bühler versatile™

# Operator's Manual

## :: 435

## :: 485

## :: 535

89002109 12/2007

## To the Owner

This manual contains information concerning the operation, adjustment, and maintenance of Buhler Versatile 4WD tractors. You have purchased a dependable machine. With only proper care and operation can you expect to receive the performance and long service built into this tractor.
**HAVE ALL OPERATORS READ THIS MANUAL CAREFULLY AND KEEP IT AVAILABLE FOR READY REFERENCE.**

The tractor was designed to pull agricultural equipment in agricultural applications at field speeds of 7.2 KPH (4.5 MPH) or greater. Proper ballasting to provide equal traction to front and rear axles under moderate to heavy load will improve tractor performance and life. Your Buhler Versatile dealer will instruct you in the general operation of your tractor. Your dealer's staff of factory–trained service technicians will be glad to answer any questions that may arise regarding the operation of your tractor.

For engine maintenance not covered in this manual, follow the instructions provided in the Cummins Engine Operator's manual. Before putting the tractor in service, become familiar with the procedures outlined in both manuals.

At this time biodiesel blends up to B5 are the only blends approved for use in all Cummins engines for both On highway and Off highway markets. B5 which is a blend of 5 percent pure biodiesel (B100) and 95 percent standard petroleum diesel has demonstrated to have no impact on engine performance, durablilty or maintenance. The industry standard known as ASTM D6751 defines the specification for B100. However, this standard currently lacks a specification for stability. Without a specification for stability, the quality of the fuel blends higher than B5 could degrade to a point which could damaging to engines. Cummins is supporting industry efforts to add a stability spec to the current ASTM standard, and continues to evaluate the impact of these blends on the durability of engines. Until this spec is developed and tested, other blends of biodiesel will be unsuitable for use in Cummins On highway and Off highway engines.

The warranty coverage that is extended to your Buhler Versatile 4WD tractor is explained in the Warranty and Limitation of Liability Agreement form. Your dealer will provide you with a copy of the warranty and retain a copy which you have signed. After you read the warranty, ask your dealer to explain any points that you may not understand.

Do not modify, alter, or permit anyone else to modify or alter this tractor or any of its components, or any tractor function, without first consulting an authorized Buhler Versatile dealer. If you have any questions regarding tractor modifications, contact Buhler Versatile Inc., 1260 Clarence Ave, Winnipeg MB, R3C 4E8.

Your safety, and the safety of those around you depends upon the care and good judgement you use while operating this equipment. Read the safety precautions carefully.

For a complete list of the delivery service checks performed by your dealer, refer to the Delivery Report in this manual. The first copy is your record of the service performed and the second copy, which is to be removed from the manual, is your dealer's record. **MAKE SURE THAT BOTH COPIES ARE SIGNED BY YOURSELF AND YOUR DEALER.**

After you have operated the tractor for 50 hours, have your dealer perform the factory recommended first 50–hour service. Return this manual with your tractor to the dealer so the "First 50–Hour Service" checklist can be filled out. You will be responsible for the cost of lubricants, fluids, filters and other items replaced as part of normal maintenance. Prior to taking the tractor to your selling dealer for service, it is recommended that you contact them to determine any other charges for which you may be responsible.

All data given in this book is subject to production model variations. Dimensions and weights are approximations only, and the illustrations do not necessarily show tractors in standard condition. For exact information about any particular tractor, please consult your Buhler Versatile dealer.

**CAUTION: THIS SYMBOL IS USED THROUGHOUT THIS BOOK WHENEVER PERSONAL SAFETY IS INVOLVED. TAKE TIME TO READ AND FOLLOW THE INSTRUCTIONS.**

**CAUTION: PICTURES IN THIS MANUAL MAY SHOW PROTECTIVE SHIELDING OPEN OR REMOVED TO BETTER ILLUSTRATE A PARTICULAR FEATURE OR ADJUSTMENT.**

**BE CERTAIN, HOWEVER, TO CLOSE OR REPLACE ALL SHIELDING BEFORE OPERATING THE MACHINE.**

### Improvements

Buhler Versatile Inc. is continually striving to improve its products. We reserve the right to make improvements or changes when it becomes practical and possible to do so, without incurring any obligation to make changes or additions to the equipment sold previously.

# Operator's Manual - Contents

# Section 1 Contents - Safety Information

## Introduction to this manual

This manual has been prepared to assist you in the correct procedure for breaking in, driving, operating, and maintaining your tractor.

The manual is divided into 6 sections with contents page at the beginning of each section itemizes the section in detail. A detailed index is also provided at the back of this manual.

The sections are:

**Section 1 - Safety Information**

**Section 2 - General Information**

**Section 3 - Operation**

**Section 4 - Lubrication and maintenance**

**Section 5 - Troubleshooting Charts**

**Section 6 - Specifications**

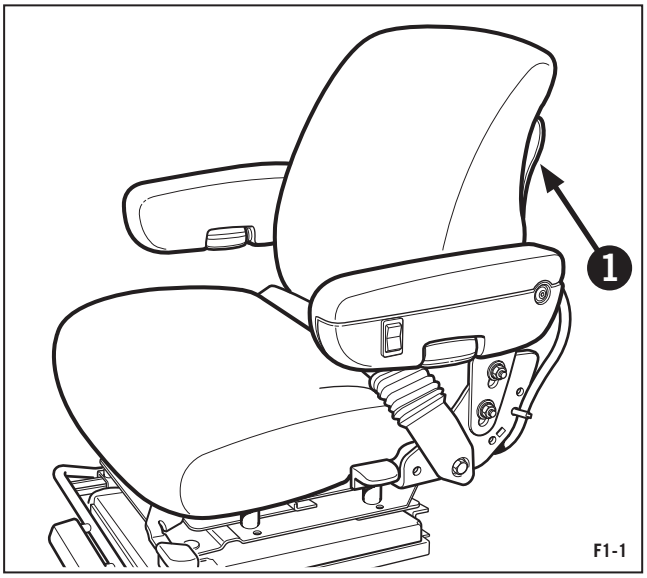
Read this manual carefully and keep it along with other tractor information in the storage pocket attached to the rear of the seat (1) for future reference. If at any time you require advice concerning your tractor, do not hesitate to contact your authorized Buhler Versatile dealer. He has factory trained personnel, genuine replacement parts, and the necessary equipment for your service requirements.

Your tractor has been designed and built to give maximum performance, economy and ease of operation under a wide variety of operating conditions. Prior to delivery, the tractor was carefully inspected, both at the factory and by your dealer, to ensure that it reaches you in optimum condition. To maintain this condition and ensure trouble–free operation, it is important that the routine services, as specified in this manual, are carried out at the recommended intervals.

All data given in this book is subject to production variations. Dimensions and weights are approximate only, and the illustrations do not necessarily show tractors in standard condition. For exact information about any particular tractor, please consult your authorized dealer.

The company policy is one of continuous improvement, and the right to change prices, specifications or equipment at any time without notice is reserved.

Section 1 of this manual lists the precautions to be observed to ensure your safety and the safety of others. Read the safety precautions carefully and follow the advice offered **BEFORE** operating the tractor.




## Tractor Statement of Use

Buhler Versatile has designed the 435, 485 and 535 4WD articulated tractors to be used in customary agricultural applications. Using the tractor in an industrial only application (ie. road building) will not be covered by warranty.

The machine is constructed to use specific tire combinations along with additional ballast to properly distribute weight and power for the operation of agricultural equipment.

To obtain maximum performance and durability, the tractor must be operated and maintained in a manner as described in this manual. Failure to follow the information contained in this manual may lead to premature deterioration or personal injury.

You have made a substantial investment in this agricultural tractor and it demands proper operation and maintenance.

**PLEASE FOLLOW YOUR OPERATOR'S MANUAL.**

# Precautionary Statements

## Personal Safety

Throughout this manual and on machine decals, you will find precautionary statements **("CAUTION", "WARNING", and "DANGER")** followed by specific instructions. These precautions are intended for the personal safety of you and those working with you. Please take the time to read them.

**CAUTION: THE WORD "CAUTION" IS USED WHERE A SAFE BEHAVIORAL PRACTICE ACCORDING TO OPERATING AND MAINTENANCE INSTRUCTIONS AND COMMON SAFETY PRACTICES WILL PROTECT THE OPERATOR AND OTHERS FROM ACCIDENT INVOLVEMENT.**

**WARNING: THE WORD "WARNING" DENOTES A POTENTIAL OR HIDDEN HAZARD WHICH HAS A POTENTIAL FOR SERIOUS INJURY. IT IS USED TO WARN OPERATORS AND OTHERS TO EXERCISE EVERY APPROPRIATE MEANS TO AVOID A SURPRISE INVOLVEMENT WITH MACHINERY.**

**DANGER: THE WORD "DANGER" DENOTES A FORBIDDEN PRACTICE IN CONNECTION WITH A SERIOUS HAZARD.**

**FAILURE TO FOLLOW THE "CAUTION", "WARNING", AND "DANGER" INSTRUCTIONS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.**

## Machine Safety

Additional precautionary statements **("ATTENTION" and "IMPORTANT")** are followed by specific instructions. These statements are intended for machine safety.

*ATTENTION: The word "ATTENTION" is used to warn the operator of potential machine damage if a certain procedure is not followed.*

*IMPORTANT: The word "IMPORTANT" is used to inform the reader of something he needs to know to prevent minor machine damage if a certain procedure is not followed.*

# Safety

## Precautionary Statements

National Safety Council statistics indicate many people die or suffer serious injury each year as a result of farm accidents.

Don't become a statistic or victim.

Carefully review the procedures given in this manual with all operators ANNUALLY. It is important that all operators be familiar with, AND FOLLOW, safety precautions.

Operating instructions must be given to everyone using the tractor before operation and at least once yearly thereafter in compliance with OSHA Regulation 1928.57 (United States).

A careful operator is the best operator. Most accidents can be avoided by observing certain precautions. To help prevent accidents, read and take the following precautions before operating the tractor. Equipment should be operated only by those who are responsible and instructed to do so.

## The Tractor

1. **Read the Operator's Manual carefully before using the tractor. Lack of operating knowledge can lead to accidents.**
2. **Only allow properly trained and qualified persons to operate the tractor.**
3. **Do not permit anyone but the operator to ride on the tractor, especially children. The instructional seat (optional) is used for instructing or service diagnosing only.**
4. **Keep safety decals free of dirt or grime. Replace safety decals if missing, illegible or damaged.**
5. **Do not modify, alter, or permit anyone else to modify or alter the tractor or any of its components or any tractor function without first consulting an authorized Buhler Versatile dealer.**
6. **Install all shields before starting or operating the tractor.**
7. **Always use the steps and handrails when entering and exiting the tractor. Never jump from the tractor. There is a danger of catching clothing on protruding parts.**

## Driving the Tractor

1. **Always sit in the driver's seat while starting or driving the tractor.**
2. **When driving on public roads always use hazard lights (and extremity lights where applicable). Have consideration for other road users by pulling to the side of the road so that any following traffic may pass.**
3. **Dim the tractor lights when meeting a vehicle at night. Make sure the lights are adjusted to prevent blinding the driver of an oncoming vehicle.**
4. **Reduce engine speed before turning or applying the brakes.**
5. **Any towed vehicle whose total weight exceeds that of the towing tractor must be equipped with brakes for safe operation.**
6. **Never apply the differential lock when turning. When engaged, the differential lock will increase the effort required to turn the tractor and increase the turning radius.**
7. **Always check overhead clearance, especially when transporting the tractor. Watch where you are going, especially at row ends, on roads, and around trees and low overhanging obstacles.**
8. **To avoid overturns, drive the tractor with care and at speeds compatible with safety, especially when operating over rough ground, when crossing ditches or slopes and when turning corners.**

9. Use extreme caution when operating on steep slopes.
10. Keep the tractor in the same gear when going down hill as would be used when going uphill. Do not coast or freewheel down hills.
11. When descending steep grades, select a sufficiently low gear to maintain control with minimum braking.
12. Drive the tractor slowly on hillsides and curves to eliminate the danger of tipping. Avoid slopes which are too steep for safe operation. Avoid sharp uphill turns.
13. When driving out of a ditch, gully or up a steep hillside, engage the clutch slowly. Avoid sharp uphill turns.
14. Use caution when driving near the edge of a ditch or gully. It may cave in, causing the tractor to roll over.
15. Use extreme caution when operating the tractor on single wheels. The danger of tipping increases. Do not travel at high speeds.
16. Before transporting the tractor and implement on public roadways, check with authorities for local regulations.
17. Use the wide transport marker lights to clearly indicate the full width of the tractor with those tire options.
18. Ensure towed implements are equipped with slow–moving vehicle (SMV) signs when traveling on public roads.
19. Install additional lights on implement rear to safeguard against rear–end collisions. Daybreak and dusk are particularly dangerous. Buhler Versatile tractors have seven–pin trailer connectors to facilitate installation of extra lighting.
20. Be aware of the transport width of towed implements. Install additional lights to the sides of wide implements to alert passing traffic. Keep clear of the approaching lane.
21. Use hazard warning flashers as required by law when transporting or driving the tractor on public roads. Use extremity lighting kit when required or deemed necessary.
22. Use extreme caution when pulling heavy loads at road speeds. Avoid hard application of the tractor brakes at high speed.

## Operating the Tractor

1. Apply the parking brake, place the PTO control in the “OFF” position, the lift control in the down position, the remote control valve levers in the neutral position and the transmission lever in neutral before starting the tractor.
2. Do not start the engine or operate controls while standing beside the tractor. Always sit in the tractor seat when starting the engine or operating the controls.
3. Do not bypass the transmission neutral start circuit. Consult your authorized dealer if your neutral start controls malfunction.
4. Use jumper cables only in the recommended manner. Improper use can result in a tractor runaway.
5. Avoid accidental contact with the gear shift lever while the engine is running. Unexpected tractor movement can result from such contact.
6. Do not get off the tractor while it is in motion.
7. Shut off the engine and PTO and apply the parking brake before getting off the tractor.
8. Do not park the tractor on a steep incline.
9. Do not operate the tractor engine in an enclosed building without adequate ventilation. Exhaust fumes can cause death.
10. The cab air filter is designed to remove dust from the air but will not exclude chemical vapor. Follow the chemical manufacturer’s directions regarding protection from dangerous chemicals.
11. Always wear a protective mask when working with toxic spray chemicals. Follow the directions on the chemical container.
12. If the power steering or engine ceases to operate, stop the tractor immediately as the tractor will be more difficult to control.

13. WARNING: RELIEVE PRESSURE BEFORE STOPPING THE ENGINE TO CONNECT OR DISCONNECT HYDRAULIC, STEERING, WATER, OR FUEL LINES.

14. **Pull only from the drawbar. Use only a drawbar pin that locks in place. Pulling from the tractor rear axle or any point above the axle may cause the tractor to overturn.**
15. **Be sure hydraulic couplers are properly mounted and will disconnect safely in case of accidental detachment of the implement.**
16. **Do not leave equipment in the raised position when the vehicle is stopped or unattended.**
17. **Ensure any attached equipment or accessories are approved for use and are correctly installed. Maintained in accordance with the instructions issued by the equipment or accessory manufacturer.**
18. **Remember that your tractor, if abused or incorrectly used, can be dangerous and become a hazard both to the operator and to bystanders. Do not overload or operate with attached equipment which is unsafe, not designed for the particular task, or is poorly maintained.**
19. **The cab is designed to meet and exceed the applicable noise level standards (86dBA). However, noise (sound pressure level) in the workplace can exceed this level when the cab window is open. Therefore, it is recommended that the operators wear suitable ear protectors when operating in high noise level conditions.**
20. **Always keep sleeves, jackets or other clothing relatively tight and belted. Loose clothing may catch in moving parts and result in personal injury or death.**
21. **Use steps and hand holds when mounting and dismounting the tractor or for servicing components too high to reach from the ground.**
22. **Lock the seat in position and buckle your safety belt before operating the tractor.**
23. **Do not operate the tractor when you are tired, sick, or impaired in any way.**
24. **Never operate the tractor in confined areas, or when visibility next to the tractor is reduced. Injury to bystanders or damage to the tractor or equipment may result.**
25. **When hitching drawn equipment to the drawbar, only allow an assistant between the tractor and implement if the tractor is off, in neutral and the brakes are engaged.**
26. **Do not leave implements with the hydraulic cylinders fully extended or retracted where the heat from the sun can cause the hydraulic fluid to expand. Hydraulic pressure can rupture the hoses, releasing high pressure oil causing personal injury.**
27. **Be careful when turning with an implement. Lift it from the ground if possible during turns. Side thrust caused by the implement could damage the tire and implement.**
28. **Use transport locks, lower the implement to the ground and securely block the frame before servicing the implement. Relieve pressure from the hydraulic system and shut off the tractor.**

## Operating the PTO

1. **When operating PTO–driven equipment, shut off the engine and wait until the PTO stops before getting off the tractor and disconnecting the equipment.**
2. **Do not wear loose clothing when operating the power take–off or when near rotating equipment.**
3. **When operating stationary PTO–driven equipment, ensure that the park brake is set and the gearshift lever is in neutral, block the rear wheels front and rear and engage the articulation lock. Do not leave the tractor unattended. If you must leave the tractor for any reason, stop the engine and remove the key.**
4. **To avoid injury, do not clean, adjust, unclog or service PTO driven equipment when the tractor engine is running.**
5. **Make sure all PTO shields are in position at all times.**
7. **Take special care in hook–up of implements to the PTO.**

## Servicing the Tractor

**Most accidents can be avoided by observing certain precautions. To help prevent accidents, read and take the following precautions before servicing the tractor.**

1. **The cooling system operates under pressure which is controlled by the radiator cap. It is dangerous to remove the cap while the system is hot. Always turn the cap slowly to the first stop and allow the pressure to escape before removing the cap entirely. Wear gloves when removing the cap.**
2. **Do not smoke while refueling the tractor. Keep any type of open flame away.**
3. **Keep the tractor and equipment, particularly brakes and steering, maintained in a reliable and satisfactory condition to ensure your safety and comply with legal requirements.**
4. **To prevent fire or explosion, keep open flames away from the battery or cold–weather starting aids. To prevent sparks which could cause explosion, use jumper cables according to instructions.**
5. **Do not attempt to service the air conditioning system. It is possible to suffer severe frost bite or injury from escaping refrigerant. Special equipment and instruments are required to service the air conditioning system which uses R134A refrigerant. See your authorized Buhler Versatile dealer for service.**
6. **Stop the engine before performing any service on the tractor.**
7. **Escaping diesel/hydraulic fluid under pressure can penetrate the skin causing serious injury.**
   - **DO NOT use your hand to check for leaks. Use a piece of cardboard or paper to search for leaks.**
   - **Stop the engine and relieve pressure before connecting or disconnecting lines.**
   - **Tighten all connections before starting the engine or pressurizing lines.**
   - **If fluid is injected into the skin, obtain medical attention immediately or gangrene may result.**
8. **Do not modify, alter or permit anyone else to modify or alter the tractor or any of its components or any tractor function without first consulting an authorized Buhler Versatile dealer.**
9. **Unqualified persons should not remove or attempt to adjust a pump, injector, nozzle or any other part of the fuel injection system. Failure to follow these instructions can result in serious injury.**
10. **Continuous long–term contact with used engine oil may cause skin cancer. Avoid prolonged contact with used engine oil. Wash skin promptly with soap and water.**
11. **Tractor wheels are very heavy. Handle with care and ensure, when stored, they cannot fall and cause injury.**
12. **Dispose of all drained fluids and removed filters properly. Follow local laws governing disposal of used engine oil.**
13. **Never oil, grease or adjust the tractor while it is running. Do not leave the engine running while the tractor or drawn equipment is being adjusted, repaired or cleaned.**
14. **Be sure all connections are tight and lines and hoses are undamaged. Before disconnecting hydraulic lines, relieve all pressure. Do not overfill the hydraulic tank.**
15. **Do not smoke and avoid open flames when servicing batteries.**
16. **Starting fluid is highly flammable. Do not use near fire, sparks, or open flames.**
17. **Remove mud, crop residue, chains and tools from steps and operator's platform. They may interfere with pedal operation or entry/exit from the tractor.**
18. **Never operate the tractor with a damaged tire. The tire may explode.**
19. **Tighten all connections before starting the engine or pressurizing lines.**

## Diesel Fuel

1. Under no circumstances should gasoline, alcohol or blended fuels be added to diesel fuel. These combinations can create an increased fire or explosive hazard. In a closed container, such as a fuel tank, these blends are more explosive than pure gasoline. Do not use these blends.
2. Do not smoke while refueling the tractor or when standing near fuel. Keep any type of open flame away.
3. Never remove the fuel cap or refuel with the engine running. Allow the tractor to cool off before fueling.
4. Use the proper fuel transfer hose and nozzle. Make sure the nozzle and hose are grounded to dissipate static electric charges.
5. When refueling, make sure the nozzle is in contact with the filler neck of the tractor fuel tank before fuel starts to flow and during the entire time fuel is flowing.
6. Maintain control of the fuel filler pipe nozzle when filling the tank.
7. Do not fill the fuel tank to capacity. Allow room for expansion.
8. Wipe up spilled fuel immediately.
9. Always tighten the fuel tank cap securely.
10. If the original fuel tank cap is lost, replace it with a genuine replacement cap. A non–approved cap may not be safe.
11. Keep equipment clean and properly maintained.
12. Do not drive equipment near open fires.
13. Never use fuel for cleaning purposes.
14. Arrange fuel purchases so that summer grade fuels are not held over and used in the winter.
15. Ground fuel storage tanks to prevent static buildup.

## Safety Cab

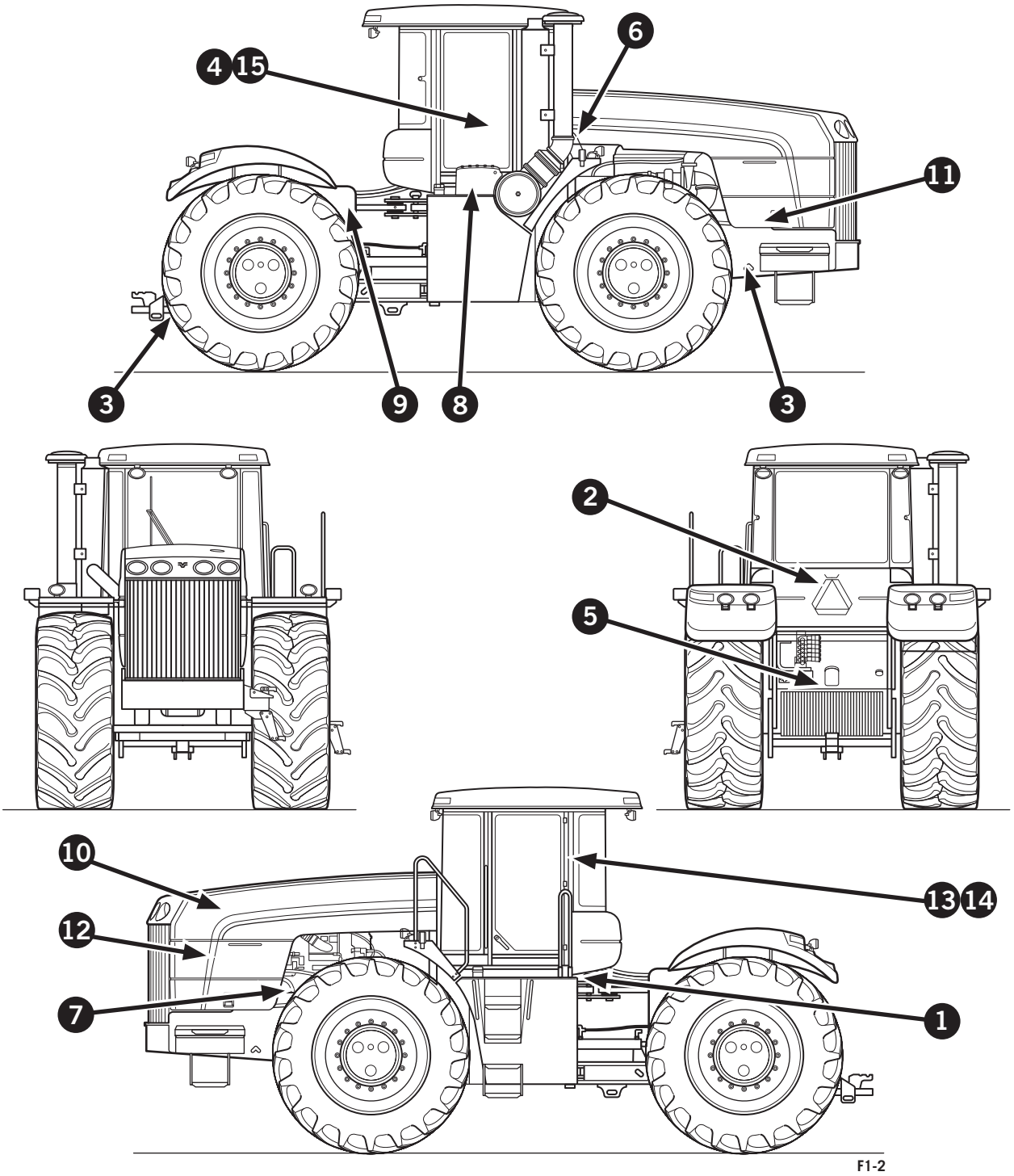
Your tractor is equipped with a safety cab which must be maintained in a serviceable condition. Be careful when driving through doorways or working in confined spaces with low headroom.

1. Do not modify, drill, weld, or alter the safety cab in any way. Doing so could render you liable to legal prosecution in some countries.
2. Never attempt to straighten or weld any part of the main frame or retaining brackets which have suffered damage. By doing so you may weaken the structure and endanger your safety. Replace all damaged parts.
3. Never attach chains or ropes to the cab or main frame for pulling purposes.
4. Never take unnecessary risks even though your safety cab affords you the maximum protection possible.
5. Do not carry harmful chemicals in the cab. Chemicals may rupture the container, and the fumes may poison the operator.
6. The tractor cab is not designed to provide a “sprayer safe” environment for the operator. When applying chemicals from a spray unit, do not rely on the cab filter elements to provide protection to the operator from the airborne chemicals.

## Safety Labels

The following warning signs are installed on the tractor in the areas indicated. They are intended for your safety and for those working with you. Please become familiarized with the content and location of these warning signs.

Make sure all warning signs are legible. Clean or replace where necessary. Replacements warning signs can be obtained from your Buhler Versatile dealer.

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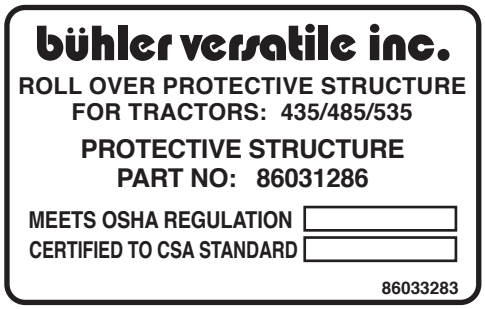
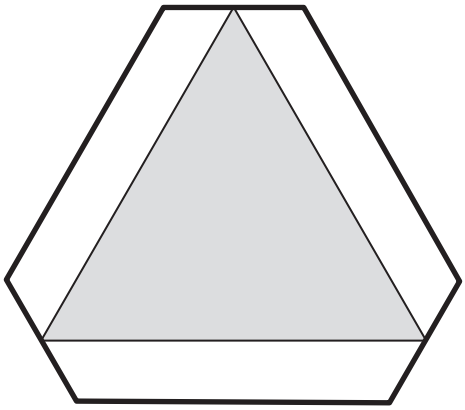
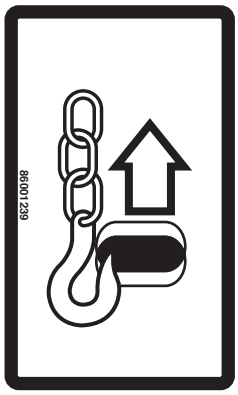



1. ROPS Certificate - Located left underside of cab.

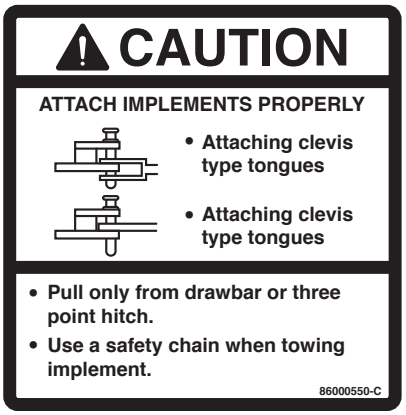


2. Slow-Moving Vehicle - Located on rear of cab.

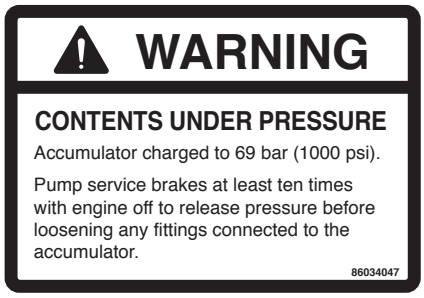



3. Tie down brackets - Located on frames.


4. Park Brake - Located inside cab on right hand window

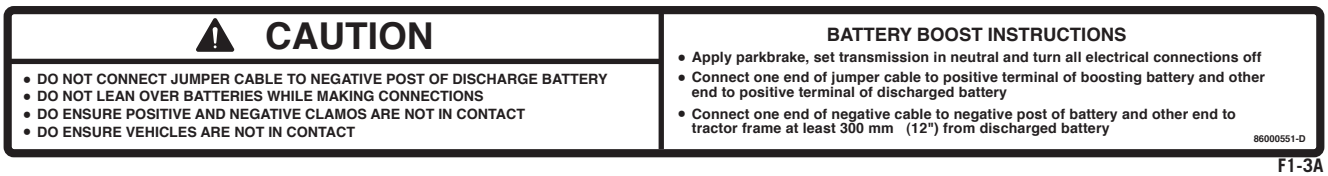



5. Implement Attaching - Located above the drawbar at the rear of the tractor.




6. Accumulator Pressure - Located on the fender support above the multifunction valve.


7. Jump starting - Located on the left side frame next to the starter.




F1-3A

8. Battery Boosting - Located on the underside of the battery cover.

**⚠ WARNING**

**ARTICULATING JOINT**

**STAY CLEAR OF THIS AREA WHEN ENGINE IS RUNNING**

**TO PREVENT PERSONAL INJURY**

- Shut off engine before servicing articulation area.
- Engage articulation lock before lifting tractor, transporting tractor on another vehicle, performing maintenance in articulation area or operating stationary PTO equipment.
- Disengage lock before driving the tractor,

86000554-C

9. Pivoting Frames - Located on the right and left sides.

**⚠ CAUTION**

**PRESSURIZED SYSTEM**

Remove cap slowly

86000548-C

10. Radiator Cap Pressure - Located on the left side of the hood at the access hole for the radiator cap.

**⚠ CAUTION**

**HOT EXHAUST SYSTEM COMPONENTS**

86000549-C

11. Hot Exhaust - Located on the right side frame under engine hood.

**⚠ WARNING**

**Keep hands and clothing away from rotating fan and belts.**

**Failure to comply could result in death or serious injury.**

86501511-E

12. Engine Cooling Fan - Located on both sides of radiator under the engine side shields

**⚠ CAUTION**

**This instructional seat has been provided only for training operators or diagnosing machine problems.**

**Keep all other riders off the tractor and equipment.**

**Always wear your seat belt.**

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13. Instructional Seat - Located inside cab on left hand door post.

**⚠ CAUTION**

**This roll over protective structure meets OSHA and other safety standards when installed in accordance with approved factory mounting instructions**

**The protection afforded may be impaired if it has been subjected to alteration, structural damage, or involved in an overturn accident. In these cases the entire structure must be replaced.**

**BE SURE OPERATION AND SAFETY INSTRUCTIONS ARE GIVEN TO ANYONE USING THIS TRACTOR AT THE TIME OF INITIAL ASSIGNMENT AND ANNUALLY THEREAFTER.**

**Read the operator's manual provided.**

**BEFORE STARTING:**

- **Know all the operating and safety instructions in the operator's manual and on the machine.**
- **Securely fasten your seatbelt.**
- **Be sure the transmission is in neutral, PTO is disengaged and implement hydraulic levers are in neutral.**
- **Be sure all shields are in place.**
- **Hitch only to drawbar or three point hitch lift points.**
- **No riders should be permitted in the cab or on the tractor.**
- **Make sure everyone is clear of the machinery.**
- **Do not allow children to operate the tractor.**

**WHEN OPERATING:**

- **Avoid operating tractor near holes, ditches or steep slopes.**
- **Reduce speed when turning, crossing slopes and on rough, slick, or muddy surfaces.**
- **Avoid jerky starts or stops.**
- **Use flashers and extremity lights when required.**

**BEFORE DISMOUNTING, SERVICING, CLEANING OR ADJUSTING TRACTOR OR IMPLEMENT:**

- **Bring tractor to a complete stop. Lower implement, shift transmission to neutral, set park brake.**
- **Stop engine and wait for all moving parts to come to a complete halt. Remove key if leaving tractor.**

**FAILURE TO FOLLOW ALL OF THE ABOVE INSTRUCTIONS COULD LEAD TO SERIOUS INJURY.**

86000553-D

14. ROPS Caution - Located inside cab on left hand door post.

**IMPORTANT**

**CLUTCH PEDAL MUST BE DEPRESSED & TRANSMISSION MUST BE IN NEUTRAL TO START TRACTOR**

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F1-3B

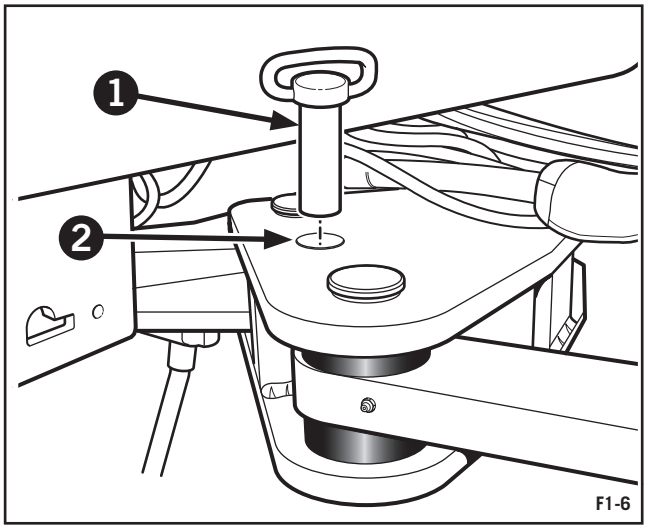
15. Clutch Pedal operation - Located inside cab on right hand window

# Additional Safety Items

## Articulation Locks

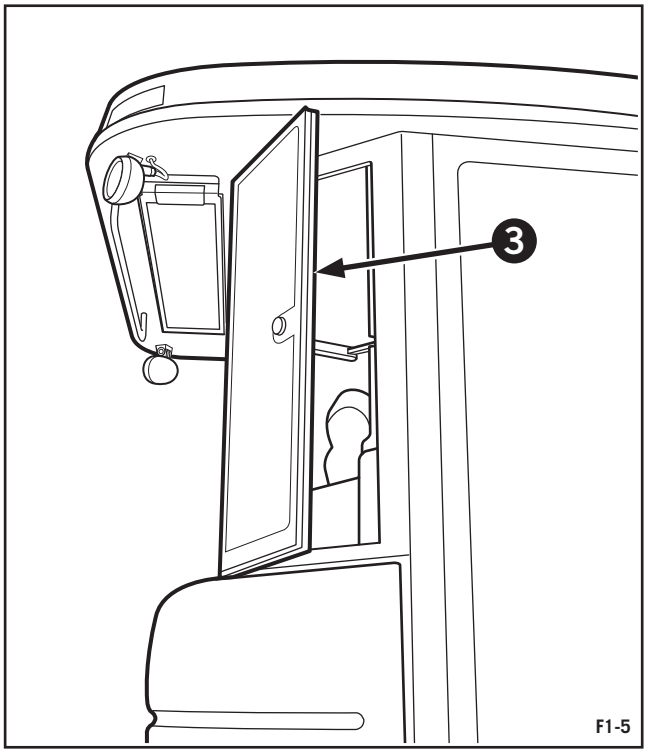
1. Use the articulation lock during stationary applications, servicing, jacking or overhaul operations. Do not use when the tractor is operating.
2. Before engaging the lock, drive the tractor to a level surface, put the steering straight, engage the park brake, put the gearshift in neutral and stop the engine.
3. Remove the pin (1) from the storage position located on the right of the swing frame and insert the pin through the hole on the left of swing frame (2).

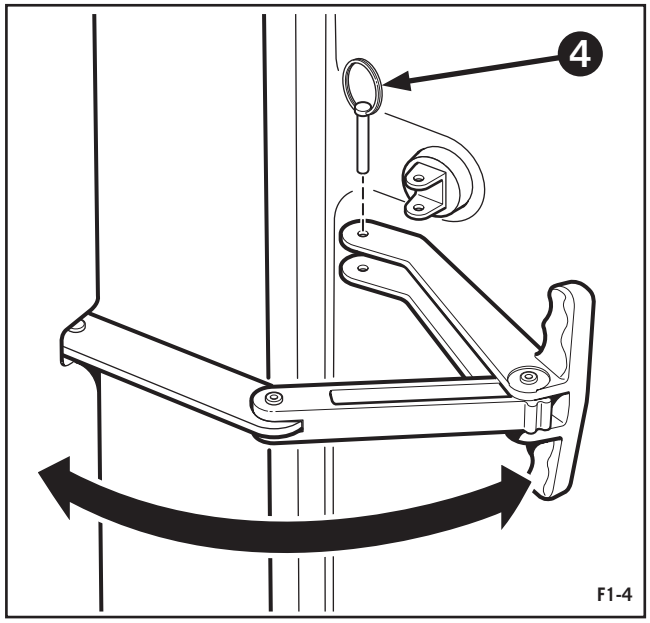
   **NOTE: It may be necessary to start the engine and articulate the frame slightly to enable the articulation pin to seat properly through the swing frame and front frame.**




## Emergency Exit

1. The cab has an emergency exit located in the right rear of the cab (3). To operate, pull out the pin (4) attaching the lever to the glass window. This will allow the window to open beyond the latch. If greater access is required, the silicone hinge/seal can be cut to remove the window completely.



## Safety Cab

A safety cab incorporates a Roll Over Protective Structure (ROPS). Safety belts are standard fitted equipment for the tractor at the time of factory assembly. The safety belt, when used by the operator, maximizes the protection offered by the ROPS.

**WARNING: ALWAYS USE YOU SAFETY BELT WITH THE CAB/ROPS TO PREVENT BEING THROWN FROM THE TRACTOR IN THE EVENT OF ROLLOVER. SAFETY BELTS SAVE LIVES WHEN THEY ARE USED.**

Information regarding the safety cab/ROPS and safety belt are available from your authorized Buhler Versatile dealer.

### ROPS Maintenance and Inspection

After the first 50 hours of operation and every 1500 of operation (or yearly, whichever comes first):

1. Check the torque of the cab/ROPS mounting bolts, as detailed in the lubrication and maintenance section of this manual.
2. Check the operators seat mounting bolts and safety belt mounting bolts. Tighten the seat mounting bolts to 40 N·m (30 ft-lbs.). Replace any worn or damaged parts.

### Damage to the Cab/ROPS

If the tractor has rolled over or the cab has been damaged (such as striking an overhead object during transport), it must be replaced to provide the original protection.

*IMPORTANT: Do not try to weld or straighten the cab/ROPS.*

After an accident, check for damage to the cab/ROPS, operator's seat, safety belt and safety belt mountings. Replace all damaged parts before operating the tractor.

**WARNING: NEVER ATTACH, CHAINS, ROPES OR CABLES TO THE CAB/ROPS FOR PULLING PURPOSES. ALWAYS PULL FROM THE TRACTOR DRAWBAR. BE CAREFUL WHEN DRIVING THROUGH DOOR OPENINGS OR UNDER LOW OVERHEAD OBJECTS. MAKE SURE THERE IS SUFFICIENT OVERHEAD CLEARANCE FOR THE CAB/ROPS.**

**WARNING: IF THE CAB/ROPS IS REMOVED OR REPLACED, MAKE CERTAIN THAT THE PROPER HARDWARE IS USED AND THE RECOMMENDED TORQUE VALUES ARE APPLIED TO THE ATTACHING BOLTS. SEE YOUR AUTHORIZED BUHLER VERSATILE DEALER.**

# Section 2 Contents - General Information

# Tractor Orientation

## Overall Description

The Models 435, 485 and 535 tractors are classified as 4–wheel drive articulating vehicles. The tractors consist of front and rear frame assemblies which steer by pivoting at the center articulation joint.

The front frame, (1) incorporates the engine, fuel tanks, transmission, front drive axle, and cab. The rear frame, (2) incorporates the rear drive axle and supports any implements that are operated by the tractor. This type of design allows for greater flexibility of weight distribution, depending upon operating conditions and type of implement. The operator can ballast the tractor to best suit the needs of the particular operation.

The construction of the tractor is a modular-type construction. This means that the major components are individual units which are supported within the front and rear frames. This makes for easier serviceability and longer life due to reduced structural stress on components.

## Tractor Terminology

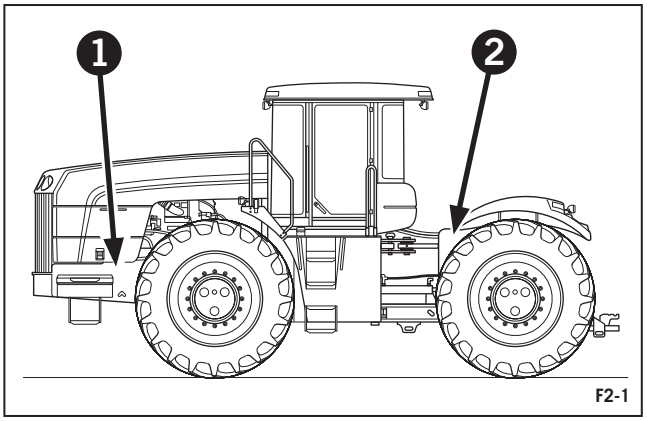
This manual uses the following terms to describe tractor function and directional relationships:

**Front** (1) - The engine end of the tractor. This direction will also be referred to as the "Forward Direction of Travel".

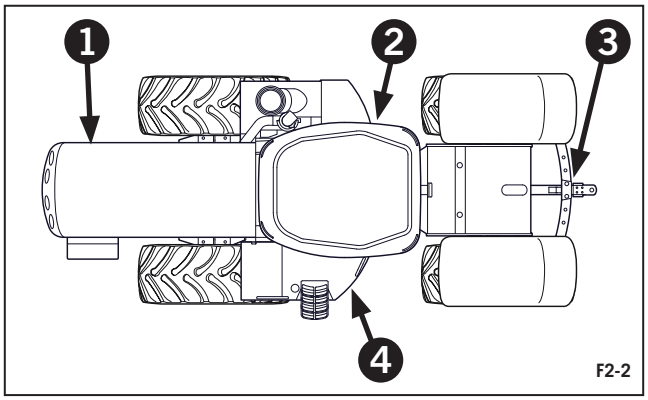
**Right** (2) - The console side of the cab.

**Rear** (3) - The drawbar end of the tractor, which is used for pulling implements.

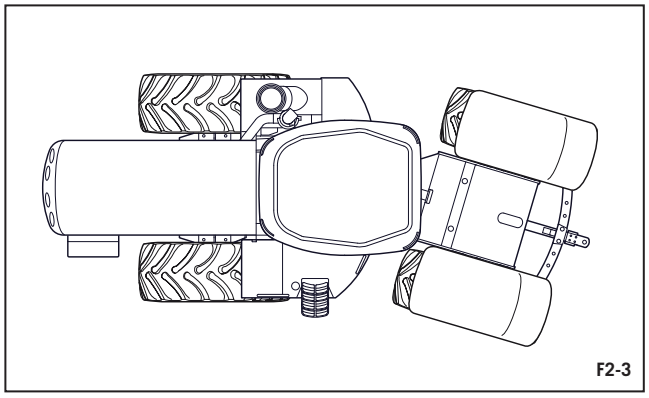
**Left** (4) - The doorway side of the cab.



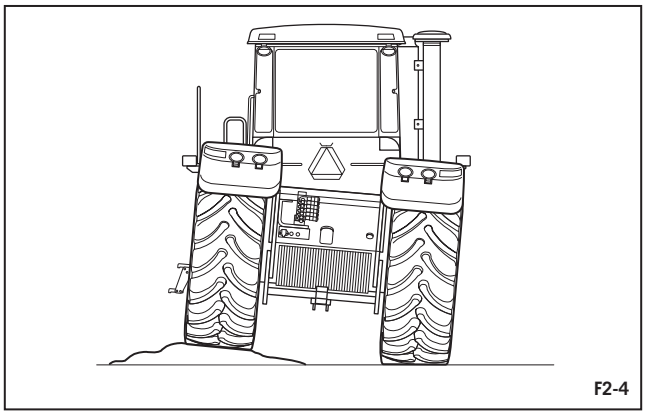
F2-1



F2-2


F2-3

**Articulation** - The ability to steer by pivoting between front and rear frame sections.


F2-4

**Oscillation** - The ability of a vehicle to twist, allowing travel over uneven terrain.

## Tractor Identification Data

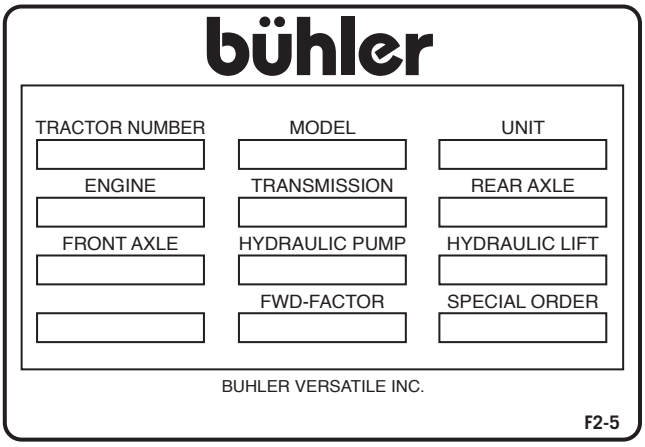
The tractor and its major components are identified using serial numbers and/or manufacturing codes.

These codes are recorded on the Vehicle Identification Plate, (ID plate).

**NOTE: Tractor identification data must be supplied to the dealer when requesting parts or service. Identification data is needed to aid in identifying the tractor if it is ever stolen.**

Please record the following identification data in the sample ID plate, right.

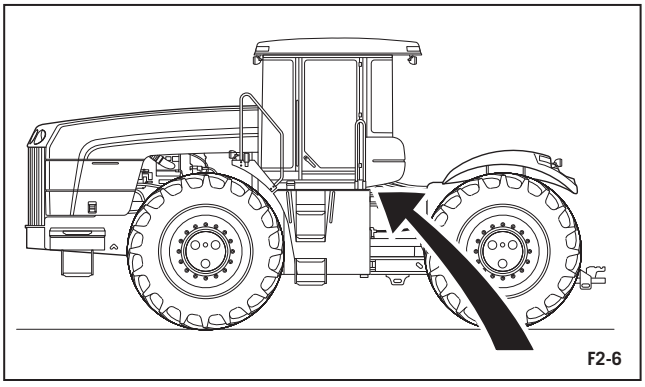
The following information provides the locations of the identification data.




### Vehicle Identification Plate

The Vehicle Identification Plate (1) is located on the left rear underside corner of the cab.

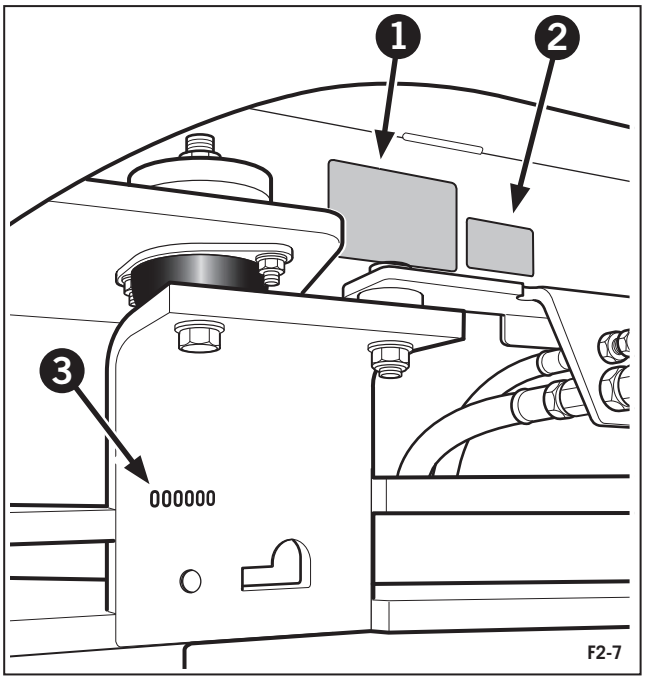
The ROPS identification plate (2) is located adjacent to it.




### Tractor Identification

The tractor serial number (3) is stamped on the front frame.

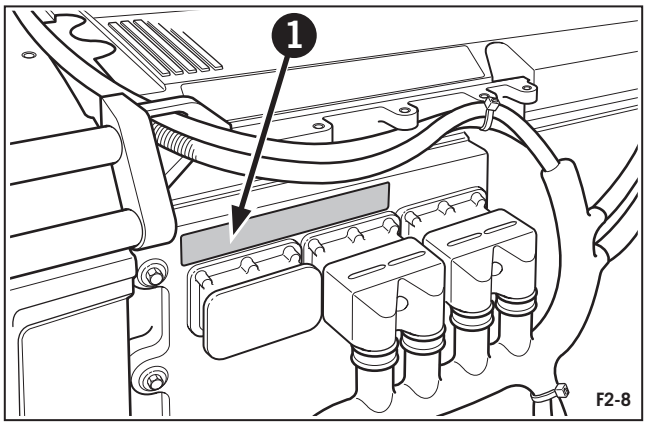
This serial number stamp is used in the event that the Tractor Identification Plate is removed or mutilated.



## Engine Identification

The Cummins engine used in your Buhler Versatile 4WD tractor is serviced solely by the Cummins Engine Company through its authorized dealers and distributors. Many Buhler Versatile dealers are authorized Cummins dealers. If your dealer is not, he will arrange for the engine service on your tractor to be carried out by an authorized Cummins engine dealer or distributor. For service, warranty, and parts information, contact your Buhler Versatile dealer.

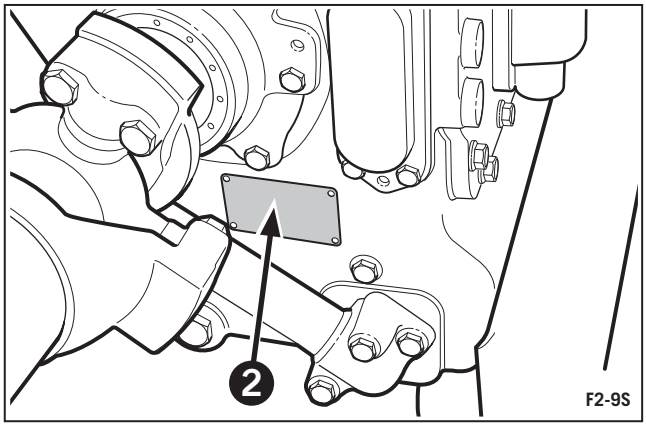
For the 435, 485 and 535 tractor (Cummins QSX15 engine), the Engine Identification Plate (1) is located on the front left side of the engine block below the valve cover.




## Transmission Identification

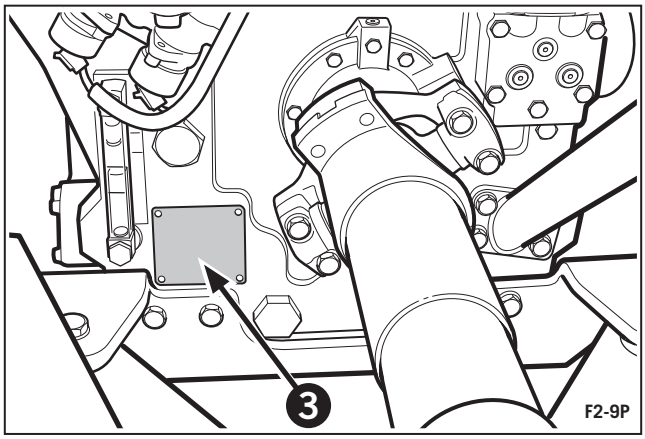
### Synchromesh Transmission (12 x 4 Synchronized)

The serial number plate is on the right rear of the transmission case (2). This is a 6-digit alpha numeric number.



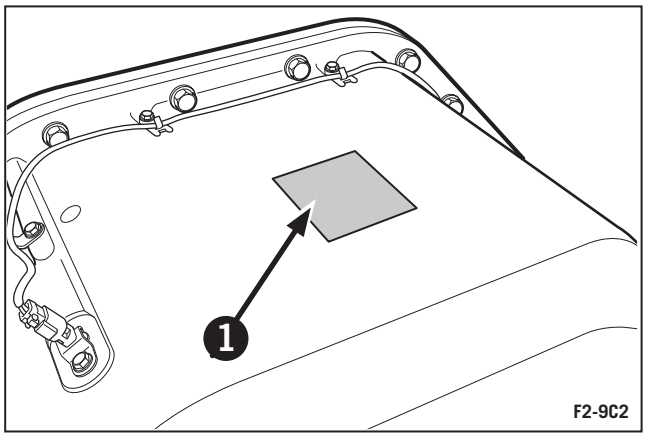

### 1407 Twindisc Powershift Transmission

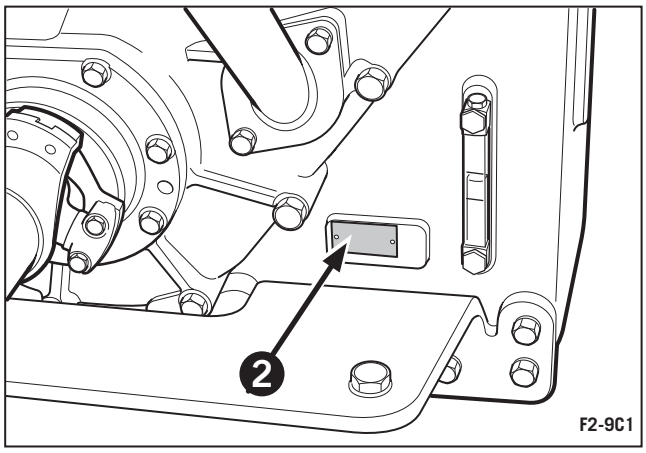
The serial number plate is located on the left rear of the transmission case (3).



**CAT TA22 Powershift Transmission**

There are two serial number plates, located on the top of the transmission case (1) and on the bottom rear right below the transmission oil level sight glass (2).

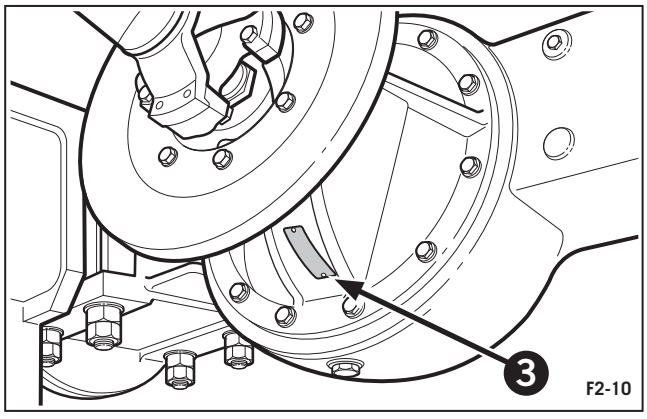



## Front & Rear Axle Identification

On the underside (or topside) of the input shaft is the Differential Identification Plate (3) containing differential model information.

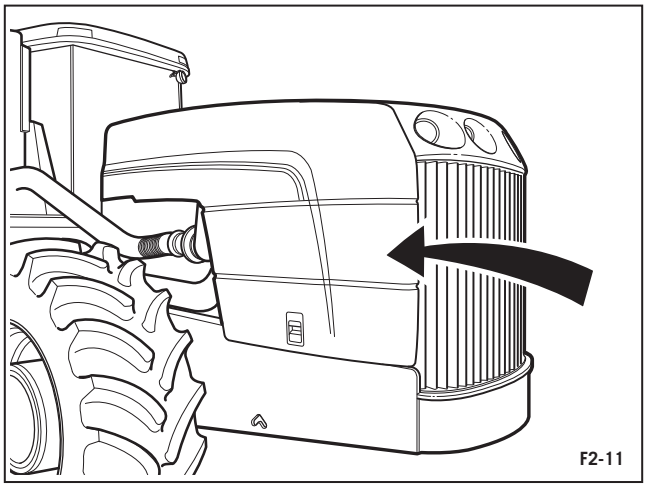
**NOTE: Make a copy of the information recorded in the preceding paragraphs and keep in a safe location in the event your operator's manual is lost or destroyed.**



# Protective Shielding

## Engine Side Covers

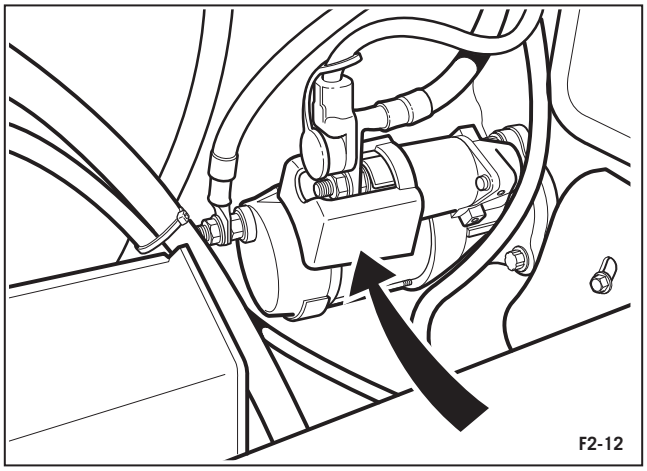
The side covers protect the operator from hot and/or moving parts. Do not operate the tractor unless the engine side covers are in place and latched.


F2-11

## Starter Solenoid Shield

The shield covers the starter solenoid electrical connections to prevent accidental contact. The shield must be installed whenever the batteries are connected to the electrical system. Always disconnect battery before removing the shield.

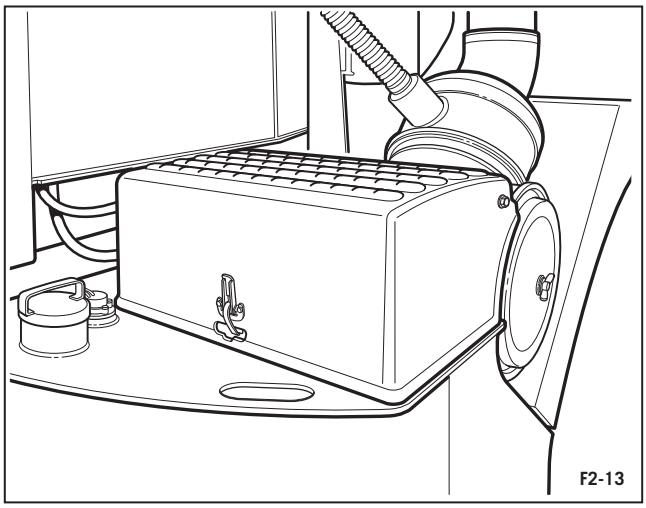
**DANGER: NEVER ATTEMPT TO START THE TRACTOR BY BYPASSING THE WIRES TO THE STARTER MOTOR.**


F2-12

## Battery Cover

The battery cover protects the batteries from damage and the electrical connections from accidental contact. The battery cover must always be in place and latched during operation.

**WARNING: INSTALL ALL PROTECTIVE SHIELDS BEFORE STARTING OR OPERATING THE TRACTOR.**


F2-13

## Break-in Periods

The first 50 hours of operation are the most critical for insuring long and dependable tractor life. Please carry out the following procedures:

1. Review the tractor Pre-delivery Checklist contained in the assembly manual with your dealer. Be sure all applicable items on the sheet have been checked.
2. Check all fluid levels and be sure all systems are filled with the correct fluids for your operating conditions.
3. Check the engine, transmission, and hydraulic oil levels hourly during the first 10 hours of operation.
4. Inspect the tractor for leaks hourly during the first 10 hours of operation.
5. Torque the wheel bolts to 715 N·m (525 ft-lbs) after the first hour of operation and after every three hour of operation for the first day. Re-tighten to the specified torque daily until wheel hardware maintains the specified torque.
6. Operate the engine at 3/4 load as much as possible during the first 50 hours (3/4 load is approximately one gear lower than would be normally used to pull a matched load).
7. Do not operate the engine at idle speed or maximum horsepower for more than 5 minutes at a time for the first 50 hours.
8. Check the frame pivot pin, drag link and steering cylinder cap screw torques after the first 10 hours of operation. Torque the frame pivot pin to 1365 N·m (1000 ft-lbs) and the remaining pins to 175 N·m (130 ft-lbs).
9. Have your dealer complete the “First 50-Hour Service” checklist at the end of this manual.

### Engine Break-in

The Cummins engine used in Buhler Versatile 4WD tractors has been run on a dynamometer before installation but not enough to be considered broken in.

1. Do not operate the engine at more than 3/4 load for the first 24 hours of operation. Full load should only be held for short intervals during the next 24 hours of operation.
2. Check the oil level every 8 to 10 hours for the first 100 hours of operation.
3. Follow the recommendations outlined in the Cummins manual supplied with your tractor.

## Towing The Tractor

*IMPORTANT: The tractor should only be towed a short distance such as out of a building. Do not tow down roadways or as a method of transport. Haul the tractor on a trailer.*

If towing the tractor is necessary, use a strong chain or cable of sufficient strength to tow the vehicle. Consult your Buhler Versatile Dealer. Tow the tractor **BACKWARD** from the drawbar or **FORWARD** from both of the front tie-down slots. Use the tie-down slots in the front and rear frames to attach the chains to the tractor.

*IMPORTANT: Do not tow the tractor by hooking to the engine cross brace.*

1. Engage the parking brake, then shift transmission in neutral. Attach the chain to the tractor.
2. If possible start the engine and let the engine run so that full use can be made of the power steering and brakes. If the engine cannot be run engage the articulation lock. (see page 1-12)

   *IMPORTANT: If the engine is not operational, and the transmission internal components are rotated by the axle drive shafts for a long period of time, possible transmission damage due to lack of lubrication may result.*

   *IMPORTANT: When the engine is running, the clutch, transmission input shaft, and transmission output shafts will also be driven. Be sure that these components are functional prior to starting the engine.*
3. Release the parking brake and tow the tractor.

**WARNING: WHEN THE TRACTOR IS TOWED AND THE ENGINE IS NOT RUNNING THERE WILL BE NO BRAKES AVAILABLE ON THE TRACTOR RESULTING IN A POSSIBLE COLLISION. ALWAYS USE A SOLID TOWING BAR BETWEEN THE TRACTOR AND THE TOWING VEHICLE. THE TOWING VEHICLE MUST BE OF ADEQUATE SIZE TO STOP THE TOWED TRACTOR.**

**CAUTION: DO NOT TOW THE TRACTOR FASTER THAN 8 KPH (5 MPH). ENGAGE THE ARTICULATION LOCK WHEN IT IS NOT POSSIBLE TO STEER THE TRACTOR (WITH THE ENGINE RUNNING).**

**WARNING: ONLY USE CABLES OF SUFFICIENT STRENGTH TO TOW THE TRACTOR. IF A CABLE BREAKS OR SLIPS, IT MAY WHIP WITH SUFFICIENT FORCE TO CAUSE SERIOUS INJURY. WHEN USING A CHAIN, ATTACH WITH THE HOOK OPEN SIDE FACING UP; IF IT SLIPS, IT WILL DROP DOWN INSTEAD OF FLYING UPWARD CAUSING SERIOUS INJURY.**

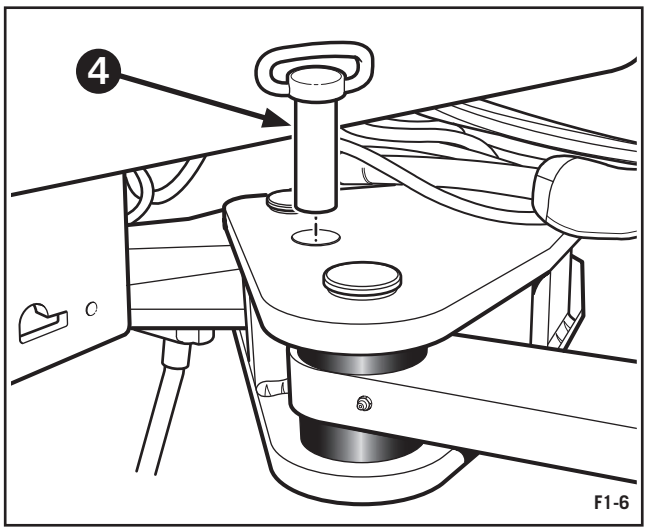
## Transporting the Tractor

1. Haul the tractor with all four wheels on to a flatbed trailer.
2. Remove the outer duals or triples during transporting unless special permits allow for over-width hauling. Consult local authorities for information on over-width hauling.
3. Make an accurate measurement of the highest point on the tractor when it is loaded on the transporter. Consult local authorities regarding over-height hauling based on the measurements taken.
4. Tie-down brackets are located in the following positions.

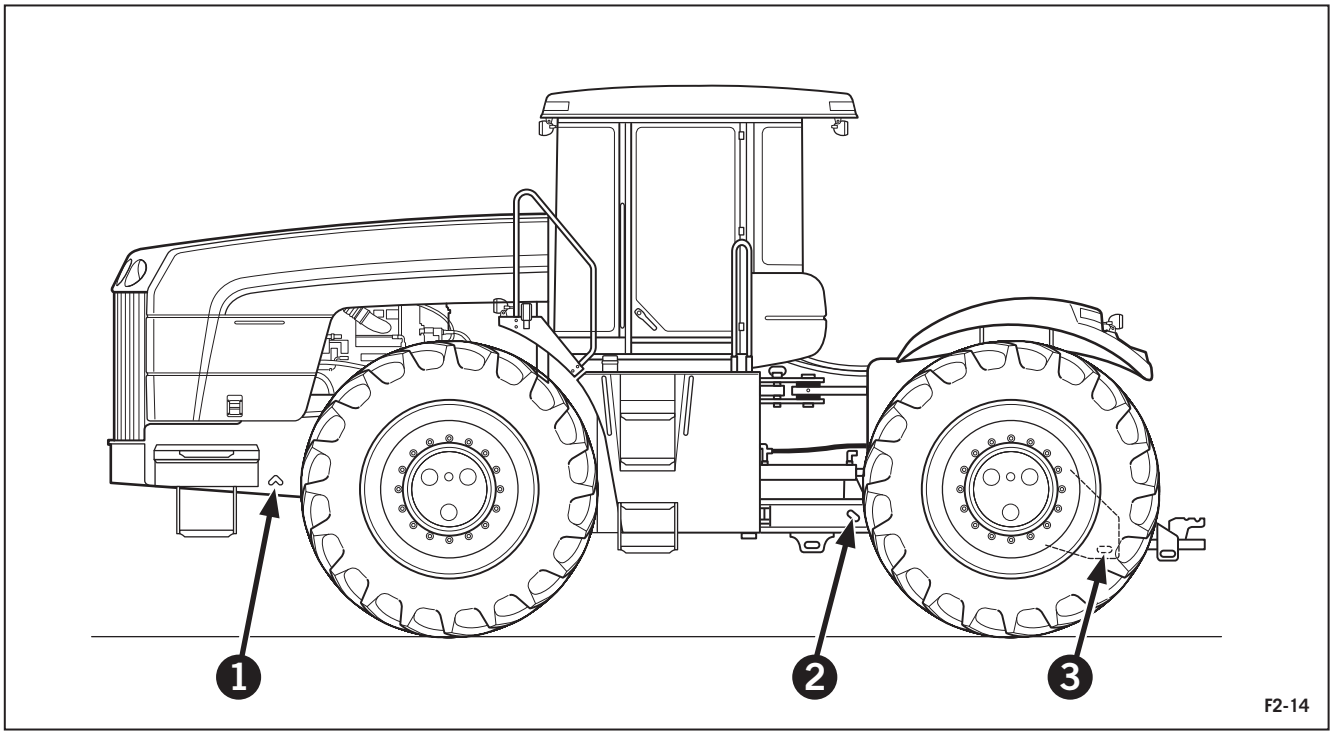
Cutout slots (1) are located on either side of the front frame to allow a chain hook to be used to hold down the front end of the tractor.

Tie-down brackets are located on either side of the rear frame, in the articulation area (2) and on the drawbar cage (3). Use a chain of adequate size, routed through the brackets to hold down the tractor.

6. Always fully engage the park brake and install the articulation lock pin (4) when transporting the vehicle.



F1-6



F2-14

# Section 3 Contents - Operation

## Introduction

Read this section thoroughly. It details the location and operation of the various instruments, switches and controls on this tractor.

Do not start the engine or attempt to drive or operate the tractor until you are fully accustomed to all the controls. If in doubt about any aspect of operation of the tractor, consult your authorized dealer.

Pay particular attention to the break–in recommendations in section 2 to ensure that your tractor will give the long and dependable service for which it was designed.

Perform lubrication and maintenance schedules as detailed in Section 4.

## Pre–operation Checks

After completing the daily lubrication and maintenance operations, perform a walk around visual inspection of the tractor. Pay particular attention to the following items:

- Fan belt for cracks
- Engine area for accumulation of debris
- Hoses, lines, and fittings for leaks or damage.
- Tires for damage
- Hardware for looseness
- Driveline and hydraulic pump areas for leaks or debris accumulation
- Make sure the tractor is ballasted properly for the work to be performed (see “Ballasting” in this Section)
- Check dual or triple wheel mounting bolt torque

Make any necessary repairs before using the tractor.

## Precautionary Statements

- **DO NOT OPERATE THE TRACTOR IN A CLOSED BUILDING.**
- **BEFORE STARTING THE ENGINE, BE SURE ALL OPERATING CONTROLS ARE IN NEUTRAL OR OFF AND THE PARK BRAKE IS ENGAGED.**
- **OPERATE ALL CONTROLS ONLY FROM THE OPERATOR’S SEAT.**
- **STOP THE ENGINE BEFORE SERVICING THE TRACTOR.**
- **KEEP ALL SHIELDS IN PLACE.**
- **STOP THE ENGINE BEFORE RAISING THE ENGINE SIDE SHIELDS.**
- **USE HAND HOLDS AND STEPS WHEN MOUNTING AND DISMOUNTING THE TRACTOR.**
- **USE THE ARTICULATION LOCK IN STATIONARY APPLICATIONS AND SERVICING. DO NOT USE WHEN THE TRACTOR IS MOVING.**
- **ON HIGHWAYS, SIGNAL BEFORE STOPPING, TURNING, OR SLOWING THE TRACTOR.**
- **USE PROPER SAFETY DEVICES TO WARN OF SLOW–MOVING VEHICLE WHEN DRIVING ON PUBLIC ROADS. CHECK WITH LOCAL AUTHORITIES CONCERNING HIGHWAY TRAVEL.**
- **WIDE TRANSPORT MARKER LIGHTS ARE SUPPLIED WITH ALL TIRE OPTIONS. USE THEM.**

# Welding & Battery Charging

## Precautions: Welding

To avoid damage to the electronic/electrical systems, always observe the following:

1. Always disconnect **BOTH** cables from the batteries before carrying out any welding on the tractor or on any implement attached to the tractor.
2. Position the welder ground cable clamp as close to the welding area as possible. Never weld on one frame member (i.e., front or rear frame) and have the ground strap of the welder on the other frame. Doing this can cause damage to the hoses, articulation bearings, and wire harnesses in the articulation joint area.
3. Never allow welding cables to lay on, near or across any electrical wiring or electronic component while welding is in progress.
4. On Powershift transmission equipped units, remove the electrical connectors attached to the transmission electronic controller, even when the negative cable of the battery is disconnected, to provide additional protection to the transmission controller.
5. Always have an assistant standing by with a fire extinguisher to put out any fires that may start due to welding procedures.
6. Always completely clean the area to be welded so that it is free of any grease, fuel or oil before welding.

## Precautions: Battery Charging

1. Never make or break any of the charging circuit connections, including the connection at the batteries, when the engine is running.
2. Never short any of the charging components to ground.
3. Do not use a booster battery of higher than 12 volts nominal voltage.
4. Always observe correct polarity when installing the batteries or using a booster battery to jump start the engine. Follow the instructions in this manual when jump starting the tractor. Connect positive to positive and negative to negative.
5. Always disconnect the negative cable from the batteries when charging the batteries in the tractor with a battery charger.

**WARNING: BATTERIES CONTAIN SULPHURIC ACID. IN CASE OF CONTACT WITH SKIN, FLUSH THE AFFECTED AREA WITH WATER FOR FIVE MINUTES. SEEK MEDICAL ATTENTION IMMEDIATELY.**

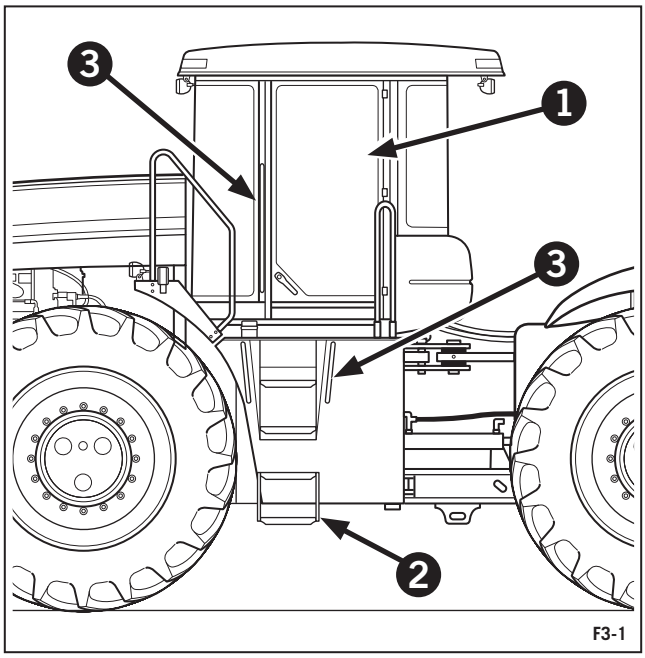
**AVOID CONTACT WITH THE SKIN, EYES OR CLOTHING. WEAR EYE PROTECTION AND PROTECTIVE CLOTHING WHEN WORKING NEAR BATTERIES.**

## The Cab

### Entering the Cab

The cab has been designed for operator comfort and convenience. The roof and floor are insulated to reduce noise.

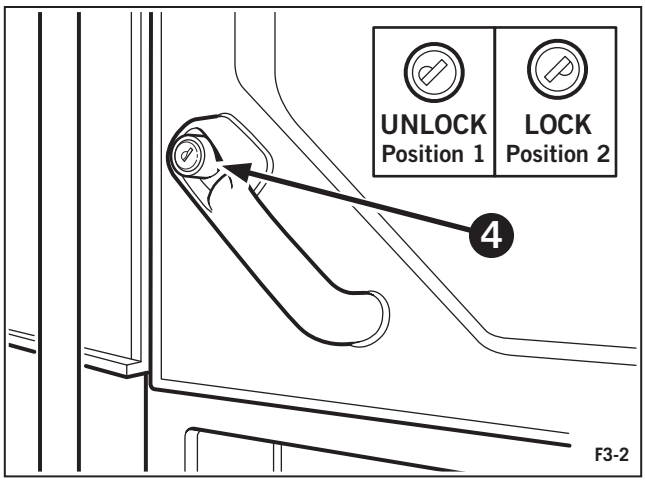
**CAUTION: THE CAB IS NOT DESIGNED TO PROVIDE A "SPRAYER SAFE" ENVIRONMENT FOR THE OPERATOR. WHEN APPLYING CHEMICALS FROM A SPRAY UNIT, DO NOT RELY ON THE CAB FILTER ELEMENTS TO PROVIDE PROTECTION TO THE OPERATOR FROM AIRBORNE CHEMICALS.**



F3-1

### Cab features include:

- Air suspension operators seat (Optional semi active seat)
- Tinted glass
- Opening rear window
- Fresh air heater/defroster
- Air-conditioning
- Interior lighting
- Instructional seat (optional)
- Storage tray
- Trouble light (optional)
- Cigarette lighter and ashtray
- Radio/CD (optional)
- Accessory power sockets



F3-2

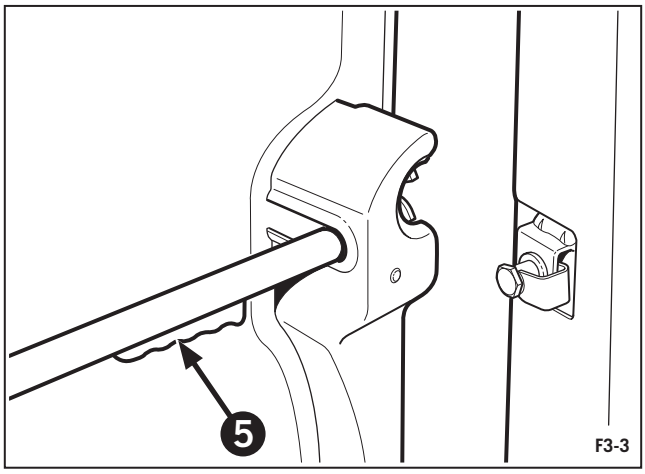
The cab is entered through the single door (1) using the entry ladder (2) and grab handles (3) located on the left side of the tractor. The door is hinged at the rear and is held in the fully open position by a gas spring.

The push-button door latch is located on the outside bottom corner of the door (4).

The door latch can be locked with the ignition key. The latch is unlocked in position 1 and locked in position 2.

To open the door from inside squeeze the door latch (5) while pushing door open.

The inside latch will open the door even if the door is locked from the outside.



F3-3

## Rear Window / Emergency Exit

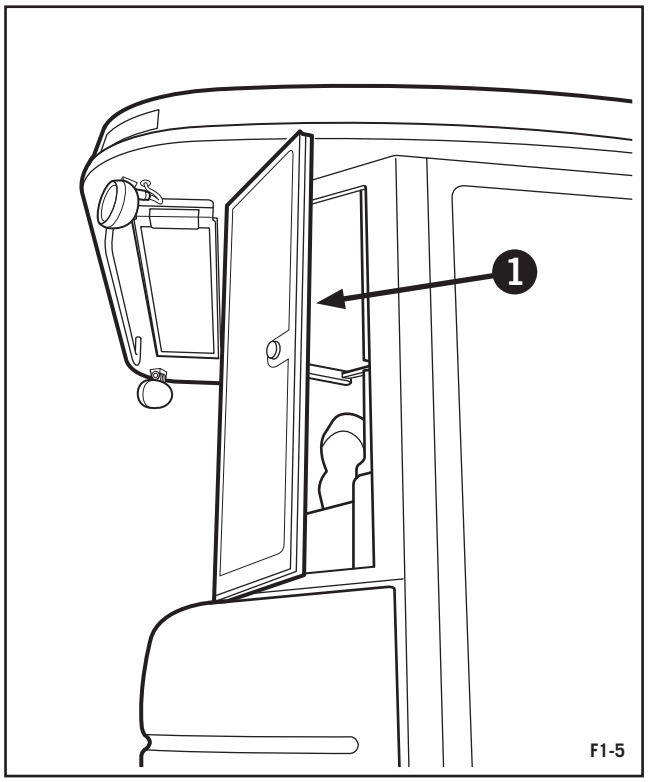
The right rear window, (1), can be opened to provide ventilation. The window can be locked open, closed, or positioned partially open.

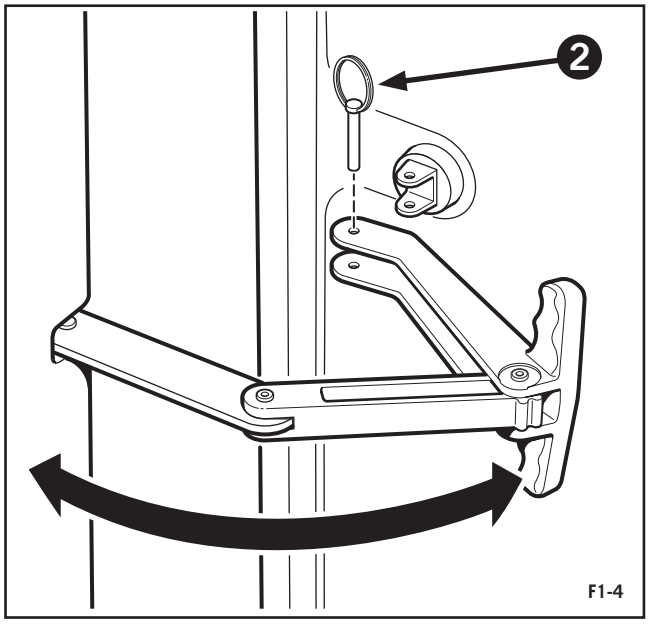
To lock the window, pull the handle in and forward in an arc. The handle will fold, go over center and lock.

To open the window, pull the handle back and push out. The handle will unfold. There are four detents in the handle, which will hold the window in a partially open position. To lock in the full open position, continue rotating the handle outward until the handle stops. This is also an over center position, which will prevent the window from closing unless the latch is pulled.

The rear window also serves as an emergency exit in the event that the cab door cannot be opened. To operate, pull out the pin (2) attaching the handle to the glass window.

This will allow the window to open wide enough for exit. If greater access is required, the silicone hinge/ seal can be sliced through with a knife to remove the window completely.



## Operator's seat

The tractor is equipped with a choice of operator's seat.

### The Standard Seat

### The Deluxe Seat

(Equipped with: adjustable headrest, heated seat cushion, semi-active air suspension system.)

**NOTE: Before operating the tractor, it is important to adjust the seat, steering wheel, and controls to the most comfortable position.**

### Seat Belt

**WARNING: THIS TRACTOR IS EQUIPPED WITH A RETRACTABLE SEAT BELT. ALWAYS USE THE SEAT BELT.**

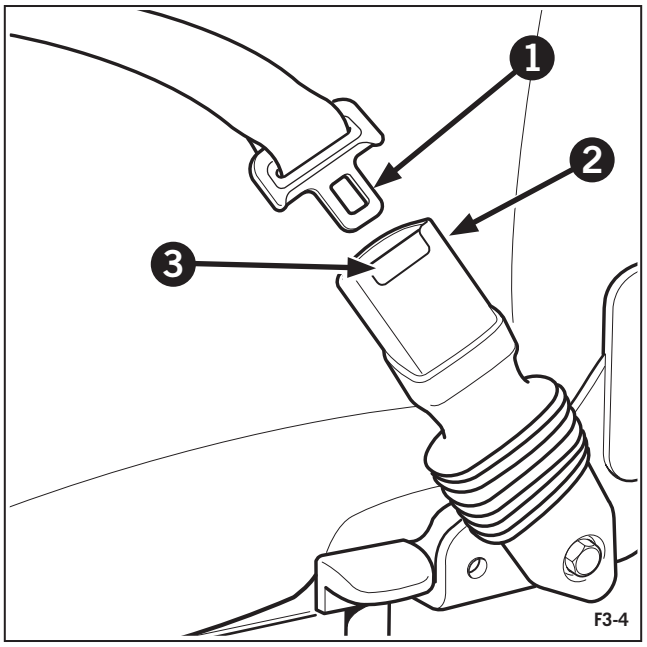
The seat belt automatically adjusts for the size of the individual in the seat.

To fasten the belt, pull the belt from the reel and push the tongue end (1) into the buckle end (2) until a click indicates it is properly engaged.

To release the belt, push the red release button (3) on the buckle and remove the tongue from the buckle.

To clean the belt, sponge with clean, soapy water. Do not use solvents, bleach or dye on the belt as these chemicals will weaken the webbing.

Replace the belt when it shows signs of fraying, damage or general wear.



## Standard Seat

The seat is equipped with controls to permit the following adjustments for personal comfort.

**NOTE: All adjustments should be made in the following order while sitting in the seat.**

Adjust the seat using the following procedures:

**NOTE: With the engine off, adjust the seat by turning the ignition switch to the "ACC" position. DO NOT START THE ENGINE.**

**1. Height/Weight Adjustment**

Raise - Depress the top of the switch. Release when the desired height is obtained.

Lower - Depress the bottom of the switch. Release when the desired height is achieved.

**2. Backrest Angle Adjustment**

Lift the lever and tilt the backrest to the desired position. Release the lever to lock the backrest in position.

**NOTE: The backrest will tilt backward far enough to contact the rear window.**

**3. Fore/Aft Position Adjustment**

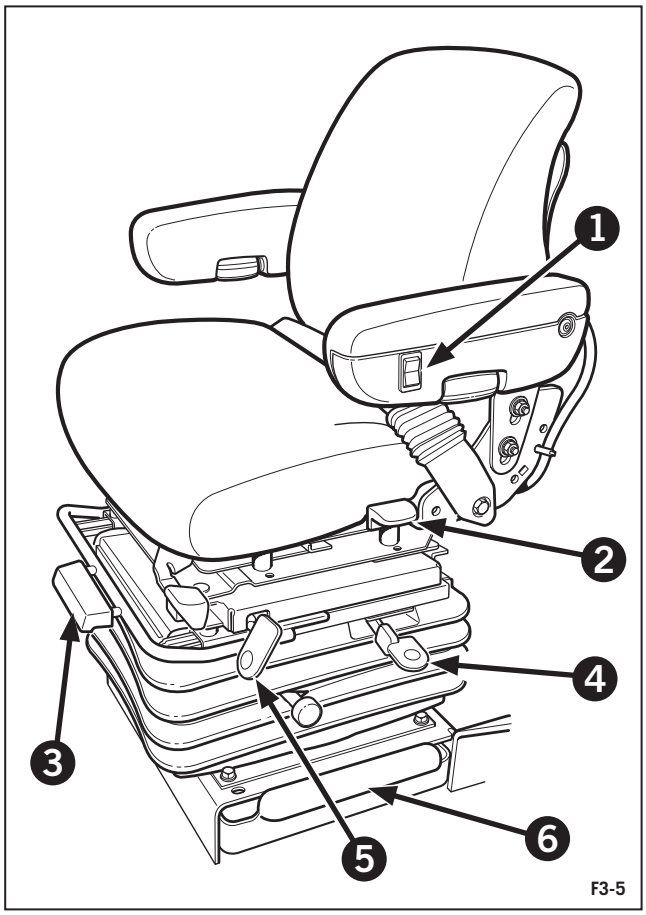
Pull up on the lever and move the seat fore/aft through the 178 mm (7") adjustment range to the desired position. Release the lever to lock the seat into position.

**4. Fore/Aft Float**

Pull up on the lever to allow the seat to float fore and aft 51 mm (2"). Push down on the lever to lock the seat into position.

**5. Lateral Float**

Pull up on the lever to allow the seat to float laterally 51 mm (2"). Push down on the lever to lock the seat into position.




**6. Storage tray**

Pull out for access.

### 6. Dampener Adjustment

The firmness of the ride can be adjusted as follows:

**Soft -** Rotate the control knob clockwise to decrease the firmness of the seat bounce.

**Firm -** Rotate the control knob counterclockwise to increase the firmness of the seat bounce.

### 7. Swivel Adjustment

**The seat can be adjusted to:**

- Lock in the forward position.
- Lock in one position to the left of center.
- Lock in one of four positions to the right of center (increments of 7° for a total of 28° rotation)
- Provide a free swing position without locking in any position.

**To adjust the seat swivel:**

1. Move the swivel control lever partially to the rear.
2. Swing the seat to the desired position.
3. Release the lever to lock the seat into position.

**NOTE: Moving the control lever fully rearward will provide the free swing position.**

### 8. Lumbar Adjustment

Adjust as follows:

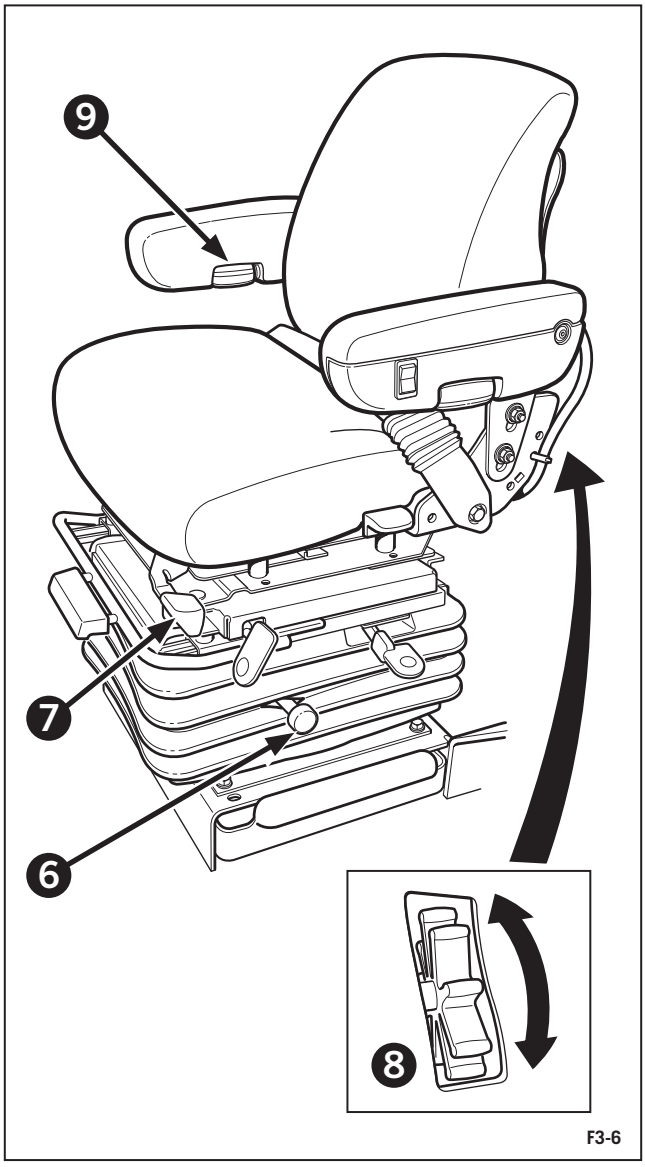
**Increase support -** Rotate the wheel down.

**Decrease support -** Rotate the wheel upwards.

### 9. Armrest Angle Adjustment

Rotate the roller on each armrest to adjust to the desired angle.

Both armrests can also be raised up to the full vertical position for easy access.



F3-6

## Deluxe Seat

The seat is equipped with controls to permit the following adjustments for personal comfort.

**NOTE: All adjustments should be made in the following order while sitting in the seat.**

Adjust the seat using the following procedures:

**NOTE: With the engine off, adjust the seat by turning the ignition switch the "ACC" position. DO NOT START THE ENGINE.**

**1. Height/Weight Adjustment**

Depress the top of the switch to raise the seat. Release when the desired height is obtained.

Depress the bottom of the switch to lower the seat. Release when the desired height is achieved.

**2. Backrest Angle Adjustment**

Lift the lever and tilt the backrest to the desired position. Release the lever to lock the backrest in position.

**NOTE: The backrest will tilt backward far enough to contact the rear window.**

**3. Fore/Aft Float**

Pull up on the lever to allow the seat to float fore and aft 51 mm (2"). Push down on the lever to lock the seat into position.

**4. Lateral Float**

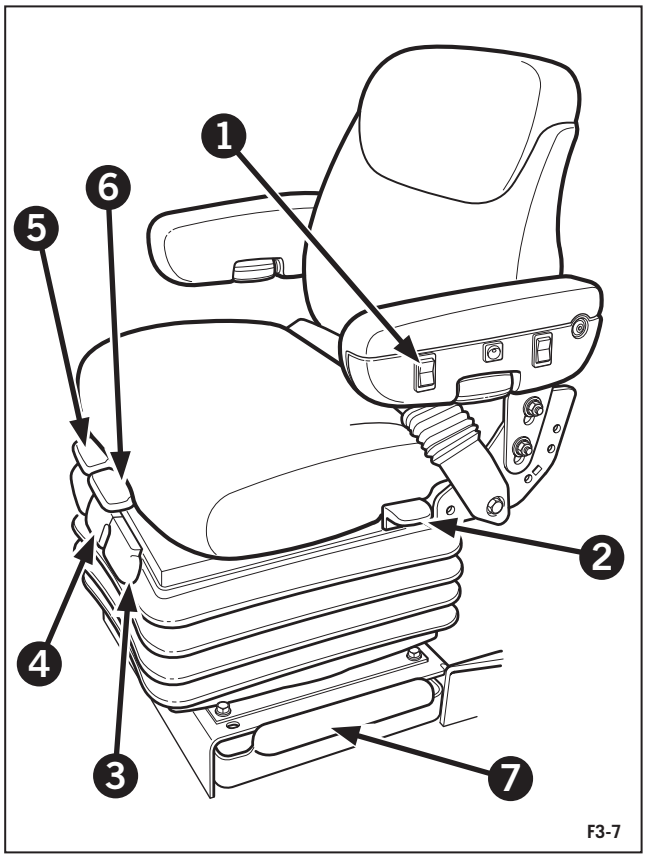
Pull up on the lever to allow the seat to float laterally 51 mm (2"). Push down on the lever to lock the seat into position.

**5. Swivel Adjustment**

Pull up on the lever to swivel the seat. Push down on the lever to lock the seat into position.

**6. Fore/Aft Position Adjustment**

Pull up on the lever to move the seat forward or backward to the desired position. Push down on the lever to lock the seat into position.




**7. Storage tray**

Pull out for access.

### 7. Heated seat cushion

The seat incorporates a thermostatically controlled heating element within the seat cushion which maintains a comfortable working temperature in cold conditions. Depress the top of the switch to activate. The indicator switch lamp will illuminate. To switch off, depress the bottom of the switch.

### 8. Dampener Adjustment

The seat incorporates a semi-active suspension system that greatly reduces vibration to the operator.

**NOTE: The suspension system is factory calibrated and should only be serviced by an authorized Buhler Versatile dealer.**

Depress the top of the switch to increase the increase the firmness of the ride.

Depress the bottom of the switch to soften the ride.

### 9. Lumbar Adjustment

Adjust as follows:

**Increase support -** Rotate the wheel down.

**Decrease support -** Rotate the wheel upwards.

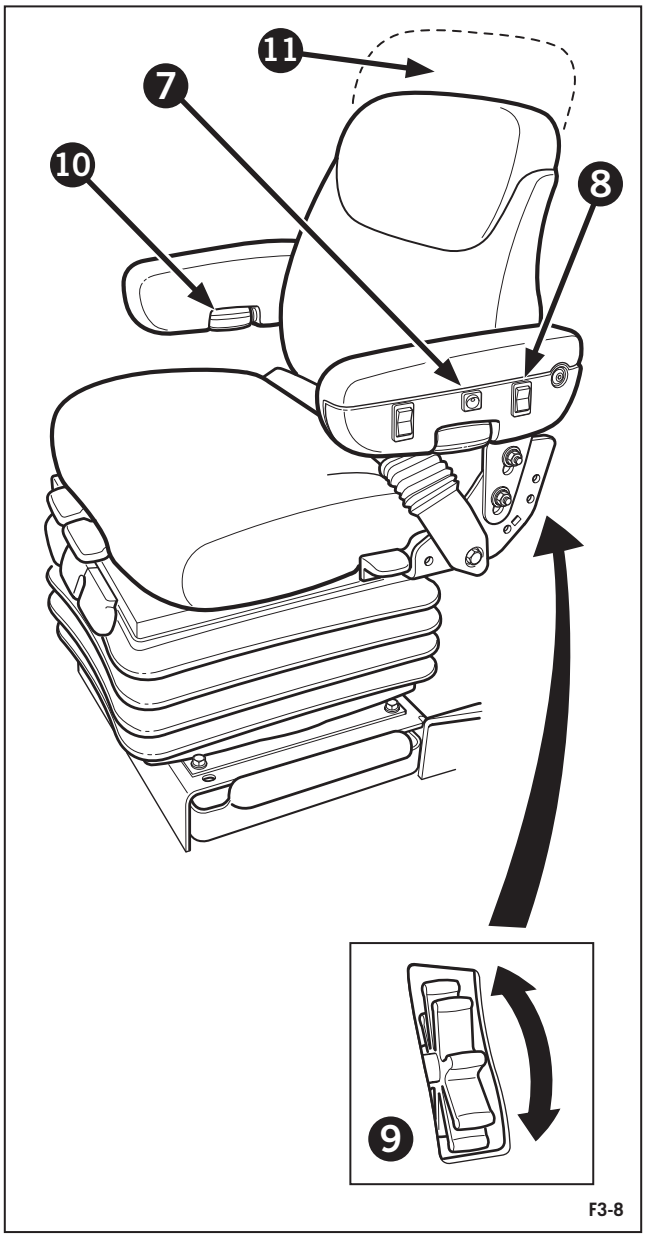
### 10. Armrest Angle Adjustment

Rotate the roller on each armrest to adjust to the desired angle.

Both armrests can also be raised up to the full vertical position for easy access.

### 11. Headrest Adjustment

The headrest can by raised to the desired position by pulling upward, using the handle incorporated in the back of the headrest.



F3-8

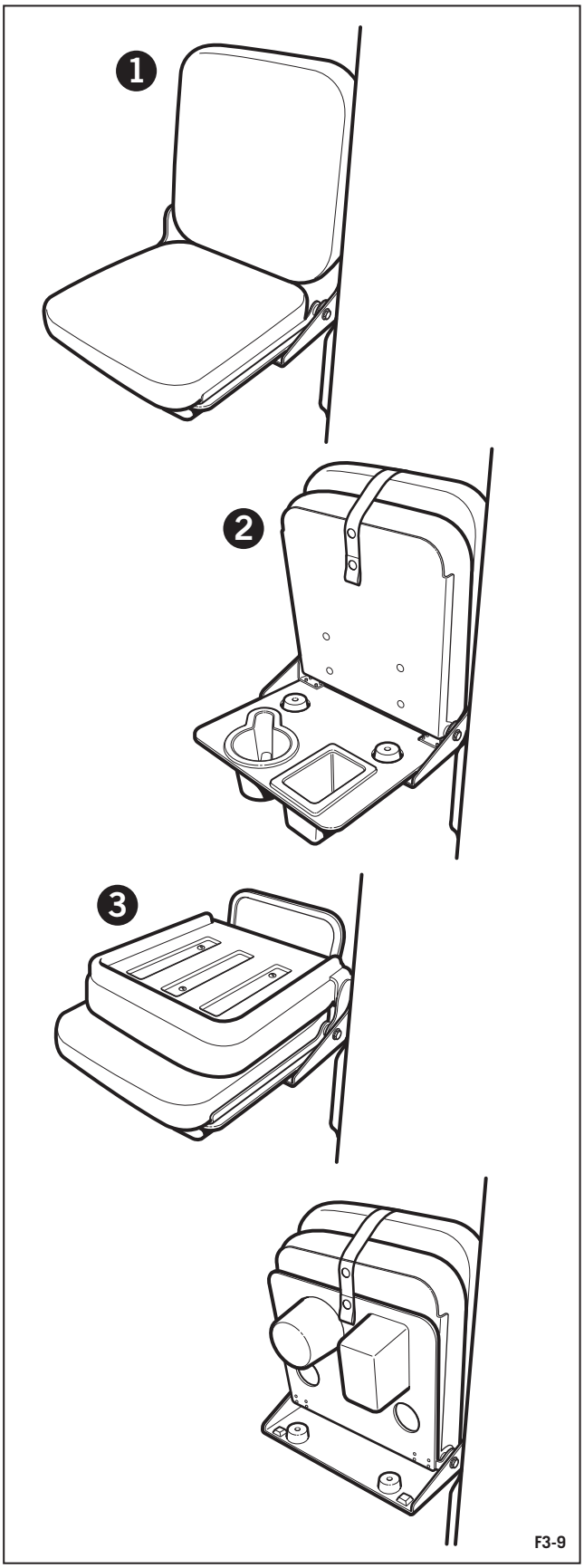
## Instructional Seat (Optional)

An instructional seat (1) with seat belt is available for the purpose of providing seating for training a new operator on the operation of the tractor.

**WARNING: INSTRUCTIONAL SEAT IS USED ONLY FOR INSTRUCTING OR SERVICE DIAGNOSING ONLY. DO NOT PERMIT OTHERS TO RIDE, ESPECIALLY CHILDREN. SEAT BELT MUST BE WORN AT ALL TIMES.**

A strap is provided to secure the seat cushion in a raised position (2) when the seat is not being used for training. This will expose the utility tray incorporating a cup holder and storage tray.

The seat back is designed to carry a laptop computer in the lowered position (3).



F3-9

## Controls and Instruments Overview

The information on the following pages identifies, locates and describes the function of the controls and instruments located in the cab.

**WARNING: DO NOT OPERATE THE TRACTOR UNTIL YOU ARE THOROUGHLY FAMILIAR WITH THE LOCATION AND OPERATION OF ALL CONTROLS.**

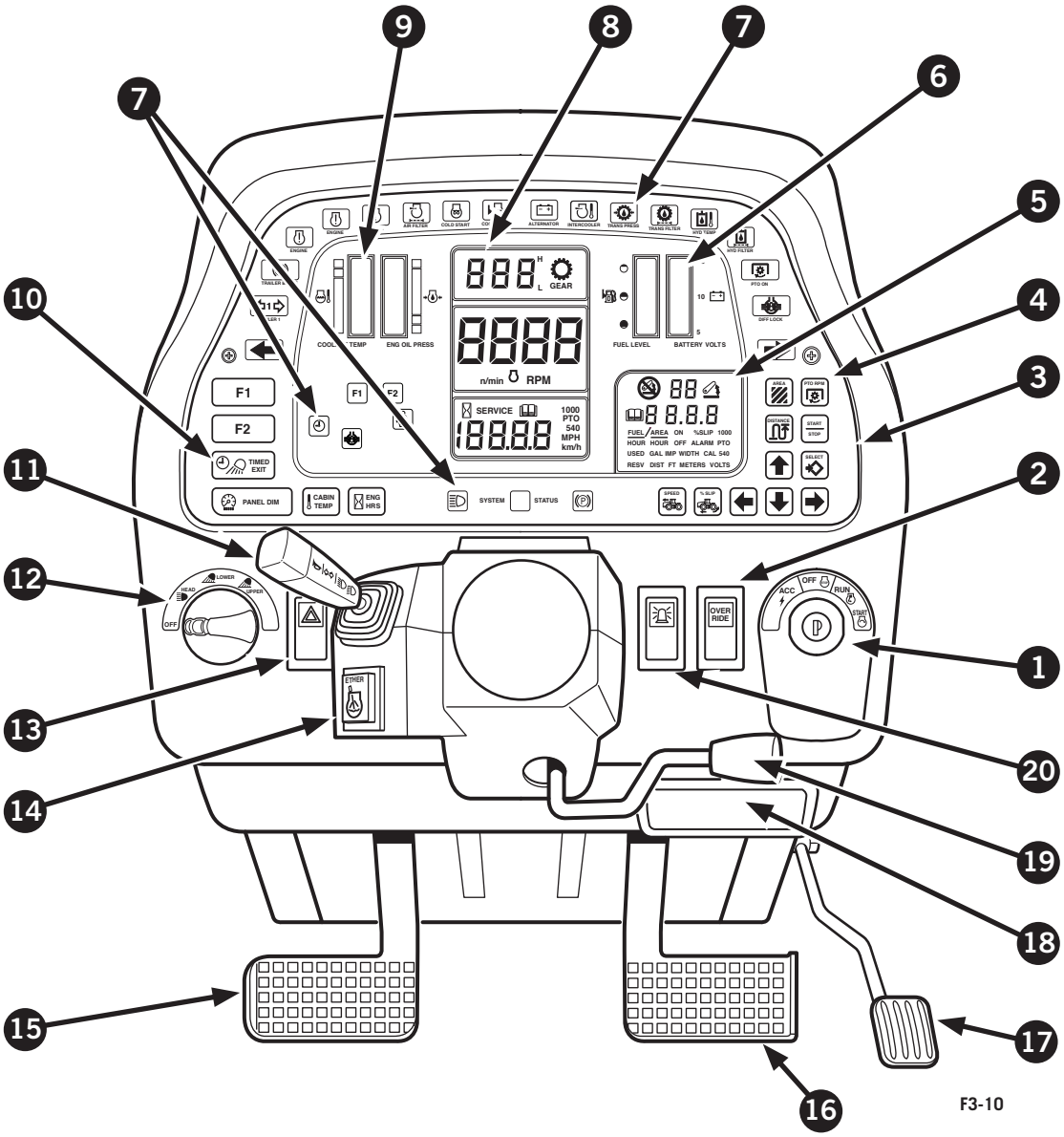
The controls have been divided into the following four areas:

**Forward Operator Controls**

**Overhead Controls**

**Right Side Console Controls**

**Additional Cab Controls**



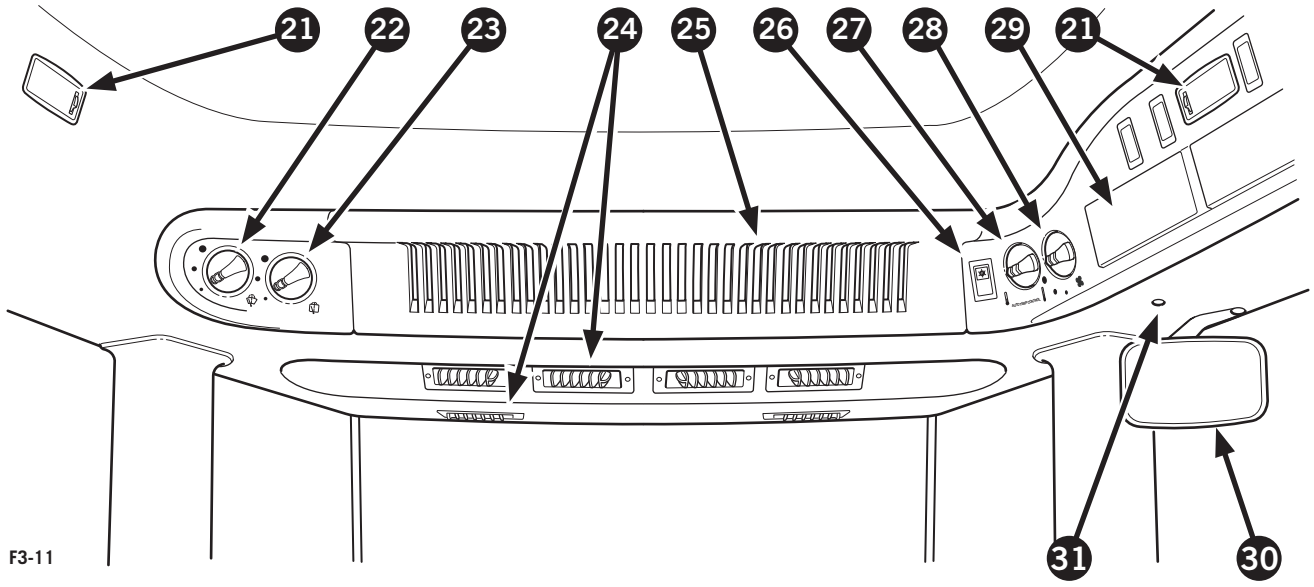

**Forward Operator Controls**
(steering wheel omitted for clarity)

## Forward Operator Controls

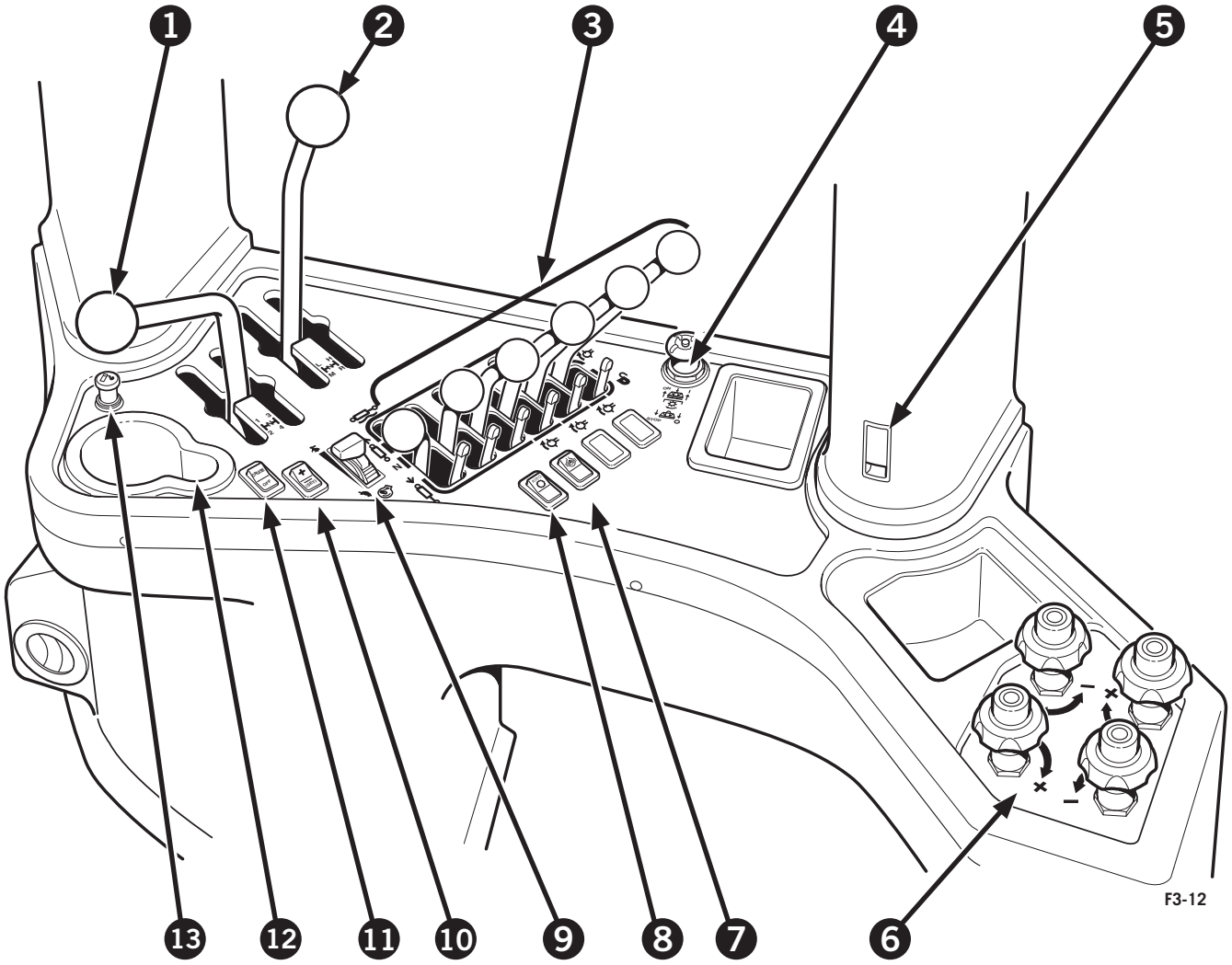
1. Key-start/stop switch, 4 position
2. Engine shut down override switch
3. Electronic Instrument Cluster (EIC) including:
4. 11 touch sensitive switches for selecting EIC functions and aid in calibration
5. Tractor Performance Monitor (TPM)
6. Fuel level and battery voltage bar graphs
7. 26 Indicator and warning lamps
8. Central display (LCD) indicates:
   Top - transmission gear information
   Middle - engine speed
   Bottom - hours, ground speed, PTO speed as selected
9. Coolant temperature and oil pressure bar graphs
10. 6 touch sensitive function switches: timed exit, panel light, cabin temperature, engine hours
11. Multi-function switch: horn, turn signal, high/low beam
12. Master light switch, 4 position
13. Hazard warning switch
14. Ether (cold start) button
15. Clutch control pedal
16. Brake pedal
17. Decelerator pedal
18. Ashtray
19. Steering wheel tilt control lever
20. Roof beacon (optional)

## Overhead Controls

21. Dome lights
22. Front windscreen wiper/washer switch
23. Rear windscreen wiper/washer switch (optional)
24. Heater/air-conditioning vents
25. Recirculation vent
26. Air conditioner on/off switch
27. Temperature control selection switch
28. Fan switch
29. Radio (optional)
30. Rearview mirror
31. Right hand console lamp

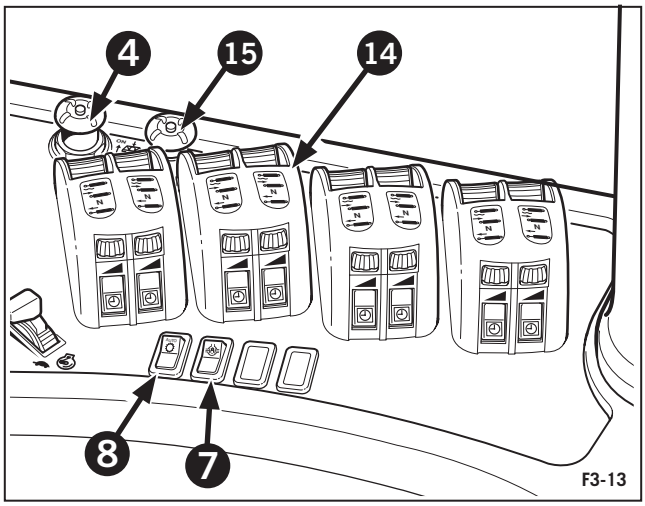



**Overhead Controls**

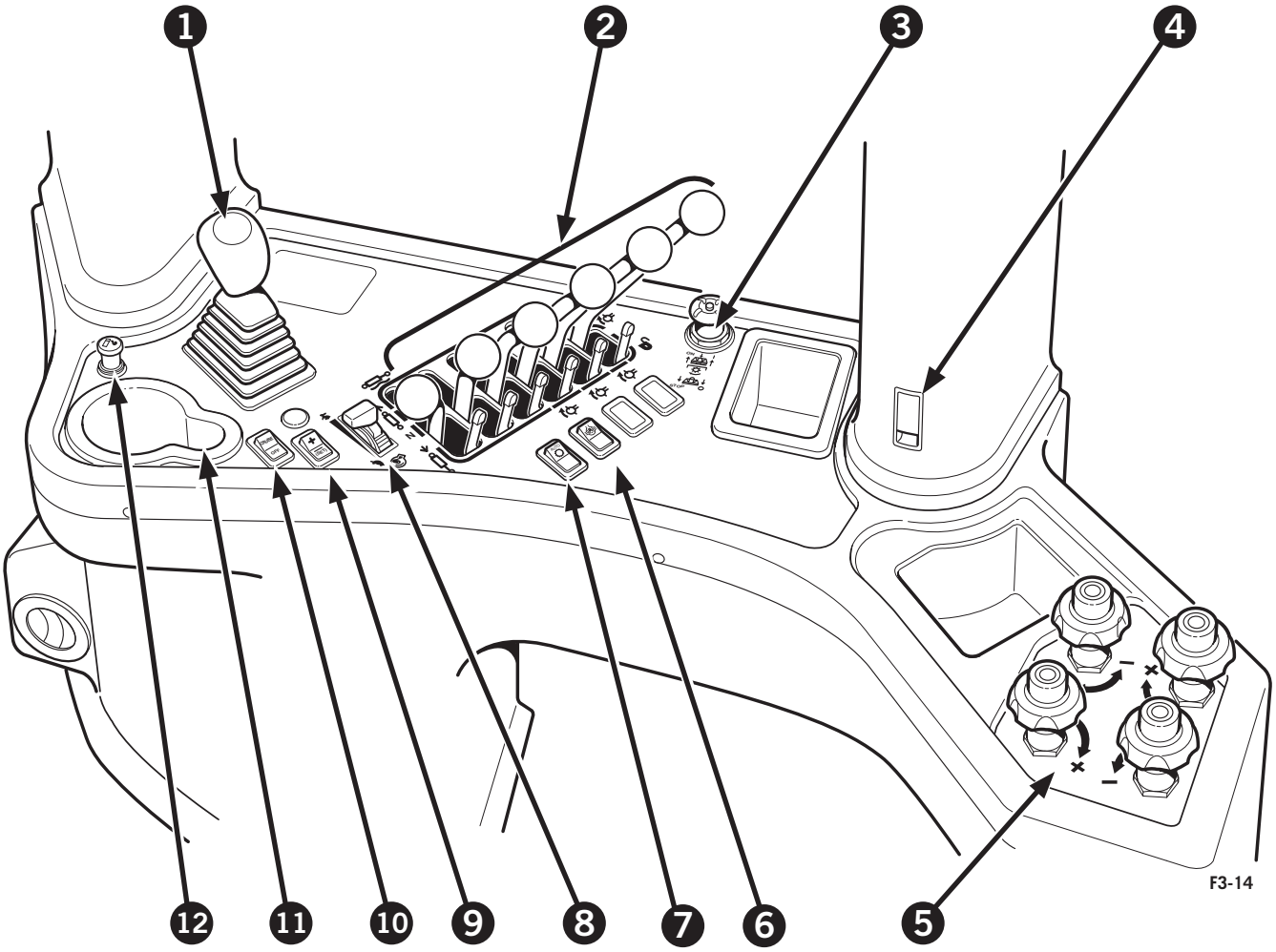



**Right Side Console Controls - Synchromesh Transmission with Manual Hydraulics**

1. Gear selector
2. Range selector
3. Hydraulic lever control 1-6
4. PTO - Power Take Off (optional)
5. Fuse & relay panel cover
6. Flow controls 1-4
7. CAT TA22 transmission autoshift switch (optional)
8. Differential lock switch (optional)
9. Hand throttle control lever
10. Cruise control +/- increment/decrement switch
11. Cruise control on/off switch
12. Cup holder
13. Cigarette lighter
14. Electro-hydraulic control pods (optional)
15. Electro-hydraulic engagement switch

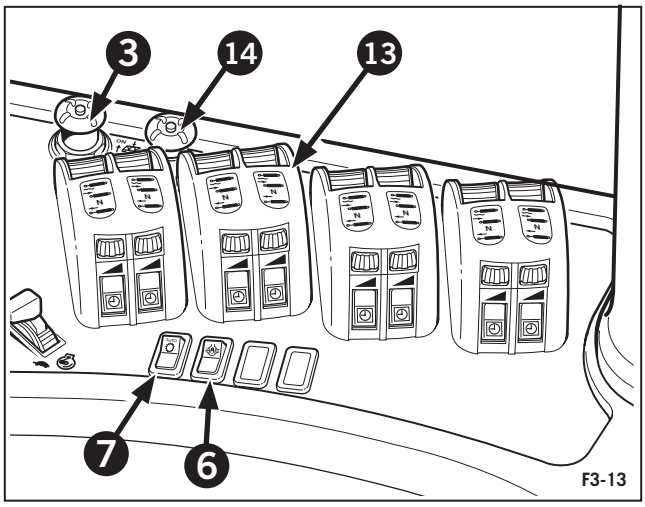



**Synchromesh transmission with optional Electro-hydraulics**




**Right Side Console Controls - Optional 1407 Twindisc or CAT TA22 Powershift Transmission with Manual Hydraulics**

1. Bumpshift lever
2. Hydraulic lever control 1-6
3. PTO - Power Take Off (optional)
4. Fuse & relay panel cover
5. Flow controls 1-4
6. CAT TA22 transmission autoshift switch (optional)
6. Differential lock switch (optional)
7. Hand throttle control lever
9. Cruise control +/- increment/decrement switch
10. Cruise control on/off switch
11. Cup holder
12. Cigarette lighter
13. Electro-hydraulic control pods (optional)
14. Electro-hydraulic engagement switch




**Powershift transmission with optional Electro-hydraulics**

## Steering Wheel and Column

The steering column may be adjusted for tilt and telescope to provide a comfortable operating position.

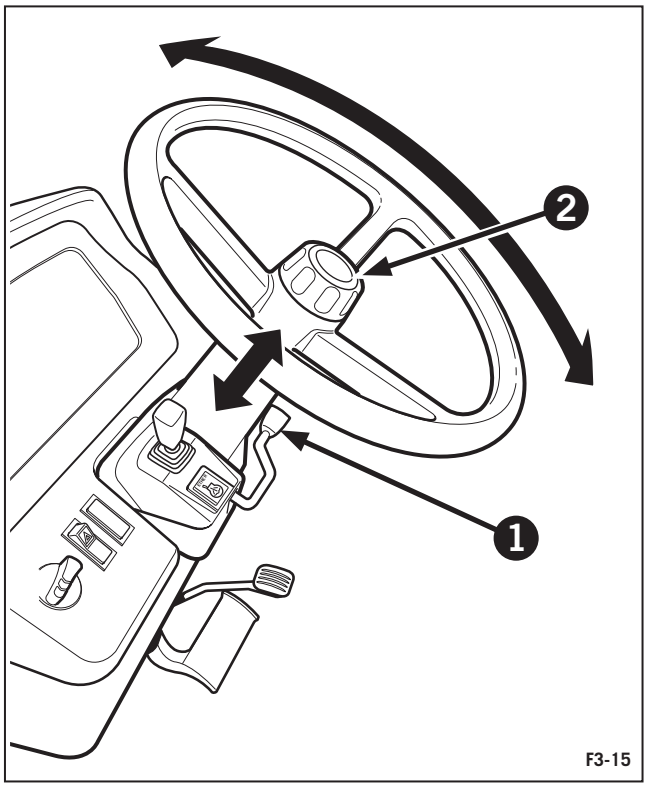
### Steering Wheel Tilt Control

To tilt the steering wheel, pull the tilt control lever (1) upward. Position the steering wheel at the desired angle and lock in position by releasing the control lever. The steering wheel can be tilted upward to the top stop to allow easy exit from the seat.

### Steering Wheel Telescopic Adjustment

To telescope the steering wheel rotate the center locking knob (2) counterclockwise and unlock the steering column. Slide the steering wheel up or down to the desired position and lock the column in place by rotating the locking knob (2) clockwise.

*IMPORTANT: Your tractor is equipped with hydrostatic power steering. Never hold the steering wheel against either of the articulation stops for more than 10 seconds or for more than a total of 10 seconds in any one minute. Failure to observe this precaution may result in damage to the steering system components.*



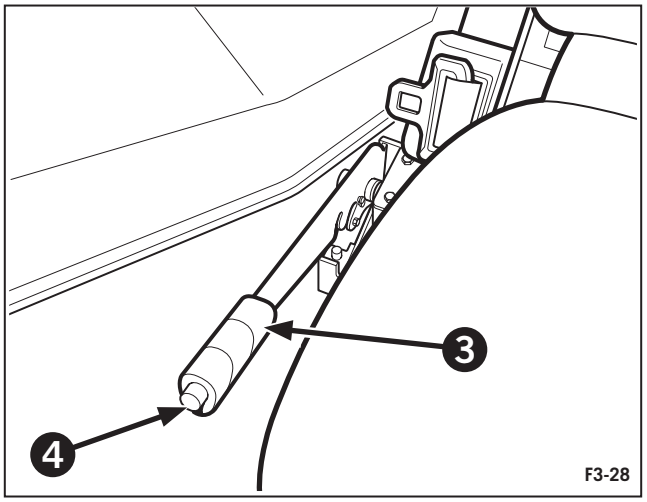

### Parking Brake

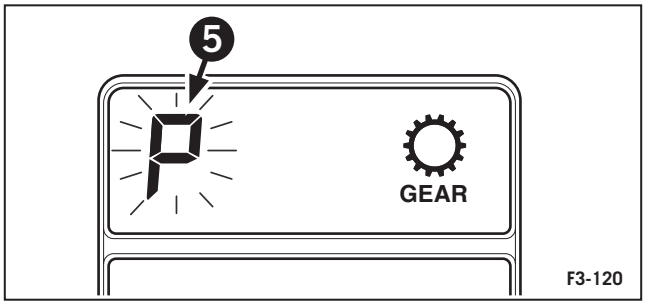
The parking brake (3) is located on the floor to the right of the operator's seat. To engage the parking brake, pull the lever up. To disengage, raise the lever up slightly, then depress button (4) and push the lever down.

**CAUTION: THE PARKING BRAKE MUST BE ENGAGED BEFORE THE OPERATOR LEAVES THE SEAT.**

*NOTE: A two-minute pulsating audible alarm will sound with a flashing parking brake lamp to remind the operator to engage the parking brake if the tractor engine is stopped without the parking brake applied. The parking brake indicator lamp will illuminate when the parking brake is applied.*

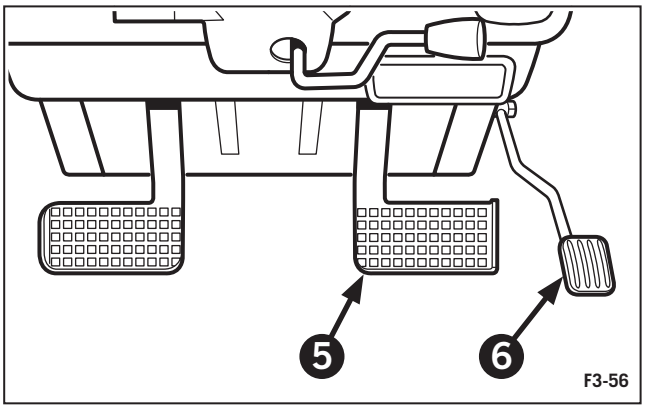
*IMPORTANT: To prevent the tractor from being driven with the parking brake applied a flashing "P" will be displayed in the transmission LCD of the EIC (5) and the parking brake warning lamp will flash along with a continuous audible alarm. Tractors equipped with the CAT TA22 transmission require that the parking brake be engaged before the engine will start.*



## Foot Brake

The foot brake pedal (5) is located in the lower right corner of the operator's console near the cab floor. The pedal should be depressed to bring the tractor to a stop once the clutch pedal is fully depressed.




**CAUTION: KEEP THE CAB FLOOR AREA FREE FROM DEBRIS OR OBJECTS WHICH MAY OBSTRUCT THE OPERATION OF THE BRAKE PEDAL. KEEP THE PEDAL CLEAN AND DRY TO PREVENT YOUR FOOT FROM SLIPPING OFF THE PEDAL.**

**DANGER: NEVER LEAVE THE OPERATOR'S SEAT WITHOUT FIRST BRINGING THE TRACTOR TO A COMPLETE STOP USING THE FOOT BRAKE, AND THEN ENGAGING THE PARKING BRAKE.**

**DANGER: NEVER OPERATE THE TRACTOR IF THE FOOT OR PARKING BRAKE DOES NOT FUNCTION PROPERLY.**

**DANGER: NEVER RELY SOLELY ON THE TRANSMISSION TO HOLD THE TRACTOR STATIONARY WHEN PARKED; ALWAYS ENGAGE THE PARKING BRAKE.**

## Decelerator Pedal

At the lower front of the right console is the decelerator pedal (6) which can be used to reduce engine speed when turning or while shifting. Fully depressing the decelerator pedal will reduce the engine to an idle speed of 1400 RPM. If the pedal is not fully depressed, engine speed will be reduced proportionally. When the pedal is released, engine speed will return to the previous throttle setting.

*IMPORTANT: Do not release the decelerator before completing the turn. If the transmission is in a high gear, the tractor will accelerate quickly, reducing the time to correct tractor direction.*

## Forward Operator Control Console

The following description details the controls located in the forward operator's console.

### Ignition Switch

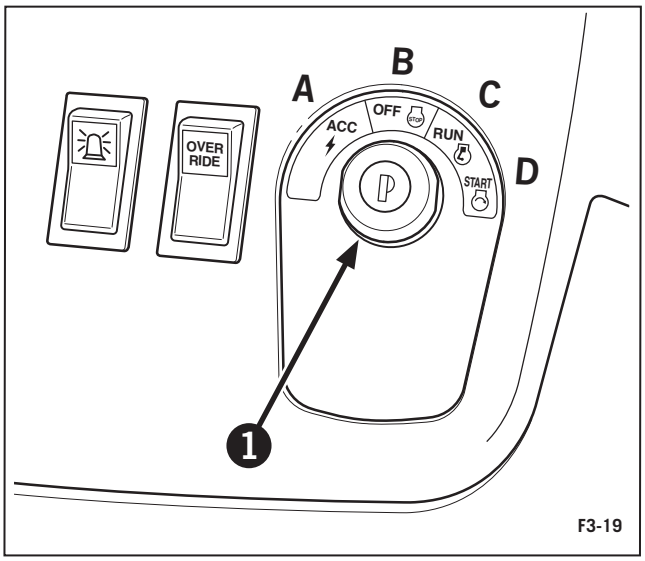
The ignition switch (1) has four key positions.

**Position A** - Accessories "ON," Engine "OFF"

**Position B** - Engine and electrical equipment "OFF"

**Position C** - Warning lights and instruments "ON." Engine RUN position.

**Position D** - Starter motor operates




### Engine Shut Down Override Switch

The rocker switch (2) allows the operator to override the automatic shut down. See "Operating the Engine" for details on the automatic shut down feature. The switch should only be used to move the tractor to a safe area for investigation and repair. Push the top of the switch to override the shut down system. Push the bottom of the switch to return to normal (automatic shut down) operation.

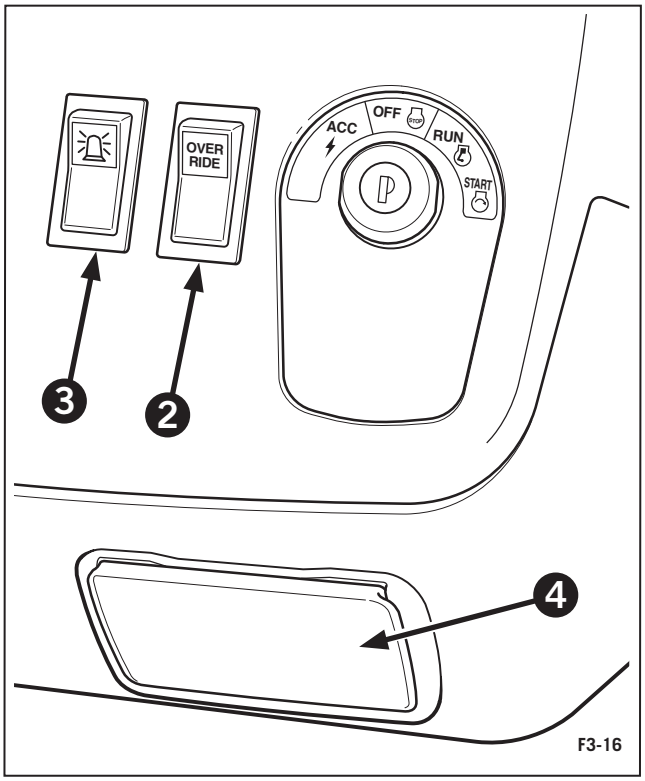
### Rotary Beacon Switch (optional)

The rocker switch (3) controls the operation of the beacon. Push the top of the switch to operate the beacon. Push the bottom of the switch to turn the beacon off. Tractors without rotary beacons have a blanking plate in place of the switch.

### Ashtray and Cigarette Lighter

The ashtray (4) can be tilted out for convenient use. To clean the ashtray, pull it upward and out from the dash and empty.

The cigarette lighter (page 3-14) is located on the left of the right hand console. Push the lighter in to activate. It will automatically pop out when heated. Return lighter to it's socket after use.



## Master Light Switch

The master light switch (1) has 4 positions.

**Position A** - Full counterclockwise is off.

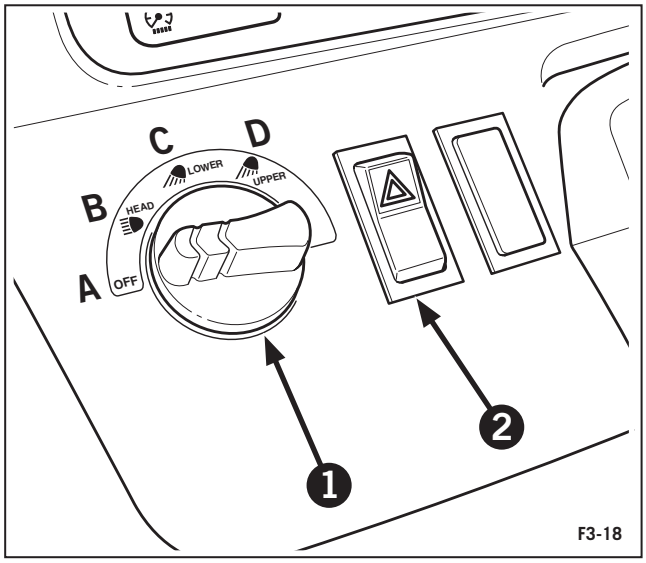
**Position B** - Headlights and parking lights

**Position C** - Headlights and parking lights and lower work lights

**Position D** - All work lights, headlights and parking lights.

## Hazard Warning Light Switch

Push the top of the rocker switch (2) to activate the hazard lights. Push the bottom of the switch to turn the hazard lights off.




## Multi Function Switch

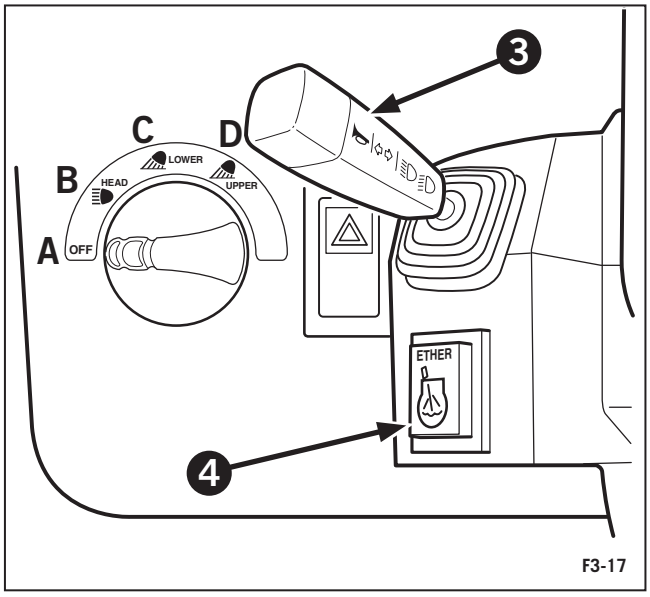
The lever type multifunction switch (3) operates the horn, turn signals, headlight flash and is used to select high or low beam.

**Turn Signals -** Move the lever upward to indicate a right turn, or downward to indicate a left turn. The turn signal warning light on the warning light bar will flash when the signals are operated. The opposite warning light on the warning light bar will also light, but will remain steady. The turn signal must be manually returned to neutral after the turn is completed. An audible warning will sound if the turn signals are left on for more than two minutes

**Headlights (High/Low Beams) -** With the master light switch in positions B, C or D, the multifunction switch lever can be pulled toward the steering column to change the headlights between high and low beam.

**Headlight Flash -** With the master light switch in position A (Off), the multifunction switch lever can be pulled toward the steering column to flash the high or low beams of the headlights.

**Horn -** Press the button on the end of the multifunction switch lever to activate the horn.




## Ether Cold Start Button

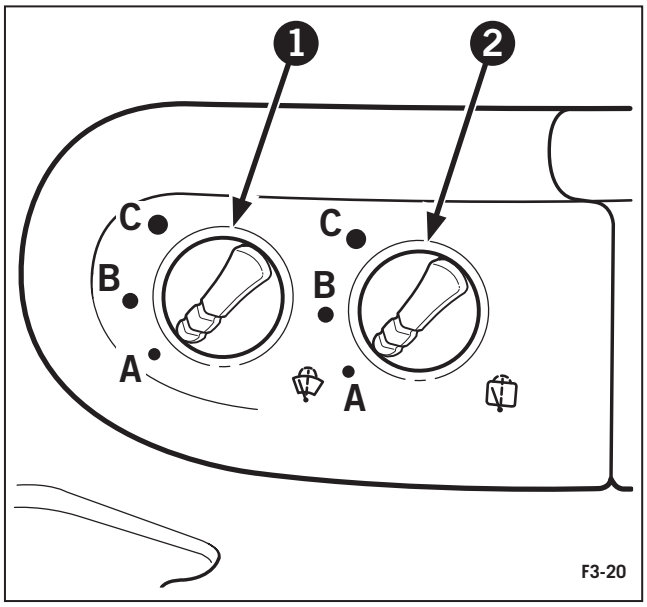
The ether cold start button (4) is used to inject ether, a highly combustible substance, into the engine intake manifold. Ether will ignite in the engine at temperatures far below those needed to ignite diesel fuel.

Use the ether to assist the engine starting in temperatures at or below 0° C (32° F).

**Note: See cold-weather starting on page 3-51 for detailed operation.**

## Overhead Controls

The following description details the overhead controls located in the cab roof.




### Front Windshield Wiper/Washer Switch

The front windshield wiper switch (1) is a three position switch.

**Position A** - Off

**Position B** - Slow

**Position C** - Fast

Press the switch to operate the screen washer.

When the front windshield wiper switch is turned off, the wiper arm will always park on the right side of the windshield.

### Rear Window Wiper/Washer Switch (optional)

The rear window wiper switch (2) is also a three position switch and operates as the front windshield switch.

**Position A** - Off

**Position B** - Slow

**Position C** - Fast

Press the switch to operate the screen washer.

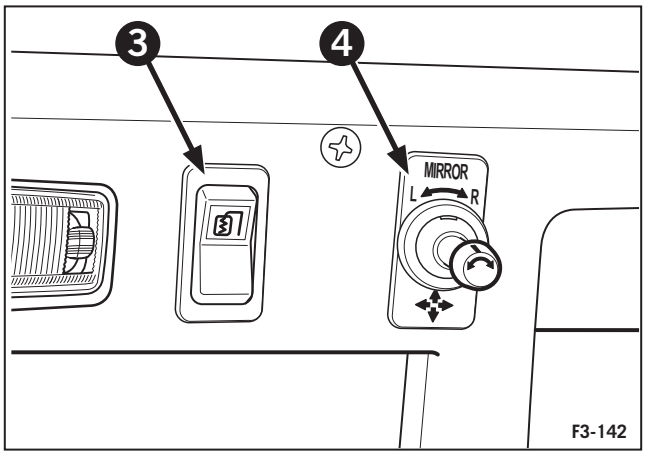
When the rear window wiper switch is turned off, the wiper arm will always park on the left side of the window.

### Power Heated Mirrors (optional)

The power heated mirrors controls are located on the right side in the cab roof.

The mirror controls consist of a momentary rocker switch (3) which activates the mirrors heating elements for nine minutes before automatically switching off.

The mirrors are adjusted with the joystick (4). Turning the joystick left or right to select the required mirror, moving the joystick up and down or left and right to obtain the desired position.



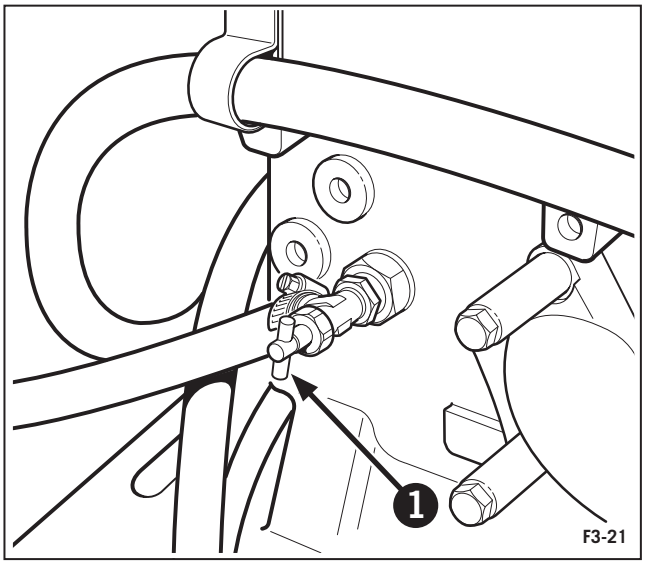
## Climate Controls

### Heater

Before activating the heater, open the heater valve on the rear/right side of the engine block (1). Under most cold-weather conditions it is not necessary to have the valve completely open.

During hot weather, shut the heater valve off. This will ensure that no engine coolant will flow into the heater core.

Make sure the air conditioner is deactivated except during defrosting. To increase the cab interior temperature for cold weather operation, start the engine and make sure the coolant temperature bar graph indicates two or more bars. Rotate the temperature control switch (3) to increase the temperature. Adjust the fan speed switch (4) to increase or decrease air flow.




### Air Conditioning Operation

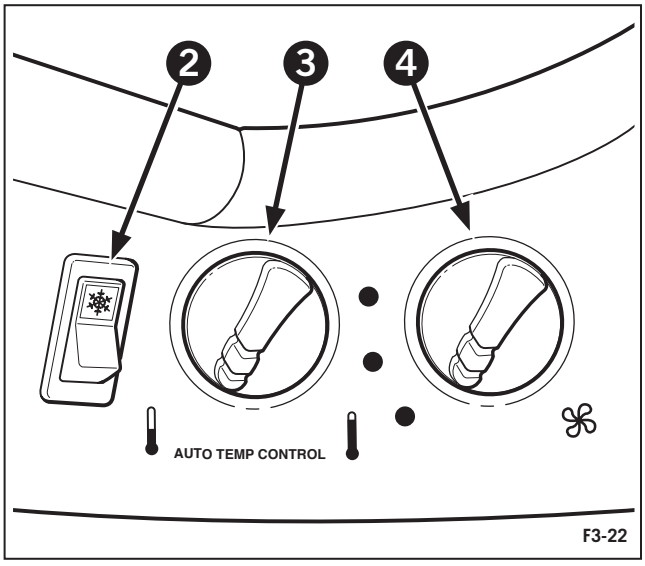
**CAUTION: THE AIR CONDITIONING SYSTEM USES R134A REFRIGERANT. DO NOT MIX WITH OTHER REFRIGERANTS. DO NOT ATTEMPT TO TOP OFF THE SYSTEM WITH ANY OTHER REFRIGERANTS. CONSULT A QUALIFIED TECHNICIAN FOR ALL AIR CONDITIONING REPAIRS.**

The climate controls consist of a rocker switch (2) which activates the air conditioning, and two rotary switches, controlling the temperature (3) and the pressurizer fan (4).

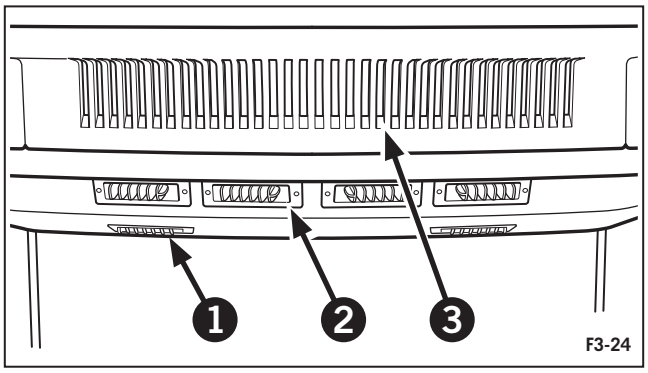
Depress the top of the air conditioning rocker switch (2) to activate the air conditioner. Depress the bottom of the switch to deactivate the air conditioner.

The temperature control switch (3) is used to maintain a constant temperature. Rotate the temperature control switch counterclockwise to increase cooling. Adjust the fan speed switch (4) to increase or decrease air flow.

To aid in defrosting the windshield and side windows the air conditioner and heater may be operated at the same time. The air conditioner will remove moisture from the air while the heater warms the air in the cab. When the windows are clear, deactivate the air conditioner.



*IMPORTANT: Always turn the air conditioner off when cooled or dehumidified air is not required. This is especially important during cold weather as damage to the compressor could result. For proper air conditioner operation, the cab air filter must be serviced regularly. (See Lubrication & Maintenance section).*




## Pressurizer Vents

The pressurizer has adjustable and fixed vents to direct air flow as required.

Fixed vents (not shown) direct air to the windshield to aid defrosting and defogging.

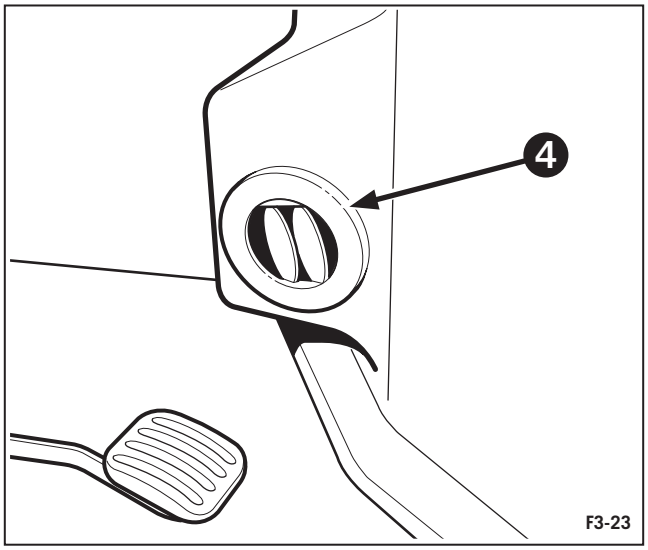
Two adjustable vents (1) can be directed onto the front side windows and door to aid defrosting and defogging.

Four adjustable vents (2) face the operator.

Vent (3) is for air re-circulation.

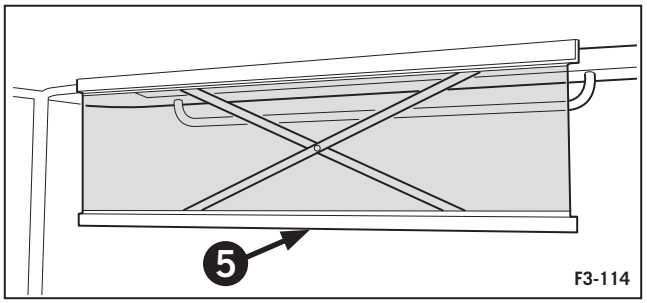
Rotate the vents inside their housings to direct air as required. The slide lever inside the vent can be moved side to side to direct air flow to the left or right.

For additional comfort, a floor vent (4) is provided at the bottom of the right hand console.




## Sun Blind

A sun blind is provided front and rear. Pull down on the bottom frame (5) and extend to the desired position. Push up to retract.



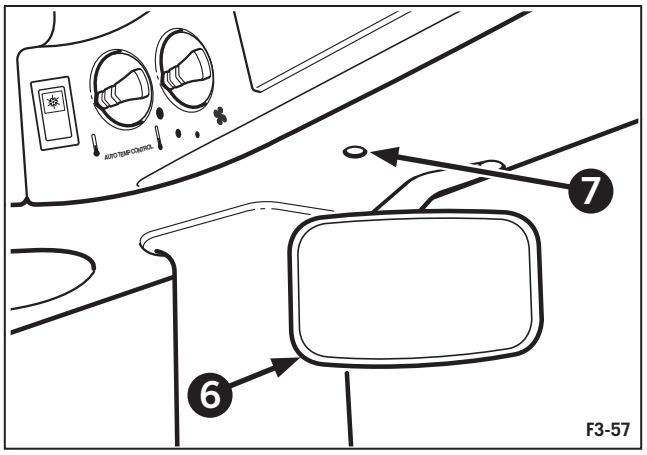

## Mirror

An interior rear view mirror (6) is provided for your convenience. It is located on the right post and is adjustable.

**NOTE: To provide a wider view, the mirror has a convex lens. This causes objects to appear farther away than they are.**

## Console Light

A console light (7) is provided to illuminate the right console. The light comes on when the master light switch is set to positions B, C or D. (see page 3-19).



## Trouble Light (Optional)

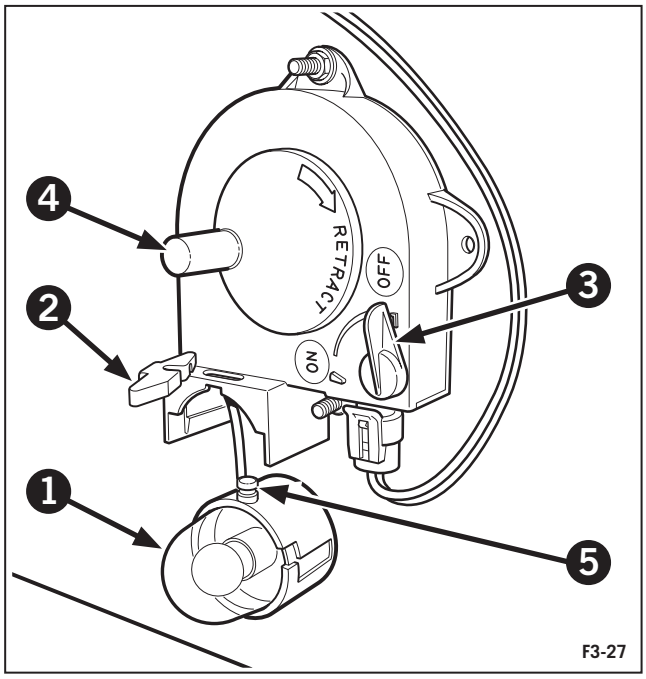
A trouble light is located in the left, rear corner of the cab, under the rear deck. The light has a 5.5 M (18') power cord attached. To remove the light (1) move the locking lever (2) to the left and carefully pull the light downward while unwinding the cable from the holder. The light base is magnetic which enables attachment to the tractor for convenience while working.

The light switch (3) is a two-position switch. With the switch lever in the off position (vertical), the light is off. With the switch lever in the on position (horizontal), the light will come on when the cab door is open.

The trouble light, when it is stowed in it's cradle, is used in conjunction with the cab dome lights to illuminate the cab interior when the cab door is open.

**NOTE: The trouble light has been designed to turn off when the door is closed.**

To stow the trouble light, reel in the cable with the crank handle (4) inserting the pin (5) into its socket, and lock in position with the lever (2).

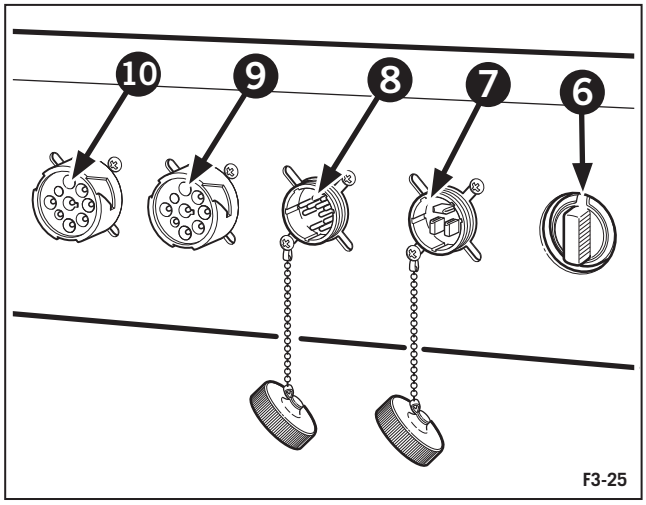


F3-27

## Power Outlets

Three power outlets are located in the rear deck behind the operator's seat.
Outlet (6), 12 volt, 1-pin accessory connector.
Outlet (7), 12 volt, 3-pin accessory connection.
Outlet (8), 16-pin diagnostic connector.
Outlet (9), Cummins diagnostic connector.
Outlet (10), CAT TA22 transmission diagnostic connector **(Optional CAT TA22 Installation only)**

**NOTE: On earlier models a Cummins engine diagnostic cable, BVI p/n: 86033779 is supplied with the tractor and is located in the storage tray under the seat. This cable connects to the 16 pin connector (8) and the Cummins insite tool harness.**



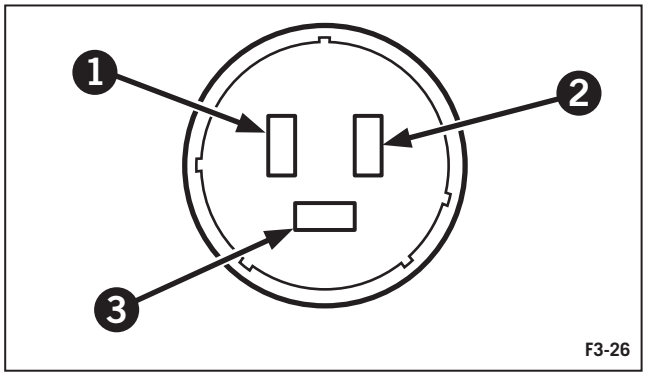
F3-25

The 3-pin accessory plug (7) has 3 terminals.

**Pin 1** - Key switched 12 volt power source protected by a 20-amp fuse.

**Pin 2** - Live 12 volt power source protected by a 20-amp fuse.

**Pin 3** - Ground.



F3-26

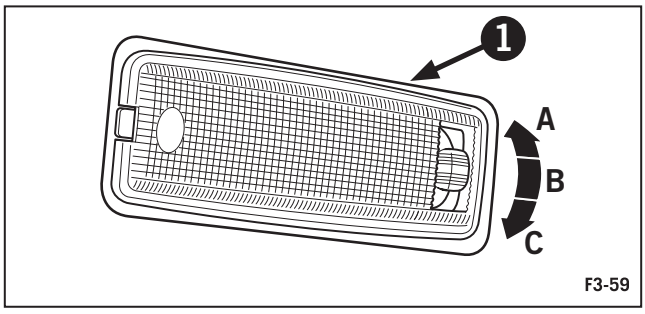
## Dome Lights

Two dome lights (1) are provided in the cab roof to illuminate the interior. Each light can be set to one of three positions.

**Position A** - On when the door is open

**Position B** - Off

**Position C** - On




## Cab-Mounted Accessory Bracket (Optional)

The cab has an optional bracket for mounting cab accessories, ie: Implement Monitor Boxes, Gauges, CB Radio, and Cellular Phone. The bracket is equipped with three power outlets:

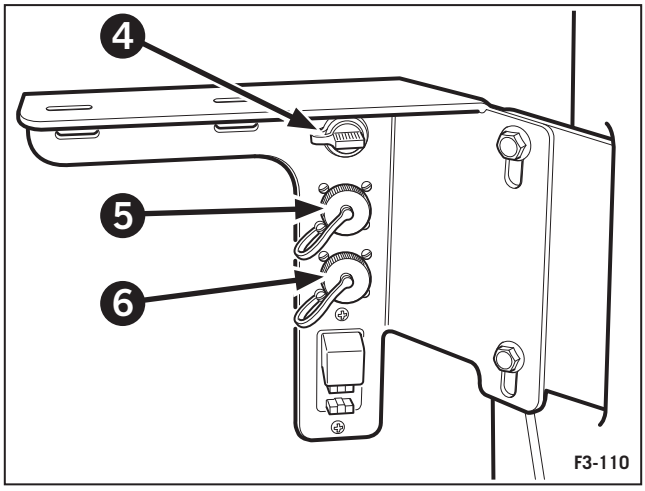
Socket (4) is a 12 volt, 1-pin accessory connector.

Plugs (5&6) are 12 volt, 3-pin accessory connections. These plugs have 3 terminals:

**Pin 1** - Key switched 12 volt power source protected by a 20-amp fuse.

**Pin 2** - Live 12 volt power source protected by a 20-amp fuse.

**Pin 3** - Ground.



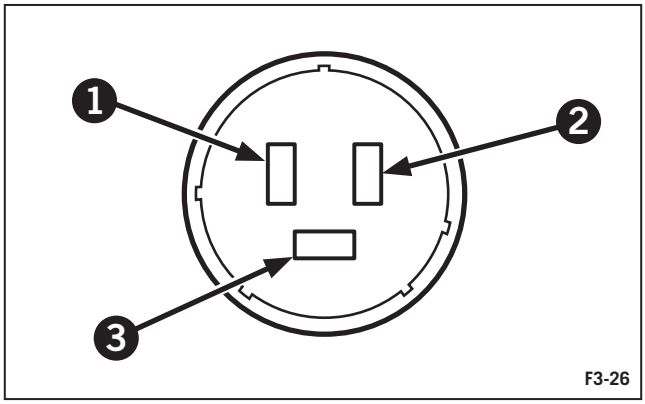

## Radio (Optional)

A radio/cassette or radio/CD player can be installed in the cab of your tractor.

**P/N: 86032815 - radio/cassette**
**P/N: 86032814 - radio/CD player**

If you require installation of either of these units, please contact your Buhler Versatile dealer.

A separate instruction manual is supplied with each radio and should be followed for proper radio operation.



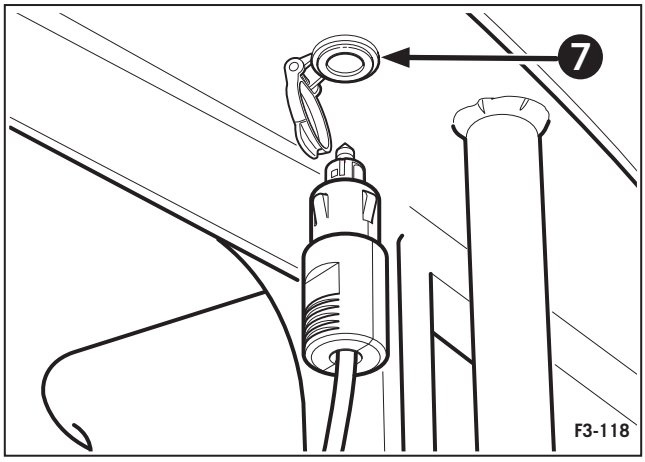

## Rotary Beacon (Optional)

A rotary beacon with a magnetic base can be mounted in one of three locations on the roof cap.

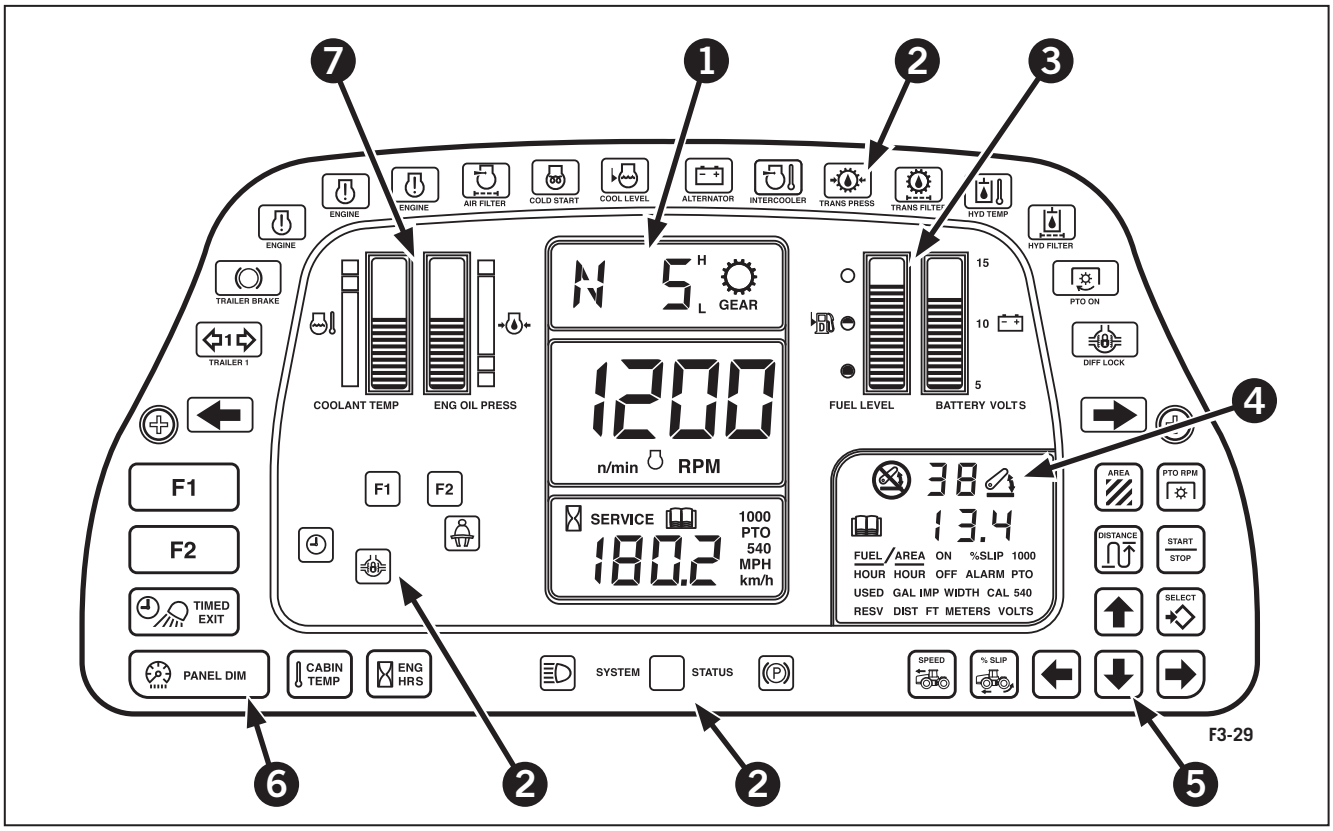
The power cable is connected to the socket (7) located to the left of the door underneath the roof cap.

The beacon is operated by the switch on the right hand side of the forward control console.

The rotary beacon kit is available from you a Buhler Versatile dealer, **P/N: 86031163**



## Electronic Instrument Cluster




## Introduction

The following information details the operation and programming of the Electronic Instrument Cluster (EIC). The above illustration of the EIC shows an example of a normal operating display.

When the key-start switch is turned on, a self-test of all the Liquid Crystal Display (LCD) segments and warning lamps is activated, the audible alarm will sound for approximately one second and all lamps will be illuminated briefly to confirm that the bulbs are functioning. The LCD background areas are illuminated when the tractor key switch is turned on. They also have dimmer controlled back lighting.

The EIC is divided into the following areas:

1. The central LCD displays transmission gear information at the top. Engine speed in the middle and operating hours/ground speed and PTO speed at the bottom.
2. There are 26 colored indicator or warning lamps, which provide operating information or give warning of system malfunctions.
3. Fuel level and battery volts are displayed in the right bar graphs.
4. The Tractor Performance Monitor (TPM) is displayed on the right side of the cluster. The TPM provides information on 3-point hitch and other selected system information. Fault code information is also displayed.
5. Eleven touch-sensitive switches select EIC functions for display within the TPM. The switches are also used for calibration purposes.
6. Four touch-sensitive switches are used to control timed exit, cabin temperature (optional), engine hours and instrument lighting.
7. Coolant level and engine oil pressure are displayed in the left bar graphs.

## Audible Alarm

An audible alarm will sound under the following conditions:

- when the ignition is first switched on.
- when a warning light illuminates or a bar graph indicates a malfunction.

The alarm will alert the operator that a malfunction has occurred.

Depending on the severity of the malfunction, the alarm will sound as follows:

Non-Critical Alarm - An audible alarm sounds for one second only. The tractor will continue to operate, but the cause of the alarm should be investigated and corrected.

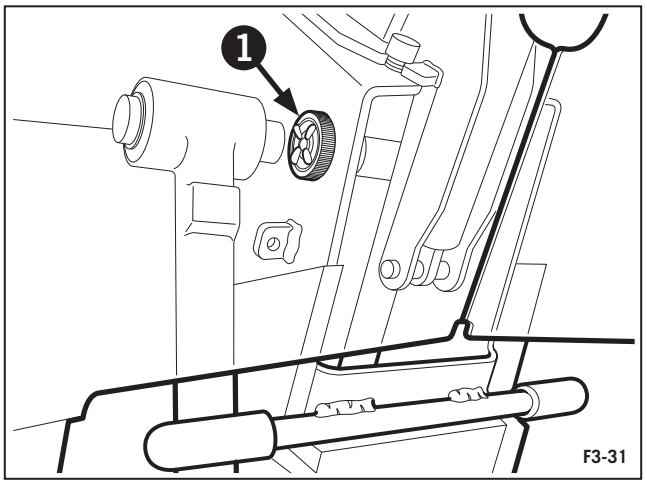
Critical Alarm - A continuous pulsating tone will sound until the malfunction is corrected or the engine is switched off. The engine "STOP" message will flash in the center display for 30 seconds before automatic engine shut down occurs. The cause of the malfunction should be located and corrected immediately to prevent damage to the tractor.

The audible alarm has a rotary volume control (1) located on the left side of the steering column below the front controls. Rotate the alarm cover to adjust the volume.

## Automatic Engine Shut Down

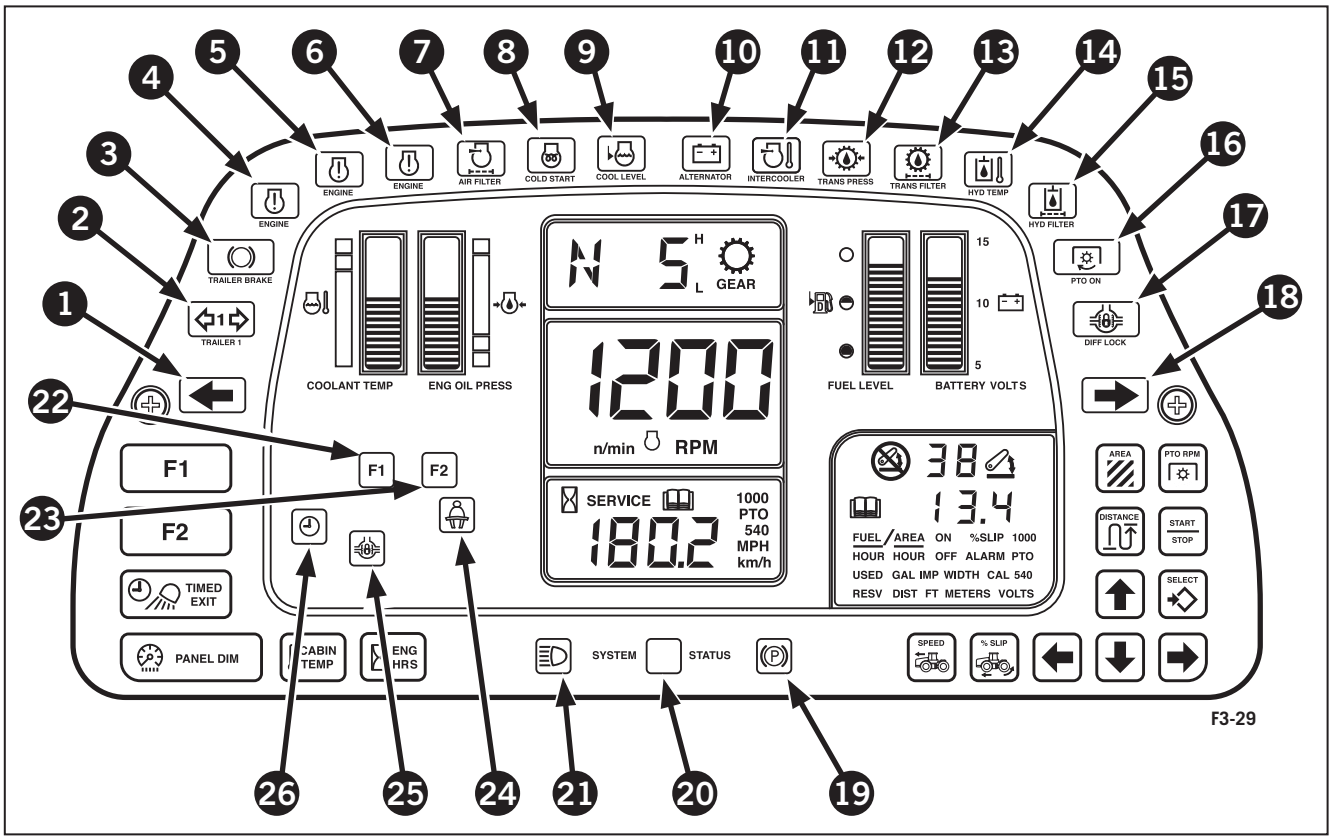
An automatic engine shut down feature is standard equipment. This feature will automatically shut down the engine within 30 seconds under the following conditions:

- Transmission oil pressure low
- Engine oil pressure low
- Intake manifold temperature high-critical
- Engine coolant temperature high-critical
- Engine coolant level low
- Electrical charging system voltage low
- Engine oil temperature high-critical


**WARNING: THE ENGINE SHUT DOWN FEATURE IS FULLY AUTOMATIC. IT CAN BE OVERRIDDEN BY THE OPERATOR TO DRIVE THE TRACTOR TO A SAFE LOCATION. THE OVERRIDE SWITCH IS TO THE RIGHT OF THE STEERING COLUMN AND SHOULD ONLY BE USED TO MOVE THE TRACTOR FAR ENOUGH TO AVOID A DANGEROUS SITUATION.**

(See "Engine Shut down Override Switch Operation" page 3-18).




## Indicator, Warning Lamps and Audible Alarm

The twenty-six colored status lamps, shown above, provide operating information or give warning of system malfunction. The malfunction warning lamps are accompanied by an audible alarm.

The status lamps/audible alarm function as follows:

**1. Left Turn Signal**

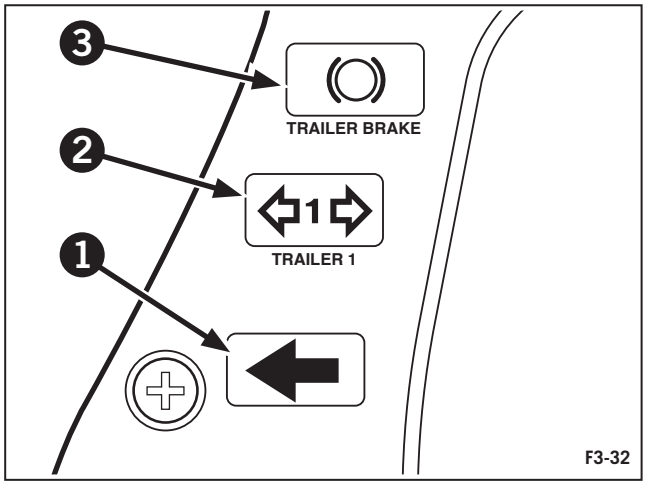
The Turn Signal lamp (1) will flash in unison with tractor left-hand turn signal. An audible alarm will sound if the turn signals are left on for more than two minutes.

**2. Trailer 1 Turn Signal**

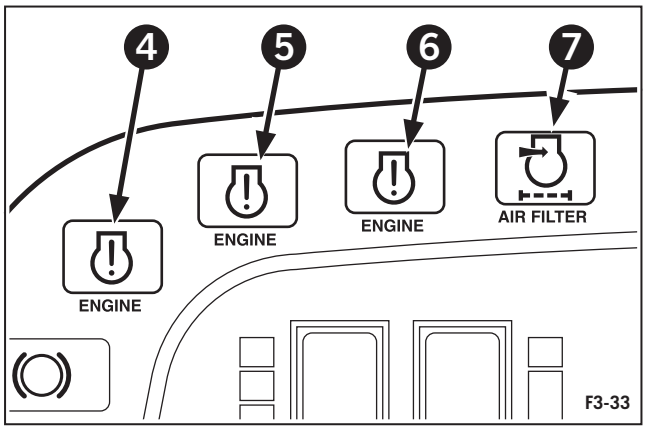
Not used.

**3. Trailer Brake**

Not used.



In the event of an engine fault occurring, 1 of 3 warning lamps will flash depending on the level of the fault.




**4. Engine Maintenance - Attention (white lamp)**

Illuminates when engine maintenance is required. A fault code is also displayed.

**5. Engine Maintenance - Warning (yellow lamp)**

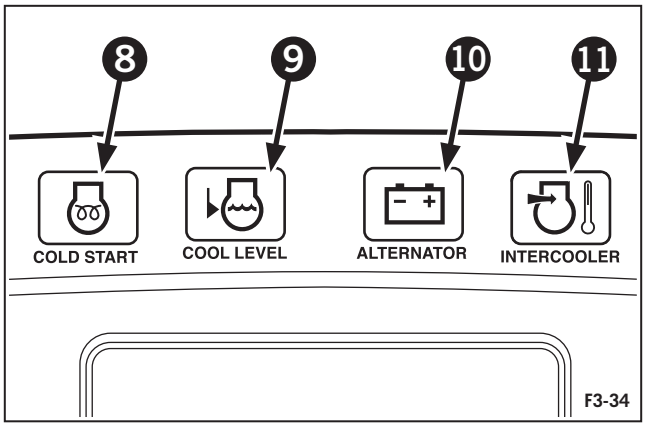
Illuminates when a non-critical fault occurs in the electronic engine control system. As soon as possible, contact your Buhler Versatile dealer.

**6. Engine Maintenance - Critical (red lamp)**

Illuminates when a critical fault occurs in the electronic engine control system. The alarm will sound and the engine "STOP" message will flash in the center display for 30 seconds before automatic engine shut down occurs. The cause of the malfunction should be located and corrected immediately to prevent damage to the tractor.

**7. Air Filter Restriction**

The Air Filter lamp will illuminate accompanied by the non-critical alarm if the fault has existed for 10 seconds. Stop the tractor and service the air filter to prevent engine damage.




**8. Cold Start**

The Cold Start lamp will illuminate when outside temperature is at or below 0° C (32° F).

Use the ether cold start to assist engine starting in cold weather, (see page 3-51).

**9. Coolant Level Low**

The Coolant Level lamp will illuminate when coolant drops below the sender level. A critical alarm will sound. Check for leaks and refill cooling system.

**10. Alternator Charge Indicator**

The Alternator lamp will illuminate steady if the alternator is not charging the battery. The lamp will flash and the non-critical alarm will sound if an overcharge condition occurs.

**11. Intercooler Overheated**

The Intercooler lamp will illuminate and the non-critical alarm will sound when an overheat condition occurs. The cause of the alarm should be determined and corrected before further operation or engine damage may occur.

**12. Transmission Oil Pressure**

The Transmission Oil Pressure lamp will illuminate accompanied by the critical alarm, indicating that the transmission lubrication circuit oil pressure is low.

The engine "STOP" message will flash for 30 seconds before automatic shut down occurs.

Stop the engine and investigate the cause.

**13. Transmission Filter**

The Transmission Filter lamp will illuminate indicating a restricted or blocked filter. The filter is now in a bypass condition and is no longer filtering the oil returning to the transmission. The filter should be serviced within 1 hour of operation.

**14. Hydraulic Oil Temperature**

The Hydraulic Oil Temperature lamp will illuminate indicating that the hydraulic oil temperature is too high. Stop the engine and investigate the cause.

**15. Hydraulic Filter**

The Hydraulic Filter lamp will illuminate indicating a restriction or blockage in one of the two filters. The filter is now in a bypass condition and is no longer filtering the oil returning to the reservoir. The filter should be serviced within 1 hour of operation.

**16. PTO On (Optional)**

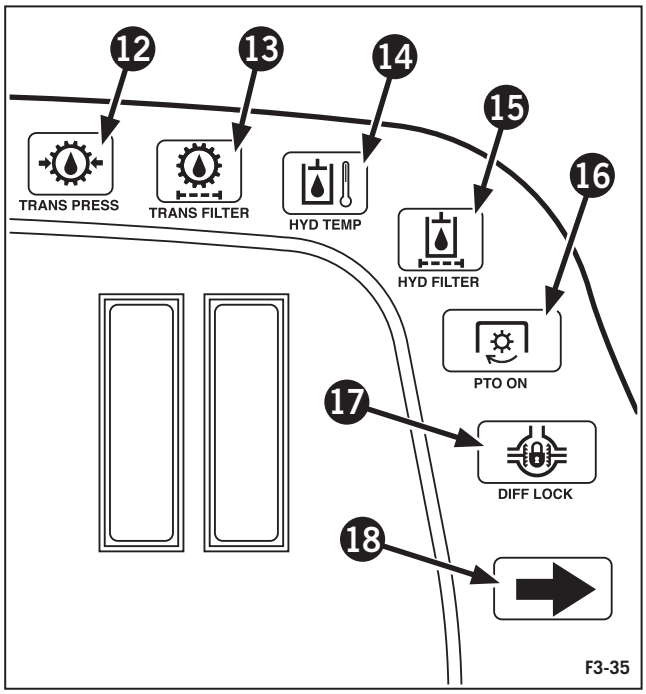
The PTO lamp will illuminate when the PTO switch is engaged.

**17. Diff Lock (Optional)**

The Diff Lock lamp will illuminate when the differential lock switch is engaged.

**18. Right Turn Signal**

The Turn Signal lamp will flash in unison with tractor right-hand turn signal. An audible alarm will sound if the turn signals are left on for more than two minutes.



**19. Parking Brake**

The Parking Brake lamp will illuminate when the park brake is applied (raised).

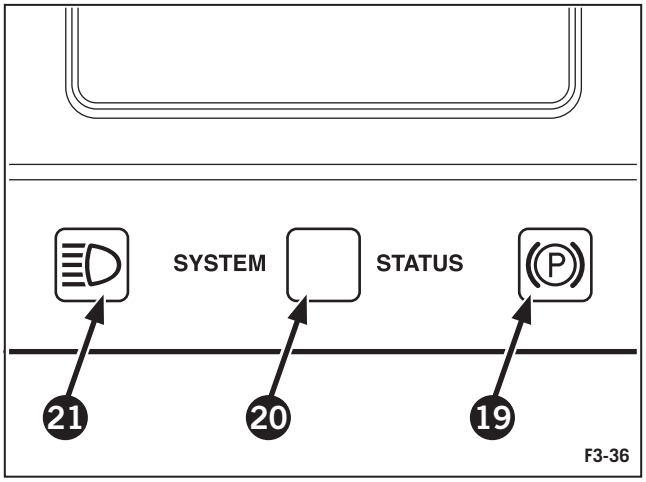
**WARNING: TO AVOID PERSONAL INJURY, ALWAYS APPLY THE PARKING BRAKE BEFORE LEAVING THE TRACTOR SEAT.**

**20. System Status**

The System Status lamp is illuminated when all systems are normal. It flashes when a malfunction is detected in a system monitored by the warning lamps or bar graphs.

**21. Headlight High Beam**

The High Beam lamp will illuminate when the tractor lights are switched to high beam.




**22. F1**

For future expansion/accessories

**23. F2**

For future expansion/accessories

**24. Safety Belt**

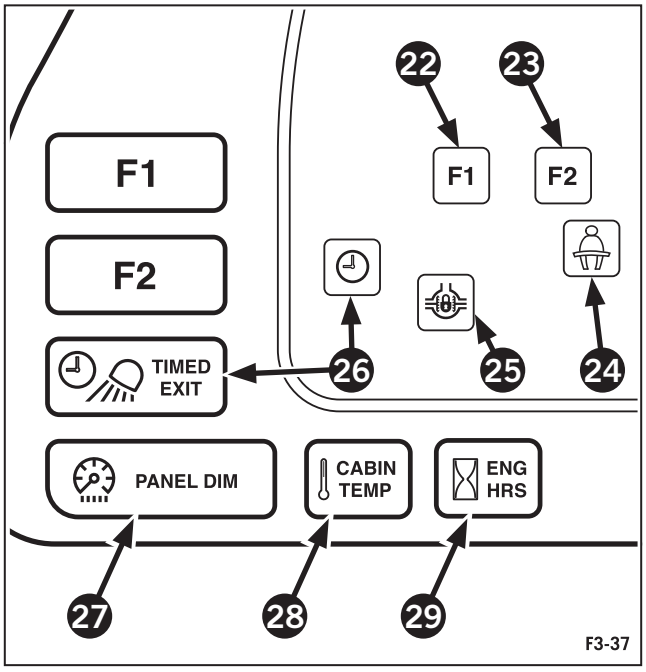
The Safety Belt lamp illuminates when the ignition switch is turned to the "RUN" position and stays illuminated for five seconds to remind the operator to fasten the safety belt.

**25. Auto Diff Lock**

The Auto Diff Lock lamp illuminates when Auto differential lock is engaged.

**26. Timed Exit**

Press to toggle between delayed lighting settings. Lamp illuminates when timer is set.




**27. Panel Dim**

Press to toggle between illumination settings. (see page 3-35 for details).

**28. Cabin Temperature (optional)**

Press to indicate cabin temperature in TPM display.

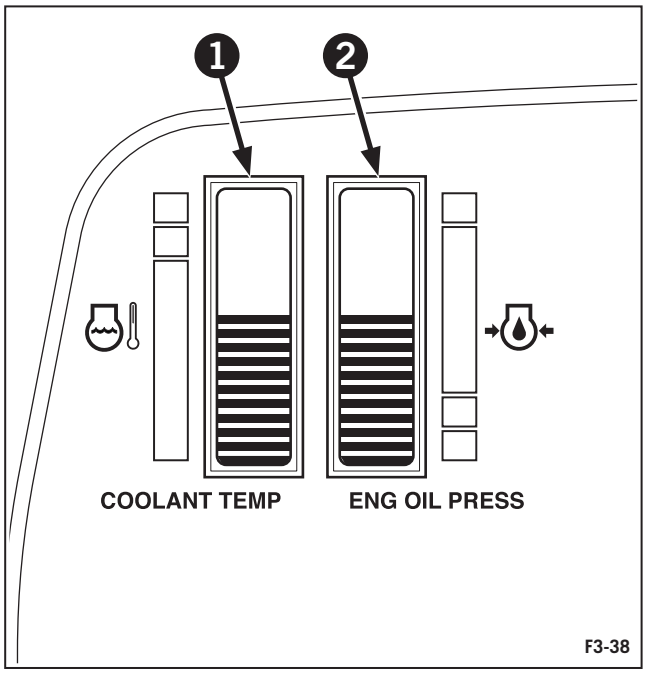
**29. Engine Hours**

Press to display engine hours.

## Bar Graph Displays (LCD)

The four bar graphs each consist of twenty LCD segments.

All bar graph sensors are continuously tested for faults. If a fault occurs, the bar graph will flash and a fault code will be stored.




### Engine Coolant Temperature

The outside left bar graph (1) registers coolant temperature. One segment of the bar graph will be displayed if the engine is cold. The number of segments displayed will increase as the engine warms up. With the engine at normal operating temperature, up to fifteen segments will be displayed. The normal working range is indicated by the green area of the adjacent range display.

Should the coolant temperature exceed a predetermined level, the coolant temperature bar graph will flash. The critical alarm will sound and the legend “STOP” will flash in the central display for 30 seconds before automatic engine shut down occurs.

Stop the engine immediately and investigate the cause.

**NOTE: The bar graph indicates engine coolant temperature only. It is not an indication of coolant level. The engine coolant must be checked daily.**

### Engine Oil Pressure

The inside left bar graph (2) indicates engine oil pressure. With normal engine oil pressure, up to sixteen segments of the bar graph will be displayed.

This is represented by the green area of the adjacent range display.

Should engine oil pressure fall below a designated level, the bar graph will flash. The critical alarm will sound, the word “STOP” will flash in the central display for 30 seconds before automatic engine shut down occurs.

Stop the engine immediately and investigate the cause.

**NOTE: The bar graph indicates engine oil pressure only. It is not an indication of oil level. The engine oil level must be checked daily by means of the dipstick.**

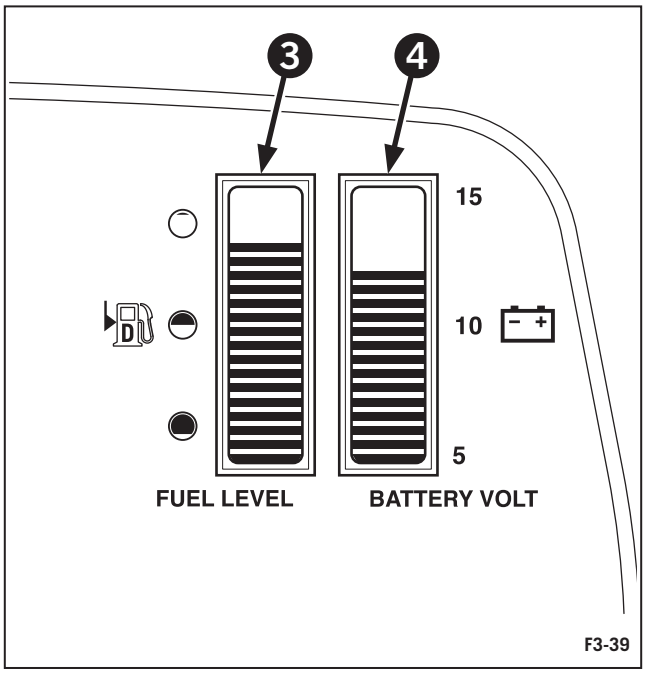
## Fuel Level

The inside right bar graph (3) indicates fuel level. Each segment of the bar graph display represents one-twentieth (approximately 5 percent) of the total fuel content of the tank.

When the fuel level falls so that only two segments of the bar graph are displayed, the bar graph will flash continually and the non-critical alarm will sound for one second.

The system also has a feature to assist the operator during refueling procedures. An audible indicator alerts the operator when the tanks are filled to 3/4 capacity (15 bars) and 19/20 or 95% (19 bars).

**NOTE: This feature only operates when the ignition switch is set to the "RUN" position.**




**CAUTION: ALWAYS SHUT THE ENGINE OFF DURING REFUELING PROCEDURES**

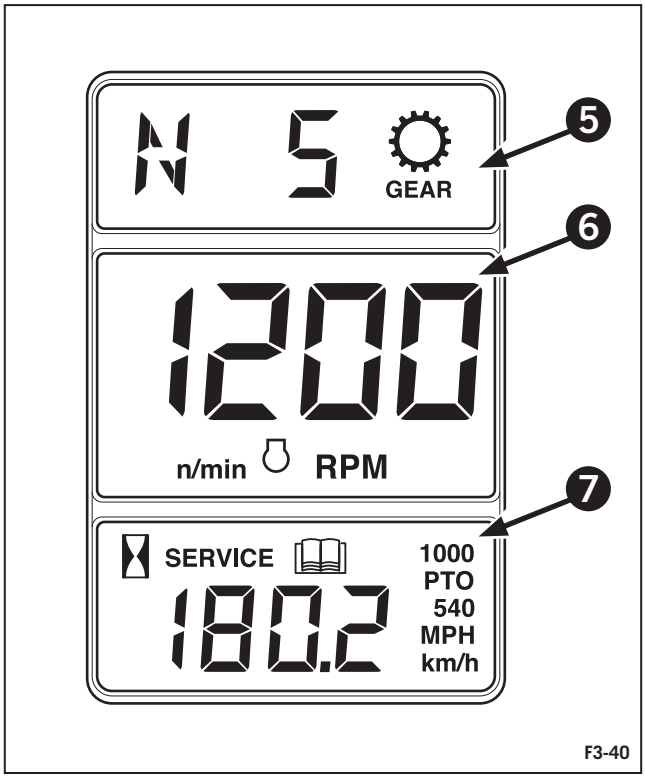
## Battery Volts

The outside right bar graph (4) indicates battery voltage.

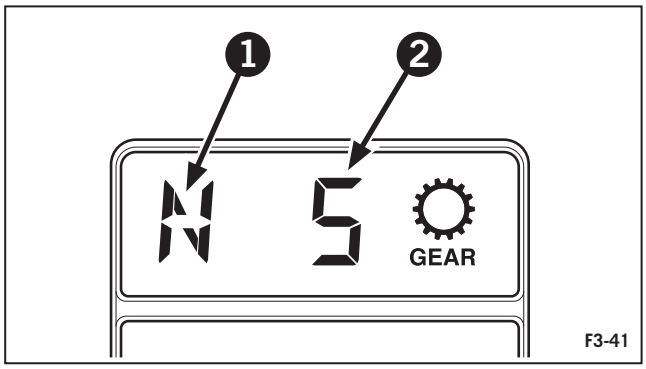
## Central Display

Three liquid crystal displays (LCD) are located in the center of the instrument cluster.

5. The top LCD is the digital transmission gear shift position display.
6. The center LCD is the digital engine speed display.
7. The lower LCD will display selected information as follows:
   - Tractor ground speed (MPH or km/h)
   - PTO speed (rev/min)
   - Engine hours accumulated (actual time)
   - Service alert - as required
   - Timed exit - as required



## Transmission Gear Shift Position Display




The top LCD provides a display of the gear selected.

The left figure (1) displays a letter as follows:

F - Forward gear selected*

N - Neutral selected

R - Reverse gear selected*

A - Automatic shift selected (Powershift option only)

P - Parking brake applied*

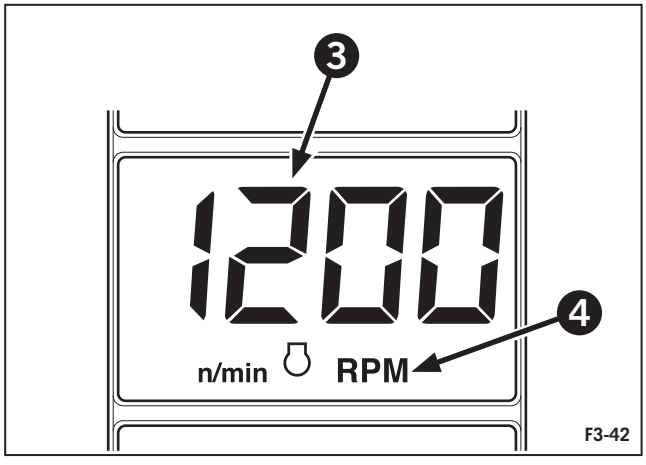
CL - Clutch depressed* (Synchromesh only)

The right figure (2) displays gear 1-12 or 1-16 depending on the transmission options.

*If the letter "P" is flashing, the display is indicating an "Operator Prompt" where the parking brake is inappropriately on or off or out of sequence with the transmission control lever. To return to normal operation, release or apply the parking brake as appropriate. Return the transmission control lever to neutral, release the parking brake, then shift to either forward or reverse as desired.

**NOTE: A tractor equipped with synchromesh transmission will only display gear shift position when moving.**

## Engine Speed Display



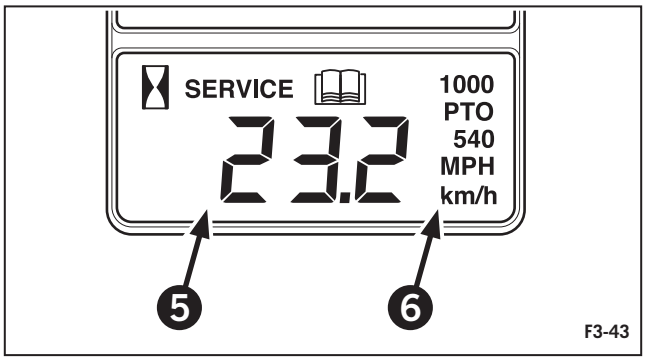

With the engine running, the digital value (3) of the engine RPM will be displayed, together with the RPM legend (4) in the center LCD.

The engine LCD registers in increments of 10 RPM.

If a critical engine or driveline fault should occur, the word "STOP" will flash for 30 seconds before automatic engine shut down occurs.

## Selectable Display

Using the key pad, the lower display will allow the operator to select one of following displays:

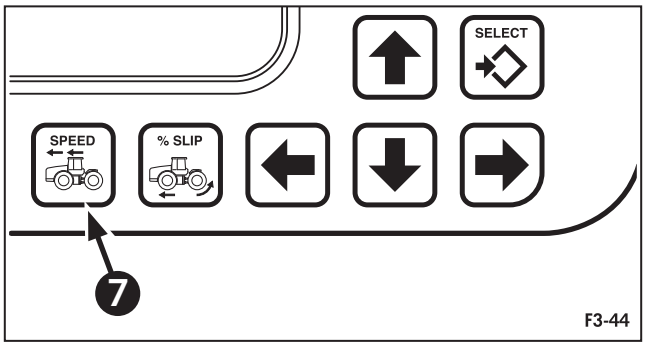



### Ground Speed Display (Speedometer)

The Ground speed (5) and the MPH or km/h legend (6) will be displayed when the tractor is moving. Switching between MPH or km/h is covered within EIC programming in this section. When the display is set to another mode the ground speed may be recalled at any time by touching the GROUND SPEED button (7).

**NOTE: The speedometer senses rotation of the rear axle and may be subject to errors caused by the effects of wheel slip, tire pressures/condition, etc. If the optional radar sensor is installed, the tractor senses true ground speed for greater measurement accuracy.**

**NOTE: The lower central display will automatically show ground speed if the tractor is traveling at more than 20 km/h (12.4 MPH ).**




### Engine Hour Meter

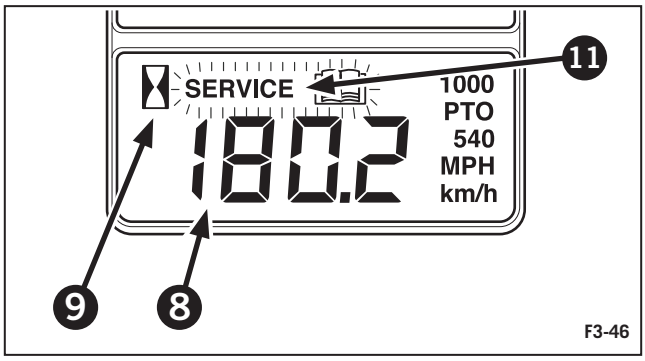
When the KEY-START switch is turned on, the LCD will display the hours the engine has operated (8) and the hour meter symbol (9).

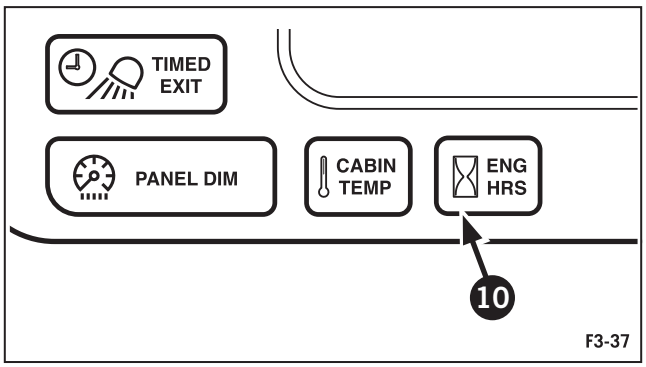
Driving the tractor will cause the display to change automatically to ground speed. The hour meter display may be recalled at any time by touching ENGINE HOUR button (10).

With the engine running, the hour meter will accumulate hours in increments of 0.1 hours until 1999.9 hours are reached. After that time, the hour meter will accumulate complete hours only, e.g. 2000, 2001 hours, etc.

**NOTE: Accumulated hours are stored in the computer permanent memory which is not affected by disconnecting the tractor batteries.**

The hour meter may be programmed to remind the operator when the next scheduled service is due.




## Service Alert

When a Service Alert is reached, the word “SERVICE” (11) will flash along with the selected display. See “Setting the service alert intervals” on page 3-41.

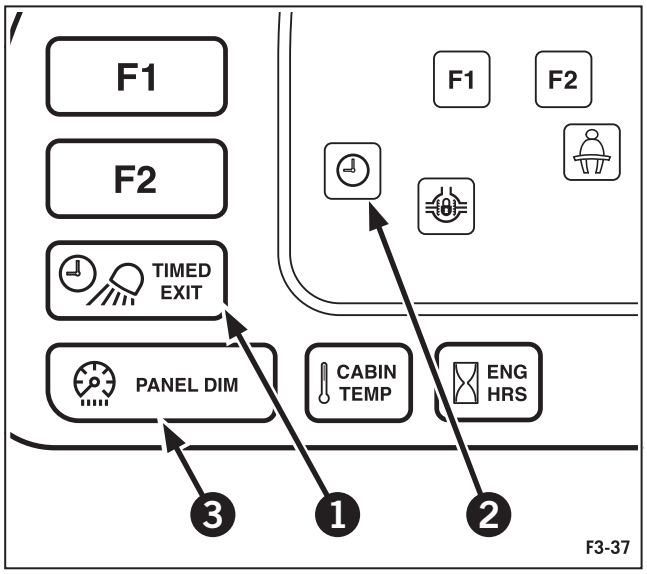
## Timed Exit

The Timed Exit feature enables the worklights and headlights to be set to remain on for a period of time after the tractor has been switched off.

The TIMED EXIT button (1) is used to set up the exit timer. Pressing the switch once will temporarily display the status of the timer in the lower section of the central LCD panel. Pressing the TIMED EXIT button while the status is displayed will cycle forward through each of the possible timer settings. The timer may be set in 10-second increments up to a maximum of 60. When the timer is set to zero, the display will show "OFF."

When the key switch is turned off, the worklights and headlights will stay on for the specified number of seconds.

A "Timed Exit" status light (2) illuminates whenever the timer is set.




## Panel Dim

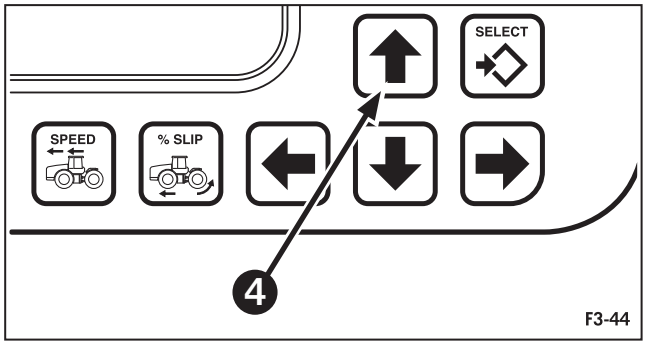
The PANEL DIM button (3) controls the brightness of the EIC backlight and the warning lights.

The EIC maintains four brightness settings:

1. Daytime Dim
2. Daytime Bright
3. Night Dim
4. Night Bright

Pressing the PANEL DIM (3) button toggles between "Bright" and "Dim" settings. When the headlight/worklight rotary switch is in the "OFF" position, The "Daytime" settings are active. With the headlight/worklight rotary switch "ON" the "Night" settings are active.

The brightness of the active set-point can be set to any level between 1 (dim) and 11 (brightest). To increase/decrease the brightness level, hold down the PANEL DIM switch (3) while pressing the UP arrow button (4). To decrease the brightness level, hold down the PANEL DIM button (3) and press the DOWN arrow button. Each time the arrow button is pressed, the brightness will increase or decrease by one level. All four settings will be saved when the key is turned off.



# EIC Tractor Performance Monitor (TPM)

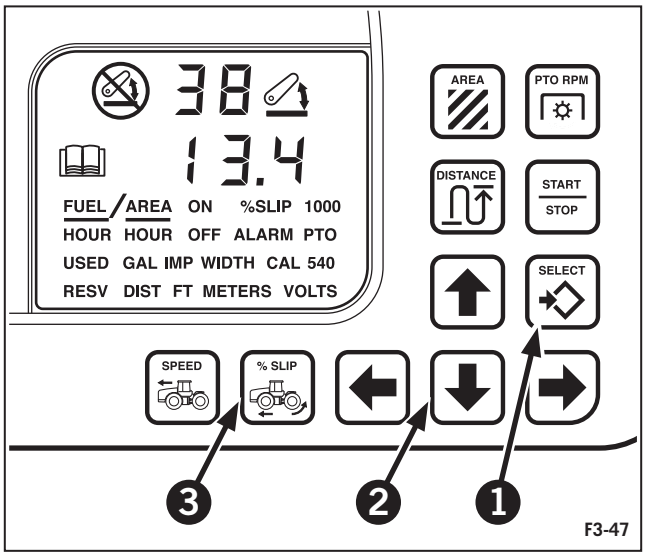
## Introduction

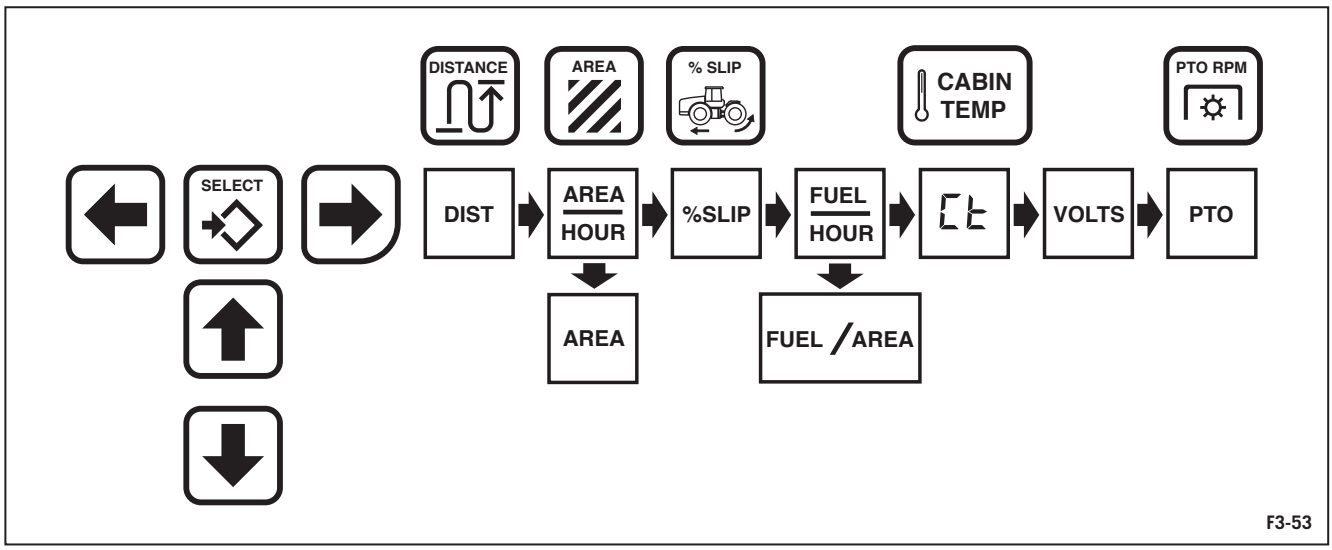
The Tractor Performance Monitor (TPM) is located in the lower right-hand corner of the EIC display.

The monitor is controlled by eleven touch sensitive buttons as detailed.

The following information can be accessed by toggling the select button (1) together with the arrow buttons (2) to obtain the required display. Shortcut display button (3), where available, can also be used.

Diagram (F3-53) shows an overview of the display navigation.




## Selectable Display Information

- Distance measurement in feet or meters
- Area per hour forecaster (acres or hectares)
- Area accumulated (acres or hectares)
- Wheel slip percentage with adjustable alarm point (optional feature)
- Fuel per hour
- Fuel per area
- Cabin temperature
- Battery voltage
- PTO speed (optional)

## Selectable Display Information

The following information may be selected for display:

**Area Per Hour Forecaster**
**(see page 3-43 for calibration)**

Area Per Hour Forecast is displayed by pressing the AREA button (1) or toggling the SELECT button. The "AREA/HOUR" legend (2) will display, together with a forecast of the area that will be worked in one hour (3) if the current rate of work is continued.

This forecast is based on the last 5 seconds running average. The forecast may be in acres (FT) (4) or hectares (METERS).

The unit of measure can be changed between FT/METER. See "EIC programming" in this section.

**NOTE: If the radar option is not installed, area per hour calculations are based on axle speed and are subject to inaccuracies caused by wheel slip that may be present.**

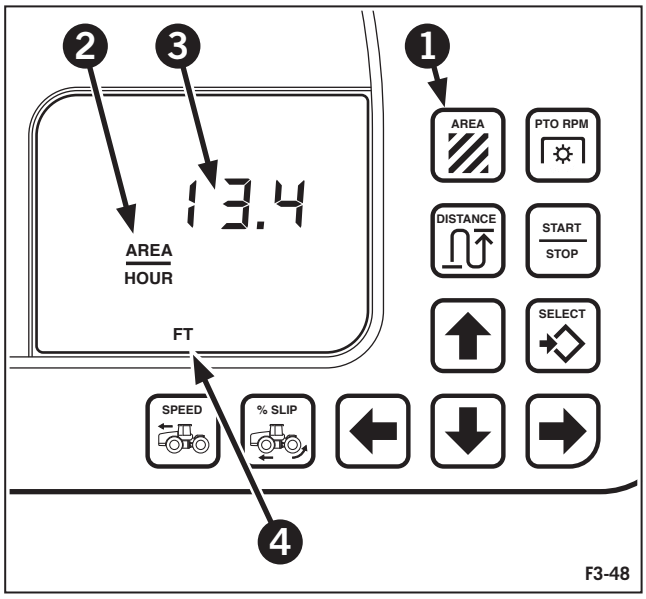
**Area Accumulator (see page 3-43 for calibration)**

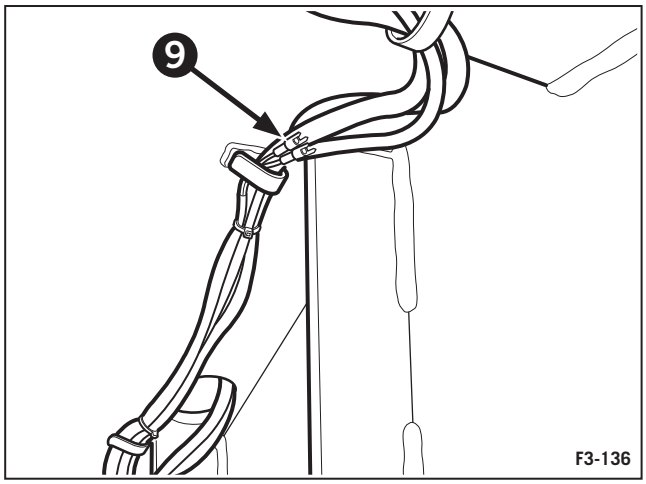
Accumulated area (total area worked) (5) is displayed by depressing the AREA button (1) until "AREA" and "ON" (6) will be displayed. Area is displayed in acres or hectares. Touch the START/STOP button (7) and the word "OFF" (8) will display indicating the area counter is shut off. Toggle between Area Per Hour and Area Accumulator by pressing AREA button (1)

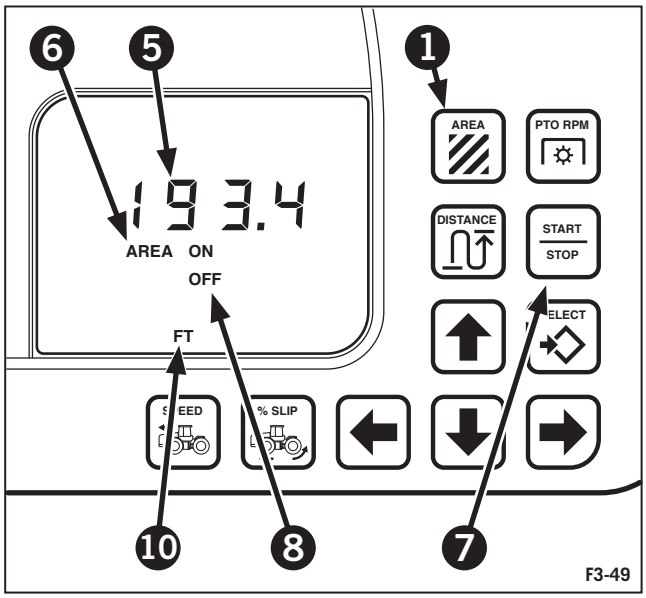
**NOTE: A remote implement status switch P/N: 9702509, can also be added to the tractor, by the use of a harness located under the rear frame next to the trailer plug. RF049B (green wire) and RF144 (black wire) (9). If extra length is needed a harness can be purchased from you Local Buhler Versatile dealer: P/N 86034242. In order for the harness to work, the wire located on the tractor trailer plug pin 4 must be disconnected and the expose wire covered with electrical tape. The green wire RF049C must be installed into pin 4 of the tractor trailer socket. By adding a contact switch to a trailing implement, the area counter can be turned on and off by lowering and raising the implement.**

English display (acres), designated by "FT" legend (10) starts to accumulate in increments of 0.1 acres.

When 1000 acres are reached, area accumulation continues in whole acres. When 9999 acres are reached, the display will reset to zero.



Metric display (hectares), designated by METERS legend starts to accumulate in increments of .01 hectares. When 100.0 hectares are reached, area accumulation continues in increments of 0.1 hectares until 1000 is reached. The display will then accumulate whole hectares. When 9999 hectares are reached, the display will reset to zero.

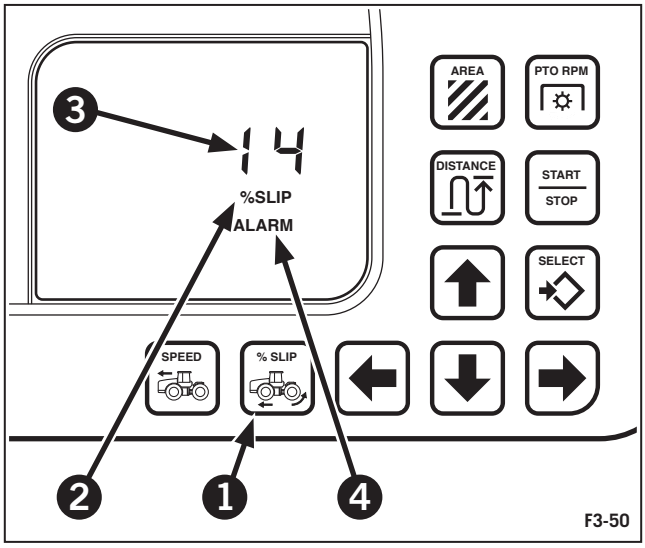
With AREA selected, area accumulation can be reset to zero by holding down the START/STOP button for three seconds until a "beep" is heard from the audible alarm.

**NOTE: If the radar option is not installed, area calculations are based on axle speed and are subject to inaccuracies caused by wheel slip that may be present.**

**Wheel Slip (with Radar Option)**

Touch the % SLIP selector button (1). The "% SLIP" legend (2) will display together with a two-digit slip value (3) in the main TPM display. The slip value is detected by the comparison of theoretical ground speed (axle rotation sensor) with true ground speed (radar sensor).

**WARNING: THE RADAR GROUND SPEED SENSOR EMITS A LOW INTENSITY MICROWAVE SIGNAL WHICH WILL NOT CAUSE ANY ILL EFFECTS IN NORMAL USE. ALTHOUGH THE SIGNAL INTENSITY IS LOW, DO NOT LOOK DIRECTLY INTO THE FACE OF THE SENSOR WHILE IN OPERATION SO AS TO AVOID EYE DAMAGE.**

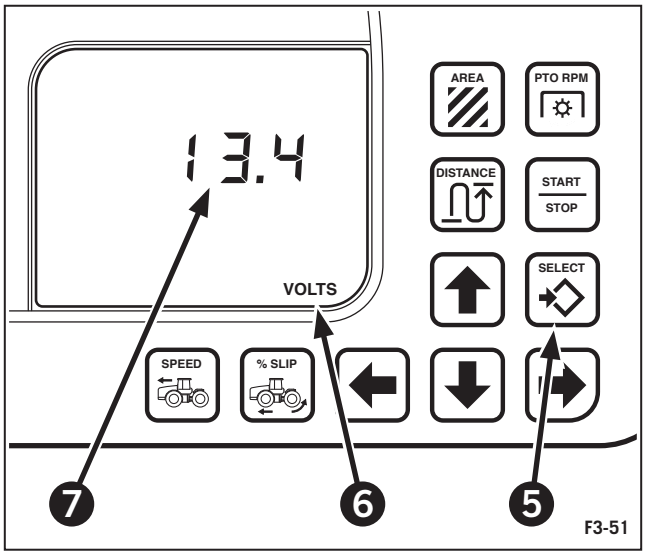



**Slip Alarm (with Radar Option)**

A slip alarm point may be entered - see "EIC Programming." When wheel slip exceeds the value entered, the alarm will sound for one second. If wheel slip is selected, the "% SLIP" (2) legend will be displayed. In addition, the "ALARM" (4) legend will flash and continue to flash until wheel slip is reduced below the preset level.

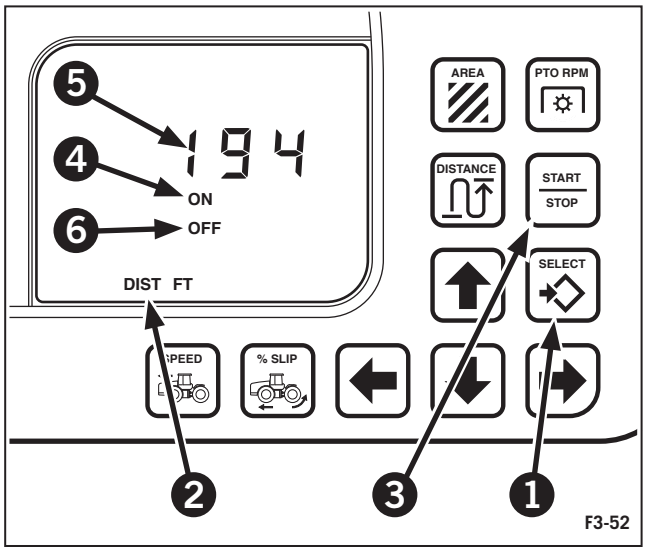
**Battery Voltage**

Touch the SELECT button (5) until the "VOLTS" legend (6) is displayed together with a digital display of battery voltage (7) to the nearest tenth volt.



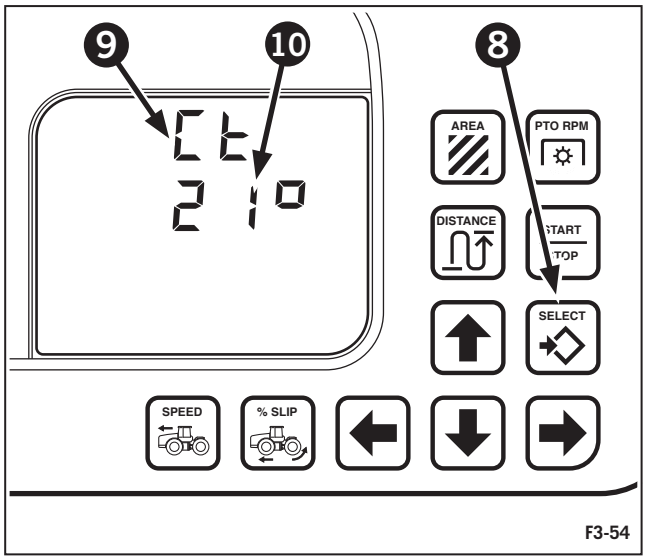
### Distance Measurement

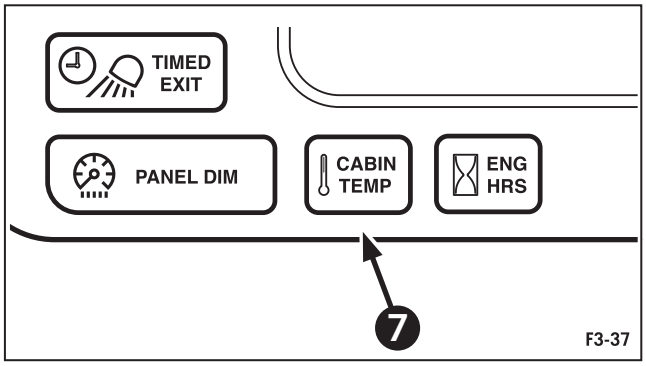
Touch the SELECT button (1) again and the "DIST FT" (2) or "DIST METERS" legend will be displayed. The tractor will now measure distance in feet or meters. Operate the tractor normally and press the START/STOP button (3) at the point where distance measuring is to begin. The "ON" legend (4) will be displayed along with a digital display of distance traveled (5). At the end of the distance, again press the START/STOP button (3). A digital display of distance traveled (5) in feet or meters will be displayed with the "OFF" legend (6). If the START/STOP button is again pressed, additional feet or meters will be added to the existing measurement. Pressing the START/STOP button (3) for more than three seconds will zero the display.




### Cabin Temperature (Optional)

In tractors fitted with the automatic temperature control system, cabin temperature can be displayed by depressing the CABIN TEMP button (7) or by toggling the SELECT button (8). The "Ct" legend (9) will display, together with temperature reading (10).



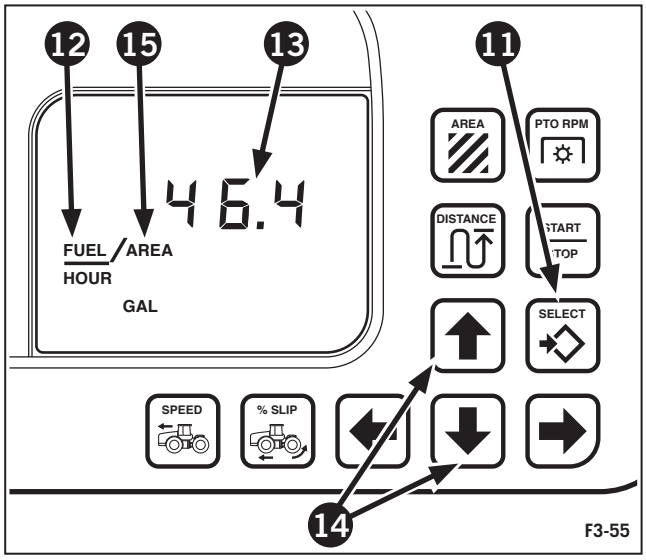




### Fuel Per Hour

Fuel per hour is displayed by toggling the SELECT button (11). The FUEL/HOUR legend (12) will display together with rate of fuel consumption in liters or gallons per hour (13). (For switching between metric and imperial see page 3-42).

### Fuel Per Area

Fuel per area is displayed by selecting fuel per hour mode and then toggling the UP and DOWN arrow buttons (14). The fuel per area legend (15) will display together with the related fuel consumption in liters or gallons per hour/area.



## Fault Codes

In the event that a fault occurs within the tractor electrical circuits, a malfunction warning symbol "READ YOUR MANUAL," (1) will flash on and off and the code will be stored. The tractor is factory set to display normal TPM functions and to store fault codes.

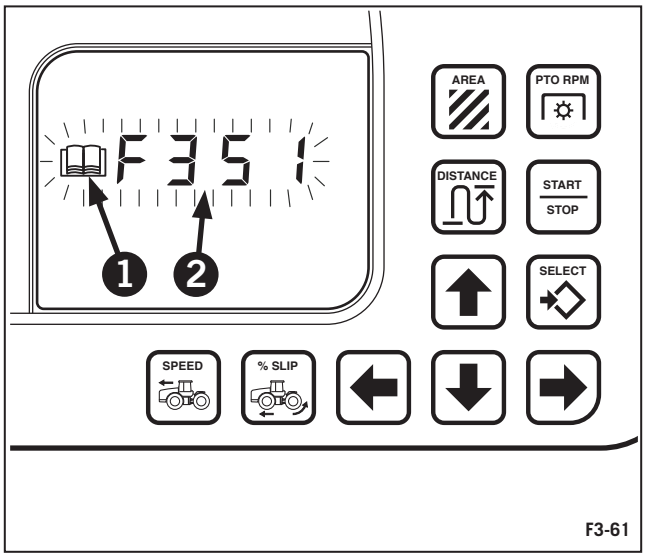
To view fault codes as they occur, see "Turning active fault display on/off" on page 3-42

Fault codes (2) will be displayed as flashing three-digit number preceded by the letter "F."

The fault code indicates the tractor circuit or sensor in which the fault lies and the type of fault, e.g., short circuit, open circuit, sensor failure, etc.

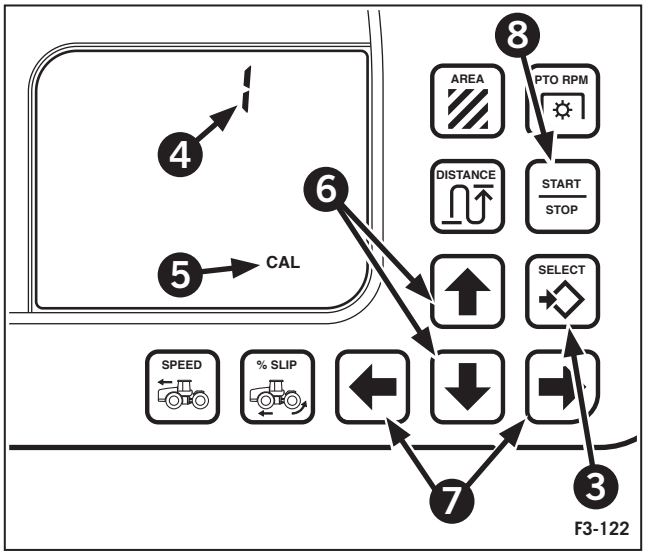
A complete detailed list of fault codes, their cause and remedy may be seen in "Section 5 - Troubleshooting Charts.

If necessary, contact your Buhler Versatile authorized dealer and quote the fault code number.




### Entering Fault Codes (Mode 2)

1. Hold the SELECT button (3) for two seconds
2. The TPM will display "1" (4) and "CAL (5)." Use the UP/DOWN arrows (6) to change the display (4) to "2"
3. Hold the SELECT button (3) for two seconds to enter into Mode 2 (Fault Codes)

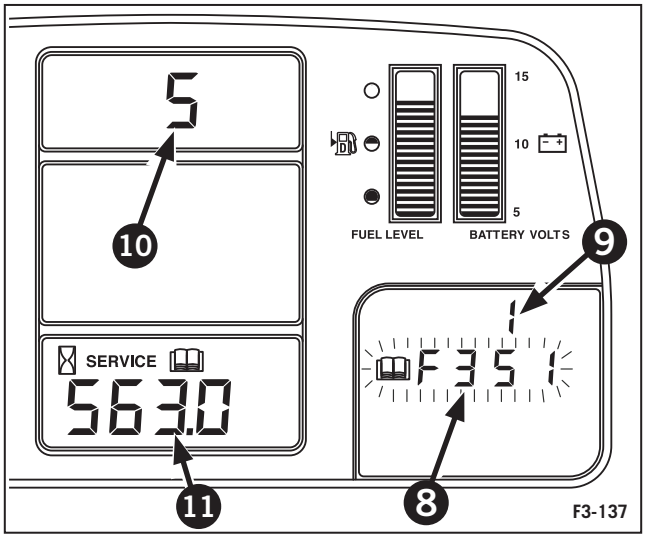



### Viewing Fault Codes

Touch the LEFT/RIGHT arrow buttons (7) to cycle through stored fault codes. Each fault code will be displayed along with the number of times the fault has occurred, the engine hours of the most recent occurrence, and the position of the fault code in the stored list.

The illustration, F3-137 shows a typical fault code display.

8 - Fault Code, 9 - Item number, 10 - Number of occurrences, 11 - Engine hours of the last occurrence.




### To Exit Mode 2

Touch the START/STOP (8) button to return to the calibration menu. Touch the START/STOP button (8) again to return to normal operation.

# EIC Calibration

## Electronic Instrument Control System (EIC) - Calibration

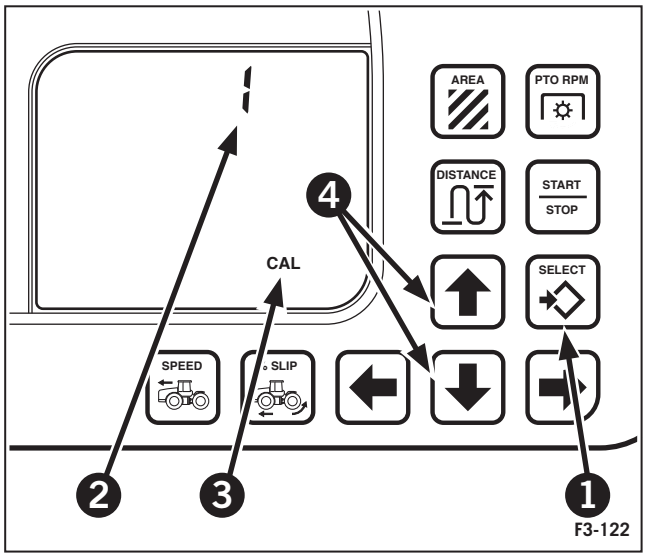
The EIC system is factory pre-calibrated with the required operating presets and fault codes, however, it is necessary to verify Mode 1 calibration settings and become familiar with the calibration procedure.

To access the Electronic Instrument Control System for programming and calibration, follow the "Entering Operator Calibration (Mode 1)". All programming and calibration is done with the key switch in the "RUN" position and the engine off.

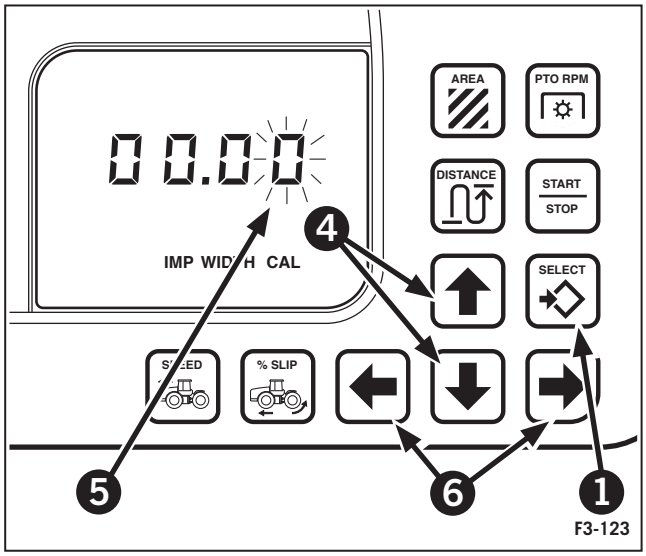
## Entering Operator Calibration (Mode 1)

1. Hold the SELECT button (1) for two seconds
2. The TPM will display "1" (2) and "CAL (3)." (If it does not, use UP and DOWN arrow button (4) to change the display to "1")
3. Hold the SELECT button (1) for two seconds to enter into mode 1 (Operator Calibration)
4. Touch the SELECT button (1) to cycle through the six Operator Calibration screens:

| Calibration Screen | Without TPM | With TPM |
|---|---|---|
| Implement width | 1 | 1 |
| Slip percent threshold | - | 2 |
| Service alert/intervals | 3 | 3 |
| Area preset | 4 | 4 |
| Fault code display on/off | 5 | 5 |
| English/Metric units selection | 6 | 6 |



F3-122



F3-123

## 1. Setting the implement width

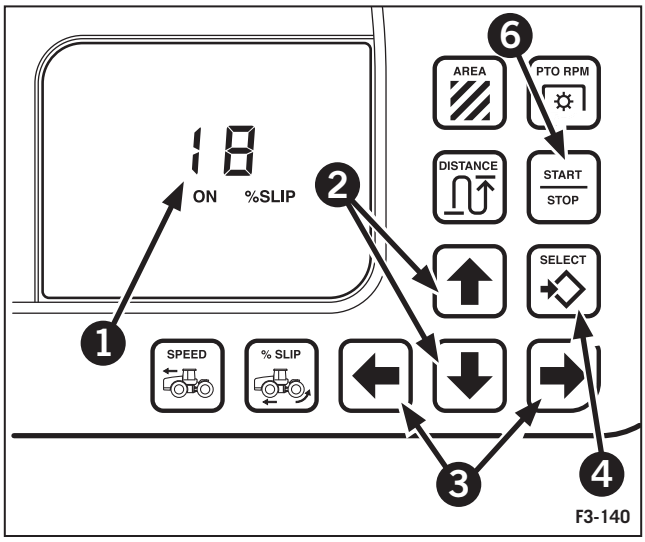
The implement width is used in all area calculations performed by the TPM. It is a measure of the working width of the implement.

1. Enter the width of the implement. The selected (flashing) digit (5) can be changed by touching the UP and DOWN arrow buttons (4). Other digits may be selected by touching the LEFT and RIGHT arrow buttons (6).
2. Once the implement width has been entered, touch the SELECT button (1) to confirm the change.

## 2. Slip percent threshold

On tractors equipped with an optional radar speed sensor, the slip alarm can be used to notify the operator whenever the wheel slip percentage is above a certain threshold.

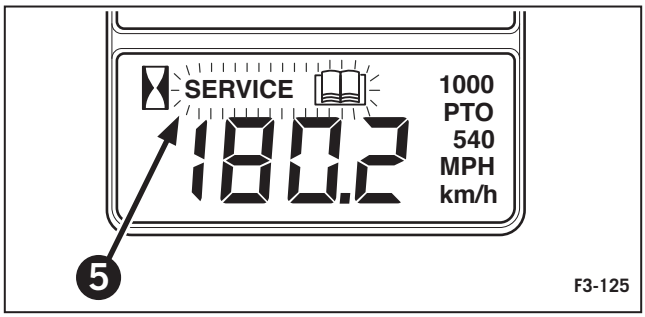
1. To set the slip alarm threshold, enter the desired maximum percent slip (1). The selected (flashing) digit can be changed by touching the UP and DOWN arrow buttons (2). Other digits may be selected by touching the LEFT and RIGHT arrow buttons (3). The alarm can be disabled entirely by setting the threshold value to zero.
2. Once the desired threshold value has been entered, touch SELECT button (4) to confirm the change.




## 3. Setting the service alert intervals

The two service alert intervals can be used to remind the operator that regular scheduled maintenance is required. The service alerts are based on engine hours. If, for example, a service alert is set to 50 hour intervals, it will become active at 50 hours, 100 hours, 150 hours, etc. Once a service interval becomes active, the word “SERVICE” (5) will flash in the lower portion of the central display until the alert is cleared by the operator.

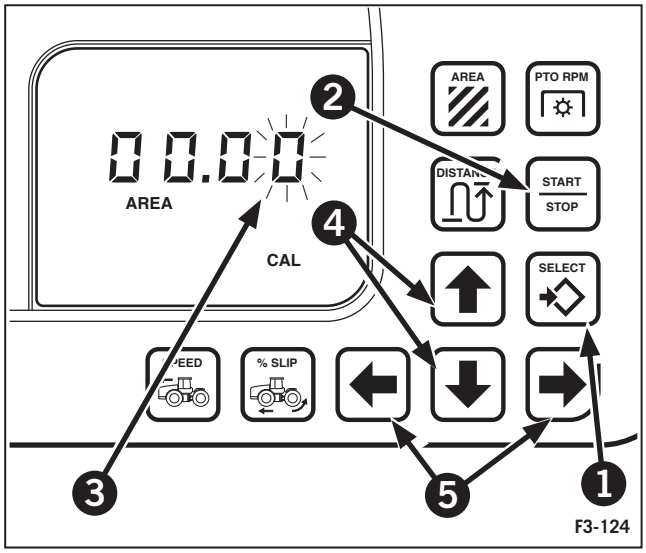
1. To set a service alert interval, enter the desired number of hours. The selected (flashing) digit can be changed by touching the UP and DOWN arrow buttons (2). Other digits may be selected by touching the LEFT and RIGHT arrow buttons (3).
2. Once the interval has been entered, touch the SELECT button (4) to confirm the change.
3. If a service interval is active, the service alert display will be flashing. Hold the START/STOP button (6) to clear the alert.



## 4. Setting the area preset

The area accumulator calculates the total area covered by the tractor. The accumulated area is stored in the area preset when the tractor is switched off. When the tractor is started again, area accumulation starts from the stored preset.

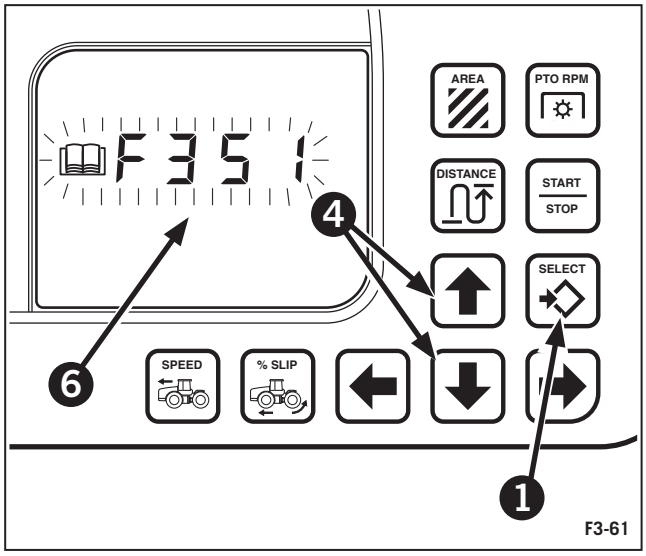
1. To modify the area preset, enter the desired area. The selected (flashing) digit (3) can be changed by touching the UP and DOWN arrow buttons (4) . Other digits may be selected by touching the LEFT and RIGHT arrow buttons (5).
2. The area preset may be cleared by holding the START/STOP button (2) for two seconds.
3. Once the desired area preset has been entered, touch the SELECT button (1) to confirm the change.




## 5. Turning active fault display on/off

Whenever a fault is detected by the electrical system, a fault code is stored in the EIC memory, and the flashing book icon appears in the TPM display. If active fault display is turned on the fault code will also be displayed as a flashing number in the TPM.

1. To toggle active fault display, touch the UP and DOWN arrow button (4). When active fault display is on, the display will show “ON” (6) and fault code. When active fault display is off, the display will only show “OFF”.
2. Touch the SELECT button (1) to confirm the change.



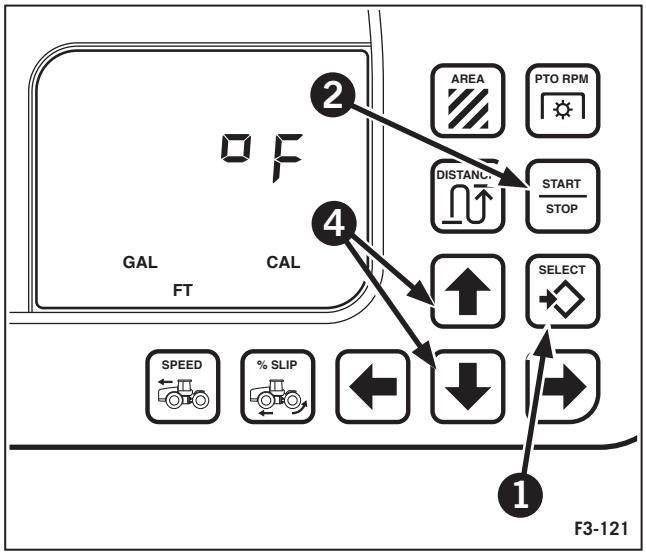

## 6. Selecting between Imperial and Metric units

The EIC can display measurements in either English (Imperial) units, or in Metric units.

1. To select the desired display units, touch the UP and DOWN arrow buttons (4). When English units are selected, the display will show “°F”, “GAL”, and “FT”. When Metric units are selected, the display will show “°C”, “L”, and “METERS”.
2. Touch the SELECT button (1) to confirm the change.

### To exit Mode 1

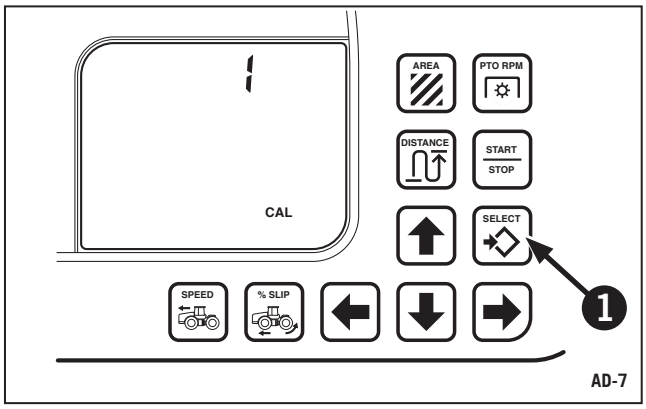
Touch the START/STOP button (2) to return to the calibration menu. Touch the START/STOP button (2) again to return to normal operation.

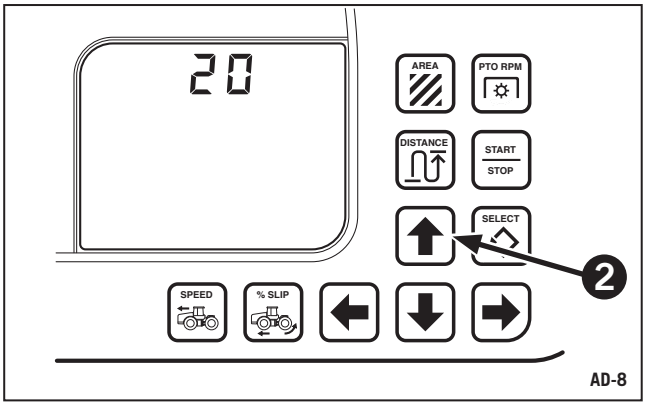


## Entering Wheel speed calibration (Mode 20)

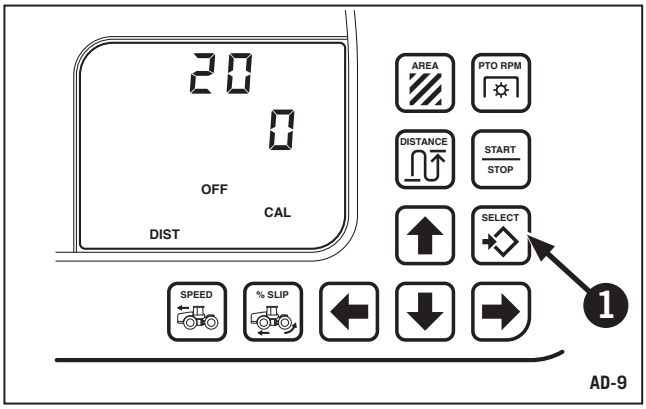
**A 100 meter (328 ft) track is required to perform wheel speed calibration.**

1. Drive tractor to the start of the designated test area.
2. Stop the tractor 10 m before the start line.
3. Press and hold the SELECT button (1) on the Tractor Performance Monitor (TPM) display for 2 seconds until TPM displays “1”.
4. Touch the UP arrow button (2) until the TPM displays “20”.

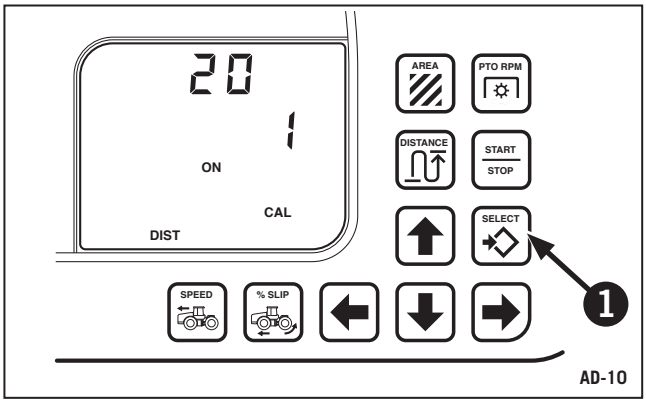


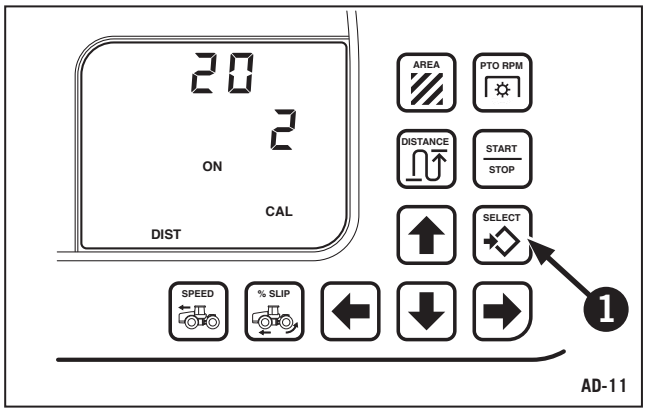

5. Press and hold the SELECT button (1) on the TPM for 2 seconds until TPM displays “DIST CAL 0”.



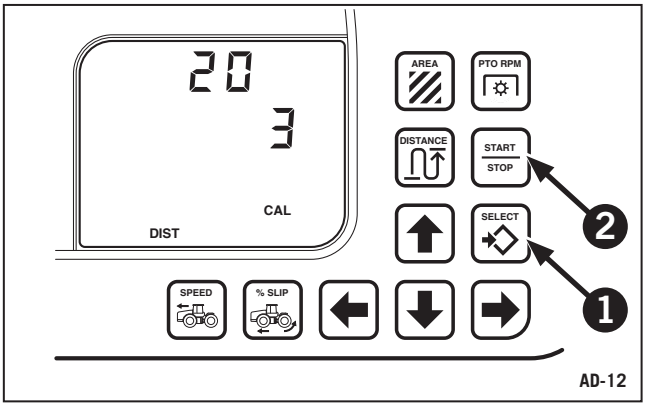

6. Select a low gear and drive the tractor forward.
7. As the tractor crosses the “Start Line” touch the SELECT button (1) once. The TPM will display “DIST CAL 1”
8. Continue driving until the tractor reaches the “Finish Line”.



9. As the tractor crosses the “Finish Line” touch the SELECT button (1) once. The TPM will display “DIST CAL 2”.

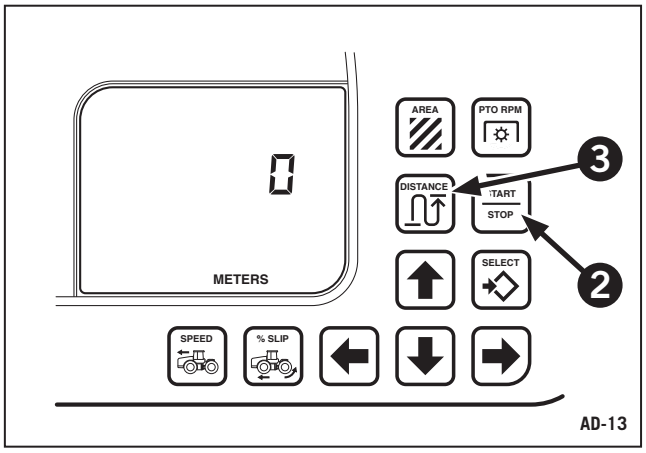



10. Touch select button (1) again to save the calibration. The TPM will display “DIST CAL 3”.
11. Touch start/stop button (2) twice to exit mode 20.
12. Drive the tractor around and stop 10 m before the finish line.




## Distance check

1. Touch the distance button (3) once. If the TPM does not display “0 meters or feet” hold the start/stop button (2) for 2 seconds to clear the display.
2. Select a low gear and drive the tractor forward.
3. As the tractor crosses the “Finish Line” touch the start/stop (2) button once. The TPM will begin accumulating distance traveled
4. Continue driving until the tractor reaches the “Start Line”.
5. As the tractor crosses the “Start Line” touch the start/stop (2) button once. The TPM should show approximately 100 m (+/- 5 m), (328 ft (+/- 15 ft). If not, re-run distance check.



## Right Side Console Controls

### Synchromesh Transmission Control Levers

The synchromesh transmission is controlled by two control levers. Range shift lever (1) and gearshift lever (2).

The transmission has three forward gears, low, medium, high and reverse gear controlled by the range shift lever (1). Within each range, including reverse, there are four synchronized speeds, 1 to 4, controlled by gearshift lever (2). The synchronized speeds allow for easier shifting within each range. This combination allows for twelve forward speeds and four reverse speeds.

### Powershift Transmission Control Lever with Neutral Lock (1407 Twindisc and CAT TA22 Transmission)

The Powershift transmission control lever (3) is used to select forward or reverse travel and to change transmission speeds. Move the lever forward for forward travel and rearward for reverse travel. A neutral-lock switch (4) is also fitted to the lever.

**NOTE: The control lever may only be moved to the forward or reverse positions if the neutral lock latch on the control lever knob is depressed. Neutral may be selected without depressing the neutral lock latch.**

The Powershift transmission control lever is also used to make instantaneous upward or downward speed changes. Move and then release the lever to the right for upward changes and to the left for downward changes. See "Transmission Operation" in this section for details.

### Hand Throttle Control Lever

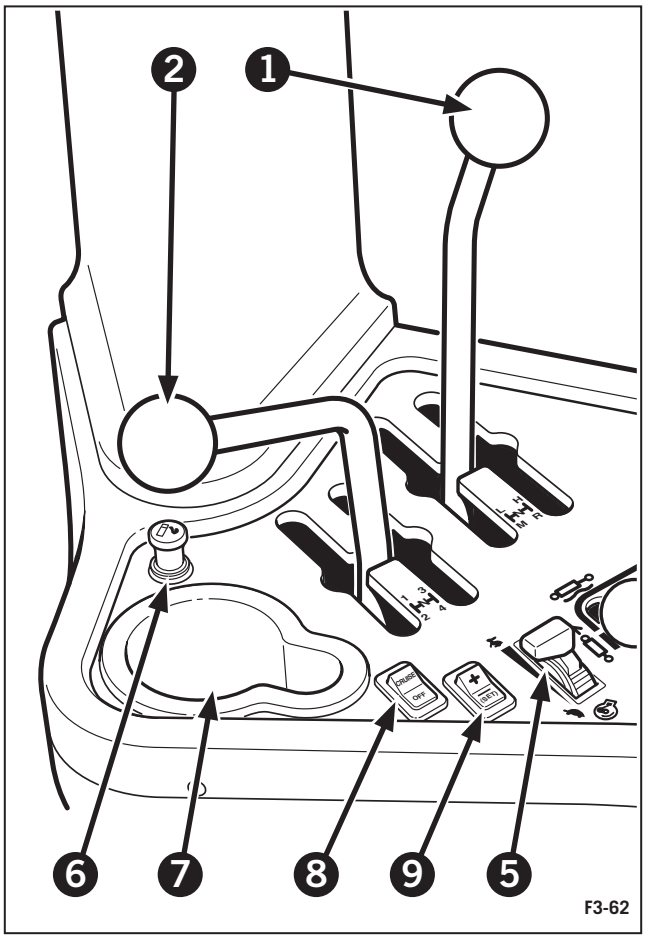
The lever (5) controls engine speed. Push forward to progressively increase engine speed. Pull rearward to reduce engine speed.

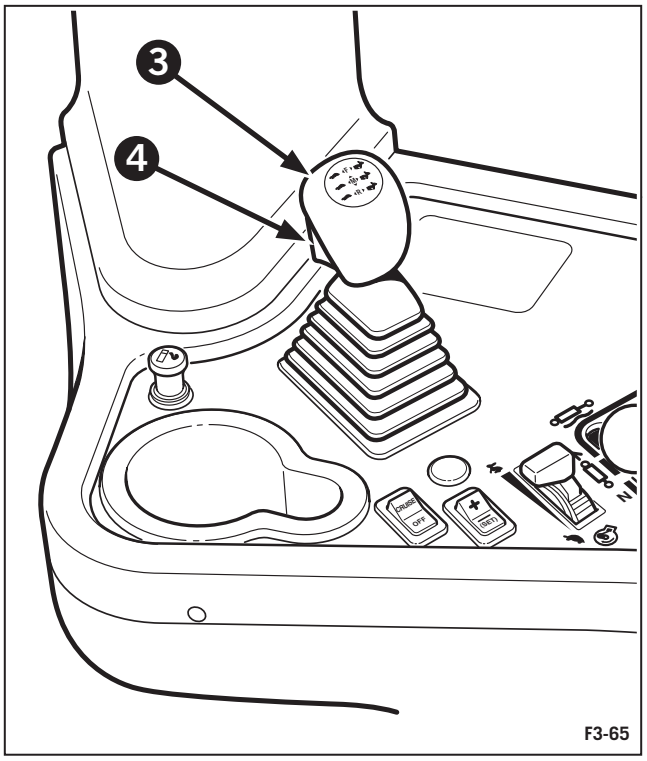
### Cigarette lighter

Push the lighter (6) in until it latches. When it pops out, remove from its socket and return after use.

### Cup holder

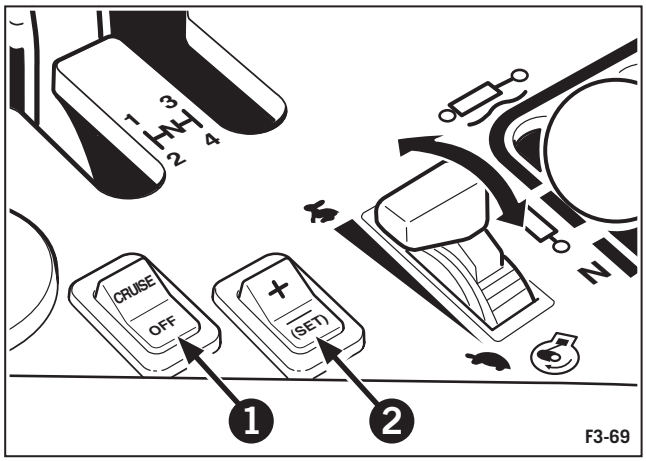
A cup holder (7) is provided for convenience.



### Cruise Control Operation

Cruise control automatically keeps the engine speed at a specified RPM. Two switches control cruise mode operation. The "CRUISE/OFF" switch (1) enters and exits cruise mode. The "+/- (SET)" switch (2) adjusts the cruise setting. When cruise mode is activated, the engine returns to the last cruise setting, if possible, based on throttle lever position.

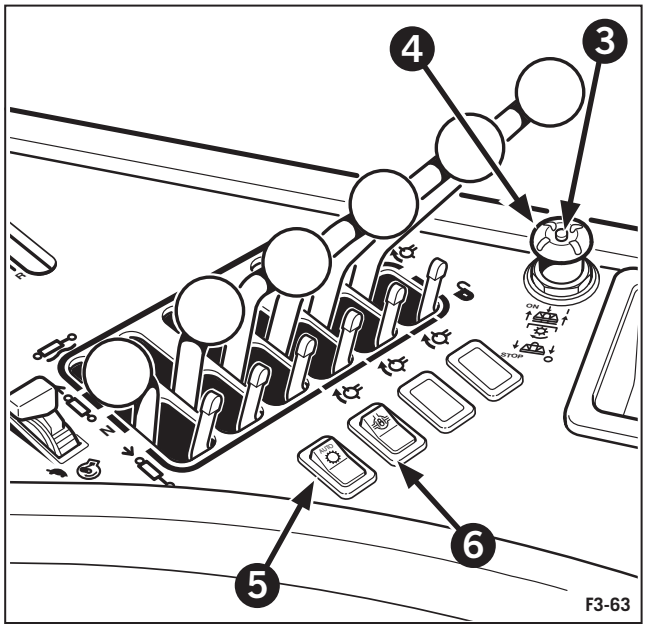



### PTO Engagement Switch - yellow (optional)

To engage the PTO depress the button (3) in the center of the PTO engagement switch (4) and pull the knob upwards. To disengage the PTO, push the knob down.

### CAT TA22 Transmission Autoshift Switch (optional)

Press and release the front/symbol of autoshift momentary switch (5) to engage the transmission auto shift. The letter "A" will be displayed in the powershift display when autoshift is engaged. Press and release the switch again to disengage the autoshift function. See page 3-64 for details of operation.




### Differential Lock Switch (optional front & rear)

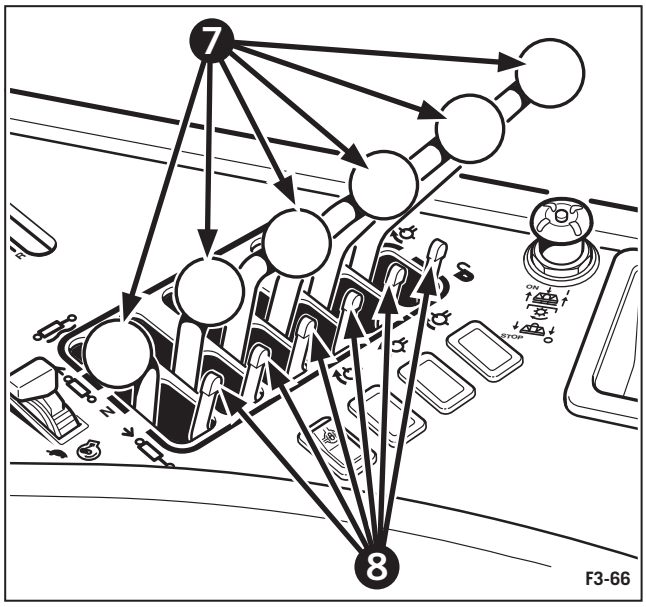
Press the front/symbol of differential lock switch (6) to engage the self-holding differential. The DIFF LOCK warning light will illuminate on the EIC when the differential lock is engaged. Press the rear of the switch to disengage. See page 3-66 for details of operation. The differential lock will disengage if the back part of the switch is depressed, if the foot brake is applied or when ground speeds exceed 16 KPH (10 MPH).

### Remote Hydraulic Valve Controls - Manual

**Note: See "Remote Control Valve Operation" on page 3-74 for details of operation before use.**

Up to six remote hydraulic control levers (7) are located on the right console. These are color-coded to match the quick couplers at the rear of the tractor.

The levers have four positions: neutral, extend (or raise), retract (or lower) and float, as indicated by the decals. When not in use, the levers should be in the neutral position where they can be locked to prevent accidental actuation.



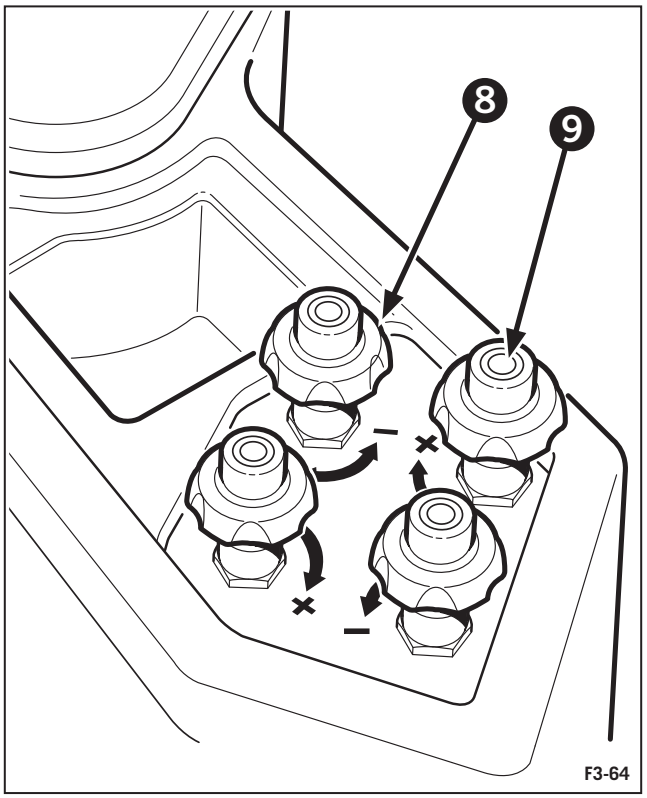

### Lockout Levers - Manual

Below each control lever is a corresponding lockout lever (8) to prevent or limit travel of the control lever. **See page 3-75 for details of operation.**

## Hydraulic Flow Controls - Manual

Hydraulic flow to the remote valves 1 to 4 is controlled by four rotary knob style flow controls (8). Each knob can be rotated clockwise to increase flow and counterclockwise to decrease flow.

The knobs are color coded for identification with the remote valve it controls. **See page 3-77 for details of operation.**



## Remote Hydraulic Valve Control - Electro-hydraulic (Optional)

Each lever (3) activates a four position remote electro-hydraulic valve. From neutral pull the lever rearward to the stop for raise. Push forward one position at a time for neutral, lower and float.

Each lever is color coded for identification with the remote valve it controls.

**Note: See "Remote Electro-hydraulic Control Valves" on page 3-83 for details of operation before use.**

## Electro-hydraulic Engagement Switch (gray)

Depressing button (1) in the center of the engagement switch (2) while pulling upwards on the knob will engage the electro-hydraulic controls for the rear remote valves.

Pushing the knob down will disengage the electro-hydraulic controls and all hydraulic flow to the rear remote valves.

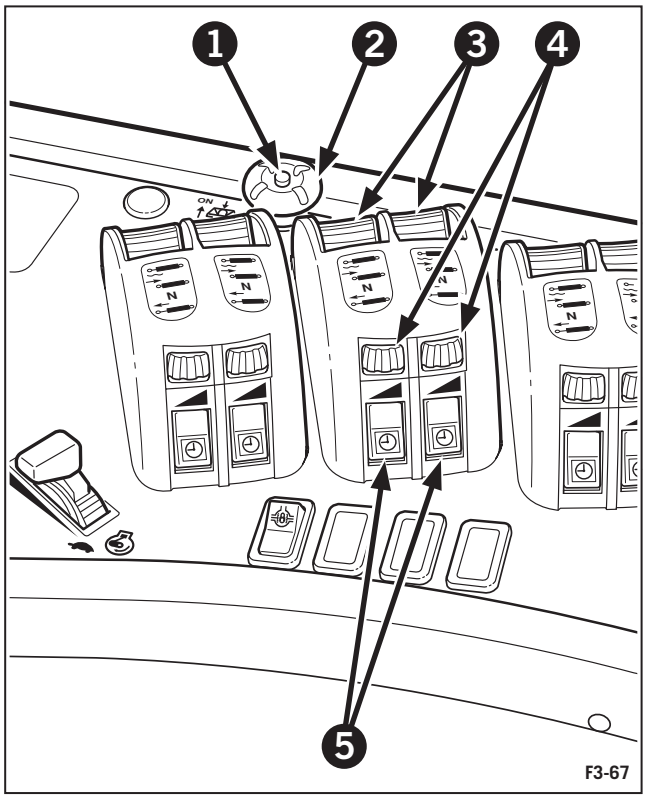
*IMPORTANT: The remote valve electro-hydraulic engagement switch is provided as an isolator stop switch. It can be used to immediately stop operation of the rear remote hydraulics by quickly depressing the knob. The stop switch only controls the remote valves and has no effect on the three point hitch link operation, thereby isolating operation of the rear remote hydraulics from the three point hitch link operation.*

## Remote Valve Electro-hydraulic Flow Control Knobs

Each remote valve has a flow control knob (4) to meter oil flow. The knob controls flow from 4 to 102 L/MIN (1 to 27 GPM). Turn the knob so the higher vertical decal stripe is visible to increase the rate of oil flow. Turn the knob so the lower vertical decal stripe is visible to decrease the rate of oil flow. **See page 3-87 for details of operation before use.**

## Remote Valve Electro-hydraulic Manual/ programmable Operation Switches

Each remote valve has a manual/programmable operation switch (5). When the top of the switch is activated the lever (3) operates in the manual mode. When the bottom of the switch is activated the lever (3) can be operated with a programmed release to neutral. **See page 3-85 for details of operation before use.**



## Tractor Start-Up and Engine Operation

**WARNING: AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY. DO NOT START THE ENGINE BY SHORTING ACROSS STARTER TERMINALS. THE ENGINE CAN START AND THE MACHINE CAN MOVE WHEN THE STARTING SAFETY SWITCH IS BYPASSED.**

**CAUTION: PREVENT INADVERTENT TRACTOR OR IMPLEMENT MOVEMENT. BE SURE THE HYDRAULIC CONTROL LEVERS ARE IN NEUTRAL AND THE 3-POINT HITCH IS SET TO THE LOWEST POSITION PRIOR TO STARTING THE TRACTOR WHEN ATTACHED TO AN IMPLEMENT.**

**THE TRACTOR CAN MOVE AS SOON AS THE ENGINE IS STARTED BY TURNING THE STEERING WHEEL, EVEN WITH THE PARK BRAKE ENGAGED AND THE TRANSMISSION IN NEUTRAL. BE SURE ALL PERSONNEL ARE CLEAR OF THE TRACTOR BEFORE STARTING.**

### Prestart Inspection

Do the following before starting the engine each day:

1. Check the engine oil level and adjust, if necessary.
2. Check the coolant level and adjust, if necessary.
3. Check and clean the radiator and grill for dirt and debris, if required.
4. Check the transmission and hydraulic oil tank levels and adjust, if necessary.
6. Check differential oil levels.
7. Inspect the condition of all belts, lights, switches, hoses, lines, fittings, seals, tires, nuts and bolts. Replace or tighten, if required.
8. Check the drawbar and 3-point hitch for wear, especially around metal-to-metal contact parts.
9. Check wheel bolt torques.

### Engine Starting

*IMPORTANT: Protect the turbocharger during start-up by not opening the throttle or accelerating above 1000 RPM until the engine oil bar graph reads in the normal range.*

Avoid excessive engine speed during warm-up.

1. Fasten your seat belt.
2. Put the transmission in neutral.
3. On tractors equipped with a PTO, put the switch to the “OFF” position. A safety switch on PTO-equipped models permits engine starting only when the PTO is off.
4. Engage the park brake.
5. Check to be sure that the remote hydraulic levers are in the neutral position.
6. On tractors equipped with a 3-point hitch, make sure that the hitch controls are set to the lowest position.
7. Set the engine throttle to the lowest position.
8. Turn the ignition to “RUN” to activate the electrical accessories. Observe the warning lamps to be sure they are functioning.
9. Engage the clutch pedal
10. Turn the ignition to the “START” position to crank the engine, and release when the engine starts.

    The switch has a starter protection feature built-in. If the switch is rotated to the start position, and then released to the run position, it will be necessary to rotate the switch to the stop position in order to make another attempt to start the tractor. This will prevent an accidental engagement of the engine starter motor when the engine is already running.

*IMPORTANT: To prevent starter motor damage, never crank the engine for more than 30 seconds. If the engine does not start within 30 seconds, wait 2 minutes to cool the starter motor before recranking.*

11. Once the engine has started, allow it to idle and warm up before adding a working load.

*IMPORTANT: Pay attention to the warning light bar and electronic monitor for any indication of a problem. Stop the tractor immediately and investigate the problem.*

## Cold-Weather Starting

The ether cold starting aid may be used to assist the engine starting in temperatures at or below 0°C (32°F).

**CAUTION: STARTING FLUID IS HIGHLY FLAMMABLE. DO NOT USE NEAR FIRE, SPARKS, OR FLAMES. BE SURE ALL OPERATORS READ THE CAUTIONARY INFORMATION ON CONTAINERS.**

**NOTE: The vehicles electronic control system prevents ether from being injected into the engine if the engine coolant temperature is above 27˚ C (80˚ F).**

After following steps 1 to 10 under "Engine Starting," proceed as follows:

1. If the engine does not start within 15 seconds of cranking, depress the ether aid button (1) for two seconds while the engine is cranking to inject starting fluid and then release. If the engine does not start after 15 more seconds, release the ignition switch. Allow the starter motor to cool down for two minutes, and repeat the procedure.

**NOTE: The ether injection function only operates while the start motor is cranking the engine.**

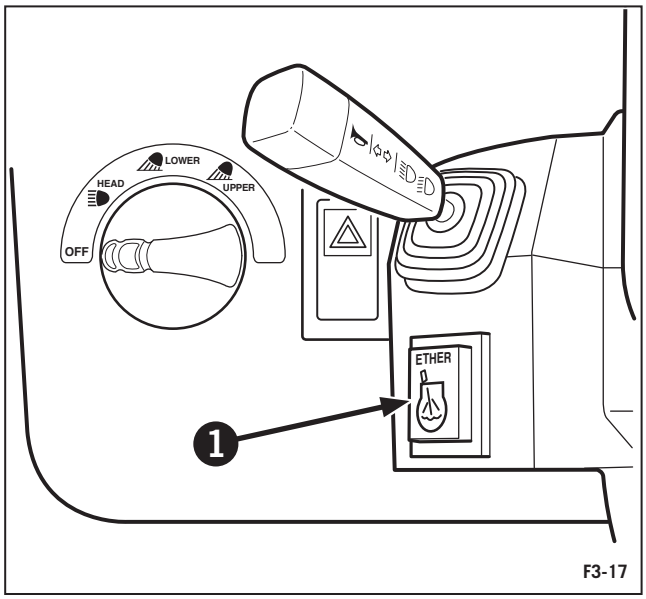
*IMPORTANT: Use only one starting fluid charge per engine crank cycle of 30 seconds. Never hold the button longer than 5 seconds, as damage to the electric solenoid valve may result.*

2. If, after the engine starts, it runs roughly while at low idle with an outside ambient temperature below 0° C (32° F), it is permissible to press the cold start button and inject an additional amount of starting fluid into the engine to aid in engine warm-up.

**NOTE: The cold start system injects a 4.8 cc metered shot of starting fluid into the engine with each depression of the switch.**

*ATTENTION: Use a maximum of three injections of starting fluid into the engine for initial start-up and engine warm-up. If the engine will not start or will not smooth out, shut the tractor off and investigate the cause. See "Engine Troubleshooting" in Section 4 of this manual.*

3. Once the engine has started, allow it to warm up before putting it under load.



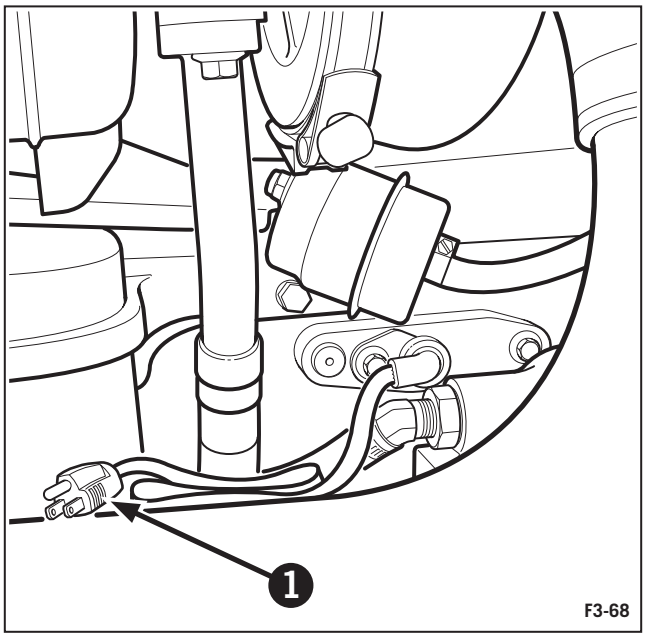

*IMPORTANT: Pay attention to the warning light bar and electronic monitor for any indication of a problem. Stop the tractor immediately and investigate the problem.*

**NOTE: If the engine fails to start after three attempts, use a block heater or other means to warm the engine.**

## Engine Block Heater

Block heaters are standard equipment on Buhler Versatile tractors. The block heater cord (1) is located on the right side of the engine beneath the turbocharger.

A 3-wire 15-amp extension cord is required to connect the block heater to a grounded 115-volt electrical outlet.




**WARNING: TO AVOID SHOCKS OR OTHER INJURIES, NEVER USE AN UNGROUNDED OR INADEQUATE EXTENSION CORD. ALWAYS USE A GROUNDED 3-WIRE EXTENSION CORD WITH A 3-WIRE PLUG WHICH IS RATED FOR AT LEAST A 15-AMPERE LOAD, AND PROTECTED BY A SUITABLE FUSE OR CIRCUIT BREAKER.**

To operate the heater, plug the heater cord in for at least four hours before attempting to start the engine. Maximum starting ability is usually obtained after four hours of heater operation.

Disconnect the cord when the engine has started. Make sure that the cable is safely secured after use.

**WARNING: ELECTRICAL SHOCK HAZARD! BE SURE CORDS ARE PROPERLY GROUNDED. DO NOT HANDLE IF WET. DO NOT PLUG THE HEATER IN IF NOT IMMERSED IN COOLANT, IT MAY OVERHEAT AND BURST CAUSING INJURY.**

## Tractor Boosting

**CAUTION: WHEN SERVICING BATTERIES, DISCONNECT THE NEGATIVE (BLACK) CABLES BEFORE THE POSITIVE (RED) CABLES. WHEN CONNECTING CABLES, CONNECT THE POSITIVE (RED) CABLE FIRST, THEN THE NEGATIVE (BLACK). THIS WILL REDUCE THE POSSIBILITY OF SPARKING AND BATTERY EXPLOSION.**

**WARNING: ALL BATTERIES GENERATE HYDROGEN GAS, WHICH IS HIGHLY FLAMMABLE. IF IGNITED BY A SPARK OR FLAME, THE GAS MAY EXPLODE VIOLENTLY CAUSING A SPRAY OF ACID, FRAGMENTATION OF THE BATTERY AND POSSIBLE SEVERE PERSONAL INJURY, PARTICULARLY TO THE EYES.**

**THEREFORE, AS A SAFETY PRECAUTION:**

- **WEAR PROTECTIVE CLOTHING AND GOGGLES.**
- **DO NOT SMOKE OR EXPOSE THE BATTERY TO OPEN FLAME.**
- **DO NOT CONNECT OR DISCONNECT LIVE CIRCUITS.**

**FOLLOW THE CONNECTION PROCEDURE AS OUTLINED.**

## Connection Procedure

1. Set the park brake, put the transmission in neutral, PTO clutch control and all accessories OFF.
2. Attach one end of the booster cable (red) to the positive terminal of the booster batteries and the other end of the same cable (red) to the positive terminal of the center battery on the tractor.
3. Attach one end of the negative cable (black) to the negative terminal of the booster battery, and the other end of the same cable (black) to a ground on the tractor frame at least 305 mm (12") from the discharged batteries. **DO NOT CONNECT TO THE NEGATIVE POST OF THE DISCHARGED BATTERIES.**
4. Be sure that the clamps from one cable do not touch the clamps of the other cable. Do not lean over the battery when making connections.
5. Start the tractor following normal engine starting procedures.
6. When the tractor starts, remove the booster cables. Disconnect the negative cable (black), then the positive cable (red).
7. If the tractor fails to start, charge the batteries.

*The 435, 485 and 535 tractors have three batteries connected in parallel. Each battery having 950 CCA (BCI Group 31).*

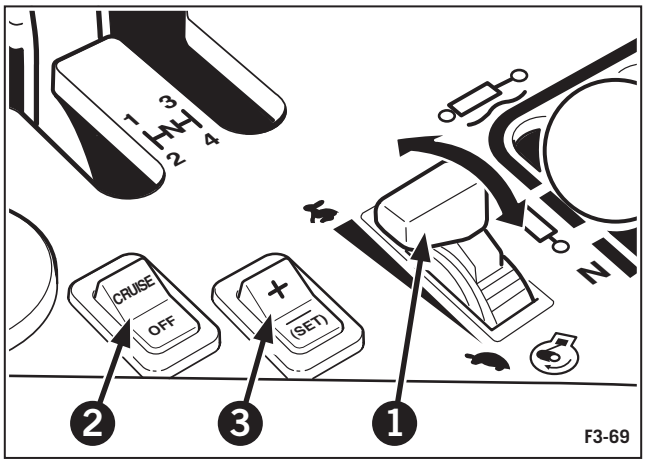
# Tractor Operation

## Hand Throttle Control Lever

The tractor is equipped with a hand throttle, located on the right console. Rated operating speed is 2100 RPM. Idle speed is 875 RPM. High idle no load speed is 2225 RPM.

To increase engine speed, move the lever (1) forward (rabbit). Pulling the lever backward will reduce engine speed (turtle).

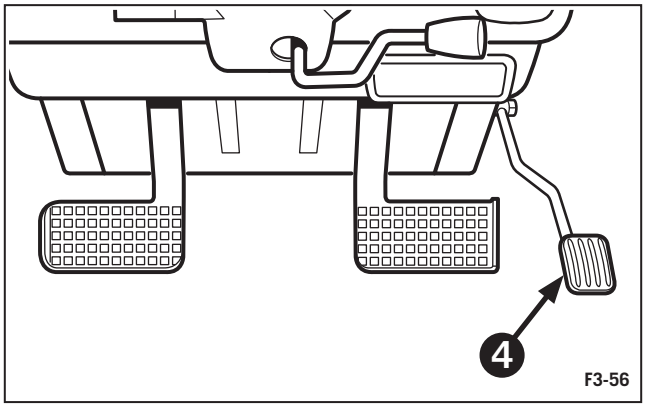
Fuel consumption can be reduced by operating at lower engine speeds under light load.




## Decelerator Pedal

At the lower front of the right console is the decelerator pedal (4) which can be used to reduce engine speed when turning or while shifting. When fully depressed, engine speed will drop to 1400 RPM. If the pedal is not fully depressed, engine speed will be reduced proportionally. When the pedal is released, engine speed will return to the previous throttle setting.

*IMPORTANT: Do not release the decelerator before completing the turn. If the transmission is in a high gear, the tractor will accelerate quickly, reducing the time to correct tractor direction.*




## Cruise Control Operation

Cruise control automatically keeps the engine speed at a specified RPM. Two switches control cruise mode operation. The “CRUISE/OFF” button (2) enters and exits cruise mode. The “+/–(SET)” button (3) adjusts the cruise setting.

When cruise mode is activated, the engine returns to the last cruise setting, if possible, based on throttle lever position.

The cruise function can be set to any engine RPM between idle and high idle, but the operating cruise RPM cannot exceed the RPM set by the hand throttle. For example, if the cruise setting is 1800 RPM but the hand throttle is at a normal 1700 RPM position, cruise will not increase the RPM above 1700 RPM.

Operating cruise RPM always stays about 100 RPM under the normal throttle RPM setting.

**Setting** - Move the throttle handle higher than the desired cruise setting and press the “CRUISE” button (2) to enter cruise operation.

The engine cruise will not engage unless the throttle lever is set to a higher operating speed than the cruise set point. The engine speed will remain at the cruise setting RPM.

Adjust the cruise setting with the “+/–(SET)” button (3). Set the cruise mode with the throttle lever at Full Throttle (throttle lever fully forward) whenever possible. Cruise function will disengage if the cruise RPM is set to a value equal to the throttle position RPM, moving the throttle to a higher position will return cruise function.

The “+/–(SET)” button will change the setting 10 RPM per momentary push. When the button is held down, the RPM will continue to move up or down. However, the dash RPM display will not keep up with RPM changes when the button is held down. In this case, it is advisable to estimate the setting by ear, wait for the dash to catch up, and fine tune the RPM using momentary pushes.

It is never possible to set the cruise higher than the current throttle lever position.

If the last cruise setting was above the throttle position, the system will remember that cruise setting unless the "+/–(SET)" button is pressed in cruise mode. The cruise RPM will return to the stored cruise setting if the throttle is moved above that RPM.

The electronic system remembers the current cruise control setting at all times. The cruise setting remains in memory after the cruise switch is turned off, after the engine is shut off, or if the batteries are disconnected.

**Alternate Engine Speed Overrun**

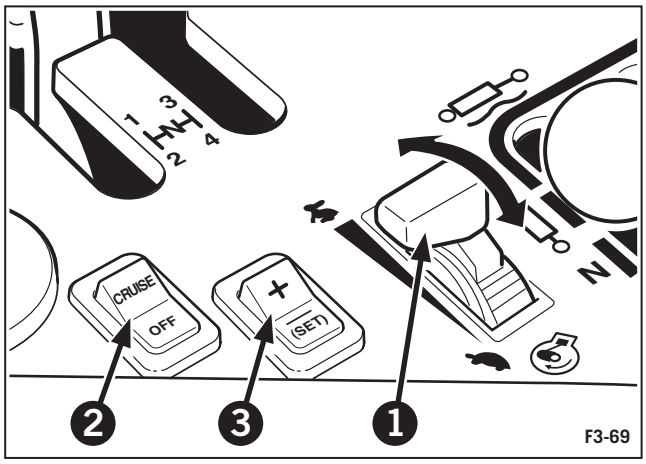
The alternative engine speed overrun feature of the electronic engine controls provide a higher ground speed when traveling over the road with the tractor.

All QSX 15 engines in 435, 485 and 535 tractors have a rated engine speed of 2100 RPM. Actual high idle engine speed, when the throttle lever is placed in the full forward position, is 2225 +/– 50 RPM. Overrun of the engine will occur in normal loaded operating conditions when tractor ground speed is below approximately 18.5 KPH (11.5 MPH).

In situations where engine load is minimal and tractor ground speed is high, above 18.5 KPH (above 11.5 MPH), the Electronic Engine Control System will progress to an alternate engine speed overrun condition. The full throttle overrun will now be 2350 +/– 50 RPM). An example of this would be a tractor traveling at 12.9 KPH (8 MPH), over the road, with the throttle lever fully forward and the cruise switch in the OFF position. Maximum engine RPM shown on the EIC of the tractor will be 2225 +/– 50 RPM. If the transmission is shifted into a higher gear and ground speed increases above 18.5 KPH (11.5 MPH), the engine will accelerate to a new higher speed, with the EIC now displaying a maximum engine speed of 2350 +/– 50 RPM.

If tractor ground speed is reduced below 18.5 KPH (11.5 MPH), the system will revert to the 6% normal overrun mode.

*IMPORTANT: Loads placed on the engine while roading (implements, road grade) will affect tractor ground speed and the alternate speed overrun feature.*



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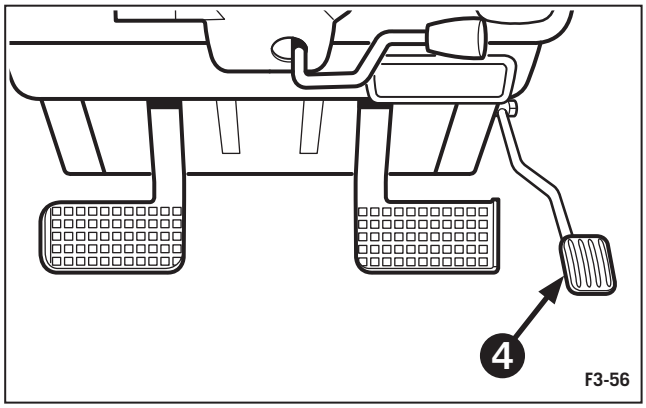


F3-56

**Deceleration (manual or pedal)** - When in cruise mode and hand throttle (1) moves lower than the cruise setting, the cruise RPM decreases as well and stays 100 RPM less than the normal RPM for that throttle position. The RPM will increase back up to the cruise setting if the throttle handle is moved forward again.

Example: With the throttle handle at Full Throttle, the cruise is set to 1800 RPM. When the throttle handle is moved back past the normal 1800 RPM position, the cruise speed will drop to 1700 RPM and continue to decrease as the throttle decreases. When the handle moves back up to full throttle, the cruise speed increases until it reaches 1800 RPM again.

Using the deceleration pedal (4) in cruise mode works the same as moving the throttle handle. If the decelerator pedal causes the engine speed to decrease past the cruise setting, the cruise speed will decrease as well. When the decelerator pedal is released, the cruise RPM will return to the specified setting. **It is not possible to use the "+" button to increase the cruise setting higher than the current throttle position.**

**Exiting Cruise Mode** - Pressing the "OFF" button (2) exits cruise mode and returns to the normal engine speed for the current throttle position. The cruise function can be used in this way for two-speed applications. The throttle position for high speed, the cruise setting for low speed.

## Stopping the Tractor

1. Gradually slow down the tractor. Set the throttle as low as possible.
2. Disengage the clutch, apply the brake and put the controls into neutral.
3. Reduce the engine speed to Idle. Run the engine for 3 to 5 minutes before shutdown to allow the engine to cool.
4. Shut down the engine and remove the key. Turn all electrical accessories OFF.
5. Ensure that the parking brake is engaged before exiting the tractor.

   *IMPORTANT: If the engine has overheated, allow it to idle an extended length of time to reduce the temperature. If the temperature does not return to normal or the coolant level warning lamp is ON, shut down the tractor immediately.*

**CAUTION: KEEP THE CAB FLOOR AREA FREE FROM DEBRIS OR OBJECTS WHICH MAY OBSTRUCT THE OPERATION OF THE BRAKE PEDAL. KEEP THE PEDAL CLEAN AND DRY TO PREVENT YOUR FOOT FROM SLIPPING OFF THE PEDAL.**

**DANGER: NEVER LEAVE THE OPERATOR'S SEAT WITHOUT FIRST BRINGING THE TRACTOR TO A COMPLETE STOP USING THE FOOT BRAKE, AND THEN ENGAGING THE PARKING BRAKE.**

**DANGER: NEVER OPERATE THE TRACTOR IF THE FOOT OR PARKING BRAKE DOES NOT FUNCTION PROPERLY.**

**DANGER: NEVER RELY SOLELY ON THE TRANSMISSION TO HOLD THE TRACTOR STATIONARY WHEN PARKED, ALWAYS ENGAGE THE PARKING BRAKE.**

# Transmission Operation

## Synchromesh Transmission Operation

The Synchromesh transmission has three forward ranges and one reverse range. Within each range, including reverse, there are four synchronized speeds. The synchronized speeds allow for easier shifting within each range. This combination allows for twelve forward speeds and four reverse speeds.

All shifting is done manually, in conjunction with the clutch. The transmission incorporates a shaft brake, which is designed to stop transmission rotation when shifting between ranges. This is activated when the range lever is in neutral and the clutch pedal is fully depressed.

*IMPORTANT: Engage the clutch at a low throttle setting and as light a draft load as possible to extend clutch and synchronizer life. Do not engage the clutch when the throttle is set higher than 1700 RPM while under load. Raise the implement whenever possible during shifting.*

Use the decelerator pedal to bring the engine speed down when shifting or engaging the clutch.

All gears in the transmission are constantly in mesh. When a range is selected, shift collars splined to the shafts are being engaged with the range gears. **The tractor must be at full stop in order to shift between ranges.**

The transmission bearings and gears are pressure lubricated. The lubrication circuit consists of a gear pump located on and driven by the transmission, an oil cooler located in front of the engine radiator, a filter located inside the frame at the front of the tractor, and the oil distribution manifold on the transmission. The transmission case acts as a reservoir.

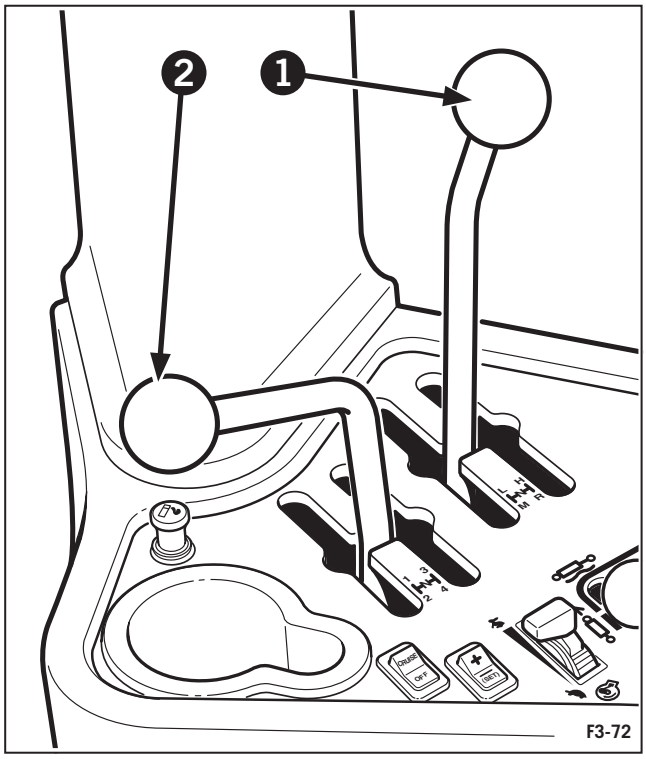
Should the transmission oil pressure warning lamp come on, (page 3-29) immediately shut down the tractor and contact your Buhler Versatile dealer to investigate the cause of lubrication failure.

**CAUTION: KEEP THE CAB FLOOR AREA FREE FROM DEBRIS OR OBJECTS WHICH MAY OBSTRUCT THE OPERATION OF THE CLUTCH PEDAL. KEEP THE PEDAL CLEAN AND DRY TO PREVENT YOUR FOOT FROM SLIPPING OFF THE PEDAL, CAUSING ABRUPT ENGAGEMENT.**

**Range Shifting**

1. Be sure the engine speed is below 1700 RPM. Whenever possible, reduce engine speed to idle.
2. Depress the clutch fully and bring the tractor to a complete stop. Place the range shift lever (1) in neutral. Wait three to four seconds to allow the transmission to slow down to a near stopped condition before selecting the desired range. Shift pattern decals are located behind the shift lever indicating range position.
3. If you are not able to move to the desired position, turn the steering wheel to the left or right to allow gears to mesh.
4. Slowly release the clutch pedal to achieve a smooth start.
5. Reset the engine speed to operating range.

The range shift decal located in front of the range shift lever positions for high (H), medium (M), low (L), or reverse (R) range.



### Gear Shifting within a Range

*IMPORTANT: It is recommended that shifting gears with the tractor in motion be limited to light draft or rolling loads and only within a set range.* ***Do not attempt to shift between ranges without first coming to a complete stop.***

1. Depress the clutch pedal fully.
2. Move the gearshift lever (2) to the required gear. Shift patterns are located in front of the shift levers indicating gear position.

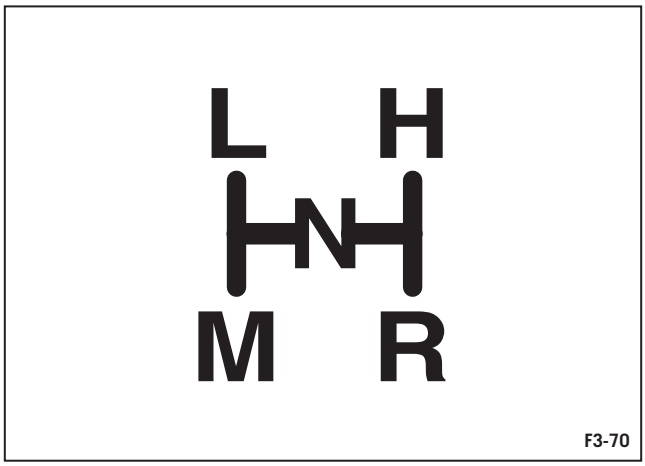
   **NOTE: It is not necessary to reduce engine speed for shifts within a range, but is recommended to increase the life of shift components.**
3. Release the clutch pedal slowly to insure a smooth transmission engagement.

   **NOTE: While it is possible to shift with the tractor in motion within a range, under heavy loads the tractor will probably come to an abrupt stop before the shift is complete. For your safety, it is recommended that the operator throttle down, raise any implements, and stop before attempting any shifts.**

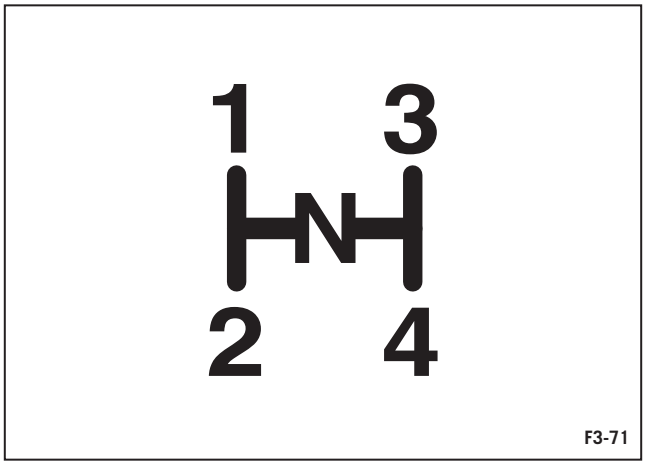
### Forward/Reverse Shifting

Shuttle shifting should not be attempted between the forward and reverse ranges while the tractor is still moving. Harsh transmission engagement will occur as well as damage to the range shift mechanisms in the transmission.

1. Bring the tractor to a complete stop before shifting the range lever.
2. Select the range desired.
3. Release the clutch pedal slowly to achieve a smooth start.




**Range shift pattern**




**Gear shift pattern**

## 1407 Twindisc Powershift Transmission Operation

The 1407 Twindisc Powershift transmission gears are constantly in mesh. Gear shifting is done by the use of eight electronically controlled hydraulic clutches in the transmission.

There are twelve forward speeds and two reverse speeds.

Clutch selection is controlled by electric solenoid valves which direct hydraulic oil to the required clutches. When the operator selects a gear, an electronically controlled shift system activates the solenoids required for the specified gear.

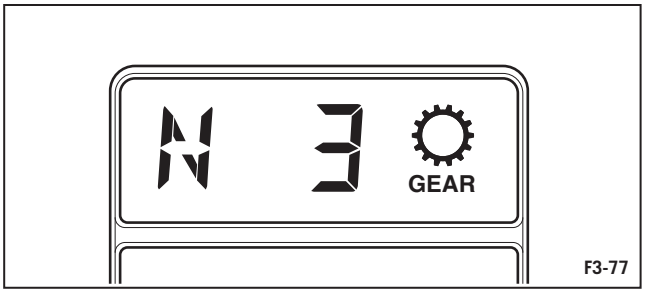
The clutch pedal is used to modulate pressure to the master clutch allowing the operator to feather engagement to any of the first seven forward gears or first reverse gear. Use of the clutch pedal allows for safe, accurate positioning of the tractor when hitching up implements or operating in confined spaces. Optimum inching control, particularly with heavy loads, is best achieved in lower gears and by reducing engine RPM.

The transmission controller has built-in error codes which may appear on the display of the tractor. Refer to “Transmission Troubleshooting” in Section 5 for an explanation and possible causes of the error codes.

### Transmission Shifting

When the tractor is started, the transmission display module will display N3 showing that the shifter is in neutral position and that it is the default 3rd gear selection. Depressing the clutch pedal with the tractor stationary will automatically change the transmission to the first gear setting. By shifting the shift lever forward the transmission automatically will go to any gear selected from 1st to 7th gears.

**NOTE: When gears 4 thru 7 are selected, the programming starts the tractor in 3rd gear and automatically shifts up to the pre-selected gear.**



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The 1407 Twindisc Powershift transmission is operated by a single control lever (1). Because the transmission has only one control lever, it is extremely easy to use.

**NOTE: The control lever is equipped with a neutral lock button (2). The control lever may only be moved to the forward or reverse positions if the neutral lock button on the control lever knob is depressed. Neutral may be selected without depressing the neutral lock button.**

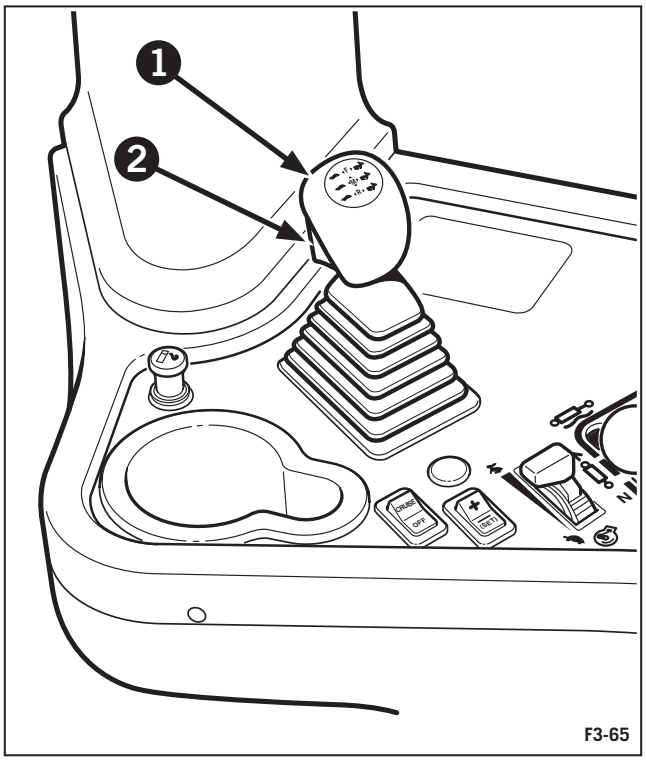
The control lever is used to select forward or reverse travel and to change transmission speeds. Move the lever forward for forward travel and rearward for reverse travel.

*IMPORTANT: Shifting the transmission at low throttle setting and a light draft load will extend clutch life.*

The control lever is also used to make instantaneous upward or downward gear ratio changes. Nudge the lever to the right for upward changes and to the left for downward changes. (In this context, "nudge" means move the lever and then release.)

Consecutive gear ratio changes may be made, either by nudging the lever several times or by holding the lever to the left or right and allowing the transmission to shift through the gear ratios automatically.

**NOTE: Reverse gears are displayed as RI and R2.**




**Automatic Range Select**

Depressing the clutch pedal while the tractor is moving causes a neutral condition, allowing the electronic control to automatically select a transmission range matching tractor ground and engine speeds when the clutch pedal is released. For example, if the tractor is in ninth gear forward and the operator depresses the clutch pedal, tractor ground speed will be reduced but engine RPM will remain the same. The transmission controller will sense the reduction in ground speed and automatically shift the transmission down to a gear that will match the ground speed when the clutch pedal is released.

If the clutch pedal is held down and the tractor comes to a rolling stop, the transmission controller will shift the tractor to first gear.

**The transmission will not shift to neutral unless the control lever is put in the neutral position.**

**Forward/Reverse Shifting**

The automatic modulation feature of the 1407 Twindisc Powershift transmission allows the transmission to be shuttled from a pre-selected forward gear (1st through 7th gear) to R1 using the control lever. Shuttling the control lever back to forward will return the tractor to the pre-selected gear up to 7th gear.

It is not necessary to come to a complete stop for this shuttle shifting operation.

## CAT TA22 Powershift Transmission Operation

### Transmission Description

The transmission is a 16 forward and 4 reverse speed constant mesh countershaft design. It accomplished this by utilizing five shafts: input, intermediate, planetary output, transfer gear output, and reverse. It involves 7 rotating clutch groups (8 with optional PTO) and 2 stationary clutch groups.

The transmission clutches are controlled by the transmission control module and the transmission shifts in response to operator inputs (direction selector position, upshift/downshift requests, inching pedal position, autoshift mode, etc). There are two different modes of normal transmission operation: manual shift mode and autoshift mode.

### Transmission Operation

The TA22 Powershift transmission is operated by a single control lever (1). Because the transmission has only one control lever, it is extremely easy to use.

**NOTE: The control lever is equipped with a neutral lock button (2). The control lever may only be moved to the forward or reverse positions if the neutral lock button on the control lever knob is depressed. Neutral may be selected without depressing the neutral lock button.**

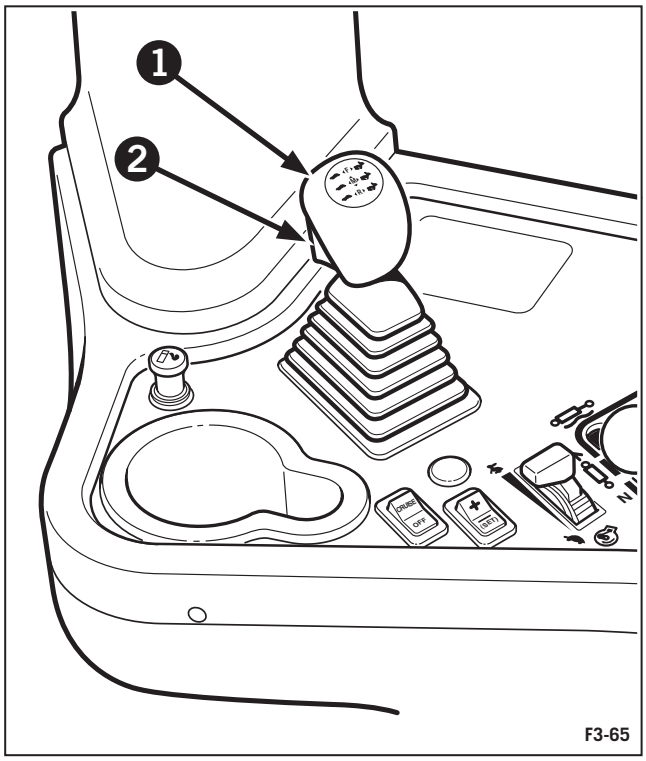
The control lever is used to select forward or reverse travel and to change transmission speeds. Move the lever forward for forward travel and rearward for reverse travel.

*IMPORTANT: Shifting the transmission at low throttle setting and a light draft load will extend clutch life.*

The control lever is also used to make instantaneous upward or downward gear ratio changes. Nudge the lever to the right for upward changes and to the left for downward changes. (In this context, “nudge” means move the lever and then release.)

Consecutive gear ratio changes may be made, either by nudging the lever several times or by holding the lever to the left or right and allowing the transmission to shift through the gear ratios automatically.

**NOTE: Reverse gears are displayed as RI and R4.**



**Before start up**

- Always refer to the Pre-operation Checks and Cab Features
- Ensure transmission bumpshift lever is in neutral.
- Fully apply parking brake.
- PTO switch is in the disengaged position (Optional Equipment)

**During initial Start up**

During power up the transmission control system initializes and ensures that the machines does not move until the direction selector is first moved to or in neutral and then moved to a non-neutral gear. Following successful completion of all power-up function, normal operation is established.

In order to optimize cold weather shifting and inching performance, the transmission automatically undergoes a clutch cycling function that engages all the input clutches one at a time to top pressure. By doing so, the clutch passages of the input clutches will be purged of air and will enable better shifting and inching response when cold. This function will only activate if the transmission hydraulic oil temperature is below 30°C at the time of startup.

Upon engine startup, this feature will disengage clutch 8 (Neutral Clutch) and engage the input clutches one at a time. The parking brake must be engaged in order for this feature to initiate.

The entire cycle should take about 10 seconds after the start of the function. During this time, slight periodic engine lug may be noted. This is normal.

If machine movement is desired immediately after startup, the operator can cancel the cycling feature by disengaging the parking brake and shift into gear. The clutch cycling feature will automatically discontinue and disengage to allow full transmission control to the operator.

**NOTE: Shifting and inching performance in some gears may not be optimum if the cycling feature is interrupted.**

**NOTE: The clutch cycling feature does not initiate if there are speed sensor or parking brake faults.**

## Transmission and Parking Brake Operational Interaction

The transmission shall neutralize whenever the parking brake is engaged. A SPDT switch in the parking brake circuit determines parking brake engagement status. The transmission will not shift into gear unless the parking brake status is “OFF”.

## Cold Temperature Operations

Upon start-up of the transmission, if the transmission hydraulic oil temperature is below 20°C, all function associated with inching, auto-modulation, and shuttle shift will be limited to F1 and R1.

**NOTE: Once the target gear (or direction is achieved) full gear range is available for normal in gear operation.**

**NOTE: Once the transmission oil is at or above 20°C, the cold oil operation function will be disabled. Once disabled, it will not be re-enabled until the next ECM power cycle or if the transmission oil temperature drops below 18°C.**

## Shift Inhibits

Transmission overspeed protection: If the transmission controller detects that a downshift will produce speeds exceeding the established engine overspeed, the shift will not be performed. The operator must slow down the machine by decreasing the throttle or apply the service brakes before the downshift will occur.

**NOTE: Engage a suitable low gear before traveling downhill.**

## Inching

When the inching pedal is depressed to less than 6% of pedal travel (0% being fully depressed), the directional clutch will immediately disengage (note that the clutch will partially disengage when the pedal is depressed to about 35% of travel). Releasing the clutch pedal will proportionally increase the directional clutch pressure slowly from zero to a predetermined inching pressure. When the clutch pedal is fully released (greater than 85% of pedal travel), then the clutch pressure will be automatically modulated to full pressure. Inching is used for shifts out of neutral or for maneuvering slowly for implement hookup.

Default gear for launching the machine will be F5 and R1. Inching will be allowed from F1 to F10 and R1 to R2 (subject to clutch energy analysis).

**CAUTION: Inching time is NOT limited, and thus if an operator holds the inching pedal below the auto-modulate threshold, excessive heat can be generated and clutch damage can occur.**

## Auto-modulation

This strategy is used to shift the machine out of neutral to any gear within the max allowed inching gear range. This feature should be used in loaded conditions to minimize clutch energies and ensure a smooth shift out of neutral. Auto-modulation should be used to launch the machine during normal operation. Only use the inching method if fine speed control is needed for maneuvering or implement hook-up.

*ATTENTION: Selected Gear will match the Operator Requested Gear except for when the shifter is in Neutral. When the shifter is in Neutral, the selected gear will show what forward gear the operator will get when the shifter is place in forward.*

### Shuttle Shifts (Directional Shifts)

Shuttle shift is used to go from forward direction to reverse, or vise versa, as quickly as possible without the use of the inching pedal. This is accomplished by using single clutch shifts. Shuttle shift will be allowed between F1 and R1, F2 and R1, F3 and R1, F4 to R1, and F5 to R2 (subject to clutch energy analysis). If a shuttle shift is initiated from gears above the allowed gear, the transmission controller will downshift the transmission to the allowed gear and then initiate the shuttle shift.

In order to perform a shuttle shift, move the shifter from the current direction into the opposite direction quickly and smoothly. The shifter must not linger in the Neutral position for more than 0.3 seconds. If the shifter stays in Neutral for more than 0.3 seconds before being moved to the opposite direction of travel, then a shift to Neutral will be initiated followed by an auto-modulation shift into gear. This can cause undesirable shift harshness and the desired gear may not be achieved.

## Speed Matching

Speed matching will enable the operator to push in the inching pedal or shift to Neutral while coasting and have the transmission automatically select a gear to better match the current machine speed when the inching pedal is released or the shifter is placed back into gear. Transmission will speed match from F16 down to default or maximum launch gear for starting (F10).

## Manual Shift Mode

During manual shift operation, the transmission shifts in response to specific operator actions: moving the bumpshift lever forward or back for direction change, or from side to side for upshift or downshift, (gear change) or depressing the inching pedal (manual modulation control). The transmission will override the operator requested gear only when an operator request can not be accommodated due to performance limitations or to match the transmission gear to the transmission input/output speed ratio (speed matching).

There are predetermined delays between upshifts and downshifts. If rapid upshifts or downshifts are requested, and if the shifts can not be carried out in the requested time, the transmission will queue the requested shifts and upshift or downshift at the quickest time allowed. This strategy will allow better shifts by letting the engine speed recover before the next shift. This will also reduce the risk of engine stall caused by rapidly upshifting and reduce the risks of engine overspeed caused by rapidly downshifting.

Queued shifts can be canceled by using the bumpshift lever to downshift. For example, if the transmission is in F7 currently and the requested gear is F15, by moving the bumpshift lever to the left (downshift) once, the requested gear will become F7.

Queued shifts can also be used in autoshift modes. When in gear and using the autoshift mode, queued shifts can be accumulated if rapid upshift or downshift are requested beyond the established gear limits.

## Automatic Shift Mode

During autoshift operation, the transmission upshifts and downshifts automatically based on the strategy of the selected autoshift mode but without exceeding the maximum requested gear.

## Autoshift

This auto shift mode can be used to simulate the functionality of a typical automatic transmission on an automobile. Machine speed is controlled by throttle position and load. The transmission will upshift to the maximum sustainable gear and downshift when load increases or speed reduction is requested.

Autoshift mode can be used to achieve the maximum performance of the machine. If the load to the machine increases and the engine is lugged down below the optimum operating point in any gear, the transmission will automatically downshift to provide optimum performance. When the load condition has passed, the transmission will automatically upshift to maximize speed and output of the machine.

Transmission shift points are determined by transmission output speed (engine speed).

Once in autoshift mode, selecting a certain gear using the shifter will set the maximum gear that the transmission can operate up to. For instance, if the operator upshifts to F12, then the machine will only shift up to F12, even if it is capable of operating in gears above F12. Similarly, if the max gear is set at F12 and the machine is loaded and only capable of operating in F9, then it will stay in F9 until the load condition has subsided.

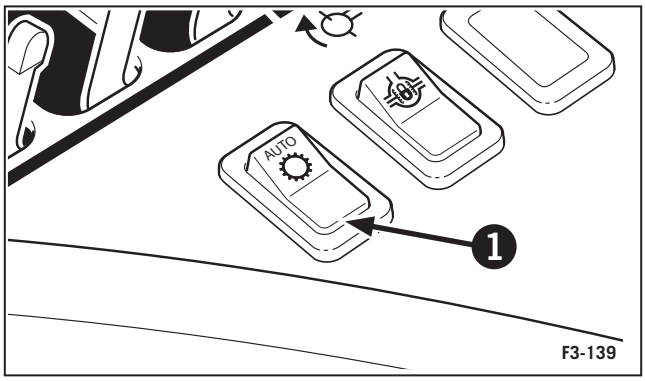
**NOTE: The autoshift mode is meant to operate with the throttle set to full. If operating at part throttle, the machine may not upshift because the upshift point might not be reached at part throttle conditions. Similarly, if the throttle is lowered to the point where the downshift point is reached, it will downshift even if the machine is not loaded.**

### Autoshift Enable and Termination

The autoshift mode will be engaged through the use of the momentary SPDT auto function switch (1). Press and release the front/symbol of the switch to engage autoshift. Press and release the switch again to disengage the autoshift function. The letter “A” will be displayed in the powershift display (2) when autoshift is engaged.

Once engaged, the transmission enters autoshift mode between F1 and the max gear limit set to the current desired gear. The operator is then allowed to upshift or downshift to change the max gear limit.

When autoshift mode is disengaged through the use of the auto function switch, the transmission will remain in the current gear and enter manual shift mode.





### Rules of Operation

During autoshift, all manual upshifts and downshift requests using the bumpshift lever to upshift / downshift will be utilized to change the max gear limit. All shifts will be performed automatically based to autoshift shift points.

During autoshift, if the inching pedal is pressed or if the shifter is placed into Neutral, the function will be terminated immediately.

- Upon inching pedal release or placing the shifter back into gear, gear selection will be based upon the selection made by the Speed Matching function.
- If the inching pedal was pressed down or the shifter placed into Neutral while operating in a gear that is at or above the max allowed launch gear, and if the tractor coasted to slow speeds or stop, unless changed by the operator while the inching pedal is down or in Neutral, the max allowed start gear will be used to launch the machine.
- Otherwise, the gear previously operated in that is below the max allowed launch gear will be used.
- The transmission will not resume autoshift mode until the operator request the activation autoshift through the auto function switch.
- If a shuttle shift is attempted while in autoshift, the shuttle shift will be initiated through the normal shuttle shift routine and autoshift will be disabled.

If the machine is operating at the max gear limit and the operator manually request a downshift, the transmission controller will downshift the transmission as long as the downshift will not cause engine overspeed, even when the downshift point is not satisfied.

**Inching Pedal Calibration**

To ensure the proper operation of the inching pedal and to prevent false diagnostics at machine start-up, an inching pedal calibration is required during the initial factory startup of the machine.

In order to perform the inching pedal calibration, use the following steps:

- Turn the key switch to “OFF”.
- Place shifter in Neutral and the inching pedal is in the fully released position.
- Turn key to ON position and wait until the machine display is running normally.
- Acknowledge and troubleshoot any faults that are displayed (make sure no faults exist for the inching pedal sensor and limit switch).
- Without performing any other functions, depress fully (and hold for minimum of 1 second) and release fully the inching pedal four times in a row. (Note that the limit switch must toggle with the inching pedal firmly depressed).
- Note any fault conditions on the machine display.
- By the fourth pedal press, a message should appear on the display indicating a successful inching pedal calibration. If a successful inching pedal calibration does not show up on the display, check for diagnostics on the inching pedal sensor and switch and verify the sensor and switch are working properly.
- If fault conditions exist involving the inching pedal sensor or switch, follow troubleshooting guides to resolve the fault conditions. Perform the inching pedal calibration once the faults has been resolved.

**NOTE: The calibration can be performed whenever the machine is powered up, but is not necessary every time since the calibration values are stored into permanent memory in the transmission ECM. The inching pedal calibration is required if hardware adjustments or replacements are made to the inching pedal assembly items (pedal linkage, sensor, switch, etc.)**

**Diagnostic/Protection Mode**

In the event that the transmission controls detect a malfunction, an operator warning is generated while action is taken to minimize damage to the machine.

The response strategy when a solenoid or machine function error occurs is to keep the machine in the current operating condition if possible.

If a fault occurs that prevents further operation in the current gear, then the transmission will shift into neutral immediately.

**Advanced Default Mode (Limp Home/Default Mode)**

If the transmission is shifted to neutral due to fault conditions (either by the operator or the transmission controller), further operation in gears up to F6 (if available) will be allowed. Shifts out of Neutral up to F6 can be initiated. If requested gear is not available the highest available gear less than the requested gear will be engaged.

If a short to battery fault occurs on clutches 1, 2, 3, 4, 8, or 9, and if the transmission shifts into Neutral (either requested by operator or the transmission controller), the transmission will remain in Neutral until corrective action has been taken to clear the fault. Default Mode cannot be initiated during these clutch faults due to the lack of modulation profile for the output clutches (lack of adequate lube for modulation).

**NOTE: If a solenoid fault occurs in gears above F6, the transmission will be allowed to maintain gears above F6 if possible, but once shifted below F6 or into Neutral, the F6 limit will apply.**

**NOTE: The Advanced Default Mode will be incorporated in the software only. Loss of power to the ECM will result in all solenoids de-energizing.**

**Differential Lock (optional front & rear)**

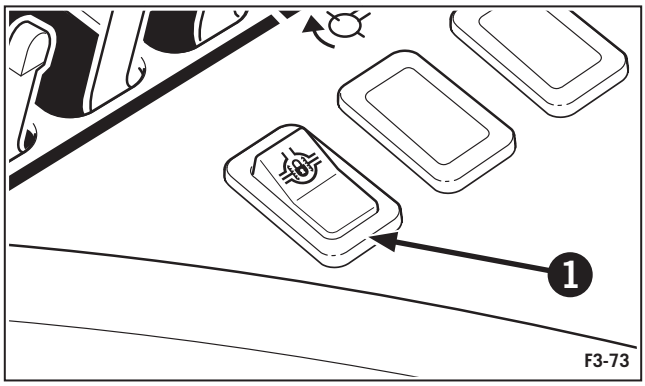
The tractor may be factory equipped with an electronically controlled front and rear axle differential lock. This will provide additional tractive effort on hillsides or wet ground. The switch (1) is a three position momentary switch located on the right console. To activate, push and hold for two seconds the front of the switch. An indicator light will illuminate on EIC (2). The differential lock can be locked when the tractor is moving or stopped.

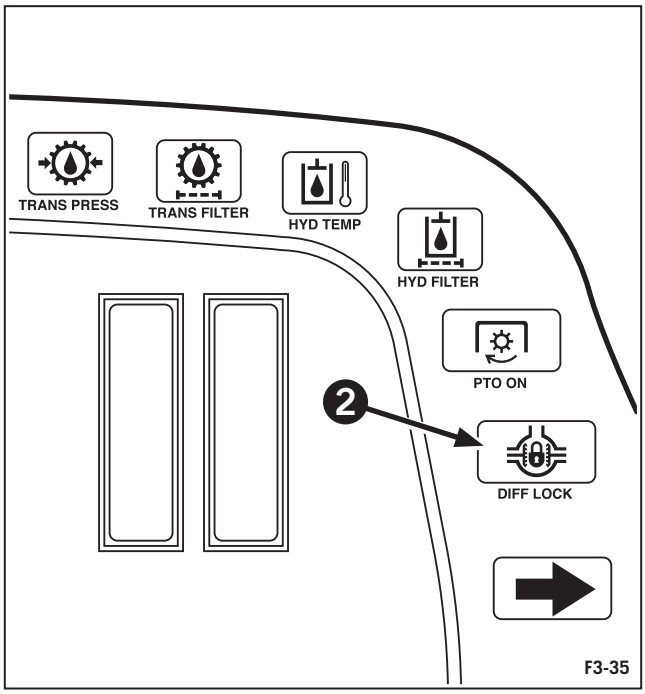
*IMPORTANT: Do not engage the differential lock when the tractor wheels are spinning or when the wheels are turning at different speeds, such as an end of the field turn. Drivetrain damage may result.*

To disengage the differential lock, push the rear of the switch down until the indicator light on the EIC turns off. Depressing the brake pedal will also disengage the differential lock.

Disengage the differential lock when not required, such as during high speeds and road travel, turning and parking, or when additional traction is not needed.

**CAUTION: DO NOT USE THE DIFFERENTIAL LOCK WHEN DRIVING THE TRACTOR ON ROADS OR STEERING MAY BE IMPAIRED.**



## Drawbar Operation

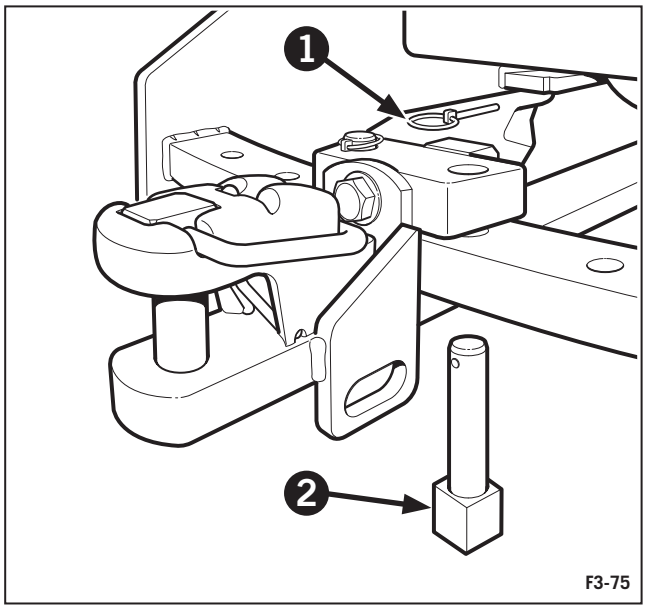
The drawbar height is fixed and must not be altered. It is designed to produce maximum traction for the wheelbase, tire size, weight distribution and ballast of the tractor. The drawbar length is non adjustable.

The drawbar is free-swinging and should be positioned for the best performance and the least side draft. There are five drawbar positions available. To swing the drawbar, pull the hairpin clips (1) from the wear blocks (2). Remove the wear blocks, swing the drawbar to the desired position and reinstall the wear blocks.

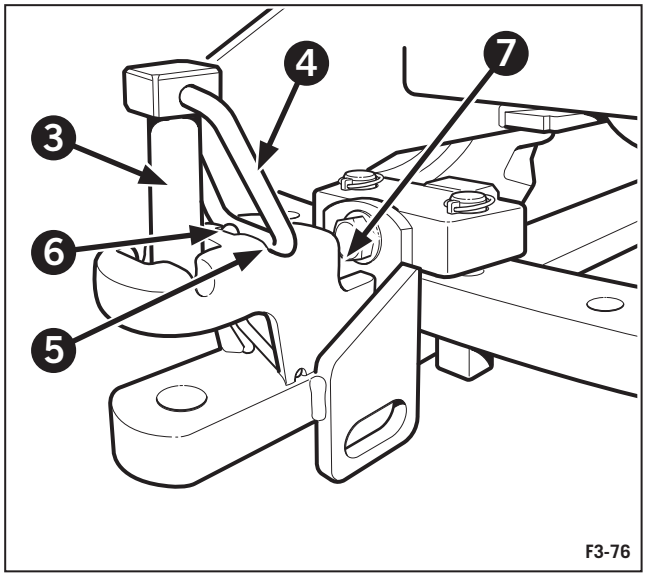
Choose a position that is right for the job and insert the pin and wear block in that position to keep the drawbar from moving.

It is recommended that the drawbar be pinned in position at all times. On occasion, it may be necessary to allow the drawbar to swing freely for implements that place side loads on the rear of the tractor. The drawbar can be used in a swinging application but may require replacement of the drawbar wear block after extended use.

Clevis-type implement hitches should be connected only to the lower plate of the drawbar. Other hitches should be connected between the plates as shown on the decal on top of the drawbar wear block.



F3-75



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### Automatic Hitch Pin

The drawbar is equipped with a hitch pin that will automatically drop in place when hitching up to implements.

To operate, place the hitch pin (3) in the raised position. Retaining ring (4) fits in the upper notch (5) of the clevis to hold the hitch pin in the raise position. Release strap (6) must be positioned in front of the retaining ring as shown. The drawbar is now prepared to hitch to the implement.

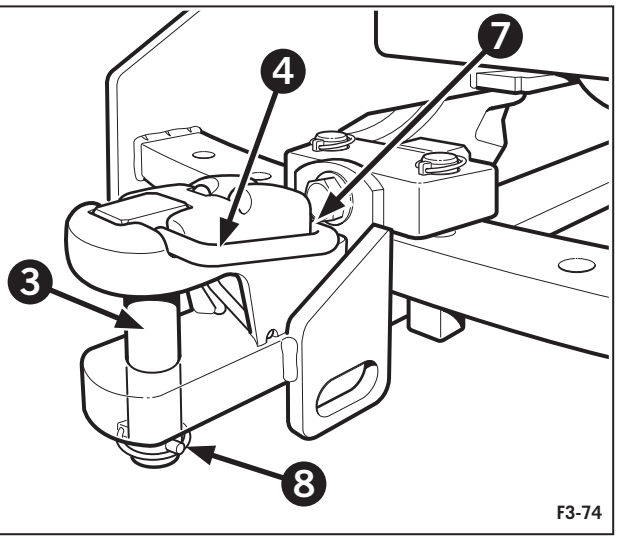
When backing the tractor to attach the implement, the implement hitch will contact the release strap (6) when aligning the drawbar. As the release strap is pushed forward it dislodges the retaining ring (4). Hitch pin (2) will drop as the retaining ring (4) slides down the incline (7) on the front of the clevis. The implement is now attached to the tractor without requiring the operator to leave the cab of the tractor.

**WARNING: NEVER ALLOW ANYONE TO STAND BETWEEN THE TRACTOR AND IMPLEMENT WHILE BACKING THE TRACTOR TO THE IMPLEMENT. ALWAYS BRING THE TRACTOR TO A COMPLETE STOP PLACE THE SHIFT LEVERS IN NEUTRAL AND ENGAGE THE PARKING BRAKE BEFORE ALLOWING ANYONE BEHIND THE TRACTOR TO HITCH THE IMPLEMENT.**

After the hitch pin (3) drops into place, retaining ring (4) locks into the lower notch (7) of the clevis preventing the hitch pin from inadvertently unhitching.

**IMPORTANT: Always install a safety retaining pin in the hitch pin (8) to secure the hitch pin and prevent any accidental unhitching of the implement.**

To manually unhitch the implement, first pivot the retaining ring (4) up away from notch (7) then pull the hitch pin from the clevis.

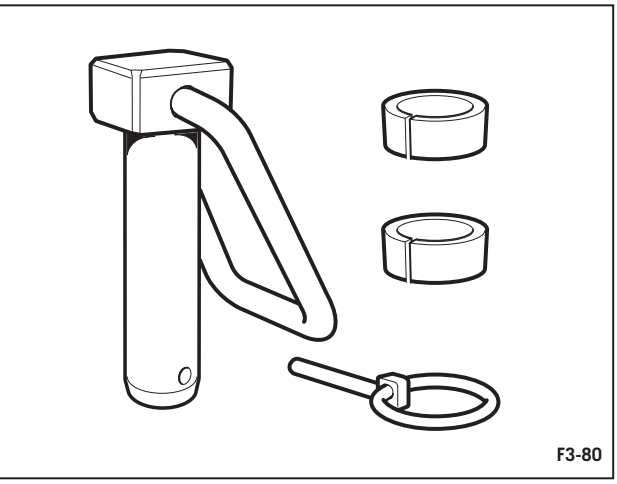



The vertical load on the drawbar must be considered as ballast and added to the weight of the tractor. Do not exceed the maximum operating weight of the tractor.

**WARNING: ALWAYS SECURE THE DRAWBAR TO PREVENT SWINGING WHEN TRANSPORTING EQUIPMENT OR WHEN OPERATING ANY EQUIPMENT EXCEPT GROUND ENGAGING EQUIPMENT.**

## 38.1 mm (1-1/2") Drawbar Pin Conversion Kit

A 38.1 mm (1-1/2") drawbar pin conversion kit is available from your Buhler Versatile dealer, P/N: 86030679 (Automatic). This kit allows the existing drawbar pin to be replaced with a 38.1 mm (1-1/2") diameter pin to fit implements with 38.1 mm (1-1/2") tongue holes.




## Drawbar Loading

The maximum recommended weight that can be carried on the drawbar is as follows:

Max. Vertical Load 4535 kg (10,000 lbs.)

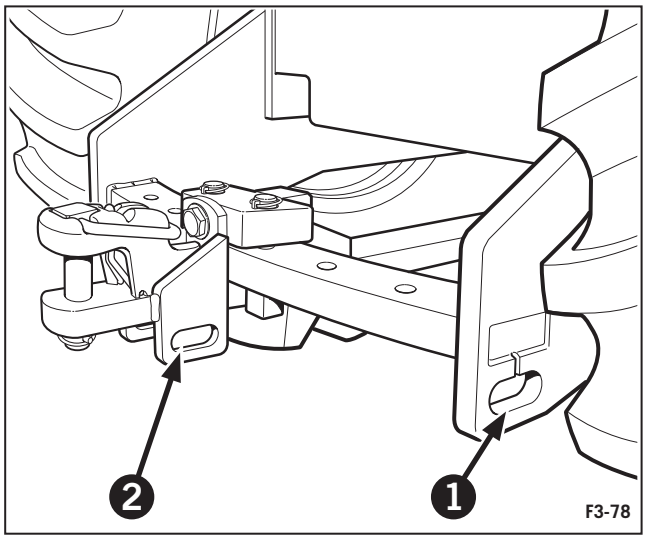
*IMPORTANT: Loads on the drawbar increase greatly when traveling in rough conditions. Reduce speed to reduce the possibility of damage to the tractor or implement.*

## Implement Safety Chains

Implements that have safety chains can be attached to the tractor using the tie-down slots (1) and the chain slot (2) on the drawbar and drawbar cage. Make sure the chain has enough slack in it to allow the tractor to turn and not restrict implement turning.

The safety chain should be strong enough to carry the gross weight of the implement to be towed by the tractor. Check the implement operator's manual for weight and safety chain attachment instructions.

Your Buhler Versatile dealer can assist in properly attaching safety chains to the tractor.




## Implement Transport

Use the following precautions when attaching and towing implements with the tractor:

- Hook equipment to the drawbar only.
- Be sure that the drawbar is locked in position with the side wear blocks to keep it from swinging side to side.
- When transporting implements on the highway, place the drawbar in the center position to stabilize the tractor and towed implement.
- Use the drawbar pin retainer on the drawbar at all times to prevent the equipment from unhitching from the tractor.
- Use safety chains from the drawbar and drawbar cage to the implement when on public roads to prevent the equipment from rolling into oncoming traffic or ditches should the hitch pin be lost.
- Use a safe towing speed as specified by the implement manufacturer.
- Use safety warning equipment as required by law.

**CAUTION: WHEN TOWING LOADS OR IMPLEMENTS ABOVE 16 KM/H (10 MPH), THE TOWED IMPLEMENT MUST NOT EXCEED THE WEIGHT OF THE TRACTOR, UNLESS THE IMPLEMENT IS EQUIPPED WITH BRAKES. IF EQUIPPED WITH BRAKES, THE IMPLEMENT WEIGHT MUST NOT EXCEED 2 TIMES THE TRACTOR WEIGHT.**

## External Lighting

Your tractor is equipped with external lighting for safety and night time/low light operation.

Lighting is controlled by the master light switch (1). A functional description of the master light switch can be found on page 3-19.

Illustration F3-82 shows the location of the following external lighting:

Road lights (2) (high/low beam) x 2

Lower work lights (3&4) x 8

Upper work lights (5) x 4 (optional)

Signal/hazard lights (6) x 4

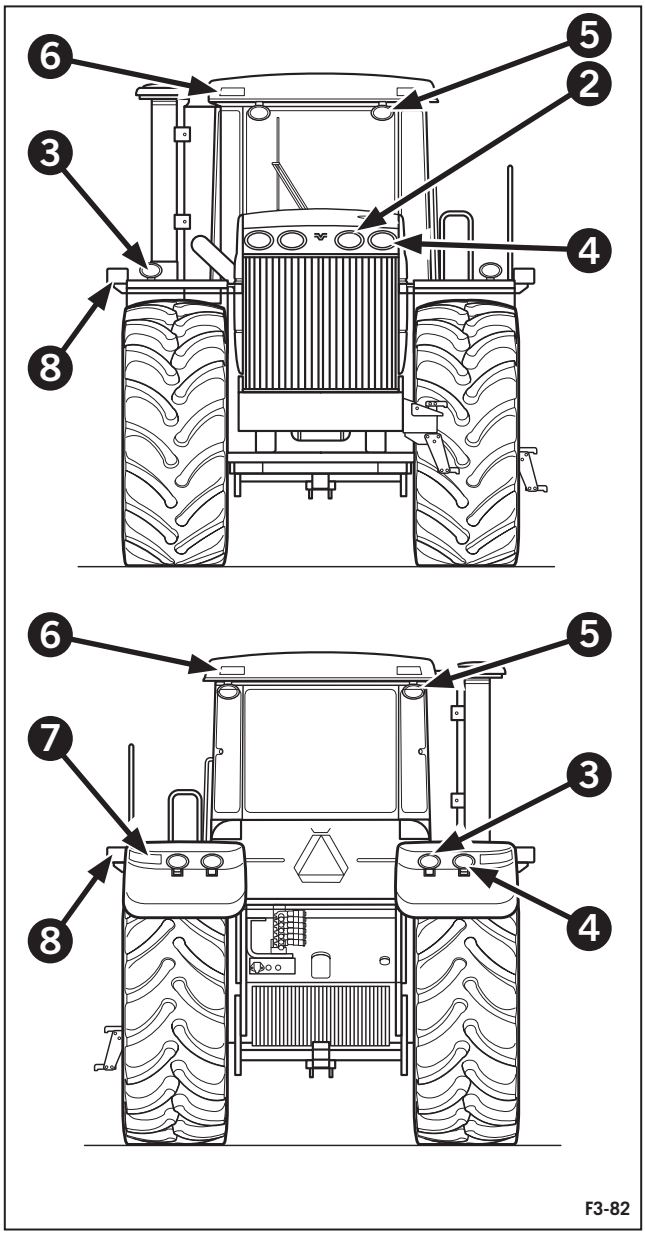
Tail/brake/signal lights (7) x 2

Extremity/signal (8) x 2

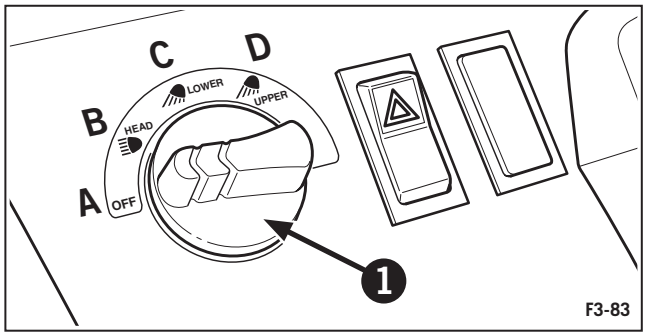
Extendable extremity lights (8), located in the front fender are utilized when the tractor is configured with dual and triple tires.

To adjust, release the two locking bolts (9) and extend the lights to cover the full width of the tires. Lock in place by tightening bolts.

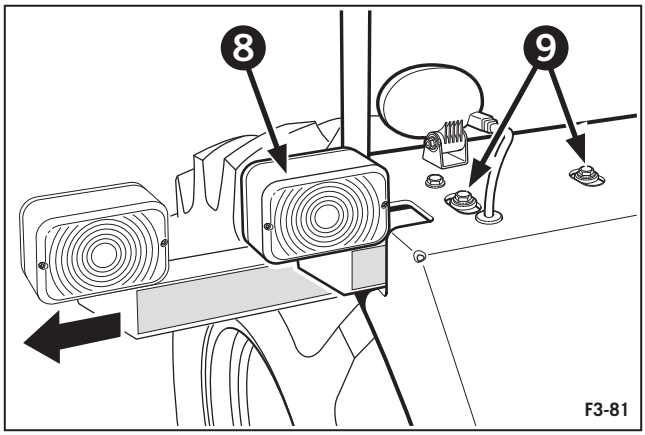
HID-Xenon work lamps located in position (4) are either factory fitted or are available from your authorized Buhler Versatile dealer. These lamps provide a more natural light output 2.5 times greater than standard halogen bulbs.



F3-82



F3-83



F3-81

## Trailer Socket

The trailer socket is attached to the hydraulic remote coupler bracket at the rear of the tractor.

It is a seven-pin connector that can be used for a trailer light hookup or as an outlet to attach an optional implement status switch.

The pins in the socket are identified as follows:

**Pin 1 - Ground**

**Pin 2 - Work lamps**

**Pin 3 - Left flasher**

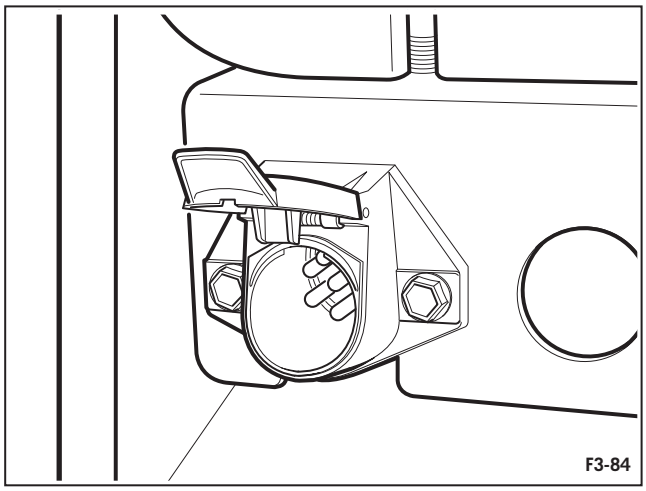
**Pin 4 - Stop lamps**

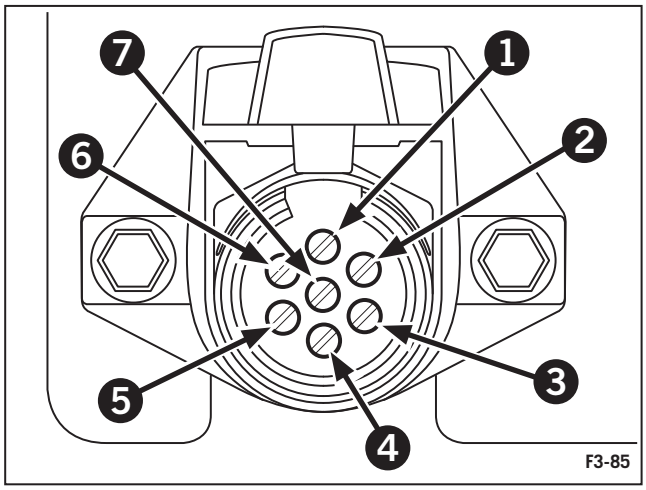
**Pin 5 - Right flasher**

**Pin 6 - Tail lamps**

**Pin 7 - Auxiliary (key switched 12 volt source protected by a 20 amp fuse)**

There is a male connector available through your Buhler Versatile dealer, (BVI p/n: 59624), that can be purchased to accommodate trailer wire harnesses.

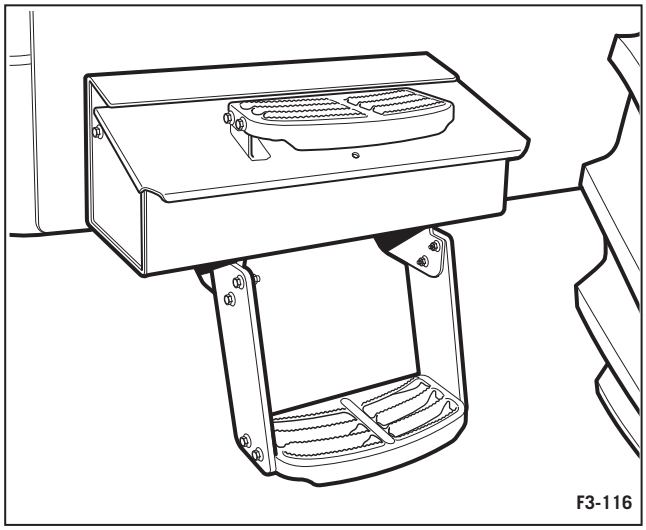

F3-84



F3-85

## Toolbox/storage tray

A toolbox/storage tray is located on the left front frame of the tractor. The toolbox lid will accommodate a lock.


F3-116

## Hydraulic System

The tractor comes equipped with either a standard manual hydraulic or the optional electro-hydraulic (EHR) system. The system consists of a hydraulic reservoir, a load-sensing variable-flow hydraulic pump, an implement valve assembly with flow control capability, quick couplers, a filter and oil coolers as standard equipment.

A master control valve provides priority flow for steering and excess flow to the implement valve. A closed center steering motor receives priority flow which feeds the steering cylinders.

### Hydraulic Quick Couplers

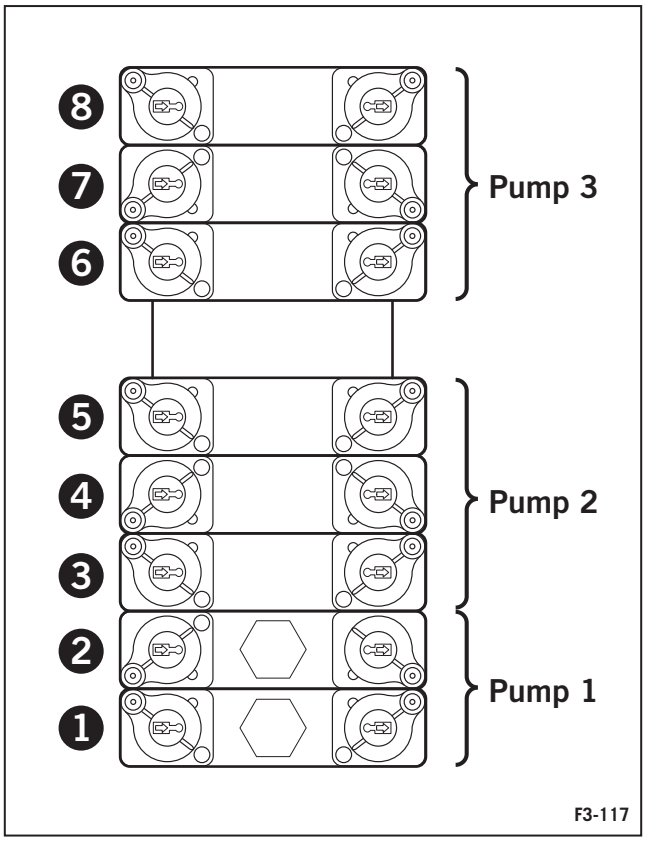
Tractors with manual hydraulics are equipped with four or six remote couplers. Tractors with optional electro-hydraulics (EHR) are equipped with four, six or eight couplers.

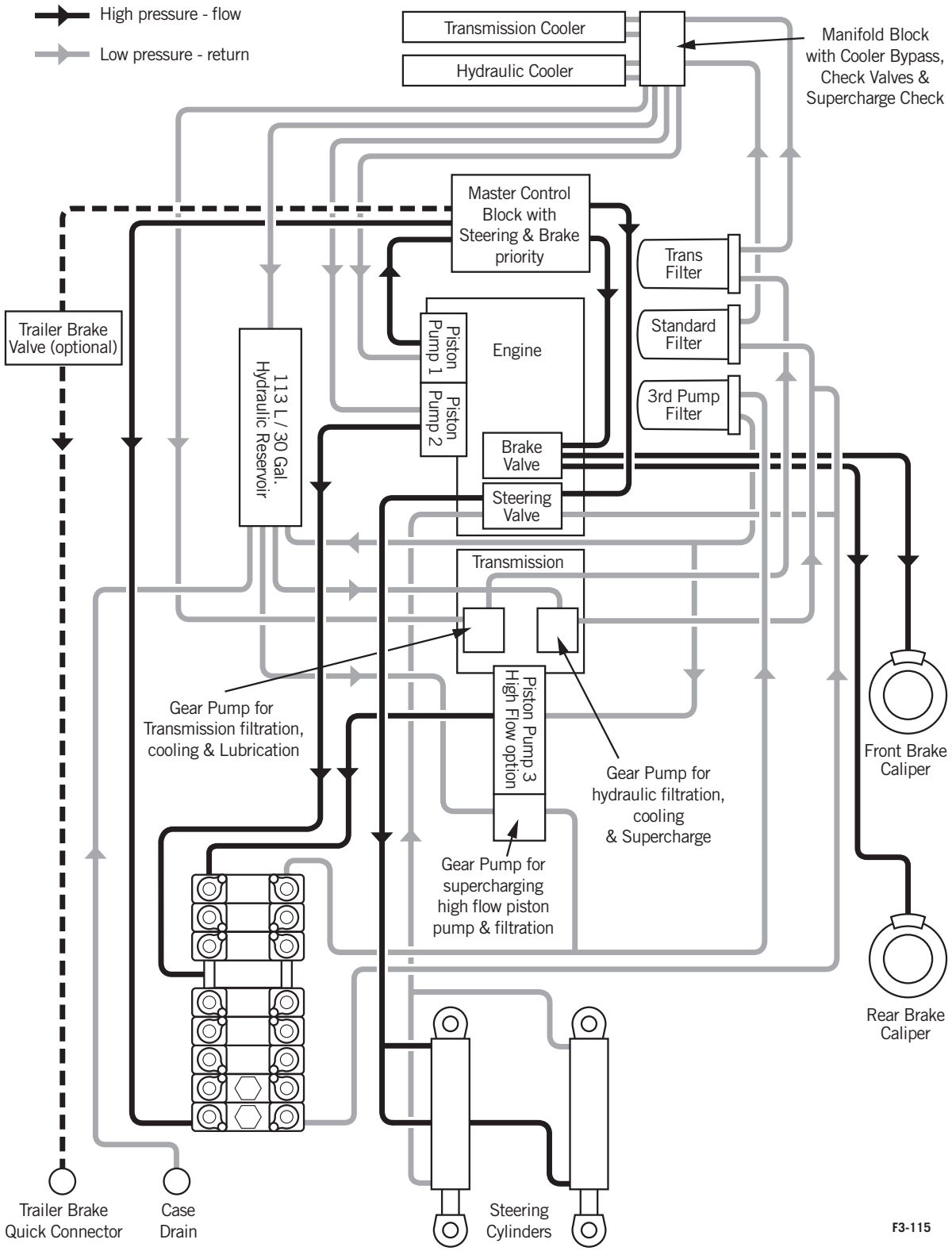
Each remote coupler is color coded with it's corresponding control lever.

From bottom to top:

1. Control lever 1 (Green) with load check
2. Control lever 2 (Blue) with load check
3. Control lever 3 (Brown)
4. Control lever 4 (Gray)
5. Control lever 5 (Black)
6. Control lever 6 (White)
7. Control lever 7 (Purple)
8. Control lever 8 (Lime)

Load checks are installed in the “extend” port of the lower two control valves 1 and 2.






**Hydraulic System Schematic Diagram**

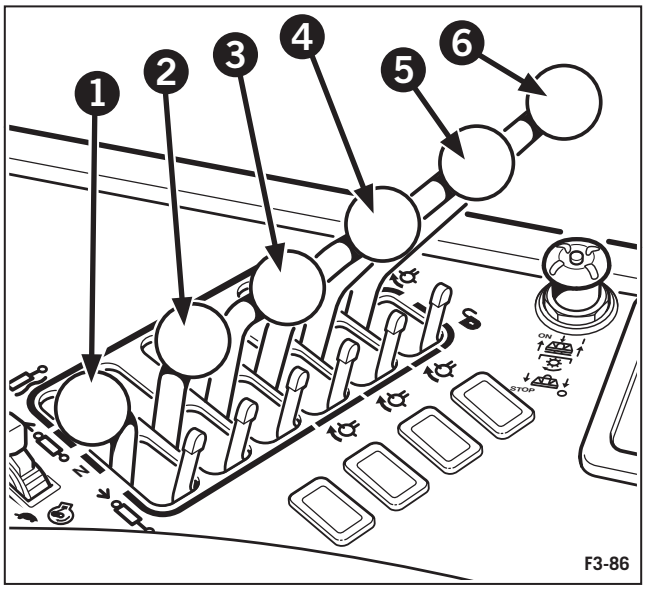
**NOTE: some components illustrated above may be optional equipment.**

## Remote Control Valve Operation - Manual

Up to six remote hydraulic circuits are controlled by levers located on the right console. These are color-coded to match the quick couplers at the rear of the tractor.

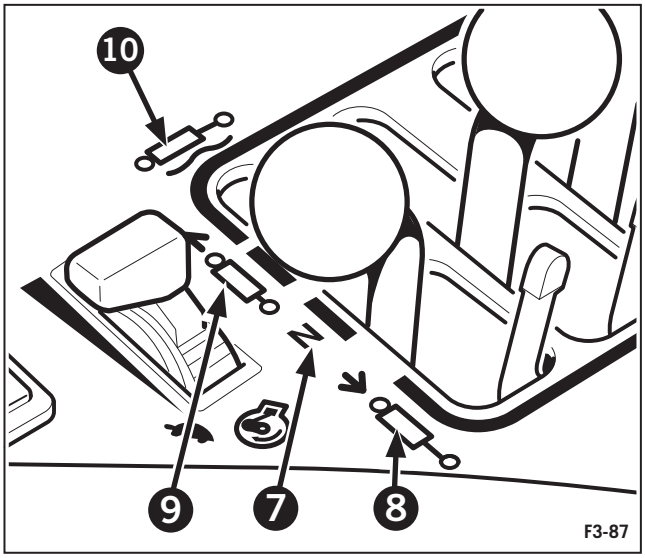
The colors are as follows: (from left to right), green (1) blue (2), tan (3) and gray (4). (Optional - black (5), white (6).

**NOTE: Tractors with manual hydraulics are fitted with either Standard Flow System (4 or 6 remote valves), or High Flow System (6 remote valves). See page 3-82 for details.**



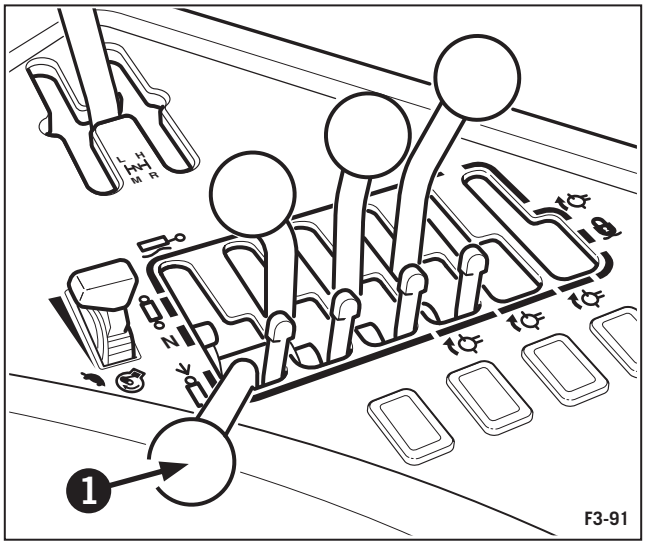
F3-86

The levers have four positions: neutral (7), extend (raise) (8), retract (lower) (9) and float (10) as indicated by the decals. When not in use, the levers should be in the neutral position where they can be locked to prevent accidental actuation.



F3-87

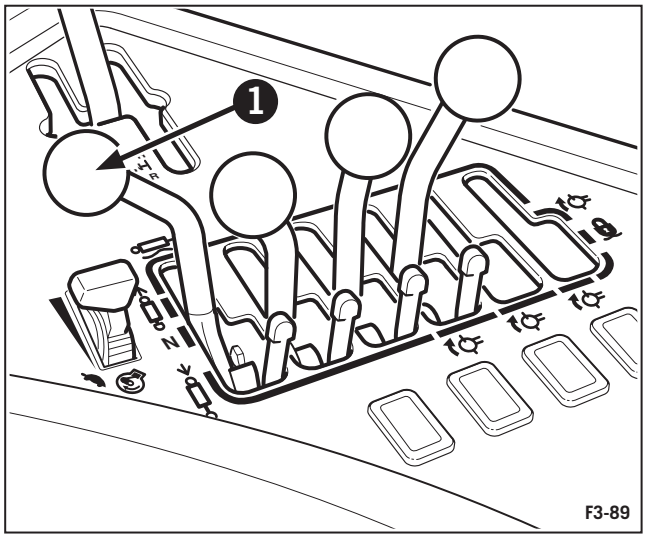
For the extend position, the lever (1) is pulled toward the operator. This is normally the implement raise position. An adjustable pressure release detent will hold the lever in the raised position until the cylinder reaches the end of its travel, then release to the neutral position. The lever lockout has no function in this position.



F3-91

For the retract position, the lever (1) should be moved away from the operator one position. An adjustable pressure detent will hold the control lever in this position until the cylinder reaches the end of its travel, then release to the neutral position. To prevent over-travel into the float position, the lockout lever can be moved to the first (center) position.

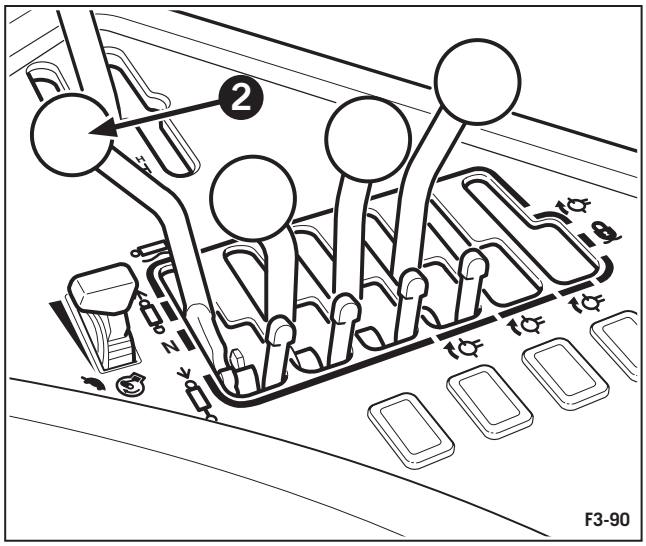
*IMPORTANT: Do not manually restrain a lever to override the detent release for continuous operation or excessive noise and detent damage may occur.*




The float position (2) is the position farthest away from the operator, two detents from neutral.

The float position will be locked out when the lockout lever is in the first detent and the control lever is in neutral. Once in the retract or float position, the lockout lever can be moved to the second detent to prevent the lever from moving back into the neutral position for motor operation.

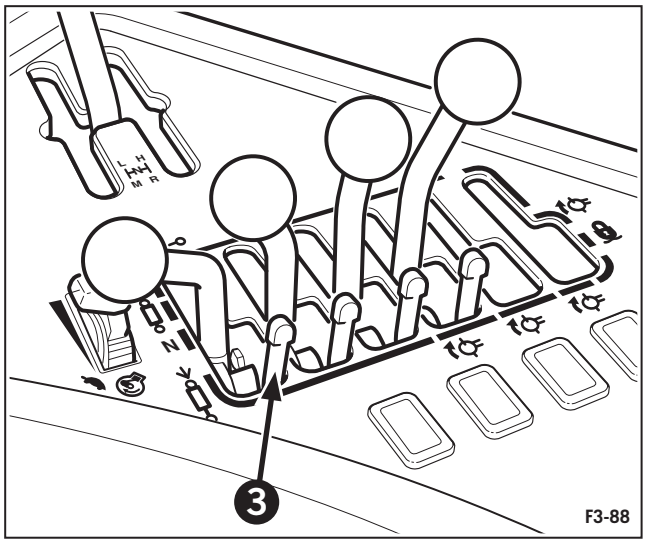
The float position is generally used for implements that are designed to "float" over the ground during normal operation. When the remote valve is in the float position, hydraulic oil on the rod end and piston end of a cylinder can flow freely from one side of the cylinder to the other.



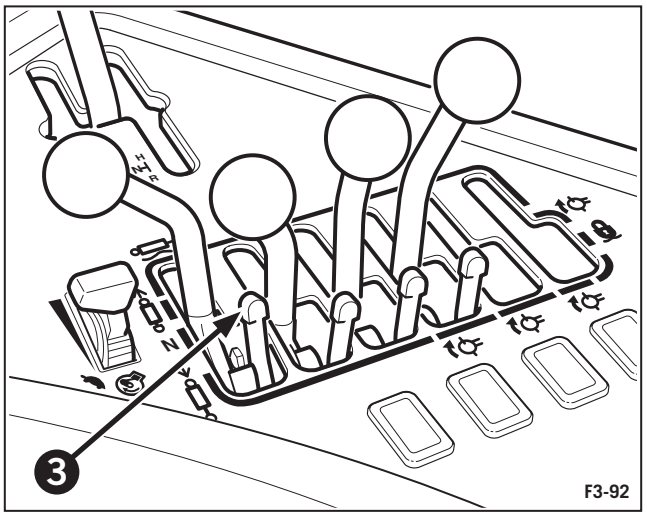

## Lockout Levers

Below each control lever is a corresponding lockout lever to prevent or limit travel of the control lever. The lockout lever has three positions.

The rearward position (3) (closest to the operator) releases the lock and allows full travel to all control lever positions.



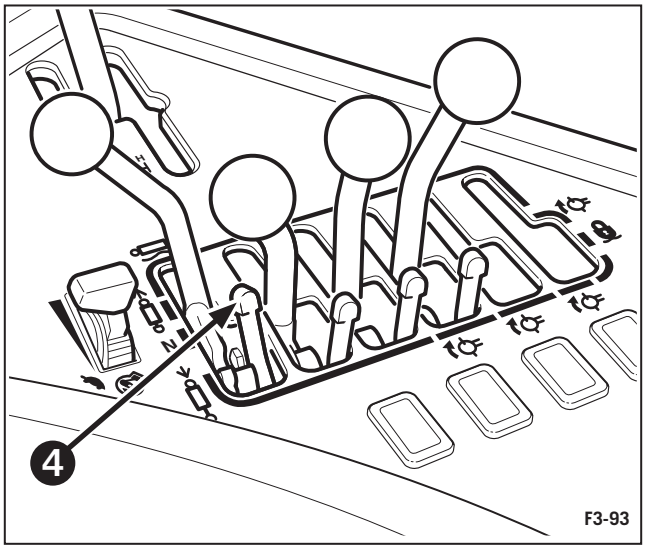
The second position (3) prevents the control lever from entering the float position.




The final position (4) has two functions. It will lock the lever into the neutral position to prevent accidental actuation of the lever. If the lockout lever is moved to this position while the control lever is in the retract position, the control lever is limited to travel between the float and retract positions. This position can be used for continuous flow applications.

By limiting the travel of the remote control lever from returning to the neutral position during continuous flow applications, the lockout will protect the hydraulic system from pressure spikes created by hydraulically driven implements during implement shutdown.

*IMPORTANT: When shutting off hydraulically driven implements, place the remote lever in the float position to allow the implement to coast to a stop. Shut the tractor off and place the remote lever in the neutral position.*



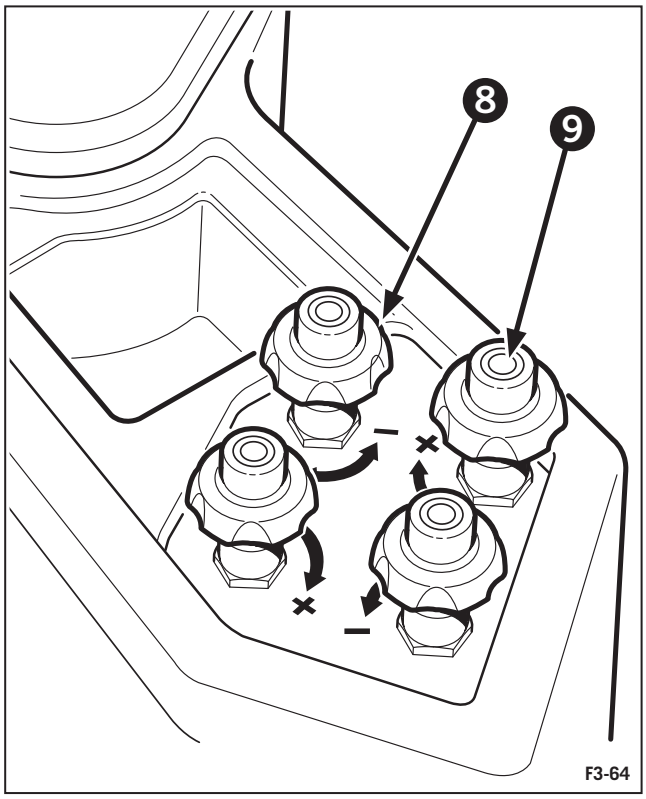
## Hydraulic Flow Controls - Manual

Hydraulic flow to the remote valves 1 to 4 is controlled by four rotary knob style flow controls (8). Each knob can be rotated clockwise to increase flow and counterclockwise to decrease flow.

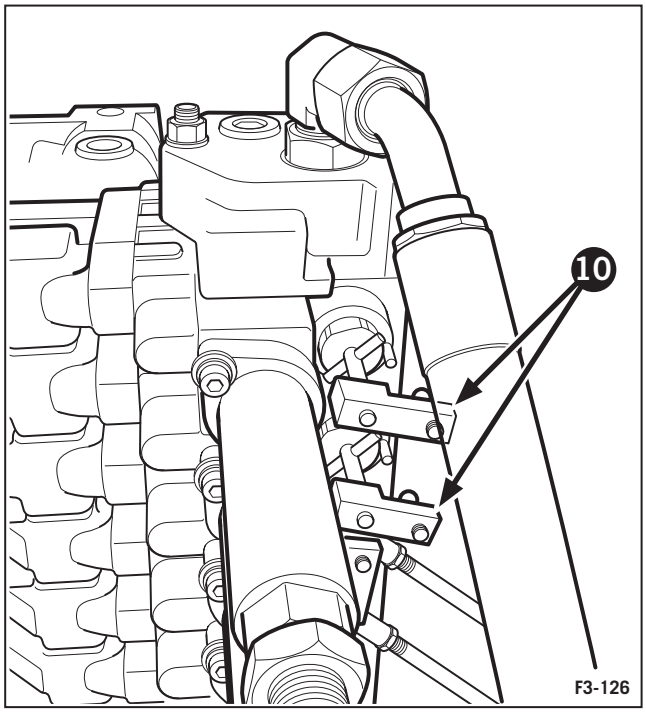
The knobs are color coded for identification with the remote valve it controls.

By pushing the button in the center of the knob (9) the control knob can be pulled upward or pushed downward to change the coarse flow control setting.

Each valve spool has a flow control valve to meter oil flow to that coupler. Flow can range from a minimum of 11.4 L/min (3 GPM) to full available flow 114L/min (approximately 28 GPM).




**NOTE: For tractors equipped with six remote valves, flow to remote valves 5 & 6 (the top two sections), are controlled by rotating by hand, the valve flow control links on the rear of the remote valve manifold (10), clockwise to decrease flow and counterclockwise to increase flow.**



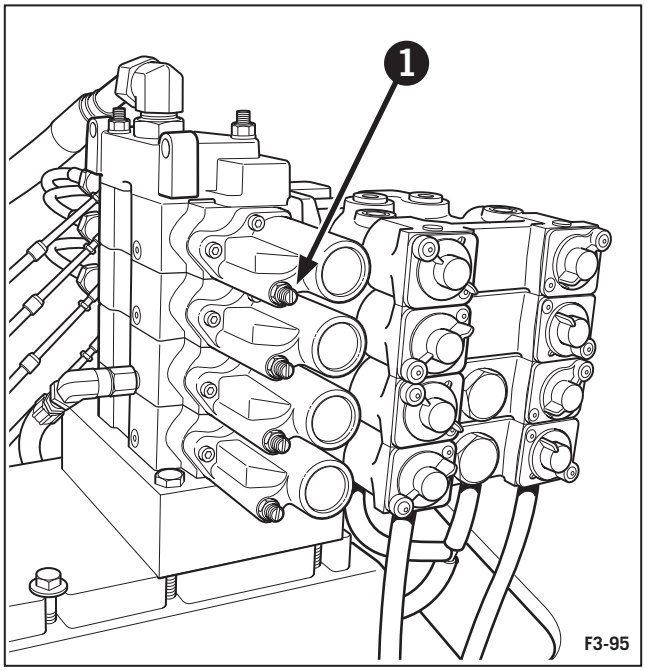
## Pressure Release Detent Adjustment

The detent adjustment screw (1) located on the rear of the valve, may be adjusted to vary the system pressure required to return each lever to the neutral position.

To adjust, loosen the jam nut and rotate the screw clockwise to increase the release detent pressure. A variable pressure flow meter should be used to slowly raise the system pressure to accurately set each detent. The adjustment should be made by your authorized Buhler Versatile dealer.

**NOTE: The factory pressure release detent setting is 150 bar (2175 PSI).**

**WARNING: ONLY ADJUST THE SCREW WHEN THE REMOTE CONTROL LEVERS ARE IN NEUTRAL AND THE TRACTOR IS SHUT OFF.**



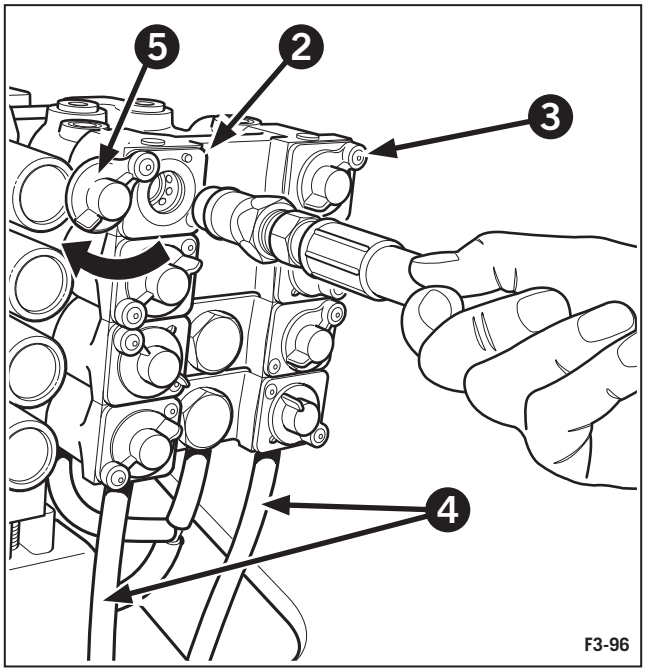

## Hydraulic Quick Couplers

Each remote valve section has a pair of hydraulic quick couplers located at the rear of the tractor. These are color-coded with the hydraulic control levers in the cab. The couplers are self-sealing and leverless and require no tools for connecting and disconnecting hoses. The couplers also permit hoses to detach themselves from the coupler should an implement become disconnected from the tractor.

The left section couplers (2) are identified by an “extend/raise” symbol on the couplers dust cover and the right section (3) are identified by a “retract/lower” symbol on the couplers dust cover.

Excess oil drain hoses (4) are attached to each coupler to drain away oil released during connection and separation of the couplers.

The couplers will accept standard (1/2") SAE or ISO tips. The couplers can be connected or disconnected under pressure.




## Coupler Connection

1. To connect couplers, wipe the outside tip of the coupler to remove any dust and minimize contamination.
2. Swing the dust cover (5) aside and insert the hose into the coupler, making sure the hose is properly seated.
3. Actuate the remote valve to supply hydraulic pressure which will complete the hydraulic coupling of the tractor and implement.

To ease removal and installation of the couplers, relieve the pressure in the system. Securely support the implement. Make sure no one will be injured by moving equipment when relieving pressure in the system. Move the control switch to the float position with the engine running. This will relieve the pressure. Turn the engine off with the control switch still in float. After the engine is shut down return the control switch to the neutral position. The couplers can now be connected or disconnected with minimal pressure and effort.

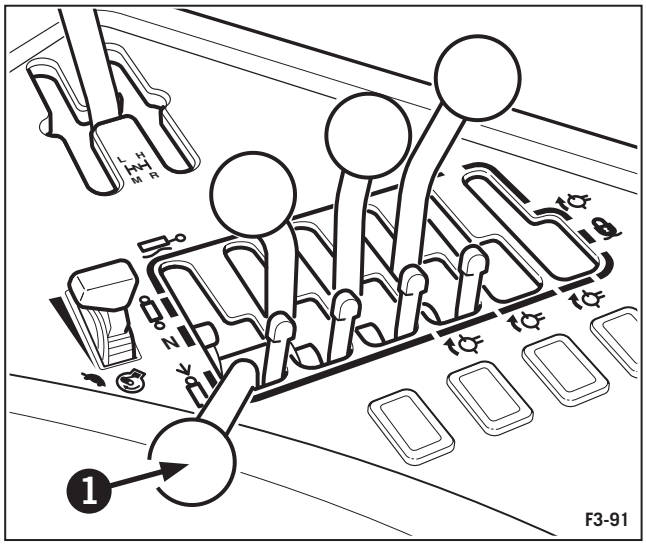
When using a double-acting cylinder, connect the supply hose from the cylinder to the extend/raise coupler (right side) and the return hose to the retract/lower coupler (left side). To extend a double-acting cylinder, pull the remote lever rearward to position (1). To retract the cylinder, push the control lever forward one position from neutral (2).

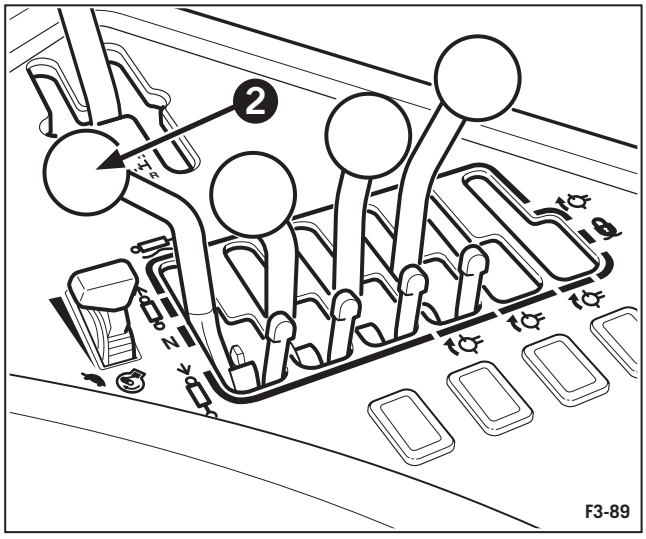
When using a single-acting cylinder, connect the supply line to the right coupler. To extend the cylinder, pull the remote lever rearward to position (1). To retract the cylinder, push the control lever forward one position from neutral (2).

To disconnect the coupler, make sure that the remote control lever is in the neutral position and the engine is off. Check to be sure that the implement has its transport stops in place or is lowered to the ground.

Grasp the coupler tip behind its hose connection and firmly pull the connector out of the coupler. Replace the dust cover on the coupler and cover the tip of the hose with a protective cap to minimize contamination.

**WARNING: HYDRAULIC FLUID ESCAPING UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SERIOUS PERSONAL INJURY. WEAR GLOVES AND PROTECTIVE CLOTHING WHEN SERVICING HYDRAULICS. BE SURE THAT ALL CONNECTIONS ARE TIGHT AND HOSES AND LINES ARE UNDAMAGED.**




## Bleeding Remote Cylinders

When connecting a cylinder with trapped air (i.e., a new cylinder, one that has been out of service, or one that has had the hoses disconnected), it will be necessary to bleed the cylinder to remove the air.

With the hoses connected to the remote control valve couplers at the rear of the tractor, position the cylinder with the hose end uppermost and extend and retract the cylinder seven or eight times using the remote control valve operating lever. Check the hydraulic tank oil level before and after operating the remote cylinder.

## Operating Continuous Flow Hydraulic Equipment

Continuous flow hydraulic equipment (i.e., hydraulic motors) should be connected as per the table below depending on the coupler manifold configuration. The supply hose is connected to the a left coupler and the return hose is connected to the corresponding right coupler.

| Manual hydraulics | Connect to row |
|---|---|
| 4 to 6 Section | 3 to 6 |
| **Electro-hydraulic** | **Connect to row** |
| 4 section | 4 |
| 6 set (high flow) | 4 or 6 |
| 8 set (high flow) | 5 or 8 |
| (1 starting at the bottom) | |

## Low Pressure Return Circuit

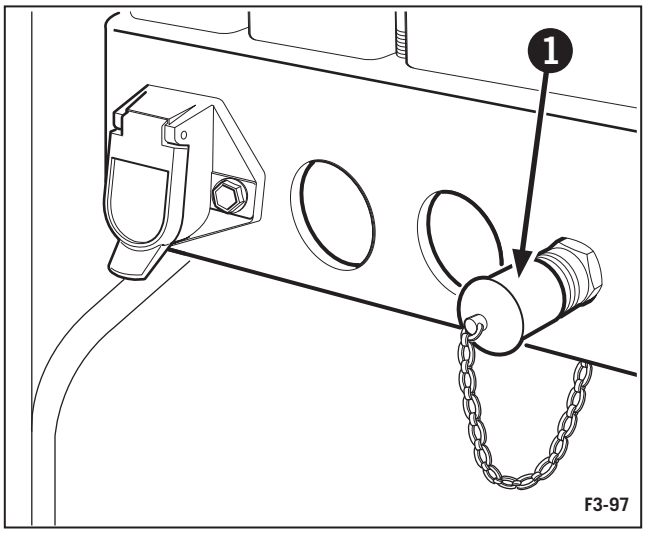
A low pressure return line (1) is installed below the hydraulic couplers that runs directly back to the hydraulic reservoir. The low pressure return circuit will reduce back pressure in the remote hydraulic return line which will result in more efficient hydraulic motor operation. The return circuit can also be used in applications where low return oil pressure is desired to improve implement operation such as orbit motor case drain lines.

Connect the return line from the hydraulic motor or implement to the coupler.

**NOTE: Connectors and couplers are available from your Buhler Versatile authorized dealer.**

Use the flow control knobs to regulate the motor speed. This will ensure that the hydraulic system will supply only the oil required by the motor. This will allow higher oil flow reserve for other valve sections and their oil circuits.

**NOTE: Hydraulic motors that are equipped with (1/2") supply and return hoses, and require less than 10 GPM, can be hooked up directly to the gray couplers. Hydraulic motors that have (3/4") supply and return hoses, and require greater than 37.85 L/min (10 GPM), should be hooked up to the optional (3/4") coupler kit. See "Optional Hydraulic Equipment" later in this section for more information on this kit.**




With the remote control valve lever fully forward in the float position, the motor will be stationary. The hydraulic motor will operate if the lever is moved to the retract position. To stop the motor, move the lever from the retract position to the float position. In the float position, the motor will be able to stop slowly, which will not damage the motor. When moving from the float position to the neutral position, i.e., for road travelling, move through the retract position quickly to prevent pressurizing the circuit.

*IMPORTANT: When operating continuous flow equipment, the remote control valve lever must not be moved from the full on position to the neutral or raise positions as damage to the equipment may result. Use the lockout levers on the control levers to prevent the levers from moving to these positions.*

Observe the following to further protect the tractor and equipment:

- Do not open any bypass valve in the equipment or motor. Use the flow control valve to control the rate of flow or speed of the motor.
- Do not hold the remote control valve lever to operate the equipment. If the detent will not hold the lever in the retract position, check the equipment for proper adjustment or contact your dealer for assistance in adapting the equipment to suit the tractor.
- To ensure optimum hydraulic oil cooling, operate continuous flow equipment at the highest flow setting (by use of the flow control valve) and lowest engine speed that will give the required machine performance and speed.

## Hydraulic Motor Applications

The hydraulic system is a load sensing, pressure and flow compensating system. Pressure and flow are regulated by a load sensing line from the implement valve. For proper and efficient use of the system, low volume open center hydraulic motors or closed center system motors with restricting orifices removed and bypass valve closed should be used. Motor speed must be regulated with tractor implement valve flow control rather than bypass valves and orifices at the motor. This will reduce heat buildup, save oil for other simultaneous operations of the implement valve, and increase system reliability.

1. Use hydraulic motors designed for closed center or pressure/flow load compensating hydraulic systems only. Do not use a hydraulic motor designed for open center hydraulic systems unless it is adapted for use by removing the inlet restrictor.
2. Be sure the hydraulic motor does not have restrictors in the ports or fittings.
3. Hydraulic motors rated at less than 37.85 L/min (10 US GPM) may be equipped with 12mm (1/2") ID hoses and standard (ASAE/SAE/ISO) couplers.
4. Hydraulic motors rated at greater than 10 US GPM (37.85 L/min) should be connected with 19 mm (3/4") hoses and (ASAE/SAE/ISO) couplers to prevent excessive restriction and heat generation.

## Low Pressure Return Circuit - Case Drain

A case drain line (1) is available to connect the return line from the hydraulic motor or implement to the coupler. This low pressure return circuit will reduce back pressure in the remote hydraulic return line which will result in more efficient hydraulic motor operation. The return circuit can also be used in applications where low return oil pressure is desired to improve implement operation such as orbit motor case drain lines.

**NOTE: Connectors and couplers are available from your Buhler Versatile authorized dealer.**

## Optional Hydraulic Equipment - 19 mm (3/4") Coupler Kit

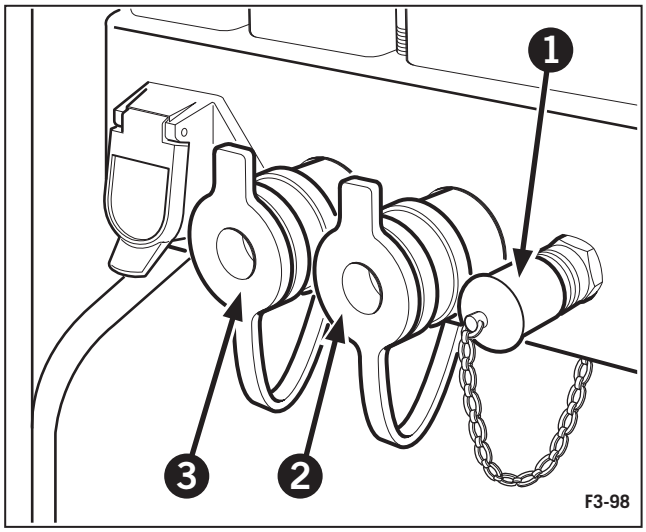
An optional coupler Kit: (BVI P/N: 86033182) is available for hydraulic motors that require 19 mm (3/4") couplers. The kit includes supply (2) and return (3) couplers that are fitted below the main valve coupler assembly.

## Operating remote equipment simultaneously or remote equipment and hydraulic lift simultaneously

**NOTE: Hydraulic pump output varies with engine speed. Oil flow will be relatively constant in the remote control valve circuits if the flow control valve is used to provide reduced oil flow, thus providing constant operating speed for hydraulic motors, etc. even if engine speed varies. Maintain the engine speed above the minimum required for simultaneous operation of all required circuits and vary ground speed by selection of the appropriate gear ratio.**

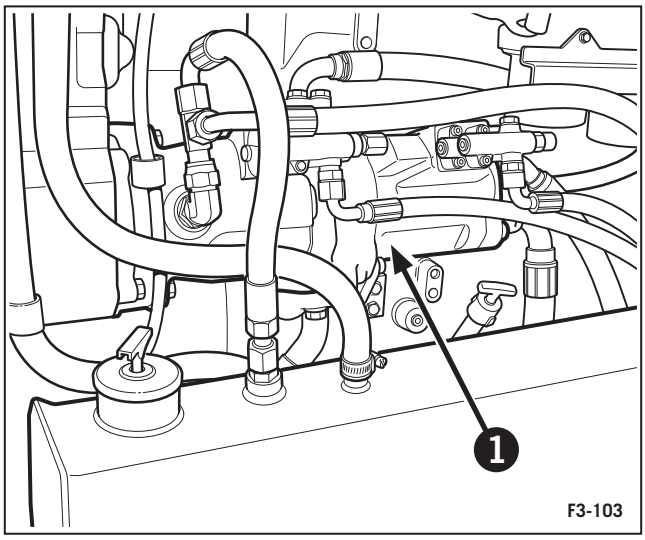
If operating two or more remote control valves simultaneously or remote valves and 3-point hitch, the flow control should be adjusted to provide a partial flow to each valve circuit. (The hydraulic system of the tractor is designed to provide adequate oil flow to the implement valve to satisfy system demand, regardless of the number of valve sections that are activated (i.e. running an air seeder fan motor and lifting the cultivator).

By adjusting the flow control of each valve section, the system performance will be maximized and will show up as proper performance of the implement functions.



## Remote Control Valve Operation - Electro-Hydraulics (EHR) (Optional)

Tractors are equipped with either a Standard Flow System or High Flow System.




## Standard Flow System - 4 to 6 control valves

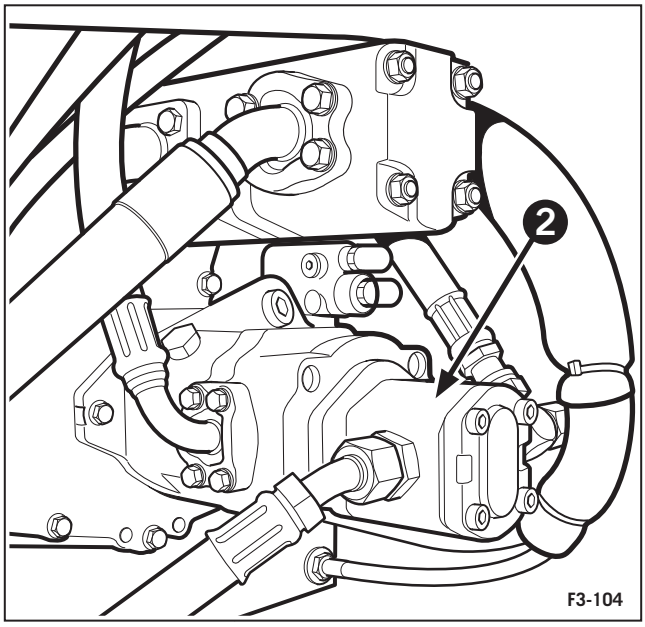
The standard flow system consists of dual variable displacement piston pumps located in tandem on the left side of the engine (1). The Pumps have a combined rating of 208 L/min (55 GPM). Pump 1 provides priority hydraulic supply to the steering and braking system followed by remote control valves 1 and 2. Pump 2 supplies remote control valves 3 to 6.

The remote control valve assembly is divided internally into two separate systems. One side of the system can be used for the operation of a high flow/low pressure requirement and the other side of the system can be used for a low flow/high pressure requirement such as found on certain hydraulic driven air seeders.

## High Flow System (Optional) - 6 or 8 control valves

Tractors equipped with the High Flow Plus system have a supplementary third, piston/gear pump mounted on the rear of the transmission case (2). The pump is rated at 95 L/min (25 GPM) providing a total system rating of 303 L/min (80 GPM).

The high flow system offers increased flow and triple system capability which will allow for more efficient operation of large individual hydraulic loads such as dual orbit motors and remote cylinders.




(Synchromesh transmission shown)

**WARNING: HYDRAULIC OIL ESCAPING UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SERIOUS INJURY.**

- **Use a piece of cardboard or paper, instead of your hand, to search for leaks.**
- **Stop the engine and relieve pressure before connecting or disconnecting lines.**
- **Tighten all connections before starting the engine or pressurizing lines.**

**If any fluid is injected into the skin, obtain medical attention immediately or gangrene may result.**

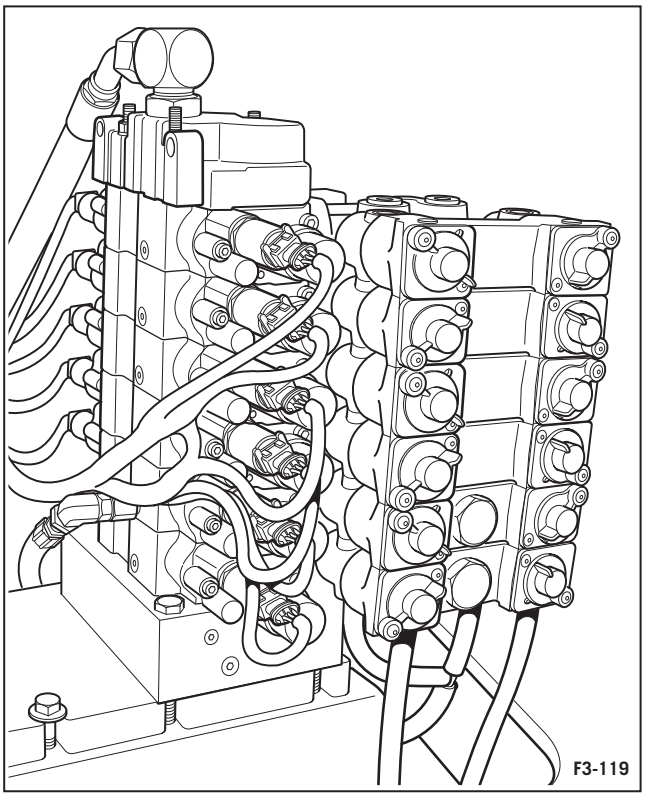
## Electro-Hydraulic Remote Control Valves

Remote control valves are available to operate external hydraulic cylinders, motors, etc. The valves are located at the rear of the tractor.

Tractors with a standard hydraulic system can be equipped with four or six remote control valves.

Tractors with a high flow hydraulic system can be equipped with six or eight remote control valves.

**NOTE: The total system flow is not available to operate any one single hydraulic circuit. The maximum available flow from any one remote valve is 95 ± 8 L/min (25 GPM± 2 GPM).**


F3-119

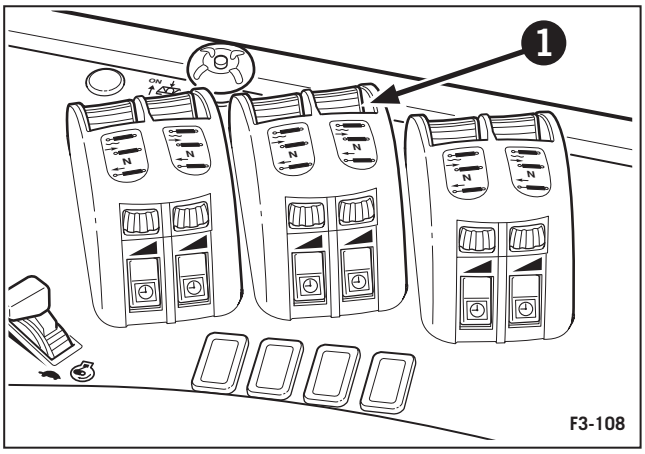
## Electro-Hydraulic (EHR) Control Pods

The EHR valves are operated by finger controlled levers located in the Control Pods (1) (two valves per pod).

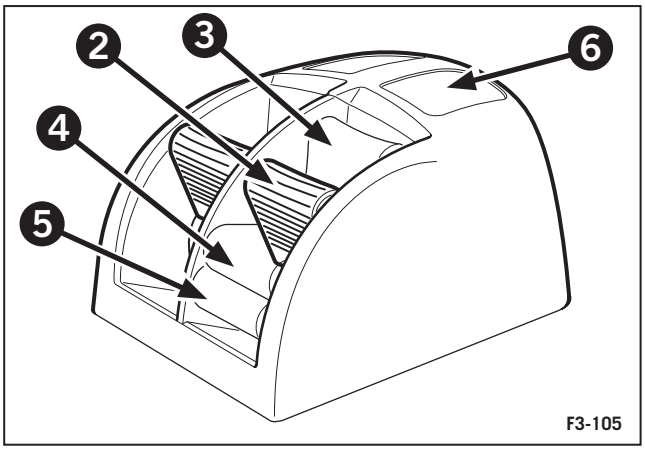
Each control lever is identified by a color coded decal (6) which corresponds with it's color coded remote valve.

The remote valve control levers have four positions: neutral, extend, retract and float.

Pull the lever back from the neutral position (2) to the "extend" (raise) position (3). From neutral, push forward to the "retract" (lower) position (4). Push the lever fully forward to the float position (5).



F3-108

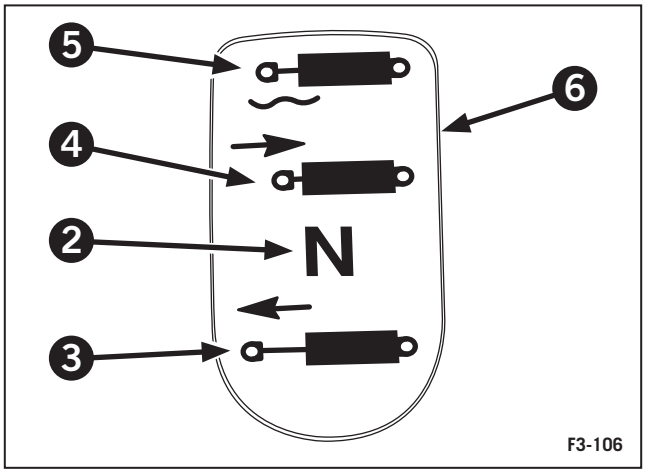


F3-105

Float will permit the cylinder to extend or retract allowing equipment such as scraper blades to "float" or follow the ground contour.

The "float" position is also used for retracting a single-acting cylinder and for the OFF position for hydraulic motors.

**NOTE: Do not hold the lever in the fully extend or retracted position after a remote cylinder has reached the end of its stroke. Doing so will overheat the oil and may lead to failure of hydraulic pump driveline components.**

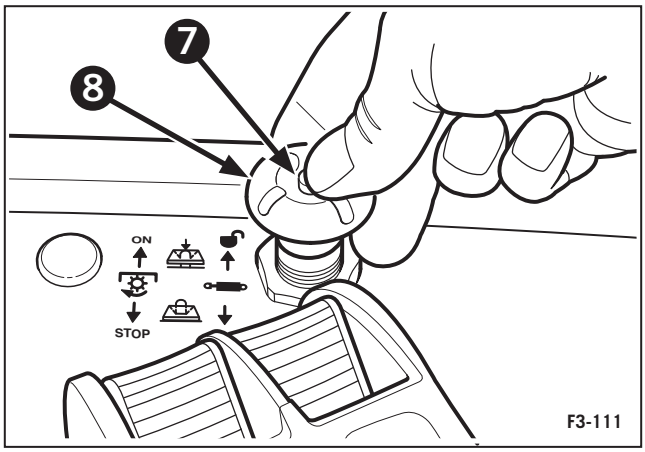


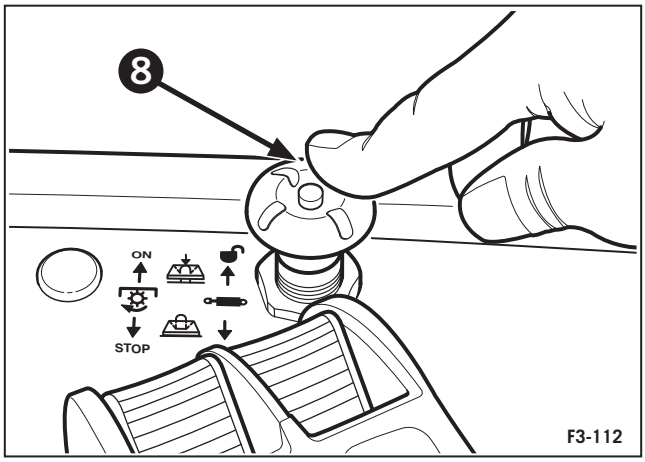

## Engagement Switch

The control levers and remote valves will operate only when the system is activated by the EHR engagement switch. To activate the EHR system, depress the center button (7) in the engagement knob (8) and pull the knob up until it stops, then release the center button and knob. The EHR system is operational whenever the engine is running.

To turn off the remote electro-hydraulics, depress the engagement switch knob (8) as shown.

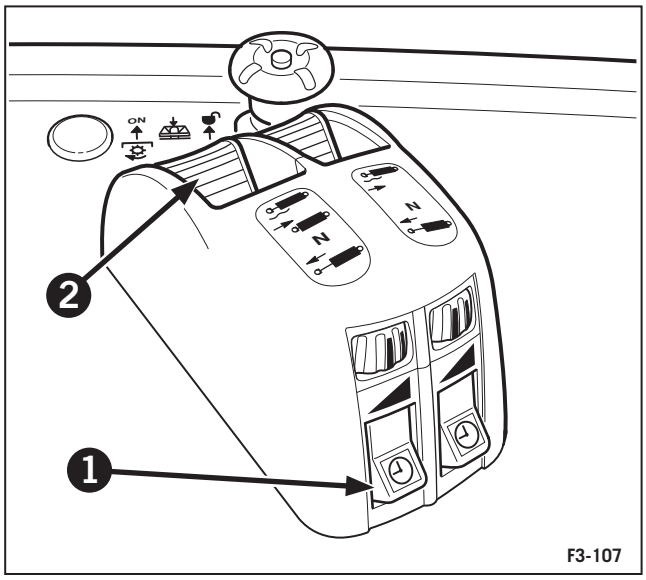
*IMPORTANT: The remote valve EHR engagement switch is provided as an isolator stop switch. It can be used to immediately stop operation of the rear remote hydraulics by quickly depressing the knob. The stop switch only controls the remote valves and has no effect on the three point hitch link operation, thereby isolating operation of the rear remote hydraulics from the three point hitch link operation.*



## Manual-Programmable Operation

Rocker switch (1) is used to select either the manual or programmed operation for each of the remote control levers.




### Manual Operation

Manual operation is provided primarily for the operation of continuous flow applications, such as hydraulic motors. To operate the remote EHR valves in manual mode, depress the top of rocker lever (1) as shown. In the manual mode, the control lever (2) can be operated in the four positions, neutral, extend, retract and float. When the control lever is left in either the extend, retract or float positions the control lever WILL NOT automatically return to the neutral position and shut the flow of oil off to the rear remotes regardless if the system reaches maximum pressure. The control lever must MANUALLY be returned to neutral.

In manual operating mode there is no automatic return to neutral. This allows for efficient operation of motors without nuisance shut downs when the remote valve inadvertently returns to neutral. When operating hydraulic motors it is important to always use the RETRACT position to activate the motor and the FLOAT position to stop the motor. Using the float position to stop the motor allows the motor to come to a gradual stop preventing any damage to the motor itself.

*IMPORTANT: Never use the neutral position from the extend or retract position to stop a hydraulic motor. Sudden hydraulic lock up of the system can cause extensive damage to the motor.*

*IMPORTANT: Do not operate the control levers in the manual mode when operating remote cylinders. When the cylinder has reached the end of its stroke the control lever will not return to neutral and the hydraulic system relief valve will be activated. This will overheat the oil and may lead to failure of the hydraulic and driveline components.*

### Programmable Operation

Programmable operation is provided primarily for operation of hydraulic cylinders. This feature allows the operator to program a time delay between when the control levers are activated and when they will automatically return to neutral. To operate the remote EHR valves in programmed mode, depress the bottom of rocker switch (1) as shown.

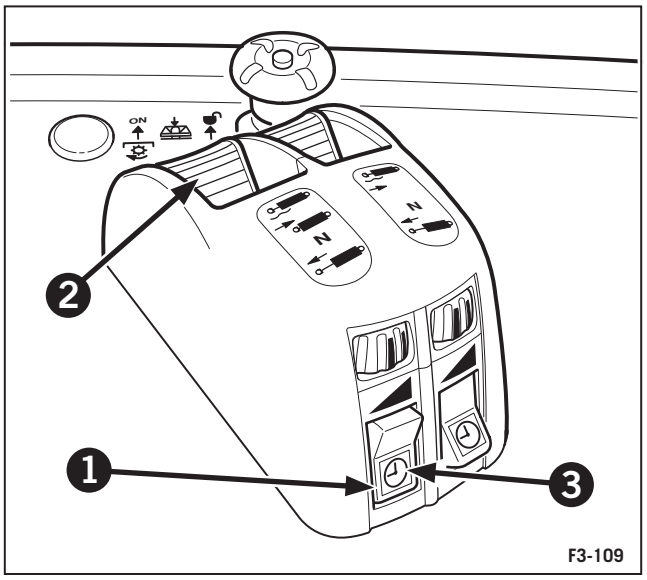
When the bottom of the switch is depressed, light (3) in the switch will begin to flash. This is an indication to the operator that a timed sequence must be programmed into the EHR controller. The light will continue to flash for ten seconds to allow time for the operator to begin the programming sequence.

If a program is not started within this ten second period, the controller will not accept any sequence and the remote control lever (2) will not remain latched in either the extend or retract positions.

To program the EHR system, first ensure that the cylinder hydraulic hoses are properly connected to the appropriate rear remote valve. Start the tractor engine and ensure the EHR engagement switch is up/on. Set the tractor engine RPM's at the normal operating speed in which the cylinder is to be operated. This is important as the programming of the control levers is based on a time interval to correspond to the time it takes the cylinder ram to extend as well as retract. Any change in engine rpm will have an effect on hydraulic flow (GPM) and therefore the time it takes the cylinder to extend and retract. The control lever timed program always remains the same regardless of oil flow (GPM) until reprogrammed. Therefore consistent operation is required for the system to operate correctly. Using the corresponding color coded programming switch (1) depress the bottom of the switch so light (3) begins to flash. While the light is flashing use control lever (2) to extend the cylinder. As soon as the control lever is activated the programming light will go on solid. Hold the lever until the cylinder is extended to the desired position and then return the lever to the neutral position. When the lever is returned to the neutral position the programming light will once again begin to flash indicating that the retract phase of the cycle needs to be programmed.

Next use lever (2) to retract the cylinder. As soon as the lever is activated the programming light will go on solid. Hold the lever until the cylinder is retracted to the desired position and then return the lever to the neutral position. After the second phase has been completed the programming light will go out indicating that the programming has been memorized. The lever timed operation is now programmed for the extend and retract operation of the cylinder.

Repeat the above sequence to program the remaining levers.




Programming of the lever can be performed in either sequence, extend/retract, retract/extend or one sequence only, extend or retract. The program for the individual lever (2) will remain the same even when the engine is stopped and the ignition switch is in the off position, as long as the programming switch (1) remains in the program position as shown. The maximum allowable time limit for any programmed timed operation is two minutes.

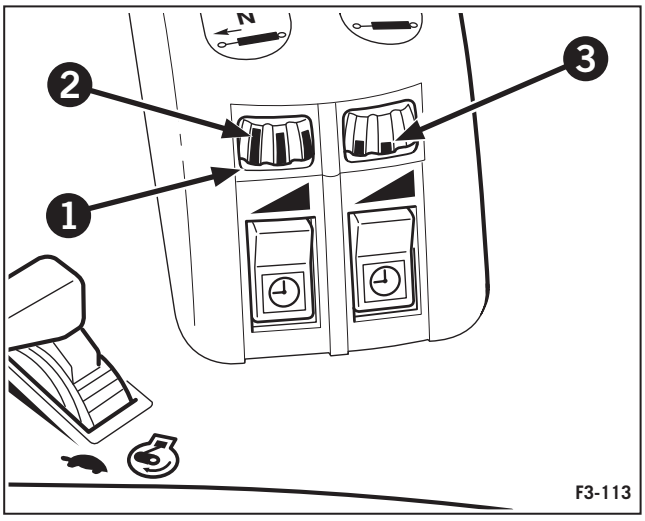
Programming the lever with the engine and hydraulic flow off is possible however accuracy of actual operation will be marginal. Whenever a hydraulic application is changed, the lever should be reprogrammed to suit the new operation.

When operating in the timed programmed mode, feathering of the hydraulic flow is possible by moving the lever variably anywhere between the neutral position and the fully opened position. The timed operation sequence only begins once the lever has been locked in the fully opened position.

Should the lever be moved to the float position no timed program is possible and the lever must be returned back to neutral manually.

### Flow Control Adjustment

Each remote valve has a flow control knob (1) to meter oil flow. The knob controls flow from 4 to 102 L/MIN (1 to 27 GPM). Turn the knob so the higher vertical decal stripe (2) is visible to increase the rate of oil flow. Turn the knob so the lower vertical decal stripe, (3) is visible to decrease the rate of oil flow.




**WARNING: BEFORE CONNECTING OR DISCONNECTING HYDRAULIC HOSES AT THE REMOTE CYLINDERS, RELIEVE THE PRESSURE IN THE CIRCUIT BY FIRST STARTING THE ENGINE AND THEN MOVE THE CONTROL SWITCHES FULLY FORWARD TO THE "FLOAT" POSITION. THEN STOP THE ENGINE.**

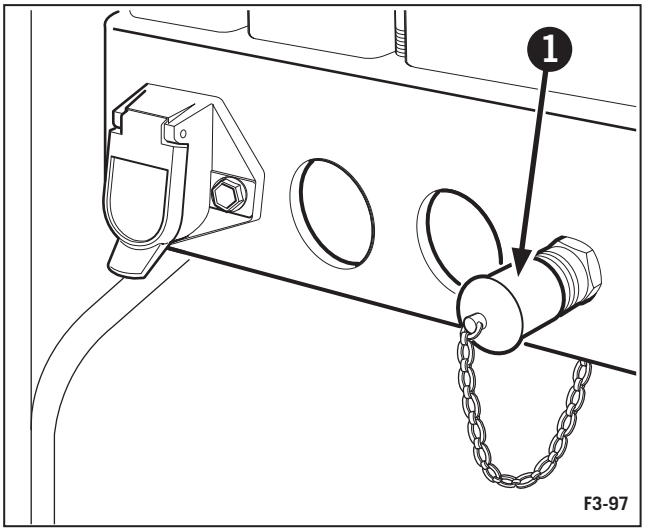
**MAKE SURE NO ONE WILL BE INJURED BY MOVING EQUIPMENT WHEN RELIEVING PRESSURE IN THE SYSTEM. BEFORE DISCONNECTING CYLINDERS OR EQUIPMENT, MAKE SURE THE EQUIPMENT OR IMPLEMENT IS SUPPORTED SECURELY.**

**NEVER WORK UNDER EQUIPMENT SUPPORTED BY A HYDRAULIC DEVICE BECAUSE IT MAY DROP IF THE CONTROL IS ACTUATED (EVEN WITH THE ENGINE STOPPED) OR IN THE EVENT OF HOSE FAILURE, ETC. ALWAYS USE A SECURE SUPPORT FOR EQUIPMENT WHICH MUST BE SERVICED WHILE IN THE RAISED POSITION. MAKE SURE THAT OIL CONTAINED WITHIN THE REMOTE CYLINDERS IS CLEAN AND IS OF THE CORRECT GRADE.**

### Low Pressure Return Circuit - Case Drain

A case drain line (1) is available to connect the return line from the hydraulic motor or implement to the coupler. This low pressure return circuit will reduce back pressure in the remote hydraulic return line which will result in more efficient hydraulic motor operation. The return circuit can also be used in applications where low return oil pressure is desired to improve implement operation such as orbit motor case drain lines.

**NOTE: Connectors and couplers are available from your Buhler Versatile authorized dealer.**



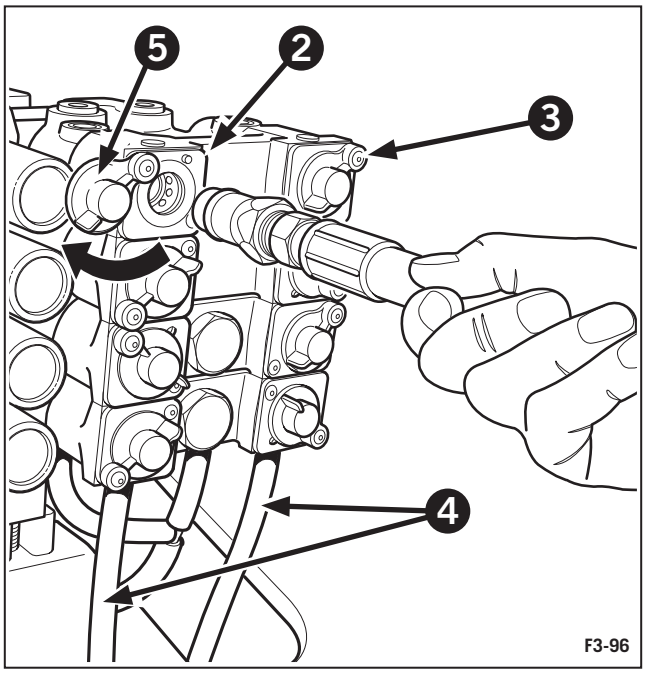
## Hydraulic Quick Couplers

Each remote valve section has a pair of hydraulic quick couplers located at the rear of the tractor. These are color-coded with the hydraulic control levers in the cab. The couplers are self-sealing and leverless and require no tools for connecting and disconnecting hoses. The couplers also permit hoses to detach themselves from the coupler should an implement become disconnected from the tractor.

The left section couplers (2) are identified by an “extend/raise” symbol on the couplers dust cover and the right section (3) are identified by a “retract/lower” symbol on the couplers dust cover.

Excess oil drain hoses (4) are attached to each coupler to drain away oil released during connection and separation of the couplers.

The couplers will accept standard (1/2") SAE or ISO tips. The couplers can be connected or disconnected under pressure.




## Coupler Connection

1. To connect couplers, wipe the outside of the coupler and the tip of the implement to remove any dust and minimize contamination.
2. Swing the dust cover (5) aside and insert the hose into the coupler, making sure the hose is properly seated.
3. Actuate the remote valve to supply hydraulic pressure which will complete the hydraulic coupling of the tractor and implement.

To ease removal and installation of the couplers, relieve the pressure in the system. Securely support the implement. Make sure no one will be injured by moving equipment when relieving pressure in the system. Move the control switch to the float position with the engine running. This will relieve the pressure. Turn the engine off with the control switch still in float. After the engine is shut down return the control switch to the neutral position. The couplers can now be connected or disconnected with minimal pressure and effort.

## Connecting Single-acting Cylinders

Connect the hose from a single-acting cylinder to the left extend/raise coupler on the remote control valve, as previously described.

To extend a single-acting cylinder, pull the lever back to the “extend” position.

Manually return the lever to the neutral position to stop the cylinder before it is fully extended or allow the valve to return to neutral automatically when the cylinder reaches the end of its stroke and timed operation.

To retract a single-acting cylinder, move the lever forward to the “retract” position.

*IMPORTANT: Always use the “float” position to lower a single-acting cylinder. The “retract” position is for double-acting cylinders only.*

## Connecting Double-acting Cylinders

Connect the feed hose from a double-acting cylinder to the left extend/raise coupler on the remote control valve and the return hose to the right retract/lower coupler, as previously described. To extend a double-acting cylinder, pull the lever back to the “extend” position.

To retract a double-acting cylinder, push the lever forward past neutral to the “retract” position.

Further forward movement of the lever will select “float” which will allow the cylinder to extend or retract freely. This feature is very helpful when carrying out work with equipment such as scraper blades and loaders.

## Operating Continuous Flow Hydraulic Equipment

Continuous flow hydraulic equipment (e.g. hydraulic motors) should be connected to the 3RD remote control valve couplers with the pressure hose connected to the right retract coupler and the return hose connected to the low pressure return circuit as described previously in this section.

Use the flow control to regulate the motor speed. The #1 flow control should be adjusted to regulate the orbit motor speed. If the flow control is open too far, the 3-point hitch and other remote valves will slow down or stop. This will ensure that the hydraulic system will only supply the oil required by the motor. Extra pump capacity will not be used except when other remote valve sections are operated.

With the remote lever fully forward in the “float” position, the motor will be stationary. The hydraulic motor will operate if the lever is pushed forward to the “retract” position. To stop the motor, move the lever from the retract position to the float position. In the float position the motor will be able to stop slowly, which will not damage the motor.

*IMPORTANT: When operating continuous flow equipment, the remote control valve lever must not be moved rearward to the neutral or raise positions as damage to the equipment may result.*

Observe the following to further protect the tractor and equipment.

- Do not open any bypass valve in the equipment or motor. Use the flow control to regulate the rate of flow or speed of the motor.
- Do not hold the remote control valve lever to operate the equipment.
- To ensure optimum hydraulic oil cooling, operate continuous flow equipment at the highest flow setting (by use of the flow control) and lowest engine speed that will give the required machine performance and speed.
- Do not use the #1 valve circuit to operate continuous flow equipment that requires more than 137.90 bar (2,000 PSI). The #1 flow control may shut the rest of the system down if the continuous pressure is too high. Connect these loads to any other valve section.

## Hydraulic Motor Application

1. Use hydraulic motors designed for closed center or pressure/flow load compensating hydraulic systems only. **Do Not** use a hydraulic motor designed for open center hydraulic systems unless it is adapted for use by removing the inlet restrictor.
2. Rating: Hydraulic motors up to 1.26 L/SEC (20.0 GPM) @ 15.50 MPa (2248 PSI) can be used.
3. Be sure the hydraulic motor does not have restrictors in the ports or fittings.
4. Hydraulic motors less than 0.63 L/SEC (10 GPM) may be equipped with 12.7 mm (1/2") ID hoses and standard (ASAE/SAE/ISO) couplers.
5. Hydraulic motors greater than 0.63 L/SEC (10 GPM) should be connected with (3/4") hoses and (ASAE/SAE/ISO) couplers to prevent excessive restriction and heat generation.
6. It is recommended to use the low pressure return line to reduce back pressure in the remote hydraulic return line which will result in more efficient hydraulic motor operation. The low pressure return circuit can also be used in applications where low return oil pressure is desired to improve implement operation such as with orbit motor case drain lines, or implement mounted hydraulic control valves.

## Operating remote equipment simultaneously or remote equipment and hydraulic lift simultaneously

**NOTE: Hydraulic pump output varies with engine speed. Oil flow will be relatively constant in the remote control valve circuits if the flow control is used to provide reduced oil flow, thus providing constant operating speed for hydraulic motors, etc. even if engine speed varies. Maintain the engine speed above the minimum required for simultaneous operation of all required circuits and vary ground speed by selection of the appropriate gear.**

If operating two or more remote control valves simultaneously or remote valves and hydraulic lift, all the flow control knobs should be adjusted to provide a partial flow. Otherwise, all the available flow may be directed to the full flow circuit when the pressure in that circuit is less than that of the other circuits in use.

## Bleeding Remote Cylinders

When connecting a cylinder with trapped air, i.e. a new cylinder, one that has been out of service or one that has had the hoses disconnected, it will be necessary to bleed the cylinder to remove the air.

With the hoses connected to the remote control valve couplers at the rear of the tractor, position the cylinder with the hose end uppermost and extend and retract the cylinder seven or eight times using the remote control switch. Check the hydraulic oil tank level before and after operating the remote cylinder.

## Wheels, Tires and Articulation Blocks

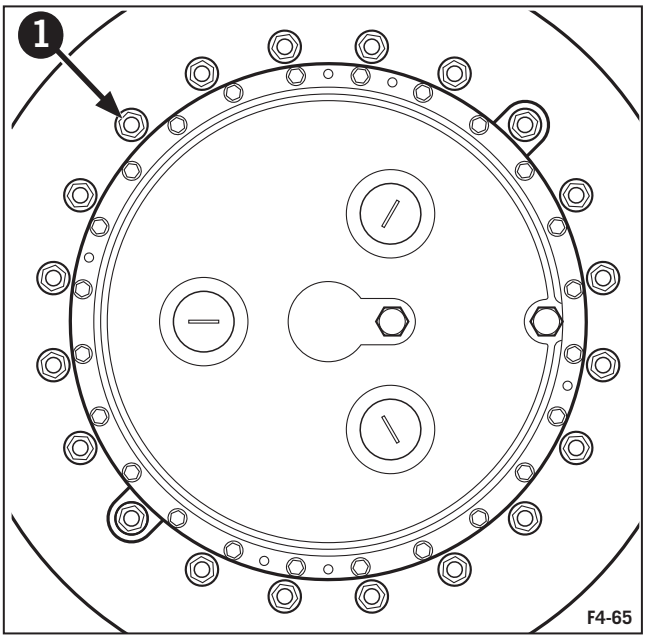
### Wheel Installation

Determine the tire size and wheel configuration to be used on the tractor and follow the proper installation procedure from the methods detailed below.

**CAUTION: USE EXTREME CAUTION WHEN REMOVING AND HANDLING WHEELS. USE A CARRIER FOR HANDLING WHEELS.**

**CAUTION: STOP THE ENGINE AND ENGAGE THE PARK BRAKE AND ARTICULATION LOCK BEFORE WORKING ON TIRE INSTALLATION.**

**CAUTION: BLOCK THE WHEELS OF THE TRACTOR WHEN JACKING UP THE AXLES.**




### Single wheels

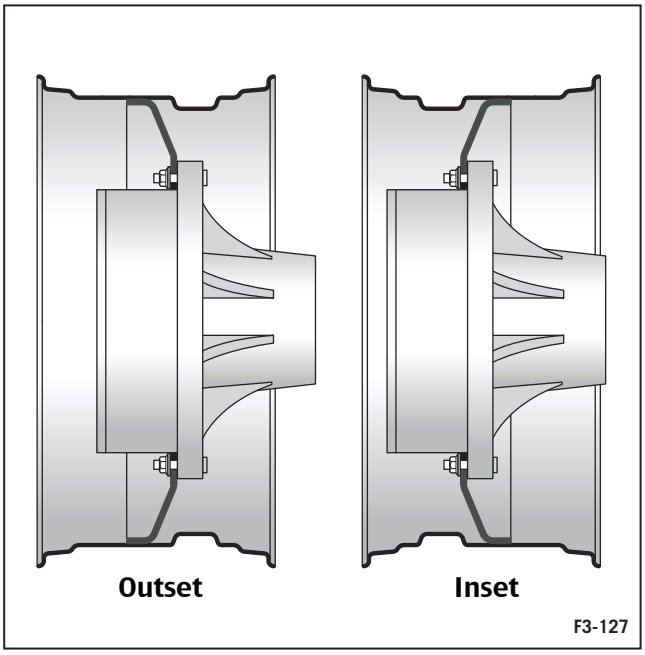
Tire configurations approved for single wheel use may be positioned with the dish of the wheel inset or outset depending upon the operator's choice.

**CAUTION: WITH THE WHEEL INSET, THE TRACTOR WILL BE LESS STABLE ON HILLSIDES. FOR HILLY TERRAIN, IT IS RECOMMENDED THAT THE TIRES BE OUTSET.**

Torque the wheel mounting nuts (1).

**Torque Value:** 710 N·m (525 in-lbs.)

**Wrench size:** 1¼" (1.250")




**Single Wheel Configurations**

### Standard and Row Crop Drum Style Dual Wheels

a. Row crop drum duals have a longer drum on the outer wheel to give proper spacing for 30" row crops. Follow the listed procedure for both styles of duals.

b. Put 51 mm - 76 mm (2" - 3") wood blocking under the wheel to be dualed.

c. There are 20 nuts (1) that retain the inner wheel to the planetary hub. Remove 18 of the 20 nuts from the wheel, leaving 2 nuts (2) 180° apart on the wheel as shown. This will retain the rim to the hub and fit into the notches (3) on the outside duals rim. Choose the two remaining nuts carefully so that the valve stem of both wheels are accessable (4) for easier tire inflation pressure maintenance later.

d. Using an appropriate lifting device, lift the outside wheel rim and pilot it onto the planetary studs. Make sure that the two (3) notches in the outer wheel rim align with the two nuts remaining on the inner wheel rim.

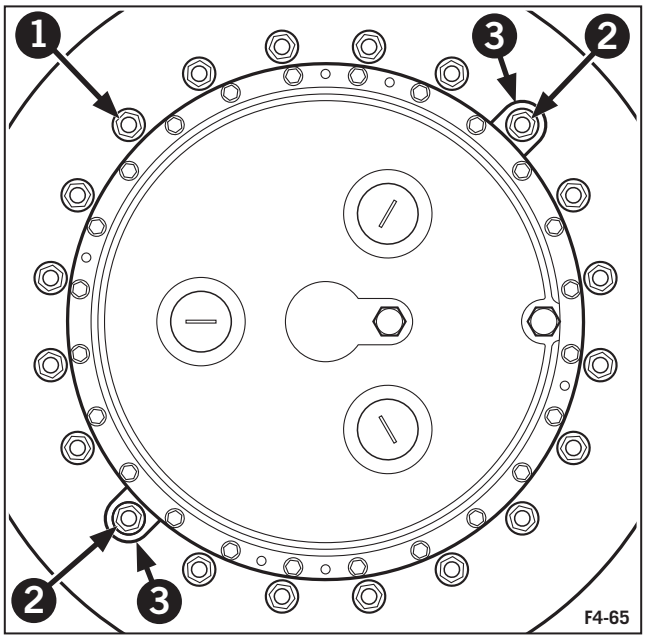
**DANGER: THE DRUM-STYLE DUAL WHEELS ARE EXTREMELY HEAVY AND WILL EASILY TIP TOWARD THE DRUM END OF THE WHEEL. USE AN APPROPRIATE LIFTING DEVICE AND SAFETY CHAINS WHEN HANDLING DRUM-STYLE WHEELS.**

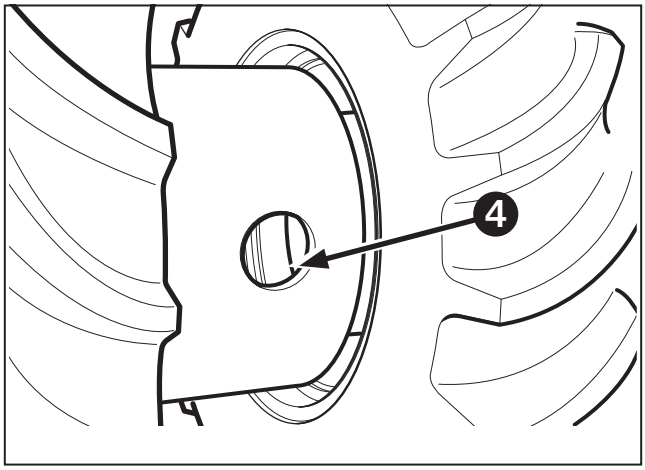
e. Reinstall the 18 nuts (1) removed in Step c.

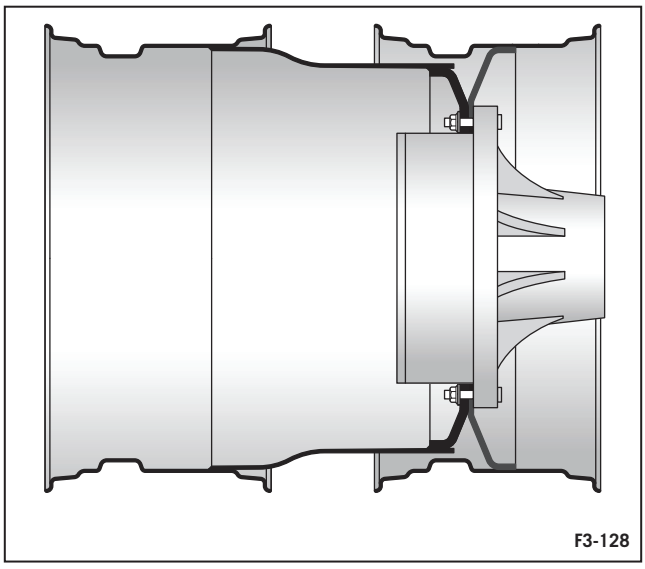
f. Torque the wheel nuts to 710 N·m (525 ft-lbs).

g. Repeat the above procedure for the other remaining wheels.

h. Drive the tractor, steering lock to lock. Park the tractor and recheck the torques on the wheel nuts as described in Step f.




**Dual Wheel configuration**

### Standard Drum-Style Triple Wheels

a. For triple tire configuration, it is only permissible to install the inner wheel with the rim inset (narrow tread width).

b. Put a 51 mm - 76 mm (2"-3") wood block under the wheel to be tripled.

c. There are 20 nuts (1) that retain the inner wheel to the planetary hub. Remove 18 of the 20 nuts from the wheel, leaving 2 nuts (2) 180° apart on the wheel as shown. This will retain the rim to the hub and fit into the notches (3) on the center wheel's rim. Choose the two remaining nuts carefully so that the valve stem of both wheels are accessable (4) for easier tire inflation pressure maintenance later.

d. Using an appropriate lifting device, lift the center wheel rim and pilot it onto the planetary studs. Make sure that the two slots in the center wheel rim align with the two nuts remaining on the inner wheel rim.

**DANGER: THE DRUM-STYLE DUAL AND TRIPLE WHEELS ARE EXTREMELY HEAVY AND WILL EASILY TIP TOWARD THE DRUM END OF THE WHEEL. USE AN APPROPRIATE LIFTING DEVICE AND SAFETY CHAINS WHEN HANDLING DRUM-STYLE WHEELS.**

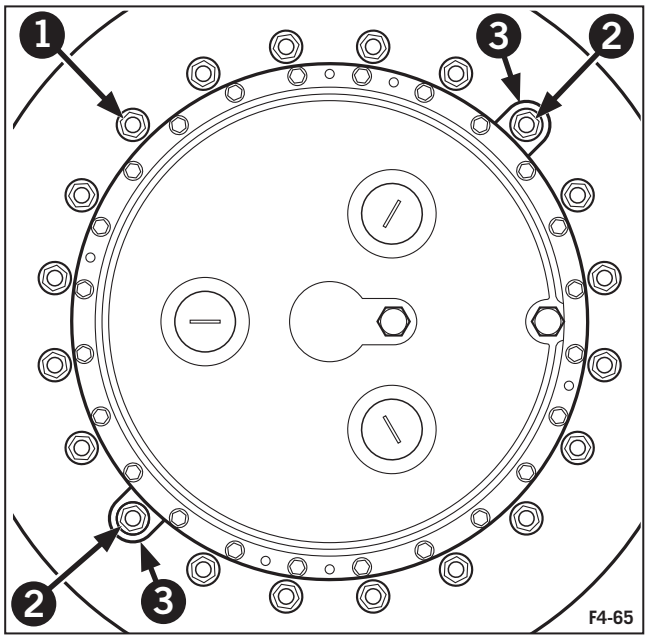
**NOTE: Do not mix up the center wheel with the outer wheel. The center wheel has a dishwelded (5) in the inner diameter to bolt the outside drum to.**

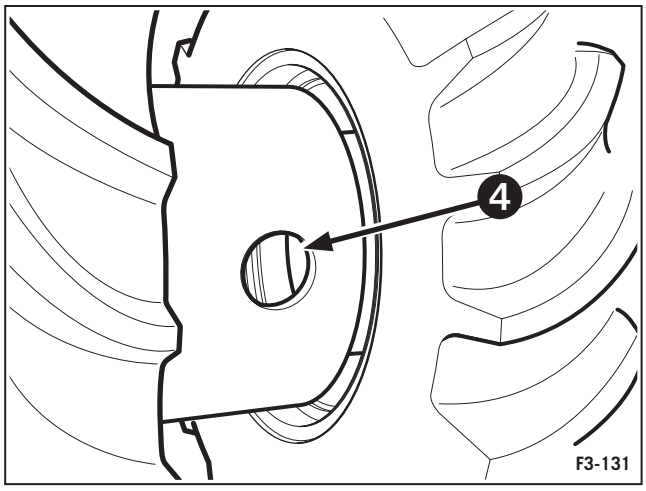
**NOTE: Install the wheels so that both inner and center treads face the same direction.**

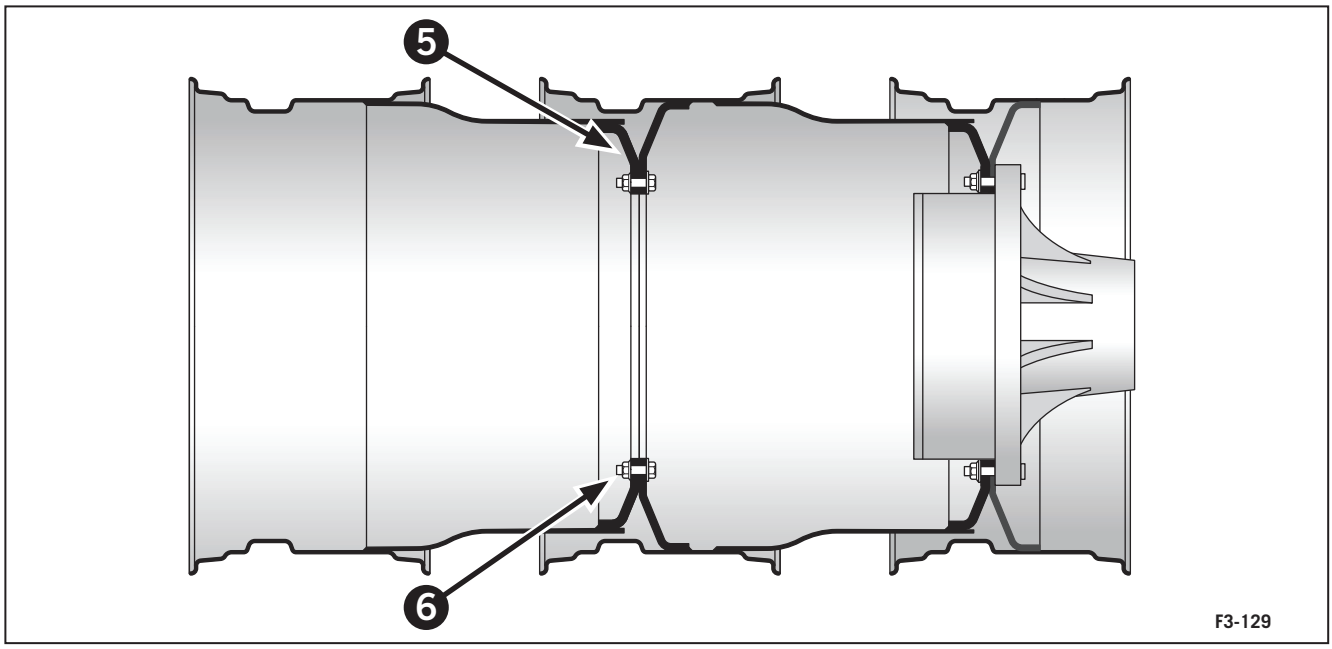
**NOTE: Install the center wheel so that the valve stem is in line with the inner and outer wheels.**

e. Reinstall the 18 nuts (1) removed in Step c. Torque the wheel nuts to 710 N·m (525 ft-lbs).

f. Using an appropriate lifting device, lift the outer wheel and pilot it into the center wheel. Line up the holes in the center wheel dish with the holes in the outer wheel drum.






**Triple Wheel Configuration**

**NOTE: Install the wheels so that both center and outer treads face the same direction.**

g. Install the twenty cap screws (6), washers and nuts through the wheel rims. Torque the nuts to 710 N·m (525 ft-lbs).

**NOTE: The drums on the center and outer wheels have large cutouts in them to assist in installing the drum hardware.**

h. Repeat the above procedure for the other three sets of triple wheels.

i. Drive the tractor, steering from lock to lock. Park the tractor and recheck the torques on the inner and outer wheel nuts as detailed in Steps e and g.

## Tire Selection

Selecting the proper size and type of tires is important in achieving maximum tractor efficiency. Various sizes and types of tires are available for your tractor. Refer to table below for approved tire sizes and articulation block configurations for your tractor.

**NOTE: If a specific size of tire or tire configuration is not listed under a particular model, do not attempt to install that size tire.**

The tires selected for your tractor must be able to support the weight of the tractor and equipment. The tires must also be able to provide adequate tire traction to utilize the tractor engine horsepower and turn it into useful drawbar horsepower.

You will have to adjust the ballast, tire pressure and tractor weight split between the front and rear axles for various loads and conditions to achieve the best ride and performance.

Always maintain the proper air pressure in the tire to carry the load. Do not over inflate radial or bias ply tires. Radial tires will work with LOWER air pressures. Radial tires will show up to 20% sidewall deflection or bulge when properly inflated.

The force that enables the tires to drive the tractor must be transmitted through the tire sidewalls. The tires work best when all the tires on a given axle are working at the same rate.

Think of them like a shock absorber; they must respond the same way to share the load equally.

## Factors Determining Best Tire Performance

**Good Performance**

- Proper air pressure for the load
- Proper sidewall deflection
- 8%-15% wheel slip
- Proper tire size for expected load
- Less than 50% fill of liquid ballast
- Maintaining equal tire pressure in all tires on a given axle

**Poor Performance**

- High or low air pressure
- Stiff sidewalls
- High or low wheel slip
- Overloaded or underloaded tire
- Treating tires on an axle differently.

Refer to “Ballasting” later in this section for proper tractor weight procedures once the tire size has been selected.

## Tire Configurations

| Tire Size | Articulation blocks | |
|---|---|---|
| | Duals | Triples |
| 20.8R42 R1W | None | 38 deg |
| 520/85/42 R1W | None | 38 deg |
| 520/85R46 R1W | None | 38 deg |
| 620/70R42 R1W | None | 33 deg |
| 650/65R42 R1W | None | 33 deg |
| 650/85R38 R1W | None | 33 deg |
| 710/70R38 R1W | None | N/A |
| 710/70R42 R1W | None | N/A |
| 800/70R38 R1W | 38 deg | N/A |
| 850/60R38 | 38 deg | N/A |
| 900/50R42 R1W | 38 deg | N/A |

## Articulation Blocks

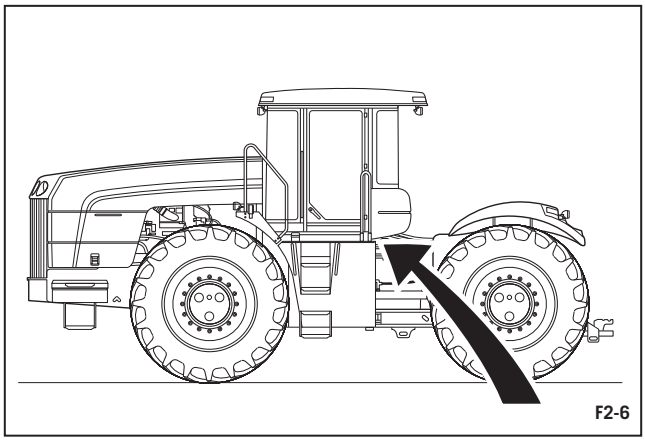
Each individual tire size requires a specific articulation block to be used with that tire size.

Refer to the table opposite for the maximum articulation angle allowed based on tire selection.

There are three possible articulation angles used on the tractor. They are 42°, 38° & 33°. The following information shows what each articulation block configuration looks like. The articulation block mounting plates are located on either side of the front frame adjacent to the fuel tanks.

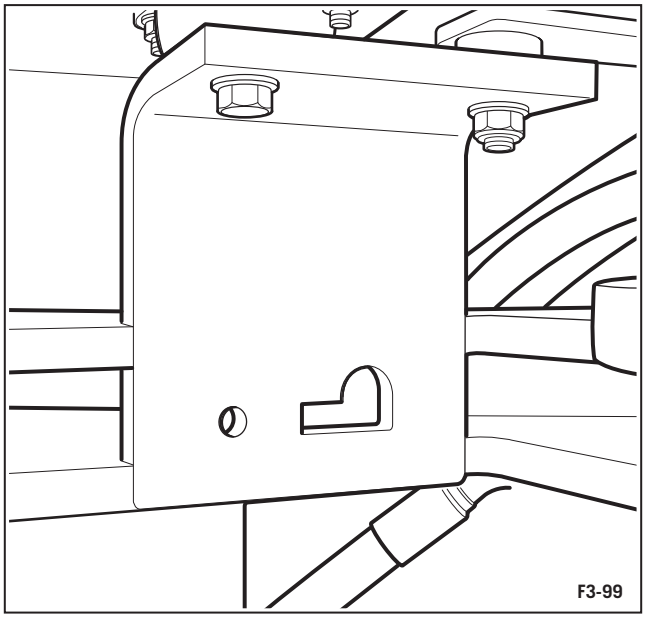
*IMPORTANT: Install the proper articulation blocks on the tractor before the dual or triple wheels are installed on the unit to prevent any accidental damage from occurring.*

**NOTE: Any tractor that is equipped with a PTO option requires a 38° articulation block kit be installed on it. If the tire size of the tractor requires a 33° articulation kit, use those kits instead of the 38° kit for a PTO option.**

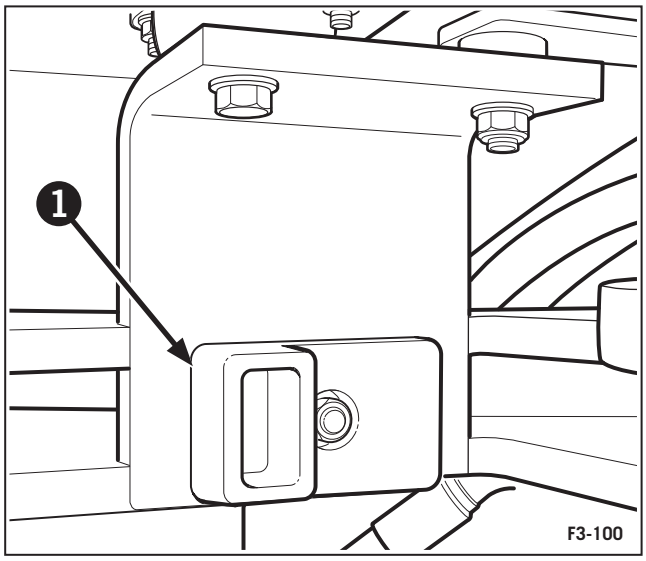

F2-6

**WARNING: IMPROPER ASSEMBLY OF THE ARTICULATION BLOCKS CAN CAUSE THE TRACTOR WHEELS TO CONTACT THE FUEL TANK WHEN TURNING. MAKE SURE THE ARTICULATION ANGLE IS WITHIN LIMITS.**

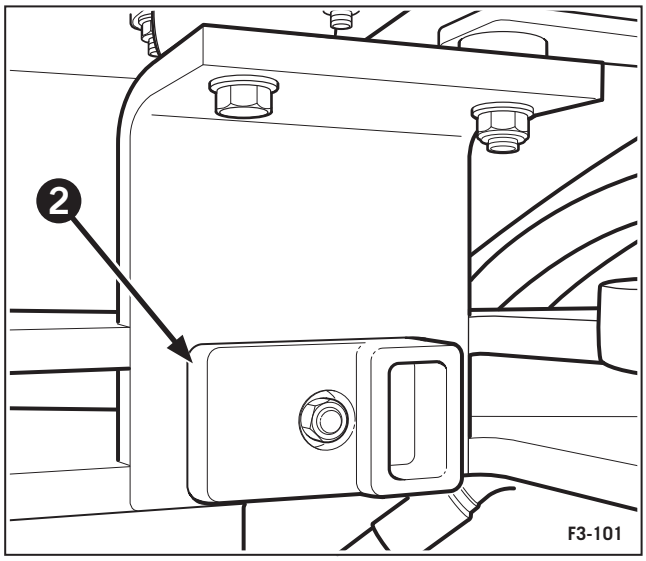
42° - The maximum turning angle allowed by the steering cylinders is 42°. If your tractor tire size allows an angle of 42°, no articulation blocks are required.


F3-99

38° - To limit the articulation angle to 38°, use the articulation blocks with the thick section toward the outside (1).




33° - To limit the articulation angle to 33°, use the articulation blocks with the thick section to the inside (2).



# Ballasting

## Basic Rules of Thumb for Ballasting

1. When using fluid, put equal amounts in each tire on a given axle.
2. Ballast tractors to a minimum amount as a starting point.
3. For light-duty application, weight distribution front to rear is not as important as in heavier draft applications.
4. At maximum operating weight, the correct recommended weight distribution of 55/45 (front/rear) for drawbar applications and 65/35 (front/rear) for 3-point hitch applications is essential.
5. Set tire inflation pressures based on weight carried by each wheel. Do not go below 55 kPa (8 PSI) on radial tires.

## Application and Ballasting

Buhler Versatile 4WD tractors work in many different conditions and operations. Therefore it is up to the operator to ensure that the tractor is performing at its peak in its specific operations.

Unlike crawler-type tractors, these tractors are designed to operate at speeds of 7.2 KPH (4.5 MPH) and higher. At these speeds, they are more productive and are less likely to have mechanical breakdowns.

Many factors determine a tractor's productivity. Factors such as the size of the load, tractor wheel slip, tire rolling resistance, tractor operating weight and tractor weight distribution all must be taken into consideration when operating this tractor.

## Loads Matched to the Tractor

Do not operate the tractor with heavy implement loads that need the use of gears in the lower ranges. The tractor is made for continued field operation at the rated HP and ground speed of 7.2 KPH (4.5MPH) and faster with a load that is correctly matched to the tractor. If you operate the tractor with too much ballast and pull too heavy a load for a long period of time in the low gears, you will cause damage to the drivetrain and decrease tire life.

The best traction occurs when wheel slip is between 8% and 15% for drawbar work and 13% to 15% for 3-point hitch work.

The extra 5% is to compensate for additional tire distortion caused by weight transfer from the hitch.

If possible, remove ballast when not needed for lighter loads.

Pull lighter loads at a faster speed to do more work and increase efficiency. Do not overweight the tractor to pull very heavy loads.

If the implement cannot be pulled at the needed depth at 7.2 KPH (4.5 MPH) or greater, the implement is over matched for your tractor.

The best guide to follow in ballasting is to not have the full load wheel slippage fall below 12%.

This amount of slippage is your best protection against overloading.

## Wheel Slip

Wheel slippage is a vital consideration in any farming operation. Too much slippage represents lost time and wasted production. Too much wheel slippage is a major cause of wheel traffic-induced soil compaction. Too little can result in reduced reliability of the drivetrain.

Strive for 8% to 15% wheel slippage on a 4WD.

Wheel slip is defined as the amount of tire rotation "wasted" during one complete rotation of a tire. Wheel slip is not a deterrent to tractor operation. It is a necessary function of the tires and helps prevent damage to the tractor drivetrain due to tractor overload.

Every time a tractor wheel makes a revolution, the wheel covers a certain distance. On a very firm dry surface (i.e., asphalt), the distance covered in one tire revolution will be very close to the actual circumference of the tire. On a very loose surface (i.e. sand), the distance covered in one tire revolution will be significantly less than the actual circumference of the tire. This "wasted" distance is referred to as wheel slip.

Every tire contact on every surface will produce some amount of wheel slip. If there were no wheel slip, significant drivetrain wear would be present and damage to the tractor may occur. Ballasting the tractor and operating with the proper size and inflated tires will maintain wheel slip at a manageable level (8%-15%).

## Measuring Wheel Slip

One of the functions of the Tractor Performance Monitor is to measure wheel slip automatically and inform the operator if the wheel slip is at an unacceptable level based on a pre-programmed value set by the operator. For more information on the wheel slip feature, see "Tractor Performance Monitor" earlier in this section.

If the tractor does not have the optional Tractor Performance Monitor, wheel slip can be measured as follows:

1. Put a reference mark on the side of the tractor rear tire.
2. Operate the tractor with the implement in the ground.
3. While the tractor is moving, have an assistant put a marker on the ground outside the implement width where the reference mark on the tire comes down to the ground.

**DANGER: MAKE SURE THE ASSISTANT IS CLEAR OF THE IMPLEMENT AND TRACTOR DURING WHEEL SLIP MEASUREMENTS.**

4. Continue to move along with the tractor and count ten wheel revolutions. Put a second marker on the ground outside the implement width where the reference mark on the tire comes down to the ground for the tenth time.
5. Lift the implement out of the ground. Put the tractor in position next to the first ground marker and put a new reference mark on the rear tire to aligned with it.
6. Operate the tractor, with the implement raised, from the first ground marker to the second ground marker. Count the number of wheel revolutions between the two ground markers.
7. The tire will require fewer revolutions to cover the same distance because of less slip. The following table will determine the percent of wheel slip from the number of wheel revolutions:

When you have too much ballast installed on the tractor, you will see the clear shape of the tire bar in the ground which is an indication of no slippage. With too little ballast, the tire barmarks will not show because of the tire slippage.

| Revolutions of Wheel | Slip % |
|---|---|
| 9-1/2 | 5 |
| 9 | 10 |
| 8-1/2 | 15 |
| 8 | 20 |
| 7-1/2 | 25 |
| 7 | 30 |

**Too Little Ballast**

1. Excessive wheel spin
2. Power loss
3. Tire wear
4. Excessive fuel consumption
5. Lower productivity

**Too Much Ballast**

1. Increased drivetrain load and power operating cost
2. Power loss
3. Tire strain
4. Soil compaction

5. Lower productivity, i.e., more power required to move the overloaded tractor, allowing less power available to pull the implement.

## Rolling Resistance

The greatest loss of engine power occurs in the area of traction factors such as rolling resistance and wheel slippage. Those losses will occur in any and every practical traction situation.

Therefore, choosing the right amount of weight is the first step. Too little weight permits excessive wheel slippage while too much weight increases soil compaction and rolling resistance. Rolling resistance is the power required to roll the tractor's tires forward with no load except weight.

### Tractor Weight Distribution

Although Buhler Versatile 4WD tractors are manufactured with an approximate weight distribution of 65% - 67% over the front axle and 33% - 35% over the rear axle, the intent of the design is to have the tractor operating in the field with an ideal 50/50 dynamic weight distribution.

The benefits of operating a tractor in the field under the ideal 50/50 dynamic weight distribution are:

1. The work is divided equally between the axles, allowing a more even distribution of work and load.
2. Compaction is lessened since the axles are the lightest force possible on the soil. If a 13,636 kg (30,000 lbs) tractor has a 50/50 split, each axle exerts a force of 6,818 kg (15,000 lbs). A 60/40 split would create an 8,182 kg (18,000 lbs) force under the heavier axle, increasing the compaction by 1364 kg (3000 lbs).
3. Maximum traction, with the least rolling resistance, is gained by distributing the load equally between both axles.
4. With the total tractor weight equally divided (under load) on all four wheels, you increase reliability by spreading the torque output of the tractor equally to all four wheels. The greatest torque always goes to the wheels with the most weight.

**NOTE: The tractor has a maximum axle weight capacity:**

| Model | Maximum continuous weight per axle |
|---|---|
| 435 | 27,000 lbs. |
| 485 | 30.000 lbs. |
| 535 | 32,000 lbs. |

(Based on 100 lbs/hp x 60%)

## Calculation of Ballast

The following information is provided as a guide for proper ballasting:

### Shipping Weight and Fore/Aft Ratio

The shipping weight of the tractor will be approximate distributed at 65% - 67% on the front axle and 33% - 35% on the rear axle.

**Do not assume that every tractor will come from the factory with this weight distribution.**

Various options and wheel packages will significantly change the weight of the tractor. Determine the shipping weight BEFORE any ballast is added to the tractor by weighing the tractor on a scale. This is the most accurate method of determining actual tractor weight and ballasting the unit correctly. Possible locations of a scale of adequate size to weigh the tractor would be a feed/fertilizer store, asphalt plant, gravel quarry, grain elevator, etc.

**NOTE: There is an additional method of calculating the shipping weight of the tractor using calculated weight from theoretical value charts located in the Section 6 of this manual. Weighing the tractor on a scale is preferred.**

When weighing the tractor, pull the front axle on the scale first. Make sure the inside wheels of the dual or triple tires are fully on the scales and the outer tires are off of the ground. Since most scales are less than 3 m (10") wide, driving the inner wheels up on wooden blocks will accomplish this. Repeat this procedure for the rear axle. Record the unballasted weight of each axle. Add the weight recorded for each axle together to get a total tractor shipping weight. Divide the individual axle weights by the total tractor shipping weight to get the front to rear weight distribution percentage.

**Example:**
**425, 485 & 535 Unballasted Shipping Weight**

| | |
|---|---|
| Front axle weight: | 9,130 kg (20,130 lbs.) |
| Rear axle weight: | 4,821 kg (10,630 lbs.) |
| Total tractor shipping weight: | 13,592 kg (30,758 lbs.) |
| Weight distribution Front axle: | 9,130÷13,952 (20,130÷30,758) = 65% |
| Rear axle: | 4,820÷13,952 (10,628÷30,952) = 35% |

**NOTE: The above example is not an exact shipping weight of a tractor. Weigh your specific tractor to get accurate figures to work with.**

For optimum performance the tractor requires ballasting to obtained 50% balance of the load being carried on each axle during field work. This makes each axle pull its share of the load so that one axle is not overworked.

## Operating Weight and Fore/Aft Ratio

It has been determined that Buhler Versatile 4WD tractors operate at top efficiency when ballasted to 45.3 Kg (100 lbs) per engine brake horsepower. This is the total vehicle weight at which the tractor can pull an implement and propel itself without causing excess soil compaction. The following chart shows recommended operating weights based on tractor model by horsepower at 45.3 Kg (100 lbs) per horsepower ballast.

| Model | Rated Horsepower | Recommended Operating Weight at 100 lbs/HP |
|---|---|---|
| 435 | 435 | 19,750 kg (43,500 lbs.) |
| 485 | 485 | 22,000 kg (48,500 lbs.) |
| 535 | 535 | 24,267 kg (53,500 lbs.) |

## Additional Ballast Requirements

Total ballast to be added can now be calculated by subtracting the shipping weight of the tractor, from the recommended operating weight, determined from the chart.

Example:

| | |
|---|---|
| Recommended Operating Weight: 485 (485 HP) | 22,000 kg (48,500 lbs.) |
| Shipping Weight: 485 (485 HP) | 13,952 kg (30.758 lbs.) |
| Total Ballast to be Added: | 8,048 kg (17,742 lbs.) |

The figure of 8,048 kg (17,742 lbs.) is the total amount of ballast to be added to the tractor to get it to 45.3 kg (100 lbs) per horsepower. This total ballast figure now needs to be divided between the front and rear axle.

To calculate the amount of ballast to be added to each axle, first determine what type of implement the tractor will be used with.

If the tractor is to be used with a drawbar pull-type implement, the field ready ballasted weight distribution should be 55% on the front axle and 45% on the rear axle of the recommended operating weight. Once the tractor is in the field operating with the implement, the draft load imposed on the tractor by the implement will balance the weight distribution between the axles to a 50/50 dynamic ratio.

The following chart details an example of the correct front to rear ballasting on a 485 tractor with a drawbar application based on the previous calculations.

| | Total kg (lbs) | Front kg (lbs) | Rear kg (lbs) |
|---|---|---|---|
| Optimum Operating Weight & Percentage 45.3kg x 485 (100 lb x 485) | 22,000 kg (48,500 lbs.) | 22,000 kg (48,500 lbs.) | 22,000 kg (48,500 lbs.) |
| Scaled Shipping Weight | 13,952 kg (30.758 lbs.) | 7,673 kg (48,500 lbs.) | 6,279 kg (48,500 lbs.) |
| Additional Ballast Required/Axle | 8,048 kg (17,742 lbs.) | 4,426 kg (9,757 lbs.) | 3,622 kg (7,985 lbs.) |

## Ballasting Weights

Ballasting weight is to be added in the form of front, upper or rear weight kits available from your Buhler Versatile dealer.

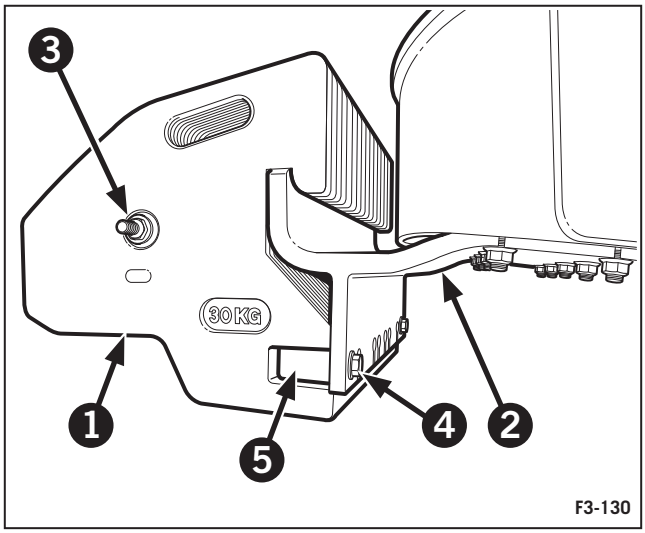
The weight kits are suitcase in style allowing ballast to be easily installed and removed, depending on the varying needs.

### Front weights

The front weight kit is available with a set of twelve, twenty four or forty, 30 kg (67 lbs), suitcase style weights (1). The bracket (2) and hardware, weighs approximately 130 kg. (285 lbs). Most applications will not require front weight packages.

Front weights can be removed by releasing one of the tie rod nuts (3) and withdrawing the tie rod from the weight package. Loosen the bolt (4) on the rear of the bracket and remove the cast block (5). The weights can now be lifted from the bracket.

The last four weights on the right and left hand side are held in place by the cast block (5) installed through the weight cut out. The remaining weights are held in position by the tie rod.




### Upper weights

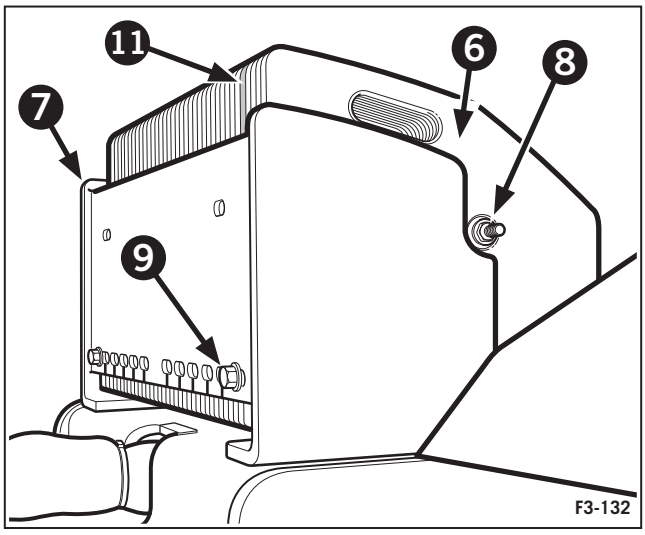
The upper weight kit is available with a set of twelve, twenty four or forty 30 kg (67 lb), suitcase style weights (6). The bracket (7) and hardware weighs approximately 342 kg. (755 lbs).

**NOTE: The upper weight kit is designed to add ballast equally to the front and rear.**

Upper weights can be removed by releasing the left hand tie rod nuts (8) and withdrawing the tie rod fully toward the opposite fender. Loosen the bolt (9) on the rear of the bracket releasing the cast block (10).

**NOTE: The last four weights on the right and left hand side are held in place by the cast block installed through the weight cut out. The remaining weights are held in position by the tie rod.**

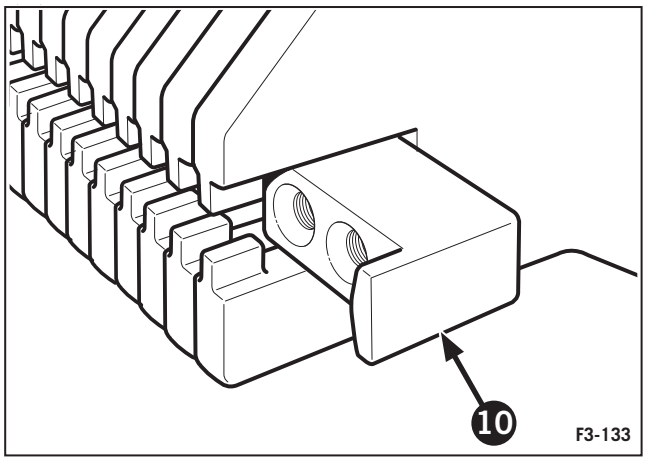
Pry upward on the fifth weight (11) from the left and remove it from the tractor. Starting with the sixth weight from the left remove six additional weights from the bracket. Slide the four remaining left hand weights to the right and remove. Remove the cast block (10). Slide the remaining weights to the left and remove them from the bracket. This will expose the right hand retaining block.



Remove the block and remove the remaining four weights from the bracket together with the tie rod.

**NOTE: When installing fewer weights make sure that they are positioned in the center of the bracket.**

**NOTE: For details on the upper weight kit bracket see page 4-25.**



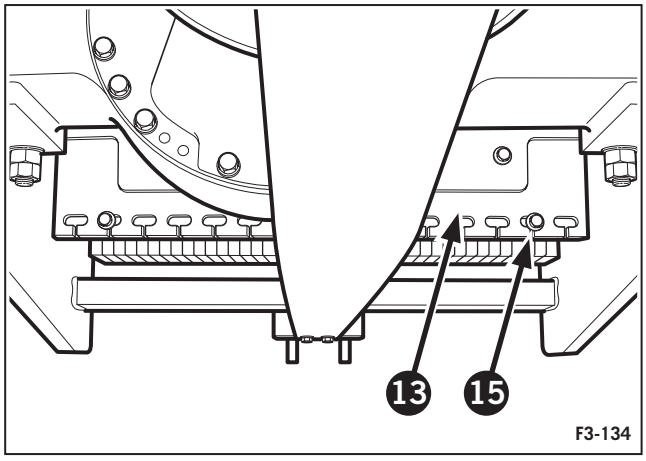

**Weight bracket removed for clarity**

## Rear weights

The rear weight kit is available with a set of twelve, twenty four or forty two, 30 kg (67 lbs), suitcase style weights (12). The bracket (13) and hardware, weighs approximately 98 kg. (215 lbs).

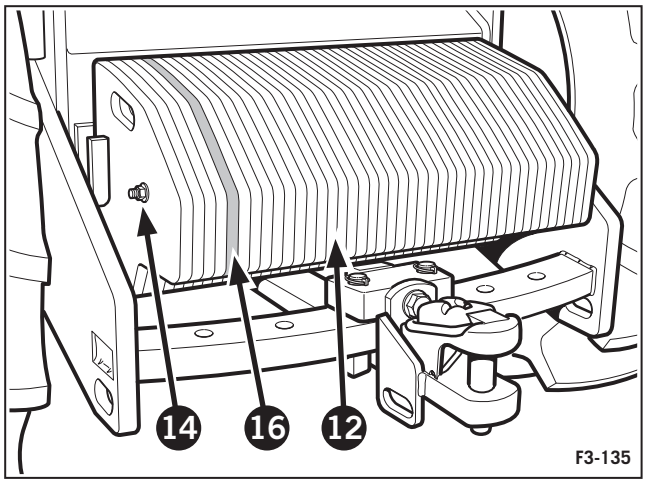
**NOTE: The rear weight kit cannot be installed on units that have a PTO option or a 3-point hitch option. The PTO or 3-point hitch is considered part of the rear axle ballast.**

Rear weights can be removed by releasing the left hand tie rod nuts (14) and withdrawing the tie rod fully toward the opposite fender. Loosen the bolt (15) on the rear of the bracket releasing the cast block (10).




**NOTE: The last four weights on the right and left hand side are held in place by the cast block installed through the weight cut out. The remaining weights are held in position by the tie rod.**

Pry upward on the fifth weight (16) from the left and remove it from the tractor. Starting with the sixth weight from the left remove six additional weights from the bracket. Slide the four remaining left hand weights to the right and remove. Remove the cast block (10). Slide the remaining weights to the left and remove them from the bracket. This will expose the right hand retaining block.




Remove the block and remove the remaining four weights from the bracket together with the tie rod.

**NOTE: When installing fewer weights make sure that they are positioned in the center of the bracket.**

**NOTE: For details on the upper weight kit bracket see page 4-25.**

**Ballasting C of G Calculation Table**

| | | | | Weight Added to Axle (lbs) | |
|---|---|---|---|---|---|
| | Calculated Weight (kg) | Calculated Weight (lbs) | C of G | Front | Rear |
| **Front Weight Bracket** | 180.115 | 397.086 | -4403 | 626.479 | -229.393 |
| **Front Weights (12 X 30 kg)** | 360 | 793.664 | -4786 | 1330.100 | -536.436 |
| **Front Weights (24 X 30 kg)** | 720 | 1587.328 | -4786 | 2660.199 | -1072.871 |
| **Front Weights (40 X 30 kg)** | 1200 | 2645.547 | -4786 | 4433.666 | -1788.119 |
| | | | | | |
| **Rear Weight Bracket** | 100.624 | 221.838 | 2235 | -27.588 | 249.425 |
| **Rear Weights (12 X 30 kg)** | 360 | 793.664 | 2460 | -144.488 | 938.152 |
| **Rear Weights (24 X 30 kg)** | 720 | 1587.328 | 2460 | -288.975 | 1876.303 |
| **Rear Weights (40 X 30 kg)** | 1200 | 2645.547 | 2460 | -481.625 | 3127.172 |
| **Rear Weights (42 X 30 kg)** | 1260 | 2777.824 | 2460 | -505.707 | 3283.531 |
| | | | | | |
| **Upper Weight Bracket** | 163.288 | 359.988 | 897 | 78.736 | 281.252 |
| **Upper Weights (12 X 30 kg)** | 360 | 793.664 | 1073 | 137.772 | 655.892 |
| **Upper Weights (24 X 30 kg)** | 720 | 1587.328 | 1073 | 275.544 | 1311.784 |
| **Upper Weights (40 X 30 kg)** | 1200 | 2645.547 | 1073 | 459.240 | 2186.307 |

# Section 4 Contents - Lubrication & Maintenance

# General Information

## Introduction

This section gives full details of the service procedures necessary to maintain your tractor at peak efficiency. The Lubrication and Maintenance Chart provides a ready reference to these requirements. Each operation is numbered for easy reference.

In addition to the regular maintenance operations listed, check the following items every 10 hours or daily during the first 50 hours of operation:

- Wheel hardware for tightness.
- Planetary hub and differential oil level
- Check for leaks, loose or damaged parts.

*IMPORTANT: Park the tractor on level ground and, where applicable, extend all cylinders before checking oil levels.*

## Safety Precautions

Read and observe all safety precautions listed in Section 1, "Safety: Servicing The Tractor."

**NOTE: Dispose of used filters and fluids properly. Consult local officials for proper procedures.**

**CAUTION: DO NOT CHECK, LUBRICATE, SERVICE OR ADJUST THE TRACTOR WITH THE ENGINE RUNNING.**

## Preventing System Contamination

To prevent contamination when changing oils, filters, etc., always clean the area around the filler caps, level plugs, drain plugs, dipsticks and filters prior to removal. Before connecting remote cylinders, ensure that oil contained within them is clean, has not degenerated due to long storage, and is of the correct grade.

To prevent dirt entry during greasing, wipe dirt from the grease fittings before greasing. Wipe excess grease from the fitting after greasing.

## Flexible Maintenance Intervals

The intervals listed in the Lubrication and Maintenance Chart are guidelines to be used when operating in normal working conditions.

Adjust the intervals for environmental and working conditions. Intervals should be shortened under adverse (wet, muddy, sandy, extremely dusty) working conditions.

## Lubrication and Maintenance Chart

The chart lists the intervals when routine checks, lubrication, service and/or adjustments should be performed. Use the chart as a quick reference guide when servicing the tractor. (The operations follow the chart).

## First 50–Hour Service

At the first 50–hour service, ensure that the maintenance operations listed on the "First 50–Hour Service" checklist, located at the back of this manual, are carried out.

*IMPORTANT: Items listed in the first 50–hour check are important. If not performed, early component failure and reduced tractor life may result.*

## Fueling the Tractor

- **CAUTION: WHEN HANDLING DIESEL FUEL, OBSERVE THE FOLLOWING:**
- **DO NOT SMOKE AROUND DIESEL FUEL. UNDER NO CIRCUMSTANCES SHOULD GASOLINE, ALCOHOL, GASOHOL OR DIESELHOL (A MIXTURE OF DIESEL FUEL AND ALCOHOL) BE ADDED TO DIESEL FUEL BECAUSE OF INCREASED FIRE OR EXPLOSION RISKS. IN A CLOSED CONTAINER, SUCH AS A FUEL TANK, THEY ARE MORE EXPLOSIVE THAN PURE GASOLINE. DO NOT USE THESE BLENDS. ADDITIONALLY, DIESELHOL IS NOT APPROVED DUE TO POSSIBLE INADEQUATE LUBRICATION OF THE FUEL INJECTION SYSTEM.**
- **CLEAN THE FILLER CAP AREA AND KEEP IT FREE OF DEBRIS.**
- **FILL THE TANKS AT THE END OF EACH DAY TO REDUCE OVERNIGHT CONDENSATION.**
- **NEVER TAKE THE CAPS OFF OR REFUEL WITH THE ENGINE RUNNING.**
- **KEEP CONTROL OF THE FUEL NOZZLE WHILE FILLING THE FUEL TANKS.**
- **DON'T FILL THE TANKS TO CAPACITY. ALLOW ROOM FOR EXPANSION. IF THE ORIGINAL FUEL TANK CAPS ARE LOST, REPLACE THEM WITH BUHLER VERSATILE CAPS AND TIGHTEN SECURELY.**
- **WIPE UP SPILLED FUEL IMMEDIATELY.**
- **USE ONLY INTERNALLY GROUNDED FUELING HOSE FROM STORAGE TANK AND PUMP TO TRACTOR FUEL TANK. IF IN DOUBT CHECK WITH YOUR FUEL HOSE SUPPLIER. (AN ACCEPTABLE FUEL HOSE WOULD BE ONE WITH AN INTERNAL WIRE THAT CAN BE CHECKED USING A CONTINUITY TESTER.)**
- **WHEN REFUELING, MAKE SURE THE NOZZLE IS IN CONTACT WITH THE FILLER NECK OF THE TRACTOR FUEL TANK BEFORE FUEL STARTS FLOWING AND DURING THE ENTIRE TIME FUEL IS FLOWING.**

## Fuel Storage

Take the following precautions to ensure stored fuel is kept free of dirt, water, and other contaminants.

- Store fuel in black iron tanks, not galvanized tanks, as the zinc coating will react with the fuel and form compounds that will contaminate the injection pump and injectors.
- Install bulk storage tanks away from direct sunlight and angle them slightly so sediment in the tanks will settle away from the outlet pipe. Check the fuel storage tanks regularly for condensation by draining from the tank bottom.
- To facilitate moisture and sediment removal, provide a drain plug at the lowest point at the end opposite the outlet pipe.
- If fuel is not filtered from the storage tank, put a funnel with a fine mesh screen in the fuel tank filler neck when refueling.
- Arrange fuel purchases so summer grade fuels are not held over and used in winter.
- Ground the storage tanks to prevent static buildup.

## Fuel Requirements

The quality of fuel used is an important factor for dependable performance and satisfactory engine life. Fuels must be clean, well-refined, and noncorrosive to fuel system parts. Be sure to use fuel of a known quality from a reputable supplier.

To obtain optimum combustion and minimum engine wear, the fuel selected for use should conform to the application and property requirements outlined in the following "Diesel Fuel Selection Chart" on page 4-4.

**NOTE: When long periods of idling or cold-weather conditions below 0° C (32° F) are encountered or when continuously operating at an altitude above 1,524 m (5,000'), use Number 1-D fuel.**

Using diesel fuel with sulphur content above 0.50% requires more frequent oil changes as noted in the maintenance schedule.

The use of diesel fuel with a sulphur content above 1.3% is not recommended.

## Diesel Fuel Selection Chart

| General Fuel Class | Final Boiling | Temp. Range | Cetane (Min.) | Sulphur Content (Max.) |
|---|---|---|---|---|
| No. 1-D | 288° C (550° F) | -7° C (20° F) and below | 40* | 0.30% |
| No. 2-D | 357° C (675° F) | -7° C (20° F) and above | 40 | 0.50% |

*When continually operating at low temperatures or high altitude, a minimum cetane of 45 is required.

Do not use Number 2-D fuel at temperatures below -7°C (20°F). The cold temperatures will cause Number 2-D fuel to thicken, which may keep the engine from running. (If this happens, contact your Buhler Versatile dealer.)

For the best fuel economy, use Number 2-D whenever the temperature will permit.

To be sure a fuel meets the required properties, enlist the aid of a reputable fuel oil supplier. The responsibility for clean fuel lies with the fuel supplier as well as the fuel user.

### Adding Diesel Fuel

Fuel can be added to either tank. The two tanks are connected via a crossover tube. Total usable capacity of the two tanks is 330 U.S. gallons (1249 L).

Each fuel tank has a vent tube located on the rear corner of the tank. The tube runs vertically inside the cab frame and requires no maintenance.

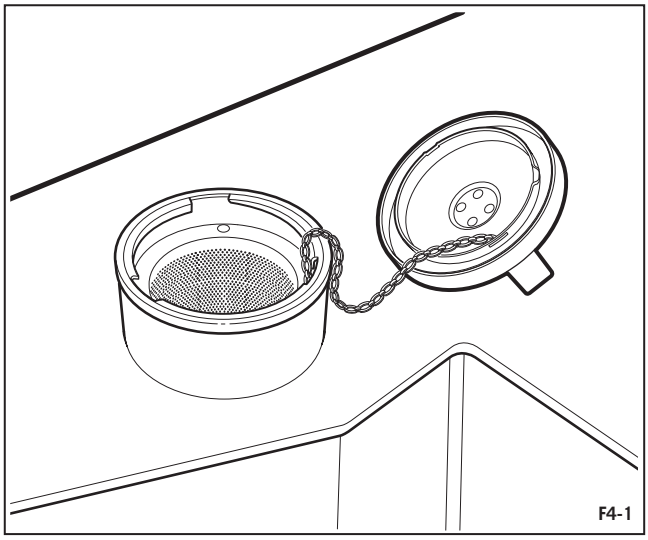
**CAUTION: DO NOT OVERFILL THE TANKS. EITHER FILL TO BOTTOM OF FILLER NECK OR USE THE ELECTRONIC INSTRUMENT CONTROL SYSTEM TO AID IN REFUELING. WHEN THE ALARM SOUNDS A SOLID TONE, THE TANK IS FULL. ALLOW ROOM FOR EXPANSION. FUEL EXPANSION OF OVERFILLED TANKS CAN RESULT IN FUEL ENTRY TO ENGINE CYLINDERS AND ACCOMPANYING HYDRAULIC LOCK.**

**IF THE ORIGINAL FUEL TANK CAPS ARE LOST, REPLACE THEM WITH BUHLER VERSATILE CAPS AND TIGHTEN SECURELY.**

To add fuel to the tractor, follow the steps below:

1. Clean the area around the fuel cap(s) to prevent debris from entering the fuel tank.
2. To remove the cap, turn handle in the center of the cap counterclockwise until loose and pull the cap from the tank. Place it in a clean area during refueling.

   **NOTE: With the engine off, and the ignition switch in the "RUN" position, the fuel fill mode of the Electronic Instrument Control System will be operational and will assist in refueling procedures. Refer to "Electronic Instrument Control System" in Section 3 for further information.**
3. After filling the tank, replace and tighten the fuel cap.


F4-1

# Inspection Access

## Engine Access

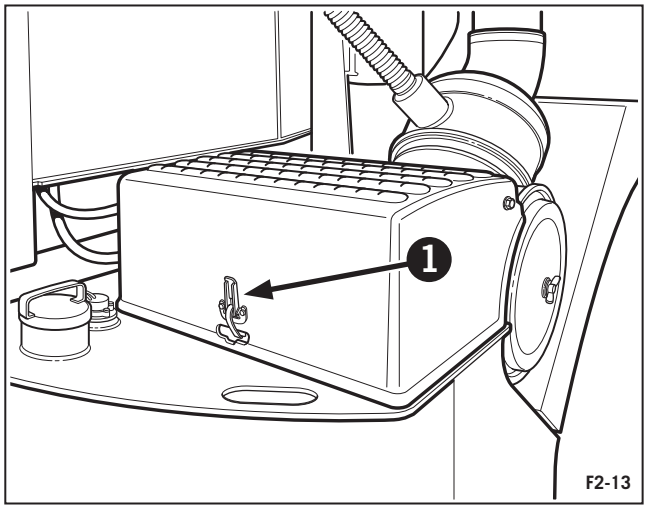
In order to perform service, inspection and lubrication operations to the tractor, it may be necessary to open or remove various panels and shields.

*IMPORTANT: After performing work on the tractor, install all safety shields before operating the tractor.*

## Battery Access

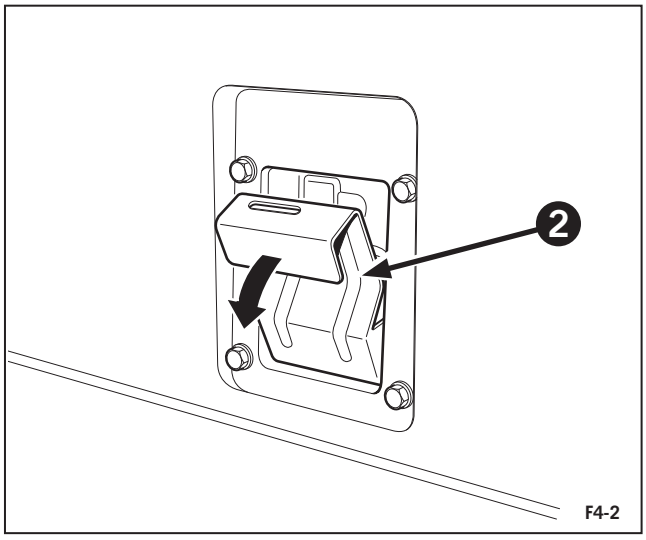
The batteries are located on top of the right side fuel tank. Release the latch (1) and lift the battery cover.

Make sure the cover is down and latched when operating the tractor.




## Opening the Hood Panels

To provide easy access to the engine, each hood side panel swings open vertically. There is an external latch, (2) that releases the panel. Each panel is held open by a single gas strut. Close the hood panels by pulling downward from the side of it and keeping a steady pressure on the panel. The gas strut will collapse and the panel will go over center and latch. Do not force the panel down against the gas strut.

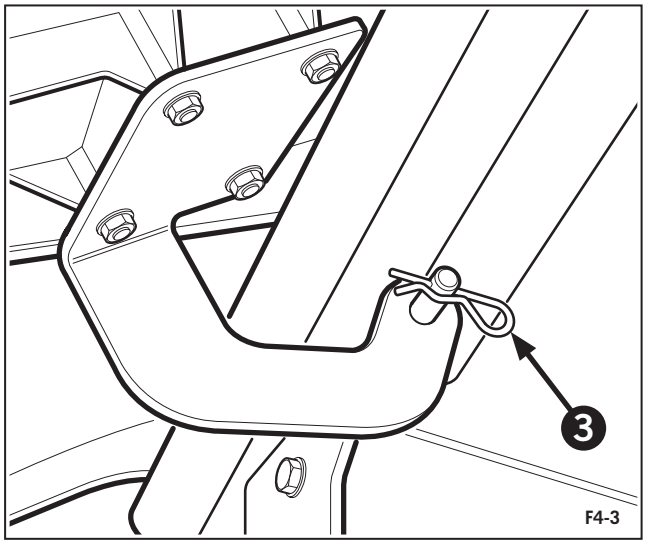



## Removing the Hood Panels

The hood panels can be easily removed if greater access is required for maintenance or service operations.

1. Remove the hairpin clips (3) from the front and rear pivot studs retaining the hood panel hinge plates.
2. Disconnect the gas strut from the hood panel.
3. Slide the panel forward to clear the pivot studs and lift clear.
4. Set the panel clear of the working area to prevent damage.

To reinstall the panels, reverse the above procedure.



## Lubrication and Maintenance Chart

| Service Interval | No. | Operation | Check | Clean | Lube | Change | Adjust | Drain |
|---|---|---|---|---|---|---|---|---|
| Every 10 hours or daily | 1 | Front grille | | • | | | | |
| | 1 | Hydraulic cooler | | • | | | | |
| | 1 | Transmission cooler | | • | | | | |
| | 1 | Air conditioner condenser | | • | | | | |
| | 1 | Intercooler | | • | | | | |
| | 1 | Radiator | | • | | | | |
| | 1 | Fuel cooler | | • | | | | |
| | 2 | Engine coolant level | • | | | | | |
| | 3 | Engine fan/water pump belt tension | • | | | | | |
| | 4 | Alternator/AC compressor belt tension | • | | | | | |
| | 5 | Engine oil level | • | | | | | |
| | 6 | Fuel filter | | | | | | • |
| | 7 | Auxiliary fuel filter (optional) | | | | | | • |
| | 8 | Hydraulic oil level | • | | | | | |
| | 9 | Transmission oil level (all transmissions) | • | | | | | |
| | 10 | Brake adjustment | • | | | | • | |
| | 11 | Lower articulation pin | | | • | | | |
| | 12 | Front steering cylinder pin, 2 off | | | • | | | |
| | 13 | Rear steering cylinder pin, 2 off | | | • | | | |
| | 14 | Upper articulation pin | | | • | | | |
| | 15 | Front drag link pin, 2 off | | | • | | | |
| | 16 | Rear drag line pin, 2 off | | | • | | | |
| | 17 | Rear axle drive shaft steady bearing | | | • | | | |
| | 18 | Air intake pipe | • | | | | | |
| Every 50 hours | 19 | Cab air filter | | • | | | | |
| | 20 | Differential oil level | • | | | | | |
| | 21 | Alternator | | • | | | | |
| | 22 | Tire air pressure | • | | | | | |
| | 23 | Planetary hub oil | • | | | | | |
| Every 250 hours | 24 | Engine oil and filter | | | | • | | |
| | 25 | Fuel filter | | | | • | | |
| | 26 | Engine supplemental coolant | • | | | | | |
| | 27 | Transmission oil filter (first startup (CAT TA22) | | | | • | | |
| | 28 | Transmission oil change* (CAT TA22) | | | | • | | |
| | 29 | Transmission breather (CAT TA22) | | • | | | | |
| | 30 | Air conditioner drain hoses | • | | | | | |
| | 31 | Air conditioner sight glass | • | | | | | |
| | 32 | Weight kit hardware (optional) | • | | | | | |
| | 33 | Wheel hardware | • | | | | | |
| Every 300 hours | 34 | Transmission filter (1407 Twindisc) | | | | • | | |
| Every 500 hours | 35 | Battery connections | | • | | | | |
| | 36 | Battery electrolyte level | • | | | | | |
| | 37 | Starter battery connections | • | | | | | |
| | 38 | Engine air pre-cleaner | | • | | | | |
| | 39 | Hydraulic suction screen | | • | | | | |
| | 40 | Hydraulic filter - standard flow | | | | • | | |
| | 41 | Hydraulic filter - high flow (optional) | | | | • | | |
| | 42 | Transmission filter (synchromesh only) | | | | • | | |

| Service Interval | No. | Operation | Check | Clean | Lube | Change | Adjust | Drain |
|---|---|---|---|---|---|---|---|---|
| Every 500 hours (cont) | 43 | Hydraulic tank breather | | • | | | | |
| | 44 | Auxiliary fuel filter (optional) | | | | • | | |
| | 45 | Differential oil | | | | • | | |
| | 46 | Planetary hub oil | | | | • | | |
| | 47 | Axle mount bolts | • | | | | | |
| | 48 | Drawbar wear block | • | | | | | |
| | 49 | Steam clean tractor | | • | | | | |
| Every 1000 hours | 50 | Transmission oil (CAT TA22) | | | | • | | |
| | 51 | Transmission suction screen (CAT TA22) | | • | | | | |
| | 52 | Engine inner/outer air element | | | | • | | |
| | 53 | Cab air filter | | | | • | | |
| Every 1200 hours | 54 | Transmission oil (1407 Twindisc) | | | | • | | |
| Every 1500 hours | 55 | Coolant system filter | | | | • | | |
| | 56 | Transmission oil (Synchromesh) | | | | • | | |
| | 57 | Transmission suction screen (Synchromesh) | | • | | | | |
| | 58 | Transmission mounts | • | | | | | |
| | 59 | Hydraulic oil | | | | • | | |
| | 60 | Engine mounts | • | | | | | |
| | 61 | Engine turbo connections | • | | | | | |
| | 62 | Radiator and heating system hoses | • | | | | | |
| | 63 | Cab mounts | • | | | | | |
| Every 2000 hours | 64 | Engine coolant | | | | • | | |
| Indicated by warning light | 65 | Engine air cleaner outer air element | | | | • | | |
| As required | 66 | Front road light bulbs | | | | • | | |
| | 67 | Work light bulbs | | | | • | | |
| | 68 | Turn signal/hazard light bulbs | | | | • | | |
| | 69 | Brake/road light bulb | | | | • | | |
| | 70 | Extremity light bulbs | | | | • | | |
| | 71 | HID light bulbs - front | | | | • | | |
| | 72 | HID light bulbs - rear | | | | • | | |
| | 73 | Dome light bulbs | | | | • | | |
| | 74 | Right console light | | | | • | | |
| | 75 | Trouble light bulb | | | | • | | |
| | 76 | Rear deck covers | • | | | | | |
| | 77/78 | Fuses and relays | | | | • | | |
| | 79 | Windshield washer fluid | • | | | | | |
| | 80 | Windshield wiper blade | | | | • | | |
| | 81 | Cab floor | | • | | | | |
| | 82 | Cab seat and upholstery | | • | | | | |
| | 83 | Ether canister | | | | • | | |
| | 84 | Fuel tanks | | | | | | • |
| | 85 | Rear fenders | | | | | • | |
| | 86 | Storage | • | • | • | • | | |

(* During the first 250 hours of operation.)

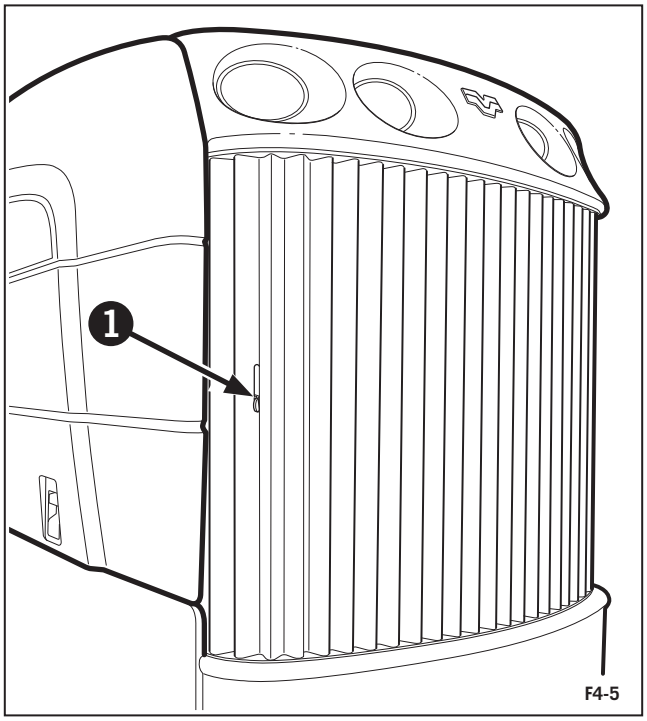
## Every 10 Hours

### Operation 1

**Clean the Front Grille, Hydraulic Cooler, Transmission Cooler, Air-Conditioning Condenser, Charge Air Cooler and Fuel Cooler**

Access to the components can be gained by opening the front grille screen. To open the front grille, lift the latch (1) and swing the grille outward until it locks in the fully open position.

The grille screen locking arm (2) must be released before closing the grille.



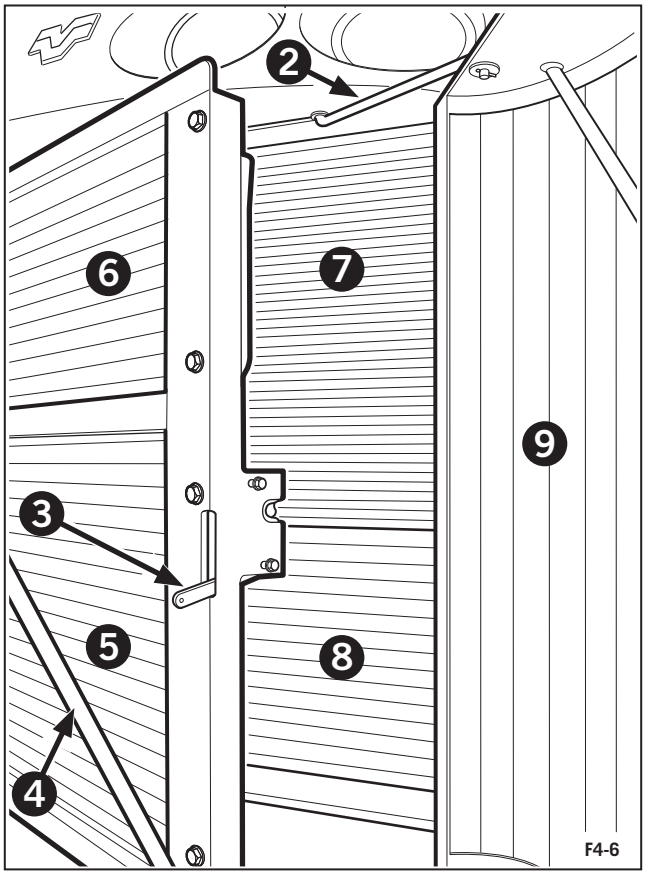

Lift the latch lever (3) upward and swing the fuel cooler/condenser assembly outward using the crossbar (4).

The condenser (5), fuel cooler (6), charge air cooler (7), Hydraulic oil cooler (8) and grille screen (9) are now exposed and can be thoroughly cleaned using compressed air. Remove any chaff or debris that has accumulated in the fins of the components.

Blowing compressed air in both directions through the fins will clean the components completely. Make sure that all perimeters of the components are cleaned.

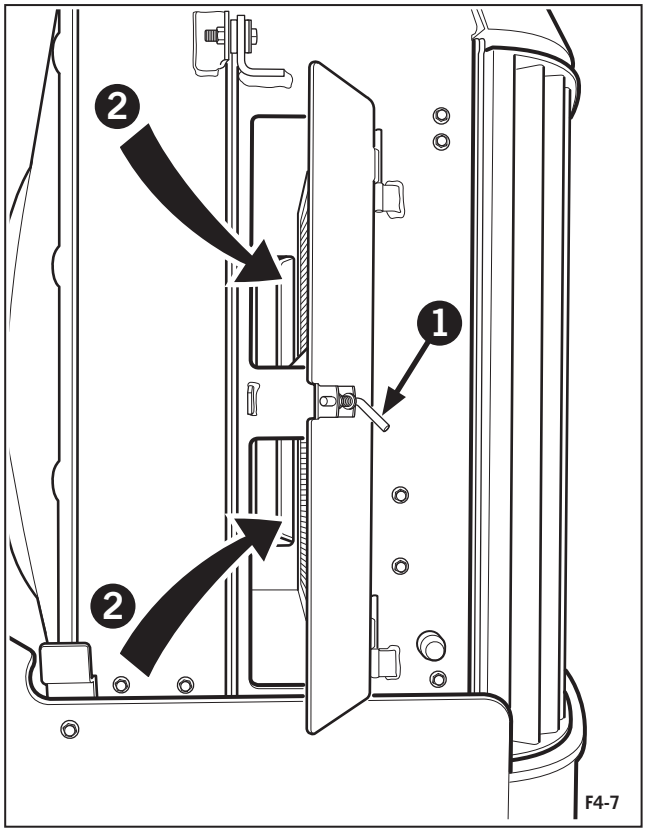
Inspect the coolers for any sign of leakage or damage.

**NOTE: Never use a high-pressure washer to clean out radiator fins. The fins will be bent over and the radiator core rendered useless.**



Release the latch (1) and open the access doors on either side of the radiator to gain access to the cavity between the radiator and the intercooler/oil cooler (2). Remove any chaff or debris that has accumulated in the fins of the components and thoroughly clean using compressed air.

**CAUTION: TO AVOID POSSIBLE EYE INJURY, ALWAYS WEAR SAFETY GLASSES WHEN USING COMPRESSED AIR. DEBRIS PROPELLED BY HIGH-PRESSURE AIR CAN ENTER THE EYES AND CAUSE SERIOUS INJURY.**

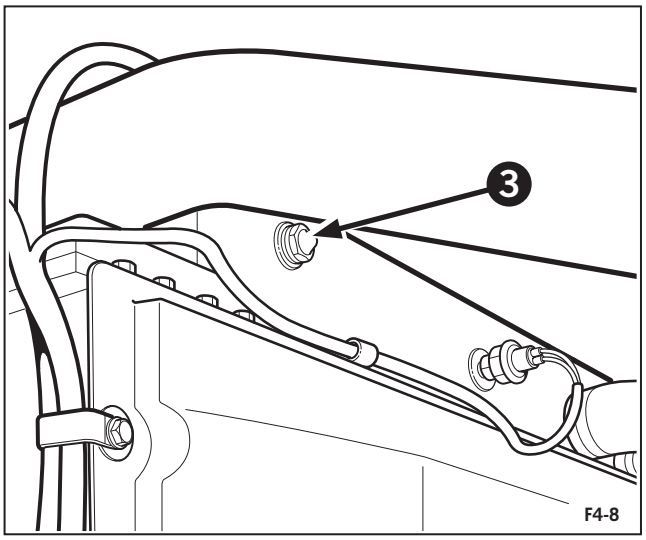



## Operation 2

### Check the Engine Coolant Level

The level of coolant in the engine can be easily checked without removing the radiator cap.

To check the coolant level, open the left engine shield and look at the sight glass (3) located at the top left corner of the radiator. Engine coolant should completely fill the sight glass.



If the engine coolant is low, add coolant through the radiator cap (1) accessed on top of the hood.

**CAUTION: THE COOLING SYSTEM OPERATES UNDER PRESSURE WHICH IS CONTROLLED BY THE RADIATOR CAP. IT IS DANGEROUS TO REMOVE THE CAP WHILE THE SYSTEM IS HOT. ALWAYS TURN THE CAP SLOWLY TO THE FIRST STOP AND ALLOW THE PRESSURE TO ESCAPE BEFORE REMOVING THE CAP ENTIRELY. WEAR GLOVES WHEN REMOVING THE CAP.**

The coolant added to the engine must meet specific requirements. Use a low silicate antifreeze which meets Engineering Standard GM 6038-M, or which contains no more than 0.1% anhydrous alkali metasilicate and meets either Engineering Standard GM 1825-M or GM 1899-M, which are performance specifications.

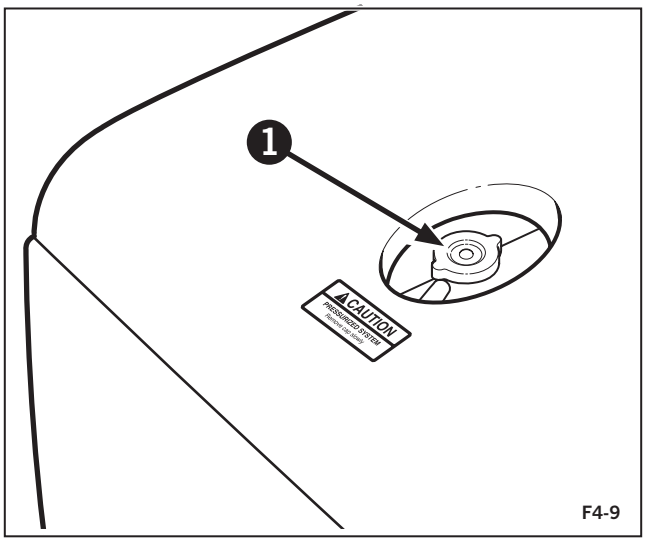
**NOTE: Factory fill is a fully formulated coolant mixture (pink in color). Propylene or ethylene glycol can be mixed in the cooling system.**

Use soft water in the coolant mixture. Contaminants in hard water neutralize the corrosion inhibitor components. Water must not exceed 300 ppm hardness, or contain more than 100 ppm of either chloride or sulphate.

## Antifreeze

Antifreeze must be used in any climate for both freeze and boiling point protection. Cummins Engine Company, Inc. recommends a 50% concentration level, 40% - 60% range of ethylene glycol or propylene glycol in most climates. Antifreeze at 68% concentration provides the maximum freeze protection and must never be exceeded under any condition. Antifreeze protection decreases above 68%.

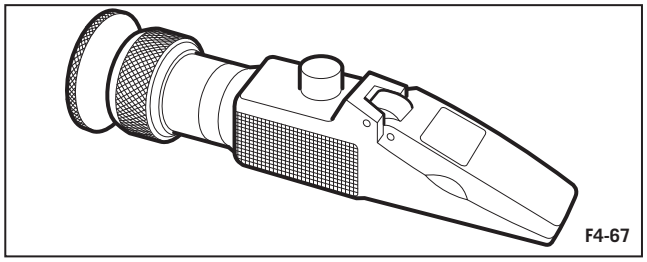
| | Ethylene Glycol | Propylene Glycol |
|---|---|---|
| 40% | -23°C (-10°F) | -21°C (-6°F) |
| 50% | -37°C (-34°F) | -33°C (-27°F) |
| 60% | -54°C (-65°F) | -40°C (-56°F) |
| 68% | -71°C (-90°F) | -63°C (-82°F) |



F4-9

**NOTE: Propylene glycol antifreeze protection levels CANNOT be checked using the same hydrometer as would be used with ethylene glycol antifreeze.**

**You must check the concentration level using a refractometer. Both propylene and ethylene glycol protection levels (of a mixture of both) can be measured with the refractometer (P/N: CC2806).**


F4-67

Once the protection level of the coolant is decided (ratio of water to antifreeze), the mixture must contain one unit of Cummins DCA4 (dry chemical additive) per gallon of coolant. A DCA unit is equal to 42.5 g (1.5 dry ounces) or120 ml (4 liquid ounces). Your Buhler Versatile dealer can assist you in obtaining the DCA4 additive.

*IMPORTANT: Failure to maintain DCA4 in the cooling system will cause cooling system corrosion and engine failure.*

*IMPORTANT: The concentration of DCA4 should be checked with a test kit, available from Cummins / Fleetguard or through your Buhler Versatile dealer (P/N: CC2602).*

*IMPORTANT: Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50° C (120° F).*

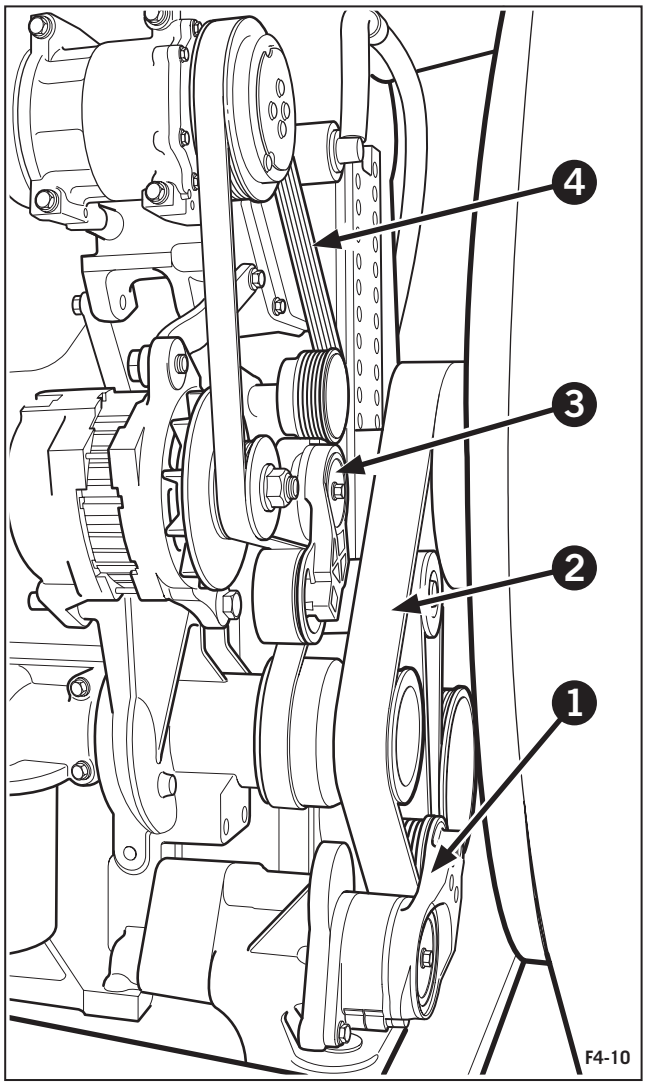
## Operation 3

**Check the Fan/Water Pump Belt Tension**

The engine fan and water pump share the same drive belt (2). A self adjusting spring-loaded idler (1) keeps a constant tension on the belt. If the belt is found to be loose, check the pivot of the spring-loaded idler for binding. If the spring-loaded idler is operating fine, belt replacement maybe necessary.

If the belt requires replacement, install a square end of a 19 mm (3/4") breaker bar into the slot of the idler and release the spring tension by pushing down on the wrench. Slip the old belt off the engine pulleys and install a new belt. Release the wrench and allow the spring-loaded idler to apply belt tension.

**Replacement Fan/Water Pump Belt P/N: 86033867**




## Operation 4

**Check the Tension on Alternator/A/C Compressor Belt**

The alternator and AC compressor share the same drive belt (4). A self adjusting spring-loaded idler (3) keeps a constant tension on the belt. If the belt is found to be loose, check the pivot of the spring-loaded idler for binding. If the spring-loaded idler is operating fine, belt replacement maybe necessary.

**NOTE: The fan/water pump belt has to be removed first to gain access - see above.**

If the belt requires replacement, install a square end of a 13 mm (1/2") breaker bar into the slot of the idler and release the spring tension by pushing up on the wrench. Slip the old belt off the engine pulleys and install a new belt. Release the wrench and allow the spring-loaded idler to apply belt tension.

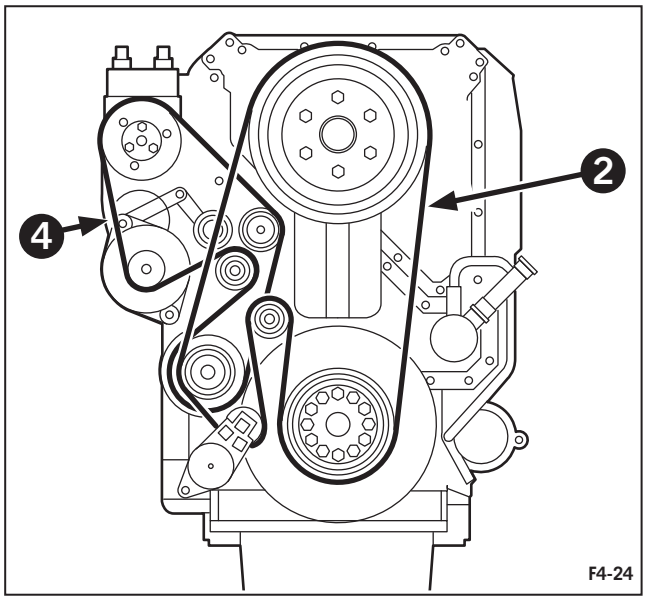
**Replacement Alternator/A/C Compressor Belt P/N: 86033868**

**NOTE: Drive belts are available from your Buhler Versatile dealer.**

**NOTE: Refer to your Cummins Engine Manual for more information regarding belt replacement, wear guidelines, and pulley alignment.**

Figure F4-24 shows the correct routing of the belts.

- Fan/water pump belt (2)
- Alternator/AC compressor belt (4)

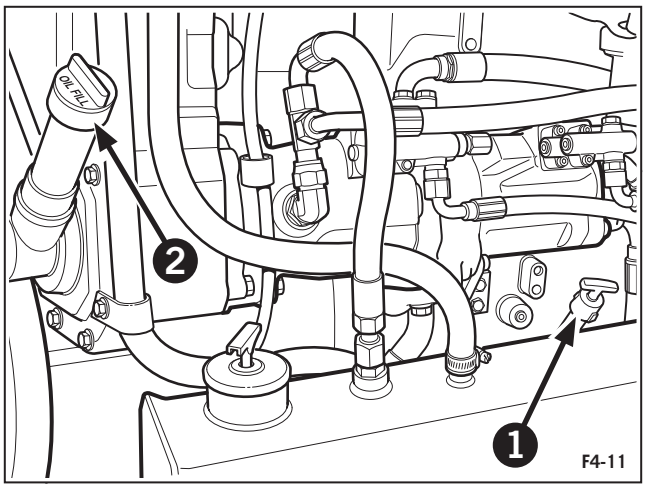


## Operation 5

### Check the Engine Oil Level

Check the engine oil level using the dipstick located on the left side of the engine. This should be done after the engine has been turned off and oil in the lubrication system has had time to drain back into the oil pan.

Unscrew the dipstick handle (1) and pull the dipstick from the tube. The dipstick is marked to show the minimum (ADD) instead of (L) and maximum (FULL) oil level for the engine. If additional oil is needed in the engine, unscrew the filler cap handle (2) and add oil as necessary.




**NOTE: The vehicle must be level when checking the oil level.**

*IMPORTANT: Never operate the engine with the oil level below the ADD mark or above the FULL mark. Wait at least five minutes after shutting off the engine to check the oil. This allows time for the oil to drain to the oil pan.*

**NOTE: The engine is filled with 10W-30 oil at the factory. This weight oil aids in coldweather starting at the manufacturing facility. SAE 15W-40 oil as listed is the preferred viscosity oil for normal operation.**

Buhler Versatile and Cummins Engine Co. recommend the use of a high quality SAE 15W-40 heavy-duty engine oil with an API classification of CE or CF-4 for most applications.

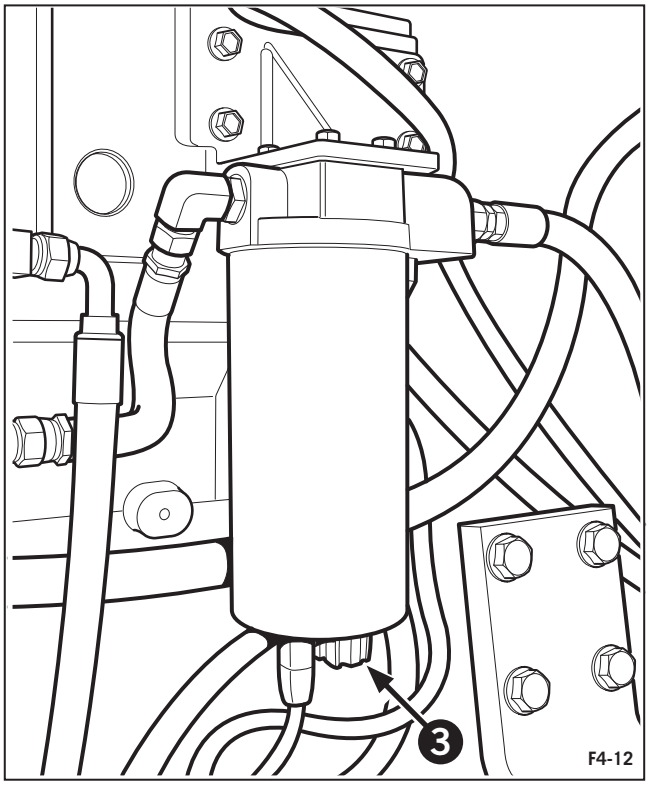
Additional information on engine oil use under extreme conditions (hot or cold weather) can be found in the Cummins Engine Manual provided with the tractor.

## Operation 6

### Drain the Fuel Filter

During operation, the fuel filter on the engine will separate water that may be in the fuel system.

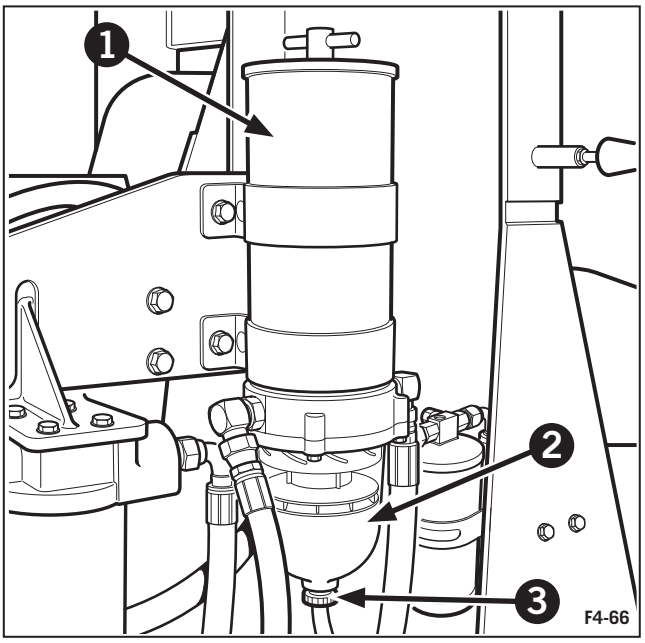
Accumulated water and contaminants must be drained from the fuel filter by opening the small plastic valve (3) on the bottom of the filter, and draining fluid out into a suitable container until clean fuel runs from the valve. Close the valve and hand tighten only.



## Operation 7

### Drain the Auxiliary Fuel Filter (Optional)

Tractors fitted with an auxiliary fuel filter (1) require that the filter be drained of separated water. Visually inspect the collection bowl (2) and drain off any water and contaminants into a suitable container by opening the small plastic valve (3) on the bottom of the filter bowl (3). Drain until clean fuel runs from the valve. Close the valve and hand tighten only.



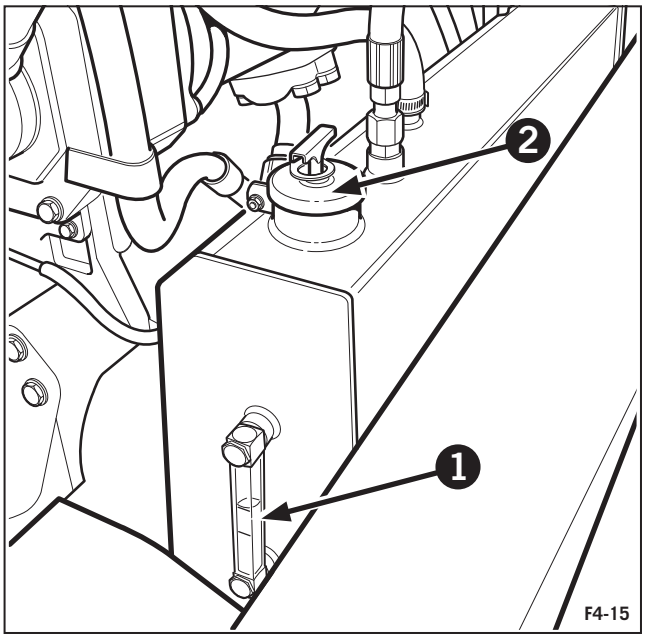

## Operation 8

### Check the Hydraulic Oil Level

The oil level in the hydraulic oil reservoir must be maintained to ensure proper operation of the hydraulic system.

The hydraulic oil reservoir tank located on the left side of the engine compartment incorporates a sight gauge (1) mounted on it's front face. The sight gauge is marked with an "ADD" and "FULL" line indicating oil level. If additional hydraulic oil is required, remove the cap (2) from the filler tube and add oil as necessary.

When checking oil level, take into consideration the implement attached to the tractor. Depending on whether the implement is in a raised or lowered position, the tank level could be above or below the optimum level.

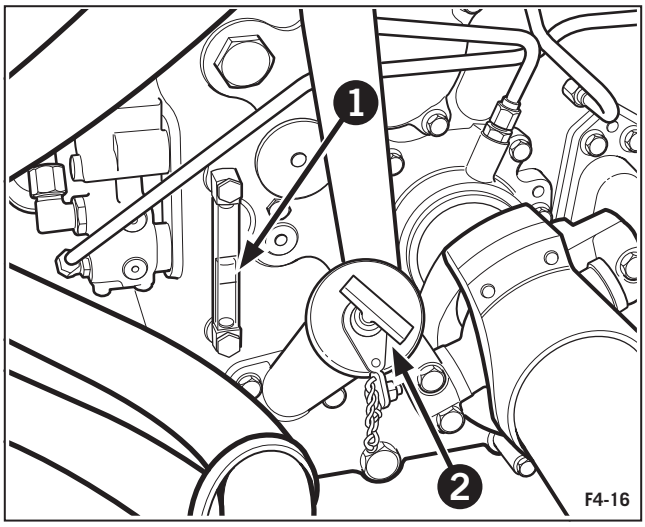


## Operation 9

### Check the Transmission Oil Level

When checking the transmission oil, ensure the following:

- Check the oil level with the tractor parked on a level surface with the engine shut off.
- With cold oil, the oil level should show in the sight glass section designated as cold. Add oil if necessary to bring the oil level to the bottom of the cold section of the sight glass.
- With hot oil, the oil level should show in the sight glass section designated as hot. Add oil if necessary to bring the oil level to the bottom of the hot section of the sight glass.

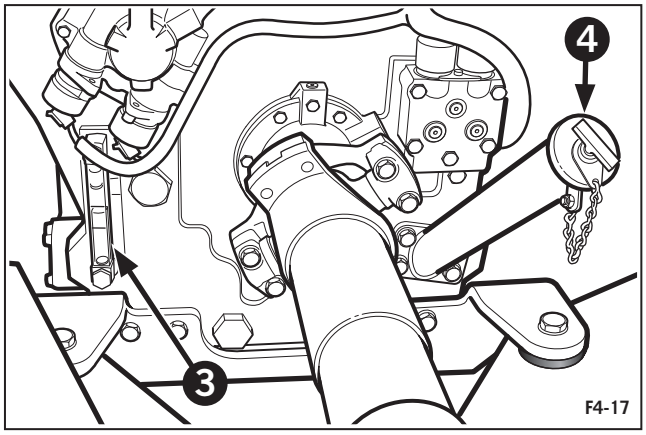


**Synchromesh Transmission**

### Synchromesh Transmission

The oil level for the Synchromesh transmission is easily checked by looking at the sight gauge (1) located on the rear lower left corner of the transmission case.

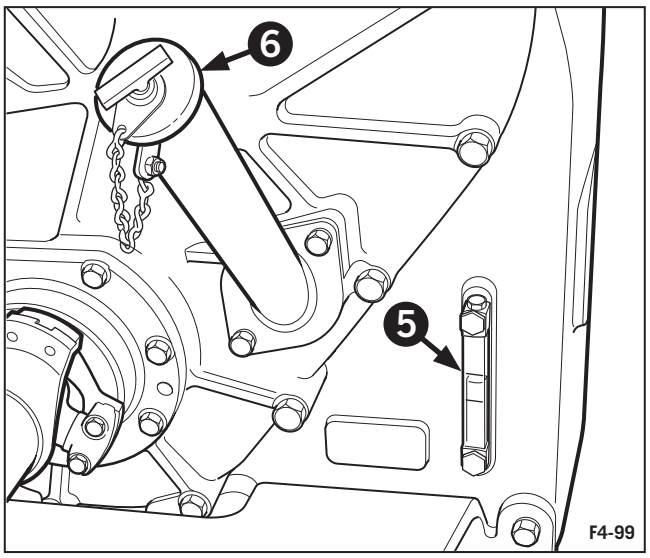
The sight gauge has an “ADD” and “FULL” line indicated on it. If additional transmission oil is required, remove the cap (2) from the filler tube and add oil as necessary.



**1407 Twindisc Powershift Transmission**

### 1407 Twindisc Powershift Transmission

The oil level for the 1407 Twindisc Powershift transmission is checked by looking at the sight gauge located on the rear lower left corner of the transmission case (3). If additional transmission oil is required, remove the cap (4) from the filler tube and add oil as necessary.



**CAT TA22 Powershift Transmission**

### CAT TA22 Powershift Transmission

The oil level for the CAT TA22 Powershift transmission is checked by looking at the sight gauge located on the rear lower right corner of the transmission case (5). If additional transmission oil is required, remove the cap (6) from the filler tube and add oil as necessary.

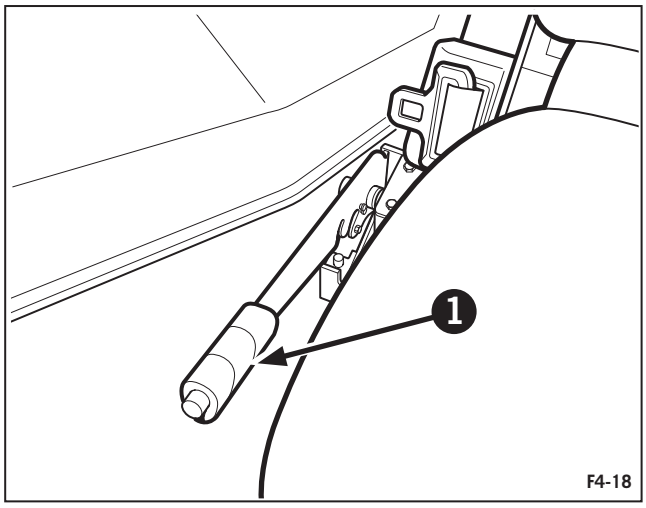
**NOTE: Do not operate the transmission with oil levels above or below the recommended settings. Either condition can result in overheating or loss of power and damage to the equipment.**

## Operation 10

### Parking Brake Adjustment

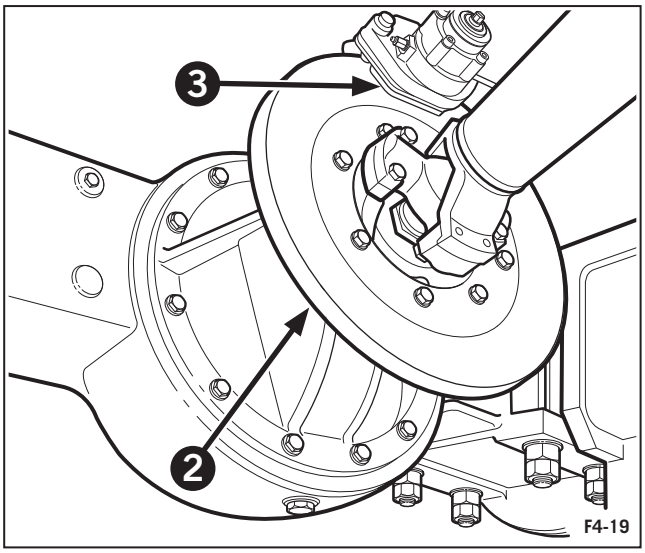
The foot and parking brake unit is self-adjusting and requires no maintenance.

Engaging and disengaging the parking brake lever (1) several times will activate the self-adjusting mechanism within the caliper and keep the brake in proper adjustment. This will ensure a proper set point for the brake to stop the tractor and hold it on an incline when parked.




Visually inspect the brake rotors front and rear (2) for nicks or damage and the brake pads for wear. The pads (3) must be replaced if they are worn to 1 mm (1/32") or less. Consult your Buhler Versatile dealer for assistance in replacement of the brake rotor or pads.

**WARNING: ENSURE THAT THE BRAKES ARE IN GOOD WORKING ORDER BEFORE OPERATING THE TRACTOR.**



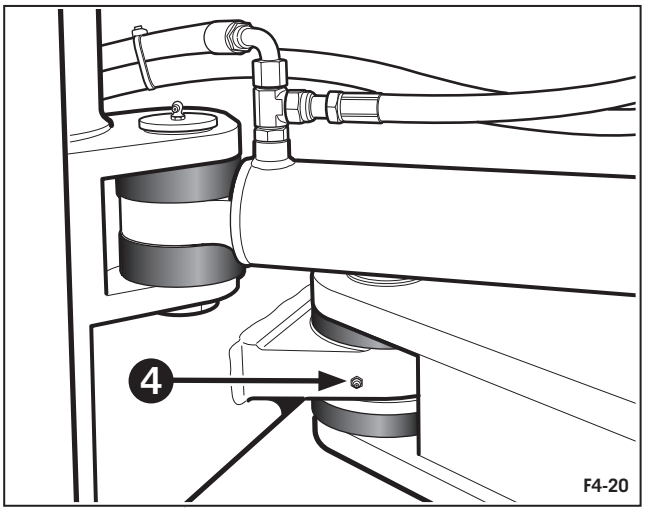

## Operation 11

### Lubricate the Lower Articulation Pin

Lubricate the grease fitting (4) until grease flows from around the pin seals. This will purge any dirt accumulated in the pivot pin area.

Start the unit and articulate from side to side to work the grease into the joint.

Use Moly base grease (NLGI 1 Lithium, Moly).



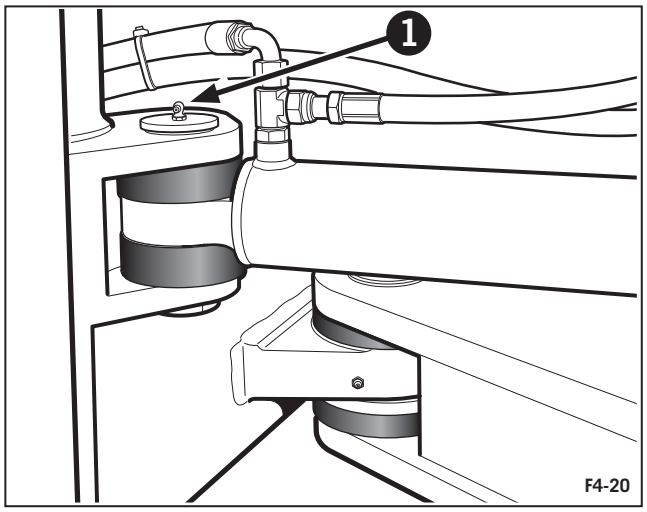
## Operation 12

**Lubricate the Front Steering Cylinder Pins**

Lubricate the two grease fittings (1) (one on each side) until grease flows from around the pin seals.

This will purge any dirt accumulated in the pivot pin area.

Use Moly base grease (NLGI 1 Lithium, Moly).

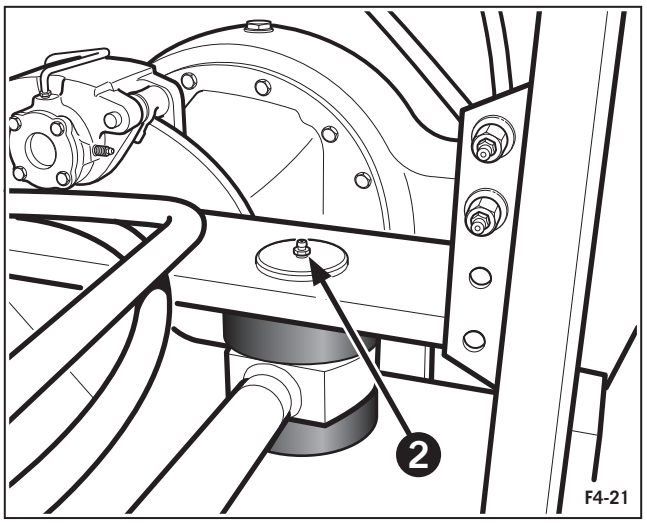



## Operation 13

**Lubricate the Rear Steering Cylinder Pins**

Lubricate the bottom two grease fittings (2) (one on each side) until grease flows from around the pin seals. This will purge any dirt accumulated in the pivot pin area.

Use Moly base grease (NLGI 1 Lithium, Moly).



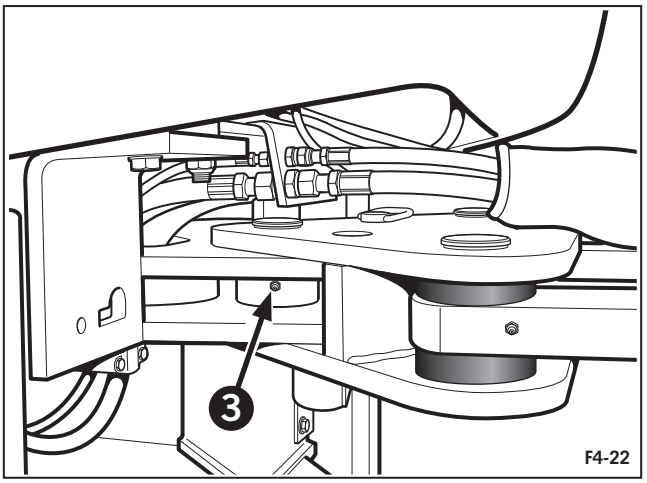

## Operation 14

**Lubricate the Upper Articulation Pin**

Lubricate the grease fitting (3) until grease flows from between the frame pieces. This will purge any dirt accumulated in the pivot pin area.

Start the unit and articulate from side to side to work the grease into the joint.

Use Moly base grease (NLGI 1 Lithium, Moly).

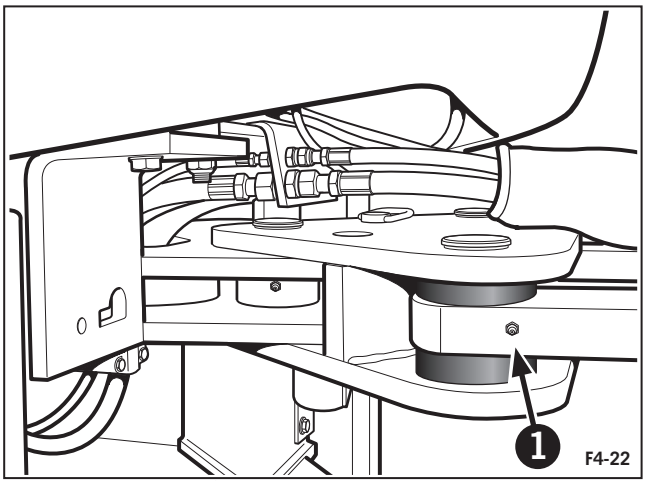


## Operation 15

**Lubricate the Front Drag Link Pins**

Lubricate the grease fittings (one on each side) (1) until grease flows from around the pin seals. This will purge any dirt accumulated in the pivot pin area.

Use Moly base grease (NLGI 1 Lithium, Moly).

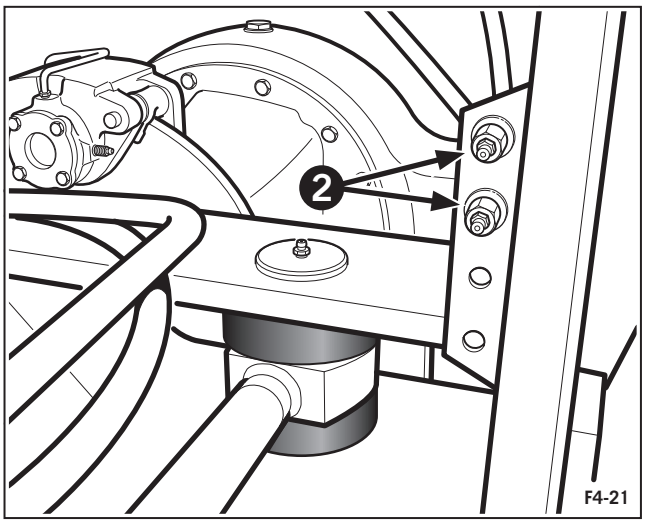



## Operation 16

**Lubricate the Rear Drag Link Pins**

Lubricate the top two grease fittings (2) remotely mounted on the left rear frame, until grease flows from around the pin seals. This will purge any dirt accumulated in the pivot pin area.

Use Moly base grease (NLGI 1 Lithium, Moly).

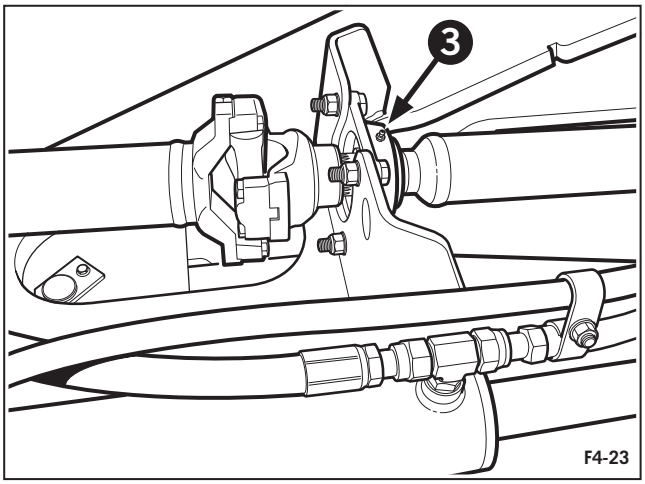



## Operation 17

**Lubricate the Rear Axle Drive Shaft Steady Bearing**

Lubricate the grease fitting (3) until grease flows from the bearing area. This will purge any dirt accumulated in this area.

Use Moly base grease (NLGI 1 Lithium, Moly).



## Operation 18

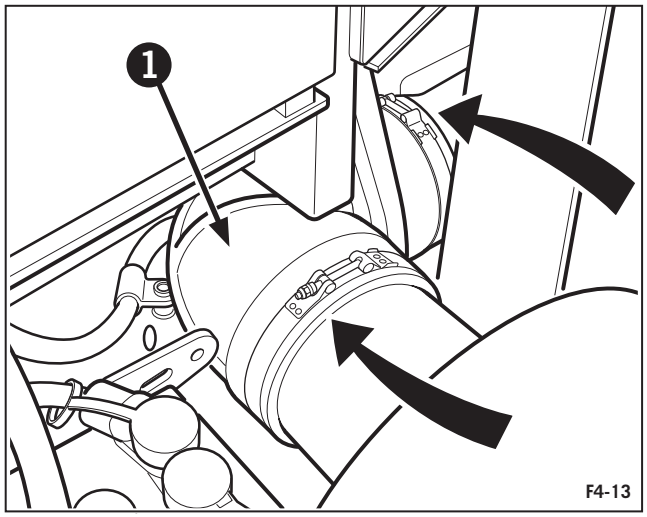
### Air Intake Piping / Charge Air piping

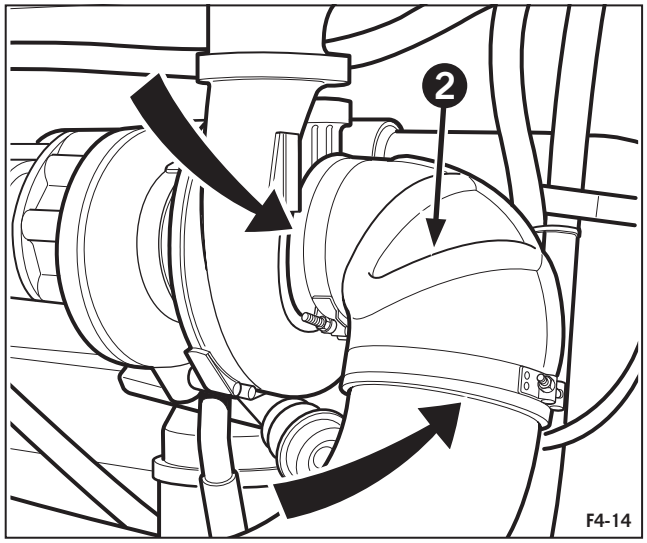
Inspect the air intake piping, daily, for cracked hoses, loose clamps, or punctures that could damage the engine with particular attention to the two connections (1&2) between the air cleaner and turbocharger.

Tighten or replace parts, as necessary, to make sure the air intake system does not leak.

**Torque Value:** 8.5 N·m (75 in-lbs)

Check for corrosion of the intake system piping under the clamps and hoses. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean as required.

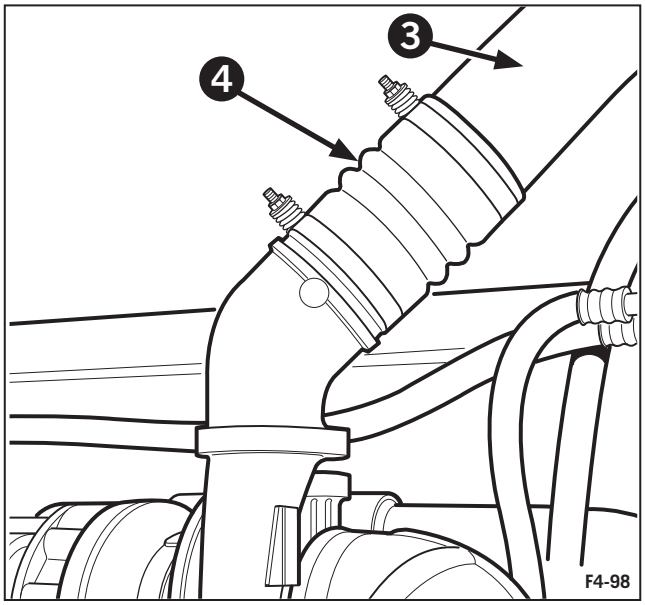



Inspect the two charge air pipes (3) and four connection hoses (4) for cracks, loose clamps, or punctures that could damage the engine.

Tighten or replace parts, as necessary, to make sure the charge air system does not leak.

**Torque Value:** 7.35 N·m (65 in-lbs)



## Operation 19

### Clean the Cab Air Filter

The cab air filter (1) located on the underside of cab roof above the rear window. It must be cleaned to keep the cab air system operating at maximum efficiency.

**Note: In humid conditions, such as occur on most early mornings, do not switch on the blower prior to servicing the filter. Damp particles drawn into the filter may be difficult to remove without washing.**

**Note: The filter is made of specially treated paper with a rubber sealing strip bonded to the upper surface. Do not damage the element during removal.**

To remove the cab air filter, unscrew the knob (2). This will release the filter frame (3) allowing it to swing down sufficiently to remove the filter. Remove the filter element and check the seal (4) around it's perimeter for nicks or cracks. Replace the element if any damage is found.

The filter element may be cleaned using either method A or B depending on the condition of the element.

**Method A**

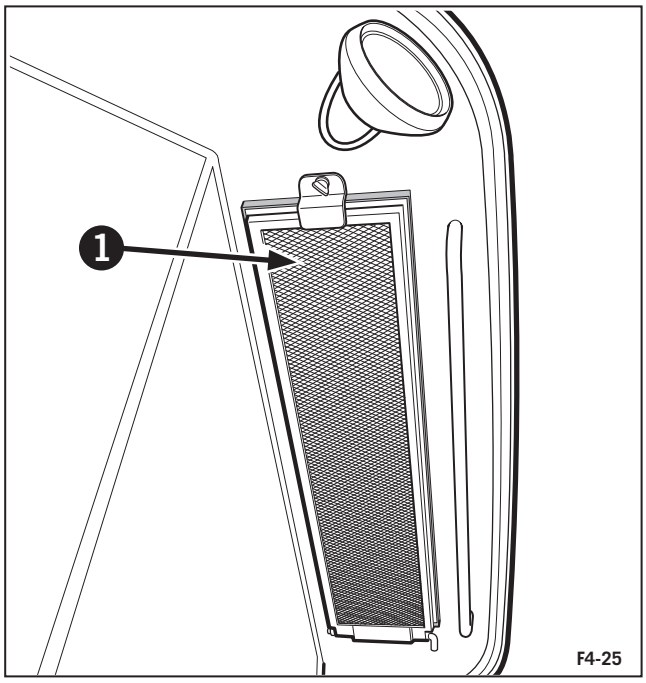
Clean the element with compressed air not exceeding 2 bar (30 PSI). Hold the nozzle at least 300mm (12") from the filter to prevent damage to the paper pleats. Direct the compressed air through the filter opposite the normal air flow.

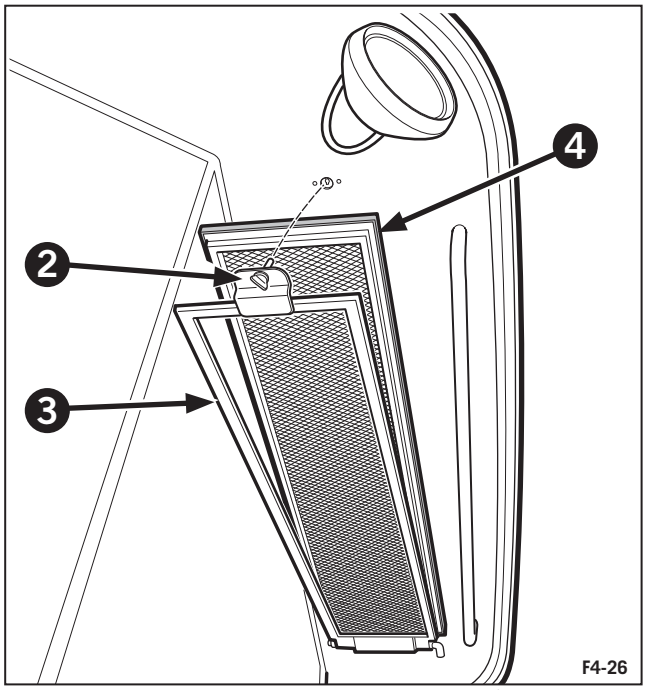
**WARNING: WEAR EYE PROTECTION AND A FACE MASK WHEN CARRYING OUT THIS OPERATION.**

**Method B**

1. Soak the filter for 15 minutes in warm water containing a mild detergent.
2. Rinse the filter with running water below 1.4 bar (20 PSI).
3. Shake off excess water and allow to air dry.

**IMPORTANT:** Do not attempt to dry the filter with heat or compressed air and do not install until thoroughly dry as the filter may rupture. It is recommended that a new filter is installed at this service and the washed one put aside for installation at a subsequent service. Store the spare filter in a dry place and wrap it to prevent dust contamination or damage.



**NOTE: Wash the filter more frequently when operating in extremely dusty conditions.**

**NOTE: Replace the filter when holes or tears are visible.**

**NOTE: The element may be washed a maximum of 10 times.**

Reinstall the filter into its frame. Lift the assembly in to place and lock in position using the knob (2).

**WARNING: THE CAB AIR FILTER IS DESIGNED TO REMOVE DUST FROM THE AIR BUT WILL NOT EXCLUDE CHEMICAL VAPOR. FOLLOW THE CHEMICAL MANUFACTURERS DIRECTIONS REGARDING PROTECTION FROM DANGEROUS CHEMICALS.**

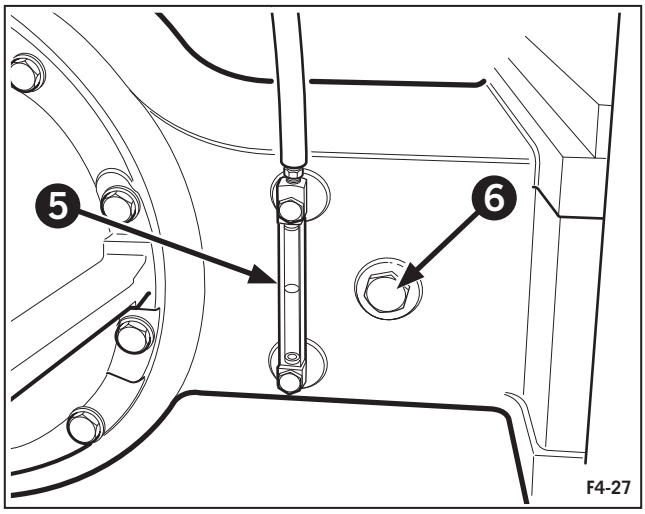
## Operation 20

### Check the Differential Oil Level

Differential oil level must be maintained to provide adequate lubrication and cooling to the differential components.

Check the differential oil level in both axles when the tractor is on a level surface and has been stationary for one hour to allow the oil in each of the axles and planetary hubs to level out.

Each axle housing has a convenient sight gauge (5) located on the right half of the axle when facing the differential input. The oil level in the gauge should be even with the center of plug (6). If additional differential oil is required, remove the plug (6) and add oil as necessary.




**Torque Value:** 61-75 N·m (45-55 ft-lbs)

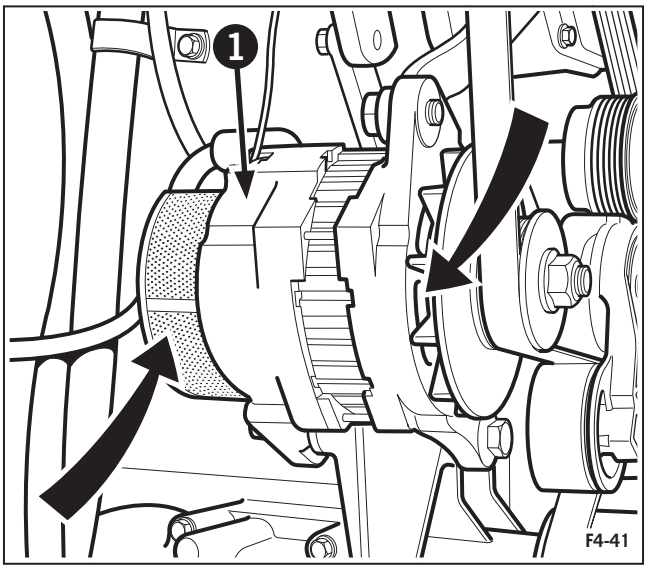
**Wrench size:** 1¼" (1.250")

Buhler Versatile recommends 85W140 GL5 oil be used in temperatures above or 80W90 GL5 in temperatures below 0°C (32°F).

## Operation 21

### Clean the Alternator

Clean the fine dust accumulated in the alternator (1) with compressed air.




**WARNING: WEAR APPROPRIATE EYE AND FACE PROTECTION WHEN USING COMPRESSED AIR. FLYING DIRT AND DEBRIS CAN CAUSE PERSONAL INJURY.**

## Operation 22

### Check the Tire Air Pressure

It is extremely important that tires (singles, duals, or triples) are kept at proper inflation pressures, based on the load being carried by the tires.

A special tire gauge capable of measuring low pressure, 0 to 1.4 bar (0 to 20 PSI) is required.

**NOTE: If the tires are ballasted with a calcium chloride/water solution, check pressure with the valve stem at the top of the tire.**

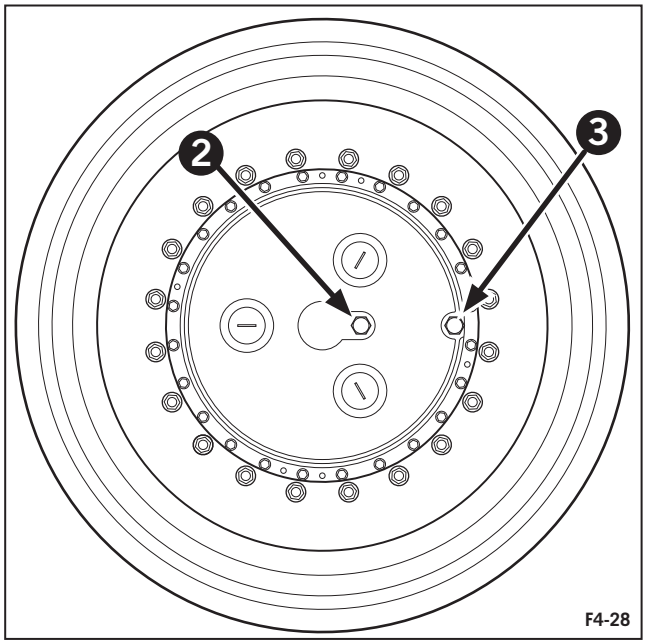
See the "Tire Load and Inflation Tables" in Section 6 of this manual for the proper inflation pressures.

## Operation 23

### Check the Planetary Hub Oil Level

The oil in the four planetary hubs (two on each axle) must be maintained at the proper level to provide lubrication for the outboard planetaries.

To check the planetary hub oil level, rotate the tire so that the plugs (2 & 3) are in the 3 or 9 o'clock position. Remove the drain plug (3) and see if oil runs out or is level with the plug opening. If no oil runs out, the hub requires oil. Remove the fill plug (2) and add oil until it runs out of the check plug (3). Replace both plugs.




**Torque Value:** 61-75 N·m (45-55 ft-lbs)

**Wrench size:** 1¼" (1.250")

Check the differential oil level when the tractor is on a level surface and has been stationary for one hour to allow the oil in the axle and planetary hubs to level out.

Buhler Versatile recommends 85W140 GL5 oil be used in temperatures above 0°C (32°F) or 80W90 GL5 in temperatures below 0°C (32°F).

# Every 250 Hours

## Operation 24

### Change the Engine Oil and Filter

To change the engine oil and filter, operate the engine until the coolant temperature reaches 60° C (140° F). Shut off the engine.

There are two oil plugs (3) located on the bottom of the oil pan. Either plug can be removed to drain the oil. Drain the oil completely to make sure all the oil and suspended contaminates are removed from the engine.

**NOTE: All model tractors use one single oil filter mounted on the right-hand side of the engine.**

Clean the area around the oil filter head (4). Unscrew the old filter (5) and discard.

Clean the sealing surface of the filter head. The O-ring may stick on the filter head. Make sure it is removed.

**NOTE: Fill the new filter with clean engine oil.** (The lack of lubrication during the delay until the filter is charged with oil is harmful to the engine). Apply a light film of oil to the gasket sealing surface before installing the new filter.

Install the new filter on the filter head. Tighten the filter until the gasket contacts the filter head surface. Tighten the filter an additional 1/2 to 3/4 of a turn.

**NOTE: Over-tightening can distort the threads or damage the filter element seal. Do not use tools to tighten the filter.**

Clean and check the oil drain plug threads and the sealing surface. Install and tighten the oil drain plug.

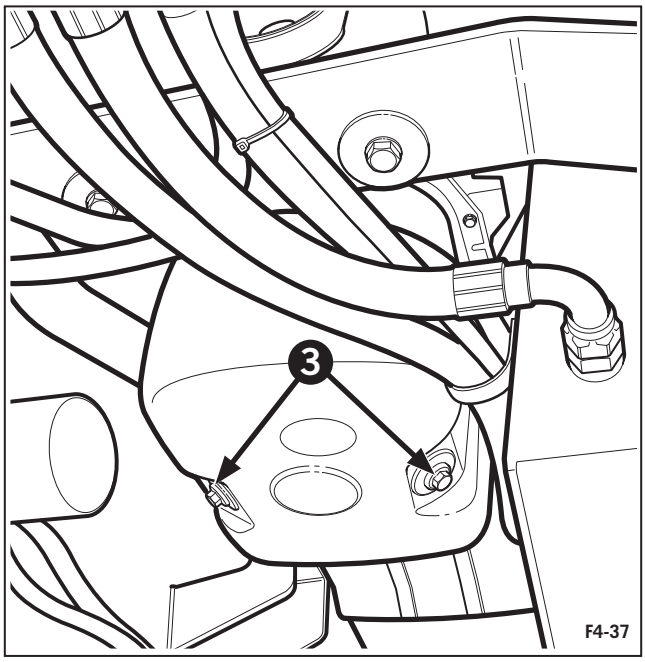
**Torque Value:** 47 N·m (35 ft-lbs)

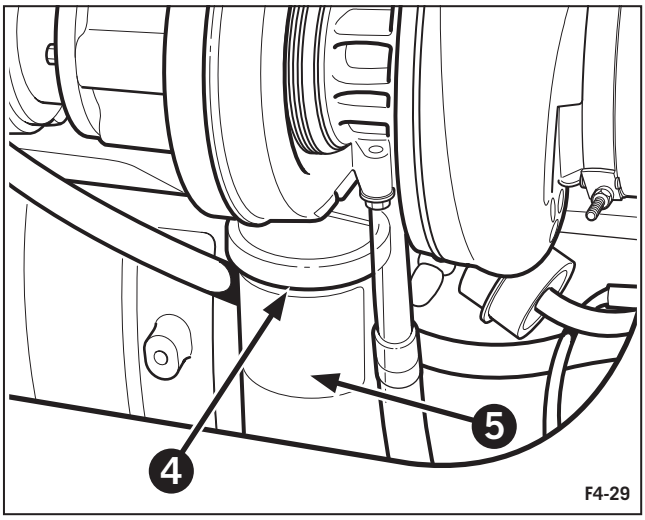
**Wrench size:** 3/4"

Fill the engine with high quality 15W-40 multi-viscosity oil to the proper level as indicated by the dipstick. The oil change capacity (oil pan and filter filled to capacity) is 45.4 L (12 Gal).

**NOTE: The engine is filled with 10W-30 oil at the factory. This weight of oil aids coldweather starting at the manufacturing facility. SAE 15W-40 oil as listed is the preferred viscosity oil for normal operation.**

Operate the engine at idle speed and inspect for leaks at the filters and drain plugs.




**NOTE: Engine oil pressure must be indicated on the EIC display within 10 seconds after starting. If oil pressure is not registered within 10 seconds, shut off the engine immediately to avoid engine damage. Confirm the correct oil level in the oil pan.**

Shut off the engine. Wait approximately five minutes to let the oil drain from the upper parts of the engine. Check the oil level again.

Add oil as necessary to bring the oil level to the (FULL) mark on the dipstick.

*IMPORTANT: Discard used engine oil according to local laws and regulations.*

## Operation 25

**Change the Fuel Filter**

**WARNING: FUEL IS FLAMMABLE. KEEP ALL CIGARETTES, FLAMES, PILOT LIGHTS, WELDING EQUIPMENT, AND SWITCHES OUT OF THE WORK AREA AND AREAS SHARING VENTILATION TO AVOID SEVERE PERSONAL INJURY OR DEATH WHEN WORKING ON THE FUEL SYSTEM.**

Clean the area around the fuel filter head and filter (3). Disconnect the wiring harness from the water-in-fuel sensor (4).

Unscrew and discard the old fuel filter (5).

Use a clean, lint-free towel to clean the filter head gasket surface.

Apply a thin coat of clean engine oil to the gasket surface and the O-ring in the center of the fuel filter.

**CAUTION: MECHANICAL OVERTIGHTENING OF THE FILTER CAN DISTORT THE THREADS OR DAMAGE THE FILTER ELEMENT SEAL.**

**NOTE: The engine is equipped with a priming pump and does not require the fuel filter to be filled prior to the installation if the following filling procedure is followed.**

Install the new filter onto the filter head. Tighten the filter until the gasket contacts the filter head surface.

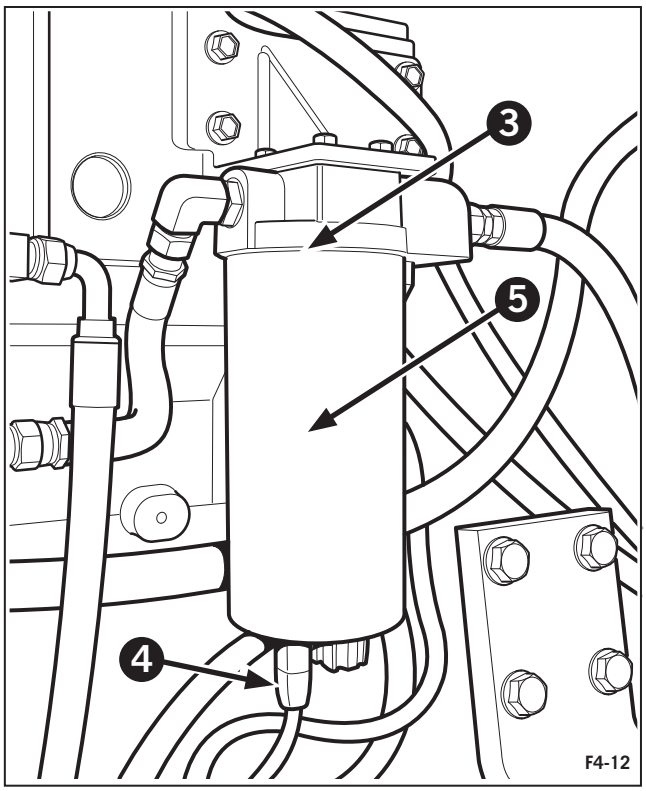
Tighten the filter an additional 3/4 of a turn after the gasket contacts the filter head surface, or as specified by the filter manufacturer.

**NOTE: If the filter is equipped with a water-in-fuel sensor, rotate the sensor to desired location, and re-connect the wiring harness.**

To prime the fuel filter, turn the ignition switch to the ON position and leave for two minutes. The engine can then be started.

**NOTE: The engine will, perhaps, run rough for several minutes until the air is out of the system.**

**Replacement fuel filter element P/N: 86034027**




## Operation 26

**Check the Engine Supplemental Coolant**

The SCA protection additive level must also be checked whenever coolant is added or the cooling system filter is changed.

A test kit, complete with instructions, to check the concentration level is available from your Cummins dealer.

Follow the instructions in the kit to maintain proper SCA protection level.

## Operation 27

**Change the Transmission Oil Filter (CAT TA22)**

The transmission filter (1) is located behind the transmission.

The transmission filter is a spin-on type and is removed by turning it counterclockwise.

**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

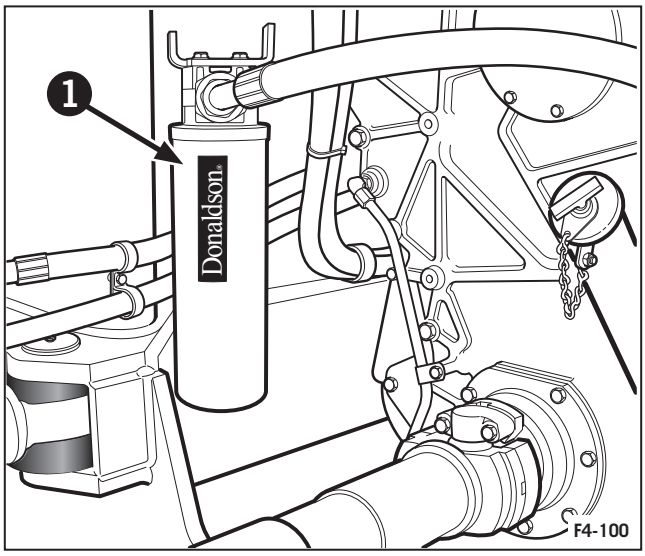
To install the new filter, lubricate the O-ring on top of the new filter with clean transmission oil. Install the filter to the filter head, hand-tightening until the seal contacts the filter head. Tighten the filter an additional 1/2 to 3/4 turn.

**NOTE: Some oil, approximately 2 L (4 qt.), may be lost when the filter changed. Be sure to replenish the lost oil.**

Start the engine and check for leaks at the filter.

**Replacement transmission filter P/N: 86034346**

**NOTE: Do not operate the transmission with oil levels above or below the recommended levels. Either condition can result in overheating or loss of power and damage to the equipment.**




## Operation 28

**Optional - Change the Transmission Oil after first 250 hours of operation (CAT TA22)**

Check the oil level with the tractor parked on a level surface with the engine shut off.

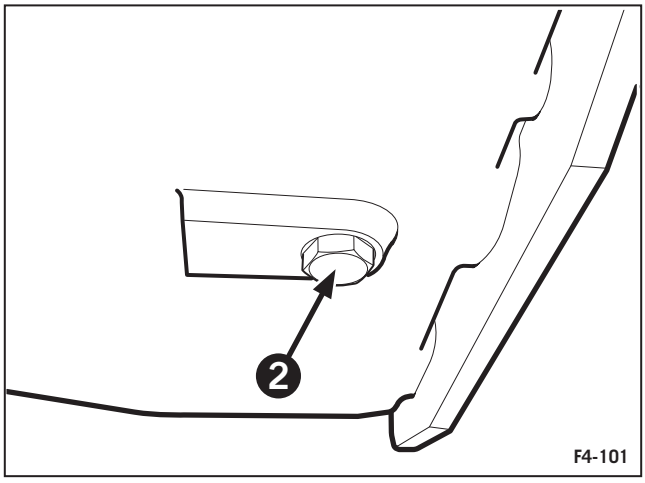
Operate the tractor a sufficient amount of time to warm up the transmission oil. Remove the drain plug (2) from the transmission housing and allow the oil to drain into a pan.

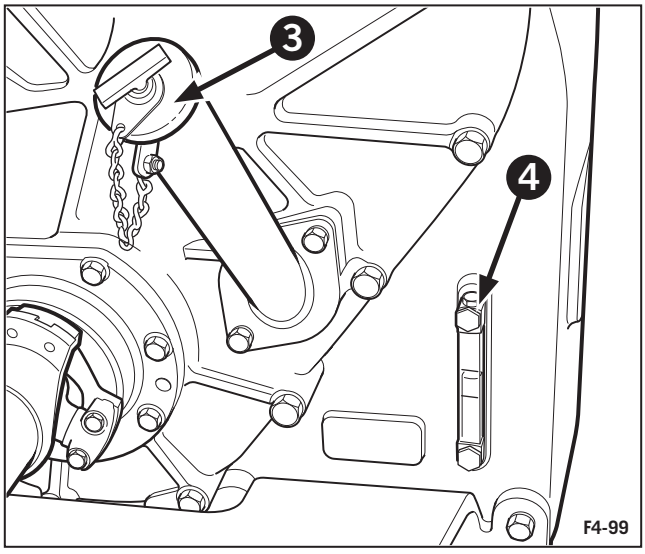
Clean the drain plug with a none flammable cleaning solvent.

Replace the drain plug and torque to 108 N·m (80 ft-lbs ± 5%). Refill the transmission with new oil through the fill tube (3) to the proper level as indicated by the sight gauge (4).

**NOTE: 3.8 L (1 US gal) of transmission oil will raise the level in the sight gauge 10 mm (0.4 inch).**

Visually inspect the transmission for leaks. Check for leaks under the transmission and around the drain plug.



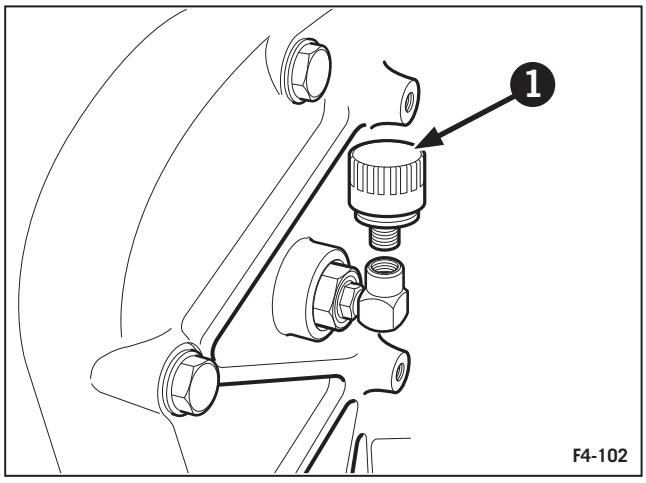
## Operation 29

**Clean the Transmission Breather (CAT TA22 only)**

The transmission breather (1) is located on the upper rear side of the transmission. Unscrew and remove the breather.

Clean the breather in clean, nonflammable solvent.

Re-install the breather.



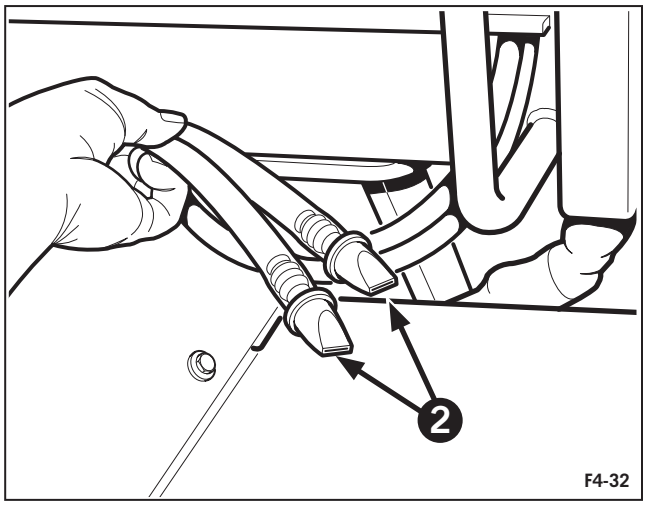

## Operation 30

**Check the Air-Conditioner Drain Hoses**

A/C drain hoses are routed down inside the front cab door posts (two per side) and exit below the front frame.

Withdraw the hoses and inspect the dust valves (2) fitted to the end of each tube. Ensure that they are sealing properly and that condensation from the A/C can drain away. Clean when necessary. If the dust valves are missing, replace. Refit drain tubes between the fender and frame.

**NOTE: Blocked drain tubes can lead to the A/C unit filling with condensation and leaking into the roof headliner causing damage to electrical components.**

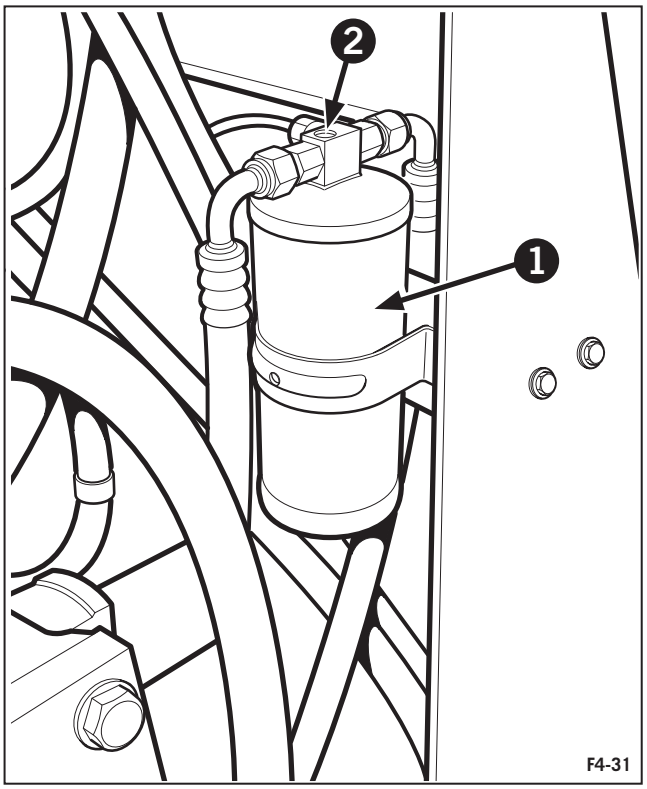


## Operation 31

### Check the Air-Conditioner Sight Glass

The air-conditioner sight glass should be checked to see if the system is functioning properly.

The receiver/drier (1) is located on the rear, left hand hood support. Check the sight glass (2) on the top of the receiver tank every 250 hours. If clear, the system is in good condition; if bubbles flow across the sight glass with the engine running, the system may be low on refrigerant. If the glass is cloudy, it is an indication that the system is contaminated with moisture. When moisture is present, the dryer will have to be replaced by a qualified air-conditioning service technicians. Contact your Buhler Versatile dealer.




**WARNING: NEVER LOOSEN, OR DISCONNECT ANY OF THE HOSES IN THE AIR-CONDITIONING SYSTEM.**

**THE AIR-CONDITIONER HOSES ARE UNDER PRESSURE AT ALL TIMES, EVEN WHEN THE TRACTOR IS NOT RUNNING.**

**DO NOT ATTEMPT TO SERVICE THE AIR-CONDITIONING SYSTEM. IT IS POSSIBLE TO SUFFER SEVERE FROSTBITE OR INJURY FROM ESCAPING REFRIGERANT. SPECIAL EQUIPMENT AND INSTRUMENTS ARE REQUIRED TO SERVICE THE AIR-CONDITIONING SYSTEM WHICH USES R134A REFRIGERANT. SEE YOUR AUTHORIZED BUHLER VERSATILE DEALER**

## Operation 32

**Check the Weight Kit (Optional) Hardware Torques**

Check the hardware securing the front, upper rear and rear weight brackets and weights to the tractor.

**Front weight kit -** Check the ten flanged nuts (1) securing the bracket to the tractor and torque to 633 N·m (467 ft-lbs).

Check the weight mounting bolts (2) securing the weights to the weight bracket and torque to 480 N·m (354 ft-lbs).

Check the tie rod nuts (3) and torque to 633 N·m (467 ft-lbs).

**Rear weight kit**

Check the eight bolts (4) securing the bracket to the tractor and torque to 633 N·m (467 ft-lbs).

The rear weights are mounted using the same procedure as the front weight kit. Check the weight mounting bolts (2) securing the weights to the weight bracket and torque to 480 N·m (354 ft-lbs).

Check the tie rod nuts (3) and torque to 633 N·m (467 ft-lbs).

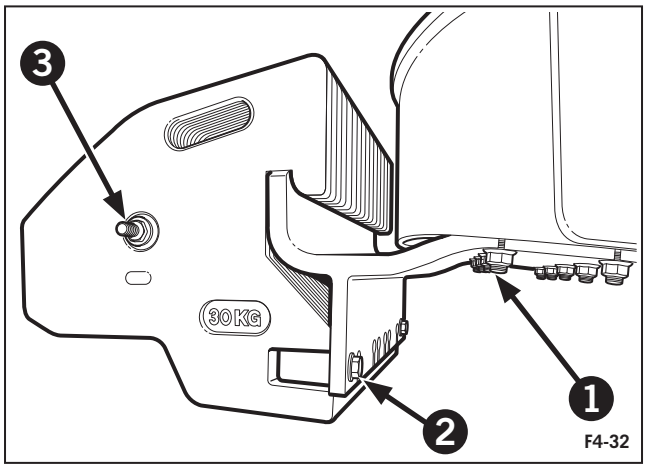
**Upper rear weight kit (not shown)**

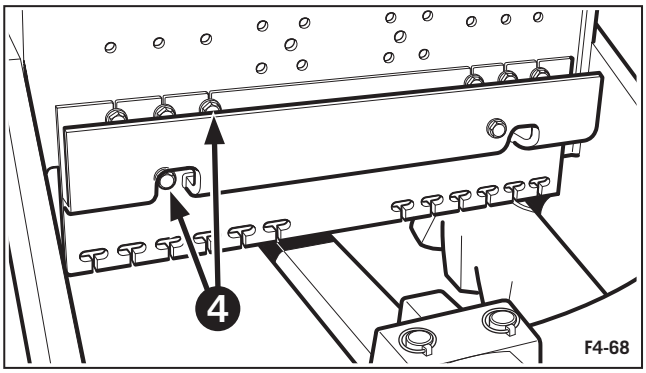
Check the six bolts (5) securing the bracket to the tractor and torque to 633 N·m (467 ft-lbs).

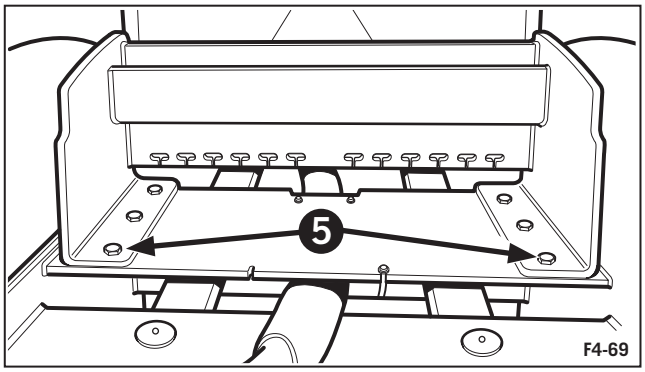
The upper rear weights are mounted using the same procedure as the front weight kit. Check the weight mounting nuts (2) securing the weights to the weight bracket and torque to 480 N·m (354 ft-lbs).

Check the tie rod nuts (3) and torque to 633 N·m (467 ft-lbs).

**Wrench size:** 30 mm




## Operation 33

**Check the Wheel Hardware Torque**

All wheel mounting hardware must be checked for proper torque. The following chart shows wheel torques, based on wheel configuration.

**Wrench size:** 30 mm

**NOTE: For identification of particular hardware components, see Operation 75 later in this section.**

| Configuration | Torques |
|---|---|
| Singles | Wheel to Hub Nuts<br>710 N·m (525 ft-lbs.) |
| Standard and Special Row Crop Drum Duals | Wheel to Hub Nuts<br>710 N·m (525 ft-lbs.) |
| Drum Style Triples | Wheel to Hub Nuts<br>710 N·m (525 ft-lbs.)<br>Center Wheel to Outer Wheel Nuts<br>710 N·m (525 ft-lbs.) |

## Operation 34

**Change the Transmission Oil Filter**
**(1407 Twindisc Powershift Transmission Only)**

The transmission filter (1) is located inside the front frame on the right side of the tractor directly below the engine.

The transmission filter is a spin-on type and is removed by turning it counterclockwise.

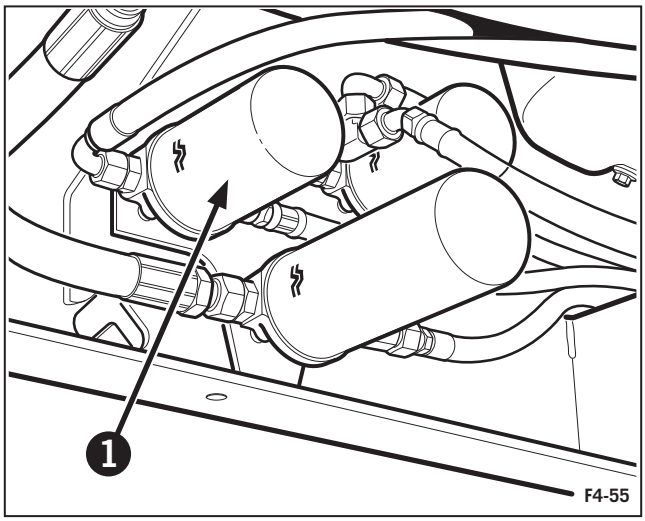
**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

To install the new filter, lubricate the O-ring on top of the new filter with clean transmission oil. Install the filter to the filter head, hand-tightening until the seal contacts the filter head. Tighten the filter an additional 1/2 to 3/4 turn.

**NOTE: Some oil, approximately 0.95 L (1 qt.), may be lost when the filter is unscrewed from the filter head. Be sure to replenish the lost oil.**

Start the engine and check for leaks at the filter.

**Replacement transmission filter P/N: 86029162**



## Operation 35

### Clean the Battery Connections

The battery connections must be cleaned and tightened to maintain proper operation of the electrical system of the tractor.

Remove the three battery ground cable connections, (1) first, and then the three positive cable connections, (2) before cleaning. Each connection has a rubber boot covering it for protection. The connections are loosened by turning the nut counterclockwise and pulling the connection from the battery mounting stud.

Clean the battery stud, battery cable and mounting nut thoroughly with a brush and reinstall the cables. Attach the positive cables first and the ground cables last.

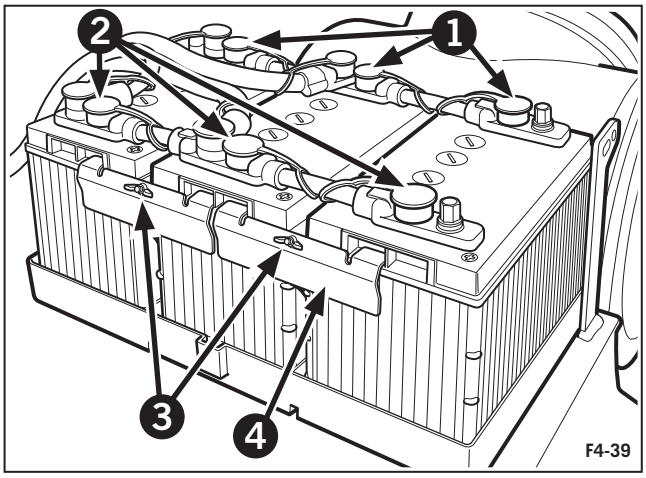
**CAUTION: WHEN SERVICING THE BATTERIES, DISCONNECT THE NEGATIVE (BLACK) CABLES BEFORE THE POSITIVE (RED) CABLES. WHEN CONNECTING THE CABLES, CONNECT THE POSITIVE CABLE FIRST, THEN THE NEGATIVE. THIS WILL REDUCE THE POSSIBILITY OF SPARKING AND BATTERY EXPLOSION.**

**WARNING: ALL BATTERIES GENERATE HYDROGEN GAS, WHICH IS HIGHLY FLAMMABLE. IF IGNITED BY A SPARK OR FLAME, THE GAS MAY EXPLODE VIOLENTLY CAUSING A SPRAY OF ACID, FRAGMENTATION OF THE BATTERY, AND POSSIBLE SEVERE PERSONAL INJURY, PARTICULARLY TO THE EYES.**

**THEREFORE, AS A SAFETY PRECAUTION:**

- **WEAR PROTECTIVE CLOTHING AND GOGGLES.**
- **DO NOT SMOKE OR EXPOSE THE BATTERY TO OPEN FLAME.**
- **DO NOT CONNECT OR DISCONNECT LIVE CIRCUITS.**

If the batteries require removal, disconnect the cables as previously detailed. Loosen the wing nuts (3) and lower the clamps (4) downward. Lift the battery to be removed from the battery tray.




*(Battery cover omitted for clarity)*

## Operation 36

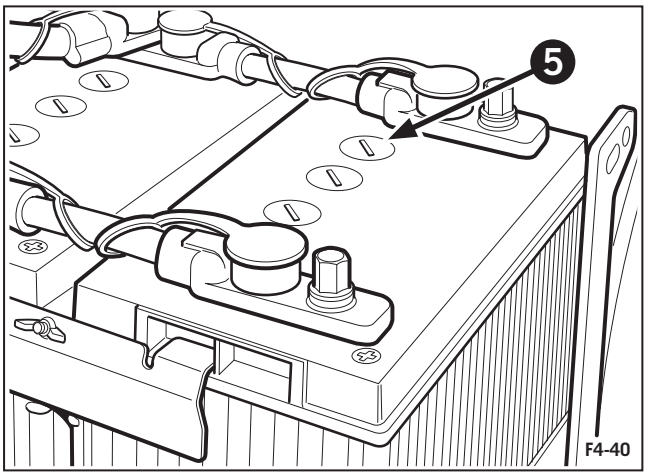
**Check the Battery Electrolyte Level**

To check the battery electrolyte level, clean the top of the batteries with a damp cloth.

Remove the six fill plugs (5) from each battery. Check that the electrolyte level is 6 mm (1/4") below the filler neck of each cell. Add distilled or demineralized water as required. Do not overfill.

Replace all fill plugs.

Check for loose cable connections. Tighten as required.




**WARNING: BATTERIES CONTAIN SULFURIC ACID. IN CASE OF CONTACT WITH SKIN, FLUSH THE AFFECTED AREA WITH WATER FOR FIVE MINUTES. SEEK MEDICAL ATTENTION IMMEDIATELY.**

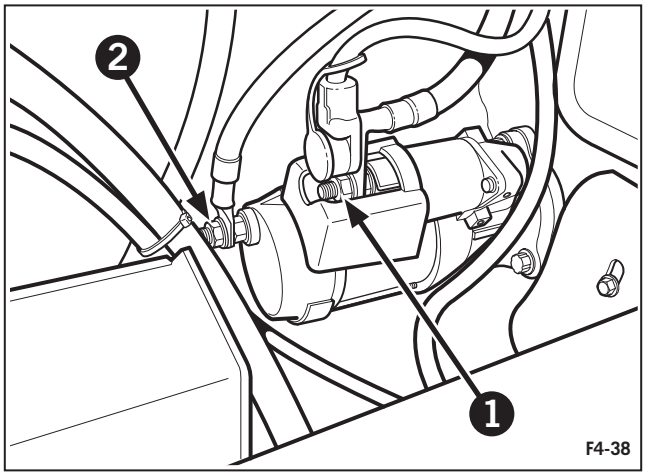
**WARNING: AVOID CONTACT WITH THE SKIN, EYES OR CLOTHING. WEAR EYE PROTECTION WHEN WORKING NEAR BATTERIES.**

## Operation 37

**Check the Starter Battery Connections**

Check to be sure that the battery cable connection (1) and the ground connection (2) are tight and clean where they attach to the engine starter. Clean and tighten as necessary.

The starter is located on the left side of the engine.



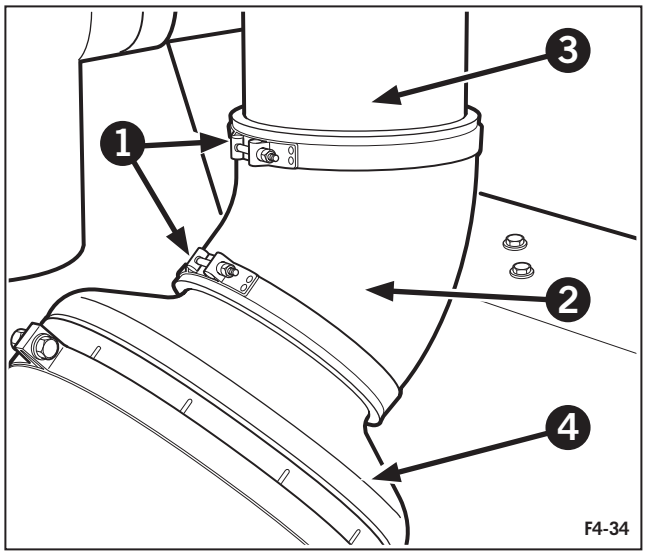

**WARNING: DISCONNECT THE BATTERY CABLES AT THE BATTERY BEFORE WORKING ON THE BATTERY CABLE CONNECTIONS AT THE STARTER.**

## Operation 38

### Clean the Engine Air Precleaner

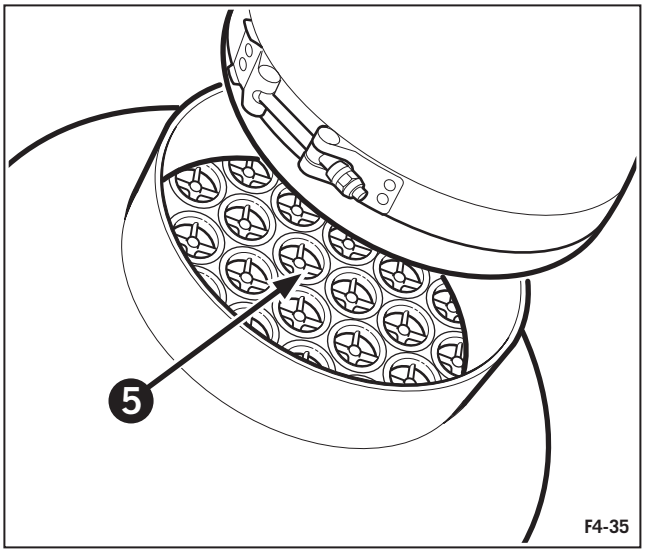
The engine air precleaner must be checked to be sure that debris is not causing any obstruction at the precleaner inlet.

To inspect the inlet to the precleaner, loosen the two hose clamps (1) attaching boot (2) to the air cleaner tube (3) and the precleaner (4).



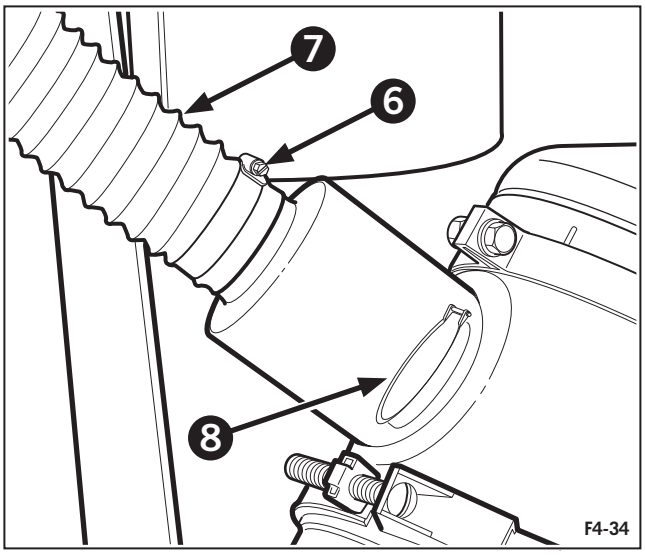

Slide the boot toward the front of the tractor on the tube. Inspect the inlet (5) of the precleaner, and remove any debris accumulated in this area.

After the precleaner is cleaned, reinstall the boot and tighten the hose clamps securely.




Loosen the clamp (6) and disconnect the aspirator hose (7) where it connects to the precleaner aspirator tube.

Inspect by looking down inside the precleaner aspirator tube and remove any accumulated debris. Check that the flapper door (8) is operating properly.



## Operation 39

### Clean the Hydraulic Suction Screen

The hydraulic suction screen (1) is located in the rear of the hydraulic oil reservoir tank.

Remove the drain plug (2) and drain the hydraulic oil from the hydraulic oil reservoir tank before removing the suction screen.

To remove the suction screen, first clean the top of the tank where the hydraulic hose attaches to the suction screen port.

Unscrew and remove the hose (3).

Unscrew and remove the suction screen (1).

Cover the open fitting (4) to prevent contaminants entering the tank.

Use a cleaning solvent to wash any debris from the suction screen.

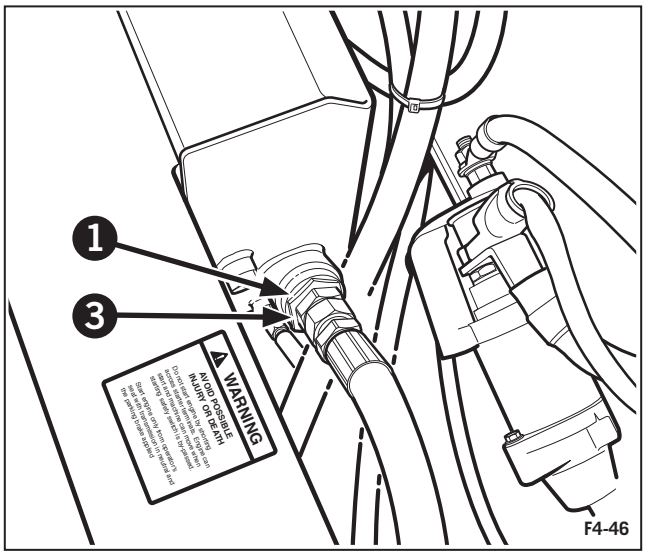
Reinstall the suction screen (1) into the tank and tighten securely. Reinstall the hose (3) into suction screen and tighten securely.

Refit the drain plug (2) tighten securely.

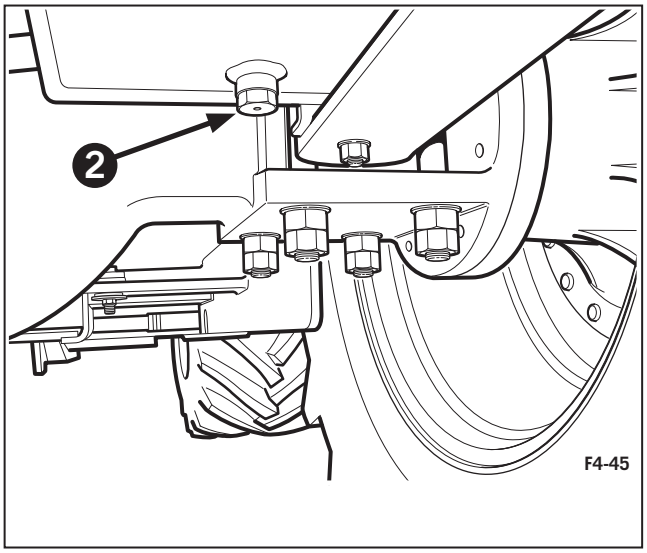
**Torque Value:** 81 N·m (60 ft-lbs)

**Wrench size:** 1¼" (1.250")

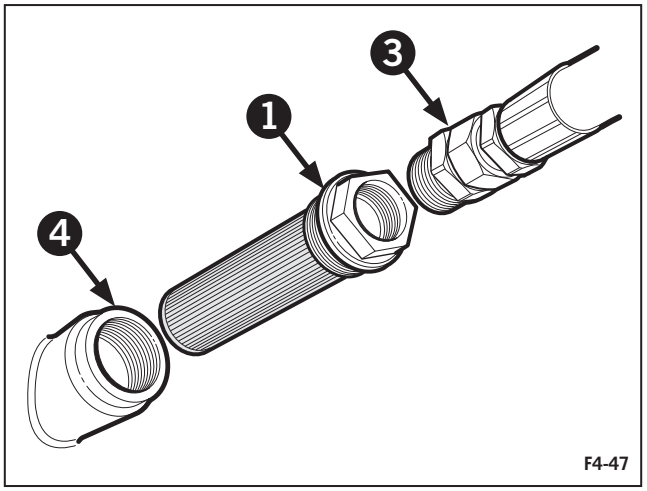
Refill the hydraulic oil reservoir tank to the correct level.



F4-46



F4-45



F4-47

## Operation 40

**Change the Hydraulic Oil Filter - (Standard Flow)**

The Standard Flow hydraulic filter (1) is located inside the front frame on the right side of the tractor directly below the engine.

The hydraulic filter is a spin-on type and is removed by turning it counterclockwise.

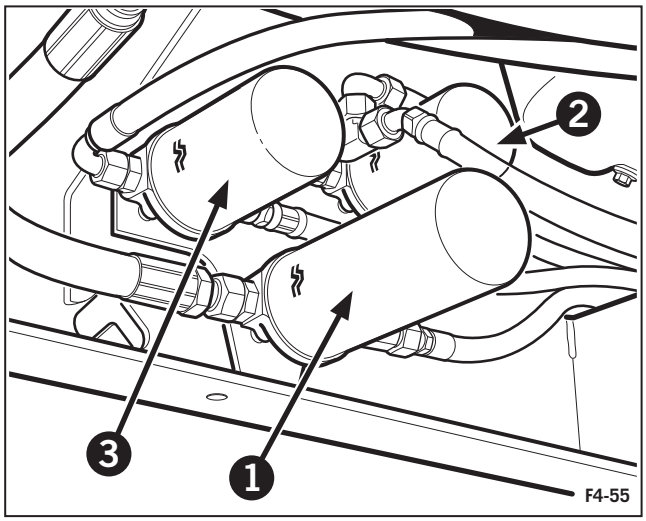
**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

To install the new filter, lubricate the O-ring on top of the new filter with clean hydraulic oil. Install the filter to the filter head, hand-tightening until the seal contacts the filter head. Tighten the filter an additional 1/2 to 3/4 turn.

**NOTE: Some oil, approximately 1.9 L (2 qts.), may be lost when the filter is unscrewed from the filter head. Be sure to replenish the lost oil.**

Start the engine and check for leaks at the filter.

**Replacement hydraulic filter - standard P/N: 86033080**




## Operation 41

**Change the Hydraulic Oil Filter - (Vehicle fitted with High Flow option)**

The High Flow hydraulic filter (2) is located inside the front frame on the right side of the tractor directly below the engine.

The hydraulic filter is a spin-on type and is removed by turning it counterclockwise.

**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

To install the new filter, lubricate the O-ring on top of the new filter with clean hydraulic oil. Install the filter to the filter head, hand-tightening until the seal contacts the filter head. Tighten the filter an additional 1/2 to 3/4 turn.

**NOTE: Some oil, approximately 1.9 L (2 qts.), may be lost when the filter is unscrewed from the filter head. Be sure to replenish the lost oil.**

**Replacement hydraulic filter - high flow P/N: 86029146**

## Operation 42

**Change the Transmission Oil Filter (Synchromesh Transmission Only)**

The transmission filter (3) is located inside the front frame on the right side of the tractor directly below the engine.

The transmission filter is a spin-on type and is removed by turning it counterclockwise.

**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

To install the new filter, lubricate the O-ring on top of the new filter with clean transmission oil. Install the filter to the filter head, hand-tightening until the seal contacts the filter head. Tighten the filter an additional 1/2 to 3/4 turn.

**NOTE: Some oil, approximately 0.95 L (1 qt.), may be lost when the filter is unscrewed from the filter head. Be sure to replenish the lost oil.**

Start the engine and check for leaks at the filter.

**Replacement transmission filter P/N: 86029162**

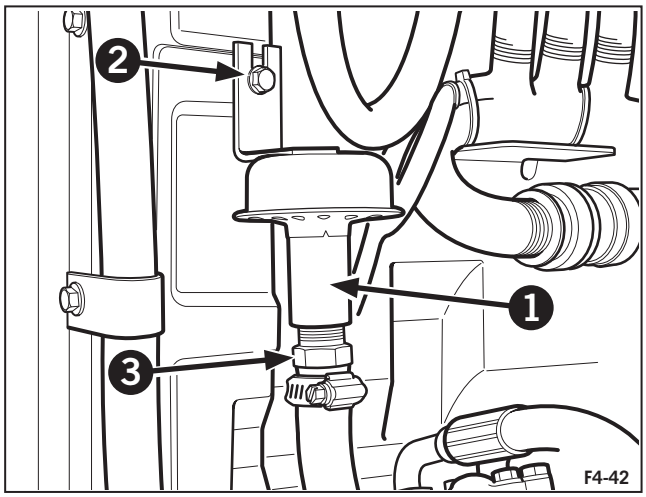
## Operation 43

**Clean the Hydraulic Tank Breather**

The hydraulic tank breather (1) is located on the left side of the engine above the hydraulic tank.

Remove the breather by loosening the mounting bolt (2) and slide the breather mounting bracket clear. Unscrew the breather from its hose (3). Clean the breather using low pressure air, 1.7 bar (25 PSI) or less.

Reinstall the breather using the reverse procedure.




## Operation 44

**Change the Auxiliary Fuel Filter (Optional)**

**WARNING: FUEL IS FLAMMABLE. KEEP ALL CIGARETTES, FLAMES, PILOT LIGHTS, WELDING EQUIPMENT, AND SWITCHES OUT OF THE WORK AREA AND AREAS SHARING VENTILATION TO AVOID SEVERE PERSONAL INJURY OR DEATH WHEN WORKING ON THE FUEL SYSTEM.**

Clean the area around the fuel filter cover (4).

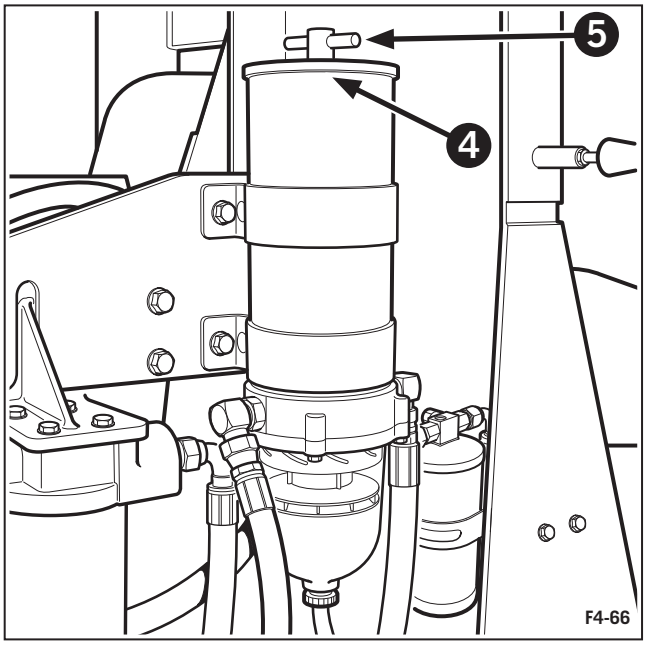
Unscrew the T-handle (5) and remove the cover (6).

Remove the filter element by pulling upward on the handles (7) with a twisting motion. Discard the element.

Fit new filter element into filter body.

Remove the old O-rings from the cover (8) and T-handle (9) and refit with new seals (supplied with the new element). Lubricate the seal with a thin coating of clean engine oil or diesel fuel before installation.

Replace the cover and tighten T-handle, by hand only. Do not use tools.



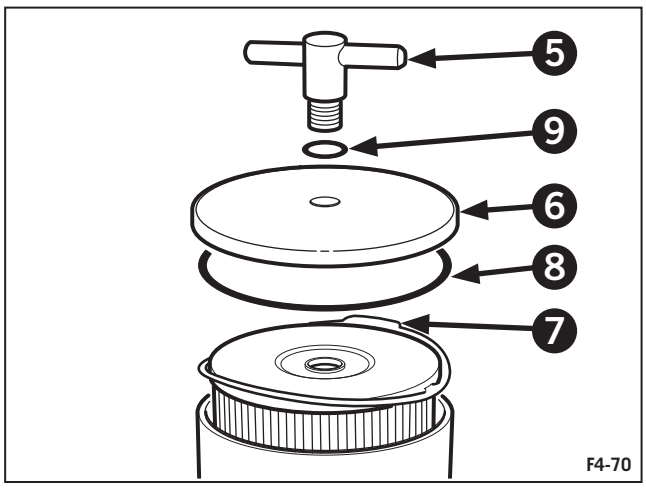

**NOTE: The engine is equipped with a priming pump and does not require the fuel filter to be filled prior to the installation if the following filling procedure is followed.**

To prime the fuel filter, turn the ignition switch to the ON position and leave for two minutes. The engine can then be started.

**NOTE: The engine will, perhaps, run rough for several minutes until the air is out of the system.**

**Replacement auxiliary fuel filter P/N: 86033134**

Start the engine and check for leaks at the filter.



## Operation 45

**Change the Differential Oil**

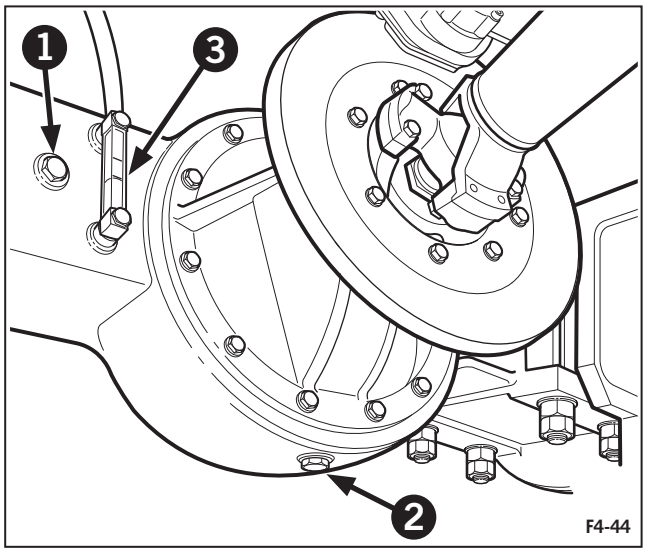
Before changing the differential oil, operate the tractor a sufficient amount of time to warm up the oil in the differentials. Loosen the check plug (1) and remove the drain plug (2) allowing the oil to drain completely from the differential housings.

Replace the drain plug (2) and tighten it to 74 N·m (55 ft-lbs). Make sure the sealing surface on the plug is in good condition.

Refill the differentials through the check plug (1) to the proper level as indicated by the sight gauge (3).

Buhler Versatile recommends that 85W140 GL5 oil be used in temperatures above 0°C (32°F) or 80W90 GL5 in temperatures below 0°C (32°F).

**NOTE: Oil will flow from the differential to the planetary hubs. Change the oil with the tractor on a level surface and allow the differential and planetary hub oil to level out.**




## Operation 46

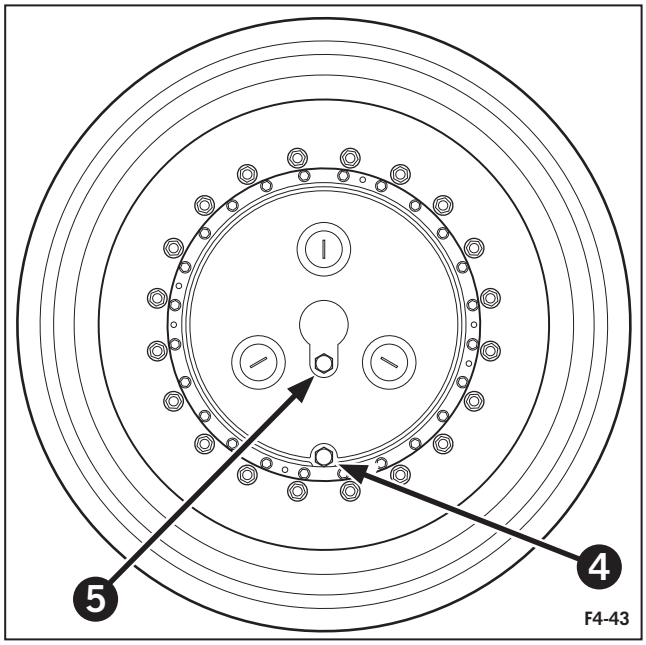
**Change the Planetary Hub Oil**

To drain the planetary hub oil, rotate the tire so that the drain plug (4) is at the 6 o'clock position. Loosen the fill plug (5) to allow all of the oil to drain from the planetary hub. Make sure that the plug (4) is retightened, and then refill the hub as detailed in operation 23.

**Torque Value:** 61-75 N·m (45-55 ft-lbs)
**Wrench size:** 1¼" (1.250")

Buhler Versatile recommends that 85W140 GL5 oil be used in temperatures above 0°C (32°F) or 80W90 GL5 in temperatures below 0°C (32°F).

**NOTE: Oil will flow from the differential to the planetary hubs. Change the oil with the tractor on a level surface and allow the differential and planetary hub oil to level out.**

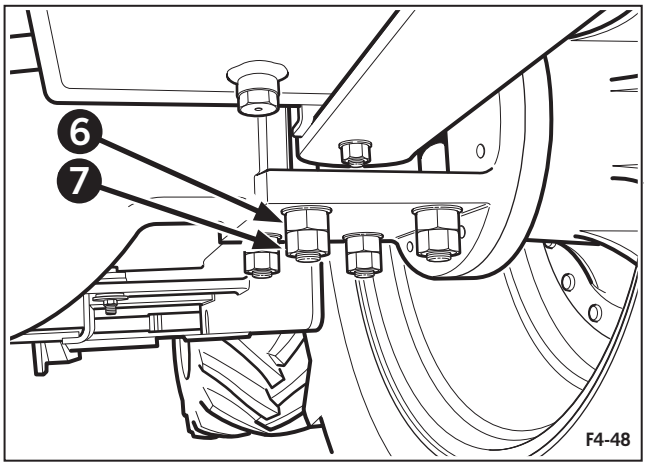



## Operation 47

**Check the Axle Mount Bolt Torque**

Check the axle mount bolts for proper torque.

Torque the nuts (6) and (7) to 1335 N·m (1000 ft-lbs). There are four sets of nuts on each end of both axles. **Wrench size:** 1¼" (1.250").



## Operation 48

### Check the Drawbar Wear Blocks

Inspect the stop wear blocks (1) for excessive wear. If there is wear on the blocks, rotate them 90° to provide a new wear surface for the drawbar to ride against.

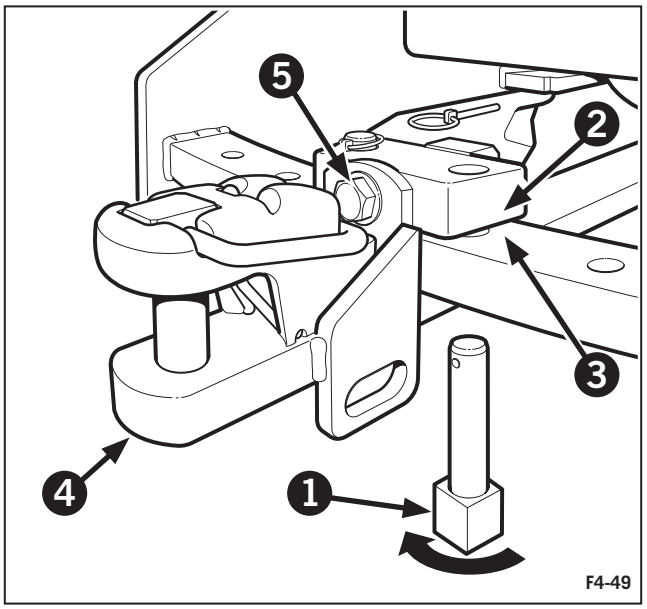
Measure the clearance between the top bridge plate (2) and the drawbar support (3). If there is 3 mm (1/8") or less clearance, replace the wear block under the bridge plate.

Remove the stop wear blocks (1).

Support the drawbar (4) and remove the bridge plate bolt (5). Lift off the top bridge plate (2). Replace the wear block and reassemble the bridge plate. Torque the bridge plate bolt (5) to 952 N·m (702 ft-lbs).

Replace the stop wear blocks (1).

**NOTE: The wear block under the bridge plate is attached to the plate with four cap screws. Be sure to reinstall the wear block cap screws during reassembly.**




## Operation 49

### Steam Cleaning the Tractor

If mud or debris is allowed to build up on the tractor, it can cause a safety hazard as well as detract from the appearance of the tractor.

Using a steam cleaner or high pressure washer, clean the tractor from end to end, paying particular attention to the underside and wheel area.

**CAUTION: ALWAYS SHUT THE TRACTOR OFF WHEN CLEANING OR SERVICING.**

*IMPORTANT: Never spray cold water on a hot tractor engine. The sudden temperature change may cause cracking of the cast iron components. The cold water hitting the injection pump can cause the components rotating inside the pump to seize due to the sudden temperature change.*

*IMPORTANT: Do not use caustic soaps that can cause damage to the paint finish on the tractor. Read the manufacturer's instructions carefully on the soap package.*

*IMPORTANT: Do not spray high pressure water into the cooler/radiator area of the front grille. Damage to the cooling fins will result.*

## Operation 50

**Change the Transmission Oil (CAT TA22 Transmission)**

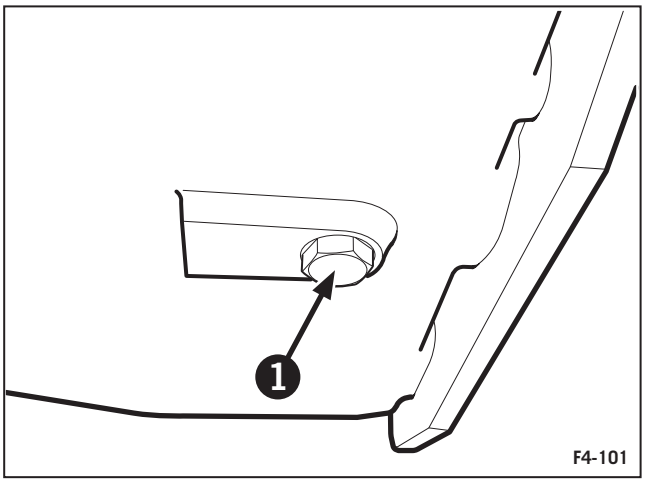
Check the oil level with the tractor parked on a level surface with the engine shut off.

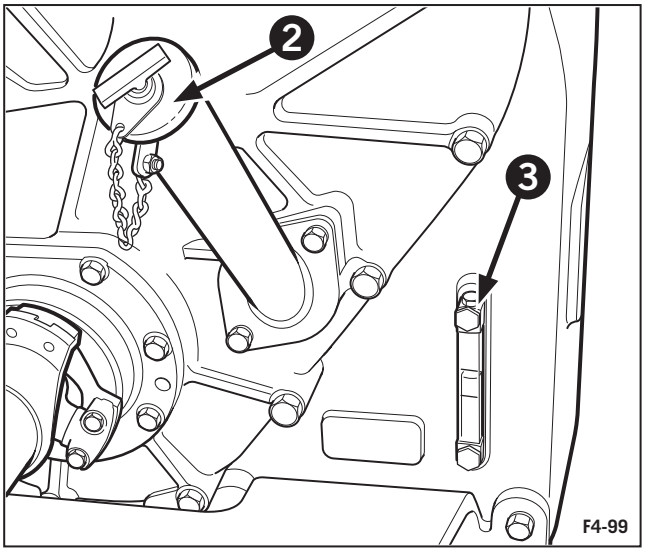
Operate the tractor a sufficient amount of time to warm up the transmission oil. Remove the drain plug (1) from the transmission housing and allow the oil to drain into a pan.

Replace the drain plug and torque to 108 N·m (80 ft-lbs ± 5%). Refill the transmission with new oil through the fill tube (2) to the proper level as indicated by the sight gauge (3).

**NOTE: 3.8 L (1 US gal) of transmission oil will raise the level in the sight gauge 10 mm (0.4 inch).**

Visually inspect the transmission for leaks. Check for leaks under the transmission and around the drain plug.




## Operation 51

**Clean the Transmission Suction Screen (CAT TA22 Transmission)**

The CAT TA22 transmission has a removable sump screen located on the right hand side/front of the transmission case. To remove the suction screen, proceed as follows:

**NOTE: It is not necessary to drain the transmission oil before removing the suction screen.**

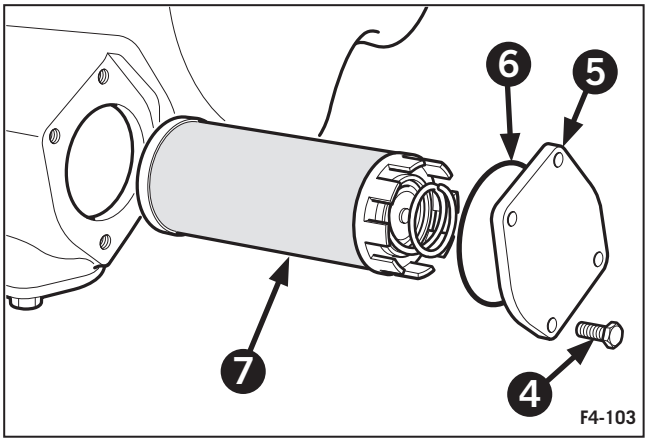
Remove four bolts (4) and cover plate (5) from the transmission housing.

Remove the O-ring (6) from the inside face of the cover plate. Inspect the O-ring for condition before refitting into the the groove on the inside face of the cover plate. Replace the O-ring if it is damaged.

Remove the the suction (7) screen from the transmission housing and clean with a none flammable cleaning solvent.

Re-install the suction screen into the housing ensuring that it seats properly.

Reinstall the cover plate (2) with four bolts (1) and torque to 75 N·m (55 ft-lbs).



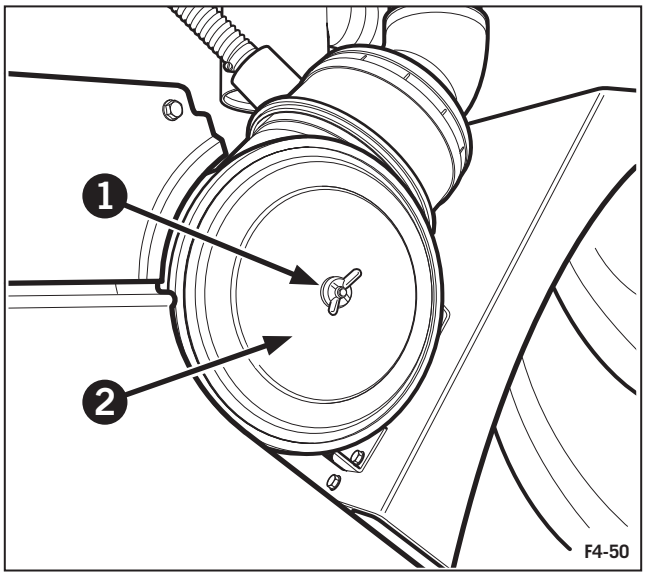
## Operation 52

### Change the Engine Inner and Outer Air Cleaner Elements

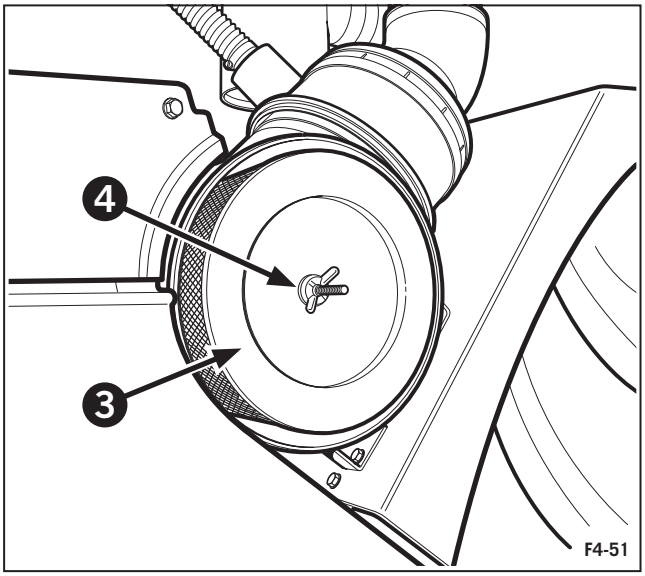
The engine air cleaner consists of a large outer element, smaller safety element, and an exhaust aspirated precleaner. The precleaner removes dirt from the air and discharges it through the exhaust muffler.

*IMPORTANT: When servicing the air cleaner, wear a mask when changing the air filters. Do not breath in dust.*

To access the inner and outer elements, remove the large wing nut (1) on the outside of the cover. Remove the cover (2) from the air cleaner canister.

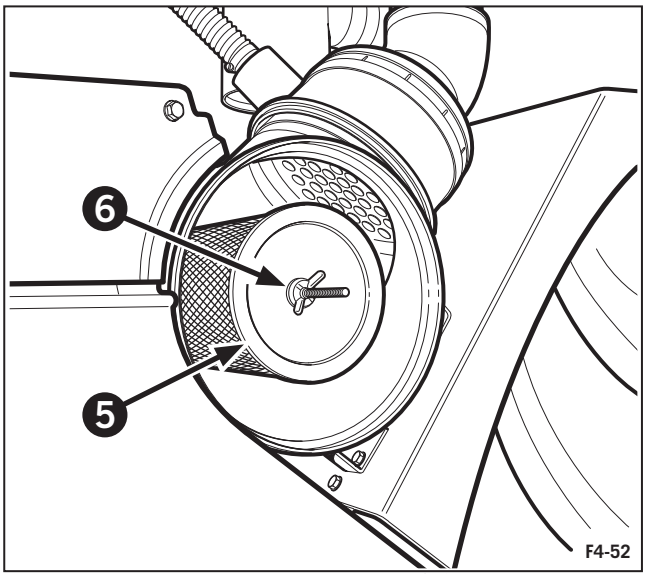



Remove the outer element (3) by removing the wing nut (4) and pulling the element from the canister. Discard the old element.

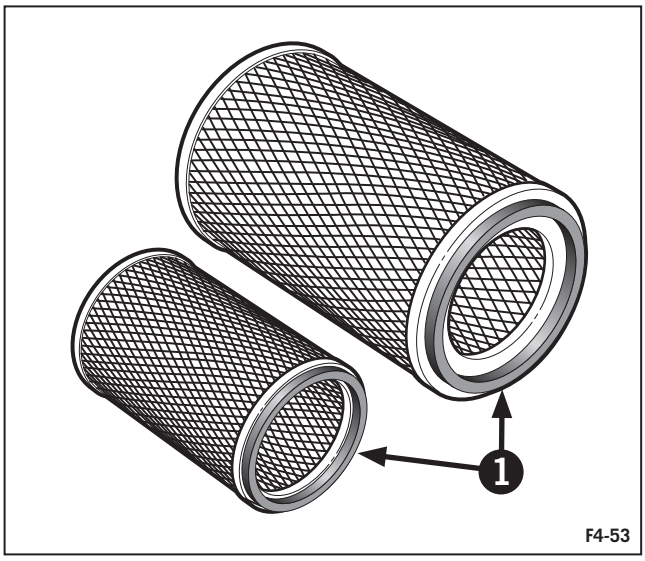



Remove the inner element (5) by removing the wing nut (6) and pulling the element from the canister. Discard the old element.

Clean the inside of the air cleaner body with a lint-free towel before installing the element.



Inspect the seal (1) on both new elements before installing. Cracks or chips in the element sealing rubber indicate that the element is defective and must be replaced.

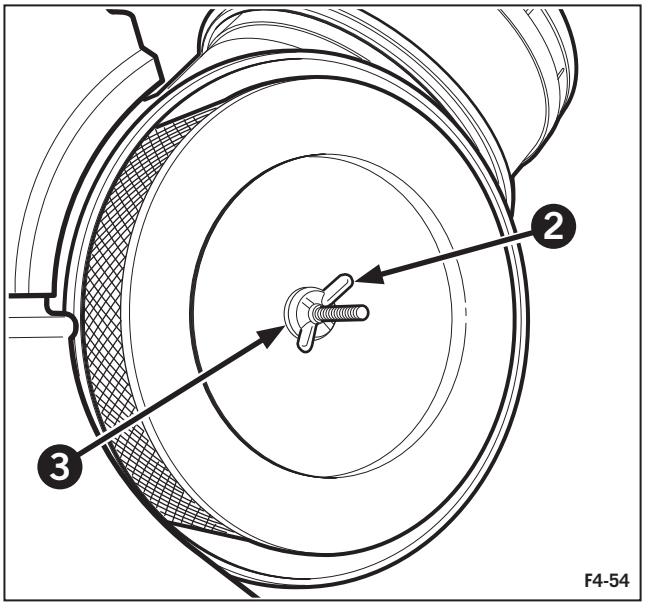



Install the elements into the canister. Be sure that the seal on the end of the filters fully contacts the air cleaner body. The wing nuts (2) have a small seal (3) on the inner face which should be in good condition before the wing nuts are tightened. If the seals (3) are damaged, replace them. Tighten the wing nuts securely.

**Replacement outer (Primary) element P/N: 86034042**

**Replacement inner (Safety) element P/N: 86034041**

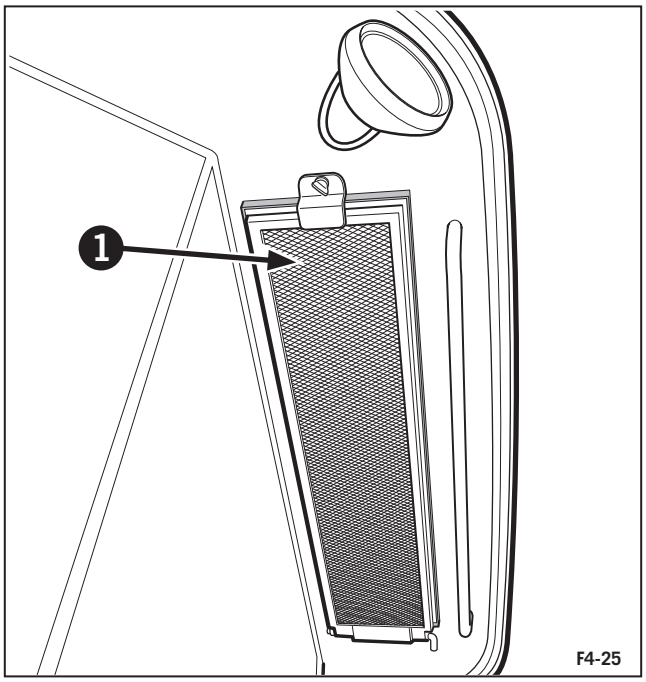
**NOTE: Replacement elements can be obtained from your Buhler Versatile dealer.**



## Operation 53

### Change the Cab Air Filter

The cab air filter (1) located on the rear of the cab must be changed periodically to keep the cab air system operating at maximum efficiency.




To remove the cab air filter, unscrew the knob (2). This will release the filter frame (3) allowing it to swing down sufficiently to remove the filter.

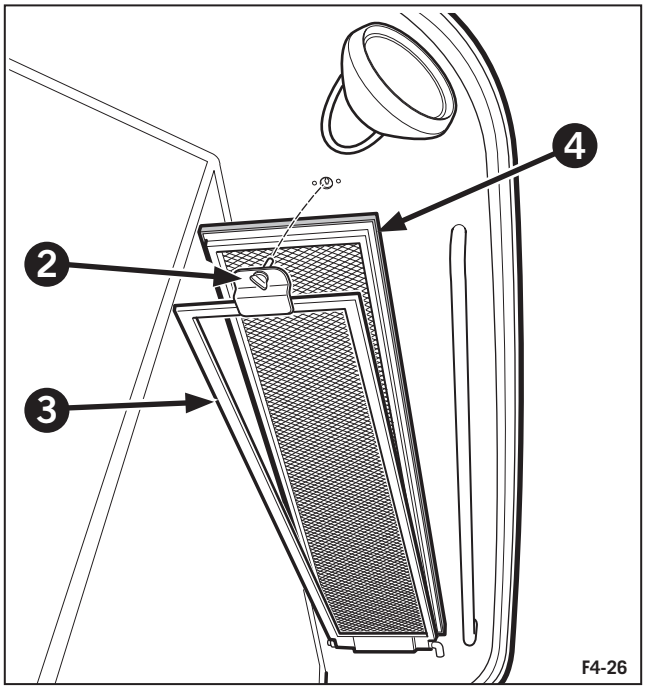
Hold a light on one side of the new element and check for ruptures. A pinpoint of light indicates a rupture in the element paper. If this occurs, the element is defective and must be replaced.

Install the new element into the frame and check the seal (4) around the perimeter of the element for nicks or cracks. Replace the element if any damage is found.

Reinstall the filter into its frame. Lift the assembly into place and lock in position using the knob (2).

**Replacement cab air filter P/N: 86032161**

**NOTE: Replacement elements can be obtained from your Buhler Versatile dealer.**




**WARNING: THE CAB AIR FILTER IS DESIGNED TO REMOVE DUST FROM THE AIR BUT WILL NOT EXCLUDE CHEMICAL VAPOR. FOLLOW THE CHEMICAL MANUFACTURERS DIRECTIONS REGARDING PROTECTION FROM DANGEROUS CHEMICALS.**

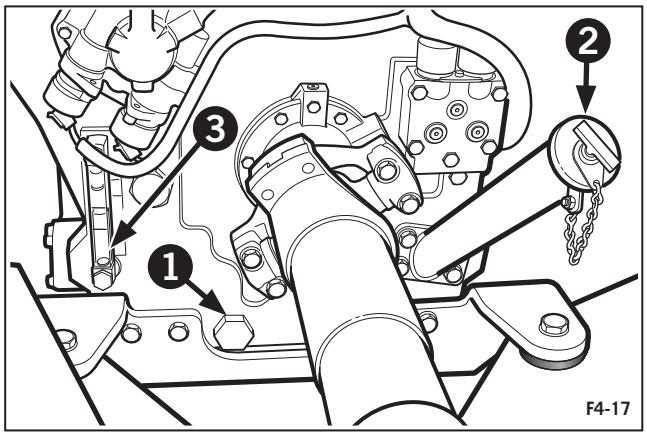
## Operation 54

**Change the Transmission Oil**
**(1407 Powershift Transmission Only)**

To drain the transmission oil, use the following procedure based on the type of transmission the tractor is equipped with.

Operate the tractor a sufficient amount of time to warm up the transmission oil. Remove the drain plug (1) from the lower left hand rear location on the transmission housing and allow the oil to drain into a pan.

Replace the drain plug and torque to 108 N·m (80 ft-lbs ± 5%). Refill the transmission with new oil through the fill tube (2) to the proper level as indicated by the sight gauge (3).



## Operation 55

**Change the Coolant System Filter**

The coolant system filter must be changed to ensure the proper level of DCA4 (dry chemical additive) is maintained in the engine cooling system to provide maximum protection against corrosion. To change the filter, proceed as follows:

Turn the coolant shutoff valve (1) to the "OFF" position. Remove the radiator cap. Unscrew and discard the old coolant filter (2). Clean the gasket surface on the filter head. Apply a light film of lubricating oil to the gasket sealing surface before installing the new coolant filter.

**NOTE: All model tractors have one single coolant system filter with a shut off valve mounted on the right-hand side of the engine.**

**WARNING: DO NOT REMOVE THE RADIATOR CAP FROM A HOT ENGINE. HOT STEAM WILL CAUSE SERIOUS PERSONAL INJURY. REMOVE THE COOLANT SYSTEM PRESSURE CAP AND CLOSE THE SHUTOFF VALVES BEFORE REMOVING THE COOLANT FILTER. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY FROM HEATED COOLANT SPRAY.**

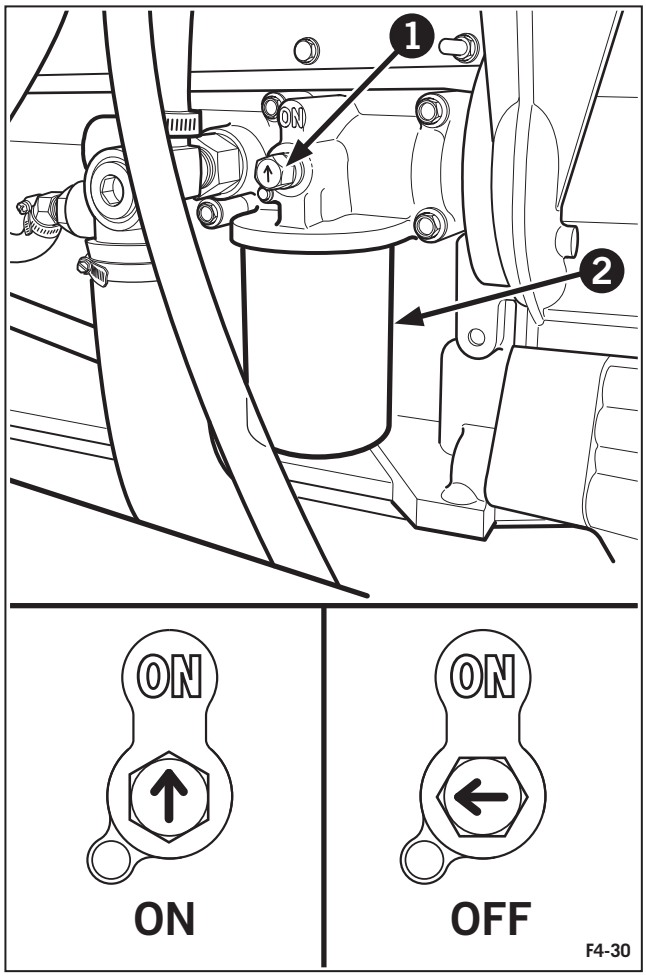
**NOTE: Do not allow oil to get inside the filter. Oil will adversely affect the DCA4.**

Install the new filter on the filter head. Tighten the filter until the gasket contacts the filter head surface.

Tighten the filter an additional 1/2 to 3/4 of a turn.

**NOTE: Over-tightening can distort the threads or damage the filter head. Do not use tools to tighten the filter.**

Turn the coolant shutoff valve to the "ON" position. Operate the engine, and check for coolant leaks. After the air has been purged from the system, check the coolant level again.



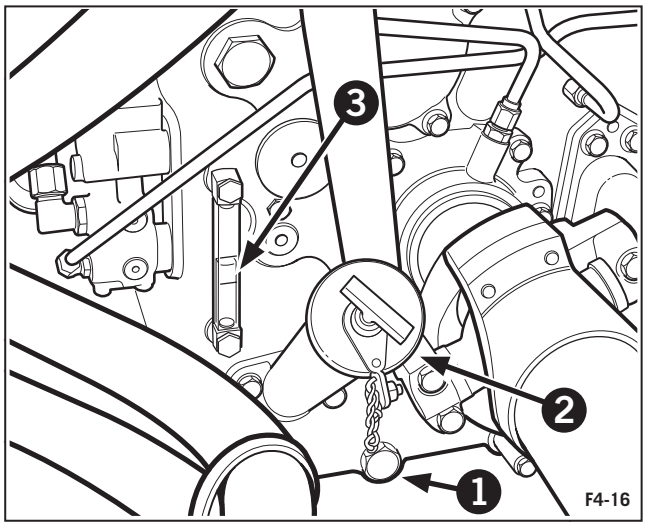
## Operation 56

**Change the Transmission Oil (Synchromesh Transmission Only)**

To drain the transmission oil, use the following procedure based on the type of transmission the tractor is equipped with.

**Synchromesh Transmission** - Operate the tractor a sufficient amount of time to warm up the transmission oil. Remove the drain plug (1) from the transmission housing and allow the oil to drain into a pan.

Replace the drain plug and torque to 108 N·m (80 ft-lbs ± 5%). Refill the transmission with new oil through the fill tube (2) to the proper level as indicated by the sight gauge (3).




**Synchromesh Transmission Only**

## Operation 57

**Clean the Transmission Suction Screen (Synchromesh Transmission Only)**

The synchromesh transmission has a removable sump screen located under the suction tube that will require cleaning periodically. To remove the suction screen, proceed as follows:

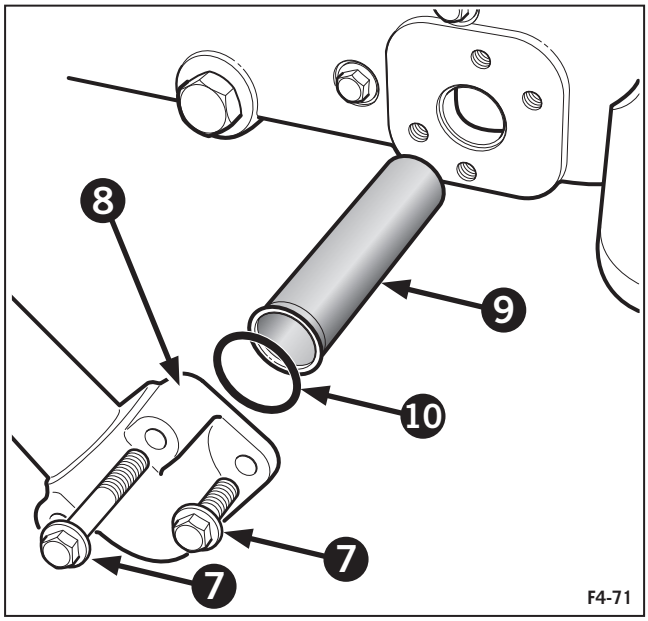
Drain the transmission oil (see operation 49).

Loosen and remove the four cap screws (7) that mount the suction tube block (8) to the rear face of the transmission. Push the tube out of the way to access the suction port.

Remove the suction screen (9) from the port and clean it in a suitable solvent. Replace the screen into the suction port.

Remove the O-ring (10) from the front face of the suction tube block (8). Check that it is in good condition before refitting into the suction tube block. Replace the O-ring (10) if it is damaged. Reinstall the suction tube block bolts (7) and torque to 75 N·m (55 ft-lbs).

*IMPORTANT: The 1407 Twindisc powershift transmission has a non-removable suction screen that does not require maintenance.*




**Synchromesh Transmission Only**

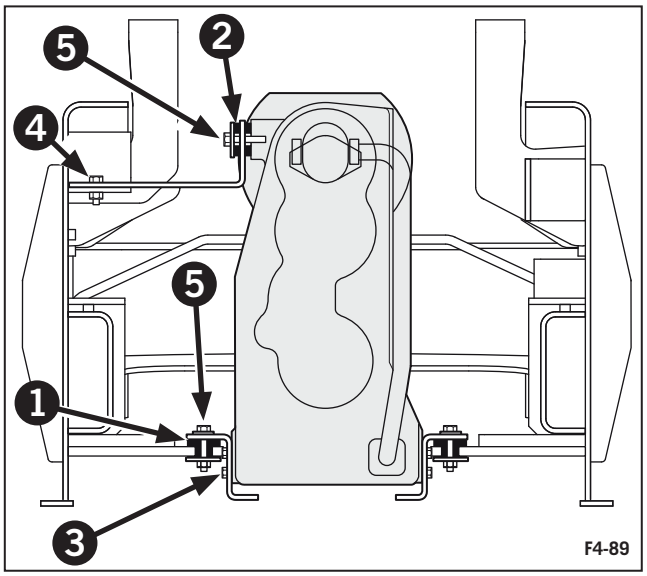
## Operation 58

### Check the Transmission Mounts

Check the rubber transmission mounts and mounting hardware for condition and torque on both the Synchromesh and powershift transmissions.

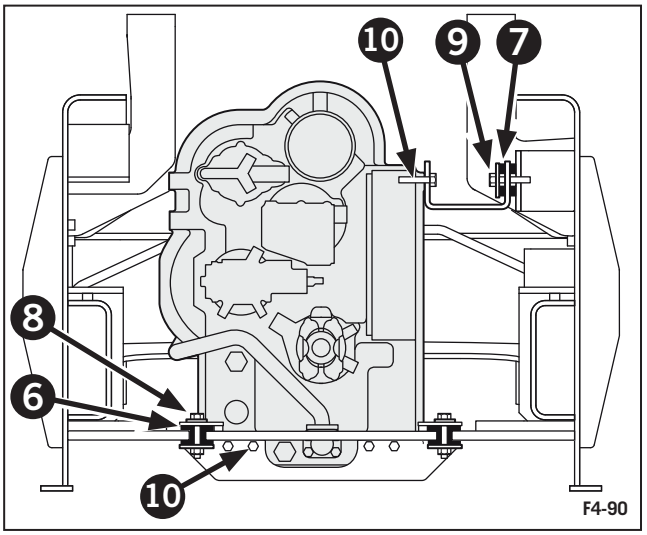
### Synchromesh transmission

The Synchromesh transmission is held in the front frame of the tractor by four bottom mounts (1) and two top mounts (2). Inspect the mounts for deterioration and wear. Torque the lower mounting bracket bolts (3) to 224 N·m (165 ft-lbs) and the upper mounting bracket bolts (4) to 397 N·m (293 ft-lbs). Torque the mount bolts (5) to 280 N·m (205 ft-lbs).




### 1407 Twindisc Powershift transmission

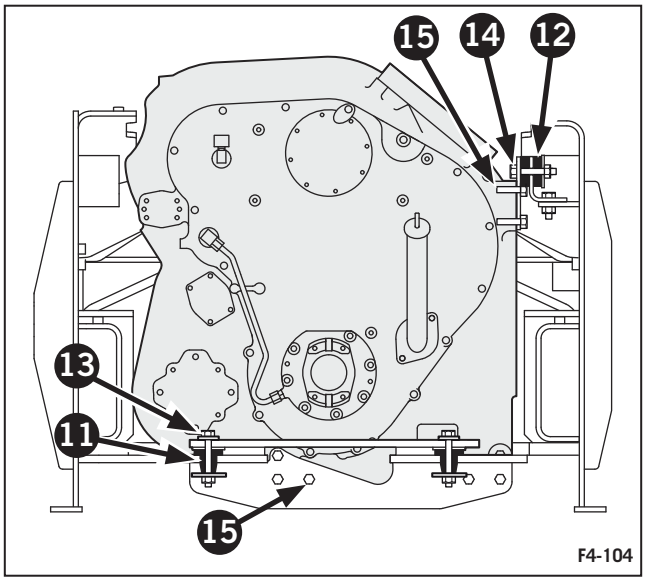
The 1407 Twindisc Powershift transmission is held in the front frame of the tractor by four bottom mounts (6) and two top mounts (7). Inspect the mounts for deterioration and wear. Torque the lower mounting bracket bolts (8) and the upper mounting bracket bolts (9) to 224 N·m (165 ft-lbs). Torque the mount bolts (10) to 280 N·m (205 ft-lbs).




### CAT TA22 Powershift transmission

The CAT TA22 Powershift transmission is held in the front frame of the tractor by four bottom mounts (11) and two top mounts (12). Inspect the mounts for deterioration and wear. Torque the lower mounting bracket bolts (13) and the upper mounting bracket bolts (14) to 224 N·m (165 ft-lbs). Torque the mount bolts (15) to 280 N·m (205 ft-lbs).

If the transmission mounts require replacement, contact your Buhler Versatile dealer.



## Operation 59

### Change the Hydraulic Oil

To drain the hydraulic oil from the hydraulic reservoir, use the following procedure:

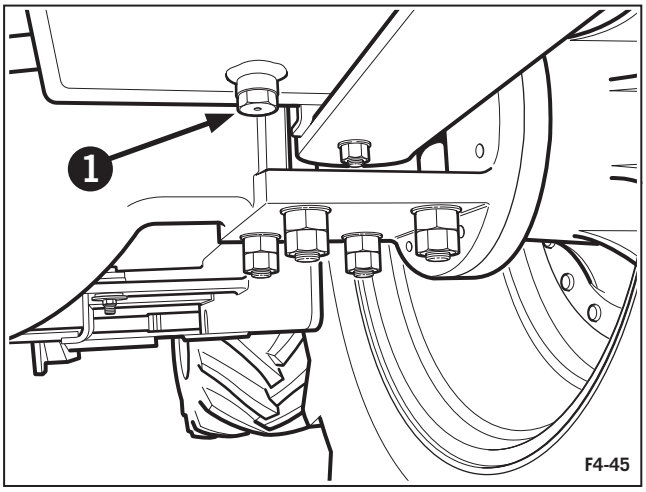
Run the tractor to warm up the hydraulic system, and collapse all external remote cylinders or 3-point hitch lift cylinders to decrease the amount of oil remaining in the hydraulic system when the oil is drained.

Remove the drain plug (1) from the bottom of the hydraulic reservoir tank under the front frame of the tractor. Allow all the oil to drain from the reservoir into a suitable container.

Replace the plug and tighten. Refill the reservoir to the proper level as indicated on the sight gauge. Restart the tractor. Extend any remote mounted cylinders and 3-point hitch lift cylinders and recheck the oil level. Add oil as necessary.

**Torque Value:** 81 N·m (60 ft-lbs)

**Wrench size:** 1¼" (1.250")



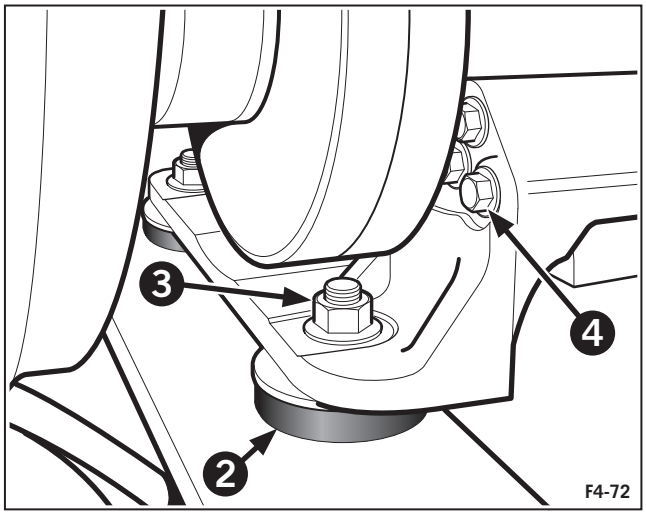

## Operation 60

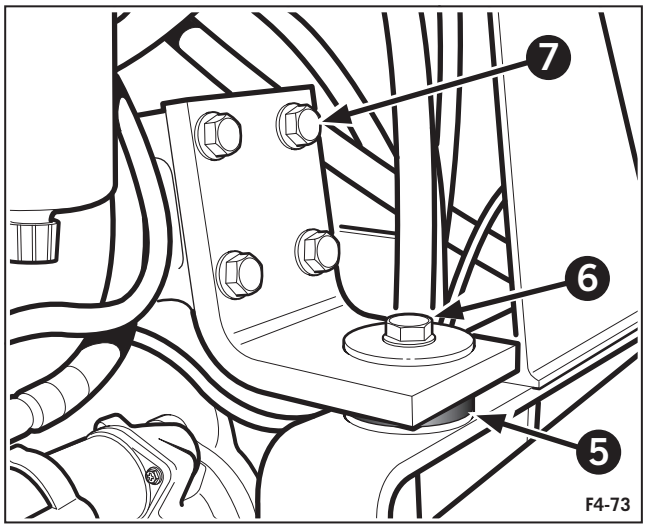
### Check the engine mounts

The engine is mounted in stationary rubber mounts at the two rear corners and the front center of the engine in the front frame of the tractor. The front center mount is a double rubber mount assembly.

Check the front mounts (2) for wear or deterioration and torque the mount bolts and nuts (3) to 280 N·m (205 ft. lbs.). Torque the bolts (4) mounting the bracket to engine to 260 N·m (190 ft-lbs).

Check the two rear mounts (5) for wear or deterioration and torque the mount bolt and nut (6) to 280 N·m (205 ft. lbs.). Torque the mounting bracket to engine bolts (7) to 260 N·m (190 ft-lbs).



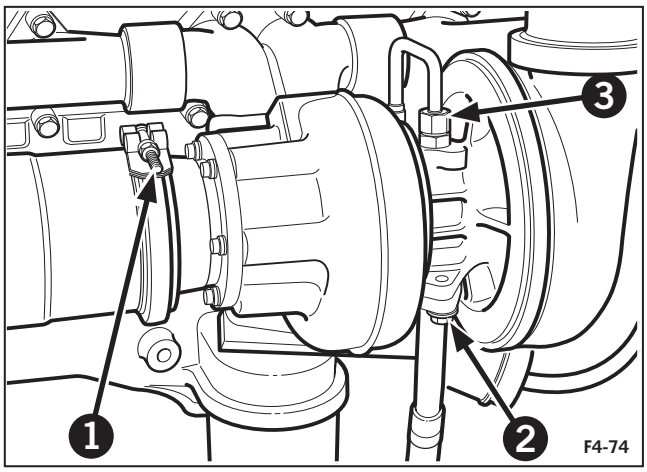



## Operation 61

### Check the Engine Turbocharger Connections

Check the exhaust pipe to turbo outlet clamp (1). Torque the clamp to 9 N·m (80 in. lbs.). Torque the lower oil drain line cap screws (2) to 27 N·m (239 in-lbs). Tighten the upper oil supply line fitting (3) to 20 N·m (177 in-lbs)

Tighten the four nuts that mount the turbocharger to the exhaust manifold of the engine to 61 N·m (45 ft-lbs). (Not shown).

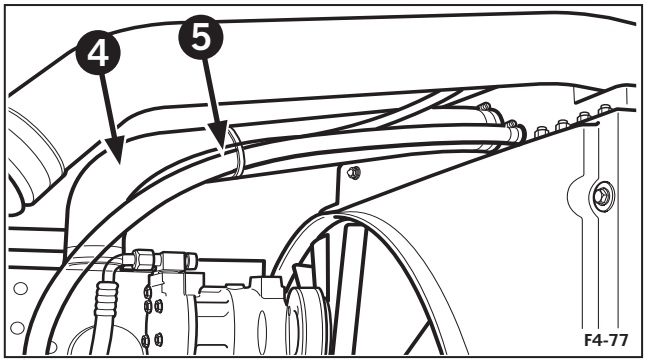


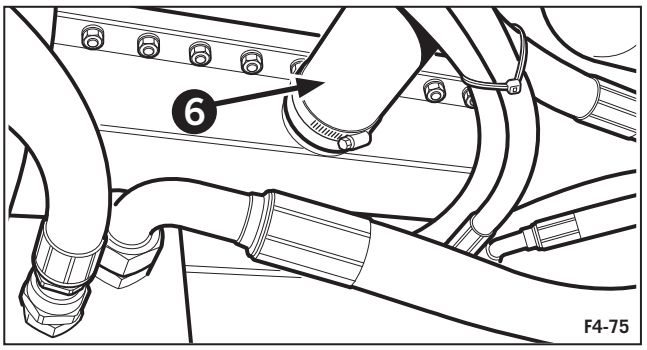

## Operation 62

### Check the Radiator and Heating System Hoses

Check the upper (4) and lower (5) radiator hoses for deterioration due to heat or contact with other engine components. Inspect the fill hose (6) for similar wear or damage.

If any hoses in the engine cooling system or tractor heating system require replacement, contact your Buhler Versatile dealer.



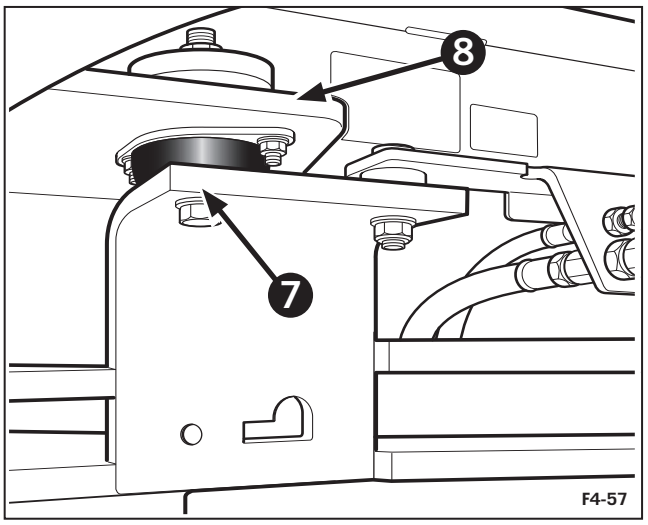

## Operation 63

### Check the Cab Mounts

The cab is mounted on four rubber mounts in each corner of the cab.

Check the mounts for wear or deterioration and torque the mount nut and bolts (7) to 217 N·m (160 ft-lbs). Torque the nut and bolts (8) that hold the mounts to the frame to 97 N·m (72 ft-lbs).

If the mounts require replacement, contact your Buhler Versatile dealer.



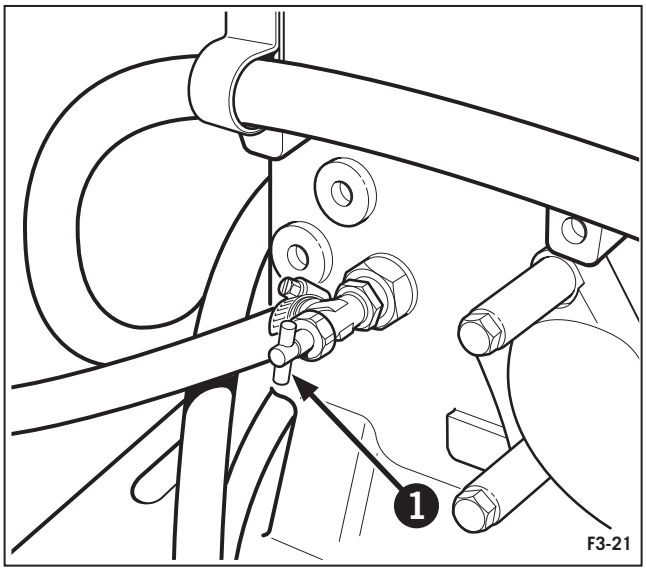
## Operation 64

**Change the Engine Coolant**

**WARNING: BEFORE DRAINING THE COOLING SYSTEM, WAIT UNTIL THE ENGINE TEMPERATURE IS BELOW 50°C (120°F) BEFORE REMOVING THE RADIATOR PRESSURE CAP. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY FROM HEATED COOLANT SPRAY.**

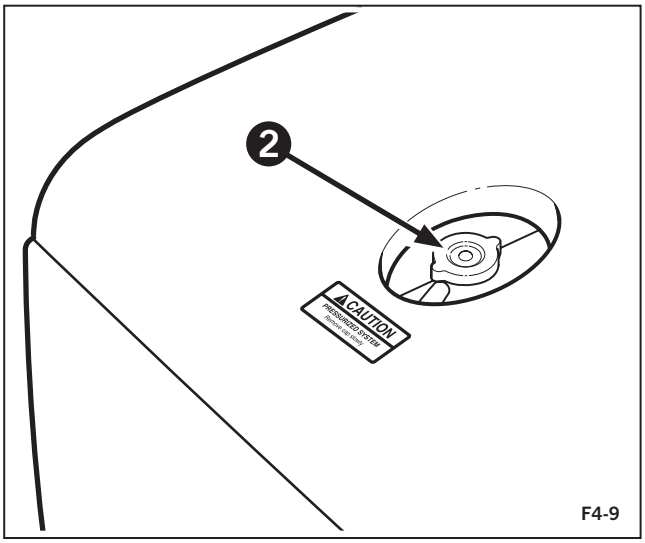
The cooling system must be clean to work correctly. Drain the system, and flush with clean water. If the system shows mineral buildup, scale, rust, or oil, clean with a heavy-duty engine coolant cleaner and follow the manufacturer's directions.

To drain the cooling system, first turn the temperature control knob in the cab to the maximum heat position. Make sure the heater valve (1) on the rear/right of the engine is fully open.



F3-21

Remove the radiator cap (2) from the top of the radiator.



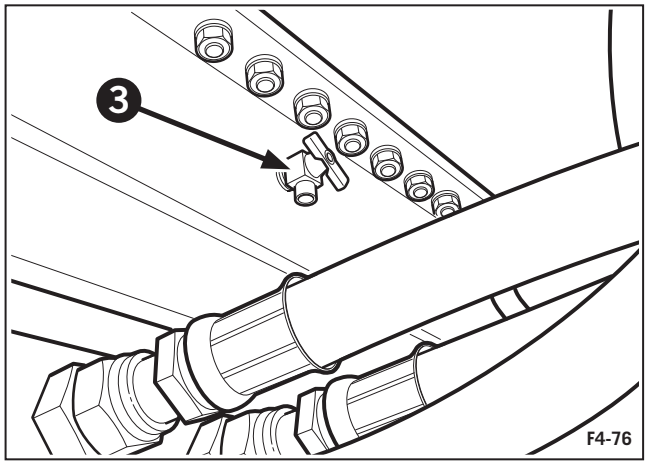
F4-9

**WARNING: THE COOLANT SYSTEM OPERATES UNDER PRESSURE WHICH IS CONTROLLED BY THE RADIATOR PRESSURE CAP. IT IS DANGEROUS TO REMOVE THE PRESSURE CAP WHILE THE SYSTEM IS HOT. WHEN THE SYSTEM HAS COOLED, USE A THICK CLOTH AND TURN THE CAP SLOWLY TO THE FIRST STOP AND ALLOW THE PRESSURE TO ESCAPE BEFORE FULLY REMOVING THE CAP.**

**COOLANT SHOULD BE KEPT OFF THE SKIN. ADHERE TO THE PRECAUTIONS OUTLINED ON THE ANTIFREEZE AND INHIBITOR CONTAINERS, WHERE USED.**

To drain the radiator, open the petcock (3) located at the bottom center of the radiator.

Drain all the coolant into a suitable container and follow all local laws and regulations for disposal.



F4-76

To remove the coolant in the engine block, disconnect the lower radiator hose (4) from the base of the radiator. This will drain whatever coolant is in the water jacket of the engine.

Drain all the coolant into a suitable container and follow all local laws and regulations for disposal.

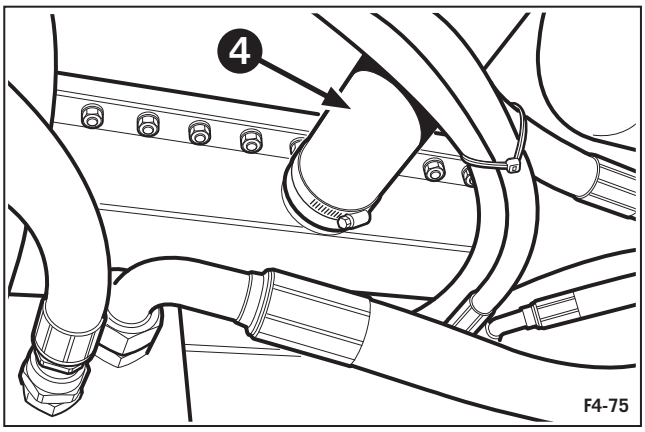
Turn off the coolant filter shutoff valve so the filter is isolated from the cooling system during cleaning and flushing operations.

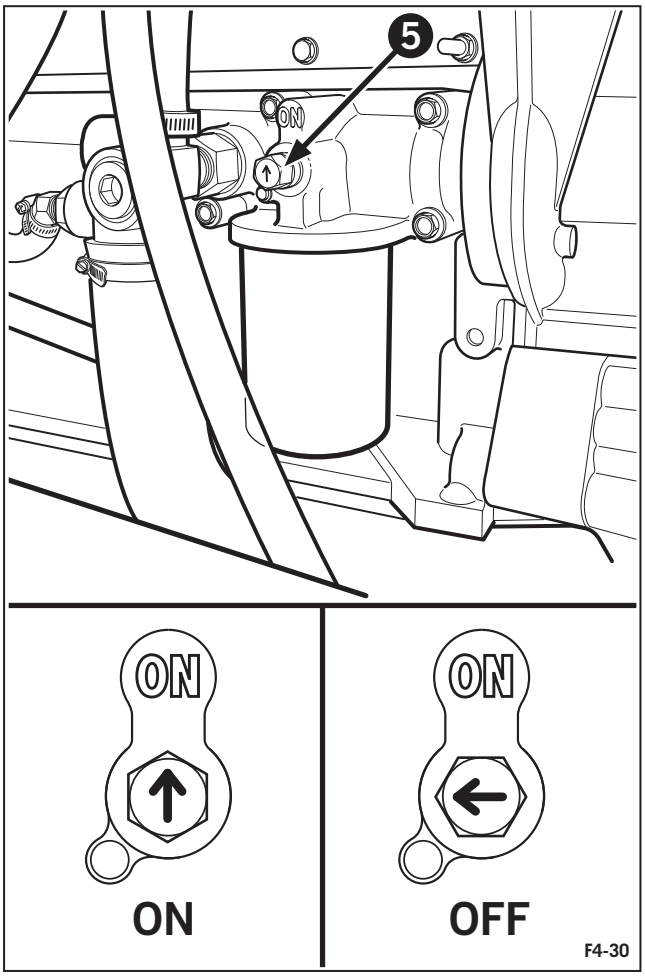
*IMPORTANT: Failure to isolate the cooling system filter by closing the shutoff valve will contaminate the cooling system filter, and the filter will have to be replaced whether its change interval has been reached or not.*

**Flushing the Cooling System**

Refer to page 8-25 of the Cummins QSX15 engine operation and maintenance manual supplied with the tractor for the correct coolant system flushing schedule and procedure.

After the cooling system is cleaned, retighten the petcock (3) and reinstall the lower radiator hose (4). Open the cooling system filter shutoff valve (5).



The coolant added to the engine must meet specific requirements. Use coolant from one of the following sources:

**NOTE: Factory fill is a fully formulated coolant mixture, (pink in color). Propylene and ethylene glycol can be mixed in the cooling system.**

Refill the cooling system using a low silicate antifreeze which meets Engineering Standard GM 6038-M, or which contains no more than 0.1% anhydrous alkali metasilicate and meets either Engineering Standard GM 1825-M or GM 1899-M, which are performance specifications.

Use soft water in the coolant mixture. Contaminants in hard water neutralize the corrosion inhibitor components. Water must not exceed 300 ppm hardness or contain more than 100 ppm of either chloride or sulphate.

Antifreeze must be used in any climate for both freeze and boiling point protection. Cummins Engine Company, Inc. recommends a 50% concentration level, 40% - 60% range of ethylene glycol or propylene glycol inmost climates. Antifreeze at 68% concentration provides the maximum freeze protection and must never be exceeded under any condition. Antifreeze protection decreases above 68%,

| | Ethylene Glycol | Propylene Glycol |
|---|---|---|
| 40% | -23°C (-10°F) | -21°C (-6°F) |
| 50% | -37°C (-34°F) | -33°C (-27°F) |
| 60% | -54°C (-65°F) | -40°C (-56°F) |
| 68% | -71°C (-90°F) | -63°C (-82°F) |

**NOTE: Propylene glycol antifreeze protection levels CANNOT be checked using the same hydrometer as would be used with ethylene glycol antifreeze.**

**You must check the concentration level using a refractometer. This tool is available from your Buhler Versatile dealer under P/N CC2806. Both propylene and ethylene glycol protection levels (of a mixture of both) can be measured with the refractometer.**

Once the protection level of the coolant is determined (ratio of water to antifreeze), the mixture must contain one unit of Cummins DCA4 (dry chemical additive) for every gallon of mix. A DCA unit is equal to 42.5 g (1.5 dry ounces) or 120 ml (4 liquid ounces). Your Buhler Versatile dealer can assist you in obtaining the DCA4 additive.

*IMPORTANT: Failure to maintain the DCA4 in the cooling system will cause cooling system corrosion and engine failure.*

*IMPORTANT: Check the concentration of DCA4 with a test kit, available from Cummins and Fleetguard through your Buhler Versatile dealer.*

*IMPORTANT: Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C (120°F).*

Start and run the engine until normal operating temperature is reached. Stop the engine and allow the coolant to cool.

**NOTE: The coolant level will drop as coolant is pumped around the system.**

Remove the radiator cap and add coolant to the radiator to bring the coolant level to the bottom of the filler neck. Install the radiator cap.

**NOTE: If the engine is not going to be operated immediately following the coolant and filter change, run the engine for one hour to ensure that the chemical conditioner within the system is dispersed into the cooling system.**

The coolant capacity for the 435, 485 and 535 tractor is 72 L (19 Gal).

## Operation 65

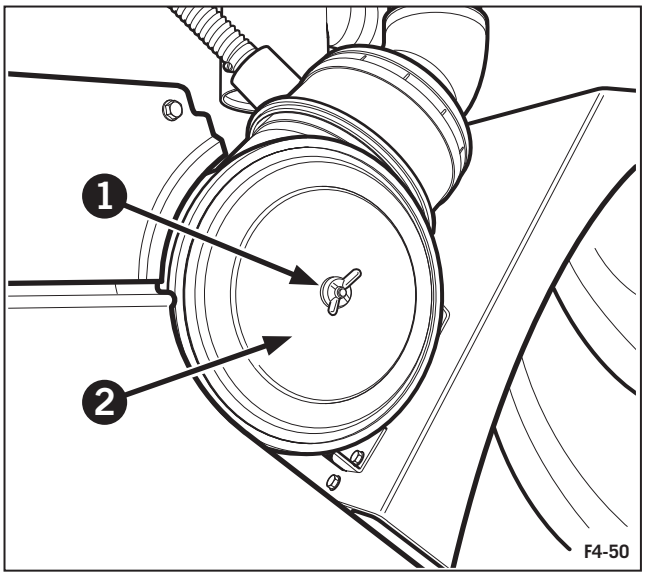
### Change the Engine Air Cleaner Outer Element

If the restriction indicator warning light illuminates on the EIC display, it is necessary to change the outer air filter element. This may occur outside the set maintenance schedule due to adverse working conditions.

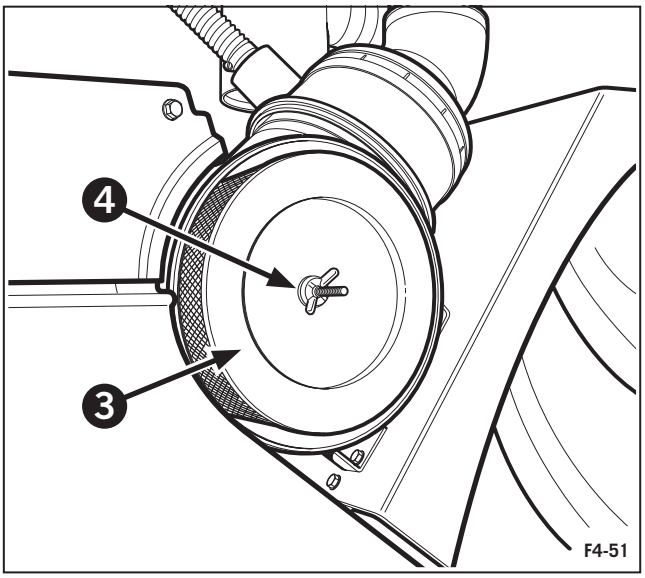
*IMPORTANT: When servicing the air cleaner:*

- *Wear a mask when cleaning the air filter. Do not breath in dust.*

To access the outer element, remove the large wing nut (1) on the outside of the cover. Remove the cover (2) from the air cleaner canister.



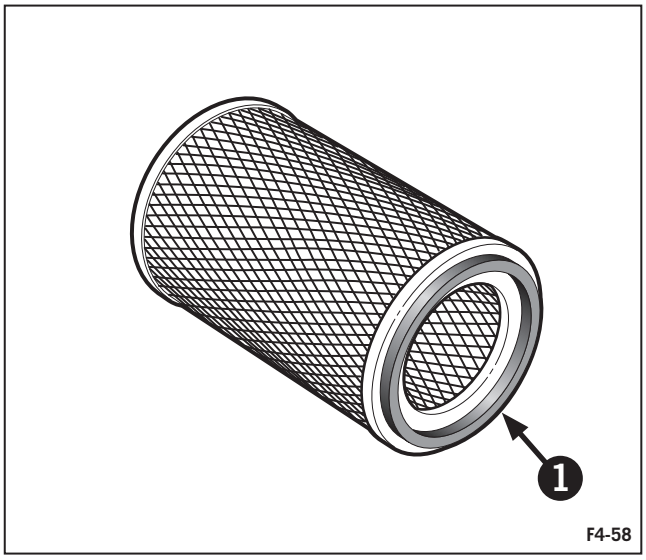

Remove the outer element (3) by removing the wing nut (4) and pulling the element from the canister. the element.

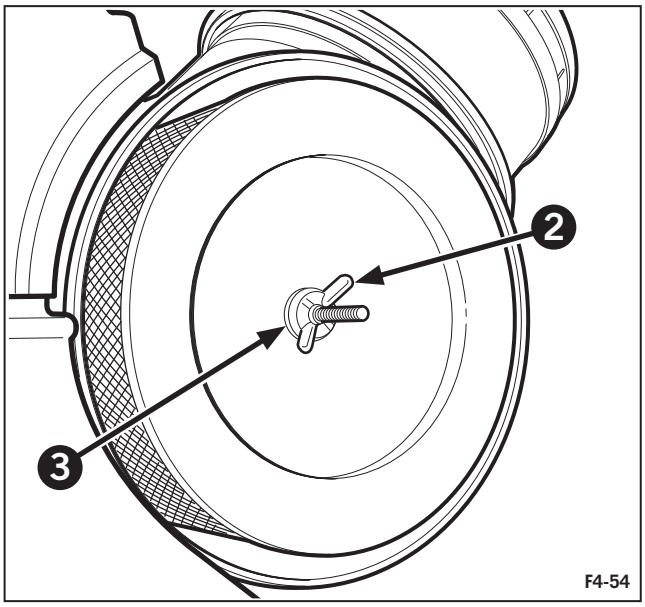


Clean the air cleaner body with a lint-free towel before installing the element.

Inspect the element seal (1) before installing. Cracks or chips in the element sealing rubber indicates a new element must be installed.

Install the air filter back into the canister. Be sure the seal on the end of the filter fully contacts the air cleaner body. The wing nut (2) has a small seal (3) on the inner face, and the seal should be in good condition before the wing nut is tightened. If the seal is damaged on the wing nut, replace it. Tighten the nut securely.



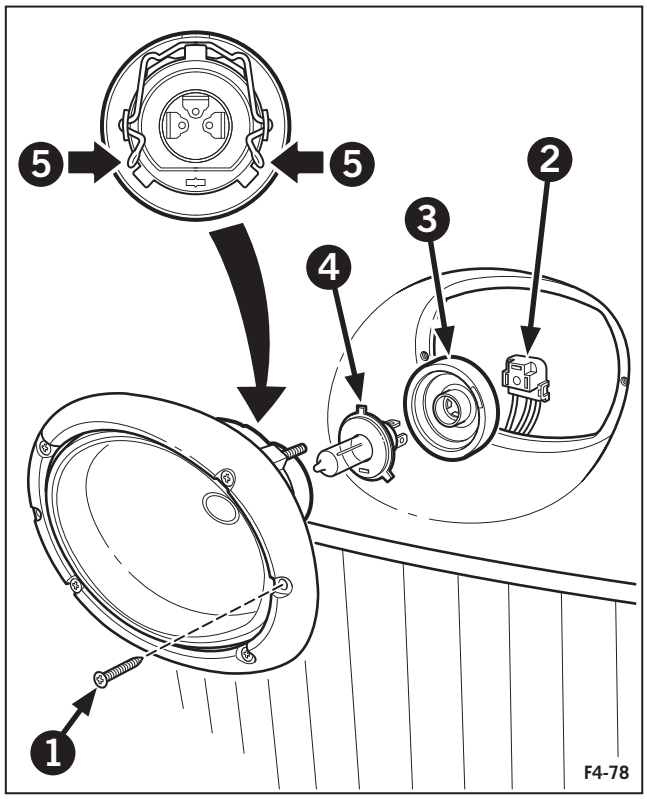



## Operation 66

**Road lights - High/Low Beam Bulb Replacement**

To replace a road light bulb, remove the two screws (1) retaining the lamp unit to the body work and withdraw the lamp unit. Unplug the connector (2) and remove the rubber cover (3). Remove the bulb (4) by releasing the spring clip (5). Replace the bulb using the reverse procedure taking care not to touch the new bulb glass.

**Replacement bulb, P/N: 9626307**

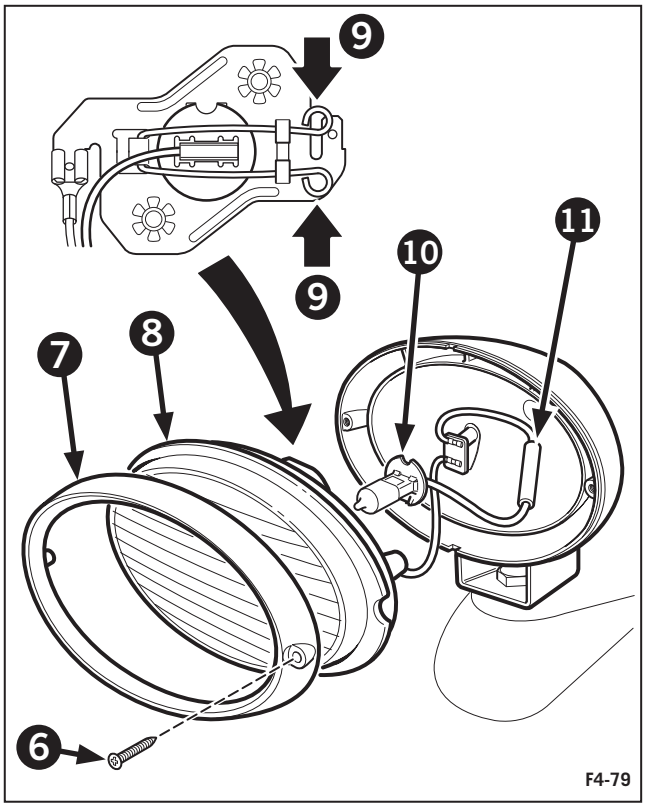



## Operation 67

**Work Lights Bulb Replacement**

To replace a work light bulb, remove the two screws (6) retaining the surround (7) and lift the lamp unit (8) away from the casing. Release the spring clip (9) and remove the bulb (10) from the lamp unit. Unplug the connector (11). Replace the bulb using the reverse procedure taking care not to touch the bulb glass.

**Replacement bulb, P/N: 9703399**



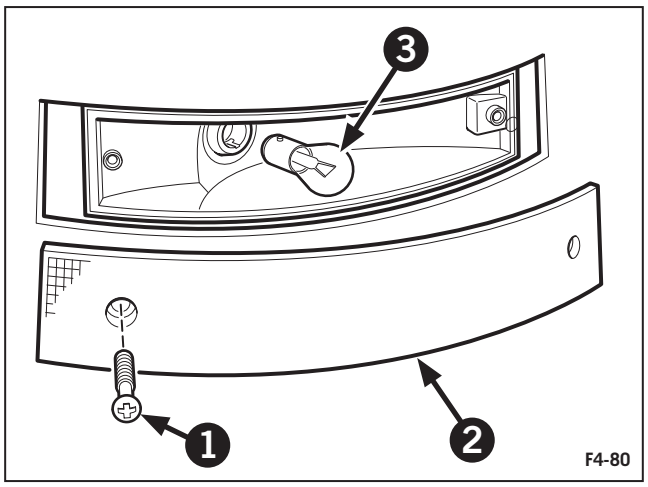

Replacement bulbs can be purchased from your Buhler Versatile dealer.

## Operation 68

**Turn Signal/Hazard Lights Bulb Replacement (Roof)**

To replace a roof turn signal/hazard light bulb, remove the two retaining screws (1) and remove the lens cover (2). Remove the bulb (3). Replace the bulb using the reverse procedure.

**Replacement bulb, P/N: 529068**




## Operation 69

**Brake/Road Lights Bulb Replacement (Fender)**

To replace a brake/road light bulb, remove the two retaining screws (1) and remove the lens cover (2). Remove the bulb (3). Replace the bulb using the reverse procedure.

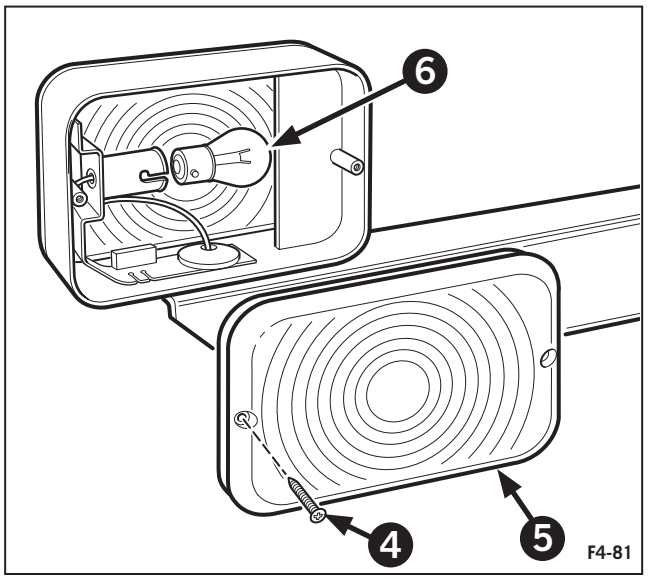
**Replacement bulb, P/N: 86537133**

## Operation 70

**Extremity Lights**

To replace an extremity light bulb, remove the two retaining screws (4) and remove the lens cover (5). Remove the bulb (6). Replace the bulb using the reverse procedure.

**Replacement bulb, P/N: 529068**




## Operation 71

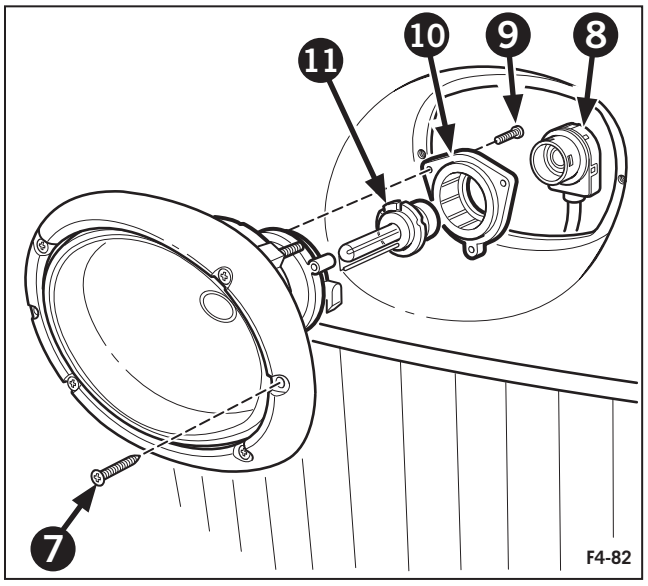
**HID Work lights (Front)**

To replace a front HID work light bulb, remove the two screws (7) and withdraw the lamp unit from the body work. Disconnect the plug (8) by turning anti-clockwise. Remove the three screws (9) and the retaining ring (10). Remove the bulb (11). Replace the bulb using the reverse procedure taking care not to touch the bulb glass.

**Replacement bulb, P/N: 86032753**

**WARNING: THIS LAMP UNIT OPERATES AT HIGH VOLTAGE AND SHOULD BE ISOLATED BEFORE MAINTENANCE IS CARRIED OUT.**

Replacement bulbs can be purchased from your Buhler Versatile dealer.



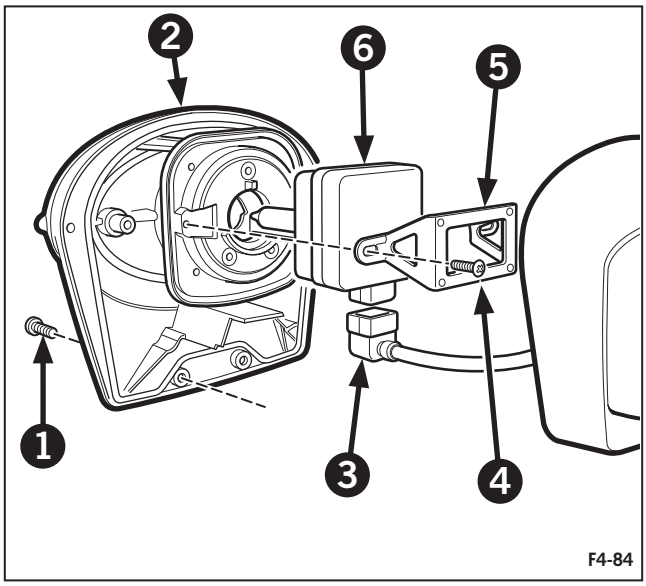
## Operation 72

### HID Work lights (Rear)

To replace a rear HID work light bulb, remove the four screws (1) retaining the lamp unit (2) to the casing and withdraw the lamp unit. Disconnect the plug (3). Remove the three screws (4) and the retaining bracket (5). Remove the bulb unit (6). Replace the bulb using the reverse procedure taking care not to touch the bulb glass.

**WARNING: THIS LAMP UNIT OPERATES AT HIGH VOLTAGE AND SHOULD BE ISOLATED BEFORE MAINTENANCE IS CARRIED OUT.**

**Replacement bulb, P/N: 86034812**



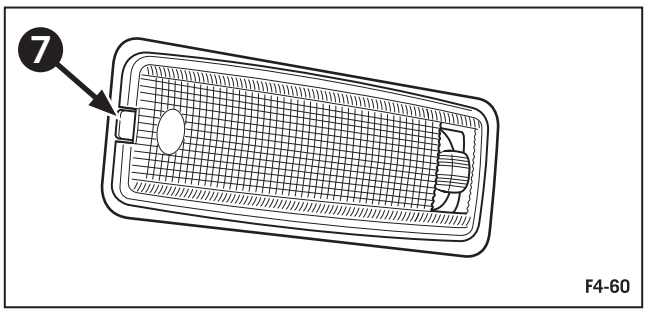
F4-84

## Operation 73

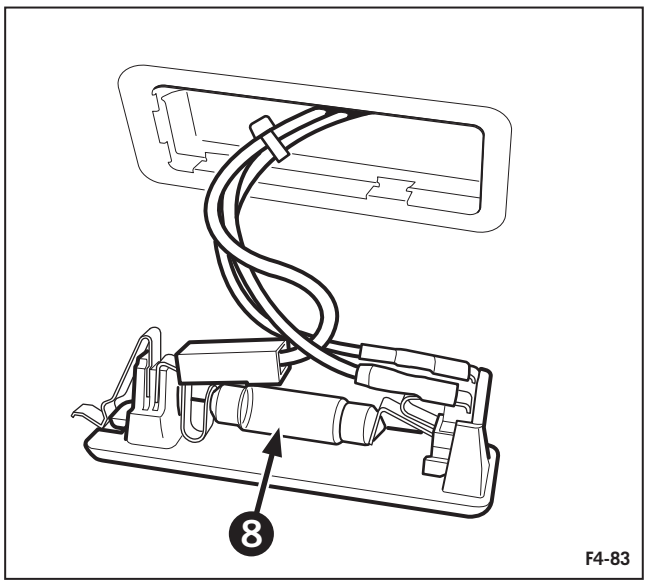
### Dome Lights

To replace a rear dome light bulb, push in the spring clip (7) and release the lamp unit from the surround. Remove the bulb (8) from the lamp unit. Replace the bulb and refit the lamp unit into the surround.

**Replacement bulb, P/N: 9849911**



F4-60



F4-83

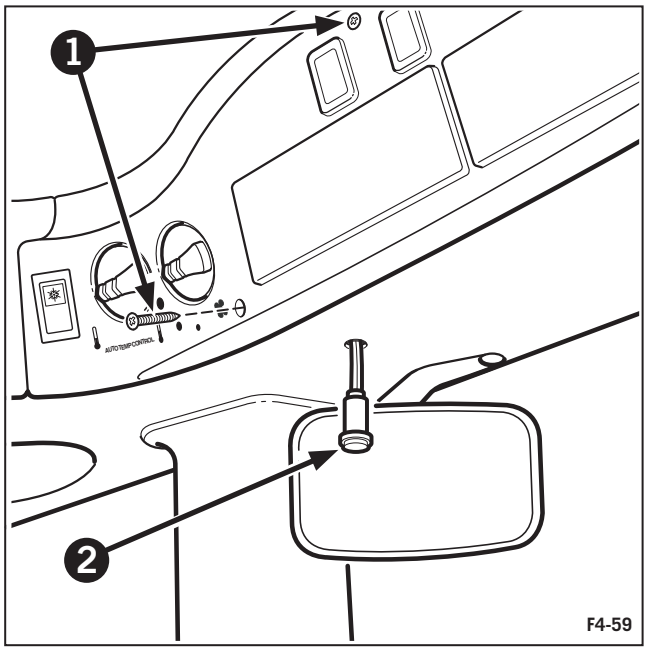
Replacement bulbs can be purchased from your Buhler Versatile dealer.

## Operation 74

### Right Console Light

To replace the right console light unit, remove the five screws (1) retaining the overhead console unit and lift the unit away. Locate the console light connector block and disconnect. Pull the lamp unit (2) out from the roof lining. Replace the lamp unit using the reverse procedure.

**Replacement bulb, P/N: 86033164**

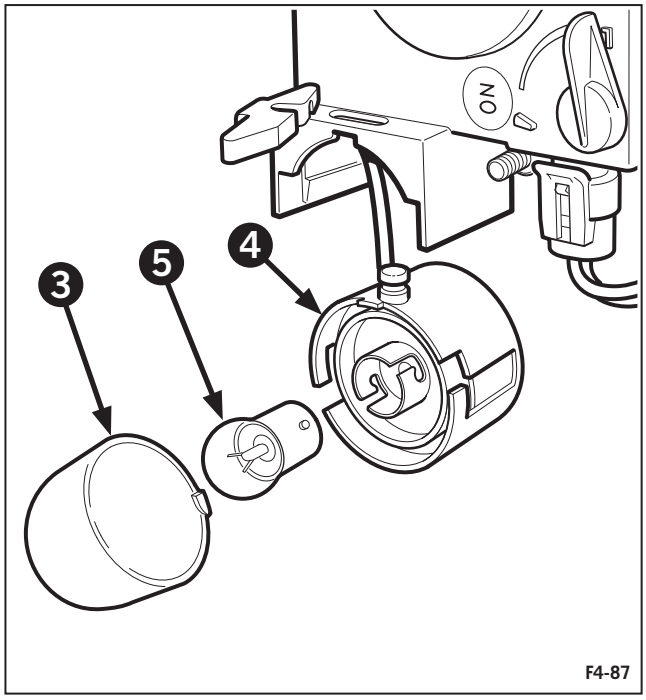



## Operation 75

### Trouble Light

To replace the trouble light bulb, Remove the glass (3) from the lamp unit (4). Remove the bulb (5). Replace the bulb unit using the reverse procedure.

**Replacement bulb, P/N: 9.9CP, GE232 or equivalent**

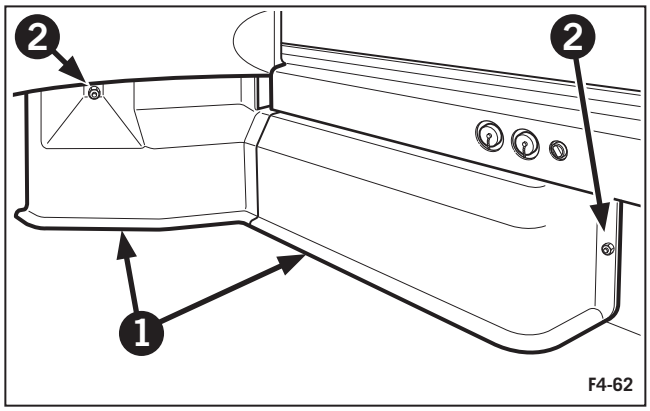



Replacement bulbs can be purchased from your Buhler Versatile dealer.

## Operation 76

### Rear Deck Panel Covers Removal

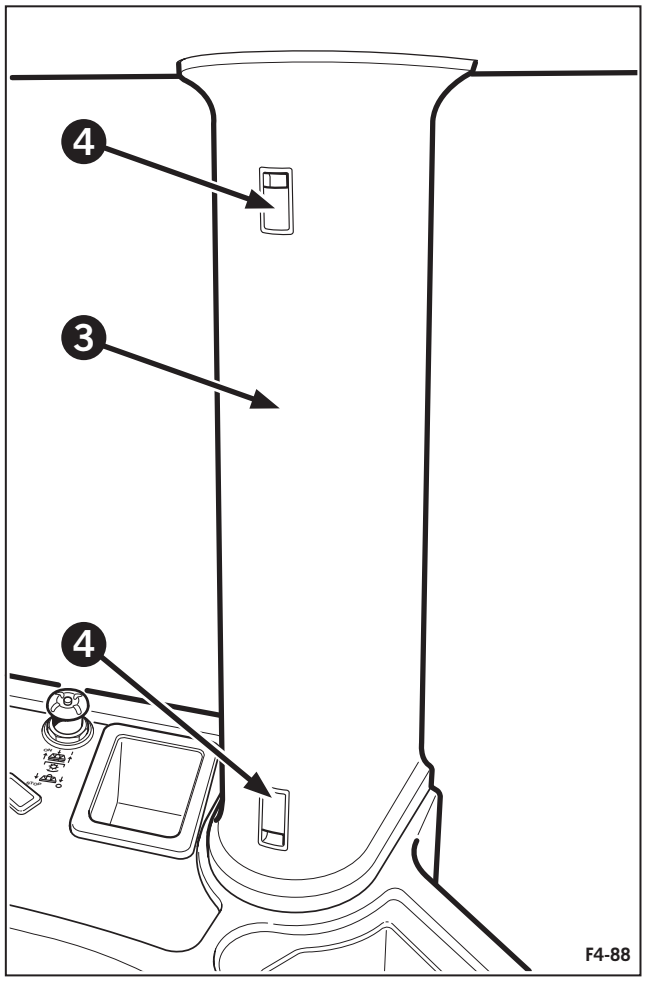
The rear deck panel covers (1) can be removed to gain access to the right side console controls and VMM unit. Remove the two 10 mm nuts (2) remove the covers. The covers are joined together with Velcro for easy removal and re-installation. (Seat not shown for clarity).




## Operation 77

### Fuse and Relay Cover Removal

The fuse and relay panel is located above the right console. The cover (3) is removed for service by releasing the two latches (4) and sliding the cover away. To replace the cover, slide the cover back into position and re-latch.

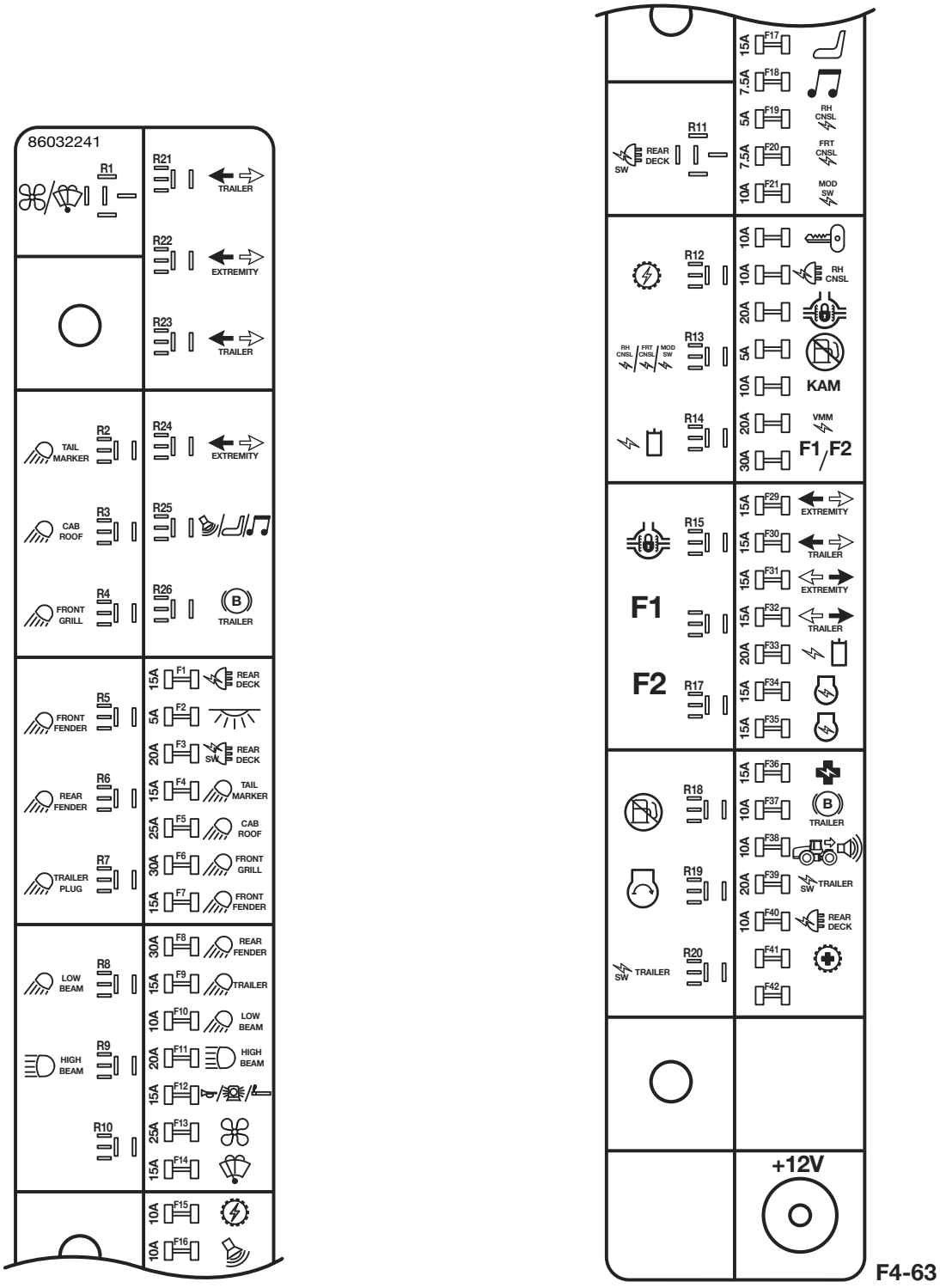


## Operation 78

### Changing Fuses and Relays

The fuse and relay panel houses all the fuses and relays that are used in the electrical system and is clearly marked for all electrical functions. There are no circuit breakers on Buhler Versatile 4WD tractors.

A decal of this panel layout is located inside the fuse/relay cover.




F4-63

## Relays

**R1** Hvac and Windhield Wiper/washer (see fuses no. 13 and 14)

**R2** Marker Lights (See fuse no. 4)

**R3** Cab Roof Work Lamps (See fuse no. 5)

**R4** Front Grill Work Lamps (See fuse no. 6)

**R5** Front Fender Work Lamps (See fuse no. 7)

**R6** Rear Fender Work Lamp (See fuse No. 8)

**R7** 7-pin Trailer Plug (Pin 2) Work Lamp (See fuse no. 9)

**R8** Road Lamps - Low Beam (See fuse no. 10)

**R9** Road Lamps - High Beam (See fuse no. 11)

**R10** Spare - Not Used (See fuse no. 42)

**R11** Rear Deck - Power Plug Switched Power (Pin 1) (See fuse no. 3)

**R12** Transmission Control Module (See fuse no. 15)

**R13** Power Console Switches (See fuses no. 19, 20 and 21)

**R14** Electro-hydrulics (See fuse no. 33)

**R15** Differential Lock (See fuse no. 24)

**R16** Accessory Function No. 1 (See fuse no. 28)

**R17** Accessory Function No. 2 (See fuse no. 28)

**R18** Engine Key Switch Fuelling Signal (See fuse no. 25)

**R19** Starter Relay Signal (See fuse no. 22)

**R20** 7-pin Trailer Plug (Pin 7) +12v Key Switched Power (See fuse no. 39)

**R21** 7-pin Trailer Plug (Pin 3) Left Hand Signal Lamp (See fuse no. 30)

**R22** Extremity Left Hand Signal (See fuse no. 29)

**R23** 7-pin Trailer Plug (Pin 5) Right Hand Signal Lamp (See fuse no. 32)

**R24** Extremity Right Hand Signal (See fuse no. 31)

**R25** Radar/seat/radio (See fuses no. 16, 17, and 18)

**R26** 7-pin Trailer Plug (Pin 4) Stop Lamp (See fuse no. 37)

## Fuses

**F1** (15 amps) Rear Deck - Power Plug Live Power (Pin B)

**F2** (5 amps) Dome Lamp

**F3** (20 amps) Rear Deck - Power Plug Live Power (Pin 1) (See relay no. 11)

**F4** (15 amps) Marker Lamps (See relay no. 2)

**F5** (25 amps) Cab Roof Work Lamps (See relay no. 3)

**F6** (30 amps) Front Grill Work Lamps (See relay no. 4)

**F7** (15 amps) Front Fender Work Lamps (See relay no. 5)

**F8** (30 amps) Rear Fender Work Lamps (See relay no. 6)

**F9** (15 amps) 7-pin Trailer Plug (Pin 2) Work Lamp (See relay no. 7)

**F10** (10 amps) Road Lamps - Low Beam (See relay no. 8)

**F11** (20 amps) Road Lamps - High Beam (See relay no. 9)

**F12** (15 amps) Horn/beacon/cigarette Lighter

**F13** (25 amps) Hvac (See relay no. 1)

**F14** (15 amps) Windshield Wiper/washer (See relay no. 1)

**F15** (10 amps) Transmission Control Module (See relay no. 12)

**F16** (10 amps) Radar (See relay no. 25)

**F17** (15 amps) Seat (See relay no. 25)

**F18** (7.5 amps) Radio (See relay no. 25)

**F19** (5 amps) Right Hand Console (See relay no. 13)

**F20** (7.5 amps) Front Console (See relay no. 13)

**F21** (10 amps) Control Modules - Key Switch Signal (See relay no. 13)

**F22** (10 amps) Key Switch Power
See...
ACC = relays no. 11 and 25
RUN = relays no. 12, 13 and 20
START = relay no.19

**F23** (10 amps) Right Hand Console Power Socket

**F24** (20 amps) Differential Locks (See relay no. 15)

**F25** (5 amps) Engine Key Switch Fuelling Signal (See relay no. 18)

**F26** (10 amps) Keep Alive Memory

**F27** (20 amps) VMM Control Module

**F28** (30 amps) Accessory Function No. 1 And 2 (See relays no. 16 and 17)

**F29** (15 amps) Extremity Left Hand Signal (See relay no. 22)

**F30** (15 amps) 7-pin Trailer Plug (Pin 3) Left Hand Signal Lamp (See relay no. 21)

**F31** (15 amps) Extremity Right Hand Signal (See relay no. 31)

**F32** (15 amps) 7-pin Trailer Plug (Pin 5) Right Hand Signal Lamp (See relay no. 23)

**F33** (20 amps) Electro-hydraulics (See relay no. 14)

**F34** (15 amps) Engine Ecm Power 1 Of 2

**F35** (15 amps) Engine Ecm Power 2 Of 2

**F36** (15 amps) Diagnostics Connector Power (Pin 1)

**F37** (10 amps) 7-pin Trailer Plug (Pin 4) Stop Lamp (See relay no. 26)

**F38** (10 amps) Backup Alarm

**F39** (20 amps) 7-pin Trailer Plug (Pin 7) +12v Key Switched Power (See relay no. 20)

**F40** (10 amps) Rear Deck - Power Socket

**F41** (----) 1407 Transmission Diagnostics

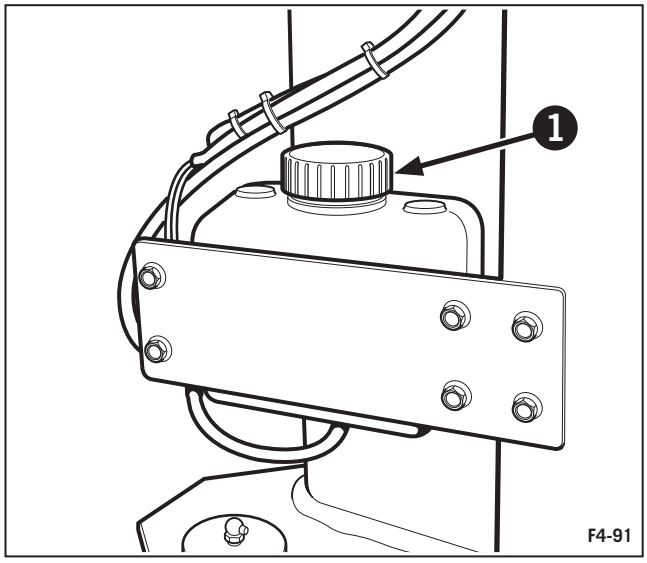
**F42** (----) Not Used

## Operation 79

**Check the Windshield Washer Fluid**

The front and (rear-optional) windscreen washers are fed from a single reservoir located behind the right hand fuel tank.

Remove the lid (1) on the reservoir and add fluid as necessary.




## Operation 80

**Change the Windshield Wiper Blades**

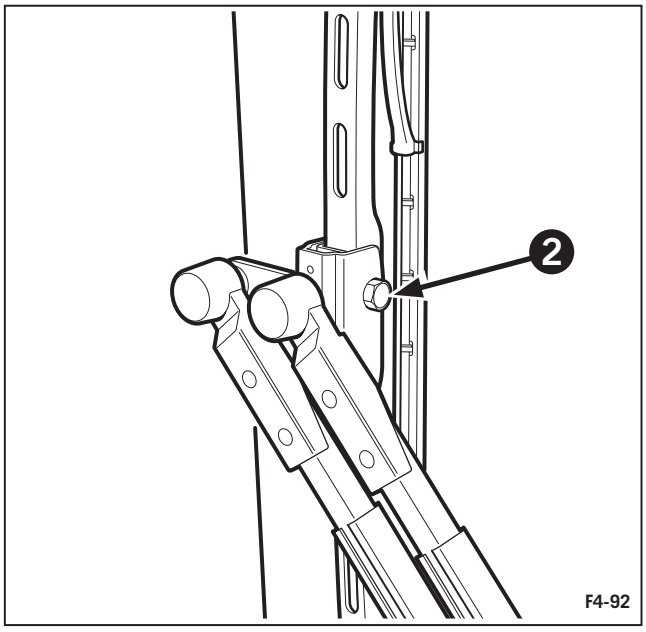
The front and rear windshield wiper blades can be changed using the following procedure:

Pivot the wiper arm outward away from the window. Remove the blade bolt (2) from the center of the blade. Install the new blade and reinstall the center bolt.

The front and rear windshield wiper blade is 713 mm (28") long.

**Replacement wiper blade (front & rear)**

**P/N: 86032440**




## Operation 81

**Clean the Cab Floor**

Keep the cab floor free of dirt and debris that may cause an obstruction or safety hazard, especially around the brake and clutch pedal area.

The cab floor should be kept clean by periodically vacuuming or sweeping, and washing.

The floor mat can be removed from the cab floor by rolling it away from the walls of the cab and pulling it upward and away from the floor. The floor mat is a two-piece rubber mat that can be washed using a mild detergent.

## Operation 82

**Clean the Cab Seat and Upholstery**

When the soft trim material and seat become dirty, they should be wiped clean. Dip a cloth in a warm water/detergent solution and wring out as much of the water as possible. Wipe the interior material with the damp cloth.

The interior molding inside the cab can be cleaned with a water/detergent solution as needed.

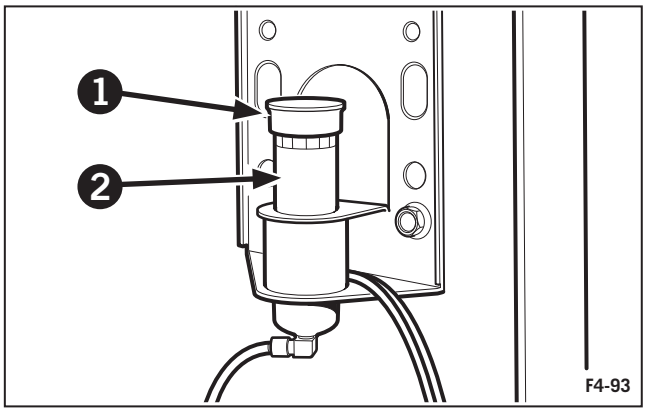
## Operation 83

**Change the Ether Canister**

The cold start solenoid is mounted on the left side of rear hood support.

Remove the protective yellow cap (1) or unscrew the empty ether canister anti-clockwise from the top of the solenoid valve (2), making sure that the gasket remains in place. Lubricate the gasket with a light film of clean oil.

Remove the protective cap from the new ether canister.

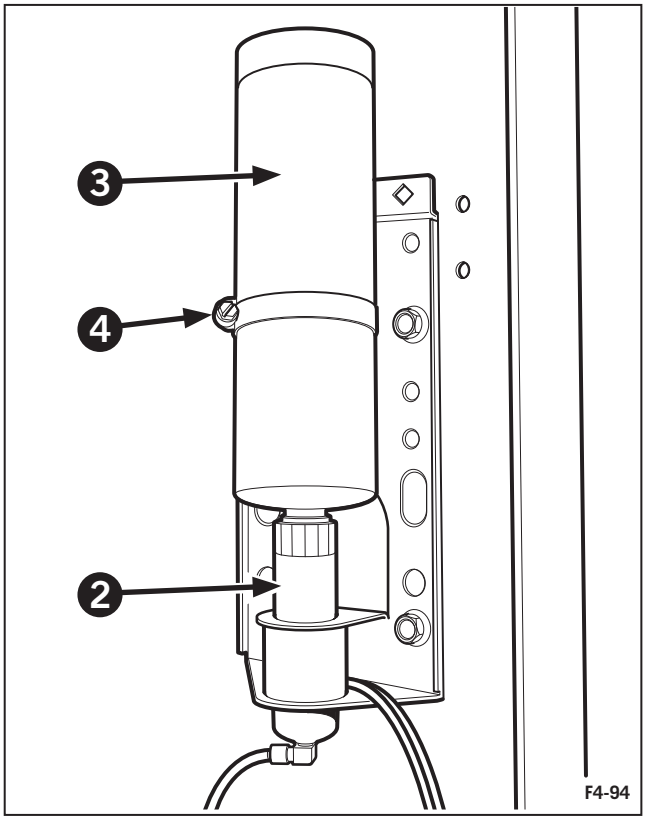



Lower the ether canister (3) into the top of the solenoid valve (2) and screw it in clockwise.

Tighten the ether canister hand tight only.

Once the ether canister is screwed into the solenoid valve, secure the canister firmly by attaching the clamp (4) around the canister. Tighten the clamp.

**NOTE: The ether bottle is not shipped as standard equipment from the factory and should be sourced locally.**




**CAUTION: STARTING FLUID IS HIGHLY FLAMMABLE. DO NOT USE NEAR FIRE, SPARKS, OR FLAMES. BE SURE ALL OPERATORS READ THE CAUTIONARY INFORMATION ON THE CANISTER.**

**CAUTION: THE ETHYL ETHER USED AS COLD START FLUID IS EXTREMELY FLAMMABLE, TOXIC, AND FATAL IF SWALLOWED. AVOID CONTACT WITH EYES OR SKIN. AVOID BREATHING THE FUMES.**

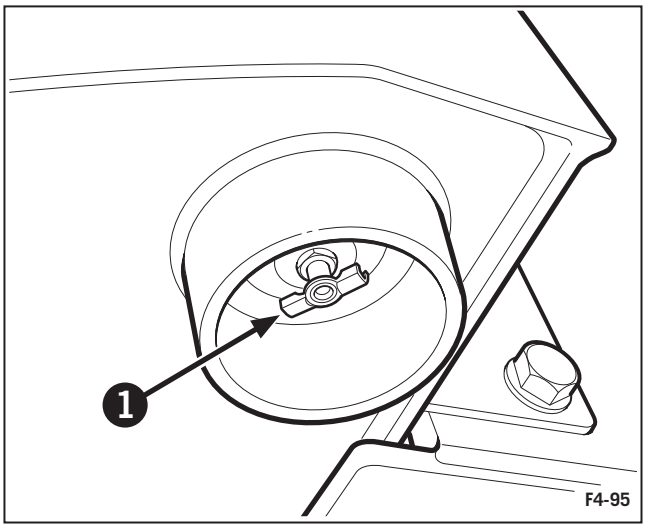
**IF SWALLOWED, DO NOT INDUCE VOMITING. CALL DOCTOR IMMEDIATELY.**

**IF COLD START FLUID ENTERS EYES OR FUMES IRRITATE EYES, WASH EYES WITH LARGE QUANTITIES OF CLEAN WATER FOR 15 MINUTES. CONTACT A DOCTOR, PREFERABLY AN EYE SPECIALIST, IMMEDIATELY.**

## Operation 84

### Drain the Fuel Tanks

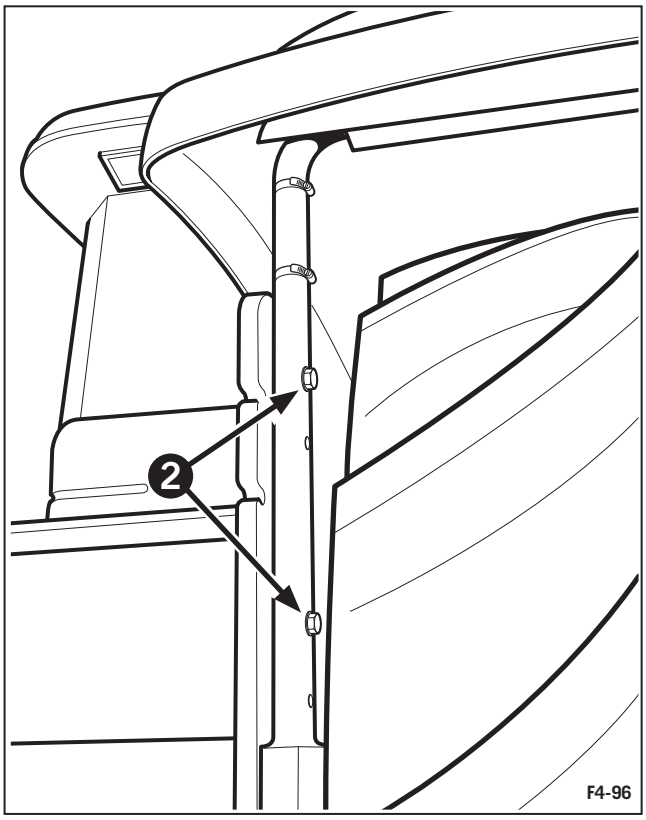
The fuel tanks can be drained by opening the petcock, (1) located on the bottom, rear inside corner of each fuel tank. Drain all the fuel from the tanks into suitable containers and retighten the petcock. Dispose of the fuel (if necessary) according to local laws and regulations.




## Operation 85

### Rear Fender Height Adjustment

Rear fender height can be adjusted by removing the four bolts (2) that attach each fender support to the rear frame. Move the fender to the desired height and reinstall the bolts. Torque the bolts to 165 N·m (125 ft-lbs.).



## Operation 86

### Storing the Tractor

**NOTE: Storage refers to periods of approximately three months or greater.**

### Preparation

Change the hydraulic oil.

Change the transmission oil.

Change the engine coolant.

Drain and flush the oil from the differentials and planetary housings. Fill with new oil.

Change the engine oil and filter.

Start the engine. While the engine is warming up, operate the transmission, hydraulic system, steering and differentials to distribute new lubricant to components. Warm engine to at least 70°C (160°F). Stop the engine.

Clean the tractor of all debris, dirt, and accumulated grease.

Drive the tractor to the storage location.

Relieve tension on the alternator, compressor, water pump, and fan belt.

Coat all exposed hydraulic cylinder shaft areas with grease or a rust preventive.

Fill the fuel tanks with fuel.

Refer to the Cummins operator's manual for more engine related preparations.

### Storing

Use plastic bags or tape to seal the following openings: muffler, fuel tank breather, air intake filter, and engine crankcase breather.

Touch up all scratches or chips.

Block up the tractor to remove weight from the tires.

Cover the tires if they will be exposed to heat or direct sunlight.

If the tractor is to be stored outside, cover it with a waterproof canvas or other protective material.

Remove the batteries from the tractor and store them in a cool, dry, weatherproof area. Do not store on a concrete floor.

### Removal from Storage

Remove the protective covering from the tractor tires and seals from the air intake filter, muffler, fuel tank and engine crankcase breather.

Remove the blocks. Lower the tractor onto the tires.

Correct any leaks.

Inflate the tires to the recommended pressure.

Install fully charged batteries. Tighten the battery connections.

Tension the alternator, compressor, water pump and fan belt.

Check the fluid level of the engine crankcase, differentials, planetaries, transmission, hydraulic reservoir, brake cylinder reservoir and engine cooling system.

If the fuel filter is changed during or after storage, be sure that the filter, pump and lines are primed.

Drain sediment from the fuel tanks.

Refer to the Cummins operator's manual for more engine related preparations.

### Initial Engine Start-up

Initial engine start-up after long periods of storage can place abnormal loads on the cranking system. Do not crank the engine longer than 30 seconds. Allow at least two minutes between cranking cycles to permit the starting motor to cool and the batteries to recover.

*IMPORTANT: On initial start of engine, do not increase speed above 1000 RPM, unless necessary to prevent stalling, until the engine oil pressure is normal.*

See "Engine Starting" and "Cold-Weather Starting" in Section 3.

If the engine does not start after 30 seconds, prime the fuel system using the following procedure:

Remove the fuel filter and fill it with clean filtered fuel.

*IMPORTANT: Fuel poured directly into the filter will not be cleaned by the filter and will go directly into the fuel pump. Be sure that the fuel is clean.*

Start the engine. If the engine still does not start, consult your Buhler Versatile dealer.

# Section 5 Contents - Troubleshooting

**The troubleshooting charts in this section list possible problems, their causes, and corrective actions.**

## Engine

| Problem | Possible Cause | Correction |
|---|---|---|
| **Engine will turn over but will not start, or starts hard** | Incorrect starting procedure. | Review starting procedures. |
| | Low or no fuel. | Check fuel level. |
| | Air in fuel lines. | Bleed fuel system. |
| | Incorrect engine oil viscosity. | Use correct viscosity oil. |
| | Incorrect fuel for operating temperature. | Use correct type fuel for temperature conditions. |
| | Contaminated fuel system. | Clean system/replace filter element. |
| | Clogged fuel filter. | Replace filter element. |
| | Malfunctioning fuel injector(s). | Contact Buhler Versatile dealer. |
| | Malfunctioning fuel solenoid. | Contact Buhler Versatile dealer. |
| | Clogged air filter. | Clean or replace air filter. |
| **Engine runs rough and/ or stalls** | Clogged fuel filter. | Replace filter. |
| | Clogged air filter. | Clean or replace air filter. |
| | Engine cylinder temperature too low for clean fuel burn. | Refer to “Cold-Weather Starting” (Section 3). |
| | Contaminated fuel system. | Clean system replace filter element. |
| | Malfunctioning fuel injector(s). | Contact Buhler Versatile dealer. |
| **Engine does not appear to develop full power** | Engine overloaded. | Shift to lower gear or reduce load. |
| | Air cleaner restricted. | Service air cleaner. |
| | Clogged fuel filter. | Replace filter. |
| | Incorrect type of fuel. | Use correct fuel. |
| | Engine overheated. | See “Engine Overheats” (later in this chart). |
| | Low engine operating temperature. | Contact Buhler Versatile dealer. |
| | Implement incorrectly adjusted. | See implement operator’s manual. |
| | Malfunctioning fuel injector(s). | Contact Buhler Versatile dealer. |
| | High idle speed is low. | Contact Buhler Versatile dealer. |
| | Engine Power Derate | Refer to EICS operation (Section 3). Contact Buhler Versatile dealer. |
| | Cruise control set too low | Disengage cruise control or reset to higher speed. |

## Engine

| Problem | Possible Cause | Correction |
|---|---|---|
| **Engine knocks** | Low oil level. | Add correct grade and amount of oil. |
| | Low oil pressure. | Contact Buhler Versatile dealer. |
| | Engine overheated. | See “Engine Overheats” (later in this chart). |
| **Low engine operating temperature** | Engine temperature gauge faulty. | Contact Buhler Versatile dealer. |
| | Malfunctioning thermostat(s). | Contact Buhler Versatile dealer. |
| | Tractor used on very light loads. | Contact Buhler Versatile dealer. |
| **Low oil pressure** | Low oil level. | Add oil as required. |
| | Oil pressure gauge faulty. | Contact Buhler Versatile dealer. |
| | Wrong grade or viscosity oil. | Drain and refill with correct grade and viscosity oil. |
| | Engine component failure. | Contact Buhler Versatile dealer. |
| **Excessive oil consumption** | Engine oil level too high. | Reduce oil level. |
| | Incorrect viscosity oil. | Use correct viscosity. |
| | External oil leaks. | Contact Buhler Versatile dealer. |
| | Plugged breather tube vent filter. | Contact Buhler Versatile dealer. |
| | Engine component failure. | Contact Buhler Versatile dealer. |
| **Engine overheats** | Restricted cooling system fins. | Clean radiator, cooler and front grill. |
| | Excessive engine load. | Shift to a lower gear or reduce load. |
| | Low engine oil level. | Add oil as required. |
| | Low coolant level. | Fill cooling system. Check for leaks. |
| | Faulty radiator cap. | Replace cap. |
| | Loose or worn fan belt. | Check automatic tensioner. Replace belt if worn. |
| | Cooling system plugged. | Flush cooling system. |
| | Malfunctioning thermostat(s). | Contact Buhler Versatile dealer. |
| | Hose connection leaking. | Tighten hose connection. |
| | Malfunctioning temperature gauge. | Contact Buhler Versatile dealer. |
| **Air filter restricted** | Clogged air filter. | Clean or replace filter. |
| | Aspirator malfunction. | Contact Buhler Versatile dealer. |

## Engine

| Problem | Possible Cause | Correction |
|---|---|---|
| **Excessive fuel consumption** | Incorrect type of fuel. | Use correct fuel. |
| | Clogged or dirty air cleaner. | Service air cleaner. |
| | Engine overloaded. | Shift to lower gear or reduce load. |
| | Implement incorrectly adjusted. | See implement operator's manual. |
| | Low engine temperature. | Contact Buhler Versatile dealer. |
| | Excessive ballast. | Adjust ballast. |
| | Fuel injection nozzles dirty. | Contact Buhler Versatile dealer. |
| | External leaks. | Repair leaks. |
| | Fuel pump calibration changed. | Contact Buhler Versatile dealer. |

## Synchromesh Transmission

| Problem | Possible Cause | Correction |
|---|---|---|
| **Tractor does not move** | Transmission out of oil. | Check oil level and fill as necessary. |
| | Failure of input driveline or engine coupler. | Contact Buhler Versatile dealer. |
| | Park brake engaged. | Disengage parking brake. |
| | Clutch cable stuck. | Contact Buhler Versatile dealer. |
| **Low transmission lube pressure** | Transmission out of oil. | Check oil level and fill as necessary. |
| | Defective sensor circuit. | Contact Buhler Versatile dealer. |
| | Restricted transmission filter. | Replace filter. |
| | Pressure sender failure. | Contact Buhler Versatile dealer |
| **Transmission lubrication filter bypass** | Filter is restricted. | Replace filter. |
| | Extremely cold temperature. | Run tractor at low idle for 30 minutes to warm up system. If light is still illuminated, contact Buhler Versatile dealer. |
| | Sensor circuit failure. | Contact Buhler Versatile dealer. |
| | Sensor failure. | Contact Buhler Versatile dealer. |

| Fault Code | Description | Correction |
|---|---|---|
| **F387** | Low Transmission Oil Pressure Warning | Contact Buhler Versatile dealer |
| **F388** | Transmission Oil Pressure Sensor Short To Ground | Contact Buhler Versatile dealer. |
| **F392** | Transmission Filter Plugged | Contact Buhler Versatile dealer. |

## 1407 Twindisc Powershift Transmission

The following list of fault codes may appear in the gear display of the EIC if a transmission fault is present.

If the cause of the fault cannot be corrected by the measures suggested, contact your Buhler Versatile dealer.

| Fault code | Description | Correction |
|---|---|---|
| **E00** | Input power has dropped below 0.4 volts for more than 0.1 seconds | Low battery voltage<br>Loose connection<br>Bad ground<br>Bad power relay contacts<br>Contact Buhler Versatile dealer |
| **E01, E02, E05, E04, E05** | Internal control problem | Contact Buhler Versatile dealer |
| **E06** | Output speed signal missing transmission shifts to neutral if clutch pedal depressed - 1st engaged when clutch is released | Contact Buhler Versatile dealer |
| **E08** | Range selector switch combination invalid | Contact Buhler Versatile dealer |
| **E09** | Clutch pedal signal out of range or bottom pedal switch error | Contact Buhler Versatile dealer |
| **E11** | Engine load signal out of proper range | Contact Buhler Versatile dealer |
| **E12** | Input speed sensor circuit shorted or open | Contact Buhler Versatile dealer |
| **E13** | Output speed sensor circuit shorted or open | Contact Buhler Versatile dealer |
| **S1, S2, S3, S4, S5, S6, S7, S8, S9** | Designated solenoid shorted or open | Contact Buhler Versatile dealer |
| **F387** | Low Transmission Oil Pressure Warning | Contact Buhler Versatile dealer |
| **F388** | Transmission Oil Pressure Sensor Short To Ground | Contact Buhler Versatile dealer |
| **F392** | Transmission Filter Plugged | Contact Buhler Versatile dealer |

**NOTE: Repairs and adjustments to the 1407 twindisc powershift control system require special service tools and procedures to be performed by qualified technicians only; contact your Buhler Versatile dealer.**

## CAT TA22 Powershift Transmission

The following fault codes may appear in the gear display of the EIC if a fault occurs in the CAT TA22 Powershift transmission. Contact your Buhler Versatile dealer for assistance in correcting the fault.

| | |
|---|---|
| **F348** | Inching pedal position sensor signal out of range low |
| **F349** | Inching pedal position sensor signal out of range high |
| **F386** | High Transmission Oil Temperature Shutdown |
| **F387** | Low Transmission Oil Pressure Warning |
| **F388** | Transmission Oil Pressure Sensor Short To Ground |
| **F389** | Transmission oil temperature sensor short to ground |
| **F390** | Transmission oil temperature sensor open circuit / short to +battery |
| **F392** | Transmission Filter Plugged |
| **F702** | Transmission output speed sensor #1 bad component |
| **F703** | CAT data link not communicating |
| **F704** | J1939 data link not communicating |
| **F705** | Transmission clutch #7 solenoid short to +battery |
| **F706** | Transmission clutch #7 solenoid open circuit |
| **F707** | Transmission clutch #7 solenoid short to ground |
| **F708** | Transmission clutch #8 solenoid short to +battery |
| **F709** | Transmission clutch #8 solenoid open circuit |
| **F710** | Transmission clutch #8 solenoid short to ground |
| **F711** | Transmission clutch #9 solenoid short to +battery |
| **F712** | Transmission clutch #9 solenoid open circuit |
| **F713** | Transmission clutch #9 solenoid short to ground |
| **F714** | Inching pedal switch inputs incorrect |
| **F715** | Inching pedal switch improper response |
| **F716** | Inching pedal position sensor signal abnormal |
| **F717** | Transmission output speed sensor #2 bad component |
| **F718** | Transmission clutch #1 solenoid short to +battery |
| **F719** | Transmission clutch #1 solenoid open circuit |
| **F720** | Transmission clutch #1 solenoid short to ground |
| **F721** | Transmission clutch #2 solenoid short to +battery |
| **F722** | Transmission clutch #2 solenoid open circuit |
| **F723** | Transmission clutch #2 solenoid short to ground |
| **F724** | Transmission clutch #3 solenoid short to +battery |
| **F725** | Transmission clutch #3 solenoid open circuit |
| **F726** | Transmission clutch #3 solenoid short to ground |
| **F727** | Transmission clutch #4 solenoid short to +battery |
| **F728** | Transmission clutch #4 solenoid open circuit |
| **F729** | Transmission clutch #4 solenoid short to ground |
| **F730** | Transmission clutch #5 solenoid short to +battery |
| **F731** | Transmission clutch #5 solenoid open circuit |
| **F732** | Transmission clutch #5 solenoid short to ground |
| **F733** | Transmission clutch #6 solenoid short to +battery |
| **F734** | Transmission clutch #6 solenoid open circuit |
| **F735** | Transmission clutch #6 solenoid short to ground |
| **F736** | Upshift switch inputs incorrect |
| **F737** | Downshift switch inputs incorrect |
| **F738** | 5 Volt sensor power supply above normal |
| **F739** | 5 Volt sensor power supply below normal |
| **F740** | 5 Volt sensor power supply short to +battery |
| **F741** | 5 Volt sensor power supply short to ground |
| **F742** | 10 Volt sensor power supply above normal |
| **F743** | 10 Volt sensor power supply below normal |
| **F744** | Transmission lever position sensor signal out of range high |
| **F745** | Transmission lever position sensor signal out of range low |
| **F746** | Transmission lever position sensor signal abnormal |
| **F747** | Auto mode switch incorrect |
| **F748** | Transmission oil pressure sensor open circuit or short to +battery |
| **F749** | Transmission overspeed |

## Electrical System

| Problem | Possible Cause | Correction |
|---|---|---|
| **Electrical system is inoperative** | Loose or corroded battery connections. | Clean and tighten connections. |
| | Sulfated batteries. | Check each battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity. |
| | Fuse or relay failure. | Check fuse panel. |
| | Ignition switch failure. | Contact Buhler Versatile dealer. |
| **Starter speed low and engine cranks slowly** | Loose or corroded connections. | Clean and tighten connections. |
| | Low battery output. | Check each battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity of each battery. |
| | Incorrect viscosity engine oil. | Use correct viscosity oil for temperature conditions. |
| | Defective starter. | Contact Buhler Versatile dealer. |
| **Starter inoperative** | Transmission speed lever in gear. | Place shift lever in neutral. |
| | Clutch pedal not depressed. | Depress clutch pedal when starting. |
| | Loose or corroded connections. | Clean and tighten loose connections. |
| | Dead batteries. | Charge or replace batteries. |
| | PTO (option) switch on. | Turn switch off. |
| | Incorrect ignition operation. | Turn ignition to “OFF,” then to “START” position. |
| | Neutral start switch or PTO switch malfunction. | Contact Buhler Versatile dealer |
| | Fuse or relay failure. | Check fuse panel. |
| | Ignition switch failure. | Contact Buhler Versatile dealer. |
| **Charge indicator lamp stays on with engine running** | Low engine idle speed. | Increase idle speed. |
| | Loose belt. | Check automatic belt tensioner. |
| | Malfunctioning battery(ies). | Check each battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity. |
| | Malfunctioning alternator. | Contact Buhler Versatile dealer. |

## Electrical System

| Problem | Possible Cause | Correction |
|---|---|---|
| **Tractor runs for a short time and shuts off** | Automatic shutdown mode activated. | Check audio and visual indicators for cause of shutdown. Contact Buhler Versatile dealer. |
| | Partially restricted fuel line. | Contact Buhler Versatile dealer. |
| **Electrical system high/ low voltage** | Loose or corroded terminal connections. | Clean and tighten connections. |
| | Shorted out electrical system. | Contact Buhler Versatile dealer. |
| | Sulfated batteries. | Check each battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity. |
| | Loose or worn belt. | Check alternator belt tension. Replace belt if required. |
| **Batteries will not charge** | Loose or corroded terminal connections. | Clean and tighten connections. |
| | One or more batteries defective or sulfated. | Check each battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity. |
| | Loose or worn belt. | Check alternator belt tension. Replace belt if required. |

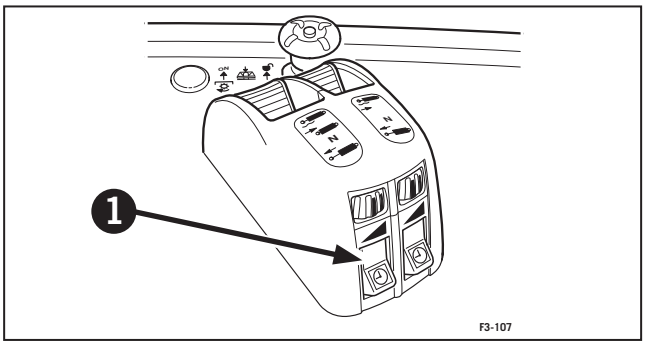
## Hydraulic System

| Problem | Possible Cause | Correction |
|---|---|---|
| **Complete hydraulic system does not operate** | Low oil level. | Fill system. |
| | Restricted hydraulic filter. | Replace hydraulic filter. |
| | Restricted reservoir suction screen. | Clean screen. |
| | Malfunctioning hydraulic system. | Contact Buhler Versatile dealer. |
| | Blown fuse - faulty relay* | Replace fuses and or relay* |
| **Hydraulic oil overheats** | Oil level low or high. | Adjust oil level. |
| | Oil cooler or radiator plugged. | Clean oil cooler and radiator. |
| | Blocked oil filter element. | Replace filter. |
| | Flow control improperly adjusted. | Adjust flow control to lower flow position. |
| | Hydraulic load or orbit motor system not matched to tractor. | Contact Buhler Versatile dealer. |
| **Hoses will not uncouple** | Hoses being pulled at 15° angle or greater. | Pull straight back on hoses. |
| **Hoses will not couple** | Lines are still pressurized. | Place hydraulic system into float |
| | Incorrect male connectors. | Replace connectors with ISO-(1/2") standard connectors available from your Buhler Versatile dealer. |
| **Detent disengages prematurely** | Equipment exceeds detent pressure settings. | Contact Buhler Versatile dealer. |
| | High pressure standby set too low. | Contact Buhler Versatile dealer |
| | Detent release pressure set too low | Contact Buhler Versatile dealer. |
| | Incorrect time set on electric valve. | Contact Buhler Versatile dealer. |
| **Remote attachment operates too fast or too slow** | Flow control not properly adjusted. | Adjust flow control. |
| | Incorrect oil viscosity | Change oil to correct specification. |
| **Hydraulic filter bypass warning light on** | Clogged filter. | Replace filter. |
| **Remote attachment does not operate** | Hoses not completely connected. | Attach hoses correctly. |
| | Load exceeds system capacity. | Reduce load or increase cylinder size. |
| | Lever lock restricts control lever movement. | Reposition lock. |

* Applies to optional the Electro-hydraulics (EHR) system

## Hydraulic System - Electro-Hydraulic

Faults occurring in the EHR system (optional) will be indicated by a code flashed in the left hand, timed detent switch (1) in each of the EHR control pods. Faults for both sections in the pod will be indicated.




| Pod | Section | Pod | Section |
|---|---|---|---|
| 1 | 1A+1B, 2A+2B | 3 | 5A+5B, 6A+6B |
| 2 | 3A+3B, 4A+4B | 4 | 7A+7B, 8A+8B |

| No. of Flashes | Description of Error | Corrective Action |
|---|---|---|
| 1 | - | - |
| 2 | EERPOM inconsistent | Contact Buhler Versatile Dealer |
| 3 | Solenoid 1A open | Check wiring harness connection to Solenoid on implement valve 1A / Contact Buhler Versatile Dealer |
| 4 | Solenoid 1B open | Check wiring harness connection to Solenoid on implement valve 1B / Contact Buhler Versatile Dealer |
| 5 | Solenoid 2A open | Check wiring harness connection to Solenoid on implement valve 2A / Contact Buhler Versatile Dealer |
| 6 | Solenoid 2B open | Check wiring harness connection to Solenoid on implement valve 2B / Contact Buhler Versatile Dealer |
| 7 | Lever 1 pot open or short to ground | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 8 | Lever 1 pot short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 9 | Lever 1 active switch open or short to GRND | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 10 | Lever 1 active switch short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 11 | Lever 1 full flow switch short to PWR | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 12 | Lever 1 float switch open or short to GRND | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 13 | Lever 1 float switch short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 14 | Lever 2 pot open or short to ground | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 15 | Lever 2 pot short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 16 | Lever 2 active switch open or short to GRND | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 17 | Lever 2 active switch short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 18 | Lever 2 full flow switch short to PWR | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 19 | Lever 2 float switch open or short to GRND | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |
| 20 | Lever 2 float switch short to power | Check wiring harness connection to Lever 1 and 2 Contact Buhler Versatile Dealer |

## Brake System

| Problem | Possible Cause | Correction |
|---|---|---|
| **Park brake inoperative** | Worn brake pads. | Replace brake pads. |
| | Broken park brake cable. | Replace broken cable. |
| | Brake out of adjustment. | Operate park brake lever several times to automatically adjust brakes. If there is no improvement, contact your Buhler Versatile dealer. |
| **Pedal bottoms out or feels mushy** | Brake piston seal leaking. | Contact Buhler Versatile dealer. |
| | Worn brake pads. | Replace brake pads. |
| | Brake bleed screw not sealing. | Tighten bleeder. |
| | Leakage in brake valve. | Contact Buhler Versatile dealer. |
| | Air in system. | Bleed brake system. |
| | Brakes out of adjustment. | Operate brake pedal several times to automatically adjust. If there is no improvement, contact your Buhler Versatile dealer. |
| | Malfunctioning master control valve. | Contact Buhler Versatile dealer. |

## Cab

| Problem | Possible Cause | Correction |
|---|---|---|
| **Dust enters the cab** | Improper seal around filter element. | Check seal condition. |
| | Plugged filter. | Clean or replace filter. |
| | Defective filter. | Replace filter. |
| | Excessive air leak(s) in cab floor, windows, or door. | Seal air leak(s). |
| **Pressurizer air flow low** | Plugged filter. | Clean or replace filter. |
| | Heater core or evaporator core plugged. | Contact Buhler Versatile dealer. |
| **Cab windows fog up** | Excessive moisture in cab air system. | Position air vents toward windows. |
| | | Use air-conditioner system and recirculation control along with the heating system to dehumidify cab air. |
| | | Check air-conditioner drain hoses for restriction. |
| **Heating system does not heat** | Defective engine thermostats. | Contact Buhler Versatile dealer. |
| | Heater core plugged. | Contact Buhler Versatile dealer. |
| | Heater valve shut off at engine. | Turn on heater valve at engine and adjust temperature control knob to the heat position. |
| | Cab heater valve not functioning. | Contact Buhler Versatile dealer. |
| **Air-conditioner does not cool** | Condenser plugged. | Clean radiator, oil cooler, and condenser. |
| | Low refrigerant. | Check sight glass for bubbles. Contact your Buhler Versatile dealer. |
| | Compressor belt slipping or damaged. | Check belt tension and belt condition |
| | Heater control turned on. | Turn temperature control knob fully counterclockwise for maximum cooling. Shut off heater hose valve at engine. |
| | Fuse or relay defective. | Replace fuse or relay. |

## Operation

| Problem | Possible Cause | Correction |
|---|---|---|
| **Tractor rides rough** | Incorrect seat adjustments. | Adjust seat ride and dampener. |
| | Faulty seat suspension. | Contact Buhler Versatile dealer. |
| | Incorrect ballast. | Ballast tractor correctly. |
| | Tire inflation pressure too high. | Inflate tires correctly. |
| | Implement mismatched with tractor. | Remove implement from tractor. |
| | Implement adjusted incorrectly. | Adjust implement per implement operator's manual. |
| **Tractor "hops" or bounces during operation** | Incorrect ballast. | Ballast tractor correctly. |
| | Incorrect tire pressure. | Inflate tires correctly. |
| | Incorrect tire size, configuration or type. | Contact Buhler Versatile dealer. |

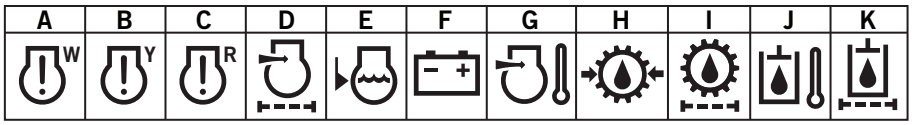
## Fault Codes

In the event that a fault occurs within the tractor electrical circuits, a malfunction warning symbol "READ YOUR MANUAL," will flash on and off and a fault code will be stored. To view fault codes as they occur, see "Turning active fault display on/off" on page 3-42

The following charts detail a complete list of fault codes, their cause and remedy. If necessary, contact your Buhler Versatile authorized dealer and quote the fault code number.

For viewing and clearing fault codes see: section 3 - Operation, page 3-40.

**Key to Warning Lamps**




| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F200 | - | Sensor 5V supply failed HIGH | Contact Buhler Versatile Inc (BVI) Service Center |
| F201 | - | Output circuit SHORT | Contact Buhler Versatile Inc (BVI) Service Center |
| F207 | - | Brakes engaged while moving | Contact Buhler Versatile Inc (BVI) Service Center |
| F208 | - | Sensor 5V supply failed LOW | Contact Buhler Versatile Inc (BVI) Service Center |
| F210 | - | Module unexpectedly reset | Contact Buhler Versatile Inc (BVI) Service Center |
| F211 | - | CAN bus interference detected | Contact Buhler Versatile Inc (BVI) Service Center |
| F212 | - | CAN bus failure detected | Contact Buhler Versatile Inc (BVI) Service Center |
| F213 | - | EEPROM data corrupted (bad checksum) | Contact Buhler Versatile Inc (BVI) Service Center |
| F214 | - | EEPROM data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F215 | - | Digital input system failure | Contact Buhler Versatile Inc (BVI) Service Center |
| F216 | - | Analog input system failure | Contact Buhler Versatile Inc (BVI) Service Center |
| F217 | J | Hydraulic oil temperature high | Check Hydraulic Oil Level/Check and Replace Hydraulic Oil Filters as required<br>Clean oil cooler and front grill<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F387 | H | Transmission oil pressure low | Check Transmission Oil Level<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F388 | H | Transmission oil pressure sensor - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F391 | K | Hydraulic oil filter restriction | Check Hydraulic Oil Filter<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F392 | I | Transmission oil filter restriction | Check Transmission Oil Filter<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F400 | C | Engine Coolant Temperature High – Critical | Clean Radiator and front grill<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F401 | C | Engine Oil Pressure Low – Critical | Check Engine Oil Level<br>Contact Buhler Versatile Inc (BVI) Service Center |
| F406 | B | Engine Coolant Temperature Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F407 | B | Engine Coolant Temperature Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F408 | B | Engine Oil Pressure Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |

| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F417 | D | Engine air filter restriction | Check Air Filter/ Contact Buhler Versatile Inc (BVI) Service Center |
| F418 | C & E | Engine Coolant Level Low - Critical | Check Engine Coolant Level/ Contact Buhler Versatile Inc (BVI) Service Center |
| F419 | F | Alternator not charging | Contact Buhler Versatile Inc (BVI) Service Center |
| F440 | B & G | Intake Manifold Temperature Sensor #1 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F441 | B & G | Intake Manifold Temperature Sensor #1 Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F442 | C & G | Intake Manifold Temperature #1 High - Critical | Contact Buhler Versatile Inc (BVI) Service Center |
| F443 | B | Intake Manifold Pressure Sensor #1 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F444 | B | Intake Manifold Pressure Sensor #1 Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F445 | B | Intake Manifold Pressure Sensor Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F454 | C | Engine Speed High - Critical | Contact Buhler Versatile Inc (BVI) Service Center |
| F500 | B | Accelerator Pedal Position Sensor Supply Voltage Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F501 | B | Accelerator Pedal and Speed/Position Sensor #1 Supply Voltage Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F502 | B | Engine Speed/Position Sensor #2 (Camshaft) Supply Voltage | Contact Buhler Versatile Inc (BVI) Service Center |
| F503 | B | Hand Throttle Idle Validation Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F504 | B | Hand Throttle Idle Validation Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F505 | C | Hand Throttle Idle Validation Circuit - out of calibration | Contact Buhler Versatile Inc (BVI) Service Center |
| F506 | B | Sensor Supply Voltage #1 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F507 | B | Sensor Supply Voltage #1 Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F508 | B | Auxiliary Temperature Sensor Input # 1 Circuit – shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F509 | B | Auxiliary Temperature Sensor Input # 1 Circuit – shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F510 | B | Auxiliary Pressure Sensor Input # 2 Circuit – shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F511 | B | Auxiliary Pressure Sensor Input # 2 Circuit – shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F512 | B | Injector Metering Rail #2 Pressure Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |

| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F513 | B | Injector Metering Rail #2 Pressure Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F514 | B | Injector Metering Rail #2 Pressure Malfunction | Contact Buhler Versatile Inc (BVI) Service Center |
| F515 | B | Injector Metering Rail #2 Pressure High - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F516 | B | Injector Metering Rail #2 Pressure Low - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F517 | B | Vehicle Speed Sensor Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F518 | B | Vehicle Speed Sensor Circuit - tampering has been detected | Contact Buhler Versatile Inc (BVI) Service Center |
| F519 | C | Accelerator Pedal Position Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F520 | C | Accelerator Pedal Position Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F521 | C | Accelerator Pedal Position Sensor Circuit - invalid frequency | Contact Buhler Versatile Inc (BVI) Service Center |
| F522 | C | SAE J1939 Multiplexing Accelerator Pedal Sensor System Error | Contact Buhler Versatile Inc (BVI) Service Center |
| F523 | B | OEM Alternate torque validation switch - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F524 | B | Fuel Delivery Pressure Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F525 | B | Fuel Delivery Pressure Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F526 | B | Fuel Pressure High - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F527 | B | Fuel Pressure Low - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F528 | B | Water in Fuel Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F529 | B | Water in Fuel Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F530 | A | Water in Fuel Indicator High – Maintenance | Check for Water in Fuel Filter/ Contact Buhler Versatile Inc (BVI) Service Center |
| F531 | B | Engine Oil Pressure Sensor Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F532 | B | Engine Oil Pressure Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F533 | B | Engine Oil Pressure Low - Warning | Check Engine Oil Level/ Contact Buhler Versatile Inc (BVI) Service Center |
| F534 | A | Low Oil Level in the Centinel makeup oil tank | Contact Buhler Versatile Inc (BVI) Service Center |
| F535 | B | Fuel Supply Pump Inlet Pressure Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F536 | B | Fuel Supply Pump Inlet Pressure Sensor Circuit – shorted low | Contact Buhler Versatile Inc (BVI) Service Center |

| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F537 | B | Fuel Supply Pump Inlet Pressure Low - warning level | Check Fuel Level/Check Fuel Filter/ Contact Buhler Versatile Inc (BVI) Service Center |
| F538 | B | Turbocharger #1 Speed High - warning level | Contact Buhler Versatile Inc (BVI) Service Center |
| F539 | - | Engine Hot Shutdown | Contact Buhler Versatile Inc (BVI) Service Center |
| F540 | B | Engine Shutdown Commanded by J1939 | Contact Buhler Versatile Inc (BVI) Service Center |
| F541 | B | Ambient Air Pressure Sensor Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F542 | B | Ambient Air Pressure Sensor Circuit – shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F543 | B | Ambient Air Pressure Sensor Circuit – shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F544 | B | Sensor Supply Voltage #2 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F545 | B | Sensor Supply Voltage #2 Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F546 | B & E | Engine Coolant Level Sensor Circuit - data incorrect | Contact Buhler Versatile Inc (BVI) Service Center |
| F547 | B | Power Lost without Ignition Off | Contact Buhler Versatile Inc (BVI) Service Center |
| F548 | C | Engine Control Module – Internal failure | Contact Buhler Versatile Inc (BVI) Service Center |
| F549 | B | Engine Control Module – data lost | Contact Buhler Versatile Inc (BVI) Service Center |
| F550 | B | Engine Control Module - Warning Software error | Contact Buhler Versatile Inc (BVI) Service Center |
| F551 | - | Fuel Shutoff Valve Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F552 | - | Fuel Shutoff Valve Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F553 | C | Fuel Shutoff Valve - stuck open | Contact Buhler Versatile Inc (BVI) Service Center |
| F554 | B | Fueling Actuator #1 Circuit - open circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F555 | B | Fueling Actuator #1 Circuit - grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F556 | B | Timing Actuator #1 Circuit - open circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F557 | B | Timing Actuator #1 Circuit - grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F558 | - | SAE J1939 datalink - cannot transmit | Contact Buhler Versatile Inc (BVI) Service Center |
| F559 | B | SAE J1939 Multiplexing PGN Timeout Error | Contact Buhler Versatile Inc (BVI) Service Center |
| F560 | B | SAE J1939 Multiplexing Configuration Error | Contact Buhler Versatile Inc (BVI) Service Center |
| F561 | B | Fan Clutch Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F562 | B | Injector Solenoid Valve Cylinder #1 Circuit – grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F563 | B | Injector Solenoid Valve Cylinder #2 Circuit – grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F564 | B | Injector Solenoid Valve Cylinder #3 Circuit – grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |

| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F565 | B | Injector Solenoid Valve Cylinder #5 Circuit – grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F566 | B | Injector Solenoid Valve Cylinder #6 Circuit - grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F567 | B | Injector Metering Rail #1 Pressure Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F568 | B | Injector Metering Rail #1 Pressure Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F569 | B | Injector Metering Rail #1 Pressure Malfunction | Contact Buhler Versatile Inc (BVI) Service Center |
| F570 | B | Injector Metering Rail #1 Pressure High - warning level | Contact Buhler Versatile Inc (BVI) Service Center |
| F571 | B | Turbocharger #1 Wastegate Control Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F572 | - | Cylinder Power Imbalance between cylinders | Contact Buhler Versatile Inc (BVI) Service Center |
| F573 | C | Electrical Charging System Voltage Low - Critical Level | Contact Buhler Versatile Inc (BVI) Service Center |
| F574 | B | Electrical Charging System Voltage High - Warning level | Contact Buhler Versatile Inc (BVI) Service Center |
| F575 | B | Electrical Charging System Voltage Low - Warning Level | Contact Buhler Versatile Inc (BVI) Service Center |
| F576 | B | Battery #1 Voltage High - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F577 | B | Battery #1 Voltage Low - Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F578 | C | Engine Oil Temperature High - Critical | Contact Buhler Versatile Inc (BVI) Service Center |
| F579 | B | Engine Oil Temperature Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F580 | B | Engine Oil Temperature Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F581 | C | Engine Speed/Position Sensor Circuit - lost both of two signals from the magnetic pickup sensor | Contact Buhler Versatile Inc (BVI) Service Center |
| F582 | B | Engine Speed/Position Sensor Circuit - lost one of two signals from the magnetic pickup sensor | Contact Buhler Versatile Inc (BVI) Service Center |
| F583 | B | Auxiliary Input/Output #2 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F584 | B | Transmission Output Shaft (Tailshaft) Speed High – Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F585 | B | Transmission Output Shaft (Tailshaft) Speed Low – Warning | Contact Buhler Versatile Inc (BVI) Service Center |
| F586 | B | Auxiliary Input/Output #3 Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |

| Fault Codes | Warning Lamp | Cause | Action |
|---|---|---|---|
| F587 | - | Additional OEM/Vehicle Diagnostic Codes have been logged. Check other ECM's for DTC's. | Contact Buhler Versatile Inc (BVI) Service Center |
| F588 | C | Foot Throttle Pedal Position Sensor Circuit - shorted high | Contact Buhler Versatile Inc (BVI) Service Center |
| F589 | C | Foot Throttle Pedal Position Sensor Circuit - shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F590 | C | SAE J1939 Multiplexing Remote Throttle Data Error | Contact Buhler Versatile Inc (BVI) Service Center |
| F591 | - | Engine Speed/Position #2 - Cam sync error | Contact Buhler Versatile Inc (BVI) Service Center |
| F592 | B | Fueling Actuator #2 Circuit - open circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F593 | B | Fueling Actuator #2 Circuit - grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F594 | B | Timing Actuator #2 Circuit - open circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F595 | B | Timing Actuator #2 Circuit - grounded circuit | Contact Buhler Versatile Inc (BVI) Service Center |
| F596 | B | Engine Oil Burn Valve Solenoid Circuit – shorted low | Contact Buhler Versatile Inc (BVI) Service Center |
| F597 | A | Real Time Clock - Power Interrupt | Contact Buhler Versatile Inc (BVI) Service Center |

# Section 6 Contents - Specifications

The specifications on the following pages are given for your information and guidance. For further information concerning the tractor, consult your authorized Buhler Versatile dealer.

Our policy is one of continuous improvement, and the right to change prices, specifications, or equipment at any time without notice is reserved.

All data given in this book is subject to production variations. Dimensions and weights are approximate only. For exact information about any particular tractor, please consult your authorized Buhler Versatile dealer.

## General Dimensions

**435, 485, 535**

Wheelbase - Center of axle to center of axle 3900 mm (153.5")

Overall Length - Front nose to end of drawbar (no weight kits) 7606 mm (299.4").
With weight kit 817.9 mm (321.7)

Distance from center of front axle to nose of tractor (no weight kit) 2361 mm (93.0")

Distance from center of rear axle to end of drawbar 1345 mm (53.0")

## Overall Heights

The overall height of the tractor will be determined by the tire size chosen. Single, dual, or triple tire configuration will not affect height. The following dimensions are for all model tractors based on tire size.

| Tire Size | Overall heights | | |
|---|---|---|---|
| | Top of Exhaust | Top of Cab | Top of Drawbar |
| 20.8 R42 R1W Radial | 3897mm (153.4") | 3658mm (144.0") | 513mm (20.2") |
| 520/85 R42 R1W Radial | 3889mm (153.1") | 3651mm (143.7") | 506mm (19.9") |
| 520/85 R46 R1W Radial | 3943mm (155.2") | 3704mm (145.8") | 559mm (22.0") |
| 620/70 R42 R1W Radial | 3897mm (153.4") | 3658mm (144.0") | 513mm (20.2") |
| 650/65 R42 R1W Radial | 3872mm (152.4") | 3633mm (143.0") | 488mm (19.2") |
| 650/85 R38 R1W Radial | 3923mm (154.4") | 3684mm (145.0") | 539mm (21.2") |
| 710/70 R38 R1W Radial | 3877mm (152.6") | 3638mm (143.2") | 493mm (19.4") |
| 710/70 R42 R1W Radial | 3940mm (155.1") | 3701mm (145.7") | 556mm (21.8") |
| 800/70 R38 R1W Radial | 3928mm (154.6") | 3689mm (145.2") | 544mm (21.4") |
| 850/60 R38 Radial | 3917mm (154.2") | 3678mm (144.8") | 533mm (20.9") |
| 900/50 R42 R1W Radial | 3895mm (153.2") | 3656mm (143.9") | 511mm (20.1") |

## Overall Widths

The overall width of the tractor will be determined by the tire size chosen. Single, dual, or triple tire configuration will also affect machine widths. The following chart details overall widths by tire size and configuration for 435,485 and 535 tractor models. **Width is outside of outer tire to outside of outer tire.**

| Tire Size | Overall Width | | |
|---|---|---|---|
| | Single | Dual | Triple |
| 20.8 R42 R1W Radial | 3180mm (125.2") | 3996mm (157.3") | 5395 (212.4") |
| 520/85 R42 R1W Radial | 3180mm (125.2") | 3985mm (156.9") | 5383 (211.9") |
| 520/85 R46 R1W Radial | 3180mm (125.2") | 3994mm (157.2") | 5398 (212.5") |
| 620/70 R42 R1W Radial | 3180mm (125.2") | 4351mm (171.3") | 5910 (232.7") |
| 650/65 R42 R1W Radial | 3180mm (125.2") | 4376mm (172.3") | 5935 (233.7") |
| 650/85 R38 R1W Radial | 3180mm (125.2") | 4629mm (182.2") | 6047 (238.1") |
| 710/70 R38 R1W Radial | 3180mm (125.2") | 4689mm (184.6") | N/A |
| 710/70 R42 R1W Radial | 3180mm (125.2") | 4720mm (185.9") | N/A |
| 800/70 R38 R1W Radial | 3230mm (127.2") | 5118mm (201.5") | N/A |
| 850/60 R38 Radial | 3332mm (131.2") | 5299mm (208.6") | N/A |
| 900/50 R42 R1W Radial | 3429mm (135.0") | 5485mm (216.0") | N/A |

## Wheel Tread Width

The wheel tread width of the tractor will be determined by the tire size chosen. Single, dual, or triple tire configuration will also affect wheel tread width. The following chart details overall width by tire size and configuration for 435,485 and 535 tractor models. **Tread width is shown from center of inner wheel to center of inner wheel, and center of outer wheel to center of outer wheel. (Center of middle wheel to center of middle wheel also shown for triple option.)**

| Tire Size | Tread Width (to tire centerlines) | | |
|---|---|---|---|
| | Single | Dual | Triple |
| 20.8 R42 R1W Radial | 2049 (80.7") | 3447mm (135.7") | 4845 (190.7") |
| 520/85 R42 R1W Radial | 2049 (80.7") | 3447mm (135.7") | 4845 (190.7") |
| 520/85 R46 R1W Radial | 2048 (80.7") | 3454mm (136.0") | 4860 (191.3") |
| 620/70 R42 R1W Radial | 2154 (84.8") | 3726mm (146.7") | 5298 (208.6") |
| 650/65 R42 R1W Radial | 2154 (84.8") | 3726mm (146.7") | 5298 (208.6") |
| 650/85 R38 R1W Radial | 2278 (89.7") | 3979mm (156.7") | 5397 (212.5") |
| 710/70 R38 R1W Radial | 2278 (89.7") | 3979mm (156.7") | N/A |
| 710/70 R42 R1W Radial | 2166 (85.3") | 4004mm (157.6") | N/A |
| 800/70 R38 R1W Radial | 2240 (88.2") | 4240mm (166.9") | N/A |
| 850/60 R38 Radial | 2350 (92.5") | 4450mm (175.2") | N/A |
| 900/50 R42 R1W Radial | 2400 (94.5") | 4600mm (181.1") | N/A |

## Turning Geometry

Turnaround diameter is measured from the center point of the front axle and is a measurement of how far a tractor will move with each turn. **The turnaround diameter is based solely on articulation angle and is not a function of tire size or configuration.**

**Articulation Angle** **Turnaround Diameter**

42° . . . . . 10.0 m (394")
38° . . . . . 11.19 m (441")
33° . . . . . 11.33 m (514")

## Maximum Tractor Weight

The following table shows the maximum allowable weight of each tractor model.

| Model | Recommended Operating Weight lbs. |
|---|---|
| 435 | 45,000 lbs. (100 lbs. per HP) |
| 485 | 50,500 lbs. (100 lbs. per HP) |
| 535 | 54,000 lbs. (100 lbs. per HP) |

## Tractor Shipping Weight

Shipping weight of a tractor can be calculated based on the standard equipment and options ordered (or dealer installed) before any liquid ballast is added to the tractor. To calculate the shipping weight, pick the appropriate front, rear, and total weight values from the following tables (A-F). Once the shipping weight is found, the tractor can be ballasted and the tire air pressure set. See “Ballasting” in Section 3.

Example: Tractor: 485 tractor with 1407 Twindisc Powershift transmission, 710/70 x R42 R1 drum-style duals, high flow hydraulic pump and 100 gallon tank of fuel (378.5 L).

| Table Info | Front Axle Weight kg (lbs.) | Rear Axle Weight kg (lbs.) | Total Weight kg (lbs.) |
|---|---|---|---|
| A | 9130 (20,130) | 4821 (10,630) | 13592 (30,758) |
| B | 2428 (5354) | 2428 (5354) | 4857 (10,708) |
| C | N/A | N/A | N/A |
| D | 300 (660) | 168 (370) | 453 (1000) |
| E | 52 (115) | 38 (85) | 91 (200) |
| F | 184 (407) | 133 (294) | 317 (701) |
| Totals | 12094 (26,662) | 7588 (16,728) | 19292 (42,531) |

**NOTE: The weights shown in tables A-F are calculated values. Exact weights are only obtainable by putting the tractor on a scale.**

### A. Base Tractor Weight

A base tractor is considered to be fitted with synchromesh transmission, no tires or rims, a standard drawbar, no fuel in the fuel tanks, no operator, no special added equipment, and no ballast.

Front Axle Weight . . . . . 9130 kg (20,130 lbs.)
Rear Axle Weight . . . . . 4821 kg (10,630 lbs.)

Total Base Tractor . . . . . 13592 kg (30,758 lbs.)

## B. Tire Weights

The following chart lists the weight of the tire, tube and rim by tire size and wheel configuration.

Buhler Versatile offers a choice of tires. The chart is based on an average tire weight of the brand offered for a particular tire size. The weights shown are for front and rear axle and overall weight by configuration.

| Tire Size | Configuration | Front Axle kg (lbs.) | Rear Axle kg (lbs.) | Total tire Weight kg (lbs.) |
|---|---|---|---|---|
| 20.8 R42 R1W Radial | Singles | 798.3 (1760) | 798.3 (1760) | 1596.6 (3520) |
| 520/85 R46 R1W Radial | Singles | 965.2 (2128) | 965.2 (2128) | 1930.5 (4256) |
| 620/70 R42 R1W Radial | Singles | 973.4 (2146) | 973.4 (2146) | 1946.8 (4292) |
| 650/65 R42 R1W Radial | Singles | 1037.8 (2288) | 1037.8 (2288) | 2075.6 (4576) |
| 650/85 R38 R1W Radial | Singles | 854.5 (1884) | 854.5 (1884) | 1709.1 (3768) |
| 710/70 R38 R1W Radial | Singles | 979.7 (2160) | 979.7 (2160) | 1959.5 (4320) |
| 710/70 R42 R1W Radial | Singles | 1143.0 (2520) | 1143.0 (2520) | 2286.1 (5040) |
| 800/70 R38 R1W Radial | Singles | 1277.3 (2520) | 1277.3 (2520) | 2554.6 (5632) |
| 850/60 R38 Radial | Singles | 1303.6 (2874) | 1303.6 (2874) | 2607.2 (5748) |
| 900/50 R42 R1W Radial | Singles | 1343.5 (2962) | 1343.5 (2962) | 2687.1 (5924) |
| 20.8 R42 R1W Radial | Duals | 1731.8 (3818) | 1731.8 (3818) | 3463.6 (7636) |
| 520/85 R46 R1W Radial | Duals | 1970.4 (4344) | 1970.4 (4344) | 3940.8 (8688) |
| 620/70 R42 R1W Radial | Duals | 2033.9 (4484) | 2033.9 (4484) | 4067.8 (8968) |
| 650/65 R42 R1W Radial | Duals | 2033.9 (4484) | 2033.9 (4484) | 4325.4 (9536) |
| 650/85 R38 R1W Radial | Duals | 2162.7 (4768) | 2162.7 (4768) | 3688.6 (8132) |
| 710/70 R38 R1W Radial | Duals | 1844.3 (4066) | 1844.3 (4066) | 4385.3 (9668) |
| 710/70 R42 R1W Radial | Duals | 2428.5 (5354) | 2428.5 (5354) | 4857.1 (10708) |
| 800/70 R38 R1W Radial | Duals | 2753.3 (6070) | 2753.3 (6070) | 5506.6 (12140) |
| 850/60 R38 Radial | Duals | 2806.8 (6188) | 2806.8 (6188) | 5613.7 (12376) |
| 900/50 R42 R1W Radial | Duals | 2932.9 (6466) | 2932.9 (6466) | 5865.9 (12932) |
| 20.8 R42 R1W Radial | Triples | 2854.0 (6292) | 2854.0 (6292) | 5708.0 (12584) |
| 520/85 R46 R1W Radial | Triples | 3286.7 (7246) | 3286.7 (7246) | 6573.5 (14492) |
| 620/70 R42 R1W Radial | Triples | 3349.3 (7384) | 3349.3 (7384) | 6698.6 (14768) |
| 650/65 R42 R1W Radial | Triples | 3542.5 (7810) | 3542.5 (7810) | 7085.1 (15620) |
| 650/85 R38 R1W Radial | Triples | 3310.3 (7298) | 3310.3 (7298) | 6620.6 (14596) |
| 710/70 R38 R1W Radial | Triples | N/A | N/A | N/A |
| 710/70 R42 R1W Radial | Triples | N/A | N/A | N/A |
| 800/70 R38 R1W Radial | Triples | N/A | N/A | N/A |
| 850/60 R38 Radial | Triples | N/A | N/A | N/A |
| 900/50 R42 R1W Radial | Triples | N/A | N/A | N/A |

## C. Weight Packages

Adding a front or rear weight package to a tractor affects the weight distribution per axle as well as the total tractor weight. In addition, the actual weight effect applied to the axle is amplified by the distance the weight is hung away from the axle center line. **The following chart shows the gross weight of each weight kit and the net result of adding the kit on the front and rear axle.**

| | Total Weight of Kit kg (lbs.) | Effect on Front Axle kg (lbs.) | Effect on Rear Axle kg (lbs.) |
|---|---|---|---|
| Front Weight Kit<br>130 kg (397 lbs.) bracket<br>40 x 30 kg (67 lbs.) weights | 1396 (3077) | Adds<br>2387 (5262) | Removes<br>991 (2185) |
| Upper Rear Weight Kit<br>342 kg (360 lbs.) bracket<br>40 x 30 kg (67 lbs.) weights | 1379 (3040) | Adds<br>303 (669) | Adds<br>1075 (2371) |
| Rear Weight Kit<br>98 kg (222 lbs.) bracket<br>42 x 30 kg (67 lbs.) weights | 1377 (3036) | Removes<br>220 (486) | Adds<br>1598 (3522) |
| Total effect of putting a complete Front, Upper Rear and Rear Weight Kit on the Tractor | 4152 (9153) | Adds<br>2470 (5445) | Adds<br>1682 (3708) |

Multiply every pound of weight added to the front weight kit by 1.71 and add this figure to the front axle. Multiply every pound of weight added to the front weight kit by 0.71 and subtract this figure from the rear axle weight. The total effect on the tractor should be the sum of the front rear and should equal the weight added.

Multiply every pound of weight added to the upper rear weight kit by 0.78 and add this figure to the rear axle. Multiply every pound of weight added to the upper rear weight kit by 0.22 and add this figure from the front axle weight. The total effect on the tractor should be the sum of the front effect less the rear effect and should equal the weight added.

Multiply every pound of weight added to the rear weight kit by 1.16 and add this figure to the rear axle. Multiply every pound of weight added to the auxiliary rear weight kit by 0.16 and subtract this figure from the front axle weight. The total effect on the tractor should be the sum of the front effect less the rear effect and should equal the weight added.

## D. Optional Transmission and Axle Weights

Adding an axle or Powershift transmission option to the tractor will effect the weight on the front and rear axle. The following chart shows the effect on the axle by option and model.

**NOTE: 1407 Twindisc Powershift transmission is only fitted on 435 tractor models up to serial No: 700478**

| Model | Option | Effect on Front Axle kg (lbs.) | Effect on Rear Axle kg (lbs.) | Total Weight Change kg (lbs.) |
|---|---|---|---|---|
| 435 | 1407 Twindisc Powershift Transmission | Adds 300 (660) | Adds 168 (370) | Adds 453 (1000) |
| 435,485, 535 | CAT TA22 Powershift Transmission | Adds 575 (1266) | Adds 383 (844) | Adds 957 (2110) |
| 435, 485, 535 | Heavy Duty Axles | Adds 77 (170) | Adds 77 (170) | Adds 154 (340) |

## E. Optional Equipment

Adding an option to the tractor will effect the weight on the front and rear axle.
The following chart shows the effect on the axle by option and model.

| Model | Option | Effect on Front Axle kg (lbs.) | Effect on Rear Axle kg (lbs.) | Total Weight Change kg (lbs.) |
|---|---|---|---|---|
| 435, 485, 535 | High Flow Hydraulic Pump | Adds 52 (115) | Adds 38 (85) | Adds 91 (200) |

## F. Diesel Fuel

Fuel added to the fuel tanks has to be factored in to the base tractor weight. To do this, use the following equation:

liters of fuel x 0.84 kg/L = fuel weight (kg)
(Gallons of fuel x 7.01 lbs./gal.) = fuel weight (lbs.)

The effect on the front and rear axle must also be calculated. Multiply the total fuel weight by 0.58 for the front axle and 0.42 for the rear axle.

**Example:**

100 L fuel added
100 L x 0.84 kg/L = 84 kg
84 kg x 0.58 = 49 kg added to front axle
84 kg x 0.42 = 35 kg added to rear axle

100 gal. fuel added
100 gal. x 7.01 lbs./gal. = 701 lbs.
701 lbs. x 0.58 = 407 lbs. added to front axle
701 lbs. x 0.42 = 294 lbs. added to rear axle

## Engine

| | 435 | 485 | 535 |
|---|---|---|---|
| Manufacturer | Cummins Engine Co. | | |
| Engine Model | QSX15 | | |
| Maximum Horsepower Rating kW (BHP @ 2100 RPM) SAE J 1995 | 324 (435) | 362 (485) | 399 (535) |
| Type | 6-cylinder, 4-cycle, In-Line, Overhead 4 Valve per cylinder Diesel Engine | | |
| Aspiration | Turbocharged & Air to Air Intercooled | | |
| Bore x Stroke | 137x170 mm, (5.39 x 6.70 in.) | | |
| Displacement | 15 L (915 ($in^3$) | | |
| Compression Ratio | 17:1 | | |
| Firing Order | 1-5-3-6-2-4 | | |
| Lubrication System: Pressure @ Idle | 69 kPa (10 PSI) | | |
| Pressure @ Rated Speed | 248 kPa (35.9) | | |
| Maximum Fuel Consumption: @ Maximum Rated Output & Speed* | 210 gm/kwShr (0.345 lbs/hp-hr) | | |
| Low Idle Speed | 875 | | |
| High Idle Speed | 2225 | | |
| Engine Torque @ Rated Speed (2100 RPM) (ft-lbs.) | 1475 (1088) | 1645 (1213) | 1814 (1338) |
| Peak Engine Torque @ listed Engine Speed - N·m (ft-lbs.) @ RPM | 1992 (1469) @1400 | 2219 (1637) @1400 | 2449 (1806) @1400 |
| Torque Rise | 35% | 35% | 35% |
| CPL # (Control Parts Listing) | 8469 - SC2 | 2825 - SC2 | 2825 - SC2 |

* 1 Liter of diesel fuel weighs approximately 0.84 Kg.
1 gallon (US) of diesel fuel weighs approximately 7.01 lbs.

## Air Intake & Exhaust

| | 435 | 485 | 535 |
|---|---|---|---|
| **Air Intake** - Precleaning | Exhaust Aspirated w/ Precleaner | | |
| Air Filter Configuration | Primary (Outer) Secondary (Inner) | | |
| Air Flow - L/S (CFM) @ 2100 RPM | 580 (1230) | 595 (1260) | 612 (1296) |
| **Exhaust Outlet** - Muffler Type | Perforated tube and center plug with venturi for intake. Precleaner aspiration. | | |
| Air Flow - L/S (CFM) @ 2100 RPM | 1260 (2670) | 1359 (2880) | 1444 (3060) |

## Fuel System

| | 435 | 485 | 535 |
|---|---|---|---|
| **Fuel Tanks:**<br>Total Capacity | 1325 L (350 gal.) | | |
| Usable Capacity | 1249 L (330 gal.) | | |
| Vented | Both Tanks | | |
| Fuel Filter | Single Element | | |
| Ether Cold Start Aid | Measured 4.8 cc shot of fluid at each switch activation. Thermoguard protected above 27°C (81°F) | | |
| Fuel Flow | Drawn from left tank, passes through the engine fuel system. Return fuel goes through the fuel cooler back to the right tank. Crossover pipe between the two tanks. Separate fill spout and drain on each tank. | | |

## Cooling System

| | 435 | 485 | 535 |
|---|---|---|---|
| Coolant Capacity | 72 L (19 gal.) | | |
| Radiator Core Size (L x W) - mm (in.) | 1128 x 1170 mm (44.4 x 46.1 in.) | | |
| Fins per Inch | 9 | | |
| Number of Rows | 5 | 5 | 7 |
| Fan Diameter - mm (in.) x Blade Pitch Width - mm (in.) | 838 x 89 (33 x 3.50) | 914 x 96 (36 x 3.78) | 965 x 96 (38 x 3.78) |
| Number of Blades | 8 | | |
| Pressure Cap Setting | 97 kPa (14 PSI) | | |
| Thermostat Opens | 82°C (180°F) | | |
| Thermostat Full Open | 91°C (195°F) | | |
| Type of System | Pressurized recirculating full flow bypass with filter and corrosion inhibitor. | | |

## Transmission

| **Synchromesh Transmission** | |
|---|---|
| Number of speeds | 12 forward speeds; 4 reverse speeds |
| Shift type | 4 synchronized gears in each of 3 forward ranges |
| Gear shifting | Double cone style synchronizer on the top shaft |
| Range shifting | Sliding collars on the bottom shaft |
| Lubrication | Self-contained pump, reservoir providing pressurized lubrication to bearings and gears |
| Clutch type | Hydraulically actuated wet clutch on the input shaft |
| Clutch diameter | 280 mm (11") |
| Number of clutch plates | 8 friction, 8 separator |
| Clutch brake | Hydraulically actuated on second shaft 140 mm (5.5") diameter, 3 plates (1 separator, 2 friction) |
| Filter | 10-micron w/344 kPa (50 PSI) with bypass relief |

| **1407 Twindisc Powershift Transmission** | |
|---|---|
| Number of speeds | 12 forward speeds; 2 reverse speeds |
| Shift type | Electrically actuated - valve activates 3 (out of 8) clutch packs to provide the selected gear ratio |
| Type of gear | Constant mesh spur |
| Clutch type | Wet clutch pack: hardened steel plates and organic fiber friction plates |
| Lubrication | Self-contained pump, reservoir providing pressurized lubrication to bearings and gears |
| Clutch brake | Electronically controlled by activating opposing clutches |
| Filter | 10-micron w/344 kPa (50 PSI) with bypass relief |

| **CAT TA22 Powershift Transmission** | |
|---|---|
| Number of speeds | 16 forward speeds; 4 reverse speeds |
| Shift type | Electrically Actuated – Valve activates 2 (out of 9) clutch-packs to provide the selected gear ratio |
| Type of gear | Constant mesh countershaft |
| Clutch type | Wet clutch pack; friction disc and steel plates |
| Lubrication | Self-contained pump, reservoir providing pressurized lubrication to bearings and gears |
| Filter | 5 micron w/276 kPa (40 PSI ) with bypass relief |

## Drivelines

| Component | 435 | 485 | 535 |
|---|---|---|---|
| Torsional Coupler @ Engine Torque Rating | 1412 N·m (12,000 (in-lbs.) | | |
| **Engine to Transmission Drive Shaft** | | | |
| Size | 7C (8.5C optional with HD Axles) | 8.5C | |
| Cross and Bearing Lube - Interval Hrs. | N/R | N/R | |
| Slip Yoke Lube - Interval Hrs. | N/R | N/R | |
| **Transmission to Front Axle Drive Shaft** | | | |
| Size | 8C (8.5C optional with HD Axles) | 8.5C | |
| Cross and Bearing Lube - Interval Hrs. | N/R | N/R | |
| Slip Yoke Lube - Interval Hrs. | N/R | N/R | |
| **Articulation Drive Shaft** | | | |
| Size | 8C (8.5C optional with HD Axles) | 8.5C | |
| Cross and Bearing Lube - Interval Hrs. | N/R | N/R | |
| Slip Yoke Lube - Interval Hrs. | N/R | N/R | |
| **Rear Axle Drive Shaft** | | | |
| Size | 8C (8.5C optional with HD Axles) | 8.5C | |
| Cross and Bearing Lube - Interval Hrs. | N/R | N/R | |
| Slip Yoke Lube - Interval Hrs. | N/R | N/R | |

N/R - Not Required

## Axles & Differentials

| | 435 | 485 | 535 |
|---|---|---|---|
| Differential Make | Eaton Okubo (optional) | Okubo | |
| Differential Series | 23000 | QD | |
| Differential Reduction | 4.88 | | |
| Differential Spiral Direction<br>Front Axle<br>Rear Axle | <br>LH<br>RH | | |
| Differential Shot Peened | Yes | | |
| Planetary Hub Reduction | 5.285 | | |
| Planetary Sun Gear Shot Peened | No | | |

## Hydraulic System

| | |
|---|---|
| Type of System | Closed center load sensing |
| Nominal Pressure<br>High (standby)<br>Low (standby) | <br>19.3 - 19.7 mPa (2800 - 2850 PSI)<br>2.07 - 2.24 kPa (300 - 325 PSI) |
| Flow at Rated Engine Speed<br>High Flow option | 208 L/min (55 GPM)<br>303 L/min (80 GPM) |
| Pump | Dual Variable Displacement Piston |
| Suction Filter | 30-mesh Screen |
| Main Filter | 10-micron w/344.8 kPa (60 PSI) Bypass Relief |
| Remote control valve | 4, 6 or 8 Section |
| Detent pressure | 15.5 mPa (2250 PSI) or timed for EHR |
| Flow Control | Individual Adjustment in Cab (only first 4 sections on manual valve) |
| Couplers<br>Number<br>Type | <br>4, 6 or 8 Sets<br>Leverless Quick Disconnect |

## Drawbar

| | |
|---|---|
| Hitch | 51 mm (2") Class 4 - 38 mm, (1-1/2") optional |
| Type | One-Piece 5-Position w/ Replaceable Wear Block |
| Clevis | Bolt-On Quick Hitch<br>Bolt-On Bottom lowers Hitch Point 140 mm (5.5") |
| Clevis Throat Opening | 90 mm (3.5") |
| Height to Top of Drawbar | 488 mm to 559 mm (19.2" to 22") |
| Maximum Offset | 405 mm (15.9") |

## Brake System

| | |
|---|---|
| Type | Dry disc - two |
| Disc Diameter | 508 mm (20") |
| Disc Thickness | 19 mm (0.75") |
| Service Brake | Hydraulic-Actuated Foot Pedal |
| Park Brake | Cable Operated Mechanically actuated |
| Caliper | Single W/Dual pads - two |

**NOTE: The tractor has a maximum towing capacity of permisable implement weight before t**

## Steering System

| | |
|---|---|
| Pump | Variable Displacement Pump |
| Maximum Pressure | 17.2 Bar (2500 PSI) |
| Flow at Rated Engine Speed | 114 L/min (30 GPM) |
| Cylinder Diameter | 89 mm (3.5") |
| Cylinder Stroke | 535 mm (21.1") |
| Maximum Articulation Angle (no blocks) | 42º |
| Steering Column<br>Tilt<br>Telescope | <br>45º<br>100 mm (3.88") |
| Steering Wheel<br>Diameter<br>Turning effort (Engine Idle) | <br>406 mm (16")<br>1.7 N·m (1.25 ft. lbs.) |

## Electrical System

| | |
|---|---|
| Batteries<br>Power (SAE Group 31)<br>Qty | 12V Low Maintenance<br>950 CCA<br>3 |
| Alternator | 12V - 130 - amp Maximum Voltage - 13.8 V |
| Starter | 12V Negative Ground |
| Lights<br>Qty<br>Optional<br>HID (Optional) Front<br>Rear | 55W Quartz Halogen Sealed Beam<br>6 - 100 x 160 mm Oval, 4 - 120 x 180 mm Oval<br>4 - 100 x 160 mm Oval<br>2 - 120 x 180 mm Oval<br>2 - 100 x 160 mm Oval |
| Extremity Lights | 2 - Extendable Mounted |
| Safety | 4 - Amber Roof Mounted Flashers<br>2 - Stop/ Tail Rear Fender Mounts |

## Air-Conditioning & Heating System

| | |
|---|---|
| Refrigerant | R-134A |
| Refrigerant Charge | 2880 grams (6.35 lbs.) |
| Cooling Capacity | 24,000 btu/hr |
| Heating Capacity | 23,250 btu/hr |
| Fan Volume | 14.2 mm3/min (500 cfm) |
| Filter Area | 2012 $cm^2$ (312 $in^2$) |
| Compressor<br>Oil capacity<br>Number of pistons<br>Displacement<br>Clutch | <br>300 ml (10.1 oz)<br>7<br>154.9 cc per rev (9.5 cu in per rev)<br>Electromagnetic actuation |

## Capacities

| | 435 | 485 | 535 |
|---|---|---|---|
| Fuel Tanks<br>Total Capacity<br>Usable Capacity | | 1325 L (350 gal)<br>1249 L (330 gal) | |
| Hydraulic<br>Reservoir<br>Total System | | 113.6 L (30 gal)<br>155.2 L (41 gal) | |
| Axle/Differential<br>Differential Housing (before S/N 700495)<br>Differential Housing (after S/N 700494)<br>Planetary Hubs (each)<br>Total System (one axle) (before S/N 700495)<br>Total System (one axle) (after S/N 700494) | | <br>55 L (14.5 gal)<br>37 L (9.8 gal)<br>10 L (2.6 gal)<br>75 L (19.8 gal)<br>57 L (15.1 gal) | |
| Engine<br>Engine Crankcase<br>Oil Filter | | <br>44 L (11.6 gal)<br>3.8 L (1.0 gal) | |
| Cooling System | | 83 L (22 gal) | |
| Air-Conditioning System<br>Refrigerant<br>Refrigerant Oil Capacity | | <br>2.88 kg (6.35 lbs.)<br>300 ml (10.1 oz) | |
| Windshield Washer<br>Reservoir | | <br>3.8 L (4 qt) | |
| Transmission (System capacity)<br>Synchromesh<br>1407 Twindisc Powershift<br>CAT TA22 Powershift | | <br>37.9 L (10 gal)<br>47.4 L (12.5 gal)<br>64.0 L (16.9 gal) | |

## Lubricants & Fluids

| Components | Specification |
|---|---|
| Engine Oil | 10W - 30 API CL.4 |
| Transmission Oil<br>Synchromesh<br>1407 Twindisc Powershift<br>CAT TA22 Powershift | <br>(See Note 1 below)<br>(See Note 1 below)<br>(See note 2 below) |
| Hydraulic Oil | See Note 1 below |
| Differential Oil | 85W140 GL5 -- ABOVE 0°C (32°F)<br>80W90 GL5 -- BELOW 0°C (32°F) |
| Planetary Hub Oil | 85W140 GL5 -- ABOVE 0°C (32°F)<br>80W90 GL5 -- BELOW 0°C (32°F) |
| Grease | Lithium Base EP High Temperature |
| Engine Coolant (Includes DCA4 Additive) | Factory Filled - Fully Formulated (Pink in Color) |
| Fuel | 2-D -- ABOVE --7°C (20°F)<br>1-D -- BELOW --7°C (20°F) |
| A/C Refrigerant | R134A |

**Note 1. Lubricant brand equivalency chart for the transmission/hydraulic system.**

| Brand | Imperial Oil Esso | Shell | Texaco | Amoco | Petro-Canada | Exxon Mobil |
|---|---|---|---|---|---|---|
| Specification | Hydraul 56 | Donax TD | TDH | 2016 (USA)<br>01055 (Can) | Duratran | 424 |

**Note 2. Lubricant brand equivalency chart for the transmission/hydraulic system - CAT TA22 transmission**

| Brand | Imperial Oil Esso | Caterpillar |
|---|---|---|
| Specification | Hydraul 56 | MTO 10W30 |

## Speed charts

Speeds at 2100 engine rpm - km/h (mph)

### Synchromesh Transmission

| Tire Group | Low Range | | | | Medium Range | | | | High Range | | | | Reverse | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| A | 3.1 | 3.6 | 4.2 | 4.8 | 5.6 | 6.5 | 7.6 | 9.9 | 11.5 | 13.4 | 15.7 | 18.3 | 4.0 | 4.6 | 5.4 | 6.3 |
| B | 3.2 | 3.7 | 4.4 | 5.0 | 5.8 | 6.8 | 7.9 | 10.3 | 12.1 | 14.1 | 16.4 | 19.1 | 4.2 | 4.9 | 5.7 | 6.6 |
| C | 3.3 | 3.9 | 4.5 | 5.2 | 6.1 | 7.1 | 8.3 | 10.8 | 12.6 | 14.7 | 17.1 | 20.0 | 4.3 | 5.1 | 6.0 | 7.0 |
| D | 3.5 | 4.2 | 4.8 | 5.5 | 6.5 | 7.6 | 8.8 | 11.5 | 13.4 | 15.6 | 18.2 | 21.3 | 4.6 | 5.4 | 6.4 | 7.5 |

| Typical Tire Groups | | | |
|---|---|---|---|
| A | B | C | C |
| 24.5 X 32 R1<br>30.5 X 32 R1<br>20.8 X 38 R1 | 30.5 X 32 R2<br>18.4 X 42 R1<br>20.8 X 38 R2<br>710/70 X 38 R1 | 20.8 X 42 R1<br>710/70 X 38 R1<br>850/60 X 38 R1<br>900/50 X 42 R1 | 800 X 38 R1<br>710/70 X 42 R1 |

### 1407 Twindisc Powershift Transmission

| Tire Group | Low Range | | | | | | | | | | | | Reverse | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| A | 3.7 (2.3) | 4.5 (2.8) | 5.3 (3.3) | 6.4 (4.0) | 7.7 (4.8) | 9.1 (5.7) | 10.7 (6.7) | 12.8 (8.0) | 15.2 (9.5) | 18.2 (11.4) | 31.9 (13.7) | 25.9 (16.2) | 4.6 (2.9) | 8.0 (5.0) |
| B | 4.0 (2.5) | 4.6 (2.9) | 5.6 (3.5) | 6.7 (4.2) | 8.0 (5.0) | 9.6 (6.0) | 11.2 (7.0) | 13.4 (8.4) | 15.8 (9.9) | 19.0 (11.9) | 23.0 (14.4) | 27.2 (17.0) | 4.9 (3.1) | 8.5 (5.3) |
| C | 4.1 (2.6) | 5.0 (3.1) | 5.8 (3.6) | 7.0 (4.4) | 8.3 (5.2) | 9.9 (6.2) | 11.7 (7.3) | 14.1 (8.8) | 16.6 (10.4) | 19.8 (12.4) | 24.0 (15.0) | 28.3 (17.7) | 5.1 (3.2) | 8.8 (5.5) |

| Typical Tire Groups | | |
|---|---|---|
| A | B | C |
| 24.5 X 32 R1<br>30.5 X 32 R1<br>20.8 X 38 R1 | 30.5 X 32 R2<br>18.4 X 42 R1<br>20.8 X 38 R2 | 20.8 X 42 R1<br>710/70 X 38 R1<br>850/60 X 38 R1 |

### CAT TA22 Powershift Transmission

| Tire Group | Forward gears | | | | | | | | | | | | | | | | Reverse | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 1 | 2 | 3 | 4 |
| A | (2.1) | (2.6) | (3.3) | (4.2) | (5.0) | (5.7) | (6.4) | (7.2) | (8.1) | (9.1) | (10.2) | (11.5) | (13.7) | (17.4) | (20.5) | (23.0) | (1.7) | (4.0) | (4.5) | (11.0) |
| B | (2.2) | (2.8) | (3.5) | (4.5) | (5.3) | (6.0) | (6.8) | (7.6) | (8.6) | (9.6) | (10.9) | (12.2) | (14.6) | (18.5) | (21.8) | (24.4) | (1.8) | (4.3) | (4.8) | (11.6) |

**NOTES:** 1. **Based on 2100 engine RPM, 26/1 axle ratio, radial tires**
2. **15th gear limited to 1950 engine RPM**
3. **16th gear limited to 1725 engine RPM**

**NOTE: To calculate ground speed at an engine speed other than 2100 RPM, use the following formula:**

$$\left(\frac{\text{Desired Engine speed}}{\text{2100 RPM}}\right) \text{ X chart speed = ground speed}$$

| Typical Tire Groups | |
|---|---|
| A | B |
| (Approx. 226"-230" L.R.C.)<br>900 X 42<br>520 X 42<br>710 X 38 | (Approx. 240"-244" L.R.C.)<br>800 X 38<br>710 X 42<br>520 X 46 |

L.R.C. = Loaded Rolling Circumference

## Tire Load and Inflation Tables

Use the following chart and guidelines to determine the proper inflation pressure for tires on a given axle. Divide the axle weight by the number of tires on an axle to determine the load to be carried by each tire.

### U.S. Measure

| Inflation Pressure (PSI) | 6 | 9 | 12 | 15 | 17 | 20 | 23 |
|---|---|---|---|---|---|---|---|
| **20.8 R42** | | | | | | | |
| Singles - lbs. | 3740 | 4800 | 5680 | - | - | 7600 | - |
| Duals - lbs. | 3290 | 4220 | 5000 | - | - | 6690 | - |
| Triples - lbs. | 3070 | 3720 | 4660 | - | - | 6230 | - |
| **520/85 R46** | | | | | | | |
| Singles - lbs. | 4080 | 4940 | 5680 | 6600 | 7400 | 8250 | 9100 |
| Duals - lbs. | 3590 | 4350 | 5000 | 5810 | 6410 | 7260 | 8010 |
| Triples - lbs. | 3350 | 4050 | 4660 | 5410 | 6070 | 6770 | 7460 |
| **620/70 R42** | | | | | | | |
| Singles - lbs. | 4540 | 5360 | 6400 | 7150 | 8050 | 9100 | 9900 |
| Duals - lbs. | 4000 | 4720 | 5630 | 6290 | 7980 | 8010 | 8710 |
| Triples - lbs. | 3720 | 4400 | 5250 | 5860 | 6600 | 7460 | 8120 |
| **650/65 R42** | | | | | | | |
| Singles - lbs. | 4400 | 5360 | 6150 | 7150 | 8050 | 8800 | 9350 |
| Duals - lbs. | 3870 | 4720 | 5410 | 6290 | 7080 | 7740 | 8230 |
| Triples - lbs. | 3610 | 4400 | 5040 | 5860 | 6600 | 7220 | 7670 |
| **650/85 R38** | | | | | | | |
| Singles - lbs. | - | - | - | - | - | - | - |
| Duals - lbs. | - | - | - | - | - | - | - |
| Triples - lbs. | - | - | - | - | - | - | - |
| **710/70 R38** | | | | | | | |
| Singles - lbs. | 5360 | 6400 | 7400 | 8550 | 9650 | 10700 | 11700 |
| Duals - lbs. | 4720 | 5630 | 6510 | 7520 | 8490 | 9420 | 10300 |
| Triples - lbs. | 4400 | 5250 | 6070 | 7010 | 7910 | 8770 | 9590 |
| **710/70 R42** | | | | | | | |
| Singles - lbs. | 5520 | 6600 | 7850 | 8800 | 9900 | 11000 | 12300 |
| Duals - lbs. | 4860 | 5810 | 6910 | 7740 | 8710 | 9680 | 10820 |
| Triples - lbs. | 4530 | 5410 | 6640 | 7720 | 8120 | 9020 | 10090 |
| **800/70 R38** | | | | | | | |
| Singles - lbs. | 6400 | 7600 | 9100 | 10200 | 11700 | 12800 | 14300 |
| Duals - lbs. | 5630 | 6690 | 8010 | 8980 | 10300 | 11260 | 12580 |
| Triples - lbs. | 5250 | 6230 | 7460 | 8360 | 9590 | 10500 | - |
| **850/60 R38** | | | | | | | |
| Singles - lbs. | - | - | - | - | - | - | - |
| Duals - lbs. | - | - | - | - | - | - | - |
| **900/50 R42** | | | | | | | |
| Singles - lbs. | 5680 | 6800 | 7850 | 9100 | 10200 | 11400 | 12300 |
| Duals - lbs. | 5000 | 5980 | 6910 | 8010 | 8980 | 10030 | 10820 |

**U.S. Measure (continued)**

| Inflation Pressure (PSI) | 6 | 9 | 12 | 14 | 16 | 20 | 24 |
|---|---|---|---|---|---|---|---|
| **850/60 R38** | | | | | | | |
| Singles - lbs. | - | - | - | - | - | - | - |
| Duals - lbs. | - | - | - | - | - | - | - |
| **900/50 R42** | | | | | | | |
| Singles - lbs. | 5680 | 6800 | 7850 | 9100 | 10200 | 11400 | 12300 |
| Duals - lbs. | 5000 | 5980 | 6910 | 8010 | 8980 | 10030 | 10820 |

**NOTE: For shipping purposes, tire inflation pressures may be increased to 30 psi (210 kPa). Inflation pressure must be adjusted to correct operating inflation before operation.**

**At higher transport speeds (above 20 mph) and lower pressures (less than 12 psi) increased inflation pressure may be required for vehicle stability.**

**When running lower inflation pressures, it is extremely important to use an accurate air pressure gauge.**

## Part Numbers For High Usage Items

| Component | Part Number |
|---|---|
| Belt - Fan / Water Pump | 86033867 |
| Belt - Alternator/A/C Compressor | 86033868 |
| Block Heater & Cord | Contact Cummins Representative |
| Ether Canister | Source Locally |
| Filter - Cab | 86032161 |
| Filter - Engine Air Outer (Primary) | 86034042 |
| Filter - Engine Air Inner (Safety) | 86034041 |
| Filter - Engine Fuel/Water Separator | 86034027 |
| Filter - Engine Fuel/Auxiliary (Optional) | 86033134 |
| Filter - Engine Oil | 86034028 |
| Filter - Engine Coolant Water | 86034029 |
| Filter - Transmission (Synchromesh & 1407 Twindisc powershift) | 86029146 |
| Filter - Transmission (CAT TA22 powershift) | 86034346 |
| Filter - Hydraulic (standard)<br>(High Flow) | 86033080<br>86029146 |
| Fuse 5-amp | 9623775 |
| Fuse 7.5-amp | 9623776 |
| Fuse 10-amp | 9811773 |
| Fuse 15-amp | 9623774 |
| Fuse 20-amp | 9804895 |
| Fuse 25-amp | 9504310 |
| Fuse 30-amp | 86516011 |
| Fuse Puller | 86000363 |
| Ignition Key | 86502201 |

## Replacement Bulbs

| Description | Bulb Part Number |
|---|---|
| Head Lamps | 9626307 |
| Worklamps (Std) | 9703399 |
| Roof-Mount Worklamps | 529068 |
| Turn Signal/Hazard/Extremity | 529068 |
| Stop/Tail Lamps | 86537133 |
| Interior Dome Lamps | 9849911 |
| Trouble Lamp | 9.9CP GE232 or equivalent |
| RH Console Lamp | 86033164 |
| Front HID Lamp (Optional) | 86032753 |
| Rear HID Lamp (Optional) | 86034812 |

## Wheel and Tire Options

Wheel and Tire sets are available as optional field accessories. Consult your Buhler Versatile dealer for option availability.

## Paint (Spray Cans)

| Color | PartNumber |
|---|---|
| Red | 86029274 |
| Cream | 86029270 |

## Optional Equipment

The following chart lists the optional field and factory installed accessories that are available for 435, 485 and 535 tractors. Not all kits are available for all models. Consult your Buhler Versatile dealer for option availability.

| Kit Part Number | Description | Installation Time (Hours) |
|---|---|---|
| 86034749 | Front Weight Bracket Kit | 2.0 |
| 86034750 | Upper Weight Bracket Kit | 2.0 |
| 86034751 | Rear Weight Bracket Kit | 2.0 |
| 86034744 | Weight Kit - 12 x 30 Kg | 0.5 |
| 86034745 | Weight Kit - 24 x 30 Kg | 0.7 |
| 86034746 | Weight Kit - 40 x 30 Kg | 0.8 |
| 86034747 | Weight Kit - 42 x 30 Kg | 1.0 |
| 86070703 | 33° and 38° Articulation Block Kit | 0.5 |
| 86070702 | 31° Articulation Block Kit | 0.5 |
| 109029 | Transmission Sump Heater (Synchromesh Transmission, Non-PTO Only) | 2.0 |
| V59624 | Trailer 7-Pin Electrical Connector | 0.5 |
| 86033190 | Roof-Mounted Front and Rear Worklight Kit | 1.5 |
| 86030679 | (1.5") Diameter Hitch Pin Kit | 0.5 |
| 86033182 | (3/4") Coupler Kit - 1 Set | 1.5 |
| 86033183 | (3/4") Coupler Kit - 2nd Set | 1.5 |
| 86030510 | Monitor Bracket/Power Bar Kit | 0.5 |
| 86032122 | Auxiliary 3-Pin Connector Kit | 0.5 |
| 86023024 | Base Radio - AM/FM Cassette | 0.5 |
| 86023025 | Deluxe Radio - AM/FM Cassette | 0.5 |
| 86035165 | Satellite Radio - Deluxe - CD/MP3 | 0.5 |
| 86035166 | Satellite Radio - Deluxe - CD/MP3/Sirius | 0.5 |
| 86035167 | Satellite Radio - Deluxe - CD/MP3/XM | 0.5 |
| 86035171 | Antenna Satellite - Universal | 0.5 |
| 86023026 | Deluxe Radio - CD/AM/FM | 0.5 |
| 86033143 | Deluxe External Mirror Kit | 2.0 |
| 86035467 | Power Heated Mirror Kit | 2.5 |
| 86513451 | Radar "Y" Adapter Harness | 0.2 |
| 86031188 | Backup Alarm Kit (Powershift Transmission Equipped Tractors) | 1.0 |
| 86031220 | Backup Alarm Kit (Synchromesh Transmission Equipped Tractors) | 1.0 |
| 86031163 | Roof Mounted Rotary Beacon kit | 1.5 |
| 86032757 | Roof Mounted Work Light Kit | 1.5 |
| 86070810 | Radar Sensor | 1.0 |
| 86033274 | Training Seat | 1.0 |
| 86033222 | Rear Wiper/Washer | 5.0 |
| 86033172 | Front & Rear Sunvisor | 1.5 |
| 86033341 | Auxiliary Fuel Filter | 1.5 |

## Hardware Torque Values

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the tractor.

*IMPORTANT: DO NOT use the values listed in the charts if a different torque value or tightening procedure is specified in this manual for a specific application. Torque values listed are for general use only.*

Make sure fastener threads are clean and not damaged

**NOTE: A torque wrench is necessary to properly tighten hardware.**

## Minimum hardware tightening torques

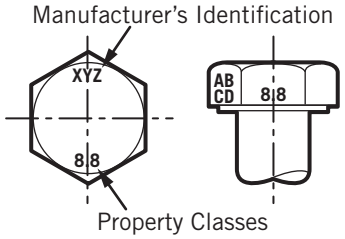
In foot pounds (newton-meters) for normal assembly applications.

**Metric hardware and locknuts**

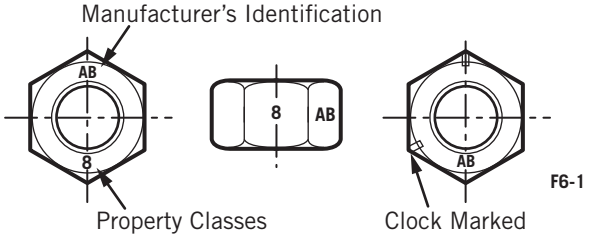
| Nominal Size | Class 5.8 | | Class 8.8 | | Class 10.9 | | Locknut Cl.8 W/cl8.8 Bolt |
|---|---|---|---|---|---|---|---|
| | Unplated | Plated W/zncr | Unplated | Plated W/zncr | Unplated | Plated W/zncr | |
| M4 | 15* (1.7) | 19* (2.2) | 23* (2.6) | 30* (3.4) | 33* (3.7) | 42* (4.8) | 16* (1.8) |
| M6 | 51* (5.8) | 67* (7.6) | 79* (8.9) | 102* (12) | 115* (13) | 150* (17) | 56* (6.3) |
| M8 | 124* (14) | 159* (18) | 195*(22) | 248* (28) | 274* (31) | 354* (40) | 133* (15) |
| M10 | 21 (28) | 27 (36) | 32 (43) | 41 (56) | 45 (61) | 58 (79) | 22 (30) |
| M12 | 36 (49) | 46 (63) | 55 (75) | 72 (97) | 79 (107) | 102 (138) | 39 (53) |
| M16 | 89 (121) | 117 (158) | 137 (186) | 177 (240) | 196 (266) | 254 (344) | 97 (131) |
| M20 | 175 (237) | 226 (307) | 277 (375) | 358 (485) | 383 (519) | 495 (671) | 195 (265) |
| M24 | 303 (411) | 392 (531) | 478 (648) | 619 (839) | 662 (897) | 855 (1160) | 338 (458) |

**NOTE: Torque values shown with* are inch pounds.**

**Identification of Hex Cap Screws and Carriage Bolts - Classes 5,6 and Up**




**Hex Nuts and Locknuts Classes 05 and Up**



## Minimum hardware tightening torques

In foot pounds (newton-meters) for normal assembly applications.

**Inch hardware and locknuts**

| Nominal Size | SAE Grade 2 | | SAE Grade 5 | | SAE Grade 8 | | Locknuts | |
|---|---|---|---|---|---|---|---|---|
| | Unplated or Plated Silver | Plated W/zncr Gold | Unplated or Plated Silver | Plated W/zncr | Unplated or Plated Silver | Plated W/zncr | GR.B w/ GR5 Bolts | GR.C w/ GR5 Bolts |
| 1/4 | 55* (6.2) | 7.2* (8.1) | 86* (9.7) | 112* (13) | 121* (14) | 157* (18) | 61* (6.9) | 86* (9.8) |
| 5/16 | 115* (13) | 149* (17) | 178* (20) | 229* (26) | 250* (28) | 324* (37) | 125* (14) | 176* (20) |
| 3/8 | 17 (23) | 22 (30) | 26 (35) | 34 (46) | 37 (50) | 48 (65) | 19 (26) | 26 (35) |
| 7/16 | 27 (37) | 35 (47) | 42 (57) | 54 (73) | 59 (80) | 77 (104) | 30 (41) | 42 (57) |
| 1/2 | 42 (57) | 54 (73) | 64 (87) | 83 (113) | 91 (123) | 117 (159) | 45 (61) | 64 (88) |
| 9/16 | 60 (81) | 77 (104) | 92 (125) | 120 (163) | 130 (176) | 169 (229) | 65 (88) | 92 (125) |
| 5/8 | 83 (112) | 107 (145) | 128 (174) | 165 (224) | 180 (244) | 233 (316) | 90 (122) | 127 (172) |
| 3/4 | 140 (198) | 189 (256) | 226 (306) | 293 (397) | 319 (432) | 413 (560) | 160 (217) | 226 (306) |
| 7/8 | 142 (193) | 183 (248) | 365 (495) | 473 (641) | 515 (698) | 667 (0904) | 258 (350) | 364 (494) |
| 1 | 213 (289) | 275 (373) | 547 (742) | 708 (960) | 773 (1048) | 1000 (1356) | 386 (523) | 545 (739) |

**NOTE: Torque values shown with * are inch pounds.**

**Identification of Hex Cap Screws and Carriage Bolts**

Grade 2 SAE Bolts | Grade 5 SAE Bolts | Grade 8 SAE Bolts | Regular Nuts | SAE Grade 5 Hex Nuts | SAE Grade 6 Hex Nuts

**Locknuts**


Grade Identification
Grade A: No Notches
Grade B: One Circumferential Notch
Grade C: Two Circumferential Notches

Grade Identification
Grade A: No Mark
Grade B: Letter B
Grade C: Letter C

Grade Identification
Grade A: No Marks
Grade B: Three Marks
Grade C: Six Marks
Marks need not be located ta corners

F6-2

# Index

## California

### Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

**Dealer Copy**

# Delivery Report

## 435, 485 and 535 Tractors

Delivery Date _____

Owner's Name _____

Address _____

Dealer's Name _____

Address _____

Tractor: Model No. _____ Serial No. _____

Engine: Model No. _____ Serial No. _____

Using the Operator's Manual as a guide, instruction was given as indicated by the check marks.

( ) Safety precautions and practice

( ) Lubrication points and schedule

( ) Use of optional equipment

( ) Operation of all controls

( ) Preseason service

( ) All safety shielding is installed

( ) End-of-season service

( ) Warranty coverage

( ) Proper use of operator's manual

( ) Customer given operator's manual

( ) Local Cummins Dealer/Distributor contacted with engine information

Dealer Representative's Signature _____

"I have been instructed in the operation, maintenance, and safety features of this machine as detailed in the operator's manual."

Owner's Signature _____

**Customer Copy**

# Delivery Report

## 435, 485 and 535 Tractors

Delivery Date _____

Owner's Name _____

Address _____

Dealer's Name _____

Address _____

Tractor: Model No. _____ Serial No. _____

Engine: Model No. _____ Serial No. _____

Using the Operator's Manual as a guide, instruction was given as indicated by the check marks.

( ) Safety precautions and practice

( ) Lubrication points and schedule

( ) Use of optional equipment

( ) Operation of all controls

( ) Preseason service

( ) All safety shielding is installed

( ) End-of-season service

( ) Warranty coverage

( ) Proper use of operator's manual

( ) Customer given operator's manual

( ) Local Cummins Dealer/Distributor contacted with engine information

Dealer Representative's Signature _____

"I have been instructed in the operation, maintenance, and safety features of this machine as detailed in the operator's manual."

Owner's Signature _____

**Dealer Copy**

# First 50 hour Service

**Check and adjust, as required**

| Description | OK |
|---|---|
| **Stationary Checks - Engine Off** | |
| Clean front grill, coolers & radiator | |
| Check engine coolant level | |
| Check engine fan/ water pump belt tension | |
| Check alternator/AC belt tension | |
| Change the engine oil | |
| Change the engine oil filter | |
| Check the air cleaner connections | |
| Change the engine coolant system filter | |
| Check the level of DCA4 coolant additive | |
| Check the battery connections at the starter | |
| Check the radiator, heater hoses and connections | |
| Clean the engine air cleaner outer element | |
| Check tire air pressure according to ballast on axle | |
| Clean the cab air filter | |
| Check the air conditioner sight glass | |
| Check the battery connections at the battery | |
| Clean the alternator | |
| Check the battery electrolyte level | |
| Check windshield washer fluid level | |
| Check for proper operation | |
| Change the planetary hub oil | |
| Change the differential oil | |
| Check the transmission oil level | |
| Change the transmission filter | |
| Change the hydraulic oil | |
| Change the hydraulic filter | |
| Check all wheel hardware torque | |
| Lubricate the lower articulation pin | |

| Description | OK |
|---|---|
| Lubricate the upper articulation pins | |
| Lubricate the rear steering cylinder pins | |
| Lubricate the front steering cylinder pins | |
| Lubricate the rear drag link pins | |
| Lubricate the front drag link pins | |
| Lubricate the rear axle drive shaft steady bearing | |
| **Safety Items Checks** | |
| Seat belt operation | |
| All safety shields installed | |
| Neutral start switch(es) operative | |
| Parking brake operation and adjustment | |
| Articulation lock operation | |
| **Stationary Checks - Engine Running** | |
| All operative checks are to be performed with the tractor at normal operating temperature | |
| Lights and instruments for proper operation | |
| Maximum no-load and idle speed adjustments | |
| Hydraulic system | |
| Remote control valves and lockout levers | |
| Flow control operation | |
| Transmission shifting and gear selection | |
| **Performance service checks** | |
| Road test engine operation including throttle and governor operation | |
| Transmission | |
| Steering control | |
| Differential lock engagement and disengagement (optional) | |
| Brake action | |

## Service Performed

Tractor Model No. _____ Tractor Serial No. _____

Owner's Signature _____ Date _____

Dealer's Signature _____ Date _____

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