



Test Monitoring Center

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Sequence IIIF Information Letter 04-1
Sequence No. 14

April 13, 2004

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: Incorporation of Past Information Letters into the Test Method
Revised Intake Manifold Gasket
Additional Allowable Sealing Materials

This Information Letter addresses specific parts and procedures pertaining to quality, consistency, performance, and accountability of test parts as part of the ongoing effort by the panel to ensure continual process improvement of the Sequence IIIF test. This Information Letter references Test Method D6894-03.

Incorporation of Past Information Letters into the Test Method

The Sequence IIIF Test Procedure has been formally approved and published as Test Method D6894-03 by ASTM International. However, the published version does not include the revisions to the test procedure published in Information Letters 02-3, 02-4, 03-1, 03-2, and 03-3. As such, those numerous revisions to the Test Method are being included as part of this Information Letter as editorial corrections. The appropriate revised sections are attached.

Revised Intake Manifold Gasket

During the March 23, 2004, teleconference meeting of the Sequence III Surveillance Panel, the panel approved a motion to implement the use of a new intake manifold-to-cylinder head gasket in the Sequence IIIF test. This new gasket is a revised GM SPO part designed to help prevent oil leaks in the 3800 Series II engine, which is used in Sequence IIIF testing. A revised Table A2.1 is attached.

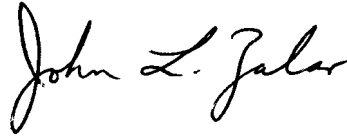
Additional Allowable Sealing Materials

During the January 20, 2004, teleconference meeting of the Sequence III Surveillance Panel, the panel approved a motion to allow the use of a new sealing material, in addition to the materials currently specified in the test procedure, in Sequence IIIF testing. One of the previous materials is no longer available via GM SPO and this new material supercedes that old material. At this time, the material is

only available in tube form, but work is ongoing to secure a source of it in the more economical cartridge formats. A revised 7.6.3 is attached.



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John L. Zalar
Administrator
ASTM Test Monitoring Center

Attachments

c: ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/procedure_and_ils/IIF/IL04-1.pdf

Distribution: Electronic Mail

¹This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B0 on Automotive Lubricants.

Current edition was approved Dec. 1, 2003, published in January 2004, and is complete through Information Letters 04-1.

6.6 Sequence IIIF Fluid Conditioning Module -Use the Kundinger Fluid Conditioning Module⁸ to control the following parameters: engine coolant, condenser coolant, oil cooler coolant, exhaust manifold coolant, and the test fuel supply. The system incorporates the following features: pumps, flow meters, flow control and three-way control valves, external heating and cooling systems, pressure regulator and low-point drains. The system integrates with the test stand data acquisition and control computer for process control. If a laboratory wishes to build its own Fluid Conditioning Module, a list of suitable equipment can be found in A12.

⁸ A suitable Fluid Conditioning Module is available from Kundinger Fluid Controls, 171 Harmon Rd., Auburn Hills, MI 48326.

6.10.5 The oil cooler, oil filter, or both may be replaced once per test if the oil filter pressure differential is greater than 100 kPa during test operations or if bypass operation is detected.

6.10.5.1 Replacement of the oil cooler, oil filter, or both may be performed only once per test (i.e. if a filter is replaced at 30 h, the cooler cannot be replaced at 50 h).

6.10.5.2 If the oil filter is replaced during the test, drain any oil contained in the old oil filter into the new oil filter before installing it on the test engine.

6.10.5.3 No new test oil may be added to the engine as a result of oil filter or oil cooler replacement. Consider as oil consumption any oil lost as a result of oil filter or oil cooler replacement.

6.10.5.4 If the oil cooler, oil filter, or both are replaced during a test, place a note in the test report detailing what components were replaced and when they were replaced.

6.11 Fuel System- Contained in the Fluid Conditioning Module is a pressurized, recirculating fuel system, including a pressure regulator to provide $377.5 \text{ kPa} \pm 12.5 \text{ kPa}$ ($54.75 \pm 1.83 \text{ psi}$) fuel pressure. The system should be switched off so no fuel pressure is present at the injector rail during engine shutdowns.

7.5.2 Mineral spirits meeting Specification D 235 Type II Class C requirements.

Warning – Flammable. Health Hazard.

7.6.3 Only GM Autocare Assembly Adhesive^{xx}, part number 12346141, Dow RTV Grade 3154 sealer^{yy}, or, Prematex Ultra Black Sealer, part number 24105, are allowable for use on the oil pan gasket and intake manifold gasket only. See Sequence IIIF Engine Assembly Manual section 4 sheet 13 and section 6 sheet 6.

^{xx} GM Autocare Assembly Adhesive is available from local GM dealers.

^{yy} Dow RTV Grade 3154 sealer is available from commercial sources.

^{zz} Permatex Ultra Black Sealer is available from commercial sources.

9.5.3.1 The block should be cleaned in a heated bath or temperature-controlled automated parts washer before and after honing. Follow the suggested 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. The soap and water solution shall be changed at least every six months.
- 2) Set the temperature of the water to 140°F.
- 3) Do not, in any manner, pre-condition the water that is being used.
- 4) Ensure that all coolant passages are blocked off to prevent cleaning solutions from entering the passages prior to installing the engine in the parts washer.
- 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 mineral spirits.
- 7) Wipe cylinder bores out with a lint-free towel.

8) Spray engine block with a mixture of 50/50 build-up oil and mineral spirits.

9.9.11 If desired, check the main bearing bore clearances using a mandrel, part BX-398-1, according to the following procedure:

Starting from the front of the block, slide the mandrel through all four main bearing bores. If excessive resistance is encountered while inserting the mandrel, remove the mandrel from the engine block and inspect the main bearing bores for burrs, nicks, dirt, alignment problems, or any abnormalities. Use 400 grit paper or a fine stone to carefully remove any nicks, burrs, scratches, or dirt. Then use a clean shop towel with mineral spirits to wipe the affected surfaces. Reinstall the mandrel to ensure that it can freely pass through all four main bearing bores. If the mandrel will not clear the bores after the above steps have been completed, the block should not be used. Notify the Test Developer of the problem. After honing, the above procedure should be repeated prior to final engine build. The mandrel is an alignment and clearance gage only, not an assembly tool. The mandrel should not be in the bores when installing the main bearing caps or torquing the main bearing bolts.

9.10.1 Piston Rings- The rings are pre-sized for each run and check the gap in the cylinder bore for each test.

9.10.1.1 Prior to checking the piston ring gaps, remove any paint marks on the rings using acetone and a soft cloth, followed by a mineral spirits rinse.

9.10.1.2 The top ring gap shall be $1.067 \text{ mm} \pm 0.051 \text{ mm}$ ($0.042 \text{ in} \pm 0.002 \text{ in.}$). The bottom ring gap shall be $0.965 \text{ mm} \pm 0.051 \text{ mm}$ ($0.038 \text{ in} \pm 0.002 \text{ in.}$). The top ring gap shall be larger than the bottom ring gap and the difference between the two ring gaps shall be between 0.076 mm and 0.152 mm (0.003 in and 0.006 in.). If the ring gap difference is below 0.076 mm (0.003 in.) contact the Test Developer. Check the ring gap with a Starrett Ring Taper Gage No. 270^{xx} with the ring positioned in the cylinder bore using a piston ring depth gage (drawing RX-118602-B). Position the rings at 23.67 mm (0.932 in.) below the cylinder block deck surface during gap measurement.

^{xx} A Starrett Ring Taper Gage No. 270 has been found suitable. It is available from commercial sources.

9.10.1.3 Record the top and bottom ring gaps on Form 12, Hardware Information, in standardized report form set (See A5). Ring gaps shall be recorded and reported in mils ($1 \text{ mil} = 0.001 \text{ in.}$).

9.11.3 Measure the maximum pre-test dimension of each camshaft lobe, transverse to the camshaft axis to the nearest 0.001 mm (0.00004 in.). This dimension is at the rear edge of all lobe positions (lobes are numbered from the front to the rear of the camshaft). Record the measurements on internal laboratory forms. See 9.7.

9.11.4 After measuring, coat the camshaft with build-up oil.

9.11.5 Measure the pre-test length of the lifters at the center of the lifter foot to the nearest 0.001 mm (0.00004 in.). Record the measurements on internal laboratory forms. See 9.7.

9.11.6 Record the unique serial number for each lifter on internal laboratory forms. See 9.7. Do not use electro-mechanical scribing devices. Do not place any marks on the lifter body or foot.

9.13.1 Coat the camshaft lobes and journals with a light film of test oil on the journals.

{Note 39 deleted}

9.14 Main Bearings-Verify that the main bearing bore areas in the engine block and bearing caps are clean. Install new main bearings, part number OHT3F-042-2, in the engine block and main bearing caps, and lightly oil the bearing surfaces with build-up oil. Use new main bearing cap bolts for each Sequence IIIF test engine build.

9.36 External Oil Cooling System-Install the external oil cooling system as follows:

9.36.1 Install the Oil Filter Housing Assembly, part number OHT3G-080-1, on the engine front cover. Refer to Section 4 Sheet 4 of the Sequence IIIF Engine Assembly Manual.

9.36.2 Install an Oil Cooler, part number OHT3F-030-2, using Connector part number OHT3F-039-3, as shown in the Sequence IIIF Engine Assembly Manual section 8 sheet 3.

9.36.3 Install an Oil Filter Adapter Fitting, part number OHT3F-043-2, and an Oil Filter Adapter, part number OHT3F-035-2, as shown in the Sequence IIIF Engine Assembly Manual section 8 sheet 3.

9.36.4 Install the Bypass Valve Assembly Housing, part number OHT3F-084-1, on the Oil Filter Engine Adapter, as shown in the Sequence IIIF Engine Assembly Manual section 8 sheet 3b.

9.36.5 Install a thermocouple in the External Bypass System to detect operation in bypass mode. If bypass is detected during a test it shall be noted in the comments section of the test report. No reporting of this temperature data is required.

9.49.1 Install a new oil filter OHT3G-057-3.

9.49.2 Measure the initial fill of 5.50 L (5 qt, 26 oz) of fresh test oil using a flask calibrated to Class A standards^A.

^A A 6000mL Erlenmeyer Flask, part number OHT3G-086-1, has been found suitable and is available from the Central Parts Distributor.

9.49.3 Add the initial fill of 5.50 L (5 qt, 26 oz) of fresh test oil through the rocker cover oil fill cap.

10.4.4.1 Send by mail one copy of the standard final report (Use the report forms supplied by the ASTM TMC. Report forms can be obtained from the TMC web site: <ftp://ftp.astmtmc.cmu.edu/datadict/> or by contacting the TMC.) to the Test Developer, and one copy of the report to the ASTM TMC, at the following addresses in order that the records are received within 30 days of test completion.

General Motors Corporation
Engine Engineering Building
Mail Code 483-730-322
Sequence IIIF Test Coordinator
823 Joslyn Road
Pontiac, MI 48340-2920

Test Report Clerk
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206

12.3.3 If the piston deposits cannot be rated immediately after the pistons are removed from the engine, store the pistons in a desiccator for no longer than 72 h from end of test before rating. Do not wipe the pistons before storing them. See 12.4.

12.4.3.4 All raters of Sequence IIIF engine parts shall attend a Rating Workshop annually. If raters miss a scheduled workshop, they shall attend alternate training within 90 days, as directed by the TMC.

12.5.3 Use dimensional measuring equipment accurate to 0.01mm. Before each measurement session, use standards traceable to the National Institute of Standards and Technology, to ensure measuring equipment accuracy. Include standards having length values within 1.3 mm (0.05 in.) of the typical lifter and lobe measurements taken. Use the same equipment and standards for post-test measuring as were used for pre-test measuring. If a calibration shift between pre-test and post-test measurements is detected, evaluate the shift to determine its effect on the wear measurements. Record the results of the evaluation, and any corrective action taken.

12.10.4 Determine the computed oil level in milliliters at the end of the test, in Fig. A9.1. The computed oil level is found by subtracting 708mL from the oil level as measured on the dipstick, to account for samples not returned (236mL oil

sample and 472mL of new oil) to the engine as in previous shutdowns. Enter the number in the end-of-test total column on Fig. A9.1 in position “c.”

13.5 Reporting of Candidate Oil Tests – If the non-reference oil test results are also to be submitted as candidate oil test results to the ACC Test 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. Include the ACC Code of Practice Test Laboratory Conformance statement.

14.1.1 *Intermediate Precision Conditions*—Conditions where test results are obtained with the same test method using the same test oil, with changing conditions such as operators, measuring equipment, test stands, test engines, and time.

Note ZZ: Intermediate precision is the appropriate term for this test method, rather than repeatability, which defines more rigorous within-laboratory conditions.

TABLE 1 Reference Oil Test Precision

Variable	Intermediate precision (i.p.)	Intermediate Precision Standard Deviation (Si.p.)	Reproducibility (R)	Reproducibility Standard Deviation (SR)
PVIS ^A	0.0396956	0.014177	0.0415632	0.014844
WPD	1.562	0.558	1.714	0.613
APV	0.557	0.199	0.557	0.199
PV60 ^A	0.4611208	0.164686	0.5393668	0.192631

^A This parameter is transformed, using the transformation shown below. When comparing two test results on this parameter, first apply the transformation to each test result. Compare the absolute difference between the transformed results with the appropriate (intermediate precision or reproducibility) precision limit.

<i>PVIS</i>	=	Percent viscosity increase at 80 h, in transformed units. The results transformed using the transformation: $1/\sqrt{PVIS}$.
<i>WPD</i>	=	Weighted Piston Deposits, in merits.
<i>APV</i>	=	Average piston skirt varnish, in merits.
<i>PV60</i>	=	Percent viscosity increase at 60 h, in transformed units. The results transformed using the transformation: $\ln(PV60)$.

Table A2.1 Parts to be Replaced Every Test

PART DESCRIPTION	PART NUMBER
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, #1 AND 3	OH-102
BEARING, MAIN, LOWER, #4	OH-103
BEARING, MAIN, LOWER, FLANGE, #2	OH-104
BEARING, MAIN, UPPER, FLANGE, #2	OH-105
BEARING, CAM BUSHING, POSITIONS 1 & 4	3F028-09
BEARING, CAM BUSHING, POSITIONS 2 & 3	3F028-10
Bolt, Camshaft Sprocket	24501366
Bolt, Cylinder Head, Long	25527831
Bolt, Cylinder Head, Short	25533811
Bolt, Flywheel	24505092
Bolt, Main Cap	24503056
Bolt, Main Cap, Side	24505576

Revised Sections of Sequence IIIF Test Procedure

PART DESCRIPTION	PART NUMBER
Bolt, Rear Cover Housing	24503970
Bolt, Rocker Arm, Special Test	3F-058-02
Camshaft, Special Test, including Manganese-phosphate coating	OHT3F-008-8
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
Gasket, Cylinder Head, left	24503802
Gasket, Cylinder Head, right	24503801
Gasket, Front Cover	24502252
Gasket, Oil Filter Adapter	25534742
Gasket, Oil Pan	24502397
Gasket, Oil Suction Tube	24501259
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 & 2, GRADE 12	OHT3F-053-1
PISTON, TEST, RUNS 3 & 4, GRADE 34	OHT3F-054-1
PISTON, TEST, RUNS 5 & 6, GRADE 56	OHT3F-055-1
PLATE, CAMSHAFT THRUST, .1520" THICKNESS	OHT3F-011-2
Plug, Engine Block Core Hole	24500867
Plug, Cylinder Head Core Hole	3835577
Plug, Cylinder Head Cup	9427698
Plug, Engine Block, Oil Gallery	24500867
Plug, Ignition Spark	AC R42LTSM
Plunger, Oil Relief	25530949
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	24501696
Seal, Crankshaft Front Oil (Lip Seal)	24504098
Seal, Crankshaft Rear Oil (Lip seal)	25534760
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)	24507423
Valve, Intake (STD)	12569550

Table A2.2 Parts to be replaced as needed

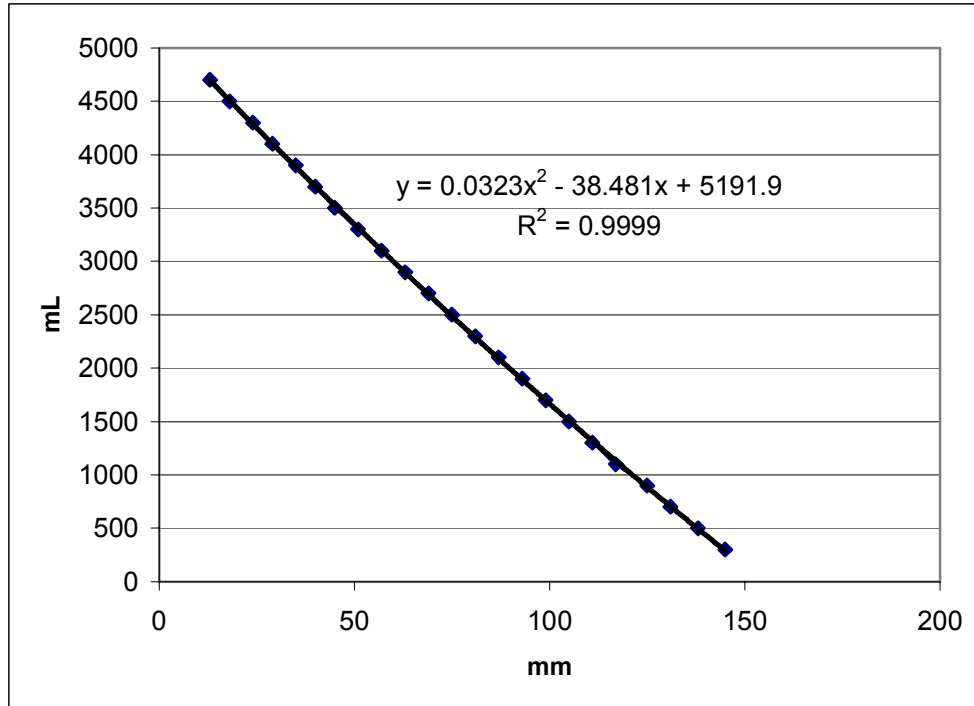
PART DESCRIPTION	PART NUMBER
ADAPTER, BLOWBY BREATHER TUBE	OHT3F-040-1
ADAPTER, OIL FILTER	OHT3F-035-1
Adapter, Throttle Body, Air Inlet	OHT3F-001-2
Balancer, Harmonic	24507058
Bearing, Balance Shaft Front (part of 24502388)	SKF6205-2ZNRJEM
Block, Engine Assembly	24506028
Bolt / Screw, Thrust Plate retainer	25519242
Bolt, Connecting Rod	25531956
Bolt, Counter Balance Gear	24501367
Bolt, Counter Balance Shaft retainer	24500055
Bolt, Harmonic Balancer	24506341
Bolt, Oil Filter Adapter	24504713
Bolt, Oil Pan	24502791
Bolt, Oil Suction Tube	24505570
Bolt, Rocker Cover W / Washer	25534748
Bolt, Screw Camshaft Sensor	25526395
Bolt, Screw, Oil Gearotor, Cover	25519242
Bolt, Stud Type, Front Cover & Crankshaft Sensor	24504717
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, FRONT, IMPREGNATED	OHT3G-085-1
Cover, Oil Gearotor	25521935
Cover, Rocker Arm Valve Cover Left Side Plastic	25534753
Crankshaft	34502168
DIP STICK, 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, Balanceshaft Drive	24504792
Gear, Balanceshaft 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
Magnet, Camshaft Position Sensor	10456195

Revised Sections of Sequence IIIF Test Procedure

PART DESCRIPTION	PART NUMBER
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 & SHIM PACK	OHT3F-025-1
ASSEMBLY INCLUDES:	
STARTER, AIR	3F025-03
MUFFLER, STARTER, AIR	3F025-04
SHIM PACK, STARTER, AIR	3F025-05
MUFFLER, STARTER, AIR	3F025-04
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, IIIF 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 BLOCKOFF	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
PLUG, DRAIN, MODIFIED	OHT3F-063-1
Pump, Oil, Gearoter Set	24505433
Rail, Fuel	17113198
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	2450055
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, MAF	24503983
Sensor, Mass Air Flow (2 Bolt, Use with Throttle Body 24507235)	24503983
Sensor, Mass Air Flow (3 Bolt, Use with Throttle Body 24507230)	24504302
SENSOR, MODIFIED COOLANT TEMPERATURE	OHT3F-056-1
Shaft Assembly, Counter Balance	24502388
Shield, Crankshaft Position Sensor	24506440

PART DESCRIPTION	PART NUMBER
SHIM PACK, STARTER, AIR	3F025-05
SHIM, STEEL, .005" THICK, 10 PER PKG.	OHT3F-072-005
SHIM, STEEL, .010" THICK, 10 PER PKG.	OHT3F-072-010
SHIM, STEEL, .015" THICK, 10 PER PKG.	OHT3F-072-015
SHIM, STEEL, .020" THICK, 10 PER PKG.	OHT3F-072-020
SHIM, STEEL, .031" THICK, 10 PER PKG.	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
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

A3. Sequence IIIF Engine Oil Dipstick Calibration Curve



OHT3G064-1 DIPSTICK, METRIC, EXTENDED LENGTH

DATE: 04/30/2003

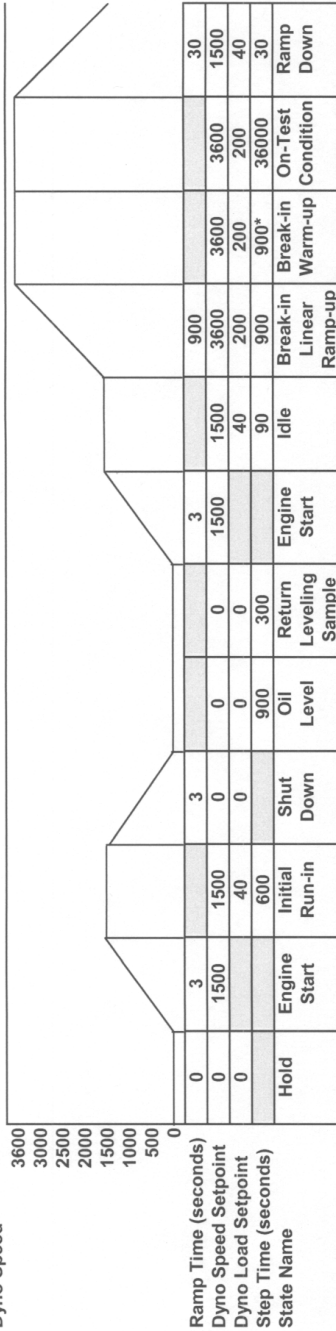
<u>mm</u>	<u>mL</u>	-	<u>mm</u>	<u>mL</u>	-	<u>mm</u>	<u>mL</u>
1	5153		51	3313		101	1635
2	5115		52	3278		102	1603
3	5077		53	3243		103	1571
4	5038		54	3208		104	1539
5	5000		55	3173		105	1508
6	4962		56	3138		106	1476

Revised Sections of Sequence IIIF Test Procedure

7	4924	57	3103	107	1444
8	4886	58	3069	108	1413
9	4848	59	3034	109	1381
10	4810	60	2999	110	1350
11	4773	61	2965	111	1318
12	4735	62	2930	112	1287
13	4697	63	2896	113	1256
14	4659	64	2861	114	1225
15	4622	65	2827	115	1194
16	4584	66	2793	116	1163
17	4547	67	2759	117	1132
18	4510	68	2725	118	1101
19	4472	69	2690	119	1070
20	4435	70	2657	120	1039
21	4398	71	2623	121	1009
22	4361	72	2589	122	978
23	4324	73	2555	123	947
24	4287	74	2521	124	917
25	4250	75	2488	125	886
26	4213	76	2454	126	856
27	4176	77	2420	127	826
28	4140	78	2387	128	796
29	4103	79	2353	129	765
30	4067	80	2320	130	735
31	4030	81	2287	131	705
32	3994	82	2254	132	675
33	3957	83	2220	133	645
34	3921	84	2187	134	615
35	3885	85	2154	135	586
36	3848	86	2121	136	556
37	3812	87	2089	137	526
38	3776	88	2056	138	497
39	3740	89	2023	139	467
40	3704	90	1990	140	438
41	3668	91	1958	141	408
42	3633	92	1925	142	379
43	3597	93	1893	143	350
44	3561	94	1860	144	320
45	3526	95	1828	145	291
46	3490	96	1795	146	262
47	3455	97	1763	147	233
48	3419	98	1731	148	204
49	3384	99	1699	149	175
50	3349	100	1667	150	146

Annex A8.2

Seq. IIIF Test States
Dyno Speed



Temperature °C

Oil Filter Block

Engine Coolant Out

Condenser Coolant Out

Pressure kPa

Exh. Back Right/Left

Inlet Air

Fuel

Flow L/m

Engine Coolant

Condenser Coolant

Oil Cooler (3-way)

50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Off	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5	377.5
160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

* Typical warm-up transition time to on test condition about 8 minutes.

** Typical warm-up transition time to on test condition about 18 minutes.

All ramp times are linear with respect to dyno speed and load settings.

All temp., press., and flow settings are setpoint changes between states. Control systems should allow for overshoot and stabilization.

System	Component	Make	Model	Comments
Fuel	Pump	KFI	10210	12 VDC
	Flow Meter	Micro Motion		
	Pressure Regulator (on-rack)	Weldon	2040-200-A-170	
	Heat Exchanger	Elanco	M11	
	Check Valve	Sharpe	FNW-16	
	Solenoid Valve	Skinner	72218RN4UV00N0H222P3	
	Filter	Racor	110A	
System	Component <th>Make</th> <th>Model</th> <th>Comments</th>	Make	Model	Comments
Engine Coolant	Pump	Aurora	341ABF 1-1/2 x 2 x 9	
	Flow Meter	ABB/Fisher Porter	10VT1000	1111ADH11C12AA0A has been replaced
	Heat Exchanger	Elanco	M71FL	
	Heater	Chromalox	ARTMS-1250TL	
	3-Way Control Valve	SVF	T7-6666TT150-S1	2" Valve
	2-Way Control Valve	Orion/Badger Meter	9003GCW36SV3A29L36	2" Valve (same as used on Sequence VIB)
	Inlet Line I.D. / Total Length	2"	226"	Total run from Process Controller to Engine Inlet Adapter
System	Component	Make	Model	Comments
Breather Tube	Pump	Aurora	133-BF-E03 1-3/4 x 3/4	
	Flow Meter	Sparling	FM625*	
	Heat Exchanger	Elanco	M21	
	Heater	Chromalox	3CVCHS-151	
	3-Way Control Valve	SVF	T7-6666TTSE-S1	1/2" Valve
	2-Way Control Valve	SVF	V7-6666NTSE-V60	1/2" Valve
	Back Pressure Valve	???		
System	Component	Make	Model	Comments
Oil Cooler	Pump	Aurora	133-BF-E03 1-3/4 x 3/4	
	Flow Meter	Sparling	FM625*	
	3-Way Control Valve	SVF	T7-6666TTSE-S1	1/2" Valve
	2-Way Control Valve	SVF	V7-6666NTSE-V30	1/2" Valve

Table A12.2 Fluid Conditioning Module Components