



An **IC Industries** Company

Abex Corporation
Friction Products Division
1827 Powers Ferry Rd.
Building 20
Marietta, GA 30067
(404) 953-2045

DATE : April 14, 1986
SUBJECT: Direct Distributor Mailing
FROM : Joe Eberhart
TO : All Abex H/D Sales Personnel

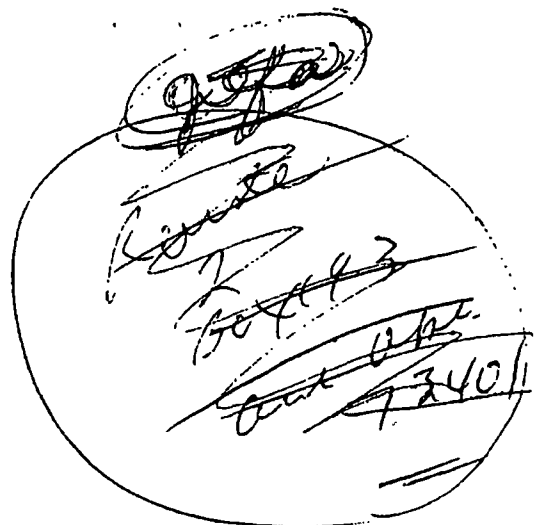
The attached materials are being sent to all Abex H/D Distributors covering the school bus program. Servicing this market segment is paying off in added sales and increased market share.

Please take time to review the Abex Brakeliner program on all your Distribution calls.

Regards,

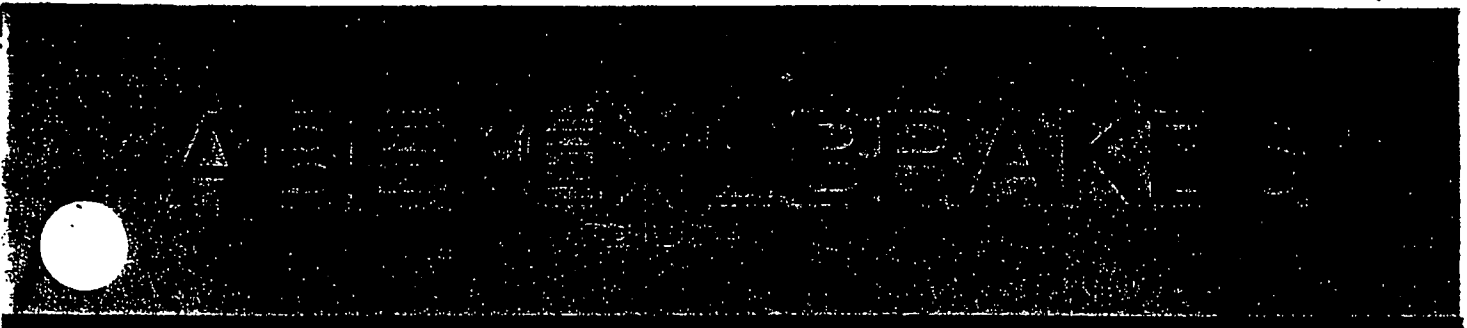
Joe Eberhart

JNE:fp



SCF-ABEX-2889

SC1 03095



Introducing Asbestos-Free Hydraulic Disc Pads

for Medium Duty Trucks and School Buses

With performance you can count on for:

- **Improved Effectiveness**

For improved stopping distance.

- **Improved High Temperature Performance**

For users with severe duty cycles and fleets operating in mountainous regions.

- **Improved Wear Characteristics**

Tests by fleets across the country have shown improvement.

- **Quieter Operation**

Brake squeal and noise reduced significantly.

Giving O.E. top performance with 100% Asbestos-Free materials for Medium Trucks and School Bus applications for Ford, GMC and IHC

Abex

An **IC Industries** Company

AA-1009 APS

Friction Products Division

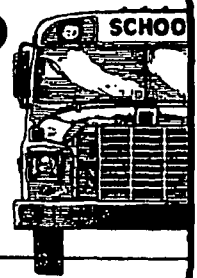
1827 Powers Ferry Rd.
Building 20
Marietta, GA 30067
(404) 953-2045

SC1 03096

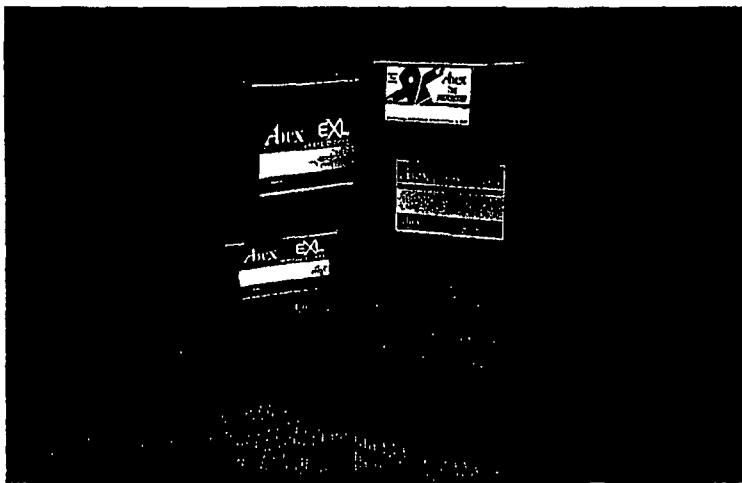
Abex®

An IC Industries Company

BRAKELINER SCHOOL BUS TECHNICAL BULLETINS



Friction Products Division, 3001 W. Big Beaver Rd., Troy, Michigan 48064-3184



**Abex
Brake Linings
give you
more stops...
safely!**

ABEX **EXL** 685 FF

Asbestos-Free Complete Line of Block and Strip for Hydraulic or Air Brakes

Abex EXL is the new asbestos-free brake lining that is FIRST in durability, FIRST in endurance and FIRST in stopping performance...a brake lining designed to keep your school bus fleet FIRST in lower per mile costs.

The reason: An improved product formulation using glass fibers in combination with other high temperature friction stabilizers.

Abex EXL has undergone extensive dynamometer and vehicle testing. The results of this testing show the EXL lining maintains its frictional stability extremely well under high temperature conditions. Additional testing with school bus fleets has shown substantial increases in the life of the lining while drum life doubled in many applications.

The end result is a premium quality, asbestos-free brake lining that, like other Abex premium linings, delivers superior stopping performance, but EXL lasts considerably longer.

ABEX **PROTECTOR** 667 FF

Strip Lining for Hydraulic and Air Brakes

Protector lining is designed to meet the demands of school busses and in-city delivery vehicles contending with severe stop and go conditions. Why depend on linings designed for standard truck brake systems when Protector is engineered for your braking needs.

The Protector lining will deliver reliable performance for safer stops because it is designed and built for longer lining life and minimum drum wear.

ABEX **HD PREMIUM** 614 EF

Brake Blocks for Air Brakes

Heavy Duty Premium Block is engineered to deliver high performance whether engaged in high temperature braking on the open highway or low speed braking in the city.

Whatever your school bus braking needs are, be assured our Premium lining will stop you safely.

Offering superior wet friction characteristics as well as good fade resistance and recovery. Heavy Duty Premium is capable of withstanding soak temperatures in excess of 500°F.

When relining, it is important to review the following check list:

Hydraulic Brakes

- ☐ **Check Master Cylinder:**
Apply brakes with moderate pedal force. Rebuild or replace if pedal creeps toward floorboard.
- ☐ **Check Vacuum Booster for Power Assist:**
Apply brakes, pedal should pull toward floorboard when engine is started.
- ☐ **Check Hoses and Tubing:**
Tighten or replace all hoses and steel tubing fittings which are leaking fluid at their connections. Replace tubing if restricted or deteriorated due to rust.
- ☐ **Check Wheel Cylinders:**
Rebuild or replace those which show signs of leaking.
- ☐ **Check Shoe Return Springs:**
Inspect for cracks and stretching. Replace those which are defective, but only in axle sets. (New return springs are recommended).
- ☐ **Check Brake Adjusters:**
Clean and lubricate brake adjusters for free operation.
- ☐ **Check Diameter of Brake Drums:**
Machine drums and match with appropriate thickness lining. Discard drum if worn beyond rebore limit cast into drum. Diameter of drums on an axle must not differ by more than .010 inch.
- ☐ **Check Clearance:**
Lining to drum contact must be in center of shoe. Clearance between lining and drum at ends of shoe must be approximately .010 inch.

Air Brakes

- ☐ **Check Camshaft Bushings:**
Inspect camshaft bushings. Replace if worn to .020 inch oversize.
- ☐ **Check Camshaft for Wear:**
Measure cam shaft if worn .010 inch undersize in bushing area, or, if cam face is worn, replacement is necessary.
- ☐ **Check Spider Anchor Pin Holes:-**
Replace bushings if worn more than .010 inch oversize.
- ☐ **Check Shoe Rollers for Wear:**
Replace if worn or flat spotted.
- ☐ **Check Anchor Pins for Wear:**
Replace if worn more than .010 inch undersize.
- ☐ **Check Diameter of Brake Drums:**
Machine drums and match with appropriate thickness lining. Discard drum if worn beyond rebore limit.
- ☐ **Check Clearance:**
Lining to drum contact must be in center of shoe. Clearance between lining and drum at ends of shoe must be approximately .010 inch.
- ☐ **Check Hoses:**
Tighten or replace all hoses which are leaking.
- ☐ **Check Shoe Return Springs:**
Inspect for cracks and stretching. Replace those which are defective, but only in axle sets. (New return springs are recommended).



An **IC Industries** Company



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Abex Corporation
Friction Products Division
1827 Powers Ferry Rd.
Building 20
Marietta, GA 30067
(404) 953-2045

DATE : April 14, 1986
SUBJECT: Abex School Bus Program
TO : Abex Heavy Duty Distributors
FROM : J. N. Eberhart

The School Bus Marketing Program is one that all Abex Heavy Duty Distributors have taken advantage of. And by doing so, it will pay off in added sales for all.

To assist you and your sales people to take full advantage of this program, we are enclosing a quantity of technical bulletins and sign-up reply cards for our Brakeliner mailing.

As you know, Abex sends out on a quarterly basis technical information to over three thousand school bus fleets. This information is proving to be of service to these fleets for proper brake maintenance.

If you have any school bus fleets not on our mailing list, this is the time to sign them up. There is no charge for this service, and each account will receive a complete updated binder.

For more details on our Abex Brakeliner program, contact your Abex EXL Brake District Sales Manager.

Joseph N. Eberhart
Director, Marketing Services
Aftermarket Sales

JNE:fp

Encl.



Customer
Purchase Order # _____

SCHOOL BUS PROGRAM Special Order Form

SOLD TO: _____ SHIP TO: _____

Program Dates March 1, 1986 to June 30, 1986

ABEX ASBESTOS-FREE PREMIUM BRAKE SETS		
SET NUMBER	QUANTITY	BONUS SETS
4223 AD		
4311 GD #		
4311 JD #		
4317 GD #		
4514 D #		
4514 CD		
4514 GD #		
4515 ED #		
4515 GD #		
4524 D #		
4549 D #		
4549 CD #		
4602 D #		
4605 D #		
4615 D #		
4625 BD #		
4644 AD #		
4654 D		

ABEX EXL BRAKES SUPREME ASBESTOS-FREE		
SET NUMBER	QUANTITY	BONUS SETS
EX 4223 AD #		
EX 4311 GD #		
EX 4311 JD #		
EX 4317 GD #		
EX 4514 D #		
EX 4514 CD #		
EX 4514 GD #		
EX 4515 ED #		
EX 4515 GD #		
EX 4524 D #		
EX 4549 D #		
EX 4549 CD #		
EX 4602 D #		
EX 4605 D #		
EX 4615 D #		
EX 4625 BD #		
EX 4644 AD #		
EX 4654 D #		

ABEX EXL BRAKES PREMIUM ASBESTOS-FREE		
SET NUMBER	QUANTITY	BONUS SETS
EN 4223 AD #		
EN 4311 GD #		
EN 4311 JD #		
EN 4317 GD #		
EN 4514 D #		
EN 4514 CD #		
EN 4514 GD #		
EN 4515 ED #		
EN 4524 D #		
EN 4549 D #		
EN 4549 CD #		
EN 4602 D #		
EN 4605 D #		
EN 4615 D #		
EN 4625 BD #		
EN 4644 AD #		

ABEX EXL BRAKES HYDRAULIC DISC PADS		
SET NUMBER	QUANTITY	BONUS SETS
MS 7108 (D184)		
MS 7141 (D224)		
MS 7142 (D225)		
MS 7149 (D236)		

NOTE: All bonus sets must be of
same like product and part numbers
listed on this order form.

Date Order Received

Number of Sets Ordered

Number of Bonus Sets

Numbers available in over size.
Please indicate on order form when ordering
over size numbers.

Mail your orders to your Abex Serving Warehouse



Friction Products Division

AA-1030 APS

An **ICI** Industries Company

1827 Powers Ferry Rd., Building 20, Marietta, GA 30067

SC1 03100

ABEX^{EXL} BRAKES

Customer
Purchase Order # _____

SCHOOL BUS PROGRAM Special Order Form

SOLD TO: _____ SHIP TO: _____

Program Dates March 1, 1986 to June 30, 1986

ABEX PROTECTOR STRIP SETS		
SET NUMBER	QUANTITY	BONUS SETS
PR 1245 AD #		
PR 1245 CD #		
PR 1252 D #		
PR 1255 D #		
PR 1276 D #		
PR 1278 D		
PR 1279 D #		
PR 1280 D #		
PR 1280 BD		
PR 1290 D #		
PR 1294 D #		
PR 1294 AD #		
PR 1307 D #		
PR 1308 D		
PR 1308 AD #		
PR 1345 AD		
PR 2032 D #		
PR 2039 D #		
PR 2060 D #		
PR 4562 AD		
PR 4596 D #		
PR 4597 D #		
PR 4639 D #		
PR 4640 D #		
PR 4646 D #		
PR 4647 D		

ABEX EXL BRAKES ASBESTOS-FREE STRIP SETS		
SET NUMBER	QUANTITY	BONUS SETS
EX 1245 AD #		
EX 1245 CD #		
EX 1252 D #		
EX 1255 D #		
EX 1276 D #		
EX 1278 D		
EX 1279 D #		
EX 1280 D		
EX 1280 BD		
EX 1290 D #		
EX 1294 D #		
EX 1294 AD #		
EX 1307 D #		
EX 1308 D #		
EX 1308 AD #		
EX 1345 AD		
EX 2032 D #		
EX 2039 D		
EX 2060 D #		
EX 4562 AD #		
EX 4596 D #		
EX 4597 D #		
EX 4639 D #		
EX 4640 D #		
EX 4646 D #		
EX 4647 D		

Numbers available in over size.

Please indicate on order form when ordering over size numbers.

NOTE: All bonus sets must be of same like product and part numbers listed on this order form.

Mall your orders to your Abex Serving Warehouse

Date Order Received _____

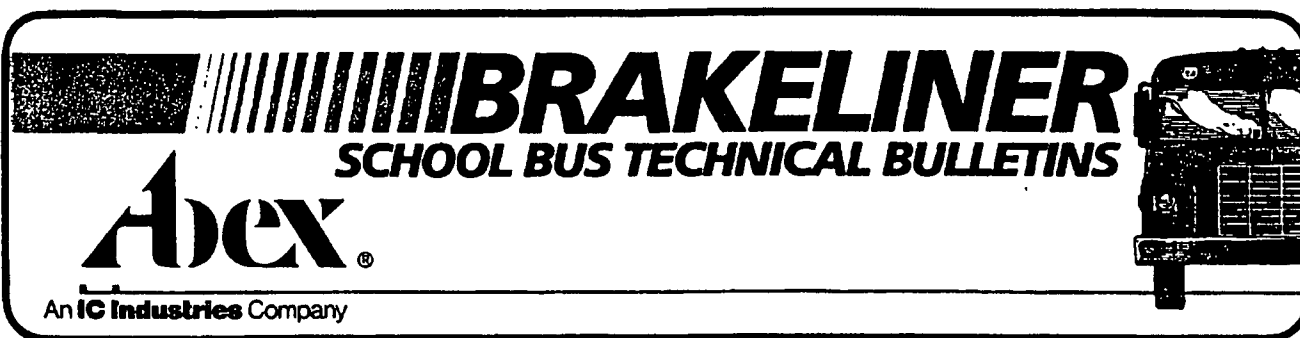
Number of Sets Ordered _____ Number of Bonus Sets _____

Abex
An IC Industries Company

Friction Products Division
1827 Powers Ferry Rd., Building 20, Marietta, GA 30067

AA-1029 APS

SC1 03101



FRICTION PRODUCTS DIVISION, 1827 POWERS FERRY RD., BUILDING 20, MARIETTA, GA 30067

BRAKE LINER

ANALYZING BRAKE COMPLAINTS

WHEN CONFRONTED WITH BRAKE PROBLEMS, FIRST ASCERTAIN THE NATURE OF THE COMPLAINT. BE SPECIFIC IN UNDERSTANDING THE PROBLEM. IF POSSIBLE, EXPERIENCE THE PARTICULAR PROBLEM. LISTED BELOW ARE FOUR MOST COMMON COMPLAINTS AND THEIR CAUSES, WHICH WILL HELP TO IDENTIFY THE PROBLEM:

COMPLAINT	CAUSE
INSUFFICIENT BRAKES	LINING C.O.F. TOO LOW INSUFFICIENT LINE PRESSURE FRONT BRAKES NOT OPERATING PROPERLY REAR BRAKES NOT OPERATING PROPERLY MALFUNCTION OF BOOSTER POOR LINING TO DRUM CONTACT BRAKES OUT OF ADJUSTMENT PARTIAL SYSTEM OPERATING
UNEVEN BRAKING	WEAK OR BROKEN SHOE RETURN SPRINGS PUSHROD LENGTHS NOT SAME ON AXLE WEAK OR BROKEN CHAMBER SPRING BRAKES NOT ADJUSTED EQUALLY BROKEN SLACK ADJUSTER
GRABBY BRAKES	CONTAMINATED LINING EXCESSIVE DISC ROTOR RUNOUT DISC ROTOR NOT UNIFORM IN THICKNESS ECCENTRIC BRAKE DRUM LOOSE LINING FLAT SPOT ON CAM OR ROLLER FAULTY RELAY VALVE BROKEN CHAMBER RETURN SPRING
BRAKE NOISE	POOR LINING TO DRUM CONTACT BENT BRAKE SHOE — INCORRECT RADIUS BRAKE SHOE TABLE NOT FLAT LINING GLAZED BRAKE DRUM BLUE SPOTTED BRAKE DRUM WORN OVERSIZE BRAKE DRUM TOO THIN BRAKE DRUM OUT OF ROUND CONTAMINATED LINING

Abex®

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BRAKELINER SCHOOL BUS TECHNICAL BULLETINS



Bulletin No. 3

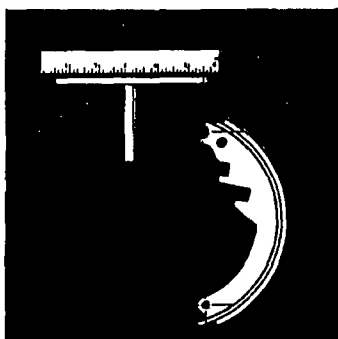
Friction Products Division, 3001 W. Big Beaver Rd., Troy, Michigan 48064-3184

Brake Noise

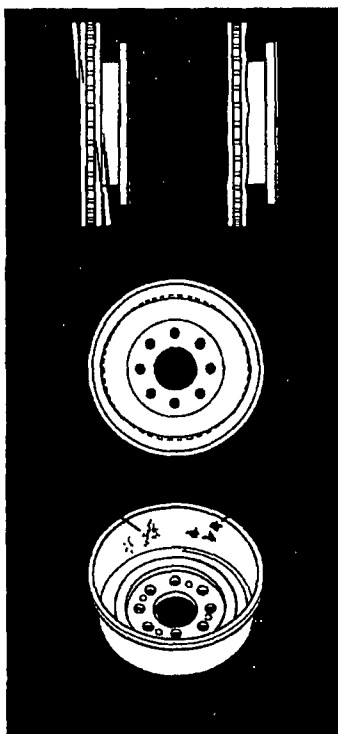
Acceptable brake performance after brake reline is dependent upon how well the brake system was inspected and the quality of maintenance performed. Efficient brake operation requires every component in the system to be in good working condition.

One of the most common complaints on school buses is brake noise. Brake noise is usually the result of inconsistencies in the brake system. Some factors affecting brake noise are as follows:

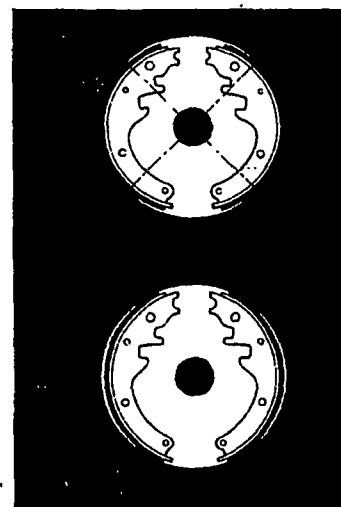
- 1 **Lining to Drum Contact**
Check all used brake shoes for being bent and/or stretched.
Shoe table must be flat to within .002 inch per 1 inch of table width.
Measure shoe.
Compare dimension "X" to that of new shoe.
If difference is greater than 1/64", discard shoe.



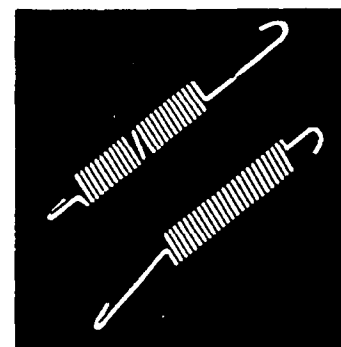
- 2 **Machine Disc Rotors and Brake Drums** for concentricity with spindle and axle. Machining disc rotors and drums may remove heat checks and blue spots, but they will reappear later. As a result of heat input from braking, it is best to replace severely heat checked and blue spotted rotors or drums during reline. Remember, replace rotors or drums in pairs. It is suggested that new drums also be machined on their hub to minimize runout.



- 3 **Use Oversize Lining** when drum diameter will accept it. There should be .005-.010 inch clearance between lining and drum at points A and B. Center contact is desirable for smooth braking. To insure optimum lining and drum life, each brake must do its share of the braking. Improper lining and drum contact will result in wheels with good contact to be over-worked, resulting in abused lining and drums/rotors.



- 4 **Brake Hardware**
Brake shoe hold down springs or clips and shoe return springs must be replaced at each reline. Return springs of varying tensions must be installed in their proper locations.



BRAKELINER

SCHOOL BUS TECHNICAL BULLETINS

Abex®

An IC Industries Company



Bulletin No. 2

Friction Products Division, 3001 W. Big Beaver Rd., Troy, Michigan 48064-3184

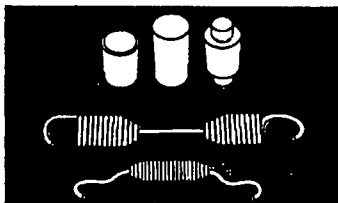
Extending Brake Drum Life

One of the most expensive parts of a brake system that must be replaced periodically is the brake drum. Its length of service greatly depends upon how abusive the driver may have been, the type of service, how well the brake was maintained and how well the torque balance is with the other brakes in the system.

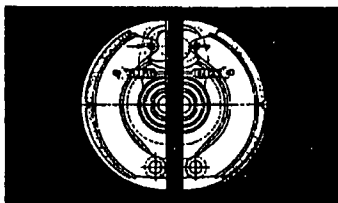
The life of a brake drum will be reduced, if for any reason any of the brakes are required to do more than their fair share of the braking effort. For this reason, it is most important to treat all brakes the same, giving them equal maintenance and replacement parts.

Listed below are several factors which affect brake drum service life:

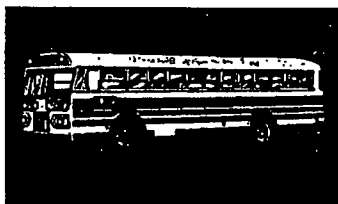
- 1 Each brake must be kept in good mechanical condition. Worn bushings, anchor pins, rollers, shoes and weak shoe return springs must be replaced at each reline.



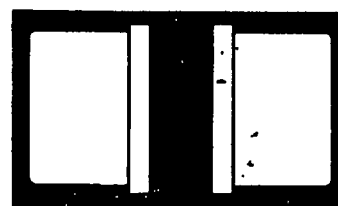
- 2 The radius of new brake lining must match that of the brake drum to prevent localized areas of high energy input which will result in blued spots and drum heat checking.



- 3 Each brake must do its fair share of the braking



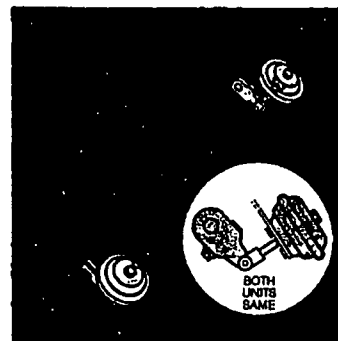
- 4 The diameter of the two brake drums on an axle should not differ by more than .010 inch.



- 5 Brake linings and brake drums from different manufacturers must not be mixed on a common axle and, preferably, not on the same vehicle.



- 6 The type of air chamber and length of the slack adjuster must be the same for either side of an axle with the same size brakes.



- 7 Brake adjustment should be performed on all brakes of a unit at the same time and each brake must be adjusted as closely as possible to having the same clearance as the other. Brakes should be adjusted by using a feeler gauge to establish the proper lining to drum clearance. Minimum clearances on top and bottom shoes are .010 inch for used lining and .020 inch for new lining.



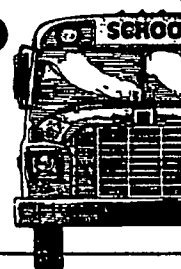
The drum is a very important part of the brake system and, if the system is well maintained, not only will drum life be at an optimum, but also all other brake component parts.

BRAKELINER

SCHOOL BUS TECHNICAL BULLETINS

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An IC Industries Company



Bulletin No. 1

Friction Products Division, 3001 W. Big Beaver Rd., Troy, Michigan 48064-3184

Visual Air Brake Inspection

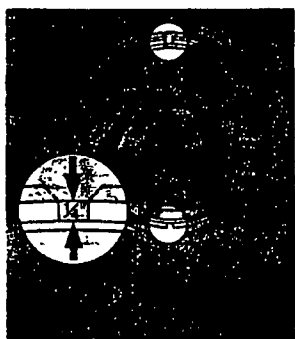
Numerous components of a brake system may be checked for damage or worn parts by a visual inspection. This inspection may be completed in a short period of time and may save numerous hours and additional costs at a later date due to the prevention of further component damage and wear. Also safety related items such as worn brake linings, brakes in need of adjustment and excessive air leaks will be brought to attention.

Listed below are several brake related items which may be visually inspected for malfunctioning or excessively worn parts:

1. Defective slack adjuster
2. Incorrect chamber push rod length
3. Worn S-cam bushings
4. Broken chamber return spring
5. Broken brake drum
6. Broken shoe roller
7. Different type air chamber
8. Different length slack adjuster
9. Bent chamber push rod.
10. Missing brake block.

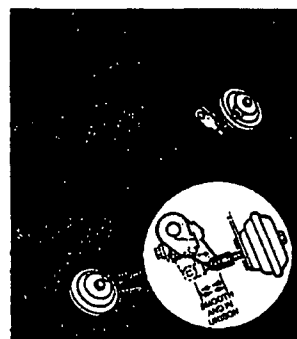
1 Lining Thickness

A lining thickness of at least $\frac{1}{4}$ inch must be noted at the center of each shoe or the brake is in need of reline.



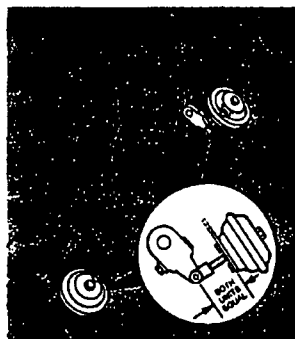
3 Brake Actuation

Brake apply and release action must be smooth and in unison on the same axle. Sluggish movement of a slack adjuster suggests a worn S-cam, flat areas on the shoe rollers or a sticking relay valve.



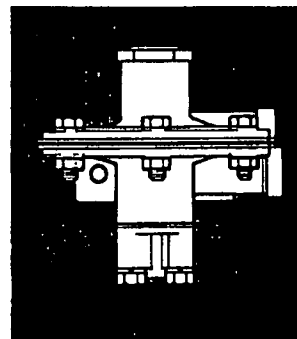
2 Chamber Stroke

By comparing the positions of the slack adjusters, when the brakes are in the released and applied positions, an indication of the brake adjustment may be obtained. A noticeable variation in relative position of the slack adjusters, on the same axle, indicates that one or more of the following undesirable conditions exist:



4 Brake Release

The sound of air being exhausted from the brake chambers through the relay valve must diminish in intensity rapidly and smoothly.



Remember, the few minutes spent on conducting an inspection will save hours if a road call is necessary or if the vehicle is involved in an accident due to brake component failure.



An **IC Industries** Company

Abex Corporation
Friction Products Division
Suite 710
3001 West Big Beaver Rd.
Troy, MI 48064-3184
(313) 643-4400

SUBJECT: 1986 School Bus Program

TO: All Abex Distributors

Abex is pleased to announce our 1986 School Bus Program. This program is designed to concentrate on a profitable segment of the Heavy Duty Aftermarket. There are an estimated 13,500 school bus fleets registered with the Department of Transportation. Recently a survey of school bus fleets was conducted to determine what replacement parts were purchased most frequently. The survey indicated that brakes were the third or fourth most frequently purchased replacement products.

Our program this year is designed to enable our Heavy Duty Distributors to participate in this segment of the market.

The School Bus Program offers:

Complete coverage for all air and hydraulic brake applications.

Two complete asbestos-free brake block products:

EXL Supreme
EXL Premium

New semi-metallic disc brakes for school buses.

Complete line of asbestos products for air and hydraulic applications.

School Bus Program ingredients:

Products included in the Program:

EXL Supreme	H.D. Premium
EXL Premium	Protector Strip
EXL Strip	
Disc Pads	

Length of Program:

March 1 through June 30

Qualifying Order

100 sets of combined products offered in the program.

Free Goods

For every 100 sets ordered you will receive 10 sets of like products at no charge.

Free goods must be selected from the part numbers offered on the school bus order form.

Free goods must be selected on a like product for like product basis. Example: An order for 100 sets of EXL Supreme would receive 10 sets of EXL Supreme. Also an order for 100 sets made up of 50 sets of EXL Supreme, 30 sets of EXL Premium and 20 sets of Protector would qualify for 5 sets of EXL Supreme, 3 sets of EXL Premium and 2 sets of Protector.

(10%)

Support Material

Order forms provided for your ordering convenience.

AA1024 Product Flyer.

AA1025 Product Flyer.

Sales Support

Abex sales personnel are available for field work to assist in making this program a success.

The School Bus Program will count towards the Abex 1 for 1 Program.

Introducing Asbestos-Free Hydraulic Disc Pads

for Medium Duty Trucks and School Buses

With performance you can count on for:

- **Improved Effectiveness**

For improved stopping distance.

- **Improved High Temperature Performance**

For users with severe duty cycles and fleets operating in mountainous regions.

- **Improved Wear Characteristics**

Tests by fleets across the country have shown improvement.

- **Quieter Operation**

Brake squeal and noise reduced significantly.

Giving O.E. top performance with 100% Asbestos-Free materials for Medium Trucks and School Bus applications for Ford, GMC and IHC

Abex

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AA-1009 APS

Friction Products Division

1827 Powers Ferry Rd.
Building 20
Marietta, GA 30067
(404) 953-2045

SC1 03108



An **IC Industries** Company

Friction Products Division

1827 POWERS FERRY RD., BUILDING 20, MARIETTA, GA 30067

Asbestos-free brake linings turn to fiber glass

Asbestos, a material whose name means "incombustible" in ancient Greek, was the material of choice for manufacturing brake linings until recently. The fibrous mineral has excellent heat resistance, tensile strength and flexural strength characteristics, and it is easily processed into brake linings.



Abex EXL brake linings are manufactured from a friction material whose matrix is centered around chopped strand fiber glass in a thermosetting polymer resin.

Now, however, brake lining manufacturers have developed asbestos-free materials.

No material was overlooked as a possible replacement for asbestos. The search included fiber glass, the material the Friction Products Division of Abex Corporation, Winchester, Va., settled on as the best asbestos replacement. The company is using fiber glass reinforcement in its **ABEX EXL** (extra long life) brake linings.

ABEX EXL brake linings are available for automobiles, trucks, off-road vehicles and industrial brakes — all of the brake products it traditionally offers in asbestos. **ABEX EXL** friction material is a matrix centered around PPG chopped strand in a thermosetting polymer system.

Abex, a member company of IC Industries, has been manufacturing brake linings since 1902, when it began producing brake shoes for locomotives and railroad cars. Today, it is the world's largest producer of friction materials, with 16 plants throughout the world supplying brake linings for automobiles, trucks, airplanes, off-road vehicles, material-handling equipment and industrial machinery.

Abex began investigating alternate materials for asbestos when higher braking temperatures and higher wear rates became apparent as vehicles were downsized and tractor/trailer trucks were made more streamlined in response to government-mandated fuel-

efficiency goals and the public's demand for fuel-efficient cars.

Smaller cars, more aerodynamic design, smooth-rolling radial tires and front-wheel-drive necessitated smaller and lighter brake components and overall brake system redesigns. The typical 1983 disc brake rotor is two inches smaller and 15 pounds lighter than its 1973 counterpart. Brakes on compact and subcompact cars, therefore, absorb more energy than before. Brake and automobile manufacturers began to look for environmentally acceptable materials that performed even better than asbestos.

Truck brakes today also operate at higher temperatures, mainly because of improvements that have reduced drag and improved fuel economy. Aerodynamic flaring, lower axle ratios, radial tires and declutching fans have reduced drag in tractor/trailers by about 100 horsepower over the past six years. Today, a typical tractor/trailer descending a three percent grade must develop 369 percent more brake horsepower to stop than in 1973.

Nonmetallic and metallic linings

Abex's research for a high-performance, asbestos-free brake lining material covered nonmetallic and metallic materials.



As tractor/trailers became more aerodynamic, reduced drag caused brakes to work harder, increasing wear and operating temperatures. Trucks like this Mack Ultra-Liner demand more brake horsepower than less "slippery" trucks of 10 years ago.

In the metallic group, Abex developed semi-metallic and sintered lining materials. Sintered materials — which are metal and ceramic powders fused (sintered) together — offer extreme heat resistance. They are typically used for aircraft brakes and for heavy-duty disc brakes for trucks.

Semi-metallic materials are iron powders and fibers bound together in phenolic resins. Semi-metallics, while not new technology, were first used in police cars; they now are standard for most original-equipment disc brake pads.

Fiber glass advantages

In nonmetallic materials, Abex's research focused on fiber glass, carbon, aramid and ceramic fibers. Fibers were analyzed and tested for heat resistance, friction, composite strength, technological compatibility, cost, and environmental aspect characteristics.

Abex rated carbon, aramid and ceramic fibers as having limited environmental qualities, for it could find no long-term studies on the health effects of these materials. On the other hand, fiber glass has been produced for nearly half a century, and medical research to date indicates no significant health effects in man resulting from exposure to fiber glass.

While fiber glass is more expensive than asbestos, it is the lowest-cost alternative. Analysis showed, however, that brake linings reinforced with fiber glass provide better wear rates and longer life, making fiber glass brake linings more cost-effective. Abex also points out that longer intervals between replacing fiber glass brake linings compared with asbestos brake linings save on labor costs. In short, fiber glass brake linings produce significantly lower user costs.



The first original-equipment application for Abex' fiber glass-reinforced brake lining was on the rear drum brakes of the 1982 Ford Ranger pickup truck.

FIBER SELECTION SUMMARY

	Service Temp. °C	Friction Characteristics	Composite Strength	Technological Compatibility	Cost	Environmental Aspects
Fiber Glass	750	G	G	G	G	G
Carbon	550	F	G	F	P	U
Ceramic	1,650	G	F	F	P	U
Aramid	500	F	G	F	F	U
Asbestos	600	G	G	E	E	P
P-Poor F-Fair G-Good E-Excellent U-Unknown						

Fiber selection summary shows why Abex selected fiber glass as an alternative to asbestos for Abex EXL brakes.

Compatibility with existing technology

A prime consideration in choosing an alternative for asbestos was the alternative material's compatibility with existing process technologies. Fiber glass proved to be the most compatible of the alternatives.

Fiber glass also offered the second-highest service temperature — 750°C. (1,380°F.). This surpassed even asbestos' 600°C. (1,100°F.) service temperature. Furthermore, the mechanical strength of fiber glass-reinforced brake linings was determined to be superior to the other alternatives and, in fact, better than asbestos-reinforced linings.

ABEX EXL friction material was in development for several years, with development work focused on the heavy-duty and automotive markets. Some of the first products developed were truck blocks and heavy-duty strips. Its first original-equipment application in the passenger car/light truck industry was on the 1982 (and 1983) Ford Ranger rear drum brake, where the Abex fiber glass-reinforced material outperformed the traditional asbestos materials while offering an answer to the environmental concern surrounding asbestos.

Reprinted from Reinforcement Digest, a PPG Industries publication.

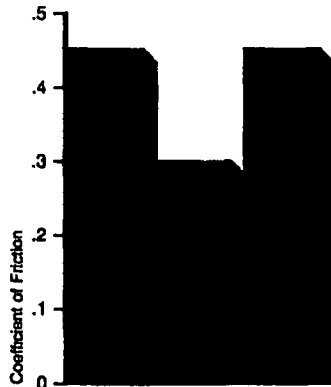
ABEX^{EXL} BRAKES

ASBESTOS-FREE

Heavy Duty Brake Linings Deliver Long Life and More Value.

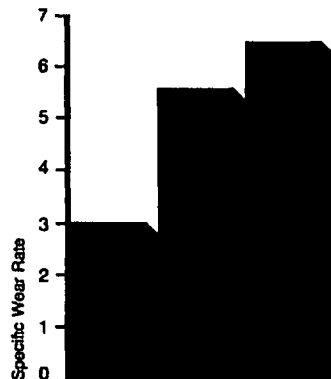
Why Fiberglass

The decision to use fiberglass as an asbestos substitute was the result of extensive laboratory testing which compared the numerous alternatives. Fiberglass was tested against Kevlar[®] aramid, carbon and ceramic fiber materials to determine which offered the best combination of heat resistance, strength, stability, endurance and overall value. The test results below are for your own comparison.



Coefficient of Friction

Like ceramic material, fiberglass proved to have a high coefficient of friction. It's significantly higher than Kevlar[®] aramid, plus it remains stable over the life of the lining.



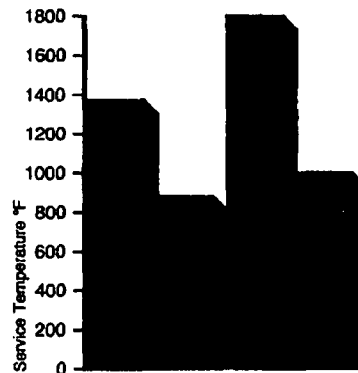
Specific Wear Rate

A relative characteristic, both ceramic and Kevlar[®] aramid materials wore down considerably faster than fiberglass material. The result is long, dependable life, and without abrasive steel slag materials.

Kevlar[®] is a registered trademark of E.I. DuPont de Nemours & Company, Inc.

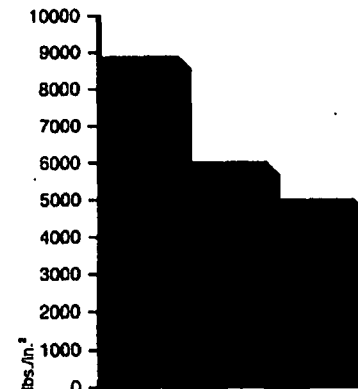
The First Choice

Based on these and other tests, fiberglass material was chosen as the best alternative to asbestos fiber. Using any of the other materials would have required either a sacrifice to performance, durability or strength. The obvious choice was fiberglass. Because at Abex, quality will not be compromised.



Heat Resistance

A primary consideration for stability and wear, fiberglass withstood much more heat for a longer period of time than carbon or Kevlar[®] aramid. The clear choice once again was fiberglass.



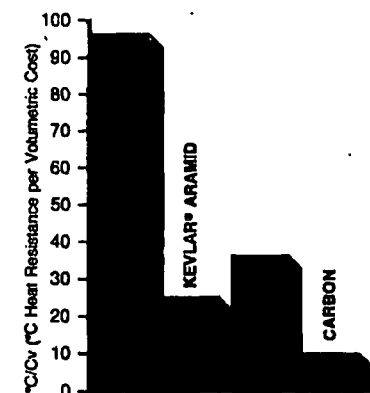
Flexural Strength

The ability of a fibrous material to resist breakage is critical to its long lasting integrity. Fiberglass is 50% stronger than the alternative reinforcements, which helps prevent rivet shifting and lining cracking while in service.



Reinforcing Value

Since performance at high cost is unacceptable, calculations were made to determine the relative material values. Fiberglass proved to be 4 to 12 times a better value than Kevlar[®] aramid and ceramic materials respectively.



Heat Resistance Value

The relative heat resistance of fiberglass shows it is by far the best choice for obtaining structural integrity at a reasonable cost.

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EX 1294 D #		
EX 1294 AD #		
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EX 1308 D #		
EX 1308 AD #		
EX 1345 AD		
EX 2032 D #		
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EX 4514 GD #		
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EX 4515 GD #		
EX 4524 D #		
EX 4549 D #		
EX 4549 CD #		
EX 4602 D #		
EX 4605 D #		
EX 4615 D #		
EX 4625 BD #		
EX 4644 AD #		
EX 4654 D #		

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EN 4311 JD #		
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EN 4514 D #		
EN 4514 CD #		
EN 4514 GD #		
EN 4515 ED #		
EN 4524 D #		
EN 4549 D #		
EN 4549 CD #		
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EN 4605 D #		
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