

TO: MSPM Distribution  
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SUBJ: Multics Standard Magnetic Tape Format (BB.3.01)  
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Several changes have been made to the standard tape format.  
They are summarized below:

1. Error indicator records have been removed.
2. The record number for the reel sequence is now contained in the trailer.
3. The format of certain header and trailer words has been clarified.

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### Identification

Multics Standard Magnetic Tape Format  
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### Purpose

This section describes the standard physical format to be used on seven-track and nine-track magnetic tapes on Multics. Any magnetic tape not written in the standard format described here is not a Multics standard tape. (A magnetic tape device interface module which reads and writes tape in the standard format is described in section BF.6.05).

### Standard Record Format

Each physical record consists of a 256-word (9216-bit) data space enclosed by an eight-word header and an eight-word trailer. The total record length is then 272 words (9792 bits). The header and trailer are each 288 bits. This physical record will require 1224 frames on nine-track tape and 1632 frames on seven-track tape. This is approximately 1.54 inches on nine-track tape and 2.04 inches on seven-track tape, not including inter-record gaps. (Record gaps on nine-track tapes are approximately 0.6 inches and on seven-track tapes are approximately 0.75 inches).

### Physical Record Header

The following is the format of the physical record header:

- word 1: constant with octal representation 670314355245.
- words 2 and 3: Multics standard unique identifier (70 bits, left-justified). Each record will have a different "unique identifier". (See MSPM section BY.15.01).
- word 4: bits 0-17: number of this physical record in this physical file, beginning with record 0.  
bits 18-35: number of this physical file on this physical reel, beginning with file 0.
- word 5: bits 0-17: number of data bits in data space, not including padding;  
bits 18-35: total number of bits in data space. (This should be a constant equal to 9216.)

word 6: flags indicating the type of record. Bits are assigned considering the leftmost bit to be bit 0 and the rightmost bit to be bit 35. Word 6 also contains a count of the rewrite attempt, if any:

<u>Bit</u>	<u>Meaning if Bit is 1</u>
0	This is an administrative record (one of bits 1 thru 13 is 1).
1	This is a label record.
2	This is an end-of-reel (EOR) record.
3-13	Reserved.
14	One or more of bits 15-26 are set.
15	This record is a rewritten record.
16	This record contains padding.
17	This record was written following an End of Tape (EOT) condition.
18	This record was forced out by drain.
19-26	Reserved.
27-35	If bits 14 and 15 are 1, this quantity indicates the number of the attempt to rewrite this record. If bit 15 is 0, this quantity must be 0.

word 7: contains the checksum of the header and trailer excluding word 7, i.e., excluding the checksum word. (See section BB.6.01 for description of standard checksum computation.)

word 8: constant with octal representation 512556146073.

#### Physical Record Trailer

The following is the format of the trailer:

word 1: constant with octal representation 107463422532.

- words 2 and 3: standard Multics unique identification (duplicate of header).
- word 4: total accumulative number of data bits for this logical tape (not including padding and not including administrative records).
- word 5: padding bit pattern.
- word 6: bits 0-11: reel sequence number (multi-reel number), beginning with reel 0;  
bits 12-35: physical file number, beginning with physical file 0 of reel 0.
- word 7: the number of the physical record for this logical tape, beginning with record 0.
- word 8: constant with octal representation 265221631704.

Note: The octal constants listed above were chosen to form elements of a single-error-correcting code whether read as eight-bit tape characters (nine-track tape), or six-bit tape characters (seven-track tape).

#### Administrative records

The standard tape format includes two types of administrative records:

tape label

End of Reel (EOR) record

The administrative records are of standard length: 8-word header, 256-word data area, and 8-word trailer.

The tape label record is written in the standard record format. The data space of the tape label record contains:

- words 1-8      32 character ASCII installation code. This identifies the installation which labelled the tape.
- words 9-16     32 character ASCII reel identification. This is the reel identification by which the operator stores and retrieves the tape.
- remaining words    Padding pattern.

The EOR record contains only padding bits in its data space. The standard record header of the EOR record contains the information which identifies it as an EOR record. (Word six, bits zero and two are one.)

### Standard Tape Format

The first record on the tape following the beginning of tape (BOT) mark will be the tape label record. Following the tape record will be an end-of-file mark (EOF). Subsequent reels of a multi-reel sequence will also have a tape label followed by EOF. (An EOF mark is the standard sequence of bits on a tape which is recognized as an end-of-file by the hardware. See BF.6.04 for description of standard EOF.)

Following the tape label and its associated EOF are the data records. An EOF will be written after every 128 data records with the objective of increasing reliability and efficiency of reading and positioning within a logical tape. Records which are repeated because of transmission, parity, or other data alerts are not included in the count of 128 records. The first record following the EOF will have a physical record count of 0 mod 128.

An end-of-reel sequence will be written at the end of recorded data.

An EOR sequence is:

EOF mark

EOR record

EOF mark

EOF mark

### Density and Parity

Both nine-track and seven-track standard tapes will be recorded in binary mode with odd ones lateral parity. Standard tape density is 800 frames per inch (bpi).

### Data Padding

The padding bit pattern will be used to fill administrative records and the last data record of a reel sequence. The padding bit pattern is not specified in this section.

Write Error Recovery

Multics standard tape error recovery procedures differ from the past standard technique in that no attempt is made to backspace the tape on write errors. If a data alert occurs while writing a record, the record will be rewritten. If an error occurs while rewriting the record, that record will again be rewritten. As many attempts as desired may be made to write the record. No backspace record is issued.

The above write error recovery procedure is to be applied to both administrative records and data records.