

SFF Committee  
SFF-8200 Specification for  
Suite of 2.5" Form Factor Specifications

**EXPIRED**

This specification has been incorporated as a standard of the Electronic Industries Association, and can be purchased through Global Engineering (303-792-2181) in hard copy form as EIA-720.

The SFF practice of making Expired Specifications unavailable has been modified for cases where the information is unavailable in an electronic format.

EIA standards and draft standards are not available electronically, so the SFF is continuing to provide this revision of the specification. Be aware that if any changes were made during the EIA approvals process, they are not reflected in this copy.

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SFF Committee

**SFF-8200 Specification for  
Suite of 2.5" Form Factor Specifications**

Rev 2.0

May 25, 2004

Secretariat: SFF Committee

**Abstract:** This document contains the many SFF specifications related to 2.5" form factor devices, which are typically directly mounted to a printed circuit board. Specifications which are available individually are included here in a comprehensive set.

This specification provides a common specification for systems manufacturers, system integrators, and suppliers of removable medium drives and medium changers. This is an internal working specification of the SFF Committee, an industry ad hoc group.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this specification.

**Support:** This specification is supported by the identified member companies of the SFF Committee.

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**EXPRESSION OF SUPPORT BY MANUFACTURERS**

The following member companies of the SFF Committee voted in favor of this industry specification.

AMP  
Conner Peripherals  
DEC  
ENDL  
Hewlett Packard  
IBM  
Maxtor  
Methode  
Quantum  
Robinson Nugent  
Seagate

If you are not a member of the SFF Committee, but you are interested in participating, the following principles have been reprinted here for your information.

#### **PRINCIPLES OF THE SFF COMMITTEE**

The SFF Committee is an ad hoc group formed to address storage industry needs in a prompt manner. When formed in 1990, the original goals were limited to defining de facto mechanical envelopes within which disk drives can be developed to fit compact computer and other small products.

Adopting a common industry size simplifies the integration of small drives (2 1/2" or less) into such systems. Board-board connectors carrying power and signals, and their position relative to the envelope are critical parameters in a product that has no cables to provide packaging leeway for the integrator.

In November 1992, the SFF Committee objectives were broadened to encompass other areas which needed similar attention, such as pinouts for interface applications, and form factor issues on larger disk drives. SFF is a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Specifications created by the SFF Committee are expected to be submitted to bodies such as EIA (Electronic Industries Association) or an ASC (Accredited Standards Committee). They may be accepted for separate standards, or incorporated into other standards activities.

The principles of operation for the SFF Committee are not unlike those of an accredited standards committee. There are 3 levels of participation:

- Attending the meetings is open to all, but taking part in discussions is limited to member companies, or those invited by member companies
- The minutes and copies of material which are discussed during meetings are distributed only to those who sign up to receive documentation.
- The individuals who represent member companies of the SFF Committee receive documentation and vote on issues that arise. Votes are not taken during meetings, only guidance on directions. All voting is by letter ballot, which ensures all members an equal opportunity to be heard.

Material presented at SFF Committee meetings becomes public domain. There are no restrictions on the open mailing of material presented at committee meetings. In order to reduce disagreements and misunderstandings, copies must be provided for all agenda items that are discussed. Copies of the material presented, or revisions if completed in time, are included in the documentation mailings.

The sites for SFF Committee meetings rotate based on which member companies volunteer to host the meetings. Meetings have typically been held during the ASC T10 weeks.

The funds received from the annual membership fees are placed in escrow, and are used to reimburse ENDL for the services to manage the SFF Committee.

If you are not receiving the documentation of SFF Committee activities or are interested in becoming a member, the following signup information is reprinted here for your information.

Membership includes voting privileges on SFF Specs under development.

CD\_Access Electronic documentation contains:

- Minutes for the year-to-date plus all of last year
- Email traffic for the year-to-date plus all of last year
- The current revision of all the SFF Specifications, as well as any previous revisions distributed during the current year.

Meeting documentation contains:

- Minutes for the current meeting cycle.
- Copies of Specifications revised during the current meeting cycle.

Each electronic mailing obsoletes the previous mailing of that year e.g. July replaces May. To build a complete set of archives of all SFF documentation, retain the last SFF CD\_Access mailing of each year.

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## Foreword

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers in which space was at a premium and time to market with the latest machine was an important factor. System integrators worked individually with vendors to develop the packaging. The result was wide diversity, and with space being such a major consideration in packaging, it was not possible to replace one vendor's drive with a competitive product.

The desire to reduce disk drive sizes to even smaller dimensions such as 1.8" and 1.3" made it likely that devices would become even more constrained in dimensions because of a possibility that such small devices could be inserted into a socket, not unlike the method of retaining semiconductor devices.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology in disk drives. After two informal gatherings on the subject in the summer of 1990, the SFF Committee held its first meeting in August.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced problems other than the physical form factors of disk drives. In November 1992, the members approved an expansion in charter to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

At the same time, the principle was adopted of restricting the scope of an SFF project to a narrow area, so that the majority of specifications would be small and the projects could be completed in a rapid timeframe. If proposals are made by a number of contributors, the participating members select the best concepts and uses them to develop specifications which address specific issues in emerging storage markets.

Those companies which have agreed to support a specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF Specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

Suggestions for improvement of this specification will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in 1990 has included a mix of companies which are leaders across the industry.

## 1 Scope

This standard defines the dimensions and connector locations of 63.5 mm (2.5") small form factor disk drives.

The purpose of this standard is to define the external characteristics of small form factor disk drives so that products from different vendors may be used in the same mounting configurations.

The standard provides specifications on external dimensions, connectors, connector placement, and mounting holes to assist manufacturers in the systems integration of small form factor disk drives.

## 2 General

### 2.1 Related documents

The following standards are relevant:

- |   |             |
|---|-------------|
| - SATA/ATA-7 (AT Attachment -7)   | T13/D1532V3 |
| - SPI-5 (SCSI Physical Interface -5)  | T10/1525    |
| - FCAL-2 (Fibre Channel Arbitrated Loop 2)  | NCITS.332   |
| - SAS (Serial Attached SCSI)  | T10/1562    |
| - Dimensioning and tolerancing  | ANSI-Y14.5M |
| - Detail Specification for Trapezoidal Connector 0.50" Pitch used with Single Connector Attach -2 | EIA PN-3651 |

### 2.2 Source

This standard is based on the SFF-8201 (2 1/2" drive form factor dimensions), SFF-8212 (2 1/2" Drives with 50-pin Connector), SFF-8221 (Pre-Aligned 2.5" Drive >10mm Form Factor), SFF-8222 (2.5" Drive w/SCA-2 Connector) and SFF-8223 (2.5" Drive w/Serial Attachment Connector) specifications developed by the SFF Committee.

The SFF Committee is an industry ad hoc group which was formed in 1990 to define a common mechanical envelope for the newly emerging 2.5" disk form factor. The original goal was broadened in 1992 to encompass other form factors and to resolve any industry issues that are either not addressed by the standards process or need an immediate solution.

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## 3 General Description

The application environment for small form factor disks is any computer, cabinet, or enclosure connecting to one or more drives in a restricted packaging environment.

The purpose of this specification is to provide information that will assist vendors to design products that can fit the same packaging envelope.

Small form factor disks are widely used where low power and small size are important configuration parameters.

## 4 Interface Requirements

## 4.1 Power and Grounding

### 4.1.1 Power

The drive receives DC power through the same connector that contains the signal lines if it is a direct mount to a receptacle on a board. Certain supported Interface Standards require DC power to be delivered through the same connector that contains the signal lines.

### 4.1.2 Grounding

Provision for tying the DC logic ground and the chassis ground together or for separating these two grounds is vendor specific.

## 4.2 I/O signals connectors

The I/O signals connectors are suited to different applications. The defined configurations are:

- A 50-pin low density connector for Parallel ATA and Parallel SCSI
- An SCA-2 connector for Parallel SCSI
- An SCA-2 connector for Fibre Channel Arbitrated Loop
- A unitized serial connector for Serial Attached SCSI
- A unitized serial connector for Serial ATA

See the respective Industry Interface Standard for pin assignments and application information.

## 5 Physical configurations

This content is based on SFF-8201 (2 1/2" drive form factor dimensions).

### 5.1 Physical Dimensions

Any physical measurements shall be performed at 20 °C +/- 2 °C. The drive shall not be exposed to any conditions (transit temperatures, shock, etc.) beyond the manufacturer's specified limits before measurement.

#### 5.1.1 Generic Drive Dimensional Information

Table 1 defines the generic drive dimensional information that applies to all 63.5 mm (2.5") disk drives as shown in Figures 1, 2 and 3. Dimensions identified as obsolete are for reference and may apply to existing device features. New devices are to be designed to dimensions that are not identified as obsolete.

Figure 1 and Figure 2 define the generic drive dimensions for 63.5 mm (2.5") disk drives, and shows relationships among the dimensions. It also defines the size and location of the mounting holes.

Figure 3 is a reference for the length of the form factor plus connector. See the applicable connector location definition for connector location requirements.



Table 1 Generic Form Factor Dimensions

Dimension	Millimeters	Inches	Comments
A 1	19.05	(0.750)	
A 1	17.00	(0.669)	
A 1	15.00	(0.591)	
A 1	12.70	(0.500)	
A 1	10.50	(0.413)	
A 1	9.50	(0.374)	
A 1	8.47	(0.333)	
A 1	7.00	(0.276)	
A 2	0.00	(0.000)	
A 3	0.50	(0.020)	
A 4	69.85	(2.750)	
A 5	0.25	(0.010)	
A 6	101.85 max	(4.010) max	Obsolete
A 6	100.45 max	(3.955) max	New requirement
A10	100.20	(3.945)	PATA/SCSI Interface
A11	100.50	(3.957)	SAS/SATA Interface
A12	110.20	(4.339)	PSCSI/FCAL Interface
A23	3.00	(0.118)	
A24	34.93	(1.375)	Obsolete
A25	38.10	(1.500)	Obsolete
A26	M3	(N/A)	
A27	0.50	(0.020)	
A28	4.07	(0.160)	
A29	61.72	(2.430)	
A30	34.93	(1.375)	Obsolete
A31	38.10	(1.500)	Obsolete
A32	M3	(N/A)	
A33	0.50	(0.020)	
A37	8.00	(0.315)	
A38	3.00 min	(3.00) min	
A41	2.50 min	(2.50) min	
A50	14.00	(0.551)	
A51	90.60	(3.567)	
A52	14.00	(0.551)	
A53	90.60	(3.567)	

## NOTES:

1. (A4+A5) represents the maximum width of the drive, 70.10 mm (2.760 in).
2. Dimensions A10, A11, and A12 are based on a nominal form factor length of 100.20 mm (3.945 in).
3. Unless diameter targets indicate specific areas, dimensions for a surface apply to a single point minimum. If a surface is not flat, the dimension applies to the highest raised location on that surface.

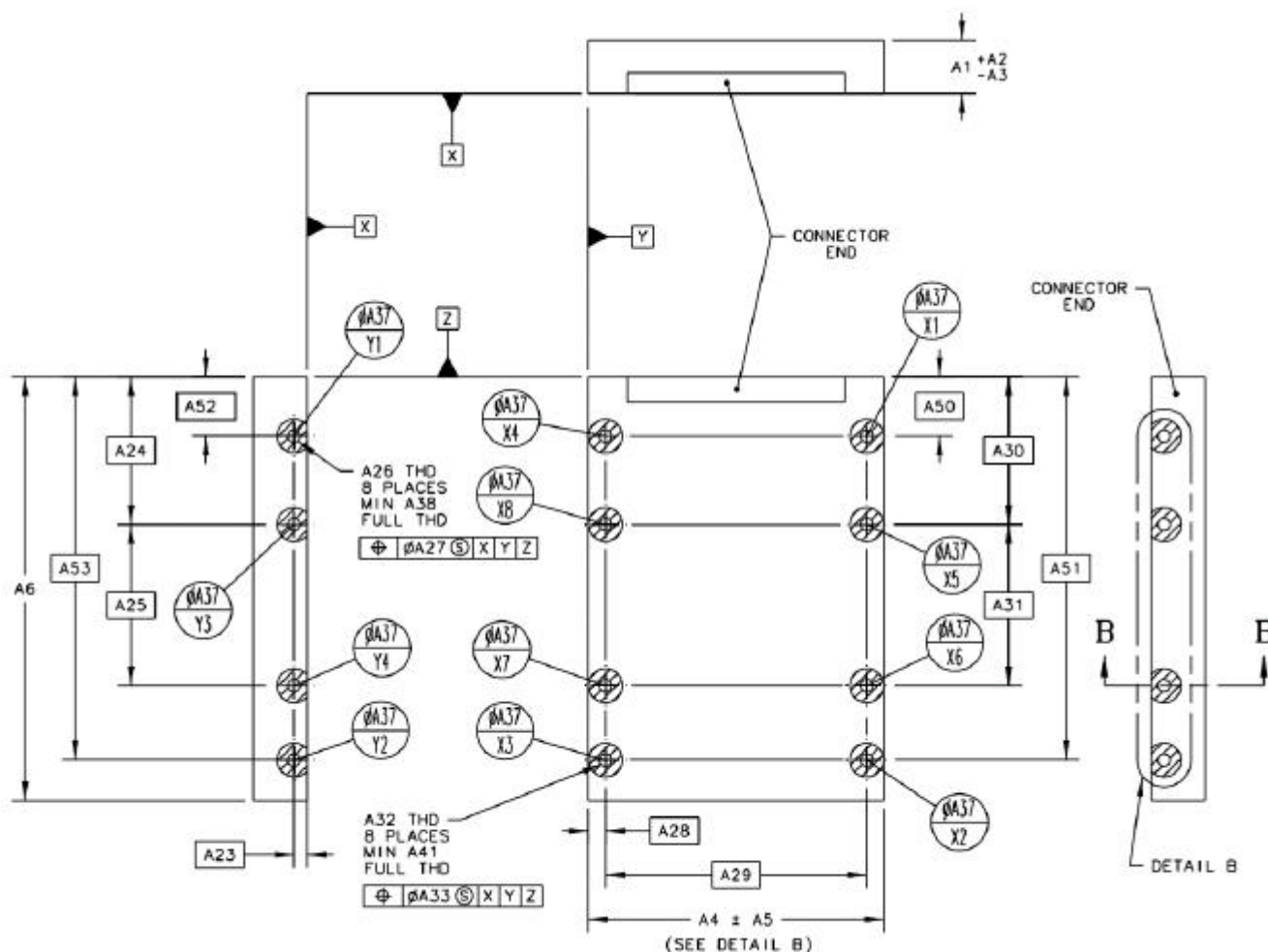


Figure 1 Generic Form Factor Of 63.5 mm (2.5") Disk Drive

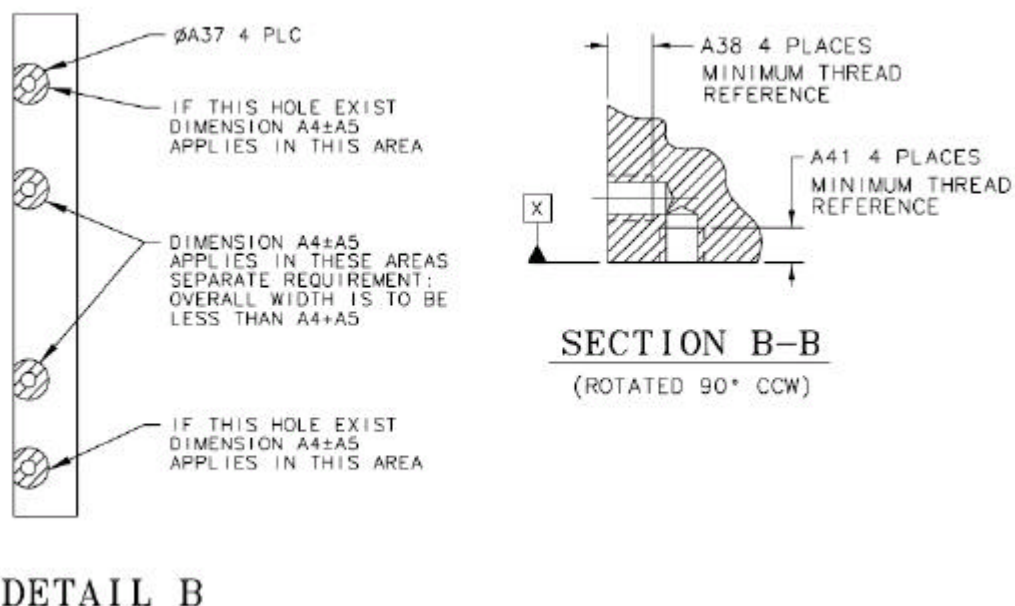


Figure 2 Detail Views Of Generic 63.5 mm (2.5") Disk Drive Form Factor

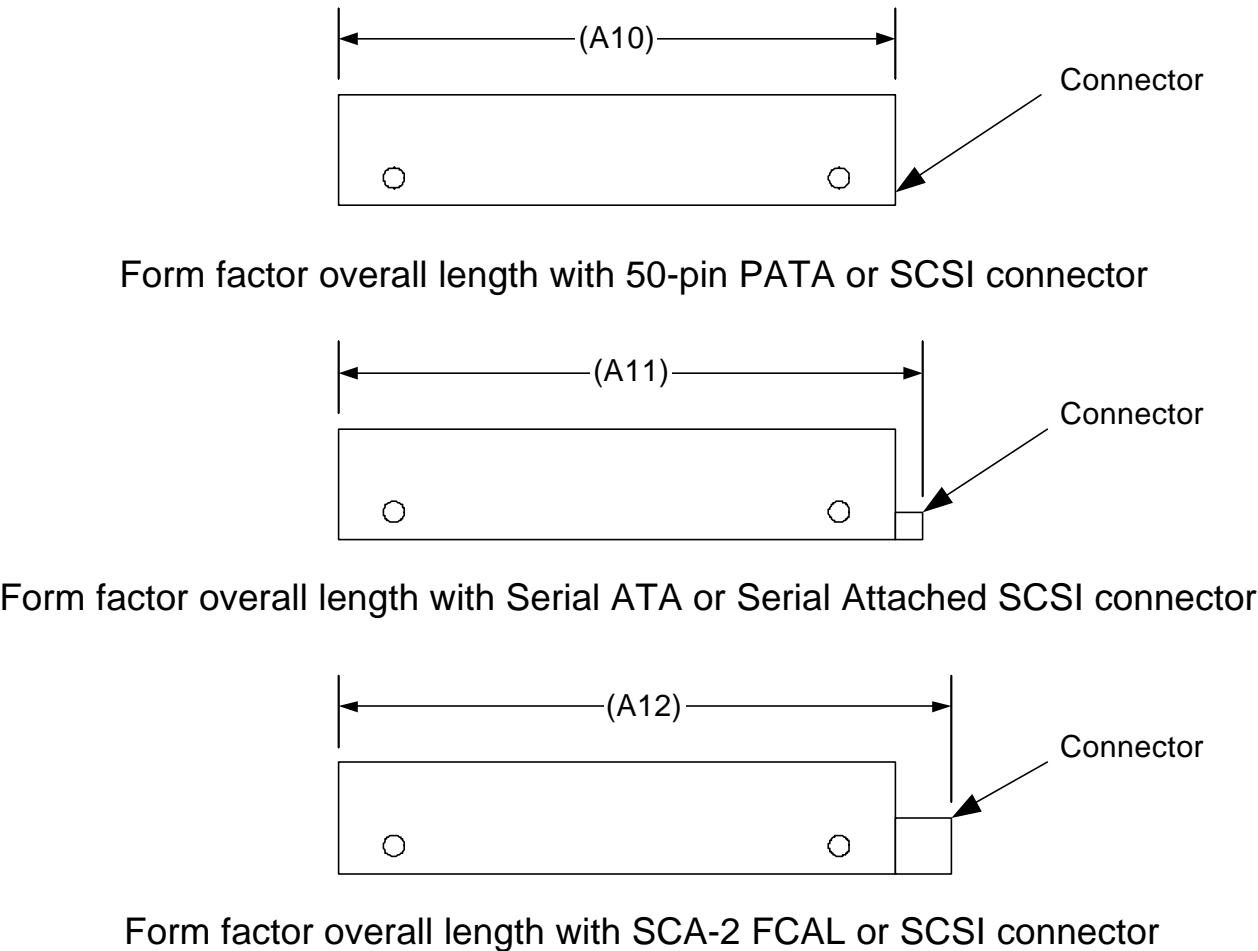


Figure 3 Length Of 2.5" Disk Drive With Connector

## 5.1.2 Pre-Aligned 63.5 mm (2.5") Drive &gt; 10 mm (0.394 in) Form Factor

This content is based on SFF-8221 (Pre-Aligned 2.5" Drive >10mm Form Factor).

Table 2 defines the drive dimensional information that applies to a superset of the generic 63.5 mm (2.5") disk drives as shown in Figure 4. This superset defines the dimensions for 63.5 mm (2.5") magnetic disk drives with special features to facilitate attachment of a handle directly to the drive and a key area to enhance use in an enclosure. Specifically, two threaded holes and corresponding flat mounting surfaces are specified on the end of the form factor opposite the I/O connector for handle attachment and a key area is specified on the side and top of the form factor near the connector end to be used with a mechanical stop feature to prevent connector interference with a backplane should the unit be inserted at 180° rotation from its normal mounting orientation.

Figure 4 defines the form factor dimensions for pre-aligned 63.5 mm (2.5") drive > 10 mm (0.394 in), and shows relationships among the dimensions. It also defines the size and location of the mounting holes.

Table 2 Pre-Aligned 2.5" Drive > 10 mm (0.394 in) Form Factor Dimensions

Dimension	Millimeters	Inches
A1	15.00	(0.591)
A2	0.00	(0.000)
A3	0.50	(0.020)
A4	69.85	(2.750)
A5	0.25	(0.010)
A6	100.20	(3.945)
A7	4.50	(0.177)
A8	2.5	2.5
A9	59.50	(2.343)
A10	3.00	(0.118)
A11	10.00	(0.394)
A12	0.13	(0.005)
A13	17.00	(0.669)
A14	7.50	(0.295)
A19	1.02	(0.040)
A23	3.00	(0.118)
A26	M3	n/a
A27	0.50	(0.020)
A28	4.06	(0.160)
A29	61.72	(2.430)
A37	8.00	(0.315)
A38	3	3
A52	14.00	(0.551)
A53	90.60	(3.567)

## NOTES:

1. Unless otherwise indicated in the figure, all dimensions have a tolerance of  $\pm 0.25$  mm ( $\pm 0.010$  in).
2. A4+A5 represents the maximum width of the form factor, 70.10 mm (2.760 in).
3. Unless diameter targets indicate specific areas, dimensions for a surface apply to a single point minimum. If a surface is not flat, the dimension applies to the highest raised location on that surface.
4. Diameters indicated on the surface of the form factor opposite the connector end specify a minimum size for mounting surfaces in addition to being target areas for the A6 dimension.

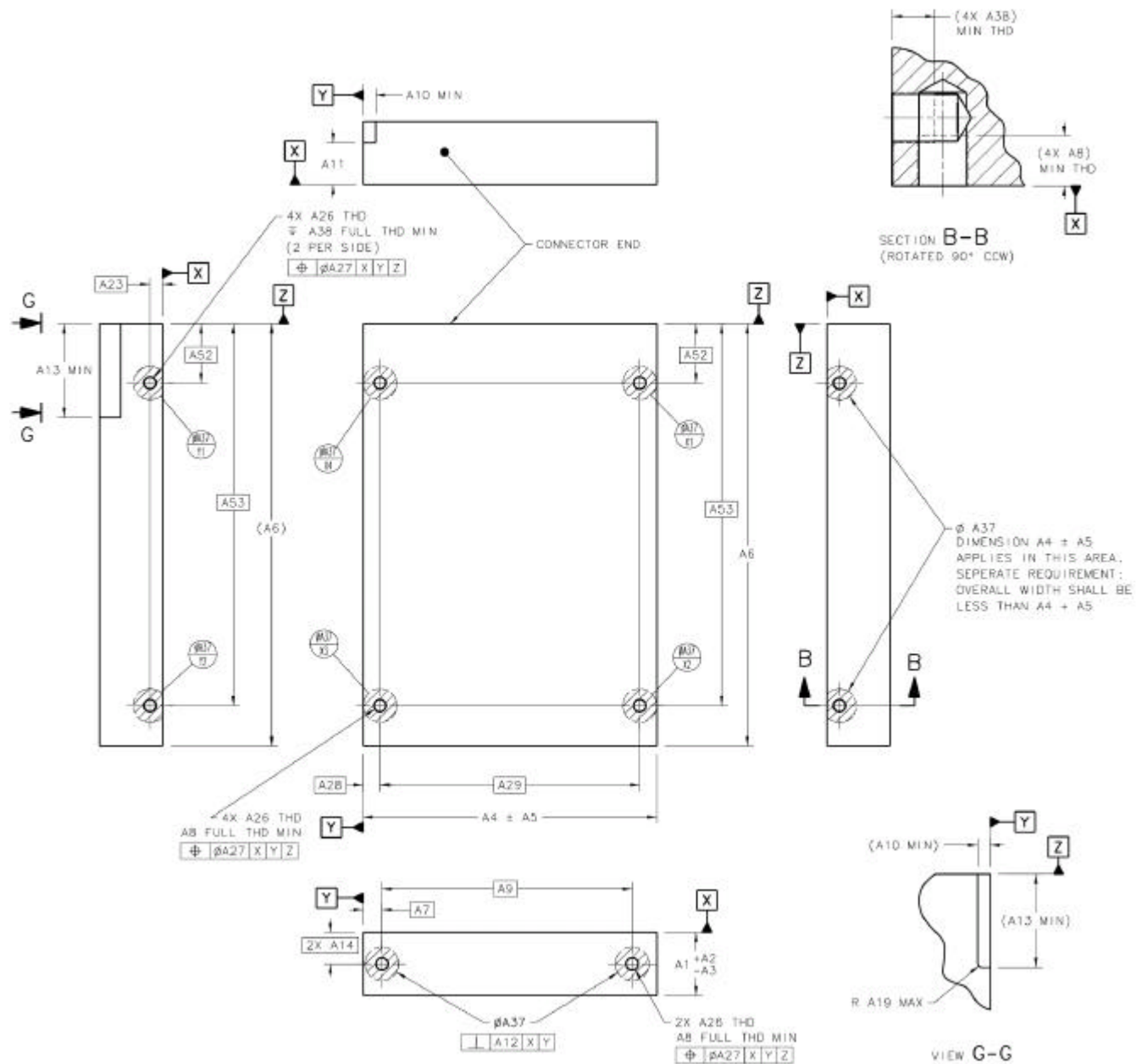


Figure 4 Pre-Aligned 2.5" Drive > 10 mm Form Factor

## 5.2 Connector Space

The drive PCB and/or connector may extend beyond the HDA. If it does, there is a space at the end of the HDA underneath or above the PCB or connector overhang. Such "dead space" is not to be encroached upon in any way by the host system.

## 5.3 Connector Configurations

Care must be taken in the application of these drives so that excessive stress is not exerted on the connectors. Backplane configurations must pay particular attention so that the connector is not damaged due to excessive side loading, compressive forces, or from supporting the weight of the device.

### 5.3.1 50-Pin Connector

This content is based on SFF-8212 (2 1/2" Drives with 50-pin Connector).

Table 3 contains the dimensions represented in Figure 5, which defines the location of the 50-pin connector on 63.5 mm (2.5") disk drives. A clear-out zone inside the drive form factor provides room for the system connector and is defined by dimensions A34, A35 and A36. Dimensions A39 and A40 define a chamfer that provides a lead in as the system and drive connectors mate.

Table 3 50-Pin Connector Location

Dimension	mm	in
A7	31.17	(1.227)
A8	1.00	(0.039)
A9	3.99	(0.157)
A10	10.14	(0.399)
A11	2.00	(0.079)
A12	2.00	(0.079)
A13	0.50	(0.020)
A14	0.03	(0.0012)
A15	0.75	(0.030)
A16	0.10	(0.004)
A17	0.50	(0.020)
A18	0.03	(0.0012)
A19	0.50	(0.020)
A20	0.10	(0.004)
A21	3.86	(0.152)
A22	0.20	(0.008)
A34	1.00 min	(0.039) min
A35	8.00 max	(0.315) max
A36	60.20 min	(2.370) min
A39	1.25 min	(0.049) min
A40	0.25 min	(0.010) min
A54	10.24	(0.403)

Notes:

1. X, Y and Z are datums
2. A15 and A19 control the location of the connector as a whole
3. A16 and A20 control the location of the pins within the connector

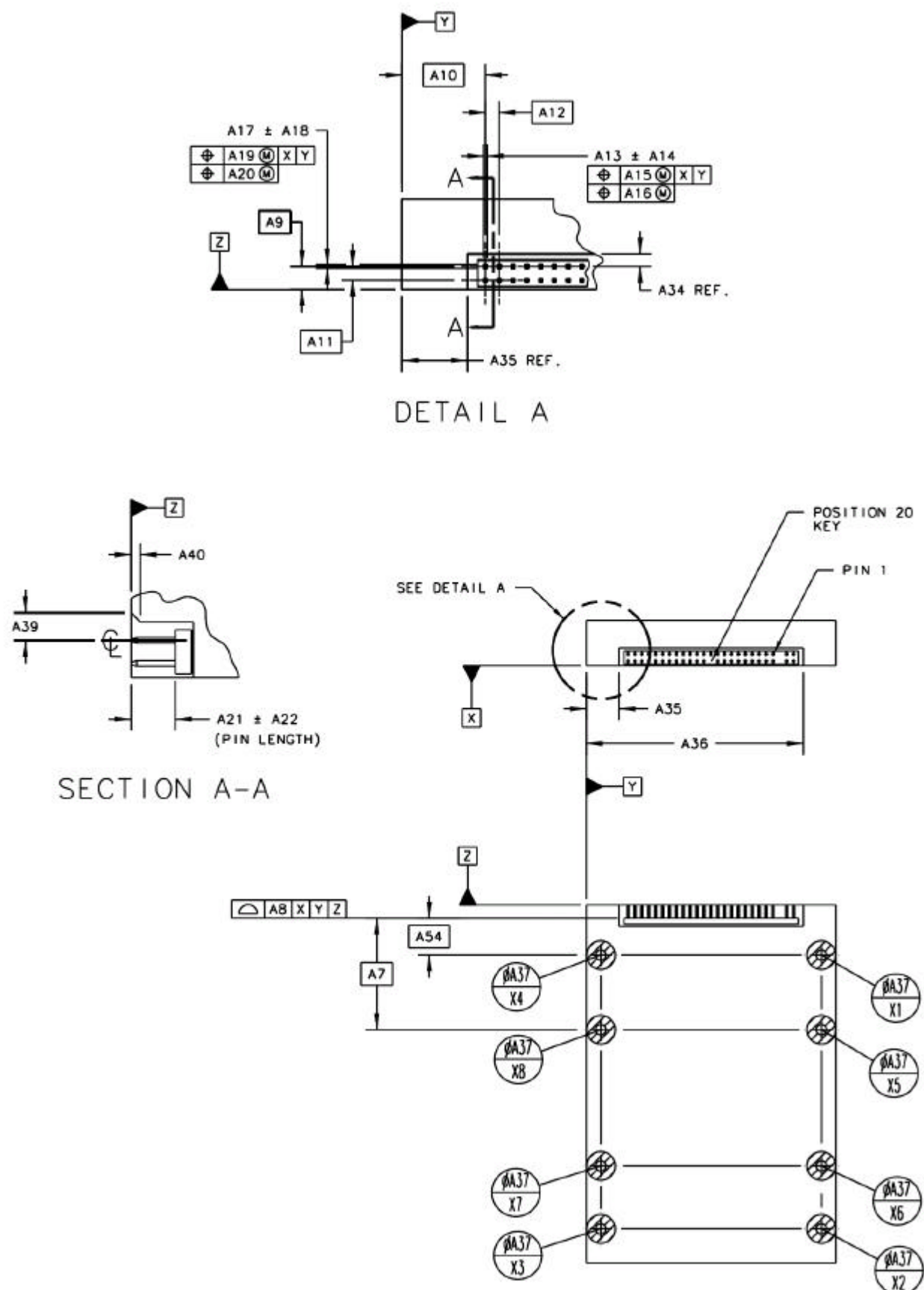


Figure 5 50-Pin Connector On 63.5 mm (2.5") Disk Drive

### 5.3.2 SCA-2 (Single Connector Attach) Interface Connector

This content is based on SFF-8222 (2.5" Drive w/SCA-2 Connector).

Table 4 contains the dimensions represented in Figure 6 or Figure 7, which defines the location of the SCA-2 (Single Connector Attach) interface connectors for parallel SCSI (80-pin) and Fibre Channel (40-pin) on 63.5 mm (2.5") disk drives. Dimensions are optionally referenced from the bottom form factor mounting hole or the form factor side mounting hole, depending on the application.

This specification defines a drive that can be directly inserted into the backplane of a cabinet, without the need for a cable, and provides information necessary to assist manufacturers in the systems integration of small form factor disk drives. This specification allows only one location for the interface connector on the drive.

Provision exists in the SCA-2 connector for improved mating via guides that incorporate provision for mating ground prior to mating any other signals.

This specification provides dimensions that are optionally referenced from the form factor bottom mounting hole or the form factor side mounting hole, depending on the final product application. This optional methodology prevents excessive tolerance stack-up between the two mounting screw locations when the connector is referenced to only one mounting screw location and the form factor drawing is used to determine the location of the connector to the other mounting screw location. The optional approach is used to avoid double dimensioning.

Table 4 SCA-2 Connector Location

Dimension	Millimeters	Inches	Comments
A1	69.85	(2.750)	
A2	66.50	(2.618)	80-position
A2	41.10	(1.618)	40-position
A3	1.00	(0.039)	
A4	0.35	(0.014)	
A5	7.00	(0.276)	
A6	1.00	(0.039)	
A7	4.00	(0.157)	
A8	24.00	(0.945)	
A9	0.35	(0.014)	
A10	0.50	(0.020)	

Notes:

1. Reference drawing EIA PN-3651 for connector details.
2. Millimeter is the controlling dimensional unit.



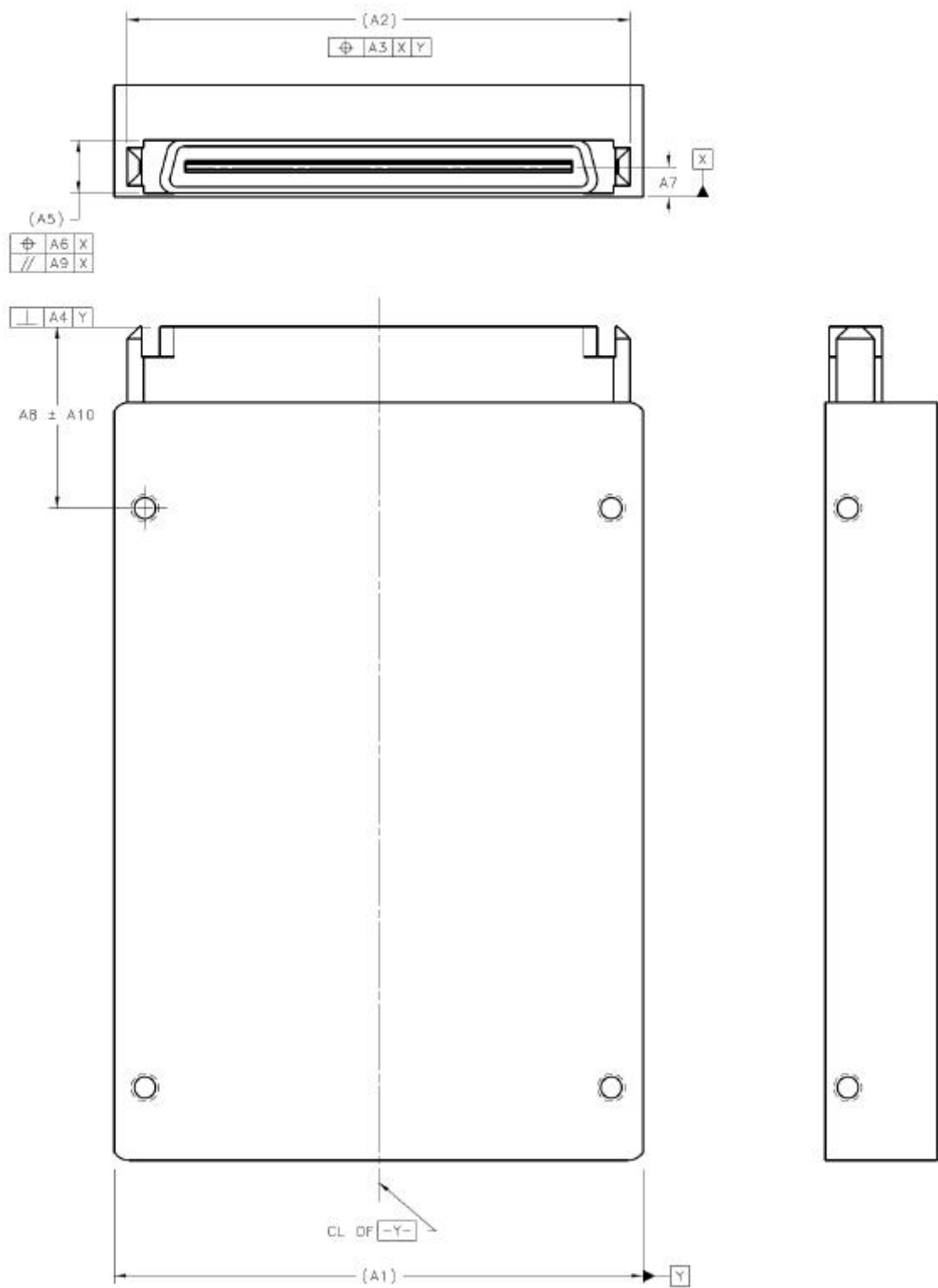


Figure 6 (OPTION 1) SCA-2 Connector Referenced To Bottom Mounting Screw On 63.5 mm (2.5") Disk Drive

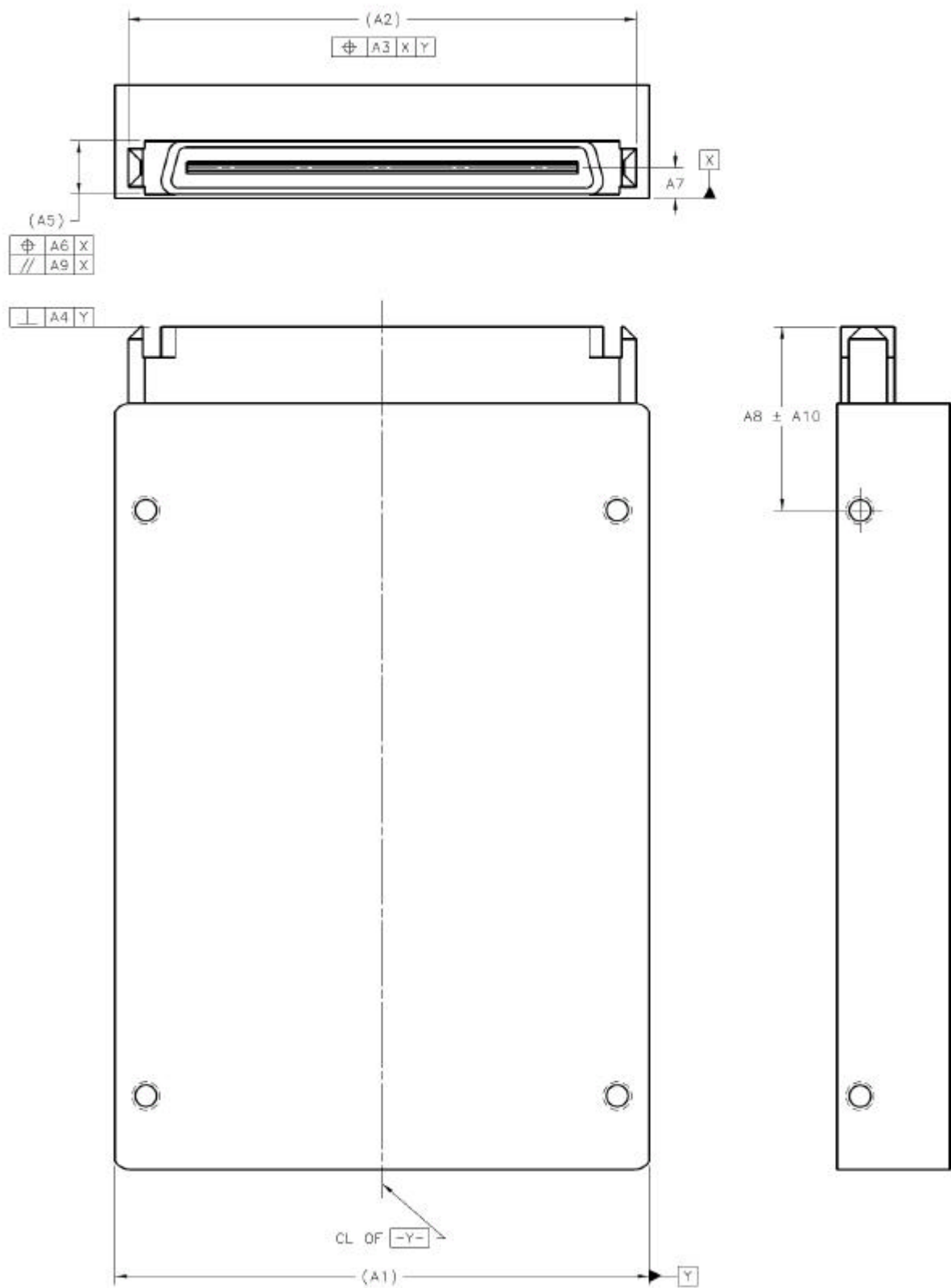


Figure 7 (OPTION 2) SCA-2 Connector Referenced To Side Mounting Screw On 63.5 mm (2.5") Disk Drive

### 5.3.3 Serial Interface Connector

This content is based on SFF-8223 (2.5" Drive w/Serial Attachment Connector).

Table 5 contains the dimensions represented in Figure 8 or Figure 9, which defines the location of the serial interface connector for Serial Attached SCSI (SAS) and Serial ATA applications on 63.5 mm (2.5") disk drives. Dimensions are optionally referenced from the bottom form factor mounting hole or the form factor side mounting hole, depending on the application. The connector nominally protrudes 0.3 mm (0.012) beyond the drive form factor connector end.

This specification defines a drive that can be directly inserted into the backplane of a cabinet, without the need for a cable, and provides information necessary to assist manufacturers in the systems integration of small form factor disk drives. Alternately, a cable may be used to supply power and to connect to the data port(s) of the drive. This specification allows only one location for the interface connector on the drive. A backplane with a SAS receptacle connector may accept either a SAS or SATA drive. SATA backplane and cable connectors do not accept SAS drive connectors.

Provision exists in the serial connector for improved mating via guides. Staggered pin lengths incorporate provision for mating ground prior to mating any other signals.

This specification provides dimensions that are optionally referenced from the form factor bottom mounting hole or the form factor side mounting hole, depending on the final product application. This optional methodology prevents excessive tolerance stack-up between the two mounting screw locations when the connector is referenced to only one mounting screw location and the form factor drawing is used to determine the location of the connector to the other mounting screw location. The optional approach is used to avoid double dimensioning.

Table 5 Serial Connector Location

Dimension	Millimeters	Inches
A1	69.85	(2.750)
A2	42.73	(1.682)
A3	33.39	(1.315)
A4	0.40	(0.016)
A5	4.00	(0.157)
A6	0.76	(0.030)
A7	3.50	(0.138)
A8	9.40	(0.370)
A9	0.25	(0.010)
A10	1.00	(0.039)
A11	4.80	(0.189)
A12	0.38	(0.015)
A13	13.43	(0.529)
A14	37.20	(1.465)
A15	1.50	(0.059)
A16	1.00	(0.039)
A17	1.00	(0.039)
A18	0.30	(0.012)
A19	1.00	(0.039)
A20	0.50	(0.020)

Notes:

1) Millimeter is the controlling dimensional unit.

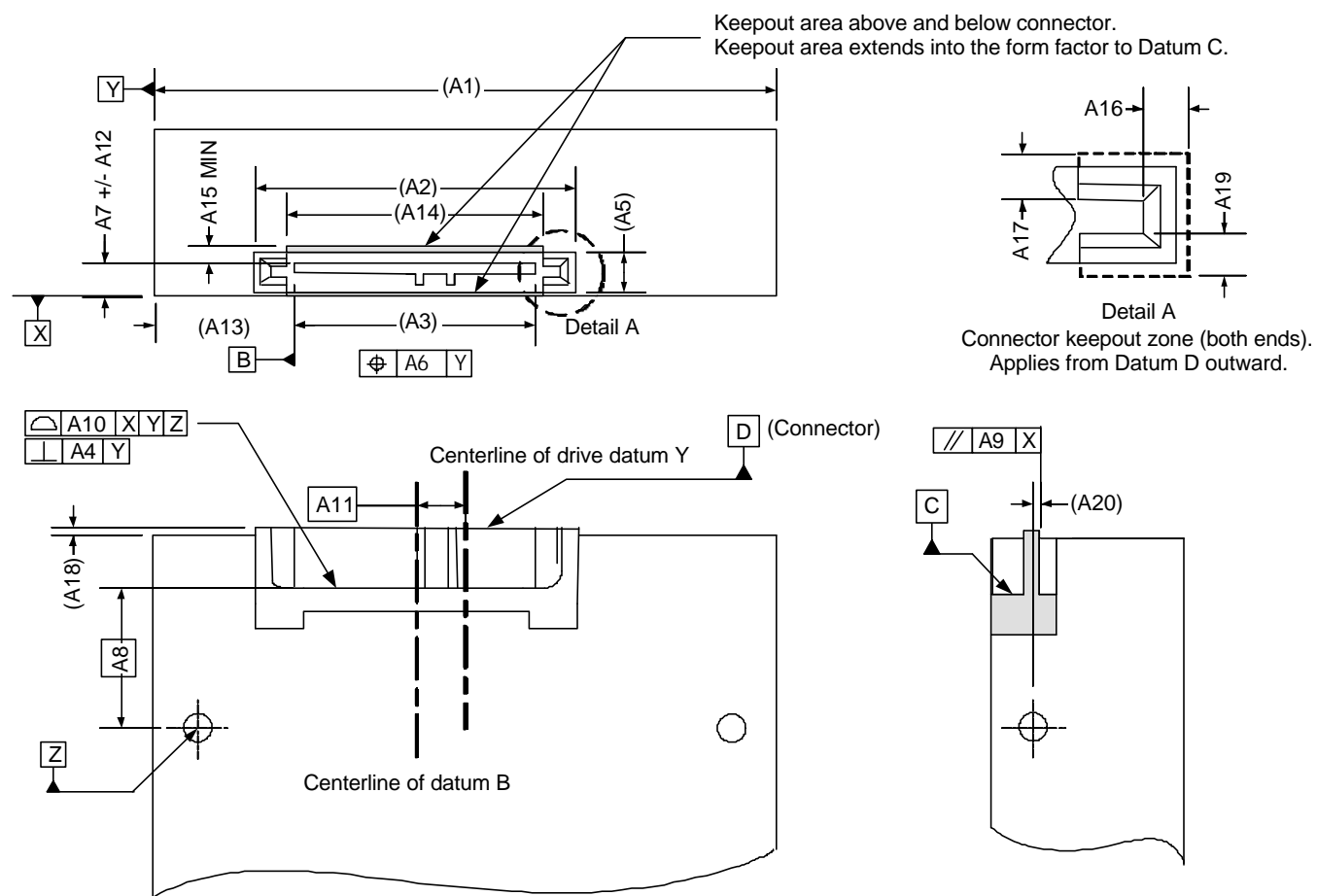


Figure 8 (OPTION 1) Serial Connector Referenced To Bottom Mounting Screw On 63.5 mm (2.5") Disk Drive

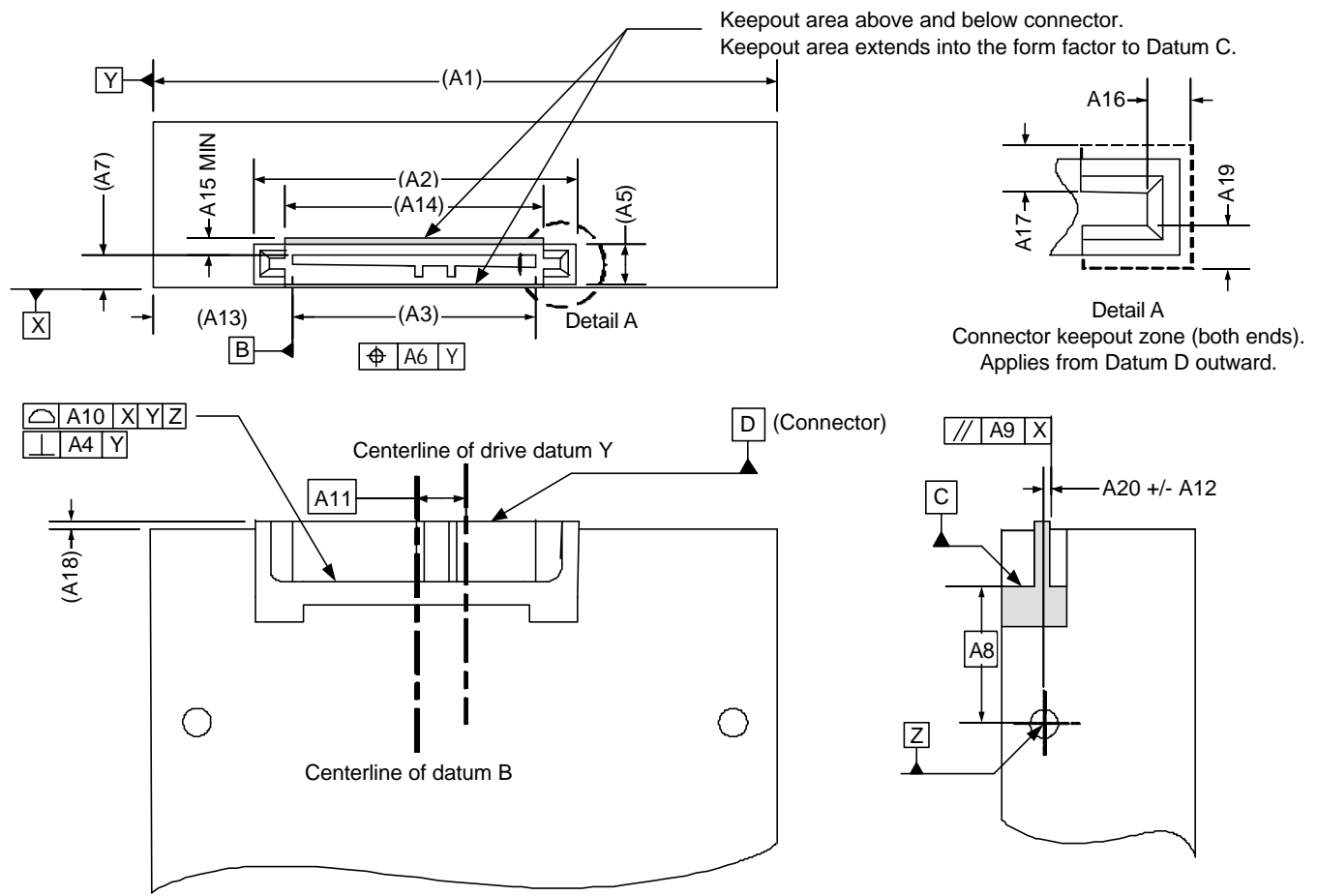


Figure 9 (OPTION 2) Serial Connector Referenced To Bottom Mounting Screw On 63.5 mm (2.5") Disk Drive

#### 5.4 Cooling Airflow

Except at the attachment points, 0.75 mm (0.030 in) minimum clearance around the drive is recommended for cooling airflow.

#### 6 Mounting considerations

This content is based on SFF-8201 (2 1/2" drive form factor dimensions).

The mounting holes for 2.5" disk drives have had to change over time in order to accommodate the packaging of more platters in a disk drive. Although only 4 holes are needed for either side or bottom mount, the system manufacturer may have to provide for up to 8 different locations to mount a wide selection of drives. Refer to Table 1 to identify obsolete mounting hole locations.

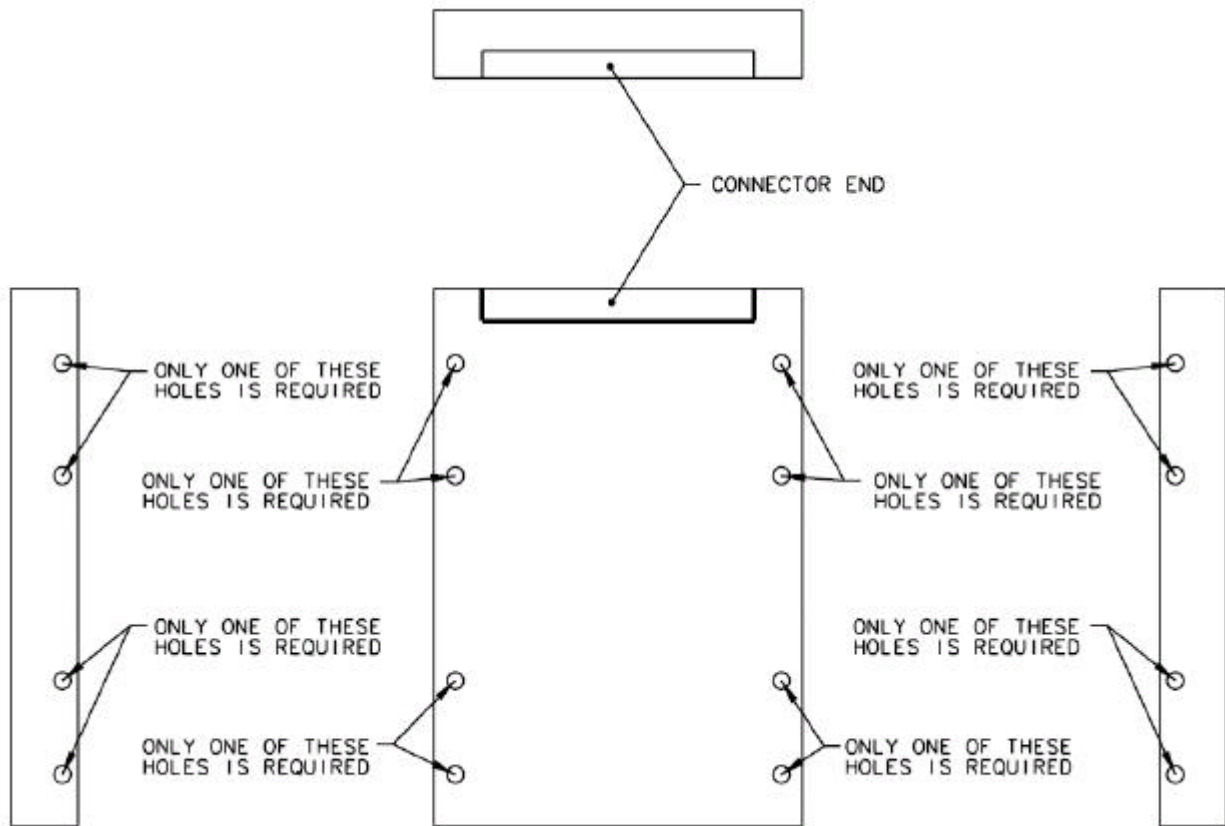


Figure 10 Mounting Hole Locations