

LIBRARY

Multipurpose Petroleum Base Fluids - SAE J73



Handbook Supplement

All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE Standard or SAE Recommended Practice, and no commitment to conform to or be guided by any technical report.

Published July 1967

©Society of Automotive Engineers, Inc. 1967

In formulating and approving technical reports, the Technical Board, its Councils and Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents.

—SAE Technical Board Rules and Regulations

Printed in U. S. A.

Report of Special Coordinating Committee on Hydraulic Fluid approved November 1962.

GENERAL INFORMATION

Specifications for multipurpose petroleum base fluids are given to reflect current industry practice in the usage of such materials in agricultural, construction, industrial, and other special purpose vehicles. Such fluids have been found to provide satisfactory performance in various current vehicle designs. However, because of the special nature of certain of the fluids, adequate testing must be performed to determine that any specific fluid is satisfactory for purposes other than that for which it was developed. In lieu of adequate tests, these fluids should not be used except as recommended by the vehicle manufacturer. Such fluids may be designated

by the vehicle manufacturer to be used in transmissions, axles, final drives, central hydraulic systems actuating various vehicle functions including hydraulic brakes, or for other purposes where it is necessary to use a special fluid.

SCOPE

The specifications cover a wide range of fluid properties and their suitability for use at various ambient temperatures depends on the design of the vehicle (Table 1). There is a continuing effort to develop general specifications which will be more widely applicable to a greater number of designs.

Table 1 - Specifications

Tests	Test Method	Test Limits				
		73R1	73R2	73R3	73R4	73R5
Viscosity	ASTM D 445 for measurement of low temperature viscosity by the Brookfield Method	39,000 SUS at -40 F max	12,000 SUS at 0 F max	12,000 SUS at 0 F max	48,000 SUS at 0 F max	100,000 SUS at 0 F max
		45 SUS at 210 F min	58 SUS at 210 F min	44-58 SUS at 210 F	50-58 SUS at 210 F	58-70 SUS at 210 F
Flash Point	ASTM D 92	320 F min	360 F min	360 F min	375 F min	390 F min
Pour Point	ASTM D 97	-65 F max	-20 F max	-20 F max	-10 F max	0 F max
Foaming	ASTM D 892	300 - 25 - 300 ml after 10 minutes settling all sequences				
Oxidation - Stability	MIL-L-2104 Engine Performance Test	-	-	Pass	-	Pass
	MIL-L-45199A Engine Performance Test	-	-	-	-	-
	MIL-L-10295A Engine Performance Test	Pass	-	-	-	-
Antiwear	ASTM D 811	Must contain 0.04%, (min) zinc as zinc dialkyldithio phosphate				
Rust Protection	ASTM D 665 A	Pass	Pass	Pass	Pass	Pass
Corrosion Resistance	ASTM D 130 (3 hr at 212 F)	1 max	1 max	1 max	1 max	1 max
Aniline Point	ASTM D 611	180 F, min - 225 F, max				
Compatibility	MIL-L-2104A Specification homogeneity and compatibility requirements	-	-	Pass	-	Pass
	MIL-L-45199A Specification homogeneity and compatibility requirements	-	-	-	-	-
Other Special Requirements		-	-	-	-	-

Table 1 - Specifications (continued)

Tests	Test Method	Test Limits				
		73R6	73R7	73R8	73R9	73R10
Viscosity	ASTM D 445 for measurement of low temperature viscosity by the Brookfield Method	12,000 SUS at 0 F max 44-58 SUS at 210 F	48,000 SUS at 0 F max 50-58 SUS at 210 F	100,000 SUS at 0 F max 58-70 SUS at 210 F	750 cs at 32 F max 4.82 cs at 212 F min	2000 cs at 32 F max 7.29 cs at 212 F min
Flash Point	ASTM D 92	360 F min	375 F min	390 F min	320 F min	320 F min
Pour Point	ASTM D 97	-20 F max	-10 F max	0 F max	-10 F	+5 F
Foaming	ASTM D 892	300 - 25 - 300 ml after 10 minutes settling all sequences			300 ml after 5 minutes blowing 0 ml after 10 minutes settling	
Oxidation - Stability	MIL-L-2104A Engine Performance Test	-	-	-	-	-
	MIL-L-45199A Engine Performance Test	Pass	-	Pass	-	-
	MIL-L-10295A Engine Performance Test	-	-	-	-	-
Antiwear	ASTM D 811	-	-	-	-	-
Rust Protection	ASTM D 665A	Pass	Pass	Pass	-	-
Corrosion Resistance	ASTM D 130 (3 hr at 212 F)	1 max	1 max	1 max	2 max	2 max
Aniline Point	ASTM D 611	180 F, min - 225 F, max			180 F, min - 260 F, max	
Compatibility	MIL-L-2104A Specification homogeneity and compatibility requirements	-	-	-	-	-
	MIL-L-45199A Specification homogeneity and compatibility requirements	Pass	-	Pass	-	-
Other Special Requirements		-	-	-	-	-

Table 1 - Specifications (continued)

Tests	Test Method	Test Limits		
		73R11	73R12	73R13
Viscosity	ASTM D 445 for measurement of low temperature viscosity by the Brookfield Method	2400 cp at 0 F max 5.75 cs at 210 F min	12,000 SUS at 0 F max (extrapolated) 46 SUS at 210 F max	1500 SUS at 0 F max 55-65 at 100 F
Flash Point	ASTM D 92		385 F min	275 F min
Pour Point	ASTM D 97	-20 F max	-25 F max	-55 max
Foaming	ASTM D 892	300 - 25 - 300 ml after 10 minutes settling all sequences	See Appendix B	-
Oxidation - Stability	MIL-L-2104A Engine Performance Test	See Appendix A	See Appendix B	-
	MIL-L-45199A Engine Performance Test	See Appendix A	See Appendix B	-
	MIL-L-10295A Engine Performance Test	See Appendix A	See Appendix B	-
Antiwear	ASTM D 811	See Appendix A	See Appendix B	-
Rust Protection	ASTM D 665A	See Appendix A	See Appendix B	Pass
Corrosion Resistance	ASTM D 130 (3 hr at 212 F)	See Appendix A	See Appendix B	See Appendix C
Aniline Point	ASTM D 611	-	185 - 208	180 - 200
Compatibility	MIL-L-2104A Specification homogeneity and compatibility requirements	-	-	-
	MIL-L-45199A Specification homogeneity and compatibility requirements	-	-	-
Other Special Requirements		See Appendix A	See Appendix B	See Appendix C

Table 1 - Specifications (continued)

Tests	Test Method	Test Limits				
		73R14	73R15	73R16	73R17	73R18
Viscosity	ASTM D 445 for measurement of low temperature viscosity by the Brookfield Method	64,000 cp at -40 F max 4500 cp at -10 F max 49 SUS at 210 F min	1550 cs at 0 F max 6.9 cs at 212 F min	145-165 SUS at 100 F (90 VI, min)	700 cs at 32 F max 7.3 cs at 212 F min	195-210 SUS at 100 F 45 SUS at 210 F min
Flash Point	ASTM D 92	320 F min	345 min	350 F min	320 F min	380 min
Pour Point	ASTM D 97	-	-40 F max	-25 F max	-20 F max	-20 F max
Foaming	ASTM D 892	See Appendix D	See Appendix E	150-0 50-0 150-0	100-0 max (all sequences)	100-0 max (all sequences)
Oxidation - Stability	MIL-L-2104A Engine Performance Test	See Appendix D	See Appendix E	See Appendix F	See Appendix G	-
	MIL-L-45199A Engine Performance Test	See Appendix D	See Appendix E	See Appendix F	See Appendix G	-
	MIL-L-10295A Engine Performance Test	See Appendix D	See Appendix E	See Appendix F	See Appendix G	-
Antiwear	ASTM D 811	See Appendix D	See Appendix E	-	See Appendix G	See Appendix H
Rust Protection	ASTM D 665 A	Pass	-	Pass	-	-
Corrosion Resistance	ASTM D 130 (3 hr at 212 F)	See Appendix D	1 max	1 max	1 max	1 max
Aniline Point	ASTM D 611	-	-	180 - 220	See Appendix G	-
Compatibility	MIL-L-2104A Specification homogeneity and compatibility requirements	See Appendix D	See Appendix E	See Appendix F	See Appendix G	-
	MIL-L-45199A Specification homogeneity and compatibility requirements	See Appendix D	See Appendix E	See Appendix F	See Appendix G	-
Other Special Requirements		See Appendix D	See Appendix E	See Appendix F	See Appendix G	See Appendix H

APPENDIX A

HYDRAULIC TRANSMISSION FLUID, TYPE C-1

SCOPE - This specification covers type C-1 hydraulic transmission fluid to be used in heavy-duty truck, bus, and earthmoving vehicle transmissions.

REQUIREMENTS -

1. General - The fluid shall give satisfactory operation of commercial hydraulic transmissions when operating under the conditions specified by the manufacturer.

The fluid shall not cause corrosion of aluminum, copper, iron, lead, silver, or any of their alloys under transmission operating conditions.

2. Physical and Chemical Requirements -

- (a) Viscosity at 210 F, cs - 5.75 minimum.
- (b) Viscosity at 0 F, cp - 2400 max.
- (c) Pour point, F - Minus 20 F max.
- (d) Water content, max - None.
- (e) Antifoam property -

Sequence (1) - No limit immediately following the bubbling period but a maximum of 300 ml after 10 minutes of foam collapse.

Sequence (2) - No limit immediately following the bubbling period, but a maximum of 25 ml after 10 minutes of foam collapse.

Sequence (3) - No limit immediately following the bubbling period, but a maximum of 300 ml after 10 minutes of foam collapse.

- (f) Antiwear Property - See paragraph 4, Special Tests.
- (g) Oxidation Resistance - See paragraph 4.
- (h) Effect on Rubber Seals - See paragraph 4.

3. Test Procedures -

- (a) Viscosity at 210 F - ASTM D 445.
- (b) Viscosity at 0 F - Tentative ATF Type A Brookfield Viscosity.

- (c) Pour Point - ASTM D 97-47.
- (d) Water Content - ASTM D 95-46.
- (e) Antifoam Property - ASTM D 892-46 T.
- (f) Antiwear Property - See paragraph 4.
- (g) Oxidation Resistance - See paragraph 4.
- (h) Effect on Rubber Seals - See paragraph 4.

4. Special Tests -

(f) Antiwear Property Test - Use a standard production power steering pump obtained from the service department of one of the following local dealers: Buick, part no.

5682637; Cadillac, parts no. 5681016, 5682664; Oldsmobile, part no. 5680745; Pontiac, parts no. 5682001, 5682665. (These parts, or the current Model Year equivalent, are also available through United Motors Service. The parts listed cover the pump with two hose fittings. The pumps may be obtained less these fittings. The rings and vanes needed for each test may be purchased separately. Other pump parts may be obtained as required.)

Run at 5150 rpm, 300 psi output pressure for 30 minutes. Limit maximum reservoir oil temperature to 155 ± 5 F by water cooling. Weigh pump vanes before and after test. For an oil to satisfactorily pass this test, the vane weight loss shall be no more than 0.04%.

(g) Oxidation Resistance -

(1) Bench Test - This test is that described in Federal Specification VV-L-791d, amendment 1, method number 530.8.2, dated 20 June 1950, modified as follows:

Condenser - not used.

Bath Temperature, F - 300 ± 2 .

Test Metals - 17 in. each of coiled 25 ga. (B.W.G.) copper and No. 36 reagent grade iron wire.

Oil Volume, cc - 300.

Air, water-saturated at 100 F, 1/hr - 8 ± 0.5 .

To pass this test, the oil shall not gain more than 15% in viscosity at 210 F, SUS after 150 hr.

(2) Transmission Test - Use a 1955 Powerglide transmission, or current Model Year equivalent, with the stator and stator clutch reversed to provide a heating unit. Rotate at 1700-1800 rpm, no load, in drive position, for 300 hr. Maintain the sump oil temperature at 325 ± 2 F by controlling the circulation of the oil through an external water-cooled heat exchanger. For an oil to satisfactorily pass this test: No varnish shall have accumulated on the front or rear pumps or on the manual valve. No sludging of the screen or of other parts shall have occurred.

(h) Effect on Rubber Seals Test - Procure from Acadia Synthetic Products Div. transmission rubber seals molded from Acadia 3612 compound, Chevrolet part no. 3702920.

Cut into 2-3/4 in. sections. Heat section in test oil for 70 hr at 300 ± 2 F. At the end of the test the seal surface shall exhibit no tackiness or decomposition. The maximum durometer A reading change shall be ± 5 . The volume change shall be between +1 and +5%. When bent back on itself, the seal material shall not crack.

APPENDIX B
COMBINATION HYDRAULIC AND
TRANSMISSION FLUID

SCOPE - This specification covers requirements for a fluid suitable for use in certain hydraulic transmission, and power steering systems.

PROPERTY REQUIREMENTS - The material purchased to this specification shall conform to the requirements shown in Table B-1.

WATER TOLERANCE - When tested as described in Section B.5, the fluid shall have no more than the following settling of additives, water, or both: condition, A; settling, max, emulsion must be fluid.

OXIDATION-CORROSION - When tested as shown in Section B.1, the oxidation-corrosion characteristics of the material shall meet the requirements of Table B-2. In addition, this material after rest shall have a maximum precipitation number of 0.05, and no deposit or film shall be visible on the glassware ("A" rating).

Compatibility With Rubber-Like Materials - To insure that this material is compatible with rubber-like materials in the systems, this fluid shall pass the following tests:

High Temperature Bend - Shall not crack or check the

Table B-1 - Property Requirements

Property	Specification Limit	ASTM Test Designation ^a
Viscosity		
0 F, SUS, max	12,000	D 341
210 F, SUS, min	46	D 88
Index, min	90	D 567
Pour Point, F, max	-25	D 97
Flash Point, F, min	385	D 92
Aniline Point, F	185-208	D 611
Bottom Sediments and Water, max.	0.01	D 1796
Strong Acid No., max	0	D 664 or D 974
Precipitation No., max	0.01	D 91
Sulfur, %, max ^b	1.00	D 129
Saponifiable matter, %	3.6	BT 4
Color (NPA), max	8	D 155
Foaming		
After blowing, M1, max	300	D 892(all sequences)
After settling, M1, max	30	(with 1% water added)
Humidity-Corrosion (Rusting)		
As received, hr, min	50	
After subjection to oxidation-corrosion test, hr	Report	
After addition of 1% water (agitate for 5 minutes in a paint shaker), hr	Report	See Section B.4
Total Base No.	Report	D 664
Sulfated Ash, min, %	0.25	D 810
Phosphorus, min, %	0.015	D 811

^a Latest issue, unless otherwise specified.

^b Fluid shall contain 0.32% sulfur, minimum, in the form of sulfurized sperm oil.