

AGROWPLOW[®]

AP05 Series
AP11 Series
AP31 Series
AP51 Series
AP71 Series
AP81 Series
AP91 Series
Cotton Bed Renovator

AGROWPLOW | 55 Wellington St, Molong NSW
v20.1

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Local Agrowplow Dealer:

'Prosperity Through Soil Care'

Disclaimer

Every effort has been made to ensure that the information in this manual was accurate and up to date at the time of printing. Agrowplow Pty Ltd reserves the right to make subsequent changes to the machine or this manual, where necessary, without notification.

Agrowplow Pty Ltd will not be responsible for any damage or consequential loss arising out of misinterpretation or failure to follow recommended procedures. Nor will it be liable for any damage caused by or arising out of modification or misuse of its product.

The owner has a responsibility to protect himself and others by observing all safety information and by ensuring all operators are well acquainted with the safety information, trained in the correct use of the machine and applying safe work practices.

The Owner's Manual

Your new Agrowplow will give long and efficient service if given normal care and operated properly.

This owner's manual is provided so that you can become thoroughly familiar with the design of the machine and to obtain information on correct operation, adjustment and maintenance. Only people well acquainted with these guidelines should be allowed to use this machine.

Right and left hand references in this manual are determined by standing behind the machine and facing in the direction of travel.

The manual is considered as part of your machine and must remain with the machine when it is sold.

Delivery Inspection

On delivery of your new Agrowplow please check that the machine is not damaged. In cases of shipping damage, please ask your dealer to arrange for the appropriate claim to be lodged immediately.

Assemble any parts supplied loose and inspect your machine with the aid of this manual to familiarise yourself with its features. If you have any queries ask your dealer straight away.

The machine is covered by our 12 month warranty on faulty parts, subject to normal use. Record below the serial number of your machine to help trace the machine and assist us when you order parts.

Model: _____

Serial Number: _____

Options

- | | |
|--|--|
| <input type="checkbox"/> Hydraulic Shank | <input type="checkbox"/> Levelling Bar Trailing |
| <input type="checkbox"/> Rigid Shank | <input type="checkbox"/> Hydraulic Lift Trailing |
| <input type="checkbox"/> CAT 2 Hitch | <input type="checkbox"/> Depth Stop Wheels |
| <input type="checkbox"/> CAT 3 Hitch | <input type="checkbox"/> Hydraulic Lift Wheels |
| <input type="checkbox"/> CAT 4 Hitch | <input type="checkbox"/> Mounted Flexiroller |
| <input type="checkbox"/> Furrower | <input type="checkbox"/> Hydraulic Coulters |
| <input type="checkbox"/> Mulch Blade | <input type="checkbox"/> Rigid Coulters |
| <input type="checkbox"/> Inclusion Plate | |
| <input type="checkbox"/> Sweeps | |

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Agrowplow – Company Profile

Agrowplow Pty Ltd is an innovative, soil conscious company committed to developing "Soil Care" products for improved, sustainable agriculture.

The founders of Agrowplow had the foresight to see that farmers needed to improve their practices if farming was to be sustainable.

The first Agrowplow was designed and built in 1977 to improve soil structure, increase humus levels and increase water infiltration and storage deep into the soil.

Today the company's range of Agrowplows and Agrowdrills are widely accepted by farmers and agricultural researchers for their unique capabilities. The term "Agrowplow" has become a "farming concept" rather than just another implement.

The company's range of specialised Agrowplows, Agrowdrills and other products are designed and manufactured under strict code of sustainable agricultural mechanisation, and promoted under the slogan:

"Prosperity Through Soil Care"

The company's research and development division develops world leading technology for Agrowplow which has resulted in a well-earned reputation of turning market "Ideas" into reality.

Development is undertaken with the professional guidance of fully qualified design engineers with the use of 3D CAD/CAM that supports the complete design to manufacture process. All designs are manufactured to the highest standards of quality control.

Agrowplow has a large factory area (3500 square metres) with extensive fabrication equipment. Experienced and qualified personnel form an extensive resource in all areas.

Agrowplow - building soil care products for improved, sustainable agriculture.

1. Safety

Agricultural machinery presents an operator with hazards associated with setting up, on and off road transport, tillage and seeding applications, as well as machine service and maintenance. The operator must be aware of these hazards.

The dealer will explain the capabilities, safe application, service requirements and restrictions of the machine and demonstrate the safe operation of the machine according to Agrowplow's instructions. The dealer can also identify unsafe modifications or use of unapproved attachments.

The following publications provide information on the safe use and maintenance of the machine and attachments:

- The operator's manual delivered with the machine gives operating information as well as routine maintenance and service procedures. It is a part of the machine and must stay with the machine if it is sold. Replacement operator's manuals can be ordered from your Agrowplow Dealer.
- The machine has decals that instruct on safe operation and care.

1.1. Shared Responsibility for Safety

1.1.1. *Why is farm safety important?*

Farming is dangerous. Farms have many conditions that create dangerous situations including increasing use of machines and chemicals, confined spaces, live animals, constantly changing weather conditions, very young and very old people and continual financial pressure to get crops in and harvest off on time. As any combination of these factors can become lethal, control of occupational health and safety risks has become an essential farm management competency.

Taking risks with the lives of family members or employees is not something that should ever be contemplated!

Farm accidents are often workplace accidents of a different kind. While any workplace accident is a tragedy, a farm accident is often a family disaster where a breadwinner, grandparent, child or other family member is injured or killed. At times the tragedy is made worse by the fact that another family member may have caused the accident and is charged with an offence under occupational health and safety legislation.

Considering that the likelihood of an accident can be significantly reduced by people being more safety conscious, safety should be a topic of frequent discussion among family members and farm employees. Children also need to be trained to recognise hazards and to never use machinery as a plaything, as they too can play a role to remind others to never take safety risks. The loss of fun that kids might otherwise have on machinery is nothing compared to the grief of harm done to a child.

1.1.2. *Four Big Reasons Why Safety Is Important*

- Accidents Hurt
- Accidents Cost
- Accidents Involve Others
- Accidents Can Be Avoided

1.1.3. *How to Create Safety Awareness*

The Safety slogan – 'Think it, Talk it, Work it', summarises what we all must do to make workplaces that are without risk to the extent that is reasonably practicable. Assuming that the chain of responsibility is working as it should,

machinery will be properly guarded, safety switches fitted and proper information given by way of Operator Handbooks, decals, verbal instruction and so on to all relevant personnel.

Risk awareness and proper use of a machine is the result of an employer having been given relevant information, taking safety seriously, and ensuring that each operator of a machine is properly trained and supervised.

1.1.4. Consultation

Providing information is a good beginning. Each employee must then be free to further discuss safety related matters and ask for further assistance from your employer, Health and Safety Representative, or workplace OH&S Authorities if required. Consultation is always best if it is done cooperatively, as part of the way business is normally done, at smoko discussions or at more formal meetings depending on the topic and your business situation.

Ultimately, we are only safe at work when everyone who is responsible for safety has played their part and the employer, supervisor and the person using a hazardous machine “thinks it, talks it and works it”. Safe working conditions are the result of a safety culture in which everyone participates, where it would be unacceptable to behave any other way.

1.1.5. Hazard Identification

A hazard is something that has the potential to cause harm to a person. Where you are now there may be hundreds of hazards. Some hazards have so little potential for harm, due to their likelihood, that we can disregard them. Other hazards, because of the real and likely potential for serious harm, must not only be identified, but also controlled so as to eliminate or reduce the potential for harm to a person.

1.2. Safe Operation

This section offers general guidelines for the safe operation of machinery. It does not replace local, state or federal safety regulations.

Agrowplow has made every effort to highlight all risks to personnel or property. Owners and operators have a responsibility to exercise care and safe work practices at all times in the vicinity of the machine. Owners are advised to keep up to date on safety issues and to communicate these to all users of the machine. If you have safety concerns specifically related to this machine, contact your dealer immediately.

1.2.1. Operator Safety

Read this manual carefully before operating new equipment. Learn how to use this machine safely. Be thoroughly familiar with the controls and the proper use of the equipment before using it.

Take careful note of all safety instructions both in this manual and on the machine itself. Failure to comply with instructions could result in personal injury and / or damage to the machine. Replace missing or damaged safety decals on the machine and ensure that these remain clearly visible.

It is the owner’s responsibility to ensure that anyone who operates, adjusts, lubricates, maintains, cleans or uses the machine in any way has had suitable instruction and is familiar with the information in this manual. Operators and other users of the machine should be aware of potential hazards and operating limitations.

1.2.2. Have Training with Actual Operation

- Operator training must consist of a demonstration and verbal instruction.
- This training is given by your dealer when the machine is delivered.
- New operators must start in an area without bystanders and use all the controls until they can operate the machine safely under all conditions of the work area.

1.2.3. Know the Work Conditions

- Operators must know any prohibited uses or work areas. They need to know about excessive slopes and rough terrain.
- Operators must know the local road transport regulations, and understand the dangers and requirements of transporting wide and heavy equipment.
- Always wear protective clothing when servicing the machine.
- For operators to be qualified, they must not use drugs or alcoholic drinks that impair their alertness or coordination while working. Operators who are taking prescription drugs must get medical advice to determine if they can safely operate a machine.

1.3. Warning Decals

Safety Warning Decals are a means of communication the presence of hazards and appropriate risk controls to machinery operators.

- Do not remove any safety instruction decals.
- Ensure that any safety decals are clear and visible. Clean and replace as necessary.

1.3.1. Hazardous Machinery

Misuse or incorrect operation on any machine could cause serious injury or death to either the operator or bystanders. It is important to always fully read the Operator's Manual and understand all operating and safety procedures before using the machine. If you have any queries relating to safety or the operation of any machine contact your Agrowplow dealer immediately.

All guards and safety devices must be kept on the machine and maintained in a functional condition. If necessary to remove guards or safety devices for maintenance they must be replaced before commencing operation.

Sound the horn before starting the machine and before moving off to alert bystanders of your intentions. Bystanders must also be well clear of the machine before operating.

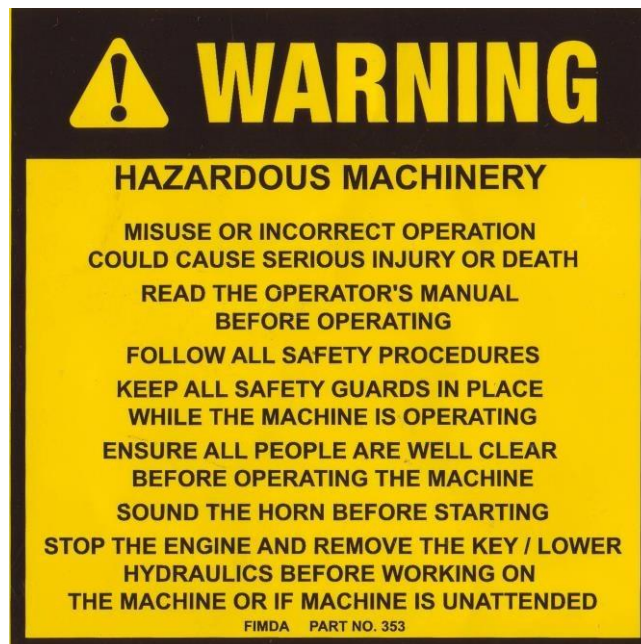


Figure 1 Hazardous Machinery Decal

If the machine is to be left unattended the hydraulics must be lowered and the engine stopped. This will prevent accidental operation of the machine.

1.3.2. Bystanders



Figure 2 Do Not Operate Near Bystanders Decal

Do not operate any agricultural machinery near bystanders. Serious injury or death to bystanders could occur if they come in contact with projectiles, chemical spray, fertiliser and/or grain dust and moving machinery.

Sound the horn before starting the machine and before moving off to alert bystanders of your intentions. Make sure bystanders are well clear of the machine before operating.

1.3.3. Machinery Safety Guards



Figure 3 Rotating or Moving Machinery Decal

Safety hazards related to exposed drive belts, pulleys, chains, sprockets and other mechanisms must be clearly identified and properly guarded. Some hazardous mechanisms like tynes and coulter discs cannot carry out their intended function if they are guarded and must, therefore, be controlled by an alternative means. Guards must be fixed in place with bolts, locks or fasteners that require a tool or key to remove them.

Always wear Personal Protective Equipment (PPE) including overalls whilst operating the machine. Loose items of clothing, jewellery (including watches), or long hair could all become entangled in rotating or moving parts causing serious injury or death.

Keep clothing and body extremities well clear of pinch points while the machine is operating. Keep well clear of moving parts at all times. These include drive chains, sprockets, shafts, wheels, discs, pivot points, etc. Guards are

provided with the machine for safety reasons where practical without compromising machine performance. Ensure these are always fitted during operation.

1.3.4. Hydraulic Fluid Penetration

A hydraulic fluid leak can, under high pressure, penetrate a human body

Appropriate risk controls must be established to safe guard against hydraulic fluid penetration. All hydraulic machinery should be inspected regularly. Worn hoses and faulty connections, valves or cylinders, must be repaired or replaced.

Operators should be warned that, in some cases, residual pressure can remain in a hydraulic system after it is shut down. In these situations the cause of the residual pressure needs to be identified and controlled to avoid the possibility of a high pressure hydraulic fluid leak or the unintended operation or movement of the machine or attachment.

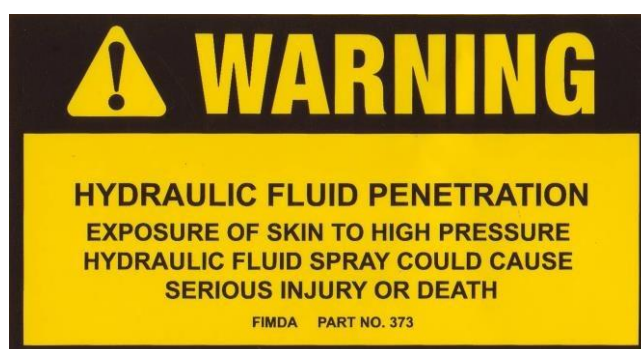


Figure 4 Hydraulic Fluid Penetration Decal

Relieve the pressure before disconnecting any hydraulic or other lines. Make all repairs and tighten all fittings before re-connection to pressurised fluid. Keep your hands and body away from any pinholes or high pressure jets. Search for leaks with a piece of cardboard instead of using your hand directly.

Avoid any contact with fluids leaking under pressure, because the fluids can penetrate the skin surface. Any fluid which penetrates the skin will need to be removed immediately by a medical expert. Seek specialist advice on this type of injury.

To eliminate the risk of serious injury or death:

- Repair or replace all possible causes of leaking hydraulic fluid, including:
 - Faulty valves, cylinders and components;
 - Worn hoses and fittings.
- Train operators to shut down pressure pumps or pressure sources before coupling or uncoupling hydraulic connectors
- Never use bare hands to check hoses for leaks. Use a piece of paper to detect a high pressure spray
- Use Personal Protective Equipment.

Instruct operators to wear protective equipment, including safety glasses, if there is a high likelihood of a high pressure hydraulic leak.

1.3.5. Hot Components

During operation hydraulic components such as motors, pumps and valve blocks can become quite warm. Do not touch these components until they have cooled down otherwise serious injury such as burns could result.



Figure 5 Heat Source Decal

1.3.6. Three Point Linkage



Figure 6 Three Point Linkage Decal

The three point linkage on a tractor creates numerous pinch and crush points that could cause serious injury or death. Keep well clear of this area when the engine is running.

Shut the engine off for all attachment, un-attachment and maintenance in this region.

1.3.7. Service Access

Using incorrect access points could result in serious injury or death as a result of slipping and /or falling. Agricultural machinery contains many sharp edges and points. Some of these can and should be guarded, whilst other sections cannot be guarded without compromising the working function of the machine.

Always use access platforms and access ladders to carry out maintenance or refilling. If maintenance is required on parts of the machine not serviced by an access platform always use a ladder or some other form of access device.



Figure 7 Do Not Climb On This Machine Decal

Do not ride on, or allow passengers on, the machine. Under no circumstances are passengers to be permitted on the machine while it is in operation or being transported. Any platforms and/or steps are provided solely for the purpose of preparing the machine for use.



Figure 8 Do Not Enter This Area Decal

Always shut the engine off before climbing into, onto or under machinery. If engines are operating power could accidentally be directed to components in these areas and cause serious injury or death.

Always keep clothing and hands clear of all engine driven components. Serious injury or death could result by contact with fast or powerful components.



Figure 9 Engine Driven Components Decal

1.3.8. *Handle Agricultural Chemicals Safely*



Figure 10 Chemical Hazard Decal

All farm chemicals including fertilisers should be stored, used, handled and disposed of safely and in accordance with the manufacturer's recommendations. Read the product label before using, noting any warnings or special cautions, including any protective clothing or equipment that may be required.

Do not eat or smoke while handling chemicals, fertilizers or coated seeds. Always wash your hands and face before you eat, drink or use the toilet.

Store chemicals, fertilizers and coated seeds out of reach of children and pets, and away from food and animal feeds. Any symptoms of illness during or after using chemicals should be treated according to the manufacturer's recommendations. If severe, call a physician or get the patient to hospital immediately. Keep the container and/or label for reference.

1.3.9. *Controlling Noise*



Figure 11 Noise Exposure Decal

Excessive noise levels can cause permanent hearing impairment. The incidence of hearing impairment increases as the exposure to noise increases. Noise levels are cumulative and increase with each extra noise.

Noise can be reduced by eliminating sounds. Isolate noisy operations by making sure that they are carried out away from other people.

Provide sound reducing equipment such as a cab on a tractor. Avoid using noisy equipment if possible.

Use warning signs to remind people to wear hearing protection and reduce noise. Have staff that work in noisy environments undergo an annual hearing check.

Always wear earplugs, or similar devices, when carrying out noisy activities.

1.3.10. Battery Explosion

Automotive lead/acid batteries may explode when improperly handled or used. Explosion may cause a person to be injured by the force of the explosion or a spray of sulphuric acid to their face or body.

Battery explosion may occur due to:

- Severe over heating due to overuse;
- A metal object being dropped on a battery causing a short circuit;
- A spark igniting hydrogen gas emitted when being charged;
- A spark igniting hydrogen gas when a battery is being installed or when jumper leads are applied.



Figure 12 Battery Explosion Decal

Operators must wear protective eye wear, gloves and clothing when handling or connecting batteries.

Batteries should always be covered when installed.

The final connection of a battery should always be the earth lead to the chassis or engine block, not to the battery.

1.3.11. Tyre Inflation

Tyres must not be inflated with unregulated air pressure where the pressure could exceed limits specified by a manufacturer.

Tyre inflation must always be observed by a competent operator to ensure the following is correct:

- Tyre to rim fitment
- Tyre / bead lubrication
- Bead seating
- Inflation pressure.



Figure 13 Tyre Inflation Decal

An operator must always face the tyre tread from the side and not from the face and no operator should stand in the blast trajectory of any tyre during inflation. The blast trajectory is the area in front of the wheel face.

Tyre explosion may be due to:

- Improper fitting of the tyre
- Improper fitting or damage to the rim or locking ring
- Excessive air pressure
- Inflation of damaged tyres or rims. Damaged tyres or rims must not be inflated until the damaged item is replaced or repaired to the satisfaction of a competent person. Used tyres must be inspected inside and out prior to fitment. Rims must be clean, free of rust, not cracked, distorted or improperly repaired. Do not inflate over 35psi to seat beads
- Unknown damage to the tyre casing causing a zipper effect casing failure
- Tyre / wheel incompatibility. Tyres must only be fitted to rims for which they are verified as being compatible by a competent person
- No lubrication. Tyres must always be lubricated with a suitable lubricant that allows proper seating without damage to the tyre or the use of excessive pressure.

1.3.12. *Electrical Hazards*



Figure 14 Electrical Hazard Decal

Contact with overhead power lines or other electrical supplies or devices can cause serious injury or death. Avoid contact with these objects at all times.

Look Up and Live!

1.3.13. *Raised Wings*



Figure 15 Raised Wing Decal

A failure of the wings mechanical lock or a failure in the hydraulic circuit can cause the rapid collapse of the wing itself. Contact with a falling wing can cause serious injury or death by crushing, impalement or other forms of trauma.

1.4. Ergonomic Safety

1.4.1. *Personal Protective Equipment*

Employers must provide a safe workplace for their employees.

Employers are responsible to ensure that Personal Protective Equipment (PPE) is available for use in situations where it makes a practical contribution to controlling hazards and safety risks.

Employers must also ensure that PPE is in good condition and is properly used by employees.

1.4.2. *Working at Heights*

Where work is required at heights where a fall of more than two meters is possible, operators must be aware of hazards caused by:

- Unstable, sloping or slippery surfaces;
- Proximity to unguarded edges;
- Other non-fall hazards.

Risks must be controlled by the most practicable of the following means:

- Do the task at ground level
- Use suitable equipment that provides a solid elevated working surface
- Use fall prevention system (safety harness)

Ladders are the least preferred means of working at heights and should only be used when there is no viable alternative such as:

- Stairs
- Cherry picker
- Portable steps
- Forklift with appropriate platform
- Scaffold

Emergency procedures including first aid must be available.

A safety harness must also be used where required by the nature of the task.

Where employees must work at height in situations including servicing of machines proper equipment, such as a ladder and proper training in its use and emergency procedures must be provided.

In other situations where employees must often or always work at height a proper scaffold or mobile platform must be provided which provides a solid working surface. Other potential hazards that may cause falls, such as fatigue from using a spray gun and exposure to paint fumes must be minimised.

1.5. Maintenance

1.5.1. *Practice Safe Maintenance*

Keep the machine in safe working condition. Routine maintenance and regular servicing will help reduce risks and prolong the life of the machine. General Maintenance Accidents occur most frequently during servicing and repair. The following general rules must be followed when maintaining or working with machinery:

- All operating and maintenance manuals must be read before and referred to while using or servicing any piece of equipment.
- Turn off all machinery power sources and isolate the machine before making adjustments, doing lubrication, repairs or any other maintenance on the machine.
- Ensure that the machine hydraulics are disconnected from the power source.
- Wear gloves when handling components with cutting edges, such as any ground cutting components.
- Beware of hazards created by springs under tension or compression when dismantling or maintaining the machine.
- It is recommended that you clean the machine before commencing maintenance.
- When machinery is fitted with hydraulics, do not rely on the hydraulics to support the machine. During maintenance or while making adjustments under the machine, always lock the hydraulics and support the machine securely. Place blocks or other stable supports under elevated parts before working on these.
- Extreme caution should be used when clearing coulters, tynes or soil openers. These may be very sharp and cause serious injury.
- Use due care when adjusting or maintaining any aspect of the Agrowplow. Failure to do so may result in serious injury.

1.5.2. Electrical Maintenance

Disconnect the electrical supply from the tractor before doing any electrical maintenance. When welding with electronic equipment in modern tractors and on machinery it is advisable to disconnect the machine from the tractor or at least disconnect the alternator and battery before attempting any welding.

1.6. Transporting the Machine

Ensure that all linkage pins and security clips are fitted correctly. With trailing machines tow with the drawbar only as this is the only safe towing point on the machine. Always check that bystanders are clear before starting and moving the tractor and the machine. Plan safe routes of travel, and be aware of power lines and other roadside hazards. Take particular care when towing implements on hillsides.

Do not pull trailed Agrowplows with any vehicle other than a tractor.

In most instances the weight of the Agrowplow exceeds the unbraked towing capacity of the tow vehicle (except tractors). Not only is this unsafe it will also void the vehicle manufacturer's warranty.

Do not ride or allow passengers on the machine. This machine is not designed to carry passengers and therefore no riders are permitted at any time.

Please consult your local transport authority regarding the use of 'Oversize' signs, escort vehicles and lighting equipment when transporting agricultural machines on public roads.

When transporting the machine:

- A speed of 30 km/h must not be exceeded. Transporting at greater speeds will result in loss of implement control and cause serious damage or injury.
- Do not transport the Agrowplow without the tractor drawbar being in a locked position. Transporting without the drawbar locked will result in loss of implement control and serious damage or injury.
- Do not transport an Agrowplow with a vehicle of less gross mass than that of the Agrowplow being towed. Transporting with a smaller lead vehicle will result in loss of implement control and cause serious damage or injury.
- Make sure the Agrowplow does not exceed the unbraked towing capacity of the lead vehicle.
- Do not pull trailed Agrowplows from any point other than from the tractor drawbar. Pulling from a point other than the designated tractor drawbar can result in tractor instability and cause serious damage or injury.
- Do not operate when visibility is limited e.g. in foggy conditions. Do not operate outside daylight hours unless lights are fitted.
- Please consult your local road transport authority for road use e.g. Oversize Transport.
- Avoid holes, ditches and obstructions which may cause the machine to tip over, especially on hillsides.
- Never drive near the edge of a gully or steep embankment as it might cave in.
- Slow down for hillsides, rough ground and sharp turns.

1.7. Un-Hitching the Machine

When unhitching the Agrowplow:

- Always unhitch on a solid, flat surface
- Always lower the hydraulics of the machine. The Agrowplow is more stable when the undercarriage is resting on the ground than if it is left in the raised position. Machines left in the raised position are susceptible to hydraulic failure causing the machine to crash to the ground and a rapid discharge of

pressurised hydraulic fluid. Lowering the Agrowplow to the ground will also relieve pressure from the hydraulic circuit making it safer and easier to connect and disconnect the hydraulic couplings.

- Always place chocks behind and in front of the wheels to prevent accidental movement on the machine.
- Always lower the jack stand to 'take the weight' of the A-frame. This will provide further stability to the parked Agrowplow.

1.8. Risk assessment

Practicing an attitude of safety will require all operators are trained in performing risk assessments. A risk assessment must be performed for any new task or change in routine. It is also recommended that risk assessments be performed (even if only mentally) for all routine tasks and any occasion of usage. It is the owner's responsibility to ensure the machine is used safely.

The table on the next page is a guide to assess the severity of hazards associated with the machines use. The columns listed include:

- Hazard Type – lists hazards for assessment and notes whether they are relevant to the machine
- Cause of Hazard – lists the area or application of the machine which applies to the hazard
- Risk Control – lists appropriate safety measures to protect personnel and equipment from damage or harm

The risk assessment rating is calculated from the following table by taking the value for 'Risk Severity' and adding it to the value for 'Likelihood of Occurrence'.

RISK ASSESSMENT	Rate the severity & likelihood of any hazards present within the machine			
RISK SEVERITY	4 = Possible fatality	3 = Major injury	2 = Minor injury	1 = Negligible injury
LIKELIHOOD OF OCCURRENCE	4 = Very likely	3 = Likely	2 = Unlikely	1 = Very unlikely
FREQUENCY	If the exposure to a hazard is very frequent e.g. continuous, compared to weekly, monthly etc., this should be reflected in increased likelihood of occurrence.			
Add the Risk Severity to the likelihood of Occurrence to calculate the Risk Assessment Rating				

Table 1 Risk Assessment

The Risk Control measures listed should be in accordance with the following risk assessment ratings:

- Less than 3 – Low Risk, Acceptable Hazards

Issues to be reviewed with regularity but no specific action is required. Machine usage with awareness.

- 3 to 4 – Medium Risk, Hazards to be managed

Decals or warning signage should be fixed in reasonable locations. All personnel who interact with the machine should be warned of the hazard. Operators to be trained to never operate machine when safety measures are not being adhered to.

- 5 and higher – High Risk, Unacceptable Hazards

Operators must be trained to check that no risk of this hazard is present before or while using machine and must never use the machine when any risk of this hazard is present.

HAZARD TYPE		CAUSE OF HAZARD		RISK CONTROL
Is there a potential for injury or illness due to ...	YES or NO	What is the cause or source of the hazard ...	RISK ASSESS RATING	Determine and apply appropriate risk controls after considering Hierarchy of Risk Control
CRUSHING Crushing or impact during operation	YES	Attachment of machinery to tractor with 3pt link or hitch Folding Frame sections (folding ploughs only)	4 + 1 = 5	Do not operate with personnel on machine Clearly view crush area when reversing tractor toward machinery Fit transport lock for road or longer "on farm" travel (folding ploughs only) Apply safety stands before performing maintenance
ENTANGLEMENT Entanglement, drawing in, pinching or trapping	YES	Entanglement in wheel or shanks Rotating augers & similar mechanisms for moving seed/fertiliser (Ploughs with fertiliser box)	4 + 2 = 6	Do not operate with personnel on machine Do not operate with personnel in machine path
STRIKING OR IMPACT An object striking the operator or another person	YES	Material discharge from shank or striking rock Maintained activity replacing points	3 + 2 = 5	Do not operate with personnel in close proximity to plough Use eye and face protection when removing or replacing shank points
CUTTING A cutting, stabbing or shearing	YES	Shank point in operation, shearing against ground	4 + 2 = 6	Do not operate with personnel under plough or in its path
SLIPPING - PERSONNEL slipping, tripping or falling	YES	Moving over machine while removing trash, changing points or shin guards Walking over aerated and unstable ploughed ground	2 + 2 = 4	Apply 3 points of contact for access at all times Ensure no loose or hanging hoses or similar items that could cause a trip hazards Use caution and appropriate footwear when walking on unstable ground
SLIPPING - MACHINERY uncontrolled machine movement	YES	Travelling over slopes, slippery or sodden ground	3 + 2 = 5	Use tractor of equal or greater weight than towed weight See Tractor hazard control
EXPOSURE Exposure to vibration, heat, radiation, friction or abrasion	NO	Heat from tractor, see tractor hazard control		
NOISE Excessive noise	YES	Operation noise	1 + 1 = 2	Apply hearing protection if noise becomes hazardous
HIGH PRESSURE FLUID PENETRATION Hydraulic fluid leak	YES	Hydraulic tube or fitting leaking high pressure oil (ploughs with hydraulic system only)	3 + 1 = 4	Inspect hydraulic system for leaks using appropriate caution Use correct fittings & correct pressure rating for hoses in maintenance
HAZARDOUS SUBSTANCES Hazardous or dangerous substances or suffocation	NO	Exhaust from Tractor, see tractor hazard control		
MANUAL HANDLING Manual handling or ergonomic conditions	YES	Maintenance operations removing trash, changing shanks, adjusting shanks	2 + 2 = 4	Practice safe lifting of heavy objects Perform maintenance tasks in workshop with lift assistance
EXPLOSION Sudden release of pressure, chemical combustion	YES	Bursting tyre	3 + 1 = 4	Do not pressurise tyres beyond recommended pressure
ELECTROCUTION Electrocution, electrical burn	YES	Contact with underground electrical cables Contact with overhead cables	4 + 1 = 5	Practice electrical safety in the event unearthing underground cables (Folding ploughs only) Look up before folding plough wings into transport position.

Table 2 Risk Assessment Rating

2. Operational Expectations and Limitations

2.1. Completing Safe Use Instruction (SUI) & Pre Delivery Inspection (PDI) Reports

At the time and point of delivery an Agrowplow dealer or salesperson must present the SUI & PDI documents to the purchaser as a record of the installation process. This should be the result of a face to face installation. The intended purpose for the machine is to be discussed and confirmed including:

- Reasonable depth and speed of use in the country it is to be used in.
- Limitations to the use of the machine according to an intended application that prevents a safety hazard arising.
- Limitations to the use of the machine to avoid premature wear or damage to the machine.
- Reasonable expectations of the machine when paired with other equipment such as the intended tractor and any other implements being towed.

This conversation will be specific to the machines application and the type of country it is being used in. Some customers may need to be told to lift their machine over rocky outcrops, others may need to understand the wear rate of sandy soils and others the varying speed and depth which is reasonable in dry or wet conditions. Agrowplow expects and trusts our dealers to represent our product into their local environment and for the customer's application.

The use of the SUI and PDI Reports is mandatory. Each document must be completed as part of the sales process of every machine and returned to Agrowplow. Each completed document must detail:

1. The intended use of the machine.
2. Safe operating procedures for the proper use of the machine and the safety controls that have been used to reduce or eliminate identified hazards.
3. A warning of the existence of hazards remaining in the machine and an explanation as to why the hazard remains.
4. Limitations to the use of the machine resulting from any remaining hazards as recorded on the SUI Report.
5. Limitations to the use of the machine according to an intended application that prevents a safety hazard arising;
6. Limitations to the use of the machine to prevent damage or premature wear.
7. Any additional training the operator may require to use the machine safely.

DEALERS ARE RESPONSIBLE BY LAW TO DETERMINE THAT MACHINES ARE SUITABLE AND PROPERLY EQUIPPED FOR THE APPLICATION THEY KNOW OR SHOULD REASONABLY HAVE KNOWN THE MACHINE WILL BE USED FOR. THIS IMPLIES THAT A SUPPLIER MUST ENQUIRE WHAT THE MACHINE IS TO BE USED FOR, AND A FURTHER REVIEW OF SAFETY CONTROLS MUST BE CARRIED OUT, IN VIEW OF THE SPECIFIC APPLICATION THE MACHINE TO THIS INTENDED PURPOSE.

The purchaser must sign the completed SUI as evidence that information and training has been provided and that the purchaser now has the responsibility to train all other operators. It is the responsibility of the purchaser to ensure all other operators are trained.

THE ORIGINAL SUI AND PDI FORMS MUST BE COMPLETED, SIGNED AND RETURNED TO AGROWFLOW

3. Machine Setup

3.1. Hitching and Levelling

The plough should be matched to the tractor size to maximise performance and efficiency. A mismatched tractor and implement may be inefficient, cost money, be unsafe or risk premature wear on the machinery.

3.1.1. Three Point Linkage Models

The three-point linkage lift capacity of the tractor will generally determine the required tractor size. Check the tractor's operator's manual for details.

It may be necessary for the tractor to be front weighted when using the Agrowplow. The larger ploughs are very heavy and will transfer weight off the front wheels. This can be very dangerous in hilly areas and when travelling at speed on the road. Consult the tractor's operator's manual for recommendations.

The hitching and levelling procedure is as follows:

1. Attach and level the Agrowplow laterally (side to side) using the screw adjustable linkage arm.
2. Set both depth wheels evenly at the desired working depth and tighten the locking collar or retaining bolt firmly.
3. Set the angle of approach (fore-aft level) using the tractor's adjustable top link. Set up the front and rear depth to be equal.
4. Start working at the desired depth and observe the level of the machine from both the side and the rear.
5. Readjust and repeat the above procedure if necessary.
6. Retighten the locking collar on the top link after completing adjustments.

It is very important that the Agrowplow be levelled correctly to achieve good results. Set up the front and rear shanks so they are working at the same depth.

Three point linkage stabiliser bars must be used at all times particularly if coulters are being used. Adjust the stabilisers to bring the Agrowplow directly behind the tractor, allowing only slight side-to-side movement.

The tractor's three-point linkage system should be operated in the 'float' mode allowing the Agrowplow to be supported by the depth wheels and to follow the ground contours. Consult the tractor operator's manual for details.

3.1.2. Trailing Models

Hitching

The hitching procedure is as follows:

1. Pin the tractor drawbar into the central position.
2. Attach the Agrowplow to the drawbar and set the adjustable levelling tube so that the machine is approximately level.

Warning: *Ensure the drawbar pin is locked into position so that it cannot work itself out when the machine is in operation or transit. Failure to do this may result in serious injury or death.*

3. Attach the hydraulic coupling to your tractor remote outlet, taking care to clean away any dirt.
4. The working depth of a trailing Agrowplow is controlled by the hydraulic rams attached to the wheel assemblies. These are operated by the remote hydraulic system.
5. Connect the levelling tube to the top lugs of the tower.
6. Disengage the jack stand and adjust the hitch level to suit the drawbar height of the tractor. When level, ensure the levelling tube is locked using the locknut.

Hydraulic Lift Circuit

The procedure to connect and prime the hydraulic lift circuit is as follows:

1. Ensure both the tractor remotes and the hose couplings are clean and then connect to the tractor.
2. Loosen the hydraulic connector on the input line (barrel end) of the right hand wheel lift cylinder. This should be done to allow air to escape while the hydraulics are being primed.
3. Slowly pressurise the hydraulics until oil appears at the loosened connection on the right hand cylinder.

Note: *Stand well clear of the loosened connection as oil under pressure can spray wildly outwards. It is a good idea to place a hessian bag or similar material over the connection to minimise oil movement.*

4. Retighten the connection as soon as oil appears.
5. Continue to prime the hydraulic lift circuit until the right hand cylinder is fully extended. Hold the hydraulics open for a further 15 to 20 seconds to allow air to clear from the circuit.
6. Fully raise and lower the machine several times to expel any residual air trapped in the circuit.

The lift circuit is now fully primed and the Agrowplow can now be moved.

Levelling

Set up the plough to be level while operating. The levelling procedure is as follows:

1. Start working at the desired depth and observe the machine from both the side and the rear.
2. Adjust the levelling tube so that the machine is level from front to rear.
3. Retighten the locking collar on the levelling tube when adjustments are completed.

It is very important that the Agrowplow be levelled correctly to achieve good results. Ensure that the front and rear shanks are working at the same depth.

3.1.3. Hitching Conversion

The AP71 ploughs can be operated as either a trailed or three-point linkage machine. It is standard with Three Point Linkage however an optional Trailing Kit can be either factory or retro fitted.

A three-point linkage machine can be converted to a trailing machine by fitting:

- The trailing drawbar assembly
and
- The trailing hydraulic kit including cylinders, hoses and couplings

3.2. Working Depth

Working depth will vary depending on the soil type and conditions and the objective of the ploughing operation. The drawbar power of the tractor will also have an influence on working depth. As a guide Agrowplow recommends 15 to 20 horsepower (11 – 15 kW) per shank.

The following are important guidelines:

- Operating depth needs to be deeper than the hard pan or compacted layer being targeted.
- Working too shallow will have a minimal effect and will increase surface disturbance.
- Working too deep may cause shanks to 'lay back' particularly on hydraulic recoil models or will cause shear pin failure on rigid models.
- **Do not** work deeper than the shank pivot points. This will prevent the shank protection device from functioning correctly.

Consult an Advisory Officer for a recommendation regarding working depth if unsure.

3.3. Operating Speed

The Agrowplow will produce the best results if operated between 2 and 6 km/h. Optimum speed will vary with the soil type, moisture content, vegetative cover, root matter and rock present.

Slower than 2km per hour may not achieve the shattering effect (see chapter 5. Plough Operation), while higher speeds will increase soil surface disturbance, reduce penetration run increased risks of breakage. High speeds will also increase wear on the blades.

3.4. Optional - Mulch Blades

The Agrowplow can be fitted with Mulch Blades to allow for deep ripping and a weed kill in one pass while still maintaining minimal surface disturbance. Mulch Blades should not be used too deep as the blades will not cut the root system. The shanks will 'lay back' as a result of increased load and hence increase surface disturbance. Draft load on the tractor will also be higher.

The blades are attached to the rear of the shank by bolting the blade clamps through the holes running down the rear spine of the shank.

The procedure for setting up Mulch Blades is as follows:

1. Attach the Mulch Blades to the shanks so they cut approximately 50mm below the surface.
2. Operate the Agrowplow and observe depth and weed kill.
3. Adjust the position of the Mulch Blades if necessary.
4. Retighten the retaining bolts after a few hectares of operation.

3.5. Optional - Furrowers

The 24" Agrowplow Shank can be fitted with Furrowers to allow for the creation of furrows or the reformation of bed walls. Furrowers will drastically increase the load on the shank and hence tractor draft force.

The furrowers are attached to the rear of the shank through the holes running down the rear spine of the shank. The procedure for setting up Furrowers is as follows:

1. Determine working depth of the shank.
2. Set the vertical position of the Furrowers at the approximate desired furrow height.
3. Operate the Agrowplow and furrow height and formation.
4. Adjust the position of the Furrowers up or down as necessary.
5. The pitch of the Furrowers can also be adjusted using the adjusting screw at the rear of the assembly.
6. Retighten the retaining bolts after a few hectares of operation.

3.6. Optional - Coulters

Optional coulters are available to suit both rigid and spring release shanks. Coulters are used to minimise surface disturbance and assist in residue handling. This is beneficial in pasture renovation applications.

Different shank styles and shank protection systems have different coulters arrangements available. Please consult your Agrowplow dealer to determine the right coulters to suit your application and machine.

Points to consider when using coulters:

- Coulters should be adjusted to approximately 50mm working depth when the shank is at the desired working depth.
- Do not turn sharp corners with rigid coulters fitted.
- Be aware of immovable objects, as some coulters are not fitted with a protection device.

The Agrowplow can be equipped with either plain or fluted coulters. Key factors to consider when choosing the type of coulters are:

- **Plain Coulters**
 - Used where best appearance of the finished job is required.
 - Used in harder soil where maximum penetration is required.
 - Lower wear rate than fluted coulters
- **Fluted Coulters**
 - Perform better in very heavy trash conditions.
 - Cause less smearing in clay type soils.
 - More aggressive soil surface disturbance.

4. Undercarriage Set Up

This section outlines the different set up procedures for the different Shank Protection Systems.

4.1. Rigid Shear Pin Shanks

Rigid Shear Pin shanks are available on all models in the Agrowplow range. Shank protection is via a shear pin inserted in lieu of one of the mounting bolts at the top of the shank. These shear pins are designed to fail at a predetermined force. Once this force is exceeded the pin fails and the shank lays back.

Shear pin failure is finite and a 'failed' shear pin cannot be reused.

The procedure to replace a shear pin is as follows:

1. Lift the machine out of the ground.
2. Fit ram safety stops (if applicable)
3. Remove any remaining parts from the failed shear pin
4. Reposition shank back into working position
5. Insert new shear pin
6. Secure shear pin with locking clips

Do not use a non-standard shear pin (such as a standard bolt) in place of the correct shear pin. Agrowplow will not be held responsible for any failure, injury or death resulting from the use of incorrect shear pins.

4.2. Hydraulic Recoil Shanks

Hydraulic Recoil shanks are available on all models in the Agrowplow range except the Vineyard Plow and AP11.

Shank protection is via a hydraulic recoil system. The system is pressurised from oil in the tractors hydraulic system. As the shank encounters an obstacle the oil is forced out of the cylinder back into the circuit increasing the pressure in the accumulator. When the obstacle is cleared the accumulator forces the oil back into the cylinder returning the shank to its operating position.

The pressure in the operating system can be adjusted according to the operating conditions by increasing or decreasing the oil level in the circuit. A shut off valve is located near the base of the accumulator to either open or close the circuit from the tractors hydraulic system.

Operational Warning

The hydraulic system is not designed to have more than half the shanks in the assembly recoiled at the same time. The hydraulic assembly is not designed to be in a state of constant recoil or repetitive recoil of more than 6 times a minute. If during operation the shanks are consistently compressed, the majority of shanks are compressed at the same time or individual shanks are being recoiled more than 6 times a minute, **the operator must raise the working depth of the machine to avoid excess wear and potential damage to the machine.**

4.2.1. Hydraulic Shanks Operational Limits and Accumulator Pre-charge Pressure

The accumulator pre-charge pressure will be written on the end of the accumulator.

Accumulator Pre-charge	Shank Assembly	Minimum/Maximum Hydraulic System Pressure
90 bar (1300psi)	#8 Shank	105 – 150 bar (1500 – 2200psi)
115 bar (1660psi)	#9 Shank	125 – 150 bar (1800 – 2200psi)
140 bar(2030psi)	#9 Shank	145 – 165 bar (2100 – 2400psi)

Table 3 Hyd Shanks Operational Limits & Accumulator Pre-Charge Pressure

The values in this table related to ploughing ‘reasonably clean country’. Values may need to be reduce for rocky country and the operator may need to raise the working depth of the plough to avoid damage to the machine. Consult your Agrowplow dealer or call Agrowplow for further information.

Do not exceed Maximum Pressure as this may cause damage.

Do not operate at less than Minimum Pressure as this will damage the shanks as they will be allowed to ‘lay back’ causing their operating geometry to change. The accumulator bladder may also get pinched by the accumulator spring valve. This will cause premature wear of the shanks and possible accumulator failure.

Agrowplow will not be held responsible for any failure, injury or death resulting from the operation outside of these parameters.

4.2.2. Accumulator Pre-Charge Pressure and Testing

The accumulator pressure balances against the hydraulic oil pressure and gives the oil in the shank pistons somewhere to go when the shanks recoil.

Nitrogen may leak out of the accumulator over time. If the accumulator pressure drops lower than the recommended pressure this will result in premature wear and part breakages. No accumulator pre-charge will cause the plough to become rigid, with no shear point or recoil protection. Using the plough without correct accumulator pressure will void warranty. Check the accumulator pressure before use. To test the pressure in the accumulators:

- 1 Pressurise the hydraulic system to above the pre-charge pressure in the accumulator
 - for example if the accumulator was pre-charged to 140bar(2030psi), charge the system to 2300psi
- 2 Slowly release the pressure from the hydraulic system
- 3 Watch the gauge for the moment when it changes speed.
 - The gauge should slowly drop as the accumulator balances against the tractor pressure. When the accumulator empties of oil, the gauge should quickly drop.
 - Note the reading from when the gauge started to quickly drop, compare this value with the pre-charge value for the accumulator.
- 4 If the accumulator has lost pressure since it was last pre-charged, have it charged to the correct level.

In a hydraulic system where there is more than one accumulator, this test will show the pressure of the lowest charged accumulator in the system.

4.2.3. Priming the Hydraulic Recoil Circuit

Before commencing operation the hydraulic circuit of the Agrowplow must be primed. The procedure is as follows:

1. Fold the wings down (if applicable).
2. Open the shut off valve so oil can flow to and from the tractor.
3. Loosen the hydraulic hose connection at the base of each recoil cylinder (one per shank).
4. Lower the machine to the ground so the blades are just touching the surface.
5. Drive forward slowly and at the same time lower the machine to the ground until each shank is in the full recoil position. This removes any air from the system.
6. Slowly pressurise the hydraulics until oil appears at the loosened connection on the cylinders.

Note: *Stand well clear of the loosened connection as oil under pressure can spray wildly outwards. It is a good idea to place a hessian bag or similar material over the connection to minimise oil movement.*

7. Retighten all connections as soon as oil appears
8. Raise the machine to its full transport height
9. Continue increasing pressure until at the required working pressure.

The recoil circuit is now fully primed and the Agrowplow can now be used.

5. Plough Operation

The Agrowplow machines are designed to work in a range of different soil types and conditions however like all machines they have limitations. This section maps out some of the issues which may be faced while ploughing and how one might best work toward achieving the desired results without damaging or causing undue wear on the machine. The conditions discussed here are a summary from all over Australia and will not all be relevant to your specific application. Consider these issues with respect to your own experience and knowledge of your land and application. The Agrowplow is part of a broader farming system – the ‘Soil Care System of Farming’. This may include crop rotations with different varieties, cereals or legumes and even break crops.

5.1. Ploughing in ideal conditions

In ideal conditions the blade of the shank pierces the ground down at the working depth. The blade acts like a wedge lifting the soil. As the soil is forced to lift it cracks and shatters into clods. The shattered soil then crumbles around the leg of the shank as it slides through the ground. These ideal conditions include the knowledge that the ground is free of rock because it has been tilled before. This allows the operator to work faster, confident that they will not hit obstructions. The greater working speed increases the shattering effect in the soil producing better quality tillage.

Do not aim for a nice clean, smooth seedbed. The even soil surface usually comes at the expense of compaction underneath. This leads to poor root growth and slow moisture penetration. Do not try and destroy large surface clods. This will break down naturally over time.

Breaking lots of shear pins or having the shank recoil regularly is often the first sign that the conditions your plough is working in are pushing the machine harder than it was designed for. The plough is designed to have the shank in its vertical position, not kicking back at an angle and only recoiling occasionally. If the conditions are such that the machine cannot function with the shank in the upright position or the shanks are consistently recoiling it is important for the longevity of your machine that you work appropriately to suit the conditions of your country.

5.2. Ploughing in tough conditions

The Agrowplow shanks are designed to operate in their upright position. If the recoil assemblies are kicking back regularly or the hydraulics are not recovering back to the upright position then they are not ploughing correctly and the machine is likely to be at risk of breakage or in the lease, undue wear. The shanks should be operating predominantly in their upright position with only the occasional recoil.

Trying to plough dry, compacted soil with rock, gravel or high silica content is going to put higher strain on the all the components of the plough. Attempting to plough in tough conditions at full depth or at increased speeds will also test the ploughs capabilities. Ploughing virgin country at full depth increases the risk that unexpected rock or roots may be just under the surface. Pairing a large tractor with a small plough increases the risks of damage to the plough as the tractor can pull the plough through conditions which would stall a smaller machine.

No single piece of advice will work for all conditions,

With that said, we suggest the following:

On the first pass plough slowly at a shallow depth, especially in virgin country. If the plough functions well without striking obstructions make a second pass at an increased depth. In the event that the plough strikes rock or obstructions which cause the shanks to recoil, remove the obstructions before ploughing again. If the obstructions cannot be addressed such as bedrock or seams of rock which come close to the surface, lift the plough over these features rather than force it through them.

If a hardpan has formed under the ground, work the blades under the hardpan rather than through it. It's best not to put the blades into the hardpan continuously as this increases wear on the blades and is harder work for the tractor. By placing the blades under the hardpan, the wedging action of the blades will cause the hardpan to crack upward requiring less fuel for the tractor and reduced blade wear.

Gauge the depth and speed of the machine to the conditions. If the soil is deep, easy to till and known to be free of obstructions then the plough can be lowered deeper and worked at a faster speed. If the country is rough or unknown, lift the machine and slow its operation so that striking unexpected obstacles won't put undue force on the shank assemblies. When the plough encounters a large obstacle, ease off on the acceleration, lift the plough or investigate the size and scale of the obstruction. When the soil proves free of obstacles, make another pass at an increased depth. Repeat this process till working at full depth and increased speed is possible without striking obstructions.

If working with a large machine with longer shanks on the rear tool bar and the machine is struggling to penetrate in tough conditions, consider adjusting the angle of approach so the machine tilts slightly forward. Work slow and shallow while testing the ploughs performance before working deeper or faster.

Ploughing in tough conditions may take multiple passes with other operations such as rock picking, unearthing roots or mapping untillable ground features. Passes can be repeated with the shank following down the same trench as a previous pass, offset from the previous pass or at an angle, each with different effect.

5.3. Specific Conditions

5.3.1. *Soil Moisture Content*

The moisture content of the ground significantly changes the effect of tillage. Tillage may be ineffective in soil with a high moisture content if the soil does not shatter or crack. If the soil allows the shanks to slide through the ground, wait for dryer conditions before ploughing. Extremely low moisture content can make some ground types almost impenetrable and cause breakages and undue wear on the plough. Working to the conditions or waiting for rain will reduce the risk of damage and undue wear.

As a guide to determine if the soil is ready to Agrowplow follow this procedure:

1. Dig to the depth at which you wish to work with a shovel and remove a section of soil from this depth.
2. Drop the section of soil on the ground from a height of approximately 450mm and observe how it breaks up.

If the soil breaks into a 'crumb' structure it is ready to work. If the pile appears dry, cloddy and dusty or if it doesn't break up and appears glazed on the surface then the soil is not ready for the Agrowplow and will need to dry out or get wetter accordingly.

5.3.2. *Compaction and Hard Pans*

One of the ploughs most rewarding applications is to work the blades under a compacted hardpan, cracking it up and allow for water and crops to penetrate deeper into the soil bed. This however may not be advisable in all seasons. If the overall ground compaction and low moisture content has resulted in hardened ground conditions such that shank penetration is pore or at the limits of the machines capability then waiting for rain may reduce the risk of damaging

your machine. Dry and compacted conditions can lead to specific issues for the hydraulic recoil assembly. While in operation listen for a chattering or shuddering effect caused by the shank repeatedly recoiling by an inch or so and then snapping back into position. Prolonged exposure to this form of shuddering has been shown to cause wear to the shank assembly bushes, hydraulic cylinder and in some cases breakages. If the shanks fail to penetrate, skip along the surface of the hard pan unable to crack through or shudder during operation it is advisable to wait for easier conditions.

5.3.3. Gravel, sand and high abrasion

All ground engaging components, including the shank will wear faster when working in high abrasion or sandy soil. Replacing the blade and shin or leg guards in a timely manner will save wear on the shank. Given enough work even the shank will become worn and require replacement. A range of hard face and tungsten tile ground engaging components are available to allow farmers to find the most cost effective solution for their specific application.

5.3.4. Surface Cover

Retaining crop residue such as stubble mulch both on the surface and in the root system below will protect the soil from both wind and water erosion. It will also improve moisture penetration and retention and retain heat. The root systems of previous crops and valuable organic matter to the soil and allow easier penetration of new root systems.

5.3.5. Adjusting Angle of Approach

The angle of approach of the machine can be changed by adjusting the hitch and levelling tube of the machine or the angle of the 3pt linkage. Initially the machine should be set up with no angle of approach (flat relative to the ground) ensuring all shanks will operate at equal depths. This is the recommended and intended angle of operation.

With the larger ploughs which have long shanks on the rear tool bar and standard shanks on the front tool bar working tough conditions where the machine isn't penetrating well, the machine may be tilted slightly forward giving the machine a positive angle of approach. The positive angle of approach may allow a machine with longer shanks on the back row to penetrate better.

5.4. Suggested Parameters

In our experience which may or may not be applicable to your specific application, these suggestions have proven reasonable:

- 2km per hour is working slowly and may not be fast enough to achieve consistent shattering of the soil.
- 7km per hour is working fast and risks damage if the machine hits a large or rigid obstruction.
- 150-200mm is working shallow and should be reasonable for most conditions as long as the machine is not shuddering or hooking on obstructions. If there is a hardpan, penetrate the blades below the hardpan layer rather than try to force the blades through it.
- Working at the maximum depth allows for the most aggressive tillage but should not be attempted if the conditions may lead to the machine being damaged.
 - 400mm is the maximum working depth of the #8 shank
 - 450mm is the maximum working depth of the #9 shank (standard)
 - 600mm is the maximum working depth of the #9 long shank
- The machine must be level from side to side.
- The machine should be level front to back unless intentionally working with a positive angle of approach. Angle of approach can be up to 4°.

6. Maintenance

The Agrowplow is an extremely robust and durable machine and will give many years of service with simple routine maintenance.

Relevant spare parts manuals can be found on the Agrowplow website under 'Spares and Manuals', see:

<http://www.agrowplow.com.au/agrowplow-spare-parts-manual>

6.1. Pre-Operation Check

Check the following points before operation:

- Check all nuts and bolts are tight.
- Check shank spacing's and alignment are correct.
- Check all grub screws are tight.
- Check Accumulator Pressure has not changed, see 0

6.2. Daily Service

Before starting work each day the Agrowplow should be carefully checked for the following:

- Loose blade mounting bolts. Tighten as necessary.
- Correct fitting of Shin Guards.
- Correct fitting of Shear Pins (where fitted).
- Loose hydraulic fittings.
- Excessively worn soil openers (where fitted). Replace as necessary.
- Excessively worn coulters (where fitted). Replace as necessary.
- Quick visual check of entire machine.

6.3. Lubrication

The lubrication schedule for the Agrowplow is as follows:

Item	Action	Interval
Wheel Arm Pivots	Grease	100 Working Hours
Wheel Axle Bearings	Grease	Annually
Wing Fold Pivots	Grease	100 Working Hours
Coulter Pivots	Grease	20 Working Hours
Coulter Axles	Grease	Annually

Table 4 Plough Lubrication Schedule

Note: Not all models have all the lubrication points mentioned above.

6.1. Bolts and Hardware

Check all bolts and hardware after the first 50 hours of use. All fasteners should be checked and retightened as required during an annual service.

6.1.1. Wheel Nut Torque Chart

Stud Thread Size	Wheel Nut Torque - Nm (lb ft)
M10	75 (55)
M12 (and ½" UNF)	130 (97)
M14	205 (151)
M16	315 (232)
M18	435 (321)
M20	620 (457)
M22	840 (620)
M24	1070 (798)

Table 5 Wheel Nut Torque Chart

Agrowplow does not warrant faults relating to wheel nut tightness. It is the responsibility of the operator to check and maintain wheel nut torque on a regular basis.

6.1.1. Standard Torque Chart

Thread Size	Torque (Nm)		
	Grade 4.6	Grade 8.8	Grade 10.9
M8	15	28	40
M10	29	55	80
M12	50	95	140
M16	125	240	350
M18	175	330	475
M20	240	475	675
M22	330	650	925
M24	425	825	1150
M27	625	1200	1700
M30	850	1650	2300

Table 6 Standard Torque Chart

Unless otherwise specified, Grade 8.8 is the common standard for all hardware on the machine.

Bolts should only be replaced with equal or higher grade bolts. If replaced by a higher grade bolt then the original bolt torque should be applied.

6.2. Replacing Blades

You should replace blades when they wear past the tungsten tip or lose their point. Blunt tips or worn blades will reduce the digging efficiency of the Agrowplow and will substantially increase shank wear.

The procedure for changing knock-on blades is as follows:

- 1 Place the Agrowplow on a hard surface and lift to the highest position and secure using the ram safety stoppers.
- 2 Turn the tractor off.
- 3 Wear safety equipment.
- 4 Replace blades as required,
 - For #9 shanks where the blade is secured with a roll pin: use the roll pin tool and a hammer to tap the roll pin out of the shank assembly, replace the blade and tap a new roll pin into place.
 - For #8 shank where the blade is hammered onto the shank: use a light hammer, knock the back of the blade to remove it from the shank. Hammer the new blade on using the supplied shank tool. Do not use a large hammer as this will damage the tungsten tips or hard facing of the blade.
- 5 Remove safety stops before resuming work.

6.3. Shin Guard Replacement

The Shin Guard is used to protect the front base of the shank from excessive wear.

The procedure for changing the Shin Guard is as follows:

1. Place the Agrowplow on a hard surface and lift to the highest position and secure using the ram safety stoppers.
2. Turn the tractor off.
3. Remove the blade according to the procedures outlined in either Section “Replacing Blades” above.
4. Remove worn Shin Guard. A slight tap with a hammer may be necessary.
5. Install new Shin Guard and if necessary tap back on gently. Do not use a large hammer as this will damage the Shin Guard
6. Reinstall blade according to the procedures outlined above.

6.4. Coulter Replacement

Coulter replacement procedure is as follows:

Place the Agrowplow on a hard surface. Lift to the highest position and secure using the ram safety stoppers.

1. Turn the tractor off.
2. Remove retaining bolts.
3. Replace worn coulters.
4. Replace and tighten retaining bolts.

7. Trouble Shooting Guide

7.1. Underframe

The Problem	Possible Cause	Possible Solution
Poor penetration	Soil is too dry	Wait for rain or irrigate
	Worn blades	Replace blades
	Machine not level	Adjust levelling tube to suit
	Ground too hard	Lift machine and work at a shallower depth
	Mulch Blades too deep	Set blades shallower
	Blunt Coulters	Sharpen or replace coulters
High blade wear	Soil is too dry	Wait for rain or irrigate
	Not working deep enough	Lower Agrowplow to work below the compacted layer
	Highly abrasive soil	Use tungsten tipped points
Uneven blade wear	Machine not level	Level the Agrowplow
	Compaction behind tractor tyres	Reduce load on rear tractor tyres
	Uneven spring adjustment	Adjust all springs the same
Shanks 'laying back'	The soil is too dry and hard	Wait for rain or commence irrigation
	Machine not level	Adjust levelling tube or top link to suit
	Working too fast	Slow to a suitable speed
	Too much rock in the ground	Avoid rocky areas
	Insufficient spring pressure	Increase spring pressure
	Insufficient hydraulic pressure	Increase hydraulic pressure
Too much surface disturbance	Not working deep enough	Adjust deeper
	Working too fast	Slow to a suitable speed
	Coulters not cutting cleanly	Sharpen the existing coulters Fit new coulters
	Coulters not working deep enough	Adjust to approx 50mm
	Mulch Blades too shallow	Adjust Mulch Blades deeper
Too deep on one side	Incorrect depth setting	Adjust depth stoppers evenly
	Low depth wheel pressure on one side	Inflate to recommended pressures
	Low tractor tyre pressure	Inflate as recommended in tractor manual
Poor Shattering of soil	The soil is too wet	Wait for soil to dry
	Not working below compacted layer	Adjust deeper
	Working too slow	Increase speed
Coulter 'bulldozing' soil	Coulter worn out	Replace coulter
	Seized bearing	Replace coulter bearing

Table 7 Undercarriage Troubleshooting Guide

7.2. Hydraulics

The Problem	Possible Cause	Possible Solution
Uneven lift	Hydraulics not primed	Prime hydraulic system
Poor lift response	Air in hydraulic hose	Bleed air from system
	Low oil level in tractor	Add oil according to tractor operation manual
Failure of shank to return to working position	Air in circuit	Bleed air from system
	Loose hydraulic connections	Tighten hydraulic connections
	Insufficient hydraulic pressure	Increase hydraulic pressure
	Accumulator return valve failed	Incorrect valve Valve blocked
Shanks not recoiling when hitting a rock, snapping castings or bolts	Accumulator pressure too low See Accumulator test in Chapter 5.2.2	Have accumulator recharged to correct pressure.

Table 8 Hydraulic Troubleshooting Guide

8. Specifications

8.1. AP05

Model		AP05		
No of Shanks		3	4	5
Shank Spacing		600mm – 900mm	450mm – 600mm	600mm with stubs
Number of Toolbars		1		
Rigid Shear Pin Shank Specs		24" #8 Shank Style, 1100kg (2400lb) Maximum Breakout at Blade		
Working Width		2000mm – 2700mm	1800mm – 2400mm	3000mm
Transport Width		2032mm		2696mm with stubs
Working Depth		400		
Drawbar Power	kW	34 – 45	45 – 60	56 - 75
	hp	45 – 60	60 – 80	75 - 100
Linkage		Category II Three Point Hitch		
Optional Depth Stop		Depth Wheels - 175/70 R13		
		Roller		
Frame		150 x 150 x 9mm (6" x 6" x 3/8") RHS Toolbars Fully Welded Frame 100 x 50 x 6mm (4" x 2" X 1/4") RHS Tower		
Optional Coulters		NOT AVAILABLE		

Table 9 AP05 Specifications

8.2. AP11 Series Agrowplow

Model		AP11	
No of Shanks		5	7
Shank Spacing		330mm (13")	
Number of Toolbars		2	
Toolbar Spacing		1m	
Rigid Shear Pin Shank Specs		#8 Shank, 1100kg (2400lb) Breakout at Blade	
Working Width		1.65m (5' 5")	2.31m (7' 7")
Transport Width		2.1m (6' 10")	2.75m (9')
Working Depth		350mm (14")	
Under Frame Clearance		540mm	
Drawbar Power	kW	60 – 90	75 – 104
	hp	80 – 120	100 – 140
Linkage		Category II Three Point Hitch	
Manual Depth Wheels		13 x 165 HT	
Frame		Fully Welded Frame 100 x 100 x 6mm (4" x 4" x 1/4") RHS Toolbars 100 x 50 x 6mm (4" x 2" X 1/4") RHS Tower	
Optional Coulters		350mm (14") Coulters – Plain or Fluted	

Table 10 AP11 Specifications

8.3. AP31 Series Agrowplow

Model		AP31	
No of Shanks		7	9
Shank Spacing		330mm (13")	
Number of Toolbars		2	
Toolbar Spacing		1.15m	
Rigid Shear Pin Shank Specs		24" #8 Shank Style, 1100kg (2400lb) Maximum Breakout at Blade	
Hydraulic Recoil Shank Specs		24" #8 Shank Style, 900kg (2000lb) Maximum Breakout at Blade	
Working Width		2.31m (7' 7")	2.97m (9' 9")
Transport Width		2.71m (8')	3.40 m (11' 2")
Working Depth		400mm	
Under Frame Clearance		Rigid 670mm / Hydraulic 730mm	
Drawbar Power	kW	75 – 104	100 – 134
	hp	100 – 140	135 – 180
Linkage		Category II Three Point Hitch	
Manual Depth Wheels		235/80 – R15 AT	
Frame		100 x 100 x 9mm (4" x 4" x 3/8") RHS Toolbars 100 x 50 x 6mm (4" x 2" X 1/4") RHS Tower Fully Welded Frame Safety Stands	
Optional Equipment		Coulters Mounted Flexi Roller	

Table 11 AP31 Specifications

8.4. AP51 Series Agrowplow

Model	AP51		
No of Shanks	9	11	
Shank Spacing	380		
Number of Toolbars	2		
Toolbar Spacing	1.35m		
Rigid Shear Pin Shank Specs	#9 Shank Style 4800kg (10560lb) Maximum Breakout at Blade		
Hydraulic Recoil Shank Specs	#9 Shank Style 1850kg (4070lb) Maximum Breakout at Blade		
Working Width	3.42m (11' 3")	4.18m (13' 9")	
Transport Width	4.57m (14' 12")	5.33m (17' 6")	
Working Depth	450mm		
Drawbar Power	kW	134 – 200	164 – 246
	hp	180 – 270	220 – 330
Linkage	Category III Three Point Hitch		
Manual Depth Wheels	11.5/80 – 15.3 Implement Wheels		
Frame	150 x 150 x 9mm (6" x 6" x 3/8") RHS Toolbars Fully Welded Frame		
Optional Equipment	Coulters Mounted Flexi Roller		

Table 12 AP51 Specifications

8.5. AP71 Series Agrowplow

Model		AP71		
No of Shanks		11	15	
Shank Spacing		409mm (1' 4")	400 (1' 4")	
Number of Toolbars		2		
Toolbar Spacing		1.875m		
Rigid Shear Pin Shank Specs		#9 Shank, 4800kg (10560lb) Maximum Breakout at Blade		
Hydraulic Recoil Shank Specs		#9 Shank, 1850kg (4070lb) Maximum Breakout at Blade		
Working Width		4.5m (14' 9")	6.0m (19' 8")	
Transport Width		5.42m (17' 9")	6.93m (22' 9")	
Working Depth		450mm		
Drawbar Power	kW	164 – 246	223 – 336	
	hp	220 – 330	300 – 450	
Linkage	Standard	Cat III Three Point Hitch		
	Optional	Trailing		
Wheels	Depth Wheels	400/60 – 22.5 Floatation Tyres		
	Hydraulic Lifts			
Frame		Fully Welded RHS Frame 200 x 200 x 9mm (8" x 8" x 3/8") RHS Toolbars 200x 100 x 9mm (8" x 4" x 3/8") RHS Spreader Bars 25mm (1") Plate Tow Lugs Safety Stands		
Optional Equipment		Trailing or 3 Point Linkage Coulters Mounted Flexi Roller Wide Wing Points		

Table 13 AP71 Specifications

8.6. AP81 Series Agrowplow

Model		AP81		
No. of Shanks		17	19	23
Shank Spacing		529mm (20.83")	529mm (20.83")	522mm (20.55")
Number of tool bars		2		
Rigid Shear Pin Shank Specs		#9 Shank Style, 4800kg (10560lb) Maximum Breakout at Blade		
Hydraulic Recoil Shank Specs		#9 Shank Style, 1600kg (3520lb) Maximum Breakout at Blade		
Working Width		9m	10m	12m
Transport Width		6.87m/9.84m	6.87m/9.84m	6.8m/11.9m
Working Depth		450mm		
Drawbar Power	kW	260 – 336	300	373
	hp	350 – 450	400+	500+
Linkage		Trailing with Levelling bar Optional Trailing with Hydraulic Level Lift		
Depth Wheels		15.5/80-24 Grip Star		
Wing Lock		None	Over Centre Wing Fold with Locking Pins	
Section Float		None	±10° Wing Ground Following	
Number of Wheels		4		
Number of Sections		3		
Frame		200 x 200 x 9mm (8" x 8" x 3/8") Toolbars		
Optional Equipment		Wide Wing Point Leading Depth Stop Wheel Inclusion Plates Coulters		

Table 14 AP81 Specifications

8.7. AP91 Series Agrowplow

Model		AP91		
No. of Shanks		11 Rows with 16 Shanks	17 Rows with 26 Shanks	23 Rows with 34 Shanks
Shank Spacing		545mm (21.46")	529mm (20.83")	522mm (20.55")
Number of tool bars		3		
Rigid Shear Pin Shank Specs		#9 Shank Style, 4800kg (10560lb) Maximum Breakout at Blade		
Hydraulic Recoil Shank Specs		#9 Shank Style, 1600kg (3520lb) Maximum Breakout at Blade		
Working Width		6m (19' 8")	9m (29' 6")	12m (39' 4")
Transport Width		5.7m (18' 8")	6.85m/9.25m (22' 6"/30' 4")	6.8m/11.9m (22' 4"/39' ½")
Working Depth		600mm Maximum		
Under Frame Clearance	Shank Rigid	850mm		
	Hydraulic Shank	1000mm		
Drawbar Power	kW	260 – 336	300	373
	hp	350 – 450	400+	500+
Linkage		Trailing with Level Lift		
Depth Wheels		15.5/80-24 Grip Star		
Wing Lock		None	Over Centre Wing Fold with Locking Pins	
Section Float		None	±10° Wing Ground Following	
Number of Wheels		2	4	
Number of Sections		1	3	
Frame		200 x 200 x 9mm (8" x 8" x 3/8") Toolbars		
Optional Equipment		Wide Wing Point Leading Depth Stop Wheel Inclusion Plates Coulters		

Table 15 AP91 Specifications

8.8. Cotton Bed Renovator

Model		CBR					
Working Width		4m (13' 2")		6m (20')		8m (26' 3")	
Side or Centre Bust		Side	Centre	Side	Centre	Side	Centre
Number of Shanks		13	9	19	13	25	17
Number of Furrowers		5		7		9	
Number of tool bars		3					
Shank Protection		Rigid Shear Pin					
Transport Width		5.1m (16' 9")		6.7m (21' 11")		9.2m (30' 2")	
Drawbar Power	kW	145-195		190-250		250-300	
	hp	195-260		250-340		330-400	
Linkage		Cat III & Cat III Quick Hitch					
Depth Wheels		10.5 x 20					
Number of Sections		3					
Number of Wheels		2					

Features	Fully Welded 150 x 150 x 9mm (6" x 6" x 3/8") Frame Safety Stands Height & Pitch Adjustable Furrowers
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Rigid Shank Protection	1700lb Maximum Breakout At Blade
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Optional Equipment	Pitch Adjustable Furrowers Mulch Blades
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Table 16 Cotton Bed Renovator Specifications

9. Warranty

9.1. Warranty Policy

Agrowplow warrants to its Dealer, who in turn warrants to the purchaser, that each new Product, part or accessory will be free from defects in material and workmanship for 12 months after delivery and installation by an Agrowplow Dealer, according to the conditions outlined.

This warranty is in lieu of all other warranties (except those of title), expressed or implied, and there are no warranties of fitness for the particular purpose. In no event shall Agrowplow be liable for downtime expenses, loss of machine use, loss of crops, loss of profits, injury or damage arising from accident, direct or indirect loss, or other incidental, consequential or special damages.

The Safe Use Inspection (SUI) and Pre Delivery Inspection (PDI) Forms must be filled in and returned to Agrowplow by the Dealer or Agrowplow representative within seven days of delivery and installation of the unit. By signing the SUI & PDI Forms, the owner acknowledges that he is responsible for the safe operation of the product, and that he undertakes to fully train any person that might operate the product.

9.2. Conditions of Warranty

In the event of a defect which may result in a warranty claim:

- The Owner must provide the Authorised Dealer with written notice of the defect within 14 days of its occurrence, and allow reasonable time for replacement or repair.
- At Agrowplow's request the Dealer will ensure any failed parts are freighted to the Agrowplow factory. Transportation of the Agrowplow product to the Authorised Servicing Dealer for warranty work is the responsibility of the Owner.
- The Warranty is not transferable to any third party or subsequent purchaser.
- Components and conditions not covered by warranty include:

Abuse

Failure resulting from neglect, improper operation, lack of required maintenance or continued use of machine after the discovery of a defect which results in greater damage to the unit.

Environmental Conditions and Application

Deteriorated or failed components such as hydraulic hoses, seals, valves or connections damaged by corrosive materials, dirt, sand, excessive heat or moisture. Warranty determination for these types of failures will be made by Agrowplow only after inspection of failed components.

Normal Wear

Normal wear and consumable items such as oils and lubricants, nuts, bolts, washers, grease caps, spanners, jacks, bearing housings, axles, poppet valves or seal kits for hydraulic cylinders, seals, points, discs, axles, tyres, machine adjustment and periodic service. These are considered to be normal wear items and are not warranted.

Maintenance

Component failure caused by non-performance of scheduled maintenance such as correct lubrication and maintenance, tightening or replacement of bolts, nuts, fittings, shields and covers.

Damage

Damage or machine failure caused by carelessness, accidents, improper operation, inappropriate transportation or storage of the machine, parts or attachments.

Alterations

Any unauthorised alteration, modification, attachments or unauthorised repairs to the Agrowplow product, parts or attachments. Written approval must be obtained from Agrowplow for any such items to maintain warranty.

Replacement Parts & Service Work

The Labour or expenses involved in any of the following replacements or service tasks is the responsibility of the owner:

- Replacement of faulty tyres
- Soil opener replacement
- Metering roller adjustment or replacement
- Any bearing replacement
- Adjustments (refer to manual)
- Drive shaft adjustment or replacement
- Periodic service work.

Agrowplow and its Dealers are not responsible or liable for any such expenses.

Clean-up Time

Agrowplow does not pay for cleaning the products, parts, accessories or work area before or after the warranty repair. Clean-up time is affected primarily by the application or conditions in which the unit is operated and maintained. Since clean-up time can be so variable, cleaning time should be considered a customer expense.

Transportation & Insurance Costs

Warranty does not cover transportation or insurance costs for its products or other equipment needing repair or replacement of warranted components.

Travel Time

Travel time required for warranty repairs is the responsibility of the Owner.

Diagnostic Time

Warranty does not cover time required to diagnose a warranty problem. Diagnostic time is affected greatly by the training and expertise of the technician employed to do the job. With proper training of service personnel, diagnostic time should be at a minimum. Agrowplow expects that Dealers will assign a well-trained and proficient technician to handle warranty repairs. Diagnostic time is considered a dealer expense.

Non – Genuine Parts

Use of parts other than Agrowplow parts for repair of warranted parts will automatically negate any warranty. Warranted components must be replaced with genuine Agrowplow repair parts by an authorized Agrowplow representative.

Unauthorised Repairs

Repairs by an unauthorised agent will automatically forfeit any warranty. Warranty repairs must be carried out by an Authorised Agrowplow Dealer only, and only after Agrowplow's authorisation has been obtained.

Special Warranty Considerations apply in respect to the following:

Tyres, Hydraulics and Castings:

These items are covered by their respective manufacturer's warranty. For example many tyre manufactures will only warrant tyres pro rata. Claims for faults relating to these components must follow Agrowplow's normal claim procedures.