

ENGINEERING MATERIAL SPECIFICATION

Material Name

Specification Number

**FLUID, AUTOMATIC TRANSMISSION,
FRICTION MODIFIED, RED**

WSS-M2C919-D

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

Material specification requirements are to be used for initial qualification of materials.

3.1 QUALITY SYSTEM REQUIREMENTS

Material suppliers and part producers must conform to the Company's Quality System Requirements.

3.2 INFRARED SPECTROPHOTOMETRY AND/OR THERMAL ANALYSIS

IR spectra and thermograms established for initial approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. All samples shall produce IR spectra and thermograms that correspond to the reference standard when tested under the same conditions.

3.3 COLOR

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

Dyed red

Color Rating

6.5 to 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 32000-cycle durability test. Color number after 32000-cycle test must match or exceed unused fluid color number by no more than 1 whole number.

Date	Action	Revisions
2001 08 08	Activated	J. Sprys

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3.4	MISCIBILITY TEST (FLTM BJ 120-03)	No separation
3.5	VISCOSITY	
3.5.1	KINEMATIC At 100 °C, New Fluid (ISO 3104/ASTM D 445)	5.0 – 6.0 mm ² /s
3.5.2	KINEMATIC At 100 °C, min (ASTM D 445) After 20 hrs KRL (DIN 51350)	5.00 mm ² /s
3.5.3	At 150 °C:	
	Un-degraded, 200/s shear rate, ULSV,	2.0 mPa.s, min
	Un-degraded, 1 X 10E06/s shear rate, UHSV,	1.8 mPa.s, min
	Degraded, 200/s shear rate, DLSV,	2.0 mPa.s, min
	Degraded, 1 X 10E06/s shear rate, DHSV,	1.8 mPa.s, min
3.5.4	At 100 °C:	
	Un-degraded, 200/s shear rate, ULSV, min	4.7 mPa.s
	Un-degraded, 1 X 10E06/s shear rate, UHSV, min	4.7 mPa.s
	Degraded, 200/s shear rate, DLSV, min	4.7 mPa.s
	Degraded, 1 X 10E06/s shear rate, DHSV, min	4.7 mPa.s

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

Note 2: Construct Viscosity Loss Trapezoid using data from 3.5.3 and 3.5.4.
Plot viscosity as the logarithmic ordinate and the shear rates as the abscissa per Figure 1.

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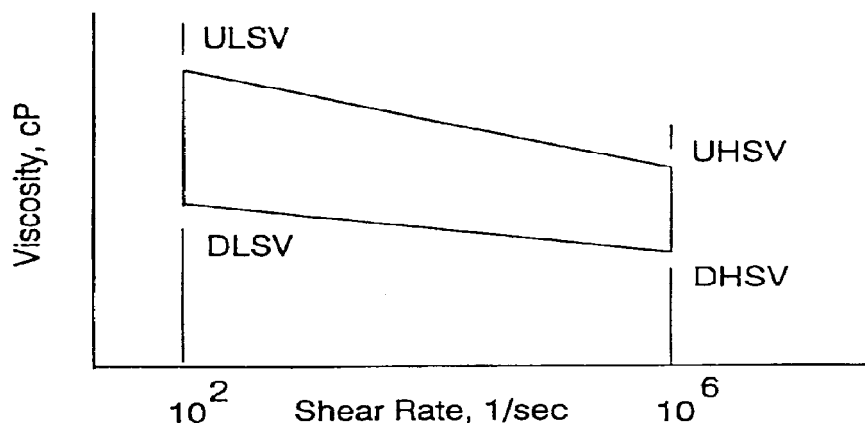


Figure 1. Schematic For Viscosity Loss Trapezoid

3.5.5	At - 40 °C, New Fluid (ASTM D 2983)	7500K +/- 2K mPa.s
3.5.6	Evaporation loss, 150 °C, 2 hr, max. (NOACK Test)	5 %
3.5.7	Viscosity after (3.5.6), -40 °C, max change (ASTM D 2983)	2K mPa.s
3.6	FLASH POINT, min (ISO 2592/ASTM D 92)	200 °C
3.7	COPPER STRIP, max (ISO 2160/ASTM D 130, 3 h at 150 °C) (No water added)	1b
3.8	ANTI-FOAMING PROPERTIES (ASTM D 892)	Foam Tendency Foam Stability at end of 5 min at end of 1 min blowing period settling period
	Sequence 1, max.	30 mL 0 mL
	Sequence 2, max.	40 mL 0 mL
	Sequence 3, max.	30 mL 0 mL
	Sequence 4, max	70 mL 0 mL

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

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- 3.9 NONCORROSION AND NONRUSTING PROPERTIES** No visible rust
(ASTM D 665, Procedure A, 24 h)
- 3.10 EFFECT ON FORD MOTOR COMPANY REFERENCE SEAL COMPOUNDS**
- 3.10.1 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 3.5 +/- 2.5 %
 - . Hardness, Durometer A +/- 7
Change from original
- 3.10.2 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 5.5 +/- 2.5 %
 - . Hardness, Durometer A +/- 5
Change from original
- 3.10.3 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 10 +/- 5 %
 - . Hardness, Durometer A -15/-40
Change from original
- 3.10.4 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 3.5 +/- 2.0 %
 - . Hardness, Durometer A +/- 8
Change from original
- 3.10.5 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 10 +/- 6 %
 - . Hardness, Durometer A +/- 5
Change from original

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3.11 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

3.12 WEAR

3.12.1	VANE PUMP WEAR TEST, wt. loss, max (ASTM D 2882 at 80 +/- 3 °C, 6.9 mPa) 10 mg	
3.12.2	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)	0.55
	600 RPM, 150 °C (Average of 2 tests)	0.55
3.12.3	Falex EP test (ASTM D 3233)	
	No seizure load at 100 °C, 1 minute	545.0 kg
	No seizure load at 150 °C, 1 minute	453.6 kg
3.12.4	Timken Wear Test, burnish width, mm (ASTM D 2782)	
	4.08 kg load, 100 °C, 10 minutes (Average of 2 tests)	0.7 max. No Scoring
	4.08 kg load, 150 °C, 10 minutes (Average of 2 tests)	0.7 max. No Scoring
3.12.5	FZG Gear wear test, Load Stage Pass (ASTM D 5182)	
	1450 RPM, 15 min at 100 °C start temperature	12
	1450 RPM, 15 min at 150 °C start temperature	12

3.13 TOXICITY

The fluid manufactured and formulated to this specification must not contain skin sensitization components and the entire formulation must be validated by testing, following a 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"

3.14 CONTINUOUS SLIP EVALUATION (m m-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.

3.14.1 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:

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

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

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

3.14.2 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.

3.14.3 Assembly Procedure. (See machine set up parameters)

3.14.3.1 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.).

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

3.14.3.3 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.

3.14.3.4 Install pack into test head.

3.14.3.5 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 degrees apart, 60 degrees 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).

3.14.3.6 Install the spacers between the cover and the outermost clutch plate to locate the "bulk oil" type J thermocouple (or RTD's, resistance temperature devices) as close to the center of the test pack as possible. Install "bulk oil" thermocouple (or RTD's, resistance temperature devices) between the 4 and 5 o'clock position to within 1.0 mm of steel core plate O.D. (Without touching steel plate.)

3.14.3.7 Check clutch plate pack free movement. Clearance is 0.36 +/- 0.13 mm. This measurement, conveniently made with a depth micrometer, is made between the head and outermost clutch plate while the pack is pressed into the head with finger pressure (about 1 kg) at the sites of measurements.