



## Test Monitoring Center

4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213

(412) 268-3315

June 21, 1991

### SEQUENCE IID AND IIIIE INFORMATION LETTER 60

To: Sequence IID and IIIIE Mailing List

Subjects: Sequence IID and IIIIE Parts Procurement and Usage  
Sequence IIIIE ORLD Reporting Limits

This Information Letter implements action items approved during the joint meeting of the Sequence IID and IIIIE Surveillance Panels held in St. Louis, Missouri on May 8 and 9, 1991. This Information Letter addresses specific procedures pertaining to quality, consistency, availability and accountability of all test parts as part of the ongoing effort by the panels to ensure continual process improvement of the Sequence IID and IIIIE tests (i.e., improved precision/consistent severity).

#### Sequence Test Parts Procurement, Classification, and Usage Guidelines

Based on the equipment supplier guidelines, approved by the Sequence IID and IIIIE Surveillance Panels, the Surveillance Panels recommended to the Test Developer the continued relationship with Bowden Manufacturing, including the newly defined responsibilities as Central Parts Distributor.

Based on input from the Batch Concept/Quality Task Force Group, all Sequence test parts have been categorized into one of the following categories.

#### Parts Classifications:

- 1) **Critical Parts:** (parts known to affect test severity). These parts will be identified with a serial number or a batch lot control number as supplied by the Central Parts Distributor.
- 2) **Non-Production Parts:** Parts no longer available except through the Central Parts Distributor or by special order through the Test Developer.
- 3) **Service Parts Operations (SPO):** Those remaining parts available through local GM Dealer networks.

Shown as Attachment 1 is a list of the Sequence IID and IIIIE parts according to the above categories.

Parts Procurement and Usage Guidelines:

The following table and text summarizes procedural requirements for parts procurement, usage and accountability as applied to the Sequence IID and IIIE tests.

Parts usage guidelines

	First in First out	Order Qty.	In-House Inventory	Use / Rej. Required	Report Entry
Critical Parts	Yes	60 Days	6 Month	Yes	Ser.#
Non-Prod. Parts	Yes	N/A	6 Month	N/A	N/A
SPO Parts	Yes	N/A	6 Month	N/A	Some

- 1) All parts are to be used on a first-in first-out (FIFO) basis at all laboratories.
- 2) By direction of the Surveillance Panels, the Central Parts Distributor is required to maintain a minimum six-month Industry Inventory of critical parts and must rotate this inventory according to the FIFO process. Therefore, the maximum order quantity of critical parts will be limited to a sixty-day (two month) supply for any given laboratory. Order quantities for non-production and SPO parts are also encouraged to be as small as practical to ensure a more timely inventory turnover.
- 3) The maximum inventory permitted at the laboratories for all parts is a six-month supply and lower inventories are encouraged to, once again, ensure a more timely inventory turnover.
- 4) All critical parts are to be identified by serial number or by batch lot control numbers.
- 5) All parts are to be used as received unless specific modifications are specified in the test procedures.
- 6) All critical parts shipped from the Central Distributor will be accompanied by a parts accountability form, Attachment 2. If any parts are rejected at the laboratory level, the reason for rejection must be stated in the appropriate column of the form and a copy immediately faxed to the TMC, Test Developer and the Central Parts Distributor. All rejected parts must be saved for return shipment to the Central Parts Distributor semi-annually on April 15, and October 15, or earlier as directed by the Test Developer.

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- 7) SPO qualified parts lists are to be updated quarterly via the information letter process. Any part number deviations from this list are not allowed except for depletion of NOS (new old stock), which must then be recorded in the supplementary test notes as a deviation in hardware usage.


The effective date for implementation of this program is no later than January 1, 1992.

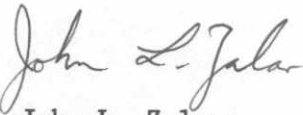
Sequence IIIIE ORLD Reporting Limits:

It was brought to the attention of the Surveillance Panel that in rare instances, adjusted ORLD ratings could generate values higher than 10.0. Effective as of the date of this letter the reporting form, Figure 16a, has been revised to limit the reported engine average ORLD, after the application of the correction formula, to a maximum value of 10.0. Section 9.2.4 of the procedure has also been changed and is included in this letter.

Test Developer Note:

The procedures for parts procurement, usage, accountability and classification contained in this information letter necessitate numerous changes to the text of both procedures. A special Ad-Hoc group has been formed to review the new Sequence IIIIE ASTM Procedural Standard with Mr. Norm Hunstad on July 29, 30, and 31, 1991. We also plan to review the existing Sequence IID Procedure, if possible, at that time. It is our intent to incorporate all necessary changes to both procedures during this review. We have included most of the required changes in the Appendices to this letter and plan to have both procedures updated by January 1, 1992.

  
Stephen P. Bergin  
Fuels and Lubricants Dept.  
General Motors Research Laboratories

  
John L. Zalar  
Administrator  
ASTM Test Monitoring Center

Attachments

(ATTACHMENT 1)

Sequence IID Critical Parts List

All rated parts:

Valve lifters  
Relief valve  
Pushrods

Pistons

Piston rings  
Cylinder heads  
Intake valve seals  
Valve springs  
Engine oil pump casting  
Breather tube  
Oil heat exchanger

Sequence IID Non-Production Parts

Engine block  
Intake manifold gasket  
Intake manifold seal, front and rear  
Rear main crankshaft seal, rope packing  
Exhaust manifold  
Rocker cover assembly  
Intake manifold

Sequence IID Service Parts Operations (SPO) List

List to follow at later date.

Sequence IIIIE Critical Parts List

Pistons  
Piston rings  
Engine bearings  
Cylinder heads  
Engine block  
Crankshaft  
Valve lifters  
Oil filter  
Camshaft  
Harmonic balancer  
Timing indicator  
Valve springs  
Rotators  
Oil heat exchanger

Sequence IIIIE Non-Production Parts

Flywheel  
Oil filter gasket (for use with camshaft hold-back fixture)  
Intake manifold gasket  
Intake manifold seal, front and rear  
Rear main crankshaft seal, rope packing  
Dipstick  
Rocker cover assembly

Note: Some parts listed as "Critical" may not be available at this time through the Central Parts Distributor (i.e., pistons, rings, seals, springs, and oil filters). Laboratories will receive updated information as controlled batch lots for these parts become available.

## SEQUENCE IIIIE TEST PARTS AVAILABLE THROUGH SERVICE PARTS OPERATIONS (SPO)

LAST UP-DATE June 19, 1991

SID CLARK  
 FUELS & LUBRICANTS DEPT.  
 GM RESEARCH LABORATORIES  
 (313) 986-1929 / 8-226-1929

PART  
 NUMBER  
 SERVICE

PART NAME

REMARKS

PART NUMBER SERVICE	PART NAME	REMARKS
1264952	ADAPTER, INDICATOR TIMING POINTER	
1241851	ARM, ROCKER LH	
1241850	ARM, ROCKER RH	
271629	BOLT, BALANCER TO CRANK	
25532736	BOLT, CAM SPROCKET SPL LENGTH	
25518478	BOLT, CARB. TO MANIFOLD	
9430184	BOLT, CARB. TO MANIFOLD	
1356635	BOLT, CHAIN DAMPER	
25531956	BOLT, CONN. ROD	
25527831	BOLT, CYL. HEAD 1986 (12)	
25525953	BOLT, CYL. HEAD 1986 (4)	
25526454	BOLT, DIST. HOLD DOWN	
558805	BOLT, FLYWHEEL MANUAL TRANS. (OLDS PART)	
25519889	BOLT, FT. COVER 1 REQUIRED	
25515641	BOLT, FT. COVER 2" LONG (WASHER ON BOLT)	
25519892	BOLT, FT. COVER 2-3/4 LONG	
25515639	BOLT, FT. COVER 3 REQUIRED	
25519891	BOLT, FT. COVER 7/8 LONG	
25510188	BOLT, FUEL PUMP (OIL FILL ADAPTER)	
25518193	BOLT, INTAKE MANIFOLD (3)	
25518194	BOLT, INTAKE MANIFOLD (6)	
1249603	BOLT, INTAKE MANIFOLD (1) SPECIAL	
25517807	BOLT, MAIN CAP	
25524524	BOLT, OIL PAN 1986 & 87 (17)	
25520079	BOLT, OIL PAN 1986 & 87 (3)	
431503	BOLT, OIL PICK-UP SCREEN	
25518361	BOLT, OIL PUMP TO FT. COVER	
1254198	BOLT, ROCKER SHAFT	
14057098	BOLT, STARTER	
14057099	BOLT, STARTER	
1262028	BRACKET, FT. ENGINE MOUNT (MAY BE SUBSTITUTED W/NON-PRODUCTION TYPE)	
1894979	CAP, DISTRIBUTOR H.E.I.	
1194380	CAP, OIL PUMP RELIEF VALVE	
17111526	CARB., 2BBL 1986-87	
1257408	CHAIN, TIMING	
1976925	COIL, DISTRIBUTOR PICK-UP	
1985474	COIL, IGNITION H.E.I.	
12020132	CONNECTOR, MIXTURE CONTROL SOL.	
25522648	COVER ASM, FT. TIMING 1986-87	
966639	COVER ASM, OIL PUMP 1986-87, W/VALVE	
25532546	DAMPER ASM, CHAIN	
25523502	DAMPER, BALANCER CRANKSHAFT (18.57 OZ. IN. BAL)	
1103470	DISTRIBUTOR ASM, H.E.I. (MODIFICATION NECESSARY USING 1875990 MODULE)	
25010792	ELEMENT, OIL FILTER (AC PF47)	
5651803	FILTER, CARB. FUEL INLET	
22507720	GASKET, CARB. AIR HORN, INLET ADAPTER	
25502203	GASKET, CARB. BASE	
25525919	GASKET, CYL. HEAD 1986 - 87	
25536024	GASKET, EGR VALVE	
25537228	GASKET, FT. TIMING COVER	
12337247	GASKET, FUEL PUMP	

PART NUMBER SERVICE	PART NAME	REMARKS
17076144	GASKET KIT,CARB. 86 - 87	
12328756	GASKET KIT,CYL.HEAD 1986 - 87	
12328745	GASKET KIT,ENG. OVERHAUL 1986-87	
25519461	GASKET KIT,FT COVER	
25521994	GASKET,OIL PAN 1985-87	
14090908	GASKET,OIL PAN PLUG	
25512860	GASKET,OIL PUMP COVER	
25533198	GASKET,OIL PUMP PICKUP TUBE	
25515852	GASKET,OIL PUMP RELIEF VALVE	
25523348	GASKET,ROCKER COVER	
1250390	GASKET, COOLANT OUTLET	
1358410	GASKET, COOLANT INLET PLATE	
1892082	GEAR,DIST. DRIVEN	
25527727	HOUSING,PICKUP TUBE & SCREEN	
17068311	JET & ROD PKG.,METERING	
17068865	JET & ROD PKG.,METERING	
17068820	JET & ROD PKG.,METERING	
17068819	JET & ROD PKG.,METERING	
17067865	JET & ROD PKG.,METERING	
17078466	JET & ROD PKG.,METERING	
838029	KEEPER,RETAINER VALVE SPRING CAP	
1352537	KEY,DAMPER/CRANK BALANCER	
25509950	MANIFOLD,CAST IRON INTAKE	
1875990	MODULE,IGNITION (DIST. MODIFICATION NECESSARY)	
25522005	NUT,OIL PAN DRAIN	
25536865	PAN ASM,OIL 1985-86	
25536321	PIN,CYL. HEAD DOWEL	
12338119	PIN,DOWEL BELL HOUSING TO TRANS.	
25536321	PIN,FT. COVER DOWEL	
1193214	PIN,OIL PUMP IDLER GEAR	
25536321	PIN,WATER PUMP DOWEL	
25513253	PLUG,CUP BLOCK & HEADS	
25513252	PLUG,CUP BLOCK & HEADS 31 MM	
3835577	PLUG,FT. OIL GALLERY	
5613324	PLUG,IGNITION SPARK (AC R42TS)	
3921988	PLUG,OIL PAN DRAIN(BOLT/SCREW)	
444777	PLUG,REAR OIL GALLERY	
17076144	POWER KIT,CARB. 85-86	
12337257	PUMP,ENG. OIL OVERHAUL KIT(INCL. BLTS,GRS,CVR & GKT)	
25510025	PUSHROD,INT. & EXH.	
1254371	RETAINER,ROCKER ARM (PLASTIC)	
25506520	ROD ASM,CONNECTING	
10498150	ROTOR,DISTRIBUTOR	
1305044	SEAL,CRANKSHAFT FT. ROPE	
1959331	SEAL,DIST. OIL (DIST. HOUSING TO ENGINE BLOCK BORE)	
25535162	SEAL,INTAKE GUIDE ONLY	
1052621	SEALER,GM (FOR USE WITH REAR MAIN SEAL)	
1050026	SEALANT,GM (LIGHT BROWN MATERIAL)	
1052917	SEALER,GM SILICONE (BLACK 3 OZ)	
1052914	SEALER,GM SILICONE (BLACK) 10OZ. TUBE	
1052366	SEALER,GM SILICONE (RED) 3OZ. TUBE	

PART NUMBER SERVICE	PART NAME	REMARKS
25508368	SEAT,OIL FILTER BY-PASS VALVE	
1254201	SHAFT,ROCKER ARM	
1193966	SHEDDER,CRANK FT. SEAL	
25500331	SHIELD,STARTER SOL.	
1246249	SHIM,STARTER .015	
1193967	SLINGER,CRANKSHAFT	
17111102	SOLONOID KIT,MIXTURE CONTROL 85-87	
1358909	SPRING,CHAIN DAMPER	
25515389	SPRING,OIL FILTER BY-PASS VALVE	
25529875	SPRING,OIL PUMP RELIEF VALVE	
25523200	SPRING,THROTTLE RETURN	
25523115	SPROCKET,GEAR CAM 86-87	
25519954	SPROCKET,GEAR CRANKSHAFT TIMING	
10496872	STARTER ASM	
12014836	TERMINAL,MIXTURE CONTROL SOL.	
1281380	VALVE,EXHAUST STD	
25512098	VALVE,INTAKE STD	
25515387	VALVE,OIL FILTER BY-PASS	
25528408	VALVE,OIL PUMP RELIEF	
25525918	WASHER,BALANCER CRANK	
120393	WASHER,FT. COVER BOLT	
1984360	WASHER/SPRING DIST.GEAR/HOUSING	
12043723	WIRE SET,H.E.I. (OR EQUIVALENT, SEE PROCEDURE)	



- s. Spark plugs, two sets per test, AC Part R42CTS at 1.14 mm (0.045 in) gap
- t. Gasket, exhaust manifold (Appendix A.33), Part 40033
- u. Seal, crankshaft rear main (Appendix A.52)
- v. Rocker cover gasket (Appendix A.38)
- w. Gear, camshaft sprocket
- x. Main bearings (Appendix A.56)
- y. Connecting rod bearings (Appendix A.56)
- z. Camshaft bearings (Appendix A.56)
- aa. Valve rotators (Appendix A.45 or A.52), Part RC155 or BX-305-1, respectively
- ab. Camshaft hold-back bearing (Appendix A.54)

7.2.3.2 Parts Replaced as Necessary-

- a. Engine block (Appendix A.52), Part BX-380-2
- b. Dipstick, hole plug (Appendix A.52), Part BX-386-1
- c. Dipstick, calibrated (Appendix A.52), Part BX-385-1
- d. Valve springs (Appendix A.39), Part ARB-931
- e. Keys, valve spring cap
- f. Front timing cover
- g. Crankshaft (Appendix A.52), Part BX-304-1
- h. Flywheel bolts
- i. Bolt, int. manifold (3/8 16 x 1 5/8"), (6)
- j. Bolt, int. manifold front, special, (1)
- k. Bolt, int. manifold (3/8 16 x 1 3/8), (3)
- l. Gasket, carburetor to manifold
- m. Oil pump, engine (OH kit)
- n. Camshaft thrust washer (Appendix A.5), Part RX-118624-B
- o. Pushrods

7.2.2 Fastener Torque Specification and Torquing Procedures-

7.2.2.1 Cylinder Head Bolts-The cylinder head bolts (part nos. 25527831 (long) or 25525953 (short) are to be thoroughly cleaned and Perfect Seal No. 4 Sealing Compound (Appendix A.25) is to be applied to the threads. After the cylinder head bolts are finger tight, they are to be torqued in the sequence shown in the 1987 Buick Service Manual (page 6A5-8, Fig. 9). Tighten cylinder head bolts gradually, first torque at 34 N•m (25 ft lbs), second torque at 81 N•m (60 ft lbs) or 1/4 turn then repeat with 81 N•m (60 lb-ft) or 1/4 turn once again in the proper sequence.

7.2.2.2 Intake Manifold Bolts-Install the intake manifold using thoroughly cleaned bolts oiled with EF 411 (Appendix A.31). After the bolts are finger tight, they are to be torqued in the sequence shown in the 1987 Buick Service Manual (Page 6A5-5, Fig. 4). Tighten the intake manifold bolts gradually until snug, first torque at 47 N•m (35 ft lbs), second torque to 64 N•m (47 ft lbs) and repeat at 64 N•m (47 ft lbs) once again.

7.2.2.3 Miscellaneous-The following bolt torques are specified:

	<u>Torque N•m (ft lbs)</u>
a. Bolts for main bearings caps 1, 2, 3, and 4	135 (100)
b. Flywheel bolts	81 (60)
c. Connecting rod bolts	54 (40)
d. Timing gear to camshaft bolts	42 (31)
e. Front cover to block	30 (22)
f. Crankshaft balance bolt	270 (200)
g. Rocker arm shaft bolts	35 (25)
h. Rocker arm cover bolts	10 (7)

i. Oil pump cover plate, front cover housing	11	(8)
j. Oil pan bolts	10	(7)
k. Carburetor to intake manifold bolts	26	(19)
l. Stud, camshaft hold-back	47	(35)
m. Locknut, camshaft hold-back brg.	40	(30)

7.2.3 Parts Replacement—See Appendix A.4 and A.5 for information regarding parts.

7.2.3.1 New Parts Required Each Test—

- a. Camshaft (Appendix A.52), Part RX 8619-3
- b. Seals, intake manifold, front and rear (Appendix A.52)
- c. Gaskets, intake manifold (Appendix A.52)
- d. Piston rings (Appendix A.34), Part K089703
- e. Head, pan, front cover, and oil pickup tube gaskets
- f. Piston, (Appendix A.35), Bohn Part 25522904
- g. Cylinder heads (Appendix A.52), Bowden Part BX-370-1
- h. Valve lifters (Appendix A.52), Bowden Part BX-302-1
- i. Valves, intake
- j. Valves, exhaust
- k. Seals, intake valve stem
- l. Chain, engine timing
- m. Connecting rod bearings #3 & #5 (Appendix A.56)
- n. Camshaft hold-back Belleville spring (Appendix A.39)
- o. Rocker arms, (RH) and (LH)
- p. Rocker arm retainers
- q. Rocker arm shafts
- r. Oil filter, PF47

9.2.4 Oil Ring Land Deposits-Using CRC Manual 14 (Non-Rubbing Scale, Appendix A.51), rate the oil ring land face above the oil ring on all six pistons, Fig. 11C. The overall ring land deposit rating is the average rating of the six ring lands. This rating should be adjusted according to the following equation:  $ORLD_{adjusted} = (ORLD \times 1.16) + 0.48$ . (Note: ORLD ratings above an 8.20 before adjustment will equate higher than 10.0. Figure 16a limits the maximum adjusted reporting value to 10.0.) The adjusted rating should be listed on the report summary sheet. Rate only the deposit present, ignoring any, freshly-chipped areas. The remaining, unchipped ring land deposit is to be considered 100% of the rated land area. The percent of ring land deposit which is chipped off should be noted in the report supplemental sheet.

9.2.5 Scuffing and Wear (Visual Inspection)-Visually rate, and report the number of camshaft lobes and lifter feet that are scuffed, Figs. 5C and 5D. In addition, rate each of the following parts visually and report the number "scuffed", "worn", or "scuffed and worn":

- a. Valve stem tips, Fig. 11C.
- b. Rocker arm pads, Fig. 11C.

Occasionally, a valve rotator will fail to induce valve rotation. If this occurs, the rating of the associated valve tip and pad should be omitted. However, incidents of non rotation must be noted in the report. Failure of a valve to rotate may also cause valve burning. Valve rotators which perform satisfactorily may be used for several tests; however, they must be thoroughly cleaned between tests.

Figure 5F

SEQUENCE IIIIE HARDWARE INFORMATION

OIL CODE: \_\_\_\_\_ TEST NO.: \_\_\_\_\_

ENGINE NUMBER: \_\_\_\_\_ BUILD COMPLETION DATE: \_\_\_\_\_

Block Serial Number: \_\_\_\_\_ Piston Code: \_\_\_\_\_

Crankshaft Serial Number: \_\_\_\_\_ Batch (Date Stamped): \_\_\_\_\_

Camshaft Serial Number: \_\_\_\_\_ Size (Grade): \_\_\_\_\_

Lifter Codes: \_\_\_\_\_ Piston Ring Codes: \_\_\_\_\_

Batch (Receive Date): \_\_\_\_\_ Batch (Package Date): \_\_\_\_\_

Code: \_\_\_\_\_ Top Ring: \_\_\_\_\_

Cylinder Head Serial Number: \_\_\_\_\_ Second Ring: \_\_\_\_\_

Left: \_\_\_\_\_ Oil Rail: \_\_\_\_\_

Right: \_\_\_\_\_ Oil Spacer: \_\_\_\_\_

Bearing Kit Serial Number: \_\_\_\_\_ Oil Filter Type: \_\_\_\_\_

Figure 16a

Test Cell \_\_\_\_\_ Test No. \_\_\_\_\_  
 Engine No. \_\_\_\_\_ Oil Code \_\_\_\_\_  
 Rater \_\_\_\_\_ Date \_\_\_\_\_

Oil Ring Land Deposits (ORLD) Rating

	Un-Corrected CRC Rating	% Chipped Areas
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

Un-Corrected Engine Average (ORLD) \_\_\_\_\_

Corrected Ring Land Rating. =  $(ORLD * 1.16) + .48$   
 Reported Engine Average \_\_\_\_\_  
 (Maximum reporting value = 10.0)

Piston Ring Condition

Piston	Top / Stuck	Bottom Slug.	Oil Ring % Plug
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**A.4 TEST PARTS**

Test parts are to be ordered by category:

Critical Parts: (Appendix A.52)

Non-Production Parts: (Appendix A.5 or A.52)

Service Parts Operations (SPO): Local GM Dealer

**A.5 SPECIAL SEQUENCE IIIIE TEST PARTS**

Special parts may be made by any capable independent machine shop or may be obtained by contacting:

General Motors Research Laboratories  
Attention: Sequence IIIIE Test Developer  
Fuels and Lubricants Department  
30500 Mound Road  
Warren, MI 48090-9055  
Telephone: (313) 986-1929

**A.6 EXTERNAL OIL PUMP**

Viking Model G 4125,  $22.7 \pm 1.89$  L/m ( $6 \pm 0.5$  gpm) at 1140 rpm, with 0.1277 mm (0.005 in.) rotor O.D. clearance, no relief valve. Available through local Viking distributors or:

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

**A.7 EXTERNAL OIL SYSTEM HEAT EXCHANGER**

Bowden Heat Exchanger #BX-350-1 Assembly (A.52).

**A.8 EXTERNAL OIL SYSTEM AND OTHER 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

**A.48 ENGINE LIFT CHAIN**

BT6606 may be ordered from:

Burroughs Tool and Equipment Company  
2429 N. Burdick Street  
Kalamazoo, MI 49007  
Telephone: (616) 345-5163 or (616) 345-2700

**A.49 MOTOR MOUNTS**

May be ordered from:

Republic Auto Parts  
2020 E. Nine Mile Road  
St. Clair Shores, MI  
Telephone: (313) 772-4500

**A.50 TERTI-TOWELS**

Available from local suppliers of Kimberley Clark products.

**A.51 CRC RATING MANUALS**

Rating Manuals No. 12 and No. 14 may be ordered from:

Coordinating Research Council, Inc.  
219 Perimeter Center Parkway, Suite 400  
Atlanta, GA 30346  
Telephone: (404) 396-3400

**A.52 CENTRAL PARTS DISTRIBUTOR**

Bowden Manufacturing Corporation  
Attention: Dwight Bowden  
4590 Beidler  
Willoughby, OH 44094  
Telephone: (216) 946-1770  
FAX: (216) 946-1789

**A.53 OIL CONTROL VALVE**

Badger Meter Inc.  
Precision Products Division  
6116 E. 15th Street  
Tulsa, OK 74112  
Telephone: (918) 836-8411

**A.54 ANDREWS BEARING**

Part #D1 may be ordered from;

M.P.B. Corporation  
Spartanburg, South Carolina  
Telephone: (803) 582-0892



