

Hydraulics

Matthew Whitten
Brookhaven College

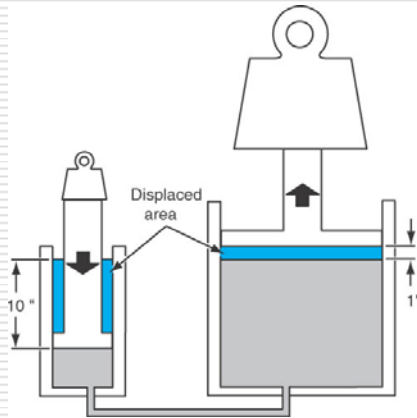
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Hydraulics

- Pascal's law: force applied to a confined fluid has this force equally distributed throughout the liquid.

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Pascal's law

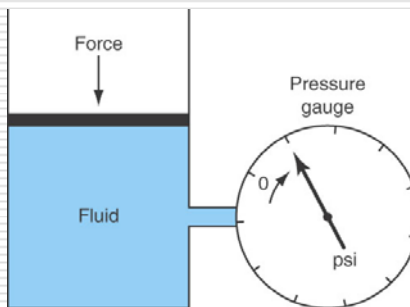


- ❑ A small amount of force can be used to apply great force.
- ❑ This great force can be used for lifting or application of clutches in transmissions.

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Measure of pressure

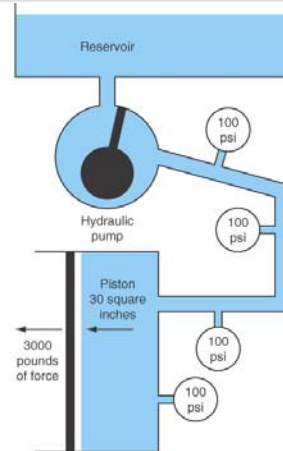
- ❑ Pounds per Square Inch. (PSI.)
- ❑ The force applied is evenly distributed within the fluid.
- ❑ If the force is 144 lbs. on the piston and the piston is 12 square inches. What is the Psi?



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Working system

- ❑ A piston of 30 square inches can apply 300 lbs with only 10 psi of system pressure.



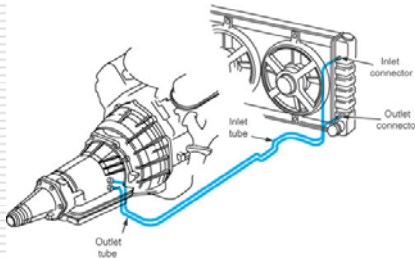
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Uses of hydraulic pressure

- ❑ Lubrication
- ❑ Cooling
- ❑ Apply force/Disengage Force
- ❑ Hydraulic control system

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Cooling

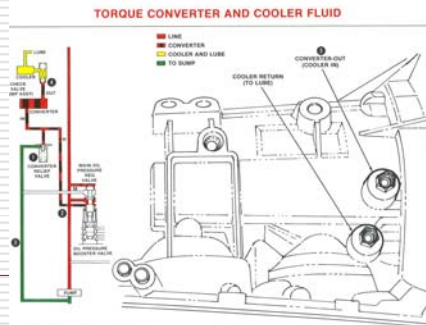


- ❑ Radiator coolers:
 - Main: Actual purpose is to heat the fluid to operating temperature for cold driving.
 - Secondary: Used to cool transmission fluid directly and components indirectly.
 - External coolers are only for cooling.
- ❑ Comes directly from greatest heat source of transmission.
 - What is this source?

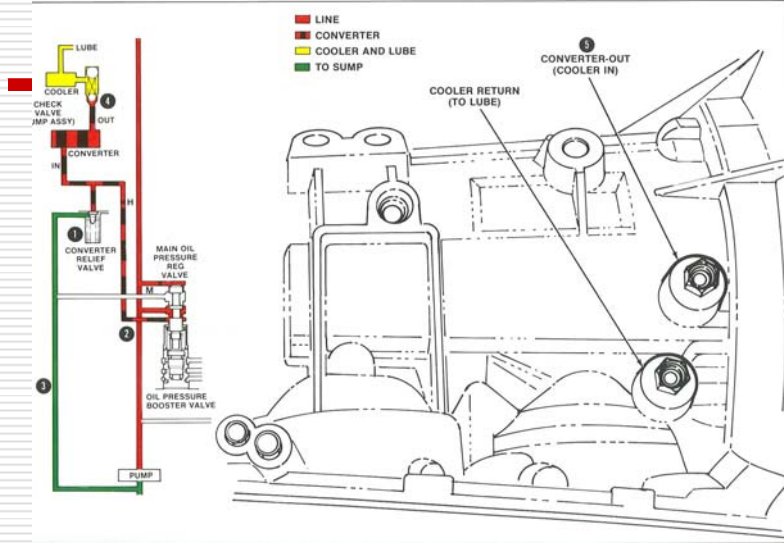
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Cooling system

- ❑ The cooling system is important to transmission life and shift feel.
- ❑ Each application has it's own transmission fluid flow rate and some have pressure specifications.
- ❑ There is a test to check the operation of the cooling system.



TORQUE CONVERTER AND COOLER FLUID



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Cooler flow test

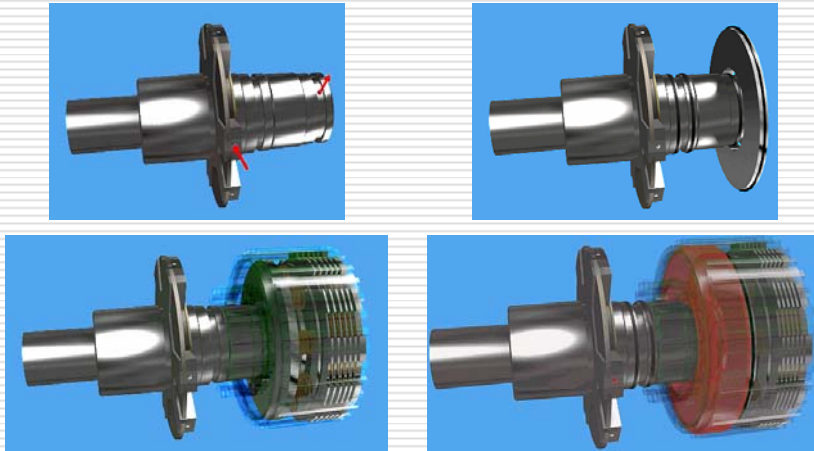
Transmission Fluid Cooler Flow Check

NOTE: The transmission linkage/cable adjustment, fluid level, and line pressure must be within specification before performing this test. Refer to service procedures as outlined.

1. Remove transmission fluid level indicator from filler tube.
2. Place funnel in filler tube.
3. Raise vehicle on a hoist and place suitable safety stands under vehicle.
4. Remove cooler return line (rear fitting) from fitting on transmission case.
5. Connect one end of a hose to cooler return line and route other end of hose up to a point where it can be inserted into funnel at filler tube.
6. Remove safety stands and lower vehicle. Insert end of hose into funnel.
7. Start engine and run at idle with transmission in NEUTRAL position.
8. When fluid flowing from hose is solid, a liberal amount of fluid should be observed. "Liberal" is described as about .47L (1/2 quart) delivered in 30 seconds. If liberal flow is observed, test is completed.
9. If flow is not liberal, stop engine. Disconnect hose from cooler return line and connect it to converter out line fitting (front fitting) on transmission case.
10. Repeat steps 7 and 8. If flow is now liberal, refer to appropriate section for diagnosis of transmission fluid cooler. If flow is not liberal, service pump or converter assembly.

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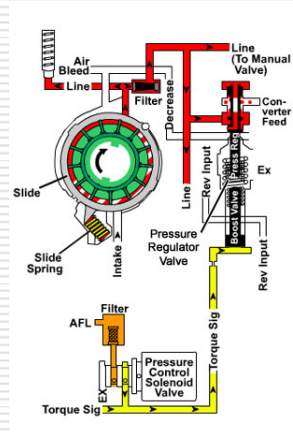
Application Force/ Disengagement Force



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Hydraulic control system

- Used to control shift timing and feel.
- Types of pressure:
 - Cooling
 - Line
 - Governor
 - Throttle pressure
 - Modulator pressure
 - Apply pressure
 - Boost pressure



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Producers of pressure

- ☐ Automatic transmissions rely heavily on the use of hydraulic pressure and flow for operation.
- ☐ The production of pressure and flow is done with a hydraulic pump.
- ☐ The pump is driven by the engine through the converter hub or an oil pump drive shaft.

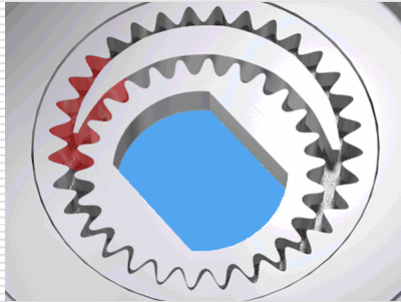
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Pump types

- ☐ There are four types of hydraulic pumps. Only three are commonly used in Ford Automatic Transmissions.
- ☐ Types:
 - Gear and crescent
 - Gerotor
 - Variable vane
 - External gear

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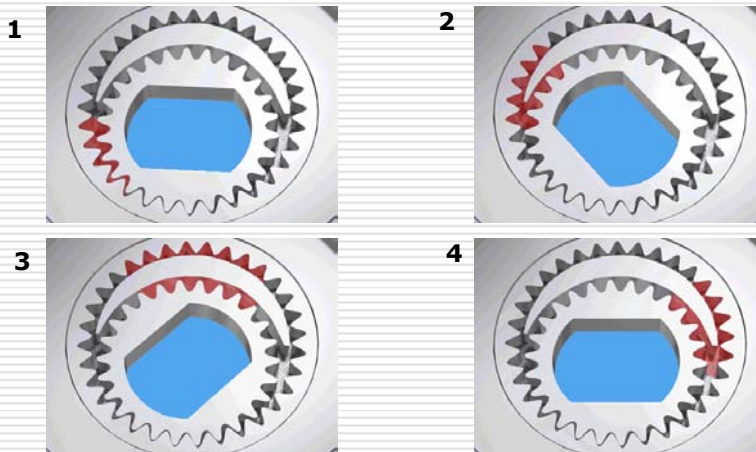
Gear and Crescent



- Components:
 - Internal drive gear
 - External driven gear
 - Stationary housing with crescent shaped boss.
- The internal gear is driven by the converter hub.

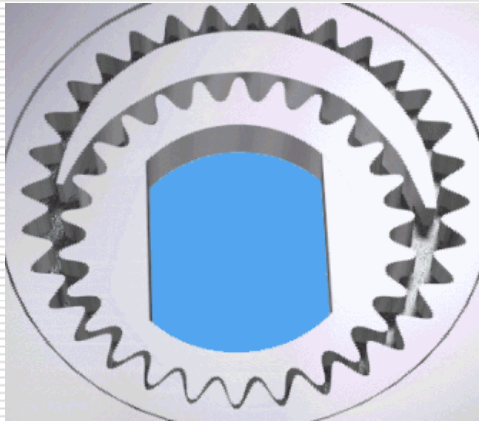
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Gear and Crescent Operation



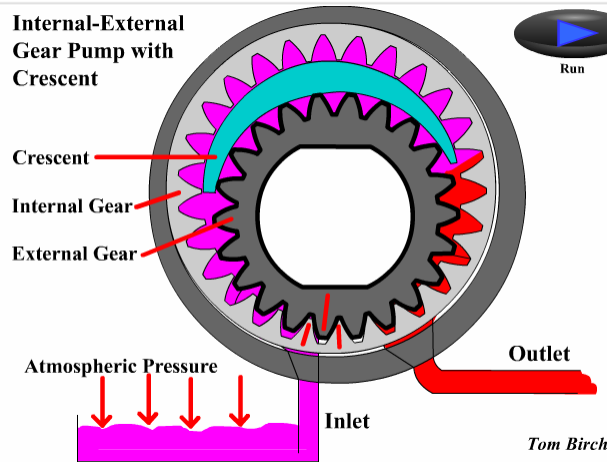
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Operation



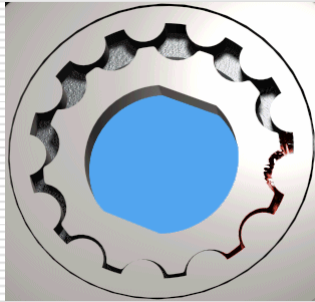
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Internal-External Gear Pump with Crescent



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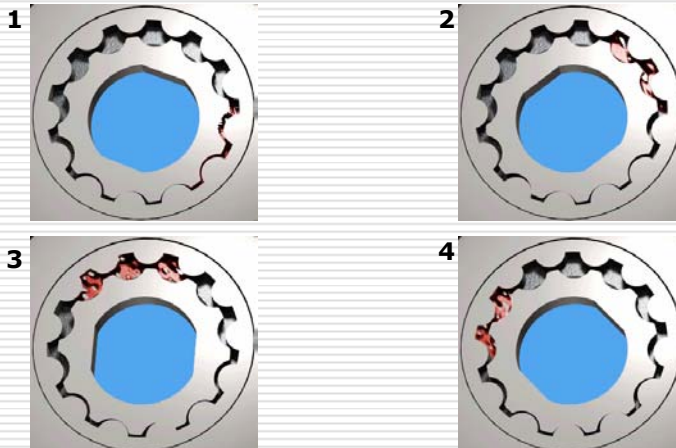
Gerotor



- Components:
 - Internal drive gear
 - External driven gear
- The internal gear is driven by the converter hub.

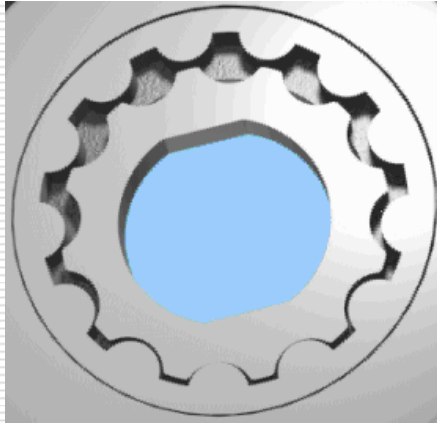
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Gerotor operation



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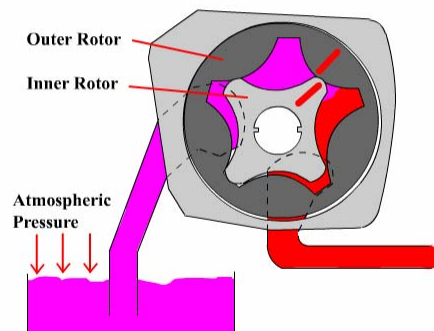
Gerotor Operation



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Gerotor Operation

Gerotor Pump



Tom Birch

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Variable Vane



□ Components:

- Bore ring
- Pump bore ring spring
- Bore ring pivot
- Bore ring pivot seal
- Bore ring seal
- Vanes
- Vane support rings
- Rotor

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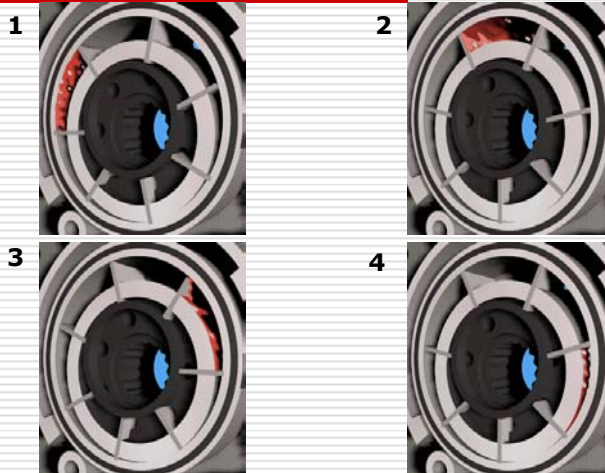
Variable Vane



- ## □ The variable vane
- is driven using an oil pump drive shaft drive off of the torque converter case.

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Variable Vane Operation



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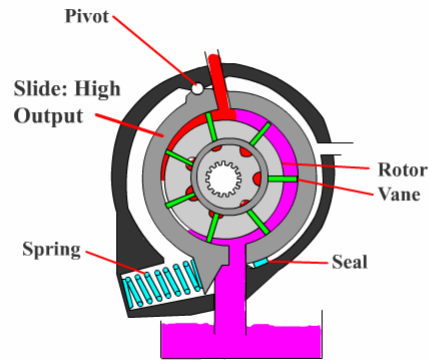
Variable Vane Operation



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Variable Vane Operation

Variable Vane Pump



Run

Tom Birch