Date: 13 April 2000
To: T10 Technical Committee
From: Ralph O. Weber (ENDL Texas)
David Chambliss (IBM)
Subject: Corrections to EXTENDED COPY

This proposal corrects several problems discovered during the implementation of the EXTENDED COPY command. The r0 revision of this proposal is being prepared for review by the SNIA (Storage Networking Industry Association) Backup Working Group. Following the review, r1 will be prepared for presentation and review at the May T10 Commands, Architecture, and Protocols Working Group meeting.

The proposal is organized as follows:

1) Changes instantiated in each proposal revision are summarized
2) New additional sense code definitions are summarized
3) Changes to the RECEIVE COPY RESULTS command are specified
4) The EXTENDED COPY command description from SPC-2 revision 16 is presented in its entirety with change bars, underlined text, and strikeout text shown the proposed changes

Changes made in 00-211r0

The description of the handling of errors that are detected during the processing of segment descriptors has been modified and clarified in several ways. Previously terminal error conditions have been made non-terminal under carefully specified conditions. The use of additional sense codes have been added to clarify error conditions. The residual count information has been specified to apply to the destination device (the previous text was ambiguous and could have applied to the source device). The FAILED SEGMENT DETAILS service action has been added to the RECEIVE COPY RESULTS command to facilitate returning additional error information to the application client.

When the segment descriptor instructs that data be held for later delivery to the application client, the data held has been changed from the read data to the processed data.

Read ahead operations have been made allowable for block type devices and prohibited for stream type devices.

Use of the SILI bit for tape devices has been made reserved in SPC-2 with provisions for defining SILI usage in a future version of SPC.

The usage of the CAT and PAD bits has been clarified. Substantial new text has been added clarifying the interaction of residual data in new segment descriptors.

The text describing the segment descriptors has been made compatible with the changes in the CAT and PAD bits and other changes in the description of copy data processing. The text also has been simplified. The DC (destination count) bit is made reserved for the stream to stream segment descriptor and the TRANSFER COUNT field is renamed BYTE COUNT.

The segment descriptor that verifies the accessibility of a target device has been enhanced to allow optionally a TEST UNIT READY command to be sent as the accessibility test.

Two editorial errors (incorrect header sizes, 12 instead of 16) introduced by 00-165r0 have been corrected.

A vendor specific service action code has been added to the RECEIVE COPY RESULTS command.

The data returned by the OPERATING PARAMETERS service action on the RECEIVE COPY RESULTS command has been expanded to include a data format code, more reserved bytes and a maximum transfer size for stream devices.

Summary of new additional sense code values

This proposal includes the definition of a new ASC (additional sense code) value, 2Eh, to cover errors detected by a device functioning as an initiator during the processing of a command sent to that device the target (e.g., the EXTENDED COPY command or some of the XOR commands). For the convenience of the SPC-2 editor, all the new ASC/ASCQ definitions are listed here. All these ASC/ASCQ definitions are new and all of them should have the same device type utilization as TOO MANY TARGET DESCRIPTORS (26h/06h).

ASC	ASCQ	Description
2Eh	00h	ERROR DETECTED BY THIRD PARTY TEMPORARY INITIATOR
2Eh	01h	THIRD PARTY DEVICE FAILURE
2Eh	02h	COPY TARGET DEVICE NOT REACHABLE
2Eh	03h	INCORRECT COPY TARGET DEVICE TYPE
2Eh	04h	COPY TARGET DEVICE DATA UNDERRUN
2Eh	05h	COPY TARGET DEVICE DATA OVERRUN

Revisions to the RECEIVE COPY RESULTS command

In 7.16, make the changes identified by change bars in the RECEIVE COPY RESULTS service action codes table.

Table 92 – RECEIVE COPY RESULTS service action codes

Code	Name	Description	Returns Data
00h	COPY STATUS	Return the current copy status of the EXTENDED COPY command identified by the LIST IDENTIFIER field.	Immediately
01h	RECEIVE DATA	Return the held data read by EXTENDED COPY command identified by the LIST IDENTIFIER field.	When identified command has completed
03h	OPERATING PARAMETERS	Return copy manager operating parameters.	Immediately
04h	FAILED SEGMENT DETAILS	Return copy target device sense data and other information about the progress of processing a segment descriptor whose processing was not completed during processing of the EXTENDED COPY command identified by the LIST IDENTIFIER field.	Immediately
05h-1Eh	Reserved		
1Fh	Vendor Specific		

In 7.16.3, make the changes identified by change bars in the OPERATING PARAMETERS parameter data format table. Note: there are no backwards compatibility issues with these changes because there are no previous versions of SPC that describe the RECEIVE COPY RESULTS command.

Table 97 – Parameter data for the OPERATING PARAMETERS service action

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3				AVAILABLE DATA (n-4)				(LSB)
4								
7				Reserved				
8	(MSB)							
9				MAXIMUM TARGET DESCRIPTOR COUNT				(LSB)
10	(MSB)							
11				MAXIMUM SEGMENT DESCRIPTOR COUNT				(LSB)
12	(MSB)							
15				MAXIMUM DESCRIPTOR LIST LENGTH				(LSB)
16	(MSB)							
19				MAXIMUM SEGMENT LENGTH				(LSB)
20	(MSB)							
23				MAXIMUM INLINE DATA LENGTH				(LSB)
21	(MSB)							
27				HELD DATA LIMIT				(LSB)
28	(MSB)							
31				MAXIMUM STREAM DEVICE TRANSFER SIZE				(LSB)
32								
35				Reserved				
36				MAXIMUM CONCURRENT COPIES				
37				DATA SEGMENT GRANULARITY (log 2)				
38				INLINE DATA GRANULARITY (log 2)				
39				HELD DATA GRANULARITY (log 2)				
40								
42				Reserved				
43				IMPLEMENTED DESCRIPTOR LIST LENGTH (n-43)				
44								
n				List of implemented descriptor type codes (ordered)				

At the appropriate location in 7.16.3 add the following description of the new field.

The MAXIMUM STREAM DEVICE TRANSFER SIZE field indicates the maximum transfer size, in bytes, supported for stream devices.

Add a new clause 7.16.4 to describe the new FAILED SEGMENT DETAILS service action.

7.16.4 FAILED SEGMENT DETAILS service action

In response to the FAILED SEGMENT DETAILS service action, the copy manager shall return details of the segment processing failure that caused termination of the EXTENDED COPY command (see 7.4) identified by the LIST IDENTIFIER field in the CDB. Table t1 shows the format of the information returned by the copy manager in response to a FAILED SEGMENT DETAILS service action. If a device server supports the EXTENDED COPY command (see 7.4), then it shall also support the RECEIVE COPY RESULTS command with FAILED SEGMENT DETAILS service action.

When processing of an EXTENDED COPY command is aborted and processing of a segment descriptor is incomplete, the copy manager shall preserve details about the progress in processing of that descriptor. These details enable the application client to obtain information it needs to determine the state in which target devices (in particular stream devices) have been left by incomplete processing.

Table t1 — Parameter data for the FAILED SEGMENT DETAILS service action

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			AVAILABLE DATA (n-4)				
3								(LSB)
4				Reserved				
55								
56	EXTENDED COPY COMMAND STATUS							
57	Reserved							
58	(MSB)			SENSE DATA LENGTH (n-59)				
59								(LSB)
60	SENSE DATA							
n								

The application client should issue a RECEIVE COPY RESULTS command with FAILED SEGMENT DETAILS service action immediately following failure of the EXTENDED COPY command to insure that the information is not discarded by the copy manager. The copy manager shall discard the failed segment details:

a) after all failed segment details held for a specific EXTENDED COPY command have been successfully transferred to the application client;
b) when a RECIEVE COPY RESULTS command with FAILED SEGMENT DETAILS service action has been received from the same initiator with a matching list identifier, with the ALLOCATION LENGTH field set to 0;
c) when another EXTENDED COPY command is received from the same initiator using the same list identifier;
d) when the copy manager detects a hard reset condition; or
e) when the copy manager requires the resources used to preserve the data.

The AVAILABLE DATA field shall contain the number of bytes of failed segment details available for delivery to the application client. If the amount of failed segment details data sent to the application client is reduced due to insufficient allocation length, the AVAILABLE DATA field shall not be altered and the failed segment details shall not be

discarded. If no failed segment details data is available for the specified list identifier then the AVAILABLE DATA field shall be set to zero and no data beyond the AVAILABLE DATA field shall be returned.

The COPY COMMAND STATUS field contains the SCSI status value that was returned for the EXTENDED COPY command identified by the LIST IDENTIFIER field in the CDB.

The SENSE DATA LENGTH field indicates how many bytes of sense data are present in the SENSE DATA field.

The SENSE DATA field contains the sense data caused the copy manager to terminate abnormally the EXTENDED COPY command identified by the LIST IDENTIFIER field in the CDB.

NOTE n1 Specific uses of the reserved bytes 4 to 55 are under discussion, but may not be resolved in time for SPC-2. Possible uses include indicating the number of successful, failed, and indeterminate transfer operations to source and destination copy targets device. The inclusion of an indefinite length sense data field is a step of significant value. The fields still being discussed are not good candidates for inclusion in a separate service action because they need to be created and discarded under the same circumstances as the fields already defined.

Revisions to the EXTENDED COPY command

Beginning on the next page, the complete text from the SPC-2 revision 16 definition is shown with proposed changes. Changes in this text from the content of SPC-2 revision 16 are marked with change bars. In a few cases, only a word or two has been added and just these words are underlined. Word underlining is used sparingly. When understanding of the proposed changes is facilitated by seeing the SPC-2 revision 16 text, that text is shown with strikeouts. The change bars, underlines, and strikeouts are cumulative through all revisions of this proposal.

7.4 EXTENDED COPY command

The EXTENDED COPY command (see table 21) provides a means to copy data from one set of logical units to another set or to the same set of logical units. The entity within a device server that receives and performs the EXTENDED COPY command is called the copy manager. The copy manager is responsible for copying data from the source device(s) to the destination device(s). The copy source and destination devices are logical units that may reside in different SCSI devices or the same SCSI device (in fact all the devices and the copy manager may be the same logical unit).

Table 21 — EXTENDED COPY command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (83h)							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	(MSB)			PARAMETER LIST LENGTH				
11								
12								
13								(LSB)
14	Reserved							
15	CONTROL							

Before the copy manager is instructed to move data, the application controlling the data movement shall independently execute any activities necessary to prepare the source and destination devices for the EXTENDED COPY command. These activities could include media changer commands, loading of tapes, MODE SELECT commands reservation commands, positioning of tape, and etc. After all preparatory actions have been accomplished, the EXTENDED COPY command should be issued to the copy manager to start the data transfer.

The PARAMETER LIST LENGTH field specifies the length in bytes of the parameter data that shall be contained in the Data-Out Buffer. A parameter list length of zero indicates that no data shall be transferred. This condition shall not be considered as an error.

The EXTENDED COPY parameter list (see table 22) begins with a sixteen byte header that contains the LIST IDENTIFIER field, the STR, and NRCR bits, the command's priority, the length of the target descriptor list, the length of the segment descriptor list, and the length of the optional inline data. Immediately following the header is one or more target descriptors, followed by one or more segment descriptors, followed by any optional inline data.

Table 22 — EXTENDED COPY parameter list

Bit Byte	7	6	5	4	3	2	1	0
0	LIST IDENTIFIER							
1	Reserved		STR	NRCR	Reserved	PRIORITY		
2	(MSB)			TARGET DESCRIPTOR LIST LENGTH (n-12)				
3								(LSB)
4				Reserved				
7								
8	(MSB)			SEGMENT DESCRIPTOR LIST LENGTH (m-k+1)				
11								(LSB)
12	(MSB)			inline data length				
15								(LSB)
	Target descriptor(s)							
16				Target descriptor 0				
47								
				. .				
n-31				Target descriptor x				
n								
	Segment descriptor(s)							
k				Segment descriptor 0 (See specific table for length.)				
k+l								
				. .				
				Segment descriptor y (See specific table for length.)				
m								
	Inline data							

NOTE 6 Unexpected results may occur when an initiator fails to zero the reserved bytes in this parameter list. Copy managers should insure that the reserved bytes 4 through 7 contain zeros.

The LIST IDENTIFIER field is a unique value selected by the application client to identify the extended copy operation to the copy manager. The list identifier also may be used in the RECEIVE COPY RESULTS command (see 7.16) to request status for a specific EXTENDED COPY command. The LIST IDENTIFIER value shall be unique for each concurrent EXTENDED COPY command sent by an initiator. If the copy manager detects a duplicate LIST IDENTIFIER value the command shall be terminated with a CHECK CONDITION, the sense key shall be set to ILLEGAL REQUEST and the additional sense data shall be set to OPERATION IN PROGRESS.

The PRIORITY field establishes the priority of this EXTENDED COPY command relative to other commands being executed by the same device server. All commands other than copy commands have a priority of 1. Priority 0 is the highest priority, with increasing PRIORITY values indicating lower priorities.

A Sequential Stripped bit (STR) value of one indicates to the copy manager that most of the disk references in the parameter list represent sequential access of several stripped disks. This may be used by the copy manager to implement read-ahead. A STR value of zero indicates to the copy manager that disk references are not necessarily sequential.

If the No Receive Copy Results (NRCR) bit is one, the application client shall not send a RECEIVE COPY RESULTS command to collect the results of this parameter list. If NRCR is zero, the application client may send RECEIVE COPY RESULTS command to receive the results of this parameter list.

The TARGET DESCRIPTOR LIST LENGTH contains the length in bytes of the target descriptor list that immediately follows the parameter list header. The number of target descriptors equals the length in bytes of the target descriptor list divided by 32.

An EXTENDED COPY command may reference one or more target devices (which are the source and/or the destination logical units). Each target device is described by a target descriptor. All target descriptors have their formats specified by an EXTENDED COPY descriptor code. A copy manager need not support all target descriptor formats. See 7.4.5 for a detailed description of the target descriptors.

Segment descriptors reference target descriptors by their position, or index, in the target descriptor list. The index for a target descriptor is the starting byte number for the target descriptor in the parameter data minus 16 divided by 32. The maximum number of target descriptors permitted within a parameter list is indicated by the MAXIMUM TARGET COUNT field in the copy manager's operating parameters (see 7.16.3). If the number of target descriptors exceeds the allowed number, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to TOO MANY TARGET DESCRIPTORS.

The SEGMENT DESCRIPTOR LIST LENGTH contains the length in bytes of the segment descriptor list that follows the target descriptors. See 7.4.6 for a detailed description of the segment descriptors. The maximum number of segment descriptors permitted within a parameter list is indicated by the MAXIMUM SEGMENT COUNT field in the copy manager's operating parameters (see 7.16.3). If the number of segment descriptors exceeds the allowed number, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to TOO MANY SEGMENT DESCRIPTORS.

The maximum length of the descriptors (both target and segment) permitted within a parameter list is indicated by the MAXIMUM DESCRIPTOR LIST LENGTH field in the copy manager's operating parameters (see 7.16.3). If the combined length of the target and segment descriptors exceeds the allowed value, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to PARAMETER LIST LENGTH ERROR.

The INLINE DATA LENGTH field contains the number of bytes of Inline data, after the last segment descriptor. A value of zero indicates that no inline data is present.

The copy manager shall move data from the source devices to the destination devices in the manner proscribed by the segment descriptors. The specific commands issued by the copy manager to the source and destination devices while processing the segment descriptors is vendor specific. Upon completion of an EXTENDED COPY command that returns GOOD status, the source and destination devices (particularly stream devices) shall be positioned at deterministic locations such that the device could be repositioned to the same location by the application client with appropriate commands.

7.4.1 Errors detected before starting processing of the segment descriptors

Errors may occur during processing of an EXTENDED COPY command before the first segment descriptor is processed. These conditions include parity errors while transferring the EXTENDED COPY command, invalid parameters in the CDB or parameter data, invalid segment descriptors, and inability of the copy manager to continue operating. In the event of such an exception condition, the copy manager shall:

a) terminate the EXTENDED COPY command with CHECK CONDITION status; and
b) set the VALID bit in the sense data to zero. The sense key shall contain the sense key code describing the exception condition (i.e.: not COPY ABORTED).

7.4.2 Errors detected during processing of segment descriptors

Errors may occur after the copy manager has begun processing segment descriptors. These include invalid parameters in segment descriptors, invalid segment descriptors, unavailable targets referenced by target descriptors, inability of the copy manager to continue operating, and errors reported by source or destination target devices. If the copy manager receives a CHECK CONDITION status from one of the target devices, it shall recover the sense data associated with the exception condition and clear the ACA condition (if any) associated with the CHECK CONDITION status.

A determination that a target device is unreachable, or a failure of a target device to respond properly to commands, shall not cause termination of the EXTENDED COPY command until execution of commands on that target device is required for processing of a segment descriptor. Specifically, it shall not be considered an error if a target descriptor selected by a source or target index describes a target device that is nonexistent or unreachable, when the parameters of the segment descriptor are such that no commands need to be issued to that target device (e.g., if the block count is zero).

If processing of a segment cannot complete because the copy manager is unable to establish communications with a target device, or because the target device does not respond to INQUIRY, or because the data returned in response to INQUIRY indicates an unsupported logical unit, then the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to COPY TARGET DEVICE NOT REACHABLE.

If processing of a segment cannot complete because the data returned in response to an INQUIRY command indicates a device type that does not match the type in the target descriptor, then the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INCORRECT COPY TARGET DEVICE TYPE.

If the copy manager has issued a command other than INQUIRY to a target device while processing an EXTENDED COPY command and the target device either fails to respond with status or responds with status other than BUSY, TASK SET FULL, ACA ACTIVE, or RESERVATION CONFLICT the condition shall be considered a target device command failure. In response to a target device command failure the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to THIRD PARTY DEVICE FAILURE.

If a target device responds to a command from the copy manager with a status of BUSY, TASK SET FULL, ACA ACTIVE, or RESERVATION CONFLICT the copy manager shall either retry the command or terminate the EXTENDED COPY command as a target device command failure.

NOTES

n2 It is assumed that the copy manager will employ a sensible vendor-specific policy to decide when to stop retrying.

n3 RESERVATION CONFLICT is listed only to give the copy manager leeway in multi-port cases. The copy manager may have multiple ports that can reach a target device, and there may be a third-party reservation for one of these ports. The copy manager may need to try access from multiple ports to find one with access.

If a target device responds to an input or output operation with a GOOD status but less data than expected is transferred, then the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and additional sense code shall be set to COPY TARGET DEVICE DATA UNDERRUN. If an overrun is detected, then the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and additional sense code shall be set to COPY TARGET DEVICE DATA OVERRUN.

Following an exception condition detected during segment descriptor processing, the copy manager shall:

a) terminate the EXTENDED COPY command with CHECK CONDITION status;
b) set the sense key code to COPY ABORTED;
c) indicate the segment that was being processed at the time of the exception by writing the segment number to third and forth bytes of the COMMAND-SPECIFIC INFORMATION field. The segment number is based on the relative position of the segment descriptor in the EXTENDED COPY parameter list. The first segment descriptor in the parameter list is assigned descriptor number zero, the second is assigned one, etc.;
d) If any data has been transferred for the segment being processed at the time the error occurred, the residual for the segment shall be placed in the INFORMATION field, and the valid bit shall be set to 1. If the segment descriptor specifies a transfer count in blocks, then the residual count is the number of destination blocks remaining for transfer, otherwise, the residual count is the number of bytes remaining for transfer to the destination. If no data has been transferred for the segment being processed at the time the error occurred, then the VALID bit shall be set to 0 and the contents of the INFORMATION field are not defined. Segment descriptors that do not specify a transfer count shall not have a valid residual count returned;
e) If the exception condition is reported by the source logical unit, then the first byte of the COMMAND-SPECIFIC INFORMATION field shall specify the starting byte number, relative to the first byte of sense data, of an area that contains (unchanged) the source logical unit's status byte and sense data. A zero value indicates that no status byte and sense data is being returned for the source logical unit;
f) If the exception condition is reported by the destination logical unit, then the second byte of the COMMAND-SPECIFIC INFORMATION field shall specify the starting byte number, relative to the first byte of sense data, of an area that contains (unchanged) the destination logical unit's status byte and sense data. A zero value indicates that no status byte and sense data is being returned for the destination logical unit;
g) ~~If, during the processing of a segment descriptor, the copy manager determines that a target is not reachable,~~If segment processing is terminated because a target device is unreachable or as the result of a target command failure, then the SENSE-KEY SPECIFIC field shall be set as described in 7.22.1, with the FIELD POINTER field indicating the first byte of the target descriptor that identifies the target;
h) If, during the processing of a segment descriptor, the copy manager detects an error in the segment descriptor, then the SENSE-KEY SPECIFIC field shall be set as described in 7.22.1, with the FIELD POINTER field indicating byte in error. The FIELD POINTER field may be used to indicate an offset into either the parameter data or the segment descriptor. The SD bit is used to differentiate between these two cases. The SD bit shall be set to zero to indicate the FIELD POINTER field contains an offset from the start of the parameter data. The SD bit shall be set to one to indicate the FIELD POINTER field contains an offset from the start of the segment descriptor;
i) The copy manager shall preserve information for the FAILED SEGMENT DETAILS service action of the RECEIVE COPY RESULTS command (see 7.16.4). The information shall be discarded as described in 7.16.4.

7.4.3 Abort task management functions

When a device server processes an ABORT TASK, ABORT TASK SET, or CLEAR TASK SET task management function that terminates an EXTENDED COPY command, the copy manager shall ensure that all commands and data transfers generated by the terminated EXENDED COPY command have been terminated and are no longer transferring data before allowing the task manager to complete the task management function. This requirement shall also apply to the processing the PREEMPT AND ABORT service action on the PERSISTENT RESERVE OUT command as described in 5.4.2.5.3.

7.4.4 Descriptor type codes

Target descriptors and segment descriptors share a single set of code values that identify the type of descriptor (see table 23). Segment descriptors use codes in the range 00h to BFh. The definitions of codes between C0h and DFh are vendor specific. Target descriptors use codes in the range E0h to FFh.

Table 23 — EXTENDED COPY descriptor type codes (page 1 of 2)

Descriptor type code	Reference	Description [1]	Shorthand [1]
00h	7.4.6.1	Copy from block device to stream device	block→stream
01h	7.4.6.2	Copy from stream device to block device	stream→block
02h	7.4.6.3	Copy from block device to block device	block→block
03h	7.4.6.4	Copy from stream device to stream device	stream→stream
04h	7.4.6.5	Copy inline data to stream device	inline→stream
05h	7.4.6.6	Copy embedded data to stream device	embedded→stream
06h	7.4.6.7	Read from stream device and discard	stream→discard
07h	7.4.6.8	Verify block or stream device operation	
08h	7.4.6.9	Copy block device with offset to stream device	block<o>→stream
09h	7.4.6.10	Copy stream device to block device with offset	stream→block<o>
0Ah	7.4.6.11	Copy block device with offset to block device with offset	block<o>→block<o>
0Bh	7.4.6.1	Copy from block device to stream device and hold a copy of processed data for the application client **[2]**	block→stream +application client
0Ch	7.4.6.2	Copy from stream device to block device and hold a copy of processed data for the application client **[2]**	stream→block +application client
0Dh	7.4.6.3	Copy from block device to block device and hold a copy of processed data for the application client **[2]**	block→block +application client
0Eh	7.4.6.4	Copy from stream device to stream device and hold a copy of processed data for the application client **[2]**	stream→stream +application client

NOTES

[1] Block devices are those with peripheral device type codes 0h, 4h, 5h, 7h, and Eh. Stream devices are those devices with peripheral device type codes 1h and 3h. Sequential-access (tape) devices are those with peripheral device type code 01h. See 7.5.1 for peripheral device type code definitions.

[2] The application client shall use the RECEIVE COPY RESULTS with a RECEIVE DATA service action to retrieve data held for it by the copy manager (see 7.16.2).

Table 23 — EXTENDED COPY descriptor type codes (page 2 of 2)

Descriptor type code	Reference	Description [1]	Shorthand [1]
0Fh	7.4.6.7	Read from stream device and hold a copy of processed data for the application client **[2]**	stream→discard +application client
10h	7.4.6.12	Write filemarks to sequential-access device	filemark→tape
11h	7.4.6.13	Space records or filemarks on sequential-access device	space→tape
12h	7.4.6.14	Locate on sequential-access device	locate→tape
13h	7.4.6.15	Image copy from sequential-access device to sequential-access device	<i>tape→<i>tape
14h	7.4.6.16	Register key	
15h - BFh		Reserved for segment descriptors	
C0h - DFh		Vendor unique descriptors	
E0h	7.4.5.1	World Wide Name target descriptor	
E1h	7.4.5.2	N_Port target descriptor	
E2h	7.4.5.3	N_Port with World Wide Name checking target descriptor	
E3h	7.4.5.4	Parallel Interface T_L target descriptor	
E4h	7.4.5.5	Identification descriptor target descriptor	
E5h - FFh		Reserved for target descriptors	

NOTES

[1] Block devices are those with peripheral device type codes 0h, 4h, 5h, 7h, and Eh. Stream devices are those devices with peripheral device type codes 1h and 3h. Sequential-access (tape) devices are those with peripheral device type code 01h. See 7.5.1 for peripheral device type code definitions.

[2] The application client shall use the RECEIVE COPY RESULTS with a RECEIVE DATA service action to retrieve data held for it by the copy manager (see 7.16.2).

7.4.5 Target descriptors

All target descriptors are 32 bytes in length and begin with a four-byte header (see table 24) that contains the DESCRIPTOR TYPE CODE field, which identifies the format of the descriptor. The assigned values for target descriptors type codes are shown in table 23. Support for each target descriptor format is optional. If copy manager receives an unsupported descriptor type code in a target descriptor, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to UNSUPPORTED TARGET DESCRIPTOR TYPE CODE.

Table 24 — Target descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E0 - FFh)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	Target descriptor parameters							
27								
28	Device type specific parameters							
31								

The DESCRIPTOR TYPE CODE field is described in 7.4.4. The PERIPHERAL DEVICE TYPE field is described in 7.5.1. The value in the DESCRIPTOR TYPE CODE field determines the format of the target descriptor parameters that follow the four-byte header and precede the device type specific parameters. The values in the DESCRIPTOR TYPE CODE field are listed in table 23.

The value in the PERIPHERAL DEVICE TYPE field determines the format of the device type specific parameters that follow the target descriptor parameters. The device type specific parameters convey information specific to the type of device identified by the target descriptor. Table 25 lists the peripheral device type code values having formats defined for the device type specific parameters in a target descriptor. Peripheral device types with code values not listed in table 25 are reserved in the EXTENDED COPY parameter list.

Table 25 — Device type specific parameters in target descriptors

Peripheral Device Type	Reference	Description	Shorthand
00h, 04h, 05h, 07h, and 0Eh	7.4.5.6	Block devices	Block
01h	7.4.5.7	Sequential-access devices	Stream or Tape
03h	7.4.5.8	Processor devices	Stream

The copy manager may, prior to processing a segment descriptor, verify the information in a target descriptor's device specific fields. However, the copy manager shall not issue any commands that change the state of the target device to verify the information.

7.4.5.1 World Wide Name target descriptor format

The target descriptor format shown in table 26 is used to identify a target using its World Wide Name.

Table 26 — World Wide Name target descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E0h)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	(MSB)	LOGICAL UNIT NUMBER						
11								(LSB)
12	(MSB)	WORLD WIDE NAME						
19								(LSB)
20	Reserved							
27								
28	Device type specific parameters							
31								

The DESCRIPTOR TYPE CODE and PERIPHERAL DEVICE TYPE fields and the device type specific parameters are described in 7.4.5.

The LOGICAL UNIT NUMBER field specifies the logical unit within the SCSI device addressed by the data in the WORLD WIDE NAME field that shall be the target (source or destination) for EXTENDED COPY operations.

The WORLD WIDE NAME field shall contain the port World Wide Name defined by the Physical Log In (PLOGI) extended link service, defined in FC-PH.

NOTE 7 The World Wide Name target descriptor format burdens the copy manager with translating the World Wide Name to an N_Port identifier (see 7.4.5.2).

7.4.5.2 N_Port target descriptor format

The target descriptor format shown in table 27 is used to identify a target using its N_Port.

Table 27 — N_Port target descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E1h)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	(MSB)	LOGICAL UNIT NUMBER						
11								(LSB)
12	Reserved							
20								
21	(MSB)	N_Port						
22								
23								(LSB)
24	Reserved							
27								
28	Device type specific parameters							
31								

The DESCRIPTOR TYPE CODE and PERIPHERAL DEVICE TYPE fields and the device type specific parameters are described in 7.4.5.

The LOGICAL UNIT NUMBER field specifies the logical unit within the SCSI device addressed by the data in the N_PORT field that shall be the target (source or destination) for EXTENDED COPY operations.

The N_PORT field shall contain the FC-PH port D_ID to be used to transport frames including PLOGI and FCP-2 related frames.

7.4.5.3 N_Port with World Wide Name checking target descriptor format

Targets addressed using their N_Port with World Wide Name checking are identified using the target descriptor format shown in table 28.

Table 28 — N_Port with World Wide Name checking target descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E2h)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	(MSB)			LOGICAL UNIT NUMBER				
11								(LSB)
12	(MSB)			WORLD WIDE NAME				
19								(LSB)
20	Reserved							
21	(MSB)			N_Port				
22								
23								(LSB)
24				Reserved				
27								
28				Device type specific parameters				
31								

The DESCRIPTOR TYPE CODE and PERIPHERAL DEVICE TYPE fields and the device type specific parameters are described in 7.4.5.

The LOGICAL UNIT NUMBER field specifies the logical unit with in the SCSI device addressed by the data in the N_PORT and WORLD WIDE NAME and fields that shall be the target (source or destination) for EXTENDED COPY operations.

The WORLD WIDE NAME field shall contain the port World Wide Name defined by the Physical Log In (PLOGI) extended link service, defined in FC-PH.

The N_PORT field shall contain the FC-PH port D_ID to be used to transport frames including PLOGI and FCP-2 related frames.

When the copy manager first processes a segment descriptor that references this target descriptor, it shall confirm that the D_ID in the N_PORT field is associated with the World Wide Name in the WORLD WIDE NAME field. If the association cannot be confirmed, the EXTENDED COPY command shall be terminated because the target is unavailable (see 7.4.2). The copy manager shall track configuration changes that affect the D_ID value for the duration of the EXTENDED COPY commands. An application client generating the EXTENDED COPY commands is responsible for tracking configuration changes between commands.

7.4.5.4 Parallel Interface T_L target descriptor format

Targets addressed using their parallel SCSI bus Target ID, and logical unit number are identified using the target descriptor format shown in table 29.

Table 29 — Parallel Interface T_L target descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E3h)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	(MSB)			LOGICAL UNIT NUMBER				
11								(LSB)
12	Vendor unique							
13	TARGET IDENTIFIER							
14	Reserved							
27								
28	Device type specific parameters							
31								

The DESCRIPTOR TYPE CODE and PERIPHERAL DEVICE TYPE fields and the device type specific parameters are described in 7.4.5.

The LOGICAL UNIT NUMBER field specifies the logical unit with in the SCSI device addressed by the data in the TARGET IDENTIFIER field that shall be the target (source or destination) for EXTENDED COPY operations.

The TARGET IDENTIFIER field specifies the SCSI target identifier to be used when this target descriptor identifies the source or destination of an EXTENDED COPY operation.

7.4.5.5 Identification descriptor target descriptor format

The target descriptor format shown in table 30 instructs the copy manager to locate a target and logical unit that returns a device identification VPD page (see 8.4.3) containing an Identification descriptor having the specified CODE SET, ASSOCIATION, IDENTIFIER TYPE, IDENTIFIER LENGTH, and IDENTIFIER field values. The copy manager may use any N_Port, target identifier and logical unit number values that result in matching VPD field values to address the copy device. If multiple N_Port, target identifiers and logical unit number combinations access matching VPD field values, the copy manager may use any combination to address the copy device and shall try other combinations in the event that one combination becomes non-operational during the processing of an EXTENDED COPY command.

Table 30 — Identification descriptor target descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (E4h)							
1	Reserved			PERIPHERAL DEVICE TYPE				
2	Reserved							
3	Reserved							
4	Reserved				CODE SET			
5	Reserved		ASSOCIATION		IDENTIFIER TYPE			
6	Reserved							
7	IDENTIFIER LENGTH (n-7)							
8	(MSB)			IDENTIFIER				
n								(LSB)
n+1	Reserved							
27								
28	Device type specific parameters							
31								

The DESCRIPTOR TYPE CODE and PERIPHERAL DEVICE TYPE fields and the device type specific parameters are described in 7.4.5.

The contents of the CODE SET, ASSOCIATION, IDENTIFIER TYPE, IDENTIFIER LENGTH, and IDENTIFIER fields are specified in 8.4.3.

The identifier length shall be 20 or less. If the identifier length is 20 there shall be no reserved bytes between the target descriptor parameters and the device type specific parameters.

Some combinations of code set, association, identifier type, identifier length and identifier do not uniquely identify a logical unit to serve as a copy target device. The application client shall not send such combinations to the copy manager.

7.4.5.6 Device type specific target descriptor parameters for block device types

The format for the device type specific target descriptor parameters for block device types (device type code values 00h, 04h, 05h, 07h, and 0Eh) is shown in table 31.

Table 31 — Device type specific target descriptor parameters for block device types

Bit / Byte	7	6	5	4	3	2	1	0
28	Reserved					PAD	Reserved	
29	(MSB)							
30	DISK BLOCK LENGTH							
31								(LSB)

The PAD bit is used in conjunction with the CAT bit (see 7.4.6) in the segment descriptor to determine what action should be taken when a segment of the copy does not fit exactly into an integer number of destination blocks.

The DISK BLOCK LENGTH field contains the number of bytes in a disk block for the logical device being addressed.

The copy manager may read ahead from sources of block device type. That is, the copy manager may perform read operations from a source disk at any time and in any order during processing of an EXTENDED COPY command, provided that the relative order of writes and reads on the same blocks within the same target descriptor does not differ from their order in the segment descriptor list.

7.4.5.7 Device type specific target descriptor parameters for stream device types

The format for the device type specific target descriptor parameters for the sequential-access device type (device type code value 01h) is shown in table 32.

Table 32 — Device type specific target descriptor parameters for stream device types

Bit / Byte	7	6	5	4	3	2	1	0
28	Reserved					PAD	~~SILI~~ Reserved	FIXED
29	(MSB)							
30	STREAM BLOCK LENGTH							
31								(LSB)

The contents of the FIXED bit and STREAM BLOCK LENGTH field are combined with the STREAM DEVICE TRANSFER LENGTH FIELD in the segment descriptor to determine the length of the stream read or write operation as specified in table 33.

The PAD bit is used in conjunction with the CAT bit (see 7.4.6) in the segment descriptor to determine what action should be taken when a segment of the copy does not fit exactly into an integer number of destination blocks.

~~The sili bit indicates the value used in the sili bit of any read commands issued to the target.~~

All read commands issued to sequential-access type devices shall have the SILI bit equal to zero.

Table 33 — Stream device transfer lengths

FIXED **bit**	STREAM BLOCK LENGTH **field**	**Description**
0	0	Use variable length reads or writes. The number bytes for each read or write is specified by the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor.
0	not 0	The command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST.
1	0	The command shall be terminated with a CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST
1	not 0	Use fixed record length reads or writes. The number of bytes for each read or write shall be the product of the STREAM BLOCK LENGTH field and the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor.

NOTE n4 It is anticipated that bit 1 of byte 28 in the device type specific target descriptor parameters for stream device types will be used to indicate the value of the SILI bit for read commands, after it established how the copy manager shall process tape reads of unknown block length without error.

The copy manager shall not read ahead from sources of stream device type. That is, the read operations required by a segment descriptor for which the source is a stream device shall not be started until all write operations for previous segment descriptors have completed.

7.4.5.8 Device type specific target descriptor parameters for processor device types

The format for the device type specific target descriptor parameters for the processor device type (device type code value 03h) is shown in table 34.

Table 34 — Device type specific target descriptor parameters for processor device types

Bit Byte	7	6	5	4	3	2	1	0
28	Reserved					PAD	Reserved	
29	Reserved							
31								

The PAD bit is used in conjunction with the CAT bit (see 7.4.6) in the segment descriptor to determine what action should be taken when a segment of the copy does not fit exactly into an integer number of SEND or RECEIVE commands.

When the processor device is a source, the number of bytes to be transferred by a SEND command shall be specified by STREAM DEVICE TRANSFER LENGTH field in the segment descriptor. When the processor device is a destination, the number of bytes to be transferred by a RECEIVE command shall be specified by STREAM DEVICE TRANSFER LENGTH field in the segment descriptor.

7.4.6 Segment Descriptors

All segment descriptors begin with the eight byte header shown in table 35.

Table 35 — Segment descriptor header

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (00h-3Fh)							
1	Reserved						DC	CAT
2	(MSB)			DESCRIPTOR LENGTH				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)

The descriptor type code field is described in 7.4.4. Support for each segment descriptor format is optional. If copy manager receives an unsupported descriptor type code in a segment descriptor, the command shall be terminated with CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to UNSUPPORTED SEGMENT DESCRIPTOR TYPE CODE.

The destination count (DC) bit is used in those segment descriptors where both the source and destination devices have the same storage structure (block or stream). The DC bit is only applicable to segment descriptors with descriptor type code values of 02h (block→block, see 7.4.6.3), 03h (stream→stream, see 7.4.6.4), 0Dh (block→block+application client, see 7.4.6.3), and 0Eh (stream→stream+application client, see 7.4.6.4). The DC bit is reserved for all other segment descriptors. Details of usage for the DC bit appear in the clauses defining the segment descriptors that use it.

~~The cat bit is used in conjunction with the pad bit in the target descriptors to define what action should be taken when a segment of the copy does not fit exactly into an integral number of destination blocks. Table 36 defines the operation of the pad and cat bits.~~

Editors Note 1 - ROW: SNIA-BWG reviewers should be aware that the use of numbers to enumerate the entries in the two lists below means that the operations are to be performed in the order listed. If it is appropriate to preform the operations in any order, then the numbers need to be replaced with letters.

In processing a segment descriptor, the copy manager may be required:

1) To read source data by issuing data input commands to the source device;
2) To process data, which generally designates data as destination data intended for transfer to the destination device; and
3) To write some or all of the destination data to the destination device.

The number of blocks to read and write, the number of bytes to process, and the nature of processing are determined by the segment descriptor type code, the parameters of the segment descriptor, and the amount of source or destination data retained from the previous segment, if any.

Except as otherwise specified by particular segment descriptor type codes:

1) Just enough read operations shall be performed to supply (together with source data retained from the previous segment) the number of bytes to be processed;
2) Processing consists of removing bytes from the source data and designating them as destination data, without change.
3) As many write operations as possible shall be performed with the destination data, including any destination data retained from the previous segment.

Exceptions and clarifications to these general rules are described the clauses defining the individual segment descriptor type codes and in table t2.

Table t2 — Descriptor Type Code Dependent Copy Manager Processing (page 1 of 2)

Segment Descriptor Type Code	Reference	Description
02h (block→block) or 0Dh (block→block+application client) with DC=0	7.4.6.3	The number of bytes processed is determined by the BLOCK DEVICE NUMBER OF BLOCKS field for the source blocks (see applicable type code definition clauses for details).
00h (block→stream) or 0Bh (block→stream+application client)	7.4.6.1	
02h (block→block) or 0Dh (block→block+application client) with DC=1	7.4.6.3	The number of blocks or byte range specified shall be output to the destination device. If retained destination data is sufficient to perform the output then no data shall be processed. Otherwise, just as much data as needed shall be processed (which may involve reading data from the source device) so that the destination data (which includes any destination data retained from the previous segment) is sufficient.
00h (block→stream) or 0Bh (block→stream+application client)	7.4.6.1	
09h (stream→block<o>)	7.4.6.10	
0Ah (block<o>→block<o>)	7.4.6.11	
08h (block<o>→stream)	7.4.6.9	The required blocks shall be read from the source device, the designated byte range shall be extracted as source data, and the designated number of bytes (starting with residual source data, if any) shall be processed.
03h (stream→stream) or 0Eh (stream→stream+application client)	7.4.6.4	The number of bytes specified in the segment descriptor shall be processed.
04h (inline→stream)	7.4.6.5	
05h (embedded→stream)	7.4.6.6	
06h (stream→discard) or 0Fh (stream→discard+application client)	7.4.6.7	
13h (<i>tape→<i>tape)	7.4.6.15	The data movement shall not involve "processing" as described here. Retained source or destination data, if any, shall not be used and shall be retained or discarded as if the CAT bit were equal to one.
Note: One segment descriptor type code may be listed multiple times in this table.		

Table t2 — Descriptor Type Code Dependent Copy Manager Processing (page 2 of 2)

Segment Descriptor Type Code	Reference	Description
10h (filemark→tape)	7.4.6.12	No data shall be processed and no read or write operations shall be performed on target devices. Retained source or destination data, if any, shall be retained or discarded as if the CAT bit were equal to one.
11h (space→tape)	7.4.6.13	
12h (locate→tape)	7.4.6.14	
14h (register key)	7.4.6.16	
04h (inline→stream)	7.4.6.5	Processing shall append the inline or embedded data to the destination data, and no source data shall be processed.
05h (embedded→stream)	7.4.6.6	
06h (stream→discard)	7.4.6.7	Processing shall remove the specified number of bytes from the source data and discard them, and no destination data shall be written to any device.
0Fh (stream→discard+application client)	7.4.6.7	Processing shall remove bytes from the source data and hold them for retrieval by the application client.
0Bh (block→stream+application client)	7.4.6.1	A copy of the processed data shall be held for retrieval by the application client.
0Ch (stream→block +application client)	7.4.6.2	
0Dh (block→block+application client)	7.4.6.3	
Note: One segment descriptor type code may be listed multiple times in this table.		

Reads and writes shall be performed using whole-block transfer lengths determined by the block size, transfer length, or both. Therefore some source data may remain unprocessed and some destination data may not have been transferred at the end of a segment. If so, the residue shall be handled according to the CAT bit in the segment descriptor and the PAD bits of the source and destination target descriptors, as defined in table 36.

Table 36 — PAD and CAT bit definitions (page 1 of 2)

PAD bit in		CAT bit	Copy manager action
Source target descriptor	**Destination target descriptor**		
1	0	0	~~On inexact segments, the copy manager shall strip input characters from the final source block(s), always stopping at the end of a complete block.~~ Any residual source or destination data shall be discarded.
0 or 1	1	0	~~On inexact segments, the copy manager shall add pad characters (00h) to the destination block to completely fill the block.~~ If any residual destination data is present after writing the designated byte range for a segment descriptor of type of 09h or 0Ah, or if any residual destination data is present after the designated number of blocks have been written for a segment descriptor of type of 02h or 0Dh with the DC equal to one, or for a segment descriptor of type of 01h or 0Ch, then the command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to UNEXPECTED INEXACT SEGMENT. Otherwise, any residual destination data shall be padded with zeroes to make a whole block transfer. Any residual source data shall be handled as if the CAT bit is equal to one.

Table 36 — PAD **and** CAT **bit definitions** (page 2 of 2)

PAD **bit in**		CAT **bit**	**Copy manager action**
Source target descriptor	**Destination target descriptor**		
0 or 1	0 or 1	1	~~The copy manager shall always write or read complete blocks. On inexact segments, the remainder of the destination block data shall be taken from the next segment. If the cat bit is one on the last segment of an EXTENDED COPY command the command shall be terminated with a CHECK CONDITION status. The sense key shall be set to an COPY ABORTED and the additional sense code shall be set to UNEXPECTED INEXACT SEGMENT.~~ Any residual source data shall be retained as source data for a subsequent segment descriptor, and shall be processed as source data before any data read from a source device during that subsequent segment descriptor. Any residual destination data shall be retained as destination data for a subsequent segment descriptor, and in all cases shall be written before any data processed during that subsequent segment descriptor. It shall not be an error if either the source or destination target index in the following segment descriptor does not match the corresponding target index with which residual data was originally associated. If the CAT bit is one on the last segment of an EXTENDED COPY command any residual data shall be discarded; this shall not be considered an error.
0	0	0	~~The occurrence of an inexact segment when both pad bits and the cat bit are all zero shall be an error.~~ If there is residual source or destination data the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to an COPY ABORTED and the additional sense code shall be set to UNEXPECTED INEXACT SEGMENT.

A few segment descriptors have either no source or no target and handling of the PAD bit for those descriptors shall be as follows. For segment descriptor types 04h (inline→stream, see 7.4.6.5) and 05h (embedded→stream, see 7.4.6.6), the handling shall be as if the PAD were equal to zero for the source target descriptor. For segment descriptor types 06h and 0Fh (stream→discard and stream→discard+application client, see 7.4.6.7), handling shall be as the PAD were equal to zero for the destination target descriptor.

The DESCRIPTOR LENGTH field contains the length in bytes of the fields that follow the DESCRIPTOR LENGTH field in the segment descriptor. In most cases, the length is constant.

The SOURCE TARGET DESCRIPTOR INDEX field contains an index into the target descriptor list (see 7.4) identifying the source target device. The DESTINATION TARGET DESCRIPTOR INDEX field contains an index into the target descriptor list (see 7.4) identifying the destination target device. Some segment descriptor formats do not require a SOURCE TARGET DESCRIPTOR INDEX field or a DESTINATION TARGET DESCRIPTOR INDEX field, in which case the field is reserved.

If the target identified by a SOURCE TARGET DESCRIPTOR INDEX field or a DESTINATION TARGET DESCRIPTOR INDEX field is not accessible to the copy manager, then the command shall be terminated with a CHECK CONDITION status, the sense key shall be set to COPY ABORTED and the additional sense code shall be set to UNREACHABLE COPY TARGET.

7.4.6.1 Block device to stream device operations

The segment descriptor format shown in table 37 is used by the copy operations that move data from a block device to a stream device or vice versa.

Table 37 — Block device to or from stream device segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (00h, 01h, 0Bh, or 0Ch)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (0014h)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved							
9	(MSB)			STREAM DEVICE TRANSFER LENGTH				
10								
11								(LSB)
12	Reserved							
13	Reserved							
14	(MSB)			BLOCK DEVICE NUMBER OF BLOCKS				
15								(LSB)
16	(MSB)			BLOCK DEVICE LOGICAL BLOCK ADDRESS				
23								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Two DESCRIPTOR TYPE CODE values use the segment descriptor format shown in table 37 and described in this clause.

For descriptor type code 00h (block→stream) or descriptor type code 0Bh (block→stream+application client), the copy manager shall copy the data from the source block device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination stream device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using the logical blocks starting at the location identified by the BLOCK DEVICE LOGICAL BLOCK ADDRESS field. As many blocks shall be read as necessary to process a number of bytes equal to the contents of the DISK BLOCK LENGTH field in the target descriptor for the source device times the contents of the BLOCK DEVICE NUMBER OF BLOCKS field. The data shall be written to the stream device starting at the current position of the media.

For descriptor type code 0Bh (block→stream+application client), the copy manager ~~shall copy the data from the source block device identified by the source target descriptor index field to the destination stream device identified by the destination target descriptor index field using the logical blocks starting at the location identified by the block device logical block address field and continuing for the number of blocks specified in the block device number of blocks field. The data shall be written to the stream device starting at the current position of the media. The copy manager~~ also shall hold a copy of the processed data for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service

action as described in 7.16.2. If the copy manager supports the 0Bh descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 20 (0014h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written on each write operation to the stream device. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the sequential-access device type.

~~The BLOCK DEVICE NUMBER OF BLOCKS field specifies the number logical blocks to be read in the segment. A value of zero indicates that no blocks shall be transferred in this segment. This shall not be considered as an error.~~

The BLOCK DEVICE NUMBER OF BLOCKS field specifies the length, in source logical blocks, of data to be processed in the segment. A value of zero shall not be considered as an error. No data shall be processed, but any destination data retained from a previous segment shall be written if possible to the destination in whole-block transfers. A value of zero shall not modify the handling of residual data.

The BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting logical block address on the block device for this segment.

7.4.6.2 Stream device to block device operations

The segment descriptor format shown in table 37 (see 7.4.6.1) also is used by the copy operations that move data from a stream device to a block device. Two DESCRIPTOR TYPE CODE values use the segment descriptor format shown in table 37 and described in this clause.

For descriptor type code 01h (stream→block) or descriptor type code 0Ch (stream→block+application client), the copy manager shall copy the data from the source stream device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination block device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using the stream data starting at the current position of the stream device. The data shall be written to logical blocks starting at the location identified by the BLOCK DEVICE LOGICAL BLOCK ADDRESS field and continuing for the number of blocks specified in the BLOCK DEVICE NUMBER OF BLOCKS field.

For descriptor type code 0Ch (stream→block+application client), the copy manager ~~shall copy the data from the source stream device identified by the source target descriptor index field to the destination block device identified by the destination target descriptor index field using the stream data starting at the current position of the stream device. The data shall be written to logical blocks starting at the location identified by the block device logical block address field and continuing for the number of blocks specified in the block device number of blocks field. The copy manager~~ also shall hold a copy of the <u>processed</u> data for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service action as described in 7.16.2. If the copy manager supports the 0Ch descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 20 (0014h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be read from the source stream device on each read operation. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in

the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the sequential-access device type.

The BLOCK DEVICE NUMBER OF BLOCKS field specifies the number blocks to be written by the segment. A value of zero indicates that no blocks shall be ~~transferred~~ written in this segment. This shall not be considered as an error.

The BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting logical block address on the block device for this segment.

7.4.6.3 Block device to block device operations

The segment descriptor format shown in table 38 is used by the copy operations that move data from a block device to a block device.

Table 38 — Block device to block device segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (02h or 0Dh)							
1	Reserved						DC	CAT
2	(MSB)							
3	DESCRIPTOR LENGTH (0018h)							(LSB)
4	(MSB)							
5	SOURCE TARGET DESCRIPTOR INDEX							(LSB)
6	(MSB)							
7	DESTINATION TARGET DESCRIPTOR INDEX							(LSB)
8	Reserved							
9	Reserved							
10	(MSB)							
11	BLOCK DEVICE NUMBER OF BLOCKS							(LSB)
12	(MSB)							
19	SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS							(LSB)
20	(MSB)							
27	DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS							(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Two DESCRIPTOR TYPE CODE values use the segment descriptor format shown in table 38 and described in this clause.

For descriptor type code 02h (block→block) or descriptor type code 0Dh (block→block+application client), the copy manager shall copy the data from the source block device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination block device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using the logical blocks starting at the location identified by the SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS field. The data shall be written to logical blocks starting at the location identified by the DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS field.

If the DC bit equals zero, as many blocks shall be read as necessary to process a number of bytes equal to the contents of the DISK BLOCK LENGTH field in the target descriptor for the source device times the contents of the

BLOCK DEVICE NUMBER OF BLOCKS field, and as many writes as possible will be performed using any destination data retained from the previous segment and the data processed in this segment. If the DC bit equals one, the number of blocks specified by the BLOCK DEVICE NUMBER OF BLOCKS field shall be written to the destination block device, as many bytes shall be processed as necessary for these writes to be performed, and as many blocks shall be read as necessary to supply the data to be processed.

For descriptor type code 0Dh (block→block+application client), the copy manager ~~shall copy the data from the source block device identified by the source target descriptor index field to the destination block device identified by the destination target descriptor index field using the logical blocks starting at the location identified by the source block device logical block address field and continuing for the number of blocks specified in the block device number of blocks field. The data shall be written to logical blocks starting at the location identified by the destination block device logical block address field. The copy manager~~ also shall hold a copy of the processed data for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service action as described in 7.16.2. If the copy manager supports the 0Dh descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.

The CAT bit is described in 7.4.6.

The destination count (DC) bit indicates whether the BLOCK DEVICE NUMBER OF BLOCKS field refers to the source or destination device. A DC bit of zero indicates that the BLOCK DEVICE NUMBER OF BLOCKS field refers to the source device. A DC bit of one indicates that the BLOCK DEVICE NUMBER OF BLOCKS field refers to the destination device.

The DESCRIPTOR LENGTH field shall contain 24 (0018h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

~~The block device number of blocks field specifies the number of blocks to be transferred from the source block device to the destination block device. A value of zero indicates that no blocks are to be transferred. This shall not be considered as an error.~~

The BLOCK DEVICE NUMBER OF BLOCKS field specifies the number of blocks to be processed (if DC=0) or to be written to the destination device (if DC=1). A value of zero shall not be considered as an error. If the DC bit equals one, a value of zero indicates that no destination blocks shall be written and the only processing to be performed is that any source or destination data retained from the previous segment shall be handled as residual data as described in 7.4.6. If the DC bit equals zero, a value of zero indicates that no source blocks shall be read and no source data shall be processed, but any destination data retained from a previous segment shall be written if possible to the destination in whole-block transfers, and any residual data shall be handled as described in 7.4.6.

The SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the logical block address from which the reading of data will start.

The DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the logical block address to which the writing of data will begin.

7.4.6.4 Stream device to stream device operations

The segment descriptor format shown in table 39 is used by the copy operations that move data from a stream device to a stream device.

Table 39 — Stream device to stream device segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (03h or 0Eh)							
1	Reserved						~~DC~~ Reserved	CAT
2	(MSB)							
3	DESCRIPTOR LENGTH (0010h)							(LSB)
4	(MSB)							
5	SOURCE TARGET DESCRIPTOR INDEX							(LSB)
6	(MSB)							
7	DESTINATION TARGET DESCRIPTOR INDEX							(LSB)
8	Reserved							
9	(MSB)							
10	SOURCE STREAM DEVICE TRANSFER LENGTH							
11								(LSB)
12	Reserved							
13	(MSB)							
14	DESTINATION STREAM DEVICE TRANSFER LENGTH							
15								(LSB)
16	(MSB)			~~TRANSFER COUNT~~				
19	BYTE COUNT							(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Two DESCRIPTOR TYPE CODE values use the segment descriptor format shown in table 39 and described in this clause.

For descriptor type code 03h (stream→stream) or descriptor type code 0Eh (stream→stream+application client), the copy manager shall copy the data from the source stream device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination stream device identified by the DESTINATION TARGET DESCRIPTOR INDEX field. Data shall be read from the source stream device starting at the current position of the source stream device. Data shall be written to the destination stream device starting at the current position of the destination stream device. ~~The transfer count and dc fields define the number of read or write operations to be performed by the copy manager.~~ The BYTE COUNT field defines the number of bytes to be processed by the copy manager. The copy manager shall perform read operations as necessary to supply the source data, and as many write operations as possible using the destination data.

For descriptor type code 0Eh (stream→stream+application client), the copy manager ~~shall copy the data from the source stream device identified by the source target descriptor index field to the destination stream device identified by the destination target descriptor index field. Data shall be read from the source stream device starting at the current position of the source stream device. Data shall be written to the destination stream device starting~~

~~at the current position of the destination stream device. The transfer count and dc fields define the number of read or write operations to be performed by the copy manager. The copy manager~~ also shall hold a copy of the processed data for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service action as described in 7.16.2. If the copy manager supports the 0Eh descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.

The CAT bit is described in 7.4.6.

~~The destination count (dc) bit indicates whether the transfer count field refers to the source or destination device. A dc bit of zero indicates that the transfer count field indicates the number of read operations to be performed on the source device. A dc bit of one indicates that the transfer count field indicates the number of write operations to be performed on the destination device.~~

The DESCRIPTOR LENGTH field shall contain 16 (0010h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The SOURCE STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be read from the source stream device on each read operation. See 7.4.5.7 for a description of how data in the SOURCE STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the source sequential-access device type.

The DESTINATION STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written to the destination stream device on each write operation. See 7.4.5.7 for a description of how data in the DESTINATION STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the destination sequential-access device type.

~~The transfer count field specifies the number of read/write operations that shall be executed for this segment descriptor. A value of zero indicates that no reads or writes are to be performed. This shall not be considered as an error. The dc bit indicates whether the number of reads or writes is specified.~~

The BYTE COUNT field specifies the number of bytes that shall be processed for this segment descriptor. A value of zero shall not be considered as an error; and shall indicate that no source blocks shall be read and no source data shall be processed, but any destination data retained from a previous segment shall be written if possible to the destination in whole-block transfers, and any residual data shall be handled as described in 7.4.6.

7.4.6.5 Inline data to stream device operation

The segment descriptor format shown in table 40 instructs the copy manager to write inline data from the EXTENDED COPY parameter list to a stream device.

Table 40 — Inline data to stream device segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (04h)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (0010h)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved							
9	(MSB)			STREAM DEVICE TRANSFER LENGTH				
10								
11								(LSB)
12	(MSB)			inline data offset				
15								(LSB)
16	(MSB)			INLINE DATA NUMBER OF BYTES				
19								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 04h (inline→stream) instructs the copy manager to write inline data from the EXTENDED COPY parameter list to a stream device. The inline data shall be read from the optional inline data at the end of the EXTENDED COPY parameter list. The data shall be written to the destination stream device identified by the DESTINATION TARGET DESCRIPTOR INDEX field starting at the current position of the stream device. Any destination data retained from a previous segment descriptor shall be written before the data of the current segment descriptor. Any source data retained from a previous segment descriptor shall not be processed, and shall be handled as residual source data.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 16 (0010h). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written to the stream device on each write operation. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the destination sequential-access device type.

The value in the INLINE DATA OFFSET field is added to the location of the first byte of inline data in the EXTENDED COPY parameter list (see table 22) to locate the first byte of inline data to be written to the stream device. The INLINE DATA OFFSET value shall be a multiple of 4.

The INLINE DATA NUMBER OF BYTES field specifies the number of bytes of inline data that are to be transferred to the stream device. A value of zero shall not be considered an error.

If the sum of the INLINE DATA OFFSET and the INLINE DATA NUMBER OF BYTES values exceeds the value in the INLINE DATA LENGTH field (see table 22), the copy manager shall terminate the command with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INLINE DATA LENGTH EXCEEDED.

7.4.6.6 Embedded data to stream device operation

The segment descriptor format shown in table 41 instructs the copy manager to write embedded data from the segment descriptor to a stream device.

Table 41 — Embedded data to stream device segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (05h)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (n-4)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved							
9	(MSB)			STREAM DEVICE TRANSFER LENGTH				
10								
11								(LSB)
12	(MSB)			EMBEDDED DATA NUMBER OF BYTES				
13								(LSB)
14				Reserved				
15								
16				EMBEDDED DATA				
n								

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 05h (embedded→stream) instructs the copy manager to write embedded data from the segment descriptor to a stream device. The embedded data shall be read from the segment descriptor. The data shall be written to the destination stream device identified by the DESTINATION TARGET DESCRIPTOR INDEX field starting at the current position of the stream device. Any destination data retained from a previous segment descriptor shall be written before the data of the current segment descriptor. Any source data retained from a previous segment descriptor shall not be processed, and shall be handled as residual source data.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain the length in bytes of the fields that follow the DESCRIPTOR LENGTH field (including embedded data). The value in the DESCRIPTOR LENGTH field shall be a multiple of 4.

The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written to the stream device on each write operation. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the destination sequential-access device type.

The EMBEDDED DATA NUMBER OF BYTES field specifies the number of bytes of embedded data that are to be transferred to the stream device. A value of zero shall not be considered an error. The EMBEDDED DATA NUMBER OF BYTES value shall be less than or equal to the DESCRIPTOR LENGTH value minus 12.

7.4.6.7 Stream device to discard operation

The segment descriptor format shown in table 42 instructs the copy manager to read data from a stream device and not copy it to any destination device.

Table 42 — Stream device to discard segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (06h or 0Fh)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (000Ch)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	Reserved							
7	Reserved							
8	Reserved							
9	(MSB)			STREAM DEVICE TRANSFER LENGTH				
10								
11								(LSB)
12	(MSB)			NUMBER OF BYTES				
15								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Two DESCRIPTOR TYPE CODE values use the segment descriptor format shown in table 42 and described in this clause.

For descriptor type code 06h (stream→discard) or descriptor type code 0Fh (stream→discard+application client), the copy manager shall read data as necessary from the source stream device identified by the SOURCE TARGET DESCRIPTOR INDEX field starting at the current position of the source stream device. ~~The data read shall not be transferred to any destination device.~~ The number of bytes indicated by the NUMBER OF BYTES field shall be removed from the source data, starting with any source data retained from the previous segment.

For descriptor type code 06h the removed data shall be discarded and not written to any destination device. For descriptor type code 0Fh the removed data shall be held for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service action as described in 7.16.2. If the copy manager supports the 0Fh descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.

~~For descriptor type code 0Fh (stream→discard+application client), the copy manager shall read data from the source stream device identified by the source target descriptor index field starting at the current position of the source stream device and hold a copy of the read data for delivery to the application client upon completion of the EXTENDED COPY command in response to a RECEIVE COPY RESULTS command with RECEIVE DATA service action as described in 7.16.2. If the copy manager supports the 0Fh descriptor type code it also shall support the RECEIVE COPY RESULTS command with RECEIVE DATA service action.~~

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 12 (000Ch). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The SOURCE STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be read from the source stream device on each read operation. See 7.4.5.7 for a description of how data in the SOURCE STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the source sequential-access device type.

The NUMBER OF BYTES field specifies the number of bytes to be ~~read from the stream device~~ removed from the source data.

7.4.6.8 Verify device operation

The segment descriptor format shown in table 43 instructs the copy manager to verify the accessibility of a device.

Table 43 — Verify device operation segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (07h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0008h)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	Reserved							
7	Reserved							
8	Reserved							TUR
9	Reserved							
10	Reserved							
11	Reserved							

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 07h instructs the copy manager to verify the accessibility of the device identified by the SOURCE TARGET DESCRIPTOR INDEX field. ~~The~~

~~accessibility should be verified without disturbing established unit attention or ACA conditions, for example, using the INQUIRY command (see 7.5).~~

The DESCRIPTOR LENGTH field shall contain 8 (0008h). The SOURCE TARGET DESCRIPTOR INDEX field is described in 7.4.6.

Support for a value of one in the TUR (Test Unit Ready) bit is optional. If a TUR value of one is supported and the TUR bit contains one, then a TEST UNIT READY command shall be used to determine the readiness of the device. If a TUR value of one is not supported and the TUR bit contains one, then the EXTENDED COPY command shall be terminated with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INVALID FIELD IN PARAMETER LIST. The SENSE-KEY SPECIFIC field shall be set as described in 7.4.2. If the TUR bit contains one, then the accessibility should be verified without disturbing established unit attention or ACA conditions, for example, using the INQUIRY command (see 7.5).

7.4.6.9 Block device with offset to stream device operation

The segment descriptor format shown in table 44 is used to instruct the copy manager to move data from a block device with a byte offset to a stream device or vice versa.

Table 44 — Block device with offset to or from stream device segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (08h or 09h)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (0018h)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved							
9	(MSB)			STREAM DEVICE TRANSFER LENGTH				
10								
11								(LSB)
12	(MSB)			NUMBER OF BYTES				
15								(LSB)
16	(MSB)			BLOCK DEVICE LOGICAL BLOCK ADDRESS				
23								(LSB)
24	Reserved							
25	Reserved							
26	(MSB)			BLOCK DEVICE BYTE OFFSET				
27								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 08h (block<o>→stream) instructs the copy manager to copy the data from the source block device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination stream device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using data starting at the location identified by the BLOCK DEVICE BYTE OFFSET field in the logical block identified by the BLOCK DEVICE LOGICAL BLOCK ADDRESS field and continuing for the number of bytes specified in the NUMBER OF BYTES field. The data shall be written to the stream device starting at the current position of the media.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 24 (0018h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written on each write operation to the stream device. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the sequential-access device type.

The NUMBER OF BYTES field specifies the number bytes to be read. A value of zero indicates that no bytes shall be transferred in this segment. This shall not be considered as an error.

The BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting logical block address on the source block device for this segment.

The BLOCK DEVICE BYTE OFFSET field specifies the offset into the first source block at which to begin reading bytes.

7.4.6.10 Stream device to block device with offset operation

The segment descriptor format shown in table 44 (see 7.4.6.9) also is used to instruct the copy manager to move data from a stream device to a block device with a byte offset.

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 09h (stream→block<o>) instructs the copy manager to copy the data from the source stream device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination block device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using the stream data starting at the current position of the stream device. The data shall be written starting at the location identified by the BLOCK DEVICE BYTE OFFSET field in the logical block identified by the BLOCK DEVICE LOGICAL BLOCK ADDRESS field and continuing for the number of bytes specified in the NUMBER OF BYTES field.

The content of the starting logical block on the destination device before the starting offset shall be preserved. The content on the ending logical block beyond the end of the transfer shall be preserved. The copy manager may implement this operation by reading the starting and ending logical blocks, modifying a portion of the blocks as required, and writing the full blocks to the destination device.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 24 (0018h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The STREAM DEVICE TRANSFER LENGTH field specifies the amount of data to be written on each write operation to the stream device. See 7.4.5.7 for a description of how data in the STREAM DEVICE TRANSFER LENGTH field in the segment descriptor interacts with data in the STREAM BLOCK LENGTH field in the device type specific target descriptor parameters for the sequential-access device type.

The NUMBER OF BYTES field specifies the number bytes to be read. A value of zero indicates that no bytes shall be transferred in this segment. This shall not be considered as an error.

The BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting logical block address on the destination block device for this segment.

The BLOCK DEVICE BYTE OFFSET field is the offset into the first destination block at which to begin writing data to the destination block device.

7.4.6.11 Block device with offset to block device with offset operation

The segment descriptor format shown in table 45 instructs the copy manager to move data from a block device with a byte offset to a block device with a byte offset.

Table 45 — Block device with offset to block device with offset segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (0Ah)							
1	Reserved							CAT
2	(MSB)			DESCRIPTOR LENGTH (001Ch)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	(MSB)			NUMBER OF BYTES				
11								(LSB)
12	(MSB)			SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS				
19								(LSB)
20	(MSB)			DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS				
27								(LSB)
28	(MSB)			SOURCE BLOCK DEVICE BYTE OFFSET				
29								(LSB)
30	(MSB)			DESTINATION BLOCK DEVICE BYTE OFFSET				
31								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 0Ah (block<o>→block<o>) instructs the copy manager to copy the data from the source block device identified by the SOURCE TARGET DESCRIPTOR INDEX field to the destination block device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using data starting at the location identified by the source BLOCK DEVICE BYTE OFFSET field in the logical block identified by the SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS field and continuing for the number of bytes specified in the NUMBER OF BYTES field. The data shall be written starting at the location identified by the DESTINATION BLOCK DEVICE BYTE OFFSET field in the logical block identified by the DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS field.

The content of the starting logical block on the destination device before the starting offset shall be preserved. The content on the ending logical block beyond the end of the transfer shall be preserved. The copy manager may

implement this operation by reading the starting and ending logical blocks, modifying a portion of the blocks as required, and writing the full blocks to the destination device.

The CAT bit is described in 7.4.6.

The DESCRIPTOR LENGTH field shall contain 28 (001Ch). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The NUMBER OF BYTES field specifies the number bytes to be read. A value of zero indicates that no bytes shall be transferred in this segment. This shall not be considered as an error.

The SOURCE BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting address on the source block device for this segment.

The DESTINATION BLOCK DEVICE LOGICAL BLOCK ADDRESS field specifies the starting logical block address on the destination block device for this segment.

The SOURCE BLOCK DEVICE BYTE OFFSET field specifies the offset into the first source block at which to begin reading bytes.

The DESTINATION BLOCK DEVICE BYTE OFFSET field is the offset into the first destination block at which to begin writing data to the destination block device.

7.4.6.12 Write filemarks operation

The segment descriptor format shown in table 46 instructs the copy manager to write filemarks or setmarks on the destination tape device.

Table 46 — Write filemarks operation segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (10h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0008h)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved						WSMK	Reserved
9	(MSB)			TRANSFER LENGTH				
10								
11								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 10h (filemark→tape) instructs the copy manager to write filemarks or setmarks to the destination tape device identified by the DESTINATION TARGET DESCRIPTOR INDEX field starting at the current position of the tape device. If the PERIPHERAL DEVICE TYPE field in the target descriptor identified by the DESTINATION TARGET DESCRIPTOR INDEX field does not contain

01h, the copy manager shall terminate the command with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INVALID OPERATION FOR COPY SOURCE OR DESTINATION.

The DESCRIPTOR LENGTH field shall contain 8 (0008h). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

If the write setmark (WSMK) bit is one, the TRANSFER LENGTH field specifies the number of setmarks to be written. If the WSMK bit is zero, the TRANSFER LENGTH field specifies the number of filemarks to be written.

7.4.6.13 Space operation

The segment descriptor format shown in table 47 instructs the copy manager to send a SPACE command (see SSC) to the destination tape device.

Table 47 — Space operation segment descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (11h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0008h)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	Reserved					CODE		
9	(MSB)			COUNT				
10								
11								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 11h (space→tape) instructs the copy manager to send a SPACE command to the destination tape device identified by the DESTINATION TARGET DESCRIPTOR INDEX field. If the PERIPHERAL DEVICE TYPE field in the target descriptor identified by the DESTINATION TARGET DESCRIPTOR INDEX field does not contain 01h, the copy manager shall terminate the command with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INVALID OPERATION FOR COPY SOURCE OR DESTINATION.

The DESCRIPTOR LENGTH field shall contain 8 (0008h). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The CODE and COUNT field contents in the SPACE command sent to the destination tape device shall be copied from the CODE and COUNT fields in the segment descriptor. All other fields in the SPACE command sent to the destination tape device that affect the positioning of the tape shall be set to zero.

7.4.6.14 Locate operation

The segment descriptor format shown in table 48 instructs the copy manager to send a LOCATE command (see SSC) to the destination tape device.

Table 48 — Locate operation segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (12h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0008h)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	(MSB)			BLOCK ADDRESS				
11								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 12h (locate→tape) instructs the copy manager to send a LOCATE command to the destination tape device identified by the DESTINATION TARGET DESCRIPTOR INDEX field. If the PERIPHERAL DEVICE TYPE field in the target descriptor identified by the DESTINATION TARGET DESCRIPTOR INDEX field does not contain 01h, the copy manager shall terminate the command with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INVALID OPERATION FOR COPY SOURCE OR DESTINATION.

The DESCRIPTOR LENGTH field shall contain 8 (0008h). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The BLOCK ADDRESS field contents in the LOCATE command sent to the destination tape device shall be copied from the BLOCK ADDRESS field in the segment descriptor. All other fields in the LOCATE command sent to the destination tape device that affect the positioning of the tape shall be set to zero.

NOTE 8 The restrictions described above for the LOCATE command limit the operation to locating SCSI logical block addresses in the current tape partition.

7.4.6.15 Tape device image copy operation

The segment descriptor format shown in table 49 instructs the copy manager to perform an image copy from the source tape device to the destination tape device.

Table 49 — Tape device image copy segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (13h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0008h)				
3								(LSB)
4	(MSB)			SOURCE TARGET DESCRIPTOR INDEX				
5								(LSB)
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	(MSB)			COUNT				
11								(LSB)

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 13h (<i>tape→<i>tape) instructs the copy manager to create a compatible image of the source device medium identified by the SOURCE TARGET DESCRIPTOR INDEX field on the destination device medium identified by the DESTINATION TARGET DESCRIPTOR INDEX field beginning at their current positions. If the PERIPHERAL DEVICE TYPE field in the target descriptor identified by the SOURCE TARGET DESCRIPTOR INDEX field or the DESTINATION TARGET DESCRIPTOR INDEX field does not contain 01h, the copy manager shall terminate the command with a CHECK CONDITION status. The sense key shall be set to COPY ABORTED and the additional sense code shall be set to INVALID OPERATION FOR COPY SOURCE OR DESTINATION.

The DESCRIPTOR LENGTH field shall contain 8 (0008h). The SOURCE TARGET DESCRIPTOR INDEX and DESTINATION TARGET DESCRIPTOR INDEX fields are described in 7.4.6.

The tape image copy operation terminates when:

a) the source device encounters an end-of-partition as defined by the source device;
b) the source device encounters an end-of-data as defined by the source device (i.e., BLANK CHECK sense key);
c) the copy manager has copied the number of consecutive filemarks specified in the count field from the source device to the destination device; or
d) the copy manager has copied the number of consecutive filemarks and/or setmarks specified in the count field from the source device to the destination device, if the RSMK bit in the device configuration page (see SSC) of the source device is on.

The COUNT field of zero indicates that the EXTENDED COPY command shall not terminate due to any number of consecutive filemarks or setmarks. Other error or exception conditions (e.g., early-warning, end-of-partition on destination device) may cause the EXTENDED COPY command to terminate prior to completion. In such cases, it is not possible to calculate a residue, so the information field in the sense data shall be set to zero.

7.4.6.16 Register key operation

The segment descriptor format shown in table 50 instructs the copy manager to register a persistent reservations key (see 5.4.2.3) with the device identified by the DESTINATION TARGET DESCRIPTOR INDEX field.

Table 50 — Register key segment descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE CODE (14h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH (0018h)				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			DESTINATION TARGET DESCRIPTOR INDEX				
7								(LSB)
8	(MSB)			RESERVATION KEY				
15								(LSB)
16	(MSB)			SERVICE ACTION RESERVATION KEY				
23								(LSB)
24	Reserved							
27								

The DESCRIPTOR TYPE CODE field is described in 7.4.4 and 7.4.6. Descriptor type code 14h instructs the copy manager to register a persistent reservations key with the device identified by the DESTINATION TARGET DESCRIPTOR INDEX field using a PERSISTENT RESERVE OUT command with a REGISTER service action (see 7.13.1).

The DESCRIPTOR LENGTH field shall contain 24 (0018h). The DESTINATION TARGET DESCRIPTOR INDEX field is described in 7.4.6.

The RESERVATION KEY and SERVICE ACTION RESERVATION KEY field contents in the PERSISTENT RESERVE OUT command sent to the destination device shall be copied from the RESERVATION KEY and SERVICE ACTION RESERVATION KEY fields in the segment descriptor.

NOTE 9 The initiator sending the EXTENDED COPY command may need to remove the reservation key held by the copy manager as described in 5.4.2.5 prior to sending the EXTENDED COPY command.