An IC Industries Company

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February 22, 1980

Mr. E. W. Drislane
Executive Director
Friction Materials Standards Institute, Inc.
E-210 Route 4
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Dear Ed:

Please find enclosed a response to your letter of February 8, 1980. Obviously, I would appreciate all efforts to keep enclosed information as confidential as possible. I would particularly appreciate all efforts to prevent other friction materials manufacturers from learning about the content of my reply; although, it perhaps does not contain any revolutionary thoughts or ideas.

Many thanks.

Sincerely yours,

B. Iwarsson
President

BI/ad

Attachment

1. Today's non-asbestos disc brake linings (NADBL) are generally referred to as resin bonded metallics (RBM) or semi-metallics. The basic ingredients used in this type of non-asbestos lining are steel fiber and/or iron powder. It should be noted that these ingredients <u>are not</u> direct asbestos replacements. In essence, the majority of asbestos friction material technology has little application to NADBL.

   NADBL require several other ingredients which represent a significant change from past practice. While these ingredients are not necessarily unique or new to the friction material industry, the quantities required and their function in NADBL compositions is of importance. Typically, these ingredients include anti-corrosive/rust inhibiting compounds, natural and synthetic graphite, and molybedenum compounds.

2. It must be emphasized that the steel fiber used in NADBL is not a substitute for asbestos. It is the basis for a new friction material matrix. The steel fibers used in NADBL are typically single strands 1 to 4 mm in length and .12 to .25 mm in diameter.

3. Generally the NADBL offer advantages in the areas of fade and resistance and durability. This is particularly true in high brake load (front wheel drive) and non-ventilated rotor situations which result in high temperature operation.

The primary problems associated with NADBL are as follows:

(a) NADBL have significantly higher thermal conductivity than asbestos linings. This results in increased thermal transfer to the brake fluid. This condition can result in "fluid boil" which manifests itself as complete loss of brake system control and severely limited braking ability.

(b) NADBL display inferior physical strength as compared to asbestos linings. This attribute has created various problems with regard to shoe and lining assembly.

The conditions described above have been improved in some cases via the use of asbestos-based backing which provides improved structural integrity between the lining and shoe and acts as thermal barrier restricting heat transfer to the brake fluid.

(c) It has been our experience that NADBL display reverse speed sensitivity. This condition is best described as an increase in lining effectiveness with increasing speeds. This characteristic is opposite to previous experience with asbestos linings which decrease in effectiveness with increasing speeds. The fact that the lining effectiveness/speed relationship has inversed could cause negative driver reaction, simply because it is not what he is accustomed to and could cause unexpected wheel lock at high speeds.

(d) As the primary ingredient in NADBL is iron, oxidation is somewhat of a problem. Under certain conditions the friction face will actually rust. The resultant oxides can cause unusual performance characteristics as well as high wear and/or scoring of the opposing surface.

(e) NADBL perform best at elevated temperatures. Consequently, complaints of "low friction" are common during the first few brake applications while the brakes are at ambient conditions.

(f) Generally, NADBL are somewhat noisier than conventional asbestos linings. Many of today's NADBL used a noise insulating device. The device is generally a metal shim and/or rubber based material applied to the back of the lining assembly.

(g) It should be noted that NADBL are significantly heavier than conventional asbestos products by a factor of approximately 2:1. This is primarily due to the difference in density between asbestos (2.6g/cc) and iron (7.68g/cc). This difference results in a considerably heavier and more costly product.

4. All original equipment NADBL produced today by our corporation utilize an asbestos backing material. All vehicles involved use NADBL in both pad positions (inner and outer).

5. The time and money spent on the development of non-asbestos brake linings depend on the application and the extent of deviation from existing products. For example, the development

of a new matrix containing an organic fiber. Processing methods of RBM materials have been studied for 15 years while completely new methods may have to be developed for materials containing organic fibers.

As a guideline, the development of a new non-asbestos matrix from the bench level to commercialization would involve a minimum of three years and $500,000.

6. Problems associated with the use of asbestos pads for replacement of NADBL. A major factor in the selection of NADBL for OEM applications was simply that many of the new vehicles/brake systems required a "higher performance" lining due to the increased operating temperatures of the brake. Therefore, on vehicles where NADBL is used at an OEM level, due to the performance requests, NADBL should be used in the aftermarket in order to maintain acceptable brake performance and durability.

Advantages associated with the use of asbestos pads for replacement of NADBL. The following advantages apply only where NADBL are not required to achieve acceptable brake performance.

The use of asbestos pads would alleviate the problems as detailed in Section 3. In fact, we believe some of the problems associated with NADBL will be magnified in the aftermarket. For example, the fluid boil problem could become more severe if improper brake fluids are used.

The shoe and lining assembly problem could expand due to the variety of methods employed by rebuilders and the oxidation problem be more prevalent simply due to the time it takes for a product to get through the distribution system.

In addition to the above, the cost of NADBL will be a disadvantage (refer to item 10).

7. The composition and manufacturing technology by our corporations are not protected by patents.

8. At this time, Abex Corporation has several licensees authorized to produce resen bonded metallic material.

9. Non-asbestos disc brake material cannot be produced in existing facilities without substantial input in the areas of capital and operation costs. Today we would need $1.5 million in order to convert existing equipment to handle RBM's. In addition to this, we would require a half million dollars for tooling and one year for the acquisition of additional machinery.

10. The projected unit cost for the three part numbers mentioned in a non-asbestos formula is exactly twice that of the asbestos-based formulas.

11. A conversion of our 1979 production to resin-based metallics would be eliminating the consumption of 7 tons of asbestos.