PRODUCT SHEET:

RAMPTECH® VACUUM POWER ASSIST BRAKE BOOSTER
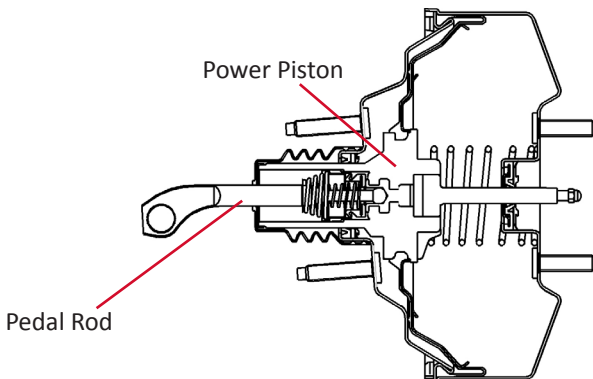
RAMPTECH®
ENGINEERED FOR THE RAMP

components of the brake booster were both redesigned and tested to perform under higher amounts of stress.

It has been shown through both Finite Element Analysis (FEA) and physical tests that if force is not applied along the same axis as the pedal rod centerline and/or excessive force is used past the design limits, the original designed pedal rod will fail in the GSE environment.

To overcome these design limits, a new pedal rod and power piston design was created to better stand up to the rigors of the GSE environment. This new design has been shown to have a significant advantage in structural strength, both through FEA and physical tests. This will allow the new design to compensate for minor variations in brake booster installations, as well as accommodating increased force from the operator.

Overall the new RAMPTECH® Brake Booster designed for the ramp will last longer than the original. Added strength, optimized geometry, and improved materials were developed for enhanced performance.

Sage Parts
Part Number
324045

DESCRIPTION

The RAMPTECH® Brake Booster recognizes a new standard for quality. We listened to users in the field and engineered a new and improved version of the original design Brake Booster.

The original Brake Booster design was made for lighter-weight automotive vehicles. Airport ramp equipment utilizing the brake booster under even minimal loads is of a much higher weight than the vehicles originally targeted for this booster application. To accommodate the higher weights and meet ramp requirements, the pedal rod and the power piston

Power Piston

Pedal Rod

IMPROVEMENTS

✓ Redesigned pedal rod displacement axis to accommodate installation alignment issues
✓ Finite element analysis for optimized pedal rod geometry
✓ Power piston material and design was improved to accommodate higher stopping loads
✓ Batch control with date code and order number
✓ This is a new unit -- NO CORE REQUIRED

REPLACES

TUG - T6-8007-101
TIGER - TIG-8007-101
A1 CORDONE - 54-74000

Sage Parts Plus, Inc.
30 Hub Drive, Melville, NY 11747
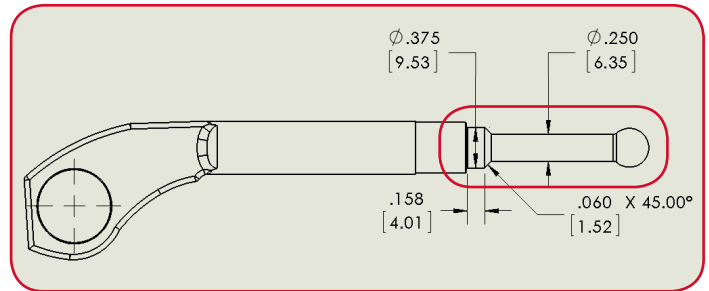+1.877.SAGE.877 | +1.631.501.1300 Tel
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PEDAL ROD IMPROVEMENT:

RAMPTECH® VACUUM POWER ASSIST BRAKE BOOSTER

The pedal rod design was changed to increase the Factor of Safety (FOS). This increase will allow for minor variations in the geometry of the vehicle firewall, which may cause the booster pedal rod to not be completely perpendicular to the firewall when the brakes are applied.

Stress Behavior and Factor Of Safety Test
New Design - 800N applied at 0 degrees

Brake booster/Brake pedal system operation
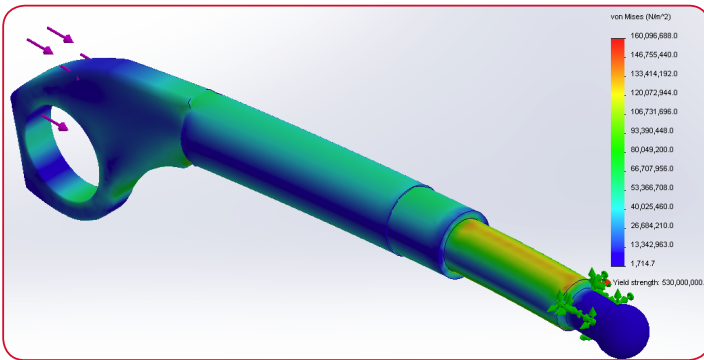
OLD DESIGN

The new pedal rod has a more robust design through several added features. The weakest point of the pedal rod where it commonly fails was moved closer to the ball end of the pedal rod. This greatly reduces the shearing force at that location since it's pivot point is now closer to the ball end. Also, the chamfer at that location has been replaced by a fillet which helps reduce the stress concentration factor at that location. These changes was accompanied by an overall increase in the pedal rod's diameter at key locations to increase its ability to withstand forces that may be encountered in a GSE environment.
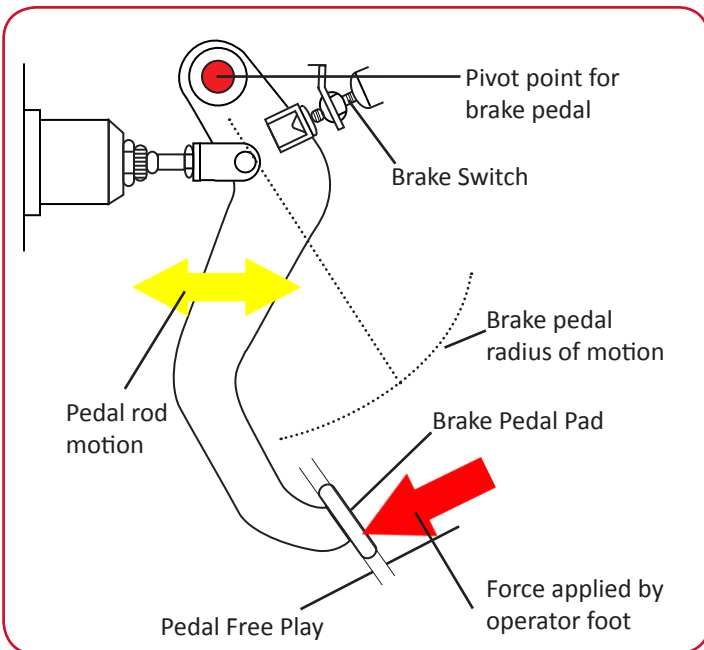
NEW DESIGN
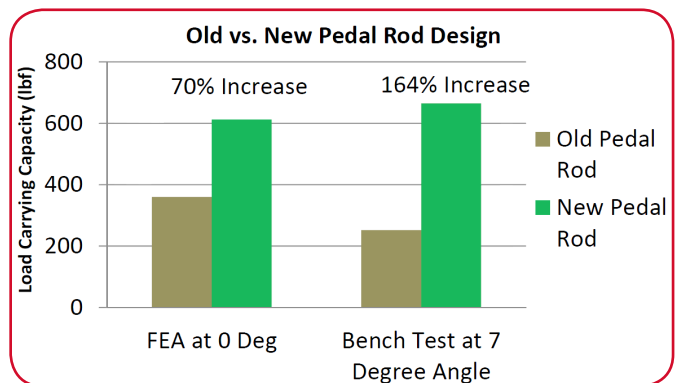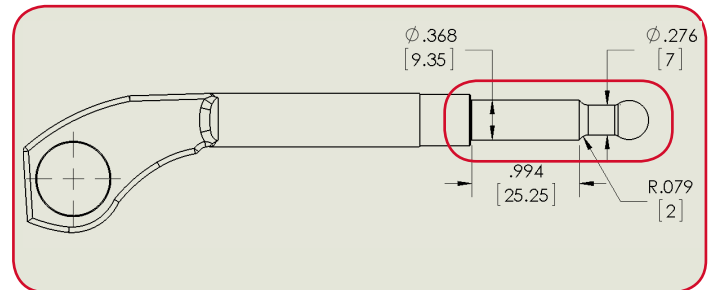
Comparison of Maximum Load Carrying Capacity of the old and new pedal rod designs from both the FEA and bench testing.

POWER PISTON IMPROVEMENT:
RAMPTECH® VACUUM POWER ASSIST BRAKE BOOSTER

Heavy Duty Power Piston

The power piston is an integral part of the vacuum assisted booster assembly. Primarily, it serves as a displacement link between the vehicle's brake pedal and the master-cylinder piston. As such, this component is exposed to high mechanical forces generated by the vehicle operator.

Historically, this booster design was originally intended to be used on passenger vehicles, which had specific braking requirements. In the GSE industry, a typical ramp tractor can have a GVW from 3,750 lb. to 7,500 lb. with a drawbar pull capacity of range of 3000 lb. to 6,000 lb. As a reference, the curb weight of a 1979 Ford Mustang was roughly 2,700 lbs. The braking forces for GSE vehicles are significantly higher than commercial vehicles, as a result of the higher loads. With the increased braking force requirements comes additional stresses and internal forces, which act on the booster elements.
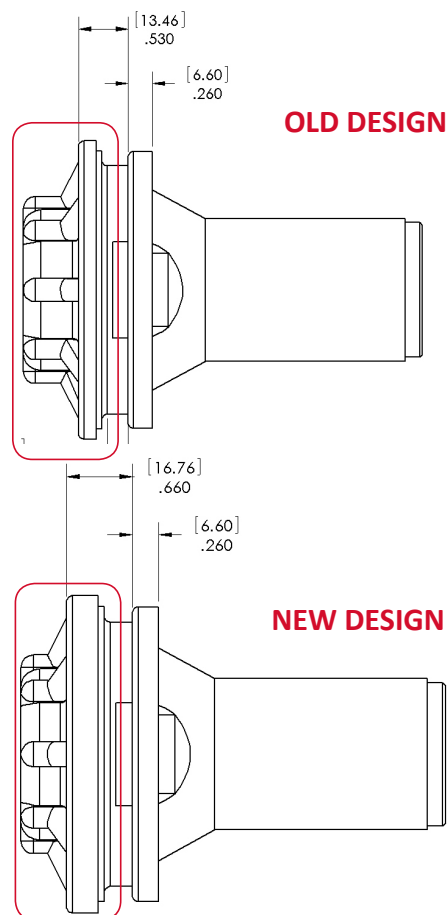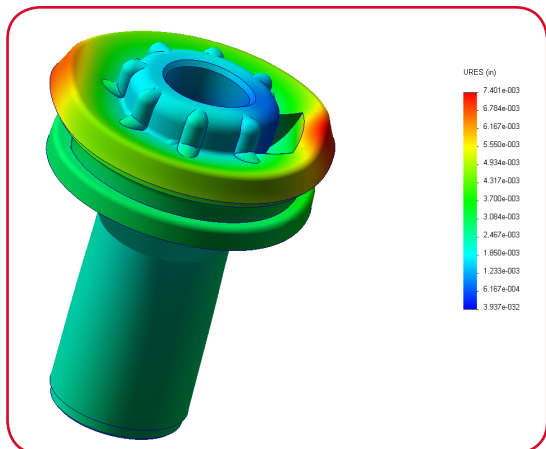
Based on this understanding, we set out to explore the possibility of enhancing the robustness of the power piston [among other components]. Our goal was to ensure that this product will be able to safely accommodate the braking requirements for the GSE industry, while maintaining the original design integrity. That is – we did not want to reinvent the wheel, but rather reshape it to meet customer's needs.

A numerical simulation study was completed to explore the material and dimensional parameters of the power piston. During the first phase, we evaluated the performance of the current material and piston design as a function of braking load requirements. These results helped us pinpoint the exact area of concern and the proper material specifications. For example, by increasing the diaphragm retaining flange of the power piston by 3 mm we were able to increase the yield load capacity by 72%. Furthermore, we were able to identify a proprietary material with special fill reinforcement that would minimize the displacement and stress concentration acting on the flange, thus adding additional robustness.

These modifications and enhancements are not visible to the naked eye, but rather work behind the scenes to produce a more robust and industry specific product.

FEA - Displacement Distribution at 2,000lb load

OLD DESIGN

NEW DESIGN