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**Burroughs Corporation**



COMPUTER SYSTEMS GROUP  
SANTA BARBARA PLANT

P.S. 2212 5181  
B1800/B1700 TAPESORT

**PRODUCT SPECIFICATION**

REV LTR	REVISION ISSUE DATE	APPROVED BY	REVISIONS
E	6-11-79	<i>Male</i>	Changes for Mark 9.0 Release  3-2 Updated SORT.FILES Added FILLER and SORT.PURGE.INPUT.FILES

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 B1800/B1700 TAPE SORT  
 P.S. 2212 5181 (E)

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### GENERAL

B1800/B1700 Tape Sort, released under the name SORT/TAPESORT, allows the user to sort a designated file(s) using magnetic tape storage for work files. In addition, the program permits the user to alter the collating sequence through a virtual collating capability that is defined at execution time by the Collation Table file (See Section Four below).

Tape Sort is defined for implementation with SDL, UPL, and COBOL languages and is called by the SORT program or by an MCP communicate.

This product specification describes the input, output, and memory requirements of the Tape Sort 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 various options allowed in the Sort statement and the function and structure of the Collation Table file.

### RELATED DOCUMENTATION

<u>NUMBER</u> -----	<u>NAME</u> -----
P.S. 2201 2389	SDL S-Language
P.S. 2201 6729	COBOL S-Language
P.S. 2201 6752	B1800/B1700 SORT Language
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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### FUNCTIONAL DESCRIPTION: SORT/TAPESORT

SORT/TAPESORT arranges the records of a designated file according to assigned keys in the specified collating sequence. Signed keys are sorted algebraically; i.e., negative numbers are less than any positive number; and ascending or descending order for each key may be specified.

The maximum number of SORT keys is 30 unsigned keys, or 15 signed keys. 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.

### INPUT

#### INPUT MEDIA

The input medium to SORT/TAPESORT can be any one of the following:

- A. Cards
- B. 7-track magnetic tape(s)
- C. 9-track magnetic tape(s)
- D. Head-Per-Track (HPT) disk
- E. Disk pack(s) or cartridge(s)

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### INPUT RESTRICTIONS

Any input file must be wholly contained on a single hardware type. A mixture of hardware types (such as 7-track and 9-track magnetic tapes, or HPT disk and disk pack, for example) 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 his responsibility to make certain that the format is acceptable to the hardware type he has selected.

### INPUT LIMITATIONS

The maximum record length for sorting is 65,535 bits. (8191 bytes).

The maximum block-size limit is a function of the available memory space. Input records that are larger than output records (from SORT) are truncated on the right to match the smaller size.

### INPUT PARAMETERS

The parameters required by SORT/TAPESORT are described in the SORT Information table. The number of records to be sorted should be passed from the calling program for non-disk files. This will provide optimal allocation of memory. If zero records are specified, a default of 20,000 will be used.

For head-per-track disk or disk-pack input files, the number of records is obtained from the header information.

Additionally, information is required about the disposition of input/output files (type of CLOSE) and unreadable blocks in the input data file. The Sort keys and the Collate Table file (if used) must also be specified. (See Sort Key Tables and Collate Table file below.)

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The user may also sort a specific portion of the file by specifying the initial record and the size of the partition.

By default, records with parity errors will cause SORT/TAPESORT to terminate. If the PARITY DISCARD option is used, however, those records with parity errors will be discarded and SORT will continue to process the file.

A maximum of 10 INCLUDE/DELETE keys will be allowed on input. An S-op compares these keys, using the AND and OR logic for joining them. The inclusion/deletion is performed before translation. For a description of the keys and how they are generated, see B1800/B1700 SORT Language Product Specification.

### MAIN MEMORY REQUIREMENTS

SORT/TAPESORT operates in a minimum of 8K bytes of main memory. The MCP dynamically allocates additional main memory at run time if additional main memory is available from the roll-out of the calling program or if the memory specified is insufficient for the specified sort. Additional memory will be allocated in one-K bytes, up to a maximum of 20K bytes.

The minimum main memory requirement is larger for those files specifying record or block sizes approaching the defined maximum size (See INPUT LIMITATIONS).

### TAPE REQUIREMENTS

The user may specify from three to eight tapes for work files. Each file will be opened on the first available scratch tape. Since the work file buffers are adjusted to a mod 24 boundary, the files can reside on any hardware type. The only exception is the first file, which will always be placed on a unit with the same hardware type as the output file if it is a tape. This will insure that a unit of the proper hardware type is available for the final output pass.

If all of the records to be sorted will fit into the memory allocated to the sort, and neither a dupcheck nor tagsort is requested, then a sort will be performed in memory without using any of the tape work files.

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### QUIPUT

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

- A. Cards
- B. 7-track magnetic tape(s)
- C. 9-track magnetic tape(s)
- D. HPT disk
- E. Disk pack(s) or cartridge(s)
- F. Line printer

Output records to a line printer that are smaller than a printer line appear left-justified with space fill on the right. The added content of other output records defined to be larger than input records is nulls.

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

Unless the STABLE option is specified, 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.

### OUTPUT RESIRICIION

If the output file is specified as "ANY TAPE", the user must insure that the data format is compatible with the available tape units.



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### VARIABLE LENGTH RECORDS

**SORT/TAPESORT** accepts as input, and produces for output, variable-length records. When variable-length records are used, the record size is stored right-justified in the first four bytes of each record. The maximum record and block sizes are specified in the SORT information block. The MCP blocks the records into the output buffer when writing a variable-length file until the buffer cannot hold another record. At that time the physical I/O is performed and blocking resumes at the beginning of the buffer.

When this type of file is passed to **SORT/TAPESORT**, each input record is standardized at the maximum length of the longest variable record. No sort key location should be specified which is outside the bounds of the shortest variable-length record to be sorted.

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### SOFTWARE IMPLEMENTATION

**SORT/TAPESORT** is invoked by an MCP Communicate. For language constructs that apply to a particular source language, the user must 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

Controls in the following tables (3.1-3.3) invoke **SORT/TAPESORT** interface:

```

*****
*
* CT.VERB = 29
* CT.OBJECT = BASE RELATIVE ADDRESS OF SORT
* INFORMATION TABLE
* CT.ADVERB = RESTART BIT(1)
* DUPCHECK BIT(1)
* W1.PID BIT(1)
* W2.PID BIT(1)
* RESERVED BIT(8)
* CT.1 = BASE RELATIVE ADDRESS OF SORT KEY TABLE
* CT.2 = INPUT FILE NUMBER
* CT.3 = OUTPUT FILE NUMBER
* CT.4 = COLLATE FILE NUMBER ELSE NOT ZERO
* CT.5 = ZERO
* CT.6 = BASE RELATIVE ADDRESS OF DELETE KEY
* TABLE OR NOT ZERO
* CT.7 = IF W1.PID THEN BASE RELATIVE ADDRESS OF
* 10 CHARACTER NAME ELSE NOT ZERO
* CT.8 = IF 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 = RECORD SORT           *
*                       10 = TAG SORT                   *
*   SORT.HDWR           BIT(6)  MUST BE TAPE             *
*                       (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.REC.SIZE      BIT(24) RECORD SIZE              *
*   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.RECSIZ    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/DELETE        *
*   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 1-99                *
*                       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)  DUPLICATE CHECKING       *
*   SORT.TAGRPG        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=USE EXTERNAL COLLATE TABLE *
*   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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```

*****
*
*   UNSIGNED KEY(S)
*   01 KEY.FLAGS           BIT(4),
*   02 FILLER              BIT(1),      Z=0
*   02 DIRECTION           BIT(1),      Z0 = ASCENDING
*                                   Z1 = DESCENDING
*
*   02 FILLER              BIT(1),      Z=0
*   02 TRAN KEY            BIT(1),      ZCOLLATE OPTION
*   01 KEY.LENGTH          BIT(12),     ZLENGTH OF KEY IN BITS
*   01 KEY.DISPLACEMENT    BIT(20),     ZLOCATION FROM
*                                   BEGINNING OF RECORD
*
*   SIGNED KEY(S)
*
*   01 KEY FLAGS           BIT(4),
*   02 SIGN.FLAG           BIT(1),      Z1 = SIGN
*   02 FILLER              BIT(1),      Z=0
*   02 NEW.FORMAT          BIT(1),      Z1 = THIS FORMAT
*   02 FILLER              BIT(1),      Z=0
*
*   01 LENGTH.ANC.SIGN,    Z=240D3
*   02 SIGN.LENGTH         BIT(4),      ZSIGN LENGTH
*   02 SIGN                 BIT(8),      ZSIGN
*   01 SIGN.DISPLACEMENT  BIT(20),     ZLOCATION OF SIGN FROM
*                                   BEGINNING OF RECORD
*
*****
    
```

Table 3.3 SORT KEY(S)

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### SORT RESTART MECHANISM

If SORT/TAPESORT is abnormally terminated, the user can restart it by inserting the job number of the aborted Sort task into the Sort Information Table (See Table 3.2) and reissuing the Sort Communicate (see Table 3.1). SORT/TAPESORT will reposition the work files and restart from the last completed pass.

### SORT KEY DESCRIPTORS

Signed keys are coded with two table entries. The first entry is the sign description and is composed of an ascending or descending flag, sign length in bits, negative sign pattern, and sign displacement within the record. A second entry describes the remainder of the signed field and is coded in the same manner as an unsigned key.

### SELF-CHECKING

A self-checking feature which enhances the integrity of data on tape will detect errors in reading blocks of data. Whenever this occurs a DS or DP situation naming the worktape in error will be reported on the SPO. This feature checks misread blocks of data from worktapes only.

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### IAGSORT-IAGSEARCH

When there is not enough tape available to sort a complete file because records are large compared to the keys, a tagfile of relative record pointers may be created with a TAGSORT. If a TAGSEARCH is performed the relative record pointers will be used to access the input file randomly (DISK ONLY) and write the entire record into the output file. TAGSORT may not output to cards or printer.

### DUPLICATE CHECKING

The duplicate checking option will produce a file containing pointers that are the same format as the output of a TAGSORT (8 bytes containing 4 byte pointers). The first pointer indicates to the relative position of the duplicate record in the output file and the second designates which record(s) it duplicates. The file will be labeled SD.0000 (the four zeros represent the job number at execution).

### ISAM INDEXES

SORT/TAPESORT has the ability to produce a file that can be used as an ISAM index. Specifically, the Sort programs 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 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.

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**STABLE OPTION**

Setting of this option will cause SORT/TAPESORT 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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### COLLATE TABLE FILE

#### GENERAL: COLLATE

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

This option permits the alteration of the sequence in which SORT/TAPESORT 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 sort key described as unsigned alphanumeric are affected by the collation capability. 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/TAPESORT.
- 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 having the same rank for the ordering of the records.

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



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### FUNCTIONAL DESCRIPTION: COLLATE

**SORT/TAPESORT** 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**).

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.

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.

The sort program 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/TAPESORT** 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 translation operation before being passed to the sort program comparison logic. Computational (i.e., 4-bit) sort key fields are not affected by the translation.

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CHANGES FOR MARK VII.0 RELEASE:

Note: Line changes are indicated by a vertical bar (|) in the right-hand margin.

PAGE

CHANGE

PAGE	CHANGE
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	References to SORT changed to SORT/TAPESORT throughout.
1-1	Minor rewording of some sentences.
2-4	Paragraph on output of equal-key records rewritten.
3-2	SORT INFORMATION table updated.
3-3	SORT KEY(S) table updated.
3-5	Job number now 4 digits. Section of ISAM indexes added.
3-6	STABLE OPTION added.
4-1 to 4-2	Description of COLLATE rewritten to reflect major changes for this release.

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