

bühler  
**versatile**



# *Operator's Manual*

*# 435*

*# 485*

*# 535*

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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.



## 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

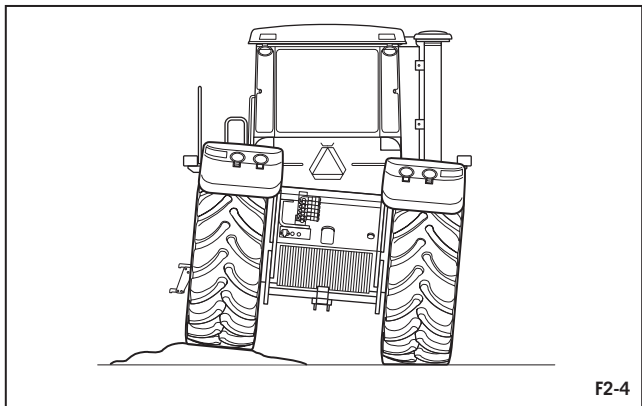
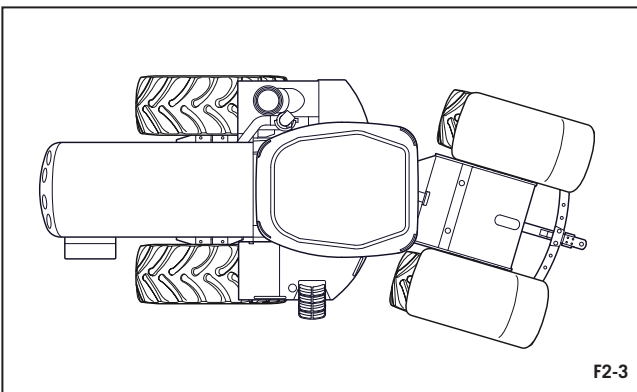
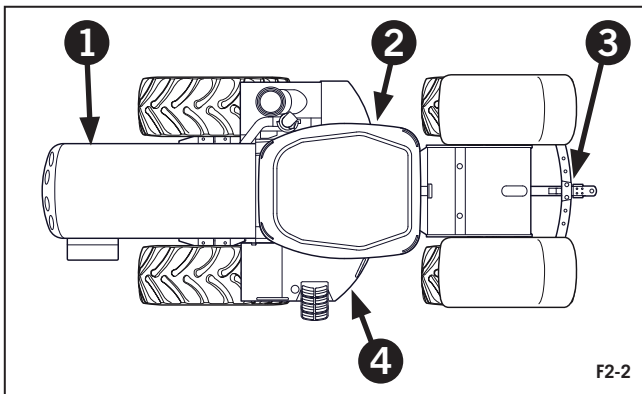
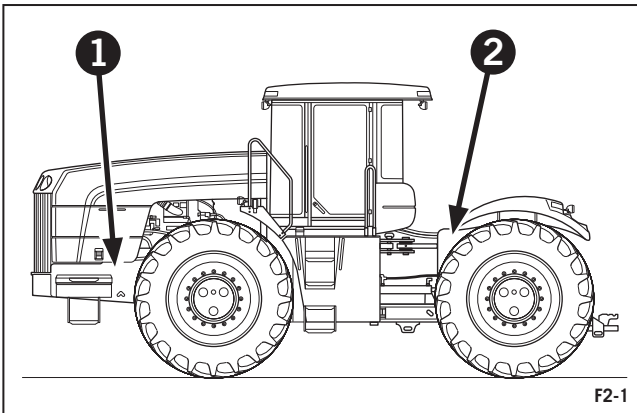
This manual uses the following terms to describe tractor function and directional relationships:

**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.



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

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



## 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 HANDHOLD SAND 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.**



## 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.

The controls have been divided into the following four areas:

**Forward Operator Controls**

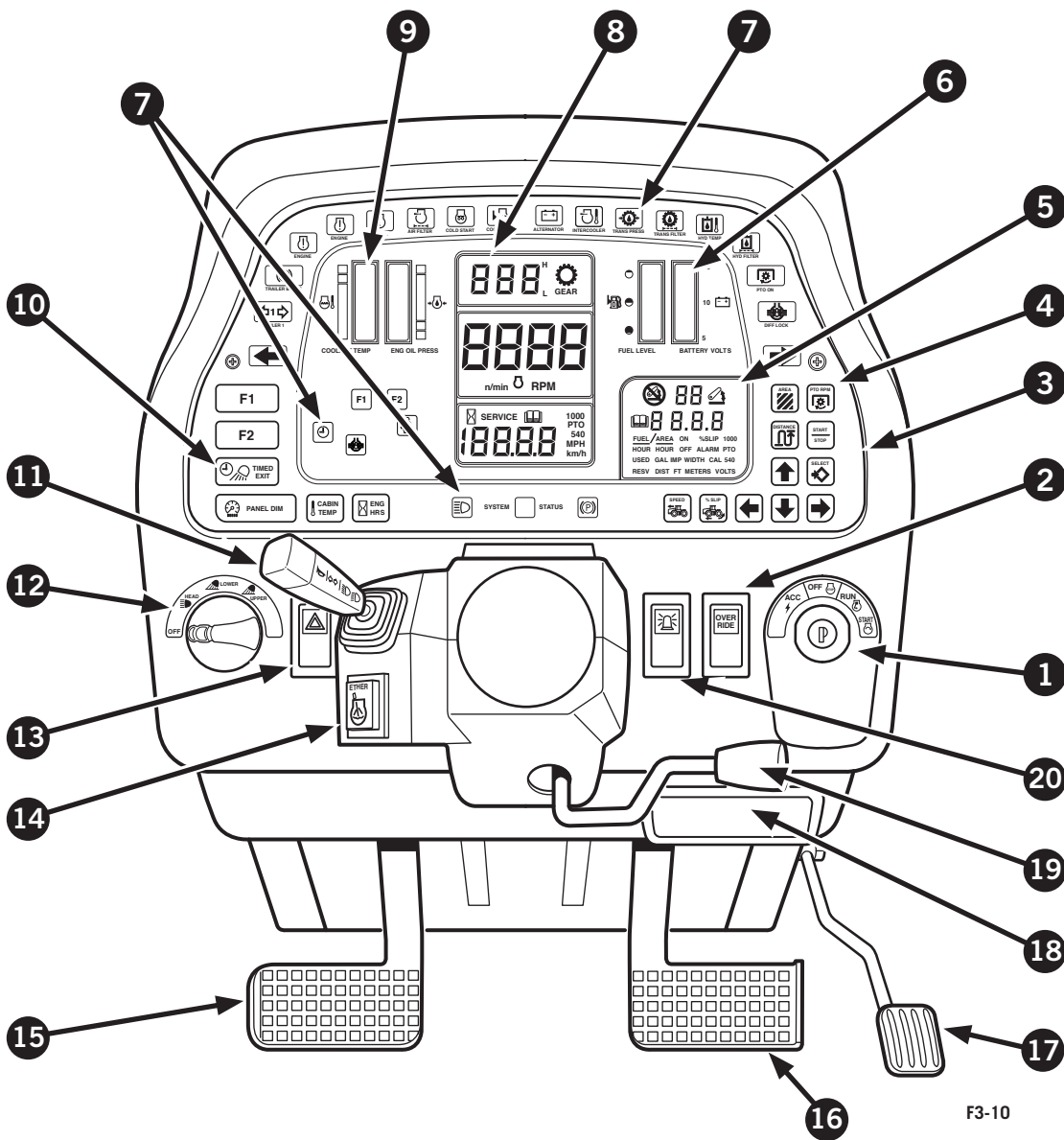
**Overhead Controls**

**Right Side Console Controls**

**Additional Cab Controls**



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



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

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**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.

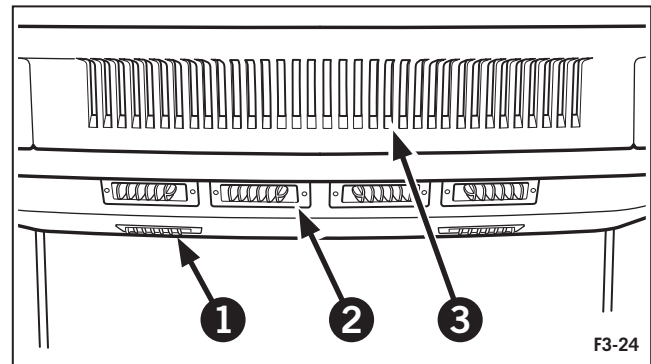
Two adjustable vents (1) can be directed onto the front side windows and door to aid defrosting and defogging.

Four adjustable vents (2) face the operator.

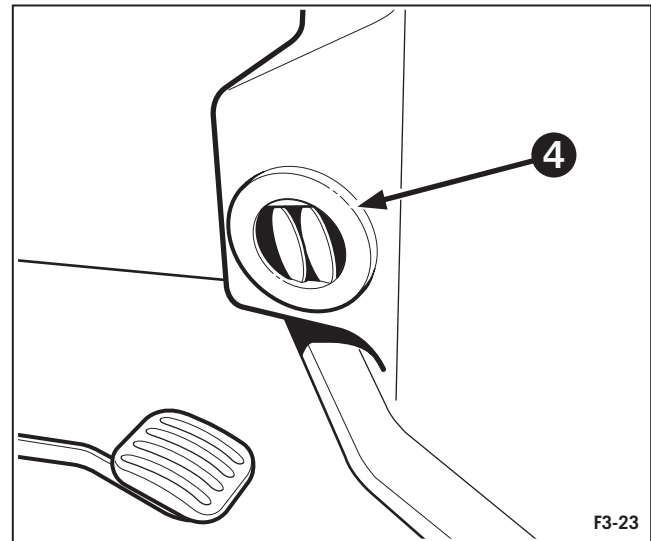
Vent (3) is for air re-circulation.

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.



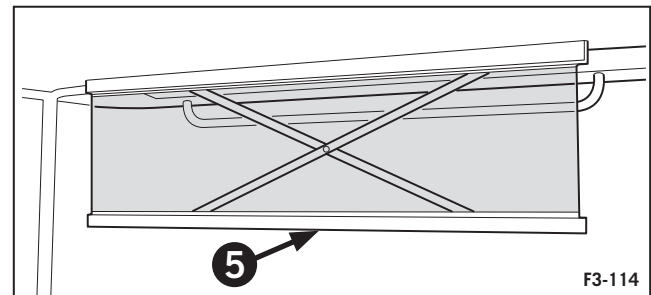
F3-24



F3-23

### 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.



F3-114

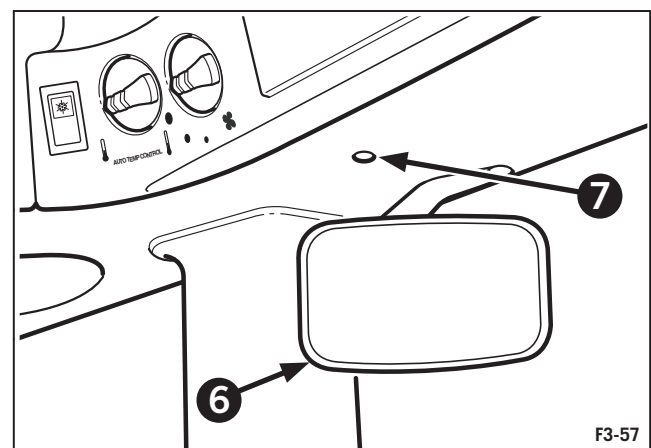
### Mirror

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).



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### 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**

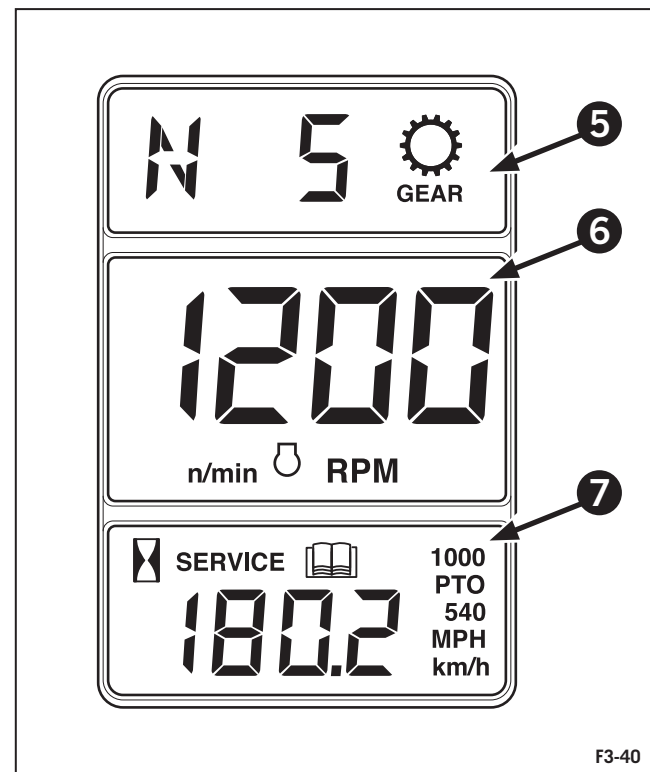
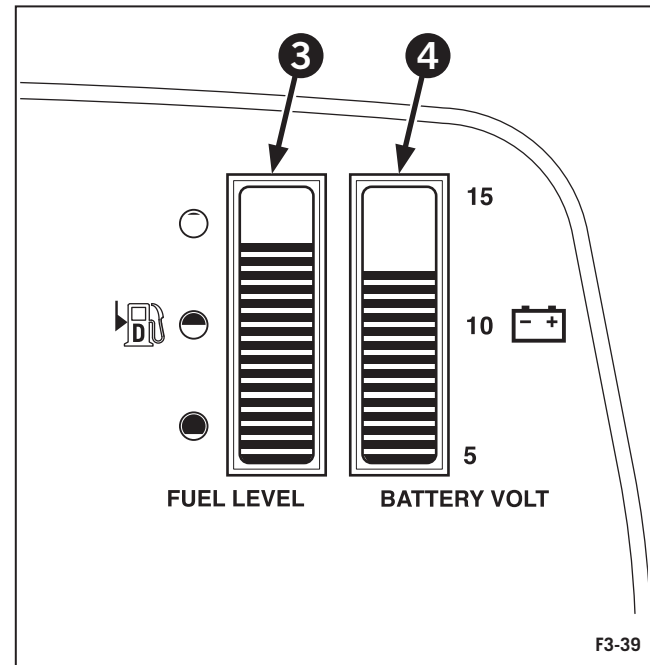
### Battery Volts

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

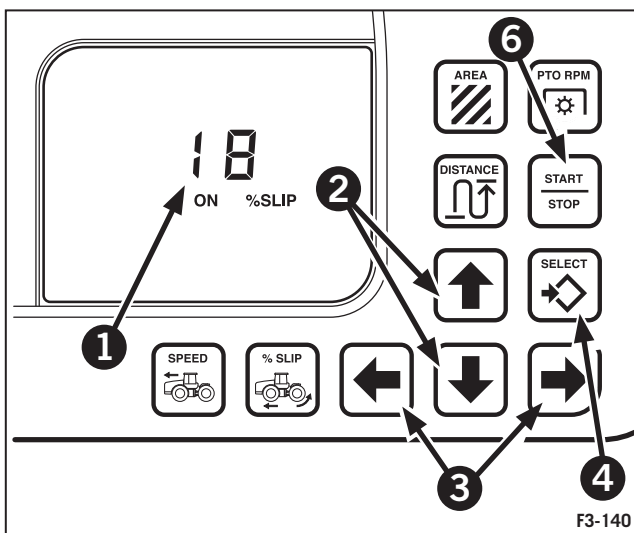




## 2. Slip percent threshold

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.

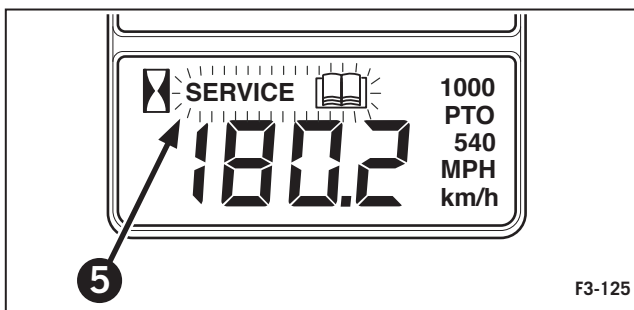
1. To set the slip alarm threshold, enter the desired maximum percent slip (1). The selected (flashing) digit can be changed by touching the UP and DOWN arrow buttons (2). Other digits may be selected by touching the LEFT and RIGHT arrow buttons (3). The alarm can be disabled entirely by setting the 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.





### 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.



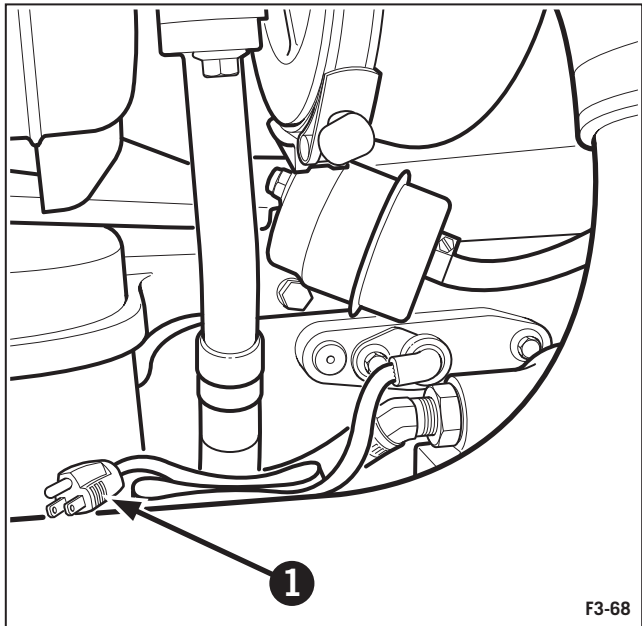
**WARNING: TO AVOID SHOCKS OR OTHER INJURIES, NEVER USE AN UNGROUNDED OR INADEQUATE EXTENSION CORD. ALWAYS USE A GROUNDED 3-WIRE EXTENSION CORD WITH A 3-WIRE PLUG WHICH IS RATED FOR AT LEAST A 15-AMPERE LOAD, AND PROTECTED BY A SUITABLE FUSE OR CIRCUIT BREAKER.**

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 IMMERSSED IN COOLANT, IT MAY OVERHEAT AND BURST CAUSING INJURY.**



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### **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.



## 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

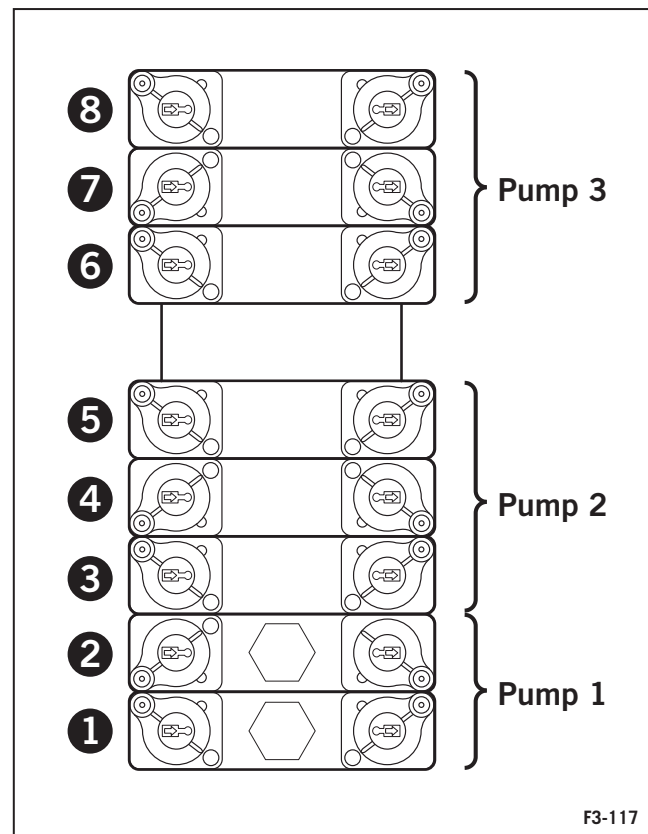
Tractors with manual hydraulics are equipped with four or six remote couplers. Tractors with optional electro-hydraulics (EHR) are equipped with four, six or eight couplers.

Each remote coupler is color coded with its 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.





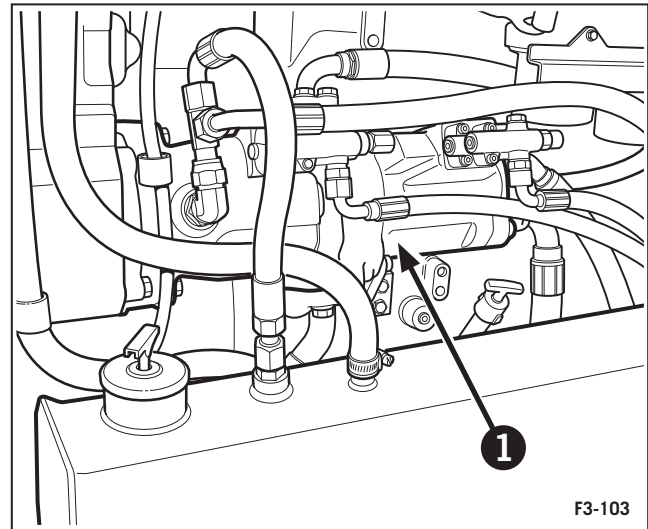
### **Remote Control Valve Operation - Electro-Hydraulics (EHR) (Optional)**

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).

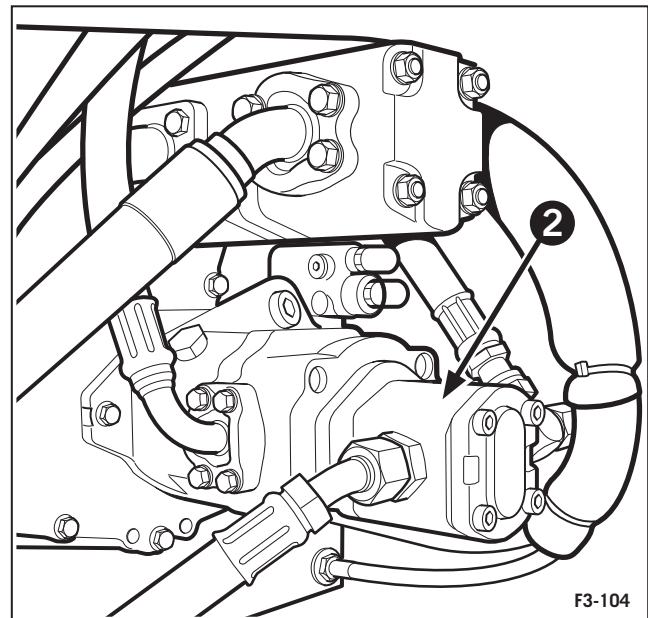
The high flow system offers increased flow and triple system capability which will allow for more efficient operation of large individual hydraulic loads such as dual orbit motors and remote cylinders.



**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.



(Synchromesh transmission shown)

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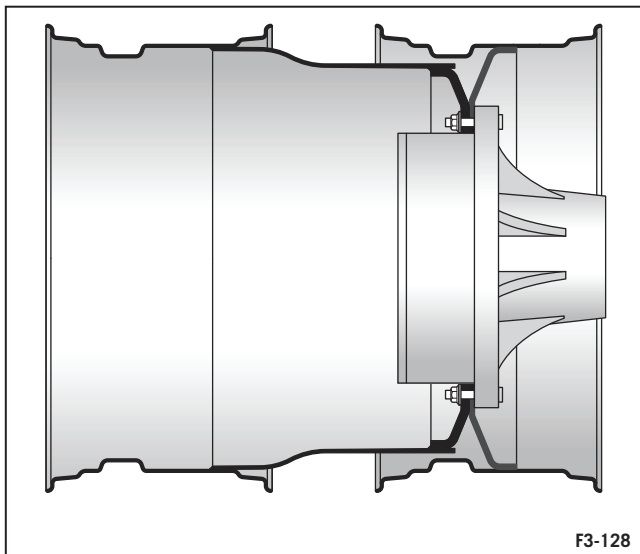
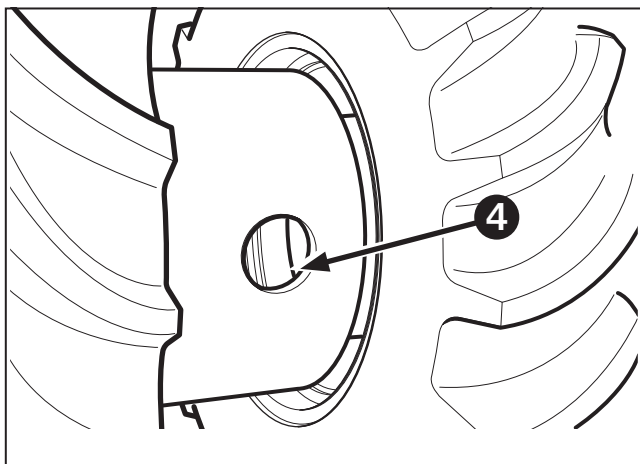
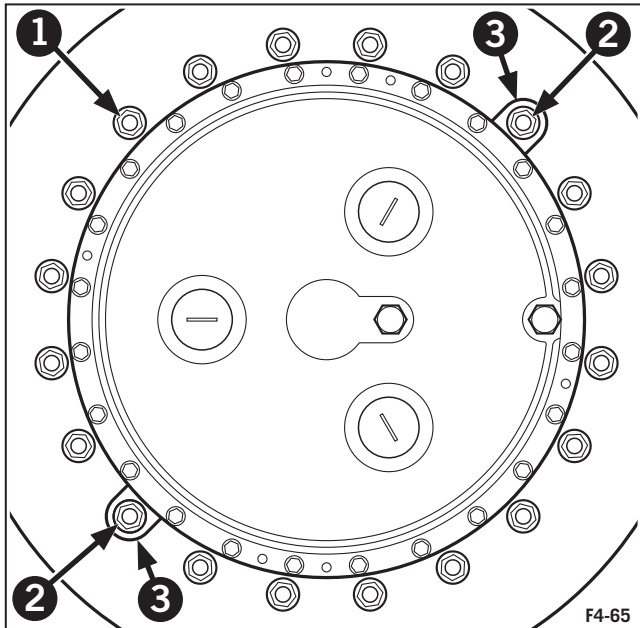
### Standard and Row Crop Drum Style Dual Wheels

- 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.
- Put 51 mm - 76 mm (2" - 3") wood blocking under the wheel to be dualled.
- 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 accessible (4) for easier tire inflation pressure maintenance later.
- 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.**

- Reinstall the 18 nuts (1) removed in Step c.
- Torque the wheel nuts to 710 N·m (525 ft-lbs).
- Repeat the above procedure for the other remaining wheels.
- 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



## Ballasting Weights

Ballasting weight is to be added in the form of front, upper or rear weight kits available from your Buhler Versatile dealer.

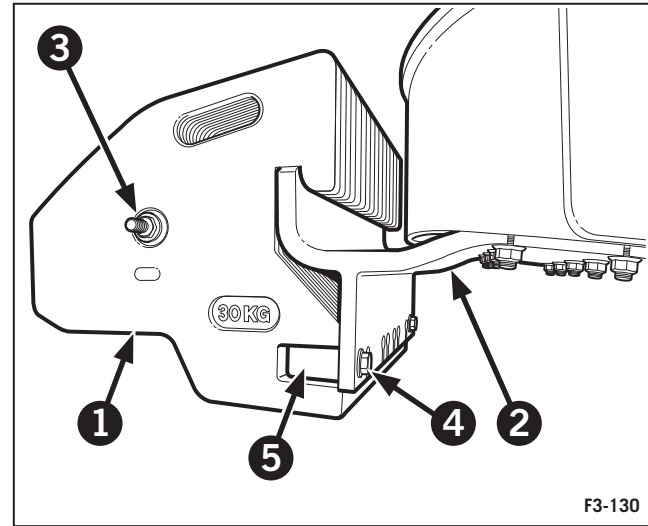
The weight kits are suitcase in style allowing ballast to be easily installed and removed, depending on the varying needs.

### 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.



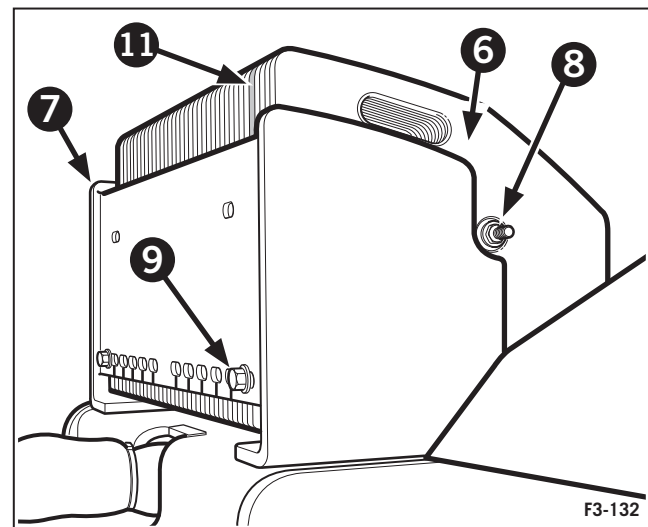
### Upper weights

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.



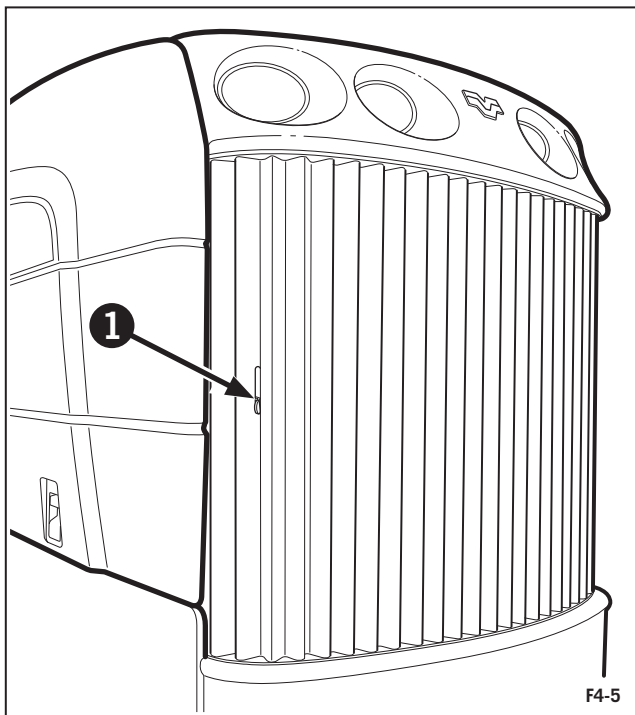
## Every 10 Hours

### 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.



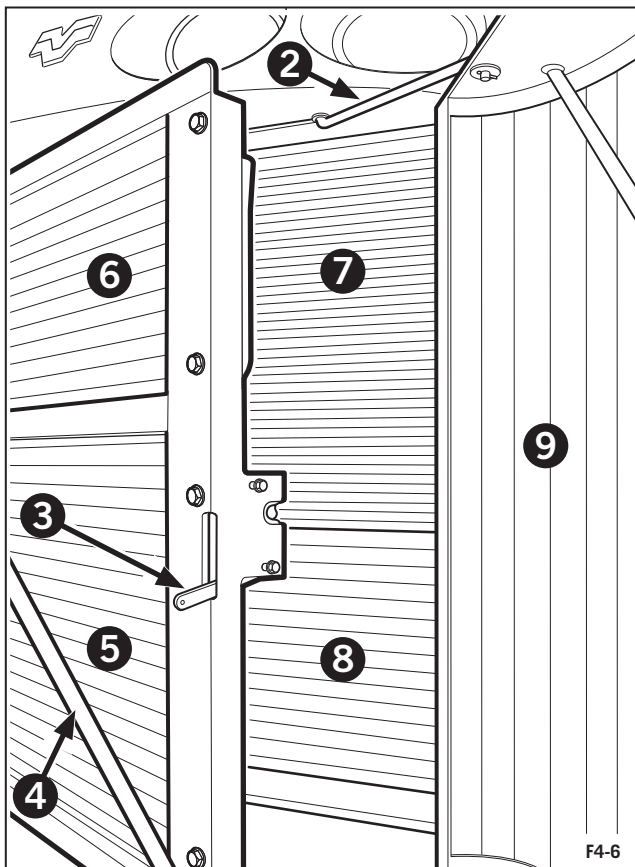
Lift the latch lever (3) upward and swing the fuel cooler/condenser assembly outward using the crossbar (4).

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.**





### Operation 18

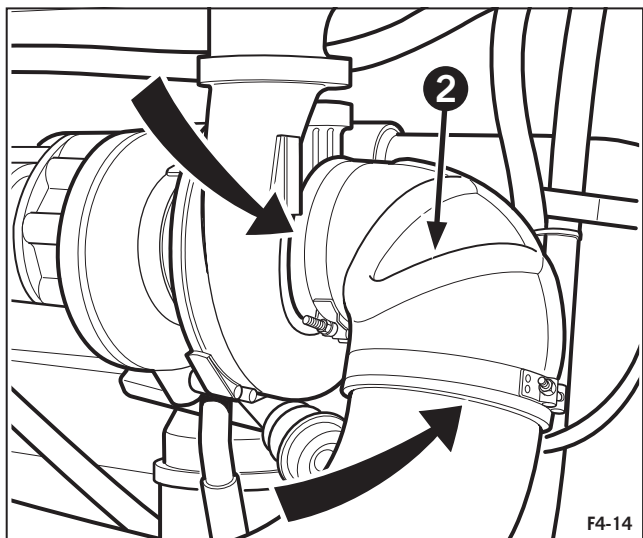
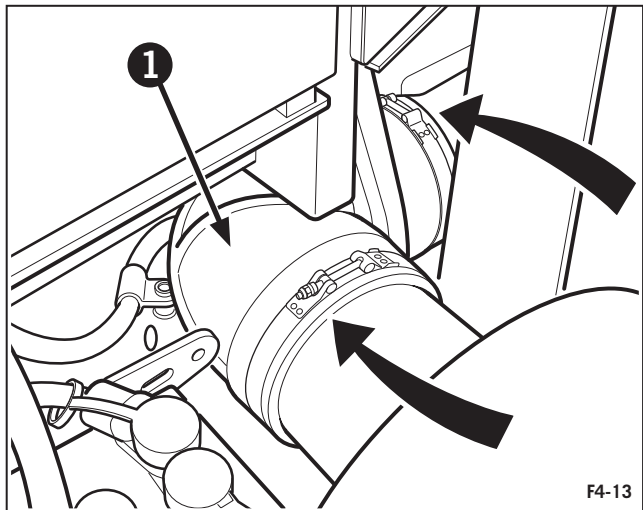
#### Air Intake Piping / Charge Air piping

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)

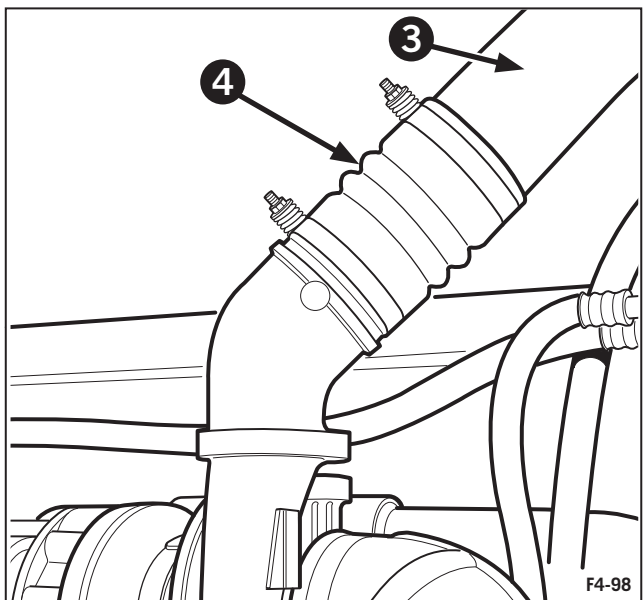
Check for corrosion of the intake system piping under the clamps and hoses. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean as required.



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 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.

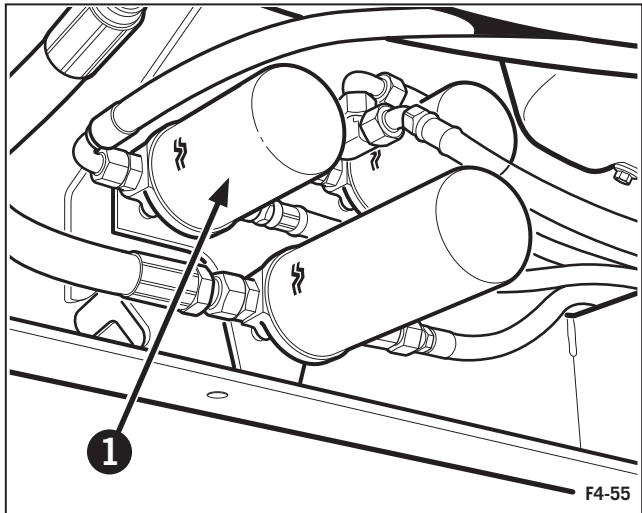
**NOTE: Dispose of used oil filters in accordance with federal, provincial, state, local laws and environmental regulations.**

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 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.

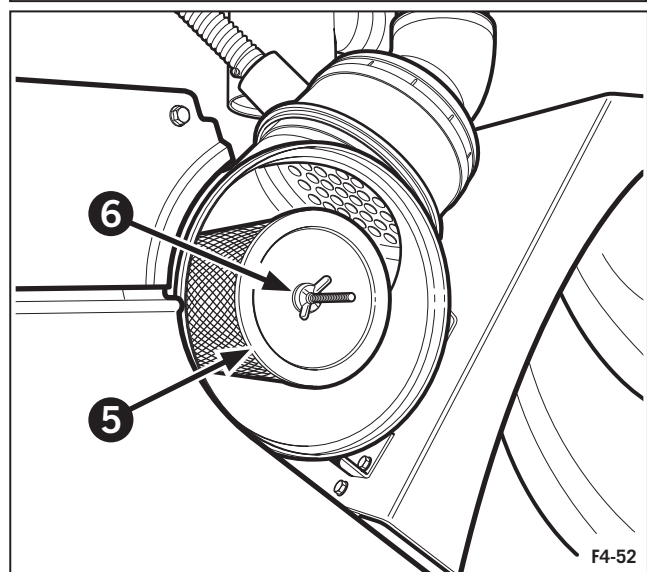
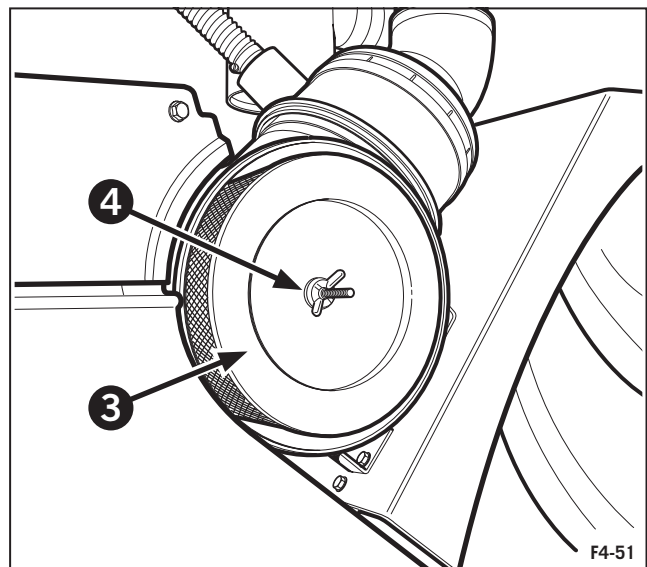
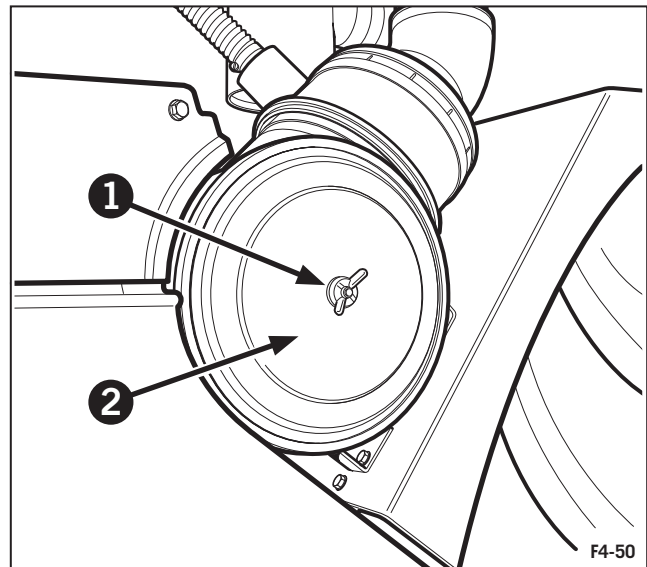
*IMPORTANT: When servicing the air cleaner, wear a mask when changing the air filters. Do not breath in dust.*

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.





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.

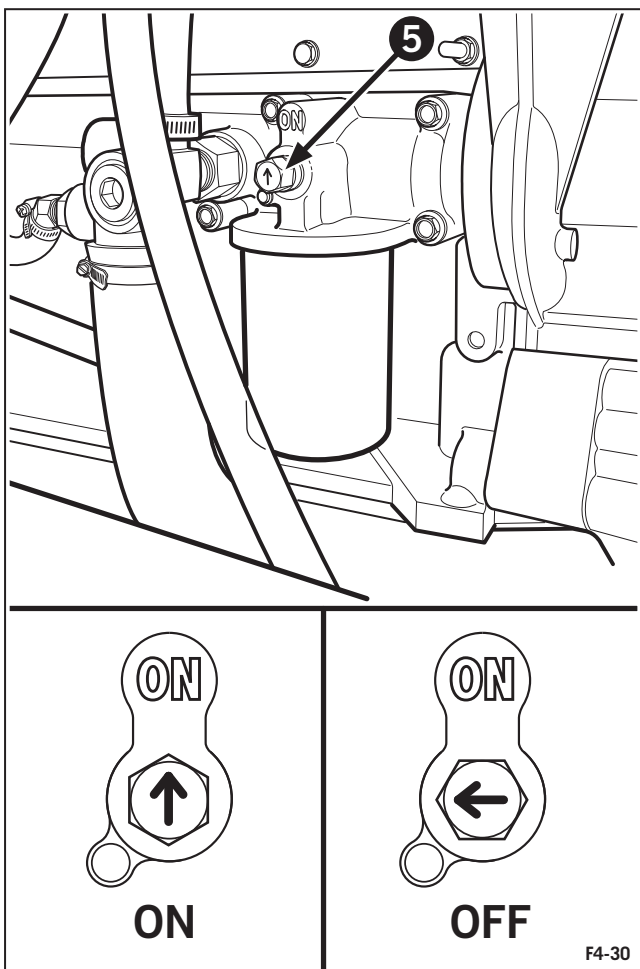
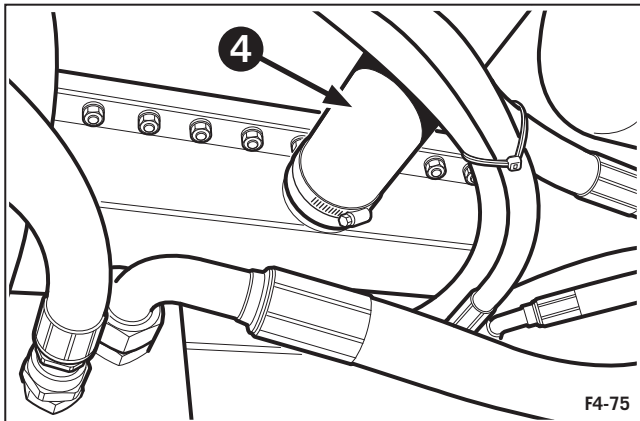
Turn off the coolant filter shutoff valve so the filter is isolated from the cooling system during cleaning and flushing operations.

*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).





## Relays

<b>R1</b>	Hvac and Windshield Wiper/washer (see fuses no. 13 and 14)	<b>F9</b>	(15 amps) 7-pin Trailer Plug (Pin 2) Work Lamp (See relay no. 7)
<b>R2</b>	Marker Lights (See fuse no. 4)	<b>F10</b>	(10 amps) Road Lamps - Low Beam (See relay no. 8)
<b>R3</b>	Cab Roof Work Lamps (See fuse no. 5)	<b>F11</b>	(20 amps) Road Lamps - High Beam (See relay no. 9)
<b>R4</b>	Front Grill Work Lamps (See fuse no. 6)	<b>F12</b>	(15 amps) Horn/beacon/cigarette Lighter
<b>R5</b>	Front Fender Work Lamps (See fuse no. 7)	<b>F13</b>	(25 amps) Hvac (See relay no. 1)
<b>R6</b>	Rear Fender Work Lamp (See fuse No. 8)	<b>F14</b>	(15 amps) Windshield Wiper/washer (See relay no. 1)
<b>R7</b>	7-pin Trailer Plug (Pin 2) Work Lamp (See fuse no. 9)	<b>F15</b>	(10 amps) Transmission Control Module (See relay no. 12)
<b>R8</b>	Road Lamps - Low Beam (See fuse no. 10)	<b>F16</b>	(10 amps) Radar (See relay no. 25)
<b>R9</b>	Road Lamps - High Beam (See fuse no. 11)	<b>F17</b>	(15 amps) Seat (See relay no. 25)
<b>R10</b>	Spare - Not Used (See fuse no. 42)	<b>F18</b>	(7.5 amps) Radio (See relay no. 25)
<b>R11</b>	Rear Deck - Power Plug Switched Power (Pin 1) (See fuse no. 3)	<b>F19</b>	(5 amps) Right Hand Console (See relay no. 13)
<b>R12</b>	Transmission Control Module (See fuse no. 15)	<b>F20</b>	(7.5 amps) Front Console (See relay no. 13)
<b>R13</b>	Power Console Switches (See fuses no. 19, 20 and 21)	<b>F21</b>	(10 amps) Control Modules - Key Switch Signal (See relay no. 13)
<b>R14</b>	Electro-hydraulics (See fuse no. 33)	<b>F22</b>	(10 amps) Key Switch Power See... ACC = relays no. 11 and 25 RUN = relays no. 12, 13 and 20 START = relay no.19
<b>R15</b>	Differential Lock (See fuse no. 24)	<b>F23</b>	(10 amps) Right Hand Console Power Socket
<b>R16</b>	Accessory Function No. 1 (See fuse no. 28)	<b>F24</b>	(20 amps) Differential Locks (See relay no. 15)
<b>R17</b>	Accessory Function No. 2 (See fuse no. 28)	<b>F25</b>	(5 amps) Engine Key Switch Fuelling Signal (See relay no. 18)
<b>R18</b>	Engine Key Switch Fuelling Signal (See fuse no. 25)	<b>F26</b>	(10 amps) Keep Alive Memory
<b>R19</b>	Starter Relay Signal (See fuse no. 22)	<b>F27</b>	(20 amps) VMM Control Module
<b>R20</b>	7-pin Trailer Plug (Pin 7) +12v Key Switched Power (See fuse no. 39)	<b>F28</b>	(30 amps) Accessory Function No. 1 And 2 (See relays no. 16 and 17)
<b>R21</b>	7-pin Trailer Plug (Pin 3) Left Hand Signal Lamp (See fuse no. 30)	<b>F29</b>	(15 amps) Extremity Left Hand Signal (See relay no. 22)
<b>R22</b>	Extremity Left Hand Signal (See fuse no. 29)	<b>F30</b>	(15 amps) 7-pin Trailer Plug (Pin 3) Left Hand Signal Lamp (See relay no. 21)
<b>R23</b>	7-pin Trailer Plug (Pin 5) Right Hand Signal Lamp (See fuse no. 32)	<b>F31</b>	(15 amps) Extremity Right Hand Signal (See relay no. 31)
<b>R24</b>	Extremity Right Hand Signal (See fuse no. 31)	<b>F32</b>	(15 amps) 7-pin Trailer Plug (Pin 5) Right Hand Signal Lamp (See relay no. 23)
<b>R25</b>	Radar/seat/radio (See fuses no. 16, 17, and 18)	<b>F33</b>	(20 amps) Electro-hydraulics (See relay no. 14)
<b>R26</b>	7-pin Trailer Plug (Pin 4) Stop Lamp (See fuse no. 37)	<b>F34</b>	(15 amps) Engine Ecm Power 1 Of 2
<b>Fuses</b>		<b>F35</b>	(15 amps) Engine Ecm Power 2 Of 2
<b>F1</b>	(15 amps) Rear Deck - Power Plug Live Power (Pin B)	<b>F36</b>	(15 amps) Diagnostics Connector Power (Pin 1)
<b>F2</b>	(5 amps) Dome Lamp	<b>F37</b>	(10 amps) 7-pin Trailer Plug (Pin 4) Stop Lamp (See relay no. 26)
<b>F3</b>	(20 amps) Rear Deck - Power Plug Live Power (Pin 1) (See relay no. 11)	<b>F38</b>	(10 amps) Backup Alarm
<b>F4</b>	(15 amps) Marker Lamps (See relay no. 2)	<b>F39</b>	(20 amps) 7-pin Trailer Plug (Pin 7) +12v Key Switched Power (See relay no. 20)
<b>F5</b>	(25 amps) Cab Roof Work Lamps (See relay no. 3)	<b>F40</b>	(10 amps) Rear Deck - Power Socket
<b>F6</b>	(30 amps) Front Grill Work Lamps (See relay no. 4)	<b>F41</b>	(----) 1407 Transmission Diagnostics
<b>F7</b>	(15 amps) Front Fender Work Lamps (See relay no. 5)	<b>F42</b>	(----) Not Used
<b>F8</b>	(30 amps) Rear Fender Work Lamps (See relay no. 6)		



## 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
<b>E00</b>	Input power has dropped below 0.4 volts for more than 0.1 seconds	Low battery voltage Loose connection Bad ground Bad power relay contacts Contact Buhler Versatile dealer
<b>E01, E02, E05, E04, E05</b>	Internal control problem	Contact Buhler Versatile dealer
<b>E06</b>	Output speed signal missing transmission shifts to neutral if clutch pedal depressed - 1st engaged when clutch is released	Contact Buhler Versatile dealer
<b>E08</b>	Range selector switch combination invalid	Contact Buhler Versatile dealer
<b>E09</b>	Clutch pedal signal out of range or bottom pedal switch error	Contact Buhler Versatile dealer
<b>E11</b>	Engine load signal out of proper range	Contact Buhler Versatile dealer
<b>E12</b>	Input speed sensor circuit shorted or open	Contact Buhler Versatile dealer
<b>E13</b>	Output speed sensor circuit shorted or open	Contact Buhler Versatile dealer
<b>S1, S2, S3, S4, S5, S6, S7, S8, S9</b>	Designated solenoid shorted or open	Contact Buhler Versatile dealer
<b>F387</b>	Low Transmission Oil Pressure Warning	Contact Buhler Versatile dealer
<b>F388</b>	Transmission Oil Pressure Sensor Short To Ground	Contact Buhler Versatile dealer
<b>F392</b>	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.**



<b>Fault Codes</b>	<b>Warning Lamp</b>	<b>Cause</b>	<b>Action</b>
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



**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.**

	<b>Total Weight of Kit kg (lbs.)</b>	<b>Effect on Front Axle kg (lbs.)</b>	<b>Effect on Rear Axle kg (lbs.)</b>
Front Weight Kit 130 kg (397 lbs.) bracket 40 x 30 kg (67 lbs.) weights	1396 (3077)	Adds 2387 (5262)	Removes 991 (2185)
Upper Rear Weight Kit 342 kg (360 lbs.) bracket 40 x 30 kg (67 lbs.) weights	1379 (3040)	Adds 303 (669)	Adds 1075 (2371)
Rear Weight Kit 98 kg (222 lbs.) bracket 42 x 30 kg (67 lbs.) weights	1377 (3036)	Removes 220 (486)	Adds 1598 (3522)
Total effect of putting a complete Front, Upper Rear and Rear Weight Kit on the Tractor	4152 (9153)	Adds 2470 (5445)	Adds 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.



## 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
<b>A</b>	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>B</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
<b>C</b>	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
<b>D</b>	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 30.5 X 32 R1 20.8 X 38 R1				30.5 X 32 R2 18.4 X 42 R1 20.8 X 38 R2 710/70 X 38 R1				20.8 X 42 R1 710/70 X 38 R1 850/60 X 38 R1 900/50 X 42 R1				800 X 38 R1 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
<b>A</b>	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>B</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)
<b>C</b>	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 30.5 X 32 R1 20.8 X 38 R1				30.5 X 32 R2 18.4 X 42 R1 20.8 X 38 R2				20.8 X 42 R1 710/70 X 38 R1 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
<b>A</b>	(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>B</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:

$$\left( \frac{\text{Desired Engine speed}}{2100 \text{ RPM}} \right) \times \text{chart speed} = \text{ground speed}$$

Typical Tire Groups	
A	B
(Approx. 226"-230" L.R.C.) 900 X 42 520 X 42 710 X 38	(Approx. 240"-244" L.R.C.) 800 X 38 710 X 42 520 X 46

L.R.C. = Loaded Rolling Circumference

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