SERVICE SCHOOL 2013

4000 Series Tractor Training Outline

Day 1

- Introduction to Hydraulic System
- Closed-Loop Hydrostatic Drive Circuit
- Open-Loop Implement Circuit
- Testing & Filtering Procedures
- Hydraulic Troubleshooting
- Axles & Transaxles
- Maintenance & Adjustments
- Electrical Systems

Day 2

- Kubota Engine Training
- Kawasaki Engine Training
- Routine Engine Maintenance
- Engine Failure Analysis
- Warranty

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Ventrac Model 4500

Engine Options

Kubota (Liquid-Cooled)

- **4500Z - WG972 -** 32hp Gas (optional Liquid Propane)
- **4500Y - D902** – 25hp Natural Diesel (available April/May 2013)
  - Both feature **60 Amp** alternators
  - Slope rating - **20° Continuous / 30° Intermittent**

Kawasaki (Liquid-Cooled)

- **4500P - FD851D** - 31hp Gas / Digital Fuel Injected (DFI)
  - **30 amp** alternator
  - Slope rating - **30° Continuous**

Briggs & Stratton Vanguard (Air Cooled)

- **4500K - Model 54 -** 31hp Gas (Big Block)
  - Engine oil cooler std (receives cooling airflow from flywheel)
  - **20/50 amp** alternator
  - Slope rating **- 20° Continuous / 30° Intermittent**

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Ventrac Model 4200

Engine Options

Kawasaki – (Liquid-Cooled)

- 27-hp Gas (FD750D-ES02)
  - **20 amp** alternator
  - Slope rating - **25° Continuous / 30° Intermittent**
  - **Discontinued – June 2012**

B&S – 3/LC Vanguard/Daihatsu

- 31-hp Gas - 950G (580447 / 0305-E2)
  - Slope rating - **25° Continuous / 30° Intermittent**
  - **Discontinued – June 2011**
- 26.5-hp Diesel - 950D (582447 / 0405-E2)
- 31-hp Turbo Diesel - 950DT (588447 / 0305-E2)
  - Slope rating - **30° Continuous**
  - All 3 feature **40 amp** alternators
  - **Discontinued – March 2013**

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Ventrac Model 4100

Briggs & Stratton – Vanguard (Air-Cooled)

- 31-hp Big Block (Model 543477-2144-G1) 20/50 amp alternator
  - 20 amp at 1750 RPM, 50 amp at 3600 RPM
  - Electric fuel pump (KFC1391 – KFC3640)
  - Vacuum fuel pump (KFC3641 and after)
  - External engine oil-cooler
  - **Discontinued – July 2012**

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Introduction to Hydraulic Systems

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Introduction to Hydraulics

Hydraulic Systems (fluid power) are never 100% efficient

- Some systems are more efficient then others:
  - **Geroller** style pumps/motors – approx. 65-70%
  - **Gerotor** or **Gear** pumps/motors – approx. 75-80%
  - **Piston** pumps/motors – approx. 90-95%
  - **Vane** pumps/motors – approx. 90-95%

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Introduction to Hydraulics

Fluid/Oil Viscosity

- **Viscosity** - the measure of a fluid's resistance to flow
- **Viscosity Index (VI)** - measures a fluid's viscosity change with temperature change; the **higher** the **VI**, the **less** a fluid's viscosity will change as temperature changes
- **Hydraulic Fluid (VI)**
  - **Standard**, mineral-based hydraulic oil has a **VI** close to **100**
  - **Premium**, multi-grade hydraulic oil may have a **VI** up to **140**
  - **Ventrac's** Hydro-Torq 5W30 Synthetic Hydraulic Oil has a **VI** of **160**

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Introduction to Hydraulics

Hydraulic Oil & Temperature Extremes

- **Cold Extremes –** oil may thicken significantly
  - **Reduces** oil flow and lubrication, especially at startup
  - Mineral-based oils may thicken to the point of causing pump cavitation and/or **complete loss of lubrication**
- **Hot Extremes -** oil may thin significantly
  - **Reduces** the oils ability to to carry load
  - Mineral-based oils may **shear** allowing **metal-to-metal** contact
  - Greatly accelerates **oil break-down** (decomposition**)**
  - **Lowers component efficiency** - thin oil bypasses through component tolerances much more easily

Introduction to Hydraulics

Causes for Excessive Heat and Efficiency Loss

- **Extreme duty cycles** – (driving 10 miles continually pulling heavy trailer)
- **Excessive Load & High Operating Pressure**
  - Pushing/pulling heavy loads (especially in high range)
  - Climbing hills in high range (use low range at 15 degrees or above)
  - Low range reduces system pressure by half, minimizes heat and stress
- **Air and/or Water in Oil** – (both can cause pump cavitation)
  - Air enters through loose/damaged components on suction side of pump
  - Water may enter through breather system or by adding contaminated oil
- **Using Non-Recommended Hydraulic Oil**
  - Ventrac's full synthetic hydraulic oil helps reduce friction and heat

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Introduction to Hydraulics

Causes for Component Wear

- **Lack of Proper Lubrication**
  - Using the wrong type or viscosity of oil
  - Air and/or water in the system
    - Foam or bubbles (big or small) in the oil level sight-tube are telltale signs there may be air and/or water in the system
- **Contamination**
  - More than 70% of all hydraulic system failures are a result of system contamination

Introduction to Hydraulics

Oil Contamination

- Component wear is **most often** caused by contaminates entering the system from an outside source
- Contamination can be dirt, metal, water, automatic transmission fluid, motor oil - anything other than the recommended hydraulic oil**.**
- The **more efficient** the component, **the greater the risk** for damage from contamination (Piston pumps/motors 90-95%)

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Introduction to Hydraulics

Contamination Particle Size

- Contaminate size is measured in **Microns (µm)**
  - A micron (or micrometer) is one millionth of a meter (.00004")
  - 25 micron is equal to .001 (one-thousandth of an inch)

Approximate Micron Size Examples:

- Grain of salt or sand - 100-micron
- Human hair - 80-micron
- Lower limit of visibility - 40-micron
- Red blood cells - 8-micron
- Bacteria around - 2-micron

4000 Series Filtration

Suction filter 25-micron

Return filter 10-micron

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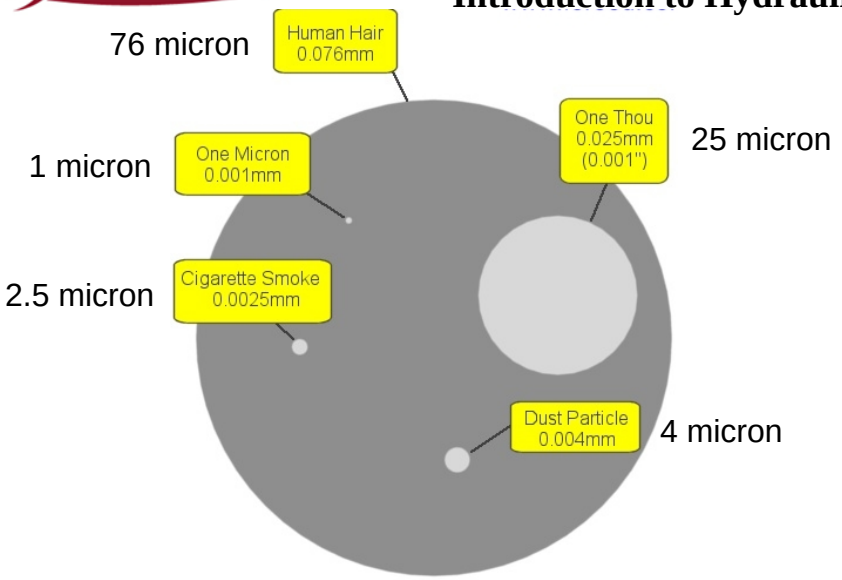
Introduction to Hydraulics



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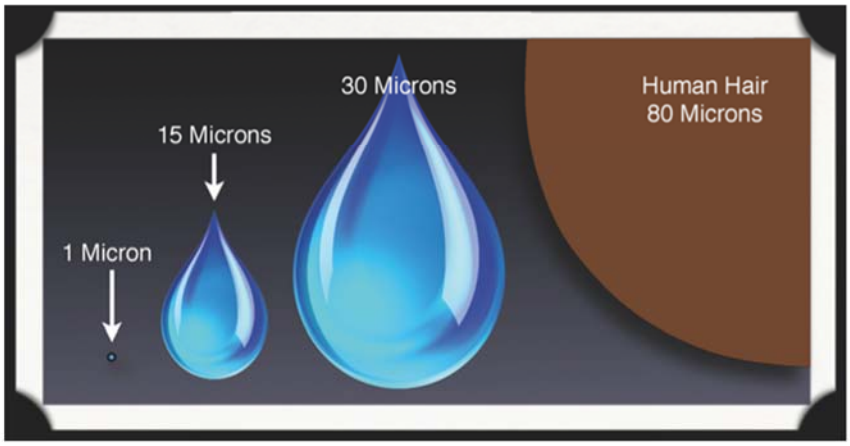
Introduction to Hydraulics



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Types of Hydraulic Circuits

Open-Loop **Closed Loop**

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Types of Hydraulic Circuits

Open-Loop Circuit

- **Oil always return back to the tank**
  - **Closed-Centered** – Oil is stopped at control valve, pressure is achieved & maintained (pressure compensated pump)
  - **Open-Centered** – Oil flows through control valve, no pressure is achieved until valve is activated
- **Ventrac uses only Open-Centered Systems..**

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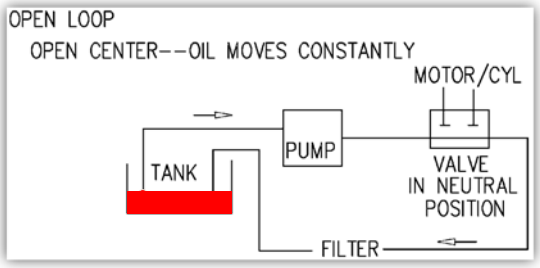
Types of Hydraulic Circuits

Open-Loop – Open Centered

- Oil is drawn from tank by the pump, routed to the valve/s and, if valve is not actuated, oil flows through and back to tank.



Note: All Ventrac implement or auxiliary circuits are Open-Centered

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Types of Hydraulic Circuits

Closed-Loop Circuit

- In **theory** the oil never returns back to the tank. It continually circulates from the pump to the motor/s and back to the pump
- Due to pump & motor design, **5-10%** of oil continually escapes to the case of the pump and motors, therefore the addition of make up oil is necessary
- Closed-loop circuits generally do not have in-loop filtration. Therefore it is **CRITICAL** that the **closed-loop circuit** is kept free of contamination

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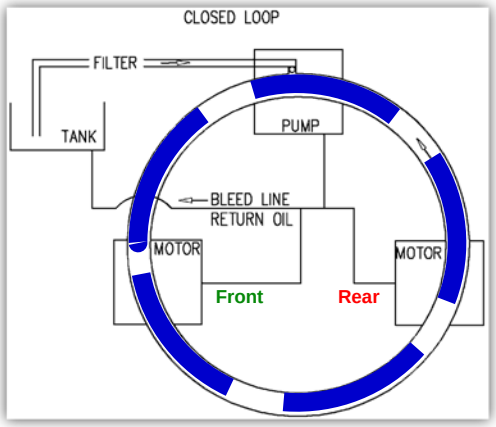
Types of Hydraulic Circuits

Closed-Loop – Series Circuit

On Ventrac 4000 Series Tractors

When the **Direction Lever** is placed in **Forward** motion:

- Oil is pumped to the **REAR** motor **FIRST**, then to the **FRONT** motor and back to pump



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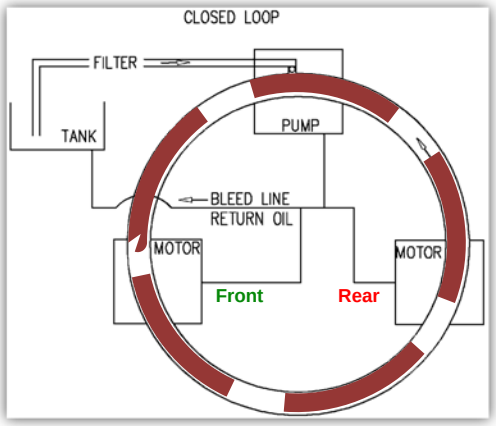
Types of Hydraulic Circuits

Closed-Loop – Series Circuit

On Ventrac 4000 Series Tractors

When the **Direction Lever** is placed in **Reverse** motion:

- Oil is pumped to the **FRONT** motor **FIRST**, then to the **REAR** motor and back to the pump.



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4000 Series Hydraulic Systems

Two Circuits

- **Hydrostatic Drive Circuit**
  - Closed-loop
  - **100-5000 psi** depending on workload
- **Implement/Aux Circuit**
  - Open-loop – Open-centered
  - **900-1000 psi** regulated by pump relief valve

Note: The Oil Reservoir is the Front Transaxle only

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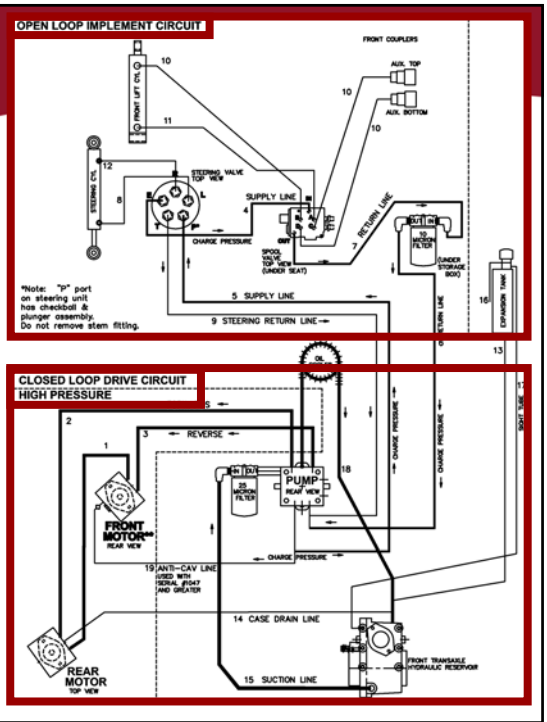
4100/4200 Hydraulic Diagram

Two Circuits

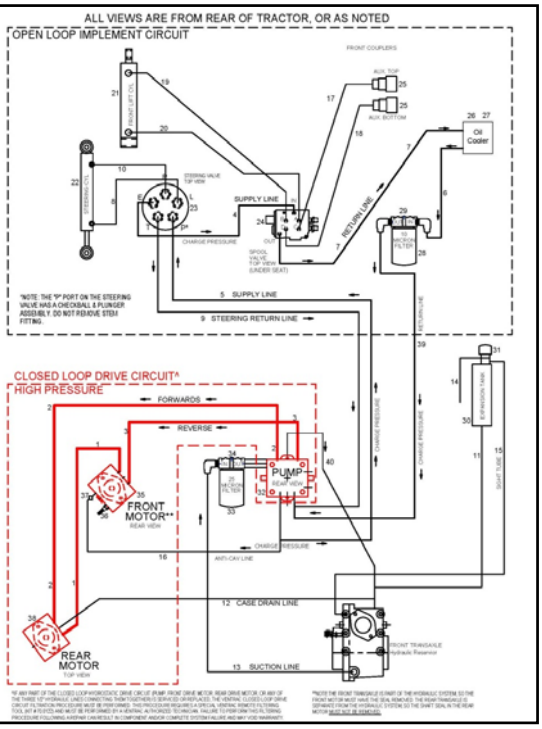
Open-Loop Implement Circuit

Closed-Loop Drive Circuit



4500 Hydraulic Diagram

Two Circuits



Differences

- Return filter – located upfront below suction filter
- Hydraulic Oil Cooler
  - Radiator type with thermostat controlled fan
  - Reversing fan switch - provides some heat to operator

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Hydrostatic Drive Circuit

Closed-Loop / Series Circuit

- 1 – Hydraulic Pump
- 2 – Hydraulic Motors (one on each transaxle)
- 3 - ½” High Pressure Lines

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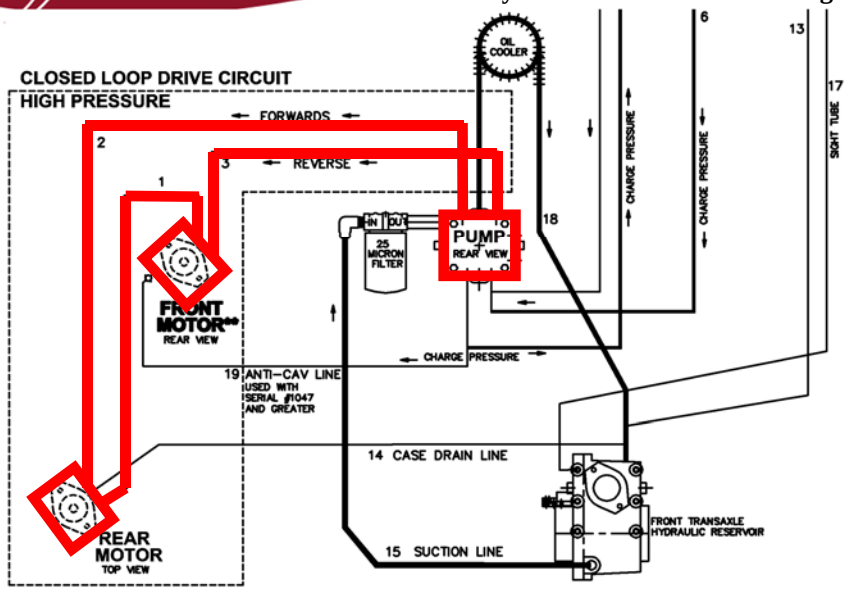
Hydrostatic Drive Circuit Diagram



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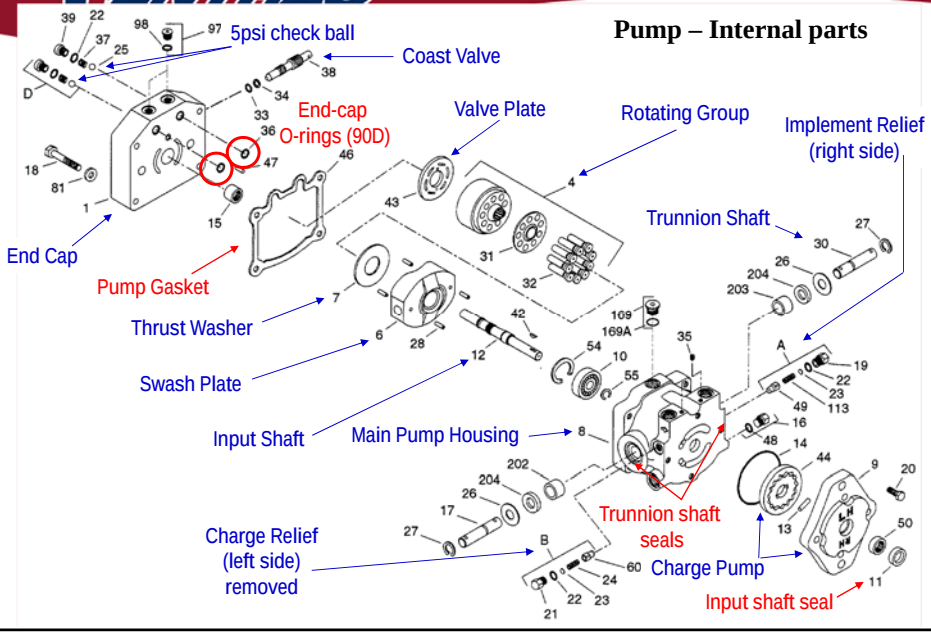
Hydraulic Pump

Series 15 Sauer Danfoss

Pump – Internal parts

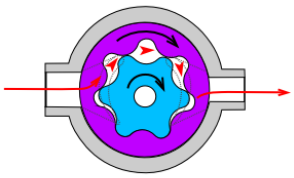


Hydrostatic Drive Circuit

Gerotor Charge Pump

Gerotor, gear type pump on front of hydrostatic drive piston pump

- **Fixed displacement** – approx. 4-GPM
- Tolerant of contaminates



Charge pump supplies oil for both circuits:

- **Primary function** - fill & maintain **Hydrostatic Drive Circuit**
  Replaces oil loss (5-10%) due to inefficiencies
- **Secondary function** – provide oil pressure for the **Implement Circuit**
  - Steering, lift, 3-point & aux
  - **Implement Relief** set at **900-1000 PSI**

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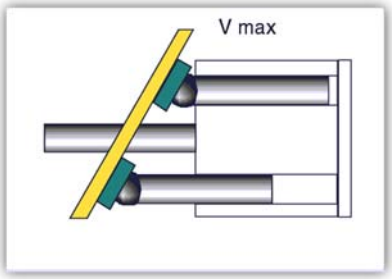
Hydrostatic Drive Circuit

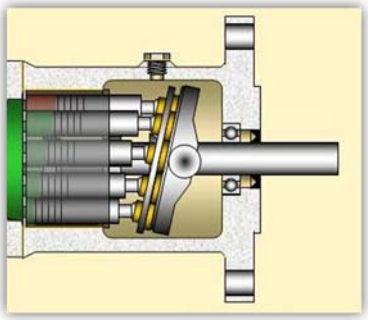
Axial Piston Pump

Variable Displacement

- Controlled by SDLA lever
- High efficiency, **90-95%**
- **Intolerant of Contamination**
- **70PSI** min charge into pistons
- Components usually repairable



Pump is part of closed-loop circuit



Mechanical Torque Limiter

(No relief valve to cause heat)

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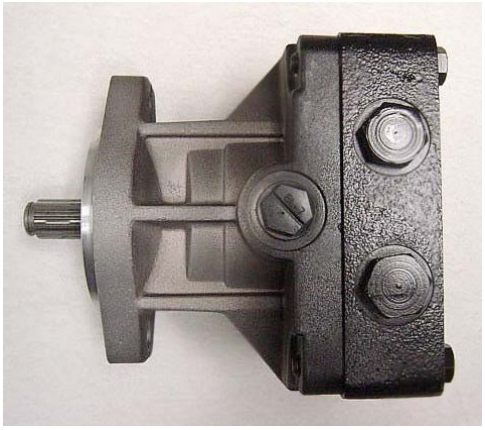
Hydraulic Pump

Series 15 Sauer Danfoss



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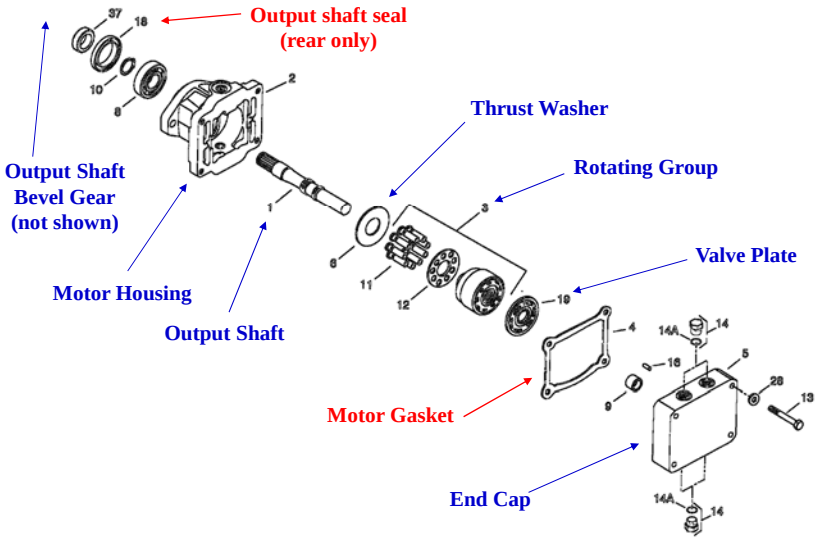
Motor – Internal parts



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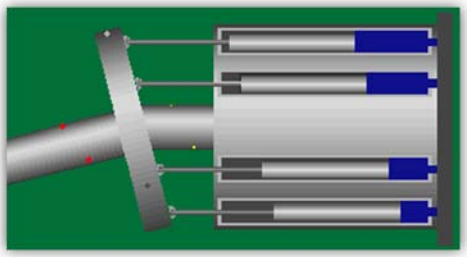
Hydrostatic Drive Circuit

Axial Piston Motor



Fixed displacement

- Same rotating group as pump
- **70PSI min** charge into pistons
- Two motors in **Closed Loop - Series Circuit** (one on each transaxle)
- **Forward motion** - oil goes to **Rear** motor **first** then to **Front** motor

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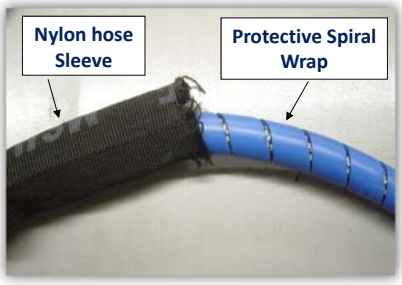
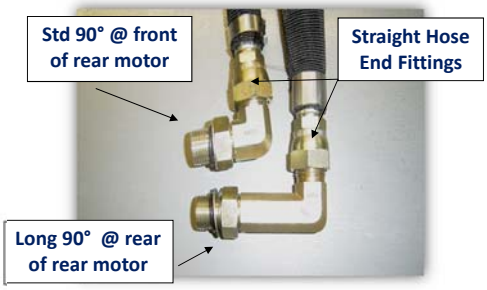
Hydrostatic Drive Circuit

½" Drive Lines

4100/4200 – (O-ring face seal fittings)

- **Dec-2005** – Changed rear motor lines to a specialty hose with **Teflon inner tube**, pump to front motor line changed to steel tube
- **Dec-2008** – Added **protective spiral wrap** to Teflon hose, changed rear motor lines to ends straight ends and motor fittings 90°.





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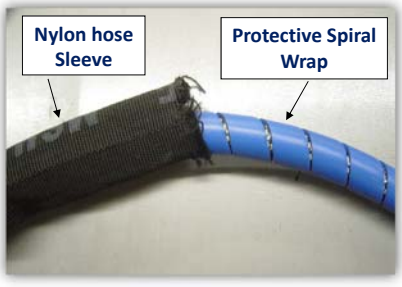
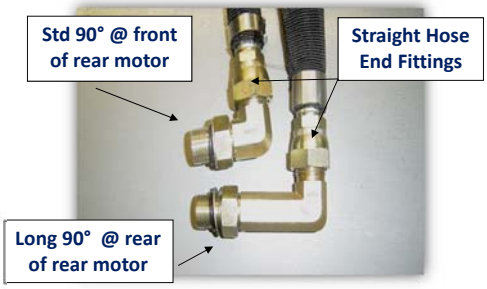
Hydrostatic Drive Circuit

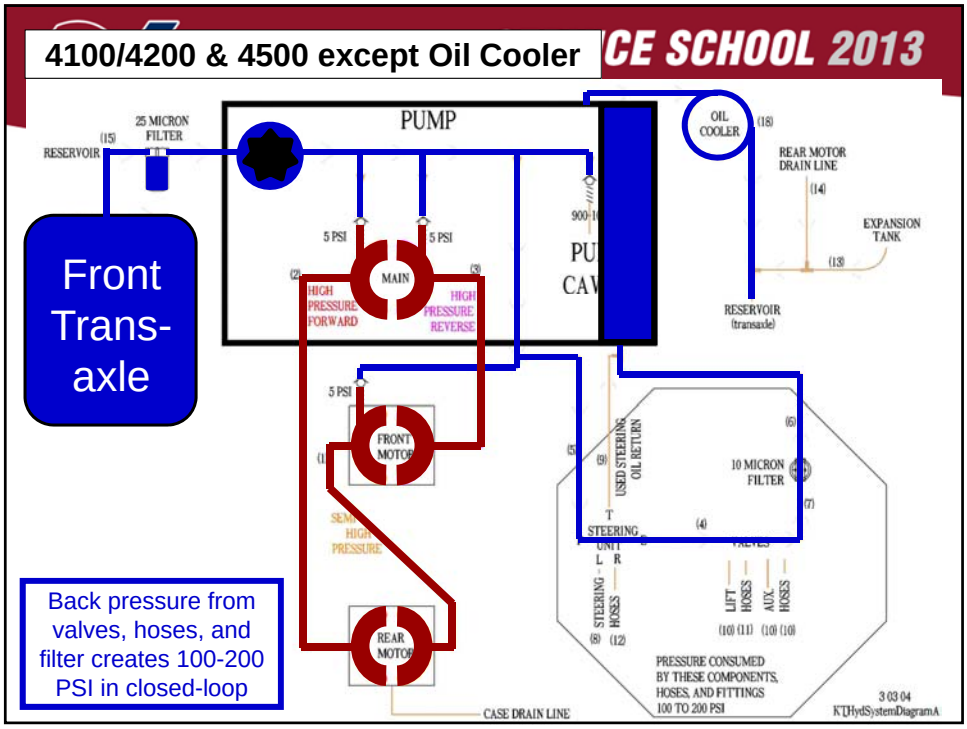
½" Drive Lines

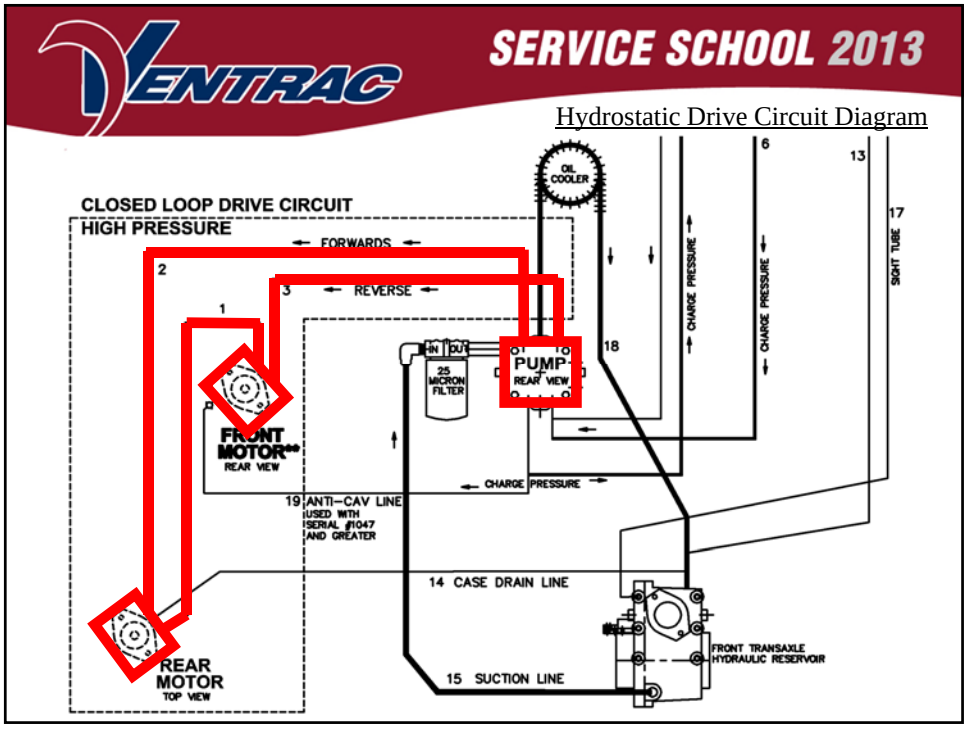
4500 – (O-ring face seal fittings)

- **July-2012** – All 3 ½" lines are the specially **Teflon** inner tube hose with **protective spiral wrap** and **straight hose ends**, (discontinued use of steel tube)






4100/4200 & 4500 except Oil Cooler
CE SCHOOL 2013
Front Trans-axle
PUMP
25 MICRON FILTER
RESERVOIR
OIL COOLER
REAR MOTOR DRAIN LINE
EXPANSION TANK
RESERVOIR (transaxle)
5 PSI
5 PSI
MAIN
HIGH PRESSURE FORWARD
HIGH PRESSURE REVERSE
FRONT MOTOR
REAR MOTOR
10 MICRON FILTER
USED STEERING OIL RETURN
STEERING UNIT
STEERING HOSES
LIFT HOSES
AUX. HOSES
PRESSURE CONSUMED BY THESE COMPONENTS, HOSES, AND FITTINGS 100 TO 200 PSI
CASE DRAIN LINE
Back pressure from valves, hoses, and filter creates 100-200 PSI in closed-loop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SERVICE SCHOOL 2013
Hydrostatic Drive Circuit Diagram
CLOSED LOOP DRIVE CIRCUIT
HIGH PRESSURE
FORWARDS
REVERSE
OIL COOLER
CHARGE PRESSURE
SIGHT TUBE
25 MICRON FILTER
PUMP
REAR VIEW
FRONT MOTOR
REAR VIEW
ANTI-CAV LINE
USED WITH SERIAL #1047 AND GREATER
CASE DRAIN LINE
SUCTION LINE
FRONT TRANSAXLE HYDRAULIC RESERVOIR
REAR MOTOR
TOP VIEW

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Piston Pumps & Motors
Failure Analysis

Most component failures are caused by outside contamination

- **Common Contaminates and Sources**
  - Steel-braid filings (replacement hoses)
  - Rubber hose particles (replacement hoses)
  - Outside Dirt (during repair of pump or motor)

Most common cause of damage and failure in drive system

- Installing **unclean**, non-Ventrac replacement hoses
- Not using Ventrac's **remote filtering tool** after performing repairs

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Piston Pumps & Motors
Failure Analysis

Inspecting a rotating group:

Inspect brass slipper-feet for:

- **Scratches**, **grooves** or **wear** on face
  - Caused by dirt/contamination
- **Pounded**, **rolled** or **deformed** edges
  - Cavitation (lack of 70PSI charge)
  - Will happen if towed in gear, (axles must be in neutral when towing)
- Piston feet with **light** scratches can generally be repaired by lapping
  - New pistons .025, min service .010
  - Lap with 400 grit sandpaper

Piston Pumps & Motors
Failure Analysis

Rotating Groups (continued)

Inspect piston hold-down plate

- Inspect for bending or breakage
  - **Must be flat, if not replace**

Ventrac has individual replacement parts and complete rotating groups in stock

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Piston Pumps & Motors
Failure Analysis

Thrust Washer

- Washer must be flat and smooth (no nicks, grooves or warpage).
- If it is not flat and smooth, **REPLACE IT!**

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Piston Pumps & Motors
Failure Analysis

Inspection of Valve Plate

- Examine surface for scratches or grooves in the **brass face**
  - Caused by dirt/contamination
- A smooth surface is **CRITICAL** as it prevents oil leakage from the Vacuum side to Pressure side
- In most cases **valve plates** can be repaired by lapping

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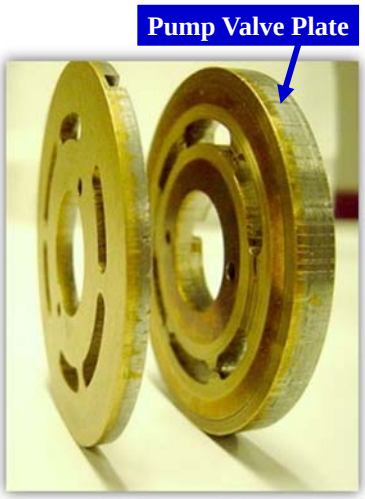
Piston Pumps & Motors
Failure Analysis

Valve plate – (continued)

- Pump valve plate is **thicker** than the motor valve plate
- Pump valve plate has **relief grooves** cut into the plate to reduce noise

Valve plates CAN NOT be interchanged!



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Piston Pumps & Motors
Failure Analysis

Motor Thrust Surface

- Inspect surface for damage, MUST be true and smooth
- If grooved or otherwise damaged, replace with new motor

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Piston Pumps & Motors
Failure Analysis

Front Motor

- Output shaft seal is removed
- Oil that escapes to the motor case returns to front transaxle through spinning bearing

Rear Motor

- Output shaft seal is left in place
- Oil that escapes to the motor case returns to front transaxle via case drain hose
- If seal leaks, oil will fill rear transaxle (motor likely damaged from contamination)

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Piston Pumps & Motors
Repair

Caution: When repairing a pump or motor it is very seldom necessary to completely remove or replace unit

- The following components are easily accessed and replaced with the hydraulic pump and hydraulic motors in place
  - Pump or motor end-cap gasket
  - Pump input shaft seal
  - Pump or motor rotating group, valve plate and thrust washer

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Piston Pumps & Motors
Repair

Oil leaking to exterior of pump or motor

- **Pump or motor end-cap gasket** (Do not remove or replace pump or motor)
  - Remove 4 bolts on end cap and replace gasket (torque bolts to 35lbs)
- **Pump input shaft seal** (Do not remove or replace pump)
  - Remove radiator and/or shields, remove pump drive coupler (u-joint)
  - Remove seal with seal pick or screw (screw into metal face of seal)
- **Pump trunnion shaft seals** (Do not remove or replace pump)
  - Remove necessary shields and linkage to access seals with pump in tractor
- **Motor to transaxle sealing surface** (Remove motor)
  - Use a silicone type gasket sealant to reseal surface
  - Units built prior to 2007 used an O-ring, reseal these with sealant as well

Note: All lip seals are Viton material (withstands 300° + temperatures)

Implement Circuit Components

Open-Loop

Implement Oil Supplied by Charge Pump

- Steering Valve
- Control or Spool Valve/s (lift, 3-point, aux)
- Steering, Lift and Three Point (if equipped) Cylinders
- ¼ inch & 3/8 inch hydraulic lines

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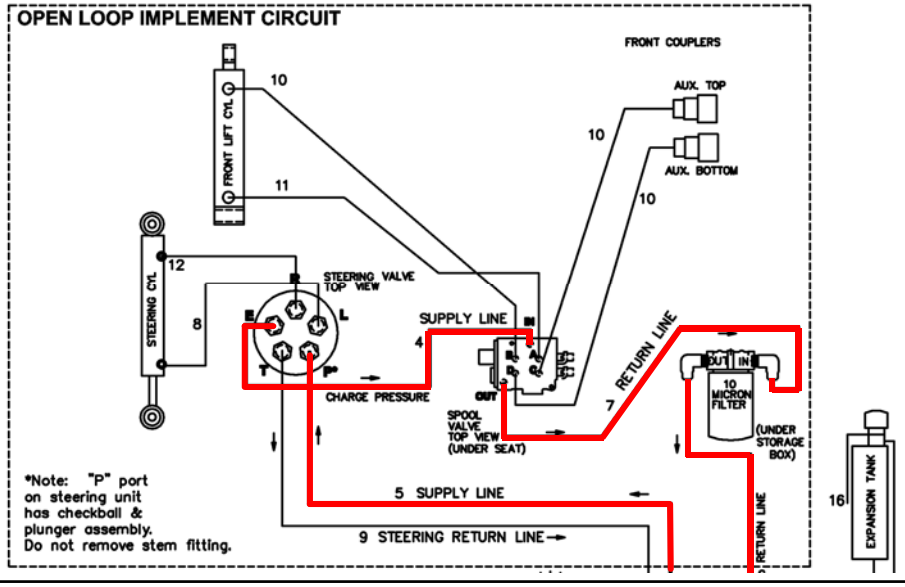
Implement System Diagram



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Implement Circuit

Steering Valve – Sauer Danfoss

Steering valve receives priority oil

- Used steering oil returns directly back to tank
- If all implement pressure is needed to steer, no pressure will be available for lift, auxiliary or 3-point
- No steering valve failures on units built after 2004, steering valve P-port was revised

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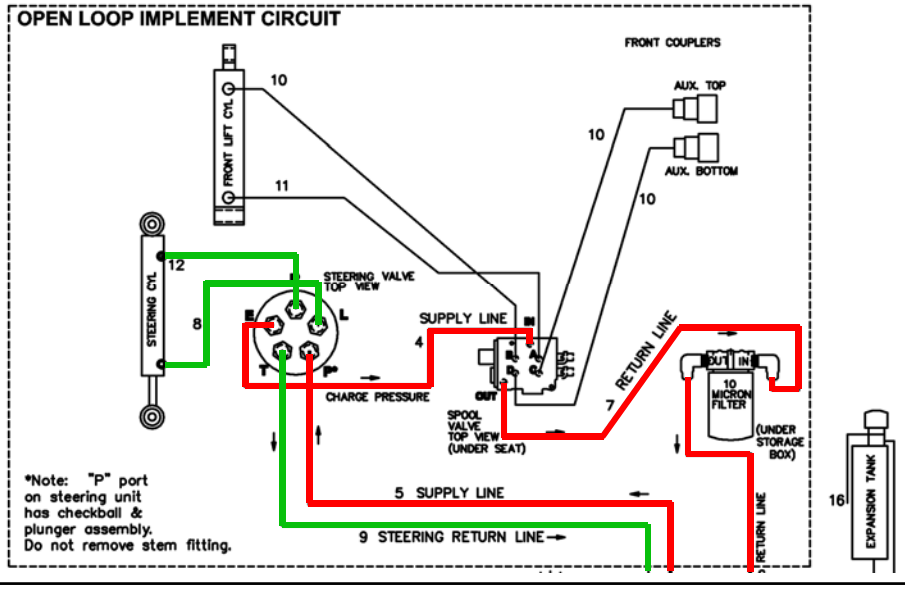
Implement System Diagram



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Implement Circuit

Steering Valve – Sauer Danfoss

- **DO NOT REMOVE** the long stem fittings, small parts in P-port of valve

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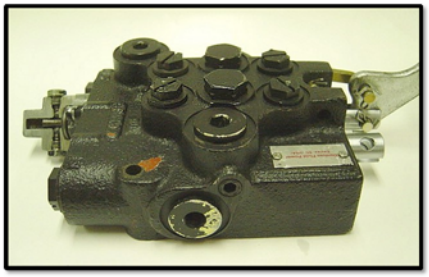
Implement Circuit

Control/Spool Valve – Sauer DanFoss

Float position standard on lift spool

- Optional on aux spool (Must install with reel mower)



- Corrosion in detent area may cause valve to stick or move hard
- If valve will not stay in float, detent stem is worn (replace detent kit)
- Remove float-cap to clean and lubricate periodically
- O-ring on either end of spool keeps oil from leaking external

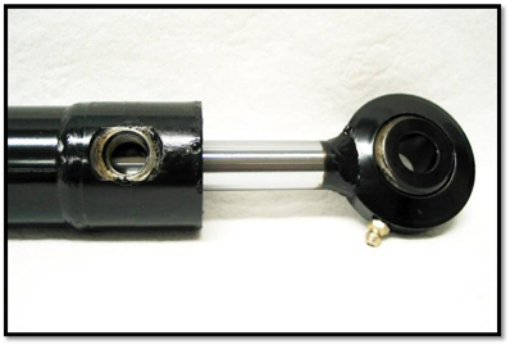
Note: Internal tolerances vary, slow down drift of attachment is normal

SERVICE SCHOOL 2013

Implement Circuit
Cylinders

Since 2005 all cylinders are a <u>welded, non-repairable cylinder</u>

- Grease zerk fittings at all pivot points
- O-ring-boss seal at cylinder ports

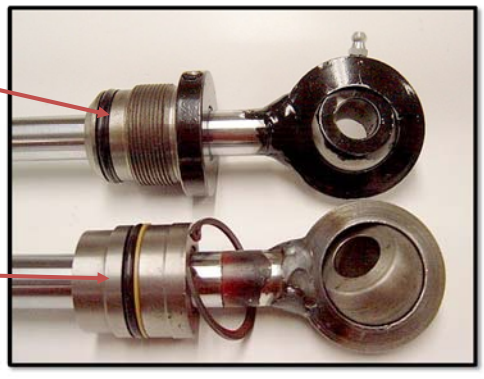


SERVICE SCHOOL 2013

Implement Circuit
Cylinders

<u>Direct Force – 03-04</u>
- •Screw-on end-caps
- •O-ring seal ports
- •Grease-able pivots

<u>Energy – 98-early 03</u>
- •Snap-ring end-caps
- •NPT fittings at ports
- •No grease zerks



Note: <u>Replace failed cylinders with new style welded cylinders</u>

SERVICE SCHOOL 2013

Implement Circuit
Cylinder Troubleshooting

Piston Seal Failure – Seal will not hold oil pressure internally

Lift Cylinder - Attachment may drift down rapidly

Steering Cylinder

- Continually turning steering wheel to maintain straight line
- Steering seems jerky or erratic
- Lose of steering in one or both directions

Rod Seal Failure – Seal allows oil to leak externally

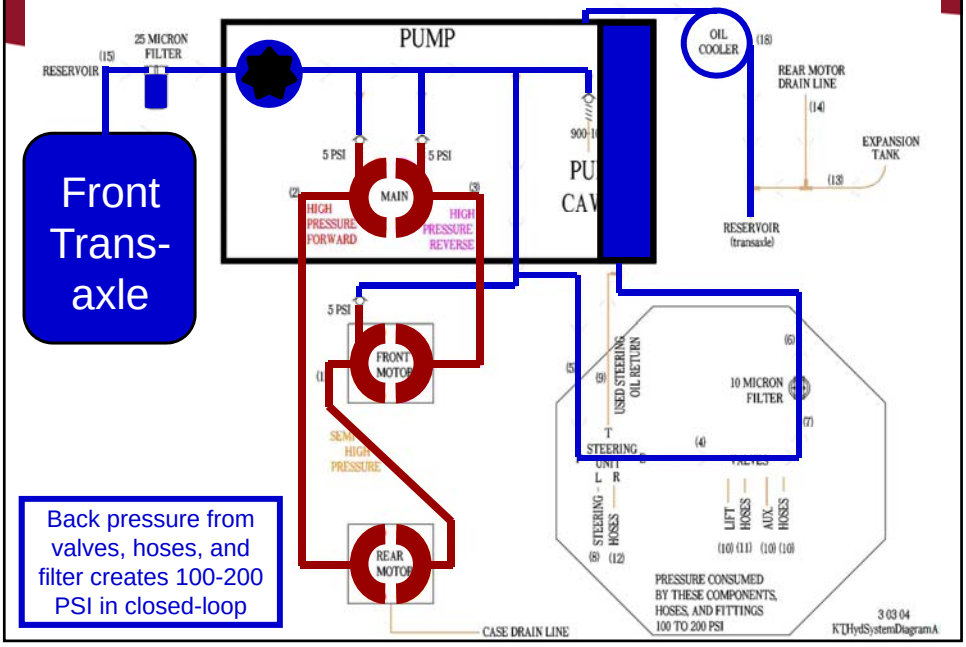
SERVICE SCHOOL 2013

Implement Circuit

Hydraulic Lines & Fittings

- All 1/4” & 3/8” hose are J.I.C flare fittings
- 4100/4200 - Implement supply and return lines from pump to steering valve are steel tube
- 4500 – Implement supply and return lines are common hydraulic hose (discontinued use of steel tube)
- All Implement circuit hoses are abrasion resistant hydraulic hose

4100/4200 & 4500 except Oil Cooler



Testing & Filtering

Checking Implement Pressure

- Install 2000 psi gauge **(Ventrac part 70.0090)** into an auxiliary quick-coupler
- Raise RPM's to full throttle
- Actuate auxiliary control lever
- Pressure should be between 900-1000 Psi at 3600 RPM's

Testing & Filtering

Remote Filtering Tool (Ventrac Part 70.0122)

- **6-micron** absolute filter cartridge (recommend replacing every 5 years)
- Backflow check valve installed

SERVICE SCHOOL 2013

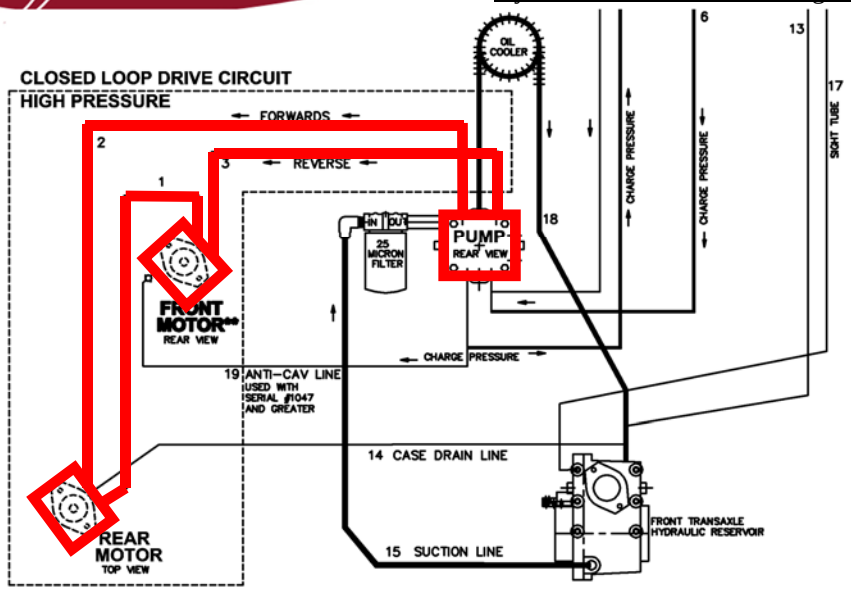
Testing & Filtering

Filtering Closed-Loop Hydrostatic Drive System

- **Filtering tool MUST be used anytime closed-loop drive system is opened!**
- **Opening the Closed Loop System Includes:**
  - Replacing **ANY** of the 1/2" hoses or fittings
  - Repairing or replacing the hydraulic pump
  - Repairing or replacing the front or rear hydraulic motor

SERVICE SCHOOL 2013

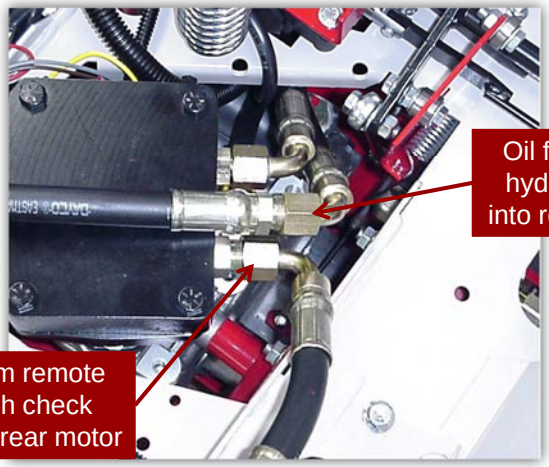
Hydrostatic Drive Circuit Diagram



SERVICE SCHOOL 2013

Testing & Filtering

Remote Filter Hookup – Rear Motor



Oil flows from hydraulic line into remote filter

Oil flows from remote filter through check valve back to rear motor

SERVICE SCHOOL 2013

Testing & Filtering

Procedure for Filtering Closed-Loop Drive System

- Attach remote filter assembly at the rear motor
- Place high/low selector in the **NEUTRAL** position
- Start engine and raise RPMS to approx 2000
- Stroke forward & reverse lever approx half stroke in reverse
- Run filtering process approx 10-min at half throttle
- Allow oil to cool before removing remote filter

Failure to perform procedure may cause severe damage and will void warranty!

SERVICE SCHOOL 2013

Hydraulic Troubleshooting

Step 1: Check Implement Circuit pressure to get a base line reading

- **Minimum** - 850 PSI
- **Maximum** – 1100 PSI (full throttle, warm oil)
- Relief set at factory - 900-1000 PSI

- Relief pressure can be increased by adding shims to pump

CAUTION:

- Damaged pump/motor or steering valve can cause low implement pressure
- Troubleshoot system **completely** before shimming pump relief valve

Hydraulic Troubleshooting

Changing Implement Relief Valve Pressure Setting

Implement relief valve located on the right side of pump

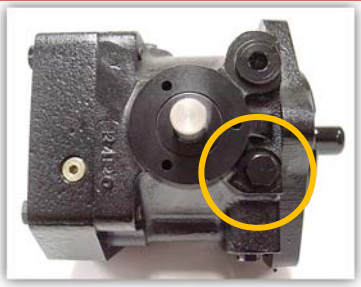
Shims insert into 5/8 hex-head cap

- .005 shim = 25-50 PSI – (21.0106)
- .010 shim = 100 PSI – (21.0094)
- .020 shim = 200 PSI – (21.0093)

Implement Relief Spring (21.0087)

- May need to replace if less than .790 inch
- **New springs** - .800 inch or greater

Not to exceed 1100 PSI (warm oil)



SERVICE SCHOOL 2013

Hydraulic Troubleshooting

Symptom - **Loss of steering & lift**, (forward/reverse are good)

Step 1: Check implement pressure

- Will most likely be very low (250-500 psi)

Probable Cause

- Internal check ball in P-port of steering valve missing or not functioning allowing oil to bypass back to tank
- O-rings in main pump end-cap may have failed, allowing oil pressure to leak internally to case of pump (O-ring part # 26.0009)

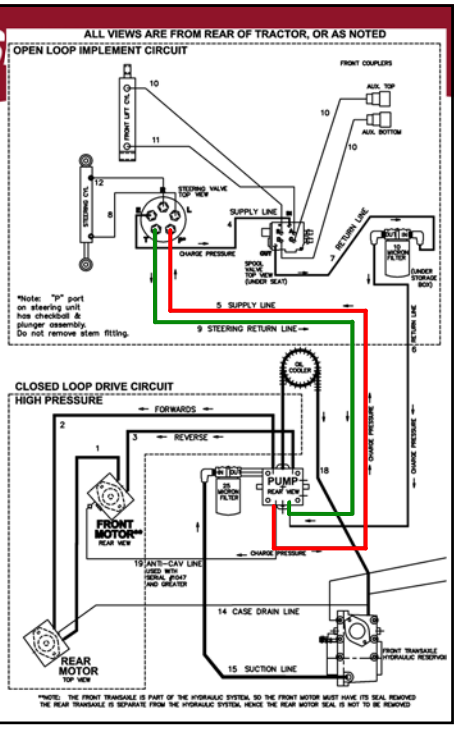
Contact Ventrac Service if unsure on repair procedures

Hydraulic Troubleshooting

Bypassing Steering Valve

Test Procedure

- Cap off **Number 9** steering return line and steering valve **T-port** stem fitting to force oil through circuit
- If the steering valve is bypassing, implement pressure will return and lift will function correctly
- **Will not be able to steer due to steering return being capped off**



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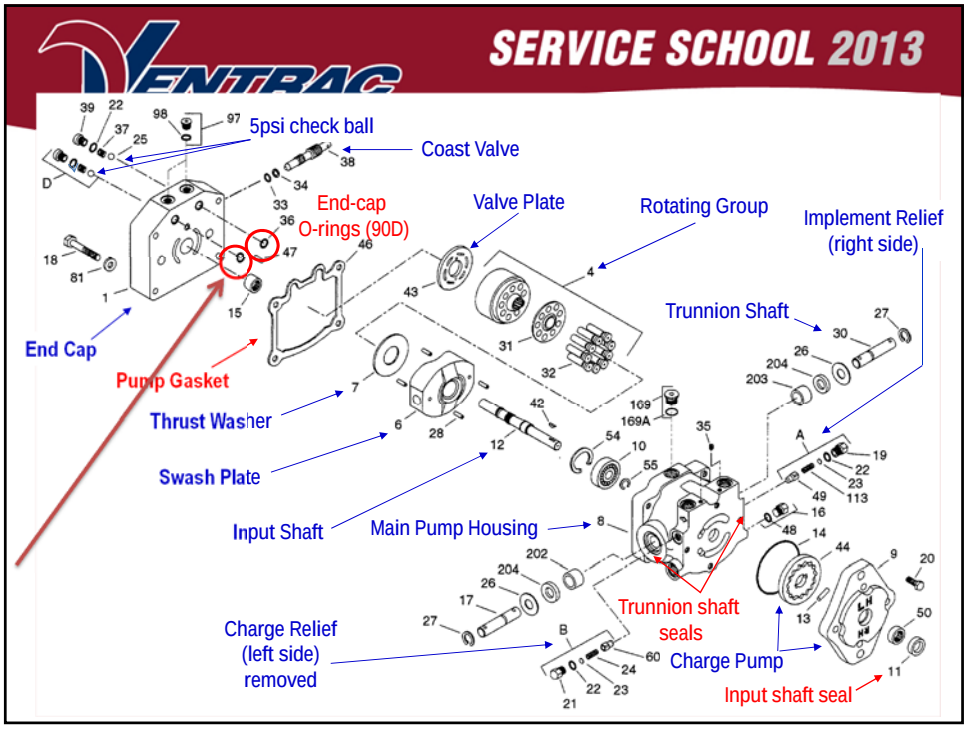
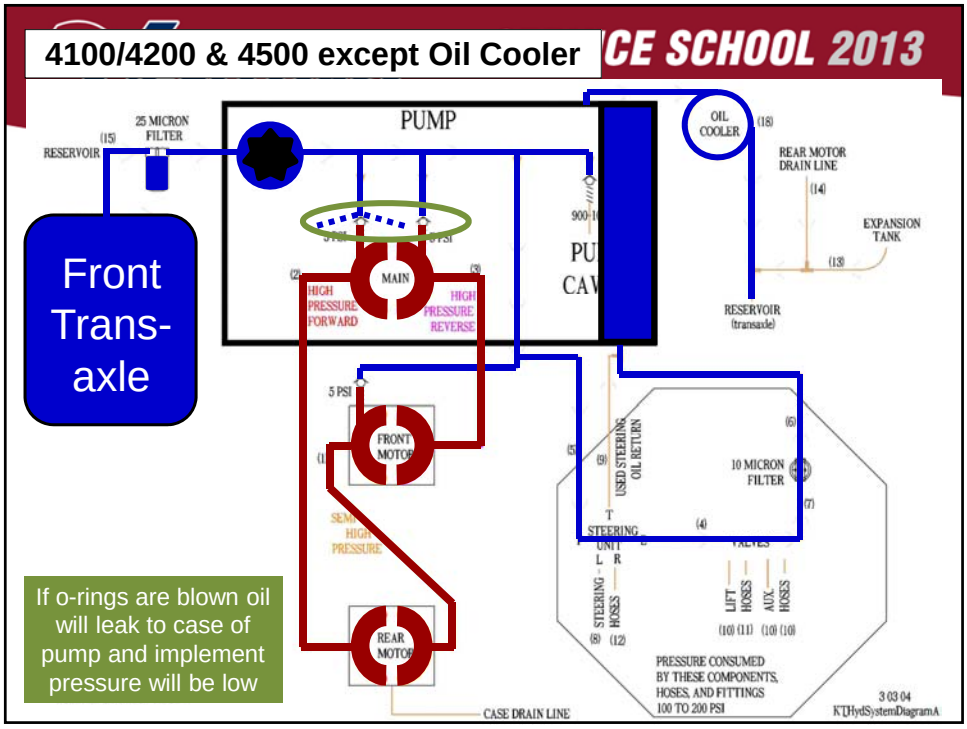
Hydraulic Troubleshooting

Testing steering valve for missing check-ball & keeper or worn seat

- If the **P-port** stem fitting was removed or loosened prior to symptom remove valve and replace check-ball & keeper

- If tractor was manufactured **prior** to **mid-2004** and P-port stem fitting was not loosened; **The check-ball and seat are worn** (replace valve, component was redesigned mid-2004)
- If test **DID NOT** restore lift & implement pressure, inspect pump end cap for failed (blown) O-rings


SERVICE SCHOOL 2013
5psi check ball
Coast Valve
End-cap
O-rings (90D)
Valve Plate
Rotating Group
Implement Relief
(right side)
Trunnion Shaft
End Cap
Pump Gasket
Thrust Washer
Swash Plate
Input Shaft
Main Pump Housing
Charge Relief
(left side)
removed
Trunnion shaft
seals
Charge Pump
Input shaft seal


4100/4200 & 4500 except Oil Cooler
CE SCHOOL 2013
Front
Trans-
axle
PUMP
25 MICRON
FILTER
RESERVOIR
OIL
COOLER
REAR MOTOR
DRAIN LINE
EXPANSION
TANK
RESERVOIR
(transaxle)
MAIN
HIGH
PRESSURE
FORWARD
HIGH
PRESSURE
REVERSE
5 PSI
FRONT
MOTOR
REAR
MOTOR
USED STEERING
OIL RETURN
10 MICRON
FILTER
STEERING
UNIT
L R
LIFT
HOSES
AUX.
HOSES
PRESSURE CONSUMED
BY THESE COMPONENTS,
HOSES, AND FITTINGS
100 TO 200 PSI
CASE DRAIN LINE
If o-rings are blown oil
will leak to case of
pump and implement
pressure will be low

SERVICE SCHOOL 2013

Hydraulic Troubleshooting
Tow/Coast Valve

Symptom – Forward/Reverse feel "spongy" (tractor moves slowly) or tractor will not move at all (Steering & lift are good)

Step 1: Check implement pressure

- Will most likely be good (900-1000 psi)

Probable Cause

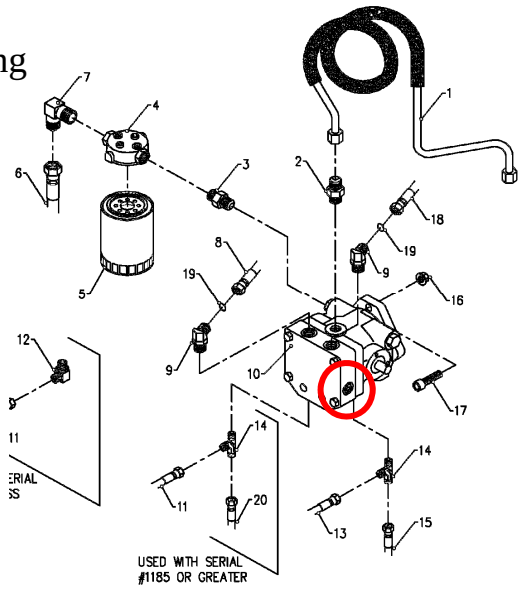
- **Tow/Coast Valve** on pump allowing oil to bypass
- Tighten Tow Valve with **3/16 inch** Allen wrench

SERVICE SCHOOL 2013

Hydraulic Troubleshooting
Tow/Coast Valve

Ventrac does not use tow valve

- **To Tow unit;** Place **high/low** lever to neutral (center) position
- Push or Tow at **SLOW speeds** only



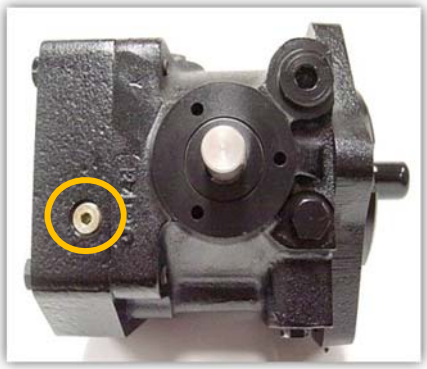
SERVICE SCHOOL 2013

Hydraulic Troubleshooting
Tow/Coast Valve

Tightening the Tow/Coast Valve

- Tighten with a 3/16" Allen wrench
- Cut short leg of an Allen wrench to a ½" (12.7mm) length
- **Ensure** the end of the Allen wrench is completely seated in the Tow/Coast valve
- **Loosen** the Tow/Coast valve, (some force may be necessary), then **firmly** retighten the valve.

Early Model 4000 Tractors – featured a ¼" Allen head shaft



SERVICE SCHOOL 2013

Hydraulic Troubleshooting
Drive Motors

Symptom – Forward/Reverse poor, (steering & lift weak while driving)

Step 1: Check implement pressure to get base line
- Will most likely be good while not driving

Step 2: Load hydrostatic drive system
- Push against something solid or climb steep hill
- Do this is both forward and reverse direction

Step 3: Check implement pressure while loading drive system
- If pressure is low in **Forward** motion **Rear** motor is damaged
- If pressure is low in **Reverse** motion **Front** motor is damaged
- If pressure is **low** in **both directions; both motors** are damaged

Hydraulic Troubleshooting

Poor Drive Motor/Pump Performance

Probable Cause

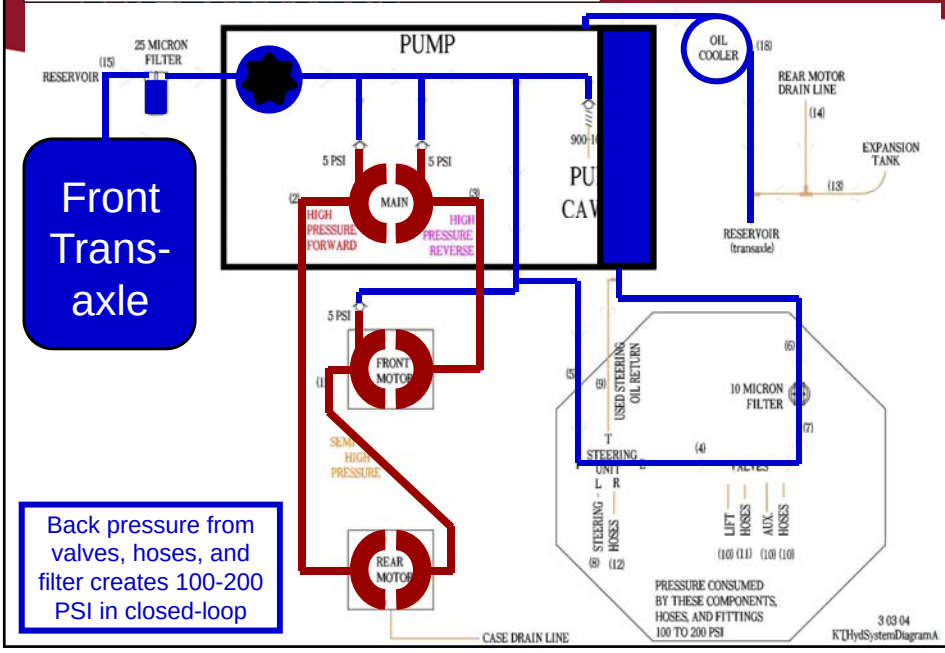
- **Damage from Contamination**
  - Non – OEM replacement hoses (steel-braid filings or hose particles)
  - Repairing pump or motor (outside dirt)
  - Not using the remote filtering tool after repairs

Other Possible Causes

- Towing unit without shifting transaxles to neutral **(damages rotating group)**
- Operating with insufficient lubrication
- **Note:** When opening the **Closed-Loop Drive System** to repair a pump/motor; **INSPECT ALL THREE for possible damage**

SERVICE SCHOOL 2013

4100/4200 & 4500 except Oil Cooler



VENTRAC SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Checking Hydraulic Oil Level

4100/4200

Inspect clear sight tube at expansion tank

- Oil level should be in safe zone of decal
- **Do not overfill** or oil will push out overflow breather hose
- Hydraulic system capacity = **12 Quarts**
  - Drain & fill = aprox. 9 quarts

Oil level

4500

VENTRAC SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Hydraulic Oil & Filters

4100/4200 Hydraulic Oil Filters

- Two 30gpm (paper element) filters
- Non-bypass filter heads

10-Micron Return Line Filter

25-Micron Suction Line Filter

SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Hydraulic Oil & Filters

4500 Hydraulic Oil Filters

- **Suction Filter** – Filters all incoming oil to pump
  - 25 Micron (Synthetic Media) Filter
  - 30-GPM, (non-bypass filter head)
- **Return Filter** – Filters "Implement Circuit" return oil
  - 10 Micron (Paper Element) Filter
  - 6-GPM, (non-bypass filter head)

SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Hydraulic Oil & Filters

Return Line Filter - 10-micron

- Filters all Implement Circuit oil before returning to front transaxle
  - On an average, all implement circuit oil passes through the 10-micron filter once every min @ 3600 RPM
  - Eliminates contamination from entering the system through auxiliary hydraulic couplers!
- **Implement Circuit Includes:** steering, lift, 3-point and auxiliary couplers

SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Hydraulic Oil & Filters

Service Interval

- **4100/4200**
  - Hydraulic filters, hydraulic oil & rear transaxle oil = 5 years or 2000hrs
- **4500**
  - Hydraulic filters = 1 year or 1000hrs (smaller 6gpm return filter)
  - Hydraulic oil, rear transaxle oil = 5 years or 2000hrs

(See maintenance chart in operators manual)

Exceptions

- Replace hydraulic oil & filters any time the system has been contaminated with Dirt, Water or Metal from component failure

Hydraulic Oil

- **Ventrac ® Hydro-Torq XL** 5W-30 Full Synthetic (Jan 2007)
- **Amsoil ATH 30** Synthetic Tractor Hydraulic (prior to 2007)

Note: Both synthetic oils are compatible with petroleum based oils

SERVICE SCHOOL 2013

Hydraulic Service & Maintenance

Synthetic Hydraulic Oil

Ventrac HydroTorq ® Synthetic Hydraulic Oil Advantages

- **High Viscosity Index - (160)**
  - More stable under temperature extremes
  - Maintains proper lubrication at high operating temperatures
- **Low Pour Point** – flows to temperatures as low as **-47°F**
  - Better cold start protection and lubrication
- **High Shear Factor - (film strength)**
  - Ability to maintain a film of oil between moving parts at higher temperature and pressure.
- **Additive Package** - Anti-foam, Anti-wear and Oxidation Inhibitors

Transaxles

2600 Series Peerless Transaxles

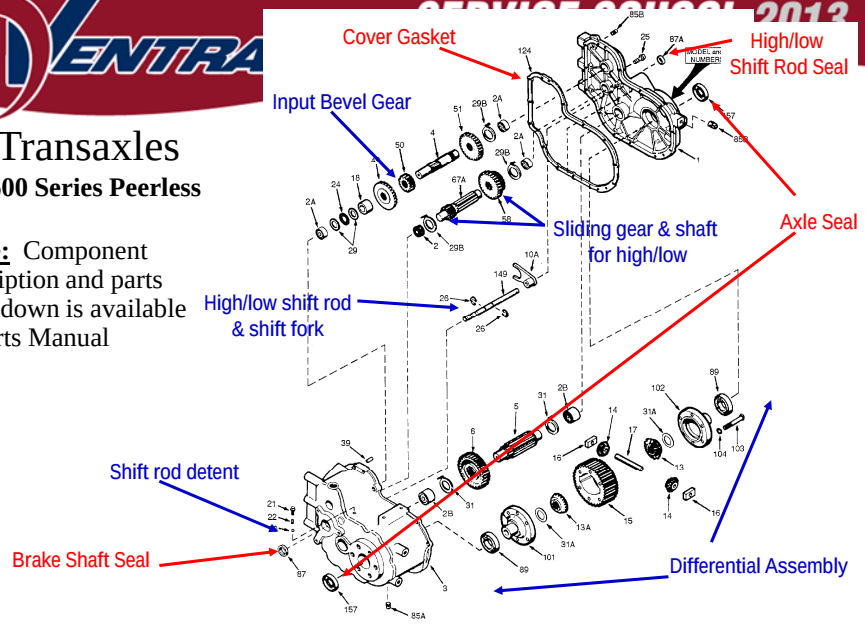
- **Two speed** transaxles – **High range** 10mph / **Low range** 5mph
  (One lever shifts both axles)
- **Extremely durable** - Very few internal component failures
- **New transaxle casting design** (January 2006)
  (Eliminated potential for porosity and stress cracks)

SERVICE SCHOOL 2013

Transaxles

2600 Series Peerless

Note: Component description and parts breakdown is available in Parts Manual



SERVICE SCHOOL 2013

Transaxles

Rear Axle Oil & Service

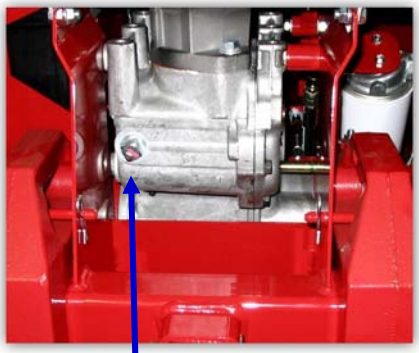
Rear Transaxle is Independent

- Uses the same oil and service interval as hydraulic system
- Oil capacity = **4.5-quarts**
- Check oil level every **250hrs**
  - Should be close to bottom of 3/4 inch hole at rear of transaxle

Both transaxles have drain ports on bottom

- 3/16 inch Allen wrench on rear
- 5/16 inch Allen wrench on front

Not part of the hydraulic system



Oil fill plug

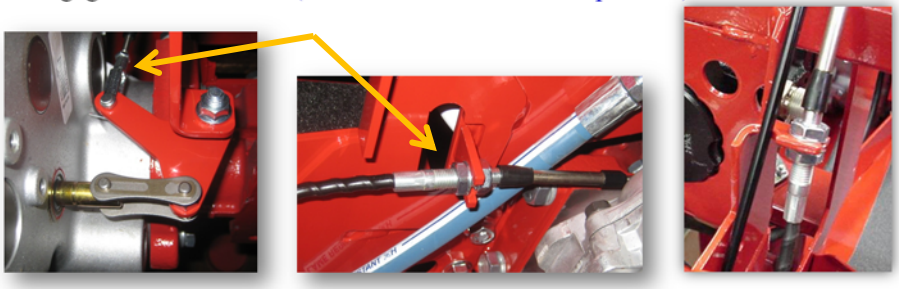
SERVICE SCHOOL 2013

Transaxles

High/Low Shift Cable Adjustment

Front transaxle is connected to Rear transaxle by adjustable cable

- If rear axle gear noise is observed in high or low, shift-rod may not be moving far enough to reach the detent position
- Adjust **cable anchor** and/or **turnbuckle** until proper shift rod and gear engagement is obtained (shift-rod must reach detent position)



TIP: Remove master link and move shift-rod manually into detent position and then test unit **(Ensure both axles are in same range!)**

SERVICE SCHOOL 2013

Axles & Hubs

Description

Current Axle on 4100/4200/4500

- 40mm (1 9/16) forged shaft and hub (one piece assembly)
- Ribbed housing, larger bearing (bearing moved closer to hub)
- Backup oil seal behind axle bearing
- 4200 - WEB2555 (August 2006) 4100 - KEC1501 (August 2007)

SERVICE SCHOOL 2013

Axles & Hubs

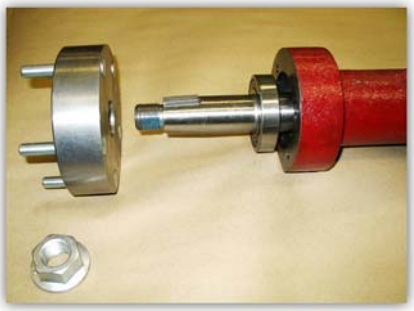
Description (cont)

Earlier Units

- 35mm (1 3/8") shafts with tapered keyway, hub assembly and 1" lock nut

- To replace bearing remove locknut & hub and press bearing off of shaft

Note: Axle Nut Torque 350 foot pounds (474.53 Nm)



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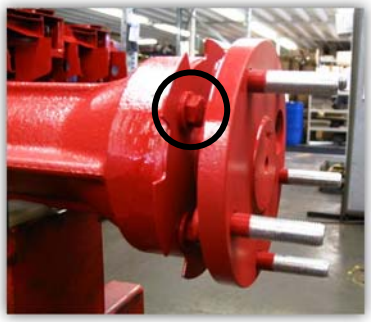
Axles & Hubs

Axle Removal Procedure

- Remove 4-bolts holding bearing in place
- Slide shaft & bearing out from axle housing
- Axle oil seal is between the transaxle and axle housing



VENTRAC SERVICE SCHOOL 2013

General Maintenance

Lubrication Points

Front hitch arms

- Grease zerk fittings at pivot points
- Replaceable pivot bushings

Upper Center Pivot

- Greaseable & replaceable

Cylinders & Lower Center Pivot

- Lift, steering & 3-point all have grease zerks at ends
- Newer units have grease zerk fittings on lower pivot bar

SERVICE SCHOOL 2013

Service & Maintenance

Tires & Duals

Single Tires - Standard HD Field Trax Tire

- **9-12** psi is recommended for normal tractor operations
  - (Factory setting is 9-psi)
- May use up to **16** psi depending on application such as:
  - Lifting heavy loads with the Loader, Slip Scoop etc

Using Dual Tires

- Outside tire pressure - **5 psi (or half of inner tire)**
- Torque spec for dual draw-bolt – **120 ft. lbs.**
- Duals **are not** to be used with the **loader attachment**

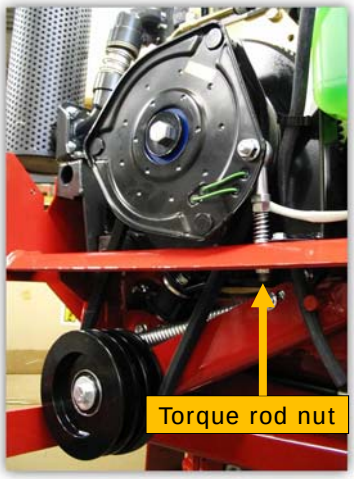
SERVICE SCHOOL 2013

Service & Maintenance

Changing PTO Belt

4200 Briggs 3/LC Engines

- Remove belt from double idler pulley
- Remove torque rod nut from bottom of frame cross member
- Disconnect the clutch wire plug (Right-side)
- Remove belt and replace with new one
- Reinstall clutch wire and torque rod and nut



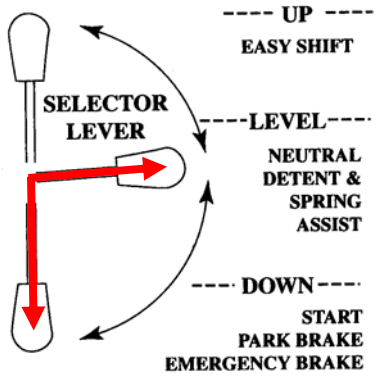
VENTRAC SERVICE SCHOOL 2013

Service & Maintenance

Neutral Adjustment

4100/4200 Control Selector

- **Park brake** position (Down)
  - **Spring assist to neutral** position (Level/Center)
- The tractor should come to a complete stop and you should not here any pump whine
- If **pump noise** is observed in **either position**, the pump neutral arm may require adjustment



VENTRAC SERVICE SCHOOL 2013

Service & Maintenance

Pump Neutral Adjustment

4100/4200 Pump Neutral

- Shift transaxles to neutral or raise unit off the ground
- Start engine, move park lever to center position (spring assist to neutral)
- Loosen both jamb nuts on F/R linkage rod connected pump control arm
- Slightly loosen 5/16 nut (slotted hole below right weight transfer chains)
- Move bolt until pump whine stops

Tip: Tapping wrench while nut still has some tension applied, work best!

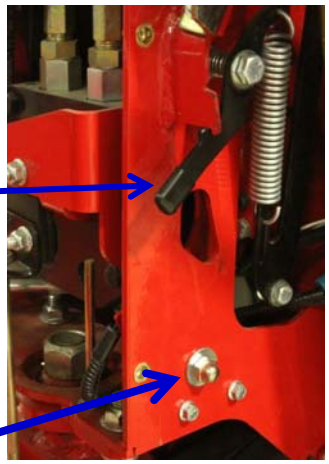
SERVICE SCHOOL 2013

Service & Maintenance

Pump Neutral Adjustment

4500 Pump Neutral

- Support unit off ground so tires may spin freely
- Set parking brake and place a weight on the seat to activate operator presence seat switch
- Place the "Neutral Assist" lever in "On" position (down) to engage neutral assist spring
- Start unit and run engine at 2000 RPM's
- Release parking brake and observe direction of tire rotation. If tires rotate forward, neutral adjustment bolt must move up in frame slot.
- Loosen "Acorn" nut slightly, tap with a rubber mallet until tires stop rotating



Note: See Operator Manual pg 56 for complete instructions.

SERVICE SCHOOL 2013

Service & Maintenance

Pump Neutral (Micro) Switch

4500 Neutral Switch Adjustment

- When adjusted properly the "Neutral Switch" light input on the TCM should be **"On"** when SDLA lever is in the "Neutral" position but go **"Off"** out as soon as the SDLA lever is moved in the forward or reverse direction
- The neutral switch mounting bracket has 2 slotted holes, loosen bolts and adjust by rotating bracket forward or backward
- See owner/operator manual pg 56-57 for detailed instructions on how to properly adjust

4100/4200 Parking Brake Adjustment

- 16 Square inches of braking surface
- Adjust brake tension by tightening lock nut on top of linkage rod
- Adjust brake so tractor will not roll when brake is engaged on a hillside

SERVICE SCHOOL 2013
Service & Maintenance
Parking Brake

4500 Parking Brake Adjustment

- 16 Square inches of braking surface
- Adjust brake tension by tightening the lock nut on the bottom of the brake rod
- If more brake tension is needed loosen the jamb nut at the top of the brake rod and thread the rod further into the rod end
- Adjust brake so tractor will not roll when brake is engaged on a hillside

SERVICE SCHOOL 2013

Service & Maintenance

Steering Turning Radius

- Three turning radius adjustment holes
- When using duals move cylinder to center hole
- When using a cab move cylinder to outside hole

SERVICE SCHOOL 2013

Service & Maintenance

Clutch Air Gap

Check Annually or When Installing New Clutch

- **Clutch Air Gap** should be **.020 inches**
- Use feeler gauge between silver & black discs at the three access slots
- **Symptoms:** Clutch will engage when cold but not when clutch is hot after use

SERVICE SCHOOL 2013

Service & Maintenance

"Burnishing In" a New Clutch

Burnishing – the process of **engaging clutch momentarily** & then **disengaging it** and allowing it to stop so to properly "seat in" new PTO clutch discs

Procedure

- Set engine at 1450 RPM's – Burnish for 10 times
- Set engine at 2900 RPM's – Burnish for 10 times
- Set engine at full RPM's – Burnish for 10 times
- Allow clutch to cool before doing final adjustments
- Repeat procedure for Setting Air Gap

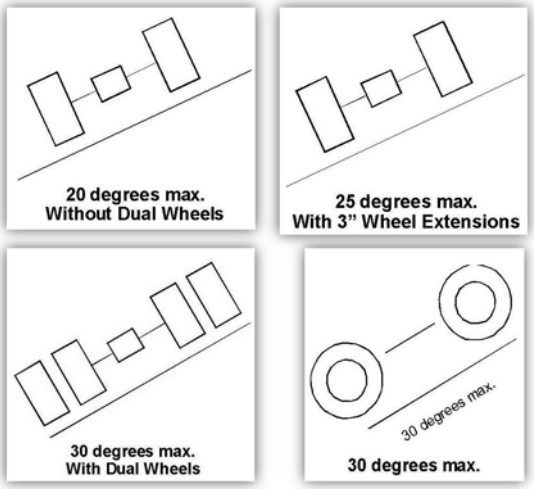
SERVICE SCHOOL 2013

Operation & Safety

Slope / Hillside Operation

Slope Operation

- **Single tires** – Standard factory tire setup - **20º**
- **Single tires with 3" wheel extensions added** - **25º**
- **Dual Wheel Option** - **30º**
  - **Up & Down or Sideways**



SERVICE SCHOOL 2013

4500 Electrical System

Electrical Schematic Explanation

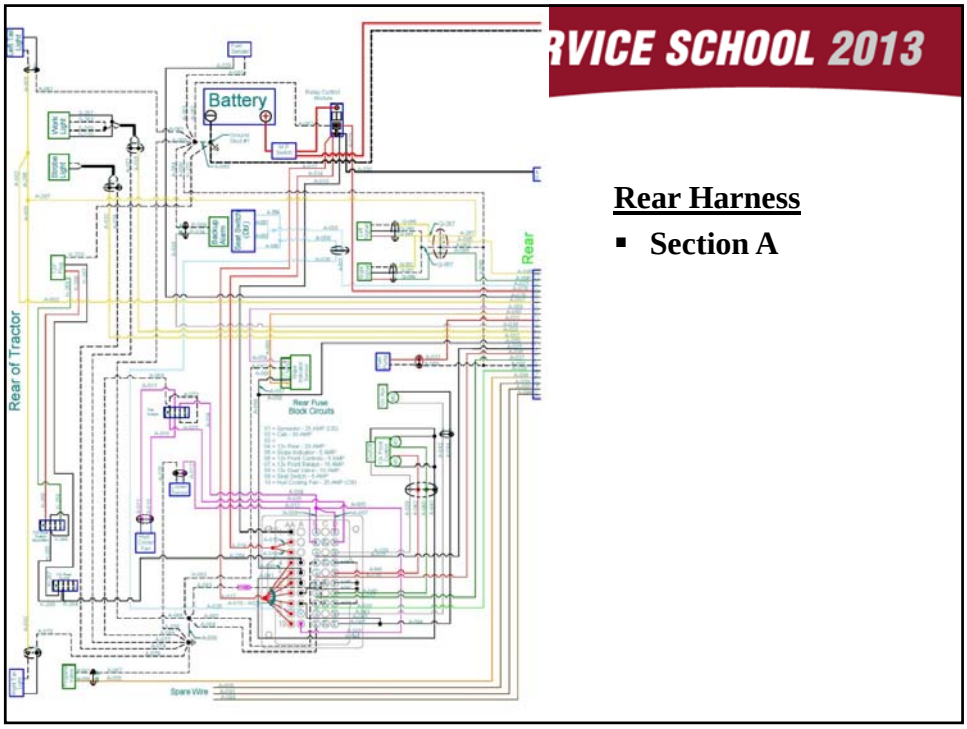
- **Harness Design** - Tractor harness broken up into 4 primary sections
  - Rear Harness - Section A
  - Dash Harness - Section B
  - Front Harness - Section C
  - Engine Harness Sections
    - B&S 31hp air-cooled (4500K) – D
    - Kawasaki 31hp DFI (4500P) – E
    - Kubota 32hp Gas (4500Z) – F
    - Kubota 25hp Diesel (4500Y) – G

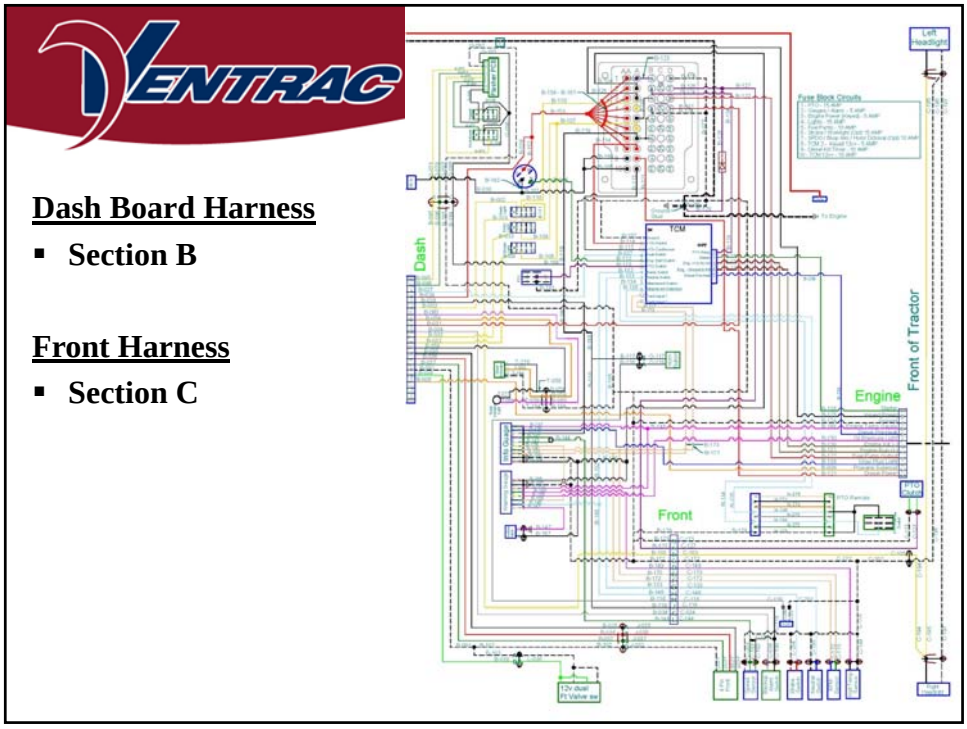
SERVICE SCHOOL 2013

4500 Electrical System

Electrical Schematic Explanation

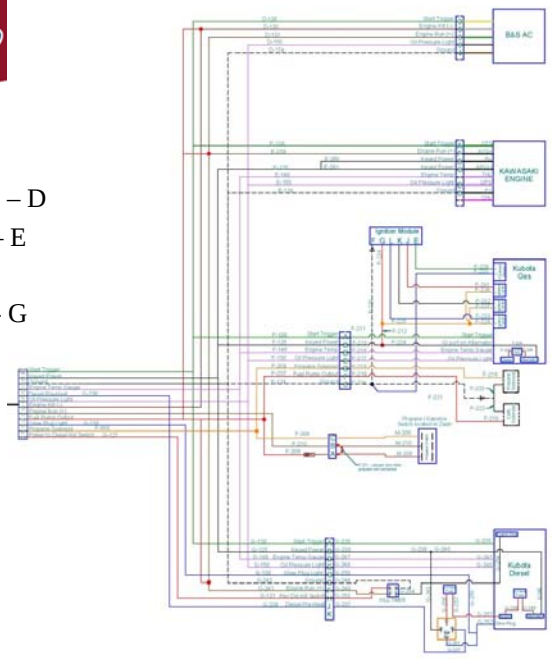
- **Optional Accessory Kits (Plug & Play Harness)**
  - H and I were left open for future kit expansion
  - 12 volt Front – Section J
  - 12 volt Rear – Section K
  - 12 volt Dual Hydraulic Valve – Section L (not yet available)
  - Propane – Section M
  - PTO Remote (for Generator) – Section N
  - Horn – Section O
  - Backup Alarm – Section P
  - Directional Lights – Section Q
  - Strobe Light – Section R
  - Work Lights – Section S
  - Slope Indicator – Section T
  - U – left open for future expansion


RVICE SCHOOL 2013
Battery
Rear of Tractor
Rear
Rear Fuse Block Circuits
Spare Wire
Rear Harness
Section A


VENTRAC
Dash Board Harness
Section B
Front Harness
Section C
Dash
TCM
Front of Tractor
Engine
Front
Left Headlight

Engine Harness

- B&S 31hp air-cooled (4500K) – D
- Kawasaki 31hp DFI (4500P) – E
- Kubota 32hp Gas (4500Z) – F
- Kubota 25hp Diesel (4500Y) - G



SERVICE SCHOOL 2013

4500 Electrical System

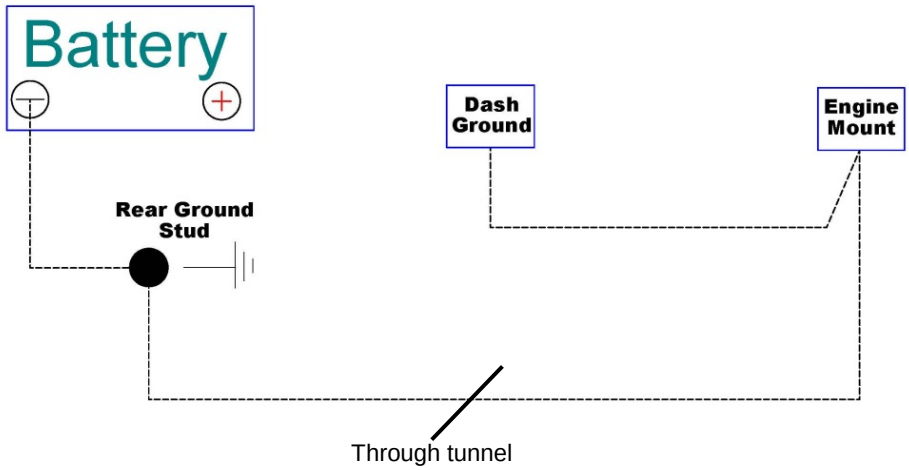
Wire Labeling & Harness Code

- Lettering System
- Wire Identification Number
- Wire Color and Circuit Type
  - Black – Ground
  - Dark Blue – Pre Heat
  - Lt Blue – Safety Circuit
  - Brown - Engine Run / Kill
  - Gray – 12v Aux / Horn Power
  - Green – Start / Speed (mph & kph) Directional
  - Light Green – 12v Aux
  - Orange – Propane / Slope
  - Pink – Alarm
  - Purple – PTO
  - Red – Power
  - Tan – RPM
  - White – Power
  - Yellow - Lights / Directional

SERVICE SCHOOL 2013

4500 Electrical System

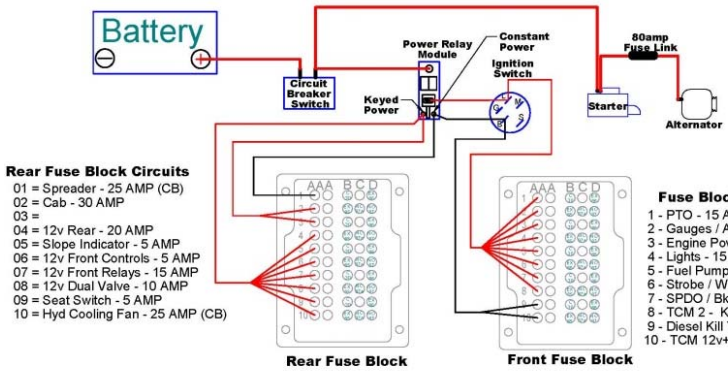
Ground (Negative) Circuit



SERVICE SCHOOL 2013

4500 Electrical System

Positive Circuit



Rear Fuse Block Circuits

01 = Spreader - 25 AMP (CB)
02 = Cab - 30 AMP
03 =
04 = 12v Rear - 20 AMP
05 = Slope Indicator - 5 AMP
06 = 12v Front Controls - 5 AMP
07 = 12v Front Relays - 15 AMP
08 = 12v Dual Valve - 10 AMP
09 = Seat Switch - 5 AMP
10 = Hyd Cooling Fan - 25 AMP (CB)

Fuse Block Circuits

1 - PTO - 15 AMP
2 - Gauges / Alarm - 5 AMP
3 - Engine Power (Keyed) - 5 AMP
4 - Lights - 15 AMP
5 - Fuel Pump - 10 AMP
6 - Strobe / Worklight (Opt) 15 AMP
7 - SPDO / Bkup Alm / Horn/ Dctional (Opt) 10 AMP
8 - TCM 2 - Keyed 12v+ - 5 AMP
9 - Diesel Kill Timer - 10 AMP
10 - TCM 12v+ - 10 AMP

4500 Electrical System

TCM - (Tractor Control Module)

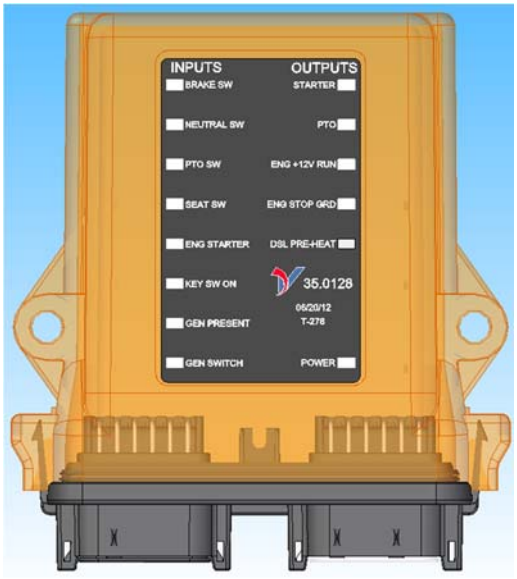
- Controls all Safety Circuits & Time Delay Functions
  - Reduction of Relays (11 relays w/o TCM plus kits)
- The only connection between the TCM and the gauges is the trigger pick up for the tachometer and the brake switch

SERVICE SCHOOL 2013

4500 Electrical System

TCM – (Tractor Control Module)

- Functions
- Safety Circuit
- Pre-Heat Timer
  - Key on – 6 Seconds
  - Key in Start Position – Continuous
  - Key on, Engine started - 5 seconds



SERVICE SCHOOL 2013

4500 Electrical System

TCM – Troubleshooting

Tractor Function	Power	Brake Switch	Neutral Switch	PTO Switch	Seat Switch	Engine Start	Key Switch	Generator Present	Generator Switch
Engine Start	X	X	X			X	X		
PTO Engage	X			X	X		X		
PTO Engage with Generator	X	X	X	X			X	X	X
Engine run without operator in seat	X	X	X				X		
Engine run with operator in seat	X				X		X		
Engine Stop - Coil Ground	X								

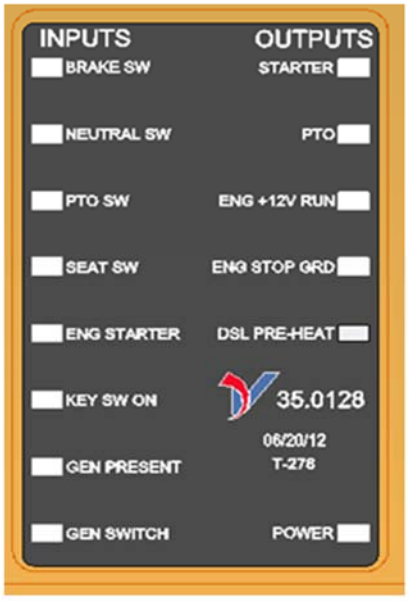
SERVICE SCHOOL 2013

4500 Electrical System

TCM - (Tractor Control Module)

Troubleshooting

- Where to start looking



SERVICE SCHOOL 2013

4500 Electrical System

Electrical Components Explanation

- **Battery Disconnect Switch** (150 amp circuit breaker)
  - Recommend switching off when not operating unit (daily)
  - May drain battery is switch is left on more than a week or two
- **Power Relay Module**
  - Two 50 amp fuses
- **Gauges & Sending Units**
  - **Oval Information Gauge** (RPM, Speed, Hours, Temp, Fuel, Glow-plug light)
  - **Fuel sending unit**
    - 240-265 ohms for an empty tank, 20-30 ohms on full tank
  - **Round Alarm Gauge**
    - Voltage readout & alarm, temp alarm, oil pressure alarm, park brake light
- **Switches**
  - Switches are new “Otto” brand switches similar to cab switches. (K5)

SERVICE SCHOOL 2013

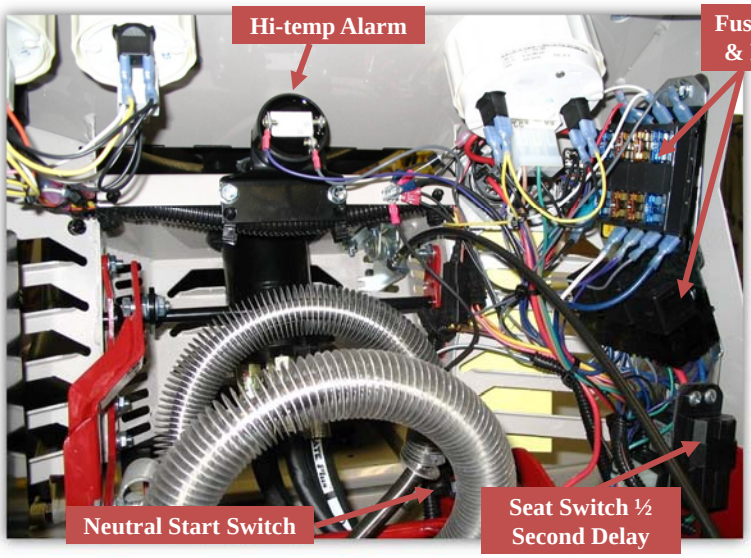
4500 Electrical System

Connectors & Terminal Types

Terminal	Terminal Crimpers	Terminal Removal Tool
Weather Pack - (20 amp)	72.0026 – Red Handle 408	72.0030 – Yellow Handle 421
Metri-Pack 150 - (14 amp)	72.0027 – Black Handle 509	72.0029 – Green Handle 422
Metri-Pack 280 - (30 amp	72.0027 – Black Handle 509	72.0029 – Green Handle 422
Metri- Pack 630 - (46 amp)	72.0026 – Red Handle 408	72.0029 – Green Handle 422
Metri-Pack 800 - (60 amp)	72.0026 – Red Handle 408	72.0029 – Green Handle 422
GT150 - (15 amp)	72.0026 – Red Handle 408 72.0027 – Black Handle 509	72.0029 – Green Handle 422
Deutsch - (13 amp)	72.0028 – Deutsch HTD-48-00	Extra Small Screw Driver (flat)
Souriau - (15 amp)	72.0027 – Black Handle 509	72.0031 – Black Handle

SERVICE SCHOOL 2013

4100/4200 Electrical System



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4100/4200 Electrical System

Inline Fuses

All Briggs and Stratton Vanguard Engines

- 1 fuse in starter wiring harness

All Kawasaki Engines

- 2 fuses in starter wiring harness

SERVICE SCHOOL 2013

4100/4200 Electrical System
Ground Connections (all units)

Dash Panel Electrical Components

- Dash panel components are grounded by a 10/32 inch bolt under the dash panel

Rear Frame to Battery

- 10 gauge wire under seat, runs from negative battery terminal to the frame
- If wire is melted or looks like it has been hot check main battery ground at engine

SERVICE SCHOOL 2013

4100/4200 Electrical System
Ground on Briggs 3/LC Engines

Engine to Frame

- Braided cable grounds engine to frame at right front motor mount

Lights, Clutch & Ignition Module

- Left front side of engine.
- 16 gauge wire runs up 10/32 inch bolt under dash to supply component ground

SERVICE SCHOOL 2013

4100/4200 Electrical System

Ground on Briggs 3/LC Engines

Negative ground cable - Right rear of engine block

- Originally mounted to right rear motor mount bracket
- Moved cable to engine block due to powder coat paint not allowing good ground
- If **starter cranks slow, check negative** cable for proper grounding

SERVICE SCHOOL 2013

4100/4200 Electrical System

Ground on Kawasaki 27Hp Engine

Negative Battery Cable

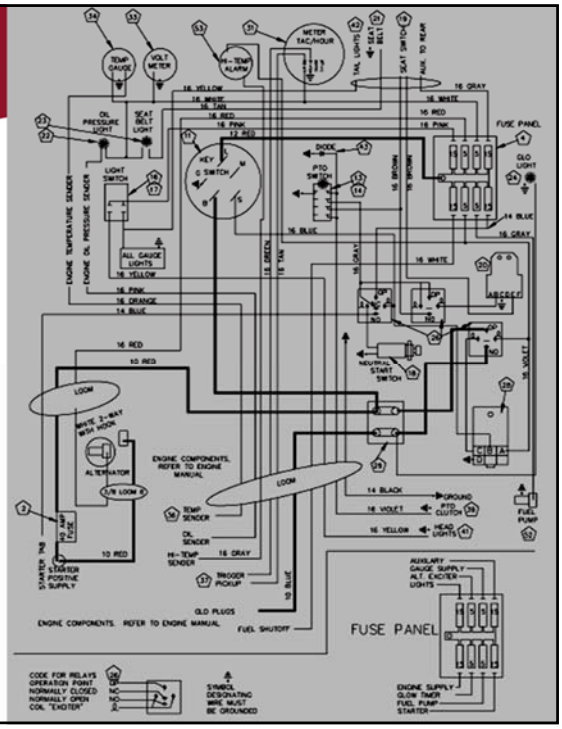
- **Left front** – mounted directly to engine block

Electric Clutch & Lights

- Left front side of engine.
- 16 gauge wire runs up 10/32 inch bolt under dash to supply component ground

4100/4200 Electrical Schematic

Schematic in parts manual specific to each engine option



SERVICE SCHOOL 2013

Kubota Engine Training

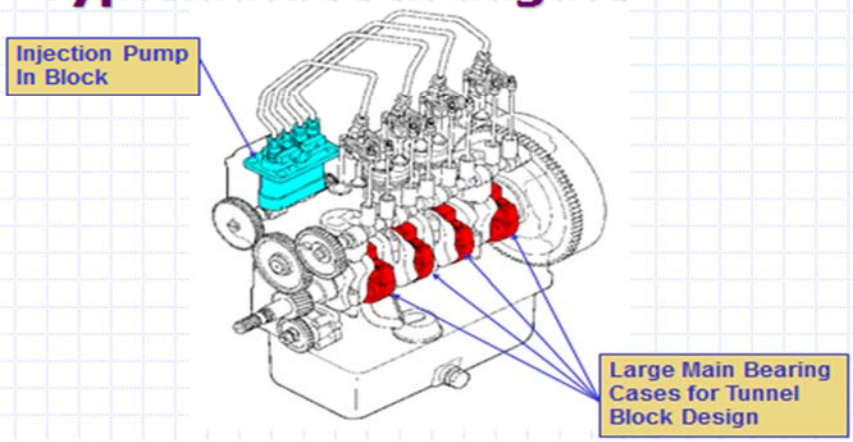
Z602/D902 & WG972 Comparison

- Exactly Like A Z482/D722 or WG752 Except:
- Larger Bore and Stroke than Super Mini
- Molybdenum Disulfide Coated Pistons
- Half-float Head Cover
- Oil Pan attaches to block and gearcase

VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training

Typical Kubota Engine



VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training

Engine Overhaul Marks

Connecting Rod:

Numbers must line up, and must be installed toward injection pump side

Main Bearing Cases:

Marked "Flywheel" on flywheel side of case

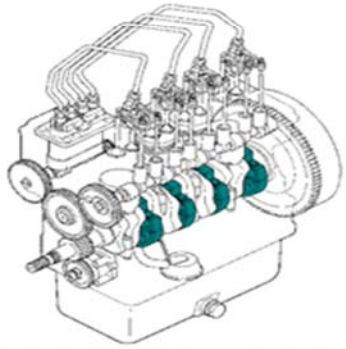
Pistons: Arrow on piston must point toward injection pump side of engine (Diesel) or exhaust side (Gas).

VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training

Main Bearing Cases

- Main Bearing Cases are marked on flywheel side.
- Installing backward can result in oil starvation to bearings
- Cases may be smaller toward front of engine



VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training

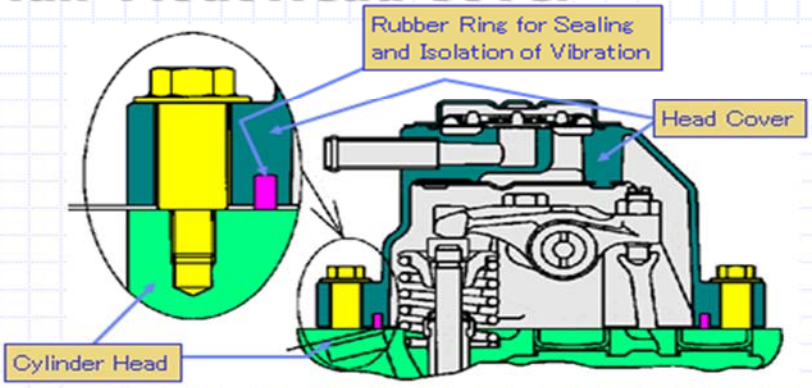
Molybdenum Disulfide Coated Pistons

- Molybdenum Disulfide Coating allows for less clearance on cold starts
- Lower noise from piston slap
- Reduces possibility of scoring on cold startup

SERVICE SCHOOL 2013

Kubota Engine Training

Half-Float Head Cover



Half-Float Head Cover reduces noise by 2 decibels!

SERVICE SCHOOL 2013

Kubota Engine Training

Gaseous Fuels

- Gasoline
  - Fuel must be Vaporized and Mixed with Air
  - Vaporizing and Mixing done in Carburetor
  - OR
  - Fuel Injection sprays a mist into the intake manifold vaporizing and mixing air and fuel
- Propane
  - Fuel Vaporized in Vaporizer
  - Mixing Done in Mixer or Carburetor

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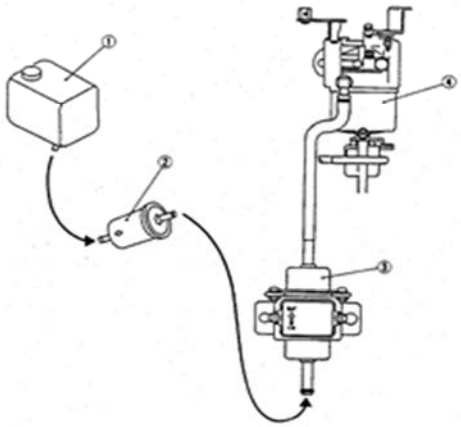
Kubota Engine Training

Typical Gasoline Fuel System



1. Fuel Tank
2. Fuel Filter
3. Fuel Pump (Electric)
4. Carburetor

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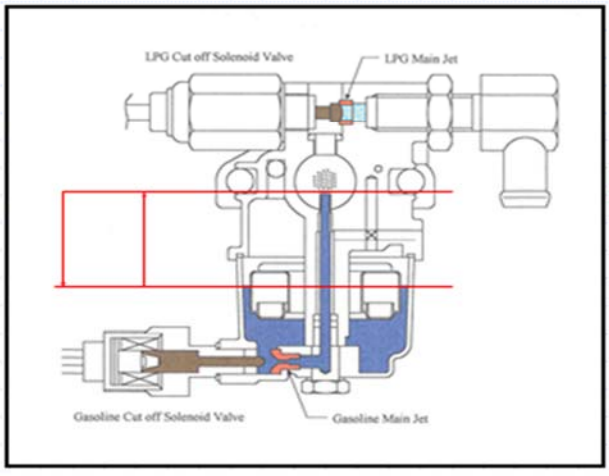
Kubota Engine Training

Carburetor



- Gasoline or Gasoline and Propane
- Solenoid to shut off fuel

Propane Vaporizer

- Primary Chamber. Liquid fuel is decompressed and evaporated.
- Secondary Chamber. Decompresses gas to approximately atmospheric pressure.
- Water Passage. The engine coolant is used to supply heat to evaporate the LPG.
- Vacuum Lock Chamber. Locks fuel in the primary chamber when engine is off.
- **Not Field Serviceable.**

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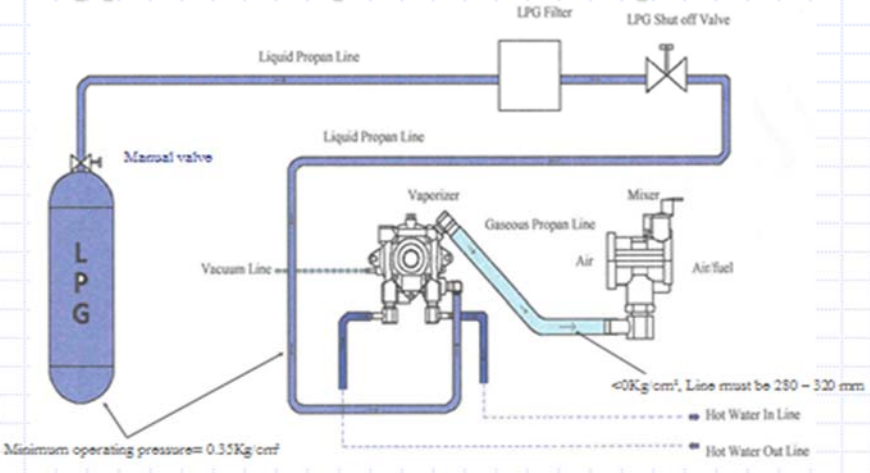
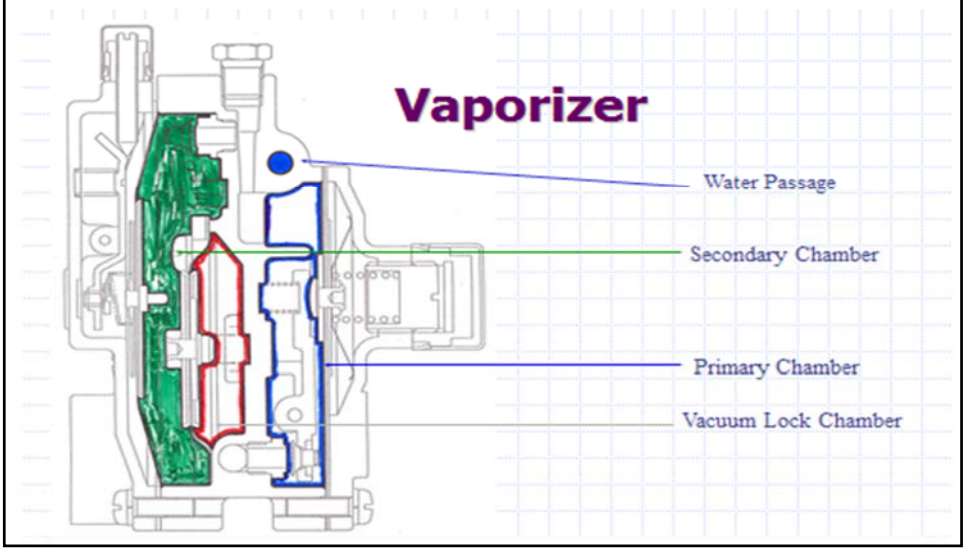
Kubota Engine Training

Typical Propane Fuel System



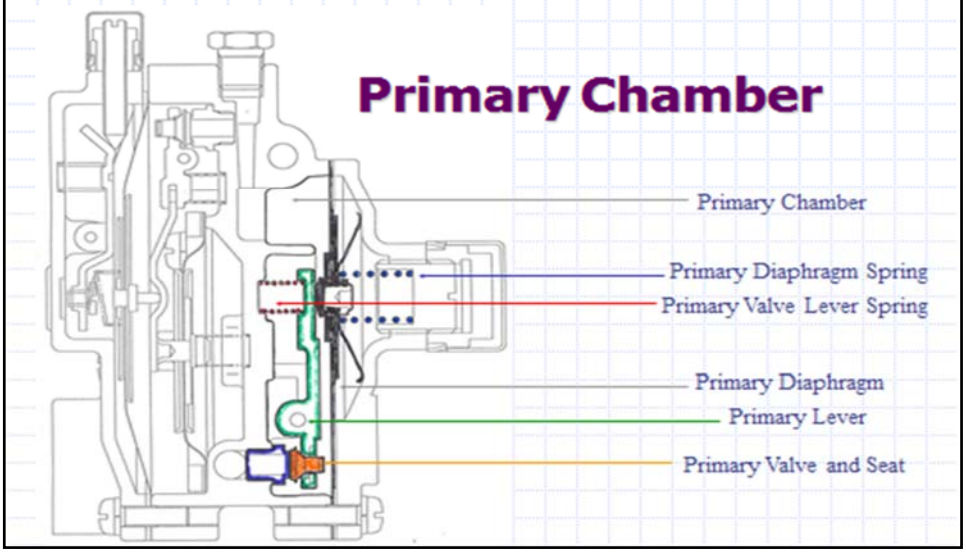
VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training



VENTRAC SERVICE SCHOOL 2013

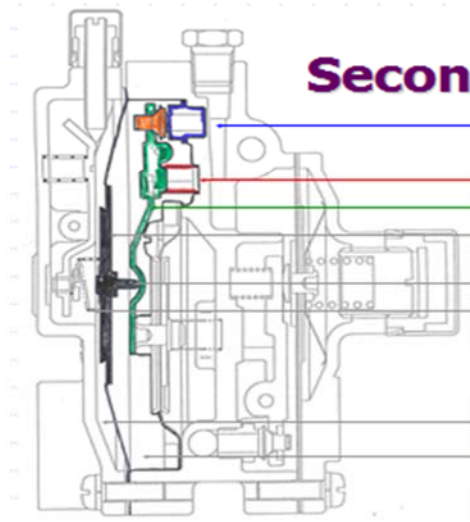
Kubota Engine Training



SERVICE SCHOOL 2013

Kubota Engine Training

Secondary Chamber

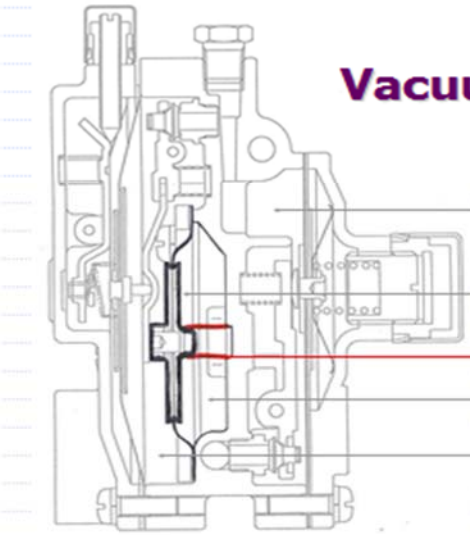


- Secondary Valve and Seat
- Secondary Lever Spring
- Secondary Valve Lever
- Secondary Diaphragm
- Diaphragm Pin
- Balance Spring
- Atmosphere Chamber
- Secondary Chamber

SERVICE SCHOOL 2013

Kubota Engine Training

Vacuum Lock Chamber

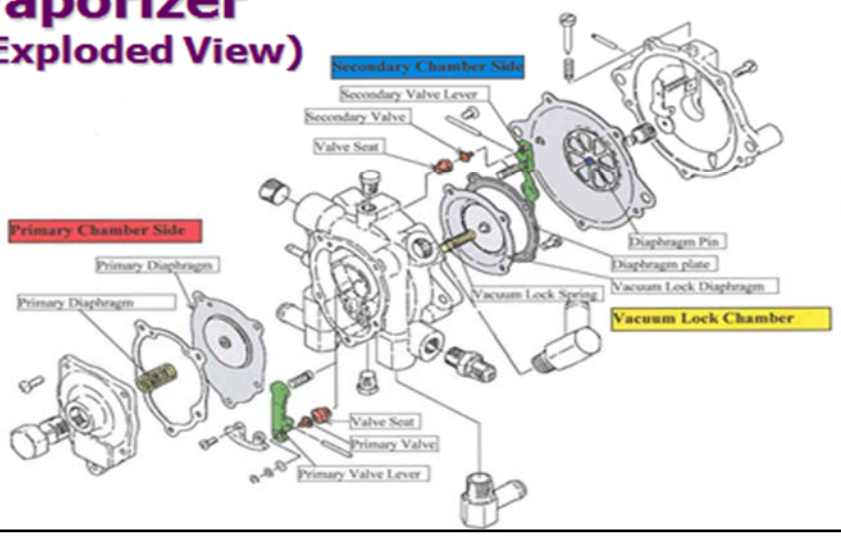


- Primary Chamber
- Vacuum Lock Diaphragm
- Diaphragm Spring
- Vacuum Lock Chamber
- Secondary Chamber

SERVICE SCHOOL 2013

Kubota Engine Training

Vaporizer (Exploded View)



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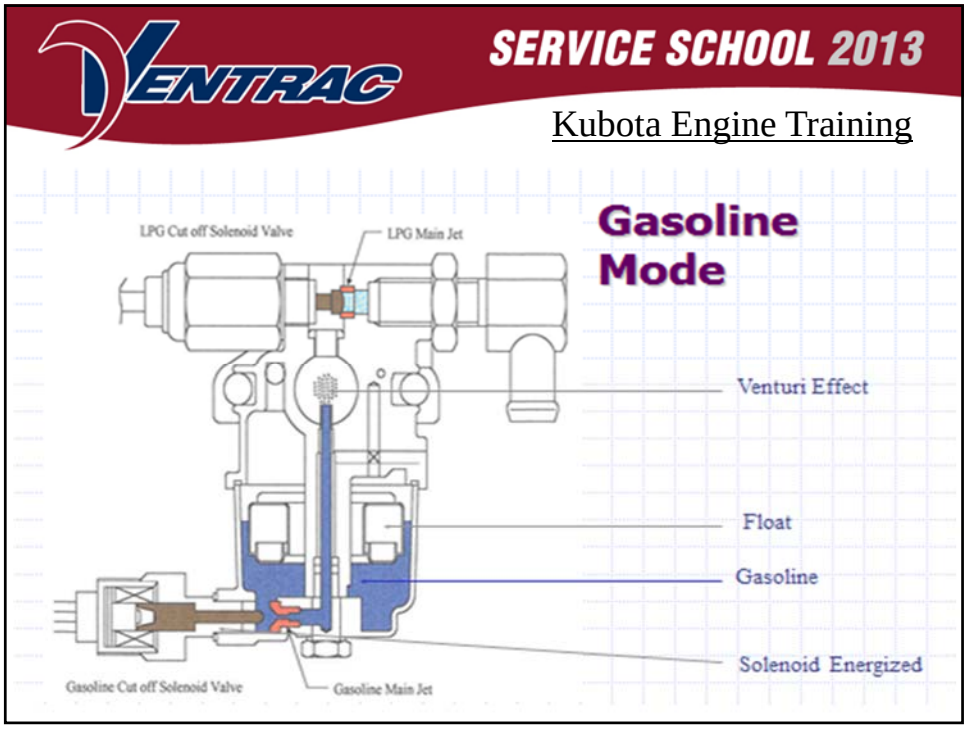
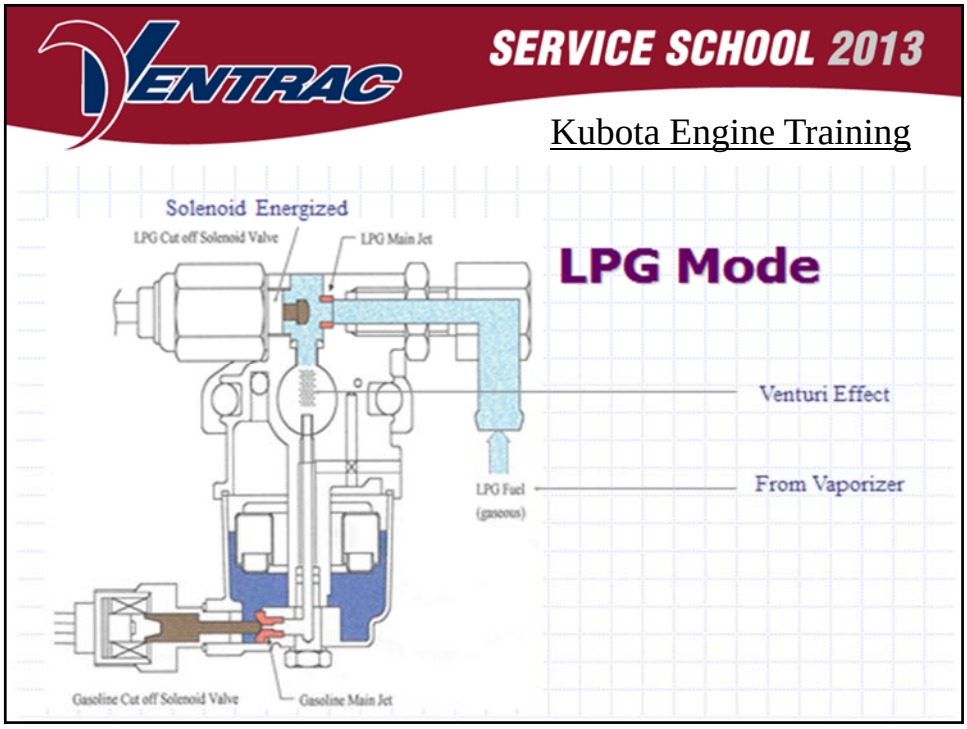
Kubota Engine Training

Carburetor and Mixer

- Throttling Device.
- Creates Pressure Differential.
- Blends Air and Fuel.
- Multiple Fuel Capability.
- Gasoline and LPG Valves are Normally Closed.
- Shuts Off Fuel.


VENTRAC
SERVICE SCHOOL 2013
Kubota Engine Training
Gasoline Mode
LPG Cut off Solenoid Valve
LPG Main Jet
Venturi Effect
Float
Gasoline
Solenoid Energized
Gasoline Cut off Solenoid Valve
Gasoline Main Jet


VENTRAC
SERVICE SCHOOL 2013
Kubota Engine Training
Solenoid Energized
LPG Cut off Solenoid Valve
LPG Main Jet
LPG Mode
Venturi Effect
LPG Fuel
(gaseous)
From Vaporizer
Gasoline Cut off Solenoid Valve
Gasoline Main Jet

Ignition by Spark

- WG972 – Distributorless Ignition
  - 3 Ignition Coils
  - Ignition Module or Ignitor
  - Magnetic Pickup Sensor

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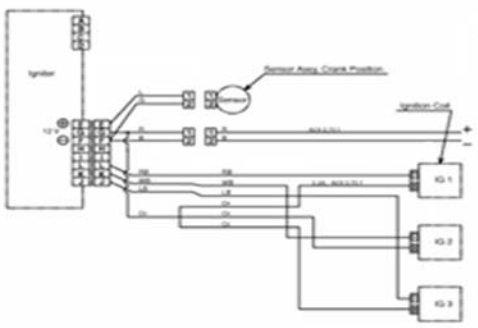
Kubota Engine Training

WG972 Ignition System



- Should be voltage at coils
- Check resistance of coils
- Ignitor has chart in WSM for checking with Fluke meter

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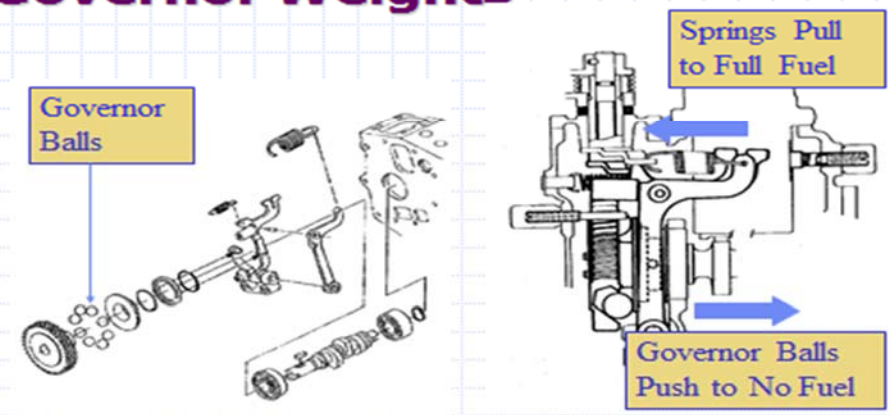
Kubota Engine Training

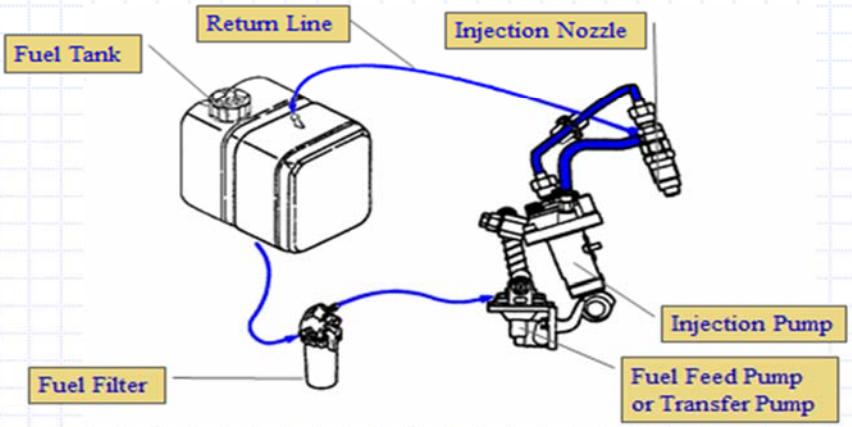
Governor Weights



VENTRAC SERVICE SCHOOL 2013

Kubota Engine Training

Typical Fuel System

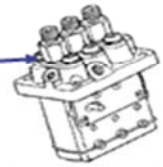


SERVICE SCHOOL 2013

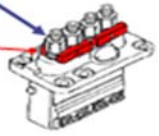
Kubota Engine Training

Removing Injection Lines

- When removing injection lines, be sure to hold the delivery valves on the injection pump
- On Denso pumps with clamps on the delivery valves, you will have to send the pump out for reset if you move the delivery valve.



Zexel
Bosch



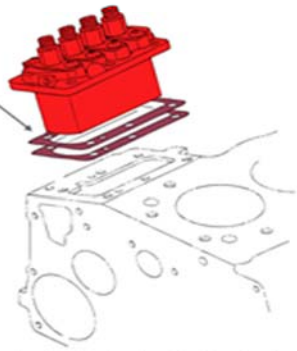
Denso

SERVICE SCHOOL 2013

Kubota Engine Training

Injection Timing

- Adjusted by shims
- Approximately 0.5 degree change for each 0.05 mm shim change
- More shims – timing is retarded
- Less shims – timing is advanced



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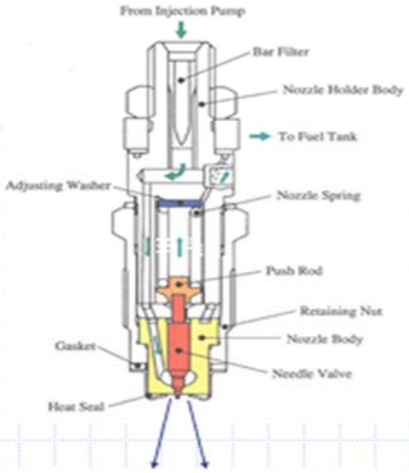
Kubota Engine Training

Indirect Injection Nozzle

- Typical "Pop-off" pressure: 1991 – 2134 PSI
- Conical spray pattern
- Adjusting Washer
- Adjusted using shims



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Kubota Engine Training

Testing Injectors

- Single Stage Nozzles:
  - Indirect Injection
- Pop-off Pressure
- Spray Pattern
- Nozzle Leakage

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Kubota Engine Training

Indirect Injection & Direct Injection Comparison

Indirect Injection

Direct Injection

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Kubota Engine Training

Indirect Injection & Direct Injection Comparison

- Advantages of Indirect Injection
  - Lower Noise
  - Lower Exhaust Emissions
  - Less High Load Smoke
  - Less Irritating Diesel Odor

- Advantages of Direct Injection
  - Lower Fuel Consumption
  - Less Frequent Need for Oil Changes
  - Cooler Running, Needs Smaller Radiator
  - Better Starting

Kubota Engine Troubleshooting

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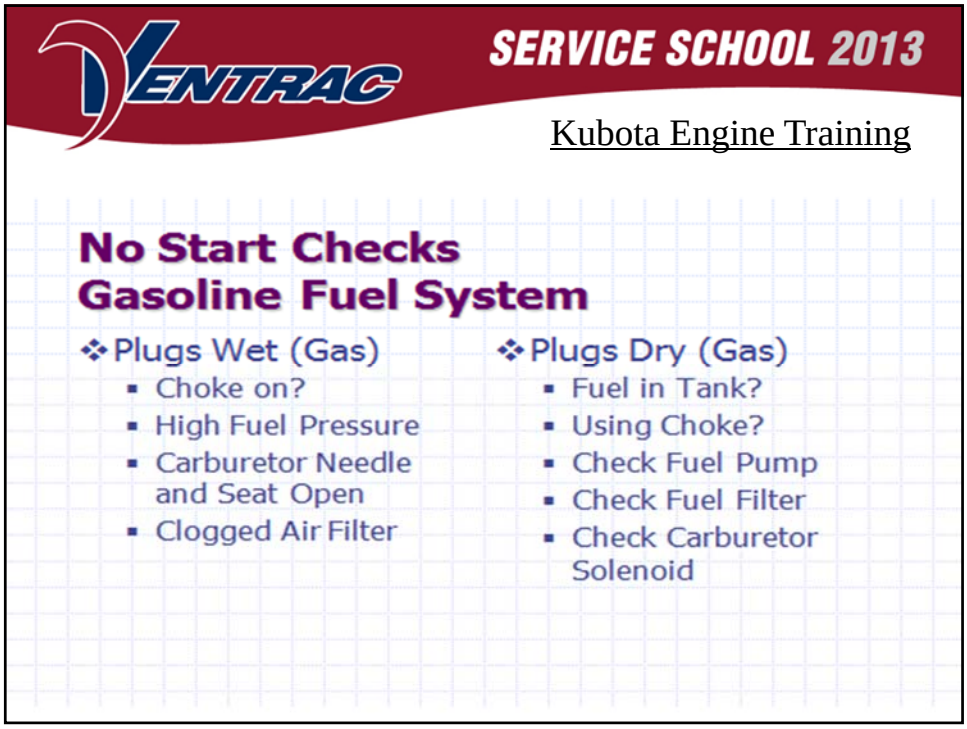
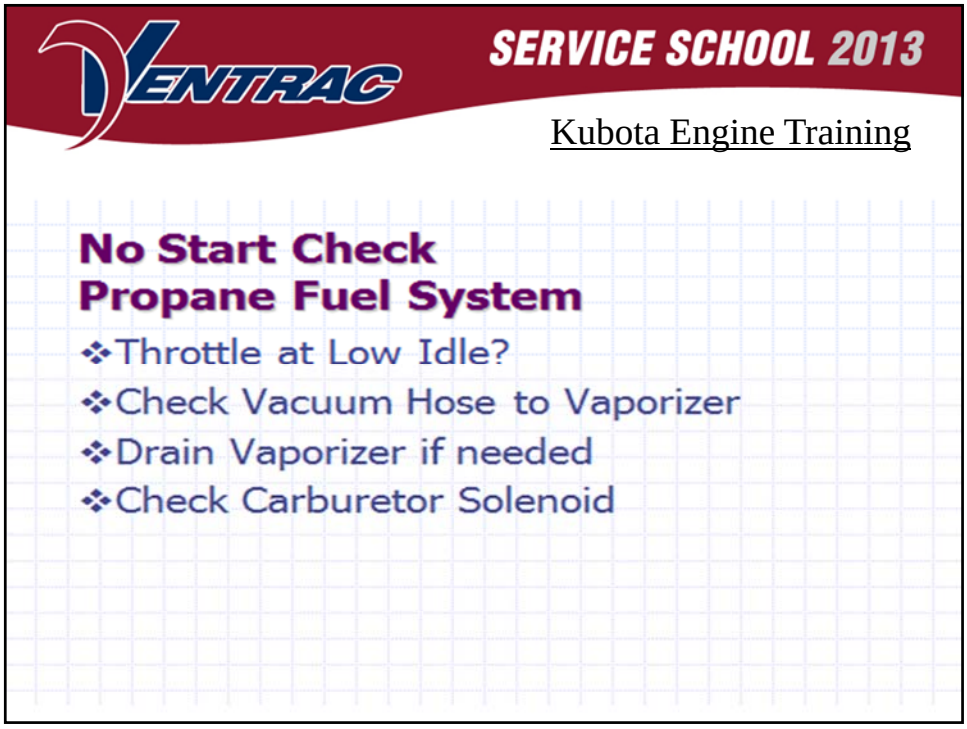
Kubota Engine Training

Troubleshooting Procedure

- Question the customer – understand the complaint
- Verify the complaint – do it yourself!
- Eliminate as many possibilities as you can early in the process
- Use your mind and senses before your tools


VENTRAC
SERVICE SCHOOL 2013
Kubota Engine Training
No Start Checks
Gasoline Fuel System
Plugs Wet (Gas)
Choke on?
High Fuel Pressure
Carburetor Needle and Seat Open
Clogged Air Filter
Plugs Dry (Gas)
Fuel in Tank?
Using Choke?
Check Fuel Pump
Check Fuel Filter
Check Carburetor Solenoid


VENTRAC
SERVICE SCHOOL 2013
Kubota Engine Training
No Start Check
Propane Fuel System
Throttle at Low Idle?
Check Vacuum Hose to Vaporizer
Drain Vaporizer if needed
Check Carburetor Solenoid

"Dead" Center Cylinder

On any Overheating Complaint, or any loss of compression on center cylinders - check the following BEFORE disassembly:

- Antifreeze Concentration
- Check for Leaks
- Check Belt Tension
- Check Thermostat
- Air Flow Through Radiator
- Coolant Flow Through System
- Is Fan on Properly?

VENTRAC SERVICE SCHOOL 2013
Kubota Engine Training

Smoke

- Black Smoke
  - Too much fuel for the amount of air
  - Air Cleaner clogged
  - Choke on
  - Fuel Pressure High
  - High Altitude
    - Kits are available
- Blue/Gray Smoke
  - Oil Overfilled
  - Check Fuel Quality, 2 Stroke Oil?
  - Rings or Valve Guides

SERVICE SCHOOL 2013

Kubota Engine Training

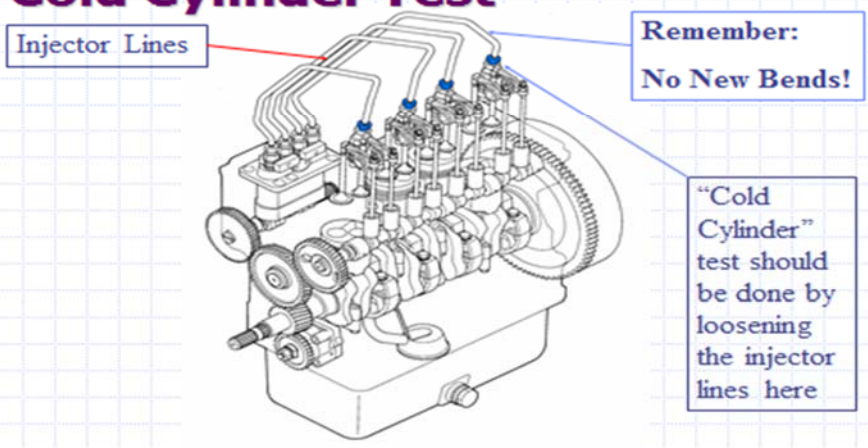
No Start, Black Smoke

- Black smoke is: too much fuel for the amount of air.
- Check:
  - Air filter clogged
  - Fuel Injection pump
  - High parasitic load

SERVICE SCHOOL 2013

Kubota Engine Training

Cold Cylinder Test

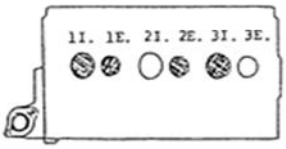


SERVICE SCHOOL 2013

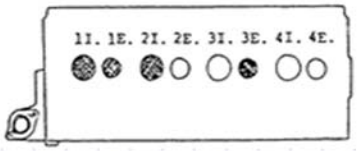
Kubota Engine Training

Valve Adjustment Procedure

D CODE ENGINES (3 CYLINDERS)



V CODE ENGINES (4 CYLINDERS)



- Valve clearance is the same for both intake and exhaust valves
- At TDC compression on #1, adjust valves marked black
- At TDC exhaust on #1 adjust valves marked white

SERVICE SCHOOL 2013

Kubota Engine Training

"Dead" Cylinder

- Compression Test
- Engine disassembly
- Check:
  - Intake Manifold plugged on 1 cylinder
  - Engine Damage
  - Exhaust Manifold plugged on 1 cylinder

"Dead" Center Cylinder

On any Overheating Complaint, or any loss of compression on center cylinders - check the following BEFORE disassembly:

- Antifreeze Concentration
- Check for Leaks
- Check Belt Tension
- Check Thermostat
- Air Flow Through Radiator
- Coolant Flow Through System
- Is Fan on Properly?

SERVICE SCHOOL 2013
Kubota Engine Training

White Smoke

- Cold Combustion
  - High Altitude
  - Low Compression
  - Low Engine Temperature
  - Late Injection Timing
  - Poor Fuel Quality
- Water or Coolant in the Combustion Chamber

Introduction to Kawasaki FD851D Fuel Injection System

- **Orientation** - Cylinder #1 is on the oil filter side and Cylinder #2 is on the starter side
- System uses single barrel, throttle body, electronic control unit, pressure regulator, intake air pressure sensor, intake air temperature sensor, water temperature sensor, fuel pump and fuel injectors
- **Before servicing the fuel injection system**, turn off the key and **disconnect** the lead that connects the **fuel injection harness** to the **battery positive** and **THEN** disconnect the desired component connection
- DFI delivers the correct amount of fuel for efficient engine operation. Fuel requirements vary depending on engine speed, load, atmospheric pressure, engine and air inlet temperature

SERVICE SCHOOL 2013
Kawasaki Engine Training

Kawasaki FD851D Fuel Injection

- Kawasaki has determined specific air /fuel calibration requirements for varied conditions. Sensors measure the **engine load**, **engine speed**, **air temp** and **coolant temp** and **atmospheric pressure**
- These measurements reference a fuel delivery map that is **pre-programmed** into the engine Electronic Control Unit to precisely control the engines fuel demands
- **Engine speed** – uses voltage pulses from the magneto coils to sense engine speed and crankshaft position – **there is no dedicated crankshaft position sensor.** The ECU **does not** control the ignition coils. The ignition voltage pulse in the primary coil winding is created when the magnet on the flywheel passes the ignition coil

Kawasaki FD851D Fuel Injection

- **The Vacuum Sensor is mounted in the throttle body**. It is **connected to a metered orifice** located in the throttle plate to **measure intake manifold pressure**. When the key is in the **"on/run"** position, the **vacuum pressure sensor records an atmospheric pressure measurement.** The value is then **stored in the ECU and is not updated until the engine is restarted**

- It is important to leave the key in the "on" position for at least ½ to 1 second before cranking. This ensures the vacuum pressure sensor has time to record an atmospheric pressure reading.

NOTE: If the key switch is rotated too quickly the ECU will go to a default atmospheric pressure and may not allow for optimized engine operation

SERVICE SCHOOL 2013
Kawasaki Engine Training

Kawasaki FD851D Fuel Injection

- **Engine load is determined by pressure in the intake manifold**. The ECU uses the vacuum/pressure reading to calculate the fuel requirement. When the **engine** is under **heavy load**, the **mechanical governor opens the throttle plate** and a **decrease** in **vacuum (increase in pressure)** is measured by the sensor. When the load is lightened, the increase in vacuum is measured by the sensor

- **Air temp sensor is located in the air inlet after the air filter** but before the throttle body. The ECU uses this sensor to measure the air temperature entering the throttle body to assist in calculating air density

Kawasaki FD851D Fuel Injection

- The **coolant temp sensor** is **used** by the **ECU** to **correctly calculate fuel needs and is located in the intake manifold coolant passage**
- **The throttle body's function is to meter the air flow**. It has two ports with traditional butterfly valves controlled by the engine governor. When the engine is under heavy load, the governor opens the throttle plates reducing the restriction of air flow in the intake system. **The governor assembly on this engine operates similarly to carbureted engines**
- The fuel pump on the Ventrac 4500 comes on when the key is turned to the "**on"** or "run" position and remains on until the key is turned off. The **minimum output pressure** should be **24 psi** with a **maximum** of **26 psi** at high idle and no load

SERVICE SCHOOL 2013
Kawasaki Engine Training

Kawasaki FD851D Fuel Injection

- The **fuel pressure regulator is mechanically operated**, **responding to changes in intake manifold pressure**. The regulator **controls fuel pressure by changing the resistance to fuel flow in the fuel rail from the pump back to the tank**. It is mounted to the throttle body and controlled by vacuum
- **The purpose of the fuel injectors is to spray fuel**. When the **key** is in the **"run"** or **"on"** position and the wire harness is disconnected from the fuel injector, **there will be battery voltage at the positive terminal of each fuel injector**
- The **ECU** receives information from the sensors and **uses a predetermined fuel delivery map to calculate fuel requirements**

Kawasaki FD851D Fuel Injection

- The **ECU calculates when and how long** to energize the fuel injector solenoids and then **grounds** the control terminal on the fuel injector for the proper amount of time

- **Operational Theory Explanation**

- **ECU Function Before Starting**:
- When the key is turned **"on",** or to the **"run"** position, the ECU receives power through the main power system provided by **Ventrac**. The ECU **immediately** energizes the **fuel pump relay** supplied by **Ventrac**. The fuel pump then delivers fuel to the throttle body assembly. The **ECU also collects data from the vacuum pressure sensor, the air temperature sensor and the coolant temperature sensor**

SERVICE SCHOOL 2013
Kawasaki Engine Training

Kawasaki FD851D Fuel Injection - ECU Operation

- **Before** cranking, **atmospheric pressure** is **measured** by the **vacuum pressure sensor**. The atmospheric pressure reading is then stored by the ECU until the tractor is shut down. The **atmospheric pressure readings** are an **indicator** of **altitude** and used by the ECU fuel delivery map. **Atmospheric pressure plus ambient air temperature determines air density**

- **Engine temperature** is measured by the **coolant temperature sensor** located in the intake manifold coolant passage near cylinder head #2. This reading allows the ECU fuel delivery map to determine if the engine is hot or cold and adjust fuel delivery accordingly. This feature also allows the DFI engine to start without a choke

Kawasaki FD851D Fuel Injection - ECU theory *(cont)*

- **ECU Function During Cranking:** When the engine is cranking, the ignition coils send a voltage pulse to the ECU each time the flywheel magnet passes an ignition coil. These pulse signals to the ECU determine crankshaft position and engine speed. **Both** fuel injectors open together on every crankshaft revolution **(batch firing)**
- **ECU Function While Engine is Running**: As the engine warms up, the ECU adjusts air/fuel mixture based on information from the coolant temperature sensor
- The ECU changes the air/fuel mixture by increasing or decreasing the pulse width signal sent to the fuel injectors, effectively increasing or decreasing the amount of fuel delivered

SERVICE SCHOOL 2013
Kawasaki Engine Training

Kawasaki FD851D Fuel Injection - ECU theory *(cont)*

- When the throttle lever is moved from the low idle position to the to the high idle position, or a load is applied, the governor responds by opening the throttle plates. The ECU receives a signal from the vacuum pressure sensor indicating a change in manifold vacuum. The ECU reacts to the vacuum pressure sensor by adjusting the pulse width of the fuel injectors.
- As the vacuum to the fuel; pressure regulator changes, the regulator adjusts the fuel flow volume returning to the tank. Fuel pressure will be at its highest when the engine is running under full load and at wide open throttle. Because intake manifold vacuum is lower(atmospheric pressure higher) the fuel pressure must increase to keep the pressure differentials across the fuel injectors constant.

Kawasaki FD851D Fuel Injection - ECU theory *(cont)*

- **NOTE:** Fuel pressure varies with engine speed and load. **Fuel pressure** should be **24.9 – 26.4 psi** with engine at **high idle** and **no load.**
- During engine operation, the ECU constantly reads information from sensors and engine speed from the ignition coils to determine the engines fuel requirements.
- **CAUTION:** The fuel in the system is under pressure even when the engine is shut down. To **release** the pressure, **turn the fuel pressure relief screw counterclockwise one turn.** This will allow the fuel in the system that is under pressure to return to the fuel tank. **Remember** to **close** the fuel pressure relief screw **after** completing the **service**.

SERVICE SCHOOL 2013

Routine Engine Maintenance

Safety First

⚠ WARNING

Before making any repairs or adjustments, lower attachment to the ground, set parking brake, shut the engine off, and remove the key.

- See current Owner/Operator manuals for proper Service and Maintenance care and instructions

Follow the Ventrac Service Interval Charts!

SERVICE SCHOOL 2013

Routine Engine Maintenance

Engine Oil & Filters

V-Twin Engines - (Briggs & Kawaski)

- Initial oil change at **8** hours
- Every **50** hours thereafter

3 Cylinder Engines – (Briggs & Kubota)

- Initial oil change at **50** hours
- Every **100** hours thereafter

- **See engine operators manual for oil specifications**
  - SAE10w-30 (petroleum) installed from factory
  - Diesel engines – use diesel oil with API rating of CF or later
  - Gasoline engines – API rating of SH or later
  - Synthetic engine oil may be used and is recommended especially in severe duty applications, **DOES NOT ALTER SERVICE INTERVAL**

SERVICE SCHOOL 2013

Routine Engine Maintenance

Engine Oil & Filters

Severe Duty Applications

- In **applications** where the **engine** is **continually** subjected to **dirt, sand or high operating temperatures** engine **MUST be serviced more often**

Examples of severe applications:

- Poultry barn cleaning
- Dirt & seedbed preparation (Using Power Rake attachment)
- Heavy brush mowing (Using Tough-cut mower deck)
- Commercial mowing in very dry or dirty environments

In severe operating conditions reduce service intervals by HALF!!

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Routine Engine Maintenance

Cooling System

Engine Coolant

- Maintain fluid at full mark with a 50/50 mixture of water and antifreeze

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Routine Engine Maintenance

Cooling System

- Radiator & screen **MUST** be kept clean to allow engine to cool properly
- **Inspect** radiator & screen **frequently** when working in **dry, dirty conditions**
- **Do not operate engine above 220°F (104 C).**
- High-temp warning alarm will sound if temps continue to climb above 220°)
- If alarm sounds stop driving & turn PTO off
  - Remove debris from screen
  - **Allow engine to run until back to normal operating temperature**

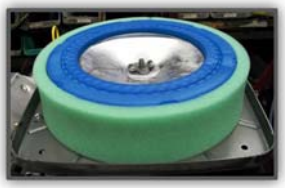
SERVICE SCHOOL 2013

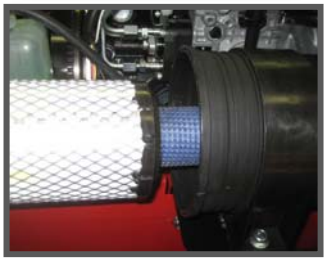
Routine Engine Maintenance

Air Filter System

Service Interval for Air-Cleaner

- **Depends on application and/or environment**
- **200 hours** - (See Ventrac operator manual)
- Replace filters **more often** in **dusty/dirty** environments
- Heavy–duty Donaldson canister air-filters are standard on all Ventrac® installed Briggs and Stratton Engines as of May 2008





Failure to maintain filters properly may result in engine damage!

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Routine Engine Maintenance

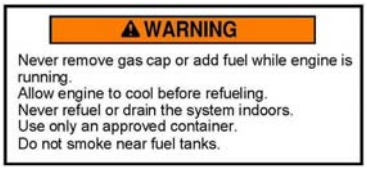
Fuel & Storage

Winter Blend & Ethanol Gas

- No more than 10% Ethanol
- Can cause vapor lock in spring time

Diesel Fuel

- Algae can grow in fuel & plug filters



Storage on Gasoline Engines

- 1– 4 months - Use fuel stabilizer
- 4 months & longer drain and run until carburetor is empty
- If operating on slopes keep fuel tank filled to a **minimum level of 1/3 full** so engine does not run out fuel

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Routine Engine Maintenance

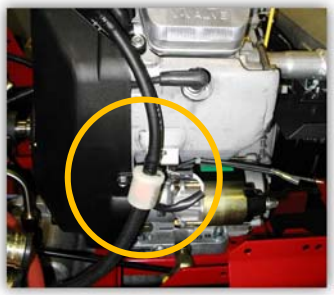
Fuel System

In-Line Filter in Tunnel Area

- **All 4500's** & 4200 Briggs 3/LC gas units
- 26.5 Diesel prior to UEB2928
- 31 Turbo Diesels prior to WEB2929

In-Line Filter Engine Bay

- All 4100's (Briggs & Kaw)
- 4200 27hp Kawasaki



Note: **If engine lacks power or will not accelerate to full RPM replace fuel filter!**

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Routine Engine Maintenance

Fuel System

ALL Diesels

- Fuel Filter/ Water Separator - **10-micron**
  (Changed from 2-micron Oct 2006)
- Periodically check bowl & drain water or dirt

Note: **If engine lacks power or will not accelerate to full RPM replace fuel filter**

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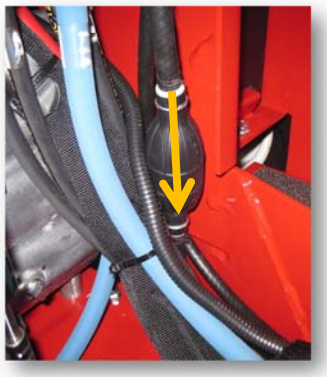
Routine Engine Maintenance

Fuel System

4200 Diesels after Serial UEB2928 & WEB2929

- Electric fuel pump & in-line fuel filter removed (mid 2007)
  - Injection pump has built in transfer pump
- Fuel primer bulb added in place of in-line filter
  - Directional check valve
  - Make sure arrow is pointed towards engine



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Routine Engine Maintenance

Fuel System

Fuel shut-off valve

- **4100/4200** - Located under seat
  - Added to 4100's on serial# 1485 & after
  - Added to 4200's on serial# 2928 & after
- **4500**
  - Located above battery disconnect (visible and accessible from operator station)

SERVICE SCHOOL 2013

Failure Analysis

Premature Engine Failure

99% of all engine failures are due to lack of proper maintenance

1. **Dirt Ingestion**
   - For every gal of fuel used, a block of air 100' x 100' x 10' (930.48m x 30.48m x 3.04m) is consumed by the engine
2. **Insufficient Oil Lubrication**
   - The primary function of engine oil is to lubricate, secondary function is to carry heat away from components
3. **Overheating**

Note: Each one will effect the other (snowball effect)

SERVICE SCHOOL 2013

Failure Analysis

Premature Engine Wear

Dirt Ingestion - Caused by -

- Dirty or damaged air filter element or air filter sealing surface
- Loose or damaged intake hoses or gaskets
- A dirt trail is usually evident if intake components are studied closely

Complaint

- Low power and hard starting

Conditions Created

- Wear and scaring on pistons, rings & cylinder walls
- Low compression
- Worn valves and/or valve guides
- Damaged to turbo fins

Failure Analysis

Premature Engine Failure

Insufficient Lubrication

- Low oil level
- Overheating engine caused deterioration of oil
- Incorrect oil or oil viscosity
- Not changing oil at recommended service intervals
- Oil is dirty or has deteriorated and no longer has the ability to lubricate properly

Conditions Created

- Worn/spun or seized bearings & journals
- Piston, ring and cylinder damage
- Broken turbo shaft

Piston Rod Failure – Lack of Lubrication




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Failure Analysis

Premature Engine Failure

Overheating Causes

- Clogged or damaged radiator fins and screen
- Plugged or damaged cooling system (air-cooled has cooling fins)
- Oil that can no longer provide proper lubrication and cooling

Results of Overheating

- Components expand and/or warp causing excessive friction
- Engine oil deteriorates and losses its ability to lubricate properly
- Loss of cylinder compression, engine starts hard or has low power

Conditions Created

- Blown head gasket, warped head
- Scuffing on piston skirts & cylinder walls
- Broken or damaged valves and/or valve seat

DAMAGE DUE TO OVERHEATING

Piston skirts display scuffing in streaks on all 3 pistons, particularly in the pin bore area, with little or no scuffing on the first land. Sludge deposits in ring groove area signify a loss of ring control.

When this type of damage appears on most or all pistons, cooling system failure and/or inadequate lubrication is the likely cause.

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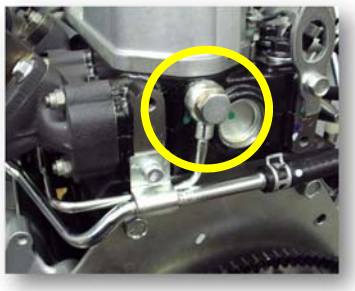
Failure Analysis

Preventative Maintenance

Turbocharger on 31hp Diesel Engine

- Operates at 80,000-100,000 RPMS
- Subjected to extreme heat (engine exhaust)
- Needs constant supply of good, clean oil

Oil screen in banjo fitting on the side of head (filters oil supply)



Caution: Screen may plug and restrict oil flow if oil is not serviced regularly!

- Turbo bearing will wear or seize causing turbo shaft to break
- **Inspect oil supply line and clean banjo fittings yearly**.
- Install new banjo fittings if installing new turbo (New fitting comes w/ new turbo)

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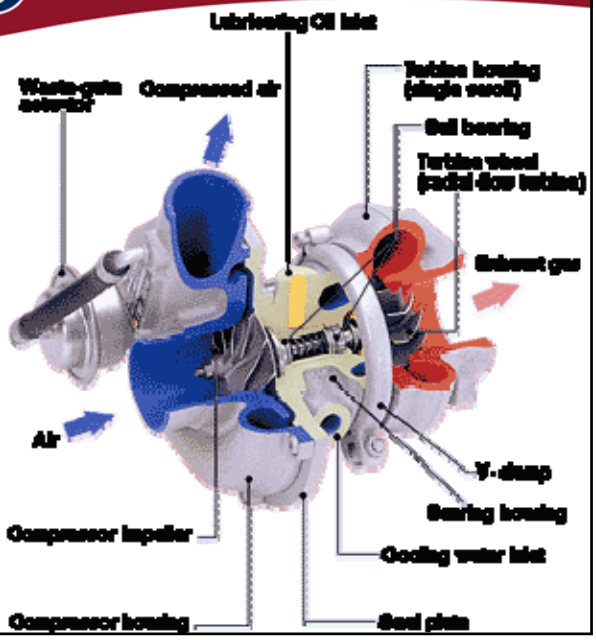
Failure Analysis

Turbocharger



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Failure Analysis

Preventative Maintenance

New Turbo

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Failure Analysis

Preventative Maintenance

Dirt Ingestion

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Failure Analysis

Preventative Maintenance

Lack of Lubrication - Worn Bearing

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Failure Analysis

Preventative Maintenance

Damage from Foreign Object

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Failure Analysis

Preventative Maintenance

Keep Equipment Failures to a Minimum!

- Enforce preventative service & maintenance programs
  - Repair damaged or worn parts before they cause more damage
- Use quality OEM lubricants, filters & replacement parts
  - Stock a supply of service & maintenance parts
- Train operators on how to properly use and maintain equipment
  - What symptoms should they listen and look for?
  - Operator **must notify** mechanic or supervisor anytime something appears wrong, different or questionable

NO Substitute for Regular Maintenance – Its PAY ME NOW or PAY ME MORE LATER

VENTRAC SERVICE SCHOOL 2013

Engine Warranty

Briggs & Stratton Vanguard Engines

- 3/LC Daihatsu Engine Warranty - **2** years + **3**rd year **Major Parts Only**
- V-Twin Big Block Engine War**ranty** – **3** years
- Warranty can be submitted through Ventrac or a Briggs Distributor

Kubota Engines

- **2** years + **3rd** year on **Major Parts Only**
- Ventrac is a **Self-Servicing OEM** – All Parts, Service, Warranty Claims and Warranty Authorization must come through Ventrac

Kawasaki Engines - **3** year engine warranty

- Contact Kawasaki directly for all Parts, Service & Warranty Support

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BRIGGS & STRATTON

Kubota KUBOTA ENGINE AMERICA

Briggs & Kubota Engine Warranty through Ventrac

- **Prior authorization required by Ventrac for all major engine repairs**
- Submit warranty claim within **30-days** of repair/replacement!
  - Claims are submitted on the Ventrac Dealer Network Website
  - Digital pictures of failed components are normally required

Note: Perform compression AND leak-down tests **before** engine is disassembled.

SERVICE SCHOOL 2013

Prior Authorization Required by the Ventrac Service Dept

Briggs & Stratton and Kubota Engines

- Complete Engine Replacement
- Short Block (V-Twin only)
- Injectors
- Injection Pump
- Turbo Charger
- Cylinder Head & Gasket
- Main & Rod Bearings
- Crankshaft
- Pistons & Rings
- Carburetor
- Ignition Components
- **Any** 3rd year major parts
- Policy Adjustments

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Required Service Reference Manuals

- **Briggs & Stratton**
  - 3/LC Service Manuals (Gas & Diesel) - **(Ventrac # 72.0009)**
  - V-Twin A/C Service Manual - **(Ventrac # 72.0010)**
- **Kubota Engines**
  - Ventrac is producing our own interactive engine parts manual
  - Engine Service Repair Manuals - **(part # to follow)**

All Engine Repair and Operator Manuals are on the Dealer Network

Required Engine Service Tools

- **Diesel Compression Tester**
  - Briggs glow-plug adapter – (Ventrac # 72.0024)
  - Kubota glow-plug adapter – (part # to follow)
- **Cylinder Leak-down Tester**
- **Coolant System Pressure Test Kit**
  - Universal adapter to fit various radiator necks – (72.0032)
- Briggs V-Twin - .166 Ignition Tester
- Briggs 3/LC - .400 Ignition Tester
- **Briggs V-Twin Flywheel Puller** (special tool for the 20/50 Flywheel)
- Briggs Dial Indicator (to set timing on 3/LC Diesel injection pump)
- DC Shunt or High Capacity Amp Meter
  - To test high amperage draw: (Clutch, Starter, Spreader Motor etc)

VENTRAC SERVICE SCHOOL 2013

Ventrac's *V-Plus* Warranty

3-Year Homeowner / 2-Year Commercial

Introduced September 1st 2003

- **New In-stock Dealer Inventory**, starting with Ventrac Serial Number's:
- 4200 – Serial Number 1388
- 4100 – Serial Number 1091
- 3000 - Serial Number 1081
- Attachments purchased from V.P.I since May 1st 2003

V-Plus Warranty

(continued)

- **ET200 Turbine Blower** – 2-year warranty homeowner/commercial (turbine only)
- **HG100/HG150 Generator** – 1 year warranty homeowner/commercial **(generator only)**
- **Rental Program Warranty** - 180-days

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Ventrac's Warranty is Transferable

- Submit a new registration with date of transfer, new customer information etc.
- Equipment transfers carry the remainder of the original warranty period with the **following exceptions**:

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Warranty Transfer Policy

- Equipment originally registered as **3-year homeowner use** and transferred to a **commercial user**, warranty changes to the remainder of a **2-year commercial warranty** **(Reduced by one year)**
- Transferring equipment **originally registered** as **2-year commercial use**, warranty will always remain 2-years from the date of original purchase

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Product Warranty Validation

Product Registration & Pre-delivery Checklist

- Complete PDL checks at time of sale prior to delivery
- Register products within **ten (10) days** of sale
  - **Dealer Network Website – "New Registration"**
- Retain signed hard copy of registration at dealership

Warranty Claims

- **Must submit claim within 30-days of repair/replacement!**
  - **Dealer Network Website – "Ventrac Claims"**
- Retain defective part/s until warranty claim has been paid or denied
- **Defective parts** with a **Dealer Cost of $125** or more **MUST be returned** for warranty evaluation
  - Contact Service Department for an RGA# (Return Good Authorization Number)

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Ventrac V-Plus Servicing Dealers

For those dealers who strive to be the best in product knowledge and provide exceptional after-the-sale service and support

Venture Products Inc. recognizes them as a
"V-Plus Servicing Dealer"

V-Plus Servicing Dealers

Warranty Compensation

- **Labor** – Paid at Posted Shop Labor Rate
- **Parts** – Reimbursed at Dealer Cost **+ 15%**
  - Code-D net cost items paid at part cost

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V-Plus Servicing Dealer

Warranty Compensation

Dealers **not** maintaining the *"V-Plus Servicing Dealer"* status will receive the following:

- **Labor** – reimbursed at up to $40.00 per hr
- **Parts** – reimbursed at dealer cost

SERVICE SCHOOL 2013

V-Plus Servicing Dealer

Requirements

- Authorized Ventrac Dealer in good standing
- Purchase & maintain dealer specialty tool kit (#70.0121)
- Stock an adequate supply of genuine Ventrac parts
- Maintain Authorized Servicing Dealer status for:
  Vanguard, 3/LC, Kubota & Kawasaki engines
- Employ at least one technician that has completed the Ventrac® Dealer Service School and attend any future training requirements

SERVICE SCHOOL 2013

Ventrac Service School

Requirements

Ventrac Dealer Service School

- New dealers signing on must attend a Dealer Service School by the end of the upcoming fall/winter training sessions
- Ventrac's Training Instructors will provide Engine Training on the Briggs & Stratton, Daihatsu and Kubota Engines that we use
- Open to all dealership employee's at no registration cost..