nuturn CORPORATION

E. R. KOSS
TECHNICAL SERVICES

APR 27 1982

NUTURN CORP.

Koss

Internal Memorandum

TO: R. L. Armer

DATE: April 26, 1982

FROM: M. T. McDonough

cc: E. Koss
C. Sinclair
F. Skelton

RE: SEMI-METALLIC 3401N8

Per the attached letter provided me at the Sears meeting on Friday, April 23, it would appear that we as yet have some significant homework to do before Sears will approve our new semi-metallic disc pad.

Please advise dates and specific action to be taken.

Sincerely,

M. T. McDonough

MTM/skb

PLAINTIFF'S EXHIBIT

MAR-403

E. R. KOSS
TECHNICAL SERVICES

April 15, 1982

APR 27 1982

NUTURN CORP.

F. Andelbrat
Department 628

Re: Nuturn 3401 N8 Disc Brake Pads

I have reviewed Nuturn's test data dated February 18, 1982, March 17, 1982 and April 5, 1982 covering their tests on their new, proposed semi-metallic disc pad formulation, 3401 N8. This formulation is intended to replace their original 3401 N formulation, necessitated by a suspected problem of causing excessive rotor wear.

Tests conducted by Nuturn include:

1. Road tests per SAE J8435/J937b on a full-size, 1978 Chevrolet station wagon and a 1980 Chevrolet Citation (effectiveness and fade tests).

2. Frictional characteristics per SAE J661A (friction code determination).

3. Inertial dynamometer testing simulating the 1978 Chevrolet station wagon and a Ford Escort, using a modified Ford normal use durability schedule (determination of pad and rotor wear characteristics).

Nuturn's dynamometer test results using Ford's normal use durability schedule clearly shows the new 3401 N8 formulation is superior to the 3401N formulation for both rotor wear and pad wear. However, this test does not demonstrate wear characteristics considered totally realistic of normal or heavy useage driving. Consequently, this dynamometer test data should not be used to project realistic life. Similarly, because the test does not produce significantly high brake temperatures where friction materials wear rapidly, especially characteristic of downsized cars, performance on downsized cars has not been satisfactorily demonstrated. More representative data would be obtained using a vehicle brake system proven to cause high brake wear (such as the Citation) and the complete Ford "Combined Durability Route For Passenger Cars" over at least twice the number of route cycles and repeated several times to verify the integrity of the data.

Furthermore, to date, no extended actual use tests have been reported for this material. To reduce the potential of another recall, high mileage tests under actual driving conditions should be conducted.

Fade and recovery data from the road tests on both the 78 Chevrolet and 80 Citation are generally equivalent to OEM and the original 3401N formulation. However, effectiveness (a measure of pedal effort) tests indicate a slightly poorer performance level than either the 3401N or OEM materials. Although performance levels are less, they are still within SAE specifications and should provide adequate braking.

Similarly, frictional characteristics of the 3401 N8 material are slightly less than the 3401 N material but still qualifying for an "FE" edge code. While no comparison to OE is provided in Nuturn's data, specified friction levels should be satisfactory.

In conclusion, the 3401 N8 material satisfactorily meets all applicable SAE test specifications and is superior to the 3401N material, based on Nuturn's data. However, wear and possibly subjective noise characteristics of the pad and rotor still need additional testing to generate a satisfactory confidence level in the product.

E. M. Steffan
AO GROUP - DEPT. 817AO

EMS/fw

cc: C. Harrison, D/817