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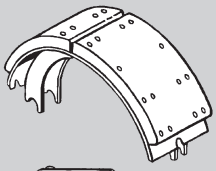
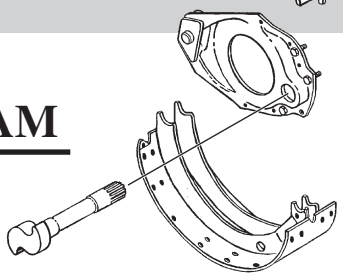
Air Brake



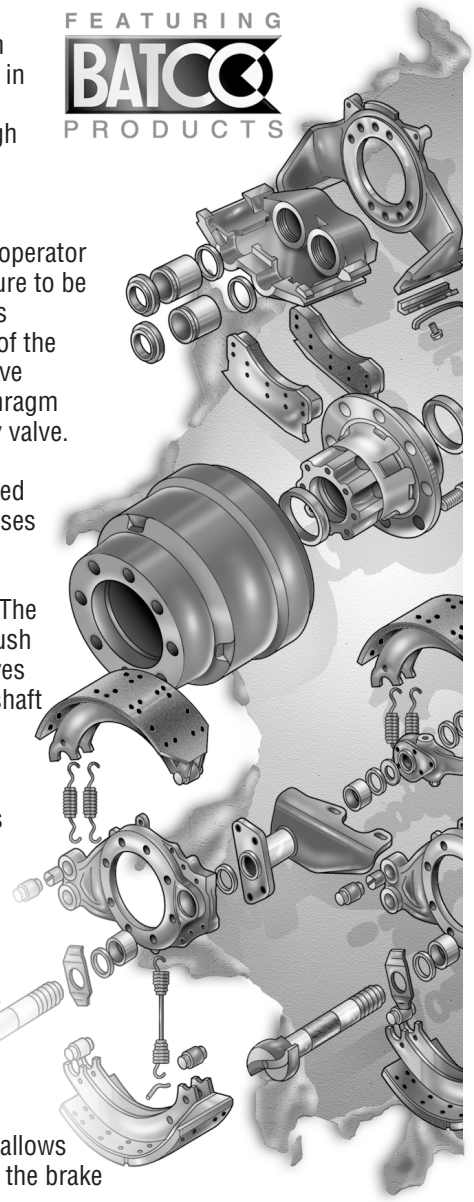


PRODUCT EMPHASIS PROGRAM

The Heavy Duty Air Brake System

The most common brake system in the heavy truck market today is the air supplied s-cam drum brake. The system begins with an air compressor driven by the engine to supply air to a holding tank (air tank). Most air systems contain an air dryer between the compressor and air tank to take moisture and other contaminants out of the air. Air tanks should have a drain valve in the bottom of the tank to purge moisture from condensation. Moisture and other contaminants in an air system can cause o-rings in the various air valves to swell and make the plungers stick. This makes the valve inoperable and it will have to be replaced. Air entering the main air tank passes through a ball and spring loaded "check valve". This keeps air from bleeding out of the tank when the compressor is not running.

FEATURING BATCO PRODUCTS



The main air tank on the tractor is controlled by the foot valve in the cab. When the operator steps on the pedal of the foot valve, they push down a plunger that allows air pressure to be released from the main air tank to the relay valves for the steer and drive axle brakes (pushing down the plunger also covers the quick release diaphragm on the bottom of the foot valve and closes it off). The air pressure from the foot valve enters the relay valve through the control line and fills a cavity in the valve with air. This cavity has a diaphragm with a plunger on the other side of it which controls the flow of air through the relay valve. When the cavity fills with air, the plunger is pushed down to allow the air in the tank at the relay valve to be released to the air chambers. Also, when the plunger is pushed down it covers the quick release diaphragm on the bottom of the relay valve and closes it off (more about the quick release diaphragm in a minute).

The air from the relay valve tank passes through the brake hose to the air chamber. The air chamber has a cavity with a diaphragm and a push rod on the other side. The push rod is attached to the slack adjuster. When this cavity fills with air the push rod moves the slack adjuster and the slack adjuster rotates the camshaft. The head of the camshaft between the brake shoes is shaped like an "S" and as it rotates it spreads the brake shoes apart.

The brake shoes are lined with friction material and contact the brake drum which is attached to the hub/wheel assembly. The friction material slows down the wheel assembly by taking the kinetic energy of rotation and turning it into heat. The hub/wheel assembly mounts the tires which transfers the slowing down of rotation to the ground and stops the vehicle.

When the operator takes their foot off the pedal, the plunger in the foot valve comes up; this releases the air in the control line of the relay valve and allows the plunger in the relay valve to come up and release the air in the air chamber out through the quick release in the bottom of the relay valve. When the air is released from the air chamber the push rod return spring moves the push rod back which pulls the slack adjuster. Pulling the slack adjuster returns the camshaft to its' original position and allows the brake shoe return spring to release the brake shoes from the brake drum. When the brake shoes release from the brake drum it stops the slowing down of the vehicle.

Now that we've completed a brief overview of the air brake system, lets look at the main components in the air system.

Air Compressor

The air compressor is usually driven by the engine, either by a belt or through a gear driven shaft. There are different sizes and styles of air compressors, but they generally have an internal crankshaft attached to pistons which reciprocate and pump air. They contain their own oil supply in the crankcase for lubrication, and if the piston rings become worn, the compressor can start to "pump oil" into the air system. At this point the compressor would need to be replaced. There is usually an air intake filter on the compressor which needs to be serviced on a regular basis depending on the operating environment of the vehicle.

Air Valves

Whether a foot or relay valve, these two are generally the same internally. They have an inlet or supply port(s) for air to come in and delivery port(s) for the air to go out. A control port on the top of a relay valve is for air to fill a cavity with a diaphragm that controls the plunger. A foot valve doesn't have a control line since it is the operator's foot on the pedal that controls the plunger. A plunger in the middle of the valve controls the flow of air through the ports and the plunger covers a quick release diaphragm on the bottom of the valve when pushed down. Contaminated air (especially with oil from the compressor) can cause the o-rings on the plunger to swell and make the plunger stick.

Air Brake Hoses

Air brake hoses should be free of external cracks and still be flexible. If you pinch the hose with your fingers and it does not return to its' normal shape, it should be replaced. Air brake hoses can swell internally from air contaminated with oil and block the passage of air. A good test for a hose that is suspected of being swollen internally is to disconnect it from the air chamber, and while holding the end of the hose a few inches from your hand, have someone make a brake application to see how much air comes out of the end of the hose. If very little air comes out, the hose probably needs to be replaced.

Air Chambers

There are two types of air chambers, service chambers and combination service/parking brake chambers. Service chambers can only make regular brake applications and have no parking brake. A combination chamber has the service brake and the spring (or parking) brake mounted on top of the service chamber "piggy back". A spring brake has a diaphragm inside the chamber to hold air and keep the coil spring retracted when not being used (where the name "spring brake" comes from for the parking brake).

When the truck is parked, the operator pulls the dash valve which releases air out of the control line of the spring brake valve. This allows the plunger in the spring brake valve to come up and open the quick release diaphragm on the bottom. Once the quick release is open, the air in the spring brake is released (this is that rush of air you always hear) and the coil spring expands to move the push rod. The push rod moves the slack adjuster which rotates the camshaft and spreads the brake shoes. Once the brake shoes fully contact the brake drum, the parking brake is set.

When the operator is ready to use the truck again, they push the parking brake dash valve in which sends air to the control port of the spring brake valve. This fills the cavity in the top of the spring brake valve with air and pushes the plunger in the spring brake valve down. When the plunger is pushed down it covers the quick release diaphragm on the bottom of the spring brake valve and allows air from the spring brake air tank to fill the spring brake chambers. As the air fills the spring brake side of the combination chamber, and retracts the coil spring, it allows the brakes to be released (if everything is working properly, you should see the push rod and slack adjuster move the camshaft back to its' original position).

A spring brake chamber with a bad shaft seal will leak air over to the service side of the chamber and you will hear air "hiss" out of the relay valve quick release when the brakes are not being applied. The only cure for this is to remove the brake hose for each chamber one at a time until you find the one that has air coming out. This will tell you which spring brake needs to be replaced, not the relay valve.

Slack Adjusters

Most trucks today come supplied with automatic slack adjusters. There are different types of adjusting mechanisms but the idea is to have the slack adjuster "automatically" adjust slack out of the brake as the brake lining, camshaft bushings, etc. wear out. The main thing with a slack adjuster, whether automatic or manual, is to be sure it is installed correctly. Most automatics come with a template or gauge to make sure the angle of the slack adjuster to the push rod of the air chamber is set up correctly. Failure to set this angle correctly will result in the adjusting mechanism of the automatic slack to function improperly.

Slack Adjusters *Continued*

A manual slack adjuster should be at no more than a 90° angle to the air chamber push rod when the brakes are fully applied. The main thing to remember about a slack adjuster, whether manual or automatic, is that it cannot compensate for being installed wrong. All a slack adjuster does is exactly what its' name says, it adjusts "slack" out of the brake as the brake lining, camshaft bushings, etc. wear out. Adjusting the slack will only bring it back to its' originally installed position, whether right or wrong.

So when you replace an air chamber, be sure to calculate where to cut the push rod so the slack adjuster is installed correctly. Don't just cut the push rod of the new air chamber to match the length of the old one, the old one might be wrong.

Camshafts

Camshafts have different diameter spider/support bearing journals and number of splines, but they all perform the same function. The "S-head" camshaft is the component that actually spreads the brake shoes and applies them to the brake drum. With the addition of "extended service" brakes over the last decade, the main thing to be aware of is to have the right style camshaft head with the brake shoe you are using. Dana has their "Xtra-Life", Eaton their "Extended Service" and Rockwell their "Q Plus". According to the manufacturers, their "extended service" style camshafts can be used with their regular brake shoes or "extended service" shoes. Their "extended service" shoes can only be used with "extended service" camshafts and not with the original style camshafts.

Camshaft bushings are made of various materials and should be lubricated regularly. The camshaft "S-head" centers the brake shoes in the brake drum and the camshaft spider bushing is what keeps the camshaft in its' proper position. A worn camshaft spider bushing will allow the bottom brake shoe to "drag" on the brake drum and generate excessive heat. Always be sure to check the camshaft and camshaft bushings at each brake shoe change.

Brake Shoes

As previously stated with the camshafts, make sure you have the right style brake shoe for the camshaft you are using. Most brake shoes today are of a "quick-change" style that makes changing the shoes much easier than in the past. Brake hardware should meet or exceed original equipment manufacturer specifications, especially the return springs. Most axle manufacturers use music wire for their brake return springs and shot-peen them. An inferior brake return spring will fatigue and stretch, allowing the bottom brake shoe to "drag" on the brake drum. This will generate excessive heat and cause the brake lining on the bottom brake shoe to wear out prematurely.

Friction material for brake shoes should be selected based upon the truck's application and the environment it will be used in, not simply the price of the lined brake shoe. The wrong friction material can cause the brake assembly to under perform and in some instances not be sufficient to stop the truck safely. Brake parts should not be purchased solely on price. Make sure all the brake parts you buy meet or exceed the original equipment manufacturers specifications.

Brake Drums

A brake drum is nothing more than a "heat sink". When the brake shoes contact the brake drum the friction material takes the kinetic energy of the wheel assembly rotation and slows it down, generating heat. The brake drum absorbs this heat and dissipates it into the surrounding atmosphere. A brake drum that has been turned once cannot do this as well as a new brake drum since turning the brake drum removes metal from it which lessens its ability to absorb heat and dissipate it. If turning a brake drum does not clean up "heat checking" cracks in the drum (it usually doesn't) the brake drum should be replaced. "Heat check" cracks are caused by the drum becoming hot and expanding to the point where the metal starts to separate in an effort to dissipate the excessive heat.

Seeing "heat check" cracks in a brake drum are a good reason to look elsewhere in the brake system for what is generating all the additional heat. Possibly the bottom brake shoe is "dragging" due to a stretched return spring or worn camshaft spider bushing. Maybe the air chamber push rod is cut wrong and the automatic slack adjuster is adjusting out to far, or the brake shoes are not fully releasing after a brake application due to a fatigued return spring.

Air Brake System Check List

The Air Compressor

- ✓ Is the inlet filter in good condition?
- ✓ Is the compressor pumping oil?

The Air Valves

- ✓ Does any valve have a plunger that "sticks"?
- ✓ Does the quick release on each valve function properly?
- ✓ Are there any air contaminants dripping out of the quick release of any valve?

Air Brake Hoses

- ✓ Does any hose have external cracks?
- ✓ Are all the brake hoses still flexible?
- ✓ Do any hoses crack when you try to bend them in a new direction?

Air Chambers

- ✓ Are all the push rods cut to the right length?
- ✓ Do any of the push rods not move when the air for the spring brakes is released? *(this would indicate a broken coil spring in a spring brake)*
- ✓ Do any relay valves "hiss" air out of the bottom quick release? *(this would indicate a bad spring brake shaft seal)*

Slack Adjusters

- ✓ Are all the slack adjusters installed correctly?
- ✓ Are the slack adjusters at a 90° angle to the push rod when the brakes are fully applied?
- ✓ If using automatic slack adjusters, are all the adjusting mechanisms functioning properly?

Camshafts

- ✓ Are any camshaft bushings worn out?
- ✓ Are all the camshafts the proper one for the brake shoe being used with them?
- ✓ Are any of the camshaft bearing journals grooved?

Brake Shoes

- ✓ Do all the brake shoes still have sufficient lining on them?
- ✓ Are any of the brake return springs stretched?
- ✓ Are any of the brake rollers flat sided and sliding instead of rolling?

Brake Drums

- ✓ Are any of the brake drums "heat checked"?
- ✓ Are any of the drums beyond the maximum allowed diameter?
- ✓ Are any brake drums cracked through to the outside of the drum?

Whatever your air brake part needs are, always insist on genuine Dayton Parts air brake foundation parts

Catalogs and Support Materials

Catalog 212 - Air Brake Parts