

REFERENCE MANUAL

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**DMF II SORT**



**SYSTEM TEN** COMPUTER BY **SINGER**

**SINGER**  
BUSINESS MACHINES

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**SINGER**  
**BUSINESS MACHINES**

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## PREFACE

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This manual provides the programmer with specific information required to sort files on the Singer Model 40 and 42 Disc drives. The programmer must have a working knowledge of the Disc Management Facility (DMF) and should refer to the DMF II Reference Manual (Publication No. 44-B800-401-00).

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Section 1  
GENERAL DESCRIPTION

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## GENERAL DESCRIPTION

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The DMF II Sort program for the System Ten\* computer sorts disc records into a user-specified sequence. Up to five input files may be concatenated for sorting and may be contained on tape or disc. Output may be directed to a separate file or may replace one of the input files. Each field may be specified to be ascending or descending and to have either character or numeric collating sequences. By specifying INCLUDE and OMIT parameters, specific input records may be selected. Otherwise, all records are automatically sorted. The selected records may optionally be reformatted under parameter control to provide more efficient processing and disc space utilization. Up to ten sort control fields may be specified. The DMF II Sort has a special facility to allow restarting of the sort, if necessary.

All input and output are performed via DMF II LIOCS. The maximum block size for tape or disc is 1000 characters. Blocking and deblocking will be performed by LIOCS. Both cylinder- and surface-mode disc packs can be used. Control files can be used to identify the files accessed by the sort at execution time, instead of using command statements. The data and work files that are accessed by the DMF II Sort cannot be invalidly accessed by any other programs which are operating simultaneously.

Applicable documents related to the use of DMF II Sort are the DMF II Reference Manual (Publication No. 44-B800-401-00) and the Assembler II Reference Manual (Publication No. 44-B151-401-00).

\*A TRADEMARK OF THE SINGER COMPANY.

Section 2  
SYSTEM GENERATION

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INSTALLATION PROCEDURE  
OPERATING INSTRUCTIONS

## SYSTEM GENERATION

---

The DMF Disc Sort uses the permanent low core device assignments for determining where the sort parameters are to be read, where the progress messages are to be written, and where the sort diagnostic listing is to be written.

The DMF MAINT/ASSIGN function must be used to alter any of the device assignments. The logical devices used by the sort are:

- READ The sort control parameters are input from this device.
- CONO The sort progress messages are output to this device.

All data devices are specified in the parameters via pool.file identification. User exits (for Model 21 processors only) may use all DMF II facilities, including the standard device assignments and any specific DMF II files through common resident DMF II.

### INSTALLATION PROCEDURE

- FILE The DMF Disc Sort object deck into a DMF pool; refer to the DMF Reference Manual.
- CREATE A relative access work pool (or pools) which will be able to handle any sort that may be attempted. The equation on page 4-2 should be used for determining the necessary size. The pool must be a null pool.

### OPERATING INSTRUCTIONS

The READ and CONO devices must be properly assigned, via the PERM mode of assignment, prior to starting the sort.

The sort may be initiated via the conversational loader or a Job Stream File. Sort parameter statements must be in the Job Stream File, if a JSF is present, or in the READ unit.

Section 3  
DISC SORT STRUCTURE

---

ASSIGNMENT PHASE

INPUT PHASE

EXTERNAL SORT PHASE

GATHER PHASE/OUTPUT PHASE

FINAL CONTROL PHASE

## DISC SORT STRUCTURE

---

The DMF II Sort functions through the following sequentially executed program phases:

- Assignment Phase
- Input Phase
- External Sort Phase
- Gather Phase/Output Phase
- Final Control Phase

### ASSIGNMENT PHASE

The assignment phase processes the control statements via the syntax analyzer and validates the sort parameters to ensure that the specified data is sufficient for proper sort execution. The data contained on the control statements is then expanded to provide the necessary parameters used by the subsequent sort phases.

Unless output to CONO is assigned to IGN, or the input is from a conversational device, the control statements are listed during this phase, including any diagnostic messages.

If the control statements entered are incorrect syntactically, or the parameters are inconsistent or incomplete, the sort will terminate at the end of this phase. However, if the input parameters are satisfactory, the Internal Sort Phase is automatically loaded.

During this phase, all tape and disc drives required are checked to ensure that they are all on-line. If not, the operator is notified and requested to turn the drives on.

### INPUT PHASE

In the input phase the input files are opened and processed sequentially. The records are read into core, selected, reformatted, sequenced, and written out in variable-length strings,

## DISC SORT STRUCTURE

---

taking advantage of any inherent ordering of the data. These strings are then passed to the external sort phase in the sort work area.

The input user exit replaces the standard input read, select and format processing, delivering records which are then sorted into the strings.

If a GATHER or ADDRROUT sort type is requested, only the key information in the record and record address is sorted.

### EXTERNAL SORT PHASE

The external sort phase performs successive merges of the strings created in the assignment phase, reducing the number of strings until the number remaining can be processed by the last merge pass. Checkpoints are taken during this phase to permit interruption of the sort and subsequent restart. The last merge pass is initiated and, if GATHER was not requested, these remaining strings are merged, sequence-checked, and written into the user's output file according to the specified output parameters. If GATHER was requested, the strings are merged, sequence-checked, and written in to the work file.

### GATHER PHASE/OUTPUT PHASE

The gather phase reads the sorted keys and retrieves the records in an optimal manner, writing them in to the output file in sorted sequence. If not a GATHER sort, the output phase performs the final merge and writes the data in to the specified output file. The records are sequence-checked before they are written.

The output user exit replaces the standard output writing, disposing of the data however desired.

### FINAL CONTROL PHASE

This phase prints the sort control information as compiled by input and output sort phases, and the sort terminates.

Section 4  
CONTROL STATEMENT SYNTAX

---

GENERAL DESCRIPTION

CONTROL STATEMENT PREPARATION CONSIDERATIONS

WORK AREA CONSIDERATIONS

CHECKPOINT/RESTART

USER EXITS

PARAMETER STATEMENTS

SORT

INCLUDE/OMIT

FIELD

OUTPUT

WORK/RESTART

INPUT

COMMENT STATEMENT

END CONTROL STATEMENT

## CONTROL STATEMENT SYNTAX

---

### GENERAL DESCRIPTION

Control statements are required for each sort execution to define the user's specific sort operation. The control statements are read by the assignment phase of the disc sort. The control statements may be entered on the Model 30 Card Reader, the Model 70 Workstation or Model 80 Display. Provision is made for comments within the control statement input stream.

All control cards submitted to the sort are listed on the sort log (CONO) and validated for correct syntax and proper parameter specifications. Syntax errors will be flagged by an asterisk(\*) below and near the erroneous field. Functional errors will be indicated by an appropriate diagnostic message.

### CONTROL STATEMENT PREPARATION CONSIDERATIONS

The control statements are analyzed by the Syntax Analyzer.

When an asterisk (\*) appears in position one, the entire statement will be treated as a comment and will receive no processing other than being listed on the sort log.

The operation (SORT,INPUT,OUTPUT,WORK,END,INCLUDE,OMIT, and RESTART FIELD) entry may be started in position one, or may be preceded by any number of blank positions. The operation field must be followed by at least one blank.

Optional values contained in parenthetical expressions may be omitted from right to left and do not require commas to indicate their omission. For example, in

(VALUE1,VALUE2,VALUE3,VALUE4)

if VALUE3 and VALUE4 were omitted, the expression is written as

(VALUE1,VALUE2)

However, if VALUE3 were omitted, but VALUE4 were specified, then a comma would be inserted to indicate the omitted value, as follows:

(VALUE1,VALUE2,,VALUE4)

The OMIT,INCLUDE, and FIELD statements must appear in a logical sequence. All other control statements may appear in any order with the exception of the END card which must be the last to mark the end of the control statement input.

All control statements, with the exceptions of INCLUDE, OMIT, and FIELD, and certain explicit value declarations, must appear because there are no preset sort parameters.

A control statement continuation is indicated by a non-blank character in column 80. If the last character in position 80 is a semicolon, it should not be included.

WORK AREA CONSIDERATIONS

One or two work files may be specified for each sort execution. The first work file area specified will contain the control and checkpoint area.

Approximately 2.1 times the number of sectors of the input data in work file format is required for one sort work area, or 1.05 times the number of sectors in work file format in each of the two work files.

Work file formats can become complicated by efficiency considerations. The work file record size will be the output record size for NON-GATHER and NON-ADDRROUT sorts. For GATHER and ADDRROUT sorts, the work file record size will be 8 + the sum of the lengths of all control fields. With this work file record size, the amount of work file space can be calculated as follows:

$$\frac{200}{\text{work file record size}} = B \text{ (only the integer portion of B should be used)}$$

$$\frac{\# \text{ of records in input file}}{B} = K$$

Then for two work files, the number of sectors required is:

Work file 1 50 + K sectors  
 Work file 2 K sectors

For one work file, the number of sectors required is  $50 + 2 * K$  sectors. At execution time, the minimum number of records that are able to be sorted in the current work file configuration will be printed for reference.

More work file space may be specified without loss of performance. Work file sizes need not be identical.

#### CHECKPOINT/RESTART

Throughout the external sort phase, checkpoints of the progress of the sort will be taken. The effect of these checkpoints is to provide the user with the capability of restarting the sort with negligible duplication in the event of a requested step cancellation, machine failure, or power failure. The operator may request the program to perform a controlled step cancellation after a checkpoint by forcing a service request condition in the sort partition.

Before calling in the sort for a restart, the operator must call the MAINT UNLOCK function and unlock the work pool.file(s). Restart is effected by invoking the sort and entering a RESTART command through the READ logical unit. The END card is also required to logically terminate the input data. The RESTART command must identify the work area(s) used initially.

No other sort control cards except END may be specified since the restart procedure retrieves all the necessary information from the work file. No intervening use of the sort work files is permitted. The only information specified on the restart card is the work file names as specified on the work control card for the sort. If the message level is 2 on the sort control card, status messages will be specified each time a check point is taken.

Job stream file processing in progress when the restart was required will not be resumed by the sort via a restart operation. The user must specify the correct job stream sequence to the sort with restart commands to process from a job stream file.

#### USER EXITS

Input and output user exits are available on the Model 21 Processor. Either or both exits may be active in a single sort.

Each user exit is a pool.file name, loaded by the sort through a call to the Common Resident Load function. The user exits may perform additional overlays and use other DMF II facilities, while using only the core space allocated to them. They should not, however, terminate the sort, which would leave the sort work files open with permanent locks.

The contents of the index registers should be saved when the exit gains control and should be restored just before returning control to sort.

#### Space

User exits are employed only in a sort which utilizes a 10K common region allocated to the sort. User exit phases must be partition resident, below location 5000.

The highest ten bytes of each user exit are, by convention, the entry point for that user exit. Space below this entry point is available to the user exit code, within the constraints under DMF II. Sorting efficiency increases as user exits decrease. If both input and output user exits are present in the same sort each exit should be as small as possible. The exits will reuse the same low partition area, but not necessarily all of the same area.

The sort program will not use the DMF II partition transient area below 1000 during the presence of either user exit.

No core area will be common between the input and output user exits, because the external sort phase will reuse the user exit area. Information may be passed from one area to the other in data records, or in a separate file. Input and output user exits can share code only by loading a common subprogram into their own areas.

#### Input User Exit

The input user exit is responsible for delivering each data record to the sort. This replaces the sort functions of reading the input files, selecting the records to be sorted, and reforming the record using the field select function. When the input user exit is active, no input file description parameters, include/omit parameters, or field parameters, will be accepted by the sort.

With each call by the sort to the input user exit, either a record is moved into the location specified by the sort followed by a normal return, or an end of file return is made. The last 10 bytes of the input user exit is the entry point. The calling sequence in the sort is:

LINK 31, user exit

```

NOP   BUFADR,EOFADR

```

Normal return is indirect through register 3:

```

MA   1(4,3),*+16           SET ADDR OF BUFF IN MOVE INST
MC   data(rcd length),o    MOVE DATA TO SORT RCD AREA
B    &31                   NORMAL RETURN

```

Following the EOF return, no further calls are made to the input user exit. The sort calls the user exit from partition, but the record area supplied (BUFADR) may be in extended common. Indirect addressing, and consequently user exits, are available only on the Model 21 Processor.

#### Output User Exit

The output user exit passes records from the sort in sequence and disposes of them. The output user exit replaces the sort function of writing an output file. The output sequence check is performed regardless of the presence of the output user exit.

The normal sort call to the output user exit is:

```

LINK      31, EXIT
NOP       BUFADR,0

```

The end of file call to the output user exit is:

```

LINK      31,&EXIT+1

```

No data is supplied with the end of file entry. These calls will always be in partition. The BUFADR location, where the sort record is located, may be in common.

The last 10 bytes of the output user exit should be:

```

EXIT      BC      EOFADR(0),NORMAL(5)

```

to direct the end of file and normal calls to the proper routines.

Normal return is indirect through register 3:

```

B        &31                NORMAL RETURN

```

#### Restart Considerations

No restart facility is provided for the input phase of the sort. Consequently, input user exits have no special concern for the sort restart function.

The output phase of the sort may be aborted and restarted as the last checkpoint. This checkpoint is taken before the output phase is begun, before loading the output user exit. A restart with an output user exit will be successful if the user exit code can be repeated. Consideration should be given to the consequences of a restart when constructing an output user exit.

After a restart, the Job Stream Control Block is not re-established as it was under the initial running of the sort. Thus the user exit should not expect a restart to the running from a JSF file simply because the initial run of the sort had a JSF file.

#### Early or Abnormal Termination

The sort initializes location 300 to an equal sign and locations 301 and 314 to blank to indicate continuation of the job stream prior to any user exits. It never modifies these locations, except for further setting of location 314 with the appropriate error/communication code. A user exit may set its own value into 314, which would only be overridden by the sort if a functional sort error occurred.

The sort must terminate properly to assure proper disposition of the sort data and work files. Thus user exits must never terminate the sort prematurely.

#### PARAMETER STATEMENTS

The parameter statements listed below are in the standard Singer syntax. The statements contain all information required to perform a sort. The sort may contain multiple parameter statements but never use the Work or Restart statements simultaneously.

- Sort (required)
- Input (required)
- Output (required)
- Restart (required to restart the sort if it is terminated prematurely)
- Include (not required)
- Omit (not required)
- Field (not required)
- Comment (not required)

---

End (required, must be the last statement in the parameter string)

## SORT

The sort control fields are specified on this statement. The first field is the most significant. Each field is described according to its location within the record, its length, whether it controls in ascending or descending sequence, and whether it is sequenced algebraically (signed numeric) or according to the simple character collating sequence. If not specified, the order is assumed to be ascending and the sequencing is character. Up to ten control fields may be specified.

Three types of sort may be specified: Normal, GATHER, and ADDRROUT.

For the normal sort no STYPE= is specified. This type of sort must have an output record size of 100 characters or less, because the entire record is carried with the sort keys throughout the sort. The output record contains all the information in the record.

For GATHER and ADDRROUT sorts, only the record address and the key field information are carried through the sort, and only input records from disc files may be processed. The difference between GATHER and ADDRROUT is that the GATHER sort automatically retrieves the original records in an optimal manner before writing to the output file. The ADDRROUT option produces a relative output file of relative record numbers for use by RPG II to retrieve records via the record address feature. The GATHER or ADDRROUT type must be used for all records that are greater than 100 characters. ADDRROUT sorts may not activate the record reformatting functions. An ADDRROUT sort must have only one input file. When GATHER is used, all input files remain on the drives used during the input phase for the duration of the sort.

The message level option allows a particular level of messages to be printed on CONO.

Level 0 causes no messages to be issued to CONO during sort execution. Control cards will be typed on CONO unless the READ input device is conversational.

Level 1 causes only statistical messages to be typed.

Level 2 causes statistical and status messages to be typed. Statistical messages identify the number of records processed. Status messages identify the taking of a checkpoint.

If FIELD statements are used and the sort type is:

GATHER - the sort key fields must reference the input record since reformatting is performed in the Output Phase for this sort type.

NORMAL - the sort key fields must reference the reformatted record since reformatting is performed in the Input Phase for this sort type.

```

SORT KEY = (S1,L1[, [O1][,T1]])
KEYS  [, (S2,L2[, [O2][,T2]])].....
      [, (S10,L10[, [O10][,T10]])][,MSGLVL=n]
      [,STYPE= GATHER(G) [;]
      ADDRROUT(A)
    
```

S1...S10 Starting location of sort key (relative to 1). Must be 1-4 numeric digits and must not be greater than the input record size required.

L1....L10 Length of sort key. Must be 1-2 numeric digits.  $([S1+L1]-1) \leq \text{input record size}$ . Must be  $\leq 99$  for a character key and  $\leq 9$  for a signed numeric key.

O1.....O10 Sequence of sort for this key. A = ascending sequence; D = descending sequence. Optional - A is the default.

T1.....T10 Type of sort key. C = character; S = signed numeric. If the records contain negative numbers in this field specify S, otherwise specify C which allows a faster sort. Optional - C is the default:

NOTE: 1 indicates the most major sort key  
 2 indicates the next most major sort key  
 10, or the last key specified, indicates the most minor sort key

MSGLVL = n This parameter specifies the message level to be used by the sort. n must be a single numeric digit. The sort uses 0, 1, 2 at this time; any other digit will cause 0 level to be used. Optional -0 is the default.

SYPT=ADDRROUT/A This parameter specifies the type of sort to be processed. ADDRROUT (optionally spelled  
 STYPE=GATHER/G

A) is valid for relative and direct files only. This sort will write a relative output file containing relative record numbers only. GATHER (optionally spelled G) is valid for all file types. This sort will use only the sort key and the record disc address in the work record. If the output record is multi-sector, the sort type defaults to GATHER, since this will facilitate faster sorts. Optional - a normal sort is the default. That is, the entire record is used as the work record.

#### Examples

```
SORT KEY=(1,3,,S),MSGLVI=1,STYPE=G;  
SORT KEYS=(1,3),(10,15,D),STYPE=ADDRROUT;  
SORT KEYS=(1,3),(2,8,,S),(15,5,D,S);
```

NOTE: The semicolon (;) statement terminator is required if comments are present in the same record as the parameter statement. The sort statement is required for all sorts except RESTART when it is prohibited.

#### INCLUDE/OMIT

If either of these statements is present, then the sort is operating under record selection control. Each input record is then checked against the conditions specified on these statements, in the sequence in which the statements are presented to the sort. When a condition is met for an input record it is included, if it matches an include condition, or omitted from the sort, if it matches an omit condition. If a record does not match all conditions, it is omitted. If an INCLUDE or OMIT statement present has a void condition expression, then any record will match.

Up to five INCLUDE and/or OMIT statements may be specified. The INCLUDE/OMIT statement is not valid with an input user exit. INCLUDE/OMIT statements may not be used with an input user exit.

Up to five conditions may be AND'ed together on a single statement. Each condition consists of the following items:

- A starting location in the record.
- A relational operator.
- A constant.

The starting location in the record specifies the first character in the field relative to one. The relational operators are as follows:

<u>Condition Specified</u>	<u>Operator</u>
Record is greater than the constant.	GT
Record is greater than or equal to the constant.	GE
Record is equal to the constant.	EQ
Record is less than or equal to the constant.	LE
Record is less than the constant.	LT
Record is not equal to the constant.	NE
Record is algebraically greater than the constant	AGT
Record is algebraically less than the constant.	ALT
Record is algebraically greater than or equal to the constant.	AGE
Record is algebraically less than or equal to the constant.	ALE

The constant can be up to 20 characters for logical relations and 9 digits for algebraic relations. It must be enclosed in apostrophes. The length of the compare is governed by the length of the constant so that 10,LT,'YYY' is a 3 character logical compare of locations 10, 11, 12 of the record with the value of the constant.

In the following examples, the file is an accounts receivable master with a name record (1 in column 1), an address record (2 in column 2), and old balance record (3 in column 1) (balance in column 2-8):

Example 1

Select only the name record for names from A to D and Y through Z, where the name starts in column 2.

INCLUDE (1,EQ,'1'),(2,GE,'A'),(2,LE,'D')

INCLUDE (1,EQ,'1'),(2,GE,'Y'),(2,LE,'Z')

Example 2

Select all name and address records and all old balance records with negative balances.

OMIT (1,EQ'3'),(2,AGE,'000000')  
Explicitly omits those records with a 3 in column 1 and where the balance is greater than or equal to zero.

INCLUDE (includes all records not previously omitted)

The total number of INCLUDE/OMIT conditions that can be specified is limited to five.

```
INCLUDE [ ACTIVE. ....,ACTIVE5 ]
OMIT    [ DELETE. ....,DELETE4 ]

[, (S1,REL1,'STR1')][,(S5,REL5,'STR5')][;]
```

INCLUDE This keyword directs the sort to use only those records which meet the conditions specified by the remaining parameters.

OMIT This keyword directs the sort to ignore those records which meet the conditions specified by the remaining parameters.

The INCLUDE/OMIT parameters are optional; if neither is used, all records in the file are sorted.

If only INCLUDE is used, the records specified are sorted and the remainder is automatically omitted.

If only OMIT is used, an INCLUDE statement with no parameters must be specified since an automatic INCLUDE is not used.

ACTIVE1..... This parameter specifies that the sort should test for active relative records.

ACTIVE5  
ACTIVE may be specified as any of the five entries.

This parameter generates a greater than or equal to (GE) comparison for the character o in position 1 of the record: (1,GE,'@')

Optional - no default.

DELETE1..... This parameter specifies that the sort should test for a logically deleted relative record.

DELETE must always be the last entry in the parameter list and must never be the fifth entry.

This parameter generates a range check similar to: (1,GE,'o'),(1,LE,'?')

Optional - no default

[(S1,REL1,'STR1')].....[(S5,REL5,'STR5')]

S1...S5                   The starting location of the record field to be compared with the literal 'STR1'.

This parameter must be 1-4 numeric digits and must be equal to or less than the input record size.

REL1....REL5           This is a two- or three-character operation that specifies the type of comparison used to determine whether the record is included or omitted.

STR1....STR5           This is the literal to be used for testing the input record field starting at S1...S5. The length of the literal determines the length of the input record field used in the comparisons. For an alphanumeric comparison, a literal of up to 20 characters may be specified; for numeric comparisons, 9 digits is the maximum.

Valid Examples:

```
INCLUDE (15,GE,'B065C'),ACTIVE;
OMIT (33,LT, 'MM'),(57,EQ,'DATE'),DELETE;
INCLUDE ACTIVE, DELETE;
OMIT (14,AGE,'470');
INCLUDE;
```

Invalid Examples:

```
INCLUDE (15,GE,'B'), DELETE , (33,LT,'MC');
OMIT (15,GE,'C'),ACTIVE,(',EQ, '='), (2,EQ,'M'), DELETE;
```

NOTE: DELETE must be the last entry and must never be the fifth entry.

OMIT/INCLUDE parameters are in an OR relation with each other (up to 5 per sort). The entries in an OMIT/INCLUDE statement are in an AND relation (up to 5 entries per statement).

## FIELD

The field statement directs the formation of records for sorting from:

Data fields from the input record.

Constants

The disc record address of the input record.

The sort record and the output record are the length of the fields identified on the field statement. This length must not be more than 100 characters.

The field statement is not permitted in an ADDRROUT sort or in a sort with the input user exit.

Fields selected may be overlapping or duplicated.

With field, sort control fields must refer to the record sorted as specified by the field statement for normal sorts. If the sort type is GATHER, the sort control fields must refer to the input record. For NORMAL sorts, reformatting occurs immediately after the record in read; for GATHER sorts, reformatting occurs just before the output record is written.

The FIELD statements (up to 15 per sort) define an output record which is different from the input record. The FIELD parameters specify which data is to be placed into the output record. The possibilities are:

Data from the input record

Constant zero(s)

Constant space(s)

The disc address of the corresponding input record

Constant literal (up to 20 characters in length)

---

SSSS	Specifies the starting location of the input record field to be moved to the output record.  Must be 1-4 numeric digits and must be $\leq$ input record size. Required for type 1 FIELD statements.
EEEE	Specifies the ending location of the input record field to be moved to the output record.  Must be 1-4 numeric digits where $((SSSS+EEEE)-1) \leq$ record size. Optional - defaults to 1.
ZERO/ZEROS	Specifies that LLLL zeros are to be moved to the output record. Required for type 2 statements.
SPACE/SPACES	Specifies that LLLL spaces are to be moved to the output record. Required for type 3 statements.
LLLL	Specifies the number of spaces or zeros to be moved. Must be 1-2 numeric digits. Optional - defaults to 1.
*	Specifies that the disc address (7 positions) of the input record is to be moved to the output record. This will be the relative record number for relative or direct files, or the sector number for linked sequential files. This value will be followed by a digit (1-5) which denotes the input file number from which this record was built.
'STRING'	Specifies a literal to be moved to the output record.

Up to 20 characters may be specified.

The order of the FIELD statements in the parameter string is of critical importance. The fields specified are moved to the output record in the order found. For example:

A FIELD=(\*) (relative record 12736), third file specified on the INPUT control statement)

```

B FIELD=(15,20)    (contains ABCDEF)
C FIELD=(SPACE)
D FIELD=(1,12)    (contains 012345678901)
E FIELD=(ZEROS,15

```

will generate this output record

```

A(8)   B(6)  C(1) D(12)      E(15)
00127363 ABCDEF 0 012345678901 0000000000000000

```

for a length of 42 characters.

## OUTPUT

The output statement specifies the output block size and the pool.file for the output file or the pool.file for the user exit.

The output block size must be equal to or a multiple of the output record size. For an ADDRROUT sort, the record size is 7; for a GATHER sort, it is equal to the input record size. Otherwise, it is equal to the input record size unless FIELD statements are present. Default size for the output block size is equal to the output record size. Output blocking is permissible only with relative access disc files and tape files.

The output file for an ADDRROUT sort must be a relative access file.

Except for GATHER and ADDRROUT, the output file for the sort may be specified to be the same as an input file. The sorted data will replace the original input data during the Output Phase.

```
OUTPUT EXIT = POOL1.FILE1[,BLKSIZE=BBBB][;]
```

```
OUTPUT FILE = POOL1.FILE1[,BLKSIZE=BBBB][;]
```

EXIT This parameter specifies the file name of the user exit to be used with this sort.

FILE This parameter specifies the file which will contain the final sorted output.

BLKSIZE This parameter specifies the output file block size. The default is the output file record size. This parameter should not be used with linked sequential output files.

Examples:

```
OUTPUT EXIT = SYSPOL.MOD4;
OUTPUT FILE = DATA.ACCNT,BLKSIZE=200;
```

WORK/RESTART

The work file(s) specified are relative access files of the proper size (see work area considerations). One or two files may be specified. To maximize efficiency of the sort, two work files should be specified, and if possible, they should be on separate drives with the first work file on a drive different from the input file(s). If this is not possible, when using surface mode packs, the same cylinders should be allocated on separate tracks, to minimize the seek time involved in the sort. The input and output drives should be separated from the work file drives where possible. The first work file specified will contain the sort control information.

$$\left. \begin{matrix} \text{WORK} \\ \text{RESTART} \end{matrix} \right\} \left\{ \begin{matrix} \text{POOL} \\ \text{POOLS} \\ \text{FILE} \\ \text{FILES} \end{matrix} \right\} = \text{POOL1}[\text{.FILE1}][,\text{POOL2}[\text{.FILE2}]];$$

WORK This keyword is used to specify the work area(s) for a normal sort.

RESTART This keyword is used to specify the work area(s) for a RESTART sort. The work area(s) specified must be the same as those specified for sort which was terminated. The work area(s) must not be used between termination and restart.

POOL1[FILE1]  
[POOL2[FILE2]] The pools specified must be relative access pools. If the file name is omitted, the pool name is used as the default file name.

Examples:

```
WORK POOLS = WRK01,WRK02
WORK FILES = WRK01,WRK02.WRKF2
```

## INPUT

The input control statement may contain the following information:

Record Size = 1-1000; Block Size = 1-1000, optional if supported  
and either

Input File Specifications

or

User Exit Specification

The block size and record size information will be passed directly to the DMF II File Control Block without validation other than syntax checking, and will be used for buffer allocation throughout the input phase. The user exit specification is a pool,file name.

Up to five input files may be specified on disc and/or tape. The record size must be identical for all files. All disc files must have the same organization. The files will be opened consecutively, so that only one file will be open at a time. All files will be processed by LIOCS in a sequential manner as described in the DMF II Reference Manual. However, if STYPE GATHER is specified, all disc input files are open concurrently during the GATHER Phase, and all files must be mounted on the same drive number that was used during the Input Phase.

Magnetic tape and IOCS files must be referenced via control files.

The control statements listed below are fully explained on the following pages:

```
INPUT EXIT = POOL.FILE,RECSIZE=RRRR[,BLKSIZE=BBBB][;]
INPUT FILE = [*]POOL1.FILE1[,[*]POOL2.FILE2].....
              [, [*]POOL5.FILE5],RECSIZE=RRRR,
              [,BLKSIZE=BBBB]
              [,TARGET=POOLT.FILET][;]
```

EXIT=POOL.FILE      This parameter specifies the file name of the user exit to be used with this sort.

FILE=                This parameter is used to specify the input file(s) to be processed by this sort.

For multiple input file sorts, each file must be the same type (except for tape input) and have identical record sizes.

TARGET=                   When input file types differ or an input tape file has records over 100 characters, the TARGET= parameter must be used.

The target file specified must be a relative access file. The asterisk (\*) preceding the input pool,file name indicates that this input file should be copied into the target file prior to beginning the sort.

RECSIZE                   This parameter is used to specify the record size of the input file(s). For multiple input file sorts, all files must have records of the same length. 1-4 numeric digits are required.

BLKSIZE                   This parameter should be used only with a single input file sort. If multiple input files are being sorted and the BLKSIZE parameter is used, all input files must have the same block size. 1-4 numeric digits are required if this parameter is used.

Examples:

```
INPUT EXIT = SYSPOL.MOD5,RECSIZE=100;
INPUT FILE = DATA.ACCNT,*DATA.INVNTY,
            DATA.PCKLST,*NEW.ACCNT,
            RECSIZE=150,BLKSIZE=300,
            TARGET=TEMP.TEMP;
```

COMMENT STATEMENT

Any 1-79 character entry following an asterisk (\*) that has been entered in position one will be printed as a comment statement in the sort log but will not be otherwise processed.

The parameters of the comment statement (see Table 4-5) are shown below:

\*Comments

Example

```
*PERSONNEL SORT PFL09Q PROJECT CHGS & DATES SEQ 710925
```

This comment statement says that file PFL09Q will be a sort of personnel by project charge numbers and dates; sort will have been completed Sept. 25, 1971.

END CONTROL STATEMENT

The END control statement is required to mark the end of the control statement deck; hence, any control or comment statements following the END control statement will not be included in the DMF II Disc Sort Program specified in the statements preceding the END control statement.

END/Comments

Example:

END/PRINT 7 COPIES FOR DISTRIBUTION A

In the example above, the END control statement marks the end of the control statement input and includes a final comment to print seven copies for distribution list A.

Section 5  
SORT USAGE CONSIDERATIONS

---

EQUIPMENT CONFIGURATION

I/O FILES

WORK AREA

I/O ERRORS

SORT KEYS

## SORT USAGE CONSIDERATIONS

---

### EQUIPMENT CONFIGURATION

The following minimum equipment configuration is required to execute the DMF II Sort program:

Model 20 or 21 CPU with a minimum of 10K partition.

Model 20 or 21 CPU with a minimum of 10K common (20K required for user exits)

Model 30 Card Reader, Model 70 Workstation or Model 80 Display

Model 50 Line Printer, Model 70 Workstation or Model 80 Display

Model 40 or 42 Disc Drive(s) (one or more)

*Requires ?* Model 45 Tape Drive(s) (one or more)

### I/O FILES

The DMF II Sort supports Linked Sequential, Relative Access, and Direct Access files on input and output. Variable Sequential files and Indexed Linked Sequential files are not supported. Direct Access files are handled in the same manner as Relative Access files. Unless INCLUDE and OMIT cards are used, every record location in a Relative Access file or a Direct Access file will be sorted, including the deleted and available record areas. Output files must pre-exist, or they will be written as a new Linked Sequential file.

Magnetic tape files are supported on input and output, and must contain fixed-length records. Variable-length magnetic tape files are not supported.

Control files can be used to identify input and/or output file parameters at DMF II Sort execution time. The command statements refer to the control files, and the control files refer to the data file.

WORK FILE

A work file must be available to the DMF II Sort program. It can be defined by assigning the name of an existing WORK FILE.

The WORK FILE must be a relative access file. The sort will check the contention flag in the work file label. If the file is being used by a program in another partition, the following message:

```
T)SORT :WORK FILE pppppp.ffff IN USE
```

will be displayed informing the operator to re-run the sort using a different work file; if the file is not being used, the sort will set the flag.

The DMF II Sort is flexible in terms of the number of sort key fields, record selection criteria, and record reformatting capabilities. However, it imposes restrictions in the use of the core work area. A maximum of 980 characters is available for use by the routines. To calculate the amount of space required, total the following values:

- All alphanumeric sort keys require 20 bytes.
- All numeric sort keys require 40 bytes.
- The INCLUDE/OMIT cards require 10 bytes plus the sum of all constants on that card rounded to the next tens value.
- Logical compares on an INCLUDE/OMIT cards require 20 characters.
- Numeric compares on an INCLUDE/OMIT cards require 30 characters.
- Each single column move, multiple column move or constant move on a FIELD card requires 10 characters.
- Each multiple column SPACE/ZERO field or tag insertion requires 20 characters.
- The FIELD card requires 10 characters plus the sum of characters in the constants supplied to the next higher tenth boundary.

Example:

```
INCLUDE      (1,EQ,'HDR'),(33,ALT,'45')
SORT         (33,3,D,S),(20,1)
FIELD       =  *
FIELD       =  (Space,13)
FIELD       =  (2D)
FIELD       =  (Zero,12)
FIELD       =  (33,34)
```

The INCLUDE card requires  $10+10+20+30 = 70$  characters.

The SORT card requires  $20+40 = 60$  characters.

The FIELD card requires  $10+0+(3 * 20)+(2 * 10) = 90$  characters.

TOTAL: 220 characters

Space limitation should not be a problem unless a considerable number of long constants are used in the INCLUDE/OMIT and FIELD cards.

## I/O ERRORS

Unrecoverable I/O errors cause the premature termination of the sort, with a message indicating the error. See Section 7 for the printed output information displayed with this termination.

## SORT KEYS

Up to ten sort control fields can be specified in the SORT Control Statement. The sort control fields can be noncontiguous and/or overlapped. However, total field size from the sort control card may not exceed 92 characters if a GATHER or ADDRROUT sort type is requested.

Character or signed-numeric collating can be specified for each sort control field in the SORT Control Statement. The most major sort field is specified first; the most minor sort field is specified last.

### Character Key

Maximum character key length is 100 positions for a single sort control field; the minimum character key length is one position.

All of the sort control fields must be wholly contained by the record.

Sorting a character key follows the sequence specified in the ANSI (American National Standards Institute) Table of Characters arranged in ascending sequence of value. See Table 5-1.

Table 5-1. ANSI TABLE OF CHARACTERS

␣ Space [blank]	0 Zero	@ At sign	P -0
! Exclamation	1 One	A	Q -1
" Quote	2	B	R -2
# Number	3	C	S -3
\$ Dollar	4	D	T -4
% Percent	5	E	U -5
& Ampersand	6	F	V -6
' Apostrophe	7	G	W -7
( Left paren.	8	H	X -8
) Right paren.	9	I	Y -9
* Asterisk	: Colon	J	Z
+ Plus	; Semi-colon	K	[ Left bracket
, Comma	< Less than	L	\ Reverse slant
- Hyphen [minus]	= Equal	M	] Right bracket
. Period	> Greater than	N	^ Circumflex
/ Slash	? Question	O	_ Underline

Signed-Numeric Key

A maximum of nine positions of mixed data (numeric and character) may be included in a data field specified for a signed-numeric key sort.

Each group of numeric data specified in the SORT Control Statement is converted to a signed numeric key by a form numeric operation. See Table 5-2 below:

Table 5-2. FORM NUMERIC EXAMPLES

Numeric data field:	5,376.68	837.59-	bbb374V	9R53/42-9
Signed-numeric key:	00537668	008375Y	000374V	000953429

Section 6  
SORT DIAGNOSTICS

---



## SORT DIAGNOSTICS

---

The following is a list of the DMF II Sort program diagnostic messages with an explanation of each message and the recommended response. Additional messages may be displayed by DMF II LIOCS or by service routines. (See the DMF II Reference Manual.)

NOTE: The prefixes of diagnostic messages are defined as follows:

- I) = Information for operator
- A) = Operator action required
- W) = Warning message
- T) = Terminal error with run terminated

### W) SORT:ALLOCATED COMMON LOCKED, NO COMMON USED

When attempting to allocate EXTENDED COMMON core space, the sort found that no EXTENDED COMMON was available.

- The sort will continue in a partition-only mode.
- User exits will cause the sort to terminate if no common is available.

### T) SORT:BLOCKSIZE NOT A MULTIPLE OF RECORD SIZE

The input BLKSIZE parameter did not specify a value which was a multiple of the input RECSIZE value

or

The output BLKSIZE parameter did not specify a value which was a multiple of the output record size. The user should:

- Ensure that the input BLKSIZE value is a multiple of the input record size (and that it matches the BLKSIZE value in the file label).
- Ensure that the output BLKSIZE value is a multiple of the output record size.

## SORT DIAGNOSTICS

---

The output record size is altered by the use of FIELD statements, and by the sort type - ADDR0UT. The user should:

- Correct the BLKSIZE parameter or remove the parameter from the statement.
- Rerun the sort.

### I) SORT:CHECKPOINT

A checkpoint record was just written. The sort may be restarted at this point.

- Information message.

### T) SORT:CHECKPOINT NOT TAKEN

RESTART was attempted for a sort which was terminated prior to a checkpoint being written.

- Rerun the sort.

### T) SORT:COPY INDICATED, NO TARGET FILE SPECIFIED

One or more input file names were preceded by an asterisk and no TARGET parameter was specified.

- If a copy is required, specify a TARGET file
- or
- Remove the asterisk(s) if a copy is not required.
  - Rerun the sort.

### W) SORT:COPY REQUESTED, NO SOURCE FILES SPECIFIED

The INPUT control statement contained the TARGET parameter; however, none of the input file names was preceded by an asterisk.

- If a copy is required, precede the proper file names with an asterisk

or

- Remove the TARGET parameter if a copy is not required.
- Rerun the sort.

#### T) SORT:CORE RESTRICTIONS EXCEEDED

The 980 character core restriction for sort keys, FIELD reformatting and record selection has been exceeded.

#### I) SORT:END OF SORT

Displayed on CONO. Normal end-of-job.

- Information message.

#### W) SORT:ERROR DURING ALLOCATION OF EXTENDED COMMON

The common allocation service routine returned an error status. The sort will not be able to use EXTENDED COMMON for this run.

- If user exits are specified, the sort will terminate.
- If no user exits are specified, the sort will continue.

#### T) SORT:ERROR DURING LOCATE/LOAD

The user exit file contained a bad sector or the user exit could not be found on the SYSRES volume controlling the sort. If user exits are not being used, display the sort object file and contact the nearest SBM analyst for assistance.

T) SORT:EXCESSIVE SORT KEY LENGTH FOR GATHER/ADDROUT

The sum of all keys exceeds 92 characters and the sort type requested was GATHER or ADDROUT. If the output record is a multi-sector record, GATHER is automatically used.

- If the keys must total more than 92 characters, the file must be sorted twice. Otherwise, reduce the size of the sort keys.

T) SORT:EXCESS CONTROL STATEMENT

Two or more control statements of the same type have been encountered.

- Remove the duplicate statement(s).

I) SORT:EXTENDED COMMON BEING USED

The sort program has successfully allocated a page of EXTENDED COMMON.

- Information message.

I) SORT:EXTERNAL SORT

This phase has begun.

- Information message.

T) SORT:FIELD CARD INVALID WITH ADDRROUT

Record reformatting is not permissible with ADDRROUT sorts.

- Resolve the inconsistent parameters and resubmit.

## T) SORT:FIELD CARD REFERENCES DATA OUTSIDE RECORD

- Check input record size and (a,b) or (a) values.
- Correct and resubmit.

## T) SORT:FIELD START LOCATION GREATER THAN END

In the form (a,b) of the FIELD card, a is greater than b.

- Check a and b and resubmit.

## T) SORT:FILE TYPE INCOMPATIBLE WITH GATHER/ADDRROUT

A non-relative access file was specified for ADDRROUT. The file is not disc resident for GATHER, or a user exit has been specified.

- Correct condition and resubmit.

## I) SORT:GATHER PHASE

The GATHER process has begun.

- Information message.

## T) SORT:I/O ERROR S mnnnnn

The disc access method returned an error status code when an attempt was made to access sector mnnnnn. The code S is the status code returned by the disc access method.

- If the error reoccurs, display the file and call the nearest SBM analyst for assistance.

## T) SORT:ILLEGAL OUTPUT FILE TYPE

The output file specified cannot contain the sorted output for one of the following reasons:

## SORT DIAGNOSTICS

---

- The output file is a direct or variable file.
- The output file is an index file.
- The output file is a linked-sequential file and blocking was requested.
- The output file is a linked-sequential file and an ADDROUT sort was requested.
- Specify a valid output file.
- Rerun the sort.

### T) SORT:INCLUDE/OMIT CARD REFERENCES DATA OUTSIDE RECORD

The INCLUDE/OMIT fields reference locations outside of the input record.

- Correct INCLUDE/OMIT cards and resubmit.

### I) SORT:INITIALIZATION PHASE

No syntax errors encountered; END card encountered; parameters are being validated.

- Information message.

### T) SORT:INPUT CARD POOL.FILE MISSING

This message indicates a serious problem in the DMF II syntax analyzer service routine or the sort semantic routine. Contact the nearest SBM analyst for assistance if this problem reoccurs.

### T) SORT:INPUT RECORD SIZE NOT SPECIFIED OR ZERO

The input control statement did not contain a RECSIZE parameter or the RECSIZE was specified as zero.

- Specify the correct size.
- Resubmit.

## T) SORT:INSUFFICIENT PARTITION CORE FOR SORT EXECUTION

This message indicates that the sort does not have enough partition core due to special features.

- Reduce size of user exit.
- Reduce number of sort control statements.

## I) SORT:INTERNAL SORT PHASE

This phase has begun.

- Information message.

## T) SORT:INVALID LENGTH FOR NUMERIC INCLUDE/OMIT

The literal specified in an INCLUDE/OMIT statement was longer than 9 digits and an arithmetic comparison was requested.

- Shorten the literal
- or
- Make the comparison alphanumeric.
  - Rerun the sort.

## T) SORT:INVALID RESTART WORK FILE SPECIFICATIONS

The sort cannot perform a restart because of one of the following reasons:

- The RESTART statement specified a work area not used by the terminated sort, or the first work area on the RESTART statement was not the first work area on the WORK statement.
- The work area containing the checkpoint information was used after the sort was terminated but before the RESTART was initiated.

## SORT DIAGNOSTICS

---

- Specify proper work areas

or

- Rerun the sort.

### T) SORT:KEYWORD EXPECTED, NOT FOUND

A statement was encountered in the sort parameters which did not have a recognizable keyword.

- Check for absence or incorrect spelling of a keyword.
- Correct and resubmit.

### T) SORT:nnnnnnn ADDITIONAL SECTORS REQUIRED

The value nnnnnnn indicates the number of additional work area sectors required to sort the file.

- If one work area was specified, provide an additional work area, follow the formula in the sector concerning work area considerations

or

- Specify a larger work area.
- If two work areas were specified, replace one with a larger area.
- Rerun the sort.

### I) SORT:nnnnnnn RECORDS INPUT FROM pppppp.fffff

nnnnnnn records read from the input file.

- Information message.

## I) SORT:nnnnnnn RECORDS SELECTED FOR PROCESSING

The value nnnnnnn indicates the number of records from the input file(s) which will be sorted.

- Information message.

## I) SORT:n,nnn,nnn TOTAL RECORDS OUTPUT TO pppppp.ffffff

n,nnn,nnn records written into the output file.

- Information message.

## T) SORT:ONLY ONE FILE ALLOWED WITH USER EXIT

An input user exit and more than one POOL.FILE was specified. The EXIT parameter specifies a user assembled object program which will process the input file(s) external to the sort.

- Remove the extraneous pool.file names which are not user exits

or

- Change the EXIT parameter to a FILE parameter if the pool.file names are data files.
- Rerun the sort.

## T) SORT:OUTPUT BLOCKSIZE GREATER THAN 1000

The output blocksize must be 1000 characters or less.

- Reduce blocksize to a value below 1000 but still a multiple of the record size.
- Rerun the sort.

## T) SORT:OUTPUT BLOCKSIZE NOT A MULTIPLE OF OUTPUT RECORD SIZE

The output blocksize value must be an even multiple of the output record size.

- Alter output blocksize to a valid value.
- Be sure that FIELD statements are correct.
- Rerun the sort.

I) SORT:OUTPUT FILE BEING WRITTEN

The output file is being written from the work area.

- Information message.

T) SORT:OUTPUT POOL.FILE NAME IS MISSING

This message indicates a problem in the DMF II syntax analyzer service routine or in the sort semantic routine. Contact the nearest SBM analyst for assistance if this problem reoccurs.

T) SORT:PERMANENT I/O ERROR ON WORK FILE SECTOR nnnnnn

A condition code 1 was returned during an attempt to access the work area at sector nnnnnn. This problem will result from using an uninitialized work area or from a disc seek problem.

- If a problem persists after initialization, call the nearest SBM analyst for assistance.

T) SORT:PROGRAM CHECK AT nnnn

The value nnnn indicates the core address where the program check occurred. This message will appear only if the sort is running in an MTIOC-II partition when the program check occurs.

- If the error is repetitive, call the nearest SBM analyst for assistance.
- All files will be closed.

## T) SORT:READ ERROR

The sort was unable to read the sort control statement file (JSF or READ unit).

- Correct the device problem.
- Rerun the sort.

## A) SORT:READY DEVICE Cn

- Ready the device and press the ENTER key to continue.

## T) SORT:RECORD AND BLOCK SIZES MUST BE EQUAL FOR EXIT

An input user exit was specified and the RECSIZE and BLKSIZE parameters did not contain the same value. User exits are responsible for all deblocking.

- Remove the BLKSIZE parameter or make its value equal to the desired RECSIZE parameter value.
- Rerun the sort.

## T) SORT:RECORD SIZE LESS THAN 4

The input statement contained a RECSIZE value which was less than four

or

The output record size was altered to less than four by a FIELD statement.

- Adjust the input RECSIZE value

or

- Specify additional FIELD statements to generate an output record of at least 4 characters.
- Rerun the sort.

## SORT DIAGNOSTICS

---

### T) SORT:REQUIRED CONTROL CARDS NOT PRESENT

- One or more required control cards have been omitted from the control deck.
- Insert missing control card(s) and resubmit.

### T) SORT:RESTART CARD AND OTHER SORT CONTROL CARDS ARE MUTUALLY EXCL

The RESTART card and other types of control cards are not allowed in the input stream concurrently.

- Decide if restart or regular sort is required and remove the erroneous card.
- Resubmit the run.

### I) SORT:RESTART COMPLETED

The restart initialization phase has validated the restart parameters and is continuing.

- Information only.

### I) SORT:RESTART IN PROGRESS

The restart parameters have been verified. The sort is in the process of verifying the checkpoint records posted by the terminated sort.

- Information message.

### T) SORT:SEQUENCE ERROR ON LAST PASS DETECTED

The sort output sequence check routine failed as the output file was being written, or as records were being supplied to the user exit. The problem may result from user exit problems or from a sort defect. The output file is closed prior to termination.

- If the error is repetitive:

Check any user exits for instructions which modify core outside the exit area

or

- If no user exits were used, or if they are error free, obtain a core dump and display of the sort object. Contact the nearest SBM analyst for assistance.

T) SORT: SORT KEY LENGTH INVALID

One of the sort keys had a length of zero or was greater than 100 characters (character key) or was greater than 9 (signed numeric key).

- Adjust key length (split if necessary).

T) SORT: SORT KEY RANGE OUTSIDE OF RECORD

All or part of a sort key field is outside the specified record size.

- Check the record size.
- Check the sort key start location and field length.
- Resubmit sort and/or input control statements entering the corrected specifications.

T) SORT: SERVICE REQUEST -- SORT CANCELLED

The operator activated the service request function. All files will be closed prior to termination. If checkpoints have been taken, the sort may be resumed at the last checkpoint.

T) SORT: SORT CANNOT CONTINUE DUE TO ERRORS

The sort is returning to the conversational loader because errors were encountered in the control card stream.

- Terminal message.

## SORT DIAGNOSTICS

---

### I) SORT:SUFFICIENT WORK FILES FOR nnnnnnnn INPUT RECORDS

This is the minimum number of records that can be sorted using the specified work files and work file record sizes.

- Information message.

### W) SORT:UNEXPECTED END-OF-FILE

The END card was missing from the control deck. Check cards for complete setup.

- The sort will assume an END statement and continue.

### T) SORT:TOO MANY CONTINUES

A control statement was encountered which consisted of more than five records.

- Ensure that the last record of the statement contains a blank in position 80 (remove semicolon if necessary).
- Condense the statement to less than five records.
- Correct and resubmit.

### T) SORT:UNABLE TO OPEN WORK FILE

One of the work areas could not be opened. The OPEN routine will display a message indicating the nature of the problem. The work area has most probably been locked by another program.

- Specify another work area

or

- Correct the problem with the current work area.
- Rerun the sort.

## T) SORT:UNABLE TO OPEN/CLOSE FILE(S)

The sort received an error status code after attempting to OPEN or CLOSE a file. The file in question is indicated by an OPEN or CLOSE message immediately preceding this message.

- Correct the file problem.
- Rerun the sort.

## T) SORT:UNSUPPORTED OR CONFLICTING FILE PARAMETERS

After opening the input files, the sort detected different input file types or record sizes which did not match the RECSIZE value, or blocksizes which did not match the BLKSIZE value. This message will also appear if the input file is an indexed file or if the file is on tape and a GATHER or ADDRROUT sort is being used.

- Reduce all files to the same type (RA) via a copy

or

- Use multiple sort runs.

## T) SORT:USER EXITS REQUIRE 10K OF EXTENDED COMMON

User exits were specified while using a Model 20, or when no extended common was available.

- If the sort is being run on a Model 21 specify the parameter on the SORT control card.

## T) SORT:WORK FILE EXHAUSTED, nnnnnnn RECORDS READ

The input file(s) contained more records than can be sorted using the work file space available. nnnnnnn records have been read from the input file(s) to this point.

- Specify larger work areas and resubmit.

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