



MTS FSE MODULAR TRAINING



Hydraulic Power Unit

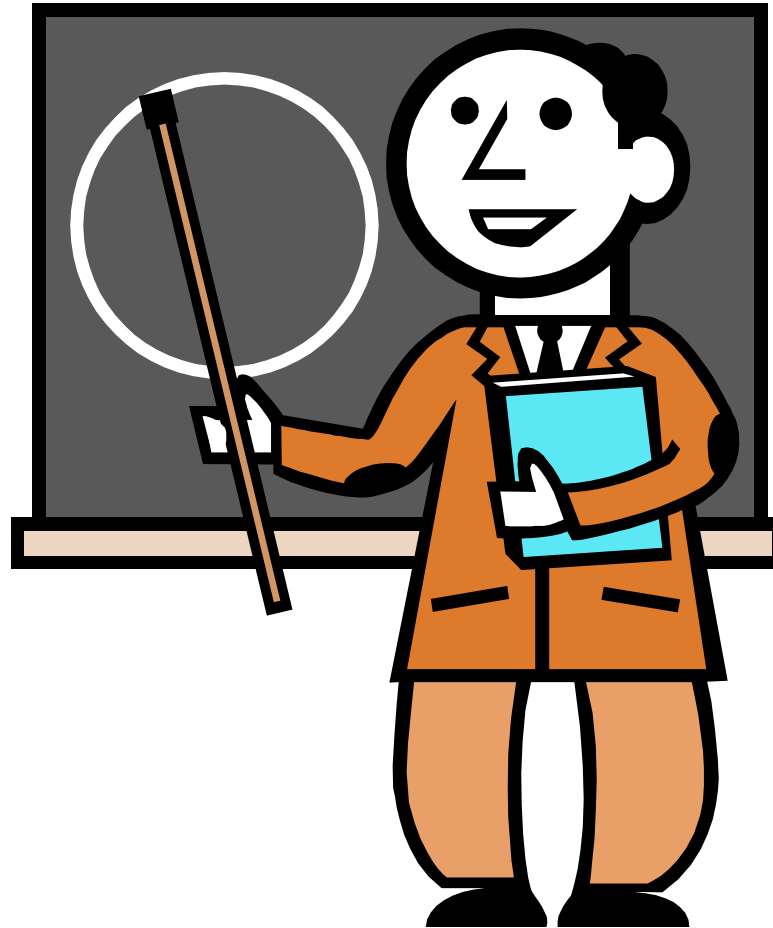
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be certain.

Introduction

- » This module will cover
 - Theory of operation
 - Operation
 - Maintenance
 - Reference Information

Theory of Operation



Hydraulic Pump

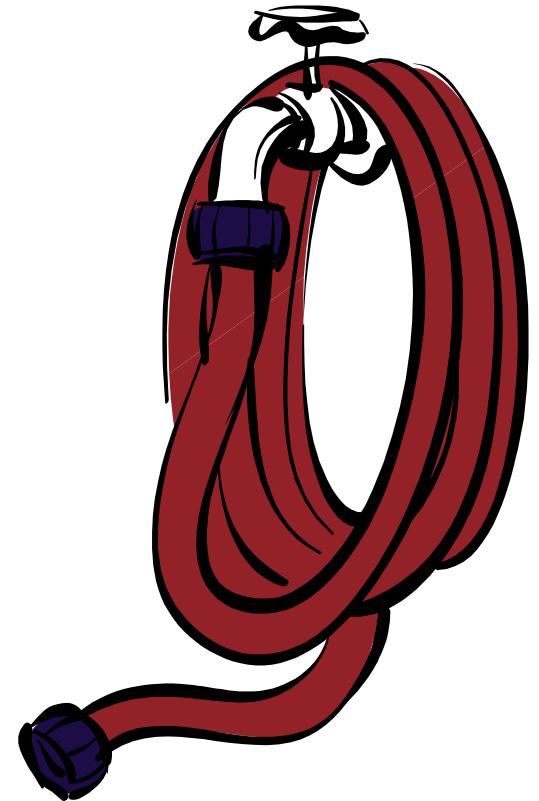
- » Here is a question to ponder:
- » What does a hydraulic pump do?
- » Does it create pressure?
- » Does it create flow?

Hydraulic Pump

- » Each HPU will contain at least one motor and one pump.
- » The motor turns the pump, as the pump turns it creates flow.
- » Pumps do not create pressure.
- » Pressure is created by applying a restriction to the output of the pump.

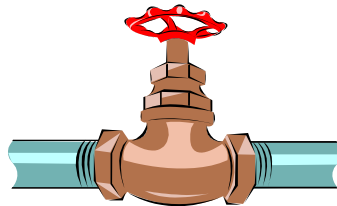
Example

- » A good example of this theory is the common garden hose.
- » When we turn on the water valve, the water flows out of the end of the hose.
- » We can increase the pressure out of the hose simply by placing our thumb over the outlet.
- » We increase the restriction thus we increase the pressure, this same logic applies to all pumps.



Solenoid Valve

- » In our hydraulic systems we use control valves to create the restriction, instead of the finger over the end of the hose.



Solenoid Valve

- » A solenoid valve often replaces the gate valve in a hydraulic system.
- » Solenoid valves are either on or off.
- » Typically when the solenoid valve is off, it allows the output to flow back to the tank.
- » When turned on, the solenoid valve blocks this flow, thus creating pressure.

Solenoid Valves

- » Solenoid valves are available in either of these two designs. Both work mechanically and electrically the same.



Hydraulic Power Unit

- » Standard MTS HPU's operate at 210 bar (3000 PSI)
 - Optional higher pressure HPU's available
 - Flow capacity Gallons per Minute (gpm) or Liters per Minute (lpm) varies depending on model and input power line frequency
 - 50 Hz models typically provide less flow than same HPU used at 60 Hz



Series 505 Hydraulic Power Unit

HPU Pump Types

- » There are two basic types of pumps commonly used in the industry, fixed volume and variable volume.

- » Fixed Volume
 - Pumps the same flow regardless of demand
 - Example: 23 gpm rated pump always pump 23 gpm.
 - Excess is recirculated to reservoir.

- » Variable Volume
 - Pumps only create the flow to equal demand
 - Example: 30 gpm rated pump might only generate 2 gpm to meet demand.
 - There is no excess flow.

Fixed Volume Pump

- » Fixed Volume or Vane type Pumps
 - Used on MTS 21 gpm and smaller HPU's (non 505 Models)
 - Not very efficient
 - Susceptible to internal wear

- » Fixed volume pumps always generate maximum rated oil flow when running. Any excess flow that is not required by the equipment in the lab is directly recirculated to the reservoir by the relief valve in the HPU

MTS HPU

- » Previous generation legacy HPU
 - 510 – 30 gpm and smaller
 - » Typically fixed volume (some variable volume styles produced)
 - 506
 - » Less than 30 gpm typically fixed volume
 - » Greater than 30 gpm typically variable volume pump

- » Silent Flo – All capacities use variable volume pump submerged in the oil reservoir
 - 505 G1 – 1st generation
 - 505 G2 – 2nd generation with updated electrical panel
 - 515 – Newest available

Pressure Adjust Circuits

- » Primary pressure adjust
 - Variable volume – Compensator adjustment located on pump
 - Fixed volume – Relief valve located on HPU manifold

- » Secondary pressure relief
 - If primary pressure adjust is adjusted to high or fails the secondary pressure relief will prevent the HPU from generating pressure beyond the setting
 - » 3000 PSI HPU secondary pressure adjust set for 3250 PSI

- » Low Pressure
 - Operated by solenoid
 - Current models dump full pump capacity flow directly to reservoir with out restriction

Oil Filtration

- » Clean contamination free oil is required for servo hydraulic systems
 - Accomplished using filters

- » MTS HPU's utilize a combination of low pressure, high pressure, and return line filters
 - Oil is filtered to a cleanliness level of 3 micron
 - There is either an electronic or mechanical dirty filter indicator
 - All low pressure and return line filters are 3 micron
 - Some high pressure filters are 10 micron or larger

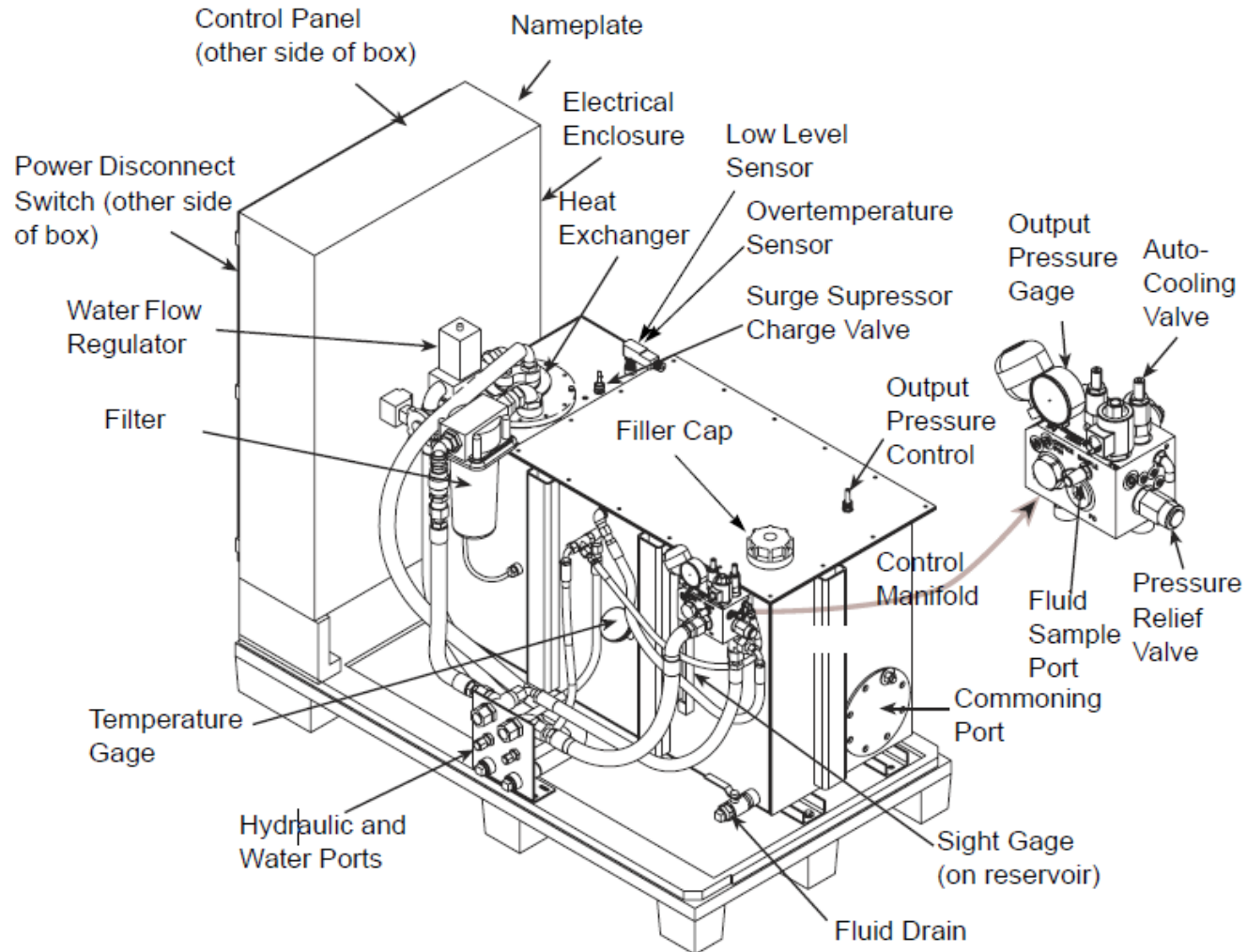
- » Example particle size in Microns:
 - Human Hair 50-300
 - Mold Spores 10-30
 - Red Blood Cells 5-10

Warning Systems

- » A temperature sensor will shut down the HPU when the oil reservoir temperature exceeds the limit
 - Normal operating temperature is 43 deg C (110 deg F)
 - On modern HPU's this limit is factory set for 55 deg C (131 deg F)
 - On older HPU's this limit is factory set for 52 deg C (125 deg F)
 - Check appropriate product manual for proper shutdown temperature

- » A oil level sensor monitors the reservoir oil level and will shut down the HPU when the oil is below the limit
 - This limit is adjusted as required

Typical Hydraulic Power Unit



Oil Cooling

- » As hydraulic oil is forced through the system, it heats up.
- » Heat can destroy or shorten the life of hydraulic oil.
- » There are two basic ways to cool the oil.
 - Water Cooled
 - Air Cooled



Cooling Circuits – Small 506 / 510 HPU

- » For Fixed volume pumps used in small 506.XX or 510.XX such as 506.01 or 510.21 all oil is sent to heat exchanger regardless of flow to lab. Fixed volume always produces maximum flow. Excess that is not used for lab testing is sent across relief valve to heat exchanger.

- » The oil which does not flow through heat exchanger and can cause the reservoir temperature to rise is
 - Drain line from lab
 - Case drain from pump
 - Secondary pressure relief

Heat Exchanger

- » Heat Exchanger: A Piece of equipment built for efficient heat transfer from one medium to another. MTS uses two methods.
 - Hydraulic Fluid to Water
 - Hydraulic Fluid to Air

- » MTS uses 2 types of heat exchanger
 - Shell and Tube
 - Plate design

- » Everyday example of a common heat exchanger
 - Radiator in automobile

- » For additional information see the Heat Exchanger Care and Water Quality Guide
 - MTS Manual P/N 015-164-000

Heat Exchanger Damage

- » A common Issue with a shell and tube heat exchanger is it will become clogged with sediment after several years of use reducing the cooling surface area of the heat exchanger
- » If enough of the heat exchanger clogs, the HPU will over heat.
- » Another concern is that the Inner tubes are copper. Chemicals in the water can have a reaction with the copper and build up contamination. This reaction is corrosive to the copper tubing.
- » Best case scenario, the HPU will simply go into an over temperature condition and interlock.
- » Worst case is that the tubes become weak enough to start leaking, allowing the cooling water and oil to mix.

Heat Exchanger Damage

- » Failed heat exchanger
 - Oil contaminated with water. Oil will have a milky white appearance.
 - » Requires oil change and complete flushing of system
 - » Monitor until water is eliminated
 - Water drain contaminated with oil.
 - » May impact local waste water treatment
 - » May have environmental impact

Oil Temperature Regulation

- » A flow control valve on the water inlet side of the heat exchanger regulates the reservoir oil temperature
 - The valve contains a probe which is inserted through the side of the reservoir to measure oil temperature
 - Higher oil temperature = more water flow

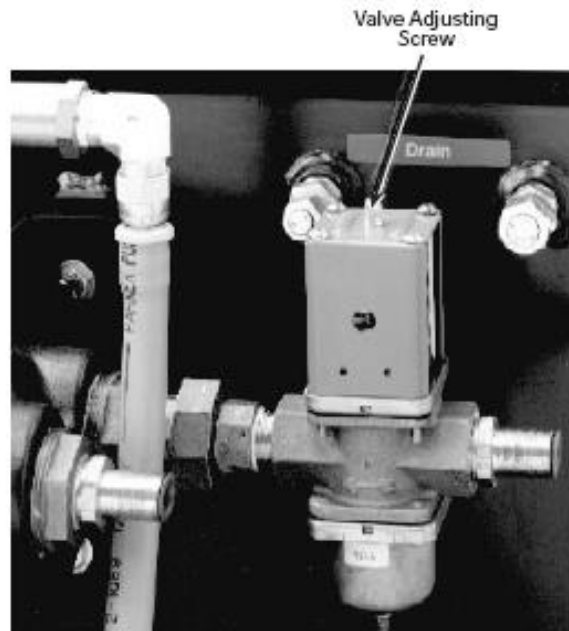


Figure 3-3. Water-Regulating Valve Adjustment

Operation



Operation

- » Typical operation sequence for local control
- » Turn on main power on electrical enclosure
- » Pull out Stop button
- » Reset any interlocks
- » Verify all interlocks are cleared
- » Switch HPU from Off to Low
- » Switch HPU from Low to High

Operation

- » To help understand the touch screen interface please read the sections on pages 40 through 46 in the 505.20/30 G2 SilentFlo Product manual from the link below.
- Main Screen
 - Status Screen
 - Operating the HPU Locally or Remotely
 - Recovering from an Interlock

[Link to 505.20/30 G2 SilentFlo Product Manual](#)

Operator's Panel 40

Main Screen 40

Status Screen 43

Operating the HPU Locally or Remotely 45

Recovering from an Interlock 46

Changing the Water Flow 47

Maintenance



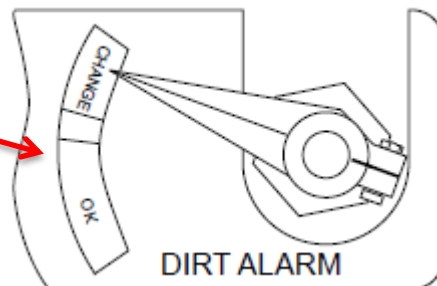
Maintenance

- » Filter Change
- » Adding Make up oil
- » Oil Sampling
- » Oil Quality
- » Oil Change
- » Surge suppressor charging

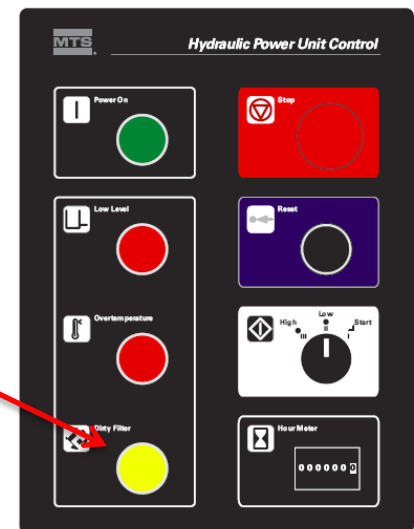
HPU Filter Change

- » The HPU filter(s) should be changed
 - When dirty filter is indicated either by panel light or mechanical indicator
 - » It is common for the dirty filter indicator lamp to turn on with cold oil.
 - » Be sure to reset indicator once oil is warm.
 - » If indicator comes back on the filter should be replaced.
 - » If indicator remains off it is not necessary to replace the filter.
 - Every 1000 hours or 6 months of operation
 - Every time the oil is changed

Mechanical
Dirty Filter
Indicator



Dirty Filter
Panel
Lamp
Indicator



Front Panel Controls

HPU Filter Change

- » Turn off the HPU.
 - Use appropriate Lock Out / Tag Out procedures
- » Check the output pressure gage.
 - Be sure the pressure is at zero before proceeding.
- » Unscrew the filter housing and remove it from the HPU.
 - Be careful not to spill any hydraulic fluid.
- » Remove the disposable element from the manifold.
 - Remove any connectors or end cap plugs from the filter element.
 - Discard any fluid contained in the filter housing and the filter element.
- » Wipe out any remaining sludge in the filter housing with a lint-free cloth.
 - Notify customer if contamination such as metal shavings detected in filter bowl
 - May require further maintenance to locate source of contamination
- » Inspect the O-rings in the manifold for any sign of deterioration. If necessary, replace the defective O-ring(s).

HPU Filter Change

- » Transfer any couplers or end cap plugs from the old filter element to the new filter element
- » Insert a new element onto the filter manifold.
- » Reinstall the filter housing.
- » Turn on the HPU and switch to high-pressure mode. Inspect the seal between the housing and the manifold for any signs of leakage. If leakage occurs, repeat this procedure (without replacing the filter element).
- » If you are changing the filter because the dirty filter indicator tripped, run the HPU for two to four hours to remove contaminants..
- » Press the **Reset** button on the HPU control panel to reset any interlocks and turn off the **Dirty Filter** indicator.

HPU Replacement Filter

- » Part numbers for replacement filter element and O-rings are not always found on HPU BOM.
 - MTS often purchases filter housing and element as a package so individual parts may not shown on BOM
 - Ensure if you get a replacement element part number from a HPU BOM that it is the element only and not the complete housing with element

- » Filter Element Part number can be located in the following places:
 - The service catalog contains MTS part numbers for the filter element and O-ring for most MTS HPU's
 - The HPU manual
 - The HMPG web site

Adding Make up oil

- » When adding make up oil
 - Only use same oil as what is currently present in system
 - Use transfer pump equipped with a 10 micron filter to add oil
 - Readjust Low Oil Level sensor after adding oil

Oil Sampling

- » The only approved method for a FSE to sample oil is using a FIST tool
 - The FIST tool is not available to be purchased by customers
 - Customer oil sample tool P/N 055-589-601
- » For sampling procedure see Fluid Care video manual in the Routine Maintenance – Fluid Care training module
- » See Fluid Care procedures located on Fluid Care page of service QMS site
 - FS-OP 4404
 - FS-OP 4405
 - FS-OP 4406



Oil Quality

- » There are several visual indicators of oil quality

- » If the oil is milky white this is an indicator of water in the oil
 - Immediately stop using the system
 - Oil must be replaced and system must be flushed until water is absent
 - Failure to stop using system will result in additional failures in the system
 - » Servo valves
 - » HSM control valves
 - » End cap nylon delamination

- » If oil is dark this does not automatically indicate bad oil

- » If oil is dark and has burned or foul odor most likely the oil needs to be replaced.
 - Recommend MTS Fluid Care to determine oil quality

HPU Oil Change

- » Press the stop button to turn off the HPU.
 - Use appropriate Lock Out / Tag Out procedures

- » Remove the filler cap and screen

- » Use a transfer pump to remove the used oil
 - Place transfer pump in filter bypass mode
 - Customer responsible for disposal

- » Replace the filter element(s)

HPU Oil Change

- » Add new oil to the reservoir
 - Use a transfer pump
 - Filter the oil to 10 micron

- » Reinstall filler cap and screen

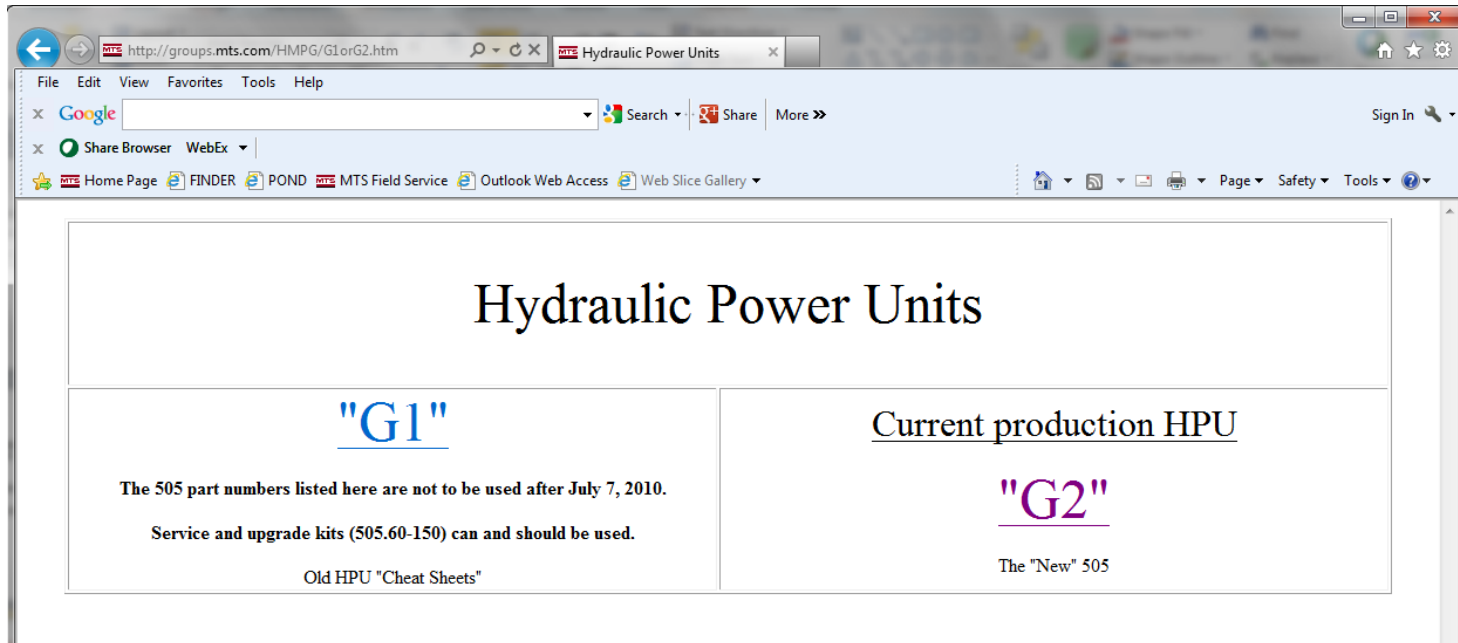
- » Turn on HPU

- » Run in high pressure and check for leaks

- » Verify that dirty filter indicator extinguishes

Additional Information

- » Additional information on current production HPU's can be located on the HMPG website.
 - From the Intranet Home Page go to
 - » Groups > HMPG > Power Units
- » <http://groups.mts.com/HMPG/G1orG2.htm>



The screenshot shows a web browser window with the URL <http://groups.mts.com/HMPG/G1orG2.htm>. The page content is as follows:

Hydraulic Power Units	
<p><u>"G1"</u></p> <p>The 505 part numbers listed here are not to be used after July 7, 2010.</p> <p>Service and upgrade kits (505.60-150) can and should be used.</p> <p>Old HPU "Cheat Sheets"</p>	<p><u>Current production HPU</u></p> <p><u>"G2"</u></p> <p>The "New" 505</p>