CHRYSLER CORPORATION

they would not be in a position to supply Chrysler's requirements for the 1981 model year.

FUTURE ACTION

Experimental order 12712 has been written requesting 916-46 pucks in the Teves configuration. Chrysler is going to rivet these pucks onto the Teves shoes and evaluate the material using a Teves brake on an L-car.

Hellens is attempting to have a complete profile of the 916-46 material by the May 1st date so that he will know whether the 916-46 is a suitable alternative to either the 2640B or 7163 material.

Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
RENelson
JWMcCool
RAPearce
DESteis
ADIndelicato

"A" PRIORITY

A. Indelicato

ABEX FRICTION PRODUCTS GROUP EXPERIMENTAL ORDER FORM

(Submit 4 Copies)

DATE: May 8, 1979

CUSTOMER: Chrysler Corporation

SHIP TO: Hold
Advise D.P. Conlon
When Ready

EXPERIMENTAL NO. W-12784

PROPOSED SHIPPING DATE: 5/16/79

P.O. NUMBER None

PRINT ATTACHED No

O.K. TO MAKE PARTIAL SHIPMENT

ATTN:

HOW SHIP:

QUANTITY	CUST. PT. NO.	ABB PT. NO.	FORMULA	PRICE
10 Axle Sets		F-694	916-46 With 891-1 Underlayer	N/C

SPECIAL INSTRUCTIONS

_____ ENTER COST ESTIMATE FOR PRODUCTION PART, ESTIMATED ANNUAL USAGE _____ PCS.

BRAKE APPLICATION DATA:

TYPE OF VEHICLE OR MACHINE Chrysler L Car MODEL NO.

DESCRIPTION OF FRICTION APPLICATION

BRAKE OR CLUTCH SIZE TYPE OF ACTUATION Hydraulic

NUMBER OF PIECES PER UNIT 4 WET OR DRY OPERATION Dry

TYPE OF TEST L.A. Traffic

COMPETITIVE FORMULA BX 7163

APPROVED: Yes or No

Has a production quotation been requested?

Make sure periodic as well as a final Experimental Report is submitted in reference to this order.

SALESMAN A.D. Indelicato

SC1 02197

ABEX

An IC Industries Company

Memorandum

Date: January 7, 1981

Subject: Status of 916-278 Formulation At Chrysler Corporation

From: G. N. Payne, Jr.

To: J. J. Lukas

According to Paul Hellens on December 23rd, it is no longer necessary for Abex to perform a 105-75 Vehicle Test on a K car by request of Chrysler Engineering. The reason for the request being at least temporarily withdrawn is the fact that Chrysler has proceeded with further vehicle testing on their own with regard to our 916-278 disc pad material.

A 105-75 Vehicle Test has been performed just recently at the Chelsea, Michigan Test Facility with favorable test results. At this time, I don't know whether the vehicle brake system was manual as opposed to automatic. In addition, a Detroit City Traffic Test is currently in progress and is expected to terminate just after the first of this year. According to Paul Hellens, the approximate lining life projection (based on the wear which had occurred after 1,000 stops) is 18,000 miles. This appears to be considerably better than the recent results of Teves.

Due to field problems on the K car, Chrysler Engineering is working on a hurry-up lining release program which will involve service usage and would probably be phased in early this year. The Evaluation Program will more than likely result in relocation of the brake pedal, a booster system modification, and a new service lining material.

Based on a number of comments made by Paul during our phone conversation, a Cycleweld lining material may be approved in the near future for original equipment use on the K car. The program with regard to release of a Cycleweld material is vacillating so much that it is extremely difficult to predict with any accuracy.

G. N. Payne, Jr.

/kb

cc: RENelson
CCowan
File

cc Payne
Indelicato, Wm
McCool
Cowan

file

G Lukas
file

February 3, 1981

Request for Quotation for Chrysler - for 916-278 Formula for the K and L Body Cars

RECEIVED
FEB 1981
FRICTION PRODUCTS
WINCHESTER, VA.



G. N. Payne, Jr.

J. W. McCool

George:
We should not quote 916-278 as a puck for drilling unless Indelicato confirms it can be drilled or we can reasonably expect that it can be drilled — the alternative is to quote an integrally molded assembly or not at all

Today I was contacted by Paul Hellens of Chrysler Engineering and it was requested that we quote to the attention of Jim Sorenson, Chrysler Purchasing Department. We are to quote on an undrilled, unchamfered puck. The pertinent drawings are as follows:

1. Kelsey Hayes print number 099910 (L car).

2. Teves print number 26,5109-0001.1 (Revision No. 4, K car).

   This is the print for the outer lining but is identical with the inner lining if a chamfer is not required.

The estimated annual volumes are:

1. L car - 600,000 inner pads and 600,000 outer pads per year.

2. K car - 4,000,000 pads per year.

The Bendix quote is approximately $1.05 per undrilled, unchamfered puck with no substantial tooling charge and the Delco quote is approximately $1.30 per puck with a $400,000 tooling charge.

Jim Sorenson refused to send us a formal RFQ because he does not have time. The quote should be made as soon as possible as Chrysler is in a hurry for the information. Mr. Sorenson said he needs the competitive quotes so a decision can be made as to which lining supplier Chrysler will work exclusively with as a second source.

2-11-81

continued . . .

Paul Hellens told me that Chrysler is very disappointed with Bendix 7163 due to its ±15% torque variability (this is not the ±3 sigma band). A high level meeting with Bendix will be demanding corrective action. Our opportunity has never been better.

G. N. Payne, Jr.

/kb

cc: JJLukas/file

Chrysler

From the desk of –
J. J. LUKAS

cc: Printer
Indelicato
Merkel

Payne /

George,

Our "plate is full with non-automotive, heavy duty disc, and the pass car/light truck market

Let's shelve it for now – we don't have capability of producing and not now interested in developing such a product

2-19-81

AL

I AGREE WITH JERRY. BORG-WARNER WON'T SELL TO CHRYSLER BY ORDER OF A POLICY DECISION – NO PROFIT OR CASH BENEFITS. THEY ARE JUST SHOPPING FOR PRICE. DON'T GET INVOLVED – WE HAVE ENOUGH "A" ITEMS.

DeJ

2/20/81

SC1 02201

Abex

An IC Industries Company

Memorandum

Date:

October 16, 1980

Subject:

Transmission Band Friction Material for Chrysler Corporation

From:

G. N. Payne, Jr.

To:

J. J. Lukas

On October 13, 1980, I met with Bill Rankin, Frank Schleuter, and Denny Zeiger at Chrysler Transmission Engineering. During the meeting it was indicated that Chrysler is looking for another source for transmission bands. The present original equipment source is Raybestos-Manhattan and is more or less a sole supplier of these parts at the moment. Borg-Warner can be figuratively considered an alternate source however their pricing at the moment will not allow Chrysler to do very much business with them. Raybestos currently supplies a paper-based friction material which is bonded to the splined metal discs.

Basically, Chrysler Engineering wants to know if we have any capability of producing any type of transmission band which they could utilize and if not, whether we are seriously interested in developing such a product.

I explained that the Cleveland Plant is presently manufacturing the sintered bronze transmission band for Ford original equipment service and that Abex had not developed the technology concerning paper-based friction materials. I explained to the men that we would thoroughly evaluate the possibility of developing this product line; and that, if necessary, I would forward prints, as well as samples of presently-used bands to both Roy Fenner at Cleveland and Dr. Merkel at Mahwah.

I was told that Chrysler expected, in the first model year, to sell one million front wheel drive automobiles which amounts to approximately five to six million transmission discs. I have no idea what portion of the front wheel drive transmission business Abex could expect to realize in the next couple of years. Frank Schleuter told me that Chrysler is paying between fifty and sixty cents per transmission band currently. The statement was made that Chrysler is very sensitive to product cost which implied to me that if we are unable to come close to this price level, that we have no real chance of obtaining any of this business.

I would like to have your suggestions as to how I might best approach a serious investigation of the feasibility of entering this market in the near future.

/la
cc: JWMcCool
RENelson

Abex

An IC Industries Company

Memorandum

Date: May 1, 1981

Subject: Meeting of Abex/Chrysler/Kelsey-Hayes on April 9, 1981

From: D. T. Sedlock

To: D. W. Grinter

Please attach the enclosed Kelsey-Hayes minutes to my Trip Report No. 243 dated April 9th. This is for your reference.

Dan Sedlock

DTS/lb

cc: JWMcCool/file
ADIndelicato
RENelson
GNPayne
RAPearce

KELSEY-HAYES COMPANY

MEETING WITH ABEX and CHRYSLER CORPORATION on 4-9-81

Present:			
	G. Waterman	—	Kelsey-Hayes
	C. Ballard	—	"
	H. Henderson	—	"
	S. Taylor	—	"
	R. Pearce	—	Abex
	D. Sedlock	—	"
	R. Modlin	—	Chrysler

The purpose of the meeting was to acquaint both Abex and Chrysler with the corroded condition of shoe and lining assemblies obtained from private vehicles after two years in service using Abex 7018 linings and K-H shoes.

It was felt that the condition and level of occurrence should be addressed together with an investigation into protective treatments. Samples were given to Abex and Chrysler. The following action was agreed:

- Chrysler will attempt to define the extent of the occurrence in the U.S. and Canada.
- K-H will investigate how quickly plated shoes could be introduced.
- Abex to propose other possible solutions.

Telephone follow-up not later than 5-1-81.

H. Henderson

HH:jkw

cc: Attendees
R. Sierota

4-21-81

SALES REPRESENTATIVE'S REPORT 4KK - full RESPONSE REQUESTED ☐
FRICTION PRODUCTS GROUP Typed 2/12/79 TYPE OF CALL Received 2/9/79 DATE 2/6/79

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION/ BRAKE ENGINEERING	D. P. C.	329
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

OFFICIALS INTERVIEWED

see last page

Gayle W. Smith - Product Engineering Manager/Brake Engineering
Paul B. Hellens - Senior Product Development Engineer

COMMENTS

916-46 PROGRAM

Hellens stated that Chrysler has begun a temperature/wear test on the 916-46. He said that the test had been interrupted, but the preliminary results indicated that the material has very good wear characteristics. Hellens said that Chrysler is planning to begin testing the 916-46 material in a Detroit city traffic schedule in the next week or so. Hellens said that the material will be tested on an L-car and that the material would be tested without any anti-noise devices.

L-CAR PROGRAM

The only problem that Chrysler is having with the Bendix 7163 material is that the customers are complaining about a "hard pedal." Chrysler feels that the effectiveness of 7163 is too low and are therefore looking for a material which will have a higher effectiveness level.

So far, Chrysler has not had any particularly bad complaints concerning noise with the 7163. Chrysler feels that this is due to the fact that the 7163 was only put into production during the late summer and that most of the driving using that material has been done in relatively cold weather. Chrysler also feels that most of the cars using the 7163 would have relatively low mileage and that the piston would probably not have cut through the Wolverine insulating gasket.

In order for us to displace the 7163 material on the L-car, we will therefore have to be able to demonstrate that the 916-46 material has a higher level of effectiveness than the Bendix material. The VW tests indicate that 916-46 and 7163 are similar in noise, so the low noise levels of 916-46 won't be much of a competitive advantage over 7163. Unfortunately, the VW tests indicate that the effectiveness of both materials are similar.

K-CAR PROGRAM

The leading candidate for the 1981 K-car Program is Cycleweld 2460B.

According to Hellens, this is an asbestos containing resin bonded metallic formulation. The main problem that Chrysler is having with this material is its inconsistent noise pattern. Chrysler reported that early batches of material had very poor noise. Up until recently, subsequent batches had demonstrated exceptionally good noise characteristics: readings in the 8 to 9 range after 1,000 to 3,000 miles of Detroit city traffic testing.

These tests were all conducted using a Kelsey-Hayes caliper. Recent batches of the 2460B material were tested using a Teves caliper and the noise results were very bad. Chrysler is not sure whether the poor noise results were the result of batch to batch variation within the 2460B or whether the 2460B/Teves caliper is just a noisy combination.

FUTURE ACTION

Hellens is going to send some Teves shoes to Winchester for integrally molding with the 916-46. The purpose of this exercise is to see if the 916-46/Teves combination is as noisy as the 2460B/Teves combination.

Experimental order 12712 has been submitted in order to supply these parts to Chrysler. Seven car sets have been requested with a "B" priority--delivery 4/1/79. When the shoes became available, I will ask that the priority be raised to an "A."

Denis

Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
ADIndelicato
RCain
WThomas
RENelson

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP Typed 3/13/79 · TYPE OF CALL File Received 3/12/79 DATE 3/8/79

H. D. Indelicato
RESPONSE REQUESTED ☐

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. C.	348
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

OFFICIALS INTERVIEWED

Paul Hellens - Senior Product Development Engineer
Dennis Komatz - Product Development Engineer

COMMENTS

STATUS OF 916-46

Chrysler has tested the 916-46 material on an L-car at the Proving Grounds. According to Hellens, the material had no difficulty passing FMVSS 105. Hellens thought that the actual test had been conducted on a vehicle with a power brake system, but that an analysis of the line pressure indicated that the material would have no problem passing FMVSS 105 with a manual brake system. Hellens said that the only reported problems were a wire brush noise during the burnish and that light rotor scoring was noticed after the test was completed.

Chrysler presently has the material on a Detroit city traffic schedule. After approximately 1,500 miles, the average noise rating of the material was reported to be 8.6. The test was conducted without using any noise insulating gaskets. The 8.6 rating is comparable to that of the Cycleweld 2640B material. Initial reports indicate that the 916-46 has a low cold effectiveness and that it is not significantly better in this area than either the 2640B or the 7163 from Bendix.

916-46 is presently being evaluated by Chrysler in Florida. It is expected that at least one additional FMVSS 105 test will be conducted on the material.

L AND K-CAR PROGRAMS

The L-car is using 7163 and a solid rotor. The K-car is going to use a ventilated rotor and the leading friction material candidates are Cycleweld's 2640B and the Bendix 7163. Chrysler would like a material with higher effectiveness than the 7163, but if one is not found, the 7163 remains suitable for the L-car and could be used on the K-car.

Cycleweld is trying to develop a material which would be suitable for both the L and K-cars. Apparently, Chrysler has no qualms about taking Bendix off the L-car Program if a superior material (at least a superior material from Cycleweld) is identified.

Bendix has stated that they must know by May 1, 1979 whether or not they are going to be asked to supply the friction material for the 1981 K-car. Bendix said that they need additional equipment and facilities and that if they did not start procuring these items by May 1, 1979,

they would not be in a position to supply Chrysler's requirements for the 1981 model year.

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Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
RENelson
JWMcCool
RAPearce
DESteis
ADIndelicato

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP Typed 3/13/79 · TYPE OF CALL File Received 3/12/79 DATE 3/8/79

H. D. [illegible]
RESPONSE REQUESTED

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. C.	348
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

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Dennis Komatz - Product Development Engineer

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SC1 02210

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

File

HD Indemnity

RESPONSE REQUESTED ☐

Typed 6/15/79 TYPE OF CALL Received 6/11/79 DATE 6/7/79

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. C.	411
ADDRESS	CITY	STATE/ZIP
12800 Oakland Boulevard	Highland Park, MI	48203
		PHONE
		956-5252

OFFICIALS INTERVIEWED

Robert G. Gergle - Development Supervisor
Dennis Komatz - Product Development Engineer
Stu E. Woolpert - Buyer

COMMENTS

COMPETITIVE POSITION

Woolpert said that Chrysler decided not to guarantee Bendix 100% of the K-car business at this time. Chrysler has promised Bendix at least 50% of the K-car business for 1981 and 1982. Woolpert said that this percentage could be increased up to 100% of Chrysler's requirements if another friction material was not released by Brake Engineering. Woolpert said that the hope at Chrysler was that over the next couple of months a suitable material could be produced by Cycleweld. Woolpert also said that based on their past performance in this area, no-one really expected Cycleweld to be very successful. Woolpert indicated that he was very uneasy about being so dependent on Bendix for these two car programs which are crucial to Chrysler's long-term viability. Woolpert said that the first year volume on the K-car was projected to be 500,000 vehicles and they would be produced in two plants. Woolpert said that the assembly of the K-car at two different plants would facilitate a dual sourcing of lining.

In summary, Woolpert was very encouraging and wanted us to continue to pursue the K-car business with Brake Engineering.

K-CAR VEHICLE TESTING

Chrysler had just completed 1000 miles of Detroit city traffic driving using a prototype version of the K-car and 916-46. Although a formal test report had not yet been prepared, I was advised that there was some "drag-chirp" as well as some groan. It is felt that the drag chirp cannot be blamed solely on the 916-46, but some blame must be put on the Teves caliper. The 916-46 had been riveted to the steel back and I noticed that there was some pulling away of the friction material from the steel back. I was able to slip the corner of a business card between the friction material and the steel back. I do not know if this is what caused the drag chirp problem, but I feel that we should take whatever reasonable steps are necessary in order to allow us to use some existing tooling to produce integrally molded assemblies for the K-car program.

L-CAR PROGRAM

Woolpert said that the Chrysler commitment to Bendix for this program extended only through 1981. So far, the only serious complaint with the 7163 material on the L-car is that it is not effective enough. There

have been some warranty problems associated with hard-pedal complaints from the field. For this reason, Brake Engineering is very interested in our 916-125 material. Mahwah is sending me some samples of this material and Chrysler will evaluate it in the very near future.

Gergle complained that his L-car with 916-46 material installed on it was making some noise. Gergle reported that the noise was "pretty bad" when it was first installed about five days ago. However, he did say that the noise had improved considerably after the first two days of driving. I told Gergle that part of the problem could probably be related to the use of the old rotor which Chrysler had not even bothered to refinish. Gergle let me drive his car for about a half an hour and I was unable to detect any noise.

FUTURE ACTION

At this point, our next step must be to follow up with Engineering to determine how serious they are about conducting an extensive lining test program using the 916-46 material for the K-car. This was discussed at my meeting with Pickford (Chief Engineer--Chassis) and Smith (Product Engineering Manager) on 5/30 so that this should not be a surprise to them.

Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
ADIndelicato
BIwarsson
SKulis
RAPearce
RENelson
DESteis

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

[redacted] - File

A.D. Indelicato
RESPONSE REQUESTED ☐

TYPE OF CALL

DATE
May 8 through May 17, 1979

CUSTOMER	REPRESENTATIVE	REPORT No.
Chrysler Corporation	R.E. Nelson	
ADDRESS	**CITY**	**STATE/ZIP**
run vehicle tests	Los Angeles	California
		PHONE

OFFICIALS INTERVIEWED

CHRYSLER

Dennis J. Komatz - Product Development Engineer
Brake Engineering

James Knoll - Development Engineer
Cycleweld

Gene, Dennis, and Doug
(three Chrysler driver/mechanics)

KELSEY-HAYES

Bob Dix - Brake Project Engineer

Dan Grieshaber - Test Engineer

W. "Goose" Gosselin - Driver/Mechanic

ALFRED TEVES, ITT

Tony Nald - Development Engineer
Germany

Driver/Mechanic (name unknown)

A 1978 Dodge Omni was rented by Ron Cutler. This was our test vehicle, which started out with approximately 18,000 miles on it. The vehicle was in good condition and ran well throughout the test. It was reportedly quiet with the original equipment on it. Before starting the test, the complete brake system was gone through with new rotors, pins and bushings, as well as the 916-46 integrally molded with bonded Wolverine HN 810-4 insulators on the front disc brakes. The rear drum brakes were relined with new shoes, new return and hold-down springs, as well as wheel cylinders and drums. There were no instruments of any type installed.

The vehicle started in L.A. traffic according to the Chrysler procedure on May 10, 1979 and was driven on the 11th, 12th, 14th through 19th, and finished on May 21st following the morning route. The daily a.m. and p.m. mileages and comments are attached. At the end, a total of 2,093.7 traffic miles were accumulated; and total overall lining miles of 2,250 miles were accumulated.

The car was driven first by Dennis Komatz on the morning run on May 11th after about 200 miles of traffic driving. It was rated as a good pedal feel and quiet with a No. 10. Each days running following that, it was rated quiet with a No. 10. Mr. Komatz rode the afternoon route with Rick Hickok driving; at this time there was 1,500 traffic miles on the lining. Again, it was rated quiet with a No. 10. Following this, Rick Hickok was left on his own; and while the car still rated a No. 10, on May 19th Rick did report a light pedal grunt and two very high frequency squeals returning on the afternoon trip to the motel. These noises could not be repeated; and by Chrysler's definition, this still rated a No. 10. On May 21st, which was the last day of operation, Dennis Komatz of Chrysler again drove the car on the final morning session through the hill and downtown traffic loop. It was again rated a No. 10 as it remained quiet and had a good pedal feel.

R.E. Nelson Report
Chrysler/L.A. Traffic Tests
May 8 - May 17, 1979

The pads have since been returned to us and measured. The actual measurements indicate a maximum point of wear of .028 on the right, front, outer pad. The point of minimum wear was .012 and occurred on the left, front, inner pad. The average wear for each of the pads was as follows:

Left front outer	.020
Left front inner	.018
Right front inner	.019
Right front outer	.018

The condition of all of the pads was excellent having 100% contact, a smooth surface with no cracks on either the surface or delaminations at the backing and friction material interface. In all cases the insulators were intact with no deterioration as a result of the test.

These wear figures should be revised in that it was necessary for the mechanic to hand sand these disc pads to prevent dragging. This was caused by the increased thickness resulting from the insulator. Because no mikes were available, it was not possible to remeasure and get an accurate figure. I would suggest that an absolute minimum of .005 be subtracted from all these readings. I did inspect the front pads before final installation; and they were generally low on the ends so actually I would recommend another, probably, .003 be removed from the end readings.

In short, the trip was 100% successful in that we were able to achieve our objective of 2,000 miles of L.A. Traffic testing without any brake noise or detrimental effect on the lining. While I did not see the rotors, indications are that there was no scoring; and I doubt if there was any significant rotor wear. We did not measure the rotors before installation--again, because mikes were not available.

The following are some notes and comments resulting from observations and discussions carried out during this test period:

My opinion, generally, about the Chrysler L.A. tests while not exactly negative is certainly less complimentary than on those tests conducted by V.W. where we have had more recent experience. Generally, the Chrysler procedure follows that of Ford, which is much simpler and does not represent as wide a range of L.A. Traffic driving as established by the V.W. procedure. Discipline is relatively poor as the drivers are not required to start the tests either in the morning or after lunch or at any specific time. There can be as much as an hour in difference of time starting in the morning and one/half hour in the afternoon. This has some effect on the repeatability of the tests and the consistency of the results as traffic patterns generally are fairly well established at any given time during the day. There seems to be no real requirement that the procedure must be followed. It was common practice to leave out a

cooling loop between the two downtown traffic runs or even leave out the second downtown traffic run if time was running late.

Reline practices were well below minimum in that generally all that was done was to install a new set of measured pads on an old rotor and with rear brakes that may have seen a number of tests.

Jim Knoll of Cycleweld commented that the rears on one of the cars had such a loud howl that they couldn't even fairly evaluate the front noise.

I truly believe that one of the reasons we were able to get through this test, in addition to having a good material, is the fact that we did a complete brake job; and we did follow the procedure faithfully while we were driving the vehicle. One thing was noted, our vehicle seemed to have a significant amount of engine braking--which requires much fewer snubs than some of the other cars we followed going down the canyon runs. This was checked by shifting the car into neutral, and it immediately began to pick up speed so there was no drag on the brakes as the vehicle coasted freely. In checking, Kelsey-Hayes admitted their car had very little engine braking, which was verified by their reported higher wear readings.

I noted the first day that 916-46 seemed to have a slight, cold friction problem. It seemed that early in the morning or after any of the cooling loops slightly more pedal effort was required. This was difficult to verify without instrumentation and seemed to be completely worked out of the brake by the third day so I do not consider it detrimental.

It was learned on May 11th that the program was going to be extended to May 23rd. This was obviously a final attempt to make sure Cycleweld had every opportunity to meet the requirements. To the best of my knowledge, no Cycleweld material was performing satisfactorily although under the conditions of reline I am not sure how any material could be proven satisfactory. In many respects this seemed to be a Chrysler program typical of many years ago where procedure was written with the apparent objective of deviation.

Jim Knoll of Cycleweld made a comment that Bendix had offered to buy Cycleweld. Supposedly the presentation was made by Bill Agee and Bill Panny to Lee Iacocca. I don't know when this offer may have been made or why as it would seem to me that Bendix would certainly have a problem with FTC if such a deal ever went through.

Dennis Komatz made a prediction that after this program was finished in L.A. that Bendix would be released as the only material for the "K" car. This would be in addition to the production business they already have on the "L" car.

It would seem to be to our advantage to continue on with this program as I have to believe both Engineering and Purchasing would feel much more at ease if there was a backup source or at least two sources--one for each car. It is difficult to believe that with the recent settlement of rather a long strike at the Bendix Cleveland, Tennessee plant and the upcoming South Bend labor problems that Bendix can feel very secure with only this one source for two cars. Both of these should be high volume vehicles with sales pressure shifting to the smaller cars.

Based on observations here I believe we should have a good chance of continuing on with 916-46. I also believe the next phase of the program should concentrate on getting Chrysler to run enough FMVSS 105-75 tests for solid validation. Following this, we will probably have to get an instrumented car and begin some sort of cooperative test program. I doubt we would be handed this business without some good, diligent test work on our part.

We might even begin to play a little on their sympathy regarding the treatment we have received on the 7018C termination.

R.E. Nelson

REN/mb

cc: R.L. Cutler/FILE Chrysler
B.J. Iwarsson
A.D. Indelicato
D.E. Steis
D.P. Conlon

SC1 02216

"L" CAR L.A. TRAFFIC TEST DAILY SUMMARY
Relined with Abex 916-46 on 5/9/1979 - 18,279 miles

Date: May 10, 1979 Driver: R.E. Nelson

	a.m. Odometer	p.m. Odometer	Totals
IN :	18456.8	18520.0	63.2
OUT:	18322.6	18456.8	134.2
			197.4

Total Lining Miles: 301

Comments: Quiet all day. Rated No. 10.

.....

Date: May 11, 1979 Driver: D.J. Komatz (a.m.)
R.E. Nelson (p.m.)

	a.m. Odometer	p.m. Odometer	Totals
IN :	18663.1	18742.8	79.7
OUT:	18543.7	18663.1	119.4
			199.1

Total Traffic Miles: 396.5
Total Lining Miles : 523.8

Comments: Good pedal feel and quiet per D. Komatz. Quiet all day. Rated No. 10.

.....

Date: May 12, 1979 Driver: R.E. Nelson

	a.m. Odometer	p.m. Odometer	Totals
IN :	18874.2	18974.0	99.8
OUT:	18742.9	18874.2	131.3
			231.1

Total Traffic Miles: 627.6
Total Lining Miles : 755.0

Comments: Quiet all day. Rated No. 10.

.....

Date: May 14, 1979 Driver: R.E. Nelson

	a.m. Odometer	p.m. Odometer	Totals
IN :	19095.3	19204.1	108.8
OUT:	18974.1	19095.3	121.2
			230.0

Total Traffic Miles: 857.6
Total Lining Miles : 985.0

Comments: Quiet all day. Rated No. 10.

SC1 02217

"L" CAR L.A. TRAFFIC TEST DAILY SUMMARY

Relined with Abex 916-46 on 5/9/1979 - 18,279 miles

Date: May 15, 1979 Driver: S. Shaefer (a.m.)
R.E. Nelson (p.m.)

	a.m. Odometer	p.m. Odometer	Totals
IN :	19346.9	19436.2	89.3
OUT:	19215.7	19346.9	131.2
			220.5

Total Traffic Miles: 1,078.1
Total Lining Miles : 1,127.9

Comments: Quiet all day. Rated No. 10.

.....

Date: May 16, 1979 Driver : R. Hickok
Observer: R.E. Nelson

	a.m. Odometer	p.m. Odometer	Totals
IN :	19567.3	19656.4	89.1
OUT:	19436.2	19567.3	131.1
			220.2

Total Traffic Miles: 1,298.3
Total Lining Miles : 1,437.4

Comments: Quiet all day. Rated No. 10.

.....

Date: May 17, 1979 Driver : R. Hickok
Observer: D.J. Komatz (p.m.)
Observer: R.E. Nelson (p.m.)

	a.m. Odometer	p.m. Odometer	Totals
IN :	19777.5	19870.3	88.6
OUT:	19662.7	19781.7	114.8
			203.4

Total Traffic Miles: 1,501.7
Total Lining Miles : 1,651.3

Comments: D. Komatz did not drive. Rated No. 10.

.....

Date: May 18, 1979 Driver: R. Hickok

	a.m. Odometer	p.m. Odometer	Totals
IN :	20017.6	20106.6	89.0
OUT:	19870.3	20017.6	147.3
			236.3

Total Traffic Miles: 1,738.0
Total Lining Miles : 1,887.6

Comments: Quiet all day. Rated No. 10.

SC1 02218

"L" CAR L.A. TRAFFIC TEST DAILY SUMMARY

Relined with Abex 916-46 on 5/9/1979 - 18,279 miles

Date: May 19, 1979 Driver: R. Hickok

	a.m. Odometer	p.m. Odometer	Totals
IN :	20241.6	20329.2	87.6
OUT:	20106.6	20241.6	135.0
			222.6

Total Traffic Miles: 1,960.3
Total Lining Miles : 2,110.2

Comments: Light pedal grant and two very high frequency squeals. Could not repeat. This happened on p.m. trip back. Still rated No. 10.

.....

Date: May 21, 1979 Drivers: R. Hickok
D.J. Komatz

	a.m. Odometer	p.m. Odometer	Totals
IN :	20469.0	-------	----
OUT:	20335.6	-------	133.4
			133.4

Total Traffic Miles: 2,093.7
Total Lining Miles : 2,250.0

Comments: Rated No. 10 with good pedal feel by D.J. Komatz.

916-46 Wear Measurements for L.A. Traffic
Chrysler "L" Car - May 1979

Shoe	No. 1 Top Trail	No. 2 Center Top	No. 3 Top Lead	No. 4 Bottom Trail	No. 5 Bottom Center	No. 6 Bottom Lead
L.F. Outer (initial)	.741	.738	.739	.741	.741	.741
Min/Max .015/.027	.715	.720	.712	.724	.726	.726
Average .020	.026	.018	.027	.017	.015	.015

100% contact. Smooth. No surface cracks or delamination at backing. Insulator intact.

L.F. Inner (initial)	.732	.731	.732	.733	.732	.733
Min/Max .012/.023	.720	.714	.709	.718	.712	.710
Average .018	.012	.017	.023	.015	.020	.023

Same as L.F. Outer. Piston did not cut through the insulator coating but piston profile visible.

R.F. Inner (initial)	.734	.731	.733	.732	.732	.732
Min/Max .015/.023	.719	.716	.711	.713	.711	.709
Average .019	.015	.015	.022	.019	.021	.023

Same as L.F. Inner except piston profile more predominant.

R.F. Outer (initial)	.737	.737	.736	.738	.737	.741
Min/Max .023/.028	.709	.715	.711	.718	.719	.717
Average .018	.028	.022	.025	.020	.018	.024

Same comments as L.F. Outer.

A.D. Indelicato

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP Typed 3/13/79 · TYPE OF CALL File Received 3/12/79 DATE 3/8/79 RESPONSE REQUESTED H. D. [illegible]

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. C.	348
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

OFFICIALS INTERVIEWED

Paul Hellens - Senior Product Development Engineer
Dennis Komatz - Product Development Engineer

COMMENTS

STATUS OF 916-46

Chrysler has tested the 916-46 material on an L-car at the Proving Grounds. According to Hellens, the material had no difficulty passing FMVSS 105. Hellens thought that the actual test had been conducte on a vehicle with a power brake system, but that an analysis of the line pressure indicated that the material would have no problem passing FMVSS 105 with a manual brake system. Hellens said that the only reported problems were a wire brush noise during the burnish and that light rotor scoring was noticed after the test was completed.

Chrysler presently has the material on a Detroit city traffic schedule. After approximately 1,500 miles, the average noise rating of the material was reported to be 8.6. The test was conducted without using any noise insulating gaskets. The 8.6 rating is comparable to that of the Cycleweld 2640B material. Initial reports indicate that the 916-46 has a low cold effectiveness and that it is not significantly better in this area than either the 2640B or the 7163 from Bendix.

916-46 is presently being evaluated by Chrysler in Florida. It is expected that at least one additional FMVSS 105 test will be conducted on the material.

L AND K-CAR PROGRAMS

The L-car is using 7163 and a solid rotor. The K-car is going to u ventilated rotor and the leading friction material candidates are Cycleweld's 2640B and the Bendix 7163. Chrysler would like a mate with higher effectiveness than the 7163, but if one is not found, 7163 remains suitable for the L-car and could be used on the K-c

Cycleweld is trying to develop a material which would be suitab both the L and K-cars. Apparently, Chrysler has no qualms abo Bendix off the L-car Program if a superior material (at least material from Cycleweld) is identified.

Bendix has stated that they must know by May 1, 1979 wheth they are going to be asked to supply the friction material f K-car. Bendix said that they need additional equipment and and that if they did not start procuring these items by Ma

SC1 02221

SALES REPRESENTATIVE'S REPORT AKK - full — RESPONSE REQUESTED ☐
FRICTION PRODUCTS GROUP Typed 2/12/79 TYPE OF CALL Received 2/9/79 DATE 2/6/79

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION/ BRAKE ENGINEERING	D. P. C.	329
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

OFFICIALS INTERVIEWED

Gayle W. Smith - Product Engineering Manager/Brake Engineering
Paul B. Hellens - Senior Product Development Engineer

COMMENTS

916-46 PROGRAM

Hellens stated that Chrysler has begun a temperature/wear test on the 916-46. He said that the test had been interrupted, but the preliminary results indicated that the material has very good wear characteristics. Hellens said that Chrysler is planning to begin testing the 916-46 material in a Detroit city traffic schedule in the next week or so. Hellens said that the material will be tested on an L-car and that the material would be tested without any anti-noise devices.

L-CAR PROGRAM

The only problem that Chrysler is having with the Bendix 7163 material is that the customers are complaining about a "hard pedal." Chrysler feels that the effectiveness of 7163 is too low and are therefore looking for a material which will have a higher effectiveness level.

So far, Chrysler has not had any particularly bad complaints concerning noise with the 7163. Chrysler feels that this is due to the fact that the 7163 was only put into production during the late summer and that most of the driving using that material has been done in relatively cold weather. Chrysler also feels that most of the cars using the 7163 would have relatively low mileage and that the piston would probably not have cut through the Wolverine insulating gasket.

In order for us to displace the 7163 material on the L-car, we will therefore have to be able to demonstrate that the 916-46 material has a higher level of effectiveness than the Bendix material. The VW tests indicate that 916-46 and 7163 are similar in noise, so the low noise levels of 916-46 won't be much of a competitive advantage over 7163. Unfortunately, the VW tests indicate that the effectiveness of both materials are similar.

K-CAR PROGRAM

The leading candidate for the 1981 K-car Program is Cycleweld 2460B.

According to Hellens, this is an asbestos containing resin bonded metallic formulation. The main problem that Chrysler is having with this material is its inconsistent noise pattern. Chrysler reported that early batches of material had very poor noise. Up until recently, subsequent batches had demonstrated exceptionally good noise characteristics: readings in the 8 to 9 range after 1,000 to 3,000 miles of Detroit city traffic testing.

These tests were all conducted using a Kelsey-Hayes caliper. Recent batches of the 2460B material were tested using a Teves caliper and the noise results were very bad. Chrysler is not sure whether the poor noise results were the result of batch to batch variation within the 2460B or whether the 2460B/Teves caliper is just a noisy combination.

FUTURE ACTION

Hellens is going to send some Teves shoes to Winchester for integrally molding with the 916-46. The purpose of this exercise is to see if the 916-46/Teves combination is as noisy as the 2460B/Teves combination.

Experimental order 12712 has been submitted in order to supply these parts to Chrysler. Seven car sets have been requested with a "B" priority--delivery 4/1/79. When the shoes became available, I will ask that the priority be raised to an "A."

Denis

Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
ADIndelicato
RCain
WThomas
RENelson

SALES REPRESENTATIVE'S REPORT — RESPONSE REQUESTED ☐
FRICTION PRODUCTS GROUP Typed 12/28/78 TYPE OF CALL Received 12/28/78 DATE 12/18/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. Conlon	307
ADDRESS	CITY	STATE/ZIP
Highland Park, MI		
		PHONE

OFFICIALS INTERVIEWED

Mr. H. Pickford Chief Engineer - Chassis
Mr. G. W. Smith Product Engineering Manager - Brake Engineering
Mr. W. H. Rankin Senior Product Development Engineer
Mr. R. G. Gergle Brake Development Supervisor

COMMENTS

POTENTIAL BUSINESS

The main purpose of my visit to Chrysler was to again express our interest in working with them for the K-car as well as the L-car programs.

In general, everyone appeared to be interested in evaluating new materials from Abex.

On the K-car, the principle competition is Cycleweld. They have until May 1st to submit an acceptable friction material for the 1981 K-car. The general feeling now is that if Cycleweld cannot come up with a material, then either Abex or Bendix will probably get the business. Bendix has the edge because of their position on the L-car. The Bendix material is 7163.

Brake Engineering is not entirely satisfied with 7163 on the L-car. Chrysler feels that the overall effectiveness of 7163 is a little too low. They would prefer to have something along the lines of 7018C in terms of effectiveness.

916-46 will be submitted to Chrysler shortly after the first of the year. Chrysler will test the material on a Detroit City traffic schedule as well as on their dynamometer. Preliminary reports from Mahwah indicate that the 916-46 is slightly higher in effectiveness than the 7163, but significantly below that of 7018C. Based on our VW work, the 916-46 appears to have an advantage over the 7163 in terms of noise. Hopefully this will carry over to the Chrysler vehicles.

SIA GASKETS

The noise insulating gaskets from SIA were given to Chrysler for their evaluation. They are going to "play" with it in an effort to determine its effectiveness.

Denis

Denis P. Conlon

DPC/lb

cc: RLCutler/AFSchmaltz/file
RENelson
RAPearce
✓ADIndelicato
DESteis

SALES REPRESENTATIVE'S REPORT ped: 11/30/78 - 11/30/78 - file RESPONSE REQUESTED ☐
FRICTION PRODUCTS GROUP TYPE OF CALL DATE 11/28/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	300
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

Gayle W. Smith - Product Engineering Manager - Brake Engineering
John L. Thon - Development Supervisor - Brake Engineering
Paul B. Hellens - Senior Product Development Engineer

COMMENTS

1981 "K" CAR

The main purpose of my visit to Chrysler was to discuss the potential for Abex lining on their 1981 front wheel drive vehicle - the "K" car.

At this time, no decision has been made concerning the opportunities for outside suppliers. Cycleweld continues to have the inside track for various political and economic reasons and Cycleweld will have until sometime in May, 1979 to develop an acceptable friction material.

I discussed 916-46 in very general terms with Paul Hellens. Hellens said that he would very much like to run some Detroit city traffic tests and some dynamometer tests on this material. The lining development work is being done on the Kelsey-Hayes L-car caliper. Hellens said that the 7163 material passes the 105 requirements when run to the "K" car conditions. Chrysler is not particularly happy with the 7163, mainly because of noise and low cold effectiveness.

Hellens said that the caliper was a modification of the caliper Teves proposed for the 1981 Pinto replacement. He said that Chrysler originally wanted to manufacture the caliper in-house, but that the estimated cost of tooling Toledo Machine ($11,000,000) was more than Chrysler wanted to spend. He mentioned that, as part of the "deal" Teves did not charge Chrysler for any tooling. Hellens said that the projection for the K car were 500,000 units the first year.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
RENelson
DESteis
ADIndelicato
RAPearce

SC1 02225

CO-S Revised 4 76

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

Typed: 7/24/78 - 7/24/78
TYPE OF CALL

RESPONSE DATE 7/ /7

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	215
ADDRESS	CITY	STATE, ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
Larry L. Shively - Product Development Engineer
Al King - Project Engineer

COMMENTS

PERSONNEL CHANGES

Thomas A. Brandon, Development Supervisor, has been promoted to a position in the Product Planning Department. As of this date, his successor has not been named. Robert W. Steere has been appointed to the newly created position of Executive Engineer - Chassis. The new Chief Engineer - Chassis has not yet been formally anncunced but the rumors indicate that it will be someone from the Truck Engineering Group, Harvey Pickford.

L-BODY

The switch to Bendix is proceeding according to schedule. Bendix has already made a production run of 30,000 pucks and Chrysler is now in the process of evaluating the samples. Although the evaluation has not been completed, preliminary results indicate that the production materials are approximately equal to the prototype materials.

Reports from the field indicate that at present, the main problem with the 7018C material is noise. There have been complaints about excessive pad and rotor wear but to date, these have not reached epidemic proportions.

K-BODY

Hellens indicated that Brake Engineering was primarily evaluating various Cycleweld materials for this heavier version of the L-body. An understanding has been reached with Cycleweld whereby a decision on their lining will be reached by late fall. If the preliminary results indicate that the Cycleweld material looks promising, that will effectively closeout the K-body program to outside lining suppliers. If the Cycleweld material has serious problems or if there is a low level of confidence that minor problems can be resolved, then Cycleweld will be out of the program and outside vendors will be invited to participate.

1228-69-A3

Rankin said that he had not yet had a chance to evaluate this material which was submitted to him for testing with the 2.75 slider.

Denis P. Conlon
jd
cc RLCutler/AFSchmaltz/File ADIndelicato ✓
RAPearce

SALES REPRESENTATIVE'S REPORT — Typed: 6/20/78 - 6-20/78 — RESPONSE REQUESTED ☐
FRICTION PRODUCTS GROUP — TYPE OF CALL — DATE 6/16/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	209
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED
Gayle W. Smith - Product Engineering Manager - Brakes
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer

COMMENTS

INTEGRALLY MOLDED PARTS AND TOOLING

Smith confirmed our previous understanding that Abex should seek payment for both the tooling and the approximately 8,000 integrally molded pieces already made from Kelsey-Hayes. Smith assured me that there would be no problem concerning the reimbursement for these items.

A letter has been written to Kelsey-Hayes formally requesting the procedures which should be followed in order to facilitate the termination of Abex's involvement with the L-car. As soon as a reply is received, the information will be passed on the P. H. Grim for proper billing to Kelsey-Hayes. Would Mr. Grim please advise me of the exact count of integrally molded assemblies which we have on hand in Winchester?

NOISE PROGRAM

Samples of Abex formula 1228-69-A3 (X1 and X2) were delivered to Chrysler for evaluation as part of their noise reduction program on the M-body vehicles (Diplomat, Le Baron). These organic materials were supplied under Experimental Order 12498. Chrysler expects to begin testing these materials within two weeks.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
ADIndelicato
PHGrim

Typed: 6/15/78 - 6/15/78

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 6/13/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	204
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI		
		PHONE

OFFICIALS INTERVIEWED
Paul B. Hellens - Senior Product Development Engineer
William H. Rankin - Senior Product Development Engineer
John L. Thos - Brake Design Supervisor
James E. Clark - Project Engineer

COMMENTS

L-CAR PROGRAM

Mr. Conway's letter to Mr. Sid Jeffe (Chrysler Vice President - Engineering) apparently received wide distribution within Chrysler. Almost everyone I spoke to commented on the positive and constructive tone of the letter and was pleased to see that Abex was interested in continuing its relationship with Chrysler.

916-40 MATERIAL

The results of Chrysler's temperature - wear dynamometer procedure were reviewed. The results were:

	OUTER	INNER
Burnish	.018"	.009"
250	.030"	.028"
325	.032"	.033"
400	.031"	.034"
475	.048"	.006"
550	.012"	.006"
Total:	.171"	.116"

Total rotor wear: .0004"

Chrysler felt that the wear numbers were high (about twice the wear of Bendix 7163) but was very pleased with the exceptionally good rotor wear figure.

Chrysler has not yet started the noise evaluation of the 916-40 material. Rankin stated that in view of the high wear numbers, he would not be surprised if that part of the evaluation procedure was dropped.

Denis P. Conlon
jd

cc RLCutler/AFSchmaltz/File
SSConway
BIwarsson
ADIndelicato ✓
DGManly
RAPearce
DESteis
RENelson

RVHA - Full Typed: 5/30/78 - 5/30/78

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/24/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	189
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

Robert Gurgle - Development Supervisor
Paul B. Hellens- Senior Product Development Engineer
William H. Rankin - Senior Product Development Engineer

COMMENTS

916-40 EVALUATION

The purpose of my visit was to drop off the samples of the 916-40 material for evaluation by Chrysler. I was assured that the material would be given an honest and fair evaluation. The temperature - wear dynamometer procedure would be started very quickly. There was some concern as to how quickly the noise evaluation procedure could be started: as a result of a shortage of drivers, the Brake Group was only able to have two vehicles for lining evaluation and both of the vehicles were presently being used to test the 7163 material.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
ADIndelicato
DESteis

SC1 02229

H. Lockwood

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/23/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	186
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

Robert W. Steere - Chief Engineer - Chassis
Gayle W. Smith - Product Engineering Manager - Brake Engineering
Robert R. Swanberg - Development Supervisor (Chelsea Proving Grounds)

(Accompanied by R. E. Nelseon, D. E. Steis and A. D. Indelicato)

COMMENTS

L-CAR PROGRAM

The purpose of this meeting was for Abex to present data on the results of our lining development program, initiated after our April 25th meeting with Chrysler. At that time, we indicated to Chrysler that we were working on a substitute material for the 7018C and that by May 20th, we would be in a position to present data to them on this new material. The new material was 916-40. Chrysler was shown the data which is attached to this report.

Mahwah ran a FMVSS 105 dynamometer test on a set of the Bendix 7163 material. A test was also run on the 916-40 material. A comparison of the tests results indicated that the 916-40 material was at best, equal to the 7163 material but in all likelihood was probably not as good as the 7163 material, especially in terms of effectiveness and speed spread. Rotor and pad measurements indicated that the 916-40 had less wear than did the Bendix material. Because of the unfavorable conclusions which could be drawn by Chrysler concerning the performance of the 916-40 material, it was decided that we would not present a comparison of the test data.

The Chrysler temperature-wear dynamometer procedure was run on the same set of 7163 pads which were used for the 105 test. The results of this test indicated that the 7163 material had extremely low rates of both pad and rotor wear. The Mahwah results correlated very closely with the results obtained by Chrysler using the 7163 material. The results of the same procedure run on the 916-40 material were eratic and confusing. The net result, however, was that the indicated wear rates were much higher than that of the Bendix material.

The objective of our data presentation was to sufficiently interest Chrysler in the new material so that they would evaluate it for possible use on the L-car. In line with this objective, two decisions were reached:

1. The 916-40 data was adjusted so that the peculiar results of certain parts of this one test were obscured.

2. The 7163 wear amounts were increased in order to make them comparable with the higher wear rates on the 916-40 material.

No one was particularly comfortable at having to resort to this kind of data manipulation. However, it was felt that several factors supported the taking of such extroadinary steps. These factors included the historic

lack of correlation between the Mahwah and Chrysler results on the temperature wear test and the unknown affect of running the 7163 material on the 105 test prior to the temperature wear procedure. It was also felt that Chrysler would not be positively influenced by our data but they could very easily be negatively influenced by our data: if the comparison were unfavorable, our material would never be tested by Chrysler. If the comparisons were favorable, Chrysler would not necessarily buy the material, but at least they would evaluate it.

Unfortunately, at the very beginning of the meeting, Steere interrupted my presentation to say that regardless of how favorably Chrysler might rate our material, there was no chance that the 916-40 material would be used on the 1979 L-car program. Steere followed this with the statement that if the material was really exceptionally good, there was some chance that Chrysler might elect to use it on the manual brake vehicles during the upcoming model year. Steere said that this chance was very slim but the pedal feel with the 7163 on a manual vehicle was not very good. Steere also stated that Chrysler would certainly evaluate any material we might wish to submit for their 1981 K-car program, but that the chances of them accepting our material for that program, were also ver remote: the Brake Engineering people were under a great deal of pressure to approve a Cycleweld material for that application. It was stated to Mr. Steere that since the April 25th meeting, Abex had expended a tremendous amount of time and money in an effort to find a suitable replacement for 7018C on the L-car program. Mr. Steere stated that he realized this but there was no way that any new material from Abex could be adequately tested and evaluated with sufficient thoroughness to support its acceptance for production. Steere stated that because Bendix was not charging Chrysler (Kelsey-Hayes) for the full amount of tooling, Chrysler was forced to commit to buying approximately one year's worth of parts from Bendix. Again, referring to the manual brake vehicle, Steere said that if the Bendix material could not adequately do the job, and if the 916-40 was able to satisfy Chrysler's requirements, it was possible that sometime in the future the 916-40 material could be introduced on the manual brake vehicles. Steere said that a tremendous amount of testing remained to be done on th3 7163 material and that because of this requirement, he did not have sufficient testing resources to evaluate the 916-40 as a candidate for immediate acceptance for production.

At this point, several factors gravitated against having an argument with Steere on this point:

1. We had some serious doubts about the superiority of the 916-40.

2. If Steere really did not want our material it would be very easy for him to justify not using it (subjective noise evaluation tests, Abex reliability as a vendor, etc).

3. A knockdown - drag-out battle at this point, espcially considering the first two factors, would probably effectively eliminate

Chrysler as a potential customer.

We presented our data, made some polite conversation at the end of the meeting and left.

At approximately 4:30 p.m., I returned to Chrysler for a private meeting with Smith. At this meeting, I expressed my extreme disappointment at Steere's comment that our material, regardless of its merit, would not be used on the L-car. I told Smith that I felt as though we had been badly mistreated, especially in light of the extensive program which we had recently completed.

Smith said that to a certain extent, the situation was mishandled by Chrysler. He was very embarrassed that I had to find out indirectly that the Bendix tooling had been released. Smith agreed that in the light of Steere's comments, it appeared as though Abex had been taken advantage of by Chrysler. He said it wasn't malicious and he hoped it didn't poison the relationship between Abex and Chrysler. He also said he was somewhat surprised by Steere's opening remark that under no circumstances would a new Abex material replace 7018C on the L-car. He pointed out that Steere immediately modified that statement by talking about the manual brake vehicles. By bringing this up, I think Smith was trying to justify his own refusal to tell us that we were off the program by pointing out that even Steere had left the door open, however slightly. Smith said that he thought Steere had been so blunt because Steere wanted to drive home very forcefully the point that Abex had no chance to get the business and that therefore, he didn't want us to waste any more money attempting to regain it. Smith had no good answer as to why Abex was not told this after the April 25th presentation, or even after the tooling had been released on May 5th. Smith offered to have a meeting with Abex in order to try to more fully explain how this situation could have developed.

I asked Smith if I had misinterpreted his comments concerning the possible use of a new Abex material or if I had failed to communicate to him the extent of our efforts to develop a substitute for 7018C. He admitted that at no time did he say that there was no chance for Abex to replace 7018C. He also said that he was fully aware of our development program.

In retrospect, I think that maybe I pushed Smith too hard: I was told (Sales Report #176, dated 5/5/78) by Purchasing (Woolpert) and Engineering (Brandon and Thon) that Abex was definitely off the L-car program, regardless of how our new material performed. After hearing that, I complained to Smith that I thought Abex should be given a chance and that Chrysler had nothing to lose by letting Abex work on developing a substitute material. Smith agreed and the test program was not stopped when the Bendix tooling was released. I think that Smith has a great deal of difficulty in flately rejecting anyone. I think it was this personal problem of his that kept him from coming out and telling me that a new Abex material was definitely out of consideration for the L-car program.

When we made our presentation on April 25th, we were all aware that we were undertaking a very risky program: we were competing against a very good friction material and we were constrained by a very tight deadline. I am disappointed that Chrysler did not live up to their part of the bargain and evaluate our new material as a possible substitute for the 7018C material.

In considering what to say at any future meeting at higher management levels of Chrysler I think serious consideration should be given to the strong possibility that our material is not superior to the 7163 material.

Denis P. Conlon

jd

attachments

cc RLCutler/AFSchmaltz/File
SSConway
BIwarsson
RENelson
ADIndelicato
DGManly
GRGraham
RAPearce
DESteis

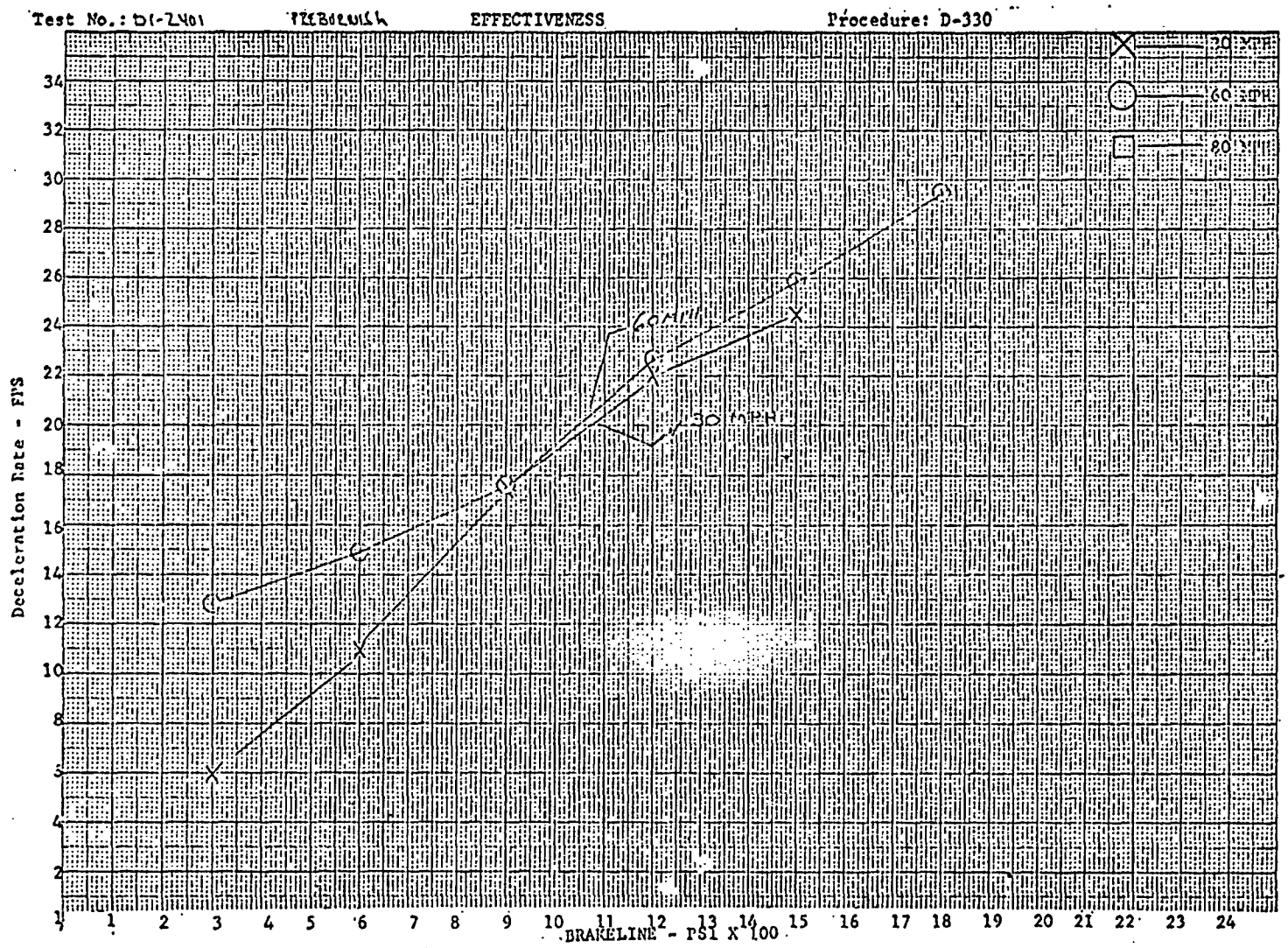
FMVSS 105

916-40 VERSUS 7018C

	PRE-BURNISH @ 1200 PSI		POST-BURNISH @ 1200 PSI			1ST FADE PSI/ STOP	2ND FADE PSI/ STOP	POST-FADE @ 1200 PSI						
	30	60	30	60	80			30	60	80				
916-40	22.0	22.5	22.0	27.5	28.5	1660/5	1150/10	22.0	35.2	38.0				
7018C 4 TEST AVG.	16.3	24.0	27	27.8	29.0	1436/5	1566/10	24.6	29.0	26.7				

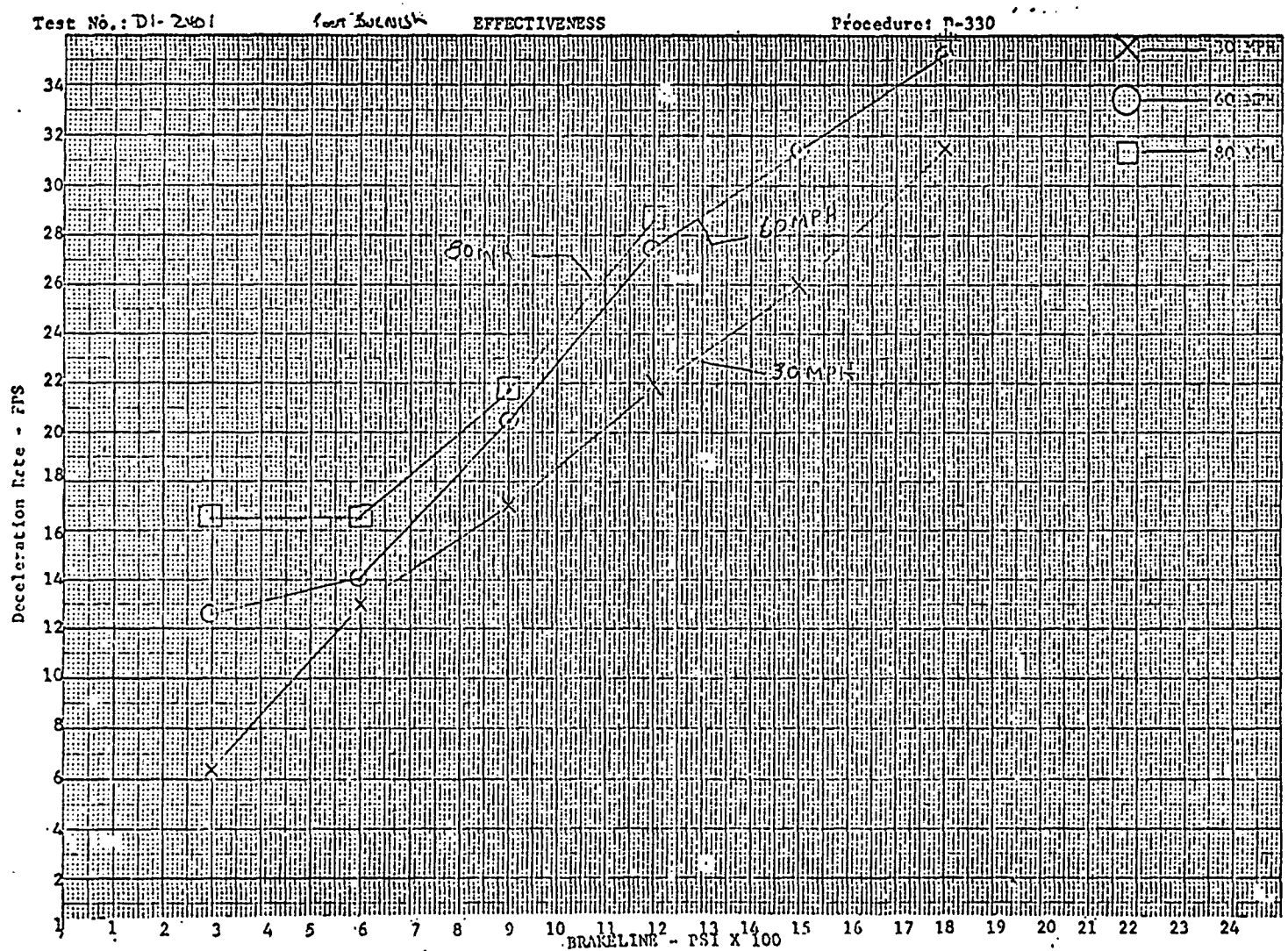
SC1 02234

916-40A1



SC1 02235

916-40A1



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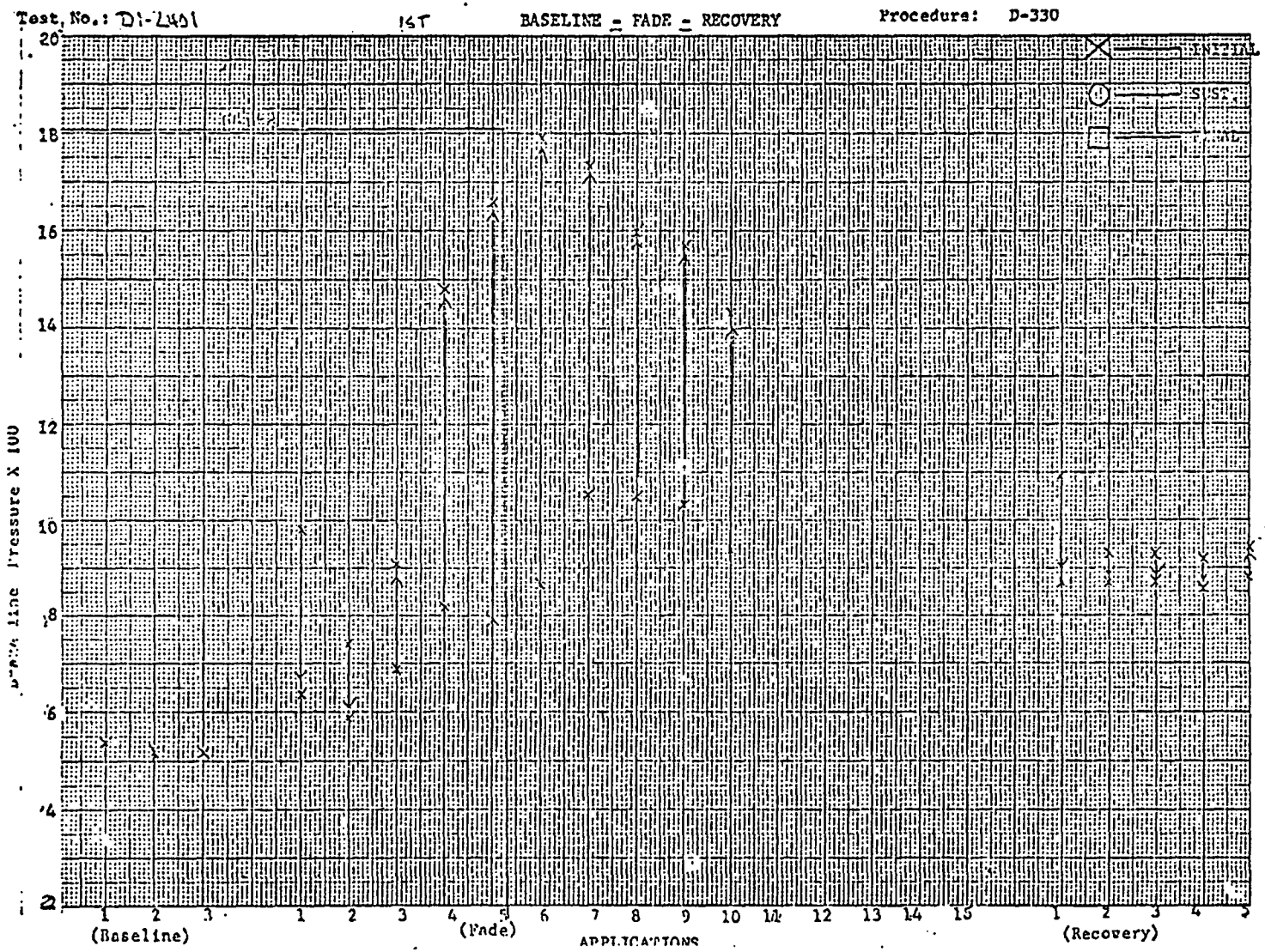
916-40A1



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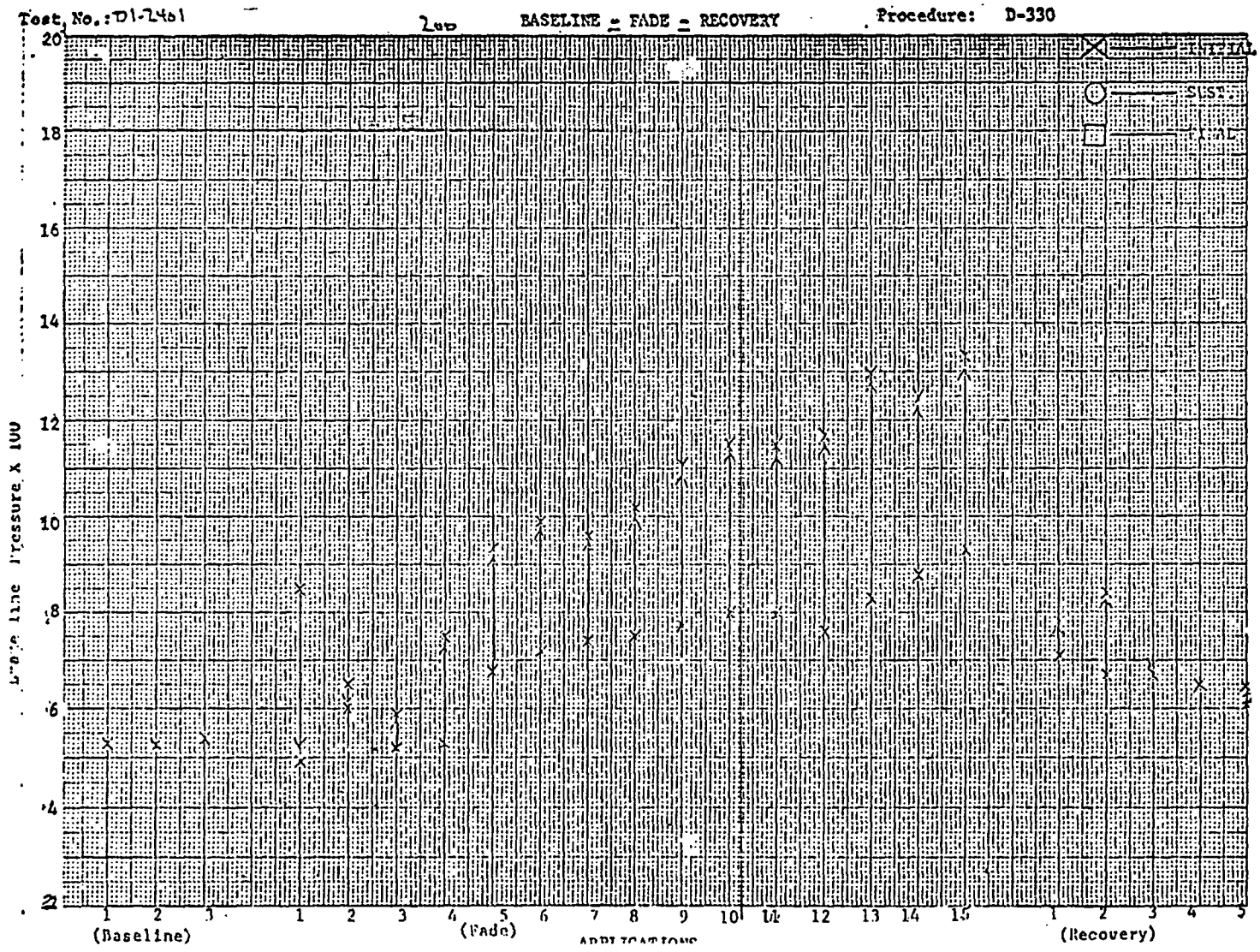
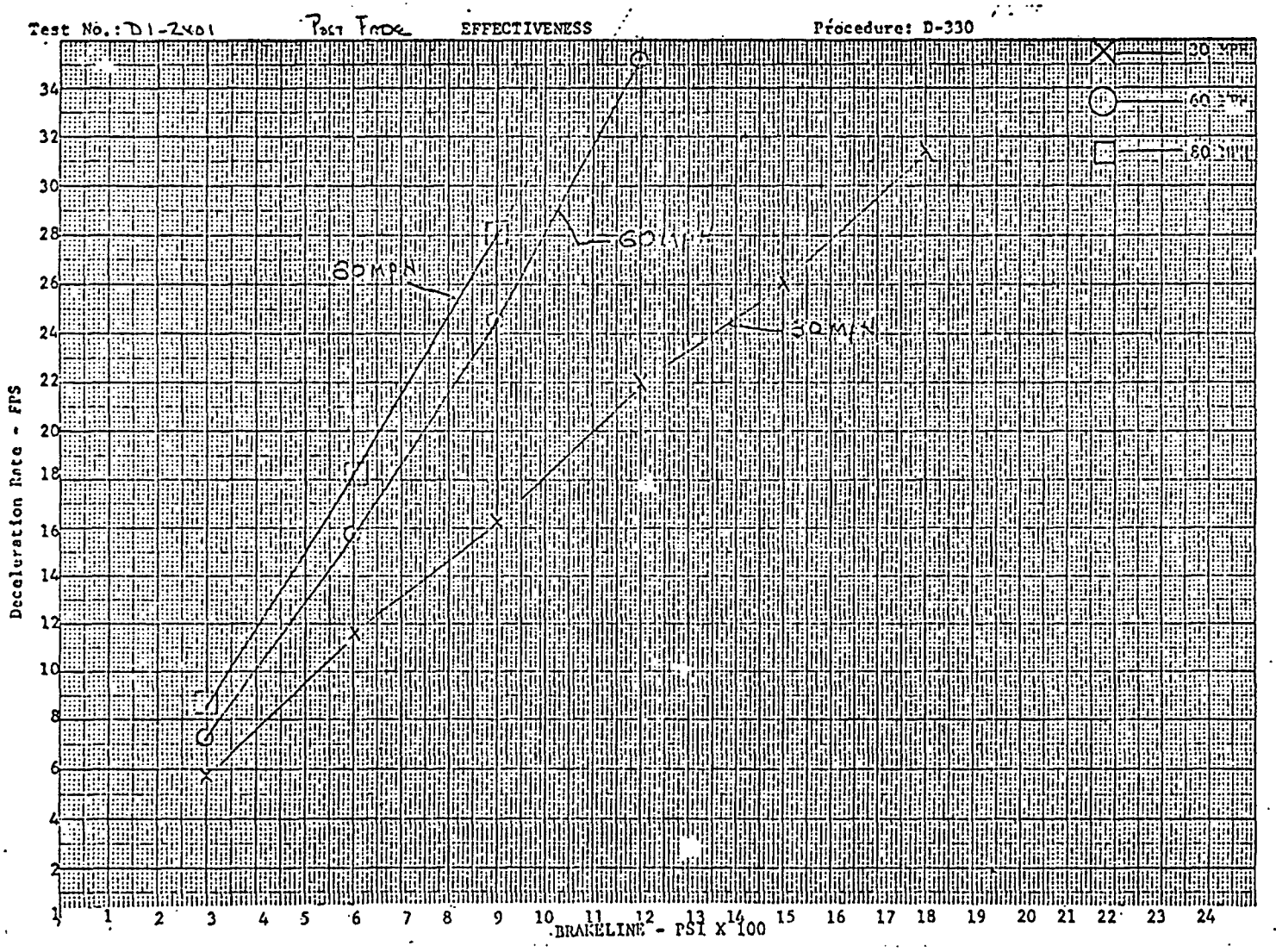
916-40A1

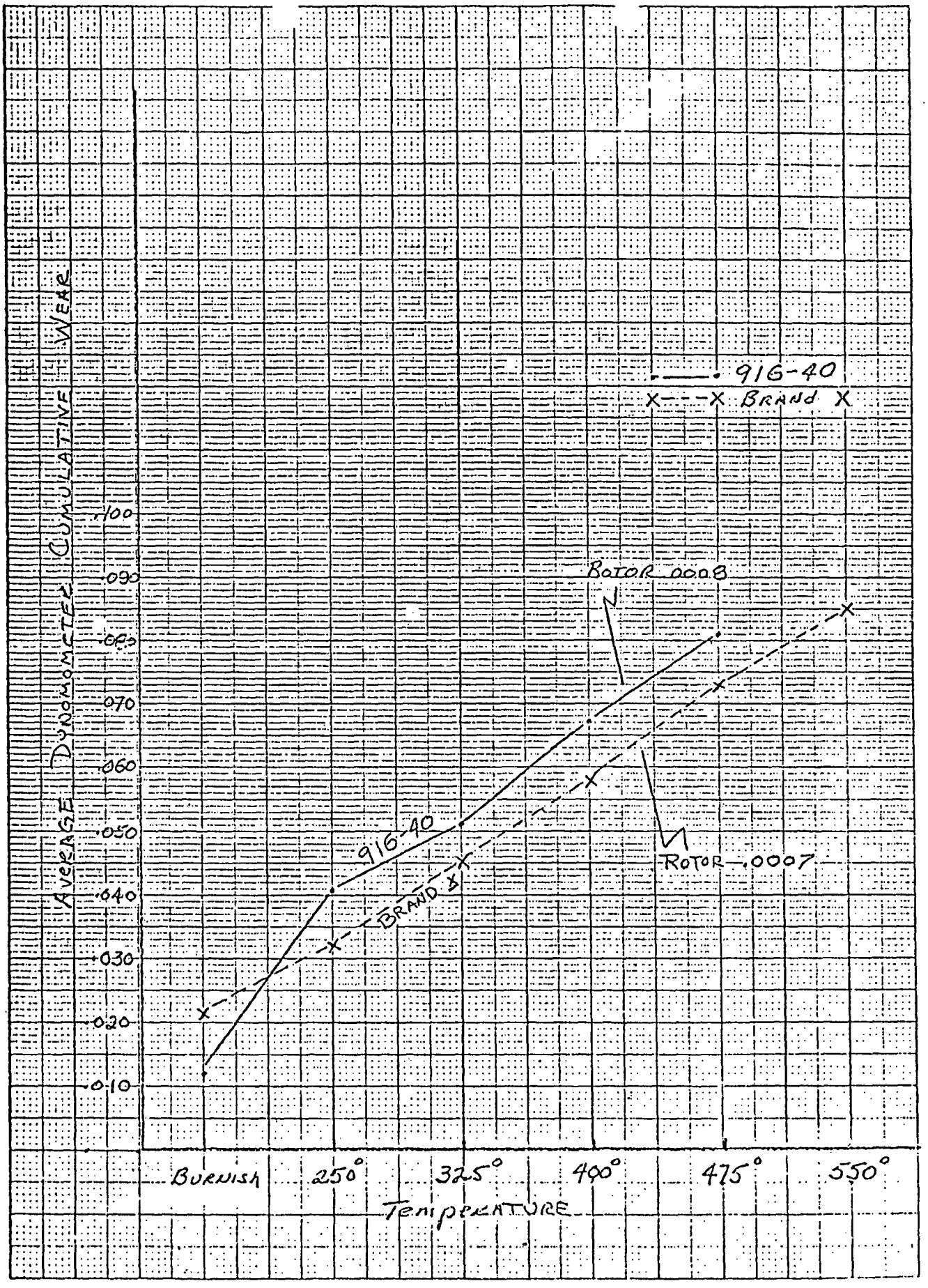


SC1 02238

916-40A1



SC1 02239



46 1331
KEUFFEL & ESSER CO. MADE IN U.S.A.

VEHICLE GENERAL ENDURANCE

Build Vehicle - Plymouth Horizon
With new rotors, drums, and friction materials
Measure - friction material - drums and rotors

Instrumentation - Data Logger
With thermocouples in all brakes, recording decelerometer, and pressure transducer

Vehicle Load - Curb + 600 lbs.

Test Procedure - 4 stops - 35 MPH to 0, 10 ft./sec.^{2}
1 stop - 35 MPH to 0, 12 ft./sec.^{2}
1 stop - 35 MPH to 0, 10 ft./sec.^{2}
1 stop - 50 MPH to 0, 10 ft./sec.^{2}
1 stop - 40 MPH to 0, 10 ft./sec.^{2}

Interval .5 miles between stops.

Cool to 200°F approximately 4.0 miles and repeat above cycle.

Repeat above conditions for 1000 miles.
Stops per 1000 miles is 952.

Measurement - Measure friction material, drums and rotors. Calculate extrapolated mileage based on:

Pad thickness	.400
Rotor	.059
Drum Lining	
Drum	.059

L-CAR WEAR SUMMARY

PROJECTED MILEAGE X1000

MATERIAL	LFO	LFI	RFO	RFI	MIN/ MIN	AVG/ MIN	MIN/ AVG	AUG/ AUG	ROTOR L	ROTOR R	9	NOISE 8	NOISE 7	6
916-40 MIN/MIN	38.1	38.1	38.1	32.9	32.9	36.8			0	0	46	10	0	0
@ 2835 Miles AVG	57.5	64.7	59.4	49.6			49.6	57.8						

SC1 02242

Date Typed: 5/22/78 - 5/22/78

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/19/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	184
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED
Gayle W. Smith - Product Engineering Manager - Brake Engineering
Robert Gurgle - Development Supervisor - Brake Engineering
William H. Rankin - Senior Product Development Engineer

COMMENTS

ABEX REPLACEMENT FOR 7018C

A discussion was held with Mr. Smith concerning the results of the Abex lining development programas outlined on April 25, 1978.

In general terms, it was stated to Smith that our development program was successful in that we had developed a new material which was vastly superior to 7018C in terms of rotor and pad wear, had less noise, but which retained essentially the same pedal feel as the 7018C material.

Smith stated that as soon as samples were received from Abex, they would be run on Chrysler's temperature wear dynamometer procedure and would be evaluated for noise. Smith stated that he was not very confident that our new material would be better overall than the Bendix 7163 material, but that he was certainly willing to evaluate it.

A meeting was set-up for Tuesday, May 23, 1978, at 1:30 p.m. Scheduled to be in attendance from Chrysler are: Robert W. Steere, Chief Engineer - Chassis; Robert W. Swanberg, Development Supervisor (Chrysler Proving Ground at Chelsea); Gayle W. Smith.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
BIwarsson
RENelson
ADIndelicato ✓
RAPearce
DESteis

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/10/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	179
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI		
		PHONE

OFFICIALS INTERVIEWED
William H. Rankin - Senior Product Development Engineer
Paul E. Hellens - Senior Product Development Egineer
Lawrence L. Shively - Product Development Engineer

COMMENTS

PERSONNEL CHANGE

Robert Gurgle has been named as Development Supervisor in the Brake Lab. He will assume some of Tom Brandon's responsibilities. Hellens and Paul Grit (Hydaulics) will report to Gurgle. Rankin will continue to report to Brandon. Gurgle comes from the Sound and Vibrations area.

7018C

The main purpose of my visit was to discuss the measurable qualities of 7163 which the new Abex lining would have to meet. As can be seen from the attached graph, the lining and rotor wear with the 7163 material is almost insignificant, especially when compared to 7018C or Cycloweld 2380. In particular, it is important to note that the average rotor wear with 7018BC was .030". This compares with average rotor wear using 7163 of .0005.

During a discussion of the 7163 performance on the Proving Ground endurance run, it was pointed out that the Bendix material was averaging about 50,000 miles pad life and infinite rotor life. The worst case that Chrysler observed was lining and rotor wear both in the 35,000 mile category. The material continues to run extremely quietly.

The only complaint about the 7163 material is that it is not as effective as the 7018C material. This is going to present some difficulties for Chrysler in balancing the vehicles.

It is my subjective opinion that if Abex had a material with a projected pad life of 35,000 miles, and projected rotor life of 50,000 miles, a noise rating "almost" as good as the 7163 but with the effectiveness and pedal feel of the 7018C material, we would be able to retain the business. Chrysler is so pleased with the effectiveness and pedal feel of the 7018C material, they would be willing, in my opinion, to give up something in these other areas in an effort to maintain that attribute of 7018C.

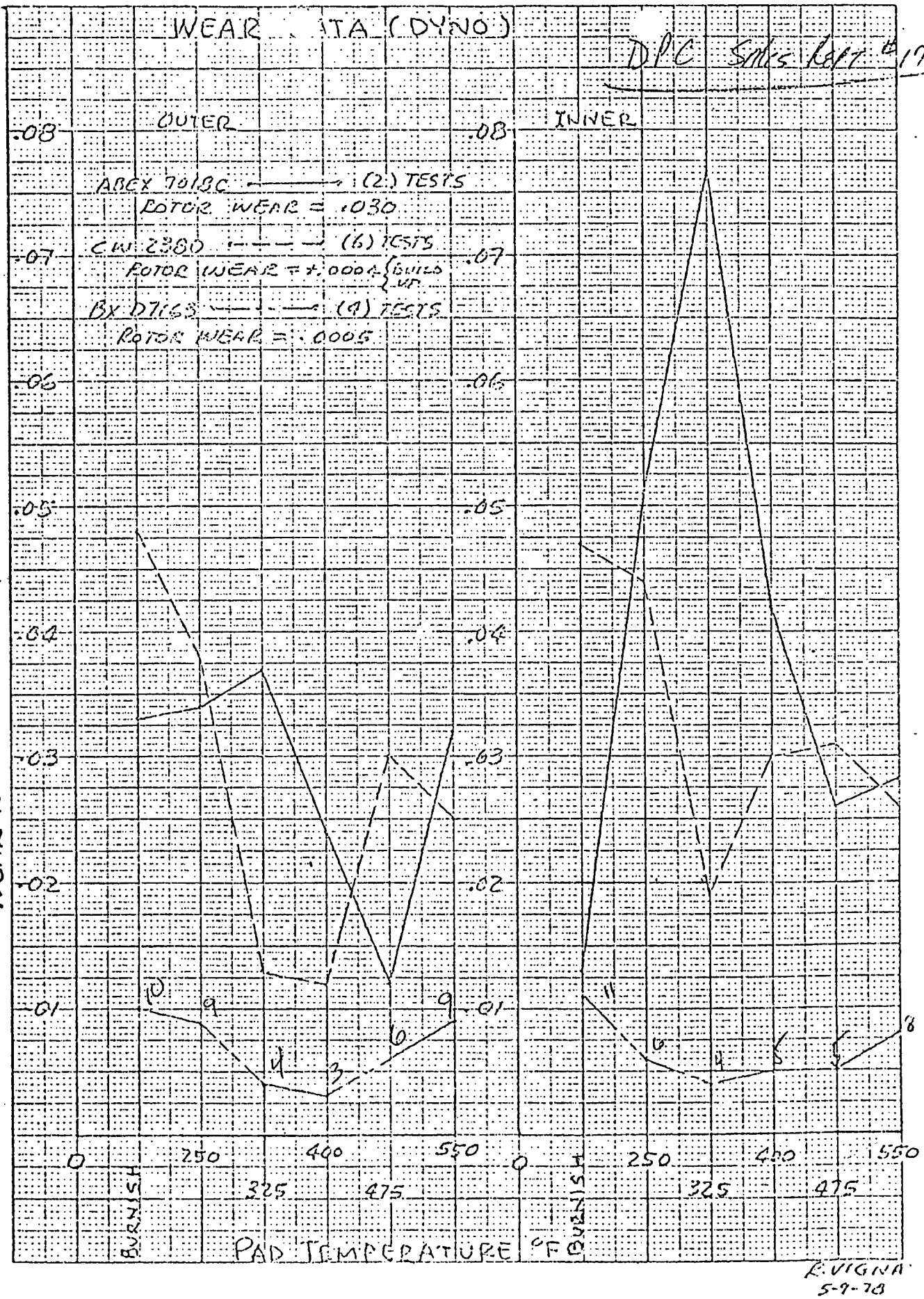
Denis P. conlon

jd

attach.

cc RLCutler/AFSchmaltz/File
BIwarsson
RENelson
ADIndelicato
DGManly
DESteis
RAPearce
GRGraham
BDybalski

SC1 02244


WEAR DATA (DYNO)
DPC Sales Rept #179
OUTER
INNER
ABEX 7018C (2) TESTS
ROTOR WEAR = .030
CW 2380 (6) TESTS
ROTOR WEAR = +.0004 {BUILD UP
BX D7163 (4) TESTS
ROTOR WEAR = .0005
WEAR RATE - INCHES
.08
.07
.06
.05
.04
.03
.02
.01
0
250
400
550
325
475
BURNISH
PAD TEMPERATURE °F
R. VIGNA
5-9-78

SC1 02245

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

Date Typed: 5/12/78 - 5/11/78 A. Andrews

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/5&9/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	176
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI		
		PHONE

OFFICIALS INTERVIEWED

Gayle Smith- Manager Product Development - Brakes
Thomas A. Brandon - Supervisor Brake Engineering
John L. Thon - Supervisor Brake Design
Stu Woolpert - Buyer

COMMENTS

RELEASE OF THE BENDIX 7163 MATERIAL

During the course of my visit to the Brake Lab to pick up some bits and pieces for the test program at Mahwah, I was advised by Paul Hellens that the tooling authorization for the Bendix 7163 material had been prepared.

I discussed this with Brandon who showed me the Product Change Notice (PCN) which had been approved by Gschwind. Brandon said that the tooling amounted to $30,000.00 and that Bendix expected to be in production by August 1, 1978. Brandon stated that the door had definitely not been closed on Abex. He said that if the development program, as outlined to Chrysler on April 25, 1978, produced a suitable material, it would be possible for Abex to retain the business.

I set up a meeting with Stu Woolpert in an effort to find out how Chrysler Purchasing felt about the anticipated switch to Bendix. To my surprise, when I arrived at Woolpert's office for the meeting, Jack Thon was already there. Thon said that he was present because Gayle Smith had to attend a previously scheduled meeting with the wheel people. The bottom line of my discussion with Thon and Woolpert was that Abex was definitely off the 1979 L-car program. I relayed my discussion with Brandon to them, and their only reply was that the situation had deteriorated since then and that Abex was definitely off the L-car, effective August 1, 1978.

I immediately spoke with Brandon and told him what happened at my meeting with Woolpert and Thon. He said that he was sorry but that the situation had changed since Friday. He stated that the severe pad and rotor wear problems had received additional high level visibility and this increased awareness of our problem caused our position to be changed.

By this time, Smith had returned from his meeting and I was able to discuss this matter with him. He stated that the situation was not as bleak as had been outlined to me. If the Abex development effort yielded a product which was superior to the 7163, he felt that Chrysler would be willing to cancel the Bendix tooling. Smith said that he doubted that Abex would be able to develop a material which was superior to the Bendix material by the May 20th deadline. He also stated that a "significant" amount of data supporting the superiority of the new Abex material over the Bendix material would have to accompany the material. Bob Steere (Chief Engineer - Chassis), was at the Chrysler Proving Ground in Chelsea so he was unavailable to discuss this

with us. However, Smith said that he could see no reason why Steere would object to the plan as outlined above. Smith stated that if Abex had enough confidence in its ability to develop a superior friction material, it would certainly be in the best interest of Chrysler to let Abex continue to develop this material and if Abex was successful, Chrysler would certainly use the material. Personally, I feel that unless our efforts produce a material which is definitely superior to the 7163, we will lose the L-car business. Chrysler feels that the rotor and pad wear of the production material is worse than that of the pilot plant material. As a result of this, Chrysler has some significant reservations about out ability to successfully bring a material from the prototype stage to production. Therefore, if we are only just as good as the Bendix material, I believe we will lose the business. Chrysler feels that the Bendix material is basically just a minor modification to an existing material (7161) and that Bendix would have no trouble producing production quantities of the 7163 material.

In spite of the obvious difficulties which we would encounter in trying to displace Bendix, I feel that we should continue to exert an all-out effort to keep this business. I think that if we can produce a demonstratively superior product, Chrysler will buy it.

On May 10, 1978, Gayle Smith called me to say that he had discussed the siutation with Steere. He said that Steere expressed an interest in any Abex material which was superior to the 7163 and that in his (Smith's) opinion, May 20th would be the absolutely last date by which the proposed Abex material could be accepted at Chrysler (with sufficient test data supporting its superiority.) By sufficient test data, Smith meant a 105 procedure, the Chrysler dynamometer wear and endurance tests and the Abex version of the low temperature endurance schedule.

TOOLING CHARGES, ETC.

During the discussion with the Purchasing people, Woolpert indicated that Chrysler would definitely reimburse Abex for the integrally molded tooling. During my discussion with Brandon, he again repeated that Chrysler would definitely pay for the tooling. He also stated that Chrysler would pay Abex for the integrally molded pieces already made.

Woolpert stated that because of the way the Product Change Notice was written, it would be necessary for Abex to obtain Kelsey-Hayes's approval on the integrally molded material before Abex could be reimbursed for the tooling. I suggest that we wait until after the 20th before we get involved with the details of how a possible termination will be handled.

Denis P. Conlon
jd

cc RLCutler/AFSchmaltz/File
BIwarsson
ADIndelicato
DGManly
GRGraham
RAPearce
DESteis
RENelson
KMWilliams

Date Typed: 5/3/78 - 5/3/78

Route RJM - file

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 5/1/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	170
ADDRESS	CITY	STATE/ZIP
HIGHLAND Park, MI.		
		PHONE

OFFICIALS INTERVIEWED

Paul B. Hellens - Senior Product Development Engineer

COMMENTS

DELAY IN CHANGE TO INTEGRALLY MOLDED ASSEMBLIES

The main purpose of my visit was to discuss with Hellens, the recent Chrysler test data on rotor wear which caused them to delay, once again, their decision to switch to the integrally molded assemblies. Based on tests of batch X-75 and X-79, Chrysler determined that in some cases the rotors were wearing out even quicker than the pads. In several cases, projected rotor life was below 7500 miles. In one case, the actual rotor wear after 6000 miles was greater than the allowable rotor wear. Hellens stated that the rotors were tested for hardness and were found to be within spec. Chrysler did not intend to analyze the metallurgical content of the rotor. Chrysler is continuing to run both integrally molded and riveted in an effort to better define the cause of excessive rotor wear problem.

Chrysler feels that the excessive rotor wear situation could have safety related implications. The safety issue arises because the piston is required to extend quite far in order to push the pad against the worn rotor. The length of the piston travel is such that the piston seal can be broken, resulting in a hydraulic failure.

COMPETITION

Hellens feels as though it is quite likely that Chrysler will proceed with the release of the 7163 (Bendix) material. He feels that Smith will authorize the tooling procurement in an effort to insure that he had some material with which to replace 7018C if the Abex Development Program does not yield a satisfactory material.

Cycleweld is putting a lot of pressure on Smith to make sure that if Abex is replaced, the L car lining business does not go to another outside lining supplier.

BATCH SIZE

Hellens stated that both Bendix and Cycleweld have had problems in successfully transferring resin bonded metallic formulations from the pilot plant to the production plant. Bendix claims to have solved this problem by making only extremely small sized batches in production.

Denis P. Conlon
jd

Discussed this point w/ Colin & REN. Many "small" P-P. batches of 7018C have the same problem. In short we don't have any data which supports this claim.

cc RLCutler/AFSchmaltz/File
BIwarsson
RAPearce
RENelson
DESteis
ADIndelicato

SC1 02248

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 4/25/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	164
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI		
		PHONE

OFFICIALS INTERVIEWED

Robert W. Steere - Chief Engineer - Chassis
Gayle Smith - Manager Product Development - Brakes
Thomas A. Brandon - Supervisor - Brake Engineering

(Accompanied by Richard A. Pearce, Donald Steis, A. D. Indelicato & R. E. Nelson

COMMENTS

GENERAL

The purpose of this visit was to discuss both the delayed switch to the integrally molded assemblies and to discuss the Abex program for developing a friction material to replace 7018C.

It was known by Abex that Chrysler was seriously considering a switch to Bendix (7163). On account of this, it was necessary for the presentation to be relatively optimistic and the tone of the presentation was one of confidence. Great care was taken to make sure that we did not "oversell" our capabilities.

INTEGRALLY MOLDED

Chrysler presented data (attached) which showed a definite deterioration in both pad and rotor wear from early 7018C samples to both current production, riveted material as well as "production type" integrally molded material (represented by batch X75 and X79). Although it was not clearly seen from the data, Chrysler Engineering said that they felt that recent riveted production resulted in the same rotor and pad wear as the recent integrally molded production. They said that this did not show up in the data because of the timing differences concerning when the tests were run: most of the riveted tests were run earlier in the program and produced better results than either the recent riveted tests or the recent integrally molded tests.

Abex presented data (attached Page 1) which indicated that the rotor and pad wear, although not as good as we would have liked to have seen, was nevertheless superior to the projected pad life and rotor life as represented by the Chrysler data. The Abex data was the result of vehicle test run to a "low temperature" wear cycle. The purpose of this cycle was to duplicate as nearly as possible the thermal characteristics of Chrysler's general endurance run. It was felt that Chrysler's very low projected rotor and pad life numbers reflected the cold wear problems of 7018C and that the test was therefore probably a very low temperature cycle. The Abex rotors were presented and it was noted that the rotors were blued. The Chrysler rotors did not evidence this characteristic. This indicated that the Abex tests were probably run at higher temperatures than the Chrysler tests. Chrysler did not have a thermal profile of their general endurance schedule but promised to obtain one within the next few days in an effort to make sure that the Abex tests were conducted

under the same thermal conditions as the Chrysler tests. Chrysler agreed that the integrally molded material had better structural integrity and noise characteristics than did the riveted material. They also agreed that the wear numbers were comparable. Based on this, Chrysler did not express any problems concerning the switch to integrally molded assemblies. Chrysler said that they would notify Abex within the next few days with their decision concerning the switch.

NEW MATERIAL

Abex reviewed with Chrysler the experimental changes which have been made to 7018C and the resulting effects on the friction material in terms of structural integrity, noise, wear, etc., (attached Page 3).

Abex also reviewed with Chrysler, the changes which have occurred in the friction material in terms of pad wear, rotor wear, noise and fade as the lining developed through the L car program. Of the four materials shown (attached Page 4), Chrysler had extensively tested two (7018BB and 7018C), they had performed a few tests on one of the materials (916-23) and had not tested one (916-31). As can be seen from the graphic representation of the characteristics of the materials, the fade and pad wear problems of 916-31 were realistically indicated.

It was stated that 916-31 would be the basis for the eventual solution to the L car friction material problem. It was stated that by changing primarily the organic modifiers, the unacceptable fade and pad wear characteristics of 916-31 would be improved.

Chrysler was told that Abex was not presently testing an improved version of 916-31. They were told that we had some ideas on how to improve 916-31 but these ideas were, as yet, untested.

A schedule (attached Page 5), was presented which indicated the extent of testing that the Research Center was prepared to do in an effort to evaluate the proposed modifications to 916-31 as quickly as possible. Essentially, the new materials will be first screened on a dynamometer 105 procedure. From there, the successful materials will be evaluated on the "low temperature" vehicle test and on the dynamometer "wear and effectiveness" procedure. In an effort to eliminate any "surprises" in going from the pilot plant to production, it was also stated that testing would be done on production made samples of the selected materials. Chrysler was told that as soon as acceptable materials were identified by Abex, samples would be provided to them for their immediate vehicle evaluation testing.

The new materials presentation was concluded along the lines that Abex wished Chrysler would delay making any decision to switch to a new friction material until May 20th. By this time, the results of the Abex lining development program would be known and the materials would have been subjected to rather extensive testing. Chrysler made no commitment to stay with Abex for any given period of time - they stated that they were looking at other

materials, but that they did not want to switch lining vendors and would therefore certainly test whatever materials Abex wished to submit to them.

Denis P. Conlon

jd

attachs.

cc RLCutler/AFSchmaltz/File
SSConway
BIwarsson
DGManly
RENelson (No attachment)
GRGraham
DESteis (No attachment)
RAPearce (No attachment)
WMiller
ADIndelicato (No attachment)

H. LIKELIHOOD

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

X — RJM
File
TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 4/3 & 4/4/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION/KELSEY-HAYES	D. P. CONLON	152
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK/PROVING GRD./JACKSON PLANT		PHONE

OFFICIALS INTERVIEWED

Chrysler
Thomas A. Brandon - Development Supervisor
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
Proving Ground
Robert R. Swanberg - Development Supervisor
Donald B. Kuornberg - Product Development Engineer
Joseph Douglas - Test Engineer
Kelsey-Hayes
Wayne Rhodes - Chief Inspector
Joe Dempsky - Inspector
Gaylord Nelson - Inspector
Jackie Lowe - Buyer

Accompanied by Mr. R. Hananel on 4/4/78 to Chrysler Proving Ground and Jackson

Comments

7018C INTEGRALLY MOLDED WEAR PROBLEMS

Chrysler, Highland Park completed a dynamometer test on batch X79. Batch X79 represents material taken from the approximately 10,000 integrally molded assemblies which have been made under production conditions. The results of the dynamometer test were essentially the same as those obtained after testing production riveted material. In both cases, the accummulated wear through the series of stops at 325°F approximated .160". This is extremely high. (Bendix 7163A total wear after an additional 900 stops, is only .045.) As bad as the test results were, they did support the Abex contention that there is no difference between the integrally molded assemblies and the pucks.

The Chrysler Proving Ground completed 1000 miles on the general endurance driving schedule testing the batch X79 ("production" integrally molded) material. Based on this test, lining life was projected to approximately 20,000 miles. Chrysler preferred to see something higher, but they were gratified to see that the results were much better than the 7400 mile projected life of the X75 material. The Proving Ground will be running two more tests, one starting on 4/6/78 and the second starting on Monday, 4/8/78. Chrysler expects to have sufficient data on which to approve the switch to the integrally molded assemblies by the end of next week.

BLACK DUST

Chrysler presented a trim ring from the vehicle which was testing the X79 material. The trim ring had been removed after approximately 300 miles of the general endurance schedule. The appearance of the ring was terrible: it was covered with black dust. The dust had caked on the trim ring and it was almost impossible to scrape it off with a fingernail. Needless to say, the Proving Ground people are very concerned about this matter.

NOISE

It was reported that the Dealers have been receiving customer noise complaints. The seriousness of these complaints has not been ascertained. Chrysler, Highland Park will again canvas the ten largest Dealers in order to better assess the seriousness of this problem.

USE OF "MARGINAL MATERIAL"

As a result of the extra expenses associated with using this material (separate handling, painting the calipers, traceability, etc.), Chrysler is balking at using additional quantities of cracked material. A final decision has not yet been reached, but I do not expect Chrysler to increase the amount of marginal material they will allow Kelsey-Hayes to ship.

I authorized Kelsey-Hayes to scrap approximately 4600 cracked pieces. This was the balance of approximately 41,000 pieces which were originally rejected by Kelsey-Hayes when cracks were noticed after the material was drilled. I examined these pieces and they were all very badly cracked. Cracks were both horizontal and vertical. The horizontal cracks occurred both within the friction material at the interface of the friction material and the underlayer. In line with our past handling of a similar situation at Kelsey-Hayes, we will be billed not more than 6¢ per piece to cover the cost of drilling the pucks. Kelsey-Hayes said that the material was sorted twice after the initial 100% inspection resulted in the parts being rejected. There were some rumblings about a $19.00 an hour charge to inspect the material but I told Kelsey that Abex would not, under any circumstances, pay for the inspection. At this point I don't think that this will be a problem.

ABEX QUALITY CONTROL

Kelsey-Hayes complained that Abex was sending parts which had cracks in them. I randomly inspected approximately 50 pieces and found that six had cracks in them. With more than 10% of the parts having cracks even before drilling, Kelsey-Hayes has a strong argument for blaming all cracks on Abex. This high level of cracks weakens the Abex position that Kelsey-Hayes is responsible for all cracks over approximately 1% of the quantity shipped.

EXPERIMENTS

The Proving Ground is going to cut down a rotor from 12.9mm to approximately 6.5mm. The purpose is to see what happens if the friction material is run at a much higher temperature. The dynamometer tests and other data indicate that the material has a severe cold wear problem. Swanberg is interested in seeing what the wear would be if the material was run at the higher temperatures which would result from the use of the thinner rotor. Unfortunately, not all the available evidence indicates that this will result in a substantial improvement. The taxi tests which were run at presumably higher temperatures did not wear very well. These vehicles were not thermocoupled so the exact temperatures are not known, but it is generally believed that they are much higher than experienced during a general endurance drive cycle. The

timing of this experiment has yet been determined.

OUTLOOK

Bendix 7163A appears to be the biggest threat: dynamometer tests show less than 25% of our pad wear and almost no rotor wear. Early noise evaluations put it in the 8 - 10 range. Proving Ground people have not run it yet. A 105 test has not yet been run on it, but bench tests indicate that the material should have no problem passing this test.

A sample of the 7163A was obtained by Ken Williams several weeks ago and sent to Mahwah for analysis. I feel that it would be a worthwhile exercise for us to attempt to copy this material.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
SSConway
BIwarsson
RENelson
ADIndelicato
HBecker
GRGraham
RAPearce
DESteis
KMWilliams

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

Date Typed: 3/28/78-2/27/78

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 3/23/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER COPPORATION	D. P. CONLON	150
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
James E. Clark - Project Engineer
Douglas B. Bain - Senior Product Development Engineer (Proving Ground)
Kelsey-Hayes
Robert E. Dix - Account Manager
Allen Korn - Project Engineer

Comments

LINING & ROTOR WEAR

The problems encountered by the Proving Ground during testing of 7018C integrally molded batch X75 were discussed: 7400 miles projected lining life and .012"/1000 miles rotor wear. It was stated that rotor wear was .001" per 1000 miles in the early development stages.

In an effort to remove all doubts about the unsuitability of batch X75 type material, Chrysler is running three more cars on general endurance schedules using the X75 material.

FMVSS 105 TEST

The Proving Ground ran a 105 test on the batch X75 material. The results were rather poor: "floorboarding" occurred during the 9th and 10th stops of the first fade and during the second effectiveness test at 80 mph. Investigation revealed that the pads were concave: they were severely worn in the middle area. This was not a problem with earlier 105 tests using 7018C.

CRACKED LINING

The structural integrity of pads which were rejected by Kelsey-Hayes (Jackson) and which were run through a 105 schedule, was reviewed. The pads which were run were rated as "fair" on a scale of "Excellent", "Good", "Fair" and "Poor". The Chrysler Proving Ground position is that a visual inspection does not appear to be a reliable predictor of the post test structural integrity. Kelsey-Hayes reported that they probably had already shipped some of the previously rejected material to Chrysler. Kelsey-Hayes was not sure whether only "good" and "excellent" rated parts were shipped or whether the parts shipped included some from all rating categories. They are going to clarify this matter.

COMPETITION

A sample of bonded Cycleweld 1816 which had sheared from the steel back was displayed. The bonding had been done by Cycleweld and appeared to be a rather poor job. It was anticipated that if 1816 was introduced, it would be bonded

and Kelsey-Hayes would do the bonding.

Chrysler is going to evaluate some Delco-Moraine 3082 material.

CHANGE TO INTEGRALLY MOLDED ASSEMBLIES

Chrysler is extremely concerned about the future switch to integrally molded assemblies as a result of the very poor performance of batch X75. In order to determine whether the X75 problem is peculiar to that batch or if for some reason, it is related to the integrally molded procedure, Chrysler wants to test some of the 10,000 integrally molded assemblies presently at Winchester. Accordingly, I have asked the plant to send up 200 pieces so that Chrysler can test them as soon as possible. If these 10,000 pieces are going to produce the same poor results as did the X75 batch, we ought to know about it as soon as possible so we can correct the problem. If the 10,000 are good, this will eliminate a lot of concern at Chrysler and also open up the opportunity to use integrally molded assemblies if the shipments of pucks are going to be less than 25,000 per week.

NOISE

Noise reports on 7018C continue to be erratic. The ratings are running mostly between 6 and 9 in Arizona. The reports indicate that the lining is a lot quieter when the humidity is higher than normal. Of course, this contradicts the results of the Jacksonville city traffic cycle where the material was reported as being extremely noisey and the humidity was probably high in Florida.

The 916-23 appears to be better than the 7018C in the noise area. The cars with this material have been consistently running in the 8 and 9 range for 80%-90% of the stops. Unfortunately, the noise increases to the 4 level on the remaining 10%-20% of the stops.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
BIwarsson
ADIndelicato
LEBretz, Jr.
RENelson
DESteis

MINUTES OF THE DRC Sales Report #150

L-CAR FRONT BRAKE MEETING

OF MARCH 16, 1978

Present:

D. B. Bain
J. E. Clark
D. P. Conlon - Abex Corp.
A. Korn - Kelsey-Hayes
W. H. Rankin
K. Rinker - Kelsey-Hayes
R. T. Robinette - Kelsey-Hayes
L. L. Shively
G. W. Smith
R. W. Steere

Lining - General

- Batch X-75, production type IME, exhibited excessive wheel "black dust" contamination at only 250 miles of general endurance on Program Car 029. Examination revealed an average wear of .020".

- D. Bain to escalate MVSS 105 testing w/X-75 parts to verify their performance, as these parts are thought to be representative of every day production IME parts about to be put into vehicle production.

- Usage of the quarantined group of 37,000 7018C lining pucks at Kelsey-Hayes, Jackson, seems apparent to maintain vehicle production. Brake Engineering examination of 8 of the questionable assemblies resulted in the following:

  - Of 5 assemblies marked as visually acceptable, all 5 appeared structurally sound when sectioned.

  - Of 3 assemblies marked as visually unacceptable, only one appeared structurally questionable when sectioned.

  K. Rinker and D. Robinette to establish visual inspection acceptance levels at Jackson and aid the plant in sorting thru this group of parts.

  P.G. to run MVSS 105 with parts representing the minimum level of quality that the plant would inspect to, and also at a level below that (i.e., unacceptable for shipment).

- CW1816 still being evaluated. Reasons for usage include the shortage of Abex parts due to their strike and a possible field fix for noise complaint vehicles. These parts may have to be limited to power only cars.

- Mr. Steere asked to have P.G. run a ride evaluation with a car equipped with 7018-C on one side and CW1816 on the other. No problem

Lining - Wear

- Summary data of dyno and vehicle studies was presented by B. Rankin and L. Shively (attached) showing erratic inboard to outboard wear imbalance. Some question pertaining to data interpretation was discussed; Kelsey-Hayes representatives to clarify with Ray Vigna and request raw data sheets from him if they desire. L. Shively to investigate if any of the calipers from the various A.E.C. test cars might still be available; K-H requesting these for evaluation of rollback characteristics, piston/seal/boot/bore/bushing/pin condition, etc., as they might relate to wear.

Caliper Assembly - Bushing Grease

- B. Rankin indicated it is too late, weatherwise, to evaluate any new submissions of grease from the Rubbers and Lubricants Laboratories. J. Clark still recommending Brake Engineering test production wheel bearing grease (B. Rankin has sample) because of its availability at dealerships and therefore its high probability of being used by mechanics.

- Samples of 2-1/2 gram packages of GE G-661 have been received and will be tested for adequacy as a potential remedy to the question of what to use in service shoe and lining rebuild kits.

- K-H Engineering still studying GE G-661 in their labs as it relates to performance, and K-H-Jackson still studying the cost and effect on the automatic bushing fill equipment of G-661 as it relates to production.

Caliper Assembly - Drag Chirp

- Kelsey-Hayes tried a new seal groove shape to improve piston rollback. A pair of aged, special grooved calipers will be supplied to Chrysler for examination. Sketch attached.

Noise

- Abex 916-23 W/HN-810-4 gasket is running noisy, in Arizona and at Proving Grounds.

- High titanium rotors being compared to production rotors using 7018C IME w/o gaskets.

- Arizona program w/7018C IME X70 running with mixed results at present.

- Additional noise information is found on the attached summary.

- K-H Manufacturing has commented on the feasibility of producing spring grooved rotors as being very unlikely; see attached report.

No attachments rec'd

J. E. Clark
Brake Engineering

cc: T. A. Brandon
R. E. Dix - K-H
P. B. Hellens
R. R. Swanberg
J. L. Thon

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

Date Typed: 3/23/78-3/23/78H.J.N.

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 3/21/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION/PROVING GROUNDS	D. P. CONLON	146
ADDRESS	CITY	STATE/ZIP
CHELSEA, MI.		
		PHONE

OFFICIALS INTERVIEWED

Robert R. Swanberg - Development Supervisor
Douglas B. Bain - Senior Product Development Engineer

COMMENTS

DURABILITY

The purpose of the visit was to discuss the Proving Ground's recent findings of extremely bad rotor and pad wear using 7018C integrally molded batch 75. As indicated on the attached sheet, the rotor wear was .012" per 1000 miles and the minimum projected life on the lining was 7400 miles. Swanberg does not think that he can approve this kind of performance. If there isn't something perculiar to batch 75 which could explain this rapid pad and rotor wear, the switch to the integrally molded configuration could be in some jeopardy. The test cycle was a general endurance schedule and not a brake test. The brakes were operated under conditions which would be encountered under normal driving conditions. The test was run for 1979 miles.

As a result of the extremely high rotor and pad wear, very bad accumulations of black dust were found. According to Chrysler, chrome polish was needed to remove the deposits.

Swanberg was also concerned about the lining crumbling along the edges of the pad. This is the first time that this has been noticed with the integrally molded material.

CRACKED LINING

A FMVSS 105 test was run using material judged to be "unacceptable" as a result of bad cracks. This was material which had been rejected by Kelsey-Hayes Jackson plant after drilling. The material had not fallen apart but looked like its structural integrity would be very bad. Severe cracks, which went through to the underlayer in some cases, were noticed. No big chunks had fallen out, however. The preliminary conclusions based on this test were that the material which looked bad after a visual inspection was unacceptable because of its questionable structural integrity.

DATA

Chrysler's disc brake wear data sheets on the following tests have been included with the copies of this report and are being sent to Messrs. Nelson and Steis:

1. Car 029 7018C X75 General Endurance

2.	Car 444	7018C	X75	105
3.	Car 839	7018C	Unacceptable	105

Denis P. Conlon

jd

attach.

cc RLCutler/AFSchmaltz/File
RENelson
DESteis
ADIndelicato
GRGraham

DISC BRAKE WEAR DATA

Car No. 444 Mod 8/212-L-44 Type Test MVSS-105-75

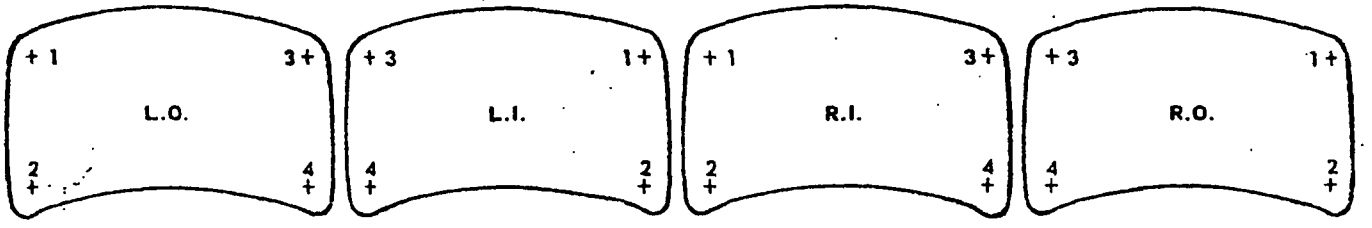
Brake Type _____

Metering Valve _____ Proportioning Valve _____

Lining Material ABEX 7018C IME X75

Rear Brake Size and Material _____

1st.	12487	3-16-78	Zincke
2nd.	13080	3-27-78	Stange
3rd.			
4th.			
5th.			
6th.			
7th.			



NOTE: SHOES SHOWN BACK SIDE UP

MICROMETER NO. X36

Use same micrometer no. for all measurements.

	START	END
L. Rotor	.495	.488 007
R. Rotor	.500	.488 012

Right inner cracked - Sent to Graham

DPC Sales Report #146

LEFT OUTER

1		3	
RDG	Wear	RDG	Wear
631		638	
555	076	577	061

2		4	
RDG	Wear	RDG	Wear
637		630	
577	060	589	041

RIGHT INNER

1		3	
RDG	Wear	RDG	Wear
628		640	
589	039	576	064

2		4	
RDG	Wear	RDG	Wear
634		632	
581	053	558	074

LEFT INNER

3		1	
RDG	Wear	RDG	Wear
624		628	
586	038	608	020

4		2	
RDG	Wear	RDG	Wear
630		631	
584	046	594	033

RIGHT OUTER

3		1	
RDG	Wear	RDG	Wear
631		632	
546	090	532	101

4		2	
RDG	Wear	RDG	Wear
635		631	
563	072	551	080

SC1 02261

DPC Sales Report #1460.

Arex 7018 C IHE X75

Program Car 029
Part Miles: 1979

Pad Wear

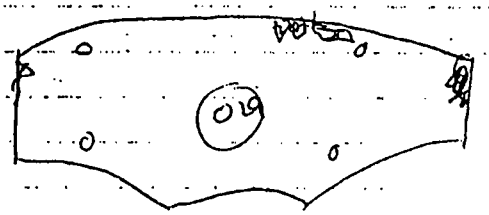
	(-)	(-)	0	(+)	Projected Life*
LO:	(.100)	.099	.097	.100	7,900
LI:	.048	.057	(.074)	.066	10,700
RI:	.072	.073	.106	(.107)	7,400
RO:	(.090)	.083	.074	.072	8,800

* Based on .400 inch available lining

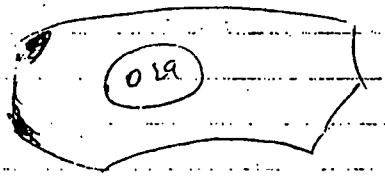
- production rotor.

Rotor Wear

	Actual	Rate
Left:	.024	.012 / 1000 miles
Right:	.023	.012 / 1000 miles



RO



LO

D R Bain
3-21-78

Car No. 029M Model 9M12-L24 Type Test Gen Eng. Line for 60 miles

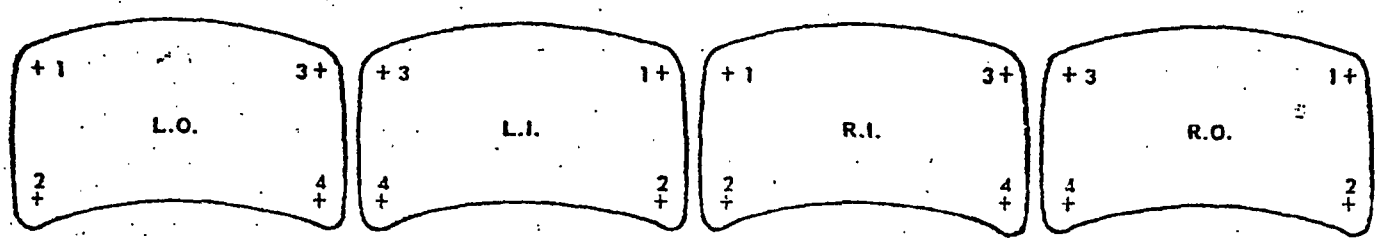
1st.	364	3-15	Hudson
2nd.	675	3-16	
3rd.	2403	3-20	
4th.			
5th.			
6th.			
7th.			

Brake Type _____

Metering Valve _____ Proportioning Valve _____

Lining Material Front Asex 7018C Batch 75 Integrally Molded

Rear Brake Size and Material _____



NOTE: SHOES SHOWN BACK SIDE UP

MICROMETER NO. 8710#M

Use same micrometer no. for all measurements.

Did not mark number locations on pads per Dow Bain.

Marked inner + outer on pad extensions.

DRC Sales Report #146

LEFT OUTER

1 RDG	1 Wear	3 RDG	3 Wear
622		621	
606		606	
522		524	

2 RDG	2 Wear	4 RDG	4 Wear
622		628	
606		611	
523		528	

RIGHT INNER

1 RDG	1 Wear	3 RDG	3 Wear
624		621	
616		610	
552		515	

2 RDG	2 Wear	4 RDG	4 Wear
624		621	
612		602	
551		514	

LEFT INNER

3 RDG	3 Wear	1 RDG	1 Wear
624		623	
607		609	
550		575	

4 RDG	4 Wear	2 RDG	2 Wear
628		628	
609		611	
560		571	

RIGHT OUTER

3 RDG	3 Wear	1 RDG	1 Wear
623		618	
603		591	
549		529	

4 RDG	4 Wear	2 RDG	2 Wear
623		621	
607		597	
551		538	

SC1 02263

PG. 57 (10-71)

DISC BRAKE WEAR DATA

RDG	ODOM.	DATE	NAME
1st.	3710	3-16-78	STARK
2nd.	4371	3-20-78	STARK
3rd.			
4th.			
5th.			
6th.			
7th.			

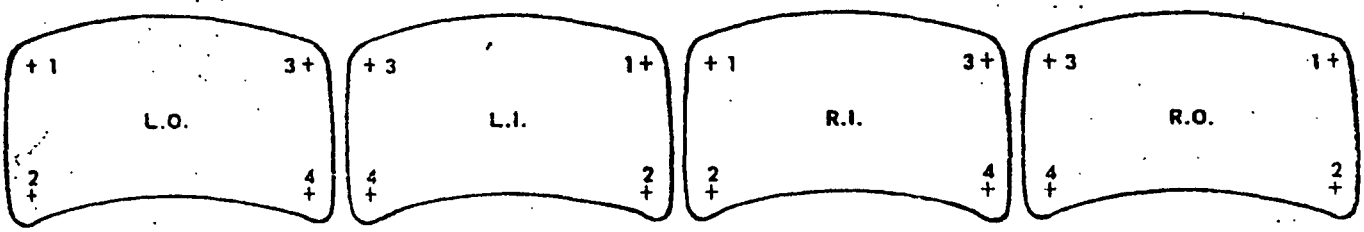
Car No. 839 M Model 9/M12L44 Type Test HVSS 10575

Brake Type _____

Metering Valve _____ Proportioning Valve _____

Lining Material ABEX 7018C RIVET "UNACCEPTABLE" CRACKS

Rear Brake Size and Material _____



NOTE: SHOES SHOWN BACK SIDE UP

LEFT ROTOR
.498 - .492 006

RIGHT ROTOR
.498 493 00

MICROMETER NO. _____

Use same micrometer no. for all measurements.

LEFT OUTER

1 RDG	1 Wear	3 RDG	3 Wear
.664	0	.661	0
595	069	.606	055

2 RDG	2 Wear	4 RDG	4 Wear
.665	0	.661	0
.618	047	626	035

RIGHT INNER

1 RDG	1 Wear	3 RDG	3 Wear
.658	0	.654	0
.636	022	615	039

2 RDG	2 Wear	4 RDG	4 Wear
.657	0	.655	0
630	027	614	041

LEFT INNER

3 RDG	3 Wear	1 RDG	1 Wear
.662	0	.668	0
635	027	656	012

4 RDG	4 Wear	2 RDG	2 Wear
.657	0	.658	0
625	032	637	021

RIGHT OUTER

3 RDG	3 Wear	1 RDG	1 Wear
.661	0	.664	0
.613	048	.604	060

4 RDG	4 Wear	2 RDG	2 Wear
.660	0	.668	0
.630	030	.625	037

DPC Sales Report
#146

SC1 02264

grading was based on a visual inspection of the parts. The sectioning exercise was undertaken in an effort to determine whether the cracks were a surface phenomenon only, or whether they extended into the material. The results were that of the three unacceptable parts, only one had a crack which penetrated the friction material. The other two had only surface cracks. Of the five thought to be acceptable, none had any cracks penetrating the interior of the pad. Chrysler was going to run several FMVSS 105 tests on material which was initially rated as useable. They were attempting to determine whether the material with what appeared to be only surface cracks was as structurally sound as material with no obvious cracks.

Assuming that the 105 tests indicated that it was okay to use material with only minor surface cracks, Chrysler would in all probability, still not use them unless the unavailability of other parts threatened the production capability of the Belevedere plant. Robinette suggested that in order to adequately protect themselves, a complete traceability record should be maintained on cars which were equipped with this "questionable" material.

STRIKE

Everyone was especially concerned about the capability of Abex to supply parts during the strike. It was mentioned by Chrysler that the Cycleweld Division was investigating the possibility of using the Abex L car tooling to make pucks in the 1816 formulation.

Mr. Steere directed that I contact Mr. Smith each morning before 8:00 a.m and update him on the latest strike developments.

PROOF TESTING

Chrysler inquired as to the status of our program to determine what the appropriate proof test load should be. I replied that we were "working on it" and it was acceptable to both Kelsey-Hayes and Chrysler.

Chrysler said that on a temporary basis, it would be acceptable if the proof test mark was not put on the integrally molded assembly at the time the material was proofed tested. They said it would be okay for this to be done as a separate operation after the test was run. They indicated that they wanted us to develop a suitable fixture for the proof test machine as quickly as possible.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
GRGraham
RAPearce
DESteis
ADIndelicato ✓
HBecker
RENelson

SALES REPRESENTATIVE'S REPORT XC RJM
FRICTION PRODUCTS GROUP

Date Typed: 3/10/78 - 3/10/78
RESPONSE REQUESTED ☐

TYPE OF CALL

DATE 3/9/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	135
ADDRESS	CITY	STATE/ZIP
DETROIT, MI		
		PHONE

OFFICIALS INTERVIEWED

Gayle W. Smith - Product Engineering Manager - Brake Engineering
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
Douglas B. Bain - Senior Product Development Engineer (Proving Grounds)
Kelsey-Hayes
Kurt H. Rinker - Engineering Manager - Passenger Car Disc Brakes
Richard T. Robinette - Product Engineer - Vehicle Braking Systems
Allen Korn - Project Engineer

Comments

LINING WEAR

Kelsey-Hayes supplied Chrysler with twelve high-titanium content rotors (see attached list). Chrysler is going to evaluate these rotors in an effort to determine whether the high-titanium content significantly improves both lining and rotor wear of the 7018C. Chrysler is also going to evaluate the high-titanium rotors for their noise characteristics.

Chrysler is presently running their wear and effectiveness schedule on 7018C riveted. The next test will be run on 7018C integrally molded. These tests will provide a baseline against which future linings will be compared.

NOISE

Chrysler has abandoned the Florida operation. Chrysler will now do its noise work at the Phoenix Test Station. At present, four L cars are in Phoenix running noise tests.

Charlie Feeser has designed a traffic schedule for Phoenix. The run is approximately forty-two miles and will take about one and a half hours to complete. Based on some preliminary runs, the front temperatures get as high as 458°F and the rears get as high as 145°F. At the beginning of the downtown cycle, the front brakes are approximately 280°F. Typically, the front brakes operate in the 300°F-400°F range during the downtown part of the cycle. So far, there is about a 100°F swing between the very high and very low aggressiveness driver.

The 7018C material has been averaging six to seven in Phoenix. There have been occurrences when the noise was much worse than that, but in general Rankin reported that the noise is in the six to seven range. The noise is about the same with the integrally molded and the production lining. The integrally molded being evaluated is from X70.

Chrysler is going to pursue the spring enclosed rotor approach. Preliminary test results indicate that the noise level is in the eight area with the spring and in the five to six area without the spring. This was dynamometer

tested only. Kelsey-Hayes has expressed some reservations about the manufacturing implications of this approach. They are going to evaluate and report on the minimum amount of wall (necessary to surround the spring) which can be accommodated in manufacturing and handling the rotor.

Chrysler reported that they ran a Detroit City traffic noise evaluation test on the recently submitted 916-23 material. This was material similar to that suggested by Mr. Bethke for VW. The initial test was run with no insulating gasket and the noise level was reported to be very bad. Chrysler is now running a second test on the material but this time it will be with the production Wolverine HN-810-4 gasket.

COMPETITION

The most encouraging development reported at the meeting was that the Cycleweld 1816 organic material is going to be dropped from active consideration.

A two-day blind test (driver's did not know which lining was being evaluated) was conducted at the Chrysler Proving Ground, using ten vehicles. The 1816 was reported to have several problems:

1. Increase in pedal effort
2. Poor Balance - the lower friction 1816 upset the balance between the front and rear brakes and resulted in premature rear wheel skid. Rear wheel skid occurred as early as a 24"/sec^2. This compares with the 30-31"/sec^2 stops which can be attained with the 7018C material prior to front wheel skid.

Gayle Smith is also against using the 1816 as a potential field fix for noise as a result of the skid and effort problems. However, if the warm weather induced field problems become as severe as the city traffic tests indicate, the 1816 could be reconsidered. (Chrysler is constantly canvassing dealers about customer noise complaints. So far this does not appear to be a problem. Three of the dealers are in warm areas - Texas and California and even these dealers are not indicating a noise problem. This has most of the Engineering people baffled.)

Another problem with the 1816 is its extremely bad wear once the temperature gets above 350°F.

PROOF TESTS

Kelsey-Hayes admitted that there has been a mix-up concerning the proof test load conditions. It was requested that Abex conduct a series of tests in order to determine what the appropriate test load should be. It was felt that the forces required to shear the lining should be determined for the following conditions in order to arrive at a logical proof test load:

1. No adhesive
2. No underlayer extruded through the shoe holes (adhesive only)

It was also suggested that a study be made to determine the effects of elevated temperatures on shear strength. The purpose behind this was to see if the relative contribution of the adhesive and the extrusion changed as the temperature increased.

The general feeling was that the proof test should be conducted at 50% of the destructive load.

The tests should be conducted using steel backs with the .250" hole which will be phased in and not the currently used rivet hole.

CRACKED PIECES

Kelsey-Hayes brought in some samples of the 38,000 pieces which were rejected at Jackson when cracks were noticed after the drilling operation was completed. Kelsey-Hayes was looking for Chrysler to approve the use of pucks which had visible cracks in them. Kelsey-Hayes said that they were only pursuing this matter because they were concerned about running out of pucks. It was agreed that Chrysler would section some of the rejected parts as well as acceptable parts. The purpose behind this was to determine if the less-severe cracks were only on the surface or whether they penetrated the puck. Secondly, Chrysler was interested in determining whether pucks with no visible cracks could contain significant internal delaminations. Kelsey-Hayes reported that when they sectioned some apparently good pucks they found that there were some with significant blisters.

Denis P. Conlon

Mail Lab Samples from D-C.

jd

cc RLCutler/AFSchmaltz/File
ADIndelicato
HBecker
RENelson
DESteis
GRGraham
BIwarsson
SSConway

ttachs.

MINUTES OF THE

L-CAR FRONT BRAKE MEETING

DAC Sales Dept. #135

OF FEBRUARY 23, 1978

Present:

D. B. Bain
J. E. Clark
D. P. Conlon - Abex Corp.
R. E. Dix - Kelsey-Hayes
C. A. Feeser
P. B. Hellens
A. Korn - Kelsey Hayes
K. H Rinker - Kelsey-Hayes
G. W. Smith

Rotors

Kelsey-Hayes submitted the first samples of high titanium content rotors for inclusion in the lining and rotor wear investigation.

Lining Wear

Half car system wear and effectiveness tests are being run with the Abex 7018C riveted and integrally molded material and will be used as baselines to judge the potential of new submissions such as CW1816, CW2380, Abex 916 and Bendix 7163.

High trace element content rotors now available will be included in the wear program as soon as possible.

Caliper Assembly - Bushing Grease

Kelsey production and Barium production materials have satisfactorily completed tests in the Materials Laboratory.

GE- GE 661 Silicon grease tests were initially unsuccessful due to the particular flow characteristics of the material. The test is being modified to generate the necessary information to judge the feasibility of releasing GE661 for production and service.

Noise

CW1816 continues to run quiet without any insulation. Vehicle and dynamometer effectiveness and wear tests will be run to judge what system deteriorations might result from a production release of CW1816.

O.D. springs for rotors are running in Florida and will be included in the Phoenix city traffic program. Kelsey-Hayes expressed concern for the manufacturing feasibility of the rotor groove.

Abex Requirements

New timing must be established for the introduction of the integrally molded material. Due to energy complications it has become necessary for Abex to make an additional 42,000 riveted assemblies.

Kelsey-Hayes shipped 10,000 shoe plates to Abex for the IME program on February 21, 1978.

NEXT MEETING WILL BE HELD MARCH 9, 1978 AT 9:30 A.M. IN CHASSIS CONFERENCE ROOM B.

P. B. Hellens
Brake Engineering

cc: T. A. Brandon
R. W. Steere
R. R. Swanberg
J. L. Thon

/nf

KELSEY-HAYES COMPANY

DPL S.R # 135

March 8, 1978

TO: K. RINKER

FROM: D. VARNELIS

SUBJECT: CHEMICAL ANALYSIS OF PROTOTYPE "L" CAR ROTOR CASTINGS MADE BY PROCESS FOUNDRY

The following is a list of sample rotors that were made with higher level of titanium that are to be used for testing by Chrysler Engineering:

SAMPLE PART NO.	CARBON (3.35 - 3.65)	MANGANESE (.44 - .90)	SULFUR (.17 max.)	SILICON (1.6 - 2.4)
792002	3.40	.78	.02	1.98
792003	3.48	.78	.02	1.94
792004	3.48	.78	.02	1.98
792005	3.46	.78	.02	1.94
792007	3.34	.76	.02	1.96
792008	3.48	.78	.02	1.96
792009	3.48	.78	.02	1.94
792010	3.44	.80	.02	1.96
792011	3.40	.80	.02	1.90
792012	3.44	.78	.02	1.94
792013	3.44	.78	.02	1.98
792014	3.40	.76	.02	1.96

TITANIUM	VANADIUM	CHROME	C.E. % (4.3 MAX) ?	BRINELL (170 -241)
.065	.010	.19	4.06	207
.066	.010	.20	4.13	229
.063	.010	.19	4.14	217
.063	.010	.20	4.11	217
.063	.010	.19	3.99	217
.068	.010	.20	4.13	217
.065	.010	.19	4.13	207
.037	.008	.19	4.09	207
.040	.008	.19	4.03	207
.037	.008	.19	4.09	212
.066	.010	.19	4.10	217
.061	.010	.19	4.05	207

SOME TO GO TO PHOENIX FOR NOISE - OTHERS TO BE DYNO TESTED TO EVALUATE EFFECTS OF ROTOR & PAD WEAR.

SC1 02271

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 2/16/78

CUSTOMER	REPRESENTATIVE	REPORT No.
Chrysler Corporation	D. P. Conlon	124
ADDRESS	CITY	STATE/ZIP
		PHONE

OFFICIALS INTERVIEWED

Thomas A. Brandon - Development Supervisor
William H. Rankin - Sr. Product Development Engineer
Charles A. Feeser - Product Development Engineer
James E. Clark - Project Engineer

COMMENTS

NOISE

Nothing dramatic in this area was brought up during the meeting. In spite of comments at previous meetings that perhaps the search for a "better gasket material" might be a waste of time, Chrysler still continues to investigate this approach.

DL-80 with a fiberglass mesh is still the best solution for bringing 7018-C (integrally molded) up to a reasonably acceptable noise level. Tests on other combinations of gaskets and adhesives are either ineffective or inconsistent.

Thiokol 1353 is being tested in Florida and the results are mixed: The material has shown an average rating of about an 8 in the city traffic cycle but it is experiencing very bad drag chirp (3-4 area). This material is being tested on a solid rotor using pads of the same size as currently being used in production. No gaskets are being used with the material under test. Kelsey Hayes is in the middle of an FMVSS 105 vehicle test using the 1353 material with larger (7/8") rear wheel cylinders, a 650 proportioning valve, and a vented rotor. The results of this test should be available within a few days. Chrysler has always felt that the manual brake system would present serious problems for any organic lining. Kelsey-Hayes, however, reported that on the dynamometer the TP-1353 appears to be comparable to the 7018-C.

It was mentioned that Cycleweld 2380 continus to run at excellent noise levels in Florida. It was also reported, however, that the Cycleweld material has not been running as well in a Detroit city traffic cycle.

ROTOR AND PAD WEAR

I presented the results (attached) of the recent Mahwah test on formula 916-23. This is a new material, the formula for which was sent over from Mr. Bethke. This material appears to have a slightly worse "cold wear" problem than did the early submissions of 7018C (see DPC Sales Report 111 - graph #1). However the pad wear is much better than that indicated for recent submissions of 7018C. Total rotor wear of .0019" was also much better than that shown on recent tests and slightly below that of the original 7018C tests. Chrysler is very anxious to test this material.

(Continued)

The controversy concerning the amount of titanium in the production rotors is still alive. A very recent test (completed 2/16/78) on Abex 7018C (X70) using a non-production rotor showed lining wear results slightly worse than that indicated on the earlier tests (also using prototype rotors) and significantly better than recent tests using production rotors. Of even more significance, total rotor wear was .0075" higher than the .003" of earlier tests but significantly below the .030" level of recent tests.

In an effort to continue with the investigation into this area, Kelsey-Hayes has received rotors from the prototype source (Process Foundry, Detroit) and is presently analyzing them for titanium content. If the titanium content is high enough, these rotors will be machined and given to Chrysler for testing.

CHANGE TO INTEGRALLY MOLDED

The change to the integrally molded assembly from the riveted assembly continues to proceed toward finalization. Kelsey-Hayes is sending several thousand steel backs to Winchester for an initial "debugging" run.

D. P. Conlon

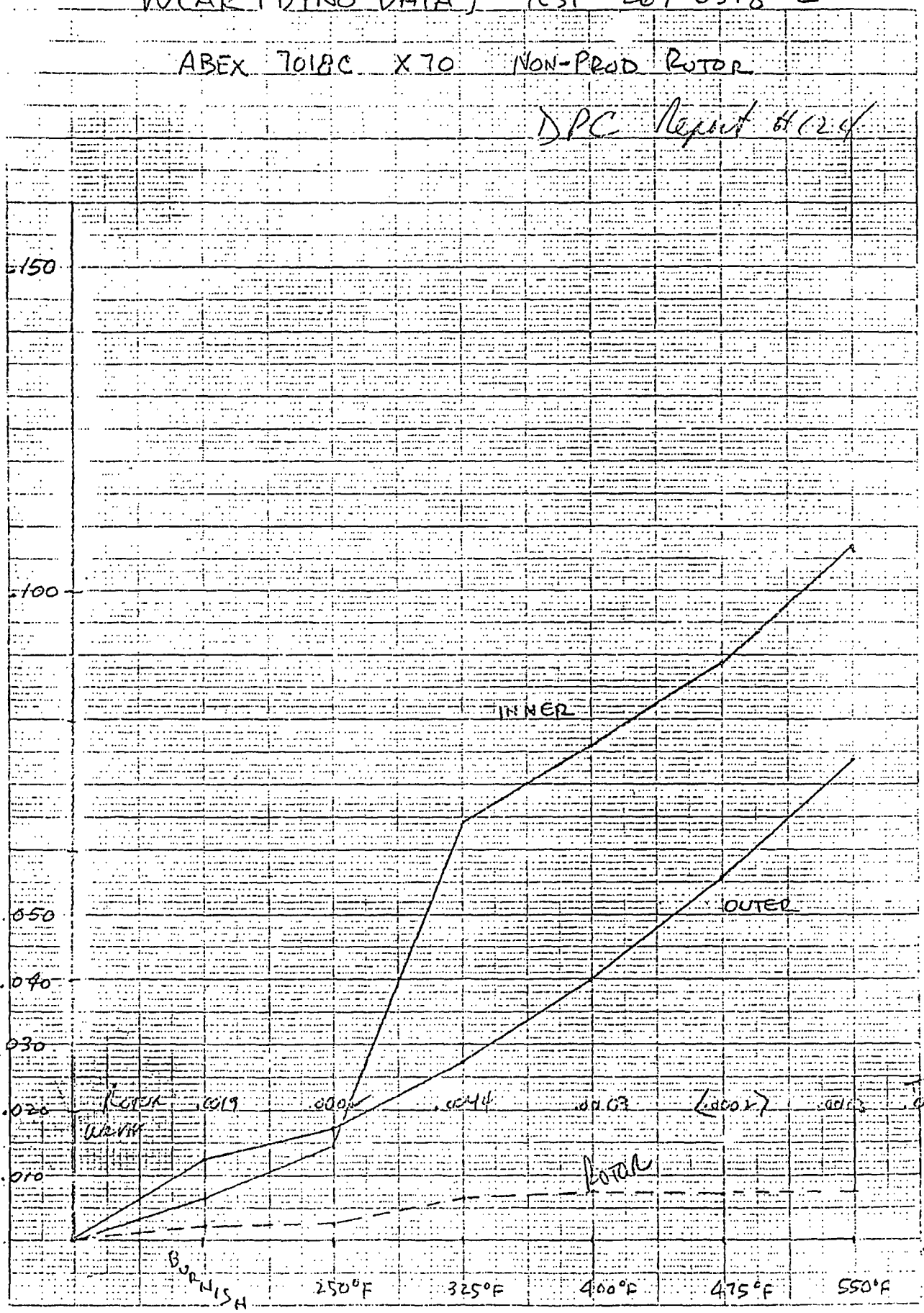
/la
Attachments

cc: RLCutler/AFSchmaltz/File
RENelson
DSteis
GRGraham
ADIndelicato

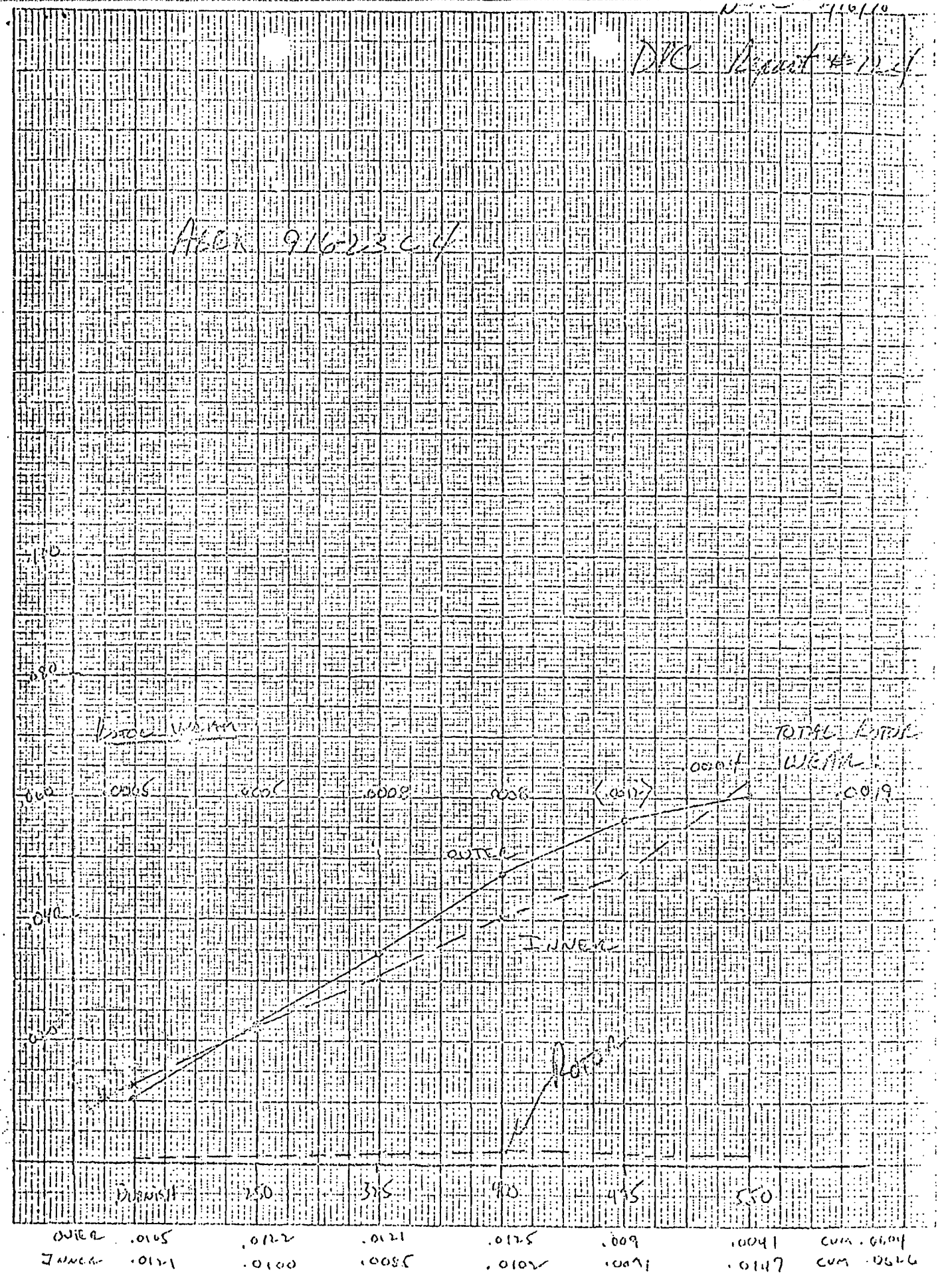
WEAR (DYNO DATA) TEST # 267-0378-2

ABEX 7018C X70 NON-PROD ROTOR

DPC Report 6/12/4



SC1 02274


DRC Request #12-1
FLOK 916-23 C.J.
TOTAL RADIAL WEAR
.0019
OUTER
INNER
.0012
.0006
.0008
.0006
.0005
.0005
.0005

MINUTES OF THE

L-CAR FRONT BRAKE MEETING

OF FEBRUARY 9, 1978

Present:

T. A. Brandon		P. B. Hellens	
J. E. Clark		W. H. Rankin	
R. E. Dix	- Kelsey-Hayes	G. W. Smith	
J. W. Douglas		D. Varnelis	- Kelsey-Hayes
K. Goering	- Kelsey-Hayes		

Rotors

Kelsey-Hayes has no prototype rotor castings on hand. Process foundry, the original prototype source, will be asked to pour additional pieces that will be machined, chemically analyzed and included in the dynamometer lining wear evaluation program. The prototype pattern will go from Process foundry to Waupaca foundry to pour higher titanium content rotors.

Lining Wear

Continuing dynamometer and laboratory evaluation of Abex 7018C material has failed to identify any obvious cause for deterioration of lining and rotor wear.

Caliper Assembly - Bushing Grease

Silicon based GE 661 grease has completed 2000 miles of vehicle testing with favorable results. The Materials Laboratory continues to evaluate the production grease and a barium based alternative.

Noise

Goodrich DL80 on fiberglass noise ratings need to be improved a point or two (on noise scale 1-10). The narrow wall section of the steel piston is breaking down the fiberglass mesh structure. Steel capped and plastic pistons will be tested to see if a reduction in unit loading will extend the life of the fiberglass mesh. Steel pistons from Kelsey will be modified to include caps and all plastic pistons available will be provided to the Highland Park development group.

Noise - (Continued)

Florida noise cars with CW2380 are rated at 8 and 9, but there is an unapplied cyclical chirp rated at 3 and 4. New caliper assemblies will be shipped to Florida and chirping calipers returned for evaluation. Viton material and Thiokol 1353 with no gasket running noise in Florida have not been satisfactory.

Arizona test vehicle noise complaints are 2:1 higher on riveted than integrally molded. Current status of IME material for production is that a 16,000 piece production run from Abex will be available approximately 2/15/78 for evaluation prior to scheduled introduction at the end of March.

Kelsey-Hayes will supply one car set of ventilated parts for testing in Florida.

NEXT MEETING WILL BE HELD THURSDAY, FEBRUARY 16, 1978, AT 9:30 A.M. IN CHASSIS CONF. ROOM 'B'.

P. B. Hellens
Brake Engineering

cc: D. B. Bain
D. P. Conlon - Abex Corp.
R. W. Steere
R. R. Swanberg
J. L. Thon

/nf

SALES REPRESENTATIVE'S REPORT Win Chester
FRICTION PRODUCTS GROUP TYPE OF CALL

Date typed: 2/1/78-2/6/78

RESPONSE REQUESTED ☐

DATE 2/2/78 (1/17/78) (1/19/78) (1/24/78)

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	111
ADDRESS	**CITY**	**STATE/ZIP**
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

W. Steere - Chief Engineer Chassis
Thomas A. Brandon - Development Supervisor
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
(and many others)

XC

COMMENTS

CHANGE TO INTEGRALLY MOLDED

It now appears as though the change to the integrally molded assembly will be made in the very near future. After a discussion on 1/31/78, with the appropriate pecple at Winchester, (EFPotts, CLBroadstrect, GNicholson, ADIndelicato), the following schedule was agreed upon and Chrysler notified accordingly:

1. Abex would ship approximately 75,000 undrilled pucks to Kelsey on March 3, 1978. Kelsey Hayes confirmed this with a Telex. These pieces were to be manufactured at the plant during the period 2/1/78 to 2/20/78.
2. Chrysler was going to initiate a PTR (production test request) covering 48,000 integrally molded assemblies. It was agreed that Abex would be in a position tc supply approximately 16,000 integrally assemblies by March 1. From this group, Chrysler would select approximately 25 for testing. Chrysler would require approximately ten days to evaluate this material. The purpose of Chrysler's test would be to make sure that there are no significant unfavorable differences between production and prototype integrally molded material. During the ten day test period Abex would proceed with the manufacturing of the balance of the PTR. It was felt that when Chrysler made their decision, on or about March 10, Abex would have completed the 48,000 piece PTR, and if no unfavorable differences were noted, Abex would then proceed to manufacture integrally molded assemblies pursuant to a production purchase order from Kelsey Hayes. It was expected that Abex would be in a position to manufacture another 50,000 pieces between March 10 and April 1. This would result in Abex being in a position to ship approximately 100,000 integrally molded assemblies to Kelsey Hayes during the first week of April.

As of 2/2/78, no cost information has been given to Kelsey Hayes or Chrysler for the integrally molded assemblies. Also, no cost information has been received from Kelsey Hayes on the steel backs. At this time, I intend to Quote Kelsey Hayes a 90¢ price per integrally molded assembly without the steel back. I do not feel as though this price will be acceptable to Kelsey Hayes and Chrysler because at this price, I feel that the cost of the integrally molded assembly will be higher than the cost of the riveted assembly. This is contrary to the general industry experience.

NOISE

There have been no improvements with 7018C in the noise area. Tests indicate that 7018C falls to an unacceptably level when subjected to a City traffic schedule. One encouraging aspect is that the material remains within the

acceptable range until it is subjected to the city traffic schedule. The hope at Chrysler is that most people will not be driving the vehicles in extended city traffic condition and that the noise level will not become a problem.

ROTOR AND PAD WEAR

Chrysler still remains unable to duplicate the earlier acceptable wear levels of 7018C. Several graphs outlining the performance of 7018C and Cycle-weld's 2380 are enclosed.

Graph I - Shows the early test of 7018C as well as some of the more recent unfavorable tests. In particular, note the very low averag rotor wear (.003") of the early tests. Later tests have rotor wea which is 5 or 10 times worse than the earlier tests. These later tests were not run passed 325° stop interval.

Graph II- Shows the results of the high and low apparent density There does not appear to be any significant improvement with the low density material.

Graph III- Shows the low density (X62) used with a prototype rotor. Note that the wear of both the pad and rotor is far in excess of the early prototype tests.

Graph IV- Compares results of testing a known good batch (X2) on a production rotor and a prototype rotor. The pad wear of the inner pad, when used with a production rotor is much better than the outer pad with the production rotor. Also note that the pad wear, both inner and outer, using the prototype rotor is almost identical to that of the inner pad and production rotor. Prototype rotor results have not been plotted, but the points are indicated by the rectangles on the pad wear line. This graph is very difficult to interprete: it could be taken to show that the rotor does not make a difference because the inner pad using a production rotor produced the same pad wear as both pads using a prototype rotor. On the other hand, the graph can be interpreted as showing that rotors do make a difference because of the much worse wear of the outer pad when using a production rotor.

Graph V - Shows Cycleweld 2380 and a prototype rotor. Pad wear is not particularly good but the rotor wear is excellent.

Graph VI- Shows Cycleweld 2380 and a production rotor. Pad wear is again not very good. It is also not significantly worse than that shown on Graph V which was with a prototype rotor. This tends to indicate that the rotor, at least when 2380 is being used, does not have much of an effect on pad life.

Graph VII - Is a full test (300 stops at all five temperatures) of 2380 with a production rotor. But the important points here, are: L. The excellent rotor wear. 2. The fair, initial pad wear and 3. The very good pad wear between the 250° and 475° levels.

As can be seen from the attached data nad graphs, Cycleweld 2380 has about the same pad wear characteristics as does the current production 7018C. The 2380 pad wear is worse than that of the earlier 7018C. Rotor wear of the 2380 is much better than current 7018C but comparable to the earlier 7018C test. In summary, 2380 is probably superior to current 7018C but inferior to the initial submission of 7018C.

POTENTIAL COMPETITION

Cycleweld's 2380 remains the most significant, competitive threat at this time. The testing in Florida continues to show this material to be virtually noiseless.

KELSEY HAYES CHEMICAL ANALYSIS

The Kelsey Hayes chemical analysis parallels that of Abex: the titanium content of the prototype rotors was higher than that of the production rotors. In an effort to resolve this issue, Chrysler has secured prototype rotors and after testing to confirm that they do have the higher titanium levels, will run official dynamometer tests on them.

The following rotors and pads have been sent to Mahwah for analysis, as requested by Mr. Graham: production rotor with X62 inner and outer. Also a production rotor with 63 inner and X62 outer. Please note that Chrysler has marked the inner pad as being from X62 and the outer as being from batch 63. I feel that this is incorrect because this does not agree with the batched numbers stamped into the steel backs by the pilot plant. The outer pad of the experiment using both 62 and 63 was severely cracked and evidenced serious chunking to the underlayer. It was also very heavily worn.

Also sent to Mahwah, were several pictures of various samples of 7018C taken at a 50X magnification. The significant feature of these pictures was the apparent powdery nature of the X2 (known good batch) in contrast to what looked like a very high fiber content in the production batches 58473 and 73517.

DISPOSITION OF CRACKED MATERIAL

A meeting has been scheduled for Monday, February 6, at Kelsey Hayes, Jackson Plant, to discuss whether Abex or Kelsey Hayes is responsible for

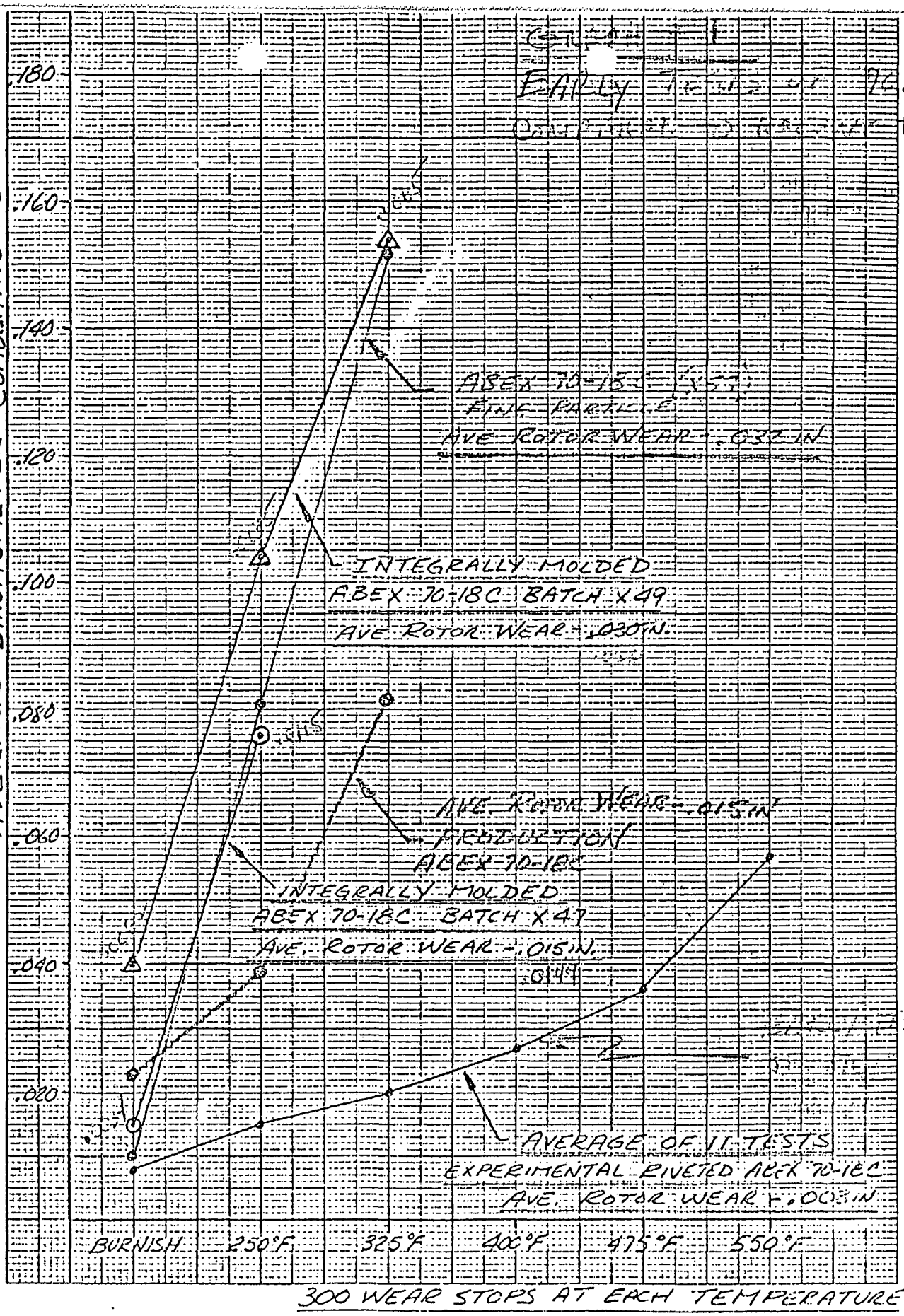
the 26,000 pads which were rejected as a result of being cracked after drilling. The Abex position in this matter is that we are responsible for only .7% of the total parts drilled. As of this date, Kelsey has drilled approximately 200,000 pads.

Denis P. Conlon

jd

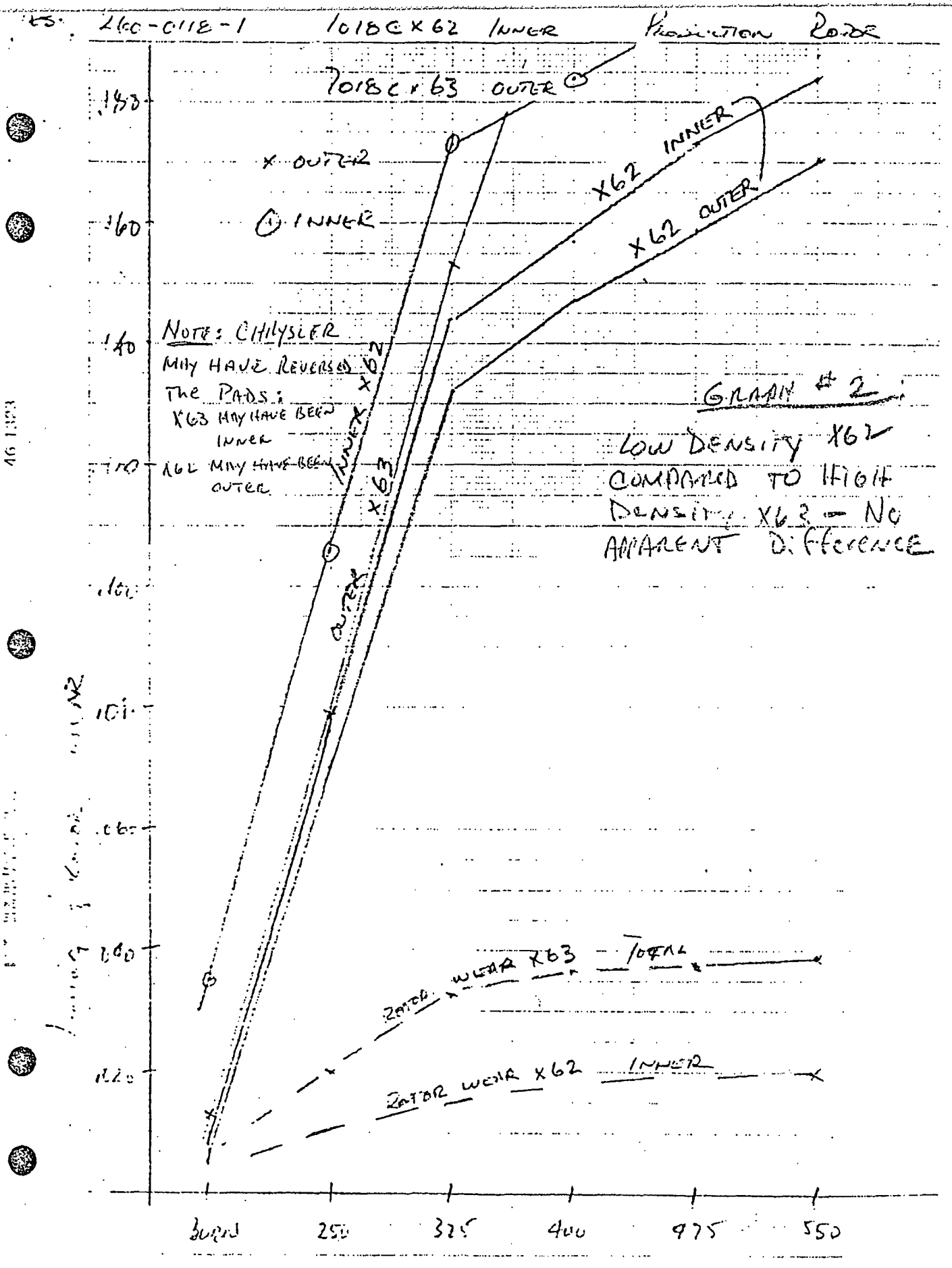
attach. as above

cc RLCutler/AFSchmaltz/File
BIwarsson
GRGraham
RENelson
ADIndelicato
DESteis



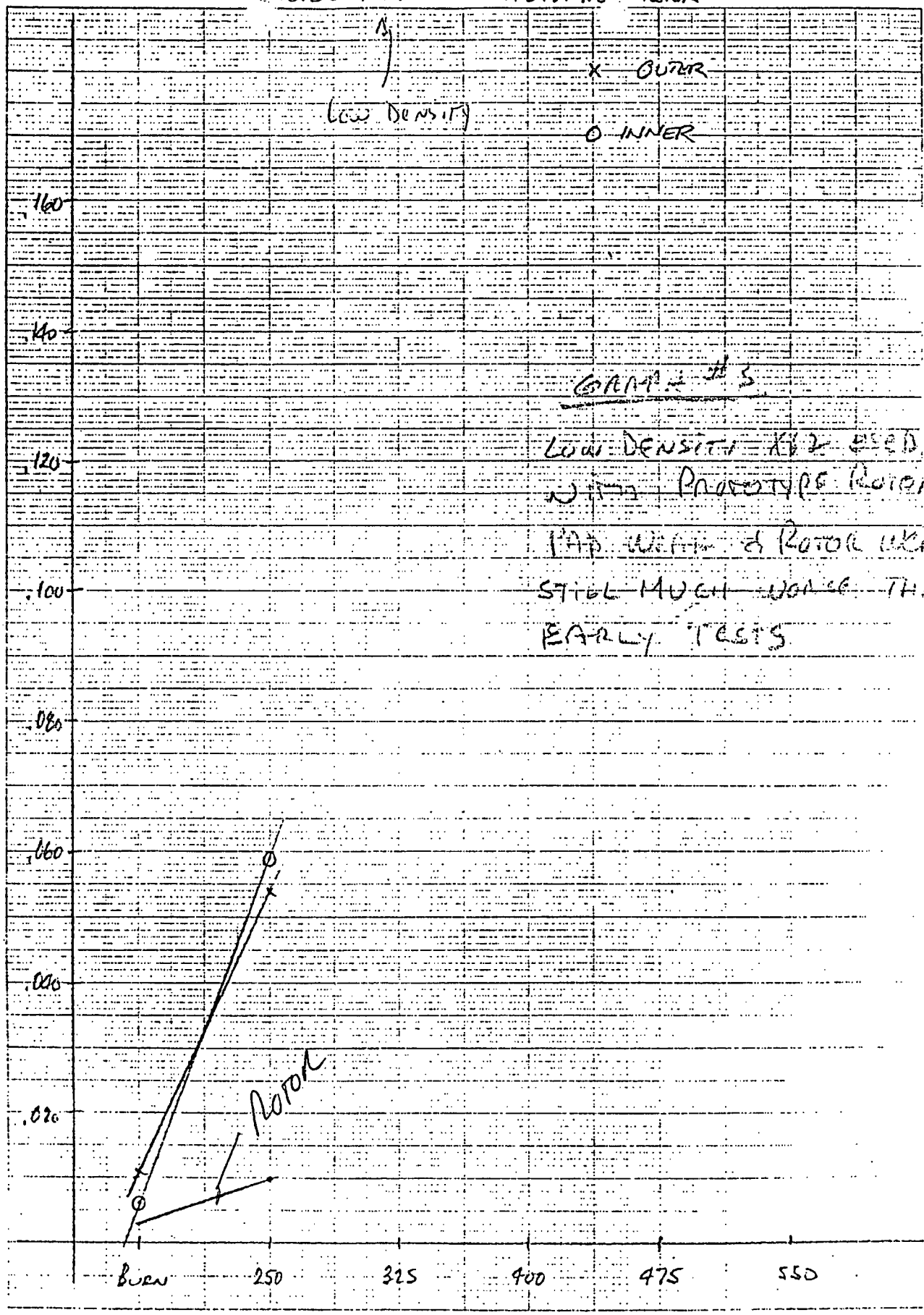
J.T. RILEY 12/11/61.

SC1 02282



260-0118-1
1018C X62 INNER
PRODUCTION ROTOR
7018C X63 OUTER
X OUTER
INNER
X62 INNER
X62 OUTER
NOTE: CHRYSLER MAY HAVE REVERSED THE PADS:
X63 MAY HAVE BEEN INNER
X62 MAY HAVE BEEN OUTER
INNER X62
OUTER X63
GRAPH #2
LOW DENSITY X62 COMPARED TO HIGH DENSITY X63 — NO APPARENT DIFFERENCE
ROTOR WEAR X63 TOTAL
ROTOR WEAR X62 INNER
BURN
250
325
400
475
550

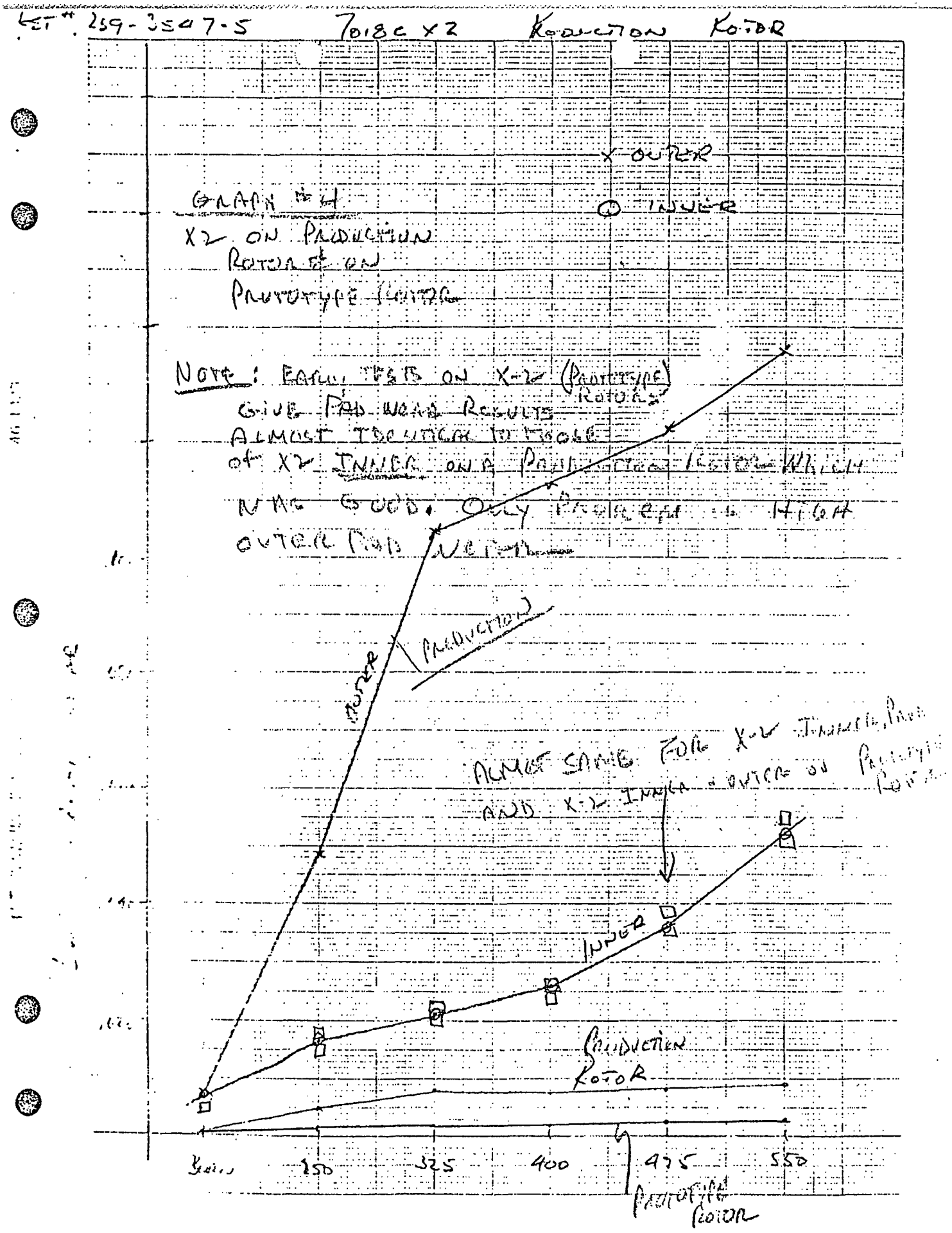
Test # 265-0318-1 7018C x62 Prototype Rotor



GRAPH # 5

LOW DENSITY K12 USED WITH PROTOTYPE ROTOR — PAD WEAR & ROTOR WEAR STILL MUCH WORSE THAN EARLY TESTS

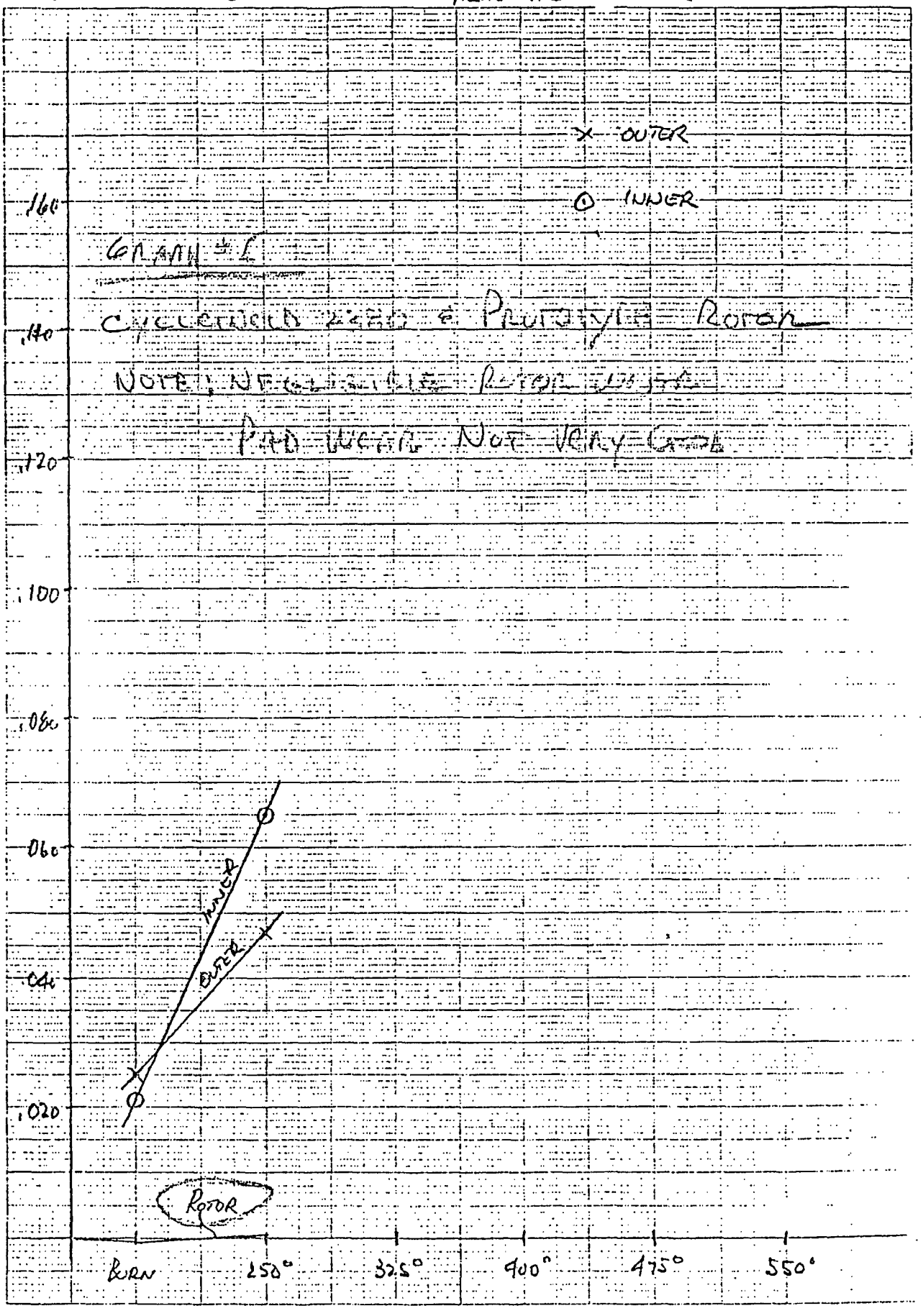
SC1 02284



LET # 259-3547-5
7018C X2
PRODUCTION ROTOR
X OUTER
O INNER
GRAPH #4
X2 ON PRODUCTION ROTOR & ON PROTOTYPE ROTOR
NOTE: EARLY TESTS ON X-2 (PROTOTYPE) ROTORS GIVE PAD WEAR RESULTS ALMOST IDENTICAL TO THOSE OF X2 INNER ON A PRODUCTION ROTOR WHICH WAS GOOD. ONLY PROBLEM IS HIGH OUTER PAD WEAR
PRODUCTION
OUTER
ALMOST SAME FOR X-2 INNER, PAD AND X-2 INNER & OUTER ON PROTOTYPE ROTOR
INNER
PRODUCTION ROTOR
250
325
400
475
550
PROTOTYPE ROTOR

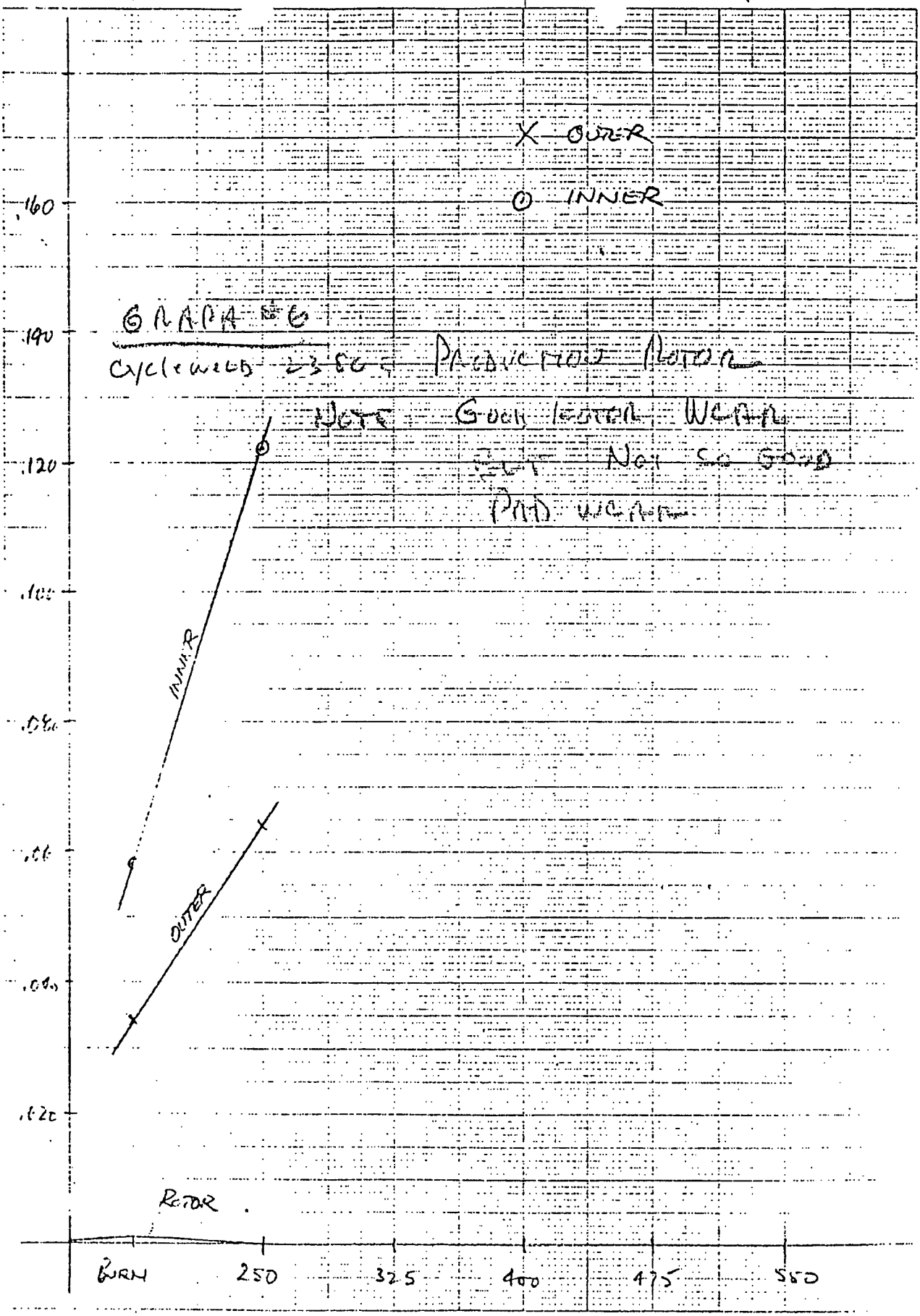
SC1 02285

Test #266-0328-1 C 2180 Prototype Rotor

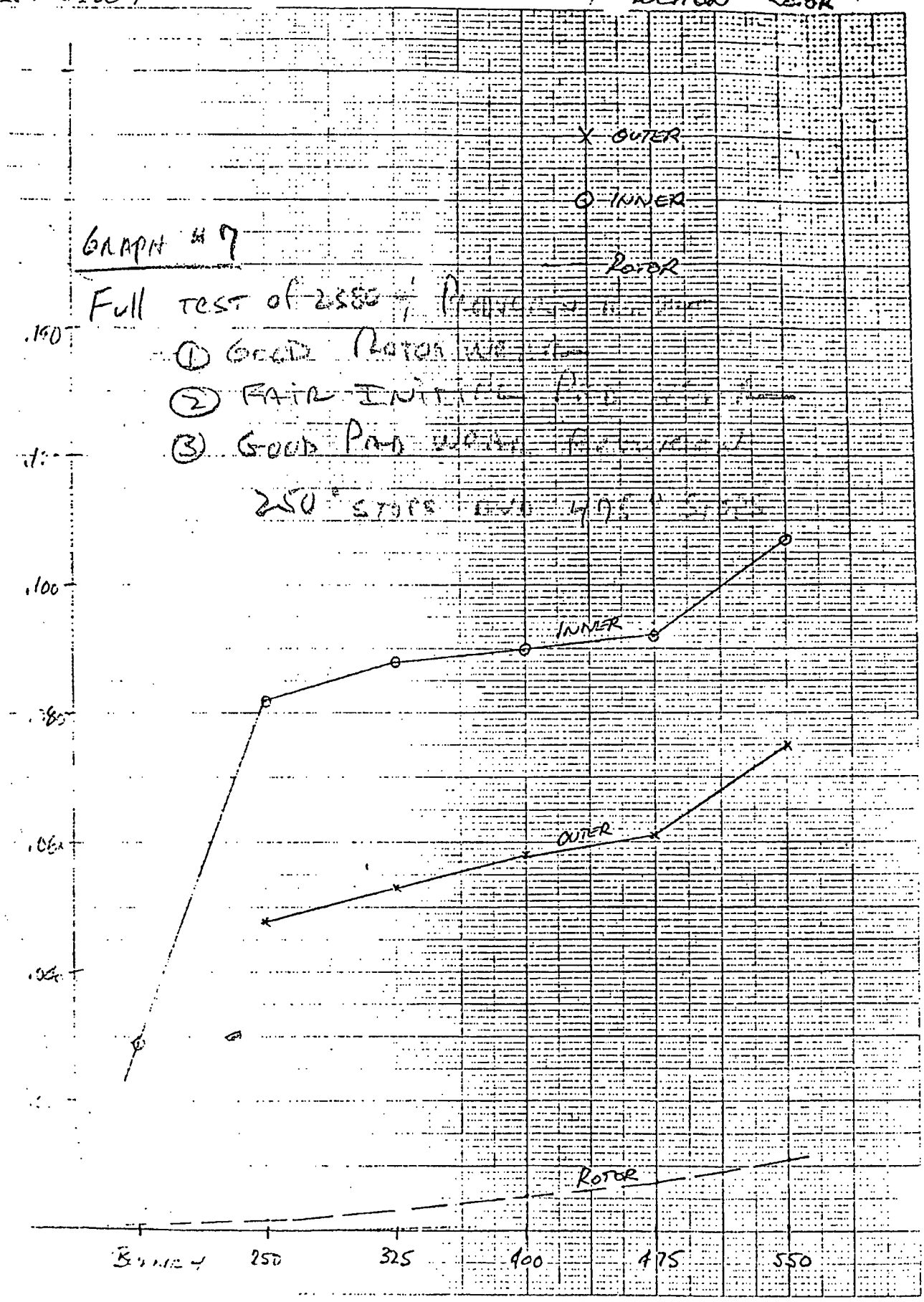


SC1 02286

Lot # 264-0308-1 CW 7380 PRODUCTION ROTOR



SC1 02287



0238-1
CW 380
Production Rotor
X OUTER
O INNER
ROTOR
GRAPH #7
Full test of 2380 + Production
① GOOD Rotor
② FAIR INITIAL
③ GOOD PAD
250° STOPS
INNER
OUTER
ROTOR
.100
250
325
400
475
550

84-110-7698 PRINTED IN U.S.A.

WEAR DATA (DYNO - WEAR & EFFECTIVENESS TEST)

TEST NO.	MATERIAL	BURNISH + EFF	250°F	325°F	400°F	475°F	550°F	TOTAL WEAR	TAPER		AVG ROTOR WEAR
1	3012 C/I	.014 / .013	.005 / .006	.004 / .009	.006 / .006	.006 / .008	.017 / .018	.052 / .055	.030 / .042		.0014
2	3012	— / —	.010 / .012	.007 / .006	.006 / .008	.014 / .012	.020 / .020	.057 / .058	.016 / .038		.0027
3	3012	.009 / .006	.008 / .007	.006 / .005	.006 / .006	.008 / .008	.023 / .018	.060 / .050	.031 / .037		.0034
4	?	.008 / .007	.007 / .008	.005 / .005	.008 / .007	.009 / .008	.025 / .023	.062 / .058	.040 / .038		.0034
5	7018C	.005 / .006	.010 / .007	.004 / .006	.009 / .007	.018 / .014	.035 / .034	.081 / .074	.011 / .021		.0023
6	7018C	.0065 / .007	.0037 / .003	.004 / .0035	.007 / .006	.0087 / .0065	.024 / .016	.0539 / .042	.034 / .033		.0033
7	7018C -X1	.009 / .006	.003 / .005	.002 / .003	.001 / .003	.006 / .006	.016 / .016	.035 / .039	? / ?		.0035
8	7018C -X1	.011 / .008	.004 / .006	.004 / .006	.008 / .010	.009 / .011	.020 / .020	.056 / .061	.029 / .052		.0 7
9	7018C -X1	.007 / .006	.0065 / .006	.005 / .005	.0065 / .0045	.008 / .011	.018 / .020	.051 / .0525	.035 / .054		.0031
1 TO 9	TOTAL AVG.	.0087 / .0074	.0064 / .0067	.0045 / .0048	.0064 / .0064	.0094 / .0094	.022 / .0206	.057 / .055	.028 / .0394		
	7, 8 & 9 AVG	.009 / .0067	.0056 / .0057	.0037 / .0047	.0052 / .0058	.007 / .009	.018 / .012	.048 / .044	.032 / .053		
	(X-2) TO 9 & 11 AVG	.0085 / .0075	.0068 / .007	.0059 / .005	.0076 / .0063	.0044 / .0098	.0157 / .0143	.0535 / .0499			
10	70-18C X2	.005	.0075	.0035	.007	.0108	.021	.0548			.0027
11	70-18C X2	.0095 / .0082	.0065 / .0098	.0068 / .006	.0088 / .0078	.009 / .0057	.0165 / .0185	.0571 / .056			.0029
1 TO 11	AVERAGE →	.0087 / .0072	.007 / .007	.0048 / .0048	.0066 / .0066	.0094 / .0092	.0201 / .0204	.0572 / .0552			.0029

R. VIGNA

SC1 02289

D.P. Conlon

MINUTES OF THE

L-CAR FRONT BRAKE MEETING

OF JANUARY 19, 1978

Present:

J. E. Clark		W. H. Rankin	
D. P. Conlon	- Abex Corp.	K. Rinker	- Kelsey-Hayes
L. L. Cole		R. T. Robinette	- Kelsey-Hayes
R. E. Dix	- Kelsey-Hayes	G. W. Smith	
K. Goering	- Kelsey-Hayes	R. R. Swanberg	

Caliper Assembly - Adapters

Dyno Chrysler spread <.025 ∴ OK
K-H: 7003 of significant change.

Chrysler will test the adapters made from S.A.E. 7003 nodular in one week. Kelsey-Hayes will test 7003 adapters during the week of January 23, and be completed by February 1.

Caliper Assembly - Pin/Bushing Grease

South West Corporation reports that MS 4304 does have lithium. Kitco slab material will be available for the Materials Lab investigation this week. Kelsey-Hayes will supply bushings to the Materials Lab immediately. Other greases submitted to the Materials Lab included G.E. Silicone 661. Chrysler Silglide will also be tested since it is readily available at all dealers.

Rotors

Kelsey-Hayes has completed the physical properties review and will complete the chemical properties this week. A report will be given at the next meeting. Abex reported that their physical properties review showed no difference between the proto type and Tiffin manufactured rotors. Abex requested ~~[illegible]~~ EUREKA manufactured rotors for analysis.

Lining Wear

Dynamometer evaluation of different lining and rotor combinations is continuing. Lot 63 showed chunking and cracking on the Chrysler dynamometer. The Abex dynamometer is not corrolating with the Chrysler dynamometer. The low density lot 62 was better than lot 63 on the Abex dynamometer and actually approached lot X2 for wear. In Chrysler's minimal amount of testing no difference could be noted between lot 62 and lot 63.

Noise

The 7018C I.M.E. material has shown a definite advantage in both Detroit and Florida testing. Both the 80 durometer acrylic and modified hydrin gasket testings have been discontinued. Four cars in Florida are now running the Unibond assembled Pajco saturated fiberglass at acceptable levels at over 1,000 miles on the longest test. After this combination is proven (or disproven) the Pajco Aluminum laminate will be tested on at least three cars, and this test will be followed by the Pajco material attached to a heated shoe and lining assembly.

THE NEXT MEETING WILL BE HELD THURSDAY, FEBRUARY 2, 9:30 A.M. in CHASSIS CONFERENCE ROOM 'B'.

W. H. Rankin

W. H. Rankin
Brake Engineering

cc: T. A. Brandon
D. B. Bain
J. W. Douglas
P. B. Hellens
R. Nelson - Abex
R. W. Steere
J. L. Thon

/nf

CO-5 Revised 4/76

Date Typed: 1/17/78-1/16/78

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 1/13/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER BRAKE ENGINEERING	D. P. CONLON	108
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED

Thomas A. Brandon - Supervisor
Paul B. Hellens - Senior Product Development Engineer
William H. Rankin - Senior Product Development Engineer

COMMENTS

CYCLEWELD 2380

I had a chance to talk with these people concerning the Cycleweld formula 2380. The material is a mixture of asbestos, iron powder and iron fibers. It has been running extremely quietly in Florida. The Brake Engineering Group has not run 105 dynamometer tests on the material. The Cycleweld people ran the tests and reported the results. Also, the Brake Engineering people have not yet run the wear and effectiveness procedure on this material. I think I will be able to obtain some samples of this new material in the next few days.

SUPPLIES FOR MAHWAH

I was able to obtain five production rotors and one bearing for Mahwah. I was also able to get the rotor and pads from a wear and effectiveness test on 7018C, X-2 riveted with a production rotor. The X-2 material exhibited cracks and chunking. There was also a wide discrepancy in pad wear between the inner and outer pads. The pads and rotors were included in the shipment of the bushings and rotors.

NOISE

Chrysler is still testing various combinations of gasket materials and adhesives in an attempt to find a suitable noise fix. To date, the results are not particularly encouraging. Rankin feels as though he has a couple of likely candidates but, at this point, everyone (even Rankin, I think) is skeptical of finding anything which will work.

BLACK DUST

Normal washing of the cars is removing the black dust. The black dust is still being deposited but it is not causing the same panic it did a little earlier. This is a result of it not being so permanently attached to whatever surface it landed on.

Denis P. Conlon
jd

cc RLCutler/AFSchmaltz/File
RENelson
BIwarsson
ADIndelicato
DESteis

SC1 02292

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

A.D. Indelicato
RESPONSE REQUESTED ☐

DATE January 12, 1978

CUSTOMER	REPRESENTATIVE	REPORT No.
Chrysler Corporation	R.E. Nelson	
ADDRESS	CITY	STATE/ZIP
	Highland Park	Michigan
		PHONE

OFFICIALS INTERVIEWED

Gayle W. Smith, Engineering Manager
Paul B. Hellens, Senior Design Engineer
Thomas A. Brandon, Engineering Supervisor
James E. Clark, Design Engineer
Lewis L. Cole, Design Engineer
Karl Goering - Kelsey-Hayes
Dick Robinette - Kelsey-Hayes
Kurt Rinker - Kelsey-Hayes

COMMENTS

This is a report on the Chrysler 'L' car meeting with the above people in attendance. The writer represented Abex in Denis Conlon's absence.

Messrs. Conlon and Cutler's copies of the January 5th meeting are attached to their respective reports. Also attached is a copy of my written report, which was discussed. There were no real comments regarding these findings. They could offer no suggestions for additional tests we might run. They will attempt to determine what material was run on the fourth production rotor and also on the prototype rotor; however, I hold little hope for them getting us any additional information. They did not have any reports on their tests; and as best I can determine, they have not run them and certainly did not volunteer to furnish any information.

There were several things with regard to the information from our temperature/wear dynamometer tests. The only suggestion they had regarding our problem of higher inboard than outboard wear would be that we should be replacing the rubber bushings and lubricating the pins after each test. They will get supplies of both the lubricant and rubber bushings to us. I advised them that we were running from 50° to 75° hotter on the inboard pad over the outboard. Also discussed our tapered wear problem, and they requested that we furnish them wear data illustrating the degree of tapered wear. They would also like to have the rotor wear for each cycle of the tests reported. Will Don Steis please furnish that as soon as possible. They seem satisfied on our approach to this wear problem and volunteered dynamometer help if we needed it. I advised them we would have to get back to them as to what particular assistance we might need.

Presently, Chrysler are running X62 (low density iron) on one side of a rotor with X63 (high density iron) on the other side of the rotor. They are running into some difficulties in trying to determine side-to-side rotor wear. Their next test will be to run with the X62 and X63 material in the opposite position. Following that they will run X62 by itself and X63 by itself. I anticipate this total program will take about three weeks to complete.

They have completed their work running X57 material against a production rotor and a prototype rotor. They are in the process of measuring the parts and preparing the report. The only comment was that the prototype rotor did result in better wear than the production rotor using the same X57 material.

For our information production rotors can be identified with a T for Tiffin and an E for Eureka. These symbols are on the rotor in the vicinity of the minimum thickness values. If there is neither an E or a T, then it is a prototype rotor.

Both Chrysler and Kelsey-Hayes are aware of the problem we are having with bearings on our dynamometer setup. This, in conjunction with the higher inboard than outboard wear, has prompted Kelsey to send us three new lefthand adapters and calipers for the dynamometer. They will also send a new set of adapters and calipers for the car. I would suggest that Don Steis contact Dick Robinette directly on this as Dick also feels there is some problem in our setup which is causing the bearing problem. It was also determined that our time for running this temperature/wear test is similar to Chrysler, which is about sixty-four hours of work.

Their chemical people in Highland Park are looking at our lining to see if they can make any suggestions as to what might be causing this. So far they have not given any indication of how they might help. Again, we offered to have conversations by our Mahwah people directly with them on any subject that would not be considered proprietary if they so desired.

Noise

Copies of the Chrysler and Kelsey-Hayes work regarding noise were distributed and are attached to this report. In general Chrysler is attempting to keep all noise values above 6; and in many of these tests, this is being accomplished with the integrally molded using the Essen backing with the standard insulator HN-810-4 at both the Chrysler Proving Ground and in Detroit Traffic. The problem generally comes when this fix is used in Florida. That traffic test indicates that the same setup frequently results in noise ratings as low as 3 and occasionally below.

Other attempts to quiet noise are being tested, primarily using different insulating materials and, in another case, a spring around the outside diameter of the rotor. They feel this 80 Duro, acrylic insulator shows good promise based on Car No. 398 up to 2,200 miles. Another insulator is a fiberglass mesh using a DL 80 adhesive on an aluminum shin, but this has very few miles. Production riveted linings with rotor springs are also running, and these are barely acceptable running most of the time at 6 and sometimes 5 ratings. Integrally molded 7018CX57 (known to be high wear material) with a standard gasket is not doing well in Florida, and that test will be discontinued.

The "shocker" of the meeting was the Cycleweld 2380 material on a Florida test car. We were introduced to this new number a week ago but were advised during this meeting the material is a semi-metallic type. The curve speaks for itself in that after a little more than a thousand miles, it is running a steady 9 which is essentially unbelievable with a standard gasket in Florida traffic. Gayle Smith was very quick and careful to point out a number of

things regarding this test such as they have no validation background other than a 105 dynamometer test. They do believe however that it will meet 105 on a car and plan to run it shortly. They have no real knowledge of wear life on the material though early indications are that it would be good. These samples are not made in a feasible production manner as they describe it as a double fill operation, which I assume means they put the backing in and press it and then fit the friction material on top of it--then finish the cure. Nevertheless, this would appear to be our real competitor because of its early excellent noise rating and the fact that it is an inhouse material. Hopefully, continued testing of this material will bring out problems similar to those we have seen with 7018C as initial testing on this material was quite favorable.

Kelsey-Hayes presented data on the noise ratings of three cars. The data is presented in somewhat of a new format showing the range for each day and their average rating for the entire day. This format was well accepted; and I agree, it appears to be a good way to graphically show what is happening. The first test was on a rotor grooved for springs but without springs and was a riveted production 7018C. Mileage was very low, but already the brake had been down to a 6 rating for two out of three days. The second car was X57 integrally molded and was nothing more than the standard gasket. This was down to a 6 rating in three out of seven days and had dipped to a low of 5. All the average ratings were above 6. The third test is on a proposed system utilizing a ventilated rotor with a larger wheel cylinder and a proportioning valve. The third day indicates this material went down as low as 3 although this lining had seen 900 miles of heat dissipation testing previously, making the results of this test somewhat dubious.

Kelsey-Hayes distributed drawings of which there are two copies each for Denis on a proposed new brake shoe. Basically, this will entail a 1/4" diameter through hole for integrally molding rather than to continue using the drilled shoe configuration. The holes will be in the same location as the present rivet holes however.

I went on record as being generally opposed to Note 7 on Drawing 101440, which calls for a proof test. Kelsey is going to rewrite this spec, 3770; however, both they and Chrysler felt that a proof test was good in spite of our record of proof testing weakening a larger part on which we had considerable experience. I do not know what the final outcome will be regarding a proof test on these parts, but it is my guess Kelsey and Chrysler will expect some sort of proof test in the final analysis.

I did not detect a sense of panic. While we have not solved the problems, I do not feel our position is any worse (and perhaps a little better) than it was a week ago. Hopefully, and I feel this is possible,

we will be able to maintain this business until we have solved the problems satisfactorily--and on that basis maintain the business at least through this model year.

Realistically, we must face the fact that the Cycleweld 2380 material is a real threat--first of all because it is an inhouse material; and secondly because it does, at least initially, appear to solve some of their problems. Anything I heard at this meeting would indicate that they intend to thoroughly test this material before releasing it rather than releasing it prematurely.

R.E. Nelson

REN/mb

attachments

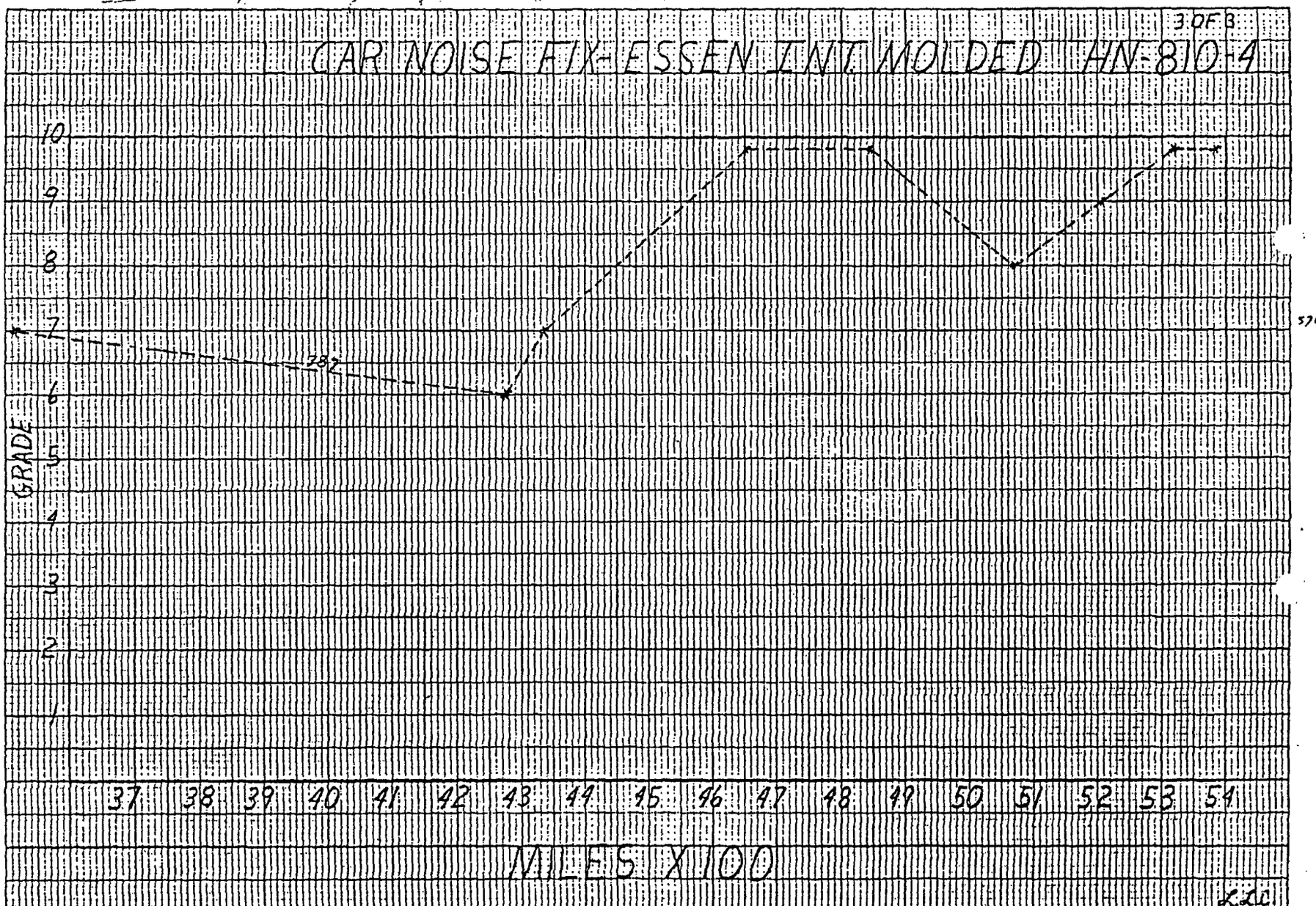
cc: D.P. Conlon
A.D. Indelicato
B.J. Iwarsson
D.E. Steis
R.L. Cutler/A.F. Schmaltz/FILE Chrysler

K·E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

P6

3 OF 3

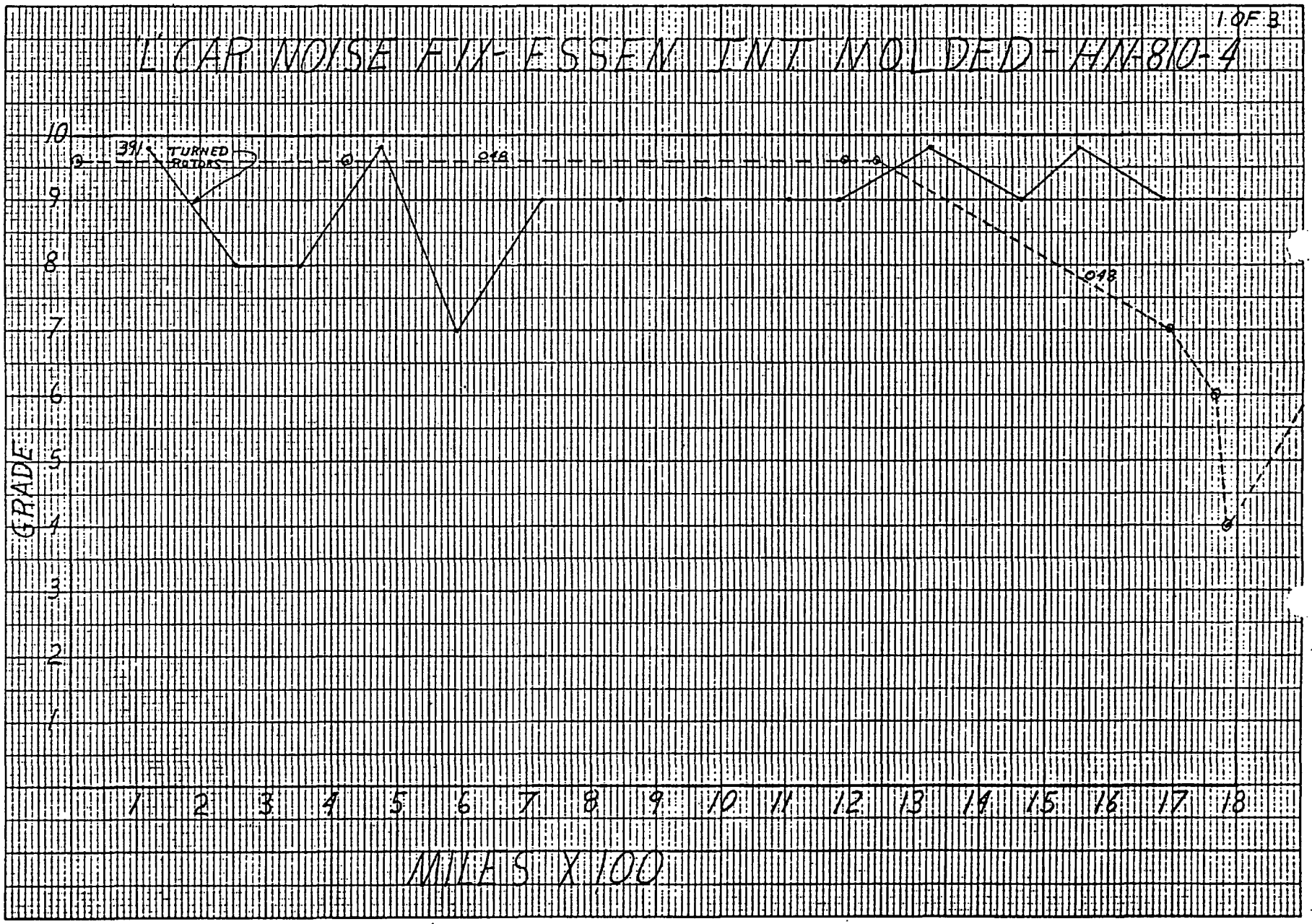
CAR NOISE FIX-ESSEN INT. MOLDED HN-810-4



5709

SC1 02297

K·E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



SC1 02298


2 OF 3
1 CAR NOISE FIX- ESSEN INT MOLDED - HM-810-4
GRADE
10
9
8
7
6
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3
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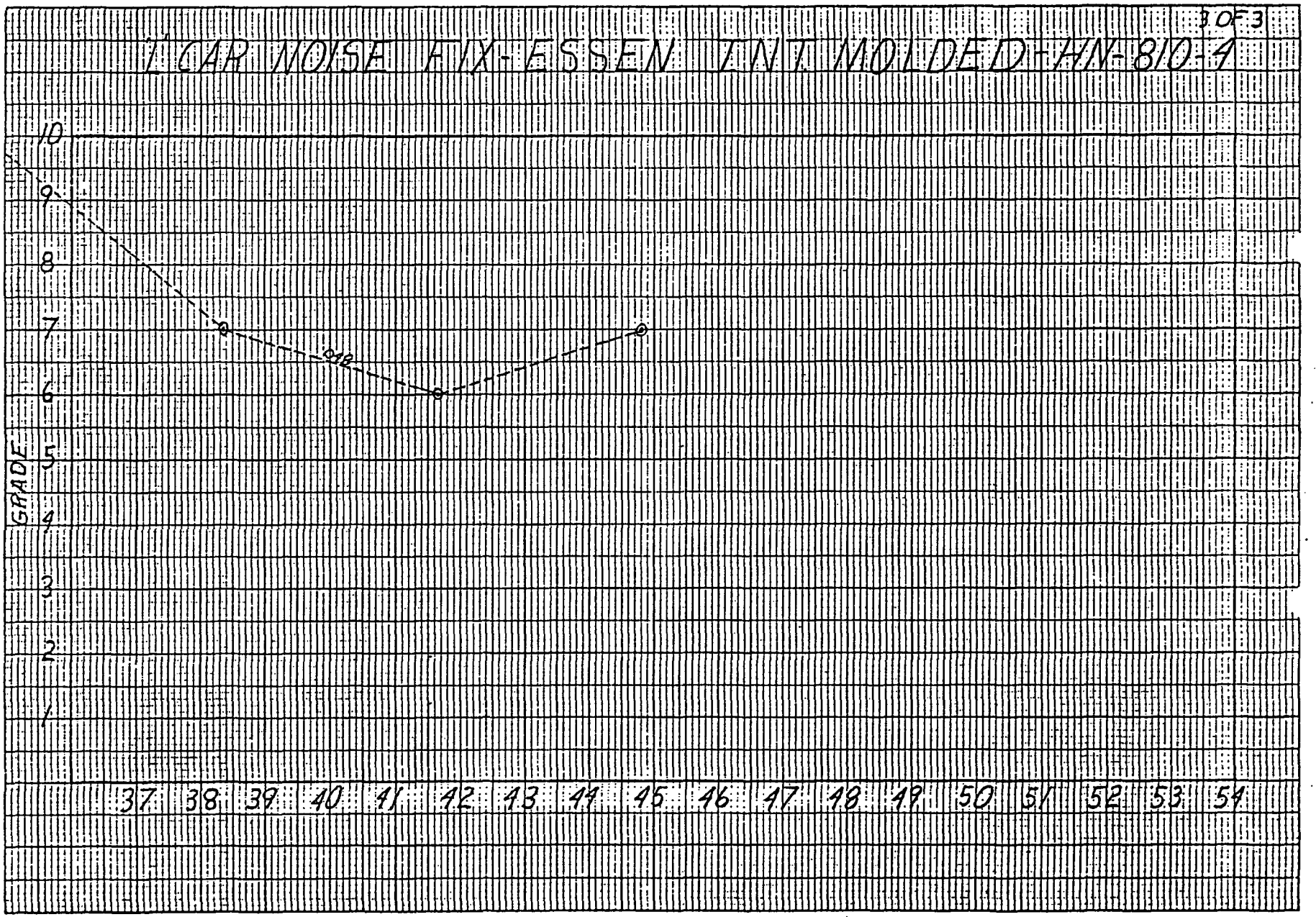
1
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
MILES X 100

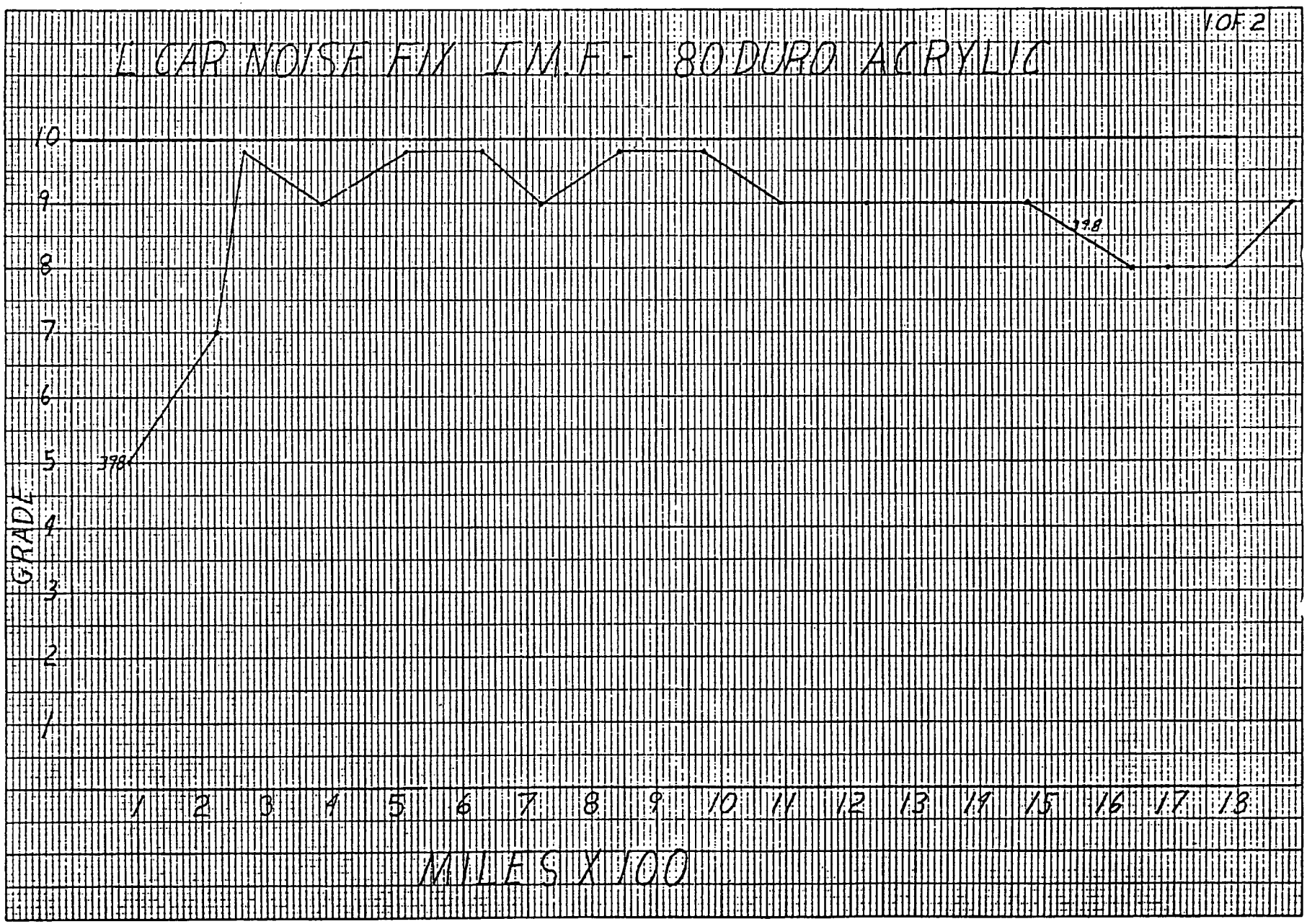
SC1 02299

K·E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

TCAR NOISE FIX-ESSEN INT MOLDED-HN-810-4



SC1 02300


1 OF 2
L CAR NOISE FIX I.M.F. - 80 DURO ACRYLIC
10
9
8
7
6
5
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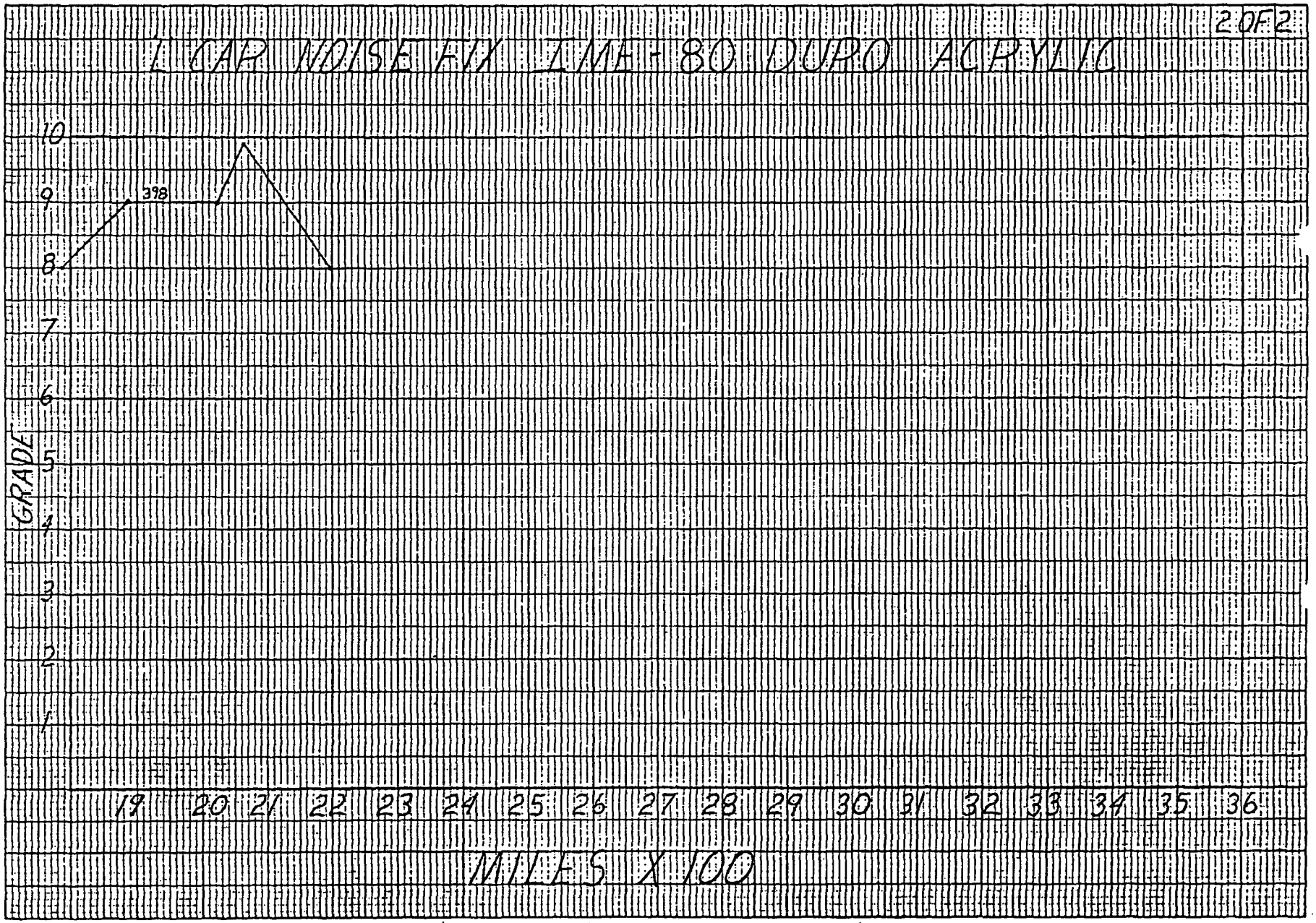
3
2
1
GRADE
398
398
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
MILES X 100

SC1 02301

K•E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



SC1 02302

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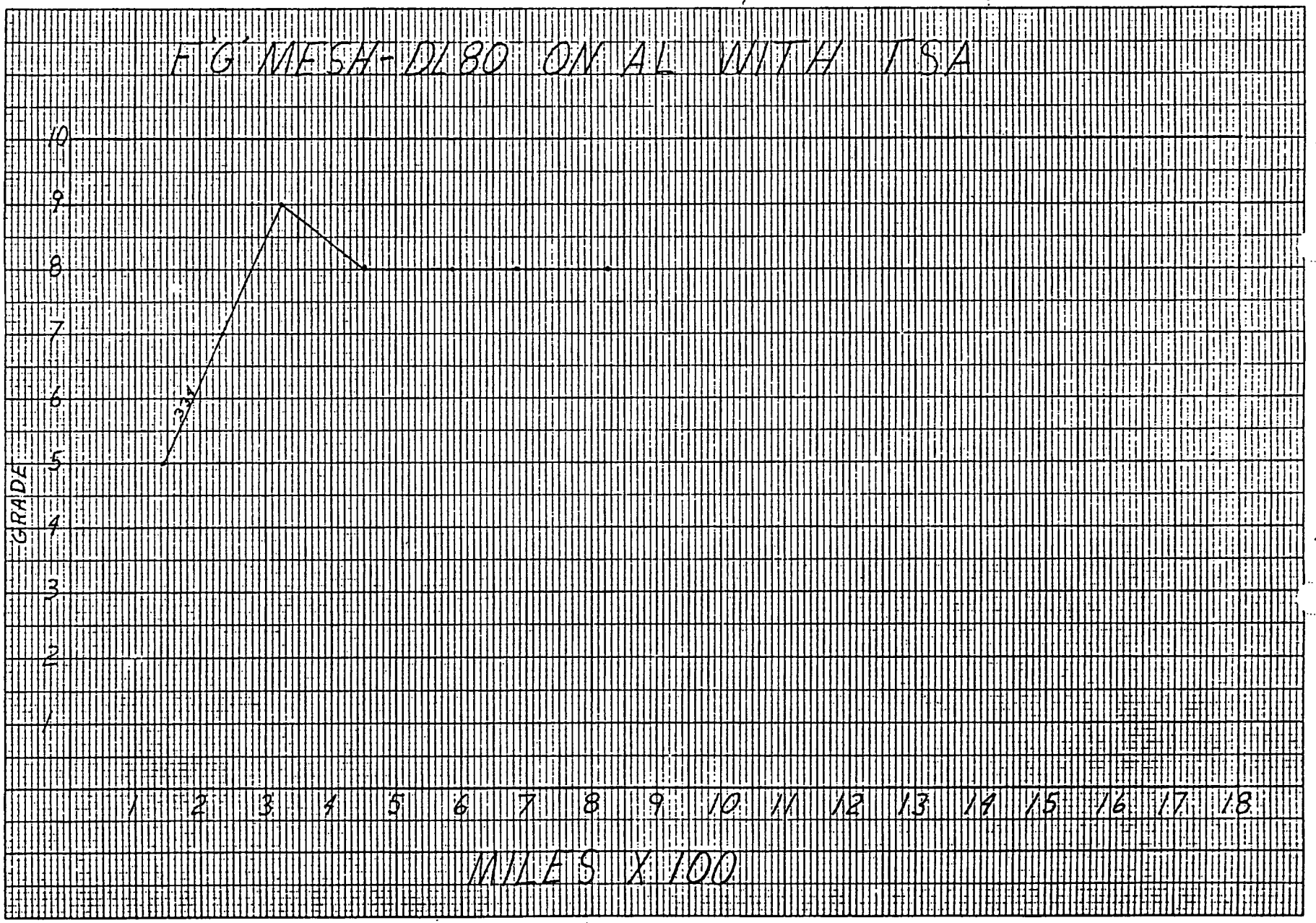
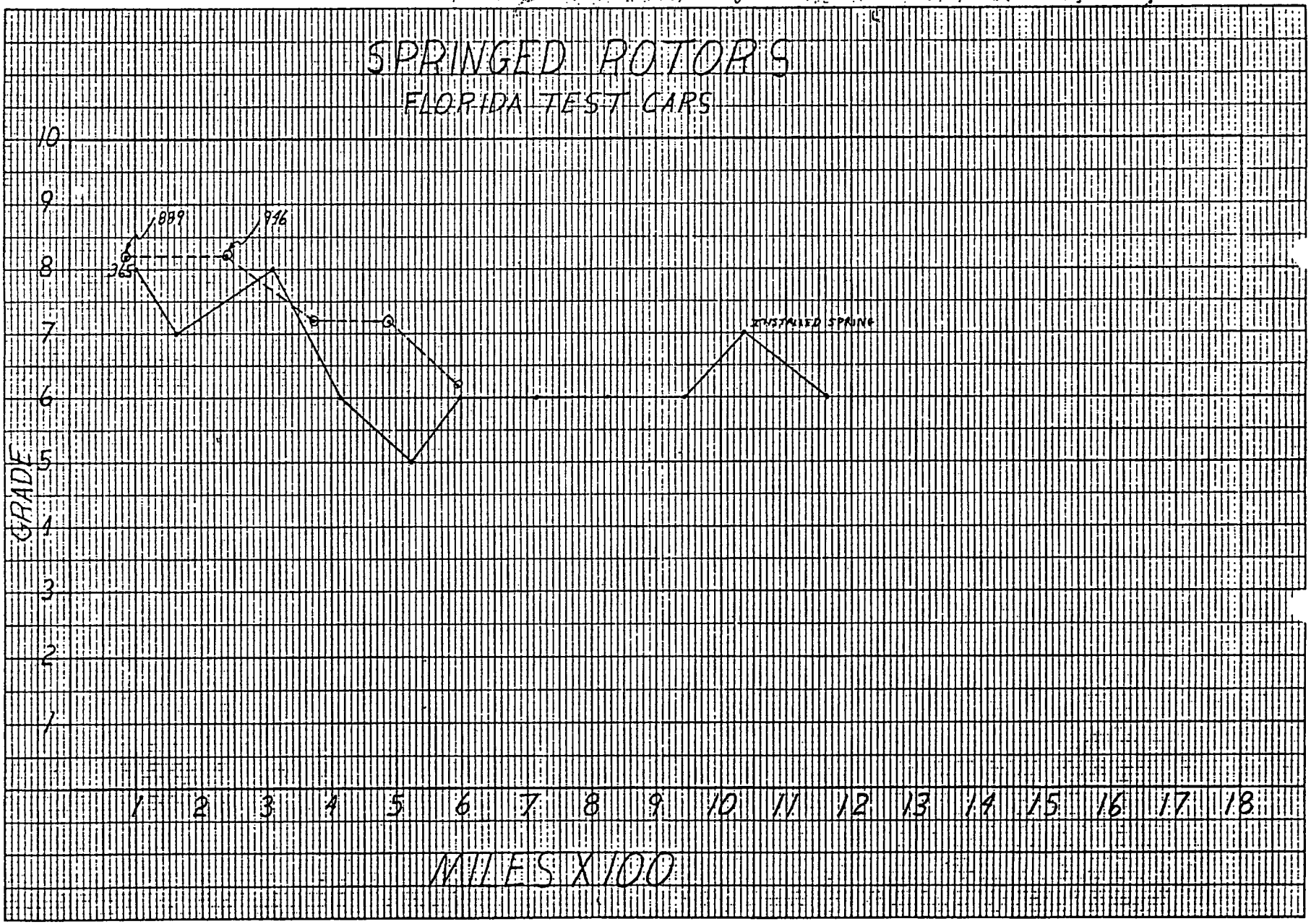
KEUFFEL & ESSER CO. MADE IN U.S.A.



K·E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



SC1 02304

K+E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

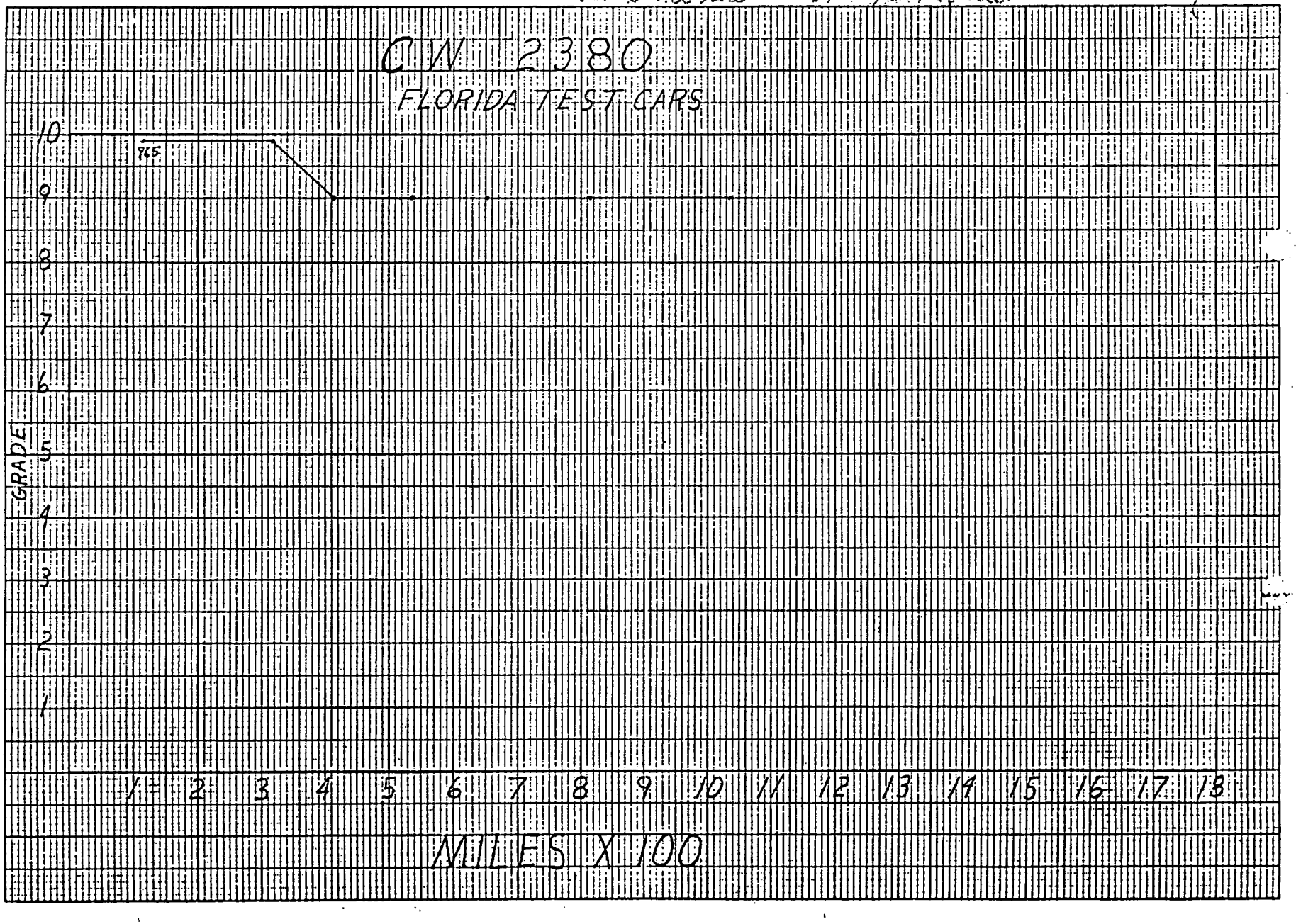
X 57 matl. won't continue w/o



SC1 02305

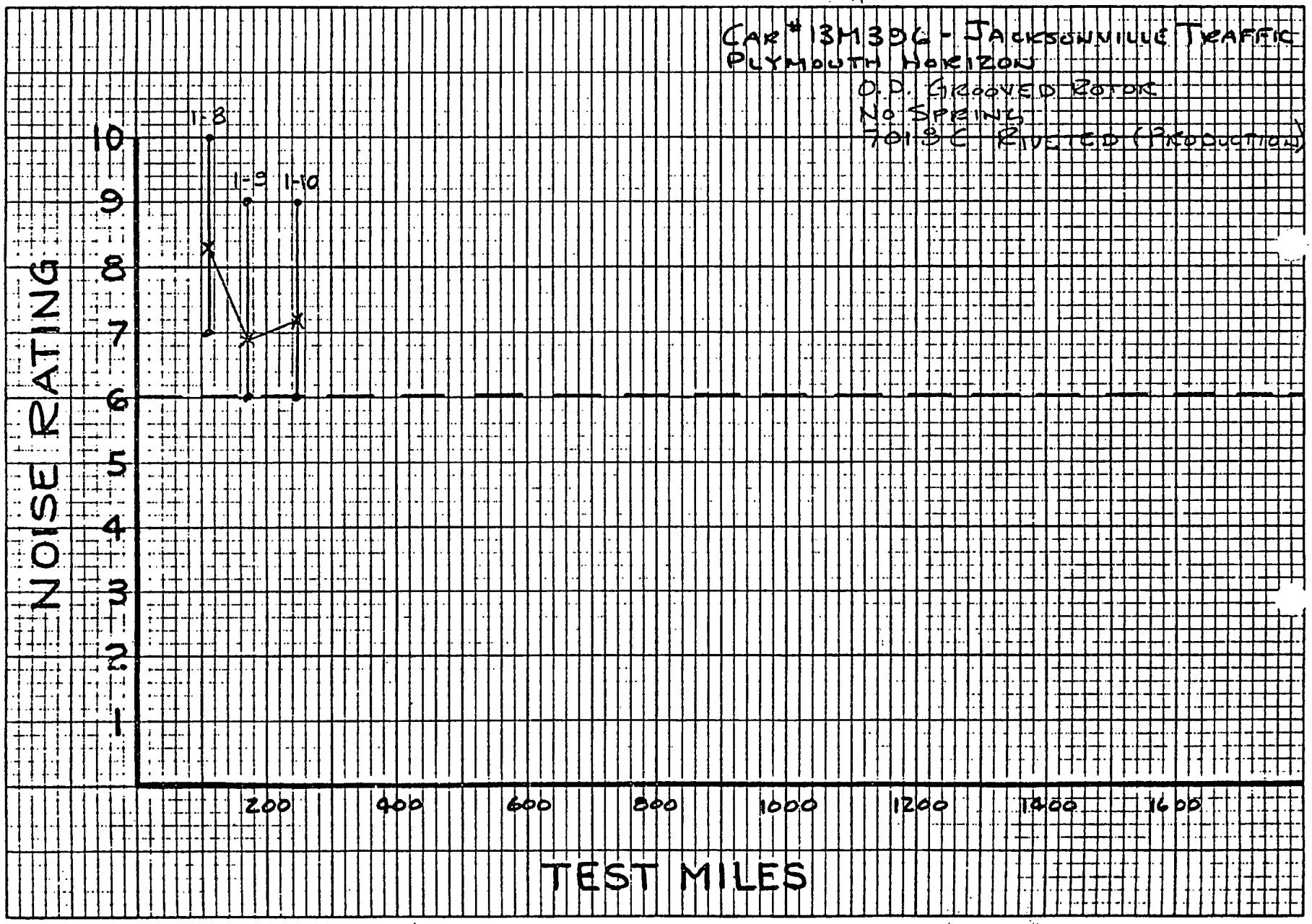
K•E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 1320

no validation [illegible] + [illegible] [illegible] 105
4 M semi met IM double filled HM 21[illegible] gasket



SC1 02306

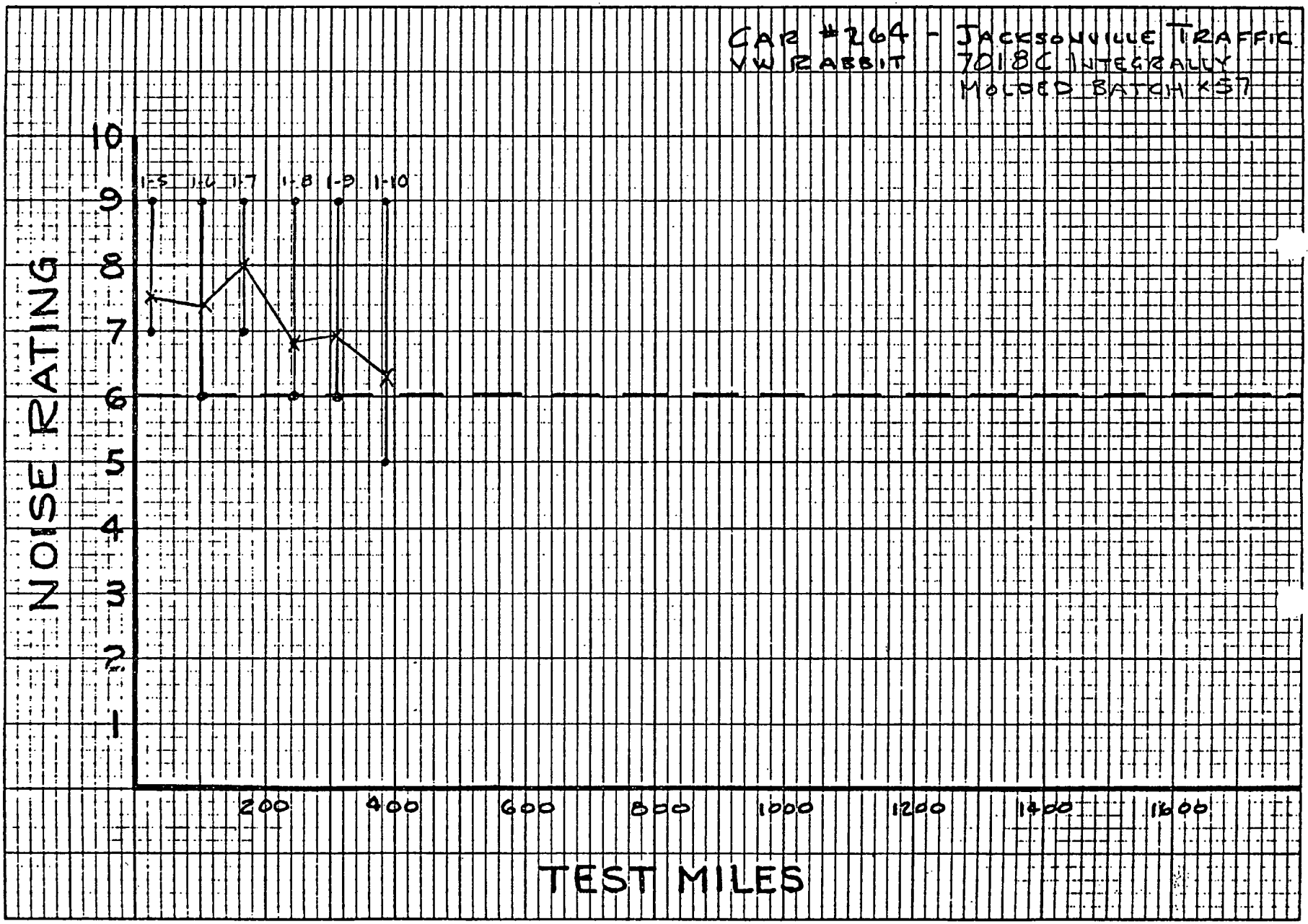
K·E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



SC1 02307

K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

XS7 IM

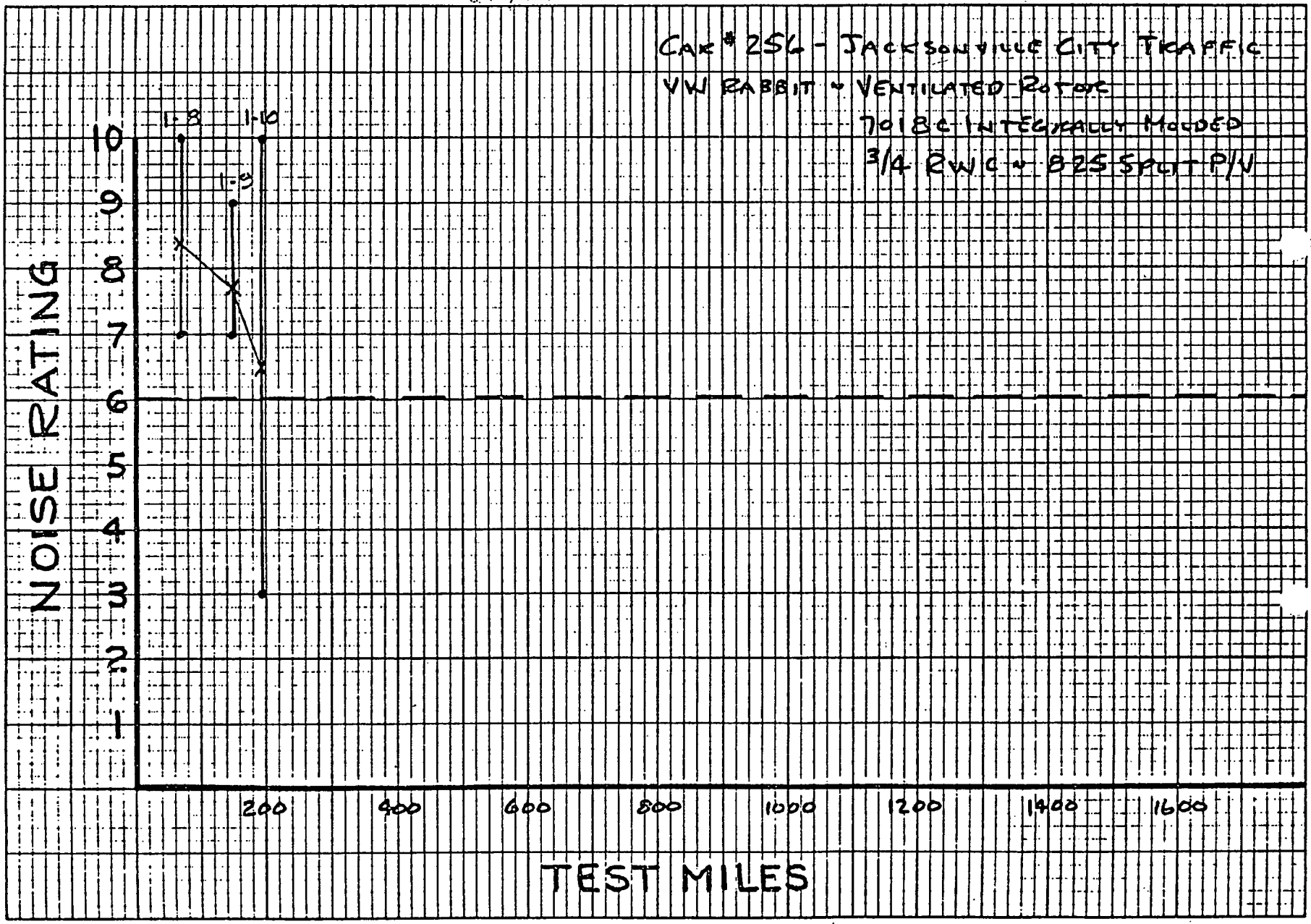


SC1 02308

K+E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 0780

900 miles heat dissipation tests
temp over 150°C



SC1 02309

Abex

January 12, 1978

SUBJECT: Abex Report - "L" Car Brake

There are two areas of work to report on:

1. Rotor Analysis
2. Dynamometer Temperature/Wear Test

1. Rotor Analysis

1.1 Brinell Hardness

		Rubbing Surface	Internal
Production	X47	187	170-174
"	X49	207	179-187
"	X57	217	196-207
"	Prod. 7018C	192	179-187
Prototype	Unknown	187	170-179

All values for the rubbing surface are the average of 4-5 readings. The structures all look normal with 95-99% pearlite. Micros are typical type A graphite. Chemical analysis is being conducted by an outside lab and should be received soon.

1.2 It would be helpful if we knew what lining was tested on the last production and prototype rotors as work is presently being done to study the rotor surface under the SEM.

1.3 We would appreciate knowing what various metallurgical tests Chrysler and Kelsey-Hayes are conducting on their samples. Any suggestions for additional tests would be welcome.

2. Dynamometer Temperature/Wear Tests

Material	Burnish	250°	325°	400°	Rotor
7018Cx57	.0142/.0273	(O/I)			.0035
7018Cx2	.009/.0133	.015/.0255	.0087/.0128	.0093/.0125	.0030
7018Cx1	.0096/.0126	.0182/.0131	.0091/.0211	.0099/.0175	.0034
7018Cx62	.0052/.0096	.0109/.0324	.0071/.0367		.0041

2.1 Our wear seems to be higher than Chrysler's overall and still shows higher inboard wear than the customary outboard high wear. Due to various reasons, we have not run any test beyond 400°. Our tests indicate an average inboard temperature of 50° higher than the outboard which correlates with our consistently higher inboard wear.

2.2 So far, the low density (X62) iron seems to be doing a good job. This is encouraging as it correlates with the theory we have developed from the SEM work.

3. Samples of 7018Cx62 (low density) and x63 (high density) iron have been dropped off.

Bob Nilson

CO-5 Revised 4/76

Date Typed: 1/4/78-1/4/78

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

TYPE OF CALL

RESPONSE REQUESTED ☐

DATE 1/3/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION	D. P. CONLON	99
ADDRESS	CITY	STATE/ZIP
DETROIT, MI.		
		PHONE

OFFICIALS INTERVIEWED

Paul B. Hellens - Senior Product Development Engineer

COMMENTS

A discussion concerning the rotor wear and lining wear problems with 7018C was held. The net result was that Chrysler was going to continue with their program of vehicle testing in Florida, beginning January 4, 1978. They would very much like to have the solution to the lining and rotor wear problems identified but recognize that this may not happen. If the solution does not come forth within a nominal (few days) length of time, Chrysler intends to accelerate their search for a lining to replace 7018C. If a solution can be found Chrysler Engineering would be under less pressure to replace 7018C, especially if some improvement in the noise area can be obtained.

At this point, Chrysler is open to all suggestions from Abex or any other friction material manufacturer. They are willing to test both organic and metallic compounds.

Chrysler would very much like to continue to work with Abex on this program but feels as though a new lining is needed unless the recently identified wear problems with 7018C can be corrected. In my opinion, the full-blown lining development program which was envisioned, has now been advanced. This program was probably six months away if noise was the only problem. With the wear problem now so severe, this six month gestation period has been eliminated.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
SSConway
RENelson
BIwarsson
BMLuts
ADIndelicato
DGManly
GRGraham
CPBiswas
WMMiller
DESteis

SC1 02312

Abex Corporation
An IC Industries Company

FRICTION MATERIALS RESEARCH

Research Center

MAHWAH, NEW JERSEY 07430
TEL: 201-529-3450

July 29, 1980

File

TO: R. E. Nelson

FROM: S. F. Kulis

SUBJECT: Your Comments Regarding the June FPD Monthly Technical Report (Letter to T. F. Merkel of 7/14/80)

RO-80-FP-02

The reason for shipment of four car sets of 916-267 to Chrysler was based on an earlier agreement reached at a Technical Meeting held in Mahwah on March 26 and 27.

Based on Alpha truck DOT testing, 916-267 still looks like a good submission. Pedal efforts are much lower than 916-46 except for the fourth 60 and 80 mph effectiveness tests. The reason for this, as you can see below, is that the pedal efforts drop dramatically for 916-46 after the fade testing. In addition, the 916-267 material had shorter stopping distances of 20 to 40 feet during the 80 mph effectiveness test.

VW Alpha Truck DOT Testing

	Shortest Stop Distance(ft)		Shortest Stop Pedal Effort (lbs)	
	916-46	916-267	916-46	916-267
1st 30 mph	44.4	50.0	81-137	55-55
2nd	43.7	46.1	79-134	59-66
4th	42.0	46.4	112-150	66-76
1st 60 mph	177.4	187.6	102-112	61-64
2nd	175.2	184.0	100-108	50-63
4th	179.0	173.7	64-66	74-99
2nd 80 mph	342.5	323.1	63-76	60-69
4th	346.7	306.9	41-44	63-80
Lt Wt 60	157.7	157.7	47-62	47-64
Non Power 60	216.7	259.5	130-143	135-139
Wear (mm)	0.90	1.03	-	-

Other promising higher friction RBM materials have been submitted for Chase C-1 testing.

Stan Kulis

Stan Kulis

SK:jb

cc: A. D. Indelicato
T. F. Merkel
R. A. Pearce
File: D-989

FRICTION PRODUCTS GROUP
Troy

Berg
File

September 2, 1977

MR. A. D. INDELICATO

SUBJECT: CHRYSLER 7018C

During the L-Car meeting this morning, Chrysler indicated that they were extremely concerned about the tendency of our friction material to delaminate along the friction material - underlayer interface. They have already had one case of a car at the Chelsea Proving Ground, shucking its lining, under non-abusive test conditions. Also, at today's meeting, Chrysler indicated that they felt the level of brake squeal was above commercially acceptable levels. They are proceeding on a crash program to do what they can to reduce the brake squeal. Chrysler has requested that both Kelsey-Hayes and Abex do what they can to eliminate this very worrisome problem. Chrysler realizes that any significant lining changes are of a long term nature, but are interested in whatever suggestions of a "Mechnical" nature we might have. By "Mechanical", Chrysler means such items as slotting, changing rivet location, etc.. I trust that you will forward any suggestions you might have in this area.

I am enclosing four (4) pieces of Chrysler's 7018C material (X1 batch), which Chrysler tested at Pike's Peak. These samples evidence the delamination problem that Chrysler is concerned about. I feel that if Abex is to retain this business for the next model year, this problem will have to be corrected.

Additional feedback from the Pike's Peak test indicates that "crunch" has not been eliminated as we previously thought, based on the Los Angeles test. The correction of the crunch problem is of decidedly lower priority than the squeal correction.

Good luck!

Denis

Denis P. Conlon

jd

cc SSConway, Jr.
RLCutler/AFSchmaltz/File
RENelson
DGManly
GRGraham
CPBiswas
DESteis

SC1 02315

Abex Corporation
An IC Industries Company

FRICTION MATERIALS RESEARCH

Research Center

MAHWAH, NEW JERSEY 07430
TEL: 201-529-3450

July 29, 1980

File

TO: R. E. Nelson

FROM: S. F. Kulis

SUBJECT: Your Comments Regarding the June FPD Monthly Technical Report (Letter to T. F. Merkel of 7/14/80)

RO-80-FP-02

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2nd	43.7	46.1	79-134	59-66
4th	42.0	46.4	112-150	66-76
1st 60 mph	177.4	187.6	102-112	61-64
2nd	175.2	184.0	100-108	50-63
4th	179.0	173.7	64-66	74-99
2nd 80 mph	342.5	323.1	63-76	60-69
4th	346.7	306.9	41-44	63-80
Lt Wt 60	157.7	157.7	47-62	47-64
Non Power 60	216.7	259.5	130-143	135-139
Wear (mm)	0.90	1.03	-	-

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Stan Kulis

SK:jb

cc: A. D. Indelicato
T. F. Merkel
R. A. Pearce
File: D-989

FRICTION PRODUCTS GROUP
Troy

Betty
File

September 2, 1977

MR. A. D. INDELICATO

SUBJECT: CHRYSLER 7018C

During the L-Car meeting this morning, Chrysler indicated that they were extremely concerned about the tendency of our friction material to delaminate along the friction material - underlayer interface. They have already had one case of a car at the Chelsea Proving Ground, shucking its lining, under non-abusive test conditions. Also, at today's meeting, Chrysler indicated that they felt the level of brake squeal was above commercially acceptable levels. They are proceeding on a crash program to do what they can to reduce the brake squeal. Chrysler has requested that both Kelsey-Hayes and Abex do what they can to eliminate this very worrisome problem. Chrysler realizes that any significant lining changes are of a long term nature, but are interested in whatever suggestions of a "Mechnical" nature we might have. By "Mechanical", Chrysler means such items as slotting, changing rivet location, etc.. I trust that you will forward any suggestions you might have in this area.

I am enclosing four (4) pieces of Chrysler's 7018C material (X1 batch), which Chrysler tested at Pike's Peak. These samples evidence the delamination problem that Chrysler is concerned about. I feel that if Abex is to retain this business for the next model year, this problem will have to be corrected.

Additional feedback from the Pike's Peak test indicates that "crunch" has not been eliminated as we previously thought, based on the Los Angeles test. The correction of the crunch problem is of decidedly lower priority than the squeal correction.

Good luck!

Denis

Denis P. Conlon

jd

cc SSConway, Jr.
RLCutler/AFSchmaltz/File
RENelson
DGManly
GRGraham
CPBiswas
DESteis

SC1 02318

Abex

File (1) Chrysler (2) Teves

An IC Industries Company

Memorandum

Date:
September 18, 1980
Subject:
Chrysler K Car Caliper Lining

From:
J. J. Lukas
To:
G. N. Payne, Jr.

In reference to my call to Jack Schram, I found out the following:

1. Bendix D-7163 is released, being used in production and is considered to be just good enough. They have a noise problem causing the use of a lubricant on the shoe's "hammer heads", an insulator on the shoe opposite the lining, and a chamfer on the lining.

2. Cycleweld 8039V is not quite as good as Bendix. It is not yet engineering released, is not yet being used in production, and it will not be, at least until October 1, when damped iron rotors are available. Even then, if used, it will only be used on power braked cars. Power brake usage is estimated at 78%.

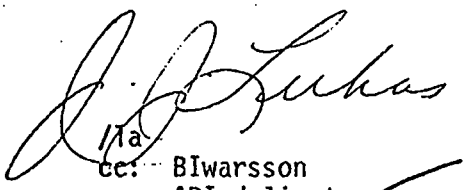
3. Regardless that Bendix FMD has been promised 50% of the business, and is now supplying 100%, and Cycleweld is still trying, Jack advised we could be sourced if we came up with a better lining. By "better" he said improved fade resistance and more effective. We did not even discuss noise but I am sure it is a given and any material has to meet the normal noise requirements.

   I questioned if our providing samples to his department in Highland Park and Teves here in Troy was sufficient participation in order for us to get the business and he said "no." He suggested we test on a K car. As a further encouragement, Jack said the K will be heavier in 1983 and there will be heavier derivatives of the car. Besides the passenger car in 1984, they plan a T-115 van-type truck (using a 60 mm brake) to be sold in rather high volumes which also would need a better than D-7163 lining material. He said he could not provide us with a car; he is having problems getting enough for his own work.

4. Jack advised that all design responsibility is in Highland Park for Chrysler and is primarily aimed at domestic vehicles although it is also their responsibility to make sure their cars meet the local regulations where they export, such as Europe and Mexico.

For the benefit of those copied, most of the above was also obtained earlier from Martin Rowell, of Teves. During our conversation with Martin we advised him of our good results with 916-278.

In a discussion with Al Indelicato today we agreed that you should write an Experimental Order to provide 916-278 for Bethke in Essen, Hellens at Chrysler, and Rowell at Teves. Further action to procure a car for our own use will be delayed until our Purchasing Meeting with Redford and Woolpert on Wednesday, September 24.



lla

cc: BIwarsson
ADIndelicato
JWMcCool
RENelson
TFMerkel
RAPearce
GKManghi
ELPNofer
HBethke

MEMORANDUM
CO-14 REV. 12-54

Note: Please use reverse side for answer, if necessary.

DATE March 30, 1977

TO: Dolly Anderson (NAME) Purchasing (LOCATION)

FROM: Joe Van Marcke

SUBJECT: Super Carbide Tool Bits (Chrysler X-7018BB Project)

It is imperative that we get 1/4" carbide tool bits as soon as possible!! Maximum allowable delivery date - one week. This is for an extremely urgent project in which in just the last day or two the requirements of disc pads needed went from 250 to 1,050 pieces. Please do everything possible to get the tool bits in as soon as possible even if you have to contact other suppliers than McKee.

Joe Van Marcke

cc: A.D. Indelicato

File: Chrysler ✓

X-7018BB

SC1 02321

FRICTION PRODUCTS GROUP
Troy

May 11, 1978

MR. A. D. INDELICATO
WINCHESTER

SUBJECT: CRACKED L-CAR PARTS

During my visit to the Kelsey-Hayes, Jackson plant on 5/10/78, I was presented with the following examples of cracked material:

Puck #1

The friction material separated from the organic underlayer while the pad was being assembled in the caliper. The material successfully completed Kelsey-Hayes's 100% inspection after drilling, the insulating gasket was bonded to the back of the shoe and the shoe and lining assembly was handled to the point at which it was to be introduced into the caliper. At that point, the material fell off the shoe. Needless to say, Kelsey-Hayes was very disturbed by this. Please note that there is no metallic friction material attached to the organic underlayer. Kelsey-Hayes is under the impression that this is due to an insufficient amount of adhesive being applied to the underlayer.

Puck #2

This is another example of the friction material completely separating from the organic underlayer. I do not know when this separation occurred, but it was somewhere between the drilling and bonding operations. In this case, there appeared to be a reasonable amount of friction material remaining on the organic underlayer. Please note that there is a significant lip along the outside diameter of the organic underlayer. I am not sure what the print specification is concerning the underlayer thickness, but this piece appears to be too thick to be within spec.

Puck #3

This is an example of some severely cracked material immediately after drilling. I noticed nothing particularly unusual about this piece except that the crack appears to run along most of the outside diameter of the puck.

SC1 02322

On pucks #2 and #3, the beveling around the outside diameter of the counterbore hole, indicates to me that perhaps the drill bits were not adequately sharpened. Do you agree with this? These marks are noticeably absent from puck #1, however. As you know, Kelsey-Hayes has been receiving pucks from Winchester with cracks in them. This has completely negated our argument that the vast majority of the post drilling cracks are caused by the drilling operation. However, for my own information, I would be very interested in your thoughts as to the relationship between this beveling and an inadequately sharpened drill bit.

Denis P. Conlon

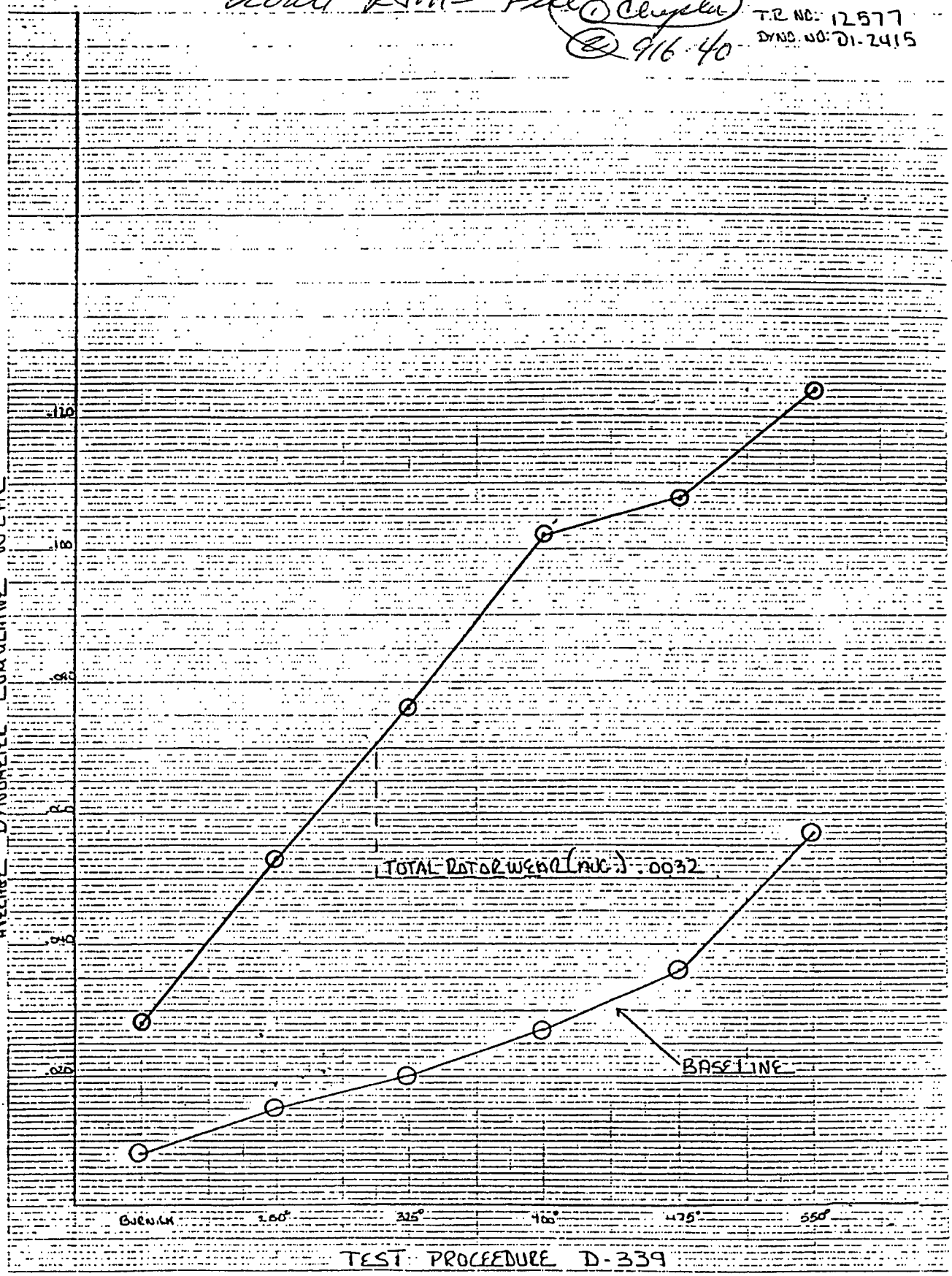
jd

enc.

cc RLCutler/AFSchmaltz/File
BIwarsson
HBecker

~~A. D. Indelicato~~
Rock RJM - File ① Chrysler
② 916-40

MATERIAL: 916-40X1
DATE: 6-14-78
T.R. NO.: 12577
DYNO. NO.: D1-2415



46 1331

SC1 02324

...ENGINEERING TEST DEPT. - RESEARCH CENTER - MARHAM, NEW JERSEY

650- Rev. 9/66 **DYNAMOMETER WEAR SHEET**

Material 916-40 X1 Page No. 1

Procedure D339 T.R. No. 12577 Test No. D1-2415

Wear Loss Check No. INITIAL By [illegible] Date 6/14/78

Measurements taken after Step No. ____ Test ____

	IN PRIMARY			OUT SECONDARY		
-1	6447	-6		11 6448	-16	
-2	6450	-7		12 6445	-17	
-3	6433	-8	WT 288.73g	13 6437	-18	WT 295.07
-4	6476	-9		14 6508	-19	
-5	6500	-10		15 6499	-20	
VG.	.6461	AVG.		AVG. 6467	AVG.	.6464

____ Primary Loss ____ Secondary Loss ____ Average Loss ____

Material Condition: NEW

Drum Condition REGROUND

			IN		OUT	
BHN	1 007	WT 3060	1	4604	1	4603
	2 012		2	4603	2	4608
	3 207		3	4602 4604	3	4606 4608
Test Stopped By:	4 207	Reason:	4	4605	4	4610

Wear Loss Check No. — By Carla M. Date 6/15/78

Measurements taken after Step No. #5 Test EFF

	PRIMARY			SECONDARY Burnish		
1	6220	-6		6 N 6060	-16	
2	6151	-7	WT. 281.70g	7 12 6155	-17	WT. 288.04 g
3	6114	-8		8 13 6188	-18	
4	6264	-9		9 14 6188	-19	
5	6207	-10		10 15 6295	-20	
S.	6191	AVG.		AVG. 6177	AVG.	6184

____ Primary Loss .0290 Secondary Loss .0290 Average Loss .0280

Material Condition: Disc

Drum Condition

	IN		OUT		Disc. WT.
1	~~4608~~	4603	~~4605~~	4602	3060
2	~~4608~~	4582 4602	~~4605~~	4578 4605	
3	~~4598~~	4602	~~4605~~	4605	
4	~~4605~~	4603	~~4605~~	4602	

Test Stopped by: ____ Reason: ____

SC1 02325

ABEX CORPORATION - ENGINEERING TEST DEPT. - RESEARCH CENTER - MAHWAH, NEW JERSEY

3650 Rev. 9/66

DYNAMOMETER WEAR SHEET

Material 516-40 X1 Page No. 2

Procedure D339 T. R. No. 125-77 Test No. D1-245-

Wear Loss Check No. ____ By WD Date 6-12-78

Measurements taken after Step No. 7 Test ____

	PRIMARY (IN)			SECONDARY (OUT) 250°		
-1	6032	-6	WT 273.20	5937	-16	WT 273.15
-2	5905	-7		5875	-17	
-3	5952	-8		5933	-18	
-4	6023	-9		5931	-19	
-5	5863	-10		6058	-20	
AVG.	5925	AVG.		5947	AVG.	5936

Primary Loss 0266 Secondary Loss 0230 Average Loss 0248

Material Condition:

Drum Condition	IN		OUT		DISC WT 3060
1	4604	4604	1, 4608	4608	
2	4604		2, 4608		
3	4602		3, 4606		
4	4604		4, 4608		

Test Stopped by: ____ Reason: ____

Wear Loss Check No. ____ By DD Date 6-16-78

Measurements taken after Step No. 9 Test ____

	PRIMARY			SECONDARY 325°		
1	5845	-6		5462	-16	
2	5732	-7	WT 265.71	5714	-17	WT 272.14
3	5730	-8		5755	-18	
4	5801	-9		5608	-19	
5	5552	-10		5860	-20	
AVG.	5732	AVG.		5679	AVG.	5706

Primary Loss 0193 Secondary Loss 0268 Average Loss 0231

Material Condition:

Drum Condition	IN		OUT		DISC WT 3060
1	4599	4601	1 4600	4600	
2	4600		2 4600		
3	4601		3 4600		
4	4602		4 4600		

Test Stopped by: ____ Reason: ____

SC1 02326

ABEX CORPORATION - ENGINEERING TEST DEPT. - RESEARCH CENTER - MAHWAH, NEW JERSEY

550 Rev. 9/66

DYNAMOMETER WEAR SHEET

Material 916 -40 X1 Page No. 3

Procedure D 339 T.R. No. 12577 Test No. D1-2415

Wear Loss Check No. 11 By Carl Date 6/17/78

Measurements taken after Step No. #11 Test Wear

400°

	PRIMARY				SECONDARY		
1	5654	6		11	5216	16	
2	5662	7	WT. 258.59 g	12	5375	17	WT. 265.22 g
3	5219	8		13	5539	18	
4	5609	9		14	5308	19	
5	5301	10		15	5591	20	
AVG.	5489	AVG.		AVG.	5406	AVG.	5448

11 Primary Loss 0243 Secondary Loss 0273 Average Loss 0258

Material Condition: IN OUT Disc WT 3060

Drum Condition	IN		OUT	
1	4575		4574	
2	4571	4573	4574	4575
3	4571		4575	
4	4573		4575	

Test Stopped by: Reason:

Wear Loss Check No. 14 By T.P. Date 6/12/78

Measurements taken after Step No. 13 Test Wear

475°

	PRIMARY				SECONDARY		
1	5620	6		11	5176	16	
2	5383	7		12	5340	17	
3	5177	8	WT. 257.14 gms	13	5431	18	WT. 262.71
4	5572	9		14	5325	19	
5	5260	10		15	5552	20	
AVG.	5402	AVG.		AVG.	5365	AVG.	5384

Primary Loss 0087 Secondary Loss 0041 Average Loss 0064

Material Condition: IN OUT

Drum Condition	IN		OUT	
1	4601		4573	
2	4562	4582	4575	4570
3	4582		4564	
4	4583		4569	

Test Stopped by: Reason:

SC1 02327

ENGINEERING TEST DEPT. - RESEARCH CENTER - MAHWAH, NEW JERSEY

550 Rev. 9/66

DYNAMOMETER WEAR SHEET

Material 916 -40 X 1 Page No. 4

Procedure D 339 T. R. No. 12577 Test No. D1 -2415

Wear Loss Check No. _____ By Carl K. Date 6/20/78

Measurements taken after Step No. #15 Test Wear 550°

	PRIMARY				SECONDARY		
1	5511	-6		6 11	5005	-16	
2	5230	-7	WT. 252.49 g	7 12	5221	-17	WT. 256.86
3	5038	-8		8 13	5328	-18	
4	5271	-9		9 14	5073	-19	
5	5180	-10		10 15	5435	-20	
G.	5246	AVG.		AVG.	5214	AVG.	0523

Primary Loss 0158 Secondary Loss 0151 Average Loss 0155

terial Condition:

	IN			OUT		
1	4580		1	4599		Disc WT.
2	4561	4574	2	4572	4575	3057
3	4575		3	4563		
4	4580		4	4565		

m Condition

st Stopped by: _____ Reason: _____

Wear Loss Check No. _____ By _____ Date _____

Measurements taken after Step No. _____ Test _____

PRIMARY			SECONDARY		
-6		11	-16		
-7		12	-17		
-8		13	-18		
-9		14	-19		
-10		15	-20		
AVG.		AVG.		AVG.	

Primary Loss _____ Secondary Loss _____ Average Loss _____

rial Condition: _____

Condition _____

Stopped by: _____ Reason: _____

SC1 02328

FRICTION PRODUCTS GROUP
Winchester

Chrysler

June 1, 1978

To: V. Fox

Subject: L-Car Pucks IM Preforms

Please process the approximately 25-30,000 IM preforms using the current puck process (rubber backed).

Grind off the IM backing prior to complete finish of part to assure properly cleaned up friction surface.

This order must be processed and held separate through all operations.

Apply new job ticket number and report to Quality Control and Inspection.

Inspection is to handle separate and keep tract of all scrap generated with this lot.

HB

Horst Becker

HB/djt

cc: E. F. Potts
J. C. Thomas
J. Lohr
D. Payne

Ticket issued dated 6/12/78
Ticket # 23270 for 25,000 pcs. For
conversion of L-Car I/m preform to
L-Car puck

J. C. Thomas Jr.
6/12/78

SC1 02329

FRICTION PRODUCTS GROUP
Winchester

June 1, 1978

Earl.
Has this been tried yet? If so by whom.
Thanks.
ADS.

TO: V.L. Fox
J.C. Thomas, III
H. Becker

Please be advised that the "L" Car IM preforms will be used for regular "L" Car puck production. Please implement this as soon as possible and advise me when completed.

E.F. Potts

E.F. Potts

EFP/dh

cc: J.F. Hinel
A.D. Indelicato

Yes
Test by VLF
AND H. Becker
EFP
6/2/78

SC1 02330

ENGINEERING TEST CENTER

ACX

Chrysler

TO: Mr. Rick McGill

DATE: May 26, 1978

Enclosed is the vehicle test report on 916-33A3 material run on the Plymouth Horizon in accordance to the FMVSS 105 regulation.

This material passes the regulation with a considerable margin, however, the rotors showed considerable scoring for this short test.

If you have any further questions, please do not hesitate to contact me.

Don Steis

kl

cc: ADI
SK
RAP
REN

No Data

SC1 02331

FRICTION PRODUCTS GROUP
Winchester

April 20, 1978

To: A. Indelicato

Subject: Chrysler L-Car I.M. Assembly

I received verbally by telephone through Dennis Conlon, that Kelsey-Hayes has approved my request for drawing change of the following:

	Present Spec.	Requested Spec.
Parallel	.005 Inches	.010 Inches
Flatness	.005 Inches	.010 Inches
Steel Back Orientation	Ident. Symbol on Backside	Ident. Symbol on Fric. Side

The foregoing is now being presented to Chrysler by Kelsey-Hayes for their approval. This letter is not a production approval, but merely used for general information. We must receive the drawing change to proceed with production.

The above would wipe out deficiencies that were present in the initial sample presentation to Kelsey-Hayes. What is needed right now is Gogan and S.P.G. range.

H. Becker D.J.T.
Horst Becker

HB/djt

cc: E. F. Potts
J. W. Powe
W. Thomas

MEMORANDUM
CO-14 REV. 12-54

Note: Please use reverse side for answer, if necessary.

DATE 4-19-78

TO: NAME R. McGill LOCATION

FROM W Thomas

SUBJECT CHRYSLER "L" IM ASSEMBLIES

PLEASE PROVIDE TWENTY ASSEMBLIES WHICH I HAVE PROVIDED STEEL BACKS ~~OF~~ FOR.
NEED A.S.A.P. FOR EVALUATION OF STEEL.

C.L.B.
A.I. ✓

SC1 02333

NC - H Becker
File

FRICTION PRODUCTS GROUP
Winchester

April 21, 1978

To: A. D. Indelicato

Subject: Chrysler L-Car I.M. Assembly

We are in need of gogan and specific gravity specifications to present to Kelsey-Hayes and/or Chrysler. Information that Quality Control has obtained reads as follows, but should not be used to set the standard or should be expanded out far enough that we can live up to what we are saying:

Range On Pucks

Gogan	15-38
S.P.G.	2.82-3.1 g/cc

For the I.M. assemblies, I suggest we open up the S.P.G. 2.8-3.15 g/cc. The gogan range should be 15-40.

The information gathered at this point should be viewed as preliminary and so presented to Kelsey-Hayes and Chrysler.

We will finalize the specification upon establishment of enough production experience.

H. Becker
Horst Becker D.J.T.

HB/djt

cc: E. F. Potts
J. W. Powe
P. H. Grim
W. Thomas

Hold off on any changes for now. We will meet w/ Chrysler Re: I-M. 7018C 4/24/78.

ADS 4/21/78

SC1 02334

Chrysler

Mr. A.D. Indelicato, Jr. ✓
Winchester Office

There were in our mail, and I
do not know where they belong.

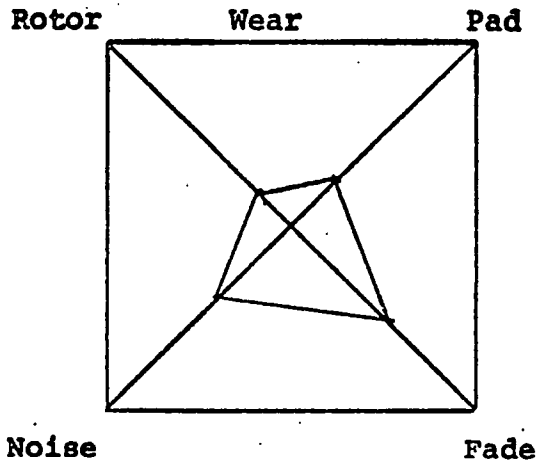
betty cunningham
1 May 1978

ASEX

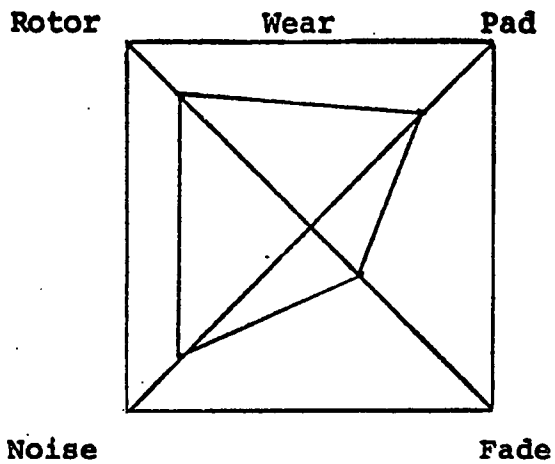
PROPERTY COMPOSITION ANALYSIS

	7018C					916-23					916-31			
	Metal Matrix A	Inorg. Mod. A	Filler A + B	Org. Mod. A		Metal Matrix A + B	Inorg. Mod. B + C	Filler A + B	Org. Mod. NONE		Metal Matrix A + B	Inorg. Mod. B + D	Filler C	Org. Mod. B
Structure	-					+					+			+
Noise	-	-				+	-				+	+		+
Rotor Wear		-	-			+	+	-			+	+		
Pad Wear		-	-			+	+	-			+			-
Stability		+	+				+	+				+	+	
Dust	-	-	-			+	+	-			+	+		
Effectiveness		+	+			+	+				+	+		
Fade		+		-			-							-

7018 BB

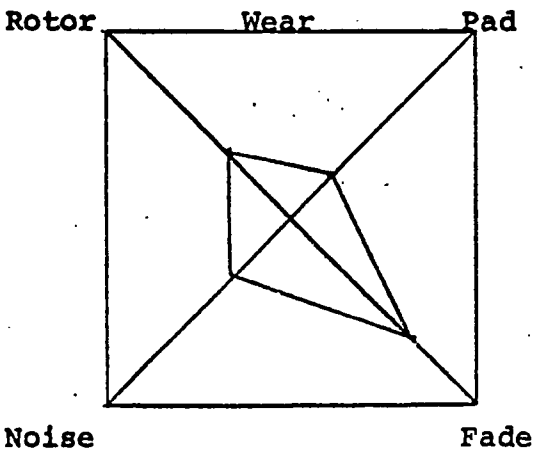


7018 C

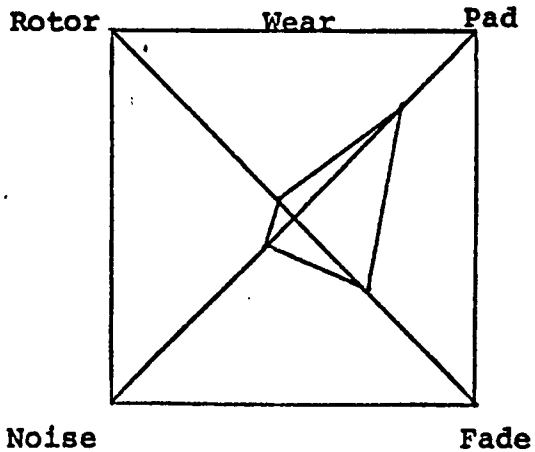


ASEX

916-23



916-31



PAGE 4

SC1 02337

ABEX

TEST PROGRAM
DYNAMOMETER/VEHICLE

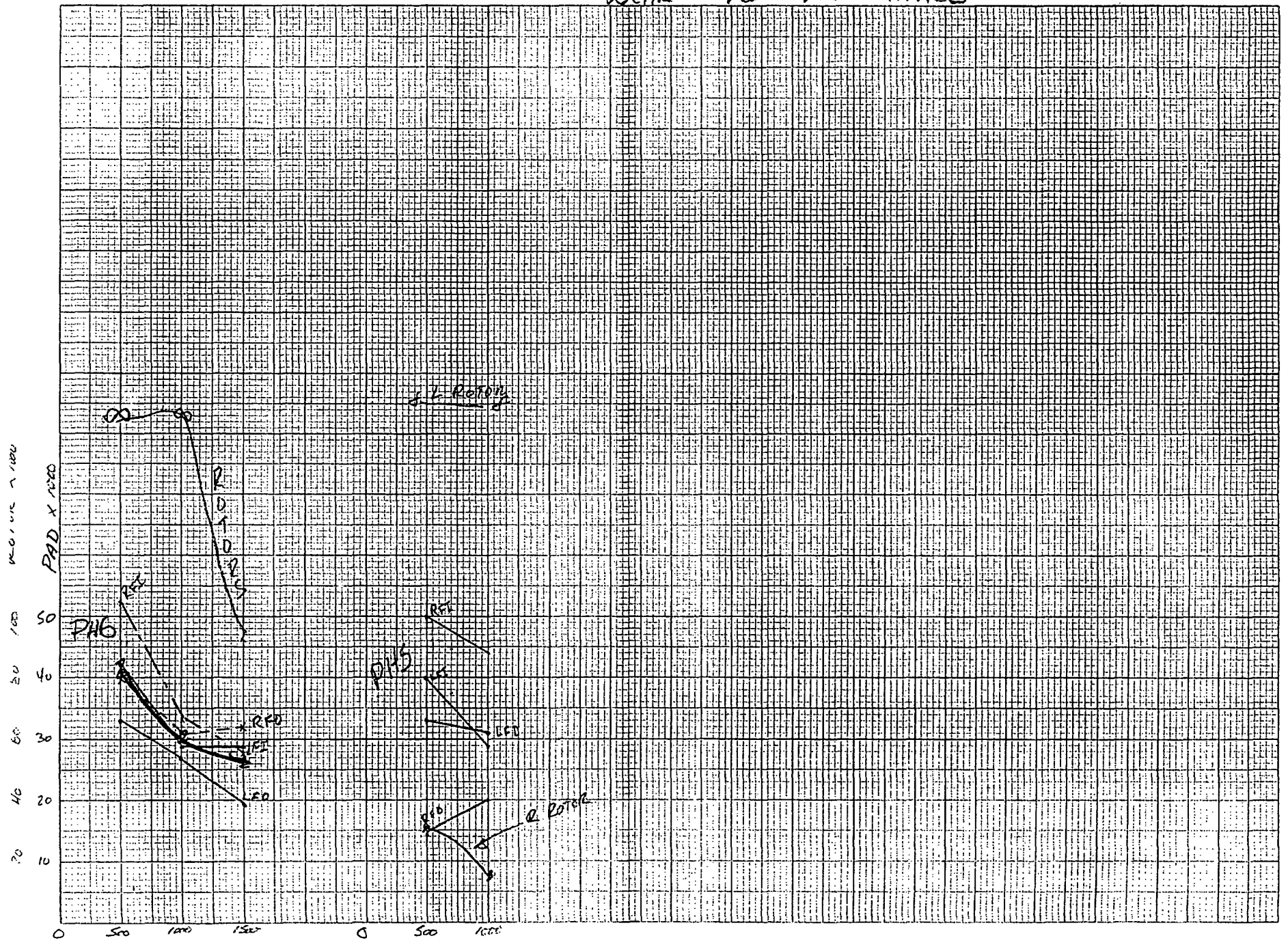
	M 4/24	T 4/25	W 4/26	T 4/27	F 4/28	S 4/29	S 4/30	M 5/1	T 5/2	W 5/3	T 5/4	F 5/5	S 5/6	S 5/7
105 Dynamometer	DOT	DOT	DOT	DOT	TEMPERATURE WEAR				TEMPERATURE WEAR			DOT PR	DOT PR	
Dynamometer Temp/Wear	TEMPERATURE WEAR				TEMPERATURE WEAR				TEMPERATURE WEAR			TEMPERATURE WEAR		
Vehicle Gen. Endurance	2,000 Miles				2,000 Miles				2,000 Miles			2,000 Miles		1,300 Miles

	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21
105 Dynamometer	DOT PR	TEMP. WEAR PROD.			TEMP. WEAR PROD.				TEMP. WEAR PROD.					
Dynamometer Temp/Wear		TEMP. WEAR PROD.			TEMP. WEAR PROD.				TEMP. WEAR PROD.					
Vehicle Gen. Endurance	700	2,000 Miles Prod.			2,000 Miles Prod.				2,000 Miles Prod.		2,000 Miles Prod.			

SC1 02338

Page 5

WEAR VS TEST MILES



SC1 02339

CO-230

LTW

		LFO	LFI	RFO	RFI		ROTOR L	ROTOR R		MIL AVG	MIN				
X79 PH5	min/min	30.8	28.6	20.0	44.0		∞	30		30.9	20.0				
	AVG	39.2	45.5	30.1	53.3					42.0	30.1				
X79 PH6	min/min	26.8	28.7	30.9	33.5		∞	∞		29.9	26.8				
	AVG	32.9	42.3	39.8	51.5					41.6	32.9				

SLAT

X79 PH4	min/min	11.4	9.7	15.4	12.4		39.1	∞		12.2	9.7				
	AVG.	13.9	13.3	18.3	22.5					17.0	13.3				
PH1	min/min	12.4	15.4	14.3	12.2		124.8	124.8		13.6	12.2				
PUCKS -	AVG	14.2	17.4	15.7	13.4					15.2	13.4				

SC1 02340

CO-250

7018C x 79 (1M)

	@ 500 Test Miles			@ 1000 Test Miles			
	Avg. Project. miles x 1000	Min Proj. miles		Avg.	Min		
LFO	37.7	NA		37.3	30.8		
LFI	50.0	NA		43.1	28.6		
ROTOR				.000"			
RFO	30.0	NA		28.6	20.0		
RFI	82.0	NA		50.7	44.4		
ROTOR				.002"			
	49.9		X	39.9	30.9		

7018C x 79 1M w/ RIVET C'BORE PATTERN II

	@ 500 Test miles
LFO	NA 22.2
LFI	NA 18.2
ROTOR	.0 —
RFO	NA 20.0
RFI	NA 20.0
ROTOR	0 —
	20.1

SC1 02341

TEST PROGRAM
DYNAMOMETER/VEHICLE

	M 4/24	T 4/25	W 4/26	T 4/27	F 4/28	S 4/29	S 4/30	M 5/1	T 5/2	W 5/3	T 5/4	F 5/5	S 5/6	S 5/7
105 Dynamometer	DOT	DOT	DOT	DOT	TEMPERATURE WEAR				TEMPERATURE WEAR			DOT PR	DOT PR	
Dynamometer Temp/Wear	TEMPERATURE WEAR				TEMPERATURE WEAR				TEMPERATURE WEAR			TEMPERATURE WEAR		
Vehicle Gen. Endurance	2,000 Miles				2,000 Miles				2,000 Miles			1,300 Miles		

	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21
105 Dynamometer	DOT PR	TEMP. WEAR PROD.			TEMP. WEAR PROD.				TEMP. WEAR PROD.					
Dynamometer Temp/Wear		TEMP. WEAR PROD.			TEMP. WEAR PROD.				TEMP. WEAR PROD.					
Vehicle Gen. Endurance	700	2,000 Miles Prod.			2,000 Miles Prod.				2,000 Miles Prod.			2,000 Miles Prod.		

SC1 02342

SC1 02343

	RoT 1/16	PaD mm	Noise 1/16	Fade 3/32
7018BB	4	9	9	8
.C	16	22	17	4
916-23	8	8	7	10
-31	2	22	3	6

Metal
A - Pwd Fe
B - Fe fiber

Filler
A - MoS_2
B - Kyanite
C - $BaSO_4$

Inorg mod
A Al_2O_3
B MgO
C Cr_2O_3
D SiO_2

Organic
A - Stearic
B = Rubber

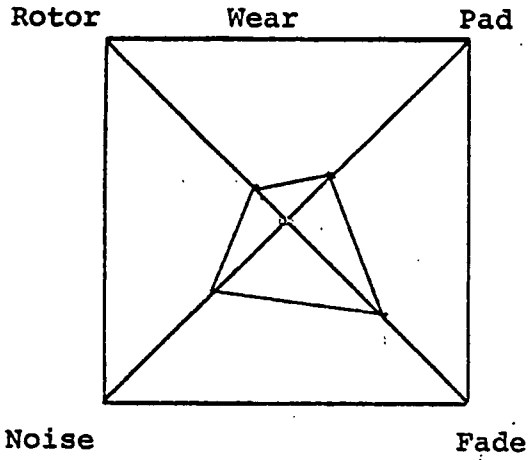
SC1 02344

PROPERTY COMPOSITION ANALYSIS

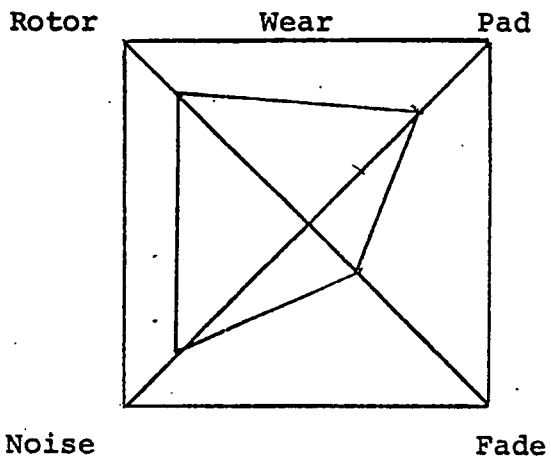
	7018 C					916-23					916-31			
	Metal Matrix A	Inorg. Mod. A	Filler A + B	Org. Mod. A		Metal Matrix A + B	Inorg. Mod. B + C	Filler A + B	Org. Mod. NONE		Metal Matrix A + B	Inorg. Mod. B + D	Filler C	Org. Mod. B
Structure	-					+					+			+
Noise	-	-				+	-				+	+		+
Rotor Wear		-	-			+	+	-			+	+		
Pad Wear		-	-			+	+	-			+			-
Stability		+	+				+	+				+	+	
Dust	-	-	-			+	+	-			+	+		
Effectiveness		+	+			+	+				+	+		
Fade		+		-			-							-

SC1 02345

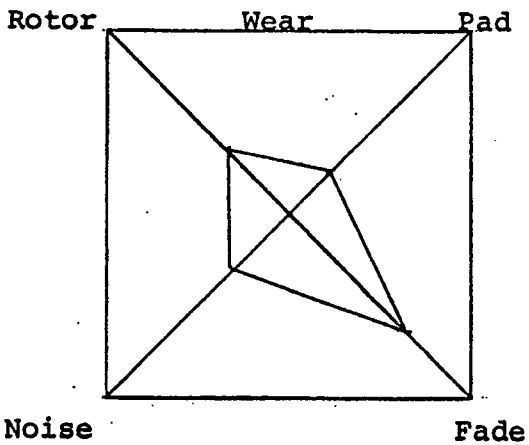
7018 BB



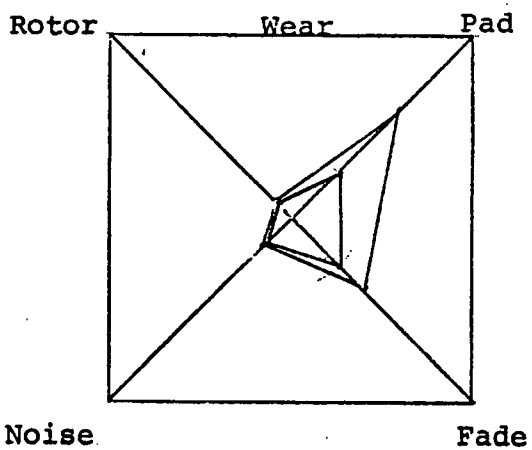
7018 C



916-23



916-31



2.

I. I M Δ
Improves vs puck
ODI x75 problem [illegible] of Fe "over [illegible]" [illegible]

Advantages of I. M
Noise
Struct Integ.
(Wear Chart) Test Procedures [illegible].

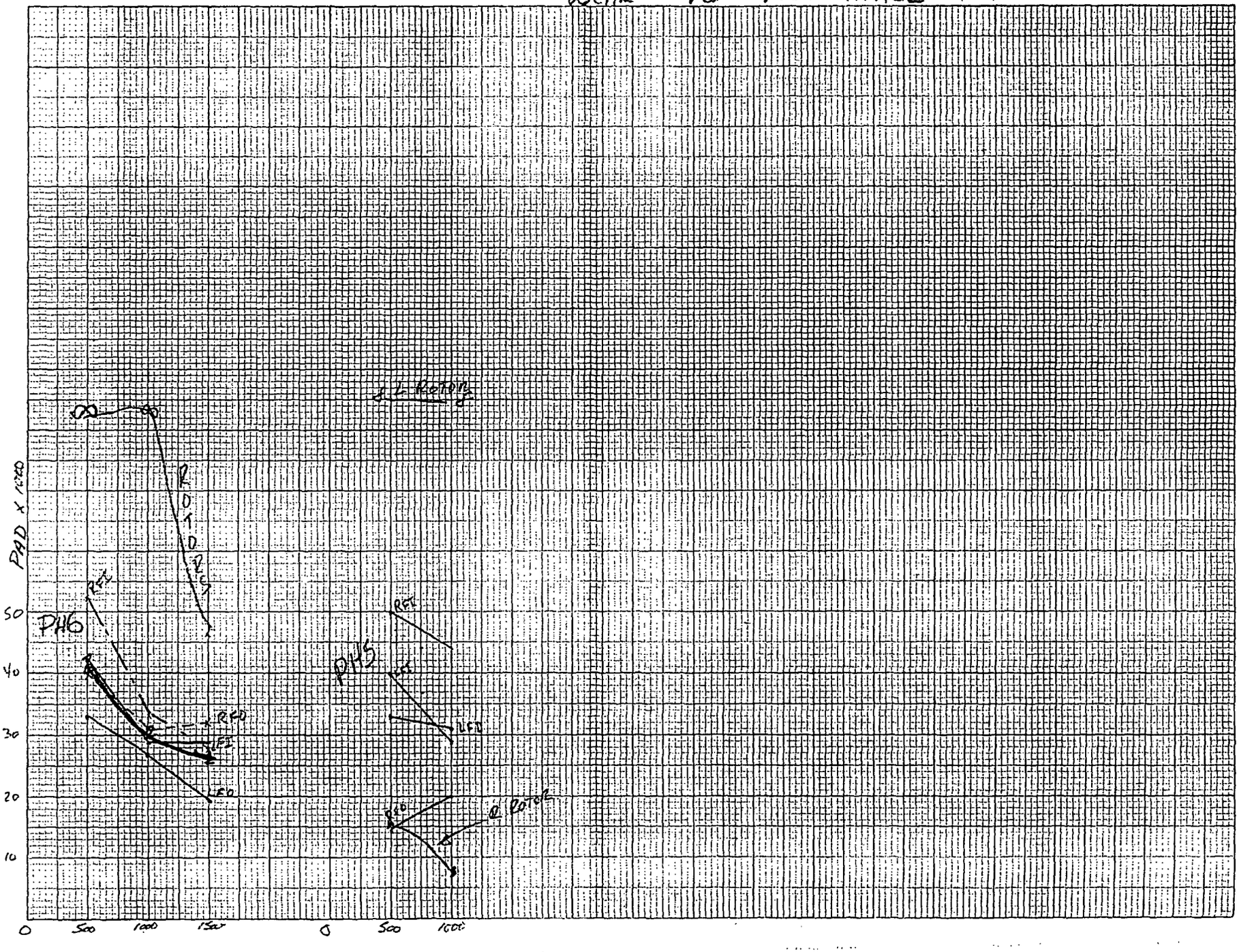
II - Improved Material for L Body -
A. ~~[illegible]~~ Metallic
Today's status (Rap)

SC1 02347

4/26 27 28 29 30 5/1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1 2 3 4
MIN
MAX

K·E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

WEAR VS TEST MILES



SC1 02348

LTW

	LFO	LFI	RFO	RFI		ROTOR L	ROTOR R		MTL AVG	MTL MIN				
X79 PH5 min/max	30.8	28.6	20.0	44.0		∞	30		30.9	20.0				
AVG	39.2	45.5	30.1	53.3					42.0	30.1				
X79 PH6 min/max	26.8	28.7	30.9	33.5		∞	∞		29.9	26.8				
AVG	32.9	42.3	39.8	51.5					41.6	32.9				
				SX-AT										
X79 PH4 min/max	11.4	9.7	15.4	12.4		39.1	∞		12.2	9.7				
AVG	13.9	13.3	16.3	22.5					17.0	13.3				
PH1 min/max	12.4	15.4	14.3	12.2		124.8	124.8		13.6	12.2				
PUCKS - AVG	14.2	17.4	15.7	13.4					15.2	13.4				

SC1 02349

CO-250

7018C x 79 (1M)

	@ 500 Test Miles			@ 1000 Test Miles											
	Avg. Project. miles x 1000	Min Proj. Miles		Avg.	Min										
LFO	37.7	NA		37.3	30.8										
LFI	50.0	NA		43.1	28.6										
ROTOR				.000"											
RFO	30.0	NA		28.6	20.0										
RFI	82.0	NA		50.7	44.4										
ROTOR				.002"											
	44.9		X	39.9	30.9										

7018C x 79 1M W/ RIVET C'BORE PATTERN #1

	@ 500 Test Miles														
LFO	NA	22.2													
LFI	NA	18.2													
ROTOR	.0 —														
RFO	NA	20.0													
RFI	NA	20.0													
ROTOR	0 —														
		20.1													

SC1 02350

Chrysler Meeting 4/25/78

ABEX 7018C LINING EVALUATION

THE FOLLOWING DATA SUMMARY PROVIDES A REVIEW OF THE NOISE, WEAR AND AGGRESSIVENESS CHARACTERISTICS OF ABEX 7018C MATERIAL THROUGH THE DEVELOPMENT PROGRAM WITH RIVETED PIECES, PRODUCTION RIVETED, AND PRODUCTION VOLUME INTEGRALLY MOLDED ASSEMBLIES.

MINIMUM AND AVERAGE LIFE PROJECTIONS ARE BASED ON THE LOW LIFE SHOE ON EACH VEHICLE.

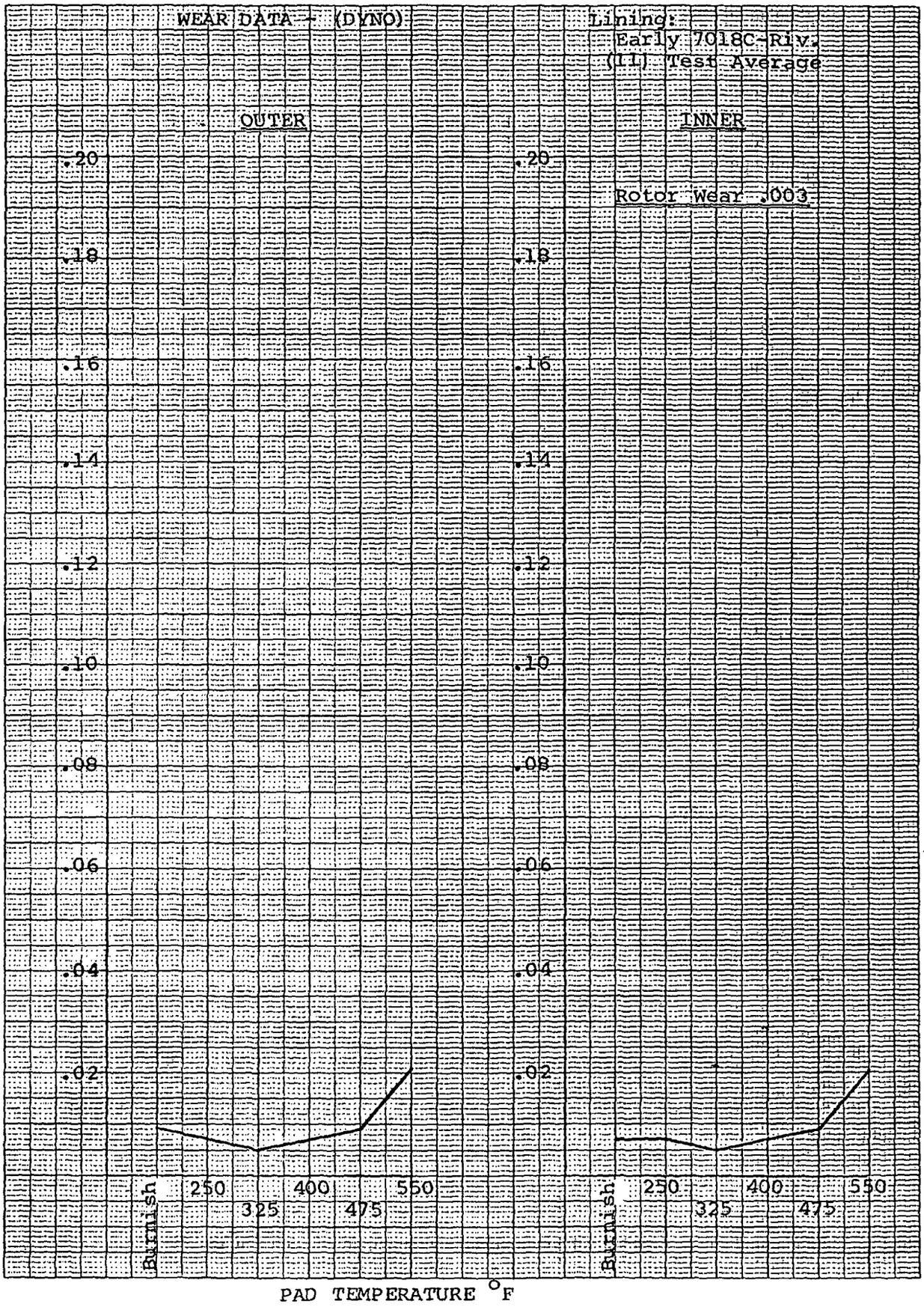
LIFE PROJECTIONS SHOWN UNDER THE ASTERISK ARE THE AVERAGE OF ALL FOUR SHOES ON EACH VEHICLE, HIGHLIGHTING THE IMPLICATIONS OF OUT-OF-BALANCE WEAR DUE EITHER TO LINING INCONSISTENCIES OR CALIPER FUNCTION PROBLEMS.

THE ATTACHED GRAPHS FURTHER ILLUSTRATE DYNAMOMETER WEAR AND VEHICLE NOISE DATA. RAW DATA IS AVAILABLE FOR REVIEW IF REQUIRED.

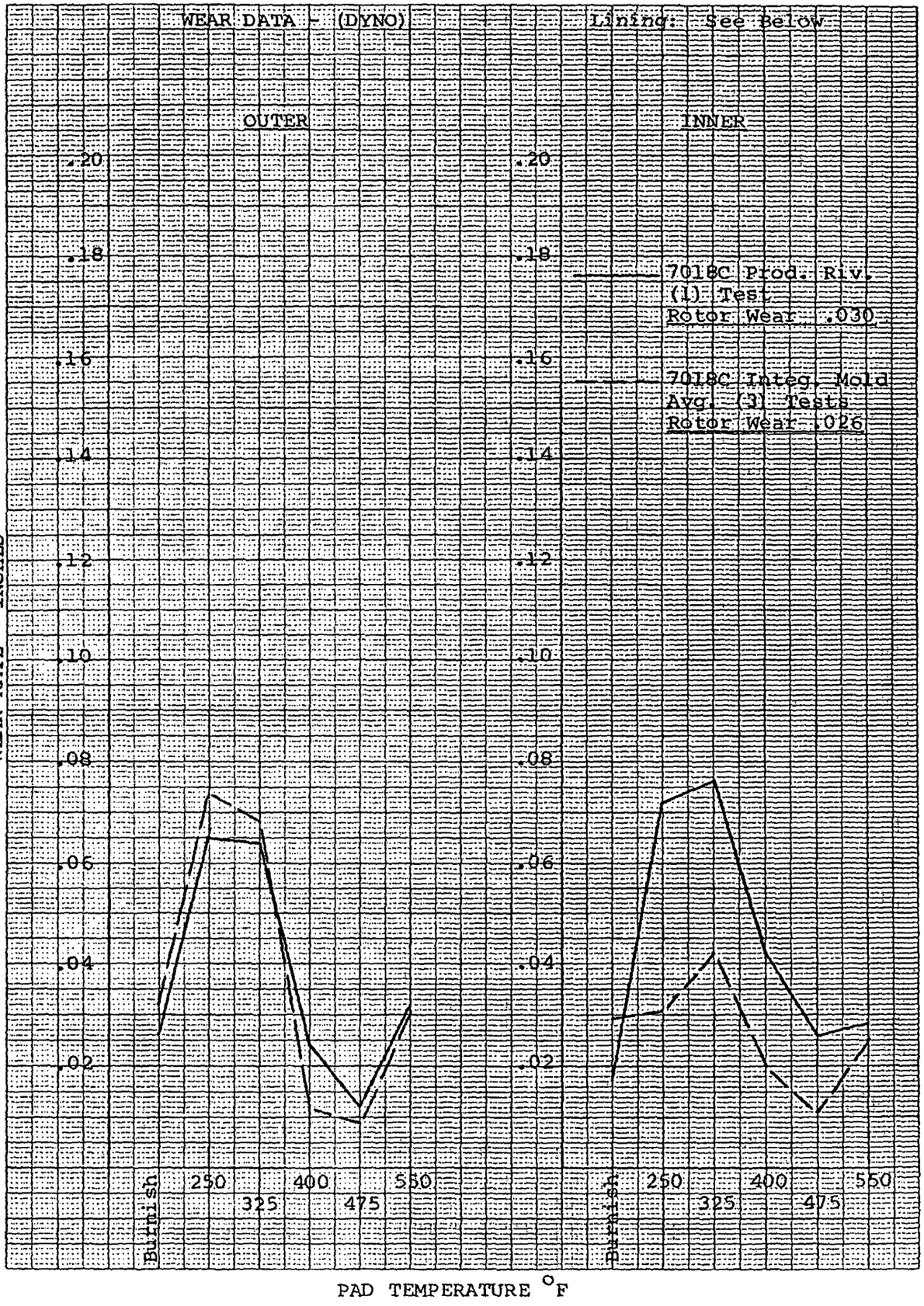
Brake Engineering
April 25, 1978

	Development			Production Riveted			Production Integral		
	Minimum	Average	*	Minimum	Average	*	Minimum	Average	*
Life Projections									
Accelerated General Endurance	15,007	24,840	45,600				4,484	17,620	26,700
Production Car Endurance				6,542	11,141	28,300			
General Endurance	20,800	30,280	48,800				4,484	6,900	14,800
Customer Operation				11,450	69,800	107,000			
Rotor Wear/1000 Miles		.001						.007	.012
Dynamometer	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.
Accumulated Wear O/I	.035/ .039	.057/ .055	.081/ .074		.223/ .261		.220/ .080	.225/ .147	.230/ .193
Rotor Wear		.003	.004		.030			.025	.032
Noise	Low	Avg.	High	Low	Avg.	High	Low	Avg.	High
Florida				2	5-	9	4	6+	9
Detroit City Traffic and P.G.				4	6	9	4	8	10

SC1 02352



46 1510
K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.



461510

10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

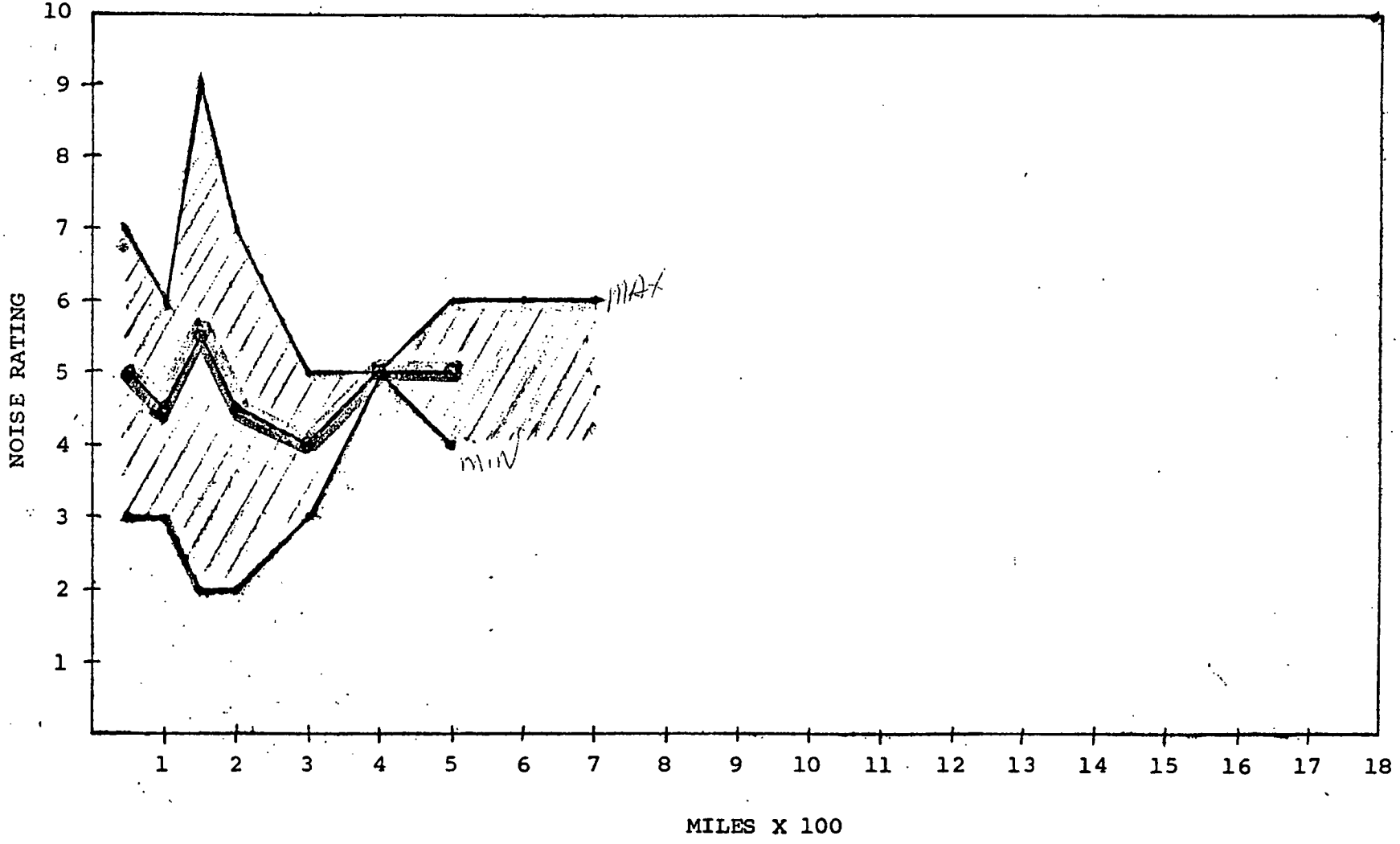
SC1 02354

PRODUCTION Rejected

MAXIMUM - AVERAGE - MINIMUM

FLORIDA TEST CARS

AVERAGE OF THREE CARS



SC1 02355

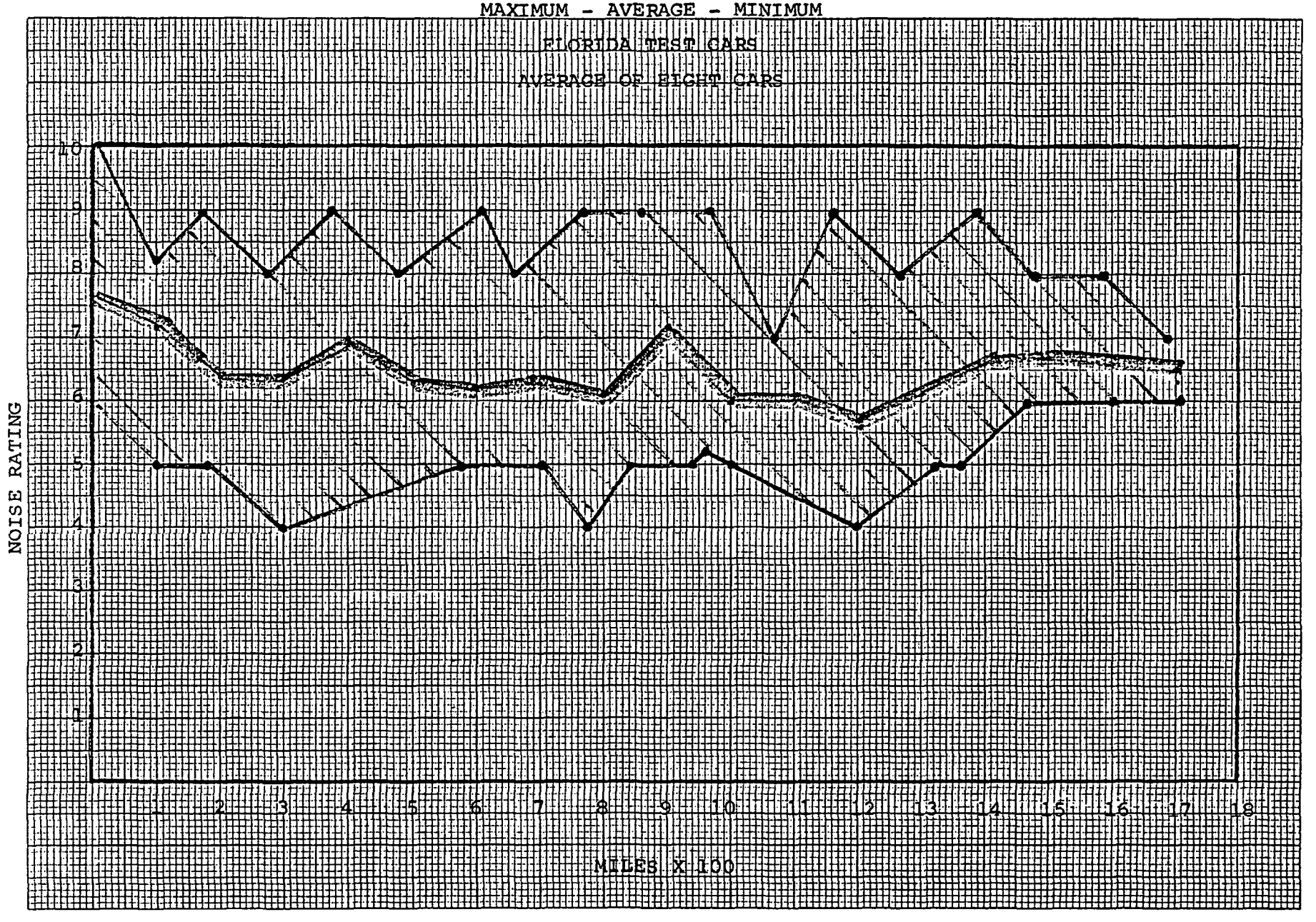
K•E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

IME

MAXIMUM - AVERAGE - MINIMUM

FLORIDA TEST CARS

AVERAGE OF EIGHT CARS



SC1 02356

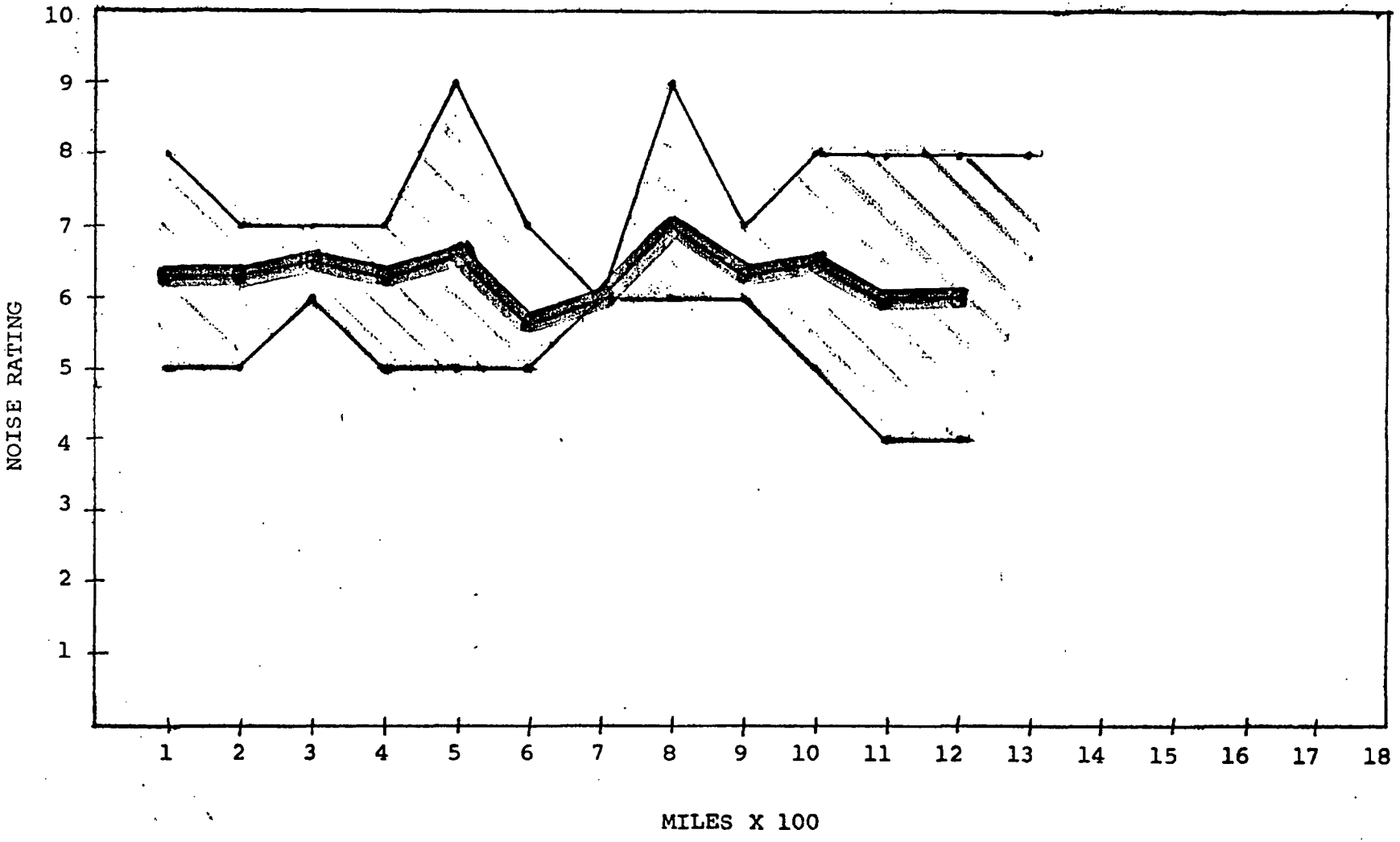
PRODUCTION

MAXIMUM - AVERAGE - MINIMUM

HIGHLAND PARK & PROVING GROUND

TEST CARS

AVERAGE OF THREE CARS

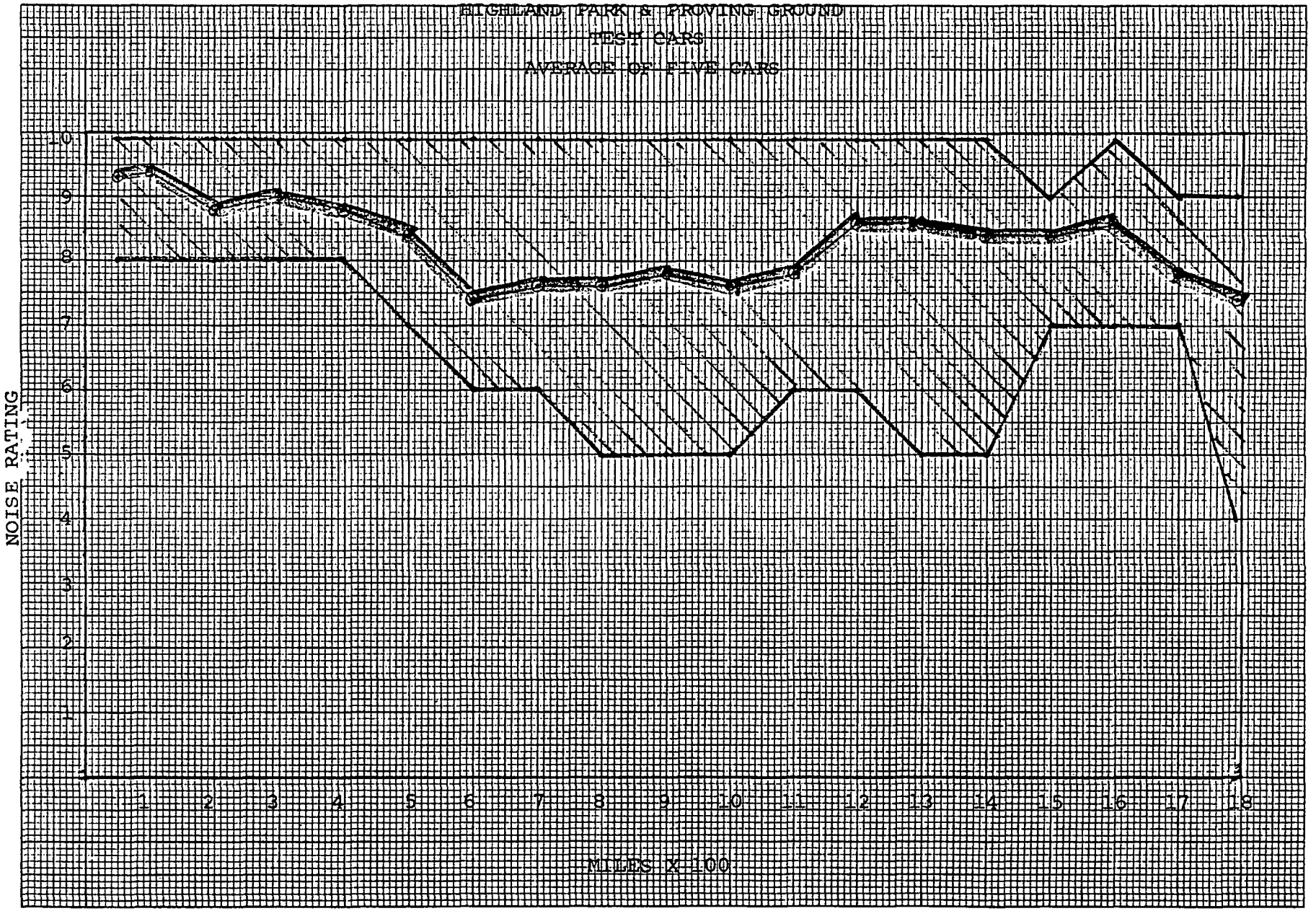


SC1 02357

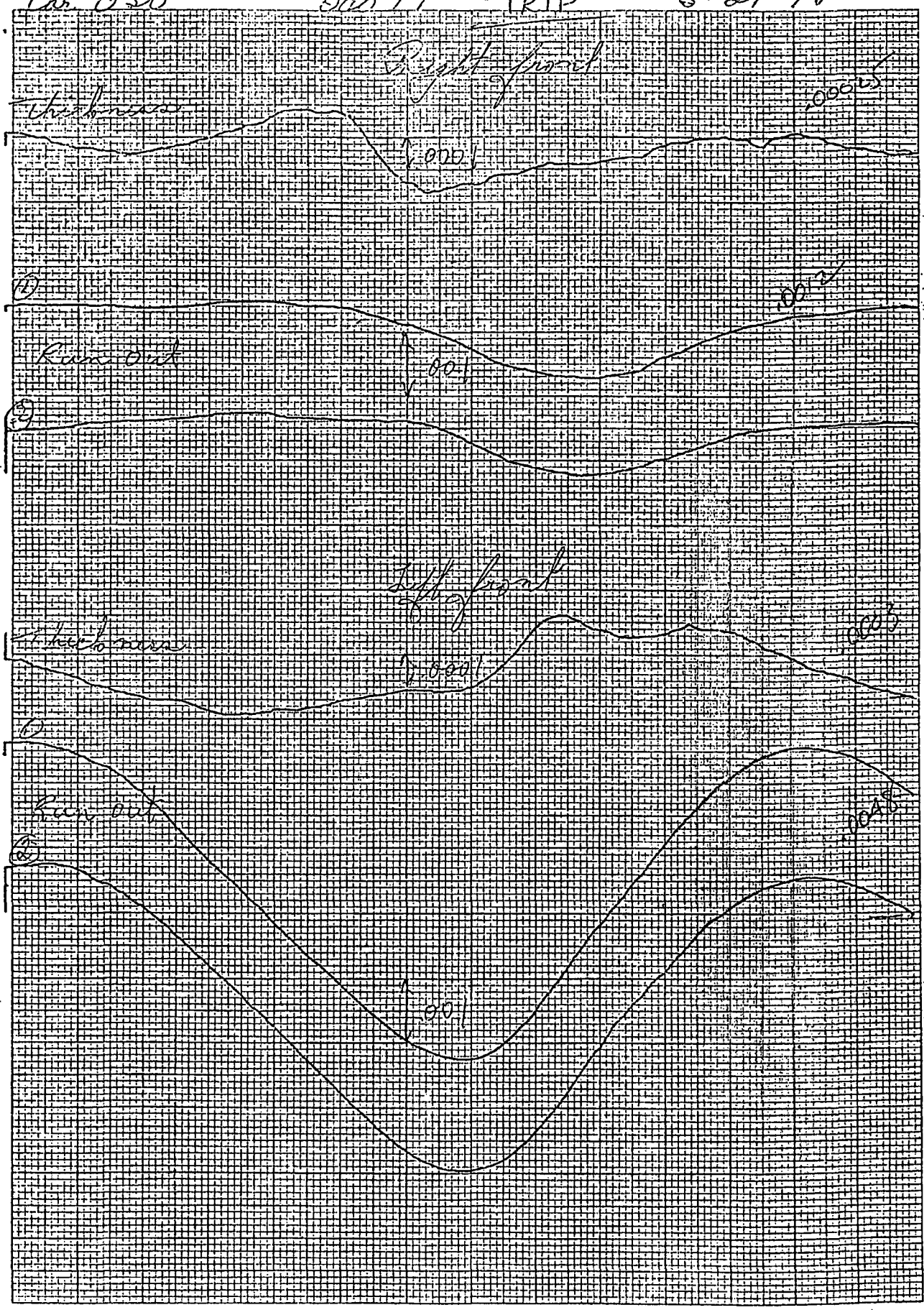
K&E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

IME

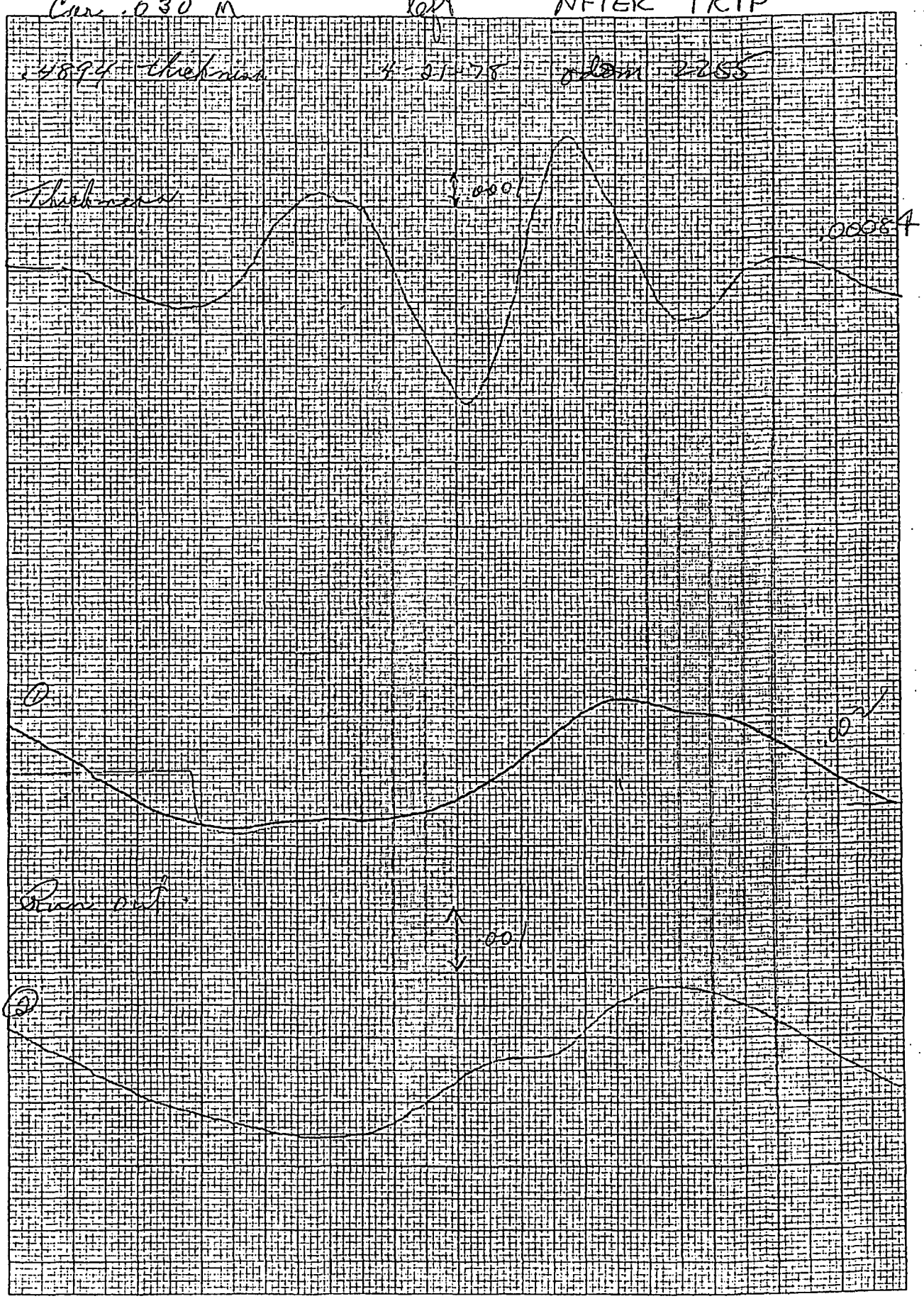
MAXIMUM - AVERAGE - MINIMUM



SC1 02358



46 1323
10 X 10 TO ¼ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



46 1320
K+E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.



46 1320
K&E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

DYNO DATA – WEAR

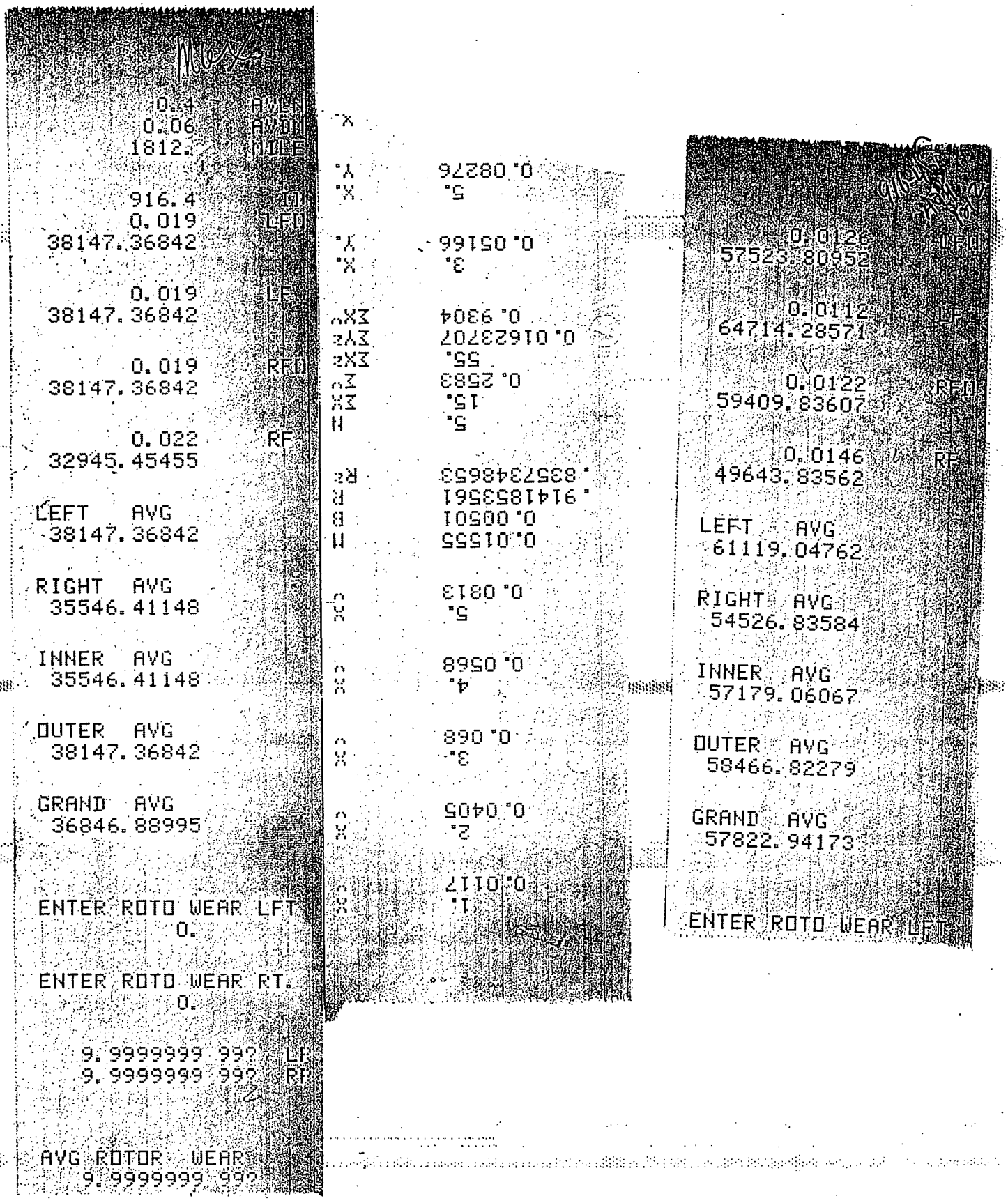
7018C (ABEX)

84-110-7028 PRINTED IN U.S.A.

IDEAL AVG.		ABEX 7018C → CONDITION	BATCH →	1 SINGLE END X2	2 SINGLE END X62	3 SINGLE END X62	4 SINGLE END X62	5 SINGLE END X70	6 SINGLE END X70	7 ½ CAR PROD.	8 SINGLE END X75	9 ½ CAR X79	10 ½ CAR X79
.010		BURNISH	O/I	.008 / .0065	.013 / .0075	.008 / .007	.011 / .006	.029 / .008	.013 / .007	.026 / .017	.011 / .011	.039 / .027	.031 / .030
.015	COLD	250°F	O/I	.040 / .010	.066 / .071	.062 / .069	.042 / .053	.045 / .085	.005 / .008	.065 / .072	.076 / .010	.072 / .060	.079 / .005
.015	COLD	325°F	O/I	.056 / .009	.013 / .067	.062 / .067		.039 / .051	.010 / .049	.064 / .026	.010 / .007	.069 / .057	.061 / .005
.015		400°F	O/I	.008 / .006	.069 / .011	.012 / .016		.009 / .007	.013 / .012	.024 / .042	.010 / .009	.011 / .012	.012 / .007
.015	HEAT	475°F	O/I	.009 / .010	.014 / .012	.011 / .011			.015 / .014	.012 / .026	.014 / .011	.019 / .010	.006 / .010
.015	HEAT	550°F	O/I	.015 / .016	.021 / .019	.013 / .014			.018 / .018	.032 / .028	.027 / .030	.028 / .027	.041 / .023
.085		TOTAL	O/I	.136 / .052	.259 / .215	.168 / .184			.074 / .107	.223 / .261	.207 / .076	.220 / .193	.224 / .080
		SHOE W/GREATER WEAR		O	O	I			I	I	O	O	O
		AVG ROTOR WEAR		.0092	.0393	.0299	–	–	.0076	.0302	.015	.0294	.0166
		TYPE OF ROTOR IF OTHER THAN PROD.					NON PROD.		NON PROD		NON PROD		
		DYNO TEST #		259-5	260-1	261-1	265-1	267-1	267-2	269-1	270-1	271-1	271-2

R. VIGNA
4-11-78

SC1 02362


0.4 AVLN
0.06 AVDN
1812. MILE
916.4 RD
0.019 LFRD
38147.36842
0.019 LF
38147.36842
0.019 RFD
38147.36842
0.022 RF
32945.45455
LEFT AVG
38147.36842
RIGHT AVG
35546.41148
INNER AVG
35546.41148
OUTER AVG
38147.36842
GRAND AVG
36846.88995
ENTER ROTO WEAR LFT
0.
ENTER ROTO WEAR RT.
0.
9.9999999 999 LR
9.9999999 999 RR
AVG ROTOR WEAR
9.9999999 999
0.08276
0.05166
0.9304
0.016237O7
0.2583
0.8357348653
0.9141853561
0.00501
0.01555
0.0813
0.0568
0.068
0.0405
0.0117
0.0126
57523.80952
0.0112
64714.28571
0.0122
59409.83607
0.0146
49643.83562
LEFT AVG
61119.04762
RIGHT AVG
54526.83584
INNER AVG
57179.06067
OUTER AVG
58466.82279
GRAND AVG
57822.94173
ENTER ROTO WEAR LFT

CO-250

L CAR WEAR SUMMARY

PROJECTED MILEAGE X 1000

Material		LFO	LFI	RFO	RFI		MIN/MIN	AVG/MIN	MIN/AVG	AVG/AVG	ROTOR L	ROTOR R	Noise 9	Noise 8	Noise 7	Noise 6
916-36	MIN/MIN	43.5	55.4	32.0	38.0		32.0	42.2			C	C	307	8	0	0
@ 3045 miles	AVG.	54.9	64.1	35.8	52.5				35.8	51.8	C	C				
916-41	MIN/MIN	38.1	38.1	38.1	32.9		32.9	36.8			O	O	46	10	0	0
@ 2835 miles	AVG	57.5	64.7	54.4	49.6				49.6	57.8						

5/22/78

MAX @ 1000 miles

	LFO	LFI	RFO	RFI	System									
916-36	.012	.008	.017	.010	.047									
-38	.019	.013	.040	.019	.091									
-40	.045	.005	.010	.016	.076									
		@ 2000 miles												
-36	.020	.016	.026	.021	.083									
-38	.043	.020	.067	.021	.151									
-40	.054	.016	.020	.024	.128									

OTD WEAR LIMIT

SC1 02365

5/23/78 Chrysler.
Steve, Smith
916-40 sign improvement over C w/regard to noise, structure, Rotor & pad wear.
Maintained effectiveness of "C".

35K/week M Steve - have gone to Bendix
1.3 m. Commit to 1 year w/Bendix Re Tooling amortization on stream
- K-body real volume. in 81.
54 mm version of L Brake -
strongly looking at Cyclewold
but not committed.
Offered us to submit, we must understand internal pressure to go w/ Cyclewold.

Even if 916-40 is great they will stay w/ Bendix. Bendix demanded 1 yr.

Still a chance they would go w/ Abex after 1 year.

If - 916-40 - is real good they could ~~st~~ extend Bendix over time, use 7163 on Power only. Bendix commitment in pcs. which equates to ≅ 1 year.

Looking at vented rotors.

Pucks on I.M
When ≃ 2 1/2 month
- 1/2 month ahead of schedule

SC1 02366

916-40 Chrysler well 2
Temp/Wear & Vehicle Test @
Penn Auburn for Noise.

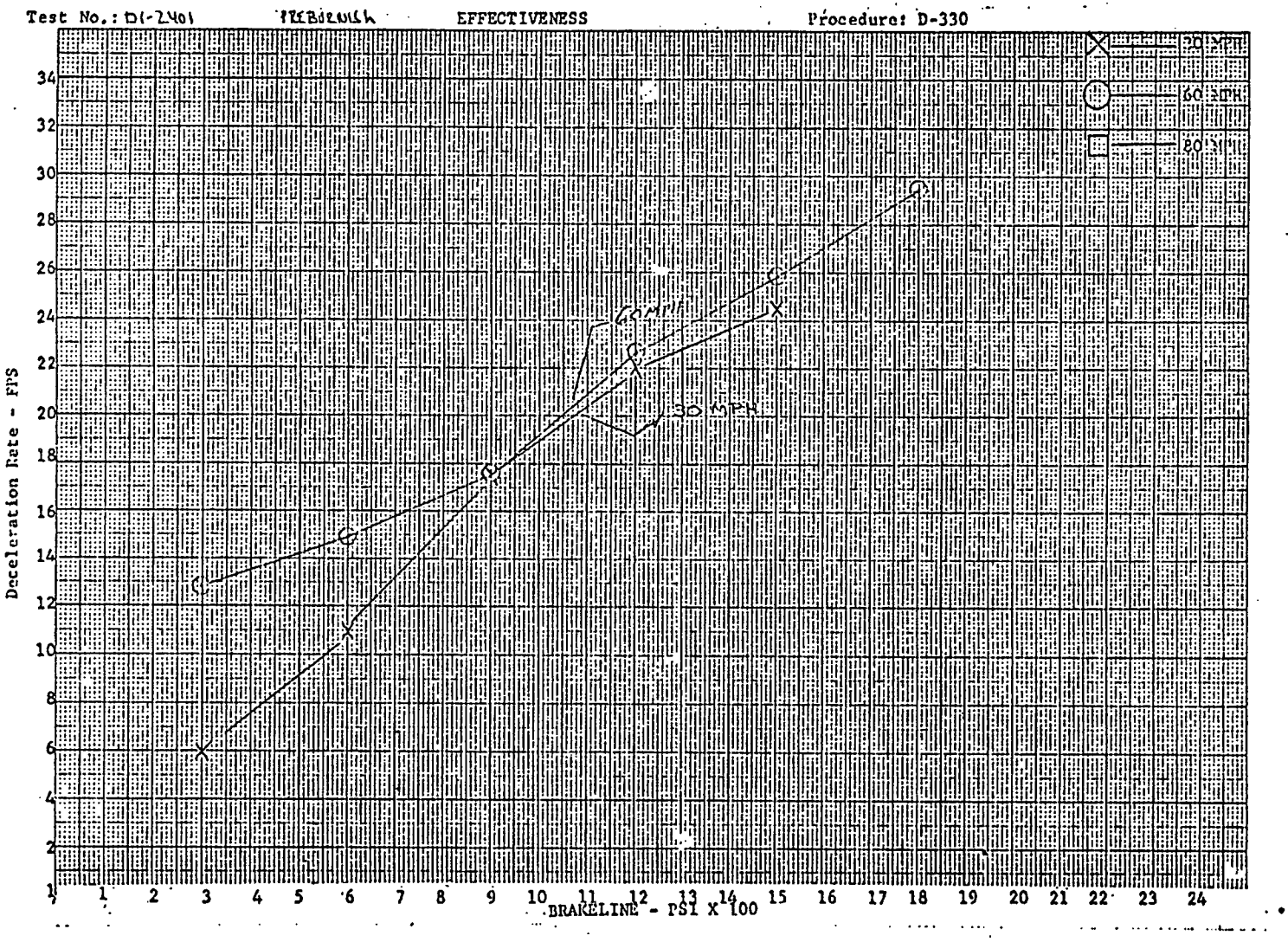
FMVSS 105

916-40 VERSUS 7018C

	PRE-BURNISH @ 1200 PSI 30	60	POST-BURNISH @ 1200 PSI 30	60	80	1ST FADE PSI/ STOP	2ND FADE PSI/ STOP	POST-FADE @ 1200 PSI 30	60	80				
916-40	22.0	22.5	22.0	27.5	28.5	1660/5	1150/10	22.0	35.2	38.0				
7018C 4 TEST AVG.	16.3	24.0	27	27.8	29.0	1486/5	1566/10	24.6	29.0	26.7				

SC1 02368

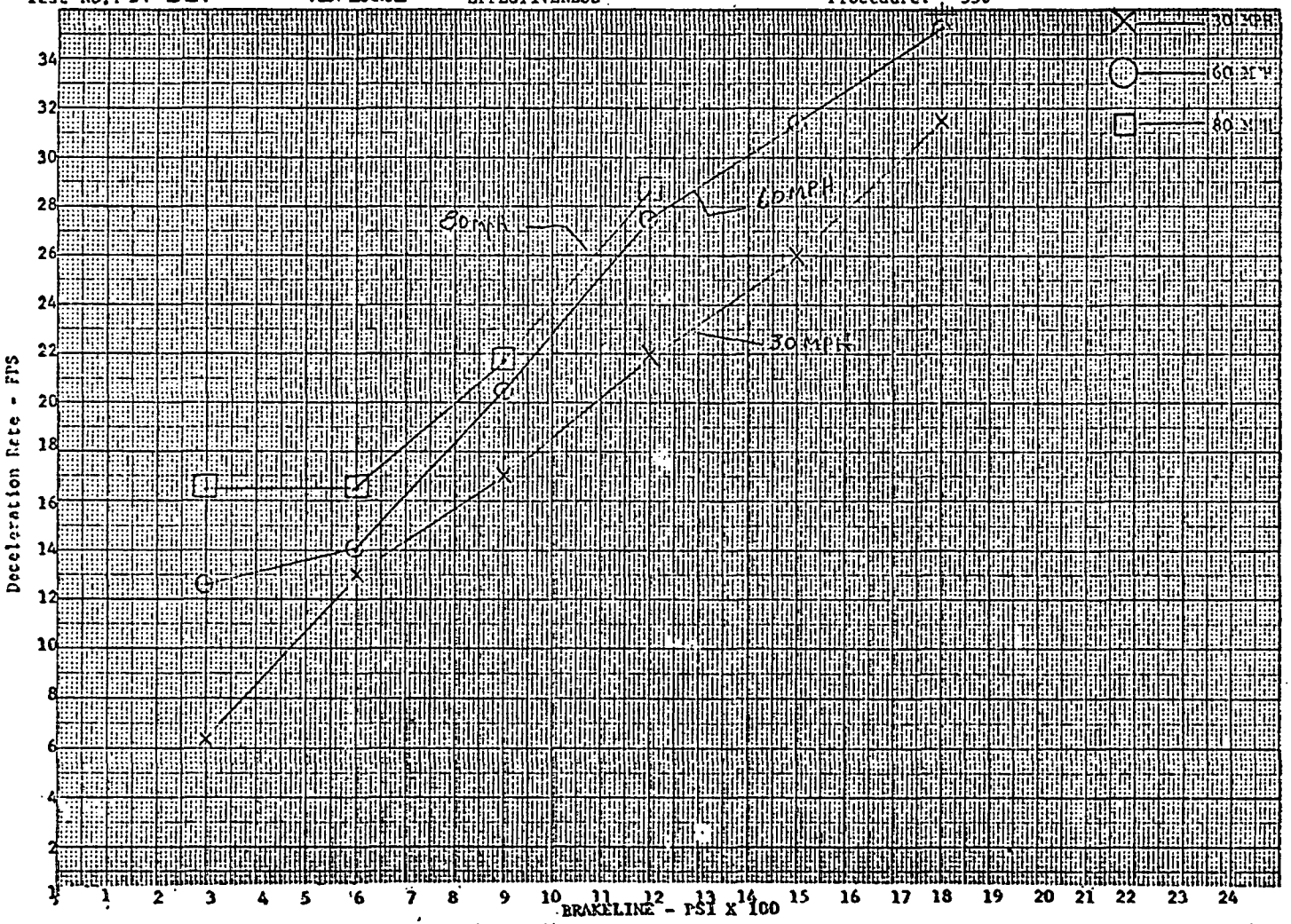
916-40A1



SC1 02369

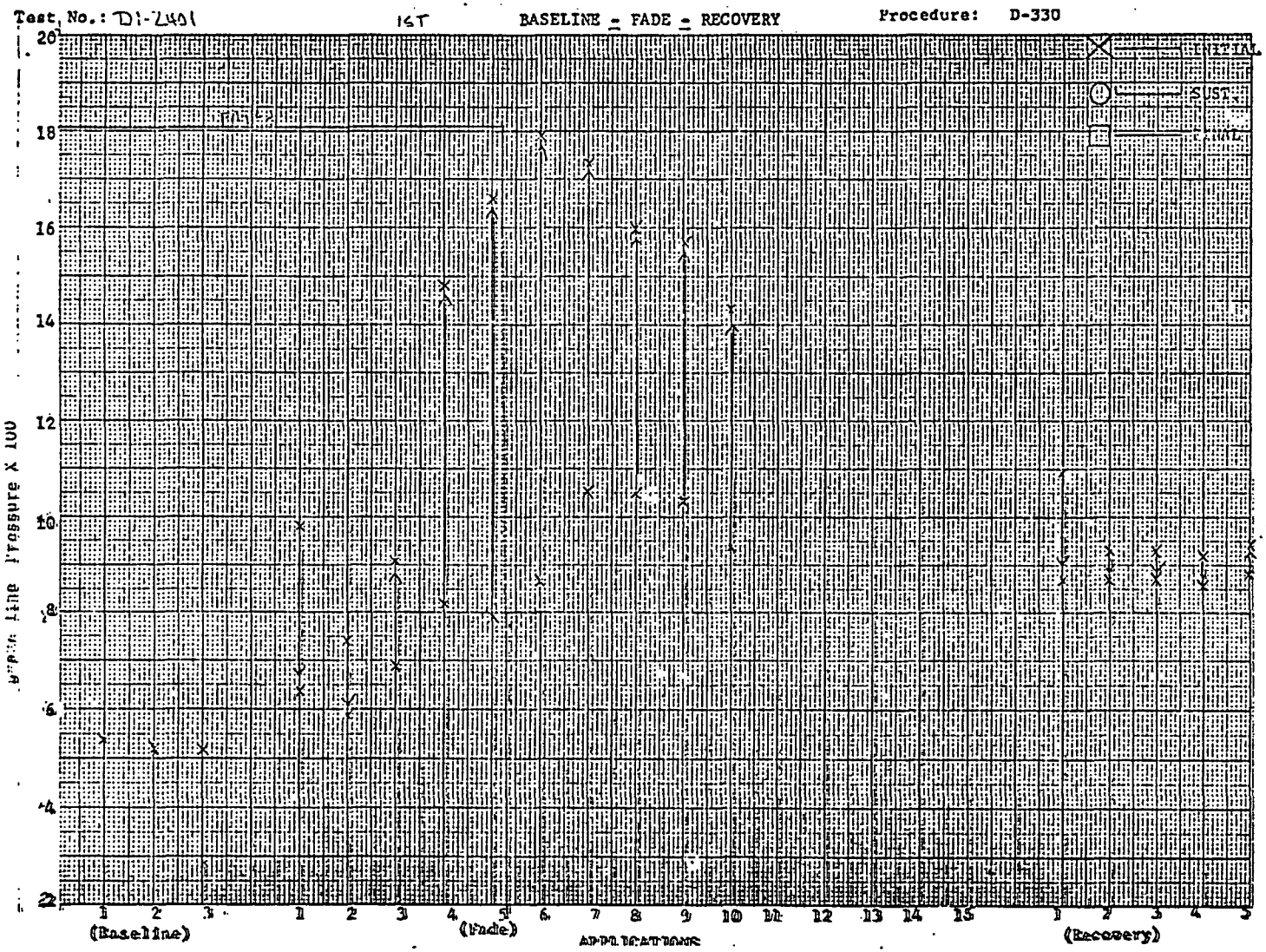
916-40A1

Test No.: D1-2401 Foot Burnish EFFECTIVENESS Procedure: D-330



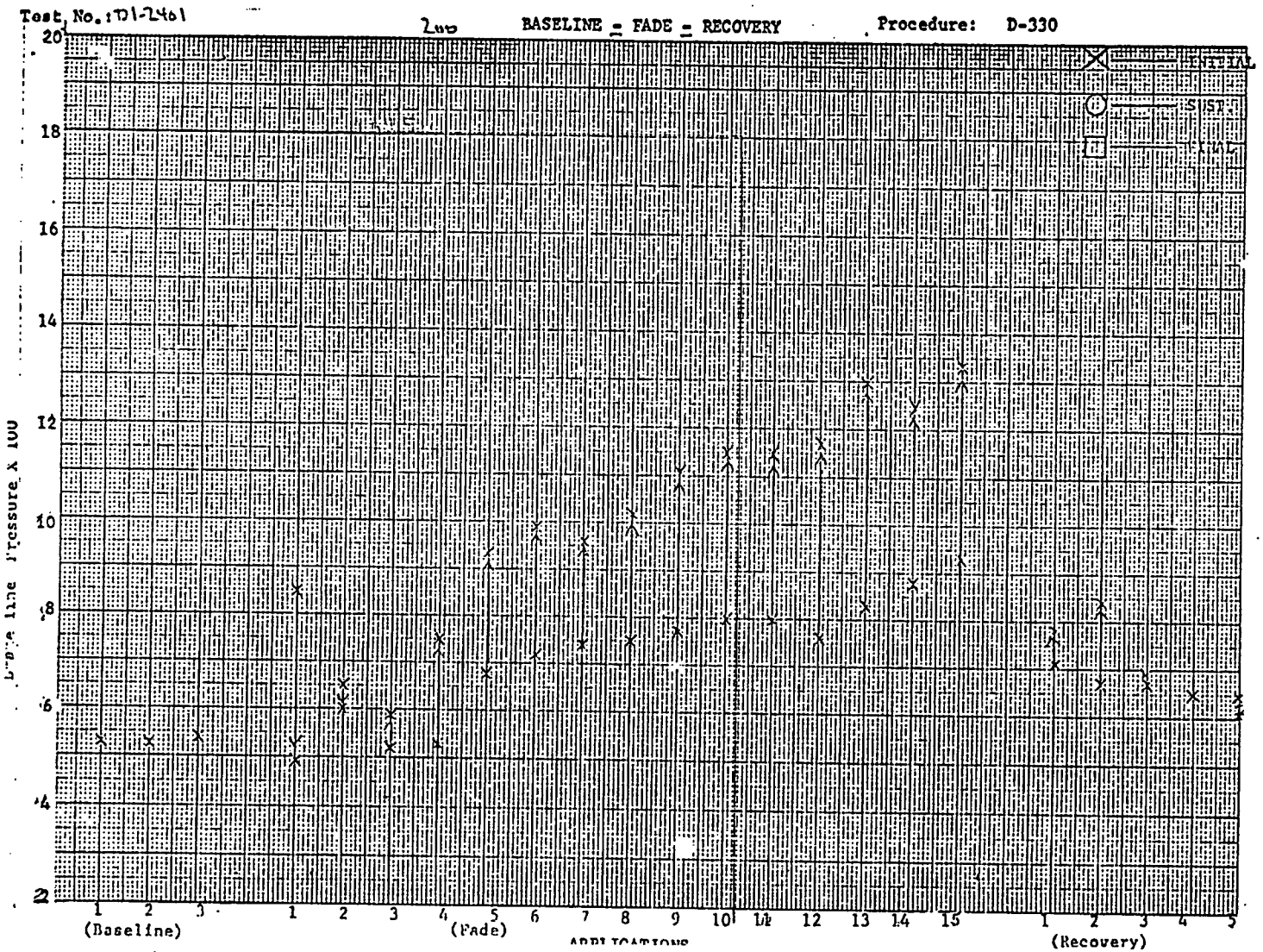
SC1 02370

916-40A1



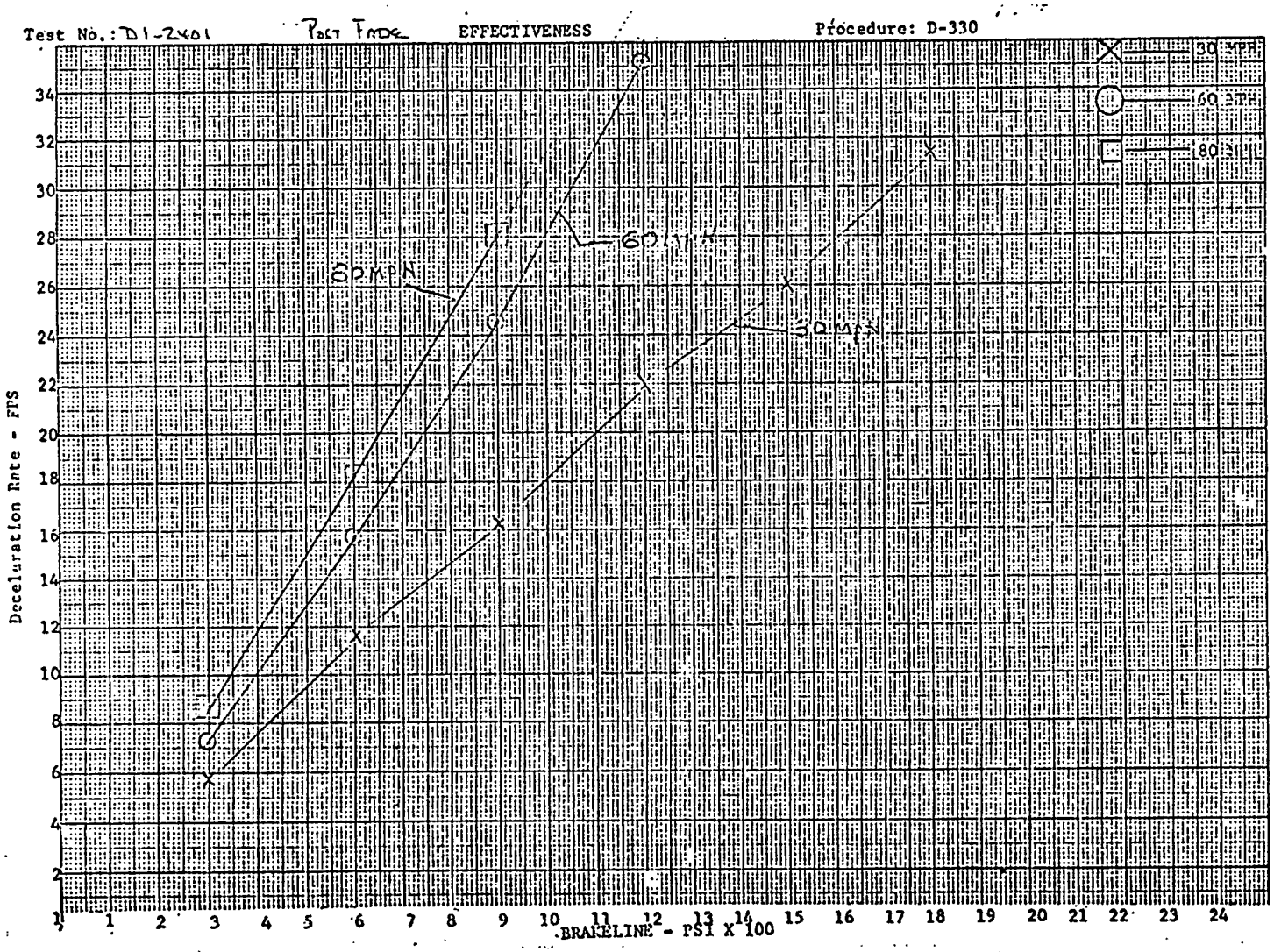
SC1 02371

916-40A1

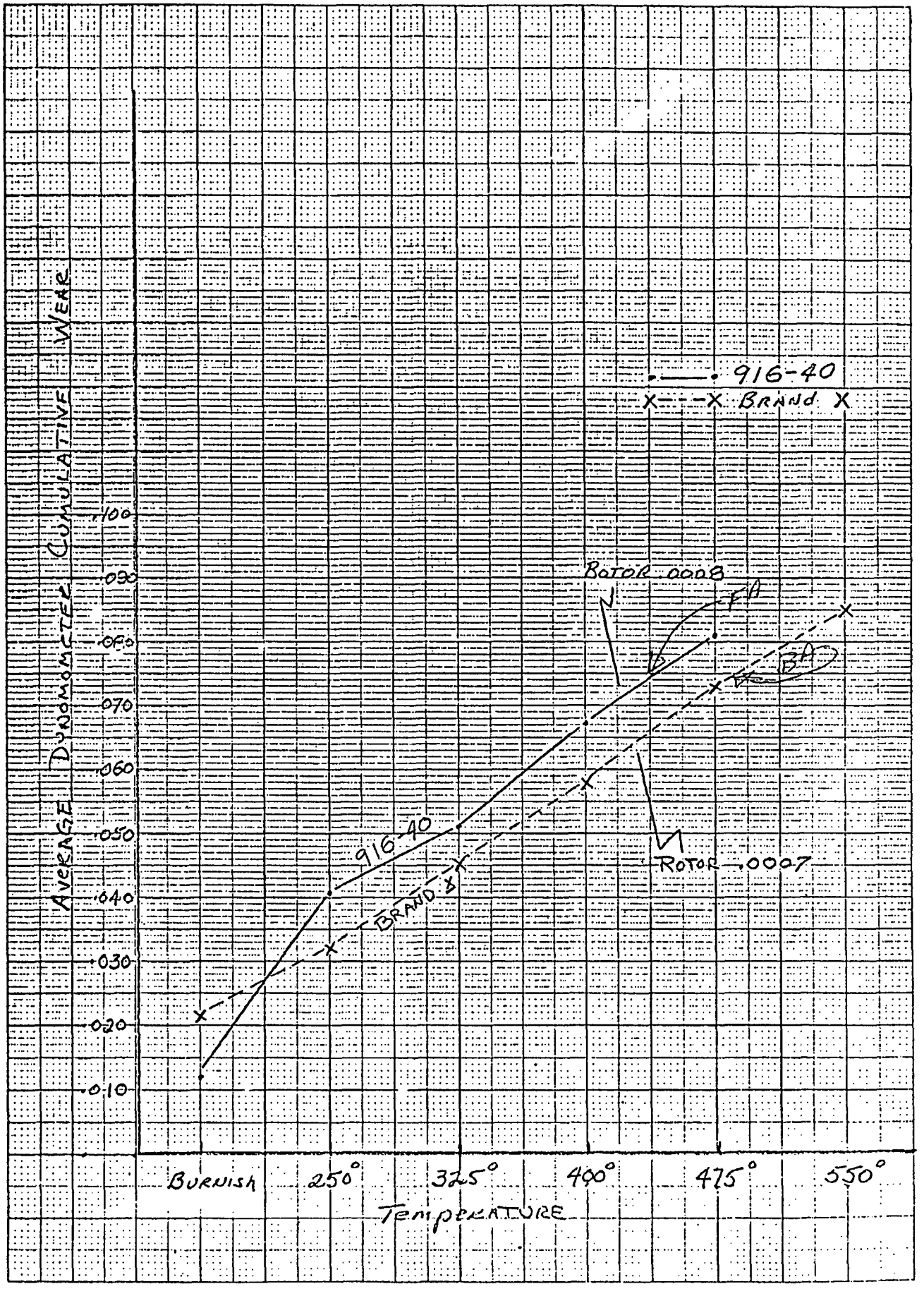


SC1 02372

916-40A1



SC1 02373



46 1331

K·E 10 X 10 TO ½ INCH 5 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

SC1 02374

VEHICLE GENERAL ENDURANCE

Build Vehicle - Plymouth Horizon
With new rotors, drums, and friction materials
Measure - friction material - drums and rotors

Instrumentation - Data Logger
With thermocouples in all brakes, recording decelerometer, and pressure transducer

Vehicle Load - Curb + 600 lbs.

Test Procedure - 4 stops - 35 MPH to 0, 10 ft./sec.^{2}
1 stop - 35 MPH to 0, 12 ft./sec.^{2}
1 stop - 35 MPH to 0, 10 ft./sec.^{2}
1 stop - 50 MPH to 0, 10 ft./sec.^{2}
1 stop - 40 MPH to 0, 10 ft./sec.^{2}

Interval .5 miles between stops.

Cool to 200°F approximately 4.0 miles and repeat above cycle.

Repeat above conditions for 1000 miles.
Stops per 1000 miles is 952.

Measurement - Measure friction material, drums and rotors. Calculate extrapolated mileage based on:

Pad thickness	.400
Rotor	.059
Drum Lining	
Drum	.059

L-CAR WEAR SUMMARY

PROJECTED MILEAGE X1000

MATERIAL	LFO	LFI	RFO	RFI	MIN// MIN	AVG// MIN	MIN// AVG	AVG// AVG	ROTOR 1	ROTOR R	9	NOISE 8	NOISE 7	6
976-40 MIN/MIN	38.1	38.1	38.1	32.9	32.9	36.8			0	0	46	10	0	0
@ 2835 Miles AVG	57.5	64.7	59.4	49.6			49.6	57.8						

SC1 02376

Monday 5/22.

916-38.

	In	Out	Avg
400°	.0097	.0113	.0105
475°	.0030	.0036	.0033

~~[illegible]~~ ROTOR .0014.

test complete by 2pm.

-40 In/out Problems.

	In	
250°	.0042	.0533

-916-38 @ 2000 miles

LFO	.024	2nd 1000 miles only	.043
LFI	007		.020
RFO	027		.067
RFI	003		.021

ROTOR L-.0005

R-.001

~~Noise great~~

916-36 for 2000 miles.

020

016

026

021 No rotor wer

Sunday
5/21

916-40 Vehicle 1000 miles max wear
~~[illegible]~~ LFO .045
I .005
R .010 est
I .016

916-38 325° T/W
In 0325 0314
Out 0303
Rotor = 0

$\bar{B}$ = .0116
$\overline{250}$ 0313
.0429
$\overline{325}$ 0314
0743 Σ to 325

D-1 -40 Sum @11 @250
2 -38 @400 late today.
Car 1 -38 2000 miles 7 pm today
2 -40 2000 9 am Monday

Summary 916-38 T/W @325 ~ 1/2 the wear of -36
but 2x higher than Bendix 7163.
Will have car durability 2K miles ~6 pm today

916-40 T/W @250 noon today. Vehicle
data = 1 pad high wear. -40 look slightly better than
-38. -36 still looks best on vehicle.

SC1 02378

5/20

1

916-38

1037 miles

Mark Weeu

LFO .019 21,831 LROTOR 0

I .013 31,907 RROTOR .001

RFO .040 *10,370

RFI .019 21,831 Noise 1#8's

*Same Car as last time. 9#9's.

916-38 T/W.

Burn In 0114 0116 ROTOR .0005

Out 0117

250 .0323 Avg 0313 .0

.0303

916-40 T/W

Burn In 0088 Avg 0117

Out 0146 0

Running 250 Complete Sun 11am 5/21

5/20

2

916-36 @ 1000 miles Defiance:

~~.0064~~

CFO .012

I .008

RFO .017

.010

-40 car had alternator go out.
Towed @ 1000 ~ 6 pm.

D-1 916-40 Scan @ 11.

2 916-38 @ 325 Scan Scan -

Carl 916-38. @ 2000 Scan 5 pm.

916-40 @ 1000. Scan 5 pm.

Dan will call me this evening.

Sat 5/20
11 am

Recap 916-38 on Vehicle @1000 miles doesn't look as good as -36. (Still having problem w/ imbalance.
916-38 on T/W test @250°F looks ~~slightly~~ better than -36.

916-40 on Vehicle had ~~[illegible]~~ problems.
will ~~[illegible]~~ have a measurement @ 6 pm Today.

916-40 on Temp/Wear business data.
~~slightly~~ better than -36.

-38 on Car looks worse than -36.
-38 on Temp/Wear look ~~slightly~~ better than -36.

No data on -40 due to Vehicle problems
Should have data on -40 by 8 pm Tonight
P/S Call 703 667-2956

@Breakers, West Palm Beach.

		916-30	916-36	916-38	916-39	916-40A1	916-36A1	916-33	916-35	916-38A2	916-32	7018C Prod N	7018C Prod.	7018C
			D2-13	D-2398	D-2379	D-2401	D-2402	D1-2400	D1-2397	D-2394	D1-2390	D1-2329	D1-2313	D1-2385
5'	30	27.5	16.3	19.5	24.5	22.0	23.1	22.0	20.0	23.0	20.0	16.9	10.8	16.73
	60	29.5	20.0	20.0	25.2	22.5	20.0	21.4	19.1	20.0	15.2	29.4	16.3	29.3
54'	30	22	23.0	27.5	28.0	22.0	19.2	18.3	20.0	22.0	31.4	over torq	21.0	29.3
26'	60	24.5	19.0	23.0	25.0	27.5	24.4	24.4	29.3	20.0	20.0	32.6	25.0	23.8
40'	80	24.5	30.0	21.6	25.7	28.6	25.5	23.5	25.0	18.0	20.2	30.0	over torq	28.6
	1ST Fill	1440	1350	1460	2000	1660	1810	1560	1390	1840	2060	887	1857	1961
	2nd Fill	1370	1125	1170	Test Stopped	1150	Test Stopped	1310	1270	1391	1480	1104	1952	1642
	30	21	23	22		22.0		23.0	24.5	21.0	24.45	24.4	22.0	27.5
	60	22	28.5	33		35.0		25.9	35.2	23.0	24.45	29.3	29.9	29.3
	80	25.5	34.5	overtorq		36.6		Not run	31.0	24.0	24.40	26.7	25.5	28.0
	IN.	0798	.0391	.0527	.0118	.0323		.0537	.0436	.0154	.0462	.0466	.0346	.0529
	OUT	0793	.0563	.0483	.0223	.0441		.0628	.0529	.0194	.0621	.0547	.0396	.0545
	Avg.	0795	.0477	.0505	.0170	.0383		.0583	.0483	.0174	.0542	.0456	.0366	.0537
	ROTOR	.0021	.0007	.002	.0011	.0038		.0022	.0003	±.0001	.0003	.0061	.0009	.0054

SC1 02382

,del

	716 3A	916-36A1	916-38	7018 C
ubunich				
30	27.5	16.3	19.5	27.5
60	24.5	20.0	20.0	25.0
?1200psi				
1st Burnish				
30	22	23.0	27.5	24.5
60	24.5	19.0	23.0	25.0
80 @1200psi	24.5	30.0	21.6	24.5
Fade 1st				
5th stop	1440	1350	1460	1700
Fade 2nd				
10th stop	1370	1125	1170	1550
Final Perform				
30	21	23	22	22.0
60	22	28.5	33	25.6
80 1200psi	25.5	34.5	overtorque	24.2

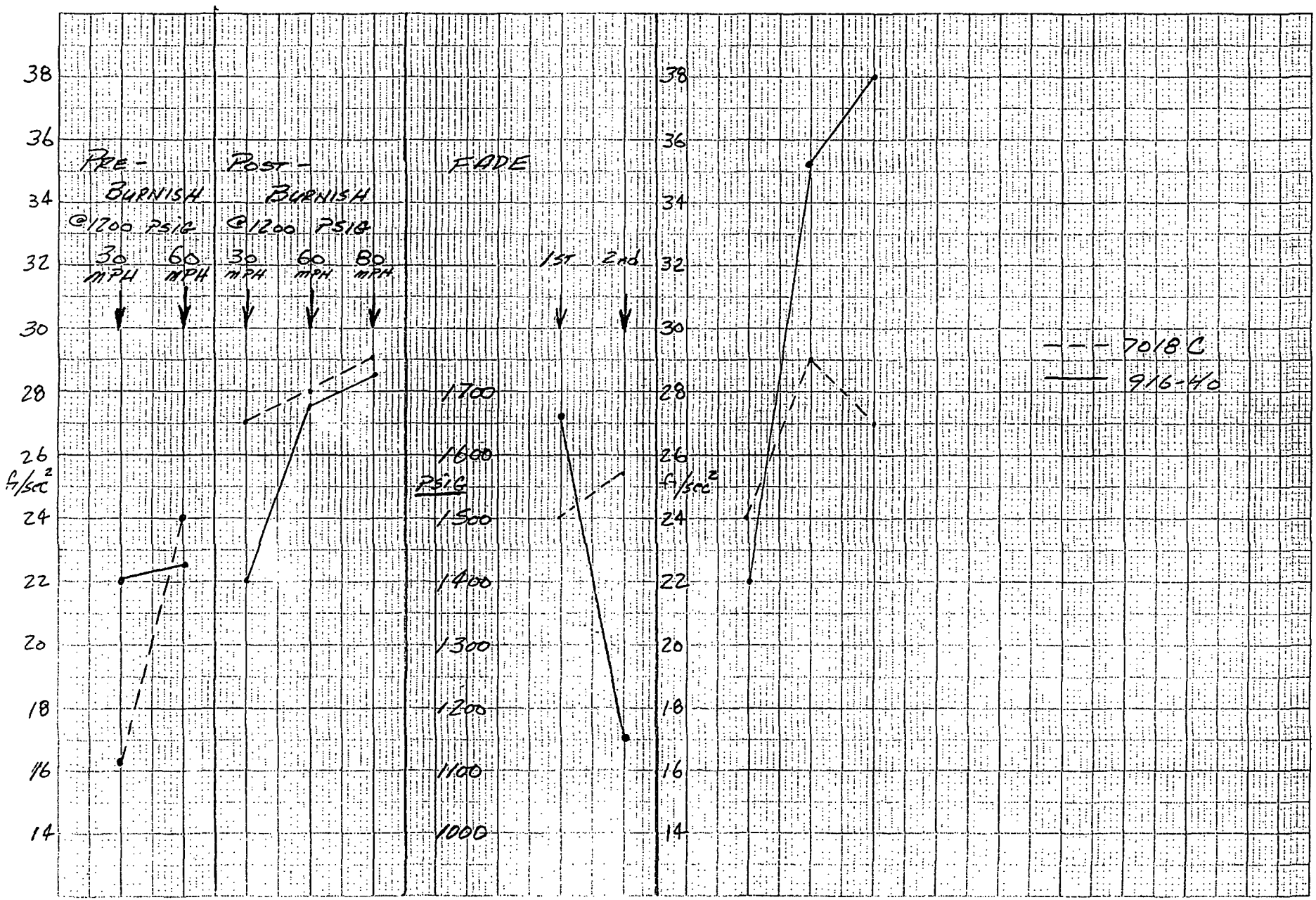
SC1 02383

CO-250

5/22/78.

		916 36	916 38	916 40					7018 BB	7018 C					
METAL	Fiber 1104	40	X	38					X	X					
	HT " 1147	X	39	X					X	X					
	FC R80	20	20	20					X	X					
	481	X	X	X											
RESIN	UM Exc. 483	10	10	10											
MOD	Bi_2SO_4 170	6	6	6					X	X					
	SiO_2 443	1	1	1					X	X					
	220-MgO	4	6	4					X	X					
DRY	Kyanite 342	X	X	X											
	MoS_2 570	X	X	X											
	1117 Al_2O_3	X	X	X											
	Rubber 275	X	1	X					X	X					
MOLD	Stearic	X	X	X											
Graphite Or Carbon	Coke-397	2	X	4					X	X					
	AS-4071	17	17	17					X	X					
	-559														

SC1 02384


Pre-
Burnish
@1700 PSIG
30 MPH
60 MPH
Post-
Burnish
@1200 PSIG
30 MPH
60 MPH
80 MPH
FADE
1st
2nd
1700
1600
PSIG
1500
1400
1300
1200
1100
1000
ft/sec²
38
36
34
32
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28
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24
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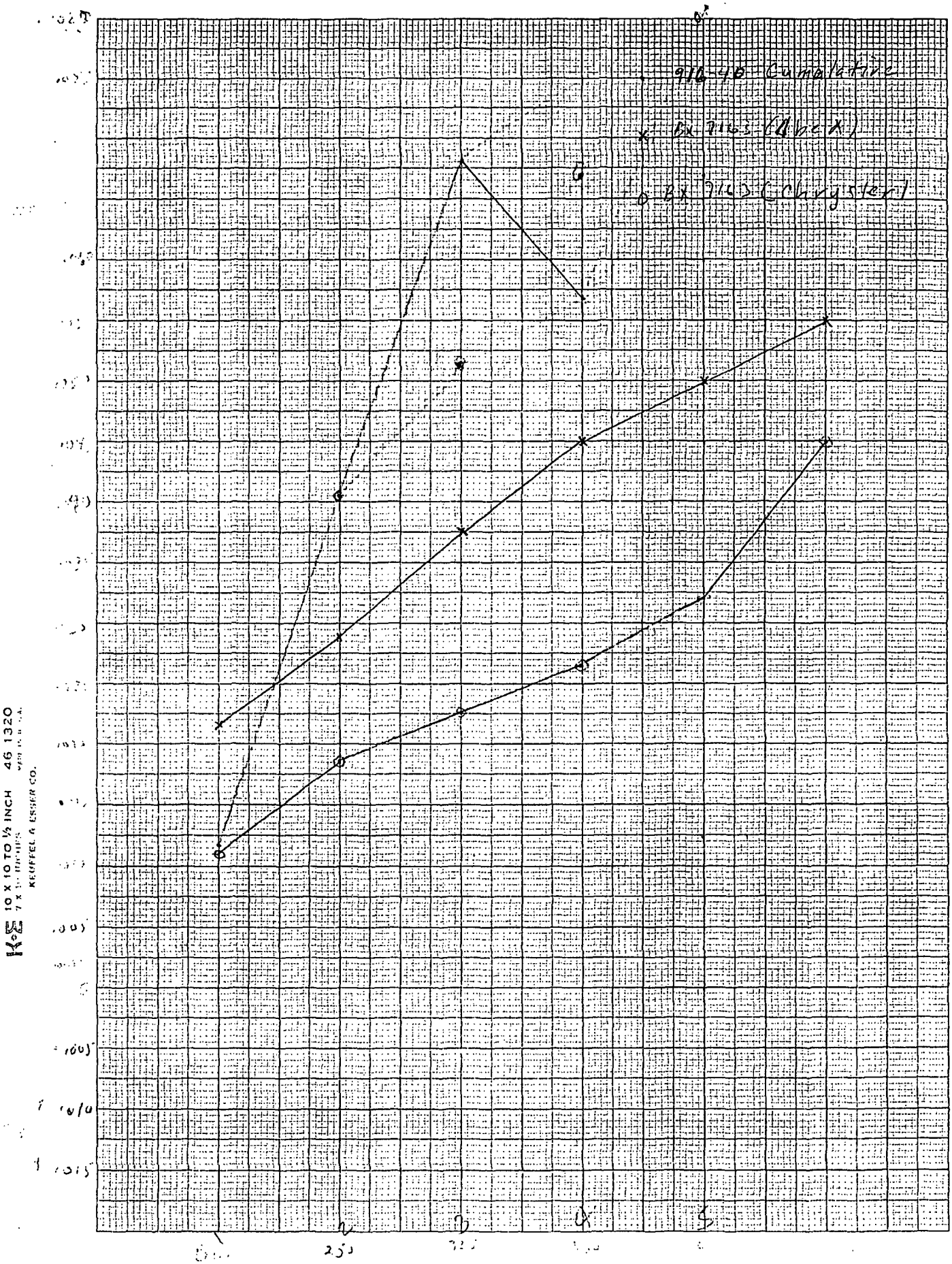
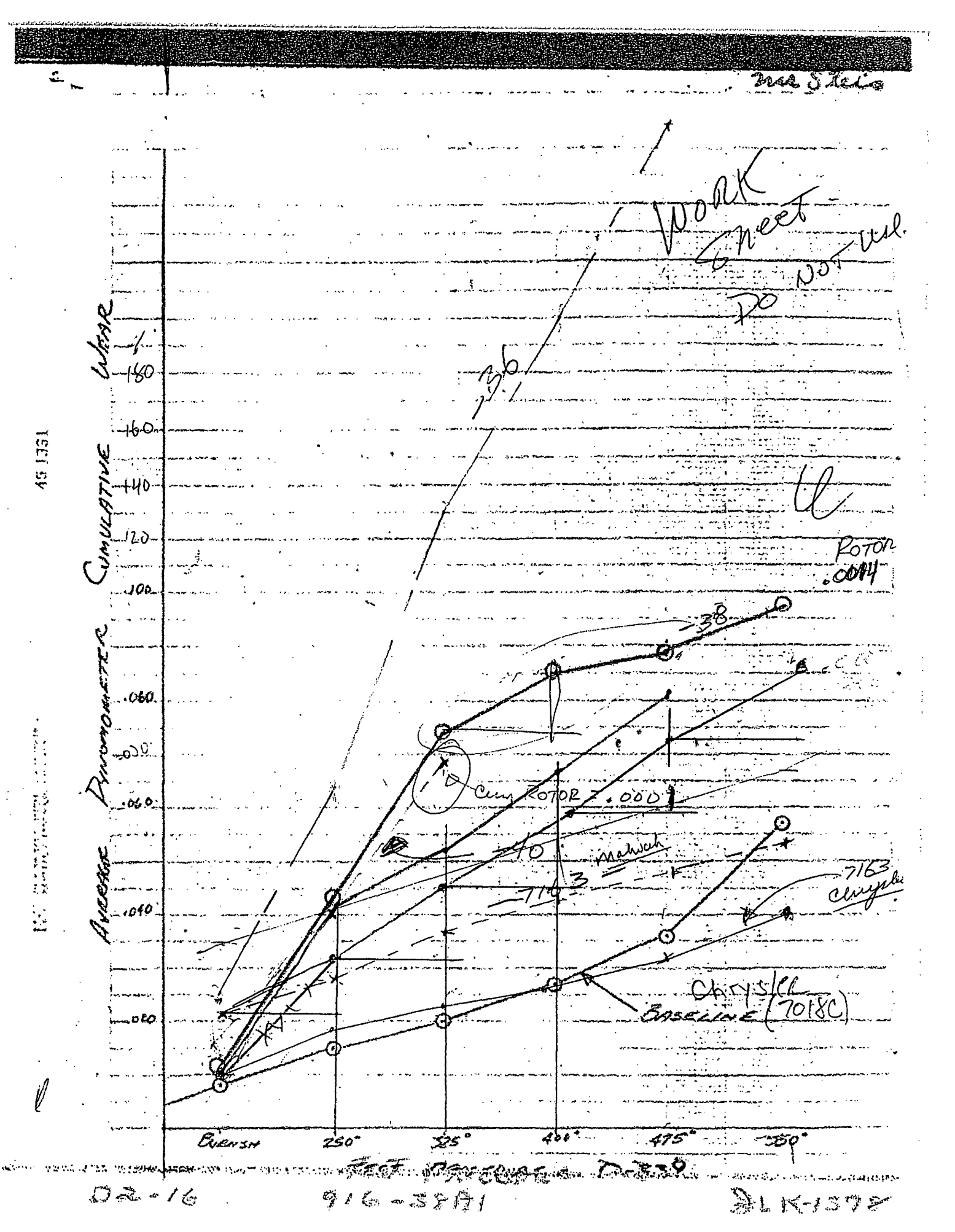
20
18
16
14
7018 C
9.16-40

SC1 02385



SC1 02386



D2-16 916-38A1 ALK-1378

SC1 02387

material —

		LFO Avg	LFO MAX	LFI Avg	LFI MAX	RFO Avg	RFO MAX	RFI Avg	RFI MAX		LF Rotor	RF Rotor				
916-36	1011	.0064 63,625	.012 33953	.0062 65677	.008 50900	.0110 37018	.017 23952	0078 52,205	.010 40720		None —					
	1011	.0074 54648	.010 40440	.0062 65225	.008 50550	.0102 39647	.013 31107	.0072 56166	.011 36763							
	2029	.0138 58811	.020 40580	.0124 65951	.016 50725	.0212 38283	.0260 31214	.0144 56361	.0210 38647	1796			Noise 307 #9 30 #8			
	1016	.0084 48380	.010 40640	.0060 67783	.008 50800	.0128 31750	.016 25400	.008 46181	.011 36945							
	3045	.0222 54864	.028 43570	.0190 64105	.022 55363	.0340 35823	.0280 32052	.0232 52500	.032 38062		None —					
916-38	1037	.0150 27653	.019 21831	.0108 38407	.013 31907	.0302 13735	.040 10370	.0132 31424	.019 21831		00	.001	9 #9	#8-1		
	1013	.0204 19862	.024 16883	.0036 112,555	.007 57855	.0176 23022	.027 15007	.0016 250250	.003 135066		0005	.0010		10 #8		
	2050	.0354 23163	.0420 19523	.0144 56944	.0200 41000	.0478 17154	.032 14385	.0148 55405	.022 37272		0005	.0020			40 #8	
	1016	.0192 21083	.020 20240	.0020 222400	.005 80960	.0572 7076	.065 6425	.0018 224858	.004 101200		0	0	62 #8	10 #9	36 #7	
	3062	.0546 22432	.059 20759	.0164 74682	.020 61240	.0030 11891	.120 10206	.0166 73753	.022 55672		.0005	.00020				
916-40	1023	.0362 11304	.045 9093	.0036 113,666	.005 81840	.0072 56833	.010 40920	.011 37200	.016 25575		000	00	15 #9			
	1011 X	.0092 45956	.014 28857	.0088 45954	.0157 26960	.0086 47023	.013 31107	.0066 61272	.010 40440		000	00	16 #9	10 #8		
	2034	.0454 17920	.0540 15066	.0128 63562	.016 50850	.0158 51493	.020 40680	.0176 46227	.024 33500		000	000				
	801 X	.0034 94235	.0050 64080	.0024 133500	.004 80100	.0036 8900	.006 53400	.0080 40050	.012 26700		000	000	15 #9			
	2835	.0488 23237	.058 19558	.0148 76621	.020 56700	.0194 56453	.023 49304	.0256 44296	.033 34363		000	000				

SC1 02388

CO-230

L CAR WEAR Summary

PROJECTED MILEAGE X 1000

Material		LFO	LFI	RFO	RFI		MIN/MIN	AVG/MIN	MIN/AVG	AVG/AVG	ROTOR L	ROTOR R	Noise 9	Noise 8	Noise 7	Noise 6
416-36	MIN/MIN	43.5	55.4	32.0	38.0		32.0	42.2			C	C	30	8	0	0
@ 3045 miles	AVG.	54.9	64.1	35.8	52.5				35.8	51.8	[illegible]	C				
416-40	MIN/MIN	38.1	38.1	38.1	32.9		32.9	36.8			C	O	46	10	0	0
@ 2835 miles	AVG	57.5	64.7	54.4	49.6				49.6	57.8						

5/22/78

MAX @ 1000 miles

	LFO	LFI	RFO	RFI	SYSTM
916-36	.012	.008	.017	.010	.047
-38	.019	.013	.040	.019	.091
-40	.045	005	.010	.016	.076
		@ 2000 miles			
-36	.020	.016	.026	.021	.083
-38	.043	.020	.067	.021	.151
-40	.054	.016	.030	.024	.128

SC1 02390

5/22/78

MAX @ 1000 miles

	LFO	LFI	RFO	RFI	System
916-36	.012	.008	(.017)	.010	.047
-38	.019	.013	(.040)	.019	.091
-40	.045	.005	.010	.016	.076
	@ 2000 miles				
-36	.020	.016	.026	.021	.083
-38	.043	.020	.067	.021	.151
-40	.054	.016	.030	.024	.120

SC1 02391

Abex

An IC Industries Company

Abex Corporation
Research Center
Mahwah NJ 07430
201 529 3450

April 14, 1978

Chrysler

TO: B. Iwarsson
Friction Products Group, Winchester

FROM: D. G. Manly

In view of the concern for major accounts and problem areas within Friction Products, the following status type comments are in order:

1. Eaton 551C - Outlook: optimistic

This formulation has continued to give us severe concern since last summer. We have completed extensive testing on a slight modification of this formulation (898-43). Most of the data has already been presented to Eaton and pronounced acceptable. We were scheduled to go into production with this before the strike and are now prepared to do so. This material has passed the DOT 121 test in 12 out of 13 tests (see Table 1). The reason for the failure is not known. We have every reason to believe that this material will continue to perform well but does not pass with the margin of safety that all of us would like to see.

Therefore, we are continuing our efforts to develop a medium friction block which will be suitable for this application. This material is already showing promise and is a totally new formulation which is in no way similar to 551C. It is a simple, straightforward product. I expect that we will have a formulation well tested by July 1.

Going back to 551C for a moment, we have unearthed a correlation of performance with changes in openness of asbestos fibers. This is a correlation on paper which looks too good to be true, and we must test it experimentally to be sure. This work should be completed by May 15. If this work proves out, we will have a total explanation of all previous results.

Another thing we have learned out of all this work is that resin level, in addition to affecting performance, can also affect scrap

rates rather substantially. We intend to pursue this avenue in the hope of a reduced cost on current production.

In summary, we have a passable 551C formulation now for Eaton. We also know, incidentally, that this material is better than current Carlisle production. We are not comfortable with this, however, and plan to introduce a new medium friction block to you by July 1 - which will give us the comfortable margin we need.

2. Chrysler - Outlook: pessimistic

This is a very severe problem for us, and one on which we may, because of extreme time pressure, lose. Bendix is now in with 7163A which is looking good, but a 105 test is yet to be run. We plan to work on this, but I cannot be hopeful that a solution will come in time. The analysis on this product was only completed the week of April 10, so that we are really starting at ground zero. At this point it is impossible for me to predict when or if we will come up with a duplicate for 7163A. However, it is certainly unlikely that it will be done in less than 1-2 months.

We have one other test in the works for Chrysler, which is a version of 1202-2, an organic. Testing on this will be complete April 19.

3. Drum Wear - Outlook: cautious optimism

For GM 3/4 ton truck we are currently testing a primary of 129-10 (equivalent to Inland 4035) and a secondary of 822-40. This material passed DOT 105 requirements on April 14 and we will finish the first 1,000 mile wear test on April 19. This is a two-step resin which has a considerable amount of older test data that indicate satisfactory wear. It may cause us problems as far as plant capacity is concerned, but we feel that it is the most likely solution to the problem.

As a back-up for GM we will also test 129-10 and a secondary which is supposed to be a duplicate of Inland 4050. We plan an LA traffic test on April 24, DOT by April 25, and wear testing complete by May 8 or 9.

We also have a product for the school bus program, 822-31 x 16 which has passed the DOT test and shows good wear characteristics. Parts are being made now for International Harvester and Wagner.

As you are aware, we have gone through a period of extreme crisis and we are far from out of the woods. However, there is light at the end of the tunnel. Eaton has taken so much of our effort that other areas have suffered. This will continue to occur as long as we run from one crisis

to another. It is in all of our interests to avoid this kind of situation. We have learned that meaningful dyno testing takes a long time. We are confident of 898-43 for Eaton only because we have a good background. This testing alone represents two weeks of continuous dyno effort. It is unrealistic to think of a solution to a problem in less than a month if everything goes well. More likely we are looking at 3 months or longer. Therefore, the more lead time we have the better off we will be.

I would like to appeal to everyone involved not to submit a borderline product to a customer unless absolutely necessary. All too often it is accepted, we stop work on it, and later on we are all rudely awakened by the threat of a recall or loss of business. We must all watch this in the future.

D. G. Manly
DGM/is
Attachment

cc: S. S. Conway
R. L. Cutler
R. G. Nelson
G. R. Graham
D. E. Steis
A. D. Indelicato

Table #1

Eaton 16½ x 7

MFG.	Formula	Test No.	Wheel Id.	Rolling Radius	Slack Adjuster	Cogan	Specific Gravity	Ret. @ 80 psi	Efficiency	Peak Psi	OnSet Lining	OnSet Drum	Peak Psi	OnSet Lining	OnSet Drum	Hot Point Peak Psi
Winchester	898-43X2	8-298	10,000	22.2	5.5	30-46	2.05-2.08	.336		82	379	480	105 ✓	363	384	136
Winchester	898-43A1	8-277	10,000	22.2	5.5.	25-27	2.01-2.03	.396	90%	60	380	476	66	381	380	81
Winchester	898-43A	8-279	10,000	22.2	5.5	25-30	2.02-2.03	.451	91%	57	366	524	57	365	428	66
Winchester	898-43A1	8-280	10,000	22.2	5.5	25-30	1.99-2.02	.481	84%	52	362	521	50	361	418	69
Winchester	898-43X1	8-281	10,000	22.2	5.5	23-41	2.05-2.08	.494	90%	48	354	518	50	350	420	63
Winchester	898-43X1	6-645	10,000	22.2	5.5	23-41	2.05-2.08	.579	NA	42	350	469	49	338	366	59
Winchester	898-43X2	6-646	10,000	22.2	5.5	30-46	2.05-2.08	.535	NA	56	399	674	76	426	629	111
Winchester	898-43X1	8-282	10,000	22.2	5.5	23-41	2.05-2.08	.424	91%	56	422	538	69	405	437	78
Winchester	898-43X2	8-283	10,000	22.2	5.5	30-46	2.05-2.08	.457	91%	58	390	512	62	375	421	72
Winchester	898-43X2	6-647	10,000	22.2	5.5	30-46	2.05-2.08	.430	NA	56	327	430	79	312	324	90
Winchester	898-43X2	8-284	10,000	22.2	5.5	30-46	2.05-2.08	.454	91%	52	375	525	61	378	432	71
Winchester	898-43X2	6-648	10,000	22.2	5.5	23-41	2.05-2.08	.407	NA	59	343	444	83 ✓	339	338	105
Winchester	898-43X1	8-285	10,000	22.2	5.5	23-41	2.05-2.08	.443	91%	54	392	507	61	371	400	81

SC1 02395

File
852-105
Chrysler
Mahwah

June 13, 1978

D.E. Steis
Mahwah, New Jersey

This is in reply to your Report dated May 26, 1978 on the 105 tests covering 916-33A3 material on a Plymouth Horizon. I agree with the Report in that the material seems to pass everything with a very good margin. I did note that in the first fade the pedal did go to the floor on the 9th and 10th stops indicating maximums of 81 and 82 lbs. pedal force respectively. This is an indication that apparently there is some compressibility or at least some deflection within the system--again indicating a possible problem on master cylinder displacement. Nontheless, it far exceeded the requirements. The second fade did not show any similar pedal floorboarding and, again, far exceeded any of the requirements.

I share your concern about the condition of the brake rotors with medium scoring even though there was no actual wear reported or data shown in the Report that could be used to get a specific figure.

No mention is made as to whether or not this material was made with commercial iron or not. There is no question however that the performance was apparently higher than really needed, and this should provide a clue for future work in that we do not need this high a friction level to satisfy the 105 requirements.

In view of the fact that this program is now slowed up significantly, I would suggest that any future work on this or similar material be switched over to VW. What is probably needed but would not recommend under the circumstances of the 'L' car program, would be to turn around and repeat that on the dynamometer to get some correlation between dynamometer and vehicle 105 tests, which were never established during the 'L' car program. This might be considered as an early project on the VW once we get the Phase IV brakes installed. This type of information tends to give greater flexibility to the test program.

R.E. Nelson

REN/mb

cc: A.D. Indelicato
R. McGill
R.A. Pearce
RO 1251 File

"A" PRIORITY

ABEX FRICTION PRODUCTS GROUP EXPERIMENTAL ORDER FORM

(Submit 4 Copies)

DATE: 6/8/77

EXPERIMENTAL NO. W-12222

CUSTOMER: Chrysler

PROPOSED SHIPPING DATE: 6/8/77

P.O. NUMBER

PRINT ATTACHED No

O.K. TO MAKE PARTIAL SHIPMENT Yes

SHIP TO: SEE BELOW

ATTN:

HOW SHIP: See Below

QUANTITY	CUST. PT. NO.	ABB PT. NO.	FORMULA	PRICE
25	Chrys. "L"		7018BB @ 5,000 pcs.	N/C
25	"		7018BB @ 4,000/8,000 pcs.	N/C

ALL PARTS TO BE MADE FROM SAME LAB BATCH OF MIX.
USE 683-49 BACKING.

SHIP 12 PCS. EACH TO CHRYSLER (ADI TO HAND-CARRY).
SHIP 8 PCS. EACH TO MAHWAH (AIR FREIGHT D. STEIS)
ATTENTION

SPECIAL INSTRUCTIONS RETAIN 4 PCS. EACH AT WINCHESTER.

ENTER COST ESTIMATE FOR PRODUCTION PART, ESTIMATED ANNUAL USAGE _____ PCS.

BRAKE APPLICATION DATA:

TYPE OF VEHICLE OR MACHINE "L" Car and or dyno. MODEL NO.

DESCRIPTION OF FRICTION APPLICATION Disc Pad front

BRAKE OR CLUTCH SIZE TYPE OF ACTUATION Hyd.

NUMBER OF PIECES PER UNIT 4 WET OR DRY OPERATION Dry

TYPE OF TEST FMSS 105

COMPETITIVE FORMULA

APPROVED: Yes or No

Has a production quotation been requested?

Make sure periodic as well as a final Experimental Report is submitted in reference to this order.

CC: JVM
R-MCGILL

SALESMAN

SC1 02397

SALES REPRESENTATIVE'S REPORT
FRICTION PRODUCTS GROUP

Typed: 9/12/78 - 9/11/78
TYPE OF CALL

A. D. INDELICATO
RESPONSE REQUESTED ☐
DATE 9/6, 7/78

CUSTOMER	REPRESENTATIVE	REPORT No.
CHRYSLER CORPORATION/ BRAKE ENGINEERING DIVISION	D. P. CONLON	250
ADDRESS	CITY	STATE/ZIP
HIGHLAND PARK, MI.		
		PHONE

OFFICIALS INTERVIEWED
Gayle W. Smith - Product Engineering Manager - Brake Engineering
John L. Thon - Development Supervisor
William H. Rankin - Senior Product Development Engineer
Paul B. Hellens - Senior Product Development Engineer
Stuart E. Woolpert - Buyer

COMMENTS

SETTLEMENT OF CRACKED LINING PROBLEM

The main purpose of my visit was to begin the process of reaching a settlement as to what responsibility Chrysler and Kelsey-Hayes had for the 73,000 pieces of cracked lining which were rejected by Kelsey-Hayes after cracks were noticed subsequent to the drilling operation.

As a result of the points raised during several conversations with A. D. Indelicato, I felt that our best chance would be for us to try to get both Chrysler and Kelsey-Hayes involved in this problem. Therefore, the following two arguments were formulated:

1. If Abex had been allowed to proceed with the introduction of the integrally molded assemnlies, most of the scrap problem would have been eliminated. There was no problem with cracking of the I/M assemblies and if there was no need to drill, then there would be no possibility of Kelsey-Hayes cracking the parts. This argument is being used for the purpose of making sure that Chrysler does not wash its hands of the problem by saying that it is a matter between Kelsey-Hayes and Abex.

2. If Kelsey-Hayes had properly drilled the parts, the scrap rate would have been significantly lower than the actual scrap rate. This would have considerably reduced the number of rejected parts.

In addition to Smith, Thon and Woolpert, I presented this information to Jackie Lowe (Buyer - Kelsey-Hayes - Jackson Plant). She, of course, rejected that part concerning the incorrect drilling by Kelsey-Hayes. She used the familiar argument that if the parts were manufactured properly, then they would not have cracked. She said that Kelsey-Hayes was following the standard drilling practices for metallic lining and that it was only with the Abex pads that the cracking problem appeared. She also reminded me that Kelsey-Hayes was not charging Abex for the 100% inspection of the drilled parts nor was Kelsey-Hayes charging Abex for the drilling of the rejected parts. She said that Don Varblow (Plant Manager - Jackson) would be notified, and that in all probability, a meeting would be set up for the near future.

The reaction at Chrysler was more positive than that of Kelsey-Hayes. They agreed that if the switch to I/M had been made then there would have been no cracking problem after the switch. Chrysler wanted to have a meeting including

the representatives from Abex, Chrysler Brake Engineering, Chrysler Purchasing, Kelsey-Hayes - Jackson and Kelsey-Hayes Engineering.

I think this will be a very long and drawn-out sequence of events. At this point, I do not have any firm basis for estimating whether or not the outcome will be favorable to Abex.

TRIP TO MAHWAH

The preliminary details of the Chrysler-requested visit to Mahwah and Toms River were worked out with Rankin. The trip is going to take place on Tuesday, September 12, 1978, and is principally for the benefit of Mr. Sergio Flores, the Supervisor of Vehicle Testing at Chrysler de Mexico S.A. In addition to Mr. Flores, the following people will probably make the trip: John L. Thon, Development Supervisor; Larry L. Shively, Product Development Engineer, Raymond Vigna, Product Development Engineer. There is some possibility that Harvey Pickford (the new Chief Engineer - Chassis, replacing Robert W. Steere, who was promoted) will be able to attend. Mr. Pickford will not be back from vacation until Monday, September 11, and therefore, we will not know for certain until then.

Denis P. Conlon

jd

cc RLCutler/AFSchmaltz/File
BIwarsson
EFPotts
ADIndelicato