

# Data Set Encryption information in DFSMSHsm inventory records – OA52810 ++HOLD for Documentation

## Data Set Encryption information saved in the DFSMSHsm inventory records

Date: February 28, 2018

Version: ++HOLD for DOC

### Contents

Data Set Encryption information saved in the DFSMSHsm inventory records .....	1
Version History:.....	3
OVERVIEW: .....	3
PUBLICATION CHANGES:.....	3
z/OS DFSMSHsm Data Areas .....	4
z/OS DFSMSHsm Data Areas> MCK—Control Data Set Key and Record Header .....	4
z/OS DFSMSHsm Data Areas> MCD—Migration Control Data Set Data Set Record .....	6
z/OS DFSMSHsm Data Areas>MCDX—Migration Control Data Set Data Set Record Extension.....	7
z/OS DFSMSHsm Data Areas>MCC—Backup Control Data Set Backup Version Record....	10
z/OS DFSMSHsm Data Areas >UTILP—DFSMSHsm Data Collection Interface – “M” Record .....	12
z/OS DFSMSHsm Data Areas > UTILP-DFSMSHsm Data Collection Interface >ARCUTIL Data Area Cross-Reference – “M” Record .....	13
z/OS DFSMSHsm Data Areas >UTILP—DFSMSHsm Data Collection Interface – “B” Record .....	14
z/OS DFSMSHsm Data Areas > UTILP-DFSMSHsm Data Collection Interface >ARCUTIL Data Area Cross-Reference – “B” Record .....	15
z/OS DFSMSHsm Data Areas > MCVT—Management Communication Vector Table .....	16
z/OS DFSMSHsm Diagnosis.....	16

z/OS DFSMSHsm Diagnosis>Using DFSMSHsm maintenance commands>Maintenance command: FIXCDS>Required parameters of the FIXCDS command>type: Specifying the type of control data set record.....	16
z/OS DFSMSHsm Diagnosis>Using DFSMSHsm maintenance commands>Maintenance command: FIXCDS>Required parameters of the FIXCDS command>key: Specifying the control record key.....	17
z/OS DFSMSHsm Storage Administration .....	17
z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference>Using the LIST command>Requesting information for data sets>Requesting data set information from the MCDS .....	18
z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference>Using the LIST command>Requesting information for data sets>Requesting data set information from the BCDS.....	19
z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference >Using the AUDIT command >Using the enhanced audit command to audit DFSMSHsm control information>Using the AUDIT DATASETCONTROLS (MIGRATION) command .....	21
z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference >Using the AUDIT command >Using the enhanced audit command to audit DFSMSHsm control information >Using the AUDIT DATASETCONTROLS (MIGRATION) command>Diagnosis and repair action for AUDIT DATASETCONTROLS (MIGRATION) .....	21
z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference >Using the AUDIT command >Error codes (*ERR) and diagnosis .....	22
z/OS DFSMS Access Method Services Commands.....	22
z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output....	22
z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Structure – Migrated .....	23
z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Field Descriptions > Migrated Data Set Record Field.....	24
z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output >DCOLLECT Output Record Structure - Backup.....	24
z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Field Descriptions > Backup Data Set Record Field.....	26
z/OS DFSMSHsm Implementation and Customization Guide.....	26
z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection interface > Direct invocation of ARCUTIL load module.....	26
z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection interface > Invoking the ARCUTIL load module with a user-written program >.....	26

z/OS DFSMSHsm Implementation and Customization Guide > Customizing > Tuning > Tuning patches supported by DFSMSHsm > Allowing DFSMSHsm to create encryption information in its migration and backup control data sets (new section) .....	27
z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection interface.....	27
z/OS MVS System Messages.....	28
z/OS MVS>z/OS MVS System Messages, Vol 2 (ARC-ASA)>ARC messages>ARC0734I .....	28
z/OS MVS > z/OS MVS System Messages, Vol 2 (ARC-ASA) > ARC messages > ARC6113E.....	28
z/OS MVS > z/OS MVS System Messages, Vol 2 (ARC-ASA) > ARC messages > ARC6059E.....	28
z/OS MVS > z/OS MVS System Messages, Vol 6 (GOS-IEA) > IDC messages > IDC21804I .....	28

## Version History:

- ++HOLD for DOC - Nov 16, 2017

## OVERVIEW:

DFSMSHsm has added a new record type to the Migration Control Data Set (MCDS). The key for this new record type begins with '03'X and will be referred to as the MCDX record. The MCDX record is an extension of the MCD (Migration Control Data Set Data Set Record) record and together will describe data set information at the time a data set is migrated.

The new function records the encryption information for a data set at the time of migration in this record. In addition, the encryption information for a data set at the time of backup is recorded in a new extension of the MCC (Backup Control Data Set Backup Version Record) record type in the Backup Control Data Set (BCDS).

This encryption information is also maintained in the DCOLLECT records created at the time a data is migrated or backed up and displayed by the HSM LIST command.

The creation of the encryption information to be placed in the HSM control data set will be patch enabled.

The DFHSM LIST command was changed for the MCDS and BCDS keywords to report the encryption information (type and keylabel) on new lines.

## PUBLICATION CHANGES:

Documentation for this new function has been provided in the following publications.

- z/OS MVS System Messages Vol 2 (ARC-ASA) SA38-0669-30
- z/OS DFSMSHsm Data Areas GC14-7504-30
- z/OS DFSMSHsm Diagnosis GC52-1387-30
- z/OS DFSMSHsm Implementation and Customization Guide SC23-6869-30
- z/OS DFSMS Access Method Services Commands SC23-6846-30
- z/OS DFSMSHsm Storage Administration SC23-6871-30

## [z/OS DFSMSHsm Data Areas](#)

### [z/OS DFSMSHsm Data Areas](#) > [MCK—Control Data Set Key and Record Header](#)

Each migration control data set record, backup control data set record, and offline control data set record begins with similar key and record header fields (see [Table 1](#)). The combined length of the key and record header is 64 bytes.

Added Type 3

Offsets Decimal (Hex)		Type	Length	Name	Description
0	(0)	STRUCTURE	44	MCK	Control data set entry key.
0	(0)	CHARACTER	1	MCKTYPE	<p>First byte of the control data set record key. It represents the entry type for migration control data set records, backup control data set records and offline control data set records for all but 'A', 'B', 'C', and 'D' records.</p> <p>MIGRATION CDS ENTRY TYPES:            '00'X=SYNCHRONIZATION RECORD            '01'X=AUTH USER - CODE 'U'            '02'X=FREESPACE LEV1 - CODE '1'            '03'X=MCD EXTENSION - CODE '3'            '04'X=DISK - CODE 'V'            '07'X=VOL ALLOC CNT - CODE 'N'            '10'X=STATISTICS/CONTROL - CODE 'S'            '12'X=VSAM ASSOCIATIONS - CODE 'O'</p> <p>BACKUP CDS ENTRY TYPES:            '20'X=SYNCHRONIZATION RECORD            '21'X=DVL RECORD - CODE 'Y'            '22'X=DCL RECORD - CODE 'W'            '23'X=FRD RECORD - CODE 'K'            '25'X=FRSV RECORD - CODE 'J'</p>

					<p>'26'X=MOVE BACKUP COPIES - CODE 'M'  '27'X=BACKUP MIGRATED DS - CODE 'L'  '28'X=PRIMARY VOLUME ENTRY - CODE 'P'  '29'X=DGN RECORD - CODE 'G'  '2A'X=ABR RECORD - CODE 'Q'  '2C'X=BACKUP VOLUME ENTRY - CODE 'X'  '2D'X=FRTV RECORDS - CODE 'I'  '2E'X=FRB RECORD - CODE 'F'  '2F'X=FRVP RECORD - CODE 'H'  '30'X=BCR,BVR,AND DCR RECORDS - CODE 'R'</p> <p>OFFLINE CDS ENTRY TYPES:  '32'X=SYNCHRONIZATION RECORD  '32'X=TAPE TABLE OF CONTENTS - CODE 'T'  '33'X=TAPECOPY NEEDED RECORD -CODE 'E'</p> <p>When MCKTYPE &gt;'40'X, see MCHTYPE</p>
1	(1)	CHARACTER	43	MCKKEY2	Remainder of the control data set record key.
44	(2C)	CHARACTER		MCKHDR	Start of the entry header.
44	(2C)	STRUCTURE	20	MCH	Control data set record header.
44	(2C)	FIXED	2	MCHLEN	Total length of the record, including key and header fields.
46	(2E)	CHARACTER	1	MCHTYPE	<p>Entry type for migration control data set records, backup control data set records, or offline control data set records. The MCHTYPE will equal the MCKTYPE for all but code 'A', 'B', 'C', and 'D' records.</p> <p>When MCKTYPE &gt; '40'X,  MCHTYPE='00'X, DATASET ENTRY - CODE 'D'  MCHTYPE='11'X, VSAM INTERCEPT CODE 'A'  MCHTYPE='20'X, DATASET BACKUP ENTRY - CODE 'B'  MCHTYPE='24'X, BACKUP COPY ENTRY - CODE 'C'</p>
47	(2F)	BIT(8)	1	MCHLOCK	ENTRY LOCK BYTE - NOT USED (NX)

48	(30)	CHARACTER	8	MCHTSLU	Time of the last update of the record. The time is obtained from the TIME STCK macro in the 64-bit microsecond clock format.
56	(38)	CHARACTER	8	MCHTSCR	Time of record creation. The time is obtained from the TIME STCK macro in the 64-bit microsecond clock format.
64	(40)	CHARACTER		MCHDATA	Start of variable entry data.

Table 1. MCK—Control Data Set Key and Record Header

z/OS DFSMSHsm Data Areas> [MCD—Migration Control Data Set Data Set Record](#)

Table 1. MCD—MCDS Data Set Record

Added MCDF\_MCDX and MCDF\_MCDX\_KCONV

496(1F0)	432(1B0)	BITSTRING	1	MCDFLGS4	This byte contains the following flags:
		1... ..		MCDF_CA_RECLAIM_ELIG	When set to 1, the VSAM KSDS data set was eligible for CA reclaim processing when migrated
		.1.. ..		MCDF_ZFS	When set to 1, the VSAM LINEAR data set is for ZFS usage
		..1. ....		MCDF_MCDX	When set to 1, an MCDX record exists for this MCD record as an extension of it. The key of the MCDX record is '03'x followed by 43 bytes of the data set name. For a DSN with a 44-character name, the last 4 characters are compressed to a 3-BYTE HEX string. The MCD flag, MCDF_MCDX_KCONV,

					indicates that the name was converted.
		...1 ....		MCDF_MCDX_KCONV	When set to 1, the format of the last three bytes of the MCDX key is in a compressed format which is not printable
497(1F1)	433(1B1)	CHARACTER	3	MCD_MCDX_KEY_SUFFIX	Last three bytes of the MCDX key when its key was compressed. Valid when MCDF_MCDX_KCONV is set on
500(1F4)	436(1B4)	CHARACTER	20		Reserved.

### MCD Data Area Cross-Reference

Table 1. MCD Data Area Cross-Reference Table

Name	Hex Offset	Hex Value	Struct Level
MCDF_MCDX	1F0	20	3
MCDF_MCDX_KCONV	1F0	10	3
MCD_MCDX_KEY_SUFFIX	1F1		2

## z/OS DFSMSHsm Data Areas> MCDX—Migration Control Data Set Data Set Record Extension

Added new MCDX Section

The Migration Control Data Set data set record extension (MCDX), describes additional information for an individual data set that is not described by its migrated data set record (MCD). This entry record type '3' is a record in the migration control data set.

#### Notes:

- An extension record may exist for a migrated data set. It will exist for user data sets that were:
  - Encrypted at the time of the user data set being migrated.
  - For future reasons

The 44-byte key of this record in the MCDS is the CDS record type '03'x followed by up to the first 43-bytes of the data set name. For a DSN with a 44-character name, the last 4 characters are compressed to a 3-BYTE HEX string. The last 4 data set name hexadecimal characters are converted to 6-bit values by removing the high-order two bits from each by subtracting 'C0'x from the alphanumeric characters (A-Z, 0-9) and '40'x from the valid special characters ('#', '@', '-', '\$', '.'). The results of these four 6-bit values are compressed together to form a 24-bit value. This compressed 3-character value is used to replace the last 4 characters of the DSN. The compressed 43-character data set name is then appended to the CDS record type '03'x to form the 44-byte key for a migrated data set record extension. Reverse the procedure to produce printable characters. This 3-BYTE-HEX string is stored in the MCD record field, MCD\_MCDX\_KEY\_SUFFIX.

The total length of this MCDX record is 440 bytes.

An example of the key that is used with a type '3' migration control data set data set record extension is:

FIXCDS 3 IBMUSER.VSAMKS6A.A9012345.B8901234.D789.E334

Offsets Actual / FIXCDS		Type	Length	Name	Description
0(0)			44	MCK	Migrated data set record extension key consisting of '03'x followed by 43 bytes of the data set name. For a DSN with a 44-character name, the last 4 characters are compressed to a 3-BYTE HEX string. The MCD flag, MCDX_MCDX_KCONV indicates that the name was converted.
44(2C)			20	MCH	Control data set record header. (See MCK for details.)
64(40)	0(0)	STRUCTURE	96	MCDX	Migration control data set extension entry record



64(40)	0(0)	CHARACTER	96	MCDX_ENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was migrated
64(40)	0(0)	FIXED	2	MCDX_ENCTYPE	Encryption Type <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>
66(42)	2(2)	CHARACTER	64	MCDX_ENCLABEL	Encryption Key Label <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
130(82)	66(42)	CHARACTER	30	MCDX_ENCRESV	Encryption Reserved
160(A0)	96(60)	CHARACTER	44	MCDXODSN	Data set name of the original data set (MCD Key)
248(F8)	184(B8)	CHARACTER	236	*	Reserved and unused
440(1B8)	376(178)		0	MCDXENDF	End of MCDX record

Table 1. MCDX—Migration Control Data Set Extension Entry Record

### MCDX Data Area Cross-Reference

Table 1. MCDX Data Area Cross-Reference Table

Name	Hex Offset	Hex Value	Struct Level
MCDX	40		1
MCDX_ENCLABEL	42		3
MCDX_ENCRYPTA	40		2

MCDX_ENCTYPE	40		3
MCDXEND	1B8		2
MCDXODSN	A0		2

Table 1. MCDX Data Area Cross-Reference Table

## z/OS DFSMSHsm Data Areas> MCC—Backup Control Data Set Backup Version Record

The backup control data set backup version record (MCC) describes a backup version of a data set. Backup control data set backup version records are 380 bytes long, plus 6 times one less than the number of tape volumes that are used. [The MCC extension is 142 bytes and is located after the list of tape volumes that are used for the backup version.](#)

For example, if 11 volumes are used, the record length would be computed as follows:

11 - 1 = 10  
 10 × 6 = 60  
 380 + 60 = 440  
 440 + 142 = 582

The total record length of this MCC record is 582 bytes. A maximum of 254 tape volumes can be used, so the maximum record length is 2040 bytes. The record type is C.

Offsets Actual / FIXCDS		Type	Length	Name	Description
0(0)			44	MCK	Backup control data set backup version record key, consisting of the data set name of a backup version and padded with blanks. (See MCK for details.)
44(2C)			20	MCH	Control data set record header. (See MCK for details.)
64(40)	0(0)	STRUCTURE	316	MCC	Data portion of the BCDS backup version record.
.....					
371(173)	307(133)	BIT(8)	1	MCCFLGS4	More flags

		1... ..		MCCF_ZFS	When set to 1, the VSAM LINEAR data set is for ZFS usage
		.1.. ..		MCCF_ENCR	When set to 1, the encryption information as described by MCC_ENCRYPTA is present in this MCC record
.....					
380(17C)	316(13C)	CHARACTER		MCCEND	End of Record

Table 1. MCC—BCDS Backup Version Record

The following array exists if this backup version resides on more than one tape and is addressed by the MCCNVSNO field (see [Table 2](#)):

Offsets Decimal (Hex)		Type	Length	Name	Description
0	(0)	CHARACTER	6	MCCAVERN	MCCAVERN is an array containing volume serial numbers of additional volumes after the first one that contains the backup version. The first volume serial number is given in the MCCVSN field.

Table 2. MCC—BCDS Backup Version Record Array

The following structure exists at MCCEND or after the MCCAVERN array of volume serial numbers if additional volumes (beyond MCCVSN) contains the backup version.

Offsets Decimal (Hex)	Type	Length	Name	Description
0(0)	STRUCTURE	142	MCCADDL	Additional backup version record information
0(0)	CHARACTER	96	MCC_ENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was backed up
0(0)	FIXED	2	MCC_ENCTYPE	Encryption Type <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>

2(02)	CHARACTER	64	MCC_ENCLABEL	Encryption Key Label <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
66(42)	CHARACTER	30	MCC_ENCRESV	Encryption Reserved
96(60)	CHARACTER	46	*	Reserved and unused

Table 3. MCC—Additional Backup Version information

MCC Data Area Cross-Reference -

Name	Hex Offset	Hex Value	Struct Level
MCC_ENCR	173	40	3

Nothing new to be added as we don't map structures that are not the base. An example would be the MCCAVSN structure

## z/OS DFSMSHsm Data Areas > [UTILP—DFSMSHsm Data Collection Interface – “M” Record](#)

Increased the length of the record type to add the encryption information in the migrated data set record

The following table defines the mapping for migrated data set information (record type 'M').

Table 2. ARCUTIL—Migrated Data Set Record

### MIGRATED DATA SET INFORMATION (RECORD TYPE “M”)

Offsets Decimal (Hex)	Type	Length	Name	Description
0 (0)	STRUCTURE	424	UMMDSI	Migrated data set information (defined on DCUDATA)
0 (0)	CHARACTER	44	UMDSNAM	Data set name
....				

214(D6)	BITSTRING	1	UMFLAG3	Information flag #3
	1... ..		UMEMPTY	ON, if data set was empty at the time of migration
	.1.. ..		UM_CA_RECLAIM_ELIG	ON, if the VSAM KSDS data set was eligible for CA reclaim processing when migrated
	..1. ..		UMZFS	VSAM Linear data set for zFS
	...1 ..		UMENCRDP	ON, when the data set encryption information in UMENCRYPTA is present in this migration record
	.... xxxx			Reserved
....				
296 (128)		32		Reserved
328 (148)	CHARACTER	96	UMENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was migrated. Valid when UMENCRDP is set
328 (148)	FIXED	2	UMENCRPT	Data set encryption type <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>
330 (14A)	CHARACTER	64	UMENCRPL	Data set encryption key label when encrypted <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
394 (18A)	CHARACTER	30	UMENCRPR	Data set encryption reserved
424 (1A8)		0	UMMDSIE	End of DCUMCDS

**z/OS DFSMSHsm Data Areas > UTILP-DFSMSHsm Data Collection Interface**

**> ARCUTIL Data Area Cross-Reference – “M” Record**

Add the following new field names to the table

**ARCUTIL Data Area Cross-Reference**

Table 1. ARCUTIL Data Area Cross-Reference Table

Name	Hex Offset	Hex Value	Struct Level
UMENCRDP	EE	10	3
UMENCRPA	148		2
UMENCRPT	148		3
UMENCRPL	14A		3
UMENCRPR	18A		3

z/OS DFSMSHsm Data Areas > [UTILP—DFSMSHsm Data Collection Interface – “B” Record](#)

Increased the length of the record type to add the encryption information in the backup version record

The following table defines the mapping for backup version information (record type 'B').

Table 3. ARCUTIL—Backup Version Information Record

**BACKUP DATA SET INFORMATION (RECORD TYPE “B”)**

Offsets Decimal (Hex)	Type	Length	Name	Description
0 (0)	STRUCTURE	300	UBBDSI	Backup data set information (defined on DCUDATA)
0 (0)	CHARACTER	44	UBDSNAM	Data set name
....				
161(A1)	BITSTRING	1	UBFLAG3	Information Flag 3
	1... ..		UBNOSPHERE	When set to 1, SPHERE(NO) processed at the time of backup
	..1.. ..		UBGVCN	When set to 1, GENVSAMCOMPNames processed at the time of backup
	..1. ....		UBF_RETAIN_SPCD	When set to 1, RETAINDays specified at the time of backup

	...1 ....		UBF_NEVER_EXP	When set to 1, this version will never expire. Only valid when UBF_RETAIN_SPCD is set to 1.
	.... 1...		UBENCRP	When set to 1, the data set was encrypted at the time of backup
	.... .1..		UBZFS	VSAM Linear data set for zFS
	.... ..1.		UBENCRDP	When set to 1, the data set encryption information in UBENCRYPTA is present in this backup record
	.... ...X		*	Reserved
....				
191 (BF)	FIXED	1	UBPDSEV	PDSE Version number
192 (C0)		12		Reserved
204 (CC)	CHARACTER	96	UBENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was migrated. Valid when UBENCRDP is set
204(CC)	FIXED	2	UBENCRPT	Data set encryption type <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>
206 (CE)	CHARACTER	64	UBENCRPL	Data set encryption key label when encrypted <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
270 (10E)	CHARACTER	30	UBENCRPR	Data set encryption reserved
300 (12C)		0	UBBDSIE	End of DCUBCDS

**z/OS DFSMSHsm Data Areas > UTILP-DFSMSHsm Data Collection Interface**  
**> ARCUTIL Data Area Cross-Reference – “B” Record**

Add the following new field names to the table

Table 1. ARCUTIL Data Area Cross-Reference Table

Name	Hex Offset	Hex Value	Struct Level
UBENCRDP	B9	02	3
UBENCRPA	CC		2
UBENCRPT	CC		3
UBENCRPL	CE		3
UBENCRPR	10E		3

## z/OS DFSMSHsm Data Areas > **MCVT—Management Communication Vector Table**

Add the following new field names to the table

590	(24E)	BITSTRING	1	*	Flags for CDS serialization.
		..1. ....		MCVTFENC	When set to 1, Encryption information should be maintained in the HSM Control Data Sets. The BCDS (MCC record) and the MCDS (MCDX record) will be updated/created to include the encryption information at the time of backup/migration
		...x xxxxx		*	Reserved.

### z/OS DFSMSHsm Diagnosis

z/OS DFSMSHsm Diagnosis>Using DFSMSHsm maintenance commands>Maintenance command: FIXCDS>Required parameters of the FIXCDS command>**type:**

### **Specifying the type of control data set record**

**Explanation:** type is a required positional parameter for which you substitute the alphanumeric 1-character record type identification for the control data set record you want to fix or display. [Table 1](#) shows the record types in the MCDS, BCDS, and OCDS:

Added new record type:

1 Character Record Type	3 or 4 Character Record Type	Record Type Name
-------------------------	------------------------------	------------------



<b>A</b>	MCA	MCDS alias entry record
<b>B</b>	MCB	BCDS data set record
<b>C</b>	MCC	BCDS backup version record
<b>D</b>	MCD	MCDS data set record
...	...	...
<b>1</b>	MC1	MCDS migration level 1 free space record
<b>3</b>	MCDX	MCDS data set record extension
<b>Z</b>	MCBR	BCDS data set record for retained backup copies

Table 1. Records of the Control Data Sets

**Abbreviations:** None.

**z/OS DFSMSHsm Diagnosis>Using DFSMSHsm maintenance commands>Maintenance command: FIXCDS>Required parameters of the FIXCDS command>key:  
Specifying the control record key**

[Add new section](#)

## Type 3 Migrated data set record extension

The key of the migrated data set record extension is '03'x, followed by 43 bytes of the data set name. For a data set name with a 44-character name, the last 4 characters are compressed to a 3-BYTE HEX string. Specify the external data set name with the type 3 record as DFSMSHsm processing will convert the external key to a compressed internal one as needed based on the length of the data set name specified on the FIXCDS command.

An example of the key that is used with a type '3' migration control data set data set record extension is:

```
FIXCDS 3 IBMUSER.VSAMK56A.A9012345.B8901234.D789.E334
```

Since this is a data set name with 44-characters, DFSMSHsm will internally convert it to its 43-character name to be used as part of the internal key for this record.

## z/OS DFSMSHsm Storage Administration

**z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference>Using the LIST command>Requesting information for data**

**sets>[Requesting data set information from the MCDS](#)**

New labels added and LIST output examples updated (LIST DATASETNAME/LEVEL with MIGRATIONCONTROLDATASET)

[Table 1](#) explains the output labels for a list of all data sets, all data sets that have the same first qualifier, or a specific data set.

Printer Output Label (OUTDATASET or SYSOUT)	Terminal Label	Description
ENCRYPTION TYPE	ENCRYPTION TYPE	This data set is encrypted using the type: <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> </ul> Will not be displayed if the data set is not encrypted
KEYLABEL	KEYLABEL	This data is encrypted with the key label displayed. Will not be displayed if the data set is not encrypted

Table 1. Output labels when you request MCDS information for data sets

Figure 1. Sample Printer List when You Specify LEVEL and MIGRATIONCONTROLDATASET with SYSOUT/OUTDATASEET

```

----- DFSMSHsm CONTROL DATASET - MIGRATED DATA SET-- LISTING ----- AT
10:24:20 ON 15/06/02 FOR SYSTEM=381A
DATASET NAME                MIG      LAST REF  MIGRATED
TRKS      QTY    TIMES DS SDSP    QTY    LAST MIG
                                VOLUME      DATE      DATE
ALLOC     2K BLKS MIG    ORG DS  16K BLKS  VOLUME

      G834921.RRDS.N.F40EX001.CLUSTER3          MIG101  15/04/02  11/02/02
00000020  0000006  00001 VS  NO  ***** *****
      ENCRYPTION TYPE = '0100'X  KEYLABEL =
1234567890123456789212345678931234567894123456789512345678961234
      G834921.RRDS.N.F40EX001.CLUSTER4          MIG101  15/04/02  11/02/02
00000020  0000006  00001 VS  NO  ***** *****
      ENCRYPTION TYPE = *****  KEYLABEL =
*****
    
```

Figure 2. Sample Printer List of VSAM Data Sets when You Specify DATASETNAME, SELECT(VSAM), and MIGRATIONCONTROLDATASET with SYSOUT/OUTDATASET

```

----- DFSMSHsm CONTROL DATASET - MIGRATED DATA SET-- LISTING ----- AT
10:22:08 ON 15/05/02 FOR SYSTEM=381A
DATASET NAME                MIG      LAST REF  MIGRATED
TRKS      QTY    TIMES DS SDSP    QTY    LAST MIG
VOLUME          DATE      DATE
ALLOC    2K BLKS MIG    ORG DS   16K BLKS  VOLUME

G834921.KSDS.N.F40EX001.CLUSTER3                MIG101 15/02/02  15/03/02
00000020 0000006 00001 VS  NO  ***** *****
      ENCRYPTION TYPE = '0100'X  KEYLABEL =
1234567890123456789212345678931234567894123456789512345678961234
      BASE D OBJECT NAME = G834921.KSDS.N.F40EX001.DATA3
      BASE I OBJECT NAME = G834921.KSDS.N.F40EX001.INDX3

G834921.KSDS.N.F40EX001.CLUSTER4                MIG101 15/02/02  15/03/02
00000020 0000006 00001 VS  NO  ***** *****
      ENCRYPTION TYPE = *****  KEYLABEL =
*****
      BASE D OBJECT NAME = G834921.KSDS.N.F40EX001.DATA4
      BASE I OBJECT NAME = G834921.KSDS.N.F40EX001.INDX4

```

Figure 1. Sample terminal List when You Specify DATASETNAME(dsname) and MIGRATIONCONTROLDATASET with TERMINAL

```

DSN=M01.S02.DX5.N08.PDSE                MIGVOL=ML1001 DSO=PE
SDSP=NO
LAST REF=17/03/22 MIG=17/04/13 TRKS=00000030 2K BLKS= 0000028 TIMES MIG=
00001
16K BLKS=***** LAST MIGVOL=*****
      ENCRYPTION TYPE='0100'X
      KEYLABEL=123456789012345678921234567893123456789412345678951234567896124

```

**z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration Reference>Using the LIST command>Requesting information for data**

**sets>[Requesting data set information from the BCDS](#)**

New labels added and LIST output examples updated (LIST DATASETNAME/LEVEL with BACKUPCONTROLDATASET)

[Table 1](#) explains the output labels for a list of all data sets, all data sets that have the same first qualifier, a specific data set, or list of any copy pools that a volume is a part of.

Printer Output Label (OUTDATASET or SYSOUT)	Terminal Label	Description
ENCRYPTION TYPE	ENCRYPTION TYPE	This data set is encrypted using the type: <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> </ul>

		Will not be displayed if the data set is not encrypted
KEYLABEL	KEYLABEL	This data is encrypted with the key label displayed. Will not be displayed if the data set is not encrypted

Table 1. Output labels when you request BCDS information for data sets

Figure 1. Sample Printer List Output when you specify DATASETNAME(dsname) and BACKUPCONTROLDATASET with SYSOUT/OUTDATASET

```
- DFSMSHSM CONTROL DATASET - BACKUP DATASET-- LISTING ----- AT 14:32:30 ON
10/02/25 FOR SYSTEM=3090
```

```
DSNAME = OAYYYYY.SAM.S.DS1                                BACKUP FREQ = 000,
MAX ACTIVE BACKUP VERSIONS = 002

BACKUP VERSION DATA SET NAME                            BACKUP FROM   BACKUP   BACKUP
SYS GEN  VER  UNS/  RET  BACKUP NEW                                VOLUME VOLUME DATE     TIME
CAT NMBR NMBR RET   DAYS PROF   NAME

DFHSM.BACK.T312914.OAYYYYY.SAM.A0056                    A07335 PRIM01 10/02/25
14:29:31 YES 000 002   NO 00200 NO          N**
    ENCRYPTION TYPE = '0100'X  KEYLABEL =
1234567890123456789212345678931234567894123456789512345678961234
DFHSM.BACK.T142814.OAYYYYY.SAM.A0056                    A07335 PRIM01 10/02/25
14:28:14 YES 001 001   NO ***** NO          N**
    ENCRYPTION TYPE = '0100'X  KEYLABEL =
1234567890123456789212345678931234567894123456789512345678961234

TOTAL BACKUP VERSIONS = 0000000002

----- END OF - BACKUP DATASET - LISTING -----
```

Figure 1. Sample terminal List when you specify DATASETNAME(dsname) and BACKUPCONTROLDATASET with TERMINAL

```
DSN=M03.S02.D24.N17.LINEAR                                BACK FREQ = ***  MAX
ACTIVE BACKUP VERSIONS = ***

  BDSN=DFHSMF1.BACK.T471802.M03.S02.A7101                BACKVOL=ML1001
FRVOL=LSMS09
  BACKDATE=17/04/11  BACKTIME=02:18:47  CAT=YES  GEN=000  VER=001  UNS/RET=
NO
  RACF IND=NO  BACK PROF=NO  NEWNM=NO  NOSPH=***  GVCN=***  RETDAYS=*****
  ENCRYPTION TYPE='0100'X
  KEYLABEL=234567890123456789212345678931234567894123456789512345678961234
```

TOTAL BACKUP VERSIONS = 0000000001

**z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration  
Reference >Using the AUDIT command >Using the enhanced audit command to audit  
DFSMSHsm control information>[Using the AUDIT  
DATASETCONTROLS \(MIGRATION\) command](#)**

Add new audit tests to the list:

When you specify the AUDIT DATASETCONTROLS (MIGRATION) parameter, AUDIT makes the following checks for each valid data set (D) record in the MCDS (or for only those specified by the DSNAMES or LEVELS parameter):

- If a MCD record (D) indicates that a user data set has been encrypted but there is no MCDX record (3), AUDIT reports **\*ERR 31**

When the scope of the audit is *not* limited by either DSNAMES() or LEVELS(), AUDIT makes additional checks:

- If a MCDX record (3) refers to a MCD record (D) that does not exist, AUDIT reports **\*ERR 32**

**z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration  
Reference >Using the AUDIT command >Using the enhanced audit command to audit  
DFSMSHsm control information >Using the AUDIT DATASETCONTROLS  
(MIGRATION) command>[Diagnosis and repair action for  
AUDIT DATASETCONTROLS \(MIGRATION\)](#)**

Added error code to repair list

When you request AUDIT DATASETCONTROLS (MIGRATION):

- AUDIT usually identifies a repair (and takes repair action when FIX is specified) for error messages (\*ERR) 20, 21, 22, 24, 25, 26, 27, 28, 30 and 32
- AUDIT recommends an additional diagnostic step for error messages (\*ERR) 17 and 29 if the migration tape involved is a volume written in single file format. If you want AUDIT to continue its attempt to identify a repair action, you must specify an additional AUDIT command using the recommended parameter.
- For other reported conditions and troubleshooting hints, see [Error codes \(\\*ERR\) and diagnosis](#).

z/OS DFSMSHsm Storage Administration>DFSMSHsm Storage Administration  
 Reference >Using the AUDIT command >[Error codes \(\\*ERR\) and diagnosis](#)

Added new error codes and their repair action to the 'Error Codes Used in AUDIT Reports'

Description	Audit Repair Action	Troubleshooting Hints
<p><b>*ERR 31 userdsn HAS NO MIGRATED DATA SET RECORD EXTENSION</b></p>		
<p>The MCD record (D) indicates that a user data set has been encrypted, but there is no MCDX record (3).</p>	<p>No audit repair action can be made</p>	<p>If the data set has already been recalled, then the D record is extraneous; you can use the FIXCDS command to delete it.</p> <p>If the key label is known the FIXCDS command can be used to add the MCDX record (3).</p>
<p><b>*ERR 32 userdsn—EXTRANEIOUS MIGRATED DATA SET RECORD EXTENSION</b></p>		
<p>An extraneous MCDX record (3) is referring to a MCD record (D) that does not exist.</p>	<p>If there is no MCD record (D) record, the MCDX record (3) is deleted</p>	

**z/OS DFSMS Access Method Services Commands**

**z/OS DFSMS Access Method Services Commands > [Interpreting DCOLLECT Output](#)**

Size changes for the migration and backup records.

The output data set used by DCOLLECT must be created prior to calling the function. It must have a physical sequential organization (PS) and a record format of variable (V) or variable blocked (VB). Using the following guidelines, the primary space for the data set can be estimated:

.....

Migration data

Size of record (448 + 4) \* number of data sets migrated.

Backup data

Size of record (324 + 4) \* number of data set backup versions.

## **z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Structure – Migrated**

Updates to the migrated data set record type

### **MIGRATED DATA SET INFORMATION (RECORD TYPE "M")**

<b>Offsets Decimal (Hex)</b>	<b>Type</b>	<b>Length</b>	<b>Name</b>	<b>Description</b>
24 (18)	STRUCTURE	424	UMMDSI	Migrated data set information (defined on DCUDATA)
24 (18)	CHARACTER	44	UMDSNAM	Data set name
....				
238 (EE)	BITSTRING	1	UMFLAG3	Information flag #3
	1... ....		UMEMPTY	ON, if data set was empty at the time of migration
	.1.. ....		UM_CA_RECLAIM_ELIG	ON, if the VSAM KSDS data set was eligible for CA reclaim processing when migrated
	...1. ....		UMZFS	VSAM Linear data set for zFS
	...1 ....		UMENCRDP	ON, when the data set encryption information in UMENCRYPTA is present in this migration record

	.... XXXX			Reserved
....				
320 (140)		32		Reserved
352 (160)	CHARACTER	96	UMENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was migrated. Valid when UMENCRDP is set
352 (160)	FIXED	2	UMENCRPT	Data set encryption type <ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>
354 (162)	CHARACTER	64	UMENCRPL	Data set encryption key label when encrypted <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
418 (1A2)	CHARACTER	30	UMENCRPR	Data set encryption reserved
448 (1C0)		0	UMMDSIE	End of DCUMCDS

**z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Field Descriptions > [Migrated Data Set Record Field](#)**

Add the following new field names and descriptions:

UMENCRPA - This structure defines the data set encryption information that was in use by the access method for this data set at the time it was migrated

UMENCRPT - Indicates the type of encryption used for this data set

UMENCRPL - Indicates the encryption key label that was used for this data set

UMENCRPR - Reserved encryption information for possible future use

**z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > [DCOLLECT Output Record Structure - Backup](#)**

Updates to the backup version record type

**BACKUP DATA SET INFORMATION (RECORD TYPE "B")**



Offsets Decimal (Hex)	Type	Length	Name	Description
24(18)	STRUCTURE	300	UBBDSI	Backup data set information (defined on DCUDATA)
24 (18)	CHARACTER	44	UBDSNAM	Data set name
....				
185(B9)	BITSTRING	1	UBFLAG3	Information Flag 3
	1... ....		UBNOSPHERE	When set to 1, SPHERE(NO) processed at the time of backup
	.1.. ....		UBGVCN	When set to 1, GENVSAMCOMPNames processed at the time of backup
	..1. ....		UBF_RETAIN_SPCD	When set to 1, RETAINDays specified at the time of backup
	...1 ....		UBF_NEVER_EXP	When set to 1, this version will never expire. Only valid when UBF_RETAIN_SPCD is set to 1.
	.... 1..		UBENCRP	When set to 1, the data set was encrypted at the time of backup
	.... .1..		UBZFS	VSAM Linear data set for zFS
	.... ..1.		UBENCRDP	When set to 1, the data set encryption information in UBENCRYPTA is present in this backup record
	.... ...X		*	Reserved
....				
215(D7)	FIXED	1	UBPDSEV	PDSE Version number
216(D8)		12		Reserved
228 (E4)	CHARACTER	96	UBENCRYPTA	Data set encryption information in use by the access method for this data set at the time it was migrated. Valid when UBENCRDP is set
228(E4)	FIXED	2	UBENCRPT	Data set encryption type

				<ul style="list-style-type: none"> <li>'0100'X - AES-256 XTS protected key.</li> <li>'FFFF'X - Data set is not encrypted</li> </ul>
230 (E6)	CHARACTER	64	UBENCRPL	Data set encryption key label when encrypted <ul style="list-style-type: none"> <li>All 'FF'X key label indicates that the data set is not encrypted</li> </ul>
294 (126)	CHARACTER	30	UBENCRPR	Data set encryption reserved
324 (144)		0	UBBDSIE	End of DCUBCDS

**z/OS DFSMS Access Method Services Commands > Interpreting DCOLLECT Output > DCOLLECT Output Record Field Descriptions > [Backup Data Set Record Field](#)**

Add the following new field names and descriptions:

- UBENCRPA - This structure defines the data set encryption information that was in use by the access method for this data set at the time it was backed up
- UBENCRPT - Indicates the type of encryption used for this data set
- UBENCRPL - Indicates the encryption key label that was used for this data set
- UBENCRPR - Reserved encryption information for possible future use

**z/OS DFSMSHsm Implementation and Customization Guide**

**z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection interface > [Direct invocation of ARCUTIL load module](#)**

Change ARCDATA statement

ARCDATA

Specify a DDNAME of ARCDATA that contains the records collected. ARCUTIL opens this data set with LRECL=464 264, RECFM=VB options.

**z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection**

interface > Invoking the ARCUTIL load module with a user-written program >  
**Example of invoking ARCUTIL with a user-written program**

Change DCBOUT statement in the example for the LRECL and BLKSIZE values

```
DCBOUT DCB DDNAME=COLLECT,LRECL=464,BLKSIZE=9280,DSORG=PS, X  
MACRF=(PL),RECFM=VB  
*
```

**z/OS DFSMSHsm Implementation and Customization Guide > Customizing > Tuning > Tuning patches supported by DFSMSHsm > Allowing DFSMSHsm to create encryption information in its migration and backup control data sets (new section)**

DFSMSHsm allows the creation of the encryption information for a data set that is encrypted at the time of migration or backup in its migration and backup control data sets. For a migrated data set, a new CDS record type is created (MCDX type '3' record) that contains this information. For a data set backup, the encryption information is stored in the MCC record. You must set an enabling bit to allow the encryption information to be placed in the HSM control data set. You enable this function as follows:

```
PATCH .MCVT.+24E BITS(..1.....)
```

You disable the function as follows:

```
PATCH .MCVT.+24E BITS(..0.....)
```

Enable this function only when the shared DFHSM environment has the support or coexistence for it installed.

After z/OS V2R3, the patch will be enabled by default.

**z/OS DFSMSHsm Implementation and Customization Guide > Customizing > User application interfaces > The data collection environment > Invoking the data collection interface**

**ARCUTIL return codes and reason codes**

[Table 1](#) is a summary of the return codes and reason codes issued by the ARCUTIL load module.

Added reason code 16 for return code 12 – Read error on the MCDS record type 3, migrated data set record extension.

## [z/OS MVS System Messages](#)

### [z/OS MVS>z/OS MVS System Messages, Vol 2 \(ARC-ASA\)>ARC messages>ARC0734I](#)

ARC0734I ACTION=*action* FRVOL=*volser1* TOVOL=*volser2* | TRACKS=*tracks* | RC=*retcode*, REASON=*reascodes*, AGE=*days*, DSN=*dsname*

DELETED — Delete a control data set record for a data set that is scratched. Multiple CDS records may be deleted for the same DSN.

### [z/OS MVS > z/OS MVS System Messages, Vol 2 \(ARC-ASA\) > ARC messages > ARC6113E](#)

ARC6113E  
ERROR OCCURRED IN WRITING A DFSMSHSM CONTROL DATA SET RECORD FOR DATA SET *data-set-name1* USING CONTROL FILE DATA SET *datasetname2* - RECORD TYPE THAT FAILED IS {MCA | MCD | MCO | MCDX}

- MCDX indicates that the DFSMSHsm control data set record that received the error is an MCDX control data set record.

### [z/OS MVS > z/OS MVS System Messages, Vol 2 \(ARC-ASA\) > ARC messages > ARC6059E](#)

ARC6059E ERROR OCCURRED IN OBTAINING DFSMSHSM CONTROL DATA SET RECORDS FOR DATA SET *data-set-name* BEING PROCESSED FOR AGGREGATE GROUP *agname* - RECORD TYPE THAT FAILED IS {MCA | MCD | MCO | MCV | MCDX}

- MCDX insert indicates the DFSMSHsm control data set record that received the error is an MCDX control data set record.

### [z/OS MVS > z/OS MVS System Messages, Vol 6 \(GOS-IEA\) > IDC messages > IDC21804I](#)

Appended reason code 16 to the end of the existing Reason Codes for Return Code '0C' in the IDC21804I message:

IDC21804I

...

Function

MIGRATION DATA COLLECTION SERVICE

Code

Reason Explanation

0C

Error Reading DFSMSHsm control data set.

...

10 - READ ERROR ON THE MCDS RECORD TYPE 3,  
MIGRATED DATA SET RECORD EXTENSION