# WHAT MAKES A GOOD BRAKE DRUM

There are a number of attributes that differentiate between mediocre and a good brake drum. The following highlights these and what they mean to the end user.

## 1. A HEAT ABSORPTION DEVICE (HEAT SINK)

The braking system in a vehicle converts the vehicle energy of motion into heat energy by means of friction between the brake lining and the brake surface of the brake drum when the vehicle's brakes are applied.

a). The surrounding parts, such as brake lining, rim, tire, hub, bearings, and drum absorb heat by conduction and radiation.

b). The surrounding air is heated by convection.

Radiated heat to surrounding parts is small and heat dissipated by convection to the surrounding air is slow relative to the actual time of braking. For these reasons nearly all the braking energy must be stored in the form of heat in the brake drum. This energy is stored by heating the drum material to a higher temperature than the drum temperature prior to the brake application. A heavier drum will store more energy than a light one will. A heavier drum is stronger and more fade resistant.

## 2. A CYLINDRICAL BRAKE LINING INTERFACE

The brake drum moves past a stationary brake lining. When (if) the brake surface does not move past the lining uniformly, the brake drum has run out. This will overstress the brake drum, linings, and attaching hardware, causing variable heating of the brake drum braking surface which results in heat checking, excessive ware of both the drum and lining, pulsing of the brake, and shortened life of both the drum and lining. Also to keep the drum dimensionally stable under these conditions, it must be a relatively heavy brake drum.

A heavy precise brake drum does not reduce the need for linings to fit the drum correctly. If the linings are not contoured to fit properly, the brake will not produce proper breaking torque. Poorly contoured linings cause additional mechanical stress in the drum, shoes and lining, and brake hardware. This additional stress hastens failure and greater wear.

Before linings are "burnished" or seated into the brake drum, they may rub on only a few high spots. These superheat the brake drum braking surface in very small areas and can be seen on the brake dynamometer as fire bands. A light brake application will cause this to occur whereas a snub brake application will force the lining against more of the braking surface of the brake drum thus limiting or even eliminating these types of hot spots. If these hot spots are allowed to continue, martensite hot spots will occur, and in turn drum distortion, and very early cracking can happen.

Lining that takes longer to burnish will be more likely to cause hot spotting. Many of the non-asbestos organic linings fall into this category. Since martensite hot spotted brake drums cannot usually be successfully rebored, they usually must be scrapped.

## 3. HIGH STRENGTH, HEAT, AND WEAR RESISTANT BRAKE DRUM MATERIAL

A brake drum must be strong enough to resist the maximum mechanical stress caused by the expanding and self-energized brake shoes at high temperatures. The brake drum's stiffness or resistance to deflection is derived from the thick shell structure and the stiffness of the gray cast iron. Higher tensile strength gray iron does not change the deflection of the brake drum significantly.

Although higher strength iron is more resistance to thermal stress caused by temperature gradients, as a "hot" brake surface and a "cold" outside brake drum diameter. The occurring problem here is the "cold" outside diameter of the brake drum does not want to expand to a bigger diameter, but the "hot" inside diameter of the brake drum does want to expand. The "hot" inner surface is caused to compress or compresses plastically so that it fits within the "cold" outer surface. But as the "hot" inner surface cools, cracks form because the metal was too compressed to return to its original position thus resulting in hairline surface cracks known as heat checks.

## 4. HEAVY ROTATING PARTS THAT IF IMBALANCED CAN SIGNIFICANTLY AFFECT THE VEHICLES RIDE

The mass of a 16.5" x 7" brake drum is concentrated about 9 inches radially from the hub bearing centerline. Unless the brake drum is balanced, it helps excite vibration in trucks and trailers. That is why it is important to use balanced brake drums on all front and rear applications. Most brake drum balancing is done by welding weights to the outside of the drum, but ArvinMeritor pioneered and patented a technique to balance brake drums without welding on balance weights. This is called Machine to Balance (MTB). The industry typically requires front hub/drum or hub/rotor assemblies balanced to 20-in. oz. maximum and rear hub/drum or hub/rotor assemblies balanced to 50-in. oz. maximum.

## 3. SUMMARY: THE BEST BRAKE DRUM FOR OVERALL PERFORMANCE

Is a relatively heavy brake drum
Is made from temperature and wear resistant high tensile iron
Is precisely machined
Is balanced by machining rather than adding weights

## MAXIMUM BRAKE FACE DIAMETERS

Maximum brake face diameters are indicated on ArvinMeritor Brake drums, i.e., the word “Max. Dia. 15.120 inches 384.05mm” will be found on brake drums with a 15 inch, 381mm nominal brake face diameter. This means that for safe operation the brake face diameter should never exceed 15.120 inches, 384.05mm from machining or wear.

Because we have no way of knowing the number of heat cycles or the severity of the cycles to which the drum has been subjected in actual usage, we do not recommend reboring the brake face diameter. The user is best able to judge whether the drum has sufficient life remaining to justify reboring. The maximum diameters are shown in the chart.

ArvinMeritor has engineered their brake drums to provide safe operation At the maximum brake face diameters, however, ArvinMeritor does not machine these drums to maximum diameters and cannot control the methods that others use to re-machine them after they are put into use.

Do not confuse maximum brake face with maximum rebore diameters. When the drum reaches the maximum brake face diameter, it must be removed from service. There may be some instances where it is a good economic decision to rebore a brake drum but after rebore, there must be some wear life left (at least .040 inches) prior to reaching discard diameter. ArvinMeritor does not recommend reboring brake drums for the following reasons:

1. It usually is not a good economic solution.
2. Reboring does not remove fatigue damage even though it may remove the heat checks.
3. It is very difficult to avoid running brake drums over the maximum brake face diameter.
4. Martensite (hot spots) and distortion caused by it are virtually impossible to remove.
5. Severe corrosion is frequently on the outside of the drum which weakens the drum.

| NOMINAL DIA. | | MAXIMUM BRAKE FACE DIA. | |
|---|---|---|---|
| **Inches** | **mm** | **Inches** | **mm** |
| 7.25 | 185 | 7.340 | 186.44 |
| 8.00 | 204 | 8.090 | 205.49 |
| 9.50 | 242 | 9.590 | 243.59 |
| 9.75 | 248 | 9.840 | 249.94 |
| 10.00 | 254 | 10.090 | 256.29 |
| 11.00 | 280 | 11.090 | 281.69 |
| 11.06 | 281 | 11.120 | 282.45 |
| 12.00 | 305 | 12.090 | 307.09 |
| 12.25 | 312 | 12.340 | 313.44 |
| 14.00 | 356 | 14.090 | 357.89 |
| 14.50 | 369 | 14.620 | 371.35 |
| 15.00 | 381 | 15.120 | 384.05 |
| 16.00 | 407 | 16.120 | 409.45 |
| 16.25 | 413 | 16.370 | 415.80 |
| 16.50 | 420 | 16.620 | 442.15 |
| 16.50 | 420 | 16.585 | 421.25 |
| 17.00 | 432 | 17.120 | 434.85 |
| 17.25 | 439 | 17.370 | 441.20 |
| 18.00 | 458 | 18.120 | 462.25 |
| 20.00 | 508 | 20.120 | 511.05 |
| 20.25 | 515 | 20.370 | 517.40 |
| 21.00 | 534 | 21.120 | 536.45 |

## WHEN SHOULD A BRAKE DRUM BE REPLACED?

The ability of a brake drum to perform safely is affected by a variety of factors. Conditions, which affect the life of brake drums, are listed, although this list is not intended to be all-inclusive it should serve as a useful guide. The brake drum should be replaced when any of these conditions appear.

1. Brake face diameter reaches maximum limit
2. Excessive heat checks
3. Cracks
4. Martensite spotted drums – “hot spots”
5. Worn or elongated bolt holes
6. Galling of brake surface
7. Brake drum known to have been overheated as occurs with dragging brakes
8. Brake drum warped….out of round
9. It may be necessary to replace brake drums in pairs in order to maintain proper brake balance and efficiency.

## RECOMMENDATIONS FOR LONGER BRAKE DRUM AND ROTOR LIFE

When drums are forced to fit onto a hub, there is improper match of parts for installation. The cause must be determined and corrected.

Wheel bearings should be properly adjusted to prevent the drum from picking up the load created by the braking action.

Drums and linings should be checked at periodic intervals to detect operational patterns. The use of non-asbestos organic linings can cause linings to swell and drag resulting in hot spots and lower fuel economy.

Clearance between non-applied brake linings and the drum varies slightly. See the brake system manufacturer’s recommendations for this adjustment. Proper clearance prevents excessively hot linings and drums and improves fuel economy.

Parking brakes should not be set while the drums are hot. Allow them to cool, otherwise, drum cracking and failure can result.

## DRUM FAILURE ANALYSIS

Regular and thorough inspection of your brake system is the best investment you can make for low cost per mile brake operation. Be sure you have a standard inspection timetable and follow it. The following pages list common problems you should be alert for.