

The following procedures cover MERCON® V

Miscibility

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine whether a fluid is miscible with automatic transmission fluids.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires sample jars, ASTM cloud and pour point thermometers, refrigeration apparatus, metal sample jar holder, and hot oil bath.

Procedure parameters

Two jars are partially filled with procedure fluid and mixed with reference fluids while one jar is filled with procedure fluid only. A series of cooling and heating is performed with observations at certain temperatures to determine pour point, separation, and color changes.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The pass/fail criteria require that there be no separation or color change at the end of procedure.

Viscosity

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine viscosity of procedure fluid at 100°C, -20°C and -40°C for new fluids and viscosity at 100°C and -40°C for used fluids. The new procedure fluid is also evaluated for shear stability and apparent viscosity after being used in ASTM D 4683 and ASTM D 5275.

Field service simulated

Satisfactory performance in a normally functioning transmission under service conditions is simulated.

Procedure fixture

This procedure requires glass capillary-type viscometers, glass tube holders, viscometer thermostat and bath, temperature measuring and timing devices, Brookfield viscometer, stand for low-temperature viscosity measurement, and equipment necessary for ASTM D 4683, ASTM D 5275.

Procedure parameters

New fluid is tested at 100°C, -20°C, and -40°C. At 100°C, the fluid is put into a glass capillary viscometer and placed in a bath at 100°C until the temperature stabilizes. The time for the fluid to flow from one calibration mark to another is measured. This time and the viscometer tube factor are used to determine kinematic viscosity. For measurements at -20°C and -40°C, the procedure fluid is cooled to the appropriate temperature and placed in the Brookfield viscometer following ASTM designation D 2983. For the shear stability measurement, fluid is tested for viscosity after testing by ASTM D 5275. For apparent viscosity, viscosity measurements are done after fluid is tested by ASTM D 4683.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The pass/fail criteria are as follows:

100°C (ASTM D 445)	6.8 mm ² /s min
-18°C (ASTM D 2983)	1,700 mPa·s max
-40°C (ASTM D 2983)	9,000 ± 4k mPa·s targ.val.
100°C after ASTM D 5275	6.80 ² /s min
150°C after ASTM D 4683	2.6 mPa·s
100°C after ASTM D 4683	5.7 mPa·s

Noack Volatility Procedure

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine evaporation of a procedure fluid at high temperature and -40°C Brookfield viscosity of used fluid.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

The Noack volatility procedure machine is evaluated.

Procedure parameters

The fluid is weighed initially, then heated with slight vacuum to 150°C for two hours. After cooling, the fluid is reweighed.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The pass/fail criteria currently include:

- Viscosity change after modified Noack
- ASTM D 2983, from -40°C Brookfield viscosity = 2k mPa-s, maximum
- Evaporation loss = 10%, maximum

Flash Point

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine flash point by ASTM designation D 92.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires a procedure cup, heating plate, procedure flame applicator, heater, shield, and thermocouple.

Procedure parameters

Fill the cup with the proper amount of fluid. Heat fluid and, when approaching anticipated flash point, pass procedure flame over cup. Flash point is that temperature when the procedure fluid first flashed.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The pass/fail criterion is 180°C minimum.

Copper Strip Procedure

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine copper strip corrosion by ASTM designation D 130.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires 125 ml bottle, heating oven or bath, and metal specimen conforming to ASTM D 130.

Procedure parameters

Place the copper strip in bottle and cover with procedure fluid. Heat at 150°C for three hours.

Procedure parts evaluated

The copper strip is evaluated.

Pass/fail criteria

The pass/fail criterion is 1b maximum.

Noncorrosion and Nonrusting

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine corrosion and rusting by ASTM designation D 665.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires an oil bath, 400 ml beaker, beaker cover, stirrer, grinding and polishing equipment.

Procedure parameters

Polish the specimens as per procedure. Fill beaker with 300 ml of procedure fluid and 20 ml of distilled water. Insert the procedure specimen and spin at 1000 rpm for 24 hours. Remove and rate the specimens.

Procedure parts evaluated

The procedure specimens (pins) are evaluated.

Pass/fail criteria

There must be no rust on procedure pins.

Vane Pump Wear Procedure

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine the fluid anti-wear characteristics by ASTM designation D 2882.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires the procedure fixture be an electric motor-driven Vickers 104-C pump mounted on a stand capable of controlling speed, temperatures, and pressures.

Procedure parameters

The fluid is tested for 100 hours at 1000 psi and 175°F.

Procedure parts evaluated

The weight loss to ring and vanes, any unusual wear, scuffing, deposits, and deterioration to seals are evaluated.

Pass/fail criteria

The total weight loss must not be more than 10 mg maximum.

Color

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine the color of the procedure fluid.

Field service simulated

This procedure simulates uniform identification by sight.

Procedure fixture

Performance of this procedure requires a sample container and a colorimeter consisting of light source, glass color standards, and sample container housing with cover and viewing piece.

Procedure parameters

Using a standard light source, the liquid procedure fluid is placed in the procedure container and compared with colored glass disks ranging in value from 0.5 to 8.0.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The color of the procedure fluid must fall between 6.0 and 8.0.

Anti-Shudder Durability

Specifications

This procedure covers MERCON® V.

Objective

The objective of this procedure is to determine the low speed, anti-shudder durability of the procedure fluid.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires an S.A.E. #2 friction procedure machine modified for variable low-speed operation.

Procedure parameters

Durability testing is performed for 115 hours with a clutch plate sliding speed of 160 rpm. Anti-shudder evaluations are done at 0-, 15-, and then 10-hour increments to 115 hours at sliding speeds of 2, 6, 10, 14, 20, 40, 60, 80, and 120 rpm.

Procedure parts evaluated

The steel and composition plates are evaluated.

Pass/fail criteria

The pass/fail criteria are as follows:

- In the anti-shudder evaluations, the ratio of 2 rpm to 20 rpm torques and the ratio of the 40 rpm to 120 rpm torques must not exceed 1.0 at 150°C.
- The friction plate wear limit after 115 hours at any of the six measured areas must not exceed 0.152 mm. Average wear per plate after 115 hours is not to exceed 0.076 mm.

Wear Procedure

Specifications

This procedure covers MERCON® V.

Objective

The objective of this procedure is to determine the fluid anti-wear characteristics by ASTM D 2882 (80°C, 6.9 mPa), ASTM D 5182 (1,450 rpm, 150° start temperature), ASTM D 4172 (40 Kg load, 2 hours), ASTM D 3233 (Method B), and ASTM D 2782 (9-lb. load, 150°C, 10 minutes).

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of these procedures requires all necessary equipment and hardware to procedure the fluid according to ASTM D 2882, ASTM D 5182, ASTM D 4172, ASTM D 3233, and ASTM D 2782.

Procedure parameters

The fluid is tested at various loads, pressures, and temperatures in different wear procedures.

Procedure parts evaluated

Vane pumps, gears, and bench wear procedure parts are evaluated for weight loss and wear patterns.

Pass/fail criteria

The pass/fail criteria are as follows:

ASTM D 2882	10 mg weight loss maximum
ASTM D 5182	11 load stage pass
ASTM D 4172	0.61 mm wear scar diameter, maximum (average of 2 procedures)
ASTM D 3233	750 lbs minimum (2 procedures)
ASTM D 2782	0.6 mm maximum burnish width, no scoring (average of 2 procedures)

Friction Durability

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine the friction characteristics and friction durability of the procedure fluid.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires the SAE No. 2 friction procedure machine.

Procedure parameters

Twenty thousand (20,000) cycles of 20 seconds duration are required. Clutches are engaged once each cycle absorbs $20,740 \pm 100$ joules of total energy. Fluid temperature is maintained at 135°C.

Procedure parts evaluated

The steel and composition plates are evaluated.

Pass/fail criteria

The pass/fail criteria are as follows:

- Between 400 and 20,000 cycles of operation, the midpoint dynamic torque should be between 0.140 and 0.160.
- Between 400 and 20,000 cycles of operation, the low-speed dynamic peak coefficients should be between 0.135 and 0.160.
- Between 400 and 20,000 cycles of operation, the static breakaway coefficients should be between 0.12 and 0.15.
- Between 400 and 20,000 cycles of operation, the low speed dynamic coefficient should be between 0.90 and 1.00.
- Between 400 and 20,000 cycles of operation, all stop times must fall between 0.70 and 0.90 seconds.

Anti-Foaming Properties

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine foaming characteristics of procedure fluid by ASTM designation D 892.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires an ASTM foaming procedure apparatus.

Procedure parameters

The sample, maintained at a temperature of 24°C, is blown with air at a constant rate for 5 minutes, then allowed to settle for 10 minutes. The volume of foam is measured at the end of both periods. The procedure is repeated on a second sample at 93.5°C, and then, after collapsing the foam at 24°C, a third sample is run at 150°C with 200 ml/min of air.

Procedure parts evaluated

The procedure fluid is evaluated.

Pass/fail criteria

The maximum allowable foam volume at end of 5-minute blowing period for Sequences I, II, and III is 50 ml. The maximum allowable foam volume at end of 5-minute blowing period for Sequence IV is 100 ml. Maximum allowable foam at end of 1-minute settling period is 0 ml.

Elastomer Compatibility

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine elastomer compatibility of the procedure fluid.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires ASTM D 471 equipment.

Procedure parameters

Strips of each reference elastomer, ATRR-100, ATRR-200, ATRR-300, ATRR-400, ATRR-500, ATRR-600, and ATRR-700 are immersed in tubes containing reference fluid and tubes filled with the candidate fluid. The ATRR-100 is immersed at 150°C for 168 hours. All other elastomers are immersed at 163°C for 240 hours.

Procedure parts evaluated

The elastomer reference materials are evaluated.

Pass/fail criteria

The pass/fail criteria are as follows:

	<u>Volume Change</u>	<u>Hardness Change</u>
ATRR-100	+3.5 ± 2.5%	± 7
ATRR-200	+5.5 ± 2.5%	± 5
ATRR-300	+38 ± 10%	-15 to -40
ATRR-400	+3.5 ± 2.5%	± 8
ATRR-500	+10 ± 6%	± 5
ATRR-600	+27 ± 10%	-24±10
ATRR-700	5.0 ± 5%	± 5

Aluminum Beaker Oxidation Procedure

Specifications

This procedure covers MERCON® V.

Objective

The objective is to determine the oxidation stability of the procedure fluid.

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires an aluminum beaker and associated components, bushings for gear pump, gear pump, air flow control system, temperature control systems, aluminum and copper metal strips.

Procedure parameters

The beaker is filled with procedure fluid, the circulation pump and heating element are turned on and the temperature is rapidly brought up to 155°C. At this point the procedure starts and airflow is introduced into the gear pump at 5 ml/min. Hot samples are removed periodically and the copper strip is inspected once after 50 hours and reinserted. After 300 hours at procedure temperature, the procedure is completed. The beaker and fluid are weighed before and after the procedure.

Procedure parts evaluated

The aluminum and copper metal strips, top of pump housing, the beaker, and the procedure fluid are evaluated.

Pass/fail criteria

The pass/fail criteria are as follows:

	<u>Hrs.</u>	<u>Limits</u>
Pentane Insolubles	300	less than 0.35%
TAN Change	300	3.5 max
Diff. IR, Absorbance		
Per cm path length	300	30 max
% Viscosity Inc., 40°C	300	25% max
Copper Strip Rating	50	3b max
Copper Strip Rating	300	3b max
Aluminum Strip Rating	300	no varnish
Sludge	300	no sludge
Viscosity, -40°C	300	rate and report

SOUTHWEST RESEARCH INSTITUTE

Abstracts of Procedures Performed by the Fuels and Lubricants Research Division

Calculated % wt loss 300 rate and report

Cycling Procedure

Specifications

This procedure covers MERCON®.

Objective

The objective is to determine friction retention, oxidation stability, and corrosion protection characteristics of a procedure fluid (DEXRON® III Cycling Procedure).

Field service simulated

This procedure simulates satisfactory performance in a normally functioning transmission under service conditions.

Procedure fixture

Performance of this procedure requires a Hydra-matic 4L60 automatic transmission driven by a GM 5.7L L-98

engine. The engine and transmission are mounted on a procedure stand capable of cyclic operation with control of speed, load, temperatures, and pressures.

Procedure parameters

Thirty-two thousand (32,000) accelerations through the 1–2, 2–3, and 3–4 shifts are performed.

Transmission sump temperature is maintained at 135°C. Engine speed, transmission output speed, output shaft torque, and acceleration times are all controlled during the cycle. For Dexron VI, the procedure will be run 42,000 cycles.

Procedure parts evaluated

All of the internal transmission parts are rated for sludge, varnish, deterioration, wear, and abnormal conditions.

Used lubricant analysis

The used lubricant analysis consists of viscosity, TAN, carbonyl group absorbance increase, and effluent gas O₂ content.

Pass/fail criteria

The pass/fail criteria are as follows:

- 1–2 shift time must be 0.30 to 0.75 seconds and 2–3 shift times must be 0.30 to 0.75 seconds for 20,000 cycles.
- Viscosity at 100°C must be greater than 5.0 cSt.
- TAN increase must be less than 2.5.
- IR absorbance increase must be less than 0.35.
- Brookfield viscosity of used fluid must be less than 3,000 cP.

- Transmission part condition shall be equal to or better than that obtained with reference fluids.

Ford Over-Running Clutch (AXAN OWC) Wear Procedure

The goal of this procedure is to determine if the oil can protect the inner race of the over-running clutch in a free-wheeling situation. The procedure result will be “no trenching” which means inner race intact or “trenching” which means that the rollers have worn a visible groove in the inner race.