IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451535
SHEET 1 OF 3
BLOCK NO.

1401 DATA PROCESSING SYSTEM

TEST TAPE DECKS AND SELECTION DIGITS

ORDER PART NUMBER 451270 TO OBTAIN A TEST TAPE.

THIS DOCUMENT LISTS THE TEST DECKS IN THE ORDER THAT THEY ARE WRITTEN ON THE TEST TAPE PREPARED BY THE PLANT. FOR DETAILED RUNNING PROCEDURES AND FOR ADDITIONAL INFORMATION CONCERNING THE TEST DECKS, REFER TO THE 1401 DIAGNOSTIC TEST BOOK, PART NUMBER 451396.

SELECTION DIGITS ARE REQUIRED TO RUN SOME TESTS FROM TAPE. LISTED WITH EACH TEST ARE THE SELECTION DIGITS AND THE DIGIT LOCATION CORRESPONDING TO THE TEST. WHEN RUNNING THESE TESTS FROM TAPE, ENTER ONLY THE SELECTION DIGITS THAT APPLY TO THE FEATURES ON YOUR MACHINE. REFER TO THE FIRST LOGIC BOOK TO DETERMINE THE MFI CODE OF THE FEATURES ON YOUR MACHINE.

THE FOLLOWING TABLE LISTS THE TESTS ON THE TEST TAPE. ALSO GIVEN ARE SELECTION CODES, THE SELECTION LOCATIONS, THE MACHINE FEATURE INDEX, AND THE TITLE OF THE TEST. ENTER THE SELECTION DIGITS REQUIRED TO TEST THE FEATURES ON YOUR MACHINE.

DATE	SEE INDEX	5-15-62	3-18-63	5-6-63	7-1-63	17.10.63		
ENG. CHG. NO.	CARD	115283	116745	117635	117628	TA 1976		

IBM

REPRODUCTION

DIAGNOSTIC FUNCTION TEST

PART NO. 451535
SHEET 2 OF 3
BLOCK NO.

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION DIGIT AND LOCATION
5310 E	READ TEST TAPE ROUTINE	MT	NONE
5320 E	COPY TEST TAPE ROUTINE	MT	1 IN 1254
0050 B	TEST CHARACTER AND BRANCH	BA	NONE
0060 B	TEST FOR ZONE OR WM AND BRANCH	BA	NONE
0100 B	COMPARE AND BRANCH UNEQUAL	BA	NONE
0110 B	LOAD MOVE COMPARE	BA	NONE
0210 C	LOAD MOVE DIGIT ZONE	BA	NONE
0230 B	MOVE AND ZERO SUPPRESS	BA	NONE
0300 B	TRUE ADD	BA	NONE
0310 B	COMPLEMENT AND RECOMPL ADD	BA	NONE
0330 B	RESET ADD AND SUBTRACT	BA	NONE
0350 B	ZONE ADD	BA	NONE
0360 B	BRANCH OVERFLOW	BA	NONE
**0370 D	EDIT	BA	**
1000 B	READ PUNCH PRINT SPEED	BA	3 IN 1278
1010 C	PRINT WORD MARKS	BA	1 IN 1261
1020 B	RIPPLE PRINT	BA	1 IN 1261
1022 B	NUMERICAL RIPPLE PRINT	NU	3 IN 1261
1030 B	RIPPLE PUNCH	BA	1 IN 1262
**1040 B	RIPPLE READ	BA	1 IN 1263
1050 B	PRINT PUNCH	BA	1 IN 1261 & 1262
1060 B	PRINT READ	BA	1 IN 1261 & 1263
1070 B	READ PUNCH	BA	1 IN 1262 & 1263
1080 B	PRINT READ PUNCH	BA	1 IN 1261, 1262 & 1263
1120 C	CHANNEL 9 AND 12 LATCHES	BA	1 IN 1255
2000 C	FORMS SPACING	BA	1 IN 1255
2005 A	SINGLE LINE SKIP	BA	1 IN 1255
**2010 B	FORMS SKIPPING	BA	1 IN 1255
2030 B	SPACE SUPPRESSION	XSS	1 IN 1255
3000 C	MOVE AND BINARY DECODE	CH	1 IN 1256
3010 C	MOVE AND BINARY CODE	CH	1 IN 1256
3020 C	PUNCH COLUMN BINARY	CH	1 IN 1256
**3030 C	READ COLUMN BINARY	CH	1 IN 1256
3040 C	BIT TEST	CH	1 IN 1256
3100 D	INDEXING AND STORE STARS	IN	1 IN 1257
3110 D	MOVE RECORD	IN	1 IN 1257
3130 D	I-STAR TRANSFER	IN	1 IN 1257
3200 D	MULTIPLY	MD	1 IN 1258

ENTER STORAGE SIZE

1.4K	BLANK IN 1251
2K	1 IN 1251
4K	4 IN 1251
8K	8 IN 1251
12K	2 IN 1251
16K	6 IN 1251

*OPTIONAL FEATURES REQUIRED TO OPERATE TEST.
**READ TEST DESCRIPTION BEFORE RUNNING TEST.

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NO.	115283	116745	117635	117628	TA 1976			

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DIAGNOSTIC FUNCTION TEST

PART NO. 451539
SHEET 3 OF 3
BLOCK NO.

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION DIGIT AND LOCATION
3210 B	DIVIDE	MD	1 IN 1258
3300 B	BRANCH HIGH	HL	1 IN 1259
3310 B	BRANCH LOW	HL	1 IN 1259
3320 B	BRANCH EQUAL	HL	1 IN 1259
3330 B	FIELD COMPARE	HL	1 IN 1259
3500 C	READ AND PUNCH RELEASE	FP	1 IN 1279
**3502 B	PUNCH-FEED-READ RELEASE	FP + RP	1 IN 1272 AND 1279
**3504 A	PUNCH CHECK PLANE TEST FOR PFR OPERATION ENTER	BA	1 IN 1279 1 IN 1272
**3600 E	PUNCH-FEED READ	RP	1 IN 1272
3700 B	MODIFY ADDRESS	8M, 12M, 16M	1 IN 1264
5000 C	CARD TO TAPE	MT	1 IN 1268 AND 1263
5010 C	TAPE TO PUNCH/PRINTER	MT	1 IN 1268, 1261 AND 1262
5020 C	TAPE TO TAPE	MT	1 IN 1267
5030 C	BACKSPACE SKIP	MT	1 IN 1268
5040 D	MOVE TAPE	MT	1 IN 1268
5050 D	LOAD TAPE	MT	1 IN 1268
5070 D	MOVE BINARY TAPE	MT	1 IN 1268
5080 C	VERTICAL REDUNDANCY CHECK	MT	1 IN 1268
5330 C	COMPRESSED TAPE READ AND EXPAND	CW	1 IN 1270
5500 D	729 I R G MEASUREMENT	MT	1 IN 1269
5530 B	7330 I R G MEASUREMENT	MT	1 IN 1253
9000 C	SELECT STACKER	BA	1 IN 1278
**9010 D	BRANCH ON PRINTER ERROR	BA	4 IN 1278
**9020 D	BRANCH ON PROCESS ERROR	BA	5 IN 1278
**9030 D	BRANCH ON READER ERROR	BA	6 IN 1278
**9040 C	BRANCH ON PUNCH ERROR	BA	7 IN 1278
**9100 F	CORE STORAGE WORST PATTERN	BA	1 IN 1265
**9999 B	BRANCH LAST CARD	BA	2 IN 1278
	ENTER STORAGE SIZE		
	1.4K		BLANK IN 1251
	2K		1 IN 1251
	4K		4 IN 1251
	8K		8 IN 1251
	12K		2 IN 1251
	16K		6 IN 1251
9200 A	STORAGE LISTING ROUTINES	BA	

*OPTIONAL FEATURES REQUIRED TO OPERATE TEST.
**READ TEST DESCRIPTION BEFORE RUNNING TEST.

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CORRECTIONLIST FOR 1440/1460/1401 DFT's

4 W 0 5 Print Buffer Case Pattern

In front of the transfer execute card are put two correction cards with the following content:

1. Column 1 6
   Character Y 2 4 0 1 ≠

2. Column 1 6
   Character J 3 5 0 1 W_S W_S ≙ 0-5-8

4 R 0 1 B (2. Portion) RDR PCH Function

Behind of card 53 are put 3 correction cards with the following content:

1. Column 1 15
   Character I 6 7 0 9 W_B 1 6 0 CARDS

2. Column 1 . . . 5
   Character G 9 6 1 9

3. Column 1 8
   Character E 1 5 0 3 I 7 5

4 F 0 8 Seek Overlap

The CE Pack must be used only with the Drive-Unit 0

1460: 6C12A not from File
6C14A not from Tape

4 R 0 4 B 1442 Stacker Select 1440

In front of the transfer execute card are put 2 correction cards with the following content:

1. Column 1.....52
   Character Z 3 9 4 6 ₩ TURN SS G ON TO EXECUTE TEST ON 2ND 1442 ON

2. Column 1.....8
   Character S 0 2 0 3 Z 8 4

4 C 5 5 B Sense Switch Test

To run this test from 1311 it is necessary to put the following two correction cards in front of the transfer execute card:

1. Column 1....6
   Character Z 1 9 0 1 #

2. Column 1.....8
   Character / 2 4 0 3 Z 1 9

Note: The test decks with Suffix B should run only if EC 118 627 (TA 2258 A) on logic 31.14.11.3 has been installed. 1440/1460

4 R 0 2 B Reader Punch Speed 1440

To measure the speed of second SRP, set TAD 2 in location 936. The test would automatically executed on second SRP after execution on SRP 1.

4 F 0 1 A File Function Test

In front of the transfer execute card of part 3 is put one correction card with the following content:

Column 1....7
Character N 4 6 0 1 0

4F01A File Function

6th Portion, Track Record Move with Addresses.

By performing this test, assure that the Pack Addresses correspond to the Module number if Pack Address exceeds 19 999.

4C58A Edit and Expanded Edit

Refer to Description of 4C08A. The only different is Period Comma Inversion in 4C58A.

1026-A Multi Tape Lister B 1401

Behind of card 25 are put 2 correction cards with the following content:

1. Column 1.....35
1. Character L035#57, #55#55, #55#55, #55#551001756

2. Column 1.....36
2. Character M035423N000000N000000N0000001001#57

3310 - B Branch Low 1401

In front of the transfer execute card is put the following correction card:

Column 1.....32
Character ,954954N000000N000000N0000001001

4E05B - Branch on Punch Error 1460

In front of the transfer execute card is put 1 correction card with the following content:

Column 1 6
Character W06014

1020 - B Ripple Print 1401

To run this test from Tape it is necessary to put the following correction card in front of the transfer execute card:

Column 1.....72

Character L072752,731731,731731,7317311001CR CP LSAGM GDTT XXX OP OZ TEPTZ MESM

CO	= COLON	5 8		GT	= GREATER THAN	6 8	
RP	= RIGHT PARENTHESIS	11 5 8		MZ	= MINUS ZERO	11 0	
PZ	= PLUS ZERO	12 0		GM	= GROUP MARK	12 7 8	
LT	= LESS THEN	12 6 8		DE	= DELTA	11 7 8	
SE	= SEMICOLON	11 6 8		TS	= TAPE SEGMENT MARK	0 7 8	
AP	= APOSTROPHE	0 6 8		TM	= TAPE MARK	7 8	

4R01B (1. Portion) RDR PCH Function

In front of the transfer execute card is put one correction card with the following content:

1. Column 1.....14

Character T7408$^{W}_{8}$N0000000

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DIAGNOSTIC FUNCTION TEST

PART NO. 451940
SHEET 1 OF 2
BLOCK NO.

PACKING SHEET
1401 DIAGNOSTIC FUNCTION TESTS

TEST DESCRIPTIONS

PART NUMBER	BLOCK NUMBER	MFI	TEST TITLE
451397			TABLE OF CONTENTS
451398			GENERAL INFORMATION
451402	0050B	BA	TEST CHARACTER AND BRANCH
451403	0060B	BA	TEST FOR ZONE OR WM AND BRANCH
451404	0100B	BA	COMPARE AND BRANCH UNEQUAL
451405	0110B	BA	LOAD MOVE COMPARE
451407	0210C	BA	LOAD MOVE DIGIT ZONE
451409	0230B	BA	MOVE AND ZERO SUPPRESS
451410	0300B	BA	TRUE ADD
451411	0310B	BA	COMPLEMENT AND RECOMPLEMENT ADD
451413	0330B	BA	RESET ADD AND SUBTRACT
451415	0350B	BA	ZONE ADD
451416	0360B	BA	BRANCH OVERFLOW
451417	0370D	BA	EDIT AND EXPANDED EDIT
451634	1000B	BA	READ PUNCH PRINT SPEED
451418	1010C	BA	PRINT WORD MARKS
451419	1020B	BA	RIPPLE PRINT
451476	1022B	NU	NUMERICAL RIPPLE PRINT
451420	1030B	BA	RIPPLE PUNCH
451421	1040B	BA	RIPPLE READ
451422	1050B	BA	PRINT PUNCH
451423	1060B	BA	PRINT READ
451424	1070B	BA	READ PUNCH
451425	1080B	BA	PRINT READ PUNCH
451426	2000C	BA	FORMS SPACING
451926	2005A	BA	SINGLE LINE SKIP
451427	2010B	BA	FORMS SKIPPING
451428	2020C	BA	CHANNEL 9 AND 12 LATCHES
451932	2030B	XSS	SPACE SUPPRESSION
451429	3000C	CH	MOVE AND BINARY DECODE
451430	3010C	CH	MOVE AND BINARY CODE
451431	3020C	CH	PUNCH COLUMN BINARY
451432	3030C	CH	READ COLUMN BINARY
451433	3040C	CH	BIT TEST
451434	3100D	IN	INDEXING AND STORE STARS

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DIAGNOSTIC FUNCTION TEST

PART NO. 451940
SHEET 2 OF 2
BLOCK NO.

REPRODUCTION

PACKING SHEET
TEST DESCRIPTIONS

PART NUMBER	BLOCK NUMBER	MFI	TEST TITLE
451436	3110D	IN	MOVE RECORD
451438	3130D	IN	I-STAR TRANSFER
451439	3200D	MD	MULTIPLY
451440	3210B	MD	DIVIDE
451442	3300B	HL	BRANCH HIGH
451443	3310B	HL	BRANCH LOW
451444	3320B	HL	BRANCH EQUAL
451935	3330B	HL	FIELD COMPARE
451445	3500C	FP	READ+PUNCH RELEASE
451563	3502B	FP + RP	PUNCH FEED READ RELEASE
451929	3504A	BA	PUNCH CHECK PLANE TEST
451446	3600E	RP	PUNCH FEED READ
451479	3700B	8M, 12M, 16M	MODIFY ADDRESS
451482	3800A	FCF	51-COLUMN READ
451450	5000C	MT	CARD TO TAPE
451451	5010C	MT	TAPE TO PUNCH/PRINTER
451452	5020C	MT	TAPE TO TAPE
451453	5030C	MT	BACKSPACE SKIP
451454	5040D	MT	MOVE TAPE
451455	5050D	MT	LOAD TAPE
451451	5070D	MT	MOVE BINARY TAPE
451527	5080C	MT	VERTICAL REDUNDANCY CHECK
451458	5300E	MT	WRITE TEST TAPE ROUTINE
451459	5310E	MT	READ TEST TAPE ROUTINE
451460	5320E	MT	COPY TEST TAPE ROUTINE
451461	5330C	CW	COMPRESSED TAPE READ AND EXPAND
451217	5500D	MT	I R G MEASUREMENT FOR 729
451639	5530B	MT	7330 I R G MEASUREMENT
451447	9000C	BA	SELECT STACKER
451515	9010D	BA	BRANCH ON PRINTER ERROR
451518	9020D	BA	BRANCH ON PROCESS ERROR
451521	9030D	BA	BRANCH ON READER ERROR
451524	9040C	BA	BRANCH ON PUNCH ERROR
451448	9100F	BA	STORAGE WORST PATTERN
451449	9999B	BA	BRANCH LAST CARD
451865	1T01B	MT	WRITE TEST TAPE
451866	1T02C	MT	READ TEST TAPE
451867	1T03A	MT	COPY TEST TAPE
451868	1T05C	MT	I R G MEASUREMENT
451869	1T06A	MT	TAPE ERROR
451870	1T07A	MT	TAPE RELIABILITY
451 970	9200 A	BA	STORAGE LISTING ROUTINES
451 966	1025A	STL	MULTI TAPE LISTER A
451 972	1026 A	STL	MULTI TAPE LISTER B

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ENG. CHG. NO.	115283	116745A	117635	117628	TA 1976			

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DIAGNOSTIC FUNCTION TEST

PART NO. 451381
SHEET 1 OF 1
BLOCK NO.

1401 DIAGNOSTIC FUNCTION TESTS

PACKING SHEET
BOX 2

BASIC AND OPTIONAL FEATURE TESTS.
SOME OF THESE FEATURES MAY NOT BE ON YOUR 1401.

BLOCK NUMBER	*MFI	TEST TITLE
5000C	MT	CARD TO TAPE
5010C	MT	TAPE TO PUNCH/PRINTER
5020C	MT	TAPE TO TAPE
5030C	MT	BACKSPACE SKIP
5040D	MT	MOVE TAPE
5050D	MT	LOAD TAPE
5070D	MT	MOVE BINARY TAPE
5080C	MT	VERTICAL REDUNDANCY CHECK
5300E	MT	WRITE TEST TAPE ROUTINE
5310E	MT	READ TEST TAPE ROUTINE
5320E	MT	COPY TEST TAPE ROUTINE
5330C	CW	COMPRESSED TAPE READ AND EXPAND
5500D	MT	I R G MEASUREMENT FOR 729
5530B	MT	7330 I R G MEASUREMENT
1T01B	MT	WRITE TEST TAPE
1T02C	MT	READ TEST TAPE
1T03A	MT	COPY TEST TAPE
1T05C	MT	I R G MEASUREMENT
1T06A	MT	TAPE ERROR
1T07A	MT	TAPE RELIABILITY

*REFER TO MFI CODE IN FIRST LOGIC BOOK.

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IBM DIAGNOSTIC FUNCTION TEST DESCRIPTIONS

TABLE OF CONTENTS

ORDER PART NUMBER 451396 TO OBTAIN THIS MANUAL.
THE MATERIAL CONTAINED IN THIS MANUAL IS IN THE ORDER LISTED IN THIS DOCUMENT.

IBM DIAGNOSTIC FUNCTION TEST DESCRIPTIONS

1401 DATA PROCESSING SYSTEM

INDEX OF PART NUMBERS FOR TEST DESCRIPTIONS AND CARD DECKS AND TAPE SELECTION DIGITS

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION DIGIT AND LOCATION	
0050 B	TEST CHARACTER AND BRANCH	BA	NONE	451155
0060 B	TEST FOR ZONE OR WM AND BRANCH	BA	NONE	451156
0100 B	COMPARE AND BRANCH UNEQUAL	BA	NONE	451157
0110 B	LOAD MOVE COMPARE	BA	NONE	451158
0210 C	LOAD MOVE DIGIT ZONE	BA	NONE	451160
0230 B	MOVE AND ZERO SUPPRESS	BA	NONE	451162
0300 B	TRUE ADD	BA	NONE	451163
0310 B	COMPLEMENT AND RECOMPL ADD	BA	NONE	451164
0330 B	RESET ADD AND SUBTRACT	BA	NONE	451166
0350 B	ZONE ADD	BA	NONE	451168
0360 B	BRANCH OVERFLOW	BA	NONE	451169
**0370 D	EDIT	BA	**	451170
**1000 B	READ PRINT PUNCH SPEED	BA	3 IN 1278	451629
1010 C	PRINT WORD MARKS	BA	1 IN 1261	451180
1020 B	RIPPLE PRINT	BA	1 IN 1261	451171
1022 B	NUMERICAL RIPPLE PRINT	NU	3 IN 1261	451478
1030 B	RIPPLE PUNCH	BA	1 IN 1262	451172
**1040 B	RIPPLE READ DO NOT PUT DETAIL CARDS ON TAPE	BA	1 IN 1263	451173
1050 B	PRINT PUNCH	BA	1 IN 1261 & 1262	451174
1060 B	PRINT READ	BA	1 IN 1261 & 1263	451175
1070 B	READ PUNCH	BA	1 IN 1262 & 1263	451176
1080 B	PRINT READ PUNCH	BA	1 IN 1261, 1262 & 1263	451177
**2000 C	FORMS SPACING	BA	1 IN 1255	451178
**2005 A	SINGLE LINE SKIP	BA	1 IN 1255	451925
**2010 B	FORMS SKIPPING	BA	1 IN 1255	451179
**2020 C	CHANNEL 9 AND 12 LATCHES	BA	1 IN 1255	451181
2030 B	SPACE SUPPRESSION	XSS	1 IN 1255	451931
3000 C	MOVE AND BINARY DECODE	CH	1 IN 1256	451182
3010 C	MOVE AND BINARY CODE	CH	1 IN 1256	451183
3020 C	PUNCH COLUMN BINARY	CH	1 IN 1256	451184

*OPTIONAL FEATURES REQUIRED TO OPERATE TEST.
**READ TEST DESCRIPTION BEFORE RUNNING TEST.
***THE SELECTION CODE IS ANY CHARACTER EXCEPT BLANK.

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ENG. CHG. NO.	115283	116745	117635	117628	TA 1976			

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DIAGNOSTIC FUNCTION TEST

PART NO. 451397
SHEET 3 OF 5
BLOCK NO.

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION DIGIT AND LOCATION	PART NUMBER
**3030 C	READ COLUMN BINARY DO NOT PUT DETAIL CARDS ON TAPE	CH	1 IN 1256	451185
3040 C	BIT TEST	CH	1 IN 1256	451186
3100 D	INDEXING AND STORE STARS	IN	1 IN 1257	451187
3110 D	MOVE RECORD	IN	1 IN 1257	451189
3130 D	I-STAR TRANSFER	IN	1 IN 1257	451191
3200 D	MULTIPLY	MD	1 IN 1258	451192
	ENTER STORAGE SIZE 1.4K 2K 4K 8K 2K 16K		BLANK IN 1251 1 IN 1251 4 IN 1251 8 IN 1251 2 IN 1251 6 IN 1251	
3210 B	DIVIDE	MD	1 IN 1258	451193
3300 B	BRANCH HIGH	HL	1 IN 1259	451198
3310 B	BRANCH LOW	HL	1 IN 1259	451199
3320 B	BRANCH EQUAL	HL	1 IN 1259	451200
3330 B	FIELD COMPARE	HL	1 IN 1259	451934
3500 C	READ + PUNCH RELEASE	FP	1 IN 1279	451201
**3502 B	PUNCH-FEED-READ RELEASE	FP + RP	1 IN 1272&1279	451566
**3504 A	PUNCH CHECK PLANE TEST FOR PFR OPERATION ENTER	BA	1 IN 1279 1 IN 1272	451928
**3600 E	PUNCH-FEED READ DO NOT PUT DETAIL CARDS ON TAPE	RP	1 IN 1272	451202
3700 B	MODIFY ADDRESS	8M, 12M, 16M	1 IN 1264	451481
3800 A	51-COLUMN READ	FCF	CARDS ONLY	451484
5000 C	CARD TO TAPE WRITE ON TAPE DRIVE 4.	MT	1 IN 1268&1263	451252
5010 C	TAPE TO PUNCH/PRINTER READ ON TAPE DRIVE 4.	MT	1 IN 1268, 1261 & 1262	451253
5020 C	TAPE TO TAPE READ ON TAPE DRIVE 4. WRITE ON TAPE DRIVE 5.	MT	1 IN 1267	451254
5030 C	BACKSPACE SKIP WRITE ON TAPE DRIVE 4.	MT	1 IN 1268	451255
5040 D	MOVE TAPE WRITE ON TAPE DRIVE 4.	MT	1 IN 1268	451256
5050 D	LOAD TAPE WRITE ON TAPE DRIVE 4.	MT	1 IN 1268	451257
5070 D	MOVE BINARY TAPE WRITE ON TAPE DRIVE 4.	MT	1 IN 1268	451259

*OPTIONAL FEATURES REQUIRED TO OPERATE TEST.
**READ TEST DESCRIPTION BEFORE RUNNING TEST.

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DIAGNOSTIC FUNCTION TEST

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION, DIGIT AND LOCATION	P/ NUMBER
5080 C	VERTICAL REDUNDANCY CHECK WRITE ON TAPE DRIVE 4. READ ON TAPE DRIVE 4.	MT	1 IN 1268	451525
5300 E	WRITE TEST TAPE ROUTINE WRITE ON TAPE DRIVE 1. PUTS READ, COPY, AND OTHER TESTS ON TAPE. SENSE SWITCH A ON.	MT	CARDS ONLY	451260
5310 E	READ TEST TAPE ROUTINE READ ON DRIVE 1. FIRST PROGRAM ON TEST TAPE. CAUSES EXECUTION OF OTHER TESTS ON THE TAPE.	MT	NONE	451261
5320 E	COPY TEST TAPE ROUTINE READ FROM TAPE DRIVE 1. WRITE ON TAPE DRIVE 2. DUPLICATES REEL OF TEST TAPE.	MT	1 IN 1254	451262
1026A	MULTI TAPE LISTER B	STL		451 [illegible]
1025A	MULTI TAPE LISTER A	STL		451 [illegible]
5330 C	COMPRESSED TAPE READ AND EXPAND	CW	1 IN 1270	451263
5500 D	729 I R G MEASUREMENT RUN ON HIGH DENSITY. WRITE ON TAPE DRIVE 4. READ ON TAPE DRIVE 4.	MT	1 IN 1269	451265
5530 B	7330 I R G MEASUREMENT RUN ON HIGH DENSITY. WRITE ON TAPE DRIVE 4. READ ON TAPE DRIVE 4.	MT	1 IN 1253	451640
9200 A	STORAGE LISTING ROUTINES	BA		451 969
**9000 C	SELECT STACKER	BA	1 IN 1278	451197
**9010 D	BRANCH ON PRINTER ERROR	BA	4 IN 1278	451489
**9020 D	BRANCH ON PROCESS ERROR	BA	5 IN 1278	451516
**9030 D	BRANCH ON READER ERROR DO NOT PUT DETAIL CARDS ON TAPE	BA	6 IN 1278	451519
**9040 C	BRANCH ON PUNCH ERROR	BA	7 IN 1278	451522
**9100 F	CORE STORAGE WORST PATTERN ENTER STORAGE SIZE 1.4K 2K 4K 8K 12K 16K	BA	1 IN 1265 BLANK IN 1251 1 IN 1251 4 IN 1251 8 IN 1251 2 IN 1251 6 IN 1251	451195

DO NOT PUT CARDS 61-67 ON TAPE

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DIAGNOSTIC FUNCTION TEST

PART NO. 451397
SHEET 5 OF 5
BLOCK NO.

BLOCK NUMBER	TEST TITLE	*MFI	TAPE SELECTION DIGIT AND LOCATION	PART NUMBER
9999 B	BRANCH LAST CARD DO NOT PUT DETAIL CARDS ON TAPE	BA	2 IN 1278	451196
IT01 B	WRITE TEST TAPE	MT	CARDS ONLY	451763
IT02 C	READ TEST TAPE	MT	NONE	451764
IT03 A	COPY TEST TAPE	MT	1 IN 1254	451765
IT05 C	IRG MEASUREMENT	MT	1 IN 1269	451766
IT06 A	TAPE ERROR	MT	1 IN 1268	451767
IT07 A	TAPE RELIABILITY	MT	1 IN 1268	451768

*OPTIONAL FEATURES REQUIRED TO OPERATE TEST.
**READ TEST DESCRIPTION BEFORE RUNNING TEST.

DESCRIPTIONS OR CARD DECKS FOR INDIVIDUAL BLOCKS ARE NOT AVAILABLE AS SEPARATE ITEMS FOR REPLACEMENT PURPOSES; BUT MAY BE ORDERED AS A UNIT BY PART NUMBERS SHOWN IN THIS INDEX. PART NUMBERS SHOWN ON INDIVIDUAL DESCRIPTION PAGES ARE FOR MANUFACTURING PURPOSES ONLY.

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PACKED DECK FORMAT

ALL DECKS PRESENTLY USE PACKED (MORE THAN ONE INSTRUCTION PER CARD), CHAINING AND TITLE PRINT CARDS AS WELL AS PACKED TRAILER CARDS. NEW AND REVISED DECKS FOR FUTURE RELEASES USE PACKED INSTRUCTION CARDS TO REDUCE THE CARD VOLUME. ALL OF THE PROGRAM IS PACKED. ONLY THE TITLE CARD AND THE TRAILER CARD REMAIN SEPARATE.

IN ORDER TO MAKE THE TRANSITION FROM THE TITLE CARD TO THE PACKED DECK AND BACK AGAIN FROM THE PACKED DECK TO THE TRAILER CARD, TWO TRANSITION CARDS ARE USED.

1. ONE, A SET WM CARD, IS PLACED BETWEEN THE TITLE CARD AND THE PACKED DECK.
2. ANOTHER, A CLEAR WM CARD, IS PLACED BETWEEN THE PACKED DECK AND THE TRAILER CARD.

DETAIL CARDS REMAIN UNCHANGED.
EXAMPLES OF SET WM, PACKED, AND CLEAR WM CARDS ARE GIVEN LATER.

THE NEW TEST DESCRIPTIONS HAVE THREE CHANGES IN FORMAT.

1. AN INSTRUCTION LISTING GIVES EACH INSTRUCTION WITH APPROPRIATE COMMENTS. THIS INCLUDES

INSTR ADDRESS	OP CODE	I/A ADDRESS	B ADDRESS	ANY COMMENTS

THIS IS SIMILAR TO THE OLD ONE INSTRUCTION PER CARD LISTING

2. AN 80 COLUMN LISTING OF THE CARD DECK WHICH INCLUDES.
   - A. TITLE CARD
   - B. SET WM CARD
   - C. PACKED CARDS
   - D. CLEAR WM CARD
   - E. TRAILER CARD
   - F. DETAIL CARDS. IF ANY.

3. A TABLE OF UNPRINTABLE CHARACTERS WHICH PRECEDES THE LISTING OF THE PACKED CARDS ABOVE.

   ANY UNPRINTABLE CHARACTERS IN THE 80 COLUMN LISTING WILL PRINT AN IDENTIFYING SYMBOL OF TWO CHARACTERS. THE FIRST CHARACTER WILL BE ON THE LISTING LINE. THE SECOND CHARACTER WILL BE UNDERNEATH THE FIRST ON THE FOLLOWING LINE.

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

EXAMPLE. ,019027,031,038042803 1T98GB400L046352BW04BS88
M

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PACKED CARD

THE PACKED CARDS ARE LAYED OUT AS SHOWN IN THE FOLLOWING EXAMPLE

```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

L072121,001001,001001,001001|001|INITIAL ERROR LATCHES FAILED OR CARRIAGEXXXXX 03
L067156□122122,141148,153157|001| DID NOT GO TO FOURM1402998157EB†01      XXXXX 04
L036160,161161,161161,161161|001|*07                                      XXXXX 05
L067367,340344,348349,357361|001|008012,001100|8361080AB421/340080        XXXXX 06
```

COLS. 1- 7	LOAD INSTRUCTION FOR CARD COLUMNS 33 THROUGH 72
COLS. 8-14	SET WM INSTRUCTION OR CLEAR WM INSTRUCTION
COLS. 15-21	SET WM INSTRUCTION
COLS. 22-28	SET WM INSTRUCTION
COLS. 29-32	CARD FEED INSTRUCTION WHEN LOADING FROM CARDS
COLS. 33-72	INSTRUCTIONS OR PRINT OUT COMMENTS OR CONSTANTS FOR PROGRAM
COLS. 73-76	BLOCK NUMBER
COLS. 77	BLOCK NUMBER SUFFIX
COLS. 78-80	CONSECUTIVE CARD DECK NUMBER

THE PACKED CARD CONTAINS A MAXIMUM 7 INSTRUCTIONS OR 40 CHARACTERS, WHICHEVER OCCURS FIRS . IF THE LAST WM WAS ENCOUNTERED MORE THAN 9 COLUMNS BEFORE COLUMN 72 OF THE C.RD AND IF 7 INSTRUCTIONS HAD NOT BEEN ENTERED, THE INFORMATION IS TAKEN AS A COMMENT. THE 40 COLUMNS ARE PACKED. THE NEXT CARD CLEARS THE WM SET BY ITS LOAD INSTRUCTION, AND THE MAXIMUM NUMBER OF INSTRUCTIONS THAT CAN BE PACKED IN THIS NEXT CARD IS REDUCED TO FOUR.

IN COLUMNS 8 THROUGH 28 OF THE PACKED CARD, THE SET WM INSTRUCTIONS GIVE WM LOCATIONS IN STORAGE. IN ADDITION, THE LEFT END OF THE LOAD ADDRESS SETS A WM WHOSE STORAGE ADDRESS IS B - A PLUS 33, WHERE A AND B REPRESENT THE FIELDS OF THE LOAD ADDRESS IN COLUMNS 1 THROUGH 7 OF THE PACKED INSTRUCTION CARD. TO FIND THE CARD IN WHICH AN INSTRUCTION IS LOCATED, FIND THE WM LOCATION OF THE INSTRUCTION IN THE PACKED CARDS. THEN CHECK THE B FIELD OF THE LOAD ADDRESS OF THIS CARD AND OF THE FOLLOWING CARD TO FIND WHICH ONE CONTAINS THE INSTRUCTION. FINALLY, LOCATE THE INSTRUCTION BETWEEN COLUMNS 32 AND 73.

FORMAT OF TEST DESCRIPTIONS

A. PURPOSE OF TEST.
B. LOADING PROCEDURES.
C. PROGRAM CONTROL.
D. TEST PROCEDURE.
E. STOPS.
F. PRINTOUTS.
G. COMMENTS.

THE WRITE-UP INCLUDES A FLOW CHART, A LIST OF PROGRAM INSTRUCTIONS, AND A LISTING OF ALL CARDS. TEST DECKS ARE PROVIDED FOR CARD SYSTEMS. A TEST TAPE IS PROVIDED FOR MODEL D SYSTEMS.

SENSE SWITCHES

B ON	LOOPS PORTION OF PROGRAM FOR SCOPING.
C ON	CAUSES CORRECT OPERATION TO PRINT OUT.
D ON	LOOPS ENTIRE PROGRAM
E ON	CAUSES PROGRAM TO HALT ON ERROR.
F	THE USE OF THESE TWO SENSE SWITCHES
G	VARY WITH DIFFERENT DFT'S.

THE PURPOSE OF A FLOW CHART IS TO DISPLAY IN A GENERAL WAY THE SEQUENTIAL STEPS THAT ARE NECESSARY TO EXECUTE A PROGRAM OF INSTRUCTIONS FOR A GIVEN TEST. ALTHOUGH THE FLOW CHARTS PROVIDED WITH EACH TEST DIFFER IN THE MAIN BODY OF THE PROGRAM, THE PRELIMINARY STEPS PRECEDING THE MAIN BODY AND THOSE THAT FOLLOW ARE ESSENTIALLY ALIKE.

THE GENERAL FLOW CHART DEPICTED HERE IS DESIGNED TO SHOW THOSE STEPS THAT ARE COMMON TO A MAJORITY OF THE FLOW CHARTS, PARTICULARLY THOSE THAT EMPLOY THE TITLE AND HEADING PRINT ROUTINE.

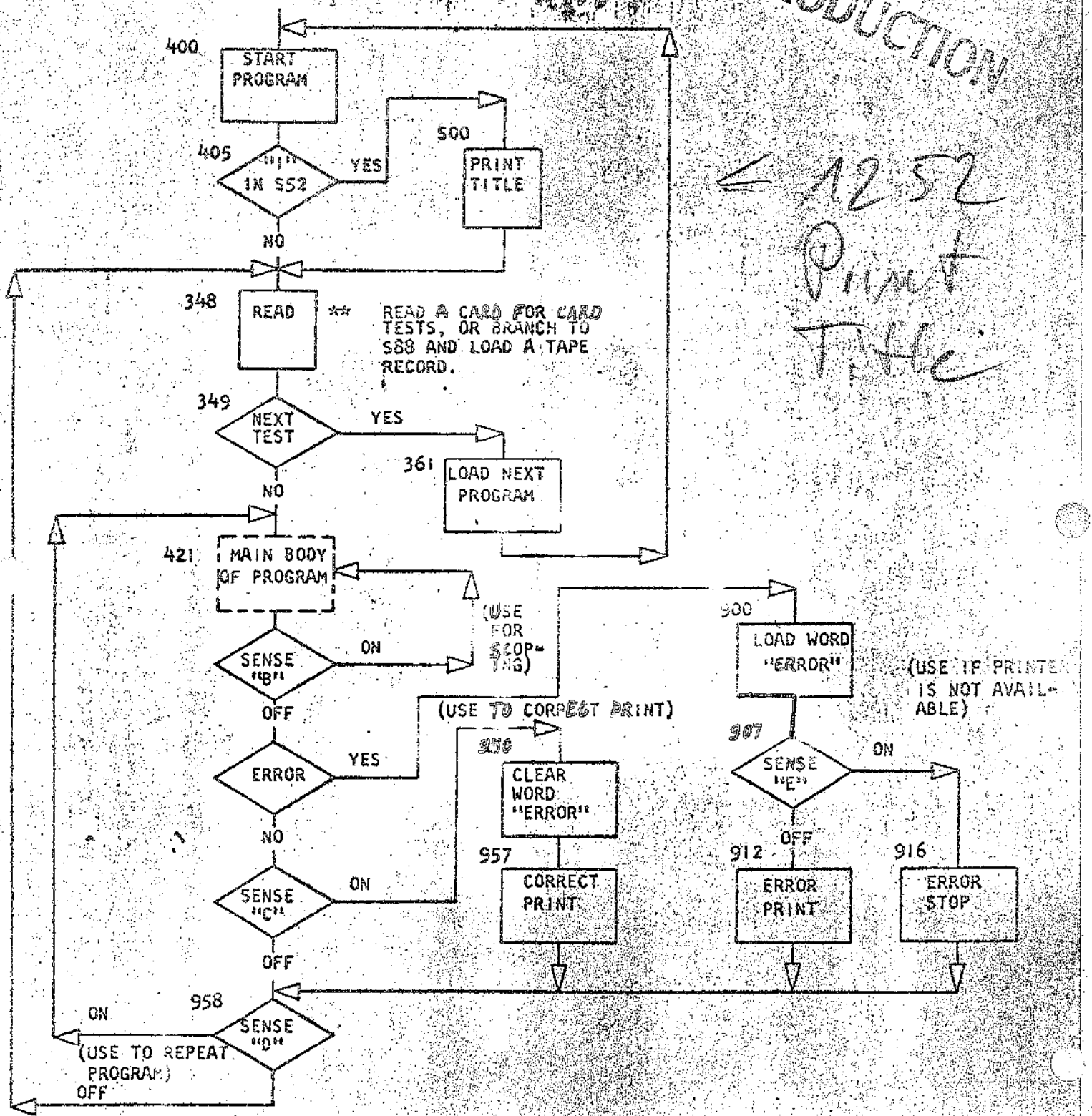
NOTICE THAT AFTER THE MAIN BODY OF THE PROGRAM, STEPS INCLUDE REFERENCE TO SENSE SWITCHES B, C, D, AND E. IF SENSE SWITCHES ARE NOT ON YOUR MACHINE, DISREGARD SEQUENCE FLOWS INDICATED BY THE ON SIDE OF THE SWITCHES.

WHEN SENSE SWITCHES ARE USED IN THE PROGRAM AND ARE NOT AVAILABLE IN THE 1401, THESE INSTRUCTIONS MUST BE CHANGED TO UNCONDITIONAL BRANCHES OR ELSE BYPASSED USING A NO-OP.

GENERAL FLOW CHART

PRODUCTION

≤ 1252 Print THE



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TROUBLE ANALYSIS PROCEDURE

PROGRAM EXECUTION MAY BE STOPPED AT ANY POINT BY USING THE ADDRESS STOP FEATURE. NOTE -- INPUT OUTPUT OPERATIONS CANNOT BE STOPPED DURING THE EXECUTE PORTION.

SINGLE CYCLE PROCESS MAY BE USED IN THESE PROGRAMS.

I/E MODE MAY BE USED DURING THE OPERATION OF THESE PROGRAMS.

SCOPING PROCEDURE

TWO METHODS ARE PROVIDED IN THE MAJORITY OF TESTS FOR INDICATING ERRORS. BOTH METHODS ARE UNDER THE CONTROL OF SENSE SWITCH E.

1. WHEN THIS SWITCH IS ON, THE MACHINE STOPS FOR ANY DETAIL CARD PROCESSED IN ERROR.
2. WHEN THIS SWITCH IS OFF, THE MACHINE PRINTS THE ERROR RESULT AND CONTINUES WITH OUT INTERRUPTION.

IN THE FIRST CASE, THE CARD PROCESSED IN ERROR MAY BE RE-PROCESSED INDEFINITELY BY SETTING SENSE SWITCHES B AND D TO THE ON POSITION AND PRESSING THE START KEY.

1. SENSE SWITCH D BRANCHES TO THE MAIN BODY OF THE PROGRAM.
2. SENSE SWITCH B EXECUTES THE MAIN OPERATION TESTED IN THE PROGRAM IN A TIGHT LOOP REPEATEDLY.

IN THE SECOND CASE, BECAUSE THE MACHINE CONTINUES WITHOUT INTERRUPTION AFTER AN ERROR IS DETECTED, THE FOLLOWING PROCEDURE IS RECOMMENDED.

1. STOP THE MACHINE MANUALLY.
2. SET SENSE SWITCHES B AND D TO THE ON POSITION.
3. REMOVE CARDS FROM THE HOPPER AND PERFORM A NON-PROCESS RUN-OUT TO CLEAR THE FEED.
4. REMOVE CARDS FOR THE BLOCK BEING TESTED FROM THE STACKER.
5. IF THE PROGRAM FOR THE ERROR CARD IS STILL IN STORAGE, REPLACE THE ERROR CARD IN THE HOPPER. PRESS THE START KEY.
6. IF THE PROGRAM FOR THE ERROR CARD IS NOT IN THE MACHINE, PLACE INSTRUCTION CARDS IN FRONT OF THE ERROR CARD, AND RE-RUN BY PRESSING THE LOAD KEY. IT MAY BE NECESSARY TO TURN THE PROCESS CHECK STOP SWITCH OFF IN ORDER TO KEEP THE PROGRAM RUNNING FOR SCOPING.

CARD READ ADDER

THE TESTS CANNOT BE RUN FROM CARDS IF THE ADDER CIRCUITRY IS NOT OPERATING PROPERLY. IF TROUBLE IS EXPERIENCED IN READING CARDS, TEST THE ADDER MANUALLY.

1. BY USE OF THE CONSOLE, SET UP THE FOLLOWING CONSTANTS IN THE LOCATIONS INDICATED

LOCATIONS	219	220	221	222	332	333
CONSTANTS						
C-BIT		X	X	X	X	X
B-BIT						
A-BIT					X	
8-BIT	X	X		X	X	X
4-BIT						
2-BIT		X		X	X	X
1-BIT	X		X			
WORD MARK	X		X		X	

2. MANUALLY SET UP THE FOLLOWING INSTRUCTIONS

INST. ADDR.	OP	A	B	REMARKS	RESULTS IN LOCATIONS 110: C	B	A	8	4	2	1	M	111: C	B	A	8	4	2	1	M
400	L	220	111	LOAD 90 INTO 90				X			X	X	X			X		X		
407	S	222	111	SUBTRACT 10 80	X			X				X	X	X	X	X		X		
414	S	222	111	SUBTRACT 10 70	X				X	X	X	X	X	X	X	X		X		
421	S	222	111	SUBTRACT 10 60					X	X		X	X	X	X	X		X		
428	S	222	111	SUBTRACT 10 50					X		X	X	X	X	X	X		X		
435	S	222	111	SUBTRACT 10 40	X				X			X	X	X	X	X		X		
442	S	222	111	SUBTRACT 10 30						X	X	X	X	X	X	X		X		
449	S	222	111	SUBTRACT 10 20	X					X		X	X	X	X	X		X		
456	S	222	111	SUBTRACT 10 10	X						X	X	X	X	X	X		X		
463	S	222	111	SUBTRACT 10 00				X		X		X	X	X	X	X		X		
470	A	333	111	ADD 0 TO 0	X		X	X		X		X	X	X	X	X		X		
477	A	333	111	ADD 0 TO 0	X	X		X		X		X	X	X	X	X		X		
484	A	333	111	ADD 0 TO 0		X	X	X		X		X	X	X	X	X		X		
491	.	400		STOP AND BRANCH 0		X	X	X		X		X	X	X	X	X		X		
495				WORD MARK																

3. EXECUTE THE PROGRAM.
TO CHECK RESULTS IN LOCATIONS 110 AND 111 AFTER EACH INSTRUCTION IS EXECUTED, SET MODE SWITCH TO SINGLE CYCLE PROCESS, OR SET TO I/E, OR SET TO ADDRESS STOP.

4. TO SCOPE ROUTINE, MANUALLY ENTER BRANCH OP IN LOCATION 491, SET PROCESS CHECK SWITCH TO OFF, AND LOOP PROGRAM.

TITLE CARD

EXAMPLE

```
COLUMNS
0        1        2        3        4        5        6        7        8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

,008015,022029,033033N      1001                DIVIDE                  32108 0A
```

THIS CARD HAS THREE FUNCTIONS

1. WHEN THE DECK IS RUN SEPARATELY, IT SETS WORDMARKS SO THAT THE FEED AND BRANCH INSTRUCTION, 1001, IN THIS CARD WILL CAUSE THE NEXT CARD TO FEED AND THE PROGRAM TO GO TO 001.
2. WHEN TESTS ARE RUN CONSECUTIVELY -- CHAINED --, THE A IN COLUMN 80 WILL BE RECOGNIZED BY THE CHAINING ROUTINE OF THE PREVIOUS TEST AS SOON AS THAT TEST HAS ENDED AND ITS PROGRAM BRANCHES TO 348. THE A WILL CAUSE A BRANCH IN THE CHAINING ROUTINE SO THAT THE READ-IN AREA IS CLEARED, A WM IS SET IN 001, A CARD IS FED, AND THE PROGRAM BRANCHES TO 001. THE CARD FED WILL BE THE SECOND CARD OF THE DECK -- THE FIRST CHAINING CARD.
3. WHEN THE DECK IS READ FROM TAPE, THE A IN LOCATION 080 PREVENTS A BRANCH TO 377 AND CAUSES THE NEXT RECORD TO READ IN. TESTS ON TAPE START IN 377. THUS THE TITLE CARD IS NOT TREATED AS A DETAIL CARD OF THE PREVIOUS TEST. THE NEXT TEST, CORRESPONDING TO THE TITLE CARD, IS READ INTO STORAGE.

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CHAINING ROUTINE

EXAMPLE

```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
L067367,340344,348349,357361!001,008012,001!001!B361080A8421/340080      32108 03
```

THE INFORMATION IS PLACED IN STORAGE AS FOLLOWS

```
STORAGE LOCATION
3         3         3         3         3         3         3         4         4
3         4         5         6         7         8         9         0         1
12345678901234567890123456789012345678901234567890123456789012345678901234567890

  ,008012,001!001!B361080A8421/340080
  !     !   !  !!      !   !     !
```

THIS ROUTINE HAS THREE FUNCTIONS:

1. IT CAUSES THE SECOND CARD IN THIS TEST TO FEED.
2. IT CAUSES DETAIL CARDS FOR THIS TEST TO FEED.
3. IT CAUSES THE TITLE CARD FOR THE NEXT TEST TO FEED.

ANY CARD THAT DOES NOT FEED BECAUSE OF THE CHAINING ROUTINE IS FED BECAUSE OF THE FEED AND BRANCH ROUTINE, 1001, THAT IS PUNCHED IN THE CARD JUST AHEAD OF IT IN THE DECK.

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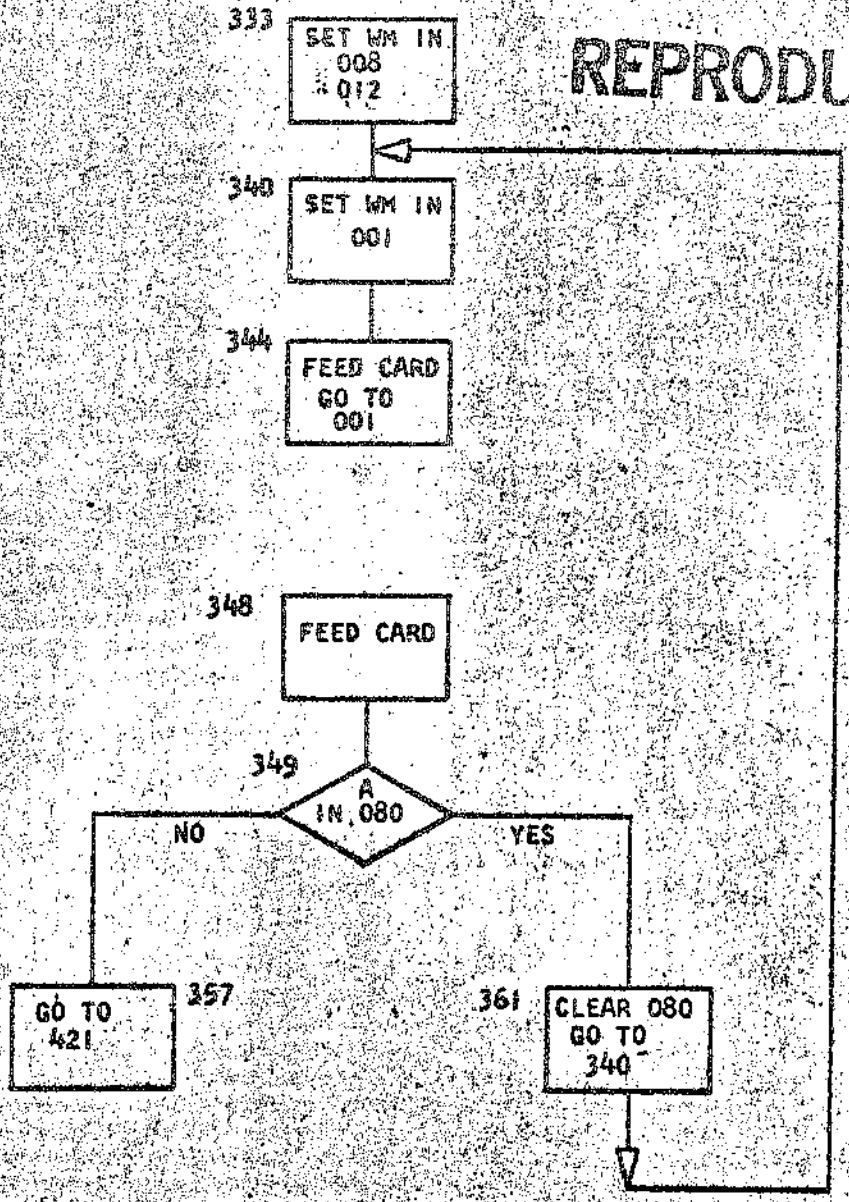
CHAINING ROUTINE FLOW CHART



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TITLE PRINT ROUTINE

EXAMPLE

```
COLUMNS
0        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
L070S17,S00501,S05912,S13S17100IRESULTS IS      2,049L0772772/2772  3210B 16
L062S47,S25529,S36537,S41545100I /40/60 /80L/892702/2702413         3210B 17


THE INFORMATION IS PLACED IN STORAGE AS FOLLOWS
STORAGE LOCATION
/        S         S         S         S         S         S         S         S
9        0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890

          2,049L0772772/2772=040/60=/80L/892702/2702413
```

THIS ROUTINE HAS THREE FUNCTIONS

1. IT CAUSES THE HEADING INFORMATION FROM THE TRAILER CARD TO BE PRINTED.
2. IT CAUSES THE COLUMNS -- RESULTS ARE, RESULTS SHOULD BE -- TO BE PRINTED IF THIS INFORMATION IS INCLUDED IN THE TEST.
3. IT CAUSES A BRANCH INTO THE MAIN PROGRAM AT 413.

THE BRANCH CHARACTER EQUAL INSTRUCTION THAT TESTS FOR TITLE PRINT 1 IN 552, IS ADDRESSED AT 405 AND OCCUPIES CORE STORAGE LOCATIONS 405 - 412. SEE PROGRAM INSTRUCTION CARDS.

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IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451398
SHEET 11 OF 16
BLOCK NO.

CARDS NEEDED FOR TAPE OPERATION

EXAMPLE


```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
L069404,377385,389393,4004041001            B389S581BS88N000M360392/332/   32108 04
```

THE INFORMATION IS PLACED IN STORAGE AS FOLLOWS

```
STORAGE LOCATION
3         3         3         3         4         4         4         4         4
6         7         8         9         0         1         2         3         4
12345678901234567890123456789012345678901234567890123456789012345678901234567890

                    B389S581BS88N000M360392/332/
                    1       1  1   1       1  1                              1
```

WHEN THE TEST IS RUN, IT WILL BE MODIFIED AS FOLLOWS TO PREVENT MORE THAN ONE TITLE PRINT OUT.

```
STORAGE LOCATION
3         3         3         3         4         4         4         4         4
6         7         8         9         0         1         2         3         4
12345678901234567890123456789012345678901234567890123456789012345678901234567890

                    B389S581BS88B421M360392
                    1       1   1   1     1
```

THIS ROUTINE HAS THREE FUNCTIONS WHEN TESTS ARE RUN FROM TAPE

1. IT ALLOWS THE TEST TAPE OPERATION OF THE TESTS TO START IN 377.
2. IF THE TEST IS NOT SELECTED, BY HAVING THE SELECTION DIGIT ENTERED IN STORAGE, THE BRANCH TO S88 CAUSES THE NEXT RECORD TO READ IN. THIS RECORD WILL BE A TITLE CARD, A TAPE MARK, OR A DETAIL CARD. DETAIL CARDS FOR THE TEST ARE BYPASSED BECAUSE OF THE BRANCH TO S88.
3. IF THE TEST IS SELECTED, THE TITLE CARD IS ALLOWED TO PRINT ONCE. THE TITLE PRINT IS BYPASSED FOR DETAIL RECORDS USED IN THE TEST. DETAIL CARDS ARE USUALLY WRITTEN AS DETAIL RECORDS ON TAPE -- 80 CHARACTERS PER RECORD. AFTER EACH DETAIL RECORD IS READ IN, THE READ TEST TAPE ROUTINE BRANCHES TO 377.

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CARDS NEEDED FOR TAPE OPERATION

EXAMPLE


```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
L069404,377385,389393,400404100;          B389S581BS88N000M360392/332/   32108 04
```

THE INFORMATION IS PLACED IN STORAGE AS FOLLOWS

```
STORAGE LOCATION
3         3         3         3         4         4         4         4         4
6         7         8         9         0         1         2         3         4
12345678901234567890123456789012345678901234567890123456789012345678901234567890

                    B389S581BS88N000M360392/332/
                    |       |   |   |       |   |                               |
```

WHEN THE TEST IS RUN, IT WILL BE MODIFIED AS FOLLOWS TO PREVENT MORE THAN ONE TITLE PRINT OUT.

```
STORAGE LOCATION
3         3         3         3         4         4         4         4         4
6         7         8         9         0         1         2         3         4
12345678901234567890123456789012345678901234567890123456789012345678901234567890

                    B389S581BS88B421M360392
                    |       |   |   |       |
```

THIS ROUTINE HAS THREE FUNCTIONS WHEN TESTS ARE RUN FROM TAPE

1. IT ALLOWS THE TEST TAPE OPERATION OF THE TESTS TO START IN 377.
2. IF THE TEST IS NOT SELECTED, BY HAVING THE SELECTION DIGIT ENTERED IN STORAGE, THE BRANCH TO S88 CAUSES THE NEXT RECORD TO READ IN. THIS RECORD WILL BE A TITLE CARD, A TAPE MARK, OR A DETAIL CARD. DETAIL CARDS FOR THE TEST ARE BYPASSED BECAUSE OF THE BRANCH TO S88.
3. IF THE TEST IS SELECTED, THE TITLE CARD IS ALLOWED TO PRINT ONCE. THE TITLE PRINT IS BYPASSED FOR DETAIL RECORDS USED IN THE TEST. DETAIL CARDS ARE USUALLY WRITTEN AS DETAIL RECORDS ON TAPE -- 80 CHARACTERS PER RECORD. AFTER EACH DETAIL RECORD IS READ IN, THE READ TEST TAPE ROUTINE BRANCHES TO 377.

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SET WORDMARK CARD

THE SET WM CARD HAS THIS FORMAT.

```
COLUMNS
0        1        2        3        4        5        6        7        8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

,008015,022029,033033N      1001                  SET WORDMARK CARD      XXXXX 02
```

THE SET WM CARD IS NECESSARY ONLY WHEN DECKS ARE CHAINED. AFTER THE TITLE CARD IS READ, THE READ AREA IS CLEARED, A WM IS SET IN COLUMN 1, A CARD IS FED, AND THE PROGRAM BRANCHES TO COLUMN ONE. ALL THIS IS THE RESULT OF THE CHAINING ROUTINE. CONSEQUENTLY, WORD MARKS MUST AGAIN BE SET UP FOR THE PACKED CARDS. THE SET WORDMARK CARD DOES THIS.

CLEAR WORDMARK CARD

THE CLEAR WM CARD HAS THIS FORMAT.

```
COLUMNS
0        1        2        3        4        5        6        7        8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

/333080N                                    CLEAR WORDMARK CARD     XXXXX 36
```

THIS CARD CAUSES THE READ-IN AREA TO BE CLEARED AND CAUSES A BRANCH TO THE CHAINING ROUTINE. THE CHAINING ROUTINE SETS UP WORD MARKS FOR THE TRAILER CARD AND CAUSES THE TRAILER CARD TO FEED.

DETAIL CARDS

EXAMPLE NUMBER 1

```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

0                   1                   ÷01                                32108 20
```

EXAMPLE NUMBER 2

```
COLUMNS
0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

R9# I-,@ +8%1+.*/2 ¤JS3-AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR¢# I-,@+8%1+.*/2 ¤
```

DETAIL CARDS USUALLY HAVE THE BLOCK NUMBER, SUFFIX, AND CARD SEQUENCE PUNCHED IN COLUMNS 73 THROUGH 80. HOWEVER SOME DETAIL CARDS DO NOT HAVE THIS BECAUSE THEY CONTAIN 80 COLUMNS OF INFORMATION.

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TEST TAPE PROCEDURE

FOR MAGNETIC TAPE SYSTEMS OTHER THAN MODEL D, CARD DECKS ONLY ARE SUPPLIED. TEST PROGRAMS MAY BE TRANSFERRED TO TAPE BY USE OF WRITE TEST TAPE ROUTINE BLOCK NUMBERS 5300 AND 1T01. HOWEVER, SINCE TRANSFERRING PROGRAMS FROM CARDS TO TAPE, OR COPYING FROM TAPE TO TAPE, REQUIRES AT LEAST A 2K OR 4K PROCESSING UNIT, TAPE SYSTEMS WITH ONLY 1.4K CANNOT PREPARE THEIR OWN TAPE. IN SUCH CASES, PART NUMBER 451270 MAY BE ORDERED FOR NON-OVLP SYSTEMS.

NOTE: 1T01, 1T02, 1T03, 1T05, 1T06 AND 1T07 ARE SUPPLIED WITH ALL CARD SYSTEMS FOR THE CE'S CONVENIENCE.

1. TEST TAPES PREPARED BY THE PLANT FOR NON-OVLAP SYSTEMS.

THE TEST TAPE IS WRITTEN IN LOW DENSITY, 200 CHARACTERS PER INCH.

IBM 1401 MODEL D IS A SYSTEM WITHOUT CARD INPUT OR OUTPUT. THEREFORE, CUSTOMER ENGINEERING TESTS FOR MODEL D SYSTEMS MUST BE RUN FROM TAPE. THE TAPE FOR MODEL D SYSTEMS IS SUPPLIED IN LIEU OF CARD DECKS.

THE FIRST RECORD ON THE TAPE IS THE READ TEST TAPE ROUTINE, BLOCK NUMBER 5310. THIS PROGRAM EXECUTES ALL TEST PROGRAMS FROM TAPE USING TAPE DRIVE NUMBER 1. THE TITLE CARD FOR THIS ROUTINE WAS NEVER WRITTEN ON TAPE.

THE SECOND RECORD ON TAPE IS THE TITLE CARD FOR THE COPY TAPE ROUTINE. THE THIRD RECORD IS THE COPY TAPE ROUTINE, BLOCK NUMBER 5320. THIS PROGRAM REQUIRES AT LEAST A 2K PROCESSING UNIT AND IS USED ONLY WHEN IT IS DESIRED TO DUPLICATE THE MASTER TAPE REEL FROM TAPE DRIVE NUMBER 1 TO TAPE DRIVE NUMBER 2. TO EXECUTE THIS PROGRAM, A 1 MUST BE MANUALLY ENTERED IN LOCATION 554, 1254.

THE REST OF THE REEL CONTAINS TITLE CARDS, PROGRAM INSTRUCTIONS, AND DETAIL CARDS FOR ALL TESTS THAT MAY BE RUN ON MAGNETIC TAPE SYSTEMS. THE TITLE AND DETAIL CARDS ARE 80 CHARACTER RECORDS. THE PROGRAM INSTRUCTIONS ARE 1249 CHARACTER RECORDS. FOR THE MOST PART, THE TESTS ARE ON TAPE IN BLOCK NUMBER SEQUENCE. SOME OF THESE TESTS CANNOT BE RUN ON MODEL D SYSTEMS.

ONE TAPE DRIVE IS REQUIRED TO RUN THESE TESTS FROM TAPE.

1. TAPE DRIVE NUMBER 1 TO READ THE MASTER TAPE REEL.
2. TAPE DRIVE NUMBER 4 TO USE AS A WORKING REEL FOR BLOCKS IN THE 5000 SERIES. TWO TAPE DRIVES CAN BE USED TO ADVANTAGE HERE.

TITLE AND HEADING PRINTOUT IS AUTOMATICALLY PROVIDED SINCE A 1 IN S52 WAS INCLUDED IN THE READ TEST TAPE ROUTINE WHEN THE TEST TAPE WAS MADE AT THE PLANT. IF TITLE AND HEADING PRINTOUT IS NOT DESIRED, THE 1 IN S52 MUST BE REMOVED BY USE OF THE ENTER KEY WHEN THE SELECTION DIGITS ARE SETUP.

2. TO WRITE TESTS ON TAPE, REFER TO 5300 OR 1T01 WRITE UP.

3. TO RUN TESTS FROM TAPE, REFER TO 5310 OR 1T02 WRITE UP.

4. TO COPY TEST TAPES, REFER TO 5320 OR 1T03 WRITE UP.

DATE	5-15-62	3-18-63	5-6-63	6-29-63	17.10.63			
CHG. NO.	115283	116745	117635	117628	TA1976			

DIAGNOSTIC FUNCTION TEST

TEST CHARACTER AND BRANCH

A. PURPOSE

TO TEST THE TEST CHARACTER AND BRANCH CIRCUITRY BY USING CHARACTERS 1,2,4,8,/,-,&, AND "BLANK" AS d - MODIFIERS.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D. ON TO REPEAT USING SAME DETAIL CARD
OFF TO CONTINUE

E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

THE INFORMATION TESTED IS ON DETAIL CARDS. THE d-CHARACTER IS IN COLUMN 2. THE ROUTINE USED IS SELECTED BY A NO-OP OR BRANCH OP IN COLUMN 72 WHICH IS MOVED INTO THE PROGRAM AT LOCATION 456.

AN EQUAL ROUTINE AT 500 TESTS ONE POSITION FOR AN EQUAL (CARD COLUMN 22).

AN UNEQUAL ROUTINE AT 467 TESTS THREE POSITIONS FOR AN UNEQUAL (CARD COLUMNS 24, 23, AND 22).

E. STOPS

920 IN STORAGE ADDRESS REGISTER. ERROR WITH SENSE E ON.

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110376	116745	TA-10844					

F. PRINTOUTS

1. CORRECT RESULTS

D MODIFIER	B FIELD CHARACTERS	RESULT SHOULD BE	RESULT IS	
1	1	EQUAL	EQUAL	B
2	2	EQUAL	EQUAL	B
1	24	UNEQUAL	UNEQUAL	N
1	8/-	UNEQUAL	UNEQUAL	N

2. ERROR RESULTS

D MODIFIER	B FIELD CHARACTERS	RESULT SHOULD BE	RESULT IS	
1	1	EQUAL	B	ERROR
2	2	EQUAL	B	ERROR
1	24	UNEQUAL	N	ERROR
1	8/=	UNEQUAL	N	ERROR

NOTE: IN THE CASE OF TEST FOR UNEQUAL CHARACTERS THE d MODIFIER (1 IN EXAMPLE 3) WAS COMPARED WITH B FIELD CHARACTERS 4, 2, AND BLANK IN THAT ORDER, IN EXAMPLE 4 IT WAS COMPARED WITH -, /, AND 8. THE FIRST ERROR DETECTED CAUSED THE ERROR PRINT-OUT.

G. COMMENTS

THE BRANCH INSTRUCTION AT 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 50 LOOPS PER CARD.

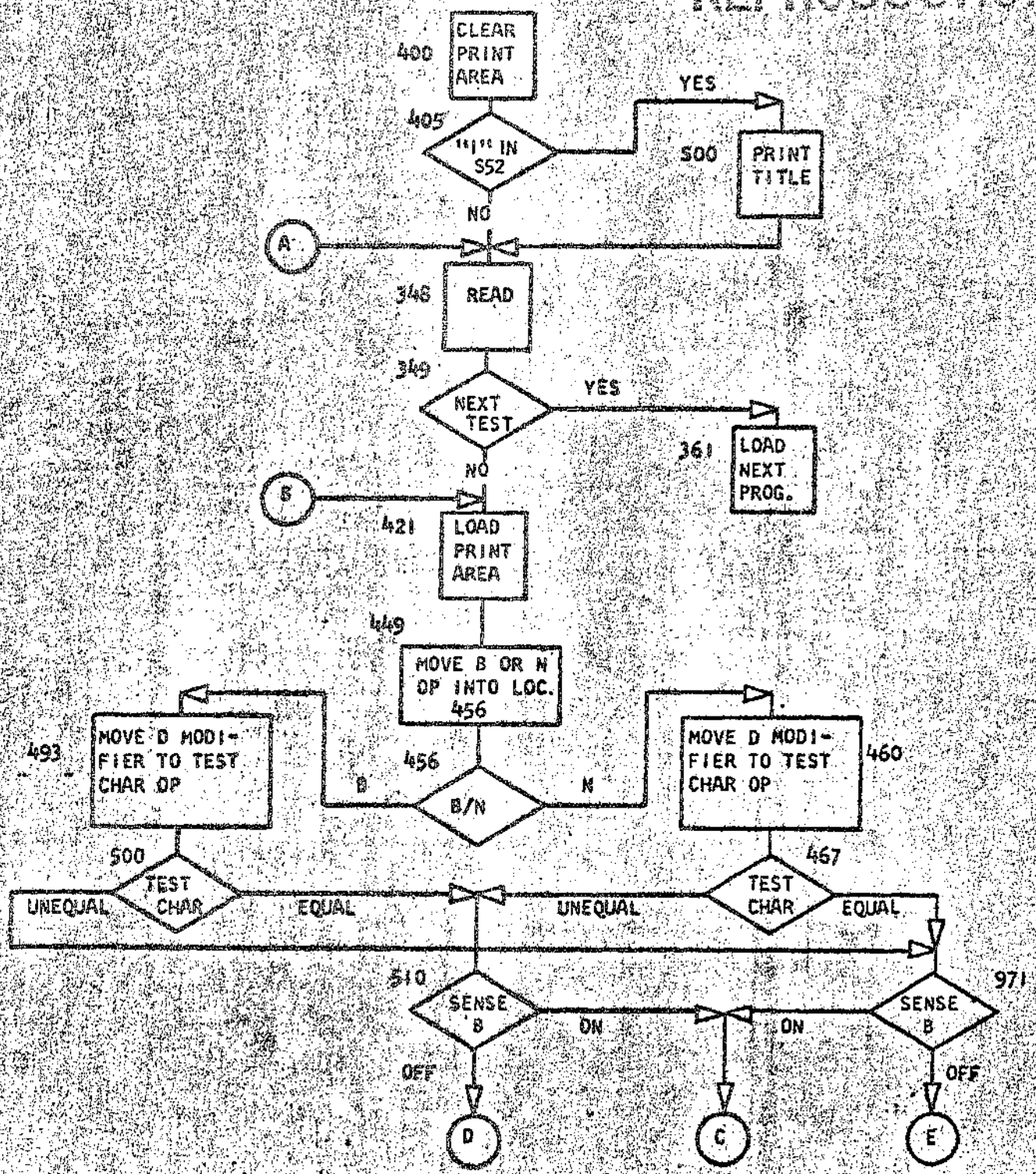
DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

IBM

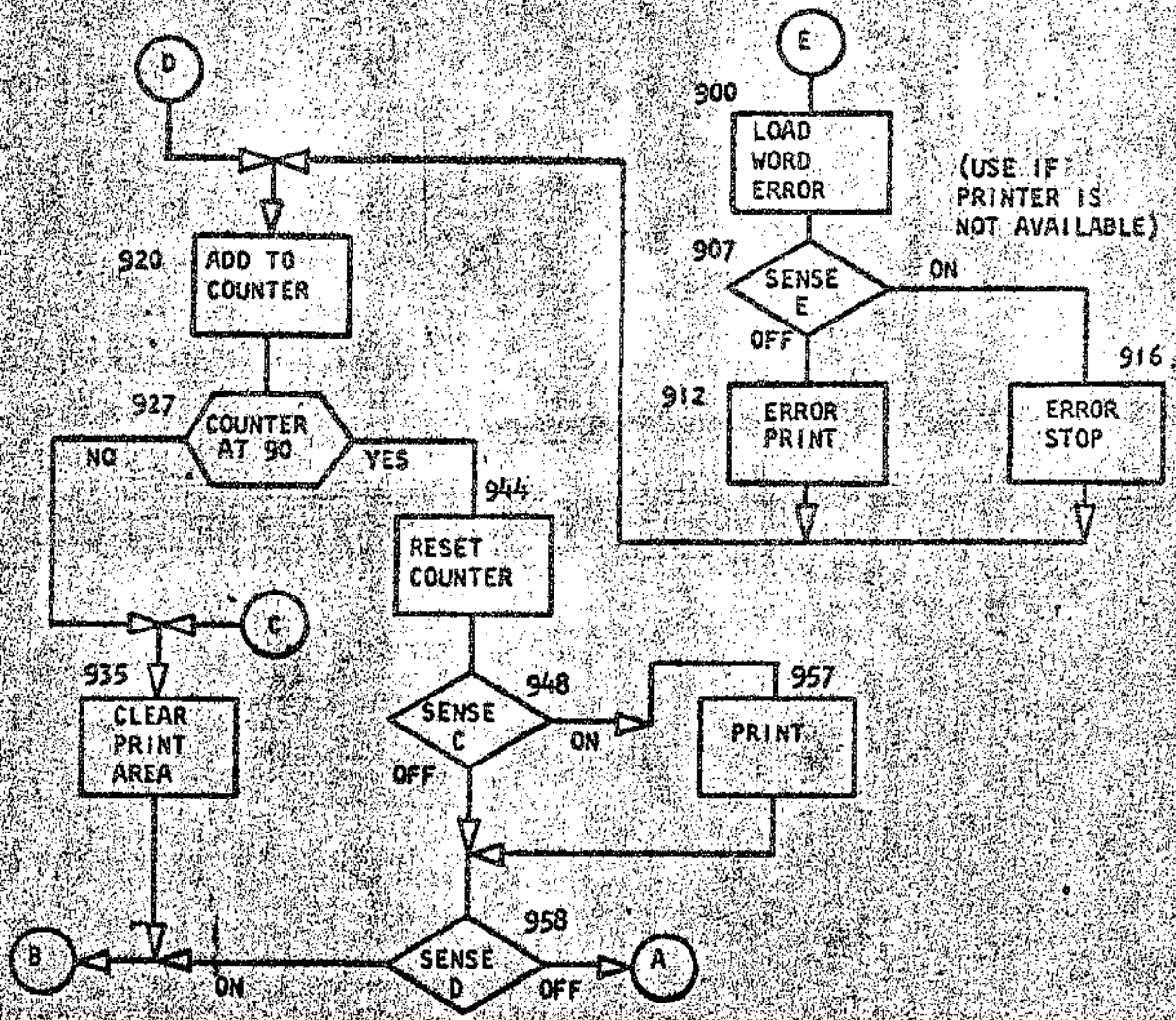
DIAGNOSTIC FUNCTION TEST

PART NO. 451402
SHEET 3 OF 8
BLOCK NO. 0050B

TEST CHARACTER AND BRANCH FLOW CHART



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	[illegible]					



DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

TEST CHARACTER + BRANCH


```
INSTRUCTION
  ADDRESS   OP  A     B          REMARKS

 377  377   B  389                USE WHEN TESTS ARE RUN FROM TAPE
 385  385   B  588                  ,,
 389  389   N  000                  ,,
 393  393   M  360  392            ,,
 400  400   /  332                START TEST
 404  404   /                       ,,
 405  405   B  500  5521           BR TO TITLE PRINT ROUTINE IF 1 IN 552
 413  413   /  080                CLEAR READ AREA
 417  417   B  348                BRANCH TO PROGRAM CHAINING ROUTINE
 421  421   ,  001  078            LOAD PRINT AREA
 428  428   L  080  299              ,,
 435  435   L  072  272              ,,
 442  442   ,  202  241            DEFINE FIELDS
 449  449   M  072  456            MAKE OP CODE
 456  456      493                 *BRANCH OR NO-OP
 460  460   M  202  474            SETUP TEST CHARACTER
 467  467   B  971  224X           *BRANCH IF ERROR
 475  475   B                        ,,
 476  476   B                        ,,
 477  477   B  935  B              LOOP ON SW B                          SS
 482  482   L  247  267            LOAD REMARKS
 489  489   B  920                 GO TO CORRECT ROUTINE
 493  493   M  202  507            SETUP TEST CHARACTER
 500  500   B  477  222X           *BRANCH IF NO ERROR
 508  508   B  971                 GO TO SWITCH B
 512  512                          *AN ASTERISK MEANS INSTRUCTION CHANGES
 900  900   L  /14  285            BEGIN ERROR PRINT ROUTINE
 907  907   B  916  E              E ON TO ERROR STOP                    SS
 912  912   2  920                 ERROR PRINT
 916  916   .  920                 ERROR STOP
 920  920   A  920  970            ADD ONE TO OPERATION COUNTER
 927  927   B  944  9699           BRANCH AFTER 90 OPERATIONS      C FOR TA
 935  935   /  332                 CLEAR PRINT AREA
 939  939   /                        ,,
 940  940   B  421                 BRANCH TO REPEAT
 944  944   S  970                 RESET OPERATION COUNTER
 948  948   B  957  C              C ON FOR CORRECT PRINT                SS
 953  953   B  958                 BRANCH TO SENSE D
 957  957   2                      PRINT CORRECT RESULTS
 958  958   B  421  D              D ON TO REPEAT                        SS
 963  963   B  348                 BRANCH TO PROG. CHAINING ROUTINE
 967  967   0  00+                 OPERATION COUNTER
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CNG. NO.	110378	116745	TA-1844					

```
 971  971  B 935 B          LOOP ON SW B                    SS
 976  976  B 900            GO TO ERROR ROUTINE
 980  980                   WORDMARK
1110  /10  E RRO R          CONSTANTS
1115  /15                      '0'
1120  /20  0  MO DIFIER       '1'
1140  /40  8  FI ELD CHARACTERS '2'
1160  /60  R ESU LT SHOULD BE  '4'
1180  /80  # ESU LT IS         '8'
```


DATE	2-2-61	3-17-63	10.5.63					
J. CHG. NO.	110378	116745	TA-1844					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    TEST CHARACTER + BRANCH 00508004
,008015,022029,033033N          1001                    SET WORDMARK CARD       00508 02
L067367,340344,348349,357361|1001,008012,001100118361080A8421/340080            00508 03
L069404,377385,389393,400404|1001          8389     BS88N000M360392/332/        00508 04
L069441,413417,421428,435442|1001BS00S521/0808348,001078L080299L072272          00508 05
L067478,449456,460467,475476|1001,20224|M072456 493M202474897|224XBB            00508 06
L068512,482489,493500,508512|1001B935BL247267B920N202507B477222XB971            00508 07
L071938,907912,916920,927935|1001L/1428S8916E2920.920A920970B9449699/332         00508 08
L056962,940944,948953,957958|1001/8421S970B957CB9582B4210                       00508 09
L049979,967971,976980,980980|1001B348000PB935BB900                              00508 10
                                                ¿
L065/39¤/07/07,/10/15,/20/40|1001    ERROR    0 MODIFIER                        00508 11
L072/79,/60/80,/80/80,/80/80|1001B FIELD CHARACTERS  RESULT SHOULD BE           00508 12
L070S17,$00S01,S05S12,S13S17|1001RESULT IS              2,049L0772772/2772      00508 13
L059S44,$25S29,S36S37,S41S45|1001¤/40/60¤/80L/892702/2702413                    00508 14
/333Q80N                                          CLEAR WORDMARK CARD           00508 15
,019027,031,038042|803|T98GB4D0L046352BW048S88   TEST CHARACTER + BRANCH 00508 16
                                                M
```

DETAIL CARDS

&	&	EQUAL		800508 17
-	-	EQUAL		800508 18
G	G			
M	M			
1	1	EQUAL		800508 19
2	2	EQUAL		800508 20
4	4	EQUAL		800508 21
8	8	EQUAL		800508 22
/	/	EQUAL		800508 23
¤	¤	EQUAL		800508 24
	12	UNEQUAL		N00508 25
	8/-	UNEQUAL		N00508 26
	2	UNEQUAL		N00508 27
	8/-	UNEQUAL		N00508 28
	1	UNEQUAL		N00508 29
	8/-	UNEQUAL		N00508 30
	12	UNEQUAL		N00508 31
	8/-	UNEQUAL		N00508 32
	12	UNEQUAL		N00508 33
	4/-	UNEQUAL		N00508 34
	12	UNEQUAL		N00508 35
	48-	UNEQUAL		N00508 36
	12	UNEQUAL		N00508 37

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	12-1844					

48/ UNEQUAL N00508 3

DATE	2-2-62	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

TEST FOR ZONE OR WM AND BRANCH

A. PURPOSE OF TEST

TO TEST THE TEST FOR ZONE OR WM AND BRANCH CIRCUITRY BY USING ONE AT A TIME THE NINE DIFFERENT d -CHARACTERS, NAMELY, 1,2,8,K,S,3,C,L, AND T.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

CHECK THAT EACH d -CHARACTER CAUSES A BRANCH WHEN IT IS SUPPOSED TO AND DOES NOT CAUSE A BRANCH WHEN IT IS NOT SUPPOSED TO. THE d -CHARACTER IS IN COLUMN ONE OF THE DETAIL CARD. THE FIELD TESTED IS IN COLUMNS 21 THROUGH 24 OF THE DETAIL CARD. COLUMN 41 OF THE DETAIL CARD IS TESTED TO DETERMINE WHICH ROUTINE TO USE.

THE ROUTINE AT 493 EXPECTS A SUCCESSFUL BRANCH.

THE ROUTINE AT 466 DOES NOT EXPECT A SUCCESSFUL BRANCH.

CONDITIONS SPECIFIED BY THE d MODIFIER THAT MUST BE MET BY THE B FIELD CHARACTERS TO CAUSE A BRANCH ARE AS FOLLOWS:

D MODIFIER	B FIELD CHARACTER
1	WORD MARK
2	NO ZONE (NO-"A", NO-"B" BIT)
B	12-ZONE ("AB" BITS)
K	11-ZONE ("B", NO-"A" BIT)
S	ZERO-ZONE ("A", NO-"B" BIT)
3	EITHER A WORD MARK, OR NO ZONE
C	EITHER A WORD MARK, OR 12-ZONE
L	EITHER A WORD MARK, OR 11-ZONE
T	EITHER A WORD MARK OR ZERO-ZONE

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

D MODIFIER	B FIELD CHARACTERS	RESULT SHOULD BE	RESULT IS
B	A	EQUAL	EQUAL
2	4	EQUAL	EQUAL
1	*	EQUAL	EQUAL
L	%	EQUAL	EQUAL
B	KT4*	UNEQUAL	UNEQUAL
K	AT4%	UNEQUAL	UNEQUAL

2. ERROR

D MODIFIER	B FIELD CHARACTERS	RESULT SHOULD BE	RESULT IS
B	A	EQUAL	ERROR
2	4	EQUAL	ERROR
1	*	EQUAL	ERROR
L	%	EQUAL	ERROR
B	KT4*	UNEQUAL	ERROR
K	AT4%	UNEQUAL	ERROR

NOTE: IN THE CASE OF TEST FOR UNEQUAL ZONE OR WORD MARK THE d MODIFIER (B IN EXAMPLE 5) WAS COMPARED WITH THE B FIELD CHARACTERS *,4,T, AND K IN THAT ORDER; IN EXAMPLE 6 THE d MODIFIER(K) WAS COMPARED WITH %,4,T, AND A. THE FIRST ERROR DETECTED CAUSED THE ERROR PRINT-OUT.

G. COMMENTS:

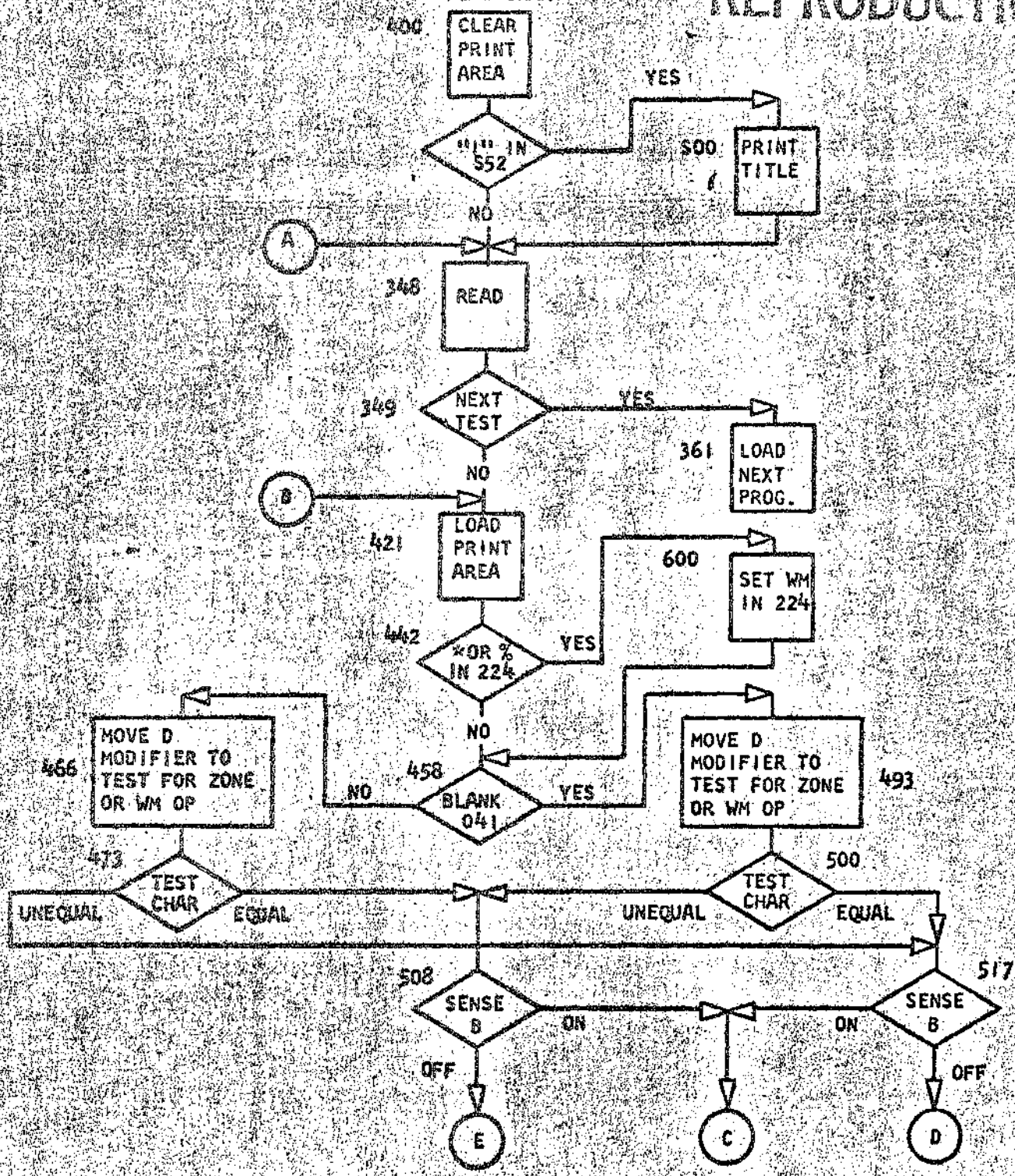
THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

IBM

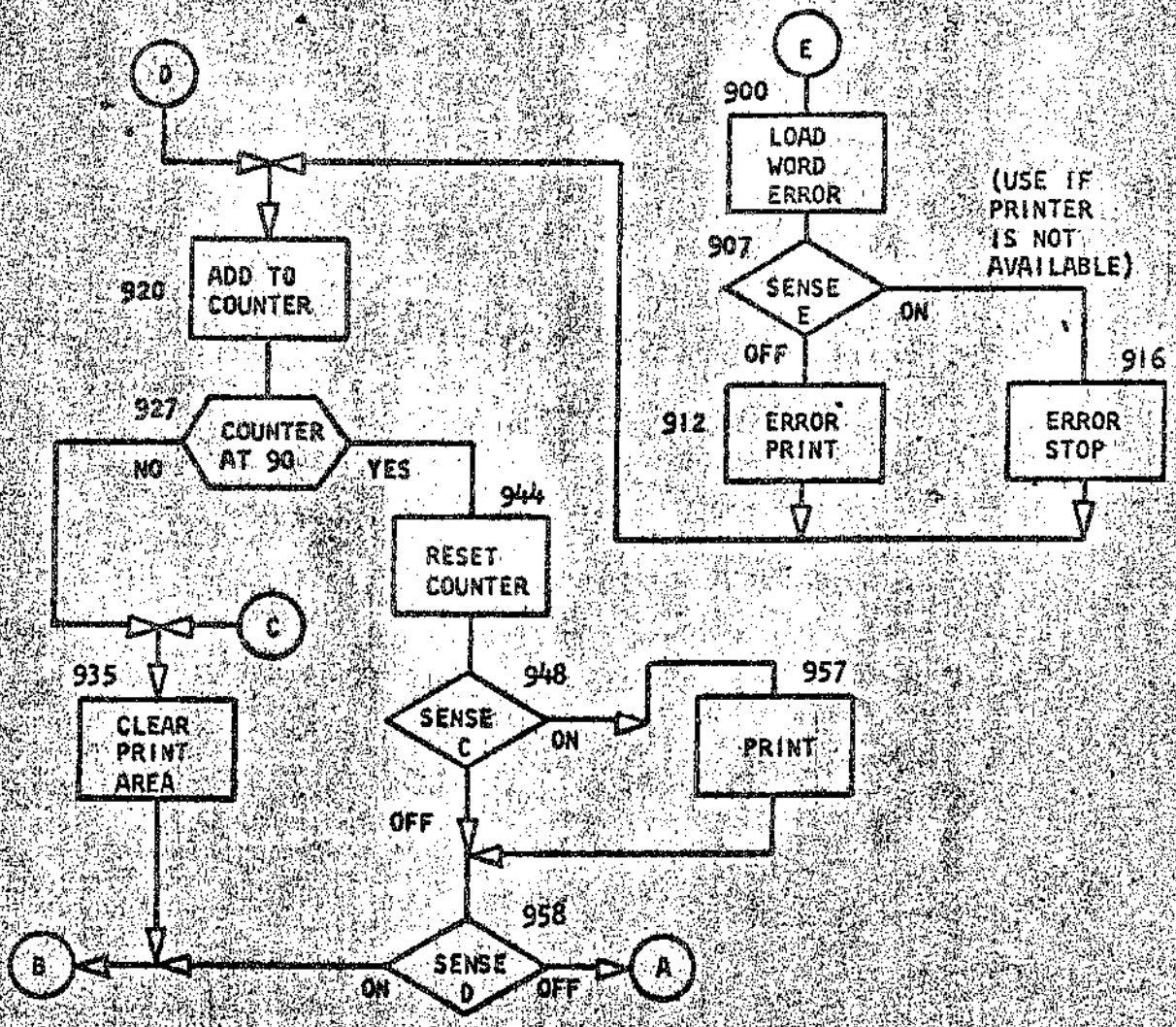
DIAGNOSTIC FUNCTION TEST

PART NO. 451403
SHEET 3 OF —
BLOCK NO. 00608

TEST FOR ZONE OR WM AND BRANCH FLOW CHART



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	116378	116745	TN-1844					



DATE	2-2-61	3-17-63	10.5.63					
J. CHG. NO.	110378	116745	TA-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

TEST ZONE OR WM + BR 00608

```
INSTRUCTION
  ADDRESS   OP A    B                    REMARKS
  377  377  B 389                        USE WHEN TESTS ARE RUN FROM TAPE
                                            ,,
                                            ,,
                                            ,,
  393  393  M 360 392
  400  400  / 332                        START TEST
  404  404  /                               ,,
  405  405  B 500 $521                   BR TO TITLE PRINT ROUTINE IF 1 IN $52
  413  413  / 080                        CLEAR READ AREA
  417  417  B 348                        BRANCH TO PROGRAM CHAINING ROUTINE
  421  421  , 001 078                    LOAD PRINT AREA
  428  428  L 080 299                        ,,
  435  435  L 072 272                        ,,
  442  442  B 537 224*                   GO SET WM
  450  450  B 537 224$                        ,,
  458  458  B 493 041                    GO TO EQUAL TEST
  466  466  M 201 480                    SETUP TEST CHARACTER FOR UNEQUAL
  473  473  V 508 224K                  *BRANCH IF ERROR
  481  481  V                                 ,,
  482  482  V                                 ,,
  483  483  V                                 ,,
  484  484  B 517                        BRANCH IF CORRECT
  493  493  M 201 507                    SETUP TEST CHARACTER FOR EQUAL
  500  500  V 517 224K                  *BRANCH IF CORRECT
  508  508  B 935 B                      LOOP ON SW B                          SS
  513  513  B 900                        GO TO ERROR ROUTINE
  517  517  B 935 B                      LOOP ON SW B                          SS
  522  522  , 241                        DEFINE FIELD
  526  526  L 247 267                    LOAD REMARKS
  533  533  B 920                        GO TO CORRECT ROUTINE
  537  537  , 224                        PART OF TEST CONDITION
  541  541  B 458                        GO AND TEST
  545  545                             *AN ASTERISK MEANS INSTRUCTION CHANGES
  900  900  L /14 285                   BEGIN ERROR PRINT ROUTINE
  907  907  B 916 E                      E ON TO ERROR STOP                    SS
  912  912  2 920                        ERROR PRINT
  916  916  . 920                        ERROR STOP
  920  920  A 920 970                    ADD ONE TO OPERATION COUNTER
  927  927  B 944 9699                   BRANCH AFTER 90 OPERATIONS      C FOR TA
  935  935  / 332                        CLEAR PRINT AREA
  939  939  /                               ,,
  940  940  B 421                        BRANCH TO REPEAT
  944  944  S 970                        RESET OPERATION COUNTER
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CNG. NO.	110378	116745	TA-1844					

```
 948  948  B 957 C                C ON FOR CORRECT PRINT                    SS
 953  953  B 958                  BRANCH TO SENSE D
 957  957  2                      PRINT CORRECT RESULTS
 958  958  B 421 D                D ON TO REPEAT                            SS
 963  963  B 348                  BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+                  OPERATION COUNTER
1110 /110 E ARO R                 CONSTANTS
1115 /115                           ''
1120 /120 D  NO DIFIER              ''
1140 /140 B  FI ELD CHARACTERS      ''
1160 /160 R ESU LT SHOULD BE        ''
1180 /180 R ESU LT IS               ''
```

DATE	2-2-61	8-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	NZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    TEST ZONE OR WM + BR      0060B00A
,008015,022029,033033N      1001                    SET WORDMARK CARD         0060B 02
L067367,340344,346349,357361I001,008012,001I001IB361080A8421/340080           0060B 03
L069404,377385,389393,400404I001          B389    BS88N000M360392/332/        0060B 04
L069441,413417,421428,435442I001BS00S521/080B348,001078L080299L072272         0060B 05
L072481,450458,466473,481481I001B537224*B537224*B493041 M201480V508224XY      0060B 06
L067516,483484,493500,508513I001VVB517     M201507V517224XB935B8900           0060B 07
L060544,522526,533537,541545I001B935B,2*IL247267B920,224B458                  0060B 08
L071938,907912,916920,927935I001L/14285B916E2920.920A9209708949699/332        0060B 09
L056962,940944,948953,957958I001/8421S970B957CB9582B4210                      0060B 10
L040970,967971,971971,971971I001B348000P                                      0060B 11
                                    I
L065/398=/07/07,/10/15,/20/401001   ERROR    D MODIFIER                        0060B 12
L072/79:/60/80,/80/80,/80/801001B FIELD CHARACTERS  RESULT SHOULD BE          0060B 13
L070517,S00S01,S05S12,S13S171001RESULT IS          2,049L0772772/2772         0060B 14
L059544,S25S29,S36S37,S41S451001=/40/60=/80L/892702/2702413                    0060B 15
/333080N                                          CLEAR WORDMARK CARD         0060B 16
,019027,031,038042803IT98GB400L046352BW04BS88     TEST ZONE OR WM + BR        0060B 17
                                    M
```

DETAIL CARDS

BKS2ICLTBCLT	A	EQUAL	0060B 18
	AKT4*EOX8*$¢*	EQUAL	0060B 19
BBKS2TCCL	KT4*	UNEQUAL	0060B 31
	AT4$	UNEQUAL	0060B 32
	AK4*	UNEQUAL	0060B 33
	AKT*	UNEQUAL	0060B 34
	AKT4	UNEQUAL	0060B 35
	OX8$	UNEQUAL	0060B 36
	EX8,	UNEQUAL	0060B 36
	EX8,	UNEQUAL	0060B 37

DATE	2-2-61	8-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	FA-1844					

3 EOR. UNEQUAL 00608.38

DATE	2-2-61	8-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TN-1844					

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451404
SHEET 1 OF 8
BLOCK NO. 0100B

COMPARE AND BRANCH UNEQUAL

A. PURPOSE OF TEST

TO TEST THE COMPARE CIRCUITRY.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES
   - B. ON TO REPEAT FOR SCOPING
     OFF TO CONTINUE
   - C. ON TO PRINT CORRECT RESULTS
     OFF TO CONTINUE
   - D. ON TO REPEAT SAME DETAIL CARD
     OFF TO CONTINUE
   - E. ON TO STOP ON ERROR
     OFF TO PRINT ERROR.
2. COUNTER
   A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

A FIELD (COLUMNS 2-3), B FIELD (COLUMNS 22-23), AND RESULT SHOULD BE FIELD (COLUMNS 41-60) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. THE B FIELD IS THEN COMPARED WITH THE A FIELD.

IF THE CONDITION IS EQUAL, A TEST IS MADE TO CHECK FOR "BLANK" IN COLUMN 41. IF BLANK, THE EQUAL-COMPARE OPERATION WAS EXECUTED CORRECTLY; IF NOT BLANK, AN ERROR IS INDICATED.

IF THE CONDITION IS UNEQUAL, A TEST IS MADE TO CHECK FOR THE LETTER "U" IN COLUMN 41. IF "U" IS PRESENT, THE UNEQUAL-COMPARE OPERATION WAS EXECUTED CORRECTLY; IF "U" IS NOT PRESENT, AN ERROR IS INDICATED.

NOTE: IN A COMPARE OPERATION AN UNEQUAL-COMPARE RESULTS WHEN THE B FIELD IS LONGER THAN THE A FIELD. THIS CIRCUIT IS TESTED BY THE LAST DETAIL CARD WHICH IS PUNCHED RW IN BOTH THE A FIELD AND THE B FIELD. NORMALLY THIS WOULD RESULT IN AN EQUAL COMPARISON IF BOTH FIELDS WERE OF EQUAL SIZE. HOWEVER, FOR THIS PARTICULAR CARD WHICH HAS AN "L" IN COLUMN 46, THE WORD MARK IS SET ONE POSITION FURTHER TO THE LEFT THAN FOR ALL OTHER CARDS, THUS ENLARGING THE B FIELD, AND FORCING AN UNEQUAL-COMPARE RESULT.

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	710378	716745	TA-1844					

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
6	6	EQUAL	EQUAL
6		UNEQUAL	UNEQUAL
8	8	EQUAL	EQUAL
8		UNEQUAL	UNEQUAL
RW	RW	UNEQUAL LARGER B FIELD	UNEQUAL LARGER B FIELD

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
6	6	EQUAL	ERROR
6		UNEQUAL	ERROR
8	8	EQUAL	ERROR
8		UNEQUAL	ERROR
RW	RW	UNEQUAL LARGER B FIELD	ERROR

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

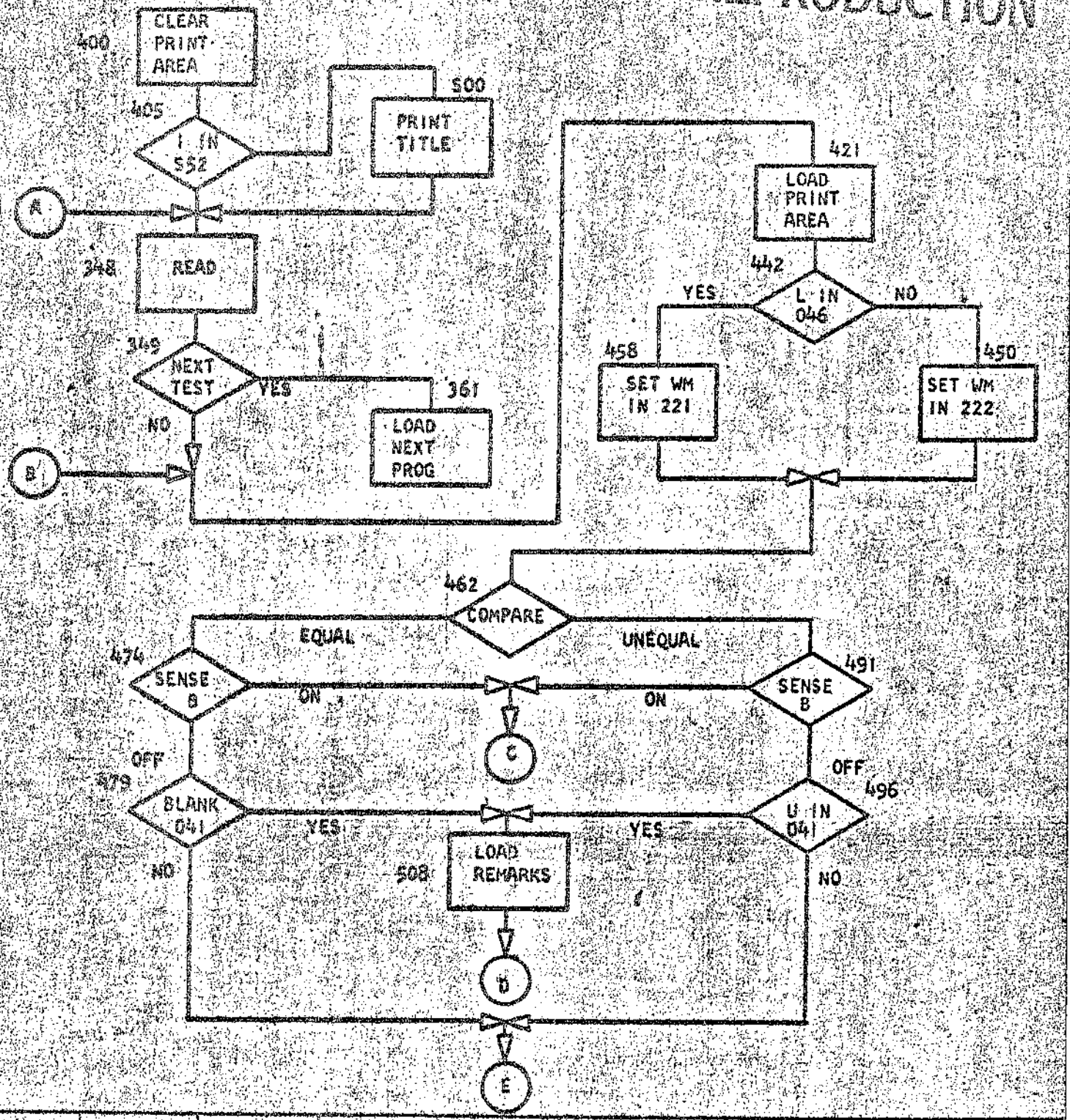
IBM

DIAGNOSTIC FUNCTION TEST

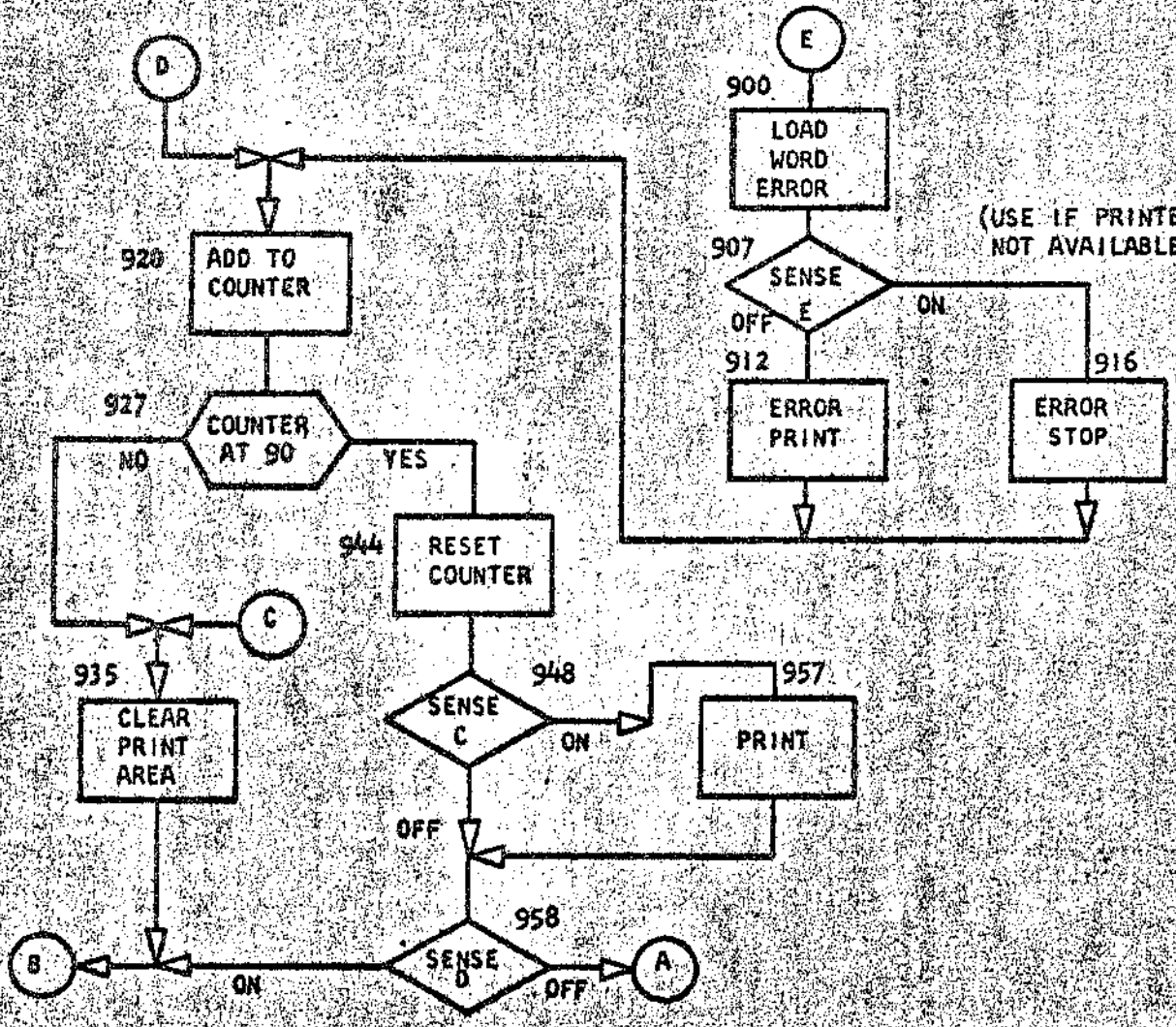
PART NO. 451404
SHEET 3 OF 8
BLOCK NO. 01008

COMPARE AND BRANCH UNEQUAL FLOW CHART

REPRODUCTION



DATE	2-2-61	2-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TR-1844					



DATE	2-2-61	3-17-63	10.5.63					
J. CHG. NO.	110378	116745	TA-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

COMPARE & BR UNEQUAL 01008

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	586		,,	
389	389	N	000		,,	
393	393	M	360	392	,,	
400	400	/	332		START TEST	
404	404	/			,,	
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	/	080		CLEAR READ AREA	
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
421	421	,	002	078	LOAD PRINT AREA	
428	428	L	080	299	,,	
435	435	L	072	272	,,	
442	442	B	458	046L	USE TEST FOR LARGER B FIELD	
450	450	,	222		DEFINE B FIELD	
454	454	B	462		GO COMPARE	
458	458	,	221		DEFINE LARGE B FIELD	
462	462	C	203	223	COMPARE	
469	469	B	491	/	GO TO UNEQUAL ROUTINE	
474	474	B	935	B	LOOP ON SW B	SS
479	479	B	508	041	BRANCH IF CORRECT	
487	487	B	900		GO TO ERROR ROUTINE	
491	491	B	935	B	LOOP ON SW B	SS
496	496	B	508	041U	BRANCH IF CORRECT	
504	504	B	900		GO TO ERROR ROUTINE	
508	508	,	241		DEFINE REMARK FIELD	
512	512	B	971		GO TO CORRECT ROUTINE	
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE	
907	907	B	916	E	E ON TO ERROR STOP	SS
912	912	2	920		ERROR PRINT	
916	916	.	920		ERROR STOP	
920	920	A	920	970	ADD ONE TO OPERATION COUNTER	
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS	C FOR TA
935	935	/	332		CLEAR PRINT AREA	
939	939	/			,,	
940	940	B	421		BRANCH TO REPEAT	
944	944	S	970		RESET OPERATION COUNTER	
948	948	B	957	C	C ON FOR CORRECT PRINT	SS
953	953	B	958		BRANCH TO SENSE D	
957	957	2			PRINT CORRECT RESULTS	
958	958	B	421	D	D ON TO REPEAT	SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE	
967	967	0	004		OPERATION COUNTER	

DATE	2-2-61	3-17-63	10.5.63						
ENG. CHG. NO.	110376	116745	TN-1844						

IBM FORM 624-7134

DIAGNOSTIC FUNCTION TEST

PART NO. 451404
SHEET 6 OF 8
BLOCK NO. 0100B


```
 971  971  L 260 280          LOAD COMMENT
 978  978  B 920              GO TO CORRECT ROUTINE
1110  /10  E RRO R           CONSTANTS
1115  /15                     **
1120  /20  A  FI ELD          **
1140  /40  B  FI ELD          **
1160  /60  R ESU LT SHOULD BE **
1180  /80  R ESU LT IS        **
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8
WS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0	
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	0	6	8	TM-TAPE MARK		7	8
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,008015,022029,033033N      1001                    COMPARE + BR UNEQUAL     01008004
,008015,022029,033033N      1001                    SET WORDMARK CARD        01008 02
L067367,340344,348349,3573611001,008012,0011001183610804842 1/340080        01008 03
L069404,377385,389393,4004041001          8389     8S88N000M360392/332/     01008 04
L069441,413417,421428,4354421001850085 21/0808348,002078L080299L072272      01008 05
L069478,450454,458462,4694741001845804 6L,2228462,221C2032238491/8935B      01008 06
L072518,487491,496504,5085121001850804 1 8900893588508041UB900,2418971      01008 07
L071938,907912,916920,9279351001L/14285B916E2920.920A9209708949699/332      01008 08
L056962,940944,948953,9579581001/8421597089 57C8958284210                   01008 09
L051981,967971,978982,9829821001B348000PL2602808920                         01008 10
                                  Z
L065/39□/07/07,/10/15,/20/401001   ERROR      A FIELD                        01008 11
L072/79,/60/80,/80/80,/80/80100□B FIELD              RESULT SHOULD BE        01008 12
L070517,S00S01,S05S12,S13S17100IRESULT IS            2,049L0772772/2772      01008 13
L059544,S25S29,S36S37,S41S451001□/40/60□/80L/892702/2702413                  01008 14
/333080N                                            CLEAR WORDMARK CARD      01008 15
,019027,031,038042803IT98G8400L046352BW048S88   COMPARE + BR UNEQUAL         01008 16
                                  M
```

DETAIL CARDS

		EQUAL		01008 17
1	1	UNEQUAL		01008 18
1	L	EQUAL		01008 19
1		UNEQUAL		01008 20
2	2	EQUAL		01008 21
2	2	UNEQUAL		01008 22
5	5	EQUAL		01008 23
2		UNEQUAL		01008 24
4	4	EQUAL		01008 25
4	4	UNEQUAL		01008 26
5	5	EQUAL		01008 27
4		UNEQUAL		01008 28
6	6	EQUAL		01008 29
	6	UNEQUAL		01008 30
7	7	EQUAL		01008 31
8		UNEQUAL		01008 32
8	8	EQUAL		01008 33
	/	UNEQUAL		01008 34
9	9	EQUAL		01008 35
/		UNEQUAL		01008 36
/	/	EQUAL		01008 37
	-	UNEQUAL		01008 38

-	-	EQUAL	01008	39
-		UNEQUAL	01008	4
H7	H7	EQUAL	01008	4
H7	HH	UNEQUAL	01008	42
RW	RW	EQUAL	01008	43
RW	RW	UNEQ LARGER B FIELD	01008	44

DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	810378	816745	TA-1844					

LOAD MOVE COMPARE

A. PURPOSE

1. TO TEST THE LOAD OP CODE WITH SINGLE CHARACTER CHAINING.

2. TO TEST THE MOVE OP CODE WITH SINGLE CHARACTER CHAINING.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

A FIELD (COLUMNS 1-10), AND RESULT SHOULD BE FIELD (COLUMNS 41-50) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES.

COLUMN 72 IS USED TO SPECIFY EITHER THE LOAD TEST OR THE MOVE TEST. AN "L" IN 72 CAUSES A BRANCH TO THE LOAD ROUTINE IN LOCATION 502. AN "M" IN 72 CAUSES A BRANCH TO THE MOVE ROUTINE IN LOCATION 513.

THE LOAD ROUTINE PLACES A WM IN THE UNITS POSITION OF THE A FIELD. SINCE THE A FIELD NOW HAS TWO WORD MARKS (ONE IN THE UNITS POSITION AND ONE IN THE LOW-ORDER POSITION, IT IS TRANSFERRED INTO THE RESULT IS PRINT AREA BY CHAINING TWO LOAD OP INSTRUCTIONS. THE WORD MARK IN THE UNITS POSITION OF THE RESULT IS AREA IS THEN REMOVED BY A CLEAR WORD MARK INSTRUCTION AND A COMPARE OPERATION IS PERFORMED COMPARING THE RESULT IS WITH THE RESULT SHOULD BE FIELD. IF THE COMPARISON IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

THE MOVE ROUTINE PLACES A WM IN THE UNITS POSITION OF THE RESULT IS FIELD. THE A FIELD IS THEN TRANSFERRED TO THE RESULT IS FIELD BY CHAINING TWO MOVE OP INSTRUCTIONS. THE WORD MARK IN THE UNITS POSITION OF THE RESULT IS AREA IS THEN REMOVED BY A CLEAR WORD MARK INSTRUCTION AND A COMPARE OPERATION IS PERFORMED COMPARING THE RESULT IS WITH THE RESULT SHOULD BE FIELD. IF THE COMPARISON IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

E. STOPS

502 IN STORAGE ADDRESS REGISTER: WRONG DETAIL CARDS OR A FAILURE IN TEST CHARACTER AND BRANCH CIRCUITRY

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE 2 ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
1111111111	1111111111	1111111111	1111111111	L
1111111111	1111111111	1111111111	1111111111	M

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD

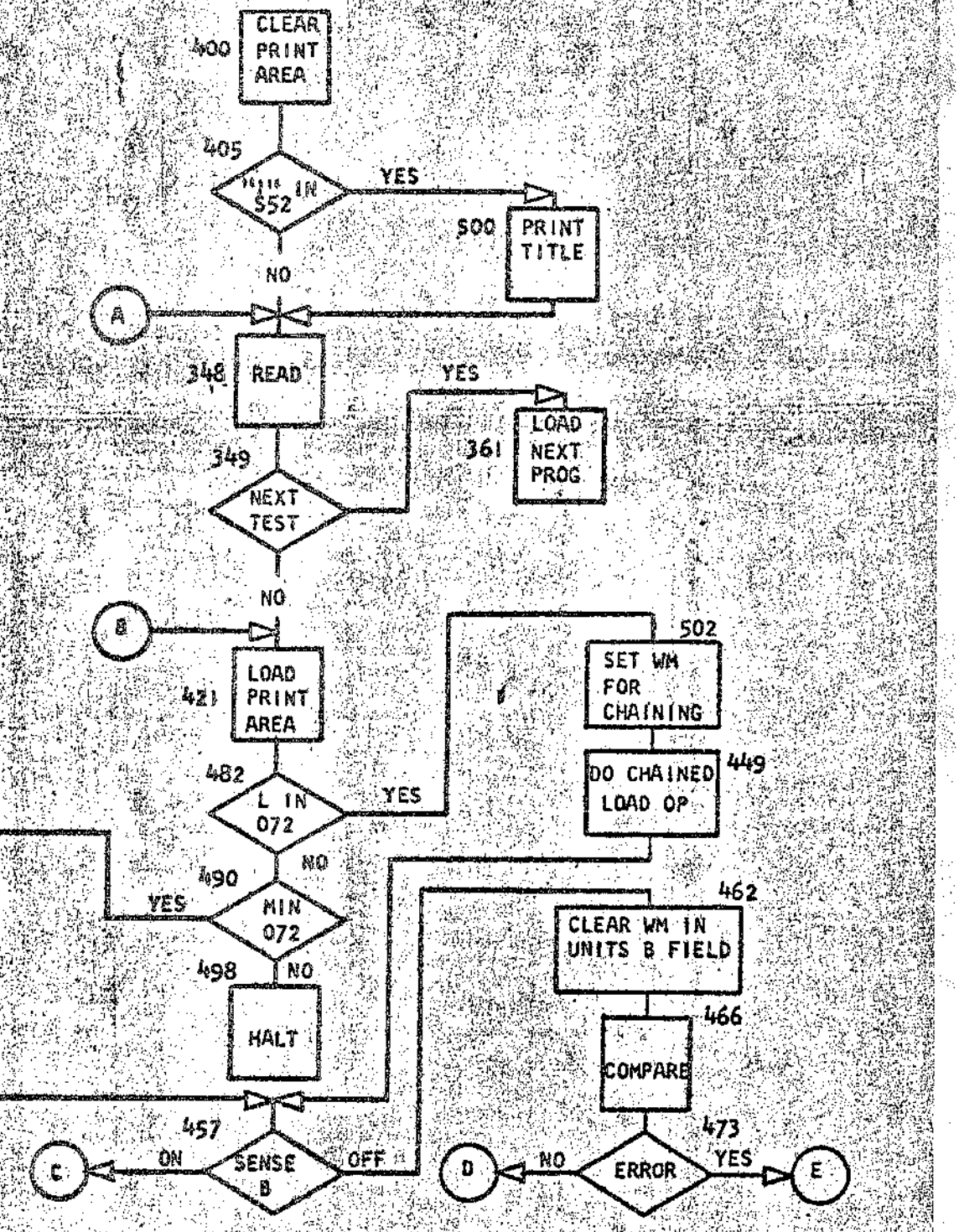
DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

IBM

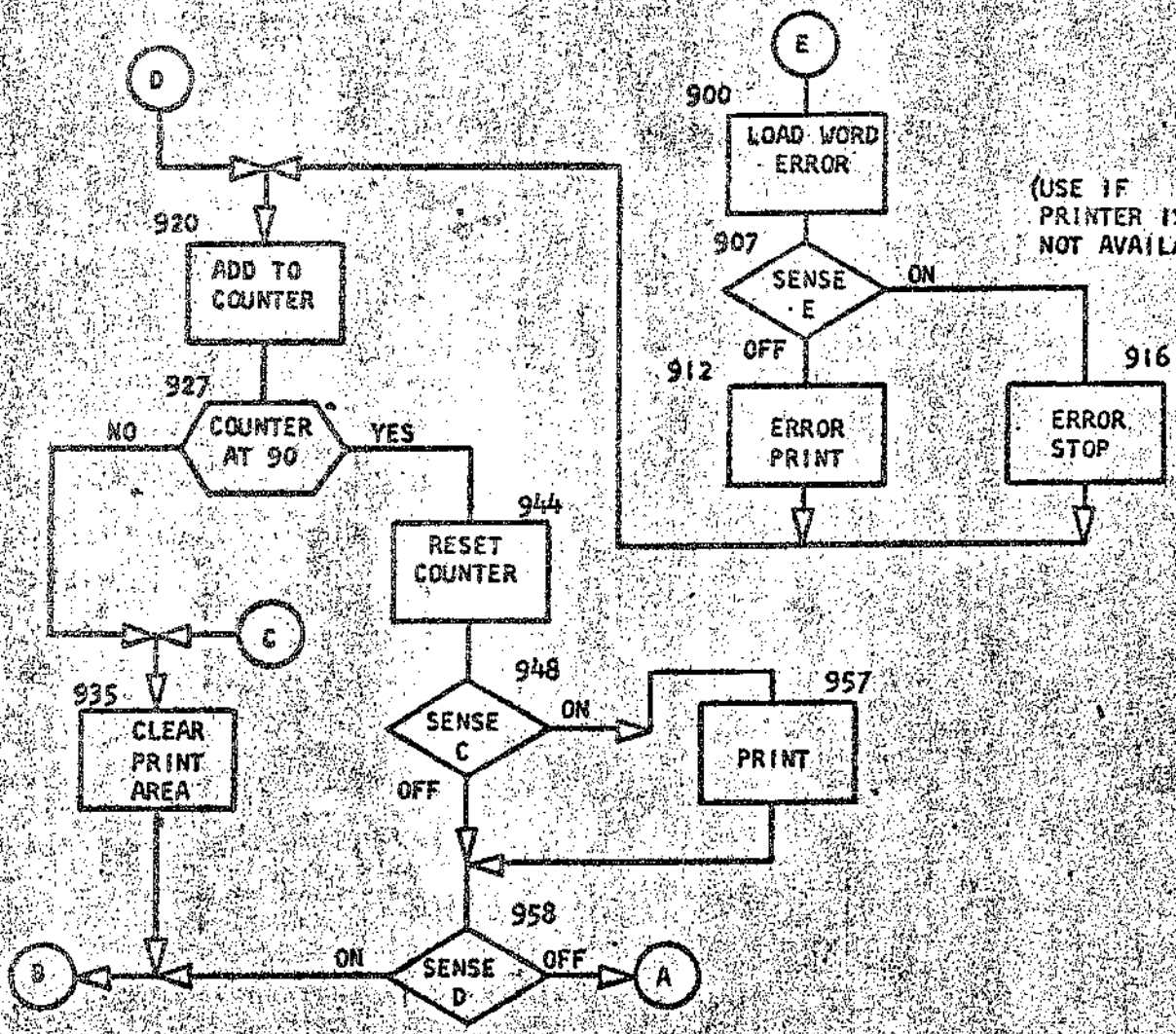
DIAGNOSTIC FUNCTION TEST

PART NO. 451405
SHEET 3 OF 8
BLOCK NO. 0110B

LOAD MOVE COMPARE FLOW CHART



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					



DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

LOAD MOVE COMPARE 0110B

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	588		"
389	389	N	000		"
393	393	M	360	392	"
400	400	/	332		START TEST
404	404	/			"
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN SS2
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	"
435	435	L	072	272	"
442	442	B	482		GO TEST FOR LOAD OR MOVE
449	449	L	210	270	LOAD ROUTINE
456	456	L			"
457	457	B	935	B	LOOP ON SW B SS
462	462	M	270		CLEAR UNITS B FIELD WM
466	466	C	270	250	COMP B FIELD TO CORRECT RESULT
473	473	B	900		BRANCH ERROR
478	478	B	920		GO TO CORRECT ROUTINE
482	482	B	502	072L	LOAD TEST
490	490	B	513	072M	MOVE TEST
498	498	.	498		NEITHER -- WRONG DETAIL CARDS
502	502	,	210	241	WM IN UNITS A FIELD -- HIGH ORDER COMP
509	509	B	449		GO LOAD TEST
513	513	,	241	270	WM IN UNITS COMP -- HIGH ORDER B FIELD
520	520	M	210	270	MOVE ROUTINE
527	527	M			"
528	528	B	457		GO AND TEST RESULTS
532	532				WORDMARK
900	900	L	/14	265	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			"
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS
953	953	B	958		BRANCH TO SENSE D

DATE	2-2-61	1-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

```
 957  957  2                    PRINT CORRECT RESULTS
 958  958  B 421 0              0 ON TO REPEAT                    SS
 963  963  B 348                BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+                OPERATION COUNTER
1110 /10  E RRO R               CONSTANTS
1115 /15                          ,,
1120 /20  A  FI ELD               ,,
1140 /40  B  FI ELD               ,,
1160 /60  R ESU LT SHOULD BE      ,,
1180 /80  R ESU LT IS             ,,
```

DATE	2-2-61	3-17-63	10.5.63					
CHG. NO.	110378	116745	TA-1844					

TABLE OF UNPRINTABLE CHARACTERS

```
LP-LEFT PARENTHESIS  12 5 8   SE-SEMICOLON 11 6 8     DE-DELTA      11 7 8
WS-WORD SEPARATOR     0 5 8   LT-LESS THAN 12 6 8     PZ-PLUS ZERO  12 0
TS-TAPE SEGMENT MARK  0 7 8   GT-GREATER THAN 6 8     TM-TAPE MARK   7 8
GM-GROUP MARK        12 7 8   MZ-MINUS ZERO  11 0     CO-COLON       5 8
RP-RIGHT PARENTHESIS 11 5 8   AP-APOSTROPHE 0 6 8
```

```
,008015,022029,033033N       1001                     LOAD MOVE COMPARE      01108001
,008015,022029,033033N       1001                     SET WORDMARK CARD      01108 02
L067367,340344,348349,3573611001,008012,0011001B361080A8421/340080           01108 03
L069404,377385,389393,4000401001         B389    BS88N000M360392/332/        01108 04
L069441,413417,421428,4354421001B500S521/080B348,001078L080299L072272        01108 05
L068477,449456,457462,4664731001B482   L210270LB9358¤270C2702508900/         01108 06
L067512,482490,498502,5095131001B920B502072LB513072M.498,2102418449          01108 07
L051531,520527,528532,5325321001,241270M210270MB457                          01108 08
L071938,907912,916920,9279351001L/142858916E2920.920A9209708949699/332       01108 09
L056962,940944,948953,9579581001/8421S97089 57CB958284 21D                   01108 10
L040970,967971,971974,9719711001B348000P                                     01108 11
                                       Z
L065/39¤/07/07,/10/15,/20/401001   ERROR     A FIELD                          01108 12
L072/79,/60/80,/80/80,/80/801001B FIELD              RESULT SHOULD BE         01108 13
L070S17,S00S01,S05S12,S13S171001RESULT IS            2,049L0772772/2772       01108 14
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                  01108 15
/333080N                                              CLEAR WORDMARK CARD    01108 16
,019027,031,0380428031T98GB400L046352BW048S88    LOAD MOVE COMPARE           01108 17
                         M
```

DETAIL CARDS

```
1111111111              1111111111              L01108 18
2222222222              2222222222              L01108 19
4444444444              4444444444              L01108 20
8888888888              8888888888              L01108 21
//////////              //////////              L01108 22
----------              ----------              L01108 23
AKT4 BLUS               AKT4 BLUS               L01108 24
CMV6 DNW7               CMV6 DNW7               L01108 25
EOX8 FPY9               EOX8 FPY9               L01108 26
GQZ0 HR#@               GQZ0 HR#@               L01108 27
I-,@ +$%0               I-,@ +$%0               L01108 28
&.*/ ¤JS3               &.*/ ¤JS3               L01108 29
1111111111              1111111111              M01108 30
2222222222              2222222222              M01108 31
4444444444              4444444444              M01108 32
8888888888              8888888888              M01108 33
//////////              //////////              M01108 34
----------              ----------              M01108 35
AKT4 BLUS               AKT4 BLUS               M01108 36
CMV6 DNW7               CMV6 DNW7               M01108 37
EOX8 FPY9               EOX8 FPY9               M01108 38
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	7A-1844					

```
GQZO HR+$                    GQZO HR+$
I-,3 +$%0                    I-,3 +$%0
I.*/ □JS3                    I.*/ □JS3
```

M01108 39
M01108
M01108 4

DATE	2-2-61	3-17-63	10.5.63					
C. CHG. NO.	110378	116745	TA-1844					

DIAGNOSTIC FUNCTION TEST

LOAD MOVE DIGIT ZONE

A. PURPOSE

1. TO TEST A LOAD OP THAT USES FOUR CHARACTER CHAINING.
2. TO TEST THE MOVE DIGIT CIRCUITRY.
3. TO TEST A MOVE OP THAT USES FOUR CHARACTER CHAINING.
4. TO TEST THE MOVE ZONE CIRCUITRY.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

A FIELD (COLUMNS 1-5), B FIELD (COLUMNS 21-25), AND RESULT SHOULD BE FIELD (COLUMNS 41-45) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. COLUMN 72 IS USED TO SPECIFY EITHER THE LOAD OR MOVE TESTING WITHIN THE PROGRAM.

1. A "D" IN COLUMN 72 CAUSES A BRANCH TO 515 WHERE A CHAINED LOAD OPERATION (4-CHARACTER INSTRUCTIONS) LOADS A SINGLE CHARACTER INTO SPECIFIC STORAGE LOCATIONS. (THEREBY SETTING UP A MOVE DIGIT PROGRAM)

2. A "Z" IN COLUMN 72 CAUSES A BRANCH TO 545 WHERE A CHAINED MOVE OPERATION (4-CHARACTER INSTRUCTIONS) MOVES ANOTHER SINGLE CHARACTER INTO SPECIFIC STORAGE LOCATIONS (THEREBY SETTING UP A MOVE ZONE PROGRAM)

3. THE MOVE DIGIT PORTION OF THE PROGRAM IS EXECUTED BY MOVING THE DIGITS OF THE A FIELD INTO THE B FIELD. THE RESULT IS THEN COMPARED WITH THE RESULT SHOULD BE FIELD.

4. THE MOVE ZONE PORTION OF THE PROGRAM IS EXECUTED BY MOVING THE ZONES OF THE A FIELD INTO THE B FIELD. THE RESULT IS THEN COMPARED WITH THE RESULT SHOULD BE FIELD.

CARDS HAVING A "D" IN COLUMN 72 CHECK TWO OPERATIONS: (1) LOAD, AND (2) MOVE DIGIT

CARDS HAVING A "Z" IN COLUMN 72 CHECK TWO OPERATIONS: (3) MOVE, AND (4) MOVE ZONE.

E. STOPS

515 IN STORAGE ADDRESS REGISTER: WRONG DETAIL CARDS OR A FAILURE IN TEST CHARACTER AND BRANCH CIRCUITRY
920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
12345	67890	12345	12345	D
&&&&&	-----	-----	-----	D
5678	AKT4	EOX8	EOX8	D
1234	EOX8	AKT4	AKT4	D
12345	67890	67890	67890	Z
&&&&&	-----	&&&&&	&&&&&	Z
AKT4	5678	EOX8	EOX8	Z
5678	AKT4	1234	1234	Z

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

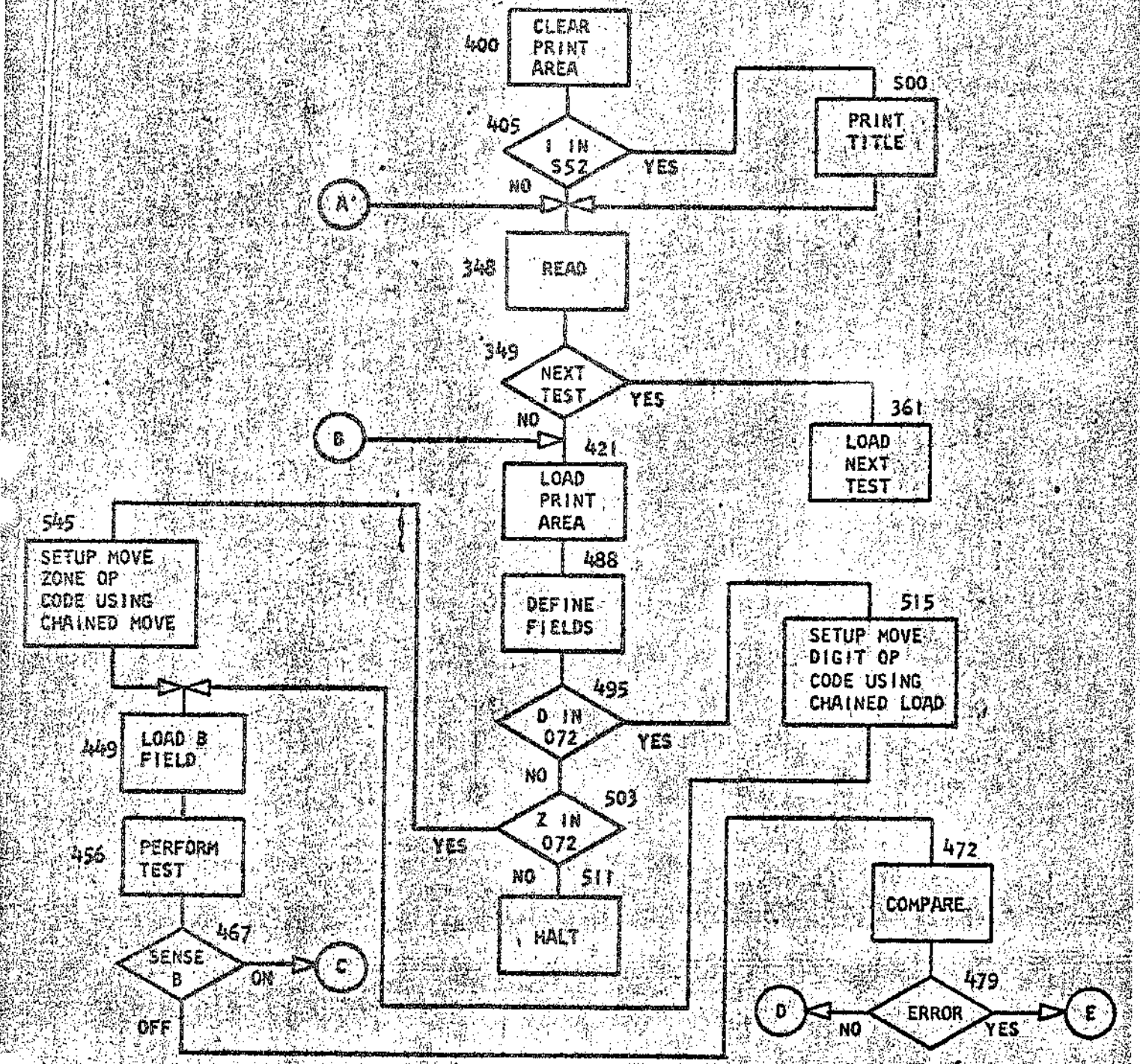
DATE	2-2-61	5-15-62	3-17-63	10.5.63				
ENG. NO.	110378	115283	116745	TA-1844				

IBM

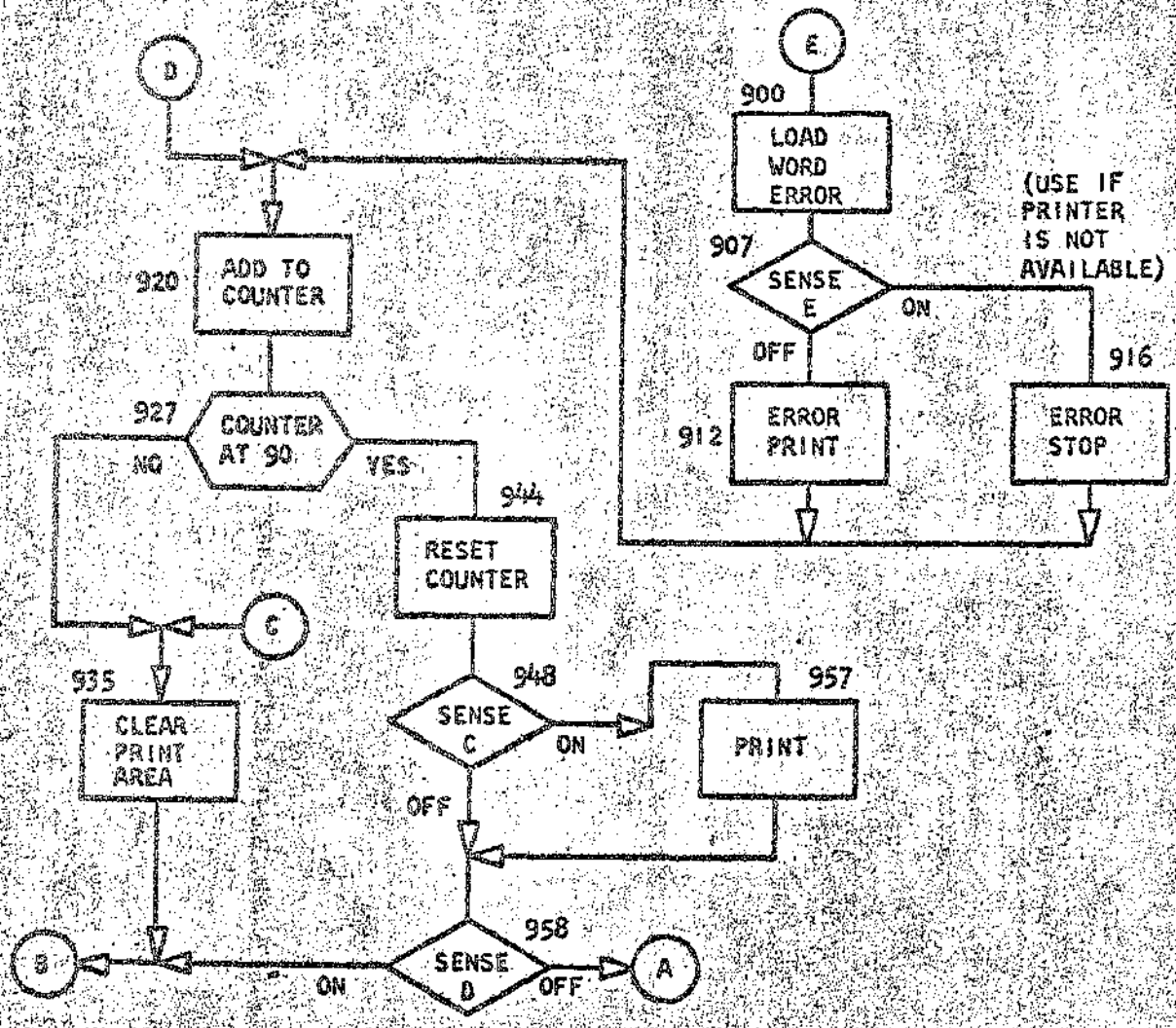
DIAGNOSTIC FUNCTION TEST

PART NO. 451407
SHEET 3 OF 7
BLOCK NO. 0210C

LOAD MOVE DIGIT ZONE FLOW CHART



DATE	2-2-61	5-15-62	3-17-63	10.5.63				
ENG. CHG. NO.	110378	115283	116785	TA-1844				



DATE	2-2-61	5-15-62	3-17-63	10.5.63				
ENG. CHG. NO.	110378	115283	116745	TA-1844				

PROGRAM LISTING FOR USE WITH FLOW CHART

*LOAD MOVE DIGIT ZONE 0210C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	,,
435	435	L	072	272	,,
442	442	B	488		GO TO SETUP
449	449	L	225	265	LOAD B FIELD
456	456	D	205	265	*EXECUTE MOVE DIGIT OR MOVE ZONE
463	463	N			* ,,
464	464	N			* ,,
465	465	N			* ,,
466	466	N			* ,,
467	467	B	935	B	LOOP ON SW B SS
472	472	C	265	245	COMPARE B FIELD TO CORRECT RESULT
479	479	B	900	/	BRANCH ERROR
484	484	B	920		GO TO CORRECT ROUTINE
488	488	,	221	241	DEFINE B FIELD + COMPARE FIELD
495	495	B	515	0720	SETUP MOVE DIGIT OP CODE
503	503	B	545	0722	SETUP MOVE ZONE OP CODE
511	511	.	511		NEITHER — WRONG DETAIL CARDS
515	515	L	971	466	LOAD OP CODE
522	522	L	971		,,
526	526	L	971		,,
530	530	L	971		,,
534	534	L	971	456	,,
541	541	B	449		GO EXECUTE MOVE DIGIT
545	545	M	972	466	MOVE OP CODE
552	552	M	972		,,
556	556	M	972		,,
560	560	M	972		,,
564	564	M	972	456	,,
571	571	B	449		GO EXECUTE MOVE ZONE
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	Z	920		ERROR PRINT

DATE	2-2-61	5-15-62	3-17-63	10.5.63				
NO. CHG. NO.	110378	115283	116745	TA-1844				

```
 916  916  .  920                    ERROR STOP
 920  920  A  920 970                ADD ONE TO OPERATION COUNTER
 927  927  B  944 9699               BRANCH AFTER 90 OPERATIONS      C -FOR TA
 935  935  /  332                    CLEAR PRINT AREA
 939  939  /                         ,,
 940  940  B  421                    BRANCH TO REPEAT
 944  944  S  970                    RESET OPERATION COUNTER
 948  948  B  957 C                  C ON FOR CORRECT PRINT                  SS
 953  953  B  958                    BRANCH TO SENSE D
 957  957  2                        PRINT CORRECT RESULTS
 958  958  B  421 D                  D ON TO REPEAT                          SS
 963  963  B  348                    BRANCH TO PROG. CHAINING ROUTINE
 967  967  0  00+                    OPERATION COUNTER
 971  971  D                        MOVE DIGIT OP CODE
 972  972  Y                        MOVE ZONE OP CODE
1110  /10  E  RRO R                 CONSTANTS
1115  /15                           ,,
1120  /20  A   FI ELD               ,,
1140  /40  B   FI ELD               ,,
1160  /60  R ESU LT SHOULD BE       ,,
1180  /80  R ESU LT IS              ,,
```

DATE	2-2-61	5-15-62	8-17-63	10.5.63				
G CHG. NO.	110378	115283	116745	TA-1844				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    LOAD MOVE DIGIT ZONE     0210C00A
,008015,022029,033033N      1001                    SET WORDMARK CARD        0210C 02
L067367,340344,348349,357361001,008012,001100181361080A8421/340080          0210C 03
L069404,377385,389393,400404001          B389     BS88N000M360392/332/     0210C 04
L069441,413417,421428,435442100181S00S521/080B348,001078L080299L072272      0210C 05
L057466,449456,463464,465466100181688    L225265D205265NNNN               0210C 06
L068502,472479,484488,495495100189358C265245B900/8920,221241B515072D        0210C 07
L070540,511515,522526,530534100185450722,511L971466L971L971L971L971456      0210C 08
L067575,545552,556560,564571100189449M972466M972M972M972M9724568449         0210C 09
L071938,907912,916920,927935100IL/142858916E2920,920A9209708949699/332       0210C 10
L056962,940944,948953,957958100I/8421S9708957C895828421D                    0210C 11
L042972,967971,972972,972972100I8348000PDY                                   0210C 12
                                    Σ
L065/39¤/07/07,/10/15,/20/401001   ERROR    A FIELD                          0210C 13
L072/79,/60/80,/80/80,/80/8010018 FIELD              RESULT SHOULD BE        0210C 14
L070S17,S00S01,S05S12,S13S17100IRESULT IS            2,049L0772772/2772      0210C 15
L059544,S25S29,S36S37,S41S45100I¤/40/60¤/80L/892702/2702413                  0210C 16
/333080N                                             CLEAR WORDMARK CARD     0210C 17
,019027,031,038042803IT98G8400L046352BW048588   LOAD MOVE DIGIT ZONE         0210C 18
                                    M
```

DETAIL CARDS

```
12345       67890       12345                                    D0210C 19
67890       12345       67890                                    D0210C 20
+++++                                                            D0210C 21
-----       +++++       +++++                                    D0210C 22
AKT4        5678        1234                                     D0210C 23
EOX8        1234        5678                                     D0210C 24
9+$¤        6789        90¤8                                     D0210C 25
5678        AKT4        EOX8                                     D0210C 26
1234        EOX8        AKT4                                     D0210C 27
12345       67890       67890                                    Z0210C 28
67890       12345       12345                                    Z0210C 29
+++++                   +++++                                    Z0210C 30
-----       +++++       -----                                    Z0210C 31
AKT4        5678        EOX8                                     Z0210C 32
EOX8        1234        AKT4                                     Z0210C 33
9+$¤        6789        6XQI                                     Z0210C 34
5678        AKT4        1234                                     Z0210C 35
1234        EOX8        5678                                     Z0210C 36
```

DATE	2-2-61	5-15-62	3-17-63	10.5.63				
ENG. CHG. NO.	110378	115283	116745	D-1044				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451409
SHEET 1 OF
BLOCK NO. 0230B

MOVE AND ZERO SUPPRESS

A. PURPOSE

TO TEST THE MOVE AND ZERO SUPPRESS CIRCUITRY

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

INFORMATION FROM THE DETAIL CARD IS MOVED INTO THE PRINT AREA FOR PRINTING PURPOSES.

WITHIN THE DETAIL CARDS, THE A FIELD IS LOCATED IN COLUMNS 1-10; THE B-FIELD, COLUMNS 21-30; AND THE RESULT SHOULD BE FIELD, COLUMNS 41-50.

WITHIN THE PRINT AREA, THE A FIELD IS MOVED AND ZERO SUPPRESSED INTO THE RESULT IS FIELD. A COMPARISON OF THE RESULT SHOULD BE FIELD TO THE RESULT IS FIELD CHECKS THE OPERATION.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

DATE	2-2-61	3-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TY-1844	TY-1844A				

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
00,000,80I		809	809
00,050T0Q0		50T Q	50T Q
00,40D0Z0Z		40D Z 9	40D Z 9

2. ERROR

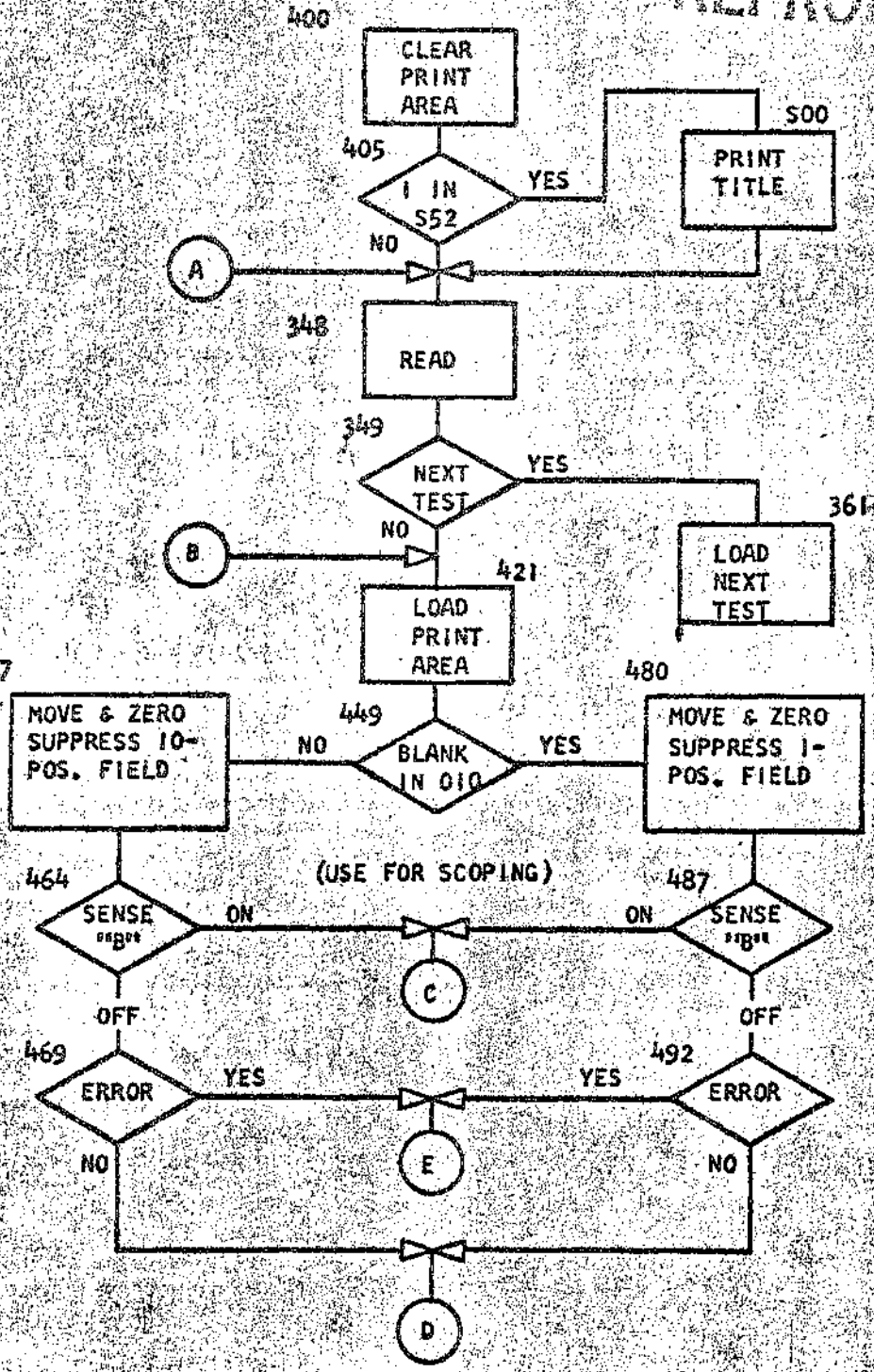
A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
00,000,80I		809	80I	ERROR
00,050T0Q0		50T Q	50T0Q0	ERROR
00,400Z0Z		40D Z 9	40D0Z0Z	ERROR

G. COMMENTS

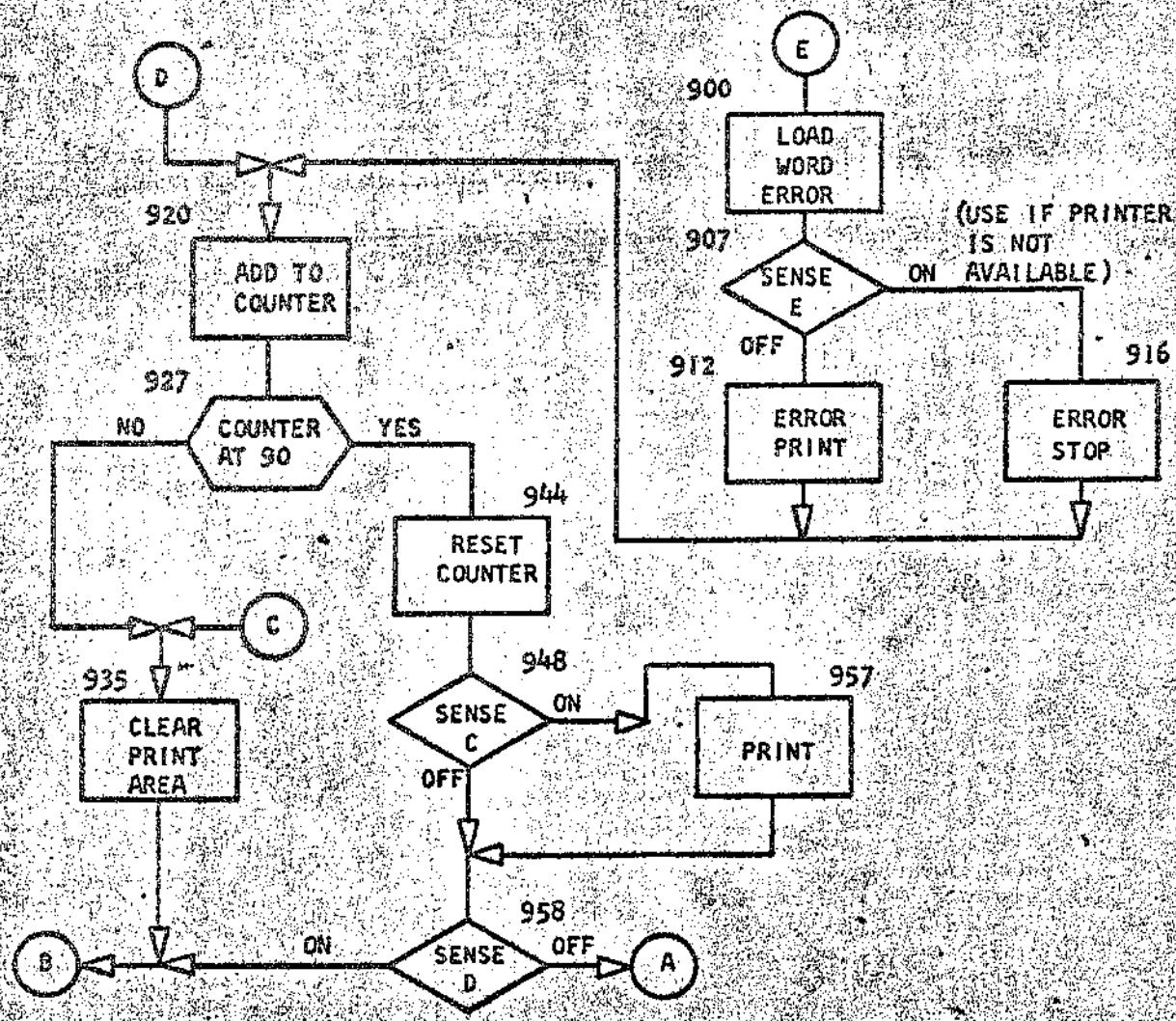
THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

DATE	2-2-61	3-17-63	10.5.63	25.6.63				
IG. CHG. NO.	110378	116745	TA-1844	TA-1844A				

MOVE AND ZERO SUPPRESS FLOW CHART



DATE	2-2-61	3-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A				



DATE	2-2-61	3-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A				

PROGRAM LISTING FOR USE WITH FLOW CHART

MOVE + ZERO SUPPRESS 02308

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	588		"
389	389	N	000		"
393	393	M	360	392	"
400	400	/	332		START TEST
404	404	/			"
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	"
435	435	L	072	272	"
442	442	,	241	265	DEFINE COMP FIELD + B FIELD
449	449	B	480	010	GO TO SINGLE CHARACTER FIELD
457	457	Z	210	270	MOVE ZERO SUPPRESS 10 CHARACTER FIELD
464	464	B	935	B	LOOP ON SW B SS
469	469	C	270	250	COMP B FIELD TO CORRECT RESULT
476	476	B	499		GO CHECK THE OPERATION
480	480	Z	201	261	MOVE ZERO SUPPRESS SINGLE CHARACTER
487	487	B	935	B	LOOP ON SW B SS
492	492	C	261	241	COMP B FIELD TO CORRECT RESULT
499	499	B	900	/	BRANCH ERROR
504	504	B	920		GO TO CORRECT ROUTINE
508	508				WORDMARK
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			"
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS
953	953	B	958		BRANCH TO SENSE D
957	957	2			PRINT CORRECT RESULTS
958	958	B	421	D	D ON TO REPEAT SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE
967	967	0	00+		OPERATION COUNTER
1110	/10	E	RRO	R	CONSTANTS
1115	/15				"

DATE	2-2-61	3-17-63	10.5.63	25.6.63					
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A					

```
1120  /20  A  FI ELD                    ,,
1140  /40  B  FI ELD                    ,,
1160  /60  R ESU LT SHOULD BE           ,,
1180  /60  R ESU LT IS                  ,,
```


DATE	2-2-61	3-17-63	10.5.63	25.6.63				
J. CHG. NO.	110378	116745	TA-1844	TA-1844A				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    MOVE + ZERO SUPPRESS      02308004
,008015,022029,033033N          1001                    SET WORDMARK CARD         02308 02
L067367,340344,348349,357361I001,008012,001100118361080A8421/340080               02308 05
L069404,377385,389393,400404I001          8389     8588N000M360392/332/           02308 04
L069441,413417,421428,435442I001B500S521/080B348,001078L080299L072272             02308 05
L070479,449457,464469,476476I001,241265848001O Z210270B9358C270250B499            02308 06
L060507,487492,499504,508508I001Z201261893588C261241890078920                     02308 07
L071938,907912,916920,927935I001L/14285891GE2920.920A9209708949699/332            02308 08
L056962,940944,948953,957958I001/B421S9708957CB9582B4210                          02308 09
L040970,967971,971971,971971I001B548000P                                          02308 10
                                  Z
L065/39¤/07/07,/10/15,/20/401001   ERROR      A FIELD                             02308 11
L072/79,/60/80,/80/80,/80/8010018 FIELD                RESULT SHOULD BE           02308 12
L070S17,S00S01,S05S12,S13S17I001RESULT IS              2,049L0772772/2772         02308 13
L059S44,S25S29,S36S37,S41S45I001¤/40/60¤/80L/892702/2702413                        02308 14
/333080N                                               CLEAR WORDMARK CARD        02308 15
,019027,031,038042B031T98GB400LO463528W04B588   MOVE + ZERO SUPPRESS              02308 16
                                  M
```

DETAIL CARDS

```
00,000,000                                                                        02308 17
00,000,009                                  9                                     02308 18
00,000,090                                 90                                     02308 19
00,000,80I                                809.                                    02308 20
00,00070AP                                70A                                     02308 21
          Z
00,0060KOR                                60K 9                                   02308 22
00,050T0QM                                50T Q                                   02308 23
          Z
00,40D0Z0Z                                40D Z 9                                 02308 24
0030N0+0-$                                30N + -                                 02308 25
020W0$0*07                                20W $ * 7                               02308 26
10G0¤0$0@0                                10G ¤ $ @                               02308 27
7                                         7                                       02308 28
R                                         9                                       02308 29
+                                                                                 02308 30
=                                                                                 02308 31
0                                                                                 02308 32
*                                         #                                       02308 34
```

DATE	2-2-61	2-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A				

DETAIL CARDS FOR PERIOD - COMMA INVERSION

```
00.000.000                                                    02308 17
00.000.009                                                    02308 18
00.000.090                                                    02308 19
00.000.801                                                    02308 20
00.00070A&                                                    02308 21
00.0060K0R                                                    02308 22
00.050T0Q-                                                    02308 23
00.40DDZ0Z                                                    02308 24
0030N0&0-$                                                    02308 25
020W0$0$07                                                    02308 26
10G0¤0#0@0                                                    02308 27
7                                                             02308 28
R                                                             02308 29
&                                                             02308 30
$                                                             02308 31
0                                                             02308 32
                                                              02308 34
```

DATE	TA 1844A							
CHG. NO.	25.6.63							

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451410
SHEET 1 OF 7
BLOCK NO. 03008

TRUE ADD

A. PURPOSE

TO TEST THE TRUE ADD CIRCUITRY.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

INFORMATION FROM THE DETAIL CARD IS MOVED INTO THE PRINT AREA FOR PRINTING PURPOSES.

A WM IS SET IN 202 TO DEFINE A SHORT (9 POSITION) A FIELD.

TRUE ADD OCCURS WHEN THE NUMBER OF NEGATIVE SIGNS ASSOCIATED WITH THE A FIELD, THE B FIELD, AND THE OP CODE (SUBTRACT IS TO BE CONSIDERED AS MINUS) IS EVEN, THE ACTUAL SIGN OF THE B FIELD WILL BE THE SIGN OF THE RESULT.

IN COLUMN 13 OF THE DETAIL CARDS. AN "S" INDICATES THAT A SUBTRACT OP CODE IS USED BECAUSE OF UNLIKE SIGNS; NO "S" INDICATES THAT AN ADD OP CODE IS USED BECAUSE OF LIKE SIGNS. THIS COLUMN IS TESTED FOR THE PRESENCE OF "S".

THE A FIELD IS ADDED TWICE (OR SUBTRACTED TWICE) FROM THE B FIELD, AND THIS RESULT IS COMPARED TO THE RESULT SHOULD BE FIELD.

DATE	2-2-61	3-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A				

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD		B FIELD	RESULT SHOULD BE	RESULT IS
E123456789	ADD OP	0000000000	0246913578	0246913578
E12345678I	ADD OP	1111111101	1358024679	1358024679
E12345678Z	ADD OP	2222222112	2469135690	2469135690
E12345678I	ADD OP	333333222T	358024580/	358024580/
E123456789	ADD OP	444443333D	4691346918	4691346918

G. COMMENTS

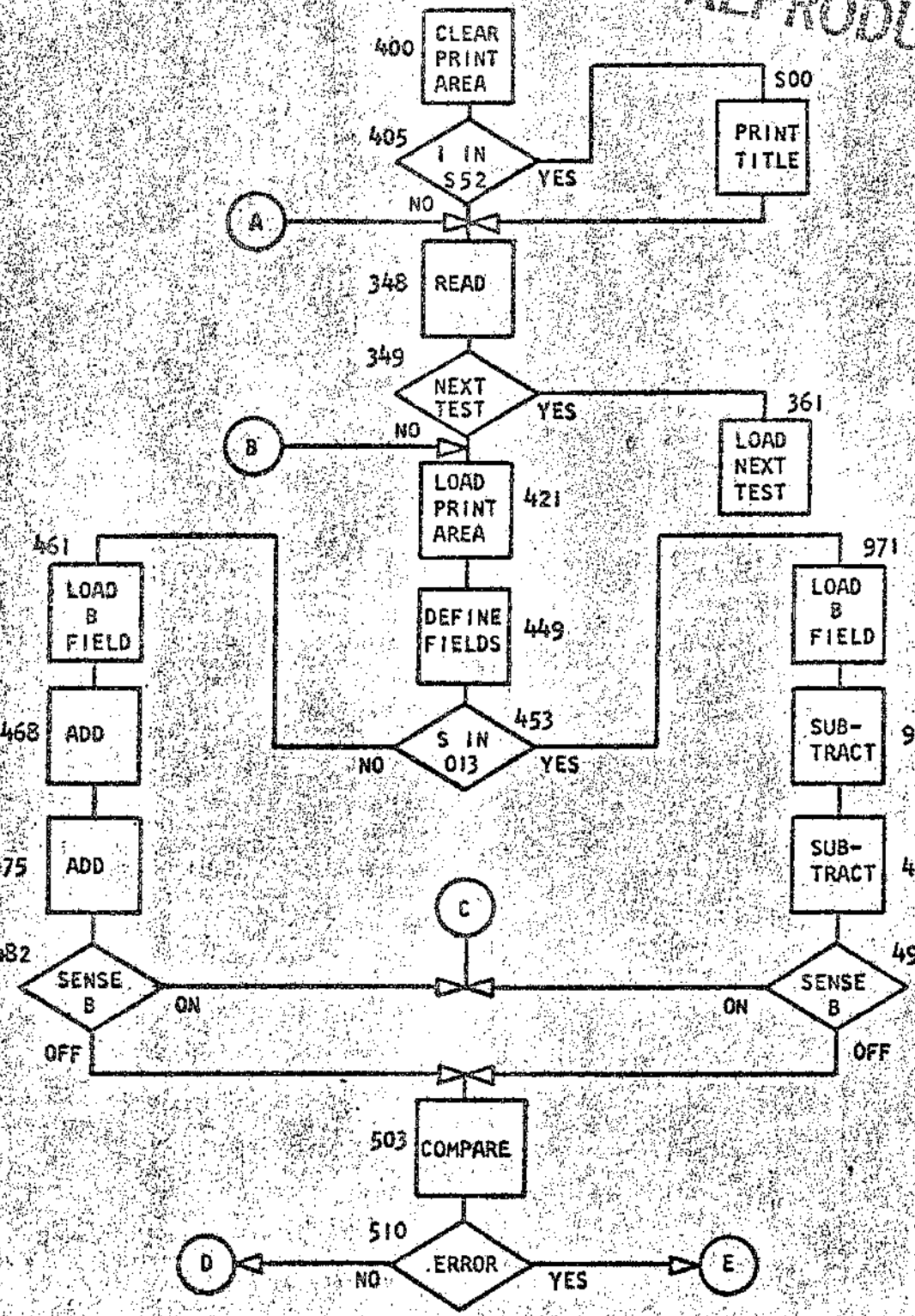
THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

IBM

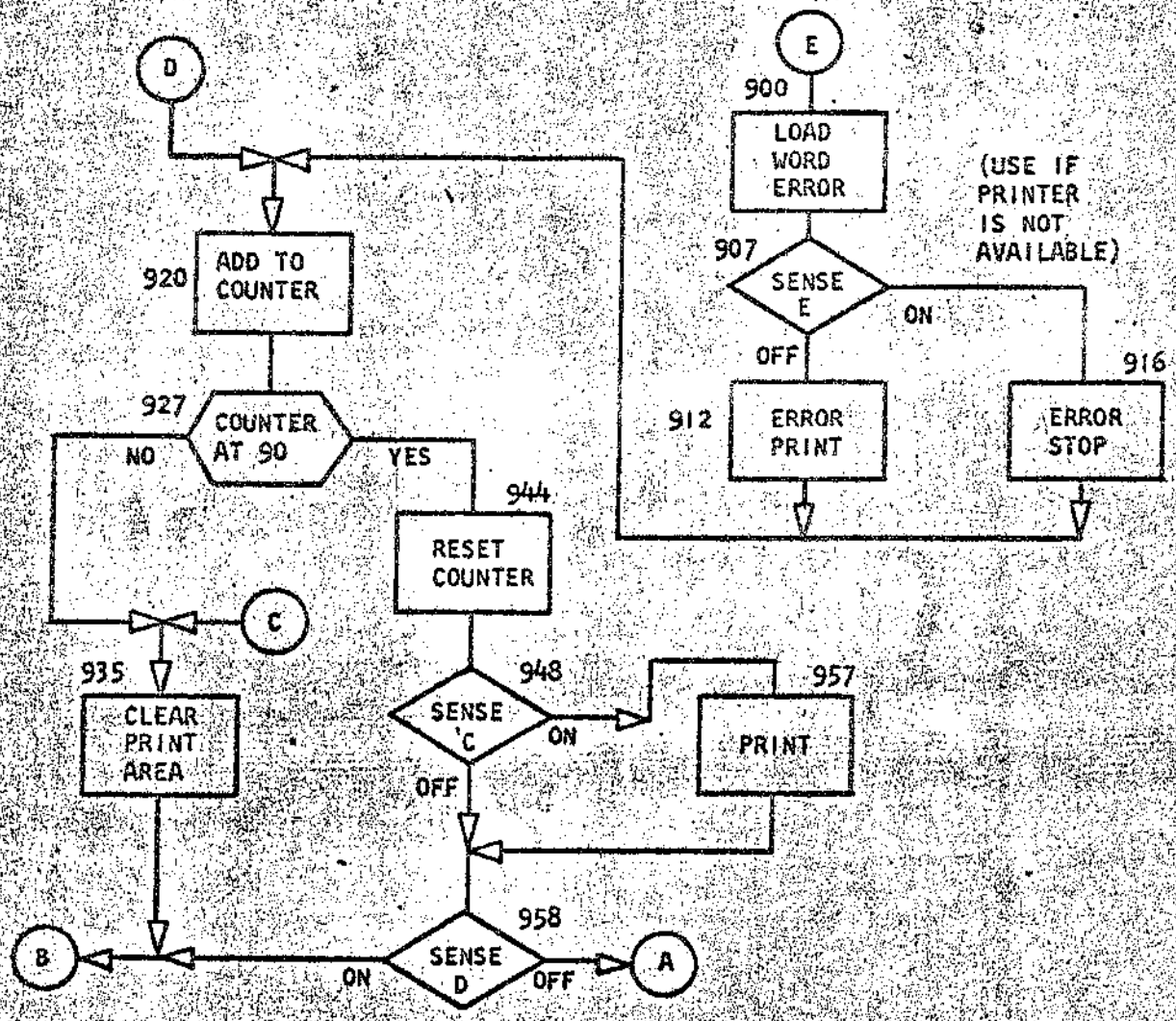
DIAGNOSTIC FUNCTION TEST

PART NO. 451410
SHEET 3 OF 7
BLOCK NO. 0300B

TRUE ADD
FLOW CHART



DATE	2-2-61	3-17-63	10.5.63	25.6.63				
ENG. CHG. NO.	110378	116745	TA-1844	TA-1844A				



DATE	2-2-61	3-17-63	10.5.63	25.6.63				
CHG. NO.	110378	116745	TA-1844	TA-1844A				

PROGRAM LISTING FOR USE WITH FLOW CHART

TRUE ADD 03008

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	388		"	
389	389	N	000		"	
393	393	M	360	392	"	
400	400	/	332		START TEST	
404	404	/			"	
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	/	080		CLEAR READ AREA	
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
421	421	,	001	078	LOAD PRINT AREA	
428	428	L	080	299	"	
435	435	L	072	272	"	
442	442	,	221	241	DEFINE B FIELD + COMPARE FIELD	
449	449	,	202		DEFINE A FIELD	
453	453	B	971	013S	GO TO SUBTRACT ROUTINE	
461	461	L	230	270	LOAD B FIELD	
468	468	A	210	270	ADD	
475	475	A	210	270	ADD	
482	482	B	935	B	LOOP ON SW B	SS
487	487	B	503		GO TEST RESULT	
491	491	S	210	270	SUBTRACT	
498	498	B	935	B	LOOP ON SW B	SS
503	503	C	270	250	COMPARE B FIELD TO CORRECT RESULT	
510	510	B	900	/	BRANCH ERROR	
515	515	B	920		GO TO CORRECT ROUTINE	
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE	
907	907	B	916	E	E ON TO ERROR STOP	SS
912	912	2	920		ERROR PRINT	
916	916	.	920		ERROR STOP	
920	920	A	920	970	ADD ONE TO OPERATION COUNTER	
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS	C FOR TA
935	935	/	332		CLEAR PRINT AREA	
939	939	/			"	
940	940	B	421		BRANCH TO REPEAT	
944	944	S	970		RESET OPERATION COUNTER	
948	948	B	957	C	C ON FOR CORRECT PRINT	SS
953	953	B	958	"	BRANCH TO SENSE D	
957	957	2			PRINT CORRECT RESULTS	
958	958	B	421	D	D ON TO REPEAT	SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE	
967	967	0	00+		OPERATION COUNTER	
971	971	L	230	270	LOAD B FIELD	

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```
 978  978  S 210 270                    SUBTRACT
 985  985  B 491                       SUBTRACT
 989  989                              WORDMARK
1110 /10  E RRO R                      CONSTANTS
1115 /15                               ,,
1120 /20  A  FI ELD                    ,,
1140 /40  B  FI ELD                    ,,
1160 /60  R ESU LT SHOULD BE           ,,
1180 /80  R ESU LT IS                  ,,
```


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DIAGNOSTIC FUNCTION TEST

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
IS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080I5,022029,033033N          1001                TRUE ADD                                  0300B00A
,0080I5,022029,033033M          1001                SET WORDMARK CARD                         0300B 02
L067367,340344,348349,357361I001,008012,001100I18361080AB421/340080                           0300B 03
L069404,377385,389393,400404I001          8389     8S88N000M360392/332/                      0300B 04
L069441,413417,421428,435442I001BS00S521/0808348,001078L080299L072272                        0300B 05
L072481,449453,461468,475482I001,221241,202897101BSL230270A210270A210270A2102700300B 06
L071520,487491,498503,5105151001B935BB503S2102708935BC2702508900/B920                        0300B 07
L071938,907912,916920,927935I001L/14285B916E2920.920A9209708944969I/332                      0300B 08
L056962,940944,948953,957958I001/8421S970B957CB95828421D                                     0300B 09
L058988,967971,978985,989989I001B348000PL230270S2102708491                                   0300B 10
                                  Z
L065/39¤/07/07./10/15,/20/401001   ERROR      A FIELD                                         0300B 11
L072/79,/60/80,/80/80,/80/8010018 FIELD                RESULT SHOULD BE                       0300B 12
L070S17,S00S01,S05S12,S13S17I001RESULT IS              2,049L0772772/2772                     0300B 13
L059S44,S25S29,S36S37,S41S45I001¤/40/60¤/80L/892702/2702413                                   0300B 14
/333080M                                                CLEAR WORDMARK CARD                   0300B 15
,019027,031,038042803IT98GB400L046352BW048588   TRUE ADD                                     0300B 16
                                  M
```

DETAIL CARDS

```
E123456789  ADD OP  0000000000          0246913578                                  0300B 17
E123456781  ADD OP  1111111101          1358024679                                  0300B 18
E123456782  ADD OP  2222222112          2469135690                                  0300B 19
E123456781  ADD OP  333333222I          358024580/                                  0300B 20
E123456789  ADD OP  444443333D          469134691B                                  0300B 21
E123456788  SUB OP  6665555556          6912469134                                  0300B 22
E123456789  SUB OP  877777777Q          9024691350                                  0300B 23
EAKTONWGQI  SUB OP  8HQYHQYHQR          913580246P                                  0300B 24
E 2 4 6 8   ADD OP   1 3 5 7 9          0143862869                                  0300B 25
E999999999  ADD OP  9999999999          /999999997                                  0300B 26
E888888888  SUB OP  9888888880          /66666666M                                  0300B 27
E987654321  ADD OP  9876543210          /851851852                                  0300B 28
E123456788  ADD OP  5555444448          580235802L                                  0300B 29
#ACGT#ACGT  ADD OP  0000000000          0913469134                                  * 0300B 30
  OTM  OTM,
#ACGT#ACGT  SUB OP  6913469134          7826938260                                  * 0300B 31
  OTM  OTM
```

* THESE CARDS CAUSE ARITHMETIC CHECK ON STERLING MACHINES

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RESET ADD AND SUBTRACT

A. PURPOSE

1. TO TEST THE RESET ADD CIRCUITRY

2. TO TEST THE RESET SUBTRACT CIRCUITRY

NOTE: A RESET ADD OR RESET SUBTRACT INSTRUCTION (1) PLACES AN APPROPRIATE SIGN (IN STANDARD FORM) IN THE UNITS POSITION OF THE ACCUMULATOR; (2) MOVES BLANKS OR NUMERICAL PORTIONS OF CHARACTERS IN THE A FIELD TO CORRESPONDING POSITIONS IN THE ACCUMULATOR; (3) INSERTS FILL-IN ZEROS IN THE ACCUMULATOR AFTER A WORD MARK IN THE A FIELD IS SENSED.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

INFORMATION IN THE DETAIL CARD IS LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. COLUMN 72 IS TESTED FOR AN "A" OR AN "S" TO DETERMINE WHICH ROUTINE IS TO BE USED (RESET ADD OR RESET SUBTRACT). IF COLUMN DOES NOT CONTAIN AN "A" OR AN "S", THE PROGRAM HALTS AND BRANCHES BACK TO THE HALT.

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COLUMN 10 IS THEN TESTED FOR A BLANK TO DETERMINE WHETHER A 5-CHARACTER A FIELD WITH A 10-CHARACTER B FIELD IS TO BE USED OR WHETHER A SINGLE CHARACTER A FIELD AND A SINGLE CHARACTER B FIELD IS TO BE USED.

IN EITHER CASE THE RESULT IS COMPARED TO THE RESULT SHOULD BE FIELD.

E. STOPS

543 IN STORAGE ADDRESS REGISTER: WRONG DETAIL CARDS OR BRANCH ON CHARACTER EQUAL CIRCUITRY FAILED.

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
01234		0000001230	0000001230	A
5678Z		000005678I	000005678I	A
_AKTM		00000 123M	00000 123M	A
I		C	C	A
01234		000000123M	000000123M	S
5678Z		000005678R	000005678R	S
_AKTM		00000 1230	00000 1230	S
I		L	L	S

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

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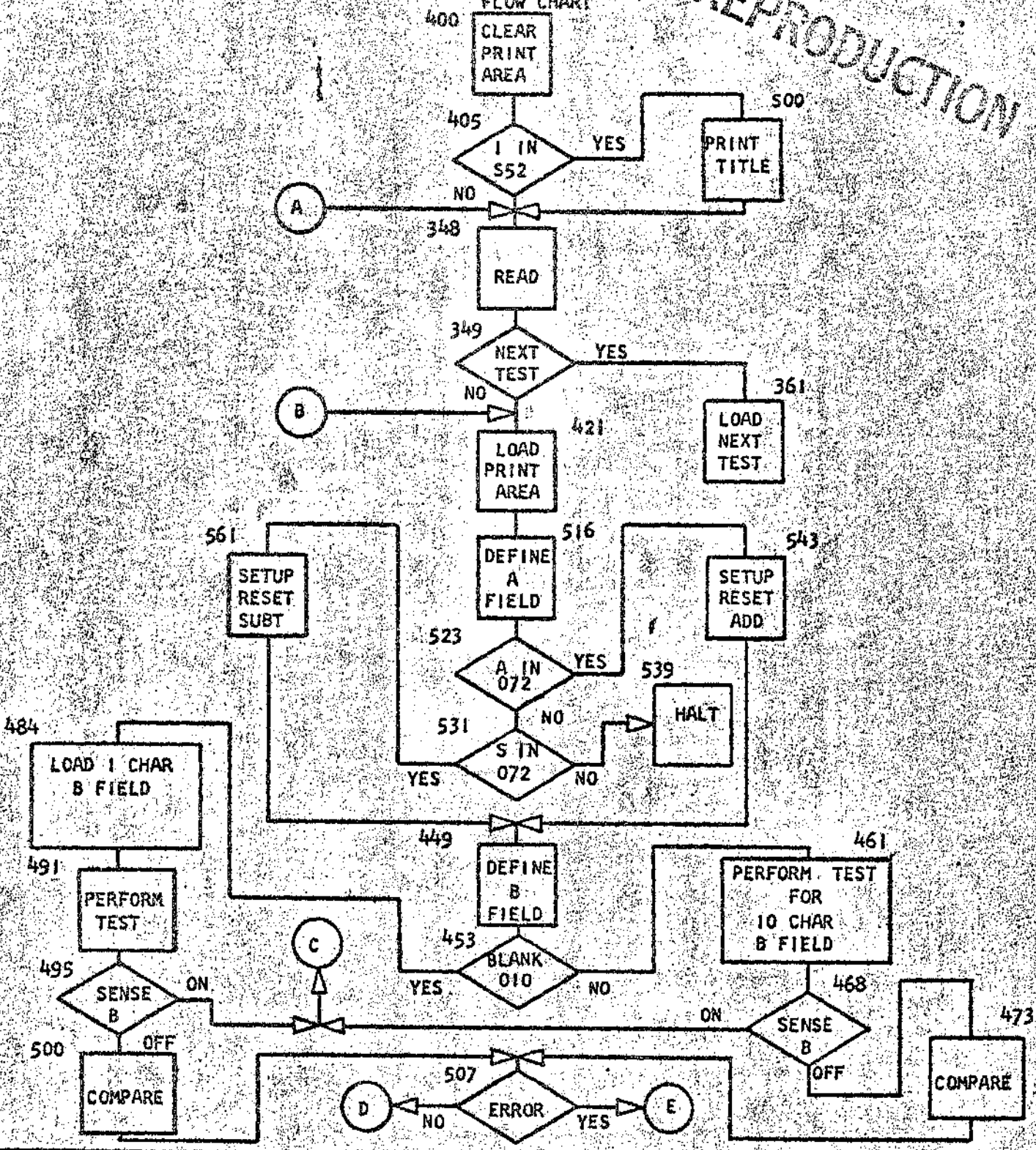
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451413
SHEET 3 OF
BLOCK NO. 03308

RESET ADD AND SUBTRACT FLOW CHART



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DIAGNOSTIC FUNCTION TEST

PART NO. 451413
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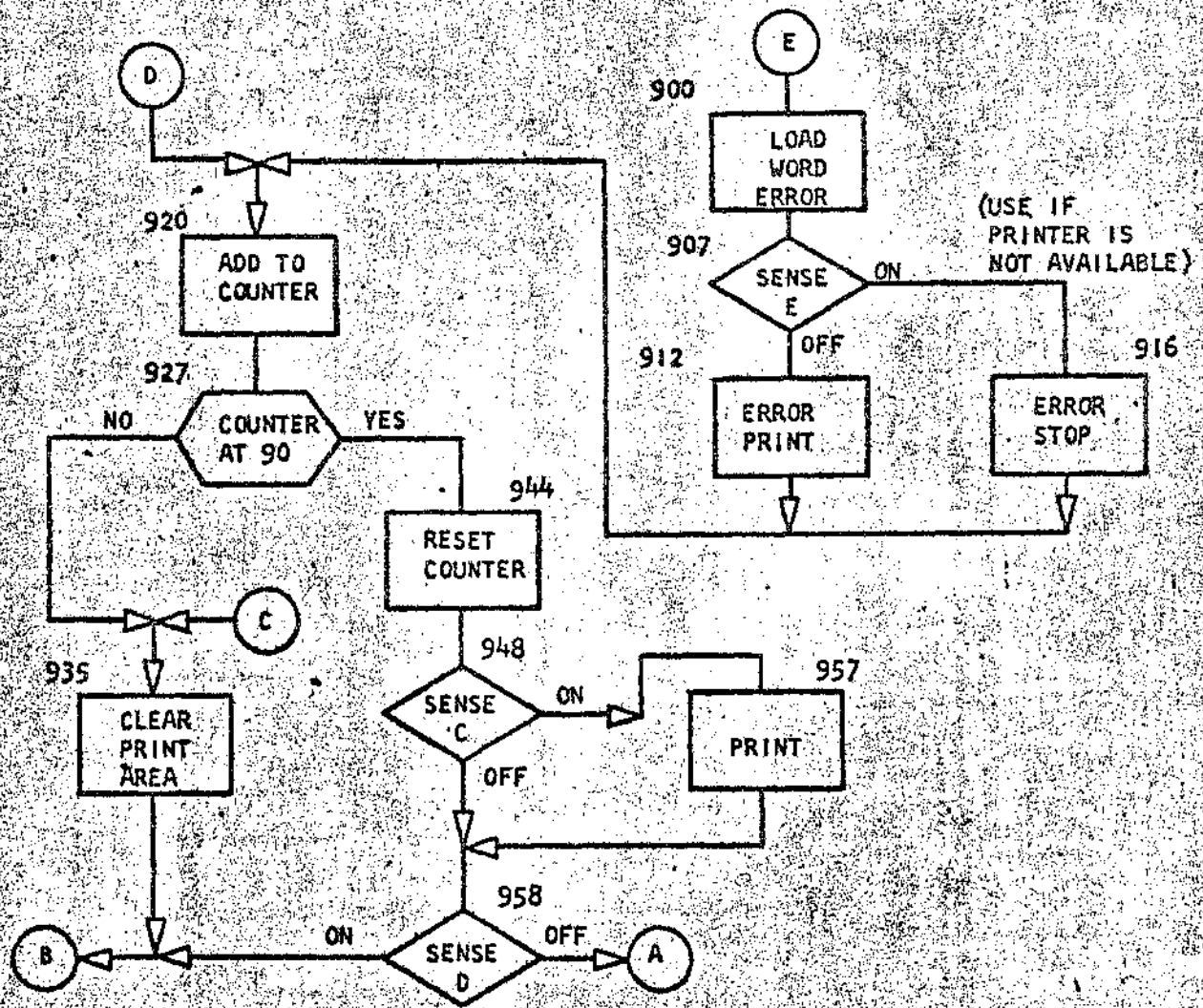
REPRODUCTION



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PROGRAM LISTING FOR USE WITH FLOW CHART

RESET ADD + SUB 03308

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	588		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	500	$521	BR TO TITLE PRINT ROUTINE IF 1 IN $52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	,,
435	435	L	072	272	,,
442	442	B	516		GO TO 516
449	449	,	261		DEFINE B FIELD
453	453	B	484	010	GO DO 1 CHARACTER FIELD
461	461	+	210	270	*DO RESET ADD OR RESET SUBTRACT
468	468	B	935	B	LOOP ON SW B $S
473	473	C	270	250	COMPARE B FIELD TO CORRECT RESULT
480	480	B	507		GO TEST RESULT OF OPERATION
484	484	L	201	261	LOAD 1 CHARACTER B FIELD
491	491	+	261		*DO RESET ADD OR RESET SUBTRACT
495	495	B	935	6	LOOP ON SW B $S
500	500	C	261	241	COMPARE B FIELD TO CORRECT RRSULT
507	507	B	900	/	BRANCH ERROR
512	512	B	920		GO TO CORRECT ROUTINE
516	516	,	206	241	DEFINE A FIELD AND COMPARE FIELD
523	523	B	543	072A	GO DO RESET ADD
531	531	B	561	072$	GO DO RESET SUBTRACT
539	539	.	539		NEITHER -- WRONG DETAIL CARD
543	543	L	971	461	SETUP RESET ADD
550	550	L	971	491	,,
557	557	B	449		GO DO RESET ADD
561	561	M	972	461	SETUP RESET SUBTRACT
568	568	M	972	491	,,
575	575	B	449		GO DO RESET SUBTRACT
579	579				*AN ASTERISK MEANS INSTRUCTION CHANGES
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP $S
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA

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```
 935  935  / 332                CLEAR PRINT AREA
 939  939  /                      ,,
 940  940  B 421                 BRANCH TO REPEAT
 944  944  S 970                 RESET OPERATION COUNTER
 948  948  B 957 C               C ON FOR CORRECT PRINT                    SS
 953  953  B 958                 BRANCH TO SENSE D
 957  957  2                     PRINT CORRECT RESULTS
 958  958  B 421 D               D ON TO REPEAT                            SS
 963  963  B 348                 BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+                 OPERATION COUNTER
 971  971  +                     RESET ADD OP CODE
 972  972  -                     RESET SUBTRACT OP CODE
1110  /10  E RRO R               CONSTANTS
1115  /15                         ,,
1120  /20  A  FI ELD              ,,
1140  /40  B  FI ELD              ,,
1160  /60  R ESU LT SHOULD-BE     ,,
1180  /80  R ESU LT IS            ,,
```

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IBM FORM 624-7313-0

1401 DATA PROCESSING SYSTEM

DIAGNOSTIC FUNCTION TEST

PART NO. 451413
SHEET 7 OF 8
BLOCK NO. 03308

TABLE OF UNPRINTABLE CHARACTERS

```
LP-LEFT PARENTHESIS 12 5 8    SE-SEMICOLON 11 6 8       DE-DELTA     11 7 8
WS-WORD SEPARATOR    0 5 8    LT-LESS THAN 12 6 8       PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8    GT-GREATER THAN 6 8       TM-TAPE MARK  7 8
GM-GROUP MARK       12 7 8    MZ-MINUS ZERO 11 0        CO-COLON      5 8
RP-RIGHT PARENTHESIS 11 5 8   AP-APOSTROPHE 0 6 8
```

```
,008015,022029,033033N       1001                     RESET ADD + SUB      0330800A
,008015,022029,033033N       1001                     SET WORDMARK CARD    03308 02
L067367,340344,348349,3573611001,008012,0011001IB361080A8421/340080       03308 03
L069404,377385,389393,4004041001          B389     BS88N000M360392/332/   03308 04
L069441,413417,421428,4354421001BS00S521/080B348,001078L080299L072272     03308 05
L070479,449453,461468,4734801001B516    ,2618484010 P21027089358C270250   03308 06
                                                   Z
L068515,484491,495500,5075121001B507L201261P26189358C26124I8900/B920      03308 07
                                          Z
L066549,523531,539543,5435431001,20624I8543072A8561072S.539L971461        03308 08
L061578,557561,568575,5795791001L97149I8449M972461M972491B449             03308 09
L071938,907912,916920,9279351001L/1428589I6E2920.920A920970B9449699/332   03308 10
L056962,940944,948953,9579581001/B421S9708957C89582B421D                  03308 11
L042972,967971,972972,9729721001B348000PPM                                03308 12
                                      ZZZ
L065/39¤/07/07,/10/15,/20/401001   ERROR     A FIELD                      03308 13
L072/79,/60/80,/80/80,/80/801001B FIELD              RESULT SHOULD BE     03308 14
L070S17,S00S01,S05S12,S13S171001RESULT IS            2,049L0772772/2772   03308 15
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413               03308 16
/333080N                                             CLEAR WORDMARK CARD  03308 17
,019027,031,0380428031T98GB400L046352BW048S88   RESET ADD + SUB           03308 18
                         M
```

DETAIL CARDS

```
    01234                            0000001230                  A03308 19
    5678Z                            000005678I                  A03308 20
     AKTM                            00000 123M                  A03308 21
     EOXH                            00000 567H                  A03308 22
     IM,@                            00000 90#¤                  A03308 23
      Z
T                                    C                           A03308 24
P                                    P                           A03308 25
I                                    I                           A03308 26
@                                    .                           A03308 27
    01234                            000000123M                  S03308 28
    5678Z                            000005678R                  S03308 29
     AKTM                            00000 1230                  S03308 30
     EOXH                            00000 567Q                  S03308 31
     IM,@                            00000 90#*                  S03308 32
      Z
T                                    L                           S03308 33
P                                    G                           S03308 34
```

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I R S03308 35
I S S03308 3

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ZONE ADD

A. PURPOSE

TO TEST THE ZONE ADDER CIRCUITRY

NOTE: THE ZONE ADDER OPERATES ONLY DURING TRUE-ADD AND THEN ONLY IF THE B FIELD LENGTH IS GREATER THAN ONE. IT OPERATES ON THE B CYCLE IN WHICH THE B FIELD WM IS SENSED, AND A NUMERIC CARRY AT THIS TIME WILL BE ADDED BY THE ZONE ADDER.

ANY ZONE BITS IN THE A FIELD THAT CORRESPONDS TO THE B FIELD WORD MARK (PLUS ANY CARRY) THAT RESULTS FROM AN EQUAL OR LONGER A FIELD WILL ADD.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER.

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

FIELDS A,B, AND RESULT SHOULD BE ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. COLUMN 2 IS THEN TESTED FOR A BLANK. IF NO BLANK A 2-POSITION A FIELD (COLUMNS 1-2) IS ADDED TO A 2-POSITION B FIELD (COLUMNS 21-22). IF COLUMN 2 IS BLANK A 1-POSITION A FIELD (COLUMN 1) IS ADDED TO A 1-POSITION B FIELD (COLUMN 21). THE RESULT IS THEN COMPARED TO THE RESULT SHOULD BE FIELD (COLUMNS 41-42). IF THE COMPARISON IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

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THE ZONE ADDER BY ITSELF CAN ADD UP TO A MAXIMUM OF 3 EITHER AS A RESULT OF ADDING ZONE BITS IN ALPHABETIC OR SPECIAL CHARACTERS IN THE HIGH-ORDER POSITIONS, OR AS A RESULT OF NORMAL CARRY TO SIGNAL AN OVERFLOW CONDITION. THESE ZONES, OR A-B CONFIGURATIONS, IN COMBINATION WITH DIGITS 1-9, MAKES 39 THE MAXIMUM NUMBER THAN CAN BE REPRESENTED OR ACCUMULATED IN THE HIGH-ORDER POSITION OF AN ACCUMULATOR. THE FOLLOWING TABLE SHOWS THE NUMERICAL VALUES OF ZONES OR A-B BIT CONFIGURATIONS.

CARD ZONES	ZONE BITS	VALUE
NO	NO	0
0	A	1
11	B	2
12	A-B	3 (LIMIT OF ZONE ADDER)

THE A-B BIT CONFIGURATIONS ARE HANDLED BY THE ZONE ADDER IN THE FOLLOWING MANNER:

BITS	BITS	BITS	
NO (0)	+ NO (0)	= NO (0)	
NO (0)	+ A (1)	= A (1)	
NO (0)	+ B (2)	= B (2)	
NO (0)	+ A-B(3)	= A-B(3)	
A (1)	+ A (1)	= B (2)	
A (1)	+ B (2)	= A-B(3)	
A (1)	+ A-B(3)	= NO (0)	ZONE ADDER OVERFLOW LOST
B (2)	+ B (2)	= NO (0)	ZONE ADDER OVERFLOW LOST
B (2)	+ A-B(3)	= A (1)	
A-B (3)	+ A-B(3)	= B (2)	

THE A-B BIT CONFIGURATIONS IN THE ZONE ADDER MAY BE FURTHER MODIFIED BY NORMAL CARRY AS A RESULT OF TRUE ARITHMETIC ADDITIONS OF DIGITS 1-9 IN THE HIGH-ORDER POSITION OF A NUMBER. EXAMPLES:

NORMAL ADDITION	ZONE ADDER EQUIVALENT	
9 + 5 = 14	9 + 5 = U (A4)	
9 + 9 = 18	9 + 9 = Y (A8)	
7 + 18 = 25	7 + Y = N (B5)	
14 + 25 = 39	U + N = I (A89)	LIMIT OF HIGH ORDER POSITION
39 + 14 = 53	I + U = T (A3)	

NOTE THAT THE ALPHABETIC CHARACTERS AND THEIR NUMERICAL EQUIVALENTS ARE THE SAME AS THOSE USED FOR ADDRESSING STORAGE LOCATIONS 10-- TO 39--. THUS, OVERFLOW CONDITIONS RECOGNIZED BY THE ZONE ADDER CAN BE USED FOR ADDRESS MODIFICATION.

IN ADDITION TO THE DETAIL CARDS FURNISHED WITH THE TEST DECK, YOU MAY USE OTHER DETAIL CARDS WITH DIFFERENT COMBINATIONS OF HIGH-ORDER CHARACTERS IN FIELDS A,B, AND RESULT SHOULD BE. THE HIGH-ORDER CHARACTER IN THE RESULT SHOULD BE FIELD MAY BE DETERMINED AS FOLLOWS:

1. CONVERT THE HIGH-ORDER CHARACTER IN FIELDS A AND B TO THEIR NUMERICAL EQUIVALENTS.
2. ADD THE TWO FIGURES.
3. SUBTRACT 40 IF THE TOTAL IS MORE THAN 39.
4. CONVERT THE RESULT TO AN ALPHABETIC OR SPECIAL CHARACTER.

	FIELD	HIGH-ORDER CHARACTER	NUMERICAL EQUIVALENT
EXAMPLE 1:	A	L	23
	B	S	12
	RESULT SHOULD BE	E	35
EXAMPLE 2:	A	F	36
	B	I	13
			49
			-40
	RESULT SHOULD BE	9	9
EXAMPLE 3:	A	P	27
	B	A	31
			58
			-40
	RESULT SHOULD BE	Y	18

THE ABOVE EXAMPLES ASSUME THAT THE HIGH-ORDER CHARACTERS IN FIELDS A AND B ARE NOT THE UNITS POSITIONS; IN OTHER WORDS, FIELDS A AND B EACH HAVE A MINIMUM OF AT LEAST TWO CHARACTERS. EXAMPLE

TWO-CHARACTER FIELDS

M 0 + M 0 = 8 0

NUMERICAL EQUIVALENT (24)0 + (24)0 = (48)0 - (40) = 8 0

WHEN FIELDS A AND B ARE SINGLE-CHARACTER FIELDS, ZONE BITS IN EITHER OR BOTH CHARACTERS ARE TREATED AS ALGEBRAIC SIGNS, THE ZONE ADDER IS NOT EMPLOYED, AND NORMAL ALGEBRAIC SIGN CONVENTIONS ARE OBSERVED. EXAMPLE:

SINGLE-CHARACTER FIELDS

	M + M	= Q
NUMERICAL EQUIVALENT	4 + 4	= 8
	I + I	= H
	+ +	+
NUMERICAL EQUIVALENT	9 + 9	= 8

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E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
40	40	80	80
ZO	RO	80	80
MO	MO	80	80
9	9	8	8
M	M	Q	Q

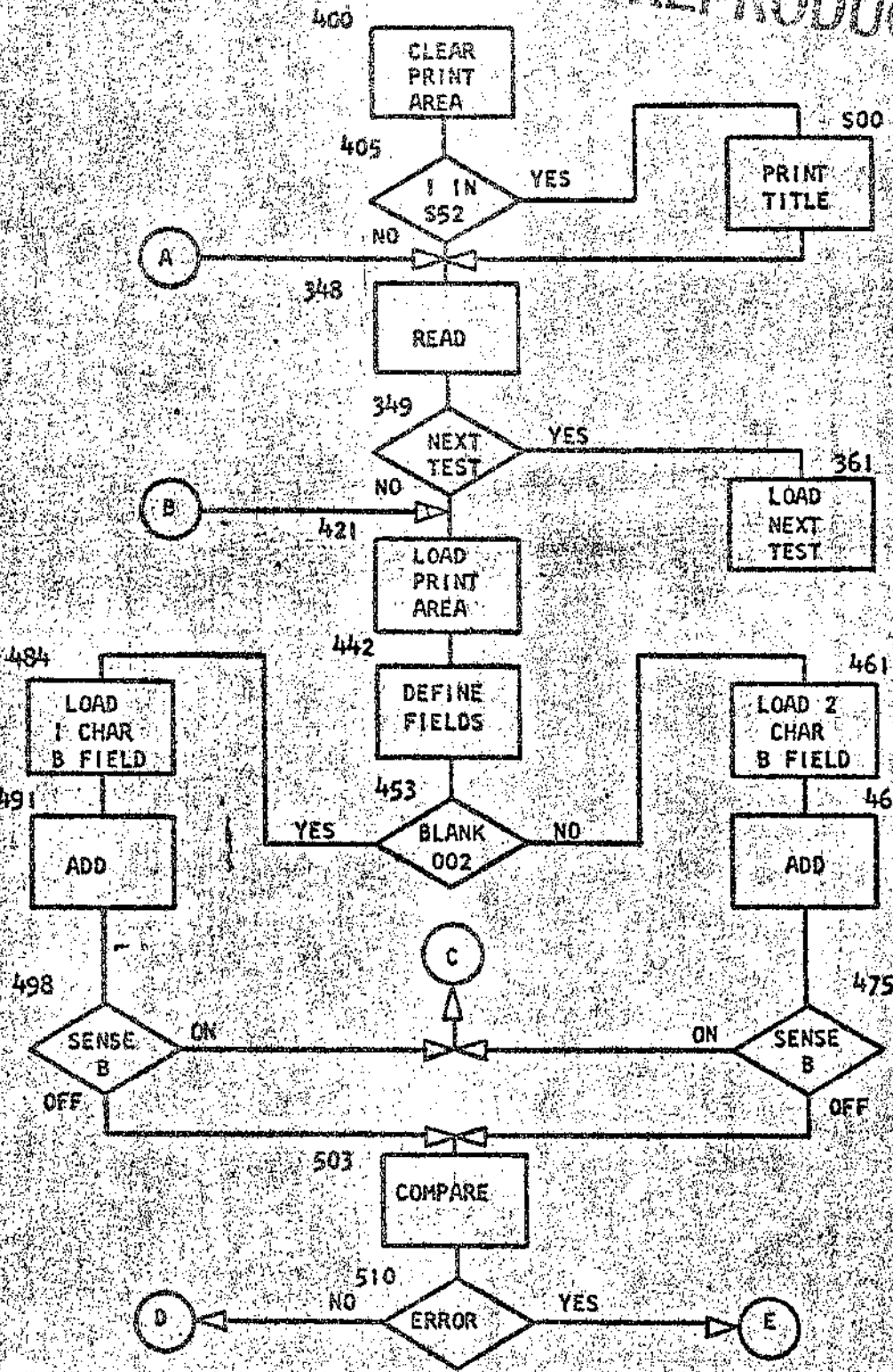
2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
40	40	80	40	ERROR
ZO	RO	80	IO	ERROR
MO	MO	80	QO	ERROR
9	9	8	Y	ERROR
M	M	Q	8	ERROR

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

ZONE ADD
FLOW CHART



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DIAGNOSTIC FUNCTION TEST

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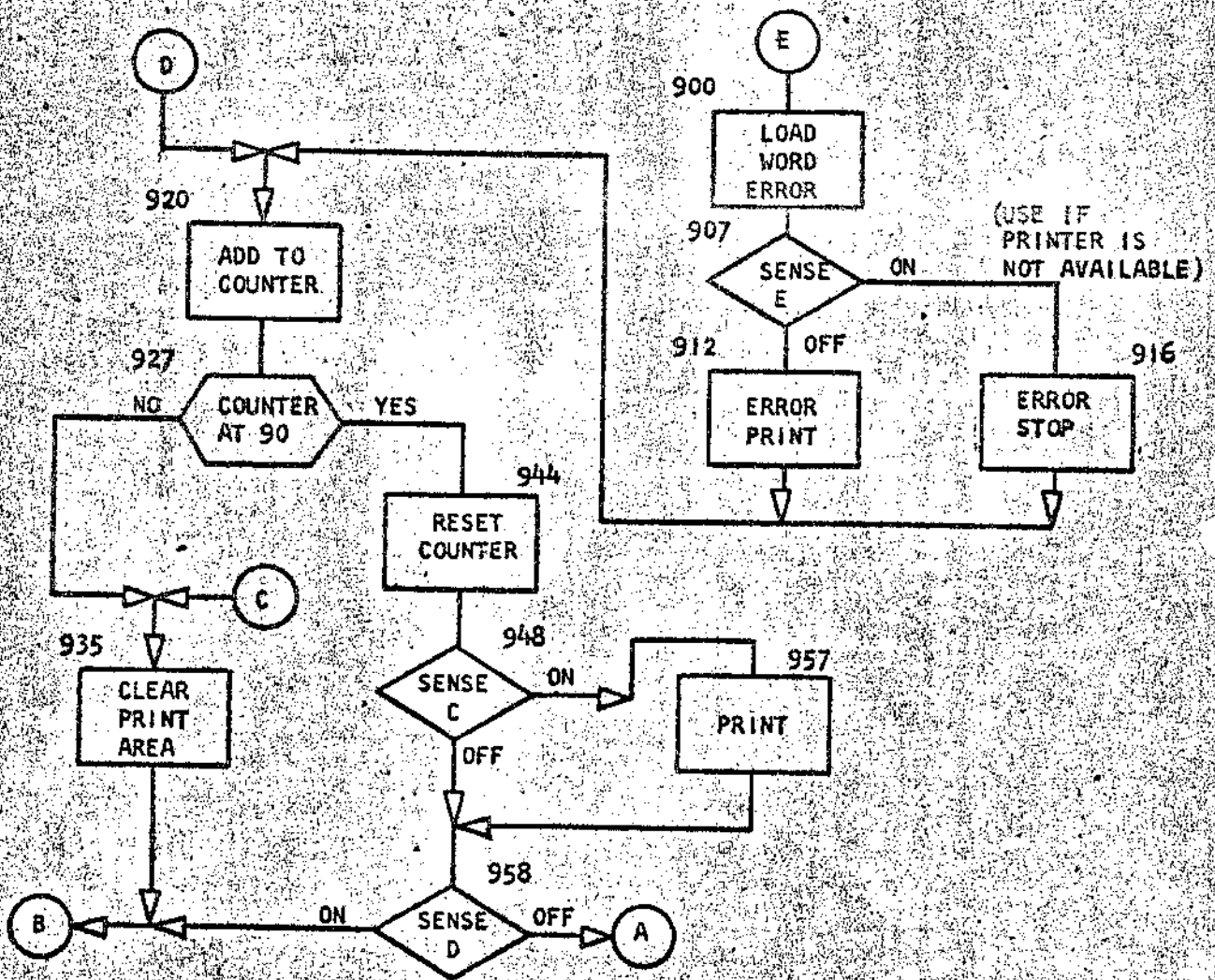
BLOCK NO. 0350B

REPRODUCTION



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

ZONE ADD 03508

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	588		"	
389	389	N	000		"	
393	393	M	360	392	"	
400	400	/	332		START TEST	
404	404	/			"	
405	405	B	500	5521	BR TO TITLE PRINT ROUTINE IF 1 IN 552	
413	413	/	080		CLEAR READ AREA	
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
421	421	,	001	078	LOAD PRINT AREA	
428	428	L	080	299	"	
435	435	L	072	272	"	
442	442	,	221	241	DEFINE B FIELD + COMPARE FIELD	
449	449	N	000		NOTHING	
453	453	B	484	002	GO TO 484 IF SINGLE CHARACTER FIELDS	
461	461	L	222	262	LOAD 2 CHAR B FIELD	
468	468	A	202	262	ADD 2 CHAR FIELDS	
475	475	B	935	B	LOOP ON SW B	SS
480	480	B	503		GO TEST RESULT	
484	484	L	221	261	LOAD SINGLE CHAR B FIELD	
491	491	A	201	261	ADD SINGLE CHAR FIELDS	
498	498	B	935	B	LOOP ON SW B	SS
503	503	C	262	242	COMPARE B FIELD TO CORRECT RESULT	
510	510	B	900	/	BRANCH ERROR	
515	515	B	920		GO TO CORRECT ROUTINE	
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE	
907	907	B	916	E	E ON TO ERROR STOP	SS
912	912	2	920		ERROR PRINT	
916	916	.	920		ERROR STOP	
920	920	A	920	970	ADD ONE TO OPERATION COUNTER	
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS	C FOR TA
935	935	/	332		CLEAR PRINT AREA	
939	939	/			"	
940	940	B	421		BRANCH TO REPEAT	
944	944	S	970		RESET OPERATION COUNTER	
948	948	B	957	C	C ON FOR CORRECT PRINT	SS
953	953	B	958		BRANCH TO SENSE D	
957	957	2			PRINT CORRECT RESULTS	
958	958	B	421	D	D ON TO REPEAT	SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE	
967	967	0	00→		OPERATION COUNTER	
1110	/10	E	RRO	R	CONSTANTS	

DATE	2-2-61	3-17-63	10.5.63						
ENG. CHG. NO.	110378	116745	TA-1844						

```
1115  /15
1120  /20  A  FI ELD
1140  /40  B  FI ELD
1160  /60  R  ESU LT SHOULD BE
1180  /80  R  ESU LT IS
```


DATE	2-2-61	5-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    ZONE ADD                    0350800A
,008015,022029,033033N      1001                    SET WORDMARK CARD           03508 02
L067367,340344,348349,3573611001,008012,00110011B361080AB421/340080             03508 03
L069404,377385,389393,4004041001          B389    BS88N000M360392/332/          03508 04
L069441,413417,421428,4354421001BS00S521/080B348,001078L080299L072272           03508 05
L070479,449453,461468,4754801001,221241N0008484002 L222262A20226289358          03508 06
L072519,484491,498503,5105151001B503L221261A201261B9358C262242B900/8920         03508 07
L071938,907912,916920,9279351001L/142858916E2920.920A9209708949699/332          03508 08
L056962,940944,948953,9579581001/8421S970B957CB958284210                        03508 09
L040970,967971,971971,9719711001B348000P                                        03508 10
                                        Z
L065/39¤/07/07,/10/15,/20/401001  ERROR     A FIELD                             03508 11
L072/79,/60/80,/80/80,/80/8010018 FIELD                 RESULT SHOULD BE        03508 12
L070S17,S00S01,S05S12,S13S171001RESULT IS               2,049L0772772/2772      03508 13
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                      03508 14
/333080N                                            CLEAR WORDMARK CARD         03508 15
L031/991001RESULT IS                ,,                                          03508 16
,019027,031,038042B031T98GB400L046352BW048S88   ZONE ADD                        03508 17
                                    M
```

DETAIL CARDS

```
40                  40                  80                                      03508 18
1M                  90                  8P                                      03508 19
 Z                                      Z
ZO                  RO                  80                                      03508 20
UO                  DO                  80                                      03508 21
MO                  MO                  80                                      03508 22
40                  UO                  YO                                      03508 23
90                  90                  YO                                      03508 24
ZO                  IO                  YO                                      03508 25
RO                  RO                  YO                                      03508 26
DO                  MO                  YO                                      03508 27
40                  MO                  QO                                      03508 28
ZO                  90                  QO                                      03508 29
UO                  UO                  QO                                      03508 30
RO                  IO                  QO                                      03508 31
DO                  DO                  QO                                      03508 32
40                  DO                  HO                                      03508 33
RO                  90                  HO                                      03508 34
UO                  MO                  HO                                      03508 35
ZO                  ZO                  HO                                      03508 36
IO                  IO                  HO                                      03508 37
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

IBM FORM 62-7139

DIAGNOSTIC FUNCTION TEST

PART NO. 451415
SHEET 10 OF 10
BLOCK NO. 0350B

4	4	8			0350B 38
9	9	8			0350B 39
M	M	Q			0350B 40
I	I	H			0350B 41
U	U	Y			0350B 42
J	9	H			0350B 43
1	R	Q			0350B 44
9	J	H			0350B 45
R	1	Q			0350B 46
/9	IM	7J			0350B 47
	Z				
/9	RM	7J			0350B 48
	Z				
/9	ZM	7J			0350B 49
	Z				

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					

BRANCH OVERFLOW

A. PURPOSE

TO TEST THE BRANCH ON OVERFLOW CIRCUITRY.

NOTE: THE OVERFLOW LATCH CAN BE SET ONLY ON A TRUE ADD OPERATION. THE LATCH IS SET WHEN A NUMERIC CARRY OCCURS IN THE B CYCLE IN WHICH THE B FIELD WM IS SENSED. THE LATCH IS RESET BY THE BRANCH INSTRUCTION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B. ON TO REPEAT FOR SCOPING
      OFF TO CONTINUE
   C. ON TO PRINT CORRECT RESULTS
      OFF TO CONTINUE
   D. ON TO REPEAT SAME DETAIL CARD
      OFF TO CONTINUE
   E. ON TO STOP ON ERROR
      OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

FIELDS A,B, AND RESULT SHOULD BE ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. A TEST FOR OVERFLOW INSTRUCTION IS THEN EXECUTED TO INSURE THAT THE OVERFLOW INDICATOR IS OFF. FIELD A (COLUMN 1-2) AND FIELD B (COLUMNS 21-22) ARE NEXT ADDED TOGETHER IN THE RESULT IS STORAGE AREA (LOCATIONS 261-262).

IF AN OVERFLOW OCCURS AS A RESULT OF THIS ADDITION, THE PROGRAM BRANCHES TO A SET OF INSTRUCTIONS TO TEST FOR A BLANK IN COLUMN 6. IF BLANK THE CONDITION IS CORRECT AND PROGRAMMING PROCEEDS FOR THE NEXT RECORD. IF NOT BLANK AN ERROR IS INDICATED.

IF AN OVERFLOW DOES NOT OCCUR AS A RESULT OF ADDING FIELDS A AND B, A TEST IS MADE FOR THE LETTER "N" IN COLUMN 6. IF THE "N" IS PRESENT THE CONDITION IS CORRECT AND PROGRAMMING PROCEEDS FOR THE NEXT RECORD. IF NOT "N" AN ERROR IS INDICATED.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
40 NO OVERFLOW	40	80	80
ZO OVERFLOW	RO	80	80
40 NO OVERFLOW	UO	YO	YO
90 OVERFLOW	90	YO	YO

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
40 NO OVERFLOW	40	80	YO	ERROR
ZO OVERFLOW	RO	80	ID	ERROR
40 NO OVERFLOW	UO	YO	QO	ERROR
90 OVERFLOW	90	YO	80	ERROR

COLUMN 6
PRINT POSITION 206

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

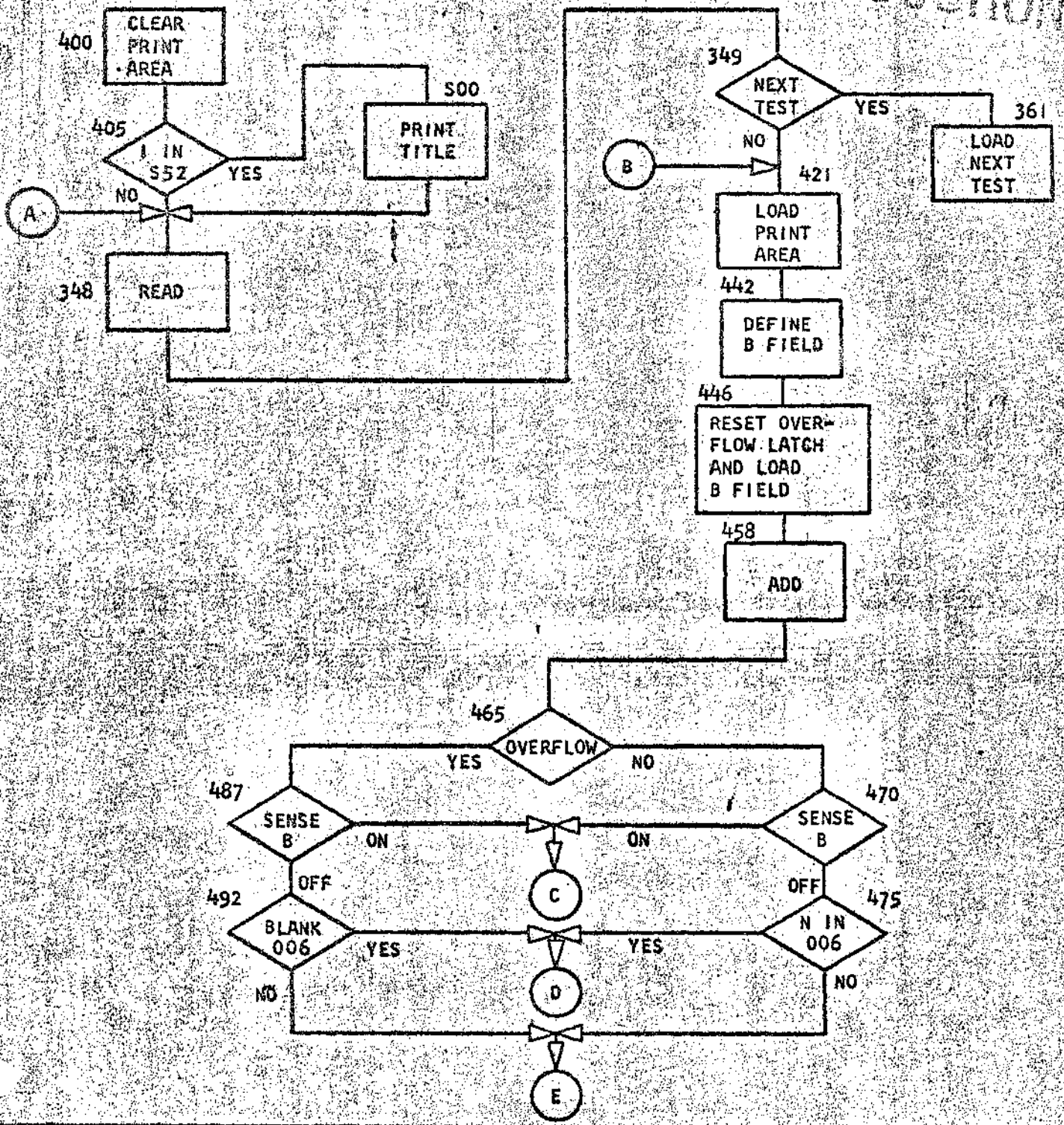
IBM

DIAGNOSTIC FUNCTION TEST

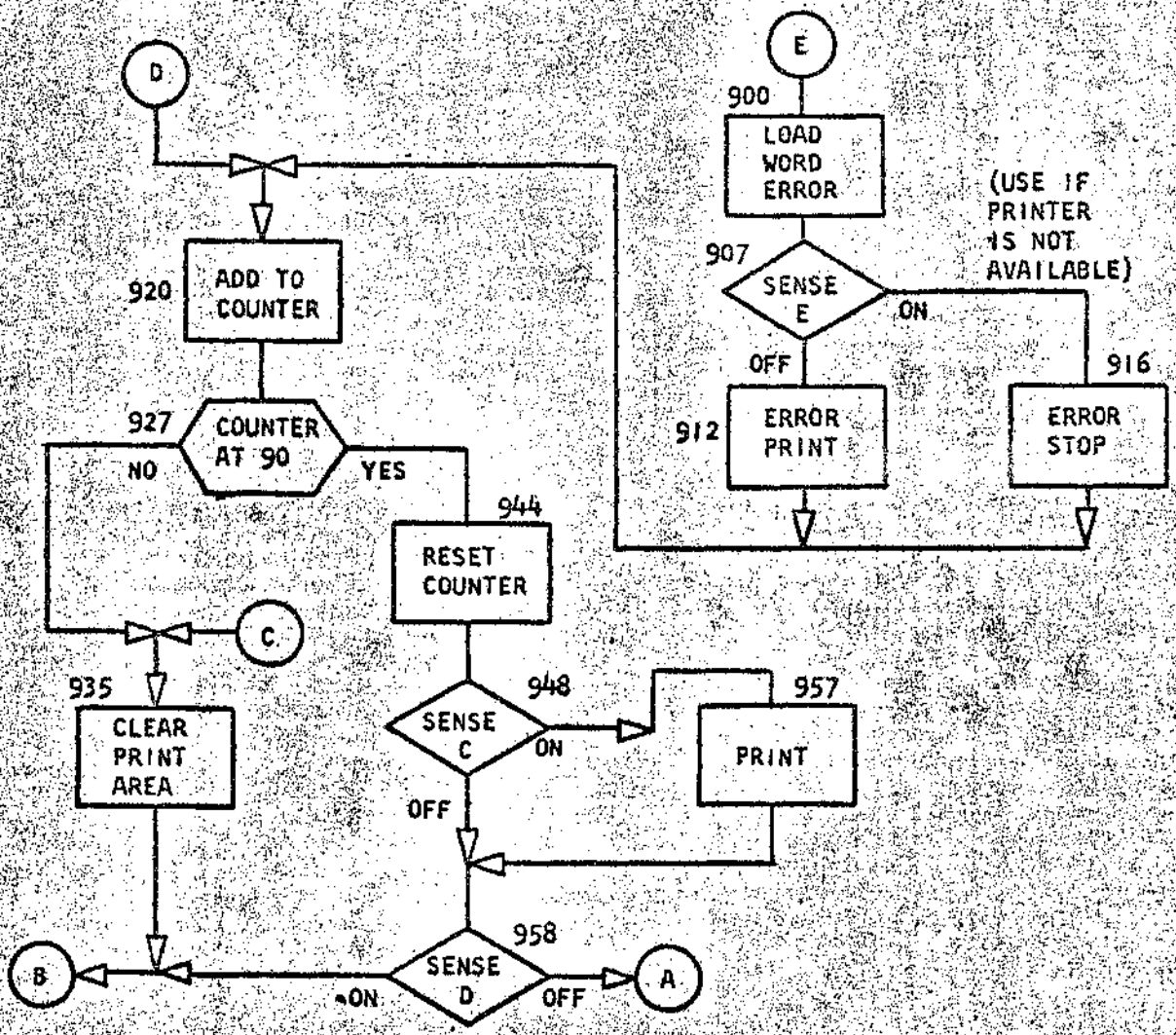
PART NO. 451416
SHEET 3 OF 8
BLOCK NO. 03608

BRANCH OVERFLOW

FLOW CHART



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TA-1844					



DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	TI-1844					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH OVERFLOW 03608

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	,,
435	435	L	072	272	,,
442	442	,	221		DEFINE B FIELD
446	446	B	451	Z	RESET OVERFLOW LATCH
451	451	L	222	262	LOAD B FIELD
458	458	A	202	262	ADD
465	465	B	487	Z	TEST OVERFLOW LATCH
470	470	B	935	B	LOOP ON SW B SS
475	475	B	920	006N	GO TO CORR ROUTINE IF N + NO OVERFLOW
483	483	B	900		GO TO ERROR ROUTINE
487	487	B	935	B	LOOP ON SW B SS
492	492	B	920	006	GO TO CORR ROUTINE IF BLANK + OVERFLOW
500	500	B	900		GO TO ERROR ROUTINE
504	504				WORDMARK
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			,,
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS
953	953	B	958		BRANCH TO SENSE D
957	957	2			PRINT CORRECT RESULTS
958	958	B	421	D	D ON TO REPEAT SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE
967	967	0	00+		OPERATION COUNTER
1110	/10	E	RRO	R	CONSTANTS
1115	/15				,,

DATE	2-2-61	3-17-63	10.5.63					
NO. CHG. NO.	110378	116745	TA-1844					

```
1120  /20  A  FI ELD                    ''
1140  /40  B  FI ELD                    ''
1160  /60  R ESU LT SHOULD BE           ''
1180  /80  R ESU LT IS                  ''
```

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    8RANCH OVERFLOW              0360B00A
,008015,022029,033033N      1001                    SET WORDMARK CARD            0360B 02
L067367,340344,348349,3573611001,008012,001100118361080AB421/340080              0360B 03
L069404,377385,389393,4004047001          B389    BS88N000M360392/332/           0360B 04
L069441,413417,421428,4354421001BS00S21/0808348,001078L080299L072272             0360B 05
L065474,446451,458465,4704751001,2218451ZL222262A2022628487Z8935B                0360B 06
L072514,483487,492500,5045041001892000GN8900893588920006 B900                    0360B 07
L071938,907912,916920,9279351001L/14285B916E2920.920A9209708949699/332           0360B 08
L056962,940944,948953,9579581001/8421S9708957CB958284210                         0360B 09
L040970,967971,971971,9719711001B348000P                                          0360B 10
                                        Z
L065/394/07/07,/10/15,/20/401001   ERROR      A FIELD                             0360B 11
L072/79,/60/80,/80/80,/80/8010018 FIELD                RESULT SHOULD BE          0360B 12
L070S17,S00S01,S05S12,S13S171001RESULT IS                2,049L0772772/2772       0360B 13
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                       0360B 14
/333080N                                                CLEAR WORDMARK CARD       0360B 15
,019027,031,038042803IT98GB400L046352BW048588   BRANCH OVERFLOW                  0360B 16
                                        M
```

DETAIL CARDS

```
40   NO OVERFLOW    40                    80                                     0360B 17
1M   NO OVERFLOW    90                    8P                                     0360B 18
Z                                         Z
ZO       OVERFLOW   RO                    80                                     0360B 19
UO   NO OVERFLOW    DO                    80                                     0360B 20
MO   NO OVERFLOW    MO                    80                                     0360B 21
UO   NO OVERFLOW    UO                    YO                                     0360B 22
90       OVERFLOW   90                    YO                                     0360B 23
ZO       OVERFLOW   IO                    YO                                     0360B 24
RO       OVERFLOW   RO                    YO                                     0360B 25
DO   NO OVERFLOW    MO                    YO                                     0360B 26
40   NO OVERFLOW    MO                    QO                                     0360B 27
ZO       OVERFLOW   90                    QO                                     0360B 28
UO   NO OVERFLOW    UO                    QO                                     0360B 29
RO       OVERFLOW   IO                    QO                                     0360B 30
DO   NO OVERFLOW    DO                    QO                                     0360B 31
40   NO OVERFLOW    DO                    HO                                     0360B 32
RO       OVERFLOW   90                    HO                                     0360B 33
UO   NO OVERFLOW    MO                    HO                                     0360B 34
ZO       OVERFLOW   ZO                    HO                                     0360B 35
/9   NO OVERFLOW    1M                    7J                                     0360B 36
                    Z
```

DATE	2-2-61	3-17-63	10.5.63					
ENG. CHG. NO.	110378	116745	IA-1844					

19	NO OVERFLOW	RM Z	73		03608 37
19	NO OVERFLOW	ZM Z	74		03608 38

EDIT AND EXPANDED EDIT

A. PURPOSE

1. TO TEST BASIC EDIT CIRCUITRY.

2. TO TEST EXPANDED EDIT CIRCUITRY (IF THE SELECTION DIGIT 1 IS IN STORAGE LOCATION 1260).

B. LOADING PROCEDURES

1. IF EXPANDED EDIT IS NOT A FEATURE OF THE SYSTEM, REMOVE CARD 15 FROM THE TEST. (THIS CARD PLACES A 1 IN LOCATION 1260.)

2. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

3. WITH THE EXCEPTION OF THE SELECTION DIGIT FOR EXPANDED EDIT (1 IN 1260), NO SELECTION DIGIT IS REQUIRED WHEN THE TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

THE PROGRAM TESTS COLUMN 72 FOR NO ZONE BITS, SIGNIFYING BASIC EDIT. (AN E DENOTES EXPANDED EDIT). ALL BASIC EDIT DETAIL CARDS ARE PROCESSED. EXPANDED EDIT DETAIL CARDS ARE PROCESSED ONLY IF LOCATION 1260 CONTAINS A 1.

NEXT, THE DATA FIELD A (COLUMNS 1-8), CONTROL FIELD B (COLUMNS 21-37), AND RESULTS SHOULD BE FIELD (COLUMNS 41-57) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. THE CONTROL WORD (FIELD B) IS THEN MOVED TO LOCATIONS 261-277 AND IMMEDIATELY FOLLOWED BY AN EDIT INSTRUCTION TO MOVE THE DATA WORD (FIELD A) INTO THE SAME AREA. THE RESULT IS NEXT COMPARED WITH THE RESULT SHOULD BE FIELD. FOR UNEQUAL CONDITIONS THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

NOTE: THE LAST DETAIL CARD FOR THE BASIC EDIT (JUST PRECEDING THE DETAIL CARDS FOR THE EXPANDED EDIT) PERFORMS AS AN EXPANDED EDIT DETAIL CARD IF THIS FEATURE IS ON THE MACHINE. TO DENOTE THIS DUAL FUNCTION CARD, IT HAS AN E IN COLUMN 71 RATHER THAN 72.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS		
00678901	$, 0. ********	$ 6,789.01********	$ 6,789.01********		
00345678 FLOATING	$, $0. &&&&&&	$3,456.78	$3,456.78		E
00006789 * PROTECT	$, *0. &&&***	$******67.89 ***	$******67.89 ***		E
00000001 DEC CNTRL	$, . 0&&&***	$ .01 ***	$ .01 ***		E
0003456R SIGN LEFT	CR 0. &&&***	CR 345.67 ***	CR 345.67 ***		E

2. ERROR

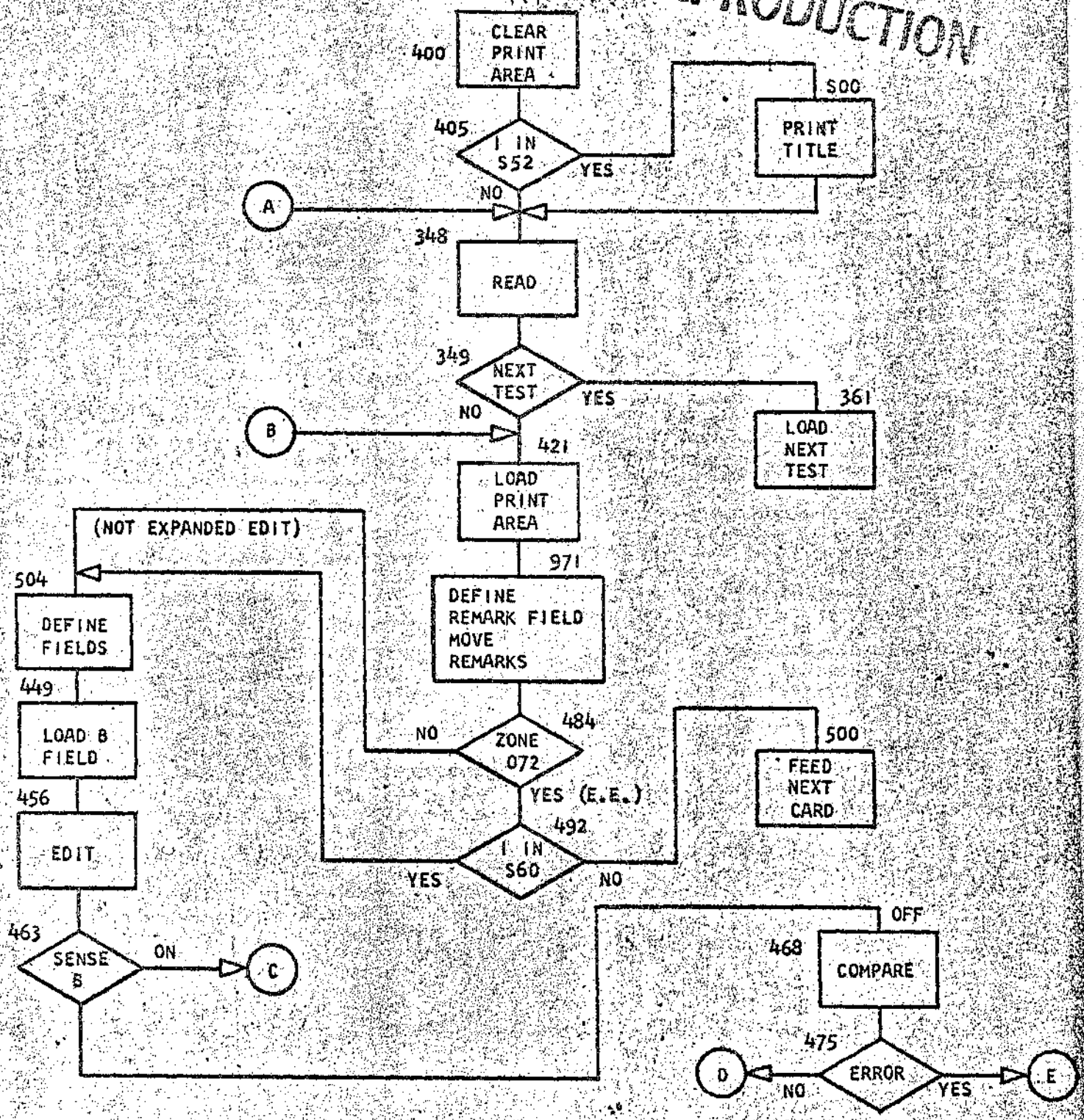
A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS			
00678901	$, 0. ********	$ 6,789.01********	$ 6,789.01			ERROR
00345678 FLOATING	$, $0. &&&&&&	$3,456.78	$ 3,456.78		E	ERROR
00006789 * PROTECT	$, *0. &&&***	$******67.89 ***	$ 67.89 ***		E	ERROR
00000001 DEC CNTRL	$, . 0&&&***	$ .01 ***	$ 1		E	ERROR
0003456P SIGN LEFT	CR 0. &&&***	CR 345.67 ***	345.67 ***		E	ERROR

G. COMMENTS

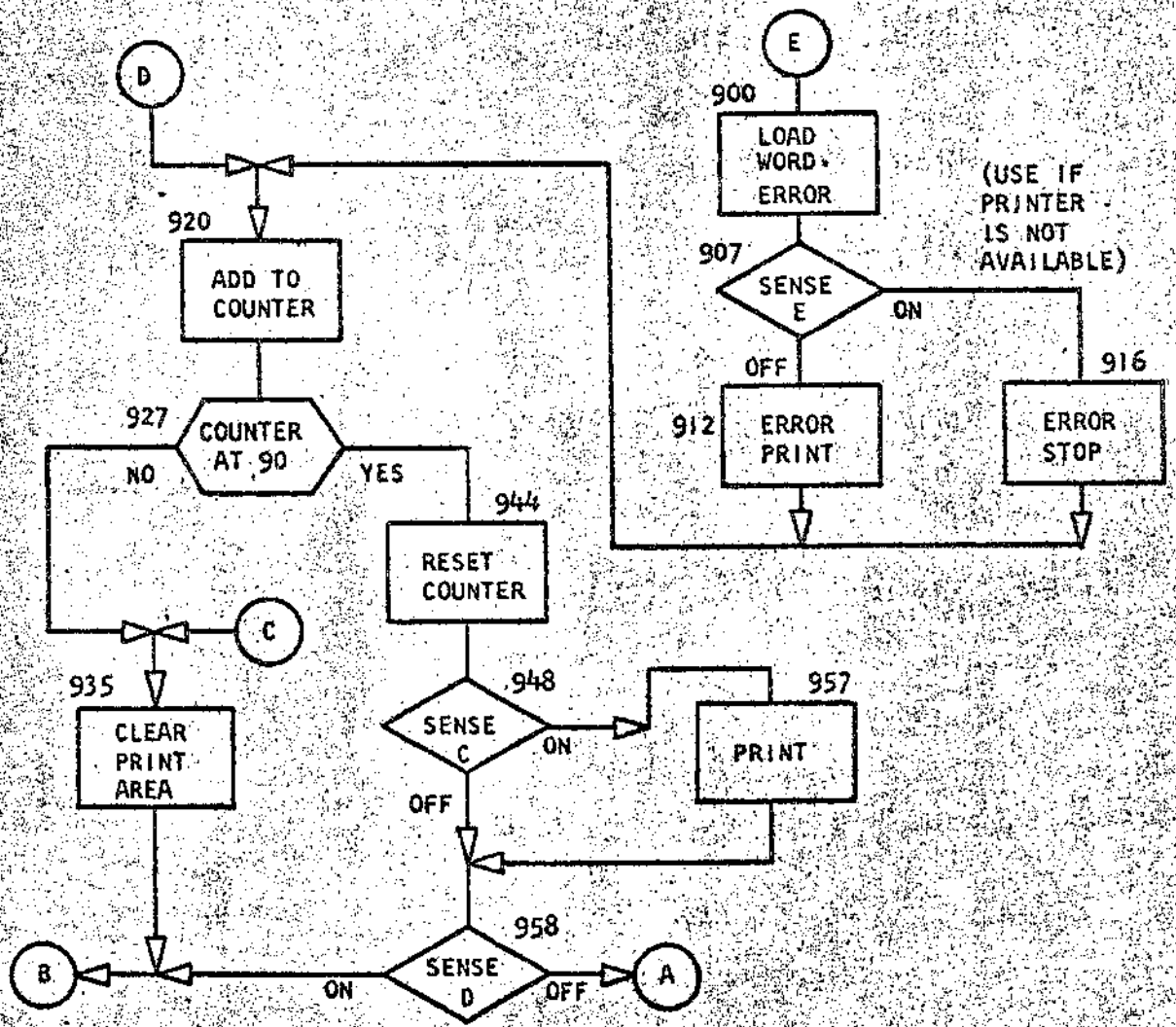
THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

DATE	2-2-61	3-17-63	7-1-63	17.10.63	18.12.63			
ENG. CHG. NO.	110378	116745	117628	TA 1976	TA-1976A			

EDIT FLOW CHART



DATE	2-2-61	3-17-63	7-1-63	17.10.63	18.12.63			
ENG. CHG. NO.	110378	116745	117628	TA 1976	TA 1976A			



DATE	2-2-61	3-17-63	7-1-63	17.10.63	18.12.63			
ENG. CHG. NO.	110378	116745	117628	TA 1976	TA 1976 A			

PROGRAM LISTING FOR USE WITH FLOW CHART

EDIT 03700

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389		USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	388		
389	389	N	000		
393	393	M	360	392	
400	400	/	332		
404	404	/			START TEST
405	405	B	500	$521	
413	413	/	080		BR TO TITLE PRINT ROUTINE IF 1 IN $52
417	417	B	348		CLEAR READ AREA
421	421	,	001	078	BRANCH TO PROGRAM CHAINING ROUTINE
428	428	L	080	299	LOAD PRINT AREA
435	435	L	070	270	
442	442	B	971		GO TO 971
449	449	L	237	277	LOAD B FIELD
456	456	E	206	272	DO EDIT OR EXPANDED EDIT
463	463	B	935	B	LOOP ON SW B
468	468	C	277	257	COMPARE B FIELD TO CORRECT RESULT $S
475	475	B	900	/	BRANCH ERROR
480	480	B	920		GO TO CORRECT ROUTINE
484	484	V	50M	0722	DO TEST IF NOT EXPANDED EDIT
492	492	B	504	560	DO EXPANDED EDIT TEST IF 1 IN 1260
500	500	B	348		FEED NEXT CARD IF E E + NO 1 IN 1260
504	504	,	221	241	DEFINE B FIELD AND COMPARE FIELD
511	511	B	449		GO LOAD B FIELD
515	515				WORDMARK
900	900	L	/14	287	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP $S
912	912	2	920		ERROR PRINT
916	916	,	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT $S
953	953	B	958		BRANCH TO SENSE D
957	957	2			PRINT CORRECT RESULTS
958	958	B	421	D	D ON TO REPEAT $S
963	963	B	349		BRANCH TO PROG. CHAINING ROUTINE
967	967	0	004		OPERATION COUNTER
971	971	,	071		DEFINE REMARK FIELD
975	975	M	072	231	MOVE REMARK

DATE	2-2-61	3-17-63	6-29-63	11.10.63	12.12.63			
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```
 982  982  B 484          GO TO 484
 986  986                 WORDMARK
1110  /10  E RRD R        CONSTANTS
1115  /15                 "
1120  /20  A FI ELD       "
1140  /40  B FI ELD       "
1160  /60  R ESU LT SHOULD BE  "
1180  /80  R ESU LT IS    "
1260  S60  1             SELECTION DIGIT FOR EXPANDED EDIT
```

DATE	2-2-61	3-17-63	6-29-63	17.10.63	18.12.63			
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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    EDIT                                  0370D00A
,008015,022029,033033N        1001                    SET WORDMARK CARD                     0370D 02
L067367,340344,348349,3573611001,008012,00110011B361080AB421/340080                         0370D 03
L069404,377385,389393,400404 1001          B389     BS88N000M360392/332/                  0370D 04
L069441,413417,421428,435442 1001BS00S521/080B348,001078L080299L070270                      0370D 05
L070479,449456,463468,4754751001B971   L237277E20827TB9358C2772578900/                       0370D 06
L067514,484492,500504,5115151001B920VS040722B504S6G18348,2212418449                         0370D 07
L071938,907912,916920,9279351001L/14287B916E2920.920A92097QB9449699/332                     0370D 08
L056962,940944,948953,9579581001/8421S970B957CB958284210                                    0370D 09
L055985,967971,975982,9869861001B348000P,071M0722818484                                     0370D 10
                                    Z
L065/39¤/07/07,/10/15,/20/401001   ERROR      A FIELD                                        0370D 11
L072/79,/60/80,/80/80,/80/8010018 FIELD                 RESULT SHOULD BE                    0370D 12
L070S17,S00S01,S05S12,S13S171001RESULT IS                2,049L0772772/2772                 0370D 13
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                                  0370D 14
L033S60¤S60S60,001001,00100110011                                                           0370D 15
/333080N                                    CLEAR WORDMARK CARD                             0370D 16
,019027,031,038042B031T98GB400L0463528W048S88   EDIT                                        0370D 17
                                    M
```

DETAIL CARDS

```
00000012                    ++++++      00000012                                            0370D 18
00000034                0   ++++++        000034                                            0370D 19
00000056                 0  ++++++          0056                                            0370D 20
00000078                  0 ++++++            78                                            0370D 21
00000901                  0 ++++++           901                                            0370D 22
00004567                 0. ++++++         45.67                                            0370D 23
00005678                , 0. ++++++        56.78                                            0370D 24
00456789                , 0. ++++**     4,567.89  **                                        0370D 25
00678901              $ , 0. ******   $ 6,789.01******                                      0370D 26
0078901K              $ , 0. +CR+**   $ 7,890.12 CR **                                      0370D 27
0089012L              $ , 0. ++-+**   $ 8,901.23 - **                                      0370D 28
00901234              $ , 0. ++++CR   $ 9,012.34                                           0370D 29
0001234V              $ , 0. ++CR+*   $   123.45   *                                       0370D 30
0012345F              $ , 0. CR+***   $ 1,234.56  ***                                      0370D 31
0012345F              $$ , 0. CR+***  $$ 1,234.56  ***                                     0370D 32
0000456G                CR0. ++++**     4CR5.67  ***                                     0370D 33
00100205                 + 0+ ++++**    1 002 05  ***                                    0370D 34
ACEGIKMO              B D F H J L NO    ABCDEFGHIJKLMN6                                    0370D 35
 BDFHJLN              A C E G I K M 6   ABCDEFGHIJKLM56                                    0370D 36
OQSUWY¤7              P R T V X Z /0    OPQRSTUVWXYZ¤/7                                    0370D 37
 PRTVXZ/              O Q S U W Y ¤ 7   OPQRSTUVWXYZ¤17                                    0370D 38
13579%+0              2 4 6 8 @ # 90    123456789@%#+90                                    0370D 39
```

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REPRODUCTION

```
 2468@#9                  1 3 5 7 9 %, ¢ 9      12345678 9@%#+99                    03700 L
00567890                  $ ,  0.  ++****      $5,678.90  ****                E 03700 41
00345678 FLOATING $         ,$0.  ++++++      $3,456.78                       E03700 42
00006789 * PROTECT. $       ,*0.  ++****    $*****67.89  ***                  E03700 43
00000001 DEC CNTRL  $       ,  .0++****      $      .01  ***                  E03700 44
00000000 DEC CNTRL  $       ,  .0++****      $           ***                  E03700 45
00000000 DEC CNTRL          $.0++****                    ***                  E03700 46
0003456P SIGN LEFT  CR      0. ++****    CR    345.67  ***                  E03700 47
0004567Q SIGN LEFT  -       0. ++****    -     456.78  ***                  E03700 48
00056789 SIGN LEFT  -       0. ++****          567.89  ***                  E03700 49
00000100 DEC CNTRL  $       ,  .0++****      $   1.00  ***                  E03700 50
```

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ENG. CHG. NO.	110378	116745	117628	TA1976	TA-1976A			

DETAIL CARDS FOR PERIOD - COMMA INVERSION

```
00000012                        &&&&&&      00000012                    0370D 18
00000034                  0     &&&&&&        000034                    0370D 19
00000056                    0   &&&&&&          0056                    0370D 20
00000078                      0 &&&&&&            78                    0370D 21
00000901                      0 &&&&&&           901                    0370D 22
00004567                    0,  &&&&&&        45,67                     0370D 23
00005678                  .  0, &&&&&&        56,78                     0370D 24
00456789                  .  0, &&&&**      4.567,89     **             0370D 25
00678901              $   .  0, ******  $   6.789,01******             0370D 26
0078901K              $   .  0, &CR&**  $   7.890,12 CR **             0370D 27
0089012L              $   .  0, &&-&**  $   8.901,23  - **             0370D 28
00901234              $   .  0, &&&&CR  $   9.012,34                    0370D 29
0001234V              $   .  0, &&CR&*  $     123,45      *            0370D 30
0012345F              $   .  0, CR&***  $   1.234,56    ***            0370D 31
0012345F              $   .  0, CR&***  $$  1.234,56    ***            0370D 32
0000456G                CR0,  &&&***        4CR5,67    ***            0370D 33
00100205                & 0&  &&&***      1 002 05     ***            0370D 34
ACEGIKMO              B D F H J L NO      ABCDEFGHIJKLMN6               0370D 35
 BDFHJLN            A C E G I K M 6      ABCDEFGHIJKLM56               0370D 36
00SUWY□7             P R T V X Z /0      OPQRSTUVWXYZ□/7               0370D 37
 PRTVXZ/             O Q S U W Y □ 7      OPQRSTUVWXYZ□17               0370D 38
13579%÷0              2 4 6 8 @ # 90      123456789@%#÷90               0370D 39
 2468@#9              1 3 5 7 9 % ÷ 9      123456789@%#÷99               0370D 40
00567890              $ .  0,  &&****     $5.678,90    ****          E 0370D 41
00345678 FLOATING $     . $0,  &&&&&&     $3.456,78                     E0370D 42
00006789 * PROTECT. $   . *0,  &&&***   $*****67,89     ***            E0370D 43
00000001 DEC CNTRL  $   .  , 0&&&***  $         ,01     ***            E0370D 44
00000000 DEC CNTRL  $   .  , 0&&&***  $                 ***            E0370D 45
00000000 DEC CNTRL          $, 0&&&***                   ***            E0370D 46
0003456P SIGN LEFT  CR      0,  &&&***  CR    345,67     ***            E0370D 47
0004567Q SIGN LEFT  -       0,  &&&***  -     456,78     ***            E0370D 48
00056789 SIGN LEFT  -       0,  &&&***        567,89     ***            E0370D 49
00000100 DEC CNTRL  $   .   , 0&&&***  $       1,00     ***            E0370D 50
```

DATE	18.12.63							
ENG. CHG. NO.	1976 A							

IBM

DIAGNOSTIC FUNCTION TEST

CAT NO. 451634
SHEET 1 OF 7
BLOCK NO. 1000B

RD-PCH-PR-SPEED TEST

A. PURPOSE OF TEST

TO PROVIDE A CONVENIENT CHECK OF THE OPERATING SPEEDS OF THE 1401, 1402, AND 1403.

B. LOADING PROCEDURE.

1. TO BE RUN FROM CARDS. PLACE THE TEST DECK IN THE FILE FEED FOLLOWED BY BLANK OR SCRAP CARDS TO BE COUNTED. PLACE SOME BLANK CARDS IN THE PUNCH FEED. BE SURE THAT ALL SENSE SWITCHES ARE TURNED OFF, EXCEPT FOR SENSE SWITCH F. IF THE SYSTEM HAS THE ADVANCED PROGRAMMING FEATURE SENSE SWITCH F SHOULD BE TURNED ON, OTHERWISE, IT SHOULD BE OFF. DEPRESS THE START RESET SWITCH, THEN THE LOAD KEY.

   AFTER THE PROGRAM CARDS HAVE BEEN ENTERED, THE MACHINE WILL REMAIN IN THE MAIN LOOP WAITING FOR AN OPERATION TO BE SELECTED FOR COUNTING.

2. TO BE RUN FROM TAPES, PLACE A 3 IN 578 AND PLACE BLANK CARDS IN READER AND PUNCH. TEST RUNS FROM THIS POINT IN SAME MANNER AS IT DOES FOR CARDS.

C. PROGRAM CONTROL

1. SENSE SWITCHES (FOR MACHINES WITHOUT SENSE SWITCHES SEE NOTE BELOW).

   B ON - START READ COUNT.
   OFF - END READ COUNT.

   C ON - START PUNCH COUNT.
   OFF - END PUNCH COUNT.

   D ON - START PRINT COUNT.
   OFF - END PRINT COUNT.

   E ON - START CYCLE COUNT.
   OFF - END CYCLE COUNT.

   F ON - FOR ADVANCED PROGRAM MACHINES
   OFF - FOR NON-ADV. PROGRAM MACHINES.

   G ON - BRANCH TO END OF TEST
   OFF - CONTINUE IN PROGRAM LOOP

   NOTE: TO RUN ON MACHINES WITHOUT SENSE SWITCHES, SUBSTITUTE "UNCONDITIONAL BRANCHES" FOR THE OPERATION TO BE SELECTED. USE THE START AND STOP KEY TO BEGIN AND END THE COUNT.

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D. TEST PROCEDURE

THE PROGRAM CONTAINS VARIOUS LOOPS UNDER THE CONTROL OF SENSE SWITCHES. THE INDIVIDUAL LOOPS CONTAIN AN OPERATION, AN ADD AND A BRANCH BACK TO REPEAT THE OPERATION. STARTING AND STOPPING THE OPERATION IS UNDER CONTROL OF A SENSE SWITCH SO THAT THE RUNNING TIME CAN BE TIMED AGAINST AN EXTERNAL REFERENCE.

THE TEST BEGINS BY CLEARING THE PUNCH AREA AND THEN RUNS CARDS INTO BOTH THE READ AND PUNCH FEEDS. IT THEN ADVANCES TO A MAIN LOOP WHICH CONSISTS OF CLEARING THE PRINT AREA, SENSE SWITCHES B,C,D AND E OFF AND A BRANCH BACK TO COMPLETE THE LOOP. TURNING SENSE SWITCH B ON INITIATES A READ AND COUNT LOOP. TURNING IT OFF TERMINATES IT. TURNING SENSE SWITCH C ON INITIATES A PUNCH AND COUNT LOOP. TURNING IF OFF TERMINATES IT. TURNING SENSE SWITCH D ON INITIATES A COUNT AND PRINT LOOP. TURNING IT OFF TERMINATES IT. TURNING SENSE SWITCH E ON INITIATES A LOOP THAT IS DESIGNED TO CHECK FOR PROPER DURATION OF 1401 CYCLES. THE LOOP CONSISTS OF AN ADD 5 FOR AN AMOUNT ACCUMULATION. THIS IS FOLLOWED BY A BRANCH ON SENSE SWITCH F, WHICH WHEN TURNED ON WILL BYPASS A NO OP. THE PURPOSE OF THIS IS TO CORRECT FOR THE NUMBER OF CYCLES TAKEN FOR I-B STAR TRANSFER CYCLES ON ADVANCE PROGRAM MACHINES. MACHINES WITHOUT THE ADVANCED PROGRAMMING FEATURE SHOULD BE RUN WITH SWITCH F OFF. A CLEAR OP FOLLOWS IN ORDER TO COMPLETE THE LOOP WITH THE PROPER NUMBER OF PROCESS CYCLES. THE TOTAL ACCUMULATED BY RUNNING THIS TEST FOR ONE (1) MINUTE SHOULD BE 347.500 WHICH WAS CHOSEN BECAUSE IT IS THE FREQUENCY OF THE BASIC 1401 OSCILLATOR. (347.500 CYCLES PER SECOND). CAUTION--IT MUST BE CONSIDERED THAT AN ERROR OF ONE (1) SECOND WOULD RESULT IN THE TOTAL BEING OFF BY 5.790.

TURNING SENSE SWITCH G ON INITIATES A BRANCH TO END OF TEST.

E. STOPS

718 IN STORAGE ADDRESS REGISTER; HALT TO SET SENSE SWITCHES.

737 IN STORAGE ADDRESS REGISTER; HALT TO RESET SENSE SWITCHES FOR NEXT TEST.

F. PRINTOUTS

AFTER EACH TEST, THE ACUTAL SPEED WILL BE PRINTED BY THE 1403 PRINTER.

G. COMMENTS

CHECKING SPEEDS:

EXAMPLE: TO CHECK READ FEED, USE A WATCH OR WALL CLOCK WITH A SECOND HAND. AT A REFERENCE POINT IN TIME, TURN SENSE B ON. AFTER ONE MINUTE OF OPERATION, TURN IT OFF. THE NUMBER OF CARDS FED WILL PRINT OUT AND THE PROGRAM WILL RETURN TO THE MAIN LOOP.

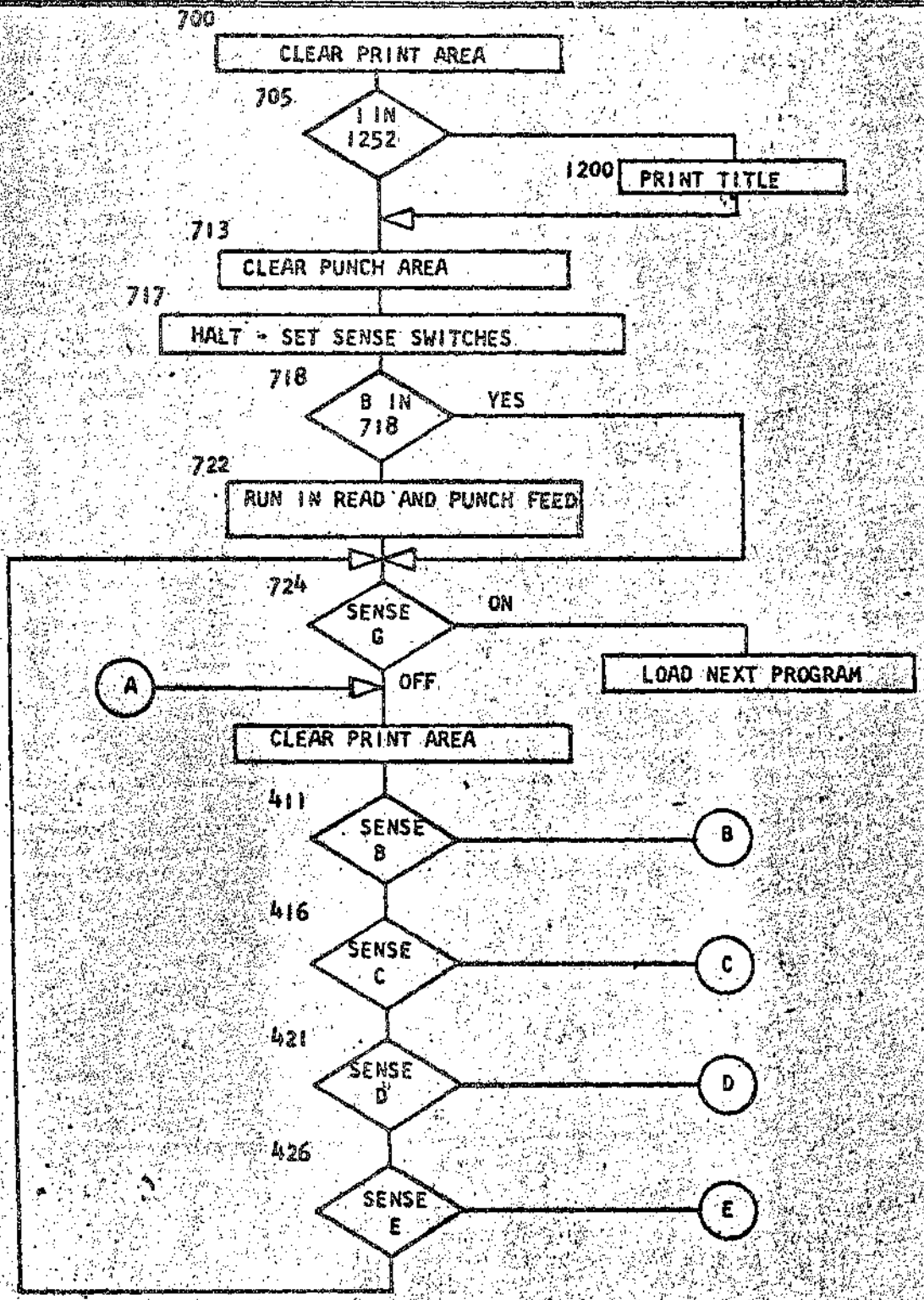
THE 1401 SPEED CHECK IS DESIGNED PRIMARILY TO CHECK FOR PROPER CLOCK OPERATION. A CIRCUIT FAILURE COULD OCCUR SUCH THAT A TRIGGER WOULD REMAIN ON FOR AN EXTRA OSCILLATOR PULSE WITH NO APPARENT MACHINE MALFUNCTION OTHER THAN A RELEASE OVER EXTENSION DUE TO INCREASED PROCESS TIME.

IBM

REPRODUCTION

DIAGNOSTIC FUNCTION TEST

PART NO. 451634
SHEET 3 OF 7
BLOCK NO. 10008



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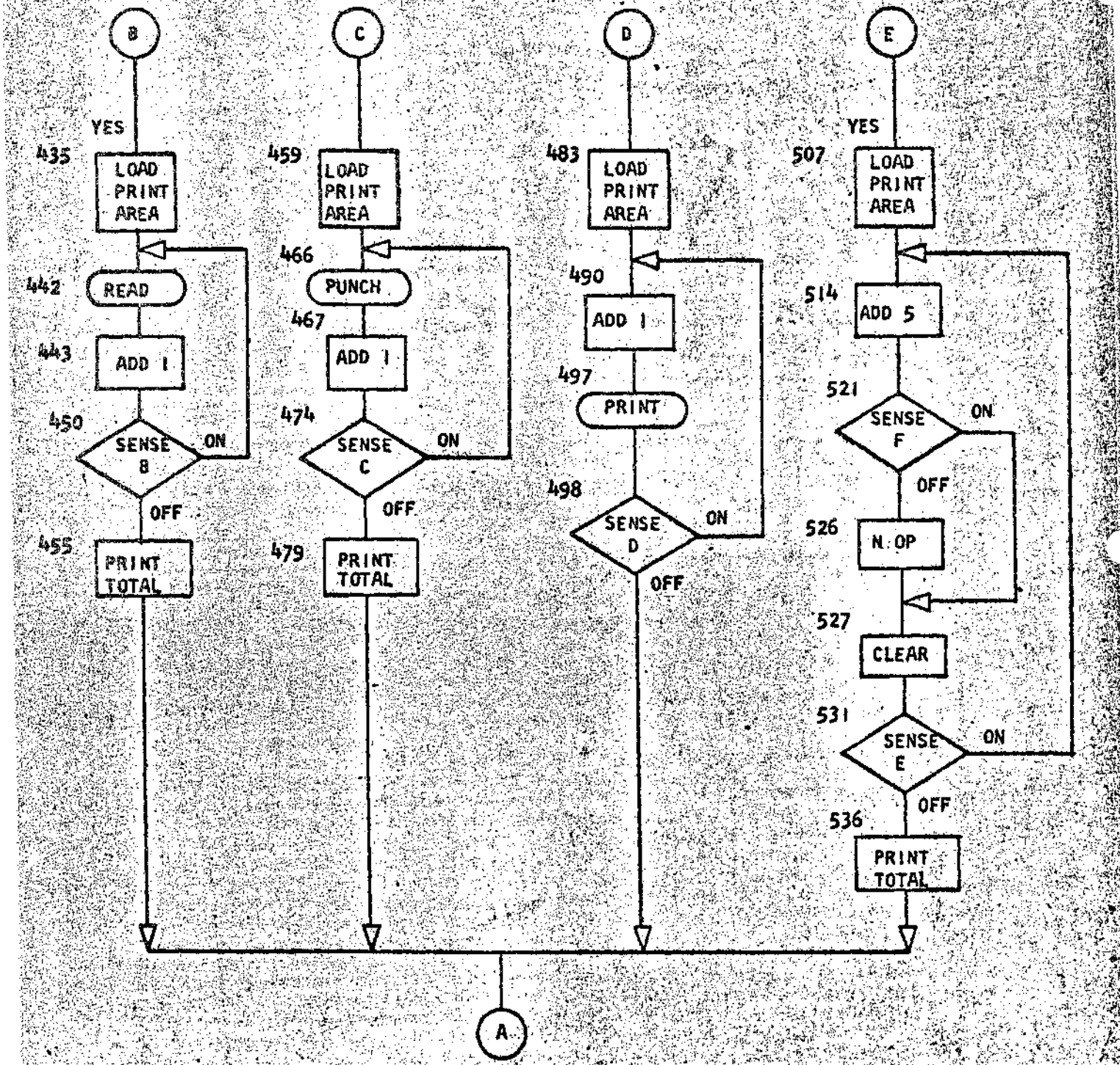
DIAGNOSTIC FUNCTION TEST

PART NO. 451634
SHEET 4 OF 7
BLOCK NO. 1000B



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PROGRAM LISTING FOR USE WITH FLOW CHART

RD-PCH-PR SPEED TEST 1000B

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	700	S783	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		**	
400	400	B	700		BRANCH TO CONTINUE	
406	406	/	332		CLEAR PRINT AREA	
410	410	/			CLEAR PRINT AREA	
414	414	B	435	B	ON-START RD COUNT	SS
416	416	B	459	C	ON-START PCH COUNT	SS
421	421	B	483	D	ON-START PRT COUNT	SS
426	426	B	507	E	ON START CYCLE COUNT	SS
431	431	B	724		REPEAT CONTINUOUS LOOP	
435	435	L	571	266	LOAD READ CONSTANT	
442	442	1			READ	
443	443	A	608	252	ADD 1	
450	450	B	442	B	OFF-END RD COUNT	SS
455	455	2	406		PRINT TOTAL READ	
459	459	L	589	266	LOAD PCH CONSTANT	
466	466	4			PUNCH	
467	467	A	608	252	ADD 1	
474	474	B	466	C	OFF-END PCH COUNT	SS
479	479	2	406		PRINT TOTAL PUNCHED	
483	483	L	607	266	LOAD PRINT CONSTANT	
490	490	A	608	252	ADD 1	
497	497	2			PRINT	
498	498	B	490	D	OFF END PRINT COUNT	SS
503	503	B	406		BRANCH TO CONTINUE	
507	507	L	553	259	LOAD CYCLES	
514	514	A	615	252	ADD 5	
521	521	B	527	F	ON-FOR ADV PROG	SS
526	526	N			CYCLE FILL	
527	527	/	831		CYCLE FILL	
531	531	B	514	E	OFF-END CYCLE COUNT	SS
536	536	2	406		PRINT TOTAL CYCLES	
540	540			CYCLES	CONSTANT	
554	554			CARDS READ	CONSTANT	
572	572			CARDS PUNCHED	CONSTANT	
590	590			LINES PRINTED	CONSTANT	
608	608	1			CONSTANT	
609	609			5	CONSTANT	
616	616				WORD MARK	
700	700	/	332		CLEAR PRINT AREA	
704	704	/			**	
705	705	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	

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```
713  713  / 180          CLEAR PUNCH AREA
717  717  .              HALT TO SET SENSE SWITCHES
718  718  N 724          *B724 TO BY-PASS RD-PCH          C FOR TA
722  722  1              RUN IN READ FEED
723  723  4              RUN IN PUNCH FEED
724  724  B 733 G        BRANCH TO END TEST                    &S
729  729  B 406          START CONTINUOUS LOOP                 &S
783  785  . 348          RESET SENSE SWITCHES FOR NEXT TEST
737  737                 WORD MARK
```

DATE	2-5-62	6-29-63	17.10.63					
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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    RD-PCH-PR SPEED TEST      10008 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD         10008 02
L067367,340344,348349,3673611001,008012,0011001183610B0AB348/340080               10008 03
L071415,385400,406410,4114161001B700S783BS88              B700  /332/84358         10008 04
L066449,421426,431435,4424431001B459C8483D8507E8724L5712661A608252                10008 05
L065482,455459,466467,4744791001B44282406L5892664A608252B466C2406                 10008 06
L070520,490497,498503,5075141001L607266A6082522B490D8406L553259A615252            10008 07
L065553,526527,531536,5405541001B527FN/8318514E2406          CYCLES              10008 08
L068589,572590,590590,5905901001      CARDS READ        CARDS PUNCHED             10008 09
L072629,608609,616616,6166161001      LINES PRINTED1    5                         10008 10
L056722,704705,713717,7187221001/332/8S00S521/180.N7241                           10008 11
L072762,724729,733737,7377371001487333G8406.348                                   10008 12
!L053S20,S01S05,S12S13,S17S2110012,049L0782762/27727!3                             10008 13
/333080N                                          CLEAR WORDMARK CARD             10008 14
,019027,031,038042B031T98GB400L046352BW048S88     RD-PCH-PR SPEED TEST            10008 15
                              M
```

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WORDMARK AND BUFFER TEST

A. PURPOSE

1. TO INSERT A WORDMARK IN EACH PRINT POSITION, TEST FOR IT AND PRINT IT.
2. TO ALTERNATELY PRINT A LINE OF PRINT AND THEN A LINE OF WORDMARKS.
3. TO TEST THE PRINT BUSY AND CARRIAGE BUSY LATCHES ON A BUFFERED MACHINE. (IF THE MACHINE IS NOT BUFFERED, ERROR PRINTOUT WILL OCCUR.)

B. LOADING PROCEDURES

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1261.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON FOR SCOPING
   OFF TO CONTINUE

   D ON TO REPEAT SECTION OF TEST
   OFF TO CONTINUE

   E ON TO STOP ON ERROR (BUFFER TEST)
   OFF TO PRINT ERROR (BUFFER TEST)

D. TEST PROCEDURE

1. THE PRINT AREA IS LOADED AND A PRINTOUT IS MADE. A WORDMARK IS INSERTED IN ADDRESS 201 AND A TEST IS MADE FOR A WORDMARK IN 201. IF THE WORDMARK IS MISSING, AN ERROR HALT OCCURS. THE ADDRESS IS INCREASED, THE WORDMARK IS INSERTED AND TESTED FOR AND PRINTED OUT UNTIL ALL 132 PRINT POSITIONS CONTAIN WORDMARKS, THEN A LINE IS PRINTED. VISUAL INSPECTION DETERMINES WHETHER AN ERROR OCCURRED.
2. THE PRINT AREA IS LOADED AND WORD MARKS ARE PLACED IN ALL 132 PRINT POSITIONS. ALTERNATE PRINT WORD MARKS AND PRINT A LINE OP-CODES ARE EXECUTED UNTIL 40 LINES HAVE PRINTED.
3. IF THE PRINTER (1403) ON THIS SYSTEM IS NOT BUFFERED OR IF THIS SECTION OF THE TEST IS NOT DESIRED, CHANGE THE INSTRUCTION IN LOCATION 622 FROM NL810 TO B348_.

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D. (CONTINUED)

THE PRINT AREA IS LOADED AND A PRINT OP IS EXECUTED. THE PRINT BUSY LATCH IS INTERROGATED FOR APPROXIMATELY 79 MS TO SEE THAT IT TURNS ON AND REMAINS ON FOR THAT PERIOD OF TIME. AFTER APPROXIMATELY 86 MS, IT IS TESTED AGAIN TO MAKE SURE THAT THE LATCH HAS TURNED OFF. NEXT A SINGLE SPACE IS EXECUTED AND THE CARRIAGE BUSY LATCH IS INTERROGATED FOR APPROXIMATELY 13 MS TO SEE THAT THE LATCH TURNS ON AND STAYS ON. AFTER APPROXIMATELY 16 MS, IT IS CHECKED AGAIN TO SEE IF IT HAS TURNED OFF. THE PROGRAM REPEATS UNTIL THE LATCHES HAVE BEEN TESTED 20 TIMES.

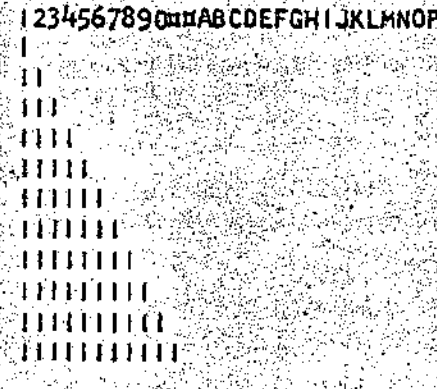
E. STOPS

STORAGE ADDRESS REGISTER

492	ERROR - TEST FOR WM IN XXX FAILED
930	ERROR - BUFFER TEST PRINT ERROR NUMBER 1. PRINTER BUSY LATCH NOT ON FOR 79 MS.
978	ERROR - BUFFER TEST PRINT ERROR NUMBER 2. PRINTER BUSY LATCH ON AFTER 86 MS.
1030	ERROR - BUFFER TEST CARRIAGE ERROR NUMBER 1. CARRIAGE BUSY LATCH NOT ON FOR 13 MS.
1080	ERROR - BUFFER TEST CARRIAGE ERROR NUMBER 2. CARRIAGE BUSY LATCH ON AFTER 16 MS.

F. PRINTOUTS

1. CORRECT



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ENG. CHG. NO.	110378	117628	TA 1976					

F. (CONTINUED)


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1234567890¤¤ABCDEFGHIJKLMNOPQRSTUVWXYZ*%*¤¤1234567890¤¤ABCDEFGHIJ

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
ALTERNATE PRINT WORDMARKS + PRINT LINE TEST·ALTERNATE PRINT WORDMA
||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
ALTERNATE PRINT WORDMARKS + PRINT LINE TEST·ALTERNATE PRINT WORDMA
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ALTERNATE PRINT WORDMARKS + PRINT LINE TEST·ALTERNATE PRINT WORDMA
||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.

          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.

          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.

          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.
```

2. ERROR - BUFFER TEST ONLY.

```
PRINT LATCH ERROR 1       BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.
                          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.

CARRIAGE LATCH ERROR 1    BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.
                          BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.
PRINT LATCH ERROR 1       BUFFERED MACHINES PRINT AND CARRIAGE BUSY TEST.
```

G. COMMENTS

1. PRINT ERROR NUMBER 1 INDICATES THAT THE PRINTER BUSY LATCH FAILED TO STAY ON FOR APPROXIMATELY 79 MS.

2. PRINTER ERROR NUMBER 2 INDICATES THAT THE PRINTER BUSY LATCH WAS ON AFTER APPROXIMATELY 86 MS.

3. CARRIAGE ERROR NUMBER 1 INDICATES THAT THE CARRIAGE BUSY LATCH FAILED TO STAY ON FOR APPROXIMATELY 13 MS.

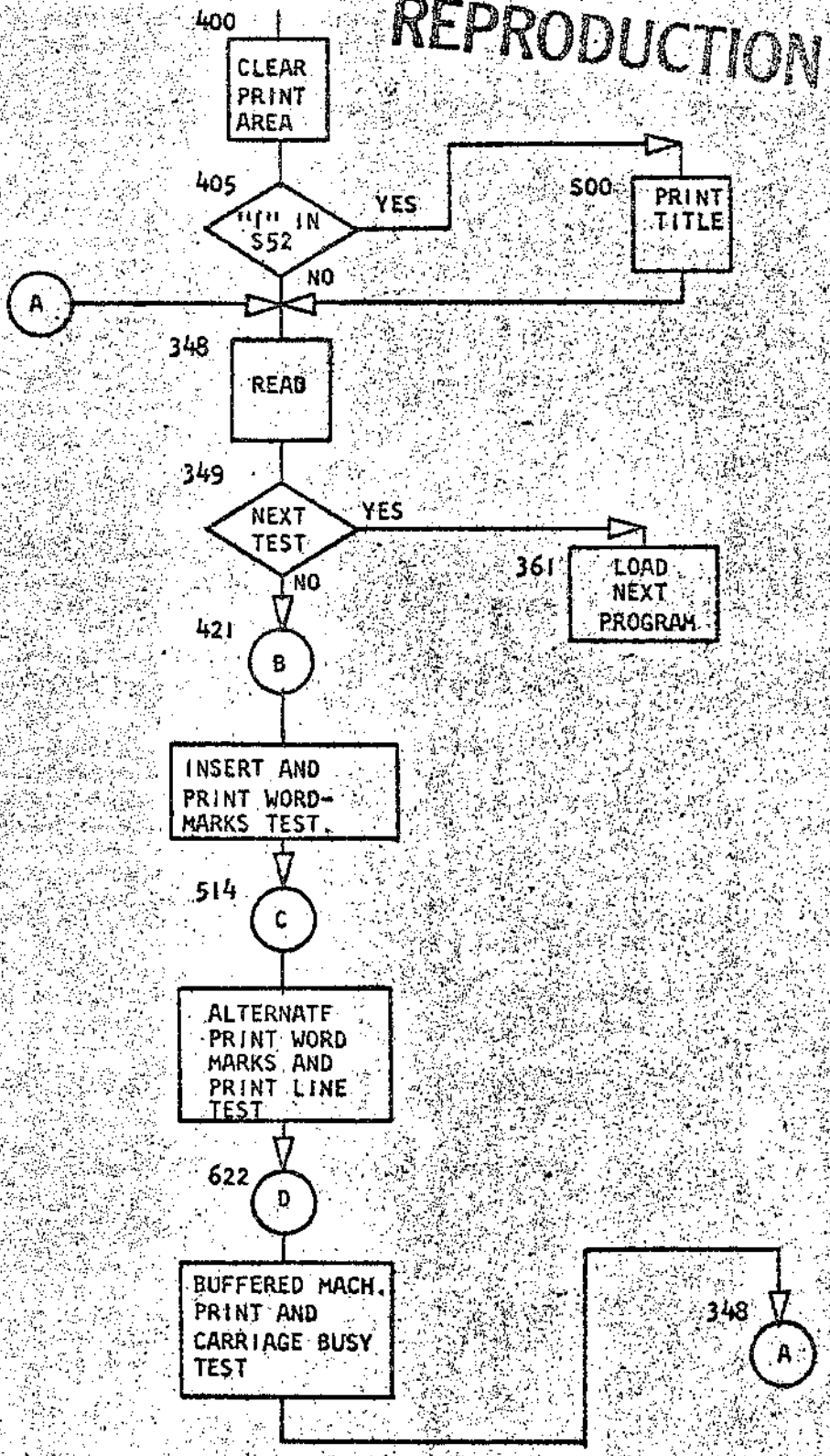
4. CARRIAGE ERROR NUMBER 2 INDICATES THAT THE CARRIAGE BUSY LATCH WAS ON AFTER 16 MS.

IBM

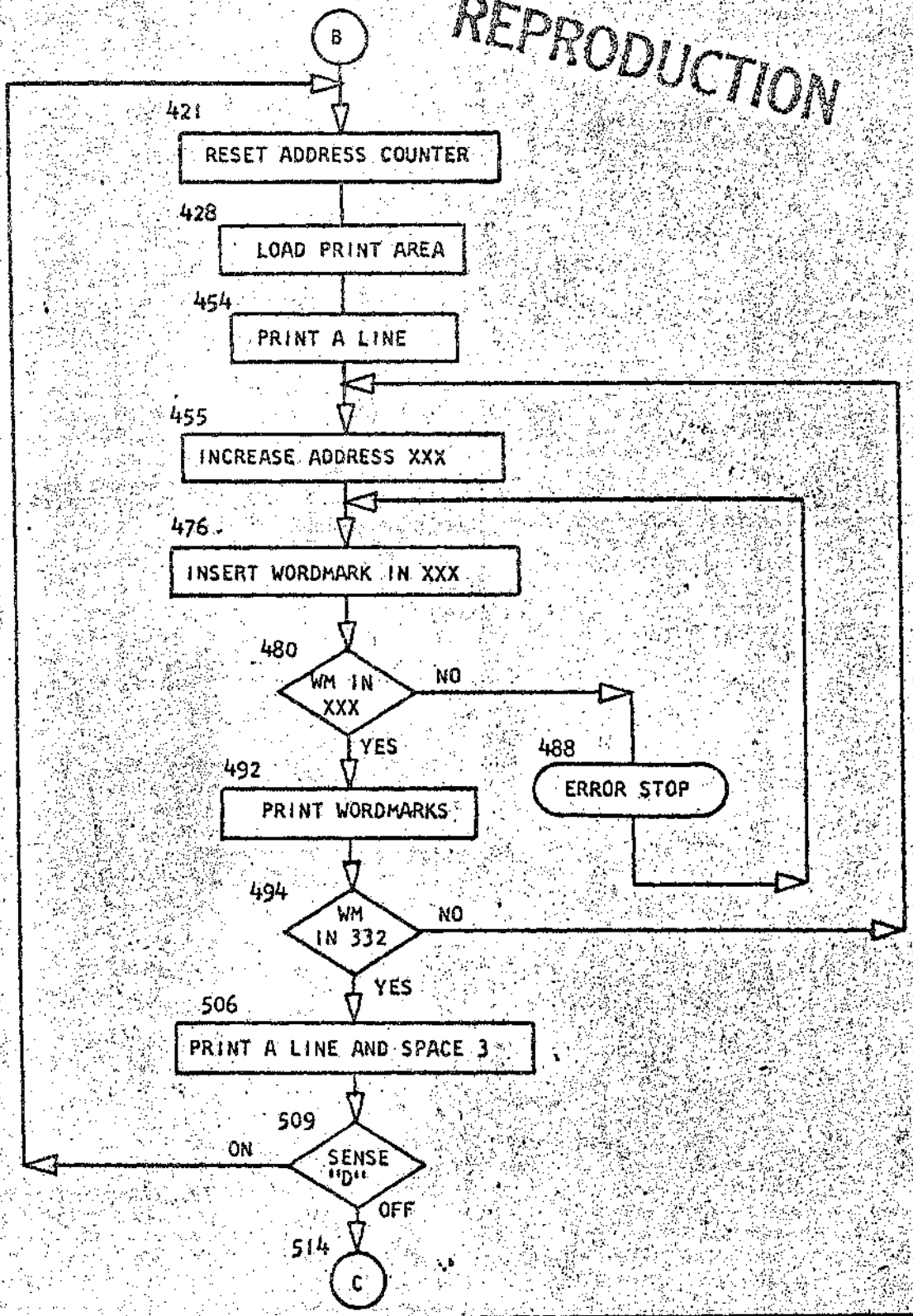
DIAGNOSTIC FUNCTION TEST

PART NO. 451418
SHEET 4 OF 13
BLOCK NO. 1010C

REPRODUCTION



DATE	2-2-61	6-29-63	17 10 63					
ENG. CHG. NO.	110378	117628	TA 1976					



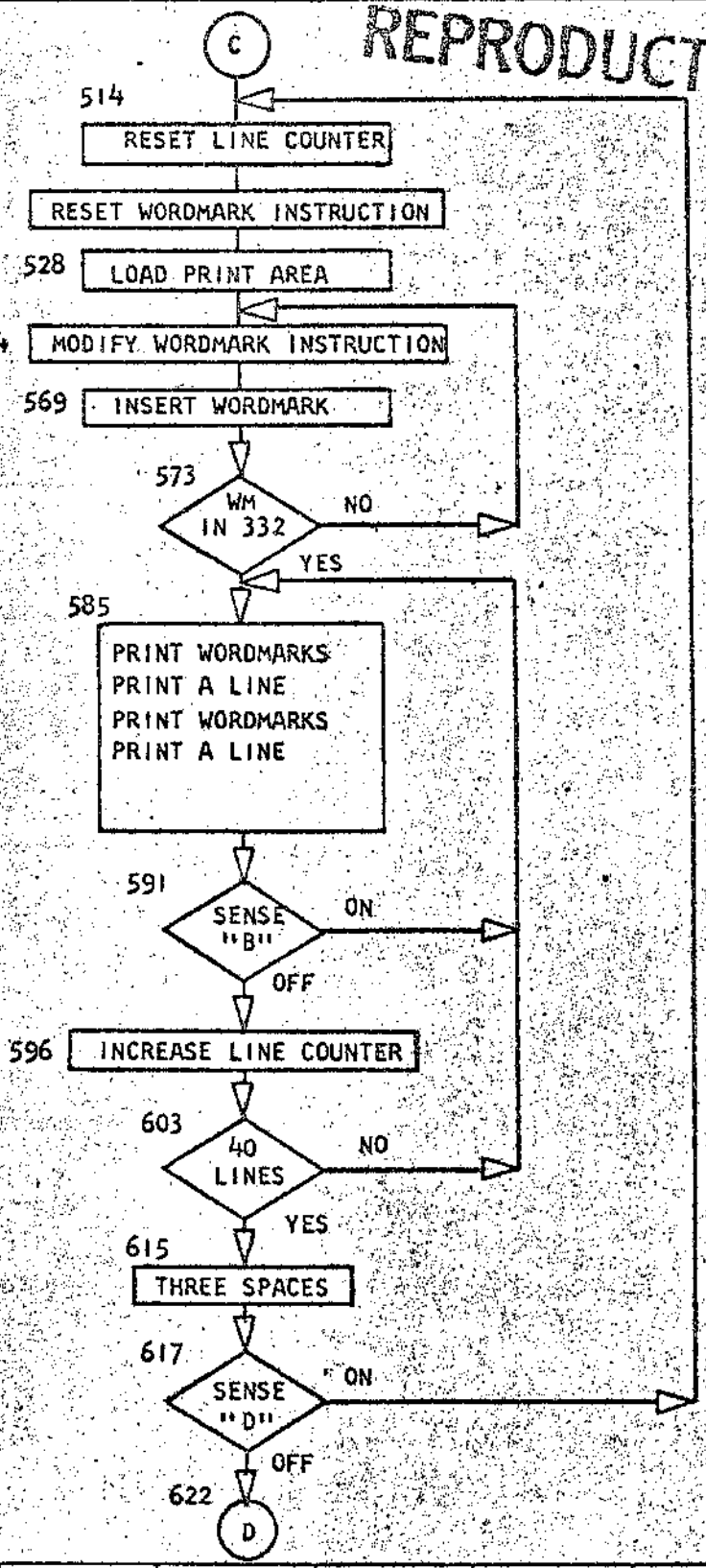
DATE	2-2-61	6-29-63	17.10.63					
NG. CHG. NO.	110378	117628	TA 1976					

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451418
SHEET 6 OF 13
BLOCK NO. 1010C

REPRODUCTION



DATE	2-2-61	6-29-63	17 10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

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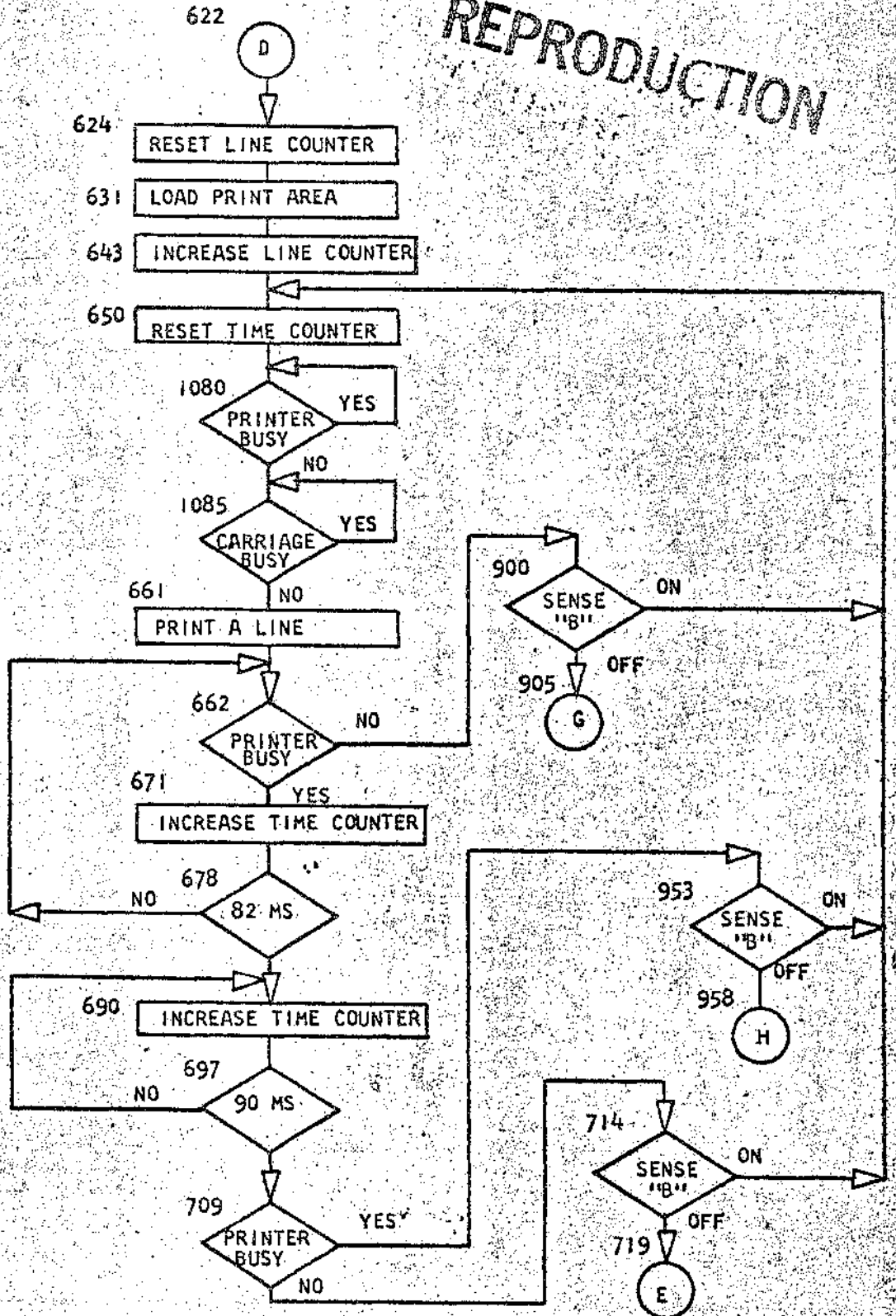
DIAGNOSTIC FUNCTION TEST

PART NO. 451418
SHEET 7 OF 13
BLOCK NO. 1010C



DATE	2-2-61	6-29-63	17.10.63					
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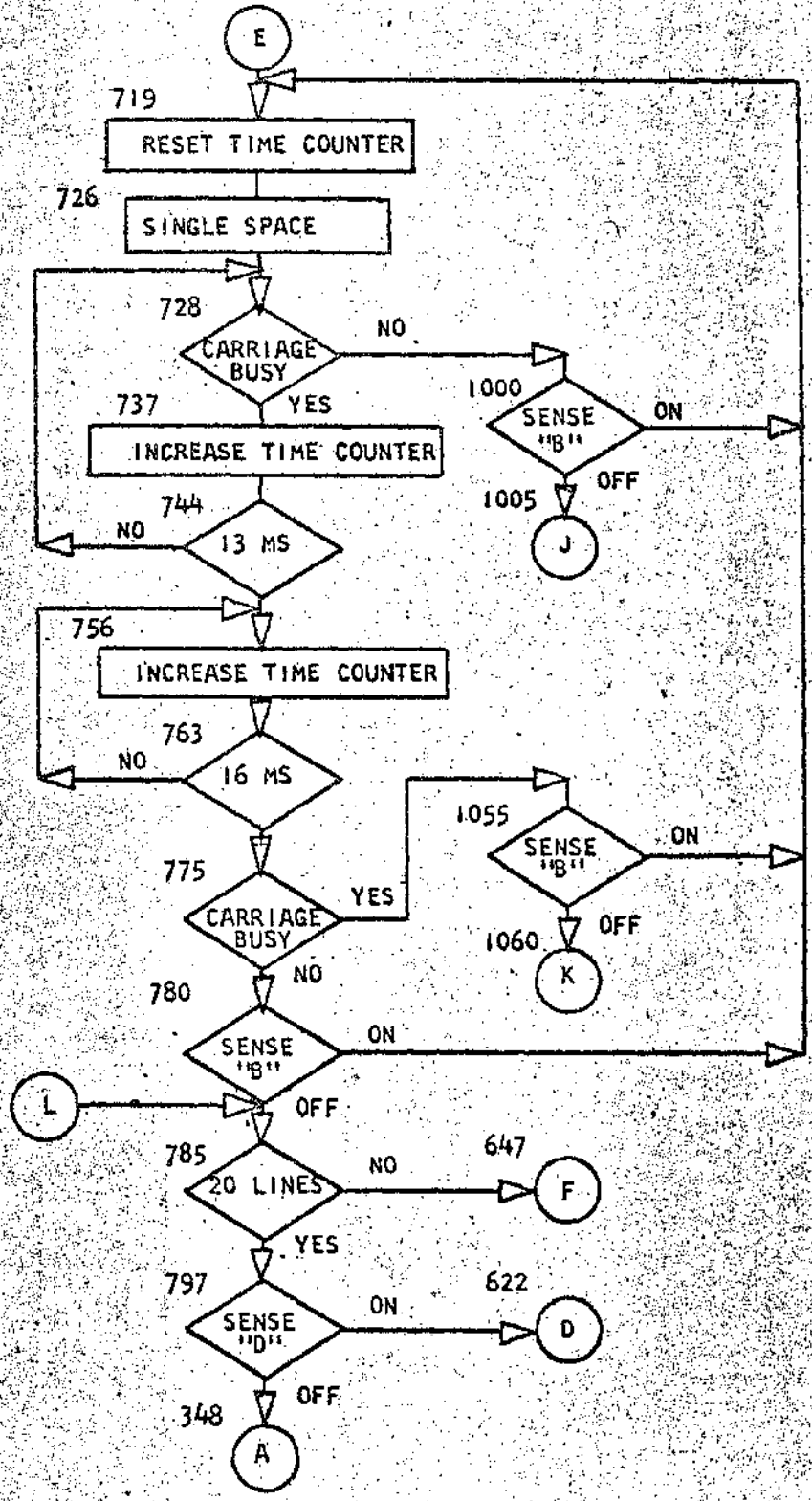
DIAGNOSTIC FUNCTION TEST

PART NO. 451418
SHEET 8 OF 13
BLOCK NO. 1010C



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

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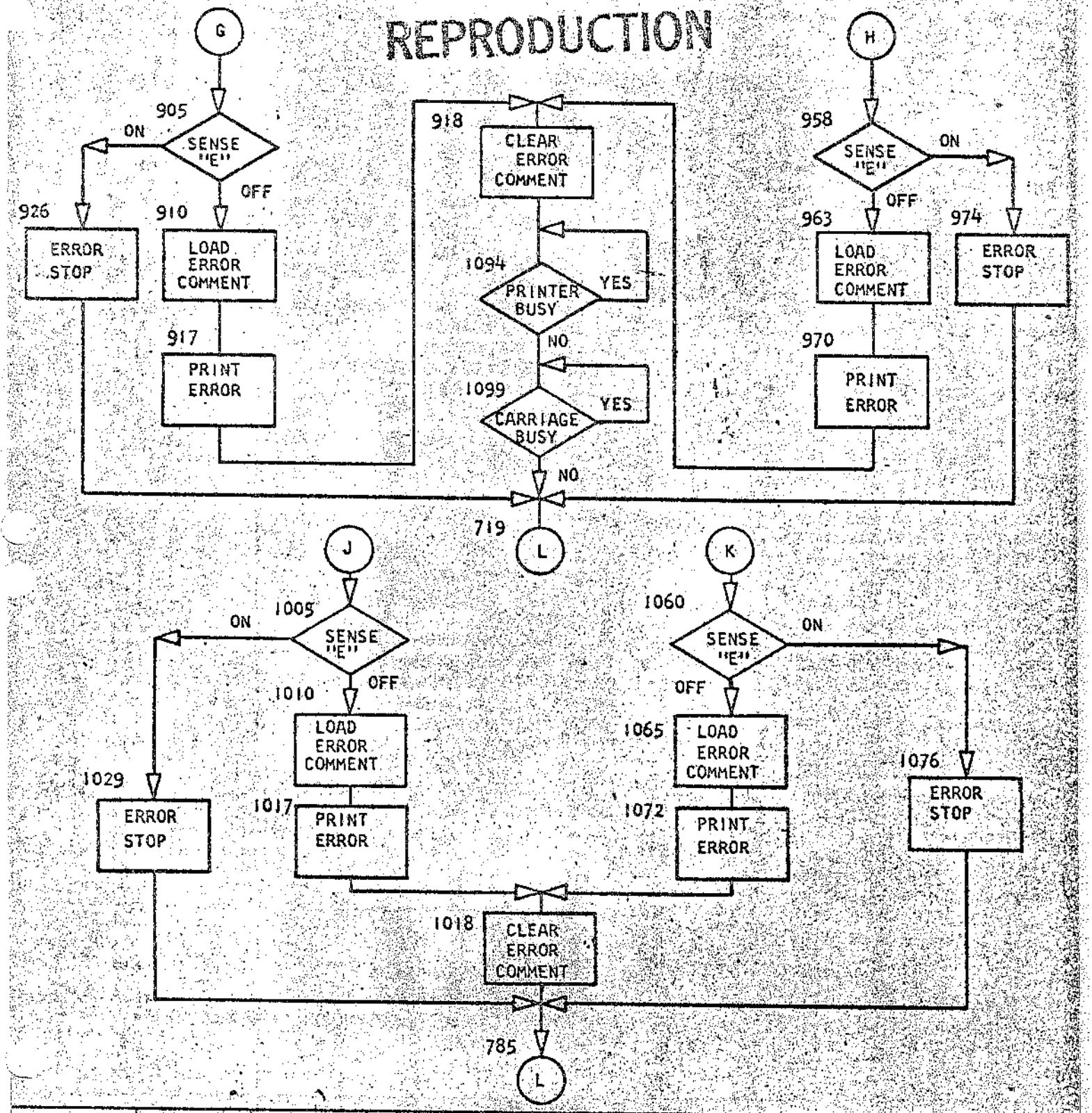
DIAGNOSTIC FUNCTION TEST

PART NO. 451418
SHEET 9 OF 13
BLOCK NO. 1010C



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PROGRAM LISTING FOR USE WITH FLOW CHART

WORDMARK AND BUFFER TEST 1010C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
087	087	4	21		LOAD A TAG AREA
377	377	B	400	S611	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	421		BRANCH TO PROGRAM
421	421	L	814	817	RESET ADDRESS COUNTER
428	428	/	332		LOAD PRINT AREA
432	432	/			,,
433	433	L	/53	244	,,
440	440	M	244	288	,,
447	447	M	244	332	,,
454	454	2			PRINT
455	455	A	455	817	INCREASE ADDRESS XXX
462	462	M	817	479	,,
469	469	M	817	486	,,
476	476	,	XXX		*INSERT WORDMARK IN XXX
480	480	V	492	XXX1	*TEST FOR WORDMARK IN XXX
488	488	.	476		ERROR STOP
492	492	2	¤		PRINT WORDMARKS
494	494	V	506	3321	TEST FOR WORDMARK IN 332
502	502	B	455		BRANCH TO INCREASE ADDRESS
506	506	F	T		PRINT A LINE AND-
508	508	2			SKIP THREE SPACES
509	509	B	421	D	D ON TO REPEAT SS
514	514	L	810	808	RESET LINE COUNTER
521	521	M	814	572	RESET WORDMARK INSTRUCTION
528	528	/	332		LOAD PRINT AREA
532	532	/			,,
533	533	L	/98	244	,,
540	540	M	244	288	,,
547	547	M	244	332	,,
554	554	,	570		MODIFY WORDMARK INSTRUCTION
558	558	A	558	572	,,
565	565	¤	570		,,
569	569	,	200		*INSERT WORDMARK
573	573	V	585	3321	TEST FOR WORDMARK IN 332
581	581	B	554		BRANCH TO MODIFY WORDMARK INSTRUCTION
585	585	2	¤		PRINT WORDMARKS
587	587	2			PRINT A LINE

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```
588  588  2 ¤                    PRINT WORDMARKS
590  590  2                      PRINT A LINE
591  591  B 585  B               B ON TO SCOPE                          SS
596  596  A 596  808             INCREASE LINE COUNTER
603  603  B 615  8071            TEST FOR 40 LINES OF PRINT
611  611  B 585                  BRANCH TO REPEAT TEST
615  615  F L                    TRIPLE SPACE
617  617  B 514  D               D ON TO REPEAT TEST                    SS
622  622  N                      *AN ASTERISK MEANS INSTRUCTION CHANGES
624  624  L 810  808             RESET LINE COUNTER
631  631  / 332                  LOAD PRINT AREA
635  635  /                        ,,
636  636  L 879  269               ,,
643  643  A 643  808             INCREASE LINE COUNTER
650  650  L 811  817             RESET TIME COUNTER
657  657  B ¢80                  BRANCH TO FREE PRINTER AND CARRIAGE
661  661  2                      PRINT A LINE
662  662  B 671  P               BRANCH ON PRINTER BUSY
667  667  B 900                  BRANCH TO ERROR PRINT 1
671  671  A 671  817             INCREASE TIME COUNTER
678  678  C 817  820             TEST FOR 78 MS
685  685  B 662  /               BRANCH TO PRINTER BUSY
690  690  A 690  817             INCREASE TIME COUNTER
697  697  C 817  823             TEST FOR 86 MS
704  704  B 690  /               BRANCH TO INCREASE TIME COUNTER
709  709  B 953  P               BRANCH ON PRINTER BUSY TO ERROR 2
714  714  B 650  B               B ON TO SCOPE                          SS
719  719  N 8/1  817             RESET TIME COUNTER
726  726  L                        ,,   ,,   ,,
727  727  F J                    SINGLE SPACE
729  729  B 738  R               BRANCH ON CARRIAGE BUSY
734  734  B ¢00                  BRANCH TO CARRIAGE ERROR 1
738  738  A 738  817             INCREASE TIME COUNTER
745  745  C 817  826             TEST FOR 13 MS
752  752  B 729  /               BRANCH TO CARRIAGE BUSY
757  757  A 757  817             INCREASE TIME COUNTER
764  764  C 817  829             TEST FOR 16 MS
771  771  B 757  /               BRANCH TO INCREASE TIME COUNTER
776  776  B ¢55  R               BRANCH ON CARRIAGE BUSY TO ERROR 2
781  781  B 719  B               B ON TO SCOPE                          SS
786  786  B 798  8072            TEST FOR 20 LINES OF PRINT
794  794  B 643                  BRANCH TO REPEAT TEST
798  798  B 622  D               D ON TO REPEAT TEST                    SS
803  803  B 348                  BRANCH TO CHAINING ROUTINE
807  807  L L                    CONSTANT
809  809  0 00                     ,,
812  812  2 00                     ,,
815  815  A AA                   COUNTER
818  818  I 63                   78 MS                          C FOR TA
821  821  I 91                   86 MS                          C FOR TA
824  824  0 41                   19.2 MS                        C FOR TA
```

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```
 827  827  0 44                          20.3 MS                          C FOR TA
 830  830  B UFF ERED MACHINES PR FIELD
 850  850  I NT  AND CARRIAGE BUS  ,,   NO WM
 870  870  Y  TE ST.                ,,    ,,
 880  880  P RIN T LATCH ERROR 1    COMMENT
 900  900  B 650 B                  B ON TO SCOPE                          SS
 905  905  B 926 E                  E ON FOR ERROR STOP                    SS
 910  910  M 898 229                MOVE ERROR COMMENT
 917  917  2                        PRINT ERROR COMMENT
 918  918  / 235                    REMOVE ERROR COMMENT
 922  922  B ¢94                    BRANCH TO FREE PRINTER AND CARRIAGE
 926  926  . 719                    ERROR HALT
 930  930  P RIN T LATCH ERROR 2    COMMENT
 953  953  B 650 B                  B ON TO SCOPE                          SS
 958  958  B 974 E                  E ON FOR ERROR STOP                    SS
 963  963  M 948 229                MOVE ERROR COMMENT
 970  970  2 918                    PRINT ERROR AND BRANCH
 974  974  . 719                    ERROR HALT
 978  978  C ARR IAGE LATCH ERROR 1  COMMENT
1000 ¢00  B 719 B                  B ON TO SCOPE                          SS
1005 ¢05  B ¢26 E                  E ON FOR ERROR STOP                    SS
1010 ¢10  M 999 232                MOVE ERROR COMMENT
1017 ¢17  2                        PRINT ERROR COMMENT
1018 ¢18  / 235                    REMOVE ERROR COMMENT
1022 ¢22  B 786                    BRANCH TO CONTINUE
1026 ¢26  . 786                    ERROR HALT
1030 ¢30  C ARR IAGE LATCH ERROR 2  COMMENT
1055 ¢55  B 719 B                  B ON TO SCOPE                          SS
1060 ¢60  B ¢76 E                  E ON FOR ERROR STOP                    SS
1065 ¢65  M ¢51 232                MOVE ERROR COMMENT
1072 ¢72  2 ¢18                    PRINT ERROR AND BRANCH
1076 ¢76  . 786                    ERROR HALT
1080 ¢80  B ¢80 P                  BRANCH UNTIL PRINTER IS FREE
1085 ¢85  B ¢85 R                  BRANCH UNTIL CARRIAGE IS FREE
1090 ¢90  B 661                    BRANCH TO CONTINUE
1094 ¢94  B ¢94 P                  BRANCH UNTIL PRINTER IS FREE
1099 ¢99  B ¢99 R                  BRANCH UNTIL CARRIAGE IS FREE
1104 /04  B 719                    BRANCH TO CONTINUE
1110 /10  1 234 567890□□ABCDEFGH   FIELD
1130 /30  I JKL MNOPQRSTUVWXYZ**    ,,   NO WM
1150 /50  * □□□                     ,,    ,,
1155 /55  A LTE RNATE PRINT WORD    ,,
1175 /75  M ARK S + PRINT LINE T    ,,   NO WM
1195 /95  E ST.                     ,,    ,,
1230 S30  0 02                     ALTER LOOP CONSTANT FOR ADV PROGRAM
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    WORDMARK AND BUFFER TEST1010C 0
,008015,022029,033033N      1001                    SET WORDMARK CARD       1010C 0
L035089N      M      N      1001421                                         1010C 0
L067367,340344,348349,357361 1001,008012,0011001 1836 1080AB421/34008?     1010C 0
L069404,377385,400404,405405 1001          8400S611BS88          /3 2/     1010C 0
L067439,413417,421428,432433 1001BS00S521/0808421L814817/332/L/53244       1010C 0
L072479,447454,455462,469476 1001M244288M2443322A4558 17M817479M817486,XXX1010C 0
L061508,488492,494502,506508 1001V492XXX1.4762¤V506332 8455FT2            1010C 0
L070546,514521,528532,533540 1001842 1DL810808M814572/332/L/98244M244288   1010C 0
L070584,554558,565569,573581 1001M244332,570A558572¤570,200V58533218554   1010C 1
L058610,587588,590591,596603 10012¤22¤28585BA596808B6158071               1010C 1
L057635,615617,622624,631635 1001B585FL8514DN L810808/332/                1010C 1
L067670,643650,657661,662667 1001L879289A643808L8118178*802867 1P8900     1010C 1
L070708,678685,690697,704709 1001A671817C8178208662/A690817C81782386 0/   1010C 1
L068744,714719,726727,729734 1001B953P8650BN8/1817LFJB738RB*00A73881/      1010C 1
L068780,752757,764771,776781 1001C8178268729/A757817C817829B757/8*55R     1010C 1
L061809,786794,798738,807803 1001871 98B798807 2B6438622DB348LL           1010C 1
L053829,812815,818821,824827 1001000200AAA163191004 1044                  1010C 1
L072869,001001,001001,001001 1001BUFFERED MACHINES PRINT AND CARRIAGE BUS1010C 1
L072909¤870870,880900,905910 1001Y. TEST.  PRINT LATCH ERROR 1 B6508B926E1010C 2
L072949,917918,922926,930930 1001M8982292/2358*94.719PRINT LATCH ERROR 2 1010C 2
L056973¤950950,953958,963970 1001   B6508897 4EM9482292918                1010C 2
L068*09,978*00,*05*10,*10*10 1001.719CARRIAGE LATCH ERROR 18719BB*26E      1010C 2
L072*49,*17*18,*22*26,*30*30 1001M9992322/2358786.786CARRIAGE LATCH ERROR1010C 2
L058*75¤*50*50,*55*60,*65*72 1001 2   B719BB*76EM*512322*18                1010C 2
L066/09,*80*85,*90*94,*99/04 1001.786B*80P8*85RB6618*94PB*99RB719          1010C 2
L072/49,001001,001001,001001 1001234567890¤¤ABCDEFGHIJKLMNOPQRSTUVWXYZ**1010C 2
L072/89¤/50/50,/55/55,/55/55 1001*¤¤¤ ALTERNATE PRINT WORDMARKS + PRINT L1010C 2
L055S12¤/90/90,S00S01,S05S12 1001IME TEST. 2,049L0772772                   1010C 2
L062S42,S17S21,S21S21,S21S30 1001/2772421          002                     1010C 3
/333080N                                          CLEAR WORDMARK CARD      1010C 3
,019027,081,038042803 1T98GB400L046352BW04BS88    WORDMARK AND BUFFER TEST1010C 3
                        M
```

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IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451419
SHEET 1 OF 10
BLOCK NO. 1020B

RIPPLE PRINT

A. PURPOSE

1. TO PRINT EVERY PRINTABLE CHARACTER IN EVERY PRINT POSITION.

2. TO TEST THE UNPRINTABLE CHARACTERS AND BLANK IN EVERY PRINT POSITION.

3. IF PRINTING STARTS WITH HOME PULSE, THIS TEST WILL INDICATE THE SUB-SCAN AND CHARACTER THAT FAILED.

B. LOADING PROCEDURES

1. PLACE TEST DECK IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1261.

C. PROGRAM CONTROL

1. CHECKING PROCEDURE

TO INDICATE THE SUB-SCAN AND CHARACTER THAT FAILED, TIE THE HOME TRIGGER OUTPUT TO THE SWITCH CONDITION WHICH TURNS OFF PRINT-READY TRIGGER. NO-OP INSTRUCTION 454 TO ELIMINATE THE HEADING PRINT OUT.

2. SENSE SWITCHES

B ON FOR SCOPING LOOP
OFF TO CONTINUE

D ON TO REPEAT SECTION OF TEST
OFF TO CONTINUE

D. TEST PROCEDURE

1. THE 48 CHARACTER FIELD IS EXPANDED INTO A 192 CHARACTER FIELD IN MEMORY. A MOVE INSTRUCTION IS MODIFIED SO THAT EACH SUCCESSIVE LINE OF PRINT IS SHIFTED ONE POSITION TO THE LEFT (RIPPLED). AFTER EACH OF THE 48 CHARACTERS HAS BEEN PRINTED IN EACH PRINT POSITION, THE TEST CONTINUES.

2. THE 18 CHARACTER FIELD CONSISTING OF: 12 UNPRINTABLE SPECIAL CHARACTERS, 3 PRINTABLE SPECIAL CHARACTERS, AND 3 BLANKS IS RIPPLED THROUGH 18 LINES AS IN PART 1.

3. WHEN TEST IS USED TO INDICATE SCAN OR SUB-SCAN, WIRE THE MACHINE TO START PRINTING AT HOME PULSE AND RE-START PROGRAM IN LOCATION 455 TO REPEAT THE FIRST SECTION OF THE TEST.

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3. (CONTINUED)

THE RIPPLE PRINT IS SET UP SO THAT ONE CHARACTER IS PRINTED DURING EACH SUB-SCAN. REFERING TO LINE 1 IN THE SAMPLE PRINT OUT THE 1 PRINTS IN POSITION 1 ON SCAN 1 SUB-SCAN 1, THE 2 PRINTS IN POSITION 2 ON SCAN 1 SUB-SCAN 2, THE 3 PRINTS IN POSITION 3 ON SCAN 1 SUB-SCAN 3, THE 4 PRINTS IN POSITION 4 ON SCAN 2 SUB-SCAN 1, ETC. UNTIL ALL 132 POSITIONS HAVE PRINTED DURING SCANS 1 THROUGH 44. THE SECOND LINE PRINTS DURING SCANS 2 THROUGH 45, THE THIRD LINE PRINTS DURING SCANS 3 THROUGH 46, ETC.

THE HEADING NUMBERS INDICATE SCANS FOR PRINTING CHARACTERS IN LINE1. EXAMPLE: PRINT POSITIONS 79,80 AND 81 WILL PRINT P,Q AND R ON SCAN 27 SUB-SCANS 1,2 AND 3 RESPECTIVELY.

A PRINT CHARACTER AND SCAN CHART IS INCLUDED TO IDENTIFY THE SCAN THAT EACH CHARACTER PRINTS FOR EACH OF THE 48 LINES WHEN PRINT START IS TIED TO THE HOME PULSE TRIGGER.

E. STOPS

THERE ARE NO PROGRAMMED STOPS IN THIS TEST

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DIAGNOSTIC FUNCTION TEST

PART NO 451415
SHEET 3 OF 1
BLOCK NO 1020B

F. SAMPLE PRINT OUT

1020B

RIPPLE PRINT

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DIAGNOSTIC FUNCTION TEST

REPRODUCTION

PART NO. 451419 SHEET 4 OF 10 BLOCK NO. 10208

ENG. CHG. NO.	DATE
110378	2-2-61
117628	6-29-63
TA 1976	17 10 63

PRINT CHARACTER AND SCAN CHART WITH PRINT START FIED TO HOME PULSE.

```
----SCAN 1 SUB-SCAN 1 LINE 1                    ----SCAN 27 SUB-SCAN 1 LINE 1
----SCAN 1 SUB-SCAN 2 LINE 1                    ----SCAN 27 SUB-SCAN 2 LINE 1
---SCAN 1 SUB-SCAN 3 LINE 1                     ---SCAN 27 SUB-SCAN 3 LINE 1

1--2--3--4--5--6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-
12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*

2--3--4--5--6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-
23456789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*A

3--4--5--6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-
3456789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*AB

4--5--6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-
456789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABC

5--6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-
56789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCD

6--7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--
6789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDE

7--8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--2--
789008#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEFGHI&.¤12345678908#/STUVWXYZ¢,%JKLMNOPQR-$*ABCDEF

8--9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--2--3--
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9--10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--2--3--4--
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22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--2--3--4--5--6--7--8--9--10-11-12-13-14-15-16-17-
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23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1--2--3--4--5--6--7--8--9--10-11-12-13-14-15-16-17-18-
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IBM

DIAGNOSTIC FUNCTION TEST

REPRODUCTION

PART NO. 451419

SHEET 5 OF 10

BLOCK NO 1020B

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 24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1---2---3---4---5---6---7---8---9---10-11-12-13-14-15-16-17-18-19-
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 25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1---2---3---4---5---6---7---8---9---10-11-12-13-14-15-16-17-18-19-20-
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 27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1---2---3---4---5---6---7---8---9---10-11-12-13-14-15-16-17-18-19-20-21-22-
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 32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-1---2---3---4---5---6---7---8---9---10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-
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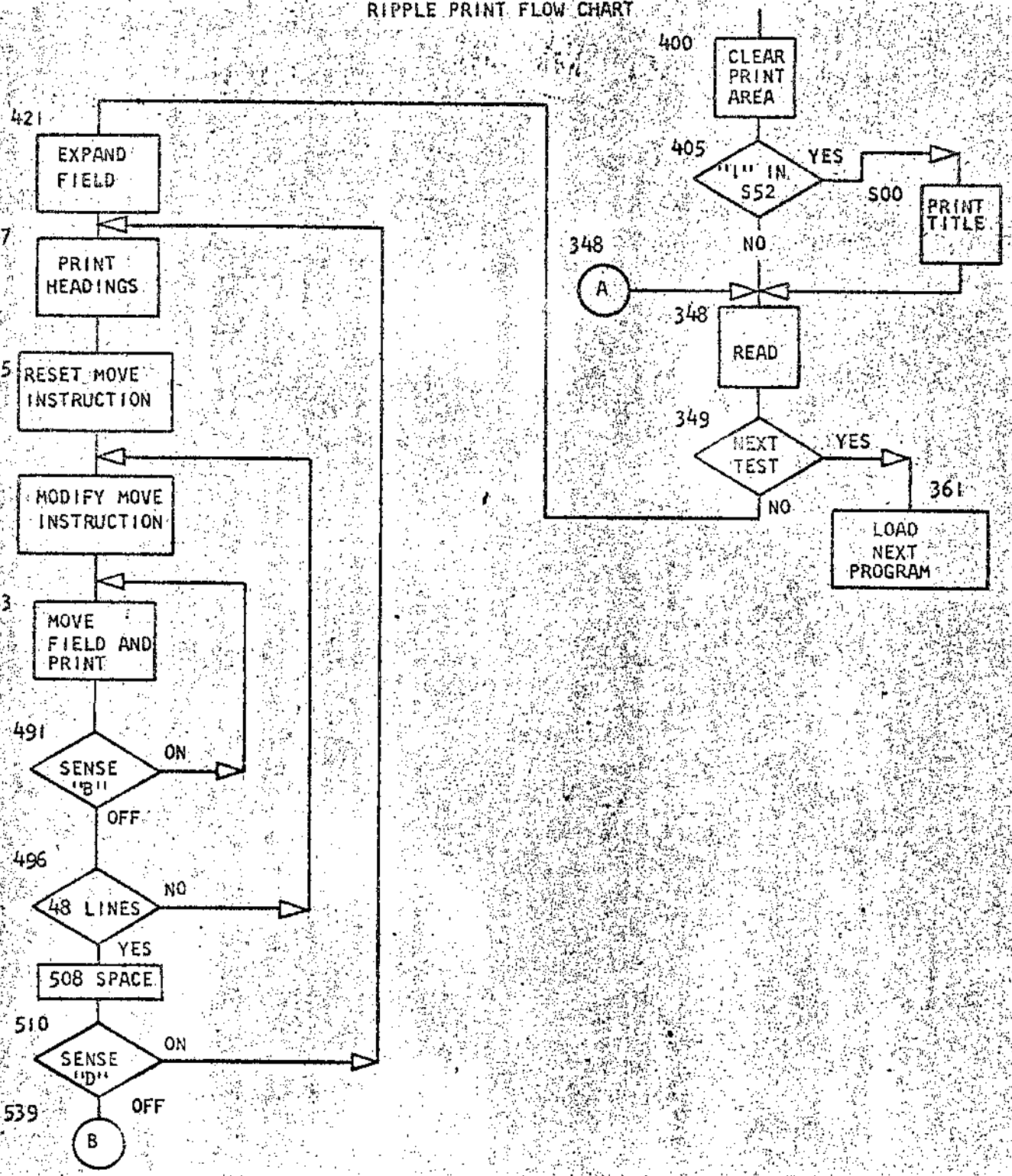
DATE	2-2-61	6-29-63	17 10 63					
ENG. ENG NO	110378	117628	TA 1976					

RIPPLE PRINT FLOW CHART

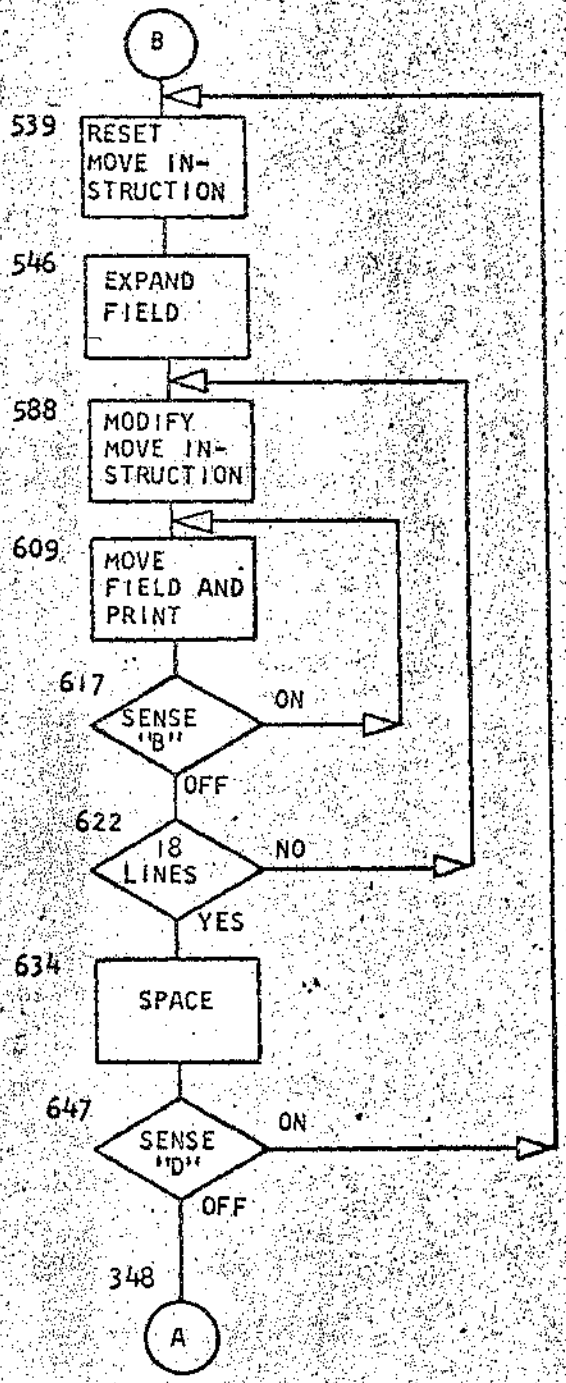


DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	7A/1976					

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451419
SHEET 7 OF 1
BLOCK NO. 10208



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

RIPPLE PRINT 10208

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S611	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	421		BRANCH TO PROGRAM
421	421	/	/92		EXPAND FIELD
425	425	/			,,
426	426	L	712	≠48	,,
433	433	M	≠48	≠96	,,
440	440	M	≠96	/92	,,
447	447	L	973	332	LOAD HEADING AND PRINT
454	454	2			NO-OP TO ELIMINATE PRINT — C FOR TA
455	455	M	658	486	RESET MOVE INSTRUCTION
462	462	M	486	733	MODIFY INSTRUCTION
469	469	A	469	733	,,
476	476	M	733	486	,,
483	483	M	/31	332	*LOAD PRINT AREA
490	490	2			PRINT
491	491	B	483	B	B ON TO SCOPE SS
496	496	C	733	661	TEST FOR 48 LINES
503	503	B	462	/	,,
508	508	F	J		SPACE
510	510	B	447	D	D ON TO REPEAT SS
515	515	B	539		BRANCH TO CONTINUE
539	539	M	658	612	RESET MOVE INSTRUCTION
546	546	Y	421	729	EXPAND FIELD
553	553	L	730	≠18	,,
560	560	M	≠18	≠36	,,
567	567	M	≠36	≠72	,,
574	574	M	≠72	/44	,,
581	581	M	≠36	/80	,,
588	588	M	612	733	MODIFY INSTRUCTION
595	595	A	595	733	,,
602	602	M	733	612	,,
609	609	M	/31	332	*LOAD PRINT AREA
616	616	2			PRINT
617	617	B	609	B	B ON TO SCOPE SS
622	622	C	733	664	TEST FOR 18 LINES
629	629	B	588	/	,,
634	634	F	J		SPACE
636	636	B	647		BRANCH TO CONTINUE
647	647	B	539	D	D ON TO REPEAT SS
652	652	B	348		BRANCH TO CHAINING ROUTINE

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

```
 656  656  / 31                              CONSTANTS
 659  659  / 79                                ,,
 662  662  / 49                                ,,
 665  665  1 234 567890#@/STUVWXY             ,,
 685  685  Z ¢.% JKLMNOPQR-$*ABCD             ,, NO WM
 705  705  E FGH I+-¤                         ,,    ,,
 713  713       +     -                       ,,
 731  731  X XX                               ,,
 842  842  1   2   3  4  5  6  7             ,,
 862  862    8   9 10 11 12 13 1             ,, NO WM
 882  882  4  15  16 17 18 19 20             ,,    ,,
 902  902  2 1 2 2 23 24 25 26 27            ,,    ,,
 922  922    28  29 30 31 32 33 3            ,,    ,,
 942  942  4  35  36 37 38 39 40             ,,    ,,
 962  962  4 1 4 2 43 44                     ,,    ,,
 032  032                                    CLEAR WM CARD                    DNL
 032  032                                    CLEAR WM CARD                    DNL
 032  032                                    CLEAR WM CARD                    DNL
 032  032                                    CLEAR WM CARD                    DNL
```

DATE	2-2-61	6-29-63	12.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8
WS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0	
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK		7	8
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,008015,022029,033033N      1001                RIPPLE PRINT                1020B 0A
,008015,022029,033033N      1001                SET WORDMARK CARD           1020B 02
L067367,340344,348349,3573611001,008012,00110011B361080A8421/340080         1020B 03
L072416,385400,404405,413417100184005611BS88          /332/BS00S521/0801020B 04
L069453,421425,426433,44044710018421//92/L712≠48M≠48≠96M≠96/92L973332       1020B 05
L069490,455462,469476,48349010012M658486M486733A469733M733486M/313322      1020B 06
L072530,496503,508510,5155151001B4838C733661B462/FJB447DB539                1020B 07
L068566¤531531,539546,5535601001        M658612Y421729L730≠18M≠18≠36         1020B 08
L067601,574581,588595,6026021001M≠36≠72M≠72/44M≠36/80M612733A595733          1020B 09
L066635,609616,617622,6296341001M733612M/313322B6098C733664B588/FJ          1020B 10
L072675,647652,656659,66266510018647        B539DB348/31/79/491234567890#1020B 11
L069712¤676676,713713,7137131001@/STUVWXYZP,%JKLMNOPQRM$*ABCDEFGHI&.¤      1020B 12
                                        Z       Z
L072752,731731,731731,7317311001CRWCP LSAGM GDTT XXX                        1020B 13
                                     OPSOZ TEPTZ MESM
L072881,001001,001001,00100110011  2  3  4  5  6  7  8  9  10 11 12 13 11020B 14
L072921¤882882,001001,00100110014 15 16 17 18 19 20 21 22 23 24 25 26 271020B 15
L072961¤922922,001001,0010011001 28 29 30 31 32 33 34 35 36 37 38 39 40 1020B 16
L072≠01¤962962,001001,001001100141 42 43 44                                1020B 17
L053S20,S01S05,S12S13,S17S2110012,049L0772772/2772421                        1020B 18
/333080N                                            CLEAR WORDMARK CARD     1020B 19
,019027,031,038042B031T98GB400L046352BW048S88   RIPPLE PRINT                1020B 20
                        M
```

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA1976					

NUMERICAL RIPPLE PRINT

A. PURPOSE OF TEST

TO TEST HAMMER FIRING BY PRINTING EVERY CHARACTER ON THE NUMERICAL CHAIN IN EVERY PRINT POSITION IN RIPPLE FASHION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 3 IN 1261.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON PERMITS SCOPING OF THE PRINTING OPERATION FOR ONE LINE
OFF TO CONTINUE

D ON REPEATS THE PROGRAM FOR THE ENTIRE TEST
OFF TO CONTINUE

D. TEST PROCEDURE

THERE ARE NO DETAIL CARDS IN THIS TEST.

A 60-CHARACTER TABLE, STORED BY THE PROGRAM IN LOCATIONS 701-760, IS EXPANDED TO A 240-CHARACTER TABLE IN LOCATIONS 701-940. A LINE COUNTER IS THEN STARTED AT 832 AND IS USED AS AN INSTRUCTION TO PRINT 132 CHARACTERS STORED IN LOCATIONS 701-832. THE 832 IN THE LINE COUNTER IS THEN COMPARED TO 891 STORED BY THE PROGRAM IN LOCATIONS 607-609. AN UNEQUAL COMPARISON ALLOWS EXECUTION OF AN INSTRUCTION TO ADD A "1" TO THE LINE COUNTER, THUS INCREASING IT FROM 832 TO 833, AND A SECOND LINE IS PRINTED WITH 132 CHARACTERS STORED IN LOCATIONS 702-833, AND SO ON, UNTIL THE NUMBER IN THE LINE COUNTER IS 891. IN THE MEANTIME, WITH SENSE SWITCH "D" SET TO THE OFF POSITION, THE RESULT PRODUCED IS A LISTING OF 60 LINES OF PRINTING A 60-CHARACTER TABLE IN RIPPLE FASHION. RIPPLE PRINTING MAY BE CONTINUED INDEFINITELY BY SETTING SENSE SWITCH "D" TO THE ON POSITION.

NOTE: THE PROGRAM PROVIDES FOR PRINTING 132 CHARACTERS ON EACH LINE, BUT ONLY 100 CHARACTERS WILL PRINT ON EACH LINE WITH A MACHINE HAVING 100 PRINT POSITIONS.

E. STOPS

NONE

DATE	3-13-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103788	1117628	TA 1976					

F. PRINTOUTS

1234 5678 90-, .$*##*$. ,-09 8765 4321 2468 0,$##357 9-.* 1234 5678 90-, ETC.
234 5678 90-, .$*##*$. , -09 8765 4321 2468 0, $ #357 9-.* 1234 5678 90-, ETC.
34 5678 90-, .$*##*$. , -09 8765 4321 2468 0, $##357 9-.* 1234 5678 90-, ETC.
4 5678 90-, .$*##*$. , -09 8765 4321 2468 0, $#357 9-.* 1234 5678 90-, ETC.
5678 90-, .$*##*$. , -90 8765 4321 2468 0, $#357 9-,* 1234 5678 90-, ETC.
5678 90-, .$*##*$. , -90 8765 4321 2468 0, $#357 9-.* 1234 5678 90-, ETC.

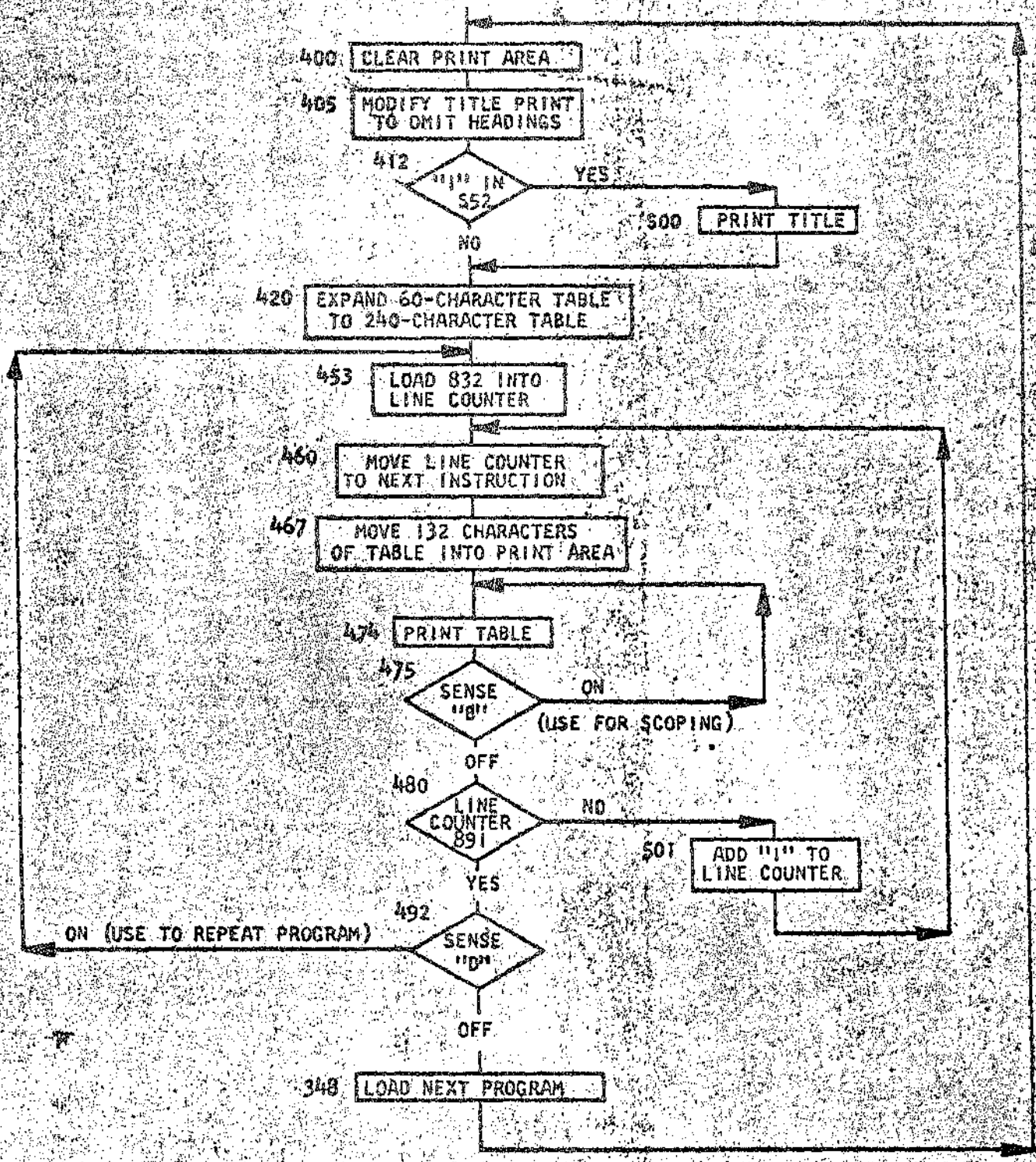
G. COMMENTS

SINCE THERE ARE NO ALPHABETIC CHARACTERS ON THE NUMERICAL CHAIN, THE BLOCK NUMBER "1022" IS PRINTED ON THE TITLE LINE WITHOUT THE LETTER SUFFIX WHEN THE "I" IS MANUALLY INSERTED IN S52.

DATE	3-13-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103788	117628	TA-1976					

NUMERICAL RIPPLE PRINT

FLOW CHART



DATE	3-13-61	6-29-63	17.10.63					
ENG. CHG. NO.	110978-B	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

NUMERICAL RIPPLE PRINT 10228

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	$613	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	$88		,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	420		BRANCH TO CONTINUE
420	420	¤	721	741	EXPAND TABLE FROM 701-760 TO 701-940
427	427	L	760	820	,,
434	434	¤	761		,,
438	438	L	820	940	,,
445	445	¤	821		,,
449	449	,	201		SET WM IN PRINT AREA
453	453	L	607	614	LOAD LINE COUNTER
460	460	M	614	470	MOVE LINE CTR INTO NEXT INSTRUCTION
467	467	M	832	332	*MOVE TABLE INTO PRINT AREA
474	474	2			PRINT
475	475	B	474	B	B ON TO SCOPE SS
480	480	C	611	614	COMPARE LINE COUNTER WITH 891
487	487	B	501	/	BRANCH TO ADD 1 IF NOT 891
492	492	B	453	D	D ON TO REPEAT TEST SS
497	497	B	348		BRANCH TO READ NEXT RECORD
501	501	A	608	614	ADD 1 TO LINE COUNTER
508	508	B	460		BRANCH TO PRINT NEXT LINE
605	605	8	32		CONSTANT TO START LINE COUNTER
608	608	1			CONSTANT TO INCREMENT LINE COUNTER
609	609	8	91		CONSTANT TO STOP LINE COUNTER
612	612	X	XX		LINE COUNTER
701	701	1	234	5678 90-, .$*¤	TABLE TO BE RIPPLE PRINTED
721	721	¤	*$.	,-09 8765 4321	,,
741	741	2	468	0,$¤ 1357 9-.*	,,

DATE	3-13-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103788	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    NUMERICAL RIPPLE PRINT    10228 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD         10228 02
L067367,340344,348349,357361 1001,008012,001100118361080AB420/340080              10228 03
L069404,377385,400404,405405 1001          B400S6138588              /332/        10228 04
L072444,413420,427434,438445 1001B500S5218420   ¤72174 1L760820¤761L8209401022B 05
L067479,449453,460467,474475 1001¤821,201L607614M614470M8323322B4748              10228 06
L072519,487492,497501,508508 1001C611614850 1/8453DB348A6086148460               10228 07
L072639¤600600,605608,609612 1001      8321891XXX                                 10228 08
L072719¤680680,701701,701701 1001                          1234 5678 90-, .$¤¤1022B 09
L072759¤720720,721741,741741 1001 ¤¤$. ,-09 8765 4321 2468 0,$¤ 1357 9-,.¤10228 10
L053S20,S01S05,S12S13,S17S21 10012,049L0762762/2772420                            10228 11
/333080N                                                CLEAR WORDMARK CARD       10228 12
,019027,031,038042B031T98GB400L046352BW048S88                                     10228 13
                        M
```

DATE	3-13-61	6-29-63	17.10.63					
ENG. CNG. NO.	1103788	117628	TA 1976					

MULTI TAPE LISTER A BLOCK 1025A

A. PURPOSE.

TO TEST FOR TAPE SKEW AND PERFORM RIPPLE PRINT.

B. LOADING PROCEDURES.

SEE GENERAL DESCRIPTION. THIS TEST CAN BE RUN ONLY FROM CARDS

C. PROGRAM CONTROL.

SEE GENERAL DESCRIPTION.

SENSE SWITCH C ON CAUSES PRINTING OF A SINGLE 1 AT THE RIGHT EDGE OF THE TAPE INSTEAD OF THE TRIANGLE PATTERN IN ROUTINE 1.

FOUR ALTERATION DIGITS MAY BE USED TO CONTROL THE PROGRAM AS FOLLOWS-

1 IN 1129 SETS THE PROGRAM FOR USE WITH 8 NARROW TAPES
2 IN 1129 SETS THE PROGRAM FOR USE WITH 4 WIDE TAPES
WM IN 1131 CAUSES PROGRAM TO DO ROUTINE 1
NO WM IN 1131 CAUSES PROGRAM TO SKIP ROUTINE 1
WM IN 1132 CAUSES PROGRAM TO DO ROUTINE 2
NO WM IN 1132 CAUSES PROGRAM TO SKIP ROUTINE 2
WM IN 1130 CAUSES PROGRAM TO USE C.E. PORTION OF TAPE SELECT TABLE
NO WM IN 1130 CAUSES PROGRAM TO USE PRESET PORTION OF TAPE SELECT TABLE

D. TEST PROCEDURE.

ROUTINE 1- A 1 FROM THE BLANKS ONES TABLE IS MOVED INTO THE PRINT AREA OF THE FIRST TAPE. THIS TAPE IS THEN SELECTED AND A PRINT OP IS PERFORMED. IF SENSE SWITCH C IS ON, THIS PROCESS IS REPEATED ON THE NEXT TAPE. IF SENSE SWITCH C IS OFF THE ABOVE PROCESS IS REPEATED INCREASING THE NUMBER OF ONES BY ONE EACH TIME. WHEN THE LEFT MOST PRINTABLE POSITION PRINTS A 1, THE ABOVE IS REPEATED ON THE NEXT TAPE. WHEN THE LAST TAPE HAS BEEN PROCESSED, THE ENTIRE ROUTINE IS REPEATED UNDER COUNTER CONTROL. THE RESULT IS TEN TRIANGULAR PATTERNS OF ONES ON EACH TAPE.

ROUTINE 2- FOUR TAPE SELECT OPS ARE INSERTED IN THE PROGRAM FROM THE TAPE SELECT TABLE -LOC. /65 THROUGH S44-. THESE TAPE PRINT AREAS ARE LOADED FROM THE RIPPLE TABLE -LOC. T02 THROUGH T62-. THE RIPPLE TABLE IS RIGHT SHIFTED ONE POSITION BY MOVING THE RIGHT MOST CHARACTER TO THE LEFT MOST POSITION OF THE TABLE. THEN ALL OTHER CHARACTERS ARE MOVED ONE POSITION TO THE RIGHT. THE FOUR TAPES ARE THEN SELECTED AND A PRINT OP PERFORMED. THE ABOVE IS REPEATED UNTIL FIFTY LINES OF RIPPLE ARE PRINTED. IF THE TAPES WERE SELECTED FROM THE C.E. PORTION OF THE TAPE SELECT TABLE -LOC. S29 THROUGH S44-, THIS ENDS THE ROUTINE. IF THE TAPES WERE SELECTED FROM THE PRESET PORTION OF THIS TABLE -LOC. /65

THROUGH 528-, THE ABOVE IS REPEATED ON OTHER TAPES. THE TAPES ARE SELECTED FROM THE PRESET PORTION OF THIS TABLE THE PRINTING OCCURS IN THE FOLLOWING SEQUENCE -THE FIRST FOUR, THE LAST FOUR, -THEN, ONLY IF NARROW TAPES- THE ODD FOUR, THE EVEN FOUR.

NOTE - TO USE THE C.E. PORTION OF THE TABLE THE N OPS SHOULD BE CHANGED TO F OPS FOR THOSE TAPES TO BE SELECTED.

E. STOPS.

INSTR. ADDR.	STORAGE ADDR. REG.	
412	413	TO ADJUST ALTERATION DIGITS.

F. SAMPLE PRINTOUT.

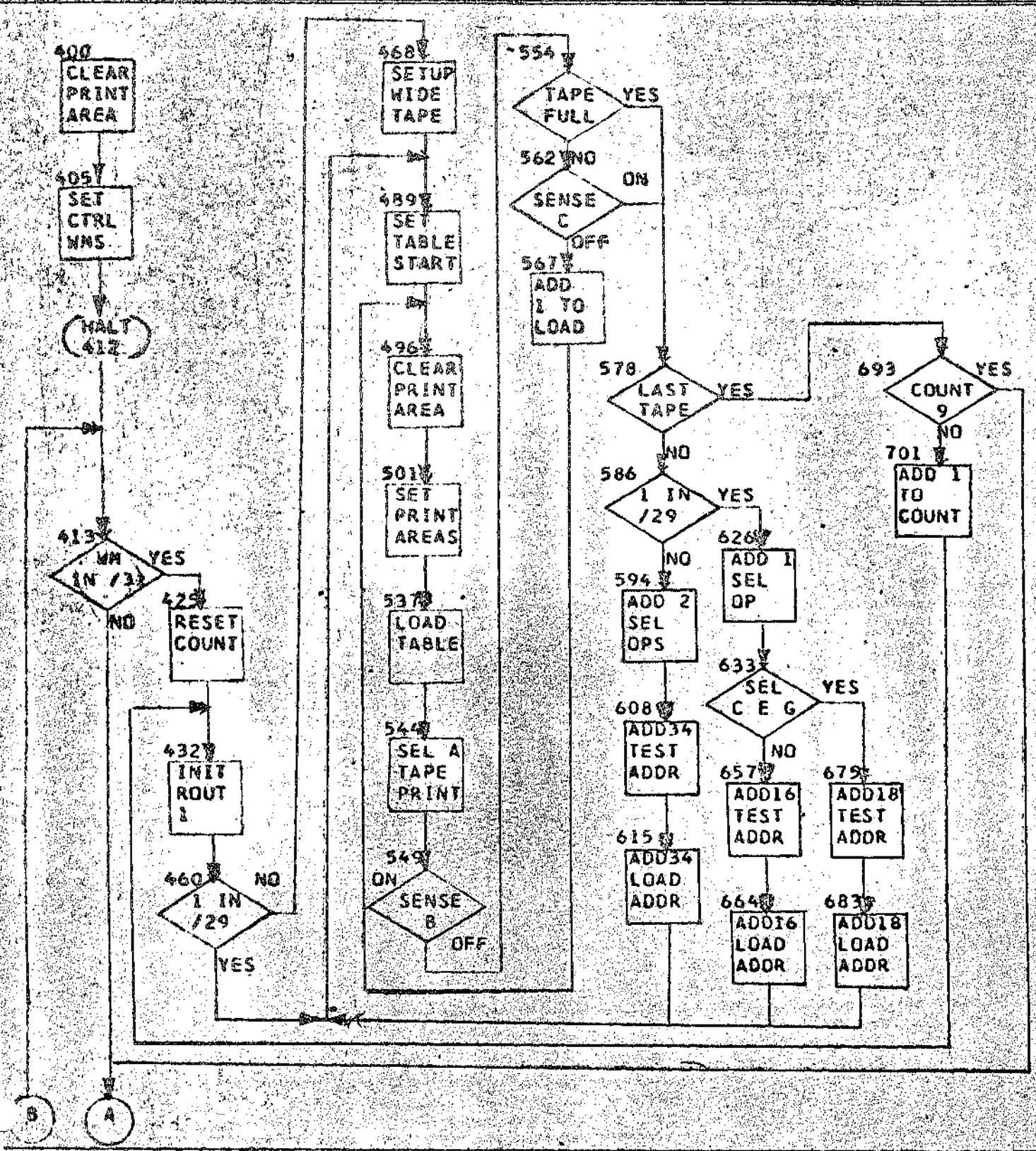
```
          1                    ROUTINE 1
         11                    ,,
        111                    ,,
       ......                  ,,
     ..........                ,,
111111111111                   ,,
          1                    ,,
         11                    ,,
        111                    ,,
       ......                  ,,
     ..........                ,,
111111111111                   ,,
5678 9/-, .$0                  ROUTINE 2
 5678 9/-, .$                  ,,
4 5678 9/, .                   ,,
34 5678 9/-,                   ,,
234 5678 9/-,                  ,,
1234 5678 9/-                  ,,
```

NOTE- THIS IS A SAMPLE. THE PRINT OUT VARIES WITH THE SIZE TAPE USED. SEE THE ABOVE DESCRIPTION.

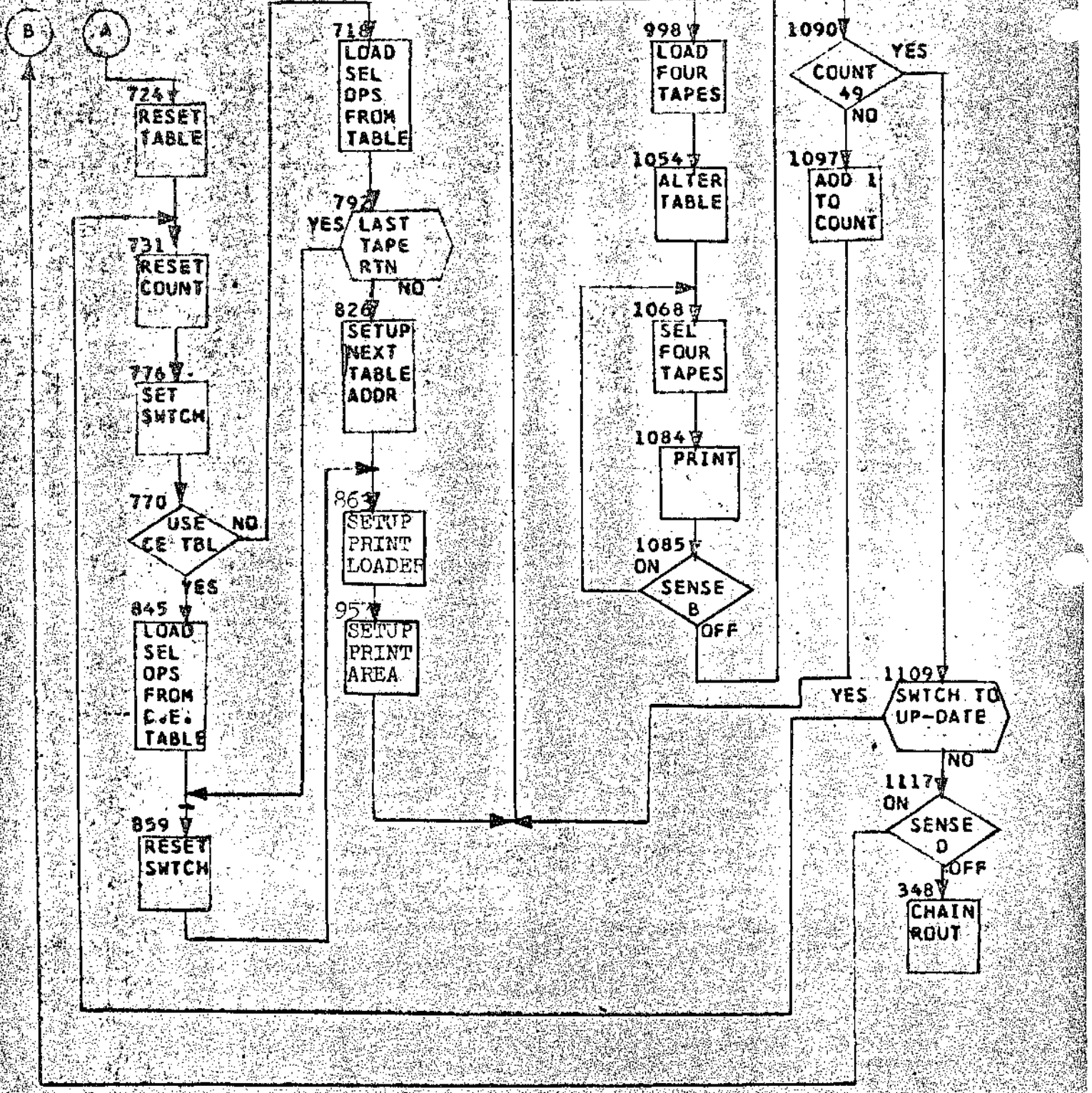
G. COMMENTS.

DUE TO THE CHARACTER OF THE PRINTER UNDER TEST, THE TITLE PRINT ROUTINE IS OMITTED.

DATE	3/17/63	4-23-63	25.6.63						
ENG. CHG. NO.	116745	117487	TI-1844A						



DATE	8/17/63	4-23-63	25.6.63					
ENG. CHG. NO.	118745	117487	9184A					



DATE	3/17/63	4-23-63	25.6.63						
ENG. CHG. NO.	116745	117487	TA 1844A						

PROGRAM LISTING FOR USE WITH FLOW CHART

MULTI TAPE LISTER A 1025A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082				TABLES
102	102				,,
110	110	1	111	1111111111	,,
125	125	1	111	1111111111	,,
139	139				,,
140	140	1	234	5678 90-, ..$*0	,,
160	160	0	*$.	,-09 8765 4321	,,
180	180	2	468	0,$0 1357 9-.*	,,
377	377	8	389	$614	USE WHEN RUNNING FROM MAG. TAPE
385	385	8	$88		,,
400	400	/	332		CLEAR PRINT AREA
404	404	/			,,
405	405	,	/31	/32	SET CONTROL WMS IN
412	412	.			HALT
413	413	V	425	/311	TEST FOR 1ST WM
421	421	B	712		BR TO ROUTINE 2
425	425	M	/35	/28	RESET COUNTER
432	432	M	/61	545	INITIALIZE ROUTINE 1
439	439	M	/51	543	,,
446	446	M	/59	547	,,
453	453	M	/54	560	,,
460	460	B	489	/291	BRANCH IF 1 IN ADWT
468	468	M	547	545	SETUP FOR WIDE TAPE
475	475	A	/36	547	,,
482	482	A	/40	543	,,
489	489	M	/57	540	RESET LOADER A FIELD
496	496	/	332		CLEAR PRINT AREA
500	500	/			,,
501	501	B	523	/292	BR IF WIDE TAPE
509	509	,	217	251	SET TAPE PRINT AREAS
516	516	,	285	319	,,
523	523	,	201	235	,,
530	530	,	269	303	,,
537	537	M	573	213	LOAD PRINT AREA LOADER
544	544	N	0		WIDE TAPE SELECT
546	546	F	A		TAPE SELECT
548	548	2			PRINT
549	549	B	544	B	BR IF SENSE SW B ON
554	554	B	578	2011	BR IF ALL 1S
562	562	B	578	C	BR IF SENSE SW C ON
567	567	A	/36	540	SHIFT IN ANOTHER 1
574	574	B	496		BR BACK

DATE	3/17/63	4-23-63	25.6.63					
ENGR. CHG. NO.	116745	117487	TA 1844A					

```
578  578  B  693  547H      BR IF LAST TP
586  586  B  626  /291      BR IF NARROW TP
594  594  A  /37  545       INCREASE SEL FOR
601  601  A  /37  547       WIDE TP
608  608  A  /44  560       SET NEXT TEST ADDRESS
615  615  A  /44  543       SET NEXT LOAD ADDRESS
622  622  B  489            BR BACK
626  626  A  /36  547       INCREASE SEL FOR NT
633  633  B  675  547C      BR TO SET ODD TAPES
641  641  B  675  547E        ,,
649  649  B  675  547G        ,,
657  657  A  /40  560       ADJUST FOR EVEN TAPES
664  664  A  /40  543         ,,
671  671  B  489            BR BACK
675  675  A  /42  560       ADJUST FOR ODD TAPES
682  682  A  /42  543       ADJUST FOR ODD TAPES
689  689  B  489            BR BACK
693  693  B  712  /289      BR IF TEST COMPLETE
701  701  A  /36  /28       INC COUNTER
708  708  B  432            BR BACK
712  712  V  724  /321      TEST FOR 2ND WM
720  720  B  /17            BR TO SENSE D
724  724  M  /64  781       RESET TABLE SETUP ROUTINE
731  731  M  547  877         ,,
738  738  M  550  869         ,,
745  745  M  553  940         ,,
752  752  M  556  952         ,,
759  759  M  /35  /28       RESET COUNTER
766  766  ,  /13            SET SWITCH 3 TO BRANCH
770  770  V  845  /301      BRANCH TO LOAD CE TABLE
778  778  M  /80  +83       LOAD F-OP NO-OP TABLE
785  785  M                    ,,
786  786  M                    ,,
787  787  M                    ,,
788  788  M                    ,,
789  789  M                    ,,
790  790  M                    ,,
791  791  M                    ,,
792  792  B  811  /292      SETUP TO EXIT -WIDE, THIN TAPE-
800  800  M  557  825         ,,
807  807  B  818              ,,
811  811  M  558  825         ,,
818  818  B  859  7818        ,,
826  826  ,  779            SETUP NEXT TABLE ADDRESS
830  830  A  /40  781         ,,
837  837  ¤  779              ,,
841  841  B  883            BRANCH -TO SETUP PRINTER LOADER
845  845  M  544  +83       LOAD CE PORTION OF TABLE
852  852  M                    ,,
853  853  M                    ,,
854  854  M                    ,,
```

DATE	3/17/63	4-23-63	25.6.63					
ENG. CHG. NO	116745	117487	TA 1844A					

```
 855  855  M
 856  856  M
 857  857  M
 858  858  M
 859  859  B  /13
 863  863  B  946  *68M      SET SWITCH 3 TO NOT BRANCH
 871  871  M  /48  998      BRANCH TO NO-OP INSTRUCTION
 878  878  B  867  950      MOVE M INTO INSTRUCTION
 885  885  B  938  875      UPDATE ROUTINE
 892  892  A  /37  869
 899  899  A  /37  940
 906  906  A  /38  952
 913  913  A  /38  877
 920  920  B  867  950
 927  927  B  938  875
 934  934  B  957  *67M
 942  942  B  863            BRANCH IF END
 946  946  M  /47  998      BRANCH BACK
 953  953  B  878            MOVE N INTO INSTRUCTION
 957  957  B  332            BRANCH BACK
 961  961  /                SETUP PRINT AREA
 962  962  B  98M  /292
 970  970  B  217  251
 977  977  B  285  319
 984  984  B  201  235
 991  991  B  269  303
 998  998  M  199  213      LOAD ALL TAPES
1005  *05  M  199  229
1012  *12  M  199  247
1019  *19  M  199  263
1026  *26  M  199  281
1033  *33  M  199  297
1040  *40  M  199  315
1047  *47  M  199  331
1054  *54  M  199  139      ALTER TO RIPPLE
1061  *61  M  198  199
1068  *68  F  A              SELECT FOUR TAPES
1070  *70  F  B
1072  *72  F  C
1074  *74  F  D
1076  *76  F  E
1078  *78  F  F
1080  *80  F  G
1082  *82  F  H
1084  *84  2                PRINT
1085  *85  B  *68  B         BR IF SENSE SW B ON
1090  *90  C  /28  /46       COMPARE FOR 49 LINES
1097  *97  A  /36  /28       ADD TO COUNT
1104  /04  B  998  /         BR BACK
1109  /09  B  731  /095      SWITCH3
1117  /17  B  413  D         BR IF SENSE SW D ON
```

DATE	3/17/63	4-23-63	25.6.63					
ENG. CHG. NO.	116745	117487	TA-1844A					

```
1122  /22  8  348          EXIT
1126  /26  0  00           COUNT
1129  /29  1               CONSTANTS
1130  /30                     ''
1131  /31                     ''
1132  /32                     ''
1133  /33  0  00              ''
1136  /36  1                  ''
1137  /37  2                  ''
1138  /38  7                  ''
1139  /39  1  6               ''
1141  /41  1  8               ''
1143  /43  3  4               ''
1145  /45  4  9               ''
1147  /47  N                  ''
1148  /48  H                  ''
1149  /49  2  13              ''
1152  /52  2  01              ''
1155  /55  1  10              ''
1158  /58  F  A               ''
1160  /60  N  C               ''
1162  /62  /  80              ''
1165  /65  F  AFB  FCFDNENFNGNH
1181  /81  N  ANB  NCNDFEFFFGFH
1197  /97  F  ANB  FCNDFENFFGNH
1213  S13  N  AFB  NCFDNEFFNGFH
1229  S29  N  ANB  NCNDNENFNGNH
1245  S45  9  98
1248  S48  ¢  68
1251  S51  ¢  67
1254  S54  9  98
1257  S57  8
1258  S58  6
 020   020
 027   027
 032   032
1012  ¢12
```

CLEAR WM CARD — DNL
CLEAR WM CARD — DNL
CLEAR WM CARD — DNL
CLEAR WM CARD — DNL

DATE	3/17/68	4-23-63	25.6.63					
ENG. CHG. NO.	116745	117487	TA 1844A					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS 12 5 8	SE-SEMICOLON 11 6 8	DE-DELTA 11 7 8
WS-WORD SEPARATOR 0 5 8	LT-LESS THAN 12 6 8	PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8	GT-GREATER THAN 6 8	TM-TAPE MARK 7 8
GM-GROUP MARK 12 7 8	MZ-MINUS ZERO 11 0	CO-COLON 5 8
RP-RIGHT PARENTHESIS 11 5 8	AP-APOSTROPHE 0 6 8	

```
,008015,022029,033033N      1001                    MULTI TAPE LISTER A      1025A 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD        1025A 02
L072121,001001,001001,0010011001                    1111111111111            1025A 03
L072161¤122122,139139,1391391001111111111111111111 1234 5678 90-, .$¤¤ ¤¤    1025A 04
L070199¤162162,001001,0010011001$. ,-09 8765 4321 2468 0,$¤ 1357 9-.$         1025A 05
L067367,340344,348349,3573611001,008012,0011001183610080A8438/340080          1025A 06
L069404,377385,400404,4054051001          8389S614BS88          /332/        1025A 07
L066438,412413,421425,4323391001,/31/32,V425/311B712M/35/28M/61545            1025A 08
L068474,446453,460468,4754751001M/51543M/59547M/5456084B9/291M547545          1025A 09
L066508,482489,496500,5015091001A/36547A/40543M/57540/332/BS23/292            1025A 10
L071547,516523,530537,5445461001,217251,285319,201235,269303MS73213NDFA       1025A 11
L070585,549554,562567,5745781001285448BS782011B578CA/3654084968693547H       1025A 12
L072625,594601,608615,6226261001B626/291A/37545A/37547A/44560A/44543B489      1025A 13
L070663,633641,649657,6446641001A/36547B675547C8675547EB675547GA/40560        1025A 14
L069700,671675,682689,6937011001A/40543B489A/42560A/42543B48987.12/289        1025A 15
L069737,708712,720724,7317381001A/36/28B432V724/3218/17M/64781MS47877         1025A 16
L072777,745752,759766,7707781001MS50869MS53940MS56952M/35/28,/13V845/301      1025A 17
L045790,785786,787788,7897901001M/80*83MMMMMM                                 1025A 18
L071829,792800,807811,8188261001M8811/292MS5782SB818MS5882588527818,779       1025A 19
L057854,837841,845852,8538541001A/40781¤779B863MS44*83MMM                     1025A 20
L055877,856857,858859,8638711001MMMM¤/13B946*68NM/48998                       1025A 21
L067912,885892,899906,9139131001,867950,938875A/37869A/37940A/38952           1025A 22
L072952,920927,934942,9469531001A/38877¤867950¤938875B957*67HB863M/47998      1025A 23
L070990,957961,962970,9779841001B878/332/8984/292,217251,285319,201235        1025A 24
L067*25,998*05,*12*19,*26*261001,269303M199213M199229M199247M199263           1025A 25
L067*60,*33*40,*47*54,*61*611001M199281M199297MI99315M199331M199139           1025A 26
L051*79,*68*70,*72*74,*76*781001M198199FAFBFCFDFEFF                           1025A 27
L061/08,*82*84,*85*90,*97/041001FGFH2B*68BC/28/46A/36/288998/                 1025A 28
L055/31,/17/22,/26/29,/31/311001B731/09S8413083480001                         1025A 29
L043/42,/33/36,/37/38,/39/411001 0001271618                                   1025A 30
L047/57,/45/47,/48/49,/52/5510013449NM213201110                               1025A 31
L071/96,/60/6Z,/65/81,/97/971001FAN0/80FAF8FCFONENFNGNHNANBNCNDFEFFFGFH       1025A 32
L064S28,S13S29,S29S29,S29S291001FANBFCNDFENFFGNHNAFBNCFDNEFFNGFH              1025A 33
L062S68,S45S48,S51S54,S57S581001NANBNCNDNENFNGNH998*68*6799886                1025A 34
/333080                                     CLEAR WORDMARK CARD               1025A 35
,019027,031,0380428031T98GB400L046352BW048S88  MULTI TAPE LISTER A           1025A 36
                              M
```

DATE	3/17/63	4-23-63	25.6.63					
ENG. CHG. NO.	116745	117487	TA 1844 A					

MULTI TAPE LISTER 8 BLOCK 1026A

A. PURPOSE.

TO CHECK ALIGNMENT AND OVER EDGE PRINTING.

B. LOADING PROCEDURES.

SEE GENERAL DESCRIPTION. THIS TEST CAN BE RUN ONLY FROM CARDS

C. PROGRAM CONTROL.

SEE GENERAL DESCRIPTION.

TWO ALTERATION DIGITS MAY BE USED TO CONTROL THE PROGRAM AS FOLLOWS-

1 IN 927 SETS THE PROGRAM FOR USE WITH 8 NARROW TAPES
2 IN 927 SETS THE PROGRAM FOR USE WITH 4 WIDE TAPES
WM IN 928 CAUSES PROGRAM TO USE C.E. PORTION OF TAPE SELECT TABLE
NO WM IN 928 CAUSES PROGRAM TO USE PRESET PORTION OF TAPE SELECT TABLE

D. TEST PROCEDURE.

FOUR TAPES ARE SELECTED BY MEANS OF THE TAPE SELECT TABLE -LOC. 964 THROUGH 1043-. EACH OF THESE TAPES IS THEN COMPLETELY LOADED A DIGIT AT A TIME WITH FOURS. THEN A PRINT OP IS PERFORMED. THIS IS REPEATED UNTIL FOURTY NINE LINES HAVE BEEN PRINTED. IF THE TAPES WERE SELECTED BY THE PRESET PORTION OF THE TABLE -LOC. 964 THROUGH 1027-, THE TAPES ARE PRINTED IN THE FOLLOWING SEQUENCE -THE FIRST FOUR, THE LAST FOUR, -THEN ONLY IF NARROW TAPES- THE ODD FOUR, THE EVEN FOUR. IF THE TAPES WERE SELECTED FROM THE C.E. PORTION OF THE TABLE, -LOC. 1028 THROUGH 1043 ONLY THOSE TAPES ARE PROCESSED. NEXT A ROUTINE CHANGES THE PROGRAM TO PRINT ZEROS INSTEAD OF FOURS AND BRANCHES BACK TO DO THIS.

NOTE - TO USE THE C.E. PORTION OF THE TABLE THE N OPS SHOULD BE CHANGED TO F OPS FOR THOSE TAPES TO BE SELECTED.

E. STOPS.

INSTR. ADDR.	STORAGE ADDR. REG.	
405	406	TO ADJUST ALTERATION DIGITS.

DATE	3/17/63	10-5-63						
ENG. CHG. NO.	116745	TA-1844						

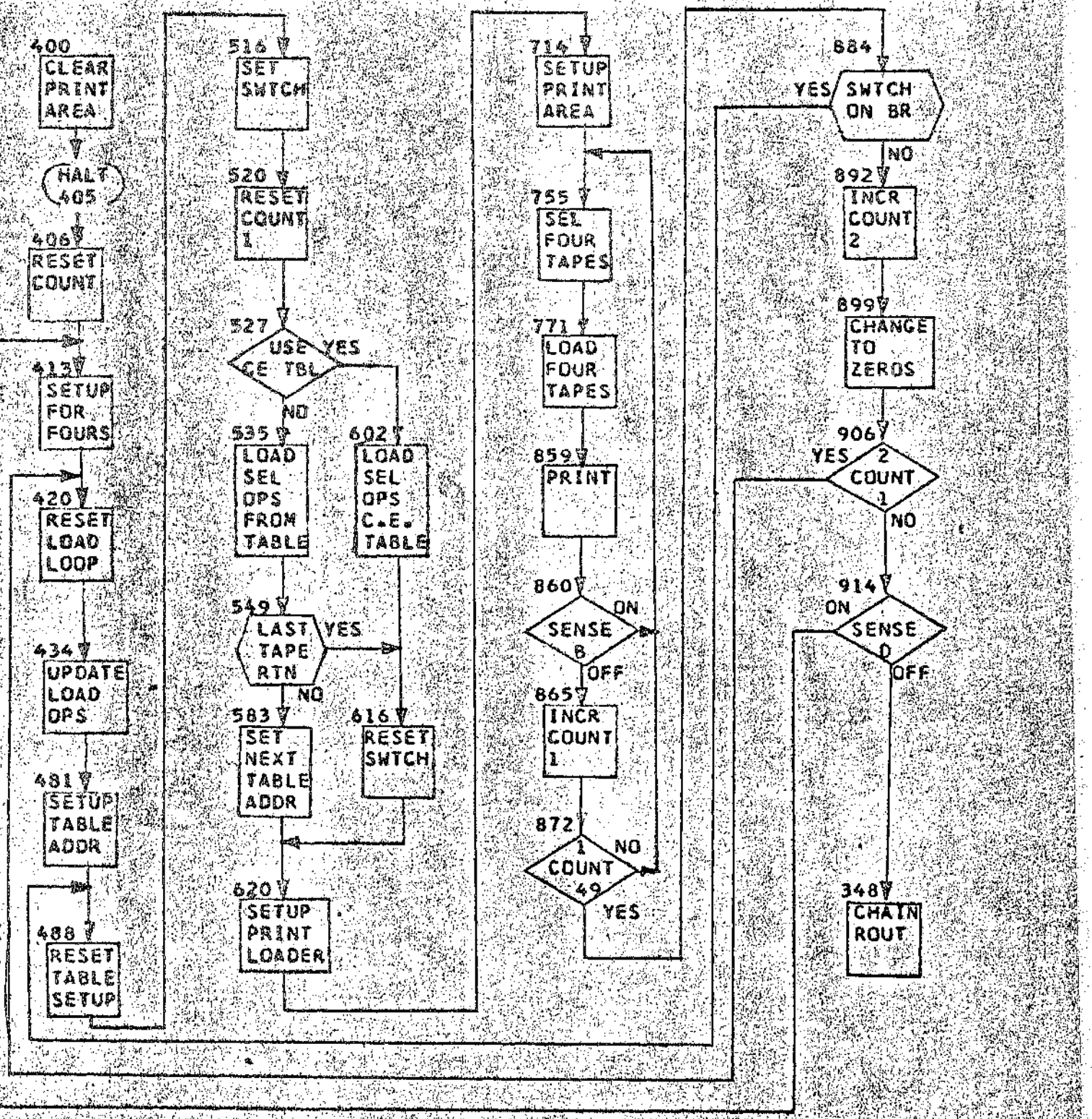
F. SAMPLE PRINTOUT.


```
4444444444444
4444444444444
4444444444444
4444444444444
0000000000000
0000000000000
0000000000000
0000000000000
```

NOTE- THIS IS A SAMPLE. THE PRINT OUT VARIES WITH THE SIZE TAPE USED. SEE THE ABOVE DESCRIPTION.

G. COMMENTS.

DUE TO THE CHARACTER OF THE PRINTER UNDER TEST, THE TITLE PRINT ROUTINE IS OMITTED.



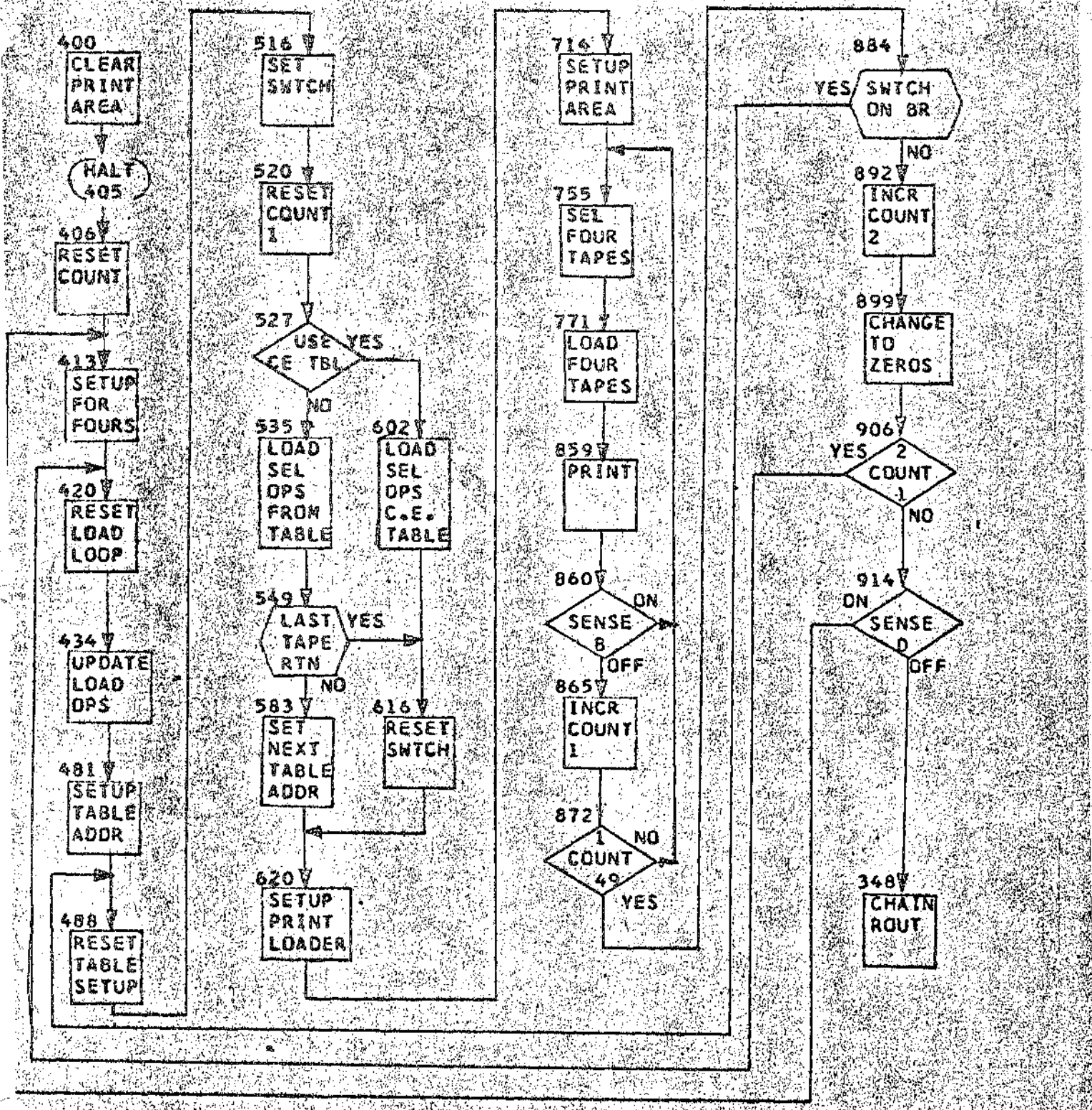
DATE	3/17/63	10.5.63							
NC. CNC. NO.	116745	TA-1844							

PROGRAM LISTING FOR USE WITH FLOW CHART

MULTI TAPE LISTER B 1026A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	5814	USE WHEN RUNNING FROM MAG. TAPE
385	385	B	588		,,
400	400	/	332		CLEAR PRINT AREA
404	404	/			,,
405	405	.			HALT
406	406	M	931	926	RESET COUNTER 2
413	413	M	943	437	SETUP TO LOAD LINE OF FOURS
420	420	M	957	447	RESET LOAD UPDATE LOOP
427	427	M	960	440	,,
434	434	M	946	774	UPDATE LOAD OPS
441	441	B	481	756H	BRANCH IF FINNISHED
449	449	,	438	445	UPDATE LOOP
456	456	A	936	440	,,
463	463	A	933	447	,,
470	470	¤	438	445	,,
477	477	B	434		BR BACK
481	481	M	963	538	RESET TABLE SETUP ROUTINE
488	488	M	¢46	626	,,
495	495	M	¢49	634	,,
502	502	M	957	697	,,
509	509	M	¢52	709	,,
516	516	,	888		SET SWITCH TO BRANCH
520	520	M	931	925	RESET COUNTER
527	527	V	602	9281	BRANCH TO LOAD CE TABLE
535	535	M	979	770	LOAD F-OP NO-OP TABLE
542	542	M			,,
543	543	M			,,
544	544	M			,,
545	545	M			,,
546	546	M			,,
547	547	M			,,
548	548	M			,,
549	549	B	568	9272	SETUP TO EXIT -WIDE, THIN TAPE-
557	557	M	¢53	582	,,
564	564	B	575		,,
568	568	M	¢54	582	,,
575	575	B	616	5387	,,
583	583	,	536		SETUP NEXT TABLE ADDRESS
587	587	A	930	538	,,
594	594	¤	536		,,
598	598	B	620		BRANCH -TO SETUP PRINTER LOADER
602	602	M	¢43	770	LOAD CE PORTION OF TABLE

DATE	9/17/63	10.5.63							
ENG. CHG. NO.	116745	TA-1844							



DATE	3/17/63	10.5.63						
ENG. CHG. NO.	116745	TA-1844						

PROGRAM LISTING FOR USE WITH FLOW CHART

MULTI TAPE LISTER B 1026A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	5614	USE WHEN RUNNING FROM MAG. TAPE
385	385	B	588		,,
400	400	/	332		CLEAR PRINT AREA
404	404	/			,,
405	405	.			HALT
406	406	M	931	926	RESET COUNTER 2
413	413	M	943	437	SETUP TO LOAD LINE OF FOURS
420	420	M	957	447	RESET LOAD UPDATE LOOP
427	427	M	960	440	,,
434	434	M	946	774	UPDATE LOAD OPS
441	441	B	481	756M	BRANCH IF FINNISHED
449	449	,	438	445	UPDATE LOOP
456	456	A	936	440	,,
463	463	A	933	447	,,
470	470	¤	438	445	,,
477	477	B	434	-	BR BACK
481	481	M	963	538	RESET TABLE SETUP ROUTINE
488	488	M	¢46	626	,,
495	495	M	¢49	634	,,
502	502	M	957	697	,,
509	509	M	¢52	709	,,
516	516	,	888		SET SWITCH TO BRANCH
520	520	M	931	925	RESET COUNTER
527	527	V	602	9281	BRANCH TO LOAD CE TABLE
535	535	M	979	770	LOAD F-OP NO-OP TABLE
542	542	M			,,
543	543	M			,,
544	544	M			,,
545	545	M			,,
546	546	M			,,
547	547	M			,,
548	548	M			,,
549	549	B	568	9272	SETUP TO EXIT -WIDE, THIN TAPE-
557	557	M	¢53	582	,,
564	564	B	575		,,
568	568	M	¢54	582	,,
575	575	B	616	5387	,,
583	583	,	536		SETUP NEXT TABLE ADDRESS
587	587	A	938	538	,,
594	594	¤	536		,,
598	598	B	620		BRANCH -TO SETUP PRINTER LOADER
602	602	M	¢43	770	LOAD CE PORTION OF TABLE

DATE	3/17/63	10-5-63							
ENG. CHG. NO.	116745	TA-1844							

```
609  609  M
610  610  M
611  611  M
612  612  M
613  613  M
614  614  M
615  615  M
616  616  =  888
620  620  B  703  755N     SET SWITCH TO NOT BRANCH
628  628  M  954  771      BRANCH TO NO-OP INSTRUCTION
635  635  ,  624  707      MOVE M INTO INSTRUCTION
642  642  ,  695  632      UPDATE ROUTINE
649  649  A  933  626
656  656  A  933  697
663  663  A  936  709
670  670  A  936  634
677  677  =  624  707
684  684  =  695  632
691  691  B  714  754W     BRANCH IF END
699  699  B  620           BRANCH BACK
703  703  M  953  771      MOVE N INTO INSTRUCTION
710  710  B  635           BRANCH BACK
714  714  /  332           SETUP PRINT AREA
718  718  /
719  719  B  741  9272
727  727  ,  217  251
734  734  ,  285  319
741  741  ,  201  235
748  748  ,  269  303
755  755  F  A             SELECT FOUR TAPES
757  757  F  B
759  759  F  C
761  761  F  D
763  763  F  E
765  765  F  F
767  767  F  G
769  769  F  H
771  771  M  934  213      LOAD PRINT AREA
778  778  M  213
782  782  M  934  229
789  789  M  229
793  793  M  934  247
800  800  M  247
804  804  M  934  263
811  811  M  263
815  815  M  934  281
822  822  M  281
826  826  M  934  297
833  833  M  297
837  837  M  934  315
844  844  M  315
```


DATE	9/17/63	10.5.63						
ID. CHG. NO.	118745	TA-1844						

```
 848  848  M 934 331                ,,
 855  855  M 331                   ,,
 859  859  2                      PRINT
 860  860  B 755 B                BR IF SENSE SW B ON
 865  865  A 932 925              INC COUNTER
 872  872  C 925 940              CHANGE PRINTOUT IF COUNT
 879  879  B 755 /                BR BACK
 884  884  8 488 884S             SWITCH
 892  892  A 932 926              SETUP EXIT FROM RIPPLE PRINT
 899  899  M 949 437              CHANGE TO PRINT OS
 906  906  B 420 9261                ,,
 914  914  B 406 D                D ON TO REPEAT
 919  919  8 348                  EXIT
 923  923  0 00                   COUNT
 926  926  0                        ,,
 927  927  1                      CONSTANTS
 928  928                           ,,
 929  929  0 00                      ,,
 932  932  1                         ,,
 933  933  2                         ,,
 934  934  4                         ,,
 935  935  1 1                       ,,
 937  937  1 6                       ,,
 939  939  4 9                       ,,
 941  941  9 46                      ,,
 944  944  9 34                      ,,
 947  947  9 52                      ,,
 950  950  9 31                      ,,
 953  953  N                         ,,
 954  954  N                         ,,
 955  955  7 54                      ,,
 958  958  7 74                      ,,
 961  961  9 79                      ,,
 964  964  F AFB FCFDNENFNGNH
 980  980  N ANB NCNDFEFFFGFH
 996  996  F ANB FCNDFENFFGNH
1012 #12  N AFB NCFDNEFFNGFH
1028 #28  N ANB NCNDNENFNGNH
1044 #44  7 55
1047 #47  7 71
1050 #50  7 71
1053 #53  7
1054 #54  5
  012  012                      CLEAR WM CARD                    DNL
```

DATE	3/17/63	10-5-63						
ENG. CHG. NO.	116745	TA-1844						

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0008015,022029,033033N      1001                    MULTI TAPE LISTER 8          1026A 0A
,0008015,022029,033033N      1001                    SET WORDMARK CARD            1026A 02
L067367,340344,348349,357361001,0080I2,0011001I8361080AB438/340080                1026A 03
L070405,377577,385400,4044051001          B389S614BS88          /332/.           1026A 04
L067440,413420,427434,441441100IM931926M943437M957447M960440M946774               1026A 05
L072480,449456,463470,477481100I8481754H,438445A936440A933447¤43844584341026A 06
L071519,488495,502509,516520100IM963538M+46626M+49634M957697M+52709,888 1026A 07
L058545,527535,542543,544545100IM931925V6029281M979770MMMM                        1026A 08
L061574,547548,549557,564568100IMMMB5689272M+53582B575M+54582                     1026A 09
L067609,583587,594598,602609100I86165387,536A938538¤5368620M+43770M               1026A 10
L042619,611612,613614,615616100IMMMMMM¤888                                        1026A 11
L068655,628635,642649,656656100IB703755NM954771,624707,695632A933626              1026A 12
L067690,663670,677684,691691100IA933697A936709A93663¤624707¤695632                1026A 13
L068726,699703,710714,718719100IB714756HB620M953771B635/332/87419272              1026A 14
L066760,734741,748755,757759100I,217251,285319,201235,269303FAFBFC                1026A 15
L053781,763765,767769,771773100IFDFEFFFGFHM934213M213                              1026A 16
L072821,789793,800804,811815100IM934229M229M934247M247M934263M263M934281 1026A 17
L069858,826833,837844,848855100IM281M934297M297M934315M315M934331M331             1026A 18
L072898,860865,872879,884892100I28755BA932925C925940875S/8488884SA932926 1026A 19
L061927,906914,919923,926927100IM9494378420926184060834800001                    1026A 20
L043938,929932,933934,935937100I 0001241116                                       1026A 21
L048954,941944,947950,953954100I4994693495293INM                                  1026A 22
L072994,958961,964980¤928928100I754774979FAFBFCFDNENFNGNHNANBNCNDFEFFFGF 1026A 23
L065*27¤995995,9964I2,*28*28100IHFANBFCNDFENFFGNHNAFBNCFDNEFFNGFH                 1026A 24
L072*67,*44*47,*50*53,*54*54100INANBNCNDNENFNGNH755777177175                      1026A 25
/333080                                                CLEAR WORDMARK CARD         1026A 26
,019027,031,038042803IT98G8400L046352BW048S88          MULTI TAPE LISTER 8         1026A 27
                              M
```

DATE	3/17/63	10.5.63							
ENG. CHG. NO.	116745	TA-1844							

DIAGNOSTIC FUNCTION TEST

RIPPLE PUNCH

A. PURPOSE OF TEST

TO TEST THE PUNCHING CIRCUITRY BY PUNCHING EVERY PUNCHABLE CHARACTER IN EVERY COLUMN OF THE CARD IN RIPPLE FASHION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1262

C. PROGRAM CONTROL

1. SENSE SWITCHES

B	ON	FOR SCOPING OF THE PUNCHING OPERATION FOR ONE CARD
	OFF	TO CONTINUE
D	ON	TO REPEAT THE PROGRAM FOR THE ENTIRE TEST
	OFF	TO CONTINUE

D. TEST PROCEDURE

THERE ARE NO DETAIL CARDS IN THIS TEST. A 60-CHARACTER TABLE IS LOADED FROM CONSTANT CARDS 10 AND 11.

THE PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

THE 60-CHARACTER TABLE, STORED BY THE PROGRAM IN LOCATIONS 701-760, IS EXPANDED TO A 180-CHARACTER TABLE IN LOCATIONS 701-880. A CARD COUNTER IS THEN STARTED AT 780 AND IS USED IN AN INSTRUCTION TO MOVE 80 CHARACTERS STORED IN LOCATIONS 701-780 INTO THE PUNCH AREA. A TEST IS NEXT MADE FOR NO-ZONE IN LOCATION 101. IF ZONE IN 101 THE PROGRAM PROCEEDS TO PUNCH THE TABLE. IF NO-ZONE THE PROGRAM BRANCHES TO A PUNCH AND BRANCH INSTRUCTION. A FAILURE TO BRANCH WILL STOP THE MACHINE.

THE 780 IN THE CARD COUNTER IS THEN COMPARED WITH 839 STORED BY THE PROGRAM IN LOCATIONS 609-611. AN UNEQUAL COMPARISON ALLOWS EXECUTION OF AN INSTRUCTION TO ADD A "1" TO THE CARD COUNTER, THUS INCREASING IT FROM 780-TO 781, AND A SECOND CARD IS PUNCHED WITH 80 CHARACTERS STORED IN LOCATIONS 702-781, AND SO ON, UNTIL THE NUMBER IN THE CARD COUNTER IS 839. IN THE MEANTIME, WITH SENSE SWITCH "D" SET TO THE OFF POSITION, THE 60 CARDS WILL BE PUNCHED WITH THE 60-CHARACTER TABLE IN RIPPLE FASHION. RIPPLE PUNCHING MAY BE CONTINUED INDEFINITELY BY SETTING SENSE SWITCH "D" TO THE ON POSITION.

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

D. (CONTINUED)

EXAMPLE OF 60-CHARACTER TABLE RIPPLE- PUNCHED:

AKT4 BLU5≠CMV6 DNW7△E0X8 FPY9$^{T}_{S}$GQZ0 HR≠#$^{\dagger}_{m}$!-@ε$%1$^{+}_{0}$.*/2¤JS3ϑAKT4 BLU5≠CMV6 DNW7 ETC.

KT4 BLU5≠CMV6 DNW7△E0X8 FPY9$^{T}_{S}$GQZ0 HR≠#$^{\dagger}_{m}$!-@ε$%1$^{+}_{0}$.*/2¤JS3ϑAKT4 BLU5≠CMV6 DNW7 ETC.

T4 BLU5≠CMV6 DNW7△E0X8 FPY9$^{T}_{S}$GQZ0 HR≠#$^{\dagger}_{m}$!-@ε$%1$^{+}_{0}$.*/2¤JS3ϑAKT4 BLU5≠CMV6 DNW7 ETC.

4 BLU5≠CMV6 DNW7△E0X8 FPY9$^{T}_{S}$GQZ0 HR≠#$^{\dagger}_{m}$!-@ε$%1$^{+}_{0}$.*/2¤JS3ϑAKT4 BLU5≠CMV6 DNW7 ETC.

BLU5≠CMV6 DNW7△E0X8 FPY9$^{T}_{S}$GQZ0 HR≠#$^{\dagger}_{m}$!-@ε$%1$^{+}_{0}$.*/2¤JS3ϑAKT4 BLU5≠CMV6 DNW7 ETC.

THE FOLLOWING SPECIAL CHARACTERS IN THE ABOVE TABLE ARE PUNCHABLE BUT NOT PRINTABLE:

≠ GROUP MARK (12-7-8)
△ DELTA (11-7-8)
$^{T}_{S}$ TAPE SEGMENT MARK (0-7-8)
$^{\dagger}_{m}$ TAPE MARK (7-8)
$^{+}_{0}$ RESET ADD (12-0) ---THIS PRINTS AS AN "ε"
ϑ RESET SUBTRACT (11-0) --- THIS PRINTS AS A "-"

E. STOPS

500 IN STORAGE ADDRESS REGISTER: ERROR IF NO PUNCH AND BRANCH.

F. PRINTOUTS

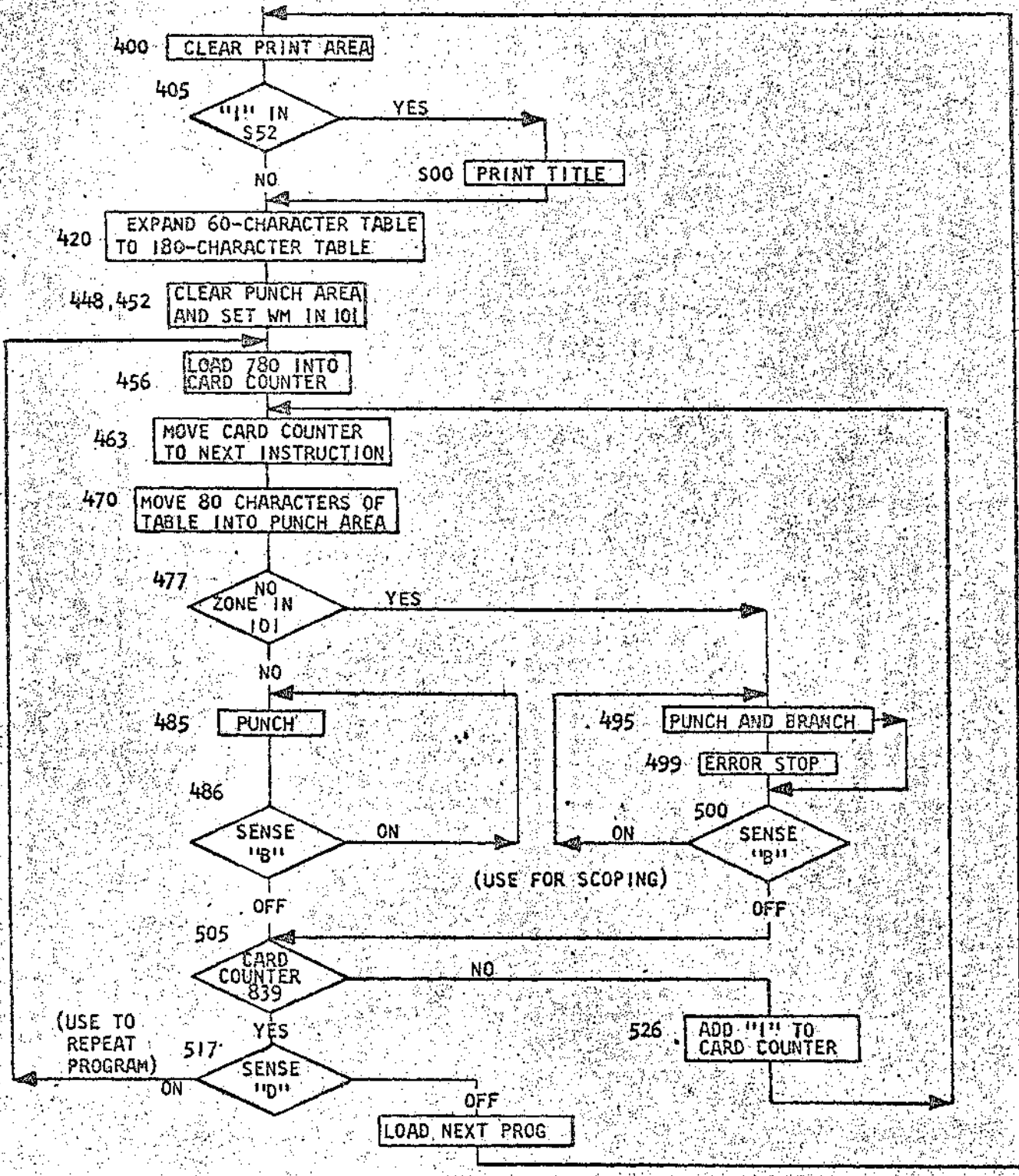
NONE

G. COMMENTS

IF DESIRED THE 60 CARDS PUNCHED IN THIS TEST MAY BE CHECKED BY THE 1401 BY USING THEM AS DETAIL CARDS FOR THE RIPPLE READ TEST (BLOCK NUMBER 1040) IN LIEU OF THOSE NORMALLY SUPPLIED WITH THAT TEST.

NOTE: IF THESE CARDS ARE USED WITH BLOCK NUMBER 1040, IT IS VERY IMPORTANT THAT THEY BE KEPT IN THE SAME ORDER AS THEY ARE PUNCHED; OTHERWISE THE RIPPLING PATTERN WILL NOT BE MAINTAINED, THUS RESULTING IN ERROR PRINTOUTS.

RIPPLE PUNCH FLOW CHART



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PROGRAM LISTING FOR USE WITH FLOW CHART

RIPPLE PUNCH 10308

INSTRUCTION ADDRESS		OP	A	B		REMARKS	
377	377	B	400	S621		USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88			,,	
400	400	/	332			START TEST	
404	404	/				,,	
405	405	-B	S00	S521		BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	B	420			BRANCH TO CONTINUE	
420	420	¤	721	741		EXPAND TABLE FROM 701-760 TO 701-880	
427	427	L	760	820		,,	
434	434	L	760	880		,,	
441	441	¤	761	821		,,	
448	448	/	180			CLEAR PUNCH AREA	
452	452	,	101			SET WM IN PUNCH AREA	
456	456	L	607	614		LOAD CARD COUNTER	
463	463	M	614	473		MOVE CARD COUNTER INTO NEXT INSTRUCTION	
470	470	M	780	180		*MOVE TABLE INTO PUNCH AREA	
477	477	V	495	1012		BR TO PUNCH AND BRANCH IF NO ZONE IN 101	
485	485	4				PUNCH	
486	486	B	485	B		B ON TO SCOPE	6S
491	491	B	505			BRANCH TO TEST FOR LAST CARD	
495	495	4	500			PUNCH + BRANCH	
499	499	.				ERROR STOP IF NO BRANCH	
500	500	B	495	B		B ON TO SCOPE	5S
505	505	C	611	614		COMPARE CARD COUNTER WITH 839	
512	512	B	526	/		BRANCH TO ADD 1 IF NOT 839	
517	517	B	456	D		D ON TO REPEAT TEST	5S
522	522	B	537			BRANCH TO READ NEXT RECORD	
526	526	A	608	614		ADD 1 TO CARD COUNTER	
533	533	B	463			BRANCH TO PUNCH NEXT CARD	
537	537	/	180			CLEAR ANY GM WM	
541	541	B	348			GO TO NEXT TEST	
605	605	7	80			CONSTANT TO START CARD COUNTER	
608	608	1				CONSTANT TO INCREMENT CARD COUNTER	
609	609	8	39			CONSTANT TO STOP CARD COUNTER	
612	612	X	XX			CARD COUNTER	
701	701	A	KT4	BLU5	CMV6 DNW7	TABLE TO BE RIPPLE PUNCHED	
721	721	E	0X8	FPY9	GQZ0 HR#@	,,	
741	741	I	-,@	+$%1+.*/2	¤JS3—	,,	

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TABLE OF UNPRINTABLE CHARACTERS

	LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
	WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
//	TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
	GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
	RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    RIPPLE PUNCH                    10308 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD               10308 02
L067367,340344,348349,3573611001,008012,0011001183610808420/340080                 10308 03
L068412,385400,404405,4134131001840085621888                /332/8S00S521           10308 04
L071451,420427,434441,4484521001842O  ¤721741L760820L760880¤761821/180              10308 05
L071490,456463,470477,4854861001,101L607614M614473M780180V49510124848S8            10308 06
L063521,495499,500505,5125171001850545OO.84958C611614852G/8456D                    10308 07
L072561,526533,537541,5415411001853746086148463/1808348                            10308 08
L072639,605608,609612,6126121001     7801839XXX                                     10308 09
L072740,721741,741741,7417411001AKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#T            10308 10
                                        M       E       S       M
L072780,001001,001001,0010011001I-,a +s81P.*/2 ¤JS3M                               10308 11
                                                Z       Z
L053S20,S01S05,S12S13,S17S2111OO12,049L0762762/2772420                              10308 12
/333080N                                                CLEAR WORDMARK CARD         10308 13
,019027,031,038042803IT98GB40QL0463528W048S88   RIPPLE PUNCH                        10308 14
                        M
```

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RIPPLE READ

A. PURPOSE OF TEST

1. TO TEST THE READING OF 2 DETAIL CARDS PUNCHED WITH MLP CODES.

2. TO TEST THE READING OF 60 DETAIL CARDS PUNCHED WITH A 60-CHARACTER TABLE IN RIPPLE FASHION. EACH CARD IS COMPARED WITH A STORED TABLE. FOR UNEQUAL CONDITIONS THE MACHINE EITHER STOPS TO PERMIT CONSOLE CHECKING OR PRINTS THE CARD INFORMATION ON THE FIRST LINE AND THAT PORTION OF THE STORED TABLE TO WHICH IT WAS COMPARED ON THE SECOND LINE, DEPENDING UPON THE SETTING OF SENSE SWITCH E.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1263 AND PLACE DETAIL CARDS 23 AND 24 AHEAD OF 60 DETAILS PUNCHED BY RIPPLE PUNCH TEST 1030 IN 1402 READ HOPPER.

C. PROGRAM CONTROL

1. SENSE SWITCHES

C ON TO PRINT CORRECT RESULTS

OFF TO CONTINUE

D ON TO REPEAT TEST WHEN TEST IS RUN SEPARATELY. DETAIL CARDS MUST BE RERUN

OFF TO CONTINUE

E ON - STOPS FOR ERROR RESULTS.

OFF - PRINTS FOR ERROR RESULTS AS FOLLOWS:

FIRST LINE - CARD INFORMATION, ERROR, AND CARD NUMBER
SECOND LINE - THAT PORTION OF THE STORED TABLE TO WHICH THE CARD WAS COMPARED.

D. TEST PROCEDURE

THE PROGRAM READS AND COMPARES 2 DETAIL CARDS (23 AND 24) PUNCHED WITH MLP CODES IN COLUMNS 1 THROUGH 7 AND CONTINUES IN THE FOLLOWING MANNER:

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D. (CONTINUED)

THE 60-CHARACTER TABLE, STORED BY THE PROGRAM IN LOCATIONS 701-760, IS EXPANDED TO A 180-CHARACTER TABLE IN LOCATIONS 701-880. A CARD COUNTER IS THEN STARTED AT "1" AND INCREMENTED BY "1" EACH TIME A DETAIL CARD IS PROCESSED. THIS CARD COUNTER SERVES THREE PURPOSES:

1) TO PRINT A CARD NUMBER IN CASE OF ERROR PRINT-OUT

2) TO COMPARE WITH A CONSTANT "60" TO CONTINUE THE TEST (UNEQUAL) OR TERMINATE THE TEST (EQUAL);

3) TO INCREMENT A RIPPLING COUNTER.

THE PURPOSE OF THE RIPPLING COUNTER, WHICH IS STARTED AT 779 AND INCREMENTED BY THE CARD COUNTER, IS TO MODIFY THE A PORTION OF THE COMPARE INSTRUCTION (LOCATIONS 493-495) SO THAT THE APPROPRIATE 80 CHARACTERS MAY BE SELECTED FROM THE 180-CHARACTER STORED TABLE IN RIPPLE FASHION AND COMPARED WITH THE CARD. IF THE COMPARISON BETWEEN THE CARD AND THE TABLE IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE. THE POSITION OF SENSE SWITCH E THEN DETERMINES WHETHER THE MACHINE STOPS TO PERMIT CONSOLE CHECKING OR PRINTS THE CARD WITH AN "ERROR" INDICATION AND CARD NUMBER ON THE FIRST LINE AND THE STORED TABLE TO WHICH IT WAS COMPARED ON THE SECOND LINE.

E. STOPS

400	IN STORAGE ADDRESS-REGISTER:	HALT TO PLACE DETAIL CARDS IN HOPPER WHEN TEST IS RUN FROM TAPE.
603	IN STORAGE ADDRESS REGISTER:	HALT TO CHECK FOR MLP READ ERROR.
661	IN STORAGE ADDRESS REGISTER:	HALT AT END OF TEST. PRESS START KEY TO LOAD NEXT PROGRAM.
920	IN STORAGE ADDRESS REGISTER:	ERROR WITH SENSE E ON

F. PRINTOUTS

FIRST LINE CARD	SECOND LINE TABLE
AKT4 BLU5 CMV6 DNW7 EOX8 FPY8 GQZ0 HR#@ I-,@ε$%!&.*12 JS7-AKT4 BLU5 CMV6 DNW7 ERROR 01	
AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#@ I-,@ε$%!&.*12 JS3-AKT4 BLU5 CMV6 DNW7	

NOTE: IF "ERROR" IS PRINTED ON THE FIRST LINE BUT THE TWO LINES AGREE, THE ERROR MAY BE IN ANY ONE OF THE 6 NON-PRINTABLE CHARACTERS, NAMELY, GROUP MARK, DELTA, TAPE SEGMENT MARK, TAPE MARK, RESET ADD, AND RESET SUBTRACT.

F. (CONTINUED)

SENSE SWITCH C ON - MACHINE PRINTS CORRECT RESULTS - CARD INFORMATION AND CARD NUMBER ON THE FIRST LINE WITHOUT THE WORD "ERROR", AND THE STORED TABLE TO WHICH IT WAS COMPARED ON THE SECOND LINE.

G. COMMENTS

THE LAST 60 DETAIL CARDS ARE THE SAME AS DETAIL CARDS PUNCHED BY RIPPLE PUNCH TEST 1030. DETAIL CARDS NUMBERED 23 AND 24 ARE SPECIAL MLP CARDS WHICH ARE NOT PUNCHED BY THE 1401. THESE TWO CARDS CONTAIN AN 8 AND 9 PUNCHES IN COLUMNS 1 THROUGH 7 IN ADDITION TO THE PUNCHES LISTED. CARDS 23 AND 24 MUST BE PLACED AHEAD OF THE 60 RIPPLE PUNCHED DETAIL CARDS.

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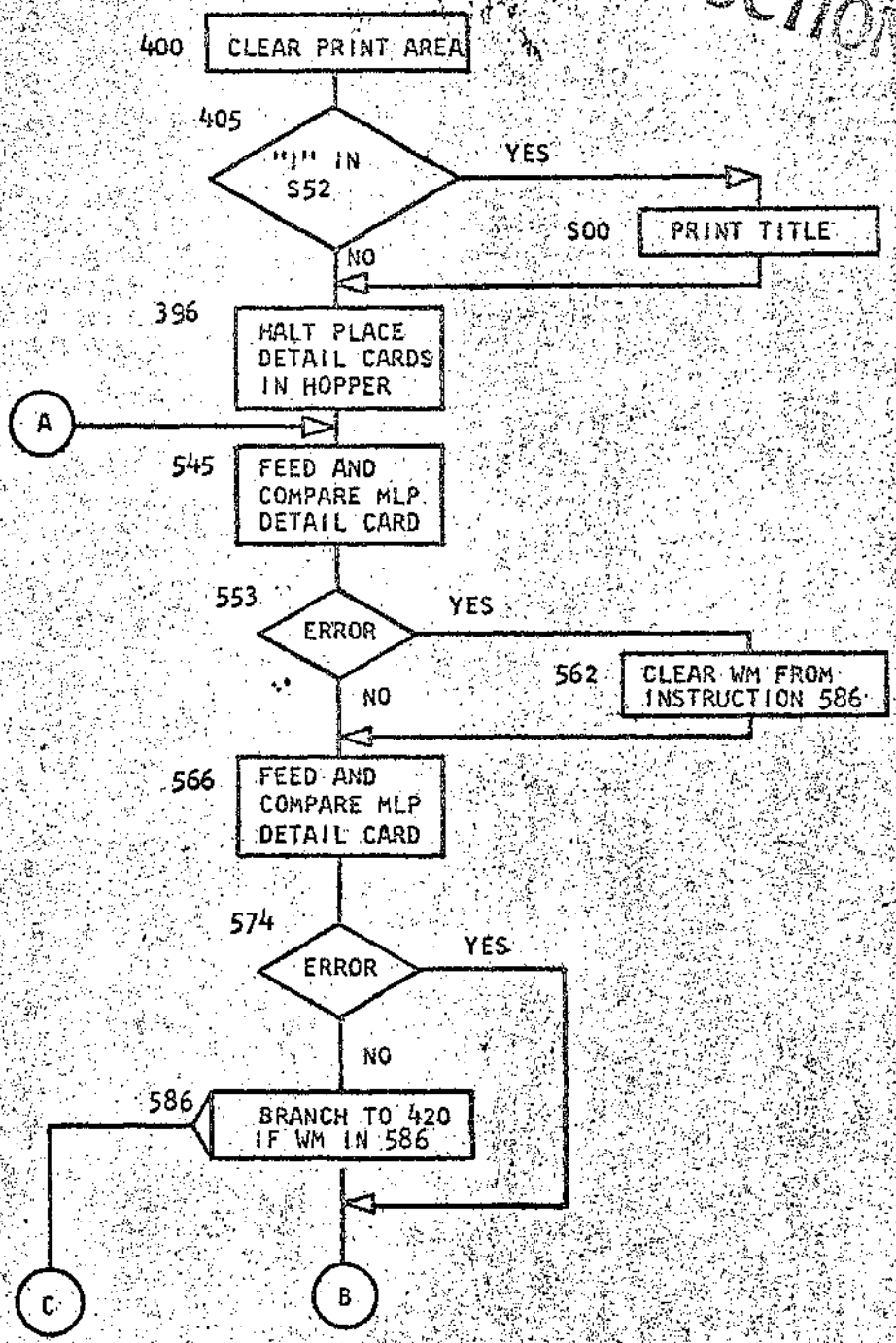
RIPPLE READ

FLOW CHART



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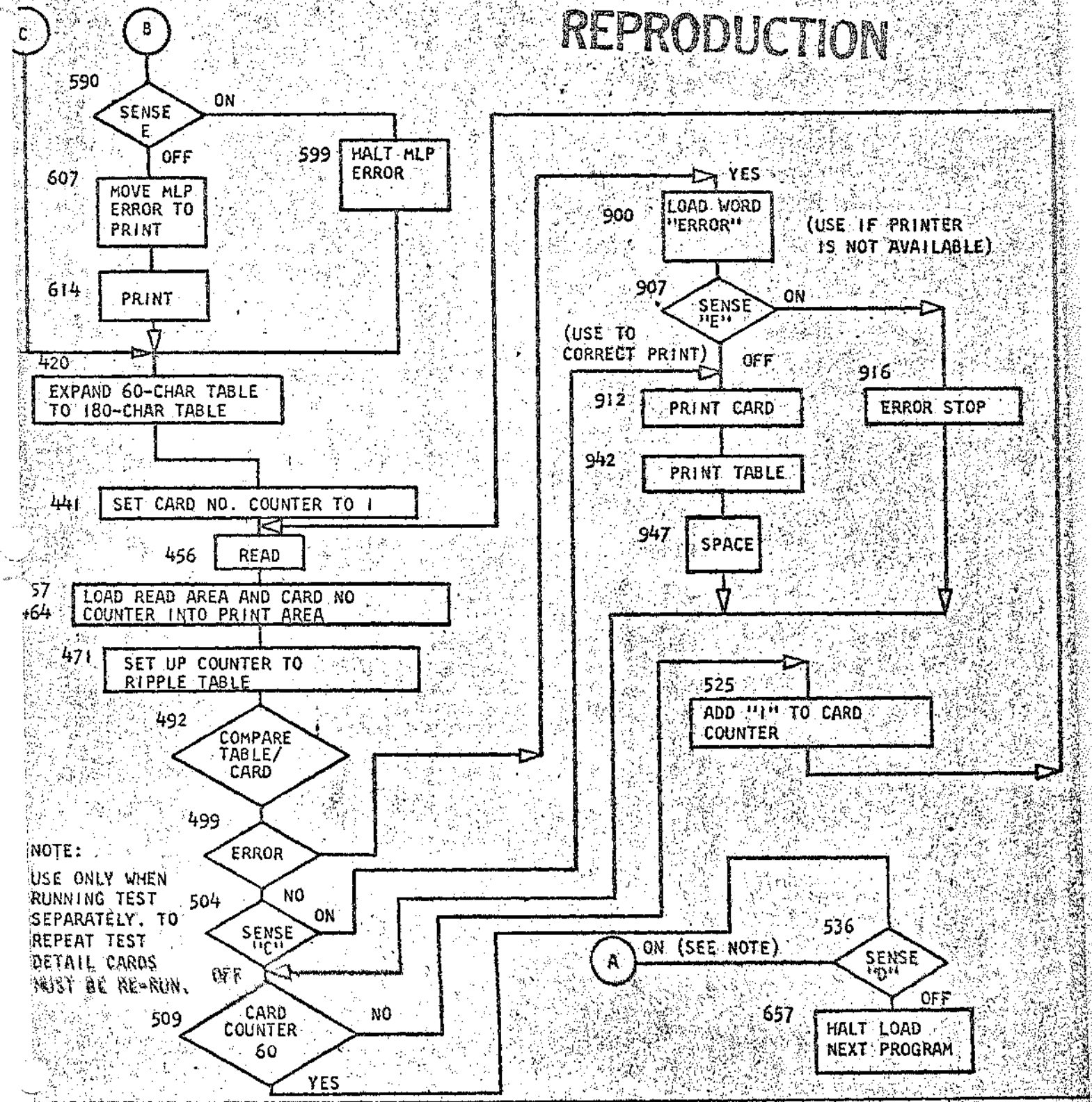

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PROGRAM LISTING FOR USE WITH FLOW CHART

RIPPLE READ 1040B

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S631	*USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	M	388	380	BYPASS DETAIL CARDS ON TAPE
396	396	.	545		HALT TO PLACE DETAIL CARDS IN HOPPER
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	396		BRANCH TO HALT
420	420	L	760	820	EXPAND TABLE FROM 701-760 TO 701-880
427	427	L	760	880	,, ,,
434	434	¤	761	821	,,
441	441	L	690	692	SET CARD COUNTER TO ONE
448	448	/	080		CLEAR READ AREA
452	452	,	001		SET WM IN 001
456	456	1			READ
457	457	L	080	280	LOAD CARD INTO PRINT AREA
464	464	L	692	299	LOAD CARD NUMBER INTO PRINT AREA
471	471	L	697	700	START RIPPLING COUNTER AT 779
478	478	A	692	700	ADD CARD COUNTER TO RIPPLING COUNTER
485	485	M	700	495	MOVE RIPPLING COUNTER INTO NEXT INSTRUCT
492	492	C	XXX	080	COMPARE TABLE WITH CARD
499	499	B	900	/	BRANCH TO ERROR PRINT ROUTINE IF UNEQ
504	504	B	912	C	C ON TO CORRECT PRINT SS
509	509	C	692	694	COMPARE CARD COUNTER WITH 60
516	516	B	525	/	BR TO ADD 1 TO CARD COUNTER IF NOT 60
521	521	B	536		BRANCH TO SENSE D IF 60
525	525	A	690	692	ADD 1 TO CARD COUNTER
532	532	B	456		BRANCH TO READ NEXT DETAIL CARD
536	536	B	545	D	D ON TO REPEAT INCLUDE MLP CARDS SS
541	541	B	649		BRANCH TO READ NEXT RECORD
546	546	1			FEED MLP DETAIL CARD
546	546	C	007	634	AND COMPARE
553	553	B	562	/	BRANCH ERROR
558	558	B	566		BRANCH CORRECT
562	562	¤	586		SETUP ERROR PRINTOUT
566	566	1			FEED MLP CARD
567	567	C	007	634	AND COMPARE
574	574	B	590	/	BRANCH ERROR
579	579	N	000	000	SELECTION CONTROL
586	586	B	420		BRANCH CORRECT
590	590	B	599	E	BRANCH ON ERROR SS
595	595	B	603		BRANCH TO ERROR PRINT

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599  599  .  620                    MLP ERROR STOP
603  603  /  299
607  607  M  648  270               MOVE MLP ERROR COMMENT TO PRINT
614  614  2
615  615  /  299
619  619  2                         SPACE
620  620  .  586                    RESET ERROR SELECTION
624  624  B  420                    BRANCH TO CONTINUE
628  628     123  413               MLP COMPARISON CONSTANT
635  635  M  LP   READ ERROR        COMMENT
649  649  /  080                    REMOVE ANY GMWM
653  653  ,  001                      ,,
657  657  .  348                    READ NEXT RECORD
661  661                            WORDMARK
689  689  0  1                      CONSTANT TO INCREMENT CARD COUNTER
691  691  X  X                      CARD COUNTER
693  693  6  0                      CONSTANT TO STOP CARD COUNTER
695  695  7  79                     CONSTANT TO START RIPPLING COUNTER
698  698  X  XX                     RIPPLING COUNTER
701  701  A  KT4  BLU5 CMV6 DNW7    TABLE
721  721  E  0X8  FPY9 GQZ0 HR##       ,,          NO WM
741  741  I  -,@  +$%1+.*/2 □JS3-     ,,          NO WM
900  900  L  /14  285                BEGIN ERROR PRINT ROUTINE
907  907  B  916  E                  E ON TO ERROR STOP
912  912  2  920                    PRINT CARD
916  916  .  509                    ERROR STOP
920  920  /  299                    CLEAR PRINT AREA
924  924  ,  201                    SET WM IN PRINT AREA
928  928  M  700  938               MOVE RIPPLING COUNTER INTO NEXT INSTRUCT
935  935  M  XXX  280               MOVE TABLE INTO PRINT AREA
942  942  2                         PRINT TABLE
943  943  /  299                    CLEAR PRINT AREA
947  947  2  509                    SPACE
951  951                            WORD MARK
1110 /10  E  RRO R                  CONSTANTS
1120 /20  F  IRS T LINE CARD           ,,
1140 /40                               ,,
1160 /60  S  ECO ND LINE TABLE         ,,
1180 /80                               ,,
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    RIPPLE READ                    10408 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD              10408 02
L067367,340344,348349,3573611001,008012,0011001 1B361080AB348/340080                 10408 03
L069404,377385,389396,4004041001          B400S6318S88M388380.545/332/               10408 04
L068440,413420,427434,4414411001 8S00S5218396   L760820L760880¤761821                10408 05
L069477,448452,456457,4644711001L690692/080,0011L080280L692299L697700                10408 06
L070515,485492,499504,5095161001A692700M700495CXXX0808900/B912CC692694               10408 07
L062545,521525,532536,5415451001 8525/B536A690692B456B545DB6491                      10408 08
L065578,553558,562566,5675741001C0076348562/B566¤5861C0076348590/                    10408 09
L067613,586590,595599,6036071001N0000008420B599EB603.620/299M648270                  10408 10
L067648,615619,620624,6286351001 2/2992,586B420  123413MLP READ ERROR               10408 11
L072688,653657,661661,6616611001/080,001.348                                         10408 12
L072728,691693,695698,7017011001 01XX60779XXXAKT4 BLU5GCMV6 DNW7DE0X8 FPY           10408 13
                                                          M       E
L072768¤729729,001001,0010011001 9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3M                   10408 14
                                      S       M       Z       Z
L067934,907912,916920,9249281001L/142858916E2920.509/299,201M700938                  10408 15
L072974,942943,947951,9519511001MXXX2802/2992509                                     10408 16
L065739¤/07/07,/10/20,/40/401001   ERROR    FIRST LINE CARD                          10408 17
L072/79,/60/80,/80/80,/80/801001                    SECOND LINE TABLE                10408 18
L070S17,S00S01,S05S12,S13S171001                    2,049L0772772/2772               10408 19
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                           10408 20
/333080N                                            CLEAR WORDMARK CARD              10408 21
,019027,031,038042B031T98GB400L046352BW04BS88  RIPPLE READ                         10408 22
                        M
```

DETAIL CARDS

```
 123413                          MLP IN COLUMNS 1 THROUGH 7                          10408 23
 123413                          MLP IN COLUMNS 1 THROUGH 7                          10408 24
AKT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D
        M       E       S       M       Z       Z       M       E
KT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE
        M       E       S       M       Z       Z       M       E
T4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0
        M       E       S       M       Z       Z       M       E
4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X
        M       E       S       M       Z       Z       M       E
 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8
      M       E       S       M       Z       Z       M       E
BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8
    M       E       S       M       Z       Z       M       E
LU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR÷#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 F
   M       E       S       M       Z       Z       M       E
```

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U5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FP
 M       E       S       M       Z       Z       M       E
5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY
 M       E       S       M       Z       Z       M       E
GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9
M       E       S       M       Z       Z       M       E
CMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9T
        E       S       M       Z       Z       M       E       S
MV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TG
        E       S       M       Z       Z       M       E       S
V6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQ
        E       S       M       Z       Z       M       E       S
6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ
        E       S       M       Z       Z       M       E       S
 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0
      E       S       M       Z       Z       M       E       S
DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0
    E       S       M       Z       Z       M       E       S
NW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 H
   E       S       M       Z       Z       M       E       S
W7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR
  E       S       M       Z       Z       M       E       S
7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠
 E       S       M       Z       Z       M       E       S
DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#
E       S       M       Z       Z       M       E       S
EOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#T
        S       M       Z       Z       M       E       S       M
OX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI
       S       M       Z       Z       M       E       S       M
X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-
       S       M       Z       Z       M       E       S       M
8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,
      S       M       Z       Z       M       E       S       M
 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@
     S       M       Z       Z       M       E       S       M
FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@
    S       M       Z       Z       M       E       S       M
PY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +
   S       M       Z       Z       M       E       S       M
Y9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$
  S       M       Z       Z       M       E       S       M
9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%
 S       M       Z       Z       M       E       S       M
TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1
S       M       Z       Z       M       E       S       M
GQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P
       M       Z       Z       M       E       S       M       Z
QZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.
      M       Z       Z       M       E       S       M       Z
Z0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*
     M       Z       Z       M       E       S       M       Z
```

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0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/
M Z Z M E S M Z
HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2
M Z Z M E S M Z
HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2
M Z Z M E S M Z
R+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤
M Z Z M E S M Z
+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤J
M Z Z M E S M Z
#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS
M Z Z M E S M Z
TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3
M Z Z M E S M Z
I-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3M
Z Z M E S M Z Z
-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MA
Z Z M E S M Z Z
,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAK
Z Z M E S M Z Z
@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT
Z Z M E S M Z Z
+$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4
Z Z M E S M Z Z
+$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4
Z Z M E S M Z Z
$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 B
Z Z M E S M Z Z
%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BL
Z Z M E S M Z Z
1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU
Z Z M E S M Z Z
P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5
Z Z M E S M Z Z
.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5G
Z M E S M Z Z M
/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P./2 ¤JS3MAKT4 BLU5GC
Z M E S M Z Z M
/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM
Z M E S M Z Z M
2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV
Z M E S M Z Z M
¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6
Z M E S M Z Z M
¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6
Z M E S M Z Z M
JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D
Z M E S M Z Z M
S3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN
Z M E S M Z Z M
3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW
Z M E S M Z Z M

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MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,2 +$%IP.=/2 □JS3MAKT4 8LU5GCMV6 DNW7
Z M E S M Z Z M

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PRINT-PUNCH

A. PURPOSE OF TEST

TO TEST THE PRINT-PUNCH CIRCUITRY BY PRINTING 20 LINES AND PUNCHING 20 CARDS FROM A STORED TABLE IN RIPPLE FASHION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1261 AND 1262.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B	ON	PERMITS SCOPING OF THE PRINT-PUNCH OPERATIONS FOR ONE LINE
	OFF	TO CONTINUE
D	ON	REPEATS THE PROGRAM FOR THE ENTIRE TEST
	OFF	TO CONTINUE

D. TEST PROCEDURE

THERE ARE NO DETAIL CARDS IN THIS TEST. THE 60-CHARACTER TABLE IS LOADED FROM CONSTANT CARDS 11 AND 12.

THE PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

THE 60-CHARACTER TABLE, STORED BY THE PROGRAM IN LOCATION 701-760, IS EXPANDED TO A 120-CHARACTER TABLE IN LOCATIONS 701-820. A CARD COUNTER IS THEN STARTED AT 780 AND IS USED IN AN INSTRUCTION TO MOVE 80 CHARACTERS STORED IN LOCATIONS 701-780 INTO THE PRINT AREA, AND ANOTHER INSTRUCTION TO MOVE THE SAME CHARACTERS INTO THE PUNCH AREA. A TEST IS NEXT MADE FOR NO-ZONE IN LOCATION 101. IF ZONE IN 101 THE PROGRAM PROCEEDS TO PRINT AND PUNCH THE RESULTS. IF NO-ZONE THE PROGRAM BRANCHES TO A PRINT-PUNCH AND BRANCH INSTRUCTION. A FAILURE TO BRANCH WILL STOP THE MACHINE.

THE 780 IN THE CARD COUNTER IS THEN COMPARED WITH 799 STORED BY THE PROGRAM IN LOCATIONS 609-611. AN UNEQUAL COMPARISON ALLOWS EXECUTION OF AN INSTRUCTION, TO ADD "1" TO THE CARD COUNTER, THUS INCREASING IT FROM 780 TO 781, AND A SECOND LINE AND CARD IS PRINTED AND PUNCHED. IN THE MEANTIME, WITH SENSE SWITCH "D" SET TO THE OFF POSITION, 20 LINES WILL BE PRINTED AND 20 CARDS PUNCHED WITH THE 60-CHARACTER TABLE IN RIPPLE FASHION. PRINTING AND PUNCHING MAY BE CONTINUED INDEFINITELY BY SETTING SENSE SWITCH "D" TO THE ON POSITION.

DATE	2-2-61	7-1-63	17.10.63					
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E. STOPS

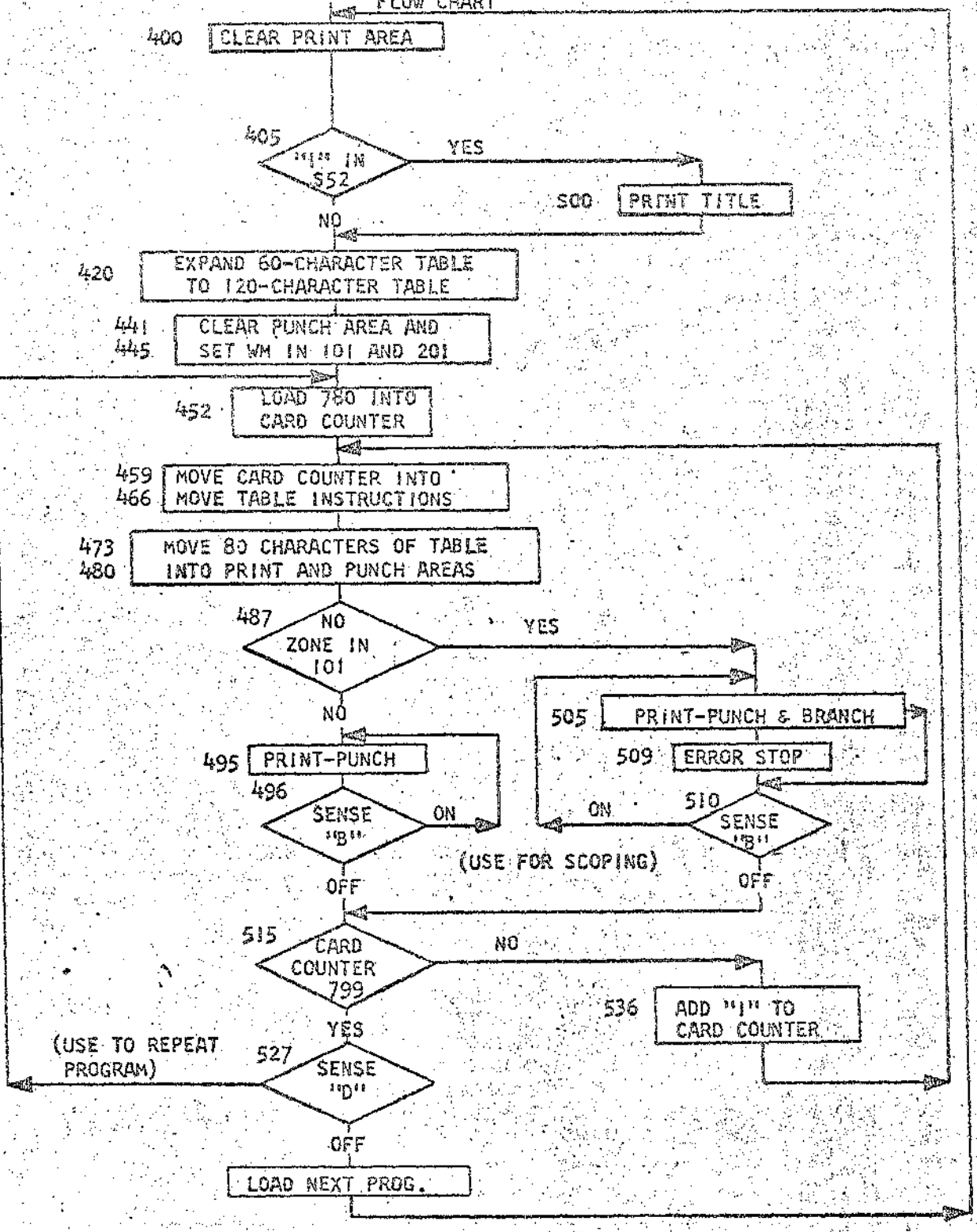
510 IN STORAGE ADDRESS REGISTER: ERROR-FAILED TO BRANCH

F. PRINTOUTS

SIMILAR TO TEST 1040.

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PRINT PUNCH FLOW CHART



DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

PRINT-PUNCH 10508

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	547	S611	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	420		BRANCH TO CONTINUE
420	420	¤	721	741	EXPAND TABLE FROM 701-760 TO 701-820
427	427	L	760	820	,,
434	434	¤	761	761	,,
441	441	/	180		CLEAR PUNCH
445	445	,	101	201	SET WM IN PUNCH AND PRINT AREAS
452	452	L	607	614	LOAD 780 INTO CARD COUNTER
459	459	M	614	476	MOVE CARD COUNTER INTO LOCATION 474-476
466	466	M	614	483	MOVE CARD COUNTER INTO LOCATION 481-483
473	473	M	XXX	280	*MOVE TABLE INTO PRINT AREA
480	480	M	XXX	180	*MOVE TABLE INTO PUNCH AREA
487	487	V	506	1012	BR TO PRINT-PUNCH + BR IF NO ZONE IN 101
495	495	6			PRINT-PUNCH
496	496	B	495	B	B ON TO SCOPE SS
501	501	B	515		BRANCH TO TEST FOR LAST CARD
505	505	6	510		PRINT-PUNCH + BRANCH
509	509	.			ERROR STOP IF NO BRANCH
510	510	B	505	B	B ON TO SCOPE SS
515	515	C	611	614	COMPARE CARD COUNTER WITH 799
522	522	B	536	/	BRANCH TO ADD 1 IF NOT 799
527	527	B	452	D	D ON TO REPEAT TEST SS
532	532	B	559		BRANCH TO READ NEXT RECORD
536	536	A	608	614	ADD 1 TO CARD COUNTER
543	543	B	459		BRANCH TO PRINT-PUNCH NEXT CARD
547	547	B	400	S621	USE WHEN TESTS ARE RUN FROM TAPE
556	555	B	348		,,
559	559	/	280		REMOVE ANY GM WM
563	563	/	180		,,
567	567	B	348		GO TO NEXT TEST
605	605	7	80		CONSTANT TO START CARD COUNTER
608	608	1			CONSTANT TO INCREMENT CARD COUNTER
609	609	7	99		CONSTANT TO STOP CARD COUNTER
612	612	X	XX		CARD COUNTER
701	701	A	KT4	BLUS CMV6 DNW7	TABLE TO BE PRINT-PUNCHED
721	721	E	0X8	FPY9 GQZ0 HR+#	,,
741	741	I	-,a	+$%1+.*/2 ¤JS3-	,,

DATE	2-2-61	7-1-63	17.10.63						
ENG. CHG. NO.	110378	117628	TA 1976						

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    PRINT-PUNCH                    10508 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD              10508 02
L067367,340344,348349,3573611001,008012,0011001183610804B420/340080                    10508 03
L068412,385400,404405,4134131001B547S611BS88              /332/BS005521                10508 04
L071451,420427,434441,4454521001B420   ¤721741L760820¤761761/180,101201                10508 05
L067486,459466,473480,4874871001L607614M614476M614483MXXX280MXXX180                    10508 06
L060514,495496,501505,5095101001V5051012684958B5156510.B505B                           10508 07
L072554,522527,532536,5435471001C611614B536/B452DB559A6086148459B400S621               10508 08
L072594,559563,567567,5675671001B348/280/180B348                                       10508 09
L072639,605608,609612,6126121001      7801799XXX                                       10508 10
L072740,721741,741741,7417411001AKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#T               10508 11
                                                M         E         S         M
L072780,001001,001001,0010011001I-,@ +$%1P.*/2 ¤JS3M                                   10508 12
                                                Z         Z
L053S20,S01S05,S12S13,S17S2110012,049L0762762/2772420                                   10508 13
/333080N                                        CLEAR WORDMARK CARD                    10508 14
,019027,031,038042B031T98GB400L0463528W048S88   PRINT-PUNCH                            10508 15
                  M
```

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PRINT-READ

A. PURPOSE OF TEST

TO TEST THE PRINT-READ CIRCUITRY, USING 20 DETAIL CARDS PUNCHED WITH A 60-CHARACTER TABLE IN RIPPLE FASHION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1261 AND 1263. PLACE DETAIL CARDS IN 1402 READ HOPPER.

C. PROGRAM CONTROL

B	ON	PERMITS THE EXECUTION OF THE PRINT-READ INSTRUCTION AS OFTEN AS DESIRED. SINCE THIS INSTRUCTION COMBINES THE OPERATION OF PRINTING ONE LINE AND READING THE NEXT CARD, PRINTING AND CARD FEEDING WILL CONTINUE UNTIL THE READ FEED HOPPER IS EMPTY.
	OFF	TO CONTINUE
D	ON	MAY BE USED ONLY WHEN THIS TEST IS RUN SEPARATELY. TO REPEAT THE TEST AS OFTEN AS DESIRED THE DETAIL CARDS MUST BE RE-RUN
	OFF	TO CONTINUE

D. TEST PROCEDURE

AFTER CLEARING THE READ AREA AND SETTING A WORD MARK IN LOCATION 001, A READ INSTRUCTION IS EXECUTED TO FEED THE FIRST DETAIL CARD. THE INFORMATION IN THE READ AREA IS THEN TRANSFERRED TO THE PRINT AREA. LOCATION 001 IS NEXT TESTED FOR NO-ZONE. IF ZONE IN 001 THE PROGRAM PROCEEDS TO PRINT-READ. IF NO-ZONE THE PROGRAM BRANCHES TO A PRINT-READ AND BRANCH INSTRUCTION. A FAILURE TO BRANCH WILL STOP THE MACHINE.

E. STOPS

459	IN STORAGE ADDRESS REGISTER: ERROR-FAILED TO BRANCH

F. PRINTOUTS

SIMILAR TO TEST 1040.

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

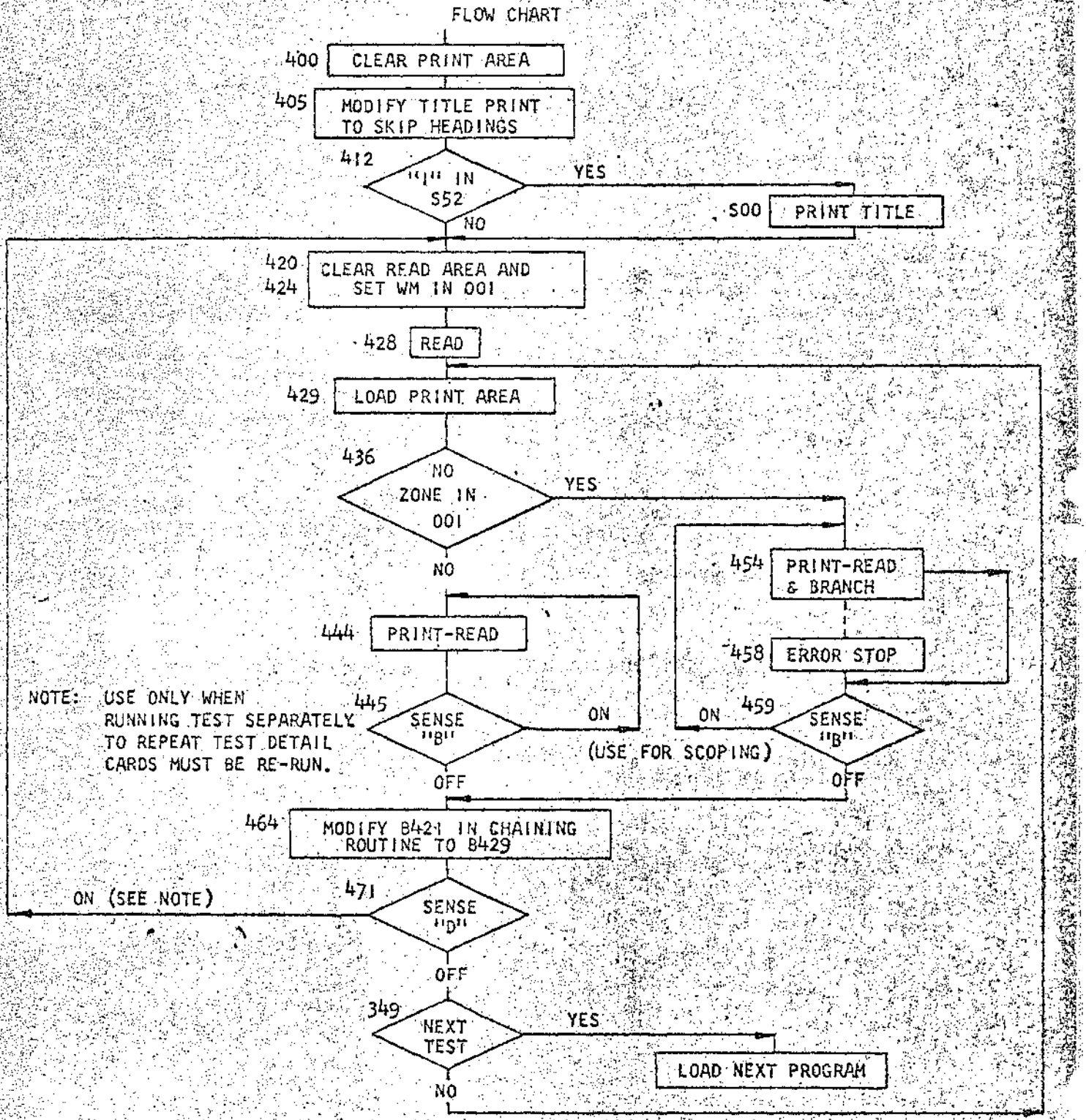
IBM FORM 624-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451423
SHEET 2 OF 5
BLOCK NO. 1060B

PRINT-READ

FLOW CHART



NOTE: USE ONLY WHEN RUNNING TEST SEPARATELY. TO REPEAT TEST DETAIL CARDS MUST BE RE-RUN.

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

PRINT-READ 1060B

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	494	S611	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		,, ,,	
393	393	M	388	380	*BYPASS DETAIL CARDS ON TAPE	
400	400	/	332		START TEST	
404	404	/			,,	
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	B	420		BRANCH TO CONTINUE	
420	420	/	080		CLEAR READ AREA	
424	424	,	001		SET WM IN READ AREA	
428	428	1			READ	
429	429	M	080	280	LOAD PRINT AREA	
436	436	V	454	0012	BRANCH IF NO ZONE IN 001	
444	444	3			PRINT-READ	
445	445	B	444	B	B ON TO SCOPE	SS
450	450	B	464		BRANCH TO CONTINUE	
454	454	3	459		PRINT-READ AND BRANCH	
458	458	.			ERROR STOP IF NO BRANCH	
459	459	B	454	B	B ON TO SCOPE	SS
464	464	B	420	D	SENSE SW D ON TO LOOP	SS
469	469	B	485	3488	BRANCH WHEN TEST IS ON TAPE	
477	477	B	361	080A	BRANCH WHEN TEST IS ON CARDS	
485	485	B	518	A	BRANCH ON LAST CARD	SS
490	490	B	429		REPEAT PROGRAM	
494	494	B	393	S631	USE WHEN TESTS ARE RUN FROM TAPE	
502	502	B	348		,, ,,	
506	506	/	080		CLEAR ANY GM WM	
510	510	,	001		,,	
514	514	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
518	518	M	080	280	PRINT LAST CARD	
525	525	2	506		,, ,,	
529	529				WORDMARK	

DATE	2-2-61	7-1-63	17.10.63						
ENG. CHG. NO.	110378	117628	TA 1976						

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8			
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0			
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8			
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8			
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8					

```
,008015,022029,033033N      1001                PRINT-READ                    1060B 0A
,008015,022029,033033N      1001                SET WORDMARK CARD             1060B 02
L067367,340344,348349,357361001,008012,0011001836108OAB429/340080           1060B 03
L069404,377385,393400,4044051001        B494S6118S88    M388380/332/        1060B 04
L071443,413420,424428,42943610018S00S5218420   /080,0011M080280V4540012     1060B 05
L057468,445450,454458,45946410013844488643459.B45488420D                    1060B 06
L069505,477485,490494,50250610018485348883610808518AB4298393S6318348       1060B 07
L072545,510514,518525,5295291001/080,0018348M0802802506                     1060B 08
L053S20,S01S05,S12S13,S17S2110012,049L0772772/2772420                        1060B 09
/333080N                    1001                CLEAR WORDMARK CARD          1060B 10
,019027,031,038042B031T98GB400L046352BW048S88   PRINT-READ                  1060B 11
                      M
```

DETAIL CARDS

```
AKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM1060B 12
        M         E         S         M         Z         Z         M
KT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV1060B 13
        M         E         S         M         Z         Z         M
T4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV61060B 14
        M         E         S         M         Z         Z         M
4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 1060B 15
      M         E         S         M         Z         Z         M
 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D1060B 16
      M         E         S         M         Z         Z         M
BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN1060B 17
    M         E         S         M         Z         Z         M
LU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW1060B 18
   M         E         S         M         Z         Z         M
U5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW71060B 19
  M         E         S         M         Z         Z         M
5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D1060B 20
 M         E         S         M         Z         Z         M         E
GCMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE1060B 21
        E         S         M         Z         Z         M         E
CMV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEO1060B 22
       E         S         M         Z         Z         M         E
MV6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX1060B 23
       E         S         M         Z         Z         M         E
V6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX81060B 24
       E         S         M         Z         Z         M         E
6 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 1060B 25
     E         S         M         Z         Z         M         E
 DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 F1060B 26
     E         S         M         Z         Z         M         E
DNW7DEOX8 FPY9TGQZ0 HR+#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FP1060B 27
     E         S         M         Z         Z         M         E
```

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ENG. CHG. NO.	110378	117628	TA 1976					

```
NW7DEOX8 FPY9TGQZO HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 8LU5GCMV6 DNW7DEOX8 FPY1060B 28
   E        S        M        Z        Z        M        E
W7DEOX8 FPY9TGQZO HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY910608 29
  E        S        M        Z        Z        M        E
7DEOX8 FPY9TGQZO HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9T1060B 30
 E        S        M        Z        Z        M        E        S
DEOX8 FPY9TGQZO HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 8LU5GCMV6 DNW7DEOX8 FPY9TG1060B 31
         S        M        Z        Z        M        E        S
```

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

READ-PUNCH

A. PURPOSE OF TEST

TO TEST THE READ-PUNCH CIRCUITRY BY PUNCHING 20 CARDS WITH A 60-CHARACTER TABLE IN RIPPLE FASHION. THE DETAIL CARDS USED IN THIS TEST ARE SIMILAR TO THE ONES USED IN THE PRINT-READ TEST (BLOCK NUMBER 1060).

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1262 AND 1263. PLACE DETAIL CARDS IN 1402 READ HOPPER.

C. PROGRAM CONTROL

B	ON	PERMITS THE EXECUTION OF THE READ-PUNCH INSTRUCTION AS OFTEN AS DESIRED. SINCE THIS INSTRUCTION COMBINES THE OPERATION OF PUNCHING ONE CARD AND READING THE NEXT CARD, PUNCHING AND CARD FEEDING WILL CONTINUE UNTIL THE READ FEED HOPPER OR THE PUNCH FEED HOPPER IS EMPTY.
	OFF	TO CONTINUE
D	ON	MAY BE USED ONLY WHEN THIS TEST IF RUN SEPARATELY. TO REPEAT THE TEST AS OFTEN AS DESIRED THE 20 CARDS PUNCHED DURING THIS TEST MAY BE REMOVED FROM THE PUNCH STACKER AND PLACED IN THE READ FEED HOPPER.
	OFF	TO CONTINUE

D. TEST PROCEDURE

AFTER CLEARING THE READ AREA AND SETTING A WORD MARK IN LOCATION 001, A READ INSTRUCTION IS EXECUTED TO FEED THE FIRST DETAIL CARD. THE INFORMATION IN THE READ AREA IS THEN TRANSFERRED TO THE PUNCH AREA. LOCATION 001 IS NEXT TESTED FOR NO-ZONE. IF ZONE IN 001 THE PROGRAM PROCEEDS TO READ-PUNCH. IF NO-ZONE THE PROGRAM BRANCHES TO A READ-PUNCH AND BRANCH INSTRUCTION. A FAILURE TO BRANCH WILL STOP THE MACHINE.

E. STOPS.

459	IN STORAGE ADDRESS REGISTER: ERROR-FAILED TO BRANCH.

F. PRINTOUTS

TITLE PRINT ONLY.

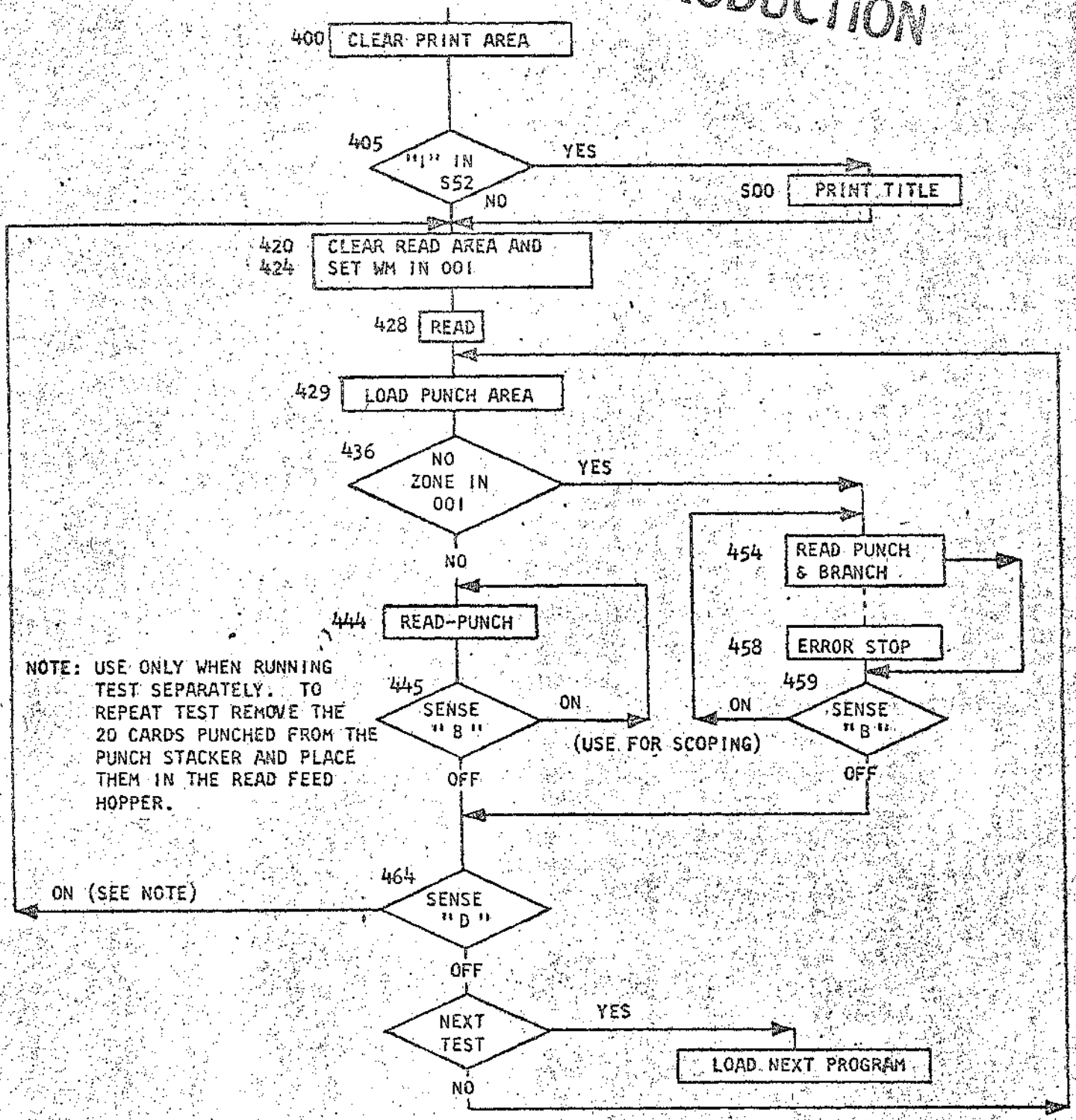
DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

G. COMMENTS

THE 20 CARDS PUNCHED IN THIS TEST SHOULD BE EXACT DUPLICATES OF THE 20 DETAIL CARDS (27-46) FURNISHED WITH THE TEST DECK.

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

READ-PUNCH
FLOW CHART



NOTE: USE ONLY WHEN RUNNING TEST SEPARATELY. TO REPEAT TEST REMOVE THE 20 CARDS PUNCHED FROM THE PUNCH STACKER AND PLACE THEM IN THE READ FEED HOPPER.

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

READ–PUNCH 10708

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	494	S621	*USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		,,	
393	393	M	388	380	BYPASS DETAIL CARDS ON TAPE	
400	400	/	332		START TEST	
404	404	/			,,	
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	B	420		BRANCH TO CONTINUE	
420	420	/	080		CLEAR READ AREA	
424	424	,	001		SET WM IN READ AREA	
428	428	1			READ	
429	429	L	080	180	LOAD PUNCH AREA	
436	436	V	454	0012	BRANCH IF NO ZONE IN 001	
444	444	S			READ–PUNCH	
445	445	B	444	B	B ON TO SCOPE	SS
450	450	B	464		BRANCH TO MODIFY CHAIN. ROUTINE	
454	454	S	459		READ–PUNCH AND BRANCH	
458	458	.			ERROR STOP IF NO BRANCH	
459	459	B	454	B	B ON TO SCOPE	SS
464	464	B	420	D	SENSE SW D ON TO SCOPE	SS
469	469	B	485	3488	BRANCH WHEN TEST IS ON TAPE	
477	477	B	361	080A	BRANCH WHEN TEST IS ON CARDS	
485	485	B	522	A	BRANCH ON LAST CARD	SS
490	490	B	429		REPEAT PROGRAM	
494	494	B	393	S631	USE WHEN TESTS ARE RUN FROM TAPE	
502	502	B	348		,,	
506	506	/	180		CLEAR ANY GM WM	
510	510	/	080		,,	
514	514	,	001		SET WM FOR CARDS	
518	518	B	348		BRANCH TO CHAINING ROUTINE	
522	522	L	080	180	PUNCH LAST CARD	
529	529	4	506		,,	
533	533				WORDMARK	

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    READ-PUNCH                    10708 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD             10708 02
L067367,340344,348349,3573611001,008012,0011001183610808A8429/340080                  10708 03
L069404,377385,393400,4044051001          B494S6218S88    M388380/332/                10708 04
L071443,413420,424428,4294361001B500S5218420    /080,0011L0801804V4540012             10708 05
L057468,445450,454458,4594641001584448B4645459.B4548B420D                             10708 06
L069505,477485,490494,5025061001B4853488836108OA8522AB4298393S63183348                10708 07
L072545,510514,518522,5295331001/180/080,0018348L0801804506                           10708 08
L053S20,S01S05,S12S13,S17S2110012,049L0772772/2772420                                 10708 09
/333080N                                        CLEAR WORDMARK CARD                   10708 10
,019027,031,038042B031T98GB400L0463528W048S88   READ-PUNCH                           10708 11
                          M
```

DETAIL CARDS

```
AKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM10708 12
        M         E         S         M         Z         Z         M
KT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV10708 13
       M         E         S         M         Z         Z         M
T4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV610708 14
      M         E         S         M         Z         Z         M
4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 10708 15
     M         E         S         M         Z         Z         M
 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D10708 16
    M         E         S         M         Z         Z         M
BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN10708 17
   M         E         S         M         Z         Z         M
LU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW10708 18
  M         E         S         M         Z         Z         M
U5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW710708 19
 M         E         S         M         Z         Z         M
SGCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D10708 20
M         E         S         M         Z         Z         M         E
GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE10708 21
        E         S         M         Z         Z         M         E
CMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEO10708 22
       E         S         M         Z         Z         M         E
MV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX10708 23
      E         S         M         Z         Z         M         E
V6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX810708 24
     E         S         M         Z         Z         M         E
6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 10708 25
    E         S         M         Z         Z         M         E
```

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ENG. CHG. NO.	110378	117628	TA 1976					

REPRODUCTION

```
 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 F1070B 26
    E         S         M         Z         Z         M         E
DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FP1070B 27
   E         S         M         Z         Z         M         E
NW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY1070B 28
  E         S         M         Z         Z         M         E
W7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY91070B 29
 E         S         M         Z         Z         M         E
7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9T1070B 30
E         S         M         Z         Z         M         E         S
DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TG1070B 31
        S         M         Z         Z         M         E         S
```

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PRINT-READ-PUNCH

A. PURPOSE OF TEST

TO TEST THE PRINT-READ-PUNCH CIRCUITRY BY PRINTING, READING, AND PUNCHING 20 DETAIL CARDS WITH A 60-CHARACTER TABLE IN RIPPLE FASHION. THE DETAIL CARDS USED IN THIS TEST ARE SIMILAR TO THE ONES USED IN THE READ-PUNCH TEST (BLOCK NUMBER 1070).

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1261, 1262 AND 1263. PLACE DETAIL CARDS IN 1402 READ HOPPER.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B	ON	PERMITS THE EXECUTION OF THE PRINT-READ-PUNCH OPERATION AS OFTEN AS DESIRED. SINCE THIS INSTRUCTION COMBINES THE OPERATION OF PRINTING, READING, AND PUNCHING, THESE THREE OPERATIONS WILL CONTINUE UNTIL THE READ FEED HOPPER OR THE PUNCH FEED HOPPER IS EMPTY.
	OFF	TO CONTINUE
D	ON	MAY BE USED ONLY WHEN THIS TEST IS RUN SEPARATELY. TO REPEAT THE TEST AS OFTEN AS DESIRED THE 20 CARDS PUNCHED DURING THIS TEST MAY BE REMOVED FROM THE PUNCH STACKER AND PLACED IN THE READ FEED HOPPER
	OFF	TO CONTINUE

D. TEST PROCEDURE:

AFTER CLEARING THE READ AREA AND SETTING A WORD MARK IN LOCATION 001, A READ INSTRUCTION IS EXECUTED TO FEED THE FIRST DETAIL CARD. THE INFORMATION IN THE READ AREA IS THEN TRANSFERRED TO THE PUNCH AREA AND THE PRINT AREA. LOCATION 001 IS NEXT TESTED FOR NO-ZONE. IF ZONE IN 001 THE PROGRAM PROCEEDS TO PRINT-READ-PUNCH. IF NO-ZONE THE PROGRAM BRANCHES TO A PRINT-READ-PUNCH AND BRANCH INSTRUCTION. A FAILURE TO BRANCH WILL STOP THE MACHINE.

E. STOPS

466 IN STORAGE ADDRESS REGISTER: ERROR-FAILED TO BRANCH

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

F. PRINTOUTS

SIMILAR TO TEST 1040

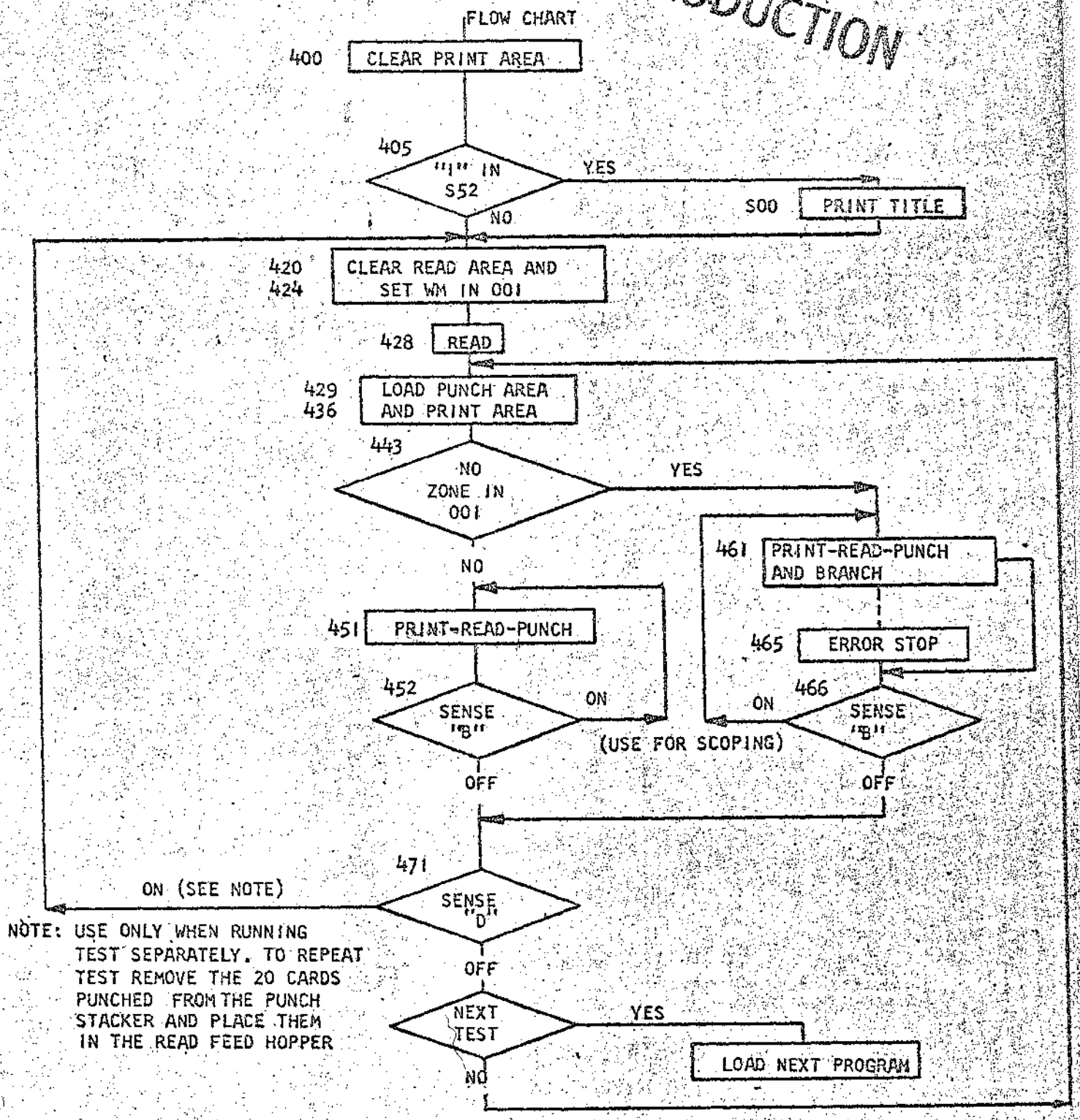
G. COMMENTS

THE 20 CARDS PUNCHED IN THIS TEST SHOULD BE EXACT DUPLICATES OF THE 20 DETAIL CARDS (28-47) FURNISHED WITH THE TEST DECK AND SHOULD ALSO AGREE WITH THE LIST PRODUCED BY THE PROGRAM.

DATE	2-2-61	7-1-63	17.10.63					
G. CHG. NO.	110378	117628	TA 1976					

PRINT-READ-PUNCH

FLOW CHART



NOTE: USE ONLY WHEN RUNNING TEST SEPARATELY. TO REPEAT TEST REMOVE THE 20 CARDS PUNCHED FROM THE PUNCH STACKER AND PLACE THEM IN THE READ FEED HOPPER

DATE	2-2-61	7-1-63	17.10.63					
NG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

PRINT-READ-PUNCH 10808

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	501	S611	USE WHEN TESTS ARE RUN FROM TAPE	
385	386	B	S88		,,	
393	393	M	388	380	*BYPASS DETAIL CARDS ON TAPE	
400	400	/	332		START TEST	
404	404	/			,,	
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	B	420		BRANCH TO CONTINUE	
420	420	/	080		CLEAR READ AREA	
424	424	,	001		SET WM IN READ AREA	
428	428	1			READ	
429	429	L	080	180	LOAD PUNCH AREA	
436	436	M	080	280	LOAD PRINT AREA	
443	443	V	461	0012	BRANCH IF NO ZONE IN 001	
451	451	7			PRINT-READ-PUNCH	
452	452	B	451	B	B ON TO SCOPE	SS
457	457	B	471		BRANCH TO CONTINUE	
461	461	7	466		PRINT-READ-PUNCH AND BRANCH	
465	465	.			ERROR STOP IF NO BRANCH	
466	466	B	461	B	B ON TO SCOPE	SS
471	471	B	420	D	SENSE SW D ON TO LOOP	SS
476	476	B	492	3488	BRANCH WHEN TEST IS ON TAPE	
484	484	B	361	080A	BRANCH IF TEST IS ON CARDS	
492	492	B	541	A	BRANCH ON LAST CARD	SS
497	497	B	429		REPEAT PROGRAM	
501	501	B	513	S621	USE WHEN TESTS ARE RUN FROM TAPE	
509	509	B	348		,,	
513	513	B	393	S631	,,	
521	521	B	348		,,	
525	525	/	180		CLEAR ANY GM WM	
529	529	/	080		,,	
533	533	,	001		SET WM FOR CARDS	
537	537	B	348		BRANCH TO CHAINING ROUTINE	
541	541	L	080	180	PRINT AND PUNCH LAST CARD	
548	548	M	080	280	,,	
555	555	6	526		,,	
559	559				WORDMARK	

DATE	2-2-61	7-1-63	17.1063					
ENG. CHG. NO.	110378	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                PRINT-READ-PUNCH          10808 0A
,008015,022029,033033N      1001                SET WORDMARK CARD         10808 02
L067367,340344,348349,3573611001,008012,0011001183610808A8429/340080      10808 03
L069404,377385,393400,4044051001          B501S611BS88    M388380/332/    10808 04
L070442,413420,424428,4294361001BS00S5218420   /080,0011L080180M080280    10808 05
L060470,451452,457461,4654661001V46100127845188471746 6.8461B            10808 06
L070508,476484,492497,501509100184200B49234888361080A8S41AB429B513S621   10808 07
L064540,513521,525529,5335371001B3488393S6318348/180/080,0018348          10808 08
L072580,548555,559559,5595591001L080180M0802806525                        10808 09
L053520,501505,512513,5175211001Z,049L0772772/2772420                     10808 10
/333080N                    1001                CLEAR WORDMARK CARD       10808 11
,019027,031,038042B031T98GB400L0463528W048S88  PRINT-READ-PUNCH          10808 12
                      M
```

DETAIL CARDS

```
AKT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM10808 13
          M          E          S          M          Z          Z          M
KT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV10808 14
         M          E          S          M          Z          Z          M
T4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV610808 15
        M          E          S          M          Z          Z          M
4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 10808 16
       M          E          S          M          Z          Z          M
 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D10808 17
      M          E          S          M          Z          Z          M
BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN10808 18
     M          E          S          M          Z          Z          M
LU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW10808 19
    M          E          S          M          Z          Z          M
U5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW710808 20
   M          E          S          M          Z          Z          M
5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D10808 21
  M          E          S          M          Z          Z          M          E
GCMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE10808 22
         E          S          M          Z          Z          M          E
CMV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE010808 23
        E          S          M          Z          Z          M          E
MV6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X10808 24
       E          S          M          Z          Z          M          E
V6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X810808 25
      E          S          M          Z          Z          M          E
6 DNW7DE0X8 FPY9TGQZ0 HR#*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 10808 26
     E          S          M          Z          Z          M          E
```

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ENG CHG. NO.	110378	117628	TA 1976					

```
 DNW7DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 8LU5GCMV6 DNW7DE0X8 F10808 27
     E         S         M         Z         Z         M         E
DNW7DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FP1080B 28
    E         S         M         Z         Z         M         E
NW7DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY1080B 29
   E         S         M         Z         Z         M         E
W7DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 8LU5GCMV6 DNW7DE0X8 FPY91080B 30
  E         S         M         Z         Z         M         E
7DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY9T1080B 31
 E         S         M         Z         Z         M         E         S
DE0X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY9TG1080B 32
          S         M         Z         Z         M         E         S
```

DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

FORMS SPACING 2000C

A. PURPOSE:

TO CHECK ALL TYPES OF SPACING SINGLY AND IN COMBINATIONS.

NOTE: SKIP TO 4 AND THE 9 AND 12 LATCHES ARE USED IN THIS TEST.

B. LOADING PROCEDURES:

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY. THE PROGRAM WILL COME TO A HALT, LOCATION 421, AFTER THE TITLE PRINT ROUTINE TO ALLOW OPERATOR TO INSTALL THE CARRIAGE TAPE. THE TEST NOW CAN BE STARTED BY PRESSING THE START KEY. WHEN RUNNING TEST FROM TAPE ENTER A 1 IN 1255.

C. PROGRAM CONTROL:

1. CHECKING PROCEDURE

WITH SENSE SWITCHES B AND E BOTH OFF, ERRORS WILL PRINT OUT. SWITCH D MAY BE USED TO LOOP PROGRAM.

WITH SENSE SWITCH B ON AND E OFF, ERRORS WILL NOT PRINT. THE PROGRAM WILL LOOP WITHOUT A HALT. THE CARRIAGE CAN BE DISENGAGED OR THE PAPER REMOVED.

WITH SENSE SWITCH B ON AND E ON, ERRORS WILL NOT PRINT. THE PROGRAM HALTS AT THE PARTICULAR ERROR STOP. THE CARRIAGE LOCATION MAY BE EXAMINED, AND THE PROGRAM WILL LOOP WHEN THE START KEY IS DEPRESSED.

2. SENSE SWITCHES:

B ON	LOOPS PROGRAM WHEN ERROR OCCURS WITHOUT PRINTING ERRORS
B OFF	ALLOWS ERRORS TO PRINT DEPENDENT ON SENSE SWITCH E
C ON	CAUSES CORRECT OPERATION TO PRINT OUT
C OFF	PREVENTS CORRECT OPERATION FROM PRINTING
D ON	LOOPS PROGRAM
D OFF	ALLOWS PROGRAM TO END WHEN ERRORS DO NOT OCCUR
E ON	CAUSES PROGRAM TO HALT ON ERROR
E OFF	ALLOWS ERRORS TO PRINT IF SENSE SWITCH B IS OFF
F	USED WHEN TEST IS RUN FROM TAPE - - MAGNETIC

D. TEST PROCEDURE:

THE CARRIAGE MOVES TO CHANNEL 5, AN INITIAL CHECK IS MADE OF THE 9 AND 12 LATCHES FOR AN OFF CONDITION. FROM THIS POINT ON ONLY THE 12 LATCH IS CHECKED.

THE TEST STARTS WITH A SINGLE SPACE AFTER PRINT AND ADVANCES TO A SINGLE SPACE BEFORE PRINT. THE ADVANCE CONTINUES THROUGH THE FOLLOWING:

DOUBLE SPACE AFTER PRINT
DOUBLE SPACE BEFORE PRINT
TRIPLE SPACE AFTER PRINT
TRIPLE SPACE BEFORE PRINT
1,2,3 SPACES AFTER PRINT
1,2,3 SPACES BEFORE PRINT
3,2,1 SPACES AFTER PRINT
3,2,1 SPACES BEFORE PRINT

THE PRINT-OUT WILL STATE -- END OF TEST TYPE OF ERROR NONE --. AT THIS POINT THE TEST ENDS.

AFTER EACH TYPE OF SPACE OPERATION THE RESULT IS CHECKED FOR AN OFF CONDITION OF THE 12 LATCH AT CHANNEL 5, WHICH HAD BEEN REACHED AFTER 90 SPACES. THE CARRIAGE SINGLE SPACES, THE 12 LATCH IS CHECKED FOR AN ON CONDITION. THE CARRIAGE AGAIN SPACES, OR PRINTS THE RESULTS OF THE CHECK AND THEN SPACES. FOUR MORE SPACES ARE TAKEN TO LOCATE THE CARRIAGE 90 SPACES AWAY FROM CHANNEL 5. HERE THE EXECUTION OF THE NEXT SPACE OPERATION BEGINS.

SHOULD AN ERROR OCCUR, THE TEST STOPS. THE MACHINE WILL EITHER PRINT OUT THE ERROR OR COME TO AN ERROR HALT. IF THE TEST IS LOOPED IT STARTS FROM THE BEGINNING, CHANNEL 5.

E. STOPS

STOR ADDR REGISTER	ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON.
421	INSTALL CARRIAGE TAPE AND DEPRESS START.
1108	ERROR #2 . 12 LATCH WAS ON AT CHANNEL 5. LATCH SHOULD HAVE BEEN RESET BY THE CHANNEL HOLE
1131	ERROR #3 12 LATCH DID NOT COME ON WHEN CARRIAGE SPACED OUT OF CHANNEL 5 INTO THE 12 CHANNEL.
1160	INITIAL ERROR - THE 9 OR 12 LATCH WAS ON AT THE END OF THE INITIAL SPACE TO 5.
1174	PROGRAM WILL STOP HERE ON ANY ERROR IF PROGRAM IS NOT LOOPED
1193	END OF TEST - NO ERRORS, DEPRESS START TO CONTINUE TO NEXT TEST.

F. PRINTOUTS

CORRECT PRINTOUTS WITH SENSE SWITCH C ON

DOUBLE SPACE BEFORE PRINT TESTED OK SPACE TEST TYPE OF ERROR

3 2 1 SPACE AFTER PRINT TEST OK SPACE TEST TYPE OF ERROR

ETC. FOR ALL CHANNELS

ERROR PRINTOUTS WITH SENSE SWITCH E OFF

SINGLE SPACE AFTER PRINT TESTED SPACE TEST TYPE OF ERROR 2

SINGLE SPACE AFTER PRINT TESTED SPACE TEST TYPE OF ERROR 3

ETC. FOR ALL CHANNELS AND ERROR CONDITIONS

G. COMMENTS

ESSENTIALLY THE CARRIAGE TAPE IS PUNCHED EVERY 8 SPACES. EACH CHANNEL PUNCH IS FOLLOWED WITH A 9 OR 12 PUNCH FOR CHECKING CORRECT OPERATION.

THIS IS THE SAME CARRIAGE TEST TAPE AS USED WITH TEST 2005A, 2010B, AND 2020C.

THE CARRIAGE TEST TAPE IS PUNCHED AS FOLLOWS.

LINE	HOLE	LINE	HOLE	LINE	HOLE
1	1	33	5	65	9
2	9	34	12	66	12
9	2	41	6	73	10
10	9	42	12	74	9
17	3	49	7	81	11
18	9	50	12	82	9
25	4	57	8	89	12
26	12	58	12	90	9

SPLICE TAPE SO THE 0 AND 96 COINCIDE.

----- SERVICE AIDS -----

LOCATION	INSTRUCTION	
181	B 674 795 2	CHANGE TEST CHARACTER OF BRANCH ON CHARACTER EQUAL TO VARY DELAY.

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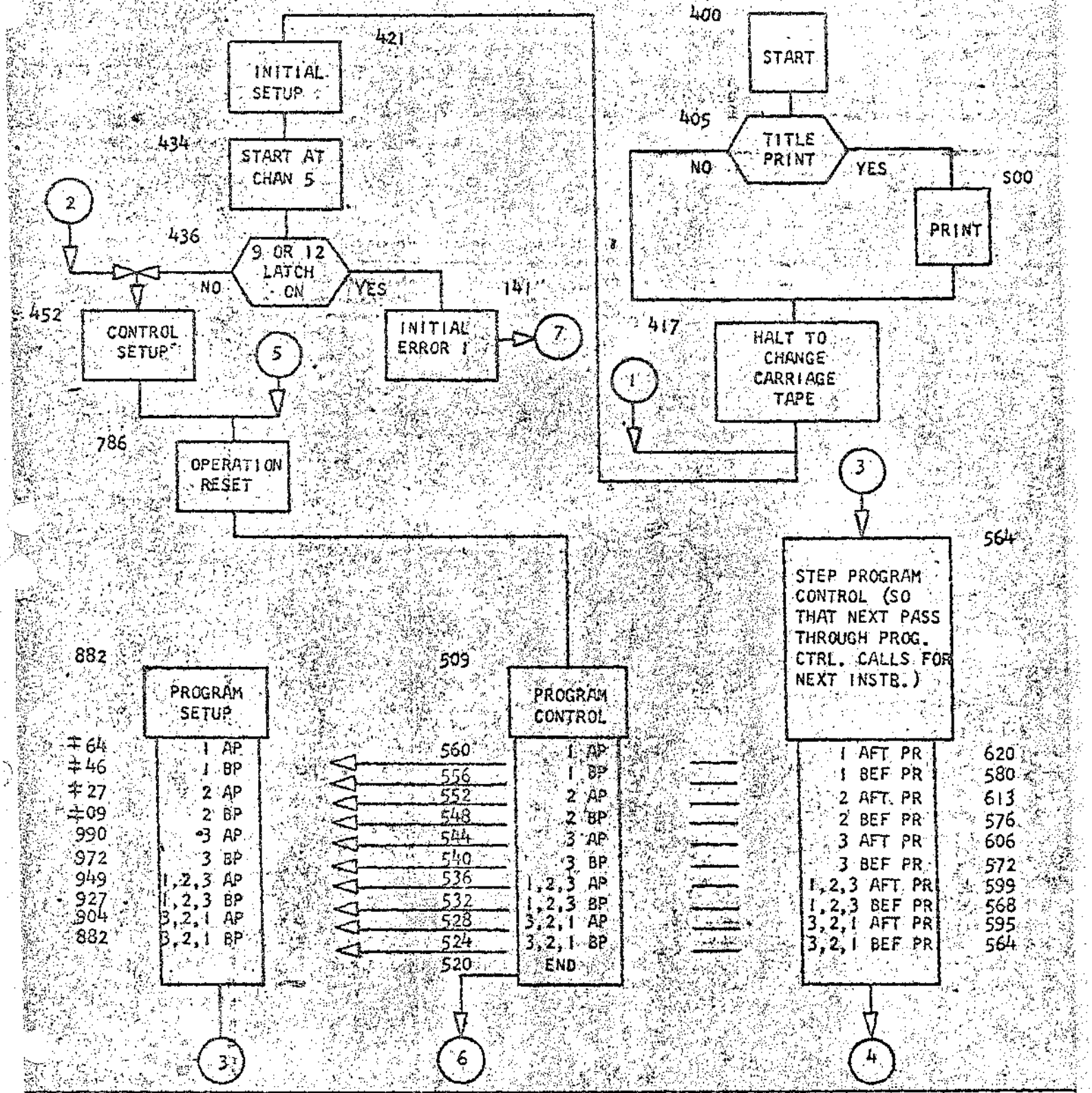
G. (CONTINUED)

LOCATION	INSTRUCTION	
452	B 456	CHANGE I-ADDRESS TO BRANCH INTO CONTROL SETUP TO START WITH ANY SPACE OPERATION DESIRED. SEE LOCATIONS 460 THRU 501.
564 THRU 620	SET WM INSTRUCTIONS	CHANGE A-FIELD ADDRESS TO 333, FOR ANY INSTRUCTION, TO PREVENT ADVANCE FROM ANY SPACE OPERATION.
661	FZ	THIS IS USED ON NON-BUFFERED MACHINES TO CHECK INTERLOCK OF FORMS OP FOLLOWED BY A FORMS OP. TO CAUSE AN ERROR, ENTER A NO-OP INSTRUCTION IN LOCATION 661. IF ERROR OCCURS WITHOUT THE NO-OP IN 661, BRANCH TO DELAY COUNTER, ENTER A BRANCH OP IN 670 AND SEE IF TROUBLE DISAPPEARS. ON BUFFERED MACHINES ONLY, WITH THE NO-OP IN 661, SPACE AFTER PRINT SHOULD FAIL BECAUSE BRANCH ON CHANNEL 12; B XXX ⌀, DOES NOT INTERLOCK AFTER PRINT. FOR BUFFERED MACHINES ONLY, WITHOUT THE NO-OP IN 661, AN IMMEDIATE SPACE SHOULD NOT CAUSE AN ERROR BECAUSE THE BRANCH SHOULD BE INTERLOCKED. IF FAILURE OCCURS, CHANGE LOCATION 670 TO A BRANCH OP, AND SEE IF THE TROUBLE DISAPPEARS.
822 THRU 838	ALL 2 ⌑ INSTRUCTIONS	ENTER C-BITS IN LOCATIONS 823, 827, 831, 835 AND 839 TO ALLOW PRINTING ON SPACE AFTER PRINT.



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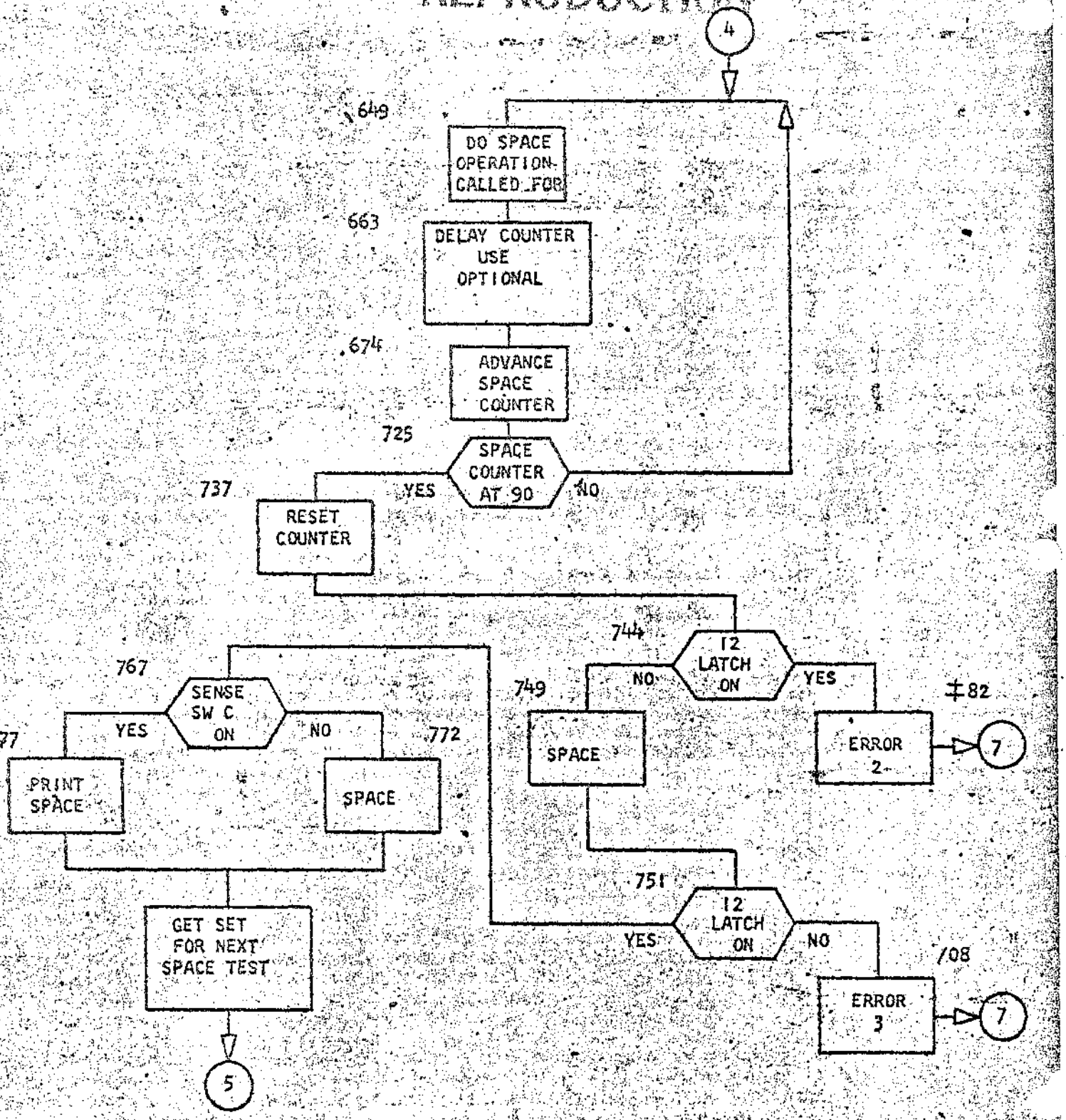
DIAGNOSTIC FUNCTION TEST



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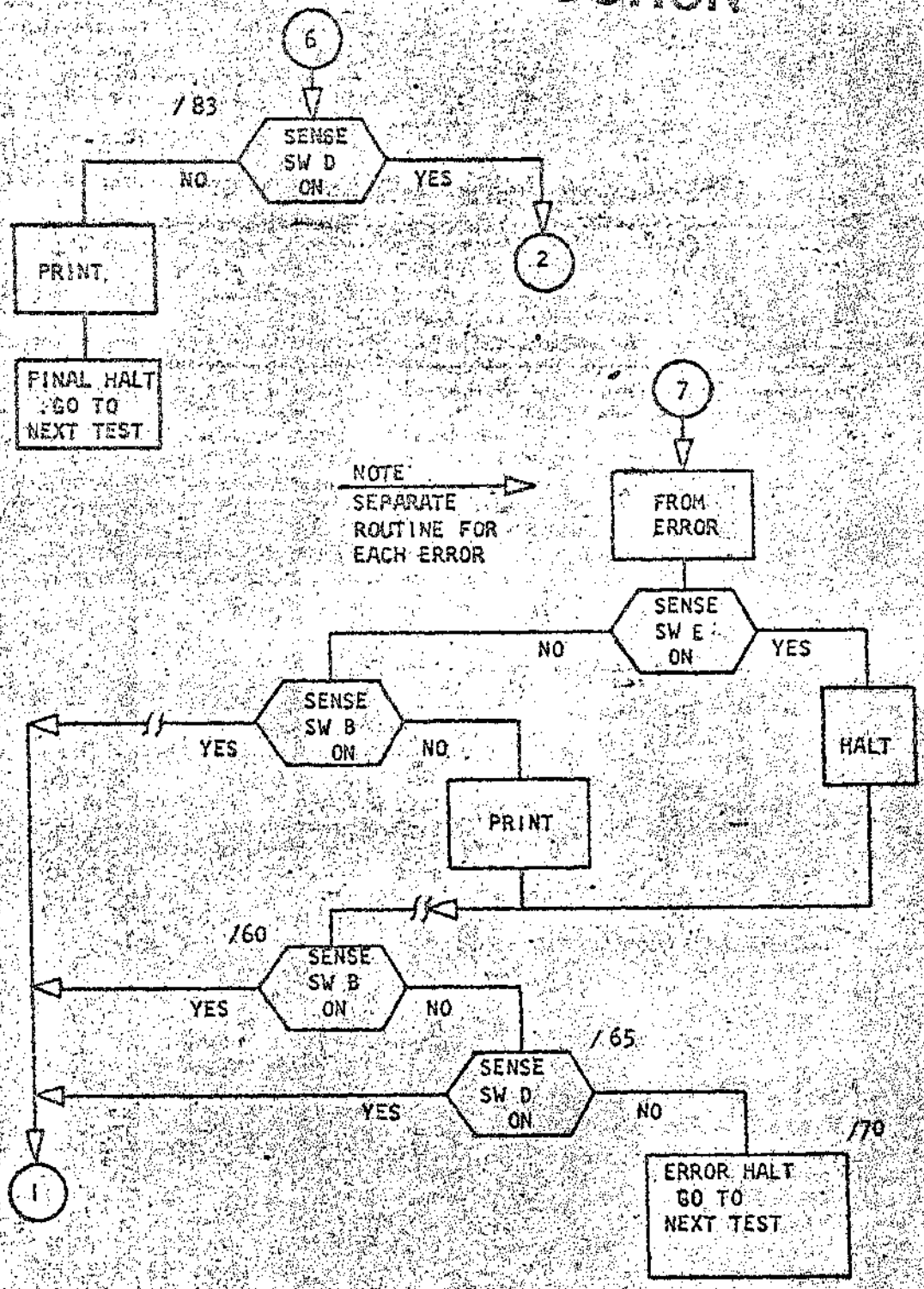
DIAGNOSTIC FUNCTION TEST



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PROGRAM LISTING FOR USE WITH FLOW CHART

FORMS SPACING 2000C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	S	ING	LE	
088	088	D	OUB	LE	* AN ASTERISK MEANS INSTRUCTIONS CHANGE
094	094	T	RIP	LE	
100	100	1	2	3	C FOR T A IS CHANGE FOR TROUBLE ANALYSIS
106	106	3	2	1	AND MEANS THAT INSTRUCTION CAN BE
112	112		SPA	CE BEFORE	CHANGED TO ANALYZE TROUBLE
125	125		SPA	CE AFTER	
137	137	P	RIN	T TESTED	
152	152	E	ND	TEST	
160	160		TY	PE OF ERROR	
176	176	N	ONE		
181	181	B	874	A952	TEST FOR END OF DELAY C FOR T A
189	189	A	865	A98	CREATE DELAY
196	196	B	181		CREATE DELAY
377	377	B	389	$551	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	580		USE WHEN TESTS ARE RUN FROM TAPE
389	389	N	000		USE WHEN TESTS ARE RUN FROM TAPE
393	393	M	360	392	USE WHEN TESTS ARE RUN FROM TAPE
400	400	/	332		START TEST
404	404	/			CLEAR PRINT AREA
405	405	B	500	$521	TITLE PRINT
413	413	/	080		
417	417	/	421		HALT TO CHANGE CARRIAGE TAPE
421	421	F	4		INITIAL SETUP
426	426	/	290		INITIAL SETUP
427	427	2			INITIAL SETUP
428	428	2			INITIAL SETUP
429	429	2			INITIAL SETUP
430	430	2			INITIAL SETUP
431	431	2			INITIAL SETUP
432	432	2			INITIAL SETUP
433	433	2			INITIAL SETUP
434	434	F	J		START AT CHANNEL 5
436	436	B	/31	9	INITIAL ERROR #1
441	441	B	/31	a	INITIAL ERROR #1
446	446	2			THE STARTING POINT OF ALL
447	447	2			SPACE TESTS IS 6 SPACES
448	448	2			PAST CHANNEL 5
449	449	2			THE TEST POINT OF ALL
450	450	2			THE TESTS IS 90 SPACES
451	451	2			AWAY AT CHANNEL 5
452	452	B	456		GO TO CONTROL SETUP C FOR T A

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```
456  456  ¤ 556                SETUP SINGLE SPACE AFTER PRINT
460  460  ¤ 552 689           SETUP SINGLE SPACE BEFORE PRINT
467  467  ¤ 548               SETUP DOUBLE SPACE AFTER PRINT
471  471  ¤ 544 685           SETUP DOUBLE SPACE BEFORE PRINT
478  478  ¤ 540               SETUP TRIPLE SPACE AFTER PRINT
482  482  ¤ 536 681           SETUP TRIPLE SPACE BEFORE PRINT
489  489  ¤ 532               SETUP 1 2 3 SPACES AFTER PRINT
493  493  ¤ 528               SETUP 1 2 3 SPACES BEFORE PRINT
497  497  ¤ 524               SETUP 3 2 1 SPACES AFTER PRINT
501  501  ¤ 520               SETUP 3 2 1 SPACES BEFORE PRINT
505  505  B 786               GO TO OPERATION RESET
509  509  / 299               PROGRAM CONTROL
513  513  N 000 000           PROGRAM CONTROL
520  520  B 874               *GO TO END ROUTINE
524  524  B 882               *SETUP 3 2 1 SPACES BEFORE PRINT
528  528  B 904               *SETUP 3 2 1 SPACES AFTER PRINT
532  532  B 927               *SETUP 1 2 3 SPACES BEFORE PRINT
536  536  B 949               *SETUP 1 2 3 SPACES AFTER PRINT
540  540  B 972               *SETUP TRIPLE SPACE BEFORE PRINT
544  544  B 990               *SETUP TRIPLE SPACE AFTER PRINT
548  548  B ¢09               *SETUP DOUBLE SPACE BEFORE PRINT
552  552  B ¢27               *SETUP DOUBLE SPACE AFTER PRINT
556  556  B ¢46               *SETUP SINGLE SPACE BEFORE PRINT
560  560  B ¢64               SETUP SINGLE SPACE AFTER PRINT
564  564  , 520               ADV FROM 3 2 1 BEFORE PRINT   C FOR T A
568  568  , 528               ADV FROM 1 2 3 BEFORE PRINT   C FOR T A
572  572  , 536               ADV FROM TRIPLE BEFORE PRINT  C FOR T A
576  576  , 544               ADV FROM DOUBLE BEFORE PRINT  C FOR T A
580  580  , 552               ADV FROM SINGLE BEFORE PRINT  C FOR T A
584  584  M ¢24 229           BEFORE PRINT TO PRINT AREA
591  591  B 631               GO TO EXECUTE
595  595  , 524               ADV FROM 3 2 1 AFTER PRINT    C FOR T A
599  599  , 532 684           ADV FROM 1 2 3 AFTER PRINT    C FOR T A
606  606  , 540 685           ADV FROM TRIPLE AFTER PRINT   C FOR T A
613  613  , 548 689           ADV FROM DOUBLE AFTER PRINT   C FOR T A
620  620  , 556               ADV FROM SINGLE AFTER PRINT   C FOR T A
624  624  M 136 228           AFTER PRINT TO PRINT AREA
631  631  M 881 250           AT EXECUTE MORE REMARKS TO PRINT
638  638  M 151                         MORE REMARKS TO PRINT
642  642  M 174 294                     MORE REMARKS TO PRINT
649  649  F X                 *          1 OR 3        BEF OR AFT PRINT
651  651  2 ¤                 *DO        1 OR 3              AFT PRINT
653  653  F X                 *SING, DOUB, OR TRIP     BEF OR AFT PRINT
656  656  2 ¤                 *DO SING, DOUB, OR TRIP        AFT PRINT
657  657  F X                 *          3 OR 1        BEF OR AFT PRINT
659  659  2 ¤                 *DO        3 OR 1              AFT PRINT
661  661  F Z                  INTERLOCK AND TEST              C FOR T A
663  663  L 855 /98            MAKE DELAY COUNTER
670  670  N 181               GO TO DELAY                     C FOR T A
674  674  N 000 000           SPACE COUNTER CONTROL
681  681  B 697               *ADVANCE SPACE COUNTER BY SIX
```

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```
685  685  B 704                *ADVANCE SPACE COUNTER BY THREE
689  689  B 711                *ADVANCE SPACE COUNTER BY TWO
693  693  B 718                 ADVANCE SPACE COUNTER BY ONE
697  697  A 859 867            ADD THREE TO SPACE COUNTER
704  704  A 863 867            ADD ONE TO SPACE COUNTER
711  711  A 863 867            ADD ONE TO SPACE COUNTER
718  718  A 863 867            ADD ONE TO SPACE COUNTER
725  725  B 737 8659           TEST SPACE COUNTER FOR 90
733  733  B 649                CONTINUE SPACE PROGRAM
737  737  M 855 867            RESET SPACE CTR TO ZERO
744  744  B 483 2              ERROR #2
749  749  F J                  SPACE TO LATCH
751  751  B 760 2              NO ERROR #3
758  758  B 708                ERROR #3
760  760  M 794 247            MOVE OK TO PRINT
767  767  B 773 C              TEST FOR PRINT
772  772  F 778 J              SPACE OUT OF LATCH
777  777  2                    PRINT CORRECT OPERATION
778  778  F J                  GET SET
780  780  F J                  FOR NEXT
782  782  F J                  SPACE
784  784  F J                  OPERATION
786  786  M 851 660            RESET SPACE OPERATION
793  793  M                    RESET SPACE OPERATION
794  794  M                    RESET SPACE OPERATION
795  795  M                    RESET SPACE OPERATION
796  796  M                    RESET SPACE OPERATION
797  797  M                    RESET SPACE OPERATION
798  798  B 509                GO TO PROGRAM CONTROL
802  802  F L
804  804  M ¤
806  806  F K
808  808  M ¤
810  810  F J
812  812  M ¤
814  814  F K
816  816  M ¤
818  818  F L
820  820  F T                    ENTER C BITS
822  822  2 ¤                    IN LOCATIONS          C FOR T A
824  824  F S                    823,827,
826  826  2 ¤                    831,835,839           C FOR T A
828  828  F /                    TO PRINT
830  830  2 ¤                    INFORMATION           C FOR T A
832  832  F S                    DURING SPACE
834  834  2 ¤                    AFTER PRINT           C FOR T A
836  836  F T
838  838  2 ¤                                          C FOR T A
840  840  M X
842  842  M ¤
844  844  M X
```

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```
 846   846  M ¤
 848   848  N X
 850   850  N ¤
 852   852  0 000                    COUNTER RESET TO ZERO
 856   856  0 030                    COUNTER ADVANCE BY THREE
 860   860  0 010                    COUNTER ADVANCE BY ONE
 864   864  0 000                    SPACE COUNTER
 868   868        SPACE TEST
 882   882  M 111 216                321 TO PRINT AREA
 889   889  M 811 656                SETUP          FJ
 896   896  M                        SETUP       N¤
 897   897  M                        SETUP     FK
 898   898  M                        SETUP   N¤
 899   899  M                        SETUP FL
 900   900  B 584                    GO TO PROGRAM ADVANCE
 904   904  M 111 216                321 TO PRINT AREA
 911   911  M 831 660                SETUP             2¤
 918   918  M                        SETUP          F/
 919   919  M                        SETUP       2¤
 920   920  M                        SETUP     FS
 921   921  M                        SETUP   2¤
 922   922  M                        SETUP FT
 923   923  B 595                    GO TO PROGRAM ADVANCE
 927   927  M 105 216                123 TO PRINT AREA
 934   934  M 819 660                SETUP          FL
 941   941  M                        SETUP       N¤
 942   942  M                        SETUP     FK
 943   943  M                        SETUP   N¤
 944   944  M                        SETUP FJ
 945   945  B 588                    GO TO PROGRAM ADVANCE
 949   949  M 105 216                123 TO PRINT AREA
 956   956  M 839 660                SETUP             2¤
 963   963  M                        SETUP          FT
 964   964  M                        SETUP       2¤
 965   965  M                        SETUP     FS
 966   966  M                        SETUP   2¤
 967   967  M                        SETUP F/
 968   968  B 599                    GO TO PROGRAM ADVANCE
 972   972  M 099 216                TRIPLE TO PRINT
 979   979  M 819 654                SETUP FL
 986   986  B 572                    GO TO PROGRAM ADVANCE
 990   990  M 099 216                TRIPLE TO PRINT
 997   997  M 839 656                SETUP   2¤
1004  1004  M                        SETUP FT
1005  1005  B 606                    GO TO PROGRAM ADVANCE
1009  1009  M 093 216                DOUBLE TO PRINT
1016  1016  M 815 654                SETUP FK
1023  1023  B 576                    GO TO PROGRAM ADVANCE
1027  1027  M 093 216                DOUBLE TO PRINT
1034  1034  M 835 656                SETUP   2¤
1041  1041  M                        SETUP FS
```

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```
1042  *42  B 613                    GO TO PROGRAM ADVANCE
1048  *46  M 087 216                SINGLE TO PRINT
1058  *53  M 811 656                SETUP FJ
1068  *60  B 580                    GO TO PROGRAM ADVANCE
1064  *64  M 087 216                SINGLE TO PRINT
1071  *71  M 831 656                SETUP    2¤
1078  *78  M                        SETUP F/.
1079  *79  B 620                    GO TO PROGRAM ADVANCE
1083  *83  M 446 296                ERROR #2
1090  *90  B /04 E
1095  *95  B 421 B
1100  /00  2 /60
1104  /04  . /60
1108  /08  M 106 296                ERROR #3
1115  /15  B /29 E
1120  /20  B 421 B
1125  /25  2 /60
1129  /29  . /60
1151  /51  M 100 296                ERROR #1
1138  /38  M 175
1142  /42  B /56 E
1147  /47  B 421 B
1152  /52  2 /60
1156  /56  . /60
1160  /60  B 421 B
1165  /65  B 421 D
1170  /70  . 348                    ERROR  FINAL HALT
1174  /74  M 179 299                CORRECT OPERATION
1181  /81  M
1182  /82  M
1183  /83  B 452 D                  GO REPEAT TEST
1188  /88  2                        PRINT CORRECT RESULTS
1189  /89  . 348                    CORRECT  FINAL HALT
1193  /93  0 K
1196  /95  D 000                    DELAY COUNTER
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	12	7	8
MS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0	
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK	7	8	
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON	5	8	
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,008015,022029,033033N        1001                    FORMS SPACING                2000C 00
,008015,022029,033033N        1001                    SET WORDMARK CARD            2000C 02
L071121,086094,100106,112112001SINGLEDOUBLETRIPLE1 2 3 3 2 1  SPACE BBF2000C 03
L070159,122122,125137,152160100100RE SPACE AFTERPRINT TESTED  END TEST  2000C 04
L068195,178181,189196,1961961001  TYPE OF ERROR NONE 8674/952A863/98     2000C 05
L037200,001001,001001,001001100181                                       2000C 06
L067367,340344,348349,357361100l,008012,001100118361080AB421/340080      2000C 07
L069404,377385,389393,400404l001          B389S5518S88N000M360392/332/   2000C 08
L056428,413417,421423,427428100lBS005521/080.421F4/29922                 2000C 09
L044440,438431,432433,436436100122222FJB/319                             2000C 10
L043451,446447,448449,450451100181/31@222222                             2000C 11
L069488,456460,467471,478402100l8456¤556¤552689¤548¤544685¤540¤536681    2000C 12
L068519,493497,501505,509513100l¤532¤528¤524¤5208786/299N000000          2000C 13
L060547,524528,532536,540544100l8/748882890548927B9498972B990           2000C 14
L060575,552556,560564,568572100l8409B*278*468*64,520,528,536             2000C 15
L069612,580584,591595,599606100l,544,552M124229B631,524,532681,540685    2000C 16
L070650,620624,631638,642649100l,548689,556M136228M881259M151M174294FX   2000C 17
L051669,653655,657659,661663100l2¤FX2¤FX2¤FZL855/98                      2000C 18
L066703,674681,685689,693697100lN181N0000008697870487118718A859867       2000C 19
L072743,711718,725733,737744100lA863867A863867A863867B7378659849M8658672000C 20
L065776,749751,756780,767772100l8*83@FJ8780@B/08M/9424787777CF778J       2000C 21
L049793,778780,782784,786793100l2FJFJFJFJN851660M                        2000C 22
L044805,795796,797798,802804100lNMMMB509FLN¤                             2000C 23
L046819,808810,812814,816818100lFKN¤FJN¤FKN¤FL                           2000C 24
L046853,822824,826828,830832100lFT2¤FS2¤F/2¤FS                           2000C 25
L046847,836838,840842,844846100l2¤FT2¤NXN¤NXN¤                           2000C 26
L066881,850852,856860,864868100lNXN¤000009300010000G    SPACE TEST      2000C 27
L054903,889896,897898,899900100lM111216M831658MMMMB564                   2000C 28
L051922,911916,919920,921922100lM111216M831660MNMMM                      2000C 29
L054944,927934,941942,943944100l8595M105216M819660MMMM                   2000C 30
L054966,949956,963964,965966100l8568M105216M839660MMMM                   2000C 31
L069*03,968972,979986,990997100lMB599N099216M819654857ZM099216M839656    2000C 32
L069*49,*05*09,*16*23,*27*34100lM8606M093216M815654857GM093216M835656    2000C 33
L069*77,*42*46,*53*60,*64*71100lMB613M087216M811654858OM087216M831656    2000C 34
L062/07,*79*83,*90*95,/00/04100lMB620M4A62968/04E842182/60./60           2000C 35
L060/41,//15/20,/25/29,/31/38100lM1062968/29E842182/60./M100296M175      2000C 36
L064/73,/47/52,/56/60,/65/70100l8/56E842182/60./60842188421D.348          2000C 37
L063/94,//81/82,/83/88,/89/93100lM179299MMB452D2.3480K                   2000C 38
L055817,800801,805812,813817100l0000 2,049L0772772/2772                  2000C 39
L059844,625529,536537,541545100lN000000N000N000000NN0002413             2000C 40
/333080N                                          CLEAR WORDMARK CARD     2000C 41
,019027,031,038042803lT98G84DDL046352BW048588   FORMS SPACING            2000C 42
```

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SINGLE LINE SKIP TEST 2005A

A. PURPOSE:

1. TEST SINGLE LINE SKIP OPERATION FOR ALL CHANNELS

2. TEST THE INTERLOCKING OF THE BRANCH ON 9 OR 12 BY A FORMS OPERATION.

NOTE: SINGLE SPACE, SKIP TO 3 AND THE 9 AND 12 LATCHES ARE USED IN THIS TEST. RUN THE 9 AND 12 LATCH TEST. 2020C BEFORE THIS TEST.

B. LOADING PROCEDURES:

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY. THE PROGRAM WILL COME TO A HALT, LOCATION 421, AFTER THE TITLE PRINT ROUTINE TO ALLOW OPERATOR TO INSTALL THE CARRIAGE TAPE. THE TEST NOW CAN BE STARTED BY PRESSING THE START KEY. WHEN RUNNING TEST FROM TAPE ENTER A 1 IN 1255.

C. PROGRAM CONTROL:

1. CHECKING PROCEDURE

WITH SENSE SWITCHES B AND E BOTH OFF, ERRORS WILL PRINT OUT. SWITCH D MAY BE USED TO LOOP PROGRAM.

WITH SENSE SWITCH B ON AND E OFF, ERRORS WILL NOT PRINT. THE PROGRAM WILL LOOP WITHOUT A HALT. THE CARRIAGE CAN BE DISENGAGED OR THE PAPER REMOVED.

WITH SENSE SWITCH B ON AND E ON, ERRORS WILL NOT PRINT. THE PROGRAM HALTS AT THE PARTICULAR ERROR STOP. THE CARRIAGE LOCATION MAY BE EXAMINED, AND THE PROGRAM WILL LOOP WHEN THE START KEY IS DEPRESSED.

2. SENSE SWITCHES

B ON	LOOPS PROGRAM WHEN ERROR OCCURS WITHOUT PRINTING ERRORS
B OFF	ALLOWS ERRORS TO PRINT DEPENDENT ON SENSE SWITCH E.
C ON	CAUSES CORRECT OPERATION TO PRINT OUT
C OFF	PREVENTS CORRECT OPERATION FROM PRINTING
D ON	LOOPS PROGRAM
D OFF	ALLOWS PROGRAM TO END WHEN ERRORS DO NOT OCCUR
E ON	CAUSES PROGRAM TO HALT ON ERROR
E OFF	ALLOWS ERRORS TO PRINT IF SENSE SWITCH B IS OFF
F	USED WHEN TEST IS RUN FROM TAPE -- MAGNETIC

D. TEST PROCEDURE:

THE CARRIAGE SINGLE LINE SKIPS TO CHANNEL 4, AND INITIAL CHECK IS MADE OF THE 9 AND 12 LATCHES FOR AN OFF CONDITION. FROM THIS POINT ON ONLY THE 9 OR 12 LATCH, WHICHEVER IS APPROPRIATE WILL BE CHECKED.

AT THIS POINT A PROGRAM LOOP IS FOLLOWED, STARTING WITH STEP 3 BELOW.

1. SINGLE LINE SKIP TO NEXT CHANNEL.

2. THE 12 LATCH IS CHECKED FOR AN OFF CONDITION. THE LATCH SHOULD HAVE BEEN TURNED OFF AS THE RESULTS OF THE SKIP.

3. THE CARRIAGE SINGLE SPACES TO THE 12 HOLE FOLLOWING THE CHANNEL HOLE AND THE 12 LATCH IS CHECKED FOR AN ON CONDITION.

4. DEPENDENT ON SENSE SWITCH C, THE CARRIAGE EITHER SINGLE SPACES OR PRINTS AND SINGLE SPACES.

5. THE CARRIAGE SPACES 5 TIMES TO MOVE INTO POSITION FOR THE NEXT SINGLE LINE SKIP AND THE 12 LATCH IS CHECKED FOR AN ON CONDITION BECAUSE THE 12 HOLE WAS THE LAST HOLE SENSED.

THE LOOP IS REPEATED FROM STEP 1 FOR SINGLE LINE SKIPS TO CHANNELS 5, 6, 7, 8, AND 9. NOW A NEW LOOP WHICH USES THE 9 INSTEAD OF THE 12 LATCH IS USED TO CHECK SINGLE LINE SKIPS TO CHANNELS 10,11,12,1,2 AND 3.

NORMALLY THE TEST WOULD END AFTER THE FIRST STEP OF THE NEXT PROGRAM LOOP. THE PRINT-OUT WOULD STATE --END OF TEST TYPE OF ERROR NONE --. HOWEVER IF SENSE SWITCH D IS ON, THE PROGRAM WILL CONTINUE TO LOOP AND IGNORE THE END OF TEST. SUCCESSFUL SKIPS ARE PRINTED OUT IF SENSE SWITCH C IS ON.

SHOULD AND ERROR OCCUR, THE TEST STOPS. THE MACHINE WILL EITHER PRINT OUT THE ERROR OR COME TO AN ERROR HALT. IF THE TEST IS LOOPED, IT STARTS FROM THE BEGINNING, CHANNEL 4. THE END OF TEST IS SIGNALLED BY A PROGRAM HALT.

E. STOPS:

STOR ADDR REGISTER	
	ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON
161	INITIAL ERROR - THE 9 OR 12 LATCH WAS ON AT THE END OF THE INITIAL SKIP TO 4.
421	INSTALL CARRIAGE TAPE AND DEPRESS START.
768	ERROR #1 12 LATCH WAS ON AT END OF SINGLE LINE SKIP. THE CARRIAGE SHOULD HAVE STOPPED ONE SPACE AHEAD OF THE 12 CHANNEL. THE STOP BRUSH SHOULD BE IN THE 12 HOLE.
788	ERROR #2 12 LATCH DID NOT TURN ON. THE CARRIAGE SHOULD HAVE SPACED INTO THE 12 CHANNEL AND TURNED ON THE LATCH. THE STOP BRUSH SHOULD BE ONE SPACE PAST THE 12 HOLE.

E. (CONTINUED)

STOR ADDR REGISTER	ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON
808	ERROR #3 12 LATCH WAS OFF WHEN CARRIAGE MOVED INTO POSITION TO EXECUTE A SINGLE LINE SKIP. THE LATCH SHOULD NOT HAVE GONE OFF BECAUSE NO CHANNEL HAD BEEN ENCOUNTERED SINCE THE LAST 12 HOLE. STOP BRUSH SHOULD BE SITTING IN THE HOLE OF THE SINGLE LINE SKIP CHANNEL.
828	ERROR #4 9 LATCH WAS ON AT END OF SINGLE LINE SKIP. THE CARRIAGE SHOULD HAVE STOPPED ONE SPACE AHEAD OF THE 9 CHANNEL. THE STOP BRUSH SHOULD BE IN THE 9 HOLE.
848	ERROR #5 9 LATCH DID NOT TURN ON. THE CARRIAGE SHOULD HAVE SPACED INTO THE 9 CHANNEL AND TURNED ON THE LATCH. THE STOP BRUSH SHOULD BE ONE SPACE PAST THE 9 HOLE.
868	ERROR #6 9 LATCH WAS OFF WHEN CARRIAGE MOVED INTO POSITION TO EXECUTE A SINGLE LINE SKIP. THE LATCH SHOULD NOT HAVE GONE OFF BECAUSE NO CHANNEL HAD BEEN ENCOUNTERED SINCE THE LAST 9 HOLE. STOP BRUSH SHOULD BE SITTING IN THE HOLE OF THE SINGLE LINE SKIP CHANNEL.
936	PROGRAM WILL STOP HERE ON ANY ERROR IF NOT IN A LOOP.
940	END OF TEST - ERROR, DEPRESS START TO CONTINUE TO NEXT TEST.
968	END OF TEST - NO ERRORS, DEPRESS START TO CONTINUE TO NEXT TEST.

F. PRINTOUTS

CORRECT PRINTOUTS WITH SENSE SWITCH C ON

03 CHANNEL TESTED OK - SINGLE LINE SKIP 09 LATCH TYPE OF ERROR

END TEST TYPE OF ERROR NONE

ETC. FOR ALL CHANNELS.

ERROR PRINTOUTS WITH SENSE SWITCH E OFF.

INITIAL ERROR LATCHES FAILED OR CARRIAGE DID NOT GO TO FOUR.

04 CHANNEL TESTED SINGLE LINE SKIP 12 LATCH TYPE OF ERROR 2

10 CHANNEL TESTED SINGLE LINE SKIP 09 LATCH TYPE OF ERROR 6

ETC. FOR ALL CHANNELS AND ERROR CONDITIONS.

DATE	3-15-63	4-25-63	25.6.63					
D. CHG. NO.	115283	116745A	TA 184A1					

G. COMMENTS

ESSENTIALLY THE CARRIAGE TAPE IS PUNCHED EVERY 8 SPACES. EACH CHANNEL PUNCH IS FOLLOWED WITH A 9 OR 12 PUNCH FOR CHECKING CORRECT OPERATION.

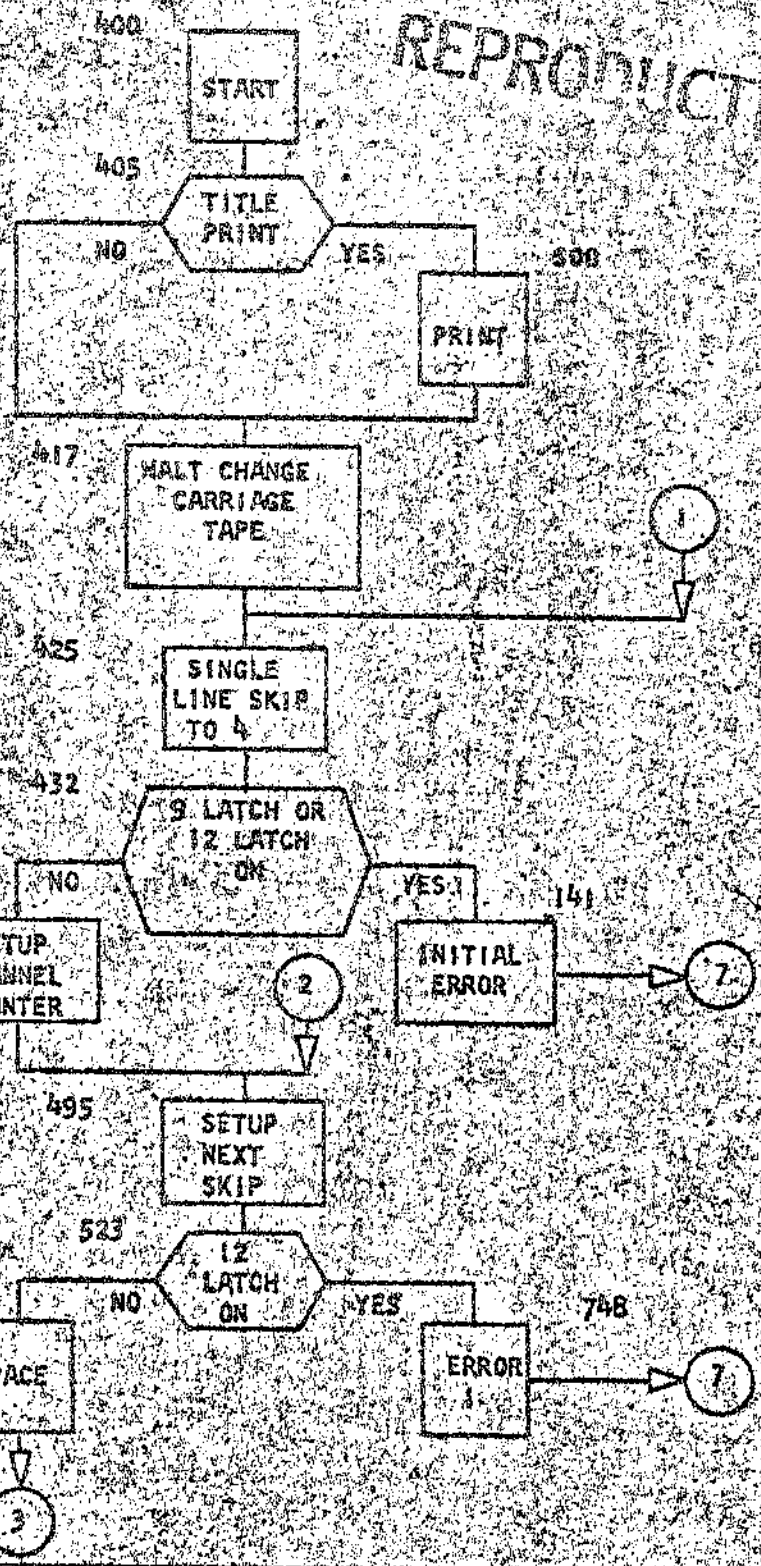
THIS IS THE SAME CARRIAGE TEST TAPE AS USED WITH TEST 2000C, 2010B, AND 2020C.

THE CARRIAGE TEST TAPE IS PUNCHED AS FOLLOWS:

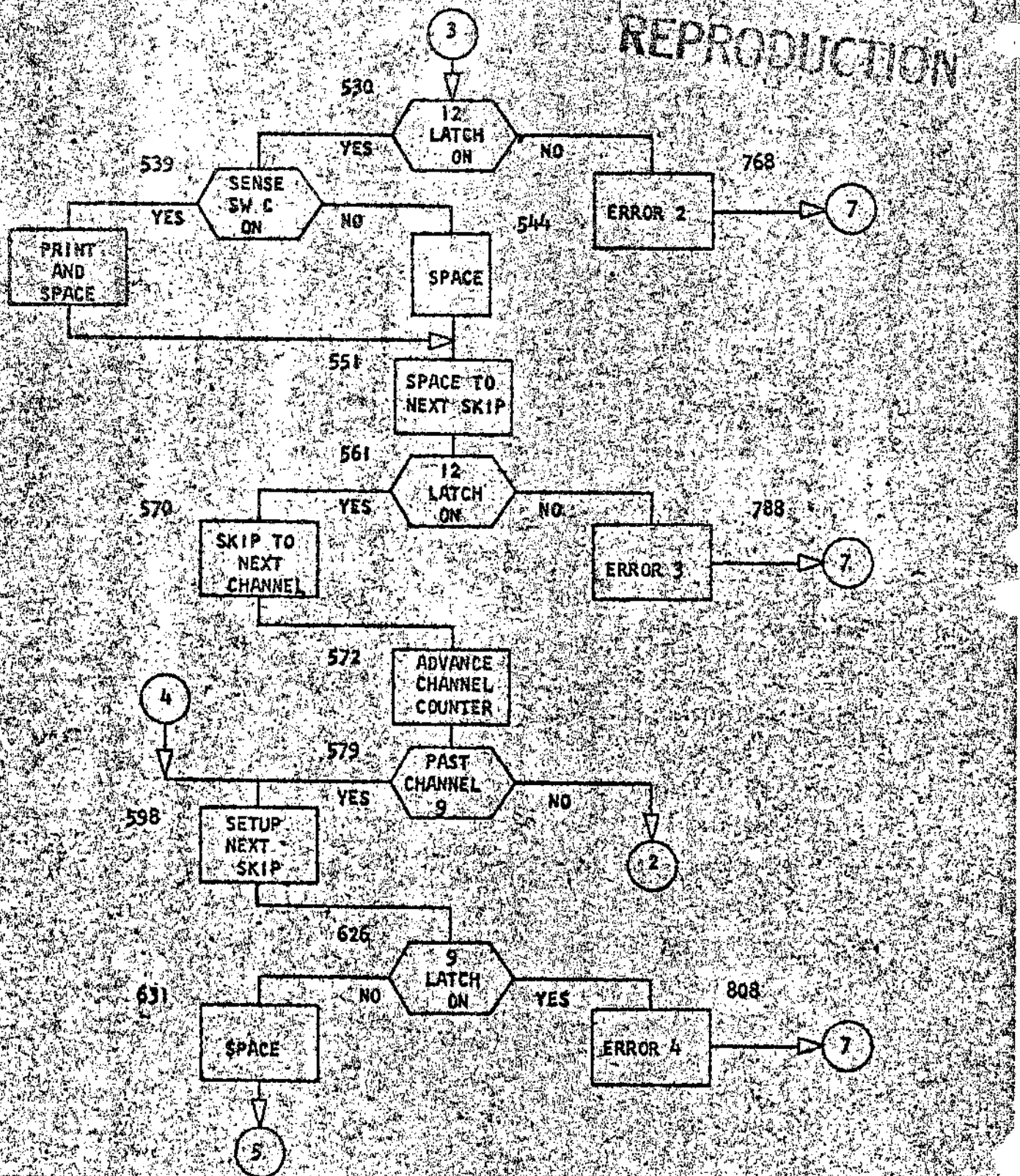
LINE	HOLE	LINE	HOLE	LINE	HOLE
1	1	33	5	65	9
2	9	34	12	66	12
9	2	41	6	73	10
10	9	42	12	74	9
17	3	49	7	81	11
18	9	50	12	82	9
25	4	57	8	89	12
26	12	58	12	90	9

SPLICE TAPE SO THE 0 AND 96 COINCIDE.

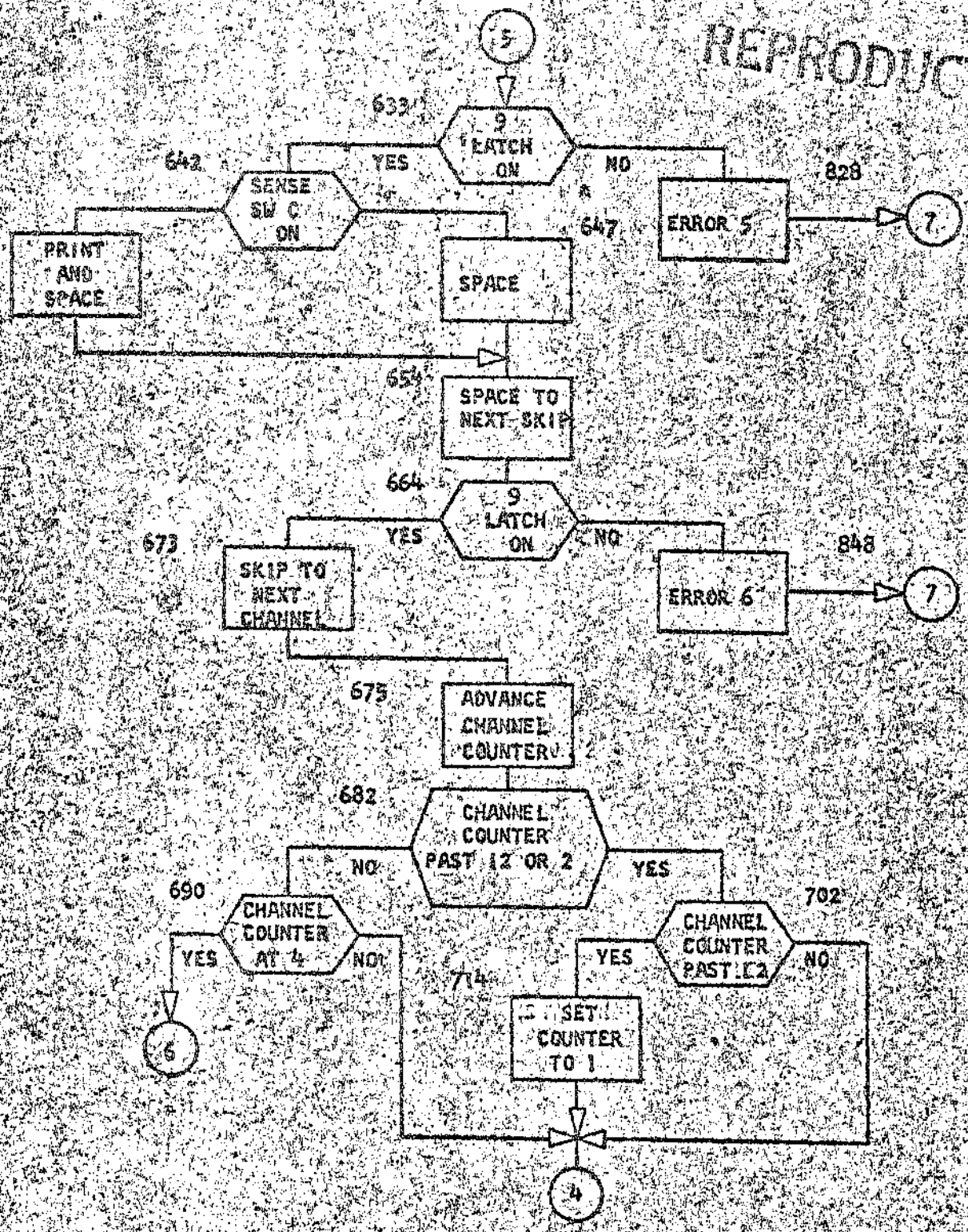
DATE	5-15-62	4-25-63	25.6.63					
ENG. CHG. NO.	111235	116745A	TA 1844A					



DATE	5-15-62	4-25-63	25.6.63					
ENG. CHG. NO.	115283	1167454	TA 18444					



DATE	5-15-62	4-25-63	25.6.63					
ENG. CNG. NO.	115283	116745A	TA 1844A					

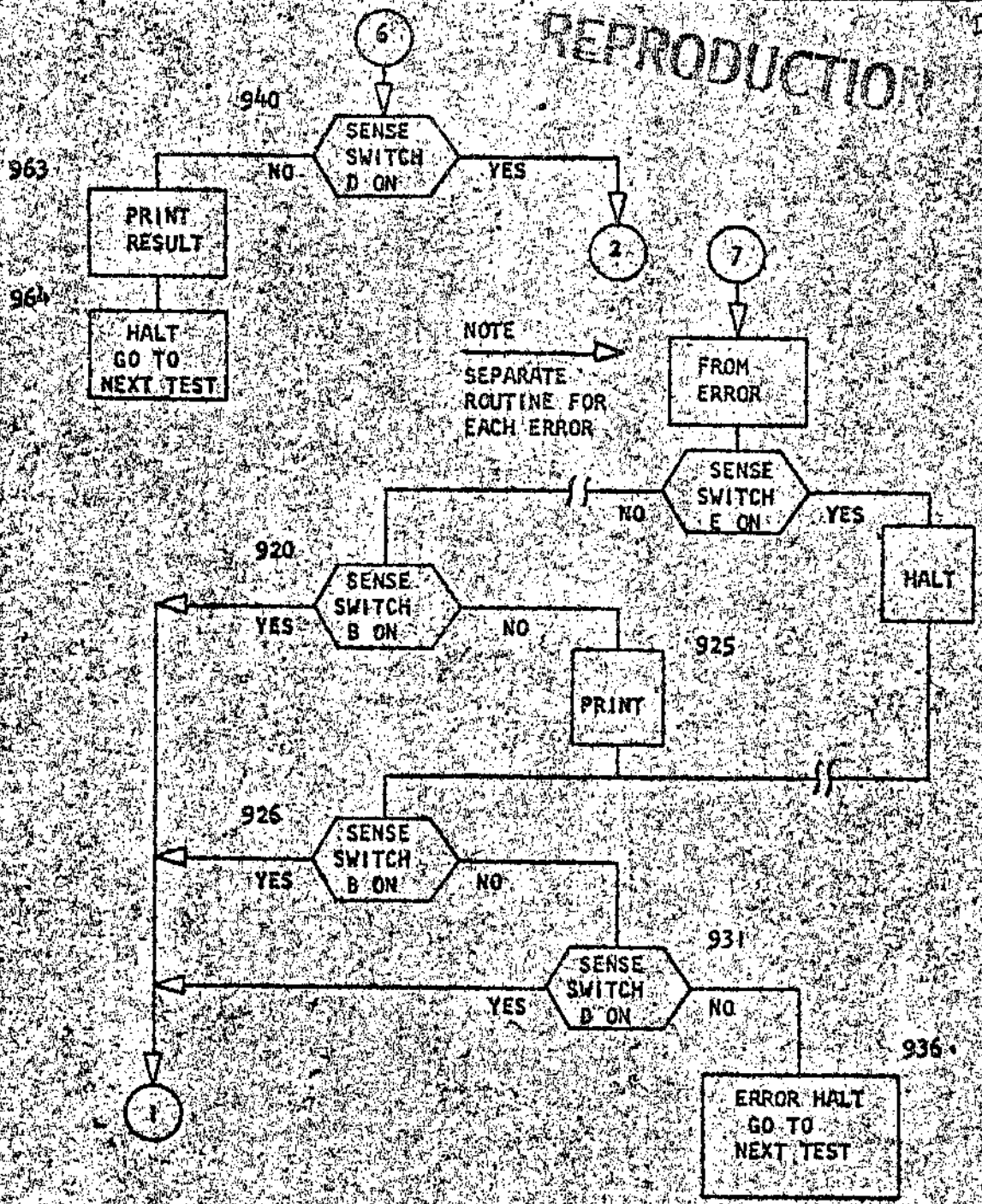


DATE	5-15-62	4-25-63	25.6.63					
ENG. CHG. NO.	115283	116745A	TA 1844-A					

IBM FORM 024-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451926
SHEET 8 OF 13
BLOCK NO. 2005A



DATE	5-15-62	4-25-63	25.6.63					
ENG. CNG. NO.	115283	116745A	TA 1844A					

PROGRAM LISTING FOR USE WITH FLOW CHART

* SINGLE LINE SKIP TEST 2005A

INSTRUCTION ADDRESS	OP	A	B		REMARKS
000	000	I	NIT	IAL	ERROR LATCHES FAILED OR CARRIAGE DID NOT GO TO FOUR
141	141	M	140	299	INITIAL ERROR
140	140	B	157	E	GO TO INITIAL ERROR HALT
156	156	B	420		GO TO SW B
157	157	B	926		GO TO SW B
160	160				WORD MARK
323	377	B	389	$551	USE WHEN TESTS ARE RUN FROM TAPE
386	386	B	568		USE WHEN TESTS ARE RUN FROM TAPE
389	389	N	000		USE WHEN TESTS ARE RUN FROM TAPE
390	390	M	360	392	USE WHEN TESTS ARE RUN FROM TAPE
400	400	/	332		START TEST
405	405	✓			CLEAR PRINT AREA
405	405	B	500	$521	TITLE PRINT
412	413	✓	080		
417	417	&	421		HALT TO CHANGE CARRIAGE TAPE
421	421	B	968		GO TO INITIAL SETUP
425	425	F	4		START AT CHANNEL 4
427	427	✓	332		CLEAR PRINT AREA
431	431	✓			
432	432	B	141	9	INITIAL ERROR
437	437	B	141	2	INITIAL ERROR
442	442	M	430	259	12 LATCH TO PRINT AREA
440	449	L	440	220	04 CHANNEL TO PRINT AREA
456	456	M	471	293	TYPE OF ERROR TO PRINT AREA
463	463	M	487	250	SINGLE LINE SKIP TO PRINT AREA
470	470	L	739	735	SET UP CHANNEL COUNTER
477	477	B	481		GO TO 12 LATCH TEST
481	481	M	450	230	CHANNEL TESTED OK-TO PRINT AREA
488	488	M	734	212	XX TO IDENTIFY CHANNEL
495	495	M	734	513	BUILD ADDRESS FROM CHANNEL COUNTER
502	502	M	908	510	9XX IS TABLE ADDRESS
509	509	M	9XX	571	*SETUP NEXT SKIP INSTRUCTION FROM TABLE
516	516	M	424	253	12 TO IDENTIFY LATCH
525	525	B	748	a	ERROR #1
528	528	F	J		SPACE TO 12 LATCH
530	530	B	539	a	NO ERROR
535	535	B	748		ERROR #2
539	539	B	550	C	GO TO PRINT
545	545	F	J		SPACE OUT OF 12
546	546	B	651		NO PRINT
550	550	2			PRINT AND SPACE OUT OF 12
551	551	F	J		SPACE

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ENG. CHG. NO.	115283	116745A	TA 1844-A						

```
 558  558  F J                    SPACE
 565  565  F J                    SPACE
 552  552  F J                    SPACE
 559  559  F J                    SPACE
 561  561  B 570 A                NO ERROR
 566  566  B 788                  ERROR #3
 570  570  F X                    *SINGLE LINE SKIP TO NEXT CHANNEL
 572  572  A 743  735             ADD TO CHANNEL COUNTER
 579  579  B 591  7340            CONTROL-GO TO 9 LATCH TEST
 587  587  B 461                  GO BACK TO 12 TEST
 593  593  M 734  212             XX TO IDENTIFY CHANNEL
 598  598  M 734  616             BUILD ADDRESS FROM CHANNEL COUNTER
 605  605  M 908  613             9XX IS TABLE ADDRESS
 612  612  M 9XX  674             *SET UP NEXT SKIP INSTRUCTION FROM TABLE
 619  619  M 422  253             9 TO IDENTIFY LATCH
 626  626  B 808  9               ERROR #4
 631  631  F J                    SPACE TO 9 LATCH
 635  635  B 642  9               NO ERROR
 636  636  B 828                  ERROR #5
 642  642  B 652  C               GO TO PRINT
 647  647  F J                    SPACE OUT OF 9
 649  649  B 654                  NO PRINT
 653  653  2                      PRINT AND SPACE OUT OF 9
 654  654  F J                    SPACE
 656  656  F J                    SPACE
 658  658  F J                    SPACE
 660  660  F J                    SPACE
 662  662  F J                    SPACE
 665  665  B 673  9               NO ERROR
 669  669  B 848                  ERROR #6
 673  673  F X                    *SINGLE LINE SKIP TO NEXT CHANNEL
 675  675  A 743  735             ADD TO CHANNEL COUNTER
 682  682  B 702  7343            CONTROL-PAST 2 OR 12 - TEST
 690  690  B 940  7344            AT 4 GO TO END ROUTINE
 698  698  B 591                  GO BACK TO 9 LATCH TEST
 702  702  B 714  7331            PAST 12 - RESET CHANNEL CTR TO ONE
 710  710  B 591                  GO BACK TO 9 LATCH TEST
 715  715  A 747  735             ADD 88 TO CHANNEL COUNTER
 721  721  M 909  732             SUPPRESS CARRY
 728  728  B 591                  GO BACK TO 9 LATCH TEST
 736  736  0 040                  CHANNEL COUNTER RESET VALUE
 740  740  0 010                  CHANNEL COUNTER INCREMENT
 744  744  0 888                  CHANNEL COUNTER RESET TO ONE
 748  748  M 912  296             ERROR #1
 755  755  B 764  E               GO TO HALT FOR ERROR #1
 760  760  B 913                  GO TO SW B
 764  764  . 926                  GO TO SW B
 768  768  M 901  294             ERROR #2
 775  775  B 784  E               GO TO HALT FOR ERROR #2
 780  780  B 913                  GO TO SW B
 784  784  . 926                  GO TO SW B
```

DATE	5-15-62	4-25-63	25.6.63					
ENG. CHG. NO.	115283	116745A	TA-1844A					

```
 784  784  N 903  296      ERROR #3
 795  795  B 804  E       GO TO HALT FOR ERROR #3
 809  809  B 918           GO TO SW B
 804  804  . 926           GO TO SW B
 808  808  N 903  294      ERROR #4
 815  815  B 824  E       GO TO HALT FOR ERROR #4
 820  820  B 918           GO TO SW B
 824  824  . 926           GO TO SW B
 828  828  N 804  295      ERROR #5
 835  835  B 844  E       GO TO HALT FOR ERROR #5
 840  840  B 918           GO TO SW B
 844  844  . 926           GO TO SW B
 848  848  N 905  276      ERROR #6
 855  855  B 864  E       GO TO HALT FOR ERROR #6
 860  860  B 918           GO TO SW B
 864  864  . 926           GO TO SW B
 868  868                  WORD MARK
 901  901  1               THIS IS A TABLE TO BE
 902  902  2               USED TO DETERMINE THE
 903  903  3               NEXT SINGLE LINE SKIP
 904  904  4               THE TABLE IS CONSTRUCTED
 905  905  5               FROM THE VALUE IN THE
 906  906  7               CHANNEL COUNTER TO WHICH
 907  907  8               IS ADDED THE PREFIX 9
 908  908  9               TABLE
 909  909  0               TABLE
 910  910  1               TABLE
 911  911  2               TABLE
 912  912  1               TABLE
 913  913  N 909  230      MODIFY REMARKS FOR ERROR
 920  920  B 421  8       LOOP ON ERROR DO NOT PRINT
 925  925  2               PRINT ERROR
 926  926  B 421  8       RESTART ON ERROR  DO NOT PRINT
 931  931  B 421  D       RESTART WITH OR WITHOUT PRINTING
 936  936  . 348           ERROR  FINAL HALT
 940  940  B 481  D       LOOP WITH OR WITHOUT PRINTING
 945  945  / 280           CLEAR PRINT AREA
 949  949  M 401  299      PLACE NO ERROR IN PRINT AREA
 956  956  M 458  270      END OF TEST TO PRINT AREA
 963  963  1               PRINT
 964  964  . 348           CORRECT OPERATION  FINAL HALT
 968  968  S 3             MAKE INITIAL SETUP
 970  970  F J
 972  972  F J
 974  974  F J
 976  976  F J
 978  978  F J
 980  980  F J
 982  982  F J
 984  984  @ 425
 988  988
```

*AN ASTERISK MEANS INSTRUCTIONS CHANGE

DATE	5-15-62	4-25-63	25.6.63					
ENG. ORD. NO.	115283	116745A	CA-1844A					

```
1023  #21  0 9
1023  #23  1 2 L ATCH
1031  #31  0 4 C HANNEL TESTED OK
1053  #51  E ND  TEST
1059  #59  T YPE  OF ERROR
1072  #72  S ING LE LINE SKIP
2008  #08  N ONE
```

DATE	5-15-62	4-25-63	25.6.63					
ENG. CHG. NO.	115283	116745A	TA-1844-A					

IBM

1401 DATA PROCESSING SYSTEM

DIAGNOSTIC FUNCTION TEST

PART NO. 451926
SHEET 13 OF 13
BLOCK NO. 2005A

TABLE OF UNPRINTABLE CHARACTERS

```
LP-LEFT PARENTHESIS   12 5 8    SE-SEMICOLON 11 6 8      DE-DELTA      12 7 8
WS-WORD SEPARATOR      0 5 8    LT-LESS THAN 12 6 8      PZ-PLUS ZERO  12 0
TS-TAPE SEGMENT MARK   0 7 8    GT-GREATER THAN 6 8      TM-TAPE MARK   7 8
GM-GROUP MARK         12 7 8    MZ-MINUS ZERO  11 0      CO-COLON       5 8
RP-RIGHT PARENTHESIS  11 5 8    AP-APOSTROPHE 0 6 8

,008016,022029,033033N         1001                  SINGLE LINE SKIP TEST    2005A00A
,008015,022029,033033N         1001                  SET WORDMARK CARD        2005A 02
L072119,082082,082082,0820821001   INITIAL ERROR LATCHES FAILED OR CARRIA2005A 03
L069156,120120,141148,153157I001GE DID NOT GO TO FOURM1402998157E8920     2005A 04
L072196,161161,161161,1611611001.926                                      2005A 05
L068367,340344,348349,3573611001,008012,0011001183610B0AB421/340080       2005A 06
L069404,377385,389393,4004041001             E389SS518S88N000M360392/332/ 2005A 07
L059431,413413,421425,4274311001BS009521/060.4218968F4/332/               2005A 08
L070469,457442,449456,4534701001814198I412M#30259L#40220M#71293M#87250    2005A 09
L071508,477481,480495,5025091001L739735848IM#50230M734212M734512M908610   2005A 10
L067543,516523,528530,5355391001M9XX571M#2425387408FJ85398B76B8550C       2005A 11
L047558,546550,551553,5555571001FJ85512FJFJFJFJ                           2005A 12
L064590,561568,570572,5795871001FJ857028789FXA743735859173408481          2005A 13
L072630,598605,612619,6266311001M734212M734615M908613M9XX674M#22253880892005A 14
L058653,633638,642647,6496531001FJ8642988288653CFJ86542                   2005A 15
L061672,656658,660662,6646691001FJFJFJFJFJ867398848                       2005A 16
L089709,675682,690678,7027101001FXA7437358702734389407344859187147331     2005A 17
L070747,714721,728736,7407441001859IA7477735M909732859I    004000100880   2005A 18
L068783,756760,764768,7757801001M9122968784E8913.926M9012968784E8913      2005A 19
L068819,788795,800804,8088151001.926M9022968804E8913.926M903296882AE      2005A 20
L062854,824828,835840,8448481001B913.926M9042968844E8913.926M905296       2005A 21
L072894,960864,868868,8688681001B864E8913.926                             2005A 22
L042904,895895,901902,9039041001          2345                            2005A 23
L039911,906907,908909,9109111001678900#2                                  2005A 24
L060939,913920,925926,9319381001IM989230842182842I884210.348              2005A 25
L062969,945949,956963,9849681001B481D/280M#91299M#582702.348F3            2005A 26
L046983,972974,976978,9809821001FJFJFJFJFJFJFJ                            2005A 27
L073#22,988#21,#23#28,#23#231001B425                                   09 2005A 28
L068#58,#31#51,#59#59,#59#591001I2 LATCH04 CHANNEL TESTED OKEND TEST      2005A 29
L072#98,#72#88,#88#88,#88#881001TYPE OF ERRORSINGLE LINE SKIPNONE         2005A 30
L057524,501505,512513,5175181001 2.049L0772772/2772N000000                2005A 31
L052544,529536,537561,5455451001N000N000000NN0002413                      2005A 32
#333080N                                             CLEAR WORDMARK CARD  2005A 33
,039027,037,038042803IT98G8400L04635284048S88  SINGLE LINE SKIP TEST      2005A 34
```

DATE	5-15-62	4-25-63	25.6.63							
ENG. CHG. NO.	115283	116745A	B.184.. A							

FORMS SKIPPING 2010B

A. PURPOSE.

1. TEST SKIPS TO ALL CHANNELS USING 6, 14 AND 22 SPACES.
2. TEST NO-LINE SKIPS.
3. TEST SINGLE ITEM EJECT.

B. LOADING PROCEDURES:

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY. THE PROGRAM WILL COME TO A HALT, LOCATION 421, AFTER THE TITLE PRINT ROUTINE TO ALLOW OPERATOR TO INSTALL THE CARRIAGE TAPE. THE TEST NOW CAN BE STARTED BY PRESSING THE START KEY. WHEN RUNNING TEST FROM TAPE ENTER A 1 IN 1255.

TO TEST LOW SPEED SKIP

1. SETUP TO RESTART AT LOCATION 421.
2. ADDRESS STOP ON LOCATION 571.
3. OBSERVE HIGH SPEED LIGHT.
4. PRESS START KEY ON PRINTER.

THE FIRST SKIP WILL BE AN INITIAL SKIP TO 4. THEN 12 SINGLE SKIPS WILL OCCUR, 6 SPACES PER SKIP.

TO TEST HIGH SPEED SKIP

1. START WITH TRIPLE SKIPS, 22 SPACES PER SKIP, BY PLACING AN 8 IN LOCATION 451.
2. SETUP TO RESTART AT LOCATION 421.
3. ADDRESS STOP ON LOCATION 571.
4. OBSERVE HIGH SPEED LIGHT.
5. PRESS START KEY ON THE PRINTER.

THE FIRST SKIP WILL BE AN INITIAL SKIP TO 4. THEN 4 TRIPLE SKIPS WILL OCCUR FOLLOWED BY A SINGLE SKIP. NEXT 4 MORE TRIPLE SKIPS WILL OCCUR FOLLOWED BY A SINGLE SKIP. LAST 4 TRIPLE SKIPS WILL OCCUR FOLLOWED BY THE PRINTING OF THE END OF TEST.

DATE	2-2-61	5-15-62	27762					
ENG. CHG. NO.	110379	115283	1459		✓			

B. (CONTINUED)

TO TEST SINGLE ITEM EJECT. I.E. SKIP FROM CHANNEL TO SAME CHANNEL AFTER PRINT.

1. ENTER NO-OP IN LOCATION 1165.

2. CHANGE NO-OP INSTRUCTION IN 580 TO A BRANCH OP, AND CHANGE THE A-FIELD TO 563.

3. ENTER A C-BIT IN 577 TO ALLOW PRINTING ON SKIP AFTER PRINT.

4. SET SENSE SWITCH C TO OFF.

5. SET UP TRIPLE SKIPS. START FROM CHANNEL 4 AS THIS IS WHERE TEST NORMALLY STARTS. THE FIRST SKIP WILL BE AN INITIAL SKIP TO 4. THE SECOND SKIP WILL BE A TRIPLE SKIP TO CHANNEL 7. ALL FOLLOWING SKIPS SHOULD BE SINGLE ITEM EJECTS TO CHANNEL 7.

6. ADDRESS STOP ON LOCATION 571.

7. SET UP TO RESTART AT LOCATION 421.

8. PRESS START KEY ON THE PRINTER.

CORRECT OPERATION------ONE LINE WILL PRINT, THEN THE CARRIAGE WILL SINGLE ITEM EJECT.

IF TWO LINES PRINT, SUSPECT THE RESET OF THE CHANNEL REGISTER. THIS RESET MAY BE CHECKED BY.

A. CHANGING THE A-FIELD ADDRESS OF THE BRANCH OP IN 580 TO 578.

B. SETTING UP A RESTART AT LOCATION 563.

C. PLACING MODE SWITCH IN RUN.

D. DEPRESSING START KEY.

E. SYNC SCOPE ON SPACE SKIP GATE.

F. SCOPING RESET OF CHANNEL REGISTER.

C. <u>PROGRAM CONTROL</u>

1. CHECKING PROCEDURE:

WITH SENSE SWITCHES B AND E BOTH OFF, ERRORS WILL PRINT OUT. SWITCH D MAY BE USED TO LOOP PROGRAM.

C. (CONTINUED)

WITH SENSE SWITCH B ON AND E OFF, ERRORS WILL NOT PRINT. THE PROGRAM WILL LOOP WITHOUT A HALT. THE CARRIAGE CAN BE DISENGAGED OR THE PAPER REMOVED.

WITH SENSE SWITCH B ON AND E ON, ERRORS WILL NOT PRINT. THE PROGRAM HALTS AT THE PARTICULAR ERROR STOP. THE CARRIAGE LOCATION MAY BE EXAMINED, AND THE PROGRAM WILL LOOP WHEN THE START KEY IS DEPRESSED.

2. SENSE SWITCHES:

B ON	LOOPS PROGRAM WHEN ERROR OCCURS WITHOUT PRINTING ERRORS
B OFF	ALLOWS ERRORS TO PRINT DEPENDENT ON SENSE SWITCH E.
C ON	CAUSES CORRECT OPERATION TO PRINT OUT
C OFF	PREVENTS CORRECT OPERATION FROM PRINTING
D ON	LOOPS PROGRAM
D OFF	ALLOWS PROGRAM TO END WHEN ERRORS DO NOT OCCUR
E ON	CAUSES PROGRAM TO HALT ON ERROR
E OFF	ALLOWS ERRORS TO PRINT IF SENSE SWITCH B IS OFF
F	USED WHEN TEST IS RUN FROM TAPE -- MAGNETIC

D. TEST PROCEDURE:

THE CARRIAGE SKIPS TO 4, AND THE FIRST SKIP OF THE TEST IS SET-UP, A SKIP TO 5. THIS IS DONE BY SETTING THE LOOP COUNTER TO 2 AND THEN ADVANCING BOTH THE LOOP COUNTER AND THE CHANNEL COUNTER. THEN THE LOOP COUNTER IS TESTED FOR A VALUE OF 3. THE 3 SIGNIFIES IT IS TIME TO SET-UP AND EXECUTE THE SKIP. THE VALUE IN THE CHANNEL COUNTER IS USED TO SET UP TWO ADDRESSES IN TWO TABLES. ONE TABLE GIVES THE VALUE OF THE NEXT SKIP. THE OTHER TABLE GIVES THE LATCH, 9 OR 12, THAT IS USED TO CHECK FOR CORRECT OPERATION OF THE TEST. THE PROGRAM IS SET UP FROM THE TABLE ADDRESSES, AND THE TEST IS EXECUTED. THE PROGRAM COUNTER IS ADVANCED. THE APPROPRIATE LATCH, 9 OR 12, IS USED TO CHECK THE OPERATION AND IS CHECKED FOR AN OFF CONDITION. A SPACE IS TAKEN, AND THE LATCH IS CHECKED FOR AN ON CONDITION. THESE CONDITIONS REPRESENT CORRECT OPERATION. THE PROGRAM COUNTER IS USED TO CONTROL THE TYPE OF SKIP TAKEN AS TO LENGTH OF SKIP. THE PROGRAM STARTS WITH SKIPS FROM ONE CHANNEL TO THE NEXT. THEN SKIPS ARE TAKEN FROM CHANNEL TO THE SECOND FOLLOWING CHANNEL. LASTLY, SKIPS ARE TAKEN FROM CHANNEL TO THE THIRD FOLLOWING CHANNEL. FOR CONVENIENCE OF REFERENCE THESE SKIPS ARE REFERRED TO AS SINGLE SKIPS, DOUBLE SKIPS, OR TRIPLE SKIPS. THE LOOP COUNTER IS RESET TO 2 TO CAUSE SINGLE SKIPS. IT IS RESET TO 1 TO CAUSE DOUBLE SKIPS. IT IS RESET TO 0 TO CAUSE TRIPLE SKIPS. IF THE LOOP COUNTER IS NOT AT 3 A BRANCH TO THE ADVANCE OF THE LOOP AND CHANNEL COUNTER IS TAKEN. IF THE LOOP COUNTER IS AT 3 A BRANCH IS TAKEN TO THE EXECUTION OF THE PROGRAM.

D. (CONTINUED)

A NO-OP MUST BE MANUALLY ENTERED INTO LOCATION 1165 TO CAUSE SKIPS AFTER PRINT. THIS WILL CAUSE AN A-BIT AND A B-BIT TO BE PLACED IN THE D-CHARACTER OF THE SKIP INSTRUCTION SET UP FROM THE TABLE AND RESULTS IN THE SKIP-AFTER PRINT. MANUALLY CHANGE THE NO-OP IN LOCATION 580 TO A BRANCH OP AND CHANGE THE A-FIELD ADDRESS TO 563 TO CAUSE SINGLE ITEM EJECT.

SHOULD AND ERROR OCCUR, THE MACHINE WILL EITHER PRINT OUT THE ERROR OR COME TO AN ERROR HALT. IF SENSE SWITCH B IS NOT ON PRESSING THE START KEY WILL CAUSE THE PROGRAM TO CONTINUE. SENSE SWITCH B ON WILL CAUSE THE PROGRAM TO RESTART. WHEN THE TEST ENDS THE PROGRAM HALTS. THE CARRIAGE TAPE MAY BE CHANGED AT THIS TIME.

THE PRINT-OUT WILL STATE EITHER --END OF TEST TYPE OF ERROR NONE--, OR IT WILL STATE --COUNT OF ERROR XXXX --, WHERE XXXX REPRESENTS THE ACTUAL NUMBER OF ERRORS COUNTED BEFORE THE TEST IS ALLOWED TO END. LOOPING THE TEST WILL BUILD UP THE ERROR COUNT. ONCE AN ERROR COUNT HAS PRINTED IT IS AUTOMATICALLY RESET. IF THE TEST IS RE-RUN ERROR FREE, THE FIRST STATEMENT WILL PRINT.

E. STOPS

STOR ADDR REGISTER		ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON
421		INSTALL CARRIAGE TAPE AND DEPRESS START.
796		PROGRAM WILL STOP HERE ON ANY ERROR IF PROGRAM IS NOT LOOPED.
1087	ERROR #1	LATCH WAS ON AT CHANNEL. LATCH SHOULD HAVE BEEN RESET BY THE CHANNEL HOLE.
1124	ERROR #2	LATCH DID NOT COME ON WHEN CARRIAGE SPACED OUT OF THE CHANNEL INTO THE 9 OR 12 CHANNEL.
1165		END OF TEST - NO ERRORS, DEPRESS START TO CONTINUE TO NEXT TEST.

F. PRINTOUTS

CORRECT PRINTOUTS WITH SENSE SWITCH C ON

003 CHANNEL TESTED OK SINGLE SKIP TEST 09 LATCH TYPE OF ERROR

008 CHANNEL TESTED OK DOUBLE SKIP TEST 12 LATCH TYPE OF ERROR

ETC. FOR ALL CHANNELS

END TEST TYPE OF ERROR NONE

ERROR PRINTOUTS WITH SENSE SWITCH E OFF

010 CHANNEL TESTED DOUBLE SKIP TEST 09 LATCH TYPE OF ERROR 1

007 CHANNEL TESTED TRIPLE SKIP TEST 12 LATCH TYPE OF ERROR 2

ETC. FOR ALL CHANNELS AND ERROR CONDITIONS.

END TEST COUNT OF ERROR 0004

G. COMMENTS

ESSENTIALLY THE CARRIAGE TAPE IS PUNCHED EVERY 8 SPACES. EACH CHANNEL PUNCH IS FOLLOWED WITH A 9 OR 12 PUNCH FOR CHECKING CORRECT OPERATION.

THIS IS THE SAME CARRIAGE TEST TAPE AS USED WITH TEST 2000C, 2005A, AND 2020C.

THE CARRIAGE TEST TAPE IS PUNCHED AS FOLLOWS:

LINE	HOLE	LINE	HOLE	LINE	HOLE
1	1	33	5	65	9
2	9	34	12	66	12
9	2	41	6	73	10
10	9	42	12	74	9
17	3	49	7	81	11
18	9	50	12	82	9
25	4	57	8	89	12
26	12	58	12	90	9

SPLICE TAPE SO THE 0 AND 96 COINCIDE.

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G. (CONTINUED)

----- SERVICE AIDS -----

LOCATION	INSTRUCTION	
181	B 584 853 3	CHANGE TEST CHARACTER OF BRANCH ON CHARACTER EQUAL TO VARY DELAY.
421	F4	TO START FROM DIFFERENT CHANNEL, ENTER D-CHARACTER VALUE OF IMMEDIATE SKIP IN 422. ALSO ENTER CHANNEL NUMBERS IN 818 -- TENS, AND 819 -- UNITS. AVOID USE OF 9 AND 12 UNLESS A TAPE HAS BEEN PUNCHED FOR THE PARTICULAR PROBLEM.
449	L 840 844	TO START WITH DOUBLE SKIPS, CHANGE THE CARACTER VALUE IN 451 TO A 7. THIS WILL START THE PROGRAM COUNTER AT 12. TO START WITH TRIPLE SKIPS, CHANGE THE CHARACTER VALUE IN 451 TO AN 8. THIS WILL START THE PROGRAM COUNTER AT 25.
563	L 575 579	THIS SETS UP A NO-LINE SKIP. IF A NO-LINE SKIP FAILURE IS SUSPECTED CHANGE A-FIELD ADDRESS TO 546, AND ENTER A BRANCH OP IN 580 TO GO TO THE DELAY COUNTER. IF TROUBLE DISAPPEARS, THE PROBLEM IS PROBABLY WITH THE E-I BRUSH DELAY. ON BUFFERED MACHINES AND IMMEDIATE SKIPS, CHANGE A-FIELD ADDRESS TO 546 TO TEST THE EFFECTIVENESS OF BRANCH ON CHANNEL 9 OR 12 AS AN INTERLOCK. FAILURE SHOULD NOT OCCUR EVEN THOUGH LOCATION 580 HAS A NO-OP. INSTRUCTIONS... B XXX 9 AND B XXX @ SHOULD INTERLOCK AFTER FORMS OP.
576	2 ⌘	TO PRINT INFORMATION ON THE PRINT OPERATION OF SKIP AFTER PRINT, ENTER C-BIT IN LOCATION 577.
580	N 181	ON ALL SKIPS WITH A NON-BUFFERED MACHINE, IF FORMS OP DOES NOT INTERLOCK, ENTER A BRANCH OP IN 580 AND SEE IF TROUBLE DISAPPEARS. ON BUFFERED MACHINES AND SKIP AFTER PRINT IF THE FORMS OP IN LOCATION 578 DOES NOT INTERLOCK ENTER A BRANCH OP IN 580 AND SEE IF THE TROUBLE DISAPPEARS. THIS WOULD PROBABLY SHOW UP AS ERROR #2 ON ERROR PRINT.
612	A 828 844	TO PREVENT ADVANCE OF THE PROGRAM, I.E. TO STAY IN ONE TYPE OF SKIP, ENTER A NO-OP INSTRUCTION IN LOCATION 612.
817	0040	ALWAYS CHANGE CHANNEL COUNTER VALUE TO AGREE WITH CHANNEL CALLED FOR BY THE D-CHARACTER OF FORMS OP IN 422-TENS IN 818, UNITS IN 819.
1165	B /87	TO CAUSE SKIPS AFTER PRINT INSTEAD OF IMMEDIATE SKIPS, ENTER A NO-OP IN 1165.

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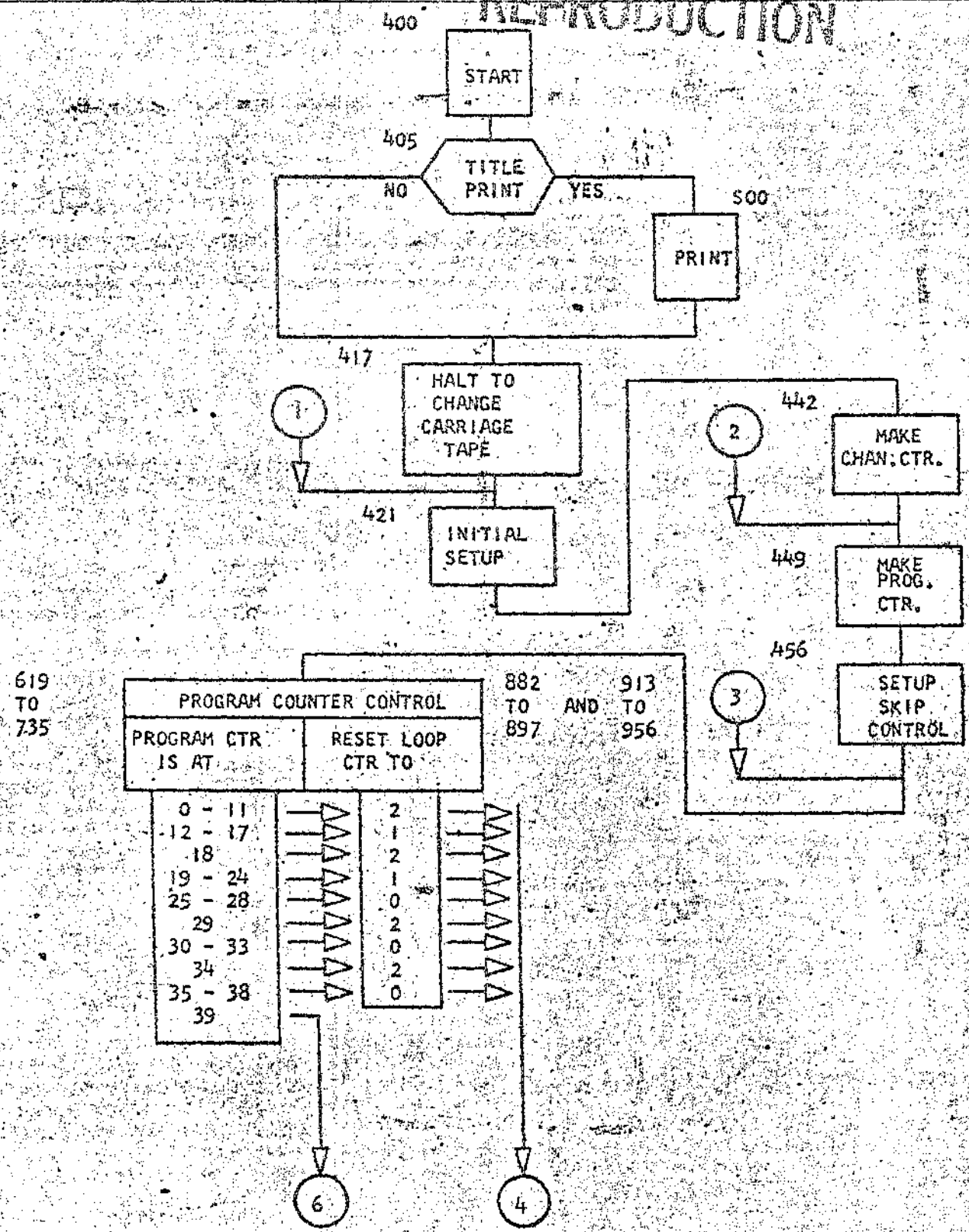

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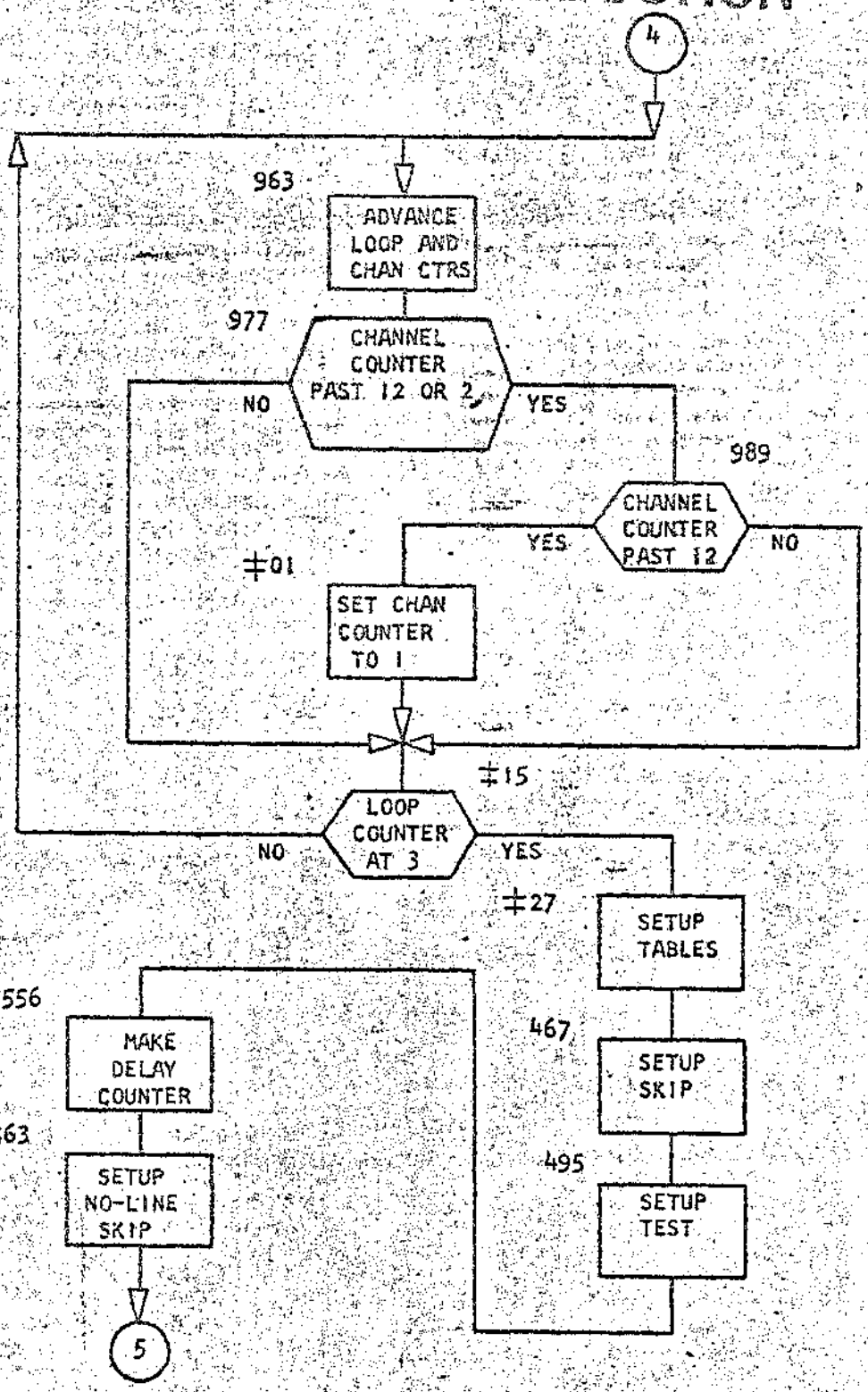

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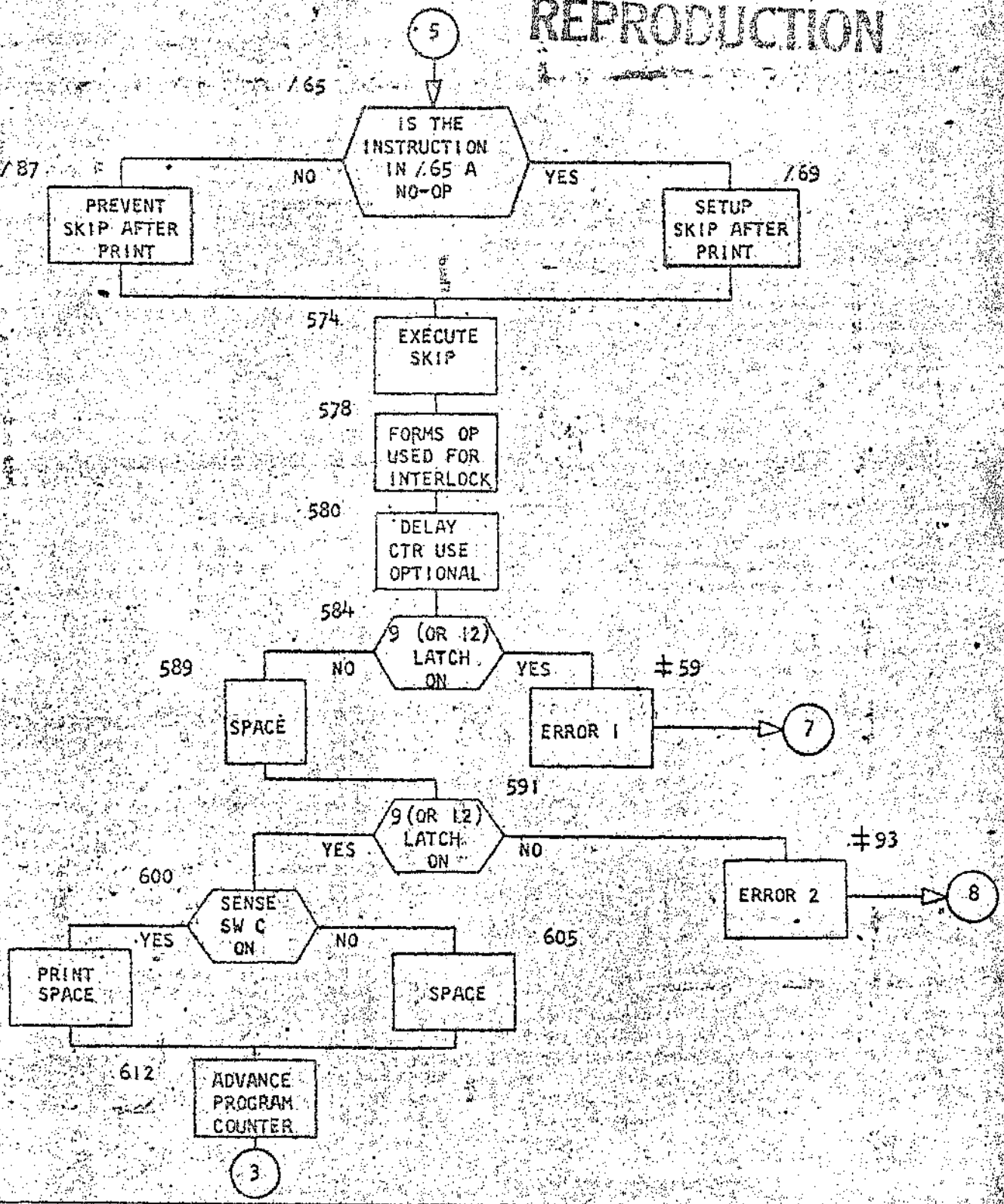

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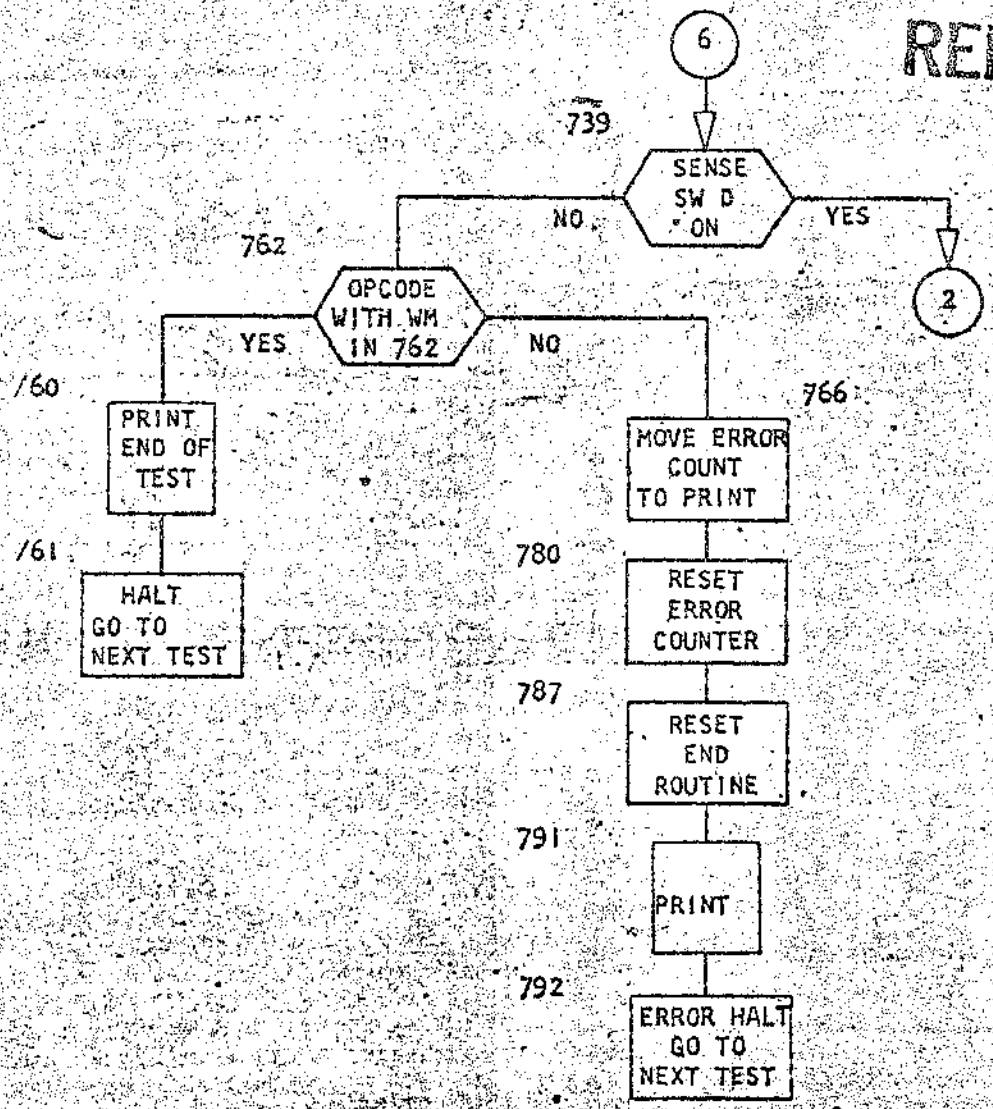
DIAGNOSTIC FUNCTION TEST



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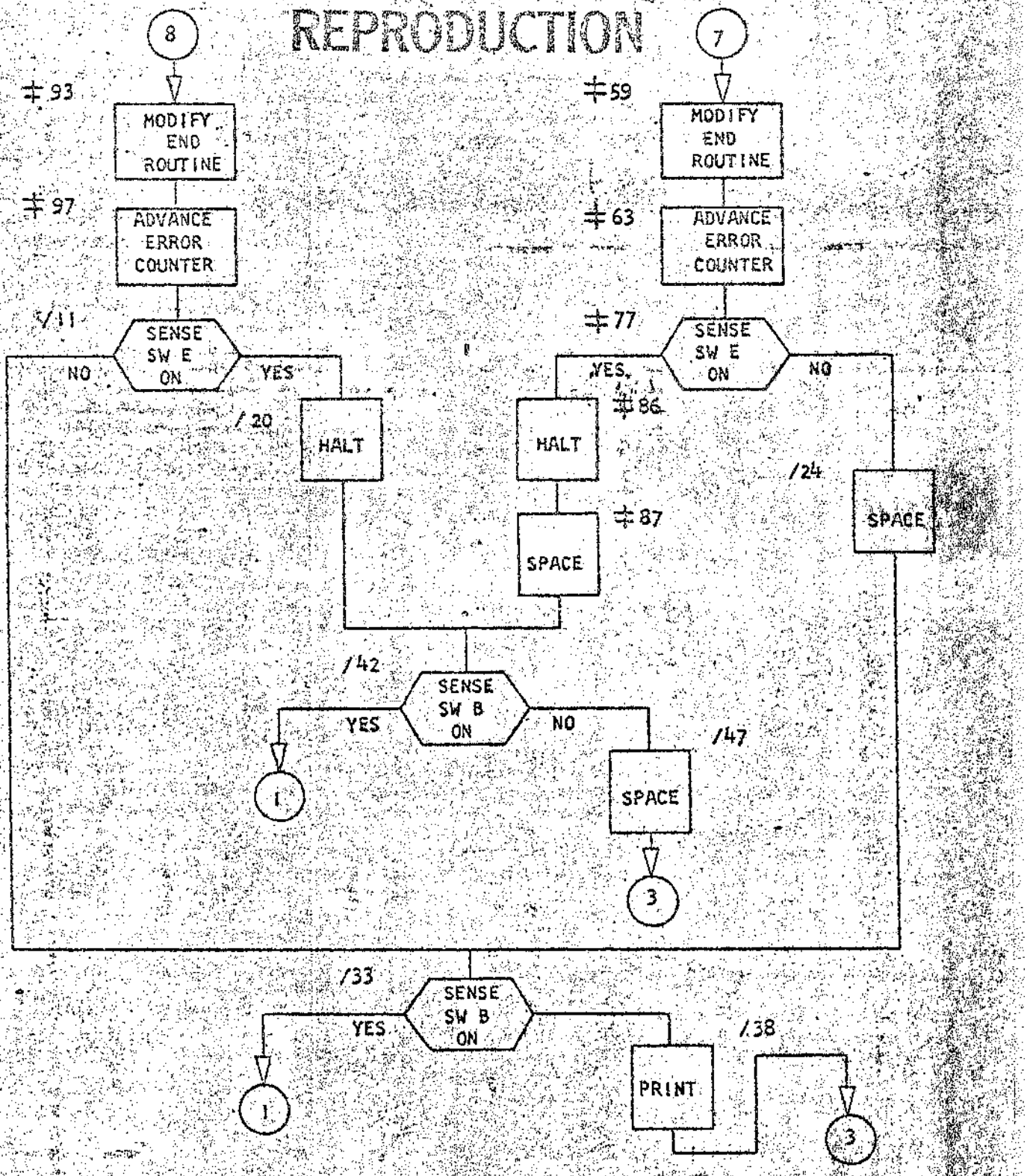
REPRODUCTION



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PROGRAM LISTING FOR USE WITH FLOW CHART

FORMS SKIPPING 20108

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	T	YPE	OF ERROR	
095	095		NON	E	
100	100	E	ND	TEST	
108	108	S	KIP	TEST LATCH	
126	126	C	HAN	NEL TESTED OK	
143	143	C	OUN	T	*AN ASTERISK MEANS INSTRUCTIONS CHANGE
148	148	T	RIP	LE	
154	154	D	OUB	LE	C FOR T A IS CHANGE FOR TROUBLE ANALYSIS
160	160	S	ING	LE	AND MEANS THAT INSTRUCTION CAN BE
168	168	0	9		CHANGED TO ANALYZE TROUBLE
170	170	1	2		
181	181	B	584	8533	TEST FOR END OF DELAY C FOR T A
189	189	A	828	858	CREATE DELAY
196	196	B	181		CREATE DELAY
377	377	B	389	S551	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		USE WHEN TESTS ARE RUN FROM TAPE
389	389	N	000		USE WHEN TESTS ARE RUN FROM TAPE
393	393	M	360	392	USE WHEN TESTS ARE RUN FROM TAPE
400	400	/	332		START TEST
404	404	/			CLEAR PRINT AREA
405	405	B	S00	S521	TITLE PRINT
413	413	/	080		
417	417	.	421		HALT CHANGE CARRIAGE TAPE
421	421	F	4		INITIAL SETUP C FOR T A
423	423	/	332		
427	427	/			
428	428	M	125	259	LATCH TO PRINT AREA
435	435	M	094	294	TYPE OF ERROR TO PRINT
442	442	L	820	816	MAKE CHANNEL COUNTER
449	449	L	840	844	MAKE PROGRAM COUNTER C FOR T A
456	456	M	889	893	SETUP SKIP CONTROL
463	463	B	619		GO TO PROGRAM COUNTER CONTROL
467	467	M	142	230	EXECUTE TEST60 OK TO PRINT
474	474	M	709	299	CLEAR ERROR FROM PRINT
481	481	M	848	491	SETUP SKIP
488	488	M	XXX	575	*SETUP SKIP
495	495	M	852	512	SETUP ERROR TEST FOR SKIP
502	502	M	852	519	SETUP ERROR TEST FOR SKIP
509	509	M	XXX	588	*SETUP ERROR TEST FOR SKIP
516	516	M	XXX	595	*SETUP ERROR TEST FOR SKIP
523	523	M	169	253	MOVE 9 LATCH TO PRINT
530	530	B	545	5889	BYPASS 12 IF 9 LATCH IS USED

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```
530  538  N 171 253          MOVE 12 LATCH TO PRINT
545  545  N 000
549  549  N 815 212          MOVE CHANNEL TO PRINT
556  556  L 840 658-         MAKE DELAY COUNTER
563  563  L 575 579          MAKE NO LINE SKIP                C FOR T A
570  570  B 765              GO TO BEFORE OR AFTER PRINT SELECTION
574  574  F X                *SKIP TO CHANNEL
576  576  2 ¤                *SKIP AFTER PRINT CONTROL        C FOR T A
578  578  F X                *NO-LINE SKIP INTERLOCK TEST
580  580  N 181              GO TO DELAY CTR                  C FOR T A
584  584  B 659 X            *ERROR #1
589  589  F J                SPACE TO LATCH
591  591  B 600 X            *NO ERROR #2
596  596  B 693              ERROR #2
600  600  B 611 C            GO TO PRINT
605  605  F J                SPACE OUT OF LATCH
607  607  B 612              GO TO PROGRAM CONTROL
611  611  2                  PRINT CORRECT RESULT
612  612  A 828 844          ADVANCE PROGRAM COUNTER          C FOR T A
619  619  B 671 8432         TEST FOR 12
627  627  B 703 8438         TEST FOR 18
635  635  B 663 8435         TEST FOR 25
643  643  B 683 8439         TEST FOR 29 OR 39
651  651  B 715 8434         TEST FOR 34
659  659  B 883              GO TO CHANNEL COUNTER CONTROL
663  663  B 727 8422         AT 25 DO TRIPLE SKIP
671  671  B 731 8421         AT 12 DO DOUBLE SKIP
679  679  B 882              GO TO CHANNEL COUNTER CONTROL
683  683  B 739 8423         AT 39 GO TO END ROUTINE
691  691  B 949 8422         AT 29 GO TO LOOP COUNTER
699  699  B 882              GO TO CHANNEL COUNTER CONTROL
703  703  B 949 8421         AT 18 GO TO LOOP COUNTER
711  711  B 882              GO TO CHANNEL COUNTER CONTROL
715  715  B 949 8423         AT 34 GO TO LOOP COUNTER
723  723  B 882              GO TO CHANNEL COUNTER CONTROL
727  727  , 889              TRIPLE SKIP SETUP
731  731  , 895              DOUBLE SKIP SETUP
735  735  B 882              GO TO CHANNEL COUNTER CONTROL
739  739  B 449 D            THIS IS END ROUTINE
744  744  / 285
748  748  N 107 270          END OF TEST TO PRINT
755  755  N 000 000          END CONTROL
762  762  B 752              *GO AND PRINT NO ERROR
766  766  N 147 285          COUNT TO PRINT
773  773  M 860 299          ERROR COUNTER TOTAL TO PRINT
780  780  L 840 880          RESET ERROR COUNTER
787  787  , 762              RESET END ROUTINE
791  791  2                  PRINT TOTAL OF ERROR COUNT
792  792  . 348              ERROR FINAL HALT
796  796                     WORD MARK
801  801  9                  THIS TABLE REPRESENTS
```

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```
802  802  9                    THE VALUE IN THE
803  803  9                    CHANNEL COUNTER TO
804  804  9                    WHICH IS PREFIXED
805  805  9                    AN 8   IT IS USED
806  806  9                    TO DETERMINE WHICH
807  807  9                    LATCH TO USE WHEN
808  808  9                    CHECKING CORRECT
809  809  9                    SKIP OPERATION
810  810  8                    LATCH TABLE
811  811  9                    LATCH TABLE
812  812  9                    LATCH TABLE
813  813  0-000                      CHANNEL COUNTER
817  817  0 040                COUNTER RESET VALUE          C FOR T A
821  821  0 880                COUNTER RESET TO ONE
825  825  0 010                LOOP RESET TO 1 + COUNTER ADVANCE
829  829  0 000                      LOOP COUNTER
833  833  0 020                LOOP RESET TO 2
837  837  0 000                LOOP RESET TO 0 + SINGLE SKIP CTR VALUE
841  841  0 000                      PROGRAM COUNTER
845  845  M XXX                *ADDRESS IN CHANNEL TABLE
849  849  M XXX                *ADDRESS IN LATCH TABLE
853  853  0 000                      DELAY COUNTER
857  857  0 000 0                    ERROR COUNTER
862  862  0 001 0              ERROR COUNTER ADVANCE
867  867  0 120                PROG CTR VALUE FOR DOUBLE SKIPS
877  877  0 250                PROG CTR VALUE FOR TRIPLE SKIPS
882  882  N 000 000            CHANNEL COUNTER CONTROL
889  889  8 913                *CHANNEL COUNTER CONTROL R0
893  893  8 931                *CHANNEL COUNTER CONTROL R1
897  897  8 949                CHANNEL COUNTER CONTROL R2
901  901  1                    THIS TABLE REPRESENTS
902  902  2                    THE VALUE IN THE
903  903  3                    CHANNEL COUNTER TO
904  904  4                    WHICH IS PREFIXED
905  905  5                    A 9   IT IS USED
906  906  6                    TO SETUP SKIP
907  907  7                    INSTRUCTIONS FROM
908  908  8                    THE VALUE IN THE
909  909  9                    CHANNEL COUNTER
910  910  0                    CHANNEL TABLE
911  911  1                    CHANNEL TABLE
912  912  2                    CHANNEL TABLE
913  913  M 153 240            TRIPLE SKIP TO PRINT
920  920  L 840 832            RESET LOOP COUNTER TO ZERO
927  927  B 963                GO TO ADVANCE LOOP COUNTER
931  931  M 159 240            DOUBLE SKIP TO PRINT
938  938  L 828 832            RESET LOOP COUNTER TO ONE
945  945  B 963                GO TO ADVANCE LOOP COUNTER
949  949  M 165 240            SINGLE SKIP TO PRINT
956  956  L 836 832            RESET LOOP COUNTER TO TWO
963  963  A 828 832            ADVANCE LOOP COUNTER
```

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```
 970  970  A  828  816    ADVANCE CHANNEL COUNTER
 977  977  B  989  8153   CHANNEL COUNTER PAST 12 OR 2
 985  985  B  *15         TEST LOOP COUNTER FOR 3
 980  980  S  *01  8141   CHANGE 13 TO 1 IN CHANNEL COUNTER
 997  997  B  *15         TEST LOOP COUNTER FOR 3
1001  *01  A  824  816    ADVANCE CHANNEL COUNTER TO 1
1008  *08  M  910  813    SUPPRESS CARRY
1015  *15  B  *27  9316   LOOP COUNTER AT 3  SETUP SKIP
1025  *23  B  963         CONTINUE CHANNEL COUNTER ADVANCE
1027  *27  M  815  848    BUILD CHANNEL TABLE ADDRESS
1034  *34  M  909  846    BUILD CHANNEL TABLE ADDRESS
1041  *41  M  815  852    BUILD LATCH TABLE ADDRESS
1048  *48  M  908  850    BUILD LATCH TABLE ADDRESS
1055  *55  B  467         GO TO EXECUTE
1059  *59  D  762         ERROR #1  MODIFY END CONTROL ROUTINE
1063  *63  A  866  861    ADVANCE ERROR COUNTER
1070  *70  M  901  296    MOVE ERROR TO PRINT AREA
1077  *77  B  *85  E      GO TO ERROR #1 HALT
1082  *82  B  /24         GO TO ERROR PRINT
1086  *86  .              ERROR #1 HALT
1087  *87  F  J           BYPASS ERROR #2 TEST
1089  *89  B  /42         GO TO SWITCH B
1093  *93  D  762         ERROR #2 MODIFY END ROUTINE
1097  *97  A  866  861    ADVANCE ERROR COUNTER
1104  /04  M  902  296    MOVE ERROR TO PRINT AREA
1111  /11  B  /20  E      GO TO ERROR #2 HALT
1116  /16  B  /26         GO TO ERROR PRINT
1120  /20  .  /42         ERROR #2 HALT  GO TO SWITCH B
1124  /24  F  J           SPACE INTO LATCH AFTER ERROR #1
1126  /26  M  797  230    CLEAR OK FROM PRINT AREA
1133  /33  B  421  B      ERROR RESTART  NO PRINT
1138  /38  2  612         PRINT ERROR AND CONTINUE PROGRAM
1142  /42  B  421  B      ERROR RESTART NO PRINT
1147  /47  F  612  J      CONTINUE PROGRAM  NO PRINT
1152  /52  M  099  299    NO ERROR TO PRINT
1159  /59  M              TYPE OF ERROR TO PRINT
1160  /60  2              PRINT END OF TEST
1161  /61  .  348         CORRECT OPERATION  FINAL HALT
1165  /65  B  /87         PUT NO OP INSTRUCTION      C FOR T A
1169  /69  M  611  576        IN /65 TO CAUSE
1176  /76  Y  /83  575        SKIPS AFTER PRINT
1185  /83  B  574         GO TO SKIP ROUTINE
1187  /87  M  096  576    ELIMINATE PRINTING
1194  /94  B  574         GO TO SKIP ROUTINE
```

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TABLE OF UNPRINTABLE CHARACTERS

LP=LEFT PARENTHESIS	12 5 8	SE=SEMICOLON	11 6 8	DE=DELTA	11 7 8
WS=WORD SEPARATOR	0 5 8	LT=LESS THAN	12 6 8	PZ=PLUS ZERO	12 0
TS=TAPE SEGMENT MARK	0 7 8	GT=GREATER THAN	6 8	TM=TAPE MARK	7 8
GM=GROUP MARK	12 7 8	MZ=MINUS ZERO	11 0	CO=COLON	5 8
RP=RIGHT PARENTHESIS	11 5 8	AP=APOSTROPHE	0 6 8		

```
,008015,022029,033038N      1001                FORMS SKIPPING          20108 00A
,008015,022029,033038N      1001                SET WORDMARK CARD       20108 02
L072121,095100,108108,108108100ITYPE OF ERROR NONEEND TESTSKIP TEST     20108 03
L064153,122122,126143,148154100ATCHCHANNEL TESTED OKCOUNTTRIPLE         20108 04
L067188,168168,170181,189189100DOUBLESINGLE 0912      B5848533.         20108 05
L049209,196201,201201,201201100A8288568181                              20108 06
L067367,340344,348349,3573611001,008012,0011001183610808A8421/340080    20108 07
L069404,377385,389393,4004041001          838955518S88N000N360392/332/  20108 08
L062434,413417,421423,427428100185005521/080.421F4/332/M125259         20108 09
L071476,442449,456463,467474100M094294L820816L840844=889893B619M142230 20108 10
L067508,481488,495502,509509100M799299M848491MXXX575M852512M852519     20108 11
L072548,516623,530538,546549100MXXX588MXXX595M16925385455889M171253N000 20108 12
L068579,556563,570574,576578100M8152I2L840856L575579B/65FX2=FX          20108 13
L059606,584589,591596,608605100N181B+59XFJB60QXB+938611CFJ              20108 14
L068642,611612,619627,635643100186122A828844867184328703843886638435   20108 1
L072682,651659,663671,679683100186838439871584348882872784228731842188822010B 1
L072722,691699,703711,715723100187398423894984228882894984218882894984282010B
L064754,727731,735739,744748100188882,889,893888284490/285M107270      20108
L069791,762766,773780,787791100N0000008/52M147285M860299L840860,7622    20108 19
L046805,796801,802803,8048051001.348      999aa                         20108 20
L039812,807808,809810,811812100laaaa999                                 20108 21
L060840,817821,825829,833837100100000040088000100000000200000         20108 22
L068876,845849,853857,862867100100000MXXXMXXX0000000000000100120       20108 23
L058902,882889,893897,901902100100250 N0000G0891138931B94912           20108 24
L039909,904905,906907,908909100134567 89                                20108 25
L060937,911912,913920,927931100100#aM153240L840832B963M159240          20108 26
L071976,945949,956963,970977100LB288328963M165240L836832A828832A828816 20108 27
L070#14,985989,997#01,*08#15100LB98981538#158#0181418#15A824816M910813 20108 28
L072#54,#23#27,*34#41,*48#55100188#2783138963M815848M909846M815852M908850 20108 29
L064#86,#59#63,#70#77,*82#86100184678762A866861M901296B#86EB/24.       20108 30
L065/19,#89#93,*97/04,/11/16100IFJB/42=762A866861M9022968/20EB/26      20108 31
L064/61,/24/26,/33/38,/42/47100I./42FJM797230842182612842IBF612J       20108 32
L063/82,/59/60,/61/65,/69/76100IM099299M2.348B/87M611576Y/83575         20108 33
L062S12,/87/94,S00S01,S05S12100IB574M0965768574  2,049L0772772          20108 34
L060840,S17S18,S25S29,S36S37100I/2772N000000N00PN000000NN000            20108 35
L036544,S45645,S45645,S45S45100I2413                                    20108 36
/3886801                                    CLEAR WORDMARK CARD         20108 37
,019027,031,038842803IT98G8400L046352BW048S88  FORMS SKIPPING           20108 38
                              M
```

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CHANNEL 9 + 12 LATCH TEST 2020C

A. PURPOSE:

TO TEST THE CARRIAGE 9 AND 12 LATCH AS FOLLOWS.

1. RESET BY ANY HOLE IN CARRIAGE TAPE.
2. SET BY 9 OR 12 HOLE IN CARRIAGE TAPE.
3. NOT RESET BY CARRIAGE MOVEMENT THAT DOES NOT SENSE A HOLE.
4. RESET BY A SKIP AFTER PRINT COMMAND.
5. CHECK BRANCH ON CHANNEL 9 AND 12 OPERATION.

NOTE: SINGLE SPACE AND SKIP TO 3 ARE USED IN THIS TEST.

TO RUN THIS TEST WITHOUT ERROR, FIELD BILL 485453 FOR STAGE 1 OR FIELD BILL 485445 FOR STAGE 2 MUST BE INSTALLED. THE FIELD BILLS ARE UNNECESSARY IF THE MACHINES ARE AT OR BEYOND THE FOLLOWING E.C. LEVELS.

STAGE 1	E.C. 110284	LOGIC PAGE 36.46.11.1
STAGE 2	E.C. 110443	LOGIC PAGE 36.43.21.2

THIS CHANGE CAUSES THE RESET OF THE 9 AND 12 LATCHES BY A SKIP AFTER COMMAND ANDED WITH SP SK GATE.

B. LOADING PROCEDURES:

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY. THE PROGRAM WILL COME TO A HALT, LOCATION 421, AFTER THE TITLE PRINT ROUTINE TO ALLOW OPERATOR TO INSTALL THE CARRIAGE TAPE. THE TEST NOW CAN BE STARTED BY PRESSING THE START KEY. WHEN RUNNING TEST FROM TAPE ENTER A 1 IN 1255.

C. PROGRAM CONTROL.

1. CHECKING PROCEDURE:

WITH SENSE SWITCHES B AND E BOTH OFF, ERRORS WILL PRINT OUT. SWITCH D MAY BE USED TO LOOP PROGRAM.

WITH SENSE SWITCH B ON AND E OFF, ERRORS WILL NOT PRINT. THE PROGRAM WILL LOOP WITHOUT A HALT. THE CARRIAGE CAN BE DISENGAGED OR THE PAPER REMOVED.

WITH SENSE SWITCH B ON AND E ON, ERRORS WILL NOT PRINT. THE PROGRAM HALTS AT THE PARTICULAR ERROR STOP. THE CARRIAGE LOCATION MAY BE EXAMINED, AND THE PROGRAM WILL LOOP WHEN THE START KEY IS DEPRESSED.

C. (CONTINUED)

2. SENSE SWITCHES:

B ON	LOOPS PROGRAM WHEN ERROR OCCURS WITHOUT PRINTING ERRORS
B OFF	ALLOWS ERRORS TO PRINT DEPENDENT ON SENSE SWITCH E.
C ON	CAUSES CORRECT OPERATION TO PRINT OUT
C OFF	PREVENTS CORRECT OPERATION FROM PRINTING
D ON	LOOPS PROGRAM
D OFF	ALLOWS PROGRAM TO END WHEN ERRORS DO NOT OCCUR
E ON	CAUSES PROGRAM TO HALT ON ERROR
E OFF	ALLOWS ERRORS TO PRINT IF SENSE SWITCH B IS OFF.
F	USED WHEN TEST IS RUN FROM TAPE -- MAGNETIC

D. TEST PROCEDURE:

THE CARRIAGE MOVES TO CHANNEL 4, AN INITIAL CHECK IS MADE OF THE 9 AND 12 LATCHES FOR AN OFF CONDITION. FROM THIS POINT ON ONLY THE 9 OR 12 LATCH, WHICHEVER IS APPROPRIATE, WILL BE CHECKED.

THE CARRIAGE NOW MOVES INTO THE 12 HOLE AND THE 12 LATCH IS CHECKED FOR AN ON STATUS. THE CARRIAGE MOVES AND AGAIN THE 12 LATCH IS CHECKED FOR AN ON STATUS. THE CARRIAGE MOVES UNTIL IT IS ONE SPACE BEFORE THE 5 HOLE AND THE 12 LATCH IS AGAIN CHECKED FOR AN ON STATUS. THE CARRIAGE MOVES TO THE 5 HOLE AND THE ABOVE TEST IS REPEATED FOR THE 5 CHANNEL. THE SAME TEST OCCURS FOR THE 6,7,8, AND 9 CHANNELS. NEXT A TEST IS MADE FOR CHANNELS 10,11,12,1,2, AND 3. IN THIS PORTION OF THE TEST THE 9 LATCH IS USED FOR TESTING.

AT THIS POINT A CHANGE IN PROCEDURE IS MADE. THE PROGRAM IS ALTERED SO WHEN THE CARRIAGE IS ONE SPACE BEFORE A CHANNEL HOLE THE APPROPRIATE 9 OR 12 LATCH IS RESET BY A SKIP AFTER PRINT COMMAND, A TEST IS MADE, AND A SPACE OCCURS. THIS TEST IS REPEATED FOR CHANNELS 4 THROUGH 3 AND THE TEST ENDS.

E. STOPS

ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON.

STOR. ADDR. REGISTER	
161	INITIAL ERROR - THE 9 OR 12 LATCH WAS ON AT THE END OF THE INITIAL SPACE TO 4.
421	INSTALL CARRIAGE TAPE AND DEPRESS START
821	ERROR #1 12 LATCH ON - NOT RESET BY CHANNEL HOLE.
841	ERROR #2 12 LATCH OFF - DID NOT COME ON FOR 12 HOLE.
861	ERROR #3 12 LATCH OFF - WENT OFF WHEN NO HOLE WAS SENSED.

NOTE: ON A BUFFERED MACHINE WITH SENSE SWITCH C ON THIS ERROR TESTS THE CONDITION STATED FOR ERROR 2.

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E. (CONTINUED)

STOR ADDR REGISTER	ERROR STOPS WILL ONLY OCCUR IF SENSE SWITCH E IS ON
881	ERROR #4 12 LATCH OFF - WENT OFF ONE SPACE BEFORE NEXT CHANNEL
901	ERROR #5 12 LATCH ON - NOT RESET BY SKIP AFTER PRINT COMMAND.
921	ERROR #6 9 LATCH ON - NOT RESET BY CHANNEL HOLE.
941	ERROR #7 9 LATCH OFF - DID NOT COME ON FOR 9 HOLE.
961	ERROR #8 9 LATCH OFF - WENT OFF WHEN NO HOLE WAS SENSED.

NOTE: ON A BUFFERED MACHINE WITH SENSE SWITCH C ON THIS ERROR TESTS THE CONDITION STATED FOR ERROR 7.

981	ERROR #9 9 LATCH OFF - WENT OFF ONE SPACE BEFORE NEXT CHANNEL.
1001	ERROR #10 9 LATCH ON - NOT RESET BY SKIP AFTER PRINT COMMAND.
1021	PROGRAM WILL STOP HERE ON ANY ERROR IF NOT IN A LOOP.
1086	END OF TEST - NO ERRORS, DEPRESS START TO CONTINUE TO NEXT TEST.

F. PRINTOUTS

CORRECT PRINTOUTS WITH SENSE SWITCH C ON

PREVIOUS CHANNEL TESTED OK 09 LATCH 10 CHANNEL TYPE OF ERROR

PREVIOUS CHANNEL TESTED OK SKIP AFTER 12 LATCH 08 CHANNEL TYPE OF ERROR

ETC. FOR ALL CHANNELS

ERROR PRINTOUTS WITH SENSE SWITCH E OFF

INITIAL ERROR LATCHES FAILED OR CARRIAGE DID NOT GO TO FOUR

12 LATCH 04 CHANNEL TYPE OF ERROR 03

PREVIOUS CHANNEL TESTED OK SKIP AFTER 12 LATCH 04 CHANNEL TYPE OF ERROR 05

ETC. FOR ALL CHANNELS AND ERROR CONDITIONS

G. COMMENTS

ESSENTIALLY THE CARRIAGE TAPE IS PUNCHED EVERY 8 SPACES. EACH CHANNEL PUNCH IS FOLLOWED WITH A 9 OR 12 PUNCH FOR CHECKING CORRECT OPERATION.

THIS IS THE SAME CARRIAGE TEST TAPE AS USED WITH TEST 2000C, 2005A, 2010B.

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G. (CONTINUED)

THE CARRIAGE TEST TAPE IS PUNCHED AS FOLLOWS:

LINE	HOLE	LINE	HOLE	LINE	HOLE
1	1	33	5	65	9
2	9	34	12	66	12
9	2	41	6	73	10
10	9	42	12	74	9
17	3	49	7	81	11
18	9	50	12	82	9
25	4	57	8	89	12
26	12	58	12	90	9

SPLICE TAPE SO THE 0 AND 96 COINCIDE

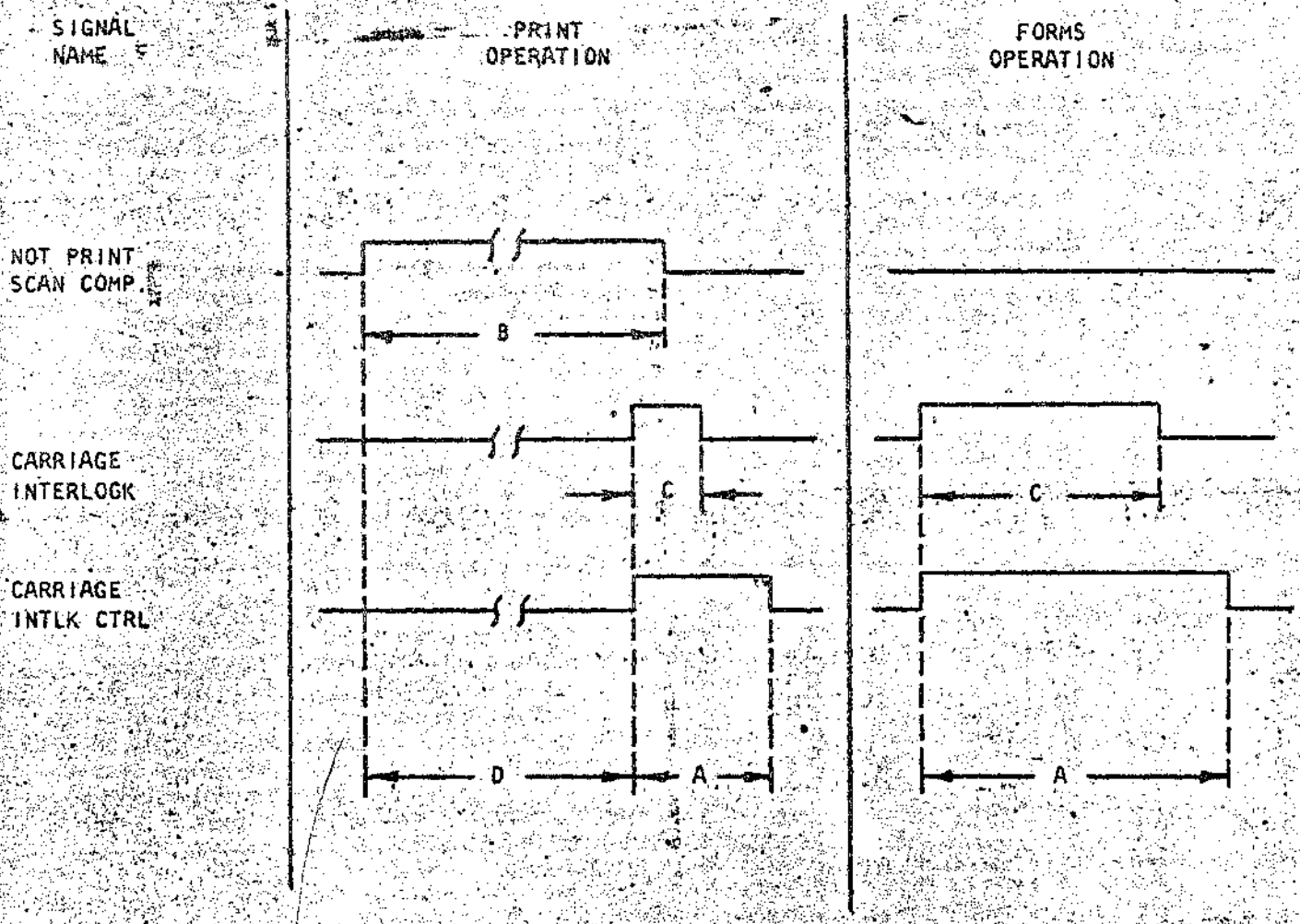
----- SERVICE AIDS -----

IF THIS TEST FAILS, CHANGE THE 10MS "CARRIAGE-INTERLOCK-CONTROL" SINGLE SHOT ON 36.44,11.1 OR 36.46.21.2 TO 20 MS AND TRY THE TEST AGAIN. IF THE TEST DOESN'T FAIL THE SECOND TIME, THE TROUBLE IS PROBABLY DUE TO THE BYPASS NEEDLE VALVE ADJUSTMENT IN THE HYDRAULIC UNIT. IF THE TEST FAILS THE SECOND TIME, THE TROUBLE IS PROBABLY DUE TO THE 4.5MS E2-BRUSH SINGLE SHOT ADJUSTMENT, TO THE FAILURE OF A FORMS OP TO INTERLOCK AFTER A FORMS OP, OR TO THE IMPROPER RELATIONSHIP BETWEEN THE E1-BRUSH AND THE CARRIAGE CHANNEL BRUSHES.

NOTE: LEAVE MACHINE WITH THE 10MS SINGLE SHOT SET AT 10MS.

INTERLOCKS DUE TO FORMS CONTROL

INSTRUCTION CALLED FOR	SIGNAL CAUSING INTERLOCK	INTERLOCK CONDITION	
		PRINT BUFFER	WITHOUT BUFFER
FORM CONTROL	CARR INLK CTRL SEE A ON NEXT PAGE	INTERLOCKS UNTIL END OF CARRIAGE OPERATION	SAME AS BUFFER
	NOT PRINT SCAN COMPLETE SEE B ON NEXT PAGE	INTERLOCKS UNTIL END OF PRINT BUT CARRIAGE OPERATION OCCURRING CAUSES THE INTERLOCK TO BE EFFECTIVE UNTIL THE END OF THE CARR INLK CTRL SIGNAL.	SAME AS BUFFER BECAUSE PRINT OPERATION MUST END BEFORE FORMS OP CAN BE SET UP AND THE CARRIAGE WILL BE OPERATING AT THE END OF THE PRINT OP.
BRANCH ON CHANNEL 9 OR 12	CARR INLK SEE C ON NEXT PAGE	INTERLOCKS UNTIL END OF CARRIAGE OPERATION	DOES NOT INTERLOCK. CHECKS IMMEDIATELY FOR CONDITION. CHECK IS MADE ANY PLACE DURING THE CARRIAGE OPERATION THAT COINCIDES WITH THE BRANCH TEST.
	NOT PRINT SCAN COMPLETE SEE D ON NEXT PAGE	DOES NOT INTERLOCK. CHECKS POSITION OF CARRIAGE AT PRINT LINE.	EFFECTIVE INTERLOCK UNTIL PRINT OPERATION IS OVER BECAUSE BRANCH OP CANNOT SET UP UNTIL PRINTING IS OVER. CHECKS CARRIAGE LOCATION OF PRINT LINE PLUS 1 BECAUSE CARRIAGE IS MOVING -- REGARDLESS OF HOW FAR CARRIAGE MOVES.



NOTE: FOR INTERLOCK CONDITIONS A,B,C AND D SEE PREVIOUS PAGE

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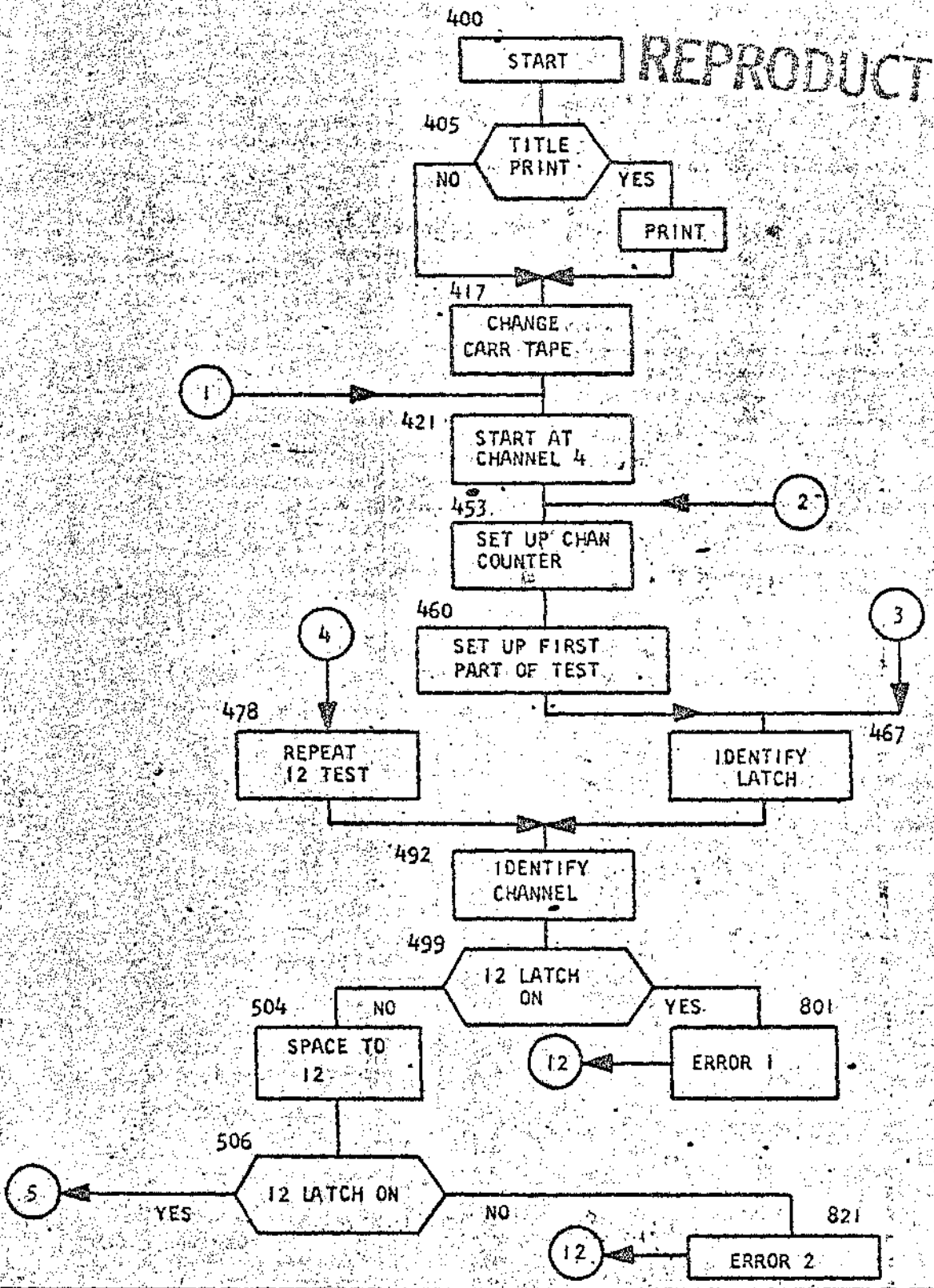

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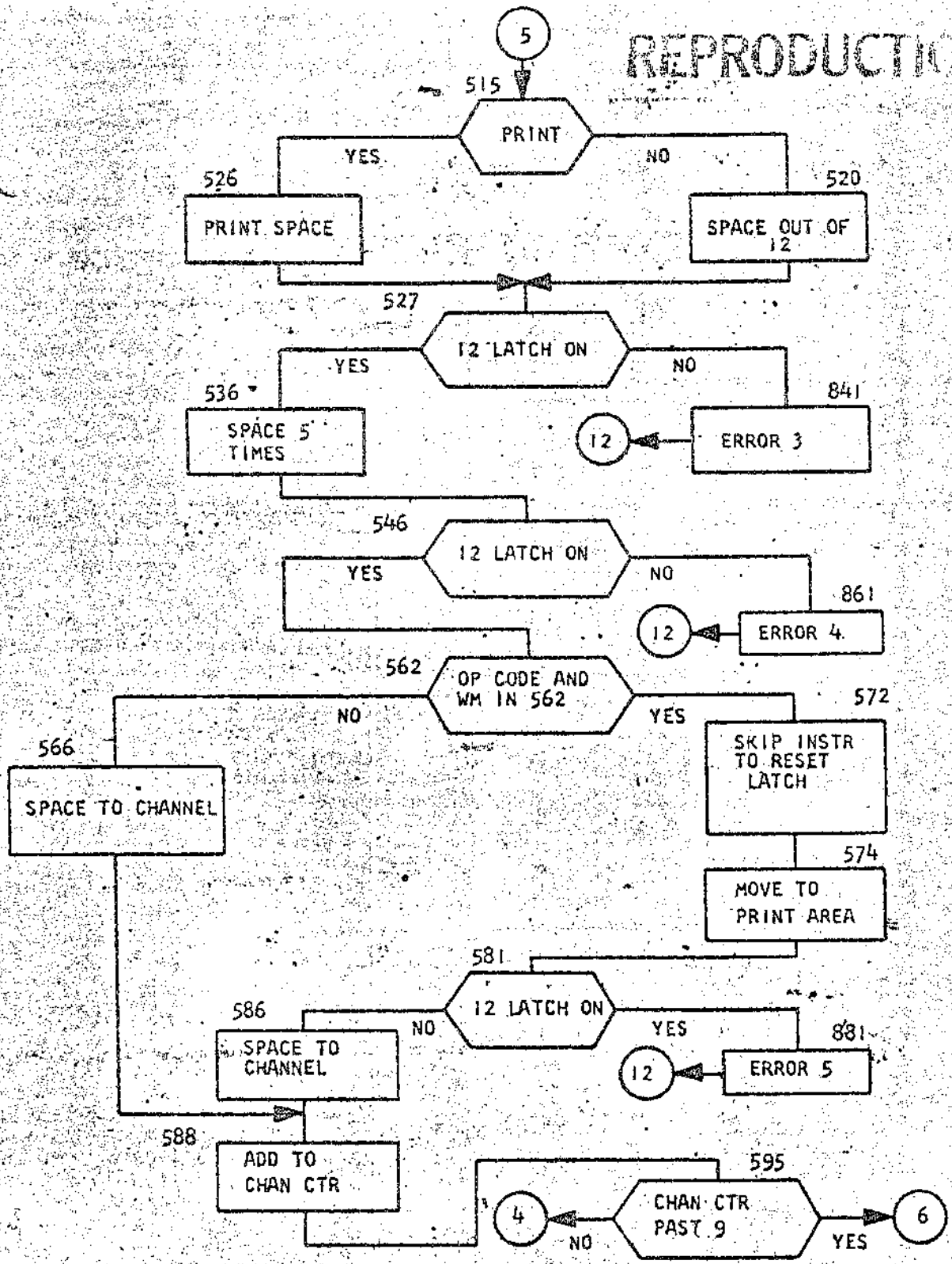
DIAGNOSTIC FUNCTION TEST



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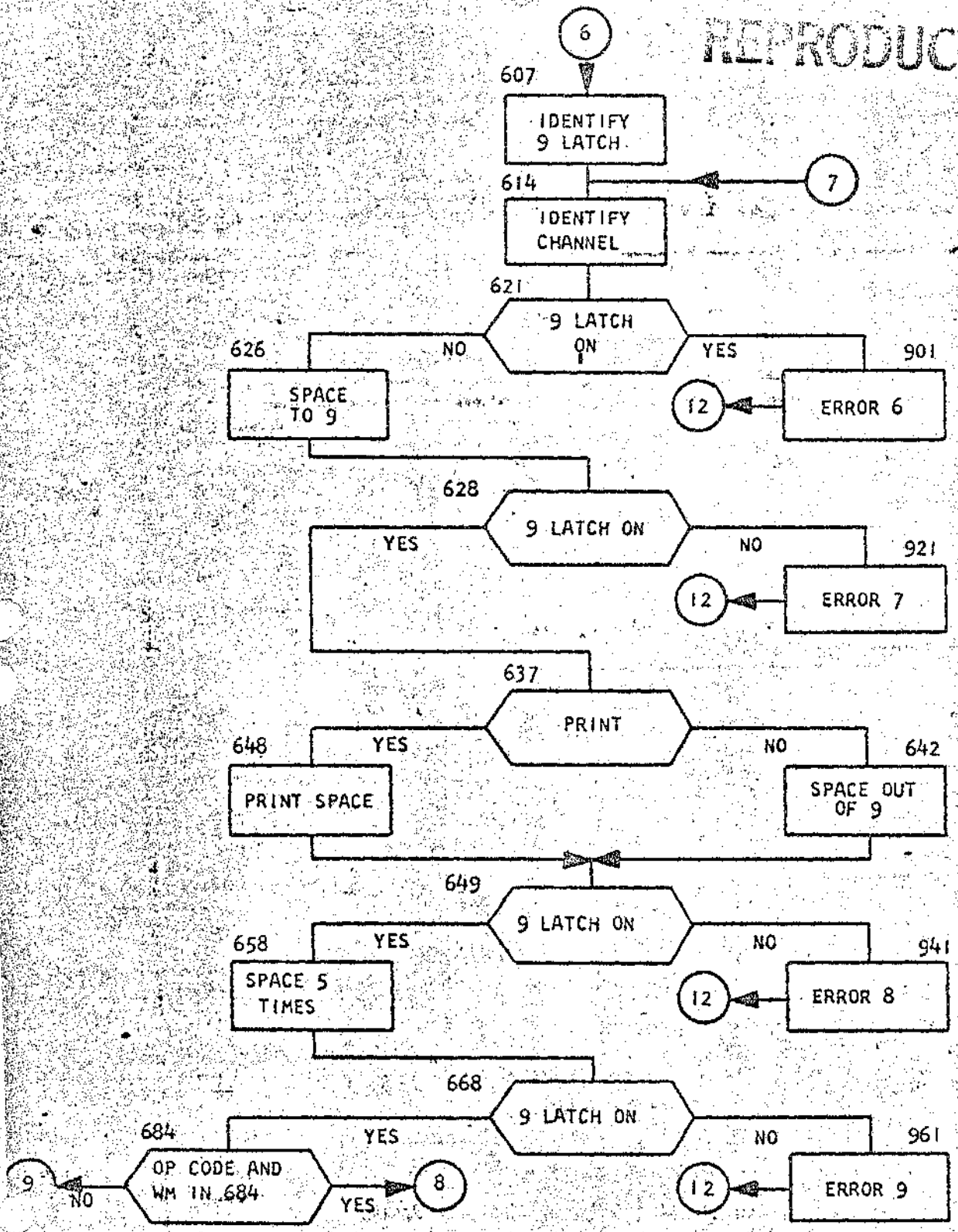

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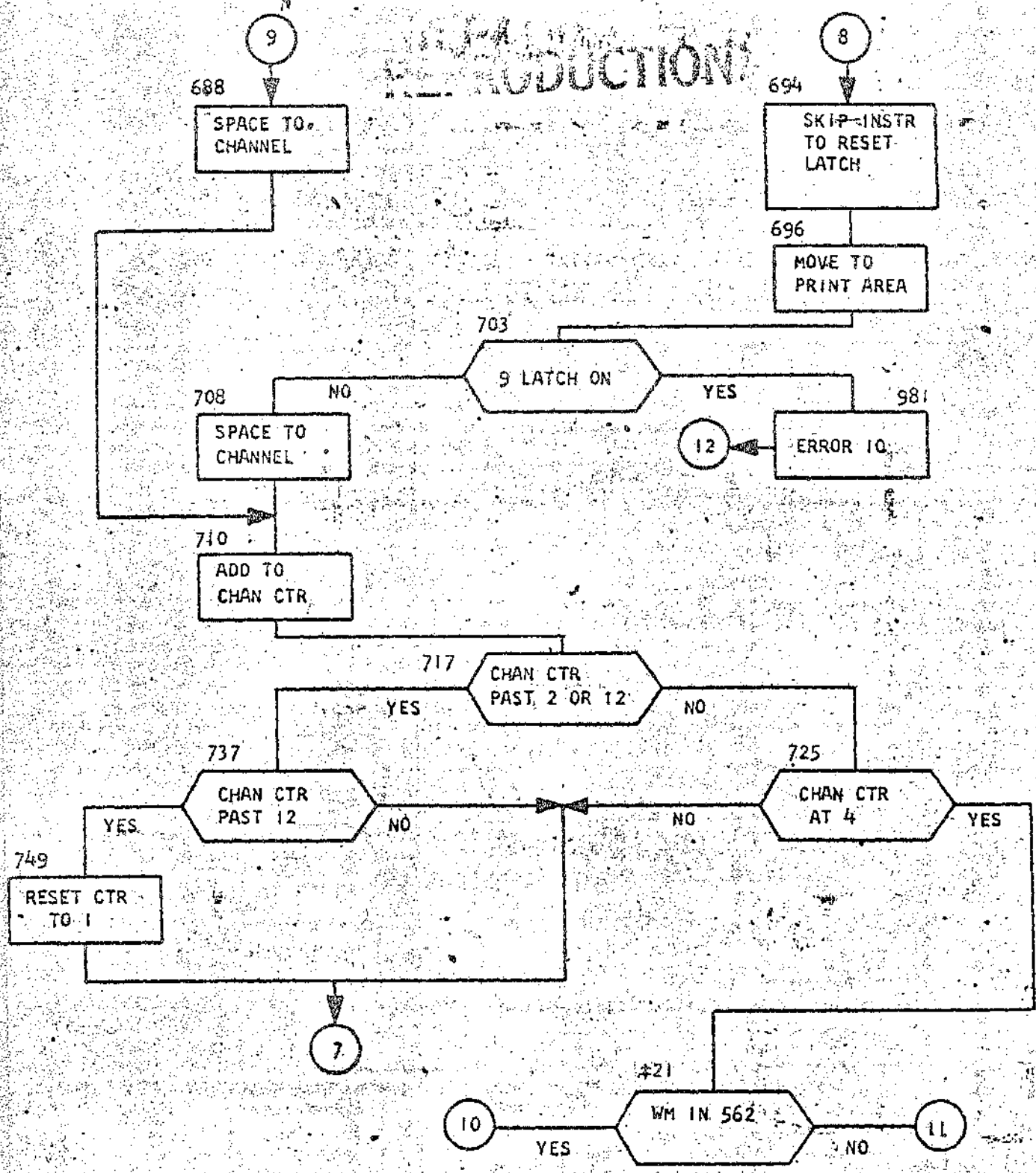
DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	5-15-62	27.7.62					
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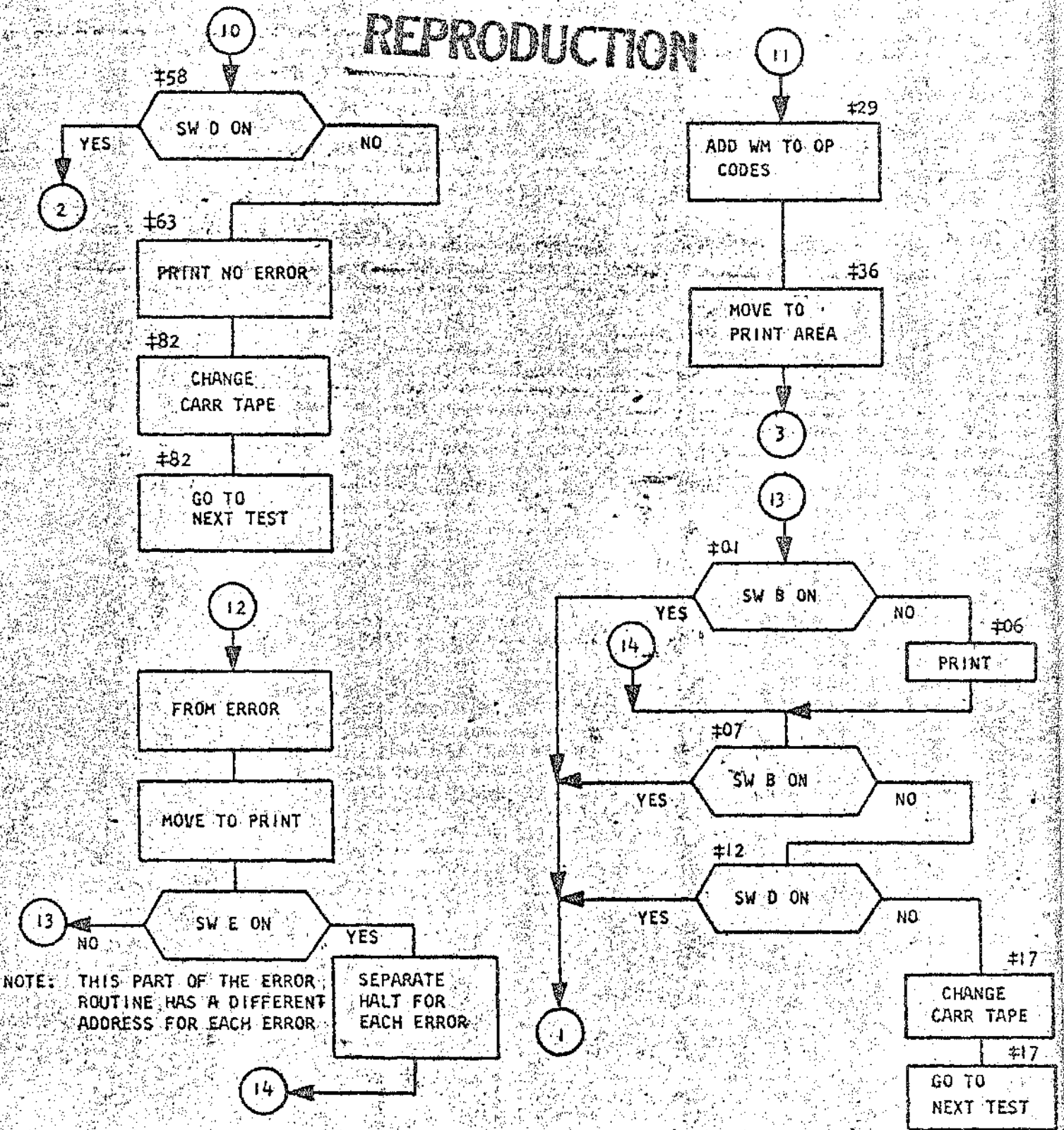

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PROGRAM LISTING FOR USE WITH FLOW CHART

9 • 12 LATCH TEST 2020C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	I	NIT	IAL	ERROR LATCHES FAILED OR CARRIAGE DID NOT GO TO FOUR
141	141	M	140	209	INITIAL ERROR
148	148	B	157	E	GO TO INITIAL ERROR HALT
153	153	B	401		GO TO SWITCH B
157	157	.	407		GO TO SWITCH B
161	161				WORD MARK
377	377	B	389	S551	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		USE WHEN TESTS ARE RUN FROM TAPE
389	389	N	000		USE WHEN TESTS ARE RUN FROM TAPE
393	393	M	360	392	USE WHEN TESTS ARE RUN FROM TAPE
400	400	/	332		START TEST
404	404	/			CLEAR PRINT AREA
405	406	B	S00	S521	TITLE PRINT
413	413	/	080		
417	417	.	421		HALT TO CHANGE CARRIAGE TAPE
421	421	B	776		GO TO INITIAL SETUP
427	427	B	141	2	INITIAL ERROR
432	432	M	/38	259	12 LATCH TO PRINT AREA
439	439	L	/16	275	04 CHANNEL TO PRINT AREA
446	446	M	/87	293	TYPE OF ERROR TO PRINT AREA
453	453	L	767	763	SET UP CHANNEL COUNTER
460	460	D	582	684	SET UP SELECTION ROUTINE
467	467	M	/32	253	12 TO IDENTIFY LATCH
474	474	B	492		GO TO 12 LATCH TEST
478	478	M	/57	219	PREVIOUS CHANNEL TESTED OK
485	485	M	/64	226	MOVED TO PRINT AREA
492	492	M	762	267	XX TO IDENTIFY CHANNEL
499	499	B	801	2	ERROR #1 12 LATCH NOT RESET BY HOLE
504	504	F	J		SPACE TO 12 LATCH
508	506	B	515	2	NO ERROR # 2
511	511	B	821		ERROR #2
515	515	B	526	C	GO TO PRINT
520	520	F	J		SPACE OUT OF 12
522	522	B	527		BYPASS PRINT
526	526	2			PRINT AND SPACE OUT OF 12
527	527	B	536	2	NO ERROR #3
532	532	B	841		ERROR #3 12 LATCH WENT OFF
536	536	F	J		SPACE
538	538	F	J		SPACE
540	540	F	J		SPACE
542	542	F	J		SPACE
544	544	F	J		SPACE

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```
546  546  B 555 @      NO ERROR #4
551  551  B 861        ERROR #4 12 LATCH WENT OFF
555  555  N 000 000    FOR ROUTINE SELECTION
562  562  B 572        GO TO SKIP AFTER ROUTINE
566  566  F J          SPACE TO CHANNEL HOLE
568  568  B 588        GO TO CONTROL
572  572  F A          RESET 12 LATCH BY SKIP AFTER
574  576  N /74 250    SKIP AFTER TO PRINT AREA
581  581  B 881 @      ERROR #5 SKIP AFTER DID NOT RESET 12
586  586  F J          SPACE TO CHANNEL HOLE
588  588  A 771 763    ADD TO CHANNEL COUNTER
595  595  B 607 7620   CONTROL - GO TO 9 LATCH TEST
603  603  B 478        GO BACK TO 12 LATCH TEST
607  607  N /26 253    09 TO IDENTIFY LATCH
614  614  N 762 267    XX TO IDENTIFY CHANNEL
621  621  B 901 9      ERROR #6 9 LATCH NOT RESET BY HOLE
626  626  F J          SPACE TO 9 LATCH
628  628  B 637 9      NO ERROR # 7 -
638  638  B 921        ERROR # 7
637  637  B 648 C      GO TO PRINT
642  642  F J          SPACE OUT OF 9 HOLE
644  644  B 649        BYPASS PRINT
648  648  2            PRINT AND SPACE OUT OF 9
649  649  B 658 9      NO ERROR #8
654  654  B 941        ERROR #8 9 LATCH WENT OFF
658  658  F J          SPACE
660  660  F J          SPACE
662  662  F J          SPACE
664  664  F J          SPACE
666  668  F J          SPACE
668  668  B 677 9      NO ERROR #9
673  673  B 961        ERROR #9 9 LATCH WENT OFF
677  677  N 000 000    FOR ROUTINE SELECTION
684  684  B 694        GO TO SKIP AFTER ROUTINE
688  688  F J          SPACE TO CHANNEL HOLE
690  690  B 710        GO TO CONTROL
694  694  F A          RESET 9 LATCH BY SKIP AFTER
696  696  N /74 250    SKIP AFTER TO PRINT AREA
703  703  B 981 9      ERROR #10 SKIP AFTER DID NOT RESET 9
708  708  F J          SPACE TO CHANNEL HOLE
710  710  A 771 763    ADD TO CHANNEL COUNTER
717  717  B 737 7623   CONTROL - PAST 2 OR 12 - TEST
725  725  B 421 7624   AT 4 - GO TO END ROUTINE
733  733  B 614        GO TO 9 LATCH TEST
737  737  B 749 7631   PAST 12 RESET CHANNEL CTR TO ONE
745  745  B 614        GO TO 9 LATCH TEST
749  749  A 775 763    ADD 88 TO CHANNEL COUNTER
756  756  B 614        GO TO 9 LATCH TEST
760  760  0 040        CHANNEL COUNTER
764  764  0 040        CHANNEL COUNTER RESET VALUE
768  768  0 010        CHANNEL COUNTER INCREMENT
```

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```
772  772  0 888                CHANNEL COUNTER RESET TO ONE
776  776  / 332                CLEAR PRINT AREA
780  780  /                    CLEAR PRINT AREA
781  781  F 3                  MAKE INITIAL SETUP
783  783  2                        .
784  784  2                        .
785  785  2                        .
786  786  2                        .
787  787  2                        .
788  788  2                        .
789  789  2                        .
790  790  F 1                  SPACE TO 4 FOR INTERLOCK AND START
792  792  B 141 9              INITIAL ERROR
797  797  B 427                GO CONTINUE TEST
801  801  M /02 297            ERROR #1
808  808  B 817 E              GO TO HALT #1
813  813  B +01                GO TO SW B
817  817  . +07                GO TO SW B
821  821  M /04 297            ERROR #2
828  828  B 837 E              GO TO HALT #2
833  833  B +01                GO TO SW B
837  837  . +07                GO TO SW B
841  841  M /06 297            ERROR #3
848  848  B 857 E              GO TO HALT #3
853  853  B +01                GO TO SW B
857  857  . +07                GO TO SW B
861  861  M /08 297            ERROR #4
868  868  B 877 E              GO TO HALT #4
873  873  B +01                GO TO SW B
877  877  . +07                GO TO SW B
881  881  M /18 297            ERROR #5
888  888  B 897 E              GO TO HALT #5
893  893  B +01                GO TO SW B
897  897  . +07                GO TO SW B
901  901  M /20 297            ERROR #6
908  908  B 917 E              GO TO HALT #6
913  913  B +01                GO TO SW B
917  917  . +07                GO TO SW B
921  921  M /22 297            ERROR #7
928  928  B 937 E              GO TO HALT #7
933  933  B +01                GO TO SW B
937  937  . +07                GO TO SW B
941  941  M /24 297            ERROR #8
948  948  B 957 E              GO TO HALT #8
953  953  B +01                GO TO SW B
957  957  . +07                GO TO SW B
961  961  M /26 297            ERROR #9
968  968  B 977 E              GO TO HALT #9
973  973  B +01                GO TO SW B
977  977  . +07                GO TO SW B
981  981  M /28 297            ERROR #10
```

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```
 988  988  B 997 E                    GO TO HALT #10
 993  993  B ¢01                      GO TO SW B
 997  ¢07  . ¢07                      GO TO SW B
1001  ¢01  B 421 8                    RESTART WITHOUT PRINTING
1006  ¢06  2                          PRINT ERROR
1007  ¢07  B 421 8                    RESTART WITHOUT PRINTING
1012  ¢12  B 421 D                    RESTART WITH OR WITHOUT PRINTING
1017  ¢17  . 348                      ERROR  FINAL HALT
1021  ¢21  V ¢47 5623                 END ROUTINE
1029  ¢29  , 562 684                  SET UP SKIP AFTER CHECK
1036  ¢36  M /74 260                  SKIP AFTER TO PRINT AREA
1043  ¢43  B 467                      REPEAT LATCH TEST FOR SK AFT CHECK
1047  ¢47  , 001                      SET WORDMARK
1051  ¢51  M 010 260                  CLEAR REMARK FOR NEXT RUN
1058  ¢58  B 432 D                    LOOP WITH OR WITHOUT PRINTING
1063  ¢63  / 260                      CLEAR PRINT AREA
1068  ¢67  M /92 298                  NO ERROR TO PRINT AREA
1074  ¢74  M ¢96 270                  END OF TEST TO PRINT AREA
1081  ¢81  2                          PRINT
1082  ¢82  . 348                      CORRECT OPERATION  FINAL HALT
1086  ¢86                             WORD MARK
1089  ¢89  E NB  TEST
1097  ¢97  N ONE
1101  /01  0 1
1103  /03  0 2
1105  /05  0 3
1107  /07  0 4 C HANNEL
1117  /17  0 5
1119  /19  0 6
1121  /21  0 7
1123  /23  0 8
1125  /25  0 9
1127  /27  1 0
1129  /29  1 1
1131  /31  1 2 L ATCH
1139  /39  P REV IOUS CHANNEL TE
1158  /58  S TED  OK
1165  /65  S KIP  AFTER
1175  /75  T YPE  OF ERROR NONE
```

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TABLE OF UNPRINTABLE CHARACTERS

LP→LEFT PARENTHESIS	12 5 8	SE—SEMICOLON	11 6 8	DE—DELTA	11 7 8
WS→WORD SEPARATOR	0 5 8	LT—LESS THAN	12 6 8	PZ—PLUS ZERO	12 0
TS→TAPE SEGMENT MARK	0 7 8	GT—GREATER THAN	6 8	TM—TAPE MARK	7 8
GM—GROUP MARK	12 7 8	MZ—MINUS ZERO	11 0	CO—COLON	5 8
RP→RIGHT PARENTHESIS	11 5 8	AP—APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    9 + 12 LATCH TEST          2020C 004
,008015,022029,033033N      1001                    SET WORDMARK CARD          2020C 02
L072121,001001,001001,001001001INITIAL ERROR LATCHES FAILED OR CARRIAGE2020C 03
L067156,122122,141148,163157001 DID NOT GO TO FOURM1402981S7EB+01          2020C 04
L036160,161161,161161,161161001.+07                                        2020C 05
L067367,340344,348349,367361001,008012,001100118361080AB421/340080        2020C 06
L069404,377385,389393,400404001          8389S551BS88N000M360392/3327      2020C 07
L066438,413417,421427,432439100185005521/080.4218776  8141aM/38259        2020C 08
L071477,446453,460467,474478100141/16275M/87293L767763a562684M/322538492   2020C 09
L069514,485492,499504,506511001M/57219M/64226M7622678801aFJB515a8821       2020C 10
L058537,520522,526527,532536100185260FJB527285360884IFJ                   2020C 11
L056561,540542,544548,551555100IFJFJFJFJ8555a8861N000000                  2020C 12
L058587,566568,572574,581586100185726FJB588FAM/742508881aFJ               2020C 13
L072627,595603,607614,621626100IA7717638407762084?8M/26253M7622678901?FJ2020C 14
L058653,633637,642644,648649100186379892186480FJB649286589                2020C 1
L051672,656660,662664,666668100189IFJFJFJFJ86779                          2020C 16
L062702,677684,688690,694696100189GIN000000B694FJ8710FAM/74250             2020C
L066736,708710,717725,733737100189819FJA7717638737762384217624B614        2020C
L063771,745749,756760,764768100187497GIB614A7757638814004000400010        2020C 19
L046785,776780,781783,784785100108804332/F3222                            2020C 20
L047800,787788,789790,792797100122222FJB14198427                          2020C 21
L068836,808813,817821,828833100IM/02297881?E8+01.+07M/04297B837E8+01       2020C 22
L068872,841848,853867,861868100I.+07M/06297B857E8+01.+07M/08297887?E       2020C 23
L067907,877881,888893,897901100184+01.+07M/18297B897E8+01.+07M/20297       2020C 24
L065940,913917,921928,933937100189I7EB+01.+07M/22297B937E8+01.+07.         2020C 25
L068976,948953,957981,968973100IM/24297B957E8+01.+07M/26297B977E8+01       2020C 26
L062+06,981988,993997,+01+061001.+07M/26297B997E8+01.+07842182             2020C 27
L072+46,+12+17,+21+29,+36+43100184218842180.348V+475621,582684M/7425084672020C 28
L063+91,+51+58,+63+67,+74+81100I,001M0102508432G/280N/92298M+962702        2020C 29
L057706,+86+89,+97/01,/03/051001.348    END TESTNONE010203                 2020C 30
L058/28,/17/19,/21/23,/25/27100104 CHANNEL050607080910                     2020C 31
L068/64,/34/39,/58/65,/65/69100IIII2 LATCHPREVIOUS CHANNEL TESTED OK       2020C 32
L072504,/75800,S01805,S05505100ISKIP AFTERTYPE OF ERROR NONE      2;0492020C 33
L068535,612613,S17618,S26629100IL0772772/2772N0000000N000N000000          2020C 34
L043644,637541,645SN5,S45545100INN00024?3                                  2020C 35
/3830B0N                                          CLEAR WORDMARK CARD      2020C 36
,019027,031,038042B081T98G84@0L0463528W048588   9 + 12 LATCH TEST          2020C 37
```

DATE	2-2-61	5-15-62	27.762					
ENG. CHG. NO.	110378	115283	1459					

SPACE SUPPRESSION

PURPOSE OF TEST

TO TEST THE SPACE SUPPRESSION CIRCUITRY BY A PRINT AND SPACE SUPRESS OPERATION.

UNITS REQUIRED

1401 PROCESSING UNIT
1402 CARD READER OR 729 TAPE DRIVE
1403 PRINTER

SENSE SWITCHES

SENSE SWITCH B ON - USED FOR SCOPING
SENSE SWITCH D ON - REPEATS PROGRAM AS OFTEN AS DESIRED.

METHOD OF TEST

THE COMPLETE TEST BLOCK CONSISTS OF THE FOLLOWING CARDS:

1. TITLE CARD (0A)
2. SET WORD MARK CARD (02)
3. PACKED INSTRUCTIONS (03-14)
4. CLEAR WORD MARK CARD (15)
5. TRAILER CARD (16)

THREE TESTS ARE MADE BY LOADING COMMENTS TO THREE SEPARATE PRINT AREAS AND PERFORMING A PRINT-SPACE SUPPRESS AFTER EACH LOAD OPERATION. THE COMPLETED LINE OF PRINT SHOULD CONTAIN ALL THREE AREAS ON ONE LINE.

DESCRIPTION OF TEST

DETAIL CARDS (41-43) CONTAINING THE COMMENT ARE LOADED INTO STORAGE POSITIONS 530 TO 661 DURING THE PROGRAM LOADING ROUTINE. THE FIRST PART OF THE COMMENT IS LOADED INTO STORAGE POSITIONS 201 TO 214 AND A PRINT-SPACE SUPPRESSION OPERATION IS EXECUTED. PRINT POSITIONS 201-214 ARE THEN CLEARED AND THE SECOND PART OF THE COMMENT IS LOADED INTO STORAGE POSITIONS 215-276. A PRINT, BRANCH, AND SPACE SUPPRESSION OPERATION IS NOW EXECUTED. IF THE PROGRAM DID NOT BRANCH THE MACHINE WILL HALT AND BRANCH TO LOCATION 447. IF A PRINT-BRANCH-SPACE SUPPRESS OPERATION WAS EXECUTED, THE SECOND COMMENT IS CLEARED AND THE THIRD COMMENT IS LOADED IN STORAGE POSITIONS 277-332. A NORMAL PRINT IS EXECUTED, AND THE ENTIRE PRINT AREA IS CLEARED.

THE PRINT AND SPACE SUPPRESS FEATURE IS WORKING CORRECTLY IF THE THREE COMMENT AREAS ARE PRINTED ON ONE LINE FORMING A SENTENCE. IF SENSE SWITCH D IS NOT USED THE ENTIRE PRINT OUT WILL CONSIST OF FOUR GROUPS OF THREE SENTENCES WITH A SPACE BETWEEN EACH GROUP.

DATE	5-15-62	27.762						
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PROCEDURE FOR RUNNING TEST BLOCK 2030 FROM TAPE

1. MANUALLY ENTER A "1" IN $55
2. SET SENSE SWITCH "F" TO THE OFF POSITION.

NOTE: THIS WILL ALLOW THE TEST TO BE EXECUTED WITH ALL OTHER TESTS THAT MAY BE CHAINED

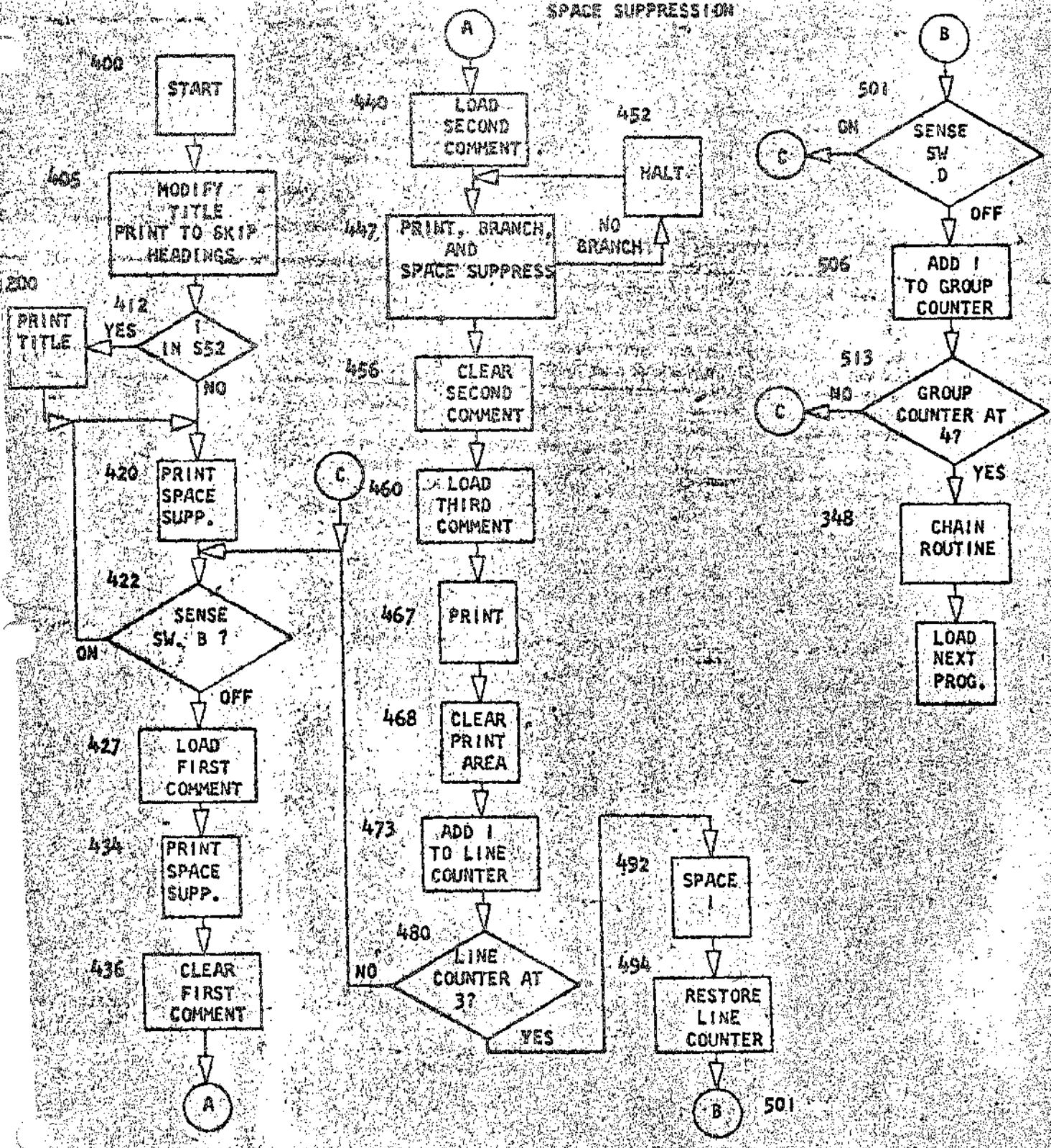
PROCEDURE FOR RUNNING ONLY BLOCK 2030 FROM TAPE

1. MANUALLY ENTER BLOCK 2030 IN LOCATIONS $73-$76
2. MANUALLY ENTER A "1" IN $55.
3. SET SENSE SWITCH "F" TO THE ON POSITION

NOTE: THIS WILL ALLOW ONLY THIS PARTICULAR TEST TO BE EXECUTED, BY-PASSING ALL OTHERS.

DATE	5-15-62	27.7.62						
ENG. CHG. NO.	115283	1459						

SPACE SUPPRESSION



DATE	5-15-62	27 7 62							
ID CHG. NO.	115283	1459							

PROGRAM LISTING FOR USE WITH FLOW CHART

SPACE SUPPRESS - 2030B

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S551	USE WHEN TESTS ARE RUN FROM TAPE
389	389	B	588		
389	389	N	000		
393	393	M	360	393	
400	400	/	332		START TEST
404	404	/			
405	405	L	525	522	ELIMINATE HEADING PRINT
412	412	B	500	S521	PRINT TITLE IF 1 IN S52
420	420	2	S		PRINT AND SPACE SUPPRESS
422	422	B	420	B	BRANCH ON B FOR SCOPING
427	427	L	543	214	LOAD FIRST COMMENT TO PRINT AREA
434	434	2	S		PRINT AND SPACE SUPPRESS
438	438	/	214		CLEAR FIRST COMMENT
440	440	L	605	276	LOAD SECOND COMMENT TO PRINT AREA
447	447	2	456	S	PRINT, BRANCH AND SPACE SUPPRESS
452	452	.	447		HALT IF NO BRANCH
458	458	/	276		CLEAR SECOND COMMENT
460	460	L	661	332	LOAD THIRD COMMENT TO PRINT AREA
467	467	2			PRINT
468	468	/	332		CLEAR PRINT AREA
472	472	/			
473	473	A	529	526	ADD 1 TO LINE COUNTER
480	480	B	492	5263	BRANCH IF THREE LINES ARE PRINTED
488	488	B	422		BRANCH IF THREE LINES NOT PRINTED
492	492	F	1		SPACE ONE
494	494	L	528	526	RESTORE LINE COUNTER
501	501	B	422	D	BRANCH ON D FOR REPEAT
506	506	A	529	527	ADD 1 TO GROUP COUNTER
513	513	B	348	5278	BRANCH TO CHAIN ROUT. IF 4 GROUPS
521	521	B	422		BRANCH TO REPEAT IF NOT 4 GROUPS
526	526	0			LINE COUNTER
527	527	0			GROUP COUNTER
528	528	0			LINE COUNTER RESTORE DIGIT
529	529	1			COUNTER INCREMENT
530	530	S	PAC	E SUPPRES	
545	545	W	ORK	ING PROPERLY. IF THIS SENTENCE IS ON 1 LINE AND PRINTING	
606	606	I	S	I N GROUPS OF THREE WITH A BLANK SPACE BETWEEN GROUPS.	

DATE	5-15-62	27762						
ENG. CHG. NO.	115283	1459						

IBM FORM 6247113-0

1401 DATA PROCESSING SYSTEM

DIAGNOSTIC FUNCTION TEST

PART NO. 451932
SHEET 5 OF 5
BLOCK NO. 20308

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS 12 5 8	SE-SEMICOLON 11 6 8	DE-DELTA 11 7 8
WS-WORD SEPARATOR 0 5 8	LT-LESS THAN 12 6 8	PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8	GT-GREATER THAN 6 8	TM-TAPE MARK 7 8
GM-GROUP MARK 12 7 8	MZ-MINUS ZERO 11 0	CO-COLON 5 8
RP-RIGHT PARENTHESIS 11 5 8	AP-APOSTROPHE 0 6 8	

```
,008015,022029,033033N        1001                      SPACE SUPPRESS         20308 0A
,008015,022029,033033N        1001                      SET WORDMARK CARD      20308 02
L067367,340344,348349,3573611001,008012,0011001183610800A84Z1/340080           20308 03
L069404,377385,389398,4000041001             8389S5518S88N000H360392/3327      20308 04
L067439,412420,422427,4344361001L525S228S00S5212S84208L54321425/214            20308 05
L068471,447452,454460,4674681001L60527624565.447/276L6613322/332               20308 06
L064505,473480,488492,4945031001/A529526849252638422#JL528526B422D             20308 07
L056529,513521,526527,5285291001A5295278348527484422 0001                      20308 08
L072569,545545,545546,5455451001SPACE SUPPRESS WORKING PROPERLY, IF THIS20308 09
L068605,670670,606606,6066061001 SENTENCE IS ON 1 LINE AND PRINTING            20308 10
L072646,001001,001001,0010011001IS IN GROUPS OF THREE WITH A BLANK SPACE20308 11
L072685,646646,001001,0010011001 BETWEEN GROUPS.                                20308 12
L057524,501505,512513,5175181001Z,049L0772772/2772#/40/60                      20308 13
L052544,529536,537541,5455451001#/80L/892702/2702413                           20308 14
/338080N                                                CLEAR WORDMARK CARD    20308 15
,010027,031,0380428031798G8400L0463528H048588          SPACE SUPPRESS         20308 16
```

DATE	5-15-62	27.7.62						
ENG. CHG. NO.	115283	1459						

DIAGNOSTIC FUNCTION TEST

BIT TEST

A. PURPOSE

TO TEST THE BRANCH IF BIT EQUAL CIRCUITRY BY USING CHARACTERS 1,2,4,8,-, "BLANK", AND A-BIT (PROGRAM GENERATED) AS D MODIFIERS. THE BITS CORRESPONDING TO THE CHARACTERS ARE COMPARED ONE AT A TIME WITH BITS IN THE B ADDRESS OF THE INSTRUCTION FOR THE FOLLOWING CONDITIONS.

1. BRANCH OCCURS WHEN BIT AT D-CHARACTER IS PRESENT IN CHARACTER SPECIFIED BY B ADDRESS.

2. BRANCH DOES NOT OCCUR WHEN BIT AT D-CHARACTER IS NOT PRESENT IN CHARACTER SPECIFIED BY B ADDRESS.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. A 1 IN S56 IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON — TO REPEAT FOR SCOPING
OFF — TO CONTINUE

C. ON — TO PRINT CORRECT RESULTS
OFF — TO CONTINUE

D. ON — TO REPEAT SAME DETAIL CARD
OFF — TO CONTINUE

E. ON — TO STOP ON ERROR
OFF — TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

ONE SET OF DETAIL CARDS IS IDENTIFIED BY A "BLANK" IN COLUMN 41 TO TEST FOR EQUAL BITS; ANOTHER SET IS IDENTIFIED BY "NO BLANK" (LETTER "U") TO TEST FOR UNEQUAL BITS.

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

D. (CONTINUED)

THE PROGRAM TO TEST FOR EQUAL BITS IS EXECUTED IN THE FOLLOWING MANNER:

THE CHARACTER IN COLUMN 1 (PRINT POSITION 201) IS MOVED INTO LOCATION 498 TO OPERATE AS A D MODIFIER TO THE BRANCH IF BIT EQUAL INSTRUCTION. THIS INSTRUCTION WILL COMPARE COLUMN 1 WITH COLUMN 23 (PRINT POSITIONS 201-223 RESPECTIVELY). IF EQUAL, BRANCH OCCURS, THE OPERATION WAS EXECUTED CORRECTLY, AND PROGRAMMING PROCEEDS WITH THE NEXT RECORD. IF UNEQUAL, NO BRANCH OCCURS, AN ERROR IS INDICATED, AND THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

THE PROGRAM TO TEST FOR UNEQUAL BITS IS EXECUTED IN THE FOLLOWING MANNER:

THE CHARACTER IN COLUMN 1 (PRINT POSITION 201) IS MOVED INTO LOCATION 472 TO OPERATE AS A D MODIFIER TO THE BRANCH IF BIT EQUAL INSTRUCTION. THIS INSTRUCTION WILL COMPARE COLUMN 1 WITH COLUMNS 23,22,21 (PRINT POSITIONS 223,222,221) IN CHAIN FASHION. IF COLUMN 1 IS UNEQUAL TO ALL THREE CHARACTERS IN COLUMNS 23,22, 21, NO BRANCH OCCURS, THE OPERATION WAS EXECUTED CORRECTLY, AND PROGRAMMING PROCEEDS WITH THE NEXT RECORD. IF COLUMN 1 IS NOT UNEQUAL TO ANY ONE OF THE BITS IN COLUMNS 23,22,21, A BRANCH OCCURS, AN ERROR IS INDICATED, AND THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE THE FIRST TIME THE ERROR OCCURS.

E. STOPS

920 IN STORAGE ADDRESS REGISTER:

ERROR WITH SENSE SWITCH E ON.

F. PRINTOUTS

1. CORRECT

D MODIFIER	B FIELD	RESULT SHOULD BE	RESULT IS
1	1	EQUAL	EQUAL
2	2	EQUAL	EQUAL
2	14	UNEQUAL	UNEQUAL
2	8/-	UNEQUAL	UNEQUAL

2. ERROR

D MODIFIER	B FIELD	RESULT SHOULD BE	RESULT IS
1	1	EQUAL	ERROR
2	2	EQUAL	ERROR
2	14	UNEQUAL	ERROR
2	8/-	UNEQUAL	ERROR

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

F. (CONTINUED)

NOTE: IN THE CASE OF TEST FOR UNEQUAL BITS THE D MODIFIER (2 IN EXAMPLE 3) WAS COMPARED WITH B FIELD BITS 4,1, AND BLANK IN THAT ORDER; IN EXAMPLE 4 IT WAS COMPARED WITH -,/, AND 8. THE FIRST ERROR DETECTED CAUSED THE ERROR PRINT-OUT.

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

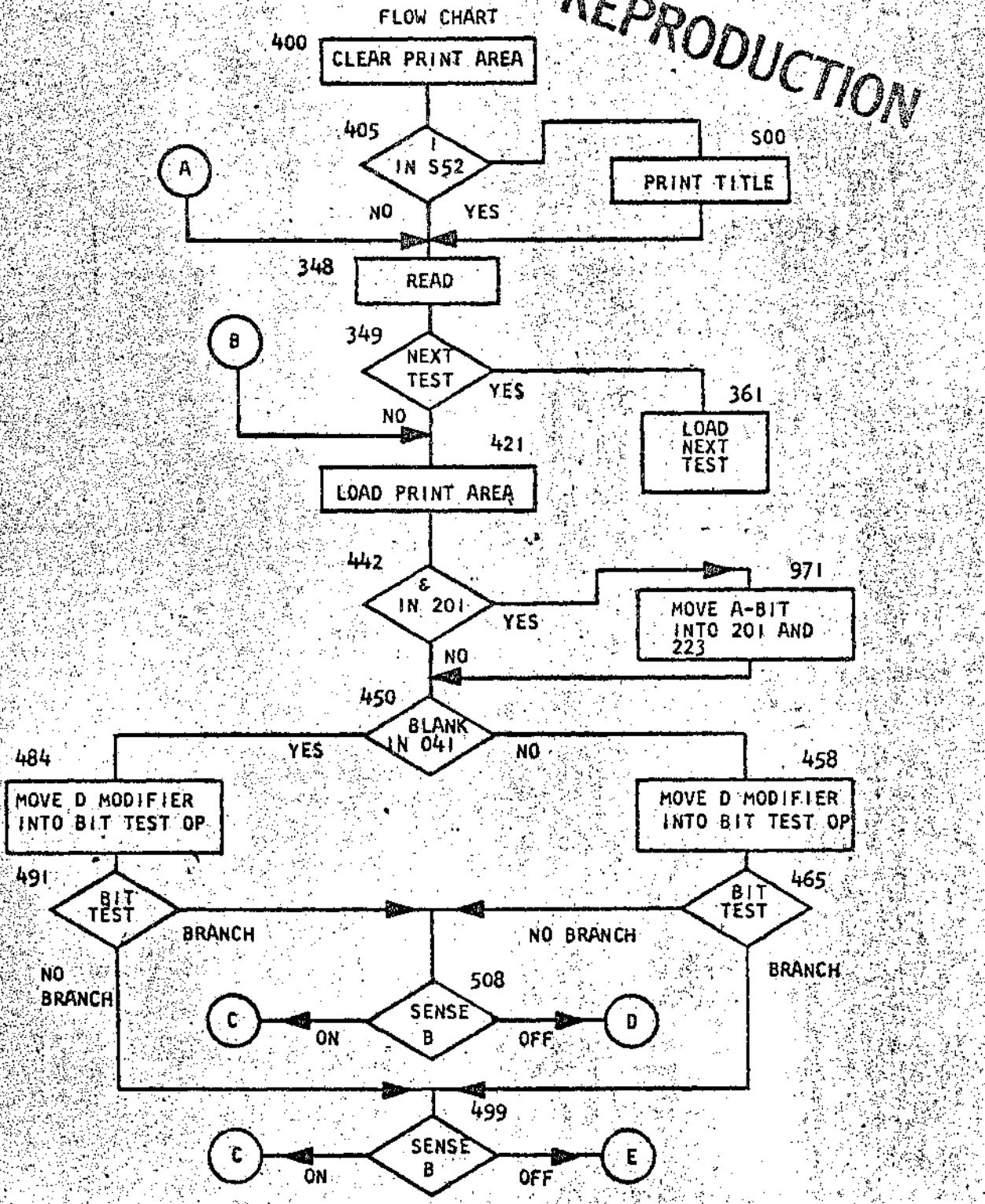
IBM

DIAGNOSTIC FUNCTION TEST

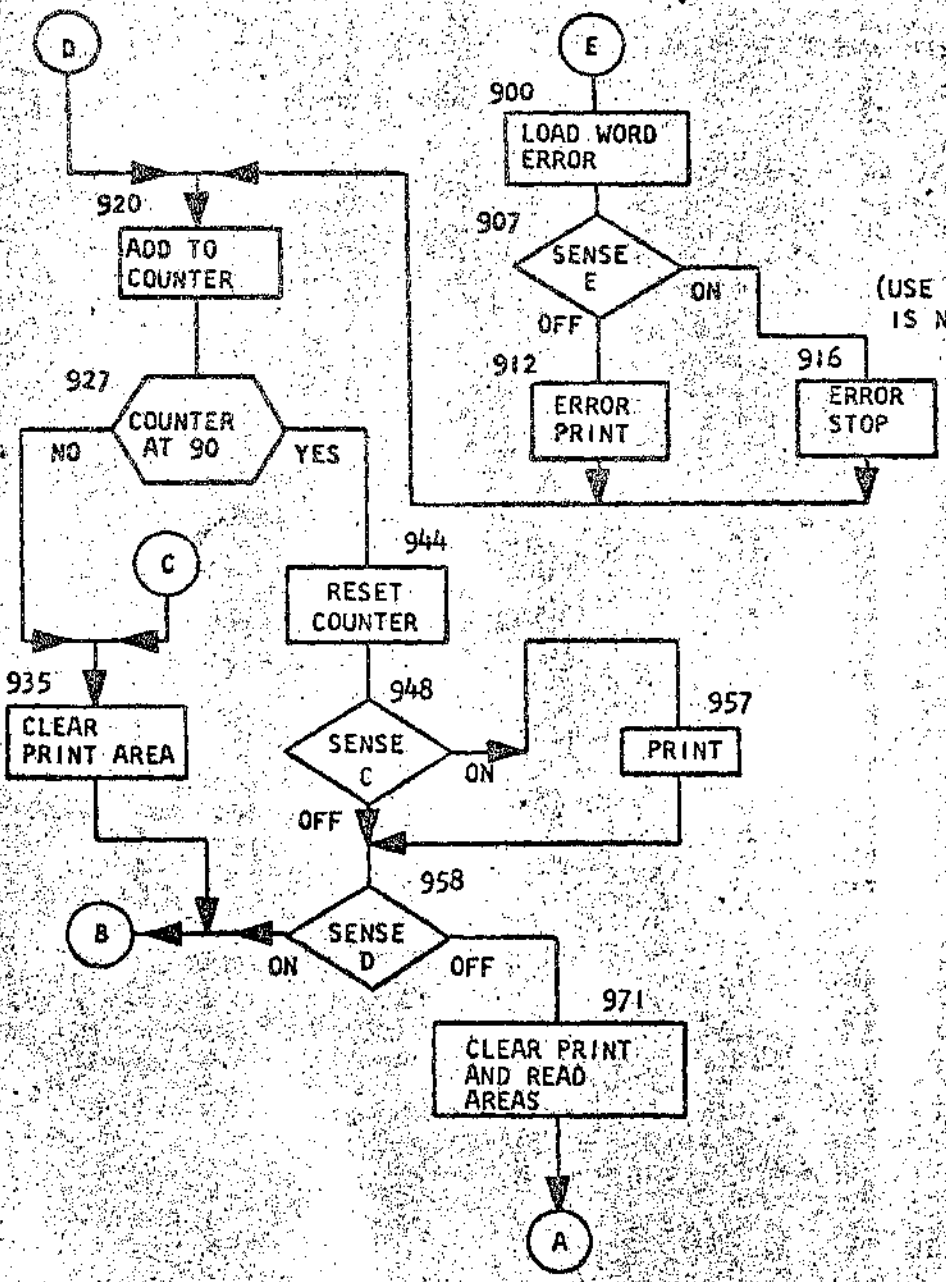
PART NO. 451433
SHEET 4 OF 8
BLOCK NO. 3040C

REPRODUCTION

FLOW CHART



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

BIT TEST 3040C

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389	S561	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		,,	
389	389	N	000		,,	
393	393	M	360	392	,,	
400	400	/	332		START TEST	
404	404	/			,,	
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	/	080		CLEAR READ AREA	
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
421	421	,	001	078	LOAD PRINT AREA	
428	428	L	080	299	,,	
435	435	L	072	272	,,	
442	442	B	971	201+	BR TO CHANGE + CHARAC TO A BIT	
450	450	B	484	041	BR TO TEST EQUAL BITS IF BLANK IN 041	
458	458	M	201	472	MOVE D MODIFIER INTO TEST BIT OP	
465	465	W	499	223X	*TEST UNEQUAL BITS	
473	473	W			* ,,	
474	474	W			* ,,	
475	475	B	508		B ON TO SCOPE	
484	484	M	201	498	MOVE D MODIFIER INTO TEST BIT OP	
491	491	W	508	223X	*TEST EQUAL BITS	
499	499	B	935	B	B ON TO SCOPE	SS
504	504	B	900		BRANCH TO ERROR PRINT ROUTINE	
508	508	B	935	B	B ON TO SCOPE	SS
513	513	,	241		LOAD RESULT COMMENT	
517	517	L	247	267	,,	
524	524	B	920		GO TO CORRECT PRINT ROUTINE	
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE	
907	907	B	916	E	E ON TO ERROR STOP	SS
912	912	2	920		ERROR PRINT	
916	916	.	920		ERROR STOP	
920	920	A	920	970	ADD ONE TO OPERATION COUNTER	
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS	C FOR TA
935	935	/	332		CLEAR PRINT AREA	
939	939	/			,,	
940	940	B	421		BRANCH TO REPEAT	
944	944	S	970		RESET OPERATION COUNTER	
948	948	B	957	C	C ON FOR CORRECT PRINT	SS
953	953	B	958		BRANCH TO SENSE D	
957	957	2			PRINT CORRECT RESULTS	
958	958	B	421	D	D ON TO REPEAT	SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE	
967	967	0	00+		OPERATION COUNTER	

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

```
 971  971  Y 971 223          MOVE A BIT INTO 201 + 223
 978  978  Y 971 201                  ''
 985  985  B 450                    ''
1110  /10  E RRO R            CONSTANTS
1115  /15                          ''
1120  /20  D  MO DIFIER            ''
1140  /40  B  FI ELD               ''
1160  /60  R ESU LT SHOULD BE      ''
1180  /80  R ESU LT IS             ''
```

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	OE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    BIT TEST                          3040C 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD                 3040C 02
L067367,340344,348349,3573611001,008012,0011001IB361080AB421/340080                     3040C 03
L069404,377385,389393,4004041001          B389S561BS88N000M360392/332/                  3040C 04
L069441,413417,421428,4354421001BS00S521/0808348,001078L080299L072272                  3040C 05
L065474,450458,465473,4744751001B971201+B484041 M201472W499223XWW                      3040C 06
L070512,484491,499504,5085131001B508       M201498W508223XB935BB90089358                3040C 07
L072552,517524,524524,524524001,241L2472678920                                          3040C 08
L071938,907912,916920,9279351001L/142858916E2920.920A9209708944969 9/332                3040C 09
L058962,940944,948953,9579581001/8421S9708957C89582B421D                               3040C 10
L072402,967971,978985,9859851001B348000PY971223Y9712018450                             3040C 11
                                  Z
L065/39¤/07/07,/10/15,/20/401001    ERROR      D MODIFIER                               3040C 12
L072/79,/60/80,/80/80,/80/8010018 FIELD                RESULT SHOULD BE                 3040C 13
L070S17,S00S01,S05S12,S13S171001RESULT IS              2,049L0772772/2772               3040C 14
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                             3040C 15
/333080N                                               CLEAR WORDMARK CARD              3040C 16
,019027,031,038042803)T98GB400L0463528W04BS88          BIT TEST                         3040C 17
                                  M
```

DETAIL CARDS

1	1	EQUAL		3040C 18
2	2	EQUAL		3040C 19
4	4	EQUAL		3040C 20
8	8	EQUAL		3040C 21
+	+	EQUAL		3040C 22
–	–	EQUAL		3040C 23
	124	UNEQUAL		3040C 24
	8/–	UNEQUAL		3040C 25
1	24	UNEQUAL		3040C 26
1	8S–	UNEQUAL		3040C 27
2	14	UNEQUAL		3040C 28
2	8/–	UNEQUAL		3040C 29
4	12	UNEQUAL		3040C 30
4	8/–	UNEQUAL		3040C 31
8	12	UNEQUAL		3040C 32
8	4/–	UNEQUAL		3040C 33
/	22	UNEQUAL		3040C 34
/	48–	UNEQUAL		3040C 35
–	12	UNEQUAL		3040C 36
–	48/	UNEQUAL		3040C 37

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

INDEXING AND STORE STARS

A. PURPOSE

TO TEST THE INDEXING AND STORE A AND B STAR CIRCUITRIES BY MODIFYING THE A AND B ADDRESSES OF AN INSTRUCTION BY INDEX FACTORS PUNCHED IN THE DETAIL CARDS AND STORED IN INDEX LOCATIONS 1, 2, AND 3. THE PROGRAM IS DESIGNED FOR ANY STORAGE SIZE FROM 1.4K TO 16K.

B. LOADING PROCEDURES

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

WHEN RUNNING TEST FROM TAPE ENTER A 1 IN 1257.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON FOR SCOPING LOOP
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT USING SAME FACTORS
OFF TO READ NEW INFORMATION
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

D. TEST PROCEDURE

THE PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

FIRST, THE PRINTOUT INFORMATION IS LOADED INTO THE PRINT AREA. SECOND, THE INDEXED INSTRUCTION (DIFFERENT FOR EACH DETAIL CARD) IS LOADED INTO THE PROGRAM. THIRD, THE INDEX FACTORS ARE LOADED INTO INDEX LOCATIONS 1 (087-089), 2 (092-094), AND 3 (097-099).

THE NEXT INSTRUCTION CLEARS LOCATION 000 TO CAUSE WRAP-AROUND TO 15999, 11999, 7999, 3999, OR 1999 TO DETERMINE STORAGE SIZE OF THE MACHINE BEING TESTED. THE HIGHEST ADDRESS IS THEN TRANSFERRED TO LOCATIONS 793-795 BY A STORE B STAR INSTRUCTION. LOCATION 795 IS THEN TESTED FOR ZONES TO DETERMINE WHETHER STORAGE SIZE IS 16K, 12K, OR 8K. IF NONE OF THESE, A TEST IS MADE FOR ZONES IN LOCATION 793 TO DETERMINE WHETHER THE MACHINE BEING TESTED IS 4K, 2K OR 1.4K. HAVING DETERMINED THE STORAGE SIZE, THE PROGRAM THEN MOVES THE PROPER INSTRUCTION INTO LOCATIONS 500-507. THIS INSTRUCTION, WHEN EXECUTED, COMPARES THE D-CHARACTER WITH THE SELECTION CODES (114826) PUNCHED IN COLUMNS 63-68 OF THE DETAIL CARD. THIS COMPARISON DETERMINES WHETHER THE DETAIL CARD IS TO BE BY-PASSED OR PROCESSED. FOR EXAMPLE, A DETAIL CARD PUNCHED 114826 WILL BE PROCESSED ON ANY MACHINE, BUT A DETAIL CARD PUNCHED 4826 WILL BE BY-PASSED ON A 1.4 OR 2K MACHINE AND PROCESSED ON A 4K, 8K, 12K, OR 16K MACHINE. A CARD PUNCHED 6 CAN ONLY BE PROCESSED ON A 16K MACHINE.

DETAIL CARDS PUNCHED WITH SELECTION CODES (114826) IN COLUMNS 63-68 TO PROCESS OR BY-PASS RECORDS AS FOLLOWS:

SELECTION CODES	PROCESS ON	CARD NUMBER
114826	ALL MACHINES	25-32
14826	2K,4K,8K,12K,16K	33-34
4826	4K,8K,12K,16K	35-37
826	8K,12K,16K	38-41
26	12K,16K	42-45
6	16K	46-48

IF THE DETAIL CARD IS TO BE PROCESSED, THE PROGRAM BRANCHES TO LOCATION 600 TO SET UP A SINGLE CHARACTER A OR B FIELD IN A LOCATION SPECIFIED BY COLUMNS 10-12 OF THE DETAIL CARD. THIS IS DONE TO PROVIDE A WORD MARK IN THE A OR B FIELD TO END THE EXECUTION PHASE OF THE INDEXED INSTRUCTION.

THE PROGRAM BRANCHES TO ADDRESS 512 TO EXECUTE THE INDEXED INSTRUCTION PUNCHED IN COLUMNS 1-7 OF THE CARD BY ADDING THE INDEX FACTORS TO THE A AND B ADDRESS OF THE INSTRUCTION, EXECUTE THE INSTRUCTION AND STORE THE RESULT OF A STAR IN LOCATIONS 261-263 AND THE RESULT OF B STAR IN LOCATIONS 264-266. THESE TWO RESULTS ARE THEN COMPARED WITH THE PRE-DETERMINED RESULT PUNCHED IN COLUMNS 41-46 AND STORED IN LOCATIONS 241-246.

E. STOPS

920 - ERROR STOP WITH E ON.
AFTER STOP CONTINUE BY PUSHING START.

F. PRINTOUTS

1. WITHOUT ERRORS

INSTR.	INDEX REG.	RESULTS SHOULD BE	RESULTS ARE	PROC. ON	
AIR85G7	**** 143 422	A340998	A340998	114826	
,TT4W07	V67 S34 ***	,R00R00	,R00R00	4826	
LPX7EN6	N5W X7X ***	LT3KT3K	LT3KT3K	26	

2. WITH ERRORS

AIR85G7	**** 143 422	A340998	A340576	114826	ERROR
,TT4W07	V67 S34 ***	,R00R00	,N67R00	4826	ERROR
LPX7EN6	N5W X7X ***	LT3KT3K	LT3KJ1S	26	ERROR

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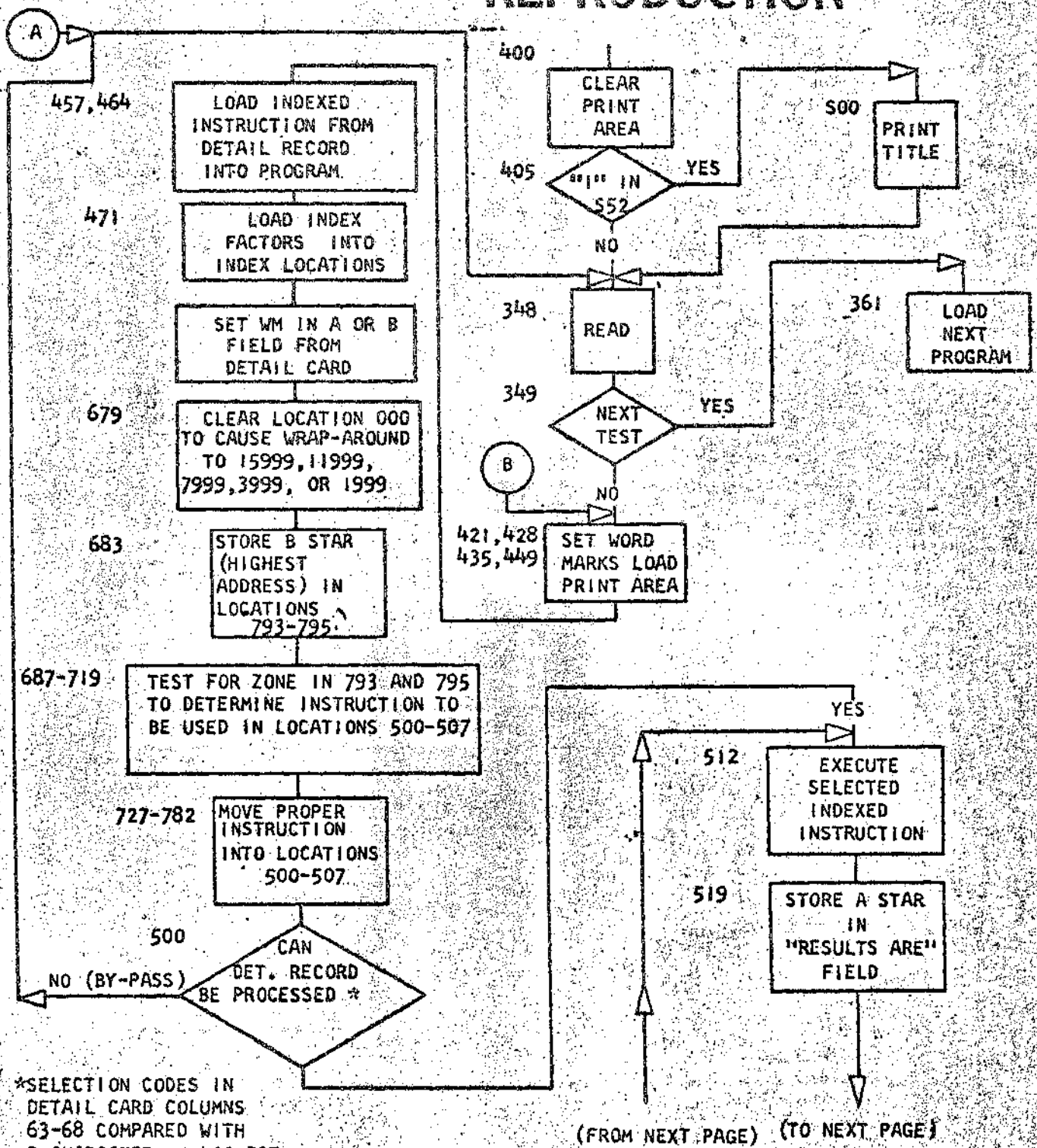

*SELECTION CODES IN DETAIL CARD COLUMNS 63-68 COMPARED WITH D-CHARACTER IN LOC. 507.

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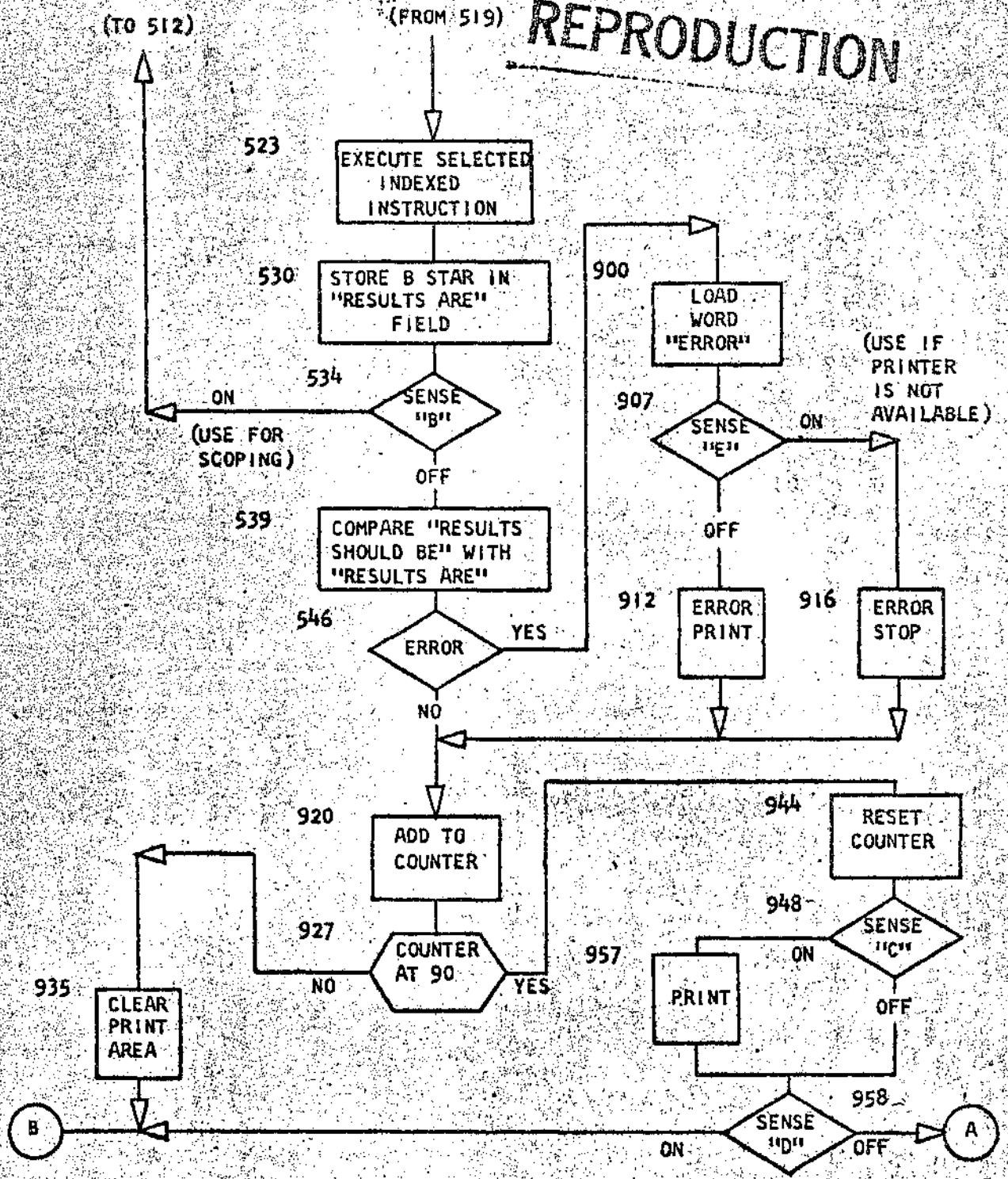
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451434
SHEET 4 OF 8
BLOCK NO. 31000

REPRODUCTION



DATE	2-2-61	2-15-61	4-27-61	7-1-63	17.10.63			
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PROGRAM LISTING FOR USE WITH FLOW CHART

INDEXING + STORE STARS 3100D

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S571	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		"
389	389	N	000		"
393	393	M	360	392	"
400	400	/	332		START TEST
404	404	/			"
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	021	LOAD PRINT AREA
428	428	,	062	078	"
435	435	L	080	299	"
442	442	L	068	278	"
449	449	L	050	250	"
456	456	N			*AN ASTERISK MEANS INSTRUCTION CHANGES
457	457	L	007	518	LOAD INDEXED INSTRUCTION FROM DETAIL
464	464	L	007	529	CARD INTO PROGRAM
471	471	L	033	099	LOAD INDEX FACTORS INTO INDEX LOCATIONS
478	478	,	099	@40	SET WORD MARKS
485	485	B	679		BRANCH TO DETERMINE STORAGE SIZE
500	500	B	600	06XX	*IF 06XX BR TO PROCESS DETAIL RECORD
508	508	B	417		IF NOT 06XX BR TO BY-PASS DETAIL RECORD
512	512	X	XXX	XXX	*INDEXED INSTRUCTION
519	519	Q	263		STORE A STAR IN -RESULTS ARE- FIELD
523	523	X	XXX	XXX	*INDEXED INSTRUCTION
530	530	H	266		STORE B STAR IN -RESULTS ARE- FIELD
534	534	B	512	B	B ON TO SCOPE SS
539	539	M	512	260	MOVE OP CODE TO RESULTS FIELD
546	546	C	268	248	TEST FOR ERROR
553	553	B	900	/	BR TO ERROR PRINT ROUTINE IF UNEQUAL
558	558	B	920		BR TO CORRECT PRINT ROUTINE
600	600	,	010		SET A OR B FIELD WM
604	604	M	012	617	ALTER INSTRUCTION 611
611	611	L	971	XXX	*LOAD BLANK INTO A OR B FIELD
618	618	L	007	207	LOAD PRINT AREA
625	625	B	512		BRANCH TO CONTINUE
679	679	/	000		CLEAR 000 TO CAUSE WRAP AROUND
683	683	H	795		STORE HIGHEST ADDR IN B STAR
687	687	V	782	795B	BR IF HIGHEST ADDR IS 15999
695	695	V	771	795K	BR IF HIGHEST ADDR IS 11999
703	703	V	760	795S	BR IF HIGHEST ADDR IS 7999
711	711	V	749	7938	BR IF HIGHEST ADDR IS 3999
719	719	V	738	793Z	BR IF HIGHEST ADDR IS 1999

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```
 727  727  M 803 507          MOVE TEST FOR 1.4K INTO PROG
 734  734  B 500              BR TO PROCESS OR BY-PASS
 738  738  M 811 507          MOVE TEST FOR 2K INTO PROG
 745  745  B 500              BR TO PROCESS OR BY-PASS
 749  749  M 819 507          MOVE TEST FOR 4K INTO PROG
 756  756  B 500              BR TO PROCESS OR BY-PASS
 760  760  M 827 507          MOVE TEST FOR 8K INTO PROG
 767  767  B 500              BR TO PROCESS OR BY-PASS
 771  771  M 835 507          MOVE TEST FOR 12K INTO PROG
 778  778  B 500              BR TO PROCESS OR BY-PASS
 782  782  M 843 507          MOVE TEST FOR 16K INTO PROG
 789  789  B 500              BR TO PROCESS OR BY-PASS
 793  793  X XX               HIGHEST ADDR STORED BY STORE B STAR INST
 796  796  B 600 0631         INSTRUC USED BY PROG IF 1.4K STOR
 804  804  B 600 0641         INSTRUC USED BY PROG IF 2K STOR
 812  812  B 600 0654         INSTRUC USED BY PROG IF 4 K STOR
 820  820  B 600 0668         INSTRUC USED BY PROG IF 8 K STOR
 828  828  B 600 0672         INSTRUC USED BY PROG IF 12 K STOR
 836  836  B 600 0686         INSTRUC USED BY PROG IF 16 K STOR
 900  900  L /14 285          BEGIN ERROR PRINT ROUTINE
 907  907  B 916 E            E ON TO ERROR STOP                    SS
 912  912  2 920              ERROR PRINT
 916  916  . 920              ERROR STOP
 920  920  A 920 970          ADD ONE TO OPERATION COUNTER
 927  927  B 944 9699         BRANCH AFTER 90 OPERATIONS      C FOR TA
 935  935  / 332              CLEAR PRINT AREA
 939  939  /                    ,,
 940  940  B 421              BRANCH TO REPEAT
 944  944  S 970              RESET OPERATION COUNTER
 948  948  B 957 C            C ON FOR CORRECT PRINT                SS
 953  953  B 958              BRANCH TO SENSE D
 957  957  2                  PRINT CORRECT RESULTS
 958  958  B 421 D            D ON TO REPEAT                        SS
 963  963  B 348              BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+              OPERATION COUNTER
 971  971                     A OR B FIELD
1110  /10  E RRO R            CONSTANTS
1115  /15                      ,,
1120  /20  I NDE XED INSTRUC.  ,,
1140  /40  I NDE X REGISTERS   ,,
1160  /60  R ESU LTS SHOULD BE ,,
1180  /80  R ESU LTS ARE PROC. ON ,,
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,035033N      1001                INDEXING + STORE STARS   3100D 01
,008015,022029,033033N      1001                SET WORDMARK CARD        3100D 02
L067367,340344,348349,3573611001,008012,0011001!8361080A8421/340080      3100D 03
L069404,377385,389393,4004041001          8389S571BS88N000M360392/332/   3100D 04
L069441,413417,421428,4354421001BS00S521/0808348,001021,062078L080299    3100D 05
L068477,449456,457464,4714781001L068278L050250NL007518L007529L033099     3100D 06
L066511,485500,508512,5125121001,099240B679          B60006XXB417         3100D 07
L066545,519523,530534,5395461001XXXXXXXQ263XXXXXXXH266B5128M512260       3100D 08
L072585,553558,558558,5585581001C268248B900/B920                         3100D 09
L072639,604611,618625,6256251001,010M012617L971XXXL0072078512            3100D 10
L070702¤665665,679683,6876951001                  /000H795V782795BV771795K  3100D 11
L067737,711719,727734,7387381001V760795SV749793BV738793ZM803507B500       3100D 12
L072777,745749,756760,7677711001M811507B500M819507B500M827507B500M835507 3100D 13
L066811,782789,793796,8048121001B500M843507B500XXX86000631B6000641        3100D 14
L072851,820828,836836,8368361001B6000654B6000668B6000672B6000686          3100D 15
L060919¤892892,900907,9129161001        L/142858916E2920.920               3100D 16
L065952,927935,939940,9449481001A920970B9449699/332/B421S970B957C         3100D 17
L072992,957958,963967,9719711001B9582842IDB348000P                       3100D 18
                                                    Z
L072/39,/10/15,/20/40,/40/401001          ERROR    INDEXED INSTRUC.       3100D 19
L072/79,/60/80,/80/80,/80/801001INDEX REGISTERS    RESULTS SHOULD BE      3100D 20
L070S17,S00S01,S05S12,S13S171001RESULTS ARE PROC. ON2,049L0772772/2772    3100D 21
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/992802/2802413                3100D 22
/333080N                                            CLEAR WORDMARK CARD   3100D 23
,019027,031,038042803IT98GB400L046352BW04BS88       INDEXING + STORE STARS 3100D 24
                          M
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DETAIL CARDS

```
S0I3012  091      ***  ***  I9I    S091090                114826  3100D 25
S/810R2  091      ***  I9I  I9I    S/19090                114826  3100D 26
S0Y20H3  082      I9I  ***  I9I    S080081                114826  3100D 27
S/S10Q2  081      I9I  I9I  ***    S/19080                114826  3100D 28
A0÷0082  082      /20  ***  ***    A/19081                114826  3100D 29
A/200M0  082      ***  082  ***    A/19081                114826  3100D 30
    Z
D0÷00P0  082      /20  ***  082    D/19081                114826  3100D 31
    Z
A1R85G7  999      ***  143  422    A340998                114826  3100D 32
H089002  091      ***  ***  ***    H086002                114826  3100D 33
H0890÷2  091      099  ***  ***    H086103                114826  3100D 34
H094002  091      ***  ***  ***    H091002                114826  3100D 35
H0940M2  091      ***  099  ***    H091103                114826  3100D 36
    Z
```

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H099002	091	***	***	***	H096002	114826	3100D	3
H0990P2 Z	091	***	***	099	H096103	114826	3100D	38
□5P09≠0 Z	X99	899	***	S99	□X98X98	14826	3100D	39
CSM48Y5	Z96	/11	752	***	CZ95Z95	14826	3100D	40
,TT4W07	R01	V67	S34	***	,R00R00	4826	3100D	41
M/F24U4	P89	L45	***	/34	MK95P88	4826	3100D	42
L259JW7	W61	U32	***	***	LW60E98	4826	3100D	43
A1P3QZ0 Z	S6X	W77	***	934	A≠3656W	826	3100D	44
DST4PQ7 Z	U3S	344	L45	***	DV77U3/	826	3100D	45
,ZHXZHX	P8Z	***	***	802	,P8YP8Y	826	3100D	46
□2KSII9	A1/	***	Q89	A12	□A1≠A1≠	826	3100D	47
MW93YHY	22K	***	***	L34	MW9222J	26	3100D	48
LPX7EN6	T3L	NSW	X7X	***	LT3KT3K	26	3100D	49
,EE5YQ9	M4M	***	55N	Q8Z	,M4LM4L	26	3100D	50
□CC33TL	F60	C33	***	33L	□F6NF6N	26	3100D	51
Y0MP3TT ZZ	76E	43K	765	***	Y76D76D	6	3100D	52
M//14EF	Z9I	88H	***	V43	MZ9HZ9H	6	3100D	53
ABCDEFG	Y94	***	***	L27	AV60Y93	6	3100D	54

MOVE RECORD

A. PURPOSE

TO TEST THE MOVE RECORD CIRCUITRY AS FOLLOWS:

1. A FIELD CHARACTERS ARE TRANSFERRED TO B FIELD.
2. WORD MARKS IN THE B FIELD ARE NOT REMOVED.
3. WORD MARKS IN THE A FIELD ARE NOT TRANSFERRED TO THE B FIELD
4. RECORD MARK IN A FIELD WILL STOP OPERATION
5. RECORD MARK IN B FIELD WILL NOT STOP OPERATION
6. GROUP MARK WORD MARK IN A FIELD WILL STOP OPERATION
7. GROUP MARK WORD MARK IN B FIELD WILL NOT STOP OPERATION
8. GROUP MARK IN A FIELD WILL NOT STOP OPERATION.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
2. A 1 IN S57 IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON — TO REPEAT FOR SCOPING
OFF — TO CONTINUE

C. ON — TO PRINT CORRECT RESULTS
OFF — TO CONTINUE

D. ON — TO REPEAT SAME DETAIL CARD
OFF — TO CONTINUE

E. ON — TO STOP ON ERROR
OFF — TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT

C. CONTINUED

PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

THE A FIELD (COLUMNS 1-12) AND DUPLICATE B FIELDS (COLUMNS 21-32, AND 61-72) ARE LOADED INTO THE CORRESPONDING PRINT AREA (STORAGE LOCATIONS 201-272). THESE FIELDS IN THE PRINT AREA ARE LABELED A FIELD, B FIELD, AND RESULT IS.

THE RESULT SHOULD BE FIELD IS LOADED INTO STORAGE LOCATIONS 241-252 FROM THE A FIELD AND THEN MODIFIED TO REPRESENT THE CORRECT RESULT.

WORD MARKS ARE SET WITHIN BOTH THE A FIELD AND THE RESULT IS FIELD, AND THE A FIELD IS MOVED BY A MOVE RECORD OPERATION INTO THE RESULT IS FIELD. THE RESULT IS CHECKED FOR THE ADDITION OR REMOVAL OF WORD MARKS IN THE B (RESULT IS) FIELD. NEXT, THIS FIELD IS COMPARED TO THE RESULT SHOULD BE FIELD.

E. STOPS

920 IN STORAGE ADDRESS REGISTER:

ERROR WITH SENSE SWITCH E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
1+1111111111+E 4444+444444444+E 8888+888888 E		1+1111111111+ 4444+444444444+ 8888+888888	1+1111111111+ 4444+444444444+ 8888+888888

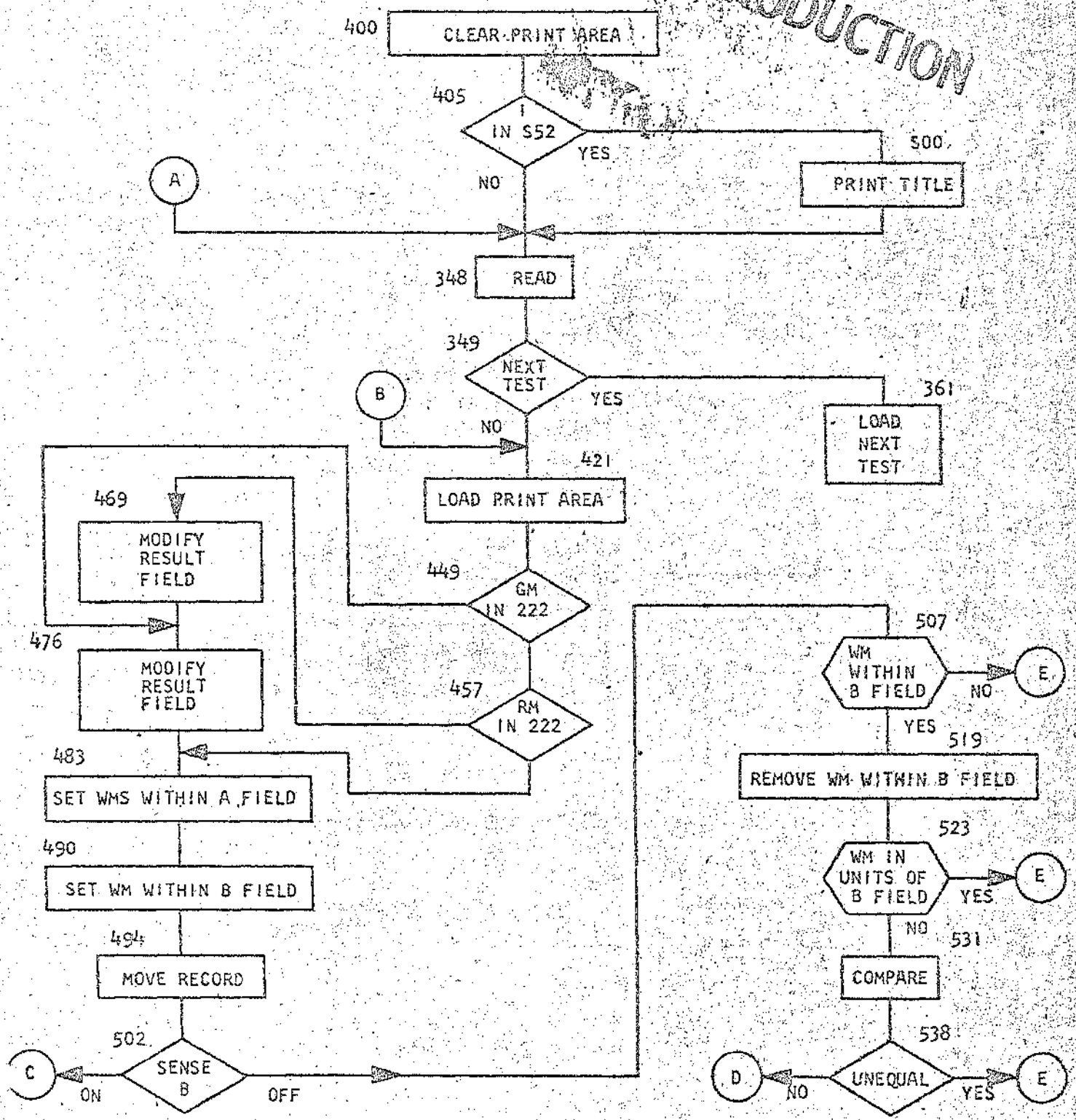
2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
1+1111111111+E 4444+444444444+E 8888+888888 E		1+1111111111+ 4444+444444444+ 8888+888888	1+ ERROR 4444+ ERROR 8888+ ERROR

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

FLOW CHART

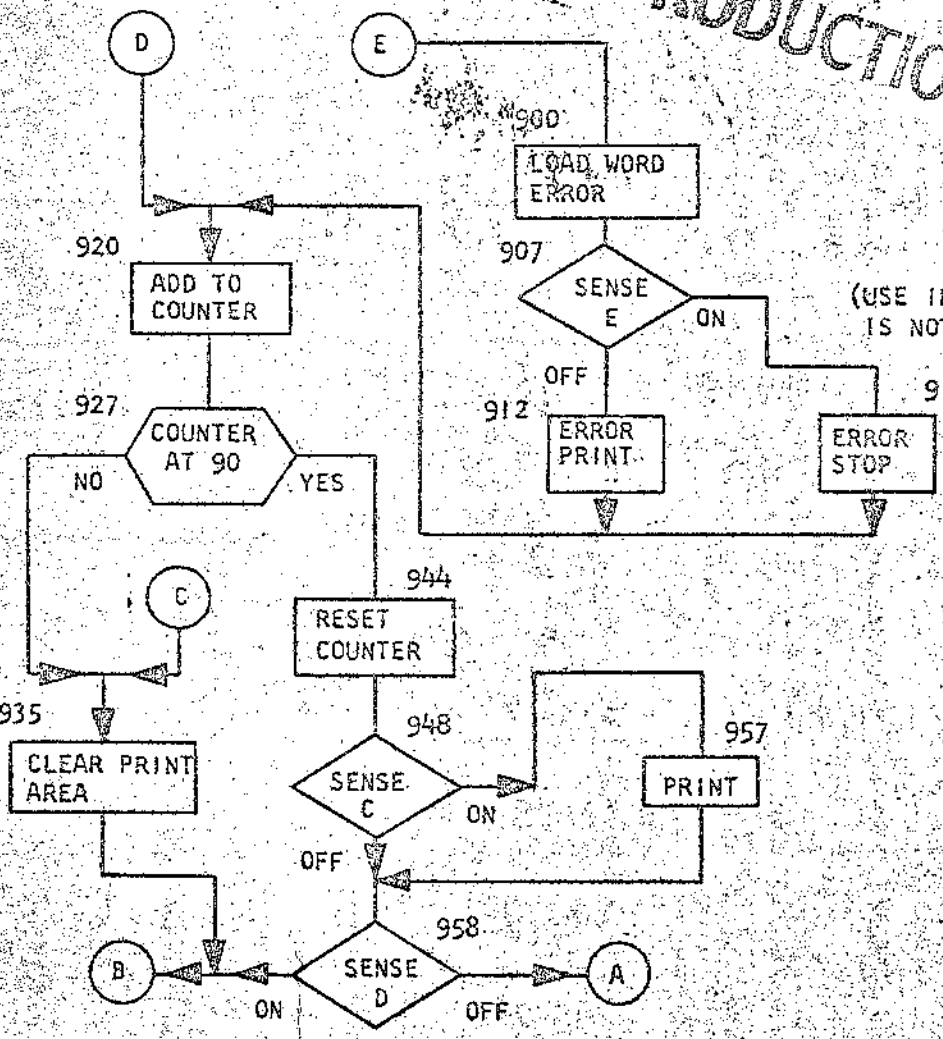


DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451436
SHEET 4 OF 8
BLOCK NO. 3110D



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

MOVE RECORD [redacted] 31100

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S571	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		"
389	389	N	000		"
393	393	M	360	392	"
400	400	/	332		START TEST
404	404	/			"
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	"
435	435	L	072	272	"
442	442	L	012	252	"
449	449	B	476	222	TEST FOR GM IN 222
457	457	B	469	222#	TEST FOR RM IN 222
465	465	B	483		NO GM OR RM IN 222
469	469	M	992	252	MODIFY RESULT SHOULD BE IF RM IN 222
476	476	M	989	252	MODIFY RESULT SHOULD BE IF GM IN 222
483	483	,	205	212	SET WMS IN MIDDLE OF A FIELD
490	490	,	266		SET WM IN MIDDLE OF B FIELD
494	494	P	201	261	MOVE RECORD
501	501	P			"
502	502	B	935	B	LOOP ON SW B FOR SCOPING SS
507	507	V	519	2661	CHECK FOR WM IN MIDDLE OF B FIELD
515	515	B	900		BRANCH ERROR
519	519	¤	266		REMOVE WM IN MIDDLE OF B FIELD
523	523	V	900	2721	ERROR IF WM IN UNITS OF B FIELD
531	531	C	272	252	COMPARE B FIELD TO CORRECT RESULT
538	538	B	900	/	BRANCH ERROR
543	543	B	920		GO TO CORRECT ROUTINE
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			"
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS
953	953	B	958		BRANCH TO SENSE D
957	957	2			PRINT CORRECT RESULTS

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

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 958  958  B 421 D                 D ON TO REPEAT                          SS
 963  963  B 971                   GO AND CLEAR PRINT AND READ
 967  967  0 00+                   OPERATION COUNTER
 971  971  / 299                   CLEAR PRINT AREA
 975  975  / 080                   CLEAR READ AREA
 979  979  B 348                   BRANCH TO PROG. CHAINING ROUTINE
 983  983
1110  /10  E RRO R                 CONSTANTS
1115  /15                           ,,
1120  /20  A  FI ELD                ,,
1140  /40  B  FI ELD                ,,
1160  /60  R ESU LT SHOULD BE       ,,
1180  /80  R ESU LT IS              ,,
```

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    MOVE RECORD                    31100 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD              31100 02
L067367,340344,348349,3573611001 0080I2,001100118361080A8421/340080                    31100 03
L069404,377385,389393,400404100I          8389S5718S88N000M360392/332/                 31100 04
L069441,413417,421428,435442100I8S00S521/080B348,001078L080299L072272                  31100 05
L066475,449457,465469,476476100IL012252847622ZG8469222*B483M992252                     31100 06
                                                M
L071514,483490,494501,502507100IW989252,205212,266P201261PB9358V5192661                31100 07
L072554,519523,531538,543543100I8900□266V900272IC2722528900/8920                       31100 08
L071938,907912,916920,927935100IL/142858916E2920.920A9209708944969 9/332               31100 09
L056962,940944,948953,957958100I/B42IS9708957C895828421D                               31100 10
L072*02,967971,975979,979983100I8971000P/299/080B348                                   31100 11
                                                Z
L065/39□/07/07,/10/15,/20/401001   ERROR     A FIELD                                     31100 12
L072/79,/60/80,/80/80,/80/8010018 FIELD                RESULT SHOULD BE                31100 13
L070S17,S00S01,S05S12,S13S17100IRESULT IS              2,049L0772772/2772              31100 14
L059S44,S25S29,S36S37,S41S45100I□/40/60□/80L/892702/2702413                             31100 15
/333080N                                        CLEAR WORDMARK CARD                    31100 16
,019027,031,038042B031T98GB400L0463528W04BS88   MOVE RECORD                            31100 17
                                M
```

DETAIL CARDS

```
8888G0SY888GE          GGGGGGGGGGGG                          GGGGGGGGGGGG31100 18
    M      M           M MMMMMMMMMM                          M MMMMMMMMMM
**********             **                                    *0          31100 19
*GGGGGGGGGGGE          *G888                                 *G888       31100 20
 MMMMMMMMMM             M                                     M
8888G0SY888GE          GGGGGGGGGGGG                          GGGGGGGGGGGG31100 21
    M      M           M MMMMMMMMMM                          M MMMMMMMMMM
8888G0SY888GE          GHGGGGGGGGGG                          GHGGGGGGGGGG31100 22
    M      M           M MMMMMMMMMM                          M MMMMMMMMMM
8888G0SY888GE          *H**********                          *H**********31100 23
    M      M
*              GE                                                        31100 24
               M
1*111111111*E                                                            31100 25
22*22222222GE                                                            31100 26
               M
444*444444444*E                                                          31100 27
8888*888888GE                                                            31100 28
               M
////T*////*E                                                            31100 29
     S
```

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ENG. CHG. NO.	110378	110378B	117628	TA 1976					

```
----D-$-----GE
    E     M
1111G11$111$E
2222.22222$GE
          M
□444G444444$E
    M
8888G0SY888GE
  M     M
```

REPRODUCTION

3110D 30

3110D 31

3110D 32

3110D 33

3110D 34

DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378B	117628	TA 1976				

I-STAR TRANSFER

A. PURPOSE OF TEST

TO TEST THE I-STAR TRANSFER CIRCUITRY BY EXECUTING A BRANCH OR NO-OP INSTRUCTION, STORING THE CONTENTS OF THE I-STAR IF BRANCH OR B-STAR IF NO BRANCH, AND COMPARING THE RESULT WITH THE RESULT SHOULD BE FIELD. FOR UNEQUAL CONDITIONS, THE MACHINE EITHER STOPS TO PERMIT CONSOLE CHECKING OR PRINTS THE RESULTS DEPENDING UPON THE SETTING OF SENSE SWITCH E.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1257.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE.

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

THE INSTRUCTION PERFORMED IN 454 (COLUMNS 1-8) AND RESULT SHOULD BE (COLUMNS 41-43) ARE TRANSFERRED FROM THE READ AREA TO THE PRINT AREA. THE INSTRUCTION IS THEN LOADED INTO THE PROGRAM IN LOCATIONS 454-461 AND EXECUTED. AS A RESULT OF THIS INSTRUCTION EITHER B-STAR IF NO BRANCH OR I-STAR IF BRANCH IS LOADED INTO LOCATIONS 261-263 OF THE PRINT AREA. THE RESULT IS THEN COMPARED WITH THE RESULT SHOULD BE. FOR UNEQUAL CONDITIONS, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR STOP WITH SENSE E ON

F. PRINTOUTS

1. CORRECT

INSTRUCTION PERFORMED IN 454		RESULT SHOULD BE	RESULT IS
B500	BRANCH	458	458
N5009981	NO BRANCH	998	998
B500999A	BRANCH	462	462
V5009992	NO BRANCH	998	998

2. ERRORS

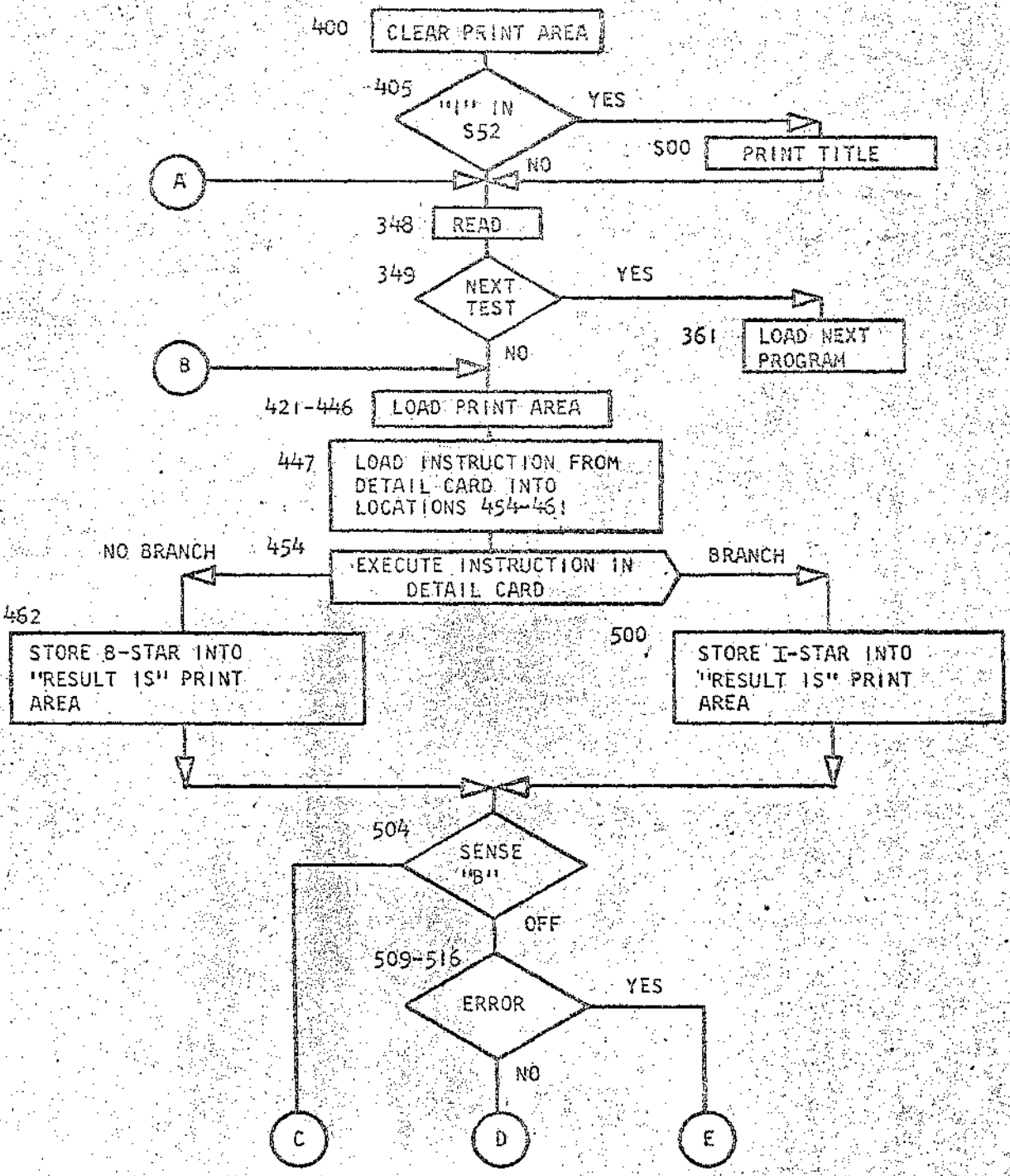
B500	BRANCH	458		ERROR
N5009981	NO BRANCH	998	462	ERROR
B500999A	BRANCH	462	998	ERROR
V5009992	NO BRANCH	998	462	ERROR

G. COMMENTS

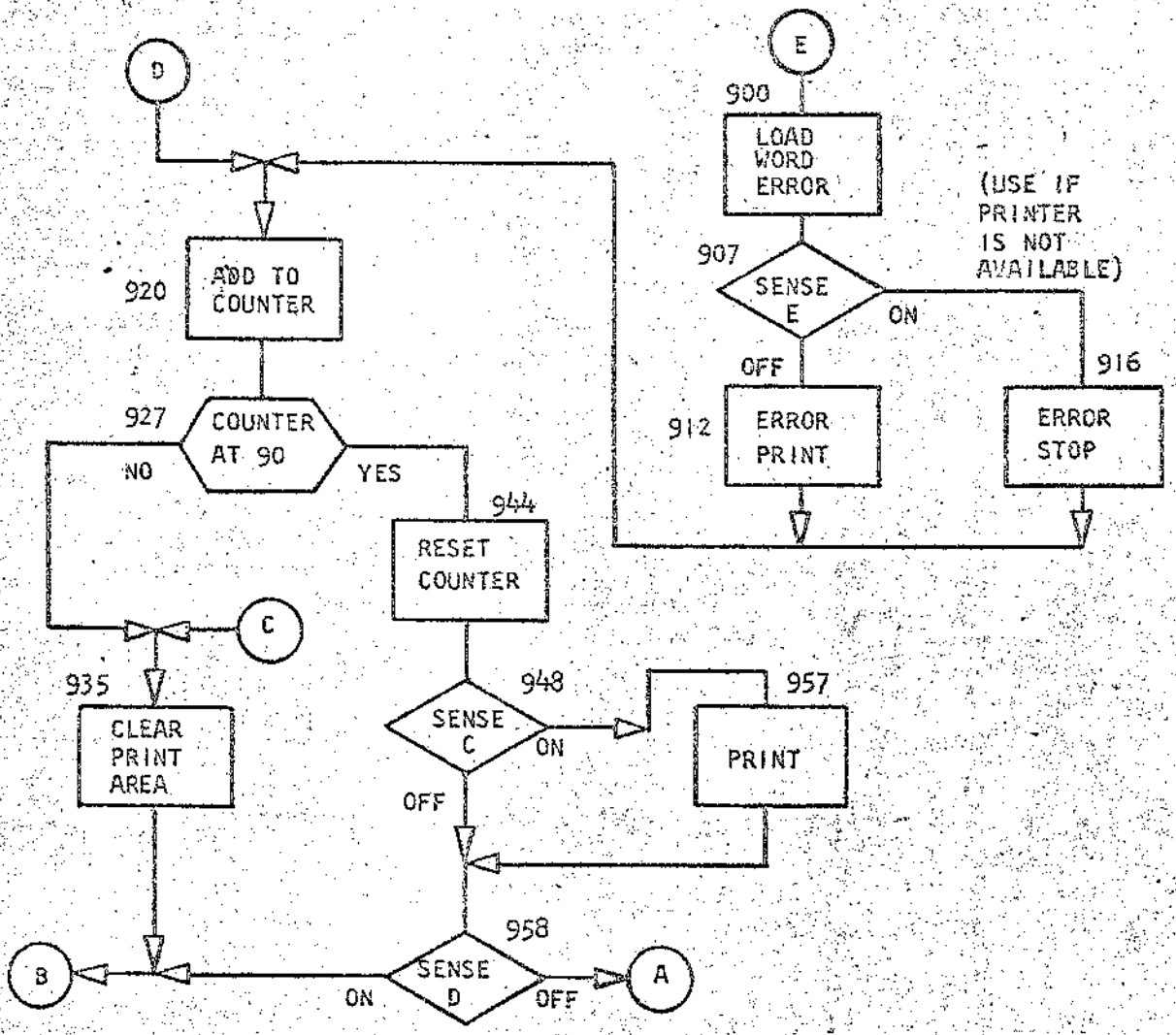
THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

I-STAR TRANSFER

FLOW CHART



DATE	2-2-61	4-27-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378C	117628	TA 1976				



DATE	2-2-61	4-27-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378C	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

I-STAR TRANSFER 3130D

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S571	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	500	S521	BR TO TIILE PRINT ROUTIME IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	041	LOAD PRINT AREA
428	428	,	078		,,
432	432	L	080	299	,,
439	439	L	072	272	,,
446	446	L			,,
447	447	L	008	461	LOAD INSTRUCTION INTO PROGRAM
454	454	X	500	XXXX	*INSTRUC READ FROM DETAIL CARD
462	462	H	263		STORE B STAR - NO BR OCCURERED IN 454
466	466	B	504		BRANCH TO SENSE B
500	500	H	263		STORE I STAR - BRANCH OCCURRED IN 454
504	504	B	935	B	B ON TO SCOPE SS
509	509	C	263	243	TEST FOR ERROR
516	516	B	900	/	BRANCH TO ERROR PRINT ROUTINE IF UNEQ
521	521	B	920		GO TO CORRECT PRINT ROUTINE
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			,,
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS
953	953	B	958		BRANCH TO SENSE D
957	957	2			PRINT CORRECT RESULTS
958	958	B	421	D	D ON TO REPEAT SS
963	963	B	348		BRANCH TO PROG. CHAINING ROUTINE
967	967	0	00+		OPERATION COUNTER
971	971	A			CHARACTERS TO BE TESTED
1110	/10	E	RRO	R	CONSTANTS
1115	/15				,,
1120	/20	I	NST	R. PERFORMED IN	,,

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ENG. CHG. NO.	110378	110378C	117628	TA 1976				

```
1140  /40  4 54                ,,
1160  /60  R ESU LT SHOULD BE  ,,
1180  /80  R ESU LT IS         ,,
```

DATE	2-2-61	4-27-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378C	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS.

LP-LEFT PARENTHESIS 12 5 8	SE-SEMICOLON 11 6 8	DE-DELTA 11 7 8
WS-WORD SEPARATOR 0 5 8	LT-LESS THAN 12 6 8	PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8	GT-GREATER THAN 6 8	TM-TAPE MARK 7 8
GM-GROUP MARK 12 7 8	MZ-MINUS ZERO 11 0	CO-COLON 5 8
RP-RIGHT PARENTHESIS 11 5 8	AP-APOSTROPHE 0 6 8	

```
,008015,022029,033033N      1001                    I-STAR TRANSFER                  3130D 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD                3130D 02
L067367,340344,348349,357361001,008012,001100118361080A8421/340080                  3130D 03
L069404,377385,389393,4004041001          B389S5718S88N000M360392/332/               3130D 04
L066438,413417,421428,432439001BS00S521/0808348,001041,078L080299                   3130D 05
L072478,446447,454462,4664661001L072272LL008461X500XXXXH2638504                     3130D 06
L072539,504509,516521,5215211001H263B935BC263243B900/B920                           3130D 07
L071938,907912,916920,9279351001L/14285B916E2920.920A9209708944969 9/332             3130D 08
L056962,940944,948953,9579581001/B421S9708957CB958284210                            3130D 09
L072402,967971,971971,9719711001B348000PA                                           3130D 10
                                    Z
L065/39¤/07/07,/10/15,/20/401001   ERROR     INSTR. PERFORMED IN                    3130D 11
L072/79,/60/80,/80/80,/80/8010014S4                 RESULT SHOULD BE                3130D 12
L070S17,S00S01,S05S12,S13S171001RESULT IS           2,049L0772772/2772              3130D 13
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                          3130D 14
/333080N                                            CLEAR WORDMARK CARD             3130D 15
,019027,031,038042803IT98G8400L0463528W048S88       I-STAR TRANSFER                 3130D 16
                                    M
```

DETAIL CARDS

```
B500     BRANCH                    458                                              3130D 17
N5009711 NO BRANCH                 971                                              3130D 18
B500     BRANCH                    458                                              3130D 19
N5009711 NO BRANCH                 971                                              3130D 20
B500971A BRANCH                    462                                              3130D 21
V5009712 NO BRANCH                 970                                              3130D 22
B500971A BRANCH                    462                                              3130D 23
V5009712 NO BRANCH                 970                                              3130D 24
V500971B BRANCH                    462                                              3130D 25
B5009711 NO BRANCH                 970                                              3130D 26
V500971B BRANCH                    462                                              3130D 27
B5009711 NO BRANCH                 970                                              3130D 28
/500100  BRANCH                    461                                              3130D 29
```

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MULTIPLY

A. PURPOSE

1. TO TEST THE MULTIPLY CIRCUITRY BY MULTIPLYING ONE FACTOR BY ANOTHER AND COMPARING THE PRODUCT WITH THE RESULT SHOULD BE FIELD.

2. TO TEST THE ABILITY OF THE AUXILIARY STARS TO ADDRESS ANY POSITION OF STORAGE. THE SYSTEM STORAGE SIZE WILL DICTATE THE ADDRESSING REQUIREMENTS OF THE AUXILIARY STARS.

B. LOADING PROCEDURE

1. WHEN RUNNING TEST FROM CARDS ENTER STORAGE SIZE IN LOCATION 1251, PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE ENTER STORAGE SIZE IN 1251 AND ENTER A 1 IN 1258.

STORAGE SIZE TO BE TESTED	CHARACTER TO BE MANUALLY ENTERED IN LOCATION 551 (1251)
1.4 - 2K	BLANK
4K	4
8K	8
12K	2
16K	6

C. PROGRAM CONTROL

1. SENSE SWITCHES

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

DATE	2-2-61	2-5-62	7-1-63	17.10.63				
3. CHG. NO.	110378	110378G	117628	TA 1976				

D. TEST PROCEDURE

THE MULTIPLICAND (A FIELD - COLUMNS 1-5), THE MULTIPLIER (B FIELD - COLUMNS 21-26), AND THE RESULT SHOULD BE FIELD (COLUMNS 41-52) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES.

ON DETAIL CARDS OTHER THAN CARD NUMBERS, 33 AND 34, A TEST IS MADE FOR 1-DIGIT FIELDS (A BLANK IN LOCATION 205). IF BLANK A 3-POSITION PRODUCT (1 POSITION IN THE MULTIPLICAND, 1 POSITION IN THE MULTIPLIER, PLUS 1) IS DEVELOPED IN LOCATION 771-773. IF NO BLANK A 12-POSITION PRODUCT (5 POSITIONS IN THE MULTIPLICAND, 6 POSITIONS IN THE MULTIPLIER, PLUS 1) IS DEVELOPED IN LOCATION 773-784.

ON DETAIL CARD NUMBER 33 A TEST IS PERFORMED TO DETERMINE THE MEMORY SIZE OF THE 1401 SYSTEM (1.4-2K, 4K, 8K OR 12-16K). THE PROGRAM THEN PERFORMS A SUBROUTINE WHICH DEVELOPS A 12-POSITION PRODUCT IN A MEMORY LOCATION SELECTED TO TEST SPECIFIC BIT POSITIONS IN THE A AUX AND B AUX STAR'S. ON DETAIL CARD NUMBER 34, A TEST IS PERFORMED TO DETERMINE IF MEMORY SIZE IS 12 OR 16K. IF 12 OR 16K A SECOND MULTIPLY SUB-ROUTINE IS PERFORMED.

THE PRODUCT IS THEN LOADED INTO THE PRINT AREA AND COMPARED WITH THE RESULT SHOULD BE FIELD. IF THE COMPARISON IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE. THE POSITION OF SENSE SWITCH E THEN DETERMINES WHETHER THE MACHINE STOPS TO PERMIT CONSOLE CHECKING OR PRINTS THE RESULTS WITH AN "ERROR" INDICATION.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
0246H	A	00000000246H	00000000246H
1234N	065M	000008073636	000008073636
R	8	07K	07K
R	R	08A	08A

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
0246H	A	00000000246H	00000000246Q	ERROR
1234N	065M	000008073636	000008073630	ERROR
R	8	07K	072	ERROR
R	R	08A	08J	ERROR

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ENG. CHG. NO.	110378	110378G	117628	TA 1976				

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

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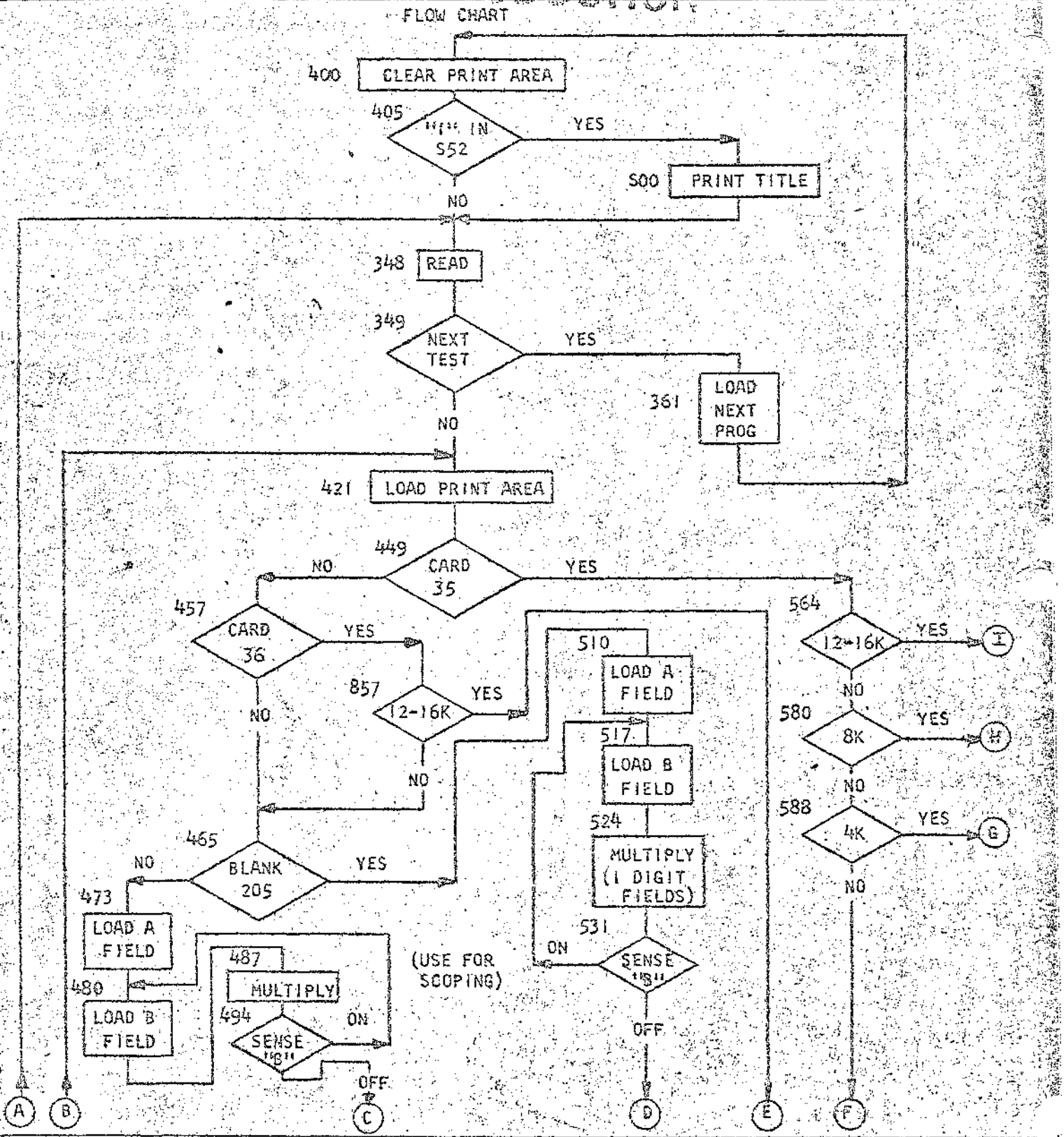
ENG. CHG. NO.	110378	110378G	117628	TA 1976				

FORM 624-7113-0

DIAGNOSTIC FUNCTION TEST

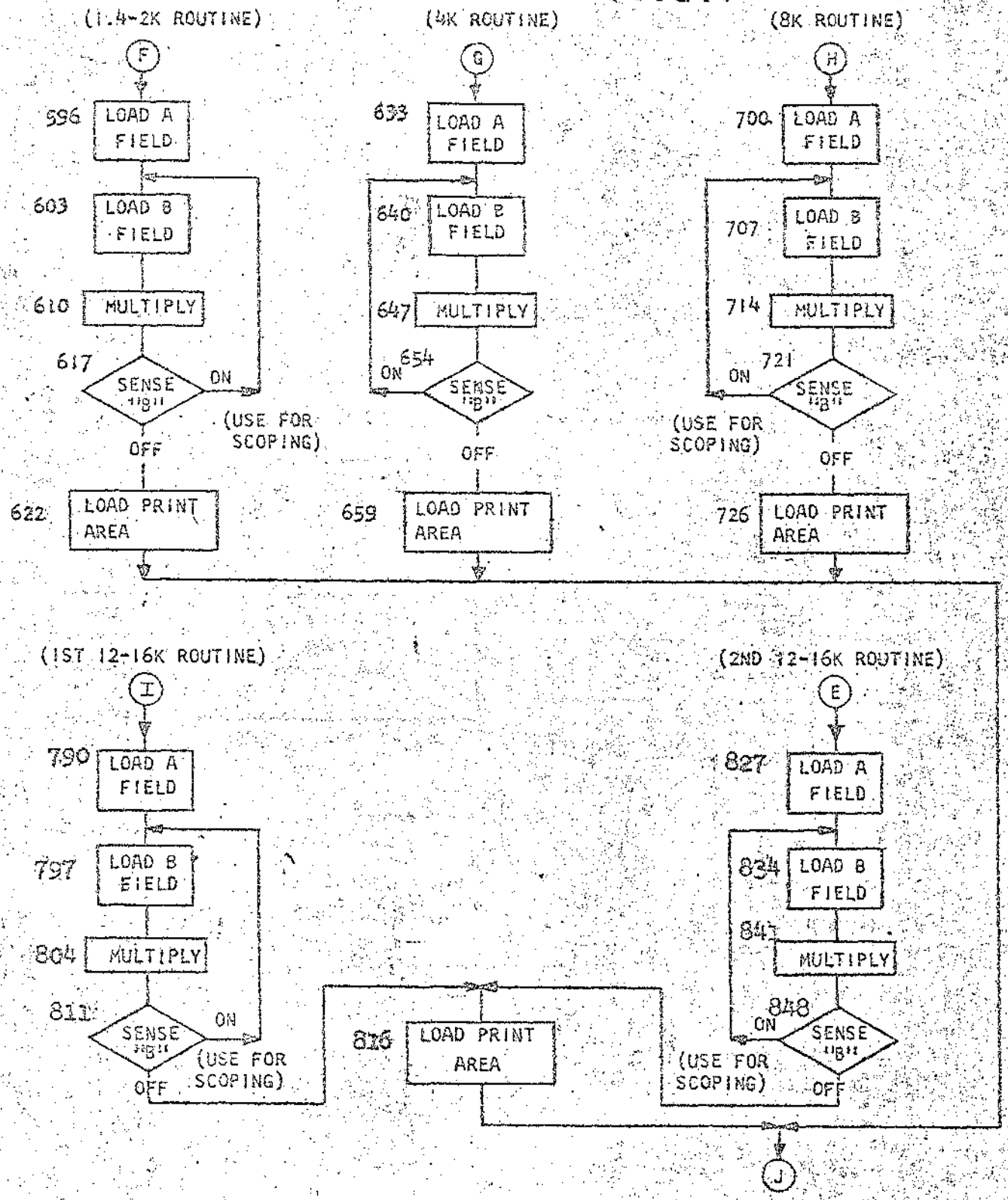
PART NO. 451439
SHEET 4 OF 105
BLOCK NO. 32000

FLOW CHART



DATE	2-2-61	2/5/62	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-C	117628	TA 1976				

DIAGNOSTIC FUNCTION TEST

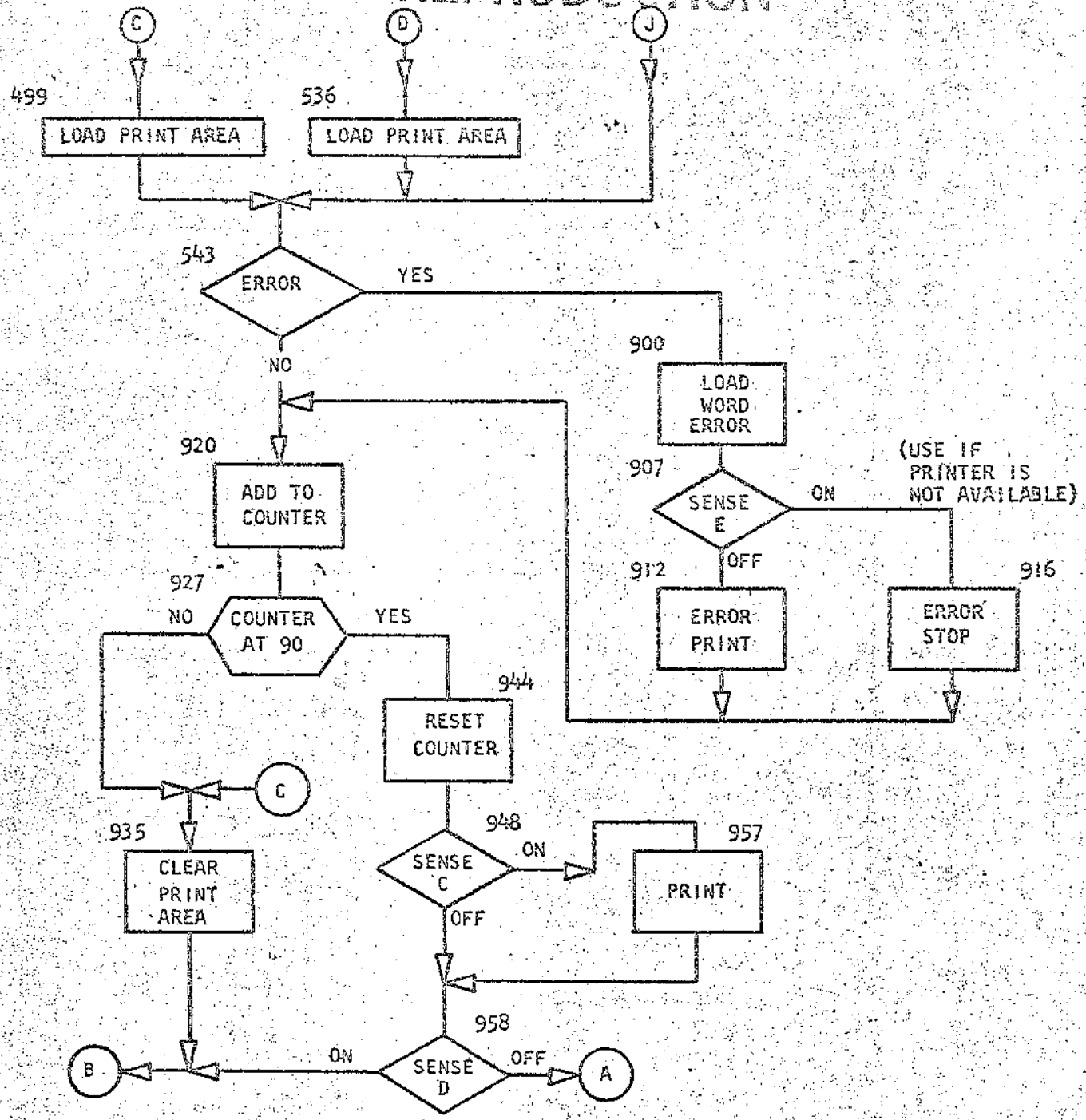


DATE	2-2-61	2/5/62	7-1-63	17.10.63				
ENG. CHG. NO.	110378	1103760	117628	TA 1976				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451439
SHEET 6 OF 10
BLOCK NO. 3200D



DATE	2-2-61	2-5-62	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378G	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

MULTIPLY 3200D

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389	S581	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		USE WHEN TESTS ARE RUN FROM TAPE	
389	389	N	000		USE WHEN TESTS ARE RUN FROM TAPE	
393	393	M	360	392	USE WHEN TESTS ARE RUN FROM TAPE	
400	400	/	332		START TEST	
404	404	/				
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	/	080		CLEAR READ AREA	
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
421	421	,	001	078	LOAD PRINT AREA	
428	428	L	080	299	LOAD PRINT AREA	
435	435	L	072	272	LOAD PRINT AREA	
442	442	,	221	241	LOAD PRINT AREA	
449	449	B	564	0720	BR TO TEST MEMORY SIZE IF A 0 IN COL 072	
457	457	B	857	0721	BR TO TEST MEMORY SIZE IF A 1 IN COL 072	
465	465	B	510	205	BR TO MULT 1 DIGIT FLD IF 205 IS BLANK	
473	473	L	205	888	LOAD A FIELD	
480	480	L	232	784	LOAD B FIELD	
487	487	@	888	784	MULTIPLY	
494	494	B	480	B	SENSE B ON TO SCOPE	SS
499	499	L	784	272	LOAD PRINT AREA	
506	506	B	543		BRANCH TO TEST FOR ERROR	
510	510	L	201	677	LOAD A FIELD	
517	517	L	223	773	LOAD B FIELD	
524	524	@	677	773	MULTIPLY WITH 1 DIGIT FIELDS	
531	531	B	517	B	SENSE B ON TO SCOPE	
536	536	L	773	263	LOAD PRINT AREA	
543	543	C	272	252	TEST FOR ERROR	
550	550	B	900	-/	BR TO ERROR PRINT ROUTINE IF UNEQUAL	
555	555	B	920	C	SENSE C ON TO CORRECT PRINT ROUTINE	SS
560	560	B	958		BRANCH TO SENSE D	
564	564	B	790	S516	TEST FOR 16K	
572	572	B	790	S512	TEST FOR 12K	
580	580	B	700	S518	TEST FOR 8K	
588	588	B	633	S514	TEST FOR 4K	
596	596	L	205	/05	BEGIN 1.4-2K MULTIPLY ROUTINE	
603	603	L	232	≠02		
610	610	@	/05	≠02	MULTIPLY	
617	617	B	603	B	SENSE B ON TO SCOPE	SS
622	622	L	≠02	272	LOAD PRINT AREA	
629	629	B	543		BRANCH TO TEST FOR ERROR	
633	633	L	205	G05	BEGIN 4K MULTIPLY ROUTINE	

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ENG. CHG. NO.	110378	110378G	117628	TA1976				

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 640  640  L 232 E22          MULTIPLY
 647  647  B GD5 E22          SENSE B ON TO SCOPE                    SS
 654  654  B 640 B            LOAD PRINT AREA
 659  659  L E22 272          BRANCH TO TEST FOR ERROR
 666  666  B 543              BEGIN 8K MULTIPLY ROUTINE
 700  700  L 205 A0V
 707  707  L 232 +0S          MULTIPLY
 714  714  B A0V +0S          SENSE B ON TO SCOPE
 721  721  B 707 B            LOAD PRINT AREA
 726  726  L +0S 272          BRANCH TO TEST FOR ERROR
 733  733  B 543              BEGIN 1ST 12-16K MULTIPLY ROUTINE
 790  790  L 205 10N
 797  797  L 232 00K          MULTIPLY
 804  804  B 10N 00K          SENSE B ON TO SCOPE                    SS
 811  811  B 797 B            LOAD PRINT AREA
 816  816  L 00K 272          BRANCH TO TEST FOR ERROR
 823  823  B 543              BEGIN 2ND 12-16K MULTIPLY ROUTINE
 827  827  L 205 A0V
 834  834  L 232 00K          MULTIPLY
 841  841  B A0V 00K          SENSE B ON TO SCOPE                    SS
 848  848  B 834 B            BRANCH TO LOAD PRINT AREA
 853  853  B 816              TEST FOR 16K
 857  857  B 827 S516         TEST FOR 12K
 865  865  B 827 S512         BRANCH TO MAIN ROUTINE
 873  873  B 465              BEGIN ERROR PRINT ROUTINE
 900  900  L /14 285          E ON TO ERROR STOP                     SS
 907  907  B 916 E            ERROR PRINT
 912  912  2 920              ERROR STOP
 916  916  . 920              ADD ONE TO OPERATION COUNTER
 920  920  A 920 970          BRANCH AFTER 90 OPERATIONS      C FOR TA
 927  927  B 944 9699         CLEAR PRINT AREA
 935  935  / 332
 939  939  /
 940  940  B 421              BRANCH TO REPEAT
 944  944  S 970              RESET OPERATION COUNTER
 948  948  B 957 C            C ON FOR CORRECT PRINT                 SS
 953  953  B 958              BRANCH TO SENSE D
 957  957  2                  PRINT CORRECT RESULTS
 958  958  B 421 D            D ON TO REPEAT                         SS
 963  963  B 348              BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+              OPERATION COUNTER
 971  971  B 935 B            LOOP ON SW B                           SS
 976  976  B 900              GO TO ERROR ROUTINE
1110  /10  E RRO R            CONSTANTS
1115  /15                    CONSTANTS
1120  /20  A  FI ELD          CONSTANTS
1140  /40  B  FI ELD          CONSTANTS
1160  /60  R ESU LT SHOULD BE CONSTANTS
1180  /80  R ESU LT IS        CONSTANTS
```

DATE	2-2-61	2-5-62	7-1-63	17.10.63				
ENG CHG NO	110378	110378G	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    MULTIPLY               3200D 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD      3200D 02
L067367,340344,348349,3573611001,008012,0011001I8361080AB421/340080       3200D 03
L069404,377385,389393,4004041001          8389S5818S88N000M360392/332/   3200D 04
L069441,413417,421428,4354421001BS00S521/0803348,001078L080299L072272    3200D 05
L070479,449457,465473,4804801001,221241856407208857072185I0205 L205888    3200D 06
L069516,487494,499506,5105171001L2327840888784848O8L784272854 3L201677    3200D 07
L070554,524531,536543,5505551001L223773@67777385178L773263C272252B900/    3200D 08
L065587,560564,572580,5885881001B920CB958B790S516B790S512870OS518        3200D 09
L066621,598603,610617,6226221001B633S514L205/05L232‡028/05‡028603B       3200D 10
L069658,629635,640647,6546591001L‡0227 2B543L205G05L232E22@G05E228640B   3200D 11
L072698,666666,666666,6666661001LE22272B543                              3200D 12
L070737,707714,721726,7337331001L205A0VL232P0S@A0VP0S8707BLP0S272B543    3200D 13
                                   Z         Z          Z
L069826,797804,811816,8238271001L20510NL23200K@10N00KB797BL00K272B543    3200D 14
L070864,834841,848853,8578651001L205A0VL23200K@A0V00KB834B8816B827S516   3200D 15
L067899,873900,900900,9009001001B827S512B465                             3200D 16
L071938,907912,916920,9279351001L/142858916E2920.920A920970B949699/332   3200D 17
L056962,940944,948953,9579581001/8421S970B957CB958284210                 3200D 18
L072‡02,967971,980988,9929991001B348000PB935BB900                        3200D 19
                                   Z
L069/19⌑‡83‡83,/10/15,/20/201001                          ERROR          3200D 20
L072/59,/40/60,/60/60,/60/601001A FIELD                B FIELD           3200D 21
L072/99,/80S00,S00S00,S00S001001RESULT SHOULD BE       RESULT IS         3200D 22
L057S24,S01S05,S12S13,S17S1810012,049L0772772/2772⌑/40/60                3200D 23
L052S44,S29S36,S37S41,S45S451001⌑/80L/892702/270241 3                    3200D 24
/333080N                                            CLEAR WORDMARK CARD   3200D 25
,019027,031,0380428031I98G8400L046352BW048S88       MULTIPLY              3200D 26
                      M
```

DETAIL CARDS

```
13579            000000          00000000000P                 3200D 27
                                            Z
0246H                 A          00000000246H                 3200D 28
1234V                 2          00000002469P                 3200D 29
                                            Z
67890                 Y          00000054312P                 3200D 30
                                            Z
13579                0R          000000122211J                3200D 31
0246Q               087          000000214710                 3200D 32
1234N              065M          00000807363P                03200D 33
                                            Z
```

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```
FPY90          TKAD          00021792690P                    13200D 34
                                    Z
                              00P                              3200D 35
                               Z
1              0              00P                              3200D 36
                               Z
B              /              00B                              3200D 37
R              8              07K                              3200D 38
Y              B              01F                              3200D 39
0              R              00M                              3200D 40
                               Z
R              R              06A                              3200D 41
```

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DIAGNOSTIC FUNCTION TEST

DIVIDE

A. PURPOSE

TO TEST THE DIVIDE CIRCUITRY BY DIVIDING ONE FACTOR BY ANOTHER AND COMPARING THE ANSWER, REMAINDER, AND OVERFLOW CONDITION WITH THE RESULT SHOULD BE FIELD. EACH PROBLEM IS TRIED 90 TIMES, AND PRINTS OUT EACH TIME AN ERROR OCCURS.

B. LOADING PROCEDURES

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1258.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON FOR SCOPING LOOP
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT DETAIL CARD
OFF TO READ NEXT CARD

E ON FOR ERROR STOP
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINOUT OCCURES PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

A DETAIL CARD IS READ AND LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. THE NUMBERS IN COLUMNS 71 AND 72 ARE USED TO MODIFY THE PROGRAM SO THAT A AND B FIELD OF FROM 1 TO 9 CHARACTERS CAN BE TESTED. THE DIVIDER IS SET UP BY A "ZERO AND ADD B FIELD" INSTRUCTION AND DIVIDED BY THE A FIELD. THE OVERFLOW INDICATOR IS TESTED AND IF AN OVERFLOW OCCURS A 2 IS MOVED INTO THE "RESULT IS" FIELD. THE "RESULT SHOULD BE" FIELD IS COMPARED TO THE "RESULT IS" FIELD. AN UNEQUAL COMPARISON CAUSES THE PROGRAM TO BRANCH TO AN ERROR ROUTINE.

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E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINOUTS

1. CORRECT

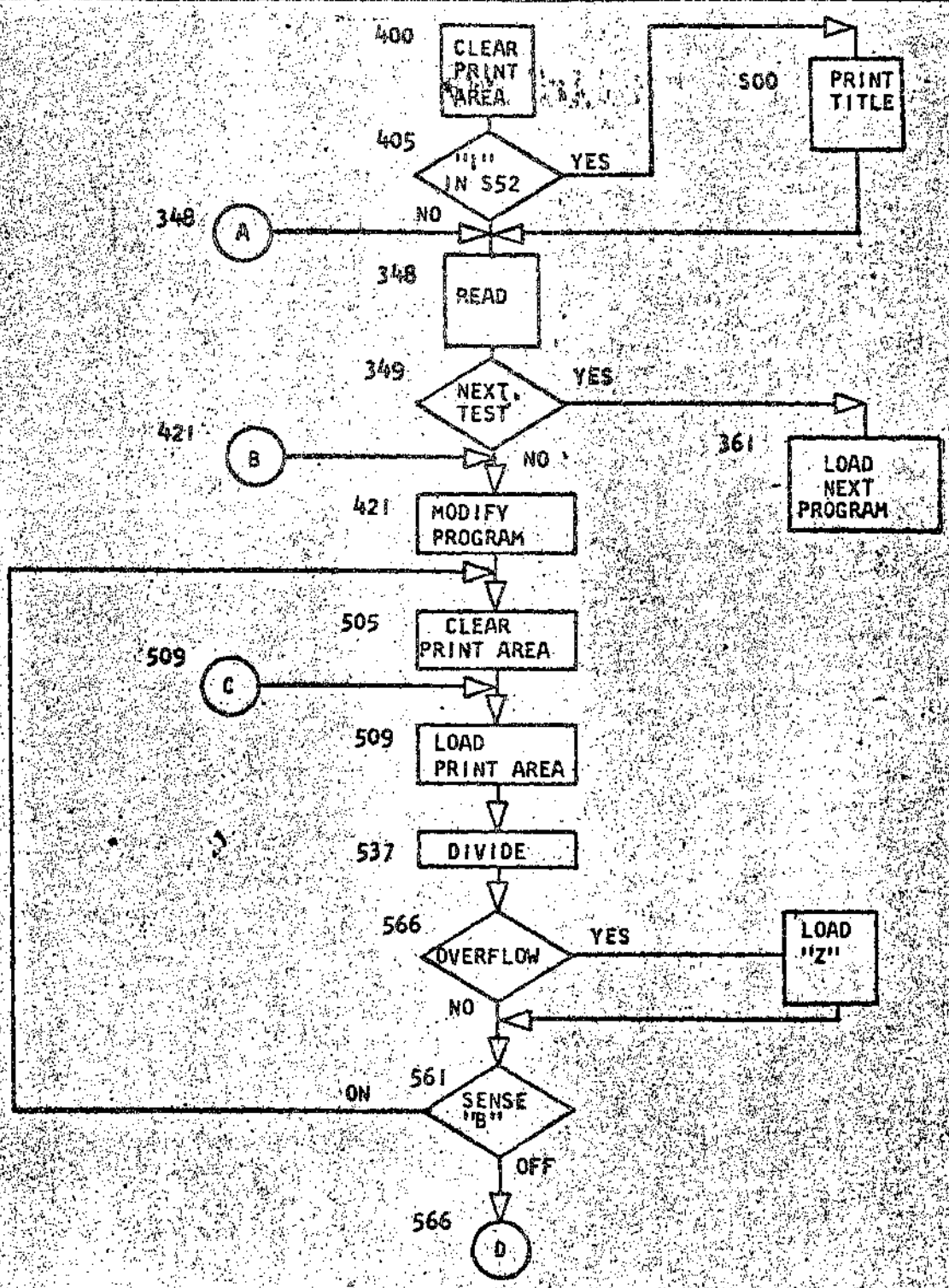
A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
0	I	Z+0I	Z+0I
7	10	0A0C	0A0C
460	8900	001I016+	001I016+
065D	1549Q	0002L00450	0002L00450
3210	1518E	0000D0234E	0000D0234E

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
0	I	Z+0I	+0I	ERROR
7	10	0A0C	Z0A0C	ERROR
460	8900	001I016+	001I016+	ERROR
065D	1549Q	0002L00450	0001L00450	ERROR
3210	1518E	0000D0234E	0000D02345	ERROR

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.



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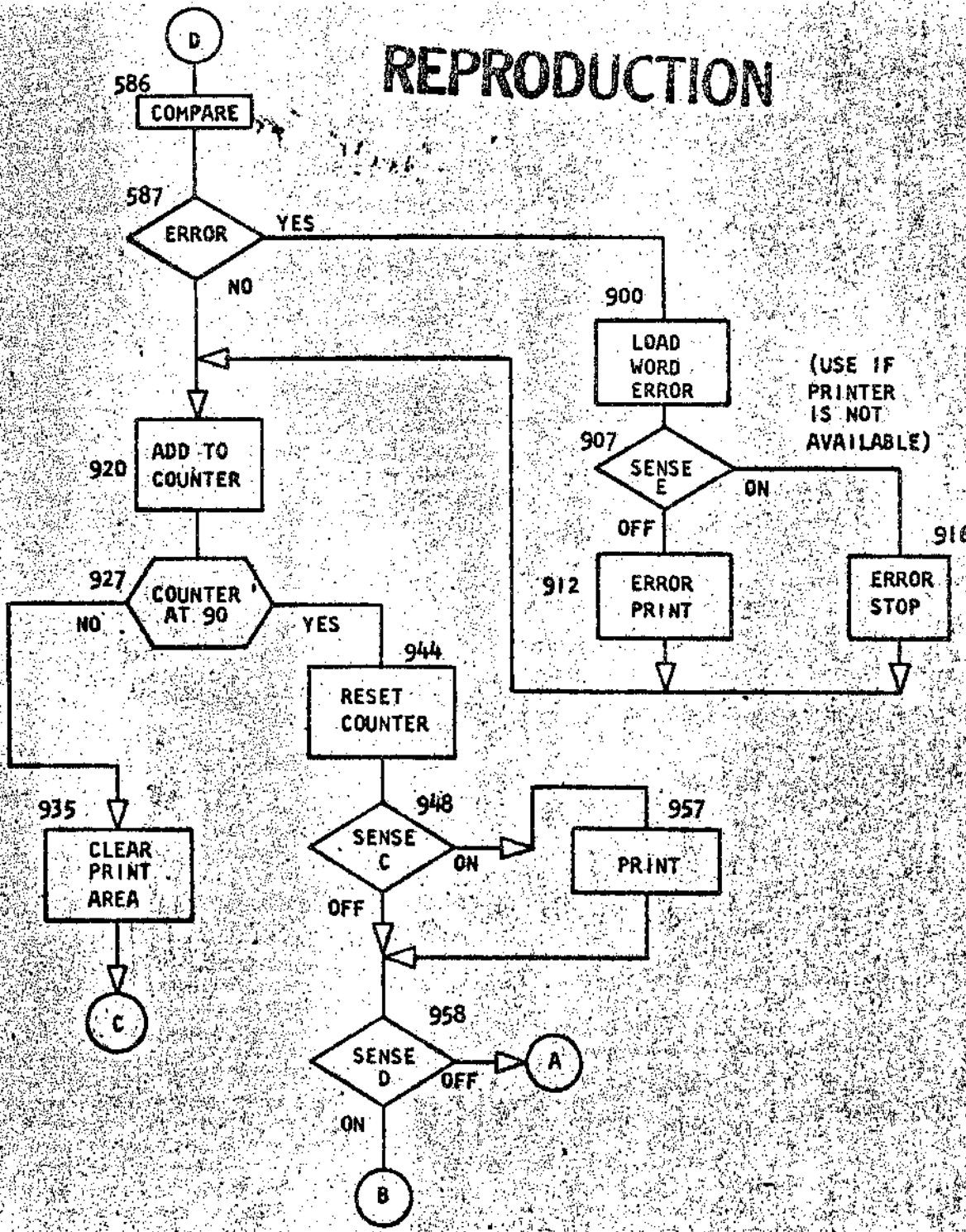

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PROGRAM LISTING FOR USE WITH FLOW CHART

DIVIDE 32108

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S581	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	069	MODIFY PROGRAM
428	428	,	071	072	,,
435	435	A	071	070	,,
442	442	A	072	070	,,
449	449	L	618	612	,,
456	456	A	070	612	,,
463	463	A	072	609	,,
470	470	M	612	543	,,
477	477	L	624	612	,,
484	484	A	071	612	,,
491	491	A	071	609	,,
498	498	M	612	555	,,
505	505	/	299		CLEAR PRINT AREA
509	509	L	068	268	LOAD PRINT AREA
516	516	,	078	221	,,
523	523	,	241	261	,,
530	530	L	080	299	,,
537	537	+	220	261	,,
544	544	B	544	Z	BRANCH ON OVERFLOW
549	549	%	200	262	*DIVIDE
556	556	B	596	Z	BRANCH ON OVERFLOW
561	561	B	505	B	B ON TO SCOPE SS
566	566	¤	241	261	TEST FOR ERROR
573	573	,	240	260	,,
580	580	C	279	259	,,
587	587	B	900	/	BRANCH TO ERROR PRINT ROUTINE
592	592	B	920		BRANCH TO PRINT ROUTINE
596	596	L	625	260	LOAD Z ON OVERFLOW
603	603	B	561		BRANCH BACK TO PROGRAM
607	607	A	AAB	88	CONSTANTS
613	613	2	202	61	,,
619	619	2	002	62	,,
625	625	Z			,,
900	900	L	/14	290	BEGIN ERROR PRINT ROUTINE

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```
 907  907  B 916 E                E ON TO ERROR STOP                    SS
 912  912  2 920                  ERROR PRINT
 916  916  . 920                  ERROR STOP
 920  920  A 920 970              ADD ONE TO OPERATION COUNTER
 927  927  B 944 9699             BRANCH AFTER 90 OPERATIONS      C FOR TA
 935  935  / 332                  CLEAR PRINT AREA
 939  939  /                       ,,
 940  940  B 509                  BRANCH TO REPEAT
 944  944  S 970                  RESET OPERATION COUNTER
 948  948  B 957 C                C ON FOR CORRECT PRINT               SS
 953  953  B 958                  BRANCH TO SENSE D
 957  957  2                      PRINT CORRECT RESULTS
 958  958  B 421 D                D ON TO REPEAT                       SS
 963  963  B 348                  BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 00+                  OPERATION COUNTER
1110  /10  E RRO R                CONSTANTS
1115  /15                         ,,
1120  /20  A  FI ELD              ,,
1140  /40  B  FI ELD              ,,
1160  /60  R ESU LT SHOULD BE     ,,
1180  /80  R ESU LT IS            ,,
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    DIVIDE                                  3210B 0A
,008015,022029,033033N          1001                    SET WORDMARK CARD                       3210B 02
L067367,340344,348349,357361 1001,008012,001100118361080AB421/340080                            3210B 03
L069404,377385,389393,400404 1001                B389S581BS88N000M360392/332/                   3210B 04
L069441,413417,421428,435442 1001BS00S521/080B348,001069,071072A071070                          3210B 05
L067476,449456,463470,477477 1001A072070L618612A070612A072609M612543                            3210B 06
L071515,484491,498505,509516 1001L624612A071612A071609M612555/299L068268                        3210B 07
L072555,523530,537544,549556 1001,078221,241261L080299P220261B544Z%20026232108 08
                                                                                  Z
L072595,561566,573580,587592 1001B596ZB505B¤241261,240260C279259B900/B92032108 09
L072635,603607,613619,625625 1001L625260B561AAABBB2202612002622                                 3210B 10
L072915¤876876,900907,912916 1001                                        L/14290B916E29203210B 11
L064947,920927,935939,940944 1001.920A920970B9449699/332/B509S970                               3210B 12
L072987,953957,958963,967967 1001B957CB9582B421DB348000P                                        3210B 13
                                                                                  Z
L064/39¤/08/08,/10/15,/20/401001  ERROR      A FIELD                                             3210B 14
L072/79,/60/80,/80/80,/80/8010018 FIELD                    RESULT SHOULD BE                     3210B 15
L070S17,S00S01,S05S12,S13S17 1001RESULT IS                 2,049L0772772/2772,                  3210B 16
L062S47,S25S29,S36S37,S41S45 1001¤/40/60¤/80L/892702/2702413                                     3210B 17
/333080N                                                   CLEAR WORDMARK CARD                   3210B 18
,019027,031,038042B031T98GB400L046352BW04BS88   DIVIDE                                          3210B 19
                                                M
```

DETAIL CARDS

```
0                   I                   ZP0I                                        1132108 20
                                        Z
7                   10                  0A0C                                        1232108 21
460                 8900                0011016P                                    3432108 22
                                                Z
065D                1549Q               0002L00450                                  4532108 23
3210                1518E               0000D0234E                                  4532108 24
2468                 0246               0000P 024F                                  4532108 25
                                                Z
0000                13571               Z0000013571                                 4532108 26
2468                0000P               0000P0000P                                  4532108 27
                      Z                             Z     Z
1                   H                   H0P                                         1132108 28
                                        Z
2                   G                   C0A                                         1132108 29
L                   F                   K0P                                         1132108 30
                                        Z
M                   N                   A0J                                         1132108 31
S                   M                   M0M                                         1132108 32
                                        Z
```

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```
6                P                POP                          1132108 33
                 Z                Z Z
1                1                AOP                          1132108 34
                                    Z
0                1               ZPOA                          1132108 35
                                    Z
1                0                POP                          1132108 36
                                  Z Z
3210          03201          0000P03201                        4532108 37
                                       Z
2400          0470M          0000J0230M                        4532108 38
                   Z                        Z
9                8                POH                          1132108 39
                                    Z
99              88              0P08H                          2232108 40
                                  Z
9               80              0H0H                           1232108 41
9                9               AOP                           1132108 42
                                    Z
9               99              1AOP                           1232108 43
                                    Z
9              909              10AOP                          1332108 44
                                    Z
1                9               IOP                           1132108 45
                                    Z
123456789  987654321  000000000H000000000I                      9932108 46
6                6               AOP                           1132108 47
                                    Z
6                7               ADA                           1132108 48
```

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BRANCH HIGH

A. PURPOSE OF TEST

1. TO TEST THE BRANCH HIGH CIRCUITRY BY COMPARING EACH OF THE 64 POSSIBLE CHARACTERS WITH ALL OTHER CHARACTERS THAT ARE SEQUENTIALLY HIGHER. ERRORS ARE DETECTED BY A NO-BRANCH (LOW OR EQUAL) WHICH FORCES A PRINTOUT OF THE TWO CHARACTERS COMPARED, RESULT SHOULD BE (ALWAYS HIGH), RESULT IS (LOW OR EQUAL), AND THE WORD "ERROR"; OR STOPS THE MACHINE WITH SENSE SWITCH E ON.

2. TO TEST THE BRANCH HIGH CIRCUITRY BY COMPARING EACH OF THE 64 POSSIBLE CHARACTERS WITH ALL OTHER CHARACTERS THAT ARE SEQUENTIALLY LOWER. ERRORS ARE DETECTED BY A BRANCH (HIGH OR EQUAL) WHICH FORCES A PRINTOUT OF THE TWO CHARACTERS COMPARED. RESULT SHOULD BE (ALWAYS LOW), RESULT IS (HIGH OR EQUAL), AND THE WORD "ERROR"; OR STOPS THE MACHINE WITH SENSE SWITCH E ON.

NOTE: NO PRINTOUT OCCURS FOR CORRECT RESULTS EXCEPT THE PRINTING OF THE TITLE AND HEADINGS WHEN "1" IS MANUALLY ENTERED IN S52.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1259.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

D ON TO REPEAT INCLUDING LOOP COUNTER
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

G ON TO REPEAT ENTIRE PROGRAM
OFF TO CONTINUE

D. TEST PROCEDURE

THE FOLLOWING CHARACTERS AND BLANKS ARE STORED IN ASCENDING SEQUENCE BY THE LOADING ROUTINE IN LOCATIONS 701-830, EXCEPT THE WORD MARKS IN ALL ODD NUMBERED POSITIONS, THE WORD SEPARATOR CHARACTER IN LOCATION 733, AND THE A-BIT IN LOCATION 739 WHICH ARE PROGRAM GENERATED:

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D. (CONTINUED)

```
            12 12 12           11 11 11          0 0 0
             5  6  7            5  6  7          5 6 7       5 6 7 12
 _ . ⌑  8  8  8  & $ *  8  8  8  - / , %  8 8 8  a # @ 8 8 8 0  A B C D E F
LOC.(777777                                      77    77                 77
    (000000                                      33    34                 66
    (123456                                      44    90                 34
```

```
                              0
       11                     2
 G H I 0 J K L M N O P Q R 8 S T U V W X Y Z 0 1 2 3 4 5 6 7 8 19 91
     (7777                   77                                  8888
LOC. (6666                   99                                  2223
     (5678                   12                                  7890
```

AFTER STORING THE ABOVE TABLE IN THE LOCATIONS INDICATED, THE FIRST TWO CHARACTERS IN LOCATIONS 701-702 (BLANK BLANK) ARE COMPARED WITH THE NEXT PAIR OF CHARACTERS IN LOCATIONS 703-704 (.BLANK). THE COMPARISON SHOULD BE HIGH; IF NOT, AN ERRONEOUS LOW OR EQUAL CONDITION BRANCHES TO AN ERROR PRINT ROUTINE AND PRINTS THE RESULTS IF SENSE SWITCH E IS OFF OR STOPS THE MACHINE IF THE SWITCH IS ON. IF THE COMPARISON IS HIGH AS IT SHOULD BE, THE PROGRAM BRANCHES TO A SET OF INSTRUCTIONS WHICH WILL INTERCHANGE THE A AND B FIELDS OF THE COMPARE INSTRUCTION. THE COMPARISON SHOULD NOW BE LOW. A TEST FOR HIGH, THEREFORE, SHOULD NOT BRANCH. IF IT DOES, AN ERRONEOUS HIGH OR EQUAL CONDITION BRANCHES TO THE ERROR PRINT ROUTINE AND EITHER PRINTS THE RESULTS OR STOPS THE MACHINE.

THE B FIELD LOADING ADDRESS (704) IN THE COMPARE INSTRUCTION IS THEN INCREASED BY 2 AND THE TWO BLANKS IN 701-702 ARE NOW COMPARED WITH ⌑ BLANK IN LOCATIONS 703-706 IN THE SAME MANNER AS DESCRIBED ABOVE, INCLUDING THE INTERCHANGING OF THE A AND B.

FIELDS IN THE COMPARE INSTRUCTION. THE TWO BLANKS HAVE BEEN COMPARED WITH ALL OTHER CHARACTERS IN THE TABLE WHEN THE B FIELD LOADING ADDRESS REACHES 830.

NEXT, THE TWO CHARACTERS IN 703-704 (.BLANK) MUST NOW BE COMPARED WITH ALL OTHER HIGHER CHARACTERS IN THE TABLE. THIS IS DONE BY SETTING BOTH THE A AND B FIELDS OF THE COMPARE INSTRUCTION TO 704 AND 706 RESPECTIVELY. THUS, THE TWO CHARACTERS IN 703-704 (.BLANK) WILL FIRST BE COMPARED TO THE TWO CHARACTERS IN 705-706 (⌑ BLANK), SECOND WITH 12-5-8 BLANK IS 707-708, THIRD WITH 12-6-8 BLANK IN 709-710, AND SO ON UNTIL THE B FIELD LOADING ADDRESS AGAIN REACHES 830.

BY CONTINUALLY INCREASING THE A AND B FIELD LOADING ADDRESSES BY 2 AS DESCRIBED ABOVE, THE LAST COMPARISON IS FINALLY MADE WHEN THE TWO CHARACTERS (90) IN LOCATIONS 827-828 ARE COMPARED WITH THE TWO CHARACTERS (91) IN LOCATIONS 829-830. THIS INDICATES THE END OF THE TEST WHICH MAY BE REPEATED AS OFTEN AS DESIRED IF SENSE SWITCH G IS IN THE ON POSITION.

E. STOPS

979 OR 1089 IN STORAGE ADDRESS REGISTER: ERROR-SENSE E ON

F. PRINTOUTS

1. CORRECT

NONE

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
A	B	HIGH	LOW	ERROR
B	F	HIGH	EQUAL	ERROR
Y	Q	LOW	HIGH	ERROR
Z	R	LOW	EQUAL	ERROR
81	91	HIGH	LOW	ERROR
91	81	LOW	HIGH	ERROR
	$	HIGH	LOW	ERROR
*		LOW	EQUAL	ERROR
		HIGH	LOW	ERROR
		LOW	HIGH	ERROR

NOTE: NO PRINTOUT OCCURS IN THE A AND B FIELD COLUMNS FOR UNPRINTABLE CHARACTERS.

G. COMMENTS

AN OPERATION COUNTER IS INCLUDED TO REPEAT EACH BRANCH ON HIGH TEST 10 TIMES. THE APPROXIMATE RUNNING TIME OF THE COMPLETE TEST IS 30 SECONDS.

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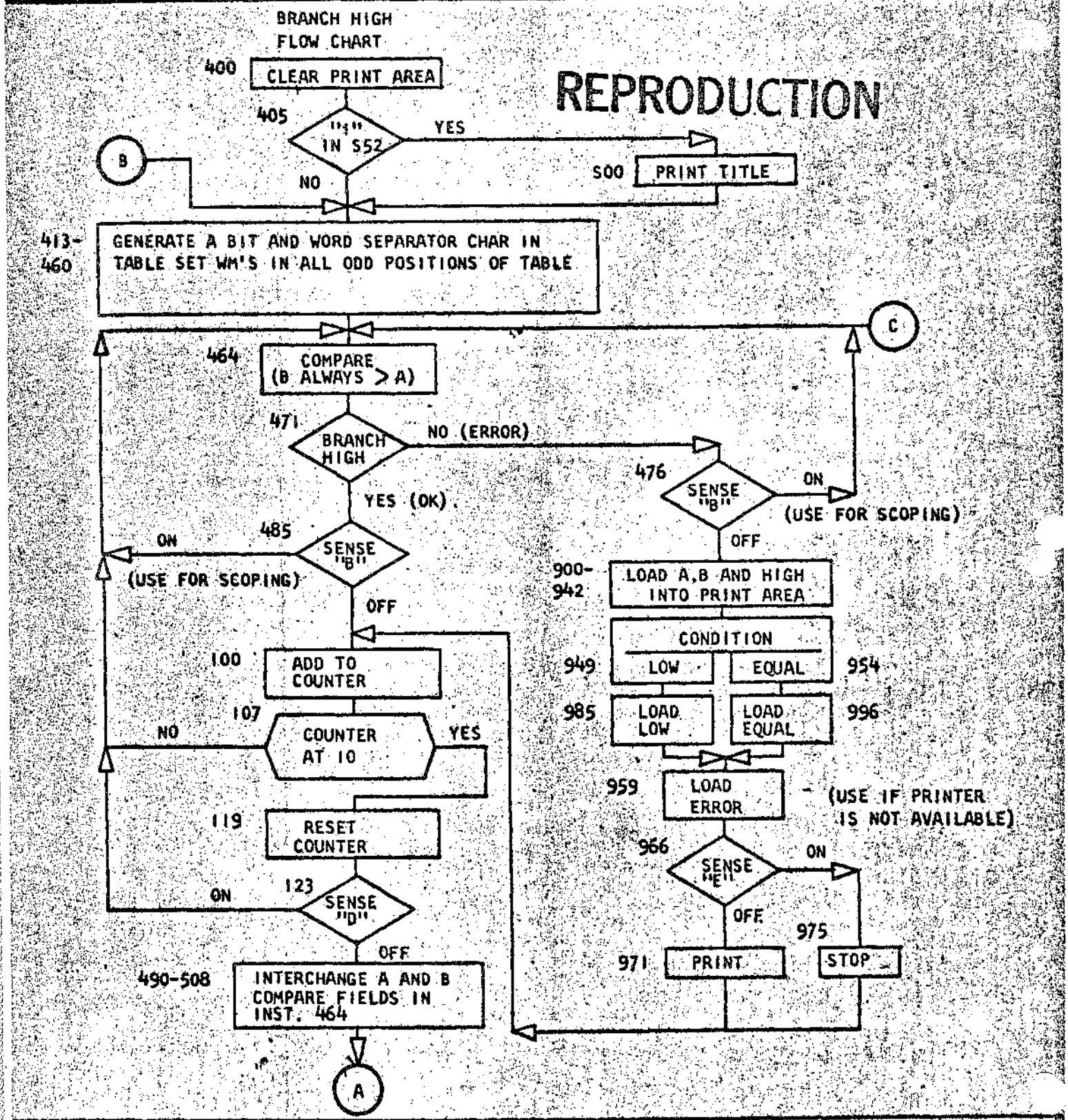
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451442
SHEET 4 OF 9
BLOCK NO. 3300B



REPRODUCTION

DATE	2-2-61	7-1-63	17.10.63					
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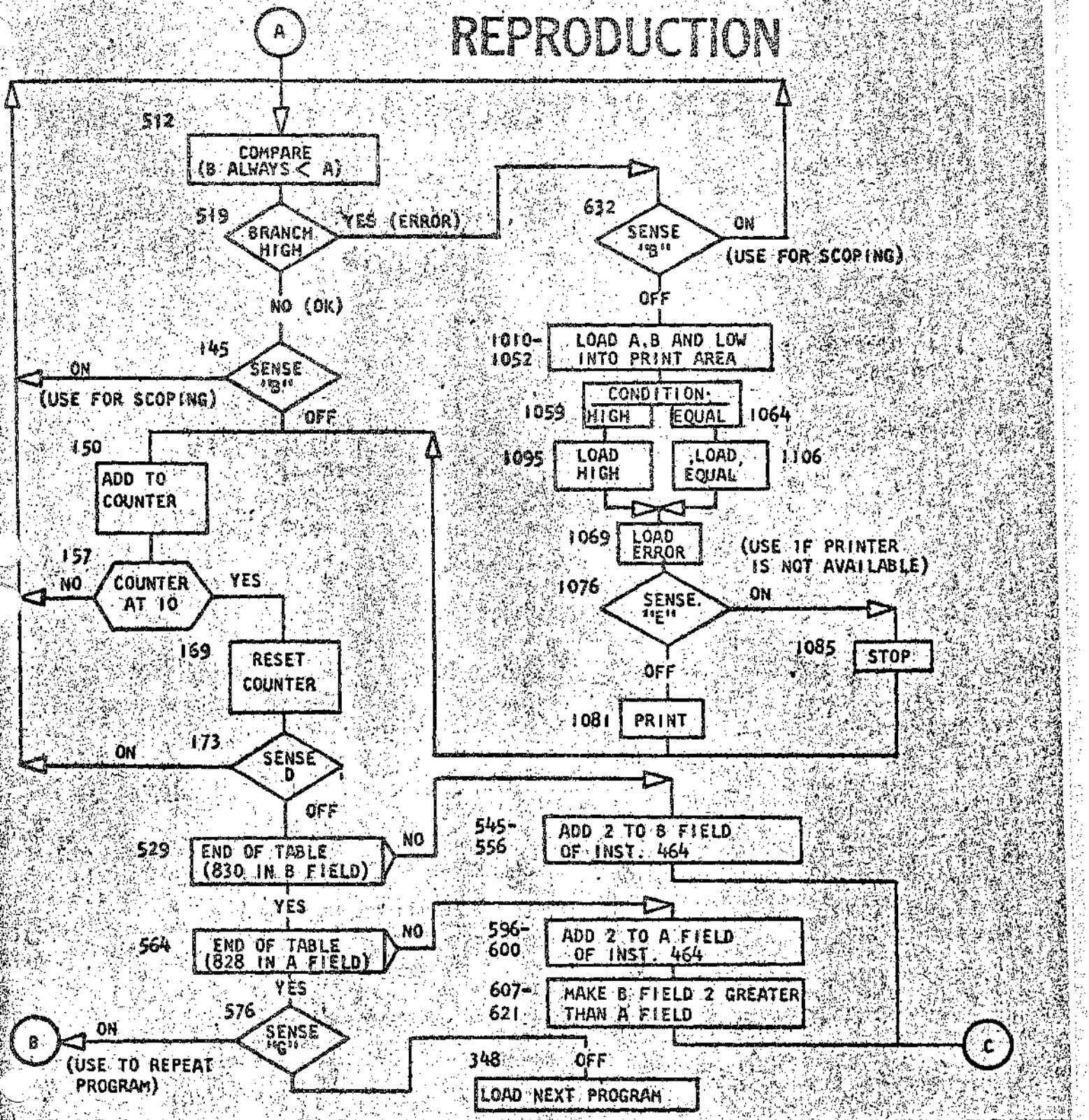
REPRODUCTION



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REPRODUCTION

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH HIGH 33008

```
INSTRUCTION
  ADDRESS   OP A    B
  100  100  A 100  371     ADD ONE TO LOOP COUNTER
  107  107  B 119  3701    BRANCH OUT OF LOOP COUNTER      C FOR TA
  115  115  B 464          REPEAT LOOP
  119  119  S 371          RESET LOOP COUNTER
  123  123  B 464  D       REPEAT LOOP ON SW D                  SS
  128  128  , 513          INTERCHANGE A + B FLDS OF COMP IN 464
  132  132  B 494          GO SET UP COMPARE FOR 512 FOR LOW COND
  145  145  B 512  B       B ON TO SCOPE                        SS
  150  150  A 150  371     ADD ONE TO LOOP COUNTER
  157  157  B 169  3701    BRANCH OUT OF LOOP COUNTER      C FOR TA
  165  165  B 512          REPEAT LOOP
  169  169  S 371          RESET LOOP COUNTER
  173  173  B 512  D       REPEAT LOOP ON SW D                  SS
  178  178  B 529          CONTINUE WITH TEST
  368  368  0 00+          LOOP COUNTER
  377  377  B 400  S591     USE WHEN TESTS ARE RUN FROM TAPE
                            ,,
  400  400  / 332          START TEST
                            ,,
  405  405  B S00  S521     BR TO TITLE PRINT ROUTINE IF 1 IN S52
  413  413  L 653  441      SET INSTR IN 438 + 464 TO INITIAL COND
  420  420  L 660  470
                            ,,
  427  427  B 850          BR TO GEN WD SEP + A BIT FOR TABLE
  434  434  ¤ 439          SET WORD MARK IN ALL ODD ADDR OF TABLE
  438  438  , 701  439    *  ,,
  445  445  V 464  8291      ,,
  453  453  A 971  441      ,,
  460  460  B 434           ,,
  464  464  C 702  704    *COMPARE
  471  471  B 485  U       BRANCH HIGH - SHOULD BRANCH
  476  476  B 464  B       B ON TO SCOPE                        SS
  481  481  B 900          BRANCH TO ERROR PRINT ROUTINE
  485  485  B 464  B       B ON TO SCOPE                        SS
  490  490  B 100          GO TO LOOP COUNTER
  494  494  M 467  518        TO SET UP COMP IN 512 FOR LOW COND
  501  501  M 470  515        ,,
  508  508  ¤ 513           ,,
  512  512  C 704  702    *COMPARE
  519  519  B 632  U       BRANCH HIGH - SHOULD NOT BRANCH
  524  524  B 145          GO TO SWITCH B
  529  529  C 470  666     TEST FOR END OF TABLE IN B FIELD OF 464
  536  536  B 545  /       BRANCH IF UNEQUAL TO ADD 2 TO B FIELD
  541  541  B 564          BRANCH TO TEST FOR END OF TABLE IN A FLD
```

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```
545  545  ,  468                    ADD 2 TO B FIELD OF COMP IN 464
549  549  A  971  470                 ,,
556  556  ¤  468                      ,,
560  560  B  464                    BRANCH TO COMPARE NEXT SET OF CHARACTERS
564  564  C  467  663                TEST FOR END OF TABLE IN A FIELD
571  571  B  596  /                  BRANCH IF UNEQUAL TO ADD 2 TO A FIELD
576  576  B  413  G                  G ON TO REPEAT TEST
581  581  ¤  711  829                CLEAR ANY GM-WM FROM PROGRAM
588  588  /  230                      ,,
592  592  B  348                    BRANCH TO READ NEXT RECORD
596  596  ,  465                    ADD 2 TO A FIELD OF COMP IN 464
600  600  A  971  467                 ,,
607  607  L  467  470                MAKE B FIELD 2 GREATER THAN A FIELD
614  614  A  971  470                 ,,
621  621  ¤  465  468                ,,
628  628  B  464                    BRANCH TO COMPARE NEXT SET OF CHARACTERS
632  632  B  512  B                  B ON TO SCOPE                          SS
637  637  B  410                    BRANCH TO ERROR PRINT ROUTINE
650  650  ,  701                    CONSTANTS TO SET INSTR TO INITIAL COND
654  654  C  702  704                 ,,
661  661  8  28                     CONSTANTS TO DETECT END OF TABLE
664  664  8  30                       ,,
667  667  H  IGH                    CONSTANTS FOR PRINTOUTS
672  672  L  OW                       ,,
677  677  E  QUA  L                  ,,
682  682  E  RRO  R                  ,,
701  701     .  ¤     +  $  *       TABLE USED IN COMPARING
721  721        -  /  ,  %            ,,
741  741  #  @        ¢  A  B  C  D   ,,
761  761  E  F  G  H  I  -  J  K  L  M  ,,
781  781  N  O  P  Q  R  +  S  T  U  V  ,,
801  801  W  X  Y  Z  0  1  2  3  4  5  ,,
821  821  6  7  819  91                ,,
850  850  Y  850  733                 GENERATE WORD SEPARATOR CHARAC FOR TABLE
857  857  Y  857  739                 GENERATE A BIT FOR TABLE
864  864  B  434                     BRANCH TO SET WORD MARKS IN TABLE
900  900  ,  929  936                 ERROR PRINT ROUTINE IF NO BR OCCURRED
907  907  M  467  931                    ON HIGH CONDITION
914  914  M  470  938                   ,,
921  921  ¤  929  936                  ,,
928  928  L  AAA  202                  ,,
935  935  L  BBB  222                  ,,
942  942  L  671  245                  ,,
949  949  B  985  T                    ,,
954  954  B  996  S                    ,,
959  959  L  686  285                  ,,
966  966  B  975  E                   E ON TO ERROR STOP                     SS
971  971  2  100                     ERROR PRINT
975  975  .  979                     ERROR STOP
979  979  B  100                     GO TO LOOP COUNTER
985  985  L  676  265                 LOAD -RESULT IS- COMMENT
992  992  B  959                       ,,
```

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```
 996  996  L 681 265                ,,
1003  #03  B 959                    ,,
1010  #10  , #39 #46                ERROR PRINT ROUTINE IF BRANCH OCCURRED
1017  #17  M 515 #41                    ON LOW CONDITION
1024  #24  M 518 #48                ,,
1031  #31  □ #39 #46                ,,
1038  #38  L AAA 202                ,,
1045  #45  L BBB 222                ,,
1052  #52  L 676 245                ,,
1059  #59  B #95  U                 ,,
1064  #64  B /06  S                 ,,
1069  #69  L 686 285                ,,
1076  #76  B #85  E                 E ON TO ERROR STOP                    SS
1081  #81  2 150                    ERROR PRINT
1085  #85  . #89                    ERROR STOP
1089  #89  B 150                    GO TO LOOP COUNTER
1095  #95  L 671 265                LOAD -RESULT IS- COMMENT
1102  /02  B #69                    ,,
1106  /06  L 681 265                ,,
1113  /13  B #69                    ,,
1120  /20  A  FI ELD                HEADINGS CONSTANTS
1140  /40  B  FI ELD                ,,
1160  /60  R ESU LT SHOULD BE       ,,
1180  /80  R ESU LT IS              ,,
```

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IBM FORM 224-7113-0

1401 DATA PROCESSING SYSTEM

DIAGNOSTIC FUNCTION TEST

PART NO. 451442
SHEET 9 OF 9
BLOCK NO. 3300B

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS 12 5 8	SE-SEMICOLON 11 6 8	DE-DELTA 11 7 8
WS-WORD SEPARATOR 0 5 8	LT-LESS THAN 12 6 8	PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8	GT-GREATER THAN 6 8	TM-TAPE MARK 7 8
GM-GROUP MARK 12 7 8	MZ-MINUS ZERO 11 0	CO-COLON 5 8
RP-RIGHT PARENTHESIS 11 5 8	AP-APOSTROPHE 0 6 8	

```
,008015,022029,033033N      1001                       BRANCH HIGH              3300B 0A
,008015,022029,033033N      1001                       SET WORDMARK CARD        3300B 02
L069136,107115,119123,1281321001A1003718119370184645371B464D,5138494          3300B 03
L070182,150157,165169,173178100185128A150371816937018512537185120852 9        3300B 04
L067367,340344,348349,3573611001,008012,001100118361080AB400/340080           3300B 05
L069404,377385,389400,40440410010O0P        8400S5918S88       .     /332/    3300B 06
                                  Z
L072444,413420,427434,43844510018500S521L653441L6604708850 .  ¤439,70143933008 07
L072484,453460,464471,4764811001V464829 1A971441B434C70270484850B464B890033008 08
L071523,490494,501508,51251910018464B8100M467518M470515¤513C704702B632U 3300B 09
L068559,529536,541545,549556100181 45 C4706668545/8564,468A971470¤468         3300B 10
L068595,564571,576581,5885921001846 4C4676638596/8413G¤711829/2308348         3300B 11
L068631,600607,614621,6286321001,465A971467L467470A971470¤4654688464          3300B 12
L072671,637650,654661,66466710018512 88+10                ,701C702704828830HIGH 3300B 13
L072711,677682,701708,7017011001LOW   EQUALERROR                  . ¤ L L G3300B 14
                                                                    P T M
L072751¤712712,721761,7417411001 + $ ¤ R S D - / , % C A T   # @ C G T P3300B 15
                                     P E E          O P S      O T M Z
L072791¤752752,761761,7817811001 A B C D E F G H I M J K L M N O P Q R *3300B 16
                                                   Z
L072831¤792792,801821,8218211001 S T U V W X Y Z 0 1 2 3 4 5 6 7 819 91 3300B 17
L064863¤832852,850857,8648641001                       Y850753Y857739         3300B 18
L068899,900900,900900,90090010018434                                          3300B 19
L067934,907914,921928,9359351001,929936M467931M470938¤929936LAAA202          3300B 20
L072974,942949,954959,9669711001LBBB222L67124589 85T8996SL686285B975E21003300B 21
L067+09,979985,992996,+03+101001.979B100  L676265B959L6812658959              3300B 22
L067+44,+17+24,+31+38,+45+451001,+39+46M515+41M518+48¤+39+46LAAA202          3300B 23
L072+64,+52+59,+64+69,+76+811001LBBB222L6762458+95UB/06SL686285B+85E2150 3300B 24
L067/19,+89+95,/02/06,/13/201001.+898150  L6712656+69L6812658+69              3300B 25
L072/59,/40/60,/60/60,/60/601001A FIELD                 B FIELD               3300B 26
L072/99,/80S00,S00S00,S00S001001RESULT SHOULD BE     RESULT IS                3300B 27
L057S24,S01S05,S12S13,S17S18100 12,049L0772772/2772¤/40/60                    3300B 28
L052S44,S29S36,S37S41,S45S451001¤/80L/892702/2702413                          3300B 29
/333080N                                           CLEAR WORDMARK CARD        3300B 30
,019027,031,0380428031T98G8400L0463528W04B588     BRANCH HIGH                 3300B 31
                         M
```

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IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451443
SHEET 1 OF 9
BLOCK NO. 3310B

BRANCH LOW

A. PURPOSE OF TEST

1. TO TEST THE BRANCH LOW CIRCUITRY BY COMPARING EACH OF THE 64 POSSIBLE CHARACTERS WITH ALL OTHER CHARACTERS THAT ARE SEQUENTIALLY LOWER. ERRORS ARE DETECTED BY A NO-BRANCH (HIGH OR EQUAL) WHICH FORCES A PRINTOUT OF THE TWO CHARACTERS COMPARED, RESULT SHOULD BE (ALWAYS LOW), RESULT IS (HIGH OR EQUAL), AND THE WORD "ERROR"; OR STOPS THE MACHINE WITH SENSE SWITCH E ON.

2. TO TEST THE BRANCH LOW CIRCUITRY BY COMPARING EACH OF THE 64 POSSIBLE CHARACTERS WITH ALL OTHER CHARACTERS THAT ARE SEQUENTIALLY HIGHER. ERRORS ARE DETECTED BY A BRANCH (LOW OR EQUAL) WHICH FORCES A PRINTOUT OF THE TWO CHARACTERS COMPARED, RESULT SHOULD BE (ALWAYS HIGH), RESULT IS (LOW OR EQUAL), AND THE WORD "ERROR"; OR STOPS THE MACHINE WITH SENSE SWITCH E ON.

NOTE: NO PRINTOUT OCCURS FOR CORRECT RESULTS EXCEPT THE PRINTING OF THE TITLE AND HEADINGS WHEN "1" IS MANUALLY ENTERED IN SS2.

B. LOADING PROCEDURES:

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1259.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

D ON TO REPEAT INCLUDING LOOP COUNTER
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

G ON TO REPEAT ENTIRE PROGRAM
OFF TO CONTINUE

D. TEST PROCEDURE:

THE FOLLOWING CHARACTERS AND BLANKS ARE STORED IN ASCENDING SEQUENCE BY THE LOADING ROUTINE IN LOCATION 701-830, EXCEPT THE WORD MARKS IN ALL ODD-NUMBERED POSITIONS, THE WORD SEPARATOR CHARACTER IN LOCATION 733, AND THE A-BIT IN LOCATION 739 WHICH ARE PROGRAM GENERATED:

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D. (CONTINUED)

		12 12 12						11 11 11						0 0 0						5 6 7 12											
		5 6 7						5 6 7						5 6 7																	
		.	⌑	8	8	8	$	*	8	8	8	-	/	,	%	8	8	8	@	#	@	8	8	8	0	A	B	C	D	E	F
	(777777														77		77														77
LOC.	(000000														33		34														66
	(123456														34		90														34

											0																				
				11							2																				
		G	H	I	0	J	K	L	M	N	O	P	Q	R	8	S	T	U	V	W	X	Y	Z	0	1	2	3	4	5	6	7	8	9	91
		7777													77																8888	
LOC.		6666													99																2223	
		5678													12																7890	

AFTER STORING THE ABOVE TABLE IN THE LOCATIONS INDICATED, THE TWO CHARACTERS IN LOCATIONS 703-704 (.BLANK) ARE COMPARED WITH THE TWO BLANKS IN LOCATIONS 701-702. THE COMPARISON SHOULD BE LOW; IF NOT, AN ERRONEOUS HIGH OR EQUAL CONDITION BRANCHES TO AN ERROR PRINT ROUTINE AND PRINTS THE RESULTS IF SENSE SWITCH E IS OFF OR STOPS THE MACHINE IF THE SWITCH IS ON. IF THE COMPARISON IS LOW AS IT SHOULD BE, THE PROGRAM BRANCHES TO A SET OF INSTRUCTIONS WHICH WILL INTERCHANGE THE A AND B FIELDS OF THE COMPARE INSTRUCTION. THE COMPARISON SHOULD NOW BE HIGH. A TEST FOR LOW, THEREFORE, SHOULD NOT BRANCH. IF IT DOES, AN ERRONEOUS LOW OR EQUAL CONDITION BRANCHES TO THE ERROR PRINT ROUTINE AND EITHER PRINTS THE RESULTS OR STOPS THE MACHINE.

THE A FIELD LOADING ADDRESS (704) IN THE COMPARE INSTRUCTION IS THEN INCREASED BY 2 AND ⌑ BLANK IN 705-706 ARE NOW COMPARED WITH THE TWO BLANKS IN 701-702 IN THE SAME MANNER AS DESCRIBED ABOVE, INCLUDING THE INTERCHANGE OF THE A AND B FIELDS IN THE COMPARE INSTRUCTION. WHEN THE A FIELD LOADING ADDRESS REACHES 830, ALL OTHER CHARACTERS IN THE TABLE HAVE BEEN COMPARED WITH THE TWO BLANKS.

NEXT, ALL OTHER CHARACTERS IN THE TABLE MUST NOW BE COMPARED WITH THE TWO CHARACTERS IN 703-704 (.BLANK). THIS IS DONE BY SETTING BOTH THE A AND B FIELDS OF THE COMPARE INSTRUCTION TO 706 AND 704 RESPECTIVELY. THUS, THE FIRST TWO CHARACTERS TO BE COMPARED WITH . BLANK IN 703-704 ARE THE TWO CHARACTERS (⌑BLANK) IN 705-706, THE SECOND ARE THE 12-5-8 BLANK IN 707-708, THE THIRD ARE THE 12-6-8 BLANK IN 709-710, AND SO ON UNTIL THE A FIELD LOADING ADDRESS AGAIN REACHES 830.

BY CONTINUALLY INCREASING THE A AND B FIELD LOADING ADDRESSES BY 2 AS DESCRIBED ABOVE, THE LAST COMPARISON IS FINALLY MADE WHEN THE TWO CHARACTERS (91) IN LOCATIONS 829-830 ARE COMPARED WITH THE TWO CHARACTERS (90) IN LOCATIONS 827-828. THIS INDICATES THE END OF THE TEST WHICH MAY BE REPEATED AS OFTEN AS DESIRED IF SENSE SWITCH G IS IN THE ON POSITION.

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E. STOPS

979 OR 1089 IN STORAGE ADDRESS REGISTER: ERROR SENSE E ON.

F. PRINTOUTS

1. CORRECT

NONE

2. ERROR

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
8	A	LOW	HIGH	ERROR
F	B	LOW	EQUAL	ERROR
Q	Y	HIGH	LOW	ERROR
R	Z	HIGH	EQUAL	ERROR
91	81	LOW	HIGH	ERROR
$		LOW	HIGH	ERROR
	*	HIGH	EQUAL	ERROR
		LOW	HIGH	ERROR
		HIGH	LOW	ERROR

NOTE: NO PRINTOUT OCCURS IN THE A AND B FIELD COLUMNS FOR UNPRINTABLE CHARACTERS.

G. COMMENTS

AN OPERATION COUNTER IS INCLUDED TO REPEAT EACH BRANCH ON LOW TEST 10 TIMES. THE APPROXIMATE RUNNING TIME OF THE COMPLETE TEST IS 30 SECONDS.

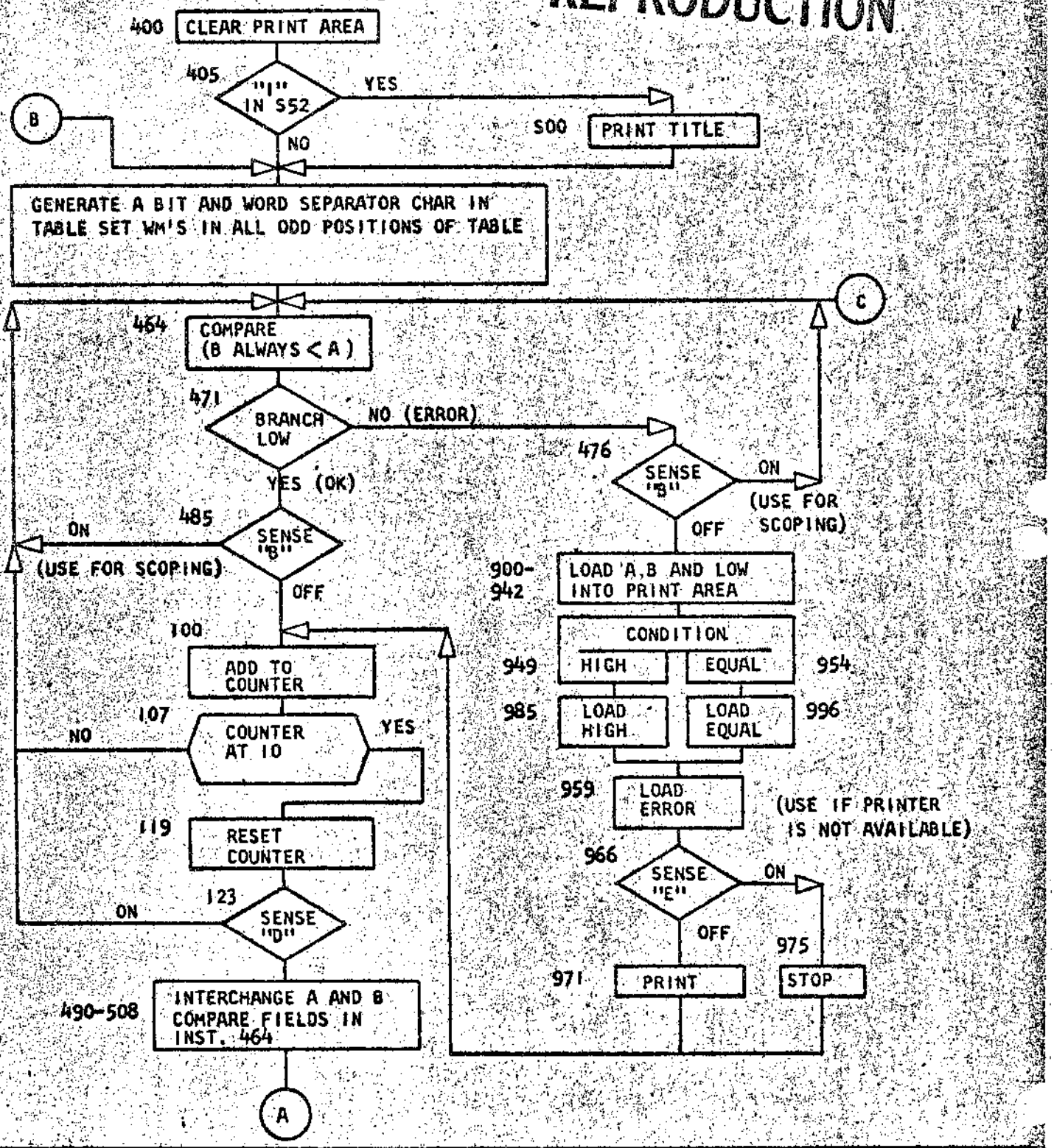
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451443
SHEET 4 OF 9
BLOCK NO. 33108

BRANCH LOW
FLOW CHART

REPRODUCTION



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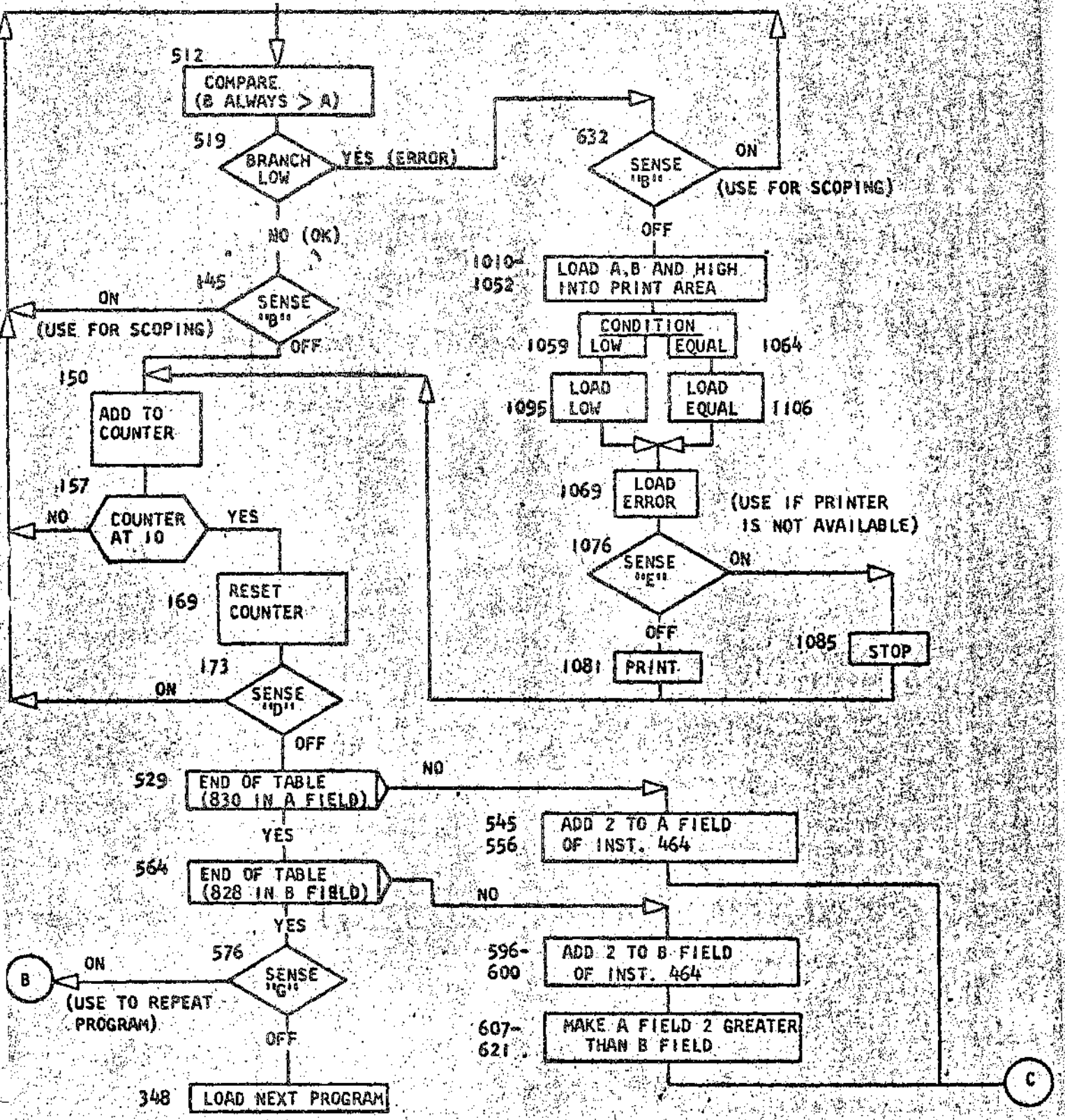
REPRODUCTION
DIAGNOSTIC FUNCTION TEST

PART NO. 451443
SHEET 5 OF 9
BLOCK NO. 33108



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH LOW 33108

```
INSTRUCTION
 ADDRESS   OP A    B                 REMARKS

  100  100  A 100  371
  107  107  B 119  3701               ADD ONE TO LOOP COUNTER
  115  115  B 464                    BRANCH OUT OF LOOP COUNTER      C FOR TA
  119  119  S 371                    REPEAT LOOP
  123  123  B 464  D                 RESET LOOP COUNTER
  128  128  , 513                    REPEAT LOOP ON SW D                    SS
  132  132  B 494                    INTERCHANGE A + B FLDS OF COMP IN 464
  145  145  B 512  8                 GO SET UP COMPARE FOR 512 FOR LOW COND
  150  150  A 150  371               8 ON TO SCOPE                          SS
  157  157  B 169  3701              ADD ONE TO LOOP COUNTER
  165  165  B 512                    BRANCH OUT OF LOOP COUNTER      C FOR TA
  169  169  S 371                    REPEAT LOOP
  173  173  B 512  D                 RESET LOOP COUNTER
  178  178  B 529                    REPEAT LOOP ON SW D                    SS
  368  368  0 00+                    CONTINUE WITH TEST
  377  377  B 400  S591              LOOP COUNTER
  385  385  B S88                    USE WHEN TESTS ARE RUN FROM TAPE
  400  400  / 332                      ,,
  404  404  /                        START TEST
  405  405  B S00  S521                ,,
  413  413  L 653  441                BR TO TITLE PRINT ROUTINE IF 1 IN S52
  420  420  L 660  470                SET INSTR IN 438 + 464 TO INITIAL COND
  427  427  B 850                      ,,
  434  434  ¤ 439                    BR TO GEN WD SEP + A BIT FOR TABLE
  438  438  , 701  439               SET WORD MARK IN ALL ODD ADDR OF TABLE
  445  445  V 464  8291           *     ,,
  453  453  A 971  441                  ,,
  460  460  B 434                       ,,
  464  464  C 704  702                  ,,
  471  471  B 485  T              *COMPARE
  476  476  B 464  B                 BRANCH LOW - SHOULD BRANCH
  481  481  B 900                    8 ON TO SCOPE                          SS
  485  485  B 464  8                 BRANCH TO ERROR PRINT ROUTINE
  490  490  B 100                    8 ON TO SCOPE                          SS
  494  494  M 467  518               GO TO LOOP COUNTER
  501  501  M 470  515                   TO SET UP COMP IN 512 FOR HIGH COND
  508  508  ¤ 513                       ,,
  512  512  C 702  704                  ,,
  519  519  B 632  T              *COMPARE
  524  524  B 145                    BRANCH LOW - SHOULD NOT BRANCH
  529  529  C 467  666               GO TO SWITCH B
  536  536  B 545  /                 TEST FOR END OF TABLE IN A FIELD OF 464
  541  541  B 564                    BRANCH IF UNEQUAL TO ADD 2 TO A FIELD
                                     BRANCH TO TEST FOR END OF TABLE IN B FLD
```

DATE	2-2-61	6-29-63	17.10.63					
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```
545  545  ,  465
549  549  A  971  467      ADD 2 TO A FIELD OF COMP IN 464
556  556  □  465
560  560  B  464           BRANCH TO COMPARE NEXT SET OF CHARACTERS
564  564  C  470  663      TEST FOR END OF TABLE IN B FIELD
571  571  B  596  /        BRANCH IF UNEQUAL TO ADD 2 TO B FIELD
576  576  B  413  G        G ON TO REPEAT TEST
581  581  ¤  711  829      CLEAR ANY GM-WM FROM PROGRAM
588  588  /  230
592  592  B  348           BRANCH TO READ NEXT RECORD
596  596  ,  468           ADD 2 TO B FIELD OF COMP IN 464
600  600  A  971  470
607  607  L  470  467      MAKE A FIELD 2 GREATER THAN B FIELD
614  614  A  971  467
621  621  ¤  465  468
628  628  B  464           BRANCH TO COMPARE NEXT SET OF CHARACTERS
632  632  B  512  8        8 ON TO SCOPE                          SS
637  637  B  410           BRANCH TO ERROR PRINT ROUTINE
650  650  ,  701           CONSTANTS TO SET INSTR TO INITIAL COND
654  654  C  704  702
661  661  8  28            CONSTANTS TO DETECT END OF TABLE
664  664  8  30
667  667  H  IGH           CONSTANTS FOR PRINTOUTS
672  672  L  OW
677  677  E  QUA  L
682  682  E  RRO  R
701  701     .  □     +  $  *  TABLE USED IN COMPARING
721  721  .  .  -  /  ,  %
741  741  #  @        ¢  A  B  C  D
761  761  E  F  G  H  I  -  J  K  L  M
781  781  N  O  P  Q  R  ¢  S  T  U  V
801  801  W  X  Y  Z  0  1  2  3  4  5
821  821  6  7  819  91
850  850  Y  850  733     GENERATE WORD SEPARATOR CHARAC FOR TABLE
857  857  Y  857  739     GENERATE A BIT FOR TABLE
864  864  B  434           BRANCH TO SET WORD MARKS IN TABLE
900  900  ,  929  936     ERROR PRINT ROUTINE IF NO BR OCCURRED
907  907  M  467  931        ON LOW CONDITION
914  914  M  470  938
921  921  □  929  936
928  928  L  AAA  202
935  935  L  BBB  222
942  942  L  676  245
949  949  B  985  U
954  954  B  996  $
959  959  L  686  285
966  966  B  975  E        E ON TO ERROR STOP                     SS
971  971  2  100           ERROR PRINT
975  975  .  979           ERROR STOP
979  979  B  100           GO TO LOOP COUNTER
985  985  L  671  265     LOAD -RESULT IS- COMMENT
992  992  B  959
```

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

REPRODUCTION

```
 996   996   L 681 265                ,,
1003   #03   B 959                    ,,
1010   #10   , #39 #46                ERROR PRINT ROUTINE IF BRANCH OCCURRED
1017   #17   M 515 #41                   ON HIGH CONDITION
1024   #24   M 518 #48                ,,
1031   #31   ¤ #39 #46                ,,
1038   #38   L AAA 202                ,,
1045   #45   L BBB 222                ,,
1052   #52   L 671 245                ,,
1059   #59   B #95 T                  ,,
1064   #64   B /06 S                  ,,
1069   #69   L 686 285                ,,
1076   #76   B #85 E                  E ON TO ERROR STOP                    SS
1081   #81   2 150                    ERROR PRINT
1085   #85   . #89                    ERROR STOP
1089   #89   B 150                    GO TO LOOP COUNTER
1095   #95   L 676 265                LOAD -RESULT IS- COMMENT
1102   /02   B #69                    ,,
1106   /06   L 681 265                ,,
1113   /13   B #69                    ,,
1120   /20   A  FI ELD                HEADINGS CONSTANTS
1140   /40   S  FI ELD                ,,
1160   /60   R ESU LT SHOULD BE       ,,
1180   /80   R ESU LT IS              ,,
```

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080I5,022029,033033N        1001                    BRANCH LOW                    33108 0A
,0080I5,022029,033033N        1001                    SET WORDMARK CARD             33108 02
L069136,107115,119123,128132100IA100371811937018464S3718464D,5138494               33108 03
L070182,150157,165169,173178100185128A150371816937018512S371851208529              33108 04
L067367,340344,348349,357361100I,008012,00110011836108OA8400/340080                 33108 05
L069404,377385,389400,404404100I000P      8400S5918S88              /332/         33108 06
                                  Z
L072444,413420,427434,438445100IBS00S521L653441L6604708850   ¤439,701439333108 07
L072484,453460,464471,476481100IV464829IA971441B434C7047028485T8464B8900333108 08
L071523,490494,501506,512519100IB464BB100M467518M470515¤513C702704B632T  33108 09
L068559,529536,541545,549556100IB145 C467666B545/B564,465A971467¤465     33108 10
L068595,564571,576581,588592100IB464C4706638596/B413G¤711829/2308348      33108 11
L068631,600607,614621,628632100I,468A971470L470467A971467¤4654688464      33108 12
L072671,637650,654661,664667100I8512BB*10          ,701C704702828830HIGH 33108 13
L072711,677682,701701,701701100ILOW  EQUALERROR                . ¤ L L G33108 14
                                                                 P T M
L072751¤712712,721741,741741100I + $ * R S O - / , % C A T   # @ C G T P33108 15
                                  P E E       O P S       O T M Z
L072791¤752752,761781,781781100I A B C D E F G H I M J K L M N O P Q R *33108 16
                                                Z
L072831¤792792,801821,821821100I S T U V W X Y Z 0 1 2 3 4 5 6 7 819 91 33108 17
L064863¤832832,850857,864864100I                Y850733Y857739               33108 18
L068899,900900,900900,900900100I8434                                         33108 19
L067934,907914,921928,935935100I,929936M467931M470938¤929936LAAA202          33108 20
L072974,942949,959966,971975100ILB8B222L6762458985U8996SL68628SB975E210033108 21
L067*09,979985,992996,*03*101001,9798100  L6712658959L6812658959             33108 22
L067*44,*17*24,*31*38,*45*451001,*39*46MS15*41M518*48¤*39*46LAAA202          33108 23
L072*84,*52*59,*64*69,*76*811001LB8B222L6712458*95T8/06SL686285B*85E215033108 24
L067/19,*89*95,/02/06,/13/201001.*898150  L6762658*69L6812658*69             33108 25
L072/59,/40/60,/60/60,/60/601001A FIELD              B FIELD                 33108 26
L072/99,/80S00,S00S00,SDOS001001RESULT SHOULO BE     RESULT IS               33108 27
L057S24,S01S05,S12S13,S17S1810012,049L0772772/2772¤/40/60                     33108 28
L052S46,S29S36,S37S41,S45S451001¤/80L/892702/2702413                          33108 29
/333080N                                        CLEAR WORDMARK CARD           33108 30
,019027,031,038042803IT98GB400LO463528W048S8B   BRANCH LOW                    33108 31
                                  M
```

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IBM

DIAGNOSTIC FUNCTION TEST

PUNCH CHECK PLANE TEST

A. PURPOSE OF TEST

1. TO EXERCISE PUNCH AND READ AREAS BETWEEN PUNCH OPERATIONS TO TEST FOR CORRECT CHECK PLANE OPERATION.
2. TO RUN PUNCH IN PUNCH-FEED-READ MODE IF THIS FEATURE IS ON THE MACHINE.

B. LOADING PROCEDURES

DO NOT RUN THIS TEST IF PUNCH RELEASE IS NOT AVAILABLE ON YOUR MACHINE.

1. TO RUN TEST FROM CARDS, 1402:
   - A. PLACE 25 BLANK CARDS IN THE PUNCH HOPPER.
   - B. REMOVE CARD 19 IF PFR IS NOT ON MACHINE.
   - C. PLACE CARD DECK, 3504, IN READ HOPPER.
   - D. TURN I/O CHECK STOP SWITCH OFF.
   - E. PRESS LOAD KEY ON 1402.

   NOTE: IF THE I/O CHECK STOP SWITCH IS ON, THE MACHINE WILL STOP AND NOT PRINT OUT ON ERROR.

2. TO RUN THIS TEST ONLY FROM THE TEST TAPE.
   - A. FOR PFR FEATURE, PLACE 1 IN 1272.
   - B. ENTER 3504 IN STORAGE LOCATIONS 1273-1276
   - C. PLACE 1 IN STORAGE LOCATION 1279.
   - D. PLACE 25 BLANK CARDS IN THE PUNCH HOPPER.
   - E. SET SENSE SWITCH F TO THE ON POSITION.

C. PROGRAM CONTROL

SENSE SWITCH B ON - LOOPS TEST WITHOUT PRINTING OR ERROR STOP AND WITHOUT REGARD TO CARD COUNT. USED FOR SCOPING.

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SENSE SWITCH C ON - PRINT CORRECT RESULT.

SENSE SWITCH D ON - REPEATS ENTIRE TEST

SENSE SWITCH E ON - HALTS ON ERROR IF SWITCH B IS OFF. SWITCH D CAN BE USED TO LOOP TEST.

SENSE SWITCH F - USE WHEN TEST IS RUN FROM TAPE.

D. TEST PROCEDURE

THE PUNCH AND READ AREA IS CLEARED, AND A PUNCH RELEASE OR A PUNCH-FEED-READ RELEASE OPERATION IS STARTED.

CARD 19 MUST BE MANUALLY REMOVED FROM THE DECK, IF A PUNCH RELEASE OPERATION IS DESIRED.

STORAGE LOCATIONS WITHIN THE READ AND PUNCH AREAS ARE USED AS ADDRESSES OF INSTRUCTIONS TO EXERCISE THESE AREAS.

AFTER APPROXIMATELY 42 MS OF DELAY, THE PUNCH OR PUNCH-FEED-READ INSTRUCTION IS EXECUTED. ERROR CHECKS ARE MADE, AND THE OPERATION IS REPEATED FOR A TOTAL OF 20 CARDS.

E. STOPS

STORAGE ADDR REG	TYPE OF HALT
599	ERROR

F. PRINTOUTS

1. WITHOUT ERRORS:

PUNCH CHECK PLANE TEST 3504A

PFR RELEASE OP WITH I/O CHECK STOP SWITCH OFF NO PUNCH ERROR CARD 001
PFR RELEASE OP WITH I/O CHECK STOP SWITCH OFF NO PUNCH ERROR CARD 002

PUNCH CHECK PLANE TEST 3504A

PUNCH RELEASE OP WITH I/O CHECK STOP SWITCH OFF NO PUNCH ERROR CARD 001
PUNCH RELEASE OP WITH I/O CHECK STOP SWITCH OFF NO PUNCH ERROR CARD 002

2. WITH ERRORS:

PUNCH RELEASE OP WITH I/O CHECK STOP SWITCH OFF PUNCH ERROR CARD 003
PUNCH RELEASE OP WITH I/O CHECK STOP SWITCH OFF PUNCH ERROR CARD 004

PFR RELEASE OP WITH I/O CHECK STOP SWITCH OFF PUNCH ERROR CARD 019
PFR RELEASE OP WITH I/O CHECK STOP SWITCH OFF PUNCH ERROR CARD 020

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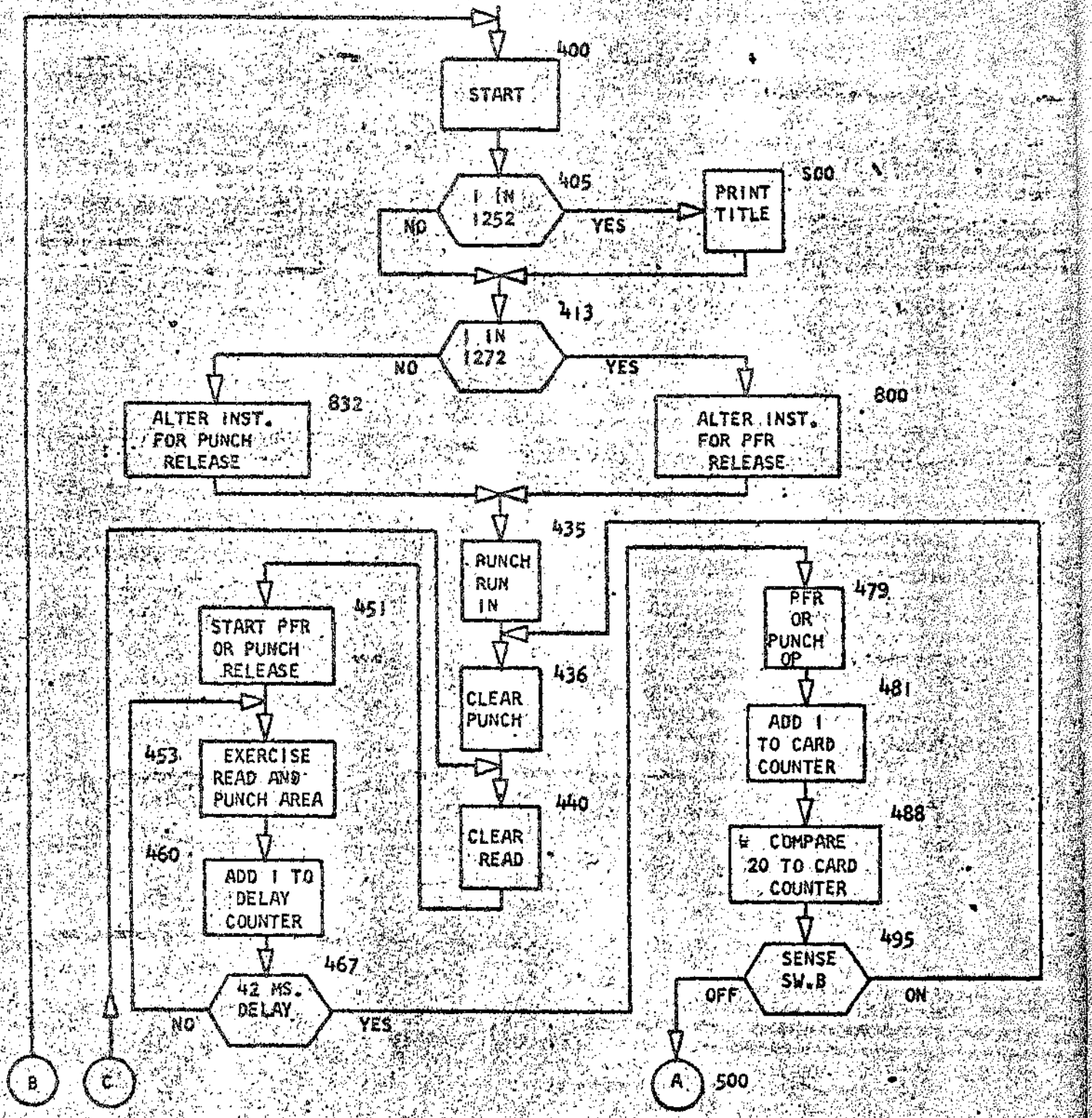
PUNCH CHECK PLANE TEST



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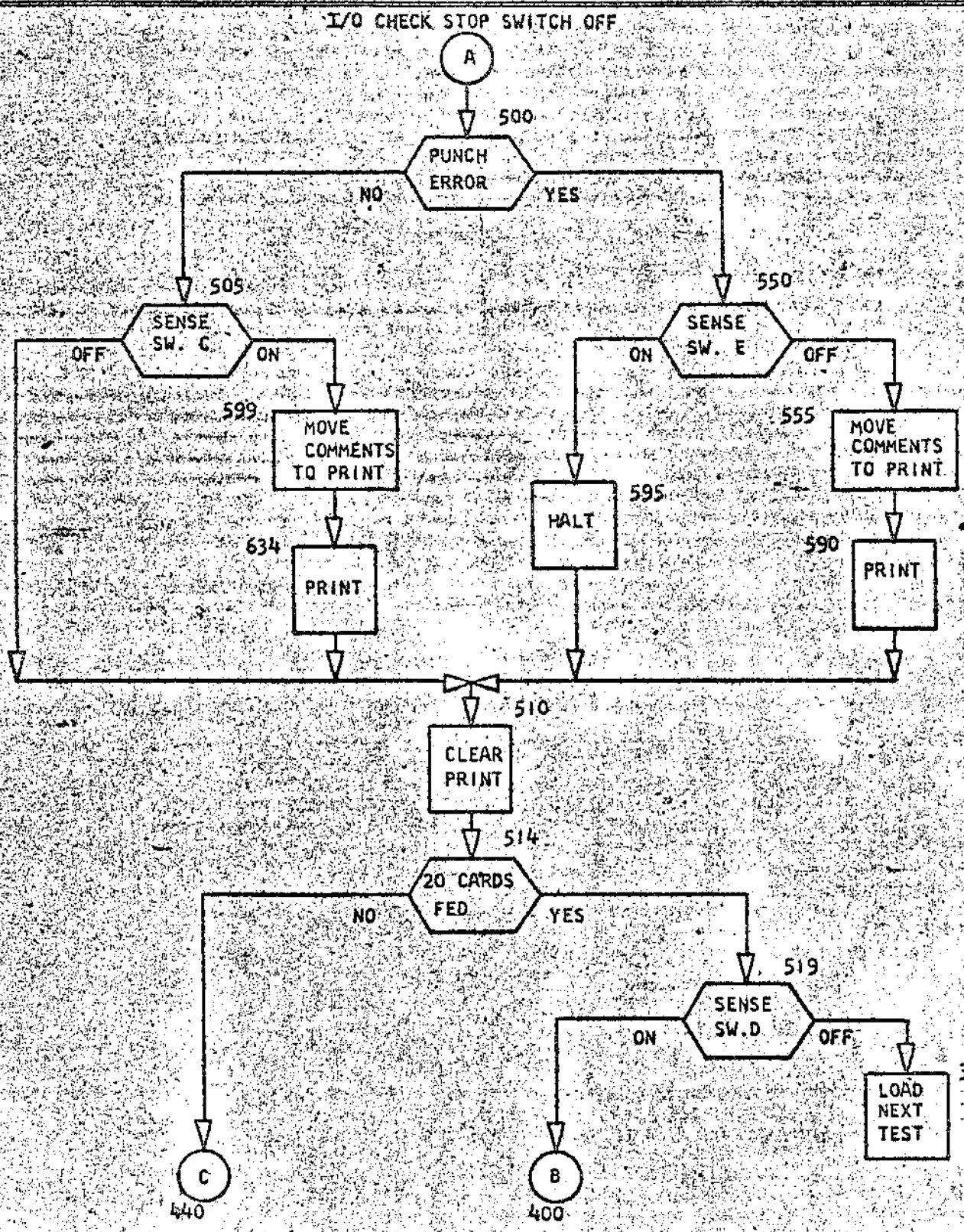
DIAGNOSTIC FUNCTION TEST

PART NO. 451929
SHEET 4 OF 7
BLOCK NO. 3504A



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PROGRAM LISTING FOR USE WITH FLOW CHART

PUNCH CHECK PLANE TEST 3504A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
378	378	B	389	9791	USE WHEN TESTS ARE RUN FROM TAPE
383	386	B	588		"
389	389	N	000		"
398	393	M	360	392	"
400	400	/	832		START TEST
404	404	/			* ASTERISK DENOTES INSTRUCTION CHANGE
405	405	B	500	5521	BR TO TITLE PRINT ROUTINE IF 1 IN 1252
413	413	B	800	5721	BRANCH FOR PFR RELEASE
421	421	B	832		BRANCH FOR PUNCH RELEASE
435	435	%			PUNCH RUN IN
436	436	/	180		CLEAR PUNCH AREA
440	440	/	080		CLEAR READ AREA
444	444	.	001	101	SET WN
451	451	9	X		*START PFR OR PUNCH RELEASE
453	453	M	070	180	EXERCISE PUNCH AREA
460	460	A	741	005	ADD 001 TO DELAY COUNTER
467	467	C	743	002	COMPARE 020 TO DELAY COUNTER
474	474	B	453	/	TEST FOR 42 MS DELAY
479	479	%	X		*START PFR OR PUNCH OP
481	481	A	741	103	ADD 001 TO CARD COUNTER
488	488	C	743	102	COMPARE 020 TO CARD COUNTER
495	495	B	436	8	B ON TO SCOPE
500	500	B	550	-	BR IF PUNCH ERROR WITH I/O SW OFF
505	505	B	599	C	C ON TO PRINT CORRECT RESULTS
510	510	/	299		CLEAR PRINT AREA
514	514	B	440	/	TEST FOR 20 CARDS FED
519	519	B	400	D	D ON TO REPEAT TEST
524	524	B	348		BR TO NEXT TEST
550	550	B	595	E	E ON TO ERROR STOP
555	555	M	702	284	LOAD PRINT AREA
562	562	M	675	256	"
569	569	M	664	244	"
576	576	M	103	288	"
583	583	M	XXX	216	* "
590	590	2			PRINT ERROR RESULTS
591	591	B	510		BR TO CHECK FOR 20 CARDS
595	595	.	510		HALT IF ERROR AND E ON
599	599	M	702	284	LOAD PRINT AREA
606	606	M	685	264	"
613	613	M	664	244	"
620	620	M	103	288	"
627	627	M	XXX	216	* "

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```
 634  634  2                          PRINT CORRECT RESULTS
 635  635  B 518                      BR TO CHECK FOR 20 CARDS
 646  646  W 1TH  1/8 CHECK STOP
 665  665  S WIT CH OFF      NO
 684  684  P UNC H ERROR    CARD
 703  703  P UNC H RELEASE OP
 719  719  P FR  RELEASE OP
 733  733  7 32                       CONSTANT
 736  736  7 18                       ,,
 739  739  0 01                       ,,
 742  742  0 20                       ,,
 745  745  R                          ,,
 800  800  M 745 452                  ALTER INST FOR PFR RELEASE
 807  807  M 745 480                  ,,
 814  814  M 735 586                  ,,
 821  821  M 735 630                  ,,
 828  828  B 435                      BR TO START TEST
 832  832  M 739 452                  ALTER INST FOR PUNCH RELEASE
 839  839  M 739 480                  ,,
 846  846  M 738 586                  ,,
 853  853  M 738 630                  ,,
 860  860  B 435                      BR TO START TEST
1222  522  1                          PFR SELECTION CARD
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080015,022029,033033N      1001                PUNCH CHECK PLANE TEST   3504A00A
,0080015,022029,033033N      1001                SET WORDMARK CARD        3504A 02
L067367,340340,348349,357361 1001,008012,0011001183610800A8413/340080     3504A 03
L069404,377385,389393,400404 1001          8389S79185S8N000M360392/332/   3504A 04
L071443,413421,435436,440444 10018S00S52168005,7218832      %/180/080      3504A 05
L069480,451453,460467,474479 1001,0011019XM070180A741003C743002B453/4%     3504A 06
L070518,488495,500505,510516 1001A741103C743102B43688550M8599C/2998440/    3504A 07
                                                        I
L068554,824650,555559,585355 10018400088348                  8595E        3504A 08
L072694,562564,576583,690591 1001M70228HM675256M864244M103288MXXX2162851035504A 09
L072634,599606,613620,627634 1001.510M70228HM683264M864244M103288MXXX2162 3504A 10
L072674,646665,665665,685665 10018510.          WITH I/O CHECK STOPSWITCH OFF3504A 11
L072714,676675,684703,703703 1001          NOPUNCH ERROR    CARDPUNCH RELEA63504A 12
L059741,871571,719733,736739 1001E OPPER RELEASE OP732718001               3504A 13
L072781,745745,745745,745745 10010208                                      3504A 14
L071820,782782,800807,814821 1001                    M745452M745480M735586 3504A 15
L071859,828832,839846,853860 1001M735830M735M739452M739480M738586M738630  3504A 16
L072899,001001,001001,001001 100184 35                                     3504A 17
L057524,601605,512513,517518 100012,0494077277 2/27728413                  3504A 18
L033872,001001,001001,001001 10011                                         3504A 19
/3830B0N                                    CLEAR WORDMARK CARD            3504A 20
,0190271031,0380428031799868400L0463528H048S88   PUNCH CHECK PLANE TEST    3504A 21
                    M
```

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IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451446
SHEET 1 OF 14
BLOCK NO. 3600E

CUSTOMER ENGINEERING TESTS
FOR THE 1401 DATA PROCESSING SYSTEM

PUNCH FEED READ

A. PURPOSE OF TEST

1. TO TEST PUNCH-FEED-READ FEATURE
2. TO TEST PFR FOLLOWED BY A READ.

B. LOADING PROCEDURES

1. TO RUN TEST FROM CARDS (1402)
   - A. PLACE DECK IN READ HOPPER.
   - B. PRESS LOAD KEY ON 1402
   - C. WHEN MACHINE HALTS AT 500, RUN CARDS OUT OF PUNCH WITH NON-PROCESS KEY.
   - D. PLACE RIPPLE PUNCHED DECK IN PUNCH HOPPER.
   - E. PLACE AT LEAST 4 BLANK CARDS BEHIND THE RIPPLE PUNCHED CARDS IN THE PUNCH HOPPER.
   - F. PRESS START KEY.
   - G. WHEN MACHINE STOPS BECUASE OF AN EMPTY READ HOPPER, PRESS START KEY.
2. TO RUN THIS TEST ONLY FROM TEST TAPE:
   - A. MANUALLY ENTER BLOCK NO. 3600 IN LOCATIONS S73-S76 AND "1" IN S72.
   - B. LOAD BLANK CARDS IN THE PUNCH FEED HOPPER.
   - C. SET SENSE SWITCH "F" TO THE ON POSITION.
   - D. PLACE AT LEAST 82 CARDS IN THE READ HOPPER (BLANK OR PUNCHED).
   - E. PRESS START KEY.
   - F. WHEN MACHINE HALTS AT 500, RUN CARDS OUT OF PUNCH WITH NON-PROCESS KEY.
   - G. PLACE RIPPLE PUNCHED CARDS IN THE PUNCH HOPPER.
   - H. PLACE AT LEAST 4 BLANK CARDS BEHIND THE RIPPLE PUNCHED CARDS IN THE PUNCH HOPPER.
   - I. PRESS START KEY

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C. PROGRAM CONTROL

1. CHECKING PROCEDURE

A. MACHINE STOPS FOR ERROR AT 690 BEFORE THE CARD IS PUNCHED.

B. LIFT THE CARDS IN THE PUNCH FEED HOPPER AND DO A NON-PROCESS RUN-OUT. THE CARD NEXT TO THE LAST CARD IN PUNCH STACKER 4 IS THE CARD THAT STOPPED THE MACHINE.

C. RE-START THE PROGRAM IN THE SINGLE-CYCLE MODE AT LOCATION 531 TO EXECUTE THE COMPARE INSTRUCTION. WITH EACH DEPRESSION OF THE START KEY WATCH THE B ≠ A LOGIC LIGHT UNTIL IT TURNS ON. AT THIS TIME THE CHARACTER IN THE STORED TABLE IS DISPLAYED IN THE A-REGISTER AND THE CHARACTER IN THE READ AREA THAT CAUSED THE UNEQUAL COMPARISON IS DISPLAYED IN THE B-REGISTER.

D. CHECK THE CHARACTER IN THE READ AREA WITH THE CHARACTER PUNCHED IN THE CORRESPONDING COLUMN OF THE CARD.

2. SENSE SWITCHES.

SENSE SWITCH C ON - CORRECT PRINT

SENSE SWITCH D ON - PERMITS PROCESSING OF MULTIPLE DETAIL SETS.

NOTE: USE ONLY WHEN TEST IS RUN SEPARATELY

SENSE SWITCH E ON - STOPS ON ERROR

SENSE SWITCH E OFF - PRINTS ERROR

D. TEST PROCEDURE:

AFTER TESTING FOR A "1" IN S52 TO PRINT OR BY-PASS THE TITLE, THE 80-CHARACTER TABLE, STORED BY THE PROGRAM IN LOCATIONS 701-780, IS EXPANDED TO A 160-CHARACTER TABLE IN LOCATIONS 701-860. THE CHARACTERS IN 701-780 ARE THEN MOVED TO THE PUNCH AREA AND A CARD IS PUNCHED AND SELECTED IN STACKER 4. A "1" IS THEN ADDED TO THE A-ADDRESS OF THE MOVE INSTRUCTION INCREASING IT FROM 780 TO 781, AND ANOTHER CARD IS PUNCHED, THIS TIME WITH CHARACTERS STORED IN LOCATIONS 702-781. THIS LOOP IS REPEATED UNTIL THE A-ADDRESS OF THE MOVE INSTRUCTION STANDS AT 860, INDICATING THAT THE LAST CARD OF THE THE SET HAS BEEN RIPPLE PUNCHED. WITH SENSE SWITCH D NORMALLY OFF, A BLANK CARD IS THEN PUNCHED IN ORDER TO SELECT THE 80TH CARD OF THE SET IN STACKER 4. FOLLOWING THIS, THE MACHINE STOPS AT LOCATION 499 (STAR AT 500).

AFTER THE PUNCHED CARDS FOLLOWED BY AT LEAST FOUR BLANK CARDS HAVE BEEN PLACED IN THE PUNCH HOPPER AND THE START KEY IS DEPRESSED, THE PROGRAM STARTS AT 500.

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D. (CONTINUED)

BEGINNING AT LOCATION 500, THE A-ADDRESSES OF THE MOVE AND COMPARE INSTRUCTIONS ARE STARTED AT 779. THE PRINT, PUNCH, AND READ AREAS ARE THEN CLEARED AND A COMMAND IS GIVEN TO READ A PRE-PUNCHED CARD AT THE PUNCH FEED READ STATION, PUNCH THE CARD AHEAD OF IT, AND BRANCH. IF NO BRANCH, AN ERROR IS INDICATED WITH THE MACHINE STOPPING AT LOCATION 555. IF BRANCH, THE PROGRAM BRANCHES TO SELECT THE CARD IN STACKER 4 AND MOVE THE READ AREA TO THE PRINT AND PUNCH AREAS. THE INFORMATION IN THE PRINT AREA SHOULD BE AN EXACT IMAGE OF THE INFORMATION IN THE READ AREA WHICH WILL LATER BE COMPARED WITH THE RIPPLE TABLE IN STORAGE. THE INFORMATION IN THE PUNCH AREA, HOWEVER, IS RE-ARRANGED IN THE FOLLOWING MANNER:

COLUMNS 1-40 ARE STORED IN PUNCH POSITIONS 141-180
COLUMNS 41-80 ARE STORED IN PUNCH POSITIONS 101-140

NOTE: THIS ARRANGEMENT PRODUCES A CRISSCROSS PATTERN WHEN THE CARD IS PUNCHED FOR THE SECOND TIME.

AT THIS POINT A COMPARISON IS MADE BETWEEN THE INFORMATION IN THE TABLE AND THE INFORMATION IN THE READ AREA.

NEXT, A READ COMMAND IS GIVEN.

A BRANCH UNEQUAL IS THEN USED TO CHECK THE PUNCH FEED READ OPERATION FOR CORRECT TRANSFER OF INFORMATION TO THE READ AREA. AN EQUAL INDICATES NO ERROR.

THE LOOP IS REPEATED UNTIL ALL DETAIL CARDS ARE READ.

E. STOPS

STORAGE ADDR. REG	TYPE OF HALT
500	TO ALLOW STKR. 4 CARDS TO BE PLACED IN PUNCH HOPPER.
555	THE 4 555 R INSTRUCTION FAILED TO BRANCH.
690	COMPARE ERROR BETWEEN TABLE AND READ IN AREA OCCURRED.

F. PRINTOUTS

TWO LINES ARE PRINTED. THE FIRST LINE WITH CARD NO. REPRESENTS THE CARD READ, AND THE SECOND LINE REPRESENTS THE TABLE. PRINTING FOR CORRECT RESULTS IS OBTAINED WHEN SENSE SWITCH C IS SET TO THE ON POSITION. THE FIRST LINE IS ALWAYS PRINTED WITH A PRINT PUNCH-FEED-READ INSTRUCTION (6R).

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F. (CONTINUED)

EXAMPLE OF ERROR PRINTOUT:

(LINE ONE IS THE CARD READ; LINE TWO IS THE TABLE IN STORAGE.)

```
&&AABBCCDDEEFFGGHHIIJJOO//SS3TUUVVWWXXYYZZRRQQPPOONNMMLLKKJJ--99887766554433221 1 ERROR 1
&&AABBCCDDEEFFGGHHIIJJOO//SSTTUUVVWWXXYYZZRRQQPPOONNMMLLKKJJ--99887766554433221 1

&AABBCCDDEEFFGGHHIIJJOO//SSTTUUVVWWXXYYZZRRQQPPOONNMMLLKKJJ--99887G6655443322 11 & ERROR 2
&AABBCCDDEEFFGGHHIIJJOO//SSTTUUVVWWXXYYZZRRQQPPOONNMMLLKKJJ--99887766554433221 1 &
```

WHEN MACHINE PRINTS CORRECT RESULTS, INFORMATION ON LINE 1 AGREES WITH INFORMATION ON LINE 2 AND THE WORD "ERROR" IS OMITTED.

NOTE: IF THE CARDS ARE NOT IN RIPPLE SEQUENCE DURING THE PUNCH FEED READ PORTION OF THE TEST, ERROR PRINT-OUTS WILL OCCUR.

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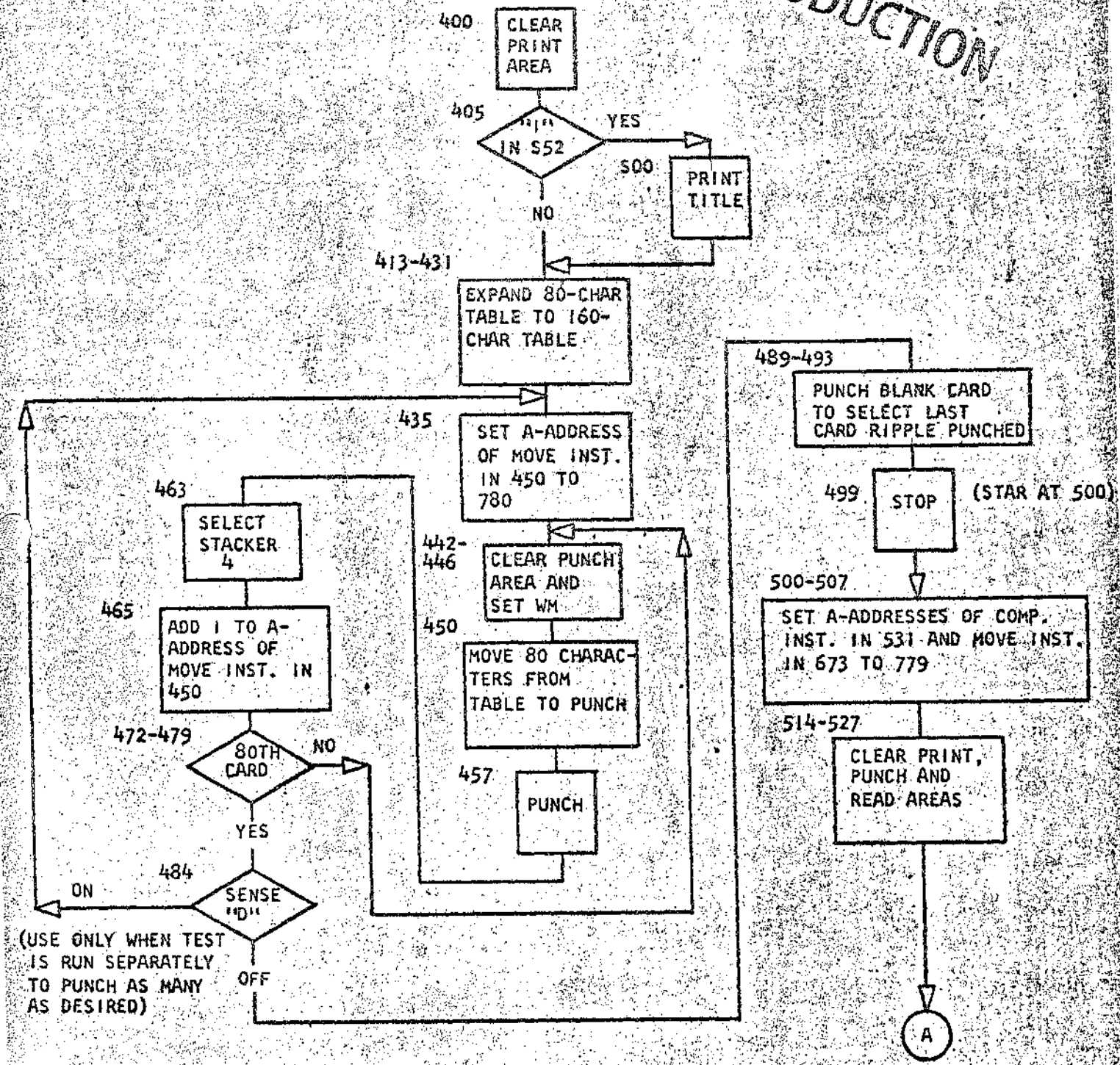
PUNCH FEED READ

FLOW CHART



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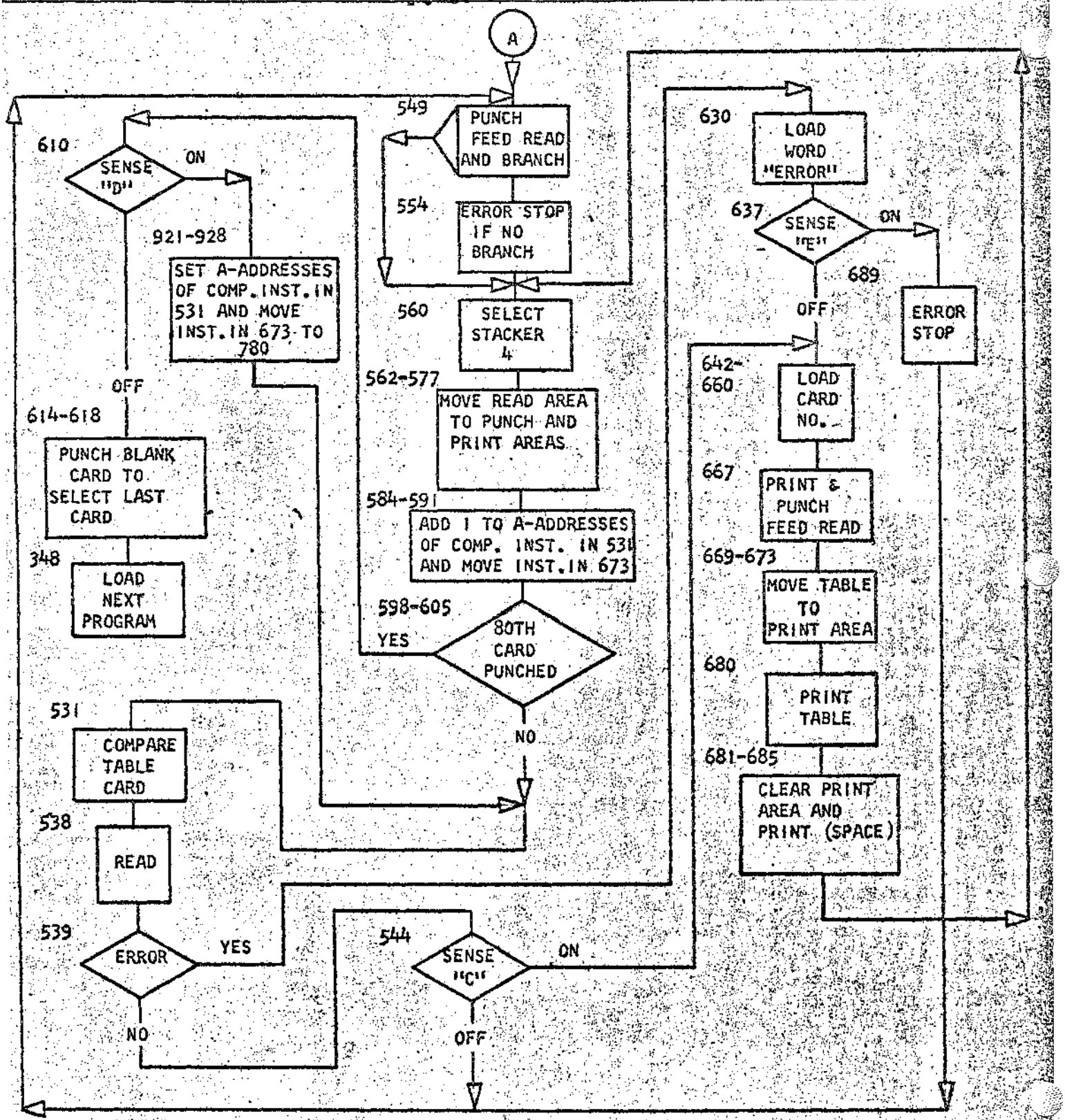

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PROGRAM LISTING FOR USE WITH FLOW CHART

PUNCH FEED READ 3600D

INSTRUCTION ADDRESS		OP	A	B	REMARKS
382	382	B	400	S721	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	¤	721	741	EXPAND RIPPLE TABLE TO 160 CHARACTERS
420	420	¤	761		
424	424	L	780	660	
431	431	¤	781		
435	435	M	903	453	SET A ADDR OF MOVE INSTR IN 450 TO 780
442	442	/	180		CLEAR PUNCH AREA
446	446	.	101		
450	450	M	780	180	*MOVE RIPPLE TABLE TO PUNCH AREA
457	457	4			PUNCH
458	458	N	000	0	NOP
463	463	K	4		SELECT 4 IF NO PUNCH ERROR
465	465	A	400	453	ADD 1 TO A ADDR OF MOVE INSTR IN 450
472	472	C	453	906	TEST IF LAST CARD HAS BEEN PUNCHED
479	479	B	442	/	BRANCH TO PUNCH NEXT CARD IF NOT LAST
484	484	B	435	D	D ON TO REPEAT PUNCHING
489	489	/	180		PUNCH BLANK CARD TO SELECT LAST CARD RIPPLE PUNCHED
493	493	4			
494	494	B	499		BRANCH TO STOP
499	499	.			STOP TO RELOAD STACKER 4 CARDS TO PUNCH
500	500	M	909	534	SET A ADDR OF COMP INSTR IN 531 TO 779
507	507	M	909	676	SET A ADDR OF MOVE INSTR IN 673 TO 779
514	514	/	299		CLEAR PRINT, PUNCH + READ AREAS
518	518	¥			
519	519	/			
520	520	.	001	101	SET WORD MARKS TO STOP MOVE INSTR
526	527	B	549		BRANCH TO PUNCH FEED READ
531	531	C	XXX	080	*TEST FOR ERROR IN READING RIPPLE INFO
538	538	1			READ
539	539	B	630	/	BRANCH TO ERROR PRINT ROUTINE IF ERROR
544	544	B	642	C	C ON TO CORRECT PRINT
549	549	1	555	R	PUNCH FEED READ + BRANCH
554	554	.			ERROR STOP IF NO BRANCH
555	555	N	000	0	NOP
560	560	K	4		SELECT STACKER 4 IF NO PUNCH ERROR
562	562	M	040	180	MOVE READ AREA TO PUNCH AREA
569	569	M	080		
573	573	/	299		CLEAR PRINT AREA

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```
527  527  M 080 280                MOVE READ AREA TO PRINT AREA
584  584  A 400 534                ADD 1 TO A ADDR OF COMP INSTR IN 531
593  593  A 400 676                ADD 1 TO A ADDR OF MOVE INSTR IN 673
598  598  C 676 906                TEST FOR LAST CARD
605  605  B 531 /                  BR TO TEST FOR READ ERROR IF NOT LAST
610  610  B 921 D                  D ON TO REPEAT TEST
615  615  / 180                    PUNCH BLANK CARD TO SELECT LAST
619  619  ½                          PUNCHED CARD
628  628  B 348                    BRANCH TO READ NEXT PROGRAM
630  630  L /19 285                LOAD WORD ERROR TO PRINT
637  637  B 689 E                  E ON TO ERROR STOP
642  642  M 676 912                MOVE CARD NO. TO PRINT AREA
649  649  S 909 912                  ,,
656  656  , 297                    ,,
660  660  Z 912 299                ,,
667  667  ö R                      PRINT AND PUNCH FEED READ
669  669  √ 299                    CLEAR PRINT AREA
673  673  M XXX 280                *MOVE TABLE TO PRINT AREA
680  680  2                        PRINT TABLE
681  681  / 280                    PRINT BLANKS TO SPACE
685  685  2 555                      ,,
689  689  .                        ERROR STOP
690  690  B 549                    BR TO PUNCH FEED READ NEXT CARD
701  701  + +AA BBCCDDEEFFGGHHII   RIPPLE TABLE
721  721  0 0// SSTTUUVVWWXXYYZZ     ,,
741  741  R RQQ PPOONNNMMLLKKJJ--    ,,
761  761  9 988 7766554433221 1      ,,
901  901  7 80                     CONSTANTS
904  904  8 60                       ,,
907  907  7 79                       ,,
910  910  X XX                     *COUNTER USED TO FIND CARD NUMBER
921  921  M 903 534                SET A FIELD OF COMP IN 531 TO 780
928  928  M 903 676                SET A FIELD OF MOVE IN 673 TO 780
935  935  B 531                    BRANCH TO REPEAT PROGRAM
1115 /15  E RRO R                  CONSTANTS
1120 /20  L INE  1 - CARD READ       ,,
1140 /40                             ,,
1160 /60  L INE  2 - TABLE IN ST     ,,
1180 /80  B RAG E                    ,,
```

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PROGRAM LISTING FOR USE WITH FLOW CHART

PUNCH FEED READ 3600E

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S721	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	¤	721	741	EXPAND RIPPLE TABLE TO 160 CHARACTERS
420	420	¤	761		,,
424	424	L	780	860	,,
431	431	¤	781		,,
435	435	M	903	453	SET A ADDR OF MOVE INSTR IN 450 TO 780
442	442	/	180		CLEAR PUNCH AREA,
446	446	,	101		,,
450	450	M	780	180	*MOVE RIPPLE TABLE TO PUNCH AREA
457	457	4			PUNCH
458	458	N	000	0	NOP
463	463	K	4		SELECT 4 IF NO PUNCH ERROR
465	465	A	400	453	ADD 1 TO A ADDR OF MOVE INSTR IN 450
472	472	C	453	906	TEST IF LAST CARD HAS BEEN PUNCHED
479	479	B	442	/	BRANCH TO PUNCH NEXT CARD IF NOT LAST
484	484	B	435	D	D ON TO REPEAT PUNCHING
489	489	/	180		PUNCH BLANK CARD TO SELECT LAST CARD RIPPLE PUNCHED
493	493	4			
494	494	B	499		BRANCH TO STOP
499	499	.			STOP TO RELOAD STACKER 4 CARDS TO PUNCH
500	500	M	909	534	SET A ADDR OF COMP INSTR IN 531 TO 779
507	507	M	909	676	SET A ADDR OF MOVE INSTR IN 673 TO 779
514	514	/	299		CLEAR PRINT, PUNCH + READ AREAS
518	518	/			,,
519	519	/			,,
520	520	,	001	101	SET WORD MARKS TO STOP MOVE INSTR
527	527	B	549		BRANCH TO PUNCH FEED READ
531	531	C	XXX	080	*TEST FOR ERROR IN READING RIPPLE INFO
538	538	1			READ
539	539	B	630	/	BRANCH TO ERROR PRINT ROUTINE IF ERROR
544	544	B	642	C	C ON TO CORRECT PRINT
549	549	4	555	R	PUNCH FEED READ + BRANCH
554	554	-			ERROR STOP IF NO BRANCH
555	555	N	000	0	NOP
560	560	K	4		SELECT STACKER 4 IF NO PUNCH ERROR
562	562	M	040	180	MOVE READ AREA TO PUNCH AREA
569	569	M	080		,,
573	573	/	299		CLEAR PRINT AREA
577	577	M	080	280	MOVE READ AREA TO PRINT AREA

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```
 584  584  A 400 534                ADD 1 TO A ADDR OF COMP INSTR IN 531
 591  591  A 400 676                ADD 1 TO A ADDR OF MOVE INSTR IN 673
 598  598  C 676 906                TEST FOR LAST CARD
 605  605  B 531 /                  BR TO TEST FOR READ ERROR IF NOT LAST
 610  610  B 921 D                  D ON TO REPEAT TEST
 615  615  / 180                    PUNCH BLANK CARD TO SELECT LAST
 619  619  4                          PUNCHED CARD
 620  620  B 348                    BRANCH TO READ NEXT PROGRAM
 630  630  L /19 285                LOAD WORD ERROR TO PRINT
 637  637  B 689 E                  E ON TO ERROR STOP
 642  642  M 676 912                MOVE CARD NO. TO PRINT AREA
 649  649  S 909 912                  ,,
 656  656  , 297                    ,,
 660  660  Z 912 299                ,,
 667  667  6 R                      PRINT AND PUNCH FEED READ
 669  669  / 299                    CLEAR PRINT AREA
 673  673  M XXX 280                *MOVE TABLE TO PRINT AREA
 680  680  2                        PRINT TABLE
 681  681  / 280                    PRINT BLANKS TO SPACE
 685  685  2 555                      ,,
 689  689  .                        ERROR STOP
 690  690  B 549                    BR TO PUNCH FEED READ NEXT CARD
 701  701  + +AA BBCCDDEEFFGGHHII   RIPPLE TABLE
 721  721  0 0// SSTTUUVVWWXXYYZZ     ,,
 741  741  R RQQ PPOONNMMLLKKJJ--     ,,
 761  761  9 988 776655443322 11      ,,
 901  901  7 80                     CONSTANTS
 904  904  8 60                       ,,
 907  907  7 79                       ,,
 910  910  X XX                     *COUNTER USED TO FIND CARD NUMBER
 921  921  M 903 534                SET A FIELD OF COMP IN 531 TO 780
 928  928  M 903 676                SET A FIELD OF MOVE IN 673 TO 780
 935  935  B 531                    BRANCH TO REPEAT PROGRAM
1115  /15  E RRO R                  CONSTANTS
1120  /20  L INE  1 - CARD READ       ,,
1140  /40  .                          ,,
1160  /60  L INE  2 - TABLE IN ST     ,,
1180  /80  O RAG E                    ,,
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                PUNCH FEED READ          3600E 0A
,008015,022029,033033N      1001                SET WORDMARK CARD        3600E 02
L067367,340344,348349,3573611001,008012,0011001B361080AB421/340080       3600E 03
L069404,377385,400404,4054051001          B400S721BS88          /332/    3600E 04
L069441,413420,424431,4354421001BS00S521¤721741¤761L780860¤781M903453    3600E 05
L062471,446450,457458,4634651001/180,101M7801804N0000K4A400453           3600E 06
L060499,479484,489493,4944991001C453906B442/B435D/18048499 .             3600E 07
L063530,507514,518519,5205271001M909534M909676/299//,0011101B549         3600E 08
L061559,538539,544549,5545551001CXXX0801B630/B642C455SR.N0000            3600E 09
L070597,562569,573577,5845911001K4M040180M080/299M080280A400534A400676   3600E 10
L071636,605610,615619,6206301001C6769068531/B921D/18048348      L/19285  3600E 11
L068672,642649,656660,6676691001B689EM67912S909912,297Z9122996R/299      3600E 12
L072712,680681,685689,6907011001MXXX2802/2802555.B549       PPAABBCCDDEE 3600E 13
                                                             ZZ
L072752¤713713,721741,741741001FFGGHHII00//SSTTUUVVWWXXYYZZRRQQPPOONNMM 3600E 14
L072792¤753753,761761,761761001LLKKJJMM99887766554433221 1               3600E 15
                                  ZZ
L069909¤873873,901904,9071010001                          780860779      3600E 16
L072949,921928,935935,9359351001XXX        M903534M9036768531            3600E 17
L072/49¤/10/10,/15/20,/40/401001      ERRORLINE 1 - CARD READ              3600E 18
L072/89¤/50/50,/60/80,/80/801001           LINE 2 - TABLE IN STORAGE       3600E 19
L057S24,S01S05,S12S13,S17S1810012,049L0772772/2772¤/40/60                  3600E 20
L052S44,S29S36,S37S41,S45S451001¤/80L/892802/2802413                       3600E 21
/333080N                                          CLEAR WORDMARK CARD      3600E 22
,019027,031,038042803!T98GB400L046352BW048S88   PUNCH FEED READ          3600E 23
                          M
```

DETAIL CARDS

```
AKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM3600E 24
       M       E       S       M       Z       Z       M
KT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV3600E 25
     M       E       S       M       Z       Z       M
T4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV63600E 26
   M       E       S       M       Z       Z       M
4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 3600E 27
 M       E       S       M       Z       Z       M
 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D3600E 28
    M       E       S       M       Z       Z       M
BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN3600E 29
   M       E       S       M       Z       Z       M
LU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW3600E 30
  M       E       S       M       Z       Z       M
U5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR#@TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW73600E 31
```

M	E	S	M	Z			M	
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```
SGCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D3600E 32
 M       E       S       M       Z       Z       M       E
GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE3600E 33
M       E       S       M       Z       Z       M       E
CMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEO3600E 34
        E       S       M       Z       Z       M       E
MV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX3600E 35
        E       S       M       Z       Z       M       E
V6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX83600E 36
        E       S       M       Z       Z       M       E
6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 3600E 37
      E       S       M       Z       Z       M       E
 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 F3600E 38
     E       S       M       Z       Z       M       E
DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FP3600E 39
    E       S       M       Z       Z       M       E
NW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY3600E 40
   E       S       M       Z       Z       M       E
W7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY93600E 41
  E       S       M       Z       Z       M       E
7DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9T3600E 42
 E       S       M       Z       Z       M       E       S
DEOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TG3600E 43
E       S       M       Z       Z       M       E       S
EOX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQ3600E 44
        S       M       Z       Z       M       E       S
OX8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ3600E 45
        S       M       Z       Z       M       E       S
X8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ03600E 46
        S       M       Z       Z       M       E       S
8 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 3600E 47
        S       M       Z       Z       M       E       S
 FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 H3600E 48
      S       M       Z       Z       M       E       S
FPY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR3600E 49
     S       M       Z       Z       M       E       S
PY9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠3600E 50
    S       M       Z       Z       M       E       S
Y9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#3600E 51
   S       M       Z       Z       M       E       S
9TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#T3600E 52
 S       M       Z       Z       M       E       S       M
TGQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI3600E 53
S       M       Z       Z       M       E       S       M
GQZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-3600E 54
        M       Z       Z       M       E       S       M
QZ0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,3600E 55
        M       Z       Z       M       E       S       M
Z0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@3600E 56
        M       Z       Z       M       E       S       M
0 HR≠#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR≠#TI-,@ 3600E 57
        M       Z       Z       M       E       S       M
```

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```
 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +3600E 58
     M        Z        Z        M        E        S        M
HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$3600E 59
    M        Z        Z        M        E        S        M
R*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%3600E 60
   M        Z        Z        M        E        S        M
*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%13600E 61
  M        Z        Z        M        E        S        M
#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P3600E 62
 M        Z        Z        M        E        S        M        Z
TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.3600E 63
M        Z        Z        M        E        S        M        Z
I-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*3600E 64
         Z        Z        M        E        S        M        Z
-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/3600E 65
        Z        Z        M        E        S        M        Z
,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/23600E 66
       Z        Z        M        E        S        M        Z
@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 3600E 67
      Z        Z        M        E        S        M        Z
 +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤3600E 68
     Z        Z        M        E        S        M        Z
+$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤J3600E 69
    Z        Z        M        E        S        M        Z
$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3600E 70
   Z        Z        M        E        S        M        Z
%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS33600E 71
  Z        Z        M        E        S        M        Z
1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3M3600E 72
 Z        Z        M        E        S        M        Z        Z
P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MA3600E 73
Z        Z        M        E        S        M        Z        Z
.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAK3600E 74
        Z        M        E        S        M        Z        Z
*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT3600E 75
       Z        M        E        S        M        Z        Z
/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT43600E 76
      Z        M        E        S        M        Z        Z
2 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 3600E 77
     Z        M        E        S        M        Z        Z
 ¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 B3600E 78
    Z        M        E        S        M        Z        Z
¤JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BL3600E 79
   Z        M        E        S        M        Z        Z
JS3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU3600E 80
  Z        M        E        S        M        Z        Z
S3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU53600E 81
 Z        M        E        S        M        Z        Z
3MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5G3600E 82
Z        M        E        S        M        Z        Z        M
MAKT4 BLU5GCMV6 DNW7DEOX8 FPY9TGQZ0 HR*#TI-,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GC3600E 83
Z        M        E        S        M        Z        Z        M
```

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```
AKT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCM3600E 84
          M          E          S          M          Z          Z          M
KT4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV3600E 85
        M          E          S          M          Z          Z          M
T4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV63600E 86
      M          E          S          M          Z          Z          M
4 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 3600E 87
    M          E          S          M          Z          Z          M
 BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 D3600E 88
    M          E          S          M          Z          Z          M
BLU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DN3600E 89
    M          E          S          M          Z          Z          M
LU5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW3600E 90
   M          E          S          M          Z          Z          M
U5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW73600E 91
  M          E          S          M          Z          Z          M
5GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7D3600E 92
 M          E          S          M          Z          Z          M          E
GCMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE3600E 93
M          E          S          M          Z          Z          M          E
CMV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE03600E 94
         E          S          M          Z          Z          M          E
MV6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X3600E 95
        E          S          M          Z          Z          M          E
V6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X83600E 96
       E          S          M          Z          Z          M          E
6 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 3600E 97
     E          S          M          Z          Z          M          E
 DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 F3600E 98
    E          S          M          Z          Z          M          E
DNW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FP3600E 99
   E          S          M          Z          Z          M          E
NW7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY3600E100
  E          S          M          Z          Z          M          E
W7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY93600E101
 E          S          M          Z          Z          M          E
7DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY9T3600E102
E          S          M          Z          Z          M          E          S
DE0X8 FPY9TGQZ0 HR≠#TI−,@ +$%1P.*/2 ¤JS3MAKT4 BLU5GCMV6 DNW7DE0X8 FPY9TG3600E103
E          S          M          Z          Z          M          E          S
```

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ENG. CHG. NO.	110378	1103788	115283	117628	TA 1976			

CUSTOMER ENGINEERING TESTS
FOR THE 1401 DATA PROCESSING SYSTEM

51-COLUMN READ

Purpose of Test

To test the 51-Column Read Feed feature. When this feature is used, brushes 1-14 and 66-80 are disabled. Since the 51-column cards are read by brushes 15-65, Location 014 becomes the Reader Cycle Point Storage Counter and will contain an & character (CBA) upon completion of the read cycle.

Units Required

1401 Processing Unit
1402 Card Reader with Interchangeable 51-Column Read Feed and Adapter Tray
1403 Printer (optional)

Operations Used	Code
Clear	(/)
Set Word Marks	(,)
Test for Character & Branch	(B------?)
Clear Word Marks	(=)
Load	(L)
Move	(M)
Add	(A)
Read	(1)
Compare	(C)
Branch	(B)
Print	(2)
Immediate-Space 1 and Branch	(F---J)
Stop (error)	(.)

Method of Test

The card format for instruction and constant cards is similar to the other decks with the following exceptions:

Columns 1-4	L 045 instead of L 031. This is necessary because the cards punched in columns 1-51 are read by brushes 15-65. Therefore, the standard L 031 instruction normally used must be increased by 14 positions.
Columns 33-72	Remarks normally punched in these columns are omitted due to reduced card capacity.
Columns 44-51	Block No. and Card No. in Instruction and Constant Cards only.
Columns 73-80	Block No. and Card No. in stub portion of all cards. This portion is used in the preparation of the card deck to facilitate end-printing of Block Nos. and Card Nos. on the 51-column portion. Stubs must be torn off before test can be performed on the 51-column basis.

The complete test deck consists of the following cards:

1. Title Card (0A)
2. Instruction and Constant Cards (02-58)
3. Title and Headings Print Routine (59-70)
4. Trailer Card (71)
5. 60 Detail Cards punched in columns 1-51. Block Nos. and Card Nos. (72-131) are printed on the left end of the 51-column card and punched on the right-end stub in columns 73-80. Stubs must be torn off before processing.

Two Sense Switches may be brought into play as follows:

Sense Switch C OFF - no printing for correct results.
ON - prints for correct results.

Sense Switch E OFF - prints for error results.
ON - stops for error results; omits printing of comment END OF TEST.

The program is executed in the following manner:

After testing for a "1" in S52 to print or by-pass the title and headings, a 60-character table, stored by the program in Locations 701-760, is expanded to a 180-character table in Locations 701-880. The Read and Punch Areas are then cleared and constants "COLUMNS,01-13&" are moved to Locations 101-114 and constants "COLUMNS,01-13" are moved to Locations 001-013; and constants "COLUMNS, 066-080" are moved to Locations 166-180 and Locations 066-080. The locations in between (115-165) will be used later to store 51 characters of the stored table; Locations 015-065 will be the normal read-in locations of the 51-column card.

A card counter is then started at "1" and incremented by "1" each time a detail card is processed. This card counter serves three purposes: 1) to print a card number in case of error print-out; 2) to end the test when the counter reaches 60; and 3) to increment a ripple counter. The purpose of the ripple counter, which is started at 750 and incremented by the card counter, is to modify the A portion of a Move instruction (Loc. 524-526) so that the appropriate 51 characters may be selected in ripple fashion from the 180-character table and moved into Locations 115-165. The characters in the working area (101-180) are then compared with the characters in the normal Read Area (Locations 001-080). If the comparison is unequal, the program branches to the Error Print Routine. The position of Sense Switch E then determines whether the machine stops to permit console checking or prints the constants, the 51 characters in the card, and the Card No. with an "ERROR" indication on the first line and the constants and the stored table to which it was compared on the second line.

When the card counter reaches 60, the comment END OF TEST is printed (Sense Switch E OFF) signalling the end of the test. The test may be repeated by reloading the 60 detail cards in the hopper and pressing the Start Key.

Checking Procedure

SENSE SWITCH E ON - Machine stops for errors.

1. Remove the last card in the stacker.
2. Re-start the program in the Single-Cycle mode at Location 535 to execute the compare instruction. With each depression of the Start Key watch the B ≠ A logic light until it turns ON. At this time the character in the stored table is displayed in the A Register and the character in the read area that caused the unequal comparison is displayed in the B Register.
3. Check the character in the read area with the character punched in the card.

SENSE SWITCH E OFF - Machine prints error results. Examples of error print-out:

First Line 1 Thru 80 Second Line Table

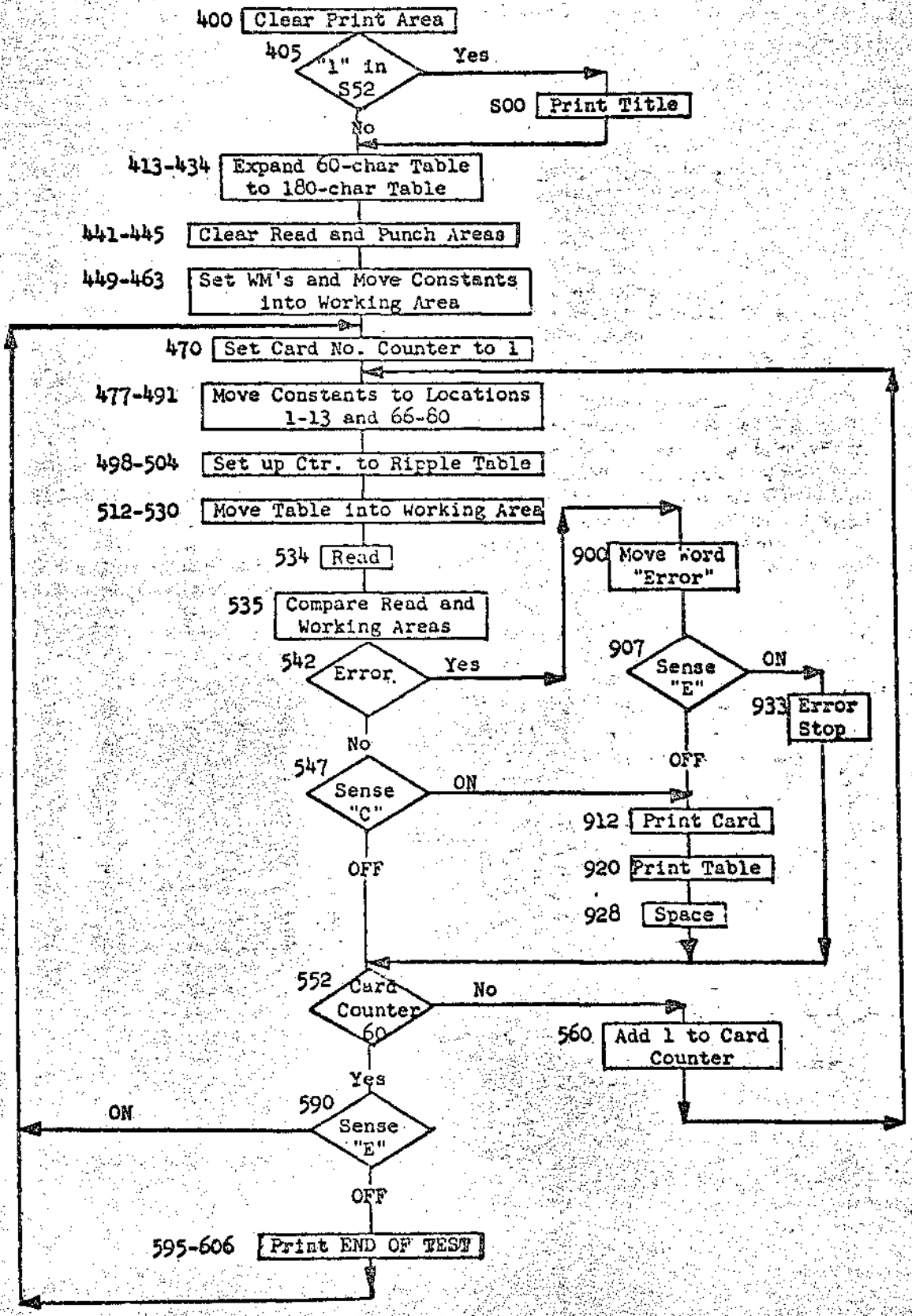
```
COLUMNS,01-13&AKT4 BLU5 CMV6 DNW7 EOX8 FPY8 GQZ0 HR+# I-,@ &$%1 .COLUMNS,066-080 ERROR 01
COLUMNS,01-13&AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR+# I-,@ &$%1 .COLUMNS,066-080
```

SENSE SWITCH C ON - Machine prints correct results. Information on the first line agrees with information on the second line and the word "ERROR" is omitted.

NOTE: Before re-loading the 60 detail cards to repeat the test, make sure that they are in numerical sequence (72-131) because if they are not in that order error print-outs will occur.

51-COLUMN READ

FLOW CHART



PROGRAM LISTING

51-COLUMN READ BLOCK 3800A

LOAD ADDR	INST ADDR	OP	A	B		REMARKS	
419	400	/	332			Clear Print Area	2
423	404	/				"	3
424	405	B	800	S52	1	Branch to Title Print if 1 in S52	4
432	413	M	721	741		Expand Table	5
439	420	L	760	820		"	6
446	427	L	760	880		"	7
453	434	M	761	821		"	8
460	441	/	080			Clear Read Area	9
464	445	/	199			Clear Working (Punch) Area	10
468	449	,	001	101		Set Word Marks	11
475	456	M	634	114		Move constants to working area	12
482	463	M	649	180		"	13
489	470	L	690	692		Set Card Counter to One	14
496	477	M	633	013		Move constants to Locations 1-13	15
503	484	M	649	080		Move constants to Locations 66-80	16
510	491	M	692	299		Move Card No. to Print Area	17
517	498	L	697	700		Start Ripple Counter at 750	18
524	505	A	692	700		Add Card Counter to Ripple Counter	19
531	512	,	115			Move Table to working area	20
535	516	M	700	526		"	21
542	523	M	xxx	165		"	22
549	530	M	115			"	23
553	534	1				Read	24
554	535	C	180	080		Compare Read and Working Areas	25
561	542	B	900	/		Branch to Error Print Routine if Unequal	26
566	547	B	912	C		C ON for correct print	27
571	552	B	590	691	6	Branch if Card Counter is 60	28
579	560	A	690	692		Add 1 to Card Counter if not 60	29
586	567	B	477			Branch	30
609	590	B	470	E		E OFF to Print END OF TEST	31
614	595	/	299			Clear Print Area	32
618	599	M	660	259		Move END OF TEST to Print Area	33
625	606	2	470			Print END OF TEST and Branch	34
629	610					Word Mark in Location 610	35
640	621	COLUMNS,01-13&				Constants	36
654	635	COLUMNS,066-080				"	37
669	650	END OF TEST				"	38
680	661	ERROR				"	39
708	689	01				Constant to increment Card Counter	40
710	691	xx				Card Counter	41
714	695	750				Constant to start Ripple Counter	42
717	698	xxx				Ripple Counter	43
720	701	AKT4	BLU5	CMV6	DNW7	Table	44
740	721	EOX8	FPY9	GQZ0	HR1#	Table	45
760	741	I-,@	&$%1	.*/2	#JS3	Table	46

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PROGRAM LISTING

```
919  900   M 665 285                Move word ERROR to Print Area          47
926  907   B 933 E                  E ON to error stop                     48
931  912   L 080 280                Load Locs. 1-80 into Print Area        49
938  919   2                        Print card and constants               50
939  920   L 199 299                Load Working Area into Print Area      51
946  927   2                        Print (Table) Working Area             52
947  928   F 552 J                  Single Space                           53
952  933   . 552                    Error Stop                             54
956  937                            Word Mark                              55

/39  /20   FIRST LINE 1 THRU 80     Constant                               56
/59  /40                           "                                      57
/79  /60   SECOND LINE TABLE       "                                      58
```

Title and Headings Print Routine

```
S19  S00   2                        Print (Space)                          59
S20  S01   , 033                    Set WM for Title and Block No.         60
S24  S05   L 065 277                Load Title & Block No. into Print Area 61
S31  S12   2                        Print Title and Block No.              62
S32  S13   / 277                    Clear Print Area                       63
S36  S17   2                        Print (Space)                          64
S37  S18   ¤ /40 /60                Clear Word Marks                       65
S44  S25   L /79 260                Load second line                       66
S51  S32   2                        Print second line                      67
S37  S33   / 260                    Clear Print                            68
S41  S37   F 413 J                  Space and branch                       69
S46  S42                            Word Mark                              70
B400            51-COLUMN READ          3800A                              71
```

60 DETAIL CARDS

```
AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .
KT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*
T4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/
4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2
 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2
BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2 ¤
LU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2 ¤J
U5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2 ¤JS
5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR#  I-,@ &$%1 .*/2 ¤JS3
                etc.
3 AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR #  I-,@ &$%1
 AKT4 BLU5 CMV6 DNW7 EOX8 FPY9 GQZ0 HR #  I-,@ &$%1
```

(Ripple Table punched in 51-column detail cards)

PRINTOUT NO.	END PRINT NO. **
1	72
2	73
3	74
4	75
5	76
6	77
7	78
8	79
9	80
etc.	etc.
59	130
60	131

**Note: End Print No. is printed on the left end of the detail cards but is not punched in the cards.

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MODIFY ADDRES

A. PURPOSE

TO TEST THE MODIFY ADDRESS CIRCUITRY (AVAILABLE ONLY ON MACHINES EQUIPPED WITH A 1406) AS FOLLOWS:

1. BY ADDING TWO 3-CHARACTER FIELDS AND COMPARING THE RESULT WITH THE RESULT SHOULD BE FIELD.

2. BY ADDING ONE 3-CHARACTER FIELD TO ITSELF AND COMPARING THE RESULT WITH THE RESULT SHOULD BE FIELD.

3. BY ADDING TWO 3-CHARACTER FIELDS WITH THE B FIELD IN SUCCESSIVELY DECREASING ADDRESSES BETWEEN 199 AND 99 AND COMPARING THE RESULT WITH THE RESULT SHOULD BE FIELD.

B. LOADING PROCEDURES

PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1264.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON FOR SCOPING LOOP
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT DETAIL CARD
OFF TO READ NEW DETAIL CARD

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

D. TEST PROCEDURE

1. 7 CHARACTER INSTRUCTION TEST

A FIELD (COLUMNS 1-4), B FIELD (COLUMNS 21-24), AND RESULT SHOULD BE FIELD (COLUMNS 41-44) ARE LOADED INTO THE PRINT AREA. IF A 4 IS IN LOCATION 072, THE PROGRAM BRANCHES TO THE 4 CHARACTER INSTRUCTION TEST PORTION OF THE PROGRAM (SEE DESCRIPTION BELOW). THE B FIELD IS THEN LOADED INTO LOCATIONS 261-264 TO BE USED AS AN ACCUMULATOR. IF AN A IS IN LOCATION 072, THE PROGRAM BRANCHES TO THE CHANGING ADDRESS PORTION OF PROGRAM (SEE DESCRIPTION BELOW). THE A FIELD IS THEN ADDED TO THE B FIELD IN THE ACCUMULATOR BY A MODIFY ADDRESS INSTRUCTION. THE RESULT IN THE ACCUMULATOR IS THEN COMPARED WITH THE RESULT SHOULD BE FIELD.

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IF THE COMPARISON IS UNEQUAL THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE (STARTS IN 900). OTHERWISE IT BRANCHES TO 920.

2. 4 CHARACTER INSTRUCTION TEST (STARTS IN 540)

THE A FIELD IS LOADED INTO LOCATIONS 261-264 TO BE USED AS AN ACCUMULATOR. THE A FIELD IN THE ACCUMULATOR IS THEN ADDED TO ITSELF BY A MODIFY ADDRESS INSTRUCTION. A BRANCH TO THE FIRST PORTION OF THE PROGRAM IS MADE FOR THE COMPARISON AND PRINT OUT (521).

3. CHANGING ADDRESS (STARTS IN 605)

THE B FIELD IS MOVED TO LOCATION 199 MODIFIED AND COMPARED AS IN THE FIRST PORTION OF THE PROGRAM. THE ADDRESS COUNTER IS THEN DECREASED BY ONE AND THE NEW ADDRESS IS MOVED INTO THE PROPER INSTRUCTIONS TO CAUSE THE PROGRAM TO LOOP UNTIL THE ADDRESS BECOMES 099. THIS PORTION OF THE PROGRAM HAS ITS OWN PRINT ROUTINE (STARTS IN 701).

E. STOPS

502 - REMOVED WORD MARK IN A FIELD
514 - REMOVED WORD MARK IN ACCUMULATOR
582,594 - REMOVED WORD MARK IN ACCUMULATOR ON 4 CHARACTER INSTRUCTION.
743,920 - ERROR STOP WITH E ON.

CONTINUE PROGRAM BY PUSHING START BUTTON.

F. PRINT OUTS

1. WITHOUT ERRORS (C ON)

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
876	123	999	999	
9HWP		9GTU	9GTU	4
87F	0A23	0191	0191	A

2. WITH ERRORS

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS	
876	123	999	989	ERROR
9HWP		9GTU	9GTV	4 ERROR

WITH THE COUNTER IN THE PRINT ROUTINE SET AT 90, A SOLID ERROR WILL BE PRINTED OUT 91 TIMES.

87F	0A23	0191	0181	A ERROR IN ADDR 156

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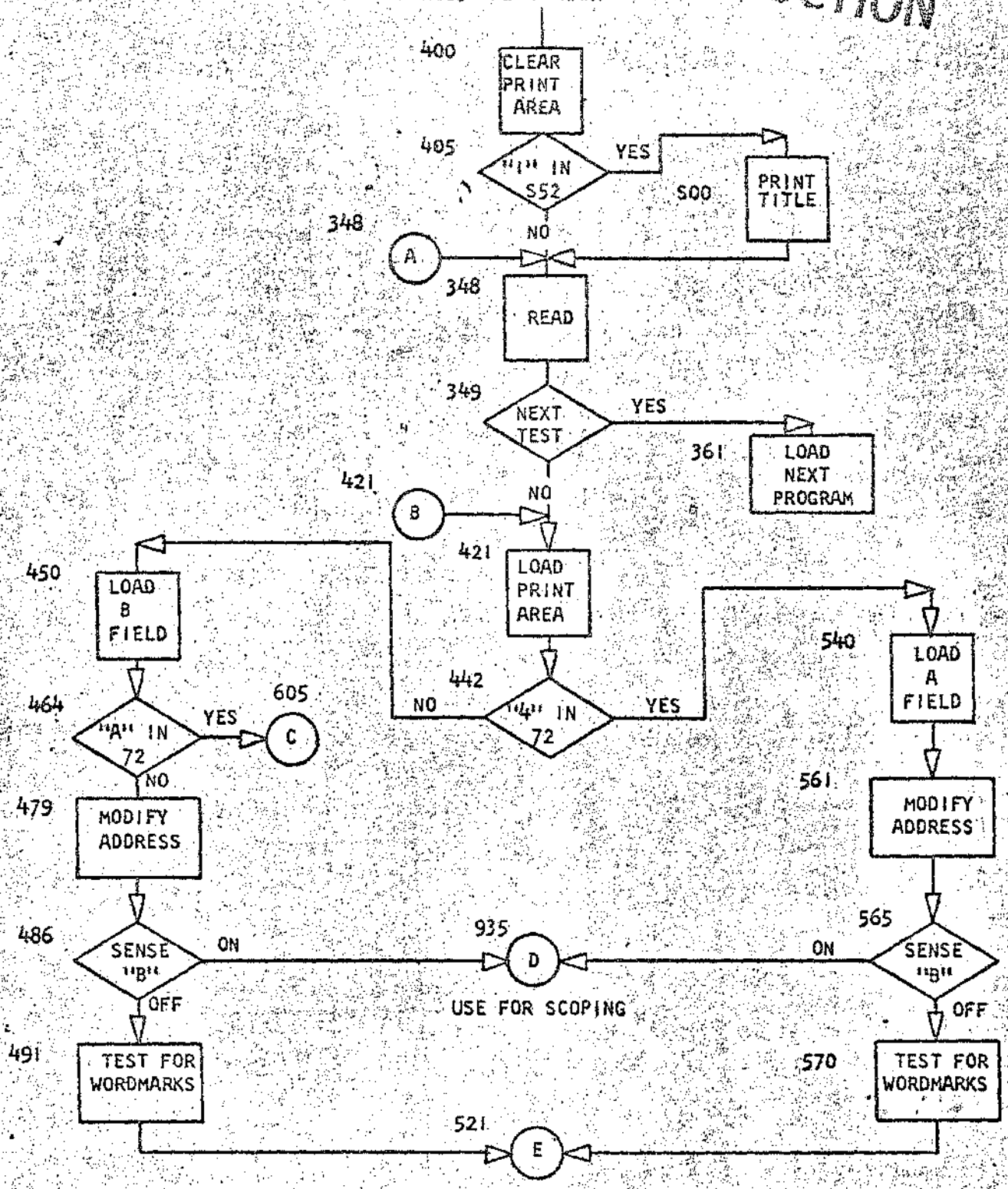
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451479
SHEET 3 OF 9
BLOCK NO. 37008

MODIFY ADDRESS FLOW CHART



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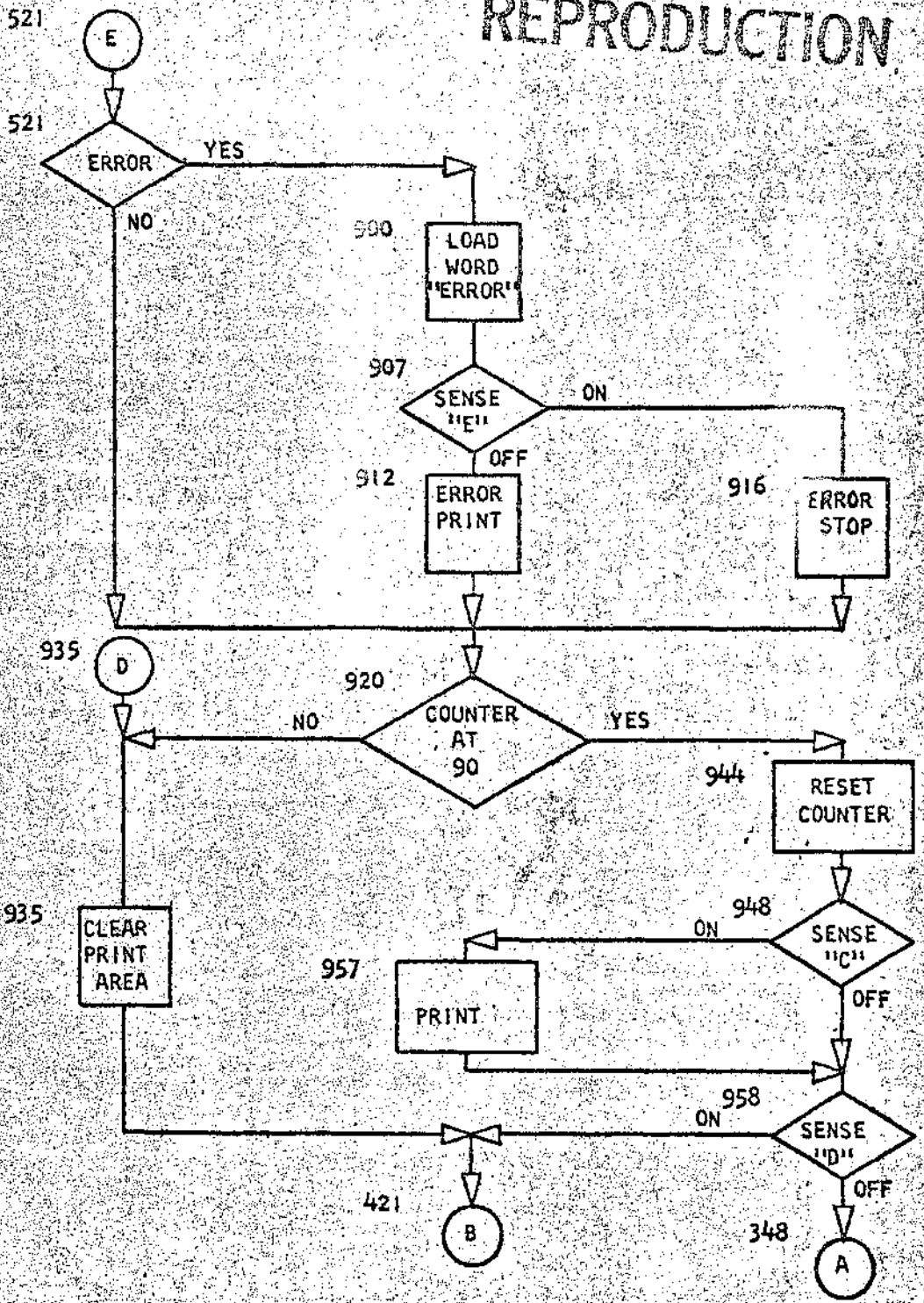
DIAGNOSTIC FUNCTION TEST

PART NO. 451479
SHEET 4 OF 9
BLOCK NO. 3700B

REPRODUCTION



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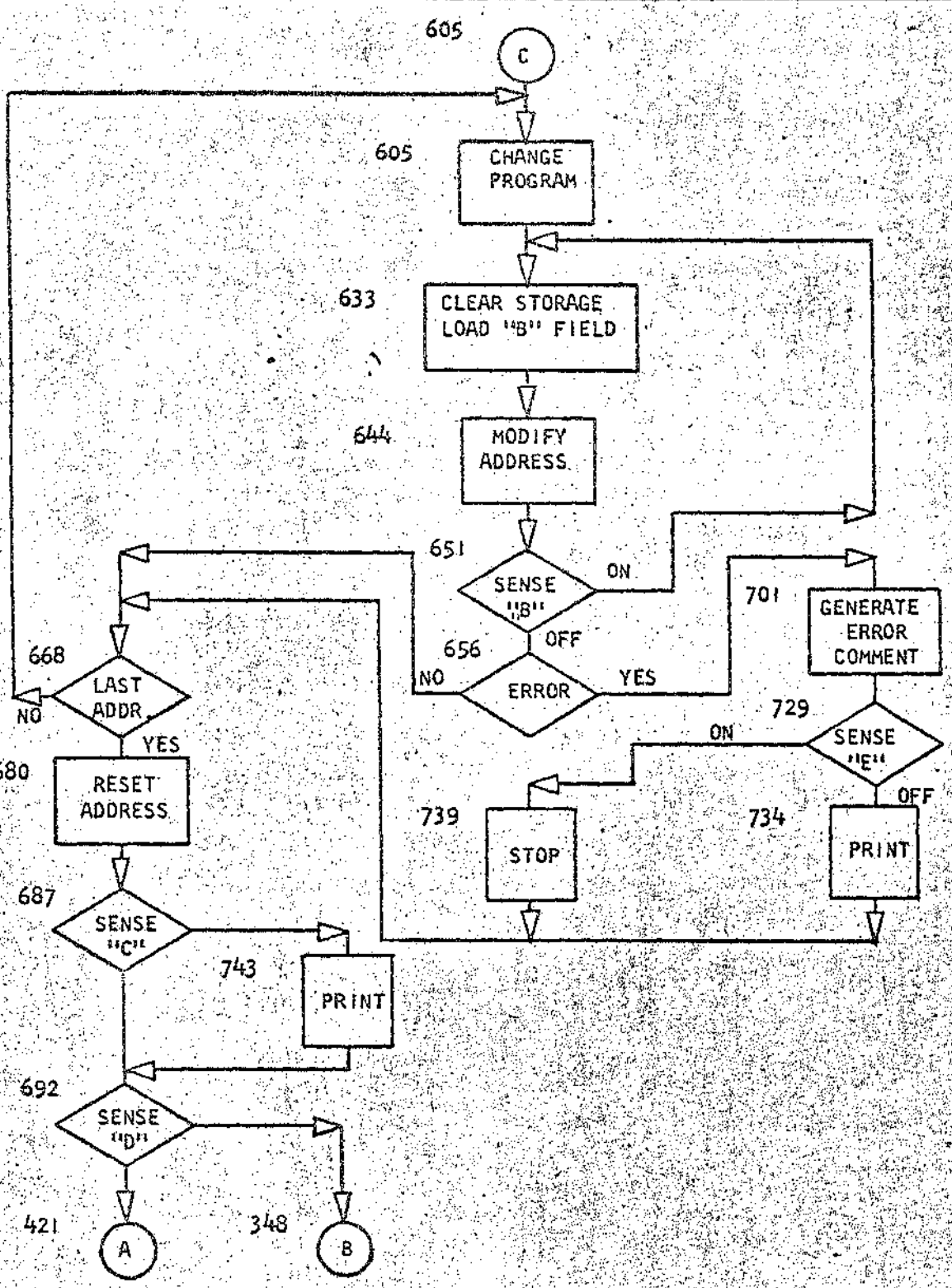
DIAGNOSTIC FUNCTION TEST

PART NO. 451479
SHEET 5 OF 9
BLOCK NO. 3700B



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PROGRAM LISTING FOR USE WITH FLOW CHART

MODIFY ADDRESS 37008

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S641	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN $52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	,,
435	435	L	072	272	,,
442	442	B	540	0724	BRANCH IF 4 IN 72
450	450	,	216	236	LOAD B FIELD
457	457	L	227	267	,,
464	464	B	605	072A	BRANCH IF A IN 72
472	472	,	203	264	INSERT WORD MARKS
479	479	#	204	264	MODIFY B ADDRESS
486	486	B	935	8	B ON TO SCOPE $S5
491	491	V	502	2031	TEST FOR WORD MARKS
498	498	-	491		,,
502	502	V	514	2641	,,
510	510	.	502		,,
514	514	¤	203	264	REMOVE WORD MARKS
521	521	C	250	270	TEST FOR ERROR
528	528	B	900	/	BRANCH TO ERROR PRINT ROUTINE
533	533	B	920		BRANCH TO PRINT ROUTINE
540	540	,	236	236	LOAD A FIELD
547	547	L	207	267	,,
554	554	,	263	264	INSERT WORD MARKS
561	561	#	264		MODIFY A ADDRESS
565	565	B	935	8	B ON TO SCOPE $S5
570	570	V	582	2631	TEST FOR WORD MARKS
578	578	.	570		,,
582	582	V	594	2641	,,
590	590	.	582		,,
594	594	¤	263	264	REMOVE WORD MARKS
601	601	B	521		BRANCH TO TEST
605	605	A	772	775	DECREASE ADDRESS BY 1
612	612	M	775	643	CHANGE ADDR OF LOAD
619	619	M	775	650	CHANGE ADDR OF MODIFY
626	626	M	775	659	CHANGE ADDR OF COMPARE
633	633	/	199		CLEAR STORAGE

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```
637  637  L 224 199          *LOAD 8 FIELD
644  644  # 204 199          *MODIFY
651  651  B 633 B            B ON TO SCOPE                    SS
656  656  C 199 244          *COMPARE
663  663  B 701 /            BRANCH TO ERROR PRINT ROUTINE
668  668  C 775 778          COMPARE ADDRESS
675  675  B 605 /            BRANCH TO REPEAT IF UNEQ.
680  680  M 781 775          RESET ADDRESS
687  687  B 743 C            C ON FOR CORRECT PRINT           SS
692  692  B 421 D            D ON TO REPEAT                   SS
697  697  B 348              BRANCH TO PROG. CHAINING ROUTINE
701  701  M 775 815          BEGIN ERROR PRINT ROUTINE
708  708  M 775 718          CHANGE ADDR OF LOAD
715  715  M 199 264          *MOVE ADDR TO COMENT
722  722  M 815 294          MOVE COMMENT TO PRINT AREA
729  729  B 739 E            E ON FOR ERROR STOP              SS
762  762  N                  *AN ASTERISK MEANS INSTRUCTION CHANGES
734  734  2                  ERROR PRINT
735  735  B 668              BRANCH TO CONTINUE
739  739  . 668              ERROR STOP
743  743  M 099 264          BEGIN CORRECT PRINT ROUTINE
750  750  M 798 294          CLEAR ERROR
757  757  2                  CORRECT PRINT
758  758  B 692              BRANCH TO SENSE D
770  770  I 99               CONSTANT
773  773  2 00               ADDR LOCATION
776  776  0 99               CONSTANT
779  779  2 00               CONSTANT
782  782                     CONSTANT
799  799  E RRO R IN ADDR XXX CONSTANT
900  900  L /14 285          BEGIN ERROR PRINT ROUTINE
907  907  B 916 E            E ON TO ERROR STOP               SS
912  912  2 920              ERROR PRINT
916  916  . 920              ERROR STOP
920  920  A 920 970          ADD ONE, TO OPERATION COUNTER
927  927  B 944 9699         BRANCH AFTER 90 OPERATIONS       C FOR TA
935  935  / 332              CLEAR PRINT AREA
939  939  /                  ,,
940  940  B 421              BRANCH TO REPEAT
944  944  S 970              RESET OPERATION COUNTER
948  948  B 957 C            C ON FOR CORRECT PRINT           SS
953  953  B 958              BRANCH TO SENSE D
957  957  2                  PRINT CORRECT RESULTS
958  958  B 421 D            D ON TO REPEAT                   SS
963  963  B 348              BRANCH TO PROG. CHAINING ROUTINE
967  967  0 00+              OPERATION COUNTER
1110 /10  E RRO R            CONSTANTS
1115 /15                     ,,
1120 /20  A  FI ELD          ,,
1140 /40  B  FI ELD          ,,
1160 /60  R ESU LT SHOULD BE ,,
1180 /80  R ESU LT IS        ,,
```

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ENG. CHG. NO.	110378B	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                  MODIFY ADDRESS          3700B 0A
,008015,022029,033033N        1001                  SET WORDMARK CARD-      3700B 02
L067367,340344,348349,3573611001,008012,0011001 1B361080AB421/340080        3700B 03
L069404,377385,389393,4004041001           B389S641BS88N000M360392/332/     3700B 04
L069441,413417,421428,4354421001BS00S521/080B348,001078L080299L072272       3700B 05
L069478,450457,464472,4794791001B5400724,216236L227267B605072A,203264       3700B 06
L067513,486491,498502,5105141001#204264B935BV502203.491V5142641.502         3700B 07
L072553,521528,533540,5475541001¤203264C250270B900/B920    ,236236L20726733700B 08
L072593,561565,570578,5825901001,263264#264B935BV5822631.570V5942641.5823700B 09
L071632,601605,612619,6266331001¤263264B521A772775M775643M775650M775659 3700B 10
L067667,637644,651656,6636681001/199L224U99#204199B633BC199244B701/         3700B 11
L072707,675680,687692,6977011001C775778B605/M781775B743CB421DB348M77581537008 12
L067742,715722,729734,7357391001M775718M199264M815294B739E2B668.668         3700B 13
L065775,750757,758762,7707731001M099264M798294286 92N          I99200       3700B 14
L072815,779782,799799,7997991001099200                   ERROR IN ADD. XXX3700B 15
L071938,907912,916920,9279351001L/142858916E2920.920A920970B9449699/332 3700B 16
L056962,940944,948953,9579581001/B421S970B957CB95@2B421D                    3700B 17
L040970,967971,971971,9719711001B348000P                                    3700B 18
                                        Z
L065/39¤/07/07,/10/15,/20/401001   ERROR     A FIELD                        3700B 19
L072/79,/60/80,/80/80,/80/801001B FIELD             RESULT SHOULD BE        3700B 20
L070S17,S00S01,S05S12,S13S171001RESULT IS           2,049L0772772/2772      3700B 21
L059S44,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                 3700B 22
/333080N                                            CLEAR WORDMARK CARD     3700B 23
,019027,031,0380428031T98GB400L046352BW04BS88   MODIFY ADDRESS              3700B 24
                          M
```

DETAIL CARDS

```
876                123                999                                  3700B 25
876                /1U                Z9‡                                  3700B 26
X8W                /2T                ROR                                  3700B 27
Y70                S2T                P9I                                  3700B 28
                                      Z
Q7W                J23                99R                                  3700B 29
Y7F                12L                Z9Z                                  3700B 30
87F               0A23               019I                                  3700B 31
87F               9A23               919I                                  3700B 32
876                ABC                III                                  3700B 33
QPO                123                R9R                                  3700B 34
HPF               9AKD               9PMP                                  3700B 35
                                      ZZZ
QXO               9JTL               9‡‡Z                                  3700B 36
QPP               9S/T               90Z0                                  3700B 37
```

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PPA	9JKL	99M≠	3700B	38
		Z		
YXW	9/8M	9PPP	3700B	39
		ZZZ		
QXX	9AK3	9MMM	3700B	40
		ZZZ		
HXG	/ST	≠≠≠	37008	41
876	9A8D	90P0	37008	42
		Z		
QPP	9J2L	9≠0≠	37008	43
U21		Q42	437008	44
9HWP		9GTU	437008	45
9RPM		9ZMY	437008	46
9HTF		9FXB	437008	47
9KEF		9SAB	437008	48
9YRN		9GRO	43700B	49
9PWV		9VTP	43700B	50
		Z		
9I7Q		9ISW	43700B	51
RGE		ZEP	43700B	52
		Z		
87F	0A23	0I9I	A3700B	53
HPF	9AKD	9PMP	A3700B	54
		ZZZ		

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ENG. CHG. NO.	1103788	117628	TA 1976					

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451563
SHEET 1 OF 8
BLOCK NO. 3502B

PUNCH-FEED-READ RELEASE

A. PURPOSE OF TEST

1. THAT AT LEAST 57 MS OF DELAY EXISTS FROM THE EARLIEST TIME A 9R OPERATION CAN BE GIVEN UNTIL A 4R OPERATION CAN BE SUCCESSFULLY GIVEN TO COMPLETE THE PFR RELEASE.

2. THAT AT 61 MS OF DELAY, THE PFR RELEASE OPERATION CONNOT BE SUCCESSFULLY COMPLETED.

B. LOADING PROCEDURES.

1. WHEN RUNNING TEST FROM CARDS:

   A. MAKE SURE PUNCH FEED IS EMPTY WHEN TEST STARTS
   B. ALLOW 1401 TO STOP WITH A PUNCH OP SET UP.
   C. PLACE APPROXIMATELY 260 PREPUNCHED CARDS (SAY RIPPLE PUNCHED) IN THE PUNCH FEED.
   D. TURN OFF ALL CHECK STOP SWITCHES.
   E. DEPRESS START KEY.
   F. WHEN MACHINE HALTS AT END OF TEST:

      1. WITH NON-PROCESS KEYS, RUN CARDS OUT OF PUNCH.
      2. TO REPEAT TEST, PLACE CARDS IN PUNCH FEED, TURN SENSE SWITCH "D" ON, AND DEPRESS START KEY.
      3. TO CONTINUE WITH NEXT TEST BLOCK, LEAVE SENSE SWITCH "D" OFF, TURN ON CHECK STOP SWITCHES AND SENSE SWITCHES AS REQUIRED BY NEXT TEST, AND DEPRESS START KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. MANUALLY ENTER A 1 IN 1272 AND 1279.
   B. FOLLOW PROCEDURE FOR RUNNING TEST FROM CARDS.

C. PROGRAM CONTROL.

1. SENSE SWITCHES

   D ON TO REPEAT TEST
     OFF TO CONTINUE

   E ON TO STOP ON ERROR
     OFF TO PRINT ERROR

D. TEST PROCEDURE

THIS TEST WILL RUN APPROXIMATELY 250 PRE-PUNCHED CARDS FROM THE PUNCH SIDE. WHEN THE MACHINE OPERATES CORRECTLY, APPROXIMATELY 100 CARDS WILL GO INTO THE 4 POCKET.

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D. (CONTINUED)

THEN AN OVEREXTENSION WILL OCCUR. AFTER THE FIRST OVEREXTENSION, AN OVEREXTENSION OCCURS ON EVERY OTHER CARDS, AND ANOTHER 100 CARDS WILL FEED. OF THESE CARDS, APPROXIMATELY 50 WILL NOT SELECT, AND APPROXIMATELY 50 WILL SELECT INTO POCKET 4. (EVERY TIME AN OVEREXTENSION OCCURS, A CARD WILL NOT SELECT). WHEN THE MACHINE OPERATES AS STATED, ERROR PRINTOUTS DO NOT OCCUR. (AN ERROR PRINTOUT WILL ALWAYS CONTAIN THE WORD "ERROR".)

BECAUSE OF THE NATURE OF THE TEST, ALL CHECK STOP SWITCHES MUST BE OFF.

E. STOPS

STORAGE ADDRESS REGISTER

659	HALT - END OF TEST
706	ERROR WITH SENSE E ON
710	ERROR WITH SENSE E ON

F. PRINTOUTS

ALL ERRORS AUTOMATICALLY PRINTOUT.

G. COMMENTS

THIS TEST IS DESIGNED TO PROVIDE TWO SPECIFIC DELAYS TO PRODUCE TWO SEPARATE CONDITIONS.

THE FIRST CONDITION IS THAT AT LEAST 57 MS OF DELAY EXISTS FROM THE EARLIEST TIME A 9R OPERATION CAN BE EXECUTED UNTIL A 4R OPERATION IS GIVEN. THE MACHINE IS OPERATING CORRECTLY IF THE CARD THAT IS RELEASED BY THE 9R INSTRUCTION IS READ CORRECTLY BY THE 4R INSTRUCTION. (THIS CONDITION INSURES THAT THE CUSTOMER IS GUARANTEED 56 MS OF COMPUTE TIME WHEN HE PROPERLY USES THE RELEASE INSTRUCTION WITH THE READ INSTRUCTION.) IF AN OVEREXTENSION OCCURS IN ERROR (PUNCH CHECK AND POSSIBLE VALIDITY CHECK), THE PRINTER WILL PRINTOUT "OVEREXTENDED-ERROR". SUCH AN ERROR CAN BE CAUSED BY FAULTY CIRCUITRY OR BY THE PUNCH RUNNING TOO FAST.

IN ORDER TO CHECK FOR 56 MS OF DELAY EXACTLY - RATHER THAN 57 MS, MANUALLY CHANGE THE 3 IN LOCATIONS 573 AND 576 TO A 0 (ZERO). THIS CHANGE REDUCES THE ZERO SUPPRESS DELAY BY 90 CYCLES, WHICH IS APPROXIMATELY 1 MS. (ACTUALLY 87 CYCLES IS VERY NEARLY 1 MS, BEING 11.54 PS X 87 = 1.00398 MS)

THE SECOND CONDITION IS THAT 61 MS OF DELAY EXISTS FROM THE EARLIEST TIME A 9R OPERATION CAN BE EXECUTED UNTIL A 4R OPERATION IS GIVEN. THE MACHINE IS OPERATING CORRECTLY IF THE CARD THAT IS RELEASED BY THE 9R INSTRUCTION IS NOT READ CORRECTLY BY THE 4R INSTRUCTION. AN OVEREXTENSION WILL OCCUR, CAUSING PUNCH AND POSSIBLE VALIDITY CHECKS. HOWEVER, THE TEST IS DESIGNED TO ANTICIPATE THIS RESULT AS NORMAL. MOREOVER, IF THE PUNCH IS RUNNING TOO SLOW AND AN OVEREXTENSION DOES NOT OCCUR, THE PRINTER WILL PRINTOUT "DID NOT DETECT OVEREXTENSION--ERROR".

G. (CONTINUED)

FOR FURTHER TESTING, IF IT IS DESIRED TO INCREASE THE DELAY BY 1 MS., MANUALLY CHANGE THE 1 IN 595 TO A 4, AND MANUALLY CHANGE THE 2 IN 598 TO A 5. THIS CHANGE WILL RESULT IN 62 MS RATHER THAN 61 MS OF DELAY. AN ADDITIONAL MILLISECOND OF DELAY CAN BE OBTAINED BY CHANGING THE 4 IN 595 TO A 7 AND BY CHANGING THE 5 IN 598 TO AN 8. ALSO, PROVISION HAS BEEN MADE TO ALLOW THE NO-OP IN 600-606 TO BE CHANGED TO A ZERO SUPPRESS OPERATION FOR EVEN MORE DELAY. HOWEVER, THIS DELAY SHOULD NEVER BE NEEDED.

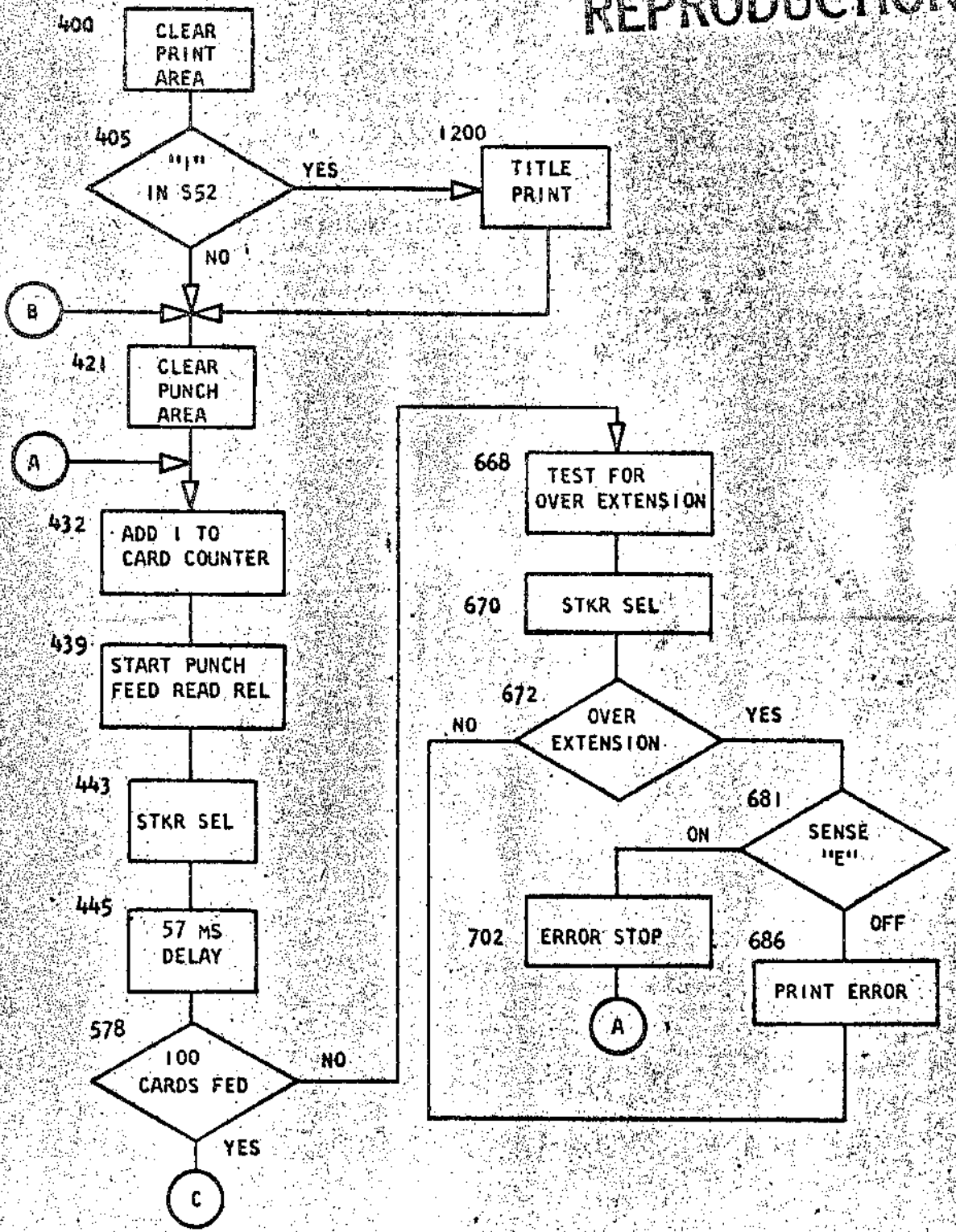
DATE	10-10-61	6-29-63	17.10.63					
ENG. CHG. NO.	1110378E	1117628	TA 1976					

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451563
SHEET 4 OF 8
BLOCK NO. 3502B

PUNCH FEED-READ RELEASE OVER EXTENSION FLOW CHART



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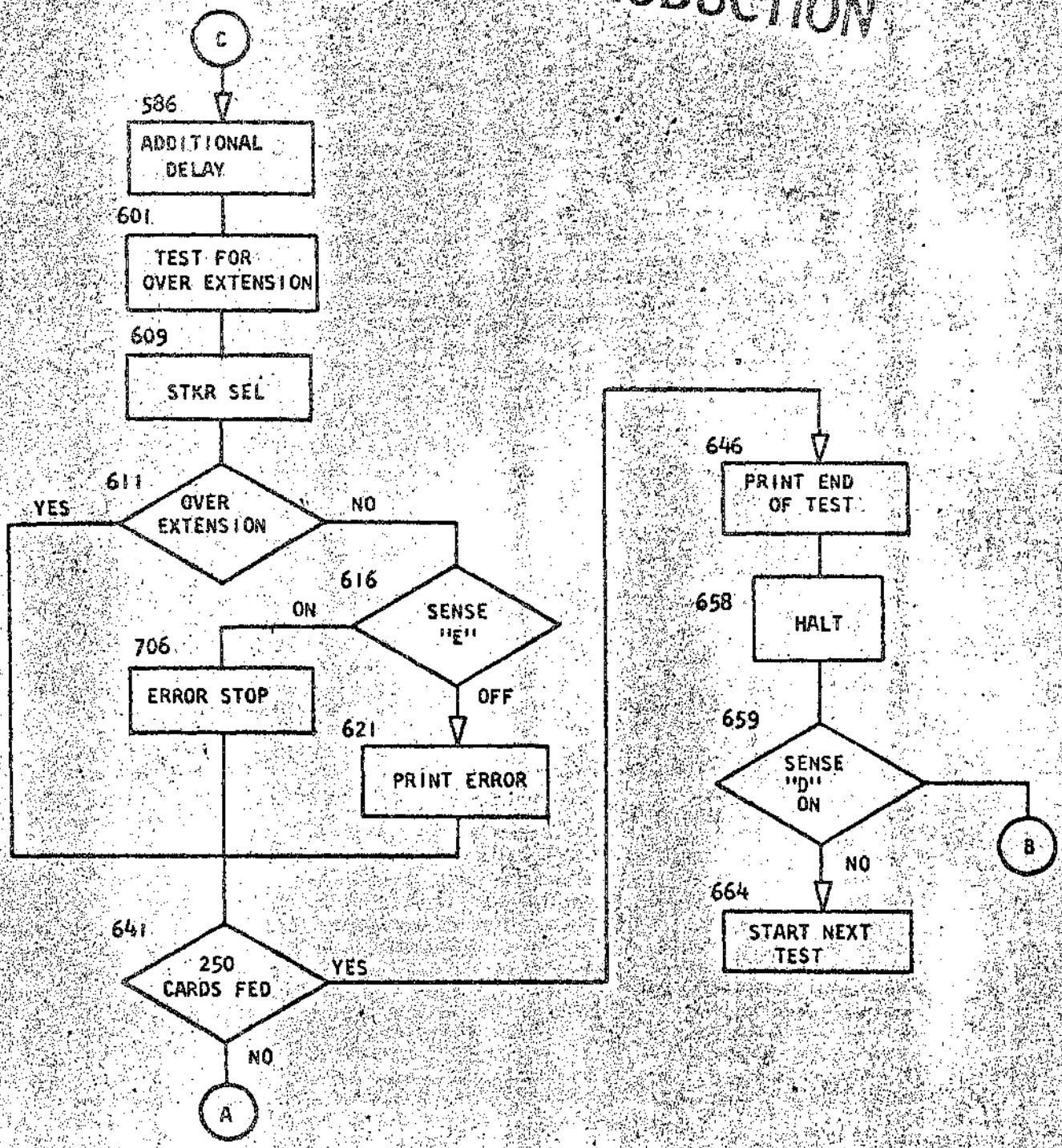

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PROGRAM LISTING FOR USE WITH FLOW CHART

PCH-FEED READ RELEASE 3502B

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	710	S721	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN 1252
413	413	/	#99		CLEAR DELAY AREA 1000 TO 1099
417	417	,	#00		SET WM IN 1000
421	421	/	180		CLEAR PUNCH AREA
425	425	M	805	802	SET UP CARD COUNTER
432	432	A	400	802	ADD 1 TO CARD COUNT
439	439	4	R		START PUNCH TO INTERLOCK PROCESSOR
441	441	9	R		START PFR RELEASE
443	443	K	4		STKR SEL
445	445	Z	#86	#87	3 MS DELAY
452	452	Z	#86	#87	3 MS DELAY
459	459	Z	#86	#87	3 MS DELAY
466	466	Z	#86	#87	3 MS DELAY
473	473	Z	#86	#87	3 MS DELAY
480	480	Z	#86	#87	3 MS DELAY
487	487	Z	#86	#87	3 MS DELAY
494	494	Z	#86	#87	3 MS DELAY
501	501	Z	#86	#87	3 MS DELAY
508	508	Z	#86	#87	3 MS DELAY
515	515	Z	#86	#87	3 MS DELAY
522	522	Z	#86	#87	3 MS DELAY
529	529	Z	#86	#87	3 MS DELAY
536	536	Z	#86	#87	3 MS DELAY
543	543	Z	#86	#87	3 MS DELAY
550	550	Z	#86	#87	3 MS DELAY
557	557	Z	#86	#87	3 MS DELAY
564	564	Z	#86	#87	3 MS DELAY
571	571	Z	#30	#31	3 MS DELAY - INCLUDES ALL THE I CYCLES
578	578	B	668	8001	BRANCH UNTIL 100 CARD HAVE FED
586	586	Z	#86	#87	ADDITIONAL 3 MS DELAY
593	593	Z	#19	#20	ADDITIONAL 1 MS DELAY INCLUDES I CYCLES
600	600	N			CAN ADD MS OF DELAY HERE
607	607	4	R		TEST FOR OVER EXTENSION - NO ERROR
609	609	K	4		STKR SEL
611	611	B	634	-	BRANCH ON OVER EXTENSION - NO ERROR
616	616	B	706	E	BRANCH TO STOP IF E IS ON SS
621	621	/	299		CLEAR PRINT AREA
625	625	M	861	250	MOVE DID NOT DETECT OVER EXTENSION
632	632	M			- ERROR TO PR. AREA

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 633  633  2                          DID NOT DETECT OVER EXTENSION - ERROR
 634  634  C 875 802                  COMPARE CD COUNT TO 250
 641  641  B 432 /                    RESTART LOOP IF CARD COUNT NOT 250
 646  646  / 299                      CLEAR PRINT AREA
 650  650  M 872 250                  MOVE END OF TEST TO PR AREA
 657  657  2                          PRINT END OF TEST
 658  658  .                          HALT
 659  659  B 413 D                    RESTART TEST IF SENSE SW D ON          $$
 664  664  B 348                      BRANCH TO NEXT TEST
 668  668  4 R                        TEST FOR OVER EXTENSION - ERROR
 670  670  K 4                        STKR SEL
 672  672  B 681 -                    BRANCH ON OVER EXTENSION - ERROR
 677  677  B 432                      RESTART LOOP
 681  681  B 702 E                    BRANCH TO STOP IF E IS ON              $$
 686  686  / 299                      CLEAR PRINT AREA
 690  690  M 825 250                  MOVE OVER EXTENDED ERROR
 697  697  2                          PRINT OVER EXTENDED - ERROR
 698  698  B 432                      RESTART LOOP
 702  702  . 432                      RESTART LOOP
 706  706  . 634                      BRANCH TO CHECK CARD COUNT
 710  710  8 400 S791                 USE WHEN TESTS ARE RUN FROM TAPE
 718  718  8 348                        ,,
 800  800      1 50                   INITIAL CARD COUNT
 806  806  0 VER EXTENDED - ERROR     PRINT OUT
 826  826  D ID  NOT DETECT OVERE       ,,
 846  846  X TEN SION - ERROR           ,,
 862  862  E ND  OF TEST               ,,
 873  873  2 50                       FINAL CARD COUNT
1120  /20                            TITLE PRINT
1140  /40  P UNC H FEED                ,,
1160  /60                READ R        ,,
1180  /80  E LEA SE OVEREXTENSION      ,,
```

DATE	10-10-61	6-29-63	17. 10 63					
ENG. CHG. NO.	1103786	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON*	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                PCH-FEED READ RELEASE    3502B00A
,008015,022029,033033N      1001                SET WORDMARK CARD        3502B 02
L067367,340344,348349,357361001,008012,00110011B361080AB400/340080       3502B 03
L069404,377385,400404,4054051001          B710S721BS88          /332/    3502B 04
L068440,413417,421425,4324391001BS00S521/≠99,≠00/180M805802A40080248R     3502B 05
L071479,443445,452459,4664731001 9RK4Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87 3502B 06
L067514,487494,501508,5155151001Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87     3502B 07
L067549,522529,536543,5505501001Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87Z≠86≠87     3502B 08
L068585,557564,571578,5865861001Z≠86≠87Z≠86≠87Z≠86≠87Z≠30≠31B6688001    3502B 09
L067620,593600,607609,6116161001Z≠86≠87Z≠19≠20N      4RK4B634MB706E       3502B 10
                                                          Z
L061649,625632,633634,6416461001/299M86125OM2C875802B432//299            3502B 11
L054671,657658,659664,6686701001M8722502.B413DB3484RK4                   3502B 12
L062701,677681,686690,6976981001B681MB432B702E/299M8252502B432           3502B 13
                                  Z
L072741,706710,718718,7187181001.432.634B400S791B348                     3502B 14
L072839,806826,826826,8268261001   1500VEREXTENDED - ERROROID NOT DETECT3502B 15
L072879¤840840,846862,8738731001 OVEREXTENSION - ERROREND OF TEST250     3502B 16
L070/39¤/02/02,/20/40,/40/401001                                         3502B 17
L072/79,/60/80,/80/80,/80/801001PUNCH FEED                  READ R3502B 18
L070S17,S00S01,S05S12,S13S171001ELEASE OVEREXTENSION2,049L0772772/2772    3502B 19
L059S44,S25S29,S36S37,541S451001¤/40/60¤/80L/992802/2802413               3502B 20
/333080N                                    CLEAR WORDMARK CARD          3502B 21
,019027,031,03804280311T98GB400L046352BW04BS88  TEST FOLLOWS BELOW       3502B 22
                                  M
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ENG. CHG. NO.	110378E	117628	TA 1976					

READ-PUNCH RELEASE

A. PURPOSE OF TEST

1. TO TEST THE START READ FEED -READ RELEASE- CIRCUITRY BY UTILIZING MAXIMUM PROCESSING TIME -31 MS- BETWEEN SUCCESSIVE READ CYCLES. DURING THIS PART OF THE TEST, CARDS SHOULD FEED AT MAXIMUM SPEED -800 CARDS A MINUTE-. ON 1401-G SYSTEM THE MAXIMUM TIME OF 56 MS IS USED.

2. TO TEST THE START PUNCH FEED -PUNCH RELEASE- CIRCUITRY BY UTILIZING MAXIMUM PROCESSING TIME -59.5 MS- BETWEEN SUCCESSIVE PUNCH CYCLES. DURING THIS PART OF THE TEST, CARDS SHOULD FEED AT MAXIMUM SPEED -250 CARDS A MINUTE-.

B. LOADING PROCEDURE

1. WHEN RUNNING TEST FROM CARDS:

A. ALLOW 1401 TO HALT WITH I STAR AT 440
B. PLACE BLANK CARDS IN READ FEED
C. DEPRESS START AND PROGRAM HALTS AT I STAR 572 WITH 50 CARDS COUNTED INTO STACKER 1.
D. CLEAR READ FEED, PLACE THE 50 BLANK CARDS IN THE READ HOPPER AND PRESS START.
E. READ CHECK STOP WITH I STAR AT 579
F. CLEAR READ FEED, PLACE CARDS IN PUNCH HOPPER AND RESTART AT 600
G. PUNCH CHECK STOP WITH I STAR AT 799
H. END OF TEST RESTART AT 348

2. WHEN RUNNING FROM TAPE:

A. ENTER A 1 IN 1279
B. FOLLOW PROCEDURE FOR RUNNING TEST FROM CARDS.

C. PROGRAM CONTROL

1. SENSE SWITCHES

G ON IF SYSTEM IS 1401-G
IF SENSE SWITCHES ARE NOT ON SYSTEM, ENTER A WM IN 859 FOR 1401-G SYSTEMS
B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

DATE	6/29/63	4/8/64	19.6.64					
ENG CHG NO.	117028	120801	TA 764					

D. TEST PROCEDURE

A CARD COUNTER IS SET TO 003 ADVANCED BY -1-, AND TESTED FOR EVERY DETAIL CARD UNTIL IT REACHES 50. IMMEDIATELY AFTER EACH READ INSTRUCTION, DELAY INSTRUCTIONS -TWO MOVE AND ZERO SUPPRESS- AND A START READ FEED INSTRUCTION ARE EXECUTED. THESE INSTRUCTIONS ARE CALCULATED TO USE UP APPROXIMATELY 9.8 MILLISECONDS OF PROCESSING TIME. IF SS G IS ON 4 MOVE ZERO SUPPRESS INSTRUCTIONS DELAY 21 MS.

AFTER THE START READ FEED INSTRUCTION, THREE MORE MOVE AND ZERO SUPPRESS INSTRUCTIONS AND A BRANCH INSTRUCTION ARE EXECUTED. THESE INSTRUCTIONS, PLUS THE INSTRUCTIONS EXECUTED AFTER THE BRANCH UP TO THE NEXT READ INSTRUCTION, ARE CALCULATED TO USE UP APPROXIMATELY 20.8 MILLISECONDS OF PROCESSING TIME. IF SS G IS ON 5 MOVE ZERO SUPPRESS INSTRUCTIONS DELAY 34.8 MS. SINCE THE PROCESSING TIME UTILIZED BETWEEN SUCCESSIVE READ CYCLES IS WITHIN THE MAXIMUM 31 MILLISECONDS ALLOWED FOR 1401, OR 55.6 MS FOR THE 1401-G, CARDS SHOULD FEED CONTINUOUSLY. IF AUDIBLE INTERRUPTION IS DETECTED, THE MAXIMUM SPEED OF 800 CARDS A MINUTE IS NOT MAINTAINED AND A FAILURE OF THE START READ FEED CIRCUITRY IS NORMALLY INDICATED.

IT MUST BE RECOGNIZED, OF COURSE, THAT THE AUDIBLE INTERRUPTION MAY BE CAUSED BY FAILURE IN OTHER PHASES OF THE LOOP RESULTING IN A DELAY IN EXCESS OF 31 MILLISECONDS. THIS CONDITION IS INTENTIONALLY FORCED BY THE PROGRAM WHEN THE CARD COUNTER REACHES 50 BY EXECUTING AN EXTRA 8 MILLISECONDS DELAY BEFORE THE NEXT READ INSTRUCTION. THIS EXTRA DELAY CAUSES A LATE READ INSTRUCTION AND THE MACHINE SHOULD THEREFORE STOP WITH THE READ CHECK ERROR LIGHT ON AND THE INCORRECTLY-READ CARD IN THE STACKER, AND THE I STAR AT LOCATION 579.

IF THE READ CHECK STOP FAILS TO OCCUR THE PROGRAM HALTS WITH THE I STAR AT 581.

TO PROCEED WITH THE SECOND PART OF THIS TEST, PERFORM A NON-PROCESS RUNOUT, RESET THE ERROR CONDITION AND PRESS START KEY.

THE PROCEDURE FOR START PUNCH FEED -PUNCH RELEASE- IS MUCH THE SAME AS FOR THE START READ FEED -READ RELEASE- EXCEPT THAT THE DELAY INSTRUCTIONS ARE CALCULATED TO USE UP APPROXIMATELY 58.5 MILLISECONDS OF PROCESSING TIME. SINCE THE PROCESSING TIME UTILIZED BETWEEN SUCCESSIVE PUNCH CYCLES IS WITHIN THE MAXIMUM 59.5 MILLISECONDS ALLOWED, CARDS SHOULD BE PUNCHED CONTINUOUSLY AT THE MAXIMUM RATE OF 250 CARDS A MINUTE. IF AUDIBLE INTERRUPTION IS DETECTED, THIS SPEED IS NOT MAINTAINED AND A FAILURE OF THE START PUNCH FEED CIRCUITRY IS NORMALLY INDICATED.

WHEN THE CARD COUNTER REACHES 50 IN THIS PART OF THE TEST, AN EXTRA 8 MILLISECONDS DELAY IS EXECUTED TO FORCE A PUNCH CHECK ERROR STOP CONDITION. THIS DELAY CAUSES A LATE PUNCH INSTRUCTION AND THE MACHINE SHOULD THEREFORE STOP WITH THE PUNCH CHECK ERROR LIGHT ON AND THE I STAR AT LOCATION 799 INDICATING THE END OF THE TEST.

IF THE PUNCH CHECK STOP FAILS TO OCCUR, THE PROGRAM HALTS WITH THE I STAR AT 801.

DATE	6/29/63	4/8/64	19.6.64					
ENG CHG NO	117638	120301	TA 764					

E. STOPS

STORAGE ADDRESS REGISTER	
440	HALT TO PLACE BLANK CARDS IN READ FEED.
572	HALT TO REMOVE 50 CARDS FROM STACKER 1. CLEAR READ FEED, PLACE 50 CARDS IN READ HOPPER AND PRESS START.
579	READ CHECK STOP. RUNOUT READ FEED, CLEAR ERROR AND PRESS START KEY.
581	ERROR STOP - NO READ CHECK STOP
799	PUNCH CHECK STOP. END OF TEST. RUNOUT PUNCH FEED, CLEAR ERROR AND PRESS START TO FEED NEXT TEST.
801	ERROR STOP - NO PUNCH CHECK STOP

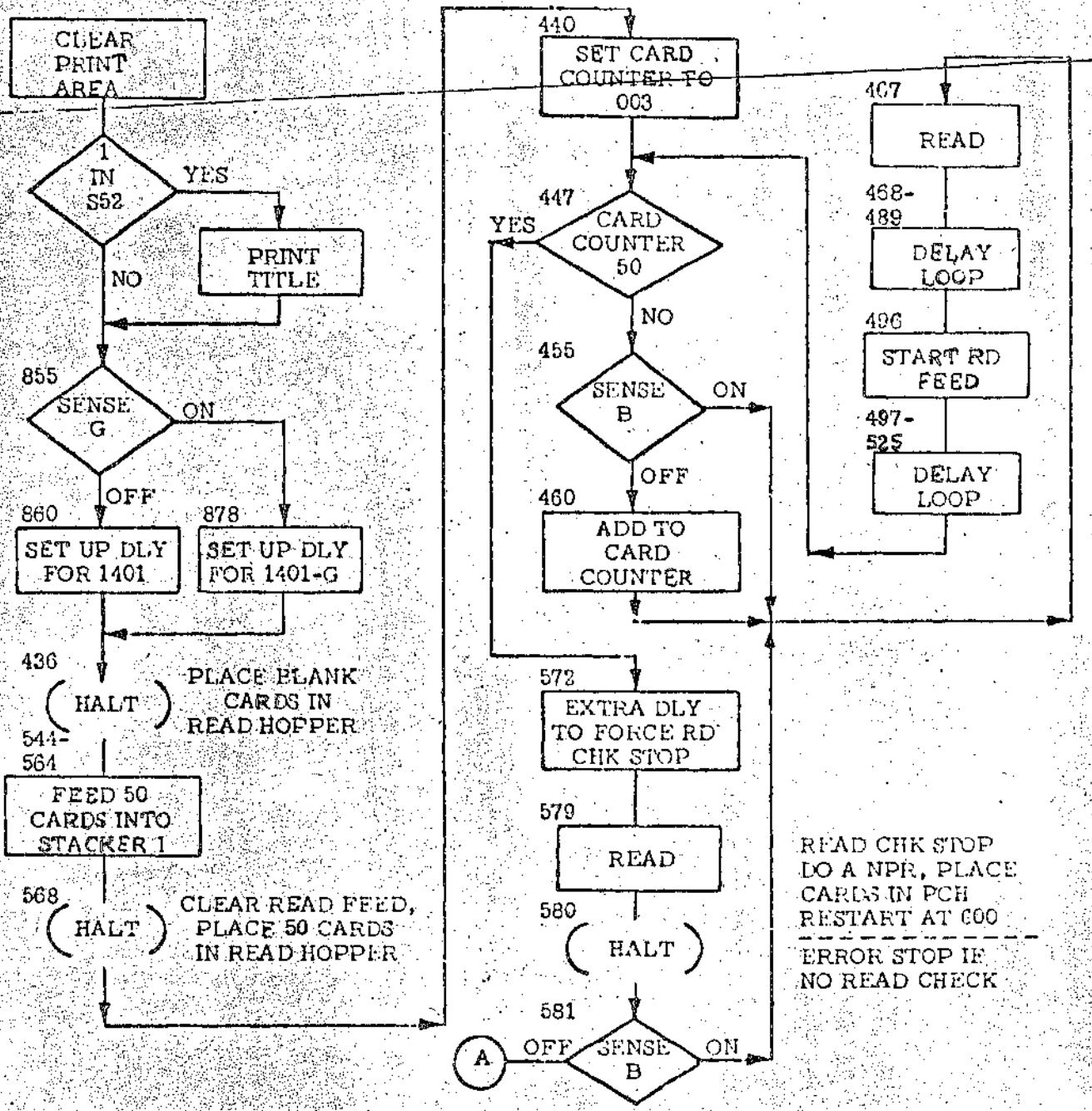
F. PRINTOUTS

NONE

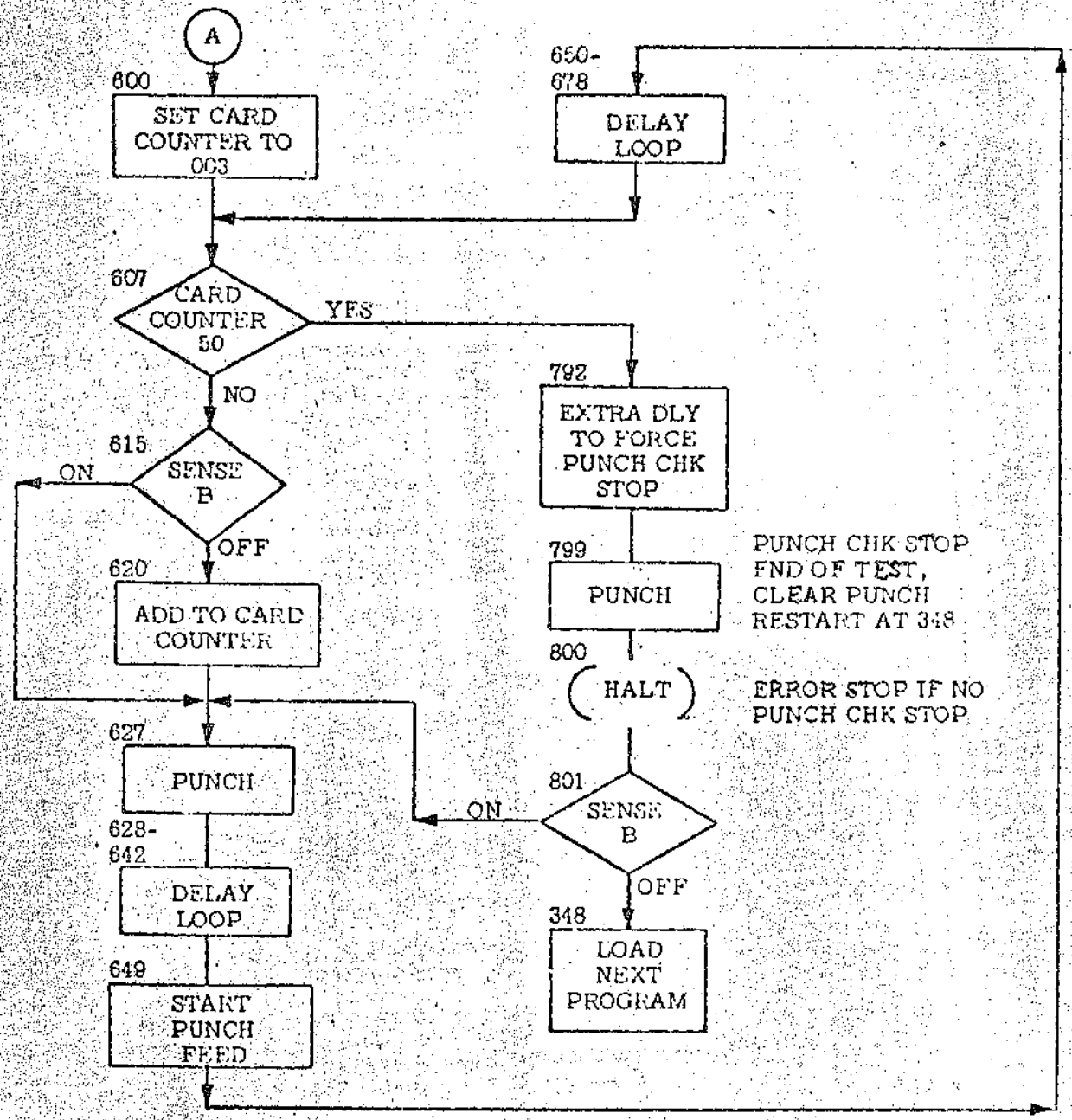
IBM FORM 624 7113 0

1401 DATA PROCESSING SYSTEM
DIAGNOSTIC FUNCTION TEST

PART NO 451445
SHEET 4 OF 8
BLOCK NO 25C0D



DATE	6/29/63	4/8/64	19.6.64					
ENG CHG NO.	117628	120301	TA 764					



DATE	6/29/63	4/8/64	19.6.64					
ENG CHG NO	117628	120301	TA 764					

PROGRAM LISTING FOR USE WITH FLOW CHART

READ PUNCH RELEASE BLOCK 3500D

ACT. ADDR	INST ADDR	OP	A	B	REMARKS
377	377	b	393	5791	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	588		,,
393	393	M	388	380	BYPASS 2 DETAIL CARDS ON TAPE
400	400	/	332		CLEAR PRINT AREA
404	404	/			,,
405	405	B	500	5521	BR. TO TITLE PRINT IF 1 IN 1252
413	413	/	199		CLEAR PUNCH AREA
417	417	B	655		BR. TO CHECK SYSTEM TYPE
421	421	N			CONSTANT TO CHANGE DELAYS
422	422	M	421	468	SET UP DELAY FOR 1401
429	429	M	421	475	,,
436	436	.	536		BR. TO FEED BLANK CARDS AFTER HALT
440	440	L	595	598	SET CARD COUNTER TO 003
447	447	B	572	5975	BR. IF CARD COUNTER 50
455	455	B	467	b	B ON FOR SCOPE LOOP
460	460	A	467	598	ADD 1 TO CARD COUNTER
467	467	1			READ A CARD
468	468	Z	257	332	EXTRA DELAY FOR 1401-G
475	475	Z	257	332	,,
482	482	Z	239	332	DLY 9.8 MS FROM READ TO START READ FEED
489	489	Z	239	332	,,
496	496	8			START READ FEED
497	497	Z	300	332	EXTRA DELAY FOR 1401-G
504	504	Z	300	332	,,
511	511	Z	294	332	DLY 20.8 MS FROM START READ FEED TO READ
518	518	Z	294	332	,,
525	525	Z	294	332	,,
532	532	B	447		BRANCH
536	536	,	101		DEFINE DELAY FIELDS
540	540	S	592		RESET INITIAL CARD COUNTER
544	544	1			FEED 2 DETAIL CARDS
545	545	1			,,
546	546	A	545	592	COUNT OUT 50 CARDS FOR TEST
553	553	1			,,
554	554	K	1		SELECT INTO POCKET 1
556	556	B	568	5915	BR. WHEN 50 CARDS ARE FED
564	564	B	546		BRANCH
568	568	.	440		HALT TO REMOVE 50 TEST CARDS
572	572	Z	331	332	EXTRA 8 MS DLY TO FORCE READ CHECK STOP
579	579	1			READ CHECK STOP - RESTART AT 600
580	580	.			ERROR - NO READ CHECK STOP
581	581	B	467	8	B ON FOR SCOPE LOOP
586	586	B	600		CONTINUE TO PUNCH TEST

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ENG. CHG. NO.	117028	120301	TA 764					

```
590  590  0 00                 INITIAL CARD COUNTER
593  593  0 03                 CONSTANT TO SET CARD COUNTER
596  596  0 00                 CARD COUNTER
599  599  2                    CONSTANT TO CHANGE DELAY
600  600  L 595 598            SET CARD COUNTER TO 003
607  607  B 792 5975           BR. IF CARD COUNTER SO
615  615  B 627 8              8 ON FOR SCOPE LOOP
620  620  A 467 598            ADD 1 TO CARD COUNTER
627  627  4                    PUNCH
628  628  2 310 332            DLY 22 MS FROM PUNCH TO START PUNCH FEED
635  635  2 309 332              **
642  642  2 310 332              **
649  649  9                    START PUNCH FEED
650  650  2 331 332            DLY 36.5 MS FROM ST PCH FEED TO PUNCH
657  657  2 331 332              **
664  664  2 331 332              **
671  671  2 331 332              **
678  678  2 208 332              **
685  685  B 607                 BRANCH
792  792  2 331 332            EXTRA 8 MS
799  799  4                    LATE PUNCH CHECK STOP - END OF TEST
800  800  .                    ERROR - NO PUNCH CHECK STOP
801  801  B 627 8              8 ON FOR SCOPE LOOP
806  806  B 348                READ IN NEXT TEST
855  855  B 878 G              G ON IF 1401-G SYSTEM
860  860  M 421 497            SET UP DELAY FOR 1401
867  867  M 421 504              **
874  874  B 422                BRANCH
878  878  M 599 468            SET UP DELAY FOR 1401-G
885  885  M 599 475              **
892  892  M 599 497              **
899  899  M 599 504              **
906  906  B 436                BRANCH
                               DETAIL CARDS
```

DATE	6/19/63	4/8/64	19.6.64					
ENG. CHG. NO	1176-8	1-[illegible]						

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 6	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                READ PUNCH RELEASE          3500D 04
,008015,022029,033033N      1001                SET WORDMARK CARD           3500D 02
L067367,340344,348349,357361100I,008012,001100IIB361089AB349/340080         3500D 03
L069404,377385,393400,404405100I          B393S7918SHB    M380380/332/      3500D 04
L067439,413417,421422,429436100I9S005521/1798855NM421468M421475.536         3500D 05
L067474,447455,460467,468475100IL595598857257758467844675981Z257332        3500D 06
L068510,482489,496497,504518100IZ257332/239332Z239332Z873033Z300332         3500D 07
L066544,518525,532536,540544100IZ294332Z294332Z294332B447,10155921          3500D 08
L059571,546553,554556,564568100IIA545592IK)456859158546.440                 3500D 09
L056595,579580,581596,590593ICOIZ3313321.B4678B600000003                    3500D 10
L064627,599600,607615,620627100I000ZL595598B7925975862.BA4675984            3500D 11
L068663,635642,649650,657664100IZ3103332Z3033322Z3103329Z3313332Z331332     3500D 12
L072703,671678,685695,685685100IZ3313332Z3313332Z208332B607                 3500D 13
L054805¤764784,792799,800801100I          Z3313324.B627B                    3500D 14
L072845,001001,001001,001001100I8348                                        3500D 15
L064877¤846948,855860,867874100I          B878GM421497M4215048422           3500D 16
L072917,885892,899906,906906100IM599468M599475M599497M5995048436            3500D 17
L047S12¤/98/98,S00S01,S05S12100I  2,049L0772772                              3500D 18
L068548,S17S21,S21S21,S21S211001/2772413                                     3500D 19
/333080N                                        CLEAR WORDMARK CARD          3500D 20
,019027,031,038042B031T98GB400LG46352BW048S88   READ PUNCH RELEASE           3500D 21
                                                                             3500D 22
                                                                             3500D 23
```

DATE	6/29/63	4/8/64	19.6.64					
ENG CHG NO	117088	1FC301	TA 764.					

DIAGNOSTIC FUNCTION TEST

HI-LO-EQUAL FIELD COMPARE

A. PURPOSE OF TEST:

TO SUPPLEMENT THE BRANCH HIGH - BLOCK 3300, BRANCH LOW - BLOCK 3310, AND BRANCH EQUAL - BLOCK 3320 DIAGNOSTIC TESTS BY COMPARING VARIABLE LENGTH FIELDS INSTEAD OF ONE OR TWO CHARACTERS. THE LENGTH OF THE COMPARE FIELDS VARIES FROM ONE TO TEN CHARACTERS.

B. LOADING PROCEDURES:

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE, ENTER A 1 IN 1259.

C. PROGRAM CONTROL:

1. SENSE SWITCHES:

B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D. ON TO REPEAT DETAIL CARD
OFF TO CONTINUE

E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

G. ON TO REPEAT INDIVIDUAL FIELD
OFF TO CONTINUE

D. TEST PROCEDURE:

A DETAIL CARD IS READ AND A PAIR OF 10 CHARACTER FIELDS ARE COMPARED. IF A BRANCH HIGH RESULTS, STORAGE POSITION 100 IS TESTED FOR AN H - BRANCH LOW, 100 IS TESTED FOR AN L - OR BRANCH EQUAL, 100 IS TESTED FOR AN E. IF THE PROGRAM BRANCHES HIGH AND THE CONTROL CHARACTER IS NOT AN H, BRANCHES LOW AND NO L IN 100, OR BRANCHES EQUAL AND NO E IN 100, THE ERROR PRINT ROUTINE IS EXECUTED. UPON BRANCHING CORRECTLY, THE COMPARE AND BRANCH HIGH, LOW OR EQUAL IS REPEATED 100 TIMES AND THE CORRECT RESULTS ARE PRINTED OUT OR BYPASSED.

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ENG. CHG. NO.	115283	117628	TA 1976					

D. TEST PROCEDURE (CONTINUED)

THE INSTRUCTIONS IN LOCATIONS 435, 442 AND 670 ARE NOW MODIFIED SO NINE CHARACTER LENGTH FIELDS ARE COMPARED 100 TIMES AS DESCRIBED ABOVE. THE LENGTH OF THE FIELDS IS REPEATEDLY REDUCED BY ONE AND COMPARED UNTIL THE FIELD LENGTH IS ONE CHARACTER. THE INSTRUCTIONS IN 435, 442 AND 670 ARE RESET FOR TEN CHARACTER FIELDS AND THE NEXT DETAIL CARD IS SIMILARLY PROCESSED.

E. STOPS:

STORAGE ADDRESS REGISTER

494 ERROR STOP - NO BRANCH
604 ERROR STOP - SENSE E ON

F. PRINTOUTS:

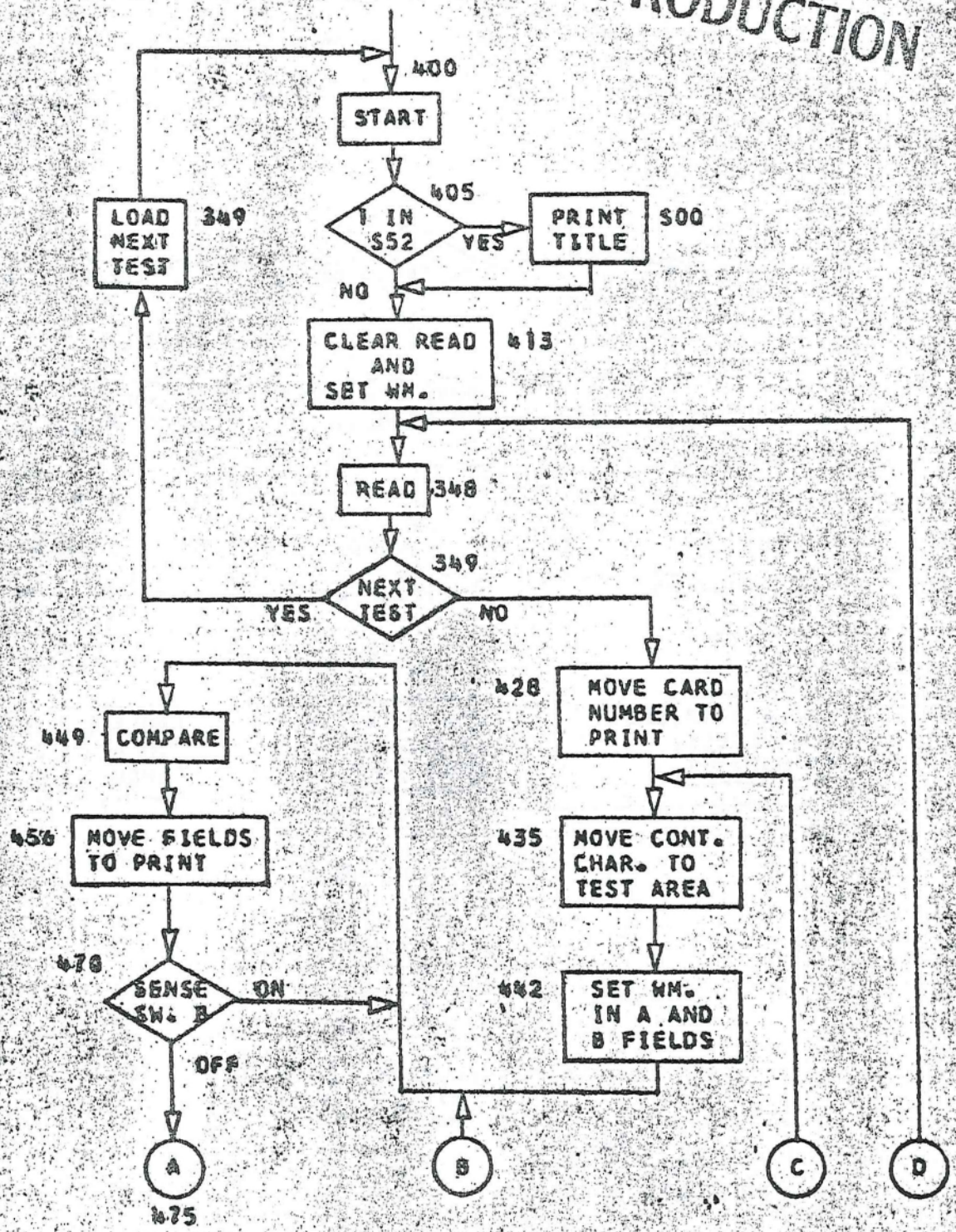
1. CORRECT:

A1B2C3D4E5	BJCKDLEMFN	HIGH	HIGH	24
1B2C3D4E5	JCKDLEMFN	LOW	LOW	24
B2C3D4E5	CKDLEMFN	HIGH	HIGH	24
2C3D4E5	KDLEMFN	LOW	LOW	24
C3D4E5	DLEMFN	HIGH	HIGH	24

E. ERROR:

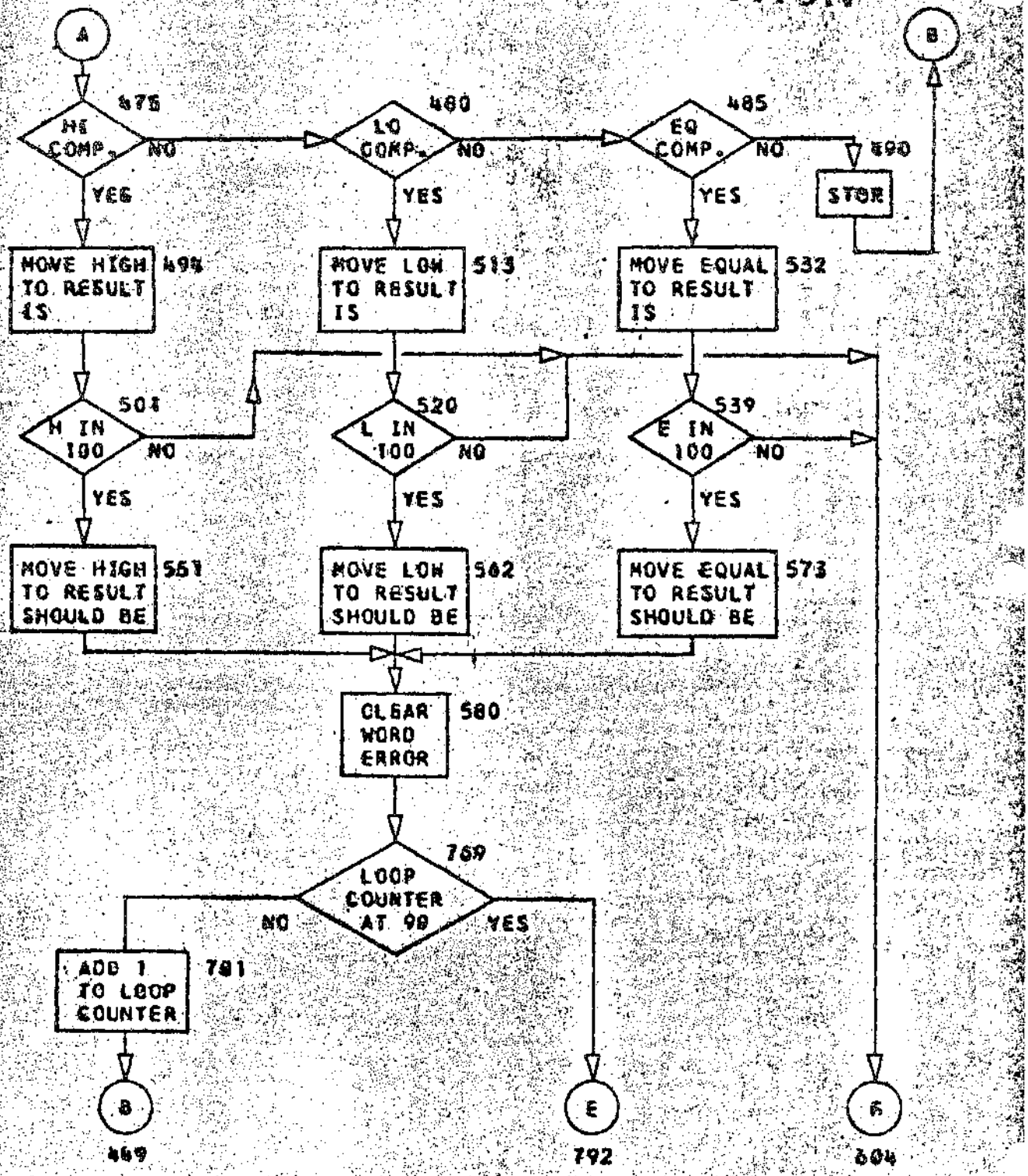
A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS		
A1B2C3D4E5	BJCKDLEMFN	HIGH	LOW	ERROR	24
1B2C3D4E5	JCKDLEMFN	LOW	EQUAL	ERROR	24
B2C3D4E5	CKDLEMFN	HIGH	EQUAL	ERROR	24
2C3D4E5	KDLEMFN	LOW	HIGH	ERROR	24
C3D4E5	DLEMFN	HIGH	EQUAL	ERROR	24

DATE	5-15-62	6-29-63	17 10 63					
ENG. CHG. NO.	115283	1152	TA 1976					

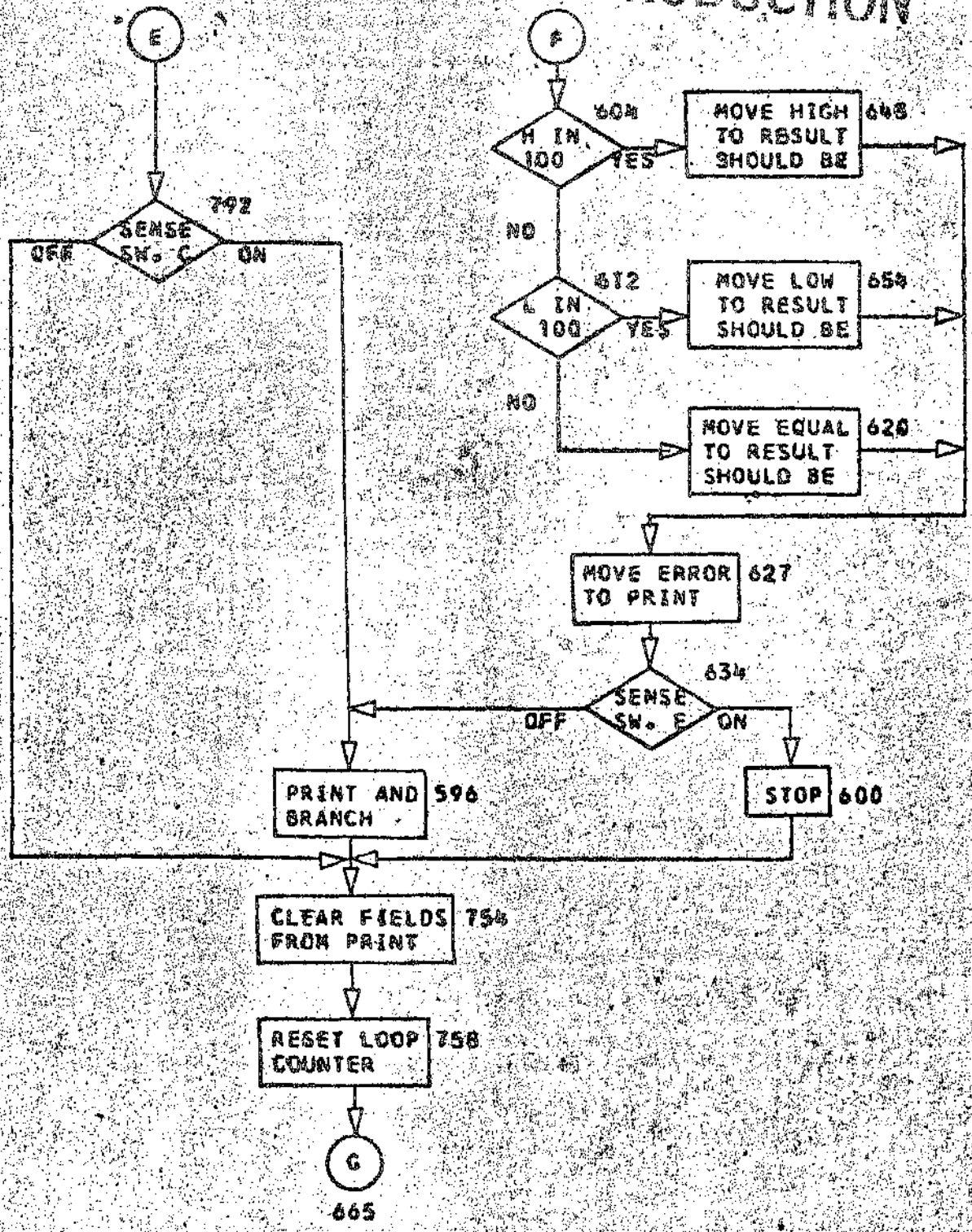


DATE	5-15-62	7-1-63	17. 10. 63					
ENG. CHG. NO.	115283	117628	TA 1976					

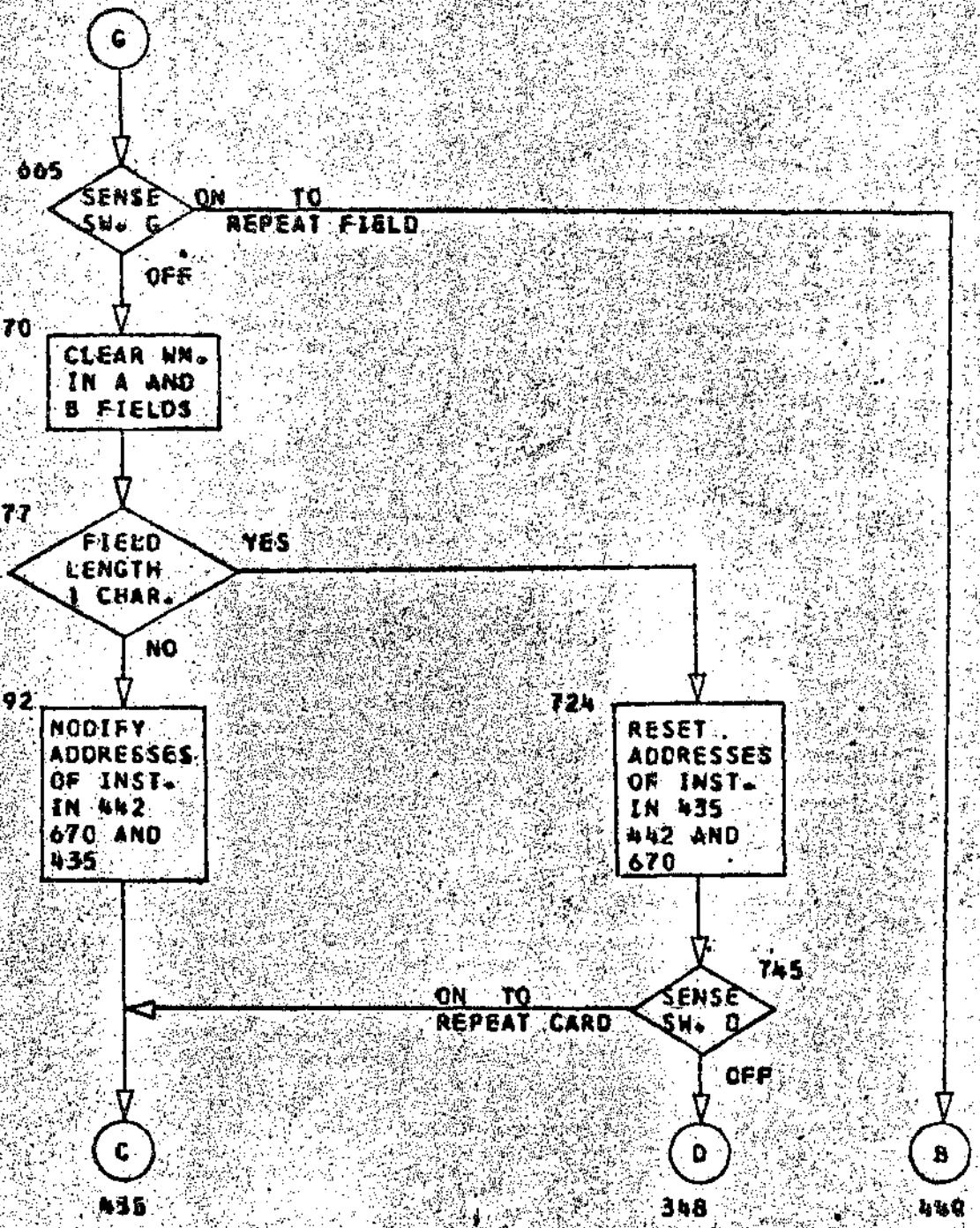
DIAGNOSTIC FUNCTION TEST



DATE	5-15-62	7-1-63	17.10.63					
ENG. CHG. NO.	115283	117628	TA 1976					



DATE	5-15-62	7-1-63	17.10.63					
ENG. CHG. NO.	115283	117628	TA 1976					



DATE	5-15-62	7-1-63	17.10.63					
ENG. CHG. NO.	115283	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

HI-LO-EQUAL FIELD COMP. 33308

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S591	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	TITLE PRINT
413	413	/	080		CLEAR READ
417	417	,	100	297	
424	424	B	348		BRANCH TO READ CARD
428	428	M	080	299	MOVE CARD NUMBER TO PRINT
435	435	M	041	100	,, CONTROL CHAR. TO TEST AREA
442	442	,	001	021	SET WM. IN A AND B FIELDS
449	449	C	010	030	COMPARE
456	456	M	010	210	MOVE FIELDS TO PRINT
463	463	M	030	230	,,
470	470	B	449	B	BRANCH ON B TO SCOPE
475	475	B	494	U	,, HIGH
480	480	B	513	T	,, LOW
485	485	B	532	S	,, EQUAL
490	490	.	449		ERROR STOP IF NO BRANCH
494	494	M	105	265	MOVE HIGH TO RESULT IS
501	501	B	551	100H	BRANCH TO CORRECT PRINT
509	509	B	604		,, ERROR PRINT
513	513	M	110	265	MOVE LOW TO RESULT IS
520	520	B	562	100L	BRANCH TO CORRECT PRINT
528	528	B	604		,, ERROR PRINT
532	532	M	115	265	MOVE EQUAL TO RESULT IS
539	539	B	573	100E	BRANCH TO CORRECT PRINT
547	547	B	604		,, ERROR PRINT
551	551	M	105	245	MOVE HIGH TO RESULTS SHOULD BE
558	558	B	580		
562	562	M	110	245	,, LOW ,,
569	569	B	580		
573	573	M	115	245	,, EQUAL ,,
580	580	M	/19	285	CLEAR WORD ERROR FROM PRINT
587	587	B	769		
596	596	2	754		PRINT AND BRANCH
600	600	.	754		ERROR STOP
604	604	B	643	100H	ERROR PRINT ROUTINE
612	612	B	654	100L	
620	620	M	115	245	EQUAL
627	627	M	/14	285	ERROR

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```
 634  634  B  600  E          BRANCH ON E TO ERROR STOP
 639  639  B  596
 643  643  M  105  245              HIGH
 650  650  B  627
 654  654  M  110  245              LOW
 661  661  B  627
 665  665  B  449  G          BRANCH ON G TO REPEAT FIELD
 670  670  ¤  001  021        CLEAR WM. FROM A AND B FIELDS
 677  677  B  724  4441       BRANCH IF 1 CHAR. FIELDS
 685  685  ,  443  671        SET WMS. FOR ADD. MOD.
 692  692  A  347  448        ADD 1 TO SET WM. ADD. IN 442
 699  699  A  347  676          ,,    CLEAR WM ADD. IN 670
 706  706  A  344  438          ,,    MOVE ADD. IN 435
 713  713  ¤  443  671
 720  720  B  435
 724  724  M  124  438        RESET ADD. OF MOVE INST. IN 435
 731  731  M  121  448          ,,          SET WM. INST. IN 442
 738  738  M  121  676          ,,          CLEAR WM. INST. IN 670
 745  745  B  435  D          BRANCH ON D TO REPEAT DETAIL CARD
 750  750  B  348               ,,   TO READ NEXT CARD
 754  754  /  230            CLEAR FIELDS FROM PRINT
 758  758  M  117  126        RESET LOOP COUNTER
 765  765  B  665
 769  769  C  126  128        BRANCH IF LOOP COUNTER AT 99
 776  776  B  792  S
 781  781  A  118  126        ADD 1 TO LOOP COUNTER
 788  788  B  449
 792  792  B  596  C          BRANCH ON C TO CORRECT PRINT
 797  797  B  754            BYPASS CORRECT PRINT
1110  /10  E  RRO  R         CONSTANTS
1115  /15                       ,,
1120  /20  A   FI  ELD          ,,
1140  /40  B   FI  ELD          ,,
1160  /60  R  ESU  LT SHOULD BE ,,
1180  /80  R  ESU  LT IS       ,,
 101  101  H  IGH              ,,
 106  106  L  OW               ,,
 111  111  E  QUA  L           ,,
 116  116  0  010  21          ,,
 122  122  0  41               ,,
 125  125  0  0                ,,
 127  127  9  9              LOOP COUNTER
                               ,,  ,,     COMP. CONST.
```

DATE	5-15-62	6-29-63	17.10.63					
ENG CHG. NO.	115283	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0008015,022029,033033N0000001001                    HI-LO-EQUAL FIELD COMP.  3330B 01
,0008015,022029,033033N0000001001                    SET WORD MARK CARD       3330B 02
L060128,106111,116122,125127001HIGH LOW  EQUAL001021041099                    3330B 03
L067367,340344,348349,3573611001,008012,001100118361080AB428/340080           3330B 04
L069404,377385,389393,4004041001          B389S591BS88N000M360392/332/         3330B 05
L069441,413417,424428,4354421001BS00S521/080,100297B348M080299M041100         3330B 06
L070479,449456,463470,4754601001,001021C010030M010210M030230B449B8494U        3330B 07
L072519,485490,494501,5095131001B513T85325.449M105265B551100HB604M110265      3330B 08
L070557,528532,539547,5515581001B562100LB604M115265B573100E8604M105245        3330B 09
L070595,562569,573580,5875961001B580M110245B580M115245M/19285B769             3330B 10
L070633,600604,612620,6276341001275 4.754B643100HB654100LM115245M/14285       3330B 11
L068669,639643,650654,6616651001B600E8596M105245B627M110245B627B449G          3330B 12
L068705,677685,692699,7067061001¤001021B724444 1,443671A347448A347676         3330B 13
L071744,713720,724731,7387451001A344438¤443671B435M124438M121448M121676       3330B 14
L068780,750754,758765,7697761001B435DB348/230M117126866SC12612887925          3330B 15
L072820,788792,797797,7977971001A1181268449859 6CB754                  ¢00633330B 16
L072/49,/15/20,/40/40,/40/40100 1ERROR      A FIELD              B FIELD      3330B 17
L072/89¤/50/50,/60/80,/80/801001            RESULT SHOULD BE     RESULT IS    3330B 18
L055S12¤/90/90,S00S01,S05S121001            2,049L0772772                     3330B 19
L060S40,S17S18,S25S29,S36S371001/2772¤/40/60¤/80L/892702/277                   3330B 20
L040S48,S45S45,S45S45,S45S451001 2413                                         3330B 21
/333080                                              CLEAR WORD MARK CARD     3330B 22
,019027,031,0380428031T98GB400L046352BW04BS88        HI-LO-EQUAL FIELD COMP.  3330B 23
                        M
```

DETAIL CARDS

```
A182C3D4E5          BJCKDLEMFN          HLHLHLHLHL                          3330B 24
018C45FG89           /STUVWXYZ          LLHHLLHHLL                          3330B 25
R8P6N4L2J0          Q873N5C2RZ          LHHLHHLHHL                          3330B 26
FIELDCOMP.          AX/7+6OMP.          LHLHLHEEEE                          3330B 27
AX/7+LOMP.          FIELDCOMP.          HLHLHLEEEE                          3330B 28
0123456789          9876543210          HHHHHHLLLLL                         3330B 29
JF8L306GNZ          JBRL196¤SZ          LLHLLHLLHE                          3330B 30
9876543210          0123456789          LLLLLHHHHH                          3330B 31
AMS/DNWXF0          KBS3,N9HF7          HLHHLHHLHH                          3330B 32
AKT4BLU5CM          ,3T2RLL9CD          LHLLHLLHLL                          3330B 33
@#/-+/#@+-          @#/-+-@#-+          LLLLLLHLHL                          3330B 34
+-/#@+@/#-          +-/#@@+#//          HHHHHHLHLH                          3330B 35
```

DATE	5-15-62	6-29-63	17.10.63					
ENG. CHG. NO.	115283	117628	TA 1976					

BRANCH EQUAL

A. PURPOSE OF TEST

TO TEST THE BRANCH EQUAL CIRCUITRY BY COMPARING AN A FIELD WITH A B FIELD FOR AN EQUAL OR UNEQUAL CONDITION. THE EQUAL OR UNEQUAL CONDITION IS THEN CHECKED FOR ACCURACY.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING FROM TAPE, ENTER A 1 IN 1259.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURES

A FIELD (COLUMNS 2-3), B FIELD (COLUMNS 22-23), AND RESULT SHOULD BE FIELD (COLUMNS 41-60) ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. THE A AND B FIELDS ARE THEN COMPARED.

IF THE CONDITION IS EQUAL, A TEST IS MADE TO CHECK FOR THE LETTER "E" IN COLUMN 41. IF E, THE EQUAL-COMPARE OPERATION WAS EXECUTED CORRECTLY; IF NOT E AN ERROR IS INDICATED AND THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE, WHICH LOADS THE WORDS "EQUAL" AND "ERROR" INTO THE PRINT AREA.

DATE	2-2-61	6-29-63	17.10.63					
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D. (CONTINUED)

IF THE CONDITION IS UNEQUAL, A TEST IS MADE TO CHECK FOR THE LETTER "U" IN COLUMN 41. IF U, THE UNEQUAL-COMPARE OPERATION WAS EXECUTED CORRECTLY; IF NOT U, AN ERROR IS INDICATED AND THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE. TWO TESTS ARE THEN MADE TO DETERMINE WHETHER THE UNEQUAL CONDITION IS HIGH OR LOW. IF HIGH THE WORD "HIGH" IS LOADED IN THE RESULT IS FIELD OF THE PRINT AREA; IF LOW THE WORD "LOW" IS LOADED INSTEAD. IN EITHER CASE, THE WORD "ERROR" IS ALSO LOADED.

THE POSITION OF SENSE SWITCH E THEN DETERMINES WHETHER THE MACHINE STOPS TO PERMIT CONSOLE CHECKING OR PRINTS THE RESULTS.

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

A FIELD	B FIELD	RESULT SHOULD BE	RESULT IS
(BLANK)	(BLANK)	EQUAL	EQUAL
I	(BLANK)	UNEQUAL	UNEQUAL
(BLANK)	I	UNEQUAL	UNEQUAL
RW	RW	EQUAL	EQUAL
RW	RR	UNEQUAL	UNEQUAL

2. ERROR

(BLANK)	(BLANK)	EQUAL	HIGH	ERROR
I	(BLANK)	UNEQUAL	EQUAL	ERROR
(BLANK)	I	UNEQUAL	EQUAL	ERROR
RW	RW	EQUAL	LOW	ERROR
RW	RR	UNEQUAL	EQUAL	ERROR

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

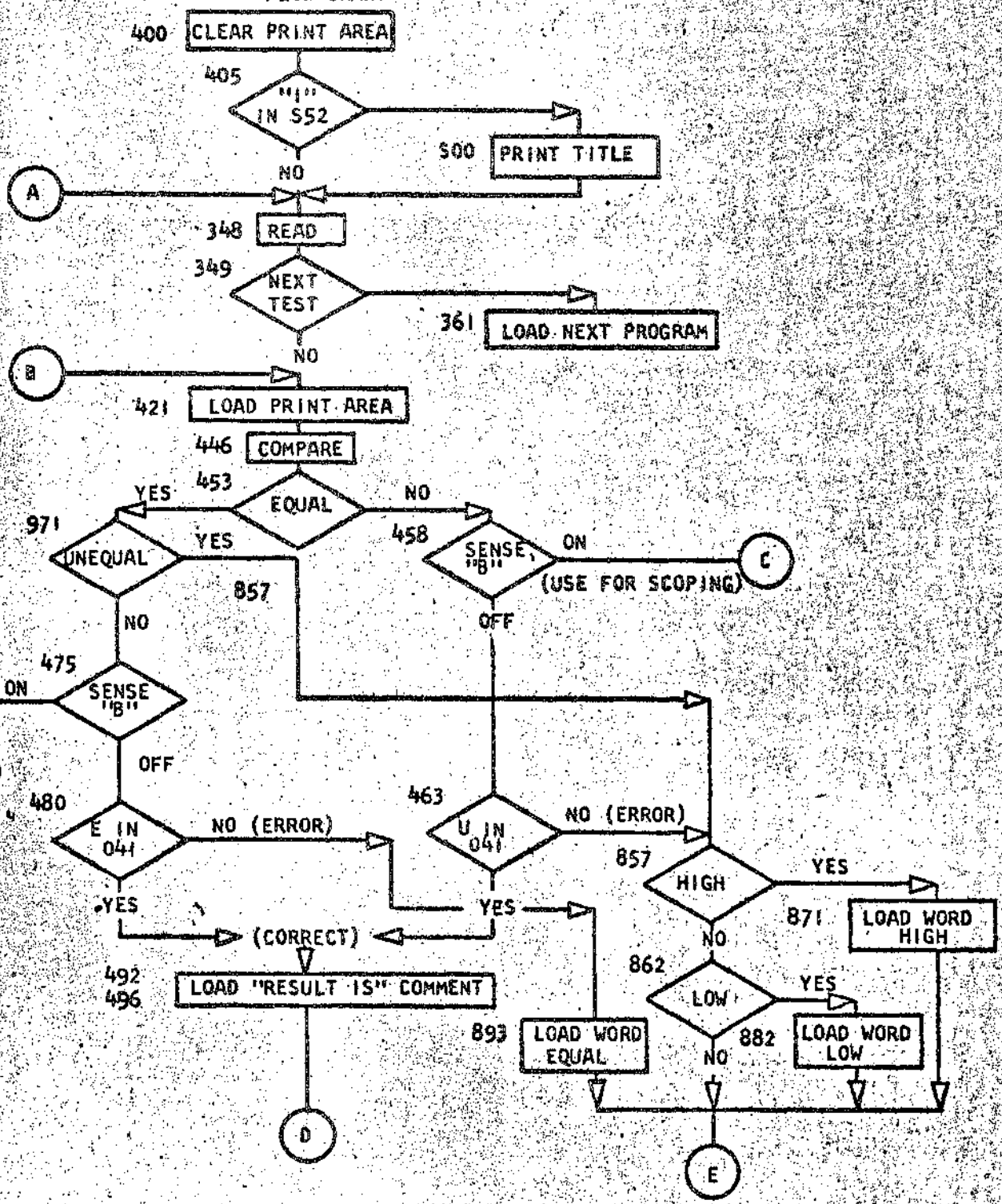
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451444
SHEET 3 OF 7
BLOCK NO. 33208

BRANCH EQUAL

FLOW CHART



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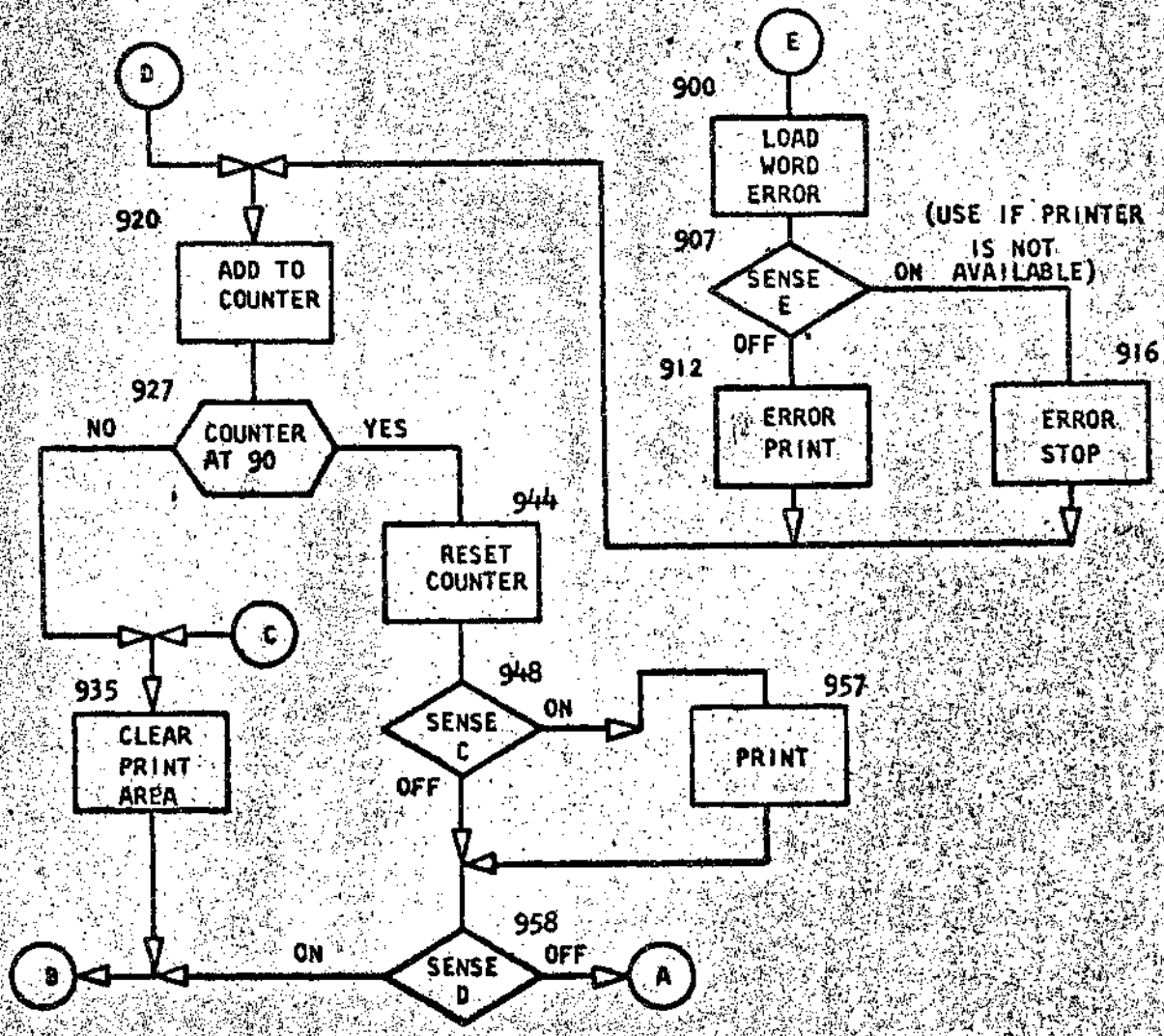
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451444
SHEET 4 OF 7
BLOCK NO. 3320B

REPRODUCTION



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PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH EQUAL 33208

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S591	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
389	389	N	000		,,
393	393	M	360	392	,,
400	400	/	332		START TEST
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	/	080		CLEAR READ AREA
417	417	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
421	421	,	001	078	LOAD PRINT AREA
428	428	L	080	299	,,
435	435	L	072	272	,,
442	442	,	222		,,
446	446	C	203	223	COMPARE
453	453	B	971	S	BRANCH EQUAL GO CHECK UNEQUAL
458	458	B	935	8	B ON TO SCOPE SS
463	463	B	492	041U	NO ERROR IF U IN 041
471	471	B	857		ERROR SHOULD BE EQUAL
475	475	B	935	8	B ON TO SCOPE SS
480	480	B	492	041E	NO ERROR IF E IN 041
488	488	B	893		GO TO EQUAL ERROR ROUTINE
492	492	,	241		LOAD -RESULT IS- COMMENT
496	496	L	250	270	,,
503	503	B	920		GO TO CORRECT ROUTINE
857	857	B	871	U	BRANCH HIGH
862	862	B	882	T	BRANCH LOW
867	867	B	900		UNEQUAL BUT NOT HIGH OR LOW
871	871	L	¢99	270	LOAD HIGH INTO PRINT AREA
878	878	B	900		CONTINUE ERROR ROUTINE
882	882	L	/09	270	LOAD LOW INTO PRINT AREA
889	889	B	900		CONTINUE ERROR ROUTINE
893	893	L	¢89	270	LOAD EQUAL INTO PRINT AREA
900	900	L	/14	285	BEGIN ERROR PRINT ROUTINE
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	920		ERROR PRINT
916	916	.	920		ERROR STOP
920	920	A	920	970	ADD ONE TO OPERATION COUNTER
927	927	B	944	9699	BRANCH AFTER 90 OPERATIONS C FOR TA
935	935	/	332		CLEAR PRINT AREA
939	939	/			,,
940	940	B	421		BRANCH TO REPEAT
944	944	S	970		RESET OPERATION COUNTER
948	948	B	957	C	C ON FOR CORRECT PRINT SS

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REPRODUCTION

```
 953  953  B 958                BRANCH TO SENSE D
 957  957  2                    PRINT CORRECT RESULTS
 958  958  B 421 D              D ON TO REPEAT                    $S
 963  963  B 980                BRANCH TO PROG. CHAINING ROUTINE
 967  967  0 004                OPERATION COUNTER
 971  971  B 857 /              ERROR EQUAL AND UNEQUAL ON
 976  976  B 475                GO TO SW B
 980  980  / 299                CLEAR ANY GM WM FROM PRINT AREA
 984  984  B 348                GO TO PROG. CHAINING ROUTINE
1080  +80  E QUA L              CONSTANTS FOR PRINTOUTS
1090  +90  H IGH                 "
1100  /00  L OW                  "
1110  /10  E RRO R               "
1115  /15                        "
1120  /20  A  FI ELD             "
1140  /40  B  FI ELD             "
1160  /60  R ESU LT SHOULD BE    "
1180  /80  R ESU LT IS           "
```

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ENG. CHG. NO.	110378	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8
WS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0	
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK		7	8
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,008015,022029,033033N          1001                    BRANCH EQUAL                    3320B 08
,008015,022029,033033N          1001                    SET WORDMARK CARD               3320B 02
L067367,340344,348349,357361!001,008012,001!001!8361080AB421/340080                     3320B 03
L069404,377385,389393,400404!001          8389S591BS88N000M360392/332/                  3320B 04
L069441,413417,421428,435442!0018S00S521/0808348,001078L080299L072272                  3320B 05
L070479,446453,458463,471475!001,222C203223897!S893S8849204!U8857B935B                 3320B 06
L072519,488492,496503,505503!001849204!E8893,241L2502708920                            3320B 07
L068892,862867,871878,882889!001887!UB882T8900L*99270B900L/092708900                    3320B 08
L066926,900907,912916,920927!001L*89270L/142858916E2920.920A920970                      3320B 09
L062956,935939,940944,948953!0018949699/332/8421S970B957C8958                          3320B 10
L059983,958963,967971,976980!0012B421D8980000PB857/8475/299                            3320B 11
                                                    Z
L072*23,001001,001001,001001!0018348                                                    3320B 12
L072/19,*90/00,/10/15,/20/20!001EQUAL     HIGH      LOW       ERROR                     3320B 13
L072/59,/40/60,/60/60,/60/60!001A FIELD             B FIELD                             3320B 14
L072/99,/80S00,S00S00,S00S00!001RESULT SHOULD BE    RESULT IS                           3320B 15
L057S24,S01S05,S12S13,S17S18!0012,049L0772772/2772¤/40/60'                              3320B 16
L052S44,S29S36,S37S41,S45S4$!001¤/80L/892702/2702413                                    3320B 17
/333080N                                            CLEAR WORDMARK CARD                 3320B 18
,019027,031,038042803!T98GB400L0463S2BW048S88       BRANCH EQUAL                        3320B 19
                                                    M
```

DETAIL CARDS

BLANK	BLANK	EQUAL		3320B 20
G GM	G GM	EQUAL		3320B 21
M	M			
1	BLANK	UNEQUAL		3320B 22
BLANK	1	UNEQUAL		3320B 23
2	BLANK	UNEQUAL		3320B 24
BLANK	2	UNEQUAL		3320B 25
4	BLANK	UNEQUAL		3320B 26
BLANK	4	UNEQUAL		3320B 27
8	BLANK	UNEQUAL		3320B 28
BLANK	8	UNEQUAL		3320B 29
/	1	UNEQUAL		3320B 30
1	/	UNEQUAL		3320B 31
-	BLANK	UNEQUAL		3320B 32
BLANK	-	UNEQUAL		3320B 33
RW	RW	EQUAL		3320B 34
RW	RR	UNEQUAL		3320B 35
RR	RW	UNEQUAL		3320B 36

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CARD TO TAPE

A. PURPOSE OF TEST

TO TRANSFER 20 CHARACTER RECORDS FROM DETAIL CARDS TO TAPE AND TEST FOR WRITE TAPE ERROR.

B. LOADING PROCEDURE

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4.
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1268 AND 1263.
   C. PLACE DETAIL CARDS IN READ HOPPER.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   A ON TO TEST FOR LAST DETAIL CARD
   OFF TO BYPASS TEST FOR LAST DETAIL CARD

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT DETAIL CARD
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

   G ON TO BACKSPACE AND READ ERROR RECORD AND LOAD INTO PRINT AREA.

D. TEST PROCEDURE

THE DETAIL CARD RECORD IN THE PRINT AREA (201-220) IS WRITTEN ON TAPE BY THE WRITE TAPE DRIVE. IF THERE ARE NO TAPE ERRORS, THE RECORD MAY BE PRINTED IF SENSE SWITCH C IS ON, OR BY-PASSED IF IT IS OFF.

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D. (CONTINUED)

IF A WRITE TAPE ERROR IS DETECTED, TWO SENSE SWITCHES MAY BE BROUGHT INTO PLAY. SENSE SWITCH G ON BACKSPACES THE ERROR RECORD AND READS IT INTO LOCATIONS 225-244. THESE INSTRUCTIONS ARE BY-PASSED IF THE SWITCH IS OFF. THE WORD ERROR IS THEN LOADED INTO LOCATIONS 281-285 AND THE ERROR,RESULTS ARE PRINTED IF SENSE SWITCH E IS OFF OR THE MACHINE STOPS AT LOCATION 910 IF IT IS ON. AFTER EITHER OF THESE INSTRUCTIONS, THE ERROR RECORD IS BACKSPACED AND SKIPPED.

E. STOPS

STORAGE ADDRESS REGISTER:

623	ERROR - WTM
910	ERROR - SENSE E ON
950	HALT - END OF REEL

F. PRINTOUTS

1. CORRECT

CARD RECORD	SENSE G ON FOR TAPE ERROR RECORD	TAPE DR 4
JJJJJJJJJJJJJJJJJJJ		TAPE WRITE
KKKKKKKKKKKKKKKKKKK		TAPE WRITE

2. ERROR

JJJJJJJJJJJJJJJJJJJ	JJJJJJJJJJIIIIIJJJJJ	TAPE WRITE ERROR
KKKKKKKKKKKKKKKKKKK	2222222222KKKKKKKKK	TAPE WRITE ERROR

G. COMMENTS

ADDITIONAL DETAIL CARDS MAY BE ADDED AS DESIRED TO TEST SPECIFIC BIT CONFIGURATION IN ADJACENT POSITIONS.

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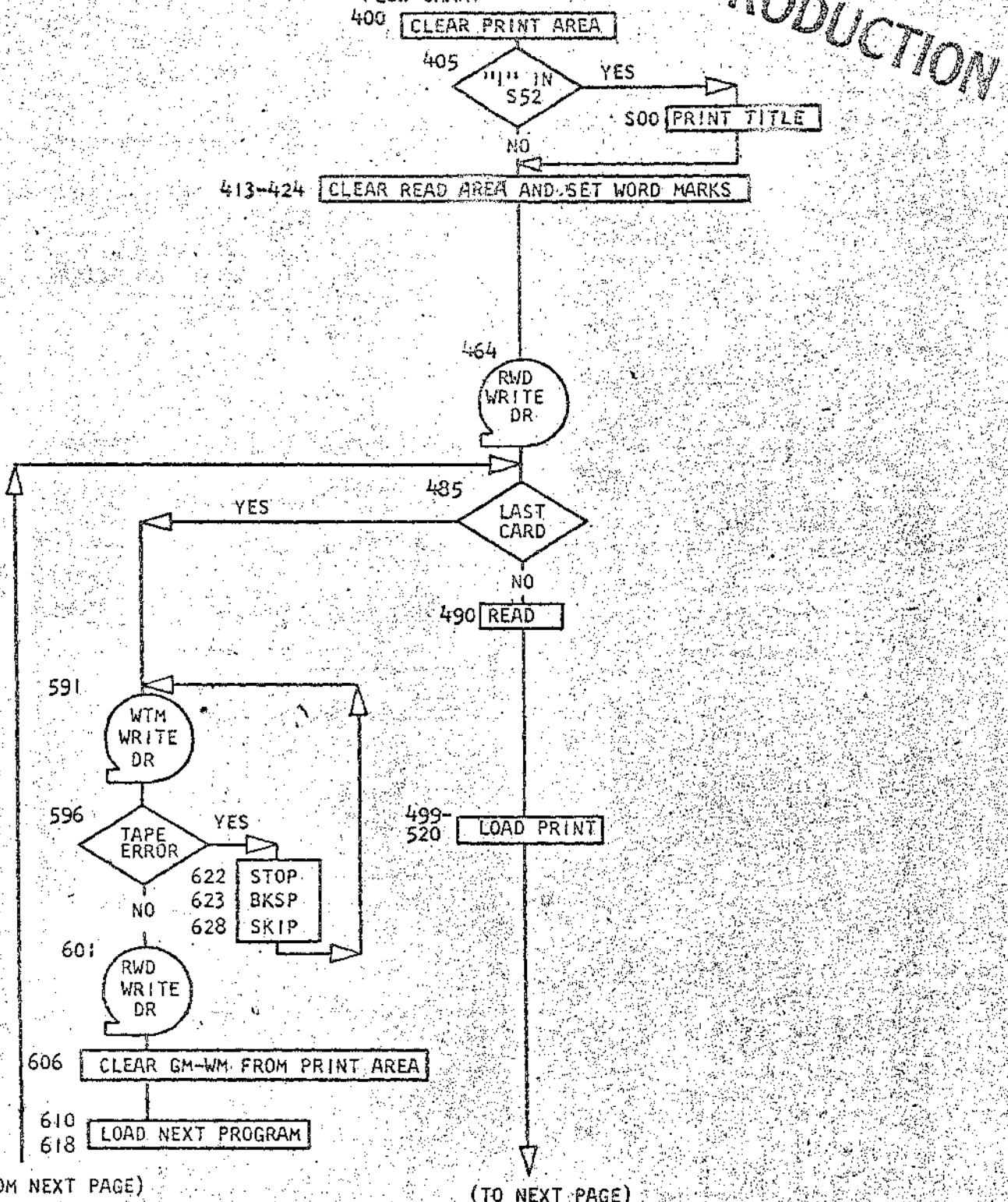
CARD TO TAPE
FLOW CHART



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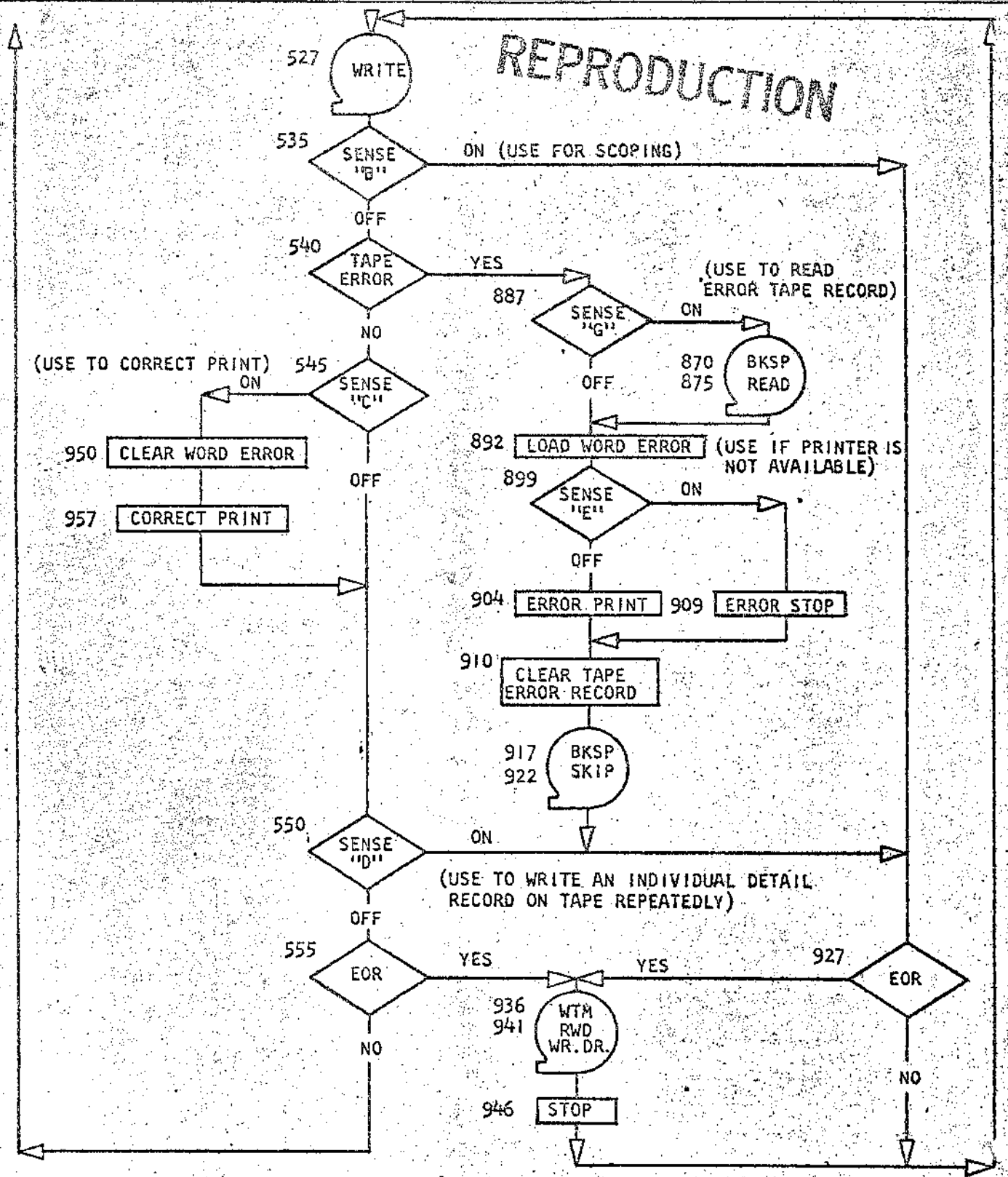
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451450
SHEET 4 OF 8
BLOCK NO. 5000C



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PROGRAM LISTING FOR USE WITH FLOW CHART

CARD TO TAPE 5000C

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	564	S681	*USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		"	
393	393	M	388	380	BYPASS DETAIL CARDS ON TAPE	
400	400	/	332		START TEST	
404	404	/				
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	/	080		CLEAR READ AREA	
417	417	,	001	078	SET WORD MARKS	
424	424	B	464		BRANCH TO CONTINUE	
464	464	U	%U4	R	REWIND	
469	469	B	485	348B	BRANCH WHEN TEST IS RUN FROM TAPE	
477	477	B	591	080A	BRANCH WHEN TEST IS RUN FROM CARDS	
485	485	B	591	A	BRANCH LAST CARD	SS
490	490	1			READ	
491	491	B	499		BRANCH TO CONTINUE	
499	499	L	/09	278	LOAD PRINT AREA	
506	506	L	080	299	"	
513	513	L	S50	221	"	
520	520	L	020	220	"	
527	527	L	%U4	201W	WRITE TAPE	
535	535	B	927	B	B ON TO SCOPE	SS
540	540	B	887	L	BRANCH ON TAPE ERROR	
545	545	B	950	C	C ON TO CORRECT PRINT ROUTINE	SS
550	550	B	927	D	D ON TO REPEAT	SS
555	555	B	936	K	BRANCH IF END OF REEL	
560	560	B	469		BRANCH TO READ NEXT CARD	
564	564	B	393	S631	USE WHEN TESTS ARE RUN FROM TAPE	
572	572	B	348		"	
591	591	U	%U4	M	WRITE TAPE MARK - END OF TEST	
596	596	B	622	L	BRANCH TO STOP IF TAPE ERROR	
601	601	U	%U4	R	REWIND - END OF TEST	
606	606	/	280		CLEAR GM-WM FROM PRINT AREA	
610	610	B	637	348B	BRANCH WHEN TEST IS RUN FROM TAPE	
618	618	B	361		LOAD NEXT TEST FROM CARDS IF NO GM	
622	622	.			WTM ERROR STOP	
623	623	U	%U4	B	BACKSPACE	
628	628	U	%U4	E	TAPE SKIP	
633	633	B	591		BRANCH TO WRITE TAPE MARK	
637	637	/	348	080	LOAD NEXT TEST	
870	870	U	%U4	B	BACKSPACE	
875	875	L	%U4	225R	READ ERROR TAPE RECORD	
883	883	B	892		BRANCH	
887	887	B	870	G	G ON TO READ TAPE ERROR RECORD	SS
892	892	L	/14	285	BEGIN ERROR ROUTINE	
899	899	B	909	E	E ON TO ERROR STOP	SS

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```
 904   904   2                          ERROR PRINT
 905   905   B 910                      BRANCH TO CLEAR TAPE ERROR RECORD
 909   909   .                          ERROR STOP
 910   910   L ÷29 244                  CLEAR TAPE ERROR RECORD
 917   917   U %U4 B                    BACKSPACE
 922   922   U %U4 E                    SKIP
 927   927   B 936 K                    END OF REEL
 932   932   B 527                      BRANCH TO WRITE TAPE
 936   936   U %U4 M                    WRITE TAPE MARK
 941   941   U %U4 R                    REWIND
 946   946   . 527                      STOP AND BRANCH TO WRITE TAPE
 950   950   L /19 285                  CORRECT PRINT ROUTINE
 957   957   2                            ,,
 958   958   B 550                      BRANCH TO SENSE D
1010   ÷10                              BLANKS TO CLEAR  PRT ERR REC
1100   /00   T APE  WRITE              CONSTANT
1110   /10   E RRO R                     ,,
1115   /15                              ,,
1120   /20   C ARD  RECORD              ,,
1140   /40   S ENS E G ON FOR TAPE      ,,
1160   /60   E RRO R RECORD             ,,
1180   /80   T APE  DR 4                ,,
1250   550                              GM WM IN 1250
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                CARD TO TAPE                    5000C 0A
,008015,022029,033033N      1001                SET WORDMARK CARD               5000C 02
L067367,340344,348349,3573611001,008012,0011001 1B361080A8348/340080            5000C 03
L069404,377385,393400,4044051001          8564S6818S88    M388380/332/          5000C 04
L072444,413417,424424,4244241001BS00S521/080,0010788464                         5000C 05
L072484,445445,464469,4774851001                    U%U4R8485348B591080A        5000C 06
L067519,490491,499506,5135201001B591A18499    L/09278L080299LS50221             5000C 07
L072559,527535,540545,5505551001L020220L%U4201WB9278B887LB950C8927D8936K        5000C 08
L068595,564572,591596,5965961001B4698393S6318348                   U%U4N        5000C 09
L064627,601606,610618,6226231001B622LU%U4R/28086373488836l.U%U4B                5000C 10
L072667,633637,637637,6376371001U%U4EB591/348080                                5000C 11
L067904,875883,887892,8999041001U%U4BL%U4225RB8928870GL/142858909E2              5000C 12
L063935,909910,917922,9279321001B910.L+29244U%U48U%U4EB936KB527                 5000C 13
L072975,941946,950957,9589581001U%U4MU%U4R.527L/1928528550                      5000C 14
L072/39,/10/15,/20/40,/40/401001TAPE WRITEERROR     CARD RECORD                 5000C 15
L072/79,/60/80,/80/80,/80/801001SENSE G ON FOR TAPE ERROR RECORD                5000C 16
L070S17,S00S01,S05S12,S13S171001TAPE DR 4          2,049L0772772/2772           5000C 17
L064S49,S25S29,S36S37,S41S451001¤/40/60¤/80L/892702/2702413                      5000C 18
L033S50,001001,001001,0010011001G                                               5000C 19
                              M
-/333080N                                   CLEAR WORDMARK CARD                 5000C 20
,019027,031,038042803IT98GB400L0463528W048S88   CARD TO TAPE                    5000C 21
                              M
```

DETAIL CARDS

```
G.G.G.G.G.G.G.G.G.G.                                                            5000C 22
                                BLANK                                           5000C 23
                                                                                5000C 24
                                                                                5000C 25
                                AMPERSAND                                       5000C 26
                                                                                5000C 27
                                                                                5000C 28
                                MINUS SIGN                                      5000C 29
                                                                                5000C 30
                                                                                5000C 31
                                                                                5000C 32
                                                                                5000C 33
                                                                                5000C 34
                                PLUS ZERO                                       5000C 35
                                                                                5000C 36
                                                                                5000C 37
                                                                                5000C 38
                                                                                5000C 39
                                                                                5000C 40
```

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MINUS ZERO

FFFFFFFFFFFFFFFFFFFF	5000C 41
GGGGGGGGGGGGGGGGGGGG	5000C 42
HHHHHHHHHHHHHHHHHHHH	5000C 43
IIIIIIIIIIIIIIIIIIII	5000C 44
MMMMMMMMMMMMMMMMMMMM	5000C 45
ZZZZZZZZZZZZZZZZZZZZ	
JJJJJJJJJJJJJJJJJJJJ	5000C 46
KKKKKKKKKKKKKKKKKKKK	5000C 47
LLLLLLLLLLLLLLLLLLLL	5000C 48
MMMMMMMMMMMMMMMMMMMM	5000C 49
NNNNNNNNNNNNNNNNNNNN	5000C 50
OOOOOOOOOOOOOOOOOOOO	5000C 51
PPPPPPPPPPPPPPPPPPPP	5000C 52
QQQQQQQQQQQQQQQQQQQQ	5000C 53
RRRRRRRRRRRRRRRRRRRR	5000C 54
SSSSSSSSSSSSSSSSSSSS	5000C 55
TTTTTTTTTTTTTTTTTTTT	5000C 56
UUUUUUUUUUUUUUUUUUUU	5000C 57
VVVVVVVVVVVVVVVVVVVV	5000C 58
WWWWWWWWWWWWWWWWWWWW	5000C 59
XXXXXXXXXXXXXXXXXXXX	5000C 60
YYYYYYYYYYYYYYYYYYYY	5000C 61
ZZZZZZZZZZZZZZZZZZZZ	5000C 62
11111111111111111111	5000C 63
22222222222222222222	5000C 64
33333333333333333333	5000C 65
44444444444444444444	5000C 66
55555555555555555555	5000C 67
66666666666666666666	5000C 68
77777777777777777777	5000C 69
88888888888888888888	5000C 70
99999999999999999999	5000C 71
00000000000000000000	5000C 72
3¤3¤3¤3¤3¤3¤3¤3¤3¤3¤	5000C 73
1F1F1F1F1F1F1F1F1F1F	5000C 74
ABCDEFGHIJKLMNOPQRST	5000C 75
UVWXYZ1234567890-+XX	5000C 76

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TAPE TO PUNCH/PRINTER

A. PURPOSE OF TEST

TO READ INTO THE PUNCH AND PRINT AREAS THE 20-CHARACTER TAPE RECORDS THAT WERE WRITTEN ON TAPE DURING THE CARD-TO-TAPE TEST (BLOCK NUMBER 5000).

B. LOADING PROCEDURE

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1268, 1261 AND 1262.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT INDIVIDUAL RECORD WHEN USED WITH B ON
   OFF TO REPEAT ALL RECORDS WHEN USED WITH B ON

   E ON TO STOP ON ERROR
   OFF TO PRINT ERRORS

   G ON TO REPEAT ENTIRE TEST
   OFF TO CONTINUE

D. TEST PROCEDURE

THE INDIVIDUAL TAPE RECORDS ARE READ INTO STORAGE. IF AN ERROR IS DETECTED THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE.

WHEN THE TAPE MARK IS SENSED BY THE READ TAPE DRIVE UNIT, AN END-OF-REEL CONDITION IS RECOGNIZED WHICH PROCEEDS TO LOAD THE NEXT PROGRAM IF SENSE SWITCH G IS OFF OR REPEATS THE TEST IF IT IS ON.

E. STOPS

917 IN STORAGE ADDRESS REGISTER: ERROR SENSE E ON

F. PRINTOUTS

1. CORRECT

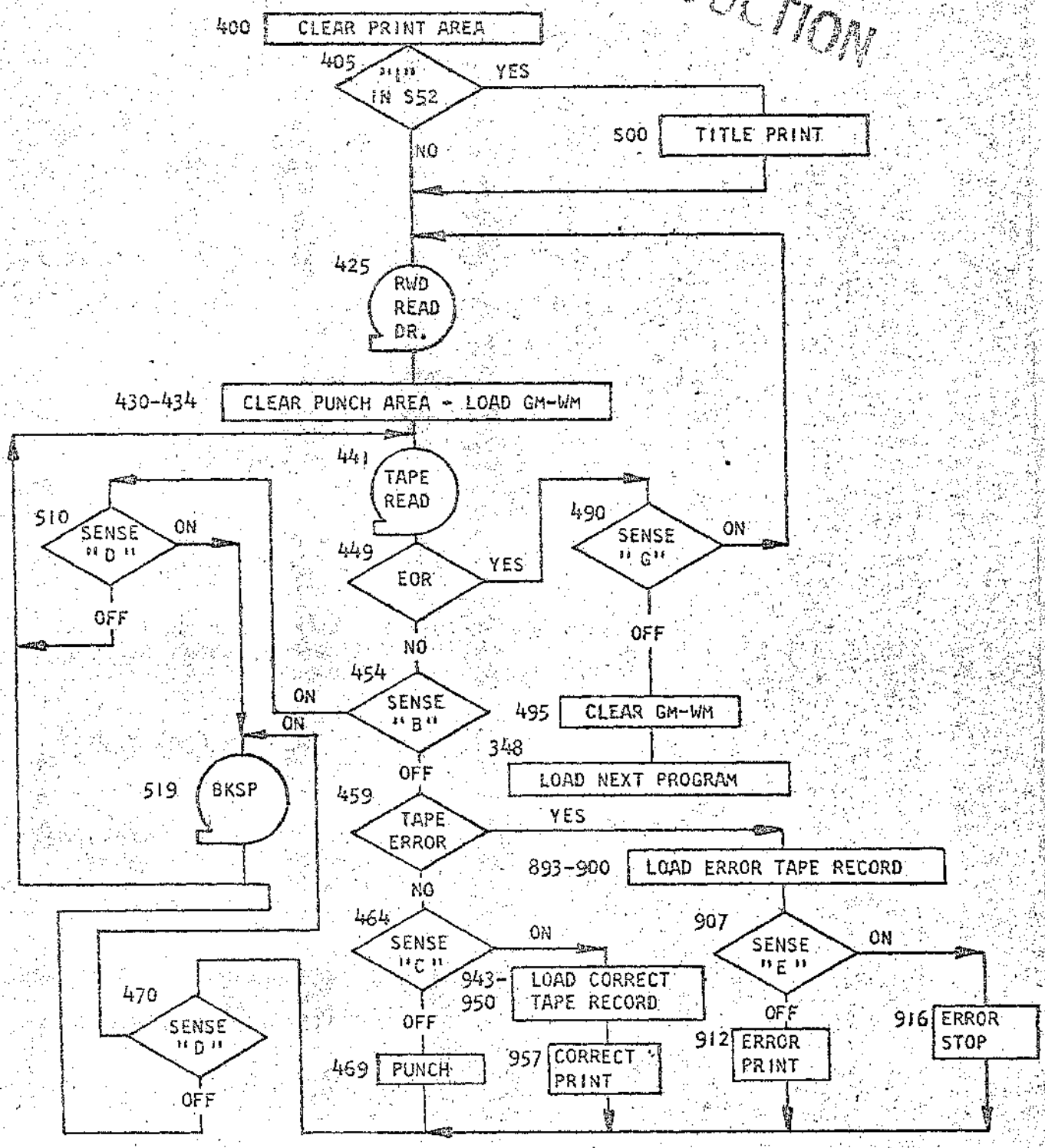
TAPE RECORD	TAPE DR 4
JJJJJJJJJJJJJJJJJJJ	TAPE READ
KKKKKKKKKKKKKKKKKKK	TAPE READ

2. ERROR

JJJJJ!!!JJJJJ!JJJJJJ	TAPE READ ERROR
KKK22222KKKKK2KKKKK	TAPE READ ERROR

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

TAPE TO PUNCH/PRINTER FLOW CHART



DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

TAPE TO PUNCH/PRINTER 5010C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	528	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	425		
425	425	U	%U4	R	REWIND
430	430	/	180		CLEAR PUNCH AREA
434	434	L	S50	121	LOAD GM WM IN LOC 121
441	441	L	%U4	101R	READ TAPE
449	449	B	490	K	BRANCH IF END OF REEL
454	454	B	510	B	SENSE B ON TO SCOPE SS
459	459	B	893	L	BRANCH ON TAPE ERROR
464	464	B	943	C	C ON TO CORRECT PRINT ROUTINE SS
469	469	4			PUNCH OR NO OP C FOR TA
470	470	B	519	D	BRANCH TO BACKSPACE. SHORT RUNS ONLY SS
470	470	B	519	D	OR TAPE WILL BE DAMAGED
475	475	B	441		BRANCH
490	490	B	425	G	G ON TO REPEAT TEST SS
495	495	/	181		CLEAR GM WMS
499	499	B	348		BRANCH TO PROGRAM CHAINING ROUTINE
510	510	B	519	D	BRANCH TO BACKSPACE. SHORT RUNS ONLY SS
515	515	B	441		BRANCH TO READ TAPE
519	519	U	%U4	B	BACKSPACE
524	524	B	441		BRANCH TO READ TAPE
528	528	B	540	S611	USE WHEN TESTS ARE RUN FROM TAPE
536	536	B	348		,,
540	540	B	400	S621	,,
548	548	B	348		,,
893	893	L	120	220	LOAD ERROR TAPE RECORD IN PRINT AREA
900	900	L	986	285	LOAD ERROR COMMENT IN PRINT AREA
907	907	B	916	E	E ON TO ERROR STOP SS
912	912	2	470		ERROR PRINT - BRANCH TO SENSE D
916	916	.			ERROR STOP
917	917	B	470		BRANCH TO SENSE D
943	943	L	120	220	LOAD CORRECT TAPE RECORD IN PRINT AREA
950	950	L	#06	285	,,
957	957	2	470		CORRECT PRINT - BRANCH TO SENSE D
961	961				WORD MARK
972	972	T	APE	READ ERROR	CONSTANT
992	992	T	APE	READ	,,
1120	/20	T	APE	RECORD	,,
1140	/40				,,

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ENG CHG. NO.	110378	117628	TA 1976					

1160 /60
1180 /80 T APE DR 4
1250 S50

GROUP MARK IN S50

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    TAPE TO PUNCH/PRINTER     5010C 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD         5010C 02
L067367,340344,348349,357361!1001,008012,001100!1B361080AB348/340080            5010C 03
L069404,377385,400404,405405!001          B528S6818S88              /332/       5010C 04
L068440,413425,430434,441441!001BS00S5218425          U%U4R/180LS50121          5010C 05
L066474,449454,459464,469470!001L%U4101RB490KB510B8893LB943C485519D             5010C 06
L072514,490495,499510,515515!001B441              8425G/1818348        B519D5010C 07
L065547,519524,528536,540548!001B441U%U4BB4418540S611B348B400S621               5010C 08
L072587,001001,001001,001001!001B348                                            5010C 09
L071906¤868868,893900,9079071001                          L!20220L986285        5010C 10
L068942,912916,917943,943943!001B916E2470.8470                                  5010C 11
L072982,950957,961972,972972!001L!20220L*062852470          TAPE READ E5010C 12
L072*22¤983983,992992,992992!001RROR     TAPE READ                              5010C 13
L069/39¤/03/03,/20/40,/40/40!001                TAPE RECORD                     5010C 14
L072/79,/60/80,/80/80,/80/80!001                                                5010C 15
L070S17,S00S01,S05S12,S13S17!001TAPE DR 4          2,049L0772772/2772           5010C 16
L064S49,S25S29,S36S37,S41S45!001¤/40/60¤/80L/892702/2702413                      5010C 17
L033S50,001001,001001,001001!001G                                               5010C 18
                                M
/333080N                                          CLEAR WORDMARK CARD           5010C 19
,019027,031,038042803!T98GB400L0463528W048S88     TAPE TO PUNCH/PRINTER         5010C 20
                                N
```

DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

DIAGNOSTIC FUNCTION TEST

TAPE TO TAPE

A. PURPOSE OF TEST

TO TRANSFER FROM ONE TAPE TO ANOTHER 20 CHARACTER RECORDS THAT WERE WRITTEN DURING THE CARD TO TAPE TEST (BLOCK 5000)

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

A. SET TAPE DRIVE 4 TO READ DETAIL RECORDS.
B. SET TAPE DRIVE 5 TO WRITE DETAIL RECORDS
C. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

A. SET TAPE DRIVE 4 TO READ DETAIL RECORDS
B. SET TAPE DRIVE 5 TO WRITE DETAIL RECORDS
C. ENTER A 1 IN 1267

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT ERRORS
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO CONTINUE

G ON TO REPEAT ENTIRE TEST
OF TO CONTINUE

D. TEST PROCEDURE

RECORDS READ FROM TAPE DRIVE NUMBER 4 ARE LOADED INTO LOCATIONS 201-220. IF THE TAPE RECORD IS READ CORRECTLY, IT IS TRANSFERRED TO LOCATIONS 225-244 AND WRITTEN ON TAPE BY TAPE DRIVE NUMBER 5.

IF THE RECORD IS READ INCORRECTLY FROM TAPE DRIVE NUMBER 4, THE PROGRAM BRANCHES TO A TAPE READ ERROR ROUTINE AND THE ERROR RECORD MAY BE PRINTED WITH A "TAPE READ ERROR" INDICATION OR THE MACHINE MAY BE STOPPED DEPENDING UPON THE SETTING

D. (CONTINUED)

OF SENSE SWITCH E. IF SWITCH D IS OFF, THE PROGRAM PROCEEDS TO READ THE NEXT TAPE RECORD; IF IT IS ON, A BACKSPACE INSTRUCTION IS EXECUTED AND THE SAME RECORD IS RE-READ AND RE-PRINTED OR RE-READ AND RE-STOPPED AS OFTEN AS IT IS READ INCORRECTLY.

IF THE RECORD IS READ CORRECTLY BUT WRITTEN ON TAPE INCORRECTLY, THE PROGRAM BRANCHES TO A TAPE WRITE ERROR ROUTINE AND THE RESULTS ARE PRINTED WITH A "TAPE WRITE ERROR" INDICATION WITH SENSE SWITCH E OFF OR THE MACHINE STOPPED WITH THE SWITCH ON. IF SWITCH D IS OFF, THE PROGRAM PROCEEDS TO BACKSPACE AND ERASE THE RECORD WRITTEN ON TAPE IN ERROR AND CONTINUES WITH THE NEXT; IF SWITCH D IS ON, THE ERROR RECORD IS RE-WRITTEN ON TAPE, AND THE RESULTS RE-PRINTED OR THE MACHINE RE-STOPPED AS OFTEN AS TAPE WRITE ERRORS OCCUR.

E. STOPS

STORAGE ADDRESS REGISTER

501	HALT-END OF REEL, TAPE DRIVE 5
586	TAPE READ ERROR-SENSE E ON
936	TAPE WRITE ERROR-SENSE E ON

F. PRINTOUTS

1. CORRECT

RECORD READ FROM DR4	SHOULD BE WRITTEN ON DR5
JJJJJJJJJJJJJJJJJJJ	JJJJJJJJJJJJJJJJJJJ
KKKKKKKKKKKKKKKKKKK	KKKKKKKKKKKKKKKKKKK

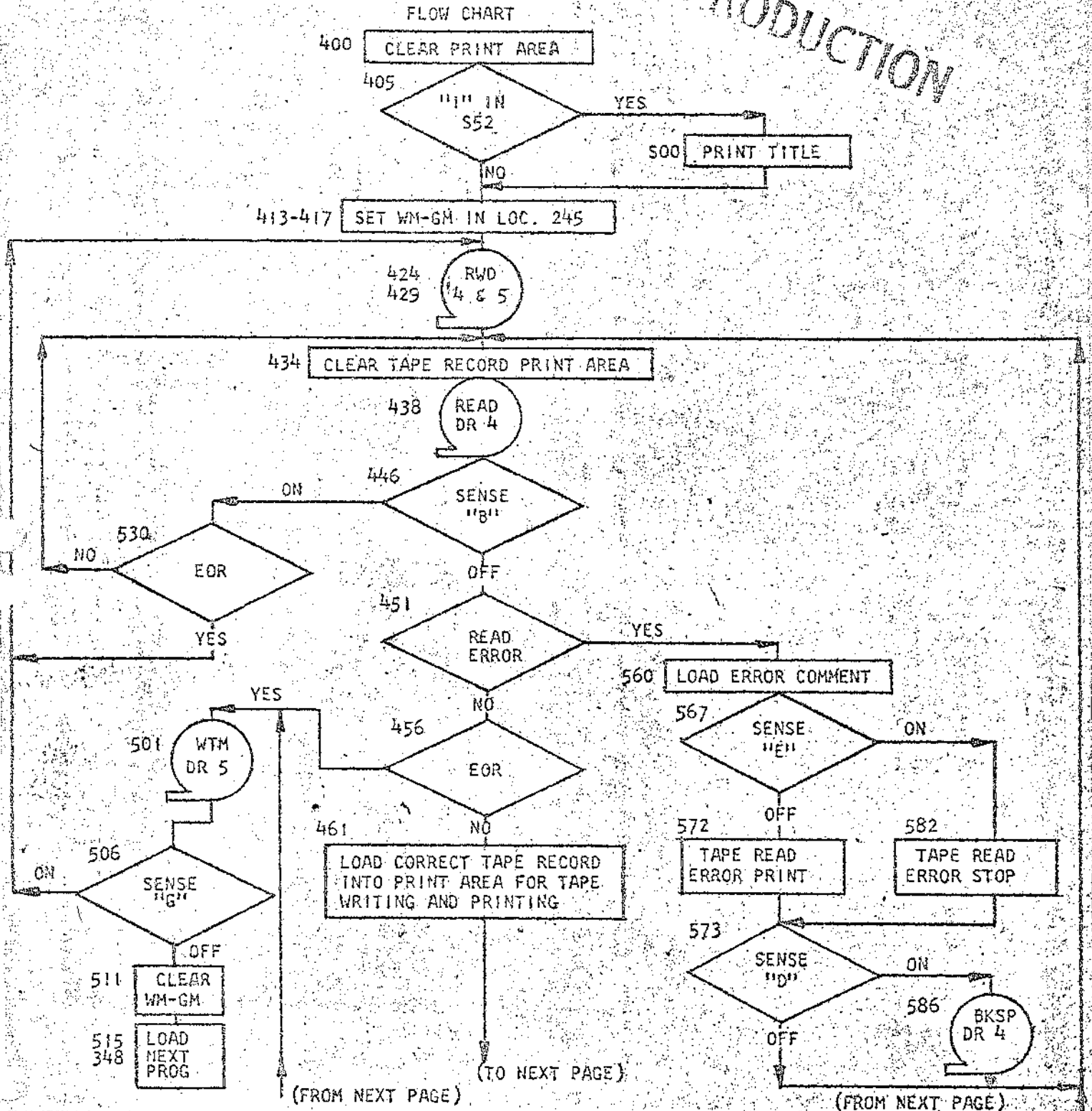
2. ERRORS

JJJJJJJ!!!JJJJ!!!!JJ		TAPE DR 4 READ ERROR
KKKKKKKKKKKKKKKKKKK	KKKKKKKKKKKKKKKKKKK	TAPE DR 5 WRITE ERROR

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CNG. NO.	110378	110378A	117628	TA 1976				

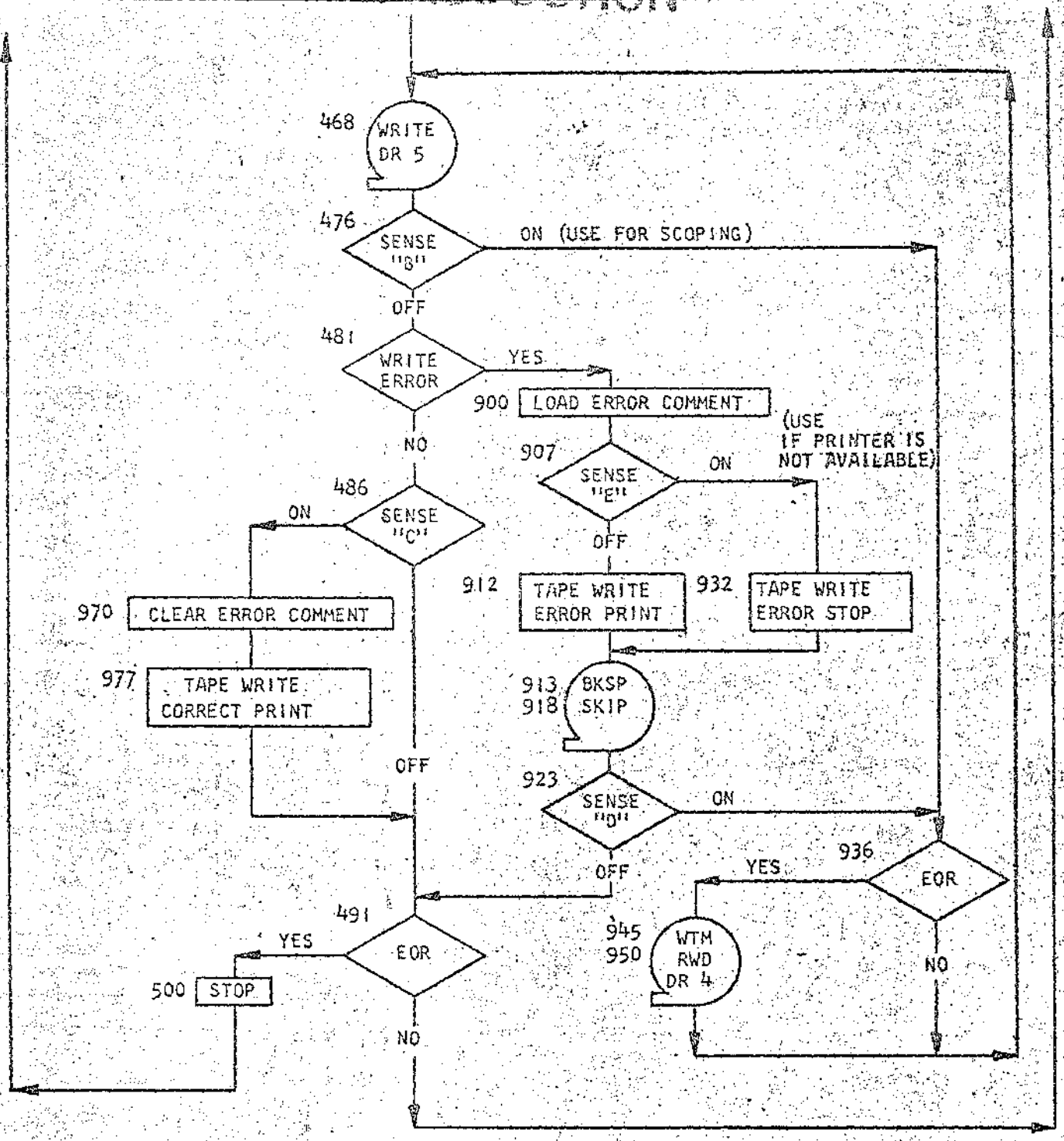
TAPE TO TAPE

FLOW CHART



DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

TAPE TO TAPE 5020C

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	400	S671	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		" "	
400	400	/	332		START TEST	
404	404	/			" "	
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	N				
417	417	L	S50	245	SET GROUP MARK IN 245	
424	424	U	%U4	R	REWIND DRIVE 4	
429	429	U	%U5	R	REWIND DRIVE 5	
434	434	/	244		CLEAR TAPE READ AND TAPE WRITE AREAS	
438	438	L	%U4	201R	READ TAPE RECORD INTO LOCS. 201-220	
446	446	B	530	B	B ON TO SCOPE	SS
451	451	B	560	L	BRANCH IF TAPE READ ERROR	
456	456	B	501	K	BRANCH IF END OF REEL	
461	461	L	220	244	LOAD CORRECT TAPE RECORD INTO 225-244	
468	468	L	%U5	225W	WRITE CORRECT TAPE RECORDS FROM 225-244	
476	476	B	936	B	B ON TO SCOPE	SS
481	481	B	900	L	BRANCH ON TAPE WRITE ERROR	
486	486	B	970	C	C ON TO CORRECT PRINT ROUTINE	SS
491	491	B	500	K	BRANCH IF END OF REEL	
496	496	B	434		BRANCH	
500	500	.			END OF TAPE DRIVE 5	
501	501	U	%U5	M	WRITE TAPE MARK DRIVE 5	
506	506	B	424	G	G ON TO REPEAT TEST	SS
511	511	/	299		CLEAR WORD AND GROUP MARKS	
515	515	B	348		BRANCH TO PROGRAM CHAINING ROUTINE	
530	530	B	424	K	BRANCH IF END OF REEL	
535	535	B	434		BRANCH	
560	560	L	÷69	285	BEGIN TAPE READ ERROR PRINT ROUTINE	
567	567	B	582	E	E ON TO ERROR STOP	
572	572	2			TAPE READ ERROR PRINT	
573	573	B	586	D	D ON TO REPEAT RECORD	SS
578	578	B	434		D OFF READ NEXT TAPE RECORD	
582	582	.	573		TAPE READ ERROR STOP	
586	586	U	%U4	B	BACKSPACE READ DRIVE	
591	591	B	434		BRANCH TO READ TAPE	
900	900	L	÷89	285	BEGIN TAPE WRITE ERROR PRINT ROUTINE	
907	907	B	932	E	E ON TO ERROR STOP	
912	912	2			TAPE WRITE ERROR PRINT	
913	913	U	%U5	B	BACKSPACE	
918	918	U	%U5	E	SKIP	
923	923	B	936	D	D ON TO REPEAT RECORD	SS
928	928	B	491		D OFF ADVANCE TO NEXT RECORD	

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CHG. NO.	110378	110378A	117628	TA 1978				

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 932  932   .  913                    TAPE WRITE ERROR STOP
 936  936   B  945  K                 BRANCH ON END OF REEL
 941  941   B  468                    BRANCH TO WRITE TAPE
 945  945   U  &U5  M                 WRITE TAPE MARK DRIVE 5
 950  950   U  &U5  R                 REWIND TAPE DRIVE 5
 955  955   B  468                    BRANCH
 970  970   M  ÷00  285               BEGIN CORRECT PRINT ROUTINE
 977  977   2  491                    CORRECT PRINT
 981  981                             WORD MARK
1050  ÷50   T  APE   DR 4 READ ERROR
1070  ÷70   T  APE   DR5 WRITE ERROR
1120  /20   R  ECO RD READ FROM DR4
1140  /40        SHOULD BE WRITTE
1160  /60   N  ON  DR5
1180  /80                             BLANKS
1250  S50                             GROUP MARK IN 1250
```

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CHG. NO.	110378	110378A	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	OE-OELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    TAPE TO TAPE                5020C 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD           5020C 02
L067367,340344,348349,357361001,008012,001100118361080AB348/340080             5020C 03
L069404,377385,400404,405405100I          8400S6718S88          /332/         5020C 04
L065437,413417,424429,434438100IBS00S52IN   LS50245U%U4RU%U5R/244              5020C 05
L070475,446451,456461,468476100IL%U420IRB5308B560LB501KL220244L%U5225W          5020C 06
L062505,481486,491496,500501100I8936BB900L8970CB500K8434.U%U5M                  5020C 07
L072545,511515,530535,535535100I8424G/299B348          B424K8434                5020C 08
L064577¤546546,560567,5725731001                  L¢69285858ZE28586D            5020C 09
L072617,582586,591591,591591100I8434.573U%U488434                              5020C 10
L064931,907912,913918,923928100IL¢89285B932E2U%U5BU%U5EB936D8491                5020C 11
L070969,936941,945950,9559701001.913B945KB468U%U5MU%U5R8468                     5020C 12
L072¢09,977981,981981,981981100IM¢002852491                                     5020C 13
L072¢89,¢70¢70,¢70¢70,¢70¢701001TAPE DR 4 READ ERRORTAPE DR5 WRITE ERROR5020C 14
L072/29¤¢90¢90,/20/20,/20/201001                                RECORD REA5020C 15
L072/69¤/30/30,/40/80,/60/6010011D FROM DR4    SHOULD BE WRITTEN ON DR5         5020C 16
L067S04¤/70/70,/80S00,S01S051001                                2,049           5020C 17
L063S35,S12S13,S17S18,S25S29100IL0772772/2772¤/40/60¤/80L/89270                 5020C 18
L047S50,S37S41,S45S50,S50S5010012/2702413    G                                  5020C 19
                                             M
/333080N                                      CLEAR WORDMARK CARD               5020C 20
,019027,031,038042803IT98GB400L0463528W048S88  TAPE TO TAPE                     5020C 21
                  M
```

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG CHG. NO.	110378	110378A	117628	TA 1976				

BACKSPACE SKIP

A. PURPOSE OF TEST

TO TEST THE BACKSPACE AND SKIP (ERASE FORWARD) CIRCUITRY BY TRANSFERRING TWO FIXED-LENGTH RECORDS FROM STORAGE TO TAPE AND BACKSPACING, SKIPPING, AND RE-WRITING THE SECOND RECORD TEN TIMES; THEN COMPARING BOTH TAPE RECORDS WITH THE TWO RECORDS IN STORAGE. ERRORS IN TAPE WRITE, TAPE READ, OR COMPARING ARE IDENTIFIED.

B. LOADING PROCEDURE

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1268

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
     OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
     OFF TO CONTINUE

   D ON TO REPEAT READ PORTION OF PROGRAM
     OFF TO CONTINUE

   E ON TO STOP ON ERROR
     OFF TO PRINT ERROR

   G ON TO REPEAT ENTIRE TEST
     OFF TO CONTINUE

D. TEST PROCEDURE

TWO FIXED LENGTH RECORDS ARE TRANSFERRED FROM STORAGE TO TAPE. RECORD 1 IS 11111111111; RECORD 2 IS RWRWRWRWRW. RECORD 2 IS BACKSPACED, SKIPPED, AND RE-WRITTEN TEN TIMES UNDER CONTROL OF A RE-WRITE COUNTER IN LOCATIONS 1054-1056, RESULTING IN APPROXIMATELY 80 INCHES OF BLANK TAPE BETWEEN RECORD 1 AND RECORD 2. THE TAPE DRIVE IS BACKSPACED TWICE AND READS BOTH TAPE RECORDS BACK INTO STORAGE AND COMPARES THEM WITH THE TWO FIXED-LENGTH RECORDS LOADED IN STORAGE BY THE PROGRAM.

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CHG. NO.	110378	110378A	117628	TA 1976				

D. (CONTINUED)

THE ENTIRE PROGRAM IS REPEATED TEN TIMES UNDER CONTROL OF A PASS COUNTER IN LOCATIONS 1052-1053.

ERRORS IN TAPE WRITE, TAPE READ, AND COMPARE ARE INDICATED ON THE PRINTOUT RESULTS BY PASS NUMBER, OPERATION (WRITE OR READ), AND TYPE OF ERRORS (TAPE OR COMPARE) WHEN SENSE SWITCH E IS SET TO THE OFF POSITION. WHEN THE SWITCH IS SET TO THE ON POSITION, TYPES OF ERRORS ARE SIGNALLED BY ERROR STOPS.

E. STOPS - SENSE E ON

STORAGE ADDRESS REGISTER	TYPE OF ERRORS	ERROR IDENT.	LOCATION
647	TAPE WRITE RECORD 1 (1111111111)	"T"	229
	TAPE WRITE RECORD 2 (RWRWRWRWRW)	"T"	263
969	TAPE READ RECORD 1	"T"	229
	COMPARE RECORD 1	"C"	238
	TAPE READ RECORD 2	"T"	263
	COMPARE RECORD 2	"C"	272

F. PRINTOUTS

1. CORRECT

PASS	OPER.	RECORD ONE	TYPE OF ERRORS	RECORD TWO	TYPE OF ERRORS
01	WRITE	1111111111		RWRWRWRWRW	
01	READ	1111111111		RWRWRWRWRW	

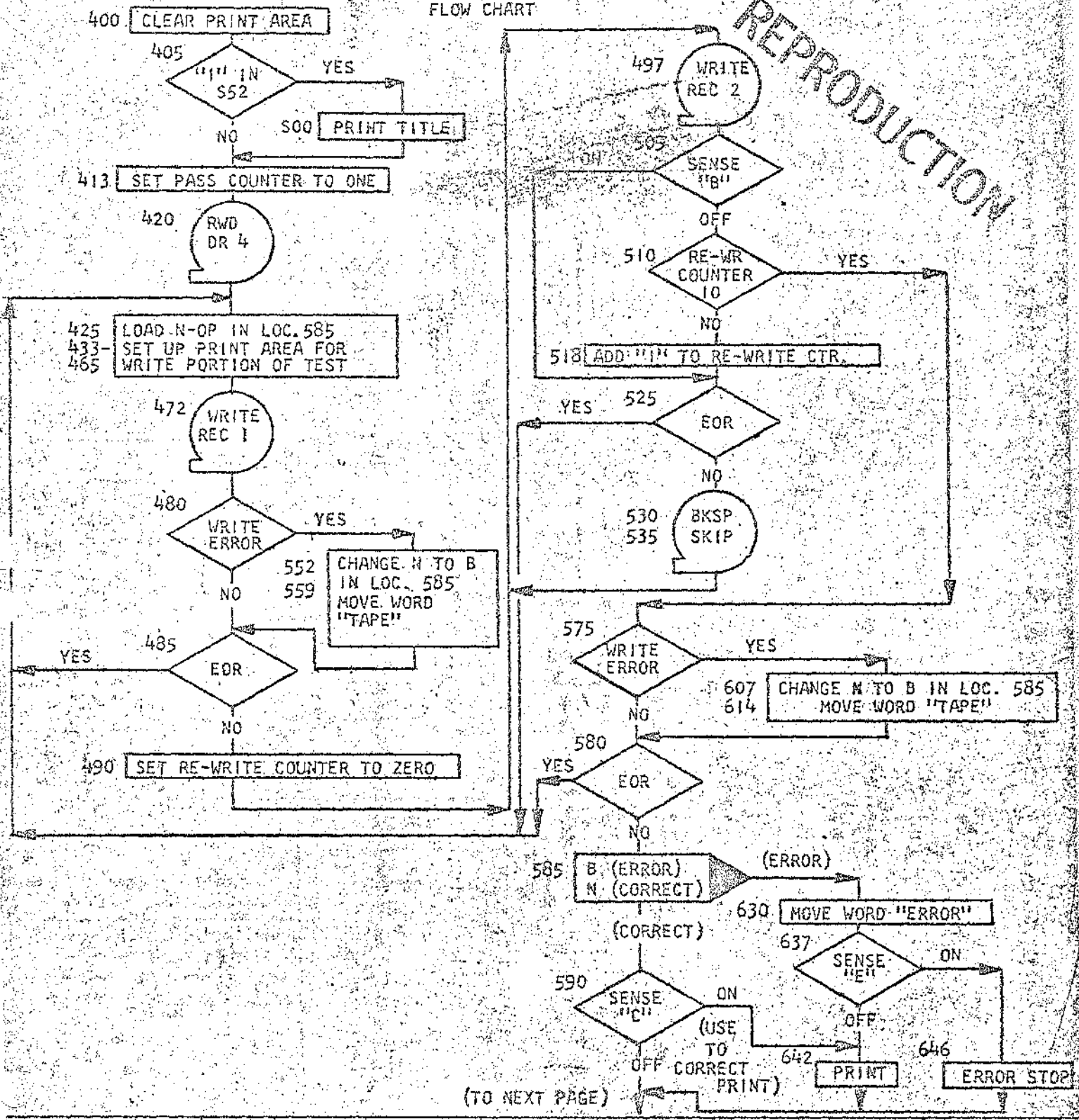
2. ERROR

PASS	OPER.	RECORD ONE	TYPE OF ERRORS	RECORD TWO	TYPE OF ERRORS	
01	WRITE	1111111111	TAPE*	RWRWRWRWRW	TAPE*	ERROR
01	READ	1111111111	TAPE* COMPARE#	RWRWRWRWRW	TAPE* COMPARE#	ERROR (WORD MARKS)

NOTE: *THE WORD "TAPE" IS PRINTED WHENEVER AN ERROR OCCURRED IN WRITING OR READING RECORD 1 OR RECORD 2.

#THE WORD "COMPARE" IS PRINTED WHENEVER RECORD 1 OR RECORD 2 AS WRITTEN ON TAPE DID NOT COMPARE WITH RECORD 1 OR RECORD 2 AS STORED BY THE PROGRAM.

BACKSPACE SKIP FLOW CHART

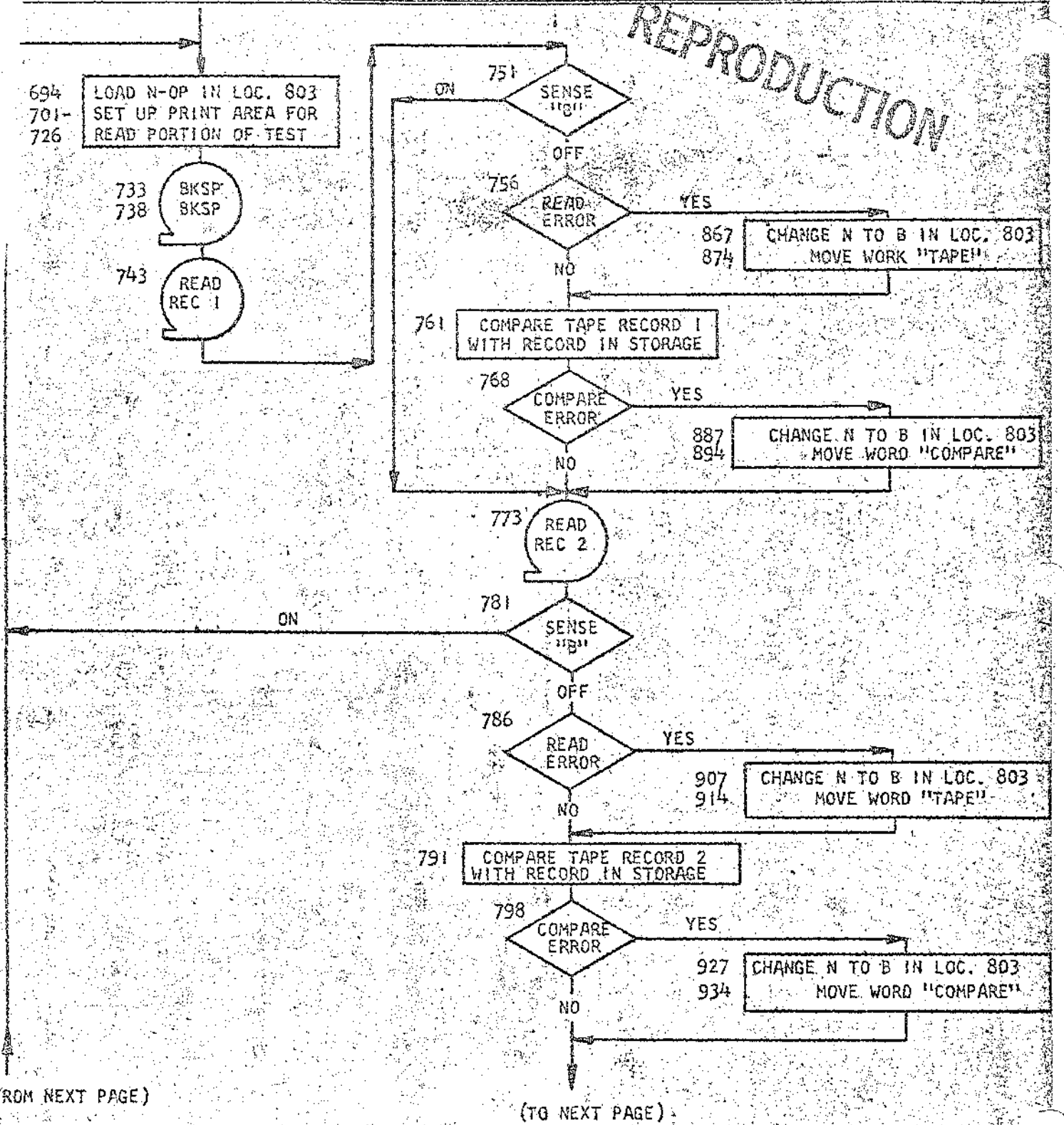


DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CHG. NO.	210378	210378-1	117628	TA 1976				

FORM 624-7113-0

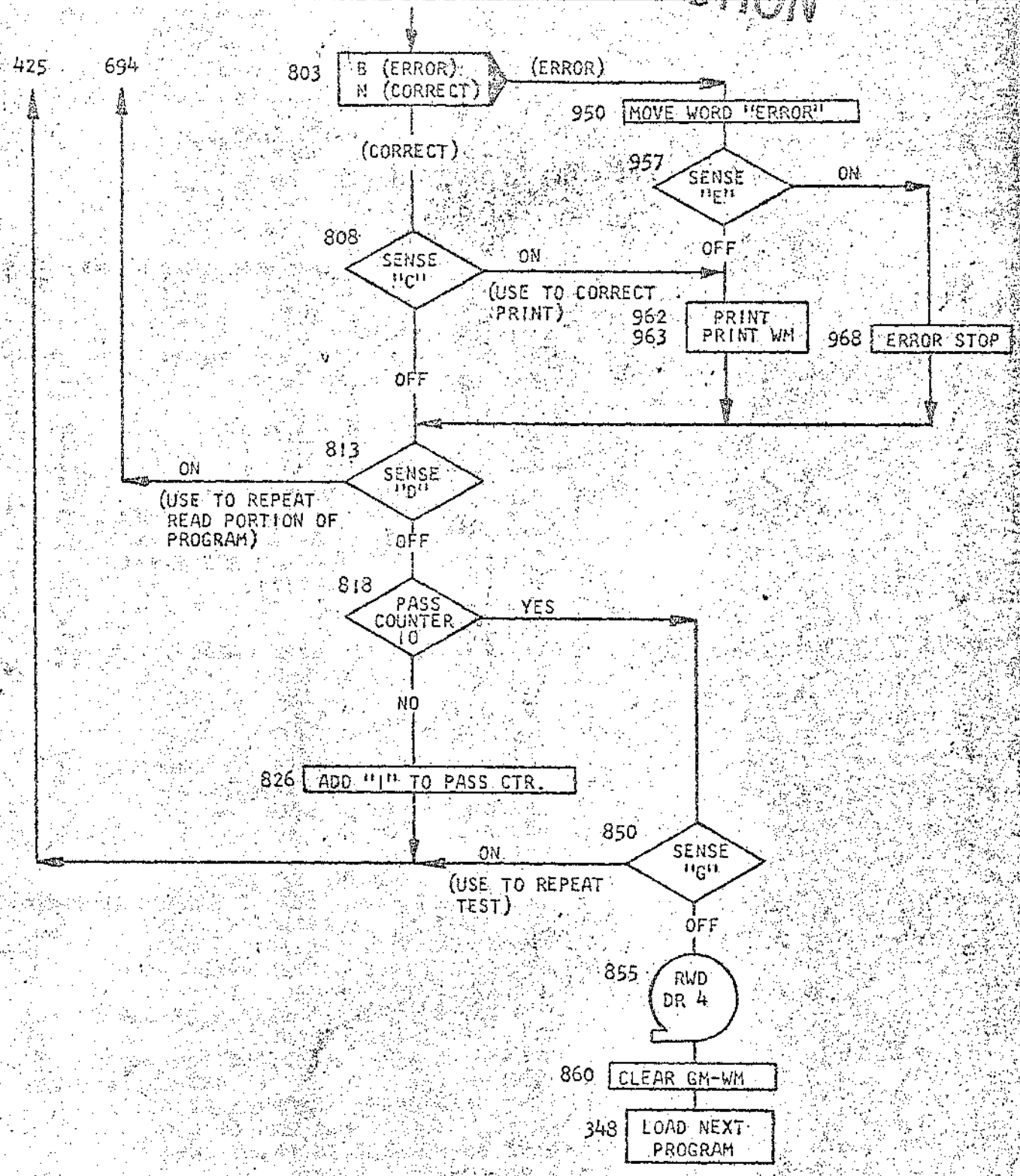
DIAGNOSTIC FUNCTION TEST

SHEET 5 OF 9
BLOCK NO. 50308



DATE	2-2-61	2-152637	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-A	117628	TA 1976				

DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	2-15-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-A	117628	TA 1976				

349 => CBA2M

PROGRAM LISTING FOR USE WITH FLOW CHART

BACKSPACE SKIP 5030C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	M	÷34	÷53	SET PASS COUNTER TO ONE
420	420	U	%U4	R	REWIND
425	425	L	432	585	LOAD -N- IN LOCATION 585
432	432	N			NOP
433	433	/	299		CLEAR PRINT AREA
437	437	M	÷53	203	MOVE PASS NO. IN PRINT AREA
444	444	M	÷64	211	MOVE WORD -WRITE- IN PRINT AREA
451	451	L	÷30	226	LOAD RECORD 1 + GM IN PRINT AREA
458	458	L	÷50	260	LOAD RECORD 2 + GM IN PRINT AREA
465	465	,	226	260	SET WM IN GM LOCATIONS
472	472	U	%U4	B	TEST FOR BACKSPACE AT LP
477	477	L	%U4	216W	WRITE RECORD 1
485	485	B	552	L	BRANCH IF TAPE WRITE ERROR
490	490	B	420	K	BRANCH IF END OF REEL
495	495	M	÷33	÷56	SET RE-WRITE COUNTER TO ZERO
502	502	L	%U4	250W	WRITE RECORD 2
510	510	B	530	B	B ON TO SCOPE SS
515	515	B	575	÷551	BRANCH IF 10 IN RE-WRITE COUNTER
523	523	A	÷20	÷56	ADD 1 TO RE-WRITE COUNTER
530	530	B	420	K	BRANCH IF END OF REEL
535	535	U	%U4	B	BACKSPACE
540	540	U	%U4	E	SKIP
545	545	B	502		BRANCH TO REWRITE RECORD 2
552	552	L	405	585	LOAD -B- IN LOC. 585 TO BRANCH ON ERROR
559	559	M	÷72	232	MOVE TAPE WRITE ERROR TO PRINT
566	566	B	490		BRANCH TO TEST FOR END OF REEL
575	575	B	607	L	BRANCH IF TAPE WRITE ERROR
580	580	B	420	K	BRANCH IF END OF REEL
585	585	N	630		*NOP IF NO ERRORS - BRANCH IF ANY ERRORS
590	590	B	642	C	C ON TO CORRECT PRINT SS
595	595	B	694		BRANCH TO BEGIN READ PORTION OF TEST
607	607	L	405	585	LOAD -B- IN LOC. 585 TO BRANCH ON ERROR
614	614	M	÷72	266	MOVE TAPE WRITE ERROR TO PRINT
621	621	B	580		BRANCH TO TEST FOR END OF REEL
630	630	M	÷84	285	MOVE WORD ERROR TO PRINT AREA
637	637	B	646	E	E ON TO ERROR STOP SS
642	642	2	694		PRINT
646	646	.			ERROR STOP

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647  647  B  694                 BRANCH TO BEGIN READ PORTION OF TEST
694  694  L  432  803            LOAD -N- IN LOCATION 803
703  703  /  299                 CLEAR PRINT AREA
705  705  M  #53  203            MOVE PASS NO. IN PRINT AREA
712  712  M  #68  210            MOVE WORD -READ- IN PRINT AREA
719  719  L  S50  226            LOAD GM-WM FOR RECORD 1
726  726  L  S50  260            LOAD GM-WM FOR RECORD 2
733  733  U  %U4  B              BACKSPACE
738  738  U  %U4  B              BACKSPACE
743  743  L  %U4  216R           READ RECORD 1 FROM TAPE
751  751  B  773  B              B ON TO SCOPE                          SS
756  756  B  867  L              BRANCH IF TAPE READ ERROR
761  761  C  225  #29            COMPARE TAPE REC 1 WITH REC IN STORAGE
768  768  B  887  /              BRANCH IF ERROR
773  773  L  %U4  250R           READ RECORD 2 FROM TAPE
781  781  B  694  B              B ON TO SCOPE                          SS
786  786  B  907  L              BRANCH IF TAPE READ ERROR
791  791  C  259  #49            COMPARE TAPE REC 2 WITH REC IN STORAGE
798  798  B  927  /              BRANCH IF ERROR
803  803  N  950                 *NOP IF NO ERRORS - BRANCH IF ANY ERRORS
808  808  B  962  C              C ON TO CORRECT PRINT                  SS
813  813  B  694  D              D REPEATS READ PORTION OF PROGRAM      SS
818  818  B  850  #521           BRANCH IF 10 IN PASS COUNTER
826  826  A  #20  #53            ADD 1 TO PASS COUNTER
833  833  B  425                 BRANCH TO REPEAT PROG. IF NOT 10TH PASS
850  850  B  425  G              G ON TO REPEAT TEST                    SS
855  855  U  %U4  R              REWIND
860  860  /  348  299            CLEAR GM-WM + BRANCH TO LOAD NEXT PROG.
867  867  L  405  803            LOAD -8- IN LOC. 803 TO BRANCH ON ERROR
874  874  M  #72  232            MOVE TAPE READ ERROR COMMENT TO PRINT
881  881  B  761                 BRANCH TO TEST FOR COMPARE ERROR
887  887  L  405  803            LOAD -8- IN LOC. 803 TO BRANCH ON ERROR
894  894  M  #79  244            MOVE COMPARE ERROR COMMENT TO PRINT
901  901  B  773                 BRANCH TO READ RECORD 2
907  907  L  405  803            LOAD -8- IN LOC 803 TO BRANCH ON ERROR
914  914  M  #72  266            MOVE TAPE READ ERROR COMMMENT TO PRINT
921  921  B  791                 BRANCH TO TEST FOR COMPARE ERROR
927  927  L  405  803            LOAD -8- IN LOC 803 TO BRANCH ON ERROR
934  934  M  #79  278            MOVE COMPARE ERROR COMMENT TO PRINT
941  941  B  803                 BRANCH TO NOP OR BRANCH
950  950  M  #84  285            MOVE WORD ERROR TO PRINT AREA
957  957  B  968  E              E ON TO ERROR STOP                     SS
962  962  2                     PRINT
963  963  2  813  ¤              PRINT WORD MARKS
968  968  .                     ERROR STOP
969  969  B  813                 BRANCH TO SENSE D
1020 #20  1  111  111111         RECORD ONE    GM IN #30
1031 #31  0  001                 CONSTANT TO INCREMENT PASS + RE-WR. CTRS
1040 #40  R  WRW  RWRWRW         RECORD TWO    GM IN #50
1052 #52  X  X                   COUNTER FOR COUNTING NO. OF PASSES
1054 #54  X  XX                  COUNTER FOR COUNTING NO. OF RE-WRITES
1060 #60  W  RIT  E              CONSTANTS FOR PRINTOUTS
```

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1065  ≠65  R EAD                          ,,
1069  ≠69  T APE                          ,,
1073  ≠73  C OMP ARE                      ,,
1080  ≠80  E RRO R                        ,,
1120  /20  P ASS   OPER.    RECOR CONSTANTS FOR HEADINGS
1140  /40  D  ON E    TYPE OF ERR        ,,
1160  /60  O RS       RECORD TWO         ,,
1180  /80     T YPE OF ERRORS            ,,
1250  S50                              GM-WM IN S50
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    BACKSPACE SKIP                5030C 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD             5030C 02
L067367,340344,348349,357361!001,008012,001!001!B361080AB348/340080               5030C 03
L069404,377385,400404,405405!001          B400S681BS88              /332/         5030C 04
L071443,413420,425432,433437!001BS00S521M*34*53U%U4RL432585N/299M*53203           5030C 05
L065476,451458,465472,477477!001M*64211L*30226L*50260,226260U%U4B                 5030C 06
L070514,485490,495502,510515!001L%U4216WB552L8420KM*33*56L%U4250WB530B            5030C 07
L069551,523530,535540,545552!001B575*551A*20*568420KU%U4BU%U4EB502               5030C 08
L070589,559566,575580,585590!001L405585M*72232B490      B607L8420KN630           5030C 09
L072629,595607,614621,630630!001B642CB694          L405585M*722668580            5030C 10
L072669,637642,646647,647647!001M*84285864GE2694.8694                             5030C 11
L067704¤670670,694701,705705!001                              L432803/299         5030C 12
L070742,712719,726733,738743!001M*53203M*68210LS50226LS50260U%U4BU%U48            5030C 13
L070780,751756,761768,773781!001L%U4216R8773B8867LC225*298887/L%U4250R            5030C 14
L069817,786791,798803,808813!001B6948B907LC259*498927/N950 B962CB694D            5030C 15
L069854,826833,850855,855855!001B850*521A*20*538425                 B425G         5030C 16
L071893,860867,874881,887894!001U%U4R/348299L405803M*72232B761  L405803          5030C 17
L072933,901907,914921,927934!001M*79244B773  L405803M*722668791  L405803         5030C 18
L067968,941950,957962,963968!001M*792788803      M*84285B968E22813¤.              5030C 19
L072*08,001001,001001,001001!0018813                                              5030C 20
L072*48¤*09*09,*20*31,*40*40!001                !!!!!!!!!!G0001      RWRWRWRWR    5030C 21
                                                                  M
L052*68¤*49*49,*52*54,*60*65!001WG XXXXX   WRITEREAD                              5030C 22
                                                M
L072/08,*73*80,*80*80,*80*80!001!TAPECOMPAREERROR                                 5030C 23
L072/48¤/09/09,/20/40,/40/40!001!                PASS  OPER.    RECORD ONE        5030C 24
L072/88¤/49/49,/60/80,/80/80!001!TYPE OF ERRORS      RECORD TWO     TYPE 0       5030C 25
L056512¤/89/89,S00S01,S05S12!001!F ERRORS   2,049L0772772                         5030C 26
L060S40,S17S18,S25S29,S36S37!001/2772¤/40/60¤/80L/992802/280                      5030C 27
L042S50,S45S50,S50S50,S50S50!0012413     G                                        5030C 28
                                                M
/333080N                                                CLEAR WORDMARK CARD       5030C 29
,019027,031,038042B031T98GB400L046352BW04BS88   BACKSPACE SKIP                    5030C 30
                                M
```

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MOVE TAPE

A. PURPOSE OF TEST

TO TEST THE MOVE TAPE CIRCUITRY BY TRANSFERRING FROM STORAGE TO TAPE TWELVE 15-CHARACTER RECORDS DEVELOPED BY THE PROGRAM. EACH RECORD WRITTEN ON TAPE IS READ BACK INTO STORAGE AND COMPARED.

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4.
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4.
   B. ENTER A 1 IN 1268

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT INDIVIDUAL RECORD
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

   G ON TO REPEAT ENTIRE TEST
   OFF TO CONTINUE

D. TEST PROCEDURE

THE TWELVE 15-CHARACTER RECORDS LISTED BELOW ARE DEVELOPED BY THE PROGRAM FROM A TABLE STORED IN LOCATIONS /01-/13 (1101-1113):

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D. (CONTINUED)

TABLE	AAKT4E0X8I-.@
RECORD 1	AAAAAAAAAAAAAAA
RECORD 2	AKAKAKAKAKAKAKA
RECORD 3	KTKTKTKTKTKTKTK
RECORD 4	T4T4T4T4T4T4T4T
RECORD 5	4E4E4E4E4E4E4E4
RECORD 6	E0E0E0E0E0E0E0E
RECORD 7	0X0X0X0X0X0X0X0
RECORD 8	X8X8X8X8X8X8X8X
RECORD 9	8I8I8I8I8I8I8I8
RECORD 10	I-I-I-I-I-I-I-I
RECORD 11	-.-.-.-.-.-.-.-
RECORD 12	.@.@.@.@.@.@.@.

NOTE: EACH RECORD IS STORED IN LOCATIONS 208-222 AND IS FOLLOWED BY A GROUP MARK-WORD MARK (‡) IN LOCATION 223.

THE FIRST SET OF INSTRUCTIONS EXTRACTS THE FIRST TWO CHARACTERS (AA) FROM THE TABLE AND BY A SERIES OF INSTRUCTIONS BUILDS IT UP TO A 15 CHARACTER RECORD, ALL A'S. THIS RECORD IS THEN WRITTEN ON TAPE BY A MOVE TAPE (WRITE) INSTRUCTION. THE RECORD IS THEN BACKSPACED AND READ BACK BY A MOVE TAPE (READ) INSTRUCTION INTO AN AREA OF STORAGE THAT HAS TWO PRE-SET WORD MARKS.

THE RECORD READ BACK INTO STORAGE IS COMPARED WITH THE STORED RECORD FROM WHICH IT WAS WRITTEN IN THE FOLLOWING MANNER:

1. TESTS ARE MADE TO INSURE THAT THE PRE-SET WORD MARKS IN THE READ-IN AREA WERE NOT REMOVED BY THE MOVE TAPE (READ) INSTRUCTION;

2. THE TWO 15-CHARACTER RECORDS AND THE GROUP MARKS ARE COMPARED BY EXECUTING THREE COMPARE INSTRUCTIONS;

3. TESTS ARE MADE TO INSURE THAT THE WORD MARKS IN THE WRITE AREA DO NOT APPEAR IN THE READ-IN AREA.

THE PROCEDURE FOR RECORDS 2 THROUGH 12 IS THE SAME AS FOR RECORD 1. AFTER THE LAST (12) HAS BEEN PROCESSED, THE PASS COUNTER IS INCREASED TO TWO AND THE WHOLE PROGRAM IS REPEATED UNTIL THE PASS COUNTER REACHES 10, INDICATING THE END OF THE TEST.

E. STOPS

STORAGE ADDRESS REGISTER	TYPE OF ERRORS	ERROR IDENT.	LOCATION
664	TAPE WRITE	"T"	227
691	TAPE READ	"T"	264
725	COMPARE	"C"	272

F. PRINTOUTS

1. CORRECT

PASS	RECORD WRITTEN	TYPE OF ERRORS	RECORD READ BACK	TYPE OF ERRORS
1	AAAAAAAAAAAAAAA		AAAAAAAAAAAAAAA	
1	AKAKAKAKAKAKAKA		AKAKAKAKAKAKAKA	
1	KTKTKTKTKTKTKTK		KTKTKTKTKTKTKTK	
	ETC.		ETC.	
10	.@.@.@.@.@.@.@.		.@.@.@.@.@.@.@.	

2. ERROR

PASS	RECORD WRITTEN	TYPE OF ERRORS	RECORD READ BACK	TYPE OF ERRORS
1	AAAAAAAAAAAAAAA	TAPE	AAAAAAAAAAAAAAA	ERR
			(WORD MARKS)	
1	X8X8X8X8X8X8X8X		X8X8X8X8X8X8X8X	TAPE ERRI
1	-,-,-,-,-,-,-,-		-±-,-±-±-,-,-,-	TAPE COMPARE ERRO

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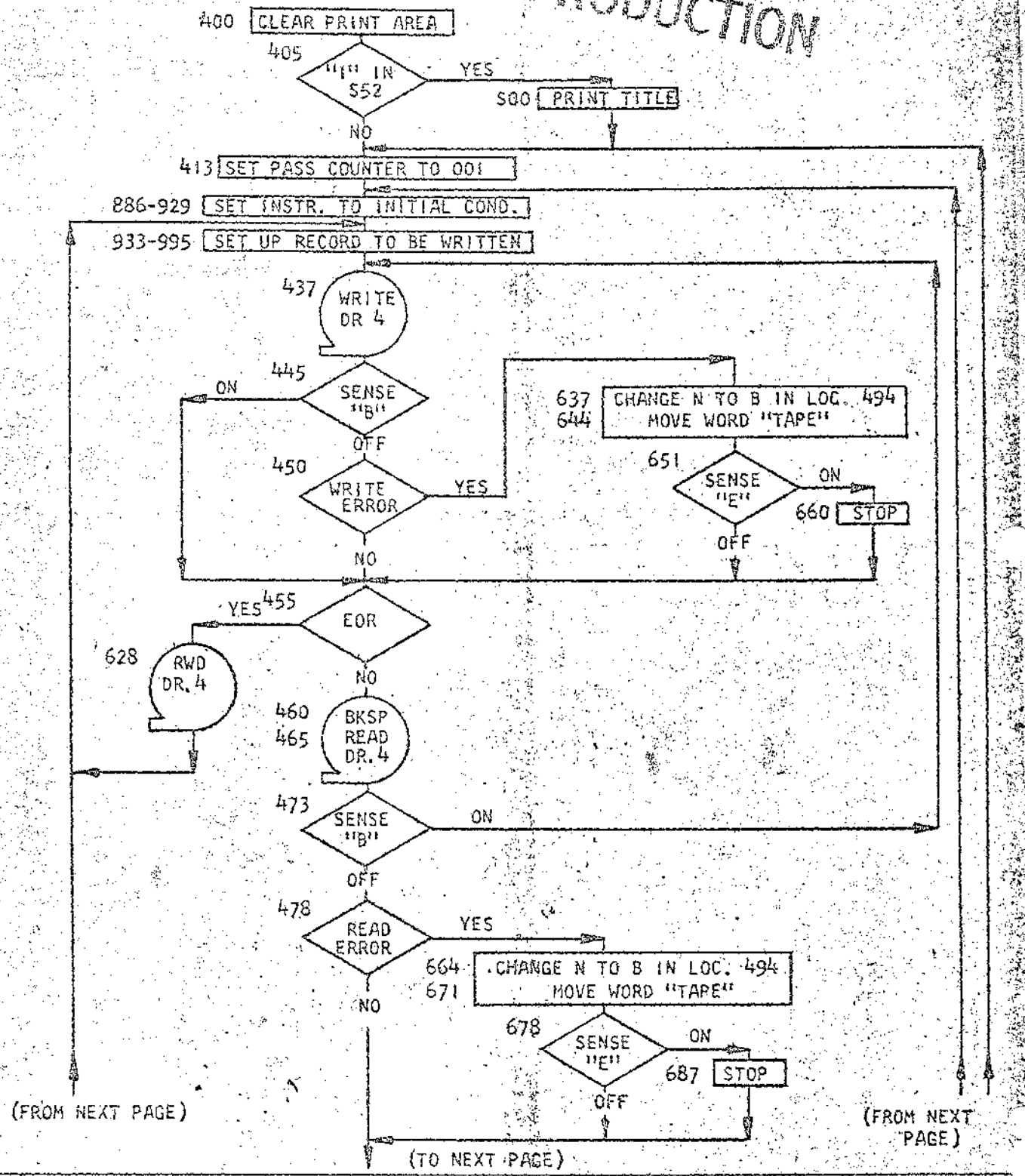
FORM 624-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451454
SHEET 4 OF 9
BLOCK NO. 50400

MOVE TAPE
FLOW CHART



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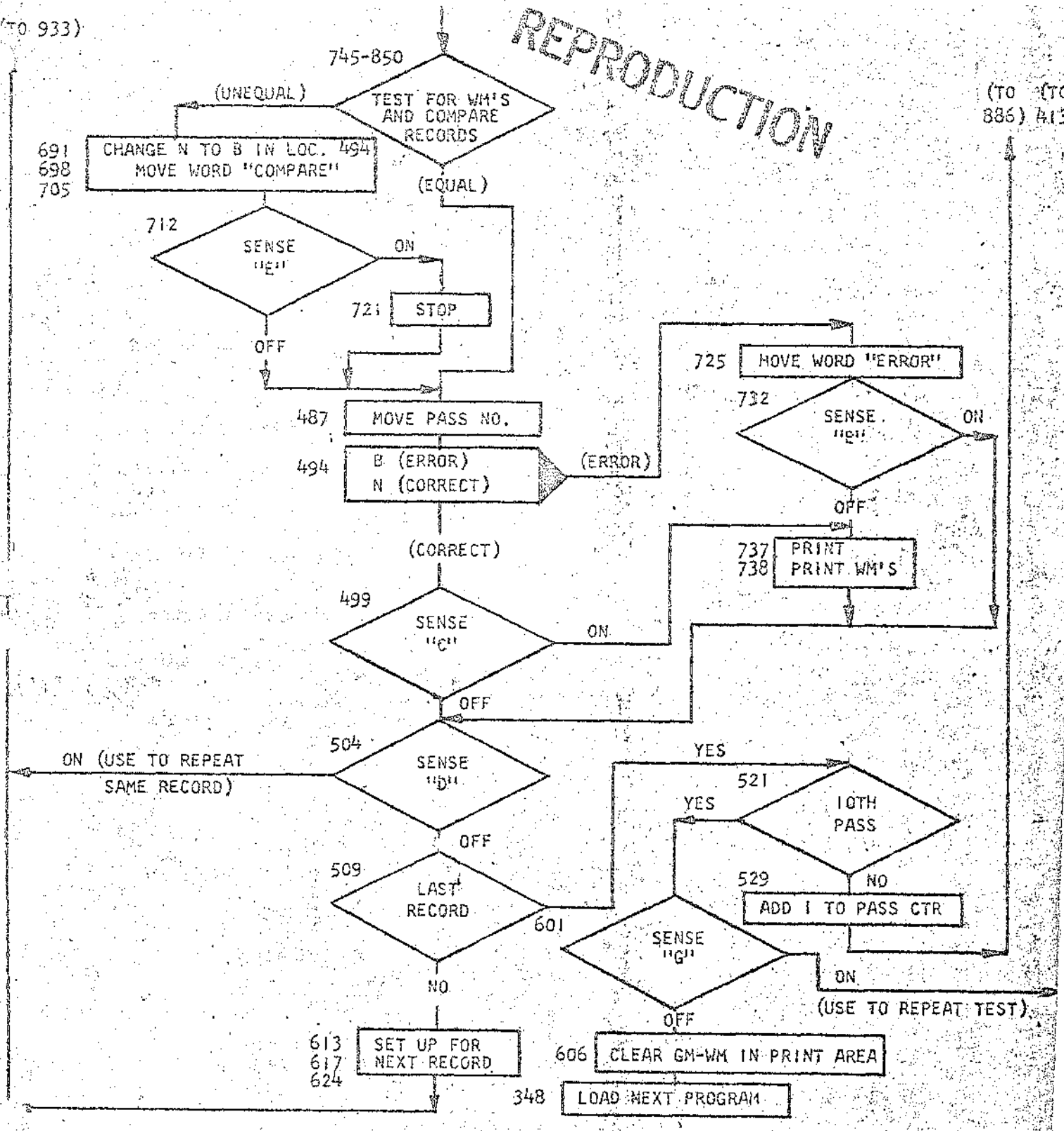
DIAGNOSTIC FUNCTION TEST



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PROGRAN LISTING FOR USE WITH FLOW CHART

MOVE TAPE 5040D

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	M	÷04	÷07	SET PASS COUNTER TO 001
420	420	N	000	0	NOP
425	425	,	199		SET WM IN 199
429	429	B	886		BR TO SET MOD INSTR TO INITIAL COND.
437	437	M	%U4	208W	WRITE 15 CHARACTER RECORD
445	445	B	455	B	B ON TO SCOPE
450	450	B	637	L	BRANCH IF WRITE ERROR
455	455	B	628	K	BRANCH IF END OF REEL
460	460	U	%U4	B	BACKSPACE
465	465	M	%U4	245R	READ BACK SAME 15 CHARACTER RECORD
473	473	B	437	B	B ON TO SCOPE SS
478	478	B	664	L	BRANCH IF READ ERROR
483	483	B	745		BRANCH TO TEST FOR ERROR BY COMPARING
487	487	Z	÷07	203	MOVE PASS NUMBER
494	494	N	725		*NOP IF NO ERRORS - BRANCH IF ANY ERRORS
499	499	B	737	C	C ON TO CORRECT ROUTINE SS
504	504	B	933	D	D ON TO REPEAT SAME RECORD SS
509	509	C	944	÷10	TEST IF LAST RECORD HAS BEEN WRITTEN
516	516	B	613	/	BRANCH IF NOT LAST RECORD
521	521	B	601	÷061	BRANCH IF END OF 10TH PASS
529	529	A	÷00	÷07	ADD 1 TO PASS COUNTER
536	536	B	886		BRANCH TO START NEXT PASS
601	601	B	413	G	G ON TO REPEAT TEST SS
606	606	/	348	299	BRANCH TO READ NEXT PROGRAM
613	613	,	942		ADD 1 TO MOVE INSTR TO SET UP NEXT
617	617	A	÷00	944	RECORD TO BE WRITTEN
624	624	B	933		BRANCH TO SET UP NEXT RECORD
628	628	U	%U4	R	REWIND
633	633	B	933		BRANCH TO SET UP SAME RECORD
637	637	L	405	494	CHANGE NOP TO BRANCH
644	644	M	÷88	230	MOVE TAPE WRITE ERROR COMMENT
651	651	B	660	E	E ON TO ERROR STOP SS
656	656	B	455		BRANCH TO TEST FOR END OF REEL
660	660	.	455		ERROR STOP IF TAPE WRITE ERROR
664	664	L	405	494	CHANGE NOP TO BRANCH
671	671	M	÷88	267	MOVE TAPE READ ERROR COMMENT
678	678	B	687	E	E ON TO ERROR STOP SS
683	683	B	745		BRANCH TO TEST FOR ERROR BY COMPARING

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 687  687  .  745                ERROR STOP IF TAPE READ ERROR
 691  691  ,  246  258           SET WM IN TAPE READ AREA
 698  698  L  405  494           CHANGE NOP TO BRANCH
 705  705  M  ¢95  278           MOVE COMPARE ERROR COMMENT
 712  712  B  721  E             E ON TO ERROR STOP                    SS
 717  717  B  487               BRANCH TO MOVE PASS NUMBER
 721  721  .  487               ERROR STOP IF ERROR DETECTED BY COMPARE
 725  725  M  /00  285           MOVE WORD ERROR TO PRINT
 732  732  B  504  E             E OFF TO ERROR PRINT                  SS
 737  737  2                    PRINT
 738  738  2  ¤                 PRINT WORD MARKS
 740  740  B  504               BRANCH TO SENSE D
 745  745  V  757  2461          TEST FOR WORD MARKS
 753  753  B  698                  ,,
 757  757  V  769  2581             ,,
 765  765  B  698                  ,,
 769  769  ¤  246  258             ,,
 776  776  ¤  260  223             ,,
 783  783  C  260  223          TEST FOR ERRORS BY COMPARING
 790  790  B  691  /               ,,
 795  795  C  258  221             ,,
 802  802  B  691  /               ,,
 807  807  C  252  215             ,,
 814  814  B  691  /               ,,
 819  819  V  691  2591         TEST FOR WORD MARKS
 827  827  V  691  2531            ,,
 835  835  V  691  2451            ,,
 843  843  ,  246  258             ,,
 850  850  B  487                  ,,
 886  886  M  ¢14  910          SET MODIFIED INSTR TO INITIAL COND
 893  893  M  ¢18  944               ,,
 900  900  ¤  908  /13          SET WORD MARKS THROUGHOUT TABLE
 907  907  ,  /01  908          *   ,,
 914  914  V  933  /131            ,,
 922  922  A  ¢00  910                  ,,
 929  929  B  900                  ,,
 933  933  /  299               CLEAR PRINT AREA
 937  937  ¤  942               SET UP 15 CHARACTER RECORD TO BE
 941  941  M  /02  209          *   WRITTEN ON TAPE
 948  948  L                       ,,
 949  949  M  209  211              ,,
 956  956  M  211  215              ,,
 963  963  L  214  222              ,,
 970  970  ,  222                  ,,
 974  974  L  550  223              ,,
 981  981  M  /40  494          CHANGE ERROR BRANCH TO NOP
 988  988  ,  246  258          SET WORD MARK IN TAPE READ AREA
 995  995  B  437               BRANCH TO WRITE TAPE
1000 ¢00  1  000  1.            CONSTANT
1005 ¢05  X  XX                 PASS COUNTER FOR NO. OF TEST PASSES
1008 ¢08  /  13,  /01M/02       CONSTANT
1085 ¢85  T  APE                CONSTANTS FOR PRINTOUTS
```

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```
1089  ≠89  C OMP ARE                    ,,
1096  ≠96  E RRO R                      ,,
1101  /01  A AKT 4EOX8I-,@              CONSTANTS FOR TAPE RECORDS
1120  /20  P ASS    RECORD WRITTE       CONSTANTS FOR HEADINGS
1140  /40  N       TYPE OF ERRORS       ,,
1160  /60        RECORD READ BACK       ,,
1180  /80      T YPE OF ERRORS          ,,
1250  S50                               GROUP MARK IN 550
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
NS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    MOVE TAPE                    5040D 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD            5040D 02
L067367,340344,348349,357361!1001,008012,001100!8361080AB348/340080              5040D 03
L069404,377385,400404,405405!1001          8400S6818S86              /332/       5040D 04
L072444,413420,425429,437445!1001BS00S521M≠04≠07N0000,1998886     M%U4208W5040D 05
L070482,450455,460465,473478!1001845588637L8628KU%U48M%U4245R8437886641          5040D 06
L070520,487494,499504,509516!1001B7452≠07203N725 8737C8933DC944≠108613/          5040D 07
L072560,529536,536536,536536!1001B601≠061A≠00≠07B886                            5040D 08
L068636,606613,617624,628633!1001B413G/348299,942A≠00944B933U%U4RB933            5040D 09
L066670,644651,656660,664671!1001L405494M≠882308660E8455.455L405494              5040D 10
L066704,678683,687691,698705!1001M≠882678687E8745.745,246258L405494              5040D 11
L065737,712717,721725,732737!1001M≠95278B721E8487.487M/00285B504E2               5040D 12
L070775,740745,753757,765769!1002¤8504 V7572461B698V769258!8698¤246258          5040D 13
L070813,783790,795802,807814!1001¤260223C2602238691/C258221869!/C252215         5040D 14
L068849,819827,835843,850850!1001B691!/V691259!V691253!V691245!,246258          5040D 15
L068885,886886,886886,886886!1001B487                                           5040D 16
L068921,893900,907914,922922!1001M≠14910M≠18944¤908/13,/01908V933/131            5040D 17
 066955,929933,937941,948949!1001A≠009108900/299¤942M/02209LM20921!             5040D 18
L071994,963970,974981,988995!1001M211215L214222,222LS50223M/40494,246258        5040D 19
L072≠34,≠00≠05,≠08≠08,≠08≠08!1001B437 !1001XXX/13,/01M/02                       5040D 20
L072/14¤≠75≠75,≠85≠89,≠96/01!1001                TAPECOMPAREERRORAAKT4E0X8I-,@   5040D 21
L072/54¤/15/15,/20/40,/40/40!1001     PASS   RECORD WRITTEN     TYPE OF E5040D 22
L072/94¤/55/55,/60/80,/80/80!1001RRORS    RECORD READ BACK   TYPE OF 'ERR05040D 23
L050S12¤/95/95,S00S01,S05S12!1001RS    2,049L0772772                             5040D 24
L060S40,S17S18,S25S29,S36S37!1001/2772¤/40/60¤/80L/992802/280                    5040D 25
L042S50,S45S50,S50S50,S50S50!1001B413     G                                     5040D 26
                                          M
/333080N                                                CLEAR WORDMARK CARD     5040D 27
,019027,031,038042B031T98GB400L046352BW048S88    MOVE TAPE                      5040D 28
                  M
```

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
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LOAD TAPE

A. PURPOSE OF TEST

TO TEST THE LOAD TAPE CIRCUITRY BY TRANSFERRING FROM STORAGE TO TAPE TWELVE 15-CHARACTER RECORDS DEVELOPED BY THE PROGRAM. EACH RECORD WRITTEN ON TAPE IS READ BACK INTO STORAGE AND COMPARED.

B. LOAD PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE.

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1268

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT FOR INDIVIDUAL RECORD
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

   G ON TO REPEAT ENTIRE TEST
   OFF TO CONTINUE

D. TEST PROCEDURE

THE TWELVE 15-CHARACTER RECORDS LISTED BELOW ARE DEVELOPED BY THE PROGRAM FROM A TABLE STORED IN LOCATIONS /01-/13 (1101-1113):

TABLE	AAKT4E0X8I-.@
RECORD 1	AAAAAAAAAAAAAA
RECORD 2	AKAKAKAKAKAKAKA

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D. (CONTINUED)

TABLE	AAKT4E0X8I-.@
RECORD 3	KTKTKTKTKTKTKTK
RECORD 4	T4T4T4T4T4T4T4T
RECORD 5	4E4E4E4E4E4E4E4
RECORD 6	E0E0E0E0E0E0E0E
RECORD 7	0X0X0X0X0X0X0X0
RECORD 8	X8X8X8X8X8X8X8X
RECORD 9	8I8I8I8I8I8I8I8
RECORD 10	I-I-I-I-I-I-I-I
RECORD 11	.-.-.-.-.-.-.-.
RECORD 12	.@.@.@.@.@.@.@.

NOTE: EACH RECORD IS STORED IN LOCATIONS 208-222 AND IS FOLLOWED BY A GROUP MARK-WORD MARK (‡) IN LOCATION 223

THE FIRST SET OF INSTRUCTIONS EXTRACTS THE FIRST TWO CHARACTERS (AA) FROM THE TABLE AND BY A SERIES OF INSTRUCTIONS BUILDS IT UP TO A 15-CHARACTER RECORD, ALL A'S. THIS RECORD IS THEN WRITTEN ON TAPE BY A LOAD TAPE (WRITE) INSTRUCTION. THE RECORD IS THEN BACKSPACED AND READ BACK BY A LOAD TAPE (READ) INSTRUCTION INTO AN AREA OF STORAGE THAT HAS TWO PRE-SET WORD MARKS.

THE RECORD READ BACK INTO STORAGE IS COMPARED WITH THE STORED RECORD FROM WHICH IT WAS WRITTEN IN THE FOLLOWING MANNER:

1. THE TWO 15-CHARACTER RECORDS AND THE GROUP MARKS ARE COMPARED BY EXECUTING THREE COMPARE INSTRUCTIONS. THESE INSTRUCTIONS ALSO CHECK THAT THE TWO PRE-SET WORD MARKS IN THE READ AREA WERE REMOVED BY THE LOAD TAPE INSTRUCTIONS.

2. TESTS ARE MADE TO INSURE THAT THE THREE WORD MARKS IN THE WRITE AREA WERE TRANSFERRED TO THE READ AREA BY THE LOAD TAPE INSTRUCTIONS.

THE PROCEDURE FOR RECORDS 2 THROUGH 12 IS THE SAME AS FOR RECORD 1. AFTER THE LAST RECORD (12) HAS BEEN PROCESSED, THE PASS COUNTER IS INCREASED TO TWO AND THE WHOLE PROGRAM IS REPEATED UNTIL THE PASS COUNTER REACHES 10, INDICATING THE END OF THE TEST. THE COMPLETE TEST (10 PASSES) MAY BE REPEATED AS OFTEN AS DESIRED BY SETTING SENSE SWITCH G TO THE ON POSITION.

E. STOPS

STORAGE ADDRESS REGISTER	TYPE OF ERRORS	ERROR IDENT.	LOCATION
664	TAPE WRITE	"T"	227
698	TAPE READ	"T"	264
725	COMPARE	"C"	272

F. PRINTOUTS

1. CORRECT

PASS	RECORD WRITTEN	TYPE OF ERRORS	RECORD READ BACK	TYPE OF ERRORS
1	AAAAAAAAAAAAAAA		AAAAAAAAAAAAAAA	
1	AKAKAKAKAKAKAKA		AKAKAKAKAKAKAKA	
1	KTKTKTKTKTKTKTK		KTKTKTKTKTKTKTK	
	ETC.		ETC.	
10	,@,@,@,@,@,@,@,		,@,@,@,@,@,@,@,	

2. ERROR

1	AAAAAAAAAAAAAAA	TAPE	AAAAAAAAAAAAAAA	(WORD MARKS)	ERROR
1	X8X8X8X8X8X8X8X		X8X8X8X8X8X8X8X	TAPE	ERROR
1	-,-,-,-,-,-,-,-		-‡-,-‡-‡-,-,-,-	TAPE COMPARE	ERROR

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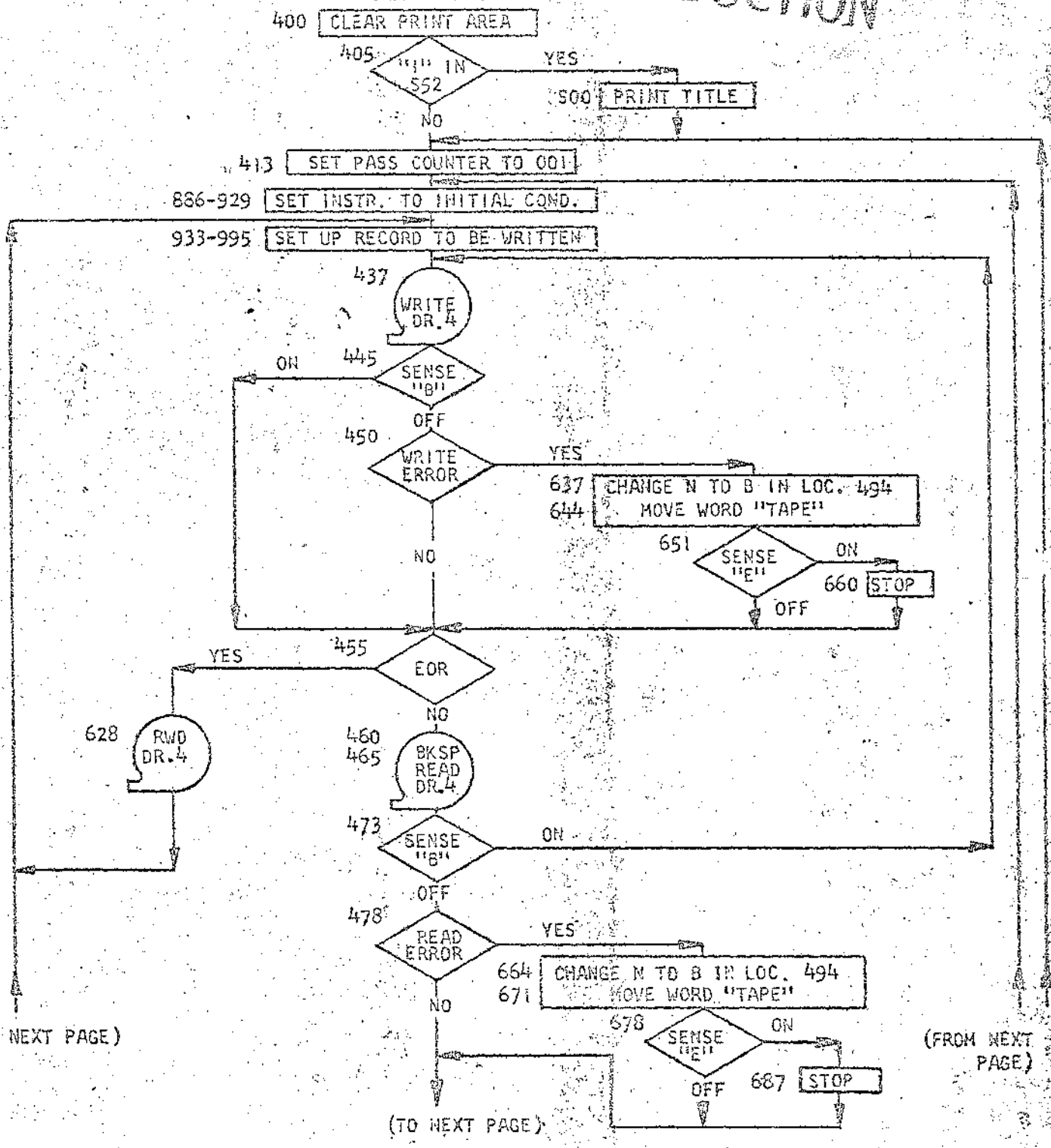
ENG. CHG. NO.	110378	110378A	117628	TA 1976				

LOAD TAPE

FLOW CHART



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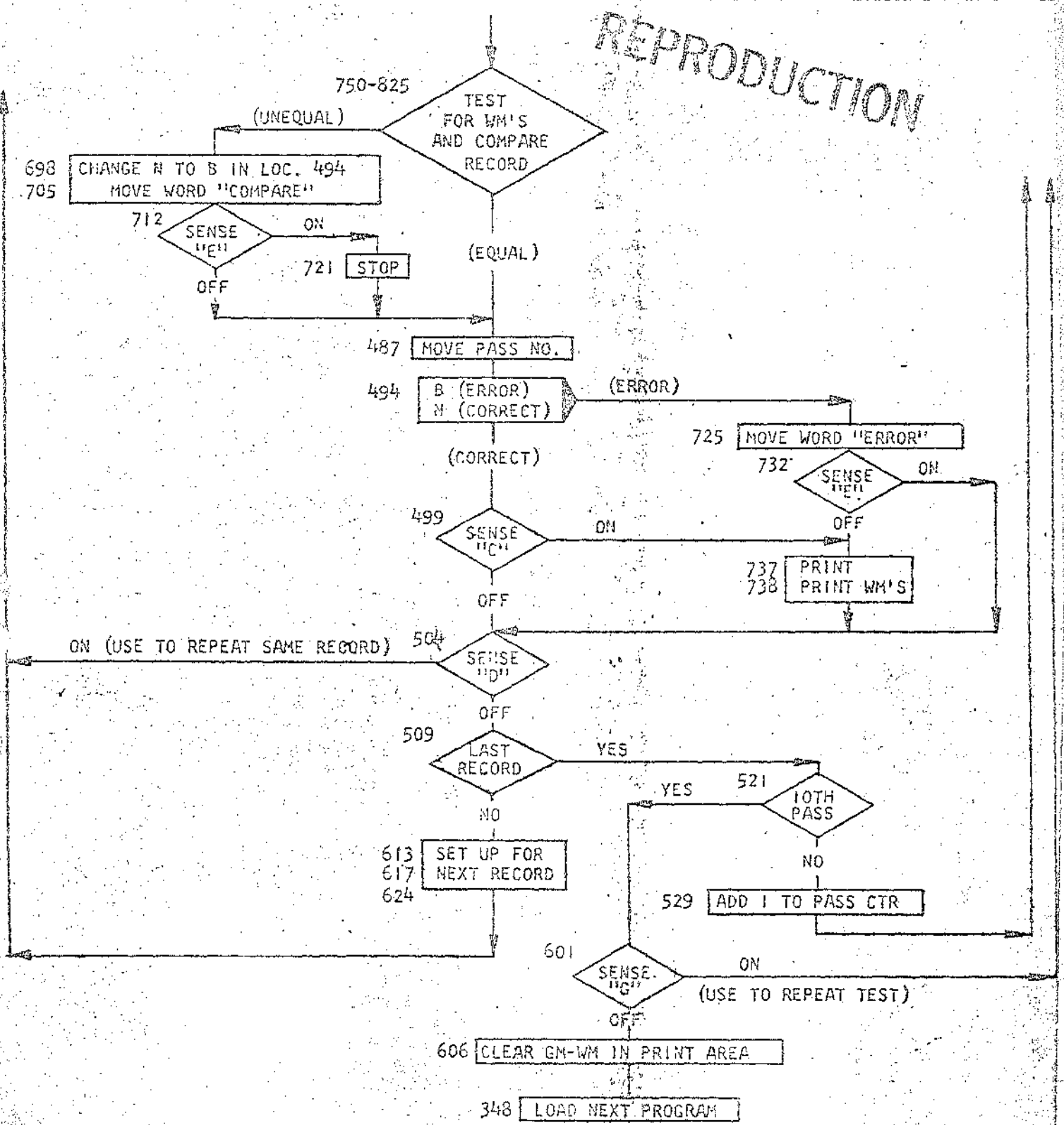
FORM 624-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451455
SHEET 5 OF 9
BLOCK NO. 5050D



DATE	2-2-61	2-15-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-A	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

LOAD TAPE 5050D

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	400	S681	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		"	
400	400	/	332		START TEST	
404	404	/				
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52	
413	413	M	≠04	≠07	SET PASS COUNTER TO 001	
420	420	N	000	0	NOP	
425	425	,	199		SET WM IN 199	
429	429	B	886		BR TO SET MOD INSTR TO INITIAL COND.	
437	437	L	%U4	208W	WRITE 15 CHARACTER RECORD	
445	445	B	455	B	B ON TO SCOPE	SS
450	450	B	637	L	BRANCH IF WRITE ERROR	
455	455	B	628	K	BRANCH IF END OF REEL	
460	460	U	%U4	B	BACKSPACE	
465	465	L	%U4	245R	READ BACK SAME 15 CHARACTER RECORD	
473	473	B	437	B	B ON TO SCOPE	SS
478	478	B	664	L	BRANCH IF READ ERROR	
483	483	B	750		BRANCH TO TEST FOR ERROR BY COMPARING	
487	487	Z	≠07	203	MOVE PASS NUMBER	
494	494	N	725		*NOP IF NO ERRORS - BRANCH IF ANY ERRORS	
499	499	B	737	C	C ON TO CORRECT ROUTINE	SS
504	504	B	933	D	D ON TO REPEAT SAME RECORD	SS
509	509	C	944	≠10	TEST IF LAST RECORD HAS BEEN WRITTEN	
516	516	B	613	/	BRANCH IF NOT LAST RECORD	
521	521	B	601	≠061	BRANCH IF END OF 10TH PASS	
529	529	A	≠00	≠07	ADD 1 TO PASS COUNTER	
536	536	B	886		BRANCH TO START NEXT PASS	
601	601	B	413	G	G ON TO REPEAT TEST	SS
606	606	/	348	299	BRANCH TO READ NEXT PROGRAM	
613	613	,	942		ADD 1 TO MOVE INSTR TO SET UP NEXT	
617	617	A	≠00	944	RECORD TO BE WRITTEN	
624	624	B	933		BRANCH TO SET UP NEXT RECORD	
628	628	U	%U4	R	REWIND	
633	633	B	933		BRANCH TO SET UP SAME RECORD	
637	637	L	405	494	CHANGE NOP TO BRANCH	
644	644	M	≠88	230	MOVE TAPE WRITE ERROR COMMENT	
651	651	B	660	E	E ON TO ERROR STOP	SS
656	656	B	455		BRANCH TO TEST FOR END OF REEL	
660	660	.	455		ERROR STOP IF TAPE WRITE ERROR	
664	664	L	405	494	CHANGE NOP TO BRANCH	
671	671	M	≠88	267	MOVE TAPE READ ERROR COMMENT	
678	678	B	687	E	E ON TO ERROR STOP	SS
683	683	B	750		BRANCH TO TEST FOR ERROR BY COMPARING	

```
 687  687  .  750                    ERROR STOP IF TAPE READ ERROR
 698  698  L  405  494               CHANGE NOP TO BRANCH
 705  705  M  #95  278               MOVE COMPARE ERROR COMMENT
 712  712  B  721  E                 E ON TO ERROR STOP                    SS
 717  717  B  487                    BRANCH TO MOVE PASS NUMBER
 721  721  .  487                    ERROR STOP IF ERROR DETECTED BY COMPARE
 725  725  M  /00  285               MOVE WORD ERROR TO PRINT
 732  732  B  504  E                 E OFF TO ERROR PRINT                  SS
 737  737  2                        PRINT
 738  738  2  ¤                      PRINT WORD MARKS
 740  740  B  504                    BRANCH TO SENSE D
 750  750  ¤  260  223               TEST FOR ERROR BY COMPARING
 757  757  C  260  223                 "
 764  764  B  698  /                   "
 769  769  C  258  221                 "
 776  776  B  698  /                   "
 781  781  C  252  215                 "
 788  788  B  698  /                   "
 793  793  V  805  2591              TEST FOR WORD MARKS
 801  801  B  698                      "
 805  805  V  817  2531                "
 813  813  B  698                      "
 817  817  V  487  2451                "
 825  825  B  698                      "
 886  886  M  #14  910               SET MODIFIED INSTR TO INITIAL COND
 893  893  M  #18  944                 "
 900  900  ¤  908  /13               SET WORD MARKS THROUGHOUT TABLE
 907  907  ,  /01  908                 "
 914  914  V  933  /131                "
 922  922  A  #00  910                 "
 929  929  B  900                      "
 933  933  /  299                    CLEAR PRINT AREA
 937  937  ¤  942                    SET UP 15 CHARACTER RECORD TO BE
 941  941  M  /02  209                 WRITTEN ON TAPE
 948  948  L                          "
 949  949  M  209  211                 "
 956  956  M  211  215                 "
 963  963  L  214  222                 "
 970  970  ,  222                      "
 974  974  L  550  223                 "
 981  981  M  /40  494               CHANGE ERROR BRANCH TO NOP
 988  988  ,  246  258               SET WORD MARKS IN TAPE READ AREA
 995  995  B  437                    BRANCH TO WRITE TAPE
1000  #00  1  000  1                 CONSTANT
1005  #05  X  XX                     PASS COUNTER FOR NO. OF TEST PASSES
1008  #08  /  13,  /01M/02           CONSTANT
1085  #85  T  APE                    CONSTANTS FOR PRINTOUTS
1089  #89  C  OMP  ARE                 "
1096  #96  E  RRO  R                   "
1101  /01  A  AKT  4EOXBI-,@          CONSTANTS FOR TAPE RECORDS
1120  /20  P  ASS     RECORD WRITTE   CONSTANTS FOR HEADINGS
1140  /40  N          TYPE OF ERRORS    "
```

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```
1160  /60        RECORD READ BACK      ,,
1180  /80     T YPE OF ERRORS          ,,
1250  S50                          GROUP MARK IN S50
```

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ENG. CHG. NO.	110378	110378A	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    LOAD TAPE                          50S0D 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD                  50S0D 02
L067367,340344,348349,357361!001,008012,001100!8361080AB348/340080                       50S0D 03
L069404,377385,400404,405405!001          8400S6816S88                  /332/            50S0D 04
L072444,413420,425429,437445!0018S00SS21M*04*07N0000,1998886     L%U4208W                50S0D 05
L070482,450455,460465,473478!001B455B8637LB628KU%U48L%U4245RB43788664L                    50S0D 06
L070520,487494,499504,509516!001B750Z*07203N725 B737C8933DC944*108613/                    50S0D 07
L072560,529536,536536,536536!001B601*061A*00*07B886                                       50S0D 08
L068636,606613,617624,628633!001B413G/348299,942A*00944893JU%U4RB933                      50S0D 09
L066670,644651,656660,664671!001L405494M*88230B660EB455.455L405494                        50S0D 10
L066704,678683,687698,705705!001M*88267B687EB750.750          L405494                    50S0D 11
L065737,712717,721725,732737!001M*95278B721EB487.487M/00285B504E2                         50S0D 12
L070775,740750,757764,769776!0012¤B504          ¤260223C2602238698/C258221                50S0D 13
L069812,781788,793801,805813!001B698/C252215B698/V8052591B698V8172531                     50S0D 14
L072852,817825,825825,825825!001B698V48724518698                                          50S0D 15
L068921,893900,907914,922922!001M*14910M*18944¤908/13,/01908V933/131                      50S0D 16
L066955,929933,937941,948949!001A*00910B900/299¤942M/02209LM209211                        50S0D 17
L071994,963970,974981,988995!001M2112!5L214222,222LS50223M/40494,246258                   50S0D 18
L072*34,*00*05,*08*08,*08*08!001B437 !000!XXX/13,/01M/02                                  50S0D 19
L067/19,*89*96,/01/20,/20/20!001TAPECOMPAREERRORAAKT4EOX8I-,@                             50S0D 20
L072/59,/40/60,/60/60,/60/60!001PASS   RECORD WRITTEN      TYPE OF ERRORS                 50S0D 21
L072/99,/80S00,S00S00,S00S00!001    RECORD READ BACK   TYPE OF ERRORS                     50S0D 22
L057S24,S01S05,S12S13,S17S18!0012,049L0772772/2772¤/40/60                                 50S0D 23
L058S50,S29S36,S37S41,S45S50!001¤/80L/992802/2802413      G                               50S0D 24
                                                          M
/333080N                                          CLEAR WORDMARK CARD                     50S0D 25
,019027,031,038042803!T98GB400L046352BW048S88     LOAD TAPE                               50S0D 26
                          M
```

DATE	2-2-61	2-15-61	6-29-63	17.10.63				
ENG. CHG NO	110378	110378A	117628	TA 1976				

MOVE BINARY TAPE

A. PURPOSE OF TEST

TO TEST THE WRITE AND READ BINARY TAPE CIRCUITRY BY WRITING TAPE RECORDS IN BINARY FORM (ODD PARITY), READING THE TAPE RECORDS WRITTEN IN BINARY FORM INTO STORAGE, AND COMPARING THE RESULTS. IN ADDITION, THE TEST ALSO CHECKS THAT THE TAPE INSTRUCTIONS ARE ACTUALLY OPERATING IN BINARY FORM.

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

A. SET WORKING TAPE DRIVE TO 4.
B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

A. SET WORKING TAPE DRIVE TO 4
B. ENTER A 1 IN 1268.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

C ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE

D ON TO REPEAT PROGRAM FOR INDIVIDUAL RECORDS
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

G ON TO REPEAT ENTIRE TEST
OFF TO CONTINUE

D. TEST PROCEDURE

THE PROGRAM IN EXECUTED IN THE SAME MANNER AS THE MOVE TAPE TEST (BLOCK NUMBER 5040), INCLUDING PRINT OUT FOR ERROR RESULTS OR CORRECT RESULTS. IN ADDITION, AFTER THE LAST RECORD OF EACH PASS THIS TEST ALSO CHECKS THAT THE TAPE INSTRUCTIONS ARE ACTUALLY OPERATING IN BINARY MODE (ODD PARITY ON TAPE). THIS IS DONE BY WRITING A TAPE MARK, BACKSPACING, AND READING IT BACK WITH A BINARY READ INSTRUCTION. SINCE A TAPE MARK CANNOT BE WRITTEN IN BINARY FORM, THE INSTRUCTION WILL RESULT IN A TAPE ERROR. THIS FORCED ERROR SHOWS THAT THE READ BINARY INSTRUCTION WORKED CORRECTLY.

D. (CONTINUED)

IF THIS FORCED ERROR DOES NOT OCCUR, IT MEANS THAT THE READ BINARY INSTRUCTION WAS NOT READING ODD PARITY AND IS IN REALITY A MACHINE ERROR. THIS WILL BE INDICATED BY A STOP IN LOCATION 581 IF SENSE SWITCH E IS ON, OR THE FOLLOWING PRINTOUT IF THE SWITCH IS OFF:

NO TAPE ERROR WHEN READING TM ERROR

E. STOPS

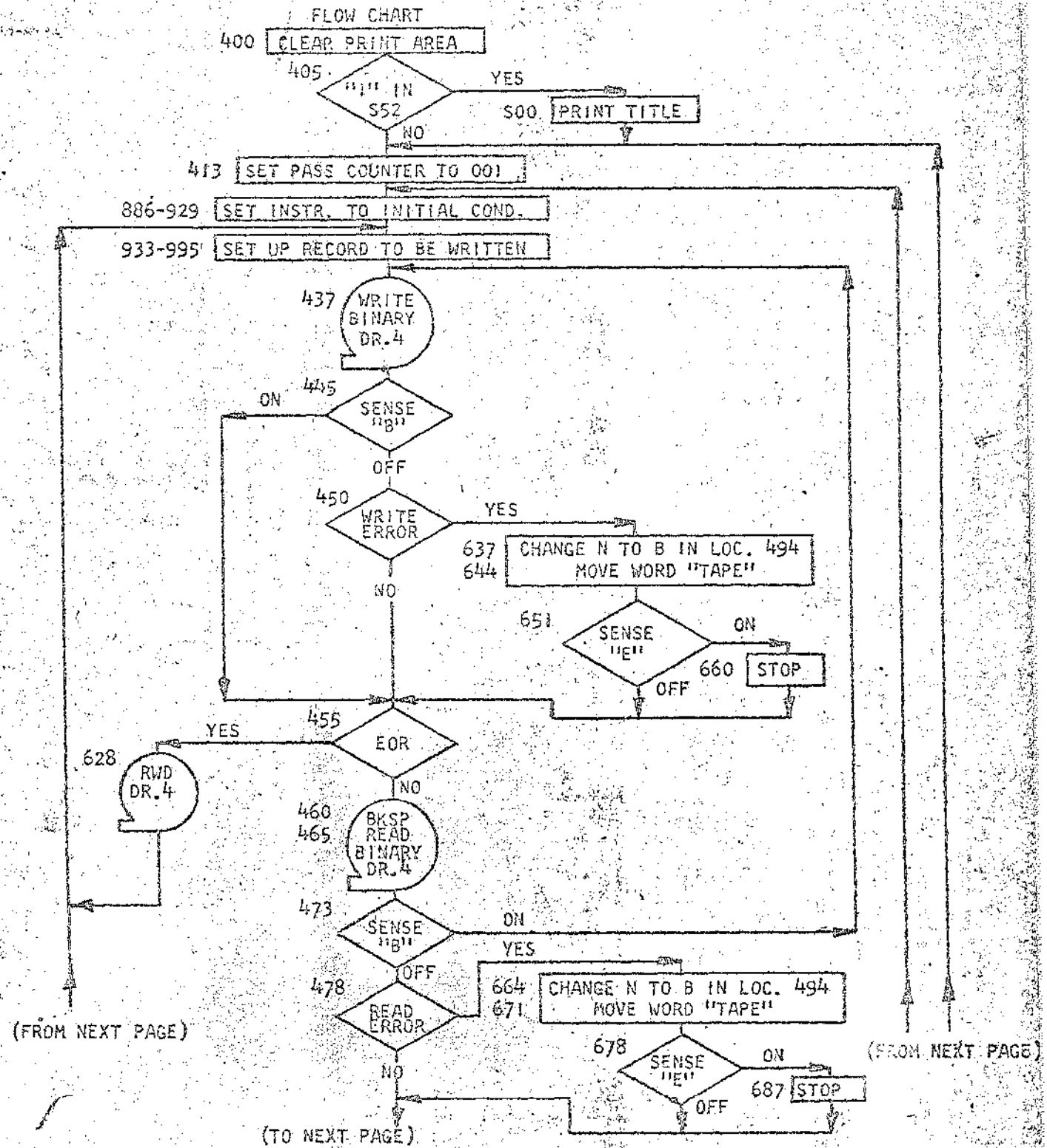
STORAGE ADDRESS REGISTER	TYPE OF ERRORS	ERRORS	ERROR IDENT.	LOCATION
582	NO TAPE ERROR WHEN READING TM			
664	TAPE WRITE		"T"	227
691	TAPE READ		"T"	264
725	COMPARE		"C"	272

F. PRINTOUTS

SIMILAR TO TEST 5040.

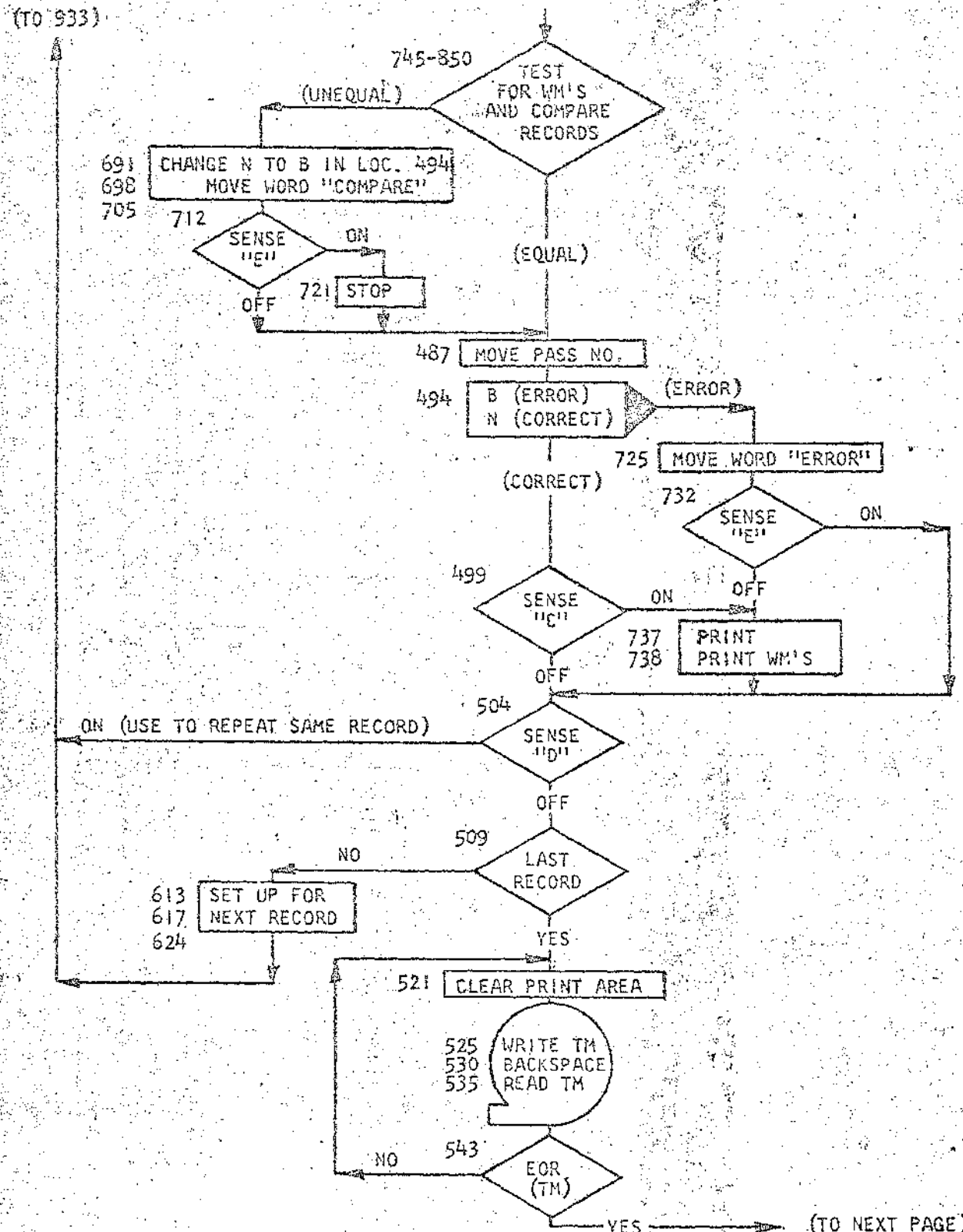
MOVE BINARY TAPE

FLOW CHART



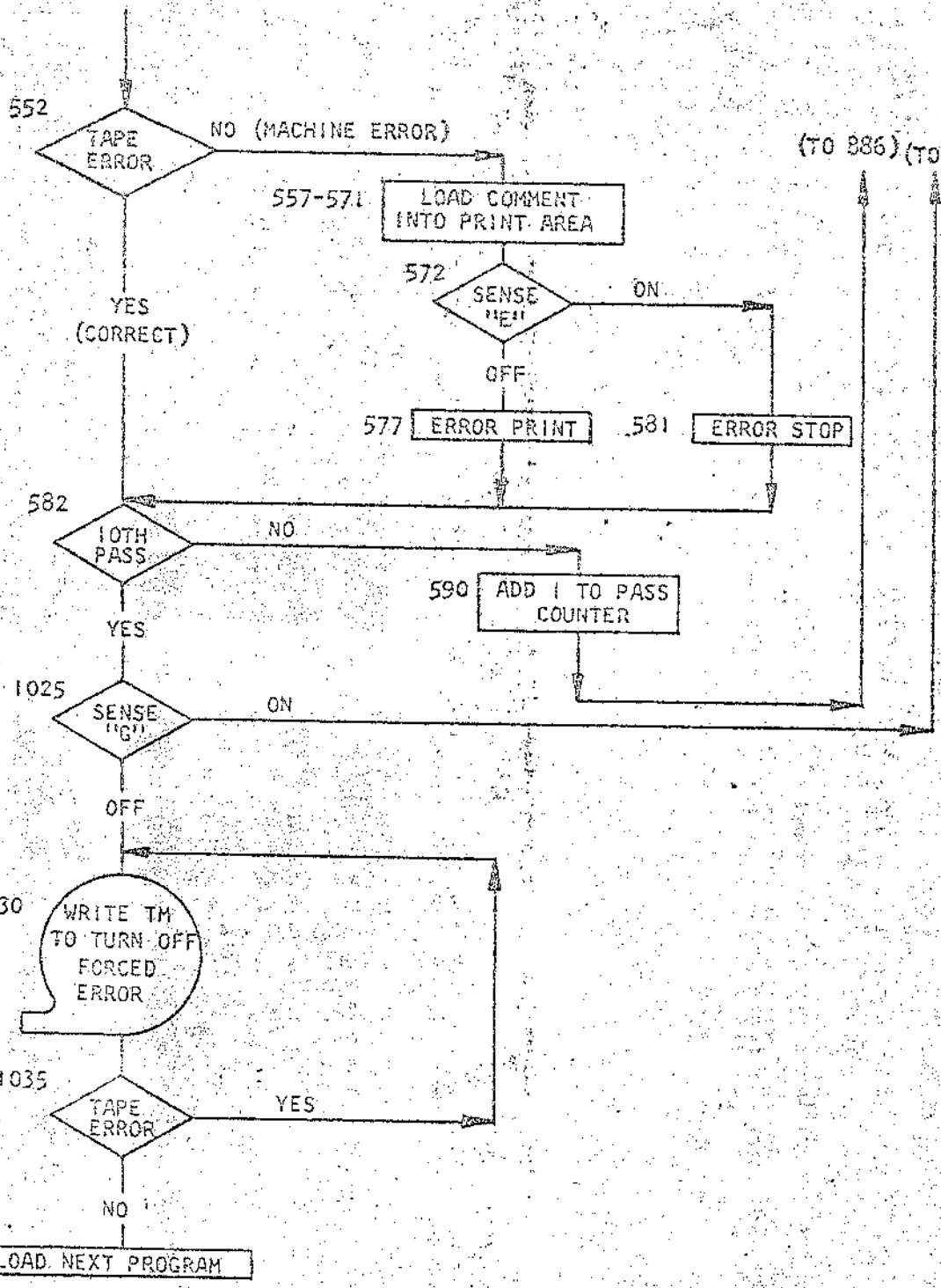
DATE	2-2-61	3-13-61	7-1-63	17. 10. 63				
ENG. CHG. NO.	110378	110378-B	117628	TA 1976				

DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	3-13-62	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-B	117628	TA 1976				

DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378a	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

MOVE BINARY TAPE 50700

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	588		,,
400	400.	/	332		START TEST
404	404	/			
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	M	#04	#07	SET PASS COUNTER TO 001
420	420	N	000	0	NOP
425	425	,	199		SET WM IN 199
429	429	B	886		BR TO SET MOO INSTR TO INITIAL COND.
437	437	M	%B4	208W	WRITE 15 CHARACTER RECORD
445	445	B	455	B	B ON TO SCOPE SS
450	450	B	637	L	BRANCH IF WRITE ERROR
455	455	B	628	K	BRANCH IF END OF REEL
460	460	U	%U4	B	BACKSPACE
465	465	M	%B4	245R	READ BACK SAME 15 CHARACTER RECORD
473	473	B	437	B	B ON TO SCOPE SS
478	478	B	664	L	BRANCH IF READ ERROR
483	483	B	745		BRANCH TO TEST FOR ERROR BY COMPARING
487	487	Z	#07	203	MOVE PASS NUMBER
494	494	N	725		*NOP IF NO ERRORS - BRANCH IF ANY ERRORS
499	499	B	737	C	C ON TO CORRECT ROUTINE SS
504	504	B	933	D	D ON TO REPEAT SAME RECORD SS
509	509	C	944	#10	TEST IF LAST RECORD HAS BEEN WRITTEN
516	516	B	613	/	BRANCH IF NOT LAST RECORD
521	521	/	299		CLEAR PRINT AREA
526	525	U	%U4	M	WRITE TAPE MARK
530	530	U	%U4	B	BACKSPACE
535	535	M	%B4	201R	READ TAPE MARK
543	543	B	552	K	BRANCH IF END OF REEL - TAPE MARK
548	548	B	521		BRANCH TO REWRITE TAPE MARK
552	552	B	582	L	BRANCH IF ERROR - SHOULD BE ERROR
557	557	L	/00	285	ERROR PRINT ROUTINE IF NO TAPE ERROR
564	564	L	885	240	WHEN READING TAPE MARK WITH BINARY OP
571	571	L			,,
572	572	B	581	E	E ON TO ERROR STOP SS
577	577	2	582		ERROR PRINT
581	581	.			ERROR STOP
582	582	B	#25	#061	BRANCH IF END OF 10TH PASS
590	590	A	#00	#07	ADD 1 TO PASS COUNTER
597	597	B	886		BRANCH TO START NEXT PASS
613	613	,	942		ADD 1 TO MOVE INSTR TO SET UP NEXT
617	617	A	#00	944	RECORD TO BE WRITTEN
624	624	B	933		BRANCH TO SET UP NEXT RECORD

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628  628  U 804 R                  REWIND
633  633  B 933                    BRANCH TO SET UP SAME RECORD
637  637  L 405 494                CHANGE NOP TO BRANCH
644  644  M ⌀88 230                MOVE TAPE WRITE ERROR COMMENT
651  651  B 660 E                  E ON TO ERROR STOP                    SS
656  656  B 455                    BRANCH TO TEST FOR END OF REEL
660  660  . 455                    ERROR STOP IF TAPE WRITE ERROR
664  664  L 405 494                CHANGE NOP TO BRANCH
671  671  M ⌀88 267                MOVE TAPE READ ERROR COMMENT
678  678  B 687 E                  E ON TO ERROR STOP                    SS
683  683  B 483                    BRANCH TO TEST FOR ERROR BY COMPARING
687  687  . 483                    ERROR STOP IF TAPE READ ERROR
691  691  , 246 258                SET WM IN TAPE READ AREA
698  698  L 405 494                CHANGE NOP TO BRANCH
705  705  M ⌀95 278                MOVE COMPARE ERROR COMMENT
712  712  B 721 E                  E ON TO ERROR STOP                    SS
717  717  B 487                    BRANCH TO MOVE PASS NUMBER
721  721  . 487                    ERROR STOP IF ERROR DETECTED,BY COMPARE
725  725  M /00 285                MOVE WORD ERROR TO PRINT
732  732  B 504 E                  E OFF TO ERROR PRINT                  SS
737  737  2                        PRINT
738  738  2 ¤                      PRINT WORD MARKS
740  740  B 504                    BRANCH TO SENSE D
745  745  V 757 2461               TEST FOR WORD MARKS
753  753  B 698                      ,,
757  757  V 769 2581                ,,
765  765  B 698                    ,,
769  769  ¤ 246 258                ,,
776  776  ¤ 260 223                ,,
783  783  C 260 223                TEST FOR ERRORS BY COMPARING
790  790  B 691 /                    ,,
795  795  C 258 221                ,,
802  802  B 691 /                  ,,
807  807  C 252 215                ,,
814  814  B 691 /                  ,,
819  819  V 691 2591               TEST FOR WORD MARKS
827  827  V 691 2531                 ,,
835  835  V 691 2451                ,,
843  843  , 246 258                ,,
850  850  B 487                    ,,
855  855  N O T APE ERROR WHEN R CONSTANTS
875  875  E ADI NG TM                ,,
886  886  M ⌀14 910                SET MODIFIED INSTR TO INITIAL COND
893  893  M ⌀18 944                  ,,
900  900  ¤ 908 /13                SET WORD MARKS THROUGHOUT TABLE
907  907  , /01 908                  ,,
914  914  V 933 /131                ,,
922  922  A ⌀00 910                ,,
929  929  B 900                    ,,
933  933  / 299                    CLEAR PRINT AREA
937  937  ¤ 942                    SET UP 15 CHARACTER RECORD TO BE
941  941  M /02 209                   WRITTEN ON TAPE
```

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```
 948  948  L                          ,,
 949  949  M 209 211                  ,,
 956  956  M 211 215                  ,,
 963  963  L 214 222                  ,,
 970  970  , 222                      ,,
 974  974  L S50 223                  ,,
 981  981  M /40 494                  CHANGE ERROR BRANCH TO NOP
 988  988  , 246 258                  SET WORD MARK IN TAPE READ AREA
 995  995  B 437                      BRANCH TO WRITE TAPE
1000  ≠00  1 000 1                    CONSTANT
1005  ≠05  X XX                       PASS COUNTER FOR NO. OF TEST PASSES
1008  ≠08  / 13, /01M/02              CONSTANT
1025  ≠25  B 413 G                    G ON TO REPEAT TEST                    SS
1030  ≠30  U %U4 M                    WRITE TM TO TURN OFF FORCED ERROR
1035  ≠35  B ≠30 L                    BRANCH IF TAPE ERROR
1040  ≠40  / 348 299                  BRANCH TO READ NEXT PROGRAM
1085  ≠85  T APE                      CONSTANTS FOR PRINTOUTS
1089  ≠89  C OMP ARE                    ,,
1096  ≠96  E RRO R                      ,,
1101  /01  A AKT 4E0X8I-,a             CONSTANTS FOR TAPE RECORDS
1120  /20  P ASS   RECORD WRITTE       CONSTANTS FOR HEADINGS
1140  /40  N       TYPE OF ERRORS        ,,
1160  /60        RECORD READ BACK       ,,
1180  /80     T YPE OF ERRORS           ,,
1250  S50                              GROUP MARK IN S50
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    MOVE BINARY TAPE          5070D 01
,008015,022029,033033N      1001                    SET WORDMARK CARD         5070D 02
L067367,340344,348349,357361!001,008012,001!001!B361080AB348/340080           5070D 03
L069404,377385,400404,405405!001          B400S6818S88          /33L/       5070D 04
L072444,413420,425429,437445!001BS00S521M÷04÷07N0000,1998886     M%84208W5070D 05
L070482,450455,460465,473478!001B455BB637LB628KU%U48M%B4245RB4378B664L        5070D 06
L070520,487494,499504,509516!001B745Z÷07203N725 B737CB9330C944÷106613/        5070D 07
L068556,525530,535543,548552!001/299U%U4MU%U48M%B4201RB552KB521B582L          5070D 08
L065589,564571,572577,581582!001L/00285L885240LB581E2582.8÷25÷061            5070D 09
L070627,597613,617624,628628!001A÷00÷078886              ,942A÷009448933      5070D 10
L068663,633637,644651,656660!001U%U4RB933L405494M÷88230B660E8455.455          5070D 11
L066697,671678,683687,691698!001L405494M÷8826786B7EB483.483,246258            5070D 12
L071736,705712,717721,725732!001L405494M÷952788721EB487.487M/00285B504E       5070D 13
L064768,738740,745753,757765!00122□8504 V7572461B698V7692581B698              5070D 14
L070806,776783,790795,802807!001□246258□260223C260223B691/C25822186911        5070D 15
L068842,814819,827835,843843!001C2$2215B691/V6912591V6912531V6912451          5070D 16
L064874,850855,875875,875875!001,2462588487 NO TAPE ERROR WHEN R              5070D 17
L071913,886893,900907,914914!001EADING TM  N÷14910M÷18944□90S/13,/01908       5070D 18
L067948,922929,933937,941948!001V933/131A÷00910B900/299□942M/02209L           5070D 19
L071987,956963,970974,981988!001M20921!M2!1215L214222,222LS50223M/40494       5070D 20
L069÷24,995÷00,÷05÷08,÷25÷251001,2462588437 10001XXX/13,/01M/02               5070D 21
L072÷64,÷30÷35,÷40÷40,÷40÷40100!8413GU%U4MB÷30L/348299                        5070D 22
L068/00□÷65÷65,÷85÷89,÷96/011001                          TAPECOMPAREERROR    5070D 23
L071/39,/20/40,/40/40,/40/40100!AAKT4EOX8!-,@      PASS   RECORD WRITTE        5070D 24
L072/79,/60/80,/80/80,/80/801001N      TYPE OF ERRORS    RECORD READ BACK      5070D 25
L070S17,S00S01,S05S12,S13S171001   TYPE OF ERRORS   2,049L0772772/2772        5070D 26
L064S49,S25S29,S36S37,S41S451001□/40/60□/80L/992802/2802413                    5070D 27
L033S50,001001,001001,00100110016                                             5070D 28
                                  M
/333080N                                          CLEAR WORDMARK CARD         5070D 29
,019027,031,038042803!T98GB400L046352BW048S88     MOVE BINARY TAPE            5070D 30
                                  M
```

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VERTICAL REDUNDANCY CHECK

A. PURPOSE OF TEST

TO TEST THE VALIDITY CHECK CIRCUITRY IN BOTH THE EVEN-PARITY AND ODD-PARITY MODE.

B. LOADING PROCEDURES:

1. WHEN RUNNING TEST FROM CARDS

   A. SET WORKING TAPE DRIVE TO 4.
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.-

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1268

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT PROGRAM FOR INDIVIDUAL CHARACTER
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

   G ON TO REPEAT ENTIRE TEST
   OFF TO CONTINUE

D. TEST PROCEDURE

FIFTY PRINTABLE CHARACTERS STORED BY THE PROGRAM ARE PROCESSED ONE AT A TIME. EACH CHARACTER IS WRITTEN ON TAPE FOUR TIMES AS FOUR SINGLE-CHARACTER RECORDS - TWICE IN EVEN PARITY AND TWICE IN ODD PARITY. THE FOUR TAPE RECORDS ARE THEN READ BACK INTO STORAGE - TWICE IN THE SAME MODE AS IT WAS WRITTEN AND TWICE IN THE OPPOSITE MODE RESULTING IN TWO FORCED ERRORS.

A TABLE COUNTER IS USED TO CONTROL SELECTION AND PROCESSING OF EACH OF THE 50 CHARACTERS IN THE TABLE STORED BY THE PROGRAM IN LOCATIONS 120-169. THE TABLE IS AS FOLLOWS:

1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ¤&$*-/,%#@⁰₀+

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D. (CONTINUED)

THE FIRST CHARACTER IS EXTRACTED FROM THE TABLE AND WRITTEN ON TAPE FOUR TIMES IN THE FOLLOWING MANNER:

RECORD 1. EVEN PARITY
RECORD 2. ODD PARITY
RECORD 3. ODD PARITY
RECORD 4. EVEN PARITY

THE SINGLE CHARACTER RECORDS ARE THEN BACKSPACED FOUR TIMES TO PLACE THE TAPE RECORDS IN POSITION FOR READING. THE FOUR TAPE RECORDS ARE THEN READ AS FOLLOWS:

RECORD 1. READ EVEN (WAS WRITTEN EVEN) SHOULD NOT RESULT IN A TAPE ERROR.
RECORD 2. READ EVEN (WAS WRITTEN ODD) SHOULD RESULT IN A TAPE ERROR.
RECORD 3. READ ODD (WAS WRITTEN ODD) SHOULD NOT RESULT IN A TAPE ERROR.
RECORD 4. READ ODD (WAS WRITTEN EVEN) SHOULD RESULT IN A TAPE ERROR.

THE ABOVE PROCEDURE IS REPEATED FOR EACH OF THE 50 CHARACTERS UNDER CONTROL OF THE A PASS COUNTER. THE TEST IS REPEATED FIVE TIMES.

E. STOPS - SENSE E ON

STORAGE ADDRESS REGISTER

919	ERROR RECORD 1
925	ERROR RECORD 2
963	ERROR RECORD 3
987	ERROR RECORD 4

F. PRINOUTS

1. CORRECT

WRITTEN EVEN	WRITTEN ODD	READ EVEN	READ ODD	INDICATED READ ERROR	CHARACTER WRITTEN	CHARACTER READ
X		X			A	A
	X	X		X	A	A
	X		X		A	A
X			X	X	A	A
X		X			S	S
	X	X		X	S	S
	X		X		S	S
X			X	X	S	S
X		X			W	W
	X	X		X	W	W
	X		X		W	W
X			X	X	W	W
X		X			Z	Z
	X	X		X	Z	Z
	X		X		Z	Z
X			XX	X	Z	Z

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IBM

DIAGNOSTIC FUNCTION TEST

F. (CONTINUED)

2. ERROR

WRITTEN EVEN	WRITTEN ODD	READ EVEN	READ ODD	INDICATED READ ERROR	CHARACTER WRITTEN	CHARACTER READ	
X		X		X	A	A	ERROR (MACHINE)
	X		X	X	S	E	ERROR (MACHINE)
X			X		W	W	ERROR (MACHINE)
	X	X			Z	Z	ERROR (MACHINE)

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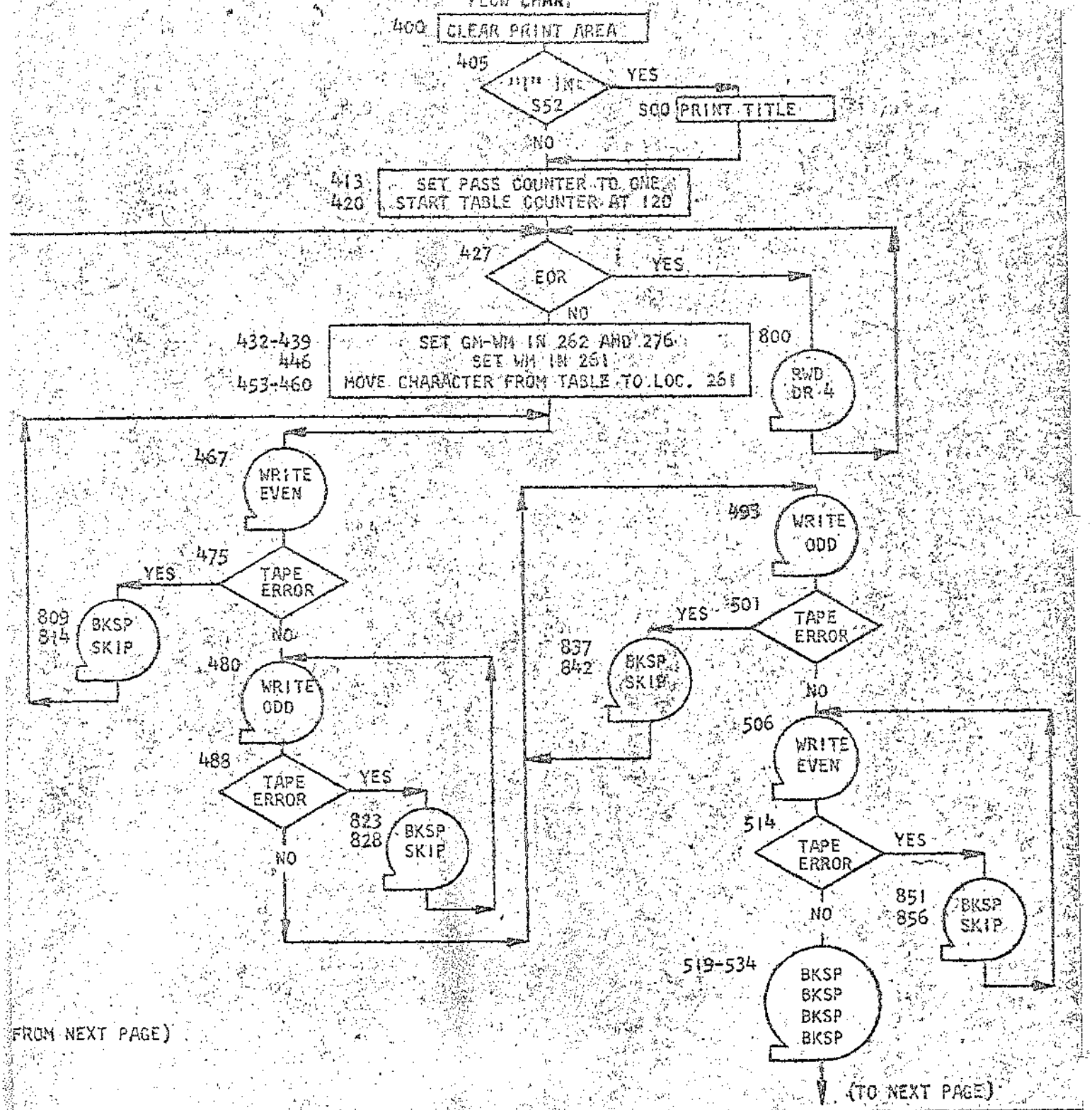
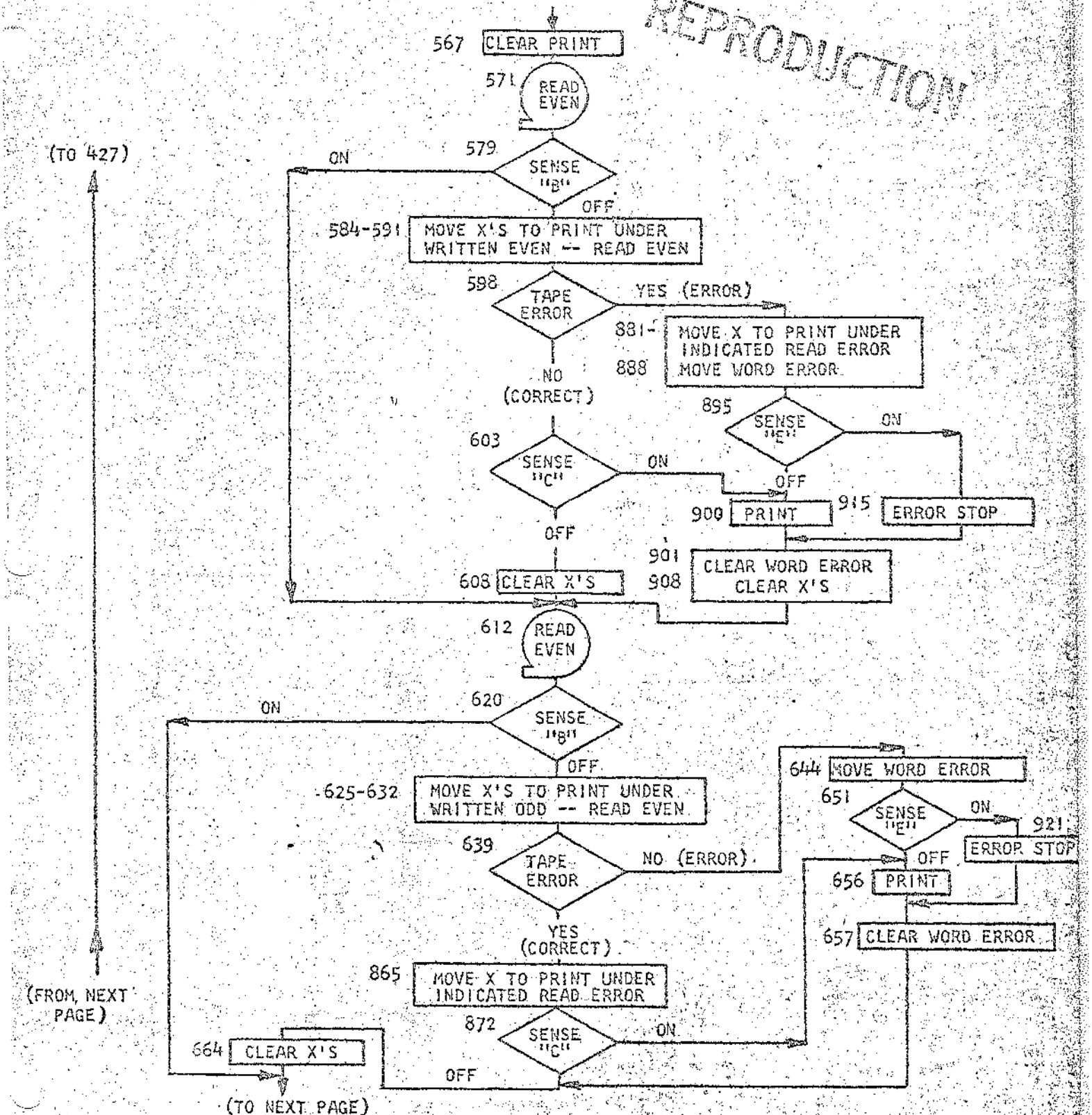
VERTICAL REDUNDANCY CHECK FLOW CHART

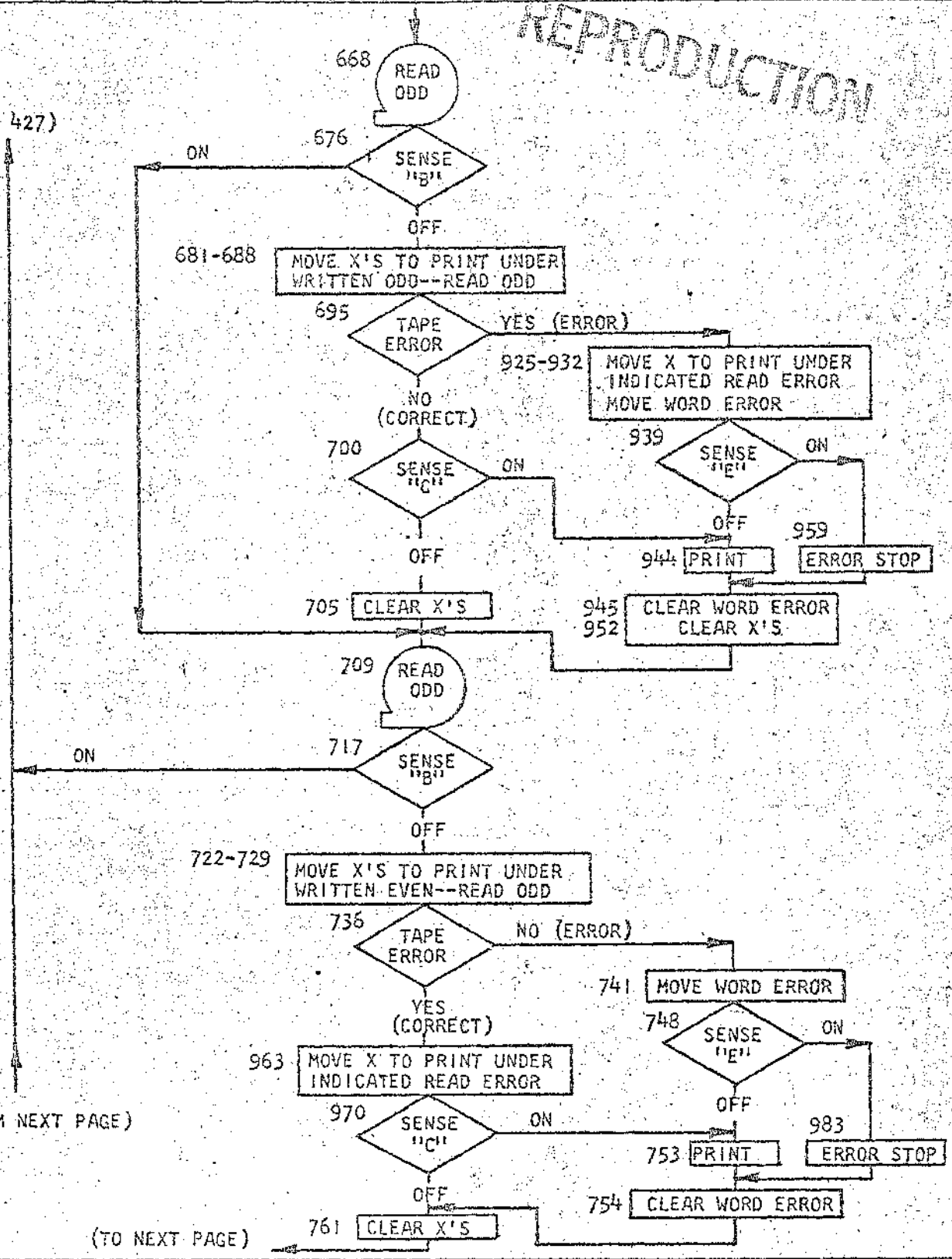


DATE	4-27-61	7-1-63	17.10.63					
ENG. CHG. NO.	1103780	117628	TA 1976					



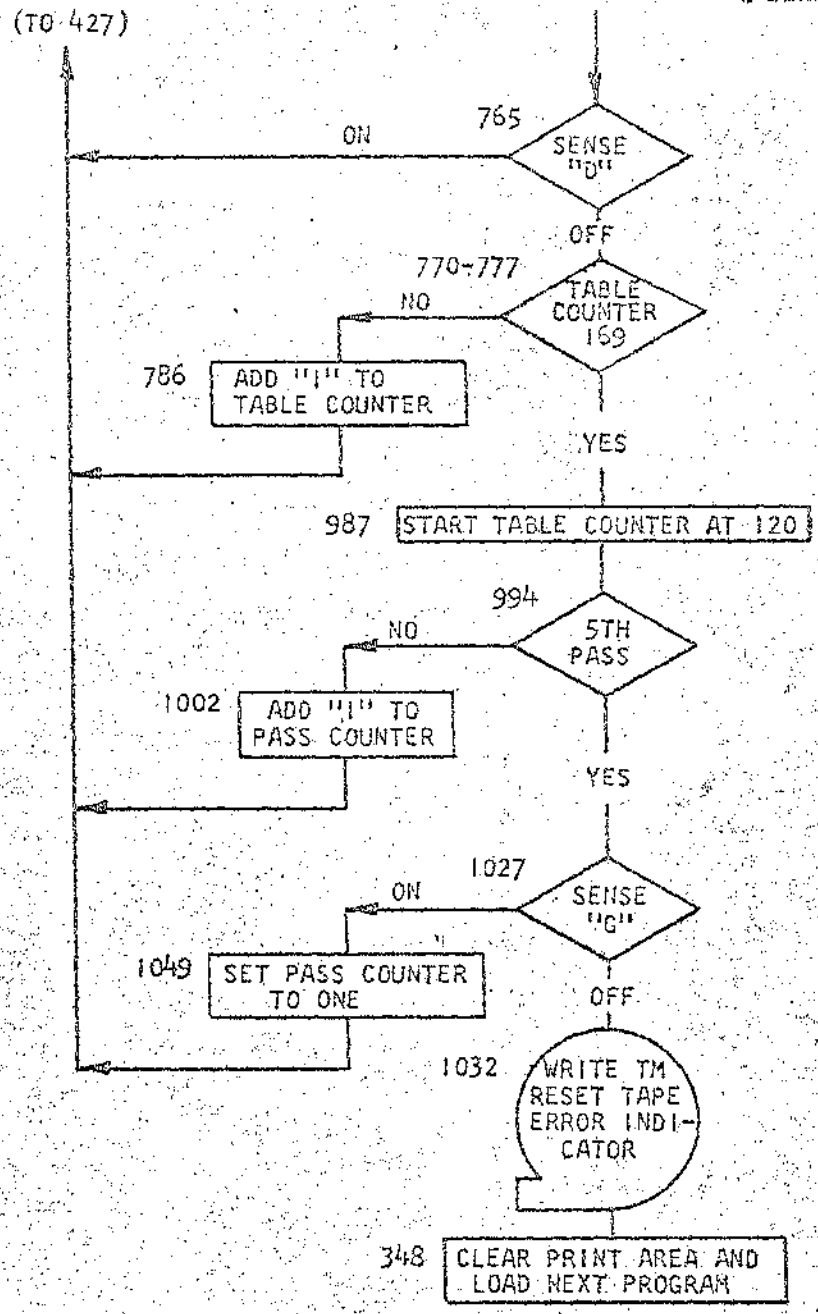
DATE	4-27-61	7-1-63	17.10.63					
ENG. CHG. NO.	1203780	117628	TA 1976	- -				

DIAGNOSTIC FUNCTION TEST



DATE	4-27-61	7-1-63	17.10.63					
ENG. CHG. NO.	130578-C	117628	TA 1976					

DIAGNOSTIC FUNCTION TEST



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ENG. CHG. NO.	1103788	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

VERT. REDUNDANCY CHECK 5080C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	0	1		CONSTANT ONE
084	084	X	X		PASS COUNTER
086	086	X	XX		TABLE COUNTER
089	089	1	20		CONSTANT START TABLE ADDR.
092	092	X			CONSTANT X
093	093	E	RRO	R	CONSTANT
098	098				CONSTANT BLANKS
104	104	1	69		CONSTANT STOP TABLE ADDR.
120	120	1	234	567890ABCDEFGHIJ	TABLE
140	140	K	LMN	OPQRSTUVWXYZ.□+$	TABLE
160	160	*	-/,	%#@+-≠	TABLE
171	171	E	VEN		CONSTANT
175	175	O	DD		CONSTANT
178	178	R	EAD	ERROR	CONSTANT
188	188	W	RIT	TEN	CONSTANT
377	377	B	400	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		CLEAR PRINT
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT IF 1 IN 1252
413	413	L	083	085	SET PASS COUNTER TO ONE
420	420	L	091	088	START TABLE AT 120
427	427	B	800	K	BRANCH IF END OF REEL
432	432	L	S50	262	LOAD GM WM IN LOC. 262
439	439	L	S50	276	LOAD GM WM IN LOC. 276
446	446	,	261	261	SET WORD MARK IN LOC. 261
453	453	M	088	463	MOVE TABLE CHARACTER TO PRINT AREA
460	460	M	XXX	261	,,
467	467	M	%U4	261W	WRITE TAPE EVEN
475	475	B	809	L	BRANCH ON TAPE ERROR
480	480	M	%B4	261W	WRITE TAPE ODD
488	488	B	823	L	BRANCH ON TAPE ERROR
493	493	M	%B4	261W	WRITE TAPE ODD
501	501	B	837	L	BRANCH ON TAPE ERROR
506	506	M	%U4	261W	WRITE TAPE EVEN
514	514	B	851	L	BRANCH ON TAPE ERROR
519	519	U	%U4	8	BACKSPACE TAPE
524	524	U	%U4	8	,,
529	529	U	%U4	8	,,
534	534	U	%U4	8	,,
539	539	B	567		BRANCH
567	567	/	250		CLEAR PRINT
571	571	M	%U4	272R	READ TAPE EVEN

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579	579	B	612	B	B ON TO SCOPE	SS
584	584	M	092	204	MOVE X TO PRINT AREA	
591	591	M	092	227	,,	
598	598	B	881	L	BRANCH ON TAPE ERROR	
603	603	B	900	C	C ON CORRECT PRINT	SS
608	608	/	250		CLEAR PRINT	
612	612	M	%U4	272R	READ EVEN	
620	620	B	668	B	B ON TO SCOPE	SS
625	625	M	092	215	MOVE X TO PRINT AREA	
632	632	M	092	227	,,	
639	639	B	865	L	BRANCH ON TAPE ERROR	
644	644	M	097	285	MOVE WORD ERROR TO PRINT	
651	651	B	921	E	E ON TO ERROR STOP	SS
656	656	2			PRINT	
657	657	M	102	285	CLEAR WORD ERROR	
664	664	/	250		CLEAR XS FROM PRINT AREA	
668	668	M	%84	272R	READ TAPE ODD	
676	676	B	709	B	B ON TO SCOPE	SS
681	681	M	092	215	MOVE X TO PRINT AREA	
688	688	M	092	235	,,	
695	695	B	925	L	BRANCH ON TAPE ERROR	
700	700	B	944	C	C ON FOR CORRECT PRINT	SS
705	705	/	250		CLEAR XS FROM PRINT AREA	
709	709	M	%84	272R	READ TAPE ODD	
717	717	B	427	B	B ON TO SCOPE	SS
722	722	M	092	204	MOVE X TO PRINT AREA	
729	729	M	092	235	,,	
736	736	B	963	L	BRANCH ON TAPE ERROR	
741	741	M	097	285	MOVE WORD ERROR TO PRINT	
748	748	B	983	E	E ON TO ERROR STOP	SS
753	753	2			PRINT	
754	754	M	102	285	CLEAR WORD ERROR FROM PRINT	
761	761	/	250		CLEAR XS FROM PRINT AREA	
765	765	B	427	D	D ON TO REPEAT	SS
770	770	C	088	106	COMPARE FOR END OF TABLE	
777	777	B	786	/	BRANCH IF NOT END OF TABLE	
782	782	B	987		BRANCH IF END OF TABLE	
786	786	A	083	088	ADD ONE TO TABLE COUNTER	
793	793	B	427		BRANCH	
800	800	U	%U4	R	REWIND TAPE DRIVE 4	
805	805	B	427		BRANCH	
809	809	U	%U4	B	BACKSPACE, TAPE DRIVE 4	
814	814	U	%U4	E	SKIP	
819	819	B	467		BRANCH	
823	823	U	%U4	B	BACKSPACE	
828	828	U	%U4	E	SKIP	
833	833	B	480		BRANCH	
837	837	U	%U4	B	BACKSPACE	
842	842	U	%U4	E	SKIP	
847	847	B	493		BRANCH	
851	851	U	%U4	B	BACKSPACE	
856	856	U	%U4	E	SKIP	

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```
 861  861  B 506                    BRANCH
 865  865  M 092 247                MOVE X TO PRINT
 872  872  B 656 C                  C ON FOR CORRECT PRINT                SS
 877  877  B 664                    BRANCH
 881  881  M 092 247                MOVE X TO PRINT
 888  888  M 097 285                MOVE WORD ERROR TO PRINT
 895  895  B 915 E                  E ON TO ERROR STOP                    SS
 900  900  2                       PRINT
 901  901  M 102 285                CLEAR WORD ERROR FROM PRINT
 908  908  / 612 250                CLEAR XS FROM PRINT AND BRANCH
 915  915  . 901                    ERROR STOP
 919  919                          WORD MARK
 921  921  . 657                    ERROR STOP
 925  925  M 092 247                MOVE X TO PRINT
 932  932  M 097 285                MOVE WORD ERROR TO PRINT
 939  939  B 959 E                  E ON TO ERROR STOP                    SS
 944  944  2                       PRINT
 945  945  M 102 285                CLEAR WORD ERROR FROM PRINT
 952  952  / 709 250                CLEAR XS FROM PRINT AND BRANCH
 959  959  . 945                    ERROR STOP
 963  963  M 092 247                MOVE X TO PRINT
 970  970  B 753 C                  C ON FOR CORRECT PRINT                SS
 975  975  B 761                    BRANCH
 983  983  . 754                    ERROR STOP
 987  987  L 091 088                START TABLE AT 120
 994  994  B #27 0855               BRANCH IF FIFTH PASS
1002  #02  A 083 085                ADD ONE TO PASS COUNTER
1009  #09  B 427                    BRANCH
1027  #27  B #49 G                  G ON TO REPEAT ENTIRE TEST            SS
1032  #32  U 804 M                  WRITE TM AND RESET TAPE ERROR INDICATOR
1037  #37  / 348 299                CLEAR AND BR TO PROG CHAINING ROUTINE
1049  #49  L 083 085                SET PASS COUNTER TO ONE
1056  #56  B 427                    BRANCH
1060  #60  M 174 205                MOVE WORD EVEN TO PRINT
1067  #67  M 177 216                MOVE WORD ODD TO PRINT
1074  #74  M 174 228                MOVE WORD EVEN TO PRINT
1081  #81  M 177 235                MOVE WORD ODD TO PRINT
1088  #88  M 187 252                MOVE WORDS READ-ERROR TO PRINT
1095  #95  M 194 264                MOVE WORD WRITTEN TO PRINT
1102  /02  M 181 274                MOVE WORD READ TO PRINT
1109  /09  2                       PRINT THIRD LINE OF HEADING
1110  /10  / 299                    CLEAR PRINT AREA
1114  /14  F 413 J                  SPACE AND BRANCH
1119  /19                          WORD MARK
1120  /20  W RIT TEN   WRITTEN     CONSTANT
1140  /40       READ    READ      CONSTANT
1160  /60    IN DICATED     CHAR   CONSTANT
1180  /80  A CTE R  CHARACTER      CONSTANT
1250  S50                          GROUP MARK WORD MARK IN LOC 1250
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N       1001                    VERT. REDUNDANCY CHECK  5080C 0A
,008015,022029,033033N       1001                    SET WORDMARK CARD       5080C 02
L054103,084086,089092,093098100101XXXXX120XERROR                             5080C 03
L068139,120120,120120,120120100l169                  1234567890ABCDEFGHIJ    5080C 04
L070177,160171,175175,175175100lKLMNOPQRSTUVWXYZ.□*$@-/,%#@PM# EVENODD      5080C 05
                                                                  ZZ
L054199,188188,188188,188188100lREAD ERRORWRITTEN                            5080C W6
L067367,340344,348349,357361100l,008012,001100lIB361080AB348/340080          5080C 07
L069404,377385,400404,405405100l          B400S681BS88          /332/        5080C 08
L066438,413420,427432,439439100lBS00S521L083085L091088B800KLS50262           5080C 09
L068474,446453,460467,475475100lLS50276,261261M088463MXXX261M%U4261W         5080C 10
L071513,480488,493501,506514100l8809LM%84261W8823LM%84261WB837LM%U4261W      5080C 11
L072553,519524,529534,539539100l8851LU%U48U%U4BU%U4BU%U4BB567                5080C 12
L069590□554554,567571,579584100l                  /250M%U4272RB612BM092204    5080C 13
L066624,598603,608612,620625100lM092227B881L8900C/250M%U4272RB668B           5080C 14
L071663,632639,644651,656657100lM092215M092227B865LM097285892lE2M102285     5080C 15
L068699,668676,681688,695700100l/250M%84272RB709BM092215M092235B925L        5080C 16
L068735,705709,717722,729736100l8944C/250M%84272RB427BM092204M092235         5080C 17
L066769,741748,753754,761765100l8963LM097285898 3E2M102285/2508427D          5080C 18
L071808,777782,786793,800805100lC0881068786/B987A0830888427   U%U4R8427      5080C 19
L065841,814819,823828,833837100lU%U4BU%U4EB467U%U4BU%U4EB480U%U4B            5080C 20
L067876,847851,856861,865872100lU%U4EB493U%U4BU%U4EB506M092247B656C          5080C 21
L070914,881888,895900,901908100lB664M092247M097285B915E2M102285/612250       5080C 22
L062944,919921,925932,939944100l.901  .657M092247M097285B959E2               5080C 23
L070982,952959,963970,975983100lM102285/709250.945M092247B753CB761           5080C 24
L072÷22,987994,÷02÷09,÷09÷091001.754L0910888÷270855A083085B427               5080C 25
L065÷55□÷23÷23,÷27÷32,÷37÷491001    B÷49GU%U4M/348299     L083085            5080C 26
L071÷94,÷60÷67,÷74÷81,÷88÷951001B427M174205M177216M174228M177235M187252     5080C 27
L072/34,/02/09,/10/14,/19/201001M194264M1812742/299F413J WRITTEN    WRIT5080C 28
L072/74□/35/35,/40/60,/60/601001TEN     READ    READ     INDICATED          5080C 29
L069S11□/75/75,/80S00,S01S051001 CHARACTER  CHARACTER  2,049L077277         5080C 30
L057S36,S13S17,S18S25,S29S361001 2/2772□/40/60□/80L/992802                   5080C 31
L046S50,S41S45,S50S50,S50S501001/280B÷60     G                               5080C 32
                                             M
/333080N                                     CLEAR WORDMARK CARD             5080C 33
,0!9027,031,038042B031T98G8400L0463S28W04BS88  VERT. REDUNDANCY CHECK        5080C 34
                  M
```

DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103780	117628	TA 1976					

WRITE TEST TAPE ROUTINE

A. PURPOSE OF ROUTINE:

TO TRANSFER READ AND COPY TEST TAPE ROUTINES AND TEST PROGRAMS FROM CARDS TO TAPE DRIVE 1.

B. LOADING PROCEDURES:

TO RUN THIS ROUTINE:

1. READY TAPE DRIVE 1.
2. PLACE CARDS IN THE FILE FEED IN THE FOLLOWING ORDER.

   A. WRITE TEST TAPE ROUTINE (BLOCK NUMBER 5300).
   B. READ TEST TAPE ROUTINE (BLOCK NUMBER 5310).
   C. COPY TEST TAPE ROUTINE (BLOCK NUMBER 5320).
   D. ALL TESTS THAT ARE TO BE WRITTEN ON TAPE.

3. TURN ON SENSE SWITCH A.
4. IF SELECTION DIGITS ARE NOT TO BE WRITTEN ON TAPE, START OPERATION BY DEPRESSING LOAD KEY ON THE CARD READER.
5. IF IT IS DESIRED TO WRITE SELECTION DIGITS ON TAPE, USE THE FOLLOWING PROCEDURE:

   A. SET 1300 IN ADDRESS STOP SWITCHES.
   B. SET 1401 TO ADDRESS STOP MODE.
   C. PRESS 1402 LOAD KEY.
   D. MACHINE WILL STOP AFTER WRITE TEST TAPE DECK HAS LOADED. PRESS START KEY.
   E. MACHINE WILL STOP WHEN SECOND CARD OF BLOCK 5310 IS LOADED. MANUALLY ENTER DESIRED SELECTION DIGITS.
   F. SET 1401 TO RUN MODE AND DEPRESS THE START KEY.

C. PROGRAM CONTROL:

SENSE SWITCH A - MUST BE TURNED ON BEFORE THE LAST CARD IS RUN OUT OF THE HOPPER TO WRITE A TAPE MARK AND CAUSE THE TAPE DRIVE TO REWIND.

D. TEST ROUTINE OPERATION:

THE WRITE TEST TAPE INSTRUCTIONS ARE LOADED INTO LOCATIONS V00-X68 (1500-1768). THESE LOCATIONS ARE CHOSEN BECAUSE WHILE TEST PROGRAMS (INCLUDING PROGRAM CHAINING AND TITLE AND HEADINGS PRINT ROUTINES) REQUIRE 1249 POSITIONS, THE READ TEST TAPE ROUTINE (BLOCK NO. 5310) WHICH FOLLOWS, GOES UP TO 1397 EXHAUSTING THE CAPACITY OF A 1.4K PROCESSING UNIT. HENCE, THE NEED FOR A PROCESSING UNIT OF AT

D. (CONTINUED)

LEAST 2K STORAGE CAPACITY TO STORE THE WRITE TEST TAPE ROUTINE. AFTER LOADING THIS ROUTINE, THE TRAILER CARD BRANCHES TO X14 (1714) TO START EXECUTING THE PROGRAM. THIS ROUTINE IS NOT WRITTEN ON TAPE.

THE FIRST INSTRUCTION EXECUTED IS TO REWIND TAPE DRIVE 1. THE NEXT INSTRUCTION STARTS THE LOADING OF THE READ TEST TAPE ROUTINE, WHICH IMMEDIATELY FOLLOWS, INTO LOCATIONS 001 THROUGH 1397. THE LAST INSTRUCTION OF THE READ TEST TAPE ROUTINE THEN BRANCHES BACK TO V09 (1509) AND THE EXECUTION OF THE WRITE TEST TAPE ROUTINE BEGINS. THE INSTRUCTION IN V09 MOVES "T65" INTO LOCATIONS 002-004. B T65 WILL THEN BECOME THE FIRST INSTRUCTION OF THE READ TEST TAPE ROUTINE DESCRIBED IN BLOCK NUMBER 5310.

A COMMAND IS THEN GIVEN TO WRITE THE READ TEST TAPE ROUTINE AS THE FIRST TAPE RECORD. THIS RECORD, AS WELL AS ALL OTHER RECORDS WRITTEN ON TAPE, IS TESTED FOR ERRORS IN TRANSMISSION AND RE-WRITTEN, IF NECESSARY. WORD MARKS IN STORAGE ARE WRITTEN AS WORD SEPARATOR CHARACTERS ON TAPE. IF NO ERRORS OCCUR, A TEST IS MADE FOR END-OF-REEL. SINCE AT THIS POINT THE ANSWER IS NO, THE READ AREA IS CLEARED, AND THE TITLE CARD OF THE COPY TEST TAPE ROUTINE IS READ INTO LOCATIONS 001-080. POSITION 080 IS THEN TESTED FOR THE LETTER A WHICH ALWAYS INDICATES A TITLE CARD. IF A IN 080, THE INFORMATION IN THE TITLE CARD IS WRITTEN AS THE SECOND TAPE RECORD.

THE NEXT CARDS TO FOLLOW ARE THE PROGRAM INSTRUCTION CARDS FOR THE COPY TEST TAPE ROUTINE. THESE INSTRUCTIONS ARE LOADED INTO VARIOUS SECTIONS OF STORAGE FROM 001 TO 403 AND WRITTEN ON TAPE AS A 1249-CHARACTER RECORD. THIS ROUTINE BECOMES THE THIRD TAPE RECORD.

FOLLOWING THIS, EACH TEST BLOCK TO BE WRITTEN ON TAPE FOLLOWS A SIMILAR PATTERN, I.E.,

TITLE CARD - 80-CHARACTER RECORD
PROGRAM - 1249-CHARACTER RECORD
DETAIL CARDS (IF ANY) - 80-CHARACTER RECORD

THIS PROCEDURE CONTINUES UNTIL EITHER AN END-OF-REEL OR LAST CARD CONDITION IS RECOGNIZED. THE FIRST CONDITION (EOR) IS SIGNALLED BY A STOP IN W45. THE SECOND CONDITION IS RECOGNIZED WITH SENSE SWITCH A ON AND NO CARDS LEFT IN THE HOPPER. THIS GIVES A COMMAND TO WRITE A TAPE MARK, RE-WIND TAPE DRIVE 1, AND STOP THE MACHINE AT LOCATION W61 (1661) BECAUSE OF THE STOP IN W60.

E. STOPS:

STORAGE ADDR REG	TYPE OF HALT
1646	END OF REEL
1661	END OF WRITE -- TAPE HAS BEEN WRITTEN

F. PRINTOUTS:

NONE

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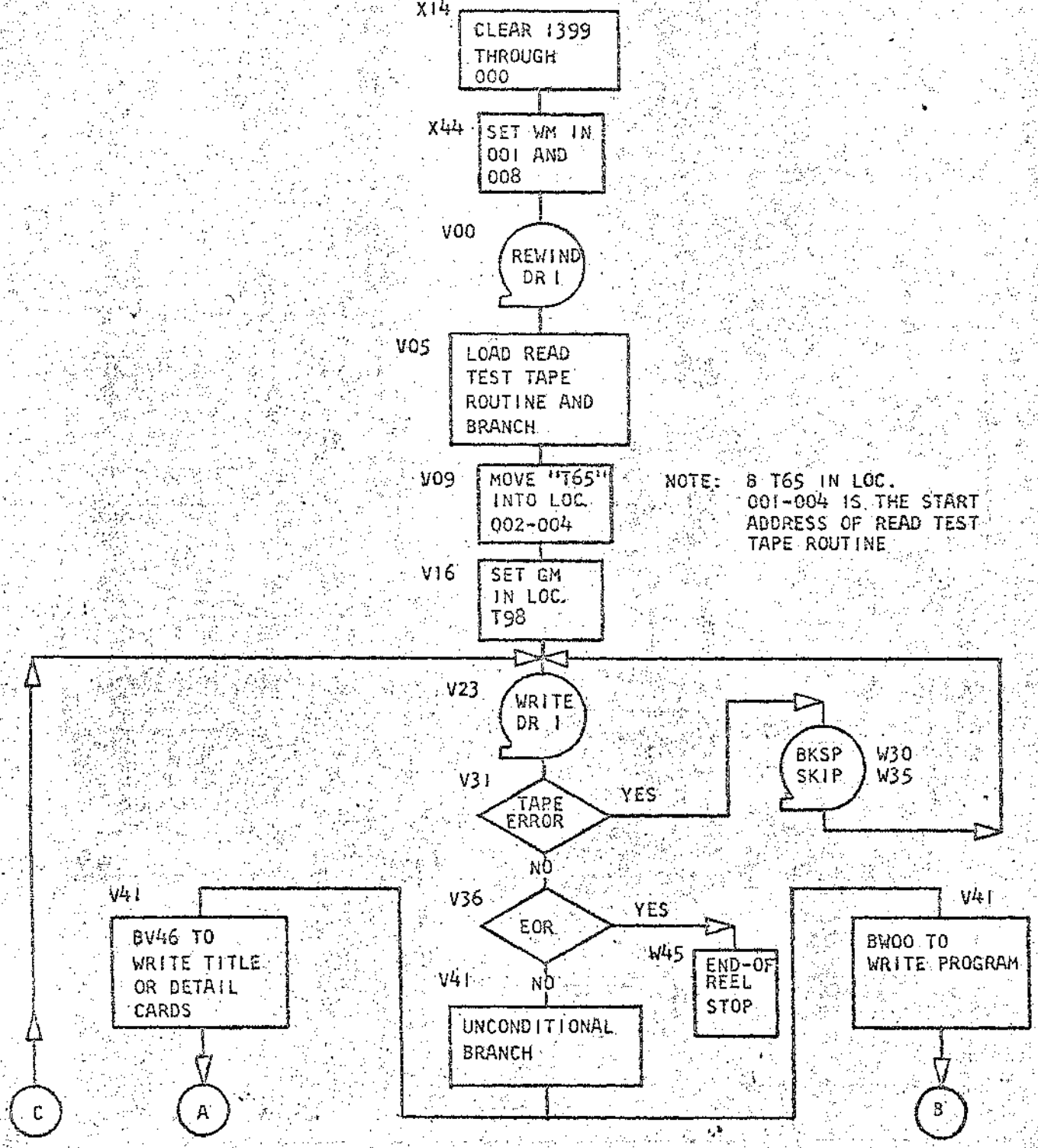
ENG. CHG. NO.	110378	110378C	115283	116745A	117628	TA 1976		

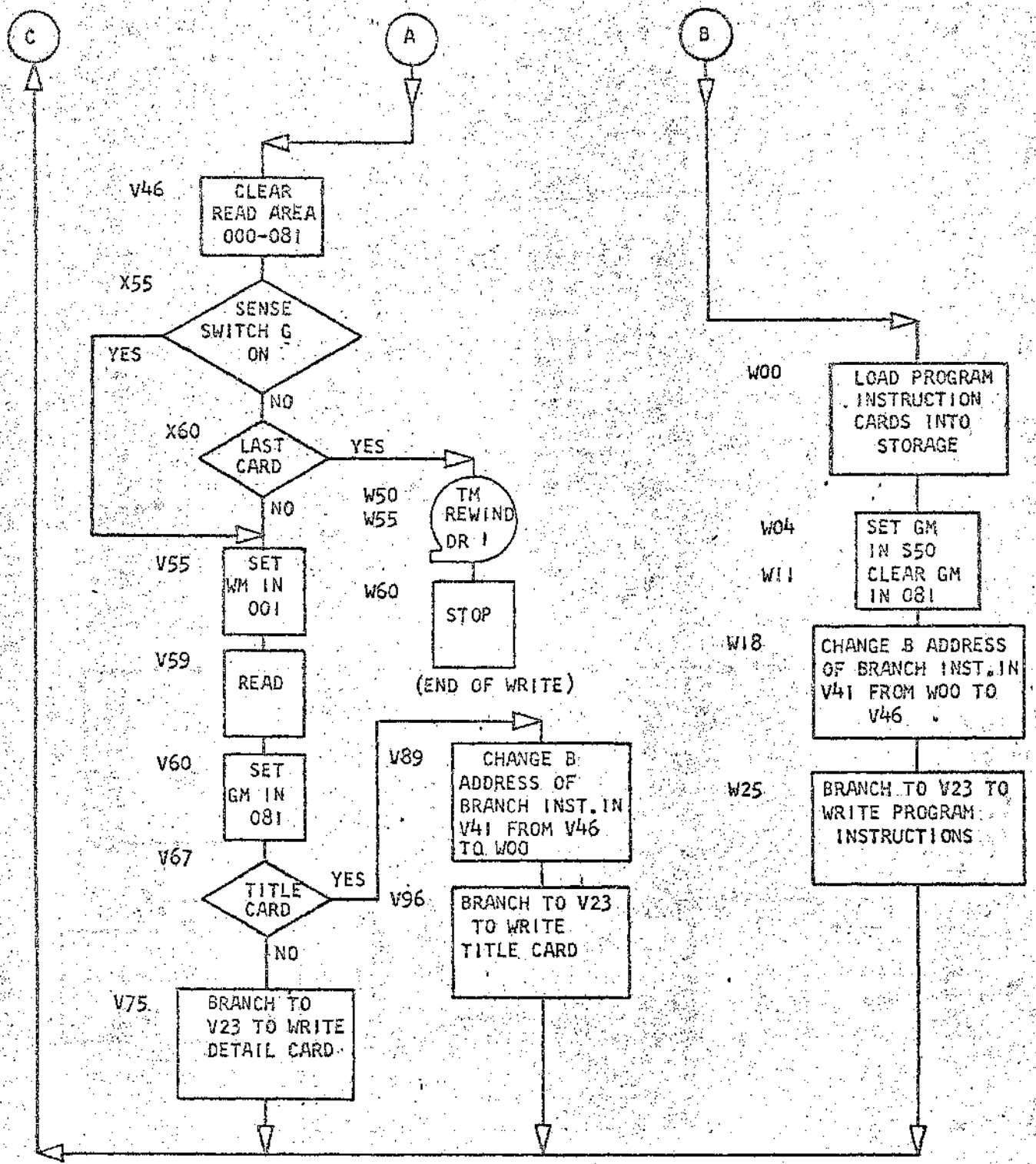
WRITE TEST TAPE ROUTINE

FLOW CHART



DATE	2-2-61	4-27-61	5-15-62	4-25-63	7-1-63	17. 10. 63		
ENG. CHG. NO.	110378	110378C	115283	116745A	117628	TA 1976		

DIAGNOSTIC FUNCTION TEST



DATE	2-2-61	4-27-61	5-15-62	4-25-63	7-1-63	17. 10. 63		
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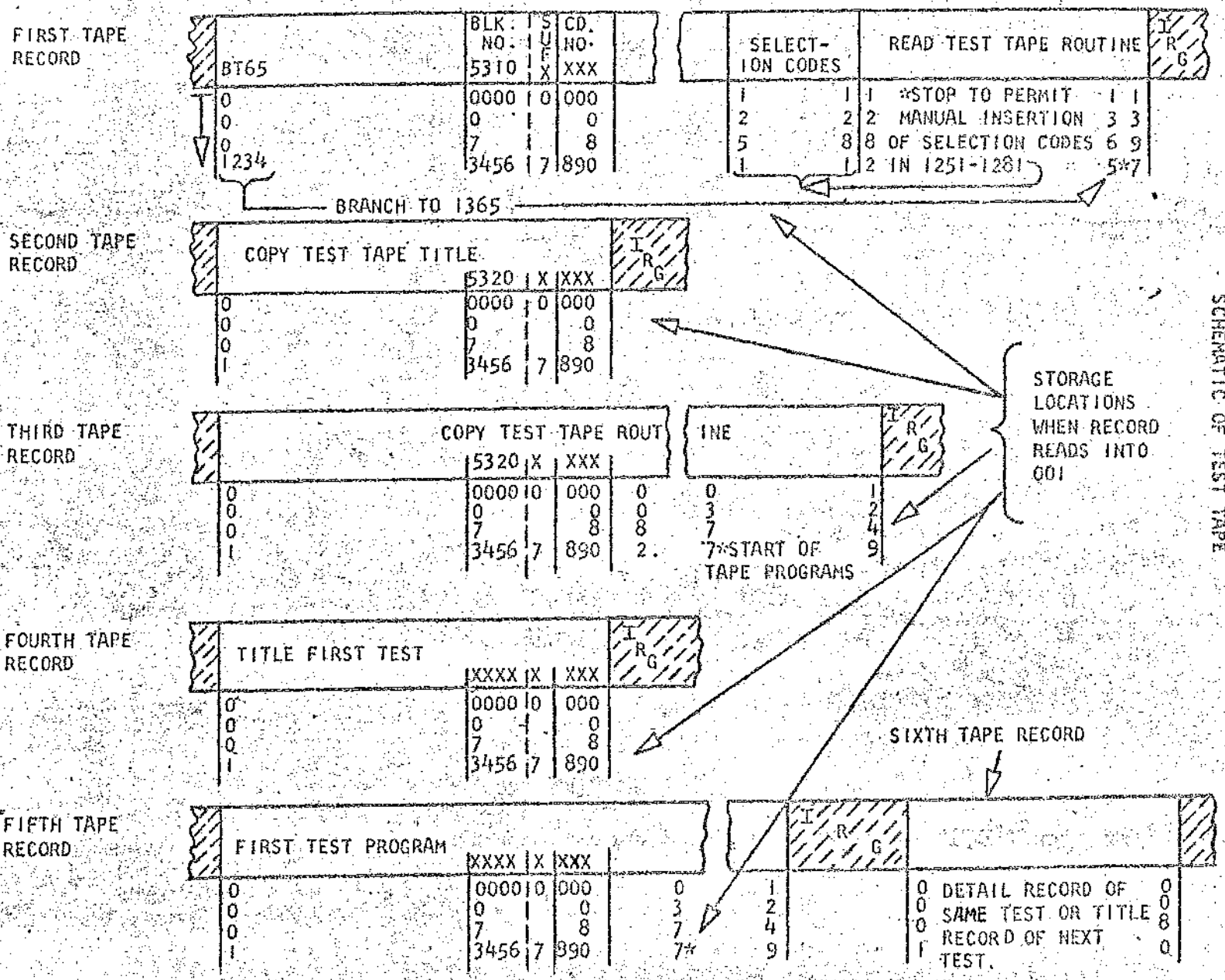
DIAGNOSTIC FUNCTION TEST
REPRODUCTION
SCHEMATIC OF TEST TAPE



ENG. CHG. NO.	DATE
110378	2-2-61
110378A	4-27-61
115283	5-15-62
116745A	4-25-63
117628	7-1-63
TA 1976	17. 10. 63

PART NO. 1521-93
SHEET 5 OF 8
BLOCK NO. 5300

PROGRAM LISTING FOR USE WITH FLOW CHART

WRITE TEST TAPE ROUTINE 5300E

INSTRUCTION ADDRESS	OP	A	B	REMARKS
1500	V00	U	%U1 R	REWIND
1505	V05	I	001	LOAD READ TEST TAPE ROUTINE INTO STORAGE
1509	V09	M	X03 004	PUT BT65 IN 001 FOR READ TEST TAPE TEST
1514	V14	L	X00 T98	LOAD GM-WM IN T98
1519	V23	L	%U1 001W	WRITE RECORD
1531	V31	B	W30 L	BRANCH IF TAPE ERROR
1536	V36	B	W45 K	BRANCH IF END-OF-REEL
1541	V41	B	V46	*BV46 FOR TITLE OR DETAIL — BW00 FOR PGM
1546	V46	✓	081	CLEAR READ
1550	V50	B	X55	GO TEST FOR LAST CARD
1555	V55	,	001	SET WORD MARK
1559	V59	I		READ TITLE OR DETAIL CARD
1560	V60	L	T98 081	LOAD GM-WM FOR TITLE OR DETAIL RECORD
1567	V67	B	V89 080A	BRANCH IF TITLE CARD
1575	V75	B	V23	BRANCH TO WRITE DETAIL CARD
1589	V89	M	X06 V44	SETUP BRANCH BW00 FOR PROGRAM RECORD
1596	V96	B	V23	GO WRITE TITLE CARD
1600	W00	I	001	READ TEST INTO STORAGE
1604	W04	L	T98 S50	TEST PROGRAM LOADED. PUT GM-WM IN S50.
1611	W11	M	W61 081	CLEAR GM FROM 081
1618	W18	M	X09 V44	SETUP BRANCH BV46 FOR DETAIL OR TITLE
1625	W25	B	V23	GO WRITE PROGRAM
1630	W30	U	%U1 B	BACKSPACE TAPE IF TAPE ERROR
1635	W35	U	%U1 E	ERASE FORWARD IF DEFECTIVE TAPE
1640	W40	B	V23	BRANCH TO RE-WRITE
1645	W45	.		END-OF-REEL STOP
1646	W46	B	W45	,,
1650	W50	U	%U1 N	WRITE TAPE MARK
1655	W55	U	%U1 R	REWIND
1660	W60	.		END WRITE STOP
1661	W61	B	W60	, ,,
1700	X00			GM-WM IN X00
1701	X01	T	65	START ADDR FOR READ TEST TAPE ROUTINE
1704	X04	W	00	B ADDR TO READ TEST RECORD INTO STORAGE
1707	X07	V	46	B ADDR TO READ TITLE OR DETAIL RECORDS
1710	X10	I	0	CONSTANT TO MODIFY CLEAR STORAGE ADDR
1732	X12	I	9	*NEW HUNDREDS AND TENS OF CLEAR STOR ADDR
1714	X14	M	X18 X23	START — SETUP NEW CLEAR STORAGE ADDR
1721	X21	✓	T99	*CLEAR STORAGE FROM 1399 DOWN
1725	X25	A	X11 X13	MODIFY CLEAR STORAGE ADDRESS
1732	X32	B	X44 X220	STORAGE CLEARED GO WRITE RECORD
1740	X40	B	X14	GO BACK TO CLEAR STORAGE LOOP

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1744   X44    . C01 008      SET WORDMARKS FOR READ TEST TAPE BLOCK
1751   X51    B V00          START ROUTINE AT V00.
1755   X55    B X65 G        BYPASS LAST CARD.  DO NOT WRITE TM.
1760   X60    B W50 A        BRANCH LAST CARD.  WRITE TAPE MARK.
1765   X65    B V55          CONTINUE WRITING
1769   X69                   *AN ASTERISK MEANS INSTRUCTION CHANGES
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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	12 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	0 6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    WRITE TEST TAPE ROUTINE    5300E00A
L068V35,V05V09,V16V23,V31W36100IU%U1R1001MX03004LX00T98L%U1001W8W301            5300E 02
L063V66,V41V46,V50V55,V59V60100IBW45K8V46 /081BX55 ,0011LT98081                 5300E 03
L060W03,V75V89,V96W00,W04W04100TBV89080A8V23          MX06V448V231001           5300E 04
L068W39,W11W18,W25W30,W35W40100ILT98S50MW61081MX09V448V23 U%U1BU%U1E            5300E 05
L072W79,W45W46,W50W55,W60W61100IBV23 -8W45U%U1MU%U1R-8W60                       5300E 06
L062X09¤W80W80,X00X01,X04X071001                    GT65W00V46                  5300E 07
                                                    M
L066X43,X12X14,X21X25,X32X40100IIOT9MX13X23/T99AX11X13BX44X220BX14              5300E 08
L057X68,X51X55,X60X65,X69X691001,0010088V008X65GBW50A8V55                       5300E 09
8X14                                                WRITE TEST TAPE ROUTINE    5300E 10
```

DATE	2-2-61	4-27-61	5-15-62	-4-25-63	7-1-63	17.10.63		
ENG. CHG. NO.	110378	110378C	115283	116745A	117628	TA 1976		

READ TEST TAPE ROUTINE

A. PURPOSE:

TO PROVIDE A PROGRAM THAT WILL RUN CUSTOMER ENGINEERING TESTS FROM TAPE.

B. LOADING AND RUNNING PROCEDURES:

1. LOAD THE TAPE ON TAPE DRIVE 1. USE SAME DENSITY AS THAT IN WHICH TAPE WAS WRITTEN. TEST TAPES WRITTEN AT THE PLANT ARE WRITTEN IN LOW DENSITY 200 CHARACTERS PER INCH.

2. LOAD WORKING REEL ON TAPE DRIVE 4. USE HIGH DENSITY, 556 CHARACTERS PER INCH, FOR BLOCK NUMBER 5500 AND BLOCK NUMBER 5530. USE EITHER DENSITY FOR OTHER TESTS.

3. PRESS TAPE LOAD KEY-
AFTER LOADING THE TEST TAPE ROUTINE, THE MACHINE PROCEEDS TO A STOP AT ADDRESS LOCATION 1369.

4. IF DESIRED, PUT A HALT, C B A 8 2 1 WM, IN S87 TO STOP THE TAPE AFTER TESTS HAVE RUN AND THE TAPE HAS REWOUND.

5. SET SENSE SWITCHES, ENTER SELECTION DIGITS AND CODES AS DESIRED. PUSH START.

TO SIMPLIFY THE ENTERING OF SELECTION DIGITS, USE THE FOLLOWING PROCEDURE:

A. MANUALLY PUNCH A CARD WITH THE FOLLOWING INFORMATION.

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
,008015,022026M080S80BT69                                 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

SELECTION DIGITS
CARD COLUMNS 51 THROUGH 80 CORRESPOND TO STORAGE LOCATIONS 1251 TO 1280.

B. PUSH START RESET KEY AND LOAD THE PREPARED CARD. AFTER EXECUTING THE CARD THE FIRST TEST FROM TAPE WILL BE LOADED. KEEP THIS LOAD CARD. IT CAN BE USED EVERY TIME TESTS ARE RUN FROM TAPE.

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6. RUNNING ONLY ONE TEST ASSOCIATED WITH A SPECIAL FEATURE, BY PASSING ALL OTHERS.

IT MAY BE DESIRABLE TO RUN ONLY ONE TEST ASSOCIATED WITH A SPECIAL FEATURE. THIS IS DONE BY COMPARING THE BLOCK NUMBER OF THE TEST, MANUALLY ENTERED IN S73 THROUGH S76, TO THE BLOCK NUMBER OF THE TEST AS IT IS READ IN FROM TAPE IN LOCATIONS 073 THROUGH 076. WITH SENSE SWITCH F ON, AN EQUAL COMPARE CAUSES THE TEST TO BE EXECUTED IF THE PROPER SELECTION DIGIT HAD BEEN PREVIOUSLY ENTERED IN STORAGE.

AFTER LOADING THE TEST TAPE ROUTINE, THE MACHINE STOPS.

1. ENTER SELECTION DIGIT, IF REQUIRED BY THE TEST.
   EXAMPLE -- 1 IN S58 FOR DIVIDE.
2. ENTER BLOCK NUMBER IN S73 THROUGH S76.
   EXAMPLE -- 3210 FOR DIVIDE.
3. SET SENSE SWITCH F ON.
4. PRESS START KEY.

NOTE: SETTING SENSE SWITCH F OFF CAUSES ALL EQUAL COMPARES TO BE BY PASSED. IN THE ABOVE EXAMPLE WITH SENSE SWITCH F OFF, THE DIVIDE TEST WILL BE BY PASSED. ALL TESTS NOT REQUIRING A SELECTION DIGIT WILL BE EXECUTED. ALL TESTS REQUIRING A SELECTION DIGIT AND FOR WHICH A SELECTION DIGIT HAS BEEN ENTERED WILL BE EXECUTED WITH THE ONE EXCEPTION OF DIVIDE.

NOTE ALSO, THAT WITH SENSE SWITCH F OFF AND NO BLOCK NUMBER IN S73 THROUGH S76, ALL TESTS NOT REQUIRING SELECTION DIGITS WILL BE EXECUTED BECAUSE OF THE UNEQUAL COMPARISON. AND ALL TESTS REQUIRING A SELECTION DIGIT AND FOR WHICH A SELECTION DIGIT HAS BEEN ENTERED, WILL BE EXECUTED.

FURTHER NOTE THAT, FOR TESTS REQUIRING A SELECTION DIGIT, THE ABSENCE OF THE SELECTION DIGIT CAUSES THE TESTS TO BE BY PASSED REGARDLESS OF THE SETTING OF SENSE SWITCH F.

7. RUNNING MULTIPLE TESTS ASSOCIATED WITH A SPECIAL FEATURE, BY PASSING ALL OTHERS.

IT MAY BE DESIRABLE AT TIMES TO RUN ONLY THOSE TESTS THAT ARE ASSOCIATED WITH A GIVEN SPECIAL FEATURE AND BY-PASS ALL OTHERS. THIS MAY BE DONE AS DESCRIBED IN THE FOLLOWING EXAMPLES BY COMPARING, FOR AN EQUAL CONDITION, ONLY THE TWO HIGH ORDER POSITIONS OF THE BLOCK NUMBERS IN 073 AND 074 TO THAT MANUALLY SET UP IN 1273 AND 1274. MANUALLY MODIFY THE TAPE READ ROUTINE IN STORAGE TO DO THIS.

COLUMN BINARY	MOVE AND BINARY DECODE	3000	1	IN S56
	MOVE AND BINARY CODE	3010	1	IN S56
	PUNCH COLUMN BINARY	3020	1	IN S56
	READ COLUMN BINARY	3030	1	IN S56
	BIT TEST	3040	1	IN S56
MULTIPLY-DIVIDE	MULTIPLY	3200	1	IN S58
	DIVIDE	3210	1	IN S58

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AFTER LOADING THE READ TEST TAPE ROUTINE, THE MACHINE STOPS.

1. CHANGE 6 TO 4 IN LOCATIONS 1341 AND 1344.
2. ENTER 1 IN LOCATION 1256 FOR COLUMN BINARY, OR 1 IN 1258 FOR MULTIPLY-DIVIDE.
3. ENTER THE TWO HIGH-ORDER POSITIONS OF BLOCK NUMBERS 30 FOR COLUMN BINARY, OR 32 FOR MULTIPLY-DIVIDE IN LOCATIONS 1273 AND 1274.
4. SET SENSE SWITCH F TO THE ON POSITION.
5. PRESS START KEY.

C. TEST PROCEDURE:

THIS ROUTINE MUST BE WRITTEN ON TAPE BY THE WRITE TEST TAPE ROUTINE. IT IS CHAINED TO THE WRITE ROUTINE. TEST DECKS TO BE WRITTEN ON TAPE ARE CHAINED BEHIND THE READ TEST TAPE ROUTINE.

BECAUSE THE READ TEST TAPE ROUTINE IS THE FIRST RECORD ON THE TEST TAPE, THE FIRST INSTRUCTION MUST BE IN 001. THIS POSITION IS ADDRESSED FIRST WHEN THE FIRST TAPE RECORD IS LOADED BY USE OF THE TAPE LOAD KEY.

THE WRITE TEST TAPE ROUTINE WILL HAVE TO CHANGE THE INFORMATION LEFT IN THE READ-IN AREA BY THE TRAILER CARD OF THE READ TEST TAPE ROUTINE. BUT BEFORE THIS OCCURS, THE TRAILER CARD MUST LOAD BS88 INTO 377 SO THAT WHEN THE READ TEST TAPE ROUTINE FIRST CALLS FOR THE EXECUTION OF A TEST AFTER A REWIND, THE PROGRAM WILL BRANCH TO S88 AND CALL FOR THE FIRST TEST TO BE READ. THE TRAILER CARD MUST DO ONE OTHER THING. IT MUST CAUSE A BRANCH TO THE WRITE TEST TAPE ROUTINE.

THE FIRST THING THAT THE WRITE TEST TAPE ROUTINE DOES IS TO CHANGE THE INSTRUCTION IN 001 TO A BRANCH TO T65. NEXT, THE RECORD IS WRITTEN ON TAPE. NOW, WHEN THE TEST TAPE IS LOADED INTO THE 1401, THE FIRST INSTRUCTION CAUSES A BRANCH TO T65, WHERE THE READ TEST TAPE ROUTINE STARTS.

D. STOPS:

1365 IN STORAGE ADDRESS REGISTER - HALT - ENTER SELECTION DIGIT.

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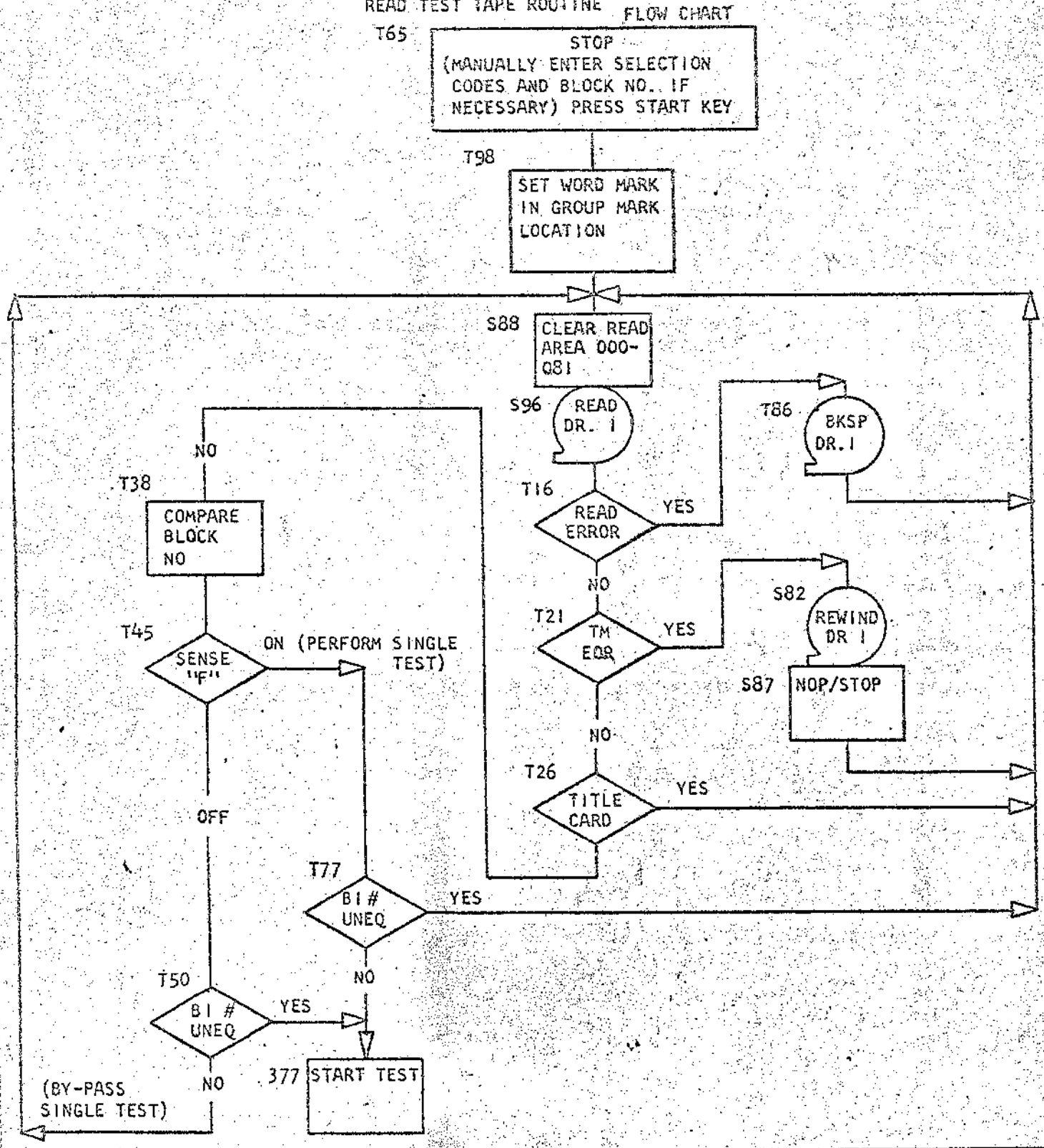
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451459
SHEET 4 OF 6
BLOCK NO. 5310E

READ TEST TAPE ROUTINE FLOW CHART



DATE	2-2-61	5-15-62	7-1-63	17 10 63				
ENG. CHG. NO.	110375	115283	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

READ TEST TAPE ROUTINE 5310E

INSTRUCTION ADDRESS		OP	A	B	REMARKS
1282	S82	U	3U1	R	REWIND DRIVE 1
1287	S87	N			CHANGE TO . TO STOP BEFORE RERUN
1288	S88	✓	081		CLEAR GM-WM FROM 081
1292	S92	,	S51		SETUP MOVE FOR GROUP MARK
1296	S96	L	3U1	003R	READ RECORD
1304	T04	M	S51		SET B-STAR TO END OF RECORD PLUS ONE
1308	T08	L	T98		LOAD GM-WM IN HIGHEST READ ADDR PLUS 1
1312	T12	¤	S51		
1316	T16	B	T86	L	BRANCH IF READ ERROR
1321	T21	B	S82	K	BRANCH IF END OF REEL
1326	T26	B	S88	080A	BRANCH TO READ NEXT RECORD IF TITLE
1334	T34	,	S73		SET WORD MARK IN BLOCK NUMBER
1338	T38	C	076	S76	COMPARE BLOCK NUMBERS
1346	T46	B	T77	F	F ON - PERFORM ONLY IF COMPARISON EQUAL
1350	T50	B	377	/	GO PERFORM TEST
1356	T56	B	S88		BYPASS TEST WITH BLOCK NO. IN S73-S76
1366	T66	.	T69		STOP TO ENTER BL NO. + SELECTION CODES
1369	T69	,	T98		SET WORD MARK IN GROUP MARK LOCATION
1378	T78	B	S88		GO READ RECORD
1377	T77	B	S88	/	GO READ RECORD
1382	T82	B	377		PERFORM TEST WITH BLOCK NO. IN S78-S76
1386	T86	U	3U1	B	BACKSPACE TO RE-READ
1391	T91	B	S88		GO RE-READ
1398	T98				GROUP MARK IN T98
377	377	B	S88		SETUP READ FOR FIRST TEST

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ENG. CHG. NO.	110378	115283	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
≡012012,015022,029033N      1001                    READ TEST TAPE ROUTINE   5310E00A
L053T07,S87S98,S92S96,T04T08100IU%U1RN/081,S51L%U1001RMS51                    5310E 02
L069TN4,T12T16,T21T26,T34T38100ILT90≡S518T86L8S82KBS88080A,S73C076S76         5310E 03
L069T81,T50T55,T65T69,T731771001BT77FB377/8S88      -T69,T98BS88BS88V        5310E 04
L049T98,T86T91,T95T98,T98T98100183770%U188S88   G                            5310E 05
                                                M
8008    L037381BV09             8S88            READ TEST TAPE ROUTINE       5310E 06
```

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CUSTOMER ENGINEERING TESTS
FOR THE 1401 DATA PROCESSING SYSTEM

COPY TEST TAPE ROUTINE

A. PURPOSE OF ROUTINE

TO PROVIDE A PROGRAM THAT WILL DUPLICATE THE MASTER TEST TAPE REEL DESCRIBED IN BLOCK NO. 5300.

B. LOADING PROCEDURES

1. TO RUN ROUTINE FROM CARDS (1402)

IF IT IS DESIRED TO LOAD THIS ROUTINE FROM CARDS, PLACE THE INSTRUCTION CARDS IN BLOCK NO. 5320 IN THE HOPPER OF 1402 AND PRESS THE LOAD KEY ON THE CARD READER. IN THIS CASE, IT IS NOT NECESSARY TO MANUALLY ENTER A "1" IN S54. TAPE READING AND TAPE WRITING WILL PROCEED AS DESCRIBED.

2. TO RUN ROUTINE FROM MAGNETIC TAPE.

TO START THE OPERATION, PRESS THE TAPE LOAD KEY. THIS WILL LOAD THE FIRST TAPE RECORD "READ TEST TAPE ROUTINE" INTO LOCATIONS 001-T97 (0001-1397). THE FIRST INSTRUCTION IN THIS ROUTINE WILL BRANCH TO A STOP INSTRUCTION IN LOCATION T65 (1365). MANUALLY ENTER A "1" IN S54 AND PRESS THE START KEY.

THE SECOND TAPE RECORD "TITLE CARD - COPY TEST TAPE ROUTINE" WILL NEXT BE READ INTO LOCATIONS 001-080. BRANCHING AGAIN TO S88, THE THIRD TAPE RECORD "COPY TEST TAPE ROUTINE" WILL BE READ INTO LOCATIONS 001-S49 (0001-1249), RETAINING THE "1" IN S54 AND THE READ TEST TAPE ROUTINE IN S82-T97. SINCE THE COPY TEST TAPE ROUTINE DOES NOT HAVE THE LETTER A IN 80, THE PROGRAM BRANCHES TO LOCATION 377, TESTS FOR THE "1" IN S54, AND BRANCHES FIRST TO LOCATION 400 AND THEN TO LOCATION 082. UP TO THIS POINT, NOTHING HAS BEEN WRITTEN ON THE BLANK REEL.

NOW, STORAGE POSITIONS 400 THROUGH 1999 ARE CLEARED, A RECORD IS READ, THEN WRITTEN, AND THE OPERATION IS REPEATED FOR THE NEXT RECORD.

C. PROGRAM CONTROL

IF, WHEN THE COPY OPERATION IS COMPLETED FOR THE FIRST TIME, SENSE SWITCH D IS IN THE ON POSITION, TAPE DRIVE #1 RE-WINDS AND ALL RECORDS ON IT ARE AGAIN COPIED ONTO THE BLANK REEL. THUS, THE MASTER REEL MAY BE COPIED ONTO THE BLANK REEL AS OFTEN AS TAPE DRIVE #2 WILL ALLOW.

D. TEST ROUTINE OPERATION

THE COPY TEST TAPE ROUTINE REWINDS TAPE DRIVES #2 AND #1, CLEARS STORAGE POSITIONS 400-Z99 (0400-1999), READS THE FIRST TAPE RECORD "READ TEST TAPE ROUTINE" INTO LOCATIONS 401-X97 (0401-1797), AND WRITES IT ON TAPE DRIVE #2. A BRANCH TO

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D. (CONTINUED)

LOCATION 092 CONTINUES THE OPERATION FOR THE NEXT RECORD, AND SO ON, UNTIL THE END OF THE COPY OPERATION. ALL RECORDS READ FROM THE MASTER REEL, AND WRITTEN ON THE BLANK REEL ARE TESTED FOR ERRORS IN TRANSMISSION AND RE-READ AND RE-WRITTEN IF NECESSARY.

WHEN THE TAPE MARK IS FINALLY SENSED ON TAPE DRIVE #1, A TAPE MARK IS WRITTEN ON THE BLANK REEL BY TAPE DRIVE #2, AND BOTH TAPE DRIVES #1 AND #2 ARE RE-WOUND. THE MACHINE THEN STOPS AT LOCATION 241, INDICATING THE END OF THE OPERATION.

E. STOPS

STORAGE ADDR REG	TYPE OF HALT
1369	READ ROUTINE--ENTER 1 IN 1254
241	END-TAPE COPIED

F. PRINTOUTS

NONE

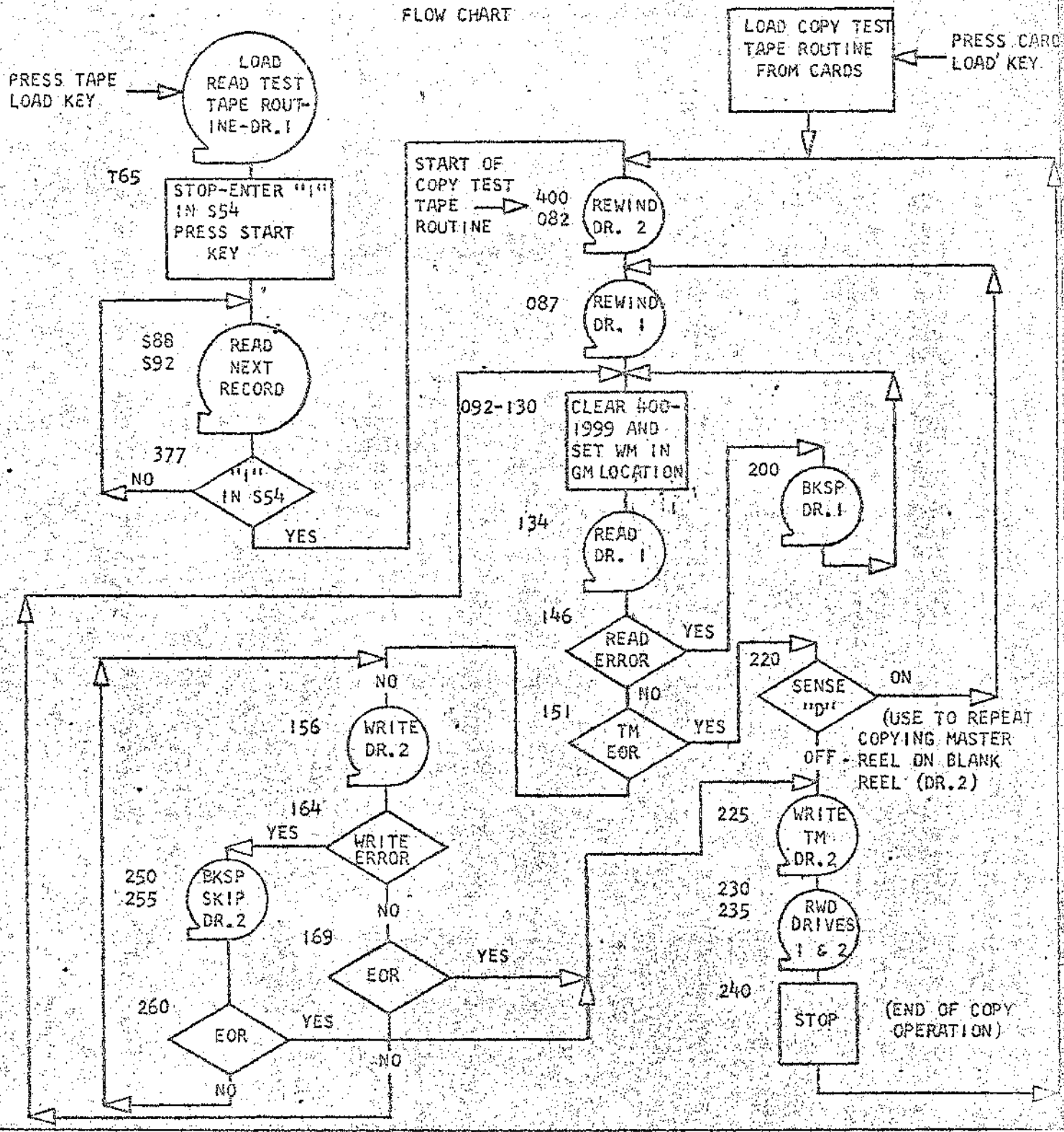
G. COMMENTS

UNITS REQUIRED:

1401 PROCESSING UNIT WITH AT LEAST 2,000 STORAGE POSITIONS.
1402 CARD READER IF THIS ROUTINE IS TO BE LOADED FROM CARDS
7330 OR 729 TAPE DRIVE #1 LOADED WITH THE MASTER TAPE REEL.
7330 OR 729 TAPE DRIVE #2 LOADED WITH A BLANK REEL.

DATE	2-2-61	2-15-61	5-15-62	27762				
ENG. CHG. NO.	110378	110378A	115283	1459				

COPY TEST TAPE ROUTINE FLOW CHART



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ENG. CHG. NO.	110378	110378A	115283	1459				

PROGRAM LISTING FOR USE WITH FLOW CHART

COPY TEST TAPE ROUTINE 5320E

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	U	%U2	R	REWIND WRITE DRIVE
087	087	U	%U1	R	REWIND READ DRIVE
092	092	L	303	106	CLEAR STORAGE FROM 400-1999
099	099	M	104		"
103	103	/	Z99		"
107	107	B	130	1044	"
115	115	,	104		"
119	119	A	306	106	"
126	126	B	099		"
130	130	,	281		SET WORD MARK IN GROUP MARK LOCATION
134	134	L	%U1	401R	READ FROM TEST TAPE
142	142	L	282		LOAD GM-WM IN HIGHEST READ ADDR. PLUS 1
146	146	B	200	L	BRANCH IF READ ERROR
151	151	B	220	K	BRANCH IF END OF READ TAPE
156	156	L	%U2	401W	WRITE ON BLANK TAPE
164	164	B	250	L	BRANCH IF WRITE ERROR
169	169	B	225	K	BRANCH IF END OF WRITE TAPE
174	174	B	092		GO CLEAR STORAGE FOR NEXT RECORD
200	200	U	%U1	B	BACKSPACE
205	205	B	092		CLEAR STORAGE AND RE-READ
220	220	B	087	D	D ON TO REPEAT COPYING TEST TAPE
226	225	U	%U2	M	WRITE TAPE MARK
230	230	U	%U2	R	REWIND BOTH DRIVES
235	235	U	%U1	R	"
240	240	.			END OF COPY PROGRAM
241	241	B	082		GO REWIND DRIVES AND RESTART
250	250	U	%U2	B	BACKSPACE WRITE DRIVE
256	255	U	%U2	S	SKIP
260	260	B	225	K	END OF WRITE TAPE. GO REWIND AND HALT.
265	265	B	156		BRANCH TO RE-WRITE
280	280				GROUP MARK IN 281
300	300	/	Z99		CONSTANTS
304	304	I	00		"
333	333	,	000	012	CHAINING ROUTINE
340	340	,	001		CHAINING ROUTINE
344	344	1	001		CHAINING ROUTINE
348	348				*AN ASTERISK MEANS INSTRUCTION CHANGES
377	377	B	400	S541	USE WHEN RUNNING PROGRAM FROM TAPE
385	385	B	588		"
400	400	B	082		BRANCH TO START PROGRAM

DATE	2-2-61	2-15-61	5-15-62	27762				
ENG. CHG. NO.	1103/8	1103/8A	115283	1459				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LI-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                    COPY TEST TAPE ROUTINE   5320E 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD        5320E 02
L058102,087092,099099,099099!001U%U2RU%U!RL303106¤104                          5320E 03
L071141,107115,119126,130134!001/Z99B130!044,104A306106B099,281L%U1%01R        5320E 04
L069178,146151,156164,169174!001L2828200L8220KL%U2401WB250LB225KB092           5320E 05
L072239,205220,225230,235235!0@1U%U1BB092          8087DU%U2RU%U2RU%U!R5320E 06
L072279,241250,255260,265265!001.8082      U%U2BU%U2EB225KB156                 5320E 07
L059306,300304,304304,304304!001 G                  /Z99100                  5320E 08
                                  M
L067367,340344,348348,348348!001,008012,0011001                               5320E 09
L059403,385400,404404,404404!001B400S5418588          8082                    5320E 10
/333080                                          CLEAR WORDMARK CARD          5320E 11
,019027,031N        B031T98GB4008W04             COPY TEST TAPE ROUTINE       5320E 12
                          M
```

DATE	2-2-61	2-15-61	5-15-62	27762				
NO. CHG. NO.	110378	110378A	115283	1459				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451461
SHEET 1 OF
BLOCK NO. 5330C

COMPRESSED TAPE READ AND EXPAND

A. PURPOSE OF TEST

TO TEST THE COMPRESSED TAPE READ AND EXPAND (MOVE AND INSERT ZEROS) CIRCUITRY BY READING AND EXPANDING TWO NUMERICAL WORDS WRITTEN ON TAPE FROM DETAIL CARDS IN A SIMULATED 7070 MODE, AND AN ALPHABETIC WORD. THE FOLLOWING ERROR ROUTINES ARE EMPLOYED.

1. TAPE WRITE ERROR
2. COMPRESSED TAPE READ ERROR
3. EXPAND (COMPARE) ERROR

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4
   B. ENTER A 1 IN 1270

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON TO REPEAT FOR SCOPING
   OFF TO CONTINUE

   C ON TO PRINT CORRECT RESULTS
   OFF TO CONTINUE

   D ON TO REPEAT PROGRAM FOR INDIVIDUAL RECORD
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

   G ON TO OMIT STORE B STAR INSTRUCTION
   OFF TO CONTINUE

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ENG. CHG. NO.	110378	110378B	117628	TA 1976				

D. TEST PROCEDURE

A CARD COUNTER IS USED TO PERFORM THE PROGRAM FOR EACH DETAIL CARD TEN TIMES BEFORE PROCEEDING WITH THE NEXT CARD. THE COMPRESSED RECORD (TWO NUMERICAL WORDS PRECEDED BY A DELTA△, AND AN ALPHABETIC WORD PRECEDED BY A DELTA, ARE LOADED INTO LOCATIONS 205-215. THE COMPRESSED TAPE RECORD IS WRITTEN AND CHECKED. IF ERROR, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD THE WORDS "TAPE WRITE ERROR."

IF NO TAPE WRITE ERROR, THE RECORD IS BACKSPACED AND A READ COMPRESSED TAPE AND STORE B-STAR INSTRUCTIONS ARE NORMALLY EXECUTED WITH SENSE SWITCH G OFF. THE ADDRESS IN THE B ADDRESS REGISTER SHOULD BE 240 (UNITS POSITION OF THE COMPRESSED TAPE RECORD) AND IS MOVED BY THE STORE B-STAR INSTRUCTION TO LOCATIONS 560-562. THESE LOCATIONS ARE THE A ADDRESS OF THE EXPAND INSTRUCTION (X) STORED BY THE PROGRAM IN LOCATION 559. IF SENSE SWITCH G IS ON, THE STORE B-STAR INSTRUCTION IS BY-PASSED AND 240 IS ENTERED IN LOCATIONS 560-562 BY A MOVE INSTRUCTION.

A TEST IS THEN MADE FOR A TAPE READ ERROR. IF ERROR THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD THE WORDS "COMPRESSED TAPE READ ERROR".

E. STOPS - SENSE E ON

STORAGE ADDRESS REGISTER

690	ERROR-TAPE WRITE
694	HALT-CHECK WRITE ERROR
750	ERROR-COMPRESSED TAPE READ
777	ERROR-EXPAND

F. PRINTOUTS

1. CORRECT

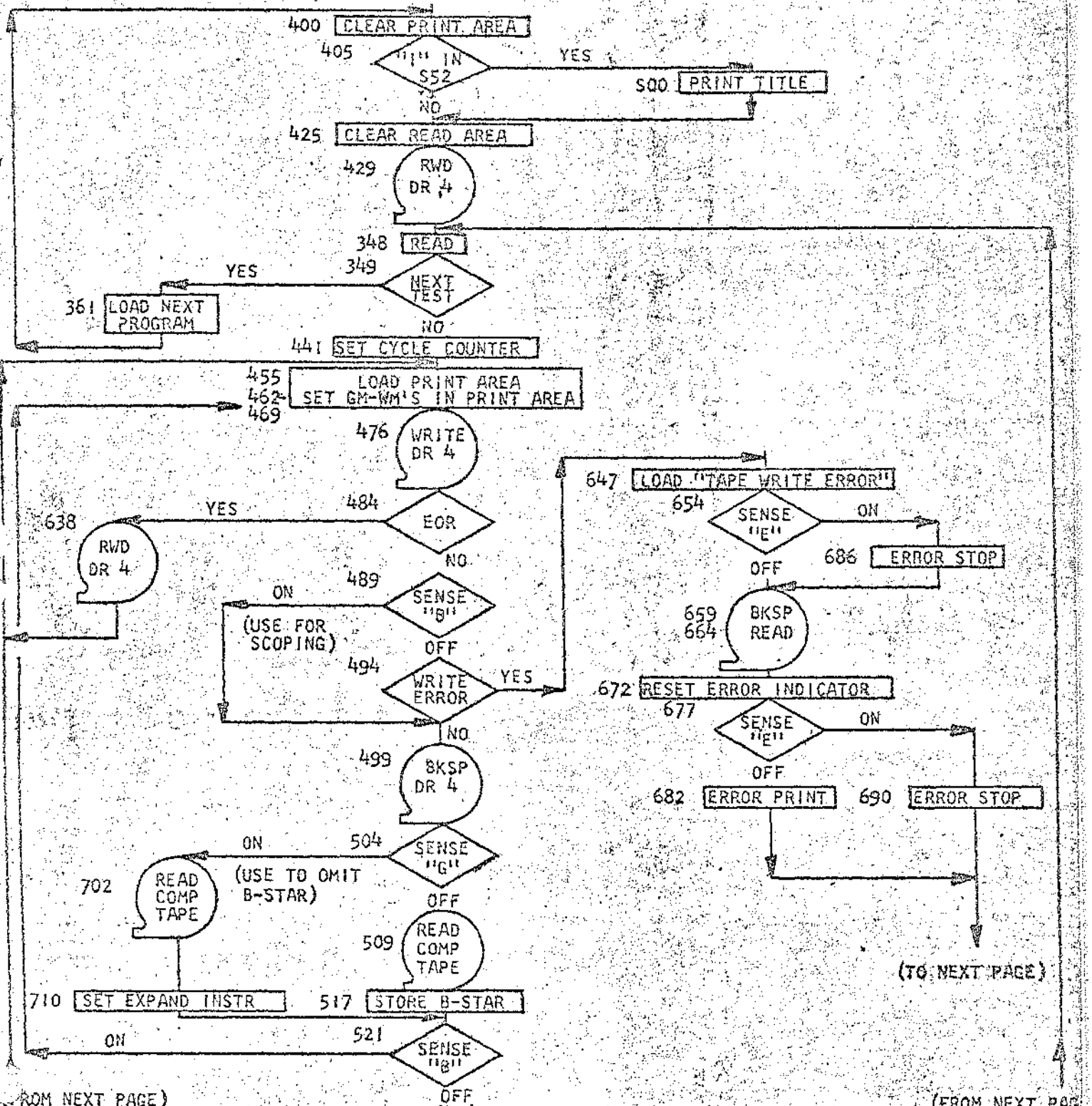
WRITE A FIELD ON TAPE	READ A-FIELD FROM TAPE	RESULT SHOULD BE	RESULT IS
△55B222K△CX	△55B222K△DX	△0000055B00222K CX	△0000055B00222K△CX
△444D33L△CX	△444D33L△CX	△0000444D00033L CX	△0000444D00033L△CX
△3333C4M△CX	△3333C4M△CX	△0003333C00004M CX	△0003333C00004M△CX

2. ERROR

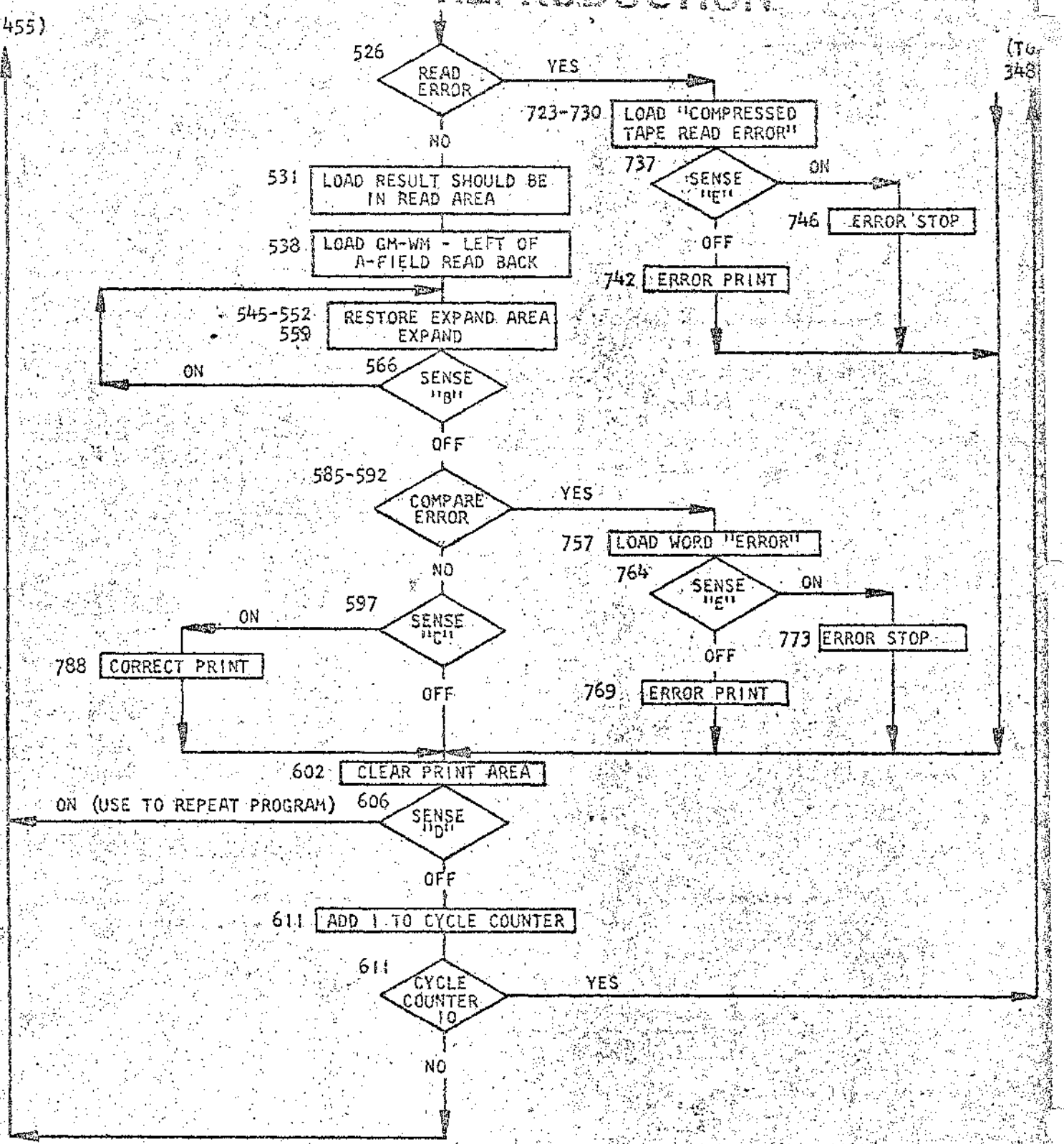
△55B222K△CX	△55B222K△CX	TAPE WRITE ERROR
△444D33L△CX	△444D33L△CX	COMPRESSED TAPE READ ERROR
△3333C4M△CX	△3333C4M△CX	△0003333C00004M△ CX 3333C4M△CX ERROR

DATE	2-2-61	3-13-61	6-29-63	17.10.63				
CHG. NO.	110378	1103788	117628	TA 1976				

FLOW CHART — COMPRESSED TAPE READ AND EXPAND



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-3	117628	TA 1976				



DATE	2-2-61	3-13-61	7-1-63	17.10.63				
ENG. CHG. NO.	110378	110378-B	117628	TA 1976				

PROGRAM LISTING FOR USE WITH FLOW CHART

COMPRESSED TAPE RD.+ EX. 5330C

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	389	S701	USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		,,	
389	389	N	000		,,	
393	393	M	360	392	,,	
400	400	/	332		CLEAR PRINT	
404	404	/			,,	
405	405	B	S00	S521	BR TO TITLE PRINT IF 1 IN 1252	
413	413	B	425		BRANCH	
421	421	B	441		BRANCH	
425	425	/	080		CLEAR CARD READ AREA	
429	429	U	%U4	R	REWIND DRIVE 4	
434	434	B	348		BR TO PROGRAM CHAINING ROUTINE	
441	441	L	793	151	RESET CYCLE COUNTER	
448	448	,	005	048	LOAD PRINT AREA	
455	455	L	015	215	,,	
462	462	L	S50	242	SET GM WM IN LOC 242	
469	469	L	S50	216	SET GM WM IN 216	
476	476	M	%U4	205W	WRITE TAPE	
484	484	B	638	K	BRANCH IF END OF REEL	
489	489	B	499	B	SENSE SWITCH B	SS
494	494	B	647	L	BRANCH IF TAPE WRITE ERROR	
499	499	U	%U4	B	BACKSPACE DRIVE 4	
504	504	B	702	G	G ON TO OMIT STORE B-STAR	SS
509	509	M	%C4	229R	READ COMPRESSED TAPE	
517	517	H	562		STORE B-STAR	SS
521	521	B	469	B	SENSE SWITCH B	
526	526	B	723	L	BRANCH IF TAPE READ ERROR	
531	531	L	066	266	LOAD PRINT AREA	
538	538	L	S50	228	LOAD GM WM LEFT OF A-FIELD	
545	545	L	811	286	RESTORE EXPAND AREA	
552	552	,	269	277	,,	
559	559	X	XXX	286	*EXPAND, X 240 286	
566	566	B	545	8	SENSE SWITCH 8	SS
571	571	B	269	277	BRANCH IF EXPAND ERROR	
578	578	N	000	000	,,	
585	585	C	286	266	,,	
592	592	B	757	/	,,	
597	597	B	788	C	C ON FOR CORRECT PRINT	SS
602	602	/	299		CLEAR PRINT AREA	
606	606	B	455	D	D ON TO OMIT CYCLE COUNT	SS
611	611	A	611	151	ADD ONE TO CYCLE COUNTER	
618	618	B	348	1501	READ NEXT FACTOR IF TENTH CYCLE	
626	626	B	455		USE SAME FACTOR IF NOT TENTH CYCLE	

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ENG. CHG. NO.	110378	110378B	117628	TA 1976				

```
 638  638  U %U4 R                    REWIND DRIVE 4
 643  643  B 455                      BRANCH
 647  647  M 834 291                  MOVE COMMENT TO PRINT
 654  654  B 686 E                    E ON TO ERROR STOP                    SS
 659  659  U %U4 B                    BACKSPACE DRIVE 4
 664  664  M %U4 229R                 READ TAPE ERROR RECORD
 672  672  B 677 L                    RESET TAPE ERROR INDICATOR
 677  677  B 690 E                    E ON TO ERROR STOP                    SS
 682  682  2 602                      ERROR PRINT
 686  686  . 659                      ERROR STOP
 690  690  . 602                      ERROR STOP
 694  694                            WORD MARK
 702  702  M %C4 229R                 READ COMPRESSED TAPE
 710  710  M 818 562                  SET 240 IN EXPAND INSTRUCTION
 717  717  B 521                      BRANCH
 723  723  M 860 274                  MOVE COMMENT TO PRINT
 730  730  M 850 291                    ,,
 737  737  B 746 E                    E ON TO ERROR STOP
 742  742  2 602                      COMP. TAPE RD. ERROR PRINT
 746  746  . 602                      COMP. TAPE RD. ERROR STOP
 750  750                            WORD MARK
 757  757  M 865 291                  MOVE COMMENT TO PRINT
 764  764  B 773 E                    E ON TO ERROR STOP                    SS
 769  769  2 602                      EXPAND ERROR PRINT
 773  773  . 602                      EXPAND ERROR STOP
 777  777                            WORD MARK
 788  788  2 602                      CORRECT PRINT
 792  792                            WORD MARK AND BLANKS
 816  816  2 40                       CONSTANT
 819  819  T APE  WRITE ERROR          ,,
 835  835  T APE  READ  ERROR          ,,
 851  851  C OMP RESSED               ,,
 861  861  E RRO R                    ,,
1120  /20  W RIT E A-FIELD ON TAP     ,,
1140  /40  E     READ A-FIELD FRO     ,,
1160  /60  M  TA PE   RESULT SHOU     ,,
1180  /80  L O B E    . RESULT IS     ,,
1250  S50                            GROUP MARK WORD MARK IN LOC 1250
```

DATE	2-2-61	3-13-61	6-29-63	17.10.63				
CHG NO.	110378	110378B	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N        1001                COMPRESSED TAPE RD.+ EX.5330C00A
,008015,022029,033033N        1001                SET WORDMARK CARD        5330C 02
L067367,340344,348349,3573611001,008012,0011001183610808A8421/340080      5330C 03
L069404,377385,389393,4004041001          B389S701BS88N000M360392/332/     5330C 04
L068440,413421,425429,4344411001BS00S5218425    8441/080U%U4RB348          5330C 05
L067475,448455,462469,4764761001L793151,005048L01521SLS50242LS50216       5330C 06
L065508,484489,494499,5045091001M%U4205WB638K8499B8647LU%U4B8702G          5330C 07
L068544,517521,526531,5385451001M%C4229RH562B4698B723LL066266LS50228       5330C 08
L072584,552559,566571,5785851001L811286,269277XXXX286B5458¤269277N0000005330C 09
L065617,592597,602606,6116181001C2862668757/B788C/2998455DA611151         5330C 10
L068653,626638,643647,6546541001834815018455          U%U4RB455M834291     5330C 11
L068689,659664,672677,6826861001B686EU%U48M%U4229RB677LB690E2602.659       5330C 12
L072729,694702,710717,7237301001.602          M%C4229RM8185628521  M8602745330C 13
L071768,737742,746750,7577641001M85029187746E2602.602          M8652918773E 5330C 14
L072808,773777,788792,7927921001602.602             2602                  5330C 15
L072848¤809809,816819,8358351001          240TAPE WRITE ERRORTAPE READ  ERR5330C 16
L072888¤849849,851861,8618611001ORCOMPRESSEDERROR                          5330C 17
L072/59,/40/60,/60/60,/60/601001WRITE A-FIELD ON TAPE   READ A-FIELD FRO5330C 18
L072/99,/80S00,S00S00,S00S001001M TAPE   RESULT SHOULD BE      RESULT IS5330C 19
L057S24,S01S05,S12S13,S17S181001Z,049L0772772/2772¤/40/60                  5330C 20
L058S50,S29S36,S37S41,S45SS01001¤/80L/992802/2802413      G                5330C 21
                                                          M
/333080N                                        CLEAR WORDMARK CARD        5330C 22
,019027,031,038042803IT98GB400L0463528W04BS88   COMPRESSED TAPE RD.+ EX.5330C 23
                    M
```

DETAIL CARDS

```
D55E222KDCX                          D0000055E00222KDCXG        5330C 24
E       E                            E         E  M
D444D33LDCX                          D0000444D00033LDCXG        5330C 25
E       E                            E         E  M
D3333C4MDCX                          D0003333C00004MDCXG        5330C 26
E       E                            E         E  M
D222228NDCX                          D0022222800000NDCXG        5330C 27
E       E                            E         E  M
D22222800DG                          D0022222800000D00G         5330C 28
E       E                            E         E  M
D222228PD A                          D0022222800000PD AG        5330C 29
E       E                            E         E  M
D22222BQD                            D0022222B0000QD  G         5330C 30
E       E                            E         E  M
```

DATE	2-2-61	3-13-61	6-29-63	17. 10. 63				
ENG. CHG. NO.	110378	1103788	117628	TA 1976				

INTER-RECORD-GAP MEASUREMENT

A. PURPOSE OF TEST

TO WRITE PAIRS OF RECORDS ON THE 729 MODEL III OR IV IN HIGH DENSITY AND MEASURE THE INTER-RECORD GAP BETWEEN THE TWO RECORDS IN MILLISECONDS. THE TEST IS EXECUTED IN TWO PARTS AND MUST BE RUN CONSECUTIVELY:

PART I - IRG MEASUREMENT - WRITE WRITES THE RECORDS ON TAPE DRIVE #4 AND FORMS GAPS UNDER SEVEN CONDITIONS OF WRITING:

GROUP	PAIRS OF RECORDS IN GROUP	DOWN TIME OF GO LINE BETWEEN WRITES		PRINTOUT COMMENT
		MODEL IV	MODEL III	
1	100	0.83 MS	1.20 MS	MINIMUM DLY
2	100	0.95 - 2.09 MS	1.33 - 2.47 MS	1-2 MS DLY
3	100	1.98 - 4.26 MS	2.35 - 4.64 MS	2-4 MS DLY
4	100	3.89 - 11.86 MS	4.26 - 12.23 MS	4-12 MS DLY
5	100	11.86 MS	12.23 MS	12 MS DLY
6	10	5 SECONDS	5 SECONDS	5 SEC DLY
7	10	0.83 MS	1.20 MS	MIN & CREEP

NOTE: DOWN TIMES OF GO LINE SHOWN IN ABOVE TABLE ARE ROUNDED TO THE NEAREST 0.01 MS. IN GROUP 7, THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND RE-WRITTEN ONCE, BUT MAY BE CHANGED AS DESCRIBED LATER.

PART II - IRG MEASUREMENT - READ READS THE RECORDS, MEASURES THE GAPS IN MILLISECONDS, AND PRINTS THE RESULTS FOR EACH OF THE SEVEN CONDITIONS. (SEE PRINTOUT EXAMPLE ON PAGE 5.)

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS:

   A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY.

   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. WHEN RUNNING TEST FROM TAPE:

   A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY.

   B. ENTER A 1 IN 1269.

C. PROGRAM CONTROL

B ON - VARIES THE NUMBER OF CHARACTERS IN THE FIRST RECORD OF EACH PAIR FROM 150 TO APPROXIMATELY 1150 CHARACTERS.

OFF - WRITES A FIXED 10-CHARACTER RECORD AS THE FIRST RECORD OF EACH PAIR.

C ON - FOR TESTING 729 MODEL III

OFF - FOR TESTING 729 MODEL II

G ON - FOR MACHINES WITH ADVANCED PROGRAM FEATURE.

OFF - FOR MACHINES WITHOUT ADVANCED PROGRAM FEATURE.

D. TEST PROCEDURE

THE FIRST INSTRUCTION IS A STOP CODE IN LOCATION 399. THIS STOP ALLOWS THE OPERATOR TO SET TAPE DRIVE ON 4, SET SENSE SWITCHES B, C, AND G AS DESIRED, AND MANUALLY MAKE TWO CHANGES IN THE PROGRAM AS FOLLOWS:

1. TO CHANGE THE 5 SECONDS DELAY IN GROUP 6 TO ANY DESIRED DELAY FROM 1 TO 39 SECONDS, CHANGE THE 5 (NO WM) IN LOCATION 098 TO APPROPRIATE CHARACTER. EXAMPLES:

   2 FOR 2 SECONDS DELAY
   + FOR 10 SECONDS DELAY
   V FOR 15 SECONDS DELAY

2. TO CHANGE THE NUMBER OF BKSP-REWRITES IN GROUP 7 TO ANY NUMBER FROM 1 TO 39 TIMES, CHANGE THE 1 (NO WM) IN LOCATION 122 TO APPROPRIATE CHARACTER. EXAMPLES:

   3 FOR 3 BKSP-REWRITES
   S FOR 12 BKSP-REWRITES
   0 FOR 20 BKSP-REWRITES

THE INSTRUCTIONS ARE SET UP TO WRITE 100 PAIRS OF RECORDS WITH MINIMUM DELAY FOR GROUP 1. DEPENDING UPON THE SETTING OF SENSE SWITCH B, THE FIRST RECORD OF EACH PAIR MAY BE A FIXED 10-CHARACTER RECORD ALWAYS WRITTEN FROM LOCATIONS S40-S49 (1240-1249) OR MAY BE

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VARIED TO START THE FIRST PAIR WITH A 10-CHARACTER RECORD AND INCREASE THE FIRST RECORD OF EACH SUCCEEDING PAIR BY 10. THIS IS DONE BY DECREASING THE B ADDRESS OF THE TAPE WRITE INSTRUCTION FROM S40 TO S30 TO S20 TO S10, ETC. THE FIRST RECORD OF THE LAST PAIR (100) IS A 1000-CHARACTER RECORD WRITTEN FROM LOCATIONS 240-1249.

THE SECOND RECORD OF EACH PAIR IS ALWAYS THE SAME. IT STARTS WITH A TAPE MARK STORED BY THE PROGRAM IN LOCATION /19 (1119) AND CONTINUES TO LOCATION 1249. AFTER ALL THE RECORDS FOR GROUP 1 ARE WRITTEN ON TAPE A COMMAND IS THEN GIVEN TO WRITE A SPACER RECORD TO SIGNAL THE END OF THE GROUP. THIS RECORD IS THE SAME AS THE SECOND RECORD OF EACH PAIR EXCEPT THAT IT STARTS WITH THE LETTERS, "IRG" STORED IN LOCATIONS 1116-1118.

THE PROGRAM THEN BRANCHES TO A SET OF INSTRUCTIONS TO VARY THE DELAY FOR GROUP 2 AND PROCEED TO WRITE 100 PAIRS OF RECORDS IN THE SAME MANNER AS FOR GROUP 1. THE PROCEDURE IS REPEATED FOR GROUPS 3, 4, AND 5 AFTER MODIFYING THE DELAY INSTRUCTIONS FOR EACH GROUP AS REQUIRED.

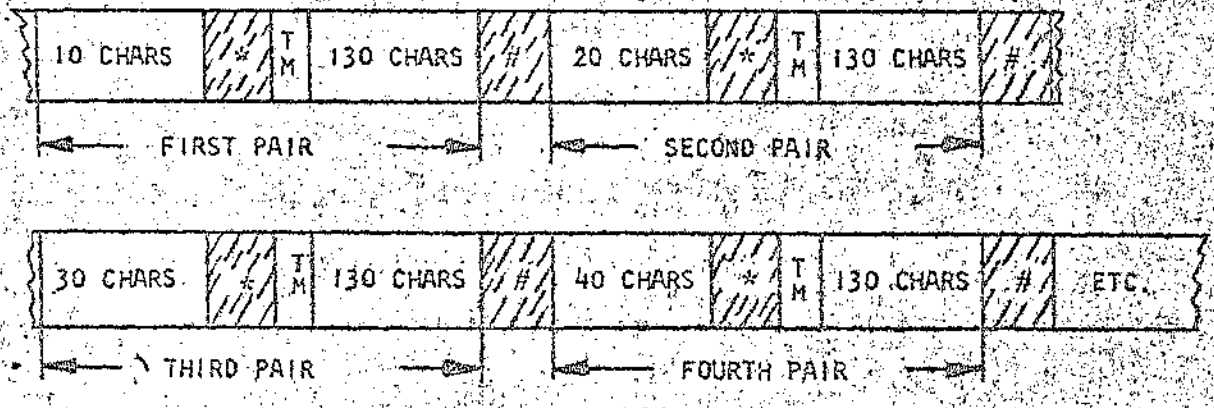
FOR GROUP 6 THE TAPE WRITE INSTRUCTIONS ARE MODIFIED TO WRITE 10 PAIRS OF RECORDS WITH A 5 SECONDS DELAY. THE PROCEDURE FOR GROUP 6 IS THE SAME AS FOR GROUPS 1, 2, 3, 4, AND 5 EXCEPT THAT WITH SENSE SWITCH B ON THE FIRST RECORD OF EACH PAIR IS VARIED IN LENGTH IN THE FOLLOWING MANNER:

1ST PAIR - 10 CHARACTERS
2ND PAIR - 110 CHARACTERS
3RD PAIR - 210 CHARACTERS
ETC.
10TH PAIR - 910 CHARACTERS

FOR GROUP 7 THE PROCEDURE IS THE SAME AS FOR GROUP 6 EXCEPT THAT THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND REWRITTEN ONCE TO TEST FOR CREEP (MAY BE MANUALLY CHANGED); ALSO THE TAPE WRITE INSTRUCTIONS ARE EXECUTED WITH MINIMUN DELAY THE SAME AS FOR GROUP 1.

THE LAST SET OF INSTRUCTIONS EXECUTED IN THE WRITE PROGRAM WRITES A TAPE MARK, REWINDS TAPE DRIVE 4, AND LOADS THE IRG MEASUREMENT - READ PROGRAM IMMEDIATELY FOLLOWING.

SCHEMATIC OF TAPE WRITTEN FOR GROUPS 1-5 WITH SENSE SWITCH B ON



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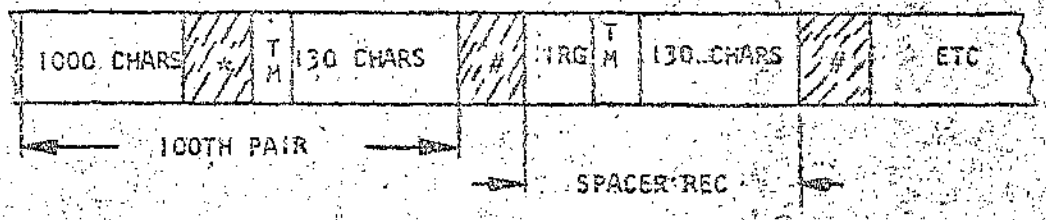

NOTE: * INDICATES INTER-RECORD GAPS MEASURED.
# INDICATES INTER-RECORD GAPS NOT MEASURED.

THE IRG MEASUREMENT - READ PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

AFTER CLEARING THE PRINT AREA, TESTING FOR A "1" IN S52 TO PRINT OR BY-PASS THE TITLE, AND AGAIN REWINDING TAPE DRIVE #4, THE PROGRAM BRANCHES TO A SERIES OF INSTRUCTIONS TO SET UP THE ROUTINE FOR MEASURING THE GAPS.

THE FOLLOWING AREAS ARE SET UP IN STORAGE TO CONTROL THE OPERATION FOR EACH GROUP:

1. A GROUP COUNTER TO COUNT EACH GROUP AND CONTROL THE SETTING UP OF INSTRUCTIONS FOR EACH OF THE SEVEN GROUPS IN THE TEST.
2. A GAP COUNTER TO COUNT THE NUMBER OF GAPS IN A GROUP (100 FOR GROUPS 1-5; 10 FOR GROUPS 6-7).
3. AN AREA FOR MINIMUM GAP USED TO STORE THE SHORTEST GAP IN MILLISECONDS WITHIN A GROUP.
4. AN AREA FOR MAXIMUM GAP USED TO STORE THE LONGEST GAP IN MILLISECONDS WITHIN A GROUP.
5. A COUNTER TO ACCUMULATE THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN A GROUP. THIS INCLUDES CORRECTION FACTOR TO ALLOW FOR RDD 144 RESTART TIME (144 USEC FOR MODEL IV, SENSE SWITCH C ON; 216 USEC FOR MODEL II, SENSE SWITCH C OFF).
6. A DELAY LOOP COUNTER TO KEEP TRACK OF THE NUMBER OF TIMES THE LOOP IS EXECUTED BEFORE A TAPE MARK IS SENSED.
7. SET UP TIME FACTOR TO BE USED FOR EACH DELAY LOOP. THIS IS UNDER CONTROL OF SENSE SWITCH G. FOR A SYSTEM WITHOUT INDEXING (SWITCH OFF), THE TIME FACTOR IS 529 USEC; WITH INDEXING (SWITCH ON), THE TIME FACTOR IS 541 USEC. THE TIME FACTOR USED IS ADDED INTO THE ACCUMULATING COUNTER (ITEM 5) EACH TIME THE LOOP IS EXECUTED. AT THE END OF THE GROUP THIS COUNTER WILL CONTAIN THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN THE GROUP.

THE FIRST RECORD OF EACH PAIR IS READ IN THE NORMAL MANNER. IMMEDIATELY FOLLOWING THIS INSTRUCTION, A DIAGNOSTIC READ INSTRUCTION (U4A) IS EXECUTED. THIS INSTRUCTION ALLOWS EXECUTION OF THE DELAY LOOP INSTRUCTIONS REPEATEDLY WHILE THE GAP IS PASSING THE READ HEAD UNTIL THE TAPE MARK (FIRST CHARACTER OF THE SECOND RECORD OF EACH PAIR) IS SENSED. TWO ERROR CONDITIONS, IF ANY, ARE DETECTED DURING DIAGNOSTIC READ:

1. IF THE EOR (TAPE MARK) INDICATOR REMAINED ON IMMEDIATELY AFTER THE DIAGNOSTIC READ (LOOP COUNTER 00). THE CONDITION IS FLAGGED BY THE SYMBOL * ERROR IN THE PRINTOUT LINE FOR THE GROUP.

2. IF THE EOR INDICATOR NEVER CAME ON AFTER THE DIAGNOSTIC READ AND THE LOOP COUNTER REACHES 100 (APPROXIMATELY 50 MS). THE CONDITION IS FLAGGED BY THE SYMBOL ERROR * IN THE PRINTOUT LINE FOR THE GROUP.

GAP TIME FOR EITHER OF THE ABOVE CONDITIONS IS NOT INCLUDED IN THE ACCUMULATING COUNTER. EACH GAP MEASURED WITHIN THE GROUP IS TESTED FOR MAXIMUM AND MINIMUM AS WELL AS ADDED INTO THE ACCUMULATING COUNTER. WHEN THE LAST GAP OF A GROUP HAS BEEN MEASURED, AN INSTRUCTION IS THEN EXECUTED TO READ THE SPACER RECORD WHICH TRAILS THE GROUP, LOAD IRG (FIRST THREE CHARACTERS) AND COMPARE THEM WITH IRG IN STORAGE. AN EQUAL COMPARISON INDICATES THAT THE TAPE AND THE PROGRAM ARE IN STEP IN WHICH CASE THE PROGRAM PROCEEDS TO LOAD AND PRINT THE RESULTS FOR THE GROUP AND CONTINUE WITH THE NEXT GROUP.

A TAPE READ ERROR BACKSPACES THE TAPE AND RE-READS THE SPACER RECORD FOR ANOTHER TRY. A COMPARE ERROR STOPS THE MACHINE AT LOCATION 755 AND INDICATES THAT THE TAPE AND THE PROGRAM ARE OUT OF STEP, POSSIBLY CAUSED BY READING A NOISE RECORD. IN THIS CASE, IT IS ADVISABLE TO RE-RUN THE WRITE PORTION OF THE TEST.

THE TEST IS COMPLETED AT THE END OF GROUP 7 AT WHICH TIME DRIVE #4 IS RE-WOUND AND THE PROGRAM FOR THE NEXT TEST IS LOADED.

E. STOPS

STORAGE ADDRESS REGISTER

400 HALT - SET UP DRIVE 4

756 ERROR IN READING SPACER RECORD

930 ERROR - CHECK RESULTS IF NO PRINTER OR NO 1 IN 1252

F. PRINTOUTS

SAMPLE PRINTOUT WITH MODEL II TAPE DRIVE UNIT

IRG MEASUREMENT - WRITE 5500

IRG MEASUREMENT - READ 5500

WRITE CONDITION	MAX	MIN	AVG	RANGE OF GAPS IN MS		
MINIMUM DLY	12.8	11.0	11.7	1.8		
1-2 MS DLY	12.8	10.8	11.8	1.9		
2-4 MS DLY	12.8	11.0	11.9	1.8		
4-12 MS DLY	12.8	9.8	10.7	3.0		
12 MS DLY	10.8	9.8	10.2	1.1	*ERROR	(1)
5 SEC DLY	10.1	9.1	9.5	1.1	ERROR*	(2)
MIN & CREEP	14.9	13.6	14.1	1.3		(3)

(RESULTS ROUNDED TO NEAREST 0.1 MS)

F. (CONTINUED)

(1) AT LEAST ONCE DURING THIS GROUP, EOR (TAPE MARK) INDICATOR WAS ON IMMEDIATELY AFTER DIAGNOSTIC READ.

(2) AT LEAST ONCE DURING THIS GROUP, EOR INDICATOR NEVER CAME ON AFTER DIAGNOSTIC READ.
IN BOTH CASES, MAX, MIN, AND RANGE FIGURES ARE CORRECT, BUT THE AVG IS IN ERROR ON THE LOW SIDE BECAUSE THE TOTAL TIME ACCUMULATED FOR THE GROUP IS ALWAYS DIVIDED BY 100 (GROUPS 1-5) OR 10 (GROUPS 6-7), EVEN THOUGH TIME FOR ONE OR MORE GAPS WITH ERROR INDICATION WAS NOT INCLUDED IN THE TOTAL TIME FOR THE GROUP. IN SUCH CASES, THE TEST SHOULD BE RE-RUN.

(3) IN THIS CASE, THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND RE-WRITTEN ONCE. THE AVERAGE CREEP, THEREFORE, IS 2.4 MS (DIFFERENCE BETWEEN MINIMUM DELAY AVG 11.7 MS, GROUP 1, AND MIN & CREEP AVG 14.1 MS, GROUP 7).

NOTE: FIGURES SHOWN IN ABOVE EXAMPLE APPLY TO MODEL II - HIGH DENSITY. IF TAPE IS WRITTEN IN LOW DENSITY, FIGURES WILL BE LARGER SINCE RDD 144 CORRECTION FACTOR IS GREATER FOR LOW DENSITY THAN IT IS FOR HIGH DENSITY.

G. COMMENTS

FOR THE 729 MAGNETIC TAPE UNIT THE IDEAL GAP LENGTH IS 0.75 INCHES. CONVERTED TO MILLISECONDS THE TIME IS AS FOLLOWS:

GAP LENGTH	MODEL II	MODEL IV
0.75 INCHES	10.0 MS	6.7 MS

ACCEPTABLE INDIVIDUAL GAPS MAY VARY APPROXIMATELY AS FOLLOWS:

GAP LENGTH	MODEL II	MODEL IV
0.69 IN. TO 0.91 IN.	9.2 MS TO 12.1 MS	6.1 MS TO 8.1 MS
ACCEPTABLE CREEP		
+0.05 IN. TO +0.2 IN.	+0.7 MS TO +2.7 MS	+0.4 MS TO +1.8 MS

NOTE: MACHINES WITHOUT PRINTERS MAY OBTAIN A PUNCH OUT OF THE IRG MEASUREMENTS BY ALTERING THE FOLLOWING INSTRUCTIONS:

INST	IS NOW	CHANGE TO
926	$\frac{*}{2}$ 931	$\frac{N}{4}$ 931
930		

THE VALUES WILL APPEAR IN PUNCHED CARDS AS FOLLOWS: (ALL OTHER INFORMATION IS INSIGNIFICANT.)

WR COND GRP	AVG	MAX	MIN	RANGE
COL 6	12-14	19-21	24-26	32-34

CONVERSION TABLE (MILLISECONDS TO INCHES)

MS	INCHES MOD III	INCHES MOD IV	MS	INCHES MOD III	INCHES MOD IV	MS	INCHES MOD III	INCHES MOD IV
.1	.0075	.0113	5.1	.3825	.5738	10.1	.7575	1.1363
.2	.0150	.0225	5.2	.3900	.5850	10.2	.7650	1.1475
.3	.0225	.0338	5.3	.3975	.5963	10.3	.7725	1.1588
.4	.0300	.0450	5.4	.4050	.6075	10.4	.7800	1.1700
.5	.0375	.0563	5.5	.4125	.6188	10.5	.7875	1.1813
.6	.0450	.0675	5.6	.4200	.6300	10.6	.7950	1.1925
.7	.0525	.0788	5.7	.4275	.6413	10.7	.8025	1.2038
.8	.0600	.0900	5.8	.4350	.6525	10.8	.8100	1.2150
.9	.0675	.1013	5.9	.4425	.6638	10.9	.8175	1.2263
1.0	.0750	.1125	6.0	.4500	.6750	11.0	.8250	1.2375
1.1	.0825	.1238	6.1	.4575	.6863	11.1	.8325	1.2488
1.2	.0900	.1350	6.2	.4650	.6975	11.2	.8400	1.2600
1.3	.0975	.1463	6.3	.4725	.7088	11.3	.8475	1.2713
1.4	.1050	.1575	6.4	.4800	.7200	11.4	.8550	1.2825
1.5	.1125	.1688	6.5	.4875	.7313	11.5	.8625	1.2938
1.6	.1200	.1800	6.6	.4950	.7425	11.6	.8700	1.3050
1.7	.1275	.1913	6.7	.5025	.7538	11.7	.8775	1.3163
1.8	.1350	.2025	6.8	.5100	.7650	11.8	.8850	1.3275
1.9	.1425	.2138	6.9	.5175	.7763	11.9	.8925	1.3388
2.0	.1500	.2250	7.0	.5250	.7875	12.0	.9000	1.3500
2.1	.1575	.2363	7.1	.5325	.7988	12.1	.9075	1.3613
2.2	.1650	.2475	7.2	.5400	.8100	12.2	.9150	1.3725
2.3	.1725	.2588	7.3	.5475	.8213	12.3	.9225	1.3838
2.4	.1800	.2700	7.4	.5550	.8325	12.4	.9300	1.3950
2.5	.1875	.2813	7.5	.5625	.8438	12.5	.9375	1.4063
2.6	.1950	.2925	7.6	.5700	.8550	12.6	.9450	1.4175
2.7	.2025	.3038	7.7	.5775	.8663	12.7	.9525	1.4288
2.8	.2100	.3150	7.8	.5850	.8775	12.8	.9600	1.4400
2.9	.2175	.3263	7.9	.5925	.8888	12.9	.9675	1.4513
3.0	.2250	.3375	8.0	.6000	.9000	13.0	.9750	1.4625
3.1	.2325	.3488	8.1	.6075	.9113	13.1	.9825	1.4738
3.2	.2400	.3600	8.2	.6150	.9225	13.2	.9900	1.4850
3.3	.2475	.3713	8.3	.6225	.9338	13.3	.9975	1.4963
3.4	.2550	.3825	8.4	.6300	.9450	13.4	1.0050	1.5075
3.5	.2625	.3938	8.5	.6375	.9563	13.5	1.0125	1.5188
3.6	.2700	.4050	8.6	.6450	.9675	13.6	1.0200	1.5300
3.7	.2775	.4163	8.7	.6525	.9788	13.7	1.0275	1.5413
3.8	.2850	.4285	8.8	.6600	.9900	13.8	1.0350	1.5525
3.9	.2925	.4388	8.9	.6675	1.0013	13.9	1.0425	1.5638
4.0	.3000	.4500	9.0	.6750	1.0125	14.0	1.0500	1.5750
4.1	.3075	.4613	9.1	.6825	1.0238	14.1	1.0575	1.5863
4.2	.3150	.4725	9.2	.6900	1.0350	14.2	1.0650	1.5975
4.3	.3225	.4838	9.3	.6975	1.0463	14.3	1.0725	1.6088
4.4	.3300	.4950	9.4	.7050	1.0575	14.4	1.0800	1.6200
4.5	.3375	.5063	9.5	.7125	1.0688	14.5	1.0875	1.6313
4.6	.3450	.5175	9.6	.7200	1.0800	14.6	1.0950	1.6425

TABLE CONTINUED (BY COLUMN) ON SHEET 8

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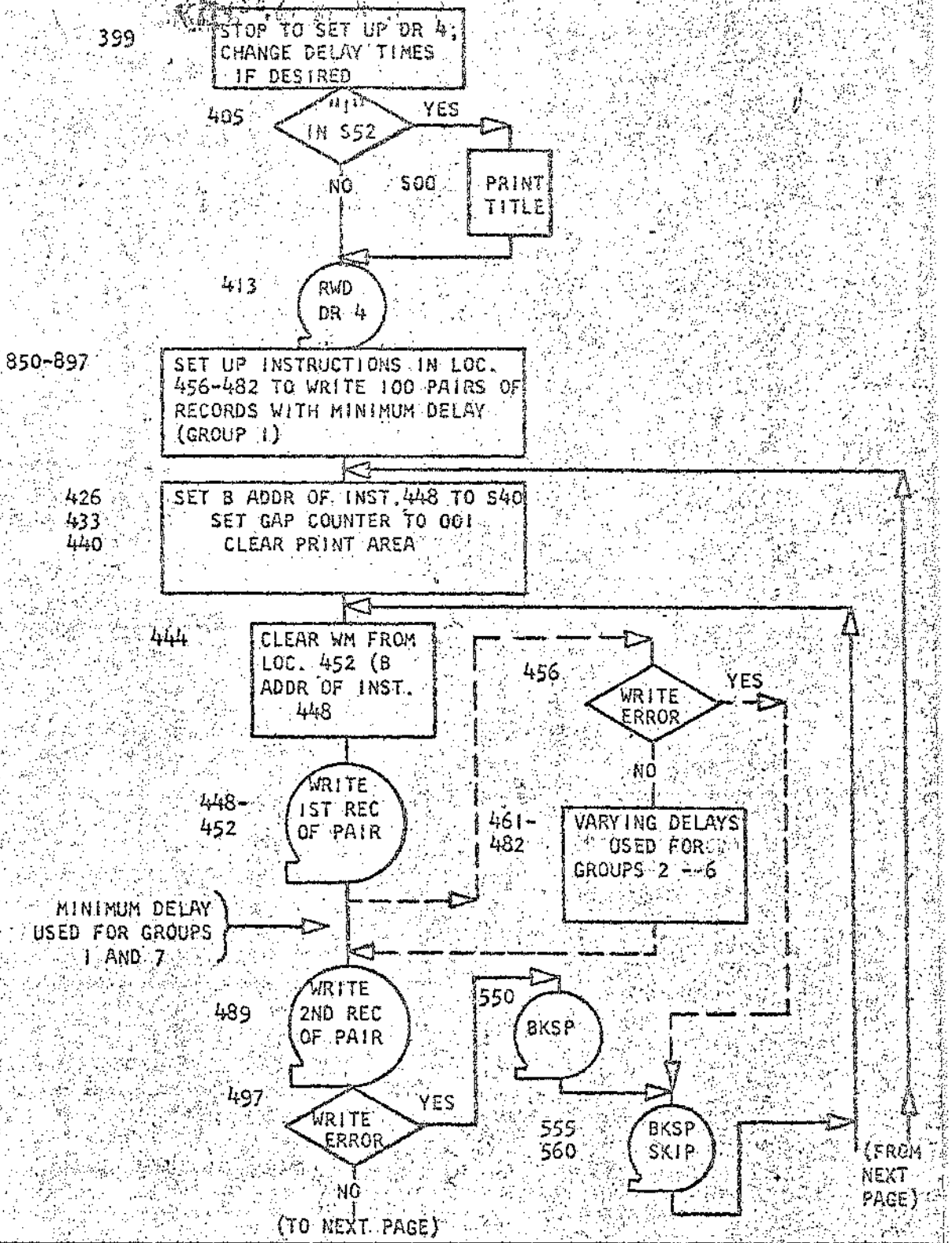
CONVERSION TABLE
(MILLISECONDS TO INCHES)

MS	INCHES MOD II	INCHES MOD IV	MS	INCHES MOD II	INCHES MOD IV	MS	INCHES MOD II	INCHES MOD IV
4.7	.3525	.5288	9.7	.7275	1.0913	14.7	1.1025	1.6538
4.8	.3600	.5400	9.8	.7350	1.1025	14.8	1.1100	1.6650
4.9	.3675	.5513	9.9	.7425	1.1138	14.9	1.1175	1.6763
5.0	.3750	.5625	10.0	.7500	1.1250	15.0	1.1250	1.6875

IRG MEASUREMENT - WRITE FLOW CHART



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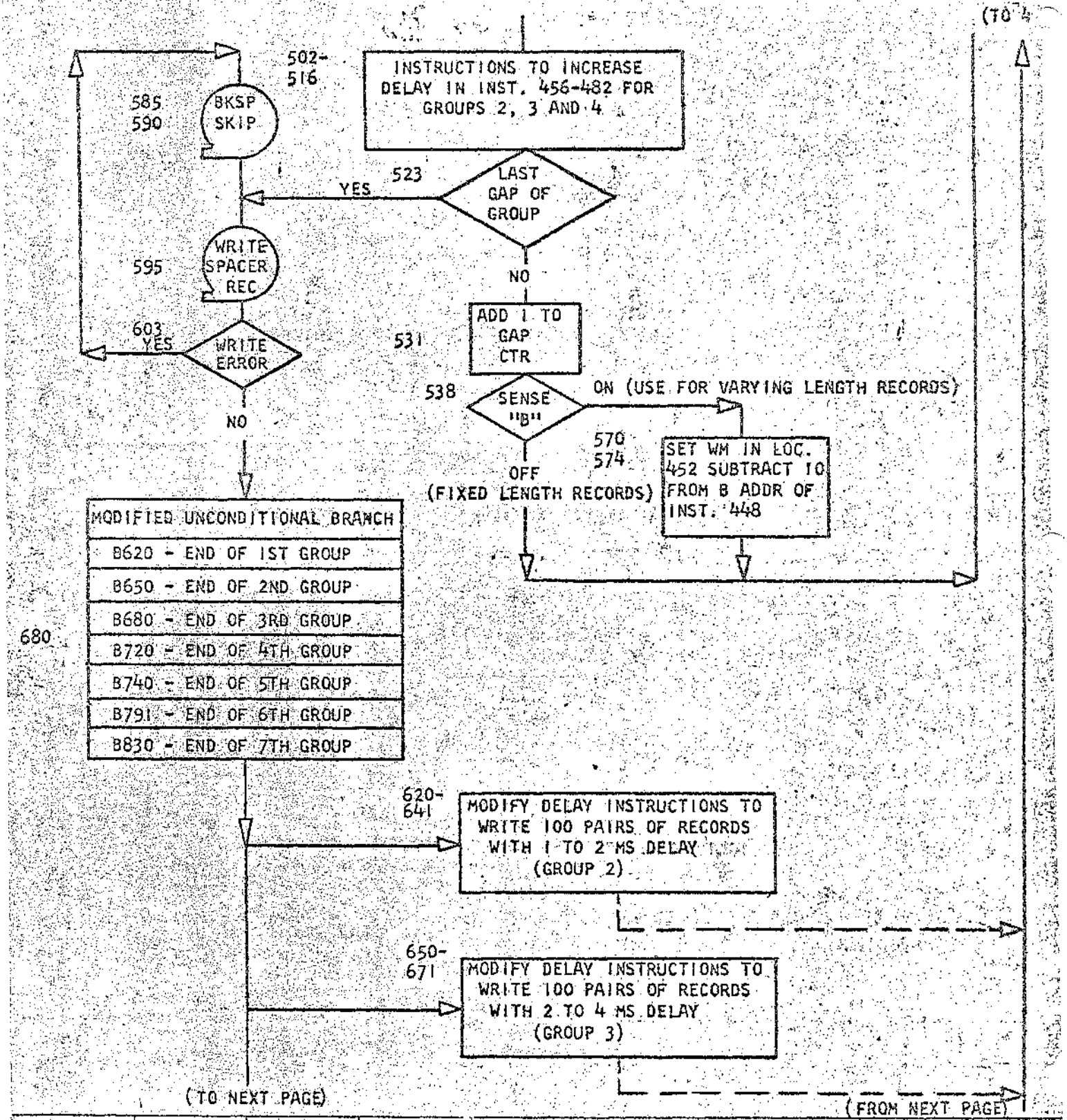

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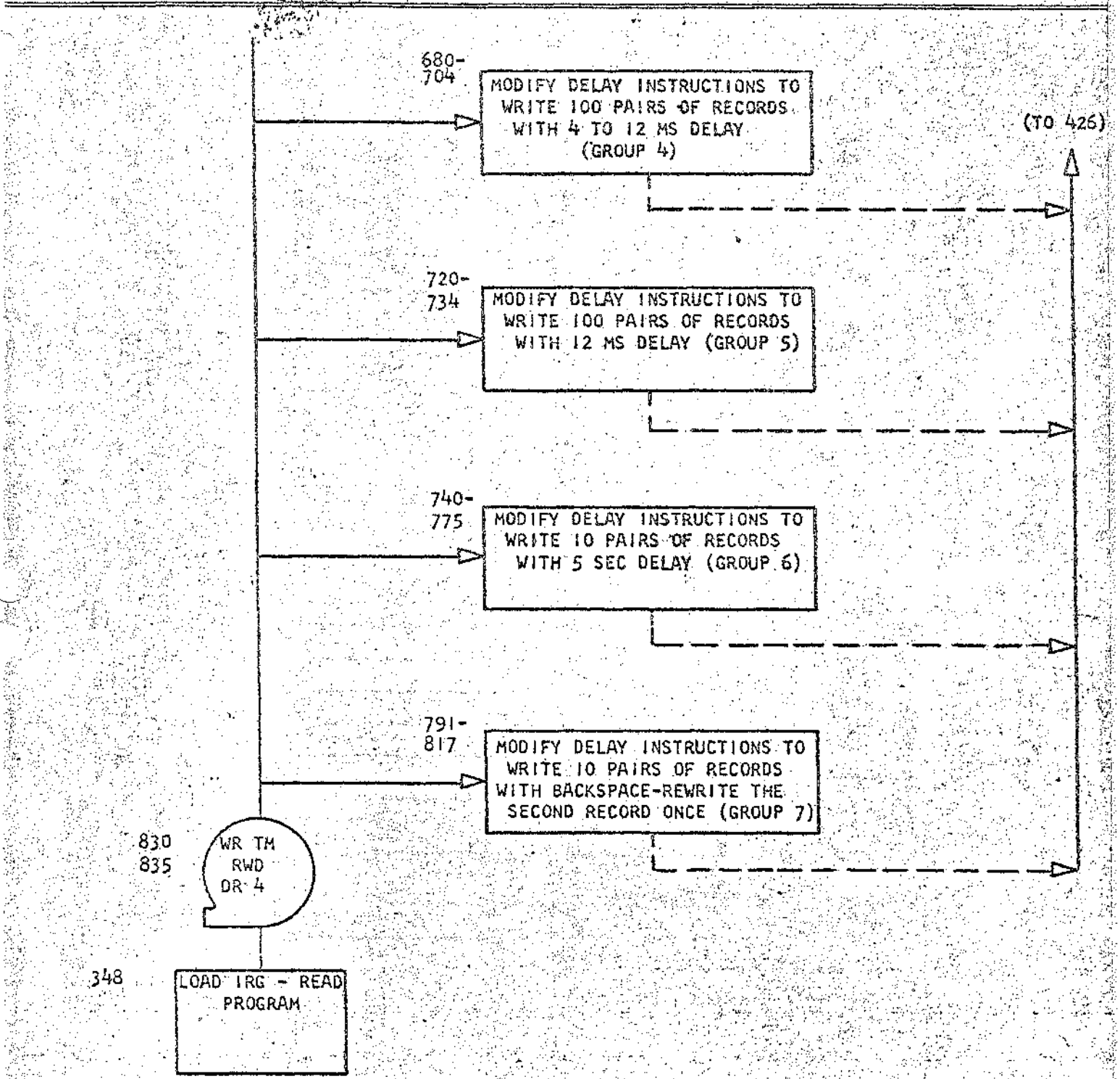
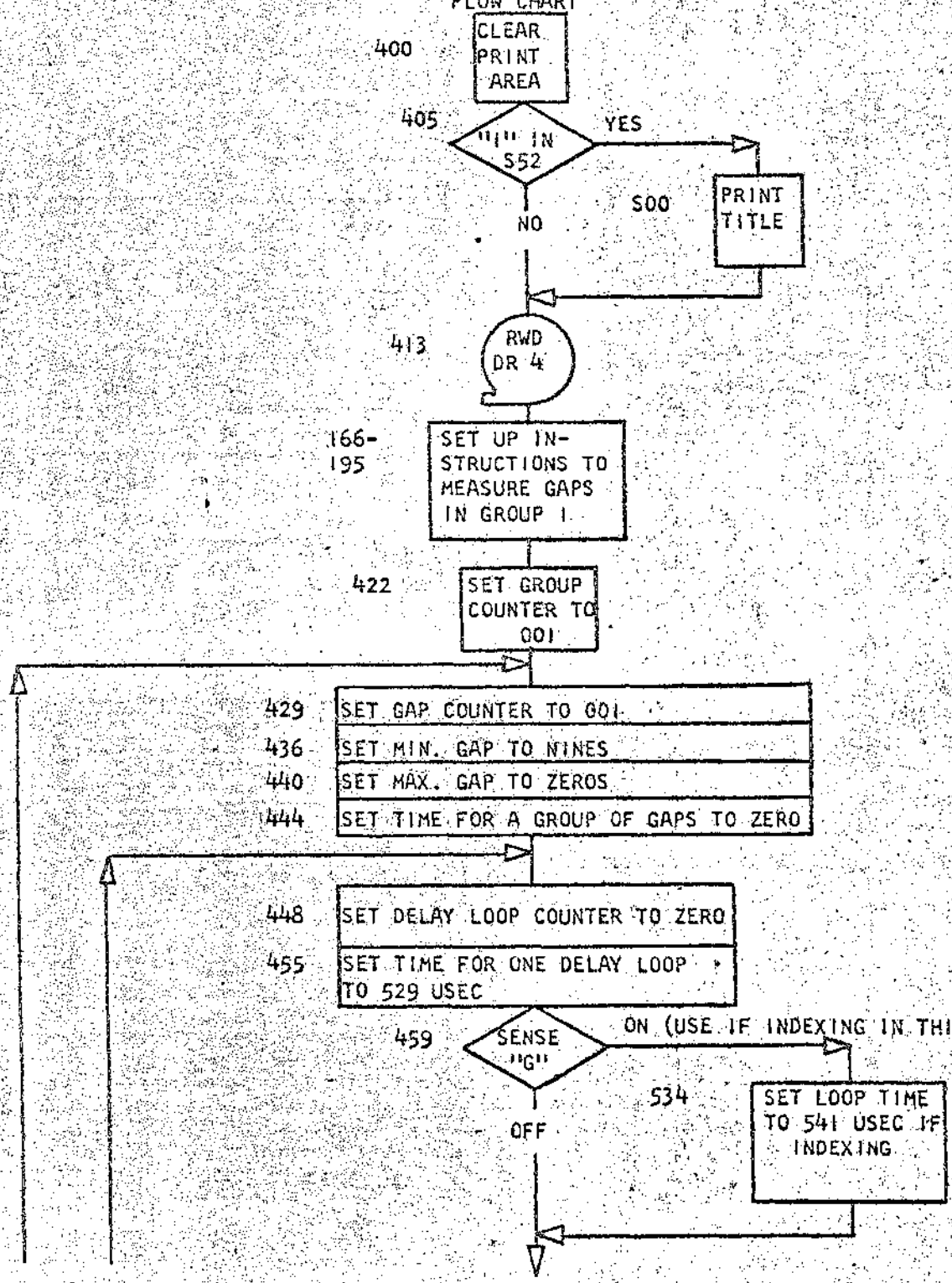
ENG. CHG. NO.	110378A	110378G	116745A	117628	TA 1976			



DATE	2-15-61	2-5-62	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378A	110378G	116745A	117628	TA 1976			

I.RG MEASUREMENT - READ FLOW CHART



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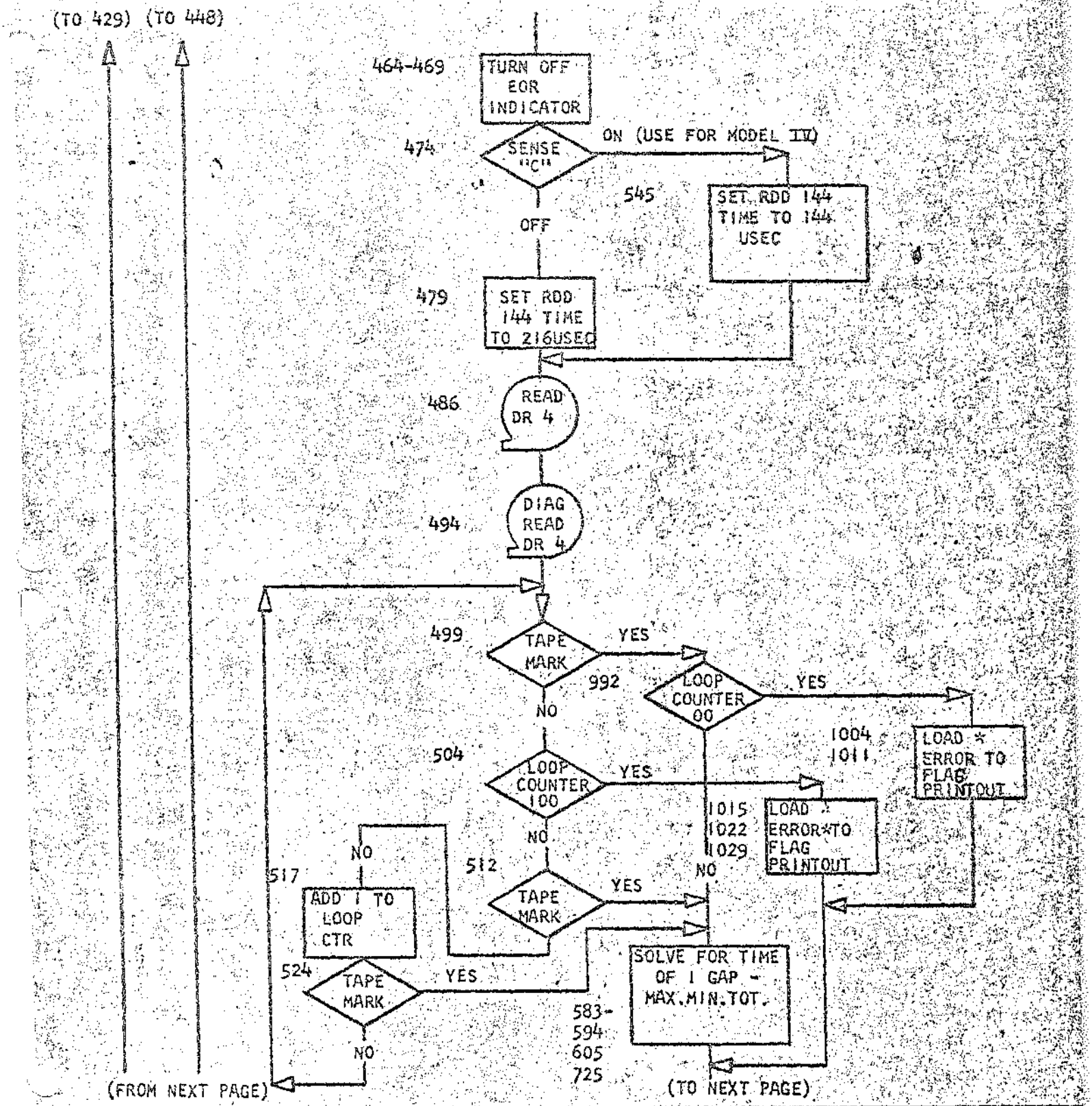
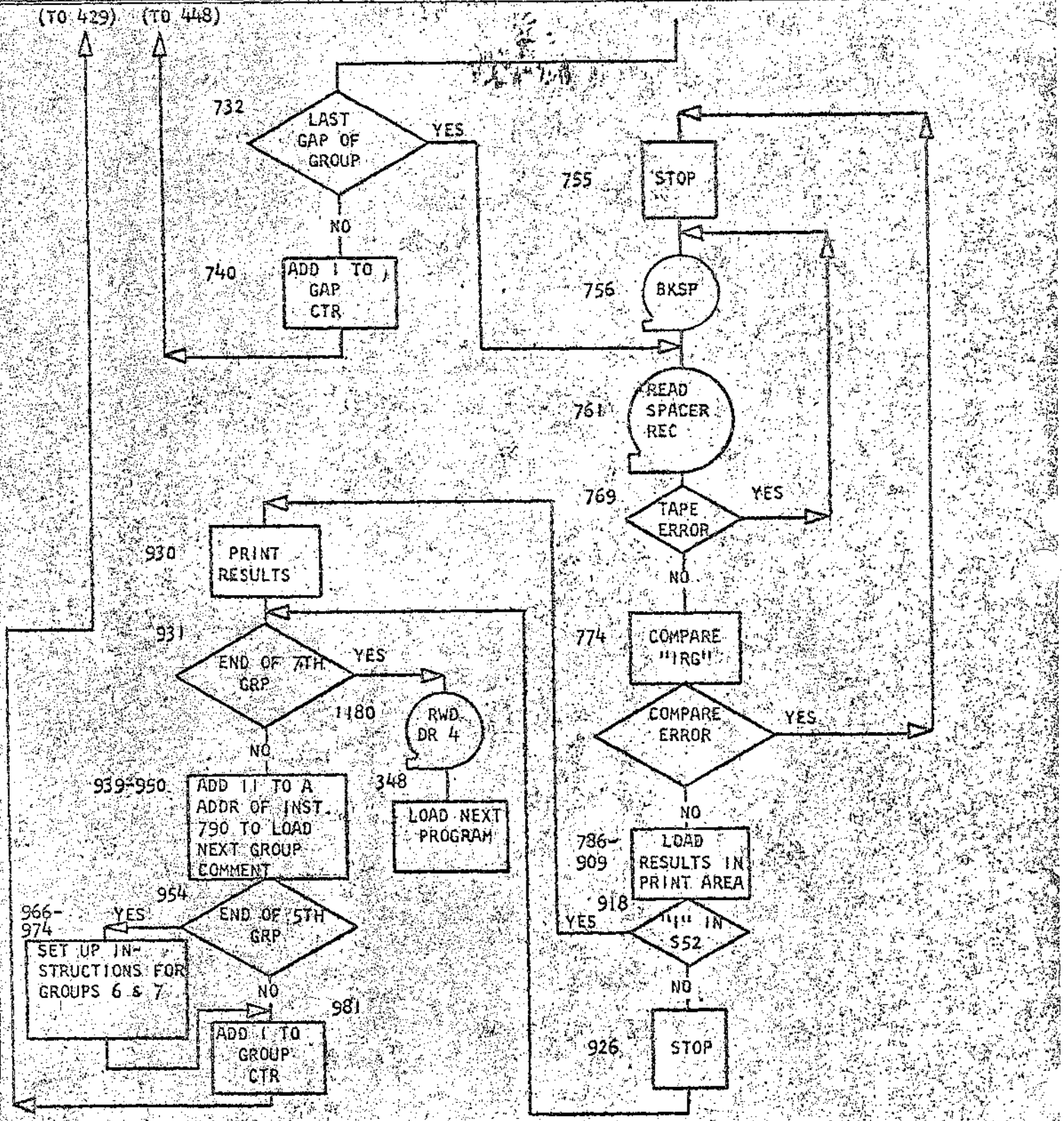
DATE	2-15-61	2-5-62	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378A	110378G	116745A	117628	TA 1976			



DATE	2-15-61	2-5-62	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378A	110378G	116745A	117628	TA 1976			



DATE	2-15-61	2-5-62	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378A	110378G	116745A	117628	TA 1976			

PROGRAM LISTING FOR USE WITH FLOW CHART

IRG MEASUREMENT – WRITE 5500D

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	1	001		CONSTANT
086	086	X	XX		GAP COUNTER
089	089	S	40		CONSTANT – B ADDR OF FIRST TAPE WR INST
092	092	I	90		CONSTANT TO SUBTRACT 10
095	095	I	00		CONSTANT TO SUBTRACT 100
098	098	5	000	005	CONSTANTS
105	105	X	XXX	X	"
110	110	1	–		"
115	115	B	523	1051	CONSTANTS TO MODIFY DELAY INSTR
123	123	U	%U4	B	"
128	128	B	468		"
133	133	B	489		"
138	138	/	489	200	"
145	145	/	489	279	"
152	152	Z	199	200	"
159	159	N	082	467	"
166	166	N	000	000	"
173	173	N	000	0	"
178	178	M	111	106	"
185	185	A	083	106	"
192	192	B	489		"
377	377	B	399	5691	USE WHEN PROGRAM IS LOADED FROM TAPE
385	385	B	S88		"
399	399	.			STOP TO SET UP DR 4 + CHANGE DELAY TIMES
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	U	%U4	R	REWIND DRIVE 4
418	418	,	199		SET WM TO LIMIT DELAY INSTR
422	422	B	850		BR TO SET INSTR FOR MINIMUM DELAY
426	426	M	091	454	SET TAPE WRITE B ADDR TO S40
433	433	M	085	088	SET GAP COUNTER TO 001
440	440	/	299		CLEAR PRINT AREA
444	444	¤	452		CLEAR WM FROM B ADDR OF TAPE WRITE INST.
448	448	L	%U4	S40W	WRITE FIRST RECORD OF A PAIR
456	456	B	489		VARIABLE DELAY
461	461	/	489	200	"
468	468	/	489	279	"
475	475	Z	199	200	"
482	482	Z	199	200	"
489	489	L	%U4	/19W	WRITE SECOND RECORD OF A PAIR
497	497	B	S50	L	BRANCH IF WRITE ERROR
502	502	N	082	467	INSTR USED TO INCREASE DELAY FOR

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```
509  509  N 000 000
516  516  N 000 000
523  523  B 595 0861
531  531  A 082 088
538  538  B 570 8
543  543  B 444
550  550  U %U4 8
555  555  U %U4 8
560  560  U %U4 E
565  565  B 444
570  570  , 452
574  574  A 094 454
581  581  B 444
585  585  U %U4 8
590  590  U %U4 E
595  595  L %U4 /16W
603  603  B 585 L
608  608  B 620
620  620  L /24 460
627  627  M 531 502
634  634  M #91 611
641  641  B 426
650  650  L /31 467
657  657  D 498 505
664  664  M #95 611
671  671  B 426
680  680  L /45 474
687  687  L
688  688  L /66 522
695  695  L
696  696  L
697  697  M #99 611
704  704  B 426
720  720  M /71 506
727  727  M /03 611
734  734  B 426
740  740  L #79 488
747  747  L
748  748  L
749  749  L
750  750  , 484
754  754  D 540 529
761  761  D 540 577
768  768  M /07 611
775  775  B 426
791  791  L 196 479
798  798  L
799  799  L
800  800  L
801  801  L 132 519
808  808  L
809  809  L
```

GROUPS 2, 3, AND 4
,,
BR TO WR SPACER REC IF LAST GAP OF GROUP
ADD 1 TO GAP COUNTER
ON TO VARY LNGTH OF FIRST REC OF PAIR SS
BRANCH TO WRITE NEXT PAIR OF RECORDS
BACKSPACE
BACKSPACE
SKIP
BRANCH TO WRITE NEXT PAIR OF RECORDS
SUBTR 10 FROM B ADDR OF TAPE WRITE TO
INCREASE LENGTH OF FIRST REC OF PAIR
BRANCH TO WRITE NEXT PAIR OF RECORDS
BACKSPACE
SKIP
WRITE SPACER RECORD
BRANCH IF WRITE ERROR
BRANCH TO LOAD NEXT TYPE OF DELAY INSTR
SET UP DELAY INSTR FOR 1 TO 2 MS DLY
,,
,,
BRANCH TO WRITE WITH 1 TO 2 MS DLY
SET UP DELAY INSTR FOR 2 TO 4 MS DLY
,,
,,
BRANCH TO WRITE WITH 2 TO 4 MS DLY
SET UP DELAY INSTR FOR 4 TO 12 MS DLY
,,
,,
,,
,,
,,
BRANCH TO WRITE WITH 4 TO 12 MS DLY
SET UP DELAY INSTR FOR 12 MS FIXED DLY
,,
BRANCH TO WRITE WITH 12 MS FIXED DLY
SET UP DELAY INSTR FOR 5 SEC FIXED DLY.
,,
,,
,,
,,
ALTER INSTR IN 523 TO COUNT 10 GAPS
ALTER INSTR IN 523 TO SUBTR 100 FROM
B ADDR OF TAPE WRITE INSTRUCTION
BRANCH TO WRITE WITH 5 SEC FIXED DLY
SET UP INSTR TO BKSP REWRITE
,,
,,
,,
,,
,,
,,

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```
 810  810  M /11 611
 817  817  B 426          BR TO BKSP-REWR SECOND RECORD OF PAIR
 830  830  U %U4 M        WRITE TAPE MARK
 835  835  U %U4 R        REWIND
 840  840  B 348          BRANCH TO LOAD READ PROGRAM
 850  850  L 158 488      SET UP INSTRUCTIONS FOR MINIMUM DELAY
 857  857  L 158             ,,
 861  861  L                ,,
 862  862  L                ,,
 863  863  L                ,,
 864  864  L 172 522        ,,
 871  871  L 172           ,,
 875  875  L                ,,
 876  876  D 507 529        ,,
 883  883  D 582 577        ,,
 890  890  M #87 611        ,,
 897  897  B 426          BRANCH TO BEGIN WRITING WITH MINIMUM DLY
1052  #52  M 104 109      CONSTANTS TO MODIFY DELAY INSTRUCTIONS
1059  #59  A 104 109           ,,
1066  #66  C 100 107           ,,
1073  #73  N CB4 68/           ,,
1084  #84  B 620 B650B6808720 UNCONDITIONAL BRANCH INSTRUCTIONS
1100  /00  B 740 87918830        FOR GROUPS 2 TO 7
1116  /16  I RG               SPACER RECORD    TM IN /19
1120  /20  B 555 L            CONSTANTS TO MODIFY DELAY INSTR
1125  /25  C 199 199                ,,
1132  /32  Z 274 275                ,,
1139  /39  / 475 200                ,,
1146  /46  A 082 474                ,,
1153  /53  A 085 481                ,,
1160  /60  A 085 488                ,,
1167  /67  B 523                    ,,
1180  /80
1250  S50                      GROUP MARK IN S50
```

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PROGRAM LISTING FOR USE WITH FLOW CHART

IRG MEASUREMENT – READ 5500D

```
INSTRUCTION
 ADDRESS   OP A   B                REMARKS

 082  082  1 000 00001             CONSTANTS
 091  091  0 000 00                  ,,
 097  097  2 07                     ,,
 100  100  4 08                     ,,
 103  103  X XX                    RDD144 TIME
 106  106  X                       GROUP COUNTER
 107  107  5 29                    TIME FOR 1 DELAY LOOP IN MSEC
 110  110  X X                     DELAY LOOP COUNTER
 112  112  X XXX XXX               CTR FOR TOTAL USEC OF GAPS IN A GROUP
 119  119  0 000 0                 MAX GAP IN A GROUP
 124  124  9 999 9                 MIN GAP IN A GROUP
 129  129  X XX                    GAP COUNTER
 132  132  X XXX X                 COUNTER FOR USEC OF 1 GAP
 137  137  X X                     COUNTER USED IN MULTIPLE ADDITION
 139  139  X XXX X                 COUNTER USED IN SOLVING FOR MAX + MIN
 144  144    0.                   CONTROL WORD FOR EDIT
 148  148  *                       CONSTANT
 149  149  I RG                    CONSTANT COMPARED TO SPACER RECORD
 152  152  9 999 9                 CONSTANTS
 157  157  5 295 41                  ,,
 163  163  I 9                     ,,
 166  166  M 332 /98               SET INSTR TO MEASURE GAPS IN GROUP 1
 173  173  D 650 665                 ,,
 180  180  D 788 738                 ,,
 187  187  D                       ,,
 188  188  M 435 793                 ,,
 195  195  B 422                   BRANCH TO SET CTRS TO INITIAL COND
 377  377  B 400 S691              USE WHEN PROGRAM IS LOADED FROM TAPE
 385  385  8 S88                     ,,
 400  400  / 332                   START TEST
 404  404  /
 405  405  B S00 S521              BR TO TITLE PRINT ROUTINE IF 1 IN S52
 413  413  U 204 R                 REWIND DRIVE 4
 418  418  B 166                   BRANCH TO SET INSTR FOR GROUP 1
 422  422  M 090 106               SET GROUP COUNTER TO 1
 429  429  M 090 131               SET GAP COUNTER TO 001
 436  436  M 156                   SET MIN GAP TO NINES
 440  440  M 089                   SET MAX GAP TO ZEROS
 444  444  M 089                   SET TIME FOR A GROUP OF GAPS TO ZEROS
 448  448  M 089 111               SET DELAY LOOP COUNTER TO ZEROS
 455  455  M 159                   SET TIME FOR 1 LOOP TO 529
 459  459  B 534 G                 G ON IF INDEXING IN THIS SYSTEM      SS
 464  464  B 469 K                 TURN OFF EOR INDICATOR
```

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```
469  469  N 000 0
474  474  B 545 C          C ON IF MODEL IV                              SS
479  479  M 096 105        SET RDD144 TIME FOR MOD II HIGH DENSITY
486  486  L %U4 S47R       READ FIRST RECORD OF A PAIR
494  494  U %U4 A          DIAGNOSTIC READ -
499  499  B 992 K          BRANCH IF TAPE MARK IS SENSED
504  504  V #15 1105       BRANCH IF NO TM SENSED AFTER 50 MS
512  512  B 594 K          BRANCH IF TAPE MARK IS SENSED
517  517  A 082 111        ADD 1 TO LOOP COUNTER
524  524  B 605 K          BRANCH IF TAPE MARK IS SENSED
529  529  B 499            BRANCH TO REPEAT LOOP
534  534  M 162 109        SET LOOP TIME TO 541 USEC IF INDEXING
541  541  B 464              ,,
545  545  M 093 105        SET RDD144 TIME FOR MOD 4 HIGH DEN
552  552  B 486              ,,
583  583  + 158 136        SOLVE FOR TIME OF 1 GAP
590  590  B 619              ,,
594  594  + 099 136          ,,
601  601  B 619              ,,
605  605  + 102 136          ,,
612  612  A 164 111          ,,
619  619  A 105 136          ,,
626  626  M 089 138        MULTIPLY DELAY LOOP COUNTER BY TIME FOR
633  633  A 109 136            1 LOOP USING MULTIPLE ADDITION
640  640  A 082 138            ,,
647  647  C 138 111            ,,
654  654  B 633 /              ,,
659  659  A 136 118        ADD USEC FOR 1 GAP TO USEC FOR A GRP
666  666  L 123 143        FIND MAX GAP
673  673  S 136 143          ,,
680  680  V 692 143K           ,,
688  688  B 699              ,,
692  692  L 136 123            ,,
699  699  L 128 143        FIND MIN GAP
706  706  S 136 143            ,,
713  713  V 725 143B           ,,
721  721  B 732              ,,
725  725  L 136 128            ,,
732  732  B 761 1291       BRANCH IF LAST GAP OF THIS GROUP
740  740  A 082 131        ADD 1 TO GAP COUNTER
747  747  B 448            BRANCH TO READ NEXT GAP
755  755  .                STOP IF ERROR IN READING SPACER RECORD
756  756  U %U4 B          BACKSPACE
761  761  L %U4 S47R       READ SPACER RECORD
769  769  B 756 L          BRANCH IF READ ERROR
774  774  C S49 151        COMPARE READ AREA TO CONSTANT -IRG-
781  781  B 755 /          BRANCH IF UNEQUAL
786  786  / 299            CLEAR PRINT AREA
790  790  L #53 212        LOAD GROUP COMMENT IN PRINT AREA
797  797  L 123 136        SOLVE FOR + LOAD RANGE IN PRINT AREA
804  804  S 128 136            ,,
811  811  A 157 135            ,,
```

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```
 818  818  L 147 242
 825  825  E 134 242
 832  832  A 157 122
 839  839  L 147 224
 846  846  E 121 224
 853  853  A 157 127
 860  860  L 147 230
 867  867  E 126 230
 874  874  A 157 115
 881  881  L 147 236
 888  888  E 114 236
 895  895  L /98 254
 902  902  M 332 /98
 909  909  B 918
 918  918  B 930 S521
 926  926  . 931
 930  930  2
 931  931  B /80 1067
 939  939  , 791
 943  943  A 875 793
 950  950  ¤ 791
 954  954  B 966 1065
 962  962  B 981
 966  966  D 873 738
 973  973  D
 974  974  D 951 665
 981  981  A 082 106
 988  988  B 429
 992  992  C 089 111
 999  999  B 583 /
1004  ÷04  M 148 /90
1011  ÷11  B ÷22
1015  ÷15  M 148 /98
1022  ÷22  M ÷40 /96
1029  ÷29  B 732
1033  ÷33  ÷ 53
1036  ÷36  E RRO R
1043  ÷43  M INI MUM DLY
1054  ÷54    1-2  MS DLY
1065  ÷65    2-4  MS DLY
1076  ÷76  4 -12  MS DLY
1087  ÷87     12  MS DLY
1098  ÷98      5  SEC DLY
1109  /09  M IN  + CREEP
1120  /20  H RIT E CONDITION
1140  /40  M AX   MIN  AVG  RA
1160  /60  N GE   OF GAPS IN MS
1180  /80  U %04 R
1185  /85  B 348
1190  /90
1247  S47  X XX
1250  S50
```

```
      SOLVE FOR + LOAD MAX IN PRINT AREA
        ,,
        ,,
      SOLVE FOR + LOAD MIN IN PRINT AREA
        ,,
        ,,
      SOLVE FOR + LOAD AVG IN PRINT AREA
        ,,
        ,,
      LOAD WORD ERROR IN PRINT AREA
         IF ANY ERRORS IN SENSING TAPE MARK
      BRANCH TO PRINT RESULTS
      PRINT RESULTS IF 1 IN S52
      STOP TO CHECK RESULTS IF NO PRINTER
      PRINT
      BRANCH TO REWIND IF END OF TEST
      ADD 11 TO A FIELD OF INSTR IN 790
         TO LOAD NEXT GROUP COMMENT
        ,,
      BRANCH IF END OF 5TH GROUP
      BRANCH TO ADD 1 TO GROUP COUNTER
      SET UP INSTR FOR A 10 GAP GROUP
        ,,
        ,,
      ADD 1 TO GROUP COUNTER
      BRANCH TO MEAS NEXT GROUP OF GAPS
      TEST FOR ZEROS IN LOOP COUNTER
      BR TO SOLVE FOR GAP TIME IF NO ZEROS
      FLAG PRINTOUT WITH  * ERROR  IF TM
         WAS SENSED BEFORE ANY DELAY LOOPING
      FLAG PRINTOUT WITH  ERROR * IF NO TM
         WAS SENSED AFTER 50 MS DELAY LOOPING
        ,,
      CONSTANTS
        ,,
      COMMENT FOR GROUP 1
      COMMENT FOR GROUP 2
      COMMENT FOR GROUP 3
      COMMENT FOR GROUP 4
      COMMENT FOR GROUP 5
      COMMENT FOR GROUP 6
      COMMENT FOR GROUP 7
      CONSTANTS FOR HEADINGS
        ,,
        ,,
      REWIND
      BRANCH TO LOAD NEXT PROGRAM
      BLANKS
      TAPE READ-IN AREA
      GROUP MARK IN S50
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS 12 5 8	SE-SEMICOLON 11 6 8	DE-DELTA 11 7 8
WS-WORD SEPARATOR 0 5 8	LT-LESS THAN 12 6 8	PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK 0 7 8	GT-GREATER THAN 6 8	TM-TAPE MARK 7 8
GM-GROUP MARK 12 7 8	MZ-MINUS ZERO 11 0	CO-COLON 5 8
RP-RIGHT PARENTHESIS 11 5 8	AP-APOSTROPHE 0 6 8	

```
,008015,022029,033033N      1001                IRG MEASUREMENT - WRITE 5500D 0A
,008015,022029,033033N      1001                SET WORDMARK CARD       5500D 02
L060109,086089,092095,098105100110011XXXS40190100500000SXXXXX           5500D 03
L067144,115123,128133,138138100111-   852310S1U%U4B8468 8489 /489200    5500D 04
L072184,152159,166173,178178100]/489279Z199200N082467N000000N0000M1111065500D 05
L044196,192192,192192,192192100]A0831068489                             5500D 06
L067367,340344,348349,357361100],008012,00110011B361080A8348/340080     5500D 07
L069404,377385,399400,4044051001 1 OF 2 5B399S6918S88          ./332/   5500D 08
L071443,413418,422426,433440100185005521U%U4R,1998850M091454M085088/299 5500D 09
L070481,448456,461468,475482100!452L%U4S40WB489 /489200/489279Z199200   5500D 10
L066515,489497,502509,516516100!Z199200L%U4/19WB550LN082467N000000       5500D 11
L071554,523531,538543,550555100!N000000B5950861A0820888570888444  U%U4B 5500D 12
L067589,560565,570574,581585100!U%U4BU%U4EB444 ,452A094454B444U%U4B     5500D 13
L069626,595603,608620,627627100!U%U4EL%U4/16WBS85LB620       L/24460    5500D 14
L069663,634641,650657,664664100!M531502M*916118426     L/31467D498505   5500D 15
L065696,671680,687688,695696100!M*95611B426      L/45474LL/66522LL      5500D 16
L069733,704720,727734,734734100!M*99611B426          - M/71506M/03611   5500D 17
L059760,740747,748749,750754100!B426  L*79488LLL,484D540529             5500D 18
L072800,768775,791798,799800100!D540577M/07611B426          L196479LLL5500D 19
L071839,808809,810817,830835100!L132519LLM/11611B426        U%U4MU%U4R 5500D 20
L063870,850857,861862,863864100!B348      L158488L158LLLL172522         5500D 21
L072910,875876,883890,897897100!L172LD507529D582577M*87611B426          5500D 22
L067*65□*31*31,*52*59,*66*661001                    M104109A104109      5500D 23
L066*99,*73*84,/00/00,/00/00100!C100107N0B468/   8620865086808720       5500D 24
L071/38,/16/20,/25/32,/39/39100!8740879B830   IRGT855SLC199199Z274275    5500D 25
                                                    M
L072/78,/46/53,/60/67,/67/671001/475200A082474A085481A0854888523         5500D 26
L065S11□/79/79,/80S00,S01S051001                    2,049L077277        5500D 27
L071S50,S13S17,S21S50,S50S5010012/2772413                            G  5500D 28
                                                                     M
/333080N                                    CLEAR WORDMARK CARD         5500D 29
,019027,031,038042B031T98GB399L046352BW04BS88  IRG MEASUREMENT - WRITE 5500D 30
                    M
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                IRG MEASUREMENT - READ  5500D20A
,008015,022029,033033N      1001                SET WORDMARK CARD       5500D202
L060109,091097,100103,106107100111000000010000002074O8XXXX529          5500D203
L061138,112119,124129,132137100IXXXXXXXXX0000099999XXXXXXXXXX          5500D204
L059165,144148,149152,157163100IXXXXX 0. *IRG999995295411 9             5500D205
L066199,173180,187188,195195100IM332/98D650665D788738DM*357938422       5500D206
L067367,340344,348349,357361100I,008012,001100118361080A8400/340080    5500D207
L069404,377385,400404,405405100I        B400S691BS88          /332/     5500D208
L071443,413418,422429,436440100IBS00S521U%U4RB166M090106M090131M156M089 5500D209
L067478,448455,459464,469474100IM089M089111M159853468469KN0000B545C    5500D210
L070516,486494,499504,512517100IM096105L%U4S47RU%U4AB992KV*151105B594K  5500D211
L067551,524529,534541,545552100IA082111B605KB499 M162109B464M093105    5500D212
L070589,583590,590590,590590100I8486                          P158136   5500D213
                                                                Z
L068625,594601,605612,619626100I8619P099136B619P102136A164111A105136    5500D214
                                  I             Z
L072665,633640,647654,659666100IM089138A109136A082138C138111B633/A136118550OD21
L072705,673680,688692,699706100IL123143S136143V692143K8699L136123L128143550OD21
L066739,713721,725732,740740100IS136143V725143BB732L136128B7611291      5500D217
L066773,747755,756761,769774100IA0821318448    .U%U48L%U4S47RB756L      5500D218
L069810,781786,790797,804811100ICS49151B755//299L*53212L123136S128136   5500D219
L067845,818825,832839,846846100IA157135L147242E134242A157122L147224     5500D220
L067880,853860,867874,881881100IE121224A157127L147230E126230A157115     5500D221
L069917,888895,902909,918918100IL147236E114236L/98254M332/98B918        5500D222
L068953,926930,931939,943950100IB930S521.93128/801067,791A875793¤791    5500D223
L070991,962966,973974,981988100IB9661065B981D873738DD951665A082106B429  5500D224
L069*28,999*04,*11*15,*22*29100IC0891118583/M148/908*22M148/98M*40/96   5500D225
L068*64,*33*36,*43*54,*65*65100IB732*53ERROR  MINIMUM DLY 1-2 MS DLY     5500D226
L065*97,*76*87,*98*98,*98*98100I 2-4 MS DLY4-12 MS DLY  12 MS DLY        5500D227
L072/37,/09/20,/20/20,/20/20100I  5 SEC DLYMIN + CREEPWRITE CONDITION    5500D228
L072/77¤/38/38,/40/60,/60/60100I  MAX   MIN   AVG   RANGE  OF GAPS IN MS 5500D229
L055S00¤/78/78,/80/85,/90S00100I  U%U4R8348          2                  5500D230
L060S28,S05S12,S13S17,S18S25100I,049L0772772/2772¤/40/60N/80             5500D231
L054S50,S36S37,S41S45,S47S50100IL/792602/2702413  XXXG                  5500D232
                                                    M
/333080N                                          CLEAR WORDMARK CARD     5500D233
,019027,031,038042B031798GB400L046352BW048S88     IRG MEASUREMENT - READ  5500D234
                  M
```

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7330 INTER-RECORD-GAP-MEASUREMENT

A. PURPOSE OF TEST:

TO WRITE PAIRS OF RECORDS ON THE 7330 IN HIGH DENSITY AND MEASURE THE INTER-RECORD GAP BETWEEN THE TWO RECORDS IN MILLI-SECONDS. THE TEST IS EXECUTED IN TWO PARTS AND MUST BE RUN CONSECUTIVELY:

PART I - 7330 IRG MEASUREMENT WRITE - WRITES THE RECORDS ON TAPE DRIVE #4 AND FORMS GAPS UNDER SEVEN CONDITIONS OF WRITING.

GROUP	PAIRS OF RECORDS IN GROUPS OF	APPROXIMATE DOWNTIME OF GO LINE BETWEEN WRITES
1	100	MINIMUM DLY
2	100	0-1 MS DLY
3	100	1-3 MS DLY
4	100	3-11 MS DLY
5	100	11 MS DLY
6	100	10-400 MS
7	100	MIN + CREEP

NOTE: DOWNTIMES OF GO LINE SHOWN IN ABOVE TABLE ARE ROUNDED TO THE NEAREST MILLISECOND IN GROUP 7; THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND REWRITTEN ONCE.

PART II - 7330 IRG MEASUREMENT - READ - READS THE RECORDS, MEASURES THE GAPS IN MILLISECONDS, AND PRINTS THE RESULTS FOR EACH OF THE SEVEN CONDITIONS. (SEE PRINTOUT EXAMPLE ON PAGE).

B. LOADING PROCEDURES

1. WHEN RUNNING TEST FROM CARDS

   A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY.
   B. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY

2. WHEN RUNNING TEST FROM TAPE

   A. SET WORKING TAPE DRIVE TO 4 AND HIGH DENSITY
   B. ENTER A 1 IN 1253.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   B ON VARIES THE NUMBER OF CHARACTERS IN THE FIRST RECORD OF EACH PAIR FROM 150 TO APPROXIMATELY 1150 CHARACTERS.
   OFF WRITES A FIXED RECORD OF APPROXIMATELY 150 CHARACTERS AS THE FIRST RECORD OF EACH PAIR.

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C. (CONTINUED)

D ON REPEATS EITHER THE WRITE OR READ PORTION OF THE TEST. (THIS CAN BE USED TO WRITE AND READ ALL TAPE DRIVES WITHOUT RELOADING THE PROGRAM.)
OFF TO CONTINUE

G ON FOR MACHINES WITH ADVANCED PROGRAM FEATURE
OFF FOR MACHINES WITHOUT ADVANCED PROGRAM FEATURE.

D. TEST PROCEDURE

THE FIRST INSTRUCTION IS A STOP CODE IN LOCATION 399. THIS STOP ALLOWS THE OPERATOR TO SET TAPE DRIVE ON 4, SET SENSE SWITCHES 8 AND 6 AS DESIRED AND CHANGE THE NUMBER OF BKSP-REWRITES IN GROUP 7 TO ANY NUMBER FROM 1 TO 39 TIMES BY CHANGING THE 1 (NO WM) IN LOCATION 122 TO APPROPRIATE CHARACTER.

EXAMPLES: 3 FOR 3 BKSP-REWRITES
S FOR 12 BKSP-REWRITES
O FOR 20 BKSP-REWRITES

THE OPERATION IS CONTINUED BY PRESSING THE START KEY. A TEST FOR A "1" IN S52 IS THEN MADE TO PRINT OR BY-PASS THE TITLE FOR THE WRITE PART OF THE TEST. THIS IS THEN FOLLOWED BY A REWIND INSTRUCTION FOR TAPE DRIVE #4, AFTER WHICH THE INSTRUCTIONS ARE SET UP TO WRITE 100 PAIRS OF RECORDS WITH MINIMUM DELAY FOR GROUP 1. DEPENDING UPON THE SETTING OF SENSE SWITCH B, THE FIRST RECORD OF EACH PAIR MAY BE A FIXED 150-CHARACTER RECORD ALWAYS WRITTEN FROM LOCATIONS /00-S49 (1100-1249) OR MAY BE VARIED TO START THE FIRST PAIR WITH A 150-CHARACTER RECORD AND INCREASE THE FIRST RECORD OF EACH SUCCEEDING PAIR BY 10. THIS IS DONE BY DECREASING THE B ADDRESS OF THE TAPE WRITE INSTRUCTION FROM /00 TO#90 TO#80 TO#70, ETC. THE FIRST RECORD OF THE LAST PAIR (100) IS A 1150-CHARACTER RECORD WRITTEN FROM LOCATIONS 100-1249.

THE SECOND RECORD OF EACH PAIR IS ALWAYS THE SAME. IT STARTS WITH A TAPE MARK STORED BY THE PROGRAM IN LOCATION /19 (1119) AND CONTINUES TO LOCATION 1249. AFTER ALL THE RECORDS FOR GROUP 1 ARE WRITTEN ON TAPE A COMMAND IS THEN GIVEN TO WRITE A SPACER RECORD TO SIGNAL THE END OF THE GROUP. THIS RECORD IS THE SAME AS THE SECOND RECORD OF EACH PAIR EXCEPT THAT IT STARTS WITH THE LETTERS "IRG" STORED IN LOCATIONS 1116-1118.

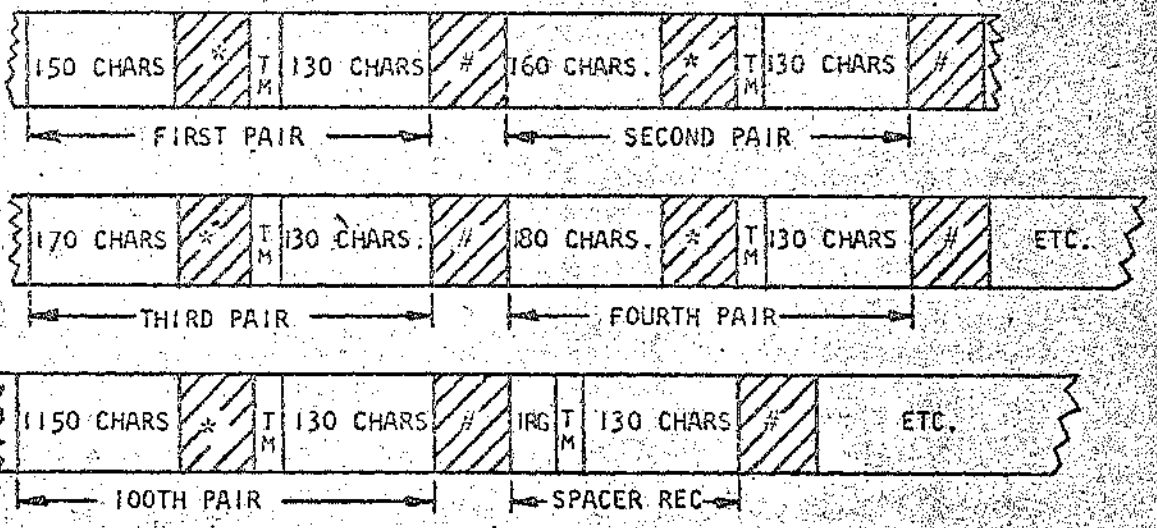
DUPLICATE

THE PROGRAM THEN BRANCHES TO A SET OF INSTRUCTIONS TO VARY THE DELAY FOR GROUP 2 AND PROCEED TO WRITE 100 PAIRS OF RECORDS IN THE SAME MANNER AS FOR GROUP 1. THE PROCEDURE IS REPEATED FOR GROUPS 3, 4, 5 AND 6 AFTER MODIFYING THE DELAY INSTRUCTIONS FOR EACH GROUP AS REQUIRED.

FOR GROUP 7 THE PROCEDURE IS THE SAME AS FOR GROUP 1 EXCEPT THAT THE SECOND RECORD OF EACH PAIR IS BACKSPACED AND REWRITTEN ONCE TO TEST FOR CREEP.

THE LAST SET OF INSTRUCTIONS EXECUTED IN THE WRITE PROGRAM WRITES A TAPE MARK, REWINDS TAPE DRIVE 4, AND LOADS THE IRG MEASUREMENT - READ PROGRAM IMMEDIATELY FOLLOWING.

SCHEMATIC OF TAPE WRITTEN WITH SENSE SWITCH B ON



NOTE: * INDICATES INTER-RECORD GAPS MEASURED.
# INDICATES INTER-RECORD GAPS NOT MEASURED.

THE IRG MEASUREMENT - READ PROGRAM IS EXECUTED IN THE FOLLOWING MANNER:

AFTER CLEARING THE PRINT AREA, TESTING FOR A "1" IN S52 TO PRINT OR BY-PASS THE TITLE, AND AGAIN REWINDING TAPE DRIVE #4, THE PROGRAM BRANCHES TO A SERIES OF INSTRUCTIONS TO SET UP THE ROUTINE FOR MEASURING THE GAPS.

THE FOLLOWING AREAS ARE SET UP IN STORAGE TO CONTROL THE OPERATION FOR EACH GROUP:

1. A GROUP COUNTER TO COUNT EACH GROUP AND CONTROL THE SETTING UP OF INSTRUCTIONS FOR EACH OF THE SEVEN GROUPS IN THE TEST.
2. A GAP COUNTER TO COUNT THE NUMBER OF GAPS IN A GROUP.
3. AN AREA FOR MINIMUM GAP USED TO STORE THE SHORTEST GAP IN MILLISECONDS WITHIN A GROUP.

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4. AN AREA FOR MAXIMUM GAP USED TO STORE THE LONGEST GAP IN MILLISECONDS WITHIN A GROUP.
5. A COUNTER TO ACCUMULATE THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN A GROUP.
6. A DELAY LOOP COUNTER TO KEEP TRACK OF THE NUMBER OF TIMES THE LOOP IS EXECUTED BEFORE A TAPE MARK IS SENSED.
7. SET UP TIME FACTOR TO BE USED FOR EACH DELAY LOOP. THIS IS UNDER CONTROL OF SENSE SWITCH 6. FOR A SYSTEM WITHOUT INDEXING (SWITCH OFF), THE TIME FACTOR IS 529 USEC: WITH INDEXING (SWITCH ON), THE TIME FACTOR IS 541 USEC. THE TIME FACTOR USED IS ADDED INTO THE ACCUMULATING COUNTER (ITEM 5) EACH TIME THE LOOP IS EXECUTED. AT THE END OF THE GROUP THIS COUNTER WILL CONTAIN THE TOTAL TIME IN MILLISECONDS FOR ALL GAPS MEASURED WITHIN THE GROUP.

THE FIRST RECORD OF EACH PAIR IS READ IN THE NORMAL MANNER. IMMEDIATELY FOLLOWING THIS INSTRUCTION, A DIAGNOSTIC READ INSTRUCTION (U%U4A) IS EXECUTED. THIS INSTRUCTION ALLOWS EXECUTION OF THE DELAY LOOP INSTRUCTIONS REPEATEDLY WHILE THE GAP IS PASSING THE READ HEAD UNTIL THE TAPE MARK (FIRST CHARACTER OF THE SECOND RECORD OF EACH PAIR) IS SENSED. TWO ERROR CONDITIONS, IF ANY, ARE DETECTED DURING DIAGNOSTIC READ:

1. IF THE EOR (TAPE MARK) INDICATOR REMAINED ON IMMEDIATELY AFTER THE DIAGNOSTIC READ (LOOP COUNTER 00). THE CONDITION IS FLAGGED BY THE SYMBOL * ERROR IN THE PRINTOUT LINE FOR THE GROUP.
2. IF THE EOR INDICATOR NEVER CAME ON AFTER THE DIAGNOSTIC READ AND THE LOOP COUNTER REACHES 100 (APPROXIMATELY 50 MS). THE CONDITION IS FLAGGED BY THE SYMBOL ERROR * IN THE PRINTOUT LINE FOR THE GROUP.

GAP TIME FOR EITHER OF THE ABOVE CONDITIONS IS NOT INCLUDED IN THE ACCUMULATING COUNTER. EACH GAP MEASURED WITHIN THE GROUP IS TESTED FOR MAXIMUM AND MINIMUM AS WELL AS ADDED INTO THE ACCUMULATING COUNTER. WHEN THE LAST GAP OF A GROUP HAS BEEN MEASURED, AN INSTRUCTION IS THEN EXECUTED TO READ THE SPACER RECORD WHICH TRAILS THE GROUP, LOAD IRG (FIRST THREE CHARACTERS) AND COMPARE THEM WITH IRG IN STORAGE. AN EQUAL COMPARISON INDICATES THAT THE TAPE AND THE PROGRAM ARE IN STEP IN WHICH CASE THE PROGRAM PROCEEDS TO LOAD AND PRINT THE RESULTS FOR THE GROUP AND CONTINUE WITH THE NEXT GROUP.

A TAPE READ ERROR BACKSPACES THE TAPE AND RE-READS THE SPACER RECORD FOR ANOTHER TRY. A COMPARE ERROR STOPS THE MACHINE AT LOCATION 755 AND INDICATES THAT THE TAPE AND THE PROGRAM ARE OUT OF STEP, POSSIBLY CAUSED BY READING A NOISE RECORD. IN THIS CASE, IT IS ADVISABLE TO RE-RUN THE WRITE PORTION OF THE TEST.

THE TEST IS COMPLETED AT THE END OF GROUP 7 AT WHICH TIME DRIVE #4 IS RE-WOUND AND THE PROGRAM FOR THE NEXT TEST IS LOADED.

E STOPS

STORAGE ADDRESS REGISTER	
400	HALT- SET UP DRIVE 4
756	ERROR WHEN READING SPACER RECORD
730	HALT- NO PRINTER OR NO 1 IN 1252

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F. PRINTOUT

7330 IRG MEAS. - WRITE 5530A

7330 IRG MEAS. - READ 5530A

WRITE CONDITION	MAX	MIN	AVG	RANGE IN MS	
MINIMUM DLY	20.6	20.1	20.4	0.5	
0.1 MS DLY	20.6	20.3	20.4	0.3	
1-3 MS DLY	20.6	20.1	20.4	0.5	
3-11 MS DLY	22.8	20.3	20.8	2.5	
11 MS DLY	22.1	21.7	21.9	0.4	*ERROR (1)
10-400 MS	22.8	21.0	21.5	1.8	ERROR *(2)
MIN AND CREEP	22.4	21.2	21.8	1.3	(3)

(RESULTS ROUNDED TO NEAREST 0.1 MS AND ARE ACCURATE TO ±0.1 MS)

(1) AT LEAST ONCE DURING THIS GROUP, EOR (TAPE MARK) INDICATOR WAS ON IMMEDIATELY AFTER DIAGNOSTIC READ.

(2) AT LEAST ONCE DURING THIS GROUP, EOR INDICATOR NEVER CAME ON AFTER DIAGNOSTIC READ. IN BOTH CASES, MAX, MIN, AND RANGE FIGURES ARE CORRECT, BUT THE AVG IS IN ERROR ON THE LOW SIDE BECAUSE THE TOTAL TIME ACCUMULATED FOR THE GROUP IS ALWAYS DIVIDED BY 100, EVEN THOUGH TIME FOR ONE OR MORE GAPS WITH ERROR INDICATION WAS NOT INCLUDED IN THE TOTAL TIME FOR THE GROUP. IN SUCH CASES, THE TEST SHOULD BE RE-RUN.

(3) IN THIS CASE, THE SECOND RECORD OF EACH PAIR IS BACKSPACE AND REWRITTEN ONCE. THE AVERAGE CREEP, THEREFORE, IS 1.4 MS (DIFFERENCE BETWEEN MINIMUM DELAY AVG. AND MIN AND CREEP AVG.).

G. COMMENTS

FOR THE 7330 MAGNETIC TAPE UNIT THE IDEAL GAP LENGTH IS A .75 INCHES, OR 20.8 MS CONVERTED TO MILLISECONDS ACCEPTABLE GAPS MAY VARY AS FOLLOWS:

MINIMUM	NOMINAL	MAXIMUM
19.1 MS	20.8 MS	~~24.3 MS~~ 23.8

CREEP (GROUP 7 AS COMPARED TO GROUP 1 OF THE PRINTOUT) MUST BE POSITIVE.

NOTE: MACHINES WITHOUT PRINTERS MAY OBTAIN A PUNCH OUT OF THE IRG MEASUREMENTS BY ALTERING THE FOLLOWING INSTRUCTIONS:

INST	IS NOW	CHANGE TO
926	931	N 931
930	2	4

THE VALUES WILL APPEAR IN PUNCHED CARDS AS FOLLOWS: (ALL OTHER INFORMATION IS INSIGNIFICANT.)

	COL	WR COND GRP	AVG	MAX	MIN	RANGE
		6	12-14	19-21	24-26	32-34

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DIAGNOSTIC FUNCTION TEST

PART NO. 451639
SHEET 6 OF 7
BLOCK NO 5530B

MILLISECOND TO INCH CONVERSION TABLE

MSEC	7330	729-2	729-4	MSEC	7330	729-2	729-4
0.1	.0036	.0075	.01125	4.9	.1764	.3675	.55125
0.2	.0072	.0150	.02250	5.0	.1800	.3750	.56250
0.3	.0108	.0225	.03375	5.1	.1836	.3825	.57375
0.4	.0144	.0300	.04500	5.2	.1872	.3900	.58500
0.5	.0180	.0375	.05625	5.3	.1908	.3975	.59625
0.6	.0216	.0450	.06750	5.4	.1944	.4050	.60750
0.7	.0252	.0525	.07875	5.5	.1980	.4125	.61875
0.8	.0288	.0600	.09000	5.6	.2016	.4200	.63000
0.9	.0324	.0675	.10125	5.7	.2052	.4275	.64125
1.0	.0360	.0750	.11250	5.8	.2088	.4350	.65250
1.1	.0396	.0825	.12375	5.9	.2124	.4425	.66375
1.2	.0432	.0900	.13500	6.0	.2160	.4500	.67500
1.3	.0468	.0975	.14625	6.1	.2196	.4575	.68625
1.4	.0504	.1050	.15750	6.2	.2232	.4650	.69750
1.5	.0540	.1125	.16875	6.3	.2268	.4725	.70875
1.6	.0576	.1200	.18000	6.4	.2304	.4800	.72000
1.7	.0612	.1275	.19125	6.5	.2340	.4875	.73125
1.8	.0648	.1350	.20250	6.6	.2376	.4950	.74250
1.9	.0684	.1425	.21375	6.7	.2412	.5025	.75375
2.0	.0720	.1500	.22500	6.8	.2448	.5100	.76500
2.1	.0756	.1575	.23625	6.9	.2484	.5175	.77625
2.2	.0792	.1650	.24750	7.0	.2520	.5250	.78750
2.3	.0828	.1725	.25875	7.1	.2556	.5325	.79875
2.4	.0864	.1800	.27000	7.2	.2592	.5400	.81000
2.5	.0900	.1875	.28125	7.3	.2628	.5475	.82125
2.6	.0936	.1950	.29250	7.4	.2664	.5550	.83250
2.7	.0972	.2025	.30375	7.5	.2700	.5625	.84375
2.8	.1008	.2100	.31500	7.6	.2736	.5700	.85500
2.9	.1044	.2175	.32625	7.7	.2772	.5775	.86625
3.0	.1080	.2250	.33750	7.8	.2808	.5850	.87750
3.1	.1116	.2325	.34875	7.9	.2844	.5925	.88875
3.2	.1152	.2400	.36000	8.0	.2880	.6000	.90000
3.3	.1188	.2475	.37125	8.1	.2916	.6075	.91125
3.4	.1224	.2550	.38250	8.2	.2952	.6150	.92250
3.5	.1260	.2625	.39375	8.3	.2988	.6225	.93375
3.6	.1296	.2700	.40500	8.4	.3024	.6300	.94500
3.7	.1332	.2775	.41625	8.5	.3060	.6375	.95625
3.8	.1368	.2850	.42750	8.6	.3096	.6450	.96750
3.9	.1404	.2925	.43875	8.7	.3132	.6525	.97875
4.0	.1440	.3000	.45000	8.8	.3168	.6600	.99000
4.1	.1476	.3075	.46125	8.9	.3204	.6675	1.00125
4.2	.1512	.3150	.47250	9.0	.3240	.6750	1.01250
4.3	.1548	.3225	.48375	9.1	.3276	.6825	1.02375
4.4	.1584	.3300	.49500	9.2	.3312	.6900	1.03500
4.5	.1620	.3375	.50625	9.3	.3348	.6975	1.04625
4.6	.1656	.3450	.51750	9.4	.3384	.7050	1.05750
4.7	.1692	.3525	.52875	9.5	.3420	.7125	1.06875
4.8	.1728	.3600	.54000	9.6	.3456	.7200	1.08000

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DIAGNOSTIC FUNCTION TEST

PART NO. 451639
SHEET 7 OF 20
BLOCK NO. 5530B

MSEC	7830	729-2	729-4	MSEC	7830	729-2	729-4
9.7	.3492	.7275	1.09125	14.5	.5220	1.0875	1.63125
9.8	.3528	.7350	1.10250	14.6	.5256	1.0950	1.64250
9.9	.3564	.7425	1.11375	14.7	.5292	1.1025	1.65375
10.0	.3600	.7500	1.12500	14.8	.5328	1.1100	1.66500
10.1	.3636	.7575	1.13625	14.9	.5364	1.1175	1.67625
10.2	.3672	.7650	1.14750	15.0	.5400	1.1250	1.68750
10.3	.3708	.7725	1.15875	15.1	.5436	1.1325	1.69875
10.4	.3744	.7800	1.17000	15.2	.5472	1.1400	1.71000
10.5	.3780	.7875	1.18125	15.3	.5508	1.1475	1.72125
10.6	.3816	.7950	1.19250	15.4	.5544	1.1550	1.73250
10.7	.3852	.8025	1.20375	15.5	.5580	1.1625	1.74375
10.8	.3888	.8100	1.21500	15.6	.5616	1.1700	1.75500
10.9	.3924	.8175	1.22625	15.7	.5652	1.1775	1.76625
11.0	.3960	.8250	1.23750	15.8	.5688	1.1850	1.77750
11.1	.3996	.8325	1.24875	15.9	.5724	1.1925	1.78875
11.2	.4032	.8400	1.26000	16.0	.5760	1.2000	1.80000
11.3	.4068	.8475	1.27125	16.1	.5796	1.2075	1.81125
11.4	.4104	.8550	1.28250	16.2	.5832	1.2150	1.82250
11.5	.4140	.8625	1.29375	16.3	.5868	1.2225	1.83375
11.6	.4176	.8700	1.30500	16.4	.5904	1.2300	1.84500
11.7	.4212	.8775	1.31625	16.5	.5940	1.2375	1.85625
11.8	.4248	.8850	1.32750	16.6	.5976	1.2450	1.86750
11.9	.4284	.8925	1.33875	16.7	.6012	1.2525	1.87875
12.0	.4320	.9000	1.35000	16.8	.6048	1.2600	1.89000
12.1	.4356	.9075	1.36125	16.9	.6084	1.2675	1.90125
12.2	.4392	.9150	1.37250	17.0	.6120	1.2750	1.91250
12.3	.4428	.9225	1.38375	17.1	.6156	1.2825	1.92375
12.4	.4464	.9300	1.39500	17.2	.6192	1.2900	1.93500
12.5	.4500	.9375	1.40625	17.3	.6228	1.2975	1.94625
12.6	.4536	.9450	1.41750	17.4	.6264	1.3050	1.95750
12.7	.4572	.9525	1.42875	17.5	.6300	1.3125	1.96875
12.8	.4608	.9600	1.44000	17.6	.6336	1.3200	1.98000
12.9	.4644	.9675	1.45125	17.7	.6372	1.3275	1.99125
13.0	.4680	.9750	1.46250	17.8	.6408	1.3350	2.00250
13.1	.4716	.9825	1.47375	17.9	.6444	1.3425	2.01375
13.2	.4752	.9900	1.48500	18.0	.6480	1.3500	2.02500
13.3	.4788	.9975	1.49625	18.1	.6516	1.3575	2.03625
13.4	.4824	1.0050	1.50750	18.2	.6552	1.3650	2.04750
13.5	.4860	1.0125	1.51875	18.3	.6588	1.3725	2.05875
13.6	.4896	1.0200	1.53000	18.4	.6624	1.3800	2.07000
13.7	.4932	1.0275	1.54125	18.5	.6660	1.3875	2.08125
13.8	.4968	1.0350	1.55250	18.6	.6696	1.3950	2.09250
13.9	.5004	1.0425	1.56375	18.7	.6732	1.4025	2.10375
14.0	.5040	1.0500	1.57500	18.8	.6768	1.4100	2.11500
14.1	.5076	1.0575	1.58625	18.9	.6804	1.4175	2.12625
14.2	.5112	1.0650	1.59750	19.0	.6840	1.4250	2.13750
14.3	.5148	1.0725	1.60875	19.1	.6876	1.4325	2.14875
14.4	.5184	1.0800	1.62000	19.2	.6912	1.4400	2.16000

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DIAGNOSTIC FUNCTION TEST

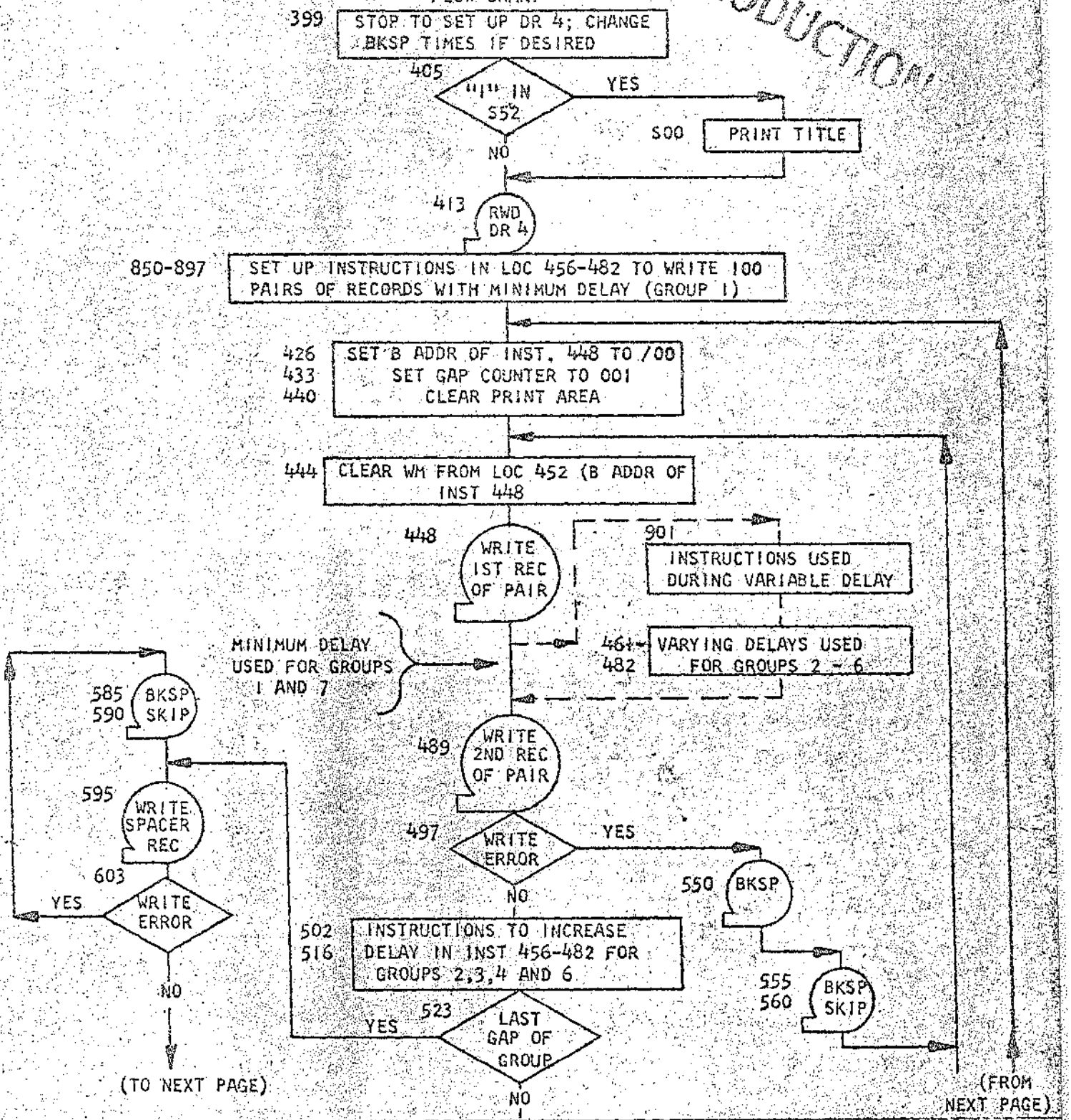
PART NO. 451639
SHEET 8 OF 20
BLOCK NO. 55303

MSEC	7330	729-2	729-4	MSEC	7330	729-2	729-4
19.3	.6948	1.4475	2.17125	24.1	.8676	1.8075	2.71125
19.4	.6984	1.4550	2.18250	24.2	.8712	1.8150	2.72250
19.5	.7020	1.4625	2.19375	24.3	.8748	1.8225	2.73375
19.6	.7056	1.4700	2.20500	24.4	.8784	1.8300	2.74500
19.7	.7092	1.4775	2.21625	24.5	.8820	1.8375	2.75625
19.8	.7128	1.4850	2.22750	24.6	.8856	1.8450	2.76750
19.9	.7164	1.4925	2.23875	24.7	.8892	1.8525	2.77875
20.0	.7200	1.5000	2.25000	24.8	.8928	1.8600	2.79000
20.1	.7236	1.5075	2.26125	24.9	.8964	1.8675	2.80125
20.2	.7272	1.5150	2.27250	25.0	.9000	1.8750	2.81250
20.3	.7308	1.5225	2.28375	25.1	.9036	1.8825	2.82375
20.4	.7344	1.5300	2.29500	25.2	.9072	1.8900	2.83500
20.5	.7380	1.5375	2.30625	25.3	.9108	1.8975	2.84625
20.6	.7416	1.5450	2.31750	25.4	.9144	1.9050	2.85750
20.7	.7452	1.5525	2.32875	25.5	.9180	1.9125	2.86875
20.8	.7488	1.5600	2.34000	25.6	.9216	1.9200	2.88000
20.9	.7524	1.5675	2.35125	25.7	.9252	1.9275	2.89125
21.0	.7560	1.5750	2.36250	25.8	.9288	1.9350	2.90250
21.1	.7596	1.5825	2.37375	25.9	.9324	1.9425	2.91375
21.2	.7632	1.5900	2.38500	26.0	.9360	1.9500	2.92500
21.3	.7668	1.5975	2.39625	26.1	.9396	1.9575	2.93625
21.4	.7704	1.6050	2.40750	26.2	.9432	1.9650	2.94750
21.5	.7740	1.6125	2.41875	26.3	.9468	1.9725	2.95875
21.6	.7776	1.6200	2.43000	26.4	.9504	1.9800	2.97000
21.7	.7812	1.6275	2.44125	26.5	.9540	1.9875	2.98125
21.8	.7848	1.6350	2.45250	26.6	.9576	1.9950	2.99250
21.9	.7884	1.6425	2.46375	26.7	.9612	2.0025	3.00375
22.0	.7920	1.6500	2.47500	26.8	.9648	2.0100	3.01500
22.1	.7956	1.6575	2.48625	26.9	.9684	2.0175	3.02625
22.2	.7992	1.6650	2.49750	27.0	.9720	2.0250	3.03750
22.3	.8028	1.6725	2.50875	27.1	.9756	2.0325	3.04875
22.4	.8064	1.6800	2.52000	27.2	.9792	2.0400	3.06000
22.5	.8100	1.6875	2.53125	27.3	.9828	2.0475	3.07125
22.6	.8136	1.6950	2.54250	27.4	.9864	2.0550	3.08250
22.7	.8172	1.7025	2.55375	27.5	.9900	2.0625	3.09375
22.8	.8208	1.7100	2.56500	27.6	.9936	2.0700	3.10500
22.9	.8244	1.7175	2.57625	27.7	.9972	2.0775	3.11625
23.0	.8280	1.7250	2.58750	27.8	1.0008	2.0850	3.12750
23.1	.8316	1.7325	2.59875	27.9	1.0044	2.0925	3.13875
23.2	.8352	1.7400	2.61000	28.0	1.0080	2.1000	3.15000
23.3	.8388	1.7475	2.62125	28.1	1.0116	2.1075	3.16125
23.4	.8424	1.7550	2.63250	28.2	1.0152	2.1150	3.17250
23.5	.8460	1.7625	2.64375	28.3	1.0188	2.1225	3.18375
23.6	.8496	1.7700	2.65500	28.4	1.0224	2.1300	3.19500
23.7	.8532	1.7775	2.66625	28.5	1.0260	2.1375	3.20625
23.8	.8568	1.7850	2.67750	28.6	1.0296	2.1450	3.21750
23.9	.8604	1.7925	2.68875	28.7	1.0332	2.1525	3.22875
24.0	.8640	1.8000	2.70000	28.8	1.0368	2.1600	3.24000

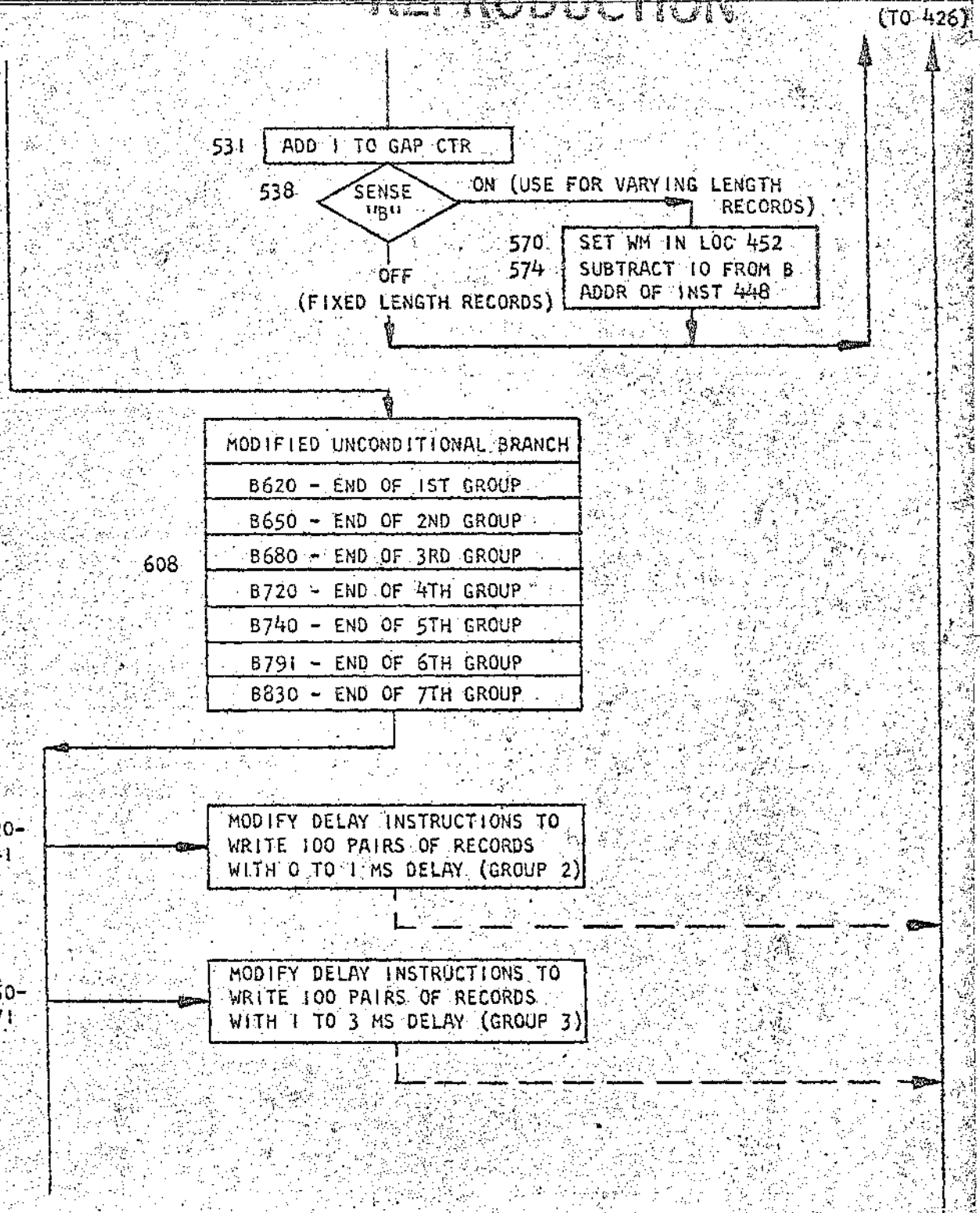
DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378G	116745	116745A	117628	TA 1976			

DIAGNOSTIC FUNCTION TEST

IRG MEASUREMENT - WRITE FLOW CHART

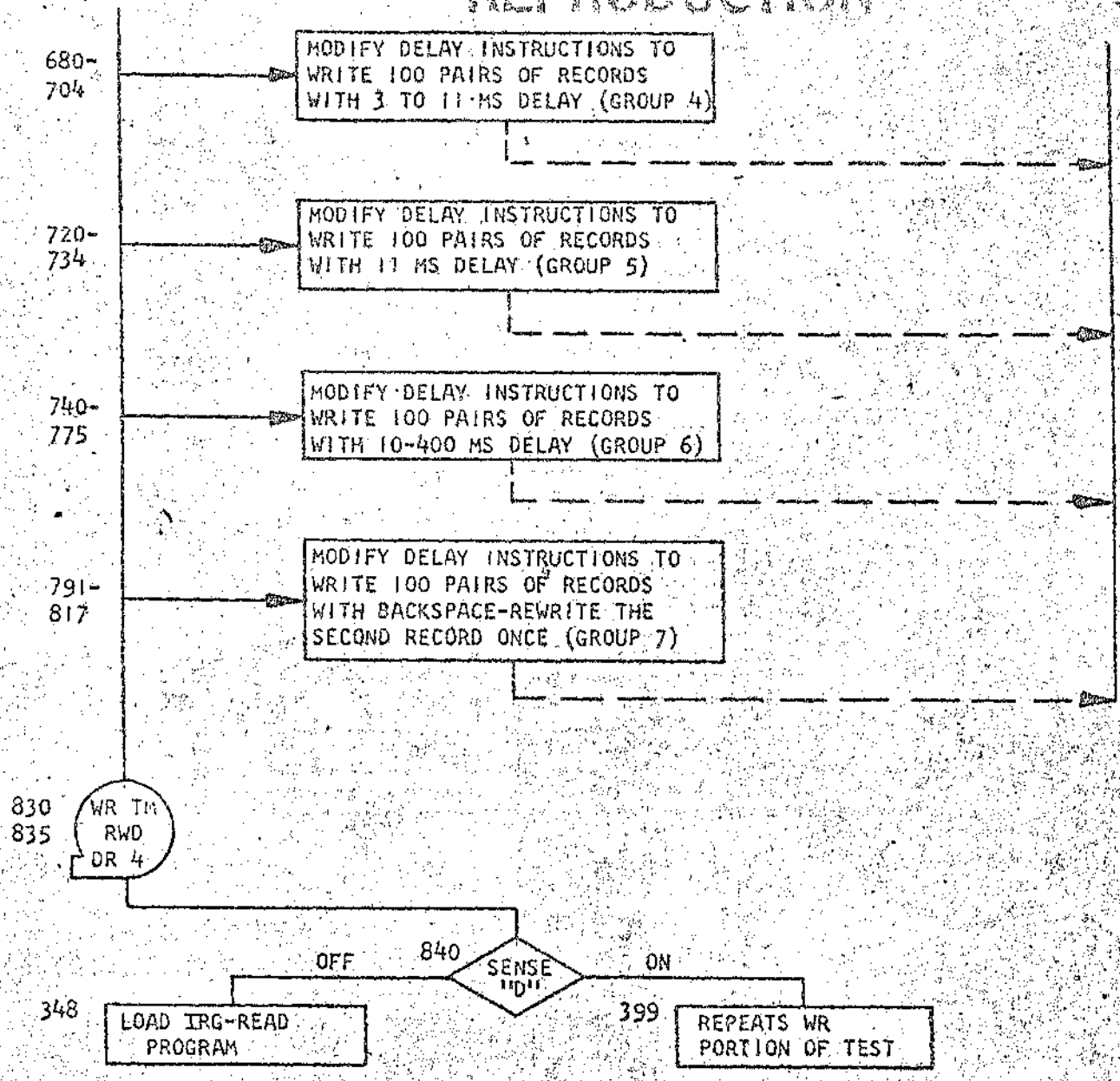


DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	1103780	116745	116745A	117628	TA 1976			



DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378G	116745	116745A	117628	TA 1976			

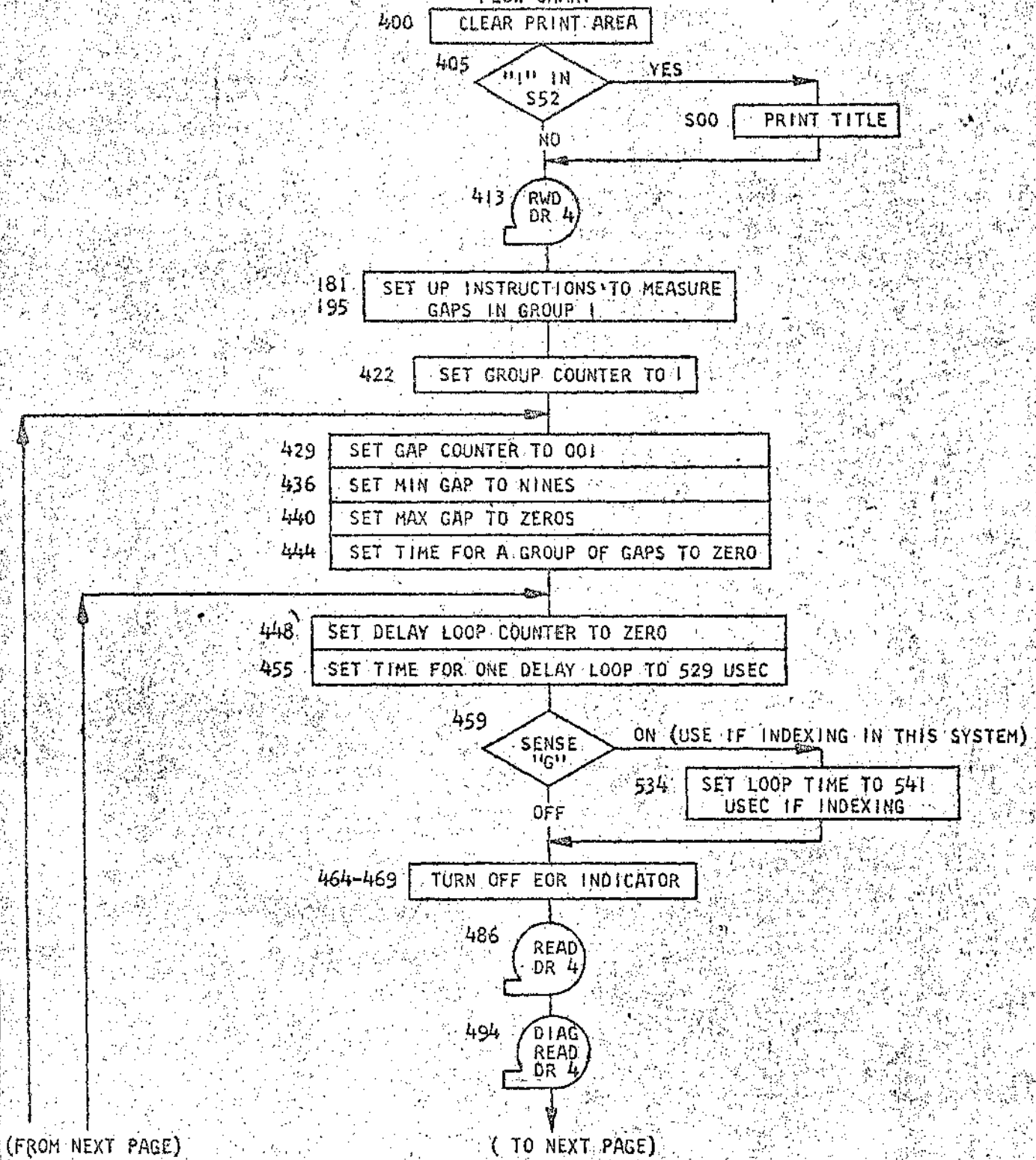
DIAGNOSTIC FUNCTION TEST



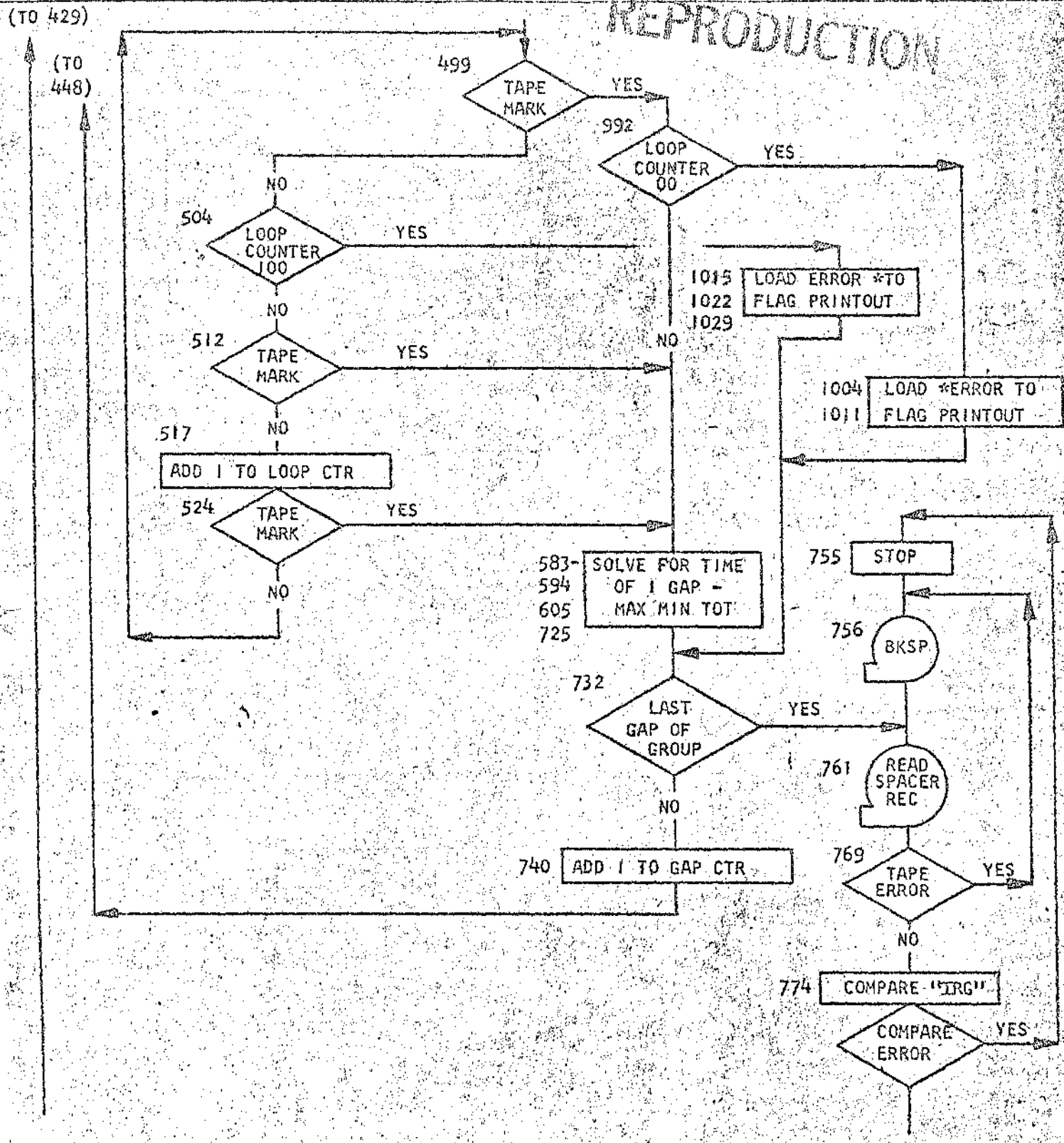
DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378G	116745	116745A	117628	TA 1976			

DIAGNOSTIC FUNCTION TEST

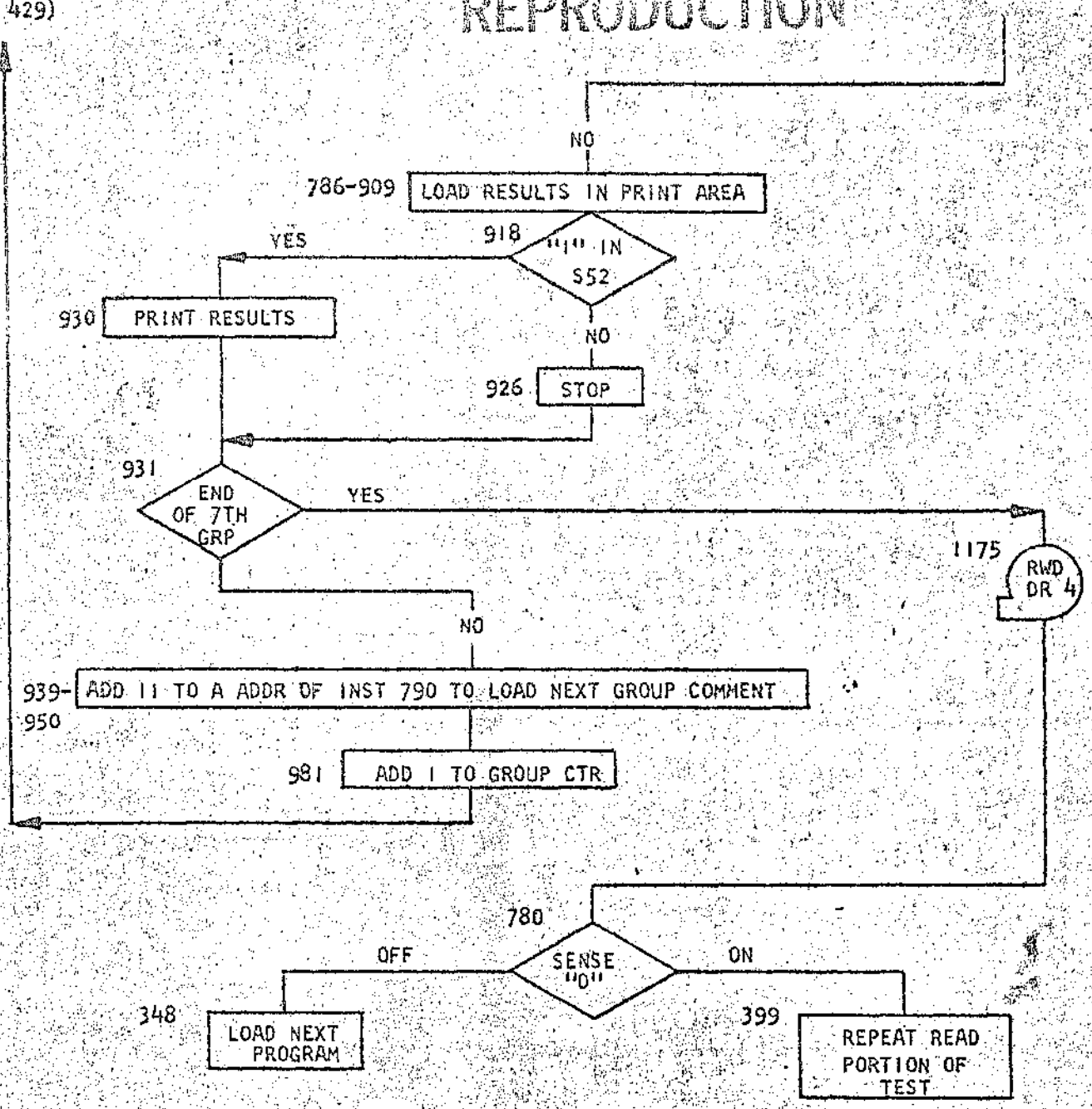
IRG MEASUREMENT - READ FLOW CHART



DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			



DATE	2-5-62	3-17-63	4-25-63	7-1-63	17. 10. 63			
ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			



DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378G	116745	116745A	117628	TA 1976			

PROGRAM LISTING FOR USE WITH FLOW CHART

7330 IRG MEAS. - WRITE 55308

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	1	001		CONSTANT
086	086	X	XX		GAP COUNTER
089	089	/	00		CONSTANT - B ADDR OF FIRST TAPE WR INST
092	092	1	90		CONSTANT TO SUBTRACT TO
098	098	S	000	005	CONSTANTS
105	105	X	XXX	X	"
110	110	1	-		"
115	115	B	523	1051	CONSTANTS TO MODIFY DELAY INSTR
123	123	U	BUS	8	"
128	128	B	468		"
133	133	B	489		"
138	138	/	489	200	"
145	145	/	489	279	"
152	152	Z	199	200	"
159	159	N	082	467	"
166	166	N	000	000	"
173	173	N	000	0	"
178	178	M	111	106	"
185	185	A	083	106	"
192	192	B	489		"
377	377	B	399	S531	USE WHEN PROGRAM IS LOADED FROM TAPE
385	385	B	S80		"
399	399	.			STOP TO SET UP OR 4
400	400	/	333		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	U	BUS	R	REWIND DRIVE 4
418	418	,	199		SET WM TO LIMIT DELAY INSTR
422	422	B	850		BR TO SET INSTR FOR MINIMUM DELAY
426	426	M	091	454	SET TAPE WRITE B ADDR TO /00
433	433	M	085	088	SET GAP COUNTER TO 001
440	440	/	299		CLEAR PRINT AREA
444	444	¤	452		CLEAR WM FROM B ADDR OF TAPE WRITE INST.
448	448	L	BUS	/00W	WRITE FIRST RECORD OF A PAIR
456	456	B	489		VARIABLE DELAY
461	461	/	489	200	"
468	468	/	489	279	"
475	475	Z	199	200	"
482	482	Z	199	200	"
489	489	L	BUS	/19W	WRITE SECOND RECORD OF A PAIR
497	497	B	550	L	BRANCH IF WRITE ERROR

DATE	2-5-62	3-17-63	4-25-63	7-1-63	11.10.63			
ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			

```
502  502  N 082 467      INSTR USED TO INCREASE DELAY FOR
509  509  N 000 000        GROUPS 2, 3, AND 4
516  516  N 000 000        ,,
523  523  B 595 0861    BR TO WR SPACER REC IF LAST GAP OF GROUP
531  531  A 082 088      ADD 1 TO GAP COUNTER
538  538  B 578 8-       ON TO VARY LNTH OF FIRST REC OF PAIR SS
543  543  B 444          BRANCH TO WRITE NEXT PAIR OF RECORDS
550  550  U %U5 B        BACKSPACE
555  555  U %U4 B        BACKSPACE
560  560  U %U4 E        SKIP
565  565  B 444          BRANCH TO WRITE NEXT PAIR OF RECORDS
570  570  , 452          SUBTR 10 FROM B ADDR OF TAPE WRITE TO
574  574  A 094 454        INCREASE LENGTH OF FIRST REC OF PAIR
581  581  B 444          BRANCH TO WRITE NEXT PAIR OF RECORDS
585  585  U %U4 B        BACKSPACE
590  590  U %U4 E        SKIP
595  595  L %U4 /16W     WRITE SPACER RECORD
603  603  B 585 L        BRANCH IF WRITE ERROR
608  608  B 620          BRANCH TO LOAD NEXT TYPE OF DELAY INSTR
620  620  L /2% 460      SET UP DELAY INSTR FOR 0 TO 1 MS DLY
627  627  M 531 502        ,,
634  634  N $91 611        ,,
641  641  B 426          BRANCH TO WRITE WITH 0 TO 1 MS DLY
650  650  L /31 467      SET UP DELAY INSTR FOR 1 TO 3 MS DLY
657  657  D 498 505        ,,
664  664  M $95 611        ,,
671  671  B 426          BRANCH TO WRITE WITH 1 TO 3 MS DLY
680  680  L /45 474      SET UP DELAY INSTR FOR 3 TO 11 MS DLY
687  687  L                ,,
688  688  L /66 522        ,,
695  695  L                ,,
696  696  L                ,,
697  697  M $99 611        ,,
704  704  B 426          BRANCH TO WRITE WITH 3 TO 11 MS DLY
720  720  M /71 506      SET UP DELAY INSTR FOR 11 MS FIXED DLY
727  727  M /03 611        ,,
734  734  B 426          BRANCH TO WRITE WITH 11 MS FIXED DLY
740  740  M 166 915      SET UP DELAY INSTR FOR 10-400 MS DLY
747  747  B 768            ,,
768  768  M /07 611        ,,
775  775  B 426          BRANCH TO WRITE WITH 10-400 MS DLY
791  791  L 196 479      SET UP INSTR TO BKSP REWRITE
798  798  L                ,,
799  799  L                ,,
800  800  L                ,,
801  801  L 132 519        ,,
808  808  L                ,,
809  809  L                ,,
810  810  M /13 611        ,,
817  817  B 426          BR TO BKSP-REWR SECOND RECORD OF PAIR
```

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ENG. CHG. NO.	1103780	116745	116745A	117628	TA 1976			

```
 830  830  U  804  M        WRITE TAPE MARK
 835  835  U  804  R        REWIND
 840  840  B  399  D        D ON TO REPEAT WRITE PORTION OF TEST SS
 845  845  B  340           BRANCH TO LOAD READ PORTION OF TEST
 850  850  L  158  488      SET UP INSTRUCTIONS FOR MINIMUM DELAY
 857  857  L  158                 ,,
 861  861  L                    ,,
 862  862  L                    ,,
 863  863  L                    ,,
 864  864  L  173  522         ,,
 871  871  L  173              ,,
 875  875  L                    ,,
 876  876  M  876  926         ,,
 883  883  M  893  915         ,,
 890  890  M  #87  611         ,,
 897  897  B  428              BRANCH TO BEGIN WRITING WITH MINIMUM DLY
 901  901  Z  331  332         INSTRUC USED DURING VARIABLE DELAYS
 908  908  Z  260  332              ,,
 915  915  B  461                 ,,
 919  919  M  #67  #63            ,,
 926  926  M  #78  #71            ,,
 933  933  M  166  926            ,,
 940  940  A  400  #63            ,,
 947  947  C  #71  #63            ,,
 954  954  B  940  /              ,,
 959  959  A  970  #71            ,,
 966  966  B  461                 ,,
 970  970  B                      ,,
1060 #60  X  XXX  0000           ,,
1068 #68  X  XXX  0001           ,,
1084 #84  B  620  8650B680B720   UNCONDITIONAL BRANCH INSTRUCTIONS
1100 #00  B  748  87918830           FOR GROUPS 2 TO 7
1116 #16  I  RG                  SPACER RECORD    TM IN /19
1120 #20  B  901                 CONSTANTS TO MODIFY DELAY INSTR
1125 #25  C  199  199                 ,,
1132 #32  Z  274  275                 ,,
1139 #39  /  475  200                 ,,
1146 #46  A  082  474                 ,,
1153 #53  A  085  481                 ,,
1160 #60  A  085  488                 ,,
1167 #67  B  523                      ,,
1246 S46                         GM-WM IN 1250
1250 S50
```

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ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			

PROGRAM LISTING FOR USE WITH FLOW CHART

7330 IRG MEAS. - READ 55308

INSTRUCTION ADDRESS		OP	A	B	REMARKS
082	082	1	000	00001	CONSTANTS
091	091	1	014	4	
					,,
					,,
097	097	2	07		
100	100	4	08		,,
106	106	X			GROUP COUNTER
107	107	5	29		TIME FOR 1 DELAY LOOP IN MSEC
110	110	X	X		DELAY LOOP COUNTER
112	112	X	XXX	XXX	CTR FOR TOTAL USEC OF GAPS IN A GROUP
119	119	0	000	0	MAX GAP IN A GROUP
124	124	9	999	9	MIN GAP IN A GROUP
129	129	X	XX		GAP COUNTER
132	132	X	XXX	X	COUNTER FOR USEC OF 1 GAP
137	137	X	X		COUNTER USED IN MULTIPLE ADDITION
139	139	X	XXX	X	COUNTER USED IN SOLVING FOR MAX + MIN
144	144		0		CONTROL WORD FOR EDIT
148	148	*			CONSTANT
149	149	I	RG		CONSTANT COMPARED TO SPACER RECORD
152	152	9	999	9	CONSTANTS
157	157	5	295	41	
					,,
163	163	I	9		,,
181	181	M	333	/98	RESET INSTRUCTIONS FOR GROUP 1
188	188	M	435	793	,,
195	195	B	423		BRANCH TO SET CTRS TO INITIAL COND
377	377	B	400	S531	USE WHEN PROGRAM IS LOADED FROM TAPE
385	385	B	388		,,
399	399	.			STOP TO SET UP DRIVE 4
400	400	/	332		START TEST
404	404	/			
405	405	B	500	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	U	404	R	REWIND DRIVE 4
418	418	B	181		BRANCH TO SET INSTR FOR GROUP 1
422	422	M	090	106	SET GROUP COUNTER TO 1
429	429	M	090	131	SET GAP COUNTER TO 001
436	436	M	156		SET MIN GAP TO NINES
440	440	M	089		SET MAX GAP TO ZEROS
444	444	M	089		SET TIME FOR A GROUP OF GAPS TO ZEROS
448	448	M	089	111	SET DELAY LOOP COUNTER TO ZEROS
455	455	M	159		SET TIME FOR 1 LOOP TO 529
459	459	B	534	G	G ON IF INDEXING IN THIS SYSTEM SS
464	464	B	469	K	TURN OFF EOR INDICATOR
469	469	B	486		

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ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			

```
486  486  L  %U4  S47R    READ FIRST RECORD OF A PAIR
494  494  U  %U4  A       DIAGNOSTIC READ
499  499  B  992  K       BRANCH IF TAPE MARK IS SENSED
504  504  V  #16  1105    BRANCH IF NO TM SENSED AFTER 50 MS
512  512  B  594  K       BRANCH IF TAPE MARK IS SENSED
517  517  A  082  111     ADD 1 TO LOOP COUNTER
524  524  B  606  K       BRANCH IF TAPE MARK IS SENSED
529  529  B  499           BRANCH TO REPEAT LOOP
534  534  M  162  109     SET LOOP TIME TO 541 USEC IF INDEXING
541  541  B  464
                          **
583  583  +  158  136     SOLVE FOR TIME OF 1 GAP
590  590  B  619
                          **
594  594  +  099  136
                          **
601  601  B  619
                          **
605  605  +  102  136
                          **
612  612  A  164  111
                          **
619  619  A  095  136
                          **
626  626  M  080  138     MULTIPLY DELAY LOOP COUNTER BY TIME FOR
                            1 LOOP USING MULTIPLE ADDITION
633  633  A  109  136
                          **
640  640  A  082  138
                          **
647  647  C  138  111
                          **
654  654  B  633  /
659  659  A  136  118     ADD USEC FOR 1 GAP TO USEC FOR A GRP
666  666  L  123  143     FIND MAX GAP
673  673  S  136  143
                          **
680  680  V  692  143K
                          **
688  688  B  699
                          **
692  692  L  136  123
                          **
699  699  L  128  143     FIND MIN GAP
706  706  S  136  143
                          **
713  713  V  725  1438
                          **
721  721  B  732
                          **
725  725  L  136  128
                          **
732  732  B  761  1291    BRANCH IF LAST GAP OF THIS GROUP
740  740  A  082  131     ADD 1 TO GAP COUNTER
747  747  B  448          BRANCH TO READ NEXT GAP
755  755  -               STOP IF ERROR IN READING SPACER RECORD
756  756  U  %U4  B       BACKSPACE
761  761  L  %U4  S47R    READ SPACER RECORD
769  769  B  756  L       BRANCH IF READ ERROR
774  774  C  S40  151     COMPARE READ AREA TO CONSTANT -IRG-
781  781  B  755  /       BRANCH IF UNEQUAL
786  786  /  299           CLEAR PRINT AREA
790  790  L  #53  212     LOAD GROUP COMMENT IN PRINT AREA
797  797  L  123  136     SOLVE FOR + LOAD RANGE IN PRINT AREA
804  804  S  128  136
                          **
811  811  A  152  135
                          **
818  818  L  147  242
                          **
825  825  E  136  242
                          **
832  832  A  157  122     SOLVE FOR + LOAD MAX IN PRINT AREA
```

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ENG. CHG. NO.	110378G	116745	116745A	117628	TA 1976			

```
 839  839  L 147 224      ,,
 846  846  E 121 224      ,,
 853  853  A 157 127   SOLVE FOR + LOAD MIN IN PRINT AREA
 860  860  L 147 230      ,,
 867  867  E 126 230      ,,
 874  874  A 157 115   SOLVE FOR + LOAD AVG IN PRINT AREA
 881  881  L 147 236      ,,
 888  888  E 114 236      ,,
 895  895  L /98 254   LOAD WORD ERROR IN PRINT AREA
 902  902  M 332 /98       IF ANY ERRORS IN SENSING TAPE MARK
 909  909  B 918        BRANCH TO PRINT RESULTS
 918  918  B 930 S521   PRINT RESULTS IF 1 IN S52
 926  926  . 931        STOP TO CHECK RESULTS IF NO PRINTER
 930  930  2            PRINT
 931  931  B /76 1067   BRANCH TO REWIND IF END OF TEST
 939  939  , 791        ADD 11 TO A FIELD OF INSTR IN 790
 943  943  A 876 793       TO LOAD NEXT GROUP COMMENT
 950  950  ¤ 791           ,,
 954  954  B 981
 981  981  A 082 106   ADD 1 TO GROUP COUNTER
 988  988  B 429        BRANCH TO MEAS NEXT GROUP OF GAPS
 992  992  C 089 111   TEST FOR ZEROS IN LOOP COUNTER
 999  999  B 583 /      BR TO SOLVE FOR GAP TIME IF NO ZEROS
1004  ¢04  M 148 /90   FLAG PRINTOUT WITH  * ERROR  IF TM
1017  ¢11  B ¢22           WAS SENSED BEFORE ANY DELAY LOOPING
1015  ¢15  M 148 /98   FLAG PRINTOUT WITH  ERROR * IF NO TM
1022  ¢22  M ¢¢0 /96       WAS SENSED AFTER 50 MS DELAY LOOPING
1029  ¢29  B 732            ,,
1033  ¢33  ¢ 53         CONSTANTS
1036  ¢36  E RR0 R           ,,
1043  ¢43  M INI WUM DLY  COMMENT FOR GROUP 1
1054  ¢54    0-1  MS DLY  COMMENT FOR GROUP 2
1065  ¢65    1-3  MS DLY  COMMENT FOR GROUP 3
1076  ¢76  3 -11  MS DLY  COMMENT FOR GROUP 4
1087  ¢87     11  MS DLY  COMMENT FOR GROUP 5
1098  ¢98     10 -400 MS  COMMENT FOR GROUP 6
1109  £09  M IN  + CREEP  COMMENT FOR GROUP 7
1120  £20  W RIT E CONDITION  CONSTANTS FOR HEADINGS
1140  £40  M AX    MIN  AVG  RA
1160  £60  N GE   IN MS      ,,
1175  £75  U ¤U4 R           ,,
1180  £80  B 390 D      REWIND
1185  £85  B 348        D ON TO REPEAT READ PORTION OF TEST  SS
1190  £90              BRANCH TO LOAD NEXT PROGRAM
1247  $47  X XX         BLANKS
1250  $50              TAPE READ-IN AREA
                       GM-WN IN 1250
```

DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	1103786	116745	116745A	117628	TA 1976			

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    7330 IRG MEAS. - WRITE   5530B 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD        5530B 02
L065114,086089,092098,105110100111001XXX/00190   5000005XXXXX1-              5530B 03
L069151,123128,133138,145145100185231051U%U4BB468 B489 /489200/489279       5530B 04
L065184,159166,173178,178178100IZ199200N082467N000000N0000M111106            5530B 05
L047199,192192,192192,192192100IA0831068489                                  5530B 06
L067367,340344,348349,3573611001,008012,001100118361080A8348/340080          5530B 07
L069404,377385,399400,4044051001 1 OF 2 5B399S531BS88          ./332/        5530B 08
L071443,413418,422426,433440100IBS00S521U%U4R,199B850M091454M085088/299      5530B 09
L070481,448456,461468,475482100I452L%U4/00WB489 /489200/489279Z199200       5530B 10
L066515,489497,502509,516516100IZ199200L%U4/19WB550LN082467N000000           5530B 11
L071554,523531,538543,550555100INO00000B595086IA08208BB570BB444   U%U4B      5530B 12
L067589,560565,570574,581585100IU%U4BU%U4EB444 ,452A094454B444U%U4B          5530B 13
L069626,595603,608620,627627100IU%U4EL%U4/16WB585LB620          L/24460      5530B 14
L069663,634641,650657,664664100IM531502M*916118426      L/31467D498S05       5530B 15
L065696,671680,687688,695696100IM*95611B426      L/45474LL/66522LL           5530B 16
L069733,704720,727734,734734100IM*99611B426              M/71S06M/03611       5530B 17
L066767,740747,768768,768768100IB426  M166915B768                             5530B 18
L072807,775791,798799,800801100IM/07611B426              L196479LLLL132519555308 19
L069844,809810,817830,835840100ILLM/11611B426          U%U4MU%U4RB399D       5530B 20
L058870,850857,861862,863864100IB348 L158488L158LLLL172522                   5530B 21
L069907,875876,883890,897901100IL172LM876926M897915M*87611B426Z331332        5530B 22
L071946,915919,926933,940947100IZ260332B461M*67*63M*75*71M166926A400*63       5530B 23
L072986,954959,966970,970970100IC*71*63B940/A970*71B4618                      5530B 24
L072*99,*68*84,/00/00,/00/00100IXXXX0000XXXX0001          B620B650B680B72055308 25
L071/38,/16/20,/25/32,/39/39100IB740B7918830      IRGTB901 C199199Z274275     5530B 26
                                                        M
L072/78,/46/53,/60/67,/67/671001/475200A082474A085481A085488B523              5530B 27
L066S12¤/79/79,S00S01,S05S121001                    2,049L0772772             5530B 28
L070S50,S17S21,S46S50,S50S501001/2772413                              G       5530B 29
                                                                      M
/333080N                                          CLEAR WORDMARK CARD         5530B 30
,019027,031,038042B031T98GB399L046352BW04BS88  7330 IRG MEAS. - WRITE       5530B 31
                    M
```

DATE	2-5-62	3-17-63	4-25-63	7-1-63	17.10.63			
ENG. CHG. NO.	110378-G	116745	116745-A	117628	TA 1976			

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N.      1001                    7330 IRG MEAS. - READ    5530B20A
,008015,022029,033033N       1001                    SET WORDMARK CARD        5530B202
L062111,091097,100106,107110100110000000110144 207408    X529XX              5530B203
L064143,119124,129132,137139100XXXXXXX000009999XXXXXXXXXXXXXXX               5530B204
L069180,148149,152157,163163100 0. *IRG999995295411 9                        5530B205
L051199,188195,195195,195195100M332/98M*35793B422                            5530B206
L067367,340344,348349,357361100,008012,00110011B361080AB400/340080           5530B207
L069404,377385,399400,404405100          B400S531BS88              ./332/    5530B208
L071443,413418,422429,436440100BS00S521U%U4RB181M090106M090131M156M089       5530B209
L072483,448455,459464,469469100M089M089111M159B534GB469KB486                 5530B210
L060511¤484484,486494,499504100  L%U4S47RU%U4AB992KV*15110S                   5530B211
L072551,517524,529534,541541100B594KA082111B605KB499 M1621098464            5530B212
L070589¤552552,583590,590590100                                  P158136     5530B213
                                                                      Z
L068625,594601,605612,619626100B619P099136B619P102136A164111A095136          5530B214
                                    Z          Z
L072665,633640,647654,659666100M089138A109136A082138C138111B633/A136118 5530821
L072705,673680,688692,699706100L123143S136143V692143KB699L136123L128143 5530821
L066739,713721,725732,740740100S136143V725143BB732L136128B7611291            5530B217
L066773,747755,756761,769774100A082131B448    .U%U48L%U4S47RB756L            5530B218
L069810,781786,790797,804811100CS49151B755//299L*53212L123136S128136         5530B219
L067845,818825,832839,846846100A157135L147242E134242A157122L147224           5530B220
L067880,853860,867874,881881100E121224A157127L147230E126230A157115           5530B221
L069917,888895,902909,918918100L147236E114236L/98254M332/988918              5530B222
L068953,926930,931939,943950100B930S521.93128/751067,791A875793¤791          5530B223
L070991,981988,992992,992992100B981                              A082106B429  5530B224
L069*28,999*04,*11*15,*22*29100C0891118583/M148/90B*22M148/98M*40/96          5530B225
L068*64,*33*36,*43*54,*65*65100B732*53ERROR  MINIMUM DLY 0-1 MS DLY           5530B226
L065*97,*76*87,*98*98,*98*98100 1-3 MS DLY3-11 MS DLY  11 MS DLY              5530B227
L072/37,/09/20,/20/20,/20/20100  10-400 MSMIN + CREEPWRITE CONDITION          5530B228
L069/74¤/38/38,/40/60,/75/75100  MAX   MIN   AVG   RANGE   IN MS             5530B229
L069S11,/80/85,/90S00,S01S05100U%U4RB399D8348                 2,049L077277    5530B230
L057S36,S13S17,S18S25,S29S36100 2/2772¤/40/60N/80L/692502                      5530B231
L046S50,S41S45,S47S50,S50S50100/2702413  XXXG                                 5530B232
                                                  M
/333080N                                                CLEAR WORDMARK CARD   5530B233
,019027,031,038042803IT98GB400L046352BW04BS88   7330 IRG MEAS. - READ        5530B234
                                  M
```

DATE	2/5/62	3/17/63	4/25/63	7-1-63	17. 10. 63			
ENG. CHG. NO.	110378-G	116745	116745-A	117628	TA 1976			

NO. C8001
SHEET 0
OF 18

DIAGNOSTIC TEST

TITLE 1407 CONSOLE UNIT TEST
MACH. TYPE 1407 BY DCM APPR. WDC DATE 8-31-61

ENGINEERING CHANGE HISTORY

E/C NO.	DATE	SHEETS AFFECTED
405070	9-8-61	0-18
405070A	10-26-61	0-5, 12, 13, 15, 16

E/C NO.	405070	405070A					
DATE	9-8-61	10-26-61					

TEST C8001
1407 CONSOLE UNIT TEST

PURPOSE

The purpose of this diagnostic is to check out the operation of the 1407 Console Inquiry Unit.

DESCRIPTION

Both a READ and a WRITE in the LOAD and MOVE mode of operation is accomplished under program control. For the ALTER mode of operation, the C. E. is to do this manually. A 4K storage 1401 is necessary to test the 1407 with this diagnostic. For 1401 systems with 1.4 or 2K storages, use Test C8002.

SENSE SWITCH SET-UPS

The sense switches are used as follows:

SWITCH	FUNCTION	NORMAL SETTING
Sense Switch A	Last Card	On
Sense Switch B	For a Continuous Loop of Writing Lines 1 and 2, 3, 4, 5 in the MOVE mode of operation	Off
Sense Switch C	For a Continuous Loop Writing Lines 1 and 2, 3, 4, 5 in the LOAD mode of operation	Off
Sense Switch D	Controls the Continuous Loop Operation of the Complete Program	Off
Sense Switch E	Controls the BRANCH Back to the Same Instruction or, to the Next Instruction From an Error Routine, if off.	Off
Sense Switch F	Controls the Bypassing of An Error Print-Out.	Off
Sense Switch G	Controls the Reading In of Data From the 1407 to the 1401.	Off

Column Control Postions #9 (3656 = F56) - 9 for Bypassing The Compare Instructions of the Data Read Into the 1401 from the 1407.

Column Control Position (3657 = F57) for Looping on Carriage Return Test.

OPERATION

The diagnostic deck is placed into the 1402 hopper with three blank cards following it. The 1401 is reset with the START RESET button, and the LOAD button on the 1402 is pressed. This will cause the program to load automatically. After the program has loaded, a type-out will occur on the 1407 indicating the test number, the size of 1401 storage required, and a set of instructions for operating the test. Reference is made in this type-out to the C. E. write-up for details, therefore, this portion of the write-up should be studied carefully. There is also a flow chart entitled, "1407 Inquiry Test C8001 General" written for this diagnostic test.

The following is the sequence of operation. After the Housekeeping instructions and the instructive type-out occur, the program will advance automatically to the main portion of the program. Here the 1407 will type a line of information. Then, it will begin automatically WRITING lines 1 and 2 in the MOVE mode of operation. After WRITING lines 1 and 2, line number 3 will be written, then line number 4, followed by line number 5 - all in the MOVE mode of operation. A test is then made of Sense Switch B. If Sense Switch B is ON the 1407 will WRITE the Sense Switch B Comment and then BRANCH and WRITE lines 1 and 2, 3, 4, and 5 in the MOVE mode of operation. As long as Sense Switch B is ON, this sequence of instructions will be executed. If Sense Switch B is OFF, the program will then begin WRITING lines 1 and 2, then line 3 and line 4, and line 5 in the LOAD mode of operation. Then, If Sense Switch C is ON, the 1407 will write the Sense Switch C Comment and BRANCH to WRITE lines 1 and 2, 3, 4 and 5 in the LOAD mode of operation again. As long as Sense Switch C is ON, this sequence of instructions will be executed. If C is OFF a test is then made of Sense Switch G. (Note: Sense Switch G must be OFF for the first pass through this diagnostic.) Sense Switch G controls the reading of data from the 1407 to the 1401 core storage unit. If Sense Switch G is OFF, the program will BRANCH to test the Inquiry Latch. If the Inquiry Latch is OFF, the machine will WRITE "PRESS THE REQUEST/ENTER KEY .... NOW PRESS THE START KEY"-- if the REQUEST/ENTER Key is not pressed and the START button is pressed, the above line will be repeated. This will continue until the REQUEST/ENTER key is pressed. Then, when the START key is pressed, the machine will WRITE the following line of instruction. "READ LINE 1 MOVE PRESS RESPOND KEY AFTER LINE 1 TO PUT GMWM AT THE END OF REC." The C. E. is then to Read In line number 1 as recorded above in the MOVE mode of operation into the 1401 from the 1407 keyboard. It should be noted that the number sequence is first followed by the alphabetical sequence (with a / between R and S) followed by special characters in the upper case and special characters in the lower case and the indicative comment LINE 1. This grouping is designed to aid the C. E. in trouble-shooting the missing of zones or the missing of numbers in any transfer of data from the 1401 to the 1407 or vice-versa. After writing the indicative comment "Line1. Blank" the RESPOND key MUST be depressed. This places the GMWM in the 1401 storage. These lines of information are designed to be printed in 80 column positions. It is therefore suggested that the C. E. set the limits

on the typewriter for 80 spaces only. After writing the 80 characters in the MOVE mode of operation above, the Request Latch is again tested and the line of information, "PRESS THE REQUEST/ENTER KEY....NOW PRESS THE START KEY" is written. When the REQUEST/ENTER key is pressed and the START key is depressed, the following line of instructions will be printed, "READ LINE 1 LOAD PRESS RESPOND KEY AFTER LINE 1 TO PUT GMWM AT THE END OF REC." The program then will wait for the C. E. to READ into the 1401 core storage line 1 in the LOAD mode. (Note: Place the Word Marks in the proper position. The C. E. will have to refer to the line 1 WRITTEN in the LOAD mode.

After these lines of data have been WRITTEN into the 1401 core storage and the Respond Key pressed, the program compares the data READ into the 1401 to the data contained in the diagnostic program. If the comparison is not equal, the 1407 will type out the data lines from the diagnostic program and then the error lines. The MOVE mode information will be compared first and, if in error, will be typed first. The LOAD mode of information will be compared last and, if in error, will be typed last. Next is the Carriage Return Test. This is accomplished by placing WORD MARKS in column positions 80, 70, 60, 50, 40, 30, 20, 10, 4, 3, 2 and 1, and will print in the MOVE Mode a line for each SET WORD MARK instruction. Then the WORD MARKS are cleared and it will print in the LOAD Mode a line for each CLEAR WORD MARK instruction. A BRANCH if storage location 3657 is equal to (d) modifier (a GM) will cause the test to be repeated until the GM is removed. After this, Sense Switch D is interrogated. If Sense Switch D is ON the comment is WRITTEN concerning Sense Switch D and the program branches to the beginning of the program to write lines 1 and 2 again in the MOVE mode of operation. If Sense Switch D is OFF, the program will WRITE an instructive message concerning the ALTER mode of operation and will WRITE an instructive message concerning the END OF TEST. The information concerning the END OF TEST is as follows: "IF NO DETAIL, END OF TEST. PRESS START TO BR TO CHAIN."

If in place of the three blank cards mentioned at the beginning of this write-up a deck of cards is placed behind the Main Program, a ripple test can be run. This deck of cards must have in column 80, the letter L. This is to cause the program to READ IN another card from the 1402 and print its information on the 1407. There are two main types of cards. One is a key ripple. This will ripple one key after another from the 1407 character basket. The second type of card contained in the deck is designed to ripple every character, normal and special, and every number past every position on the 1407 typewriter except those positions that record the test number and the type of card. The last card MUST either be blank or have "END CD" written in columns 76 through 80.

It will also be noted that if Sense Switch G is turned ON after the initial reading operation, that it will type out the Sense Switch G information and then BRANCH around the READ-IN portion of the program. Then the comparison instructions, to check the data READ from the 1407 to the 1401, are executed. This comparison is why Sense Switch G must be turned OFF for the first pass through the diagnostic. If it is desired to bypass the comparison operation between the data written and the data in the 1407 diagnostic, a 9 must be

placed in storage position 3656 or it can be accomplished by placing a 9 in column 34 of the next to the last card in the Main Program. This card is The Column Control Card and has the numbers 99998 in columns 1-5. This card can also control the loop operation of any one of the test lines within the diagnostic. This is accomplished by setting the number in the control card corresponding to the number test referred to under the line of information that it is desired to loop.

The data field in the column control card begins in columns 24 and ends in column 35. Column 24 is a blank, column 25 is a 0, 26 is a 1, etc. until column 34 which is a 9 and column 35 is for a GM (12-7,8 punch). This card is sent to the field blank, however, the C. E. can place the appropriate number in this card or place the appropriate number in the proper storage location to accomplish this operation.

ERROR

For this diagnostic, turn the PROCESS CHECK SWITCH OFF. Upon an error the diagnostic will type out the procedure to be followed. If Sense Switch E is ON the program will BRANCH back to the same instruction in which the error occurred. If Sense Switch E is OFF the program will BRANCH to the instructions which cause the next line of data to be typed.

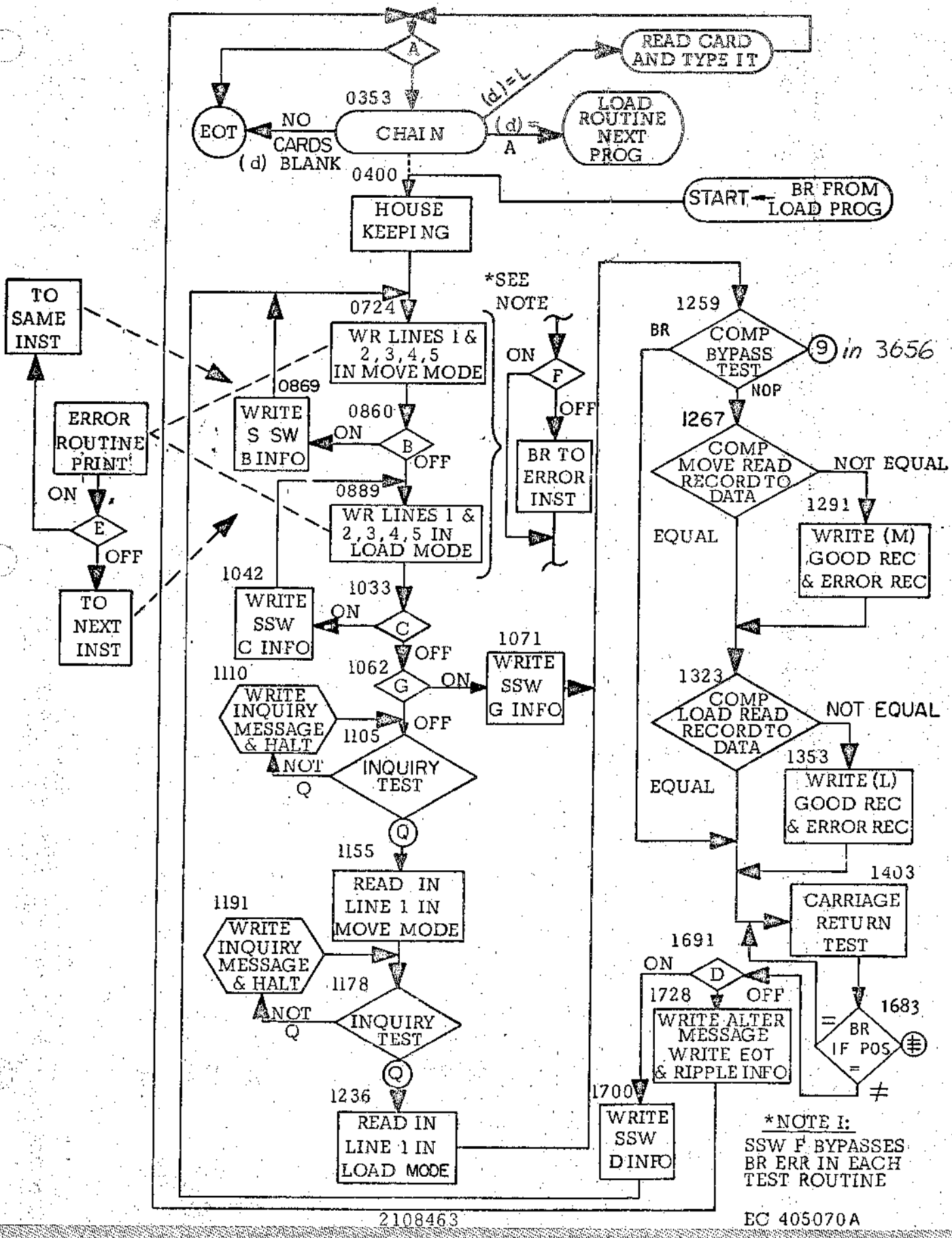
SPECIAL NOTES

It will be noted that when the machine is programmed to space, that it is, actually programmed to print a blank and then space, this is designed to test the timing circuits that are involved in a carriage return in printing a single character.

The Ripple decks are not intended to be run each time the test is run because of the time involved.

The READING-IN of every character from the keyboard Left to Right and Top to Bottom In Lower Case and Upper Case can be done in place of Line 1 and Line 2. This will test the compare circuits and should cause a type-out of this read in data and the diagnostic data. This should be done in both the MOVE and LOAD modes. Test the WM with and without a "C" bit.

1407 INQUIRY TEST C8001 (GENERAL)



*NOTE 1:
SSW F BYPASSES BR ERR IN EACH TEST ROUTINE

```
CLEAR STORAGE 1     ,008015,022026,030034,041,045,053,0570731026
CLEAR STORAGE 2     L072116,110106,105117B101/199,027A074028=027B001027B08026/0991,001/00111710
BOOTSTRAP CARD      ,008015,022029,056063/056029                              ,0240671056
```

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION	COMMENTS
	010			CTL	33					
	020			ORG	0333					
	030				* CHAIN ROUTINE		A BR LAST CARD			
	035	7		LCA	T83200	0001		0333	L L39 081	LOAD GM-WM
	040	8		MCW	&TO	0001	W	0340	M &TO 001 W	PRNT FROM RDER.
	050	1		R				0348	1	FEED A CARD
	060	4		SW	0001			0349	, 001	SET A WORD MARK
	070	8		B	0001	0080	A	0353	B 001 080 A	BR TO LOAD ROUT
	080	8		B	0333	0080	L	0361	B 333 080 L	BR TO MAIN PROG
	090	4	H00090	H	0400			0369	. 400	EOJ HALT
	110			ORG	0400					
5	000				* HOUSE KEEPING TEST C8001					
5	001				* 1407 CONSOLE UNIT TEST					
5	010	7		MN	3995	C93010& 13		0400	D I95 Q80	RM TO CENT SIGN
5	020	7		MN	3995	C93110- 24		0407	D I95 &04	RM TO CENT SIGN
5	030	7		MN	3995	C93150- 26		0414	D I95 &83	RM TO CENT SIGN
5	040	7		MN	3995	T83010& 13		0421	D I95 K22	RM TO CENT SIGN
5	080	7		SW	C95050	C93040& 9		0428	, D77 R56	SET WORD MARKS
5	110	7		SW	I40010- 31	C93010- 20		0435	, X56 Q47	SET WORD MARKS
5	120	7		SW	C93010- 11	C93010- 2		0442	, Q56 Q65	SET WORD MARKS
5	130	7		SW	C93010& 9	C93010& 18		0449	, Q76 Q85	SET WORD MARKS
5	150	7		SW	C93040& 5	C93040- 25		0456	, R52 R22	SET WORD MARKS
5	160	7		SW	C93040- 19	C93040- 13		0463	, R28 R34	SET WORD MARKS
5	170	7		SW	C93040- 7	C93040- 3		0470	, R40 R44	SET WORD MARKS
6	010	7		SW	C93110& 3	C93110- 29		0477	, &31 R99	SET WORD MARKS
6	020	7		SW	C93110- 27	C93110- 25		0484	, &01 &03	SET WORD MARKS
6	030	7		SW	C93110- 23	C93110- 21		0491	, &05 &07	SET WORD MARKS
6	040	7		SW	C93110- 17	C93110- 19		0498	, &11 &09	SET WORD MARKS
6	050	7		SW	C93110- 15	C93110- 13		0505	, &13 &15	SET WORD MARKS
6	060	7		SW	C93110- 11	C93110- 9		0512	, &17 &19	SET WORD MARKS
6	070	7		SW	C93110- 7	C93110- 5		0519	, &21 &23	SET WORD MARKS
6	080	7		SW	C93110- 3	C93110- 1		0526	, &25 &27	SET WORD MARKS
6	100	7		SW	C93110& 5	C93110& 7		0533	, &33 &35	SET WORD MARKS
6	110	7		SW	C93110& 9	C93110& 11		0540	, &37 &39	SET WORD MARKS

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PG LIN  CT  LABEL    OP    A OPERAND          B OPERAND          D    LOC   INSTRUCTION COMMENTS    C8001
 6 120   7          SW    C93110E 13         C93110E 15              0547  , E41 E43     SET WORD MARKS
 6 130   7          SW    C93110E 17         C93110E 19              0554  , E45 E47     SET WORD MARKS
 6 140   7          SW    C93110E 21         C93110E 23              0561  , E49 E51     SET WORD MARKS
 6 150   7          SW    C93110E 25         C93110E 27              0568  , E53 E55     SET WORD MARKS
 6 160   7          SW    C93110E 29         C93110E 31              0575  , E57 E59     SET WORD MARKS
 6 170   7          SW    C93150- 22         C93130- 13              0582  , E87 E63     SET WORD MARKS
 6 180   7          SW    C93130- 11         C93130-  9              0589  , E65 E67     SET WORD MARKS
 7 030   7          SW    C93150- 12         C93180- 29              0596  , E97 A61     SET WORD MARKS
 7 040   7          SW    C93180- 27         C93180- 25              0603  , A63 A65     SET WORD MARKS
 7 050   7          SW    C93180- 23         C93010E 26              0610  , A67 Q93     SET WORD MARKS
 8 010   7          LCA   T83200             C99998E  2              0617  L L39 F58     MOVE GM-WM
 8 020   8          MCW   %TO                C91010- 31         W    0624  M %TO L42 W    WR H.K. MESSAGE
 8 030   8          MCW   %TO                C90110-  1         W    0632  M %TO L39 W    SPACE
 8 040   8          MCW   %TO                C90110-  1         W    0640  M %TO L39 W    SPACE
 8 050   8          B     H08070             C99998-  9         0    0548  B 660 F47 0    BR TO HALT & BR
 8 060   4          B     P10010                                       0656  B 700          BR TO MAIN PROG
 8 070   4  H08070  H     P10010                                       0660  . 700          H. K. HALT & BR
 8 100              ORG   0700
10 000              * MAIN PROG MCW TEST
10 001              * 1407 CONSOLE TYPE-WRITER UNIT -- TEST C8001
10 010   8  P10010  MCW   %TO                C92110- 31         W    0700  M %TO N93 W    WRITE INFO DATA
10 030   8          MCW   %TO                C90110             W    0708  M %TO L40 W    SPACE
10 035   8          MCW   %TO                C90110             W    0716  M %TO L40 W    SPACE
10 040   8  P10040  MCW   %TO                T83010- 31         W    0724  M %TO J78 W    WR LINES 1 & 2
10 050   5          B     P10070                                F    0732  B 742 F        SSW # F TEST
10 060   5          B     E50010                                %    0737  B Z18 %        BR ON ERROR
10 070   8  P10070  B     P10040             C99998-  8        1    0742  B 724 F48 1    SW # 1 TEST
10 080   8          MCW   %TO                C90110             W    0750  M %TO L40 W    SPACE
10 110   8  P10110  MCW   %TO                C93110- 31         W    0758  M %TO R97 W    WRITE LINE 3
10 120   5          B     P10140                                F    0766  B 776 F        SSW # F TEST
10 130   5          B     E50110                                %    0771  B Z44 %        BR ON ERROR
10 140   8  P10140  B     P10110             C99998-  7        2    0776  B 758 F49 2    SW # 2 TEST
10 150   8          MCW   %TO                C90110             W    0784  M %TO L40 W    SPACE
11 010   8  P11010  MCW   %TO                C93150- 31         W    0792  M %TO E78 W    WRITE LINE 4
11 020   5          B     P11040                                F    0800  B 810 F        SSW # F TEST
11 030   5          B     E50210                                %    0805  B %70 %        BR ON ERROR
11 040   8  P11040  B     P11010             C99998-  6        3    0810  B 792 F50 3    SW # 3 TEST
11 050   8          MCW   %TO                C90110             W    0818  M %TO L40 W    SPACE
11 110   8  P11110  MCW   %TO                C93180- 31         W    0826  M %TO A59 W    WRITE LINE 5
```


2108463 EC 453270

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION	COMMENTS C8001
11	120	5		B	P11140		F	0834	B 844 F	SSW # F TEST
11	130	5		B	E50310		%	0839	B 296 %	BR ON ERROR
11	140	8	P11140	B	P11110	C99998- 5	4	0844	B 826 F51 4	SW # 4 TEST
11	150	8		MCW	%TO	C90110	W	0852	M %TO L40 W	SPACE
11	160	5		B	P11180		8	0860	B 869 8	BR LOOP SSW # 8
11	170	4		B	P12010			0865	B 889	BR SSW # 8 OFF
11	180	8	P11180	MCW	%TO	C96010- 13	W	0869	M %TO D79 W	WR SSW COMMENT
11	190	8		MCW	%TO	C90110	W	0877	M %TO L40 W	SPACE
11	200	4		B	P10040			0885	B 724	BR LOOP
12	000			* MAIN PROG LCA TEST						
12	010	8	P12010	LCA	%TO	C93010- 31	W	0889	L %TO Q36 W	WR LINES 1 & 2
12	020	5		B	P12040		F	0897	B 907 F	SSW # F TEST
12	030	5		B	E50410		%	0902	B -22 %	BR ON ERROR
12	040	8	P12040	B	P12010	C99998- 4	5	0907	B 889 F52 5	SW # 5 TEST
12	050	8		LCA	%TO	C90110	W	0915	L %TO L40 W	SPACE
12	110	8	P12110	LCA	%TO	C93110- 31	W	0923	L %TO R97 W	WRITE LINE 3
12	120	5		B	P12140		F	0931	B 941 F	SSW # F TEST
12	130	5		B	E50510		%	0936	B -48 %	BR ON ERROR
12	140	8	P12140	B	P12110	C99998- 3	6	0941	B 923 F53 6	SW # 6 TEST
12	150	8		LCA	%TO	C90110	W	0949	L %TO L40 W	SPACE
13	010	8	P13010	LCA	%TO	C93150- 31	W	0957	L %TO S78 W	WRITE LINE 4
13	020	5		B	P13040		F	0965	B 975 F	SSW # F TEST
13	030	5		B	E50610		%	0970	B -74 %	BR ON ERROR
13	040	8	P13040	B	P13010	C99998- 2	7	0975	B 957 F54 7	SW # 7 TEST
13	050	8		LCA	%TO	C90110	W	0983	L %TO L40 W	SPACE
13	110	8	P13110	LCA	%TO	C93180- 31	W	0991	L %TO A59 W	WRITE LINE 5
13	120	5		B	P13140		F	0999	B 409 F	SSW # F TEST
13	130	5		B	E50710		%	1004	B J00 %	BR ON ERROR
13	140	8	P13140	B	P13110	C99998- 1	8	1009	B 991 F55 8	SW # 8 TEST
13	150	8		LCA	%TO	C90110	W	1017	L %TO L40 W	SPACE
13	155	8		LCA	%TO	C90110	W	1025	L %TO L40 W	SPACE
13	160	5		B	P13162		C	1033	B 442 C	BR LOOP SSW # C
13	161	4		B	P13170			1038	B 462	BR SSW # C OFF
13	162	8	P13162	MCW	%TO	C96030- 13	W	1042	M %TO D96 W	WR SSW COMMENT
13	163	8		MCW	%TO	C90110	W	1050	M %TO L40 W	SPACE
13	164	4		B	P12010			1058	B 889	BR LOOP
13	170	5	P13170	B	P13172		G	1062	B 471 G	SSW # G TEST
13	171	4		B	P14010			1067	B 491	BR SSW # G OFF
13	172	8	P13172	MCW	%TO	C96070- 23	W	1071	M %TO E24 W	WR SSW COMMENT

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PG LIN  CT  LABEL   OP    A OPERAND        B OPERAND          D     LOC   INSTRUCTION COMMENTS   C8001
13 173   8          MCW   %TO              C90110             W     1079  M %TO L40 W  SPACE
13 174   4          B     P14370                                   1087  B S59        BR BYPASS
14 000                  * MAIN PROG READ MCW & LCA
14 010   7  P14010  LCA   I83200           I83040- 31               1091  L L39 K58    SET IN GMWM
14 020   7          LCA   I83200           C93040- 31               1098  L L39 R16    SET IN GMWM
14 030   5  P14030  B     P14080                             Q     1105  B /23 Q      BR INQ/REQ
14 040   8          MCW   %TO              C92070- 31         W     1110  M %TO N35 W  WRITE Q INST
14 050   1          H                                              1118  .            HALT FOR KEYS
14 060   4          B     P14030                                   1119  B /05        BR TO TRY AGAIN
14 080   8  P14080  MCW   %TO              C90110             W     1123  M %TO L40 W  SPACE
14 090   8  P14080  MCW   %TO              C92150- 31         W     1131  M %TO D74 W  WR INFO DATA
14 095   8          MCW   %TO              C90110             W     1139  M %TO L40 W  SPACE
14 100   8          MCW   %TO              C90110             W     1147  M %TO L40 W  SPACE
14 110   8  P14110  MCW   %TO              I40010- 31         R     1155  M %TO X56 R  RD MCW LINE 1.
14 115   5          B     P14030                             .     1163  B /05 .      BR INQUIRY IND.
14 120   5          B     P14230                             F     1168  B /78 F      SSW # F TEST
14 130   5          B     E50810                             %     1173  B J26 %      BR ON ERROR
14 230   5  P14230  B     P14280                             Q     1178  B S04 Q      BR INQ/REQ
14 235   8          MCW   %TO              C90110             W     1183  M %TO L40 W  SPACE
14 240   8          MCW   %TO              C92070- 31         W     1191  M %TO N35 W  WRITE Q INST
14 250   1          H                                              1199  .            HALT FOR KEYS
14 260   4          B     P14230                                   1200  B /78        BR TO TRY AGAIN
14 280   8  P14280  MCW   %TO              C90110             W     1204  M %TO L40 W  SPACE
14 290   8  P14280  MCW   %TO              C92350- 31         W     1212  M %TO P55 W  WR INFO DATA
14 295   8          MCW   %TO              C90110             W     1220  M %TO L40 W  SPACE
14 300   8          MCW   %TO              C90110             W     1228  M %TO L40 W  SPACE
14 310   8  P14310  LCA   %TO              I45010- 31         R     1236  L %TO Y37 R  RD LCA LINE 1.
14 315   5          B     P14230                             .     1244  B /78 .      BR INQUIRY IND.
14 320   5          B     P14370                             F     1249  B S59 F      SSW # F TEST
14 330   5          B     E50910                             %     1254  B J52 %      BR ON ERROR
14 370   8  P14370  B     P16060           C99998            9     1259  B T77 F56 9  SW # 9 COMP NOT
15 000                  * READ COMPARE ROUTINE
15 010   7  P15010  C     I83030           I40030                   1267  C K57 Y35    COMP WR TO RD
15 020   5          B     P15034                             /     1274  B S83 /      BR NOT EQ
15 030   4          B     P16010                                   1279  B T23        BR BY WR COMP
15 034   8  P15034  MCW   %TO              C90110             W     1283  M %TO L40 W  SPACE
15 035   8          MCW   %TO              C98010- 15         W     1291  M %TO F29 W  WR ERROR INFO
15 040   8  P15040  MCW   %TO              I83010- 31         W     1299  M %TO J78 W  WR WR REC
15 050   8          MCW   %TO              I40010- 31         W     1307  M %TO X56 W  WR RD REC
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2100463
EC 405070

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PG LIN  CT  LABEL   OP   A OPERAND        B OPERAND          D     LOC  INSTRUCTION COMMENTS   C8001
16 060   8          MCW  %TO              C90110             W    1315  N %TO L40 W  SPACE
16 010   7  P16010  C    C93030           I45030                  1323  C R15 Z16    COMP WR TO RD
16 011   1          C                                             1330  C            CHAIN COMPARE
16 012   1          C                                             1331  C            CHAIN COMPARE
16 013   1          C                                             1332  C            CHAIN COMPARE
16 014   1          C                                             1333  C            CHAIN COMPARE
16 015   1          C                                             1334  C            CHAIN COMPARE
16 016   1          C                                             1335  C            CHAIN COMPARE
16 030   5          B    P16037                          /       1336  B T45 /      BR NOT EQ
16 035   4          B    P16060                                  1341  B T77        BR BY WR COMP
16 037   8  P16037  MCW  %TO              C90110             W    1345  M %TO L40 W  SPACE
16 038   8          MCW  %TO              C98010- 15         W    1353  M %TO F29 W  WR ERROR INFO
16 040   8  P16040  LCA  %TO              C93010- 31         W    1361  L %TO Q36 W  WR WR REC
16 050   8          LCA  %TO              I45010- 31         W    1369  L %TO Y37 W  WR RD REC
16 060   7  P16060  MCW  T83010- 20       T83040- 31              1377  M J89 K58    SET IN AN A
16 070   4          CW   T83040- 31                               1384  ¤ K58        CLEAR WORD MARK
16 080   7          MCW  C93010- 20       C93040- 31              1388  M Q47 R16    SET IN AN A
16 090   8          MCW  %TO              C90110             W    1395  M %TO L40 W  SPACE
16 100                  * CARRIAGE RETURN TEST
16 110   4  P16110  SW   C97080                                   1403  , F28        SET WORD MARK
16 120   8          MCW  %TO              C97010-  9         W    1407  M %TO E49 W  WR RETURN LINE
16 130   4          SW   C97070                                   1415  , F18        SET WORD MARK
16 140   8          MCW  %TO              C97010-  9         W    1419  M %TO E49 W  WR RETURN LINE
16 150   4          SW   C97060                                   1427  , F08        SET WORD MARK
16 160   8          MCW  %TO              C97010-  9         W    1431  M %TO E49 W  WR RETURN LINE
16 170   4          SW   C97050                                   1439  , E98        SET WORD MARK
16 180   8          MCW  %TO              C97010-  9         W    1443  M %TO E49 W  WR RETURN LINE
16 190   4          SW   C97040                                   1451  , E88        SET WORD MARK
16 200   8          MCW  %TO              C97010-  9         W    1455  M %TO E49 W  WR RETURN LINE
16 210   4          SW   C97030                                   1463  , E78        SET WORD MARK
16 220   8          MCW  %TO              C97010-  9         W    1467  M %TO E49 W  WR RETURN LINE
16 230   4          SW   C97020                                   1475  , E68        SET WORD MARK
16 240   8          MCW  %TO              C97010-  9         W    1479  M %TO E49 W  WR RETURN LINE
16 250   4          SW   C97010                                   1487  , E58        SET WORD MARK
16 260   8          MCW  %TO              C97010-  9         W    1491  M %TO E49 W  WR RETURN LINE
16 270   4          SW   C97010-  6                               1499  , E52        SET WORD MARK
16 280   8          MCW  %TO              C97010-  9         W    1503  M %TO E49 W  WR RETURN LINE
16 290   4          SW   C97010-  7                               1511  , E51        SET WORD MARK
16 300   8          MCW  %TO              C97010-  9         W    1515  M %TO E49 W  WR RETURN LINE
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PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION			COMMENTS C8001
16	310	4		SW	C97010- 8			1523	, E50			SET WORD MARK
16	320	8		MCW	%TO	C97010- 9	W	1527	M %TO E49		W	WR RETURN LINE
16	330	4		SW	C97010- 9			1535	, E49			SET WORD MARK
16	340	8		MCW	%TO	C97010- 9	W	1539	M %TO E49		W	WR RETURN LINE
16	410	4		CW	C97010- 9			1547	¤ E49			CLEAR WORD MARK
16	420	8		MCW	%TO	C97010- 9	W	1551	M %TO E49		W	WR RETURN LINE
16	430	4		CW	C97010- 8			1559	¤ E50			CLEAR WORD MARK
16	440	8		MCW	%TO	C97010- 9	W	1563	M %TO E49		W	WR RETURN LINE
16	450	4		CW	C97010- 7			1571	¤ E51			CLEAR WORD MARK
16	460	8		MCW	%TO	C97010- 9	W	1575	M %TO E49		W	WR RETURN LINE
16	470	4		CW	C97010- 6			1583	¤ E52			CLEAR WORD MARK
16	480	8		MCW	%TO	C97010- 9	W	1587	M %TO E49		W	WR RETURN LINE
16	490	4		CW	C97010			1595	¤ E58			CLEAR WORD MARK
16	500	8		MCW	%TO	C97010- 9	W	1599	M %TO E49		W	WR RETURN LINE
16	510	4		CW	C97020			1607	¤ E68			CLEAR WORD MARK
16	520	8		MCW	%TO	C97010- 9	W	1611	M %TO E49		W	WR RETURN LINE
16	530	4		CW	C97030			1619	¤ E78			CLEAR WORD MARK
16	540	8		MCW	%TO	C97010- 9	W	1623	M %TO E49		W	WR RETURN LINE
16	550	4		CW	C97040			1631	¤ E88			CLEAR WORD MARK
16	560	8		MCW	%TO	C97010- 9	W	1635	M %TO E49		W	WR RETURN LINE
16	570	4		CW	C97050			1643	¤ E98			CLEAR WORD MARK
16	580	8		MCW	%TO	C97010- 9	W	1647	M %TO E49		W	WR RETURN LINE
16	590	4		CW	C97060			1655	¤ F08			CLEAR WORD MARK
16	600	8		MCW	%TO	C97010- 9	W	1659	M %TO E49		W	WR RETURN LINE
16	610	4		CW	C97070			1667	¤ F18			CLEAR WORD MARK
16	620	8		MCW	%TO	C97010- 9	W	1671	M %TO E49		W	WR RETURN LINE
16	630	4		CW	C97080			1679	¤ F28			CLEAR WORD MARK
16	640	8		B	P16110	C999986 1	≠	1683	B U03 F57		≠	SW # ≠ TEST
17	010	5	P17010	B	P17012		D	1691	B X00 D			SSW # D CONT LP
17	011	4		B	P17015			1696	B X20			BR SSW # D OFF
17	012	8	P17012	MCW	%TO	C96050- 13	W	1700	M %TO E09		W	WR SSW COMMENT
17	013	8		MCW	%TO	C90110	W	1708	M %TO L40		W	SPACE
17	014	4		B	P10040			1716	B 724			BR LOOP
17	015	8	P17015	MCW	%TO	C90110	W	1720	M %TO L40		W	SPACE
17	020	8		MCW	%TO	C95050- 29	W	1728	M %TO D48		W	WR ALTER INST
17	040	8		MCW	%TO	C95010- 24	W	1736	M %TO C92		W	WR CHAIN INST
17	050	8		MCW	%TO	C90110- 1	W	1744	M %TO L39		W	SPACE
17	060	4		H	0348			1752	. 348			CHAIN BR HALT
40	000				* INPUT AREA							

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION COMMENTS C8001
40	010	32	I40010	DCW	*			1787	*
40	020	32		DC	*			1819	
40	030	16	I40030	DC	*			1835	
40	070	1		DCW	*			1836	
45	010	32	I45010	DCW	*			1868	
45	020	32		DC	*			1900	
45	030	16	I45030	DC	*			1916	
45	200	1	I45200	DCW	*			1917	
50	000				* ERROR ROUTINES				
50	010	8	E50010	MCW	%TO	C94010- 31	W	1918	M %TO B50 W WRITE ERR INSR
50	020	8		MCW	%TO	C90110	W	1926	M %TO L40 W SPACE
50	021	1		H				1934	. ERROR HALT
50	030	5		B	P10040		E	1935	B 724 E BR SSW # E ON
50	040	4		B	P10070			1940	B 742 BR BACK
50	110	8	E50110	MCW	%TO	C94010- 31	W	1944	M %TO B50 W WRITE ERR INSR
50	120	8		MCW	%TO	C90110	W	1952	M %TO L40 W SPACE
50	121	1		H				1960	. ERROR HALT
50	130	5		B	P10110		E	1961	B 758 E BR SSW # E ON
50	140	4		B	P10140			1966	B 776 BR BACK
50	210	8	E50210	MCW	%TO	C94010- 31	W	1970	M %TO B50 W WRITE ERR INSR
50	220	8		MCW	%TO	C90110	W	1978	M %TO L40 W SPACE
50	221	1		H				1986	. ERROR HALT
50	230	5		B	P11010		E	1987	B 792 E BR SSW # E ON
50	240	4		B	P11040			1992	B 810 BR BACK
50	310	8	E50310	MCW	%TO	C94010- 31	W	1996	M %TO B50 W WRITE ERR INSR
50	320	8		MCW	%TO	C90110	W	2004	M %TO L40 W SPACE
50	321	1		H				2012	. ERROR HALT
50	330	5		B	P11110		E	2013	B 826 E BR SSW # E ON
50	340	4		B	P11140			2018	B 844 BR BACK
50	410	8	E50410	MCW	%TO	C94010- 31	W	2022	M %TO B50 W WRITE ERR INSR
50	420	8		MCW	%TO	C90110	W	2030	M %TO L40 W SPACE
50	421	1		H				2038	. ERROR HALT
50	430	5		B	P12010		E	2039	B 889 E BR SSW # E ON
50	440	4		B	P12040			2044	B 907 BR BACK
50	510	8	E50510	MCW	%TO	C94010- 31	W	2048	M %TO B50 W WRITE ERR INSR
50	520	8		MCW	%TO	C90110	W	2056	M %TO L40 W SPACE
50	521	1		H				2064	. ERROR HALT
50	530	5		B	P12110		E	2065	B 923 E BR SSW # E ON
50	540	4		B	P12140			2070	B 941 BR BACK

PG	LIN	CT	LABEL	OP	A OPERAND	B OPERAND	D	LOC	INSTRUCTION	COMMENTS C8001
50	610	8	E50610	MCW	%TO	C94010- 31	W	2074	M %TO B50 W	WRITE ERR INSR
50	620	8		MCW	%TO	C90110	W	2082	M %TO L40 W	SPACE
50	621	1		H				2090	.	ERROR HALT
50	630	5		B	P13010		E	2091	B 957 E	BR SSW # E ON
50	640	4		B	P13040			2096	B 975	BR BACK
50	710	8	E50710	MCW	%TO	C94010- 31	W	2100	M %TO B50 W	WRITE ERR INSR
50	720	8		MCW	%TO	C90110	W	2108	M %TO L40 W	SPACE
50	721	1		H				2116	.	ERROR HALT
50	730	5		B	P13110		E	2117	B 991 E	BR SSW # E ON
50	740	4		B	P13140			2122	B 109	BR BACK
50	810	8	E50810	MCW	%TO	C94010- 31	W	2126	M %TO B50 W	WRITE ERR INSR
50	820	8		MCW	%TO	C90110	W	2134	M %TO L40 W	SPACE
50	821	1		H				2142	.	ERROR HALT
50	830	5		B	P14110		E	2143	B /55 E	BR SSW # E ON
50	840	4		B	P14230			2148	B /78	BR BACK
50	910	8	E50910	MCW	%TO	C94010- 31	W	2152	M %TO B50 W	WRITE ERR INSR
50	920	8		MCW	%TO	C90110	W	2160	M %TO L40 W	SPACE
50	921	1		H				2168	.	ERROR HALT
50	930	5		B	P14230		E	2169	B /78 E	BR SSW # E ON
50	940	4		B	P14370			2174	B S59	BR BACK
80	000				* DATA TABLE AND COMPARE AREAS					
83	010	32	T83010	DCW	* 0123456789 ABCDEFGH1JKLMNOPQR/ST			2209		
83	020	32		DC	* UVWXYZ :@/> ¢"¤=Δ;-(#<&' %*) 0##!?			2241		
83	030	16	T83030	DC	* $,./ LINE 1.			2257		
83	040	32	T83040	DC	* AJ/1 BKS2 CLT3 DMU4 ENV5 FOW6 GP			2289		
83	050	32		DC	* X7 HQY8 IRZ9 LETTER & NUMBER IN			2321		
83	060	16	T83060	DC	* SEQ. LINE 2.			2337		
83	070	1		DCW	*		*	2338		
83	200	1	T83200	DCW	*		*	2339		
90	000				* CONSTANTS					
90	110	1	C90110	DCW	*			2340		
90	111	1	C90111	DCW	*		*	2341		
91	010	32	C91010	DCW	* THIS IS C8001. IT TESTS THE 1407			2373		
91	020	32		DCW	* . A 4K OR MORE 1401 IS REQUIRED.			2405		
91	060	32		DCW	* TURN PROCESS CK SWITCH OFF. BEF			2437		
91	070	32		DCW	* ORE EACH TEST AN INSTRUCTIVE TYP			2469		
91	080	32		DCW	* EOUT WILL OCCUR. FOR FURTHER			2501		
91	090	32	C91090	DCW	* INFORMATION SEE THE CE WRITEUP.			2533		
91	100	1		DCW	*		*	2534		

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PG LIN  CT  LABEL   OP   A OPERAND      B OPERAND       D       LOC   INSTRUCTION COMMENTS   C8001
 92 070 32 C92070  DCW   *      PRESS THE REQUEST/ENTER KEY.....   2566
 92 075 25         DC    *          NOW PRESS THE START KEY!!    2591
 92 080  1         DCW   *                                   *   2592
 92 110 32 C92110  DCW   *      THE FOLLOWING LINES OF DATA ARE    2624
 92 120 32         DC    *      SENT FROM THE 1401 TO THE 1407.    2656
 92 130 16 C92130  DC    *                    PRINTS ALL CHAR.   2672
 92 140  1         DCW   *                                   *   2673
 92 150 32 C92150  DCW   *      RD LINE 1 MOVE.   PRESS RESPOND    2705
 92 160 32         DC    *      KEY AFTER LINE 1 TO PUT GMWM AT    2737
 92 190 16         DC    *                     THE END OF REC.   2753
 92 200  1         DCW   *                                   *   2754
 92 350 32 C92350  DCW   *      RD LINE 1 LOAD.   PRESS RESPOND    2786
 92 360 32         DC    *      KEY AFTER LINE 1 TO PUT GMWM AT    2818
 92 390 16         DC    *                     THE END OF REC.   2834
 92 400  1         DCW   *                                   *   2835
 93 010 32 C93010  DCW   *      0123456789 ABCDEFGHIJKLMNOPQR/ST   2867
 93 020 32         DC    *      UVWXYZ :@√>¢"¤=Δ;-(#<&'%*) 0##!?   2899
 93 030 16 C93030  DC    *                   $,./   LINE 1.   2915
 93 040 32 C93040  DCW   *      AJ/1 BKS2 CLT3 DMU4 ENV5 FOW6 GP   2947
 93 050 32         DCW   *      X7 HQY8 IRZ9 LETTER & NUMBER IN    2979
 93 060 16 C93060  DC    *                   SEQ.   LINE 2.   2995
 93 070  1         DCW   *                                   *   2996
 93 110 32 C93110  DCW   *      :@0√>+ ¢#"¤‡=Δ?;-$(#,<&.'%/*)      3028
 93 120 32         DCW   *      2-1 UP-DN CARR. RIB SHIFT IN LCA   3060
 93 130 16 C93130  DCW   *                     MODE.  LINE 3.   3076
 93 140  1         DCW   *                                   *   3077
 93 150 32 C93150  DCW   *      :@√> ¢"¤=Δ;-(#<&'%*     ----- ALL   3109
 93 160 32         DC    *       UPPER-CASE SPECIAL CHARACTERS ‡   3141
 93 170 16 C93170  DC    *                           LINE 4.   3157
 93 175  1         DCW   *                                   *   3158
 93 180 32 C93180  DCW   *      0##!?$,./   ----- ALL LOWER-CASE   3190
 93 190 32         DC    *       SPECIAL CHARACTERS ‡              3222
 93 200 16 C93200  DC    *                           LINE 5.   3238
 93 205  1         DCW   *                                   *   3239
 93 210  8 C93210  DCW   *                              END.   3247
 93 215  1         DCW   *                                   *   3248
 93 220  1 C93220  DCW   *                                   *   3249
 94 010 32 C94010  DCW   *      ERROR--TURN CHECK STOP SW ON AND   3281
 94 020 32         DC    *       SSW # E ON AND TRY AGAIN.  MACH   3313
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C8001
PAGE 14

PROGRAM

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PG LIN  CT  LABEL   OP    A OPERAND      B OPERAND      D                 LOC   INSTRUCTION COMMENTS   C8001
94 030  32          DC    *       WILL HANG UP AT THE ERROR CHAR.        3345
94 040  32          DC    *       PRESS START. SSW # E OFF TO TRY        3377
94 050  13  C94050  DCW   *                          NEXT RECORD.        3390
94 060   1          DCW   *                                   $          3391
95 010  25  C95010  DCW   *            IF NO DTAIL, END OF TEST.        3416
95 020  30          DC    *         PRESS START TO BR TO CHAIN.          3446
95 030   1          DCW   *                                   $          3447
95 050  30  C95050  DCW   *       TEST ALTER AT ANY STD. LOC.            3477
95 060   1          DCW   *                                   $          3478
96 010  14  C96010  DCW   *                     SSW # B LOOP.           3492
96 020   1          DCW   *                                   $          3493
96 030  14  C96030  DCW   *                     SSW # C LOOP.           3507
96 040   1          DCW   *                                   $          3508
96 050  14  C96050  DCW   *                     SSW # D LOOP.           3522
96 060   1          DCW   *                                   $          3523
96 070  24  C96070  DCW   *           SSW # G BYPASS RD INST.           3547
96 080   1          DCW   *                                   $          3548
97 010  10  C97010  DC    *                          $$$$TEST $          3558
97 020  10  C97020  DC    *                           RTRN @20$          3568
97 030  10  C97030  DC    *                           RTRN @30$          3578
97 040  10  C97040  DC    *                           RTRN @40$          3588
97 050  10  C97050  DC    *                           RTRN @50$          3598
97 060  10  C97060  DC    *                           RTRN @60$          3608
97 070  10  C97070  DC    *                           RTRN @70$          3618
97 080  10  C97080  DC    *                           RTRN @80$          3628
98 010  16  C98010  DC    *                  COMPARE ERROR #             3644
98 020   1          DCW   *                                   $          3645
99 998  32  C99998  DC    *                                              3657
99 999              END   0400                                                  / 400 080
```

MASTER 1407 TYPEOUT

THIS IS C8001. IT TESTS THE 1407. A 4K OR MORE 1401 IS REQUIRED. TURN PROCESS CK SWITCH OFF. BEFORE EACH TEST AN INSTRUCTIVE TYPEOUT WILL OCCUR. FOR FURTHER INFORMATION SEE THE CE WRITEUP.

THE FOLLOWING LINES OF DATA ARE SENT FROM THE 1401 TO THE 1407. PRINTS ALL CHAR.

```
0123456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ¢"□=Δ;-(≠<&'%*)0≠#!?$,./    LINE 1.
AJ/1 BKS2 CLT3 DMU4 ENV5 FOW6 GPX7 HQY8 IRZ9 LETTER & NUMBER IN SEQ.    LINE 2.

:@0√>≠ ¢#"□!=Δ?;-$(≠,<&.'%/*)   2-1 UP-DN CARR. RIB SHIFT IN LCA MODE.  LINE 3.

;@√> ¢"□=Δ;-(≠<&'%*)   ----- ALL UPPER-CASE SPECIAL CHARACTERS !        LINE 4.

0≠#!?$,./   ----- ALL LOWER-CASE SPECIAL CHARACTERS !                    LINE 5.

0123456789bABCDEFGHIJKLMNOPQR/STUVWXYZb;@√>b¢"□=Δ;-(≠<&'%*)0≠#!?$,./bbbbLINEb1.b
AJ/1bBKS2bCLT3bDMU4bENV5bFOW6bGPX7bHQY8bIRZ9bLETTERbcbNUMBERbINbSEQ.bbbbLINEb2.b
b
:@0√>≠b¢Δ"□!=Δ?;-$(≠,<&.'%/*)bbb2-1bUP-DNbCARR.bRIBbSHIFTbINbLCAbMODE.bbLINEb3.b
:@√>b¢"□=Δ;-(≠<&'%*)bbb-----bALLbUPPER-CASEbSPECIALbCHARACTERSb1bbbbbbbbbLINEb4.b
0≠#!?$,./bbb-----bALLbLOWER-CASEbSPECIALbCHARACTERSb1bbbbbbbbbbbbbbbbbbLINEb5.b
b
```

PRESS THE REQUEST/ENTER KEY.....NOW PRESS THE START KEY!!

RD LINE 1 MOVE. PRESS RESPOND KEY AFTER LINE 1 TO PUT GMWM AT THE END OF REC.

0123456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√>b¢"□=Δ;-(≠<&'%*)0≠#!?$,./ LINE 1.

PRESS THE REQUEST/ENTER KEY.....NOW PRESS THE START KEY!!

RD LINE 1 LOAD. PRESS RESPOND KEY AFTER LINE 1 TO PUT GMWM AT THE END OF REC.

0123456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√>b¢"□=Δ;-(≠<&'%*)0≠#!?$,./ LINE 1.

```
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60≠ RTRN @70≠ RTRN @80
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60≠ RTRN @70
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30
≠≠≠≠TEST ≠ RTRN @20
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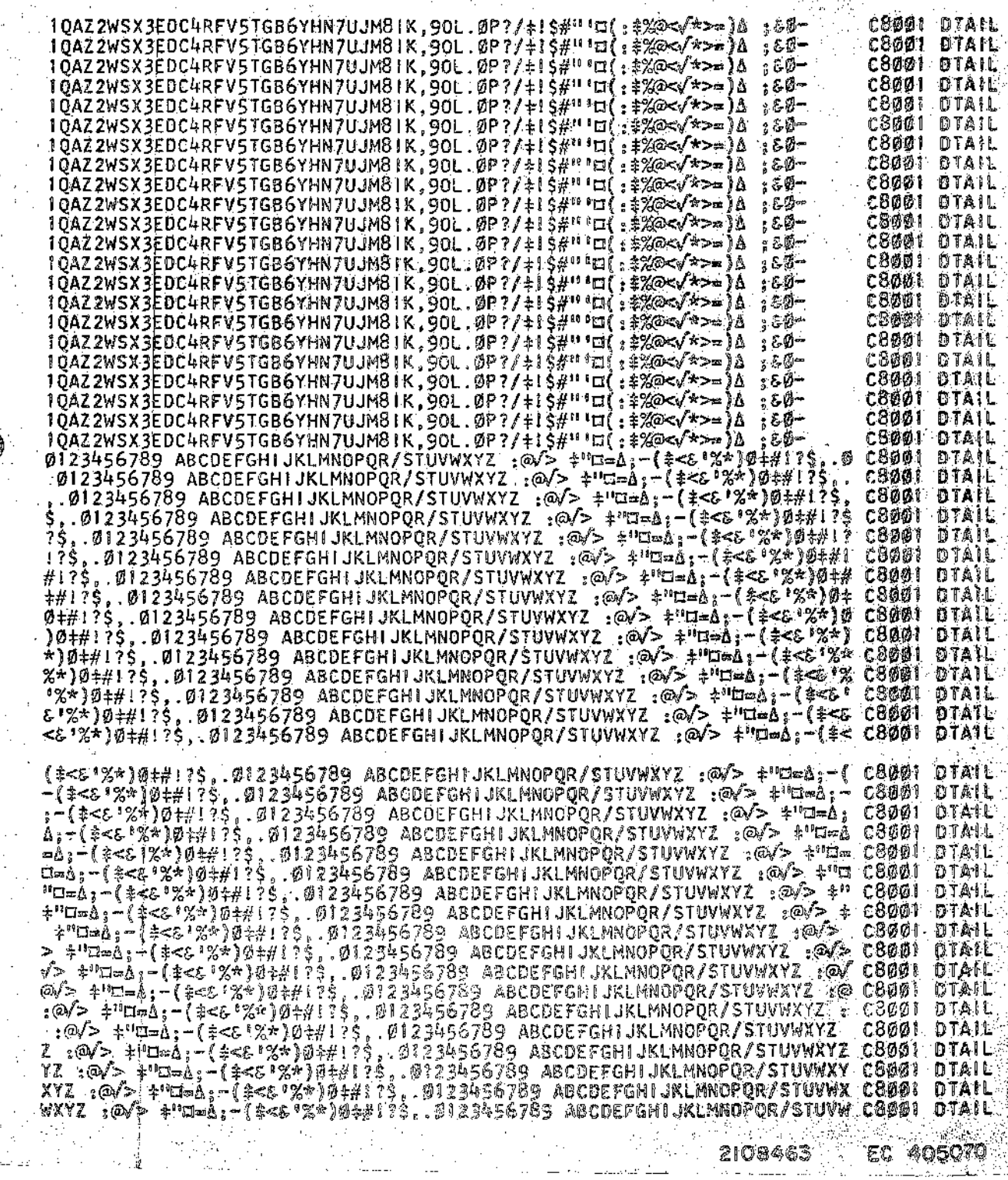
≠≠≠≠TEST
≠≠≠≠TEST ≠ RTRN @20
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60≠ RTRN @70
≠≠≠≠TEST ≠ RTRN @20≠ RTRN @30≠ RTRN @40≠ RTRN @50≠ RTRN @60≠ RTRN @70≠ RTRN @80
```

TEST ALTER AT ANY STD. LOC.
IF NO DTAIL, END OF TEST. PRESS START TO BR TO CHAIN.

NOTES:
1. SPACE MUST BE READ IN AFTER "...LINE 1". FOR PROPER COMPARE.
2. __ UNDER CHARACTER EQUALS A WORD MARK. CHARACTER PRINTS IN RED.

DETAIL CARD TYPEOUT



DETAIL CARD TYPEOUT

```
VWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR/STUV C8ØØ1 DTAIL
UVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR/STU C8ØØ1 DTAIL
TUVWXYZ ;@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR/ST C8ØØ1 DTAIL
STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR/S C8ØØ1 DTAIL
/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR/ C8ØØ1 DTAIL
R/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQR C8ØØ1 DTAIL
QR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOPQ C8ØØ1 DTAIL
PQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNOP C8ØØ1 DTAIL
OPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMNO C8ØØ1 DTAIL
NOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLMN C8ØØ1 DTAIL
MNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKLM C8ØØ1 DTAIL
LMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJKL C8ØØ1 DTAIL
KLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJK C8ØØ1 DTAIL
JKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHIJ C8ØØ1 DTAIL
IJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGHI C8ØØ1 DTAIL
HIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFGH C8ØØ1 DTAIL
GHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEFG C8ØØ1 DTAIL
FGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDEF C8ØØ1 DTAIL
EFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCDE C8ØØ1 DTAIL
DEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABCD C8ØØ1 DTAIL
CDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 ABC C8ØØ1 DTAIL
BCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 AB C8ØØ1 DTAIL
ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 A C8ØØ1 DTAIL
 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789  C8ØØ1 DTAIL
9 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456789 C8ØØ1 DTAIL
89 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø12345678 C8ØØ1 DTAIL
789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø1234567 C8ØØ1 DTAIL
6789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123456 C8ØØ1 DTAIL
56789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø12345 C8ØØ1 DTAIL
456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø1234 C8ØØ1 DTAIL
3456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø123 C8ØØ1 DTAIL
23456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø12 C8ØØ1 DTAIL
123456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø1 C8ØØ1 DTAIL
0123456789 ABCDEFGHIJKLMNOPQR/STUVWXYZ :@√> ǂ"□=Δ;-(ǂ<&'%*)Øǂ#!?$,.Ø C8ØØ1 DTAIL
```

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451447
SHEET 1 OF
BLOCK NO. 9000C

SELECT STACKER

A. PURPOSE OF TEST

TO TEST THE SELECT STACKER CIRCUITRY FOR BOTH THE CARD PUNCH AND THE CARD READER.

B. LOADING PROCEDURE

1. PLACE TEST IN 1402 HOPPER AND DEPRESS LOAD. AFTER A PROGRAM HALT IN 450 REMOVE CARDS FROM PUNCH STACKER AND PLACE IN READ HOPPER. DEPRESS START.

2. WHEN TEST IS RUN FROM TAPE, ENTER A 1 IN 1278.

C. PROGRAM CONTROL

1. SENSE SWITCHES

A ON TO FEED LAST CARD IN READER
OFF TO HALT ON EMPTY HOPPER

B ON FOR SCOPING TO REPEAT SELECT STACKER OPERATION WITHOUT CARDS FEEDING
OFF TO CONTINUE

D ON TO REPEAT ENTIRE TEST
OFF TO CONTINUE

G ON FOR SCOPING TO REPEAT CARD FEED AND STACKER OPERATION
OFF TO CONTINUE

D. TEST PROCEDURE

THE PROGRAM FEEDS 20 CARDS BLANK THROUGH THE PUNCH FEED. CARDS ARE PUNCHED 0,4 OR 8 IN COLUMN 1 AND ARE STACKED IN THE NORMAL PUNCH STACKER, STACKER 4 OR STACKER 8 RESPECTIVELY. IN ADDITION THE CARDS ARE PUNCHED 0,1 OR 2 IN COLUMN 40.

CARDS THAT WERE PUNCHED 0,1 OR 2 IN COLUMN 40 IN THE FIRST PORTION OF THE TEST ARE RUN THROUGH THE READ FEED AND SELECTED INTO THE NORMAL READ STACKER, STACKER 1 AND STACKER 2.

E. STOPS

STORAGE ADDRESS REGISTER

450 HALT-REMOVE CARDS FROM PUNCH FEED AND PLACE IN READ FEED

DATE	2-2-61	5-15-62	6-29-63	17.10.63				
ENG. CHG. NO.	110378	115283	117628	TA 1976				

E. (CONTINUED)

STORAGE ADDRESS REGISTER

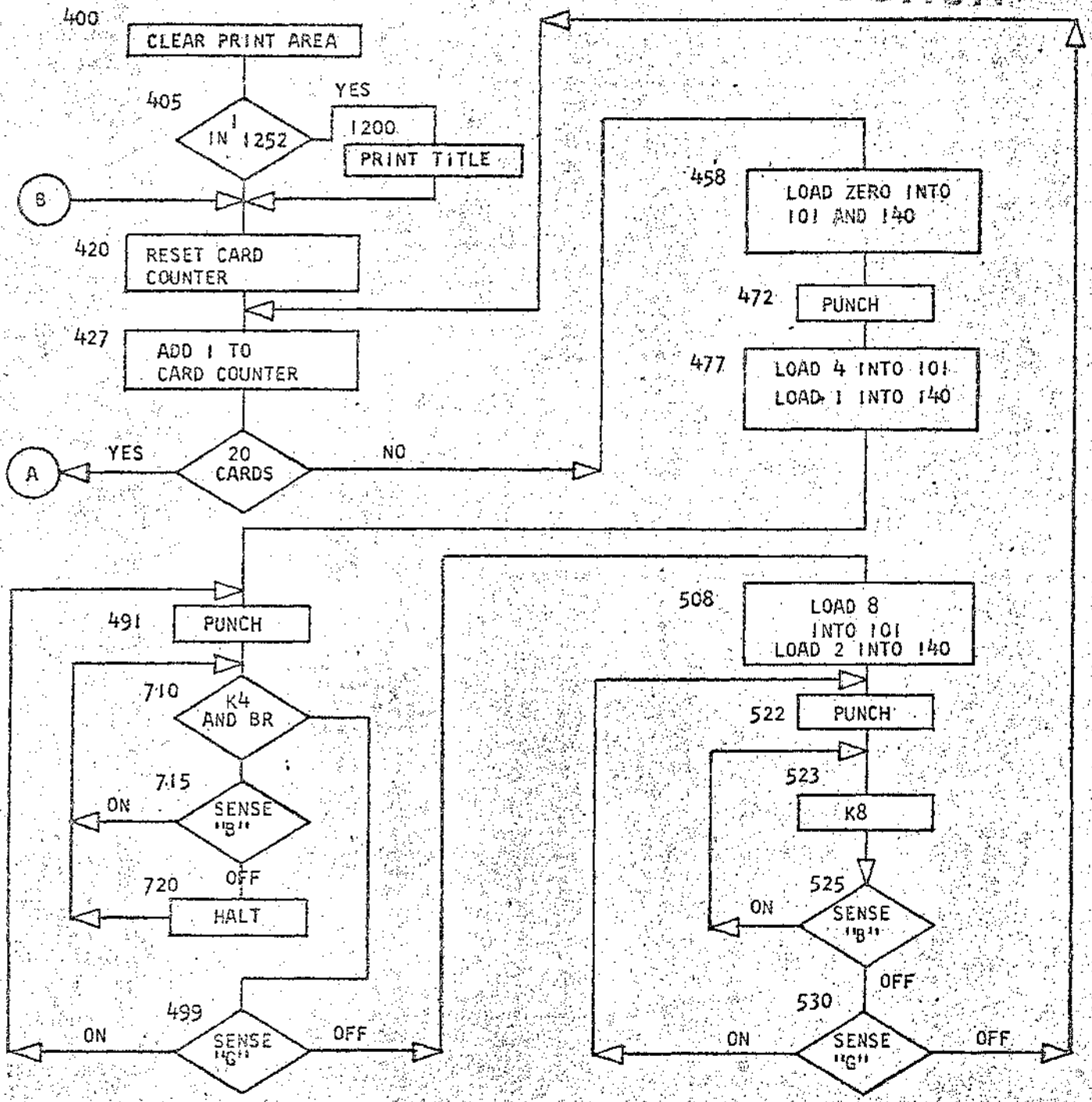
724	ERROR-NO BRANCH
738	ERROR-NO BRANCH
795,804	HALT-END OF TEST

F. PRINTOUTS

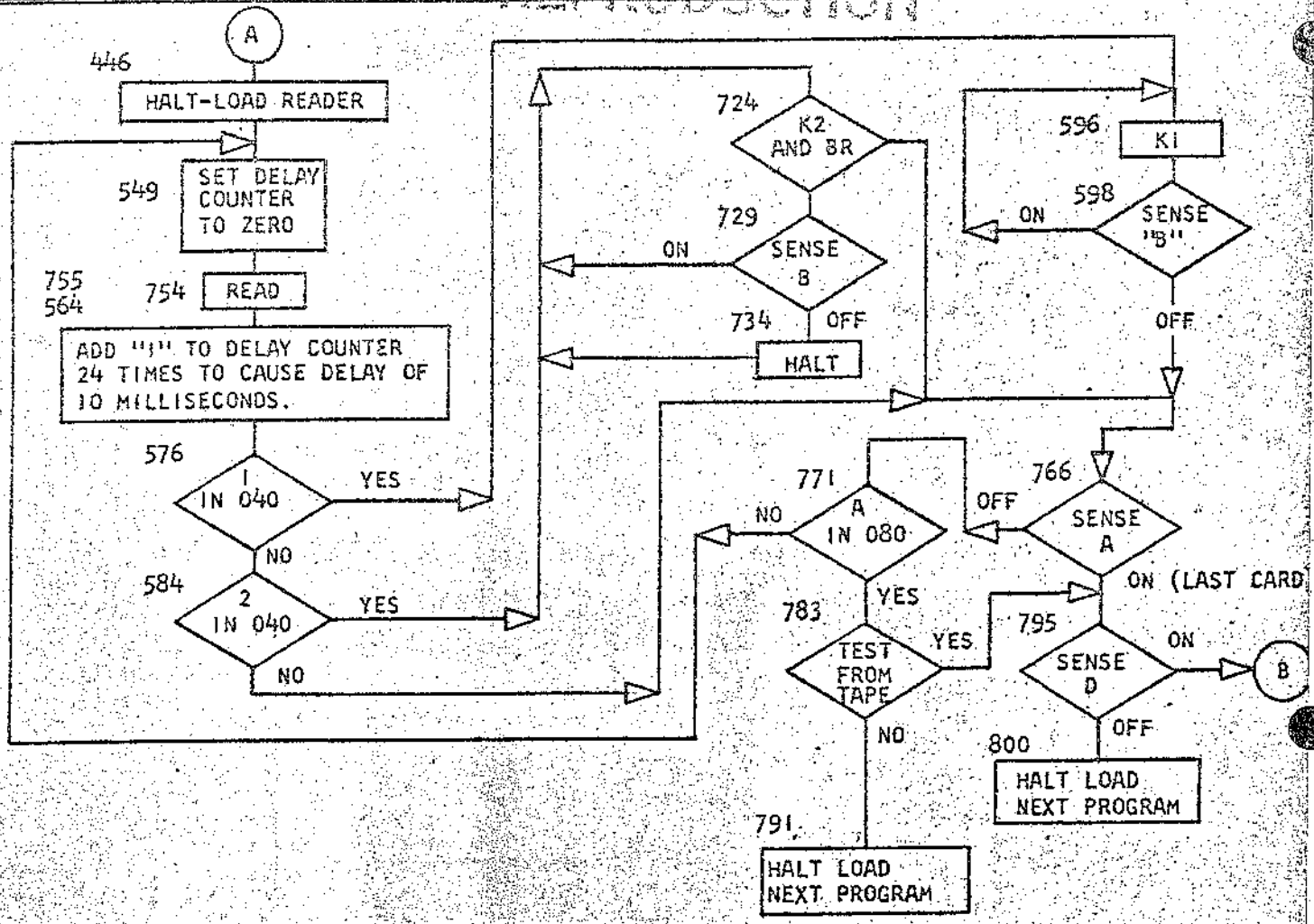
TITLE PRINT ONLY.

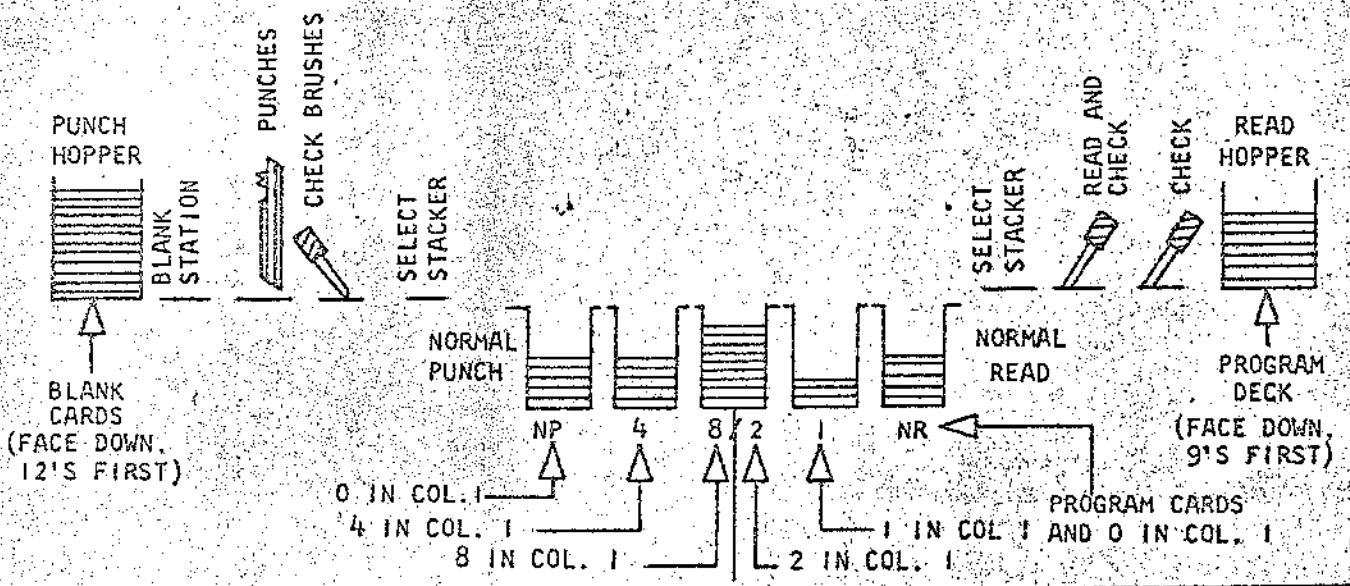
DATE	2-2-61	5-15-62	6-29-63	11.10.63				
NO. CHG. NO.	110378	115283	117628	TA 1976				

SELECT STACKER



DATE	2-2-61	5-15-62	6-29-63	17.10.63				
ENG. CHG. NO.	110378	115283	117628	TA 1976				





DATE	2-2-61	5-15-62	6-29-63	17.10.63				
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PROGRAM LISTING FOR USE WITH FLOW CHART

STACKER SELECT 9000C

INSTRUCTION ADDRESS		OP	A	B	REMARKS	
377	377	B	393	S781	*USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	S88		"	
393	393	M	388	380	BYPASS DETAIL CARDS ON TAPE	
400	400	/	332		CLEAR PRINT	
404	404	/			" "	
405	405	B	S00	S521	8R. TO TITLE PRINT IF ONE IN 1252	
413	413	B	420			
420	420	L	707	705	RESET CARD COUNTER	
427	427	A	427	705	ADD ONE TO CARD COUNTER	
434	434	C	705	709	COMPARE TO 20	
441	441	B	454	/		
446	446	.	549		HALT FOR RELOADING IN READER	
450	450				SET WM FOR HALT	
454	454	/	180		CLEAR PUNCH	
458	458	L	706	101	SET 0 IN 101	
465	465	L	706	140	SET 0 IN 140	
472	472	4			PUNCH	
473	473	/	180		CLEAR PUNCH	
477	477	L	472	101	SET 4 IN 101	
484	484	L	754	140	SET 1 IN 140	
491	491	4			PUNCH	
492	492	B	710		BRANCH TO CONTINUE	
499	499	B	491	G	SCOPE SELECT AND PUNCH INSTR.	SS
504	504	/	180		CLEAR PUNCH	
508	508	L	524	101	SET 8 IN 101	
515	515	L	708	140	SET 2 IN 140	
522	522	4			PUNCH	
523	523	K	8		SELECT STACKER 8	
525	525	B	523	B	SCOPE SELECT INSTR.	SS
530	530	B	522	G	SCOPE SELECT AND PUNCH INSTR.	SS
535	535	B	427			
549	549	L	707	701	RESET DELAY COUNTER	
556	556	B	738		BRANCH TO CONTINUE	
564	564	C	701	703	COMPARE FOR 24	
571	571	B	755	/		
576	576	B	596	0401	BRANCH ON 1	
584	584	B	724	0402	BRANCH ON 2	
592	592	B	766		BRANCH TO CHECK FOR END OF TEST	
596	596	K	1		SELECT POCKET 1	
598	598	B	596	B	SCOPE SELECT 1	SS
603	603	B	766		BRANCH TO CHECK FOR END OF TEST	
700	700	X	X		DELAY COUNTER	
702	702	2	4		CONSANT	

DATE	2-2-61	5-15-62	6-29-63	17. 10. 63				
ENG. CHG. NO.	110378	115283	117628	TA 1976				

```
704  704  X X                 CARD COUNTER
706  706  0 0                 RESET CONSTANTS
708  708  2 1                 CONSTANT
710  710  K 499 4              STACKER SELECT AND BRANCH
715  715  B 710 B              B ON TO SCOPE STACKER SELECT          SS
720  720  . 710                ERROR NO BRANCH
724  724  K 766 2              STACKER SELECT AND BRANCH
729  729  B 724 B              B ON TO SCOPE STACKER SELECT          SS
734  734  . 724                ERROR DID NOT BRANCH
738  738  N 000 000            PROGRAM CONTROL
745  745  1                    FEED BLANK DETAIL CARD
746  746  1                    FEED BLANK DETAIL CARD
747  747  D 745 746            BYPASS BLANK CARD INSTRUCTIONS.
754  754  1                    FEED CARD
755  755  A 755 701            ADD 1 TO DELAY COUNTER
762  762  B 564                BRANCH TO CONTINUE
766  766  B 795 A              BRANCH LAST CARD                      SS
771  771  B 783 080A           BRANCH TO CHECK IF TEST IS ON TAPE
779  779  B 549                BRANCH TO CONTINUE
783  783  B 795 348B           BRANCH IF TEST IS ON TAPE
791  791  . 361                FEED NEXT TEST FROM CARDS
795  795  B 420 D              REPEAT TEST                           SS
800  800  . 348                HALT BRANCH TO CHAIN ROUT.
804  804                       SET HALT WORD MARK
```

DATE	2-2-61	5-15-62	6-29-63	17.10.63				
NG. CHG. NO.	110378	115283	117628	TA 1976				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,,008015,022029,033033N  1001                    STACKER SELECT                    9000C 0
,,008015,022029,033033N  1001                    SET WORDMARK CARD                 9000C 0
L067367,340344,348349,357361001,008012,001100118361080AB348/340080                 9000C 0
L069404,377385,393400,4044051001          8393S7818S88    M388380/332/              9000C 0
L068440,413420,427434,4414411001BS00S5218420   L707705A427705C705709                9000C 0
L064472,446450,454458,4654721001B454/.549    /180L706101L7061404                    9000C 0
L067507,477484,491492,4995041001/180L472101L7541404B710   8491G/180                 9000C 0
L072547,515522,523525,5305351001L524101L7081404K8852388522GB427                    9000C 0
L060575¤548548,549556,5645711001 L7077018738    C7017038755/                       9000C 0
L072615,584592,596598,6036031001B596040187240402B766K1859688766                    9000C 1
L044707¤696696,700702,7047061001    XX240100                                        9000C 1
L062737,710715,720724,7297341001Z1K4994B7108.710K7662B7248.724                      9000C 1
L060765,745746,747754,7557621001N0000001¤1¤7457461A7557018564                       9000C 1
L070803,771779,783791,7958001001B795AB783080AB54987953488.3618420D.348              9000C 1
L072883¤844844,001804,0010011001                                                    9000C 1
L069S00¤/64/64,S00S01,S01S01!001                                          2         9000C 1
L072S40,S05S12,S13S17,S21S211001,049L0772772/2772415                                9000C 1
L072S80¤S41S41,001001,0010011001                  1                                 9000C 1
/333080N                                          CLEAR WORDMARK CARD               9000C 1
,,019027,031,038042803IT98GB400L046352BW048S88    STACKER SELECT                    9000C 2
                    M
```

DETAIL CARDS

9000C 21
9000C 22

DATE	2-2-61	5-15-62	6-29-63	17.10.63				
ENG. CHG. NO.	110378	115283	117628	TA 1976				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451515
SHEET 1 OF 5
BLOCK NO. 9010D

BRANCH ON PRINTER ERROR

A. PURPOSE OF TEST

TO TEST THE BRANCH ON PRINTER ERROR CIRCUITRY. PRINT POSITION 300 IS DISABLED BY REMOVING HAMMER DRIVER CARD NUMBER 0185 B21. THE PROGRAM BRANCHES TO ERROR PRINT ROUTINES UNDER THREE SETS OF CONDITIONS:

1. WITH PRINTABLE CHARACTER IN LOCATION 300, PRINT, AND TEST FOR PRINTER ERROR AND BRANCH. MACHINE ERROR IS INDICATED BY A NO BRANCH CONDITION.
2. TEST FOR PRINTER ERROR AND BRANCH IF INDICATOR WAS NOT RESET BY PREVIOUS TEST. MACHINE ERROR IS INDICATED BY A BRANCH CONDITION.
3. WITH BLANK CHARACTER IN LOCATION 300, PRINT, AND TEST FOR PRINTER ERROR AND BRANCH. MACHINE ERROR IS INDICATED BY A BRANCH CONDITION.

B. LOADING PROCEDURES

1. TURN CHECK STOP SWITCHES OFF.
2. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
3. WHEN RUNNING FROM TAPE, ENTER A 4 IN 1278.

C. PROGRAM CONTROL

1. SENSE SWITCHES

   D ON TO REPEAT TEST
   OFF TO CONTINUE

   E ON TO STOP ON ERROR
   OFF TO PRINT ERROR

D. TEST PROCEDURE

AFTER MACHINE STOPS AT LOCATION 399, REMOVE HAMMER DRIVER CARD NUMBER 0185 B21 FOR PRINT POSITION 300 AND SET THE I/O CHECK STOP SWITCH AND PROCESS CHECK STOP SWITCH TO THE OFF POSITION. OPERATION IS RESUMED BY PRESSING THE START KEY.

A PASS COUNTER IS USED TO REPEAT THE PROGRAM TEN TIMES. A "0" (ZERO) IS TRANSFERRED TO LOCATION 300 AND PRINTED. SINCE THERE IS NO HAMMER DRIVER FOR PRINT POSITION 300, A PRINTER ERROR CONDITION SHOULD RESULT. A BRANCH IF INDICATOR ON INSTRUCTION, THEREFORE, SHOULD BRANCH. IF NO BRANCH OCCURS THE NEXT SEQUENTIAL INSTRUCTION BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD ERROR COMMENT "PROGRAM DID NOT BRANCH ON PRINTER ERROR WITH PRINTABLE CHARACTER IN LOC 300 ERROR."

DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378C	117628	TA 1976					

D. (CONTINUED)

A SECOND BRANCH IF INDICATOR ON INSTRUCTION IS THEN EXECUTED TO TEST WHETHER THE INDICATOR WAS RESET BY THE PREVIOUS INTERROGATION. IF THE INDICATOR WAS NOT RESET, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD ERROR COMMENT "PREVIOUS INTERROGATION DID NOT RESET PRINTER ERROR INDICATOR ERROR."

A THIRD BRANCH IF INDICATOR ON INSTRUCTION IS EXECUTED AFTER CLEARING PRINT POSITION 300 AND EXECUTING A PRINT INSTRUCTION. A BLANK CHARACTER IN 300 SHOULD NOT CAUSE A PRINTER ERROR. IF IT DOES, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD ERROR COMMENT "PROGRAM BRANCHED ON PRINTER ERROR WITH UNPRINTABLE CHARACTER IN LOC 300 ERROR."

FOR CORRECT RESULTS, TWO BLANK SPACES OCCUR FOR EACH PASS.

E. STOPS

STORAGE ADDRESS REGISTER

400	HALT-REMOVE CARD 01B5 B21
497	ERROR-SENSE E ON. FAILED TO BRANCH ON ERROR.
530	ERROR-SENSE E ON. FAILED TO RESET ERROR INDICATOR
569	HALT-END OF TEST. REPLACE CARD 01B5 B21.
593	ERROR-SENSE E ON. UNPRINTABLE CHARACTER CAUSED ERROR.

F. PRINTOUTS

ERROR PRINTOUTS ONLY.

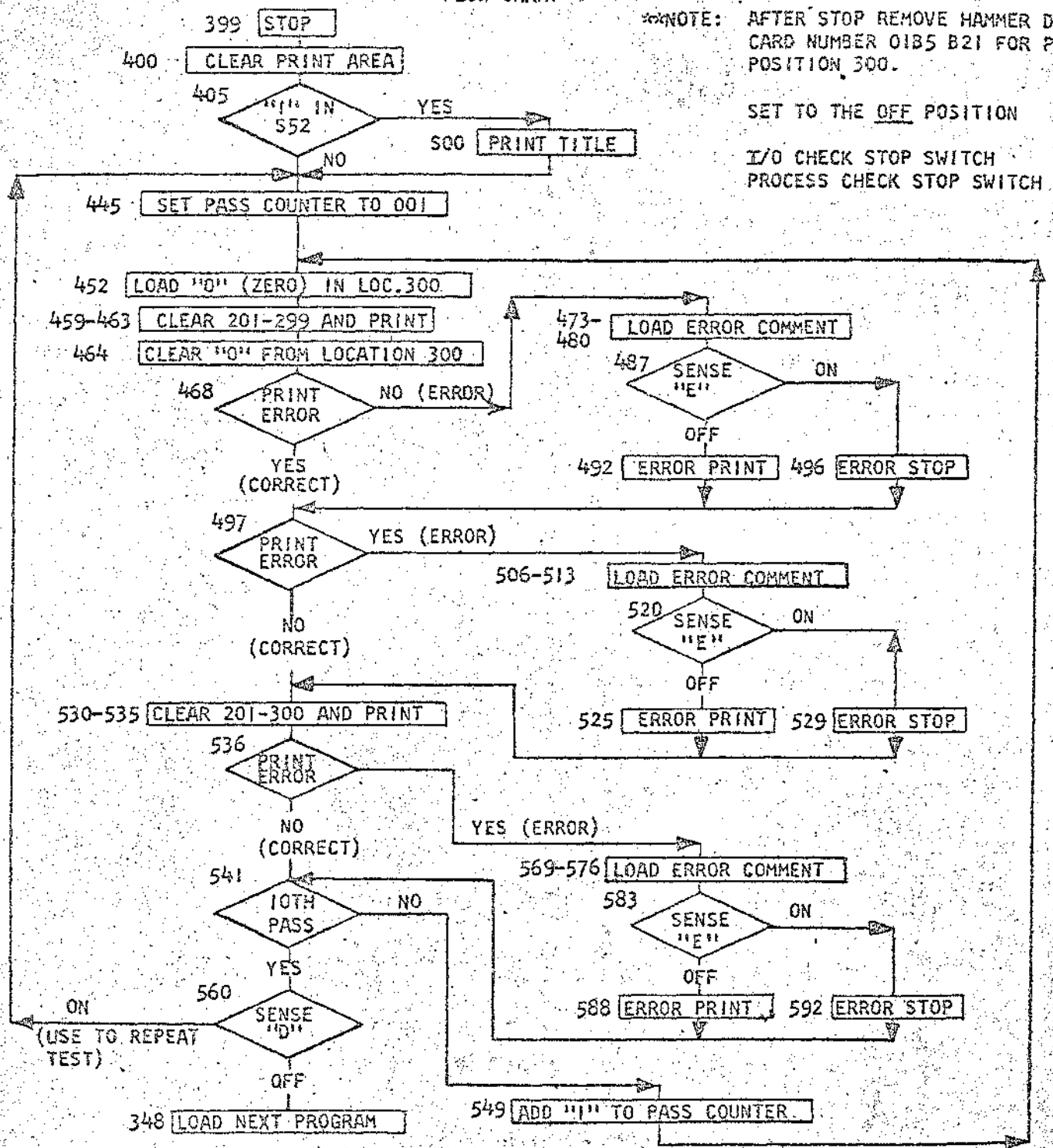
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451515
SHEET 3 OF 6
BLOCK NO. 9010D

BRANCH ON PRINTER ERROR

FLOW CHART



NOTE: AFTER STOP REMOVE HAMMER DRIVI
CARD NUMBER 0185 B21 FOR PRIN
POSITION 300.

SET TO THE OFF POSITION

I/O CHECK STOP SWITCH
PROCESS CHECK STOP SWITCH

DATE	4-27-61	7-1-63	17.10.63					
ENG. CHG. NO.	110378C	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH ON PRINTER ERROR 90100

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S784	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		"
396	396	.	445		STOP TO REMOVE SMS CARD 0185 821
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	396		BRANCH TO HALT
445	445	L	903	906	SET PASS COUNTER TO 001
452	452	L	901	300	LOAD ZERO IN LOCATION 300
459	459	/	299		CLEAR 201-299
463	463	2			PRINT - SHOULD SPACE
464	464	/	300		CLEAR CHARACTER ZERO FROM LOCATION 300
468	468	B	497	≠	BRANCH IF PRINTER ERROR - SHOULD BRANCH
473	473	L	914	285	LOAD ERROR COMMENT INTO PRINT AREA IF
480	480	L	≠80	280	NO BRANCH
487	487	B	496	E	E ON TO ERROR STOP
492	492	2	497		ERROR PRINT
496	496	.			ERROR STOP
497	497	B	506	≠	BRANCH IF INDICATOR IS NOT RESET
502	502	B	530		BRANCH IF INDICATOR IS RESET
506	506	L	914	285	LOAD ERROR COMMENT IF INDICATOR IS
513	513	L	/60	280	NOT RESET
520	520	B	529	E	E ON TO ERROR STOP
525	525	2	530		ERROR PRINT
529	529	.			ERROR STOP
530	530	/	300		CLEAR ZERO FROM LOCATION 300
534	534	/			CLEAR 201-299
535	535	2			PRINT - SHOULD SPACE
536	536	B	569	≠	BRANCH IF PRINTER ERROR - SHOULD NOT BR
541	541	B	560	9051	BRANCH TO SENSE D IF END OF 10TH PASS
549	549	A	903	906	ADD 1 TO PASS COUNTER
556	556	B	452		BRANCH TO START NEXT PASS
560	560	B	445	D	D ON TO REPEAT TEST
565	565	.	348		BRANCH TO READ NEXT PROGRAM
569	569	L	914	285	LOAD ERROR COMMENT IF PRINTER ERROR
576	576	L	≠00	280	"
583	583	B	592	E	E ON TO ERROR STOP
588	588	2	593		ERROR PRINT
592	592	.			ERROR STOP
593	593	B	541		BRANCH TO TEST PASS COUNTER
901	901	0	01X	XX	CONSTANT + PASS COUNTER
910	910	E	RRO	R	CONSTANTS FOR PRINTOUTS
921	921	P	ROG	RAM BRANCHED ON	"

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IG. CHG. NO.	L10378C	117628	TA 1976						

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 941  941  P RIN TER ERROR WITH U      ,,        NO WM
 961  961  N PRI NTABLE CHARAC IN     ,,        NO WM
 981  981    LOC  300                 ,,        NO WM
1001  ÷01  P ROG RAM DID NOT BR O     ,,
1021  ÷21  N  PR INTER ERROR WITH     ,,        NO WM
1041  ÷41    PRI NTABLE CHARAC IN     ,,        NO WM
1061  ÷61    LOC  300                 ,,        NO WM
1081  ÷81  P REV IOUS INTERROGATI     ,,        NO WM
1101  /01  O N D ID NOT RESET PRI     ,,        NO WM
1121  /21  N TER  ERROR INDICATOR     ,,        NO WM
1141  /41                             ,,        NO WM
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CC-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

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,008015,022029,033033N      1001                BRANCH ON PRINTER ERROR 9010D 0A
,008015,022029,033033N      1001                SET WORDMARK CARD       9010D 02
L067367,340344,348349,357361001,008012,001100118361080A8400/340080      9010D 03
L069404,377385,396400,404405§1001          B400S784BS88      .445/332/  9010D 04
L072444,413445,445445,445445100IBS00S521B396                            9010D 05
L067479,452459,463464,468473100IL903906L901300/2992/300B497≠L914285     9010D 06
L065512,487492,496497,502506100IL≠80280B496E2497.B506≠B530L914285        9010D 07
L055535,520525,529530,534535100IL/602808529E2530./300/2                  9010D 08
L072575,541549,556560,565569100IB569≠B5609051A90390684528445D.348L914285901OD 09
L072615,583588,592593,593593100IL≠00280B592E2593.B541                    9010D 10
L072940,910921,921921,921921100100IXXX   ERROR     PROGRAM BRANCHED ON   9010D 11
L072980□941941,001001,001001100IPRINTER ERROR WITH UNPRINTABLE CHARAC IN9010D 12
L072≠20□981981,≠01≠01,≠01≠011001 LOC 300          PROGRAM DID NOT BR 09010D 13
L072≠60□≠21≠21,001001,001001100IN PRINTER ERROR WITH PRINTABLE CHARAC IN9010D 14
L072/00□≠61≠61,≠81≠81,≠81≠811001 LOC 300          PREVIOUS INTERROGATI9010D 15
L072/40□/01/01,001001,001001100ION DID NOT RESET PRINTER ERROR INDICATOR9010D 16
L053520,S01S05,S12S13,S17S2110012,049L0772772/2772396                    9010D 17
/333080N                                          CLEAR WORDMARK CARD    9010D 18
,019027,031,038042803IT98G8400L046352BW04BS88  BRANCH ON PRINTER ERROR 9010D 19
                        M
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DATE	4-27-61	6-29-63	17.10.63					
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IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451518
SHEET 1 OF
SLOCK NO. 9020D

BRANCH ON PROCESS ERROR

A. PURPOSE OF TEST

TO TEST THE BRANCH ON PROCESS ERROR CIRCUITRY AND THE PARITY CHECKING CIRCUITS FOR THE A-REGISTER, B-REGISTER AND INHIBIT CHECK.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

2. AFTER A HALT IN 400 MANUALLY ENTER INVALID CHARACTERS LISTED IN PROGRAM LISTING.

3. TURN CHECK STOP SWITCH OFF.

4. WHEN RUNNING TEST FROM TAPE, ENTER A 5 IN 1278.

C. PROGRAM CONTROL

1. SENSE SWITCHES.

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

D ON TO REPEAT ENTIRE TEST
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR.

D. TEST PROCEDURE

A MOVE INSTRUCTION WITH THE INVALID CHARACTER IN 105 IS EXECUTED AND A PROCESS ERROR SHOULD RESULT. THE CONDITION IS DISPLAYED ON THE CONSOLE BY THE FOLLOWING LIGHTS.

PROCESS
STORAGE
B-REGISTER
A-REGISTER
CHECK RESET

UNDER CONTROL OF THE DELAY LOOP COUNTER, AN ADD INSTRUCTION IS EXECUTED 2000 TIMES BEFORE THE CONDITION IS INTERROGATED BY A BRANCH ON PROCESS ERROR INSTRUCTION. IF A BRANCH DOES NOT OCCUR, A MACHINE ERROR IS INDICATED AND THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD "PROG. DID NOT BRANCH ON PROC. ERROR AFTER MOVE WITH INV. CHAR. IN A-FIELD -MXXX100 ERROR."

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D. (CONTINUED)

IF THE PROCESS ERROR TEST RESULTS IN A BRANCH AS IT SHOULD A SECOND BRANCH IF INDICATOR ON INSTRUCTION IS EXECUTED TO TEST WHETHER INDICATOR WAS RESET BY THE PREVIOUS INTERROGATION. IF THE INDICATOR WAS NOT RESET, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD "PREVIOUS INTERROGATION DID NOT RESET THE PROCESS ERROR INDIC. ERROR."

THE PROGRAM IS REPEATED WITH THE INVALID CHARACTER IN 106, AND SO ON, UNTIL THE LAST INVALID CHARACTER IN 120 HAS BEEN PROCESSED.

E. STOPS

STORAGE ADDRESS REGISTER

400	HALT-ENTER INVALID CHARACTERS
596	ERROR-SENSE E ON. FAILED TO DETECT PARITY ERROR.
629	ERROR-SENSE E ON. FAILED TO RESET INDICATOR
679	HALT-END OF TEST.

F. PRINTOUT

ERROR PRINTOUTS ONLY

G. COMMENTS

FOR EACH PASS THE FIVE LIGHTS (PROCESS, STORAGE, B-REGISTER, A-REGISTER, AND CHECK RESET) TURN ON FOR A SHORT PERIOD AND TURN OFF FOR A LESSER PERIOD, RESULTING IN A RHYTHMIC BLINKING OF THE LIGHTS ON THE CONSOLE. THE RHYTHM IS CONTROLLED BY THE DELAY LOOP COUNTER.

NOTE: IN OBSERVING THE LIGHTS, IT IS IMPORTANT TO EMPHASIZE THAT ALL FIVE LIGHTS MUST GO ON AND OFF SIMULTANEOUSLY. IF ANY ONE OF THEM FAILS FOR ONE REASON OR ANOTHER, MACHINE ERRORS NOT DETECTED BY THE PROGRAM ARE INDICATED AND SHOULD BE INVESTIGATED.

BRANCH ON PROCESS ERROR FLOW CHART

399 STOP

400 CLEAR PRINT AREA

"1" IN 552? YES → 500 PRINT TITLE

NO

500 LOAD INSTR. M 105 100 TO LOCATIONS 522-528

507 SET DELAY LOOP COUNTER TO 0001

514-518 CLEAR LOCATION 100 AND SET WM

522 EXECUTE MOVE INSTRUCTION WITH INVALID CHARACTER IN A-FIELD

529 SENSE "B"? ON → (FROM NEXT PAGE)

OFF

534 ADD "1" TO DELAY LOOP COUNTER

541 COUNTER 2000? NO → (FROM NEXT PAGE)

YES

560 PROCESS ERROR? NO (ERROR) → 565-579 LOAD ERROR COMMENT

(USE IF PRINTER IS NOT AVAILABLE)

586 SENSE "E"? ON → 595 ERROR STOP

OFF → 591 ERROR PRINT → (TO NEXT PAGE)

YES (CORRECT)

596 PROCESS ERROR? YES (ERROR) → 605-612 LOAD ERROR COMMENT

619 SENSE "E"? ON → 628 ERROR STOP

OFF → 624 ERROR PRINT → (TO NEXT PAGE)

NO (CORRECT) → (TO NEXT PAGE)

**MANUALLY ENTER 15 EVEN-PARITY CHARACTERS IN LOCATIONS 105-120 AS SHOWN IN PROGRAM LISTING (CARD NUMBERS 10-25)

SET TO THE OFF POSITION:
I/O CHECK STOP SWITCH
PROCESS CHECK STOP SWITCH

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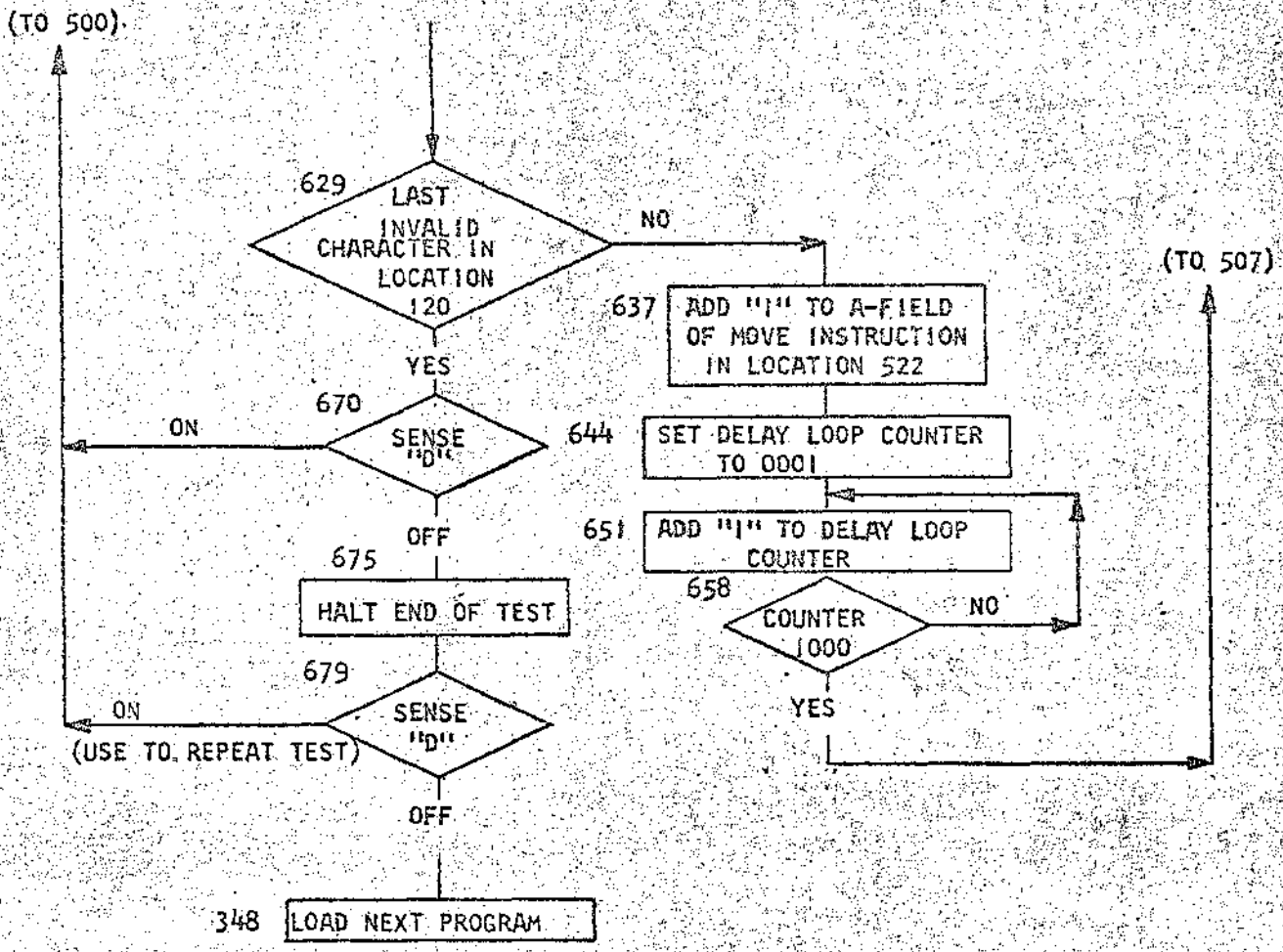

DATE	4-27-61	7-1-63	17. 10. 63					
ENG. CHG. NO.	110378-C	117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH ON PROCESS ERROR 90200

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	400	S785	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
396	396	.	500		STOP TO MANUALLY ENTER
396	396	.	500		NO BITS IN LOC 105
396	396	.	500		A 1 ,, ,, ,, 106
396	396	.	500		B 2 ,, ,, ,, 107
396	396	.	500		C 4 ,, ,, ,, 108
396	396	.	500		8 M ,, ,, ,, 109
396	396	.	500		A 21M ,, ,, ,, 110
396	396	.	500		B 4 1M ,, ,, ,, 111
396	396	.	500		C 8 1M ,, ,, ,, 112
396	396	.	500		BA 42 ,, ,, ,, 113
396	396	.	500		C A8 2 ,, ,, ,, 114
396	396	.	500		CB 84 ,, ,, ,, 115
396	396	.	500		CBA 421 ,, ,, ,, 116
396	396	.	500		CB 8 21M ,, ,, ,, 117
396	396	.	500		C A84 1M ,, ,, ,, 118
396	396	.	500		BA842 M ,, ,, ,, 119
396	396	.	500		CBA821M ,, ,, ,, 120
400	400	/	332		START TEST
404	404	/			
405	405	B	S00	S521	BR TO TITLE PRINT ROUTINE IF 1 IN S52
413	413	B	396		BRANCH TO HALT
500	500	L	896	528	SET MOVE INSTRUC TO INITIAL CONDITION
507	507	L	903	907	SET DELAY LOOP COUNTER TO 0001
514	514	/	100		CLEAR + SET WM IN B FIELD OF MOVE
518	518	,	100		,,
522	522	M	105	100	MOVE WITH INVALID CHARACTER IN A FIELD
529	529	B	S14	B	B ON TO SCOPE SS
534	534	A	903	907	DELAY
541	541	B	560	9042	,,
549	549	B	529		,,
560	560	B	596	%	BRANCH ON PROCESS ERROR - SHOULD BRANCH
565	565	L	919	285	LOAD ERROR COMMENT INTO PRINT AREA IF
572	572	L	999	280	NO BRANCH
579	579	L	528	278	,,
586	586	B	595	E	E ON TO ERROR STOP SS
591	591	2	596		ERROR PRINT
595	595	.			ERROR STOP
596	596	B	605	%	BRANCH IF INDICATOR IS NOT RESET
601	601	B	629		BRANCH IF INDICATOR IS RESET
605	605	L	919	285	LOAD ERROR COMMENT IF INDICATOR
612	612	L	#79	280	IS NOT RESET

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 619  619  B 626 E                 E ON TO ERROR STOP                    SS
 624  624  2 629                   ERROR PRINT
 628  628  .                       ERROR STOP
 629  629  B 670 5242              BR TO SENSE D IF LAST INVALID MOVE
 637  637  A 637 525               ADD 1 TO A FIELD OF MOVE INSTRUCTION
 644  644  L 903 907               DELAY
 651  651  A 903 907                 ,,
 658  658  B 507 9041              BR TO MOVE NEXT INVALID IF END OF DELAY
 666  666  B 651                   BRANCH TO CONTINUE DELAY
 670  670  B 500 D                 SENSE D ON TO REPEAT TEST             SS
 675  675  . 679                   BRANCH TO READ NEXT PROGRAM
 679  679  B 500 D                 SENSE SW D ON TO REPEAT
 684  684  / 348 120               BRANCH TO READ NEXT PROGRAM + CLEAR
 890  890  M 105 100               CONSTANTS
 900  900  0 001 XXXX                ,,
 915  915  E RRO R                 CONSTANTS FOR PRINTOUTS
 920  920  P ROG .. DID NOT BRANCH    ,,
 940  940    ON . PROC. ERROR AFTE    ,,        NO WM
 960  960  R  MO VE WITH INV.CHAR    ,,        NO WM
 980  980  . IN  A-FLD -MXXXXXX-     ,,        NO WM
1000 #00  P REV IOUS INTERROGATI     ,,
1020 #20  O N D ID NOT RESET PRO     ,,        NO WM
1040 #40  C ESS  ERROR INDIC.        ,,        NO WM
1060 #60                             ,,        NO WM
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DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103780	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                BRANCH ON PROCESS ERROR 9020D 0A
,008015,022029,033033N      1001                SET WORDMARK CARD       9020D 02
L067367,340344,348349,357361 1001,008012,001100118361080AB348/340080    9020D 03
L069404,377385,396400,4044051001        8400S785BS88      .500/332/     9020D 04
L072444,413413,413413,4134131001BS00S5218396                            9020D 05
L069521¤485485,S00507,S145181001                  L896528L903907/100,100 9020D 06
L070559,529534,541549,560560100IM105100851¤BA9039078560904285 29        9020D 07
L068595,565572,579586,591595100IB596%L919285L999280L52827885 95E2596.   9020D 08
L065628,601605,612619,624628100IB605%B629L919285L¤7928086 28E2629.      9020D 09
L069665,637644,651658,6666661001B670524 2A637525L903907A9039078507904 1  9020D 10
L072705,670675,679684,6846841001B651B500D.67985000/348120               9020D 11
L066899¤866866,890900,9009001001                        M105100          9020D 12
L072939,915920,920920,9209201001000IXXXX      ERRORPROG. DID NOT BRANCH9020D 13
L072979¤940940,001001,0010011001 ON PROC. ERROR AFTER MOVE WITH INV.CHAR9020D 14
L072¤19¤980980,¤00¤00,¤00¤001001.IN A-FLD -MXXXXX- PREVIOUS INTERROGAT19020D 15
L072¤59¤¤20¤20,001001,0010011001ON DID NOT RESET PROCESS ERROR INDIC.   9020D 16
L065S12¤/80/80,S00S01,S05S121001                    2,049L0772772       9020D 17
L072S52,S17S21,S21S21,S21S211001/2772396                                19020D 18
/333080N                                          CLEAR WORDMARK CARD    9020D 19
,019027,031,038042B031T98GB400L0463528W04BS88  BRANCH ON PROCESS ERROR 9020D 20
                        M
```

DATE	4-27-61	6-29-63	17. 10. 63					
ENG. CHG. NO.	1103780	117628	TA 1976					

BRANCH ON READER ERROR

A. PURPOSE OF TEST

TO TEST THE BRANCH ON READER ERROR CIRCUITRY. THE TEST IS DIVIDED INTO TWO PARTS:

PART 1 PROCESSES TEN DETAIL CARDS WITH VARIOUS COMBINATIONS OF INVALID CHARACTERS IN COLUMN 1. PROGRAM SHOULD BRANCH. MACHINE ERROR IS INDICATED BY A NO BRANCH CONDITION.

PART 2 PROCESSES 81 DETAIL CARDS WITH FIRST (CHECK) SET OF BRUSHES UNLATCHED FROM THE MACHINE. PROGRAM SHOULD BRANCH. MACHINE ERROR IS INDICATED BY A NO BRANCH CONDITION.

IN EACH PART A TEST IS MADE FOR READER ERROR AND BRANCH IF INDICATOR WAS NOT RESET BY PREVIOUS INTERROGATION. MACHINE ERROR IS INDICATED BY A BRANCH CONDITION.

DEPENDING UPON THE SETTING OF SENSE SWITCH E, MACHINE STOPS FOR ANY OF THE ABOVE ERROR CONDITIONS OR PRINTS THE RESULTS WITH TYPE OF ERROR COMMENTS.

B. LOADING PROCEDURES

1. TURN CHECK STOP SWITCHES OFF.

2. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

3. WHEN RUNNING TEST FROM TAPE, ENTER A 6 IN 1278 AND PLACE DETAIL CARDS PLUS 2 BLANK CARDS IN READ HOPPER.

C. PROGRAM CONTROL

1. SENSE SWITCHES

D	ON TO REPEAT FIRST OR SECOND PART OF TEST OFF TO CONTINUE
E	ON TO STOP ON ERROR OFF TO PRINT ERROR
G	ON TO REPEAT ENTIRE TEST OFF TO CONTINUE

D. TEST PROCEDURE

A COUNTER IS USED TO SIGNAL THE END OF PART 1 (TEN CARDS) AND THE END OF PART 2 (81 CARDS). ALL OF THE TEN CARDS IN PART 1 ARE PUNCHED WITH VARIOUS COMBINATIONS OF INVALID CHARACTERS IN COLUMN 1. THEREFORE, EACH CARD READ SHOULD BRANCH. IF NO BRANCH OCCURS THE PROGRAM EXECUTES INSTRUCTIONS TO LOAD "PROGRAM DID NOT BRANCH ON READER ERROR INV. CHAR. - CARD XX COL. 1. ERROR."

D. TEST PROCEDURE (CONTINUED)

IF THE READER ERROR TEST RESULTS IN A BRANCH AS IT SHOULD, A SECOND BRANCH IF INDICATOR ON INSTRUCTION IS EXECUTED TO TEST WHETHER THE INDICATOR WAS RESET BY THE PREVIOUS INTERROGATION. IF THE INDICATOR WAS NOT RESET, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD "PREVIOUS INTERROGATION DID NOT RESET THE READ ERROR INDICATOR ERROR."

AFTER 10 CARDS ARE TESTED, THE PROGRAM PROCEEDS TO RESET PROCESS ERROR INDICATORS (SENSE SWITCH D OFF) AND STOPS THE MACHINE WITH I-STAR AT LOCATION 577 AND THE BLANK SPACER CARD AT THE CHECK STATION. THIS SIGNALS THE END OF PART 1.

BEFORE PROCEEDING WITH PART 2, UNLATCH THE FIRST (CHECK) SET OF READ BRUSHES, THEN PRESS THE START KEY. WITHOUT BRUSHES AT THE CHECK STATION, A HOLE COUNT CHECK SHOULD RESULT IN A READER ERROR. A BRANCH IF INDICATOR ON INSTRUCTION, THEREFORE, SHOULD BRANCH. IF NO BRANCH OCCURS THE PROGRAM EXECUTES INSTRUCTIONS TO LOAD "HOLE COUNT COLUMN XX ERROR." THE NUMBER (XX) AFTER THE WORD COLUMN IDENTIFIES THE ONLY CARD COLUMN PUNCHED IN THE CARD.

IF THE READER ERROR TEST RESULTS IN A BRANCH, AS IT SHOULD, A SECOND BRANCH IF INDICATOR ON INSTRUCTION IS EXECUTED TO TEST WHETHER THE INDICATOR WAS RESET BY THE PREVIOUS INTERROGATION. IF THE INDICATOR WAS NOT RESET THE PROGRAM BRANCHES TO AN ERROR ROUTINE TO LOAD "PREVIOUS INTERROGATION DID NOT RESET THE READ ERROR INDICATOR ERROR."

THE PROGRAM REPEATS UNTIL ALL DETAIL CARDS HAVE BEEN PROCESSED.

BEFORE PROCEEDING TO LOAD THE PROGRAM FOR THE NEXT BLOCK, REPLACE THE CHECK BRUSHES, THEN PRESS THE START KEY.

E. STOPS

STORAGE ADDRESS REGISTER

539	ERROR STOP - SENSE E ON. FAILED TO BRANCH.
566	ERROR STOP - SENSE E ON. FAILED TO RESET INDICATOR.
580	HALT - END OF FIRST PART OF TEST. REMOVE FIRST SET OF BRUSHES AND PRESS START.
711	ERROR STOP - SENSE E ON. FAILED TO BRANCH.
747	ERROR STOP - SENSE E ON. FAILED TO RESET INDICATOR.
756	HALT - END OF TEST. REPLACE FIRST SET OF BRUSHES.

F. PRINTOUTS

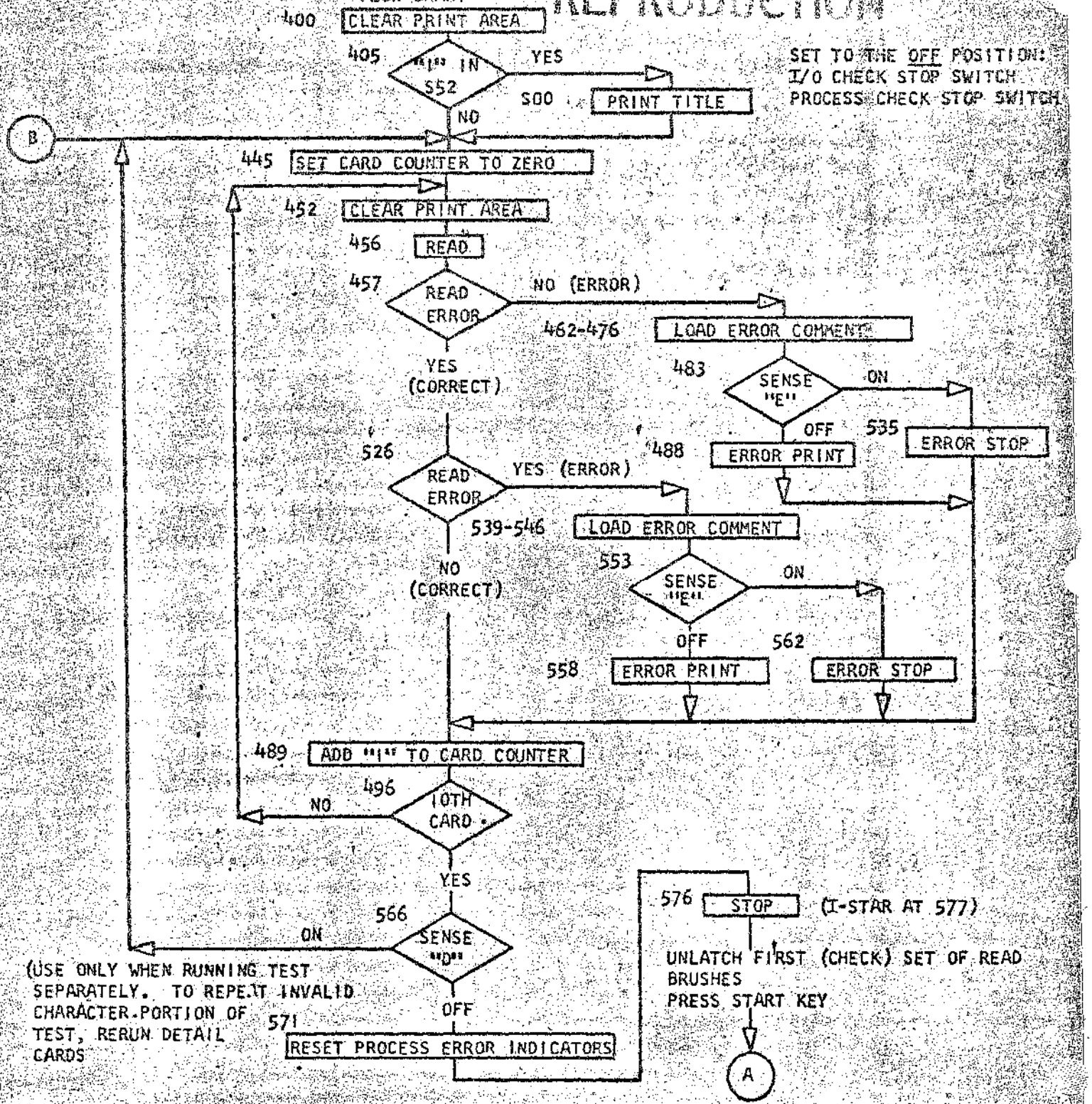
ERROR PRINTOUTS ONLY.

DATE	4-27-61	2-5-62	4-25-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378C	110378G	1167454	117628	TA 1976			

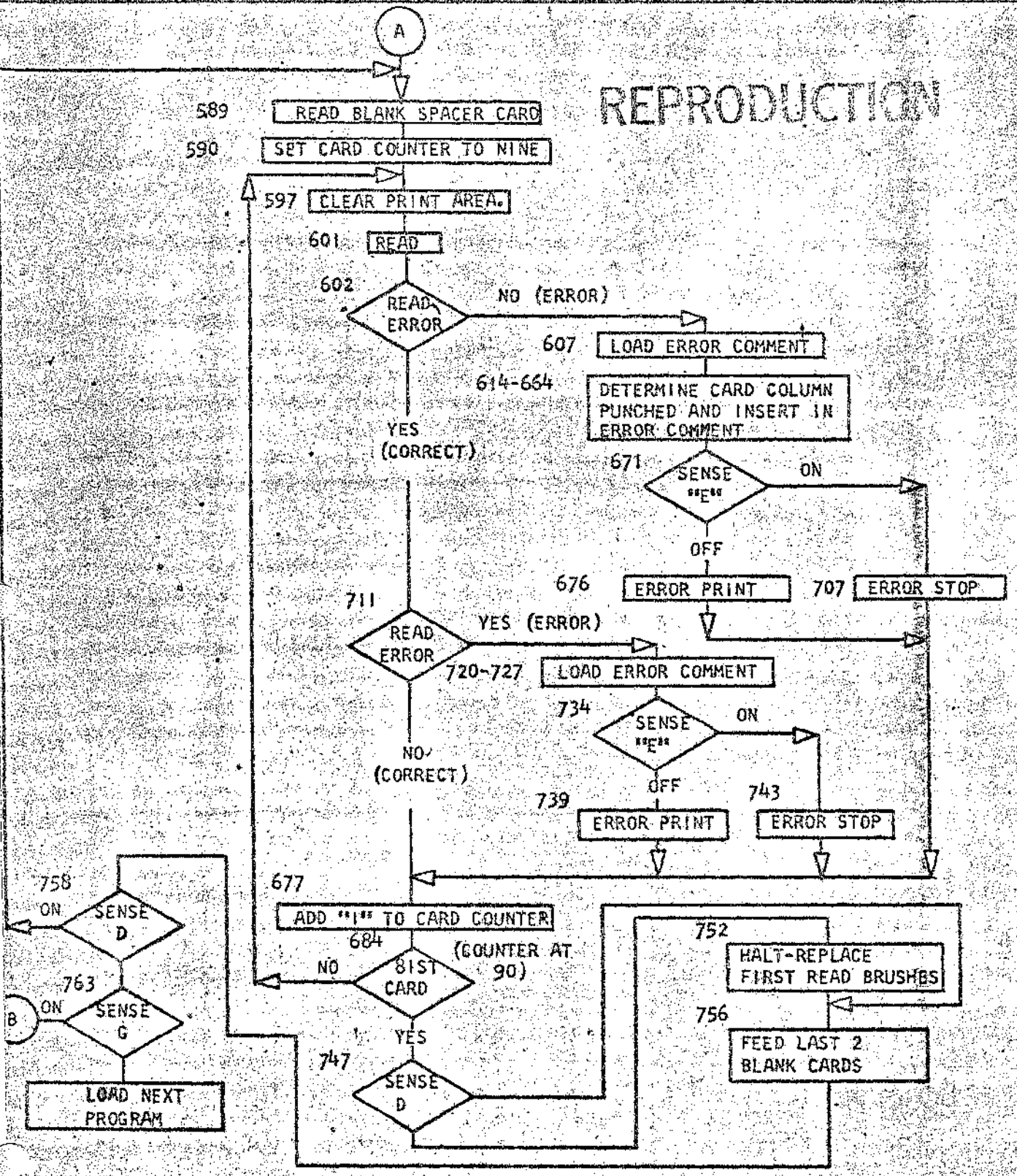
G. COMMENTS

IN MACHINES WITH THE A-BIT RPQ FEATURE INSTALLED, THE INVALID 8-2 PUNCH IN CARD NUMBER 96 BECOMES VALID. IT IS SUGGESTED THAT THIS CARD BE REPLACED BY A DUPLICATE OF CARD NUMBER 95 TO AVOID AN ERRONEOUS ERROR PRINT OUT INDICATION.

BRANCH ON READER ERROR
FLOW CHART



DATE	4-27-61	2-5-62	4-25-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378C	110378G	116745A	117628	TA 1976			



DATE	4-27-61	2-5-62	4-25-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378C	110378G	116745A	117628	TA 1976			

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH ON READER ERROR 90300

INSTRUCTION ADDRESS		OP	A	B		REMARKS	
377	377	B	393	S786		*USE WHEN TESTS ARE RUN FROM TAPE	
385	385	B	588			,,	
393	393	M	388	380		BYPASS DETAIL CARDS ON TAPE	
400	400	/	332			CLEAR PRINT AREA	
404	404	/				,,	
405	405	B	500	S521		BR TO TITLE PRINT IF 1 IN 1252	
413	413	B	787			BRANCH TO CONTINUE	
441	441	,	078				
445	445	L	782	138		SET CARD COUNTER TO ZERO	
452	452	/	299			CLEAR PRINT AREA	
456	456	1				READ	
457	457	B	526	+		BRANCH IF INVALID READ - SHOULD BRANCH	
462	462	L	941	241		LOAD ERROR COMMENT INTO PRINT AREA IF	
469	469	L	885	285		NO BRANCH	
476	476	L	080	265		,,	
483	483	B	535	E		E ON TO ERROR STOP	SS
488	488	2				ERROR PRINT	
489	489	A	783	138		ADD ONE TO CARD COUNT	
496	496	B	566	1371		BRANCH IF TENTH INVALID CARD	
504	504	B	452			BRANCH	
526	526	B	539	+		BRANCH IF INDICATOR IS NOT RESET	
531	531	B	489			BRANCH IF INDICATOR IS RESET	
535	535	.	489			ERROR STOP	
539	539	L	462	262		LOAD ERROR COMMENT INTO PRINT AREA IF	
546	546	L	485	285		INDICATOR IS NOT RESET	
553	553	B	562	E		E ON TO ERROR STOP	SS
558	558	2	489			ERROR PRINT	
562	562	.	489			ERROR STOP	
566	566	B	445	D		D ON TO REPEAT INVALID TEST	SS
566	566	B	445	D		USE INVALID DETAIL CARDS ONLY	
571	571	B	576	%		RESET PROCESS ERROR INDICATORS	
576	576	.	589			STOP -- REMOVE FIRST SET OF BRUSHES	
576	576	.	589			BRANCH TO SECOND PORTION OF PROGRAM	
580	580					D ON LOOPS SECOND PORTION OF PROGRAM	
589	589	1				READ BLANK CARD FOR HOLE COUNT TEST	
590	590	L	786	138		SET CARD COUNTER TO ZERO	
597	597	/	299			CLEAR PRINT	
601	601	1				READ	
602	602	B	711	+		BR IF READ HOLE COUNT CHECK - SHOULD BR	
607	607	L	985	285		LOAD ERR. COMMENT INTO PRT AREA IF NO BR	
614	614	L	782	642		DETERMINE CARD COLUMN	
621	621	,	640			,,	
625	625	A	783	642		,,	

DATE	4-27-61	2-5-62	4-25-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378C	110378G	116745A	117628	TA 1976			

```
632  632  ¤ 640                    ,,
636  636  B 648 XXX                ,,
644  644  B 660                    ,,
648  648  B 671 6418               ,,
656  656  B 621                    ,,
660  660  , 641                    SET WORD MARK FOR COLUMN NUMBER
664  664  M 642 273                MOVE COLUMN NUMBER INTO PRINT AREA
671  671  B 707 E                  E ON TO ERROR STOP                    SS
676  676  2                       ERROR PRINT
677  677  A 783 138                ADD ONE TO CARD COUNT
684  684  B 747 1379               BRANCH IF 81ST DETAIL CARD
692  692  B 597                    IF NOT 81ST CARD BR TO READ NEXT CARD
707  707  . 677                    ERROR STOP
711  711  B 720 +                  BR IF INDICATOR IS NOT RESET
716  716  B 677                    BR IF INDICATOR IS RESET
720  720  L ¢62 262                LOAD ERROR COMMENT INTO PRINT AREA IF
                                     INDICATOR IS NOT RESET
734  734  B 743 E                  E ON TO ERROR STOP                    SS
739  739  2 677                    ERROR PRINT
743  743  . 677                    ERROR STOP
747  747  B 756 D                  D ON TO REPEAT HOLE COUNT CHECK       SS
752  752  . 756                    STOP -- REPLACE READ BRUSHES
756  756  1                       FEED LAST TWO
757  757  1                       BLANK DETAIL CARDS
758  758  B 589 D                  D ON TO REPEAT HOLE COUNT CHECK       SS
763  763  B 465 G                  G ON REPEATS ALL OF TEST              SS
768  768  B 348                    BRANCH TO READ NEXT PROGRAM
780  780  0 00                     CONSTANT
783  783  1                          ,,
784  784  0 09                       ,,
787  787  B 799 3488               BRANCH IF TEST IS ON TAPE
795  795  B 441                    BRANCH TO CONTINUE
799  799  . 441                    HALT PLACE DETAIL CARDS IN RD HOPPER
803  803                          WORDMARK
847  847  I NV.  CHAR.-CARD       CONSTANT
866  866  ,  CO L. 1       ERROR      ,,        NO WM
902  902  P ROG RAM DID NOT BRAN      ,,
922  922  C H O N A READER ERROR      ,,        NO WM
942  942        HOLE COUNT            ,,        NO WM
962  962     C OLUMN XX      E        ,,        NO WM
982  982  R ROR                       ,,        NO WM
1002 ¢02  P REV IOUS INTERROGATI      ,,
1022 ¢22  O N D ID NOT RESET THE      ,,        NO WM
1042 ¢42     REA D ERROR INDICATO     ,,        NO WM
1062 ¢62  R                           ,,        NO WM
1081 ¢81  E RRO R                     ,,
```

DATE	4-27-61	2-5-62	4-25-63	6-29-63	11.10.63			
ENG. CHG. NO.	1103780	1103786	116745A	117628	TA 1976			

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N          1001                    8RANCH ON READER ERROR  9030D 01
,008015,022029,033033N          1001                    SET WORDMARK CARD       9030D 02
L067367,340344,348349,3573611001,008012,0011001183610B0AB421/340060             9030D 03
L069404,377385,393400,4044051001          8393S786BS88    M388380/332/          9030D 04
L072444,413441,445445,44544510018S00S5218787                        ,07890309D 05
L070482,452456,457462,4694761091L782138/29916526PL941241L885285L080265,        9030D 06
                                                  Z
L072522,488489,496504,5045041001853SE2478313885661371B452                      9030D 07
L055545¤523523,526531,5355391001    8539P8489.489L*62262                        9030D 08
                                          Z
L066579,553558,562566,5715761001L*85285B562E2489.489B445DB576%.589              9030D 09
L066613,589590,597601,6026071001          IL786138/2991871IPL985285             9030D 10
                                                        Z
L066647,621625,632636,6446481001L782642,640A783642¤640B648XXX 8660              9030D 11
L068683,656660,664671,6766771001B671641BB621,641M6422738707E2A783138            9030D 12
L068719,692707,711716,7207201001874713798597                .677B720PB677       9030D 13
                                                                  Z
L068755,727734,739743,7477521001L*62262L*85285B743E2677.677B756D.756             9030D 1
L060783,757758,763768,7807831001118589DB445GB348          0001                 9030D 15
L072823,787795,799803,8038031001009879934BBB441.441                            9030D 16
L072863¤824824,847847,8478471001                          INV. CHAR.-CARD       9030D 17
L070901¤864864,902902,9029021001   , COL. 1        ERROR                        9030D 18
L072941,001001,001001,0010011001PROGRAM DID NOT BRANCH ON A READER ERROR        9030D 19
L072981¤942942,001001,00100111001      HOLE COUNT        COLUMN XX        E9030D 20
L072*21¤982982,*02*02,*02*021001RROR                  PREVIOUS INTERROGATI9030D 21
L072*61¤*22*22,001001,0010011001ON DID NOT RESET THE READ ERROR INDICATO9030D 22
L072/01¤*62*62,*81*81,*81*811001R                     ERROR                     9030D 23
L072539,S01S05,S12S13,S17S2110012,049L0772772/2772787                           9030D 24
/333080N                                              CLEAR WORDMARK CARD       9030D 25
,019027,031,038042B031T9BGB400L0463528W048S80   BRANCH ON READER ERROR          9030D 26
                                  M
```

DETAIL CARDS

P	12, 11 7	PUNCHES IN COLUMN 1	9030D027
X	11, 0, 7	PUNCHES IN COLUMN 1	9030D028
9	6, 9	PUNCHES IN COLUMN 1	9030D029
9	5, 9	PUNCHES IN COLUMN 1	9030D030
8	1, 8	PUNCHES IN COLUMN 1	9030D031
0	2, 8	VALID ON 1410 + RPQ 898148	9030D032
9	1, 9	PUNCHES IN COLUMN 1	9030D033
4	3, 4	PUNCHES IN COLUMN 1	9030D034
5	2, 5	PUNCHES IN COLUMN 1	9030D03
6	1, 6	PUNCHES IN COLUMN 1	9030D03

DATE	4-27-61	2-5-62	4-25-63	6-29-63	17. 10. 63			
ENG. CHG. NO.	110378C	110378G	116745A	117628	TA 1976			

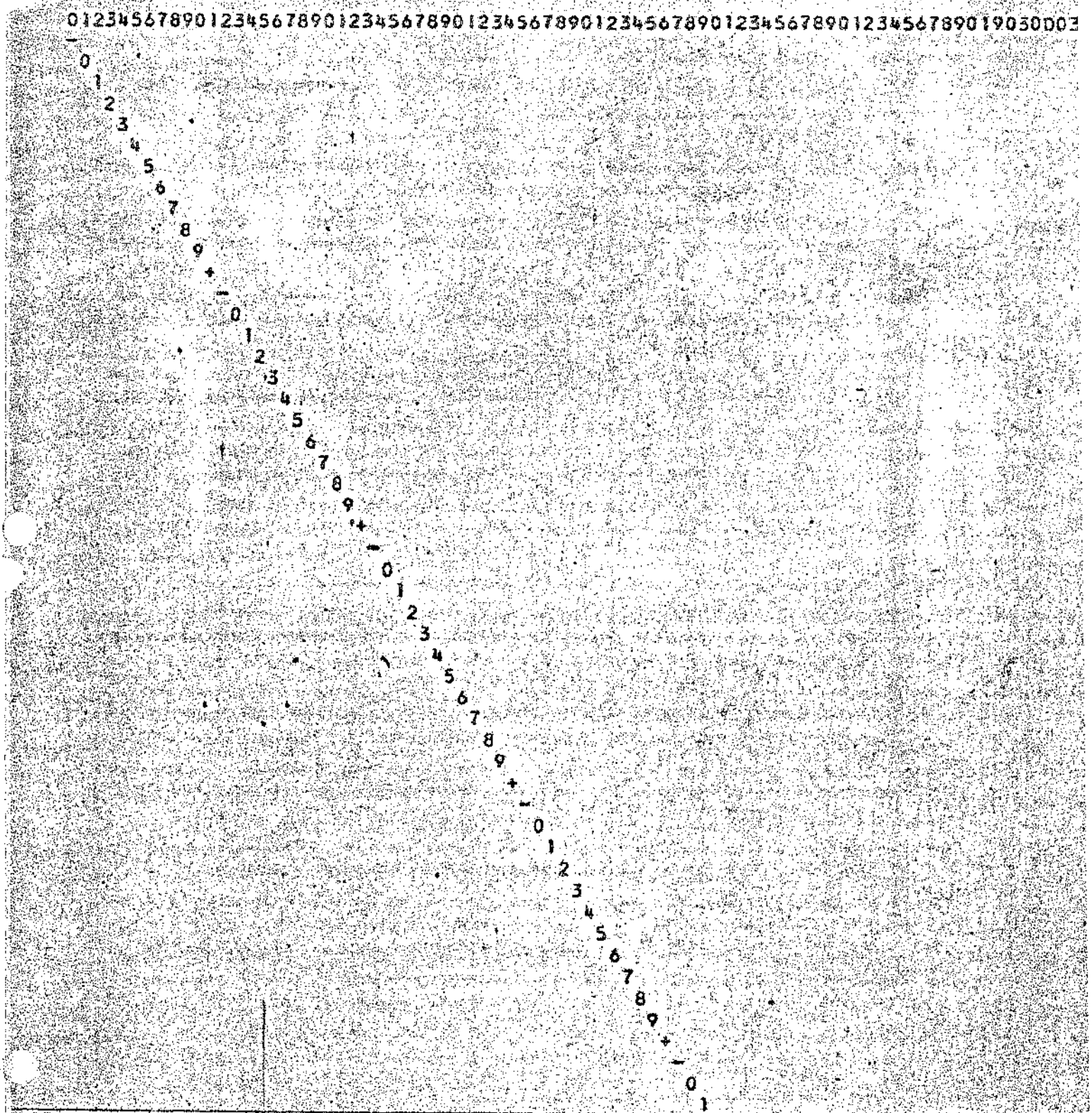
IBM FORM 624-7113-0

1401 DATA PROCESSING SYSTEM

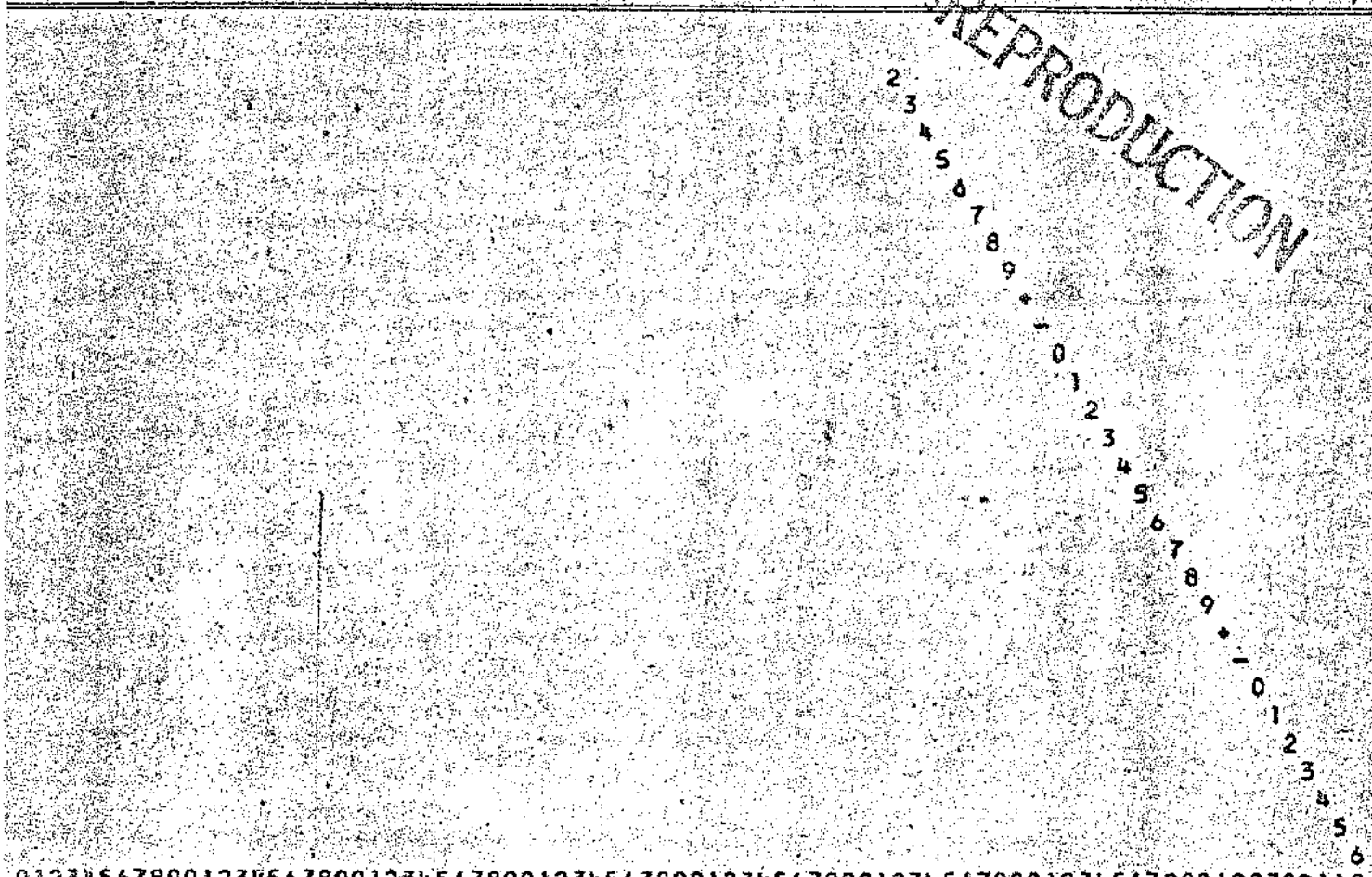
DIAGNOSTIC FUNCTION TEST

REPRODUCTION

PART NO. 451521
SHEET 9 OF 1
BLOCK NO. 90300



DATE	4-27-61	2-5-62	4-25-63	6-29-63	17.10.63			
ENG CHG NO	1103780	1103786	116745A	117628	TA 1976			



DATE	4-27-61	2-5-62	4-25-63	6-29-63	17. 10. 63			
IBX CHG. NO.	110378C	110378G	116745A	117628	TA 1976			

BRANCH ON PUNCH ERROR

A. PURPOSE OF TEST

TO TEST THE BRANCH ON PUNCH ERROR CIRCUITRY.

B. LOADING PROCEDURES

1. TURN ALL CHECK STOP SWITCHES OFF.
2. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
3. WHEN RUNNING TEST FROM TAPE, ENTER A 7 IN 1278.

C. PROGRAM CONTROL

1. SENSE SWITCHES

B ON TO REPEAT FOR SCOPING
OFF TO CONTINUE

D ON TO REPEAT ENTIRE TEST
OFF TO CONTINUE

E ON TO STOP ON ERROR
OFF TO PRINT ERROR

D. TEST PROCEDURE

THE PROGRAM PUNCHES 80 DETAIL CARDS WITH A SINGLE-HOLE CHARACTER (12,11,0,1,2,3,4,5,6,7,8, OR 9) IN A SINGLE COLUMN OF THE CARD PROGRESSIVELY FROM COLUMN 1 FOR THE FIRST CARD TO COLUMN 80 FOR THE 80TH CARD. THESE CARDS ARE RE-RUN THROUGH THE PUNCH FEED AND A HOLE-COUNT ERROR IS FORCED BY PUNCHING 80 BLANKS IN EACH CARD. A PUNCH ERROR AND BRANCH INSTRUCTION SHOULD THEREFORE BRANCH. MACHINE ERROR IS INDICATED BY A NO BRANCH CONDITION. IF NO BRANCH OCCURS THE PROGRAM EXECUTES INSTRUCTIONS TO LOAD "PROGRAM DID NOT BRANCH ON PUNCH HOLE COUNT CHECK CARD IN STACKER FOUR ERROR".

A SECOND PUNCH ERROR AND BRANCH INSTRUCTION IS EXECUTED TO TEST WHETHER THE INDICATOR WAS RESET BY A PREVIOUS INTERROGATION. MACHINE ERROR IN THIS CASE IS INDICATED BY A BRANCH CONDITION. IF THE INDICATOR WAS NOT RESET, THE PROGRAM BRANCHES TO AN ERROR PRINT ROUTINE TO LOAD "PREVIOUS INTERROGATION DID NOT RESET THE PUNCH ERROR INDICATOR ERROR".

FOR CORRECT RESULTS, NO PRINTING OCCURS AND DETAIL CARDS ARE STACKED IN THE N/P POCKET SINCE DETECTED PUNCH ERRORS NULLIFY THE SELECT STACKER 4 INSTRUCTION.

E. STOPS

STORAGE ADDRESS REGISTER

616	ERROR-SENSE E ON-FAILED BRANCH ON PUNCH ERROR.
636	ERROR-SENSE E ON-FAILED TO RESET INDICATOR.
645	HALT-END OF TEST
751	HALT-PLACE PUNCHED DETAILS IN PUNCH FEED.

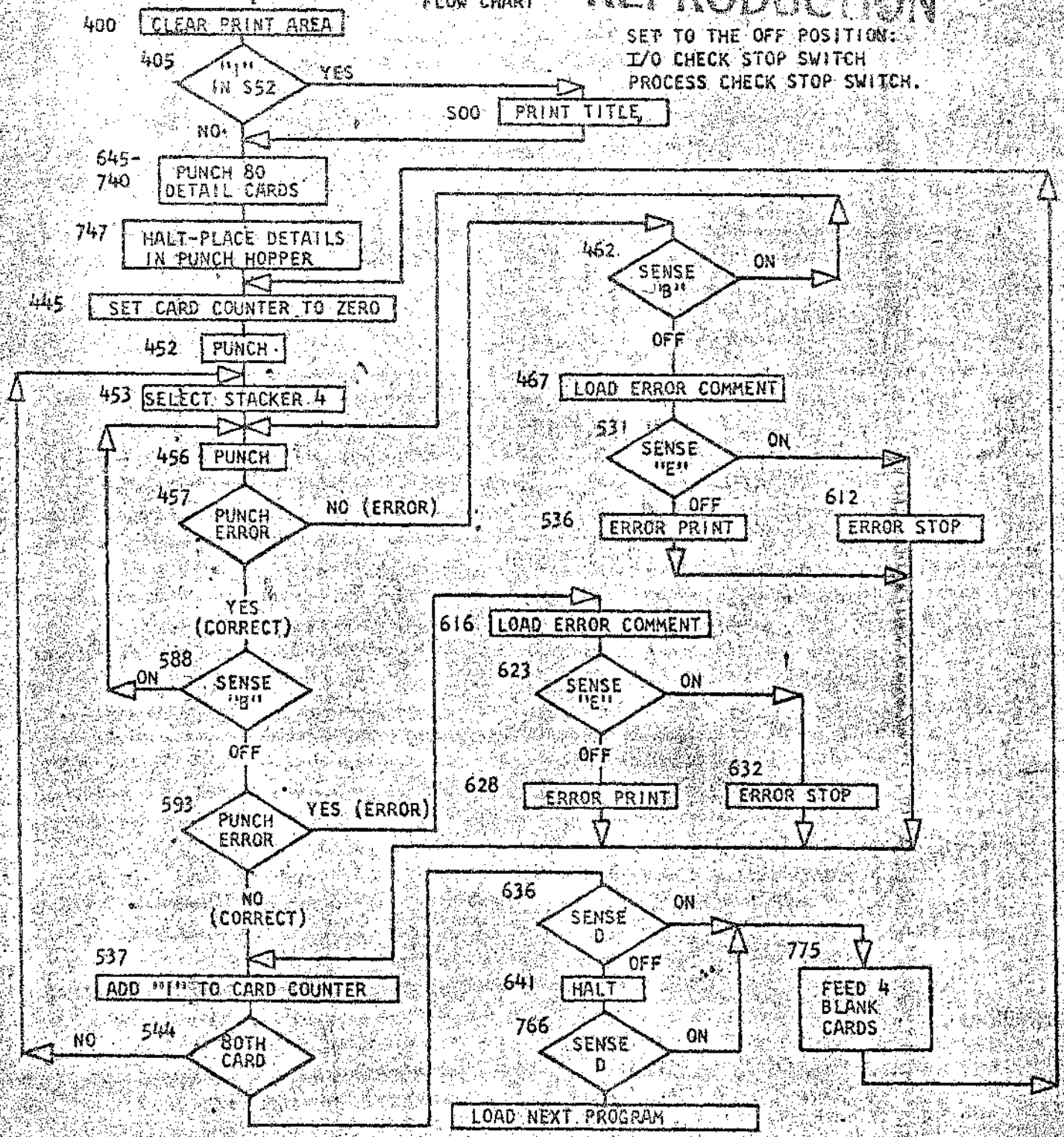
F. PRINTOUTS

ERROR PRINTOUTS ONLY.

DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103780	1116728	TA 1976					

BRANCH ON PUNCH ERROR
FLOW CHART

SET TO THE OFF POSITION:
I/O CHECK STOP SWITCH
PROCESS CHECK STOP SWITCH.



DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103780	1117628	TA 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH ON PUNCH ERROR 9040C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
368	368	X	XX		COUNTER
371	371	0	00		COUNTER RESET
377	377	B	400	S787	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	S88		,,
400	400	/	332		CLEAR PRINT
404	404	/			,,
405	405	B	S00	S521	BR TO TITLE PRINT IF 1 IN 1252
413	413	B	645		
445	445	L	373	370	SET CARD COUNTER TO ZERO
452	452	4			PUNCH
453	453	K	4		SELECT STACKER 4
455	455	N			NOP
456	456	4			PUNCH
457	457	B	588	-	BRANCH IF PUNCH ERROR
462	462	B	456	8	SENSE SWITCH 8 ON TO SCOPE
467	467	L	985	285	LOAD ERR. COMMENT INTO PRT AREA IF NO BR
474	474	B	531		BRANCH
531	531	B	612	E	E ON TO ERROR STOP
536	536	2			ERROR PRINT
537	537	A	537	370	ADD ONE TO CARD COUNTER
544	544	B	636	3698	BRANCH IF BOTH DETAIL CARD
552	552	B	453		IF NOT BRANCH TO PUNCH NEXT CARD
588	588	B	456	8	8 ON TO SCOPE
593	593	B	616	-	BRANCH IF INDICATOR IS NOT RESET
598	598	B	537		BRANCH IF INDICATOR IS RESET
612	612	.	537		ERROR STOP
616	616	L	985	285	LOAD ERR. COMMENT IF INDIC. IS NOT RESET
623	623	B	632	E	E ON TO ERROR STOP
628	628	2	537		ERROR PRINT
632	632	.	537		ERROR STOP
636	636	B	775	D	D ON TO REPEAT
641	641	.	766		,,
645	645	/	380		CLEAR PUNCH AREA
649	649	L	765	688	INITIALIZE INSTRUCTION
656	656	L	757	700	INITIALIZE INSTRUCTION
663	663	,	796	664	*SET WMS IN ALL POSITIONS OF TABLE
670	670	A	670	666	FROM 796 TO 880
677	677	¤	664		,,
681	681	V	694	8801	,,
689	689	B	663		,,
694	694	M	796	101	*MOVE EACH CHARACTER OF TABLE TO
701	701	4			THE PUNCH AREA ONE CHARACTER AT A TIME
702	702	K	8		PUNCH ONE COLUMN AND SELECT INTO

DATE	4-27-61	6-29-63	17.10.63					
ENG CHG NO	1103780	117628	TA 1976					

```
 704  704  .  695  698                 POCKET 8
 711  711  A  711  697                   ,,
 718  718  A  718  700                   ,,
 725  725  .  695  698                   ,,
 732  732  8  747  6968                  ,,
 740  740  /  694  180                   ,,
 747  747  .  445                       HALT TO PUT CARDS INTO PUNCH FEED
 751  751  R  796  101                   CONSTANTS TO INITIALIZE INSTRUCTIONS
 758  758  V  694  8801                  ,,
 766  766  8  775  D                     D ON TO REPEAT
 771  771  B  348                       GO TO NEXT TEST.
 775  775  4                           81ST CARD BLANK
 776  776  4                           82ND CARD BLANK
 777  777  4                           83RD CARD BLANK
 778  778  4                           84TH CARD BLANK
 779  779  B  445                       REPEAT TEST
 796  796  -  012 3456789+-0123456789+-0123456789+-0123456789+-0123456789+-
 857  857  0  123 456789+-0123456       ,,
 902  902  P  ROG RAM DID NOT BRAN      ,,
 922  922  C  H O N PUNCH HOLE COU      ,,
 942  942  N  T C HECK      CARD I      ,,
 962  962  N    ST ACKER FOUR    E      ,,
 982  982  R  ROR                       ,,
1002 #02  P  REV IOUS INTERROGATI      ,,
1022 #22  O  N O ID NOT RESET THE      ,,
1042 #42     PUN CH ERROR INDICAT      ,,
1062 #62  O  R                 E       ,,
1082 #82  R  ROR                       ,,
```

DATE	4-27-61	6-29-63	17.10.63					
ENG. CHG. NO.	1103780	117628	TA 1976					

REPRODUCTION

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,022029,033033N      1001                    BRANCH ON PUNCH ERROR     9040C 0A
,008015,022029,033033N      1001                    SET WORDMARK CARD         9040C 02
L067367,340344,348349,357361I001,008012,001100118361080AB348/340080          9040C 03
L069404,371377,385400,404405I001XXX000   B400S7878588              /332/     9040C 04
L072444,413445,446445,445445I0018S00S5218645                                 9040C 05
L054466,452453,455456,457462I001L3733704K4N4B588M84568                       9040C 06
                                        Z
L072506,474474,474474,474474I001L9852858531                                  9040C 07
L072570,536537,544552,552552I00186I2E2A5373708636369884S3                    9040C 08
L064615¤584584,588593,598612I001    B4568B616MB537          -537             9040C 09
                                        Z
L065648,623628,632636,641645I001L*85285B632E2537.5378775D-766/180            9040C 10
L072688,656663,670677,681689I001L765688L757700,796664A670666¤664V6948801     9040C 11
L068724,694701,702704,711718I0018663 M7961014K8,695698A711697A718700        9040C 12
L065757,732740,747751,758758I001¤6956988747696B/694180-445M796101            9040C 13
L070795,766771,775777,778779I001V6948801B775D83484 448445                    9040C 14
L072835,001001,001001,001001I001-0123456789+-0123456789+-0123456789+-012     9040C 15
L072875¤836836,001001,001001I0013456789+-0123456789+-0123456789+-01234569040C 16
L072915¤876876,902902,902902I001                          PROGRAM DID NO      9040C 17
L072955¤916916,001001,001001I001T BRANCH ON PUNCH HOLE COUNT CHECK           9040C 18
L072995¤956956,001001,001001I001CARD IN STACKER FOUR      ERROR              9040C 19
L072*35¤996996,*02*02,*02*02I001      PREVIOUS INTERROGATION DID NOT RES      9040C 20
L072*75¤*36*36,001001,001001I001ET THE PUNCH ERROR INDICATOR                 9040C 21
L072/15¤*76*76,001001,001001I001      ERROR                                  9040C 22
L053S20,S01S05,S12S13,S17S2I10012,049L0772772/2772645                        9040C 23
/333080N                                                CLEAR WORDMARK CARD  9040C 24
,019027,031,038042803I198GB400L046352BW04BS8B   BRANCH ON PUNCH ERROR        9040C 25
                                        M
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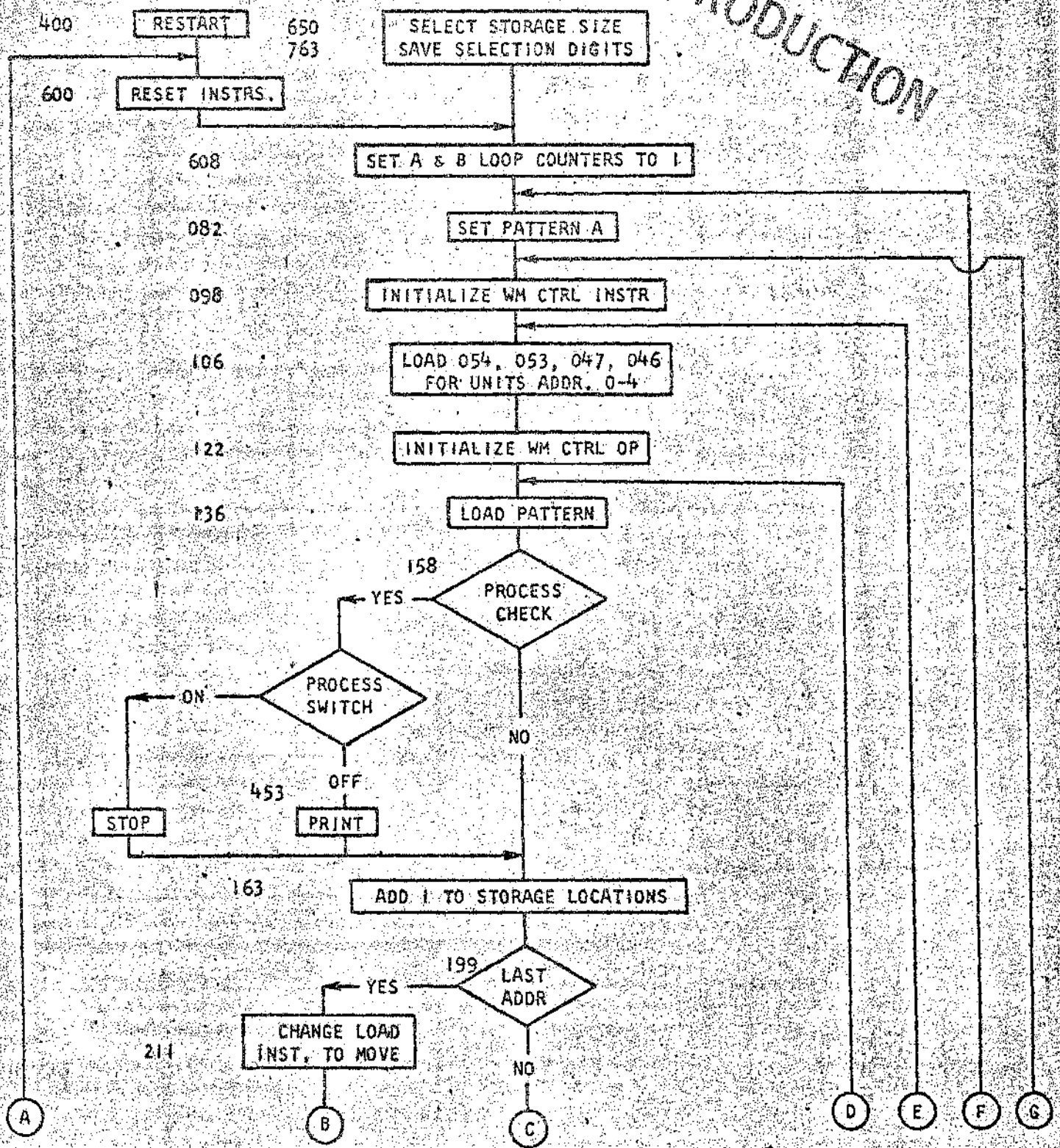
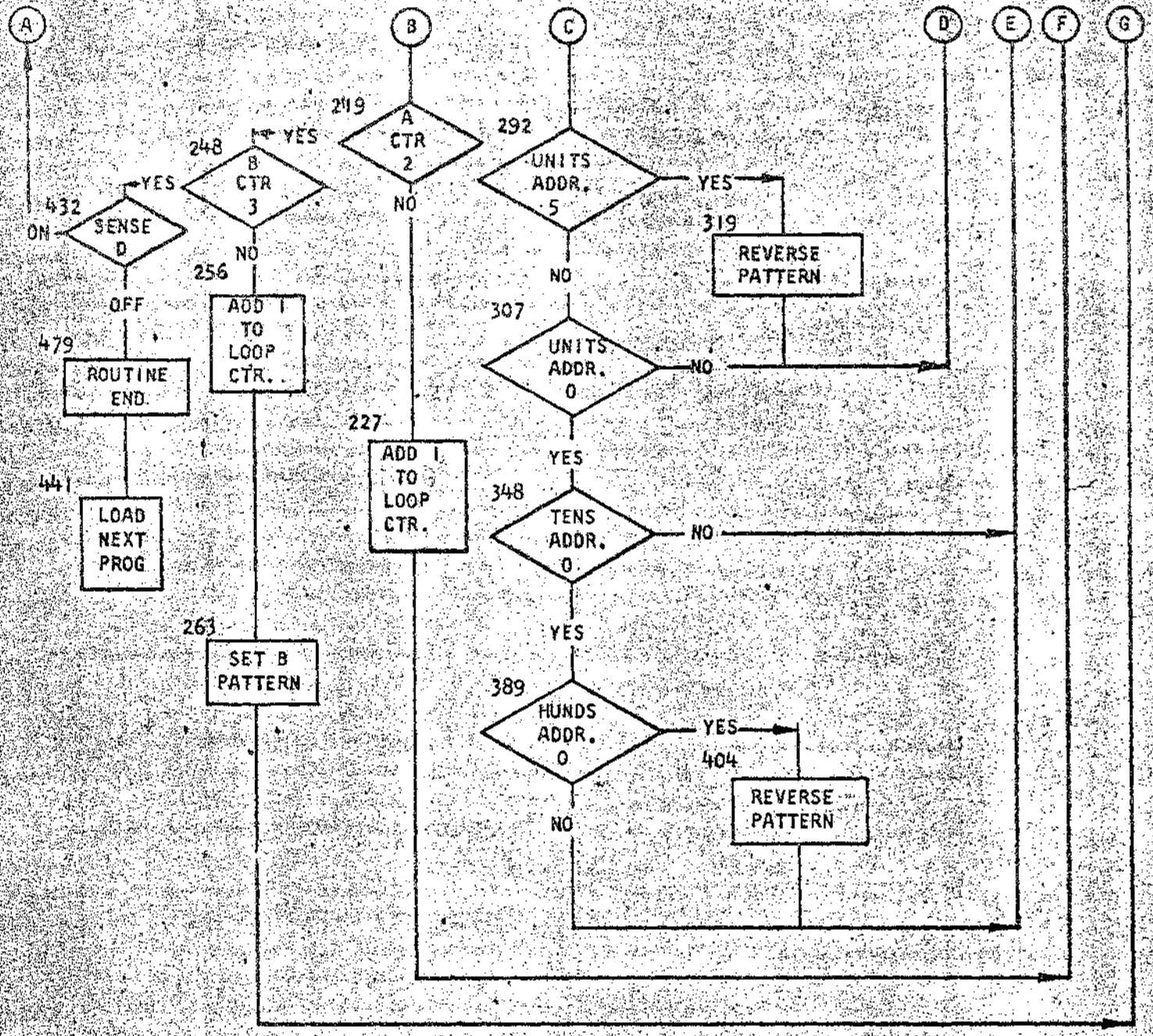
DATE	4-27-61	6-29-63	17.10.63						
ENG. CHG. NO	1103780	117628	TA 1976						



DATE	2-2-61	3-18-63	5-2-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378	116745	117635	117628	TA 1976			

MISSING PP 1 AND 2.



DATE	2-2-61	3-18-63	5-2-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378	116745	117635	117628	TA 1976			

PROGRAM LISTING FOR USE WITH FLOW CHART

STORAGE WORST PATTERN 9100F

INSTRUCTION ADDRESS		OP	A	B	REMARKS
046	046	,			WM PATTERN CHAR. - PROGRAM STORED
047	047	¤			WM PATTERN CHAR. - PROGRAM STORED
048	048	,			, FOR PATTERN A - ¤ FOR PATTERN B
049	049	¤			¤ FOR PATTERN A - , FOR PATTERN B
050	050	X			WM PATTERN INVERSION WORKING AREA
051	051	X			UNITS ADDR. - PROGRAM STORED
052	052	X			TENS ADDR. - PROGRAM STORED
053	053	W			PATTERN CHARACTER - PROGRAM STORED
054	054	R			PATTERN CHARACTER - PROGRAM STORED
055	055	W			W FOR PATTERN A - R FOR PATTERN B
056	056	R			R FOR PATTERN A - W FOR PATTERN B
057	057	X			PATTERN INVERSION WORKING AREA
082	082	L	476	056	SET R IN 056 FOR PATT A
089	089	L			SET W IN 055 FOR PATT A
090	090	L	478	049	SET ¤ IN 049 FOR PATT A
097	097	L			SET , IN 048 FOR PATT A
098	098	L	649	157	INITIALIZE WM INSTRUCTION
105	105	L			,,
106	106	L	056	054	LOAD 054 FOR UNITS ADDR 0-4
113	113	L			LOAD 053 FOR UNITS ADDR 0-4
114	114	L	049	047	LOAD 047 FOR UNITS ADDR 0-4
121	121	L			LOAD 046 FOR UNITS ADDR 0-4
122	122	M	048	150	INITIALIZE WM CTRL INSTR. 0-4
129	129	M	049	154	,,
136	136	L	053	650	LOAD PATTERN
143	143	M	054	650	,,
150	150	,	650		,,
154	154	¤	650		,,
158	158	B	453	%	PROCESS ERROR
163	163	,	140		MODIFY ADDRESSES
167	167	A	452	142	,,
174	174	M	142	149	,,
181	181	M	142	153	,,
188	188	M	142	157	,,
195	195	¤	140		,,
199	199	C	142	471	END ADDRESS
206	206	B	292	/	,,
211	211	L	634	149	CHANGE LOAD INSTRUCTION TO MOVE
218	218	L			,,
219	219	B	248	4722	IS LOOP 2 FOR PATT A COMPL
227	227	A	452	472	ADD 1 TO LOOP COUNT
234	234	B	082		RUN LOOP 2 OF PATTERN
241	241	X	XX		ERROR LOCATION FOR PRINT
248	248	B	432	4733	IS PATTERN B COMPLETE
256	256	A	452	473	ADD 1 TO B LOOP COUNT

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```
263 263 M 475 056          SET PATTERN B IN WORKING STORAGE
270 270 M 476                ,,
274 274 M 477 049            ,,
281 281 M 478                ,,
285 285 B 098              RUN PATTERN B.
292 292 D 142 051          MOVE UNITS ADDR. TO 051
299 299 B 319 0515         IS UNITS ADDR. 5
307 307 B 348 0510         IS UNITS ADDR 0
315 315 B 136              CONTINUE TO LOAD PATTERN
319 319 M 055 054          INVERT PATTERN
326 326 M 056                ,,
330 330 M 049 150            ,,
337 337 M 048 154            ,,
344 344 B 136              CONTINUE TO LOAD PATTERN
348 348 B 389 1410         IS TENS ADDR 0
356 356 B 106              RETURN TO PATTERN FOR UNITS ADDR. 0-4
360 360 B 404 0520         IS HUNDS. ADDR. 0
368 368 B 106              RETURN TO PATTERN FOR UNITS ADDR. 0-4
377 377 B 912 S651         RUN THIS TEST FROM TAPE
385 385 B +16              BRANCH TO BYPASS TEST FROM TAPE
389 389 D 140 052          SET HUND ADDR IN 052
396 396 B 360              BR TO TEST HUND ADDR
400 400 B 600              RESTART  8600 PRG LOADED
404 404 L 856 057          INVERT BASIC PATTERN
411 411 L                    ,,
412 412 L 057                ,,
416 416 L 049 050          INVERT BASIC WM PATTERN
423 423 L                    ,,
424 424 L 050                ,,
428 428 B 106              RETURN TO PATTERN FOR UNITS ADDR. 0-4
432 432 B 600 0            REPEAT TEST                          SS
437 437 B 479              *BR. TO PREPARE FOR LOADING NEXT PRG.
441 441 / 080              CLEAR READ AREA
445 445 , 001              SET WORD MARK IN LOCATION 001
449 449 1 001              READ NEXT TEST
453 453 M 142 243          SET ERROR ADDRESS IN PRINT AREA
460 460 2 163              PRINT
464 464                    WORD MARK
469 469 U 00               END ADDR. PLUS 1
472 472 X                  A LOOP COUNTER
473 473 X                  B LOOP COUNTER
474 474 #                  MODIFY INSTR FOR 8-16K STORAGE
475 475 W                  PATTERN CHARACTER
476 476 R                  PATTERN CHARACTER
477 477 ,                  WM CONTROL
478 478 ¤                  WM CONTROL
479 479 L 599 S99          *SAVE SEL DIG  L599F99 FOR TAPE
486 486 L                  MOVE TAPE READ  RECORD GROUP
487 487 L                    ,,
488 488 L                    ,,
489 489 L                    ,,
```

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```
490  490  L                          ,,
491  491  L                          ,,
492  492  L                          ,,
493  493  L                          ,,
494  494  L                          ,,
495  495  L                          ,,
496  496  L                          ,,
497  497  B  441          *BR TO F20 IF FROM TAPE
520  520  L  %U1  001R    RESTORE READ TAPE -READ TAPE INST
528  528  B  F58  L       BR IF TAPE READ ERROR
533  533  L  G99  S50     RESTORE GM
540  540  ,  T98  S50     SET WMS
547  547  L  F99  S81     RESTORE SEL DIG AFTER TAPE READ
554  554  B  T00          BR TO TAPE READ INST
558  558  U  %U1  B       BACKSPACE
563  563  B  F20          BR TO RESTORE TAPE READ INST
600  600  L  634  149     RESET LOAD PATTERN INSTRUCTION
607  607  L                          ,,
608  608  M  449  473     SET B COUNTER TO 1
615  615  M               SET A COUNTER TO 1
616  616  B  082          BRANCH TO SET PATTERN A
621  621  M  053  650     INSTRUCTION CONSTANT
628  628  M  054  650                ,,
642  642  .  650                     ,,
646  646  ¤  650                     ,,
650  650  B  694  S516    TEST FOR 16K
658  658  @  705  S512    TEST FOR 12K
666  666  B  716  S518    TEST FOR 8K
674  674  B  727  S514    TEST FOR 4K
682  682  B  738  S511    TEST FOR 2K
690  690  B  763          BR. TO SAVE SELECTION DIGITS
694  694  M  787  471     SET PROGRAM FOR 16K
701  701  B  756          BRANCH TO SET ADDRESS MODIFY
705  705  M  790  471     SET FOR 12K
712  712  B  756          BRANCH TO SET ADDRESS MODIFY
716  716  M  793  471     SET FOR 8K
723  723  B  756          BRANCH TO SET ADDRESS MODIFY
727  727  M  796  471     SET FOR 4K
734  734  B  763          BR. TO SAVE SELECTION DIGITS
738  738  M  799  471     SET FOR 2K
745  745  B  763          BR. TO SAVE SELECTION DIGITS
756  756  M  474  167     CHANGE INSTR. TO # FOR 8-16K STORAGE
763  763  ,  S51          SAVE SELECTION DIGITS
767  767  ¤  S73                     ,,
771  771  L  S99  599                ,,
778  778  B  608          BR TO START TEST
785  785  0  000  0+00-000-00  CONSTANT
800  800  .  437          1.4-2K TEST DONE CONSTANT TO BE LOADED
804  804  .  650          STOP TO ENTER STORAGE SIZE
822  822  ¤  081  S50     CLEAR WMS
829  829  L  %U1  001W    WRITE TAPE
```

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```
 837  837  B 873 L          BR IF ERROR
 842  842  B E30 K          BR IF EOR
 847  847  ¤ R99           CLEAR WM
 851  851  L %U1 001W       WRITE TAPE
 859  859  B 887 L          BR IF TAPE ERROR
 864  864  B E30 K          BR IF EOR
 869  869  B D53            BR TO TAPE WRITE ROUTINE
 873  873  U %U1 B          BACKSPACE
 878  878  U %U1 E          ERASE
 883  883  B 829            BR TO REWRITE
 887  887  U %U1 B          BACK SPACE
 892  892  U %U1 E          ERASE
 897  897  B 851            BR TO REWRITE
 905  905  L 599 F99        SAVE SEL DIG IF RUN FROM TAPE
 912  912  L 930 355        RESTORE INSTRUCTION IN 348
 919  919  B 931            BRANCH TO TEST FOR 1.4 OR 2K
 923  923  B 389 1410       CONSTANT TO BE LOADED
 931  931  B 951 S51        SELECT 1.4
 939  939  B 951 S511       OR 2K ROUTINE, FROM TAPE
 947  947  B 650            START TEST 4K OR MORE
 951  951  M 803 440        1.4-2K TEST CHANGE 437 TO STOP END TEST
 958  958  B 650            1.4-2K START TEST
 962  962  C X03 ¢99        COMPARE INST
 969  969  L 911 485        LOAD SAVE SEL DIG INST
 976  976  L /10 777        LOAD SAVE SEL DIG INST
 983  983  L S66 500        LOAD BR INST IF RUN FROM TAPE
 990  990  B 822 /          TEST FOR UNEQUAL
 995  995  L /03 388        LOAD ALTERED BR INST - 5300 TEST
1002  ¢02  L /03 557        ,,
1009  ¢09  L /17 539        LOAD ALTERED GM INST - 5300 TEST
1016  ¢16  ¤ 081 S50        CLEAR WMS
1023  ¢23  L %U1 001W       WRITE 9100 TEST
1031  ¢31  B ¢62 L          BR IF TAPE ERROR
1036  ¢36  B 087 K          BR IF TAPE EOR
1041  ¢41  L %U1 001W       WRITE READ TAPE ROUTINE
1049  ¢49  B ¢76 L          BR IF TAPE ERROR
1054  ¢54  B 087 K          BR IF TAPE EOR
1059  ¢59  B V46            BR TO TAPE WRITE ROUTINE
1063  ¢63  U %U1 B          BACKSPACE
1068  ¢68  U %U1 E          ERASE
1073  ¢73  B ¢22            BR TO TAPE WRITE INST
1077  ¢77  U %U1 B          BACKSPACE
1082  ¢82  U %U1 E          ERASE
1087  ¢87  B ¢40            BR TO TAPE WRITE INST
1097  ¢97  T 65             COMPARE FIELD
1100  /00  B S88            LOAD ALTERED BR INST - 5300 TEST
1104  /04  L S81 599        SAVE SEL DIG INST
1111  /11  L 598 S50        LOAD ALTERED GM INST
1150  /50  C X03 ¢99        LOAD COMPARE INST
1157  /57  B 012 /          LOAD BR IF UNEQUAL
1162  /62  1 001            LOAD CARD READ INST
```

DATE	2-2-61	3-18-63	5-2-63	6-29-63	17.10.63			
ENG. CHG. NO.	110378	116745	117635	117628	TA 1976			

```
 016  016                                SET WMS
,808+97N    ,+90/661001                 SET WMS                                    9100F208
N       B/50L027S881001U%U1R            INST LOADED IF 1T01 WRITE ROUTINE          9100F209
N       B/50L023S891001N /              ,,                                         9100F210
N       B/50L026S931001BT00             ,,                                         9100F211
N       B/50L026T031001/081             ,,                                         9100F212
N       B/50L030T111001L%U1001R         ,,                                         9100F213
N       B/50L029T181001LT95352          ,,                                         9100F214
N       B/50L029T251001LT94388          ,,                                         9100F215
N       B/50L027T301001BS84K            ,,                                         9100F216
N       B/50L027T351001BT86L            ,,                                         9100F217
N       B/50L030T431001BTD0080A         ,,                                         9100F218
N       B/50L030T511001VT560742         ,,                                         9100F219
N       B/50L026T551001BT00             ,,                                         9100F220
N       B/50L029T621001C076S76          ,,                                         9100F221
N       B/50L027T671001BT77F            ,,                                         9100F222
N       B/50L027T721001B377/            ,,                                         9100F223
N       B/50L026T761001BT00             ,,                                         9100F224
N       B/50L027T811001BT00/            ,,                                         9100F225
N       B/50L026T851001B377             ,,                                         9100F226
N       B/50L027T901001U%U18            ,,                                         9100F227
N       B/50L026T941001BT00             ,,                                         9100F228
,031019N   N      N    B962T98 BB04     SET WM                                     9100F229
```

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ENG. CHG. NO.	110378	116745	117635	117628	TA 1976			

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8	
WS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0		
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK	7	8		
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8	
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8					

```
,008015,022029,033033N        1001                    STORAGE WORST PATTERN     9100F 0A
,008015,022029,033033N        1001                    SET WORDMARK CARD         9100F 02
L063112,089090,097098,105106100IL476056LL478049LL649157LL056054                 9100F 03
L069149,113114,121122,129136100IL1049047LM048150M049154L053650M054650           9100F 04
L070187,143150,154158,163167100I,650¤650B453%,140A452142M142149M142153          9100F 05
L071226,174181,188195,199206100IM142157¤140C142471B292/L634149L82484722         9100F 06
L068262,211218,219227,234241100IA45247280B2   XXX     84324733A452473           9100F 07
L068298,248256,263270,274281100IM475056M476M477049M4788098    D142051          9100F 08
L040306,285292,299307,307307100I631905I5                                        9100F 09
L069343,315319,326330,337344100IB34805I0B136M055054M056M049150M048154           9100F 10
L065376,348356,360368,377377100IB1368389141OB106B40405208106                    9100F 11
L059403,377385,389396,400404100I8912S651BP16D140052836OB600                     9100F 12
L068403,377385,389396,400404100I8106     8912S651BP16D140052836OB600            9100F 13
                                                        Z
L060431,411412,416423,424428100IL056057LL057L049050LL050B106                    9100F 14
L064463,437441,445449,453460100I8600DB479/080,0011001M1422432163                9100F 15
L045476,469472,473474,475476100I     U00XX#WR                                   9100F 16
L045489,478479,486487,488489100I,¤L599S99LLLL                                   9100F 17
L039496,491492,493494,495496100ILLLLLLL                                         9100F 18
L068532,520528,533533,535533100I8441                          L%U100IRBF58L     9100F 19
L072572,540547,554558,563563100ILC99S50,T98S50LF99S81BT00U%U18BF20              9100F 20
L067607¤573573,600607,608608100I                                  L634149L      9100F 21
L070645,615616,621628,642646100IN449473MB082 M053650M054650          ,650       9100F 22
L068681,650658,666674,682682100I¤650B694S5168705S5128716S518B727S514            9100F 23
L066715,690694,701705,712716100IB738S511B763M787471B756M790471B756             9100F 24
L072755,723727,734738,745756100IM793471B756M796471B763M799471B763              9100F 25
L072795,763767,771778,785785100IM474167,S51¤S73LS995998608   00000P00M009100F 26
                                                              Z  Z
L065828¤796796,800804,808822100I0M00.437.650          ¤081S50                   9100F 27
                                                Z
L072868,837842,847851,859864100IL%U100IWB873L8E30K¤R99L%U100IW8887LBE30K9100F 28
L068904,873878,883887,892897100I8DS3U%U1BU%U1EB829U%U18U%U1EB85I                9100F 29
L066938,912919,925931,939939100IL599F99L930355B931B3891410895I$51               9100F 30
L069975,947951,958962,969976100IB951S511B650M803440B650CX03*99L911485           9100F 31
L072*15,983990,995*02,*09*16100IL/10777L5665008822/L/03388L/03557L/175399100F 32
L070*53,*23*31,*36*41,*49*54100I¤081S50L%U100IW8*62LB087KL%U100IW8*76L          9100F 33
L065*86,*59*63,*68*73,*77*82100I8087K8V46U%U1BU%U1EB*22U%U18U%U1E               9100F 34
L072/26,*90*97,/00/04,/11/1100I8*40      T65BS88LS81599LT98S50                  9100F 35
L071/65¤/27/27,/50/57,/62/661001                          CX03*998012/1001       9100F 36
¤022029,0230191001                                                              9100F 37
,012012¤015¤0330331001                                                          9100F 38
,808*97N   ,*90/661001          SET WMS                                         9100F 39
N     8/50L027S881001U%U1R      INST LOADED IF 1T01 WRITE ROUTINE               9100F 40
N     8/50L023S891001N          ,,                                              9100F 41
N     8/50L026S931001BT00       ,,                                              9100F 42
```

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IBM FORM 624-7113-0

1401 DATA PROCESSING SYSTEM

DIAGNOSTIC FUNCTION TEST

PART NO. 451448
SHEET 11 OF 11
BLOCK NO. 9100F


```
N      B/50L026T031001/G 1           ..                                          9100F 43
N      B/50L030T111001L%.1001R       ..                                          9100F 44
N      B/50L029T181001LT95352        ..                                          9100F 45
N      B/50L029T251001LT94388        ..                                          9100F 46
N      B/50L027T301001BS84K          ..                                          9100F 47
N      B/50L027T351001BT86L          ..                                          9100F 48
N      B/50L030T431001BT00080A       ..                                          9100F 49
N      B/50L030T511001WT560742       ..                                          9100F 50
N      B/50L026T551001BT00           ..                                          9100F 51
N      B/50L029T621001C076S76        ..                                          9100F 52
N      B/50L027T671001BT77F          ..                                          9100F 53
N      B/50L027T721001B377/          ..                                          9100F 54
N      B/50L026T761001BT00           ..                                          9100F 55
N      B/50L027T811001BT00/          ..                                          9100F 56
N      B/50L026T851001B377           ..                                          9100F 57
N      B/50L027T901001I %U18         ..                                          9100F 58
N      B/50L026T941001BT00           ..                                          9100F 59
.031019N    N     N    B962T98G8804     SET WM                                   9100F 60
              M025351 .= 16K .M
.008015.022029.033033N     T001                    SET WM CARD                   9100F 61
L061649.628642,646646N     1001M05300‡M05400‡            .00‡¤00‡ 4K START       9100F 62
L046149.143143,143143N     B650L05300‡M05400‡                     4K START       9100F 63
L061649.628642,646646N     1001M05300MM05400M            .00M¤00M 8K START       9100F 64
                                     Z       Z              Z    Z
L046149.143143.143143N     B650L05300MM05400M                     8K START       9100F 65
                                     Z       Z
L061649.628642.646646N     1001M05300PM05400P            .00P¤00P 12K START      9100F 66
                                     Z       Z              Z    Z
L046149.143143.143143N     B650L05300PM05400P                     12K START      9100F 67
                                     Z       Z
```

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ENG. CHG. NO.	110378	116745	117635	117628	TA 1976			

STORAGE LISTING ROUTINES

THIS BLOCK OF CARDS CONSISTS OF THE THREE FOLLOWING ROUTINES. THREE ROUTINES ARE PROVIDED SO THAT THE CE MAY SELECT THE PARTICULAR ROUTINE OR ROUTINES THAT IS BEST FOR THE GIVEN SITUATION.

I. 1401 STORAGE LISTER.

THIS PROGRAM USES THE PRINT AND CARD READ AREAS ONLY. THEREFORE, MOST PROGRAMS MAY BE RE-STARTED WITHOUT RE-LOADING THE ORIGINAL PROGRAM. THIS PROGRAM LISTS THE SENSE SWITCH SETTINGS AND ALL OF STORAGE EXCEPT 000 THROUGH 080. THIS PROGRAM IS PUNCHED IN THE FIRST 10 CARDS.

II. DIAGNOSTIC DUMP.

THIS PROGRAM LISTS THE SENSE SWITCH SETTINGS AND ALL OF STORAGE EXCEPT 000 THROUGH 080. BLANK AREAS ARE NOT PRINTED. ALPHAMERIC NOTATIONS LOCATED ABOVE 996 ARE INTERPRETED. THE ORIGINAL PROGRAM MUST BE RE-LOADED IF DATA IS CONTAINED BELOW LOCATION 997. THIS PROGRAM IS PUNCHED IN THE NEXT 52 CARDS.

III. DIAGNOSTIC DUMP JUNIOR.

THIS PROGRAM LISTS THE SENSE SWITCH SETTINGS AND STORAGE LOCATIONS 001 THROUGH 3143. BLANK AREAS ARE NOT PRINTED. ALPHAMERIC NOTATIONS IN LOCATIONS 333 THROUGH 3143 ARE INTERPRETED. THE ORIGINAL PROGRAM MUST BE RE-LOADED IF DATA IS CONTAINED IN THE READ-IN AREA, PRINT AREA OR LOCATIONS 3144 THROUGH 3994. THIS PROGRAM IS PUNCHED IN THE LAST 40 CARDS.

NOTE:

THE DIAGNOSTIC DUMPS SHOULD BE VALUABLE IN PROVIDING THE CE WITH AN UP TO DATE PROGRAM LISTING OF ANY CUSTOMERS PROGRAM. THE LISTING ALSO PROVIDES A CROSS REFERENCE BETWEEN THE ALPHAMERIC AND THE NUMERIC NOTATIONS.

DETAILED INFORMATION CONCERNING THE THREE ROUTINES FOLLOWS.

DATE	3-17-63	10.5.63						
ENG. CHG. NO.	116745	TA-1844						

1401 STORAGE LISTER

PURPOSE

TO PRINT OUT THE SENSE SWITCH SETTINGS AND THE CONTENTS OF CORE STORAGE IN A LISTING. THE LEAST POSSIBLE STORAGE IS USED SO THAT MOST PROGRAMS LISTED MAY BE RESTARTED AND RUN WITHOUT RELOADING.

LOADING PROCEDURE AND PROGRAM CONTROL

PLACE THE IO CARD DECK IN THE READER HOPPER. DEPRESS THE START RESET AND THE CARD LOAD BUTTONS. AT THE PROGRAM STOP IN CARD 7, LOCATION 033, A WORD MARK MUST BE ENTERED IN LOCATION 260 IF ADDRESS MODIFY FOR ADDRESSES ABOVE 4K IS TO BE USED. FORMS CONTROL MAY BE ELIMINATED BY ENTERING A NO OP AT LOCATION 275 RESTART IS ACCOMPLISHED BY DEPRESSING THE START BUTTON. THE START BUTTON WILL HAVE TO BE DEPRESSED ONE MORE TIME TO READ THE LAST TWO CARDS. AFTER THE LAST CARD IS READ THE LISTING BEGINS. LISTING WILL CONTINUE UNTIL AN INVALID ADDRESS IS ENCOUNTERED IN SCANNING.

TEST PROCEDURE

THE PRINT AREA AND ITS WORD MARKS ARE RECORDED ON THE FIRST TWO LINES. THE THIRD LINE PRINTS THE PRINT AREA COMMENT -PRT.AR-. THE FOURTH LINE RECORDS WHICH SENSE SWITCHES ARE ON AND THE COMMENT -SEN.SW ON-. AS THE LAST CARD IS READ THE LISTING BEGINS WITH LOCATION 001 AND SCANS MEMORY. EACH TIME A WORD MARK POSITION IS FOUND, A LINE IS PRINTED WITH THE ADDRESS OF THE WORD MARK IN THE LEFT HAND COLUMN AND UP TO FIFTY CHARACTERS. IF MORE THAN FIFTY POSITIONS ARE SCANNED WITHOUT FINDING ANOTHER WORD MARK, A PRINT WILL OCCUR AND A NEW LINE WITH AN ADDRESS AND A NO WORD MARK - NOWM- COMMENT WILL BE STARTED. NOTE: IN LOCATIONS 001 - 080 AND LOCATIONS 200 - 332, THE INFORMATION LISTED IS THIS LISTING PROGRAM RATHER THAN THE INFORMATION PREVIOUSLY STORED IN THESE LOCATIONS. LOCATIONS OF THE LISTED PROGRAM WHICH ARE NOT PRINTED OUT ARE:

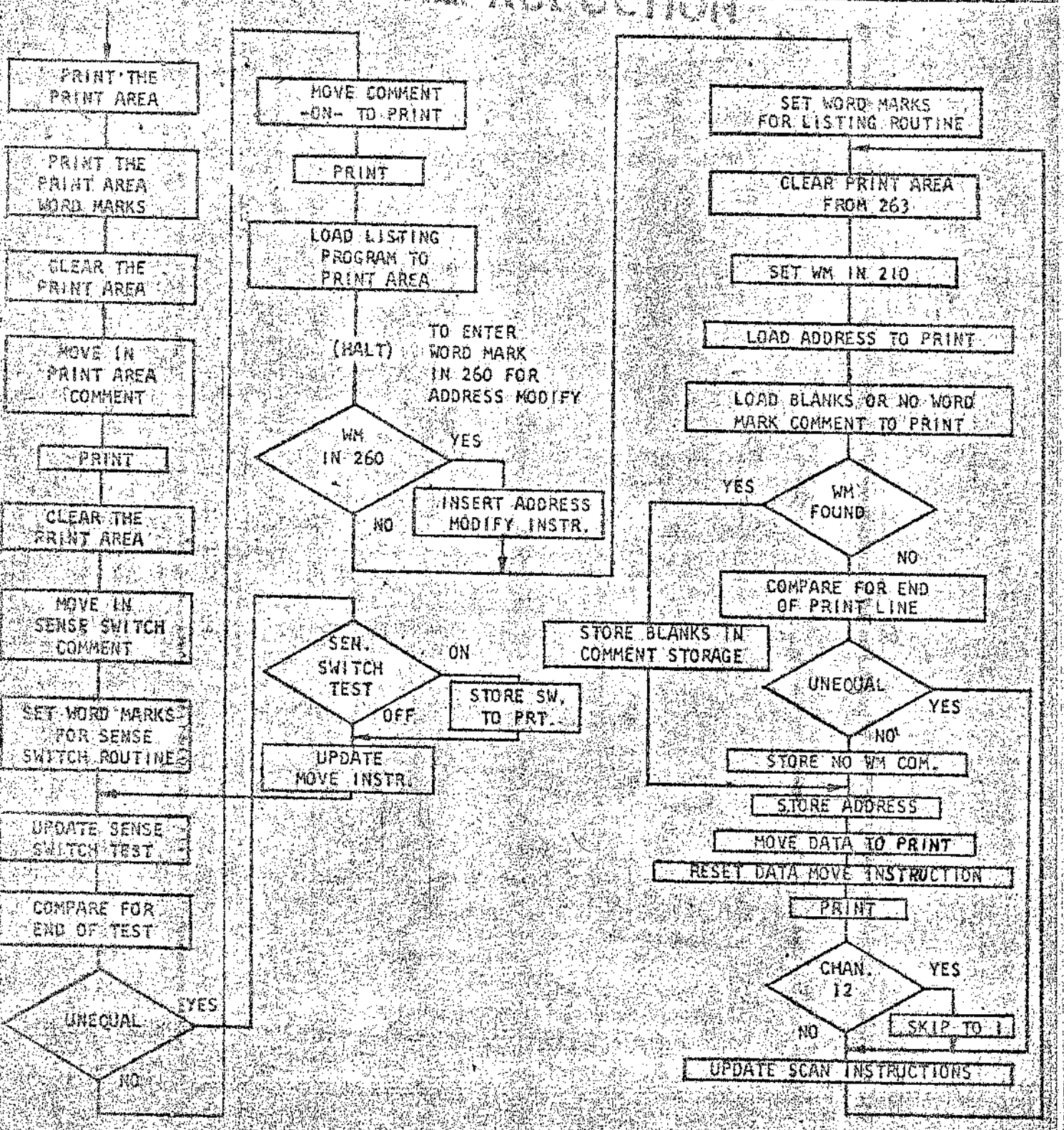
1. 000 - 080
2. THE INFORMATION FOUND IN THE LAST SCAN I.E. THE SCAN IN WHICH THE PROGRAM FOUND THE STORAGE ADDRESS ERROR. TO PRINT THIS LINE OUT, RESTART IN LOCATION 264.

STOPS

INSTR ADDR.	STORAGE ADDR REG	
033	034	STOP TO PUT A WORD MARK IN LOCATION 260 IF IT IS DESIRED TO USE ADDRESS MODIFY INSTRUCTIONS TO ENABLE LISTING MEMORY ABOVE 4K.

DATE	3-17-63	10.5.63						
ENG. CHG. NO.	116745	TA-1844						

DIAGNOSTIC FUNCTION TEST



DATE	3-17-63	10.5.63						
E. ENG. NO.	116745	TA-1844						

1401 DATA PROCESSING SYSTEM

FORM 224-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451970
SHEET 4 OF 13
BLOCK NO. 9200A

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,008015,070074B07L           1401 STORAGE LISTER                    1001     0A
,008015,022029,036043,044046,051058,07005022□/332/M079206,0650662/2061001PRT.AR2
M079206,075076,211213,215217,219221□044046,020024N□022043,040047N□0501001SEN.SH3
2074028C028076B024/B051804OA075046B001M028211B029,208208M0782092□0241001I2HON 4
□040047□020051,022033□036036B058M263075B04IF1,018049,052AL057288N□0581001     5
□065066□070074□075076M0763321001328020A328051A328054□018049□0528001HOWM15909   6
,059057,053046,042034,271275,277.V0462601001L0793081001  #323020#323051#323054 7
,080062□046053□057059,041048,055N□042015,063068,072076,013014,B068□008,00510018
□033,284288NNB022    ,2953028034 ,309316,320324,328329,331331NB068□1001        9
/263LB0210MMV2640021C0543308277/M327075M020078M001210M3320542B275□B277      001
```

DATE	8-17-65	10-5-63						
ENG. CHG. NO.	11675	TA-1844						

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8
WS-WORD SEPARATOR		0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK	7	8	
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,0080121001                                          DIAGNOSTIC DUMP JR.                    0A
,0080 12,016,023,030034,041048,049,056063,022072,,074076,080067¤023,02922¤N01012N
.....210 /300N0000NL010210L¤048A077010806730000A077028N000000B022¤0292N0FJ1012
M080067B034,017N/300/V0013001,300L3012018067036 4A076037A076040B034/30022¤N01012N
.....310 /299N,029NL010210L¤048A077010806724 00A077028N002332B022¤0292N0FJ1017
M080067B034      /332NV0011001,100L101201B0670383A076037A076040B034¤1002N0N01012N
          8067                                                  ¤300N2¤N01012
.....110 /300N,029NL010210LN000A077010806730000A077028N000000B022¤0292N0FJ1017N
                 /300/N0000000,080L081281B0670383A076037A076040B034N00022¤N01030
....+...1....2....3....                ,048¤008012¤022017¤L020300,0230161049                07
SENSE SWS   ON                  OFF                          L014214L03223 4¤074¤067N,0111011
2          B034BM080236A0010228049M080216A0010400A076015A076080B076080HNB0111016B
                ¤063063,032032FTN0/041040,001008N,015022B071                    2N0001001
¤048056¤071072,029033/029299 001                                                        14
¤041049¤076000/029300        1001                                                       15
L069A80,A51A56,A63A67,A74001 1001AI58155CI611 55BA67/,A63,C27C30MI55801                 16
L069B17,A88A95,B03811,001001 1001MI55809MI55C29VB180001BA44000 MI22206                 17
L072857,B25B32,B36843,B50001 1001MI64C32MI55210¤333AI58155MI55BS6VC150001              18
L067092,B65870,B74882,B89001 1001CI55161BB74/BC1 BC13C319AI58C32MI55                   19
L065C25,C00C05,C09C13,C15C22 1001CI67C32B836/,3338836FS¤C27C30,215                     20
L068C61,C33041,C45C52,C53C54 1001M000000VF243331,2550210259ODVF42208S                  21
L072001,C70C70,C86C94,001001 1001VF53208KVF64208BVF75210SVF86210KVF972108              22
L068037,D090 6,D23D30,001001 1001,263277,265271M215263M222277BG08217                   23
L065D70,D46054,D61D62,D63001 1001814221628I42216@0218269DDVG19216S                     24
L072E10,D79087,095E03,001001 1001VG30216KVG41216BVG52218SVG63218KVG74218B              25
L072E50,E19E27,E35E43,E50001 1001VG85217SVH03217KVH14217B8H25220 B2212750              26
L065E83,E52E60,E68E76,001001 1001DVH36219SVH47219KVH58219BVH69221S                     27
L072F23,E92F00,F08F16,001001 1001VH80221KVH91221BVI02220SVI20220KVI31220B              28
L068F59,F25F30,F37F42,F49F53 10012BF37@/A51299FF301A1742578C78A176257                  29
L069F96,F66F71,F79F82,F86F93 10018C78AI78257BC78AI80257B002AI82257BD02                 30
L072G36,G04G08,G15G19,G26G30 1001AI84257B002M216265BF24AI742678D87AI76267              31
L069G73,G41G48,G52G59,G63G70 10010BD87AI78267BD87AI80267BE11AI82267BE11                32
L072H13,G81G85,G92G99,H03H10 1001AI84266BE11DI73292M194290BE35DI75292BG92              33
L072H53,H21H25,H32H36,H43H47 1001DI77296BG92M219271BF24AI742738E76AI76273              34
L069H90,H58H65,H69H76,H80H87 10018E76AI78273BE76AI80273BF00AI82275BF00                 35
L072I30,H98I02,I09I16,I20I27 1001AI84272BF00DI73296MI94290BF24DI75296BI09              36
L069I61,I58I42,I49I53,I56I59 1001DI77296BI09M218267BE35301001A43                       37
L051180,I65I66,I73I75,I77I79 10012152 3NO WM10203040                                   38
L046194,183185,001001,001001 10018012INDEX REG.                                        39
BASI                                                                                   40
```

DATE	1-17-63	10.5.63							
ENG. NO.	116705	TA-1844							

DIAGNOSTIC DUMP 9200A

PURPOSE.

1. LIST STORAGE CONTENTS
2. INTERPRET THE ALPHAMERIC NOTATIONS.
3. LIST THE SENSE SWITCH SETTINGS.

LOADING PROCEDURES.

THE PROGRAM CAN ONLY BE LOADED FROM CARDS.
USE NORMAL CARD LOADING PROCEDURE.
THE PROGRAM MAY BE USED ON ANY 1401 SYSTEM. FOR SYSTEMS SMALLER THAN 4K, FOLLOW THE INSTRUCTIONS FOR THE 4K SYSTEM. THE 1.4 AND 2K SYSTEMS WILL STOP WITH A STORAGE ADDRESS ERROR, RATHER THAN A PROGRAM STOP.

PROGRAM CONTROL.

LOCATION 196 ENTER A 9 IF 4K OR LESS.
ENTER A Z IF 8K.
ENTER A R IF 12K
ENTER AN I IF 16K.
AT THE INITIAL PROGRAM STOP.

TEST PROCEDURE.

THE DIAGNOSTIC DUMP PRINTS ALL INFORMATION THAT IS IN STORAGE, EXCEPT LOCATIONS 000 THRU 080. THIS IS ACHIEVED BY PRINTING THE CONTENTS OF THE PRINT, PUNCH AND INDEX REGISTER AREAS FIRST. THE PROGRAMING TO DO THIS IS LOCATED WHOLLY IN THE READ-IN AREA. THEN PROGRAMING IS STORED IN LOCATIONS 001 THRU 199, TO PRINT THE CONTENTS OF STORAGE IN A PROGRAM SEQUENCE FORMAT. A PROGRAM STOP OCCURS TO ALLOW MANUAL ENTRY OF THE STORAGE SIZE. MANUAL ENTRY INSTRUCTIONS WILL BE AVAILIABLE ON THE LISTING AT THIS TIME - REFER TO THE SAMPLE PRINT OUT.

THE UNINTERPRETED PROGRAM LISTING CONTINUES UNTIL LOCATION 996 OR 997 -- DEPENDING UPON THE WORD MARK IN LOCATION 997 -- HAS BEEN PROCESSED. THEN MORE INSTRUCTIONS ARE LOADED INTO LOCATIONS 001 THRU 996. THIS PROGRAMING CAUSES THE PROGRAM LISTING TO BE INTERPRETED - REFER TO THE SAMPLE PRINT OUT.

NOTE.

THE CONTENTS OF STORAGE LOCATIONS 000 THRU 996 WILL BE ALTERED BY THIS PROGRAM.
STORAGE LOCATION 997 WILL BE PRINTED TWICE IF THERE IS NO WORD MARK IN THIS LOCATION.

STOPS.

INSTR. ADDR.	STORAGE ADDR. REG.	
008	015	ENTER STORAGE SIZE
020	024	END OF STORAGE

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ENG. CHG. NO.	116795	TA-1844							

SAMPLE PRINT OUT.

```
.......210.......220..                ...260.......270.......280.......290.......300

.......310      320..

8400
1
.......110.......120..                ...160.......170.......180.......190.......200
                                                                    010         010
                                                                    1           1
SENSE SWS  ON 0 G                OFF  B C E F                       .......*1*..*2*..*3*.
ENTER IN LOCATION 196 - 9 IF 4K, Z IF 8K, R IF 12K, I IF 16K

      353    ,001
      337    I
      338    83860

NO WM 988    8267
      992    885781
NO WM 997    094                      00997   0   94

      $17    C011/75                  01217   C   011   603
      $24    8472/                    01224   B   472 /
      $29    8464

      $73    BUTYMBFB                 01268   B 05435 14426 B   INDEX REG. 1   3
```

DATE	3-17-63	10.5.63						
ENG. CHG. NO.	116745	TA-1844						

PROGRAM LISTING FOR USE WITH FLOW CHART

DIAGNOSTIC DUMP 9200A

INSTRUCTION ADDRESS	OP	A	B	REMARKS
3016	+16			
3016	+16			
075	075	M	362 169	SET MOVE B-ADDRESS TO 215
082	082	M	190 210	MOVE ADDRESS TO PRINT
089	089	A	111 190	ADD ONE TO ADDRESS COUNTER
096	096	M	190 109	UPDATE WORD MARK TEST
103	103	V	152 XXX1	BRANCH IF NEXT WM
111	111	A	111 169	ADD ONE TO B-ADDRESS OF MOVE INSTR.
118	118	M	190	UPDATE A- ADDRESS OF MOVE INSTR.
122	122	C	190 199	BR. IF NOT LAST ADDRESS
129	129	B	138 /	"
134	134	B	150	BRANCH IF LAST ADDRESS
138	138	B	150 1689	BR. IF PRINT POSITION 90
146	146	B	089	BRANCH IF NOT POSITION 90
150	150	F	5	SPACE TWO
152	152	¤	164 167	CLEAR WMS FROM MOVE INSTR.
159	159	,	215	SET WM IN 215
163	163	M	XXX XXX	MOVE DATA TO PRINT AREA
170	170	2		PRINT
171	171	B	183 a	BRANCH IF CHANNEL 12
176	176	/	008 299	CLEAR PRINT AND BR. TO 008
183	183	F	176 1	SKIP TO ONE AND BRANCH
188	188	3	32	ADDRESS COUNTER
191	191	N	0 W M	CONSTANT
196	196	I		STORAGE SIZE
197	197	9	97	CHANGE FORMAT ADDRESS
200	200	¤	012	CLEAR WM
204	204	,	015 020	SET WMS
211	211	,	024 031	"
218	218	,	038 045	"
225	225	,	052 060	"
232	232	,	068 075	"
239	239	/	176 332	
075	075	M	192 189	SET MOVE ADDRESS TO 215
082	082	M	345 210	ADDRESS TO PRINT AREA
089	089	¤	333	CLEAR WORD MARK IN LOCATION 333
093	093	A	336 345	ADD ONE TO ADDRESS COUNTER
100	100	M	345 113	UPDATE TEST FOR WM
107	107	V	172 XXX1	BRANCH IF WM
115	115	C	345 339	BRANCH IF NOT LAST ADDRESS
122	122	B	131 /	"
127	127	B	170	BRANCH IF LAST ADDRESS
131	131	B	170 1689	BR. IF PRINT POSITION 90

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SRC CHG NO.	116745	TA-1844						

```
139  139  A 336  189          ADD ONE TO PRINT POSITION
146  146  M 345               UPDATE MOVE INSTRUCTION
150  150  C 342  189          SET WM IN 333 IF PRINT POSIT. 8
157  157  B 093  /                 ,,
162  162  , 333                   ,,
166  166  B 093               BR. TO ADD ONE
170  170  F  S                SPACE TWO
172  172  M 184  187          CLEAR WMS FROM MOVE INSTRUCTION
179  179  , 215               SET WM IN 215
183  183  M XXX  XXX          MOVE DATA TO PRINT AREA
190  190  B 376               BRANCH TO 376
200  200  B 012               CLEAR WORD MARK
204  204  , 015  020          SET WORD MARKS
211  211  , 024  031                ,,
218  218  , 038  045                ,,
225  225  , 052  060                ,,
232  232  , 068  075                ,,
239  239  V 261  1962         ADDRESS MODIFY IF GREATER THAN 4K
247  247  M 333  001                ,,
254  254  M 333  093                ,,
261  261  , 196               UPDATE LAST ADDRESS
265  265  M 196  339                ,,
272  272  / 008  299          CLEAR PRINT AND BRANCH TO 008
333  333  #                   CONSTANT
334  334  0 01                ,,
337  337  I 91                LAST ADDRESS
340  340  2 23                CONSTANT
343  343  9 97                ADDRESS COUNTER
346  346  N 0 M M             CONSTANT
351  351  1 0                 CONSTANT
353  353  2 0                       ,,
355  355  3 0                       ,,
357  357  4 0                       ,,
359  359  8 0                       ,,
361  361  1 2                       ,,
364  364  I NDE X REG. 1            ,,
376  376  V 667  3331         OMIT ACTUAL ADDR. IF WM SET
384  384  , 255               GENERATE ACTUAL INSTR. ADDR.
388  388  D 210  259                ,,
395  395  D                          ,,
396  396  D                          ,,
397  397  V 685  208S                ,,
405  405  V 696  208K                ,,
413  413  V 707  2088                ,,
421  421  V 718  2105                ,,
429  429  V 729  210K                ,,
437  437  V 740  2108                ,,
445  445  , 263  277          MOVE OP CODE AND MODIFIER
452  452  , 265  271                ,,
459  459  M 215  263                ,,
466  466  M 222  277                ,,
473  473  B 751  217          IS A-ADDR. TO BE GENERATED
```

DATE	3-17-63	10 5 63						
ENG. CHG. NO.	116705	TA-1844						

```
 481  481  B 1985 2168          ,,
 489  489  B 1985 2168          ,,
 497  497  D 218  269           GENERATE A-ADDRESS
 504  504  D                     ,,
 505  505  D                     ,,
 506  506  V 762  216S          ,,
 514  514  V 773  216K          ,,
 522  522  V 784  216B          ,,
 530  530  V 795  216S          ,,
 538  538  V 806  218K          ,,
 546  546  V 817  218B          ,,
 554  554  V 828  217S          TEST FOR A-ADDRESS INDEXING
 562  562  V 846  217K          ,,
 570  570  V 857  217B          ,,
 578  578  B 868  220           IS B-ADDRESS TO BE GENERATED
 586  586  D 221  275           GENERATE B-ADDRESS
 593  593  D                     ,,
 594  594  D                     ,,
 595  595  V 879  219S          ,,
 603  603  V 890  219K          ,,
 611  611  V 901  219B          ,,
 619  619  V 912  221S          ,,
 627  627  V 923  221K          ,,
 635  635  V 934  221B          ,,
 643  643  V 945  220S          TEST FOR B-ADDRESS INDEXING
 651  651  V 963  220K          TEST FOR B-ADDRESS INDEXING
 659  659  V 974  220B          TEST FOR B-ADDRESS INDEXING
 667  667  2                   PRINT
 668  668  B 680  3             BRANCH IF CHANNEL 12
 673  673  / 008  299           CLEAR PRINT AND BRANCH TO 008
 680  680  F 673  1             SKIP TO ONE
 685  685  A 352  257           ADD 1000 TO INSTRUCTION ADDR.
 692  692  B 421
 696  696  A 354  257           ADD 2000
 703  703  B 421
 707  707  A 356  257           ADD 3000
 714  714  B 421
 718  718  A 358  257           ADD 4000
 725  725  B 845
 729  729  A 360  257           ADD 8000
 736  736  B 445
 740  740  A 362  257           ADD 12000
 747  747  B 445
 751  751  N 216  265           MOVE MODIFIER
 758  758  B 667
 762  762  A 352  267           ADD 1000 TO A-ADDRESS
 769  769  B 530
 773  773  A 354  267           ADD 2000
 780  780  B 530
 784  784  A 356  267           ADD 3000
 791  791  B 530
 795  795  A 358  267           ADD 4000
```

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ENG. CHG. NO.	116745	TA-1844						

```
802  802  B 554
806  806  A 360 267          ADD 8000
813  813  B 554
817  817  A 362 266          ADD 12000
824  824  B 554
828  828  D 351 292          INDEX REG. 1
835  835  M 373 290          INDEX REG
842  842  B 578
846  846  D 353 292          INDEX REG. 2
853  853  B 835
857  857  D 355 296          INDEX REG. 3
864  864  B 835
868  868  M 219 271          MOVE MODIFIER
875  875  B 667
879  879  A 352 273          ADD 1000 TO B-ADDRESS
886  886  B 619
890  890  A 354 273          ADD 2000
897  897  B 619
901  901  A 356 273          ADD 3000
908  908  B 619
912  912  A 358 273          ADD 4000
919  919  B 643
923  923  A 360 273          ADD 8000
930  930  B 643
934  934  A 362 272          ADD 12000
941  941  B 643
945  945  D 357 296          INDEX REG. 1
952  952  M 373 290          INDEX REG.
959  959  B 667
963  963  D 353 296          INDEX REG. 2
970  970  B 952
974  974  D 355 296          INDEX REG. 3
981  981  B 952
985  985  M 218 267          MOVE A-ADDRESS
992  992  B 578
```

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ENG. CHG. NO.	116745	TA-1844						

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080121001                                        DIAGNOSTIC DUMP          9200A 0A
,008012,016,023,030034,041048,049,056063,022072,,074076,080067¤023,02922¤N01012N
......210 /300N0000NL010210L¤048A07701080673000A077028N000000B022¤0292N0FJ1012
M08006780 34,017N/300/V0013001,300L301201806703 64A076037A076040B034/30022¤N01012N
......310 /299M,029NL010210L¤048A07701080672400A077028N002332B022¤0292N0FJ1017
M08006730 34,017N/332NV0011011,101L101201806703 83A076037A076040B034¤20122¤N01012N
......110 /300N,029NL010210LN000A07701080673000A077028N000000B022¤0292N0FJ1017N
M0800678034      /300/V0010811,081L081281806703 83A076037A076040B034¤28122¤N01030N
......*1*...*2*...*3*.          ,048¤008012¤022017¤L020300,0230161049          09
SENSE SWS    ON                  OFF                L014214L032254¤074¤067N,0111011
2             B034BM080236A001022B049M080216A001040NA076015A076080B076080HN8011110348
/299/080,0011001                        ,067074¤011016¤L016116,117113,109,1052FLFK8101
,0080121001                                                                      13
L0802603001ENTER IN LOCATION 196 -  9 IF 4K, Z IF 8K, R IF 12K, I IF 16K
,010014F1M08105                                                                  15
,008015,022029,033033N000000 1001                                                16
L033081¤081001,001001,0010011001 9                                               1
L072121,089096,103111,1180011001M190210A111190M190109V152XXX1A111169M190         16
L069155,129134,138146,1501521001C190199B138/B150B150168 9B089FS¤184167           19
L064190,163170,171176,1831881001,215MXXXXXX2B183@/008299F1761332                 20
L066224,196197,200204,2112181001NO WM1997¤012,015020,024031,038045               21
L072264,232239,001001,0010011001,052060,068075/176332                            22
¤029022,020024N00001001                                                          23
¤033033,000000N00001200                                                          24
A111190C199190B024/1001,164167M190058M190066M190166V075XXX1B001XXX M195206M16216
L055155L051159N0000,156L044144/138080,001001,0080151001                          26
,008015,022029,033033N000000 1001                                                27
L072121,089093,100107,1150011001M345210¤333A336345M345113V172XXX1C345339         28
L067156,127137,139146,1500011001B131/B170B170188 9A336189M345C342189             29
L070194,166170,172179,1831901001B093/,333B093FS¤184187,215MXXXXXXB376            30
L071239,204211,218225,2321621001¤012,015020,024031,038045,052060,068075          31
L072278,247254,261265,2720011001V261196 2M333001M333093,196M196339/008299        32
L052352,334337,340343,3463511001#001191223997NO WM10                             33
L063383,355357,359361,3643761001203040 8012 INDEX REG. 1V6673331                 34
L069420,388395,396397,4054131001,255D210259D DV685208SV696208KV707208B           35
L070458,429437,445452,0010011001V718210SV729210KV740210B,263277,265271           36
L070496,466473,481489,0010011001M215263M222277B751217 B985216%B985216@           37
L065529,504505,506514,5220011001D218269D DV762216SV773216KV784216B               38
L072569,538546,554562,0010011001V795218SV806218KV817218BV828217SV846217K         39
L065602,578586,593594,5950011001V857217B8868220 D2212750DV879219S                40
L072642,611619,627635,0010011001V890219KV901219BV912221SV923221KV934221B         41
L069679,651659,667668,6730011001V945220SV963220KV974220B2B680@/008299            4
L070717,685692,698703,7077141001F6731A3522578421A3542578421A356257B421           4
L072787,725729,736740,7477511001A358257B445A3602578445A362257B445M216265         44
```

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ENG. CHG. NO.	116745	TA-1844						

REPRODUCTION

L069794,762769,773780,784791100 1B667A352267053 0A354267853 0A356267853 0 45
L072884,802885,813817,824828100 1A358267855 4A360267855 4A362266855 4035 1292 46
L072874,842844,853857,864868100 1M373290857 8035329288350355296883 5M219271 47
L069911,879886,890897,901908100 1B667A352273861 9A354273861 9A356273861 9 48
L072951,919923,930934,941945100 1A358273864 3A360273864 3A362272864 3035 1296 49
L065984,959963,970974,981981100 1M373290866 7D353296895 2D355296895 2 50
L044996,992001,001001,001001100 1M2102678578 51
#029022,026024N00001001 52
#03360358020 1200 53
A336345C33934SB02#/100),184187M345058M345066M345186V075XXX1B001XXX M350206M18218
#028672M339210N00001038 8020 55
,215215M0002158384 .020/031299M339011M339058M339066V001000 1B020000 M350206B001

DATE	3-17-63	10.5.63							
ENG. CHG. NO.	115745	TA-1844							

BRANCH ON LAST CARD

A. PURPOSE OF TEST

TO TEST SENSE SWITCH A FOR LAST CARD OPERATIONS. THE PROGRAM IS DIVIDED INTO THREE OPERATIONS AS FOLLOWS:

1. SENSE A ON AND CARDS IN THE FEED.
2. SENSE A ON AND NO CARDS IN THE FEED.
3. SENSE A OFF AND NO CARDS IN THE FEED.

B. LOADING PROCEDURES

1. MACHINES WITH OVERLAP FEATURE, ENTER A 1 IN 1298.

2. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.

3. WHEN RUNNING TEST FROM TAPE ENTER A 2 IN 1278.

C. PROGRAM CONTROL

1. SENSE SWITCHES

A ON - TO CONTROL LAST CARD OPERATIONS.
OFF - TO TEST PROGRAM WITHOUT CARDS IN THE HOPPER.

B ON - TO REPEAT FOR SCOPING.
OFF - TO CONTINUE.

D ON - TO REPEAT ENTIRE TEST.
OFF - TO CONTINUE.

D. TEST PROCEDURE

1. THE FIRST PORTION OF THE TEST CHECKS THE BRANCH ON SENSE A INSTRUCTION 4000 TIMES. NO BRANCH SHOULD OCCUR SINCE CARDS ARE STILL IN THE FEED. IF ONE DOES OCCUR THE MACHINE STOPS, INDICATING AN ERROR.

2. THE SECOND PORTION OF THE TEST FEEDS THE REMAINING TWO CARDS OUT OF THE FEED AND CHECKS THE BRANCH ON SENSE A INSTRUCTION 4000 TIMES. IF NO BRANCH OCCURS THE MACHINE STOPS INDICATING AN ERROR.

MACHINES WITH THE OVERLAP FEATURE AND A 1 IN 1298 ARE TESTED TO INSURE THAT THE BRANCH ON LAST CARD CIRCUITRY IS RESET AFTER THE FIRST SUCCESSFUL BRANCH.

3. THE THIRD PORTION OF THE TEST IS RUN WITH SENSE A OFF. BRANCH ON SENSE A IS AGAIN INTERROGATED 4,000 TIMES, BUT THIS TIME NO BRANCHING SHOULD OCCUR SINCE THE SWITCH IS OFF. IF BRANCHING OCCURS, THE MACHINE STOPS INDICATING AN ERROR.

DIAGNOSTIC FUNCTION TEST

E. STOPS

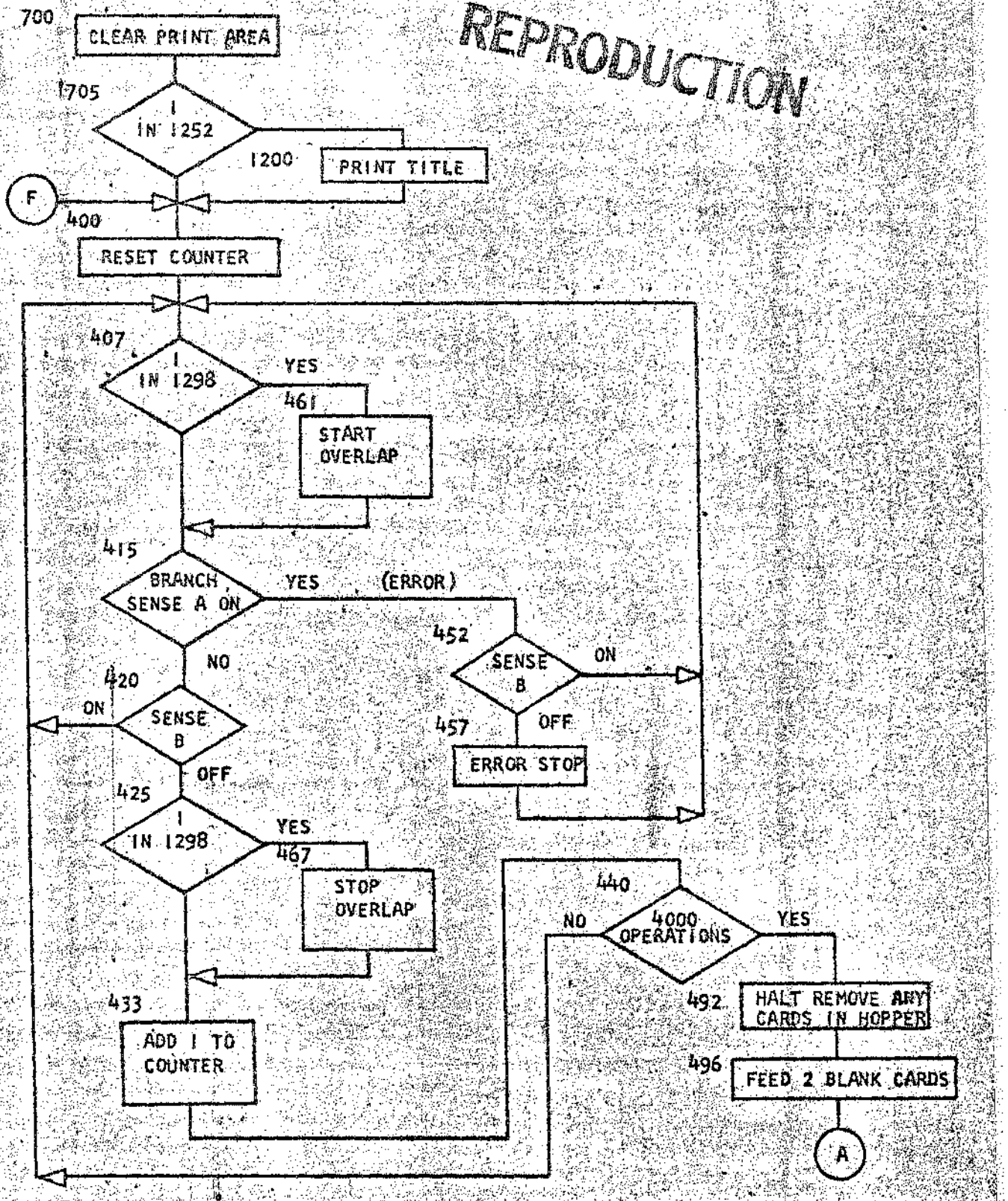
STORAGE ADDRESS REGISTER

461	ERROR - PHASE 1 - BRANCHED OCCURRED WITH CARDS IN FEED.
496	HALT - REMOVE ANY CARDS IN HOPPER
583	ERROR - PHASE 2 - NO BRANCH WITH SENSE A ON
643	HALT - WHEN TEST IS RUN FROM TAPE, DEPRESS START RESET AND START
647	HALT - WHEN TEST IS RUN FROM TAPE, PLACE 2 BLANK CARDS IN HOPPER.
730	HALT - TURN SENSE A OFF.
791	ERROR - PHASE 3 - BRANCH OCCURRED WITH SENSE A OFF.

F. PRINTOUTS

NONE

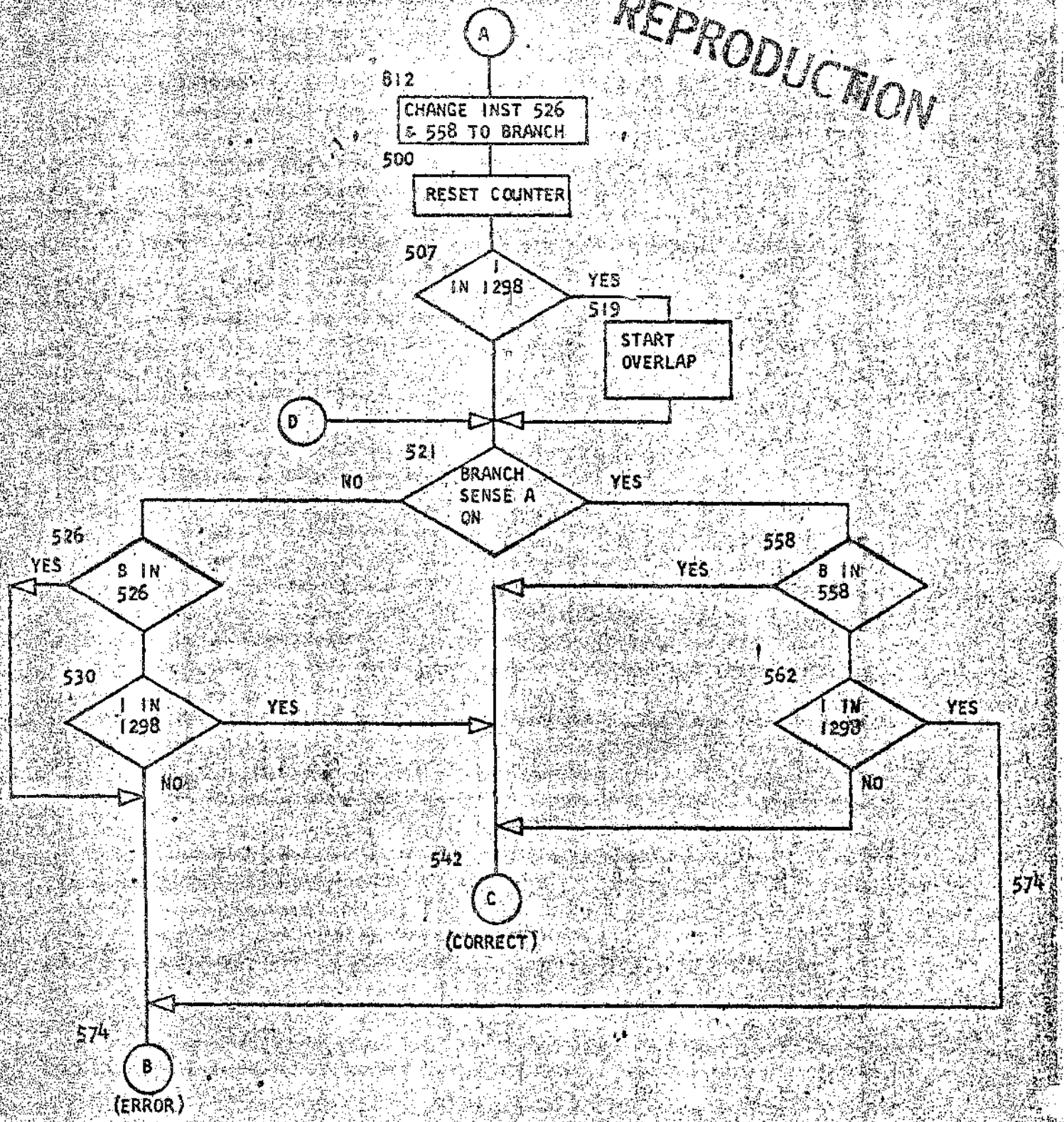
DATE	2-2-61	6-29-63	11. 10. 63					
ENG. CHG. NO.	110378	117628	TA 1976					



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					

DIAGNOSTIC FUNCTION TEST

PART NO. 451449
SHEET 4 OF 9
BLOCK NO. 99998

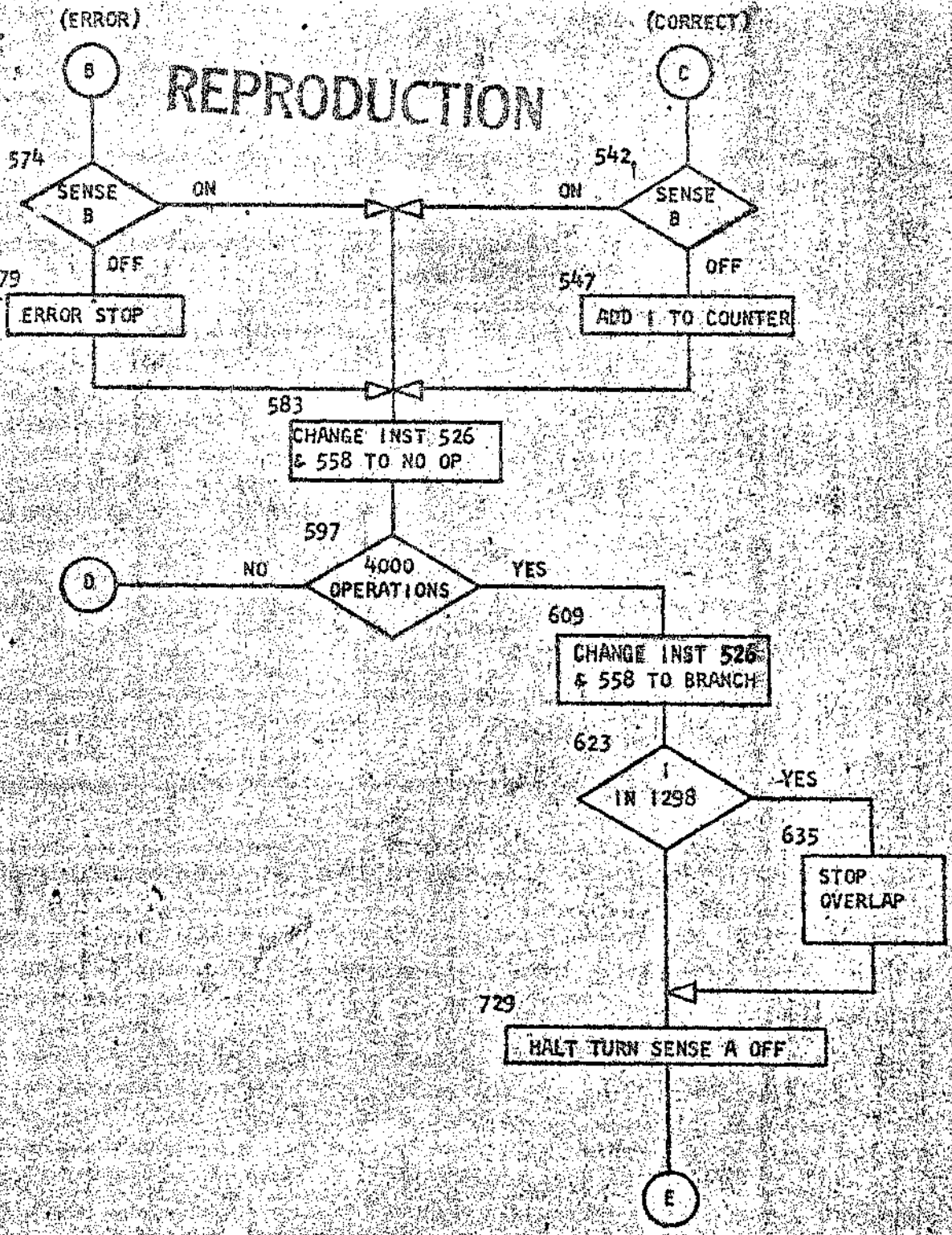


DATE	2-2-61	6-29-63	17.10.63					
NO. CHG. NO.	110378	117628	TA 1976					

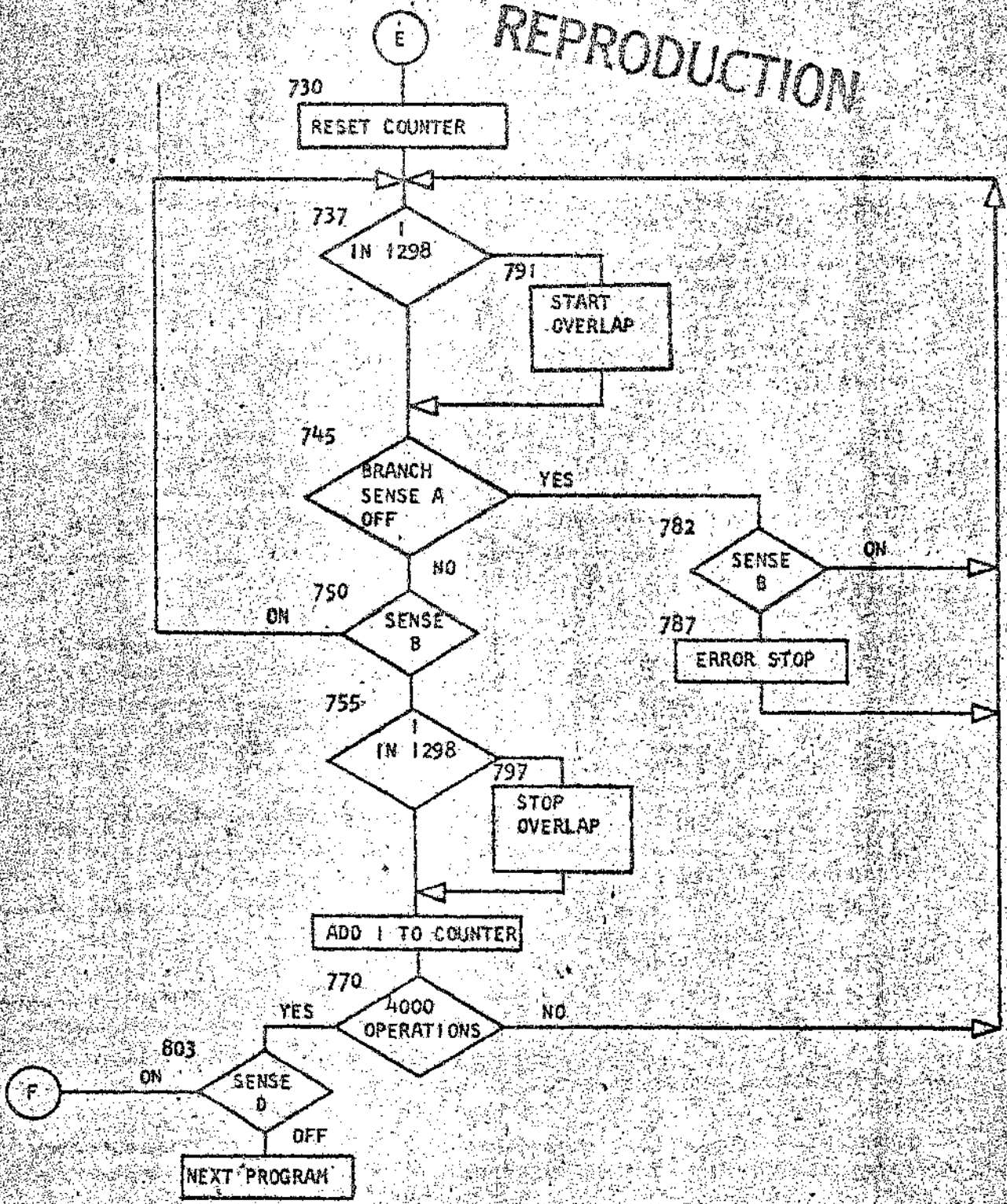
IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451449
SHEET 5 OF 19
BLOCK NO. 9999B



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA 1976					



DATE	2-2-61	6-29-63	17.10.63					
ENG. CHG. NO.	110378	117628	TA, 1976					

PROGRAM LISTING FOR USE WITH FLOW CHART

BRANCH LAST CARD 99998

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	642	S782	GO PERFORM TEST FROM TAPE
385	385	B	S88		BYPASS TEST ON TAPE
400	400	L	479	483	RESET COUNTER PHASE 1
407	407	B	461	S981	GO START OVERLAP PHASE 1
415	415	B	452	A	BRANCH ON LAST CARD PHASE 1 SS
420	420	B	407	B	LOOP ON SW B CORRECT PHASE 1 SS
425	425	B	467	S981	GO STOP OVERLAP PHASE 1
433	433	A	479	483	ADD TO COUNTER PHASE 1
440	440	B	492	4804	BRANCH AFTER 4000 TIMES C FOR TA
448	448	B	407		REPEAT PHASE 1
452	452	B	407	B	LOOP ON SW B ERROR SS
457	457	.	407		ERROR STOP PHASE 1
461	461	K	$		START OVERLAP PHASE 1
463	463	B	415		CONTINUE PHASE 1
467	467	K	.		STOP OVERLAP PHASE 1
469	469	B	433		CONTINUE PHASE 1
476	476	0	001		COUNTER RESET AND ADVANCE C FOR TA
480	480	0	000		COUNTER
492	492	.	496		HALT TO PUT LAST CARD IN FEED
496	496	1	812		FEED AND START PHASE 2
500	500	L	479	483	RESET COUNTER PHASE 2
507	507	B	519	S981	GO START OVERLAP PHASE 2
515	515	B	521		BYPASS OVERLAP PHASE 2
519	519	K	$		START OVERLAP PHASE 2
521	521	B	558	A	BRANCH ON LAST CARD PHASE 2 SS
526	526	B	574		*LAST CARD DID NOT BRANCH
530	530	B	542	S981	BRANCH CORRECT OVERLAP PHASE 2
538	538	B	574		BRANCH ERROR NO OVERLAP PHASE 2
542	542	B	583	B	LOOP ON SW B CORRECT PHASE 2 SS
547	547	A	479	483	ADD TO COUNTER PHASE 2
554	554	B	583		GO CHANGE BRANCH TO NO OP PHASE 2
558	558	B	542		*DID BRANCH ON LAST CARD PHASE 2
562	562	B	574	S981	BRANCH ERROR OVERLAP PHASE 2
570	570	B	542		BRANCH CORRECT NO OVERLAP PHASE 2
574	574	B	583	B	LOOP ON SW B ERROR PHASE 2 SS
579	579	.	583		ERROR STOP PHASE 2
583	583	M	641	526	CHANGE BRANCH TO NO OP PHASE 2
590	590	M	641	558	" "
597	597	B	609	4804	BRANCH AFTER 4000 TIMES C FOR TA
605	605	B	521		REPEAT PHASE 2
609	609	M	605	526	CHANGE NO OP TO BRANCH AT END PHASE 2
616	616	M	605	558	" "
623	623	B	635	S981	GO STOP OVERLAP PHASE 2
631	631	B	637		CONTINUE WITH PHASE 3
635	635	K	.		STOP OVERLAP PHASE 2

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ENG. CHG. NO.	110378	117628	TA 1976						

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637  637  B 729                GO START PHASE 3
641  641  N                    CONSTANT
642  642  .                    HALT - DEPRESS START RESET
643  643  . 700                HALT PUT 2 BLANK CDS IN FEED
647  647  .                    WM
700  700  / 332               START TEST  CLEAR PRINT AREA
704  704  /                                  ''
705  705  B 500 5521           GO DO TITLE PRINT
713  713  B 400                GO START PHASE 1
729  729  .                    HALT TURN SENSE A OFF
730  730  L 479 483            DEPRESS START KEY HERE   RESET CTR
737  737  B 791 5981           GO START OVERLAP PHASE 3
745  745  B 782 A              BRANCH ON LAST CARD PHASE 3          SS
750  750  B 737 B              LOOP ON SW B  CORRECT PHASE 3        SS
755  755  B 797 5981           GO STOP OVERLAP PHASE 3
763  763  A 479 483            ADD TO COUNTER PHASE 3
770  770  B 803 4804           BRANCH AFTER 4000 TIMES          C FOR TA
778  778  B 737                REPEAT PHASE 3
782  782  B 737 B              LOOP ON SW B  ERROR PHASE 3          SS
787  787  . 737                ERROR STOP PHASE 3
791  791  K $                  START OVERLAP PHASE 3
793  793  B 745                CONTINUE PHASE 3
797  797  K .                  STOP OVERLAP PHASE 3
799  799  B 763                CONTINUE PHASE 3
803  803  B 400 D              GO REPEAT TEST                       SS
808  808  B 348                GO START NEXT TEST
812  812  1                    FEED LAST CARD
813  813  M 605 526            INITIALIZE BRANCH  FOR PHASE 2
820  820  M 605 558                                    ''
827  827  B 500                GO RESET COUNTER PHASE 2
```

DATE	2-2-61	6-29-63	17 10 63					
ENG. CHG. NO.	110378	117628	TA 1976					

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12	5	8	SE-SEMICOLON	11	6	8	DE-DELTA	11	7	8
WS-WORD SEPARATOR	0	5	8	LT-LESS THAN	12	6	8	PZ-PLUS ZERO	12	0	
TS-TAPE SEGMENT MARK	0	7	8	GT-GREATER THAN	6	8		TM-TAPE MARK		7	8
GM-GROUP MARK	12	7	8	MZ-MINUS ZERO	11	0		CO-COLON		5	8
RP-RIGHT PARENTHESIS	11	5	8	AP-APOSTROPHE	0	6	8				

```
,008015,022029,033033N          1001                    BRANCH LAST CARD          99998 0A
,008045,022029,033033N          1001                    SET WORDMARK CARD         99998 02
L067567,340344,348349,3573611001,008012,0011001183610080AB400/340080              99998 03
L070414,385400,407415,4154151001B642S7828S88                L479483B461S981        99998 04
L069451,420425,433440,4484521001B452AB4078B467S981A479483B4924804B407             99998 05
L060479,457461,463467,4694761001B4078.407K$8415K.B433   0001                      99998 06
L071518,492496,500507,5155191001000O          .4961812L479483B519S981B521         99998 07
L067553,521526,530538,5425471001K$8558AB574854259B1B574858BA479483                99998 08
L068589,558562,570574,5795831001B583B542857459B185428583B.583M641526              99998 09
L065622,597605,609616,6236231001M6415588609480481521M605526M605558               99998 10
L072662,631635,637641,6426431001B635S981B637K.8729N..700                         99998 11
L069736,704705,713729,7307371001/332/8S00S521B400              .L479483           99998 12
L065769,745750,755763,7706471001B791S9818782AB737B8797S981A479483                 99998 13
L061798,778782,787791,7937971001B8034804873787378.737K$8745K.                    99998 14
L072838,803808,812813,8208271001B7638400DB3481M605526M605558B500                  99998 15
L053S20,S01S05,S12S13,S17S2110012,049L0762762/2772420                             99998 16
/333080N                                        CLEAR WORDMARK CARD               99998 17
,019027,031,038042B031T98G8700L046352BW048$88   BRANCH LAST CARD                  99998 18
                        M
```

DETAIL CARDS

```
                                                                                  99998 19
                                                                                  99998 20
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DATE	2-2-61	6-29-63	17 10 63					
ENG. CHG. NO.	110378	117628	TA 1976					

WRITE TEST TAPE ITOI

A. PURPOSE

1. TO TRANSFER ROUTINES AND TESTS FROM CARDS TO MAGNETIC TAPE.

2. TO PERMIT INTERMIXING TESTS WRITTEN FOR USE WITH READ ROUTINE BLOCK 5310 AND READ ROUTINE BLOCK ITO2.

B. LOADING AND RUNNING PROCEDURES

MACHINE MUST HAVE 4K OR GREATER STORAGE.

NOTE: MACHINES WITH 2K STORAGE USE WRITE TEST TAPE BLOCK 5300.

1. LOAD AND MAKE DRIVE 1 READY.

2. LOAD CARDS IN HOPPER IN FOLLOWING SEQUENCE
   A. WRITE TEST TAPE BLOCK ITOI
   B. READ TEST TAPE BLOCK ITO2
   C. COPY TEST TAPE BLOCK ITO3 NOT NECESSARY FOR WRITING TAPE AND MAY BE ELIMINATED IF DESIRED
   D. TESTS TO BE PUT ON TAPE.

3. TURN ON SENSE SWITCH A. THIS MAY BE DONE LATER BUT IT MUST BE ON WHEN THE LAST DECK IS IN THE READ HOPPER SO THAT A TAPE MARK WILL BE WRITTEN WHEN THE LAST CARD IS READ.

4. IF SELECTION DIGITS ARE NOT TO BE WRITTEN ON TAPE START OPERATION BY DEPRESSING LOAD KEY ON THE CARD READER.

5. IF IT IS DESIRED TO WRITE SELECTION DIGITS ON TAPE USE THE FOLLOWING PROCEDURE.
   A. SET 3000 IN ADDRESS STOP SWITCHES.
   B. SET 1401 TO ADDRESS STOP MODE.
   C. PRESS 1402 LOAD KEY.
   D. MACHINE WILL STOP AFTER FIRST THREE CARDS HAVE BEEN LOADED. PRESS START KEY.
   E. MACHINE WILL STOP WHEN THIRD CARD OF BLOCK ITO2 IS LOADED. MANUALLY ENTER DESIRED SELECTION DIGITS.
   F. SET 1401 TO RUN MODE AND DEPRESS THE START KEY.

C. PROGRAM CONTROL

SENSE SWITCH A ON TO WRITE TAPE MARK AFTER LAST TEST.

D. TEST PROCEDURE

THE FIRST RECORD WRITTEN ON TAPE IS THE READ TEST TAPE ROUTINE BLOCK ITO2. NEXT AS EACH TITLE CARD IS READ INTO STORAGE IT IS CHECKED FOR THE ABSENCE OF ZONE BITS IN THE HUNDREDS POSITION OF THE BLOCK NUMBER (CARD COLUMN 74).

IF ZONE BITS ARE PRESENT THE TITLE CARD IS WRITTEN ON TAPE (80 CHARACTER RECORD), THE PROGRAM IS READ INTO STORAGE AND WRITTEN ON TAPE AS A 1997 CHARACTER RECORD.

IF ZONE BITS ARE NOT PRESENT, THE TITLE CARD IS WRITTEN ON TAPE, THE PROGRAM READ INTO STORAGE, MODIFIED AND WRITTEN AS A 1249 CHARACTER RECORD. ALL BS88 INSTRUCTIONS ARE ALTERED TO B+16.

DATE	4-3-62	3-7-63	5-17-63	31.7.63				
ENG. CNG. NO.	115276	117135	117490	TA.1909				

E. STOPS

1. E 30 3530 END OF REEL STOP

2. E 44 3544 END OF ROUTINE STOP

F. PRINTOUTS

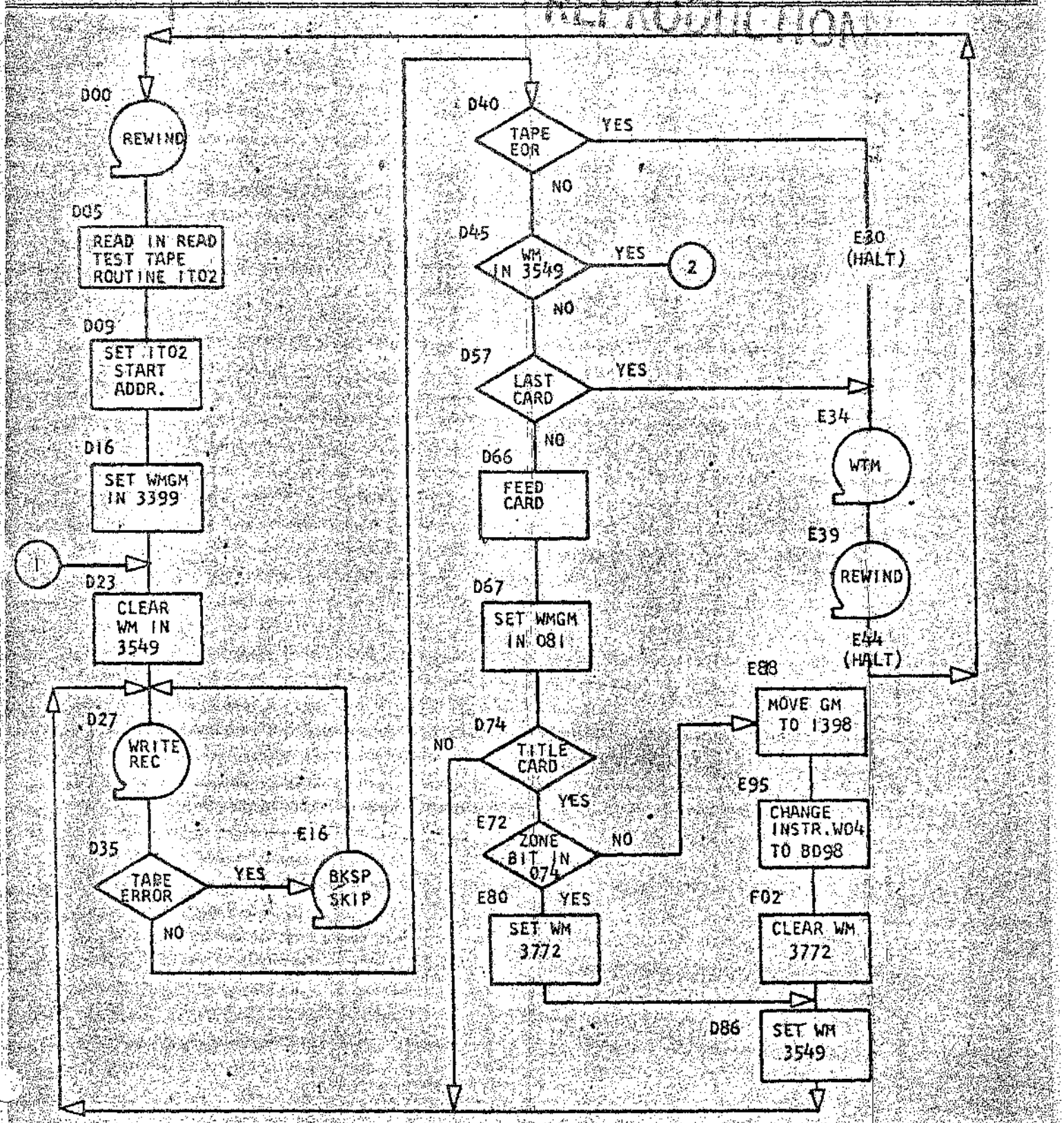
NONE

DATE	4-3-62	3-7-63	5-17-63	30.7.63				
ENG. CHG. NO.	115276	117135	117490	TA-1909				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451865
SHEET 3 OF 7
BLOCK NO. IT01S

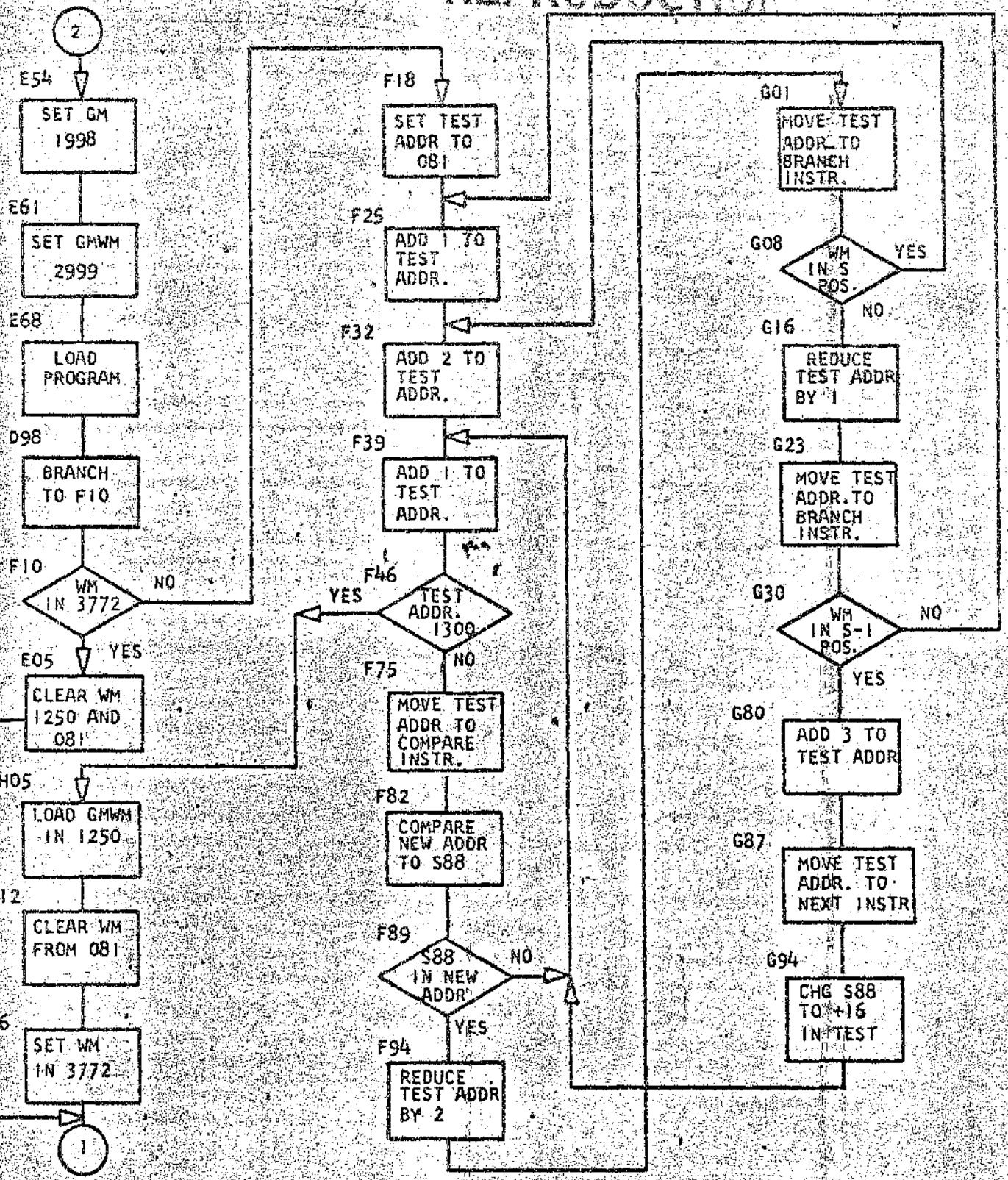


DATE	4-3-62	3-7-63	5-17-63	30.7.63				
ENG. CHG. NO.	115276	117135	117490	TA 1909				

IBM

DIAGNOSTIC FUNCTION TEST

PART NO. 451865
SHEET 4 OF 7
BLOCK NO. 1T018



DATE	4-3-62	3-7-63	5-17-63	30.7.63				
ENG. CHG. NO.	115276	117135	117490	T-1909		1		

PROGRAM LISTING FOR USE WITH FLOW CHART

WRITE TEST TAPE ROUTINE 1T01B

INSTRUCTION ADDRESS		OP	A	B	REMARKS
3016	+16				
1660	W60	I	001		FEED CARD AND BRANCH FOR WRITE ROUTINE
1664	W64	.			
3400	D00	U	%U1	R	REWIND DRIVE 1
3405	D05	I	001		LOAD RD TEST TAPE ROUTINE
3409	D09	M	E52	004	SET START ADDR. FOR RD TEST TAPE
3416	D16	L	E53	C99	LOAD GMWM IN C99
3423	D23	¤	E49		CLEAR TEST RECORD INDICATOR
3427	D27	L	%U1	001W	WRITE RECORD
3435	D35	B	E16	L	BR IF TAPE WRITE ERROR
3440	D40	B	E30	K	BR IF EOF
3445	D45	V	E54	E491	SET UP TEST RECORD FOR 1.4K
3453	D53	/	081		CLEAR GM-WM FOR HEADER + DETAIL
3457	D57	B	E34	A	BRANCH IF LAST CARD
3462	D62	,	001		WM IN 001
3466	D66	I			FEED CARD
1467	D67	L	C99	081	PUT GM WM IN 081 FOR HEADER + DETAIL
1474	D74	B	E72	080A	BRANCH IF HEADER
3482	D82	B	D27		GO WRITE DETAIL RECORDS
1486	D86	,	E49		SET INDICATOR FOR 1.4 OR 4K TEST
3490	D90	B	D27		GO WRITE THE HEADER CARD
3498	D98	B	F10		TEST DECKS BRANCH INTO HERE
3505	E05	¤	081	S50	REMOVE WM FROM GP MK FOR 4K TEST
3512	E12	B	D23		BRANCH TO CLEAR TEST RECORD INDICATOR
3516	E16	U	%U1	B	BACK SPACE
3521	E21	U	%U1	E	SKIP
3526	E26	B	D27		GO TO WRITE RECORD
3530	E30	.	E34		HALT E.O.F.
3534	E34	U	%U1	M	WRITE TAPE MARK
3539	E39	U	%U1	R	REWIND
3544	E44	.	D00		HALT AND BRANCH TO REPEAT
3548	E48	.			WM
3549	E49	X			TEST POSITION
3550	E50	3	93		CONST-READ ROUT WILL HAVE B393 IN 001
3553	E53				GM-WM
3554	E54	M	C99	Z98	PUT GM IN Z98
3561	E61	L	C99	R99	PUT GM-WM IN R99
3568	E68	B	001		GO TO SET UP TEST RECORD + WRITE
3572	E72	V	E88	0742	BRANCH IF 1.4K TEST NO ZONE
3580	E80	,	G72		SET WM IF 4K TEST
3584	E84	B	D86		GO TO SET TEST INDICATOR
3588	E88	M	C99	T98	PUT GM IN T98 FOR 1.4K TEST

DATE	4-3-62	B-17-63	5-17-63	30.7.'63				
ENG. CHG. NO.	115276	117135	117490	TA-1909		1		

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3595  E95  L  G77  W08        PUT B D98 IN W04
3602  F02  ¤  G72             SETUP SEARCH FOR B S88 IN 1.4K TEST
3606  F06  B  D86             GO INDICATE TEST FOLLOWS HEADER
3610  F10  V  E05  G721       BYPASS SEARCH IF 4K TEST
3618  F18  M  G56  G53        SET UP 081 IN WORK AREA
3625  F25  A  F25  G53        ADD 1 TO MAKE 082
3632  F32  A  F06  G53        ADD 2 TO MAKE 084
3639  F39  A  F39  G53        ADD 1 TO MAKE 085
3646  F46  B  H05  G51T       END SEARCH IF AT TOO
3654  F54  B  F75             CONTINUE SEARCH
3675  F75  M  G53  F85        SETUP COMPARISON
3682  F82  C  085  G62        *LOOK FOR S88
3689  F89  B  F39  /          BRANCH TO CONTINUE SEARCH
3694  F94  A  G68  G53        S88-SUBTRACT 2 TO
3701  G01  M  G53  G1A        ADDRESS THE S IN SSS AND
3708  G08  V  F32  0831       *TEST FOR WM UNDER S
3716  G16  A  G65  G53        NO WM UNDER S SUBTRACT 4
3723  G23  M  G53  G36        LOOK FOR WM BEFORE S
3730  G30  V  G80  0821       *WM  ASSUME B S88
3738  G38  B  F25             NO WM GO ADD 4 AND TEST AGAIN
3751  G51  X  XX0  81298      *WORK AREA AND CONSTANTS
3760  G60  S  881  99198      CONSTANTS
3769  G69  +  16X             NO WM S72 FOR 1.4K SETUP
3773  G73  B  D98             CONSTANTS
3780  G80  A  F82  G53        ADD 3 TO FIND RIGHT END OF INST BS88
3787  G87  M  G53  H00        AND
3794  G94  M  G71  085        *CHANGE BS88 TO BET6
3801  H01  B  F39             GO CONTINUE SEARCH
3805  H05  L  C99  S50        PUT GM WM S50
3812  H12  ¤  081             REMOVE WM FROM GM WM
3816  H16  ,  G72             WM IN G72 1.4K TEST IS READY TO WRITE
3820  H20  B  023             GO WRITE 1.4K TEST
```

DATE	4-3-62	1-7-63	5-17-63	30.7.63				
ENG. CHG. NO.	115276	1147135	117490	TA-1909				

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
NS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
-0080012100G1                                   WRITE TEST TAPE ROUTINE     1T01B 0A
-0080012,020N0000000,027031,038,045049,053055,1171001 CLEAR 4000 STORAGE    1T01B 02
W054010/T998031D092A072054800ILO70116,105106,110810119/0991,001/001199101T01B 03
-0080015,022029,033033N0000001001                                           1T01B 04
L072W99,W64001,001001,001001100110001.                                      1T01B 05
L072D39,D05D09,D16D23,D27D35100IU%U1RBN60NE52004LE53C99¤E49L%U1001WBE36L 1T01B 06
L066D73,D45D53,D57D62,D66D67100IBE30KVE54E491/0818E34A,0011LC99C81          1T01B 07
L070E11,D82D86,D90D98,E05001100IBE72080A8D27,E49BD27    8F10   ¤081S50    1T01B 08
L064E43,E16E21,E26E30,E34E39100IBD23U%U1BU%U1EBD27.E34U%U1MU%U1R            1T01B 09
L056E67,E48E49,E50E53,E54E611001.000.X393GMC99Z98LC99R99                    1T01B 10
                                    M
L070F05,E72E80,E84E88,E95F021G01BG01VE880742,G728D86MC99T98LG77W08¤GT2      1T01B 11
L072F45,F10F18,F25F32,F390011001BD86VE05G721MG56G53AF25G53AF06G53AF39G531T01B 12
L068F81,F54F75,001001,001001100IBHQSG51T8F75                MG53F85        1T01B 13
L066G15,F89F94,G01G08,001001100IC085G628F39/AG68G53MG53G14VF320831          1T01B 14
L067G50,G23G30,G38001,001001100IAG65G53MG53G36VG800821BF25                  1T01B 15
L068686,G60G69,G73G80,001001100IXXX081Z985881991Z98P16X8D98   AF82G53       1T01B 16
                                                  Z
-072H26,G94H01,H05H12,H16H201001MG53H00MG71085BF391C99S50¤081,G728D23        1T01B 17
-000                                                                        1T01B 18
```

DATE	4-3-62	B-17-63	5-17-63	3.7.63				
ENG. CHG. NO.	115276	116785	117490	VA 1903				

IT02 READ TEST TAPE

A. PURPOSE:

TWO SEPARATE READ ROUTINES ARE PROVIDED TO READ BASIC AND OVERLAP TESTS FROM TAPE, AND EXECUTE EACH TEST IN THE SAME MANNER AS WHEN USING CARDS. THIS ROUTINE WAS THE FIRST RECORD WRITTEN ON TAPE. SEE IT01.

B. LOAD AND RUNNING PROCEDURES:

1. LOAD MASTER TEST TAPE ON TAPE DRIVE 1 AND MAKE READY.
2. PUSH TAPE LOAD KEY, READ ROUTINE IS READ INTO STORAGE.

NOTE:

IF LESS THAN 4K STORAGE IS AVAILABLE, A STORAGE ADDRESS ERROR WILL APPEAR. OPERATE THE START RESET KEY, MANUALLY ADDRESS THE I STAR TO 001. REWIND DRIVE NUMBER 1 TO LOAD POINT, OPERATE THE START KEY.

3. PROGRAM SHOULD PROCEED TO A STOP AT ADDRESS LOCATION 404.
4. IF LESS THAN 4K STORAGE IS AVAILABLE OPERATE START RESET KEY AND SKIP TO INSTRUCTION 6 OF THIS SECTION.
5. IF 4K OR MORE STORAGE IS USED PUSH START AND PROGRAM WILL HALT AT ADDRESS 3001.
6. SET SENSE SWITCHES, ENTER SELECTION DIGITS AND CODES AS DESIRED. PUSH START.

TO SIMPLIFY THE ENTERING OF SELECTION DIGITS USE THE FOLLOWING PROCEDURE.

A. MANUALLY PUNCH A CARD WITH THE FOLLOWING INFORMATION

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
,008015,022026XXXXXXXXXX    XXXXXXXXXXXXXXXXXXXXXX    XXXXXXXXXXXXXXXXXXXXXX
```

STORAGE SIZE — (XXXXXXXXXX) — SELECTION DIGITS

LESS THAN 4K PUNCH M061S818404

4K AND GREATER PUNCH M079S998E01

CARD COLUMNS 31 THROUGH 79 CORRESPOND TO SELECTION DIGIT LOCATIONS 1251 TO 1299

B. PUSH START RESET KEY AND LOAD THE PREPARED CARD. AFTER EXECUTING THE CARD THE FIRST TEST FROM TAPE WILL BE LOADED. KEEP THIS LOAD CARD. IT CAN BE USED EVERY TIME TESTS ARE RUN FROM TAPE.

NOTE: IF READ ROUTINE FOR LESS THAN 4K IS USED, IT WILL AUTOMATICALLY BYPASS ALL TESTS WITH AN ALPHA CHARACTER IN THE SECOND POSITION OF THE BLOCK NUMBER.

C. PROGRAM CONTROL:

1. WHEN USING LESS THAN 4K READ ROUTINE A STOP CODE MAY BE ENTERED AT LOCATION 1289 AND PROGRAM WILL HALT AT THIS ADDRESS ONCE BEFORE EACH PASS THROUGH THE TAPE. ONCE INTO THE ROUTINE, THE PROGRAM MAY BE BROUGHT TO A HALT AT ADDRESS 1289 USING ADDRESS STOP MODE. CHANGING SELECTION DIGITS SHOULD BE DONE ONLY AT THIS ADDRESS.
2. WHEN USING THE 4K OR MORE ROUTINE A STOP CODE MAY BE ENTERED AT ADDRESS 3365 OR THE ADDRESS STOP METHOD MAY BE USED TO ATTAIN THE SAME RESULTS AS IN PART 1 OF THIS SECTION.

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C. PROGRAM CONTROL (CONTINUED)

3. SELECTION DIGITS:

A. S51 1251 STORAGE SIZE:

1251	BLANK	1.4K
1251	1	2K
1251	4	4K
1251	8	8K
1251	2	12K
1251	6	16K

B. S52 1252 TITLE PRINT ROUTINE

A 1 IN 1252 WILL SELECT TITLE PRINT. IF 1252 IS BLANK, THE TITLE PRINT ROUTINE WILL BE BYPASSED.

NOTE: CARD NUMBER 02, COLUMN NUMBER 33 MAY BE CHANGED FROM AN "N" TO AN "M". THIS WILL SELECT TITLE PRINT AUTOMATICALLY.

C. S53 TO S99 SELECTION DIGITS FOR VARIOUS OPTIONAL FEATURES. THESE DIGITS MAY BE FOUND IN THE INDIVIDUAL TEST WRITE-UPS OR IN THE GENERAL DESCRIPTION FOR OVERLAP TESTS.

D. TYPE RUN:

TWO ROUTINES ARE USED TO ALLOW SELECTION OR BYPASSING OF CERTAIN TESTS. THEY ARE:

1.4K ROUTINE:		4K ROUTINE ENTER IN S77-1277
SSF ON-	RUN SELECTED TEST ONLY	1
SSF ON-	RUN SELECTED GROUP ONLY	2
SSF OFF-	PASS SELECTED TEST	3
SSF OFF-	PASS SELECTED GROUP	4

E. S73-S76 ENTER BLOCK NUMBER OF TEST TO BE SELECTED OR BYPASSED.
I.E.: 3200, 9100, 1C16, 1T09, ETC.

F. S73-S74 ENTER GROUP MNEMONIC TO SELECT OR BYPASS ENTIRE GROUP.
I.E.: 32, 91, 1C, 1T, ETC.

G. S98-1298 ENTER A ONE TO SELECT OVERLAP MODE. LEAVE BLANK FOR BASIC RUN NON-OVERLAP.

H. S99-1299 IF RUNNING OVERLAP THIS ADDRESS IS USED TO SELECT A UNIT OF I-O EQUIPMENT. SEE SELECTION DIGITS IN OVERLAP GENERAL DESCRIPTION.

4. EXAMPLES FOR SELECTING OR BYPASSING TESTS OR GROUPS:

SELECTION DIGIT S77 1277 DETERMINES THE TYPE RUN TO BE MADE WHEN USING 4K READ ROUTING. 1. 4K ROUTINE USES SSF. EXAMPLES:

A. 1 - RUN SELECTED TEST.
TEST NUMBER MUST BE ENTERED IN S73-S76.
EXAMPLE: TO RUN BLOCK 3200 MULTIPLY
ENTER:
S77-1 OR SSF ON
S73-S76 -- 3200
S58-1 TO SELECT THIS TEST

B. 2 - PASS SELECTED TEST.
TEST NUMBER MUST BE ENTERED IN S73-S76.
EXAMPLE: TO PASS BLOCK 3200 MULTIPLY
ENTER:
S77-2 OR SSF OFF
S73-S76 -- 3200
SINCE THE PROGRAM WILL NOT BE RUN, NO SELECTION DIGIT IN S58 IS NECESSARY.

C. 3 - RUN SELECTED GROUP.
SELECTED GROUP MNEMONIC MUST BE ENTERED IN S73-S74.
EXAMPLE: TO RUN ALL INDEX TESTS
ENTER:
S77-3 - OR F ON
S73-S74 - 31
S57-1 - TO SELECT THESE TESTS.

D. 4 - BYPASS SELECTED GROUP.
SELECTED GROUP MNEMONIC MUST BE ENTERED IN S73-S74.
EXAMPLE: TO PASS ALL INDEX TESTS.
ENTER:
S77-4 - OR-F OFF
S73-S74 - 31
SINCE THE TESTS WILL NOT BE RUN, NO FURTHER DIGITS ARE NECESSARY.

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D. PERMANENT READ ERROR:

WHEN A READ ERROR OCCURS, AN ATTEMPT WILL BE MADE TO READ THE RECORD 10 TIMES. IF THE RECORD IS NOT READ CORRECTLY BY THE 10TH TRY, A PRINTOUT STATING THE SITUATION WILL BE GIVEN AND A PROGRAM STOP REACHED. TO IGNORE THIS PROGRAM AND CONTINUE TO THE NEXT, PUSH START. TO PROCESS THIS INFORMATION, MANUALLY TRANSFER TO 377.

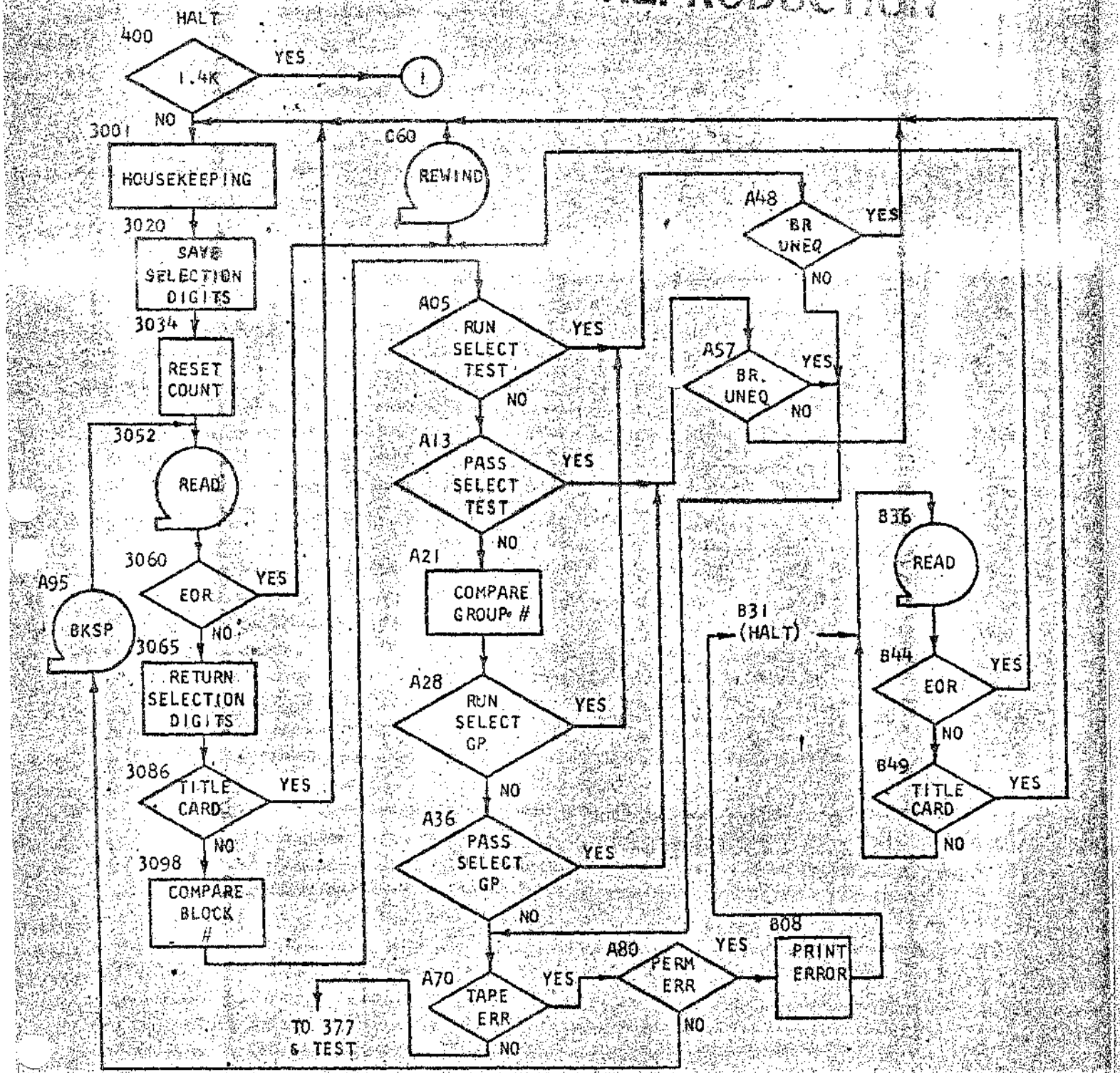
NOTE: CARD NUMBER 13 COLUMN 47 MAY BE CHANGED TO A 9. THIS WILL ALLOW 90 ATTEMPTS TO READ ANY RECORD IN ERROR.

E. TEST PROCEDURE:

THE FIRST RECORD READ IS THE TAPE READ ROUTINE. THIS ROUTINE READS IN THE TESTS AND ANALYZES THE SELECTION DIGITS TO DETERMINE IF IT IS TO BE RUN OR NOT. SINCE TESTS ARE VARIABLE TO 2K, IT IS NECESSARY FOR THE ROUTINE TO SAVE AND RESTORE THE SELECTION DIGITS 1251-1299 EACH TIME A NEW RECORD IS READ.

F. PRINTOUTS:

PERM READ ERROR BLOCK XXXXX. TO PASS TEST, PUSH START. TO PROCESS TRANSFER TO 377.



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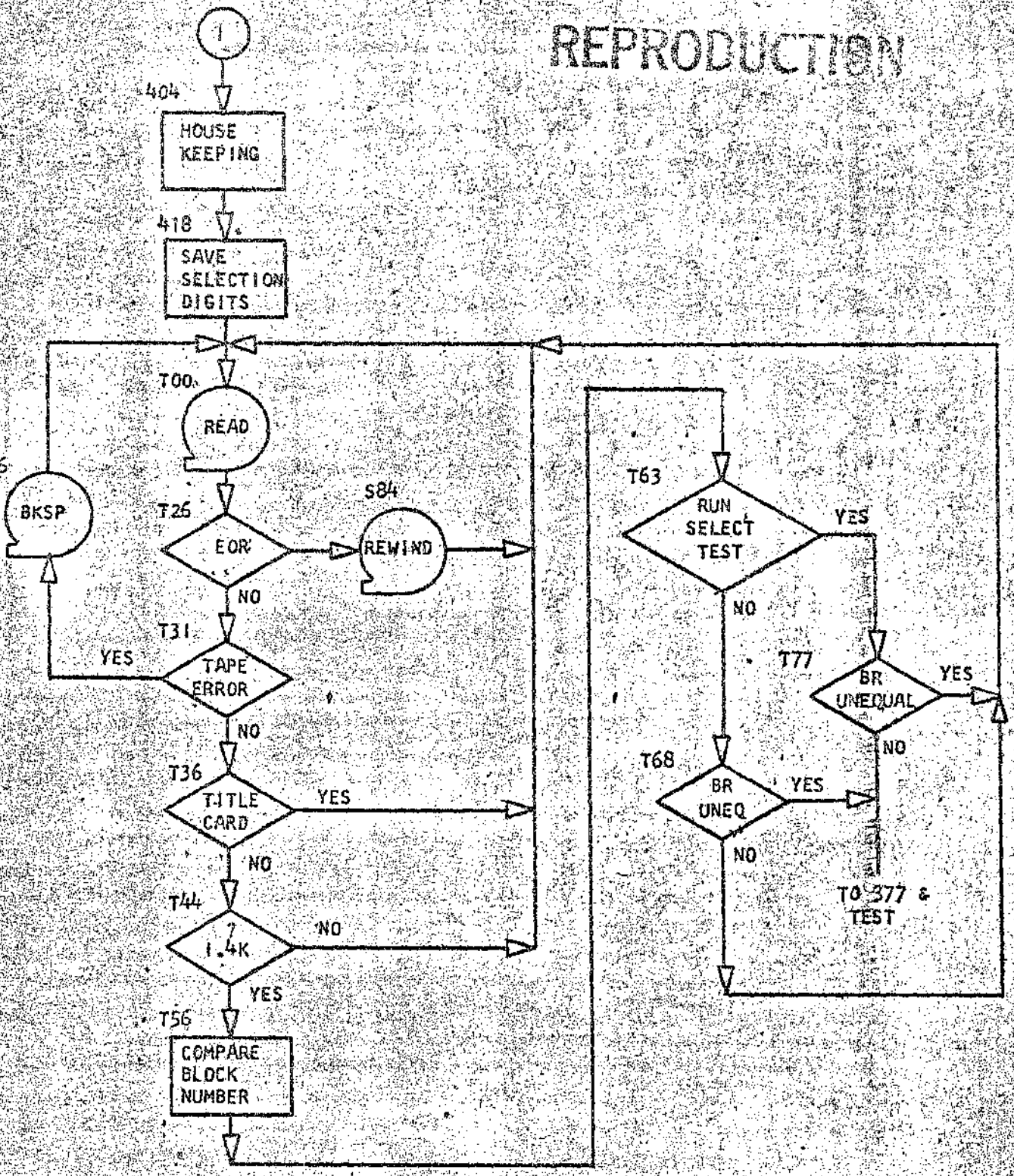
DIAGNOSTIC FUNCTION TEST

PART NO. 451866
SHEET 6 OF 7
BLOCK NO. LT02 2



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PROGRAM LISTING FOR USE WITH FLOW CHART

READ TEST TAPE ROUTINE 1T02C

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	+16		USED WHEN TEST IS RUN FROM TAPE
393	393	N	429	S52	REFERENCE SECTION C IN WRITE UP C FOR TA
400	400	.	433		HALT TO ENTER STORAGE SIZE SELEC DIGIT
404	404	,	T98	S73	4K PUSH START 1.4K START RESET START
411	411	M	430	T98	PUT GM T98
418	418	L	T98	S50	LOAD GM WM S50
425	425	B	T00		START 1.4K
429	429	1			GM IN 430
433	433	¤	S73	S84	SETUP 4K READ ROUTINE
440	440	¤	S89	S90	, ,
447	447	M	470	S99	, ,
454	454	M	470		, ,
458	458	B	+00		START 4K READ ROUTINE
1284	S84	U	%01	R	1.4K READ ROUTINE REWIND DRIVE 1
1289	S89	N			*CHANGE TO HALT C FOR TA
1290	S90	B	T00		
1300	T00	/	081		CLEAR GM WM
1304	T04	L	%01	001R	READ DRIVE 1
1312	T12	L	T95	352	PUT B T00 IN 348
1319	T19	L	T94	388	PUT B T00 IN 385
1326	T26	B	S84	K	BRANCH ON E.O.F.
1331	T31	B	T86	L	BRANCH ON TAPE READ ERROR
1336	T36	B	T00	080A	BRANCH IF TITLE CARD
1344	T44	V	T56	0742	BRANCH IF 1.4K TEST
1352	T52	B	T00		BRANCH TO READ NEXT RECORD
1356	T56	C	076	S76	COMPARE BLOCK NUMBER FOR SELECTION
1363	T63	B	T77	F	BRANCH ON F SS
1368	T68	B	377	/	RUN TEST IF BLOCK NO NOT IN S73-S76
1373	T73	B	T00		READ NEXT RECORD SS F OFF
1377	T77	B	T00	/	READ NEXT RECORD SS F ON
1382	T82	B	377		BRANCH TO RUN TEST WITH BLK NO ENTERD
1386	T86	U	%01	8	BACK SPACE AND
1391	T91	B	T00		BRANCH TO READ RECORD AGAIN
3000	+00	.			HALT TO ENTER SELECTION DIGITS
3001	+01	,	S50		SET WM TO SAVE SELECTION DIGITS
3005	+05	,	C98		MAKE GM WM IN C98
3009	+09	L	C98	R99	PUT GM WM R99
3016	+16	¤	S73		CLEAR WM IN BLOCK COMPARE AREA
3020	+20	L	S99	D99	SAVE SELECTION DIGITS
3027	+27	N	000	000	
3034	+34	L	C53	C51	RESET COUNTER
3041	+41	D	+47	S50	CLEAR GM OUT OF S50
3048	+48	/	081		CLEAR GM WM 081
3052	+52	L	%01	001R	READ A RECORD
3060	+60	B	C60	K	BRANCH ON E.O.F.

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```
3065  +65  L 099 S99          RESTORE SELECTION DIGITS
3072  +72  N 000 000
3079  +79  L R99 S50           PUT GM WM S50
3086  +86  B +16 080A         BRANCH TO READ TEST IF TITLE CARD
3094  +94  , S73              SETUP BLOCK LOCATION FOR COMPARE
3098  +98  C 076 S76          COMPARE BLOCK NUMBER
3105  A05  B A48 S771         RUN TESTS WITH BLOCK NUMBER COMPARE
3113  A13  B A57 S772         RUN TESTS WITHOUT BLOCK NUMBER COMPARE
3121  A21  C 074 S74          COMPARE 1ST TWO POSITIONS OF BLOCK NO
3128  A28  B A48 S773         RUN GROUPS WHOSE BLK NUMBERS COMPARE
3136  A36  B A57 S774         ,,  ,,  ,,  ,,  ,, DO NOT ,,
3144  A44  B A70              BRANCH TO RUN ALL TESTS
3148  A48  B +16 /            READ NEXT TEST IF BLK NO,S DON,T COMPARE
3153  A53  B A70              RUN TEST IF BLK NO COMPARES
3157  A57  B A70 /            RUN TEST IF BLOCK NO,S DON,T COMPARE
3162  A62  B +16              READ NEXT TEST IF GP NO COMPARES
3170  A70  B A80 L            BRANCH ON TAPE READ ERROR
3175  A75  B C70              BRANCH TO TEST STORAGE SIZE
3180  A80  A A80 C51          ADD 1 TO READ ERROR COUNTER
3187  A87  B B04 C501         BRANCH WHEN COUNTER REACHES TEN
3195  A95  U 3U1 B            BACK SPACE
3200  B00  B +41              BRANCH TO READ RECORD AGAIN
3204  B04  / 299              LOAD ERROR COMENTS
3208  B08  L B95 280                    ,,
3215  B15  L                            ,,
3216  B16  N                            ,,
3217  B17  N                            ,,
3218  B18  M 077 279          PUT BLOCK NO AND SUFFIX IN PRINT AREA
3225  B25  B B31 E            BRANCH TO HALT FOR PERM READ ERROR
3230  B30  2                  PRINT ERROR
3231  B31  .                  HALT ON ERROR PUSH START TO BYPASS
3232  B32  / 081              CLEAR GM WM
3236  B36  L 3U1 001R         READ TO BYPASS ERROR RECORD
3244  B44  B C60 K            BRANCH ON E.O.F.
3249  B49  B +16 080A         BRANCH TO MAIN READ ROUTINE
3257  B57  B B32              BRANCH TO BYPASS DETAIL RECORDS
3270  B70  P ERM  READ ERR BLOCK
3290  B90  X XXX X.
3296  B96  N C08              *N CHANGES TO B TO RUN 4K TESTS  C FOR TA
3300  C00  N C20              *N CHANGES TO B TO RUN 1.4K TESTSC FOR TA
3304  C04  B 377              RUN ALL TESTS
3308  C08  V +16 0742         BYPASS 1.4K TESTS
3316  C16  B 377              RUN 4K TESTS
3320  C20  V +16 074B         BYPASS 4K TESTS
3328  C28  V +16 074K           ,,  ,,  ,,
3336  C36  V +16 074S           ,,  ,,  ,,
3344  C44  B 377              RUN 1.4K TESTS
3350  C50  X X                READ ERROR COUNTER
3352  C52  0 0                          ,,  RESET
3360  C60  U 3U1 R            REWIND DRIVE 1
3365  C65  N                  *CHANGE TO HALT ENTER SELEC DIGITC FOR TA
```

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```
3366  C66   B +01                    BRANCH TO RESTART
3370  C70   M,000 0
3375  C75   B 896                    BRANCH TO CHECK STORAGE SIZE
3397  C97.                           GM IN C 98
```

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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8			
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0			
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8			
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8			
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8					

```
,008015,022029,033033N0000001001                    READ TEST TAPE ROUTINE   1T02C 0A
L072432,400404,411418,425429100IN429S52.433,T98S73M430T98LT985508T001G   1T02C 02
                                                                    M
L070470,440447,454458,462462100I¤S73S84¤S89S90M470S99M4708P00            1T02C 03
                                                                 Z
L067T18,S89S90,T00T04,T12T12100IU%U1RN8T00      /081L%U100IRLT95362      1T02C 04
L069T55,T26T31,T36T44,T52T52100ILT943B88S84K8T86L8T00080AVT560742BT00     1T02C 05
L067T90,T63T68,T73T77,T82T86100IC076S76BT77F8377/8T00BT00/8377U%U1B       1T02C 06
L036380,001001,001001,00100110018P16                                     1T02C 07
                                  Z
L066P33,P01P05,P09P16,P20P271001..,S50,C98LC9BR99¤S73LS99D99N000000       1T02C 08
    Z  Z  Z  Z  Z  Z  Z
L070P71,P41P48,P52P60,P65001100ILC53C51DP47S50/081L%U100IRBC60KLD99S99   1T02C 09
    Z  Z  Z  Z  Z  Z                    Z
L065A04,P79P86,P94P98,0010011001N000000LR99S50BP16080A,S73G076S76        1T02C 10
       Z  Z  Z  Z                       Z
L071A43,A13A21,A28A36,0010011001BA48S771BA57S772C074S74BA48S7738A57S774  1T02C 11
L067A78,A48A53,A57A62,A70A751001BA70BP16/BA70BA70/BP16 .  BA80LBC70       1T02C 12
                                  Z                 Z
L068B15,A87A95,B00804,B08B151001AA80C51BB04C501U%U1BBP41/299LB95280L      1T02C 13
                                                  Z
L052B35,B17B18,B25B30,B31B321001NNM077279BB31E2./081                     1T02C 14
L057B60,B44B49,B57001,0010011001L%U100IRBC60KBP16080AB832                1T02C 15
                                                  Z
L070C07,B90B96,C00C04,0010011001PERM READ ERR BLOCK XXXXX,NC08NC20B377   1T02C 16
L072C47,C16C20,C28C36,C44C481001VP160742B377VP16074BVP16074KVP16074SB377 1T02C 17
                                  Z              Z     Z     Z
L062C79,C52C60,C65C66,C70C751001XX00      U%U1RNBP01N00008B96            1T02C 18
                                                     Z
L034C98,001001,001001,0010011001 G                                       1T02C 19
                                  M
B008   L037T958009                BT00                                    1T02C 20
```

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COPY TEST TAPE 1T03A

A. PURPOSE

TO REPRODUCE THE MASTER TEST TAPE.

B. LOADING AND RUNNING PROCEDURES

1. LOAD THE MASTER TEST TAPE ON DRIVE 1 AND MAKE READY.
2. DRIVE 2 IS LOADED WITH THE TAPE THAT IS TO BE WRITTEN AND MADE READY.
3. PRESS THE TAPE LOAD KEY. THE READ TEST TAPE PROGRAM 1T02A IS READ INTO MEMORY.
4. PRESS THE START KEY TO START THE COPYING OPERATION.

C. PROGRAM CONTROL

1. SELECTION DIGIT- A 1 MUST BE ENTERED IN S54 1254 TO SELECT THE COPY TEST TAPE PROGRAM 1T03A FROM THE MASTER TAPE. IF THE COPY TEST TAPE PROGRAM WAS NOT WRITTEN ON THE MASTER TAPE IT CAN BE LOADED FROM CARDS.
2. SENSE SWITCH D ON TO REPEAT COPYING OF THE MASTER TEST TAPE IF MORE THAN ONE SET OF PROGRAMS IS DESIRED. NO TAPE MAKE IS WRITTEN BETWEEN THE SETS.

D. TEST PROCEDURE-DOES NOT APPLY

E. STOPS

1. 191 COPYING OPERATION COMPLETE
2. 371 PERMANENT READ ERROR
3. 586 PERMANENT WRITE ERROR

-NOTE- IF THE START KEY IS PRESSED THE PROGRAM WILL IGNORE EITHER A PERMANENT READ OR WRITE ERROR AND CONTINUE TO COPY THE RECORD.

F. PRINTOUTS

SAMPLE 1 COPYING OPERATION COMPLETE

TOTAL REC COPIED 00003 READ ERR 00000 WRITE ERR 00000

SAMPLE 2 PERMANENT READ ERROR-THE RECORD THAT CONTAINS THE PERMANENT READ ERROR WILL BE PRINTED.

```
,019026,049L077S49,0340388038Z98 B4008D98          COPY TEST TAPE       1T03A 26,
1       1    1       1       1       1   1          1
                           PERM. READ ERR
```

SAMPLE 3-PERMANENT WRITE ERROR

PERM. WRITE ERR

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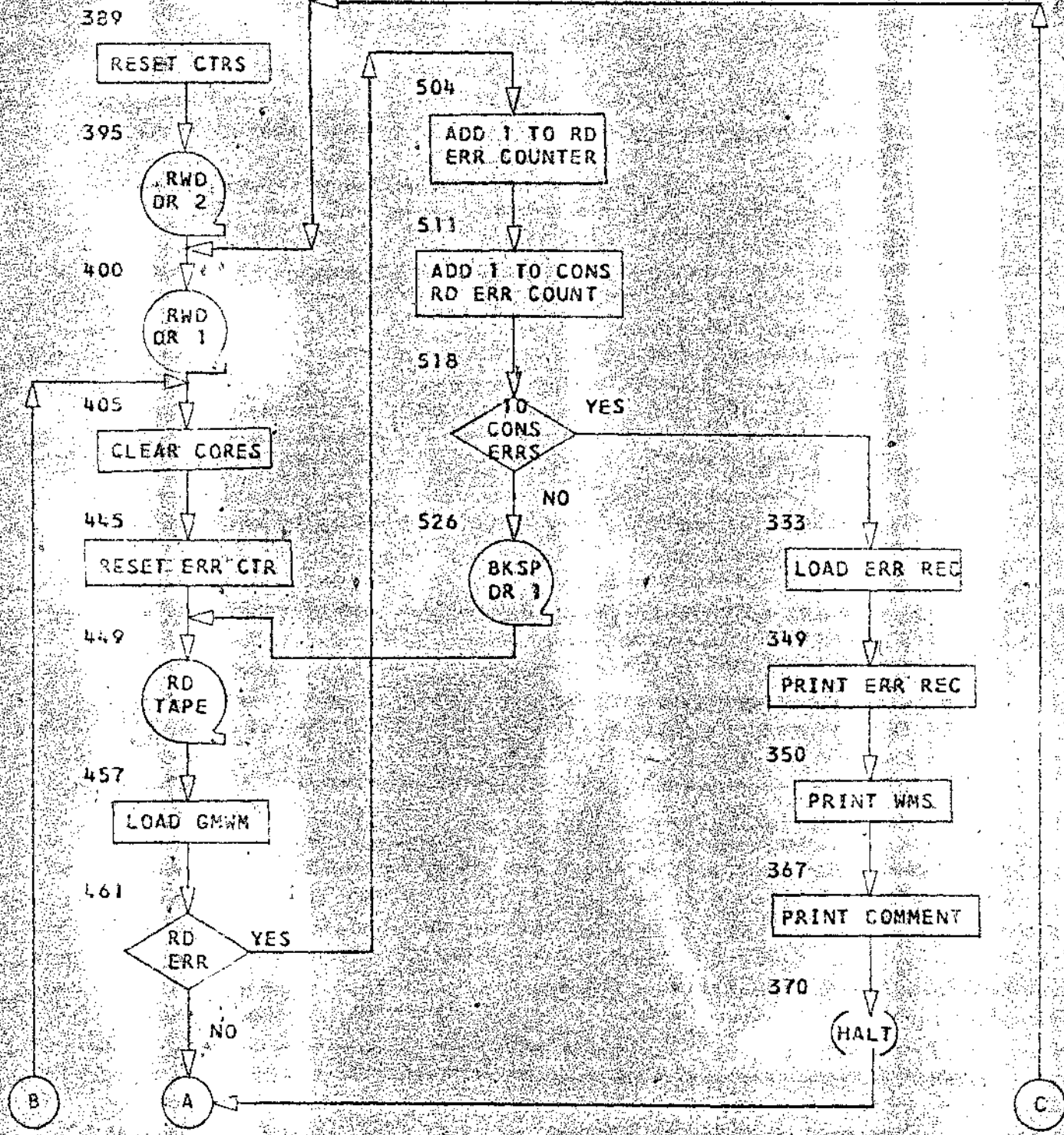
DIAGNOSTIC FUNCTION TEST



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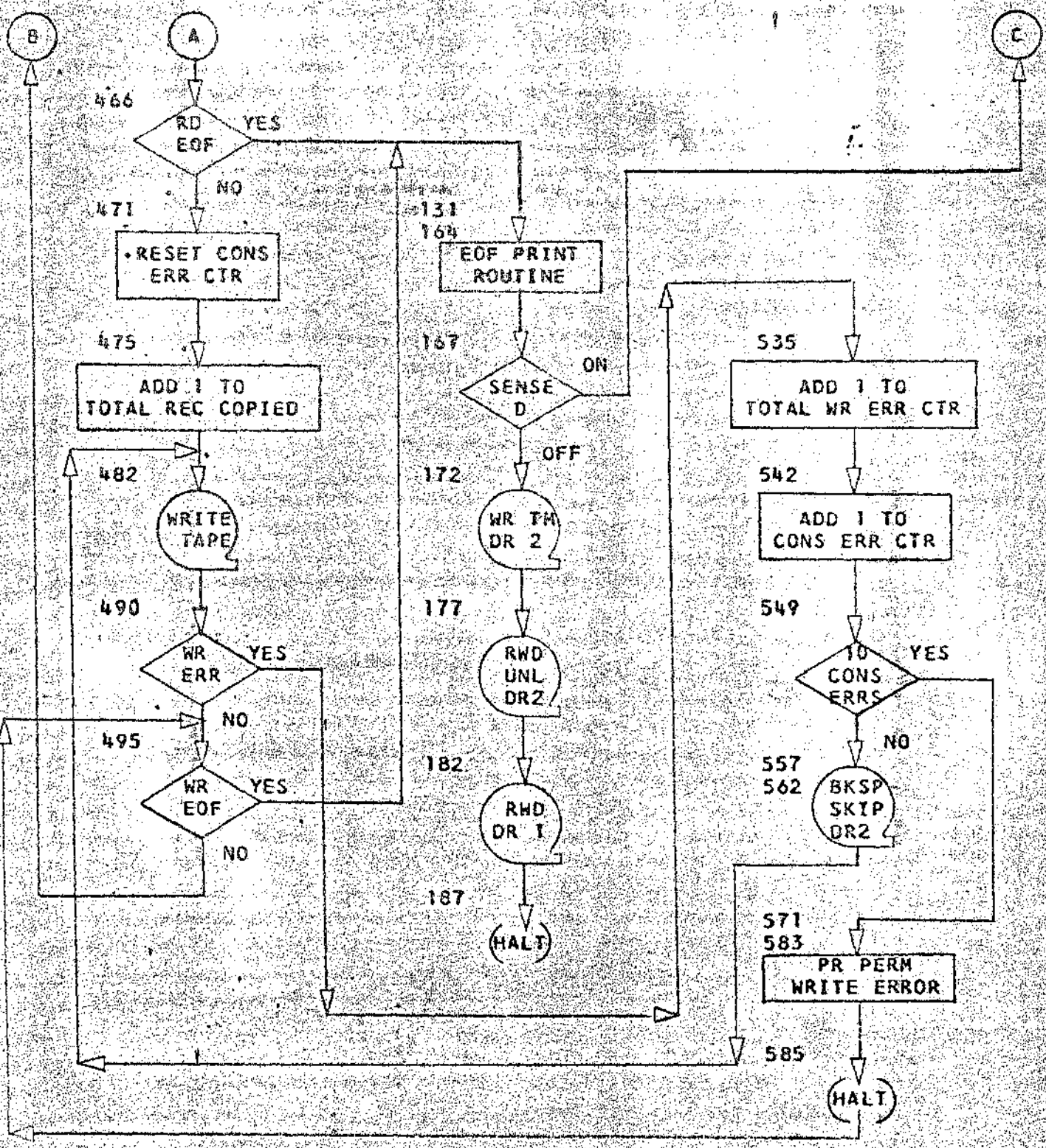

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PROGRAM LISTING FOR USE WITH FLOW CHART

COPY TEST TAPE 1T03A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
083	083	P	ERM .		CONSTANTS
088	088	T	OTA L REC COPIED .		,,
105	105		REA D ERR		,,
115	115		WRI TE ERR		,,
126	126	5			,, GM IN 133
129	129	1	0		,,
131	131	/	280		END OF FILE--PRINT TOTAL IN CTRS
135	135	L	030	270	,,
142	142	L	125		,,
146	146	Y			,,
147	147	L	023		,,
151	151	L	114		,,
155	155	Y			,,
156	156	L	016		,,
160	160	L	104		,,
164	164	2			,,
165	165	F	J		,,
167	167	B	400	D	D ON TO RE-WRITE FROM DRIVE 1
172	172	U	%U2	M	WRITE TM DRIVE 2
177	177	U	%U2	U	REWIND & UNLOAD DRIVE 2
182	182	U	%U1	R	REWIND DRIVE 1
187	187	.	187		END OF PROG HALT
191	191				WORD MARK
333	333	L	679	280	LOAD 1ST 80 CHARAC. OF ERROR REC
340	340	L			,, INTO PRINT AREA
341	341	L			,,
342	342	L			,,
343	343	L			,,
344	344	L			,,
345	345	L			,,
346	346	L			,,
347	347	L			,,
348	348	L			,,
349	349	2			PRINT ERROR REC
350	350	2	n		PRINT WMS IN REC
352	352	/	280		PRINT PERMANENT READ ERROR
356	356	M	114	240	,, COMMENT
363	363	M	087		,,
367	367	2			,,
368	368	F	1		,,
370	370	.			PERM READ ERROR HALT---
371	371	B	466		,, PRESS START TO IGNORE ERROR
377	377	B	389	SS41	USED WHEN PROG RUNS FROM TAPE

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ENG. CHG. NO.	115276	1392						

```
385  385  B  616
389  389  S  033                    ,,
393  393  S                         START PROG. & RESET WR. ERROR CTR
394  394  S                         RESET TOTAL READ ERROR CTR
395  395  U  %U2  R                 RESET TOTAL RECORD CTR
400  400  U  %U1  R                 REWIND WRITE DRIVE
405  405  M  126  442               REWIND READ DRIVE
412  412  ,  442  127               CLEAR CORES FROM 600-3999
419  419  A  130  443                 ,,
426  426  ¤  442                     ,,
430  430  B  445  4420                ,,
438  438  /  412  699                 ,,
445  445  S  007                     RESET CONSEC. ERROR CTR
449  449  L  %U1  600R              READ
457  457  L  128                   LOAD GM-WM NEXT TO READ AREA
461  461  B  504  L                BR IF READ ERROR
466  466  B  131  K                BR IF READ EOF
471  471  S  007                   RESET CONSEC. ERROR CTR
475  475  A  475  016              ADD 1 TO TOTAL REC COPIED CTR
482  482  L  %U2  600W             WRITE
490  490  B  535  L                BR IF WRITE ERROR
495  495  B  131  K                BR IF WRITE EOF
500  500  B  405                   BR TO CLEAR FOR NEXT RECORD
504  504  A  504  023              ADD 1 TO TOTAL READ ERROR CTR
511  511  A  511  002              ADD 1 TO CONSEC. ERROR CTR
518  518  B  333  0011             BR IF 10 CONSEC. ERRORS
526  526  U  %U1  B                BACKSPACE
531  531  B  449                   BR TO RE-READ
535  535  A  535  030              ADD 1 TO TOTAL WRITE ERROR CTR
542  542  A  542  002              ADD 1 TO CONSEC. ERROR CTR
549  549  B  571  0011             BR IF 10 CONSEC. ERRORS
557  557  U  %U2  B                BACKSPACE
562  562  U  %U2  E                SKIP
567  567  B  482                   BR TO RE-WRITE
571  571  M  125  241              PRINT PERMANENT WRITE ERROR
578  578  M  087                     ,, COMMENT
582  582  2                          ,,
583  583  F  1                       ,,
585  585  .                       PERM WRITE ERROR HALT---
586  586  B  495                     ,, PRESS START TO IGNORE ERROR
590  590
591  591
592  592
593  593
594  594
595  595
596  596
597  597
598  598
599  599
```

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DIAGNOSTIC FUNCTION TEST

TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5,8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080121001                                          COPY TEST TAPE          1T03A 0A
,016023N000/000,030031,038046N,0990508046    ,057,064068¤0120311001   CC1T03A 02
MZ98099B023S511M072068M06804780500047S80640470/P99A071069/023S491001Z0I0Q1T03A 03
                                                     Z
,037039B023S511/023R98M099Z98L063118LL/1010991105,001001/001118 DIAG  CC1T03A 04
,008015,022029,033033N0000001001                                         1T03A 05
L068W80,W49W56,W60W61,W69W731001/080,008012,0011BW73S511B001VW600058      1T03A 06
L051W99,W89W93,W98W99,0010011001VW60005W8001BP16                         1T03A 07
                                                    Z
L064114,088105,001001,0010018W60PERM.TOTAL REC COPIED  READ ERR          1T03A 08
L064146,126129,131135,1421468W60 WRITE ERR 5G 10/280L030270L125Y         1T03A 09
                                                   M
L052166,151155,156160,164165BW60L023L114YL016L1042FJ                     1T03A 10
L072206,172177,182187,191001BW60B400DU%U2MU%U2UU%U1R.187                 1T03A 11
L045345,340341,342343,3443458W60L679280LLLLLL                            1T03A 12
L049362,347348,349350,352356BW60LLL22¤/280M114240                        1T03A 13
L058388,367368,370371,3773858W60M0872F1.8466  8389S5418P16               1T03A 14
                                                                  Z
L062418,393394,395400,405412BW60S033SSU%U2RU%U1RM126442,442127            1T03A 15
L070456,426430,438445,4490018W60A130443¤442B4454420/412699S007L%U1600R   1T03A 16
L070494,461466,471475,482490BW60L128B504LB131KS007A475016L%U2600WB535L   1T03A 17
L072534,500504,511518,5265318W60B131K8405A504023A5110028333001IU%U18B4491T03A 18
L068570,542549,557562,567001BW60A535030A542002B5710011U%U2BU%U2EB482    1T03A 19
L052590,578582,583585,586590BW60M125241M0872F1.8495                      1T03A 20
L039597,592593,594595,596597BW60                                         1T03A 21
L072637,599001,001001,0010018W60                                         1T03A 22
L072V81,V46V43,V61V62,V70V78BW60/T99L080T80BW93Z98G1BW02072 BW320721,001 1T03A 23
                                                              M
L071W20,V90V98,W02W10,W17001BW60BW45080ABV42072DBV538W45080AN071Y71N180  1T03A 24
L056W44,W28W32,W39001,0010018W45N080180B421L070Z418V78                   1T03A 25
,019026,049L077S49,0340388038Z98GB4008D98          COPY TEST TAPE        1T03A 26
                                                  M
```

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TAPE ERROR TEST 1T06A

A. PURPOSE

TO TEST THE MAGNETIC TAPE CHECKING CIRCUITRY.

B. LOADING

THE PROGRAM INSTRUCTIONS MAY BE LOADED FROM CARDS OR MAGNETIC TAPE. IF THE PROGRAM IS TO BE RUN FROM CARDS, THERE MUST NOT BE A GROUP-MARK IN LOCATION 298 1998. A 1 MUST BE ENTERED IN LOCATION 568 1268 IF THE PROGRAM IS TO BE RUN FROM MAGNETIC TAPE.

C. PROGRAM CONTROL

SENSE SWITCH B ON	- PERMITS SCOPING
SENSE SWITCH C ON	- PRINTS CORRECT RESULTS
SENSE SWITCH D ON	- ALLOWS CONTINUOUS RUNNING OF THE VARIOUS PORTIONS OF THE PROGRAM
SENSE SWITCH E ON	- STOPS FOR ERROR RESULTS
SENSE SWITCH F ON	- ALWAYS STOPS AFTER WRITING ODD PARITY TAPE-MARK
	- ALWAYS STOPS AFTER READING NO CHECK CHARACTER
SENSE SWITCH G ON	- REPEATS THE ENTIRE FIRST PORTION -VRCR CHECKING-.
LOCATION 400	- BEGIN VRCR CHECKING IN HIGH OR LOW DENSITY
LOCATION 552 1252	- ENTER A -ONE- FOR TITLE AND HEADING PRINT-OUTS
LOCATION X60 1760	- BEGIN WRITING IN LOW-DENSITY
LOCATION X93 1795	- BEGIN WRITING TAPE-MARKS IN ODD-PARITY AND IN LOW DENSITY
LOCATION J00 2100	- BEGIN LRCR CHECKING, I.E. READING IN HIGH-DENSITY THE TAPE RECORDS JUST WRITTEN IN LOW-DENSITY

D. TEST PROCEDURES

THE TEST MAY BE DIVIDED AS FOLLOWS

1. VRCR TESTING

2. LRCR TESTING

   A. WRITE IN LOW DENSITY TO GENERATE A TAPE WHICH APPEARS TO BE AN ERROR TAPE WHEN READ IN HIGH DENSITY.

B. WRITE TAPE-MARK IN ODD PARITY
   1. TO FORCE WRITE TAPE ERRORS
   2. TO IDENTIFY END-OF-REEL

C. READ IN HIGH DENSITY TO FORCE LRCR ERRORS.

THE PROGRAM AUTOMATICALLY PROCEEDS FROM ONE SECTION TO THE NEXT. THE REPEAT LOOPS -SENSE B, D, OR G- ARE USED WITHIN EACH SECTION THEREFORE, IF THE PROGRAM HAS ADVANCED TO THE NEXT SECTION, IT IS NECESSARY TO MANUALLY RESTART THE PROGRAM IN THE DESIRED SECTION.

VRCR TESTING - TAPE DRIVE 4 IS USED AS THE WORK DRIVE AND MAY BE SET TO EITHER DENSITY. EVEN AND ODD PARITY TAPE INSTRUCTIONS ARE USED TO TURN THE TAPE ERROR INDICATOR ON AND OFF FOR EVERY OTHER TAPE READ OPERATION.

TO REPEAT THIS PORTION OF THE TEST, TURN SENSE SWITCH G ON. TO REPEAT ANY SINGLE CHARACTER, TURN SENSE SWITCH B OR D ON. IF IT IS DESIRABLE TO USE ANY GIVEN CHARACTER- TURN SENSE SWITCH B OR D ON, MANUALLY ENTER THE CHARACTER IN LOCATION 120 AND RESTART THE PROGRAM AT LOCATION 400.

AT THE COMPLETION OF VRCR TESTING, THE PROGRAM WILL STOP AT X17 1717 -STORAGE ADDRESS REGISTER-. AN INSTRUCTION TO THE OPERATOR TO SET THE DRIVE TO LOW-DENSITY WOULD BE PRINTED IF THERE WAS A 1 IN S52 1252.

LRCR TESTING - TAPE DRIVE 4 IS USED AS THE WORK DRIVE AND MUST BE SET FOR LOW DENSITY, WHILE THE LRCR ERROR TAPE IS BEING WRITTEN. THE LRCR ERROR TAPE CONSISTS OF SINGLE CHARACTER RECORDS WRITTEN IN ODD-PARITY AND LOW DENSITY. THE RECORDS ARE- C-BIT, B-BIT, A-BIT, 8-BIT, 4-BIT, 2-BIT, 1-BIT, AND A GROUP-MARK FOR THE EIGHTH RECORD. THIS SERIES OF EIGHT RECORDS WILL BE REPEATED TEN TIMES. THEN TEN TAPE-MARKS WILL BE WRITTEN AND THE PROGRAM WILL STOP AT -32 2032 -STORAGE ADDRESS REGISTER-. THIS COMPLETES THE GENERATION OF THE ERROR TAPE. AN INSTRUCTION TO THE OPERATOR TO SET DRIVE 4 TO HIGH DENSITY WOULD BE PRINTED IF THERE WAS A ONE IN S52 1252.

THE REPEAT LOOPS IN THIS PORTION ARE PRIMARILY FOR WRITING A LONG ERROR TAPE FOR USE IN THE LRCR READING SECTION. FOR EXAMPLE, TURN SENSE SWITCH D ON, START THE PROGRAM AT X39 1739, AND THE PROGRAM WILL KEEP WRITING THE RECORDS UNTIL THE END-OF-REEL. IF IT IS DESIRED TO USE A SINGLE CHARACTER, MANUALLY ENTER THE CHARACTER IN 107, SET SENSE SWITCH B ON, AND START THE PROGRAM AT X60 1760.

AN ODD-PARITY WRITE TAPE-MARK INSTRUCTION IS USED TO FORCE WRITE ERRORS. THE INSTRUCTION IS EXECUTED TEN TIMES FOR REPETITION. TO CHANGE THE NUMBER OF REPETITIONS, MANUALLY CHANGE THE CHARACTER IN LOCATION Z76 1976. FOR EXAMPLE, PLACING A 9 IN LOCATION Z76 1976 WILL CAUSE 90 TAPE MARKS TO BE WRITTEN.

AFTER AN ERROR TAPE HAS BEEN GENERATED AND THE PROGRAM HAS STOPPED AT 2032 -STORAGE ADDRESS REGISTER- DRIVE 4 MUST BE SET TO HIGH DENSITY. PRESS THE START-KEY TO CONTINUE. EVERY RECORD READ SHOULD RESULT IN AN LRCR ERROR -CORRECT MACHINE OPERATION-. IF NO TAPE ERROR IS INDICATED -MACHINE ERROR-. THE PROGRAM WILL ERROR STOP -STORAGE ADDRESS REGISTER 2291- OR ERROR PRINT DEPENDING UPON THE SETTING OF SENSE SWITCH E.

SENSE SWITCH F MAY BE HELPFUL IN TROUBLE ANALYSIS. SENSE SWITCH F ON CAUSES THE PROGRAM TO STOP AFTER EACH TAPE RECORD SO THAT THE TAPE CE PANEL MAY BE STUDIED.

THE CHARACTER SUPPLIED TO THE PRINTOUT IS OBTAINED FROM THE TABLE- HENCE, IF THE PROGRAM IS OUT OF STEP WITH THE TAPE, THIS CHARACTER HAS NO MEANING.

E. STOPS

INSTR. ADDR.	STORAGE ADD. REG.		
915	919	WRITTEN EVEN, READ EVEN	VRCR OR LRCR ERROR
921	925	WRITTEN ODD, READ EVEN	VRCR ERROR
959	963	WRITTEN ODD, READ ODD	VRCR OR LRCR ERROR
983	987	WRITTEN EVEN, READ ODD	VRCR ERROR
X13	X17	SET DRIVE 4 TO LOW DENSITY	
-71	-75	WRITE TAPE MARK	VRCR ERROR
-28	-32	SET DRIVE 4 TO HIGH DENSITY	
K87	K91	WRITTEN ODD, READ ODD	LRCR ERROR

F. SAMPLE PRINTOUTS

TAPE ERROR TEST 1T06

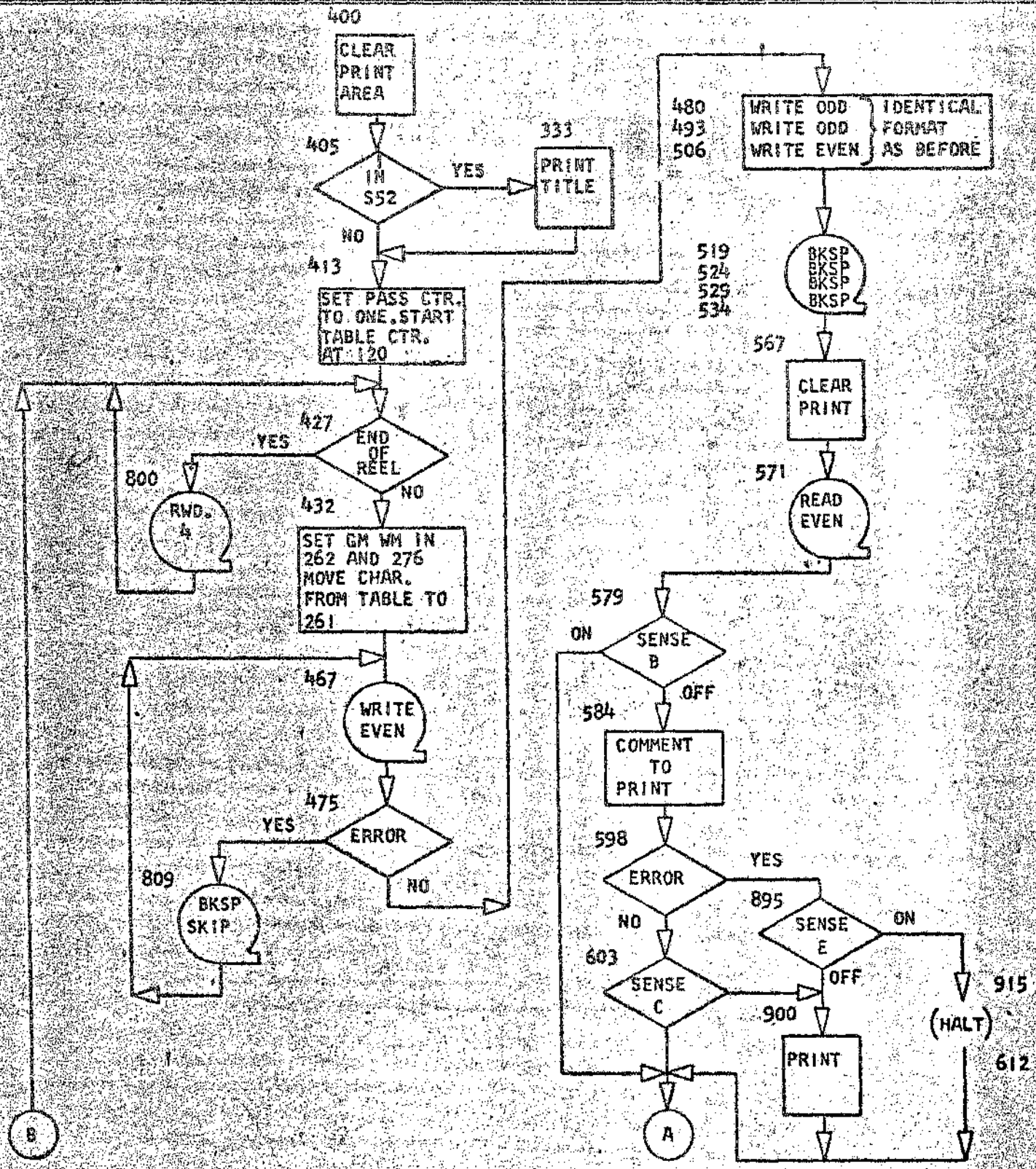
WRITTEN	READ	INDICATED READ ERROR	CHARACTER WRITTEN	CHARACTER READ	
EVEN	EVEN		1	1	
ODD	EVEN	YES	1	1	
ODD	ODD	YES	1	1	ERROR
ODD	EVEN	YES	X	X	
ODD	ODD		X	X	

SET DRIVE FOUR TO LOW DENSITY

ODD		TAPE MARK		ERROR
ODD	YES	TAPE MARK		

SET DRIVE FOUR TO HIGH DENSITY

ODD	ODD	YES			
ODD	ODD	YES	-	-	
ODD	ODD	NO	$	$	ERROR
ODD	ODD	YES	8	8	
ODD	ODD	YES	4	4	
ODD	ODD	YES	2	2	
ODD	ODD	YES	1	1	
ODD	ODD	YES	GROUP MARK	GROUP MARK	



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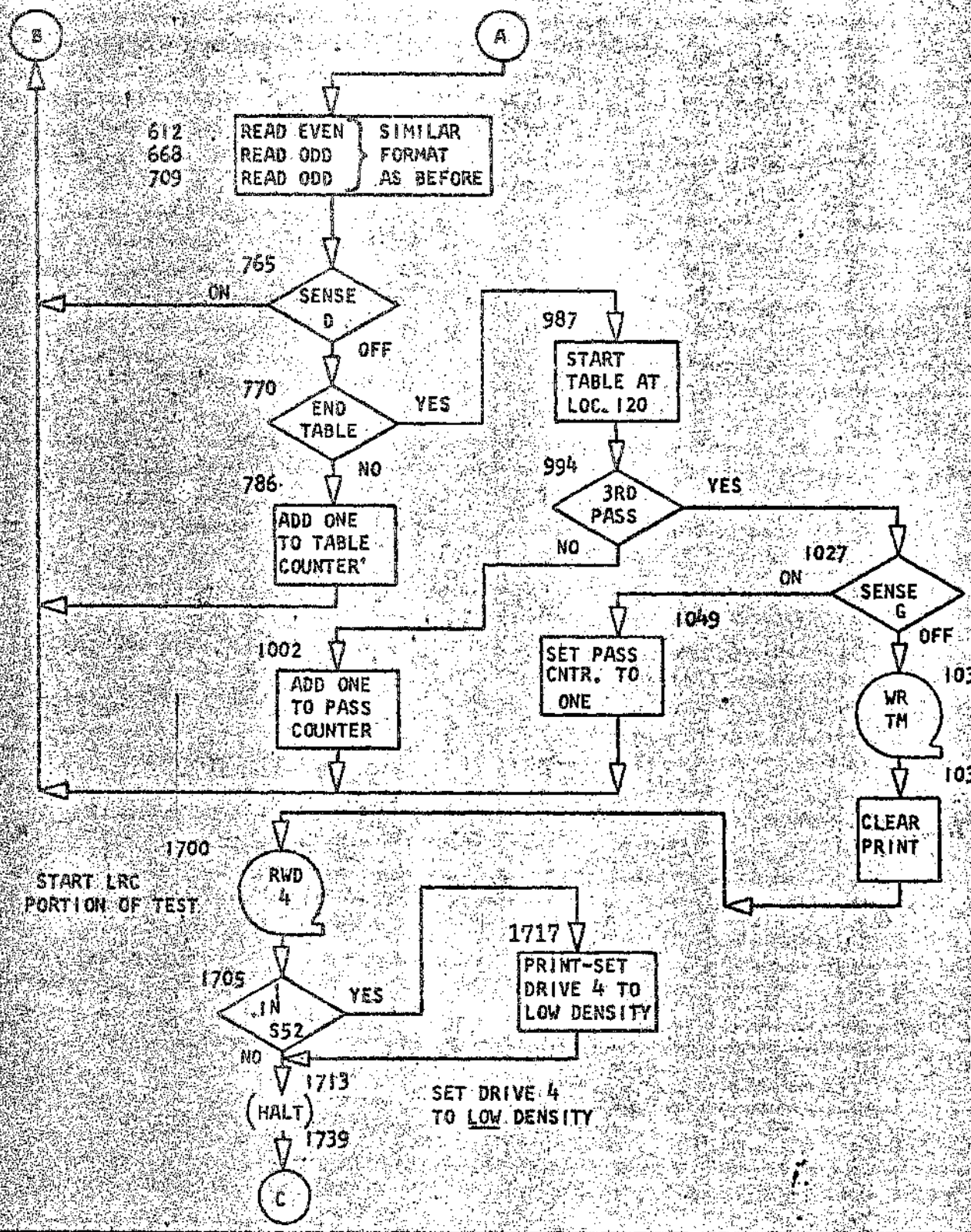

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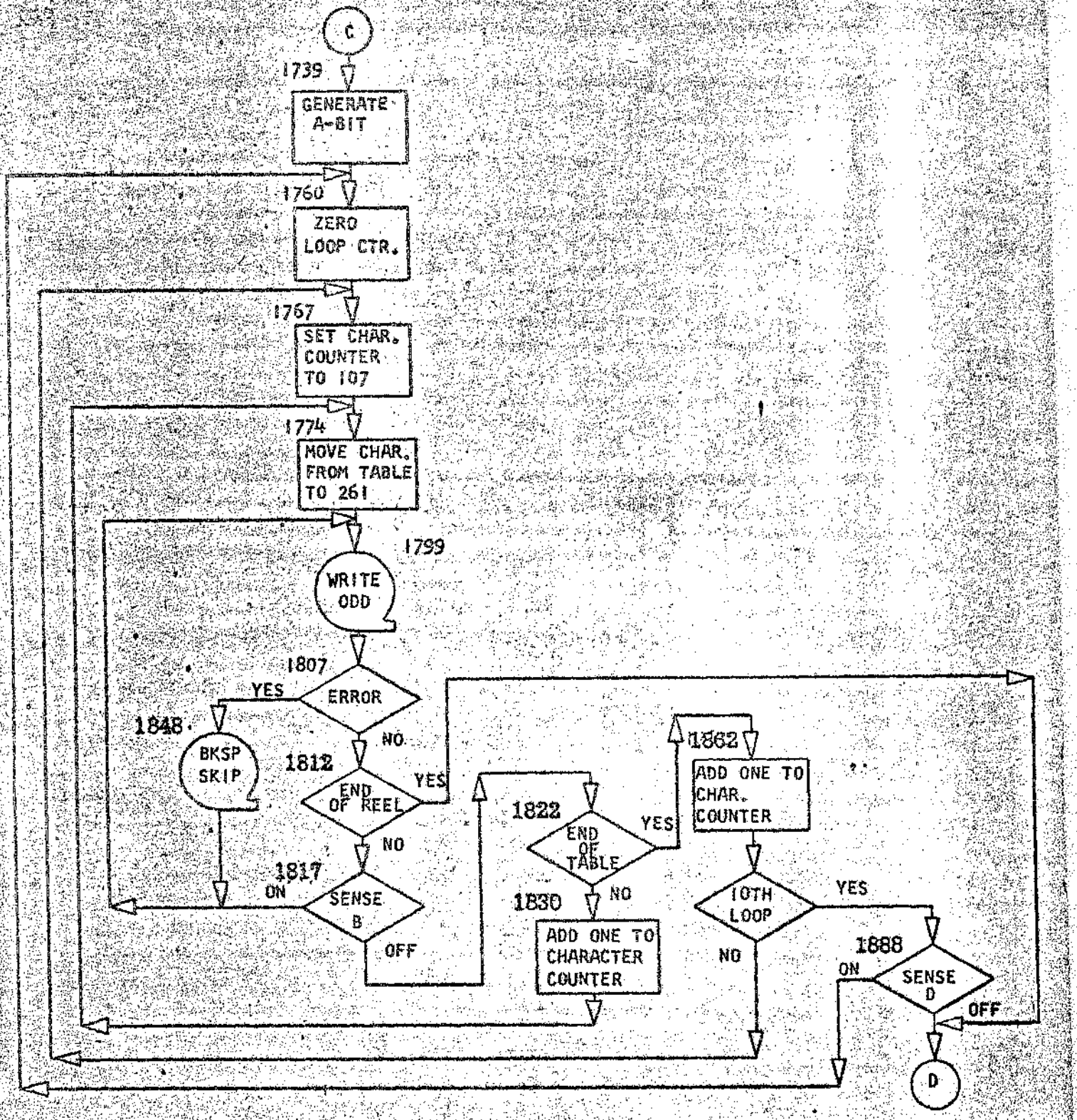

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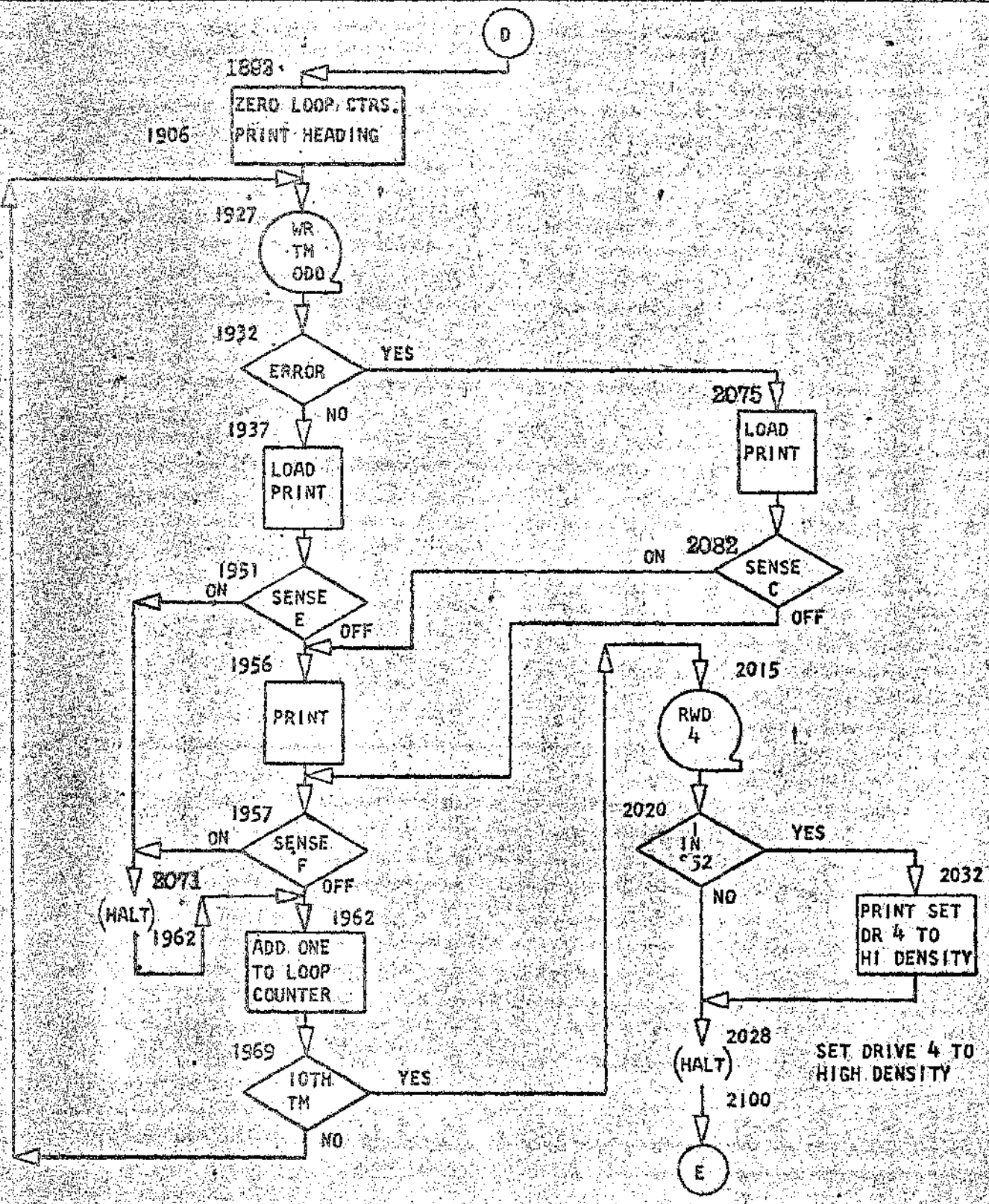

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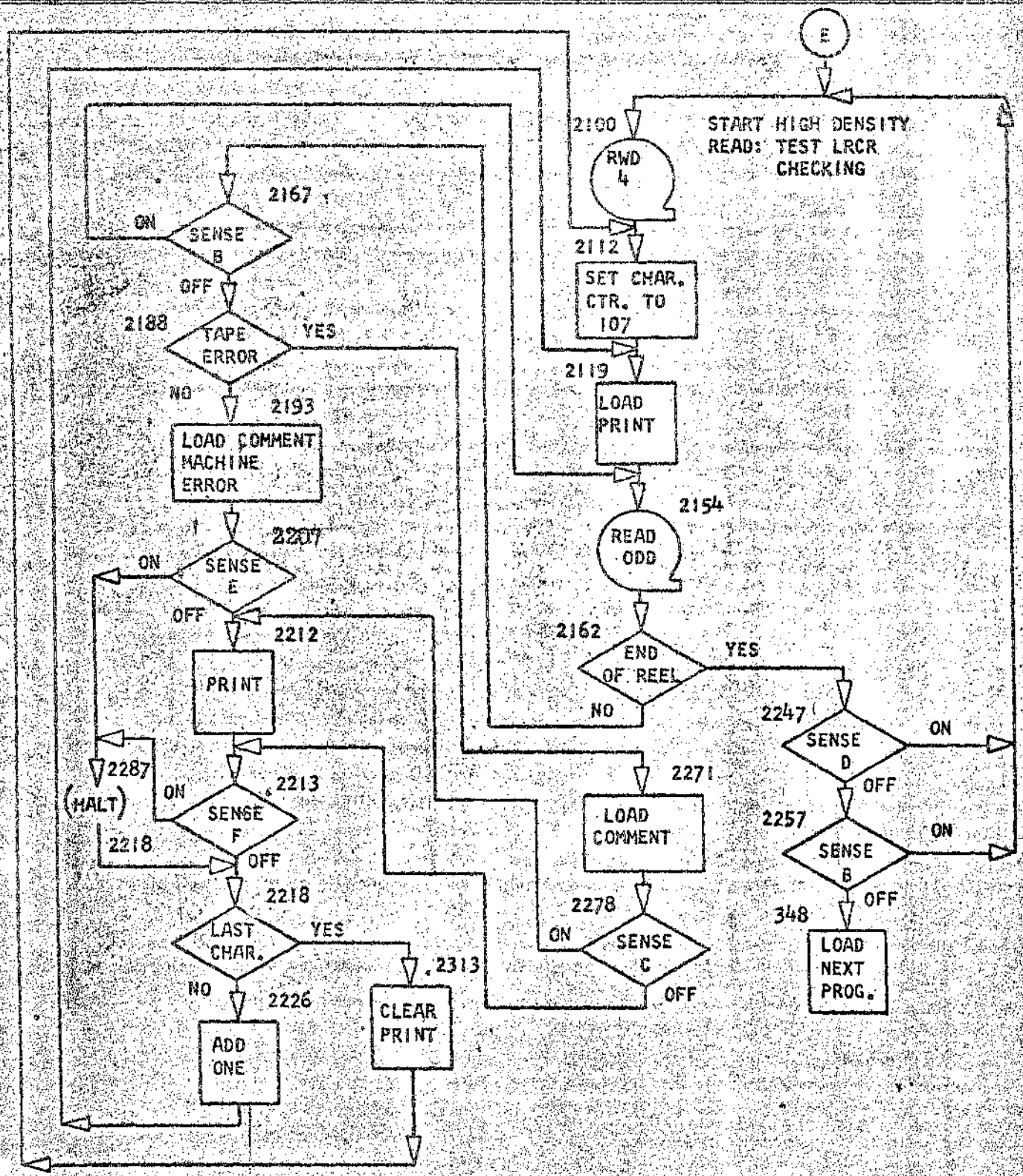

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PROGRAM LISTING FOR USE WITH FLOW CHART

TAPE ERROR TEST 1T06A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	$681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	W93		,,
389	389	N	V62		,,
393	393	M	385	389	,,
400	400	/	332		CLEAR PRINT
404	404	/			,,
405	405	B	333	$521	BR TO TITLE PRINT IF 1 IN 1252
413	413	L	083	085	SET PASS COUNTER TO ONE
420	420	L	091	088	START TABLE AT 120
427	427	B	800	K	BRANCH IF END OF REEL
432	432	L	$50	262	LOAD GM WM IN LOC. 262
439	439	L	$50	276	LOAD GM WM IN LOC. 276
446	446	,	261	261	SET WORD MARK IN LOC. 261
453	453	M	088	463	MOVE TABLE CHARACTER TO PRINT AREA
460	460	M	XXX	261	,,
467	467	M	%U4	261W	WRITE TAPE EVEN
475	475	B	809	L	BRANCH ON TAPE ERROR
480	480	M	%84	261W	WRITE TAPE ODD
488	488	B	823	L	BRANCH ON TAPE ERROR
493	493	M	%84	261W	WRITE TAPE ODD
501	501	B	837	L	BRANCH ON TAPE ERROR
506	506	M	%U4	261W	WRITE TAPE EVEN
514	514	B	851	L	BRANCH ON TAPE ERROR
519	519	U	%U4	B	BACKSPACE TAPE
524	524	U	%U4	B	,,
529	529	U	%U4	B	,,
534	534	U	%U4	B	,,
539	539	B	567		BRANCH
567	567	/	250		CLEAR PRINT
571	571	M	%U4	272R	READ TAPE EVEN
579	579	B	612	B	B ON TO SCOPE
584	584	M	174	224	WORD EVEN TO PRINT AREA
591	591	M	174	236	,,
598	598	B	881	L	BRANCH ON TAPE ERROR
603	603	B	900	C	C ON CORRECT PRINT
608	608	/	250		CLEAR PRINT
612	612	M	%U4	272R	READ EVEN
620	620	B	668	B	B ON TO SCOPE
625	625	M	177	223	WORD ODD TO PRINT AREA
632	632	M	174	236	WORD EVEN TO PRINT AREA
639	639	B	865	L	BRANCH ON TAPE ERROR
644	644	M	097	285	MOVE WORD ERROR TO PRINT
651	651	B	921	E	E ON TO ERROR STOP

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```
656  656  Z                    PRINT
657  657  M  102  285          CLEAR WORD ERROR
664  664  /  250               CLEAR PRINT AREA
668  668  M  %84  272R         READ TAPE ODD
676  676  B  709  B            B ON TO SCOPE
681  681  M  177  223          WORD ODD TO PRINT AREA
688  688  M  177  235          ,,
695  695  B  925  L            BRANCH ON TAPE ERROR
700  700  B  944  C            C ON FOR CORRECT PRINT
705  705  /  250               CLEAR PRINT AREA
709  709  M  %84  272R         READ TAPE ODD
717  717  B  427  B            B ON TO SCOPE
722  722  M  174  224          WORD EVEN TO PRINT AREA
729  729  M  177  235          WORD ODD TO PRINT AREA
736  736  B  963  L            BRANCH ON TAPE ERROR
741  741  M  097  285          MOVE WORD ERROR TO PRINT
748  748  B  983  E            E ON TO ERROR STOP
753  753  Z                    PRINT
754  754  M  102  285          CLEAR WORD ERROR FROM PRINT
761  761  /  250               CLEAR PRINT AREA
765  765  B  427  D            D ON TO REPEAT
770  770  C  088  106          COMPARE FOR END OF TABLE
777  777  B  786  /            BRANCH IF NOT END OF TABLE
782  782  B  987               BRANCH IF END OF TABLE
786  786  A  083  088          ADD ONE TO TABLE COUNTER
793  793  B  427               BRANCH
800  800  U  %U4  R            REWIND TAPE DRIVE 4
805  805  B  427               BRANCH
809  809  U  %U4  B            BACKSPACE TAPE DRIVE 4
814  814  U  %U4  E            SKIP
819  819  B  467               BRANCH
823  823  U  %U4  B            BACKSPACE
828  828  U  %U4  E            SKIP
833  833  B  480               BRANCH
837  837  U  %U4  B            BACKSPACE
842  842  U  %U4  E            SKIP
847  847  B  493               BRANCH
851  851  U  %U4  B            BACKSPACE
856  856  U  %U4  E            SKIP
861  861  B  506               BRANCH
865  865  M  197  248          INDICATE A DETECTED READ ERROR
872  872  B  656  C            C ON FOR CORRECT PRINT
877  877  B  664               BRANCH
881  881  M  197  248          INDICATE A DETECTED READ ERROR
888  888  M  097  285          MOVE WORD ERROR TO PRINT
895  895  B  915  E            E ON TO ERROR STOP
900  900  2                    PRINT
901  901  M  102  285          CLEAR WORD ERROR FROM PRINT
908  908  /  612  250          CLEAR PRINT AND BRANCH
915  915  .  901               ERROR STOP
919  919                       WORD MARK
921  921  .  657               ERROR STOP
```

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```
 925  925  M 197 248          INDICATE A DETECTED READ ERROR
 932  932  M 097 285          MOVE WORD ERROR TO PRINT
 939  939  B 959 E            E ON TO ERROR STOP
 944  944  2                  PRINT
 945  945  M 102 285          CLEAR WORD ERROR FROM PRINT
 952  952  / 709 250          CLEAR PRINT AND BRANCH
 959  959  . 945              ERROR STOP
 963  963  M 197 248          INDICATE A DETECTED READ ERROR
 970  970  B 753 C            C ON FOR CORRECT PRINT
 975  975  B 761              BRANCH
 983  983  . 754              ERROR STOP
 987  987  L 091 088          START TABLE AT 120
 994  994  B #27 0853         BRANCH IF THIRD PASS
1002 #02  A 083 085          ADD ONE TO PASS COUNTER
1009 #09  B 427              BRANCH
1027 #27  B #49 G            G ON TO REPEAT ENTIRE TEST
1032 #32  U %U4 M            WRITE TM AND RESET TAPE ERROR INDICATOR
1037 #37  / X00 299          CLEAR AND BRANCH TO 1700
1049 #49  L 083 085          SET PASS COUNTER TO ONE
1056 #56  B 427              BRANCH
1088 #88  M 187 252          MOVE WORDS READ-ERROR TO PRINT
1095 #95  M 194 264          MOVE WORD WRITTEN TO PRINT
1102 /02  M 181 274          MOVE WORD READ TO PRINT
1109 /09  2                  PRINT THIRD LINE OF HEADING
1110 /10  / 299              CLEAR PRINT AREA
1114 /14  F J                SPACE
1116 /16  V 213 3021         BR. TO 1813 IF LRC PORTION OF TEST
1124 /24  B 413              BRANCH TO 413 IF BEGINNING OF TEST
1700 X00  U %U4 R            REWIND DRIVE FOUR
1705 X05  B X17 S521         PRINT COMMENT IF 1 IN 1252
1713 X13  . X39              STOP--SET DR. 4 TO LOW DENSITY
1717 X17  M T43 261          LOAD COMMENT IN PRINT AREA
1724 X24  M                    ,,
1725 X25  2                  PRINT
1726 X26  F L                TRIPLE SPACE
1728 X28  / X13 261          CLEAR PRINT AND BRANCH TO STOP
1739 X39  Y X39 109          GENERATE A-BIT.
1746 X46  L S50 262          CONDITION PRINT AREA
1753 X53  L S50 276            ,,
1760 X60  M /42 085          ZERO LOOP COUNTER
1767 X67  M 117 088          SET CHAR. CTR. TO 107
1774 X74  . 261 261            ,,
1781 X81  M 088 X91          MOVE CHARACTER TO PRINT AREA
1788 X88  M XXX 261            ,,
1795 X95  M 261              CLEAR WORD MARK IN LOCATION 261
1799 X99  M %84 261W         WRITE MAG. TAPE IN ODD PARITY
1807 Y07  B Y48 L            BRANCH IF TAPE ERROR
1812 Y12  B Y93 K            BRANCH IF END OF REEL.
1817 Y17  B X99 8            BRANCH IF SENSE 8 ON
1822 Y22  B Y62 0884         BRANCH IF LAST CHARACTER
1830 Y30  A 083 088          ADD ONE TO CHARACTER COUNTER
1837 Y37  B X74              BR. TO SET WM AND WRITE NEXT RECORD
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1848  Y48  U %U4 B          BACKSPACE DR. 4
1853  Y53  U %U4 E          SKIP DR. 4
1858  Y58  B X99            BRANCH TO MAG. TAPE WRITE
1862  Y62  A 083 085        ADD ONE TO LOOP COUNTER
1869  Y69  B Y88 0841       BRANCH IF TENTH LOOP
1877  Y77  B X67            BRANCH TO RESET CHARACTER COUNTER
1888  Y88  B X60 D          D ON TO REPEAT WRITING
1893  Y93  M /42 085        ZERO LOOP COUNTER
1900  Z00  , 302            SET WORD MARK IN 302
1904  Z04  F K              DOUBLE SPACE
1906  Z06  / 357 299        BRANCH TO PRINT HEADINGS
1913  Z13  M 177 223        WORD-ODD-TO PRINT
1920  Z20  M T09 265        WORDS-TAPE MARK-TO PRINT
1927  Z27  U %84 M          WRITE TAPE MARK
1932  Z32  B -75 L          BRANCH ON TAPE ERROR
1937  Z37  M T83 248        WORD-NO-TO PRINT
1944  Z44  M 097 285        WORD-ERROR-TO PRINT
1951  Z51  B -71 E          E ON TO ERROR STOP
1956  Z56  2                PRINT
1957  Z57  B -71 F          F ON TO ALWAYS STOP
1962  Z62  A 083 085        ADD ONE TO LOOP COUNTER
1969  Z69  B -15 0841       BRANCH IF TENTH  LOOP
1977  Z77  / Z13 285        CLEAR AND BR. TO MOVE WD. ODD TO PRT.
2015  -15  U %U4 R          REWIND DRIVE FOUR
2020  -20  B -32 $521       PRINT COMMENT IF 1 IN 1252
2028  -28  . J00            STOP--SET DRIVE 4 TO HIGH DENSITY
2032  -32  / 299            PRINT--SET DRIVE 4 TO HIGH DENSITY
2036  -36  M TSS 262          ,,
2043  -43  M T32 250          ,,
2050  -50  ¤ T69              ,,
2054  -54  M T80 225          ,,
2061  -61  2                  ,,
2062  -62  F L              TRIPLE SPACE
2064  -64  / -28 299        CLEAR PRINT AREA AND BRANCH TO STOP
2071  -71  . Z62            STOP--CHECK CE PANEL
2075  -75  M 197 248        WORD-YES-TO PRINT
2082  -82  B Z56 C          C ON FOR CORRECT PRINT
2087  -87  B Z57            BRANCH TO TEST SENSE F
2100  J00  U %U4 R          REWIND DRIVE 4
2105  J05  L S50 286        LOAD GROUP MARK WORD MARK IN 286
2112  J12  M 117 088        SET CHARACTER COUNTER TO 107
2119  J19  , 261 261          ,,
2126  J26  M 088 J36        MOVE CHARACTER TO PRINT AREA
2133  J33  M XXX 261          ,,
2140  J40  M 177 223        WORD-ODD-TO PRINT
2147  J47  M 177 235          ,,
2154  J54  M %84 272R       READ MAG. TAPE IN ODD PARITY
2162  J62  B K47 K          BRANCH IF END OF REEL
2167  J67  B J54 B          BRANCH IF B ON
2172  J72  B K91 261        BRANCH IF GROUP MARK WRITTEN
2180  J80  B L02 272        BRANCH IF GROUP MARK READ
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2188  J88  B K71 L .                    BRANCH IF TAPE ERROR
2193  J93  M T83 248                    WORD-NO-TO PRINT
2200  K00  M 097 285                    WORD-ERROR-TO PRINT
2207  K07  B K87 E                      E ON TO ERROR STOP
2212  K12  Z                            PRINT RESULTS
2213  K13  B K87 F .                    F ON TO ALWAYS STOP
2218  K18  B L13 0884                   BRANCH IF LAST CHARACTER
2226  K26  A 083 088                    ADD ONE TO CHARACTER COUNTER
2233  K33  / J19 285                    BRANCH TO MOVE CHARACTER TO PRINT
2247  K47  U 3U4 M                      RESET TAPE ERROR INDICATOR
2252  K52  B J00 D                      REPEAT LRC TESTING
2257  K57  B J00 B                      BRANCH IF B ON
2262  K62  / 348 299                    BRANCH TO PROG. CHAIN.
2271  K71  M 197 248                    MOVE WORD-YES-TO PRINT
2278  K78  B K12 C                      C ON FOR CORRECT PRINT
2283  K83  B K13                        BRANCH TO SENSE SWITCH F
2287  K87  . K18                        LRC STOP
2291  K91  L T93 265                    WORDS -GROUP MARK- TO PRINT AREA
2298  K98  B J80                          ,,
2302  L02  L T93 277                      ,,
2309  L09  B J88                          ,,
2313  L13  / J12 285                    BRANCH TO SET CHAR. COUNTER TO 107
1140  /40                         W     CONSTANT
1160  /60  R ITT EN .   READ              ,,
1180  /80     IN DICATED     CHAR        ,,
1200  S00  A CTE R   CHARACTER           ,,
1250  S50                               GROUP MARK WORD MARK IN LOC 1250
 082   082 0 1                          CONSTANT
 084   084 X X                          PASS COUNTER AND LOOP COUNTER
 086   086 X XX                         TABLE COUNTER AND CHARACTER COUNTER
 089   089 1 20                         CONSTANT START TABLE ADDR.
 093   093 E RRO R                      CONSTANT
 098   098                              CONSTANT BLANKS
 104   104 1 69                         CONSTANT STOP TABLE ADDR.
 107   107   - 8 421 107                TABLE
 120   120 1 234 567890ABCDEFGHIJ         ,,
 140   140 K LMN OPQRSTUVWXYZ.¤£$         ,,
 160   160 * -/, %#@&-#                   ,,
 171   171 E VEN                        CONSTANT
 175   175 O DD                            ,,
 178   178 R EAD  ERROR                    ,,
 188   188 W RIT TEN                       ,,
 195   195 Y ES                            ,,
1301  T01 T APE  MARK                      ,,
1315  T15 S ET  DRIVE FOUR TO              ,,
1333  T33 L OW  DENSITY                    ,,
1344  T44 H IGH  DENSITY                   ,,
1357  T57 T O T EST THE                    ,,
1369  T69 L RC  CIRCUITS                   ,,
1381  T81 N O                              ,,
1384  T84 G ROU P MARK                     ,,
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TABLE OF UNPRINTABLE CHARACTERS

LP-LEFT PARENTHESIS	12 5 8	SE-SEMICOLON	11 6 8	DE-DELTA	11 7 8
WS-WORD SEPARATOR	0 5 8	LT-LESS THAN	12 6 8	PZ-PLUS ZERO	12 0
TS-TAPE SEGMENT MARK	0 7 8	GT-GREATER THAN	6 8	TM-TAPE MARK	7 8
GM-GROUP MARK	12 7 8	MZ-MINUS ZERO	11 0	CO-COLON	5 8
RP-RIGHT PARENTHESIS	11 5 8	AP-APOSTROPHE	0 6 8		

```
,0080121001                                          TAPE ERROR TEST          1T06A 04
,0160Z3N000/000,030031,038046N,099050B046     ,057,064068□0120311001   CC1T06A 02
MZ980998023S511M072068M068047805004758064047O/P99A071069/023549100IZ010Q1T06A 03
                                                     Z
,037039B023S51I/023R98M099Z98L063118LL/1010991105,001001/00/1118 DIAG  CC1T06A 04
,008015,022029,033033N0000001001                                         1T06A 05
L068W80,W49W56,W60W61,W69W731001/080,008012,00118W73S5118001VW600058     1T06A 06
L051W99,W89W93,W98W99,0010011001VW60005KB001BP16                         1T06A 07
                                                     Z
L057106,084086,089093,0981048W6001XXXXX120 ERROR    169                 1T06A 08
L065139,120001,001001,0010018W60 - 8421G107  123456/890ABCDEFGHIJ        1T06A 09
                                                   M
L070177,160171,175001,0010018W60KLMNOPQRSTUVWXYZ.□£$*-/,%#@PM+ EVENODD  1T06A 10
                                                                ZZ
L072217,188195,001001,0010018W60READ ERRORWRITTENYES                     1T06A 11
L056356,334341,342348,3523568W602LS4927728352  8V78/2772                 1T06A 12
L051375,364365,366367,3683728W60LS19280LLL2/2808+68                      1T06A 13
L061404,377385,389393,4004048W60 B389S681BW93NV62M385389/332/            1T06A 14
L066438,413420,427432,0010018W60B333S521L08308SL0910888800KLS50262       1T06A 15
L068474,446453,460467,0010018W60LS50276,261261M088463MXXX261M%U4261W     1T06A 16
L071513,480488,493501,5060018W608809LM%B4261WB823LM%B4261WB837LM%U4261W  1T06A 17
L072553,519524,529534,5390018W60B851LU%U48U%U48U%U48U%U488567            1T06A 18
L068602,571579,584591,598001BW60/250M%U4272R86128M174224M1742368881L     1T06A 19
L068638,608612,620625,632001BW60B900C/250M%U4272R86688M177223M174236     1T06A 20
L069675,644651,656657,664668W60B865LM097285B921E2M102285/250M%B4272R     1T06A 21
L065708,681688,695700,7050018W60B7098M177223M177235B925LB944C/250       1T06A 22
L071747,717722,729736,7410018W60M%B4272R8427BM174224M177235B963LM097285 1T06A 23
L066781,753754,761765,770777BW60B983E2M102285/250B427DC088106B786/      1T06A 24
L069818,786793,800805,809814BW60B987A0830888427    U%U4RB427U%U48U%U4E    1T06A 25
L064850,823828,833837,842847BW608467U%U48U%U4EB480U%U48U%U4EB493         1T06A 26
L069887,856861,865872,8778818W60U%U48U%U4EB506M197248B656CB664M197248    1T06A 27
L065920,895900,901908,9159198W60M097285B915E2M102285/612250.901          1T06A 28
L070958,925932,939944,9459528W60.657M197248M097285B959E2M102285/709250   1T06A 29
L067993,963970,975983,9870018W60.945M197248B753C8761     .754L091088     1T06A 30
L070+31,+02+09,+27001,0010018W608+270853A0830858427                B+49G 1T06A 31
L072+71,+37+49,+56001,0010018W60U%U4M/X00299      L0830858427            1T06A 32
L068/23,/95/02,/09/10,/14/168W60M187252M194264M1812742/299FJVZ133021     1T06A 33
L068/59,/40001,001001,0010018W608413                                  M  1T06A 34
L072/99,/80001,001001,0010018W60RITTEN      READ      INDICATED     CHAR1T06A 35
L072S39,001001,001001,0010018W60ACTER   CHARACTER                        1T06A 36
L033S50,001001,001001,Ò010018W60G                                        1T06A 37
                                                   M
L064T32,T15001,001001,0010018W60TAPE MARK     SET DRIVE FOUR TO          1T06A 38
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L068T68,T44T57,001001,0010018W60LOW DENSITYMIGH DENSITY TO TEST THE      1T06A 39
L072U08,T81T84,001001,0010018W60LRC CIRCUITSNO GROUP MARK                1T06A 40
L072V81,V46V53,V61V62,V70V788W60/T99L080T80BW93Z98G18W02072 BW320721,0011T06A 41
                                                    M
L071W20,V90V98,W02W10,W170018W608W45080ABV42072DBV53BW45080AL071Y71/180 1T06A 42
L056W44,W28W32,W39001,0010018W60L080180842ILQ70Z418V78                   1T06A 43
L060X27,X05X13,X17X24,X25X268W60U%U4R8X175521.X39MT43261M2FL             1T06A 44
L071X66,X39X46,X53X60,0010019W60/X13261     YX39109LS50262LS50276M/42085 1T06A 45
L072Y06,X74X81,X88X95,X99001BW60M117088,261261M088X91MXXX261=261M%B4261W1T06A 46
L072Y46,Y12Y17,Y22Y30,Y370018W60BY48LBY93K8X99BBY620884A083088BX74        1T06A 47
L072Y87,Y53Y58,Y62Y69,Y770018W60U%U4BU%U4EBX99A083085BY880841BX67        1T06A 48
L071Z26,Y93Z00,Z04Z06,Z13Z208W608X60DM/42085,302FK/ 57299M177223MT09265  1T06A 49
L067I61,Z32Z37,Z44Z51,Z56Z578W60U%84MBM75LMT83248M0972858M71E28M71F      1T06A 50
                                                  Z       Z     Z
L068Z97,Z69Z77,001001,0010018W60A083085BM150841/Z13285                   1T06A 51
                                                  Z
L071M53,M20M28,M32M36,M43M50BW60U%U4RBM32S521.J00/299MT55262MT32250=T69   1T06A 52
    Z  Z  Z  Z  Z  Z  Z              Z
L065M86,M61M62,M64M71,M75M828W60MT802252FL/M28299.Z62M197248BZ56C         1T06A 53
    Z  Z  Z  Z  Z  Z  Z              Z
L071J25,J00J05,J12J19,001001BW60BZ57          U%U4RLS50286M117088,261261 1T06A 54
L068J61,J33J40,J47J54,0010018W60M088J36MXXX261M177223M177235M%B4272R      1T06A 55
L070J99,J67J72,J80J88,J930018W608K47K8J548BK91261GBL02272GBK71LMT83248   1T06A 56
                                                        M     M
L072K39,K07K12,K13K18,K26K338W60M0972858K87E28K87FBL130884A083088/J192851T06A 57
L072K86,K52K57,K62K71,K78K83BW60U%U4M8J00DBJ00B/348299  M197248BK12C8K131T06A 58
L072L26,K91K98,L02L09,L130018W45.K18LT932658J80LT93277BJ88/J12285        1T06A 59
,019026,049L077S49,034038B038Z98GB4008D98          TAPE ERROR TEST       1T06A 60
                                                    M
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TAPE RELIABILITY 1107A

A. PURPOSE

TO EXERCISE UP TO NINE DRIVES USING THE OVERLAP OR NONOVERLAP MODE. RANDOM LENGTH RECORDS AND INFORMATION ARE WRITTEN AND READ. WRITE AND READ ERRORS ARE COUNTED AND TOTALS ARE PRINTED AT THE END OF THAT PARTICULAR PASS.

B. LOADING

A. FROM CARDS

1. LOAD DECK IN HOPPER. THE TEST MAY BE CHAINED WITH OTHER TESTS.

2. ENTER STORAGE SIZE IN S51 -1251-

3. SET SELECTION DIGITS AND SENSE SWITCHES AS DESIRED.

4. DEPRESS LOAD BUTTON ON READER.

5. IF RUNNING WITH SENSE B OFF A PROGRAM STOP AT 484 WILL BE ENCOUNTERED. AT THIS TIME ENTER THE NUMBER OF DRIVES TO BE EXERCISED. DRIVES MUST BE ADDRESSED FROM 1 TO THE HIGHEST NUMBER ENTERED. IF SENSE B IS ON THE NUMBER OF DRIVES AS WELL AS THE MODE OF OPERATION WILL BE READ FROM DETAIL CARDS. THIS WILL BE COVERED MORE THOROUGHLY IN PROGRAM CONTROL. AFTER THE STOP AT 484 IS ENCOUNTERED, CONTINUE BY PUSHING START.

B. FROM TAPE

1. SEE GENERAL DESCRIPTION

2. A 1 MUST BE ENTERED IN S08 -1268- TO TELL THE TAPE READ PROGRAM THAT THE TAPE TESTS ARE TO BE RUN.

3. AS WHEN RUNNING FROM CARDS, IF SENSE B IS OFF A STOP AT 484 WILL BE ENCOUNTERED. AT THIS TIME ENTER THE NUMBER OF DRIVES ON LINE. NOTE- WHEN RUNNING FROM TAPES, DRIVE 1 WILL NOT BE EXERCISED AS THIS IS THE MASTER PROGRAM TAPE. THEREFORE, IT IS NECESSARY THAT THE NUMBER OF DRIVES THAT IS ENTERED IS AT LEAST 2. LESS THAN THIS WILL CAUSE A PROGRAM STOP. LIKEWISE, WHEN RUNNING WITH SENSE B ON, THIS INFORMATION AS WELL AS THE MODE OF OPERATION WILL BE READ FROM PROGRAM DETAIL RECORDS ON TAPE.

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C. WHEN THE STOP AT 484 IS ENCOUNTERED, THE NUMBER OF DRIVES IS ENTERED IN LOCATION 001.

C. PROGRAM CONTROL

A. CARDS

THE OPTION IS GIVEN IN THIS TEST TO RUN USING PROGRAM DEVELOPED MODES OR MODES READ FROM DETAIL CARDS. IF THE FORMER METHOD IS CHOSEN ONLY THE NUMBER OF DRIVES NEED BE ENTERED WHEN THE STOP AT 484 IS ENCOUNTERED. THE PROGRAM WILL AUTOMATICALLY TEST THE DRIVES IN ALL COMBINATIONS OF MOVE AND LOAD MODE, ODD OR EVEN PARITY. MANUALLY ENTERING A 1 IN LOCATION S98 1298 WILL CAUSE THE OPERATIONS TO BE PERFORMED IN THE OVERLAP MODE. TURNING ON SENSE B WILL CAUSE THIS INFORMATION TO BE READ FROM DETAIL CARDS. THESE CARDS ARE NOT INCLUDED WITH THE TEST AND MUST BE DEVELOPED BY THE OPERATOR IF THIS METHOD OF RUNNING IS TO BE ADOPTED.

THE CARDS SHOULD BE PUNCHED IN THE FOLLOWING MANNER

COLUMN 1 - NUMBER OF DRIVES

COLUMN 2 - M TO USE MOVE MODE
L TO USE LOAD MODE

COLUMN 3 - E TO USE EVEN PARITY
O TO USE ODD PARITY

COLUMN 4 - N TO PERFORM IN NONOVERLAP
O TO PERFORM IN OVERLAP

WHEN RUNNING WITH SENSE B ON, LOCATION S98 -1298- IS NOT INTERROGATED TO DETERMINE IF OVERLAP MODE IS TO BE USED. CARD COLUMN 4 ALONE DETERMINES THIS FACTOR.

B. SENSE SWITCHES AND SELECTION DIGITS

SENSE SWITCH A - NOT USED

SENSE SWITCH B - IF ON, READ MODE INFORMATION FROM DETAIL CARDS.
NOTE- NO SCOPING LOOPS ARE INCLUDED IN THIS TEST.

SENSE SWITCH C - ON TO PRINT CORRECT RESULTS. THE ONLY CORRECT PRINTOUT INDICATES THAT THE OPERATION WAS GIVEN IN THE OVERLAP MODE AND PERFORMED IN THE OVERLAP MODE.

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SENSE SWITCH D - ON TO REPEAT THE TEST USING THE SAME MODE INFORMATION.

SENSE SWITCH E - ON TO STOP ON ERROR
OFF TO PRINT ERROR

SENSE SWITCH F - NOT USED

SENSE SWITCH G - NOT USED

LOCATION 001 - NUMBER OF DRIVES TO BE USED

LOCATION 002 - MOVE OR LOAD MODE INDICATION

LOCATION 003 - ODD OR EVEN PARITY INDICATION.

LOCATION 004 - OVERLAP INDICATION WHEN RUNNING WITH SENSE B ON.

LOCATION S51 1251- STORAGE SIZE

LOCATION S52 1252- 1 TO PRINT TITLES AND ERROR COUNTS

LOCATION S68 1268- 1 WHEN RUNNING FROM TAPE

LOCATION S98 1298- 1 TO OVERLAP WHEN NOT USING DETAIL CARDS.

LOCATION Q95 2895 TO
Q99 2899- NUMBER OF RECORDS TO BE WRITTEN ON EACH DRIVE.
NOTE: THE NUMBER Q0500 HAS BEEN ENTERED IN THIS POSITION WITH THE TEST. IF THIS NUMBER IS CHANGED A WORD MARK MUST APPEAR IN LOCATION 2895(Q95).

D. TEST PROCEDURES

42 LOCATIONS PER DRIVE ARE ASSIGNED FOR ERROR COUNTS AND INFORMATION PERTINENT TO THAT DRIVE. INFORMATION PERTAINING TO THE FIRST DRIVE WILL BE FOUND IN J00-J41 2100-2141, AND INFORMATION FOR THE SECOND DRIVE IS FOUND IN K00-K41 2200-2241, AND SO ON. THE DRIVES ARE REWOUND AND THE STORED INFORMATION IS SHUTTLED BACK AND FORTH TO A WORK AREA WHERE IT IS USED TO EXERCISE THE PARTICULAR DRIVE THAT IS REPRESENTS. RANDOM LENGTH AND RANDOM INFORMATION RECORDS -FROM 20 TO 398 CHARACTERS- ARE WRITTEN ON SEQUENTIAL DRIVES. WHEN A WRITE ERROR OCCURS, A BACKSPACE REWRITE IS GIVEN. THIS IS CONSIDERED WRITE ERROR 1 SKIP 0 AND IS INDICATED AS SUCH ON THE PRINTOUT. IF THE ERROR STILL OCCURS, A BACKSPACE SKIP IS ISSUED AND AN ATTEMPT IS MADE TO WRITE THE RECORD IN ANOTHER SECTION OF TAPE. THIS ERROR IS CONSIDERED WRITE ERROR 2 SKIP 0. IF THE ERROR STILL PERSISTS, THE SAME ROUTINE IS FOLLOWED WITH THE PRINTOUTS INDICATING WRITE ERROR 1 SKIP 1, WRITE ERROR 2 SKIP 1, AND SO ON UNTIL 6 SKIPS ARE TRIED. THIS ERROR IS CONSIDERED PERMANENT AND THE PROGRAM CONTINUES TO THE NEXT DRIVE. THEREFORE, A PERMANENT ERROR IS COUNTED WHEN AN ATTEMPT HAS BEEN MADE TO WRITE THE RECORD TWICE IN 7 DIFFERENT PORTIONS OF TAPE, AND AN ERROR OCCURED ON ALL 14 TRIES.

EACH DRIVE IS REWOUND WHEN IT HAS WRITTEN THE PRESCRIBED NUMBER OF RECORDS OR THE END OF REEL REFLECTIVE SPOT IS SENSED. THE TOTALS OF THE FIRST, SECOND AND PERMANENT WRITE ERRORS ARE PRINTED OUT. IN THE SAME MANNER AS USED FOR WRITE, THE RECORDS ARE READ BACK AND THE FIRST PART OF THE RECORD CONTAINING PERTINENT INFORMATION IS COMPARED FOR CORRECTNESS. IF A READ ERROR OCCURS, AN ATTEMPT TO REREAD THE RECORD 9 TIMES IS MADE. IF THE TENTH READ IS UNSUCCESSFUL, IT IS CONSIDERED A PERMANENT READ ERROR. A COUNT OF THE SUCCESSFUL REREADS AND PERMANENT READ ERRORS MAY BE PRINTED AT THE END OF THE READ PORTION OF THE TEST.

IN CASE OF A COMPARE ERROR THE PROGRAM SHOULD AUTOMATICALLY PUT THE DRIVE BACK IN STEP.

E. STOPS

4B4 - STOP TO ENTER NUMBER OF DRIVES

696 - STOP IF NOT ENOUGH DRIVES WHEN RUNNING FROM TAPE

X08 1708 - STOP TO INVESTIGATE ERROR COUNTS IF NOT PRINTING. SEE TEST PROCEDURE FOR DRIVE INFORMATION AREA.

X WILL BE DRIVE NUMBER

2X15-16 FIRST WRITE ERRORS

2X17-18 SECOND WRITE ERRORS

2X19-20 PERMANENT WRITE ERRORS

2X21-22 FIRST SUCCESSFUL REREADS

2X23-24 SECOND SUCCESSFUL REREADS

2X25-26 THIRD SUCCESSFUL REREADS

2X27-28 FOURTH SUCCESSFUL REREADS

2X29-30 FIFTH SUCCESSFUL REREADS

2X31-32 SIXTH SUCCESSFUL REREADS

2X33-34 SEVENTH SUCCESSFUL REREADS

2X35-36 EIGHTH SUCCESSFUL REREADS

2X37-38 NINTH SUCCESSFUL REREADS

2X39-40. PERMANENT READ ERRORS

535 1235 - WRITE OR READ ERROR STOP

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-61 2061 - PERMANENT WRITE OR READ ERROR STOP

N75 2575 - COMPARE ERROR STOP

P58 2P58 - OVERLAP ERROR STOP

F. SAMPLE PRINTOUTS

1. 1107 TAPE RELIABILITY
TITLE OF TEST CONTROLLED BY 1 IN 1252.

2. 2 DRS MOVE EVEN NONOLAP
SUBTITLE SHOWING NUMBER OF DRIVES AND MODE OF OPERATION
UNDER CONTROL OF 1 IN 1252

3. WRITE
READ
SUBTITLE SHOWING PORTION OF TEST BEING EXERCISED
UNDER CONTROL OF 1 IN 1252

4. DR 1 REC 00001 LEN 352 WR 1 SKIP 2 RD ERR #
WRITE ERROR INDICATION. UNDER CONTROL OF SENSE E.

5. DR 1 REC 00001 LEN 352 WR # SKIP # RD ERR 1
READ ERROR INDICATION. UNDER CONTROL OF SENSE E.

6. PERMANENT ERRORS ARE THE SAME AS 4 AND 5 EXCEPT THEY
ARE FOLLOWED BY THE WORD PER.

7. DR 1 RD COMP ERR REC SHLD BE XX--XX REC WAS XX--XX
COMPARE ERROR UNDER CONTROL OF SENSE E.

8. DR 1 REC 00001 OVLP
INDICATION THAT OPERATION OVERLAPPED. UNDER CONTROL OF SENSE
C.

9. DR 1 REC 00001 NONOVLP
INDICATION THAT OPERATION DID NOT OVERLAP. UNDER CONTROL OF
SENSE E.

10. WR ERRS 00500 RECS DR 1ST 2ND PER
1 02 01 00
2 00 00 00
TOTALS OF WRITE ERRORS UNDER CONTROL OF 1 IN 1252.

11. RD ERRS 00500 RECS DR 1ST 2ND 3RD 4TH 5TH 6TH 7TH 8TH 9TH PER
1 00 01 00 00 00 00 00 00 00 51

TOTALS OF READ ERRORS UNDER CONTROL OF 1 IN 1252

NOTE TWO CHARACTER COUNTERS ARE USED. IF THE COUNT GOES ABOVE 99, ZONE INFORMATION IN THE HIGH ORDER POSITION WILL INDICATE THE ERROR COUNT. AN A-BIT WILL BE 100, A B-BIT WILL BE 200, AN AB-BIT WILL BE 300. FOR EXAMPLE 29 IS 199, Q2 IS 282, AND SO ON.

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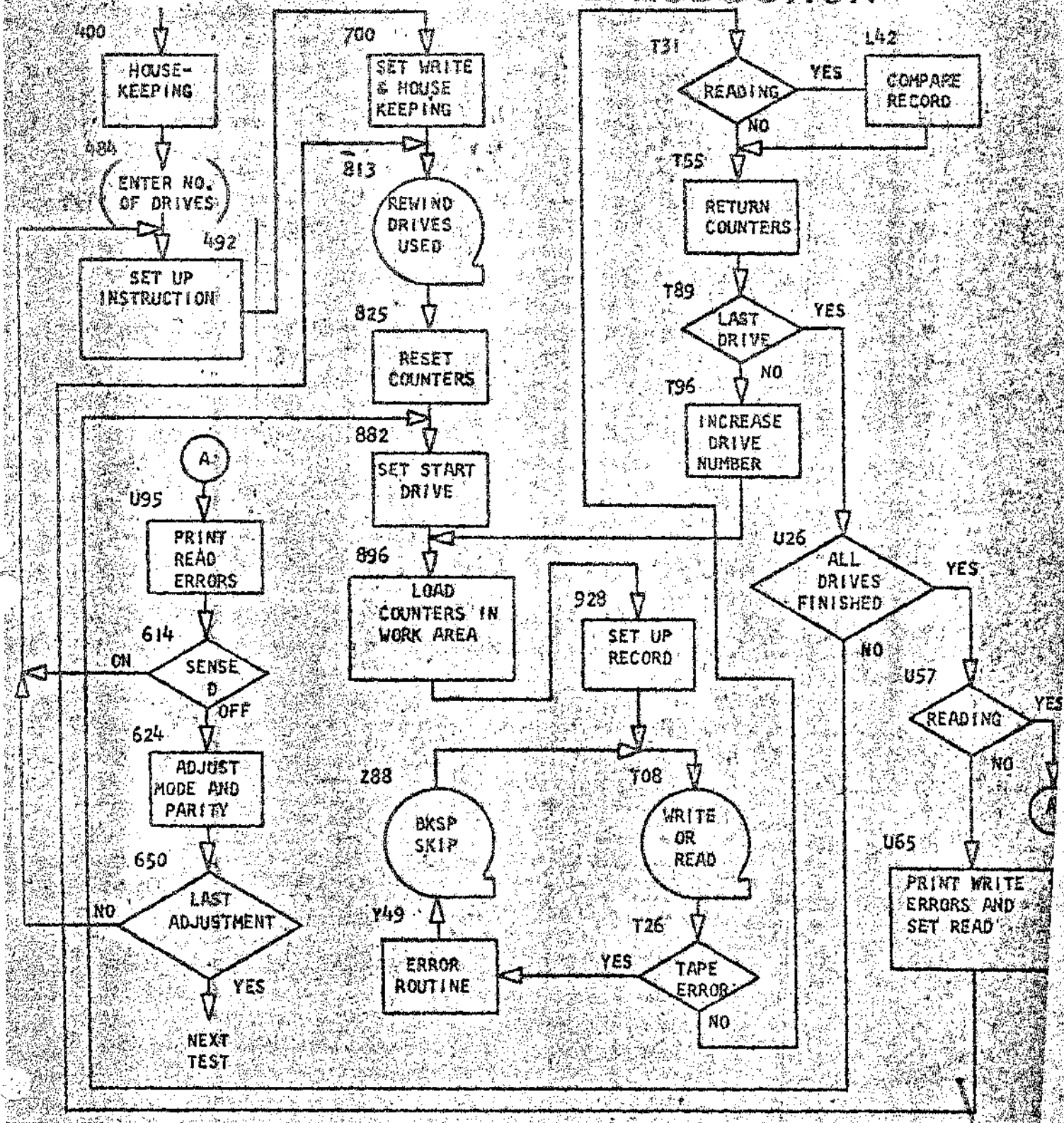
IBM FORM 624-7118-0

1401 DATA PROCESSING SYSTEM
DIAGNOSTIC FUNCTION TEST

PART NO. 451870
SHEET 1 OF 12
BLOCK NO. 1401A



DATE	4-3-62	4-26-63	25.6.63					
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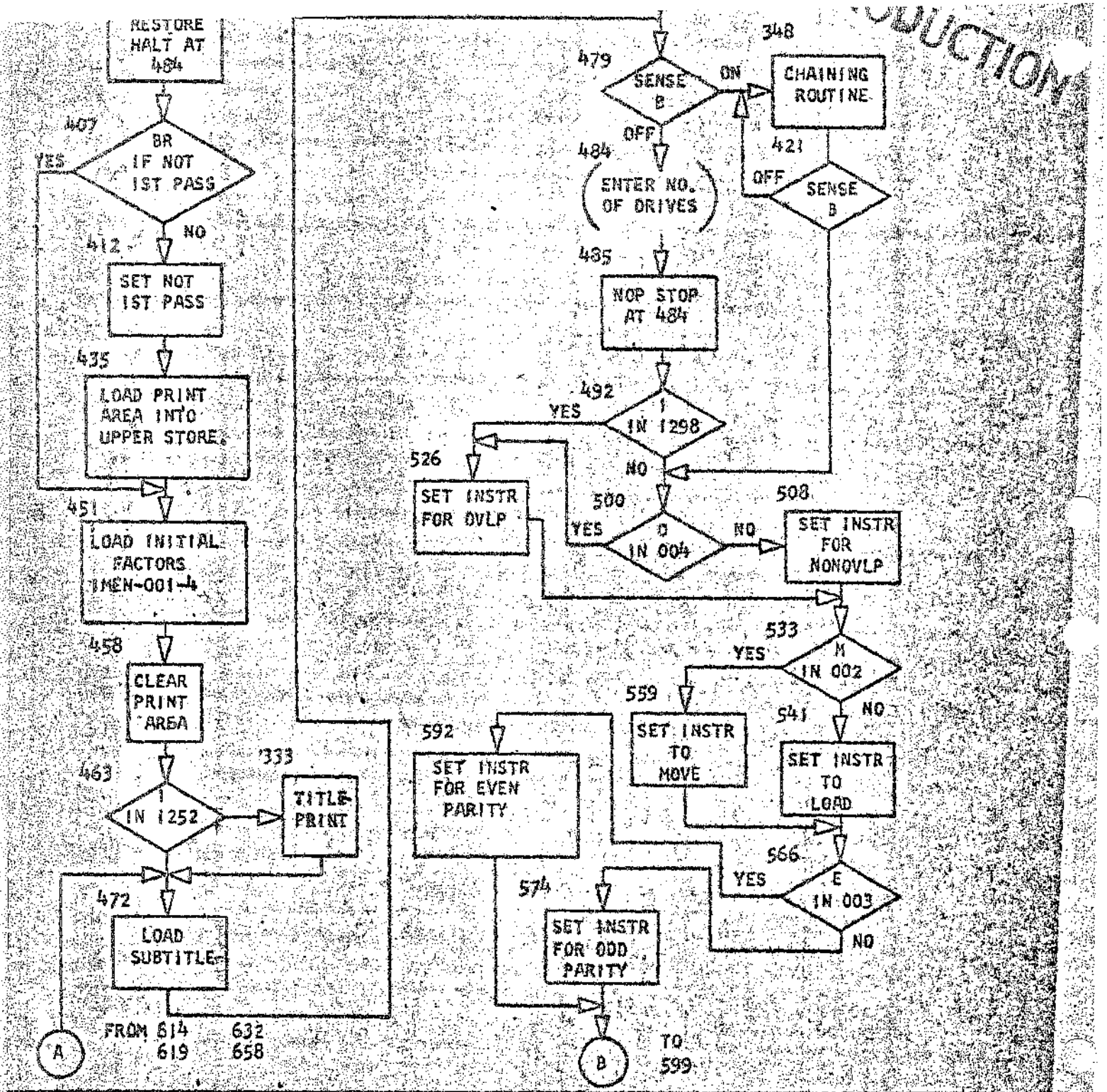

DATE	4-3-62	4-26-63	25.6.63					
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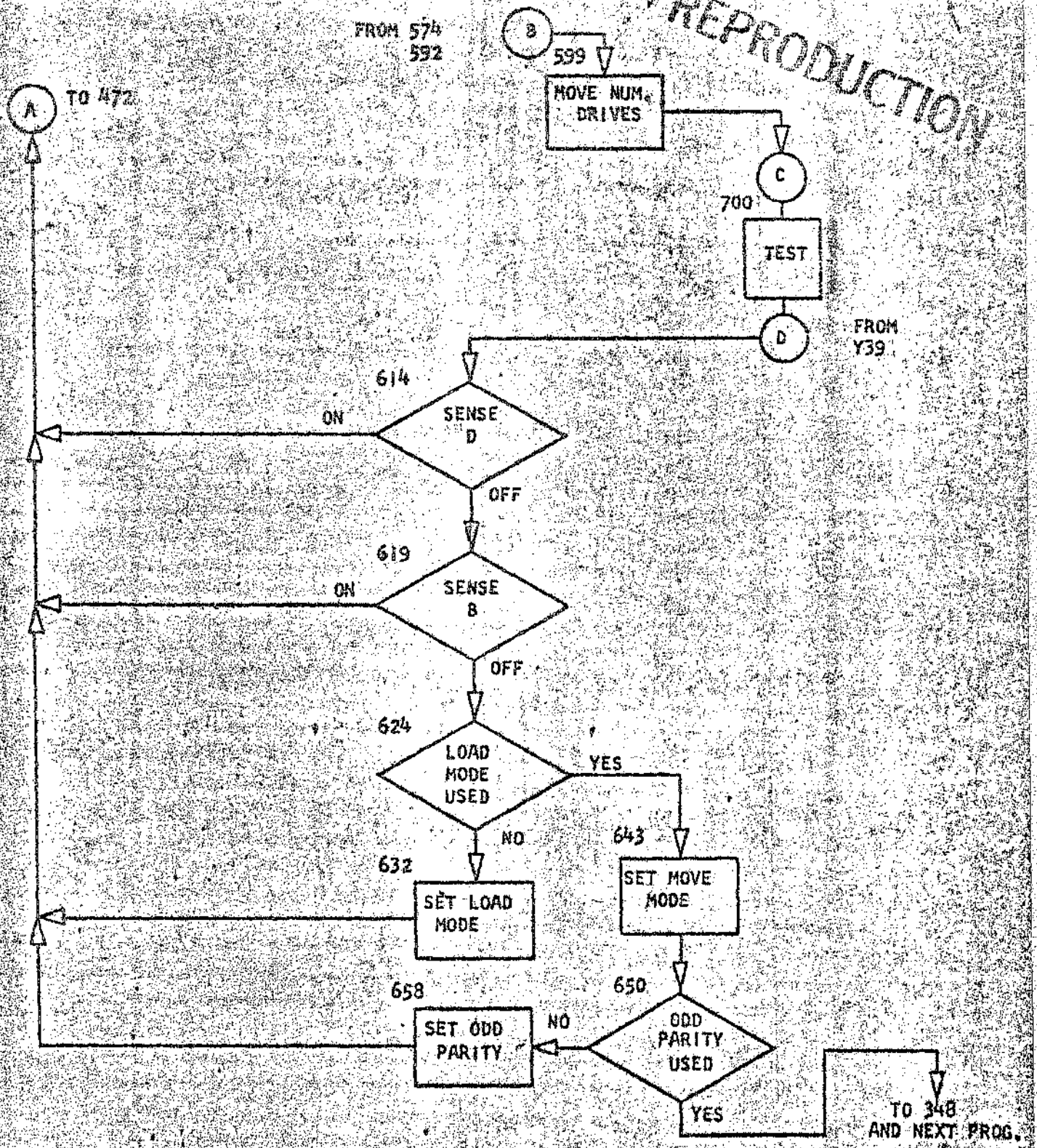

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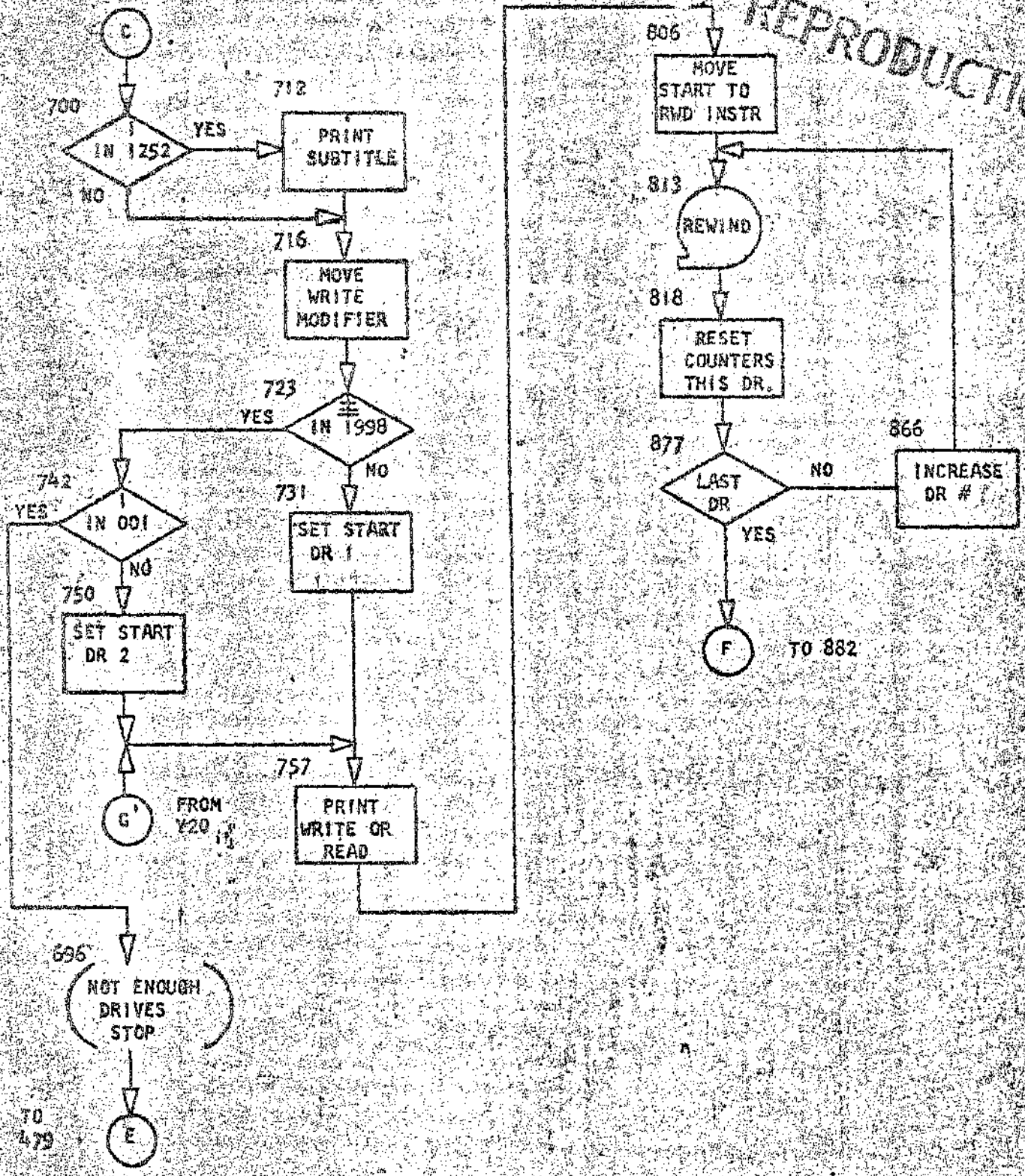
ENG. CHG. NO.	115276	117135A	11843A					



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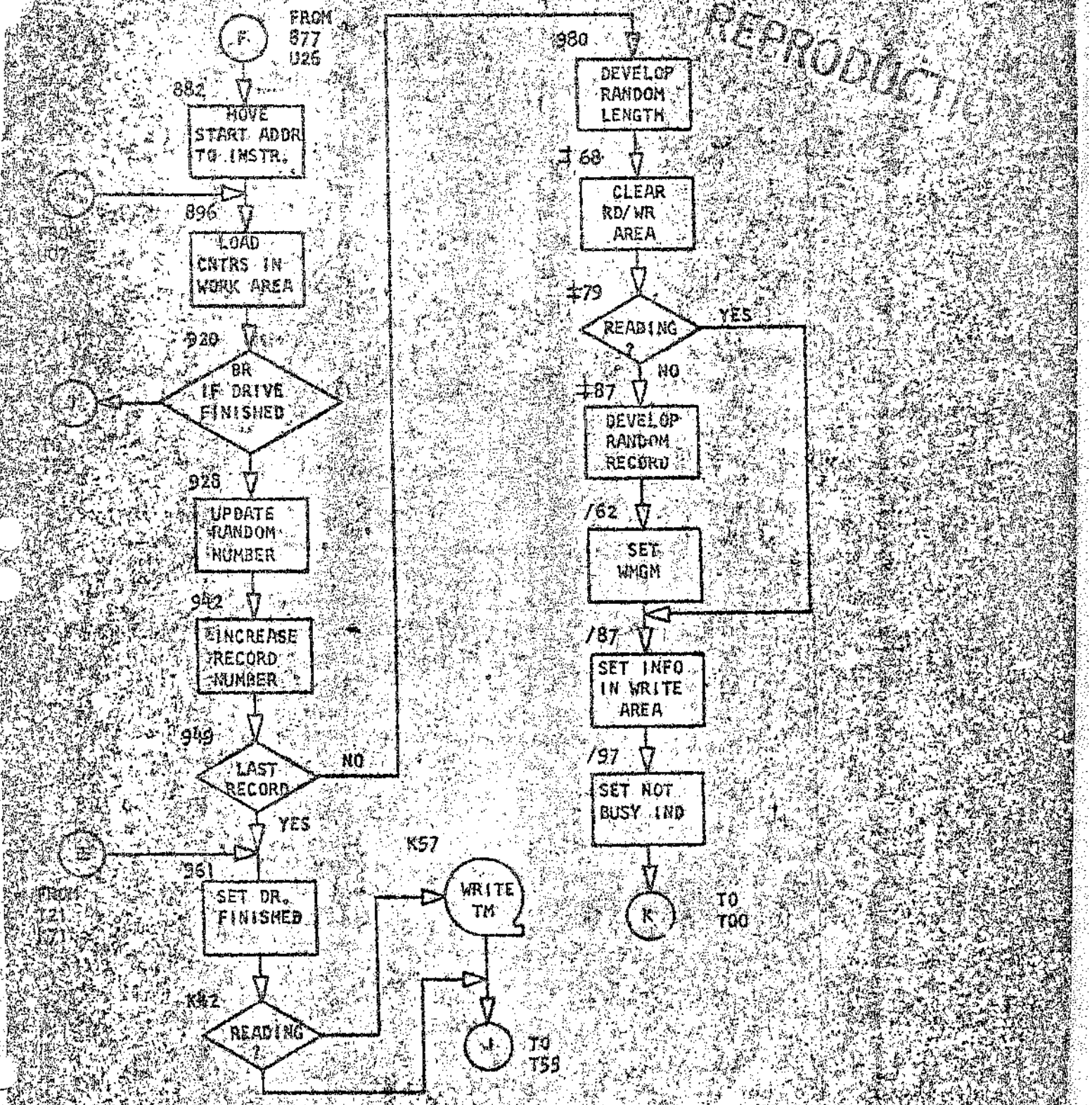
ENG. CHG. NO.	115276	117135A	TA 1843.4					



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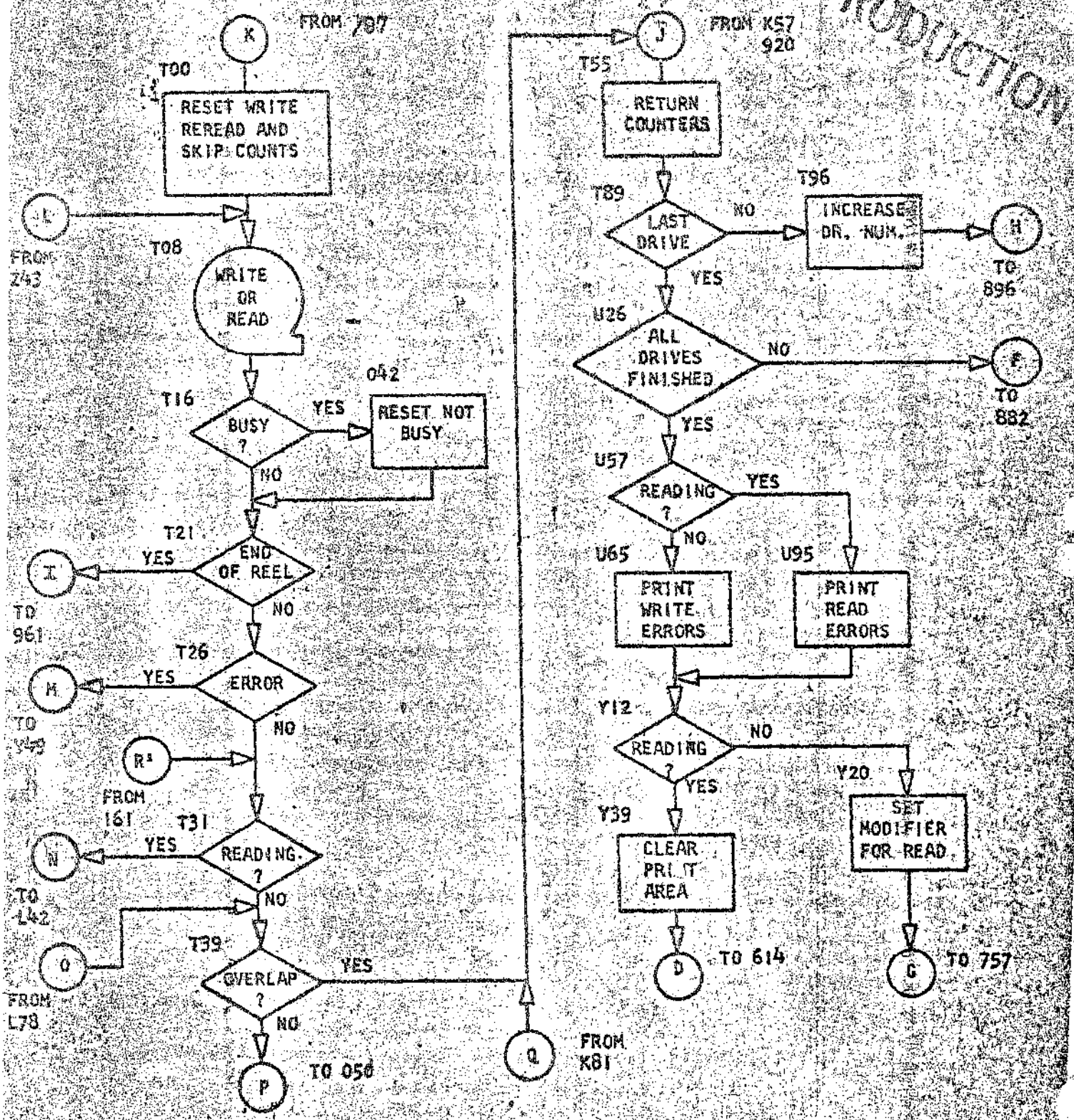
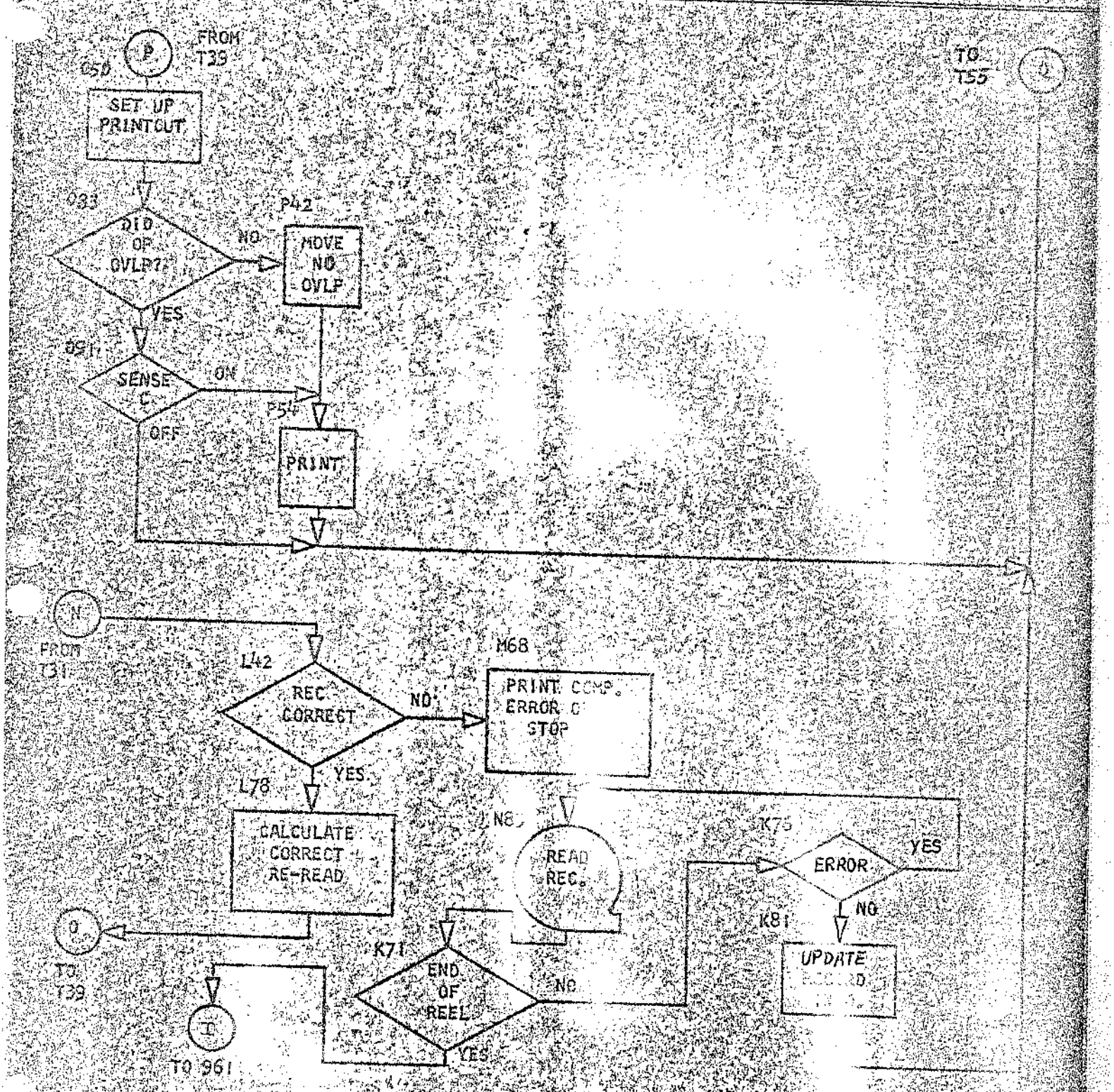
CHG NO	115276	117135A	TN 1843 A					

DIAGNOSTIC FUNCTION TEST



DATE	4-3-62	4-26-63	25.6.63					
ENG. CHG. NO.	115276	117135A	TA 1843A					



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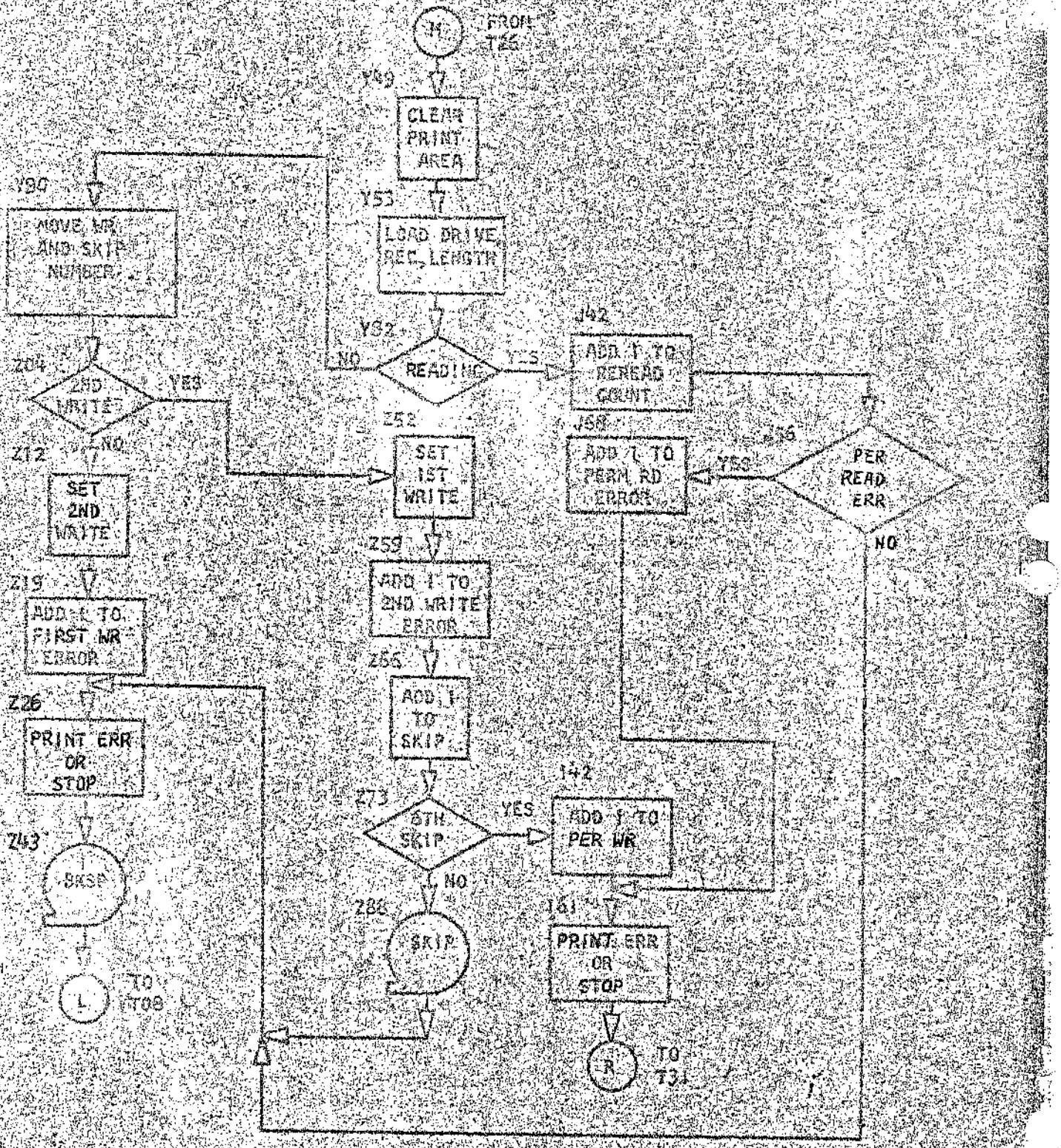
CHG. NO.	115276	117135A	TA 1843A					

DIAGNOSTIC FUNCTION TEST



DATE	4-3-62	4-26-63	25-6-63							
ENGR CHG NO.	452150	117135A	TA-18434							

PROGRAM LISTING FOR USE WITH FLOW CHART

TAPE RELIABILITY 1T07A

INSTRUCTION ADDRESS		OP	A	B	REMARKS
377	377	B	389	S681	USE WHEN TESTS ARE RUN FROM TAPE
385	385	B	W93		"
389	389	N	V62		"
393	393	M	377	389	"
400	400	L	X08	484	RESTORE HALT
407	407	N	866	9	SWITCH FOR 1 PASS ONLY
412	412	,	408		TURN ON SWITCH
416	416	B	430		
421	421	B	500	B	BR IF READING DETAIL CARDS
426	426	B	348		BR TO CHAINING TO PASS DETAIL CARDS
430	430	/	E99		LOAD UPPER STORAGE
434	434	/			"
435	435	L	332	E32	"
442	442	L			"
443	443	M			"
444	444	L			"
445	445	M			"
446	446	M			"
447	447	L			"
448	448	L			"
449	449	M			"
450	450	L			"
451	451	L	R96	004	LOAD FACTORS
458	458	/	332		CLEAR PRINT AREA
462	462	/			"
463	463	B	333	S521	PRINT TITLE IF 1 IN S52
471	471	N			
472	472	L	R90	220	LOAD SUBTITLE
479	479	B	348	B	BRANCH IF RUN FROM DETAIL CARDS
484	484	.			ENTER NUMBER OF DRIVES
485	485	M	R56	484	NOP STOP
492	492	B	526	S981	BRANCH IF USE OVERLAP
500	500	B	526	0040	BRANCH IF USE OVERLAP
508	508	M	R91	T09	MOVE % TO INSTRUCTION
515	515	M	R72	223	MOVE NON OVLP TO PRINT
522	522	B	533		
526	526	M	R92	T09	MOVE @ TO INSTRUCTION
533	533	B	559	002M	BRANCH IF USE MOVE
541	541	M	442	T08	MOVE L TO INSTRUCTION
548	548	M	R61	210	MOVE LOAD TO PRINT
555	555	B	566		
559	559	M	559	T08	MOVE M TO INSTRUCTION
566	566	B	592	003E	BRANCH IF USE EVEN PARITY

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574  574  M 566 T10        MOVE B TO INSTRUCTION
581  581  M R65 215        MOVE ODD TO PRINT
588  588  B 599
592  592  M R57 T10        MOVE U TO INSTRUCTION
599  599  D 001 201        MOVE NUMBER OF DRIVES TO PRINT
606  606  , 001
610  610  B 700            BRANCH TO TEST
614  614  B 472 D          BRANCH IF REPEAT THIS CONFIGURATION
619  619  B 472 B          BRANCH IF RUNNING FROM DETAIL CARDS
624  624  B 643 002L       BRANCH IF LOAD USED
632  632  M 442 002        MOVE L
639  639  B 472
643  643  M 643 002        MOVE M
650  650  B 348 0030       BRANCH IF ODD USED
658  658  M R62 003        MOVE O
665  665  B 472
669  669  , R94            SET WM
673  673  B 451
696  696  . 479            HALT BECAUSE NOT ENOUGH DRIVES
700  700  B 712 S521       BR IF PRINT SUBTITLE
708  708  B 715
712  712  F J              SPACE
714  714  2                PRINT SUBTITLE
715  715  N
716  716  M R55 T15        MOVE MODIFIER W TO INSTRUCTION
723  723  B 742 Z98        BR IF RUNNING FROM TAPE
731  731  L R93 E58        SET START DR 1
738  738  B 757
742  742  B 696 0011       BR IF NOT ENOUGH DRIVES
750  750  L R53 E58        SET START DR 2
757  757  N 000 0000
765  765  / 299.           CLEAR PRINT
769  769  L E27 205        LOAD WRITE IN PRINT
776  776  B 791 T15W       BRANCH IF WRITE
784  784  L E32 205        LOAD READ IN PRINT
791  791  B 803 S521.      BRANCH IF PRINT SUB TITLE
799  799  B 806
803  803  F J
805  805  2
806  806  M E58 816        MOVE START TO REWIND
813  813  U 401 R          REWIND DRIVES USED
818  818  D 816 829        RESET COUNTERS
825  825  L -40 J40          ,,
832  832  L                 ,,
833  833  L                 ,,
834  834  L                 ,,
835  835  L                 ,,
836  836  L                 ,,
837  837  L                 ,,
838  838  L                 ,,
839  839  L                 ,,
840  840  L                 ,,
```

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```
 841  841  L                                  **
 842  842  L                                  **
 843  843  L                                  **
 844  844  L                                  **
 845  845  L                                  **
 846  846  L                                  **
 847  847  L                                  **
 848  848  N  000  000                        **
 855  855  .  816                             CHECK FOR LAST DRIVE
 859  859  C  816  001                        **
 866  866  A  866  816                        **
 873  873  M  816                             **
 877  877  B  813  /                          BRANCH IF NOT LAST DRIVE
 882  882  M  E58  T11                        MOVE START TO INSTR
 889  889  D  T11  897                        MOVE DR #
 896  896  L  940  E99                        LOAD COUNTERS IN WORK AREA
 903  903  L                                  **
 904  904  L                                  **
 905  905  L                                  **
 906  906  L                                  **
 907  907  L                                  **
 908  908  L                                  **
 909  909  L                                  **
 910  910  L                                  **
 911  911  L                                  **
 912  912  L                                  **
 913  913  L                                  **
 914  914  L                                  **
 915  915  L                                  **
 916  916  L                                  **
 917  917  L                                  **
 918  918  L                                  **
 919  919  L                                  **
 920  920  C  T55  E731                       BRANCH IF DRIVE IS FINISHED
 928  928  A  852  E72                        UPDATE RANDOM NUMBER
 935  935  Y  R48  E63                        CLEAR ANY OVERFLOWS
 942  942  A  942  E64                        UPDATE REC NUMBER
 949  949  C  E64  Q99                        CHECK FOR LAST RECORD
 956  956  B  980  /                          BR IF NOT LAST RECORD
 961  961  M  R48  E73                        SET DRIVE FINISHED
 968  968  B  K42                            BRANCH TO WRITE TM
 980  980  L  E70  E67                        LOAD LENGTH
 987  987  L  R47  E35                        LOAD 980
 994  994  L  R44  E38                        LOAD 602
1001  *01  B  *06  Z                          RESET OVERFLOW
1006  *06  A  E67  E35                        ADD LENGTH TO 980
1013  *13  B  *29  Z                          BRANCH IF LARGER THAN 20
1018  *18  A  R53  E66                        ADD 20 TO LENGTH
1025  *25  B  *68                            BRANCH TO CLEAR WR/RD AREA
1029  *29  A  E67  E38                        ADD LENGTH TO 602
1036  *36  B  *45  Z                          BRANCH IF LARGER THAN 400
1041  *41  B  *68                            BRANCH TO CLEAR WR/RD AREA
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```
1045  #45  D E38 F67          REPLACE LENGTH
1052  #52  D                    ,,
1053  #53  D                    ,,
1054  #54  B 987
1068  #68  / I99              CLEAR WR/RD AREA
1072  #72  /                    ,,
1073  #73  /                    ,,
1074  #74  /                    ,,
1075  #75  , F14              SET WM TO STOP MOVE
1079  #79  B /87 T15R         BRANCH IF READ
1087  #87  L E72 E48          LOAD RANDOM NUMBER IN CHAR GEN
1094  #94  L E72                ,,
1098  #98  , E47              SET AND CLEAR WMS IN RAND CHAR GEN
1102  /02  ¤                    ,,
1103  /03  ,                    ,,
1104  /04  ¤                    ,,
1105  /05  ,                    ,,
1106  /06  ¤                    ,,
1107  /07  ,                    ,,
1108  /08  A E48              ; GENERATE RAND CHARS
1112  /12  A                    ,,
1113  /13  A                    ,,
1114  /14  A                    ,,
1115  /15  A                    ,,
1116  /16  A E48                ,,
1120  /20  A                    ,,
1121  /21  A                    ,,
1122  /22  A                    ,,
1123  /23  A                    ,,
1124  /24  A E48                ,,
1128  /28  A                    ,,
1129  /29  A                    ,,
1130  /30  A                    ,,
1131  /31  A                    ,,
1132  /32  M E47 I99          SET RAND REC
1139  /39  M E45                ,,
1143  /43  M E43                ,,
1147  /47  M E41                ,,
1151  /51  M E39                ,,
1155  /55  M I99 I94          ROLL RECORD
1162  /62  L P81 /86          SET INSTRUCTION UP
1169  /69  A E67 /86          ADD LENGTH
1176  /76  ¤ /84
1180  /80  L S50 F00          SET WMGM
1187  /87  L E72 F13          SET RAND NUMBER
1194  /94  L                  SET LENGTH
1195  /95  L                  SET RECORD NUMBER
1196  /96  L                  SET DRIVE
1197  /97  , E52              SET BUSY WM
1201  S01  B T00
1300  T00  L Q47 E57          RESET WR & SKIP COUNTER
1307  T07  L                  RESET REREAD COUNTER
```

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```
1308  T08  M  %U1  F00W        WRITE OR READ REC
1316  T16  B  042  J           BR IF BUSY
1321  T21  B  981  K           BR IF END OF REEL
1326  T26  B  Y49  L           BR IF ERROR
1331  T31  B  L42  T15R        BR TO COMPARE IF READING
1339  T39  B  T55  T09%
1347  T47  B  050
1355  T55  D  D11  T66
1362  T62  L  E99  J40         RETURN COUNTERS
1369  T69  L                     ,,
1370  T70  L                     ,,
1371  T71  L                     ,,
1372  T72  L                     ,,
1373  T73  L                     ,,
1374  T74  L                     ,,
1375  T75  L                     ,,
1376  T76  L                     ,,
1377  T77  L                     ,,
1378  T78  L                     ,,
1379  T79  L                     ,,
1380  T80  L                     ,,
1381  T81  L                     ,,
1382  T82  L                     ,,
1383  T83  L                     ,,
1384  T84  L                     ,,
1385  T85  , T11                 SET WM WITH DR NUMBER
1389  T89  C  T11  001           CHECK FOR LAST DRIVE
1396  T96  A  T96  T11           INCREASE DRIVE NUMBER
1403  U03  ¤  T11                CLEAR WM
1407  U07  B  889  /             BR TO CHECK NEXT DRIVE
1412  U12  L  E58  E53           LOAD START
1419  U19  D  E53  U30
1426  U26  B  882  J140          BRANCH IF NOT ALL DONE
1434  U34  C  E53  001           CHECK FOR LAST DR
1441  U41  A  041  E53           UP COUNT 1
1446  U48  B  U19  /             BR IF NOT LAST DR
1453  U53  / 299                 CLEAR PRINT AREA
1457  U57  B  U95  T15R          BR IF READ
1465  U65  L  Q71  Q59           SET CONSTANT FOR WRITE
1472  U72  M  D42  234           SET HEADINGS IN PRINT
1479  U79  M  D11                   ,,
1483  U83  M  Q91                   ,,
1487  U87  M  E24                   ,,
1491  U91  B  X00                 BR TO SET RECORDS
1495  U95  L  Q65  Q59           SET CONSTANT FOR READ
1502  V02  M  D42  262           SET HEADINGS IN PRINT
1509  V09  M                        ,,
1510  V10  M  Q91                   ,,
1514  V14  M                        ,,
1515  V15  B  X00
1700  X00  B  X12  S521          BRANCH IF PRINT ERRORS
1708  X08  . Y12                 INVESTIGATE ERRORS
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```
1712  X12  L  Q99  213          LOAD # RECS
1719  X19  N  Q
1721  X21  N
1722  X22  F  J                  SPACE 1
1724  X24  2                     PRINT HEADINGS
1725  X25  /  299                CLEAR PRINT AREA
1729  X29  L  E58  E53           LOAD START
1736  X36  M  Q59  X60           INITIALIZE INSTR
1743  X43  B  X55                CLEAR WM
1747  X47  D  E53  X55           MOVE DR #
1754  X54  L  J40  262           LOAD COUNTS
1761  X61  B  X85  X592          BRANCH IF LAST MOVE
1769  X69  ,  X55                ADJUST INSTR
1773  X73  A  Q53  X60           DECREASE ADDR BY 002004
1780  X80  B  X43                ,,
1785  X85  D  E53  221           MOVE DR #
1792  X92  2                     PRINT
1793  X93  C  E53  001           CHECK FOR LAST DRIVE
1800  Y00  A  Y00  E53           INCREASE DR 1
1807  Y07  B  X36  /
1812  Y12  B  Y31  T15R          BR IF READING
1820  Y20  M  R54  T15           SET R MOD  NOP REPEAT WR
1827  Y27  B  765                BR TO RWD START RD
1831  Y31  B  Y39                NOP REPEAT RD
1835  Y35  B  765
1839  Y39  /  614  299
1849  Y49  /  299                CLEAR PRINT AREA
1853  Y53  L  D91  249           LOAD PRINT AREA
1860  Y60  D  T11  204           MOVE DRIVE NUMBER
1867  Y67  L  E64  215           LOAD REC NUMBER
1874  Y74  N
1875  Y75  L  E67  223           LOAD LENGTH
1882  Y82  B  J42  T15R          BRANCH IF READ ERROR
1890  Y90  D  E56  235           MOVE SKIP NUMBER
1897  Y97  D  E57  228           MOVE WRITE NUMBER
1904  Z04  B  Z52  E572          BR IF 2ND WRITE
1912  Z12  M  R53  E57           SET 2ND WRITE
1919  Z19  A  Z19  E75           ADD 1 TO 1ST WRITE ERR
1926  Z26  B  Z35  E             STOP ON ERROR
1931  Z31  2  Z36                PRINT ERROR
1935  Z35  -                     ERROR STOP
1936  Z36  D  T11  Z46           MOVE DRIVE NUMBER
1943  Z43  U  ZU1  B             BACK SPACE
1948  Z48  B  T08                ,
1952  Z52  M  R48  E57           SET 1ST WRITE
1959  Z59  A  Z59  E77           ADD 1 TO 2ND WRITE
1966  Z66  A  Z66  E56           ADD 1 TO SKIP COUNT
1973  Z73  B  -42  E567          BR IF 6TH SKIP
1981  Z81  D  T11  Z91           LOAD DR IN SKIP
1988  Z88  U  ZU1  E             SKIP
1993  Z93  B  Z26
2042  -42  A  -42  E79           ADD 1 TO PERM WRITE
```


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```
1308  T08  M  Z01  F00W     WRITE OR READ REC
1316  T16  B  042  J        BR IF BUSY
1321  T21  B  961  K        BR IF END OF REEL
1326  T26  B  Y49  L        BR IF ERROR
1331  T31  B  L42  T15R     BR TO COMPARE IF READING
1339  T39  B  T55  T09%
1347  T47  B  050

1355  T55  D  T11  T66      RETURN COUNTERS
1362  T62  L  E99  J40
1369  T69  L                  ,,
1370  T70  L                  ,,
1371  T71  L                  ,,
1372  T72  L                  ,,
1373  T73  L                  ,,
1374  T74  L                  ,,
1375  T75  L                  ,,
1376  T76  L                  ,,
1377  T77  L                  ,,
1378  T78  L                  ,,
1379  T79  L                  ,,
1380  T80  L                  ,,
1381  T81  L                  ,,
1382  T82  L                  ,,
1383  T83  L                  ,,
1384  T84  L                  ,,
1385  T85  , T11              SET WM WITH DR NUMBER
1389  T89  C  T11  001        CHECK FOR LAST DRIVE
1396  T96  A  T96  T11        INCREASE DRIVE NUMBER
1403  U03  ¤  T11             CLEAR WM
1407  U07  B  889  /          BR TO CHECK NEXT DRIVE
1412  U12  L  E58  E53        LOAD START
1419  U19  D  E53  U30

1426  U26  B  882  J140       BRANCH IF NOT ALL DONE
1434  U34  C  E53  001        CHECK FOR LAST DR
1441  U41  A  B41  E53        UP COUNT 1
1448  U48  B  U19  /          BR IF NOT LAST DR
1453  U53  / 299              CLEAR PRINT AREA
1457  U57  B  U95  T15R       BR IF READ
1465  U65  L  Q71  Q59        SET CONSTANT FOR WRITE
1472  U72  M  D42  234        SET HEADINGS IN PRINT
1479  U79  M  D11                ,,
1483  U83  M  Q91                ,,
1487  U87  M  E24                ,,
1491  U91  B  X00             BR TO SET RECORDS
1495  U95  L  Q65  Q59        SET CONSTANT FOR READ
1502  V02  M  D42  262        SET HEADINGS IN PRINT
1509  V09  M                     ,,
1510  V10  M  Q91                ,,
1514  V14  M                     ,,
1515  V15  B  X00

1700  X00  B  X12  S521       BRANCH IF PRINT ERRORS
1708  X08  , Y12              INVESTIGATE ERRORS
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```
1712  X12  L  099  213          LOAD # RECS
1719  X19  N  0
1721  X21  N
1722  X22  F  J
1724  X24  2                     SPACE 1
1725  X25  /  299               PRINT HEADINGS
1729  X29  L  E58  E53          CLEAR PRINT AREA
1736  X36  M  G59  X60          LOAD START
1743  X43  M  X55               INITIALIZE INSTR
1747  X47  D  E53  X55          CLEAR MM
1754  X54  L  J40  262          MOVE DR #
1761  X61  B  X85  X592         LOAD COUNTS
1769  X69  .  X55               BRANCH IF LAST MOVE
1773  X73  A  G53  X60          ADJUST INSTR
1780  X80  B  X43               DECREASE ADDR BY 002004
1785  X85  D  E53  221           "
1792  X92  2                     MOVE DR #
1793  X93  C  E53  001           PRINT
1800  Y00  A  Y00  E53           CHECK FOR LAST DRIVE
1807  Y07  B  X36  /             INCREASE DR 1
1812  Y12  B  Y31  T15R
1820  Y20  M  R54  T15           BR IF READING
1827  Y27  B  765                SET R MOD  NOP REPEAT WR
1831  Y31  B  Y39                BR TO RWD START RD
1835  Y35  B  765                NOP REPEAT RD
1839  Y39  /  614  299
1849  Y49  /  299
1853  Y53  L  D91  249           CLEAR PRINT AREA
1860  Y60  D  T11  204           LOAD PRINT AREA
1867  Y67  L  E64  215           MOVE DRIVE NUMBER
1874  Y74  N                     LOAD REC NUMBER
1875  Y75  L  E67  223
1882  Y82  B  J42  T15R          LOAD LENGTH
1890  Y90  D  E56  235           BRANCH IF READ ERROR
1897  Y97  D  E57  228           MOVE SKIP NUMBER
1904  Z04  B  Z52  E572          MOVE WRITE NUMBER
1912  Z12  M  R53  E57           BR IF 2ND WRITE
1919  Z19  A  Z19  E75           SET 2ND WRITE
1926  Z26  B  Z35  E             ADD 1 TO 1ST WRITE ERR
1931  Z31  2  Z36                STOP ON ERROR
1935  Z35  .                     PRINT ERROR
1936  Z36  D  T11  Z46           ERROR STOP
1943  Z43  U  ZU1  B             MOVE DRIVE NUMBER
1948  Z48  B  T0B                BACK SPACE
1952  Z52  M  R48  E57
1959  Z59  A  Z59  E77           SET 1ST WRITE
1966  Z66  A  Z66  E56           ADD 1 TO 2ND WRITE
1973  Z73  B  -42  E567          ADD 1 TO SKIP COUNT
1981  Z81  D  T11  Z91           BR IF 8TH SKIP
1988  Z88  U  ZU1  E             LOAD DR IN SKIP
1993  Z93  B  Z26                SKIP
2042  -42  A  -42  E79           ADD 1 TO PERM WRITE
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2048  -49  L  D42  252          LOAD PERM
2056  -56  B  -65  E
2061  -61  2  T31               PRINT
2065  -65  -  T31               ERROR STOP
2069  -69  .                    WORD MARK
2142  J42  A  J42  E55          ADD 1 TO REREAD
2149  J49  D  E55  248          MOVE READ ERR NUMBER
2156  J56  B  J68  E550         BR IF PERM RD
2164  J64  B  Z26
2168  J68  A  J68  E99          ADD 1 TO PERM RD ERR
2175  J75  B  -49
2242  K42  B  K62  T15R         BR IF READING
2250  K50  D  T11  K60          MOVE DR B
2257  K57  U  2U1  M            WR TM
2262  K62  R  T55
2266  K66  B  K66  J            BRANCH IF BUSY
2271  K71  B  961  K            BRANCH IF END OF REEL
2276  K76  B  N83  L            BRANCH IF ERROR
2281  K81  M  F13  E72          UPDATE RECORD
2288  K88  M                       ''
2289  K89  M                       ''
2290  K90  B  T55
2342  L42  C  F05  E64          COMPARE REC B
2349  L49  B  M68  /
2354  L54  C  F08  E67          COMPARE REC LEN
2361  L61  B  M68  /
2366  L66  C  F13  E72          COMPARE RAND B
2373  L73  B  M68  /
2378  L78  B  T39  E550         BR IF NO ERR OR PERM.ERR
2386  L86  L  P84  M63          RESET ADD INSTR
2393  L93  B  M42
2442  M42  A  E55  ..           DOUBLE REREAD #
2446  M46  A  E55  M63          ADD DOUBLED REREAD
2453  M53  B  M61
2457  M57  A  M57  XXX          ADD 1 TO REREAD COUNTER
2464  M64  B  T39
2468  M68  /  299
2472  M72  B  N75  E            BR IF STOP ON ERROR
2477  M77  2                    SPACE
2478  M78  M  F13  273          MOVE REC WAS
2485  M85  M                       ''
2486  M86  M                       ''
2487  M87  M  P99  259             ''
2494  M94  B  N42
2542  N42  M  E72  243          MOVE REC SHLD BE
2549  N49  M                       ''
2550  N50  M                       ''
2551  N51  M  E22                  ''
2555  N55  N  000  000
2562  N62  D  E59  204          MOVE RD DR
2569  N69  F  S                 SPACE 2 AFTER
2571  N71  2  N76               PRINT ERROR
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2575  N75   .                          ERROR STOP
2576  N76   L J11 N90                   SET UP INSTRUCTION
2583  N83   / F99
2587  N87   M ZU1 F00R  -               READ TILL CORRECT
2595  N95   B K66
2642  042   B E52                      CLEAR DID NOT OVERLAP INDICATION
2646  046   B T16                      BR TO CHECK BUSY
2650  050   / 299                      CLEAR PRINT AREA
2654  054   L 890 220                  LOAD OVLP
2661  061   M E64 215                  MOVE REC NUMBER
2668  068   N
2669  069   L D52 210                  MOVE COMMENT
2676  076   D E59 204                  MOVE DRIVE USED
2683  083   V P42 E521                 BR IF THERE WAS NO OVERLAP
2691  091   B P54 C                    BR IF PRINT CORRECT RESULTS
2696  096   B TSS
2742  P42   L R72 223                  LOAD NON OVERLAP
2749  P49   .B P58 E
2754  P54   2 TSS
2758  P58   . TSS
2762  P62                              SET WM
 201  201   D R I ST 2ND 3RD 4TH S     FIND IN D01
 221  221   T H 6 TH 7TH 8TH 9TH       FIND IN D21
 240  240   P ER                       FIND IN D40
 243  243   D R 0  REC  00000 LEN      FIND IN D43
 263  263   0 00  WR # SKIP #          FIND IN D63
 279  279   R D E RR #                 FIND IN D79
 293  293   D R 0  RD COMP ERR RE      FIND IN D93
 312  312   C  SH LD BE                FIND IN E12
 323  323   W RIT E                    FIND IN E23
 328  328   R EAD                      FIND IN E28
2001  -01   0 000 0                    CONSTANTS TO RESET COUNTERS
2006  -06   0 00                         00
2009  -09   0 000 0                      00
2014  -14   0                            00
2015  -15   0 0                          00
2017  -17   0 0                          00
2019  -19   0 0                          00
2021  -21   0 0                          00
2023  -23   0 0                          00
2025  -25   0 0                          00
2027  -27   0 0                          00
2029  -29   0 0                          00
2031  -31   0 0                          00
2033  -33   0 0                          00
2035  -35   0 0                          00
2037  -37   0 0                          00
2039  -39   0 0                          00
2779  P79   F 00
2782  P82   E 79                       CONSTANT USED IN DET. CORRECT REREAD
2785  P85   .        REC WAS           PORTION OF COMP. PRINT
2844  044   0 0                       REREAD RESET CONSTANT
```

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2846  Q46  0 1
2848  Q48  I 979 96                 WR & SKIP RESET CONSTANT
                                    CONSTANT TO DEC. ADDR 89-8020
2854  Q54                           STORAGE FOR RD/WR PRINT ERR CONS
2860  Q60  J 402 62                 RD ERR PRINT CONSTANT
2866  Q66  J 202 34                 WR ERR PRINT CONSTANT
2872  Q72  R 0                      ERR PRINT CONSTANTS
2874  Q74     ERR 5 00000 REC
2895  Q95  0 050 0                  RECORD COUNT
2942  R42  6 02                     CONSTANT USED TO CREATE REC. LENG.
2945  R45  9 80                        "
2948  R48  1 357 9                  CONSTANT FOR RAND # GENERATOR
2953  R53  2                        CONSTANT FOR PROG MODIFICATION
2954  R54  R                           "
2955  R55  H                           "
2956  R56  M                           "
2957  R57  U                           "
2958  R58  L OAD                    CONSTANTS FOR PRINTING
2962  R62  O DD                        "
2966  R66  N ONO VLP                   "
2973  R73  D RS  MOVE EVEN OVLP        "
2991  R91  %                        CONSTANTS FOR PROG MODIFICATION
2992  R92  a                           "
2993  R93  1 MEN                      "
2100  J00  1                        CONSTANTS
2200  K00  2                           "
2300  L00  3                           "
2400  M00  4                           "
2500  N00  5                           "
2600  O00  6                           "
2700  P00  7                           "
2800  Q00  8                           "
2900  R00  9                           "
1250  S50  ,                        GROUP MARK
```

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IBM FORM 224-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451870
SHEET 24 OF 2?
BLOCK NO. 1T07A

TABLE OF UNPRINTABLE CHARACTERS

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LP-LEFT PARENTHESIS   12 5 8    SE-SEMICOLON 11 6 8      DE-DELTA     11 7 8
WS-WORD SEPARATOR      0 5 8    LT-LESS THAN 12 6 8      PZ-PLUS ZERO 12 0
TS-TAPE SEGMENT MARK   0 7 8    GT-GREATER THAN 6 8      TM-TAPE MARK  7 8
GM-GROUP MARK         12 7 8    MZ-MINUS ZERO  11 0      CO-COLON      5 8
RP-RIGHT PARENTHESIS  11 5 8    AP-APOSTROPHE 0 6 8

,0080121001                                          TAPE RELIABILITY      1T07A 0A
,016023N000/000,030031,038046N,0990508046     ,057,064068@0120311001    CC1T07A 02
MZ98099802335L1M072068M068047805004758064047O/P99A071069/023549100ZZOZOQ1T07A 03
                                                   Z
,0370398023551L/023R98M099Z98L063118LL/1010991105,001001/001118 DIAG  CC1T07A 04
,008015,022029,033033N0000001001                                          1T07A 05
L068W80,W49W56,W60W61,W69W731001/080,008012,0011BW73S5118001VW600058      1T07A 06
L051W99,W89W93,W98W99,0010011001VW60005KB001BP16                          1T07A 07
                                        Z
L071239,221001,001001,0010018W60DR 1ST 2ND 3RD 4TH 5TH 6TH 7TH 8TH 9TH    1T07A 08
L071278,243263,001001,0010018W60PERDR 0 REC  00000 LEN 000 WR # SKIP #    1T07A 09
L065311,293001,001001,001001BW60RD ERR #      DR D RD COMP ERR RE         1T07A 10
L068347,323328,333334,341342BW60C SHLD BE  WRITEREAD ZLS4927728368        1T07A 11
L051366,352356,357364,365366BW60BV78/2772LS19280LLL                       1T07A 12
L058392,368372,376377,385389BW602/28Q2472 838956818W93NV62                1T07A 13
L069429,400407,412416,421426BW60M377389LX08404N8669,4088430 850088348     1T07A 1/
L048445,434435,442443,444445BW60/E99/L332E32LMLM                          1T07A 15
L048461,447448,449450,451458BW60MLLMLLR96004/332                          1T07A 16
L062491,463471,472479,484485BW60/8333S521NLR9022083488.MR56484            1T07A 17
L066525,500508,515522,001001BW60852659818526004DMR91T09MR72223B533        1T07A 18
L072565,533541,548555,5590018W60MR92T09B559002MM442T08MR61210B566M559T081T07A 19
L072605,574581,588592,5990018W60B592003EM566T10MR65215B599MR57T10D0012011T07A 20
L069642,610614,619624,632639BW6D,001B70084720B4728B643002LM4420028472     1T07A 21
L072682,650658,665669,6730018W60M64300283480030MR620038472,R948451        1T07A 22
L059722,700708,712714,715716BW60.47987125521871EFJ2NMR55T15               1T07A 23
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                                          M
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L045837,832838,834835,836837BW60LM40J40LLLLLL                             1T07A 27
                                    Z
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L039911,906907,908909,910911BW60LLLLLLL                                   1T07A 31
L039918,913914,915916,917918BW60LLLLLLL                                   1T07A 32
L069955,920928,935942,949001BW60LBT55E731AR52E72YR48E8BA942E64CE64Q99     1T07A 33
L070993,961960,980987,0010018W60B980/MR48E73BK42          LE70E67LR47E35  1T07A 34
L067#28,#01#06,#13#18,#25001BW60LR44E38B#062AE67E35B#29ZAR53E668#68       1T07A 35
L071#67,#36#41,#45#52,#53#548W60AE67E38B#452B#68DE38E67DD8987             1T07A 36
L058#93,#72#73,#74#75,#79#87BW60/199//,F148/07T15RLE72E48                 1T07A 37
L045/06,#98/02,/03/04,/05/06BW60LE72,E476,□,□                             1T07A 38
L045/19,/08/12,/13/14,/15/16BW60,AE48AAAAAE48                             1T07A 3(
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L042/29,/21/22,/23/24,/28/29BW60AAAAAE48AA                                  1T07A 40
L057/54,/31/32,/39/43,/47/51BW60AAME47I99ME45ME43ME41ME39                   1T07A 41
L072/94,/62/69,/76/80,/87/948W60MI99I94LP81/86AE87/86B/84L550F00LE72F13L1T07A 42
L072S34,/96/97,S01001,001001BW60LL,E528T00                                  1T07A 43
L033S50,001001,001001,001001BW60G                                           1T07A 44
                              M
L071T38,T07T08,T16T21,T26T31BW60LQ47E57LNZU1F00W8042J8961KBY49L8L42T15R     1T07A 45
L069T71,T47T55,T62T69,T70T71BW60BT55T09%80S0     DT11T68LE99J40LLL          1T07A 46
L039T78,T73T74,T75T76,T77T78BW60LLLLLLL                                     1T07A 47
L042T80,T80T81,T82T83,T84T858W60LLLLLL,T11                                  1T07A 48
L069U25,T96U03,U07U12,U19001BW60CT11001AT98T11MT118869/LE58E53DE53U30       1T07A 49
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L069V01,U72U79,U83U87,U91U958W60LQ71059MD42234MD11MQ91ME248X00LQ65Q59       1T07A 51
L072V41,V09V10,V14V13,0D1001BW60MD42262MMQ91N8X00                           1T07A 52
L072V81,V46V53,V61V62,V70V78BW60/T99LC80T808W93298G18WO2072 BW320721,001    1T07A 53
                                    M
L071W20,V90V98,W02W10,W17001BW608W45080ABV42072DBV538W45080AN071Y71W180     1T07A 54
L056W44,W28W32,W39001,00100I8W60NO80180842ILO7QZ618V78                      1T07A 55
L057X24,X08X12,X19X21,X22X248W608X12S521,V12LQ99213NONFJ2                   1T07A 56
L068X60,X29X36,X43X47,X540018W60/299LE58E53MQ59X60MX550E53X55LJ402Q2        1T07A 57
L071X99,X69X73,X80X85,X92X938W608X85X592,X55AQ53X608X43 DE532212CE53001     1T07A 58
L071Y38,Y07Y12,Y20Y27,Y31Y35BW60AY00653BX36/8Y31IT15RMRS4T15B765BY39B765     1T07A 59
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L068Z47,Z19Z26,Z31Z35,Z36Z38W60MR53E57AZ19E75BZ35E2Z36.DT11246UXUIB         1T07A 62
L072Z87,Z52Z59,Z66Z73,Z810018W608T08MR48E57AZ59E77AZ66E568M42E567DT11Z911T07A 63
                                                                  Z
L042Z97,Z93001,001001,0010018W60UXU1E8Z26                                   1T07A 64
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    Z   Z   Z   Z  Z   Z  Z
L046M34,M23M25,MZ7M29,M31M338W60000000000000000                             1T07A 66
    Z   Z   Z   Z  Z   Z  Z
L062M64,M37M39,M42M49,M56M618W60000000 AM42E79LD422528M65E2T31              1T07A 67
    Z   Z   Z   Z  Z   Z  Z                 Z          Z
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        Z
L072J81,J49J56,J64J68,J75001BW60AJ42E59DE552448J68E9508Z26AJ68E998M49       1T07A 69
                                                                  Z
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L072L20,K88K89,K90L00,0010018W60NF13E72MM8T55      3                        1T07A 72
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L066O75,O46O50,O54O61,O680698W60MES28T16/299LR90220ME64215NLO52210          1T07A 79
L072P15,O83O91,O96P00,0010018W60DE59204VP42E5218P54C8T557                   1T07A 80
L072P81,P49P54,P58P62,P796018W60LR722238P58E2T58.T58          F001T07A 81
L072Q21,P85Q00,001001,0010018W60QE79        REC WAS8                        1T07A 82
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LD62Q73,Q46Q48,Q54Q60,Q66Q72BW6000001197998        J40262J20234RD          1T07A 83
LD72R13,Q95R00,001001,0010018W60 ERR5 00000 REC      005009               1T07A 84
LD47R56,R45R48,R53R54,R55R56BW6060298013S792RWN                            1T07A 85
LD68R92,R58R62,R66R73,R91R92BW60ULOADDDD NONOVLPORS MOVE,EVEN OVLP60       1T07A 86
LD38R98,001001,0010G1,0010018W451MEN                                       1T07A 87
,019026,049L077549,03403880381798G840080098      TAPE RELIABILITY          1T07A 88
                          M
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IBM 1401 SORT II EXERCISE

BASIC TAPE SORTING PROCEDURE

WITH THE MODERNIZATION OF BUSINESS METHODS, A DEFINITE EMPHASIS HAS BEEN PLACED ON COMPLETING VOLUME JOBS MORE QUICKLY AND EFFICIENTLY. FOR THIS REASON COMPUTERS ARE BEING UTILIZED FOR SORTING LARGE VOLUMES OF DATA INTO DESIRED SEQUENCES. IBM APPLIED PROGRAMMING HAS DEVELOPED PROGRAMS FOR VARIOUS COMPUTERS WHICH ACCOMPLISH THIS PURPOSE. FOR EXAMPLE, 1401 DPS USERS NOW HAVE AVAILABLE TO THEM THREE "CANNED" PROGRAMS; SORT 1401, 1401 SORT I, AND 1401 SORT II. THESE PROGRAMS MADE POSSIBLE THE SORTING OF LARGE VOLUMES OF TAPE RECORDS IN A RELATIVELY SHORT PERIOD OF TIME. FOR EXAMPLE A 10 COLUMN SORT ON 50,000 CARDS USING AN 083 SORTER WOULD REQUIRE APPROXIMATELY 11 HOURS. HOWEVER, IF THIS WERE DONE ON A 1401 SYSTEM USING 80 CHARACTER TAPE RECORDS, THE TOTAL TIME REQUIRED WOULD BE ONLY 1.5 HOURS.

THE USE OF COMPUTERS AND MAGNETIC TAPE HAS NOT ALTERED THE SORTING PROCEDURE AS MUCH AS IT HAS EMPHASIZED THE NEED FOR SPEED AND THE ABILITY TO HANDLE A VERY LARGE NUMBER OF RECORDS IN ONE SORT. THE BASIC METHODS OF SORTING CAN BE DEMONSTRATED BY REVERTING TO AN EXAMPLE THAT HAS BEEN USED MANY TIMES, THE SORTING OF PLAYING CARDS.

IF A PERSON IS GIVEN ONE COMPLETE DECK OF CARDS AND ASKED TO PUT THEM IN ORDER, THE PROCEDURE IS A SIMPLE ONE. MOST PEOPLE WILL MAKE AN INITIAL DISTRIBUTION BY SUIT, CREATING FOUR "FILES" OF EQUAL SIZE. AFTER THAT EACH "FILE" CAN BE SORTED BY HOLDING THE 13 CARDS OF A SUIT IN ONE HAND, WHILE THE CARDS ARE SHIFTED ABOUT AND PLACED IN ORDER. AS SOON AS EACH OF THE FOUR SUITS HAS BEEN ORDERED, THE FOUR ARE STACKED TOGETHER AND THE JOB IS COMPLETED. IN SORT TERMINOLOGY THIS WAS ACCOMPLISHED BY THE FOLLOWING BASIC SORTING METHODS: A DISTRIBUTION, AN INTERNAL SORT, AND THEN A FINAL MERGE OF FOUR SORTED FILES.

A MORE REALISTIC PICTURE OF MOST SORTING PROBLEMS IS CREATED IF THE ABOVE-PROBLEM IS COMPLICATED SLIGHTLY. ASSUME THAT 52 CARDS ARE TAKEN FROM A STACK OF CARDS WHICH CONTAINS FOUR DECKS. THE PROCEDURE OUTLINED ABOVE MIGHT WORK FOR THIS SECOND CASE, BUT THERE ARE GOOD REASONS TO DOUBT THAT IT WILL. IT IS EXTREMELY UNLIKELY THAT THE INITIAL DISTRIBUTION BY SUIT WILL PRODUCE FOUR GROUPS OF EQUAL SIZE. IN FACT, THERE MIGHT NOT EVEN BE FOUR SUCH GROUPS OR "FILES" AND THE CARDS SELECTED MAY CONTAIN TWO TO FOUR EQUAL CARDS. IF WE ALSO ADD THE STIPULATION THAT FIFTEEN IS THE MAXIMUM NUMBER OF CARDS THAT CAN BE HELD AT ONE TIME, THE SOLUTION FOR THE SECOND CASE IS CONSIDERABLY MORE DIFFICULT. IT CAN STILL BE SOLVED BY A COMBINATION OF METHODS, BUT EITHER THE SEQUENCE OF OPERATIONS WILL HAVE TO BE ALTERED OR THE INITIAL DISTRIBUTION MODIFIED.

THE FOLLOWING SECTIONS SHOW IN SOME DETAIL HOW THE MERGE AND THE INTERNAL-SORT CAN BE USED AND MODIFIED TO FIT THE VARIOUS PROBLEMS IN SORTING.

SORTING BY MERGING

THE MERGE HAS BEEN USED AS THE BASIS FOR MANY SPECIFIC SORTING PROGRAMS AND MOST OF THE GENERALIZED SORTING ROUTINES. THIS DESCRIPTION OUTLINES ONLY THE PRINCIPLES.

THE TWO WAY TAPE SORT PROVIDES A SIMPLE EXAMPLE OF MERGE SORTING. IF A GIVEN COMPUTER HAS THE ABILITY TO READ AND WRITE TAPES AND SELECT THE SMALLER OF THE ITEMS BROUGHT IN, A SERIES OF RANDOM NUMBERS CAN BE SORTED AS FOLLOWS:

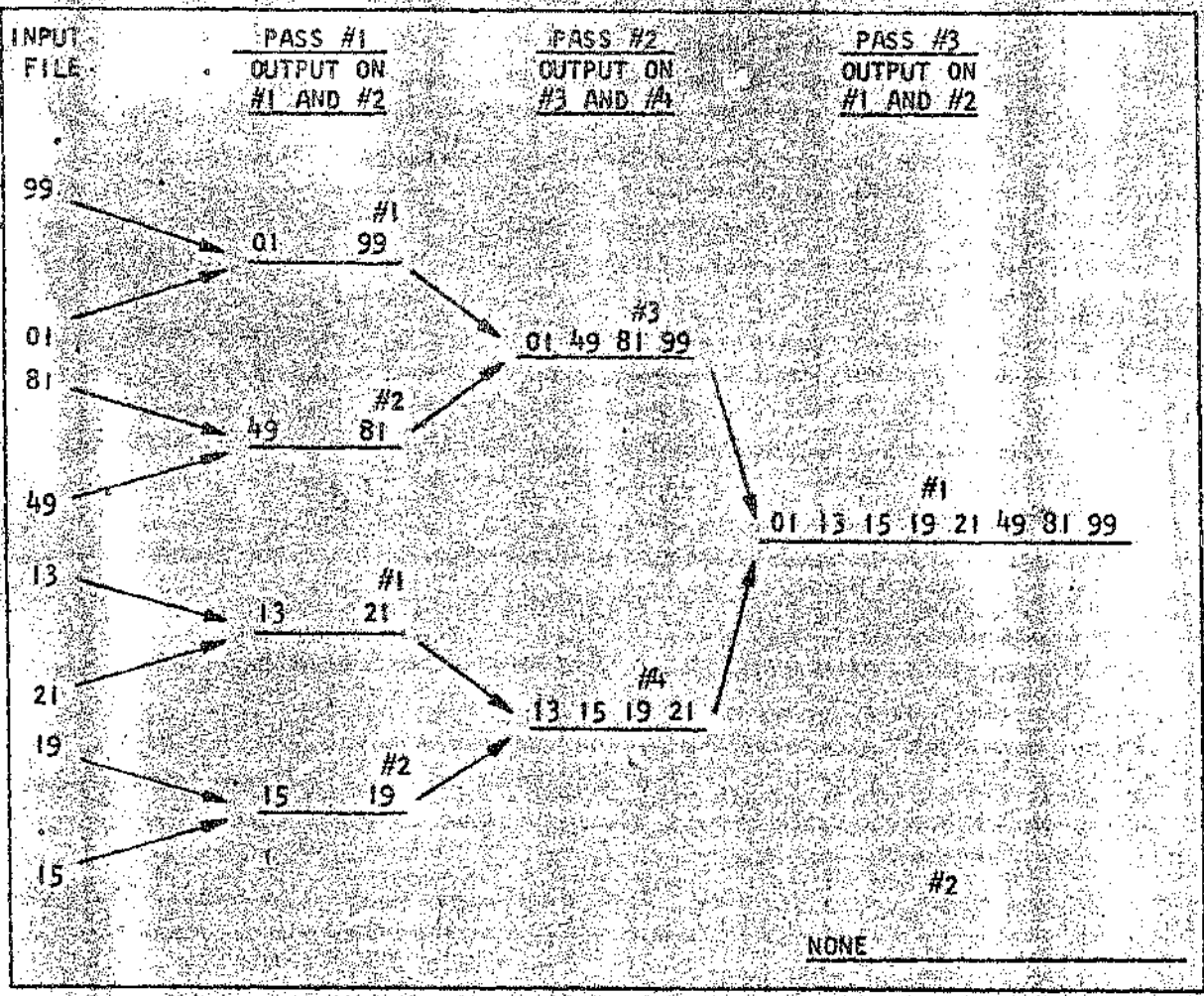
THE FIRST PASS OF THE SORT MERGES TWO SINGLE ITEMS TO CREATE SEQUENCES OF TWO ITEMS.

THE SECOND PASS, USING THE OUTPUT OF THE FIRST PASS AS INPUT, MERGES A PAIR OF THESE TWO-ITEM SEQUENCES, ONE FROM EACH OF THE TWO INPUT TAPES, AND WRITES FOUR-RECORD STRINGS ON THE OUTPUT TAPES.

CONTINUING SUCH A MERGE BY REPEATED MERGING PASSES WILL EVENTUALLY PLACE ALL RECORDS IN THE FILE INTO ONE SEQUENCE.

FIGURE 1 SHOWS HOW A SET OF NUMBERS IS GRADUALLY PUT INTO SEQUENCE BY USE OF A SIMPLE TWO-WAY MERGE. IN THE FIRST PASS, THE RECORDS ARE WRITTEN OUT ON TAPES #1 AND #2, EACH OF WHICH WILL THEN CONTAIN TWO-RECORD SEQUENCES AT THE END OF THE PASS. THE TAPES ARE REWOUND AND THE OUTPUT OF THE FIRST PASS BECOMES THE INPUT FOR THE SECOND MERGE PASS. THE FIRST TWO RECORD STRINGS FROM TAPES #1 AND #2 COMBINE TO MAKE A FOUR-RECORD SEQUENCE THAT GOES ONTO TAPE #3. THEN THE SECOND PAIR OF TWO-RECORD SEQUENCES IS MERGED AND STORED ON TAPE #4. THE MERGING PROCESS FOR THE THIRD PASS IS LIKE THAT FOR THE SECOND PASS, EXCEPT THAT THE SEQUENCES READ IN AND WRITTEN OUT ARE TWICE AS LONG AS THEY WERE IN THE PRECEDING PASS; INPUT COMES NOW FROM TAPES #3 AND #4 AND OUTPUT IS WRITTEN ONTO TAPES #1 AND #2. EACH NEW PASS DOUBLES THE LENGTH OF THE INPUT SEQUENCES. THE FILE IS SORTED WHEN THE NUMBER OF SEQUENCES IS REDUCED TO ONE. THE FINAL OUTPUT WILL ALL BE ON A SINGLE TAPE. IN THE EXAMPLE, THE SORTED RECORDS ARE STORED ON TAPE #1 AFTER THREE PASSES.

IN A SIMPLE MERGE SUCH AS ILLUSTRATED IN FIGURE 1, THE NUMBER OF MERGING PASSES IS DETERMINED BY THE NUMBER OF RECORDS TO BE SORTED AND THE ORDER OF THE MERGE. A TWO-WAY MERGE WITHOUT AN INTERNAL SORT WILL DEVELOP A SEQUENCE OF 2^n RECORDS IN n MERGING PASSES: I.E., 8 ITEMS IN THREE PASSES, 16 IN FOUR, 32 IN FIVE AND 1,024 IN TEN PASSES. AS THE NUMBER OF RECORDS TO BE SORTED INCREASES TO A LARGER NUMBER, SUCH AS ONE MIGHT REALISTICALLY EXPECT IN DATA PROCESSING APPLICATIONS, THE NUMBER OF PASSES WILL BECOME QUITE LARGE. THEREFORE, IN ACTUAL PRACTICE, A SORTING PROGRAM USUALLY INCLUDES SOME MODIFICATIONS THAT WILL REDUCE THE NUMBER OF MERGING PASSES. THE MOST COMMON METHOD IS TO PRECEDE THE MERGE BY USE OF THE INTERNAL SORT THAT IS DESCRIBED LATER.



SORTING BY A TWO-WAY MERGE

FIGURE 1

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INTERNAL SORTING

IT FREQUENTLY IS NECESSARY TO SORT OR ORDER A GROUP OF RECORDS THAT ARE LOCATED IN THE STORAGE OF A COMPUTER. THE NUMBER OF RECORDS INVOLVED MAY VARY FROM VERY FEW TO A LARGE NUMBER, POSSIBLY AS MANY AS 1000 OR MORE. INTERNAL SORTING IS USUALLY DONE IN CONJUNCTION WITH SOME OTHER PROCESSING. ROUTINES FOR INTERNAL SORTING MAY BE FOUND IN PROGRAMS WHICH RANGE FROM COMPILERS AND ASSEMBLY PROGRAMS TO GENERALIZED AND SPECIFIC SORTING PROGRAMS. BY INCLUDING AN INTERNAL SORT AS THE FIRST PHASE OF A MERGE TYPE SORT, FOUR, FIVE OR EVEN SIX OR MORE MERGE PASSES CAN BE ELIMINATED.

THE SAVINGS FOR A GIVEN FILE DEPEND ON THE NUMBER OF ITEMS INTERNALLY SORTED AND THE ORDER OF MERGE WHICH IT PRECEDES. THIS SECTION WILL DEAL PRIMARILY WITH INTERNAL SORTING METHODS THAT HAVE BEEN DEVELOPED FOR THE GENERALIZED SORTING PROGRAMS.

ANY INTERNAL SORT THAT IS SELECTED OR DEVELOPED FOR A SPECIFIC APPLICATION SHOULD BE THE RESULT OF EVALUATING SIX CONSIDERATIONS:

1. CHARACTERISTICS OF THE MACHINE
2. INPUT AND OUTPUT
3. RECORD LENGTH
4. SIZE OF CONTROL WORD
5. NATURAL SEQUENCES IN DATA
6. THE ASSOCIATED PROGRAM

THERE OBVIOUSLY IS NOT GOING TO BE ONE WAY WHICH IS BEST FOR ALL TYPES OF COMPUTERS. THEREFORE, THE FOLLOWING CONSIDERATIONS SHOULD BE EVALUATED FOR EACH PROGRAM AND A SOLUTION SELECTED WHICH INCORPORATES THEM IN THE BEST POSSIBLE WAY:

1. SORT AS MANY ITEMS AT ONE TIME AS SPACE WILL PERMIT.
2. REDUCE THE PROCESS TIME PER RECORD TO A MINIMUM.
3. MODE OF OPERATION MUST BE COMPATIBLE WITH INPUT-OUTPUT OPERATIONS AND SHOULD RESULT IN A MAXIMUM OVERLAPPING READ, WRITE AND PROCESS TIME.
4. THE MERGE TYPE SORTING PROGRAM SHOULD MAINTAIN AND UTILIZE SEQUENCES WHICH EXIST IN THE INPUT FILE.
5. THE ROUTINE SHOULD BE COMPACT AND EASILY MODIFIED.
6. THE INTERNAL SORT FOR A GENERALIZED PROGRAM MUST BE ABLE TO ACCEPT AND SORT VARIABLE LENGTH RECORDS WITH ANY SIZE CONTROL WORD.
7. THE ROUTINE SHOULD ALSO BE ABLE TO SORT ANY NUMBER OF RECORDS THAT CAN BE PACKED INTO THE RECORD STORAGE AREA.

RECORDS CAN BE SORTED EITHER (1) BY PHYSICALLY MOVING THEM AROUND UNTIL THEY ARE IN ORDER, OR (2) BY FORMING TABLES OF MACHINE ADDRESSES, "TAGS," WHICH REFER TO THE RECORDS IN STORAGE. IN THE SECOND METHOD, ONLY THE TAGS ARE MOVED DURING THE SORT. THE FINAL ORDERING OF THE TAGS INDICATES THE PROPER SEQUENCE OF THE RECORDS. AS A GENERAL RULE, THE EARLY INTERNAL SORT ROUTINES SHIFTED ENTIRE RECORDS AROUND IN MEMORY, AND THE LATER VERSIONS MOVE ONLY THE TAG REFERENCES. THERE WAS AN INTERMEDIATE PERIOD WHEN THE CONTROL WORD AND THE RECORD TAG WERE

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COMBINED AND BOTH SHIFTED IN THE SAME WAY THAT TAGS ARE NOW MOVED. FOLLOWING IS AN EXAMPLE OF AN INTERNAL SORT USING THE "TAG" METHOD OF ACHIEVING ASCENDING SEQUENCE OF RECORDS. REFER TO ATTACHED FLOW CHART, 1 AND 2.

THE FOLLOWING CONDITIONS HAVE BEEN SET UP FOR EXPLANATORY PURPOSES.

1. INPUT TAPE FILE CONTAINS FIXED LENGTH RECORDS, 20 CHARACTERS LONG WRITTEN IN RANDOM ORDER.

2. THE TEN HIGH ORDER CHARACTERS IN EACH RECORD WILL BE USED IN THE INTERNAL SORT AS THE CONTROL FIELD.

3. THE INPUT AREA IN STORAGE IS 800 POSITIONS IN LENGTH STARTING AT 001.

4. THE OUTPUT AREA IN STORAGE IS 800 POSITIONS IN LENGTH STARTING AT 1100.

STEP ONE OF THE INTERNAL SORT CONSISTS OF SETTING UP A TABLE OF TAGS IN STORAGE TO BE USED TO SORT GROUPS OF RECORDS READ INTO THE INPUT AREA. THIS IS EASILY DONE BECAUSE THE ADDRESS OF THE LOW ORDER POSITION OF THE CONTROL FIELD IN EACH RECORD IS KNOWN. DUE TO THE FACT THAT 40 RECORDS WILL BE INTERNALLY SORTED AT ONE TIME (800 POSITION INPUT AREA DIVIDED BY 20 CHARACTER RECORDS EQUALS 40 RECORDS) THE TABLE WILL CONSIST OF 40 TAGS, ONE PER RECORD. THE FIRST TAG IN THE TABLE WILL BE THE NUMBER 010 BECAUSE THIS REPRESENTS THE ADDRESS OF THE UNITS POSITION OF THE CONTROL FIELD OF THE FIRST RECORD IN THE INPUT AREA. THEREFORE, THE SECOND TAG WILL BE 030, THE THIRD 050, THE FOURTH 070, ETC. UNTIL THE LAST TAG WILL BE 790.

ONCE THE TABLE OF TAGS IS SET UP, A GROUP OF 40 RECORDS IS READ FROM THE INPUT TAPE INTO THE INPUT STORAGE AREA. AT THIS TIME, STORAGE CAN BE REPRESENTED AS FOLLOWS:

TAG AREA

040 030 050 070 090.....770 790

INPUT AREA (STARTING IN 001, LAST CHARACTER IN 800)

2345678901XXXXXXXXXX1234567890XXXXXXXXXX3456789012XXXXXXXXXX...ETC.

NOW BY USING A SERIES OF COMPARE, BRANCH AND MOVE INSTRUCTIONS, THE TAG AREA CAN BE RE-ARRANGED SO THAT IT SIGNIFIES ASCENDING ORDER OF THE RECORDS IN THE INPUT AREA. REFER TO FLOW CHART #2. AT THE COMPLETION OF THIS OPERATION STORAGE IS ARRANGED AS FOLLOWS:

TAG AREA

030 010 050.....ETC.

INPUT AREA

SAME AS BEFORE.

AT THIS POINT THE HIGHEST ORDER RECORD IN THE INPUT AREA (DETERMINED BY SELECTING THE LAST TAG IN THE TAG AREA), IS STORED IN SOME LOCATION TO BE USED IN A LATER COMPARISON.

TO FILL THE OUTPUT AREA WITH THE INTERNALLY SORTED RECORDS, THE COMPUTER EXECUTES A NUMBER OF MOVE INSTRUCTIONS USING THE TAGS MODIFIED BY PLUS 10 AS "A"-FIELD ADDRESSES AND SPECIFIC OUTPUT AREA LOCATIONS AS "B"-FIELD ADDRESSES. THE TAGS MUST BE MODIFIED BY PLUS 10 BECAUSE THE INTERNALLY SORTED RECORDS EACH CONTAIN 20 CHARACTERS. IT WAS DETERMINED PREVIOUSLY THAT ONLY THE 10 HIGH ORDER CHARACTERS WOULD BE USED AS A CONTROL FIELD. THEREFORE, TO MOVE THE ENTIRE RECORD A FACTOR OF 10 MUST BE ADDED TO EACH TAG IN ORDER TO FIND THE UNITS POSITION OF EACH RECORD. THE SPECIFIC OUTPUT AREA LOCATIONS TO BE USED AS "B"-FIELD ADDRESSES MUST BE THE ADDRESS OF THE UNITS POSITION OF EACH RECORD AS IT WILL APPEAR IN THE OUTPUT AREA. TO PLACE THE RECORDS USED IN THE ABOVE EXAMPLE IN THE OUTPUT AREA, THE FOLLOWING INSTRUCTIONS COULD BE USED:

```
M040/20
M020/40
M060/60, ETC.
```

THIS CONTINUES UNTIL THE OUTPUT AREA IS COMPLETELY FILLED.

OUTPUT AREA (AT COMPLETION OF ABOVE EXAMPLE)

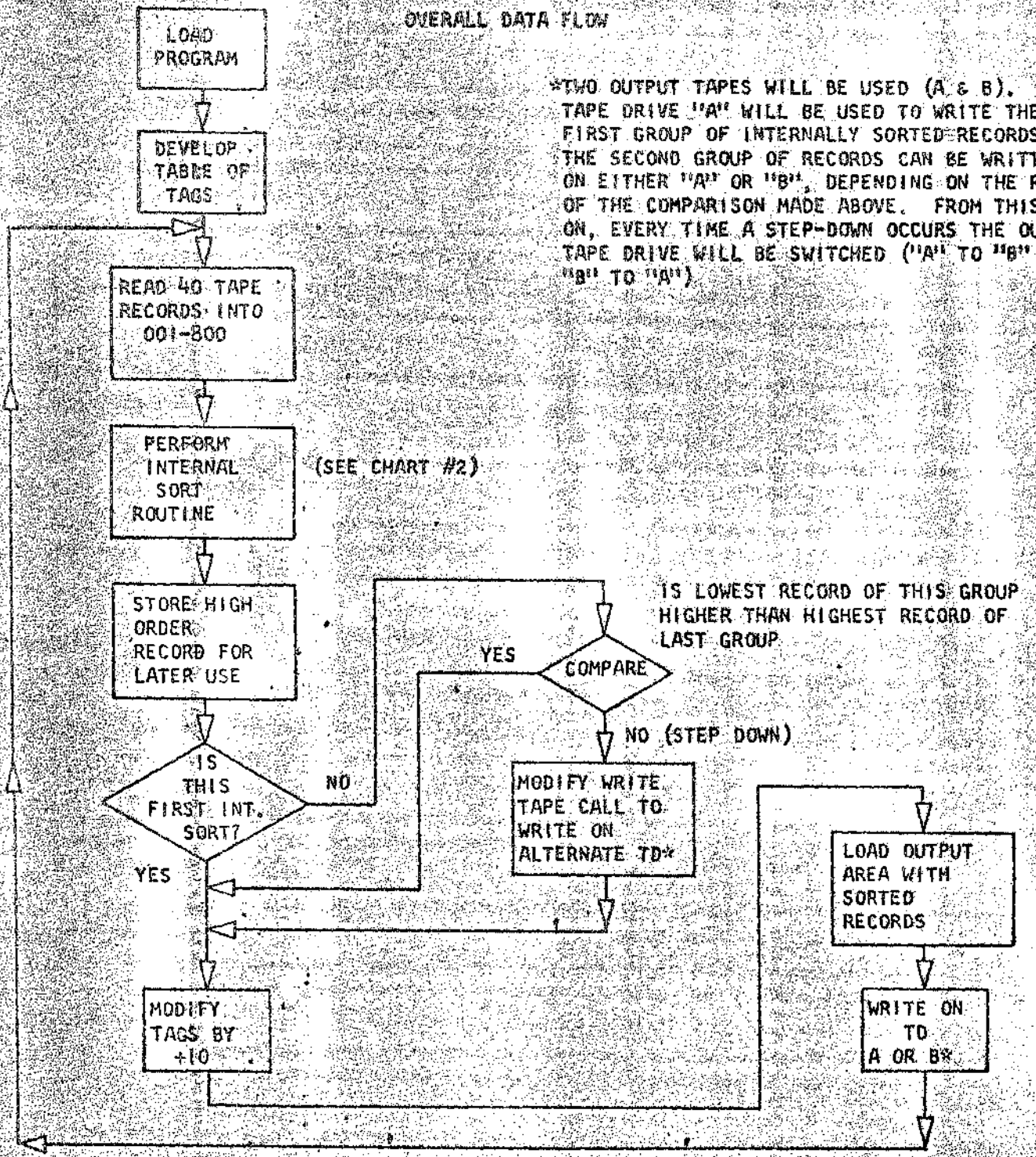
1234567890XXXXXXXXX2345678901XXXXXXXXXX3456789012XXXXXXXXXX...ETC.

IMMEDIATELY AFTER FILLING THE OUTPUT AREA, THESE 40 RECORDS ARE WRITTEN FROM THIS AREA ONTO AN OUTPUT TAPE. ANOTHER 40 RECORDS ARE READ FROM THE INPUT TAPE FILE AND THE OPERATION IS REPEATED. AT THE COMPLETION OF THE SECOND INTERNAL SORT THE HIGHEST NUMBERED RECORD OF THE FIRST INTERNAL SORT (PREVIOUSLY STORED) AND THE LOWEST NUMBERED RECORD OF THE SECOND INTERNAL SORT (SELECTED BY FIRST TAG IN TABLE) ARE COMPARED. IF THE LOWEST RECORD OF THE NEW GROUP IS HIGHER THAN THE HIGHEST RECORD OF THE LAST GROUP, THE SAME OUTPUT TAPE IS USED. HOWEVER, IF THE OPPOSITE IS TRUE, A "STEP-DOWN" IS SAID TO HAVE OCCURRED. IN THIS CASE THE SECOND GROUP OF INTERNALLY SORTED RECORDS IS WRITTEN ON A SECOND OUTPUT TAPE. THIS IS DONE IN ORDER TO FACILITATE TAPE MERGING DURING A SECOND PHASE OF THIS TAPE SORTING PROGRAM.

THE INTERNAL SORT IS CONTINUED UNTIL THE INPUT TAPE IS COMPLETELY READ. FROM THIS TWO OUTPUT TAPES HAVE BEEN ESTABLISHED, EACH CONTAINING GROUPS CONSISTING OF 40 RECORDS WRITTEN IN ASCENDING ORDER. AT THIS POINT THE SECOND PHASE OF THE TAPE SORT IS BEGUN USING THE TWO OUTPUT TAPES AS INPUTS FOR A TAPE MERGE OPERATION AS PREVIOUSLY DESCRIBED.

IT MUST BE UNDERSTOOD THAT THE ABOVE EXAMPLE WAS SIMPLIFIED TO A GREAT EXTENT TO FACILITATE UNDERSTANDING. IN PRACTICE THE ACTUAL PROGRAM IS MUCH MORE COMPLEX THAN AS STATED ABOVE. THE BASIC PRINCIPLE, HOWEVER, REMAINS THE SAME.

INTERNAL SORTING FLOW
CHART #1
OVERALL DATA FLOW



*TWO OUTPUT TAPES WILL BE USED (A & B). TAPE DRIVE "A" WILL BE USED TO WRITE THE FIRST GROUP OF INTERNALLY SORTED RECORDS. THE SECOND GROUP OF RECORDS CAN BE WRITTEN ON EITHER "A" OR "B", DEPENDING ON THE RESULTS OF THE COMPARISON MADE ABOVE. FROM THIS POINT ON, EVERY TIME A STEP-DOWN OCCURS THE OUTPUT TAPE DRIVE WILL BE SWITCHED ("A" TO "B" OR "B" TO "A").

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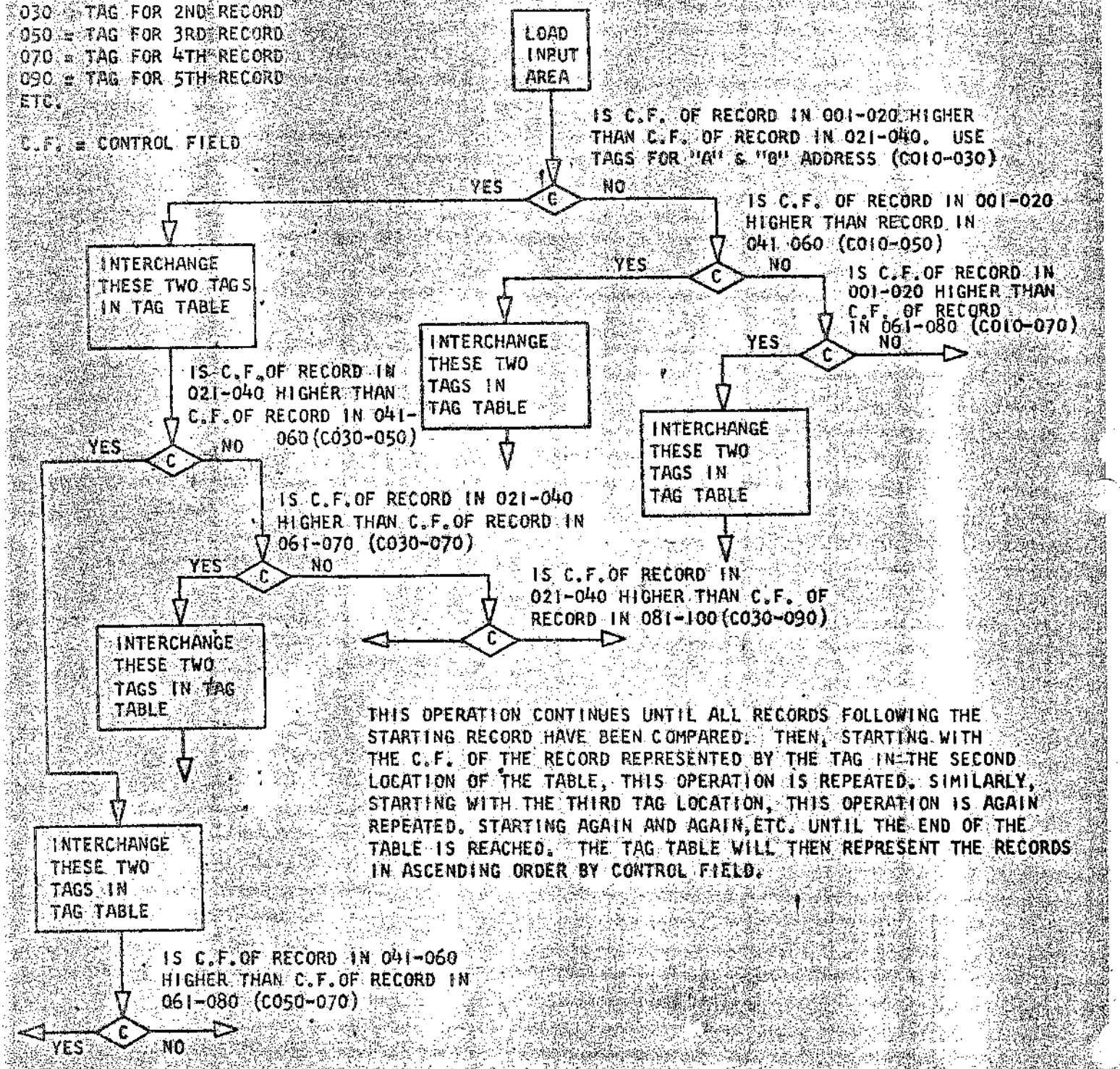
INTERNAL SORTING FLOW CHART #2
INTERNAL SORT ROUTINE

010 = TAG FOR 1ST RECORD
030 = TAG FOR 2ND RECORD
050 = TAG FOR 3RD RECORD
070 = TAG FOR 4TH RECORD
090 = TAG FOR 5TH RECORD
ETC.

C.F. = CONTROL FIELD



THIS OPERATION CONTINUES UNTIL ALL RECORDS FOLLOWING THE STARTING RECORD HAVE BEEN COMPARED. THEN, STARTING WITH THE C.F. OF THE RECORD REPRESENTED BY THE TAG IN THE SECOND LOCATION OF THE TABLE, THIS OPERATION IS REPEATED. SIMILARLY, STARTING WITH THE THIRD TAG LOCATION, THIS OPERATION IS AGAIN REPEATED. STARTING AGAIN AND AGAIN, ETC. UNTIL THE END OF THE TABLE IS REACHED. THE TAG TABLE WILL THEN REPRESENT THE RECORDS IN ASCENDING ORDER BY CONTROL FIELD.

IBM 1401 SORT I SYSTEM EXERCISE DESCRIPTION

PURPOSE

THE DECK OF CARDS THAT ACCOMPANIES THIS WRITE UP WAS DEVELOPED BY IBM APPLIED PROGRAMMING AND TEST EQUIPMENT ENGINEERING FOR USE ON THE 1401 FINAL TEST LINE. IT IS A REPLICA OF THE 1401 SORT I, VERSION 2, PATCH 4, APPLIED PROGRAM WITH VERY MINOR REVISIONS. IT IS BY NO MEANS A DIAGNOSTIC TEST; HOWEVER, IT WILL SERVE A NUMBER OF PURPOSES. MOST IMPORTANT, IT WILL ALLOW CUSTOMER ENGINEERING TO BECOME SOMEWHAT FAMILIAR WITH THE 1401 SORT I PROGRAM. FOLLOWING ARE OTHER AREAS IN WHICH THIS PROGRAM MAY BE USED.

1. IF A CUSTOMER HAS A SYSTEM CAPABLE OF USING SORT I, BUT IS NOT DOING SO, THIS DECK CAN BE USED AS A COMPREHENSIVE SYSTEM EXERCISE.
2. IF A CUSTOMER IS HAVING TROUBLE WITH THE NORMAL SORT I PROGRAM, THIS DECK CAN BE USED TO DETERMINE WHETHER THE PROBLEM IS A MACHINE OR A PROGRAM FAILURE.
3. IF A CUSTOMER IS EXPERIENCING TROUBLE RUNNING SORT I, THIS DECK CAN BE USED TO SIMPLIFY TROUBLESHOOTING. DETAILED EXPLANATIONS AND RUNNING INSTRUCTIONS ARE COVERED IN LATER SECTIONS.

SYSTEM ENGINEERING CHANGE LEVEL AND MINIMUM FEATURE REQUIREMENTS

1. ALL 1401 MOD CEF SYSTEMS WITH 4000 CHARACTER STORAGE.
2. HIGH-LOW-EQUAL COMPARE FEATURE.
3. FOUR (4) TAPE DRIVE UNITS (729II, 729IV OR 7330 TYPES).

GENERAL OPERATING PROCEDURES

1. READY TAPE UNITS 3, 4, 5 AND 6, ALL ON HI DENSITY.
2. LOAD CARDS INTO 1402 USING PROGRAM LOAD KEY. BE SURE ALL SENSE SWITCHES ARE OFF.
3. PROGRAM WILL CONTINUE AUTOMATICALLY TO THE END OF THE SORT. AT THIS POINT A MESSAGE WILL BE PRINTED SAYING, "OUTPUT 4 - END OF SORT".
4. RUNNING TIME:

   A) SYSTEMS WITH 729II'S - APPROXIMATELY 12 MINUTES
   B) SYSTEMS WITH 729IV'S - APPROXIMATELY 11 MINUTES
   C) SYSTEMS WITH 7330'S - APPROXIMATELY 15 MINUTES

GENERAL DESCRIPTION OF PROGRAM

THE PROGRAM CONSISTS OF A NUMBER OF STEPS. EACH WILL BE BRIEFLY DESCRIBED HERE AND PHASE I AND PHASE II WILL BE DISCUSSED IN DETAIL IN A LATER SECTION. REFER TO FLOW CHART #3.

1. FILE GENERATOR -

   A FILE GENERATOR ROUTINE IS INCORPORATED AS THE FIRST 52 CARDS OF THE PROGRAM. ITS PURPOSE IS TO GENERATE A TAPE FILE CONSISTING OF 5000, 20 CHARACTER RECORDS WRITTEN IN A RANDOM FASHION IN GROUPS OF

5 TO BE USED AS INPUT FOR THE SORT I PROGRAM. THE FILE WILL BE WRITTEN ON TO #3.

2. ASSIGNMENT PHASE

THE ASSIGNMENT PHASE CONSISTS OF A PROGRAM ROUTINE USED TO OPTIMIZE THE PROGRAM ON THE BASIS OF INFORMATION CONTAINED IN A CONTROL CARD IN THE PROGRAM DECK. FACTORS SUCH AS SORT CONTROL FIELD LENGTH AND ERROR ROUTINES ARE ANALYZED AND CONSTANTS ARE DEVELOPED IN ORDER TO ENABLE THE FOLLOWING PHASES OF THE PROGRAM TO BE EXECUTED MOST EFFICIENTLY.

PHASE I

PHASE I OF THE SORT I PROGRAM PROVIDES AN INTERNAL SORT. THE TAPE FILE WHICH WAS GENERATED AT THE START OF THE PROGRAM IS READ INTO THE 1401, 40 RECORDS AT A TIME. THESE 40 RECORD GROUPS ARE INTERNALLY SORTED AND PLACED ON EITHER TAPE DRIVE #5 OR TAPE DRIVE #6 AS DESCRIBED IN A PRECEDING SECTION.

PHASE II

AT THE COMPLETION OF PHASE I, PHASE II IS AUTOMATICALLY BEGUN. DURING THIS PHASE, SEVEN TWO-WAY MERGE PASSES OCCUR. THE FIRST PASS USES THE OUTPUT TAPES FROM PHASE ONE AS INPUTS AND TAPE DRIVES 3 AND 4 AS OUTPUTS. AT THE COMPLETION OF PASS ONE, PASS 2 IS BEGUN. THIS TIME THE OUTPUT TAPES FROM PHASE II, PASS ONE ARE USED AS INPUTS, AND TAPE DRIVES 5 AND 6 ARE USED AS OUTPUTS. THIS OPERATION CONTINUES UNTIL ALL 5000 RECORDS ARE IN ASCENDING SEQUENCE AND WRITTEN ON ONE TAPE DRIVE, USING THE SORT I DECK PROVIDED SEVEN PASSES WILL OCCUR WITH THE OUTPUT FILE EXISTING ON TAPE DRIVE #4.

AT THE START OF EACH PASS A CHECKPOINT RECORD IS WRITTEN ON A SPECIFIC TAPE DRIVE. THIS RECORD IS IN ESSENCE THE CONTENTS OF CORE STORAGE AND IS USED IN THE EVENT THE PROGRAM MUST BE RESTARTED. THE RESTART PROCEDURE WILL BE DISCUSSED IN DETAIL LATER.

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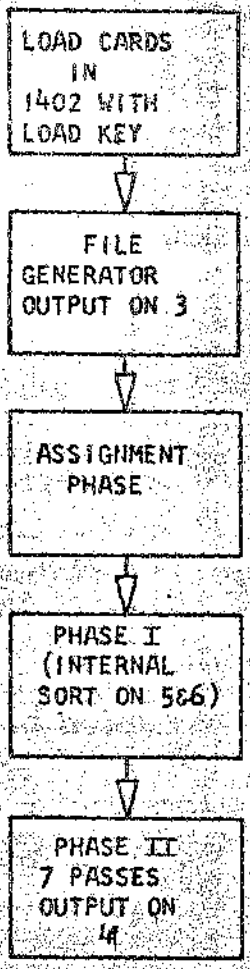
FLOW CHART #3

GENERAL SORT I DESCRIPTION



DETAILED DESCRIPTION OF SORT I SYSTEM EXERCISE

THIS DISCUSSION PERTAINS TO THE MODIFIED 1401 SORT I PROGRAM ONLY. FLOW CHARTS AND DESCRIPTIONS CAN BE APPLIED TO THE NORMAL SORT I PROGRAM ONLY IN A GENERAL MANNER. FOLLOWING ARE THE BASIC DIFFERENCES BETWEEN THE TWO PROGRAMS.

1. THE SORT I EXERCISE INCLUDES A FILE GENERATOR.
2. THE NORMAL SORT I PROGRAM CAN BE MODIFIED BY CUSTOMER PROGRAMMING TO INCLUDE CUSTOMIZED ROUTINES.
3. WITH THE EXCEPTION OF TD #4, TAPE DRIVES ARE NOT UNLOADED AT THE COMPLETION OF THE SORT WHEN RUNNING THE SORT I EXERCISE.

PHASE I SORT I EXERCISE

PHASE I CAN BE BEST EXPLAINED BY USING THE FLOW CHART LABELED "PHASE I, SORT I". EACH BLOCK IS NUMBERED. EXPLANATIONS CORRESPOND TO THE NUMBERED BLOCKS OF THE FLOW CHART. MANY "HOUSEKEEPING" BLOCKS ARE LEFT OUT IN ORDER TO MAINTAIN AN EVEN FLOW OF DATA.

1. DETERMINE MAXIMUM G

   G IS THE SYMBOL ASSIGNED TO THE NUMBER OF RECORDS THAT CAN BE INTERNALLY SORTED AT ONCE. USING THE 1401 SORT I EXERCISE G EQUALS 40.

2, 3, 4. THESE BLOCKS ARE USED TO DETERMINE THE LIMITS OF PHASE I. THEY ARE DEVELOPED ON THE BASIS OF THE INFORMATION CONTAINED IN THE CONTROL CARD IN THE PROGRAM DECK.

5. THE TAPE OUTPUT AREA IS CLEARED IN PREPARATION FOR LOADING GROUPS OF INTERNALLY SORTED RECORDS TO BE WRITTEN ON OUTPUT TAPES.

6. USING THE INFORMATION DEVELOPED IN 2, A TABLE OF ADDRESSES IS GENERATED CORRESPONDING TO THE UNITS POSITION OF THE CONTROL FIELD OF EACH RECORD. THESE TAGS ARE LATER USED TO ACCOMPLISH AN INTERNAL SORT ON 40 RECORD GROUPS AS DESCRIBED IN THE PRECEDING SECTION ON "BASIC TAPE SORTING PROCEDURES".

7. WORDS MARKS ARE SET IN THE INPUT AREA 20 CHARACTERS APART IN PREPARATION FOR ACCEPTING 20 CHARACTER TAPE RECORDS.

8, 9, 11. THESE BLOCKS SIGNIFY THE READING FROM TAPE DRIVE #3 OF 40 TAPE RECORDS INTO THE INPUT AREA. PREVIOUSLY THE FILE GENERATOR GENERATED 5000 20 CHARACTER RECORDS WRITTEN IN GROUPS OF 5. THEREFORE, EACH TIME A READ CALL IS ENCOUNTERED, 100 CHARACTERS WILL BE READ INTO THE INPUT AREA. THIS AREA IS 800 CHARACTERS IN LENGTH. TO FILL IT, THE PROGRAM WILL LOOP THROUGH BLOCKS 8, 9 AND 11 EIGHT TIMES FOR EACH INTERNAL SORT OF 40 (G) RECORDS.

10. THIS BLOCK IS NOT USED IN THE SORT I EXERCISE. IT IS INCLUDED ONLY FOR PURPOSES OF EXPLANATION. LET'S ASSUME FOR EXAMPLE THAT INSTEAD OF USING AN INPUT FILE OF 5000 RECORDS WE HAVE ONE CONTAINING ONLY 4998 RECORDS. THIS MEANS THAT THE LAST INTERNAL SORT THAT IS PERFORMED DURING PHASE I WOULD CONTAIN 38 RECORDS INSTEAD OF 40. (4998 DIVIDED BY 40 EQUALS 124 38/40) IN THIS CASE THE LAST INTERNAL SORT WOULD BE INCORRECT SO SOME PROVISION MUST BE INCLUDED THAT WILL FILL OUT THE LAST GROUP OF RECORDS TO EQUAL 6 OR 40. THIS IS DONE BY PADDING. IN OUR EXAMPLE, TWO RECORDS WOULD HAVE TO BE ADDED TO THE LAST GROUP. THESE RECORDS WOULD CONSIST OF EITHER 9'S OR BLANKS DEPENDING ON THE INFORMATION CONTAINED IN THE CONTROL CARD IN THE PROGRAM DECK.

12, 13, 14. THESE BLOCKS ACCOMPLISH THE ACTUAL INTERNAL SORTS. REFER TO THE DISCUSSION OF INTERNAL SORTING INCLUDED PREVIOUSLY IN THE SECTION ON "BASIC TAPE SORTING PROCEDURES".

15. A STEPDOWN IS THE TERM GIVEN TO THE CONDITION WHEN TWO CONSECUTIVE GROUPS OF INTERNALLY SORTED RECORDS ARE NOT IN ASCENDING ORDER. BLOCK 15 DETERMINES WHETHER OR NOT THERE HAS BEEN A STEPDOWN. THIS IS DONE BY COMPARING THE CONTROL FIELD OF THE LOWEST ORDER RECORD IN THE GROUP THAT HAS JUST BEEN SORTED TO THE CONTROL FIELD OF THE HIGHEST ORDER RECORD IN THE GROUP THAT WAS SORTED JUST PREVIOUS TO THIS ONE. IF A STEPDOWN HAS NOT OCCURRED, THIS GROUP OF RECORDS SHOULD BE WRITTEN ON THE SAME TAPE DRIVE AS THE LAST ONE WAS BECAUSE THE TWO GROUPS ARE IN ASCENDING ORDER. IF A STEPDOWN HAS OCCURRED, THIS GROUP OF RECORDS SHOULD BE WRITTEN ON THE SECOND OUTPUT TAPE DRIVE BECAUSE THE NEW GROUP STARTS WITH A RECORD LOWER THAN THE HIGHEST RECORD OF THE LAST GROUP.

16. THIS BLOCK MERELY ALTERS THE WRITE CALL INSTRUCTION TO WRITE ON THE ALTERNATE TAPE DRIVE AFTER A STEPDOWN HAS OCCURRED. FOR EXAMPLE, IF TD #5 HAD BEEN SELECTED AS THE OUTPUT TAPE AND STEPDOWN OCCURS, TD #6 WOULD NOW BECOME THE OUTPUT TAPE. IF A STEPDOWN DOES NOT OCCUR, THIS BLOCK IS BYPASSED.

17. THIS BLOCK ENCOMPASSES THE NECESSARY INSTRUCTIONS TO MOVE BLOCKS OF RECORDS INTO THE OUTPUT AREA USING THE TABLE OF TAGS ARRANGED IN BLOCKS 12 AND 13.

18, 19. THESE BLOCKS PERFORM THE WRITE INSTRUCTIONS ON THE TAPE DRIVE SELECTED IN BLOCK 16.

20. THIS BLOCK CAUSES THE PROGRAM TO EITHER REPEAT OR PROGRESS TO THE END OF PHASE I DEPENDING ON WHETHER OR NOT THE INPUT FILE IS EXHAUSTED.

21. TAPE MARKS ARE WRITTEN ON BOTH OUTPUT TAPE DRIVES AND BOTH ARE REWOUND IN PREPARATION FOR PROGRESSING TO PHASE II.

AT THE COMPLETION OF PHASE I, TWO OUTPUT TAPES HAVE BEEN CREATED EACH CONTAINING SEQUENCES OF RECORDS IN ASCENDING ORDER. PHASE II IS NOW BEGUN USING THE OUTPUT TAPES JUST CREATED AS INPUTS FOR PASS 1 OF PHASE II.

PHASE II - SORT I EXERCISE

REFER TO ATTACHED FLOW CHART LABELED "1401 SORT I - PHASE II". FOR THE SORT I EXERCISE, PHASE II WILL CONSIST OF 7 PASSES. EACH PASS WILL USE TWO INPUT TAPE DRIVES AND TWO OUTPUT TAPE DRIVES.

THE INITIAL OPERATION, UPON STARTING ANY PASS, IS TO WRITE A CHECKPOINT RECORD. THIS CHECKPOINT RECORD CONSISTS OF THE CONTENTS OF CORE STORAGE AND CAN BE USED TO RESTART THE PROGRAM FROM THE BEGINNING OF THIS PASS. THIS IS DONE BY ANALYZING THE PRINTOUT AND DETERMINING WHICH TAPE DRIVE CONTAINS THE CHECKPOINT RECORD. NEXT REWIND ALL DRIVES AND ASSIGN #1 TO THE TAPE DRIVE CONTAINING THE CHECKPOINT RECORD. RESET THE OPERATORS CONSOLE (CHECK RESET AND START RESET) AND DEPRESS THE TAPE LOAD KEY. THE CHECKPOINT RECORD WILL BE ENTERED INTO STORAGE AND T & 1401 WILL COME TO A "HALT" OPERATION. REASSIGN THE PROPER NUMBER TO THE TAPE DRIVE THAT IS NOW SET TO "#1" AND DEPRESS THE START KEY ON THE 1401. THE PROGRAM WILL CONTINUE BY REPEATING THE PASS THAT WAS INTERRUPTED. PHASE II CAN BEST BE UNDERSTOOD BY TAKING AN ACTUAL EXAMPLE MANUALLY THROUGH THE PHASE II FLOW CHART.

FOLLOWING IS AN EXAMPLE WHICH CAN BE USED. FOR THIS EXAMPLE THESE INITIAL CONDITIONS MUST BE SET UP IN ORDER TO COMPLETE PHASE II.

1. PHASE I HAS BEEN COMPLETED.
2. TWO TAPES HAVE BEEN CREATED DURING PHASE I.
   A) TAPE DRIVE #5 CONTAINS: BGZ FIL HMP TAPE MARK.
   B) TAPE DRIVE #6 CONTAINS: DGJ EKN AXY TAPE MARK.
   C) ASSUME EACH ALPHA CHARACTER ABOVE IS A TAPE RECORD. RECORDS ARE IN BLOCKED INPUTS OF 3 RECORDS TO A BLOCK. BLOCKED OUTPUT WILL ALSO BE THREE.
3. TWO INPUT AREAS IN STORAGE (A & B) EACH LARGE ENOUGH TO CONTAIN ONE BLOCK (3) OF RECORDS.
4. ONE OUTPUT AREA OF THE SAME SIZE (3 RECORDS).

USING THE CONDITION STATED ABOVE, MANUALLY COMPLETE THE SORT.

AT THE COMPLETION OF THE FIRST PASS, THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#3 BCD GJZ AHM PXY TAPE MARK
#4 DFI KLN TAPE MARK

ON THE SECOND PASS TAPE DRIVES 3 AND 4 WILL BE INPUTS AND 5 AND 6 WILL BE OUTPUTS. AT THE COMPLETION OF PASS 2 THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#5 BCD EFG IJK LNZ TAPE MARK
#6 AHM PXY TAPE MARK

ON THE THIRD PASS TAPE DRIVES 5 AND 6 WILL BE INPUTS AND 3 AND 4 WILL BE OUTPUTS. AT THE COMPLETION OF PASS 3 THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#3 ABC DEF GHI JKL MNP XYZ TAPE MARK
#4 TAPE MARK

EOF WILL BE RECOGNIZED AT THE BEGINNING OF PASS 4 AND THE ACTUAL SORT WILL BE COMPLETED. HOWEVER ONE MORE PASS WILL BE TAKEN TO CONVERT THE SORTED FILE INTO DESIRED OUTPUT BLOCKS, PROBABLY ONE RECORD PER BLOCK.

A HELPFUL METHOD OF GAINING COMPLETE UNDERSTANDING OF THE ABOVE EXAMPLE IS TO CUT SLIPS OF PAPER FOR EACH ALPHA CHARACTER. THEN THE SLIPS OF PAPER MAY BE MANUALLY MOVED FROM INPUT TAPE DRIVES TO INPUT AREAS, TO OUTPUT AREAS, AND FINALLY TO OUTPUT TAPE DRIVES. THIS METHOD WILL ALLOW THE READER TO ACTUALLY EXPERIENCE THE TWO-WAY MERGE OF PHASE II.

EXPLANATION OF PRINTOUTS - SORT I EXERCISE

LINE 1.

FILE GENERATED:

SIGNIFIES THAT FILE GENERATOR ROUTINE HAS BEEN SUCCESSFULLY COMPLETED. AT THIS POINT 5000. 20 CHARACTER RECORDS EXIST ON TD #3.

LINE 2.

L 020 G & B40 BI05 BO 01 BL 800 MFS 504519

L 020 SIGNIFIES RECORD LENGTH IS 20 CHARACTERS.

G & B40: INDICATES THE NUMBER OF RECORDS THAT CAN BE READ IN AND INTERNALLY SORTED IS 40.

BI 05: INDICATES THAT THE INPUT FILE TO PHASE I CONTAINS RECORDS BLOCKED IN GROUPS OF 5 (BI - BLOCKED INPUT)

BO 01: INDICATES THAT THE OUTPUT AT THE END OF THE SORT WILL CONTAIN RECORDS BLOCKED IN GROUPS OF ONE. (BO - BLOCKED OUTPUT).

BL 800: INDICATES THAT THE TOTAL NUMBER OF CHARACTERS THAT CAN BE HANDLED IN STORAGE AT A GIVEN TIME IS 800. (BL - BLOCK LENGTH)

MFS 504519: INDICATES THAT THE MAXIMUM NUMBER OF RECORDS THAT COULD BE SORTED USING ONE INPUT TAPE WOULD BE 504519. (MFS - MAXIMUM FILE SIZE)

LINE 3.

END OF ASSIGNMENT PHASE

INDICATES THAT ASSIGNMENT PHASE IS COMPLETED.

LINE 4.

END PHASE I

INDICATES PHASE I IS COMPLETED.

LINE 5.

MAX. PHASE 2 PASSES 07

INDICATES THAT IF MORE THAN SEVEN PASSES ARE TAKEN DURING PHASE II, PROGRAM OR MACHINE HAS FAILED.

LINE 6.

EST PHASE 7 PASSES 07

INDICATES THAT PROGRAM WILL PROBABLY BE COMPLETED IN NO LESS THAN SEVEN PASSES. LINES 5 AND 6 ARE DERIVED FROM ANALYSIS OF PHASE I.

LINE 7.

5000 RECORDS READ - PASS 00

INDICATES THAT 5000 RECORDS WERE READ INTO THE INPUT AREA DURING PHASE I.

LINE 8.

00 PAD REC ADDED - PASS 00

INDICATES THAT NO PADDING RECORDS WERE ADDED TO COMPLETE A GROUP OF 6 RECORDS. (SEE DISCUSSION ON PADDING - PHASE I).

LINE 9.

5000 REC PROCESSED - PASS 00

INDICATES THE TOTAL NUMBER OF RECORDS INCLUDING PADDING THAT WERE PROCESSED DURING PHASE I. ALL FUTURE RECORD COUNTS SHOULD AGREE WITH THIS FIGURE.

LINE 10.

PASS 01 - CKPT 3, INP 5 & 6

INDICATES PASS 01 OF PHASE II IS BEGINNING. A CHECKPOINT RECORD EXISTS ON TD #3 AND MAY BE USED AT THIS TIME TO RESTART PASS 01. INPUT TAPE DRIVES WILL BE 5 AND 6.

LINE 11.

5000 REC PROCESSED - PASS 01

INDICATES THAT PASS 01 WAS SUCCESSFULLY COMPLETED AND THE CORRECT NUMBER OF RECORDS (5000) WERE PROCESSED.

LINES 12-23.

DESCRIPTION OF PASS AND RECORD COUNT. INDICATES WHERE CHECKPOINT-RECORD WILL BE AND WHICH TAPE DRIVES ARE USED AS INPUTS.

LINE 24.

OUTP 4 - END OF SORT

INDICATES THE SORT HAS BEEN COMPLETED AND THE SORTED FILE EXISTS ON TD #4.

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SORT I, VERSION II - PRINTOUT

```
FILE GENERATED
L 020 G 6 6 40 BT 05 00 01 BL 800 RFS 504519
END OF ASSIGNMENT PHASE
END PH 1
HDX PH 2 PASSES 07
EST PH 2 PASSES 07
005000 - RECORDS READ - PASS 00
00 PAD REC ADDED - PASS 00
005000 REC PROCESSED - PASS 00
PASS 01 - CKPT 3, INP 5 & 6
005000 REC PROCESSED - PASS 01
PASS 02 - CKPT 5, INP 3 & 4
005000 REC PROCESSED - PASS 02
PASS 03 - CKPT 3, INP 5 & 6
005000 REC PROCESSED - PASS 03
PASS 04 - CKPT 5, INP 3 & 4
005000 REC PROCESSED - PASS 04
PASS 05 - CKPT 3, INP 5 & 6
005000 REC PROCESSED - PASS 05
PASS 06 - CKPT 5, INP 3 & 4
005000 REC PROCESSED - PASS 06
PASS 07 - CKPT 3, INP 5 & 6
005000 REC PROCESSED - PASS 07
OUTP 4 - END OF SORT
```

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SORT I EXERCISE TROUBLE-SHOOTING HINTS

1. TO CHECK OPERATION OF TAPE DRIVE UNITS:

   A) PLACE TAPE SELECT SWITCH ON OPERATOR'S CONSOLE IN "D" POSITION.
   B) TURN "ERROR STOP" SWITCH ON TAU C.E. PANEL "ON".
   C) LOAD AND RUN PROGRAM.
   D) EACH TIME A TAPE ERROR OCCURS THE PROGRAM WILL STOP. THE TAU CE PANEL CAN NOW BE INSPECTED AND THE TAPE ERROR CAN BE RECOGNIZED. THE TAPE DRIVE IN ERROR WILL HAVE ITS SELECT LIGHT LIT. A PATTERN CAN BE DEVELOPED BY KEEPING TRACK OF THE TAPE FAILURES AND THE ERROR CAN BE CORRECTED.
   E) TO CAUSE THE PROGRAM TO RUN AGAIN AFTER A TAPE ERROR, TURN THE TAU CE PANEL "ERROR STOP" SWITCH "OFF" THEN BACK "ON" AGAIN.

2. IMPROPER NUMBER OF PASSES - PHASE II

   A) CAN BE CAUSED BY SORTING OUT OF SEQUENCE EITHER IN PHASE I OR II.
   B) CHECK HI-LO-EQUAL CIRCUITS. RUN DIAGNOSTIC BLOCK #'S 0100A, 3300A, 3310A, 3320A UNDER MARGINAL CONDITIONS. VIBRATE THE FOLLOWING GATES IF NECESSARY:

   02A8 HI-LO EQUAL
   01B6 COMPARE

3. IMPROPER RECORD COUNT

   A) CAN BE CAUSED BY SHORT IRG ON ANY TAPE DRIVE.
   B) IF THIS IS SUSPECTED, RUN IRG DIAGNOSTIC BLOCK 5500.

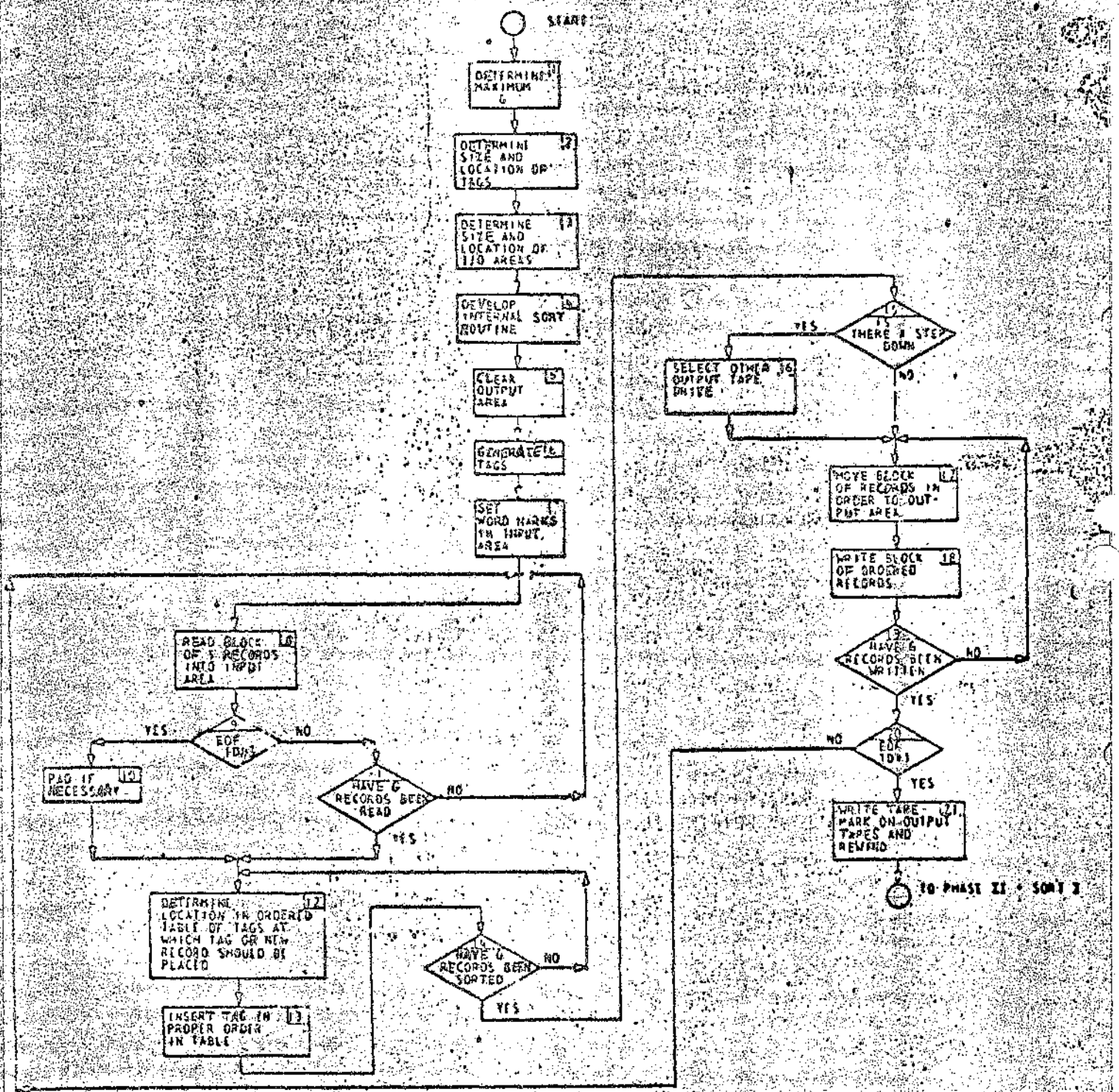
4. IT MAY BE ADVANTAGEOUS TO PRINT A LISTING OF THE SORTED OUTPUT TO CHECK SEQUENCE.

   A) THIS MAY BE ACCOMPLISHED BY WRITING A SHORT PROGRAM LOOP TO READ A RECORD, PRINT AND BRANCH TO THE TAPE READ INSTRUCTION.
   B) THE PRINTOUT OF THIS LOOP MAY BE INSPECTED FOR OUT-OF-SEQUENCE RECORDS.

IF A MORE COMPREHENSIVE DISCUSSION OF THE NORMAL 1401 SORT E PROGRAM IS DESIRED, IT MAY BE OBTAINED BY WRITING TO THE PROGRAM LIBRARY AT CHQ.

ORDER BY FILE #1.2.002.

FLOW CHART - 1401 SORT I PHASE I



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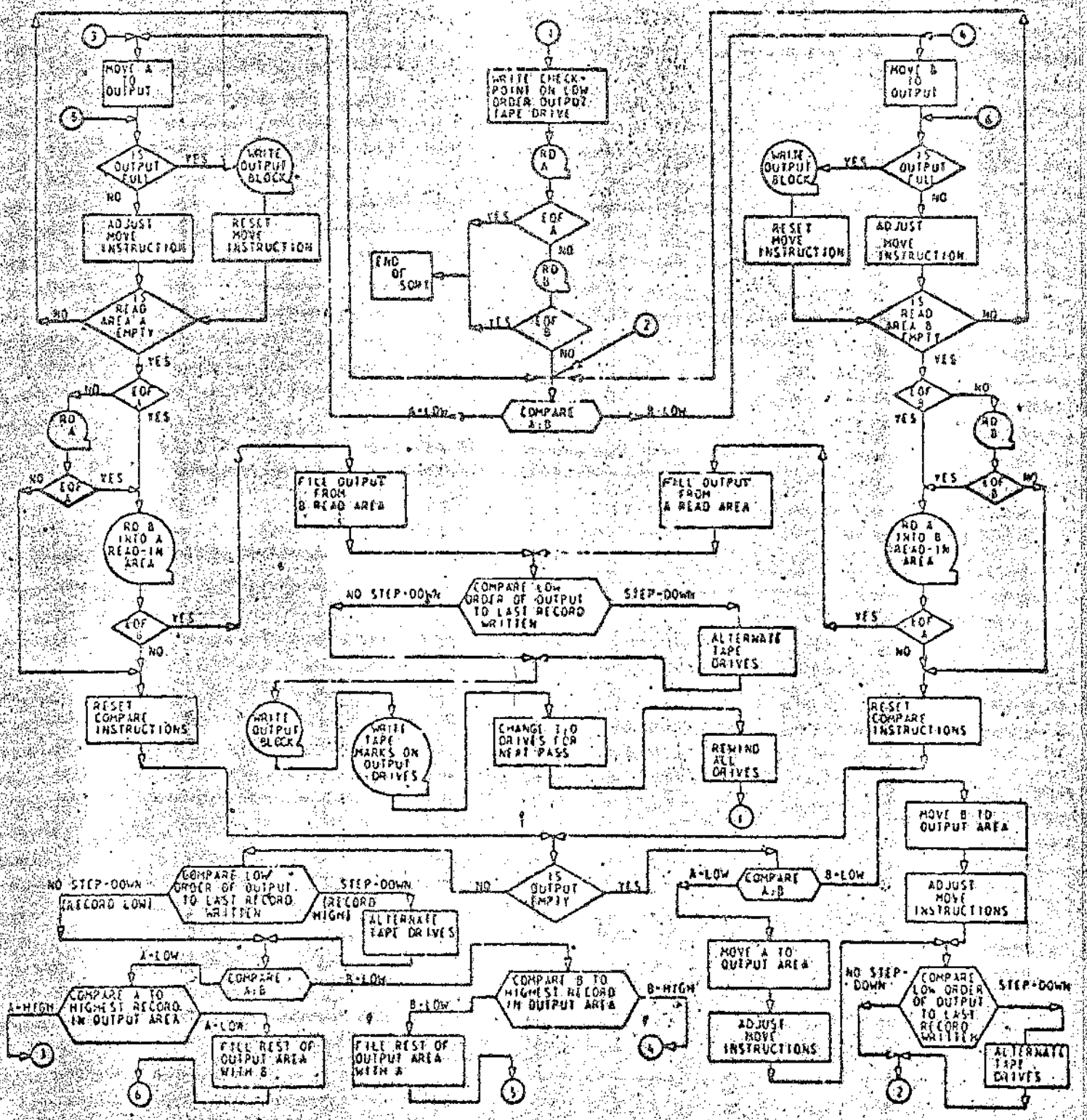
IBM FORM 433-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO 451628
SHEET 21 OF 31
BLOCK NO A01A

FLOW CHART - 1401 SORT I PHASE II



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DETAIL CARDS

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 INPUT-OUTPUT TAPE*RESTART*                         L028C95=C6B1056      2062
 80 NOT FACTOR OF B*SET 80 TO B                     L030D251056          2063
 OVERSIZE RECORD LENGTH-RESTART                     L032D57,D561056      2064
 OVERSIZE INPUT BLOCKING-RESTART  800               L036D93,D89,D911056  2065
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     CF LGTH ERROR     08441    ,E14,E27,E31,E331L026E35,E11,E128039  2067
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 NO DENSITY INDICATED-HIT START                     L031E791056          2069
 IF HIGH DENS DESIRED15350000    ,F081056           L030F09=E80,F008039  2070
          80 GREATER THAN B-80 SET TO B             L038F47,F191056      2071
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L        668      81      80                       L032G121056          2074
 BL         MFS                                    L023G35=G131056      2075
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INC PAD IND-9 PAD ASSUMEDI81I95                                L031*07,*02,*05B400  2345
                                                           ,001071¤0241001      P2346
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A365370C370093BI57S,H76H86A365H78          ,I08,I151056     L033121,H96,I03B039  P2349
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8000 201                                                L008I96,I93,I948938 C2359
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MQ31H63M%U0000W/332/MQ31I23MI232232    ,H72,H73,H80,H871L035H87,H60,H688039 T2362
F1M365I248I82UNREAD REC WRITTEN-TU 0   ,I01,I241056     L037I24,H90,H978039 T2363
MQ31I42MQ31I47U%UOMU%UOUBZ27          ,I44,I49,I531056 L029I53,I32,I398039 T2364
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                                                        ,001071¤0241001      2366
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M÷232282FLCQ19N548545SCQ12N47B545S     ,483,490,495,5021L034506,480,4818039 2370
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BM34&218P18/332/MN422282F1             ,561,562,569,5701L027571,553,557B039 2372
,576M356382L%U0001W8Y40LB÷81KB756ESQ27,591,596,601,6061L038609,576,583B039 2373
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M726B13M367B20M189C64M189E12M355&67    ,666,6731056     L035679,652,659B039 2375
M367R32M367R16M189192M340R71M343R74    ,701,7081056     L035714,687,694B039 2376
M358336BS05M                           ,727,7281056     L014728,722,726B039 2377
PASS 00 INP    &    OUT    &    A365Q10                  L034762,7561056     2378
MQ10M89MQ13N02MQ14N06MQ07M96/332/      ,784,791,7951056 L033795,770,777B039 2379
MN142322F1S365Q10Y356Q10,606,I98       ,806,813,820,8241L032827,803,804B039 2380
NU%U1RA365Q10MQ10785MQ13741MQ14745      ,841,848,8551056 L034861,829,834B039 2381
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MQ23910¤000CQ10N47B930/LI98181,Q32     ,918,923,9301056 L034933,907,911B039 2383
MQ54÷01MQ10÷35M÷562272/332/MQ56÷58     ,955,956,960,9611L034967,941,948B039 2384
M÷802242/332/B473M÷292348480           ,980,981,985,9921L028995,975,976B039 2385
        REC PROCESSED-PASS 00-ERROR                     L034÷291056         2386
      -RECORDS READ-PASS 00                             L027÷561056         2387
00 PAD REC ADDED-PASS 00,601MQ14Y43                     L035÷91,÷81,÷851056 2388
MQ14Y90MP14Y95MP17Y67BY40              ,/I31056         L025/16,÷99,/06B039 2389
MQ07727MQ13Q07M727Q13MQ08728MQ14Q08    ,S26,S331056     L035S39,S12,S19B039 2390
M728Q14MQ07586MQ13B83MQ14B88MQ07B93    ,S61,S881056     L035S74,S47,S54B039 2391
MQ08B98MQ13C03MQ14C08MQ13Q54MQ13Q99    ,S96,T031056     L035T09,S82,S89B039 2392
MQ07C35MQ08D83MQ13F73MQ13F99MQ13G46    ,T31,T381056     L035T44,T17,T24B039 2393
MQ07H02MQ08H47BU78CCQ19N59BU67SCQ12N49,T64,T71,T761056 L038T82,T52,T59B039 2394
BU67SA365Q10S365Q12Y356Q12SQ19Y356Q19  ,U02,U09,U131056 L037U19,T88,T95B039 2395
/332/MQ10M89MQ13M96MQ07N02MQ08N06      ,U32,U39,U461056 L033U52,U24,U25B039 2396
MN062242F1BJ16A365&21BX07M367Q32       ,U63,U67,U74,U781L032U84,U60,U61B039 2397
BV04N991A365&21BX30MQ07V68MQ08W41      ,V04,V111056     L033V17,U93,V00B039 2398
MQ07W09MQ08W67MQ07W31MQ08W89A365&21    ,V39,V461056     L035V52,V25,V32B039 2399
LI98333/332/M%UO201RMM32¤BM15L         ,V65,V73,V77,V781L030V82,V60,V648039 2400
BM19K2F1BW06D002M280180M%UO201R        ,V91NV95,V99,W061L031W13,V88,V898039 2401
LI998W23LBW33KU%UOB/332/M%UO201R       ,W28,W33,W37,W381L032W45,W18,W23B039 2402
MM32¤BM23LBM27K2F1M%UO201R             ,W56,W61,W62,W641L026W71,W50,W51B039 2403
M3588W81LBW91KU%UOB/332/L356333        ,W86,W91,W95,W961L031XD2,W76,W81B039 2404
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DETAIL CARDS

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M026C13M026910M029346M366801MP11F31      ,X58,X651056      L035X71,X44,X51B039  2406
MM33894MQ14G46MM33C09MQ14F73MQ14F99      ,X93,Y001056      L035Y06,X79,X86B039  2407
BT86000 LI9818IMQ14D70MQ14P03B060U%U08,Y29,Y36,Y401056 L038Y44,Y15,Y22B039  2408
C382365BY68SA365382B583A365336C336384    ,Y64,Y68,Y751056  L037Y81,Y52,Y57B039  2409
BY96SU%U0EB5T6M358336.Y92BZ27031         ,Y96,Z03,Z071056  L033Z14,Y87,Y92B039  2410
BI27931081Z5.Z27                         ,Z311056          L017Z31,Z23,Z27B039  2411
/P30/////R09J59                          ,J06,J07,J08,J091L016J15,J04,J05B039  2412
//30//////                               ,J22,J23,J=4,J251L010J25,J20,J21B039  2413
//Z33/////                               ,J32,J33,J34,J351L010J35,J27,J31B039  2414
//M356031M361M74AC34M74AE24M74MM74J87    ,J45,J52,J59,J661L037J72,J37,J38B039  2415
SM76Y356M76,000A365M76CM760BTBK26S,J85,J88,J95,K02,K071L038K10,J77,J84B039  2416
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AO98J55¤J538J45NL00M366K64MM82J48        ,K64,K68,K751056  L033K81,K56,K60B039  2418
M356031MM79J538J45M361M74MM74B285M76     ,L00,L07,L141056  L036L17,K89,K96B039  2419
Y356M76,000A365M76CM760B7BL67S,L26       ,L36,L43,L481056  L034L51,L25,L29B039  2420
AO85L28¤L268L25NL89M366L67M364M748L07    ,L67,L71,L78,L851L037L88,L59,L63B039  2421
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  034364                                                 L008M82,M77,M801056  2425
PASS 00-CKPT 0,INP 0 & 0-INTRUPT                         L032N141056          2426
INP MAY BE SAVED OR DENS CHG8240001      ,N481056          L035N49,N43,N46B039  2427
000000000100UTP. -END OF SORT606         ,N781056          L031N80,N55,N60B039  2428
M356382M%U0101M8+85L8M11KL356161         ,O80,O851056      L032091,067,075B039  2429
BT88N89 U%U0M8T88Q30D60067               ,P09,P12,P151056  L026P17,P00,P05B039  2430
M356T758507                                                L011P26,P251056      2431
     B017FBR16MQ1402TU%U0M.R16           ,029,033B032      ,008D13,017,024B039  2432
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IBM 1401 SORT III EXERCISE

BASIC TAPE SORTING PROCEDURE

WITH THE MODERNIZATION OF BUSINESS METHODS, A DEFINITE EMPHASIS HAS BEEN PLACED ON COMPLETING VOLUME JOBS MORE QUICKLY AND EFFICIENTLY. FOR THIS REASON COMPUTERS ARE BEING UTILIZED FOR SORTING LARGE VOLUMES OF DATA INTO DESIRED SEQUENCES. IBM APPLIED PROGRAMMING HAS DEVELOPED PROGRAMS FOR VARIOUS COMPUTERS WHICH ACCOMPLISH THIS PURPOSE. FOR EXAMPLE, 1401 DPS USERS NOW HAVE AVAILABLE TO THEM THREE "CANNED" PROGRAMS; SORT 1401, 1401 SORT I, AND 1401 SORT III. THESE PROGRAMS MADE POSSIBLE THE SORTING OF LARGE VOLUMES OF TAPE RECORDS IN A RELATIVELY SHORT PERIOD OF TIME. FOR EXAMPLE, A 10 COLUMN SORT ON 50,000 CARDS USING AN 083 SORTER WOULD REQUIRE APPROXIMATELY 11 HOURS. HOWEVER, IF THIS WERE DONE ON A 1401 SYSTEM USING 80 CHARACTER TAPE RECORDS, THE TOTAL TIME REQUIRED WOULD BE ONLY 1.5 HOURS.

THE USE OF COMPUTERS AND MAGNETIC TAPE HAS NOT ALTERED THE SORTING PROCEDURE AS MUCH AS IT HAS EMPHASIZED THE NEED FOR SPEED AND THE ABILITY TO HANDLE A VERY LARGE NUMBER OF RECORDS IN ONE SORT. THE BASIC METHODS OF SORTING CAN BE DEMONSTRATED BY REVERTING TO AN EXAMPLE THAT HAS BEEN USED MANY TIMES, THE SORTING OF PLAYING CARDS.

IF A PERSON IS GIVEN ONE COMPLETE DECK OF CARDS AND ASKED TO PUT THEM IN ORDER, THE PROCEDURE IS A SIMPLE ONE. MOST PEOPLE WILL MAKE AN INITIAL DISTRIBUTION BY SUIT, CREATING FOUR "FILES" OF EQUAL SIZE. AFTER THAT EACH "FILE" CAN BE SORTED BY HOLDING THE 13 CARDS OF A SUIT IN ONE HAND, WHILE THE CARDS ARE SHIFTED ABOUT AND PLACED IN ORDER. AS SOON AS EACH OF THE FOUR SUITS HAS BEEN ORDERED, THE FOUR ARE STACKED TOGETHER AND THE JOB IS COMPLETED. IN SORT TERMINOLOGY THIS WAS ACCOMPLISHED BY THE FOLLOWING BASIC SORTING METHODS: A DISTRIBUTION, AN INTERNAL SORT, AND THEN A FINAL MERGE OF FOUR SORTED FILES.

A MORE REALISTIC PICTURE OF MOST SORTING PROBLEMS IS CREATED IF THE ABOVE PROBLEM IS COMPLICATED SLIGHTLY. ASSUME THAT 52 CARDS ARE TAKEN FROM A STACK OF CARDS WHICH CONTAINS FOUR DECKS. THE PROCEDURE OUTLINED ABOVE MIGHT WORK FOR THIS SECOND CASE, BUT THERE ARE GOOD REASONS TO DOUBT THAT IT WILL. IT IS EXTREMELY UNLIKELY THAT THE INITIAL DISTRIBUTION BY SUIT WILL PRODUCE FOUR GROUPS OF EQUAL SIZE. IN FACT, THERE MIGHT NOT EVEN BE FOUR SUCH GROUPS OR "FILES" AND THE CARDS SELECTED MAY CONTAIN TWO TO FOUR EQUAL CARDS. IF WE ALSO ADD THE STIPULATION THAT FIFTEEN IS THE MAXIMUM NUMBER OF CARDS THAT CAN BE HELD AT ONE TIME, THE SOLUTION FOR THE SECOND CASE IS CONSIDERABLY MORE DIFFICULT. IT CAN STILL BE SOLVED BY A COMBINATION OF METHODS, BUT EITHER THE SEQUENCE OF OPERATIONS WILL HAVE TO BE ALTERED OR THE INITIAL DISTRIBUTION MODIFIED.

THE FOLLOWING SECTIONS SHOW IN SOME DETAIL HOW THE MERGE AND THE INTERNAL SORT CAN BE USED AND MODIFIED TO FIT THE VARIOUS PROBLEMS IN SORTING.

SORTING BY MERGING

THE MERGE HAS BEEN USED AS THE BASIS FOR MANY SPECIFIC SORTING PROGRAMS AND MOST OF THE GENERALIZED SORTING ROUTINES. THIS DESCRIPTION OUTLINES ONLY THE PRINCIPLES. THE TWO WAY TAPE SORT PROVIDES A SIMPLE EXAMPLE OF MERGE SORTING. IF A GIVEN COMPUTER HAS THE ABILITY TO READ AND WRITE TAPES AND SELECT THE SMALLER OF THE ITEMS BROUGHT IN, A SERIES OF RANDOM NUMBERS CAN BE SORTED AS FOLLOWS:

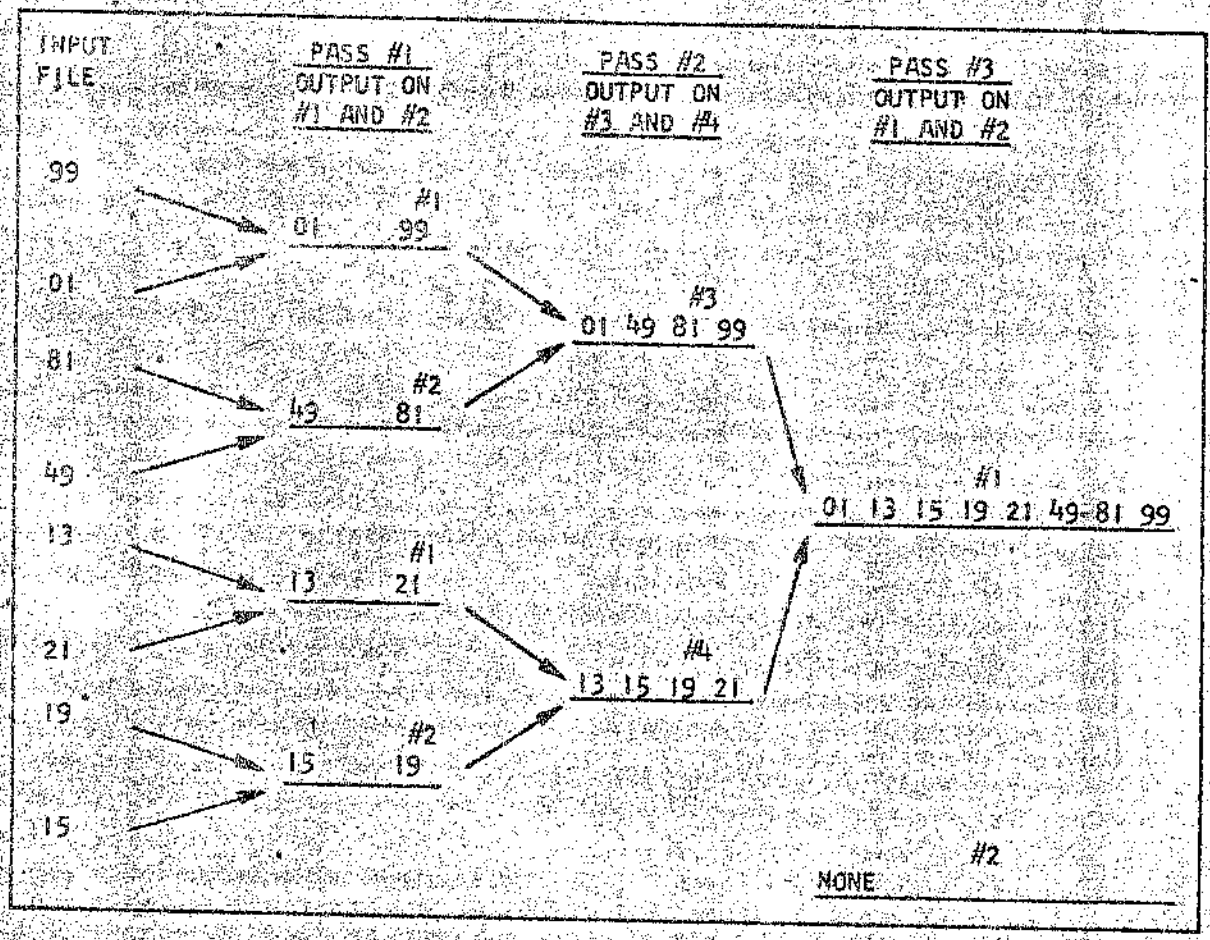
THE FIRST PASS OF THE SORT MERGES TWO SINGLE ITEMS TO CREATE SEQUENCES OF TWO ITEMS.

THE SECOND PASS, USING THE OUTPUT OF THE FIRST PASS AS INPUT, MERGES A PAIR OF THESE TWO-ITEM SEQUENCES, ONE FROM EACH OF THE TWO INPUT TAPES, AND WRITES FOUR-RECORD STRINGS ON THE OUTPUT TAPES.

CONTINUING SUCH A MERGE BY REPEATED MERGING PASSES WILL EVENTUALLY PLACE ALL RECORDS IN THE FILE INTO ONE SEQUENCE.

FIGURE 1 SHOWS HOW A SET OF NUMBERS IS GRADUALLY PUT INTO SEQUENCE BY USE OF A SIMPLE TWO-WAY MERGE. IN THE FIRST PASS, THE RECORDS ARE WRITTEN OUT ON TAPES #1 AND #2, EACH OF WHICH WILL THEN CONTAIN TWO-RECORD SEQUENCES AT THE END OF THE PASS. THE TAPES ARE REWOUND AND THE OUTPUT OF THE FIRST PASS BECOMES THE INPUT FOR THE SECOND MERGE PASS. THE FIRST TWO RECORD STRINGS FROM TAPES #1 AND #2 COMBINE TO MAKE A FOUR-RECORD SEQUENCE THAT GOES ONTO TAPE #3. THEN THE SECOND PAIR OF TWO-RECORD SEQUENCES IS MERGED AND STORED ON TAPE #4. THE MERGING PROCESS FOR THE THIRD PASS IS LIKE THAT FOR THE SECOND PASS, EXCEPT THAT THE SEQUENCES READ IN AND WRITTEN OUT ARE TWICE AS LONG AS THEY WERE IN THE PRECEDING PASS; INPUT COMES NOW FROM TAPES #3 AND #4 AND OUTPUT IS WRITTEN ONTO TAPES #1 AND #2. EACH NEW PASS DOUBLES THE LENGTH OF THE INPUT SEQUENCES. THE FILE IS SORTED WHEN THE NUMBER OF SEQUENCES IS REDUCED TO ONE. THE FINAL OUTPUT WILL ALL BE ON A SINGLE TAPE. IN THE EXAMPLE, THE SORTED RECORDS ARE STORED ON TAPE #1 AFTER THREE PASSES.

IN A SIMPLE MERGE SUCH AS ILLUSTRATED IN FIGURE 1, THE NUMBER OF MERGING PASSES IS DETERMINED BY THE NUMBER OF RECORDS TO BE SORTED AND THE ORDER OF THE MERGE. A TWO-WAY MERGE WITHOUT AN INTERNAL SORT WILL DEVELOP A SEQUENCE OF 2^n RECORDS IN n MERGING PASSES: I.E., 8 ITEMS IN THREE PASSES, 16 IN FOUR, 32 IN FIVE AND 1,024 IN TEN PASSES. AS THE NUMBER OF RECORDS TO BE SORTED INCREASES TO A LARGER NUMBER, SUCH AS ONE MIGHT REALISTICALLY EXPECT IN DATA PROCESSING APPLICATIONS, THE NUMBER OF PASSES WILL BECOME QUITE LARGE. THEREFORE, IN ACTUAL PRACTICE, A SORTING PROGRAM USUALLY INCLUDES SOME MODIFICATIONS THAT WILL REDUCE THE NUMBER OF MERGING PASSES. THE MOST COMMON METHOD IS TO PRECEDE THE MERGE BY USE OF THE INTERNAL SORT THAT IS DESCRIBED LATER.



SORTING BY A TWO-WAY MERGE

FIGURE 1

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... WITH INTERNAL
... HAVE BEEN DEVELOPED FOR THE GENERALIZED SORTING PROGRAMS. ANY INTERNAL SORT THAT IS SELECTED OR DEVELOPED FOR A SPECIFIC APPLICATION SHOULD BE THE RESULT OF EVALUATING SIX CONSIDERATIONS:

1. CHARACTERISTICS OF THE MACHINE
2. INPUT AND OUTPUT
3. RECORD LENGTH
4. SIZE OF CONTROL WORD
5. NATURAL SEQUENCES IN DATA
6. THE ASSOCIATED PROGRAM

THERE OBVIOUSLY IS NOT GOING TO BE ONE WAY WHICH IS BEST FOR ALL TYPES OF COMPUTERS. THEREFORE, THE FOLLOWING CONSIDERATIONS SHOULD BE EVALUATED FOR EACH PROGRAM AND A SOLUTION SELECTED WHICH INCORPORATES THEM IN THE BEST POSSIBLE WAY:

1. SORT AS MANY ITEMS AT ONE TIME AS SPACE WILL PERMIT.
2. REDUCE THE PROCESS TIME PER RECORD TO A MINIMUM.
3. MODE OF OPERATION MUST BE COMPATIBLE WITH INPUT-OUTPUT OPERATIONS AND SHOULD RESULT IN A MAXIMUM OVERLAPPING READ, WRITE AND PROCESS TIME.
4. THE MERGE TYPE SORTING PROGRAM SHOULD MAINTAIN AND UTILIZE SEQUENCES WHICH EXIST IN THE INPUT FILE.
5. THE ROUTINE SHOULD BE COMPACT AND EASILY MODIFIED.
6. THE INTERNAL SORT FOR A GENERALIZED PROGRAM MUST BE ABLE TO ACCEPT AND SORT VARIABLE LENGTH RECORDS WITH ANY SIZE CONTROL WORD.
7. THE ROUTINE SHOULD ALSO BE ABLE TO SORT ANY NUMBER OF RECORDS THAT CAN BE PACKED INTO THE RECORD STORAGE AREA.

RECORDS CAN BE SORTED EITHER (1) BY PHYSICALLY MOVING THEM AROUND UNTIL THEY ARE IN ORDER, OR (2) BY FORMING TABLES OF MACHINE ADDRESSES, "TAGS," WHICH REFER TO THE RECORDS IN STORAGE. IN THE SECOND METHOD, ONLY THE TAGS ARE MOVED DURING THE SORT. THE FINAL ORDERING OF THE TAGS INDICATES THE PROPER SEQUENCE OF THE RECORDS. AS A GENERAL RULE, THE EARLY INTERNAL SORT ROUTINES SHIFTED ENTIRE RECORDS AROUND IN MEMORY, AND THE LATER VERSIONS MOVE ONLY THE TAG REFERENCES. THERE WAS AN INTERMEDIATE PERIOD WHEN THE CONTROL WORD AND RECORD TAG WERE COMBINED AND BOTH SHIFTED IN THE SAME WAY THAT TAGS ARE NOW MOVED. FOLLOWING IS AN EXAMPLE OF AN INTERNAL SORT USING THE "TAG" METHOD OF ACHIEVING ASCENDING SEQUENCE OF RECORDS. REFER TO ATTACHED FLOW CHARTS 1 AND 2.

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THE FOLLOWING CONDITIONS HAVE BEEN SET UP FOR EXPLANATORY PURPOSES.

1. INPUT TAPE FILE CONTAINS FIXED LENGTH RECORDS, 20 CHARACTERS LONG WRITTEN IN RANDOM ORDER.
2. THE TEN HIGH ORDER CHARACTERS IN EACH RECORD WILL BE USED IN THE INTERNAL SORT AS THE CONTROL FIELD.
3. THE INPUT AREA IN STORAGE IS 1500 POSITIONS IN LENGTH STARTING AT 001.
4. THE OUTPUT AREA IN STORAGE IS 1500 POSITIONS IN LENGTH STARTING AT 2101.

STEP ONE OF THE INTERNAL SORT CONSISTS OF SETTING UP A TABLE OF TAGS IN STORAGE TO BE USED TO SORT GROUPS OF RECORDS READ INTO THE INPUT AREA. THIS IS EASILY DONE BECAUSE THE ADDRESS OF THE LOW ORDER POSITION OF THE CONTROL FIELD IN EACH RECORD IS KNOWN. DUE TO THE FACT THAT 75 RECORDS WILL BE INTERNALLY SORTED AT ONE TIME (1500 POSITION INPUT AREA DIVIDED BY 20 CHARACTER RECORDS EQUALS 75 RECORDS) THE TABLE WILL CONSIST OF 75 TAGS, ONE PER RECORD, OF 3 CHARACTERS EACH. THE FIRST TAG IN THE TABLE WILL BE THE NUMBER 010 BECAUSE THIS REPRESENTS THE ADDRESS OF THE UNITS POSITION OF THE CONTROL FIELD OF THE FIRST RECORD IN THE INPUT AREA. THEREFORE, THE SECOND TAG WILL BE 030, THE THIRD 050, THE FOURTH 070, ETC., UNTIL THE LAST TAG WILL BE 1490.

ONCE THE TABLE OF TAGS IS SET UP, A GROUP OF 75 RECORDS IS READ FROM THE INPUT TAPE INTO THE INPUT STORAGE AREA. AT THIS TIME, STORAGE CAN BE REPRESENTED AS FOLLOWS:

TAG AREA

010 030 050 070 090 ..... 1470 1490

INPUT AREA (STARTING IN 001, LAST CHARACTER IN 1500)

2345678901XXXXXXXXXX1234567890XXXXXXXXXX3456789012XXXXXXXXXX...ETC.

NOW BY USING A SERIES OF COMPARE, BRANCH AND MOVE INSTRUCTIONS, THE TAG AREA CAN BE RE-ARRANGED SO THAT IT SIGNIFIES ASCENDING ORDER OF THE RECORDS IN THE INPUT AREA. REFER TO FLOW CHART #2. AT THE COMPLETION OF THIS OPERATION STORAGE IS ARRANGED AS FOLLOWS:

TAG AREA

030 010 050.....ETC.

INPUT AREA

SAME AS BEFORE.

AT THIS POINT THE HIGHEST ORDER RECORD IN THE INPUT AREA, (DETERMINED BY SELECTING THE LAST TAG IN THE TAG AREA), IS STORED IN SOME LOCATION TO BE USED IN A LATER COMPARISON.

TO FILL THE OUTPUT AREA WITH THE INTERNALLY SORTED RECORDS, THE COMPUTER EXECUTES A NUMBER OF MOVE INSTRUCTIONS USING THE TAGS MODIFIED BY PLUS 10 AS "A"-FIELD ADDRESSES AND SPECIFIC OUTPUT AREA LOCATIONS AS "B" FIELD ADDRESSES. THE TAGS MUST BE MODIFIED BY PLUS 10 BECAUSE THE INTERNALLY SORTED RECORDS EACH CONTAIN 20 CHARACTERS. IT WAS

DETERMINED PREVIOUSLY THAT ONLY THE 10 HIGH ORDER CHARACTERS WOULD BE USED AS A CONTROL FIELD. THEREFORE, TO MOVE THE ENTIRE RECORD A FACTOR OF 10 MUST BE ADDED TO EACH TAG IN ORDER TO FIND THE UNITS POSITION OF EACH RECORD. THE SPECIFIC OUTPUT AREA LOCATIONS TO BE USED AS "B"-FIELD ADDRESSES MUST BE THE ADDRESS OF THE UNITS POSITION OF EACH RECORD AS IT WILL APPEAR IN THE OUTPUT AREA. TO PLACE THE RECORDS USED IN THE ABOVE EXAMPLE IN THE OUTPUT AREA, THE FOLLOWING INSTRUCTIONS COULD BE USED:

M040J20
M020J40
M060J60, ETC.

THIS CONTINUES UNTIL THE OUTPUT AREA IS COMPLETELY FILLED.

OUTPUT AREA (AT COMPLETION OF ABOVE EXAMPLE)

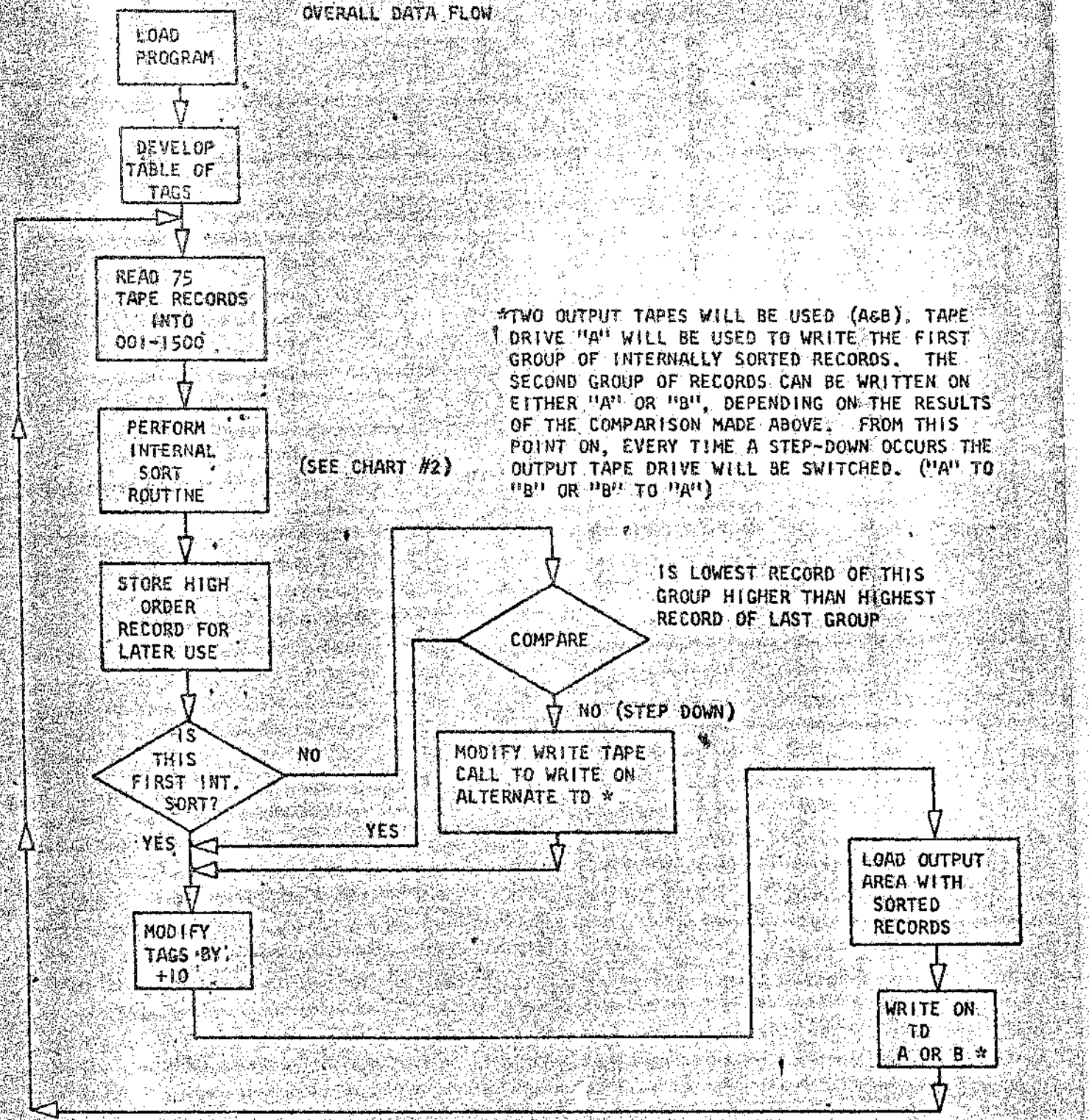
1234567890XXXXXXXXXX2345678901XXXXXXXXXX3456789012XXXXXXXXXX...ETC.

IMMEDIATELY AFTER FILLING THE OUTPUT AREA, THESE 75 RECORDS ARE WRITTEN FROM THIS AREA ONTO AN OUTPUT TAPE. ANOTHER 75 RECORDS ARE READ FROM THE INPUT TAPE FILE AND THE OPERATION IS REPEATED. AT THE COMPLETION OF THE SECOND INTERNAL SORT THE HIGHEST NUMBERED RECORD OF THE FIRST INTERNAL SORT (PREVIOUSLY STORED) AND THE LOWEST NUMBERED RECORD OF THE SECOND INTERNAL SORT (SELECTED BY FIRST TAG IN TABLE) ARE COMPARED. IF THE LOWEST RECORD OF THE NEW GROUP IS HIGHER THAN THE HIGHEST RECORD OF THE LAST GROUP, THE SAME OUTPUT TAPE IS USED. HOWEVER, IF THE OPPOSITE IS TRUE, A "STEP-DOWN" IS SAID TO HAVE OCCURRED. IN THIS CASE THE SECOND GROUP OF INTERNALLY SORTED RECORDS IS WRITTEN ON A SECOND OUTPUT TAPE. THIS IS DONE IN ORDER TO FACILITATE TAPE MERGING DURING A SECOND PHASE OF THIS TAPE SORTING PROGRAM.

THE INTERNAL SORT IS CONTINUED UNTIL THE INPUT TAPE IS COMPLETELY READ. FROM THIS TWO OUTPUT TAPES HAVE BEEN ESTABLISHED, EACH CONTAINING GROUPS CONSISTING OF 75 RECORDS WRITTEN IN ASCENDING ORDER. AT THIS POINT THE SECOND PHASE OF THE TAPE SORT IS BEGUN USING THE TWO OUTPUT TAPES AS INPUTS FOR A TAPE MERGE OPERATION AS PREVIOUSLY DESCRIBED.

IT MUST BE UNDERSTOOD THAT THE ABOVE EXAMPLE WAS SIMPLIFIED TO A GREAT EXTENT TO FACILITATE UNDERSTANDING. IN PRACTICE THE ACTUAL PROGRAM IS MUCH MORE COMPLEX THAN AS STATED ABOVE. THE BASIC PRINCIPLE, HOWEVER, REMAINS THE SAME.

INTERNAL SORTING FLOW CHART #1 OVERALL DATA FLOW

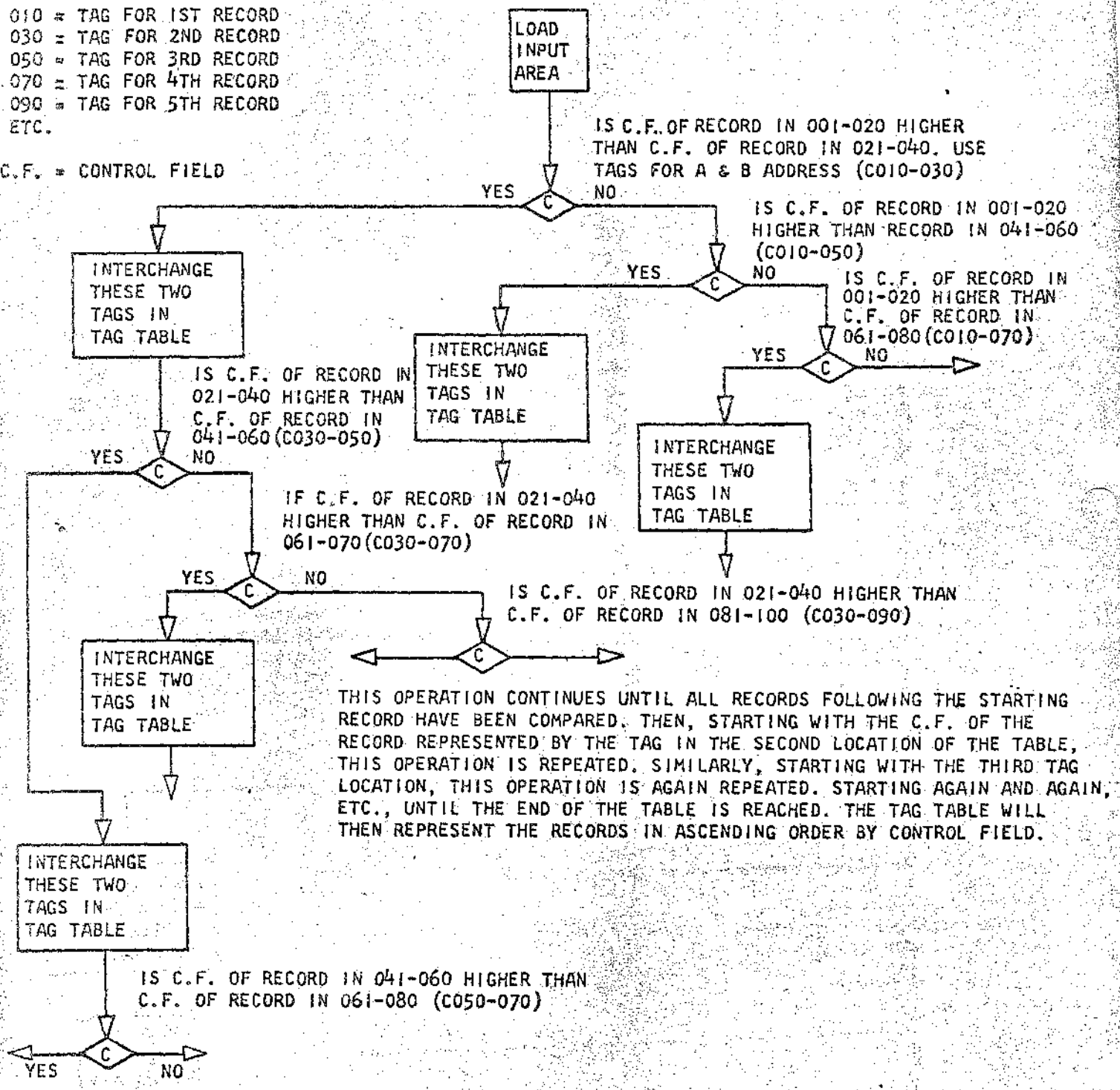


*TWO OUTPUT TAPES WILL BE USED (A&B). TAPE DRIVE "A" WILL BE USED TO WRITE THE FIRST GROUP OF INTERNALLY SORTED RECORDS. THE SECOND GROUP OF RECORDS CAN BE WRITTEN ON EITHER "A" OR "B", DEPENDING ON THE RESULTS OF THE COMPARISON MADE ABOVE. FROM THIS POINT ON, EVERY TIME A STEP-DOWN OCCURS THE OUTPUT TAPE DRIVE WILL BE SWITCHED. ("A" TO "B" OR "B" TO "A")

INTERNAL SORTING FLOW CHART #2 INTERNAL SORT ROUTINE

010 = TAG FOR 1ST RECORD
030 = TAG FOR 2ND RECORD
050 = TAG FOR 3RD RECORD
070 = TAG FOR 4TH RECORD
090 = TAG FOR 5TH RECORD
ETC.

C.F. = CONTROL FIELD



THIS OPERATION CONTINUES UNTIL ALL RECORDS FOLLOWING THE STARTING RECORD HAVE BEEN COMPARED. THEN, STARTING WITH THE C.F. OF THE RECORD REPRESENTED BY THE TAG IN THE SECOND LOCATION OF THE TABLE, THIS OPERATION IS REPEATED. SIMILARLY, STARTING WITH THE THIRD TAG LOCATION, THIS OPERATION IS AGAIN REPEATED. STARTING AGAIN AND AGAIN, ETC., UNTIL THE END OF THE TABLE IS REACHED. THE TAG TABLE WILL THEN REPRESENT THE RECORDS IN ASCENDING ORDER BY CONTROL FIELD.

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IBM 1401 SORT II SYSTEM EXERCISE DESCRIPTION

PURPOSE

THE DECK OF CARDS THAT ACCOMPANIES THIS WRITE UP WAS DEVELOPED BY IBM APPLIED PROGRAMMING AND TEST EQUIPMENT ENGINEERING FOR USE ON THE 1401 FINAL TEST LINE. IT IS A REPLICA OF THE 1401 SORT II APPLIED PROGRAM WITH VERY MINOR REVISIONS. IT IS BY NO MEANS A DIAGNOSTIC TEST; HOWEVER, IT WILL SERVE A NUMBER OF PURPOSES. MOST IMPORTANT, IT WILL ALLOW CUSTOMER ENGINEERING TO BECOME SOMEWHAT FAMILIAR WITH THE 1401 SORT II PROGRAM. FOLLOWING ARE OTHER AREAS IN WHICH THIS PROGRAM MAY BE USED:

1. IF A CUSTOMER HAS A SYSTEM CAPABLE OF USING SORT II, BUT IS NOT DOING SO, THIS DECK CAN BE USED AS A COMPREHENSIVE SYSTEM EXERCISE.
2. IF A CUSTOMER IS HAVING TROUBLE WITH THE NORMAL SORT II PROGRAM, THIS DECK CAN BE USED TO DETERMINE WHETHER THE PROBLEM IS A MACHINE OR A PROGRAM FAILURE.
3. IF A CUSTOMER IS EXPERIENCING TROUBLE RUNNING SORT II, THIS DECK CAN BE USED TO SIMPLIFY TROUBLESHOOTING. DETAILED EXPLANATIONS AND RUNNING INSTRUCTIONS ARE COVERED IN LATER SECTIONS.

SYSTEM ENGINEERING CHANGE LEVEL AND MINIMUM FEATURE REQUIREMENTS

1. ALL 1401 MOD C&F SYSTEMS WITH 8000 OR MORE POSITIONS OF STORAGE (1406).
2. HIGH-LOW-EQUAL COMPARE FEATURE.
3. FOUR (4) TAPE DRIVE UNITS (729II, 729IV OR 7330 TYPES).
4. ADVANCED PROGRAMMING FEATURE.

GENERAL OPERATING PROCEDURES

1. READY TAPE UNITS, 3, 4, 5 AND 6, ALL ON HI DENSITY.
2. LOAD CARDS INTO 1402 USING PROGRAM LOAD KEY. BE SURE ALL SENSE SWITCHES ARE OFF.
3. PROGRAM WILL CONTINUE AUTOMATICALLY TO THE END OF THE SORT. AT THIS POINT A MESSAGE WILL BE PRINTED SAYING "OUTPUT 4 - END OF SORT". THE PROGRAM STOP LIGHT WILL BE ON.
4. RUNNING TIME:

   A) SYSTEMS WITH 729II'S - APPROXIMATELY 11 MINUTES
   B) SYSTEMS WITH 729IV'S - APPROXIMATELY 10 MINUTES
   C) SYSTEMS WITH 7330'S - APPROXIMATELY 14 MINUTES

GENERAL DESCRIPTION OF PROGRAM

THE PROGRAM CONSISTS OF A NUMBER OF STEPS. EACH WILL BE BRIEFLY DESCRIBED HERE AND PHASE I AND PHASE II WILL BE DISCUSSED IN DETAIL IN A LATER SECTION. REFER TO FLOW CHART #3.

1. FILE GENERATOR -

   A FILE GENERATOR ROUTINE IS INCORPORATED AS THE FIRST 52 CARDS OF THE PROGRAM. ITS PURPOSE IS TO GENERATE A TAPE FILE CONSISTING OF 5000, 20-CHARACTER RECORDS WRITTEN IN A RANDOM FASHION IN GROUPS OF 5 TO BE USED AS INPUT FOR THE SORT II PROGRAM. THE FILE WILL BE WRITTEN ON TD#3.

2. ASSIGNMENT PHASE -

THE ASSIGNMENT PHASE CONSISTS OF A PROGRAM ROUTINE USED TO OPTIMIZE THE PROGRAM ON THE BASIS OF INFORMATION CONTAINED IN A CONTROL CARD IN THE PROGRAM DECK. FACTORS SUCH AS SORT CONTROL FIELD LENGTH AND ERROR ROUTINES ARE ANALYZED AND CONSTANTS ARE DEVELOPED IN ORDER TO ENABLE THE FOLLOWING PHASES OF THE PROGRAM TO BE EXECUTED MOST EFFICIENTLY.

PHASE I

PHASE I OF THE SORT II PROGRAM PROVIDES AN INTERNAL SORT. THE TAPE FILE WHICH WAS GENERATED AT THE START OF THE PROGRAM IS READ INTO THE 1401-75 RECORDS AT A TIME. THESE 75-RECORD GROUPS ARE INTERNALLY SORTED AND PLACED ON EITHER TAPE DRIVE #5 OR TAPE DRIVE #6 AS DESCRIBED IN A PRECEDING SECTION.

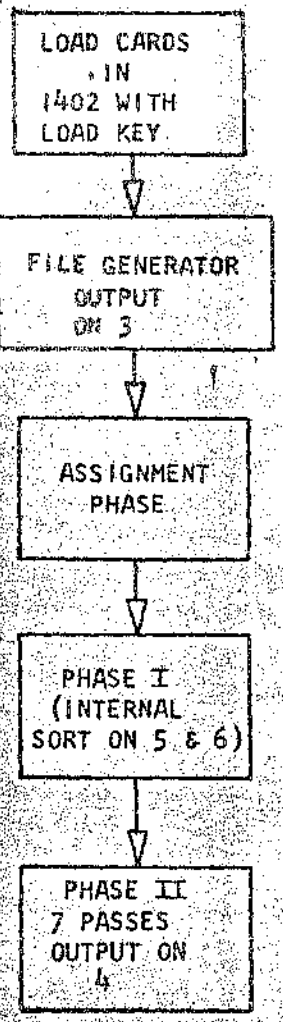
PHASE II

AT THE COMPLETION OF PHASE I, PHASE II IS AUTOMATICALLY BEGUN. DURING THIS PHASE, SEVEN TWO-WAY MERGE PASSES OCCUR. THE FIRST PASS USES THE OUTPUT TAPES FROM PHASE ONE AS INPUTS AND TAPE DRIVES 3 AND 4 AS OUTPUTS. AT THE COMPLETION OF PASS ONE, PASS 2 IS BEGUN. THIS TIME THE OUTPUT TAPES FROM PHASE II, PASS ONE ARE USED AS INPUTS, AND TAPE DRIVES 5 AND 6 ARE USED AS OUTPUTS. THIS OPERATION CONTINUES UNTIL ALL 5000 RECORDS ARE IN ASCENDING SEQUENCE AND WRITTEN ON ONE TAPE DRIVE. USING THE SORT II DECK PROVIDED SEVEN PASSES WILL OCCUR WITH THE OUTPUT FILE EXISTING ON TAPE DRIVE #4.

AT THE START OF EACH PASS A CHECKPOINT RECORD IS WRITTEN ON A SPECIFIC TAPE DRIVE. THIS RECORD IS IN ESSENCE THE CONTENTS OF CORE STORAGE AND IS USED IN THE EVENT THE PROGRAM MUST BE RESTARTED. THE RESTART PROCEDURE WILL BE DISCUSSED IN DETAIL LATER.

FLOW CHART #3

GENERAL SORT II DESCRIPTION



DETAILED DESCRIPTION OF SORT II SYSTEM EXERCISE

THIS DISCUSSION PERTAINS TO THE MODIFIED 1401 SORT II PROGRAM ONLY. FLOW CHARTS AND DESCRIPTIONS CAN BE APPLIED TO THE NORMAL SORT II PROGRAM ONLY IN A GENERAL MANNER. FOLLOWING ARE THE BASIC DIFFERENCES BETWEEN THE TWO PROGRAMS.

1. THE SORT II EXERCISE INCLUDES A FILE GENERATOR.
2. THE NORMAL SORT II PROGRAM CAN BE MODIFIED BY CUSTOMER PROGRAMMING TO INCLUDE CUSTOMIZED ROUTINES.
3. TAPE DRIVES ARE NOT UNLOADED AT THE COMPLETION OF THE SORT WHEN RUNNING THE SORT II EXERCISE.
4. MODIFY ADD (#) INSTRUCTION IS CHECKED DURING THE PROGRAM IN THE SORT II EXERCISE. IF IT HAS FUNCTIONED PROPERLY, THE ADDRESS (155) WILL BE PRINTED. IF NOT, 15T WILL BE PRINTED.

PHASE I SORT II EXERCISE

PHASE I CAN BE BEST EXPLAINED BY USING THE FLOW CHART LABELED "PHASE I, SORT II". EACH BLOCK IS NUMBERED. EXPLANATIONS CORRESPOND TO THE NUMBERED BLOCKS OF THE FLOW CHART. MANY "HOUSEKEEPING" BLOCKS ARE LEFT OUT IN ORDER TO MAINTAIN AN EVEN FLOW OF DATA.

1. DETERMINE MAXIMUM G

   G IS THE SYMBOL ASSIGNED TO THE NUMBER OF RECORDS THAT CAN BE INTERNALLY SORTED AT ONE TIME. WHEN USING THE 1401 SORT II EXERCISE, G EQUALS 75.

2, 3, 4. THESE BLOCKS ARE USED TO DETERMINE THE LIMITS OF PHASE I. THEY ARE DEVELOPED ON THE BASIS OF THE INFORMATION CONTAINED IN THE CONTROL CARD IN THE PROGRAM DECK.

5. THE CONTENTS OF CORE STORAGE ARE WRITTEN AS A CHECK POINT RECORD ON TAPE DRIVE #5. THIS RECORD CAN BE USED TO RESTART PHASE I IN CASE OF A FAILURE LATER IN THE PROGRAM. RESTART PROCEDURE IS DISCUSSED AT A LATER TIME.

6. THE ABOVE PROGRAM IS CLEARED TO MAKE AVAILABLE THE NECESSARY STORAGE AREA NEEDED TO COMPLETE PHASE I.

7. USING THE INFORMATION DEVELOPED IN 2, A TABLE OF ADDRESSES IS GENERATED CORRESPONDING TO THE UNITS POSITION OF THE CONTROL FIELD OF EACH RECORD. THESE TAGS ARE LATER USED TO ACCOMPLISH AN INTERNAL SORT ON 75 RECORD GROUPS AS DESCRIBED IN THE PRECEDING SECTION ON "BASIC TAPE SORTING PROCEDURES".

8. WORDS MARKS ARE SET IN THE INPUT AREA 20 CHARACTERS APART IN PREPARATION FOR ACCEPTING 20 CHARACTER TAPE RECORDS.

9, 10, 12. THESE BLOCKS SIGNIFY THE READING FROM TAPE DRIVE #3 OF 75 TAPE RECORDS INTO THE INPUT AREA. PREVIOUSLY THE FILE GENERATOR GENERATED 5000, -20 CHARACTER RECORDS WRITTEN IN GROUPS OF 5. THEREFORE, EACH TIME A READ CALL IS ENCOUNTERED, 100 CHARACTERS WILL BE READ INTO THE INPUT AREA. THIS AREA IS 1500 CHARACTERS IN LENGTH. TO FILL IT, THE PROGRAM WILL LOOP THROUGH BLOCKS 9, 10 AND 12 FIFTEEN TIMES FOR EACH INTERNAL SORT OF 75 (G) RECORDS.

11. THIS BLOCK IS USED IN THE SORT III EXERCISE TO FILL OUT THE LAST GROUP OF RECORDS TO BE INTERNALLY SORTED. THE FILE GENERATOR AT THE BEGINNING OF THE PROGRAM GENERATED 5000 RECORDS. THIS MEANS THAT THE LAST GROUP OF RECORDS TO BE SORTED WOULD CONTAIN ONLY 50 RECORDS. (5000 DIVIDED BY 75 EQUALS 66 50/75). IN THIS CASE THE LAST INTERNAL SORT WOULD BE PERFORMED INCORRECTLY. THEREFORE 25 RECORDS MUST BE ADDED TO THE LAST GROUP TO MARK IT EQUAL TO G (75). THIS OPERATION IS CALLED PADDING. PADDING CAN BE ACCOMPLISHED BY USING EITHER BLANKS OR 9'S DEPENDING ON THE INFORMATION CONTAINED IN THE CONTROL CARD IN THE PROGRAM DECK.

13, 14, 15. THESE BLOCKS ACCOMPLISH THE ACTUAL INTERNAL SORT. REFER TO THE DISCUSSION OF INTERNAL SORTING INCLUDED PREVIOUSLY IN THE SECTION ON "BASIC TAPE SORTING PROCEDURES".

16. A STEPDOWN IS THE TERM GIVEN TO THE CONDITION WHEN TWO CONSECUTIVE GROUPS OF INTERNALLY SORTED RECORDS ARE NOT IN ASCENDING ORDER. BLOCK 16 DETERMINES WHETHER OR NOT THERE HAS BEEN A STEPDOWN. THIS IS DONE BY COMPARING THE CONTROL FIELD OF THE LOWEST ORDER RECORD IN THE GROUP THAT HAS JUST BEEN SORTED TO THE CONTROL FIELD OF THE HIGHEST ORDER RECORD IN THE GROUP THAT WAS SORTED JUST PREVIOUS TO THIS ONE. IF A STEPDOWN HAS NOT OCCURRED, THIS GROUP OF RECORDS SHOULD BE WRITTEN ON THE SAME TAPE DRIVE AS THE LAST ONE WAS BECAUSE THE TWO GROUPS ARE IN ASCENDING ORDER. IF A STEPDOWN HAS OCCURRED, THIS GROUP OF RECORDS SHOULD BE WRITTEN ON THE SECOND OUTPUT TAPE DRIVE BECAUSE THE NEW GROUP STARTS WITH A RECORD LOWER THAN THE HIGHEST RECORD OF THE LAST GROUP.

17. THIS BLOCK MERELY ALTERS THE WRITE CALL INSTRUCTION TO WRITE ON THE ALTERNATE TAPE DRIVE AFTER A STEPDOWN HAS OCCURRED. FOR EXAMPLE, IF TD #5 HAD BEEN SELECTED AS THE OUTPUT TAPE AND STEPDOWN OCCURS, TD#6 WOULD NOW BECOME THE OUTPUT TAPE. IF A STEPDOWN DOES NOT OCCUR, THIS BLOCK IS BYPASSED.

18. THIS BLOCK ENCOMPASSES THE NECESSARY INSTRUCTIONS TO MOVE BLOCKS OF RECORDS INTO THE OUTPUT AREA USING THE TABLE OF TAGS ARRANGED IN BLOCKS 13 AND 14.

19, 20. THESE BLOCKS PERFORM THE WRITE INSTRUCTIONS ON THE TAPE DRIVE SELECTED IN BLOCK 17.

21. THIS BLOCK CAUSES THE PROGRAM TO EITHER REPEAT OR PROGRESS TO THE END OF PHASE I DEPENDING ON WHETHER OR NOT THE INPUT FILE IS EXHAUSTED.

22. TAPE MARKS ARE WRITTEN ON BOTH OUTPUT TAPE DRIVES AND BOTH ARE REWOUND IN PREPARATION FOR PROGRESSING TO PHASE II.

AT THE COMPLETION OF PHASE I, TWO OUTPUT TAPES HAVE BEEN CREATED EACH CONTAINING SEQUENCES OF RECORDS IN ASCENDING ORDER. PHASE II IS NOW BEGUN USING THE OUTPUT TAPES JUST CREATED AS INPUTS FOR PASS I OF PHASE II.

PHASE II - SORT II EXERCISE -

REFER TO ATTACHED FLOW CHART LABELED "1401 SORT I OR II - PHASE II". FOR THE SORT II EXERCISE, PHASE II WILL CONSIST OF 7 PASSES. EACH PASS WILL USE TWO INPUT TAPE DRIVES AND TWO OUTPUT TAPE DRIVES.

THE INITIAL OPERATION, UPON STARTING ANY PASS, IS TO WRITE A CHECKPOINT RECORD. THIS CHECKPOINT RECORD CONSISTS OF THE CONTENTS OF CORE STORAGE AND CAN BE USED TO RESTART THE PROGRAM FROM THE BEGINNING OF THIS PASS. THIS IS DONE BY ANALYZING THE PRINTOUT AND DETERMINING WHICH TAPE DRIVE CONTAINS THE CHECKPOINT RECORD. NEXT REWIND ALL DRIVES AND ASSIGN #1 TO THE TAPE DRIVE CONTAINING THE CHECKPOINT RECORD. RESET THE OPERATORS CONSOLE (CHECK RESET AND START RESET) AND DEPRESS THE TAPE LOAD KEY. THE CHECKPOINT RECORD WILL BE ENTERED INTO STORAGE AND THE 1401 WILL COME TO A "HALT" OPERATION. REASSIGN THE PROPER NUMBER TO THE TAPE DRIVE THAT IS NOW SET TO #1 AND DEPRESS THE START KEY ON THE 1401. THE PROGRAM WILL CONTINUE BY REPEATING THE PASS THAT WAS INTERRUPTED.

PHASE II CAN BEST BE UNDERSTOOD BY TAKING AN ACTUAL EXAMPLE MANUALLY THROUGH THE PHASE II FLOW CHART. FOLLOWING IS AN EXAMPLE WHICH CAN BE USED. FOR THIS EXAMPLE, INITIAL CONDITIONS MUST BE SET UP IN ORDER TO COMPLETE PHASE II.

1. PHASE I HAS BEEN COMPLETED.
2. TWO TAPES HAVE BEEN CREATED DURING PHASE I.

   A) TAPE DRIVE #5 CONTAINS: BCZ FIL HMP TAPE MARK.
   B) TAPE DRIVE #6 CONTAINS: DGJ EKN AXY TAPE MARK.
   C) ASSUME EACH ALPHA CHARACTER ABOVE IS A TAPE RECORD. RECORDS ARE IN BLOCKED INPUTS OF 3 RECORDS TO A BLOCK. BLOCKED OUTPUT WILL ALSO BE THREE.

3. TWO INPUT AREAS IN STORAGE (A & B) EACH LARGE ENOUGH TO CONTAIN ONE BLOCK OF RECORDS (3).
4. ONE OUTPUT AREA OF THE SAME SIZE (3 RECORDS).

USING THE CONDITIONS STATED ABOVE, MANUALLY COMPLETE THE SORT.

AT THE COMPLETION OF THE FIRST PASS, THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#3 BCD GJZ AHM PXY TAPE MARK
#4 EFI KLN TAPE MARK

ON THE SECOND PASS TAPE DRIVES 3 & 4 WILL BE INPUTS AND 5 & 6 WILL BE OUTPUTS.

AT THE COMPLETION OF PASS 2 THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#5 BCD EFG IJK LNZ TAPE MARK
#6 AHM PXY TAPE MARK

ON THE THIRD PASS TAPE DRIVES 5 AND 6 WILL BE INPUTS AND 3 AND 4 WILL BE OUTPUTS.

AT THE COMPLETION OF PASS 3 THE OUTPUT TAPES SHOULD BE AS FOLLOWS:

#3 ABC DEF GHI JKL MNP XYZ TAPE MARK
#4 TAPE MARK

EOF WILL BE RECOGNIZED AT THE BEGINNING OF PASS 4 AND THE ACTUAL SORT WILL BE COMPLETED. HOWEVER, ONE MORE PASS WILL BE TAKEN TO CONVERT THE SORTED FILE INTO DESIRED OUTPUT BLOCKS, PROBABLY ONE RECORD PER BLOCK.

A HELPFUL METHOD OF GAINING COMPLETE UNDERSTANDING OF THE ABOVE EXAMPLE IS TO CUT SLIPS OF PAPER FOR EACH ALPHA CHARACTER. THEN THE SLIPS OF PAPER MAY BE MANUALLY MOVED FROM INPUT TAPE DRIVES TO INPUT AREAS, TO OUTPUT AREA, AND FINALLY TO OUTPUT TAPE DRIVES. THIS METHOD WILL ALLOW THE READER TO ACTUALLY EXPERIENCE THE TWO-WAY MERGE OF PHASE II.

EXPLANATION OF PRINTOUTS - SORT II EXERCISE

LINE 1.

FILE GENERATED:

SIGNIFIES THAT FILE GENERATOR ROUTINE HAS BEEN SUCCESSFULLY COMPLETED. AT THIS POINT 5000 20 CHARACTER RECORDS EXIST ON TD #3.

LINE 2.

L 020 B 075 BI005 BO 001 BL 1500 MFS 0600547

L 020 SIGNIFIES RECORD LENGTH IS 20 CHARACTERS.

B 075: INDICATES THE NUMBER OF RECORDS THAT CAN BE READ IN AND INTERNALLY SORTED IS 75.

BI005: INDICATES THAT THE INPUT FILE TO PHASE I CONTAINS RECORDS BLOCKED IN GROUPS OF 5 (BI - BLOCKED INPUT)

BO 001: INDICATES THAT THE OUTPUT AT THE END OF THE SORT WILL CONTAIN RECORDS BLOCKED IN GROUPS OF ONE. (BO - BLOCKED OUTPUT).

BL 1500: INDICATES THAT THE TOTAL NUMBER OF CHARACTERS THAT CAN BE HANDLED IN STORAGE AT A GIVEN TIME IS 1500. (BL - BLOCK LENGTH).

MFS 600547 INDICATES THAT THE MAXIMUM NUMBER OF RECORDS THAT COULD BE SORTED USING ONE INPUT TAPE WOULD BE 600547. (MFS - MAXIMUM FILE SIZE).

LINE 3.

END OF ASSIGNMENT PHASE

INDICATES THAT ASSIGNMENT PHASE IS COMPLETED.

LINE 4.

PHASE I INTERNAL SORT:

INDICATES PROGRAM HAS PROGRESSED TO PHASE I.

LINE 5.

CHECKPOINT ON TAPE UNIT #5

INDICATES THAT A CHECKPOINT RECORD HAS BEEN WRITTEN ON TD #5 AND MAY BE USED ANYTIME DURING PHASE I TO RESTART PROGRAM. RESTART PROCEDURE HAS BEEN PREVIOUSLY DISCUSSED.

LINE 6.

G 075

INDICATES THAT THE NUMBER OF RECORDS THAT CAN BE INTERNALLY SORTED AT ONE TIME IS 75 (G).

LINE 7.

END OF INTERNAL SORT.

INDICATES THAT PHASE I HAS ALMOST BEEN COMPLETED.

LINE 8.

MAX. PHASE 2 PASSES 07

INDICATES THAT IF MORE THAN SEVEN PASSES ARE TAKEN DURING PHASE II, PROGRAM OR MACHINE HAS FAILED.

LINE 9.

EST. PHASE 2 PASSES 07

INDICATES THAT PROGRAM WILL PROBABLY BE COMPLETED IN NO LESS THAN SEVEN PASSES. LINES 8 AND 9 ARE DERIVED FROM ANALYSIS OF PHASE I.

LINE 10.

5000 RECORDS READ - PASS 00

INDICATES THAT 5000 RECORDS WERE READ INTO THE INPUT AREA DURING PHASE I.

LINE 11.

025 PAD REC ADDED - PASS 00

INDICATES THAT 25 PADDING RECORDS WERE ADDED TO COMPLETE A GROUP OF G RECORDS. (SEE DISCUSSION ON PADDING - PHASE I)

LINE 12.

5025 REC PROCESSED - PASS 00

INDICATES THE TOTAL NUMBER OF RECORDS INCLUDING PADDING THAT WERE PROCESSED DURING PHASE II. ALL FUTURE RECORD COUNTS SHOULD AGREE WITH THIS FIGURE.

LINE 13.

TSS

INDICATES MODIFY ADD INSTRUCTIONS (#) HAVE FUNCTIONED PROPERLY. IF FAILURE WAS ENCOUNTERED, 15 T WOULD PRINT.

LINE 14.

PASS 01 - CKPT 3, INP 5 & 6

INDICATES PASS 01 OF PHASE II IS BEGINNING. A CHECKPOINT RECORD EXISTS ON TD #3 AND MAY BE USED AT THIS TIME TO RESTART PASS 01. INPUT TAPE DRIVES WILL BE 5 AND 6.

LINE 15.

5025 REC PROCESSED - PASS 01

INDICATES THAT PASS 01 WAS SUCCESSFULLY COMPLETED AND THE CORRECT NUMBER OF RECORDS (5025) WERE PROCESSED.

LINES 16-26.

DESCRIPTION OF PASS AND RECORD COUNT. INDICATES WHERE CHECKPOINT-RECORD WILL BE AND WHICH TAPE DRIVES ARE USED AS INPUTS.

LINE 27.

OUTP 4 - END OF SORT

INDICATES THE SORT HAS BEEN COMPLETED AND THE SORTED FILE EXISTS ON TD #4.

SORT II EXERCISE - PRINTOUT

```
FILE GENERATED -
L0020 B075 B1005 B0001 BL1500 MFS0600547
END OF ASSIGNMENT PHASE
PHASE I INTERNAL SORT
CHECKPOINT ON TAPE UNIT #5
G075
END OF INTERNAL SORT
MAX. PH. 2 PASSES 07
EST. PH. 2 PASSES 07
005000 - RECORDS READ - PASS 00
   025 - PAD. REC. ADDED - PASS 00
005025 - REC. PROCESSED - PASS 00
155
PASS 01 CKPT 3 - INP. 5, 6
005025 REC. PROCESSED - PASS 01
PASS 02,CKPT 5 - INP. 3,4
005025 REC. PROCESSED - PASS 02
PASS 03 - CKPT 3 - INP. 5,6
005025 REC. PROCESSED - PASS 03
PASS 04 - CKPT 5 - INP. 3,4
005025 REC. PROCESSED - PASS 04
PASS 05 - CKPT 3 - INP. 5,6
005025 REC. PROCESSED - PASS 05
PASS 06 CKPT 5 - INP. 3,4
005025 REC. PROCESSED - PASS 06
PASS 07 - CKPT 3 INP. 5,6
OUTP. 4 - END OF SORT.
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SORT II EXERCISE TROUBLE-SHOOTING HINTS

1. TO CHECK OPERATION OF TAPE DRIVE UNITS:

   A) PLACE TAPE SELECT SWITCH ON OPERATOR'S CONSOLE IN "D" POSITION.
   B) TURN "ERROR STOP" SWITCH ON TAU C.E. PANEL "ON".
   C) LOAD AND RUN PROGRAM.
   D) EACH TIME A TAPE ERROR OCCURS THE PROGRAM WILL STOP. THE TAU CE PANEL CAN NOW BE INSPECTED AND THE TAPE ERROR CAN BE RECOGNIZED. THE TAPE DRIVE IN ERROR WILL HAVE IT'S SELECT LIGHT LIT. A PATTERN CAN BE DEVELOPED BY KEEPING TRACK OF THE TAPE FAILURES AND THE ERROR CAN BE CORRECTED.
   E) TO CAUSE THE PROGRAM TO RUN AGAIN AFTER A TAPE ERROR, TURN THE TAU CE PANEL "ERROR STOP" SWITCH "OFF" THEN BACK "ON" AGAIN.

2. IMPROPER NUMBER OF PASSES - PHASE II

   A) CAN BE CAUSED BY SORTING OUT OF SEQUENCE EITHER IN PHASE I OR II.
   B) CHECK HI-LO-EQUAL CIRCUITS. RUN DIAGNOSTIC BLOCK #'S 0100A, 3300A, 3310A, 3320A UNDER MARGINAL CONDITIONS. VIBRATE THE FOLLOWING GATES IF NECESSARY:

      02A8 HI-LO-EQUAL
      01B6 COMPARE

3. IMPROPER RECORD COUNT

   A) CAN BE CAUSED BY SHORT IRG ON ANY TAPE DRIVE.
   B) IF THIS IS SUSPECTED, RUN IRG DIAGNOSTIC BLOCK 5500 FOR 729'S OR BLOCK 5530 IRG TEST FOR 7330.

4. IT MAY BE ADVANTAGEOUS TO PRINT A LISTING OF THE SORTED OUTPUT TO CHECK SEQUENCE.

   A) THIS MAY BE ACCOMPLISHED BY WRITING A SHORT PROGRAM LOOP TO READ A RECORD, PRINT AND BRANCH TO THE TAPE READ INSTRUCTION.
   B) THE PRINTOUT OF THIS LOOP MAY BE INSPECTED FOR OUT-OF-SEQUENCE RECORDS.

5. STORAGE ADDRESS ERRORS

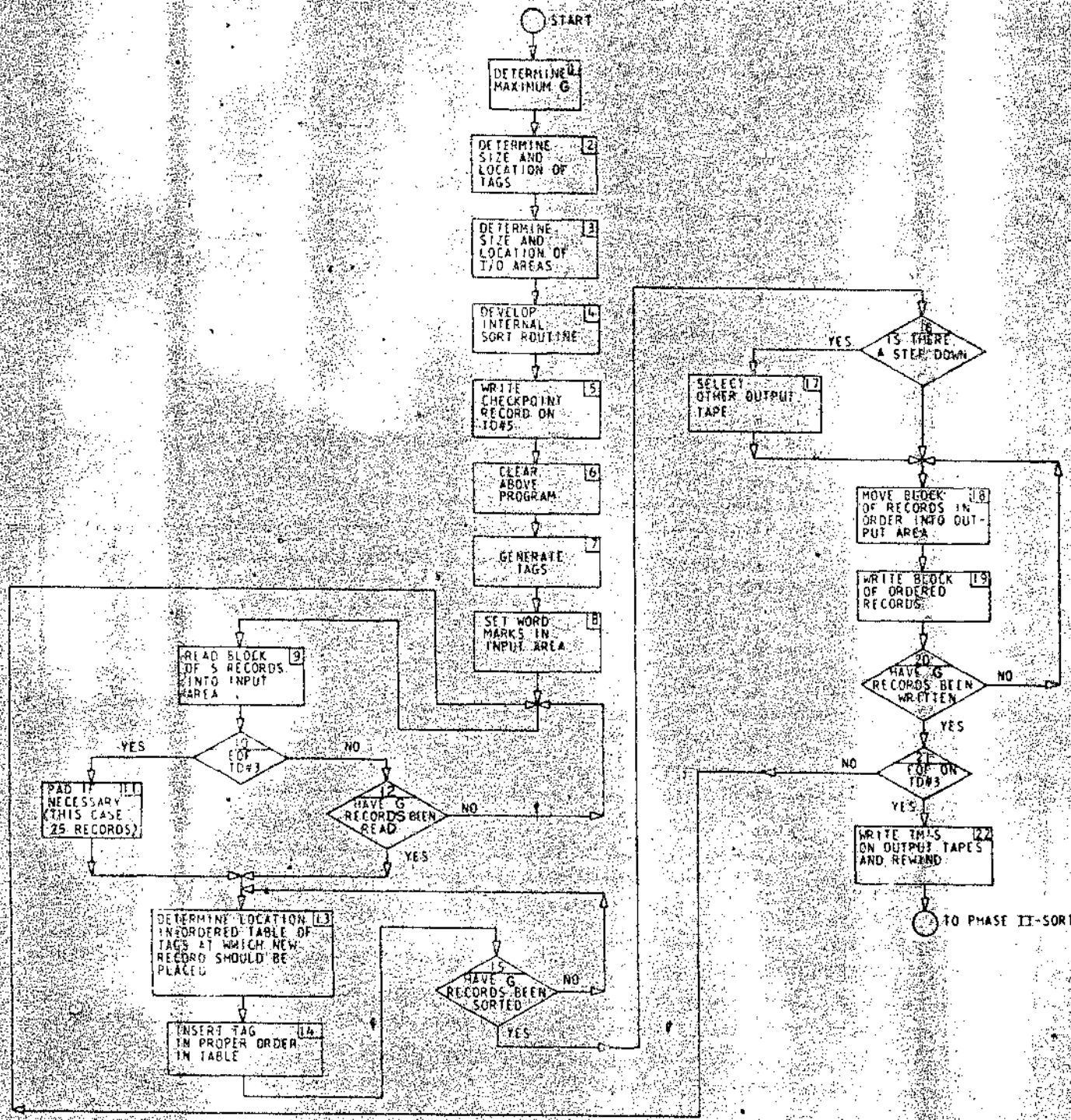
   A) MAY BE CAUSED BY MODIFY ADD (#) FAILURE. CHECK LINE 13 OF PRINTOUT. SHOULD BE I5S. IF NOT, RUN DIAGNOSTIC BLOCK 3700.

   B) MAY BE CAUSED BY INDEX FAILURE. IF THIS IS SUSPECTED, RUN INDEXING DIAGNOSTIC BLOCKS 3100, 3110 AND 3130 UNDER MARGINAL CONDITIONS. VIBRATE GATE 02B6 IF NECESSARY.

IF A MORE COMPREHENSIVE DISCUSSION OF THE NORMAL 1401 SORT II PROGRAM IS DESIRED, IT MAY BE OBTAINED BY WRITING TO THE PROGRAM LIBRARY AT CHQ.

ORDER BY FILE #1.2.003.

FLOW CHART-1401 SORT II PHASE I



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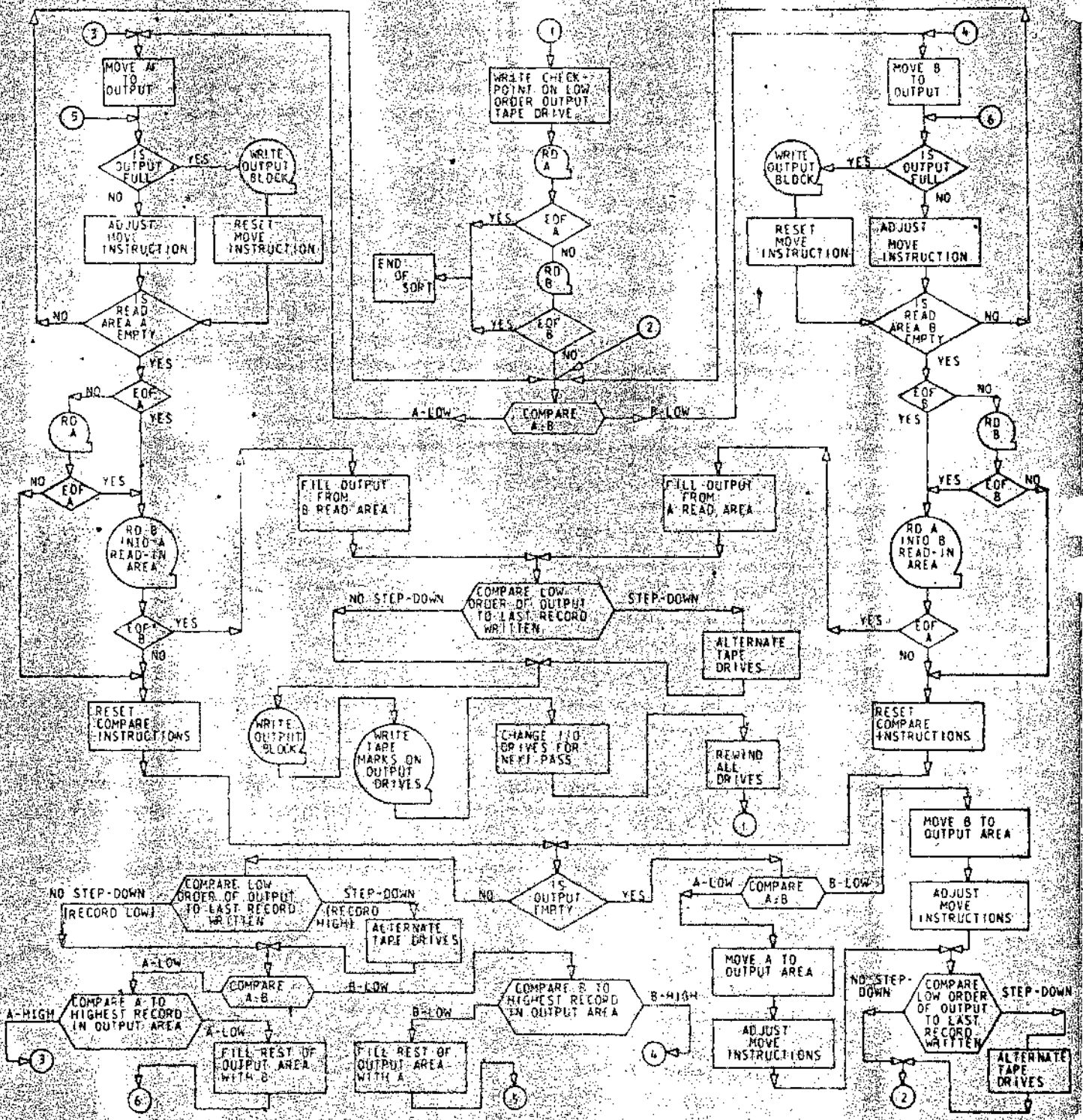
IBM FORM 824-7113-0

DIAGNOSTIC FUNCTION TEST

PART NO. 451631
SHEET 22 OF 37
BLOCK NO. AP02A

FLOW CHART- 1401 SORT III PHASE II



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DETAIL CARDS

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M65S-G6MP04460M65V-62M65Y-65M66//09      L035H59,H32H39,H46H53,04004Q1040051443  1
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M64Y51#/332/M51#2182FLFL                 L024I22,I06I10,I11I18,I1912I1040051643  1
M42352SM62V54ZM57#2272/332/M43257T       L034I56,I30I37,I44I45,I49I501040051743  1
M59V2282/332/M54T2272FK                  L023I79,I64I65,I69I70,I77I781040051843  1
M41761Z/332/M61Z224NF1MQ19037            L02900Y,I87I91,I92I99,00#00S1040051943  1
#085037#013037MO22040#085040#013040      L03504T,01W02T,03#03X,0400401040052043  1
MO25043#085043#013043M189626M189629      L03507Y,05/05Y,06V07S,0400401040052143  1
B101                                     L00504Y,040040,040040,0400401040A52143  1
/299MD402402F1806V                       L018118,105112,113115,1190401040852143  1
M189651M189654M189676M189679Y10X625      L03511T,08W09T,10#10X,0400401040052243  1
Y11U675Y00S628Y00S650YG28678YG28653       L03514Y,12/12Y,13V14S,0400401040052343  1
M085055#013055#016055MQ19058#189058      L03518T,15W16T,17#17X,0400401040052443  1
#013058MO22061#189061#013061MO25064      L03521Y,19/19Y,20V21S,0400401040052543  1
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MQI6076#189076#013076B29#086 M64Z822     L03628Z,26/26Y,27V28T,0400401040052743  1
C09663TB34U/MO95639MO95664MO95689        L03332S,29X30S,30Z31W,0400401040052843  1
MO95#59MO95/77MO95S95#344085A63T66X       L03535X,33#33X,34U35/,0400401040052943  1
C66X192B34U/MO16N74#085N74#013N74        L03339#,36V37#,37X38U,0400401040053043  1
MN74N80#67#N80B44W1866M43267TS19267T      L03642W,39Y40V,41T42#,0400401040053143  1
V44W67TKA192P03B42#/080,024056,063067     L03746T,43V44S,44W45#,45X0401040053243  1
I0582MAX PH 2 PASSES 00-ERROR            L02949S,46Y46Z,040040,0400401040053343  1
EST PH 2 PASSES 00-ERROR                 L02451W,040040,040040,0400401040053443  1
        REC PROCESSED-PASS00             L02754T,040040,040040,0400401040053543  1
      -RECORDS READ-PASS 00              L02757#,040040,040040,0400401040053643  1
000 PAD REC ADDED-PASS 00                L02559V,040040,040040,0400401040053743  1
PHASE I HASH TOTAL              3      1 L03863T,62#62W,62X63T,0400401040053843  1
 18      G81  ND10                       L01965S,63W63Y,64U64X,64Z65#1040053943  1
W76Z89T11573   001                       L02167T,65W65Z,66S66V,66Y67/1040054043  1
                                         N000000,040040,040040,040040BE00054143  1
,015022¤024056,029036,040047,0540611001,0010088001      ,0010088001      054243  1
,068072¤063067/061039                                   ,0010011040054343  1
N#4YN41/MZ6Y20UC432Z7/823U/MZ7S188        L03423T,20U20Y,21V22S,22X0401040054443  1
M347W3XM347K98M347V3UMP00S4/MD67W6S       L03526Y,24/24Y,25V26S,0400401040054543  1
MQ70/4WMQ7351#¤073/7/MQ7349VMQ73/5X       L03530T,27W28T,29#29X,0400401040054643  1
MQ73/6UMQ7067WMQ67T3XMQ67T4UMQ94/IZ       L03533Y,31/31Y,32V33S,0400401040054743  1
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M457Y5UC457Z8SB52WSM000Y3SC423000B56S/   L03848/,45/45Y,46T47*,47X040I040055143  1
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B55//MX9V220NFKAZ8T45TSZ8T459Y095459     L03654W,51W52T,52U52W,53T54*1040055343  1
B85VMY0/225B52TMY6*234B48ZNT9ZB60*       L03458*,55/55Y,56S56Z,57T57X1040055443  1
/332/MY2W2252F1.60VB58/8                 L02460U,58V58W,59T59U,59W60*1040055543  1
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M450W9*M450X3TM450P05M453450MP05453      L03589W,86Z87W,88T89*,040040I040056343  1
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M453N09M453N52M453483M453520M452P05      L035*0V,97Y98V,99S99Z,040040I040056643  1
M455452MP05455M452S15M455X85M452X90,     L035*4*,*1T*2*,*2X*3U,040040I040056743  1
M455X95,001005MZ9VMZ6Y0406MZ8U20*B*8TD   L038*7Y,*4Y*5V,*5Z*6T,*6X*7U1040056843  1
8/0S/332/MY8Y2282F1./0S                  L023/0/,*8T*8X,*8Y*9V,*9W*9Y1040056943  1
MZ9XN71M095P05000L%U0001WBW8XLBX6YK      L036/3X,/0Z/1W,/2*/2Y,/3T040I040057043  1
8U5TES000Y095000S000Y095000Y095I9F       L034/7/,/4T/4X,/5U/5Y,/6V040I040057143  1
MN95618MN92622M-0*Z78M076D79M076*46       L035S0W,/7Z/8W,/9TS0*,040040I040057243  1
M076/64M076S82M454X52M454X72M088000      L035S4/,S1US2/,S2YS3V,040040I040057343  1
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8T3U337 M095460M095461MN98633M001638     L036T1S,S8VS9S,S9ZT0W,040040I040057543  1
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MZ3*2262F18E13/332/M453U3/               L026U1*,T9ST9T,T9VT9Z,U0TU0U1040057843  1
M454Y9UMZ0W2182F1U%U0R8W8T090P8W8T090C   L838U4Y,U1YU2V,U2WU2Y,U3TU4/1040057943  1
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/332/MZ4*2342F1SZ8T457YD95457            L029V1W,V9SU9T,V0*V0/,V0TV1*1040058143  1
./4T/332/U%U1R%000M457Z4XM450Z5T          L032V4Y,V2/V2V,V2WV3/,V3VV4S1040058243  1
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C457Z8S8W5V/L000406MZ6Y20*AZ8T457.462     L037W5Y,W2ZW3U,W4/W4Y,W5V040I040058543  1
C000-0W8T3UTB60*.20*8T3U.W8TU%U08         L033W9/,W6WW7/,W7VW7Z,W8TW8X1040058643  1
8X1/P051AZ8TP05B/2*AZ8TN71CN71-0Y8X6US   L038X2Z,X0*X0X,X1/X1Y,X2V040I040058743  1
U%U0E8/0ZM-1/X5WLX5X841B75/8-1W           L034X6T,X3VX3Z,X4WX5T,X5XX6/1040058843  1
./0S./3Y000000HASH TOTAL-        ERROR   L038Y0/,X6YX7S,X7Y040,040040I040058943  1
LAST MERGE PASS-INTERRUPT                 L025Y2W,040040,040040,040040I040059043  1
        REC PROCESSED-PASS 00-ERROR       L034Y6*,040040,040040,040040I040059143  1
INP MAY BE SAVED OR DENS CHG              L028Y8Y,040040,040040,040040I040059243  1
OUTP  -END OF SORT                        L018Z0W,040040,040040,040040I040059343  1
PASS 00-CKPT 0-INP 0,0,0 INTERRUPT        L034Z4*,040040,040040,040040I040059443  1
PASS 00 INP 0,0,0 OUT 0,0,080006*2        L034Z7U,Z6YZ6Z,Z7SZ7T,Z7U040I040059543  1
000000001N U192                           L015Z8Z,Z8/Z8T,Z8UZ8V,Z8WZ8X1040059643  1
A20V2/  45400000150Y36                    L022-1/,Z9TZ9W,Z9Y-0/,-0X-0Z1040059743  1
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MH32E86MH35H55,000AH36H55CH551990F17S         L037F05,E76E83,E87E94,F0104Q1040060143  1
#344E86BE83AH36H29CH290968F47S#H39E65         L037F42,F13F17,F24F31,F3604Q1040060243  1
8E55NF76MH40F47MH43E58MH46E65BE48             L033F75,F47F51,F58F65,F7204Q1040060343  1
BG13337 NG13MH40F84MH49E58MH52E65BE48         L037G12,F84F88,F95G02,G0904Q1040060443  1
MQ19H32MH32G37MH35H55,000AH36H55CH55199       L039G51,G20G27,G34G38,G4504Q1040060543  1
BG68S#344G37BG34NG90MH40G68MQ22H328G20        L038G89,G57G64,G68G72,G79G861040060643  1
BE00337 NE00MH40G98MQ25H32BG20I0&H99          L036H25,G98H02,H09H16,H20H231040060743  1
        10038                                 L015H40,H28H30,H33H36,H37H401040060843  1
Q223500253S0                                  L015H55,H44H47,H50H53,0400401040060943  1
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