

**Recording Media Division
Fujifilm Computer Products**

FUJIFILM

**Data Storage Tape Product Training
and Technology Seminar
March 28, 2008**

**3590 – 3592
Excerpt:
Pages 63-85
of 132 pages**

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www.fujifilmusa.com/tapestorage**

Fujifilm Computer Products Tape Technology Seminar



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3590 - 3592
Pages 63-85
of 132 pages

Enterprise Tape Family 3590 and Enterprise Tape Family 3592:

- **Enterprise Tape System 3590**
 - » 3590 Model B Tape Drive
 - » 3590 Model E Tape Drive
 - » 3590 Model H Tape Drive
- **Enterprise Tape System 3592**
 - » 3592 Model J1A Tape Drive
 - » 3592 Model E05 (TS1120) Tape Drive

One Gigabyte equals one billion bytes (1 GB = 1,000,000,000 bytes).

One Megabyte equals one million bytes (1 MB = 1,000,000 bytes).

Enterprise Tape Systems

Fujifilm 3590 Tape Media



3590 High Performance & Extended High Performance Media

Magstar Drives and Fujifilm 3590 & 3590E ½"-inch Data Cartridges:

Drives	3590 Media 320 m - <u>Capacity</u>	3590 E Media 631 m - <u>Capacity</u>
3590 B (128 track, 16-channel)	10/30* GB 9 MB/sec	20/60* GB 9 MB/sec
3590 E (256 track, 16-channel)	20/60* GB 14 MB/sec	40/120* GB 14 MB/sec
3590 H (384 track, 16-channel)	30/90* GB 14 MB/sec	60/180* GB 14 MB/sec

*3:1 compressed; depending on data content, is typical for attachment to IBM zSeries Mainframe systems.

Enterprise Tape Systems

Fujifilm 3590 Tape Media



Cartridge Tape Media Compatibility
after [User Data-Format](#) is Recorded

TAPE MEDIA TYPE	DRIVE FORMAT RECORDED BY USER	CAPACITY (NATIVE)	3590 B Model 128-track <u>Drive</u>	3590 E Model 256-track <u>Drive</u>	3590 H Model 384-track <u>Drive</u>
3590 J-type	3590 B 128-Track Format	10 GB	Read & Write	Read or Reformat	Read or Reformat
	3590 E 256-Track Format	20 GB	Reformat	Read & Write	Read or Reformat
	3590 H 384-Track Format	30 GB	Reformat	Reformat	Read & Write
3590E K-type	3590 B 128-Track Format	20 GB	Read & Write	Read or Reformat	Read or Reformat
	3590 E 256-Track Format	40 GB	Reformat	Read & Write	Read or Reformat
	3590 H 384-Track Format	60 GB	Reformat	Reformat	Read & Write

Enterprise Tape Systems

Fujifilm 3590 Tape Media



Mainframe tape is not something new for Fujifilm, just something new for Fujifilm in the U.S.A. Fujifilm has sold mainframe tape since 1965 when we introduced 10½" reel-to-reel Computer Tape followed in 1987 by 3480 Cartridge System Tape and later 3490E, 3590 and 3590E. March 2004 wasn't our first sale of 3590 and 3590E, just our first sale in the U.S.A.

Fujifilm Product Codes:

Fujifilm 3590 & 3590E Tape	STANDARD	LABELED	LABELED & INITIALIZED
3590 "J" Cartridge 1050'	26400010	26400011	26400012
3590E "K" Cartridge 2070'	26400510	26400511	26400512
3590 CL (Drive Cleaning)	26400090	26400091	-----

Note: 3590 & 3590E Data Tapes have Factory Written Magnetic Servo Tracks, **Do Not Degauss.**

Enterprise Tape Systems

Fujifilm 3590 Tape Media



Questions about 3590 & 3590E?



3590 "J" Cartridge 1050'



3590E "K" Cartridge 2070'

New Tape Technology

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Enterprise - IBM 3592

IBM Enterprise Tape Drive 3592 J1A...

- High capacity, high performance, fast access
- Supports IBM & select open system platforms
- Native data transfer rate of up to 40MB/sec
- 60 & 300 GB rewritable & WORM cartridges
- Introduced September 2003

IBM Enterprise Tape Drive TS1120 – 3592 E05...

- High capacity, high performance, fast access
- Supports IBM and selected open system platforms
- Provides native data transfer rate of up to 104MB/sec
- Supports 100 GB & 500 GB rewritable & WORM 3592 cartridges (same cartridges used by 3592-J1A drives).



NEW
October 2005

IBM 3592 J70 Controller...

- Enables attachment of TotalStorage Enterprise tape drives to IBM zSeries Mainframes

IBM Enterprise Tape System TS1120 (3592 Model E05)



September 8, 2006: **Drive based Data Encryption Capabilities are now standard on all newly ordered IBM System Storage™ TS1120 Tape Drives.**

A chargeable upgrade is available for currently installed drives.

Encrypting data at tape speed helps avoid the need for host-based encryption of data and the concurrent drain on host performance or the use of specialized encryption appliances.

This new capability supports high volume data encryption for tape data, helping protect information if tape cartridges are lost or stolen.

All 3592 media, including WORM media, can be encrypted.

This is a feature that many have been anxiously awaiting; for more information, go to http://www-03.ibm.com/servers/storage/ewscast/data_encryption/

Enterprise Tape Systems

Fujifilm 3592 Data Cartridge



IBM Enterprise Tape Drive 3592

- 3592 Model J1A
- 3592 Model E05 (Total Storage Model TS1120)
- **Fujifilm 3592 "JA" Data Cartridge**
 - 300 GB native Data Capacity – 3592 J1A Drive
 - 500 GB native Data Capacity – 3592 E05 Drive
 - 40 MB/sec native Data Transfer Rate – 3592 J1A Drive
 - 104 MB/sec native Data Transfer Rate – 3592 E05 Drive
- **Enabled by Fujifilm nanocubic™ Media**
 - From 500 GB today to future TB capacities
- **New Format - September 2003**

Enterprise Tape Systems

Fujifilm 3592 Data Cartridge



Enterprise Tape Drive 3592 and Enterprise Tape Cartridge 3592:

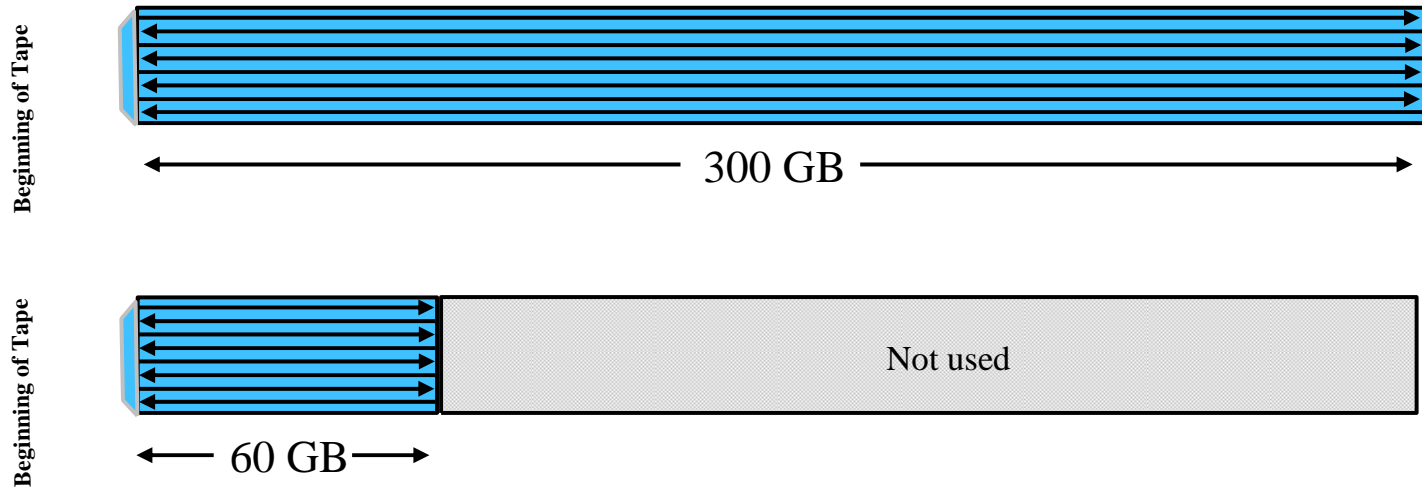
Drive	3592 Media 609 m “JA” (1998 feet)	3592 Media 609 m “JA” Alternate Format (1)	3592 Media 246 m “JJ” (807 feet)
3592 J1A (512 track, 8-channel)	300/900* GB 40 MB/sec	60/180* GB 40 MB/sec	60/180* GB 40 MB/sec
3592 E05 TS1120 (896 track, 16-channel)	500/1500* GB 104 MB/sec	100/300* GB 104 MB/sec	100/300* GB 104 MB/sec

The 609 meter Enterprise Tape Cartridge 3592, can be formatted for either high-capacity or fast-access uses. The drives handle both types of uses and can reformat cartridges as required. ⁽¹⁾ The TS1120 (3592-E05) tape drive is able to read and write 3592 cartridges in the same format as the previous 3592-J1A tape drive and can reformat tapes used in the lower capacity format to its higher-capacity format and can also reformat one used at its high capacity format to the lower capacity format of the 3592-J1A drive. However, cartridges having a 3592-E05 higher-capacity format cannot be read by the 3592-J1A tape drive, but can be reformatted by the J1A.

(1) See slides 72, 73 and 74 (1).

*3:1 compressed, depending on data content, for IBM zSeries attachment; typical expectation for all Open System attachment is 2:1 compression.

Capacity Scaling⁽¹⁾ for the 1998' 3592 JA Cartridge (For 3592 J1A Drive)*



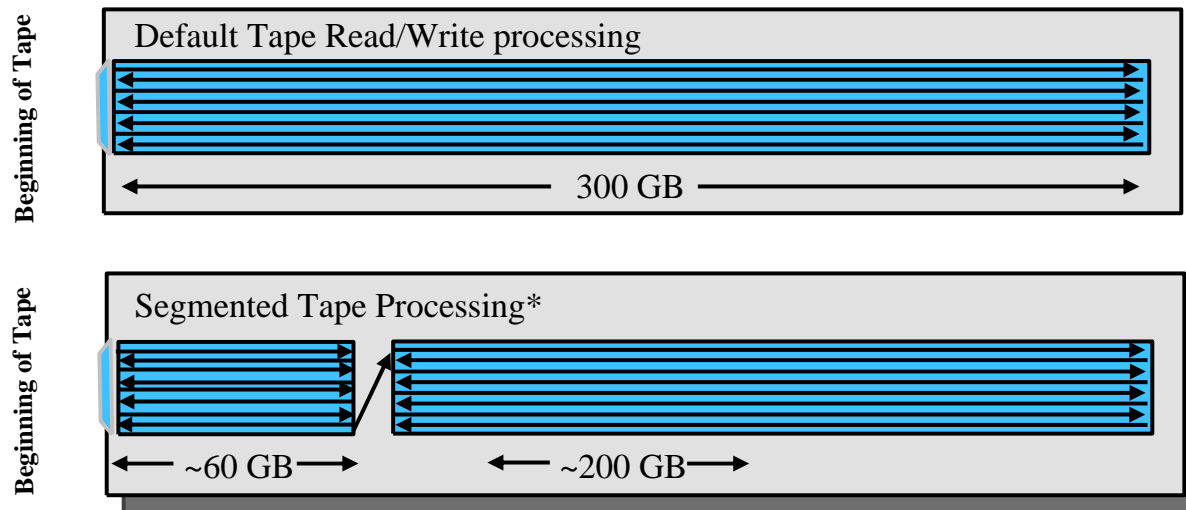
- Capacity Scaling enables cartridge to be initialized to two capacities
 - Allows standardization on a single media type
 - Initializing at 300 GB provides full cartridge storage capacity
 - Initializing at 60 GB improves average time to first byte
 - Tapes can be scaled / de-scaled as requirements change
- **When used on the new TS1120 E05 drive: Capacity is 500 GB for the full capacity Format and 100 GB for the scaled Format.**

Note 1: Capacity scaling is not supported for the Economy 246m (JJ) Tapes or WORM tapes.

Capacity-scaling and Segmentation (1)

Two data segments allows future Segmented Tape Processing (support for IBM zOS – ISV support is required for open systems).

For example, a 3592 JA cartridge on a 3592 drive with two data segments would have one 60 GB segment having very fast access, and another segment of up to 200 GB for additional capacity:



A 3592 cartridge tape can be formatted (initialized) for full capacity use or formatted with capacity scaling & segmentation, and later changed (re-formatted) for other use.

Note 1: Capacity scaling/segmenting is not supported for the Economy 246m (JJ) Tapes or WORM tapes.

Enterprise Tape Systems



- (1) In zOS / OS/390 environments, 3592 JA cartridges can be scaled down to a lower capacity (60 GB capacity for 3592 J1A drive format/ 100 GB for TS1120 drive format) for fast data access. Capacity scaling reduces the average locate time (from load point) of a random record to less than 30% of normal locate time. [ISV support required for open systems.](#)

3592 and TS1120 drives feature many connectivity options. Users can simplify operations by consolidating on a single tape cartridge technology, 3592, for all popular operating platforms.

3592 features: IBM introduced Write Once Read Many (WORM) technology for the 3592 and TS1120 tape drives, so that once written, special WORM* data cartridges cannot be overwritten.


Additionally IBM introduced support for an Economy 60 GB 3592 cartridge, which provides an alternate price/performance point.

*Fujifilm 3592 WORM Cartridges, P/N 26400330 (300GB WORM) and P/N 26400340 (60 GB WORM).

Enterprise Tape Systems

Fujifilm 3592 Data Cartridge



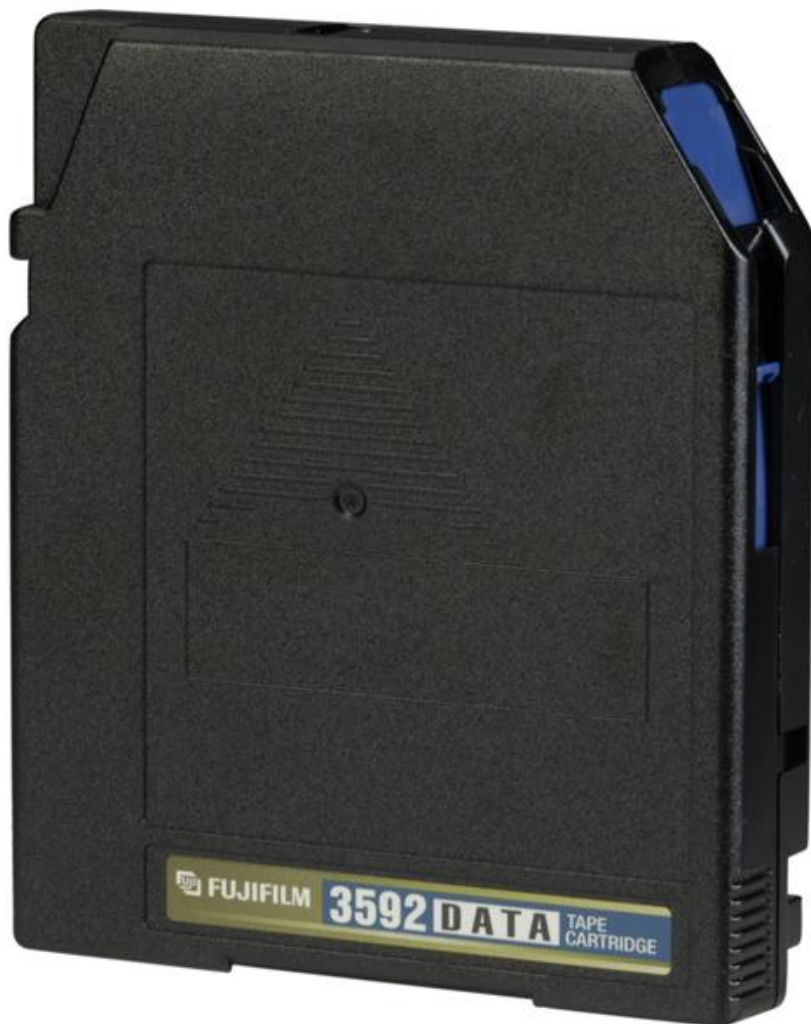
- Drive: Enterprise Tape Drive 3592 and TS1120 (3592 Model E05)
- Recording: Linear Serpentine, 512 tracks (3592-J1A drive), 896 tracks (3592-E05 drive)
- Media: nanocubic™ half-inch x 609m media and short length 246m media
- Servo: precision servo track formatting (at factory⁽¹⁾)
- Capacity: up to 500 GB native (1.5 TB 3:1 compressed*)
- Data Rate: up to 104 MB/second native data transfer rate
- Memory: Cartridge Memory built into every 3592 cartridge,  which stores cartridge identification and performance history information.
- Form: Form factor similar to 3590 cartridges, which allows 3592 tape cartridges to work in IBM 3494 and StorageTek 9310 and other enterprise libraries, alongside 3590 and 3490E cartridges.
- Compatible: The 3592 drive was the first of a new class of enterprise tape systems. 3592 and TS1120 drives are only compatible with 3592 Enterprise Tape Cartridges (*not backward compatible with 3590 or any other cartridge*).

(1) Factory written servo tracks, **do not degauss**.

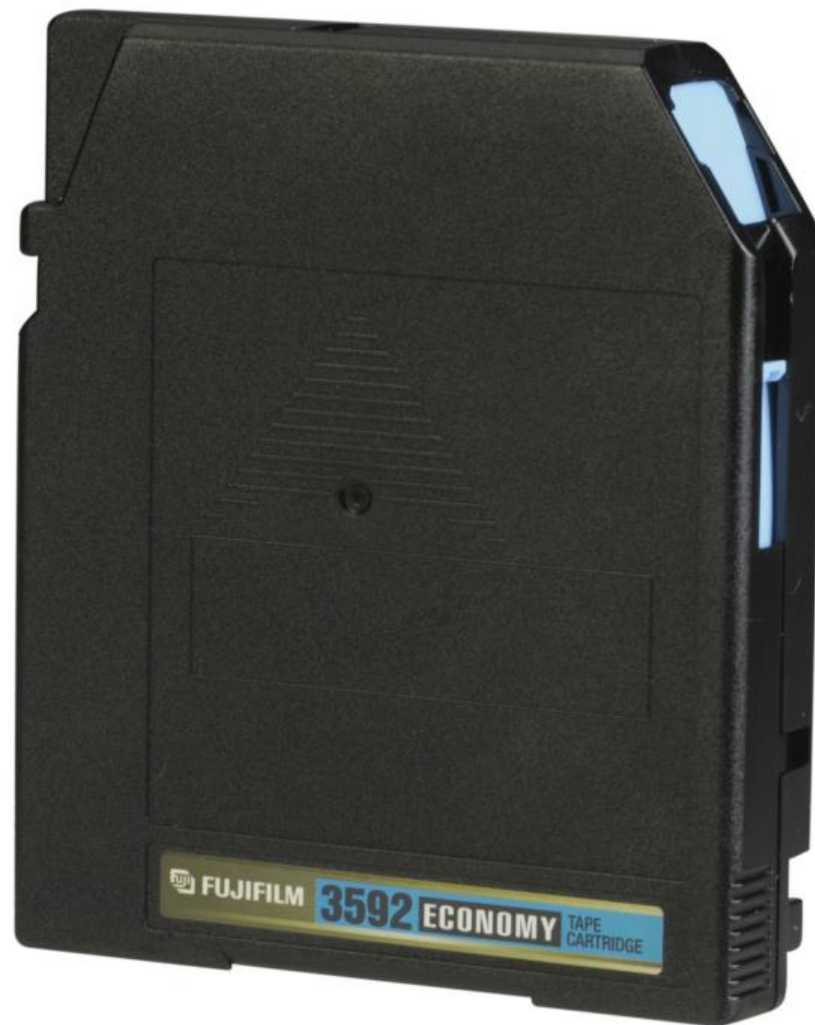
*3:1 compressed; depending on data content, is typical for attachment to IBM zSeries systems.

Fujifilm 3592 Data Cartridges

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3592 "JA" Cartridge 1998'



3592 "JJ" Cartridge 807'

Fujifilm 3592 WORM Cartridges

FUJIFILM



3592 WORM "JW" Cartridge 1998'



3592 WORM "JR" Cartridge 807'

Fujifilm 3592 L & I

Available Formats

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- Initialize with the 1st Gen drive model 3592-J1A or 2nd Gen model TS1120 (3592-EO5)
- “JA” – 300 GB < or > 500 GB
- “JJ” – 60 GB < or > 100 GB
- “JW” – 300 GB < or > 500 GB
- “JR” – 60 GB < or > 100 GB
- Pre-initialization with other format choices, scaled and segmented formats, not currently offered by Fujifilm.
- See the current Fujifilm L & I Order Form for more information on 3592 formats and Fujifilm factory initialization options.



Enterprise Tape Systems

Fujifilm 3590 & 3592 Tape

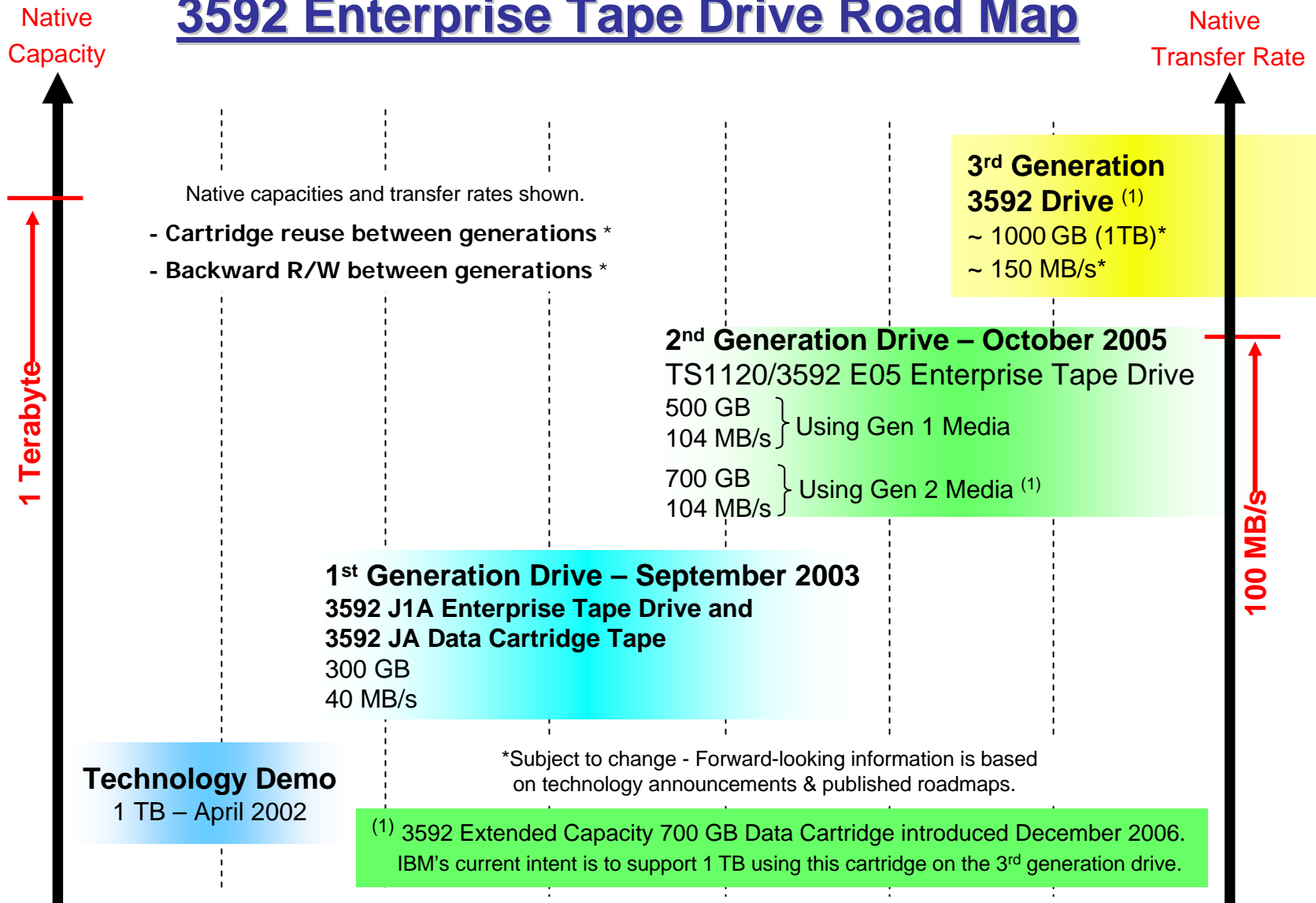


Tape Family 3590 and Enterprise Tape Family 3592:

Fujifilm Enterprise Products & Product Codes	STANDARD	LABELED	LABELED & INITIALIZED
3590 "J" Cartridge 1050'	26400010	26400011	26400012
3590E "K" Cartridge 2070'	26400510	26400511	26400512
3590 CL (Drive Cleaning)	26400090	26400091	-----
3592 DATA "JA" 1998'	26400310	26400311	26400312
3592 Economy DATA "JJ" 807'	26400320	26400321	26400322
3592 WORM "JW" 1998'	26400330	26400331	26400332
3592 WORM Economy "JR" 807'	26400340	26400341	26400342
3592 CL "CLN + JA" (50 Drive Cleans)	26400390	26400391	-----

Note: JA, JJ, JW and JR are the Media Identifier, 7th and 8th characters following the six character Volume ID of 3592 Bar Code Labels. Typical 3592 cartridge bar code label format: nnnnnnJx. Typical label format for 3592 cleaning cartridges is CLNnnnJA. Exceptions: e.g., 3592 cartridges inside a StorageTek 9310 Powderhorn Tape Library require a different bar code label schema.

3592 Enterprise Tape Drive Road Map



- IBM 1Terabyte Technology demonstrated April 2002, using Fujifilm nanocubic™ tape media.
- IBM 3592-J1A Tape Drive and 300 GB Data Cartridges began shipping September 2003.
- IBM 3592-E05 Tape Drive increases capacity of JA cartridge to 500 GB October 2005.

3592 Extended Capacity Tape Media



IBM announced 3592-JB Data Cartridges and 3592-JX WORM Cartridges, which began shipping from IBM in December 2006. Below are the basic facts about 3592 Extended Capacity media:

- The new 3592 JB/JX cartridges are compatible ⁽¹⁾ on the current TS1120 (3592 model E05) Tape Drive, providing a native capacity of 700 GB at 104 MB/second native transfer rate.
- At typical compression ratios, the 3592 JB/JX cartridges can provide usable capacity of 1.4 TB (assumes 2:1 compression) in an open system environment and 2.1 TB (assumes 3:1 compression) in an IBM System z™ environment.
- Tape length for the new JB and JX cartridges is 2706 Ft nominal (825m), versus 2001 Ft nominal (610m) for JA and JW cartridges.

It is expected that 3592 JB/JX cartridges will also be compatible with a future Gen 3 drive and reusable at an even higher capacity and data transfer rate ⁽²⁾. Media re-use on subsequent generation drives at a higher capacity is a valuable benefit of the 3592-technology roadmap ⁽³⁾.

(1) The installed base of TS1120 (3592 model E05) tape drives will require a microcode firmware update for support of the 3592 Extended Data and 3592 Extended WORM Tape Cartridges. The new firmware needed to enable the existing TS1120 drives to use the new cartridges will be made available from IBM prior to general availability of the new cartridges.

(2) Forward-looking statements and plans are subject to change; this information is the current stated intention only and subject to change. Product Road Map statements represent current intent, are subject to change or withdrawal and represent goals and objectives only.

(3) IBM Statement... Media Reuse: The IBM TotalStorage Enterprise Tape System 3592 protects future media investments by supporting full forward read and write compatibility into the next generation of 3592 drives. Additionally, the next generation of TotalStorage Enterprise 3592 drives will also provide a reformatting function, to allow current media to be reused and achieve higher capacities.

- Next generation drives allowing media reuse at a higher capacity & transfer rate is a valuable feature of the 3592 technology plan.
Fujifilm's first generation tape media already demonstrates this; its native capacity can be boosted from 300 GB to 500 GB and its transfer rate raised from 40 MB/s to 104 MB/s on a second-generation drive.
- The 3592 drives are supported for Mainframe (IBM System z™ - z/OS®) attachment, as well as select open system (e.g. Windows, Unix, Linux, Solaris, Netware) attachment.

Tape Overview – IBM zOS - OS/390, zSeries, z9, S/390 Mainframe Environments:

Tape Media/ Width & Length	Drive Model	Capacity Native	Data Rate Native	Comments
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Enterprise 3592		Linear		Drive Maker – IBM
3592 [JA], [JW*] ½" 1998'	IBM 3592 – J1A	300 GB	40 MB/s	* WORM cartridges: 609m “JW ” and 246m “JR” WORM. – 3592-J1A Drive: 512 Track – TS1120 / 3592-E05 Drive: 896 Track
	IBM 3592 – E05	500 GB	104 MB/s	
3592 [JJ], [JR*] ½" 807'	IBM 3592 – J1A	60 GB	40 MB/s	
	IBM 3592 – E05	100 GB	104 MB/s	
3592 [JB], [JX] ½" 2706'	IBM 3592 – E05	700 GB	104 MB/s	Extended 825m cartridges. JX: WORM IBM brand available December 2006.

Magstar 3590		Linear		Drive Maker – IBM
3590 [J] ½" 1050'	IBM 3590 – B	10 GB	9 MB/s	Model B: 128-Track
	IBM 3590 – E	20 GB	14 MB/s	Model E: 256-Track
	IBM 3590 – H	30 GB		Model H: 384-Track
3590-E [K] ½" 2070'	IBM 3590 – B *	20 GB	9 MB/s	* 3590-B model drives existing prior to 3/2000 can be field-upgraded to use 3590-E tapes.
	IBM 3590 – E	40 GB	14 MB/s	
	IBM 3590 – H	60 GB		

T10000		Linear		Drive Maker – StorageTek
T10000 Standard ½" 3008'	STK T10000-A	500 GB	120 MB/s	- Standard length 500 GB cartridge (917m). - Short (Sport) length and VolSafe® WORM media are available.
T10000 Sport ½" (short length)		120 GB		

T9840		Linear		Drive Maker – StorageTek
9840 ½" 886' Two-Axis Cartridge	STK T9840-A	20 GB	10 MB/s	* VolSafe® WORM: 9840 A/B drives and C/D drives). T9840 A/B/C: 288 Tracks, T9840-D: 576 Tracks. • Two-Axis, Mid-point load data cartridges
	STK T9840-B		19 MB/s	
	STK T9840-C	40 GB	30 MB/s	
	STK T9840-D	75 GB		

Tape Overview – IBM zOS - OS/390, zSeries, z9, S/390 Mainframe Environments:

Tape Media / Width & Length	Drive Model	Capacity Native	Data Rate Native	Comments
T 9940				
Linear		Drive Maker – StorageTek		
9940 ½" 2320'	STK T9940-A	60 GB	10 MB/s	<ul style="list-style-type: none"> •Single-Axis data cartridge • 9940A: 288-Track, 9940B: 576-Track * T9940B drives support VolSafe® 9940B media
	STK T9940-B *	200 GB	30 MB/s	
Redwood SD-3				
Helical		Drive Maker – StorageTek		
SD-3 ½" 298'	STK Redwood SD-3	10 GB	11 MB/s	This product line has been discontinued.
SD-3 ½" 668'		25 GB		
SD-3 ½" 1286'		50 GB		
3480/3490E				
Linear		Drive Maker – IBM, STK, Fujitsu, etc.		
3480 ½" 550'	18-Track - 3480	200 MB	3 MB/s	*1.6GB 9490EE 2200' (STK 9490 drives) & 1GB 3490E XL 1368' cartridges also.
3490E ½" 1100'	36-Track - 3490E *	800 MB		
9-Track Reel-To-Reel (10½" reel) Linear				
Linear		Drive Maker – IBM, STK, Fujitsu, etc.		
6250 Bpi ½" 2400'	IBM 3420 Model 8	169 MB	1.25 MB/s	No data compression feature; other models had slower transfer rate; all drives discontinued; drive maintenance support discontinued by all makers.
6250 Bpi ½" 3600'		254 MB		
The IBM 3420 Model 8 and plug compatible drives from other manufacturers were the last in the line of Mainframe Reel-To-Reel Computer Tape drives. 3420 Magnetic Tape Units circa 1970–1987: IBM retired the 3420 Model 8, along with earlier Models 3, 4, 5, 6 and 7 IBM reel-reel tape drives, in 1987.				

Connectivity for IBM zOS - OS/390 and Open Systems

As shown, the 3592, 3590, 3590E, T10000, T9940 & T9840 Drives can be attached to IBM mainframes supported by IBM zOS, OS/390 operating systems. These drives, which are supported by the IBM zOS, OS/390 operating systems, are also attachable in an Open System environment using their SCSI or Fibre Channel attachment. Native capacity and transfer rate specifications shown; a 3:1 increase for mainframe data and 2:1 increase for open-system data are typically assumed for compressed values.

Note: 3592, 3590, 3590E, T10000, T9940 & T9840 Data Tapes have Factory Written Magnetic Servo Tracks: **Do Not Degauss!**

Fujifilm 3590 / 3592 Media Review?

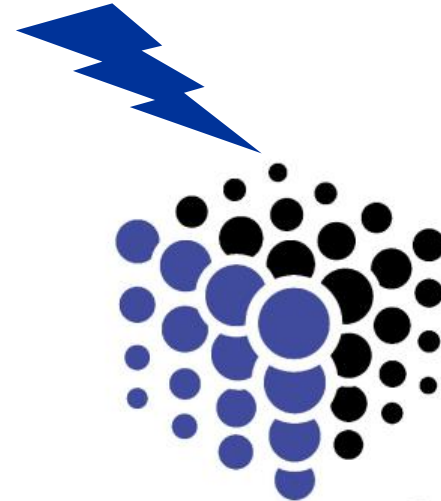


TAPE MEDIA	TAPE DRIVES	CAPACITY	
		NATIVE	COMPRESSED*
3592 DATA "JA" (1998')	TS1120 / 3592-E05	500 GB	1.5 TB
	3592 - J1A	300 GB	900 GB
3592 WORM "JW" (1998')	TS1120 / 3592-E05	500 GB	1.5 TB
	3592 - J1A	300 GB	900 GB
3592 ECONOMY DATA "JJ" (807')	TS1120 / 3592-E05	100 GB	300 GB
	3592 - J1A	60 GB	180 GB
3592 ECONOMY WORM "JR" (807')	TS1120 / 3592-E05	100 GB	300 GB
	3592 - J1A	60 GB	180 GB
3590E "K" (2070')	3590 H	60 GB	180 GB
	3590 E	40 GB	120 GB
	3590 B	20 GB	60 GB
3590 "J" (1050')	3590 H	30 GB	90 GB
	3590 E	20 GB	60 GB
	3590 B	10 GB	30 GB

*Assumes 3:1 compression, which is typical for mainframe environments. In a mainframe environment, where data typically compresses at 3:1, the TS1120 tape drive can transfer data up to 210 MB/s and the 3592-J1A tape drive can transfer data up to 120 MB/s. Typical data compression achieved in open system environments is 2:1 compression. Compressed capacity & data transfer rate in open system environments can be assumed at double (2:1) the native value. For example, the TS1120 tape drive supports a native data transfer rate of up to 104 MB/s in an open systems environment and can transfer data at up to 208 MB/s when the data compresses at 2:1 and up to a maximum of 260 MB/s when greater compression is achieved. For maximum transfer rate the host system must transfer data to/from the drive as fast or faster than the drive's transfer rate.

Questions About
Enterprise Tape

3590? – 3592?



nanocubic

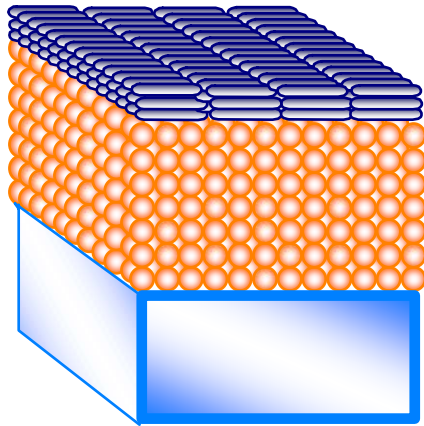
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It's What's Inside that Counts. Think Fujifilm **nanocubic™**
Media, for Today's & Tomorrow's Most **Powerful** Drives!

Think Fujifilm Media, for Today's & Tomorrow's Most Popular Drives!

***Thank
You!***

FUJIFILM



Advanced super
Thin-layer and high-
Output
**Metal
Media**

FUJIFILM



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FUJIFILM

RECORDING MEDIA



Fujifilm's Coating Technology Creates Breakthrough Products

Fujifilm began coating motion picture and photographic film in the mid 1930's using die coating technology. Simultaneous multi-coating technology was developed in 1960. Also in 1960, Fujifilm produced its first magnetic tape products. In 1965, Fujifilm began manufacturing computer tape. Fujifilm's floppy disks (8-inch) were introduced in 1977. Fujifilm began manufacturing dual-coated magnetic media in 1989 and Advanced super Thin-layer and high-Output Metal Media (ATOMM) dual-coated media in 1992. For ATOMM, Fujifilm's special die coating head simultaneously applies two separate and unique layers, one magnetic and one non-magnetic. It's a dual coating system Fujifilm invented that has allowed us to continually develop the industry's "next generation" storage products and develop nanocubic™ Technology for data storage products with even greater capacities.

