

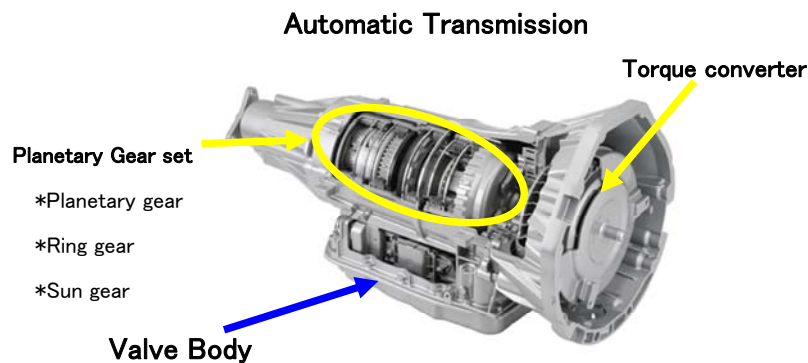
## V-BALL® Elastomeric Balls for Automatic Transmissions

Have you ever had a kidney stone? If so, you know how painful it is as the stone blocks the uric tube like an elastomeric ball in a check valve, causing your kidney to swell. Although the size of a typical kidney stone is only several millimeters, the effect to the patient's body is immeasurable.

In contrast to the effects of a kidney stone, Vernay's rubber check balls (V-BALL®) work in the automatic transmission of the car to provide a smooth, comfortable ride.

How do Vernay's rubber check balls perform when you drive an automatic transmission car?

- **The automatic transmission** is an automobile gearbox that can change gear ratios automatically as the car moves, freeing you from having to shift gears manually.



**Automatic Transmissions** contain a **Torque Converter**, a **Planetary Gear Set** and a **Valve Body**. The engine's torque (converted through the Torque Converter) drives the input shaft that is connected to the **Planetary Gear Set**, which in turn is transmitted to the optimal driving torque through the output shaft.

- The most suitable gear ratio is provided with the Planetary Gear Set, which consists of a **ring gear**, a **sun gear** and two or more **planetary gears**. The combination of these three gears is fixed and never changed like a manual transmission.
- How is the engine torque transmitted to the best driving torque without changing gear combinations?
- Through the use of a very interesting mechanism that locks or unlocks one or two gears of the **Planetary Gear Set**. The gear ratio is dependent on the combination of the rotating gear

- If the ring gear needs to be locked (stop rotating) in order to provide the most suitable torque, the ring gear is locked with the clutch system or bands. This locking is provided by squeezing the clutch disks or bands by hydraulic pressure.
- The hydraulic pressure is controlled and provided by the **Valve Body**, where Vernay's elastomeric check valve balls are working.

**The Hydraulic System** is a very complex maze of passages in the valve body. This is the control center of the automatic transmission. The picture below shows the lower part of the valve body that is separated from the upper part by a separator plate. In the maze of passages, some rubber check balls (red color) are found staying in its chamber.



Numerous rod valves go through their bores that cross the valve body maze of passages so as to control the fluid pressure and switch automatic transmission fluid (ATF) from one passage to another. This part is called the "**Valve Body**" for this reason. When a rod valve receives a demand to smoothly shift to the appropriate gear, it slides mechanically or electrically in its bore to switch ATF from one passage to another. At the same time, hydraulic pressure also switches to the appropriate clutch disks - thus the smooth shift change is achieved.

Is it enough that the rod valves switch the hydraulic pressure from one to another? If there were no Vernay rubber balls in the automatic transmission, it would be almost as painful as a kidney stone to drive since every time the transmission shifted, it would literally jerk the whole car. This is because the rod valves function is only to select the passage of fluid; the rubber balls actually control the pressure more than the rod valves. Some of the check balls perform as one-way valves and some perform as shuttle valves to supply the appropriate hydraulic pressure to correct clutch disks or bands. This accomplishes a very smooth shift change.

The next time you're driving an automatic transmission car, remember that Vernay's rubber balls are constantly working to make a smooth shifting experience.