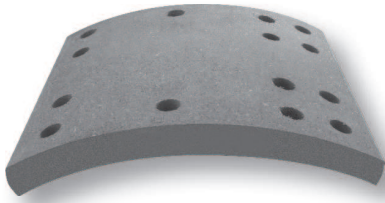




Selecting friction for severe duty application? Get the facts on temperature ratings.

Here's what the numbers really mean.



How important are temperature ratings when selecting friction for your severe duty application? Some friction suppliers may claim their friction materials have extremely high temperature ratings – 1000°F, for example – in an effort to gain customer confidence in their offerings. But before you make the decision to buy, it's important to understand the facts about brake temperatures and friction material.

Typical temperatures in brake operation

In commercial vehicle drum brake applications, temperature's critical role begins at the engagement point between the lining and the drum. The bulk drum temperature generally ranges between 600°-650°F. For a brief time during engagement, and during FMVSS testing, it's actually not uncommon for temperatures to exceed 1000°F. These two points – engagement and bulk drum – represent the full temperature range experienced by all friction materials in drum brake applications.

So why would any vehicle operator consider temperature ratings as a relevant factor when selecting friction materials for drum brakes? What's the purpose of these ratings? How are temperatures measured to obtain these ratings? And, are they being measured at the lining surface or the bulk drum temperature?

Some friction suppliers claim that their severe duty brake linings have temperature ratings from 950°-1000°F. Yet, are these temperatures really relevant for certification and selection of friction materials?

Heat transfer in braking

To start, when discussing friction temperature it's critical to have a point of reference. Since the brake system has a wide variety of components – each with unique thermal properties – it's impossible to identify one temperature as most critical to the system as a whole.

Remember, for a drum brake application, temperature starts at the engagement point. Here very high temperatures – over 1000°F – will be reached for some period of time, however that temperature is quickly dissipated when the engagement is complete and heat is transferred into the heat sink – in this case, the drum. Without that heat dissipation, the cast iron drum would be glowing red – creating an extremely difficult environment for any friction material to survive.

Repeated stops and heat transfer into the drum means the bulk temperature of both the drum and lining will slowly rise as they become heat soaked. In the case of normal commercial vehicle use with adequate cooling air, average temperatures may reach around 200-300°F on the lining and 300-500°F on the drum. All are within the acceptable range for their respective materials, phenolic resins (the key binding agents used in organic friction materials) and cast iron.

Bulk friction temperatures should never exceed 300°-400°F, regardless of the brand of friction. Even the best resins only survive to 600°F.

High temperatures degrade resins

In applications where the frequency of stops increases and/or cooling air is restricted, these temperatures can increase even more. Phenolic resins begin to degrade at temperatures ranging from 248°- 482°F.

To better withstand the temperature in severe duty applications, higher grade resins are used, but bulk friction temperatures should never exceed 300°- 400°F, regardless of the brand of friction. Even the best resins only survive to 600°F. This is the laws of chemistry and physics at work, not marketing.

Heat is the enemy of braking performance, so the goal is always to maintain lower temperatures. If not, the heat induced degradation of the phenolic resins will increase lining wear, and may also lead to brake fade – or loss of stopping power – in drum brakes.

The key to remember is that the elevated temperatures at the engagement point of the friction and drum dissipate immediately. Although it may be acceptable to measure 1000°F on the drum surface during engagement, prolonged exposure at this temperature will lead to the failure of any non-asbestos organic (NAO) friction.

Rely on proven industry standard tests, not sensational claims

As a full service OE brake system supplier with decades of experience meeting the demands of OE friction certification, Bendix believes in adhering to proven industry standard tests when it comes to the design, recommendation and application of friction materials.

The most important and accepted industry tests used by Bendix and other leading brake and friction suppliers in the OE and aftermarket friction certification process are the FMVSS 121 and SAE J2115 tests. These two tests, which all commercial vehicle drum brake friction materials must adhere to, use the following established maximum temperature limits:

- **FMVSS 121 Dynamometer Test**
Brake Power or Fade Section: 150°- 450°F is typical
- **Society of Automotive Engineers (SAE) J2115**
(Section 7 – Wear and Effectiveness at Temperature)
Measured at 250°F, 350°F, 450°F, 550°F and 650°F

For SAE and FMVSS testing temperatures, it should be noted that the temperature measured is bulk drum, not surface.

Friction customers should note that neither of these tests makes any reference to, or recommendation on, temperature ratings for friction materials. In addition, friction material certification for the major truck OEMs does not include temperature ratings for friction materials either.

The fact that the majority of brake manufacturers and most friction suppliers use these industry standard tests clearly suggests that the extreme temperature ratings claimed by some friction suppliers are irrelevant. Every friction supplier should be willing and able to provide the results of both of these tests versus emphasizing the temperature ratings of their own materials – especially when the ratings are well outside the industry's normal acceptance criteria.

The industry standard SAE and FMVSS tests do not reference or recommend temperature ratings for friction. Neither does friction certification for major truck OEMs.

Key questions to ask on temperature ratings

When a friction supplier claims temperature ranges far exceeding the normal system operating temperatures detailed above, be sure to ask these important questions:

- 1) *What temperatures – bulk drum or engagement – are they measuring and where is it being measured?*

In the absence of this information, temperature ratings are merely numbers. Friction life and performance will be dictated based solely on resin quality and how well it performs in the SAE temperature wear section.

- 2) *How can I determine my vehicle's running temperature?*

The only temperature that can be easily measured on a vehicle without instrumentation (such as thermocouples) is bulk drum temperature. If after operation, the bulk drum temperature is anywhere near 1000°F, back away from the truck – something is very wrong and it may lead to a fire. For a drum brake, 600°F is a very high temperature, and only brief in-stop temperatures should ever exceed this.



Avoid marketing hype – get the friction you need

Your brakes are the most important safety equipment on your truck, so selecting the right friction is very important. Don't let marketing hype prevent you from getting the performance, safety, and service life you need. Familiarize yourself with the key factors – including industry standard testing – ask the right questions, and partner with your friction supplier to make the right choice.

For guidance in selecting the right friction for your application, see your Bendix representative, or call 1-800-AIR-BRAKE.



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