FLUID, AUTOMATIC TRANSMISSION, FRICTION MODIFIED, RED **WSS-M2C924-A**

1. SCOPE

The material defined by this specification is a factory fill automatic transmission fluid composed of base fluids and additives.

2. APPLICATION

This specification was released originally for fluid used as a power transmission, hydraulic control, heat transfer and general lubricant in automatic transmissions requiring specific clutch and band frictional characteristics, specifically intended for engagement noise reduction and improved frictional retention characteristics.

3. REQUIREMENTS

3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements for Production Materials (WSS-M99P1111-A).

3.2 COLOR — Dyed red

(ISO 2049/ASTM D 1500 or DIN 51-578)

Color Rating — 6 - 7.5

Use the weight percent of Morton Chemical Company's Automate Red B (or equivalent) necessary to produce a distinct red hue when one drop of fluid is placed on plain white paper. Perform similar test on fluid after 20,000-cycle durability test. Color number after 20,000-cycle test must match or exceed unused fluid color number by no more than 1 whole number.

3.3 MISCIBILITY TEST — No separation

(FLTM BJ 120-03)

3.4 VISCOSITY

3.4.1	New Fluid kinematic viscosity at 100 °C (ISO 3104/ASTM D 445)	7.0 – 8.0 mm^2/s
3.4.2	After 20 hrs KRL, kinematic viscosity at 100 °C (ASTM D 445/DIN 51350)	5.00 mm^2/s, min
3.4.3	New Fluid Brookfield viscosity at -40 °C (ASTM D 2983)	15,000 max mPa.s

Date	Action	Revisions
2005 03 29	Revised	3.4.7, 3.14.5.1, 3.14.6.1, 3.14.8.1, 3.14.8.4 & 3.14.9.7 revised C. Ved
2005 02 08	Activated	C. Ved

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3.4.4 At 150 °C:

Undegraded, 200/s shear rate, ULSV,	3.0 mPa.s, min
Undegraded, 1 X 10^6/s shear rate, UHSV,	3.0 mPa.s, min
Degraded, 200/s shear rate, DLSV,	3.0 mPa.s, min
Degraded, 1 X 10^6/s shear rate, DHSV,	3.0 mPa.s, min

3.4.5 At 100 °C:

Undegraded, 200/s shear rate, ULSV	5.0 mPa.s, min
Undegraded, 1 X 10^6/s shear rate, UHSV	5.0 mPa.s, min
Degraded, 200/s shear rate, DLSV	5.0 mPa.s, min
Degraded, 1 X 10^6/s shear rate, DHSV	5.0 mPa.s, min

Note 1: Fluids are degraded 20 hrs using KRL (DIN 51350)

Note 2: Construct Viscosity Loss Trapezoid using data from 3.4.4 and 3.4.5. Plot viscosity as the logarithmic ordinate and the shear rates as the abscissa per Figure 1.

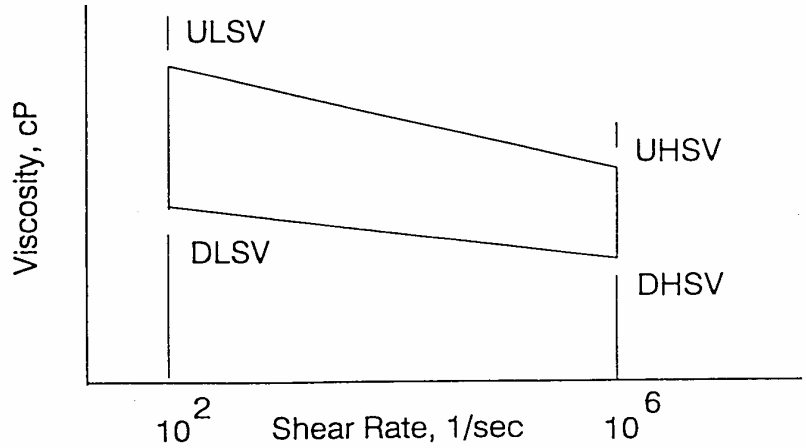

Figure 1

Schematic For Viscosity Loss Trapezoid

3.4.6	Evaporation loss, 150 °C, 2 hr, max. (NOACK Test)	15%
3.4.7	Viscosity after (3.4.6), -40 °C, max change (ASTM D 2983)	Rate & Report

3.5	**FLASH POINT, min** (ISO 2592/ASTM D 92)	195 °C

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3.6 COPPER STRIP, max 1b
(ISO 2160/ASTM D 130, 3 h at 150 °C)
(No water added)

3.7 ANTI-FOAMING PROPERTIES
(ASTM D 892)

	Foam Tendency at end of 5 min blowing period	Foam Stability at end of 1 min settling period
Sequence 1, max.	50 mL	0 mL
Sequence 2, max.	50 mL	0 mL
Sequence 3, max.	50 mL	0 mL
Sequence 4, max	100 mL	0 mL

(Sequence 4 to be tested at 150 +/- 3 °C, 200-mL/minute air)

3.8 NONCORROSION AND NONRUSTING PROPERTIES No visible rust
(ASTM D 665, Procedure A, 24 h)

3.9 EFFECT ON FORD MOTOR COMPANY REFERENCE SEAL COMPOUNDS

3.9.1 ATRR-101 Nitrile after aging 168 h at 150 +/- 3 °C per ASTM D 471, para 6.1, with aluminum block, must be within the limits below:

. Volume Change from original	-3 to 4%
. Hardness, Durometer A Change from original	+/- 6

3.9.2 ATRR-200 Polyacrylic, after aging 70 h at 163 +/- 3 °C in per ASTM D 471, para 6.1, with aluminum block, must be within the limits below:

. Volume Change from original	0 to 6%
. Hardness, Durometer A Change from original	+/- 5

3.9.3 ATRR-300 Silicone after aging 240 h at 163 +/- 3 °C per ASTM D 471, para 6.1, with aluminum block must be within the limits below:

. Volume Change from original	20 to 48%
. Hardness, Durometer A Change from original	-25 to -40

3.9.4 ATRR-400 Fluoroelastomer after aging 240 h at 163 +/- 3 °C per ASTM D 471, para 6.1, with aluminum block, must be within the limits below:

. Volume Change from original	1 to 4%
. Hardness, Durometer A Change from original	+/- 8

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3.9.5 ATRR-500 Ethylene-Acrylic after aging 240 h at 163 +/- 3 °C per ASTM D 471, para 6.1, with aluminum block, must be within the limits below:

. Volume Change from original	5 to 15%
. Hardness, Durometer A Change from original	+/- 5

3.9.6 ATRR-600 Hypalon after aging 240 hrs. in candidate fluid at 163 +/-1 °C per ASTM D 471, para 6.1, with aluminum block or fluid bath, must be within the limits below:

. Volume Change from original	5 to 35%
. Hardness, Durometer A Change from original	-5 to -15

3.9.7 ATRR-700 Hydrogenated Nitrile after aging 240 hrs. in candidate fluid at 163 +/-1 °C per ASTM D 471, para 6.1, with aluminum block, must be within the limits below:

. Volume Change from original	-2 to 4%
. Hardness, Durometer A Change from original	+/- 5

3.10 ODOR

The fluid manufactured to this specification shall meet the Automatic Transmission Operations Odor Test procedure. The fluids shall be found to be acceptable when it receives an acceptability rating of 2 or less. The Automatic Transmission Engineering Operations odor test procedure can be obtained by written request to:

Ford O H & S Department

Occupational and Environmental Health Sciences
Central Laboratory Building CPN
15000 Century Drive, Room S-120
Dearborn, MI 48120
Tel: (313) 322-4113
Fax: (313) 845-5578

3.11 WEAR

3.11.1 VANE PUMP WEAR TEST, wt. loss, max (ASTM D 2882 at 80 +/- 3 °C, 6.9 mPa)	10 mg
3.11.2 Four-Ball Wear Test, 40 Kg load, 2 hrs (ASTM D 4172) Average Wear Scar Diameter, mm max.	
600 RPM, 100 °C (Average of 2 tests)	0.60
600 RPM, 150 °C (Average of 2 tests)	0.60

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3.11.3	Falex EP test (ASTM D 3233) No seizure load at 100 °C, 1 minute No seizure load at 150 °C, 1 minute	 1000 lbs 500 lbs
3.11.4	Timken Wear Test, burnish width, mm (ASTM D 2782) 4.08 kg load, 100 °C, 10 minutes (Average of 2 tests) 4.08 kg load. 150 °C, 10 minutes (Average of 2 tests)	 0.6 max. No Scoring 0.8 max. No Scoring
3.11.5	FZG Gear wear test, Load Stage Pass (ASTM D 5182) 1450 RPM, 15 min at 100 °C start temperature 1450 RPM, 15 min at 150 °C start temperature	 8 8

3.12 TOXICITY

The fluid manufactured and formulated to this specification must not contain skin sensitization components. The entire formulation must be validated by testing, the following specific rigorous protocol. MSDS must accompany all containers other than tank cars quantities and Ford Toxicology Identification Number must be prominently displayed.

The protocol details can be obtained by written communication to:

Occupational and Environmental Health Sciences
Central Laboratory Building CPN
15000 Century Drive, Room S-120
Dearborn, MI 48120
Tel: (313) 322-4113
Fax: (313) 845-5578

And requesting the following procedure:

"Decision Tree: Dermatotoxicology Assessment of High Production Volume Vehicle Fluids such as Transmission Fluids"

3.13 CONTINUOUS SLIP EVALUATION (μ-V CHARACTERIZATION)

A modified SAE #2 machine (or Low Velocity Friction Apparatus, LVFA) with a variable speed drive system capable of producing stable torque values in 1 - 300 rpm range, and 680 Nm torque, on equipment mutually agreed upon by Ford and the Supplier.

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3.13.1 Evaluation and Durability:

Using friction plates with waffle-groove SD-1777-C friction material, run three 1 plate packs to failure. A pack is considered to be two steel separator plates and one friction plate, and referred to as the 1 plate pack. All torque information must be obtained using digitized data acquisition. All packs will be run after receiving a 30-minute break-in per procedure itemized below.

Part No. Friction Material
XP-179164 BW SD-1777-C
BW plates available from:

Request plates "___"
Borg Warner Corp.
700 S. 25th Ave.
Bellwood, IL 60104
Attn: Bruce Clay
(708) 547-2744

C8AP-7B442-A (XP-143218)
Separator Plates available from:

Request Steels "___"
Steel Part Corporation
Attn: James Baldwin
(734) 953-2410

3.13.2 Cleaning Procedure

Prior to performing these friction tests, the fixtures must be cleaned. After removing the front cover, the Spacer, Retainer Ring and Hub are removed. These parts are cleaned with Stoddard's solvent, scrubbed with a non-metallic bristle brush or non-metallic scouring pad and rinsed. The inside of the test housing, attached ports and thermocouple connections are flushed with Stoddard's solvent using a squeeze bottle. Thoroughly clean all crevices and ports in the housing where lubricant is likely to be trapped. Air-blow dry the cleaned parts and test housing.

3.13.3 Assembly Procedure. (See machine set up parameters)

3.13.3.1 Inspect rotating shaft seal (National No. 4471887) for deterioration and replace if necessary. Indication of seal failure or loss of flexibility is the escape of air past the seals. If this seal is replaced, also replace lip seals No. 1366236 and 3-21196 (both supplied by Greening Associates, Inc.).

3.13.3.2 Install clutch plate hub, snap ring, and clutch plate retainer.

3.13.3.3 Presoak clutch plates in test fluid for 5 minutes minimum and then install clutch plates in the test head in the order prescribed with plate rounded side facing operator.

3.13.3.4 Install pack into test head.

3.13.3.5 Plate temperatures are to be measured with two (2) type J thermocouples (or RTD's, resistance temperature devices). Thermocouples are to be located in each steel plate. The thermocouple holes are to be located radially, 120° apart, 60° from the top vertical position and 0.58 mm in diameter and made using EDM (electro-discharge machining). The depths of the holes are to be 13 mm (midway through the friction radius).

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