C O N F I D E N T I A L

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A I R F L E X T E S T R E P O R T

TITLE CS-CT FRICTION MATERIAL (SCAN-PAC)

PROJECT NUMBER Z0952-4 TEST DATES 11/78

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1.0 A B S T R A C T

Three non-asbestos types of friction materials were tested and compared to previous data for CS-CT friction material (Fenner 333 friction material). Two of the materials had higher overall coefficients of friction than the Fenner material, but, due to the "hard cured" rigidity of the two linings, cracking of the material in an actual brake application could be a problem and would have to be tested. It is recommended that further screening of additional materials be pursued before actual brake testing.

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2.0 PREFACE:

At present, Fenner 333 is our only acceptable and available CS-CT lining. There is a possible alternate material from the Scan-Pac Company. The testing of this material included dry and oil soaked μ, wear rate, and rivet hole strength.

The Scan-Pac material is a non-asbestos extruded material using fiberglas in place of asbestos.

3.0 OBJECTIVE:

To determine if three Scan-Pac materials are acceptable for use in CS-CT brakes.

4.0 CONCLUSIONS:

Two of the tested linings (MF-28-3D and SPC-28-8A) are performance-wise acceptable for use in CS-CT brakes (providing the coefficient of friction is not too high); however, since they are "hard cured" linings, cracking of the friction material may be a problem. Thus, the linings would have to be "life tested" on an actual brake before they could be qualified.

5.0 RECOMMENDATION:

That additional friction material screening be conducted before selecting material(s) for "life testing" on an actual brake.

6.0 TEST EQUIPMENT:

6.1 Friction Material Test Machine - See 0000 0000 H General Test Procedure

6.2 Electric balance scale M/N P323

6.3 Micrometer 0-1"

6.4 Desiccant jar to store sample

6.5 SAE 30 oil

6.6 Rivet shear jig - see Test Report Z0952-1

6.7 Load cell (1,000 lb.)

6.8 Stripchart recorder, Brush Model #240

6.9 Samples of friction material (Scan Pac) SPC-28-8A, MF-28-3D, RF-28-3M, Fenner 333

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7.0 PROCEDURE:

7.1 Strength:

The rivet hole strength test was performed on 2" square pieces of friction material. See Test Report Z0952-1 for apparatus, procedure and description of the testing of Fenner 333.

7.2 Wear-in:

The friction material was cycled one second on and two seconds off for about five hours until a stable torque was obtained. Drum speed was 200 FPM with 75 PSI of engagement pressure and a drum temperature of 225°F.

7.3 Wear Rate and μ:

The Scan-Pac was tested by the same procedure as that used for Fenner 333 in Z0952-1. The friction material was cycled one second on and two seconds off until a minimum of .005" of wear was obtained. The drum speed was 200 FPM with 300 PSI of engagement pressure and a drum temperature of 225°F.

7.4 Oil Saturation:

Pieces of friction material were soaked in SAE 30 oil for 30 minutes and then dabbed dry. They were then cycled for one second on and two seconds off at 400 FPM with 75 PSI of engagement pressure. The drum temperature was maintained at 125°F. After 1,000 cycles, the μ versus number of cycles was plotted on a graph.

8.0 TEST RESULTS:

8.1 Rivet Hole Strength:

The three pieces of Scan-Pac friction material were comparable to Fenner 333. Over 1,000 lbs. of force was needed to move the material .190 in. See Table 12.2.

8.2 Wear Rate by Volume:

The Fenner 333 friction material had a wear rate of 115 HP hr./cu. in. The Scan-Pac #RF-28-3M wore at a rate of 140 HP hr./cu. in., and the other two Scan-Pac samples wore at a rate of a little more than 400 HP hr./in.^{3}. See Table 12.2.

8.3 Coefficient of Friction μ:

The average μ for Fenner 333, at the test parameters, was .43, while the value for Scan-Pac friction materials ranged from .48 to .53. See Figure 12.1 and Table 12.2.

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8.4 Oil Saturation:

The torque recovery of the Scan-Pac friction materials, because they were less porous than Fenner 333, was higher than that of the Fenner. MF-28-3D recovered almost 90% during the 1,000 cycles. See Figure 12.1.

9.0 DISCUSSION:

9.1 Noise:

All three Scan-Pac materials produced some noise. There was no noise from the Fenner 333 during the Z0952-1 Test.

9.2 Fragility:

All three Scan-Pac materials were "hard cured", and, thus, without the flexibility of the woven Fenner 333, may present a cracking problem on CS-CT brakes. The SPC-28-8A appeared especially brittle and a small piece broke off during the wear rate test.

9.3 Torque Stability:

The friction coefficient of RF-28-3M had built up to a stable condition during the wear-in cycling at 75 PSI. Then this coefficient decreased 14% during the 3,500 cycles of wear rate testing with 300 PSI of load. The coefficient of the other two Scan-Pac samples and of the Fenner 333 became stable within 5% after 1,000 cycles. See Figure 12.1.

10.0 BIBLIOGRAPHY:

Test Report Z0952-1

11.0 CALCULATIONS:

See FMTM Standard Test Procedure #0000 0000 H.

12.0 APPENDIX:

12.1 Coefficient of Friction as a Function of Number of Cycles During Wear Rate and During Recovery From Oil Soaking

12.2 Wear Rate, μ, and Rivet Holding Force Data

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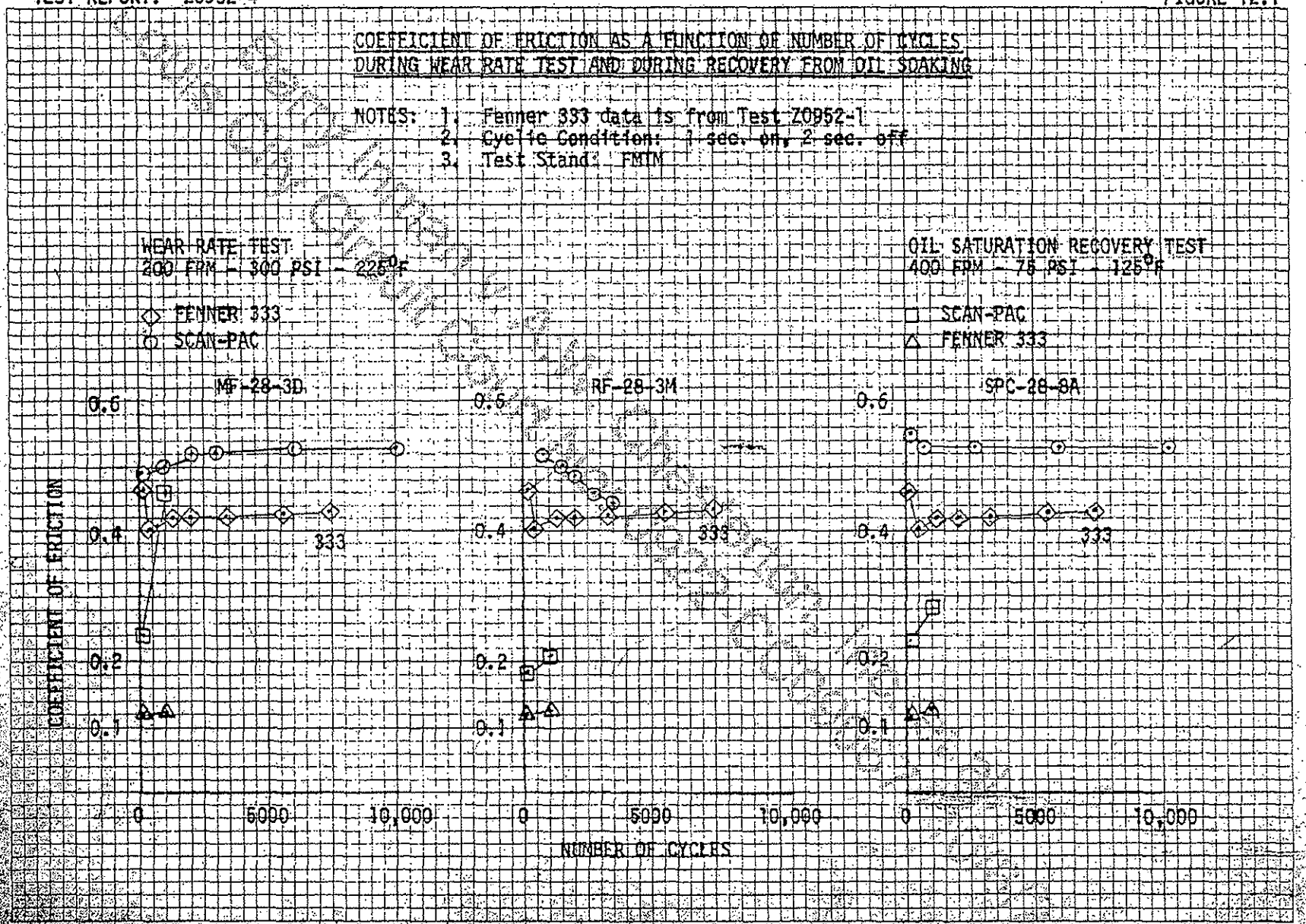
CS-CT FRICTION MATERIAL (SCAN-PAC)

TEST REPORT: Z0952-4

GR-930
FIGURE 12.1

COEFFICIENT OF FRICTION AS A FUNCTION OF NUMBER OF CYCLES DURING WEAR RATE TEST AND DURING RECOVERY FROM OIL SOAKING

NOTES:
1. Fenner 333 data is from Test Z0952-1
2. Cyclic Condition: 1 sec. on, 2 sec. off
3. Test Stand: FMIN



NOTE: Values obtained should be used for comparison only; actual clutch/brake usage values are expected to be different.

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CS-CT FRICTION MATERIAL (SCAN PAC)

TABLE 12.2

WEAR RATE, μ, AND RIVET HOLDING FORCE DATA

LINING	WEAR TEST AVG. μ	HP-HR./IN.^{3} WT.	HP-HR./IN.^{3} VOL.	TANGENTIAL FORCE, LBS. TO PRODUCE .190" OF MOVEMENT	COMMENTS
MF-28-3D	.52	315	405	1200	Squeal
RF-28-3M	.48	173	140	1150	Small squeal, torque decreases with wear.
SPC-28-8A	.53	398	432	1035	Noise just at start-up (cool); small piece broke off trailing edge.
Fenner 333	.43	116	115	1100	Data is from Z0952-1

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