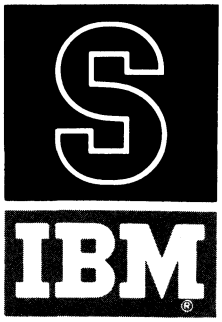

1410 DATA PROCESSING SYSTEM BULLETIN

PRELIMINARY REFERENCE MANUAL

IBM 1410 UTILITY PROGRAMS - PART III
PROCEDURE FOR AUTOMATIC TESTING (PAT)

This publication is the third and final part of a preliminary reference manual describing the utility programs for the IBM 1410 Data Processing System. Parts I and III of this manual supersede the bulletin, "Utility Programs for the IBM 1410: Preliminary Specifications, "Form J24-1435-0.

Part III represents a substantial modification and enlargement of that bulletin's description of the Procedure for Automatic Testing. In addition to complete program specifications, this part provides control card formats and detailed operating instructions.

The following parts of this manual have been published:

PART I: Card/Tape Utility Programs (Form J28-0244-0)
PART II: 1405 Disk Storage Utility Programs (Form J28-0248-0)

Address comments regarding this publication to
Programming Systems Publications, IBM Corp., P. O. Box 390, Poughkeepsie, N. Y.

PRELIMINARY REFERENCE MANUAL

IBM 1410 UTILITY PROGRAMS - PART III
PROCEDURE FOR AUTOMATIC TESTING (PAT)

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LIST OF ILLUSTRATIONS

INTRODUCTION

Purpose of this Publication

This publication describes the Procedure for Automatic Testing (PAT) for the IBM 1410 Data Processing System. It contains the necessary reference material for programmers and systems analysts, plus an Operator's Guide for machine operators. In those instances where the information concerning PAT utility programs is the same as that given for the single utility programs in Parts I and II of this manual, the reader will be referred to that material.

Prerequisites

The reader should be familiar with the Reference Manual "IBM 1410 Data Processing System," Form No. A24-1407, and Parts I and II of this manual.

Machine Requirements

PAT card/tape utility programs require the following minimum machine configuration.

10,000 positions of core storage
(for users of the PAT 10/20K version)
40,000 positions of core storage
(for users of the PAT 40K version)
1 IBM 1402 Card Read-Punch, Model 2
1 IBM 1403 Printer, Model 2
2 IBM 729 II, 729 IV, 729 V, 729 VI, or 7330 Magnetic Tape Units

NOTE: The different tape unit types can be intermixed.

PAT disk utility programs also require:

1 IBM 1405 Disk Storage Unit, Model 1 or Model 2

Purpose of the Procedure for Automatic Testing (PAT)

The Procedure for Automatic Testing (hereafter called PAT) is a method for testing object programs. This testing procedure is the orderly use of a set of utility and control programs, which are collectively called the PAT System.

Programs within the PAT System

The utility programs listed below are available to the programmer using PAT. They are in addition to the control programs and linkage routines that PAT also provides.

Clear Storage	Clear Disk Storage
Load	Disk-to-Printer
Tape File Generator A	Disk-to-Tape
Tape File Generator B	Tape-to-Disk
Trace	Disk File Generator
Branch Trace	Storage Print
Snapshot	Tape Print

NOTE: For descriptions and functions of these programs, see Parts I and II of this manual.

The Advantages of PAT

PAT has two major advantages:

1. It saves machine time.

   PAT requires a minimum of operator intervention.

2. It promotes planned testing.

   The programmer can first segment a program into routines to be separately tested with PAT. Experience has shown that this is a quick way to develop trouble-free programs.

   Then, by systematic selection of the utility programs within PAT, the programmer can examine his work from different aspects. For example, using the Trace Program during a test run, the programmer gets a printed listing of all executed instructions. If another test run is needed, the programmer may wish a listing only of executed branch instructions. He can substitute the Branch Trace Program for the Trace Program to obtain the desired listing.

The Two-Pass Concept of PAT

PAT is divided into two phases, or passes. The first (formerly called Pass I) is the Generation Pass. Part of the input for this pass is the PAT System Tape, which contains the PAT utility programs and linkages, and a generating program that will create a PAT Test Tape.

The Test Tape, in turn, will contain the program to be tested (the object program), the utility programs selected to run with the object program, and the necessary control program and linkages. This tape becomes input for the Test Pass (formerly called Pass II).

During the Test Pass, the control program directs the execution of the object program and the selected utility programs. It is possible during this pass to make additions, corrections and/or deletions to the information read into storage from the Test Tape. (See Figures 1 and 2.)

NOTE: More than one program can be tested in a single test session. Each program to be tested has a unique ID (identification) Card; all cards pertaining to that particular program make up a "packet."

The object program and its associated control and utility programs make up a "test set." Thus, a Test Tape can comprise one or more test sets, each set having a unique ID record, a control program for the Test Pass, an object program to be tested, and the utility programs selected to run with that object program (as in Figure 1.)

PAT System Tape (Channel 1, Unit 8)

*	Storage Print Program	Trace Program	Clear Disk Storage Program	Disk to Printer Program	Tape to Disk Program	Disk File Gen. Program	Disk to Tape Program	Tape File Gen. A Program	Snap-shot Program	Tape to Printer Program	Control Program for Test Tape	Gener-ating Program	Tape File Gen. B Program	Branch Trace Program

* Record to search the System Tape for the generating program.

Sample PAT Test Tape (Channel 1, Unit 9)

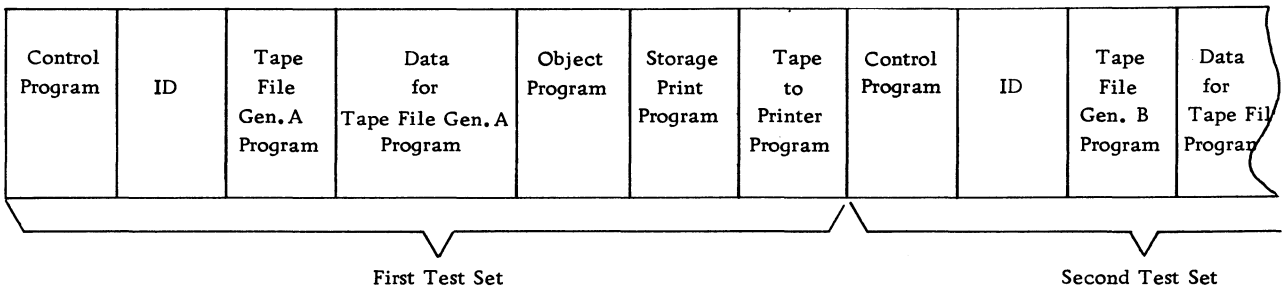

Figure 1. PAT Tapes

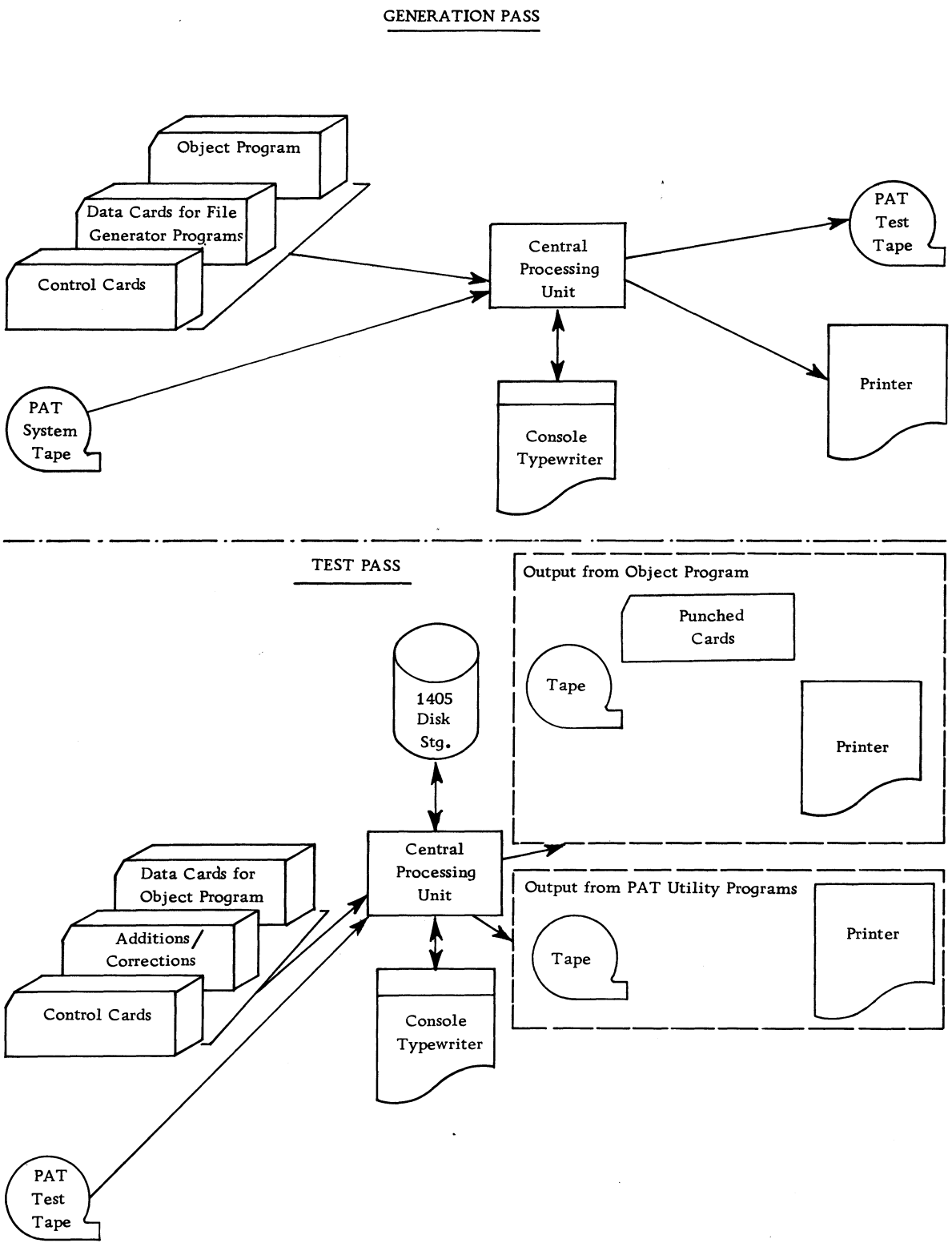

Figure 2. PAT Generation Pass and Test Pass: Input/Output

GENERATION PASS (CREATING THE 'PAT' TEST TAPE)

During the Generation Pass, the generating program is read into storage from the System Tape. This generating program then reads the packets for the object programs to be tested and creates test sets on the Test Tape. Each test set consists of its own control program, its unique ID record, an object program and associated utility programs, and the necessary linkages for a Test Pass.

NOTE: Refer to Figure 4 for placement of Generation Pass cards.

Required Control Cards

Control Cards Provided by the Programmer

When the programmer arranges the cards for the Generation Pass, he must provide certain control cards for each program to be tested. These are the ID Card, the OBJ Card, and the END Card.

'ID' CARD

This card identifies the individual program. It must be the first card in each packet.

ID Card Format

Columns	Contents
1-5	any five valid 1410 characters, including blanks.
6-7	ID
7-24	blank
25-80	may be left blank. (See NOTE below.)

NOTE: During the running of the Generation Pass, card images are listed on the 1403 Printer for each test set being put on tape. These images include the ID Card, the OBJ Card, and the control cards for the utility programs. This listing is then used for reference by the operator during the Test Pass. Programmer comments on this listing can inform the operator of special requirements for his program, unusual conditions to expect, or other information the programmer feels would be helpful.

COMMENTS CARD(S)

To put comments on the Generation Pass listing, the programmer can use columns 25-80 of the ID Card. If he requires more space, he can use any number of Comments (XXX) Cards. Comments Cards should immediately follow the ID Card.

Comments Card Format

Columns	Contents
1-3	XXX
4-7	blank
8-80	comments

'OBJ' CARD

This card defines the beginning of the object program. It must be placed immediately before the first card of the object program.

NOTE: This card may be eliminated if the object program is run with the Trace Program, the Branch Trace Program or the Snapshot Program. (See control card information for these programs.)

OBJ Card Format

Columns	Contents
1-3	OBJ
4-80	blank

'END' CARD

This card identifies the end of the object program. It must always immediately precede the execute card of the object program.

NOTE: The execute card is the last card produced by the Autocoder Processor.

End Card Format

Columns	Contents
1-3	END
4-80	blank

Control Cards Provided by the Operator

When the operator starts the Generation Pass, he places a PAT ID Card in front of the packet(s) in the card read hopper, and a ZZZ Card behind all the cards.

The PAT ID Card initiates a search of the PAT System Tape for its generating program; the ZZZ Card is the last card image on the Generation Pass listing, signifying that all the packets in the card reader have been put on the Test Tape.

NOTE: A PAT Test Tape must be contained on only one reel. This means the ZZZ Card must be read by the Generation Pass before the end-of-reel marker is sensed on the Test Tape.

Programs Automatically Included by the Generation Pass

The System Tape contains certain programs that are automatically included in each test set. They are: the Control Program, Load Program, Clear Storage Program, Storage Print Program, Clear Index Registers Program, and Rewind Tapes Program.

Control Program

This program controls the execution of the test set during the Test Pass. Included in the control program are four of the programs discussed below: the Load, Clear Storage, Clear Index Registers, and Rewind Tapes Programs. These programs, together with various control routines, make up the total PAT control program, which occupies storage locations ØØØØØ - ØØ5ØØ.

Load Program

PAT provides its own load program, which requires that all cards (except control cards) must be punched in the standard load-card format. This format is explained in PART I of this manual. The load program provided by PAT "edits" the cards when it reads them in the Generation Pass. That is, those cards that do not conform to the standard format are not put on the Test Tape, but are listed on the printer with the other card images. (See NOTE under "ID Card" - Generation Pass.)

NOTE: If the programmer requested a load program from the Autocoder Processor, he should remove the first five cards from the assembled object deck. PAT provides programs to serve the purpose of those cards.

Clear Storage Program

Storage is cleared before the loading of each object program to be tested, unless the programmer provides a control card to delete this program from the test set.

DELETING THE CLEAR STORAGE PROGRAM

If storage is NOT to be cleared before the loading of the object program in the Test Pass, the programmer must include a NO CLEAR STORAGE (NCL) control card. (See "Testing Multiphase Programs with PAT.") This card must be placed before the OBJ Card (Figure 4).

NCL Card Format

Columns	Contents
1-3	NCL
4-80	blank

Storage Print Program

The contents of core storage are printed after the execution of each object program, unless the programmer provides a control card to delete this utility program from the test set.

DELETING THE STORAGE PRINT PROGRAM

If the contents of core storage are NOT to be printed upon the completion of the object program's execution in the Test Pass, the programmer must include a NO STORAGE PRINT (NSP) control card. (See "Testing Multiphase Programs with PAT.") This card, like the NCL Card, must be placed before the OBJ Card (Figure 4).

NSP Card Format

Columns	Contents
1-3	NSP
4-80	blank

Clear Index Registers Program

This program clears the index registers to blanks and sets a high-order word mark in each of them before the object program is loaded. The Clear Index Registers Program is always included in each test set. (See "Testing Multiphase Programs with PAT.")

Rewind Tapes Program

All channel-1 tapes (except 9, which is the PAT Test Tape) are rewound when each test set ID record is located during the Test Pass. This program is always included for each object program to be tested. (See "Testing Multiphase Programs with PAT").

Utility Programs Supplied at the Programmer's Option

The programmer can select various utility programs to be executed before, with, and after the object program execution. These utility programs are included in the test sets in the order in which the PAT generation program reads the control cards for them.

NOTE: PAT programs do not check tape labels.

Tape File Generator Programs (A and B)

Control Cards

The format for these control cards is the same as that required for the single utility Tape File Generator Programs. (See Part I of this manual.)

NOTE 1: Columns 4-5 must be punched "T9" because the generating program writes the data on the Test Tape.

NOTE 2: The "*END" card must be included after each group of data cards being put on a different tape unit. The PAT generating program continues to read cards (on the assumption that they are data cards) until it finds an "*END" card or until there are no cards left in the card reader.

Use with PAT

The Tape File Generator Programs included in PAT are equivalent to the ones supplied as single utility programs. But since the utility programs are not executed until the Test Pass, the data must be written in card-image form on the Test Tape. This is the reason for punching "T9" in columns 4-5 of the control card.

The Tape File Generator Programs can be called repeatedly by sequentially arranging sets of control cards (with associated data cards) for each tape unit to be used.

NOTE: If both Tape File Generator A and Tape File Generator B are used for a particular object program, all the control cards and data cards for one generator program must be together, followed by the cards for the other generator program. (See Figure 3.)

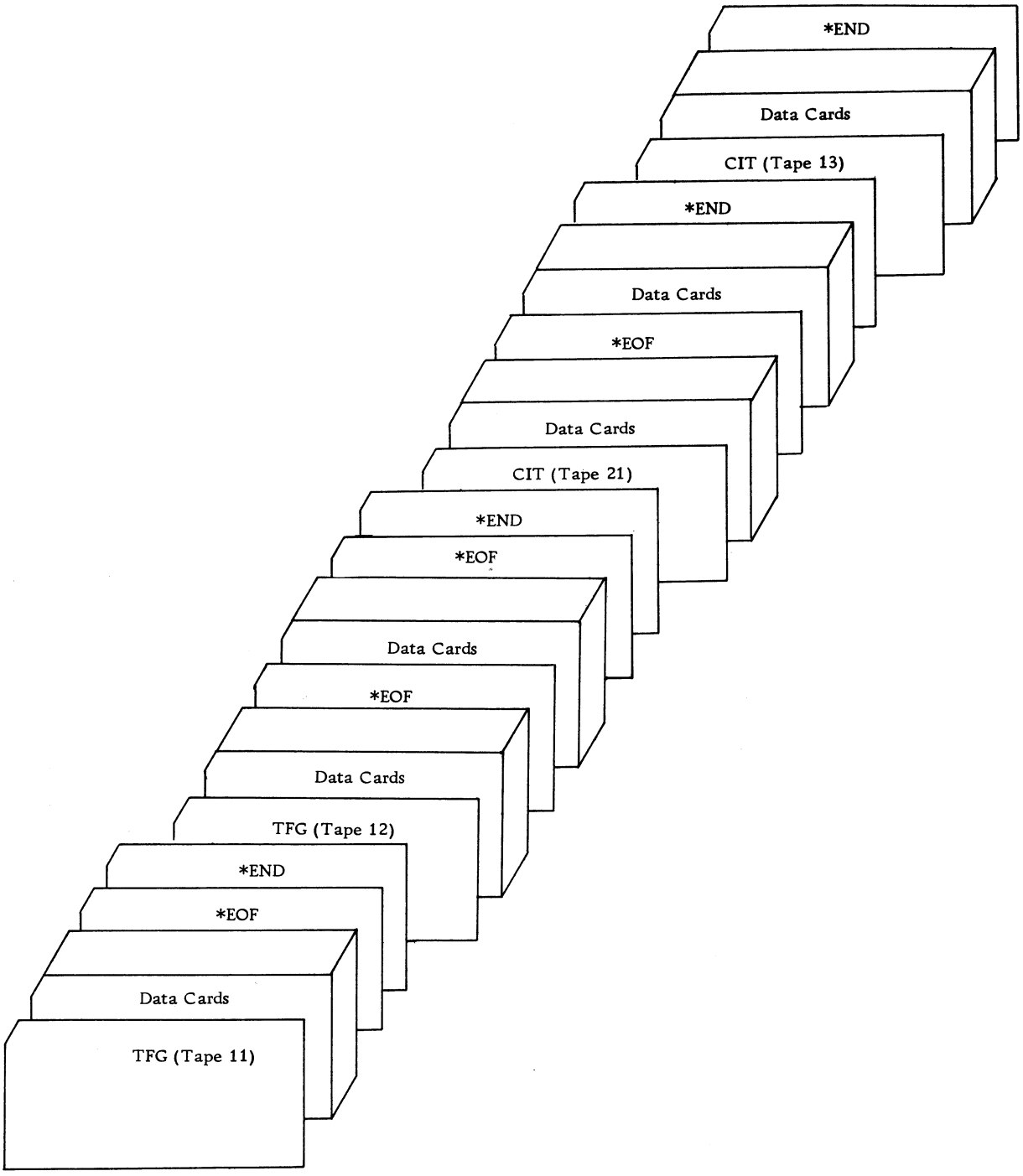

Figure 3. Card Arrangement for the Tape File Generator Programs

Trace Program

Control Card

The Trace Program control card used for PAT has a different format from the one used for the single utility Trace Program.

NOTE: This control card can replace the OBJ card. If the OBJ card is retained, however, the Trace control card must precede the OBJ card. Otherwise, PAT will not recognize it as the control card for this program, but will instead treat it as part of the object program.

The control card will be put on the Generation Pass listing since it is not in standard load-card format. But its listing after the OBJ card image will indicate that PAT did not recognize it as a control card and therefore did not put the Trace Program on the Test Tape.

Control Card Format

Columns	Contents
1-3	TRF
*4-8	sssss (Start-address)
*9-13	eeeee (End-address)
14-18	rrrrr (Relocation-address)
19-80	blank

Columns preceded by (*) are to be punched with addresses as described in Part I. (See Trace Program control card information in that Part.)

Use with PAT

The PAT Trace Program uses 2567 positions of core storage when it is run with an object program. If columns 14-18 of the control card are left blank, the Trace Program will be located from

37ØØØ to 39566 for the 40K version of PAT,
or from
Ø7ØØØ to Ø9566 for the 10/20K version.

According to the storage requirements of the object program, however, the programmer can relocate the Trace Program by punching columns 14-18 with the desired high-order (lowest storage) address of a free 2567-positions area of storage. This address must be a multiple of 100.

NOTE 1: If the Trace Program is used on a given test run, neither the Branch Trace Program nor the Snapshot Program can be used on that run.

NOTE 2: The Trace Program cannot be run with object programs that use the Processing Overlap and/or Priority special features.

Branch Trace Program

Control Card

The Branch Trace Program Control card used for PAT has a different format from the one used for the single utility Branch Trace Program.

NOTE: This control card can replace the OBJ Card. (See NOTE under "Trace Program, Control Card.")

Control Card Format

Columns	Contents
1-3	BTR
*4-8	sssss (Start-address)
9-80	blank

Columns preceded by (*) are to be punched with an address as described in Part I. (See Branch Trace Program control card information in that Part.)

Use with PAT

When it is run with an object program, the Pat Branch Trace is located from

38ØØØ to 39621 for the 40K version of PAT,
or from
Ø8ØØØ to Ø9621 for the 10/20K version.

The PAT Branch Trace is NOT relocatable.

NOTE 1: If the Branch Trace is used on a given test run, neither the Trace Program nor the Snapshot Program can be used on that run.

NOTE 2: The Branch Trace Program cannot be run with object programs that use the Processing Overlap and/or Priority special features.

Snapshot Program

Control Card

The format for this program's control card is the same as that required for the single utility Snapshot Program. (See Part I of this manual.)

NOTE: This control card can replace the OBJ Card. (See NOTE under "Trace Program, Control Card.")

Use with PAT

When it is run with an object program, the PAT Snapshot Program occupies core storage from

27ØØØ to 28171 for the 40K version of PAT,
or from
Ø7ØØØ to Ø8171 for the 10/20K version.

NOTE 1: If the Snapshot Program is used in a given test run, neither the Trace Program nor the Branch Trace Program can be used on that run.

NOTE 2: The Snapshot Program cannot be run with an object program that uses the Processing Overlap and/or Priority special features.

Tape Print Program

Control Card

The format for this control card is the same as that required for the single utility Tape Print Program. (See Part I of this manual for that information.)

Use with PAT

The PAT Tape Print Program is equivalent to the one supplied as a single utility program. When using PAT, the Tape Print Program can be called repeatedly by providing a control card for each tape to be printed.

Disk Utility Programs

Five disk utility programs are included in the PAT System. They are the Clear Disk Storage, Disk-to-Tape, Tape-to-Disk, Disk-to-Printer and Disk File Generator Programs.

The functions and specifications of these programs are given in Part II of this manual.

Control Cards

The PAT disk programs use four control cards each.

1. Program Call Card. This must always be the first card in each set of disk program control cards. Its function is to "call" a particular disk program from the PAT System. The program is placed on the Test Tape by the PAT generating program.

2. Machine Specifications Card. See Part II of this manual for the functions and format of this card.

3. Program Area Card(s). See Part II of this manual for the functions and format of this card.

4. Program End Card. This card must always be the last card in each set of disk program control cards. Its function is to indicate to the PAT generating program that all the cards for a particular disk utility program have been read.

Program Call Card Format

Columns	Contents
1-3	CDS - for Clear Disk Storage D/T - for Disk-to-Tape T/D - for Tape-to-Disk D/P - for Disk-to-Printer DFG - for Disk File Generator
4-80	blank

Program End Card Format

Columns	Contents
1-4	ECDS - for Clear Disk Storage ED/T - for Disk-to-Tape ET/D - for Tape-to-Disk ED/P - for Disk-to-Printer EDFG - for Disk File Generator
5-80	blank

Use with PAT

Except for the addition of the Program Call Card and the Program End Card, the five PAT disk utility programs are used in the same manner as the single disk utility programs described in Part II of this manual.

Testing Multiphase Programs with PAT

A multiphase program is one that is divided into separate routines (phases), each of which is executed before the succeeding phase is loaded. Each phase leaves information, either in storage or on tape, for the succeeding phase. Generally, a program is segmented into phases because its storage requirements exceed storage capacity.

When testing multiphase programs with PAT, the following procedures must be observed:

1. Each phase must have a different ID Card.

2. All utility programs that are to be executed before the execution of each phase (Tape File Generator, Disk File Generator, Clear Disk Storage and Tape-to-Disk Programs) must be executed before the execution of the first phase. (Utility programs are loaded into storage each time they are used.)

3. Similarly, the Tape Print, Disk-to-Printer, and Disk-to-Tape Programs must be executed after the execution of the last phase.

4. Each phase that leaves information in the index registers for the next phase must make provisions for saving that information. (Index registers are always cleared before each object program is loaded.)

5. Multiphase programs, in which successive phases read from, or write on, a tape started by a previous phase, should use channel-2 tape units, if available. Otherwise, there must be instructions for the operator to place the tape units in a Not Ready status between each phase. (The Rewind Tapes Program is always executed before each object program is loaded, but operates on only those units that are in a Ready status.)

NOTE: These instructions to the operator could be put on Comments (XXX) Cards. A suggested message is:

"MAKE TAPE UNITS _ AND _ NOT READY UPON COMPLETION OF THIS OBJECT PROGRAM EXECUTION.
MAKE READY AGAIN WHEN OBJ TYPES OUT FOR NEXT OBJECT PROGRAM." (Give ID of next phase.)

6. The packet for each phase (except the first) must contain a NO CLEAR STORAGE (NCL) Card.

7. A NO STORAGE PRINT (NSP) Card must be used for any phase that leaves information for the next phase in the top 350 positions of storage. (The Storage Print Program is executed from that area each time it is used.)

8. Information for successive phases must not be left below location ØØ633. (The PAT control program occupies ØØØØØ-ØØ5ØØ; locations ØØ5Ø1-ØØ632 are used as a print area after each object program execution.)

Storage Locations Used by PAT Programs

The PAT control program, the Trace Program, the Snapshot Program, and the Branch Trace Program are loaded into storage with the object program. The table below gives the storage requirements for each of these programs.

PROGRAMS	LOCATIONS	
	40K	10/20K
Control	ØØØØØ-ØØ5ØØ	ØØØØØ-ØØ5ØØ
Trace	37ØØØ-39566 *	Ø7ØØØ-Ø9566 *
Branch Trace	38ØØØ-39621	Ø8ØØØ-Ø9621
Snapshot	27ØØØ-28171	Ø7ØØØ-Ø8171

*Locations given are used if the programmer does not relocate the Trace Program.

NOTE: Additional storage restrictions must be observed if a multiphase object program is tested with PAT. (See "Testing Multiphase Programs with PAT.")

Card Arrangement for the PAT Generation Pass

The Programmer should be certain that all control cards, object program cards and data cards are correctly punched and in the proper sequence before they are sent to the machine room. Since the utility programs and the object program are put on the Test Tape and executed in the order in which they are arranged for the card reader, sequence is important in achieving a successful test run. (For example, Tape File Generator Programs are normally executed before execution of the object program; Tape Prints after the object program.)

Figure 4 illustrates proper sequencing for two Generation Pass packets. The first packet contains cards for all the utility programs available in PAT. Following the illustration is a card-by-card explanation of the deck.

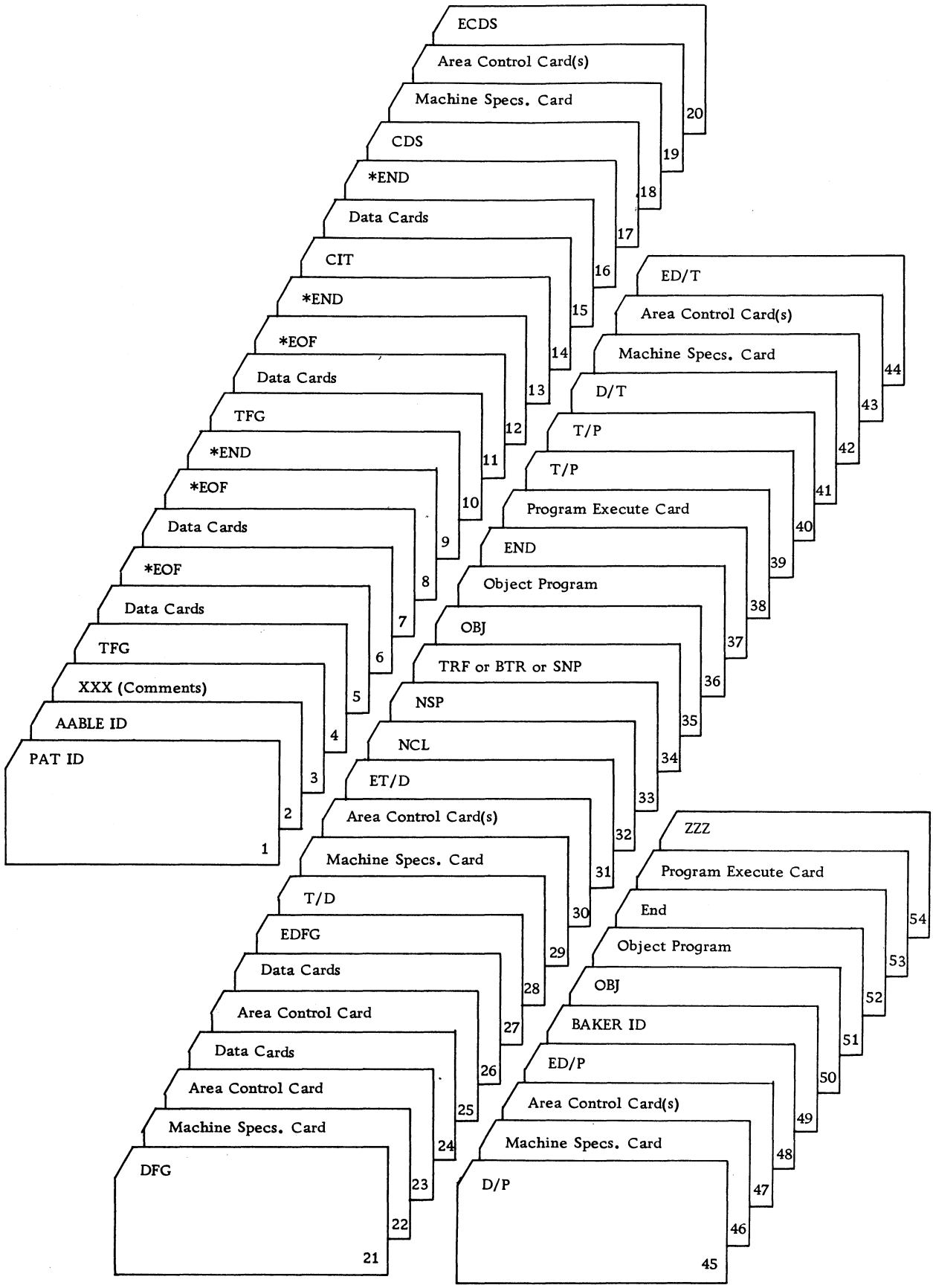

Figure 4. Card Arrangement for PAT Generation Pass

Explanation: Card Arrangement for PAT Generation Pass

Card	Explanation
1	Supplied by the operator.
2	ID Card for first object program.
3	Optional card(s) to put comments on Generation Pass 1403 listing.
4	Control card for Tape File Generator A Program (first tape unit to be used).
5	Data cards for the first of two files to be put on that tape unit.
6	Tape mark will be placed at the end of the first file.
7	Data cards for the second file to be put on the first tape unit.
8	Tape mark will be placed at the end of the second file.
9	The tape on the first unit will be rewound. This card does not cause a tape mark to be written. (This card must be included.)
10	Control card for Tape File Generator A Program (second tape unit to be used).
11	Data cards for that tape file. (One file to be generated.)
12	Tape mark will be placed at the end of that file.
13	The tape on the second drive will be rewound. (This card must be included.)
14	Control card for Tape File Generator B Program (only one tape unit selected).
15	Data cards for the tape file. (One file to be generated.)
16	Tape mark will be placed at the end of that file. The tape will then be rewound. (This card must be included.)
17-20	Control cards for the Clear Disk Storage Program.
21-23	First 3 control cards for the Disk File Generator Program.
24	Data cards for the area defined by card 23.
25	Second Area Card for the DFG Program.
26	Data cards for the area defined by card 25.
27	End Card for the DFG Program.
28-31	Control cards for the Tape-to-Disk Program.
32	Storage will not be cleared before the object program is loaded. This card is used when multiphase programs are to be tested. (However, the first phase of a multiphase program can and should use the PAT Clear Storage Program.)
33	No storage print will be taken upon the completion of the object program's execution. (This card, like card 32, is used when testing multiphase programs. For a full explanation, see "Testing Multiphase Programs with PAT.")
34	Control card for either the Trace, or the Branch Trace or the Snapshot Programs. (Only one of these programs can be used in a single test set.)
35	Definition of the beginning of the object program. If card 34 is used, this card may be eliminated.
36	Object program. (Without the first five cards given by Autocoder, if a load program was requested from the Autocoder Processor.)
37	This card causes the Generation Pass to put on the Test Tape (immediately after the object program) a record that will function during the Test Pass as an exit to the card reader for additions or corrections to the object program.

Card	Explanation
38	Program execute card. This is the last card produced by the Autocoder Processor. After the exit to the card reader (card 37), execution of the object program begins at the address on this card.
39	Control card for first tape to be printed.
40	Control card for second tape to be printed.
41-44	Control cards for the Disk-to-Tape Program.
45-48	Control cards for the Disk-to-Printer Program.
49	ID Card for the second object program.
50	Definition of the beginning of the second object program.
51	Second object program.
52	End of second object program.
53	Program execute card.
54	Supplied by the operator.

TEST PASS (RUNNING THE 'PAT' TEST TAPE)

The Test Pass is the actual execution of the object program and its associated utility programs. During the Test Pass, it is possible to make changes to the procedure and specifications originally established in the Generation Pass. (In the following discussion of these changes, the term "original" refers to information given for the Generation Pass; "new" refers to different or additional information given for the Test Pass.) The Test Pass changes are made to information in core storage. They do not alter or add to the information on the Test Tape.

NOTE: Refer to Figure 7 for placement of Test Pass cards.

Required Control Cards

Control Cards Provided by the Programmer

When the programmer arranges the cards for the Test Pass, he must provide certain control cards for each program to be tested. These are the ID Card and the PAT Execute Card.

ID Card

This is a duplicate of the ID Card used in the Generation Pass and must be the first card in each Test Pass packet. It enables the Test Pass control program to find a particular test set on the Test Tape.

For example, assume that during one run of the Generation Pass the following programs were consecutively placed on the Test Tape: AABLE/BAKER/CHUCK/DAWGG. Assume further, that the programmer now wishes to test only DAWGG. He therefore provides an ID card for only that test set. The control program will read the ID card and search the Test Tape until it finds that ID record. Then DAWGG and its associated utility programs will be executed.

In this case, DAWGG is the last program on the Test Tape. It is followed by an "END TP" record (placed there when the ZZZ Card was read in the Generation Pass) that causes the tape to be rewound. The tape will not be rewound if the programs are called for in their original sequence. But if the programmer calls for tests of DAWGG/CHUCK/BAKER/AABLE (in that order), the control program will need to rewind the tape three times to find the four ID's. Therefore, the programmer should arrange the Test Pass packets in the order in which the test sets are written on the Test Tape.

PAT Execute Card

The PAT Execute Card causes the control program to read the object program's execute record that is on the Test Tape. There must be one PAT Execute Card for each Test Pass packet. After the PAT control program loads the object program into storage, it loads corrections to the object program (if any). The PAT Execute Card is read after the corrections are loaded into storage. Execution of the object program follows immediately.

PAT Execute Card Format

Columns	Contents
1	E
2	word separator character
3-8	JØØ281
9	blank
10	word separator character
11-80	blank

Control Card Provided by the Operator

When the operator starts the Test Pass, he places a ZZZ Card behind all the cards in the card read hopper.

Object Program Corrections and Data Cards

When the PAT control program reads a card to determine whether there are any corrections (patches) to be made to the object program, it looks for cards in load-card format. Therefore, all corrections must be made in that format.

After the PAT Execute Card causes object program execution to begin, the object program might require card-input. These data cards must be placed immediately behind the PAT Execute Card.

Figure 5 shows the four possible combinations of correction cards and data cards.

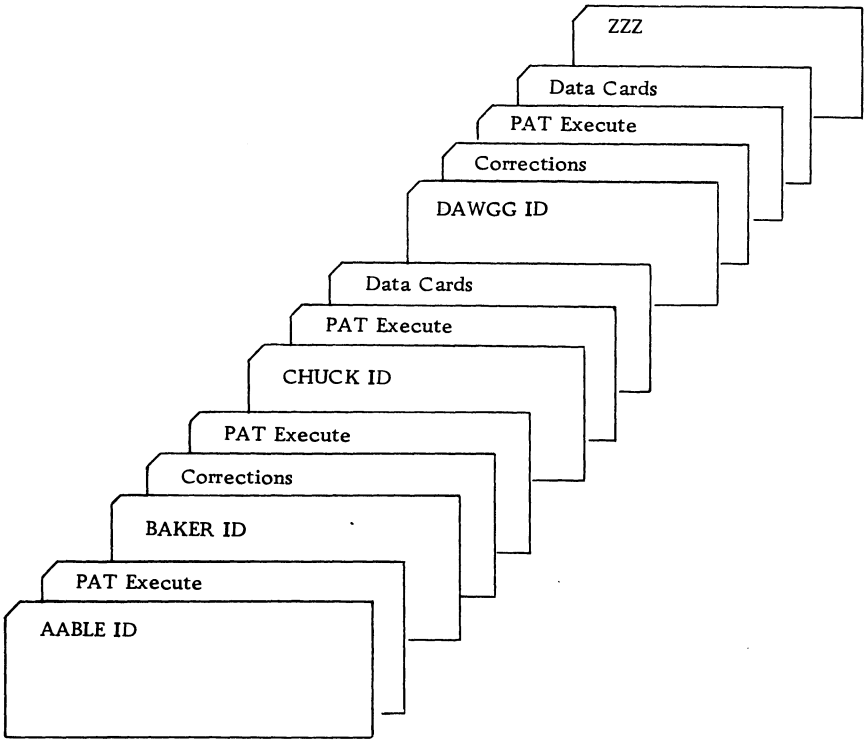

Figure 5. Object Program Corrections and Data Cards

Program AABLE has no corrections and does not read data cards; program BAKER has corrections but does not read data cards; program CHUCK has no corrections but does read data cards; and program DAWGG has corrections and reads data cards.

Substitution of a New Object Program

If it becomes necessary to substitute an entirely new object program for the one on tape, the following considerations apply:

1. If the Trace, Branch Trace, or Snapshot Program was used for the object program on the Test Tape, the original parameters must be valid for the new object program.

2. If the new object program was given a load program by the Autocoder Processor, the first five cards of the new deck MUST be discarded.

3. Two "Substitution" cards must be added to the new object deck. The first of these cards must be placed in front of the new object program. The second must be placed at the end of the new object program, but preceding the execute card (see Figure 6).

First Substitution Card Format

Columns	Contents
1	word separator character
2-6	ØØ281
7	word separator character
8-12	ØØØØ1
13	word separator character
14	N
15-80	blank

Second Substitution Card Format

Columns	Contents
1	word separator character
2-6	ØØ281
7	word separator character
8-12	ØØØØ1
13	word separator character
14	, (comma)
15-80	blank

NOTE: If the new object program uses the same execute instruction as the program on the Test Tape, then the execute card in Figure 6 is the PAT Execute Card. But if the new program's execute instruction is different from the execute record on tape, then the execute card must be the one given by the Autocoder Processor for the new object deck.

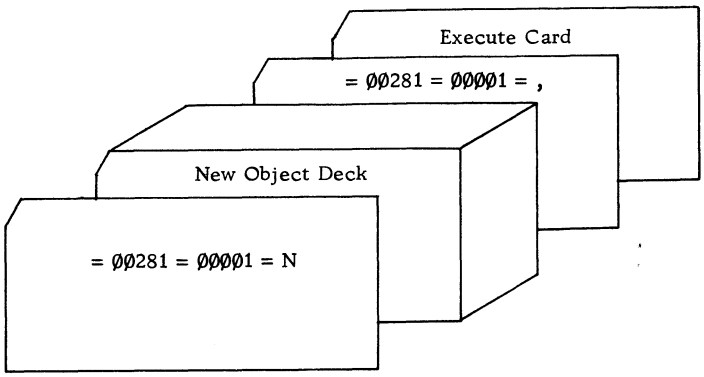

Figure 6. Substitution of a New Object Program

Control Information Changes for Utility Programs

During the Test Pass, the programmer can make certain changes to the control information given for the utility programs called in the Generation Pass.

Tape File Generator Programs (A and B)

The original tape files are always created during the Test Pass. After completion of those files, the utility program reads a card to determine whether it is an additional Tape File Generator control card.

If the programmer wishes to create more tape files than he originally specified, or if he wishes to change some of the data already written on tape, then he must provide new control cards and data cards. They will be read by the utility program at this time.

To create more tape files (on different units from the ones specified in the Generation Pass), the programmer must prepare new control cards, followed by the new data cards.

Changing data already on tape is effectively the same as creating additional files. (The original tape has been rewound and therefore the new data will be written over the original files.) The specifications of the original control card are still valid, if columns 4-5 are changed to "CD" (for card-input), instead of "T9." The control card must be followed by the complete deck of original data cards (with the revisions). (For placement of these cards, see Figure 7.)

NOTE: The Tape File Generator A Program reads a card only to determine whether it is a TFG-A control card. Similarly, the Tape File Generator B Program looks only for TFG-B control cards. If a utility program does not find a control card pertaining to itself, it returns control to the PAT control program.

Trace Program

The parameters of the Trace can be altered, but the Trace Program, itself, cannot be relocated in the Test Pass. Parameter alterations are made in **load-card** format and are read into storage when the PAT control

program branches control to the card reader for corrections to the object program. (For placement of these cards, see Figure 7.)

Format for the Start-Address Alteration Card

Columns	Contents
1	word separator character
2-6	the location (in the Trace Program) of the start-address: Ø227Ø + relocation-address.*
7	word separator character
8-12	ØØØØ5
13	word separator character
14-18	the new start-address
19-80	blank

*The relocation-address is the one punched in columns 14-18 of the original Trace Program control card. If that was 1ØØØØ, for example, then columns 2-6 of this card would be punched, 1227Ø. If no relocation-address was punched in the original control card, then columns 2-6 of this card must be punched:

3927Ø for the 40K version of PAT,
or
Ø927Ø for the 10/20K version.

Format for End-Address Alteration Card

Columns	Contents
1	word separator character
2-6	the location (in the Trace Program) of the end-address: Ø2275 + relocation-address.*
7	word separator character
8-12	ØØØØ5
13	word separator character
14-18	the new end-address
19-80	blank

*See explanation under the card format for altering the start-address. If no relocation-address was punched in the original control card, then columns 2-6 of this card must be punched:

39275 for the 40K version of PAT
or
Ø9275 for the 10/20K version.

NOTE: If the programmer wishes to bypass the Trace Program, he must prepare alteration cards in which the new end-address is that of the second instruction that follows the instruction specified by the start-address. Although this will not entirely eliminate the Trace listing (those three instructions will still be traced), execution time required by the Trace Program will be minimized.

Branch Trace Program

This program can be entirely eliminated for any given run of the Test Pass. The programmer must prepare the following deletion card.

Deletion Card Format

Columns	Contents
1	word separator character
2-6	the location of the first instruction in the Branch Trace Program*
7	word separator character
8-12	ØØØØ8
13	word separator character
14	J
15-19	the address of the first instruction of the object program**
20	blank
21	word separator character
22-80	blank

*38133 for the 40K version of PAT, or Ø8133 for the 10/20K version.
**Not necessarily the same as columns 4-8 of the original Branch Trace control card.

Placement of this card is the same as that for the Trace Program alteration cards. (See Figure 7.)

Snapshot Program

The Snapshot Program cannot be deleted or altered in the Test Pass. To eliminate the Snapshot Program and/or to substitute the Trace or Branch Trace Programs, the programmer must run another Generation Pass.

Tape Print Program

During the Test Pass, all tapes originally specified will be printed unless the programmer instructs the operator to bypass the tape print. (See "TPMK?" message in the Operator's Guide.) After the original tape prints have been executed, the Tape Print Program reads a card to determine whether there are more T/P control cards. If the programmer wishes to have more tapes printed, then the new control cards are read, and the additional tape prints executed, at this time.

The placement of the new control card(s) corresponds to the placement of the original control card(s). (See Figure 7.)

NOTE: Additional Tape Print control cards are read even if the operator bypasses the original tape print(s).

Disk Utility Programs

Additions to Original Disk Program Specifications

After each disk program completes its execution as specified during the Generation Pass, it reads a card to determine whether there is an additional Program Call Card for that particular utility program.

At this time, the programmer can give additional areas of disk storage for the disk utility programs that were called in the Generation Pass. In order to do so, he must provide four new control cards for each utility program to which he wishes to give additional specifications. (See Figure 7.) Additions can be made by both the Machine Specifications and Program Control Cards.

Additional areas for the Disk-to-Tape Program must be unloaded onto a different tape unit from those originally specified. (This program rewinds the output tapes before it goes to the card reader for new control cards.)

Corrections to Original Disk Program Specifications

If an error (caused by incorrect control card information) occurs during the execution of a disk program, the program branches control to the card reader to look for new control cards for that particular program. Therefore, a given Test Pass run can be used to correct errors of a previous Test Pass run.

For example, assume that three disk areas were originally specified for the Disk-to-Printer Program. The Program Control Card specified the Move mode for all three areas, but the third area was actually loaded in the Load mode. An error message would be written on the console typewriter when the program attempted to print that area in the Move mode. The programmer can correct the error condition during a subsequent Test Pass run by providing a new set of control cards for that utility program. But since the Disk-to-Printer Program will branch control to the card reader only after it has correctly processed the first two areas, the new Program Control Card can begin with the third area.

The Disk-to-Tape Program is an exception to the correction procedure. Because the tape has been rewound by the time the program looks for new control cards, all of the areas originally specified must be specified again on the new control cards, including any areas that may have been written on tape without error.

NOTE: Before execution, each disk utility program types a program-specification message on the console typewriter, regarding the operation it is about to perform. (Unlike the single utility disk programs, the PAT disk programs do not halt after this message, but continue processing.) Each program also types an end-of-program message, which signifies that it is transferring control to the PAT control program. (See Part II of this manual for details concerning these program messages.)

If no error messages are written between the program-specification message and the end-of-program message, the disk program was successfully completed.

Card Arrangement for the PAT Test Pass

Figure 7 illustrates proper sequencing for two Test Pass packets. Following the illustration is a card-by-card explanation of the deck. Compare this figure to Figure 4. The sequence established in the Generation Pass for program AABLE and its associated utility programs must be maintained in the Test Pass.

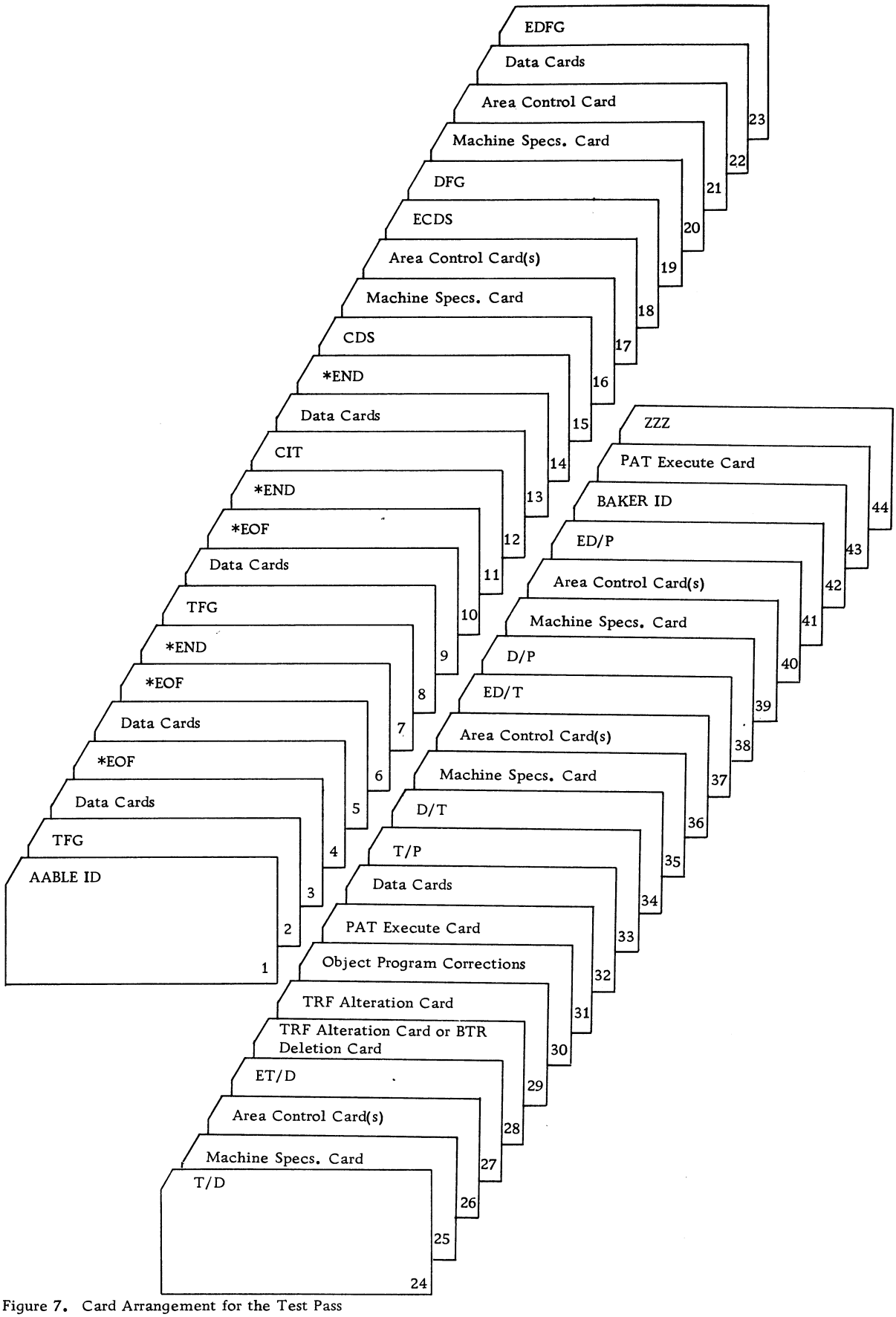

Figure 7. Card Arrangement for the Test Pass

Explanation: Card Arrangement for PAT Test Pass

Cards	Explanation
1	ID Card for first object program to be tested.
2	Original TFG-A control card: card 4, Figure 4.
3-7	Corrected data with necessary control cards for tape marks and rewinding. (Will be written over original data.)
8	Original TFG-A control card: card 10, Figure 4.
9-11	See cards 3-7, above.
12	New TFG-B control card for additional tape file.
13-14	New data with necessary control card for tape mark and rewinding.
15-18	Control cards for additional area(s) of disk storage to be cleared.
19-23	Control cards and data cards for additional disk file to be generated.
24-27	Control cards for additional area(s) of disk storage to be loaded from tape, and/or reloaded with corrected tape data.
28-29	Parameter alteration cards for the Trace Program OR deletion card for the Branch Trace Program (single card).
30	Corrections to the object program (in load-card format).
31	PAT Execute Card to branch to the Test Tape for the object program's execute record.
32	Data cards that the object program reads during its execution.
33	New control card for additional tape print.
34-37	Control cards for additional area(s) of disk storage to be put on tape.
38-41	Control cards for additional area(s) of disk storage to be printed.
42	ID Card for second object program to be tested.
43	PAT Execute Card.
44	Supplied by the operator.

NOTE: It is not necessary to include new cards for all the utility programs called for in the Generation Pass. When a utility program branches control to the card reader to look for new control cards, it reads the next card but does not stack it unless it is a control card for that program. Therefore, if a new control card does not apply to the particular utility program that is reading it, it is still available to the next utility program.

For example, if the programmer wishes to create more tape files with the Tape File Generator B Program, but does not wish to give new information to the Tape File Generator A Program, he can eliminate cards 2-11. But assume that the programmer wished to create additional files with both generator programs, and that he placed the new TFG-A control card after the new TFG-B control card. The TFG-A Program will create the tapes called for in the Generation Pass, branch control to the card reader, find a control card for a different utility program, and therefore return control to the PAT control program without creating additional tape files. Next, the TFG-B Program will create its tape files, go to the card reader, find the new TFG-B control card (left in the card read synchronizer by the TFG-A Program), stack that control card and create the additional tape file.

Now the new TFG-A control card is ready to be read. Successive utility programs will read it after their execution, leave it in the synchronizer (since it does not apply to them), and return control to the PAT control program without executing their own additions or corrections.

Thus, one misplaced control card prevents not only the reading of its own new information, but also the reading of new information for other programs.

Furthermore, if a misplaced control card is read before the PAT Execute Card, the PAT control program will "hang up" when it goes to the card reader to look for corrections to the object program, since the control cards for the utility programs are not in load card format.

OPERATOR'S GUIDE

The machine operator should be familiar with the basic concepts and terminology of PAT, as presented in the Introduction of this publication.

PAT Generation Pass (Creating the PAT Test Tape)

Control Cards Provided by the Operator

Two control cards are provided by the operator: the PAT ID Card and the ZZZ Card.

'PAT ID' CARD

This card must be placed in front of all the Generation Pass cards. It initiates a tape search for the generating program on the PAT System Tape.

PAT ID Card Format

Columns	Contents
1-3	PAT
4-5	blank
6-7	ID
8-80	blank

'ZZZ' CARD

This card must be placed behind all the Generation Pass cards. It indicates to the generating program that it has read all the cards for the Test Tape. The generating program then writes a record at the end of the Test Tape that will cause the tape to rewind every time that record is read by the Test Pass control program.

ZZZ Card Format

Columns	Contents
1-3	ZZZ
4-80	blank

Starting the Generation Pass

The following procedure must be observed to start the PAT Generation Pass:

1. Place the Generation Pass packets (with the PAT ID Card in front and the ZZZ Card behind) in the 1402 Card Reader.
2. Press READER START and END-OF-FILE.
3. Press PRINT START on the 1403 Printer.
4. Mount the PAT System Tape on channel 1, unit 8.
5. Mount a scratch tape on channel 1, unit 9. (This will become the PAT Test Tape.)

6. Clear storage from the console.

7. Display location ØØ2Ø1.

8. Set mode switch to ALTER and enter "L%B8ØØØØØ$.." into storage.

9. SET Instruction ADDRESS Register to location ØØ2Ø1.

10. Set mode switch to RUN and press START.

NOTE: If the Test Pass is to be run immediately after the Generation Pass, the operator must follow this procedure:

1. Place the Test Pass packets immediately behind the Generation Pass packets. There must be a ZZZ card behind each of these two groups of cards.

2. Press START after the Generation Pass gives the "EOJ" message, and after tape unit 9 (the Test Tape) has completely rewound to load point.

Generation Pass Messages

Printer Listing

During the Generation Pass, card images are listed on the printer for each test set. These images include the ID Card, any Comments Cards, the OBJ Card and the control cards for the utility programs. This listing should be used for reference during the Test Pass.

NOTE: The Generation Pass also lists the images of all cards not accepted by the PAT System, such as the 1410 Standard Load Program (5-card loader).

Standard Messages

The following messages are always given for a Generation Pass run.

Message	Explanation
PAT	The PAT ID Card has been read and the System Tape is being searched for the PAT generating program.
PAT PASS I	The generating program has been loaded into storage. Creation of the PAT Test Tape is about to begin.
EOJ PASS I	The ZZZ Card has been read. The PAT Test Tape is completed.

Tape Search Messages

The following messages indicate that the generating program is searching the System Tape for certain utility programs.

Message	Explanation
D/P	Tape search for the Disk-to-Printer Program.
D/T	Tape search for the Disk-to-Tape Program.
T/D	Tape search for the Tape-to-Disk Program.
DFG	Tape search for the Disk File Generator Program.
CDS	Tape search for the Clear Disk Storage Program.
*TFG	Tape search for the Tape File Generator A Program.
*TRF	Tape search for the Trace Program.
*CIT	Tape search for the Tape File Generator B Program.
*BTR	Tape search for the Branch Trace Program
*T/P	Tape search for the Tape Print Program.
*SNP	Tape search for the Snapshot Program.

NOTE: Messages preceded by (*) are given only by the 10/20 K version of PAT.

Error Messages

The following messages indicate error conditions detected in the input/output operations. The corrective actions given are based on the assumption that the Generation Pass run is to be immediately continued. (The error messages are in alphabetical order.)

Message	Explanation	Corrective Action
CD ERR	One of three possible card-read errors: 1. End-of-file 2. No transfer 3. Data check NOTE: In the case of the last or a single packet, CD ERR will be given instead of END ERR. (See END ERR below.)	1. Press END-OF-FILE and then READER START. 2. Press START. 3. Examine card in stacker "0." If it is mispunched, correct it and replace it in the read hopper in the usual manner and press START.
CRE	Card-read error.	Replace cards in the read hopper in the usual manner and press START.
END ERR (with ID)	1. END Card has been omitted from the packet for which ID is given. 2. ID Card has been detected in the middle of the object program cards.	1. This entire packet must be re-read under a new ID if it is to be placed on this Test Tape. (In the case of a last or a single packet, CD ERR will be given instead of END ERR.) 2. Address set to location ø2741 for 40K, or ø2963 for 10/20K.

Message	Explanation	Corrective Action
EOF T9	End-of-file reflective spot has been sensed on the Test Tape being created. The tape is incomplete. (The last test set was not finished, and there is no rewind record at the end of the tape.)	The tape can be used, but of course the last test set should not be called for in the Test Pass. Also, the tape will not be rewound during the Test Pass to permit the control program to continue a search for ID's called out-of-sequence.
OBJ ERR (with ID)	1. The ID Card has been omitted or mispunched. 2. The OBJ Card has been omitted. (No error exists, and this message is not given, if the object program is to be run with the Trace, Branch Trace, or Snapshot Program, and there is a control card for the utility program.	Option to Bypass. To bypass this entire packet, press START. The generating program will then read cards until it finds the ID Card for the next packet. Correction 1. Correct the ID Card or provide one if it was omitted. Replace cards in the read hopper in the usual manner. SET Instruction ADDRESS Register to location Ø13Ø9 for 40K, or Ø132Ø for 10/20K. Set mode switch to RUN and press START. 2. Provide an OBJ Card. Replace cards in the read hopper in the usual manner (this time include the last card read into stacker "1"), place the OBJ Card in front of these. Proceed as in (1) above.
PRT ER	Printer error.	Press START to try again.
PRT NO RDY	Printer Not Ready.	Place Printer in a Ready status and press START.
RAM CD ERR	The Program End Card for one of the disk utilities has been omitted or mispositioned.	Provide or correctly position the Program End Card. Replace the cards in the read hopper in the usual manner and press START.
RD ER T8	Read-error from the PAT System Tape. (This message is given by the PAT generating program.)	Press START to attempt 10 more reads.
RE	Read-error from the PAT System Tape. (This message given by the initial "tape read-in" routine.)	Press START to attempt another read.
TP 8 NR	The tape unit on which the System Tape is mounted (unit 8) is Not Ready.	Place tape unit 8 in a Ready status and press START.

Message	Explanation	Corrective Action
T9 NR	The tape unit on which the Test Tape is being generated (unit 9) is Not Ready.	Place Tape unit 9 in a Ready status and press START.
WRT ER T9	Write-error on the Test Tape. Message is given after 25 attempts.	Press START to skip tape forward. Another attempt to write is then made.

PAT Test Pass (Running the PAT Test Tape)

Control Card Provided by the Operator

The operator must place a ZZZ Card behind all the Test Pass Cards. This card is a duplicate of the ZZZ Card used for the Generation Pass.

Starting the Test Pass

If the Test Pass is run immediately after the Generation Pass, the operator must follow the procedure given in the NOTE under "Starting the Generation Pass."

If the Test Pass run is initiated at any other time, the following procedure must be observed:

1. Place the Test Pass packets (with the ZZZ card behind them) in the card reader.
2. Press READER START and END-OF-FILE.
3. Press PRINT START on the printer.
4. Mount the PAT Test Tape on channel 1, unit 9. (The Test Tape must be at load point.)
5. Clear storage from the console.
6. Display location ØØ2Ø1.
7. Set mode switch to ALTER and enter "L%B9ØØØØØ$.." into storage.
8. SET Instruction ADDRESS Register to location ØØ2Ø1.
9. Set the mode switch to RUN and press START.

NOTE: The printer listing given by the Generation Pass should be used for reference during the Test Pass.

Test Pass Messages

Standard Messages

The following messages are always given for a Test Pass run:

Message	Explanation
(ID name)	The ID Card for the indicated program has been read. The Test Tape is being searched for that test set.

Message	Explanation
FOUND	The test set indicated by the above message has been located on the Test Tape.
OBJ	The object program is about to be loaded into storage. This message is accompanied by a program halt to allow for any special set-ups that may be required by for the object program.
CRE	In the Test Pass, this message is used to indicate end-of-job for the Test Pass run. However, if there are still cards in the card read hopper, this message indicates a card-read error. (See the Error Messages.)

NOTE: The message "END TP" is given each time the control program reads the last record on the Test Tape. That record causes the tape to rewind. The control program can then continue searching for ID records from the beginning of the Test Tape.

Error Messages

The following messages indicate error conditions detected in the input/output operations. These messages are given by the PAT control program. (For error messages given by the utility programs, see Parts I and II of this manual.)

Message	Explanation	Corrective Action
RE	Read-error from the PAT Test Tape.	Press START to attempt another read.
CRE	Card-read error. (End-of-job, if all cards have been read. See the Standard Messages above.)	Replace cards in the read hopper in the usual manner and press START.

"TPMK?" Message

In PAT, the Tape Print Program halts before it prints the tape and allows the operator to write a tape mark on the tape, if it is desired. This halt is accompanied by the message "TPMK?".

If the tape to be printed has already been rewound, a tape mark should not be written, of course, and the operator simply presses START to begin execution of the tape print.

However, if the object program that created the tape did not reach an end-of-job condition, the tape has probably not been rewound. A tape mark should be written to enable the Tape Print Program to stop when it has printed all the information written by that object program.

To write the tape mark, the operator must press either PROGRAM RESET, or COMPUTER RESET, then START.

Bypassing the Tape Print Program. The tape prints specified during the Generation Pass can be bypassed in the Test Pass. When the utility program halts to permit the writing of a tape mark, the operator must follow this procedure to bypass the tape print:

1. Press COMPUTER RESET

2. SET Instruction ADDRESS Register to location Ø391Ø.

3. Set the mode switch back to RUN and press START.

NOTE: This procedure can also be used after a small portion of the tape has been printed. In this case, the operator presses STOP after the desired amount of information (as specified by the programmer) has been printed. The operator then follows the procedure above.

The PAT System Tape Creation (10/20K Version)

IBM supplies a card deck that contains all the necessary routines and utility programs to create a PAT System Tape. The following procedure must be observed:

1. If the System Tape is being created for a 20K machine, one card must be removed from the deck to enable the Storage Print Program to print the top 10K of storage. The PAT deck has two cards with "080PAT12" in columns 73-80. Remove the second one. No alteration need be made for a 10K machine.

2. Place the card deck in the 1402 Card Reader.

3. Press READER START and END-OF-FILE.

4. Mount a scratch tape on channel 1, unit 8. Place in a Ready status.

5. Clear storage from the console.

6. Display location Ø9247.

7. Set mode switch to ALTER and enter "L%11Ø9257%." into storage.

8. SET Instruction ADDRESS Register to location Ø9247.

9. Set mode switch to RUN and press START.

10. The message "EOJ" will be typed on the console typewriter upon successful completion of the PAT System Tape.

11. File protect the System Tape.

NOTE: The message "T8NR" means that the unit on which the System Tape is mounted (unit 8) is Not Ready.

The PAT System Tape Creation (40K Version)

IBM supplies a card deck that contains all the necessary routines and utility programs to create a PAT System Tape. The following procedure must be used:

1. Place the card deck in the 1402 Card Reader.
2. Press READER START and END-OF-FILE.
3. Mount a scratch tape on channel 1, unit 8. Place in a Ready status.
4. Clear storage from the console.
5. Display location 39247.
6. Set mode switch to ALTER and enter "L%1139257$." into storage.
7. SET Instruction ADDRESS Register to location 39247.
8. Set mode switch to RUN and press START.
9. The message "EOJ" will be typed on the console typewriter upon successful completion of the PAT System Tape.
10. File protect the System Tape.

NOTE: The message "T8NR" means that the unit on which the System Tape is mounted (unit 8) is Not Ready.

GLOSSARY

Control Program

Controls the execution of the test sets during the Test Pass. Each object program to be tested with PAT is automatically provided with the control program.

Generation Pass

The first of the two PAT passes. The Generation Pass accepts the PAT System Tape and card packets as input, and produces a PAT Test Tape and printer listing as output.

Generating Program

Controls the creation of the PAT Test Tape. It is part of the PAT System Tape.

Object Program

In relation to PAT, the program to be tested. It is written on the Test Tape during the Generation Pass, and executed during the Test Pass.

Packet

The particular group of cards pertaining to one object program. A Generation Pass packet contains the object program, control cards to delineate that object program, and control cards for utility programs. A Test Pass packet contains control cards to initiate execution of a test set, and cards for changes to the information given in the Generation Pass.

Pass I

See "Generation Pass."

Pass II

See "Test Pass."

PAT System Tape

The tape created from the card deck supplied by IBM. It contains the generating program for the Generation Pass, the control program for the Test Pass, and the PAT utility programs. The System Tape is input to the Generation Pass.

PAT Test Tape

The tape created by the Generation Pass. It consists of a series of test sets, followed by a rewind-tape record that enables the Test Tape to be continuously searched for particular test sets. The Test Tape is input to the Test Pass.

System Creation

The process of creating a PAT System Tape from the card deck supplied by IBM.

System Tape

See "PAT System Tape."

Test Pass

The second of the two PAT passes. The test sets created by the Generation Pass are executed in the Test Pass. A given test set can be executed in any number of Test Pass runs, each time accepting new information from the Test Pass packets.

Test Run

Can mean an entire run of the Generation Pass immediately followed by the Test Pass. Usually, however, "test run" refers to a given run of the Test Pass.

Test Set

The particular group of programs pertaining to one object program. A test set consists of the object program, the PAT control program, certain automatically included utility programs, and PAT utility programs selected by the programmer.

Test Tape

See "PAT Test Tape."

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