



Test Monitoring Center

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Sequence VG Information Letter 03-3
Sequence No. 17

September 5, 2003

ASTM consensus has not been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Sequence VG Mailing List

SUBJECT: 1. Change in Solvent Type
2. Change in Source for Engines
3. Corrections to Test Method

At the June 11, 2003 meeting of the Sequence VG Surveillance Panel, the panel agreed to the following changes to Test Method D6593.

1. The panel agreed to replace aliphatic naphtha with a solvent meeting ASTM D 235, Type II, Class C specifications. The referenced documents section has been revised to add a reference to ASTM D 235. A new Footnote 5 has been inserted and existing footnotes 5 through 12 have been renumbered. Sections 7.6.3.2, 7.6.4, 7.6.5, 7.6.6, 7.6.11, 7.6.12, 7.7.1, 8.3.4.2, 9.3.4.4, A1.3.1 and A6.4 have been revised to change aliphatic naphtha to degreasing solvent. Sections 7.6.3.2, 7.6.5 and 7.6.6 have been revised to delete the requirements to inspect parts cleaned with the solvent to verify a varnish rating of 10 or better. Also, Section 7.6.6.1 has been deleted. The varnish rating of these parts was removed with the issuance of Information Letter 02-4, but these requirements were never removed from the procedure. These changes may be implemented any time after the issuance of this letter, but must be implemented by January 1, 2004.
2. The panel agreed to begin use of the 2000 Model Year 4.6L engine, manufactured at the Romeo engine plant. Because this is a new engine and will be available for multiple runs, the disassembly and reassembly procedure has changed. Sections 7.1, 7.2, 7.3, 7.5, 7.5.5, 7.7, 7.7.1, 7.7.2, 7.7.3, 7.8, 7.8.4, 7.9.2, 7.9.4, 8.3.3.2 and Annex A5 have been revised to include what parts are to be retained during disassembly and to detail preparations for engine assembly. Sections 7.5.7, 7.5.8, 7.5.9, 7.7.5, 7.8.4.1, 7.8.4.2, 7.8.4.3, 7.8.4.4, Fig. A3.29 and Section X2.1.12 have been added to detail additional equipment and procedures required to prepare and assemble the test engine. Because additional materials and special equipment are now required, several new footnotes were added and others were renumbered or deleted, as detailed in the attached pages. In order to switch to the Romeo hardware for non-reference oil tests, the laboratory must conduct two operationally valid reference oil tests on the Romeo hardware. Once these reference oil tests are successfully completed, the laboratory will be approved to run the Romeo engines. The laboratory may continue to run tests on the non-Romeo engine hardware upon completion of the Romeo hardware references. Finally, once one laboratory has exhausted the non-Romeo hardware, the remaining laboratories must begin the switch to the Romeo hardware within one month.

3. Several other changes to the test method have been addressed. Section 16.1.2.1 has been corrected to show the difference between *two* results, where the word *two* had been omitted in previous versions. Section A7.1 has been revised to show the correct website address for the Test Monitoring Center and to add form 10, an ACC Conformance Statement.



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Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/procedure_and_ils/vgil03-3-17.pdf

Distribution: Email

(Revises Test Method D6593-02, as amended by Information Letters 02-1, 02-2, 02-3, 02-4, 02-5, 03-1 and 03-2)

2.1 ASTM Standards:

- D 86 Method for Distillation of Petroleum Products⁴
- D 235 Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)⁵
- D 287 Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)⁴
- D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)⁴
- D 381 Test Method for Existent Gum in Fuels by Jet Evaporation⁴
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the calculation of Dynamic Viscosity)⁴
- D 525 Test Method for Oxidation Stability of Gasoline (Induction Period Method)⁴
- D 873 Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)⁴
- D 1266 Test Method for Sulfur in Petroleum Products (Lamp Method)⁴
- D 1298 Test Method for Density, Relative Density (Specific Gravity) or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method⁴
- D 3237 Test Method for Lead in Gasoline by Atomic Absorption Spectrometry⁶
- D 3525 Test Method for Gasoline Diluent in Used Gasoline Engine Oils by Gas Chromatography⁶
- D 4057 Practice for Manual Sampling of petroleum and Petroleum Products⁶
- D 4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants⁶
- D 4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-ray Fluorescence Spectrometry⁶
- D 4485 Specification for Performance of Engine Oils⁶
- D 4863 Test Method for Determination of Lubricity of Two-Stroke-Cycle Gasoline Engine Lubricants⁶
- D 5059 Test Method for Lead in Gasoline by X-Ray Spectroscopy⁶
- D 5185 Test Method for Determination of Additive Elements, Wear Metals, and Contaminants Used in Lubricating Oils and Determination of Selected Elements in Base Oils by Inductively Coupled Plasma Atomic Emissions Spectrometry⁶
- D 5302 Test Method for Evaluation of Automotive Engine Oils for Inhibition of Deposit Formation and Wear in a Spark-Ignition Internal Combustion Engine Fueled with Gasoline and Operated Under Low-Temperature, Light-Duty Conditions⁶
- D 5844 Test Method for Evaluation of Engine Oils for Inhibition of Rusting (Sequence IID)⁷
- D 5862 Test Method for Evaluation of Engine Oils in Two-Stroke Cycle Turbo-Supercharged 6V92TA Diesel Engine⁷
- D 6304 Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration⁷
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁸
- G 40 Terminology Relating to Erosion & Wear⁹

⁵ *Annual Book of ASTM Standards, Vol 06.04*

Existing footnotes 5 through 12 renumbered as 6 through 13

¹⁴The Better Engineering Manufacturing Model Number 300 LX-P-2x dishwasher type parts cleaning machine, or equivalent, is suggested for this purpose. Information on availability is given in X2.1.

¹⁵The Sunnen CV-616 honing machine is a product of Sunnen Inc., 7910 Manchester, St. Louis, MO 63143.

¹⁶The Sunnen Model CRH-50 Heater or equivalent, is suggested for this purpose. Information on availability is given in X2.1.16.

Existing footnote 13 renumbered as 17

Existing footnote 14 deleted

Existing footnote 15 renumbered as 19

Existing footnote 16 renumbered as 18

Existing footnote 17 renumbered as 20

²¹NAT-50 or PDN-50 are products of Better Engineering Manufacturing, 8361 Town Court, Baltimore, MD 21236.

Existing Footnote 21 renumbered as 22

Existing Footnote 18 renumbered as 23

Existing footnotes 19 and 20 renumbered as 24 and 25

Existing footnotes 22 and 23 renumbered as 26 and 27

7.1 *Sequence VG Test Engine*--The test engine is available from Ford Motor Co. (A9.1). Parts from the engine may be used for as many as four tests. A detailed listing of all parts included in the kit is given in Annex A5.

7.2 *Required New Engine Parts*—Use the parts listed in the engine kit (See Annex A5.1). Use a new gasket kit for each test. Obtain cylinder heads from the supplier listed in X1.2.21. Use cams from the kit, polished by the supplier listed in X2.1.11.

7.3 *Reusable Engine Parts*—The parts listed in the test stand set up kit, supplemental stand set up kit, engine dress kit, engine finish and fastener kit can be reused (all of these can be used in numerous engine assemblies as long as they remain serviceable). See Annex A5. Crankshaft, connecting rods, timing chain covers and cylinder heads may be used for multiple engine assemblies as long as they remain serviceable.

7.5 *Special Engine Measurement and Assembly Equipment*—Items routinely used in laboratory and workshop are not included. Use any special tools or equipment shown in the 1994 and 2000 Crown Victoria Service Manuals¹³ for assembly. A list of these tools is shown in AnnexA4. Complete any assembly instructions not detailed in Section 7 according to the instructions in the 1994 and 2000 Crown Victoria Service Manual.

7.5.5 A total of four master bores are required for verifying the cylinder bore measurement device, for determining ring gap increase for the rings in cylinders 1 and 8, and for determining piston to bore clearance. Master bores are sized according to piston oversize as follows:

For 0.125 mm piston: 90.345 mm

For 0.25 mm piston: 90.470 mm

For 0.375 mm piston: 90.595 mm

For 0.50 mm piston: 90.700 mm

Maintain the master bores in a temperature controlled room.

7.5.7 *Engine Parts Cleaning*—Clean the engine block and cylinder heads using Model Number 300 LX-P-2x dishwasher type parts cleaning machine¹⁴, or similar apparatus.

7.5.8 *Cylinder Hone*—Use a Sunnen CV-616 for cylinder bore resizing and finishing¹⁵

7.5.9 *Connecting Rod Heater*—The piston pins are fixed to the connecting rods with an interference fit. A connecting-rod heater¹⁶ is required to facilitate installation of the piston pins and prevent piston distortion.

7.6.3.2 Submerge the RAC in agitated organic solvent (see 7.7.2) until clean (approximately 1h). Rinse the parts thoroughly with hot water(>60°C). Rinse the RAC with degreasing solvent (7.7.1) and allow to air-dry.

7.6.4 *Camshaft Baffle*-- Submerge the camshaft baffle in agitated organic solvent (see 7.7.2) until clean (approximately 1h). Rinse the parts thoroughly with hot water(>60°C). Rinse the camshaft baffle with degreasing solvent (7.7.1) and allow to air-dry. Inspect the appearance of the top surface of the camshaft baffle. If the before test rating is less than ten on the CRC varnish rating scale (Manual 20)¹⁷, polish camshaft baffle with No. 0 fine steel wool to achieve a dull finish. Rinse with degreasing solvent (7.7.1) and allow to air-dry before use.

7.6.5 *Oil Pan*-- Submerge the oil pan in agitated organic solvent (see 7.7.2) until clean (approximately 1h). Rinse the parts thoroughly with hot water(>60°C). Rinse the oil pan with degreasing solvent (7.7.1) and allow to air-dry

7.6.6 *Oil Pan Baffle*-- Submerge the oil pan baffle in agitated organic solvent (see 7.7.2) until clean (approximately 1h). Rinse the parts thoroughly with hot water(>60°C). Rinse the oil pan baffle with degreasing solvent (7.7.1) and allow to air-dry.

7.6.6.1 Deleted

7.6.11 *Oil Separators*—Clean with degreasing solvent (see 7.7.1) and allow to air dry.

7.6.12 *Timing Chain Cover*—Submerge the timing chain cover in agitated organic solvent (7.7.2) until clean (approximately 1h). Rinse the part thoroughly with hot water(>60°C). Clean with degreasing solvent (7.7.1) and allow to air dry.

7.7 *Solvents and Cleaners Required*—No substitutions for 7.7.1-7.7.5 are allowed. *Use adequate safety provisions with all solvents and cleaners.*

7.7.1 *Degreasing Solvent*, Any solvent meeting ASTM D 235, Type II, Class C may be used.

7.7.2 *Organic Solvent*, Penmul L460.^{18, 19}

7.7.3 *Dearsol 134 Acidic Cleaner*^{19, 20} with Inhibitor, RAC cooling jacket internal cleaner.

7.7.5. *Parts Cleaning Soap*, NAT-50²¹ or PDN-50²¹ have been found to be acceptable.

7.8 *Assembling the Test Engine-Preparations*—Use the test engine obtained from the supplier in 7.1. If this is the first test on a new engine, disassemble the engine in accordance with the 1994 and 2000 Crown Victoria Shop Manuals. Number the connecting rod bearing caps to the corresponding cylinders. Retain the following parts from the new engine: oil pump, main bearings, connecting rod bearings, thrust washer, oil screen spacer, oil filter gasket, oil pan gasket, exhaust manifold gasket, roller followers, valve lash adjusters, rear seal housing, crankshaft gear, timing chains, tensioners, chain rails, plus the following parts that can be used for multiple tests: cylinder block, crankshaft, connecting rods, ignition ring sensor, crankshaft and camshaft timing sensors, crankshaft vibration damper, crankshaft bolt and washer, oil filter adapter and the water pump and pulley.

7.8.4 *Block preparations*—Inspect block, including oil galleries for debris and rust. Remove any debris or rust that is found. Remove oil gallery plugs. Removal of coolant jacket plugs is left to the discretion of the laboratory. Enlarge the chamfers around the top of the cylinder bore. Spray the block with degreasing solvent (see 7.7.1). Spray block with a 50/50 mixture of degreasing solvent (see 7.7.1) and EF-411^{15, 22}. Install the stress plates with cylinder heads and torque to 37 to 43 N·m with an additional 180° in two 90° rotation increments. Head bolts may be used for a maximum of five times. Install the main bearing caps and torque to 40 N·m, with an additional 90° rotation. Install the jackscrews and torque to 8–11 N·m.

7.8.4.1 *Honing*:

- (1) Install the block in the honing machine. Use a Sunnen CV-616 honing machine to hone the block. Install the block with the right cylinder bank on the outside and the front of the block to the right. Verify the honing oil has been changed within the past 15 h, and change if necessary.
- (2) Set the honing machine to flow Sunnen LP8X fluid at a nominal rate of 7 L/min. Set the feed rate to 4 with 57 strokes per minute and spindle speed of 170 r/min. Set the stroke for 5.250 in and lower the block for 10 mm overstroke.
- (3) Install EHU512 stones. Typical pressures of 25-40 units have found to be acceptable. Hone the right bank in the following order, cylinder 1, 3, 4 and 2. Hone the left bank in the following order, Cylinder 7, 5, 8 and 6. Following this order will minimize the possibility of over heating one area of the block. The block may be rotated in the honing machine and does not have to be removed to hone the other bank.

- (4) Install JHU725 stones and hone for approximately five strokes @ 20-25 units of pressure in the order described in 7.8.4.1 (3).
- (5) Install a plateau hone brush and hone @25-30 units of pressure to obtain a surface finish of 8-13 μm . Typically 45 strokes have provided acceptable results.
- (6) Measure the cylinder bore using a bore ladder shown in A3.29. Measure bore both longitudinally and transversely. Determine the bore diameter for piston clearance purposes by adding the middle and bottom transverse bore measurements and dividing by two. Measure the piston skirt 42 mm from the top of the piston. Subtract this value from the bore measurement and verify that the piston-to-bore clearance is within 0.020-0.046 mm. Re-hone the block or choose a different diameter piston to obtain this clearance.
- (7) Determine bore taper by measuring the difference between top-to-bottom, top-to-middle and middle-to-bottom, transversely. Record the maximum value of the readings. Verify that the maximum taper does not exceed 0.006 mm. Determine out-of-round by subtracting the difference between the transverse and longitudinal bore measurements at the top, middle and bottom. Record the maximum value. Verify that the cylinder bore out-of-round does not exceed 0.020 mm.

7.8.4.2 Post Honing Cleaning:

- (1) Remove the block from the honing machine. Remove the stress plates, jackscrews, main bearing bolts and caps. Remove jackscrews from the main bearing caps.
- (2) Clean with degreasing solvent (see 7.7.1).
- (3) Place block in dishwasher type cleaning machine (see 7.5.7) and wash using soap (7.7.5) for 30 min at 60°C
- (4) Spray block with 50/50 solution of EF-411 and degreasing solvent (see 7.7.1).

7.8.4.3 Crankshaft installation:

- (1) If the crankshaft has been used previously, soak the crankshaft in organic solvent (see 7.7.2) for a minimum of 24 h.
- (2) Spray the crankshaft with degreasing solvent.
- (3) Measure the main journals and verify that the diameters are 67.483 – 67.503 mm.
- (4) Measure the connecting rods journals and verify that the diameters are 52.988 – 53.003 mm.
- (5) Install the main bearings.
- (6) Install the main bearing caps and torque to 40 N·m, with an additional 90° rotation.
- (7) Install the jack screws and torque to 9-11 N·m.
- (8) Install the jack screw bolts and torque to 19 to 23 N·m.

7.8.4.4 Piston Installation:

- (1) Install the piston on the connecting rod using Sunnen tool.

7.8.5.1 Ring Gap Adjustment:

- (1) Cut the top and second compression rings gaps as required to obtain the specified blowby flowrate, using the Sanford Piston Ring Grinder.^{19,23} Record the ring side clearance(s) and new ring gap(s) on any ring(s) adjusted. Enter the new dimension(s) on the Supplemental Operational Data sheets. Typical forms for recording these dimensions are shown in Appendix X1. Ensure that the required ring gap delta and ring side clearance are attained (Table 1). Replace rings if smaller ring gaps are required. Measure the rings for cylinders 1 and 8 in the master bore. These measurements are required to determine ring gap increase.

7.8.5.2 Piston Ring Cutting Procedure:

- (2) Cut the ring to the required gap using the ring cutting burr^{19,24} rotated at a rated speed of 3450 r/min. Remove equal amounts from both sides of the gap. Make final cuts on the down stroke only. The ring is cut with a maximum increment of 0.125 mm until the desired ring gap is achieved.
- (3) After the rings are cut remove the ring from the cutting tool, debur using a Sunnen soft stone²⁵ and wipe with a dry towel.

7.9.2 *Piston Installation*--Install pistons in proper cylinders, taking care to ensure rings are not damaged during installation. Wipe the cylinders with EF-411. Install the pistons and connecting rods with the notches facing the rear. Install the rod bearing caps and torque to 40-45 N·m with an additional 90° rotation.

7.9.4 *Cylinder Head Installation*—Cylinder heads are obtained from the supplier in A9.3 . Heads may be used for multiple tests, as long as they remain serviceable.

- (1) Disassemble heads and inspect for any debris or other deleterious materials and remove as necessary.
- (2) If the cylinder heads have not been previously used, spray the cylinder heads with degreasing solvent (see 7.7.1). If the cylinder heads have been used previously, soak in organic solvent (see 7.7.2) for 24 h, place the cylinder heads in the dishwasher type cleaning machine (7.5.7) using soap (7.7.5) at 60°C for 30 min. Promptly remove the cylinder head from the cleaning machine and spray with a 50/50 mixture of EF-411 and degreasing solvent (7.7.1).
- (3) Determine valve guide clearance at the top and middle of the heads on the transverse side of the guide. Reject any heads which exceed 0.020–0.069 mm for intake and 0.046-0.095 mm for exhaust.
- (4) Assemble the cylinder heads in accordance with the manual. Verify valves are properly seated. The method is left at the discretion of the laboratory.
- (5) Install cam bearings. Camshafts maybe installed at this time.

8.3.4.2 Regardless of the flushing technique employed, use an organic solvent (see 7.7.2) for the final flushing followed by separate rinses with hot water (>60°C) and degreasing solvent (7.7.1) before air-drying the components. *Incomplete cleaning of the external oil system may allow debris to dislodge and circulate throughout the engine during subsequent tests. Incomplete cleaning may also cause oil temperature control problems and contaminate subsequent test oils.*

8.3.2.2 Use oil filter adapter OHT6A-0007-1 (X2.1.11), oil filter OHT6A-012-2 or OHT6A-012-2LS (X2.1.11). Be sure all hoses and fittings on the oil heat exchanger are properly connected and secure. *The external oil system components shall not be brass, copper or galvanized, as these materials may influence used oil analysis.*

9.3.4.4 *Maintenance*—As a minimum, clean the blowby measurement apparatus weekly. Replace o-rings with each cleaning. Exercise particular care when cleaning the orifice meter assembly. Clean the three-way valve by soaking the valve in agitated organic solvent (see 7.7.2) followed by a hot (>60°C) water rinse and spray rinse with degreasing solvent (7.7.1). Use compressed air to force-dry. Inspect the port passages and remove any carbonaceous deposits by scraping. If the valve is disassembled for cleaning, make sure the core is properly seated upon reassembly.

12.1.1.8 Check and record oil level after break-in. If piston rings are re-gapped or replaced during or after the break-in, ensure that the oil level is brought back to the last known oil level by adding new oil or removing oil.

16.1.2.1 *Reproducibility Limit (R)*—the difference between two results obtained under reproducibility conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the values in Table 8 in only one case in twenty.

A1.3.1 *Degreasing Solvent (Meeting D 235, Type II, Class C requirements) (See 7.7.1):*

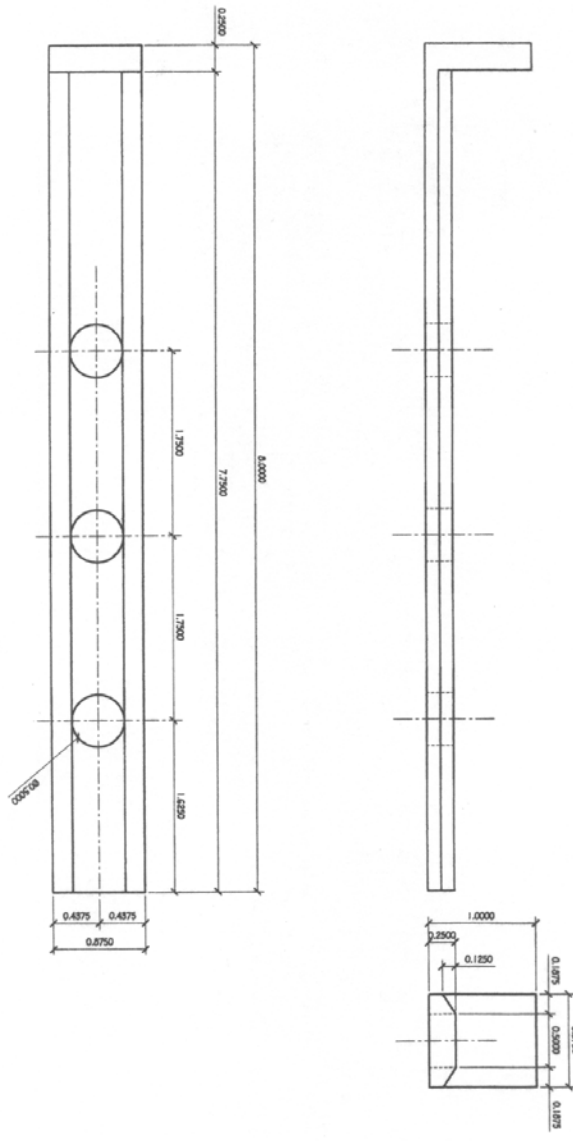


Fig A3.29 Bore Measurement Ladder

Table A5.1 Engine Parts Kit

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	OG	804	AA	Engine Assembly	2
2	D8ZE	6A666	A2B	PCV Valve (EV-98)	4
3	E5TE	9601	AB	Air Filter Element	4
4	AGSF	32P	PF4	Spark Plug Assembly	32
5	F1AE	6065	BB	Bolt M11X1.5 21035 Hex	80
6	F1AE	6345	AD	Main Bolt	36
7	F1AE	6K258	AD	Main Bolt w/Stud Pickup	4
8	Q3U1L	6K109	AA	Oversize Piston, 0.125 mm	8
9	Q3U1L	6K109	AA	Oversize Piston Ring Set, 0.125 mm	8
10	Q3U1L	6K109	AA	Oversize Piston, 0.25 mm	8
11	Q3U1L	6K109	AA	Oversize Piston Ring Set, 0.25 mm	8
12	Q3U1L	6K109	AA	Oversize Piston, 0.375 mm	8
13	Q3U1L	6K109	AA	Oversize Piston Ring Set, 0.375 mm	8
14	Q3U1L	6K109	AA	Oversize Piston, 0.5 mm	8
15	Q3U1L	6K109	AA	Oversize Piston Ring Set, 0.5 mm	8
16	1W7E	6C315	AA	Crank Sensor Assembly	4
17	1W7E	6B288	AA	Cam Position Sensor	4
18	F65E	6251	B8A	Truck Camshaft-LH ^A	4
19	F65E	6C255	A8A	Truck Camshaft-RH ^A	4
20	YU1L	6622	AA	Screen and Cover Assembly	4
21	F6TE	6529	AB	Roller Follower	64
22	F65E	6C501	AA	Valve Tappet	64
23	F5AE	6507	AA	Intake Valve ^B	24
24	F1AE	6505	CC	Exhaust Valve ^B	24
25	F1AZ	6571	A	Valve Seal ^B	48
26	F5AE	6268	AA	Timing Chain	8
27	F81E	6M269	AA	Timing Chain Tensioner – LH	4
28	F81E	6L266	AA	Timing Chain Tensioner – RH	4
29	F3AE	6K297	AA	Timing Chain Guide – LH	4
30	F3AE	6K297	BA	Timing Chain Guide – RH	4
31	1L2E	6L253	AA	Tensioner Arm – LH	4
32	1L2E	6L253	BA	Tensioner Arm – RH	4
33	XL3E	6306	BA	Crankshaft Sprocket	4
34	F9ZE	6333	AA	Main Crankshaft Bearing	20
35	F9ZE	6A338	AA	Main Crankshaft Bearing	16
36	F9ZE	6A339	AA	Thrust Bearing	4
37	F9ZE	6A341	AA	Thrust Washer	20
38	F9ZE	6211	AA	Connecting Rod Bearing Set	64
39	F8AE	6621	AA	Oil Pump Assembly	4
40		N806435	S	Oil Gallery Plug	8
41	VG	LT	01	Cylinder Head Assembly ^B	2
42	VG	FA3		Cam Bearing Set	8

^A Camshafts to be polished by supplier in X2.1.11

^B Cylinder heads are obtained from supplier in X2.1.21 and are received assembled. Quantities listed are for an additional 3 builds.

Table A5.2 Engine Dress Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	F6AE	6D080	BC	Front Cover	1
2	FOTE	9F593	D5A	Fuel Injectors	16
3	F47E	6A785	AA	Oil Separator	4
4	XL3F	9F472	AA	Sensor, Exhaust Gas Oxygen	20
5	F5AE	6C324	AB	Vacuum Line Tube	2

^A The components within the engine dress kit can be used for two tests.

Table A5.3 Stand Setup Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	F5AE	9R504	BD	Air Resonator Assembly	1
2	F3AE	12A166	BD	Ignition Bracket	1
3	F6AE	12257	EB	Ignition Mtg Bracket Assembly	1
4	F2AE	9600	BA	Air Cleaner Assembly	1
5	F6ZR	6375	AC	Flywheel	1
6	F4AE	9424	CA	Intake Manifold	1
7	F8KE	19A216	AD	Grooved Idler Pulley	1
8	F2AE	9A589	AA	Throttle Spacer	1
9	F7AE	6B209	AB	Belt Tensioner	1
10	F8AE	8501	AB	Water Pump Assembly	1
11	F6PE	6C275	AA	Adapter Plate Tensioner	2

^A Long term stand service items.

Table A5.4 Gasket Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	XL3E	6051	BB	Cylinder Head Gasket RH	1
2	XL3E	6083	BB	Cylinder Head Gasket LH	1
3	F1AE	6625	AA	Oil Pump Inlet Tube Gasket	1
4	F3AE	6700	AA	Front Crankshaft Seal	1
5	F3AE	6701	AA	Rear Crankshaft Seal	1
6	F4AE	6710	AB	Oil Pan Gasket	1
7	F4AE	9461	AA	Intake Manifold Gasket	2
8	F6AE	6584	EA	Rocker Cover Gasket RH	1
9	F6AE	6A559	EA	Rocker Cover Gasket LH	1
10	F23E	6734	AA	Oil Drain Plug Gasket	1
11	F65E	6A636	BA	Oil Filter Adapter Gasket	1
12	F1AE	6D081	AD	Front Cover Gasket RH	1
13	F1AE	6D081	BB	Front Cover Gasket Center	1
14	F1AE	6D081	CD	Front Cover Gasket LH	1
15	F65E	9E936	BC	A/Change Cntrl/Mani Gasket	1
16	E83E	9F670	AA	Idle Air Bypass Gasket	1
17	F4AE	9H486	AA	Spacer to Intake Manifold Gasket	1
18		N806807	S	Water Outlet O-ring	1
19		87006	S96	Dipstick Tube O-ring	1
20		391108	S	Water Pump O-ring	1
21	F37E	9448	AB	Exhaust Manifold Gasket	2
22	XW7E	9448	AA	Exhaust Manifold Gasket	23

^A Engine build will use a new gasket kit. The components can be reused during a test, if the parts are still serviceable.

Table A5.5 Fastener Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1		N606502	S36	Bolt M5X0.8X37 Hex Flng Pilot	8
2		N804394	S8M	Scr & Wash-M6X1.0X24 Hex Hd	7
3		N806156	S309	Bolt M8X1.25X43 Hex Flng Pilot	13
4		N808139	S100	Bolt M10X1X26.5 Hex Hd Lk Pilot	6
5		N806300	S309	Bolt M8X1.25X1.25X103.1 Hex Shld	5
6		N804178	S309	Nut M8X1.25 Hex Flng	5
7		N806154	S309	Screw & Washer M6X1.0X32.5 Hex Hd	10
8		N806178	S309	Bolt M8X1.25X93 Hex Flng Hd	2
9		N808102	S309	Bolt & Washer M8X1.25X28 Hex Hd	9
10		N806139	S2	Bolt M12X1.5X52.5 Hex Flng Pilot	1
11		N806165	S2	Washer 13.5X39.5X7.35 Flat Hardened	1
12		N605907	S2	Bolt M8X1.25X33 Hex Flng Hd Pilot	12
13		N806282	S309	Screw & Washer M8X1.25X19.0 Hex Hd	4
14		N806179	S	Screw & Washer	2
15		N806180	S2	Stud Spacer M8X1.25X37.9 Hex	1
16		N806183	S309	Oil Pump Bolt	4
17		N806177	S309	Bolt M8X1.25X53.0 Hex Flng Hd Pilot	12
18		N606543	S100	Bolt M8X1.25X53 Hex Flng	4
19		N605904	S426	Bolt	1
20		N804958	S8	Screw & Washer	4
21		N806155	S2	Screw & Washer	2

^A Long term stand service items.

Table A5.6 Engine Finish Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	F5LU	12029	AA	Ignition Coil	2
2	F5AE	9F792	AC	Fuel Rail	1
3	F2AF	12A648	AA	ECT Sensor	1
4	F3PE	9E926	NB	Throttle Assembly	1
5	F8PE	12259	LA	Wire and Bracket Assembly	1
6	F2AB	12A522	AC	Engine Wire Harness	1
7	E7EF	9F479	A2A	Map Sensor	1
8	F2VF	12B579	A2A	MAF Sensor	1
9	F5SF	12K072	AA	Ignition Module	1
10	F2RE	12297	BA	Wire Separator	12

^A Long term stand service items; they can be used as long as they remain serviceable.

Table A5.7 Supplemental Stand Set-up Kit^A

	Prefix	Part Number		Description	Quantity
		Base	Suffix		
1	F3AE	12A166	BD	Ignition Bracket	1
2	F6AE	12257	EB	Ignition Mounting Bracket	1
3	F4AE	9424	CA	Intake Manifold	1
4	F8KE	19A216	AD	Grooved Idler Pulley	1
5	F2AE	9A589	AA	Throttle Spacer	1
6	F7AE	6B209	AB	Belt Tensioner	1

^A Long term service items; can be used as long as they remain serviceable.

A6.4 Rinse the heat exchanger with degreasing solvent (see 7.7.1).

A7.1 Download the actual report forms and data dictionary separately from the ASTM Test Monitoring Center Web Page at <http://www.astmtmc.cmu.edu/> or they can be obtained in hardcopy format from the TMC.

Table of Contents

1. Title/Validity Declaration Page	Form 1
2. Table of Contents	Form 2
3. Summary of Test Method	Form 3
4. Test Result Summary	Form 4
5. Test Result Summary	Form 5
6. Operational Summary	Form 6
7. Oil Addition Record and Blowby Rates	Form 7
8. Analysis of Oil	Form 8
9. Downtime Occurrences and Other Comments	Form 9

Note A1. If the non reference oil test results are also to be submitted as candidate oil test results to the registration organization, the report forms and data dictionary that are maintained for reporting reference oil results shall also be used for reporting the candidate oil test results. The following ACC Code of Practice Test Laboratory Conformance statement shall also be included.

10. ACC Conformance Statement	Form 10
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X2.1.12 *Parts Washer and Chemicals*--A dishwasher type parts cleaner and associated chemicals can be obtained from the following supplier

Better Engineering Manufacturing
8361 Town Court Center
Baltimore, MD 21236-4964