Designation: D 5662 – 99

An American National Standard

Standard Test Method for Determining Automotive Gear Oil Compatability with Typical Oil Seal Elastomers[1]

This standard is issued under the fixed designation D 5662; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This laboratory test method[2] covers the determination of the compatibility of automotive gear oils with specific nitrile, polyacrylate, and fluoroelastomer oil seal materials.

1.2 Users of this test method should obtain Test Methods D 412, D 471, and D 2240 and become familiar with their use before proceeding with this test method.

1.3 The values stated in either SI units or inch pound units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension[3]

D 471 Test Method for Rubber Property—Effect of Liquids[3]

D 2240 Test Method for Rubber Property—Durometer Hardness[3]

D 5704 Test Method for Evaluation of the Thermal and Oxidative Stability of Lubricating Oils Used for Manual Transmissions and Final Drive Axles[4]

D 5760 Specification for Performance of Manual Transmission Gear Lubricants[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *dumbbell, n*—the specific cut shape (Die C) of an elastomer as explained in Section 13 of Test Methods D 412.

3.1.2 *formulation, n*—the specific chemical composition used in manufacturing a seal elastomer or a reference oil.

3.1.3 *percent ultimate elongation, n*—the stretch length at rupture of an elastomer dumbbell oil-aged by running this procedure minus the rupture stretch length of an untested dumbbell, all divided by rupture stretch length of the untested dumbbell and then multiplied by 100.

3.1.4 *percent volume change, n*—the change in volume of a test specimen as explained in Section 10 of Test Method D 471.

4. Summary of Test Method

4.1 Non-reference oils are tested using a modified version of Test Method D 471 on specific elastomer compounds. Measured quantities are percent ultimate elongation changes (further referred to as just percent elongation changes), durometer Type A hardness changes, and percent volume changes. Reference oils are run concurrently in the same oil bath to measure consistency from one test to another.

4.2 The duration of these tests is 240 h. Table 1 shows the types of seal materials and their associated test reference oils and temperatures. The reference oils are available from the ASTM Test Monitoring Center (TMC).[5] The seal materials are available through a Central Parts Distributor (CPD).[6]

5. Significance and Use

5.1 There are several major causes of automotive lubricant-related seal failures. This test method addresses only those failures caused by excessive elastomer hardening, elongation loss, and volume swell and attempts to determine the likelihood that an oil might cause premature sealing system failures in field use. This test method may be used as a requirement of a performance specification, such as Specification D 5760.

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[1] This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B0.03 on Gear Lubricants.

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[2] Until the next revision of this test method, the ASTM Test Monitoring Center will update changes in this test method by means of Information Letters; these can be obtained from the ASTM Test Monitoring Center, 6555 Penn Ave., Pittsburgh, Pa 15206–4489. Attention: Administrator. This edition incorporates revisions in all Information Letters through No. 98–1.

[3] *Annual Book of ASTM Standards,* Vol 09.01.

[4] *Annual Book of ASTM Standards,* Vol 05.03.

[5] Reference oils are available from the ASTM Test Monitoring Center, 6555 Penn Ave., Pittsburgh, PA 15206-4489.

[6] The Central Parts Distributor for this procedure is Test Engineering Inc., 12758 Cimarron Path, Suite 102, San Antonio, TX 78249.

TABLE 1 Seal Materials, Reference Oils, and Test Temperatures

Seal Material	Reference Oils	Test Temperature
Nitrile	No. 161, No. 162	100°C
Polyacrylate	No. 160, No. 161	150°C
Fluoroelastomer	No. 160, No. 161	150°C

5.2 Another major cause of seal failure is the formation of carbon, varnish, and sludge-like deposits on the seal lip. The deposit-forming characteristics of automotive gear oils are evaluated in Test Method D 5704. That procedure is intended in part to evaluate the potential for oils to cause premature seal failure in field service.

6. Apparatus

6.1 Specific test equipment as outlined in Test Methods D 412, D 471, and D 2240 is required.

6.1.1 *Hardness Durometer*—See Test Method D 2240.

6.1.1.1 *Calibration*—Calibrate the hardness durometer annually. Use an outside source, with standards traceable to National Institute for Standards Technology (NIST) for annual calibration. Perform checks with internal standards weekly. Checks with internal standards shall be within ± 3 points. Calibrate internal standards annually, using an outside source, with standards traceable to NIST.

6.1.2 *Tension Testing Machine*—See Test Method D 412. Set the testing machine rate of grip separation for the percent elongation change determinations at 8.5 ± 0.8 mm/s.

6.1.2.1 *Calibration*—Calibrate the tension testing machine annually. Annual calibration shall be performed by the manufacturer, using NIST traceable standards.

6.1.3 *Glass Tubes*, having an outside diameter of 38 mm and an overall length of 300 mm. The tube is fitted loosely with an aluminum foil-covered stopper.

6.1.4 *Balance*—Use any commercially available balance capable of weighing samples to the nearest 1.0 mg.

6.1.4.1 *Calibration*—Calibrate the balance annually. Use an outside source, with standards traceable to NIST for annual calibration. Perform checks with internal standards monthly, using NIST traceable weights. The difference between the weights and balance shall be < 0.5 mg. Calibrate internal standards annually, using an outside source, with standards traceable to NIST.

7. Reagents and Materials

7.1 Specific reference test oils are maintained and distributed by the TMC.[5] The oils used are labeled No. 160, No. 161, and No. 162, or current equivalent. To receive the test oils and seal materials, individual laboratories shall commit to furnishing the TMC with reference data developed using these reference materials. The TMC is also responsible for managing a system that ensures the performance and formulation concerning these reference oils.

7.2 The CPD is responsible for maintaining the numbering and tracking system for the seal elastomer batches used. Certain specific information concerning these reference materials is available only to the CPD. This information is used to ensure batch-to-batch consistency.

7.2.1 Information and location of the current CPD is also available from the TMC.

7.3 Specific reference seal elastomers used are a nitrile (NI), a polyacrylate (PA), and a fluoroelastomer (FL). Notation of the numbering system is established by the TMC as follows:

[Type] Y – X

where:

Type = NI, PA, FL,
Y = specific formulation of the elastomer type, and
X = batch number of the particular formulation.

7.4 The shelf life for the seal elastomers is two years from the date the batch was cured. Invalidate any test with a seal cure date older than two years.

7.4.1 Store the elastomers in a cool, dark, and dry place. The preferred method of storage is a refrigerator maintained at 38 to 42°F (3 to 6°C).

7.5 The shelf life of reference oils is typically five years unless the TMC, through their analysis, specifies otherwise.

7.6 Wetting solution of Aerosol OT—0.1 % sodium diocytl sulfosuccinate, made by a 1.0 % dilution of a 10 % solution with reagent water.

8. Procedure

8.1 The testing laboratory shall conduct reference oil tests concurrently with the non-reference oil in the same oil bath. Reference oils shall perform within a specific range prescribed and evaluated by TMC for validity and updated as needed.

8.2 Prior to cutting specimens and prior to performing elongation tests for initial properties, allow 3 h for the elastomer to warm to 23+ 2°C, as required by Test Method D 412. Referring to the procedure in Test Method D 412, use Die C to cut a set of twelve dumbbell specimens out of the elastomer sheets as required for each reference and non-reference oil tested.

8.2.1 Cut the dumbbells parallel to the grain using the same unaltered dies for the entire lot. When cutting dumbbells, only cut one thickness at a time to avoid any dimensional variations.

8.2.2 Cut all elastomer specimens, including those used for measuring initial properties, from the same elastomer batch. Use these dumbbells for measuring the percent elongation changes.

8.2.3 Next, cut twelve 25 by 50 by 2.0 ± 0.1-mm (1 by 2 by 0.08 ± 0.005-in.) rectangular specimens for the percent volume change and hardness testing.

8.2.4 Finally, cut twelve more NI, PA, and FL dumbbells for the purpose of determining initial elongation properties.

TABLE 2 Elastomer Specimens Required

Purpose	Nitrile		Polyacrylate		Fluoroelastomer	
	Dumb-bells	Speci-mens	Dumb-bells	Speci-mens	Dumb-bells	Speci-mens
Oil No. 160	0	0	12	12	12	12
Oil No. 161	12	12	12	12	12	12
Oil No. 162	12	12	0	0	0	0
Non-reference	12 each	12 each	12 each	12 each	12 each	12 each
Initial Properties	12	0	12	0	12	0
Totals for a Single Non-reference	48	36	48	36	48	36

8.2.5 Use Table 2 as a guide to determine the number of elastomer specimens required.

8.2.6 Randomly select sets of twelve dumbbells and twelve rectangular specimens for testing from the different sheets of test elastomers.

8.2.7 Use the following water displacement procedure in accordance with Test Method D 471 to conduct the initial and final volume measurements. Weigh the coupon in air, M1, to the nearest 1 mg. Making sure there are no air bubbles clinging to the surface, immerse the rectangular specimen into a 1.0 % wetting solution of aerosol OT before weighing it in distilled water, M2, at ambient temperature.

8.2.8 Ensure that initial elastomer properties of hardness and volume are determined prior to the start of testing. Initial elongation properties are determined just prior to running the end of test dumbbells because of instrument calibration.

8.3 Fill the test tubes with 150 ±5 mL of non-reference or reference oil as appropriate.

8.3.1 See Table 1 for combinations of reference test oils and seal materials required for testing. Test the non-reference oil using one or more of the three different seal elastomers.

8.4 Use four test tubes for each elastomer/oil combination. In each tube, suspend from a stainless steel wire hanger bent at a 90° angle (dimensions shown in Fig. 1) three rectangular specimens and three dumbbells in each of the four tubes. Place 3.0 to 5.0-mm spacers in between the specimens to aid in the separation. The spacer material shall not affect the liquid or the rubber.

8.4.1 Fig. 2 shows the arrangement of spacers and test specimens.

8.4.2 Top the test tube with a stopper wrapped in aluminum foil.

8.4.3 See Table 1 for the combinations of reference test oils and seal materials required for testing. Test the non-reference oil using one or more of the three different seal elastomers with the same batch of elastomers as being used for the reference oil.

8.4.4 Place the tubes randomly in an oil bath capable of maintaining a test oil temperature (see Table 1) within ±1°C for a period of 240 ± 0.5 h.

8.4.5 Conduct all reference and non-reference oil testing on each seal elastomer in the same oil bath. Complete reference oil and non-reference oil tests for each seal elastomer within 8 h of each other to be considered the same test.

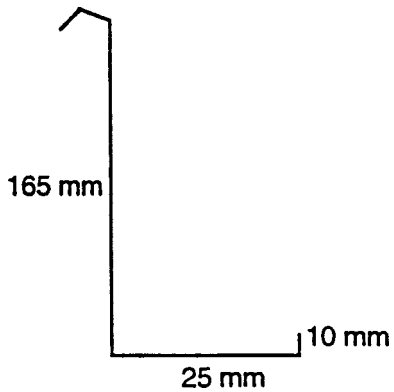

FIG. 1 Wire Hanger

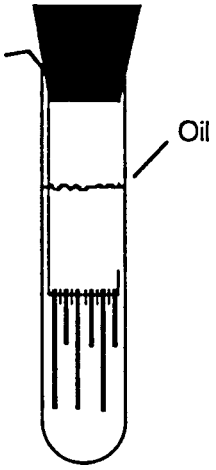

FIG. 2 Test Tube Arrangement

8.5 At the end of the test period, remove the specimens from the hot oil using the wire hanger and place them on a clean absorbent towel. Allow the specimens to cool for no longer than 30 min.

8.5.1 Remove the specimens from the wire hanger, and place them on a clean absorbent towel. Remove the excess oil with a clean absorbent towel, and begin testing.

8.6 Complete testing for durometer Type A hardness, percent volume, and percent elongation changes within 2 h of removal from the test oil.

8.7 Observe the following notes/modifications to Test Method D 471.

8.7.1 Report percent change in elongation (see Test Method D 412) and percent volume change (see Test Method D 471) from the original using the same water displacement procedure described in 8.2.7.

8.7.2 Report durometer Type A hardness change points from original (see Test Method D 2240).

8.7.2.1 On a hard horizontal surface, stack the three rectangular specimens on top of each other to obtain the 6-mm thickness required by Test Method D 2240. Hardness readings are to be taken 1 s after the pin makes contact with the elastomer. Take three readings on each side of the rectangular specimen and report the average of all six readings.

8.7.2.2 After taking the first set of measurements, rotate the bottom specimen to the top of the stack and take a second set of measurements.

8.7.2.3 Rotate the bottom specimen to the top one more time to obtain the third set of measurements.

8.7.3 For each data set, calculate the average value and the sample standard deviation using the equation:

$$\sigma = [\text{num}]1[\text{den}]N - 1\,[\text{end}]Ni{=}1\,(x_i - x)^2 \qquad (1)$$

where:

σ = sample standard deviation,
N = number of data points in the set,
X_I = individual data set value,
$|A/X)$ = mean of the data set, and
I = index to denote one of a set of data.

Change in volume, % = $[(M3 - M4)–(M1 - M2)]/(M1 - M2)\times d \times 100$

where:
$M1$ = the original weight in air,
$M2$ = the original weight in water,
$M3$ = the end of test weight in air,
$M4$ = the end of test weight in water, and
d = the density of the medium in which the specimen was weighed. In this case water is used, so the multiplication is by 1.

8.8 *Excessive Data Variability*—Criteria for determining test validity, consistent with accepted industry standards, are currently being developed by the task force in conjunction with the TMC. Should the reference test be determined to be invalid, repeat all testing on that particular oil/elastomer pair.

9. Report

9.1 Use the Final Report Forms (Annex A2) to report both the reference oil and non-reference oil test results. Report the data as specified in the Data Dictionary (Annex A3). Report the following information:

9.1.1 Percent elongation changes (see Test Methods D 412),

9.1.2 Percent volume changes (see Test Method D 471),

9.1.3 Type A durometer hardness change points (see Test Method D 2240),

9.1.4 End of test date,

9.1.5 Elastomer batch date and code,

9.1.6 Oil bath identification, and

9.2 Report to the TMC the information identified in 9.1 for the reference oils only.

10. Precision and Bias

10.1 Precision data are being developed for this test method. Test precision is established on the basis of reference oil test results (for operationally valid tests) monitored by the ASTM TMC. The research report contains industry precision data as of Nov. 19, 1993.[7] See also Annex A1.

10.2 No estimate of the bias for this procedure is possible because the performance results for an oil are determined only under the specific conditions of the test and no absolute standards exist.

11. Keywords

11.1 compatibility; elastomer; elongation change; gear oil; hardness change points; oil seal; volume change

[7] Available from ASTM Headquarters. Request RR: D02-1348.

ANNEXES

(Mandatory Information)

A1. THE ROLE OF THE TEST MONITORING CENTER

A1.1 The ASTM Test Monitoring Center (TMC) is a nonprofit organization located at 6555 Penn Ave., Pittsburgh, PA 15206-4489. It is staffed to administer engineering studies; conduct laboratory visits; perform statistical analyses of tests; to blend, store, and ship reference oils; and to provide associated administrative functions connected with the referencing and calibration of various lubricant tests. The TMC maintains a close connection with test sponsors, test developers, the surveillance panels, and the testing laboratories. The management of these functions is vested in the Test Monitoring Board, whose members are elected by Subcommittee D02.B. The TMC operates under the ASTM Charter and its associated bylaws and regulations, the bylaws of Committee D-2 and of Subcommittee D02.B, and the Rules and Regulations of the Test Monitoring Board. The operating income of the TMC is obtained from fees levied on the reference oils supplied and on the conduct of the calibration tests. These fees are set by Subcommittee D02.B and are regularly reviewed.

A1.2 *Information Letters*:

A1.2.1 It occasionally becomes necessary to change a test procedure and to notify test laboratories of the change before the change can be considered by Subcommittee D02.B on Automotive Lubricants or Committee D-2 on Petroleum Products and Lubricants. In such a case the TMC will issue an Information Letter. Subsequently, prior to each semi-annual Committee D-2 meeting, the accumulated Information Letters are balloted in Subcommittee D02.B. This ballot is reviewed at the Subcommittee D02.B meeting, and the actions taken are then considered by Committee D-2. In this way, the ASTM due process procedures are applied to the Information Letters.

A1.2.2 The review of an Information Letter prior to its original issue will differ in accordance with its nature. In the case of an Information Letter that does not affect test results, such as notification of a part number change, the TMC is authorized to issue an Information Letter. A survey or study conducted by the Surveillance Panel resulting in a recommendation for a change in hardware or procedure may result in the issuance of an Information Letter. If urgent changes to hardware or procedure are obviously necessary, the test sponsor and the TMC may issue an Information Letter and present it for approval, with the background and data, for approval by the Surveillance Panel prior to the next semiannual D-2 meeting.

A1.2.3 Authority for the issue of Information Letters was given by the Committee on Technical Committee Operations (COTCO) in 1984, as follows:

NOTE A1.1—"COTCO recognizes that D-2 has a unique and complex situation. The use of Information Letters is approved provided that each letter (at its initial issue) contains a disclaimer to the effect that it has not obtained ASTM consensus. These Information Letters should be moved to such consensus as rapidly as possible."

A1.3 *Test Monitoring Center Memoranda*—In addition to the Information Letter system, the TMC will provide information to the Surveillance Panel and to participating laboratories

in the form of ASTM TMC memoranda. These memoranda are used to convey such information as batch approvals for test parts or materials, to clarify misunderstandings concerning the test procedure, to provide notes and suggestions for the collection and analysis of special data for which the TMC may call for, or for any other matters having no direct effect on the test performance, results, or precision and bias.

A1.4 *Precision Data*—Test precision is established on the basis of reference oil (calibration) test results monitored by the ASTM TMC. Current data may be obtained from the TMC.

A2. FINAL REPORT FORMS

A2.1 The final report forms for reporting reference and non-reference oil test results are provided as Figs. A2.1-A2.8. Three sets of reference and non-reference forms (Form 1 through Form 6) are used for the three types of elastomer materials.

(OIL SEAL COMPATIBILITY TEST)
VERSION *19980122*
CONDUCTED FOR
TSTSPON1
TSTSPON2

LABVALID	V = VALID
	I = INVALID

Test Number	
Bath Number:(Flouroelastomer)	*BATHNUMF*
Bath Number:(Polyacrylate)	*BATHNUMP*
Bath Number:(Nitrile)	*BATHNUMN*

Date Completed:(Flouroelastomer)	*DTCOMPF*	EOT Time:	*EOTTIMEF*
Date Completed:(Polyacrylate)	*DTCOMPP*	EOT Time:	*EOTTIMEP*
Date Completed:(Nitrile)	*DTCOMPN*	EOT Time:	*EOTTIMEN*

Oil Code :(Flouroelastomer)	*OILCODE*	CMIR1:	*CMIR1*	CMIR2:	*CMIR2*
Oil Code:(Polyacrylate)	*OILCODE*	CMIR3:	*CMIR3*	CMIR4:	*CMIR4*
Oil Code:(Nitrile)	*OILCODE*	CMIR5:	*CMIR5*	CMIR6:	*CMIR6*

Alternate Codes:	*ALTCODE1*	*ALTCODE2*	*ALTCODE3*

In my opinion this test *OPVALID* been conducted in a manner in accordance with the Test Method D 5662 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

SUBMITTED BY:

SUBLAB
Testing Laboratory

SUBSIGIM
Signature

SUBNAME
Typed Name

SUBTITLE
Title

FIG. A2.1 Test Report Cover

(OIL SEAL COMPATIBILITY TEST)
FORM 1
REFERENCE OIL TEST RESULTS

LAB	TEST NO. (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP. °C
LAB	*BATHNUMF*	*DTSTRTF*	*DTCOMPF*	*EOTTIMEF*	*TESTLENF*	*CURBTMPF*

REFERENCE OIL No. 1

CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE FL = Fluoroelastomer
CMIR1	*RLABRF01*	*RINDRF01*	*RVISRF01*	*EBC_RFLR*	*DTEBRFLR*	*ETYPRFLR*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRF11*		*RSHCRF11*		*RVOLRF11*	
2	*RELCRF12*		*RSHCRF12*		*RVOLRF12*	
3	*RELCRF13*		*RSHCRF13*		*RVOLRF13*	
4	*RELCRF14*		*RSHCRF14*		*RVOLRF14*	
Overall Values	*RELCRF1V*	*RELSRF1S*	*RSHCRF1V*	*RSHSRF1S*	*RVOLRF1V*	*RVOSRF1S*

Initial Elastomer Properties

	From Laboratory														From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RFL1*	*ELS_RFL2*	*ELS_RFL3*	*ELS_RFL4*	*ELS_RFL5*	*ELS_RFL6*	*ELS_RFL7*	*ELS_RFL8*	*ELS_RFL9*	*ELS_RFLA*	*ELS_RFLB*	*ELS_RFLC*	*ELS_RFLX*	*ELSDRFLS*	*ELS_RFMF*
Hardness:	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*RHRDRF1*	*9 RHRDRF1A*	*RHRDRF1B*	*RHRDRF1C*	*RHRDRF1X*	*RHRSRF1S*	*RHRDRFMF*
Volume:	*RVLSRF11*	*RVLSRF12*	*RVLSRF13*	*RVLSRF14*	*RVLSRF15*	*RVLSRF16*	*RVLSRF17*	*RVLSRF18*	*RVLSRF19*	*RVLSRF1A*	*RVLSRF1B*	*RVLSRF1C*	*RVLSRF1X*	*RIVSRF1S*	*RVLSRFMF*

REFERENCE OIL No. 2

CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE FL = Fluoroelastomer
CMIR2	*RLABRF02*	*RINDRF02*	*RVISRF02*	*EBC_RFLR*	*DTEBRFLR*	*ETYPRFLR*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRF21*		*RSHCRF21*		*RVOLRF21*	
2	*RELCRF22*		*RSHCRF22*		*RVOLRF22*	
3	*RELCRF23*		*RSHCRF23*		*RVOLRF23*	
4	*RELCRF24*		*RSHCRF24*		*RVOLRF24*	
Overall Values	*RELCRF2V*	*RELSRF2S*	*RSHCRF2V*	*RSHSRF2S*	*RVOLRF2V*	*RVOSRF2S*

Initial Elastomer Properties

	From Laboratory														From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RFL1*	*ELS_RFL2*	*ELS_RFL3*	*ELS_RFL4*	*ELS_RFL5*	*ELS_RFL6*	*ELS_RFL7*	*ELS_RFL8*	*ELS_RFL9*	*ELS_RFLA*	*ELS_RFLB*	*ELS_RFLC*	*ELS_RFLX*	*ELSDRFLS*	*ELS_RFMF*
Hardness:	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*RHRDRF2*	*9 RHRDRF2A*	*RHRDRF2B*	*RHRDRF2C*	*RHRDRF2X*	*RHRSRF2S*	*RHRDRFMF*
Volume:	*RVLSRF21*	*RVLSRF22*	*RVLSRF23*	*RVLSRF24*	*RVLSRF25*	*RVLSRF26*	*RVLSRF27*	*RVLSRF28*	*RVLSRF29*	*RVLSRF2A*	*RVLSRF2B*	*RVLSRF2C*	*RVLSRF2X*	*RIVSRF2S*	*RVLSRFMF*

[A] Each Tube contains 3 coupons & 3 dumbbells
[B] Manufacturer reports specific gravity instead of volume

FIG. A2.2 Reference Oil Results - Fluoroelastomer

(OIL SEAL COMPATIBILITY TEST)
FORM #2
NON-REFERENCE OIL TEST RESULTS

LAB	TEST NUMBER (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP. C °
LAB	*BATHNUMF*	*DTSTRTF*	*DTCOMPF*	*EOTTIMEF*	*TESTLENF*	*CURBTMPF*

NON-REFERENCE OIL TEST				
OIL CODE : *OILCODE*				
LABORATORY OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE FL = Fluoroelastomer
LAB_RFLR	*VIS_RFLR*	*EBC_RFLR*	*DTEBRFLR*	*ETYPRFLR*

	% Elongation Change		Shore A Hardness Change		% Volume Change	
Tube Number [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*ELCHRF01*		*SAHCRF01*		*VOLCRF01*	
2	*ELCHRF02*		*SAHCRF02*		*VOLCRF02*	
3	*ELCHRF03*		*SAHCRF03*		*VOLCRF03*	
4	*ELCHRF04*		*SAHCRF04*		*VOLCRF04*	
Overall Values	*ELCHRFOV*	*ELCSRFSD*	*SAHCRFOV*	*SAHSRFSD*	*VOLCRFOV*	*VLSDRFSD*

Initial Elastomer Properties From Laboratory:														
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV
% Elongation:	*ELS_RFL1*	*ELS_RFL2*	*ELS_RFL3*	*ELS_RFL4*	*ELS_RFL5*	*ELS_RFL6*	*ELS_RFL7*	*ELS_RFL8*	*ELS_RFL9*	*ELS_RFLA*	*ELS_RFLB*	*ELS_RFLC*	*ELS_RFLX*	*ELSDRFLS*
Hardness:	*HRDSRF01*	*HRDSRF02*	*HRDSRF03*	*HRDSRF04*	*HRDSRF05*	*HRDSRF06*	*HRDSRF07*	*HRDSRF08*	*HRDSRF09*	*HRDSRF10*	*HRDSRF11*	*HRDSRF12*	*HRDSRFAV*	*HRSDRFSD*
Volume:	*VOLSRF01*	*VOLSRF02*	*VOLSRF03*	*VOLSRF04*	*VOLSRF05*	*VOLSRF06*	*VOLSRF07*	*VOLSRF08*	*VOLSRF09*	*VOLSRF10*	*VOLSRF11*	*VOLSRF12*	*VOLSRFAV*	*VOSDRFSD*

[A] **Each Tube contains 3 coupons & 3 dumbbells**

FIG. A2.3 Non-reference Oil Test Results - Fluoroelastomer

(OIL SEAL COMPATIBILITY TEST)
FORM #3
REFERENCE OIL TEST RESULTS

LAB	TEST NO. (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP.°C
LAB	*BATHNUMP*	*DTSTRTP*	*DTCOMPP*	*EOTTIMEP*	*TESTLENP*	*CURBTMPP*

REFERENCE OIL No. 3						
CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE PA = Polyacrylate
CMIR3	*RLABRP01*	*RINDRP01*	*RVISRP01*	*EBC_RPLY*	*DTEBRPLY*	*ETYPRPLY*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRP11*		*RSHCRP11*		*RVOLRP11*	
2	*RELCRP12*		*RSHCRP12*		*RVOLRP12*	
3	*RELCRP13*		*RSHCRP13*		*RVOLRP13*	
4	*RELCRP14*		*RSHCRP14*		*RVOLRP14*	
Overall Values	*RELCRP1V*	*RELSRP1S*	*RSHCRP1V*	*RSHSRP1S*	*RVOLRP1V*	*RVOSRP1S*

Initial Elastomer Properties

From Laboratory															From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RPL1*	*ELS_RPL2*	*ELS_RPL3*	*ELS_RPL4*	*ELS_RPL5*	*ELS_RPL6*	*ELS_RPL7*	*ELS_RPL8*	*ELS_RPL9*	*ELS_RPLA*	*ELS_RPLB*	*ELS_RPLC*	*ELS_RPLX*	*ELSDRPLS*	*ELS_RPMF*
Hardness:	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1*	*RHRDRP1A*	*RHRDRP1B*	*RHRDRP1C*	*RHRDRP1X*	*RHRSRP1S*	*RHRDRPMF*
Volume:	*RVLSRP11*	*RVLSRP12*	*RVLSRP13*	*RVLSRP14*	*RVLSRP15*	*RVLSRP16*	*RVLSRP17*	*RVLSRP18*	*RVLSRP19*	*RVLSRP1A*	*RVLSRP1B*	*RVLSRP1C*	*RVLSRP1X*	*RIVSRP1S*	*RVLSRPMF*

REFERENCE OIL No. 4						
CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE PA = Polyacrylate
CMIR4	*RLABRP02*	*RINDRP02*	*RVISRP02*	*EBC_RPLY*	*DTEBRPLY*	*ETYPRPLY*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRP21*		*RSHCRP21*		*RVOLRP21*	
2	*RELCRP22*		*RSHCRP22*		*RVOLRP22*	
3	*RELCRP23*		*RSHCRP23*		*RVOLRP23*	
4	*RELCRP24*		*RSHCRP24*		*RVOLRP24*	
Overall Values	*RELCRP2V*	*RELSRP2S*	*RSHCRP2V*	*RSHSRP2S*	*RVOLRP2V*	*RVOSRP2S*

Initial Elastomer Properties

From Laboratory															From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RPL1*	*ELS_RPL2*	*ELS_RPL3*	*ELS_RPL4*	*ELS_RPL5*	*ELS_RPL6*	*ELS_RPL7*	*ELS_RPL8*	*ELS_RPL9*	*ELS_RPLA*	*ELS_RPLB*	*ELS_RPLC*	*ELS_RPLX*	*ELSDRPLS*	*ELS_RPMF*
Hardness:	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2*	*RHRDRP2A*	*RHRDRP2B*	*RHRDRP2C*	*RHRDRP2X*	*RHRSRP2S*	*RHRDRPMF*
Volume:	*RVLSRP21*	*RVLSRP22*	*RVLSRP23*	*RVLSRP24*	*RVLSRP25*	*RVLSRP26*	*RVLSRP27*	*RVLSRP28*	*RVLSRP29*	*RVLSRP2A*	*RVLSRP2B*	*RVLSRP2C*	*RVLSRP2X*	*RIVSRP2S*	*RVLSRPMF*

[A] Each Tube contains 3 coupons & 3 dumbbells

[B] Manufacturer reports specific gravity instead of volume

FIG. A2.4 Reference Oil Test Results - Polyacrylate

(OIL SEAL COMPATIBILITY TEST)
FORM #4
NON-REFERENCE OIL TEST RESULTS

LAB	TEST NO. (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP. C °
LAB	BATHNUMP	DTSTRTP	DTCOMPP	EOTTIMEP	TESTLENP	CURBTMPP

NON-REFERENCE OIL TEST				
OIL CODE : OILCODE				
LABORATORY OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE PA = Polyacrylate
LAB_RPLY	VIS_RPLY	EBC_RPLY	DTEBRPLY	ETYPRPLY

	% Elongation Change		Shore A Hardness Change		% Volume Change	
Tube Number [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	ELCHRP01		SAHCRP01		VOLCRP01	
2	ELCHRP02		SAHCRP02		VOLCRP02	
3	ELCHRP03		SAHCRP03		VOLCRP03	
4	ELCHRP04		SAHCRP04		VOLCRP04	
Overall Values	ELCHRPOV	ELCSRPSD	SAHCRPOV	SAHSRPSD	VOLCRPOV	VLSDRPSD

Initial Elastomer Properties From Laboratory:														
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV
% Elongation:	ELS_RPL1	ELS_RPL2	ELS_RPL3	ELS_RPL4	ELS_RPL5	ELS_RPL6	ELS_RPL7	ELS_RPL8	ELS_RPL9	ELS_RPLA	ELS_RPLB	ELS_RPLC	ELS_RPLX	ELSDRPLS
Hardness:	HRDSRP01	HRDSRP02	HRDSRP03	HRDSRP04	HRDSRP05	HRDSRP06	HRDSRP07	HRDSRP08	HRDSRP09	HRDSRP10	HRDSRP11	HRDSRP12	HRDSRPAV	HRSDRPSD
Volume:	VOLSRP01	VOLSRP02	VOLSRP03	VOLSRP04	VOLSRP05	VOLSRP06	VOLSRP07	VOLSRP08	VOLSRP09	VOLSRP10	VOLSRP11	VOLSRP12	VOLSRPAV	VOSDRPSD

[A] Each Tube contains 3 coupons & 3 dumbbells

FIG. A2.5 Non-reference Oil Test Results - Polyacrylate

(OIL SEAL COMPATIBILITY TEST)
FORM #5
REFERENCE OIL TEST RESULTS

LAB	TEST NO. (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP.°C
LAB	*BATHNUMN*	*DTSTRTN*	*DTCOMPN*	*EOTTIMEN*	*TESTLENN*	*CURBTMPN*

REFERENCE OIL No. 5

CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE NI = Nitrile
CMIR5	*RLABRN01*	*RINDRN01*	*RVISRN01*	*EBC_RNIT*	*DTEBRNIT*	*ETYPRNIT*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRN11*		*RSHCRN11*		*RVOLRN11*	
2	*RELCRN12*		*RSHCRN12*		*RVOLRN12*	
3	*RELCRN13*		*RSHCRN13*		*RVOLRN13*	
4	*RELCRN14*		*RSHCRN14*		*RVOLRN14*	
Overall Values	*RELCRN1V*	*RELSRN1S*	*RSHCRN1V*	*RSHSRN1S*	*RVOLRN1V*	*RVOSRN1S*

Initial Elastomer Properties

	From Laboratory														From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RNT1*	*ELS_RNT2*	*ELS_RNT3*	*ELS_RNT4*	*ELS_RNT5*	*ELS_RNT6*	*ELS_RNT7*	*ELS_RNT8*	*ELS_RNT9*	*ELS_RNTA*	*ELS_RNTB*	*ELS_RNTC*	*ELS_RNTX*	*ELSDRNTS*	*ELS_RNIM*
Hardness:	*RHRDRN11*	*RHRDRN12*	*RHRDRN13*	*RHRDRN14*	*RHRDRN15*	*RHRDRN16*	*RHRDRN17*	*RHRDRN18*	*RHRDRN19*	*RHRDRN1A*	*RHRDRN1B*	*RHRDRN1C*	*RHRDRN1X*	*RHRSRN1S*	*RHRDRNIM*
Volume:	*RVLSRN11*	*RVLSRN12*	*RVLSRN13*	*RVLSRN14*	*RVLSRN15*	*RVLSRN16*	*RVLSRN17*	*RVLSRN18*	*RVLSRN19*	*RVLSRN1A*	*RVLSRN1B*	*RVLSRN1C*	*RVLSRN1X*	*RIVSRN1S*	*RVLSRNIM*

REFERENCE OIL No. 6

CMIR	LABORATORY OIL CODE	TMC OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE NI = Nitrile
CMIR6	*RLABRN02*	*RINDRN02*	*RVISRN02*	*EBC_RNIT*	*DTEBRNIT*	*ETYPRNIT*

	% Elongation Change		Shore A Hardness Change Points		% Volume Change	
Tube No. [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*RELCRN21*		*RSHCRN21*		*RVOLRN21*	
2	*RELCRN22*		*RSHCRN22*		*RVOLRN22*	
3	*RELCRN23*		*RSHCRN23*		*RVOLRN23*	
4	*RELCRN24*		*RSHCRN24*		*RVOLRN24*	
Overall Values	*RELCRN2V*	*RELSRN2S*	*RSHCRN2V*	*RSHSRN2S*	*RVOLRN2V*	*RVOSRN2S*

Initial Elastomer Properties

	From Laboratory														From [B] Manufact.
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV	
% Elongation:	*ELS_RNT1*	*ELS_RNT2*	*ELS_RNT3*	*ELS_RNT4*	*ELS_RNT5*	*ELS_RNT6*	*ELS_RNT7*	*ELS_RNT8*	*ELS_RNT9*	*ELS_RNTA*	*ELS_RNTB*	*ELS_RNTC*	*ELS_RNTX*	*ELSDRNTS*	*ELS_RNIM*
Hardness:	*RHRDRN21*	*RHRDRN22*	*RHRDRN23*	*RHRDRN24*	*RHRDRN25*	*RHRDRN26*	*RHRDRN27*	*RHRDRN28*	*RHRDRN29*	*RHRDRN2A*	*RHRDRN2B*	*RHRDRN2C*	*RHRDRN2X*	*RHRSRN2S*	*RHRDRNIM*
Volume:	*RVLSRN21*	*RVLSRN22*	*RVLSRN23*	*RVLSRN24*	*RVLSRN25*	*RVLSRN26*	*RVLSRN27*	*RVLSRN28*	*RVLSRN29*	*RVLSRN2A*	*RVLSRN2B*	*RVLSRN2C*	*RVLSRN2X*	*RIVSRN2S*	*RVLSRNIM*

[A] Each Tube contains 3 coupons & 3 dumbbells

[B] Manufacturer reports specific gravity instead of volume

FIG. A2.6 Reference Oil Test Results - Nitrile

(OIL SEAL COMPATIBILITY TEST)
FORM #6
NON-REFERENCE OIL TEST RESULTS

LAB	TEST NO. (BATH #)	START DATE	DATE COMPLETED	END OF TEST TIME	TEST LENGTH	TEST TEMP. C °
LAB	*BATHNUMN*	*DTSTRTN*	*DTCOMPN*	*EOTTIMEN*	*TESTLENN*	*CURBTMPN*

NON-REFERENCE OIL TEST				
OIL CODE : *OILCODE*				
LABORATORY OIL CODE	VISCOSITY GRADE	ELASTOMER BATCH CODE	ELASTOMER BATCH DATE	ELASTOMER TYPE NI = Nitrile
LAB_RNIT	*VIS_RNIT*	*EBC_RNIT*	*DTEBRNIT*	*ETYPRNIT*

	% Elongation Change		Shore A Hardness Change		% Volume Change	
Tube Number [A]	AVG	STD DEV	AVG	STD DEV	AVG	STD DEV
1	*ELCHRN01*		*SAHCRN01*		*VOLCRN01*	
2	*ELCHRN02*		*SAHCRN02*		*VOLCRN02*	
3	*ELCHRN03*		*SAHCRN03*		*VOLCRN03*	
4	*ELCHRN04*		*SAHCRN04*		*VOLCRN04*	
Overall Values	*ELCHRNOV*	*ELCSRNSD*	*SAHCRNOV*	*SAHSRNSD*	*VOLCRNOV*	*VLSDRNSD*

Initial Elastomer Properties From Laboratory:														
Specimen	1	2	3	4	5	6	7	8	9	10	11	12	AVG	STD DEV
% Elongation:	*ELS_RNT1*	*ELS_RNT2*	*ELS_RNT3*	*ELS_RNT4*	*ELS_RNT5*	*ELS_RNT6*	*ELS_RNT7*	*ELS_RNT8*	*ELS_RNT9*	*ELS_RNTA*	*ELS_RNTB*	*ELS_RNTC*	*ELS_RNTX*	*ELSDRNTS*
Hardness:	*HRDSRN01*	*HRDSRN02*	*HRDSRN03*	*HRDSRN04*	*HRDSRN05*	*HRDSRN06*	*HRDSRN07*	*HRDSRN08*	*HRDSRN09*	*HRDSRN10*	*HRDSRN11*	*HRDSRN12*	*HRDSRNAV*	*HRSDRNSD*
Volume:	*VOLSRN01*	*VOLSRN02*	*VOLSRN03*	*VOLSRN04*	*VOLSRN05*	*VOLSRN06*	*VOLSRN07*	*VOLSRN08*	*VOLSRN09*	*VOLSRN10*	*VOLSRN11*	*VOLSRN12*	*VOLSRNAV*	*VOSDRNSD*

[A] **Each Tube contains 3 coupons & 3 dumbbells**

FIG. A2.7 Non-reference Oil Test Results - Nitrile

(OIL SEAL COMPATIBILITY TEST)
FORM 7
COMMENTS

LAB	*LAB*					
Bath Number: (Flouroelastomer)	*BATHNUMF*	OILCODE:	*OILCODE*	CMIR1: *CMIR1*	CMIR2:	*CMIR2*
Bath Number: (Polyacrylate)	*BATHNUMP*	OILCODE:	*OILCODE*	CMIR3: *CMIR3*	CMIR4:	*CMIR4*
Bath Number: (Nitrile)	*BATHNUMN*	OILCODE:	*OILCODE*	CMIR5: *CMIR5*	CMIR6:	*CMIR6*

OUT-OF-LIMIT DATA AND TIME, TEST MODIFICATIONS AND COMMENTS

Number of Comment Lines	*TOTCOM*	
OCOMH001		

FIG. A2.8 Comments

A3. DATA DICTIONARY

A3.1 The data dictionary is given in Figs. A3.1-A3.5.

26-jan-1998

Data Dictionary

Sequence	Form	Test Area	Field Name	Field Length	Decimal Size	Data Type	Units/Format	Description
10	0	OSCT	VERSION	8	0	C	YYYYMMDD	OSCT VERSION 19980122
20	0	OSCT	TSTSPON1	40	0	C		CONDUCTED FOR, FIRST LINE
30	0	OSCT	TSTSPON2	40	0	C		CONDUCTED FOR, SECOND LINE
40	0	OSCT	LABVALID	1	0	C	V OR I	TEST LAB VALIDATION (V OR I)
50	0	OSCT	BATHNUMF	6	0	C		BATH NUMBER, FLOUROELASTOMER
60	0	OSCT	BATHNUMP	6	0	C		BATH NUMBER, POLYACRYLATE
70	0	OSCT	BATHNUMN	6	0	C		BATH NUMBER, NITRILE
80	0	OSCT	DTCOMPF	8	0	C	YYYYMMDD	COMPLETED DATE, FLOUROELASTOMER (YYYYMMDD)
90	0	OSCT	DTCOMPP	8	0	C	YYYYMMDD	COMPLETED DATE, POLYACRYLATE (YYYYMMDD)
100	0	OSCT	DTCOMPN	8	0	C	YYYYMMDD	COMPLETED DATE, NITRILE (YYYYMMDD)
110	0	OSCT	EOTTIMEF	5	0	C	HH:MM	END OF TEST TIME, FLOUROELASTOMER (HH:MM)
120	0	OSCT	EOTTIMEP	5	0	C	HH:MM	END OF TEST TIME, POLYACRYLATE (HH:MM)
130	0	OSCT	EOTTIMEN	5	0	C	HH:MM	END OF TEST TIME, NITRILE (HH:MM)
140	0	OSCT	CMIR1	6	0	C		CMIR 1
150	0	OSCT	CMIR2	6	0	C		CMIR 2
160	0	OSCT	OILCODE	38	0	C		NON-REFERENCE OIL CODE
170	0	OSCT	CMIR3	6	0	C		CMIR 3
180	0	OSCT	CMIR4	6	0	C		CMIR 4
190	0	OSCT	CMIR5	6	0	C		CMIR 5
200	0	OSCT	CMIR6	6	0	C		CMIR 6
210	0	OSCT	ALTCODE1	10	0	C		ALTERNATE CODE 1
220	0	OSCT	ALTCODE2	10	0	C		ALTERNATE CODE 1
230	0	OSCT	ALTCODE3	10	0	C		ALTERNATE CODE 1
240	0	OSCT	OPVALID	8	0	C		OPERATIONAL VALIDITY -- HAS/HAS NOT
250	0	OSCT	SUBLAB	40	0	C		SUBMITTED BY: TESTING LABORATORY
260	0	OSCT	SUBSIGIM	70	0	C		SUBMITTED BY: SIGNATURE IMAGE
270	0	OSCT	SUBNAME	40	0	C		SUBMITTED BY: SIGNATURE TYPED NAME
280	0	OSCT	SUBTITLE	40	0	C		SUBMITTED BY: TITLE
290	1	OSCT	LAB	2	0	C		LAB CODE
300	1	OSCT	DTSTRTF	8	0	C	YYYYMMDD	STARTING DATE, FLUOROELASTOMER (YYYYMMDD)
310	1	OSCT	TESTLENF	3	0	N	HHH	TEST LENGTH, FLUOROELASTOMER (HHH)
320	1	OSCT	CURBTMPF	5	0	N	øC	CURING BATH TEMPERATURE, FLUOROELASTOMER (øC)
330	1	OSCT	RLABRxxx	12	0	C		REFERENCE LABORATORY INTERNAL OIL CODE
340	1	OSCT	RINDRxxx	6	0	C		REFERENCE TMC OIL CODE
350	1	OSCT	RVISRxxx	7	0	C		REFERENCE SAE VISCOSITY GRADE
360	1	OSCT	EBC_Rxxx	5	0	C	nnnnn	ELASTOMER BATCH CODE (nnnnn)
370	1	OSCT	DTEBRxxx	8	0	C	YYYYMMDD	ELASTOMER BATCH DATE (YYYYMMDD)
380	1	OSCT	ETYPRxxx	2	0	C		ELASTOMER TYPE; FL, PA, OR NI.
390	1	OSCT	RELCRxxx	5	1	N	%	REFERENCE ELONGATION CHANGE (%)
400	1	OSCT	RELSRxxx	6	2	N	PERCENT	REFERENCE ELONGATION CHANGE STD. DEV. (PERCENT)
410	1	OSCT	RSHCRxxx	5	0	N		REFERENCE SHORE A HARDNESS CHANGE
420	1	OSCT	RSHSRxxx	6	2	N		REFERENCE SHORE A HARDNESS CHANGE STD. DEV.
430	1	OSCT	RVOLRxxx	6	2	N	%	REFERENCE PERCENT VOLUME CHANGE (%)
440	1	OSCT	RVOSRxxx	6	2	N	%	REFERENCE PERCENT VOLUME CHANGE STD. DEV. (%)
450	1	OSCT	ELS_Rxxx	4	0	N	%	INITIAL ELASTOMER PROPERTIES-ELONGATION (%)
460	1	OSCT	ELSDRxxx	6	2	N	%	INITIAL ELASTOMER PROPERTIES-ELONGATION STD. DEV. (%)
470	1	OSCT	RHRDRxxx	3	0	N		REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS
480	1	OSCT	RHRSRxxx	6	2	N		REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS STD. DEV.
490	1	OSCT	RVLSRxxx	6	3	N	%	REFERENCE INITIAL ELASTOMER PROPERTIES-VOLUME (%)
500	1	OSCT	RIVSRxxx	6	2	N	%	REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
510	2	OSCT	LAB_Rxxx	12	0	C		NON-REFERENCE LABORATORY INTERNAL OIL CODE
520	2	OSCT	VIS_Rxxx	7	0	C		NON-REFERENCE SAE VISCOSITY GRADE
530	2	OSCT	ELCHRxxx	5	1	N	%	NON-REFERENCE ELONGATION CHANGE (%)

FIG. A3.1 Data Dictionary

26-jan-1998 Report: ASTM Data Dictionary

Sequence	Form	Test Area	Field Name	Field Length	Decimal Size	Data Type	Units/Format	Description
540	2	OSCT	ELCSRxxx	6	2	N	%	NON-REFERENCE ELONGATION CHANGE STD. DEV. (%)
550	2	OSCT	SAHCRxxx	5	0	N		NON-REFERENCE SHORE A HARDNESS CHANGE
560	2	OSCT	SAHSRxxx	6	2	N		NON-REFERENCE SHORE A HARDNESS CHANGE STD. DEV.
570	2	OSCT	VOLCRxxx	6	2	N	%	NON-REFERENCE PERCENT VOLUME CHANGE (%)
580	2	OSCT	VLSDRxxx	6	2	N	%	NON-REFERENCE PERCENT VOLUME CHANGE STD. DEV. (%)
590	2	OSCT	HRDSRxxx	3	0	N		NON-REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS
600	2	OSCT	HRSDRxxx	6	2	N		NON-REFERENCE INITIAL ELASTOMER PROP. - HARDNESS STD. DEV.
610	2	OSCT	VOLSRxxx	6	3	N	%	NON-REFERENCE INITIAL ELASTOMER PROPERTIES-VOLUME (%)
620	2	OSCT	VOSDRxxx	6	2	N	%	NON-REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
630	3	OSCT	DTSTRTP	8	0	C	YYYYMMDD	STARTING DATE , POLYACRYLATE (YYYYMMDD)
640	3	OSCT	TESTLENP	3	0	N	HHH	TEST LENGTH, POLYACRYLATE (HHH)
650	3	OSCT	CURBTMPP	5	0	N	øC	CURING BATH TEMPERATURE, POLYACRYLATE (øC)
660	5	OSCT	DTSTRTN	8	0	C	YYYYMMDD	STARTING DATE , NITRILE (YYYYMMDD)
670	5	OSCT	TESTLENN	3	0	N	HHH	TEST LENGTH, NITRILE (HHH)
680	5	OSCT	CURBTMPN	5	0	N	øC	CURING BATH TEMPERATURE, NITRILE (øC)
690	7	OSCT	TOTCOM	2	0	Z		TOTAL LINES OF COMMENTS & OUTLIERS
700	7	OSCT	OCOMHxxx	70	0	C		OTHER DOWNTIME COMMENT XXX

FIG. A3.2 Data Dictionary

```
#########################################################################
#                                                                       #
#           D a t a  D i c t i o n a r y  R e p e a t i n g             #
#              F i e l d  S p e c i f i c a t i o n s                    #
#                                                                       #
#########################################################################
# The following contains specifications and field groupings for fields in the
# Data Dictionary that are REPEATING Fields.  These fields can be identified
# in the Data Dictionary by the Hxxx or Rxxx in the last four positions of the
# field name.
#
# Repeating fields are used to specify repeating measurements.
#
# The format for a repeating field name is 4 descriptive characters followed
# by the letter H or R followed by 3 characters for the actual interval
# the measurement was taken. The field will always be a total of 8 characters.
#
# Example ABCDHxxx.
#
# The following is the format of this specification:
#
# Column 1 - 8:   Repeating Field Name
# Column 10 - 17: The Parent Field Name of the Group
# Column 19 - 80: Comments about the Repeating Field Group.
#
# The lines following the Repeating Field Name Record will contain the required
# measurements for the particular field.  Multiple 80 characters lines
# can be specified.  A blank line marks the end of each specification.
#
# The Field Name in Column 10-17 designates the the Group in which the field
# belongs.  The First field name in a group is the Parent of the grouping
# and can be used to determine how fields should be grouped.
# The changing of the Parent Field marks the end of a repeating group
# specification.
#
# Example:
#
# VIS_Hxxx, DVISHxxx and PVISHxxx expanded for transmission (8 and 16 hours):
#
#           VIS_H008
#           DVISH008
#           PVISH008
#           VIS_H016
#           DVISH016
#           PVISH016
#
# Note:  During electronic transmission, repeating field groups must be kept
#        together within the specified group but the order within the group
#        does not have to be maintained.
#
#########################################################################
#                 Start of Field Grouping Specifications                #
#########################################################################
#
OSCT VERSION 19980122
RLABRxxx RLABRxxx   REFERENCE LABORATORY INTERNAL OIL CODE
F01 F02 N01 N02 P01 P02

RINDRxxx RLABRxxx   REFERENCE TMC OIL CODE
F01 F02 N01 N02 P01 P02
```

FIG. A3.3 Data Dictionary Repeating Field Specifications

```
RVISRxxx RLABRxxx   REFERENCE SAE VISCOSITY GRADE
F01 F02 N01 N02 P01 P02

EBC_Rxxx RLABRxxx   ELASTOMER BATCH CODE (nnnnn)
FLR NIT PLY

DTEBRxxx RLABRxxx   ELASTOMER BATCH DATE (YYYYMMDD)
FLR NIT PLY

ETYPRxxx RLABRxxx   ELASTOMER TYPE; FL, PA, OR NI.
FLR NIT PLY

RELCRxxx RELCRxxx   REFERENCE ELONGATION CHANGE (%)
F11 F12 F13 F14 F1V F21 F22 F23 F24 F2V N11 N12 N13 N14 N1V N21 N22 N23
N24 N2V P11 P12 P13 P14 P1V P21 P22 P23 P24 P2V

RELSRxxx RELSRxxx   REFERENCE ELONGATION CHANGE STD. DEV. (PERCENT)
F1S F2S N1S N2S P1S P2S

RSHCRxxx RELCRxxx   REFERENCE SHORE A HARDNESS CHANGE
F11 F12 F13 F14 F1V F21 F22 F23 F24 F2V N11 N12 N13 N14 N1V N21 N22 N23
N24 N2V P11 P12 P13 P14 P1V P21 P22 P23 P24 P2V

RSHSRxxx RELSRxxx   REFERENCE SHORE A HARDNESS CHANGE STD. DEV.
F1S F2S N1S N2S P1S P2S

RVOLRxxx RELCRxxx   REFERENCE PERCENT VOLUME CHANGE (%)
F11 F12 F13 F14 F1V F21 F22 F23 F24 F2V N11 N12 N13 N14 N1V N21 N22 N23
N24 N2V P11 P12 P13 P14 P1V P21 P22 P23 P24 P2V

RVOSRxxx RELSRxxx   REFERENCE PERCENT VOLUME CHANGE STD. DEV. (%)
F1S F2S N1S N2S P1S P2S

ELS_Rxxx ELS_Rxxx   INITIAL ELASTOMER PROPERTIES-ELONGATION (%)
FL1 FL2 FL3 FL4 FL5 FL6 FL7 FL8 FL9 FLA FLB FLC FLX FMF NIM NT1 NT2 NT3
NT4 NT5 NT6 NT7 NT8 NT9 NTA NTB NTC NTX PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8
PL9 PLA PLB PLC PLX PMF

ELSDRxxx ELSDRxxx   INITIAL ELASTOMER PROPERTIES-ELONGATION STD. DEV. (%)
FLS NTS PLS

RHRDRxxx ELS_Rxxx   REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS
F11 F12 F13 F14 F15 F16 F17 F18 F19 F1A F1B F1C F1X F21 F22 F23 F24 F25
F26 F27 F28 F29 F2A F2B F2C F2X FMF N11 N12 N13 N14 N15 N16 N17 N18 N19
N1A N1B N1C N1X N21 N22 N23 N24 N25 N26 N27 N28 N29 N2A N2B N2C N2X NIM
P11 P12 P13 P14 P15 P16 P17 P18 P19 P1A P1B P1C P1X P21 P22 P23 P24 P25
P26 P27 P28 P29 P2A P2B P2C P2X PMF

RHRSRxxx RHRSRxxx   REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS STD. DEV.
F1S F2S N1S N2S P1S P2S

RVLSRxxx ELS_Rxxx   REFERENCE INITIAL ELASTOMER PROPERTIES-VOLUME (%)
F11 F12 F13 F14 F15 F16 F17 F18 F19 F1A F1B F1C F1X F21 F22 F23 F24 F25
F26 F27 F28 F29 F2A F2B F2C F2X FMF N11 N12 N13 N14 N15 N16 N17 N18 N19
N1A N1B N1C N1X N21 N22 N23 N24 N25 N26 N27 N28 N29 N2A N2B N2C N2X NIM
P11 P12 P13 P14 P15 P16 P17 P18 P19 P1A P1B P1C P1X P21 P22 P23 P24 P25
P26 P27 P28 P29 P2A P2B P2C P2X PMF

RIVSRxxx EHRSRxxx   REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
```

FIG. A3.4 Data Dictionary Repeating Field Specifications

```
F2S

RIVSRxxx RHRSRxxx   REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
F1S N1S N2S P1S P2S

LAB_Rxxx LAB_Rxxx   NON-REFERENCE LABORATORY INTERNAL OIL CODE
FLR NIT PLY

VIS_Rxxx VIS_Rxxx   NON-REFERENCE SAE VISCOSITY GRADE
FLR NIT PLY

ELCHRxxx ELCHRxxx   NON-REFERENCE ELONGATION CHANGE (%)
F01 F02 F03 F04 FOV N01 N02 N03 N04 NOV P01 P02 P03 P04 POV

ELCSRxxx ELCSRxxx   NON-REFERENCE ELONGATION CHANGE STD. DEV. (%)
FSD NSD PSD

SAHCRxxx ELCHRxxx   NON-REFERENCE SHORE A HARDNESS CHANGE
F01 F02 F03 F04 FOV N01 N02 N03 N04 NOV P01 P02 P03 P04 POV

SAHSRxxx ELCSRxxx   NON-REFERENCE SHORE A HARDNESS CHANGE STD. DEV.
FSD NSD PSD

VOLCRxxx ELCHRxxx   NON-REFERENCE PERCENT VOLUME CHANGE (%)
F01 F02 F03 F04 FOV N01 N02 N03 N04 NOV P01 P02 P03 P04 POV

VLSDRxxx ELCSRxxx   NON-REFERENCE PERCENT VOLUME CHANGE STD. DEV. (%)
FSD NSD PSD

HRDSRxxx ELS_Rxxx   NON-REFERENCE INITIAL ELASTOMER PROPERTIES - HARDNESS
F01 F02 F03 F04 F05 F06 F07 F08 F09 F10 F11 F12 FAV N01 N02 N03 N04 N05
N06 N07 N08 N09 N10 N11 N12 NAV P01 P02 P03 P04 P05 P06 P07 P08 P09 P10
P11 P12 PAV

HRSDRxxx ELSDRxxx   NON-REFERENCE INITIAL ELASTOMER PROP. - HARDNESS STD. DEV.
PSD

HRSDRxxx HRSDRxxx   NON-REFERENCE INITIAL ELASTOMER PROP. - HARDNESS STD. DEV.
FSD NSD

VOLSRxxx ELS_Rxxx   NON-REFERENCE INITIAL ELASTOMER PROPERTIES-VOLUME (%)
F01 F02 F03 F04 F05 F06 F07 F08 F09 F10 F11 F12 FAV N01 N02 N03 N04 N05
N06 N07 N08 N09 N10 N11 N12 NAV P01 P02 P03 P04 P05 P06 P07 P08 P09 P10
P11 P12 PAV

VOSDRxxx ELSDRxxx   NON-REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
PSD

VOSDRxxx HRSDRxxx   NON-REFERENCE INITIAL ELASTOMER PROP.-VOLUME STD. DEV. (%)
FSD NSD

OCOMHxxx OCOMHxxx   OTHER DOWNTIME COMMENT XXX
```

FIG. A3.5 Data Dictionary Repeating Field Specifications