



COOLANT CONCENTRATE, HYBRID ORGANIC ACID WITH SILICATES AND NITRITES

WSS-M97B51-A1

1. SCOPE

When mixed 50/50 with water it shall be a satisfactory fluid for vehicle cooling systems that contain aluminum engine components, radiators and heater cores, ferrous metals and copper brass. These materials are for initial fill and service fill.

2. APPLICATION

WSS-M97B51-A1 was originally released for passenger car, light truck and commercial truck applications.

3. REQUIREMENTS

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

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 DOCUMENTATION

3.2.1 Approval of a new formulation

Supplier must furnish to the affected Materials Engineering activity a completed and certified copy of the attached supplements A and C and test reports demonstrating full compliance with all the requirements of this specification along with full formulation and manufacturing limits that apply to the material upon which approval is requested. Suppliers must provide full disclosure of their material formulation to, and be approved by, Materials Engineering. All tests must be certified by a qualified and authorized representative of the test facility.

3.2.2 Approval of a new supplier to an approved formulation

Supplier must furnish to the affected Materials Engineering activity a completed and certified copy of the attached supplements A and C and test reports demonstrating full compliance with paragraphs 3.1, 3.3, 3.4, 3.5.1-3.5.4, 3.6, and 3.8-3.11, of this specification (or as directed by Materials Engineering). All tests must be certified by a qualified and authorized representative of the test facility.

Date	Action	Revisions
2007 05 08	Revised	Table 1 A. Reaume
2002 08 15	Revised	Updated and renumbered
1999 12 08	Activated	



Documents

A. Reaume
Document Sharing Hub



3.2.3 Supplying an approved formulation from concentrate

Supplier must furnish to the affected Materials Engineering activity a completed and certified copy of the attached supplements A and C and test reports demonstrating full compliance with paragraphs 3.1, 3.3, 3.4, 3.5.1, 3.6 (Aluminum water pump cavitation and MTU cavitation chamber tests only), and 3.8-3.11, of this specification (or as directed by Materials Engineering). All tests must be certified by a qualified and authorized representative of the test facility.

3.3 COOLANT COMPOSITION

Coolants supplied to this specification must adhere to the following:

- . Minimum of 85% monoethylene glycol (75% virgin).
- . Anions
ASTM D 5927
Chlorides at 25 ppm max
Sulfates at 30 ppm max
Phosphates at 15 ppm max (measured by Ion Chromatography only)
Glycolate at 10 ppm max
- . Metals, 5 ppm max, each metal
ASTM D 6130
Aluminum
Calcium
Copper
Iron
Lead
Magnesium

3.4 RECYCLED CONTENT

Any redistilled (recycled) coolant, up to 10%, supplied to this specification must be pre-approved by Materials Engineering and include full documentation of the process including feedstock of used coolant, control plans, FMEA, and compositional limits. Suppliers must certify full compliance with all the requirements of this specification.

3.5 LABORATORY MATERIAL PERFORMANCE

- 3.5.1 The chemical and physical properties of coolant candidates shall meet the requirements of the tests listed below.

Table 1 requirements are screening tests to determine if candidate coolants qualify for the more intensive evaluations in para 3.7 (Fleet Test).



TABLE 1

TEST DESCRIPTION	TEST METHOD	TEST DESCRIPTION	TEST LIMITS
Color	Visual		Yellow (polymeric dye)
Suspended Matter	Visual		None
Relative Density	ASTM D 1122/ D 5931	@ 15.5/15.5 °C	1.110 - 1.145
Water	ASTM D 1123		5% max
Freezing point	ASTM D 1177/ D 3321/D 6660	@ 50% by vol	£-37 °C (-34 if measured in °F)
PH	ASTM D 1287	@ 50% by vol	7-9
Silicates	ASTM D 6130	Inductively Coupled Plasma Spectroscopy(ICP)	200 ppm, min
Reserve Alkalinity	ASTM D 1121		10 mL, min
Nitrites (as NO ₂)	FLTM AM 107-01	% by weight	0.21 – 0.26
Foaming Characteristics	ASTM D 1881	Foam height Break time	150 mL, max 3 sec, max
Effect on automotive finish	FLTM BI 113-01	Use 30% coolant/water in place of liquid soap.	No effect greater than DI water.
Viscosity	ASTM D445	@ 20 °C	Information only
Electrical Conductivity	ASTM D 1125	@ 20 °C, 50% by vol,	Information only
Thermal Conductivity	ASTM D 2717 or Report	@ 20 °C, @ 50% by vol	0.4184 mW/cm C Information only
Glassware Corrosion Test	ASTM D 1384	Cast iron, steel, brass and copper weight loss per coupon Cast aluminum, low lead solder weight loss per coupon High lead solder weight loss per coupon Average of 3 determinations	10 mg, max 10 mg, max Report
Hot surface corrosion test	ASTM D 4340	. Initial qualification - Average of 2 determinations . After FLTM 102-02 - Average of 2 determinations	mg/cm ² /week, max 1.0 mg/cm ² /week, max
Galvano-static pitting test	FLTM BL 105-01	Pitting potential, mV vs. SCR	> -400 mv

3.5.2 Compatibility with Other Coolants

Prepare samples of containing 10%/90%, 30%/70%, 50%/50%, 70%/30% and 90%/10% of test coolant and each coolant currently supplied to the market in which the coolant is to be used for both initial fill and after market applications. Samples are then tested to the following tests.

Glassware Corrosion Test (ASTM D1384) - Same test limits as in Table 1.

Hot Surface Corrosion Test (ASTM D4340) - Same test limits as in Table 1.



3.5.3 Storage Stability

Prepare hard water by adding 275 mg of calcium chloride (CaCl_2) to 1 liter synthetic corrosive water described in ASTM D1384 (Test Solutions section). Prepare six coolant samples of around 100 ml using the test coolant and the hard water solution. Samples are to have coolant concentrations of 100% (samples 1 and 2), 75% (samples 3 and 4) and 50% (samples 5 and 6). Put all samples in clean, labeled polymethylpentene (PMP) bottles for testing. (French square-type bottle may aid visual check.) All samples must pass hot and cold storage stability testing for the coolant to pass.

Hot Storage Stability - Samples 1, 3 and 5 are heat storage tested in a circulating air oven at $65 \pm 2^\circ\text{C}$ for 14 days. Remove samples on days 2, 4, 7, 10 and 14. Allow to cool to room temperature. Check for precipitates, deposits, gelation and phase separation. "Fish eyes" on the top (from defoamer) is acceptable. If anything other than "fish eyes" is present, terminate test and write as failure.

Cold Storage Stability - Samples 2, 4 and 6 are cold storage tested at -40°C for 14 days. Remove the samples on days 2, 4, 7, 10 and 14. Allow to go to room temperature. Check for precipitates, deposits, gelation and phase separation. "Fish eyes" on the top (from defoamer) is acceptable. If anything other than "fish eyes" is present, terminate test and write as failure.

3.5.4 Compatibility with Engine Hot Test Fluids (Product Chemical Procedure dated 2-15-96)

Prepare 5 samples, of about 100 ml volume, of 50% coolant concentrate and 50% deionized water (ASTM D 1193, Type IV minimum water to simulate factory fill usage). Label sample bottles 1, 2, 3, 4 and 5. Add 1, 2, 3 and 4% by volume of engine hot test fluid to samples 1, 2, 3 and 4; leave sample 5 as is.

Allow samples to sit for period of one month at ambient temperature. Observe the samples weekly for any change in appearance, such as gelling, precipitation, phase separation.

(French square-type bottle may aid visual check.)

Any changes, other than "fish eyes" deem the hot test fluid incompatible with the coolant.



3.5.5 Compatibility with Polymeric Materials

Testing shall be performed using currently approved coolant and proposed coolant. A comparison shall be made between the results for both coolants. Results of the testing must be reported to the responsible Materials Engineer. Testing will be completed by the polymer supplier under the direction of Materials Engineering.

Elastomer Testing

For currently approved materials for hoses (tube materials only), o-rings, and gaskets contact the responsible Materials Engineer.

Immersion in Engine Coolant
(FLTM BO 130-01, 1000 h at 125 +/- 2 °C)

3.5.5.1	Hardness change	Rate and Report
3.5.5.2	Tensile Strength Change, max	Rate and Report
3.5.5.3	Elongation at Break Change, max	Rate and Report
3.5.5.4	Volume Change	Rate and Report
3.5.5.5	Compression Stress Relaxation (o-rings and seals only) (ASTM D 6147, 25 % compression)	

Test Method: Measure the initial back-force (F_0) after 30 minutes at 23 +/- 2 °C. Age at 125 +/- 2 °C and take back-force (F_t) measurements at 23 +/- 2 °C after 24, 48, 96, 168 h and thereafter every 168 h until a total elapsed test time of 1000 h has been completed.

Plot $\frac{F_t}{F_0}$ against log 10 time in hours

3.5.5.5.1	Heat Aged (Test Method per Conditioning & Test Conditions paragraph in WSS-M99P1111-A)	
	F_{1000}/F_0 , min	Rate and Report
3.5.5.5.2	Immersion in Engine Coolant (Test Method per para 3.7)	
	F_{1000}/F_0 , min	Rate and Report



Plastics Testing

(FLTM BO 130-01, 1000 h at 125 +/- 2 °C,

50/50% coolant/water, 10 test specimens minimum, unaged property values shall be determined at the time of the aged properties determination)

Tensile Strength at Max Load, min Rate and Report
(ISO 527, 5mm/minute test speed)

Impact Strength, Izod, min Rate and Report
(ISO 180, Test specimens to be notched before immersion, 23 +/- 2 °C)

Heat Aging 24 hours at 80 °C, Nylon materials only
(after 100h at 125 °C in 50/50 coolant/water, 24 hours at 80 °C and 24 hours at 23 °C).

Tensile Strength at Max Load, min Rate and Report
(ISO 527, 5mm/minute test speed)

Impact Strength, Izod, min Rate and Report
(ISO 180, Test specimens to be notched before immersion, 23 +/- 2 °C)

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