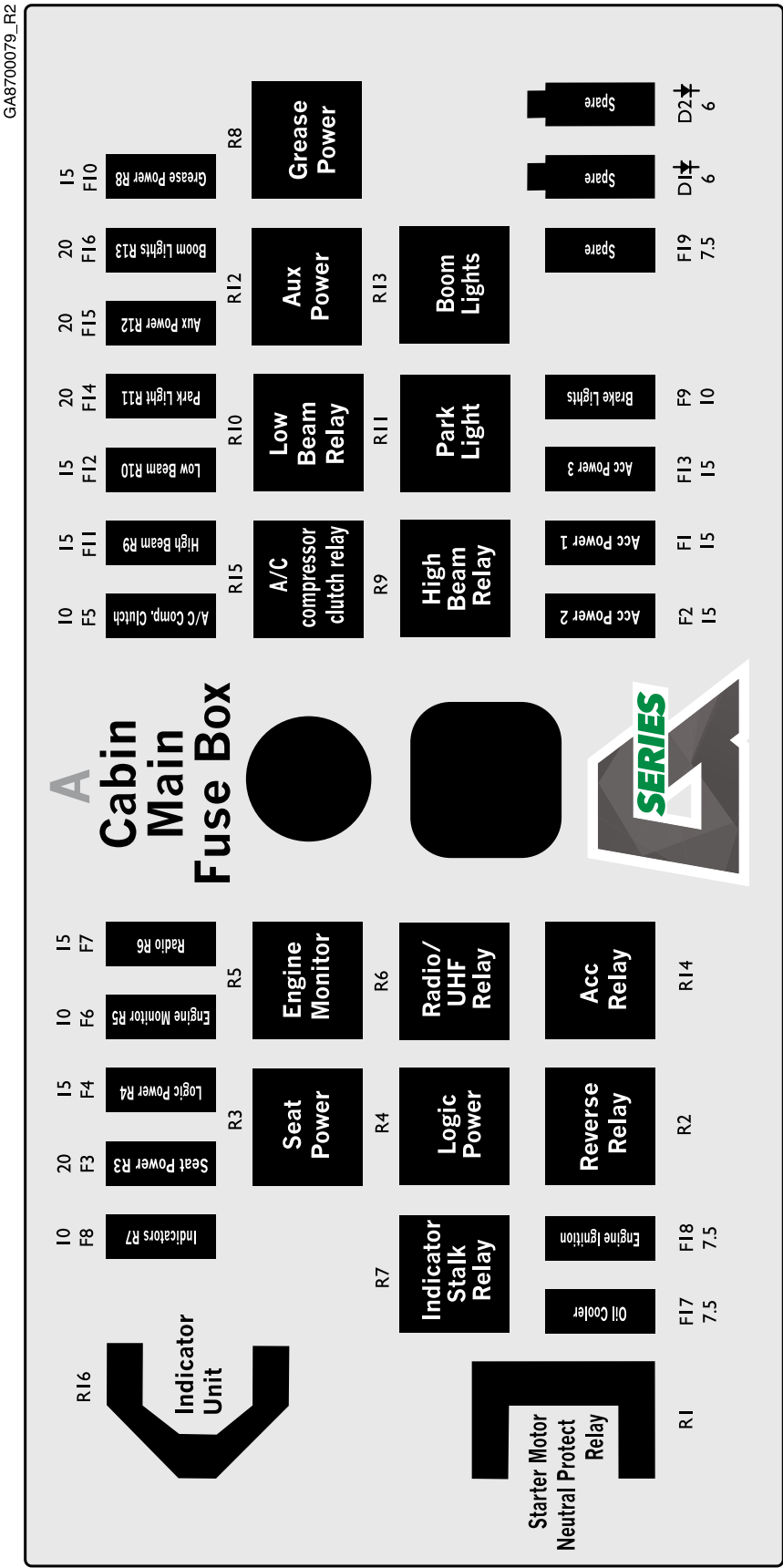
### Fuses

When a fault occurs, the corresponding circuit fuse will blow and disconnect the circuit. If a fuse has been blown identify the corresponding device and investigate the cause before replacing with a 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.



# Cabin Main Fuse Box

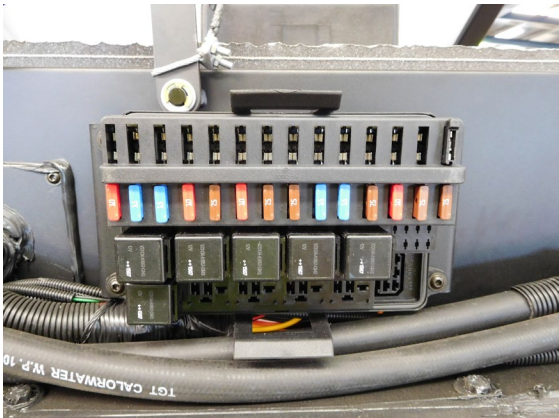
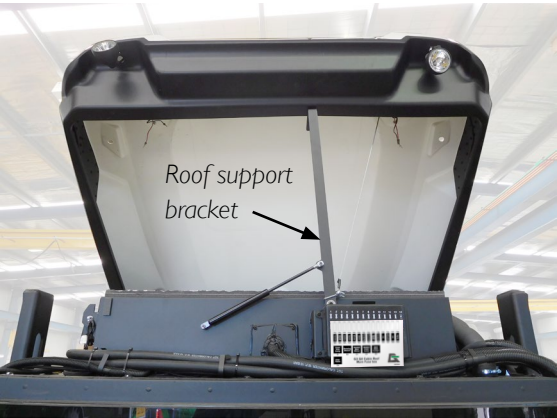


# Cabin Roof Fuse Box

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.

**WARNING:** Use ladder or work platform to get access to parts or areas of the machine above local government restrictions



F1

F2

F3

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F21

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F23

F24

F25

F26

F27

F28

Electric Mirror

Front Middle Work Lamps

Turning Beacon

Heated Mirror

Interior Light

Front Wiper

Wiper Water Tank

Interior LED Light

Front Side Work Lamps

Rear Work Lamps

Radio

Cigarette Lighter

Radio

Rear Wiper

10A

15A

15A

10A

75A

10A

75A

75A

15A

20A

75A

10A

75A

75A

Front Side Lamp

Rotating Beacon

Heated Rear Mirror

Middle Front Lamp

Rear Work Lamps

E1

E2

E3


E4

E5

Auto-Radio

E6

G3 G4 Cabin Roof Main Fuse box



GA8700431

**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.



## Optional Control Systems - Connectors

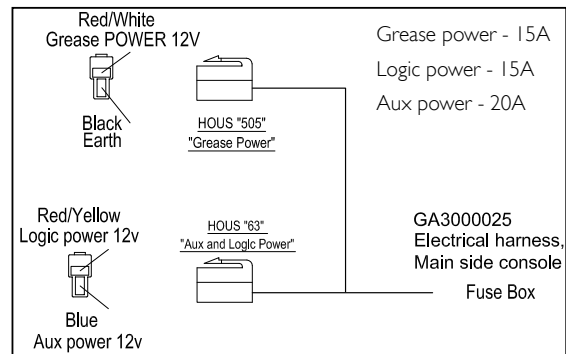
Inside the power distribution box are electrical connectors that have been provided for the connection of optional equipment.

### HOUS 505

For connection of the optional auto greasing system.  
Grease power - 15A circuit.

### HOUS 63

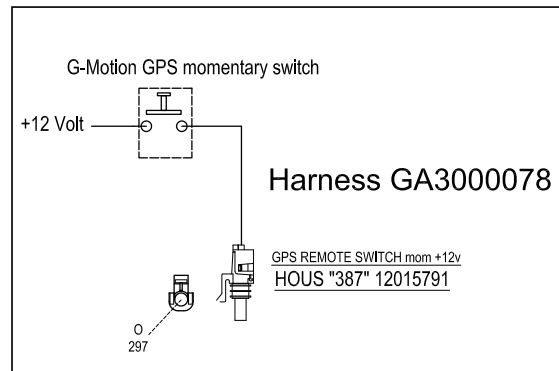
For the connection of an external controller like the Raven SmartBoom system or an auto steer system.  
Logic power - 15A circuit. Aux power - 20A circuit.



**Above:** Electrical harness for connection of optional boom height control, greasing or auto steer systems. Found inside the main cabin fuse box.

### GPS REMOTE SWITCH MOMENTARY +12V

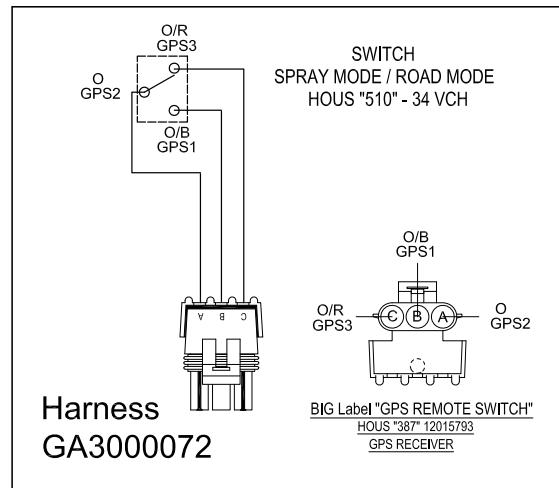
For the connection of the GPS momentary switch button mounted on the side dash. When this single pin connector is connected to the ISOBUS based cabin harness it will be able to communicate directly with the John Deere Autosteer node. To make use of this button circuit for Trimble based Autosteer systems, it should be connected independently on the cabin harness and directly to the Trimble harness instead.



**Above:** GPS resume - remote switch momentary +12V circuit.

### GPS REMOTE SWITCH

For the connection to an auto steer system. The cable has a 3 pin male weather pack plug for the customer to connect their Auto steer system. The switch is labelled Road mode/spray mode and is located on the side dash. When this 3 pin connector is connected to the ISOBUS based cabin harness it will be able to communicate directly with the John Deere Autosteer node. To make use of this button circuit for Trimble based Autosteer systems, it should be connected independently on the cabin harness and directly to the Trimble harness instead.



**Above:** GPS master - remote switch circuit.

*Continued over page*

## Optional Control Systems - Connectors

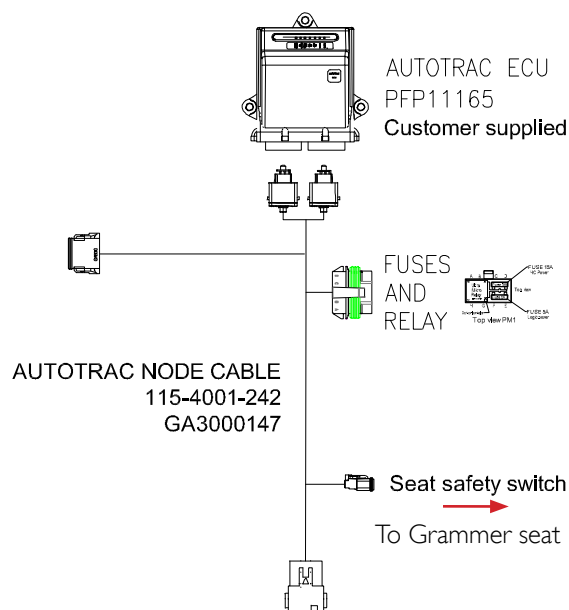
### SEAT SAFETY SWITCH

The seat safety switch or operator presence switch causes the Autosteer system to turn off when the operator leaves their seat as a safety measure.

The harness part numbered GA3000147 incorporates a connector for the seat safety switch. This connector is able to communicate directly with the John Deere Autosteer node. This connector (male) on harness GA3000147 will be joined to the Grammer cabin seat harness safety switch connector (female) when John Deere Autosteer is fitted. The seat safety switch can be optionally connected for Trimble based Autosteer systems. To do so, the seat connector should be joined directly to the Trimble harness and independently of harness GA3000147. This way the trimble node will be able to receive the signal from the seat safety switch.

### GPS RECEIVER CONNECTION POINTS

Inside the cabin roof on the left hand side, is one 12 pin connector and 2 coaxial connection points provided for roof mounted GPS receivers and antennas.



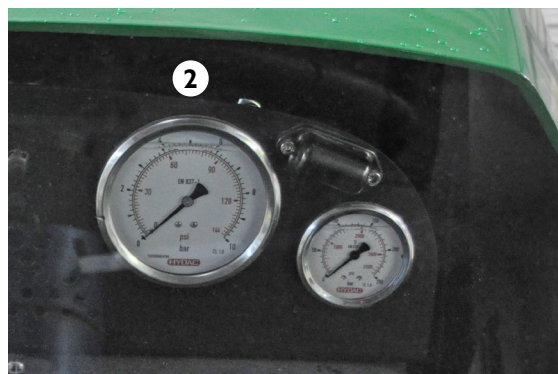
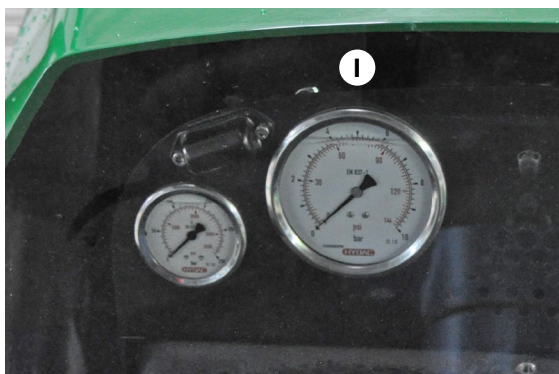
**Above:** Safety switch harness connection to back of Grammer seat.



**Above:** GPS receiver connection points inside the cabin roof near the front, on the left hand side.

## Pressure Gauges

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NO.	FEATURE
1.	Second product line pressure (If optional)
2.	Standard product line pressure (Single line)

**NOTE:** Some gauges may not be active or present depending on options fitted.

# CANtrak System

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## Understanding GEM

Generic Engine Monitor (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).

*Continued over page*

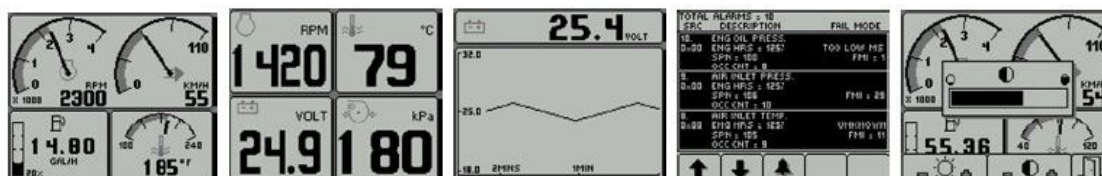
# CANtrak System



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:

NO.	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 parameters.
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.

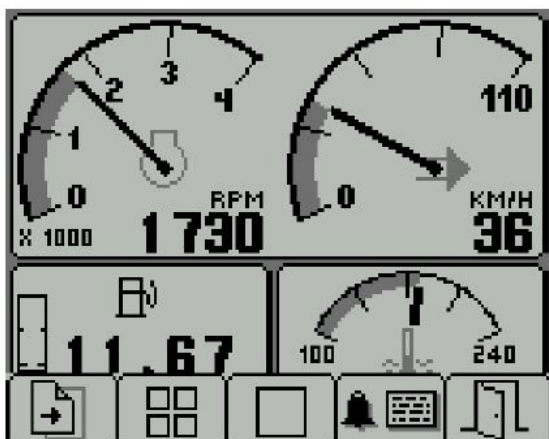
After the start up screen disappears, GEM starts displaying readings on its virtual gauges if it is connected to an active source of data. GEM displays the 'main engine display' or tri-screen on initial start up, but note that after use this changes to the screen that was last displayed (see Preferred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

## GEM 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.

*Continued over page*

# CANtrak System



**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

## The 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



**Left:** 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.

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# CANtrak System

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

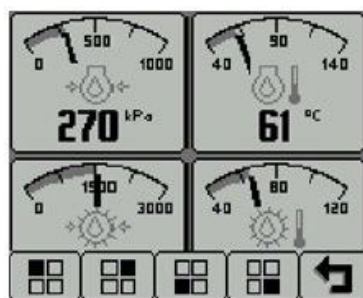
**NOTE:** Reset - which affects all resettable fuel computer parameters - is performed by allowing the button bar to disappear and pressing and holding key 1 for at least 3 seconds. If the button bar is visible then the display will move to the next parameter before the Reset. Setting Fuel Tank Reset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



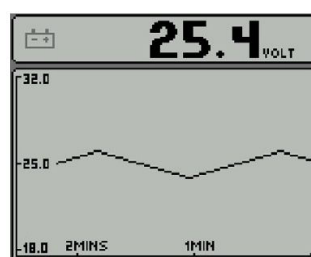
**Above:** Three default display setups available in quad-display mode.



**Above:** Adjust mode; allows users to select the individual gauge types 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.



**Above:** Example graph display plotting battery voltage.











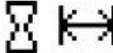
# CANtrak System - Parameters Monitored

## Engine & 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
	<b>MISCELLANEOUS</b>				
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)	√			√

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













## CANtrak System - Parameters Monitored

Icon	Parameter	Tri	Quad	Uni	DB
<b>FUEL &amp; DISTANCE</b>					
	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
<b>PRESSURE (can be kPa, PSI or bar)</b>					
	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		✓	✓	✓

Continued over page

## CANtrak System - Parameters Monitored

Icon	Parameter	Tri	Quad	Uni	DB
<b>ELECTRICAL</b>					
	Internal voltage (V)		✓	✓	✓
	Battery voltage (V)		✓	✓	✓
	Battery current (A)		✓		✓
	Alternator current (A)		✓		✓
<b>TEMPERATURE (can be °C or °F)</b>					
	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		✓		✓

# CANtrak System - Alarms

## Active & 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)



TOTAL ALARMS : 10		
SRC	DESCRIPTION	FAIL MODE
10.	ENG OIL PRESS.	TOO LOW MS
0x00	ENG HRS : 1257	FMI : 1
	SPN : 100	
	OCC CNT : 8	
9.	AIR INLET PRESS.	FMI : 29
0x00	ENG HRS : 1257	
	SPN : 106	
	OCC CNT : 10	
8.	AIR INLET TEMP.	UNKNOWN
0x00	ENG HRS : 1257	FMI : 11
	SPN : 105	
	OCC CNT : 9	

TOTAL ALARMS : 10		
SRC	DESCRIPTION	FAIL MODE
10.	ENG OIL PRESS.	TOO LOW MS
0x00	ENG HRS : 1257	FMI : 1
	SPN : 100	
	OCC CNT : 8	
9.	AIR INLET PRESS.	FMI : 29
0x00	ENG HRS : 1257	
	SPN : 106	
	OCC CNT : 10	
8.	AIR INLET TEMP.	UNKNOWN
0x00	ENG HRS : 1257	FMI : 11
	SPN : 105	
	OCC CNT : 9	

Above: Example alarm message plus alarm list screens showing unacknowledged conditions (black background) and acknowledged alarms (grey background). After acknowledgement the return key becomes active ('exit door' icon). 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.

TOTAL STORED ALARMS : 7		
SRC	DESCRIPTION	FAIL MODE
6.	ENG OIL FILTER PRESS.	DISCONNECTED
0x16	SPN : 99	FMI : 5
	OCC CNT : 5	
5.	ENG OIL LEVEL	VOLTAGE LOW
0x00	SPN : 98	FMI : 4
	OCC CNT : 4	
4.	WATER IN FUEL	VOLTAGE HIGH
0x00	SPN : 97	FMI : 3
	OCC CNT : 3	

Above: Example of stored alarms list.

# CANtrak System - 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

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# CANtrak System - Engine Fault Codes

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

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# CANtrak System - Engine Fault Codes

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

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# CANtrak System - Engine Fault Codes

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

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# CANtrak System - Engine Fault Codes

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 #1 Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
692	1172	4	Amber	Turbocharger #1 Compressor 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

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# CANtrak System - Engine Fault Codes

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
<del>753</del>	<del>723</del>	<del>2</del>	<del>Amber</del>	<del>Engine Speed Sensor #2</del>	<del>Engine Speed/Position #2 Camshaft sync error - Data Erratic, Intermittent, or Incorrect</del>
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

Continued over page

# CANtrak System - Engine Fault Codes

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

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# CANtrak System - Engine Fault Codes

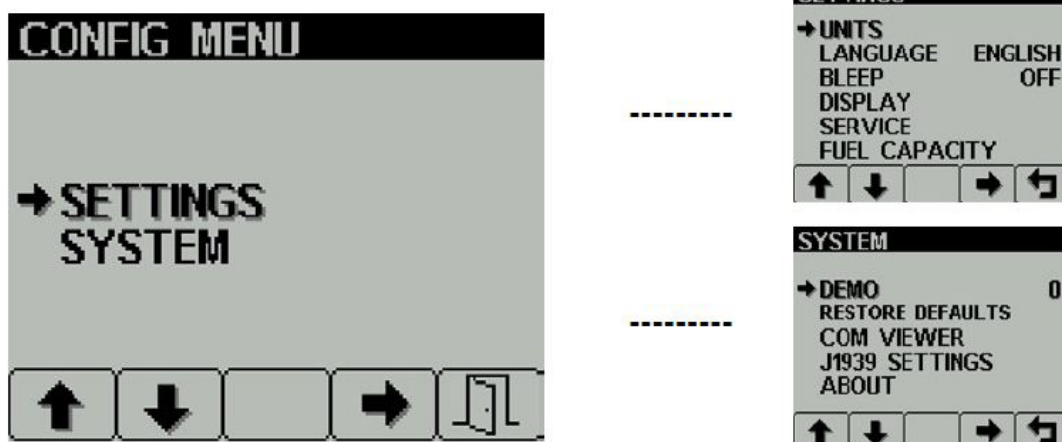
Fault Code	J1939 SPN	J1939 FMI	Lamp Colour	J1939 SPN Description	Cummins Description
2347	2790	15	None	System Diagnostic Code #1	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level
2363	1073	4	Amber	Engine Compression Brake Output # 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

# CANtrak System - Configuration

## 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 ('Exit door' icon) for at least 3 seconds while GEM is in normal operating mode. The top-level configuration menu will be displayed as shown below. Use Keys 1 and 2 (up and down arrows) to point to either SETTINGS

or SYSTEM sub-menus. Press key 4 to enter the selected sub-menu. User preferences are set in SETTINGS sub-menu. SYSTEM sub-menu accesses maintenance and low-level system configuration settings. These sub-menus are detailed below. Key 5 ('Exit door' icon) exits the current menu/sub menu. Settings are automatically stored on exit.



**Above:** The top-level Configuration menu showing two choices of SETTINGS and SYSTEM sub-menus. Pressing Key 4 enters the menu highlighted. Key 5 showing the 'exit door' icon returns you to the previous menu.

## Settings Sub-Menu

The settings sub-menu allows the user to configure or view the following items:

**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



*Continued over page*

# CANtrak System - Configuration

## System Sub-Menu

The system sub-menu allows the user to configure or view the following items:



**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

**COMVIEWER:** 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:

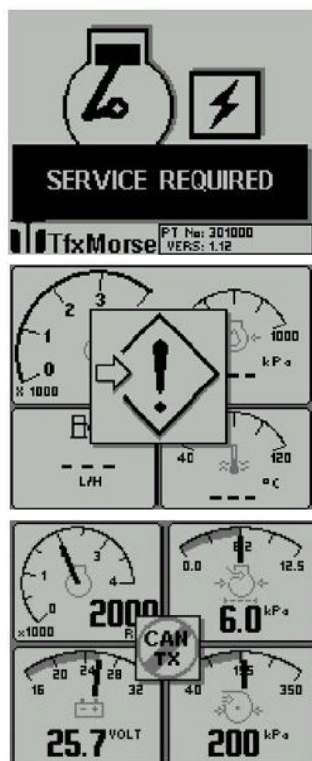
- ID NO: Unique number of the display
- EEPROM: Number of write cycles
- PART No: Software part number
- VERS: Software version number
- CHK: Flash memory checksum
- SOURCE: The source of received data
- LIB1: Low level system library version
- LIB2: Low-level graphical display interface library version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

*Continued over page*

# CANtrak System - Configuration

## Pop Up Messages & 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.
- CANTX disable. If CANTX (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)



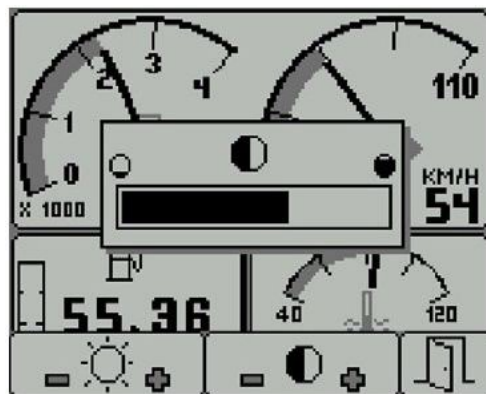
Above, top to bottom: Pop up warnings - Engine service required, a data communications failure and CANTX is disabled.

## Setting LCD Lighting & 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.



Above: Contrast level adjustment on the lighting and adjust screen.

*Continued over page*



# CANtrak System - Configuration

## 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 & 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.

## GEM 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

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- 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

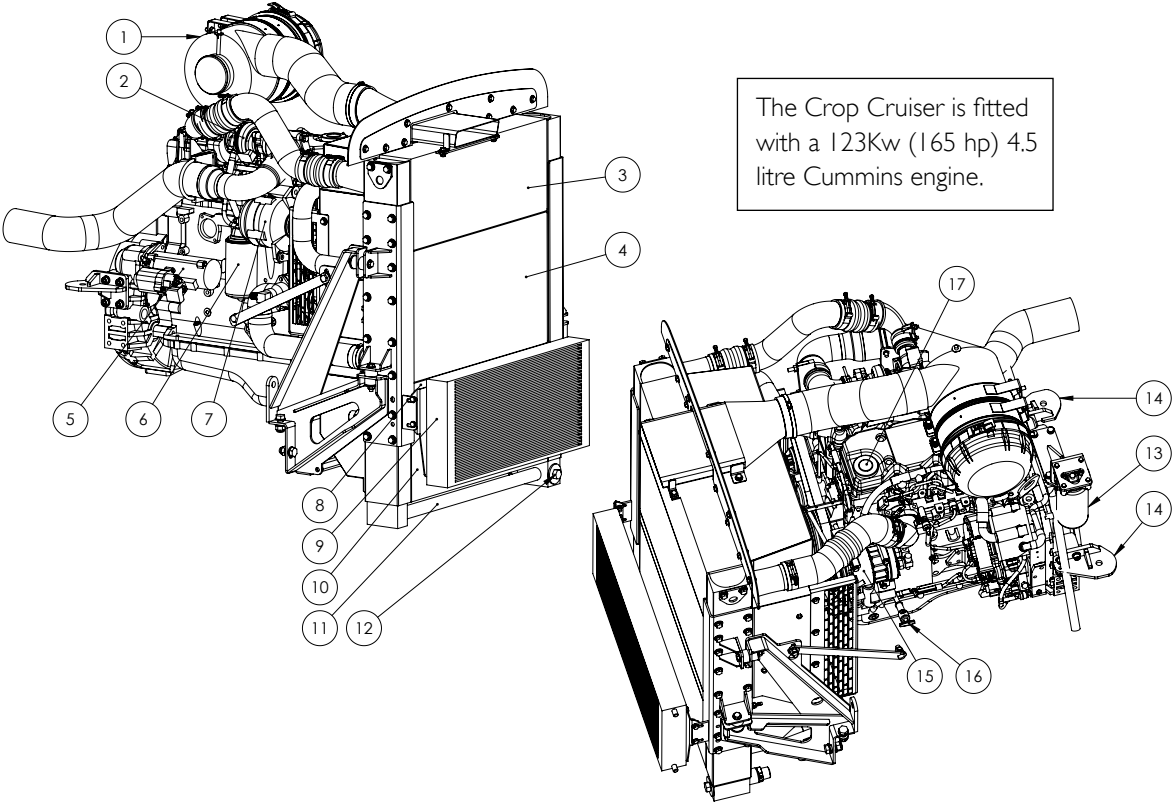
**NOTE:** The messages, icons, error codes etc displayed by GEM conform to J1939 standards wherever possible.



# Chapter 5

## DRIVETRAIN

### Engine

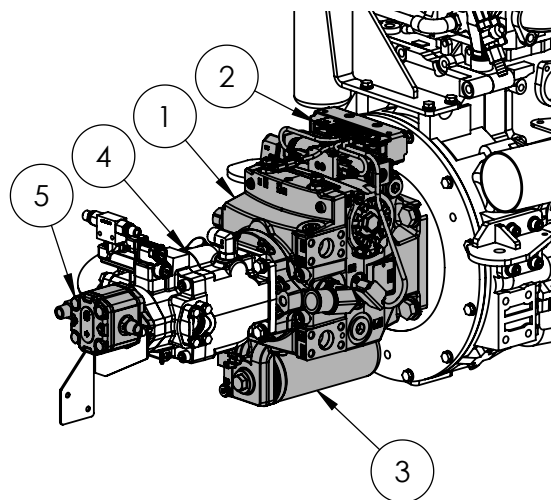


NUMBER	FEATURE	NUMBER	FEATURE
1.	Air cleaner	10.	Transmission cooler
2.	Turbo	11.	Transmission cooler - bypass tube
3.	Charge air cooler	12.	Thermal bypass valve
4.	Water jacket cooler	13.	Fuel filter
5.	Starter Motor	14.	Engine mounts
6.	Oil Filter	15.	Air-conditioning compressor
7.	Alternator	16.	Dipstick
8.	Fuel cooler	17.	Oil filler
9.	Air-conditioning condenser		

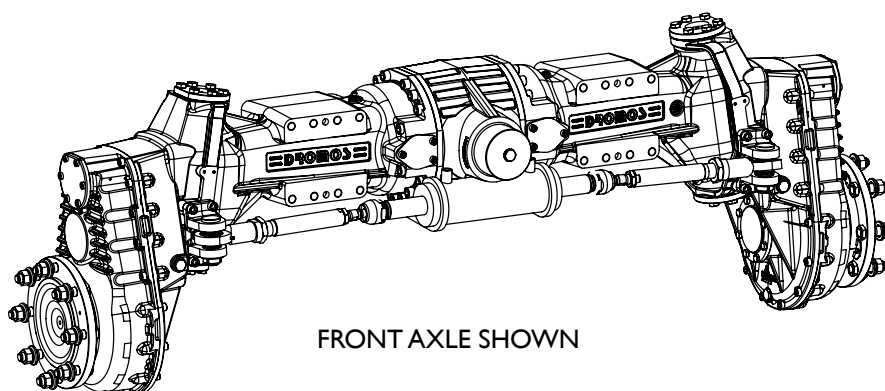
## Hydraulic Pumps

Refer to Chapter 8 'Operation' of this manual for information on using the Danfoss transmission.

NUMBER	FEATURE
1.	Transmission pump
2.	Transmission pump control unit
3.	Transmission pump filter
4.	Hydraulic systems pump
5.	Transfer case cooler pump



## Steering System



**WARNING:** The steering mode needs to be set to 2-wheel steering any time the machine is being transported via long distance and/or high speed road freight.

### STEERING MODES

The steering mode is selectable between 2-wheel and 4-wheel steering. The 4-wheel steering mode may stay engaged up to 15 Km/h before automatically switching to 2-wheel mode at higher speeds. Under deceleration down to 10 Km/h, 4-wheel steering mode will re-engage if selected.

### CAMBER

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

### STEERING TOE IN

The steering toe angle of the axles is set to 0 degrees and is not adjustable due to the needs of the 4-wheel steering system.

### STEERING KING PINS

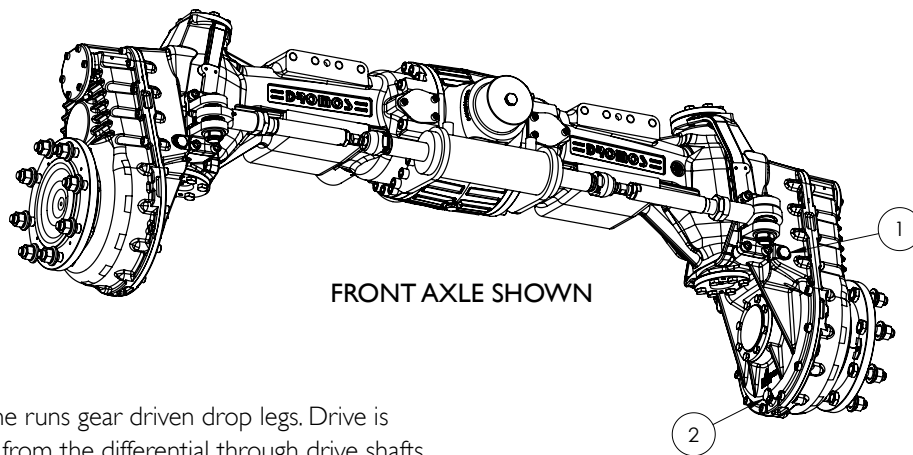
The king pins need to be greased as per the maintenance schedule found in Chapter 10 'Lubrication & Maintenance' for lubrication details.

### STEERING ANGLE POTENTIOMETERS

Refer to 'Steering' section in Chapter 10 'Lubrication & Maintenance' for replacement and calibration information.

**DANGER:** Crush hazard. This machine is fitted with 4 wheel steering. Never work in the space between the wheels and the chassis while the engine is running. The wheels may steer quickly and without warning.

## Droplegs

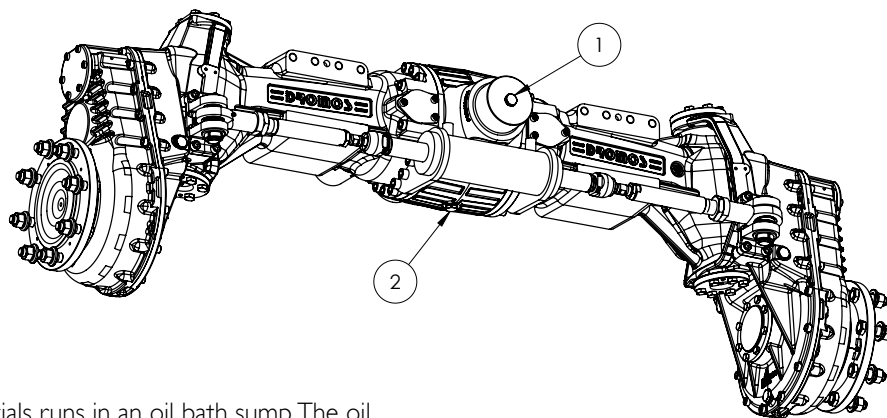


This machine runs gear driven drop legs. Drive is transferred from the differential through drive shafts to the input shaft of the drop leg.

For all service intervals and maintenance requirements for the drop legs refer to Chapter 10 'Lubrication & Maintenance'.

NUMBER	FEATURE
1.	Oil level check/fill plug
2.	Oil drain plug

## Differentials

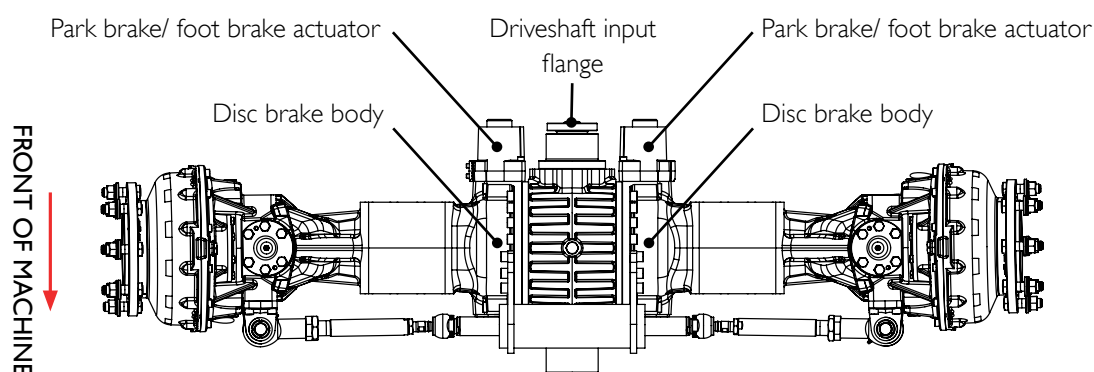


The differentials runs in an oil bath sump. The oil level can be checked by removing the level plug on the differential housing. The oil should be replaced as per the service intervals specified in the maintenance chapter.

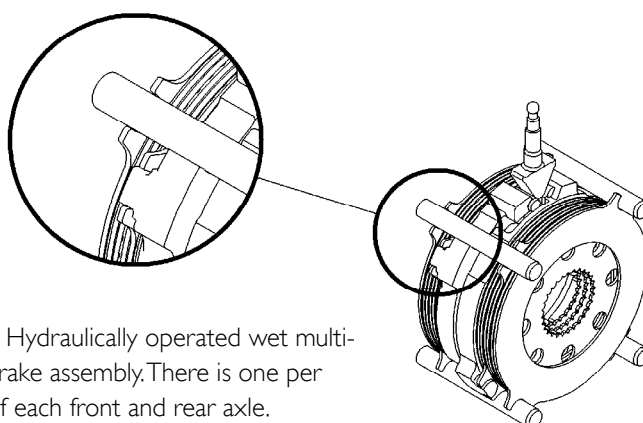
For all service intervals and maintenance requirements for the differentials refer to Chapter 10 'Lubrication & Maintenance'.

NUMBER	FEATURE
1.	Oil level check/fill plug
2.	Oil drain plug

# Braking System



FRONT AXLE SHOWN (TOPVIEW)



**Right:** Hydraulically operated wet multi-disc brake assembly. There is one per side of each front and rear axle.

This machine utilises an internal hydraulically operated wet multi-disc braking system made up of two brake bodies inside each axle. The park brake bodies are set up as negative parking brakes, while there is a separate pneumatic over hydraulic circuit set up as a positive service brake on the front axle only.

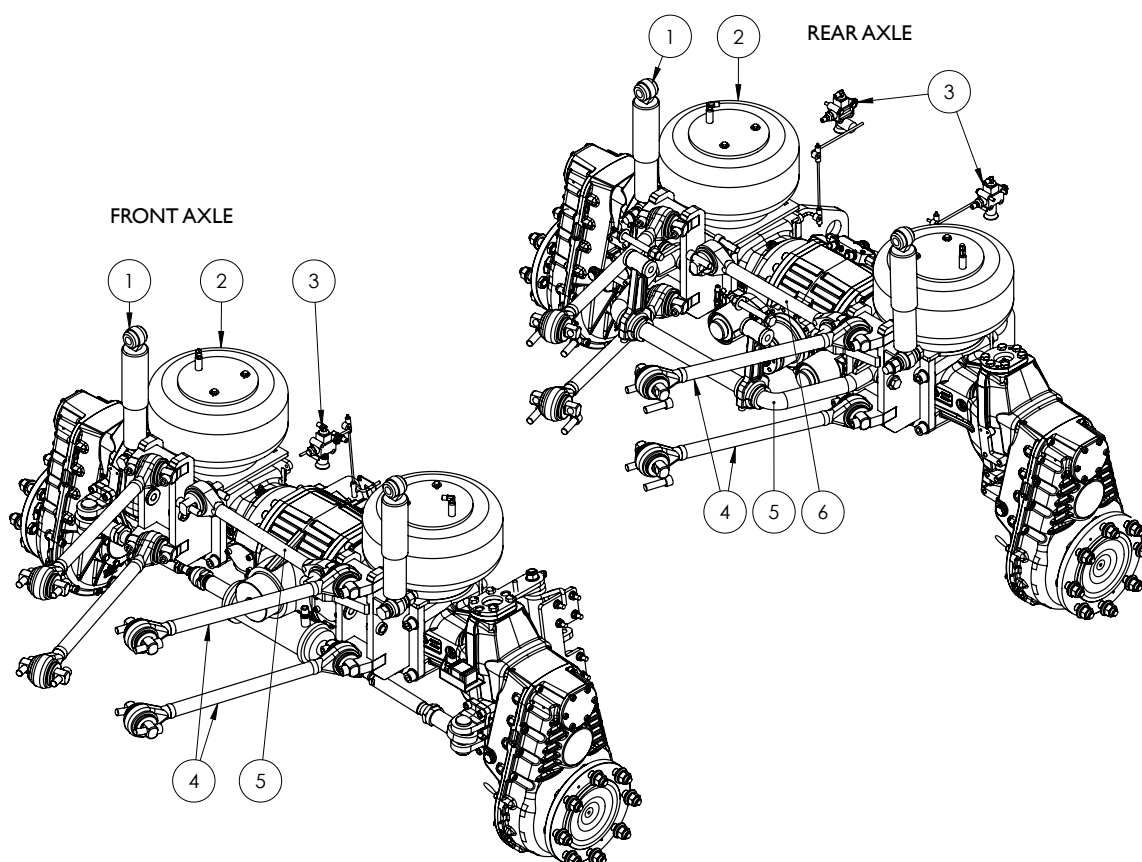
The front positive service brake is operated by a foot pedal in the cabin and should be used for emergency braking situations only. General braking should be done by pulling back on the throttle control joystick on the side console to make use of the machine's engine braking capacity via the transmission.

The park brake system is pressurised by the transmission pump's internal charge pump which is permanently set to 30 Bar. A pressure sensor and accumulator (22 Bar) regulate the pressure in the park brake circuit. If the pressure drops below 25 Bar, the park brake manifold will re-pressurise the circuit up to 30 Bar.

**NOTE:** The Park Brake is a negative type, meaning it will apply at any time that there is no hydraulic pressure going into the park brake control cylinder.

**NOTE:** Specific information on bleeding and setting the brakes can be found in Chapter 10 'Lubrication & Maintenance'.

# Suspension System



NUMBER	FEATURE
1.	Shock absorber
2.	Air bag
3.	Ride height valve
4.	Parallel link
5.	Panhard rod
6.	Sway bar (rear only)

## SUSPENSION

The suspension system is made up of a five point linkage in a v-type configuration. It consists of four parallel links, one panhard rod, two air bags and two dampers on each axle. The airbags act as springs and are also controlled by ride height valves which aim to keep the machine level during operation. 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 Chapter 10 'Lubrication & Maintenance'.



# Chapter 6

## 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 bypass 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:

PARAMETER	VALUE	UNIT
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 (l)		RPM

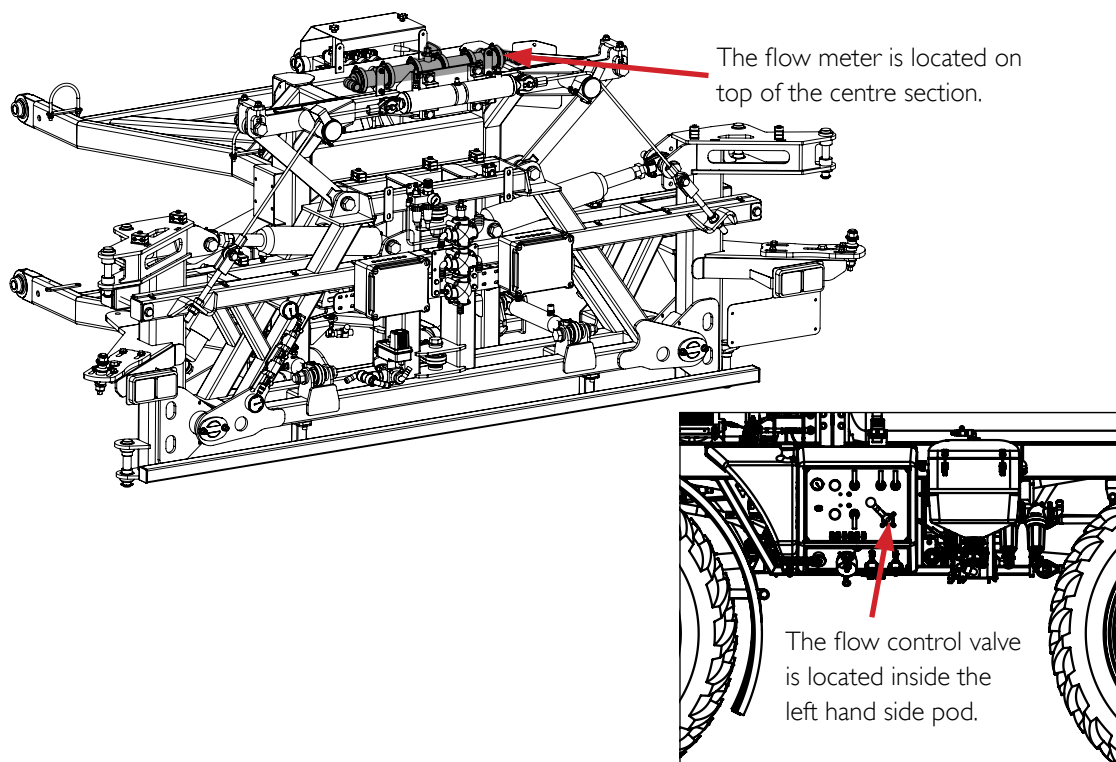
$$\text{L/min. (per nozzle)} = \frac{\text{L/ha} \times \text{km/hr} \times \text{W}}{60,000}$$

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

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



## Flow Control Valve & Flow Meter Locations



### Flow Control Valve

The Crop Cruiser can be fitted with one of two types of rate control system, namely Raven SCS4400 or an ISOBUS system. The rate controller signals the fast close valve to open and close as necessary to set the flow rate. Therefore, flow to the boom is determined by the amount of liquid allowed to bypass back to tank by the valve. The fast close valve uses a 743 control constant.

The flow control valve regulates the flow going to the boom sections directed via the console.

The flow control 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.

The fast close valve can be operated in manual mode from the console for boom priming, flushing and also troubleshooting.

### Flow Meter Calibration - Raven

If the sprayed volume from the controller does not match the tank volume that was sprayed out, then the flow meter will need to be checked and a new updated figure input into 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), while making sure the tank is level.
- On the Raven controller, make sure the 'Total Volume' reads '0'.

*Continued over page*

## Flow Meter Calibration - Raven

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- 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. It should be able to spin 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' value can be changed
  - i.e. If volume from the controller reads 3100 litres instead of 3000 litres and the original Meter Cal value is 185, then:

$$\text{New 'Meter Cal' value} = (185 \times 3100) / 3000 = 191$$

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. Variations due to nozzle wear, ground speed error and pressure irregularities can all add up to 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.

### Jug Test

The method of carrying out the "jug test" is described below.

You will need:

- A calibrated measuring container that can measure the medium in litres, in 10 ml increments. e.g. 0.45 L.
  - A timing device that counts seconds.
  - A pressure gauge mounted at the nozzle tip to verify the system pressure being delivered at the nozzle. Goldacres part number GA5077983 will enable mounting of a suitable gauge to the nozzle body bayonet fitting (not including gauge).
1. Check the plumbing system for kinked or obstructed hoses and repair or replace any hoses that might restrict the normal flow of the liquid.
  2. Start your sprayer and initiate a 'self test' procedure on your rate controller console. Set the application rate and speed to the values given in your rate chart that match your desired spray output.
  3. Then place the jug under one of the nozzles, for exactly 1 minute and record the volume of liquid collected.
  4. Repeat the test over a representative sample of the jets in each boom section.
  5. Compare the volume collected from each nozzle to the stated volume in your nozzle supplier rate chart. Variation should be no more than plus or minus 10 %.

*Continued over page*

## Nozzle Calibration

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In the event that any of your nozzles do not deliver the required volume, a further investigation is required. This 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

**NOTE:** 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 that 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](http://www.teejet.com) or Lechler web site: [www.lechler.de](http://www.lechler.de)

## Speed Sensors

---

Raven automatic rate controllers can utilise a speed reading from the:

- 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.

# Raven SCS4400 Console Calibration

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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 Raven 4000 series consoles are very similar however there may be slight differences during calibration - 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.

*Continued over page*

# Raven SCS4400 Console Calibration

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 L/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 I" 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.

*Continued over page*

# Raven SCS4400 Console Calibration

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 value 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. i.e. 12 nozzles in one section at 50cm (½ metre) spacings = 12 x 0.5m = 6m

All Boom Sections must be entered in Centimetres (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 centimetres 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)

*Continued over page*

# Raven SCS4400 Console Calibration

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 - REQUIRED WHEN PUMP IS HYDRAULICALLY DRIVEN

For RPM to be displayed on the console screen the sprayer must be fitted with a pump RPM sensor.

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 cursor down until page 2 is displayed.
4. Continue momentarily depressing the [DOWN]

key repeatedly until the cursor is adjacent to "PUMP CAL".

5. Depress the [ENTER] key 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.

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# Raven SCS4400 Console Calibration

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## 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 cursor 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 submenu 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. A Raven Fill-flow meter can be 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

*Continued over page*

# Raven SCS4400 Console Calibration

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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 =  $(185 \times 3100) / 3000 = 191$**

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.

(i.e. After 200 litres has been pumped out there is 2800 left in a 3000 litre tank).

There may need to be extra marks put on 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 Raven SCS4400 Console Calibration section).

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 values 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 XRI 10015 and XRI 10025 nozzles fitted to the sprayer the minimum pressure that the XRI 10025's can cut in at is 1.0 bar. The flow rate for an XRI 10025 nozzle at 1.0 bar is 0.57 L/min. The maximum operating pressure for an XRI 10015 is 4.0 bar, at which point the flow rate is 0.68 L/min, so this combination of nozzles overlap nicely. In actual fact the XRI 10025 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 ascertain 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 XRI 10015 and XRI 10025 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 XRI 10025 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  $60 \text{ nozzles} \times 0.57 \text{ L/min} = 34.2 \text{ L/min}$  which would be the tier 1 max rate value for the example above.

The tier 2 max rate would be  $60 \times 0.91 \text{ L/min} = 54.6 \text{ L/min}$ .

**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).

*Continued over page*

## 3TS - Boom Tier Programming

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.

### SCS4400 & 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 (L/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 m broad acre boom fitted with XRI 1002 nozzles.

The minimum recommended pressure for an XR nozzle is 1 bar. The flow rate for an XRI 1002 nozzle at 1 bar is 0.46 L/min. Thus the second tier interchange value will be  $0.46 \times 2 \times 60$  (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.

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## 3TS - Boom Tier Programming

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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.





## PRE-OPERATION

### Preparing 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 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 grease 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. Protect all surfaces with corrosion inhibitor G15.

- 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.
- 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 machine is approximately 4.2 m 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.

# Preparing Sprayer For Use

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## Overhead Power Lines

Check any areas to be sprayed for overhead 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 power lines in the spray area, exercise extreme caution when tilting boom wings.

**DANGER:** Do NOT walk on machine platform when near power lines.

## Spray Calibration

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Flow meter and spray nozzle calibration should be checked regularly to ensure that correct application rates are maintained. Refer to Chapter 6 'Calibration' for procedures to check and alter calibration if required. Also refer to your supplied spray controller manual.

## Maintenance

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Correct servicing and maintenance of the machine will ensure ongoing safe and efficient operation. Servicing and maintenance should be carried out according to the schedule in Chapter 10 'Lubrication & Maintenance'.

### During The First 8 Hours Of Operation - Checks

#### Torque Settings

- Check the torque on retaining nuts frequently.
- The wheel nuts should be checked to ensure that 350 ft/lb 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.

#### Lubrication & Hydraulic Fluids

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

- Check the hydraulic oil reservoir and transfer case 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

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

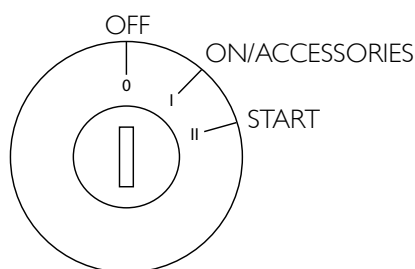
The isolator switch must be engaged to provide power to the machine systems.

To start the engine, the throttle must be in neutral, the transmission mode switch must be in neutral and the park brake must be engaged. Insert the ignition key and turn clockwise. The ignition key is located on the steering console.

## Key Positions

The key has 3 positions:

- 0 - Off, vertical position.
- I - On/accessories; in this position all cabin components will be energised.
- II - 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.



## Shut Down

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1. Bring the machine to a complete stop by pulling progressively back on the throttle until it is in the NEUTRAL position.
2. Leave the throttle in NEUTRAL.
3. Then engage park brake. The ladder will go down.
4. Place the transmission range switch into NEUTRAL.
5. Turn the key to the OFF position.
6. 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 8

## OPERATION

### Quick Drive Guide

It is the responsibility of the operator to familiarise themselves with and understand the information in this manual to ensure competent and safe operation. More detailed explanations of the driving functions are found later in this chapter.

#### HOW TO DRIVE

1. Ensure air drain valve is CLOSED. This is located under the plumbing control station on the left hand side of the sprayer.
2. Turn battery isolator ON. This is located on the front right side of the machine, above the battery compartment.
3. Check park brake switch is ON.
4. Check transfer case range switch is in NEUTRAL.
5. Select SPEED 1 on the speed mode switch.
6. Check there are no other persons on or under the machine and sound the horn.
7. Turn on ignition and start the machine.
8. Allow engine to run for least 2 minutes to allow air pressure to build up for the suspension and emergency braking system.
9. Turn park brake OFF. The ladder will raise up.
10. Select LOW RANGE. Buzzer may sound. This is OK. Buzzer will switch off once machine starts moving.
11. Select either 2 wheel steering (2WS) or 4 wheel steering (4WS) on the steering mode switch.
12. Gently move the throttle in the desired direction to begin moving forwards or backwards.



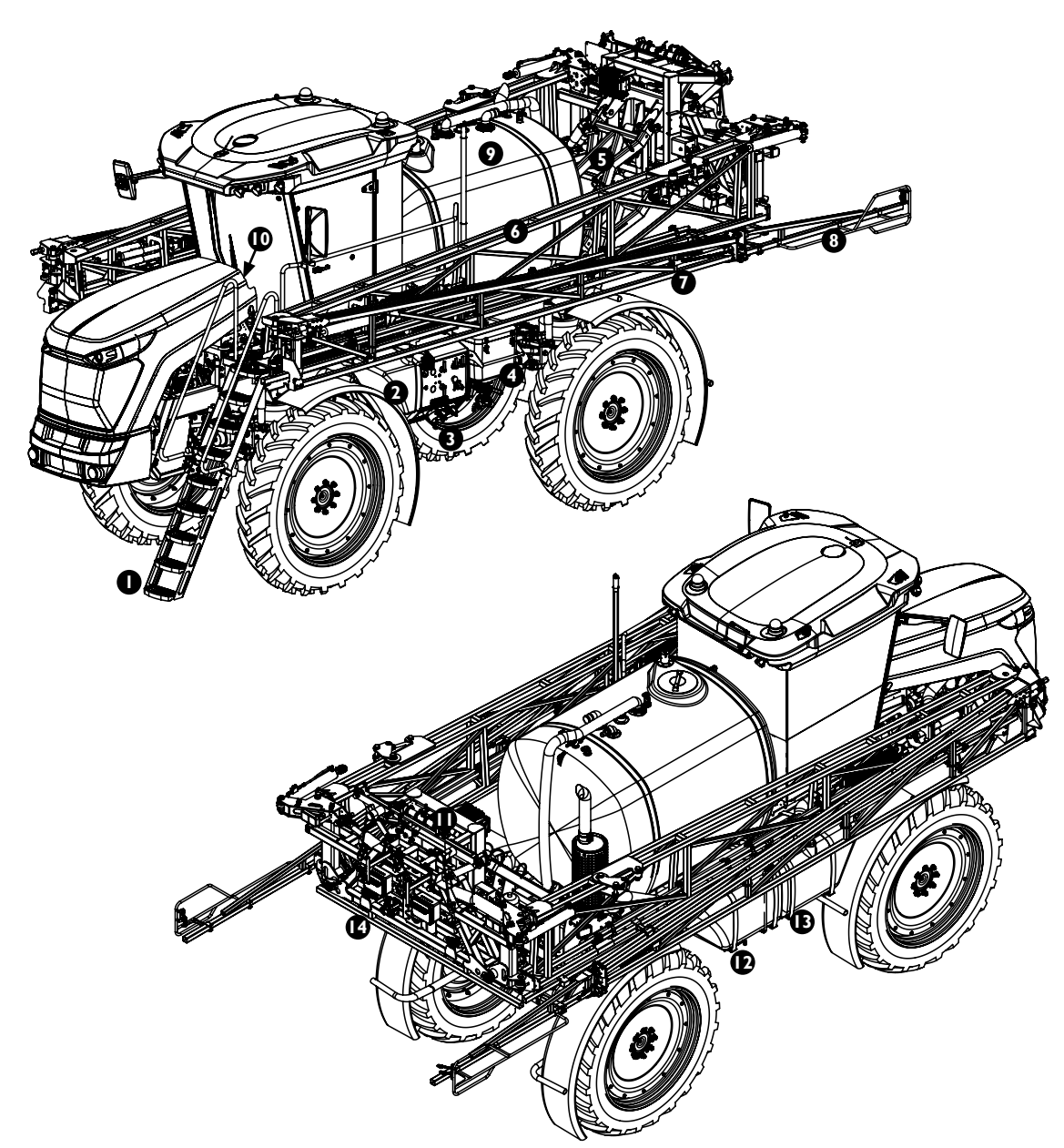
#### HOW TO STOP

1. While driving, move throttle back to centre to decelerate the machine as much as required.
2. If greater deceleration is required, then use the emergency foot brake.
3. Once machine has stopped apply park brake.
4. Select neutral on the range switch.
5. Turn engine and ignition off.
6. Wait 30 seconds and then turn the battery isolator off.

#### TRICKS TO KNOW

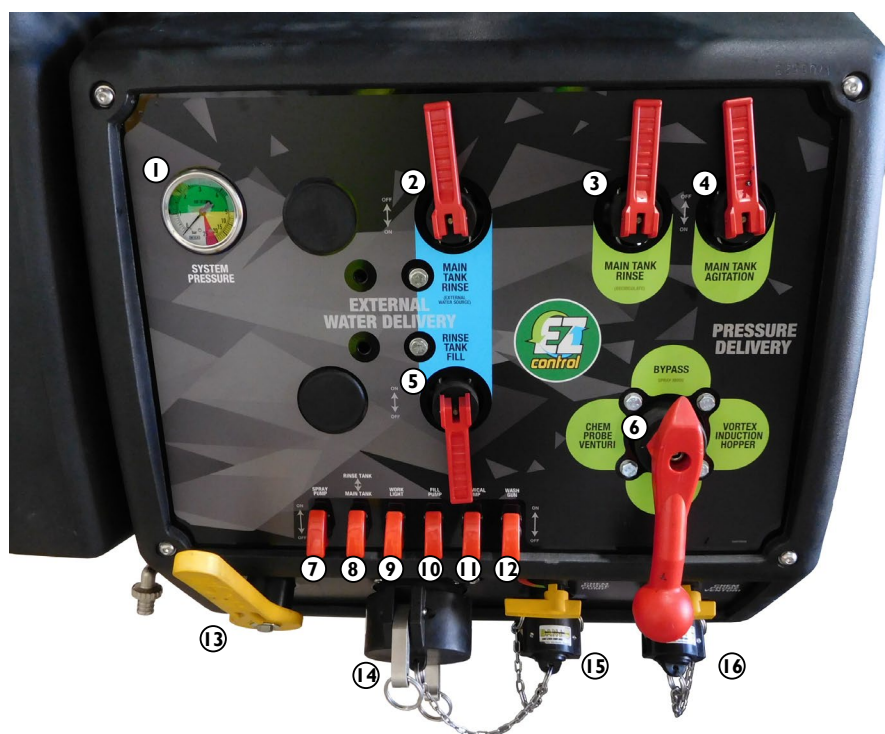
- When the park brake is turned on and then off while the engine is running, the transfer case range switch must be cycled into neutral then back into gear to allow machine to drive.
- If emergency foot brake is applied while driving it will effectively put transmission into neutral. Once foot brake is released, machine will resume driving.
- If park brake is accidentally activated while driving the transmission will drop into neutral. Once park brake is released, drive will resume.
- Transfer case will not engage when park brake is on. The cabin buzzer will sound as a warning.
- When accelerating, 4WS will cut out at 15 Km/h.
- When decelerating, 4WS will cut in at 10 Km/h.
- On engine start up, the rear steering has a 5 second activation delay.
- Transfer case can not be engaged if throttle is not in neutral position.
- Transfer case range cannot be changed while the vehicle is in motion.

# Machine Key Features



NUMBER	FEATURE	NUMBER	FEATURE
1.	Access steps to cabin	8.	3D breakaway tip
2.	Hand wash tank	9.	Main tank
3.	EZ control station	10.	Spray pressure gauges
4.	Induction hopper	11.	Flow meter
5.	Boom paralift	12.	Rinse tank
6.	Boom inner wing	13.	Fuel tank
7.	Boom outer wing	14.	Boom centre

## EZ Control Station - Key Functions



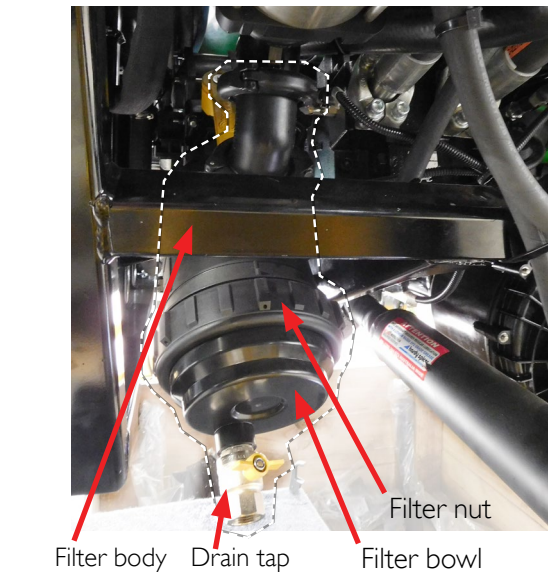
NUMBER	FEATURE	NUMBER	FEATURE
1.	System pressure gauge	9.	Work light
2.	Main tank rinse - External	10.	Fill pump
3.	Main tank rinse - Pressure	11.	Chemical pump
4.	Main tank agitation	12.	Wash gun
5.	Rinse tank fill	13.	Main tank fill - 3" - Valve
6.	Selector valve - 4-way	14.	Main tank fill - 3" - Inlet
7.	Spray pump	15.	Chemical probe - Pump
8.	Rinse tank/main tank	16.	Chemical probe - Venturi

EXTERNAL WATER DELIVERY	USE
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.

**NOTE:** These functions are only available when external water is being pumped into the system.

PRESSURE DELIVERY	USE
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 agitator
Bypass	Turn ON bypass when in spray mode
Main tank rinse (recirculate)	Turning ON allows flow to recirculate through system for a more thorough flushing/decontamination.

**NOTE:** These functions only available when the main spray pump is operating - pressuring the system.

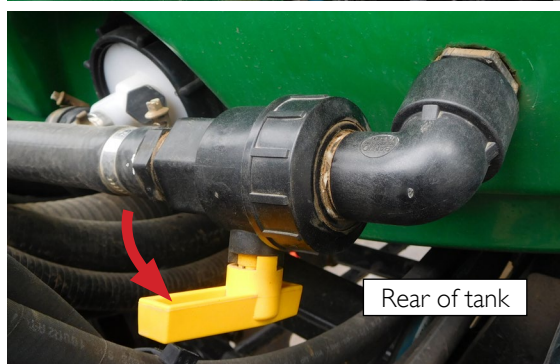




## Suction Filter

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4. Turn the 6 mm bleed line valve on the front of the main tank to OFF and turn the 1" pressure manifold bypass valve in the rear of the tank OFF.



**WARNING:** Steps 1-4 must always be completely followed before removing the suction filter bowl. This prevents a small continuous flow of fluid coming from the main tank through the spray pump and out of the suction filter housing.

4. Open the suction filter drain tap to empty it and take care to catch any chemical that comes out. Opening the tap also has the effect of relieving suction on the filter that may be holding it on and so should be done before loosening the nut.
5. Loosen the filter nut slowly after draining is complete. Stand clear of bowl and be sure to catch any remaining chemical inside in a suitable container.
6. Remove the filter bowl. Stand clear of bowl and be sure to catch any remaining chemical inside in a suitable container.
7. Clean the screen and the O-rings, then refit and ensure that O-rings are in place.
8. Once the cleaning procedure is complete and the filter bowl has been refitted, the valves should be re-opened from steps 1-4.

# Chemical Induction Hopper

## Overview

The Super Flow 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.

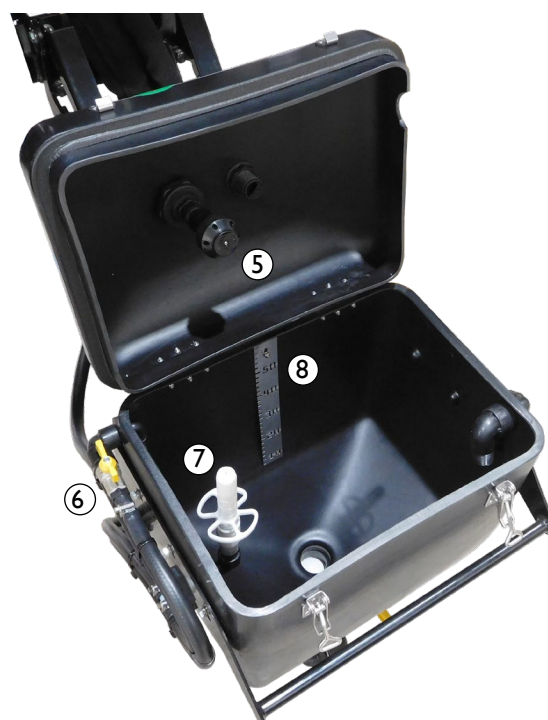
The hopper transfers the chemical via venturi effect. Water from the main spray tank is pumped under the bottom of the hopper where it passes through a venturi fitting under the hopper. This causes a suction effect and when the bottom of the hopper is open (via the hopper tank valve) the tank contents are drawn into the flow from the pump passing under the hopper and then transferred into the middle of the main spray tank. This eliminates chemical attack resulting from high concentrations of chemical coming into contact with spray components.

**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

NUMBER	FUNCTION
1.	Rinse tap
2.	Hopper breather
3.	Chemical pump inlet
4.	Drain tap & venturi ball valve
5.	Tank rinse nozzle
6.	Pressure water mixing jet valve
7.	Pressure water mixing jet
8.	Level indicator 60 L



Continued over page



# Chemical Induction Hopper

## Operation

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 spray pump three-way ball valve is pointing towards '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. Turn ON the 'Spray Pump' switch and then the 'RPM Raise' switch. Operate the pump at the speed necessary to generate at least 80 PSI delivery pressure (as displayed on the sprayer pressure gauge). Do not run it 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.

8. 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.
9. Open the hopper tank ball valve at the bottom of the hopper by turning the yellow handle down. The chemical should be now transferring to the main spray tank.
10. 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

### RINSING FROM EXTERNAL SOURCE

To rinse the Induction Hopper and chemical drums with fresh water from the external water delivery station:

**NOTE:** Spray pump must also be operating.

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 Pod's external water delivery station (blue) 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' switch and then the 'RPM Raise' switch to operate the fresh water pumping system at between 70 and 100 psi.
6. Flip the vortex Induction Hopper valve ON.
7. Open the hopper tank 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 top of the hopper.
10. To rinse the hopper, 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 so that it is horizontal.

*Continued over page*

# Chemical Induction Hopper

- Flip the vortex induction hopper valve OFF.
- Drain the hopper of any remaining liquid using the hopper drain tap at the bottom of the hopper.

## RINSING OUT THROUGH DRAIN

The hopper can be rinsed and the rinsate emptied through the hopper drain ball valve rather than transferred into the main spray tank.

**CAUTION:** Spray pump should be turned off.

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 up 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 mindful of where rinsate is deposited as it may contain chemical residue.
- This procedure will not rinse the hose from the bottom of the hopper to the main tank



Drain tap

Venturi ball valve

# Arm Rest Switches



## **SPEED 1 / SPEED 2 / SPEED 3**

Press this switch forward to increase the speed range of the machine between the first and the third positions. Press the switch backward to lower machine speed range. Most of the time, it will be appropriate to drive in the Speed 3 setting, especially on level ground. However, the operator may find it useful to move to a progressively lower setting to maximise torque to the wheels during steep ascents. This switch can be used while the machine is moving.

## **HIGH-RANGE / NEUTRAL / LOW RANGE**

This switch, along with the joystick throttle, should be centered in the 'Neutral' position before starting the engine. Place it back in this position before shut down. Once the engine is running and the park brake is released select either high range or low range for the expected driving conditions.

This switch should only be selected while the machine is stationary. Switching it while moving will cause the transmission to go into neutral mode and the machine to come to a stop. High or low modes will need to be re-selected before moving off again.

The 'Speed 1 / 2 / 3' switch can then be used at any time to more precisely balance ground speed vs. torque delivery to the wheels.

## **4 WHEEL STEERING / 2 WHEEL STEERING**

By pressing the switch forward, 4 wheel steering mode is activated which allows for tighter manoeuvring of the machine. When accelerating past 15 Km/h the steering will automatically switch to 2 wheel steering mode. Decelerating below 10 Km/h will re-engage 4 wheel steering mode if it was selected. Press backward on the switch to stay in 2 wheel steering mode at all times.

## **RINSE TANK / MAIN TANK**

Pressing the switch forward will set the spray pump to suck from the rinse tank. Pressing the switch backward will set the spray pump to suck from the main tank. The spray pump should be turned off when cycling between suction from the rinse tank and main tank. A buzzer will sound from both the cabin and the spray pod when suction is set to rinse tank. This is to remind the operator of the suction mode which helps, for example, to avoid accidental spray application from the rinse tank.

## **BOOM RECIRC ON / OFF**

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 approximately 1 minute to flush 60 L through the boom lines. The boom recirculation must be in the OFF position to begin spraying.

## **SPRAY PUMP ON / OFF**

Pressing the switch forward will turn the spray pump on. Press the switch backward to turn it off. The spray pump should be turned off when cycling between suction from the rinse tank and main tank.

## **BOOM FOLD IN**

By pressing the switch forward, the boom close function is activated. This folds both 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 allows both fold cylinders to reach their maximum extents.

The bi-fold outers must either be folded first or in unison with the inners. The boom must be at full height before folding. Stopping while the booms are folding will stress the boom.

*Continued over page*

# Arm Rest Switches

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## **BOOM FOLD OUT**

By pressing the bottom of the switch, the boom open function is activated. This folds the boom out in to the 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.

The boom inners must either be folded out first before bi-fold extension or in unison with the outers. The boom must be at full height before folding out.

## **BOOM BI-FOLD IN**

By pressing the switch forward, the bi-fold close function is activated. This command will fold the boom 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.

## **BOOM BI-FOLD OUT**

By pressing the switch backward, the bi-fold open function is activated. This switch will fold the boom 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. This function must only be activated once the inner booms have been unfolded.

## **AUTO STEER ON / OFF**

Pressing the switch forward will engage the auto steer system. The auto steering system is not compatible with 4-wheel steering mode and will default to 2-wheel steering when engaged. Press the switch backward to disengage auto steer.

## **CENTRE DIFFERENTIAL LOCK ON / OFF**

Pressing the switch forward will engage the differential lock. The differential lock should only be used when needed and never left engaged for long periods. For use in poor ground conditions only. Do not engage during wheel spin. Should not to be used at road speed. The differential lock needs to be disengaged when cornering to minimise extra load on the tyres and driveline.

# Transmission



To begin driving, check that the transmission range switch is in neutral. Check also that the joystick throttle control is in the centered neutral position. Disengage the park brake switch. Select either high or low range on the transmission range switch. Begin slowly moving the joystick throttle either forward to go forward or backward to start reversing. Use the 'Speed 1 / 2 / 3' switch at any time to maximise either ground speed or torque delivery to the wheels at lower speed.

**NOTE:** If the joystick throttle control is ever replaced, then the range will need to be re-calibrated by a qualified technician at your dealer.

## SPEED SET DIAL (MAXIMUM LIMIT)

The speed set dial can be used to set the maximum speed at full throttle in the current combination of switch settings. It can be used as a very precise type of cruise control.

## SPEED 1 / SPEED 2 / SPEED 3

Pressing the switch forward to increase the speed range of the machine between the first and the third positions. Press the switch backward to lower machine speed range. Most of the time, it will be appropriate to drive in the Speed 3 setting, especially on level ground. However, the operator may find it useful to move to a progressively lower setting to maximise torque to the wheels during steep ascents.

## HIGH-RANGE / NEUTRAL / LOW RANGE

This switch, along with the joystick throttle, should be centered in the 'Neutral' position before starting the engine. Place it back in this position before shut down. Once the engine is running and the park brake is released select either high range or low range for the expected driving conditions. The 'Speed 1 / 2 / 3' switch can then be used at any time to more precisely balance ground speed vs. torque delivery to the wheels.

**Below:** The table shows approximate maximum speeds in each combination of switch settings at full throttle.

SELECTED MODE	SPEED 1	SPEED 2	SPEED 3
HIGH RANGE	20 Km/h	30 Km/h	45 Km/h
LOW RANGE	10 Km/h	15 Km/h	20 Km/h

**NOTE:** The transmission will only shift from a higher to a lower speed setting once that lower ground speed is reached. For example, when travelling at 45 Km/h in 'Speed 3' and then selecting 'Speed 2', the ground speed must first reach 30 Km/h or less before the transmission will actually engage 'Speed 2'.



- Simple operation
- Low-limit function
- Digital boom pressure read-out
- Supports a variety of flow meters and control valves
- Audible alarms
- Self-test function
- Rate bump features

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 various components communicate directly with the Virtual terminal.

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 the console supplier to determine if an unlock code is required for additional features such as Auto section control. 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 communicate to each other.

The ISOBUS system is supplied 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:

- Total width of implement
- Number of sections & section widths
- Control type
- Meter Cal or spreader constant & product density
- Valve type & 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.



**Above:** ISOBUS system with Raven virtual terminal (VT) screen and 6 section switch box.



**Above:** Master ON/OFF foot controller

# Tank Filling

When filling the sprayer it is necessary to connect to an external water source. The external water delivery station allows several filling functions of the sprayer to be performed simultaneously.

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 (see Chapter 12 'Optional Accessories'). Filling progress can be monitored via an optional fill flow meter (see Chapter 12 'Optional Accessories').

**IMPORTANT:** Water weighs 1 kg 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.

**EXAMPLE:** Liquid nitrogen has a density of 1.28 kg per litre and the tank size is 4000 L.

$$4000 \text{ L} / 1.28 \text{ kg} = 3125 \text{ L}$$

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

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



**Above:** Fill point - 3" inlet mounted to left hand side pod. This fill point is plumbed into the pod and can also be used to fill the rinse tank. See section 'Rinse Water Tank Fill' for more details.

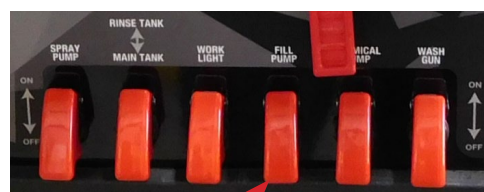
## Main Tank

### PUMPING WITH EXTERNAL PUMP:

1. Connect the 3" fill hose (not supplied) to quick fill cam lock coupling under the EZ Control POD.
2. Make sure the 3" fill point handle on the EZ control station is in the OFF position so that there can be no flow coming out of the tank (if it is not already empty) and that other fill functions are OFF.
3. Turn the fresh water pumping system on. The pressure should not be allowed to exceed 75 PSI.
4. Turn the 3" fill point handle 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 3" fill point handle OFF and then turn off the external water supply.

### PUMPING WITH OPTIONAL HYDRAULIC FILL PUMP:

1. Connect the 3" fill hose (not supplied) to quick fill cam lock coupling under the EZ Control POD.
2. Make sure the 3" fill point handle on the EZ control station is in the OFF position so that there can be no flow coming out of the tank (if it is not already empty) and that other fill functions are OFF.
3. With the engine running, turn the 'Fill Pump' switch ON. The pressure should not be allowed to exceed 75 PSI.



4. When filling is complete, turn the 'Fill Pump' switch OFF. Turn the 3" fill point handle OFF and remove the water supply from the tank fill fitting.

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# Tank Filling

## Rinse Water Tank

The rinse water tank holds approximately 300 litres and can be used to rinse the main tank, hopper and booms separately.

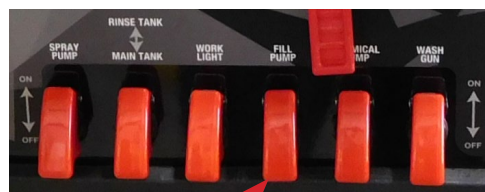
### PUMPING WITH EXTERNAL PUMP:

1. Ensure that all flip valves on the pod are turned off and connect the fresh water fill hose to the quick-fill coupling.
2. The tank lid may need to be loosened to help air escape.
3. Turn the fresh water pumping system on. The pressure should not be allowed to exceed 75 PSI.
4. Flip the rinse water tank fill valve UP to allow the flow to enter the rinse water tank.
5. When the required amount of water has been transferred to the rinse water tank, flip the rinse water tank fill valve DOWN to stop the flow and then turn off the external water supply.
6. Tighten tank lid and remove the water supply from the tank fill fitting.

### PUMPING WITH OPTIONAL HYDRAULIC FILL PUMP:

1. Ensure that all flip valves on the pod are turned off and connect the fresh water fill hose to the quick-fill coupling.

2. The tank lid may need to be loosened to help air escape.
3. With the engine running, turn the 'Fill Pump' switch ON. The pressure should not be allowed to exceed 75 PSI.



Fill pump switch

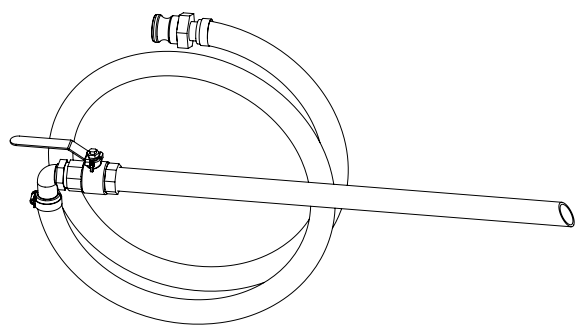
4. Flip the rinse water tank fill valve UP to allow the flow to enter the rinse water tank.
5. When the required amount of water has been transferred to the rinse water tank, flip the rinse water tank fill valve DOWN and stop the flow by turning off the external water supply.
6. Tighten tank lid and remove the water supply from the tank fill fitting.

## Hand Wash Tank

The rinse water tank holds approximately 70 L.

**CAUTION:** Make sure this tank always has sufficient clean water in it in case a chemical accident occurs and rinse water is needed to wash chemical from any contaminated persons, clothing or components.

# 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 20-50 % 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.

# Chemical Induction Probe - Venturi

## Overview

Chemical can be inducted into the main tank via the venturi effect using this system. The procedure is described below.

**NOTE:** This transfer system is intended for the induction of liquid chemicals only.

**NOTE:** 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.

**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.

## OPERATION:

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. Connect probe via the cam lever fitting.
3. OPEN the ball valve above the cam lever fitting
4. Place probe in chemical.
5. OPEN the valve on the probe.
6. Set the three way handle on the pressure delivery side of the Pod to 'Chem probe venturi'.
7. Turn on the 'Spray pump' switch ON to generate the speed necessary to produce a delivery pressure of at least 7 bar. Do not run the pump faster than 4200 RPM (Max. pressure 10 bar).

The higher the pump delivery pressure, the greater the venturi suction effect and the faster the probe will transfer the chemical. The delivery pressure should not exceed 10 bar.

8. The chemical should be now transferring to the sprayer tank via the venturi filler.
9. 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.

10. When finished, set the three way handle on the pressure delivery side of the Pod to 'Bypass' (Spray mode).

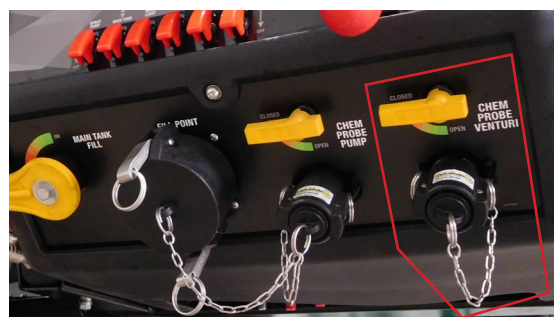
11. Flip the 'Main Tank Agitation' valve on the pressure delivery side of the Pod UP/OPEN.

12. CLOSE the 'Chem probe venturi' 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.



**Above:** EZ control pod functions used when transferring chemical via the venturi method.



**Above:** Chemical probe venturi cam lock fitting and isolating ball valve.



# Chemical Induction Probe - Pump

## Overview

Chemical can be inducted into the main tank via an electric pump using this system. The procedure is described below.

Pump Specifications:

- Flow rate - Up to 45 L/min
- Head - To 3.0 m
- Pressure - To 1.0 bar

**NOTE:** This transfer system is intended for the induction of liquid chemicals only.

**IMPORTANT:** The chemical probe should be operated 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.

**CAUTION:** Do not use the pump to transfer flammable petroleum products.

**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.

## OPERATION:

1. Connect probe via the cam lever fitting.
2. OPEN the ball valve above the cam lever fitting
3. Place probe in chemical.
4. OPEN the valve on the probe.
5. Set the three way handle on the pressure delivery side of the Pod to 'Bypass' (Spray mode).
6. Turn the 'Spray pump' switch ON and flip the 'Main Tank Agitation' valve on the pressure delivery side of the Pod UP/OPEN.
7. CLOSE the outlet ball valve on the bottom of the hopper.
8. Turn on the 'Chemical pump' switch to start transferring the chemical to the hopper. Use the internal level indicator to measure incoming chemical.

**NOTE:** The hopper has a capacity of 60 L, so it may need to be loaded in multiple batches depending on the amount of chemical to be transferred.

9. Once the desired amount is transferred to the hopper, transfer it to the main tank by setting the

4-way ball valve handle to 'Chem probe venturi' and OPEN the ball valve in the bottom of the hopper.

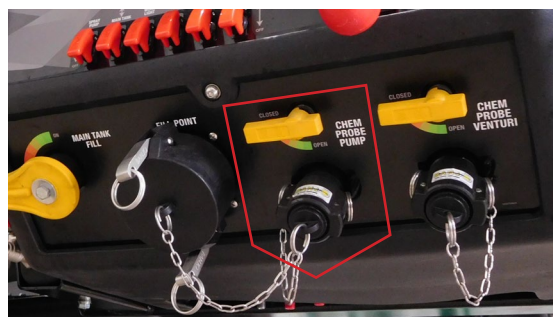
10. Once all of the chemical has been transferred, rinse the chemical container with water and transfer the rinsate to the sprayer tank via the probe. This should ensure that the entire chemical is transferred and that the probe, lines and connecting suction hose are cleaned. Induct clean water to rinse probe hose.

11. When finished, CLOSE the 'Chem probe pump' 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.



Above: EZ control pod functions used when transferring chemical via the electric pump method.



Above: Chemical probe pump cam lock fitting and isolating ball valve.

# Agitation

---

## TO AGITATE WHILE STATIONARY

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.

**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 400 L/min pump agitate for  $4000/400 = 10$  minutes.

## TO AGITATE WHILE SPRAYING

Have the bypass ball valve and agitator ball valves OPEN.

**NOTE:** The bypass ball valve must be open while spraying.

# Spraying

---

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 4200 rpm with the agitator running in order to ensure that the chemical mix is adequately agitated prior to spraying. The expected system pressure range for spraying is between 90-140 PSI or 6-10 Bar.

**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 run boom recirculation for 2 minutes.
3. Commence travel on primary swathe and engage boom master switch. Auto rate controller will now control application based on the calibration information entered by the operator.
4. To avoid overlap it is recommended that individual boom section switches are used to turn on/off sections as needed.

5. When you have completed the task at hand, please follow the flushing instructions to ensure that all plumbing is flushed.

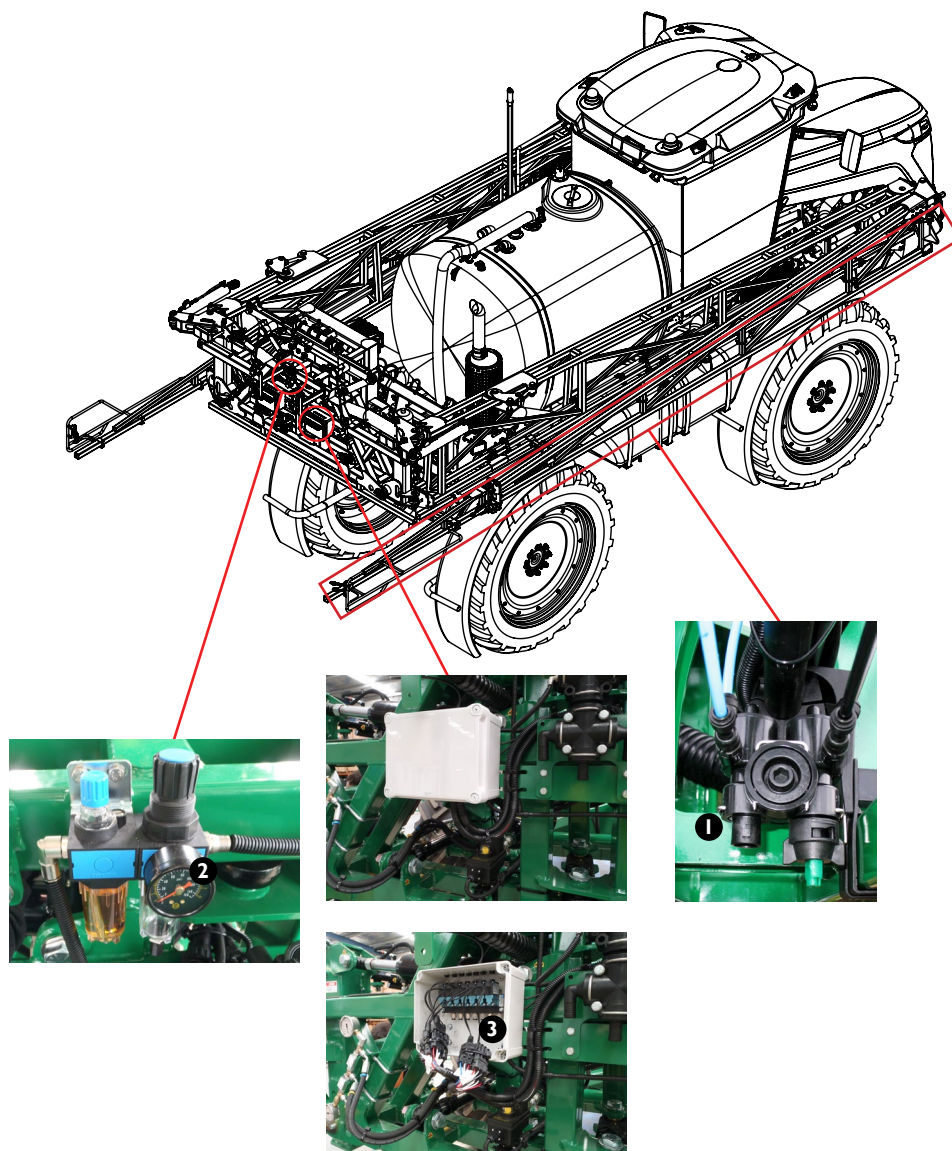


# RapidFire

## 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 AccuBoom shut off systems.



NUMBER	FEATURE
1.	Air check nozzle bodies (multiple along boom wings)
2.	Air dryer/oiler
3.	Air solenoids

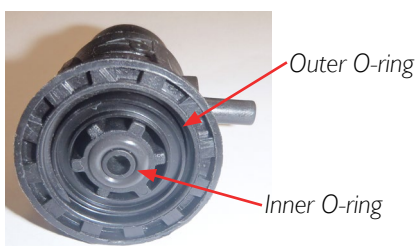
# RapidFire

## 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 140 psi. 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 140 PSI 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.

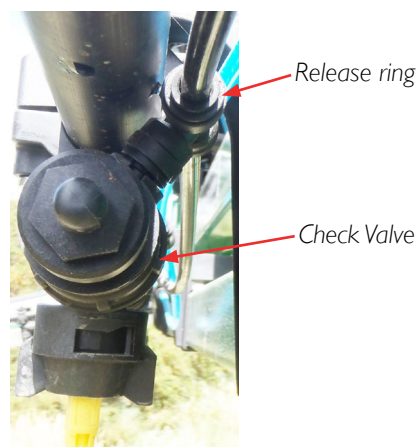
Unscrew the air check valve from the main body. Replace the O-rings that are in the air check valve.

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 RapidFire 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.

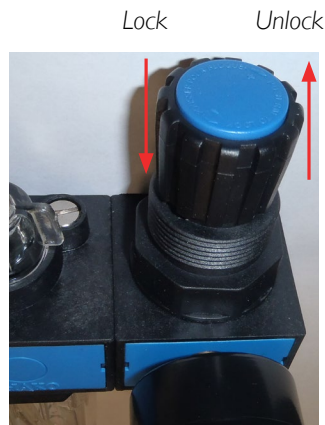
The black knob located above the water trap is used to set the air pressure. To unlock it, lift the black knob. Looking from above, turning the knob clockwise will increase pressure. Turning anti-clockwise will decrease pressure.

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.

*Continued over page*

# RapidFire



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



Oil flow adjustment screw  
- Blue

# RapidFire

## 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.

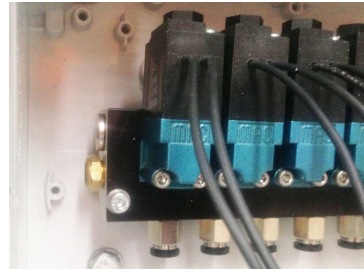


The valve should now be allowing air to flow out to the nozzle and if there is fluid in the lines, it should be coming out of the nozzle.

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.

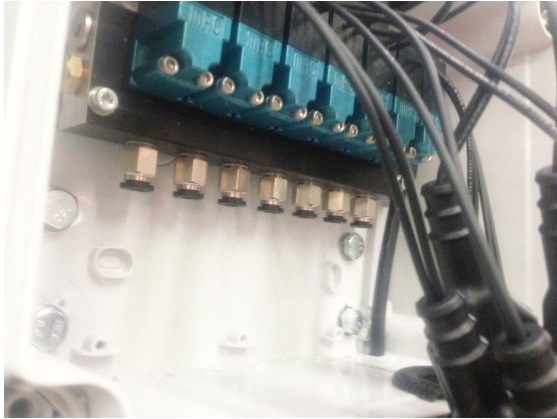
If a section of the boom will not turn on, it may be because that section has a large air leak, in the supply air to the check valves on the nozzles. To find the air leak, spray soapy water on each of the connections along that section. Replace any component that is leaking air. If the air leak can not 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.

*Continued over page*

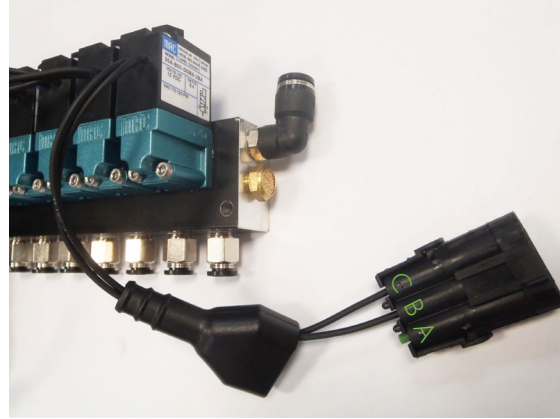


# RapidFire

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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

---

## Overview

RapidFlow is a boom recirculation system. 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.

## 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.

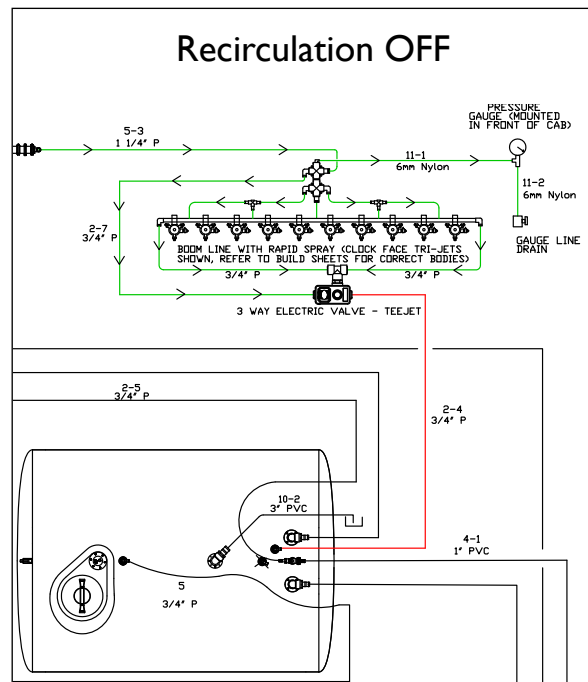
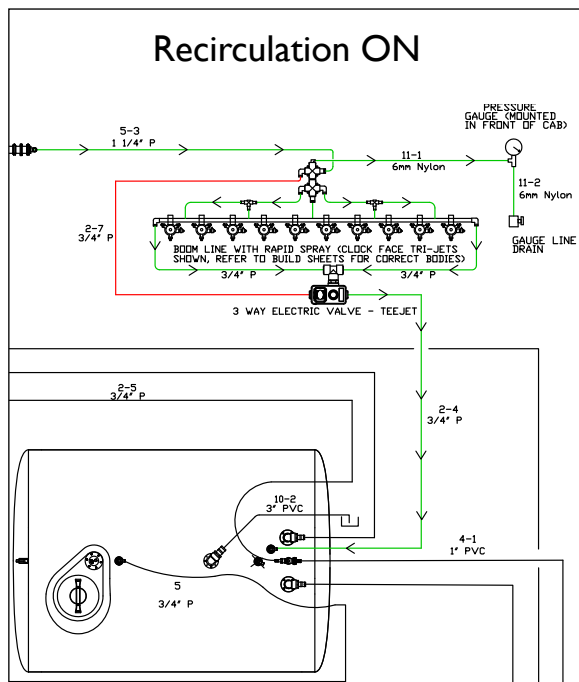
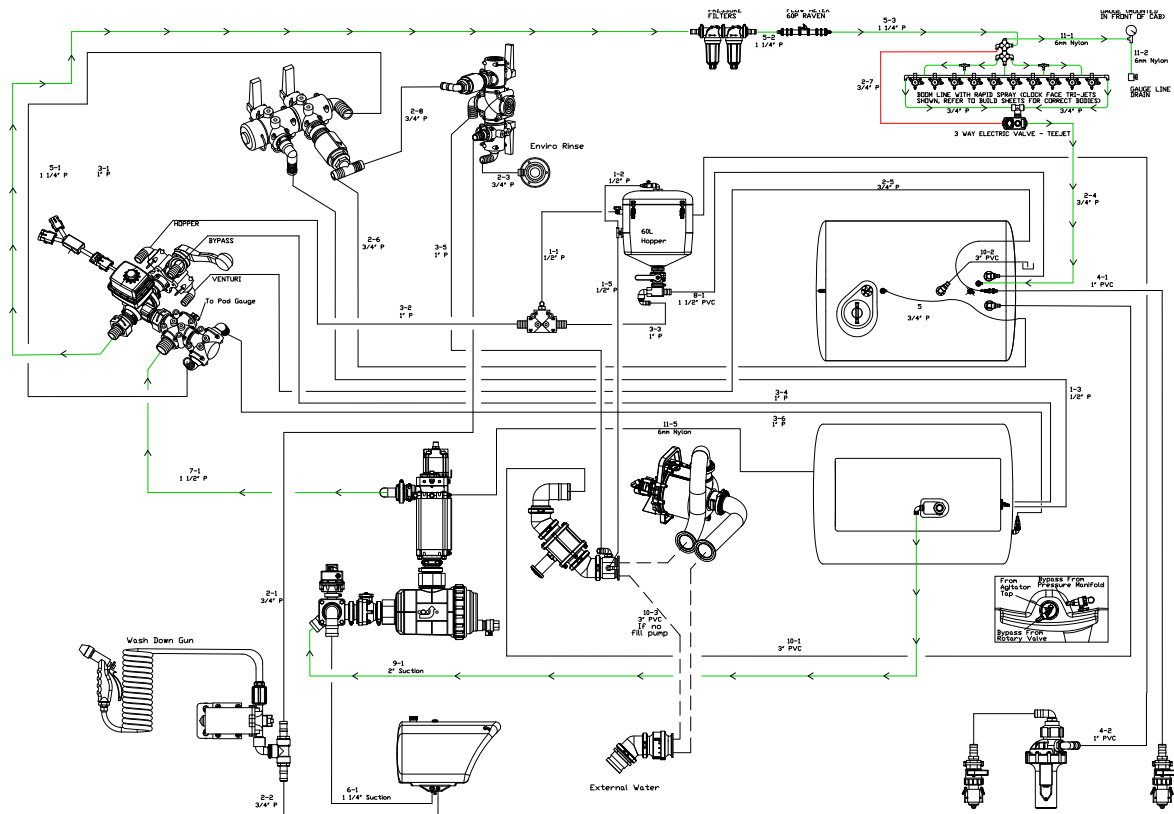
### AFTER SPRAYING (RINSING)

1. Turn off all boom sections on the console.
2. Set spray pump suction mode to rinse 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.

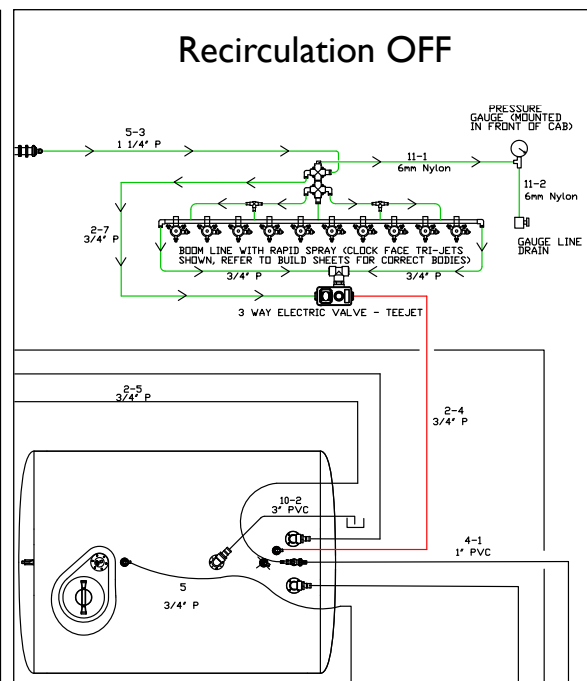
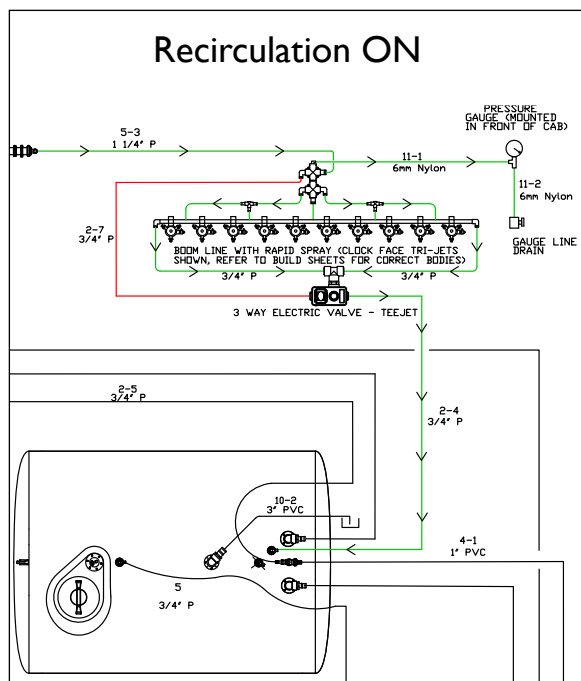
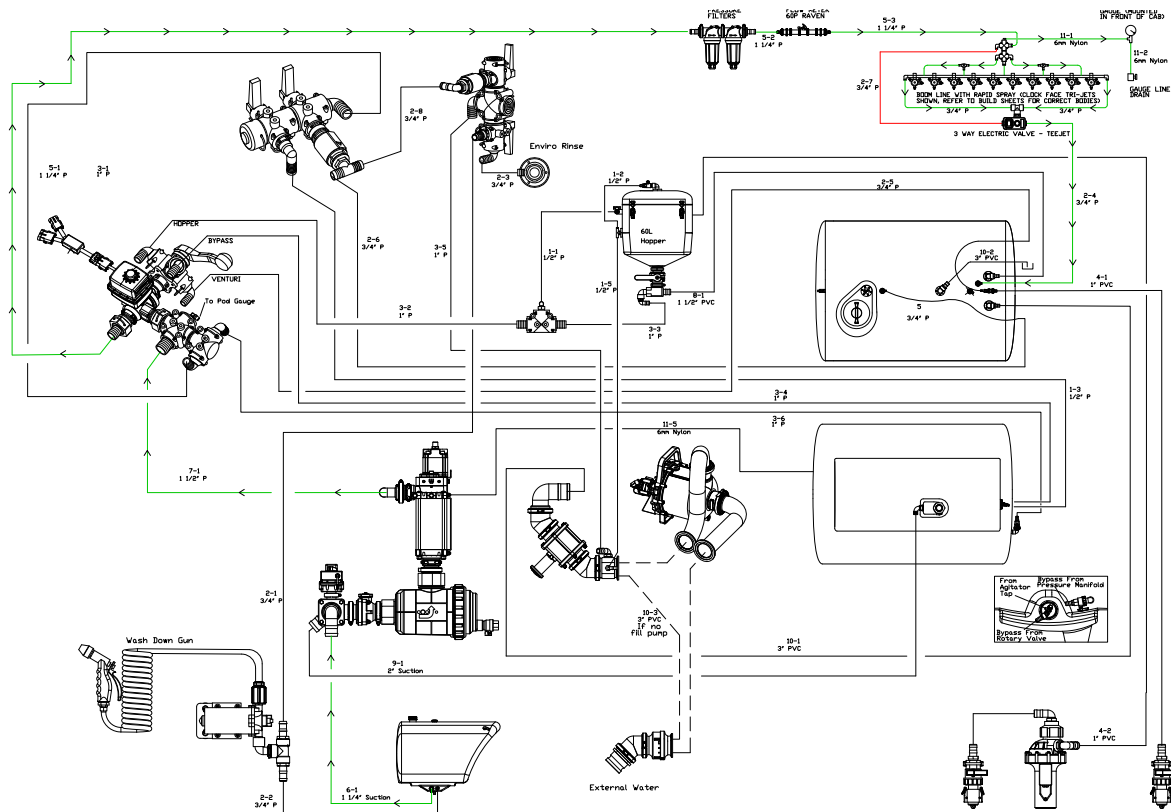
5. Turn off boom recirculation switch.
6. Turn spray pump off.
7. Reset spray pump suction mode back to main tank.

# RapidFlow - Pressure Delivery Schematic





# RapidFlow - Rinsing Schematic



# Flushing

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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 NOZZLES ONLY

This procedure will allow rinse water back into the main spray tank and through the boom recirculation system.

1. Turn spray pump off.
2. Set spray pump suction mode to rinse tank rather than main tank. A buzzer will sound in the cabin and at the EZ Control station, until it is switched back to main tank.
3. Set Raven console into manual mode. Ensure that Boom Recirculation is turned 'OFF'.
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 spray 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. This will allow rinse water back into the main spray tank.

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

## 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' section.
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.

**NOTE:** To rinse out a system with RapidFlow see Chapter 12 'Optional Accessories' RapidFlow section.

# 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 PROCEDURE

1. Fill the main spray tank with approximately 1000 L 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. Operate induction equipment (if fitted), with a quantity of fresh water in order to flush venturi system.
6. Once complete, drain chemical induction hopper delivery hose externally.

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

7. 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.

8. Once the main tank has emptied, flush the system again using fresh water to ensure the decontaminating agent is removed from the system.
9. 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 under the chassis. Turn the 3 way valve off.
10. Remove the filter bowl. As per filter removal instructions.

11. 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.
6. Drain the pressure filters.

## End 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.

**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. Empty spray pump (using suction filter drain with bleed line isolated at front of main tank) and flow meter of all water. 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.

**IMPORTANT:** Make sure any ice has thawed before using sprayer.

# Chapter 9

## BOOMS

### 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 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.

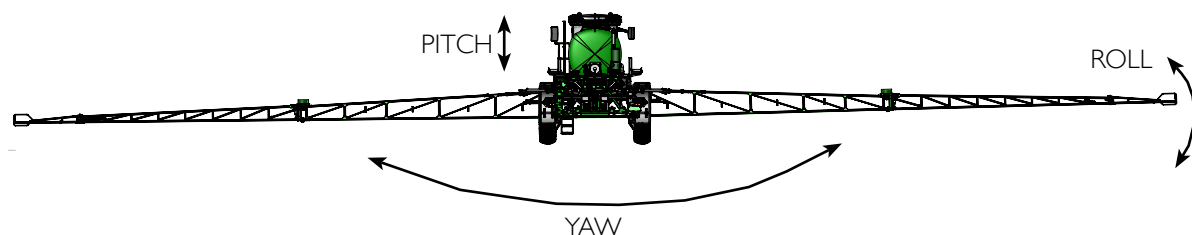
TriTech booms feature a unique (patented) boom suspension system.

This system provides suspension in three directions:

**PITCH** Hydraulic cylinders and accumulators dampen the vertical boom movement encountered over rough ground conditions.

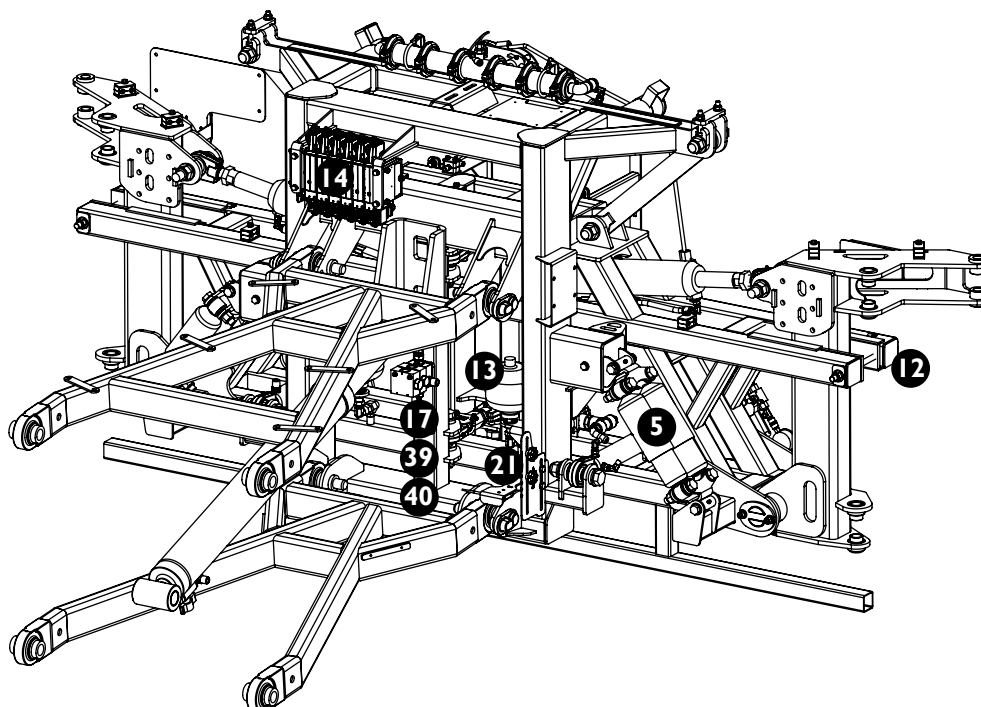
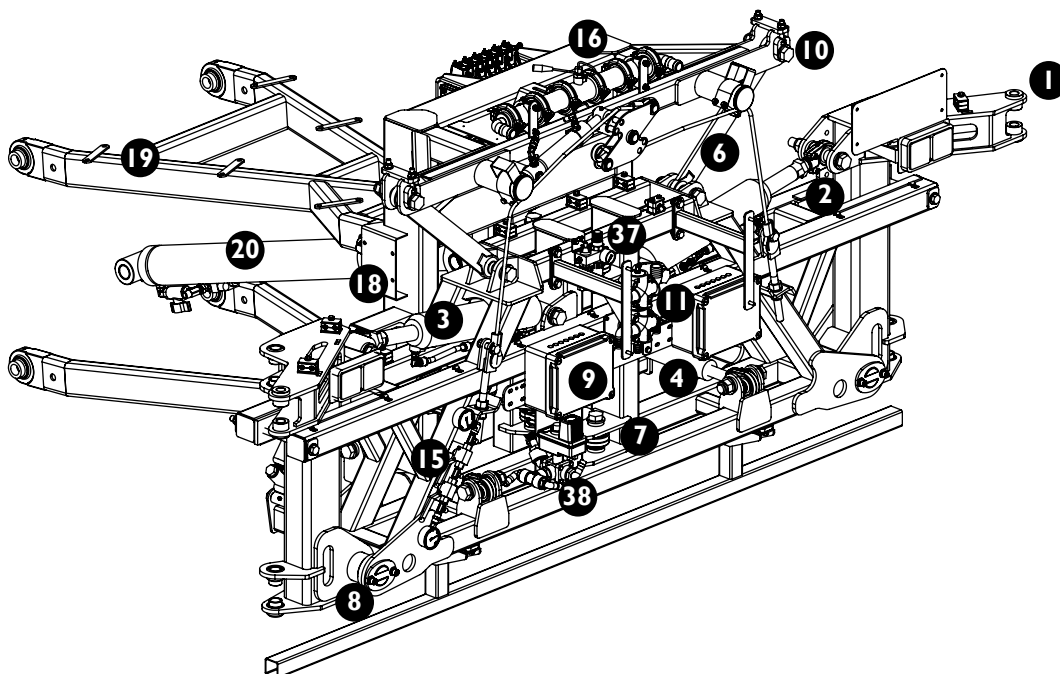
**ROLL** Shock absorbers help maintain constant boom height over sloping and uneven ground.

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



## TriTech Boom Overview

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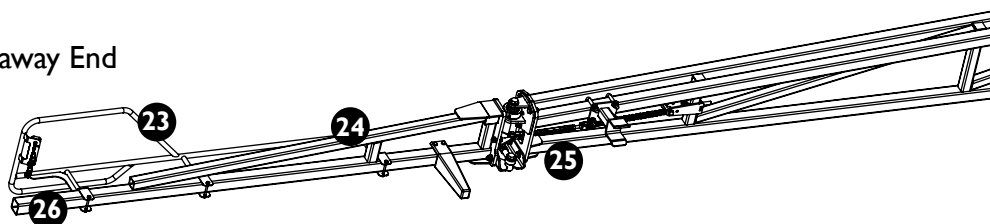
TriTech Centre Section & Paralift

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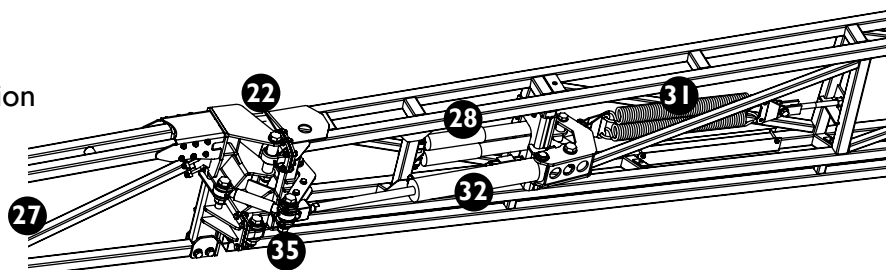


# TriTech Boom Overview

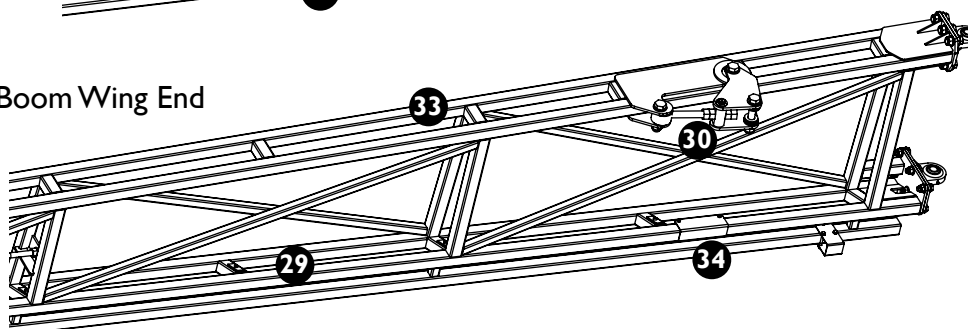
Breakaway End



Mid Section



Inner Boom Wing End



NO.	FEATURE
1.	Boom rose end
2.	Tilt arm adjuster
3.	Tilt cylinder
4.	Yaw cylinder
5.	Roll shocker
6.	Diagonal delta links
7.	Lineal delta links
8.	Tilt pin (60 mm)
9.	Rapidfire solenoid boxes
10.	Boom alignment adjuster
11.	Rapidfire flow distributor
12.	Tilt arm wear strips
13.	Hydraulic yaw accumulators
14.	Electric over hydraulic valves
15.	Hydraulic yaw controls
16.	Flow meter
17.	Hydraulic yaw - Pressure reducing valve
18.	Node mount
19.	Paralift arms
20.	Lift cylinder

NO.	FEATURE
21.	Boom lower limit switch
22.	Boom stopper bolt
23.	Boom end protector
24.	Boom breakaway tip
25.	3D breakaway mechanism
26.	Fence line jet
27.	Boom outer wing (Aluminium)
28.	Bi-fold - dampers
29.	Boom inner wing (Steel)
30.	Adjuster for fold ram
31.	Bi-fold - springs
32.	Bi-fold - hydraulic cylinder
33.	Boom top chord
34.	Boom bottom chord protector
35.	Bi-fold - adjuster rod
36.	Centre Leveling system
37.	Rapidfire oiler & dryer
38.	Rapidflow valve
39.	Flow divider - Fold
40.	Flow divider - Bi-fold

# TriTech Boom Features

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## 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 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 sprayer while the boom centre section will remain static or level as it rotates around the delta links connecting it to the Paralift rear.

Two hydraulic cylinders with individual nitrogen filled accumulators connected to each, centre and dampen the yaw movement. 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.

## Hydraulic Raise & Lower

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

Crop Cruiser 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. Boom maintenance information can be found in the Chapter 10 'Lubrication & Maintenance'.

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 be opened and closed from within the cabin.

Hydraulic cylinders with flow dividers 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.

See Chapter 11 'Troubleshooting' for help with calibrating the boom folding action.

## 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 weights can be included on the boom and placed strategically so that it compensates and balances the boom. The boom 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 in this chapter:

*Continued over page*

# TriTech Boom Features

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## 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 the valve to check if the 3A fuse is blown and replace as necessary.

## 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.

## Nozzles

The standard nozzle spacing on Goldacres booms is 500 mm. 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 catalogues and 'User's guide to spray nozzles' are available from your Goldacres dealer, or as a free download from:

TeeJet web site: [www.teejet.com](http://www.teejet.com)

Lechler web site: [www.lechler.de](http://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.

## 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

Hydraulic yaw suspension is designed to control the yaw movement of the boom centre section. Two hydraulic cylinders with individual nitrogen filled accumulators connected to each, 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.

## Hydraulic Boom Wing Tilts

TriTech 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.

*Continued over page*

# TriTech Boom Features

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## Three Tier System (3TS)

The 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, the 3TS gives you the capacity to vary application rates and speeds by switching extra nozzles on and off. The 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 means 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. The 3TS delivers everything needed for precision application at variable speeds.

## RapidFire & RapidFlow

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 AccuBoom shut off systems.

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.

The RapidFlow system is complimentary to RapidFire and is fitted at the same time.

## Bi-fold

TriTech booms incorporate a hydraulic bi-fold feature which allows the boom outer wings to be folded back independently to make the entire boom roughly half the width.

For example a 36 metre TriTech boom can fold back into 18 metres swathe width for easier spraying in tight situations.

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.

## Norac Boom Levelling - Optional

The Norac 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. The Norac system 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.

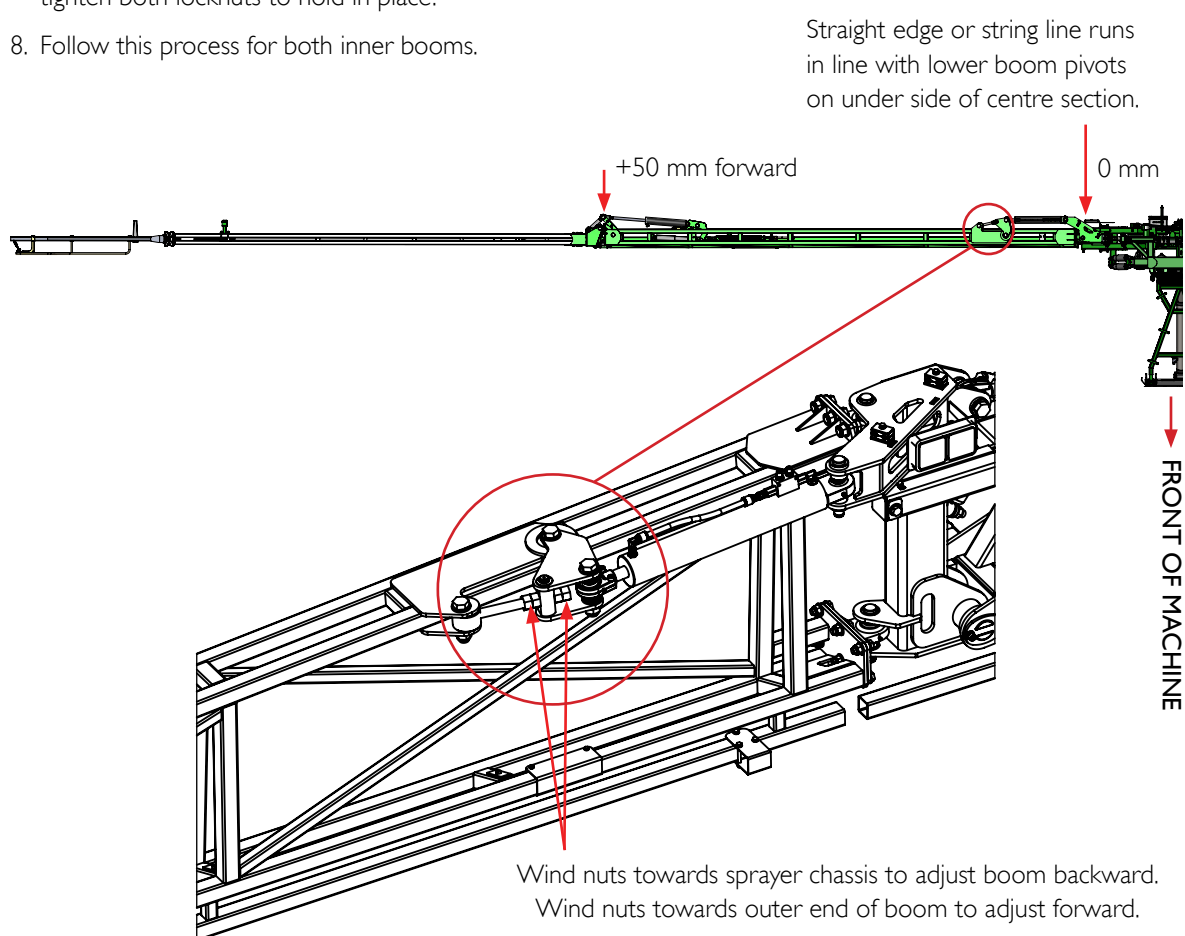
Further information on ultrasonic boom height levelling can be found in the Norac section in Chapter 12 'Optional Accessories'.

# TriTech Boom Adjustment

## Inner Steel Boom Alignment - Unfolded 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 at their full extents.
3. Look along the inner booms assess the alignment.
4. All booms must be 50 mm forward of the centre section at the joint between inner and outer booms. A string line can also be used for measuring the lead of the inner boom (see below).
5. If adjustment is required, loosen the two lock-nuts on the boom fold adjuster bolt at the rear of the boom.
6. Wind nuts towards sprayer chassis to adjust boom backward. Wind nuts towards outer end of boom to adjust forward.
7. When the boom is in the required position tighten both locknuts to hold in place.
8. 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.



# TriTech Boom Adjustment

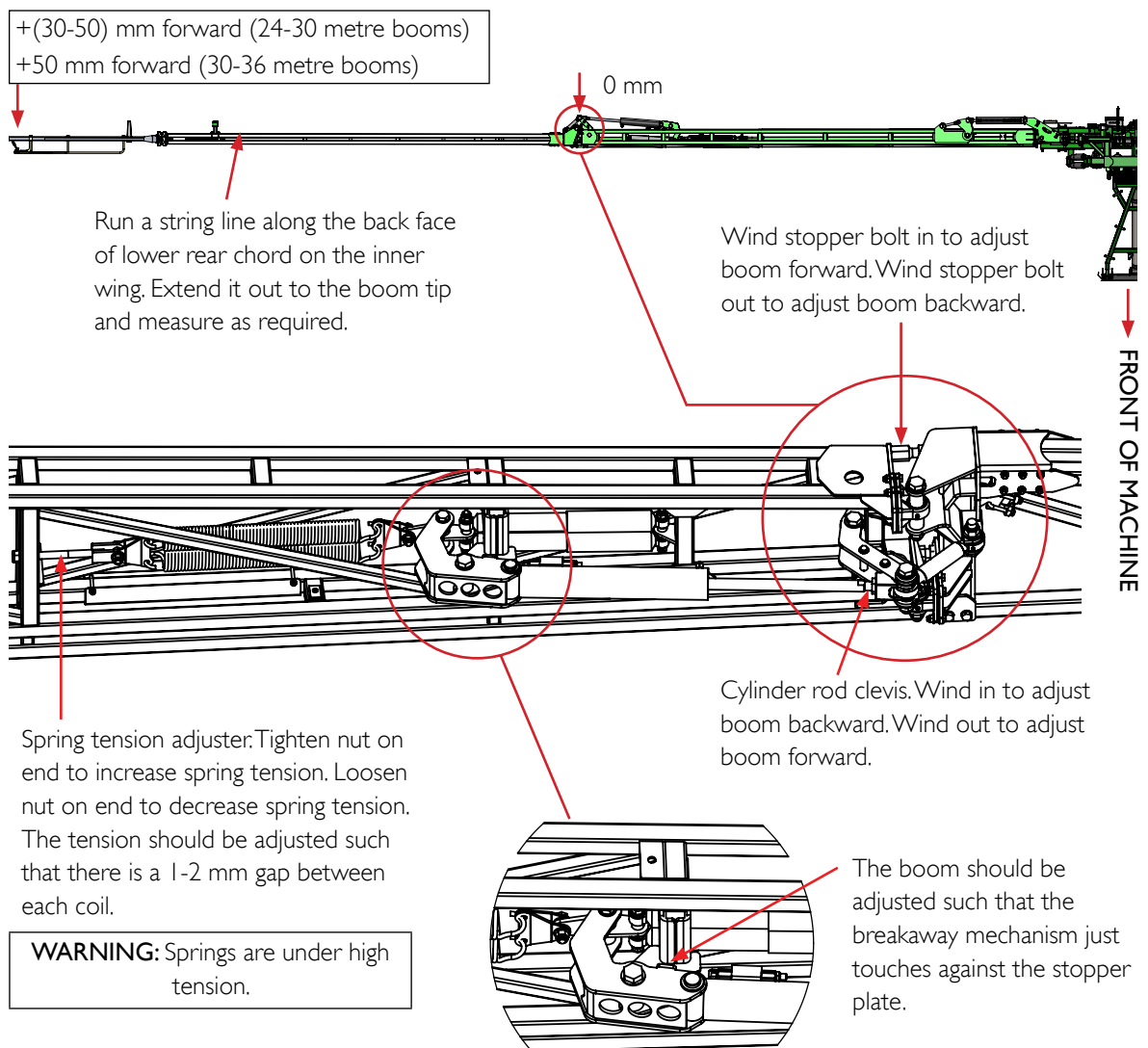
## Outer Boom Wing Alignment - Unfolded Position

1. Adjustment of the outer booms should only be done after the inner booms have been aligned.
2. For 24-30 m booms, the offset is 30-50 mm forward of the inner booms. For 33-36 m booms, the offset is 50 mm forward of the inner booms. Use a string line to assist with achieving the correct measurements.
3. To align the outer booms, the fold adjustment links and boom stopper bolts are used. To pull the outer boom forward, wind in the boom stopper bolt. The spring tension adjuster must also be shortened to maintain the fold mechanism spring tension. At the same time the fold adjustment link must also be lengthened.

4. To adjust the outer boom rearward, wind out the boom stopper bolt. At the same time the fold adjustment link must also be shortened.
5. Once correct alignment has been achieved the cable spring tension must be set so there is a 3 mm gap between the coils.

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

**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.





# TriTech Boom Adjustment

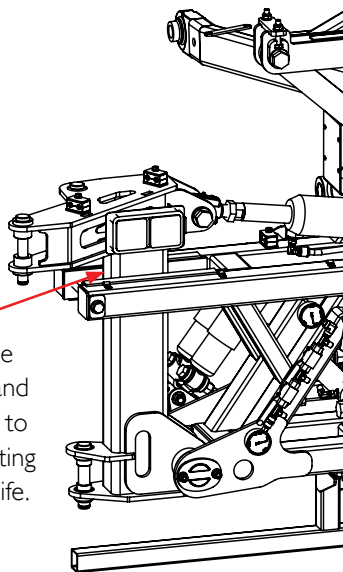
## TriTech Vertical Boom Alignment

When the boom is in the unfolded position, the inner and outer boom should be level or slightly increasing in height from the centre section relative to the ground 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 12 months of operation until the boom settles.

### INNER BOOMS - UNFOLDED

- 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 looking from the rear. This can be done by shortening or lengthening the centre section adjuster bolt at the top delta links.
- 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.

**NOTE:** Keep distance between wear pad and tilt arm at 0-0.5 mm to prevent tilt arm twisting to prolong product life. Replace wear strips when necessary.



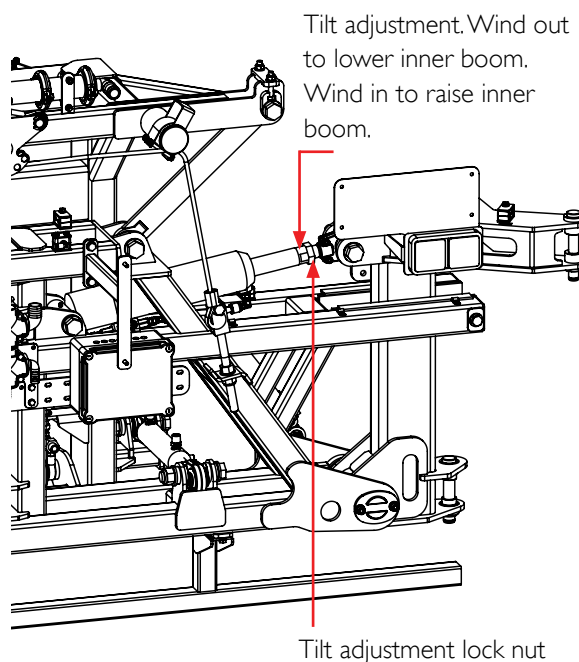
- To lengthen or shorten the tilt adjusters, the weight of both the booms will need to be supported.
- Ensure the lock nuts are tightened firmly once adjustments are complete.

### INNER BOOMS - FOLDED

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. The outer boom must saddle onto the inner boom. If the outer boom will not saddle correctly, it will not be supported in transport and will become damaged.

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:** Some regular adjustments will be required in the first 6 months of operation as the booms stretch and settle in.



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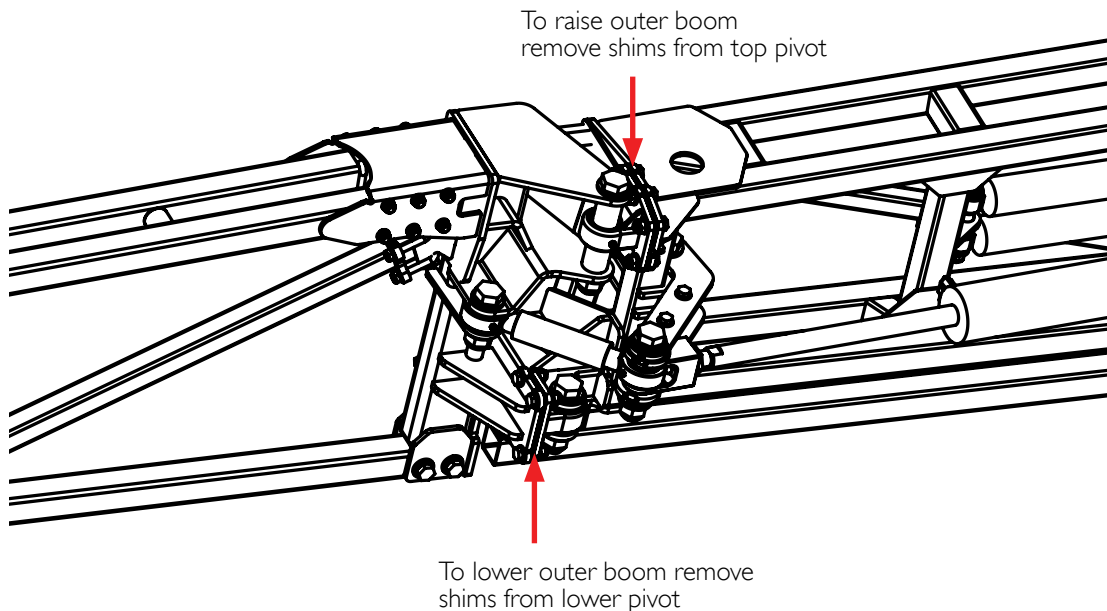
# TriTech Boom Adjustment

## OUTER BOOMS - UNFOLDED

- The height of the outer booms in the unfolded position are adjusted by adding or removing shims at the pivots between the outer and inner boom.
- There are 6-7 shim plates fitted at the time of manufacturing between each upper and lower pivot mount and the boom wings.
- 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. Re-tension the retaining bolts to 65 Nm when all adjustments are complete.

## OUTER BOOMS - FOLDED

- If the outer boom hangs too low in the folded position shims must be added to the 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.



### For 24-30 m booms:

1 shim added = 10-20 mm change at boom end

### For 33-36 m booms:

1 shim added = 20-30 mm change at boom end

# TriTech - Aluminium Outer Boom - 30-36 m

## Initial Setup

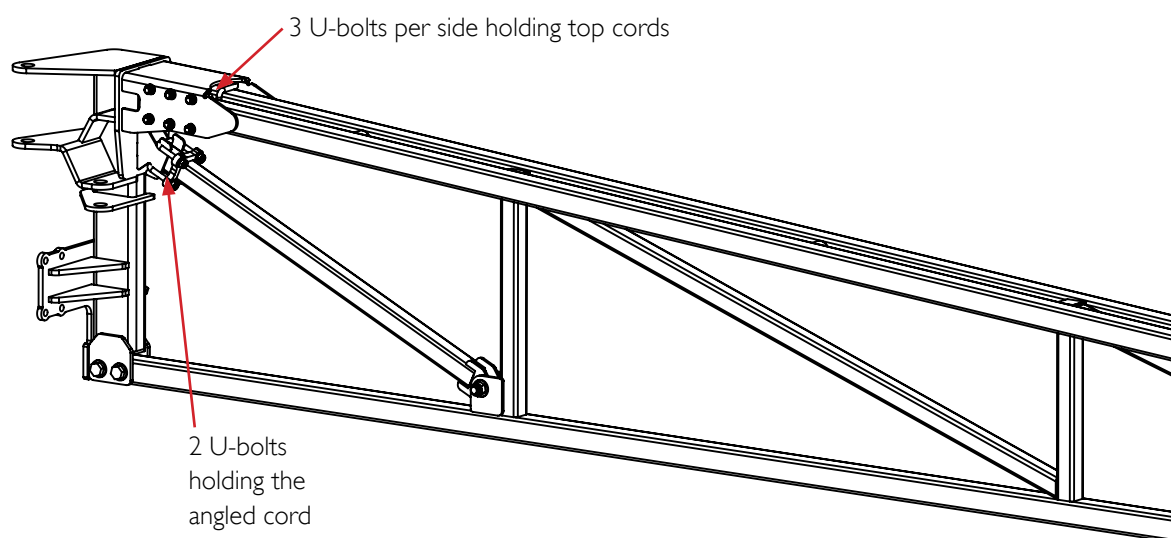
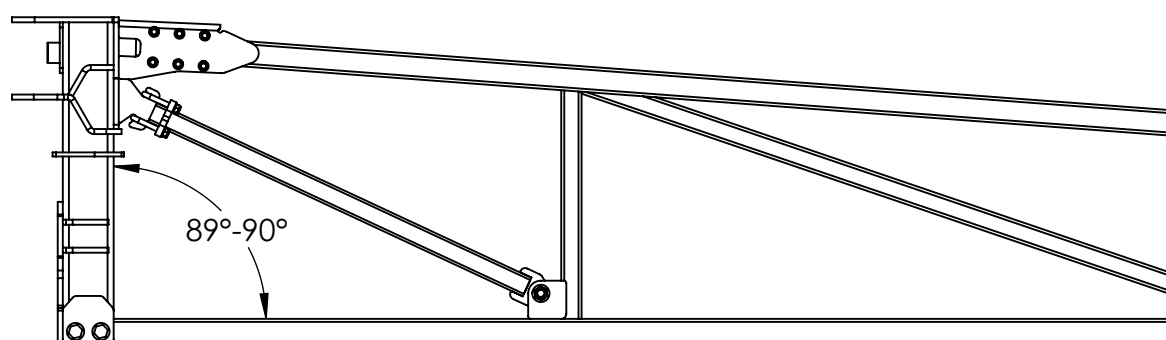
When the booms are fitted at the factory, they are made level or slightly increasing in height from the centre section. Under working conditions the aluminium outer booms will need to be checked at every 50 hour intervals as per the Maintenance Schedule.

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 inner to outer boom pivots to get the booms level. Refer to section 'TriTech Vertical Boom Alignment - Unfolded 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 cord angle is between 89-90 degrees. Then tighten all U-bolts to 30 ft/lbs.



# TriTech - Hydraulic Yaw Suspension

## Overview

Two hydraulic cylinders with individual nitrogen filled accumulators connected to each, centre and dampen the yaw movement.

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.

## Circuit Bleeding

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 cylinder by rotating the Paralift cylinder ball valve 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. Remove bleed hoses.

## Setting 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 cylinder by rotating the Paralift cylinder valve to the off position.



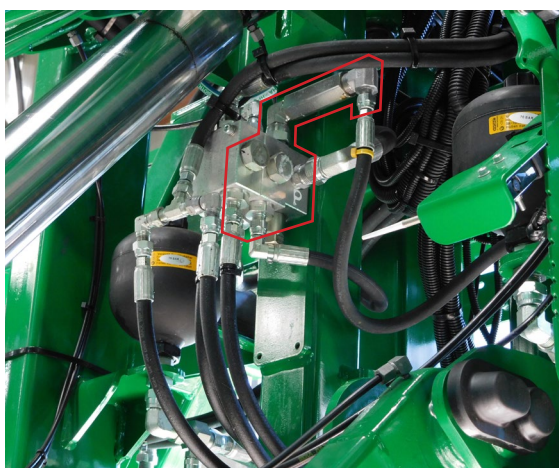
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# TriTech - Hydraulic Yaw Suspension

4. Open the hydraulic yaw charge ball valves.



5. Identify the pressure reducing valve.



6. Loosen the adjustment lock nut on the underside 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' function 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 set correctly, charge the circuit as described in next section 'System Charging'.

## System Charging

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).

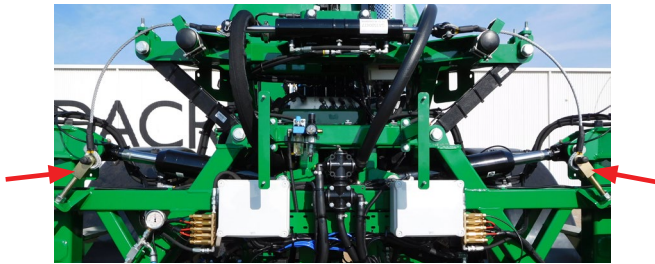
## TriTech - Centre Level

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If the centre and the booms tilt excessively when folding, the centre level cables may need to be adjusted.

To check if the booms are tilting when folding, have somebody stand behind the sprayer out of the boom reach, and watch to see which way the booms tilt when folding.

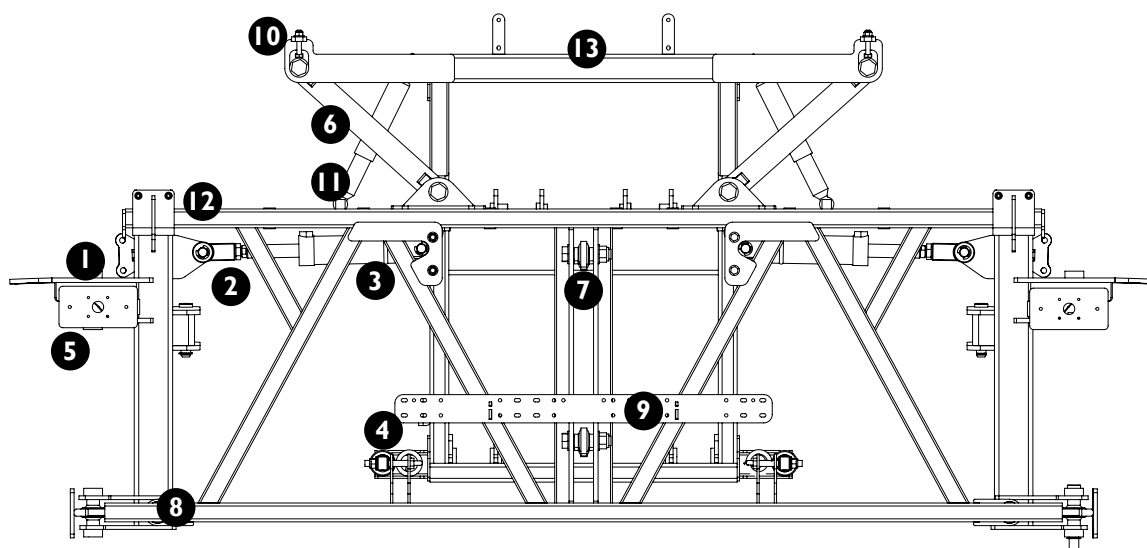
Then unfold and adjust the cables to compensate for the tilt. Then repeat procedure until the booms are level when folding.



**Above:** Centre level cable adjusters.

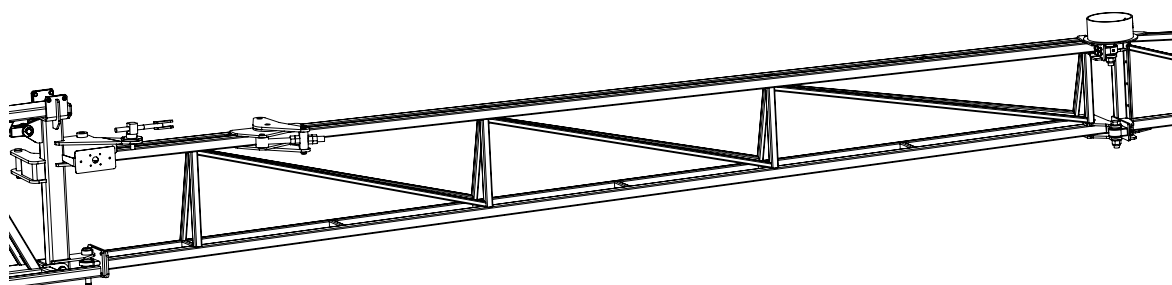


## Delta Boom Overview

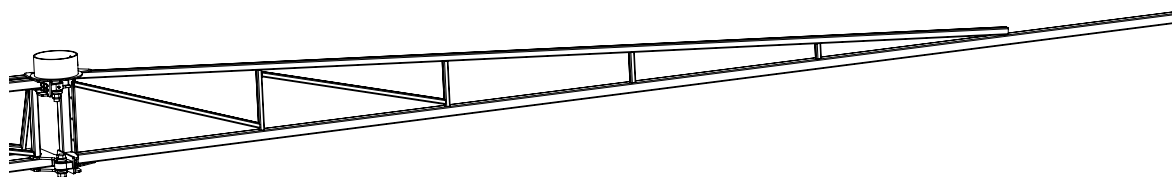


NO.	FEATURE
1.	Boom rose end
2.	Tilt arm adjuster
3.	Tilt cylinder (optional)
4.	Yaw spring (or cylinder) mount
5.	Tail light mounting plate
6.	Diagonal delta links
7.	Lineal delta links

NO.	FEATURE
8.	Tilt pin (40 mm)
9.	Boom section controls
10.	Boom alignment adjuster
11.	Roll shocker
12.	Tilt arm wear strips
13.	Flow meter
-	Electric over hydraulic valves (option)



Inner Wing



Outer Wing

# Delta Boom Features

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## 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 acts when the boom pitches up and down at the tips. Yaw suspension acts 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 a combination of springs and dampers. 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 & 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 in the vertical suspension system. Each hydraulic cylinder is connected to an individual nitrogen charged accumulator which smooths out 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 once folded in.

## Hydraulic Fold

The 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 will open and

close together so that the weight distribution is the same on 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 Chapter 11 'Troubleshooting'.

## 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 sit at the same height.

To achieve this, a boom counterweight can be included on the boom and placed strategically so that it compensates for the opposite end and balances the boom. The different sized counterweights can be used and/or moved to help 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, Paralift 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.

*Continued over page*

# Delta Boom Features

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## 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, which in turn opens or closes flow to the boom sections as required.

In the event of valve failure, unscrew the top cap and check the fuse (3A) is not blown as a first step.

## Nozzles

The standard nozzle spacing on Goldacres booms is 500 mm. 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

Delta booms from 24 metre width 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 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 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

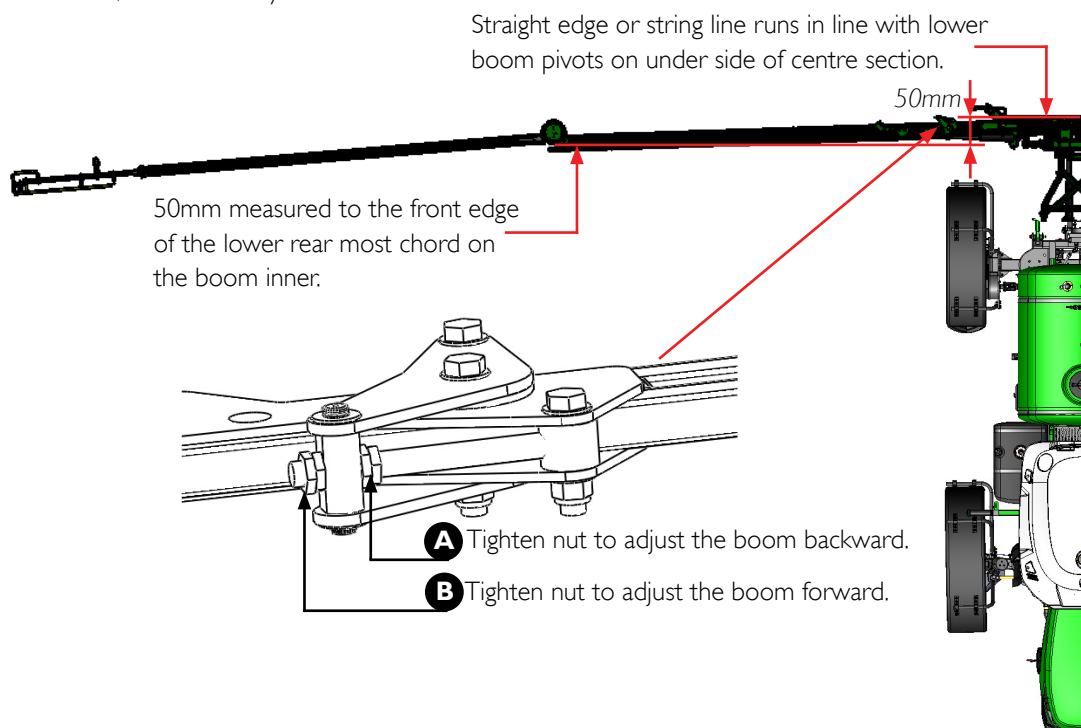
## Inner Steel Boom Alignment - Working Position

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 50 mm 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.



# Delta Boom Adjustment

## Outer Boom Wing Alignment - Unfolded Position

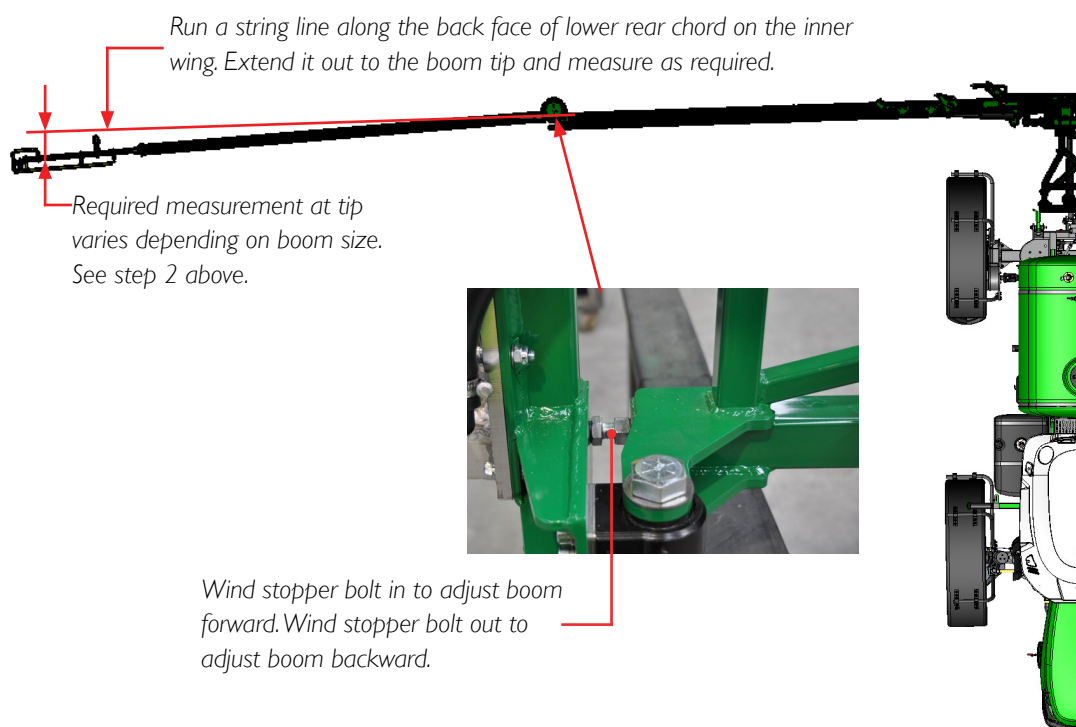
1. When adjustment of the inner booms is complete, the outer booms can be aligned.
2. Outer booms must be 30-50 mm forward of the inner booms. Use a string line to assist with achieving the correct measurements.
3. To align the outer booms, the cable adjusters and boom stopper bolt are used. To pull 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 needs to be set so there is a 3 mm gap between each coil.

**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 have the same adjustment. 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.

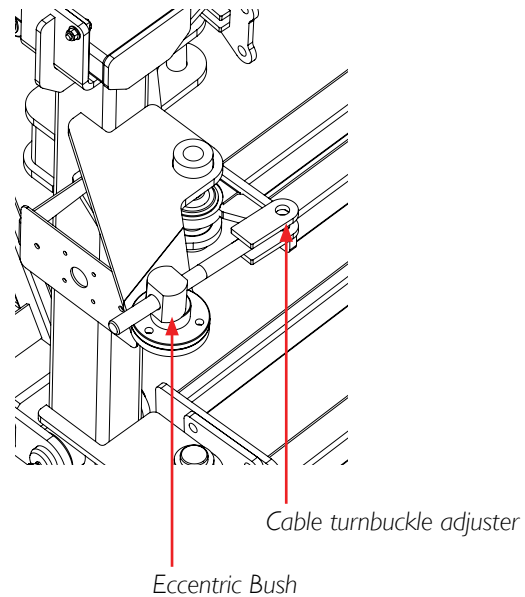


# Delta Boom Adjustment

## Outer Boom Wing Alignment - 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 3 mm 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.





# Delta Boom Adjustment

## Vertical Boom Alignment - Unfolded 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 12 months of operation until the boom settles.

### INNER BOOMS

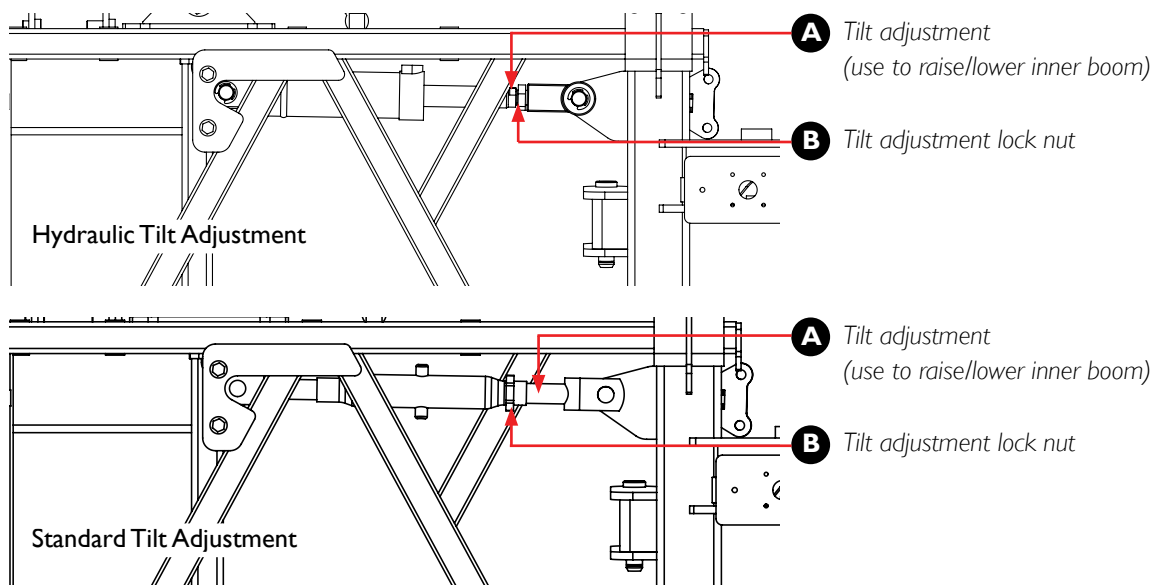
- The boom centre section must be level with the chassis before any boom adjustments are made. The centre of the centre section should line up with the centre of the Paralift when look from the rear. This can be done by either shortening or lengthening the centre section adjuster bolt at the top delta 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

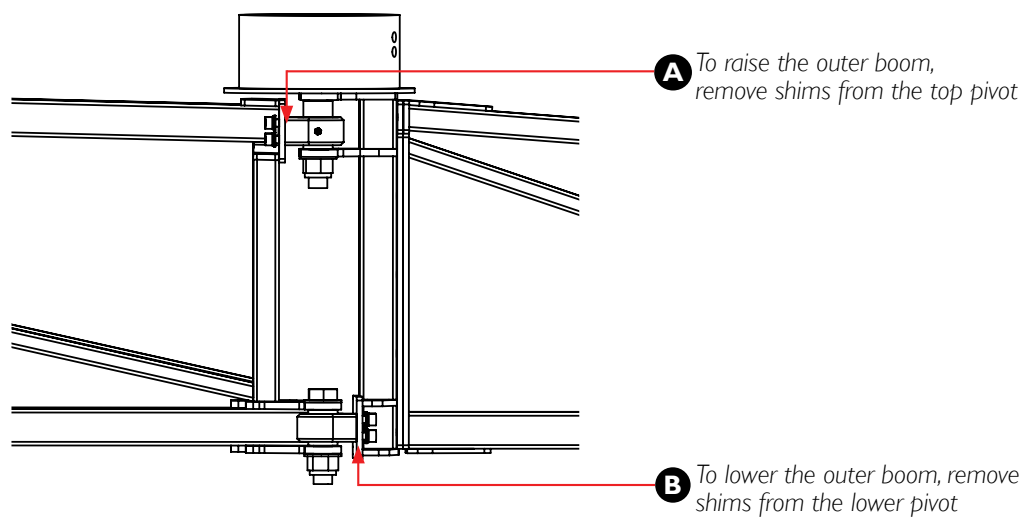
- The height of the outer booms in the working position are adjusted by adding or removing shims at the cable drum.
- The cable drum mounts are assembled in manufacturing with 6-7 shims at the upper and lower bearing blocks.
- If the outer boom hangs lower than the inner boom, remove shims from the upper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

### For 18-24 m booms:

1 shim added = 5-15 mm change at boom end

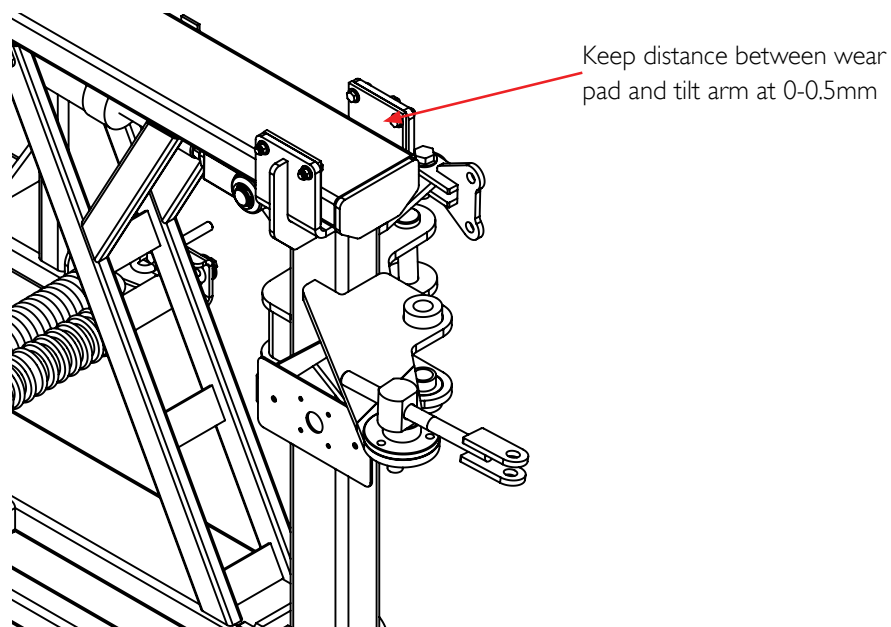


## Delta Boom Adjustment



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.



# Delta Boom Adjustment

## 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 is 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 is out the outer boom will not saddle correctly and will not be supported in transport.

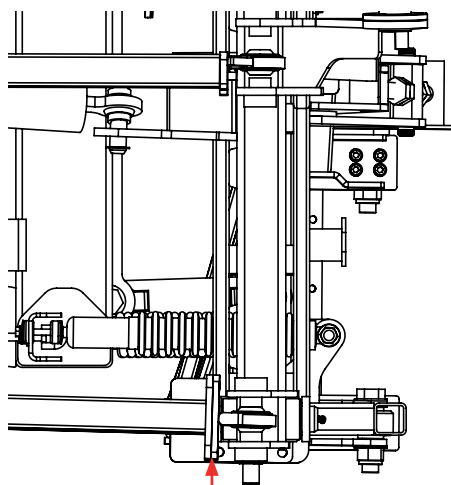


Diagram A

Place shims here

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 required in the first 6 months of operation as the booms stretch and wear 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 1 mm shim at the upper and lower pivots equals approximately 15mm change in height.

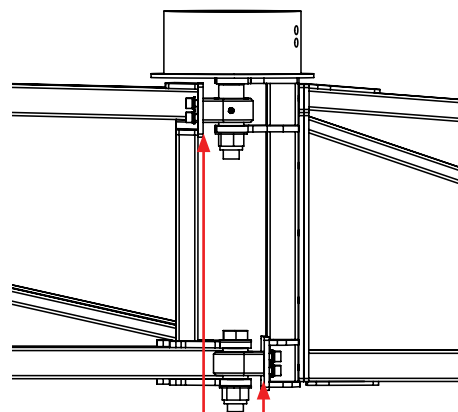


Diagram B

Place shims at both pivots

# Delta & TriTech - Three Dimensional Breakaway

## 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 52 mm from the boom tip face plate to the centre of the rose end (fig. B). Apply Loctite 243 thread lock to the grub screw and fasten.
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).
6. The spring tension must be adjusted so there is a 1-2 mm 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.

## TO ADJUST TURNBUCKLE

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.

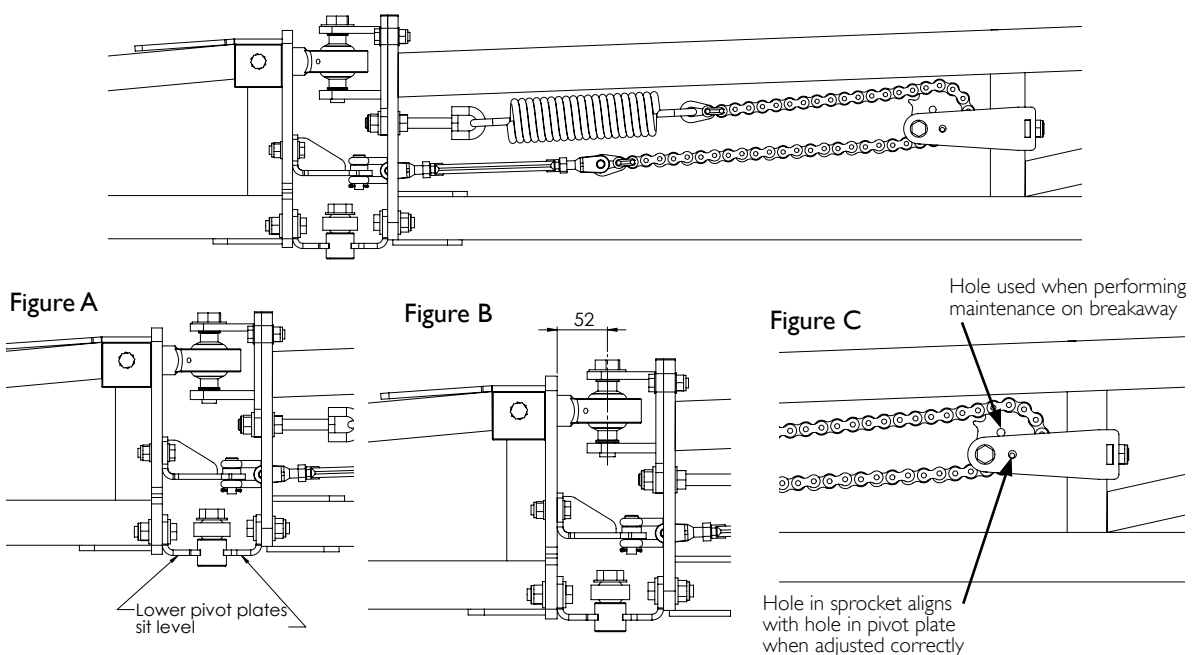
Make adjustments to turnbuckle. Pull tip back and remove the pin. Release the tip and check alignment of small hole in sprocket with pivot plate.

Repeat previous steps until the small hole in the sprocket and hole in the side plate align.

## Maintenance

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

- 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 - Initial Setup) and the spring tension. Check these on a regular basis and adjust as required.
- The spring will stretch over time and will lose tension. A spring is worn and should be replaced when there is no tension on the spring and it doesn't fully retract.
- To ensure the smooth and long lasting operation of the breakaway mechanism, it 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.



# Delta & TriTech - Boom Operation

---

## Folding Operation

### FOLDING PROCEDURE:

1. Starting with the boom in the working (unfolded) position, use the switch to tilt the wings down.
2. Use the 'Boom' UP switch in cabin to raise the boom fully.
3. Use the 'Boom Fold' IN switch to fold the boom completely in.
4. Use the 'Boom' DOWN switch in cabin to lower the boom until the boom just touches the rests.
5. Then continue to lower the rear of the boom a further 100 mm so as to put sufficient weight onto the rests.

### UNFOLDING PROCEDURE:

1. Use the 'Boom' UP switch in cabin to raise the boom fully to clear the boom rests.
2. Use the 'Boom Fold' OUT switch to fold the boom completely out so that the boom is aligned with the centre section.
3. Use the 'Boom' DOWN switch in the cabin to lower the boom to the desired height above the target.

**DANGER:** Always check for power lines while folding and unfolding the boom, as contact with lines can be fatal.

**WARNING:** 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.

**WARNING:** 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.

**NOTE:** To make the boom fold cylinders extend or compress equally on both sides, continue holding the 'Boom Fold' OUT button once the boom has fully unfolded or hold 'Boom Fold' IN once the boom has fully folded for a few extra seconds.



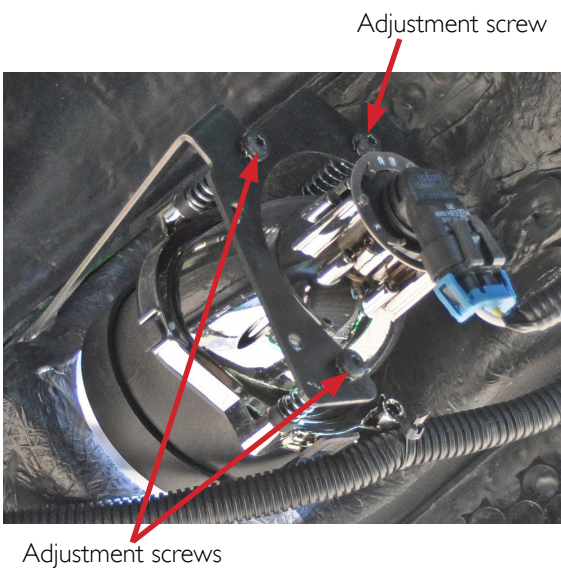


## LUBRICATION & MAINTENANCE

### Headlights

The headlights use an HB3 globe type globe. 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 instruction in reverse. Ensure bonnet has been re-clipped before driving.

Headlight alignment can be made by adjusting the three screws located around the headlight body. Make a change and then check to see the movement was in the correct direction.



SERVICE ITEM	PART NO. - GOLDACRES	PART NO. - GENERIC
Headlight - Low Beam	GA3000082	HB3 12V 60w

# Engine

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## Opening Bonnet

The bonnet is fastened down by two latches on either side. Once open, the bonnet is supported by over centre weight.

**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 on the machine.

The first filter is an in-line filter that is located on the back of the battery compartment, on the right hand side of the machine.

The water separator or primary filter is mounted on the back of the battery compartment, in the centre between the suspension links. This filter is the second point from the fuel tank, 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 an excessive amount of water is detected in the fuel.

This filter should be replaced within the first 50 hours of use and then every 250 hours of engine operation. The water trap at the base of the cylinder should be drained daily.

The Secondary filter is mounted on the rear left hand side of the engine. This filter is finer than the primary filter.

**NOTE:** Filter specifications can be found in 'Recommended Lubricants' section at the beginning of this chapter.

## Engine Oil & 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 'Recommended Lubricants' section of this chapter.

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 remote 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 through the rocker cover on the top of the engine or the filler located near the dipstick. The oil 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 'Recommended Lubricants' section at the beginning of this chapter.

## 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 50 mm below the lid when the engine is cool.

**NOTE:** Coolant level must be checked DAILY.

**CAUTION:** 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 'Recommended Lubricants' section at the beginning of this chapter.

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

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## 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 loses its tension it can also cause the belt to slip and must be replaced. The belt should be replaced every 1000 hours.

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 12 mm deflection in the belt when it is tensioned correctly. The compressor belt should be replaced every 1000 hours.

## 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.

**NOTE:** Filter specifications can be found in 'Recommended Lubricants' section at the beginning of this chapter.

# Drivetrain - Transmission & Transfer Case

The Danfoss transmission pump hydraulic oil level should be sighted between the level indicators on the reservoir tank behind the engine. Filling and draining of the oil level is done through this common hydraulic system reservoir. See 'Hydraulics' section in this chapter for more information.

**NOTE:** The transmission pump does have its own fill and drain plugs which should only be used during disassembly for service or repair purposes.

The transfer case oil level can be sighted through the inspection port on the side of the casing.

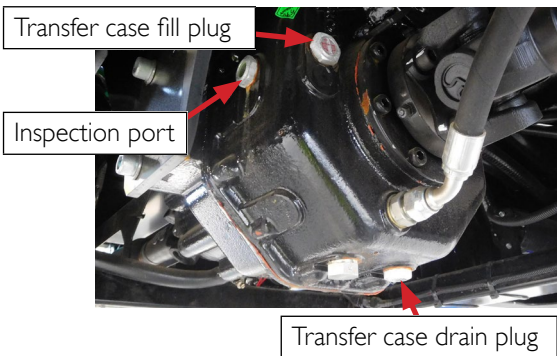
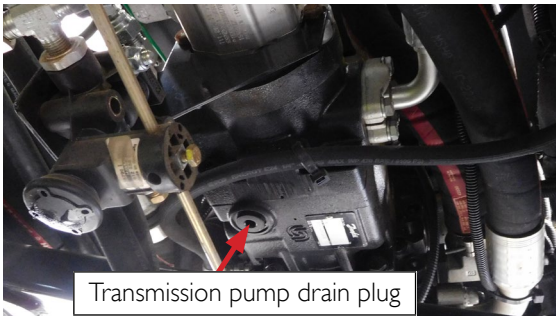
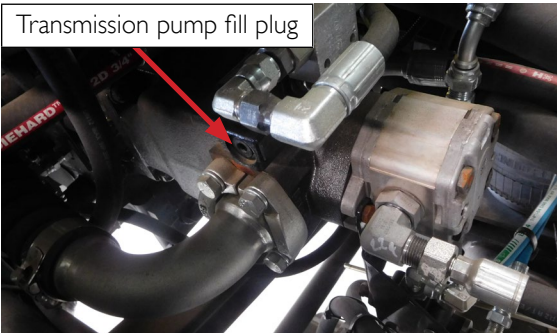
## Transmission Oil Cooler

The transmission oil cooler is integrated into the cooling package and makes use of a thermal bypass valve set at 45 °C.

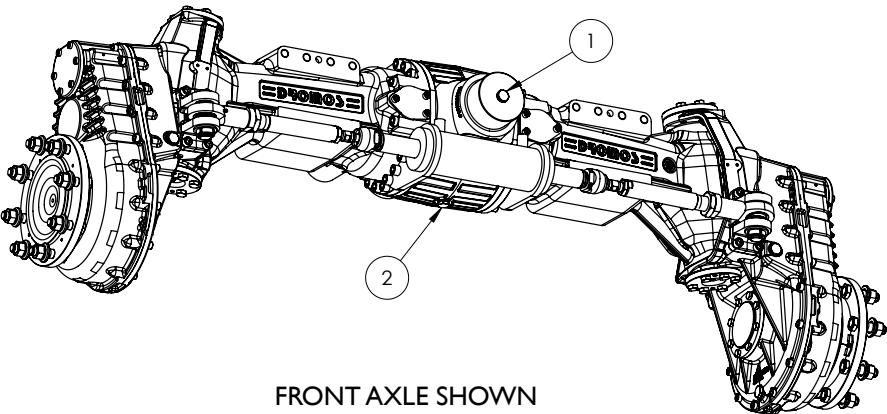
## Transfer Case Oil Cooler

The transfer case oil cooler runs through a dedicated cooler mounted under the cabin. It has a fan that runs on a 12V circuit. It is a closed loop, forced lubrication system.

Refer to the maintenance schedules and the Lubricants and Filters charts for servicing requirements in Chapter 10 'Lubrication and Maintenance'.



# Drivetrain - Differentials

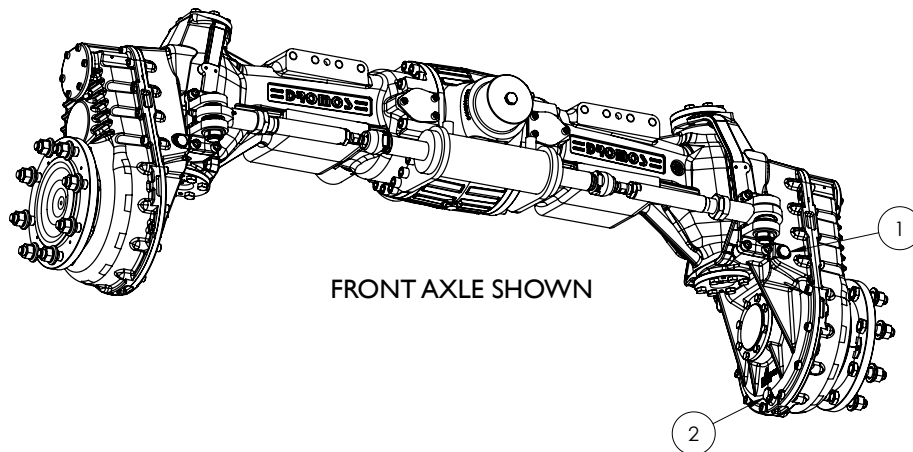


FRONT AXLE SHOWN

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

NUMBER	FEATURE
1.	Oil level check/fill plug
2.	Oil drain plug

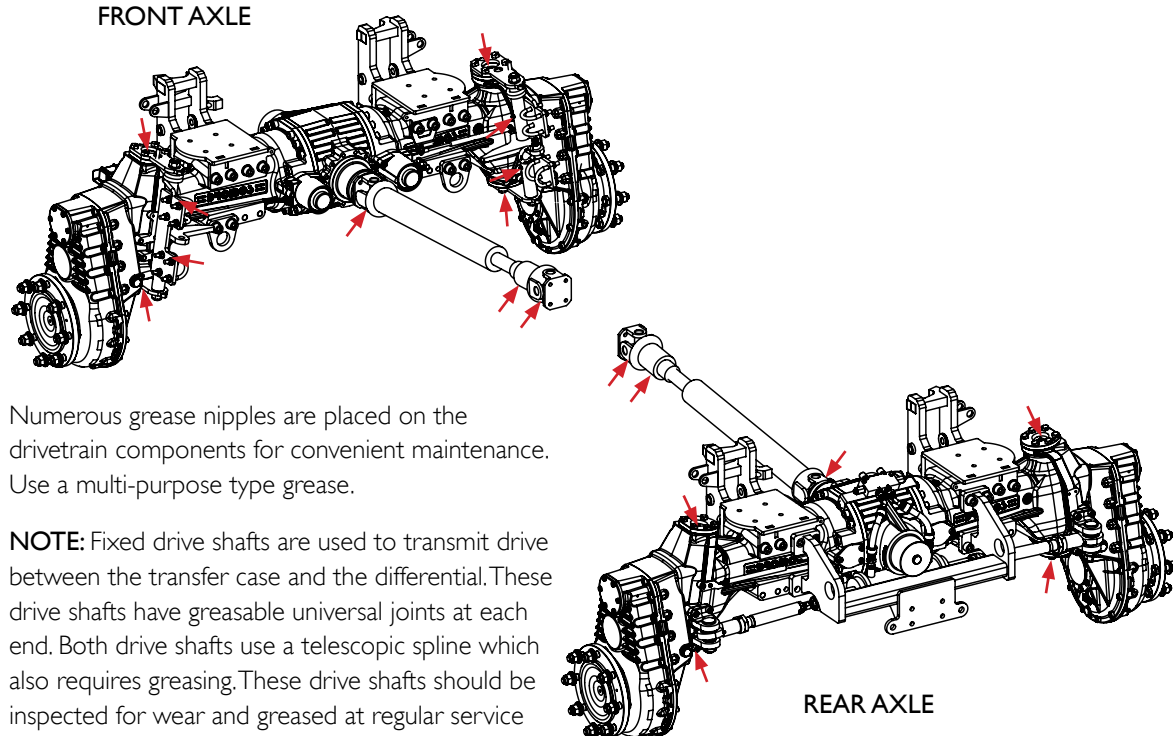
## Drivetrain - Droplegs



This machine runs gear driven drop legs. Drive is transferred from the differential through drive shafts to the input shaft of the drop leg.

NUMBER	FEATURE
1.	Oil level check/fill plug
2.	Oil drain plug

## Drivetrain - Grease Points



Numerous grease nipples are placed on the drivetrain components for convenient maintenance. Use a multi-purpose type grease.

**NOTE:** Fixed drive shafts are used to transmit drive between the transfer case and the differential. These drive shafts have greasable universal joints at each end. Both drive shafts use a telescopic spline which also requires greasing. These drive shafts should be inspected for wear and greased at regular service intervals found in 'Maintenance Schedules' at the end of this chapter.

**NOTE:** The front mudguard brackets are movable and also require greasing.

# Suspension

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The five point suspension system used on the machine consists of four parallel links, one Panhard rod and two 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 axle 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 machine 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.

## 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 Panhard 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" high tensile bolts. These links hold the axle in place while the bushes allow deflection when the wheels come 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 checked for damaged rubbers or oil leaks.

## Panhard Rods

The Panhard rods fitted to the machine are designed to prevent any sideways movement of the axles and to 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 two ride height valves which level the sprayer; the front axle has one ride height valve in the middle of the axle which maintains the required height and allows it to pivot freely.

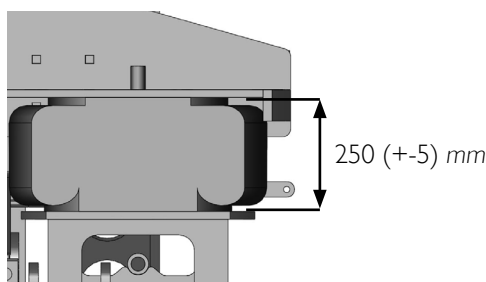
## Airbag Height settings

The distance setting for the air bags should be 250 (+/-5) mm for both front and rear. If this distance is not maintained the angle of the drive shaft changes to cause a vibration and possible damage to the drivetrain.

*Continued over page*



# Suspension



The air bags are measured from the inside of the top mount to the top of the bottom mount.

## PROCEDURE TO EVACUATE AIR BAGS FOR TRAILER TRANSPORT

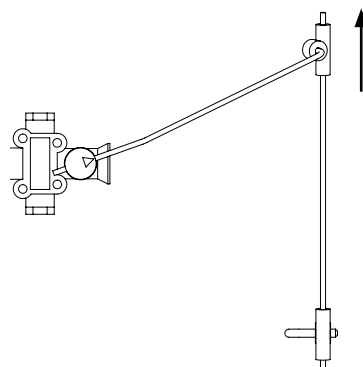
Loosen the drain tap on the air tank and drain the air. Loosen the fitting on the top of the air bag mount and release the air in the air bags. The air bags will lower on to the bump stops. Once the machine is on the bump stops tighten up the air tank valves and the fittings to the air bags. Don't alter or change the height control valve linkages to release the air.

## Ride Height Valve Adjustment

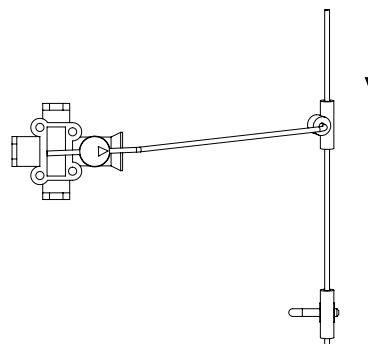
The ride height valves are used to adjust the air pressure within the air bags to maintain the correct ride height. There are two ride height valves located on each side of the rear axle and one located in the centre of the front axle.

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, this is normal. They will refill when the machine is started.



**Above:** To raise the machine, move the arm up the vertical rod.

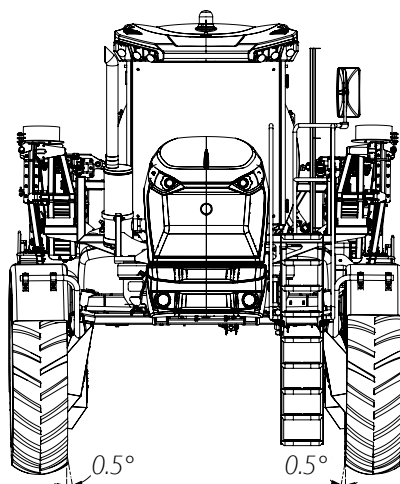


**Above:** To lower the machine, move the arm down the vertical rod.

# 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  $+0.5^\circ$ .



## Steering Lockouts

The steering system is fitted with safety lockouts that will freeze the rear steering in its current position under certain failure conditions.

These include:

- Front sensor failure
- Rear sensor failure
- Rear steering hydraulic solenoid failure
- 'Out of sync' error; The front and rear steering angle becomes too far out of sync.

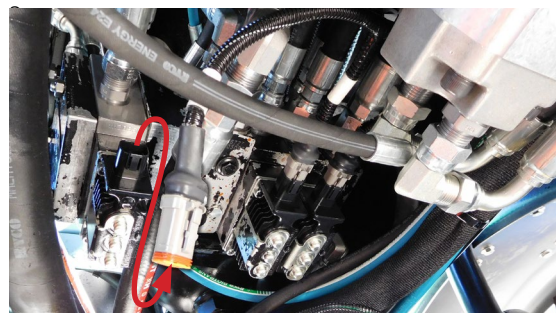
When one of these conditions occurs, a buzzer will sound inside the cabin in addition to the rear steering freezing in position. The buzzer will sound for a half-second on half-second intervals for a steering related problem. The error must be fixed and the machine re-started to turn the buzzer off.

The rear steering can be manually straightened if necessary by overriding the rear steering solenoid.

**NOTE:** The steering angle sensors may become too far out of alignment over time. In this case, they should be re-calibrated by a qualified technician at your dealer. If a steering angle sensor is discovered to be faulty and requires replacement, then it may also need to be re-calibrated by a qualified technician at your dealer.

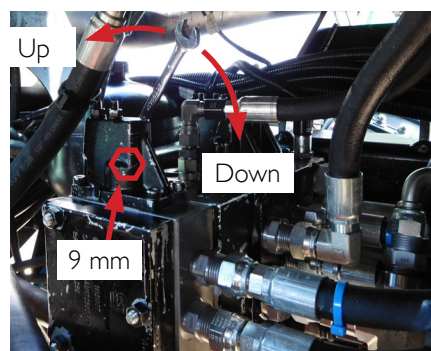
## REAR STEERING SOLENOID MANUAL OVERRIDE PROCEDURE:

1. Select 2 wheel steering mode and turn machine OFF.
2. Disconnect rear steering solenoid connector:



**Above:** The steering solenoid is on the end of the electric over hydraulic solenoid valve blocks mounted to the chassis. They are mounted to the inner chassis rail near the centre of the machine on the right hand side.

7. Choose a clear area to perform the override procedure and ensure that no persons are on or under the machine before starting the engine.
8. Use a 9 mm spanner to rotate the manual spool until the wheels are straight. Rotate down to steer left. Rotate up to steer right.



9. Reconnect the steering solenoid connector to keep dust and debris out while no further repairs are being done.

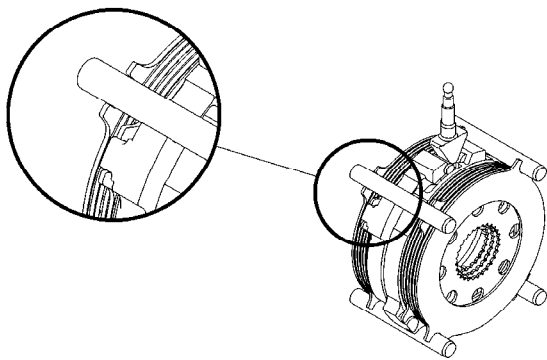
# Braking system

This machine utilises an internal hydraulically operated wet multi-disc braking system made up of two brake bodies inside each axle. The bodies are set up as negative parking brakes, while there is a separate pneumatic over hydraulic circuit set up as a positive service brake on the front axle only.

The front positive service brake is operated by a foot pedal in the cabin and should be used for emergency braking situations only. General braking should be done by pulling back on the throttle control joystick on the side console to make use of the machine's engine braking capacity via the transmission.

The park brake system is pressurised by the transmission pump's internal charge pump which is permanently set to 30 bar. A pressure sensor and accumulator (22 bar) regulate the pressure in the park brake circuit. If the pressure drops below 25 bar, the park brake manifold will re-pressurise the circuit up to 30 bar.

**NOTE:** The Park Brake is a negative type, meaning it will apply at any time that there is no hydraulic pressure going into the park brake control cylinder.



**Above:** Hydraulically operated wet multi-disc brake assembly. There is one per side of each front and rear axle.

## Brake Bleeding - Service Brake

### PROCEDURE:

1. Before starting, chock the front and rear wheels.
2. Ensure transmission switch is in neutral. Start the engine.

**CAUTION:** Ensure no person is under the machine and the transmission is in neutral when starting the machine.

**CAUTION:** It is recommended that the person bleeding the brakes wear suitable eye protection.

3. The service brake operates on the front axle only. Remove the dust cap from the bleed nipple closest to the axle housing and place it safely aside. Connect a clear plastic tube to the bleed nipple and place the opposite end of the tube into a container:

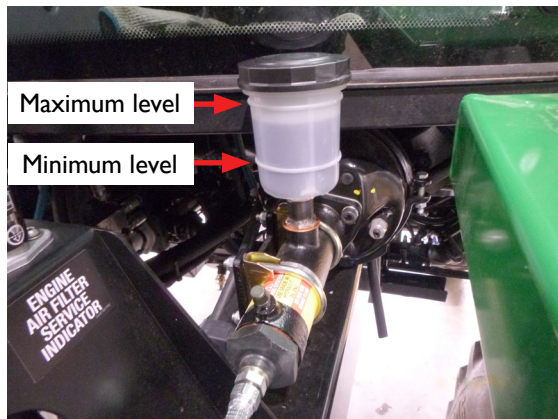


Bleed nipple on the brake actuating cylinder of the axle (bleed both left and right sides on the front axle only).

4. In the cabin, depress the brake pedal and hold.
5. A second person should loosen the bleed screw using a 14 mm spanner such that a continuous stream of fluid flows through the clear hose and air bubbles are no longer visible. At that point, the bleed screw should be re-tightened.
6. The operator in the cabin may then release the pedal. Several cycles of this procedure may be required to bleed all air out of the system and the reservoir oil level should not be allowed to drop below the minimum level at any time.
7. Repeat this procedure for the other side brake control cylinder assembly on the front axle.

*Continued over page*

# Braking system



**Above:** The oil reservoir for the service brakes should be topped up to between the maximum and minimum level marks. It is located under the front of the cabin on the left hand side.

**IMPORTANT:** Use Grade 46 hydraulic oil only. Do not use DOT4 brake fluids.

**NOTE:** Each brake actuating cylinder must be bled separately.

## Brake Bleeding - Park Brake

### PROCEDURE:

1. Before starting, chock the front and rear wheels.
2. Ensure transmission switch is in neutral. Start the engine.

**CAUTION:** Ensure no person is under the machine and the transmission is in neutral when starting the machine.

**CAUTION:** It is recommended that the person bleeding the brakes wear suitable eye protection.



Bleed nipple on the brake actuating cylinder of the axle (bleed both left and right sides and on both axles - four total).

3. Remove the dustcap from the rear most bleed nipple and place it safely aside. Connect a clear plastic tube to the bleed nipple and place the opposite end of the tube into a container.



4. A second person should loosen the bleed screw using a 14 mm spanner.
5. Switch the park brake to the OFF position to cause a continuous stream of oil to flow out.
6. Once the oil flows through the clear hose free of air bubbles, the bleed screw should be re-tightened.
7. Repeat this procedure for each of the other brake control cylinder assemblies.
8. Top up the hydraulic systems oil reservoir with an equivalent amount to what was collected in the container from all four corners.



**NOTE:** Each brake actuating cylinder must be bled separately.



# Braking System

## Brake Adjustment

### PROCEDURE:

1. Park the machine on a flat level surface, turn the engine off and chock the wheels.
2. Unscrew the cover cap from the brake actuating cylinder.
3. With a 13 mm spanner, loosen the hex fitting until the top of it is 16 mm from actuator surface.
4. With a 6 mm hex key, insert into the bore and wind internal fitting clockwise until there is strong resistance.
5. Then, wind counter-clockwise by  $2\frac{1}{4}$  turns.
6. With a 13 mm spanner, tighten the hex fitting until the top of it is 6 mm ( $\pm 0.1$  mm) from the actuator surface.

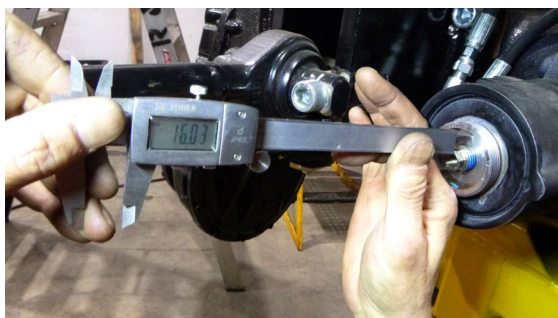


7. Replace the cover on the brake control cylinder.

## Park Brake Disengage Manual Override

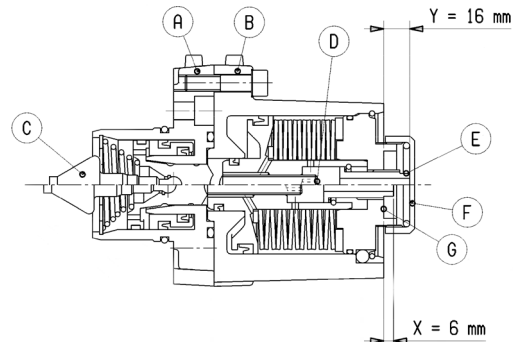
### PROCEDURE:

1. Park the machine on a flat level surface, turn the engine off and chock the wheels.
2. Unscrew the cover cap from the brake actuating cylinder.
3. With a 13 mm spanner, loosen the hex fitting until the top of it is 16 mm from the actuator surface.



4. Replace the cover cap on the brake actuating cylinder.

**CAUTION:** The park brake will now be disengaged to allow the machine to be towed but will also leave it with no form of braking when the engine is not running. Therefore the wheels need to be chocked at all times when the engine is off and the machine is stationary.

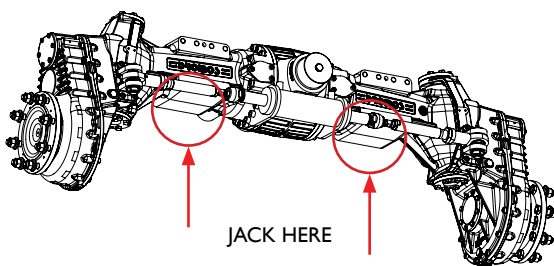


**Above:** Cross section of the brake actuating cylinder. The top half shows the actuator in the compressed state which allows the sprag (C) to back out of the brake mechanism, thereby releasing the brake disc engagement. The bottom half shows the actuator in the uncompressed state which pushes the sprag (C) into the brake mechanism, thereby engaging the brake discs.

# 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 of lifting are chocked.
- Remove the key from the ignition and the battery isolator located on the front right of machine.
- 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 approximately 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 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 important factor in maintaining the 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.

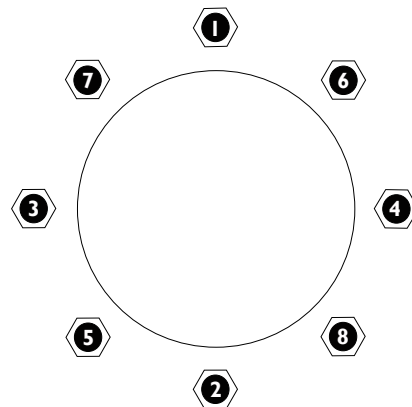
Tyre Pressures must be checked daily to maintain a satisfactory working life.

Also see chart in Chapter 3 'General Information & Specs'.

## 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 hours. Wheel nut tension specification is 350 ft/lb on all wheels.



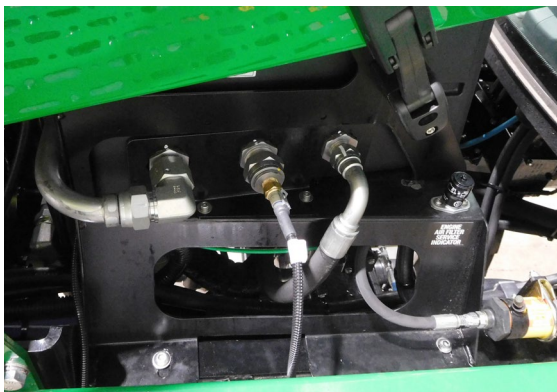
**Above:** Follow this tightening sequence to ensure even wheel nut torque distribution of 350 ft/lb.



# Hydraulics

The machine is fitted with three hydraulic pumps directly powered by the engine. The first and largest, is used to drive the transfer case, which in turn sends power to the wheels through the rest of the driveline. The second pump is used for all hydraulic functions of the machine such as boom functions, steering, spray pump and fill pump. The third and smallest pump circulates the transfer case gear oil through a dedicated cooler with 12V fan under the cabin on the right hand side. It is a closed loop, forced lubrication system.

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 in accordance with the maintenance schedule.



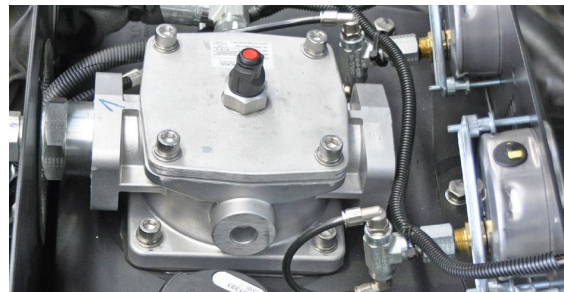
**WARNING:** Working with hydraulics is dangerous. Ensure the machine is switched off and the ignition source is isolated before working near the centre section.

**NOTE:** The lubricant specification can be found in the first table of this chapter.

**NOTE:** The transmission pump has an external filter on the bottom. It is fitted with a blockage sensor that will sound the warning buzzer in the cabin when replacement is required. The filter should be replaced according to the maintenance schedule in this chapter.

## Return Filter

The hydraulic filter is located in the tank in front of the cabin. This filter should be replaced after the first 50 hours of use and then every 500 hours after that. The return filter cleans all of the return oil from the two main hydraulic manifolds (boom functions, steering, spray pump and fill pump) 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 indicator should be checked once the oil has reached operating temperature as cold oil can cause a false reading.



**Above:** The hydraulic oil return filter is located on top of the reservoir which is mounted behind the engine and in front of the windscreen.

## Main Hydraulic System Pump

The main hydraulic systems apart from the transmission are driven by the second pump after the engine. It is a 75 cc load sense pump and provides hydraulic flow for the steering, hydraulic cylinders, spray pump and optional fill pump. It has two priority levels. The highest priority on the system is assigned to the steering. The second priority components are all others not related to steering.

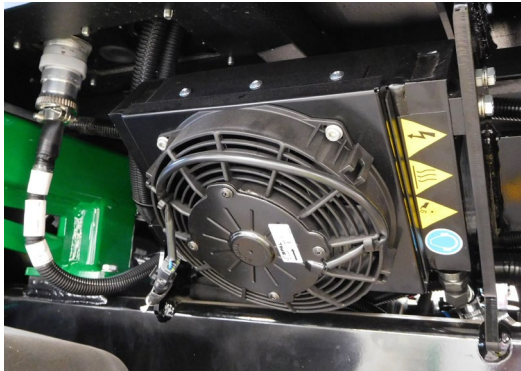
## Hydraulic Oil Cooler

The hydraulic oil cooler is integrated into the radiator cooling package. It is fitted with thermal bypass valve set to open at 45 degrees Celsius. Oil from all hydraulic functions except the transmission runs through this cooler.

# Hydraulics

## Transfer Case Oil Cooler

The transfer case oil cooler is located under the cabin on the right hand side and is ignition switched. The oil is pumped through the cooler by a dedicated pump driven by the engine. This cooler uses a 12V electric fan to keep the oil at the optimum temperature. The cooler fins should be kept clear of debris.



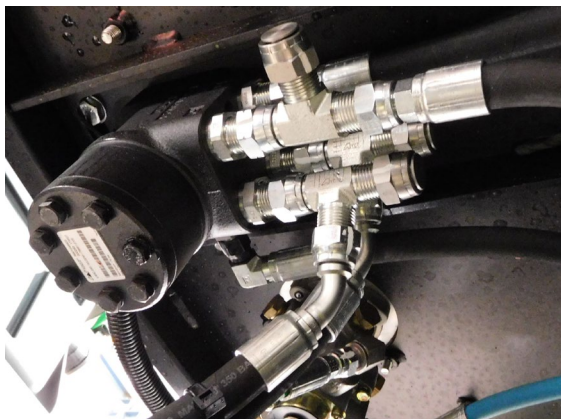
## Electric Over Hydraulic Controls

The steering, boom, spray pump and fill pump functions are controlled by electric over hydraulics solenoids. These solenoids are energised by functions on the joystick/console in the cabin and switches on the EZ control station.

The boom functions are controlled by the solenoid block mounted at the top of the boom centre section. This hydraulic block is plumbed as a load sense system. When a boom function is activated, an oil signal is sent back to the pump via the load sense line. The pump then only supplies as much oil as required to operate a particular function.

## Steering Orbitrol

The steering orbital is located under the front of the cabin. This supplies oil flow to the steering cylinder when directed by the steering wheel.



**Above:** Steering orbitrol mounted under the front of the cabin.

PORT	DESCRIPTION
P	Pressure supply
R & L	Supply and return to steering cylinders
LS	Load sense to priority valve
T	Return to reservoir

# Hydraulics

## Solenoid Valve Block - Accessories

The hydraulic steering, spray pump and fill pump functions are controlled by an electric over hydraulic solenoid valve block mounted to the inner side of the right hand chassis rail, under the cabin.



**Above:** The hydraulic steering, spray pump and fill pump functions are controlled by an electric over hydraulic solenoid valve block mounted to the chassis rail near the centre of the machine on the right hand side.

# Hydraulics

## Solenoid Valve Block - Booms

The hydraulic boom functions are controlled by an electric over hydraulic solenoid valve block mounted to the paralift rear of the centre section.



**Above:** The hydraulic boom functions are controlled by an electric over hydraulic solenoid valve block mounted to the paralift rear of the centre section.

### PARALIFT LOWERING SOLENOID

The paralift lowering function is controlled by an electric over hydraulic solenoid. It works by allowing oil out of the lift cylinder due to the force of gravity acting on it. Therefore, the hydraulic pump is only needed when raising the booms by extending the paralift ram.

This solenoid can be manually overridden in the event that it fails or for general troubleshooting purposes. To do this, wind the red knob all the way in. This will allow oil to flow out of the ram and the booms to drop.

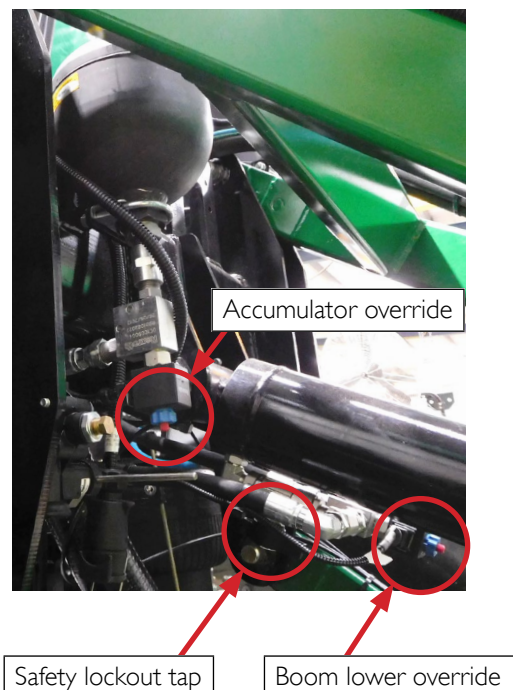
**WARNING:** Keep all persons well clear of the booms when overriding the boom lower solenoid.

**WARNING:** The paralift ram safety lockout tap should be closed off during machine transport or when working under the booms.

### PARALIFT ACCUMULATOR SOLENOID

Another electric over hydraulic solenoid is used to control oil flow to the accumulator. When the machine is off, a return spring inside the solenoid locks oil flow to the accumulator in both directions via double check valves. When the machine is on, the solenoid is powered and moves to the free flowing position, allowing oil to move back and forth to the accumulator; thereby providing boom lift suspension.

This solenoid can be manually overridden in the event that it fails or for general troubleshooting purposes. To do this, wind the red knob all the way in. This will allow oil to flow into and out of the accumulator.

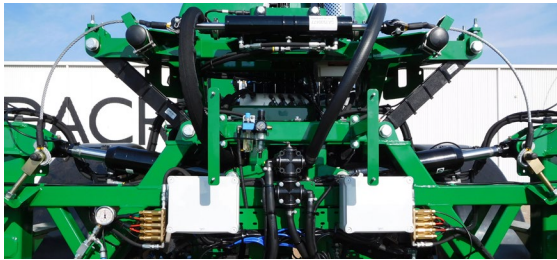




# Hydraulics

## Centre Levelling System

Fitted to the centre section of the boom is a centre levelling system. The central cylinder pulls the cables tight and holds the centre section level in relation to the Paralift. This way there can be no uneven pivoting or tilting of the booms during all folding operations.



**Above:** Centre levelling system - holds booms level when folding.

## Hydraulic Yaw

Hydraulic yaw cylinders that are fitted to the centre section get their oil supply from the pressure 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.



## Hydraulic Fill Pump (Optional)

The fill pump is controlled by the electric over hydraulic valve block mounted to the chassis rail near the centre of the machine on the right hand side.



# Pneumatic System

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The pneumatic system on this machine is used to actuate the brakes, operate the air bags, control the cabin access ladder and RapidFire system if optioned.

## Air Tank

The air system fitted to this machine incorporates an air tank located under the rear of the cabin.

Due to condensation collecting in the tank, it must be drained out on a 10 hour or daily basis. Drain fluid from the tank using the remote drain tap found under the spray pod.

**CAUTION:** Beware of high-speed particles leaving the tank. Also be aware that due to the expansion of the air the valve may become very cold.

## Pressure Relief Valve

A pressure relief valve is used to prevent the pressure within the air system exceeding acceptable limits. This valve opens when a pressure of 150 PSI is reached in the air system, venting any excess air to atmosphere.

## Pressure Protection Valve

The pressure protection valve is attached to the outlet of the air tank, 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 the tank 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.

## 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 of the air tank. 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 the tank.

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.

## Pneumatic Cylinders

There is a pneumatic cylinder used on the cabin access ladder. This cylinder gets air flow from the pneumatic manifold which is mounted under the transmission. 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 that the safety precautions are followed.



# 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 through 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 left 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

Coolant from the engine flows through the heater core causing it to radiate heat into the cabin when the engine is up to temperature. The volume of the water travelling through the system, and therefore the amount of heat transferred, may be adjusted by setting the temperature on the A/C head unit.

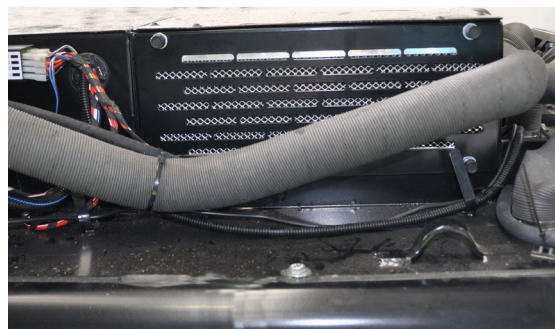
To enable the heater core to be isolated from the engine, two taps have been installed. The first tap is located on the right hand side of the engine behind the radiator. The second tap is located at the header tank.

**NOTE:** If the heating is not working when the engine is warm, ensure that the isolating taps are allowing coolant to flow through to the heater core.

## 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 which pressurises the cabin and prevents impure air entering the cab through any holes or seal leaks from outside.

To access the area under the roof, remove the 4 screws; 2 at the front, and 2 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 4 screws to hold roof down.



**WARNING:** Use ladder or work platform to get access to parts or areas of the machine above local government restrictions

**NOTE:** Filter specifications can be found at the beginning of this chapter.

# Battery System

## 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 front chassis.

After engine shutdown, wait for a minimum of 30 seconds before turning OFF the isolator switch. This allows the engine data to be saved back to the engine control module (ECM).

**CAUTION:** Not to be used as emergency stop.



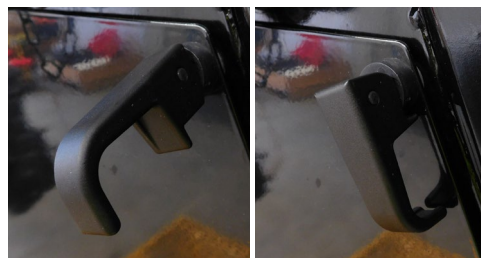
## Batteries

The electrical system operates on 12 Volts. To provide a 12V supply with sufficient current, two 12V batteries have been used in parallel. This means that the like polarity terminals have been joined.

The batteries are located at the front of the machine under the engine, inside a dedicated compartment. They are mounted on a slide out tray to assist with access.



**Above:** The isolator switch and battery compartment are located under the engine at the front of the machine. Viewed from right hand side.



**Above:** Flip the cover panel latches upward to unlock them. Then pull the panel straight off. When replacing the cover panel, make sure the panel is pushed flat and the latches are lined up with the holes before flipping them down again to lock them.



### Above & Right:

Remove the safety clip from the slide tray latch. Unlock the latch by swinging the lever to the left. The battery tray can then be pulled out to allow easier access to the batteries. Do not drive the machine unless the batteries are completely stowed.



**IMPORTANT:** Before carrying out any repairs to the electrical system turn the battery isolator switch to the OFF position.

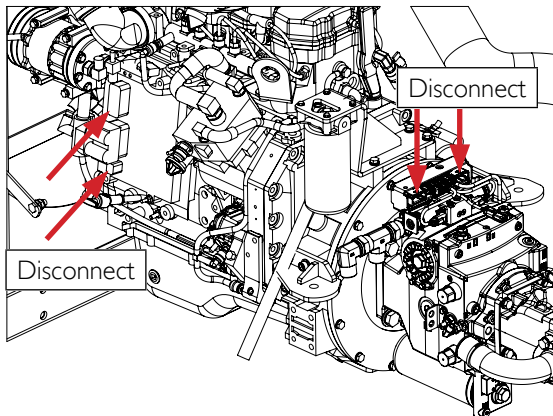
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# Battery System

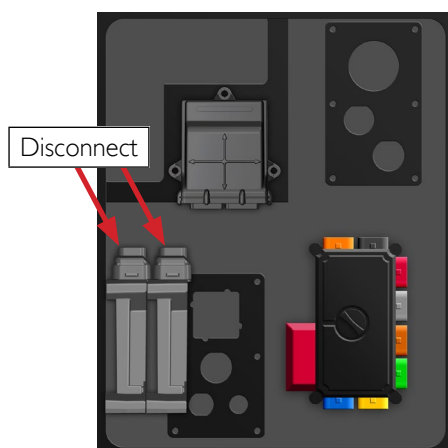
**IMPORTANT:** Before carrying out any repairs to the electrical system turn the battery isolator switch to the OFF position.

## PREPARATIONS FOR WELDING ON MACHINE

- 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.
- When welding on the sprayer ensure that all weed seeker controllers, if fitted, are totally removed from the sprayer.

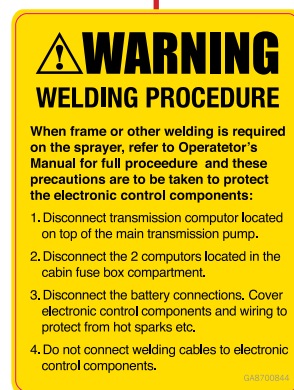
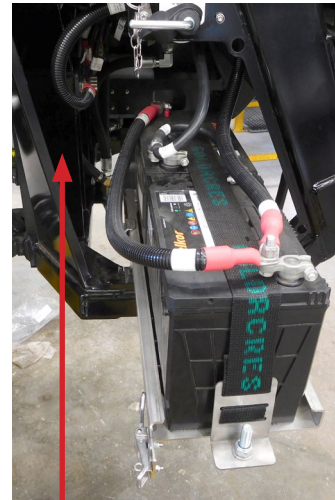


**Above:** There are two connectors going to the engine computer (one large & one small) and two 12-pin connectors going to the transmission computer that should be disconnected prior to any welding taking place on the machine.



**Above:** There are a further two transmission control modules inside the main box compartment in the cabin that should be disconnected prior to any welding taking place on the machine.

**Right:** A welding warning label is placed inside the battery compartment for quick reference.



## First Service - 50 Hours

### ENGINE

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Engine oil	Drain & Replace	GA5017913 (200L)	-
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	WZ153 (3/8" tails)

### TRANSMISSION

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Transmission external filter	Change	GA3500565	-

### TRANSFER CASE

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Transfer case oil	Change	GA5072325 (20L)	SAE 75W-90 SYN.

### FRONT & REAR AXLES

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Differential oil	Drain & Replace	GA5047310 (200L)	80W-90
Drop leg oil	Drain & Replace	GA5047310 (200L)	80W-90
Front wheel bearings	Check Pre-load & Inspect	GA5052200	-

### HYDRAULIC OIL TANK

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Hydraulic oil return filter	Replace	GA5069056	-
Hydraulic oil	Replace	GA5017199	-

### AIR-CONDITIONING

SERVICE ITEM	TYPE OF SERVICE	PART NO. - GOLDACRES	PART NO. - GENERIC
Compressor drive belt	Check & Re-tension	GA5071435	-

## Service Parts - Lubricants

SERVICE ITEM	SERVICE SPECIFICATION	CAPACITY (L)	PART NO.
Engine	SAE 15W-40 heavy duty engine oil that meets Cummins standard CES20078 API1 & CI-4	11L	GA5012457 (20L) GA5017913 (200L)
Hydraulic oil	46W Dedicated hydraulic oil eg: Total Equivis ZS 46	90L	GA5017199 (200L)
Brake fluid	46W Dedicated hydraulic oil eg: Total Equivis ZS 46 - <b>DO NOT USE DOT4</b>	0.5L per booster approx.	GA5017199 (200L)
Transfer case	SAE 75W-90 Synthetic	7.5L	GA5072325 (20L)
Differentials	80W90 API GL-5	17L (each)	GA5047310 (200L)
Driven drop leg oil	80W90 API GL-5	8L (per leg)	GA5047310 (200L)
General grease points	Multi-Purpose Grease	-	-
Steering pivot points	Molybdenum Based Grease	-	-
Coolant	TEC PG XL Cummins	36L approx.	GA5008311 (205L)
Air-conditioning unit	Oil, Sanden SP20	571 ml dry	-
	Gas R134a	2kg	-
Auto greaser	EP0	4L	-
Windscreen washer bottle	Water	1L	-
Rapidfire oiler	Air Tool Oil	50ml	GA5053550 (1L) GA5054345 (5L)

- 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.
- At the time of manufacture, G15 anti-corrosion spray is applied to all fasteners (bolts, washers and nuts) and zinc plated components.
- G15 should also be applied to the sprayer both pre and post season.
- As a guide, application to following areas are recommended but not limited to; Pump mounting bolts, boom rests, left hand pod, mudguard mounting bolts, induction hopper bolts & latches, hydraulic manifold, boom hinge bolts, airbag hose fittings and hydraulic hose crimp fittings etc.

## Service Parts - Filters

SERVICE ITEM	PART NO. - GOLDACRES	PART NO. - GENERIC
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 Pump Filter	GA3500565	-
Fuel filter (primary)	GA5051760	FS1242
Fuel filter (engine)	GA5051765	FF5612 , FF5421
Fuel filter in-line	GA5069895	WZ153 (3/8" tails)

## Service Parts - Lights

SERVICE ITEM	PART NO. - GOLDACRES	PART NO. - GENERIC
Headlight - Low Beam	GA3000082	HB3 12V 60W
Rotating beacon	GA5048975	HI 12V 55W

## Service Parts - Belts

SERVICE ITEM	PART NO. - GOLDACRES	PART NO. - GENERIC
V Belt, Air Conditioner Compressor	GA5071435	13A1080
Belt, Serpentine, Water Pump Alternator	GA5075275	-

## Tyre Pressures

GA8700822_R2 G3V & G4V MAX SPEED FULLY LOADED IS 25 KM/H		RECOMMENDED TYRE PRESSURE	
TYRE BRAND	TYRE SIZE	KPA	PSI
HARVEST	380/90R46 (14.9R46) HR45 159A8	240	35
HARVEST	AF380/90R46 (14.9R46) HR45 173D	180	26

### NOTE:

PSI = kPa × 0.145

### Example:

240 kPa × 0.145 = 34.8 PSI



# Maintenance Schedules

See end of this chapter for a list of items that need to be replaced for the first service.

After the first service, replace or inspect the items at the intervals indicated.

## Engine

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Engine oil level	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	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 belts	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	Replace
Air intake piping	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Crankcase breather tube	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Belt tensioner bearing	-	Inspect	Inspect	Inspect	Inspect	Inspect
Belt tension - (450 Nm)	-	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

**NOTE:** Engine coolant to be replaced at 2000 hours.

**NOTE:** For more detailed engine maintenance information refer to 'Cummins Operation and Maintenance Manual QSB4.5 and QSB6.7 Engine' supplied with your machine.

*Continued over page*

# Maintenance Schedules

## Transmission (Hydraulic)

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Hydraulic oil	Inspect	Inspect	Inspect	Change	Inspect	Change
External Filter	-	Inspect	Inspect	Change	Inspect	Change
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

## Transfer Case

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Oil	Inspect	Inspect	Inspect	Inspect	Inspect	Change

**NOTE:** Transfer case oil should be replaced in the first 50 hours of use. Check that metallic particles are not present on the magnetic end of the drain plug. Further changes should be carried out every 1000 hours or annually, whichever comes first.

## Axles & Drop Leg

SERVICE ITEM	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
Steering pins/bearing	-	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Tie rod ends and ball joints*	-	Lubricate Inspect	Tension Lubricate Inspect	Lubricate Inspect	Tension Lubricate Inspect	Lubricate Inspect
Universal joints	-	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Axles	-	Inspect	Inspect	Inspect	Inspect	Inspect
Toe In (1-5mm)	-	-	Measure	Measure	Measure	Measure

\* **NOTE:** Machines fitted with John Deere Autosteer systems need the tie rod ends checked and re-tensioned every 20 hours to prevent excessive toe angle change over time.

# Maintenance Schedules

## Drive Shafts

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Transfer case to differentials	-	Inspect	Inspect	Inspect	Inspect	Inspect
Universal Joints	-	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect
Slip Splines - Transfer case end	-	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect	Lubricate Inspect

## Suspension System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Polyurethane bushes	-	Inspect	Inspect	Inspect	Inspect	Inspect
Bolts and nuts *	-	Inspect	Tension	Tension	Tension	Tension
Shock absorbers	-	Inspect	Inspect	Inspect	Inspect	Inspect
Ride height valve	-	Inspect	Inspect	Inspect	Inspect	Inspect
Sway Bar Bushes	-	Inspect	Inspect	Inspect	Inspect	Inspect

**NOTE:** Polyurethane bushes, Shock absorbers, Sway bar bushes need to be replaced at 2000 hours.

**\*NOTE:** Parallel link bolts are to be torqued to 350 ft/lb.

## Braking System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Brake fluid (Hydraulic oil)	-	Inspect	Inspect	Inspect	Inspect	Replace
Brake pads (Internal)	-	Inspect	Inspect	Inspect	Inspect	Inspect
Hydraulic brake lines/hoses	-	Inspect	Inspect	Inspect	Inspect	Inspect
Brake operation	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake operation	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Parking brake switch	-	Inspect	Inspect	Inspect	Inspect	Inspect

# Maintenance Schedules

## Wheels & Tyres

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Rims	-	-	Inspect	Inspect	Inspect	Inspect
Wheel nuts (350 ft/lb)	Tension	Tension	Tension	Tension	Tension	Tension
Tyre pressure	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Tyres	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect
Rim bolts & nuts (190 ft/lb)	Tension	Tension	Tension	Tension	Tension	Tension

## Pneumatic System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Air tank	Drain	Drain	Drain	Drain	Drain	Drain
Air lines and fittings	Inspect	Inspect	Inspect	Inspect	Inspect	Inspect

## Hydraulic System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Hydraulic oil	-	Inspect	Sample	Replace	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

## Electrical System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Battery electrolyte level	-	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
Battery terminal	-	-	Clean & Protect	Clean & Protect	Clean & Protect	Clean & Protect

# Maintenance Schedules

## Air-conditioning System

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Condensor	Clean	Inspect	Inspect	Inspect	Inspect	Inspect
Air conditioner lines	-	-	Inspect	Inspect	Inspect	Inspect
Refrigerant and dryer	-	-	Inspect	Inspect	Inspect	Replace
HVAC box	-	-	Inspect	Inspect	Inspect	Inspect
Carbon filter	See below	See below	See below	See below	See below	See below
Carbon filter inlet	-	Inspect	Inspect	Inspect	Inspect	Inspect
Compressor drive belt	-	Inspect	Inspect	Adjust	Adjust	Adjust

**NOTE:** Carbon filter should be replaced every 200 hours.

## Chassis

SERVICE ITEM	DAILY (10Hrs)	WEEKLY (50Hrs)	250hrs/ 3 months	500hrs/ 6 months	750hrs/ 9 months	1000hrs/ 1 year
Ladder switch	-	-	Inspect	Inspect	Inspect	Inspect
Ladder folding mechanism	-	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate
Ladder mounting bolts	-	Tighten	Tighten	Tighten	Tighten	Tighten
Cab mount bolts and bushes	Tighten	Tighten 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	Tighten
Para lift link bushes	Lubricate	Lubricate	Lubricate	Lubricate	Lubricate	Replace
Chassis frame	-	Inspect	Inspect	Inspect	Inspect	Inspect
Induction hopper mounting	-	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

# Maintenance Schedules

## Spraying Equipment

SERVICE ITEM	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
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
Flow meter (where fitted)	Inspect Drain	Inspect Drain	Inspect Drain	Inspect Drain	Inspect Drain	Inspect Drain
Ball valves	Open & inspect	Open & inspect	Open & inspect	Open & inspect	Open & inspect	Open & inspect



# 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.

### Spray 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.
		Adjust pump speed to between 4200-4400 RPM.
		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. Close bypass valve on rear of tank.
Pressure and flow rate are too high	Agitator is consuming flow	Turn agitator off.
	Supply to pump is restricted	Check suction filter and suction filter valve.
	Bypass line is restricted or blocked.	Verify console calibration settings.
		Check if bypass valve on rear of tank is open.
		Slightly open bypass valve on rear of tank.
		Check if bypass valve on rear of tank is restricted.
		Check pump speed is not too fast.
	Blocked filters of nozzles	Check and clean all pressure and nozzle filters
The pressure on my gauge is higher than the nozzle flow indicates	Flow loss due to resistance in lines, valves and filters.	Re-calibrate console to allow for pressure loss

*Continued over page*

## Spray Pump

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 to between 4200-4400 RPM.
Pump pressure pulsating	Air leak on suction side of pump	Check suction pump for air leaks.
	Incorrect pump speed	Adjust pump speed to between 4200-4400 RPM.
Pump is noisy	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 & 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 flow meter reading	Replace flow meter
	Faulty control valve	Replace control valve Check using manual increase/decrease flow control
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
	Faulty cable	Test cable as per instructions following
	Calibration figure is incorrect	Reset meter calibration
Application rate or pressure will not alter	Faulty control valve	Test valve manually and replace if required
Control valve has failed	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
Raven Console not working	No power supply	Check loom connection at the back of the console
		Check connection to battery terminals
		Check the fuse in the back of the console
		With a multi meter; check the voltage potential across pins 1(-) and 16(+) on the 16 pin plug going into the console (Should be at least 12v)

If the flow meter fails to give accurate readings, the following actions should be taken:

- 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.

# Flow Meter & Controller

Use the following procedures to manually override the boom valves and control valve if the Raven console has failed or is otherwise not able to operate them:

## BOOM VALVE OVERRIDE

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 'Rapid Fire' section in 'Optional Accessories' chapter.

**NOTE:** Care should be taken because there is no agitation while the nozzles are not spraying.

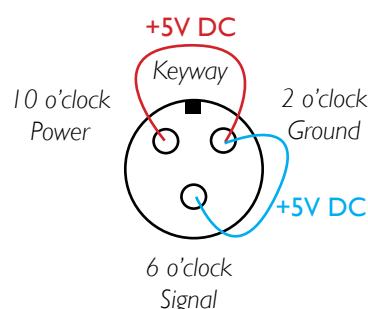
## CONTROL VALVE OVERRIDE

- 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.

## Testing Raven 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 e.g. 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 the voltage checks shown below.
6. Change [Meter Cal] number back to previous number.



### Voltage Readings

2 o'clock - 6 o'clock (+5V DC)

10 o'clock - 2 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
	Lack of pressure to venturi in top of tank	Check there are no kinked hoses and the water pressure is about 100 PSI

### ISOLATING POSSIBLE AIR LEAKS

**Step 1:** Check the operation of the chemical probe. If this will transfer water at a minimum of 30 L/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.
2. Check probe and envirodrum section.

**NOTE:** 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 & Delta Boom

PROBLEM	COMMON CAUSES	COMMON SOLUTION
Inner and outer wing are not in line with each other when the boom is unfolded	Stopper bolt holding out the boom	Adjust the boom stopper bolt
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 hydraulic lines	Unfold booms completely and hold switch for a few seconds. Then, fold booms completely and hold switch for a few seconds. Do this multiple times as necessary to purge any air out of the hydraulic lines.
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

**NOTE:** By nature, booms fitted with flow dividers don't fold 100% evenly. Hold the boom fold switch for a few seconds after the first boom has folded completely to give the other boom the chance to match the fully folded position.

### SHIM ADJUSTMENT

The shim adjustment at the cable drum will affect the position of the outer boom when unfolded and when in the folded position. Use the table below to add or remove shims. The table 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 Shims



## 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	Check value

## 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 550 kPa (80 PSI)
	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	Brake valves out of adjustment	Adjust brake valves

## Hydraulic & 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
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 & 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.

## OPTIONAL ACCESSORIES

### General Information

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The following pages provide information on Goldacres optional accessories available on this equipment.

**NOTE:** These options may not be fitted to your equipment unless ordered.

# Boom Height Control - Norac

## Overview

Boom Height Control systems maintain the boom at a preset height by monitoring field contours and making responsive boom adjustments. Using data from either 3 or 5 ultrasonic sensors, the Boom Height Control systems makes responsive height adjustments allowing booms to automatically follow the contours of the land. Maintaining spray nozzles at the recommended spray tip height allows chemical to be applied using an optimum spray pattern providing even application and reducing drift. Boom Height Control reduces the need for the operator to move their head back and forth to monitor changes in field terrain, thereby reducing stress and fatigue. This allows the operator to focus on machine operation and safety. Manual operation of a sprayer in uneven field terrain may require reduced operating speeds for continual boom adjustments.

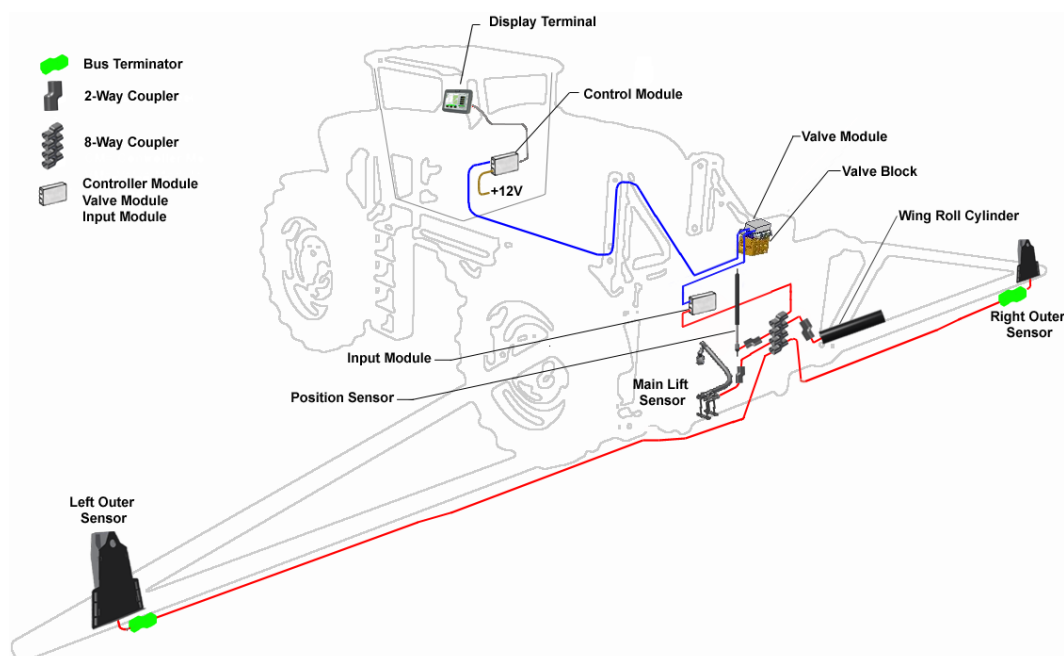
Ultrasonic sensor hardware and software is designed specifically for height control applications. The ultrasonic signals can distinguish the difference between the ground and standing crop or field residue. Boom height is controlled by choosing Soil Mode (senses the soil surface), Crop Mode (senses the top of the crop), or Hybrid Mode (technology that calculates a virtual top of the crop for more accurate control).

Refer to manufacturer's manual(s) for detailed information about this system.

[WWW.NORAC.CA](http://WWW.NORAC.CA)

PRECISION DEFINED

## Goldacres UC5 Active Wing Roll



# Hydraulic Fill Pump



**Above:** The optional hydraulic fill pump is located under the centre of the chassis on the right hand side.

## Suction & Delivery Lines

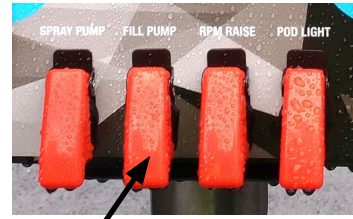
- Use good quality suction hose and fittings that will not collapse or leak air under suction.
- If pumping water from structures other than storage tanks, we recommend the use of an appropriate sized floating filter equipped with a check valve.
- It is essential the suction line to the pump is the same size as the suction port (3")

A smaller size delivery line can be used but will reduce pump output.

## PUMPING WITH OPTIONAL HYDRAULIC FILL PUMP

1. Connect the 3" fill hose (not supplied) to quick fill cam lock coupling under the EZ Control POD.
2. Locate the 'Main Tank Fill' valve on the external water delivery side of the Pod controls and flip it UP.

**NOTE:** Do not turn the tank fill ball valve off while the pump is running.



Fill pump switch

3. With the engine running, turn the 'Fill Pump' switch ON.
4. When filling is complete, turn the 'Fill Pump' switch OFF. Close the 'Main Tank Fill' ball valve and remove the water supply from the tank fill fitting.

## Setting Hydraulic Fill Pump RPM

The 3" fill pump speed is adjusted using a hydraulic flow meter. The flow rate should be set to 35L/min.

# Groeneveld Auto Greaser

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## 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 Single line 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.

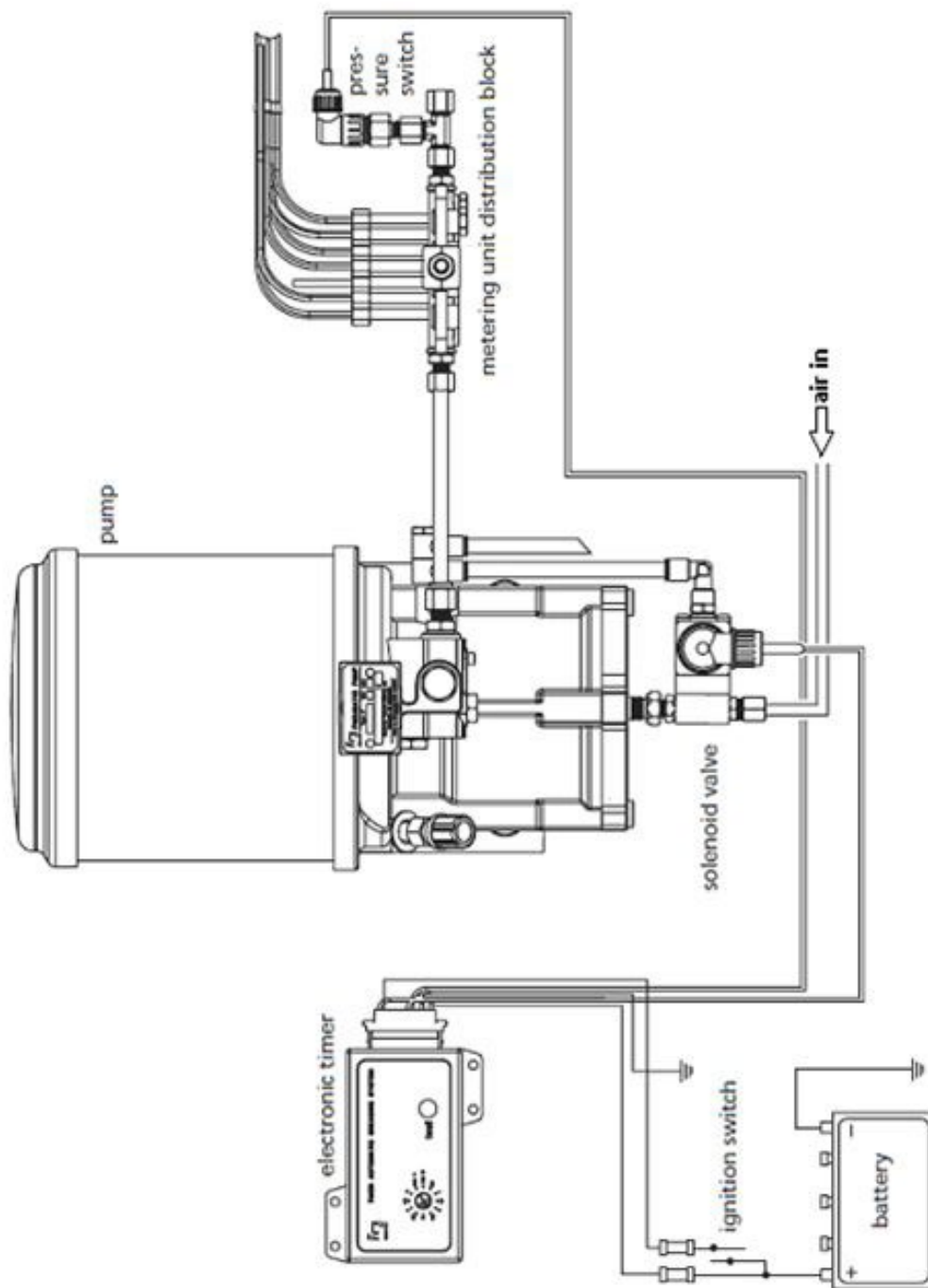
**IMPORTANT:** Instructions that if ignored will cause damage to the system or machine.

**WARNING:** Instructions that if ignored will cause personal injury or death to the operator or bystanders.



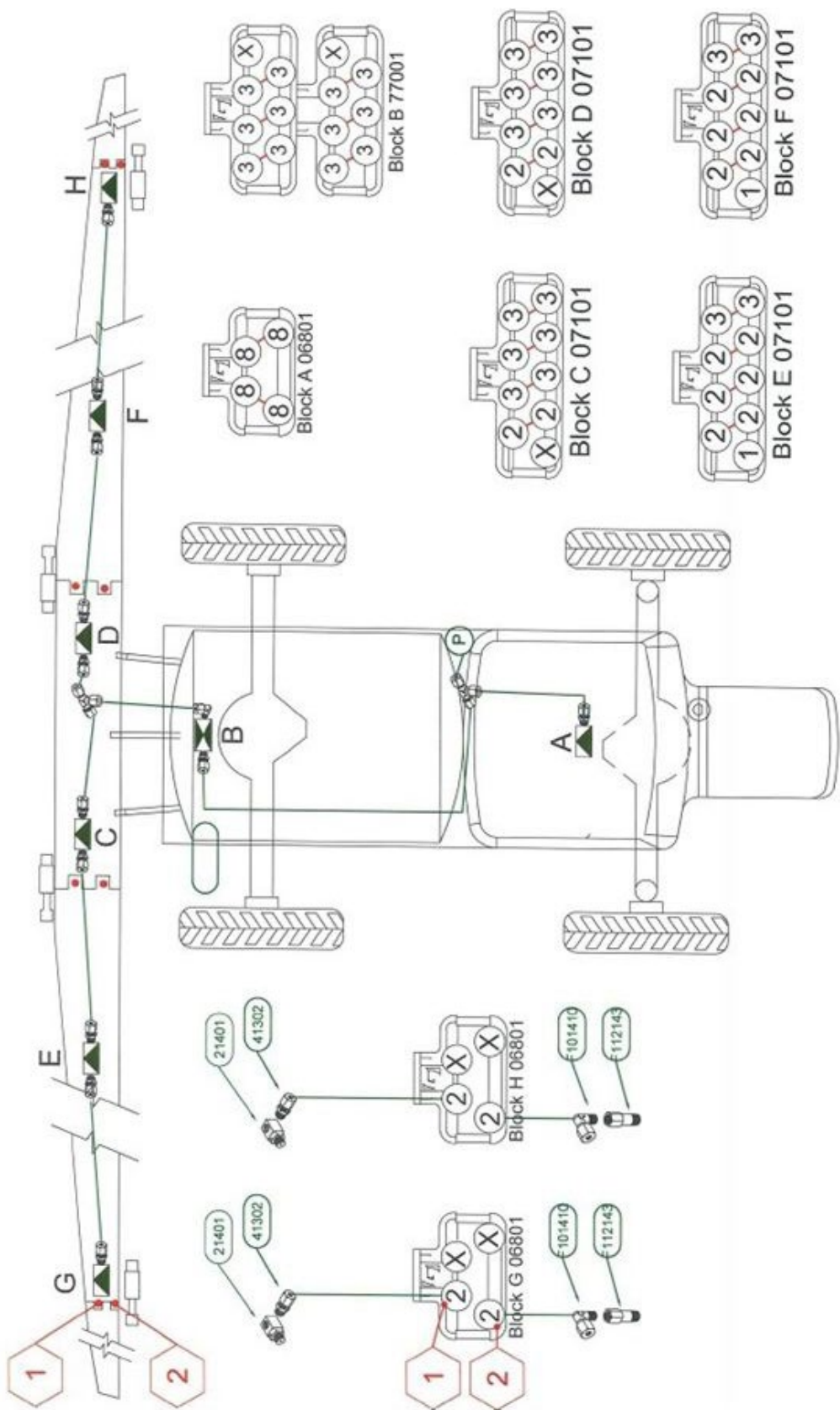
## Groeneveld Auto Greaser - Overview I

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Above: System Overview

# Groeneveld Auto Greaser - Overview II



Above: 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:

**IMPORTANT:** 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.



Pump Unit



Red tag bung must be removed



Unplugged overflow hole

*Continued over page*

## Groeneveld Auto Greaser - Components

**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.

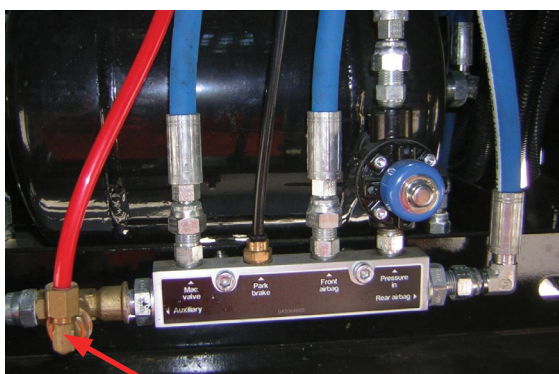
**IMPORTANT:** Do not overfill the main reservoir. Fill to about 2 cm from the top only. This instruction is also on the reservoir tank. Over filling will cause the reservoir to fracture.

**IMPORTANT:** 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.

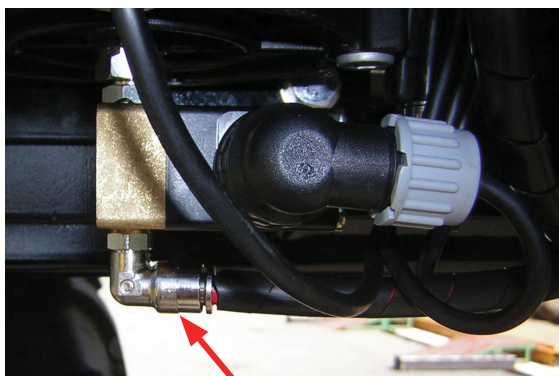
If you should happen to slightly overfill the reservoir, grease will overflow from the hole on the right of the pump unit. This will continue for about 3 days until the overflow channel is clear.

### 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.



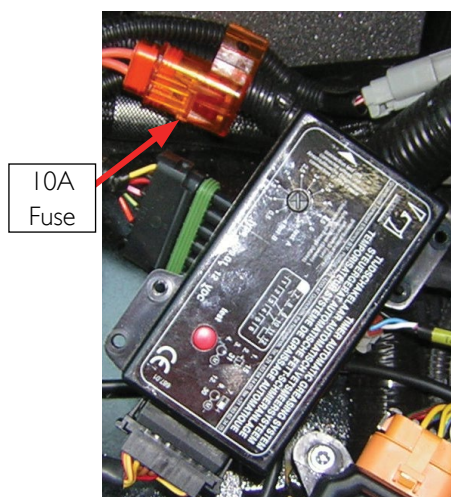
Main air supply from manifold



Main air supply input to pump unit solenoid

### Electronic Timer

The electronic timer sets the intervals for operation of the greasing system. The auto greaser applies only small, metered amounts of grease at a time. 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.



Above: Electronic timer in main fuse compartment

The timer is protected by a 10A fuse in the clear orange cover.

**IMPORTANT:** The timer should initially be preset to 90 minutes intervals as this has been found to be the optimal grease delivery interval for most applications. However, certain operating conditions will require more or less than this amount.

It is the responsibility of the operator to ensure that the machine parts are receiving sufficient lubrication.

Hotter operating conditions cause the grease to become thinner and may therefore require more frequent interval settings.

Over lubrication, as well as under lubrication, can lead to premature failure of machine components and should be avoided.

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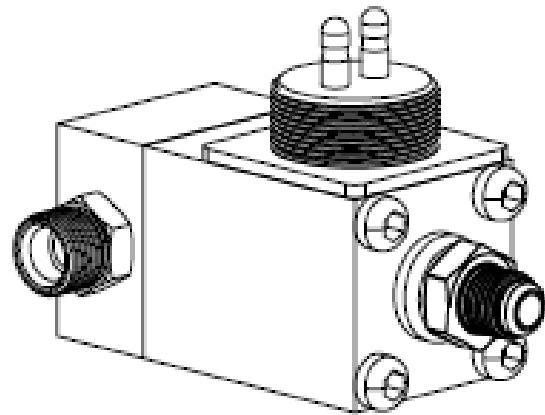


# Groeneveld Auto Greaser - Components

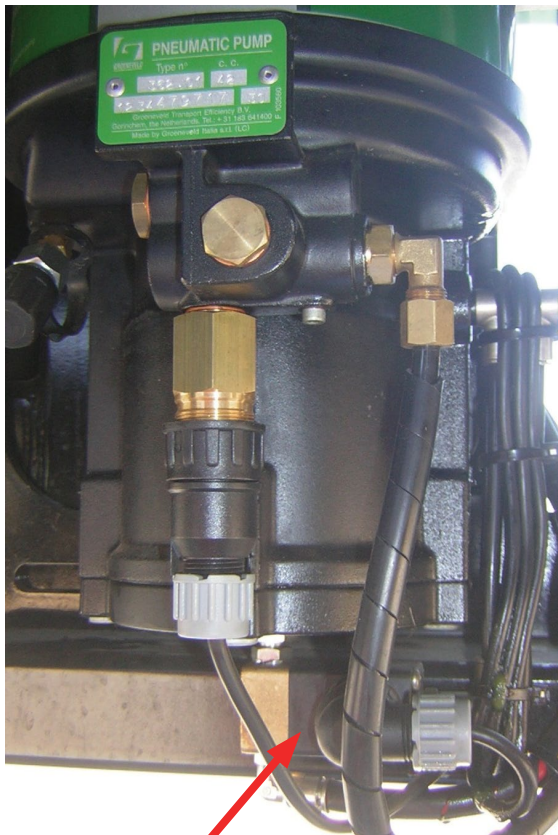
## Solenoid

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.

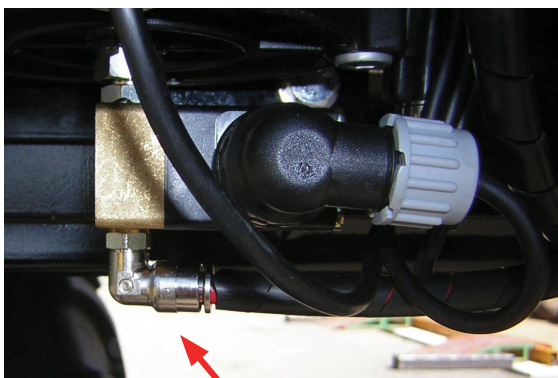
The solenoid valve between the air tank and the pneumatically operated pump (usually fitted to the pump) is a normally closed, free venting type. The valve is connected electrically by an M24 screw connector:



Above: Solenoid unit - Normally closed.



Solenoid located at bottom of pump unit



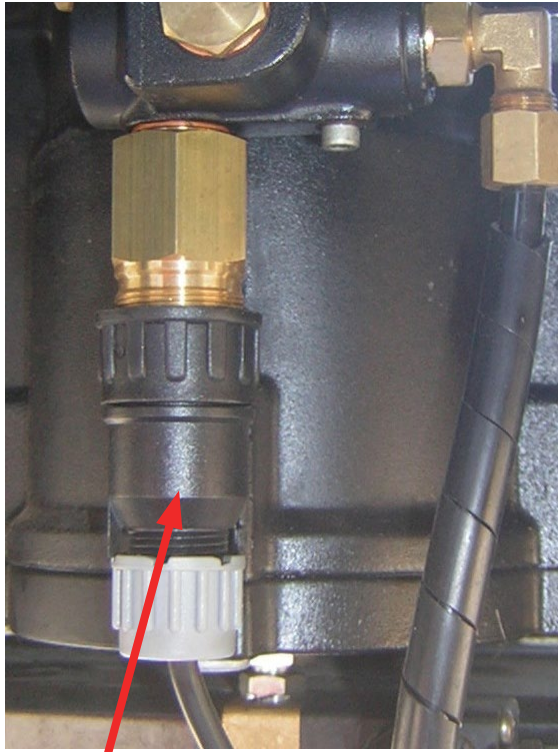
Main air supply input to pump unit solenoid

*Continued over page*

# Groeneveld Auto Greaser - Components

## 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.



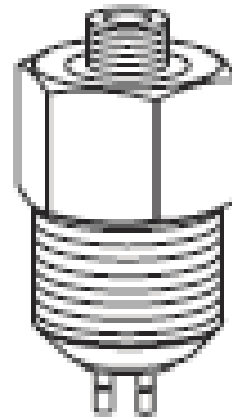
Pressure switch location

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 (6.1 Bar). 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.

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.



Above: 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.

*Continued over page*

# Groeneveld Auto Greaser - Components

## 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.



Above: Return valve

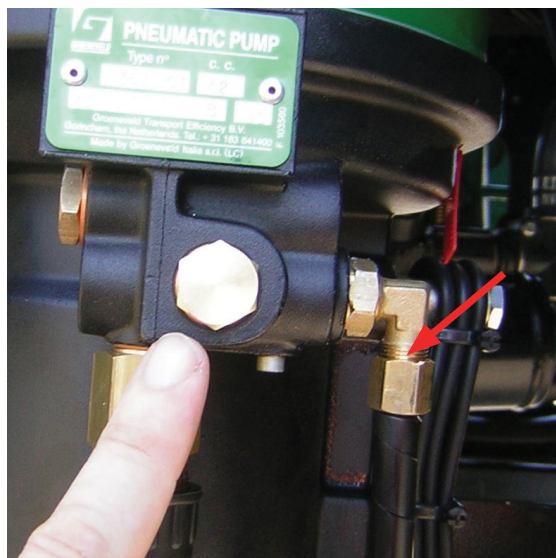
**NOTE:** Removing this blank is not advised. There is a check ball held in under spring tension that will come out at some speed. If this is lost, the return valve and non return valve will not work and the system will pump the grease back to the reservoir. If you believe there is a problem with this 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 direct.

## 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.



Above: Second grease outlet

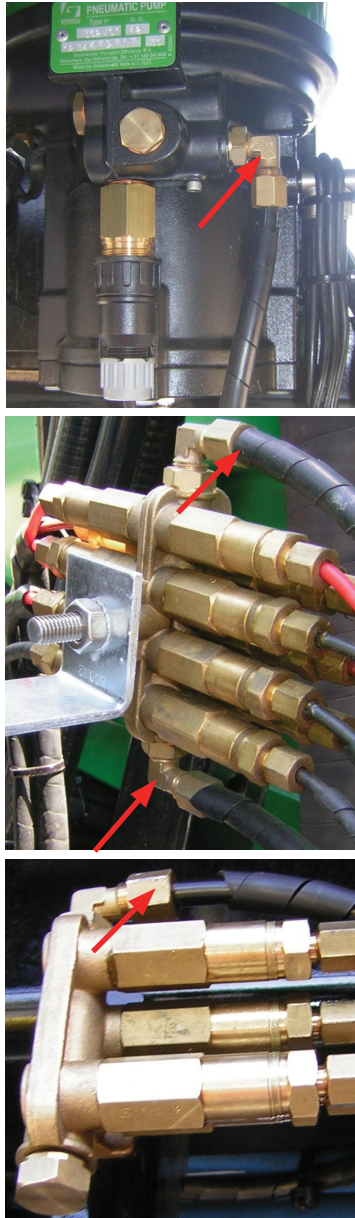
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# Groeneveld Auto Greaser - Components

## 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.



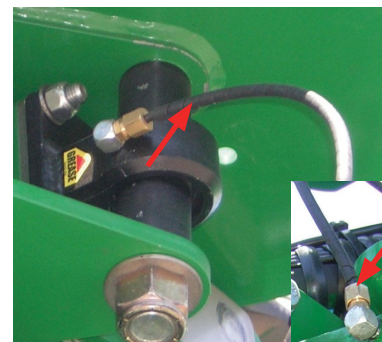
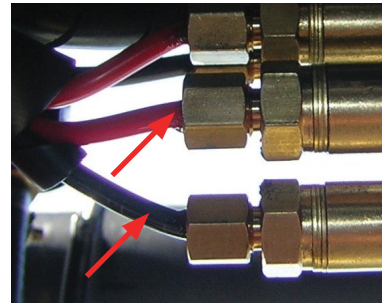
Above: Main Grease Lines

**IMPORTANT:** The main lines from the pump unit to the single or banks of metering units 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.

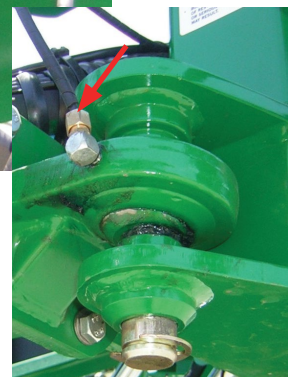
## Grease Nipple Lines

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.



Above: 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).

**IMPORTANT:** 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.

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# Groeneveld Auto Greaser - Components

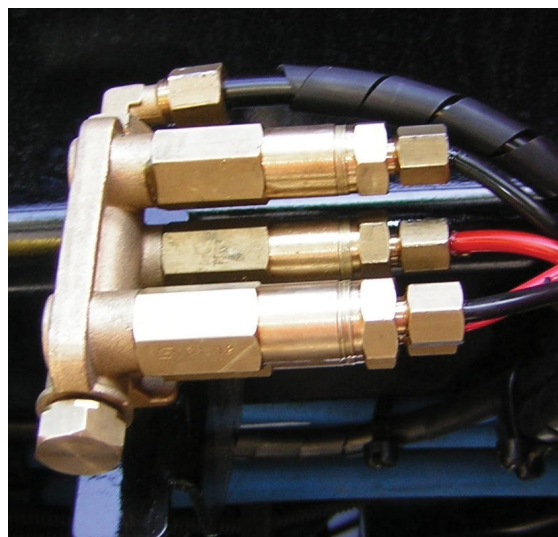
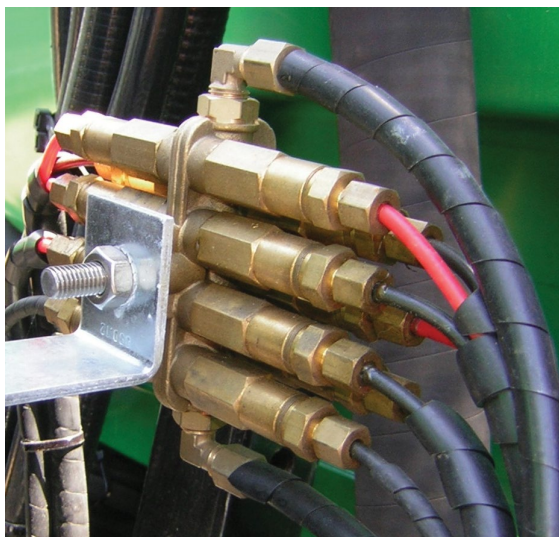
## Meter Distribution Block

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.

**IMPORTANT:** 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.



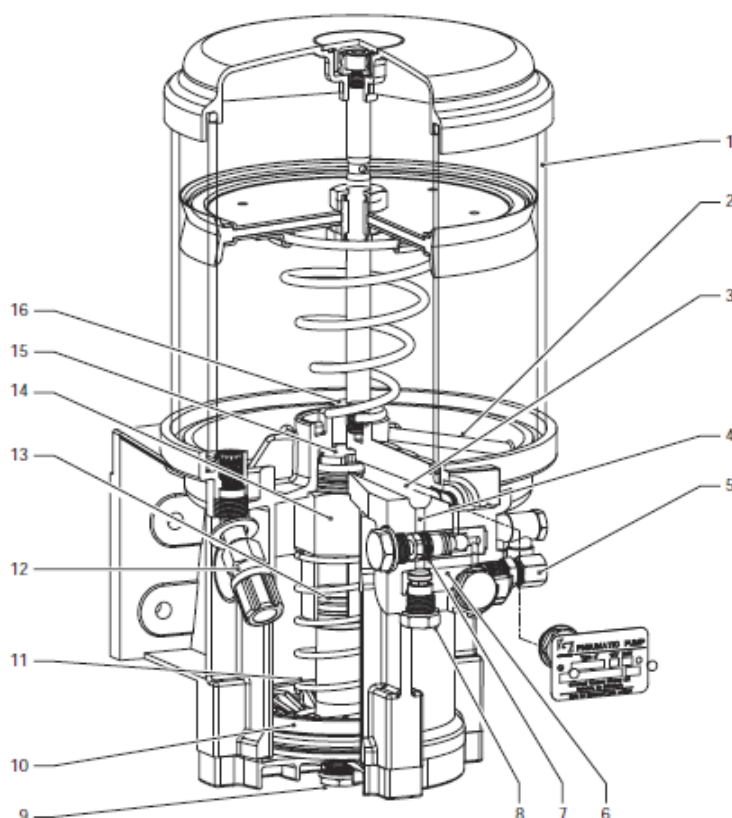
Above & Right: Bare meter distribution block



Above & Right: Fully fitted meter distribution block

# Groeneveld Auto Greaser - Pump Unit

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



Above: Pump unit exploded view

## Pump Unit Operation

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 3 minute lubrication cycle, 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.

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# Groeneveld Auto Greaser - Pump Unit

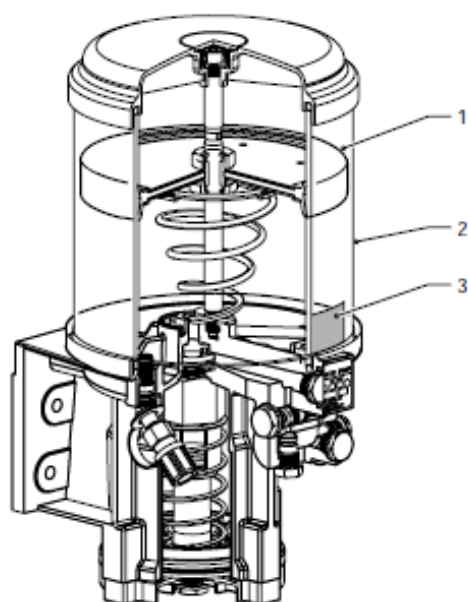
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## Pump Unit Reservoir

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.

**NOTE:** There is NO maximum level mark.



**Above:** Reservoir

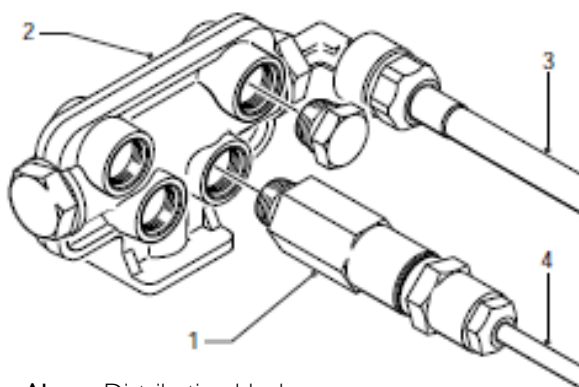
In the standard reservoir a follower plate is placed above the level of the lubricant. This plate follows the level of the lubricant; as the level falls the follower plate falls with it under the action of a tension spring. The follower plate prevents the increase of air into the lubricant and any consequent soaping of the lubricant. Funneling 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.

# Groeneveld Auto Greaser - Meter Units

## Meter Units

There are 11 metering unit types (1) available for the Single line 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.



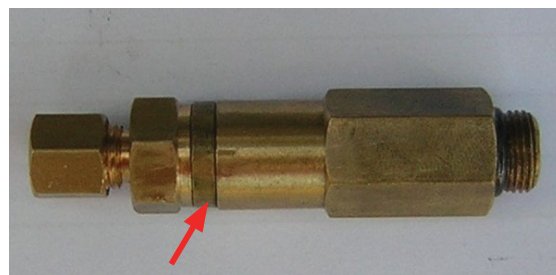
**Above:** Distribution block

**IMPORTANT:** 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.

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.

## Meter Unit Setup

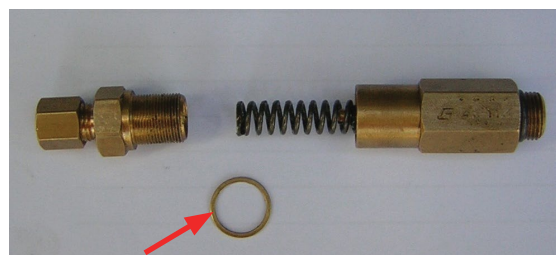
The meter units measure the dose of grease to the grease nipple. The metered dose is varied by a number of shims or spacers. If you look closely at your machine, you will see each meter will have 1, 2 or 3 shims. After that, it moves up to a spacer (equivalent to 4 shims). Then 1 spacer with 1, 2 or 3 shims, followed by 2 spacers, then 2 spacers and 1 shim (9 shim spacing).



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.

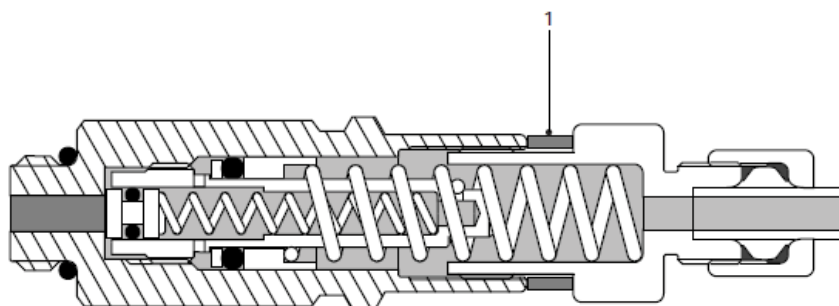
**IMPORTANT:** It is not advisable to open the metering units as this allows the entry of dirt, and thus is a potential cause of faults and failures.



Meter components showing shim

## Groeneveld Auto Greaser - Meter Unit Operation

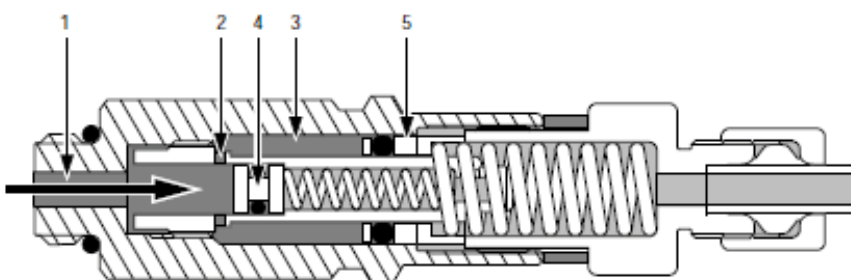
Right: Meter unit & Spacer



**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.

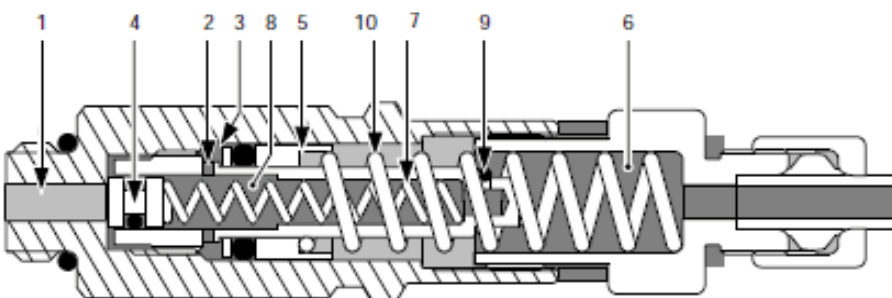
Right: Meter unit in phase A



**PHASE B.** When the pump stops and as the grease pressure drops, spring (7) 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).

Right: Meter unit in phase B



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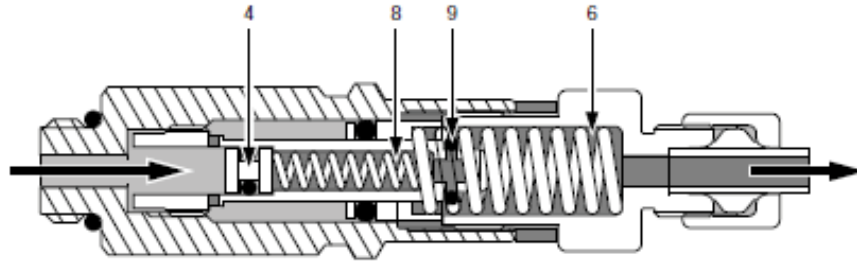


## Groeneveld Auto Greaser - Meter Unit Operation

**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).

**Right:** Meter unit in phase C

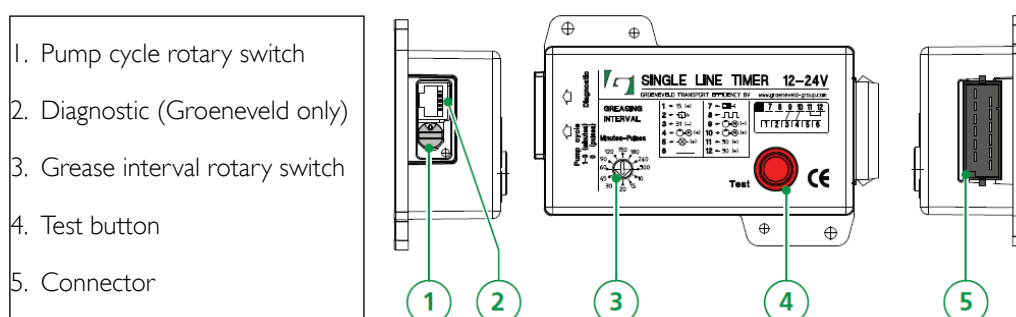


**IMPORTANT:** It is not advisable to open the metering units as this allows the entry of dirt, and thus is a potential cause of faults and failures.

# Groeneveld Auto Greaser - 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.



Above: Electronic Timer

**IMPORTANT:** The timer should initially be preset to 90 minutes intervals as this has been found to be the optimal grease delivery interval for most applications. However, certain operating conditions will require more or less than this amount.

It is the responsibility of the operator to ensure that the machine parts are receiving sufficient lubrication.

Hotter operating conditions cause the grease to become thinner and may therefore require more frequent interval settings.

Over lubrication, as well as under lubrication, can lead to premature failure of machine components and should be avoided.

## Interval Adjustment

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 h steps (0.5, 1.0, 1.5... 5 h). 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.

# Groeneveld Auto Greaser - Maintenance & Testing

## Periodic Maintenance

**IMPORTANT:** 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. Use 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

**IMPORTANT:** 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.

**IMPORTANT:** 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.

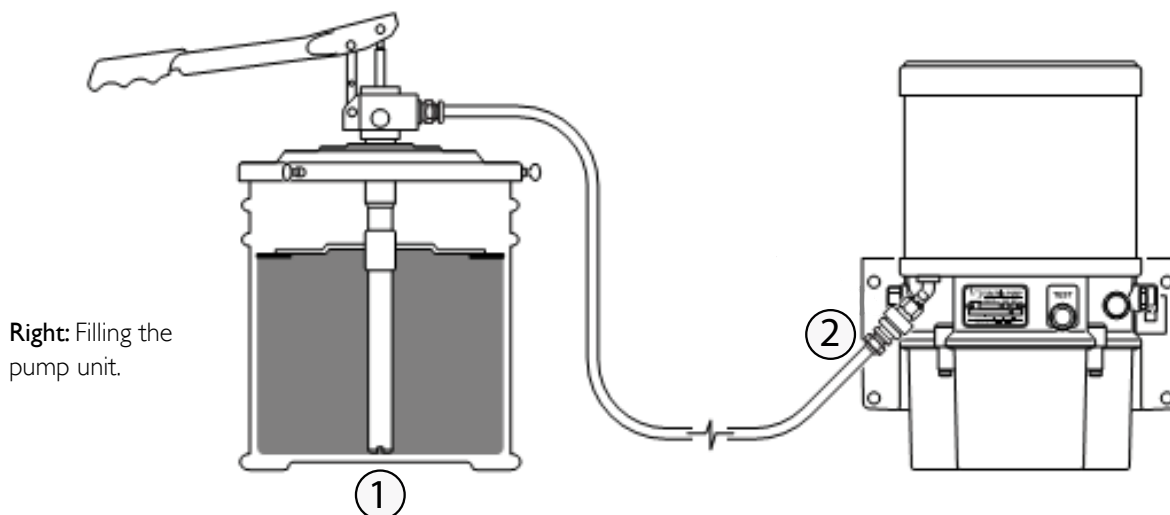
When the lubricant in the reservoir has fallen to the minimum level it must be re-filled. Generally a filler pump is used for this purpose. The procedure is as follows:

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.

*Continued over page*

# Groeneveld Auto Greaser - Maintenance & Testing

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.



## Testing 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.
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 1/20th 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.

### ACCELERATED CYCLE TEST

This allows you to test a timing cycle without waiting the full set time interval. It sets the time interval at 1/20th of its duration.

1. Set the step switch to position 'test A'.
2. Press and hold the 'test' button.

## Groeneveld Auto Greaser - Warnings Summary

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**NOTE:** Instructions given to the operator to better enhance the system.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

**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.

**IMPORTANT:** Do not overfill the main reservoir. Fill to about 2 cm from the top only. This instruction is also on the reservoir tank. Over filling will cause the reservoir to fracture.

**IMPORTANT:** 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.

**IMPORTANT:** The timer should initially be preset to 90 minutes intervals as this has been found to be the optimal grease delivery interval for most applications. However, certain operating conditions will require more or less than this amount.

It is the responsibility of the operator to ensure that the machine parts are receiving sufficient lubrication. Hotter operating conditions cause the grease to become thinner and may therefore require more frequent interval settings.

Over lubrication, as well as under lubrication, can lead to premature failure of machine components and should be avoided.

**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 direct.

**NOTE:** If you decide you want to run a second grease outlet line, please contact your Groeneveld dealer directly for technical advice.

**IMPORTANT:** The main lines from the pump unit to the single or banks of metering units 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.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

**NOTE:** There is NO maximum level mark.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

**IMPORTANT:** 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.

# Groeneveld Auto Greaser - 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 relays (16A)		internal relays (16A)	

## 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

## 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

## 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



# Groeneveld Auto Greaser - Troubleshooting

<i>Fault</i>	<i>Cause</i>	<i>Action</i>
1. All points to be lubricated are dry.	<p>a. Pump reservoir is empty.</p> <p>b. Reservoir filled with grease that is too thick and unsuitable for the system.</p> <p>c. Main pipe leaking.</p> <p>d. Electronic timer, PLC or pneumatic impulse counter not set correctly.</p> <p>If there is another cause, please consult your dealer.</p>	<p>a. Fill the reservoir (see section 9).</p> <p>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.</p> <p>c. Repair the line and bleed the system if a new piece of piping has been fitted.</p> <p>d. Reset the electronic timer, PLC or brake impulse counter.</p>
2. Pump does not work or does not reach working pressure.	<p>a. Pneumatically operated pump: No or too-low air pressure.</p> <p>b. Piston does not rise.</p> <p>If there is another cause, please consult your dealer.</p>	<p>a. Ensure there is an air pressure of 6 to 8 bar.</p> <p>b. Dismantle the cover of the pump casing and clean the piston.</p>
3. One or more lubrication points are dry while the others receive sufficient grease.	<p>a. Break in the secondary piping.</p> <p>b. Inoperative metering unit.</p>	<p>a. Repair or replace the line.</p> <p>b. Remove the metering unit and fit a new unit.</p>
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.	<p>a. Bad or open electrical connections.</p> <p>b. Solenoid valve internally fouled with water and/or rust from the vehicle air system.</p>	<p>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!</p> <p>b. Dismantle, clean and refit the valve or fit a new valve. Clean the vehicle air system.</p>
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.	<p>a. Grease level in the reservoir below the minimum.</p> <p>a. System not reaching working pressure.</p> <p>c. No cycle time interval selected on the electronic timer.</p>	<p>a. Fill the reservoir (see section 9).</p> <p>a. Top up the reservoir with grease and/or repair the main pipe, check the pump pressure with a manometer.</p> <p>c. Set a cycle time interval on the electronic timer.</p>

## Groeneveld Auto Greaser - Dealer Contacts

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### Head Office

268 Proximity Drive  
Sunshine West, Vic 3020  
Tel: 03 8329 4333  
Fax: 03 8329 4334

### Perth Branch

8/28 Belmont Avenue  
Belmont, WA 6104  
Tel: 08 9262 9800  
Fax: 08 9477 2688

### Adelaide Branch

5 George Street  
Wingfield, SA 5013  
Tel: 08 8349 6322  
Fax: 08 8262 1783

### Groeneveld Tasmania

8 Devonport Road  
Devonport, TAS 7310  
Tel: 03 6423 4256  
Fax: 03 6424 9772

### Brisbane Branch

1818 Ipswich Road  
Rocklea, QLD 4106  
Tel: 07 3272 7975  
Fax: 07 3272 7534

### Groeneveld Central QLD

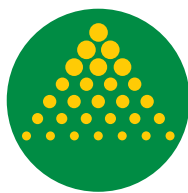
193-195 Wade Street  
Nth Rockhampton, QLD 4701  
Tel: 07 4936 4833  
Fax: 07 4936 4822

### Sydney Branch

1/36 Lidco Street  
Arndell Park, NSW 2148  
Tel: 02 9831 4933  
Fax: 02 9831 4966

### Townsville Branch

Unit 10 72-78 Crocodile Crescent  
Townsville, QLD 4810  
Tel: 07 4774 3056  
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