



Test Monitoring Center

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

SEQUENCE VIB INFORMATION LETTER 01-3
SEQUENCE NUMBER 10
October 5, 2001

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 VIA/VIB Mailing List

SUBJECT: Revisions to the Sixth Draft of Sequence VIB Procedure

The Sequence VIB Surveillance panel approved the following changes to the Sequence VIB Procedure.

1. The engine coolant system is to be pressurized to 69 ± 13.8 kPa. Section 6.5.1, Appendix A2.1, A2.2, A2.3 and Annex X1.6 have been revised to reflect this change.
2. The requirement to measure blowby has been deleted. Section 11.5.15.1 has been deleted and existing Section 11.5.15.2 has been renumbered as Section 11.5.15.1. Table 4 has also been revised to delete blowby measurements.
3. Draft 6 of the Sequence VIB Procedure revised the load cell temperature delta from $\leq 3^{\circ}\text{C}$ to $\leq 6^{\circ}\text{C}$ in Table 4, but the limit in Section 6.4.2.3 was not changed. Section 6.4.2.3 has been corrected to reflect variability of no more than $\pm 6^{\circ}\text{C}$.
4. The change in ownership of the supplier of the test fuel had been addressed in Annex X1.37, but was overlooked elsewhere in the procedure. Section 7.2 and footnote 15 have been revised to reflect the change in names for the fuel supplier.

Copies of pages 17, 35, 60, 63, 66, 80 to 82 and 126 to 137 of Draft 6 of the Sequence VIB procedure are attached, incorporating all of the above changes. Item 1 is effective for tests that start on or after October 16, 2001. Items 2, 3, and 4 are effective for tests starting on or after September 17, 2001.

Pete Misangyi
Product Engineering
Ford Motor Company

John L. Zalar
Administrator
ASTM Test Monitoring Center

Attachment

c: ftp://tmc.astm.cmri.cmu.edu/docs/gas/sequencevi/procedure_and_ils/il01-3.pdf

6.4.2.3 *Dynamometer Load Cell Temperature Control* - Control the load cell temperature. Enclose the dynamometer load cell to protect it from the variability of laboratory ambient temperatures. Maintain air in the enclosure within the operating temperature range specified by the load cell manufacturer within a variability of no more than $\pm 6^{\circ}\text{C}$ ($\pm 10.8^{\circ}\text{F}$). Control temperature by a means that does not cause uneven temperatures on the body of the load cell.

6.4.2.4 *Dynamometer Connection to Engine* - Use U-joints for the dynamometer-to- engine connection (see Section 6.2).

6.5 *Engine Cooling System* - An external engine cooling system, as shown in Figures A2.1 through A2.5 is required to maintain the specified jacket coolant temperature and flow rate during the test. An alternative cooling system is shown in Figure A2.3. The systems shall have the following features:

6.5.1 Pressurize the coolant system at the top of the reservoir. Control the system pressure to 69 ± 13.8 kPa (10 ± 2 psi). Install a pressure cap (PC-1 in Figures A2.1, A2.2 and A2.3) (X1.6) capable of maintaining system pressure within the above requirements.

6.5.2 The pumping system shall be capable of producing 130 ± 4 L/min (34.3 ± 1.1 gal/min). A Goulds G&L centrifugal pump (P-1 in Figures A2.1, A2.2 and A2.3), Model NPE, Size 1ST, mechanical seal, with a 2 hp, 3450 r/min motor, is specified (X1.7). Voltage and phase of the motor is optional.

6.5.3 The coolant system volume is not specified, however certain cooling system components are specified as shown in Figures A2.1 through A2.5. Adhere to the nominal I.D. (inside diameter) of the line sizes as shown in Figures A2.2 through A2.5.

6.5.4 The specified heat exchanger (HX-1 in Figures A2.1 through A2.3) is an ITT Standard brazed plate model 320-20, Part No. 5-686-06-020-001 or ITT Bell and Gossett brazed plate model BP-75H-20, part No. 5-686-06-020-001 (X1.8). Parallel or counterflow through the heat exchanger is permitted.

6.13.13 *Oil Filter Adapter* - Use oil filter adapter, part #F1AZ-6881, F1AE-6881 or F1AE-6884. Modify for engine coolant in thermocouple installation (6.9.5.3) or procure as part #OHT6A-009-1 (X1.30).

6.13.14 *Fuel Rail* - Use fuel rail, part #F2AZ-9F792-A or F2AE-9F792. Purchase this part from the CPD (X1.38). Modify the fuel rail inlet and outlet connections for connection to the laboratory fuel supply system.

6.14 *Miscellaneous Apparatus Related to Engine Operation*

6.14.1 *Timing Light* - Use an inductive pickup type timing light during the test.

Note 5: Caution: Some types of timing lights will read out double the actual ignition timing when used on this engine.

7. Reagents and Materials

7.1 *Engine Oil*

7.1.1 ASTM Baseline Calibration Oil (BC) (X1.2) is used for new engine break-in and as a primary calibration oil for evaluation of test oils. It is an SAE 5W-30 grade. Approximately 38 L (10 gal) of BC oil are required for each test.

7.1.2 ASTM BC Flush Oil (BCFHD) (X1.2) is a special flushing oil (BC oil with increased solubility) which is used when changing oil after a test oil has been in the engine. Approximately 6 L (6.3 qt) of Flush Oil are required for each test.

7.2 *Test Fuel* - Use only Haltermann (X1.37) HF 003 fuel.

Note 6: Warning - Danger! Extremely Flammable Vapors Harmful if Inhaled. Vapors may cause Flash Fire (See A5.2.1).

7.2.1 Make certain that all tanks used for storage are clean before they are filled with test fuel.

7.2.2 *Laboratory Fuel Sampling and Analysis* - TBD

TABLE 4 Sequence VIB Test Operating Conditions (SI Units)

Parameter	Stage	Stage	Stage	Stage	Stage
A Speed, r/min	1500	800	800	1500	1500
	± 2	± 2	± 2	± 2	± 2
A Load, Nm	98.00	26.00	26.00	98.00	98.00
	± 0.07	± 0.07	± 0.07	± 0.07	± 0.07
Nominal, Power kW	15.39	2.18	2.18	15.39	15.39
A Gallery, °C	125 ± 1	105 ± 1	70 ± 1	70 ± 1	45 ± 1
A Coolant, °C	105 ± 1	95 ± 1	60 ± 1	60 ± 1	45 ± 1
B Stabilization, min.	60	60	60	60	60

Temperatures °C

ALL STAGES

Oil Circulation	Record
Coolant Out	Record
A Intake Air	27 ± 2
C Fuel to Flowmeter	20 to 32 (delta from the maximum stage average reading shall be ≤ 4)
A Fuel to Fuel Rail	20 ± 2
C Delta Load Cell	Delta from the maximum stage average shall be ≤ 6
Oil Heater	205 maximum

Pressures

Intake Air, kPa	0.05 ± 0.02
Fuel to Flowmeter, kPa	100 minimum
Fuel to Fuel Rail, kPa	205 to 310
Intake Manifold, kPa abs.	Record
A Exhaust Back Pressure, kPa abs.	104.00 ± 0.17
Engine Oil, kPa	Record
Crankcase, kPa	0.0 ± 0.25

Flows

Engine Coolant, L/min	130 ± 4
A Fuel Flow, kg/h	Record
Humidity, Intake Air, gr/kg of dry air	11.4 ± 0.8
A Air to Fuel Ratio	14.25:1 to 15.25:1
C Air to Fuel Ratio	Delta from maximum stage average reading shall be ≤ 0.50
Ignition Timing	20° BTDC ± 2°

Notes:

Controlled parameters should be targeted for the middle of the specification range

A Critical measurement and control parameters

B Counted from the time the temperature set points are initially adjusted to the specific levels

C Difference between the maximum stage average reading of the entire test and the individual stage average readings

BSFC is calculated for each of the five stages as follows:

$$\frac{(\text{Integrated Fuel Flow}) (9549.3)}{(\text{Integrated Load}) (\text{Integrated Speed})} = \text{BSFC in kg/kW}\cdot\text{h}$$

Where:

Integrated Speed (r/min) to one decimal place
Integrated Load (N•m) to two decimal places
Integrated Fuel Flow Rate (kg/h) to three decimal places

11.5.12.1 Calculate BSFC measurements as in equation (1) for each of the six steps in each stage to four decimal places and record after rounding (Practice E 29) the average for each stage to five decimal places. Calculate the coefficient of variation (C.V.) of the six BSFC determinations. Due to the low engine operating speed and low fuel consumption in Stages 2 and 3, it is recognized that the C.V. for these Stages may tend to be higher than for Stages 1, 4 and 5.

(a) A test cannot be deemed operationally invalid for high C.V. alone.

11.5.13 *Data Logging* - Use of manual data logs is optional.

11.5.14 *BC Oil Flush Procedure for BC Oil Before Test Oil* - At the start of test, the engine is warmed up to Stage Flush conditions (Table 5) and the BC oil is flushed into the engine without shutting the engine down. The sequence of events for this flush are as follows (See 11.5.9.2 and Table A5.3):

11.5.14.1 Warm engine to Stage Flush

11.5.14.2 Double flush to BC oil

11.5.14.3 Proceed with BC oil BSFC data acquisition

11.5.15 *BSFC Measurement of BC Oil Before Test Oil* - Run Stages 1 through 5 as detailed in Table 4.

Obtain 6 BSFC measurements at each stage according to the Critical Data Acquisition Period as detailed in Table 6 and Section 11.5.12.

11.5.15.1 When six data points have been obtained at Stage 1, calculate the coefficient of variation (C.V.) for the mean BSFC of the six runs.

11.5.16 *Test Oil Flush Procedure* - After the BC oil before test oil segment is completed, the test oil is flushed into the engine without shutting the engine down. The sequence of events for this flush are as follows (See 11.5.9.2 and Table A5.2):

11.5.16.1 Double flush to test oil

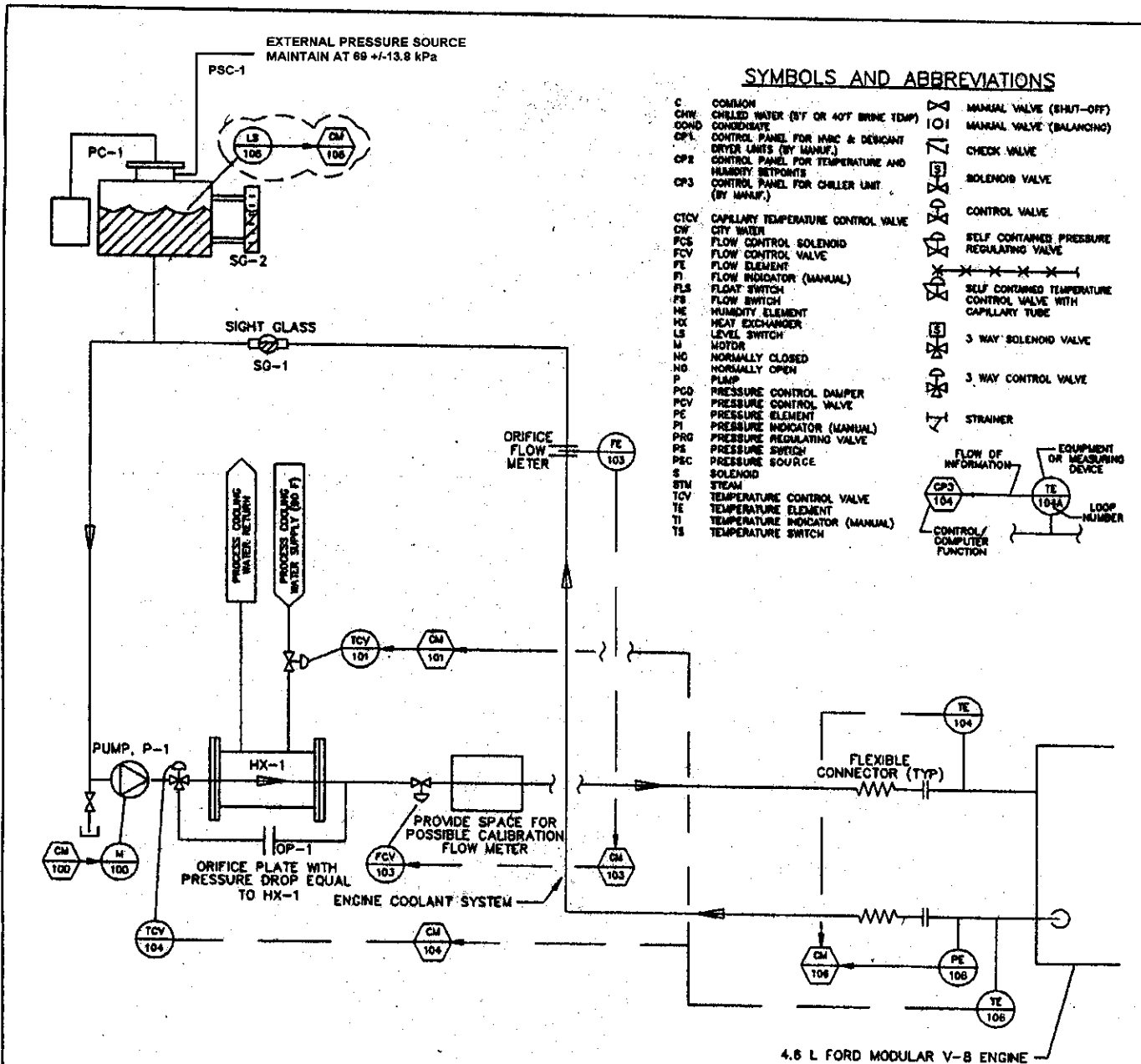
11.5.16.2 Proceed with test oil aging

11.5.17 *Test Oil Aging* - The initial 16 hours of aging is run at the conditions shown in Table 5, Phase I. This 16 h interval starts when the double flush procedure is completed. The maximum allowable off-test-time during Phase I Aging is 2 hours. If off-test time exceeds 2 hours the test is invalid. At the completion of the Phase I aging the first of two fuel economy measurements is run on the test oil.

11.5.17.1 *Oil Consumption During Aging* - Monitor test oil consumption during the 16 h aging period by observing the running oil level in the engine oil sight glass. At the completion of the test oil flush to Phase I aging the oil level is to be adjusted to the full mark. No oil additions are allowed after the first h of aging.

11.5.18 *BSFC Measurement of Aged (Phase I) Test Oil* - After Aging Phase I (16 h) has completed run Stages 1 through 5 as detailed in Table 4. Obtain 6 BSFC measurements at each stage according to the *Critical Data Acquisition Period* as detailed in Table 6 and Section 11.5.12.

11.5.19 *Aging Phase II* - At the completion of this fuel economy measurement (11.5.18) the test condition should precede to Aging Phase II conditions shown in Table 5. Aging Phase II is complete when 80 test hours have been run at these conditions. The maximum allowable off-test-time during Phase II Aging is 2 hours. If off-test time exceeds 2 hours the test is invalid.



SYMBOLS AND ABBREVIATIONS

- C COMMON
- CHW CHILLED WATER (BY OR 40°F BRINE TDWP)
- COND CONDENSATE
- CP1 CONTROL PANEL FOR HARC & DEWICANT DRYER UNITS (BY MANUF.)
- CP2 CONTROL PANEL FOR TEMPERATURE AND HUMIDITY SETPOINTS
- CP3 CONTROL PANEL FOR CHILLER UNIT (BY MANUF.)
- CTCV CAPILLARY TEMPERATURE CONTROL VALVE
- CW CITY WATER
- FCV FLOW CONTROL VALVE
- FE FLOW ELEMENT
- FI FLOW INDICATOR (MANUAL)
- FLS FLOAT SWITCH
- FS FLOW SWITCH
- HE HUMIDITY ELEMENT
- HX HEAT EXCHANGER
- LS LEVEL SWITCH
- M MOTOR
- NC NORMALLY CLOSED
- NO NORMALLY OPEN
- P PLUMP
- PCD PRESSURE CONTROL DAMPER
- PCV PRESSURE CONTROL VALVE
- PE PRESSURE ELEMENT
- PI PRESSURE INDICATOR (MANUAL)
- PRG PRESSURE REGULATING VALVE
- PS PRESSURE SWITCH
- PSC PRESSURE SOURCE
- S SOLENOID
- STM STREAM
- TCV TEMPERATURE CONTROL VALVE
- TE TEMPERATURE ELEMENT
- TI TEMPERATURE INDICATOR (MANUAL)
- TS TEMPERATURE SWITCH
- MANUAL VALVE (SHUT-OFF)
- MANUAL VALVE (BALANCING)
- CHECK VALVE
- SOLENOID VALVE
- CONTROL VALVE
- SELF CONTAINED PRESSURE REGULATING VALVE
- SELF CONTAINED TEMPERATURE CONTROL VALVE WITH CAPILLARY TUBE
- 3 WAY SOLENOID VALVE
- 3 WAY CONTROL VALVE
- STRAINER

FIG. A2.1 ENGINE COOLING SYSTEM

Power-Tek Inc.			
DATE	REVISED	DRAWN	B DCW
BY M BUDI		DATE	01-11-88
TITLE			CONF. NO.
			MO2A

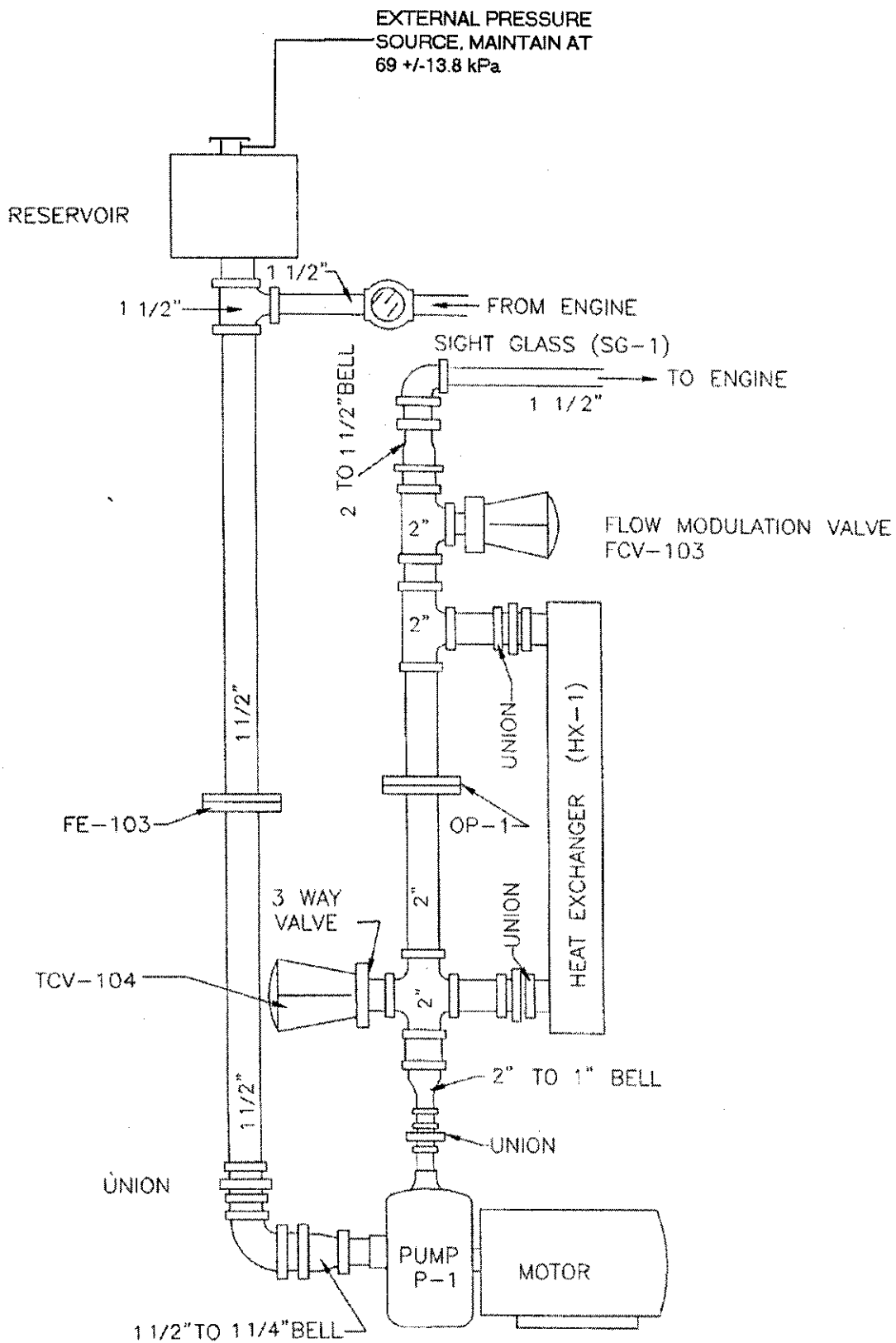


FIG. A2.2 TYPICAL ENGINE SYSTEM IN AIR-TO-CLOSE CONFIGURATION

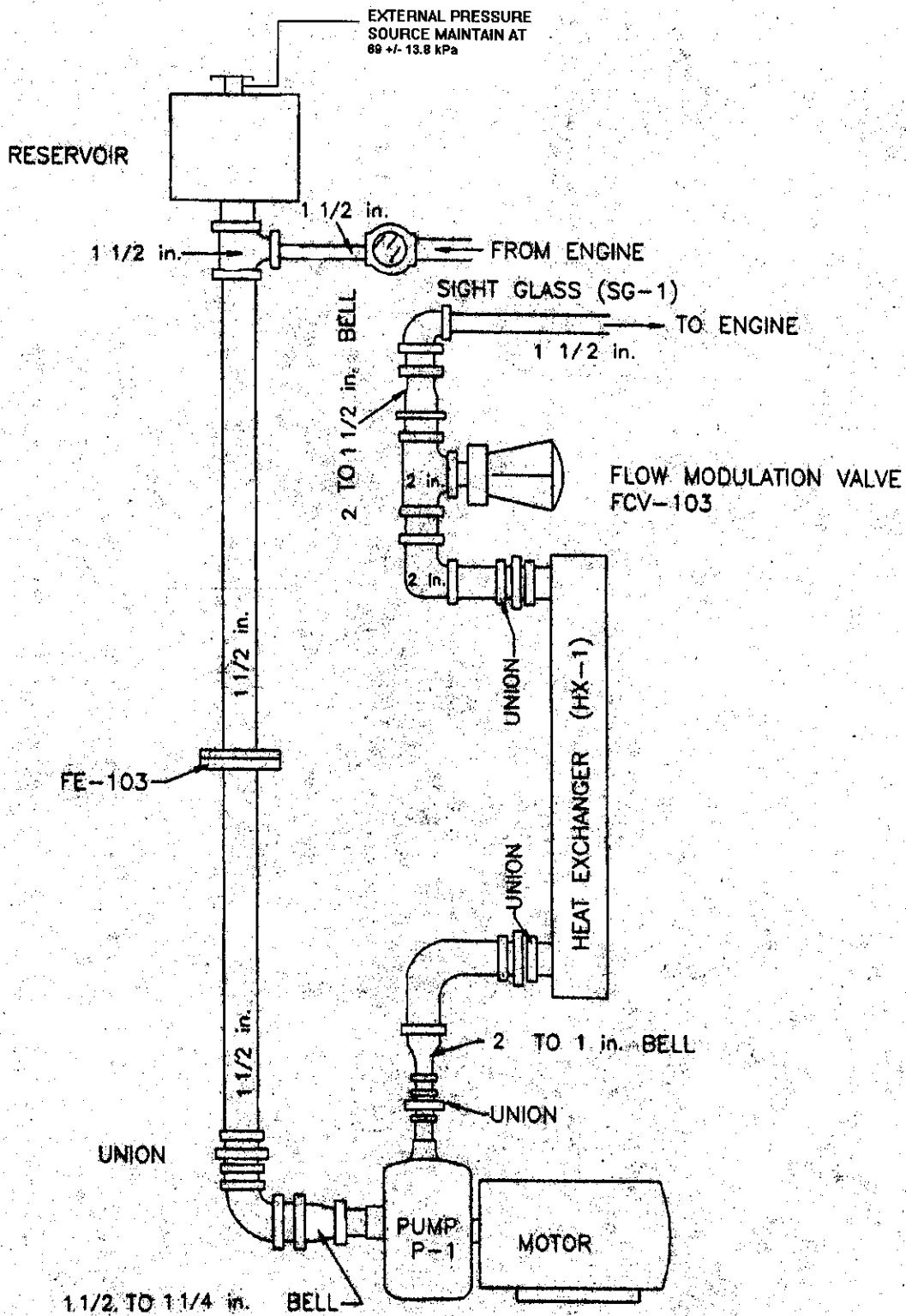


FIG. A2.3 ALTERNATIVE ENGINE SYSTEM CONFIGURATION

APPENDIX

Nonmandatory Information

X1. PROCUREMENT OF TEST MATERIALS

Throughout the text, references are made to necessary hardware, reagents, materials, and apparatus. In many cases, for the sake of uniformity and ease of acquisition, certain suppliers are named. If substitutions are deemed appropriate for the specified suppliers, permission in writing must be obtained from the Test Monitoring Center before such will be considered to be equivalent. The following entries for this appendix represent a consolidated listing of the ordering information necessary to complete the references found in the text.

X1.1 *General Communications Concerning Sequence VIB Reference Tests, Procedural Questions and Non-Reference Tests*

ASTM Test Monitoring Center
Attention: Administrator
6555 Penn Avenue
Pittsburgh, PA 15206-4489
Telephone: (412) 365-1005

X1.2 *Reference Oils and Calibration Oils*

Reference oils and calibration oils may be purchased by contacting:

ASTM Test Monitoring Center
Attention: Operations Manager
6555 Penn Avenue
Pittsburgh, PA 15206-4489
Telephone: (412) 365-1010

X1.3 *Test Engines*

Sequence VIB engines, part #R2G-800-XB (AOD-E)

AER
1605 Surveyor Blvd.
P.O. Box 979
Carrollton, TX 75011-0979
Attention: Ms. Charris Wagoner
Telephone: (972) 417-3182
Fax: (972) 417-3165

X1.4 *Dynamometer*

A Midwest Model 758 (50 HP) dry gap dynamometer may be ordered from:

Midwest Dynamometer Engineering Company
3100 River Road
River Grove, IL 60171
Telephone: (708) 453-5156
Fax: (708) 453-5171

X1.5 *Dynamometer Load Cell*

The recommended load cell is a Lebow Model 3397 which may be ordered from:

Eaton Corporation
Lebow Products
1728 Maplelawn Road
P.O. Box 1089
Troy, MI 48099
Telephone: (313) 643-0220
Fax: (313) 643-0259

X1.6 *Cooling System Pressure Cap*

A satisfactory coolant system pressure cap (69 kPa, normally closed cap) is available through local distributors.

X1.7 *Cooling System Pump (P-1)*

The specified cooling system pump may be obtained from:

Gould Pumps, Inc.
240 Fall Street
Seneca Falls, NY 13148

X1.8 *Coolant Heat Exchanger (HX-1)*

ITT (Model 320-20) or Bell & Gossett (BP 75H-20 or BP 420-20)

ITT Standard
175 Standard Parkway
Buffalo, NY 14227

Bell & Gossett ITT
8200 N. Austin Avenue
Morton Grove, IL 60053

X1.9 *Coolant Orifice Plate (Differential Pressure)*

Daniel Flow Products, Inc.
Flow Measurement Products Division
P.O. Box 19097
Houston, TX 77224
Telephone: (713) 467-6000
Fax: (713) 827-3880

X1.10 *Coolant Control Valves (TCV-104, FCV-103 and TCV-101)*

Badger Meter, Inc.
P.O. Box 581390
Tulsa, OK 74158
Telephone: (918) 836-8411

X1.11 *Differential Pressure Transducer (DPT-1)*

The recommended transducers are Viatran Model 274 or Model 374, Validyne Model DP15, and Rosemount model 1151 which may be ordered from:

Viatran Corp.
300 Industrial Drive
Grand Island, NY 14072
Telephone:(716) 773-1700

Validyne Engineering Corp.
8626 Wilbur Ave.
Northridge, CA 91324
Telephone:(818) 886-2057

Rosemount Inc.
4001 Greenbriar Street 150B
Stafford, Texas 77477
Telephone:1-800 999-9307

X1.12 *Water Pump Plate*

The water pump may be modified by the laboratory, a water pump plate may be fabricated by the laboratory or a water pump plate may be purchased from:

OHT Technologies, Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax (440) 354-7080

X1.13 *Oil Scavenge Pump (P-3)*

Houdaille Industries, Inc.
Viking Pump Division
George and Wyeth Street
Cedar Falls, IA 50613
Telephone: (319) 266-1741

X1.14 *Float Switch (FLS-136 and FLS-152)*

Imo Industries Inc.
Gems Sensor Division
1 Cowles Road
Plainville, CT 06062-1198
Telephone: (203) 747-3000
Fax: (203) 747-4244

X1.15 *Oil Circulation Pump (P-4)*

Houdaille Industries, Inc.
Viking Pump Division
George and Wyeth Street
Cedar Falls, IA 50613
Telephone: (319) 266-1741

X1.16 *External Oil System Solenoid Valves (FCV-150A, FCV-150C, FCV-150D, FCV-150E and FCV-150F)*

Burkert Contromatic Corp.
1091 N. Batavia Street
Orange, CA 92667
Telephone: (714) 744-3230
Fax: (714) 639-4998

X1.17 *External Oil System Control Valves (TCV-144 and TCV-145)*

Badger Meter, Inc.
P.O. Box 581390
Tulsa, OK 74158
Telephone: (918) 836-8411

X1.18 *Oil Heat Exchanger (HX-6)*

ITT (Model 310-20) or Bell & Gossett (Model BP 25-20 or BP 410-020)

ITT Standard
175 Standard Parkway
Buffalo, NY 14227

Bell & Gossett ITT
8200 N. Austin Avenue
Morton Grove, IL 60053

X1.19 *Electric Oil Heater Housing (EH-5)*

TEI
12718 Cimarron Path
San Antonio, TX 78249
Telephone: (210) 690-1958
Fax: (210) 690-1959

X1.20 *Oil Filter Housing Assembly and Filters (Screen) (FIL-2)*

Racor
PO Box 3108
Modesto, CA 95353
Telephone: (800) 344-3286

or

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.21 *Modified Oil Filter Adapter Assembly*

OH Technologies, Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.22 *External Oil System Hose and Quick Disconnect Fittings*

Aeroquip products are available through local distributors or:

Aeroquip Corporation
Industrial Division
1225 W. Main Street
Van Wert, OH 45891
Telephone: (419) 238-1190

X1.23 *Modified Oil Pan and Modified Oil Pick-Up Tube*

The oil pan and the oil pick-up tube may be modified by the laboratory or may be purchased from:

OH Technologies, Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.24 *Fuel Flow Measurement Mass Flow Meter*

MicroMotion, Inc.
7070 Winchester Circle
Boulder, CO 80301
Telephone: (303) 530-8400 or (800) 522-6277
Fax: (303) 530-8209

X1.25 *AFR Analyzer*

The recommended AFR analyzer is a Horiba MEXA 110 which may be ordered from:

Horiba Instruments, Inc.
17671 Armstrong
Irvine Industrial Complex
Telephone: (714) 250-4811

X1.26 *ECM/EEC (Engine Control Module)*

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.27 *Thermostat Orifice Plate*

The thermostat orifice plate may be fabricated by the laboratory or may be purchased from:

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.28 *Engine Wiring Harness Without Interface*

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.29 *Modified Coolant Outlet (Thermostat Housing)*

The thermostat housing may be modified by the laboratory or may be purchased from:

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.30 *Modified Coolant Inlet (Oil Filter Adapter)*

The coolant inlet adapter may be modified by the laboratory or may be purchased from:

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.31 *Fuel Fail Adapter Set*

The fuel rail may be modified by the laboratory or a fuel rail adapter set may be purchased from:

OH Technologies Inc.
9300 Progress Parkway
P.O. Box 5039
Mentor, OH 44061-5039
Telephone: (440) 354-7007
Fax: (440) 354-7080

X1.32 *Organic Solvent (Penmul L460)*

Penetone Corporation
74 Hudson Avenue
Tenafly, NJ 07670

X1.33 *Aliphatic Naphtha*

Available from local suppliers.

X1.34 *Cooling System Cleanser or Premixed Coolant Flush Chemicals*

Oxalic acid, 55 lbs bags

Sodium Carbonate, 50 lbs bags:

Ashland Chemical Company
P.O. Box 391
Ashland, KY 41114
Attn: Paul Dickison
Telephone: (606) 329-5044

Petro Dispersant #425 Powder, 50 lbs bags:

Witco Corporation
3230 Brookfield
Houston, TX 77045
Telephone: 1-800-231-1542 (Outside Texas)
1-800-391-1681 (Inside Texas)

Oxalic Acid 17.5 g/L (2.3 oz/gal) and Petro Dispersant #425 1 g/L (0.15 oz/gal) premixed in a single use container.

Wrico Corporation
4835 Whirlwind
San Antonio, TX 78217
Attn: Greg Wright, President
Telephone: (210) 590-4400
Fax: (210) 590-4451

X1.35 *Engine Mounts*

Lybrook Precision Products
Telephone: (313) 946-4246

X1.36 *Engine Mount Isolators (Biscuits)*

World Class Engineered Products
20994 Bridge Street
Southfield, MI 48034
Telephone: (313) 351-4090
Fax: (313) 351-4099

X1.37 *Test Fuel*

Haltermann Products
1201 South Sheldon Road P.O. Box 429
Channelview, TX 77530-0429
Telephone: 281-457-2768
Fax: 281-457-1469

X1.38 *Parts specified as "available from CPD" are to be ordered from:*

Test Engineering, Inc. (TEI)
12758 Cimarron Path, Suite 102
San Antonio, Texas 78249-3417

FOOTNOTES

(Note to document reviewers: In the published standard the footnotes will be re-located to the bottom of the appropriate column.)

¹This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B0 on Automotive Engine Oils. The multi-cylinder engine test sequences were originally developed in 1956 by an ASTM Committee D-2 group. Subsequently, the procedures were published in an ASTM special technical publication. The Sequence VIB was published as Research Report RR:Dxxxxx dated xxxxxx xx, xxxx.

²ASTM Test Monitoring Center, 6555 Penn Avenue, Pittsburgh, PA 15206-4489. For other information, refer to Research Report RR: Dxxxxx Sequence VIB Test Development. This research report and this test method are supplemented by Information Letters and Memoranda issued by the ASTM Test Monitoring Center. This edition incorporates revisions in all Information Letters through No. xx-x.

³Available from ASTM, Publications and Marketing Division, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

⁴*Annual Book of ASTM Standards, Vol. 05.01.*

⁵*Annual Book of ASTM Standards, Vol. 05.02.*

⁶*Annual Book of ASTM Standards, Vol. 05.03.*

⁷*Annual Book of ASTM Standards, Vol. 14.02.*

⁸Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001. This standard is not available separately. Either order the SAE Handbook Vol. 3, or the SAE Fuels and Lubricants Standards Manual HS-23.

⁹Available from American Petroleum Institute, 1220 L Street, Washington, DC 20005-4070.

¹⁰Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

¹¹Available from HELM, Inc., 14310 Hamilton Avenue, Highland Park, MI 48203.

¹²Available from the Secretary of the ASTM D02.B0 Subcommittee. The Secretary is J.L. Newcombe, Exxon Chemical Co., 26777 Central Blvd., Suite 300, Southfield, MI 48076-4172.

¹³A specially built 1993 4.6L Ford V-8 internal combustion engine is a product of Ford Motor Co., Dearborn, MI 48121. It is available as Part #R2G-800-XB (AOD-E) from AER, Attention: Mr. Brandy Walker, 1605 Surveyor Blvd., P.O. Box 979, Carrollton, TX 75011-0979.

¹⁴ASTM Instrumentation Task Force Research Report. Available from ASTM, Publications and Marketing Division, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

¹⁵Available from Haltermann Products, 1201 South Sheldon Road, P.O. Box 429, Channelview, TX 77530-0429, Phone: (281) 457-2768, (800) 969-2542.