



## Test Monitoring Center

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Sequence IVA Information Letter No. 01-2  
Sequence No. 6  
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***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 IVA Mailing List

SUBJECT: Revision to Cylinder Head and Test Engine Replacement Requirements  
Test Numbering Definition Revision

This Information Letter implements action items approved by the Sequence IVA Surveillance Panel. 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 IVA test.

### Revision to Cylinder Head and Test Engine Replacement Requirements

At the May 24, 2001 meeting of the Sequence IVA Surveillance Panel the panel approved a motion to revise the required intervals between cylinder head and test engine replacements from 6 runs and 12 runs respectively to 8 runs and 16 runs respectively. Under the new requirements, the cylinder head shall be replaced after the 8<sup>th</sup> run and the test engine shall be replaced after the 16<sup>th</sup> run. A reference oil test is still required when the test engine is replaced. In addition, multiple-length tests are to be counted as multiple runs for this requirement, i.e. double-length tests count as two runs, triple-length tests count as three runs, etc. This change is effective on May 24, 2001 for all currently calibrated Sequence IVA test stands.

### Test Numbering Definition Revision

At the May 24, 2001 meeting of the Sequence IVA Surveillance Panel the panel approved a motion to revise the test number definition from *stand number-stand runs since last reference oil test-total runs in laboratory* to *stand number-stand runs since last reference oil test-total runs on test stand*. This change is effective for all tests started on or after May 25, 2001. A revised data dictionary and report form set, incorporating this change, will be forthcoming in a separate publication. No renumbering of completed tests is required.

Larry M. Bendele  
Chairman  
Sequence IVA Surveillance Panel

John Zalar  
Administrator  
ASTM Test Monitoring Center

Attachments

c: [ftp://www.tmc.astm.cmri.cmu.edu/documents/gas/sequenceiv/procedures\\_and\\_ils/ivail01-2-6](ftp://www.tmc.astm.cmri.cmu.edu/documents/gas/sequenceiv/procedures_and_ils/ivail01-2-6)

## **4.1 Test Numbering Scheme**

The test number must follow the format listed below.

**AAAAA-BBBB-CCCCC**

“AAAAA” represents the stand number. “BBBB” represents the number of tests since the last calibration test on that stand. “CCCCC” represents the total number of Sequence IVA tests conducted on that stand.

As an example, 6-10-175 represents the 175<sup>th</sup> Sequence IVA test conducted on that test stand and the tenth test since the last calibration test. All tests must be consecutively numbered. Stand calibration tests are numbered beginning with zero for the “BBBB” field. Multiple-length Sequence IVA tests shall be as multiple runs for test numbering purposes, i.e. double-length tests shall be counted as two runs, triple-length tests shall be counted as three runs, etc. For example, if test number 1-3-28 is a double-length test, the next test conducted on that stand shall be numbered as 1-5-30.

### **6.2.7 Oil Cooler**

A Nissan production water-to-oil heat exchanger (part no. 21305-03E00) is inserted between the engine oil filter adapter block and the oil filter, using gasket part number 15239-53F00. See figure xxxx for installation details. The water outlet is plumbed to the cooler fitting that is oriented to the same axis as the oil filter. The cooler is oriented for both water fittings to face the rear of the engine. Flexible hoses (16 mm diameter) of approximately 0.5 m length are used to connect process water to the oil cooler.

Oil temperature is controlled by metering the flow of the process water outlet. A control system valve with Cv of 0.32 has been found to produce satisfactory control.

The Nissan oil cooler, part number 21305-03E00KT, must be replaced any time the short block assembly is replaced. Normally, this allows sixteen (16) tests to be conducted using the same oil cooler. It is recommended that any hoses to the oil cooler be replaced whenever a new oil cooler is installed.

## **6.4 Test Engine Hardware**

This section specifies the hardware required to build the test engine.

A new engine short block assembly is utilized for 16 tests, and the kit cylinder head assembly is new for the first test and the ninth (9th) test on that shortblock. The engine break-in procedure is conducted prior to the first test and the 9th test on that shortblock.

The new engine is a longblock, as received. The camshaft and rocker arms that are in the new engine are utilized for break-in purposes only. The new cylinder head is removed and modified for the cylinder head oil gallery temperature and pressure measurement port, and for valve spring force calibration. The head is cleaned and reassembled using the break-in camshaft and rocker arms. The break-in procedure is described in section 12.1.3. After the break-in, the break-in camshaft and rocker arms are replaced with the new, official Sequence IVA test camshaft and rocker arms that are the critical parts of the Sequence IVA test kit.

### **6.4.1.1 Test Engine Long-block**

The test engine long-block assembly (also called bare engine assembly) is ordered as part number A0102-76P01. It includes the final assembly of the block, pistons, rods, crankshaft, oil pan, front cover, cylinder head, rocker arm cover, etc. The camshaft and rocker arms, supplied with part number A0102-76P01, can be used during engine break-in only, but they are NOT official test parts. The short-block from part number A0102-76P01 is utilized for sixteen (16) tests. The original cylinder head from part number A0102-76P01 is utilized for tests one through eight of the sixteen tests conducted on the short-block.

#### 6.4.1.4 Cylinder Head Replacement Kit

Every engine short-block is used for sixteen (16) tests. The original cylinder head that included in part number A0102-76P01 is utilized for tests one through eight on that short-block. After the eighth test, a new replacement cylinder head is installed for tests nine through 16 on that short-block. The replacement bare cylinder head is NMC part number A1040-40F11. To assemble and install this head, one gasket and seal kit part number 11042-40F27 is required. New calibrated valve springs, intake and exhaust valves, etc. are required to be installed with the replacement head. See appendix xxxx for a detailed listing.

When the replacement head is installed onto the engine, the original camshaft and rocker arms that were supplied with part number A0102-76P01 are used for conducting another "break-in" prior to test number nine (9).

#### 6.4.4 Reusable Engine Parts

The Sequence IVA test is designed to replace the engine short-block and oil cooler every sixteen (16) tests, and the cylinder head every eighth test. If the engine demonstrates deterioration (excessive blowby or oil consumption or fuel dilution; poor compression; low oil pressure; clearances beyond service limits; stripped fasteners; etc.) prior to this expected life, the engine should be replaced and break-in and acceptable calibration test(s) conducted prior to official candidate oil testing. However, no more than sixteen tests may be conducted on a short-block or the oil cooler, and no more than eight tests allowed on a cylinder head.

The PCV valve, fuel filters, rocker cover gaskets, and air filter element should be replaced after eight tests (when a new engine or new cylinder head is installed). The ignition distributor is usually replaced when a new engine is installed.

Spark plugs are replaced for each test, just prior to the oil flush (see section 10.9.2). The spark plug (Nissan part no. 22401-30R15, NGK ZFR5E-11) are gapped at 0.99 mm (0.039").

The jacketed rocker arm cover, oil pan, oil cooler, flywheel, intake and exhaust manifolds, throttle body, modified dummy waterpump, spark plug wires, fuel injection system components, engine sensors, etc. can be reused as long as they continue to function properly.

### 10.4 Cylinder Head Preparations

All new Sequence IVA cylinder heads must be modified, cleaned, assembled, and calibrated before using the cylinder head for testing purposes. A cylinder head can be used for up to eight (8) tests.

#### 11.4.2 Replacement of Nissan Oil Cooler

The Nissan oil cooler, part number 21305-03E00KT, must be replaced any time the short block assembly is replaced. Normally, this allows sixteen (16) tests to be conducted using the same oil cooler. It is recommended that any hoses to the oil cooler be replaced whenever a new oil cooler is installed.

#### 12.1.1 Engine Coolant System Flushing

Whenever the engine shortblock is replaced (normally every 16 tests), the coolant system (including heat exchanger) should be cleaned before conducting the engine break-in. Since an external electric-driven coolant circulating pump is used, the engine should be in place but does not have to be running during the flush-cleaning process. It is recommended that sensitive components of the coolant flowmeter be excluded from the flushing chemicals. Also, the calibration of the coolant flowmeter should be checked after the coolant system flush has been completed.

#### 12.1.3 Engine Break-in Procedure

The break-in procedure is conducted, prior to lubricant evaluation testing, when a new engine shortblock, new long-block, or new cylinder head is installed on the test stand.

The break-in allows an opportunity to set the ignition-timing, purge air from the coolant system, check for leaks in the various systems, and monitor engine performance and test stand instrumentation.

Follow the prescribed break-in conditions (**Appendix A**). The engine short block assembly will be utilized for 16 tests and the cylinder head assembly will be utilized for 8 tests. Therefore, a new engine break-in will only need to be performed once every 8 tests. The necessary steps to conduct the break-in are included below.

- 1) Install the new Sequence IVA engine assembly with break-in test parts (camshaft, rocker arms, rocker shafts, etc. that come with pre-assembled cylinder head) onto the test stand.
- 2) Remove the oil drain plug and pre-fill the cavities of the cylinder head under the camshaft with break-in oil (ASTM 926-2 REO). Replace the oil drain plug once completed.
- 3) Install the rocker cover.
- 4) Charge the coolant system with a 50/50 mixture of deionized water and Texaco Havoline DEX-COOL Extended Life Coolant (Product Code 7994). The coolant system capacity is 25 liters (6.6 gallons).
- 5) Connect the stand to a fuel tank containing the Howell VG test fuel.
- 6) Measure by volume, 3.5L of break-in oil (ASTM 926-2 REO).
- 7) Install a new Nissan oil filter (p/n 15208-55Y00) onto the engine. Perform the following steps to help the oil pressure build quicker during initial start-up. Do not install a dry oil filter on a Nissan KA24E engine.
  - A) Obtain a new break-in oil filter and remove it from its packaging.
  - B) Measure out 325ml (11 ounces) of oil from the new break-in oil charge.
  - C) Holding the oil filter upright, pre-fill the filter with the 325ml (11 ounces) of new break-in oil.
  - D) Tilt the filter and slowly rotate it a full 360° several times to let the oil absorb into the entire fiber filter element.
  - E) Install the filter onto the engine. By letting the oil absorb into the entire filter element no oil should spill out when tilting the filter to install it.
- 8) Fill the engine with the remainder of the 3.5L break-in oil charge.
- 9) Circulate and preheat the engine coolant to 50°C and then warm soak the engine for 10 minutes before initial start-up.
- 10) Start the engine and crack the throttle open 5-10% to raise the engine speed, not to exceed 1500 rpm, to help the oil pressure build quicker. Target 1200 rpm during engine start-up. Once oil pressure has started to build and within 30 seconds of engine start, control engine speed to 800 rpm, control torque to 10 N-m and ramp oil temperature to 50°C.
- 11) Once the engine has achieved 800 rpm, using a timing light, set the ignition timing to 10° BTDC.
- 12) Start the break-in sequence and run through all eight (8) steps. Total running time is 95 minutes.
- 13) At completion of the break-in sequence perform a compression check on all 4 cylinders.
- 14) Once the compression check has been completed drain the engine oil for 30 minutes and remove the used oil filter.

- 15) Remove the rocker cover.
- 16) Using a suction device, remove the used break-in oil that is trapped in the cavities of the cylinder head under the camshaft.
- 17) Examine the used engine oil for unusual amounts of metal particles.
- 18) Remove the break-in test parts (camshaft, rocker arms, rocker shafts).
- 19) Check the engine assembly for anything unusual after break-in has been completed.
- 20) If everything checks out to be acceptable then the engine is ready for test work.

#### 12.3.6.2 PCV Valve Replacement

Replace the PCV valve after eight (8) tests, whenever the engine or cylinder head is replaced. The PCV valve part no. is 11810-86G00.