HydroMax System

- In normal operation, fluid from the power steering pump enters the inlet port of the HydroMax unit and flows through the pressure valve, power piston and flow switch and exits from the return port.
HydroMax System
HydroMax System

- When force is applied to the brake pedal, a pressure valve is activated which restricts the flow of fluid through the power piston. The pressure then, acting on the power piston applies a force to the master cylinder. The reaction piston provides the desired “feel” at the brake pedal.
HydroMax System

- A pressure regulating device limits the internal unit pressure developed during a full braked application and retains hydraulic pressure for steering.
HydroMax System

- The fluid flow switch is a "open" during normal brake operation and a separate check valve in the motor pump prevents fluid from backflowing through the pump.
HydroMax System

In the event of hydraulic pressure failure from the power steering pump, the flow switch “closes” and the electric motor pump provides the hydraulic power necessary to apply the brakes. The number of times the brakes can be applied in the condition is limited only by the capacity of the vehicle's electrical system.
HydroMax System

- The brakes can be applied manually if both the power (hydraulic) and reserve (electrical) systems fail.
HydroMax System

- A HydroMax hydraulic power brake system consists of:
  - A hydraulically powered booster
  - A master cylinder
  - An electric motor pump
  - A warning system
HydroMax System

- Power to the hydraulic booster for the hydroMax system is provided by and engine driven hydraulic pump which boosts pressure to the master cylinder to increase brake system effectiveness.
The Big Picture

A. Brake System (Brake Fluid)
B. Brake Booster & Power Steering System (Power Steering Fluid)
1. Power Steering Gear
2. Power Steering Pump
3. Power Steering Reservoir
4. Brake Master Cylinder Reservoir
5. Brake Master Cylinder
6. Power Booster
HydroMax Assembly
HydroMax Assembly

- The area between the HydorMax booster pushrod forward O-ring and the primary piston rear O-ring of the master cylinder is vented to the atmosphere. This venting prevent mixture of the brake fluid with toe power steering fluid in the event one or both of these o-rings begins leaking.
Engine Running – No Brake Application

HydroMax - No Brake Application
Engine Running – No Brake Application

- When the total system is functioning properly and the hydraulic pump is supplying the HydroMax unit, the flow through the unit is as shown.
- 1. Flow pressure from the power steering pump holds the HydroMax booster inlet check valve open.
- 2. Before the brake pedal is applied, fluid passes freely through the pressure valve and into the low pressure chamber.
Engine Running – No Brake Application

3. Fluid passing out of the unit holds the flow switch open, preventing operation of the electric motor pump.

4. No pressure is applied to the power piston and the master cylinder pushrod is at rest.

5. No action takes place in the master cylinder and no brake application is experienced.
Engine Running-Light Brake Application
As shown, the brake pedal has been depressed slightly. This begins the power assist action of the HydroMax unit.

1. Flow pressure from the power steering pump holds the booster inlet check valve open.

2. The brake pedal push rod begins to close the pressure valve. As the flow is restricted, pressure builds-up in the high pressure chamber. The power piston is pushed by built-up of pressure and results in power boosted movement of the master cylinder through the master cylinder push rod.
Engine Running-Light Brake Application

3. fluid passing out of the unit holds the flow switch open, preventing operation of the electric motor pump.

4. The forward movement of the master cylinder push rod forces the primary piston and actuator away from its compensating valve.

5. Hydraulic pressure builds in the primary braking system and primary brakes are applied.
Engine Running-Normal Brake Application

A. Brake Fluid
B. Power Steering Fluid
C. Air Space
1. Secondary Compensating Valve
2. Secondary Reservoir Section
3. Primary Reservoir Section
4. Primary Compensating Valve
5. Flow Switch Assembly
6. Return Port
7. Supply Port
8. Check Valve (shown open)
9. Pressure Regulator Assembly
10. Actuator Pin
11. Brake Pedal Rod
12. Reaction Piston
13. Firewall
14. Power Piston
15. Check Valve (shown closed)
16. Electric Motor Pump Assembly
17. Pressure Valve
18. Return Spring
19. End-Cap Assembly
20. Primary Piston/Actuator Assembly
21. Primary Pressure Chamber
22. Primary Piston Return Spring
23. Secondary Piston/Actuator Assembly
24. Secondary Pressure Chamber
25. Secondary Piston Return Spring
Engine Running-Normal Brake Application

- In a normal braking application (firm pedal, but not panic) the flow through the system is as follows
  
  1. Flow pressure from the power steering pump holds the booster inlet check valve open.
  
  2. Brake pedal push rod moves inward and the pressure valve partially closes.
3. Pressure to the power piston is high.
4. The master cylinder push rod moves further into the master cylinder.
5. Fluid passing out of the unit holds the flow switch open at the electric pump.
6. Both the primary and secondary actuator pistons are moved past the respective compensating valve and both the secondary and primary systems are pressurized.
Engine Running - Maximum Brake Application
Engine Running-Maximum Brake Application

- Maximum application of the brake pedal, as may be experienced during an emergency stop.
- 1. Flow pressure holds the inlet check valve open.
- 2. The brake pedal push rod moves inward, virtually closing off fluid flow through the pressure valve. This results in maximum rated pressure on the power piston, which is transferred to the master cylinder through the master cylinder push rod.
3. The pressure regulator spring compresses and allows the pressure valve to open slightly and bypass fluid through the pressure valve orifice when maximum preset pressure is exceeded.

4. Fluid passing out of the unit holds the flow switch open, preventing operation of the electric motor pump.
Engine Running-Maximum Brake Application

5. Both the primary and secondary actuator pistons are moved to the maximum braking position.

6. If the combined demand of the power steering gear and the HydroMax unit should exceed the capacity of the hydraulic pump to maintain adequate flow, the flow switch will close and the electric motor pump will provide auxiliary fluid pressure.
Engine Running-Maximum Brake Application

- In some applications the BRK ELEC MTR lamp will illuminate and the buzzer will sound for the period that the electric motor pump is operating. This will only be a momentary period when hard turning (steering) and hard braking occur simultaneously.
Hydraulic Booster Malfunction - Normal Brake Application
Hydraulic Booster Malfunction - Normal Brake Application

- When brake boost is demanded and there is no fluid flow to the HydorMax Booster unit because the engine is not running or some other condition has occurred to interrupt fluid flow; the actuation of the unit is like this.

  1. The inlet check valve closes as a result of no fluid flow entering the unit.
Hydraulic Booster Malfunction - Normal Brake Application

2. The flow switch closes since there is no flow to keep it open. This completes the electric circuit to the electric motor pump. Mounted to the bottom of the HydroMax booster unit.

3. The electric motor pump supplies fluid at a somewhat lower pressure for power braking assist. Therefore, increased pedal effort is required to stop the vehicle within a specified distance.
Hydraulic Booster Malfunction - Normal Brake Application

- THE VEHICLE SHOULD BE DRIVEN WITH EXTREME CAUTION AND IMMEDIATE SERVICE IS NEEDED.
- Operation in the master cylinder is the same as previously described for normal operation.
No Hydraulic Assist

- Flow Switch (Closed)
- Return Port (No Flow)
- Inlet Port (No Flow)
- Direct Mechanical Force from Brake Pedal
- Check Valve Opens (to relieve hydraulic fluid trapped in the low pressure chamber)
- Master Cylinder Push Rod
- Low Pressure Chamber
- Electric Motor Pump (Not Operating)
- Brake Pedal Push Rod

No Hydraulic Assist
No Hydraulic Assist

In the unlikely event that complete loss of all power assist occurs during vehicle operation, it is still possible to bring the vehicle to a controlled stop by push-through manual application of the master cylinder. However, brake pedal effort will be greatly increased and vehicle stopping distance will be significantly longer.
No Hydraulic Assist

- VERY IMPORTANT

DO NOT ATTEMPT TO DRIVE THE VEHICLE EXCEPT FOR EMERGENCY REMOVAL FROM THE ROADWAY