



Test Monitoring Center

6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

Sequence IIIF Information Letter 06-2
Sequence No. 21
August 18, 2006

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 III Mailing List

SUBJECT: 1. Procedural Enhancements from Unified Engine Build
2. Clarifications to Table A4
3. Editorial Change

1. At the June 6, 2006 meeting of the Sequence III Surveillance Panel, the panel approved a number of procedural enhancements identified as a result of the Unified Engine Build Workshop held earlier in the year. Sections 9.4.1 and 9.9.10.1 have been added and sections 9.5.3.1, 9.6.3, 9.13.3, 9.14.2, 9.18.1, 9.21, 9.25.7, 9.29 and 9.30 have been revised to reflect these enhancements. Also, several part number changes were noted and Tables A2.1 and A2.2 have been revised accordingly. A summary of part number changes has also been attached for reference. The attached changes to Test Method D6894 are effective with the next reference test conducted in the laboratory.
2. On July 28, 2006, the Sequence III Surveillance Panel approved, via email ballot, inclusion of temperatures at which API Gravity and Density analyses are conducted and the units used in determining parts per million of Sulfur in Table A4 of the test method. The revised Table A4 is attached. These changes are effective the date of this information letter.
3. In preparing this information letter, it was noted that Sections 9.1, 9.3, 9.4, 9.5.3.3 and 12.5.1 reference aliphatic naphtha, which is not listed in approved reagents, Section 7. These sections have been revised to replace aliphatic naphtha with solvent. This change is effective the date of this information letter.

Sidney L. Clark
Senior Contact Engineer
GM Powertrain Materials Engineering

John L. Zalar
Administrator
ASTM Test Monitoring Center

Attachments

c: ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/procedure_and_ils/IIIF/IL06-2.pdf

Distribution: Electronic Mail

9.1 *Condenser Cleaning*—Immediately after completing a Sequence IIIF test, remove the stainless steel condenser assembly, disassemble it, and soak it in parts cleaning agent. After the soaking, clean the inside of the tube with parts cleaning agent and a non-cuprous bristle brush. Rinse both the blowby gas and coolant sides of the condenser with clean solvent.

9.3 *Intake Manifold Cleaning*—Clean the intake manifold with solvent.

9.4 *Cleaning of Engine Parts*—Clean all engine parts (other than the block and heads; see 9.5 and 9.6) thoroughly prior to engine assembly. Degrease them first, and then brush them with parts cleaning agent. Immediately remove the cleaner by spraying with hot tap water. Blow-dry the parts with clean, dry shop air and immediately coat them with a 50/50 mixture of build-up oil and solvent.

9.4.1 Clean the connecting rods by soaking in solvent for a minimum of 2 h. Spray the rods with a 50/50 mixture of solvent and EF-411

9.5.3.1 Clean the block in a heated bath or temperature-controlled automated parts washer before and after honing. Follow the guidelines as listed below to ensure there is no rusting of the engine block coolant jacket after this process.

- 1) Use only NAT-50 or PDN-50 soap at a concentration of 16 lb of soap per 100 gal of water. Change the soap and water solution at least every six months.
- 2) Set the temperature of the water to 60°C (140 °F).
- 3) Do not pre-condition the water that is being used in any way.
- 4) Prior to installing the engine in the parts washer, ensure that all coolant passages are blocked off to prevent cleaning solutions from entering the passages.
- 5) Allow the block to run through the cleaning cycle for a period of 30 to 40 min.
- 6) After the cycle is complete, immediately remove the block from the washer and spray it down with solvent.
- 7) Wipe cylinder bores out with a lint-free towel.
- 8) Spray engine block with a mixture of 50/50 buildup oil and solvent.
- 9) Do not remove the paint dot from the crankcase area of the block
- 10) Allow the block to cool to room temperature before honing the block

9.5.3.3 After honing the cylinder walls, clean the engine block again according to 9.5.3 and spray the engine block (including all oil galleries) first with solvent followed by a 50/50 mixture of solvent and build up oil. Using this 50/50 mixture, wipe out the cylinder bores with clean cloth towels until all honing residue has been removed.

9.6.3 Clean the cylinder heads according to the recommended engine block cleaning procedure (See 9.5.3.1) or clean with solvent. Spray the heads with a 50/50 mixture of solvent and EF-411. When cleaning the heads, do not remove the paint dot.

9.9.10.1 Allow cylinder block to cool for a minimum of 10 min before taking final bore measurements.

9.13.3 *Installation of Camshaft Thrust Plate* – Lubricate the thrust plate with buildup oil and install the thrust plate to the front of the engine using new Torx[®] fasteners.

9.14.2 *Main Bearing Cap Installation*— Install the main bearing caps using new bolts for each test. Do not remove the phosphate coating from the bolts. Do not use air tools on the main bearing cap bolts to seat the caps. Install the bolts finger-tight, and tighten them according to the procedure in 9.7.4.1. Use the main bearings as received.

9.18.1 *Piston Installation*- Clean pistons using mineral spirits and air-dry. Wipe the pistons with a lint-free cloth prior to installation.

9.21 *Engine Front Cover*- Use a new front cover with each new engine block or if the oil pump gerotor housing is worn. Front covers can be used for as many as six tests. Remove any slag that may be present and debur the front cover prior to use.

9.25.7 Install new valve springs, part number OHT3F-059-5 (color code yellow). Place the smaller diameter end of the spring against the retainer. Do not remove the factory paint dot from the valve spring.

9.29 *Pushrods*-Clean the pushrods with solvent, and air-blow (Warning-see Note-45) them dry prior to installation; make certain that the oil passages are open. Wipe the pushrods with a lint-free cloth prior to installation. Lubricate the ball ends of the pushrods with buildup oil and install the pushrods. See the Sequence IIIF Engine Assembly Manual section 6 sheet 2.

9.30 *Valve Train Loading*-Install the rocker arm pivot retainer and the precision roller rockers and torque the rocker arm pedestal bolts according to the Sequence IIIF Engine Assembly Manual section 6 sheet 4. Rocker arm pivot retainers can be used for up to six tests before being replaced.

12.5.1 Clean the camshaft lobes and lifters with solvent; blow-dry them with clean, dry shop air.

TABLE A2.1 Parts to be Replaced Every Test

Part Description	Part No.
Arm, rocker with pivot bearing	OHT3F-058-1
Bearing, kit, engine	OHT3F-042-2
Kit includes:	
Bearing, connecting rod, kit, upper and lower, OH-106 assy	3F042-01
Main bearing kit, OH101 assy, includes:	3F042-02
Bearing, balance shaft front (part of 24502388)	SKF6205-2ZNRJEM
Bearing, main, lower, No.1 and 3	OH-102
Bearing, main, lower, No.4	OH-103
Bearing, main, lower, flange, No.2	OH-104
Bearing, main, upper, flange, No. 2	OH-105
Bearing, cam bushing, positions 1 and 4	3F028-09
Bearing, cam bushing, positions 2 and 3	3F028-10
Bolt, camshaft sprocket	24501366
Bolt, cylinder head, long	25527831
Bolt, cylinder head, short	25533811 or 88891770
Bolt, flywheel	24505092
Bolt, main cap	24503056
Bolt, main cap, side	24505576
Bolt, rear cover housing	24503970
Bolt, rocker arm, special test	3F-058-02
Camshaft, special test, including manganese-phosphate coating	OHT3F-008-6
Bolt / screw, thrust plate retainer	25519242
Cap, valve spring retainer	24502257
Chain, timing	24504668
Clip, retainer, piston pin	OHT3F-012-1
Cooler, oil, nickel plated, bypass closed	OHT3F-030-2
Damper, timing chain (includes bolt, retaining ring)	24503893
Filter, Pro Tec	OHT3F-057-3
Gasket kit, intake manifold lower	89017399 or 89017816
Gasket, cylinder head, left	24503802
Gasket, cylinder head, right	24503801
Gasket, front cover	24502252
Gasket, oil filter adapter	25534742
Gasket, oil pan	OHT3G-093-1
Gasket, oil suction tube	24501259 or 12581570
Gasket, rear cover housing	24507388
Gasket, rocker cover	25532619
Gasket, water outlet	24502433
Gasket, water pump	24501565
Head, cylinder	24502260
Key, camshaft sprocket	24500618
Key, valve stem keeper	1016634
Lifter, test ACI w/ flat (25338738A)	OHT3F-029-3
Pin, piston wrist, pkg. of 6	OHT3F-014-1
Piston, test, runs 1 and 2, grade 12	OHT3F-053-1
Piston, test, runs 3 and 4, grade 34	OHT3F-054-1
Piston, test, runs 5 and 6, grade 56	OHT3F-055-1
Plate, camshaft thrust, .1520 in. thickness	OHT3F-011-2
Plug, engine block core hole	24500867
Plug, cylinder head core hole	3835577
Plug, cylinder head cup	24502262
Plug, engine block, oil gallery	3835577
Plug, ignition spark	NGK TR6
Plunger, oil relief	25530949

Part Description	Part No.
Pushrod, special length, pkg. of 12	OHT3F-007-1
Retainer clip, piston pin pkg. of 12	OHT3F-012-1
1 ea. ring, piston, run 1, engine set	OHT3F-050-RUN1
1 ea. ring, piston, run 2, engine set	OHT3F-050-RUN2
1 ea. ring, piston, run 3, engine Set	OHT3F-051-RUN3
1 ea. ring, piston, run 4, engine Set	OHT3F-051-RUN4
1 ea. ring, piston, run 5, engine Set	OHT3F-052-RUN5
1 ea. ring, piston, run 6, engine Set	OHT3F-052-RUN6
Rocker arm assembly (includes: 3F058-02)	OHT3F-058-1
Rod, connecting (powdered metal)	12574505
Seal, crankshaft front oil (24504098)	OHT3G-092-1
Seal, crankshaft rear oil (25534760)	OHT36-091-1
Seal, exhaust valve stem	OHT3F-061-1
Seal, intake valve stem	OHT3F-060-1
Spring, oil relief valve	1262505
Spring, valve special test (color code yellow)	OHT3F-059-5
sprocket, camshaft	24505306
Valve, exhaust (STD)	12579949
Valve, intake (STD)	12569550

TABLE A2.2 Parts to be Replaced as Needed

Part Description	Part No.
Adapter, blowby breather tube	OHT3F-040-1
Adapter, oil filter	OHT3F-035-1
Adapter, throttle body, air inlet	OHT3F-001-2
Balancer, harmonic (24507058 or 12563265) (1997-2003)	24507058
Bearing, balance shaft front (part of 24502388)	SKF6205-2ZNRJEM
Block, engine assembly	24506028
Bolt, connecting rod	11589088
Bolt, counter balance gear	24501367
Bolt, counter balance shaft retainer	24500055
Bolt, front cover (2)	24504713
Bolt, front cover (1)	24504712
Bolt, harmonic balancer (2406341 or 24504736) (1997-2003)	24506341
Bolt, lower intake (13)	24504090
Bolt, oil filter adapter	24504713
Bolt, oil pan (2402791 or 24502164) (1997-2003)	24502791
Bolt, oil suction tube	24505570
Bolt, Rocker cover w/ washer (25534748 or 24502164) (1997-2003)	25534748
Bolt, screw camshaft sensor	25526395
Bolt, screw, oil gerotor, cover	25519242
Bolt, stud type, front cover and crankshaft sensor (short)	24504717
Bolt, stud type, front cover and crankshaft sensor (long)	24504718
Bolt, throttle body support	24503644
Bolt, upper intake long	24505205
Bolt, upper intake short	24506498
Bolt, upper intake, stud	24502453
Bracket, breather tube	OHT3F-041-1
Breather tube, S.S. material	OHT3F-075-1
Bushing, balance shaft rear	24503193
Bushing, rocker cover	OHT3F-028-1
Connector, modified for length, GM PN 24502883	OHT3F-039-2
Cover, engine front	OHT3F-085-1
Cover, oil gerotor	25521935
Cover, rocker arm valve cover left side plastic	25534751

Part Description	Part No.
Crankshaft	34502168
Dipstick, metric, extended length	OHT3G-064-1
Fitting, oil filter adapter	OHT3F-043-1
Flywheel, manual, modified P.N. 24503285	OHT3F-020-2
Gasket, exhaust, end plate	OHT3F-009-1
Gasket, exhaust, flange, metal	OHT3F-018-1
Gasket, manifold, upper intake	17113137
Gasket, oil cooler, pkg. of 50	OHT3F-074-1
Gasket, oil filter, pkg. of 50	OHT3F-062-1
Gear, balancershaft drive	24504792
Gear, balancershaft driven	24503524
Gear, counter balance drive	24504792
Gear, counter balance shaft	24503524
Grommet, rocker arm valve cover bolt	25534749
Harness, coil pack segment	3F022-2
Harness, fuel injector segment	3F022-1
Harness, wiring, dyno w/ OHT3F-056-1 sensor	OHT3F-022-1
Housing, assembly, bypass valve	OHT3F-084-1
Injector, fuel	17120601
Key, crankshaft	25534912 or 12563282
Magnet, camshaft position sensor	10456195
Manifold, cast iron	OHT3F-003-0
Manifold, exhaust, water cooled assy (one bank)	OHT3F-003-1
Assembly includes:	
1 Ea. runner, exhaust manifold	OHT3F-004-1
1 Ea. plate, rear, exhaust manifold	OHT3F-005-1
1 Ea. elbow, exhaust, modified	OHT3F-005A-1
1 Ea. plate, front, exhaust manifold	OHT3F-006-1
2 Ea. gasket, exhaust, end plate	OHT3F-009-1
1 Ea. gasket, exhaust, flange, metal	OHT3F-018-1
Manifold, lower intake	24505728
Manifold, upper intake	17096162
Meter, blowby	RX-116169-A1 REV N
Module, assembly, coil pack	1103948
Mount front engine w/ bolt pattern for coil pack	OHT3F-026-1
Mount, rear engine housing w/ air starter, muffler and shim pack	OHT3F-025-1
Assembly includes:	
Starter, air	3F025-03
Muffler, starter, air	3F025-04
Shim pack, starter, air	3F025-05
Nut, throttle body fuel rail retainer	24506469
Nut, throttle body retainer	24506469
Oil filter housing assembly, no bypass, impregnated	OHT3G-080-1
Outlet, coolant	OHT3F-034-1
Pan, IIF test, nickel plated	OHT3F-073-1
PCM, special	OHT3F-021-1
PCV, dummy	OHT3F-002-1
Pin, cylinder head locating	25536320
Pin, front cover lower	25536323
Pin, front cover upper	24501162
Pin, transmission locating	12338076
Plate, EGR block off	OHT3F-024-1
Plate, front, exhaust manifold	OHT3F-006-1
Plate, rear, exhaust manifold	OHT3F-005-1
Plate, water pump housing	OHT3F-031-1
Plug, auto hex, socket, (main oil gallery block off)	444777
Plug, dip stick	OHT3F-065-1

Part Description	Part No.
Plug, drain, modified	OHT3F-063-1
Pump, oil, gerotor set	24505433
Rail, fuel	17098211
Rail, fuel injector	17120601
Reamer, dip stick and dip stick hole plug	OHT3F-071-1
Regulator, fuel pressure, on rail	17113346
Retainer, counter balance, timing chain oiler	24500374
Retainer, rocker arm (replace after 6 tests)	24502278
Runner, exhaust manifold	OHT3F-004-1
Screen, oil pump (w/ suction pipe)	24505569
Seal, oil pan drain plug (O ring)	3536966
Sensor, camshaft position	10456148
Sensor, crankcase position	10456161
Sensor, mass air flow (2003 shielded)	12568877 or 88961007
Sensor, modified coolant temperature	OHT3F-056-1
Shaft assembly, counter balance	24502388 or 24506557
Shield, crankshaft position sensor	24506440
Shim pack, starter, air	3F025-05
Shim, steel, 0.005 in. thick, pkg. of 10	OHT3F-072-005
Shim, steel, 0.010 in. thick, pkg. of 10	OHT3F-072-010
Shim, steel, 0.015 in. thick, pkg. of 10	OHT3F-072-015
Shim, steel, 0.020 in. thick, pkg. of 10	OHT3F-072-020
Shim, steel, 0.031 in. thick, pkg. of 10	OHT3F-072-031
Sleeve, valve stem protectors (pkg. of 100)	OHT3F-070-1
Sprocket, crankshaft, special 2 Pc	OHT3F-036-1
Starter, air	3F025-03
Stud, front cover (2)	24504717
Stud, front cover (2)	24504718
Support, throttle body	24504697
Throttle body (2 bolt mass air flow sensor)	24507235
Throttle body (3 bolt mass air flow sensor)	24504302
Tool, camshaft bushing installation	OHT3F-019-2
Tool, oil pump primer	OHT3F-038-1
Tube, throttle body to fuel pressure regulator	24505671

A4. Sequence III Test Fuel Analysis (Haltermann HF003 Test Fuel)

TEST	METHOD	UNITS	HALTERMANN HF003 Specs		
			MIN	TARGET	MAX
Distillation - IBP	ASTM D86	°F	75		95
5%		°F			
10%		°F	120		135
20%		°F			
30%		°F			
40%		°F			
50%		°F	200		230
60%		°F			
70%		°F			
80%		°F			
90%		°F	305		325
95%		°F			
Distillation - EP		°F			415
Recovery		vol %		Report	
Residue		vol %		Report	
Loss		vol %		Report	
API Gravity (@60°F/60°F)	ASTM D4052	°API	58.7		61.2
Density (@15 °C)	ASTM D4052	kg/L	0.734		0.744
Reid Vapor Pressure	ASTM D323	psi	8.7		9.2
Reid Vapor Pressure	ASTM D5191	psi		Report	
Carbon	ASTM D3343	wt fraction		Report	
Carbon	ASTM E191	wt fraction		Report	
Hydrogen	ASTM E191	wt fraction		Report	
Hydrogen/Carbon ratio	ASTM E191	mole/mole		Report	
Oxygen	ASTM D4815	wt %			0.05
Sulfur (ppm)	ASTM D5453	mg/kg	3		15
Lead	ASTM D3237	g/gal			0.01
Phosphorous	ASTM D3231	g/gal			0.005
Composition, aromatics	ASTM D1319	vol %	26.0		32.5
Composition, olefins	ASTM D1319	vol %			10.0
Composition, saturates	ASTM D1319	vol %		Report	
Particulate matter	ASTM D5452	mg/L			1
Oxidation Stability	ASTM D525	minutes	240		
Copper Corrosion	ASTM D130				1
Gum content, washed	ASTM D381	mg/100mL			5
Fuel Economy Numerator/C Density	ASTM E191		2401		2441
C Factor	ASTM E191			Report	
Research Octane Number	ASTM D2699		96.0		
Motor Octane Number	ASTM D2700			Report	
Sensitivity			7.5		
Net Heating Value, btu/lb	ASTM D3338	Btu/lb		Report	
Net Heating Value, btu/lb	ASTM D240	Btu/lb		Report	
Color	VISUAL	1.75 ptb		Red	

Summary of Part Number Changes

Table A2.1

Camshaft, special test, including manganese-phosphate coating (Corrected part number)	OHT3F-008-6
Bolt / screw, thrust plate retainer (moved from Table A2.2)	25519242
Plug, cylinder head cup (corrected part number)	24502262
Plug, engine block, oil gallery (corrected part number)	3835577
Plug, ignition spark (corrected part number)	NGK TR6

Table A2.2

Balancer, harmonic (24507058 or 12563265) (1997-2003)	24507058
Listed alternate part number	
Bolt, connecting rod	11589088
Corrected part number	
Bolt, harmonic balancer (2406341 or 24504736) (1997-2003)	24506341
Listed alternate part number	
Bolt, oil pan (2402791 or 24502164) (1997-2003)	24502791
Listed alternate part number	
Bolt, Rocker cover w/ washer (25534748 or 24502164) (1997-2003)	25534748
Listed alternate part number	
Bolt, stud type, front cover and crankshaft sensor (long)	24504718
Added part description and number, omitted from previous table	
Key, crankshaft (25534912 or 12563282) (1997-203)	25534912
Listed alternate part number	
Rail, fuel	17098211
Corrected part number	
Retainer, counter balance, timing chain oiler	24500374
Corrected part number	
Retainer, rocker arm (replace after 6 tests)	24502278
Added to part list	
Shaft assembly, counter balance	24502388 or 24506557
Listed alternate part number	
Stud, front cover (2)	24504717
Stud, front cover (2)	24504718
Support, throttle body	24504697
Tube, throttle body to fuel pressure regulator	24505671
Parts added to Table, not in previous version	