CODE BULLETIN C-64

American Chemistry Council
Product Approval Code of Practice
March 2023 Edition

To: **Practitioners of the American Chemistry Council Product Approval Code of Practice and Interested Parties**

Original Issue date: **November 1, 2023**

Effective Date: **December 1, 2023**

Re: **Acceptance of the Sequence IX Aged Oil into the Product Approval Code of Practice – March 2023 Edition**

The American Chemistry Council's (ACC) Product Approval Protocol Task Group (PAPTG) reached consensus to accept the Sequence IX Aged Oil into the Product Approval Code of Practice. Sequence IX Aged Oil information is incorporated into the following Appendices:

Appendix A- Requirements for Engine Test Stand/Laboratory Calibration
Appendix B- Candidate Scheduling, Registration and Tracking Procedure
Appendix F- Multiple Test Evaluation Procedures
Appendix H- Guidelines for Minor Formulations Modifications
Appendix I- Program Guidelines

Existing text and proposed edits to the relevant Appendices are provided below. Please note: existing text and proposed edits are combined; existing text is in black and proposed edits are in **red text**.

Existing Text and Proposed Text on Page A-1

The requirements for the engine test types currently covered by the Code are defined by test type as:

Sequences IIIH, IIIHA, IIIHB, IIIH60, IIIH70, IVA, IVB, VH, VIE, VIF, VIII, IX, IX Aged Oil, X; Caterpillar 1K, 1N, 1P, 1R, C13, Caterpillar Engine Oil Aeration Test (COAT); Mack T-8, T-8E, T-11, T-12; Roller Follower Wear Test (RFWT); Cummins ISB, Cummins ISM and Volvo T-13.

Existing Text and Proposed Text on Page B-3

e) **Test**: An up-to-eight character code used to designate the type of test run.

PC		HD	
Test	**Code**	**Test**	**Code**
Sequence IIIH	IIIH	Caterpillar 1N	1N
Sequence IIIHA	IIIHA	Caterpillar 1K	1K
Sequence IIIHB	IIIHB	Caterpillar 1P	1P
Sequence IIIH60	IIIH60	Caterpillar 1R	1R
Sequence IIIH70	IIIH70	Caterpillar C13	C13
Sequence IVA	IVA	Mack T-8	T8
Sequence IVB	IVB	Mack T-8E	T8E
Sequence VH	VH	Mack T-11	T11
Sequence VIE	VIE	Mack T-12	T12
Sequence VIF	VIF	Cummins ISB	ISB
Sequence VIII	VIII	Cummins ISM	ISM
Sequence IX	IX	Roller Follower Wear Test	65L
Sequence IX Aged Oil	IXAGED	CAT Oil Aeration Test	COAT
Sequence X	X	Volvo T-13	T13

This code is permanent for each test type and is assigned by the ACC Monitoring Agency. The Test Sponsor inserts this code.

Existing Text and Proposed Text on Page F-4 through F-7

MTEP Methods for Rated Parameters

As indicated in the "MTEP Guidelines" section above, when a specification includes requirements for handling data from multiple tests, the specified MTEP method shall be used for that specification. However, for any specification that does not specify an MTEP method (e.g., an ACEA specification); the technique specified in the following table shall be used.

Test	**Type of MTEP**	**Parameter (Units) (note 1)**
Sequence IIIF	MTAC MTAC MTAC MTAC (note 2)	*Kinematic Viscosity (% increase at 40°C*) Avg. piston skirt varnish (merits) Weighted piston deposit (merits) Screened avg. cam plus lifter wear (µm) Hot stuck rings
Sequence IIIFHD	MTAC	*Kinematic Viscosity @ 60 h* (% increase)
Sequence IIIG	MTAC MTAC MTAC (note 2)	*Kinematic Viscosity (% increase at 40°C*) Weighted piston deposit (merits) *Avg. cam plus lifter wear (µm)* Hot stuck rings
Sequence IIIGA	None	No MTEP, No MTAC
Sequence IIIGB	MTAC	Phosphorus retention (%)
Sequence IIIH	MTAC MTAC	*Kinematic Viscosity (% increase at 40° C)* Weighted piston deposit (merits)
Sequence IIIHA	MTAC	*MRV Viscosity (%)*
Sequence IIIHB	MTAC	Phosphorus retention (%)
Sequence IIIH60	MTAC	*Kinematic Viscosity (% increase at 40° C)*
Sequence IIIH70	MTAC MTAC MTAC	*Kinematic Viscosity (% increase at 40° C)* Weighted piston deposit (merits) Average Piston Skirt Varnish (merits)
Sequence IVA	MTAC	Avg. cam wear (µm)
Sequence IVB	MTAC MTAC	*Avg Volume Loss Intake Bucket Lifter (mm^3)* *End of Test Iron (mg/kg)*
Sequence VG	MTAC MTAC MTAC MTAC MTAC (note 3)	Avg. engine sludge (merits) Rocker arm cover sludge (merits) Avg. piston skirt varnish (merits) Avg. engine varnish (merits) *Oil screen clogging (%)* Hot stuck compression rings
Sequence VH	MTAC MTAC MTAC MTAC (note 3)	Avg. engine sludge (merits) *Rocker arm cover sludge (merits)* Avg. piston skirt varnish (merits) Avg. engine varnish (merits) Hot stuck compression rings

Sequence VID	MTAC MTAC	FEI 2 (%) FEI SUM (%)
Sequence VIE	MTAC MTAC	FEI 2 (%) FEI SUM (%)
Sequence VIF	MTAC MTAC	FEI 2 (%) FEI SUM (%)
Sequence VIII	MTAC	Bearing weight loss (mg)
Sequence IX	MTAC MTAC	*Average Number of Preignitions* *Maximum Event*
Sequence IX Aged Oil	MTAC MTAC	*Average Number of Preignitions* *Maximum Event*
Sequence X	MTAC	*Chain Wear Stretch (%)*
Caterpillar 1K	TLM TLM TLM TLM (note 4) (note 5)	WDK (demerits) Top Groove Fill (%) *Top Land Heavy Carbon (%)* Avg. Oil Consumption (g/kW·h) Piston Ring Sticking (yes or no) Piston, Ring and Liner Scuffing (yes or no)
Caterpill ar 1MPC (note 5)	MTAC (note 6) MTAC (note 4) (note 7)	WTD (demerits) Top Groove Fill (%) Piston Ring Sticking (yes or no) Piston, Ring and Liner Scuffing (yes or no)
Caterpillar 1N	TLM TLM TLM TLM(note 4) (note 5)	WDN (demerits) Top Groove Fill (%) *Top Land Heavy Carbon (%)* Oil Consumption (g/kWh) Piston Ring Sticking (yes or no) Piston, Ring and Liner Scuffing (yes or no)
Caterpillar 1P	TLM TLM TLM TLM TLM(note 5)	WDP (demerits) Top Groove Carbon (demerits) Top Land Carbon (demerits) *Avg. Oil Consumption (0-360h) (g/h)* *Final Oil Consumption (312-360h) (g/h)* Piston, Ring and Liner Scuffing (yes or no)
Caterpillar 1R	TLM TLM TLM TLM TLM(note 5)	WDR (demerits) Top Groove Carbon (demerits) Top Land Carbon (demerits) Avg. Initial (0-252 h) Oil Consumption (g/h) Avg. Final (432-504 h) Oil Consumption (g/h) Piston, Ring and Liner Scuffing (yes or no)
Caterpillar C13	MRS (note 4) (note 8)	Caterpillar C13 Merits *Delta Oil Consumption (g/*h) Average Top Land Carbon (Demerits) Average Top Groove Carbon (Demerits) *Second Ring Top Carbon (Demerits)*

Cummins ISM	MRS (note 8) TLM	Cummins ISM Merits Crosshead Weight Loss (mg) Injector Screw Wear (mg) *Oil Filter Pressure Delta (kPa)* Sludge (merits) Top Ring Weight Loss (mg)
Cummins ISB	TLM TLM	Average Camshaft Wear (µm) Average Tappet Weight Loss (mg)
Roller Follower Wear Test	TLM	Average pin wear (mils, max) (µm, max)
Mack T-8	TLM TLM TLM	Viscosity Increase at 3.8% soot (cSt) Filter Plugging, Differential Pressure (kPa) Oil Consumption (g/kWh)
Mack T-8E	TLM TLM	Viscosity Increase at 3.8% soot (cSt) Relative Viscosity at 4.8% soot (unitless number)
Mack T-11	TLM	TGA % Soot @ 4.0 cSt increase @ 100° C TGA % Soot @ 12.0 cSt increase @ 100° C TGA % Soot @ 15.0 cSt increase @ 100° C
Mack T-12 (note 9)	TLM	Liner Wear, µm Top Ring Mass Loss, mg Lead Content at EOT, mg/kg
Mack T-12 (note 10)	MRS	Cylinder Liner Wear, µm Top Ring Mass Loss, mg *Delta Pb @ EOT, mg/kg* *Delta Pb 250 to 300 hours, mg/kh* *Oil Consumption, g/hr*
Mack T-12 (note 11)	MTAC (note 12)	Top Ring Mass Loss, mg Cylinder Liner Wear, µm
Volvo T-13	TLM	IR Peak at EOT, Abs., cm^{-1} Kinematic Viscosity Increase at 40°C, %
CAT Oil Aeration Test	MTAC (note 12)	Average Aeration, 40h to 50h, %

Notes:

1. Units for parameters in italics are transformed. See next section for specific transformations.
2. The majority of retained tests must not have ring sticking (hot stuck).
3. The majority of retained tests must not have compression ring sticking (hot stuck).
4. None of the retained tests may have piston ring sticking.
5. If three or more operationally valid tests have been run, the majority of these tests must not have scuffing. Any scuffed tests are considered non-interpretable, and no data from these tests are to be used in MTEP calculations.
6. Two methods of calculating WTD are used, one for API Category CF and a different one for API Category CF-2. Both methods use MTAC for handling test results.
7. None of the retained tests may have piston, ring or liner scuffing.
8. The parameters used in calculating the Merit Rating value are shown.
9. This TLM applies to Mack T-12 used in API Category CH-4.
10. This MRS applies to Mack T-12 used in API Category CI-4 and CJ-4.
11. This MTAC applies to Mack T-12 used in API Category CK-4 and FA-4.
12. The MTAC provision to discard any valid test result is not applicable (See Appendix F, pg. F-3, Three or More Tests, Number 2).

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List of Transformations of Rated Parameters

Test	Parameter	Transformation
Sequence IIIF	Viscosity, % Increase	1/square root of the % increase at 80 hours
Sequence IIIFHD	Viscosity, % Increase	LN (PVISH060)
Sequence IIIG	Viscosity, % Increase Avg. cam plus lifter wear	LN (PVISH100) LN (ACLW)
Sequence IIIH	Kinematic Viscosity (% increase at 40°C)	LN (PVIS)
Sequence IIIHA	MRV Viscosity (%)	LN (MRV)
Sequence IIIH60	Kinematic Viscosity (% increase at 40°C)	LN(PVISH060)
Sequence IIIH70	Kinematic Viscosity (% increase at 40°C)	LN(PVISH070)
Sequence IVB	Avg Volume Loss Intake Bucket Lifter End of Test Iron	Square root (AVLI) LN (FEWMEOT)
Sequence VG	Oil Screen Clogging	LN (oil screen clogging +1)
Sequence VH	Rocker Arm Cover Sludge	LN(10 – RCS)
Sequence IX	Average Number of Preignitions Maximum Event	Square root (AVPIE + 0.5) Square root (Maximum Event + 0.5)
Sequence IX Aged Oil	Average Number of Preignitions Maximum Event	Square root (AVPIE + 0.5) Square root (Maximum Event + 0.5)
Sequence X	Chain Wear Stretch (%)	LN(Chain Wear Stretch)
Caterpillar 1K	Top Land Heavy Carbon	LN (TLHC + 1)
Caterpillar 1N	Top Land Heavy Carbon	LN (TLHC + 1)
Caterpillar 1P	Average Oil Consumption Final Oil Consumption	LN (AOC) LN (FOC)
Caterpillar C13	Delta Oil Consumption (g/h) Second Ring Top Carbon	Square root (Delta OC) LN(R2TC)
Mack T-12	Delta Pb @ EOT Delta Pb 250 to 300 hours Oil Consumption	LN (DPbEOT) LN (DPb250300) LN (OC)
Cummins ISM	Oil Filter Pressure Delta	LN (OFDP)
Volvo T-13	Kinematic Viscosity Increase at 40°C	Square root (KV40)

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Existing Text and Proposed Text on Page H-2 through H-4

Guidelines for Specific Engine Tests

The numbered guidelines listed here are applicable only to Sequence IIIF, IIIG, IIIH, IIIH60, IIIH70, IVA, IVB, VG, VH, VID, VIE, VIF, VIII, IX, IX Aged Oil, and X engine tests. Guideline 11 must be consulted when applying these guidelines to the Sequence IX and Sequence IX Aged Oil test as indicated by footnote 1 in this section.

11. Guidelines 1 through 7 can be use with the Sequence IX and Sequence IX Aged Oil test, however, all modifications which involve a metallic detergent (e.g. performance additive package treat rate increase, metallic detergent increase, metallic detergent rebalance, or new metallic detergent introduction) requires Level 2 support for the Sequence IX and Sequence IX Aged Oil.

Existing Text and Proposed Text on Page I-1

2. When conducting base oil interchange, the final commercial formulation must contain all minor formulation modifications. For the Sequences IIIF, IIIG, IIIH, IIIH60, IIIH70, IVA, IVB, VG, VH, VID, VIE, VIF, VIII, IX, IX Aged Oil, and X engine tests in the Code, the total number of changes from the tested formulations may not exceed four, including all changes made for base oil interchange. When using a matrix core data set based on the engine tests listed above, the number of changes may not exceed four. Support data, as defined in Tab 1, must be provided.

The Code is available online at https://www.americanchemistry.com/industry-groups/petroleum-additives/product-approval-protocol-task-group-paptg/code-of-practice-resources. Comments to this Code Bulletin (C-64) should be sent to the PAPTG Manager, Colleen Stevens, prior to December 1, 2023.