

Step #1

Inspect rotor for lateral run-out, parallelism and minimum thickness specification. Compare to manufacturers specifications. If rotor is not within specifications, see Step 2.

Step #2

Replace or Machine Rotor – Ensure tool bits are sharp and brake lathe is in good operating condition.

Perform a secondary finish operation using 120 & 150 grit sandpaper with mild pressure for 60 seconds on each side.

Step #3

Wash all rotors (including new) with soap and hot water and a scrub brush, to remove oils and fine particles to prevent noise and maximize braking.

Step #4

To provide a long and quiet brake service life, Wagner recommends:

- Use a wire brush or sand/bead blasting to remove rust from caliper brackets/guides.
- Clean or Replace attaching hardware.
- Lubricate “Metal-to-Metal” contact points (brackets to guides/guides to pads) with a Molybdenum Disulfide high temperature lube, commonly called “Moly Lube”.
- Lubricate “Metal-to-Rubber” friction points (guide pins to boots) with high temperature silicone lube (Wagner # F132005) or approved moly-lube.
- Lubricate the pad to piston contact area of any pad that has an attached shim (Inboard Disc Pad).
- DO NOT lubricate or apply any compounds on the backing plate of Wagner ThermoQuiet® with “IMI” brake pads.
- Test drive vehicle and perform break-in (burnish) procedure on new brake pads: Make approximately 20 “Complete Stops” from 30-mph or 20 “Slow-Downs” from 50-mph to 20-mph with light to moderate pedal pressure, allow 30 seconds cool down between brake applications. Communicate with customers to continue this burnish process by avoiding aggressive braking for the next couple of days.

Brake Noise Solutions

Brake Caliper Cleaning and Lubrication

Disc Brake Trouble Tracer Chart

Disc Pad and Brake Shoe Break-In (Burnish) Procedure

All sound is the result of a vibration. The pitch is determined by the frequency of the vibration. This means a “slow” vibration sounds like a groan, while a “fast” vibration will sound like a squeal. A vibration in one part can induce a secondary vibration into another part, particularly as parts are lighter each year and resonate easier. In most O.E. brake designs, dampening is performed by guide clips to assure rigidity or by insulator shims behind the pads. There are two ways to solve noise.

Dampen Vibration

Hi-Temp Grease

Use high temperature silicon grease on caliper slides, and on floating pins to prevent caliper binding and chatter.

Shim Insulators

Forms a permanent cushion to dampen vibration; some pads use applied shims as insulators which may migrate or delaminate during use. Wagner ThermoQuiet ® brake pads include an Integrally Molded Insulator (IMI) which will not delaminate or migrate during use.

Prevent Vibration

Pad Tabs

Bend any retaining tabs or ears on the pads, to make sure that the pads are secure in the calipers to prevent rattle.

Rotor Finish

Block sand rotor smooth and flat using 120 to 150 grit sandpaper, to get the full pad surface contact, while preventing grab and chatter.

Cleaning

Wash with soap and hot water to remove metallic fragments trapped in the rotor surface valleys and clean oils from the surface of the rotor, soap and water scrubbing will remove all the fine grit that can not be removed by spray cleaners and gets under the new pad and causes chatter.

Hardware

Replace all anti-rattle clips, springs and pins, which can lose their spring tempering due to the higher brake heat. Make sure guide pins are not binding which would create vibration.

Brake System Noise Overview

The primary cause of brake system noise is vibration and all brake systems vibrate to one degree or another creating an initial noise. For the most part this initial noise is beyond detection to the human ear. In part this is due to the dampening effect which the larger mass brake components generate in the system. The key factor in dampening initial noise is the stability or rigidity of the brake system components. In most O.E. disc brake designs, dampening is assisted by (1) insulators called shims or noise suppression gaskets which reduce vibration between the disc rotor plate and the caliper brake pad contact surfaces and/or (2) guide plates or abutment clips and the caliper mounting brackets assure rigidity of those components.

When the initial noise in the brake system is amplified (instead of dampened) to a level which becomes disagreeable to the vehicle operator, this amplification is called a secondary vibration. The secondary vibration occurs when the initial vibration frequency reaches an audible level with a high enough frequency for the driver to hear and be concerned.

Friction materials are not normally the cause of a secondary vibration. It generally results from rust, distorted or loose components and/or the wearing or weakening of an original part. As components weaken or become fatigued from the heat and stress generated in the brake system, they no longer fit as tightly as necessary to maintain proper rigidity. Any vibration resulting from the pad backing plate to caliper contact points will result in a very audible, irritating noise such as squeal.

Many technicians believe that changing to disc pads with a “softer” (more forgiving) friction material will cure noise problems. In reality, changing to the “softer” material changes the balance of the brake system, and this results in a change in noise frequency to an inaudible noise level. The important tradeoff to consider; wear rate of softer pads is much higher, life expectancy is greatly reduced. Thermodynamics may be altered affecting brake safety and efficiency.

Understand vehicle brake balance:

- With 70%-85% or more of the braking performed by the front disc brakes while 15%-30% is done by the rear brakes.
- Older rear wheel drive vehicles performed 55%-60% of braking up front and 40%-45% in the rear brakes.
- Front wheel drive disc operating temperatures are much higher, resulting in increased glazing and wear.
- Any brake system is capable of generating noise. While braking under these extreme conditions heat build up causes glazing of the friction surfaces (a thin

surface hardening or flaking is formed on the surface of pads/shoes) and all these conditions can produce noise.

- Brake noise may be heard during light brake applications, and usually when the brakes are cold. Make sure caliper and pads move freely and are lubricated. Make sure the guides or slides are not making contact with the rotor. Remove and sand friction on a flat surface and reinstall.
- Repeated braking in heavy traffic or hilly driving conditions. During these very demanding operating conditions temperatures can reach 1000 degrees or more. At these temperatures brake squeal is a common occurrence due to a metallurgical structure change that occurs in the rotor or drum surface.

Brake Caliper Cleaning and Lubrication

Disc Brake Trouble Tracer Chart

Disc Pad and Brake Shoe Break-In (Burnish) Procedure

Failure to clean rust buildup and properly lubricate caliper brackets during brake service is proven to be a major cause of brake noise, premature wear and increased stopping distance. Federal-Mogul Motorparts' Technical Education Center recommends a meticulous cleaning and lubricating of all caliper brackets and mounting points. This will allow proper caliper/pad movement to ensure maximum brake performance and customer satisfaction.



To provide long, quiet, brake service life, Wagner recommends:

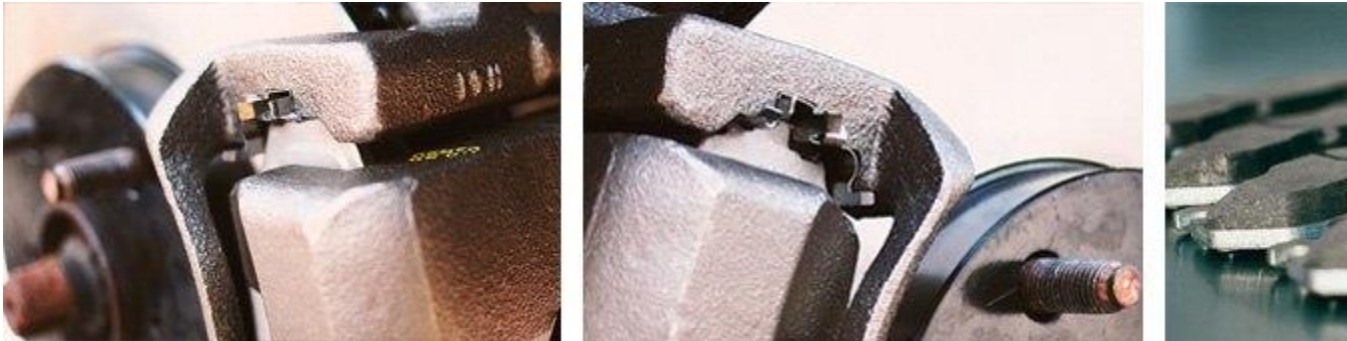
Wagner ThermoQuiet® brake pads include an Integrally Molded Insulator (IMI) which will not delaminate or migrate during use.

- Use a wire brush or sand/bead blasting to remove rust from caliper brackets/guides
- Clean or Replace attaching hardware
- Lubricate “Metal-to-Rubber” friction points (guide pins to boots) with Silicone lube

Wagner BD126003E Premium E-Coated Brake Rotor, Rear-Instruction manual

- Lubricate “Metal-to-Metal” friction points (brackets to guides/guides to pads) with a Molybdenum Disulfide lube, commonly called “Moly Lube”
- DO NOT lubricate or apply any compounds on the backing plate of Wagner ThermoQuiet® with “IMI” brake pads
- Use premium quality Wagner ThermoQuiet® brake pads
- Use premium quality rotors

Note: Molybdenum Disulfide is effective in wet or corrosive environments over a wide range of temperatures.



Proper Rotor Preparation Prevents Brake Noise

Many service technicians are experiencing comebacks on disc brake pads sooner than they expected due to noise. Proper rotor surface and cleaning are critical to overall braking performance. The Federal-Mogul Motorparts' Technical Education Center and the Rotor & Drum Engineering Facility have teamed up to provide the following information and recommendations

Rotor Surface's Impact on Brake Noise

The smoother the rotor finish, the better. When dragging a fingernail over the rotor surface, it should feel glass smooth. Obtaining the proper rotor surface finish is critical to reducing brake noise and eliminating comebacks. Many new rotors are machined to a mirror-like finish and require no additional machining prior to installation. Most shop lathes will require a secondary finish procedure to break off the “mountain peaks” that are produced when the brake rotor is machined. The recommended procedure is to block sand for 60 seconds per side with 120 grit sandpaper followed up with 60 seconds of 150 grit sandpaper. A former alternative method is to apply a non-directional finish utilizing a ball hone to provide the required surface finish of 14-75 Ra. If this secondary finish is not performed, the rotor surface fragments break off during the initial brake applications and become trapped into the microscopic grooves or valleys of the rotor. These fragments end up embedded in the brake pad and create noise. Additionally, the “peaks and grooves” prevent the proper rotor surface area from contacting the disc pad. As a result, the reduced contact points on the rotor are more prone to overheating and hardening, which

sets up the potential for vibration and noise. A secondary finish will also reduce the phonograph record type grooves, which can sometimes produce a clicking noise.

A Note Regarding Brake Lathes

Many technicians have reported very good results using the newer, more expensive round bits over the traditional three point bits. Older lathes should be inspected for wear in the arbor bearings, which will prevent the rotor being held true during machining. Adaptors should be inspected for damage and machined true to prevent run-out.

Cleaning the Rotor and Its Impact on Brake Noise

Proper cleaning of resurfaced and “new” rotors must be done. This is one of the most overlooked areas. The proper way to clean a rotor prior to installation is to use soap and hot water and a scrub brush. This will clean the particles out of the “valleys”. Brake cleaner spray will not clean fragments from the rotor surface. Subsequently, the fragments become embedded in the pads, eventually causing noise. Try the two methods (brake cleaner spray vs. soap and water). Using the “white paper towel test”, you’ll discover the soap and water method is the most effective.

The following steps are also important to reduce the vibration that causes brake noise

- Inspect and replace worn brake hardware and guide pins
- Be certain to use the proper lubricants. Molybdenum (Moly-lube) or silicone brake lube (Wagner # F132005). Properly clean and lubricate all caliper mountings and disc pad mounting points. Finally, check for proper wheel bearing adjustment and wheel nut torque.

Disc Brake Trouble Tracer Chart

Disc Pad and Brake Shoe Break-In (Burnish) Procedure

Normal Appearance



Appearance

- Normal use
- Recommend periodic maintenance

Cracked pads



Appearance

- Small cracks in center of pad

Cause

- Stress cracks caused by pads flexing
- Pads not free to slide in caliper

Effect

- Piston bends in back plate

Solution

- Lubricate caliper slides and guide pins
- Replace pads

Uneven Wear Within a Set



Appearance

- One pad within caliper set excessively worn

Cause

- Caliper guide pins / piston

Effect

- Brakes pull to one side
- Uneven, rapid pad wear

Solution

- Replace pads and service caliper
- Replace with new loaded calipers

Uneven Wear



Appearance

- Uneven wear on pad surface

Cause

- Irregularly worn brake disc (wear lip)

Effect

- Squeal and brake pedal pulsation
- Premature pad wear

Solution

- Replace rotors and pads

Metal Residue



Appearance

- Metal residue on friction surface

Cause

- Water leakage, “quenching” of the rotor causes rotor fragments to break away, transferring them to the friction material
- Particularly noticeable if heavy braking on poorly bedded rotors

Effect

- Has no detrimental effect on braking performance
- May cause rotor damage or brake squeal

Solution

- In extreme instances, replace rotors and pads

Ashing



Appearance

- Partially charred friction material (whitish outer edges)

Cause

- Prolonged excessive pad temperature due to intensive use or dragging

Effect

- Reduction in initial braking efficiency
- Excessive material deterioration
- Material becomes brittle, chips and cracks
- Excessive abnormal wear

Solution

- Providing the damage is not excessive, pads can be used and will be effective under normal use

Glazing



Appearance

- Pad friction surface “glazed”

Cause

- High intermittent pad temperature for short durations

Effect

- Temporary reduction in braking performance Solution
- Can be remedied by “normal” use

Backplate Damage



Appearance

- Damaged backplate

Cause

- Incorrect assembly
- Excessive force used during installation

Effect

- Reduced braking efficiency, irregular, wear, noise and judder
- In extreme instances, products will not fit in the caliper

Solution

- Replace Pads

Worn Out Pads



Appearance

- Friction material completely worn out

Cause

- No periodic control of pad wear

Effect

- Vehicle may pull to one side
- Damage to rotor
- High squeal and noise

Solution

- Replace Pads

Surface Contamination



Appearance

- Friction material contaminated with oil, grease or brake fluid

Cause

- Spillage during maintenance

Effect

- Vehicle may pull to one side
- Reduction in braking performance

Solution

- Replace Pads

Tapered Pads



Appearance

- Uneven wear, tapered pads

Cause

- Distorted caliper
- Caliper slides sticking
- Piston sticking
- Excessive caliper clearance

Effect

- Premature pad wear
- Uneven braking pressure
- Noise and squeal

Solution

- Replace pads
- Service or replace calipers
- Replace with new loaded calipers

Disc Pad and Brake Shoe Break-In (Burnish) Procedure

An effective burnish cycle to seat the friction materials into the opposing rotor and drum surfaces requires approximately 200 stops. The 200 stops are consistent with the burnish procedure outlined in the Federal Motor Vehicle Safety Standards FMVSS 105 and FMVSS 135. As 200 stops may not be practical for many repair shops. Therefore, we recommend the following burnish procedure:

- Make approximately 20 "Complete Stops" from 30-mph - OR -
- 20 "Slow-Downs" from 50-mph to 20-mph with light to moderate pedal pressure
- NO PANIC STOPS
- Allow at least 30 seconds between brake applications for the brake pads or shoes to cool down
- It is critical to follow cool down procedures to avoid damaging NAO, Ceramic and Semi-Met friction material as well as the rotor/drum
- No high speed stops and/or braking under heavy loads that could result in glazed or otherwise damaged linings

Using these guidelines, the friction materials will have conformed to the surface of the rotors and drums for improved stopping performance. In addition, the thermal conditioning of the friction materials during this process will increase the stability of braking effectiveness over a greater range of temperatures compared to when they were first installed.

It's a good practice for the repair shops to communicate with their customers that their technicians have conditioned the friction and rotors and that the customers should continue this process by avoiding aggressive braking for the next couple of days. Good communication of this information will be helpful and prevent comebacks.

