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P.S. 2212 5264  
B1800/B1700 DISK SORT

**PRODUCT SPECIFICATION**

REV LTR	REVISION ISSUE DATE	APPROVED BY	REVISIONS
E	6-11-79	<i>J. Hale</i>	Changes for Mark 9.0 Release
			3-2 Changed SORT.FILES - BIT(24) to BIT(8) Added FILLER and SORT.PURGE.INPUT.FILES
F	12/04/80	<i>J. Hale</i>	Change for Mark 10.0 Release
			2-3 Added "MULTIPLE INPUT FILES" input.
			3-1 Updated "TABLE 3.1 SORT COMMUNICATE".
			3-4 Added "TABLE 3.4 FILE TABLE".

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### GENERAL DESCRIPTION

The B1800/B1700 Disk Sort, released under the name SORT/VSORT, allows the user to sort a designated file(s) using head-per-track disk, disk cartridge, or disk pack storage for work files. In addition, the program allows the user to alter the collating sequence through a virtual collating sequence defined at execution time by the Collation Table File (See Section Four below).

SORT/VSORT is defined for implementation with SDL, UPL, and COBOL languages and may also be called by the SORT program.

This product specification describes the input, output, and memory requirements of the SORT/VSORT program, as well as the SORT communicate required to execute the sort function of the Master Control Program (MCP), and also the formats of the SORT information and SORT key tables. Also described are the function and structure of the collation table file.

### RELATED PUBLICATIONS

P.S. 2201 2389	SDL S-Language
P.S. 2201 6729	COBOL S-Language
P.S. 2201 6752	B1800/B1700 SORT
P.S. 2212 5371	B1800/B1700 SORT COLLATE
P.S. 2212 5405	B1800/B1700 SDL (BNF version)
1068731	B1800/B1700 Software Operational Guide

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## PRODUCT DESCRIPTION

### FUNCTIONAL DESCRIPTION: SORT/VSORT

SORT/VSORT arranges the records of a designated file according to the specified keys in a requested ascending or descending collating sequence. Signed keys are sorted algebraically, i.e., negative numbers are less than any positive number.

### MAIN MEMORY REQUIREMENTS

SORT/VSORT operates in a minimum of 8k bytes of main memory. SORT Intrinsic dynamically allocates additional main memory at run time if

1. Additional main memory is available from the rollout of the calling program; or
2. The memory specified is insufficient for the specified sort. (Additional memory will be allocated in increments of 1,000 bytes, up to a maximum of 20K bytes, until sufficient memory exists to perform a minimal sort.)

The minimum main memory requirement is dependent upon the block sizes specified for the input and output files. The maximum allowable memory is 125,000 bytes.

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## DISK REQUIREMENTS

SORT/VSORT uses system disk for scratch work files, and the total disk space required for the scratch work files is about 2 1/4 to 2 1/2 times the size of the input file. However, a workfile may be separated into two workfiles (W1 and W2) either on the same user pack or onto separate disk units and significant improvements in sorting time may be obtained. If separate workfiles are created, the appropriate modifications must be made to the pack-id field of each file's file parameter block (FPB).

## INPUT

### INPUT MEDIA

The input medium to SORT/VSORT can only be one of the following:

- a. 80-col. Cards
- b. 96-col. Cards
- c. 7-Track Magnetic Tape(s)
- d. 9-Track Magnetic Tape(s)
- e. Head-Per-Track Disk
- f. Disk Pack(s) or Cartridge(s)

### INPUT RESTRICTIONS

Any input file must be wholly contained on a single hardware type. The mixture of hardware types (such as 7-track and 9-track magnetic tapes, or HPT disk and disk pack) is not permitted for an input file.

### INPUT ASSUMPTIONS

Magnetic tape input is defaulted to EBCDIC coding if 9-track and BCL coding if 7-track. The user may specify "ANY TAPE" in which case it is the user's responsibility to make certain that the format is acceptable to the hardware type which has been selected.

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### INPUT LIMITATIONS

The maximum record length for sorting is 65,535 bits (8191 bytes). Input records that are larger than output records (from SORT/VSORT) are truncated on the right to match the smaller size. Maximum input block size depends on the available memory space.

### MULTIPLE INPUT FILES

If more than one file is input to the sort, the file numbers of the files to be sorted are put into the file table (Table 3.4) in a top down manner. The first eight bits of the table are set to zero for table format. The base relative address of the file table is stored in CT-2.

### INPUT PARAMETERS

The parameters required by the SORT are described in the SORT intrinsic interface tables. The number of records to be sorted should be passed from the calling program to the SORT for non-disk files. The SORT uses this integer to perform an optimum SORT memory allocation.

For HPT disk, disk cartridge, or disk pack input files, the number of records is obtained from the header information.

Additionally, SORT/VSORT requires information about the disposition of input/output files (e.g., type of CLOSE), the SORT keys, and the Translate Table file (if used). (See SORT Key tables in Section Three and Translate Table file in Section Four).

### OUTPUT

The output medium from the SORT can only be one of the following:

- a. 80-Col. Cards
- b. 96-Col. Cards
- c. 7-Track Magnetic Tape(s)
- d. 9-Track Magnetic Tape(s)
- e. Head-Per-Track Disk
- f. Disk Pack(s) or Cartridge(s)
- g. Line Printer



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Output records to a line printer that are smaller than a printer line appear left-justified with space fill on the right. On other devices where the output records have been defined to be larger than the input records, the records will be left-justified with nulls on the right.

Output records that are shorter than input records are truncated from the right.

Unless the STABLE option is set, there is no guarantee that the order of sorted equal-key records in the output file will duplicate the order in which they were read from the input file.

## INPUT/OUTPUT OPTIONS

### VARIABLE-LENGTH RECORDS

SORT/VSORT accepts as input, and produces for output, disk or magnetic tape variable-length records. When variable-length records are used, the record size is stored right-justified in the first four bytes of each record. No SORT key location should be specified which is outside the bounds of the shortest variable-length record to be sorted.

### RESTART CAPABILITY

When the SORT.RESTART.FLAG is set, the necessary information to restart any pass, except DISTRIBUTE, will be saved in a disk file, named SR.<JOB NUMBER>. This will protect against a system failure or a discontinued program. This feature uses both processing time and disk space.

To perform a restart, the job number of the discontinued sort must be supplied in the sort

### PARITY ACTION

Input file records with irrecoverable parity errors may be discarded during the input phase by setting the appropriate bit in the information table.

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### INCLUDING AND DELETING RECORDS

Input file records may be deleted according to a set of keys. For a description of the keys and how they are generated, see B1800/B1700 SORT LANGUAGE Product Specifications 2201 6752.

### DUPLICATE CHECKING

The occurrence of duplicate records may be checked during the last pass of the sort. If any are found a message will be displayed and a file of relative record pointers will be created. The file will be named SD.<JOB NUMBER> and it will contain 8-character records. These records contain two 4-character packed decimal pointers to the duplicated records and the records they are duplicates of.

### ISAM INDEXES

SORT/VSORT has the ability to produce a file that can be used as an ISAM index. Specifically, the program will produce a sorted file whose records consist of three- or four-byte packed-decimal pointers to the original records and the concatenated keys of the original records.

This option is available for general use and is not restricted to ISAM users since the name and attributes are defined by the person running the Sort. Problems could arise if users created indexes incompatible with COBOL or RPG and tried to use them with COBOL or RPG. COBOL and RPG have certain restrictions on the number of keys, types of keys, blocking factor and names.

The TAGRPG option produces three-byte pointers and is set by a bit one at displacement 300 in the SORT.INFORMATION.TABLE. The TAGCOBOL option produces four-byte pointers and is set by a bit one at displacement 303.

### STABLE OPTION

The setting of this option will cause SORT/VSORT to maintain the original order of records with duplicate keys when sorting. This option is controlled by the 192nd bit in the SORT.INFO.TABLE.

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### SOFTWARE IMPLEMENTATION

The sort program is invoked by an MCP communicate. For language constructs that apply to a particular source language, the user should see the appropriate source language manual.

If the optional Collate Table file is desired, the user must specify the proper file through the appropriate interface control (see Table 3.1 below).

### SORT INTERFACE

The following tables (3.1-3.3) are required as input to the SORT interface to invoke the SORT/VSORT program.

```

*****
* CT.VERB      = 29
* CT.OBJECT    = BASE RELATIVE ADDRESS OF SORT
*               INFORMATION TABLE
* CT.ADVERB    = SORT.RESTART   BIT(1)   %RESTART POSSIBLE
*               SORT.DUPCHECK  BIT(1)   %CHECK FOR DUPS ON LAST PASS
*               SORT.W1.PID    BIT(1)   %USED WITH CT.7
*               SORT.W2.PID    BIT(1)   %USED WITH CT.8
*               MUL_INPUT_FLAG BIT(1)   %0 = CT.2 IS FPB NUMBER
*                                   %1 = CT.2 IS ADDRESS
*               RESERVED      BIT(7)   %
* CT.1         = BASE RELATIVE ADDRESS OF SORT KEY TABLE
* CT.2         = INPUT FILE NUMBER OR BASE RELATIVE ADDRESS OF FILE
*               TABLE IF MUL_INPUT_FLAG = 1
* CT.3         = OUTPUT FILE NUMBER
* CT.4         = TRANSLATE FILE NUMBER OR NOT ZERO
* CT.5         = RESERVED = 0
* CT.6         = BASE RELATIVE ADDRESS OF DELETE KEY TABLE
*               OR NOT ZERO
* CT.7         = IF SORT.W1.PID THEN BASE RELATIVE ADDRESS OF 10
*               CHARACTER NAME ELSE NOT ZERO
* CT.8         = IF SORT.W2.PID THEN BASE RELATIVE ADDRESS OF 10
*               CHARACTER NAME ELSE NOT ZERO
*****

```

TABLE 3.1 SORT COMMUNICATE

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* SORT.TYPE	BIT(2)	00 = VECTOR SORT 01 = QSORT
*		10 = TAG SORT 11 = MERGE
* SORT.HDWR	BIT(6)	MAY BE DISK, DISK PACK, DISK
*		CARTRIDGE (CODED AS FPB.HDWR
*		FOR MCP)
* FILLER	BIT(8)	
* SORT.PURGE.IN-	BIT(8)	1 = CLOSE CORRESPONDING INPUT
* PUT.FILES		FILE WITH PURGE
* SORT.FILES	BIT(8)	NUMBER OF EU'S OR TAPES
* SORT.RECSIZE	BIT(24)	LARGEST KEY DISPLACEMENT
* SORT.IN.HDWR	BIT(6)	HARDWARE TYPE
* SORT.IN.RECSIZE	BIT(24)	MAXIMUM RECORD SIZE IN BITS
* SORT.IN.BLKSIZE	BIT(24)	MAXIMUM BLOCK SIZE IN BITS
* SORT.IN.CLOSE	BIT(12)	CLOSE TYPE
* SORT.IN.VARIABLE	BIT(1)	1 = VARIABLE RECORDS
* SORT.OUT.HDWR	BIT(6)	HARDWARE TYPE
* SORT.OUT.RECSIZE	BIT(24)	MAXIMUM RECORD SIZE IN BITS
* SORT.OUT.BLKSIZE	BIT(24)	MAXIMUM BLOCK SIZE IN BITS
* SORT.OUT.CLOSE	BIT(12)	CLOSE TYPE
* SORT.OUT.VARIABLE	BIT(1)	1 = VARIABLE RECORDS
* SORT.DELETING	BIT(1)	1 = INCLUDE OR DELETE RECORDS
* SORT.STABILIZE	BIT(1)	1 = MAINTAIN ORDER
* SORT.PARITY	BIT(1)	0 = DS, 1 = IGNORE RECORD
* SORT.RESTART	BIT(1)	1 = RESTART
* SORT.BIAS	BIT(7)	RANGE 0-99 DEFAULT = 50 (RANDOM)
* SORT.RECORDS	BIT(24)	NUMBER OF RECORDS IN INPUT FILE
*		DEFAULT = 20,000
* SORT.TIMING	BIT(1)	0 = NO REPORT WANTED
*		1 = PRINT SORT SPECIFICATIONS
* SORT.NUMBER.KEYS	BIT(5)	NUMBER OF SORT KEYS
* FILLER	BIT(8)	= 0
* SORT.KEY.LENGTH	BIT(16)	TOTAL LENGTH OF KEY(S) IN BITS
* FILLER	BIT(16)	= 0
* SORT.PARTITION	BIT(24)	PARTITION STARTING RECORD
* SORT.NUM.DELETE.KEYS	BIT(4)	NUMBER OF DELETE KEYS
* SORT.DUPCHECK	BIT(1)	CHECK LAST PASS FOR DUPLICATES
* SORT.TAGRPE	BIT(1)	1 = 3-BYTE POINTERS
* SORT.W1.PID	BIT(1)	% RECEIVE VALUES FROM SORT
* SORT.W2.PID	BIT(1)	% COMMUNICATE ADVERB BOOLEANS
* SORT.TAGCOBOL	BIT(1)	1 = 4-BYTE POINTERS
* FILLER	BIT(15)	= 0
* SORT.MEMORY	BIT(24)	MEMORY SIZE IN BITS TO ALLOCATE
* SORT.TAGSEARCH	BIT(1)	1 = CREATE OUTPUT FILE USING
*		SORTED TAGS
* SORT.COLLATE	BIT(1)	1 = TRANSLATE
* FILLER	BIT(31)	USED FOR INTERNAL FUNCTIONS
* SORT.RESTART.JOB	BIT(24)	JOB NUMBER OF SORT BEING RESTARTED
*		

Table 3.2 SORT INFORMATION

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**SORT KEY DESCRIPTORS**

The SORT Key Table may contain a maximum of thirty 36-bit key descriptions. Each description will specify ascending or descending order, key length, and key displacement. An additional description must be supplied for signed keys which specify the type, length, and displacement of the sign. In a combination of signed and unsigned keys, each signed key counts as two keys, and the total must not exceed 30. Each key may have a total length of 4095 bits (512 bytes).

```

*****
*
*   UNSIGNED KEY(S)
*   01 KEY.FLAGS          BIT(4),
*   02 FILLER             BIT(1),      % = 0
*   02 DIRECTION          BIT(1),      %0 = ASCENDING
*                                   %1 = DESCENDING
*   02 FILLER             BIT(1),      % = 0
*   02 COLLATE.KEY        BIT(1)      %COLLATE OPTION
*   01 KEY.LENGTH         BIT(12),     %LENGTH OF KEY IN BITS
*   01 KEY.DISPLACEMENT  BIT(20),     %LOCATION FROM
*                                   BEGINNING OF RECORD
*
*   SIGNED KEY(S)
*   01 KEY.FLAGS          BIT(4),
*   02 SIGN.FLAG          BIT(1),      %1 = SIGNED
*   02 FILLER             BIT(1),      % = 0
*   02 NEW.FORMAT         BIT(1),      %1 = THIS FORMAT
*   02 FILLER             BIT(1),      % = 0
*   01 LENGTH.AND.SIGN    % = 24000
*   02 SIGN.LENGTH        BIT(4),      %SIGN LENGTH
*   02 SIGN                BIT(8),     %SIGN
*   01 SIGN.DISPLACEMENT BIT(20),     %LOCATION OF SIGN FROM
*                                   BEGINNING OF RECORD
*
*****
    
```

TABLE 3.3 SORT KEY(S)

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```

*****
*
* C1 FILE.TABLE          BIT(80)
* 02 FILE.VERSION      BIT(8)   = 0
* 02 FILE.INPUT.NO     BIT(8)   NUMBER OF INPUT FILES
* 02 FILE.INPUT.1      INPUT FILE NUMBER
* 02 FILE.INPUT.2      INPUT FILE NUMBER
* 02 FILE.INPUT.3      INPUT FILE NUMBER
* 02 FILE.INPUT.4      INPUT FILE NUMBER
* 02 FILE.INPUT.5      INPUT FILE NUMBER
* 02 FILE.INPUT.6      INPUT FILE NUMBER
* 02 FILE.INPUT.7      INPUT FILE NUMBER
* 02 FILE.INPUT.8      INPUT FILE NUMBER
*
*****
    
```

TABLE 3.4 FILE TABLE

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## COLLATE TABLE FILE

### GENERAL: COLLATE

Use of the optional Collate Table file created by SORT invokes the virtual collating sequence capability of the program.

This option permits the alteration of the sequence in which DISKSORT orders records during the sorting process. Normally all characters encountered in the sort keys are arranged in the hardware collating sequence; i.e., 2002 through 2FF2. Only those elements of the computational sort keys are always processed according to the hardware collating sequence.

The Collate Table file can be created to:

- A. Specify a new collating sequence for the particular program invoking SORT.
- B. Retain the normal collating sequence of 2002 through 2FF2 except for certain characters whose rank in the sequence it is desired to interchange.
- C. Make a number of characters have the same rank for the ordering of the records.

The Collate Table is frequently required for foreign alphabets or conversion from other processing systems.

### FUNCTIONAL DESCRIPTION: COLLATE

The SORT intrinsic with the Collate Table file option is invoked by specifying the name of the Collate Table file in the SORT key parameters. (See SORT INTERFACE in Section Three.)

The MCP verifies that the Collate Table file is on disk before proceeding with the sort. If the file is not present at the time sort is invoked, the user is directed to load the file.

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The names of the Collate Table files should be unique to an installation so that files are not inadvertently sorted into the wrong sequence. The Collate Table file consists of two 256-byte records in a single area file on disk.

SORT/VSORT verifies the header information prior to opening the Collate Table file to ensure the file is two 256-byte records in a single-area file. If not, a syntax error is printed.

SORT/VSORT brings the Collate Table file into main memory; and, as the SORT key is extracted from each record, those elements of the SORT Key which are declared as unsigned eight-bit (byte) format are processed through a collating operation before being passed to the SORT/VSORT comparison logic. Computational (i.e., 4-bit) SORT Key fields are not affected by the translation.



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