Raybestos POWERTRAIN HT

FLUID FLOW DYNAMICS

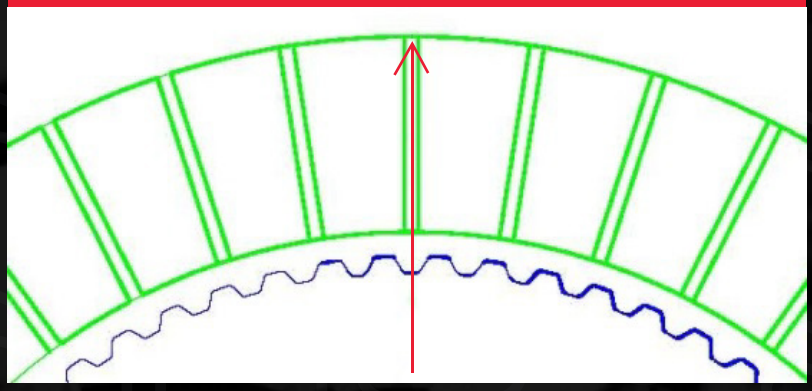
FOR FRICTION CLUTCH PLATES

Groove pattern or design will dictate the fluid flow dynamics at the clutch surface, both when the clutch is applied as well as when it is released. This means that fluid flow dynamics are essential when designing a friction plate to maximize performance and durability, and to help improve fuel economy. The design of a friction plate groove pattern must address three needs:

1. **Adequate lubrication**
2. **Reduced temperature**
3. **Reduced drag torque**

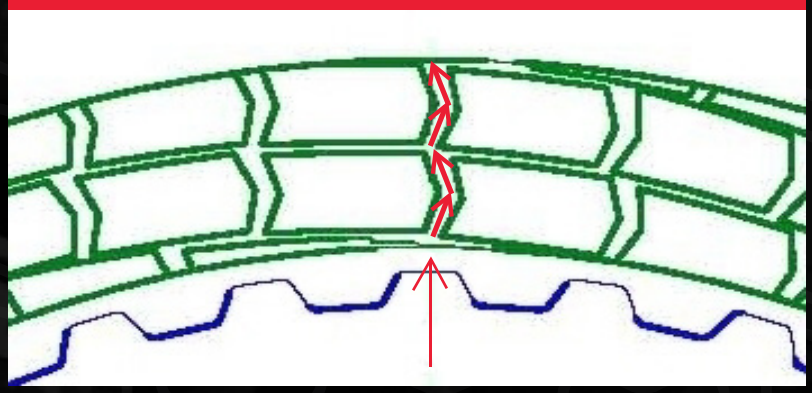
Optimum groove design results in the ideal balance of adequate lubrication, reduced temperature and reduced drag torque. With the new Hybrid Technology (HT) design, Raybestos Powertrain has developed a unique groove design that achieves an unmatched balance of optimum cooling and lubrication with an impressive reduction in drag torque.

1. ADEQUATE LUBRICATION



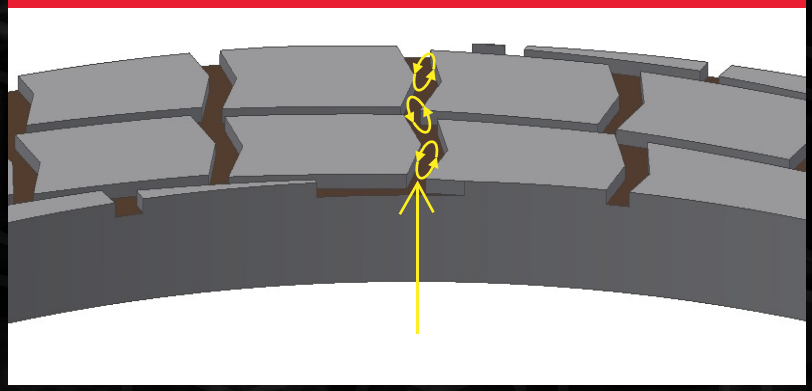
Fluid must move properly along the clutch surface in order to lubricate the steel reaction plates. When fluid flows quickly through the groove, it provides less cooling, but better lubrication. These plates usually have a radial, waffle or other type of straight-line friction groove pattern.

2. REDUCED TEMPERATURE



When fluid flows more slowly through the groove, it absorbs more heat, which provides more effective cooling. Ideally, the pattern will also promote a swirl of the oil as it flows through the groove, which improves cooling even more. These plates usually have a groove pattern that is not a straight-line design.

3. REDUCED DRAG TORQUE



Drag torque has a direct impact on fuel efficiency. An engineered balance between oil flow, groove design and clutch clearance is needed to keep the friction and steel plates separated while disengaged, yet not permit so much oil to flow between the plates that the parasitic drag greatly reduces fuel efficiency.

Patent: U.S. D803,116 S

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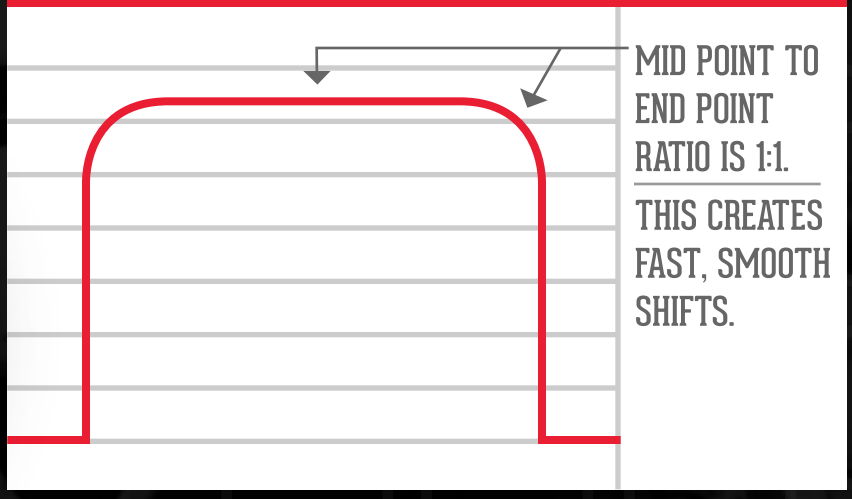
HYBRID TECHNOLOGY MATERIAL DESIGN

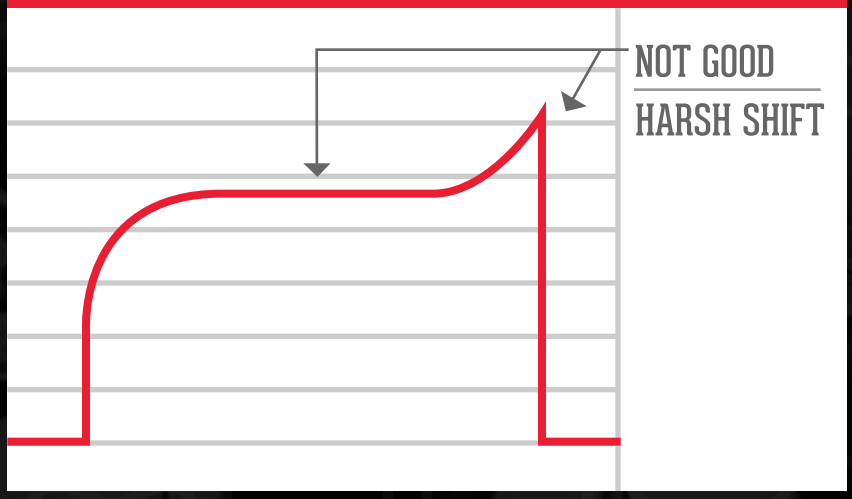
Raybestos Powertrain has combined the superior fluid flow dynamics of our unique HT groove design with a proprietary, high-energy friction material originally developed for the OEM. The result: smooth shifts, increased torque capacity, reduced drag torque and increased durability.

Using precise SAE machines, clutch performance is evaluated in a chart form known as a "torque trace." One vital test is the E/M (Endpoint/Midpoint) ratio. The closer the E/M ratio is to 1:1, the better the shift.

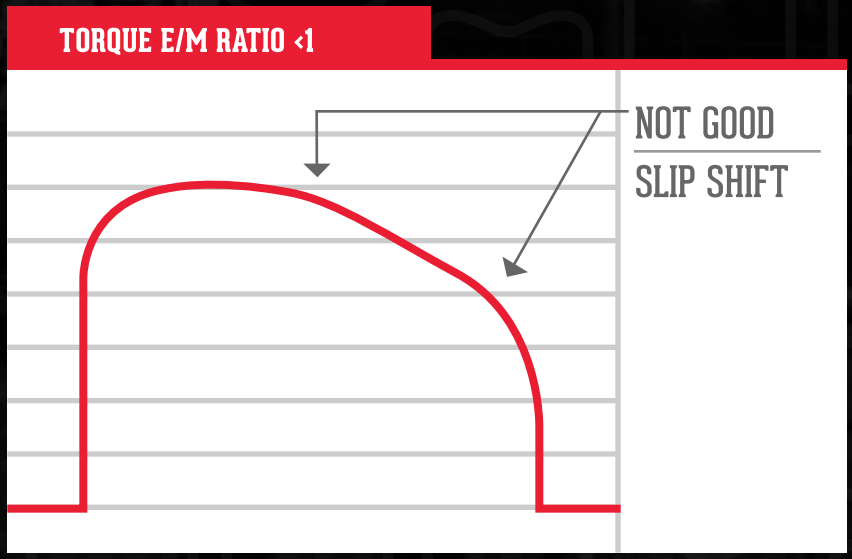
HT TORQUE E/M RATIO 1



TORQUE E/M RATIO >1



TORQUE E/M RATIO <1



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