AEROSPACE STANDARD

AS6169™	REV. A
Issued 2013-02 Stabilized 2019-08 Superseding AS6169	

AS6169: Interface Standard, Airborne EO/IR Systems, Mechanical

RATIONALE

The Technical Committee determines that the using community is moving towards newer technology and would like to alert users that this newer technology exists which may want to be considered for new design.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE AS-1C Avionic Subsystems Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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PREFACE

AS6169, Interface Standard, Airborne EO/IR Systems, Mechanical, is a standard that defines the mechanical interface between aircraft (manned and unmanned) and onboard EO/IR Systems. Its purpose is to promote platform to sensor system interface standardization by providing substantial, but not 100% commonality, interoperability, and limited interchangeability.

This document was prepared by the AS-1C4 Electro-Optic/Infrared Mechanical Interface Task Group, under the jurisdiction of the AS-1C Subcommittee, Avionic Subsystems, of the SAE AS-1 Committee, Platform Systems and System Integration.

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1. SCOPE

This standard defines the mechanical interface and specifies provisions for the electrical and environmental connectors between the host aircraft (“platform”) and a turreted electro-optic/infrared (EO/IR) sensor.

1.1 Relationship between Aircraft/Sensor Interfaces and SAE Standards

Figure 1 shows the relationship between various interfaces and their related SAE standards.

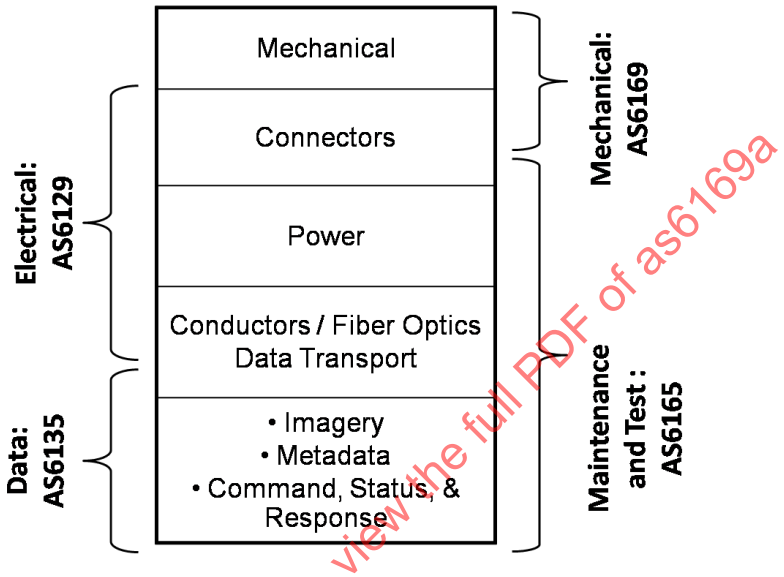

FIGURE 1 - RELATED SAE STANDARDS

AS6169 overlaps AS6129; AS6129 (electrical) covers connectors, power, conductors, fiber optics, and some aspects of data transport. AS6129 defines the platform-sensor interface (PSI) in two configurations, an EO/IR sensor with and without an external control unit (ECU). In the case where the sensor includes an ECU external to the turreted EO/IR sensor, AS6129 defines the PSI at the ECU, not at the turret. In the case where the sensor includes the ECU internal to the turreted EO/IR sensor, AS6129 defines the PSI at the turret. In contrast, AS6169 covers the mechanical mounting of the turreted EO/IR sensor to the platform plus locations for electrical and environmental connectors at the turret regardless of the configuration.

AS6135 (data) covers data (e.g., imagery, metadata, as well as command, status, and response). AS6135 overlaps AS6129 in the area of protocols for data transport. AS6165 defines the use of the sensor's electrical and data interfaces for maintenance and test purposes and as such only overlaps AS6129 and AS6135.

1.2 Purpose

The intent of this standard is to enhance interoperability, commonality, and interchangeability among equipment provided by various EO/IR suppliers and the platforms to which they are to be integrated. Adoption of this standard will improve procurement flexibility for acquisition, system integrators, and platform providers. Relevant platforms include fixed wing, rotary wing, UAS (except for micro-UAS), and lighter than air vehicles.

1.3 Application

This standard applies to all platforms and turreted EO/IR sensors that interface with each other. This coverage encompasses sensors and platforms presently in concept development stages, future platforms, sensor developments, and upgrades to legacy platforms.

2. REFERENCES

2.1 Applicable Documents

The documents listed in this section are cited in Sections 3 and 4 of this standard. This section does not include documents cited in other sections of this standard, or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in Sections 3 and 4 of this standard, whether or not they are listed here.

The following publications form a part of this document to the extent specified herein. When specified herein, the specified revision level of a document shall be used. Otherwise, the latest revision level of the specified document is implied.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS6129 Interface Standard, Airborne EO/IR Systems, Electrical

AS6135 Interface Standard, Airborne EO/IR Systems, Data

AS6165 Interface Standard, Airborne EO/IR Systems, Maintenance and Test

2.1.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, https://assist.daps.dla.mil/quicksearch/.

MIL-DTL-5002 Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapon Systems

MIL-DTL-38999 General Specification for Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environmental Resistant, Removable Crimp and Hermetic Solder Contacts

MIL-DTL-38999L General Specification for Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environmental Resistant, Removable Crimp and Hermetic Solder Contacts; Revision L with Amendment 2; May 10, 2012

MIL-PRF-55339/34 Adaptor, Connector, Coaxial, Radio Frequency (with series TNC, (Hermetic)), Class 2, Receptacle; Revision A; January 10, 2005

MIL-STD-464 Electromagnetic Environmental Effects Requirements for Systems

MIL-STD-889 Dissimilar Metals

MIL-STD-1472 Human Engineering

MIL-STD-7179 Finishes, Coatings, and Sealants for the Protection of Aerospace Weapons Systems

2.1.3 Industry Publications

ASME Y14.5 - 2009 Dimensioning and Tolerancing

2.2 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.3 Definitions

ACCESS HOLE: An opening, on the platform side of the mechanical interface, with a defined diameter, to allow top egress electrical connectors and cables to pass through and/or the turret to extend beyond the mechanical interface into the platform.

ADAPTER PLATE: A structure used to adjoin two interfaces.

CENTER OF GRAVITY: See TURRET CENTER OF GRAVITY.

CLAMPED THICKNESS: The thickness of material on the aircraft side of the mechanical interface that is between the head of the fastener and the turret side of the mechanical interface.

CLASS: See TURRET CLASS.

COMMONALITY: A shared feature or attribute. Or a shared set of features or attributes.[1]

COMPATIBLE: Capable of orderly, efficient integration and operation with other elements in a system with no modification or conversion required.[2]

DIAMETER: See TURRET DIAMETER.

DOWEL PIN: A solid, cylindrical semi-permanent pin used as a reference point to control positioning variations and attain repeatable assembly quality.[3]

DOWEL PIN SLOT: A precision milled, elongated hole for a dowel pin.

EO/IR SENSOR TURRET: A system of one or more sensors in the visible and/or infrared spectrum mounted on a gimbal that rotates about two axis, azimuth and elevation, that may also include additional sub-systems such as an external ECU.

FUNCTIONAL CHARACTERISTIC: The act of being capable of performing a particular operation or operations (example: modes, features).

INTERCHANGEABILITY: A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance.[4]

INTEROPERABILITY: The ability of two or more systems or components to exchange information and to use the information that has been exchanged.[5]

[1] Derived from definition in: the American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company, updated in 2009. Published by Houghton Mifflin Company. All rights reserved.
[2] www.thefreedictionary.com
[3] Derived from www.toolingu.com and www.wikipedia.org
[4] Federal Standard 1037C, Telecommunications: Glossary of Telecommunication Terms. http://www.its.bldrdoc.gov/fs-1037/fs-1037c.htm Visited on March 22, 2011.
[5] IEEE Glossary

LANDING ZONE: The defined area around the fastener through holes on the opposite side of the turret interface surface for seating of the fastener head and associated hardware such as washers and tooling.

MECHANICAL INTERFACE:The physical contact point(s) of the mounting surface(s) between the aircraft and turret that comply with the specified bolt circle pattern. The mechanical interface does not include the physical contact points associated with the electrical and/or environmental connectors. The mechanical interface is Datum A in Figures 6 to 16.

PERFORMANCE CHARACTERISTICS: The act of functioning or operating within specified tolerances (example: Geo accuracy, LOS, NIIRS).

PLATFORM INTERFACE: The platform side of the mechanical interface.

SIDE EGRESS: The designation given electrical and environmental connectors where the connector and/or associated cables do not pass through the access hole defined in the platform side of the mechanical interface, and remain in the immediate vicinity of the turret side of the mechanical interface before passing into the platform at another location.

TOP EGRESS: The designation given electrical connectors where the connector and/or associated cables pass through the access hole defined in the platform side of the mechanical interface into the platform, or are completely within the platform side of the mechanical interface.

TURRET: The gimbaled portion of the EO/IR Sensor System. If an adapter plate is considered on the turret side of the mechanical interface, the turret is defined as the entire assembly of the adapter plate and the gimbaled portion of the EO/IR Senor Turret.

TURRET CENTER OF GRAVITY: The point in the turret at which inertial forces may be considered to be concentrated.

TURRET CLASS: The designation given to a turret within specified physical parameters such as size, weight, and center of gravity.

TURRET DIAMETER: The diameter of the turreted EO/IR sensor is defined as the best fit circle between the outer edges of the yoke containing the elevation bearings (see Appendix A for additional clarification and examples).

TURRET INTERFACE: The turret side of the mechanical interface.

TURRET WEIGHT: The weight of the turret without fastener hardware, cabling, and additional hardware that is not within or permanently attached to the outer lines of the turret, such as a separate electronics unit.

WEIGHT: See TURRET WEIGHT.

2.4 Acronyms

Table 1 shows a list of Acronyms.

TABLE 1 - ACRONYMS

ASME	American Society of Mechanical Engineers
CG	Center of Gravity
D38999	An electrical connector that complies with MIL-DTL-38999
DTL	Detail
ECU	Electronics Control Unit
EO/IR	Electro-Optic/Infrared
F	Fastener (Fasten number depicted as F1, F2, F3, …)
LOS	Line of Sight
MIL	Military
NA	Not Applicable
NIIRS	National Image Interpretability Rating Scale
PSI	Platform Sensor Interface
STD	Standard
TU	Turret Unit
UAS	Unmanned Aircraft System
W	With

2.5 Symbols

∅	Diameter
$\varnothing_T$	Turret Diameter
⊥	Perpendicular
Ⓜ	Maximum Material Condition
▱	Flatness
//	Parallel
▼	Datum
⊤	Recess
>	Greater than
<	Less than
≤	Less than or equal to
±	Plus, minus

#	Number
I, II, III, IV	Roman Numerals 1, 2, 3, 4
≡	Defined as
⌖	True Position

3. GENERAL REQUIREMENTS

3.1 Classes

Turret Classes shall be defined per the turret's diameter, in addition to restrictions of turret's weight and center of gravity (CG). CG refers to the distance of the turret's CG from the mechanical interface. The diameter range, maximum weight, and other characteristics used to define Turret Classes shall be in accordance with Table 2.

TABLE 2 - TURRET CLASSES

Turret Class	Turret Diameter Range	Turret Weight	Turret Center of Gravity *
I	19.0 inches < $\varnothing_T \leq$ 23.0 inches	≤ 250 pounds	≤ 15.0 inches
II	13.0 inches < $\varnothing_T \leq$ 19.0 inches	≤ 150 pounds	≤ 12.0 inches
III	9.0 inches < $\varnothing_T \leq$ 13.0 inches	≤ 75 pounds	≤ 8.0 inches
IV	6.0 inches < $\varnothing_T \leq$ 9.0 inches	≤ 25 pounds	≤ 5.0 inches
Un-defined	$\varnothing_T >$ 23 inches $\varnothing_T \leq$ 6.0 inches	NA	NA

*Turret Center of Gravity is the distance measured from the Mechanical Interface (Datum A in Figures 6 to 16).

No mechanical requirements are imposed on physically separate electronics associated with the sensor system such as an ECU. This is illustrated in Figure 2.

NOTE: If the turreted electro-optic/infrared sensor contains an external ECU, it is recommended that the ECU be installed in the platform as close as possible to the sensor.

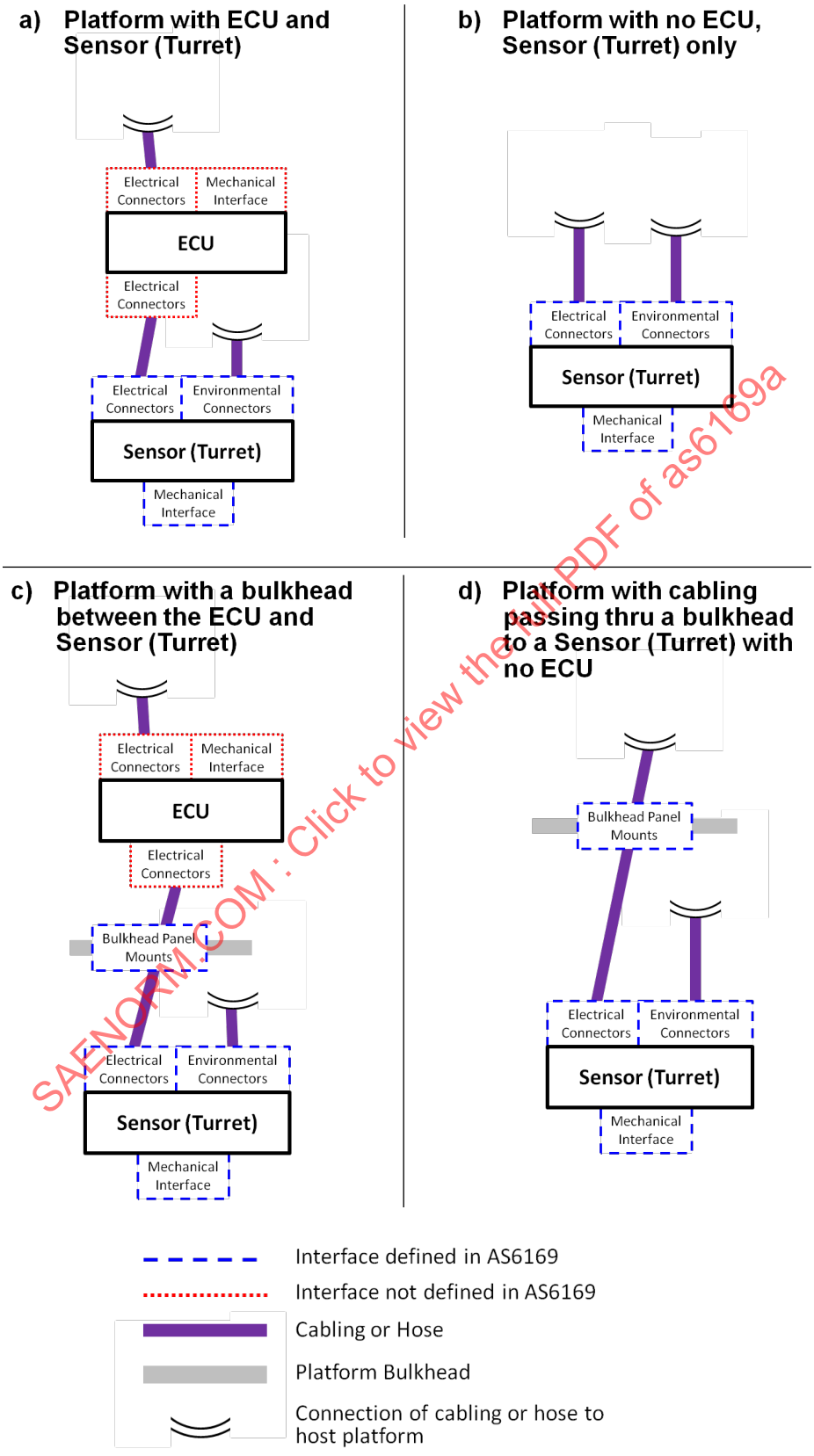

FIGURE 2 - LOCATION OF INTERFACES AND CONNECTORS

3.2 Mechanical Interface

The mechanical interface is composed of a platform side and a turret side. Adapters shall be allowed on either or both sides of the mechanical interface. The adapter(s) shall be part of the platform or turret side of the mechanical interface as described in 4.1.3. Four adapter configurations are shown in Figure 3. Figure 3a shows a configuration with no adapter. Figure 3b shows a configuration with an adapter plate on the sensor side of the interface. Figure 3c shows a configuration with an adapter on the platform side. Figure 3d shows a configuration with an adapter on both the sensor and platform sides of the adapter. An adapter is considered to be part of the platform if it is on the platform side of the mechanical interface, and to be part of the sensor if it is on the sensor side of the mechanical interface.

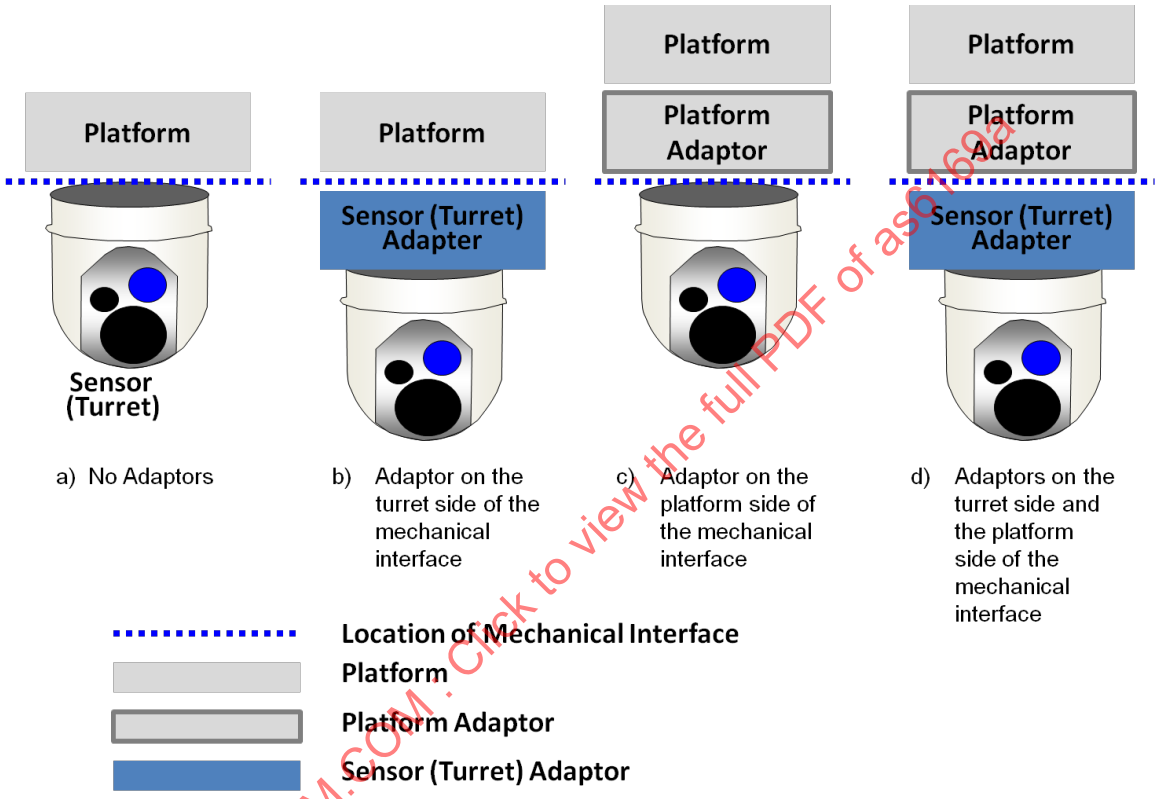

FIGURE 3 - MECHANICAL INTERFACE WITH OPTIONAL ADAPTERS

Turret Classes have two general mechanical interface configurations; the mechanical interface with an access hole for top egress electrical connectors to pass through and/or the turret to extend beyond the mechanical interface to the platform side of the mechanical interface, and the mechanical interface with no access hole. Two variations of these configurations are shown in Figure 4.

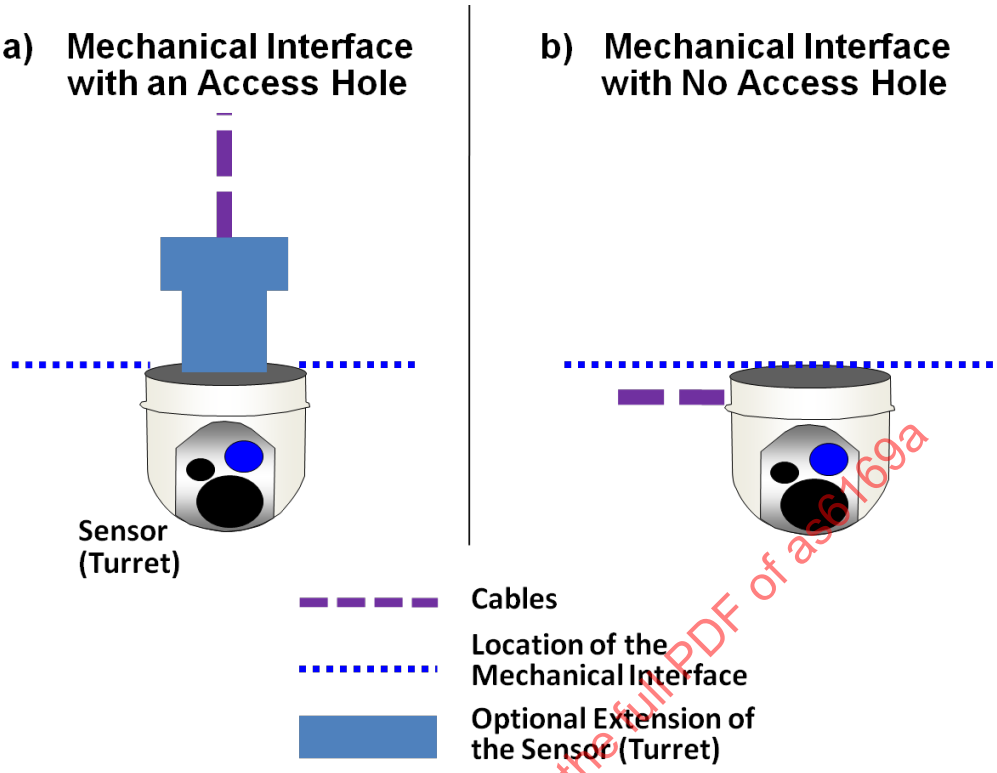

FIGURE 4 - MECHANICAL INTERFACE WITH AND WITHOUT ACCESS HOLE

NOTE: This standard does not establish the detailed requirements necessary for the mechanical interface to support the loads produced by the maximum weight, diameter, or CG of the particular turret class or turret. The strength of the platform side of the mechanical interface will be determined by the system integrator after a full examination of integration factors. The intent of this approach is to allow the procuring agency to consider future growth requirements in its trade space.

3.3 Connectors

3.3.1 Electrical Connectors

Electrical connectors for a turret with no ECU shall be in accordance with AS6129.

Turret Class I, II, and III have three mechanical interface configurations for electrical connections as shown Figures 5a, 5b, and 5d. Turret Class IV has four mechanical interface configurations for electrical connections as shown Figures 5a, 5b, 5c, and 5d. Figure 5a shows the mechanical interface with an access hole for the turret to extend beyond the mechanical interface to the platform side of the mechanical interface with side egress electrical connectors. Figure 5b shows the mechanical interface with top egress electrical connectors and an access hole for the turret to extend beyond the mechanical interface into the platform side of the mechanical interface. In Figure 5b, the turret is not required to extend through the access hole, the connectors and cables can start on the turret side of the mechanical interface and then pass through the access hole. Figure 5c shows the mechanical interface with a second type of top egress electrical connectors rotated 90 degrees to the electrical connectors shown in Figure 5b and an access hole for the turret to extend beyond the mechanical interface into the platform side of the mechanical interface. Figure 5d shows the mechanical interface with no access hole and side egress electrical connectors.

The location of the electrical connectors is provided in 4.2.1.

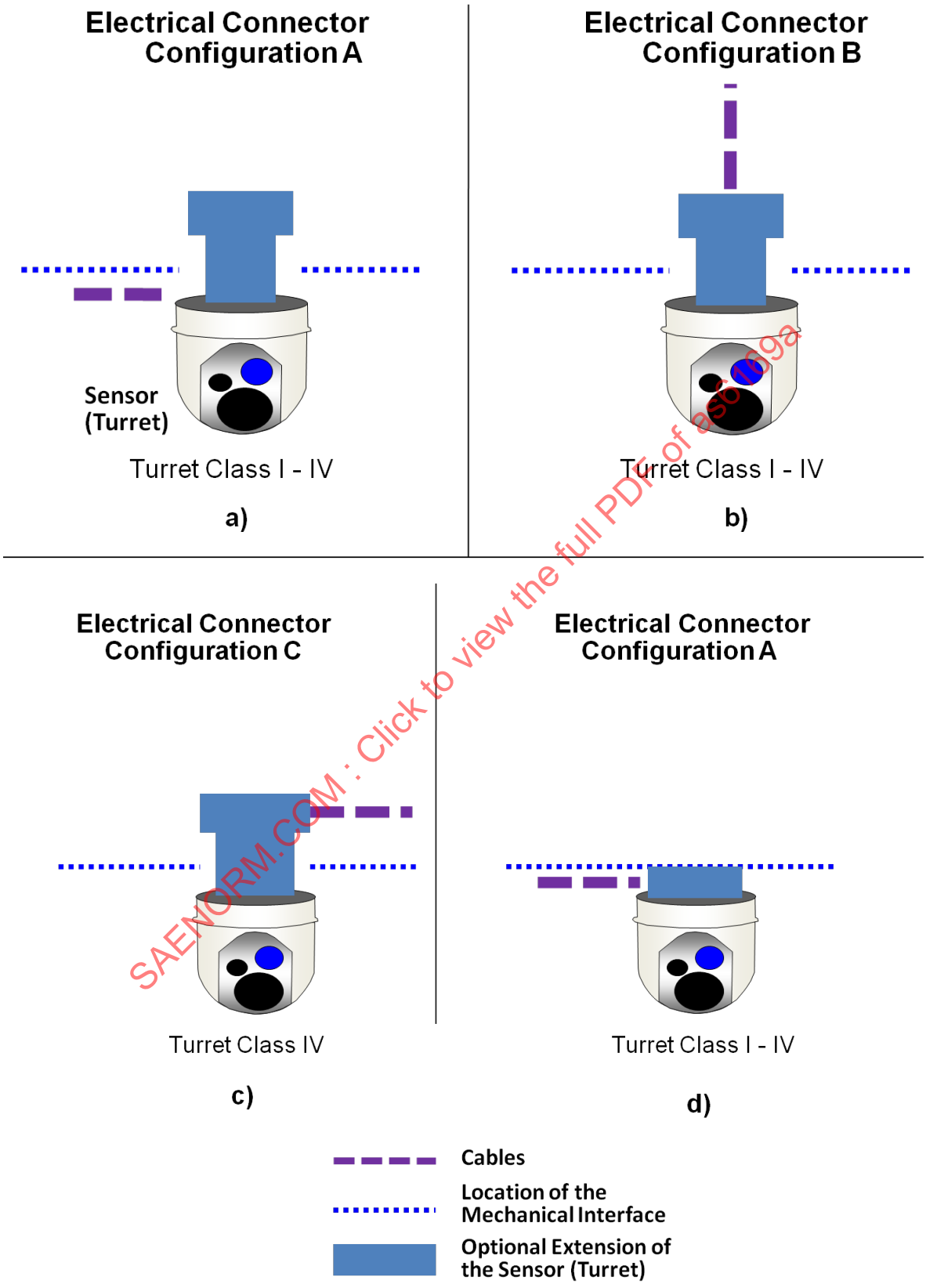

FIGURE 5 - ELECTRICAL CONNECTOR CONFIGURATIONS

3.3.2 Environmental Connector

Connector locations for optional environmental conditioning are provided in 4.2.2.

NOTE: This standard does not address the technical specifications of the environmental connector types.

4. DETAILED REQUIREMENTS

4.1 Mechanical Interface

4.1.1 Dissimilar Metals and Finishes, Coatings, and Protection

The use of dissimilar metals at the mechanical interface shall be in accordance with MIL-STD-889.

The faying surfaces of the mechanical interface shall be protected, at a minimum, in accordance with MIL-STD-7179 or MIL-DTL-5002.

All dimensioning and tolerances supplied in the figures of AS6169 shall apply after the final application of any finish, coating, and protection prior to installation onto the platform.

4.1.2 Electrical Bonding

The turret and platform side of the mechanical interface shall provide a ∅0.50 inch (+0.00 inch, -0.040 inch) conductive area centered on the fasteners to within 0.02 inch for electrical continuity between the outer housing of the turret and host platform. In accordance with MIL-STD-464, the direct current bonding levels shall be 2.5 milliohms or less across the mechanical interface.

4.1.3 Platform Side of the Mechanical Interface

The configurations for the platform side of the mechanical interface shall be in accordance with Table 3 per the defined class designations in 3.1.

NOTE: Figure 12 is the General Configuration for Class IV that can be used for any turret diameter within Class IV. Figures 13 and 15 are sub-classes of Turret Class IV as defined in Table 3.

NOTE: Only “Turret Forward” is specified in the platform side of the mechanical interface. Turret forward will be used to define the turret’s coordinate frame in reference to the mechanical interface. Turret forward has no relationship to “Platform Forward” (or the platform’s coordinate frame) until it is defined by the platform to suit integration requirements. Typically for side turrets whose azimuth gimbal has a limited range of rotation, e.g., ±200 degrees, the angular orientation of Turret Forward is the same as the center of the azimuth range of motion. In most cases of platform integration Turret Forward is also coincident with Aircraft Forward and “Center of Motion”. In these cases the cables will be mounted opposite, or 180 degrees from the direction of “Center of Motion”. However, there are some integrations where Turret Forward will be facing to the side or rear of the platform and it is desired to have the cables mounted opposite to Aircraft Forward to protect the cables from the airstream. In this case the cables will be mounted 90 degrees from Center of Motion for side looking turrets, or 0 degrees from Center of Motion for rear facing turrets. Such turrets are “special order” since the manufacturer will have to physically change the position of the cables relative to the mechanical gimbal components. In such cases of special-order turrets, the nomenclature of the turret shall be unique and different from that of the “nominal” Aircraft Forward turrets. Appendix H illustrates this with examples.

TABLE 3 - TURRET CLASS CONFIGURATIONS

Turret Class	Bolt Circle Diameter	Number of Fastener Holes	No Access Hole	Access Hole
I	13.0 inches	12, spaced 30 degrees	Figure 6	Figure 7
II	12.2 inches	6, spaced 60 degrees	Figure 8	Figure 9
III	8.0 inches	6, spaced 60 degrees	Figure 10	Figure 11
IV	2.25 inches	4, spaced 90 degrees	General Configuration: Figure 12	Not Defined
	Reference 11.011 inches	4, Reference 3.50 inches x 4.25 inches	7.0 inches < $\varnothing_T$ ≤ 9.0 inches: Figure 13	7.0 inches < $\varnothing_T$ ≤ 9.0 inches: Figure 14
	Reference 8.602 inches	4, Reference 2.50 inches x 3.50 inches	6.0 inches < $\varnothing_T$ ≤ 7.0 inches: Figure 15	6.0 inches < $\varnothing_T$ ≤ 7.0 inches: Figure 16

4.1.3.1 Class I

The platform side of the mechanical interface for Turret Class I, with no access hole, shall conform to the drawing in Figure 6.

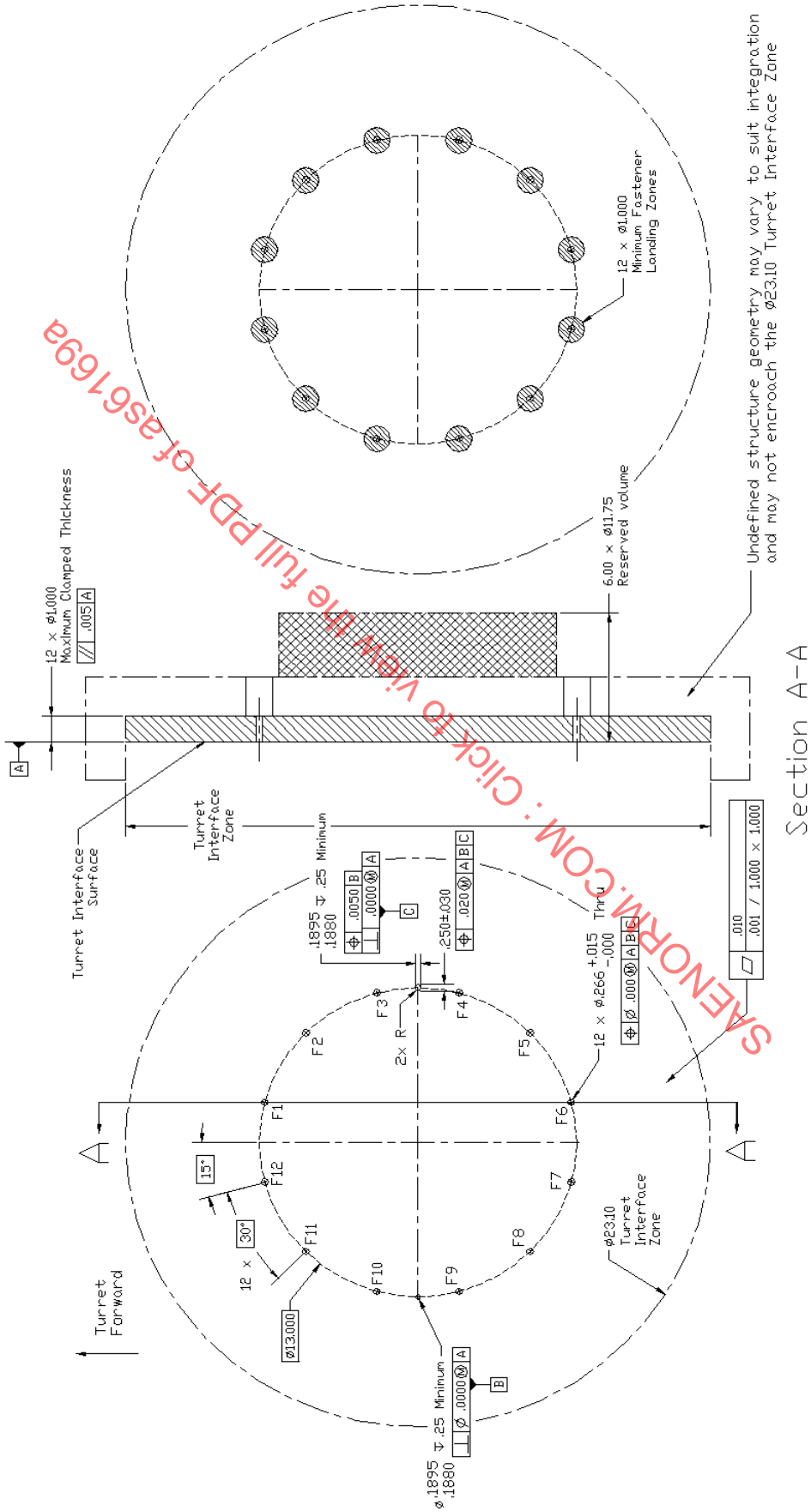

FIGURE 6 - PLATFORM INTERFACE FOR TURRET CLASS I, NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class I with an access hole shall conform to the drawing in Figure 7.

NOTE: The platform side of the mechanical interface with an access hole for turrets has a specified opening to allow top egress electrical connectors to pass through and/or the turret to extend beyond the mechanical interface.

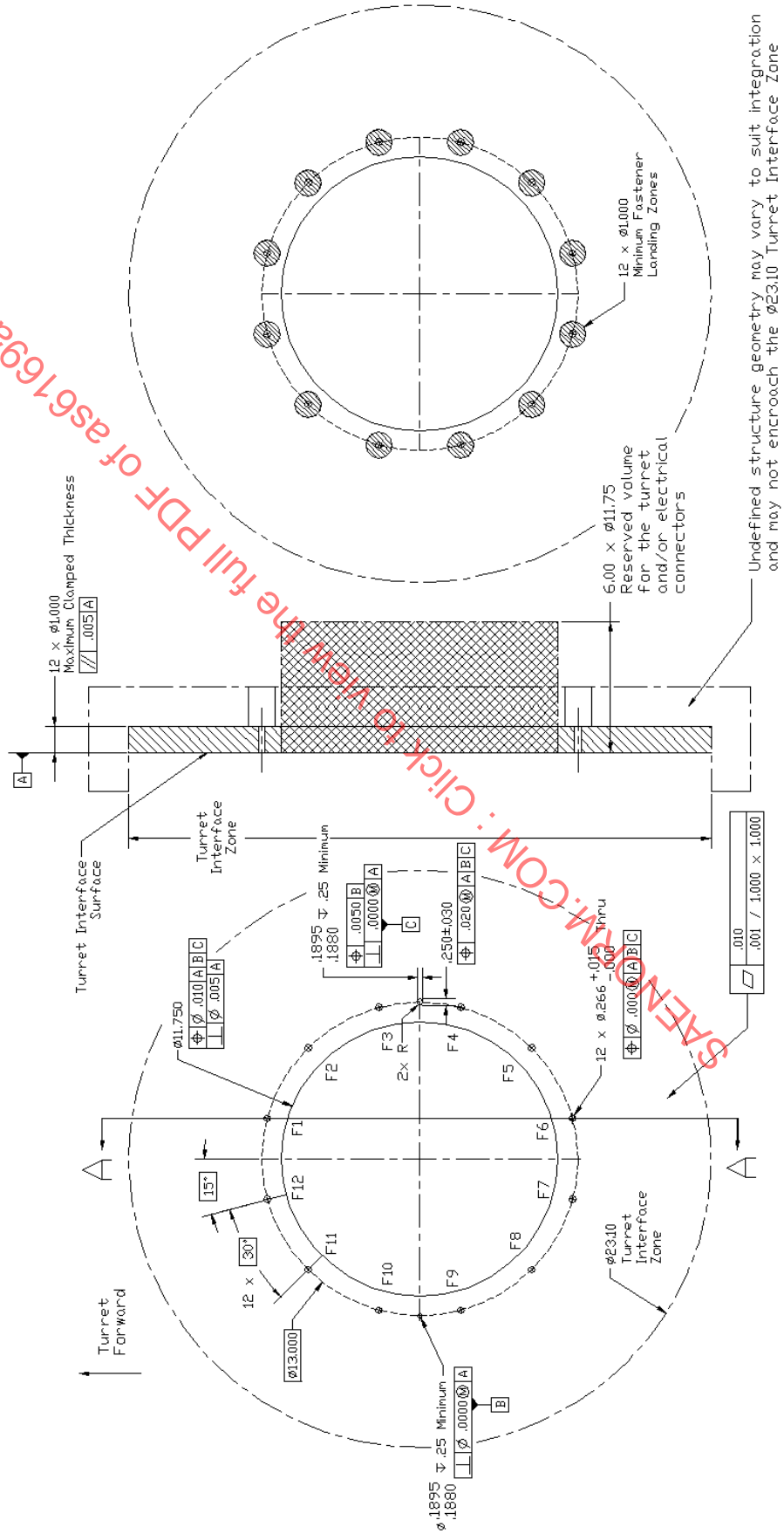

FIGURE 7 - PLATFORM INTERFACE FOR TURRET CLASS I, WITH ACCESS HOLE

4.1.3.2 Class II

The platform side of the mechanical interface for Turret Class II with no access hole shall conform to the drawing in Figure 8.

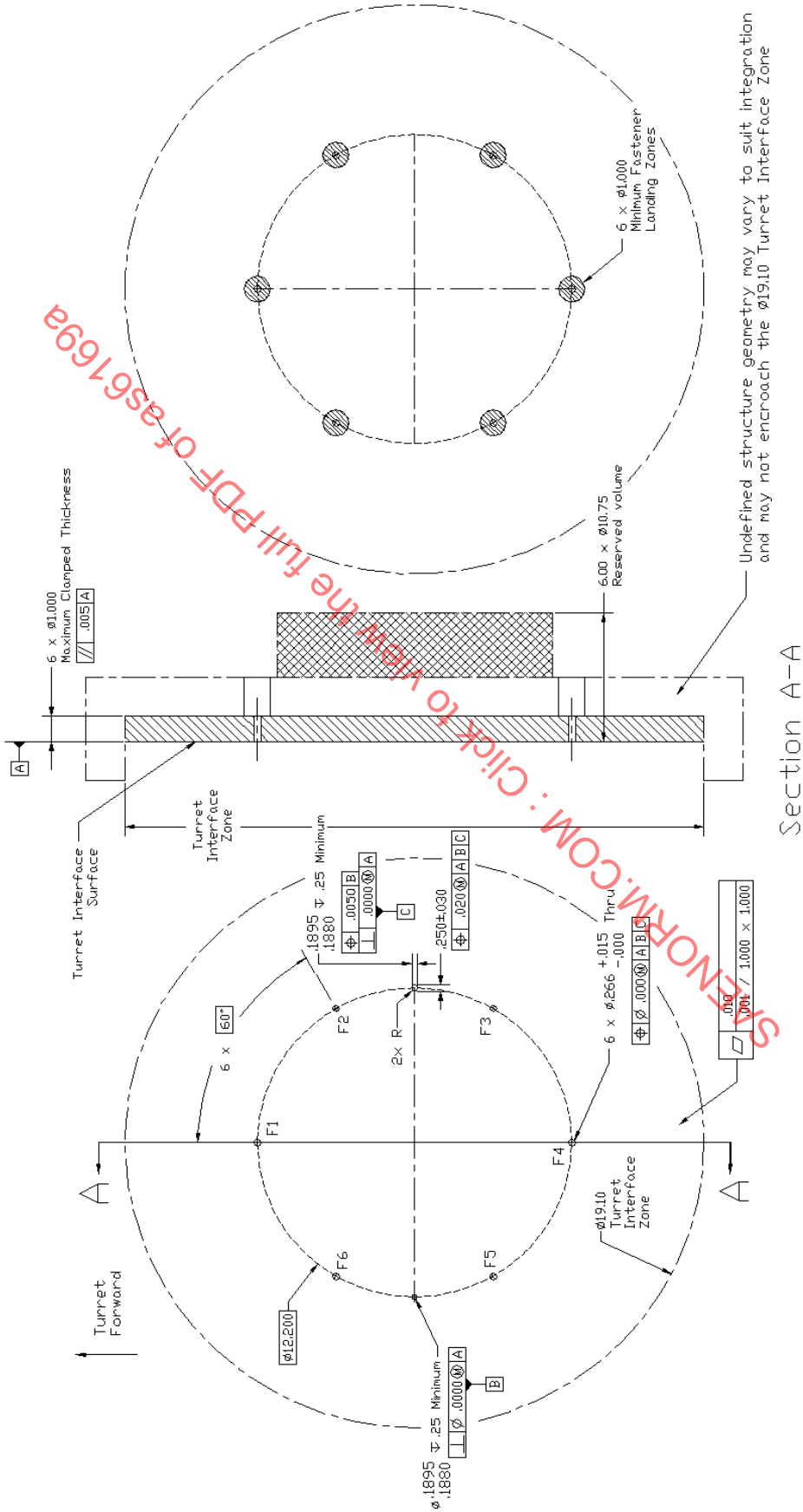

FIGURE 8 - PLATFORM INTERFACE FOR TURRET CLASS II, NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class II with an access hole shall conform to the drawing in Figure 9.

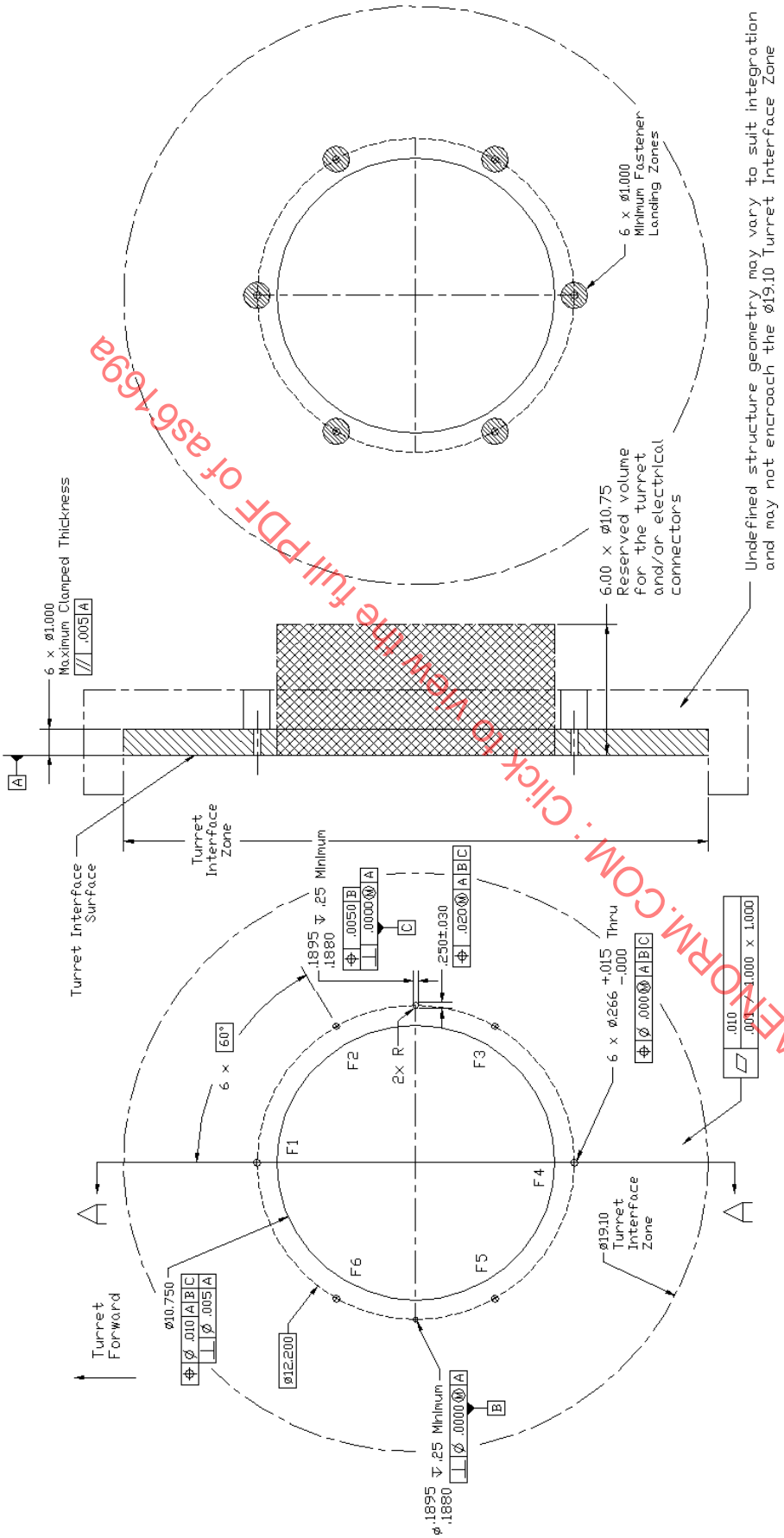

FIGURE 9 - PLATFORM INTERFACE FOR TURRET CLASS II, WITH ACCESS HOLE

4.1.3.3 Class III

The platform side of the mechanical interface for Turret Class III with no access hole shall conform to the drawing in Figure 10.

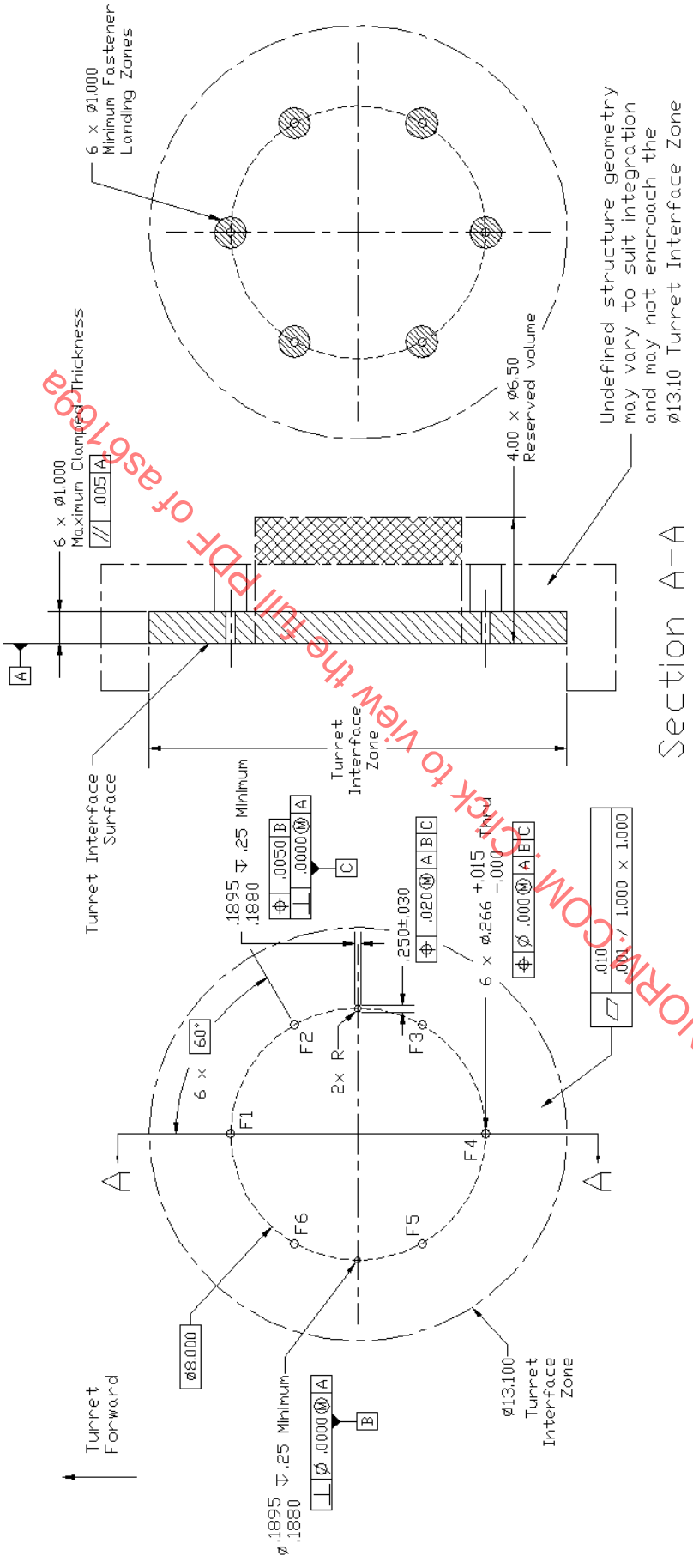

FIGURE 10 - PLATFORM INTERFACE FOR TURRET CLASS III, NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class III with an access hole shall conform to the drawing in Figure 11.

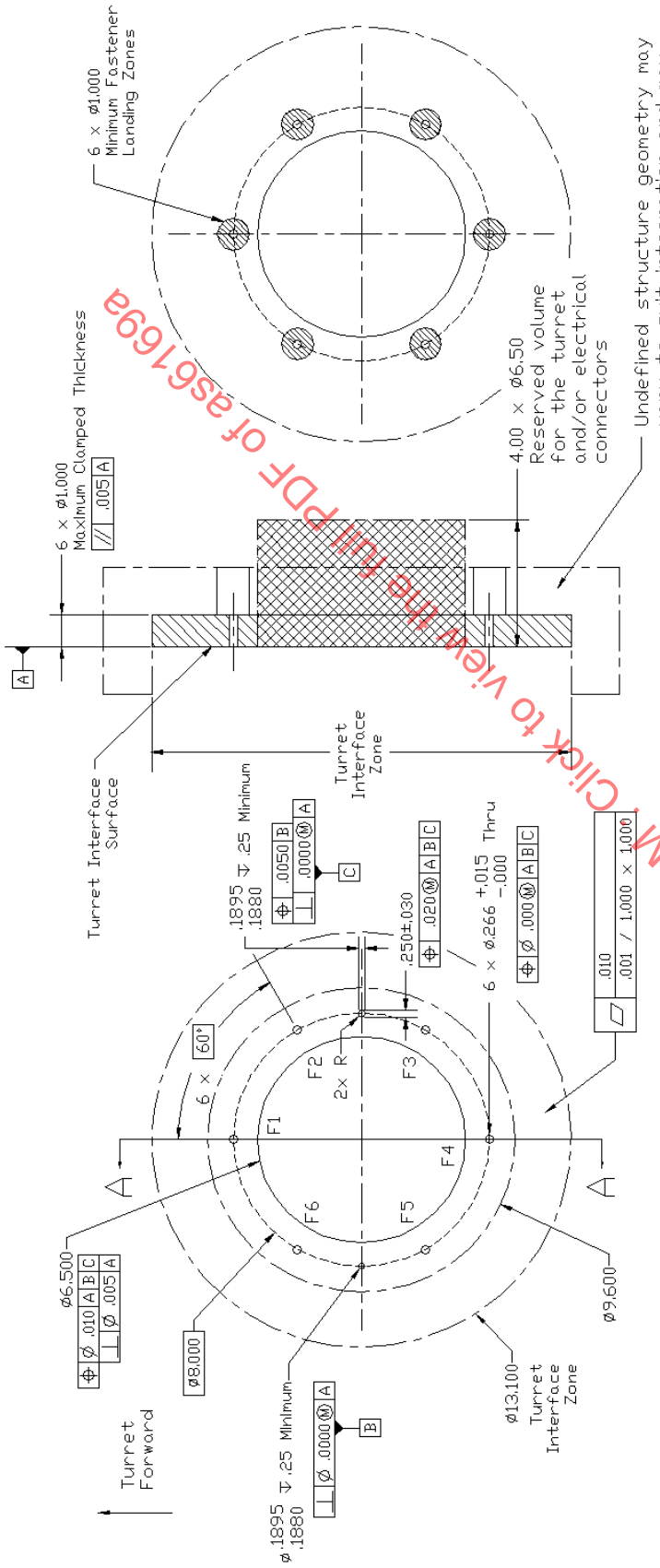

FIGURE 11 - PLATFORM INTERFACE FOR TURRET CLASS III, WITH ACCESS HOLE

4.1.3.4 Class IV

The platform side of the mechanical interface for Turret Class IV with no access hole shall conform to Figures 12, 13, or 15.

NOTE: Figure 12 is the General Configuration for Class IV that can be used for any turret diameter within Class IV. Figures 13 and 15 are sub-classes of Turret Class IV as defined in Table 3.

The platform side of the mechanical interface for Turret Class IV General Configuration, with no access hole, is shown in Figure 12.

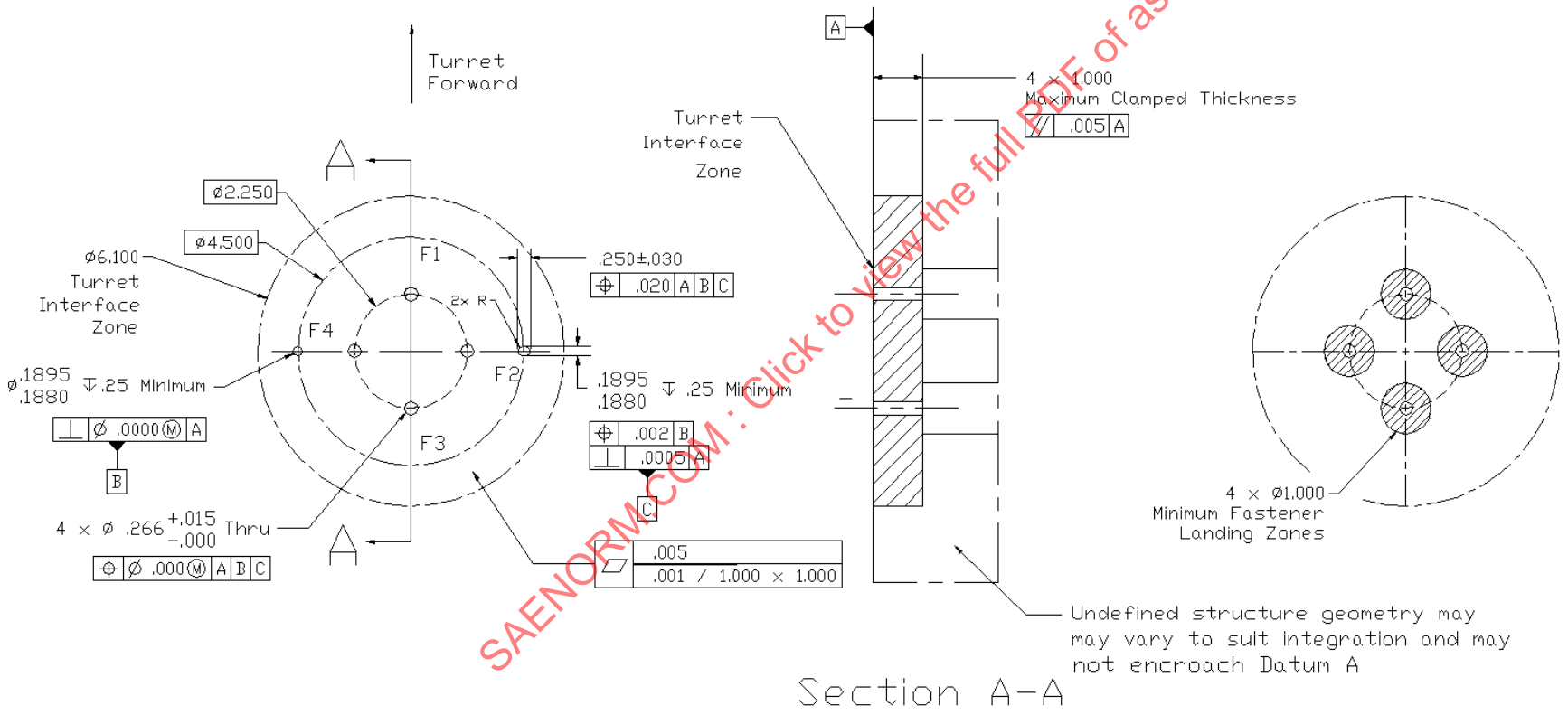

FIGURE 12 - PLATFORM INTERFACE FOR TURRET CLASS IV, GENERAL CONFIGURATION NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class IV with no access hole and 7.0 inches < $\varnothing_T$ ≤ 9.0 inches is shown in Figure 13.

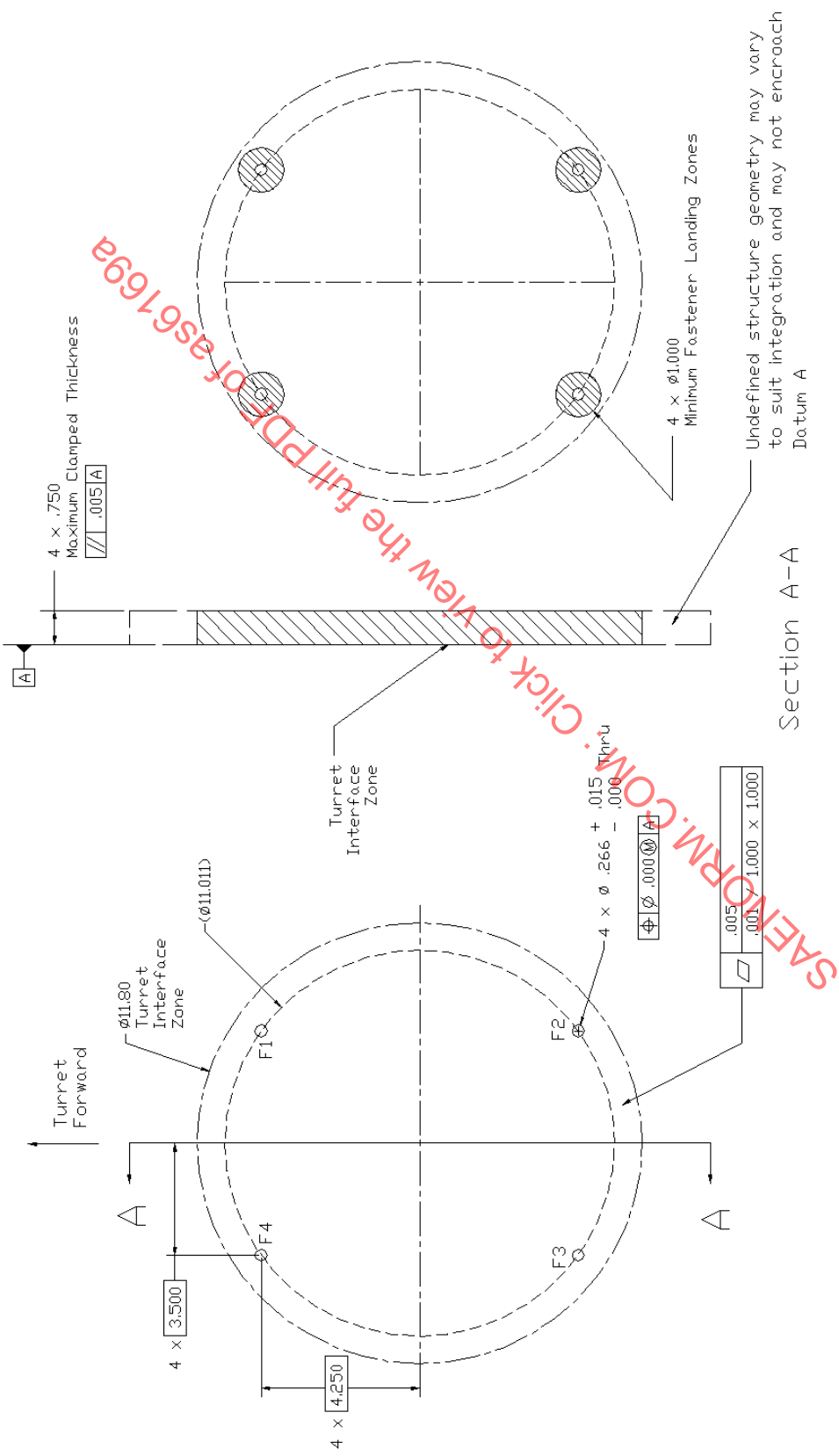

FIGURE 13 - PLATFORM INTERFACE FOR TURRET CLASS IV, 7.0 INCHES < $\varnothing_T$ ≤ 9.0 INCHES, NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class IV with an access hole and 7.0 inches < $\varnothing_T$ ≤ 9.0 inches shall conform to the drawing in Figure 14.

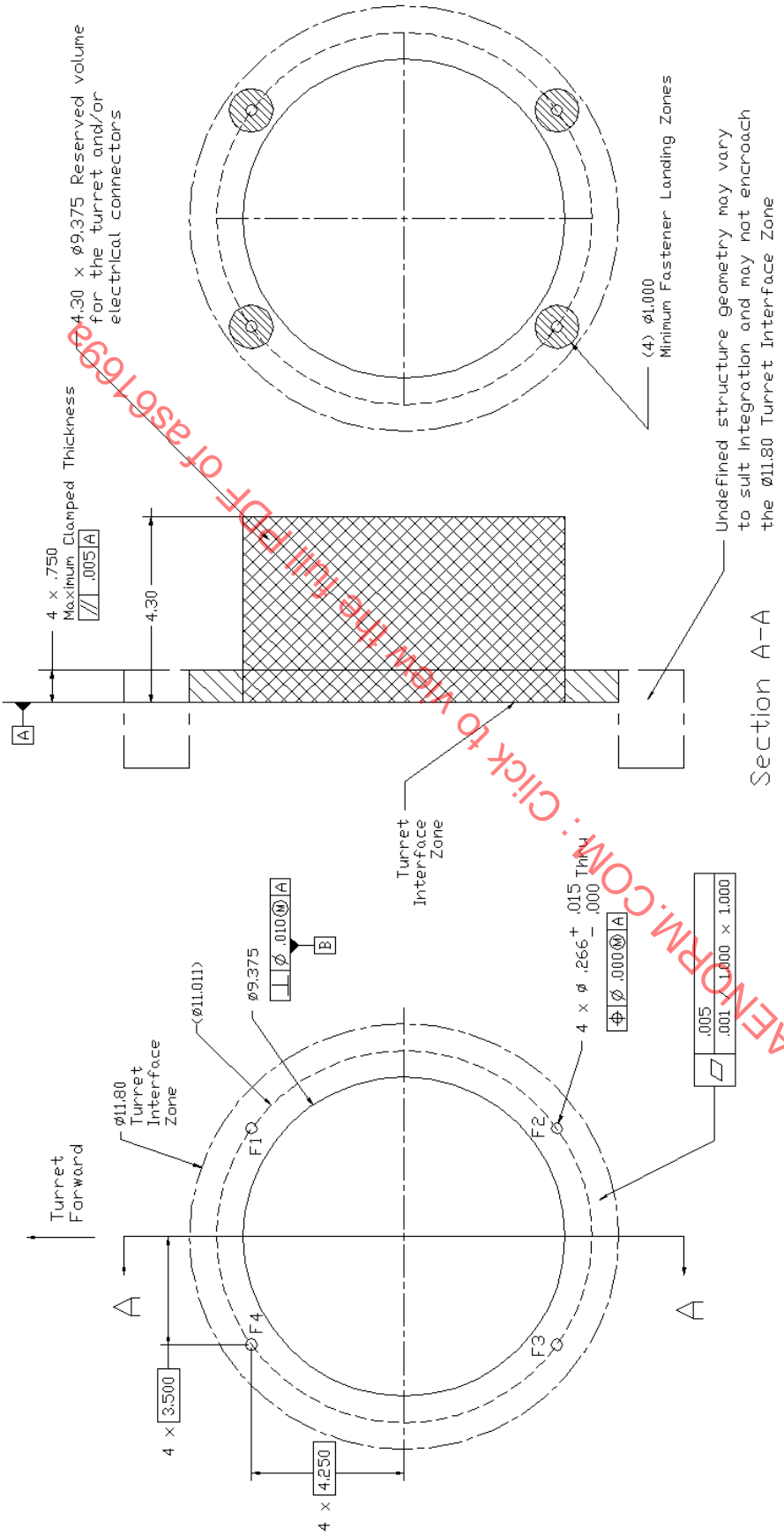

FIGURE 14 - PLATFORM INTERFACE FOR TURRET CLASS IV, 7.0 INCHES < $\varnothing_T$ ≤ 9.0 INCHES, WITH ACCESS HOLE

The platform side of the mechanical interface for Turret Class IV with no access hole and 6.0 inches < $\varnothing_T$ ≤ 7.0 inches is shown in Figure 15.

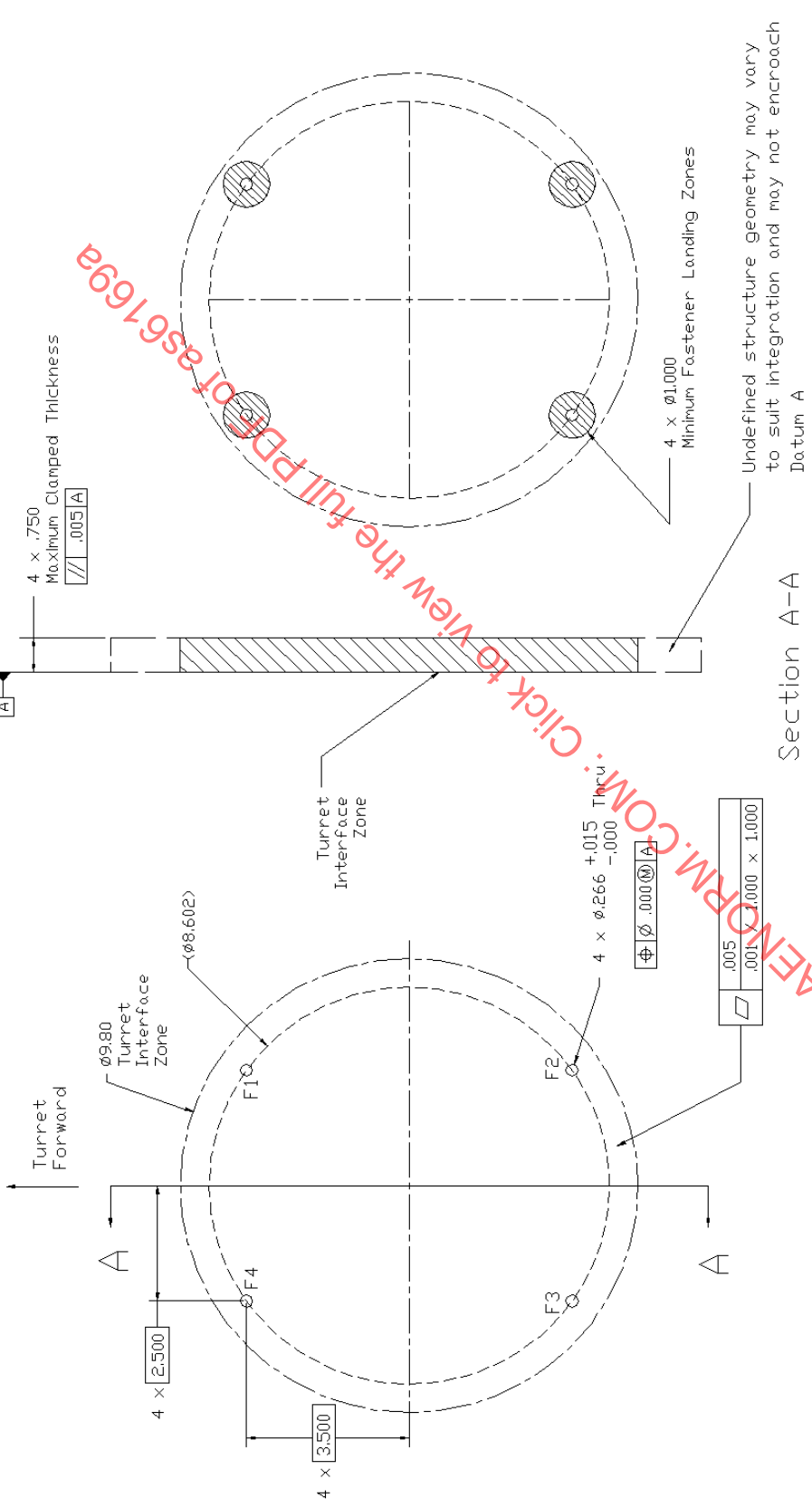

FIGURE 15 - PLATFORM INTERFACE FOR TURRET CLASS IV, 6.0 INCHES < $\varnothing_T$ ≤ 7.0 INCHES, NO ACCESS HOLE

The platform side of the mechanical interface for Turret Class IV with an access hole and 6.0 inches < $\varnothing_T$ ≤ 7.0 inches shall conform to the drawing in Figure 16.

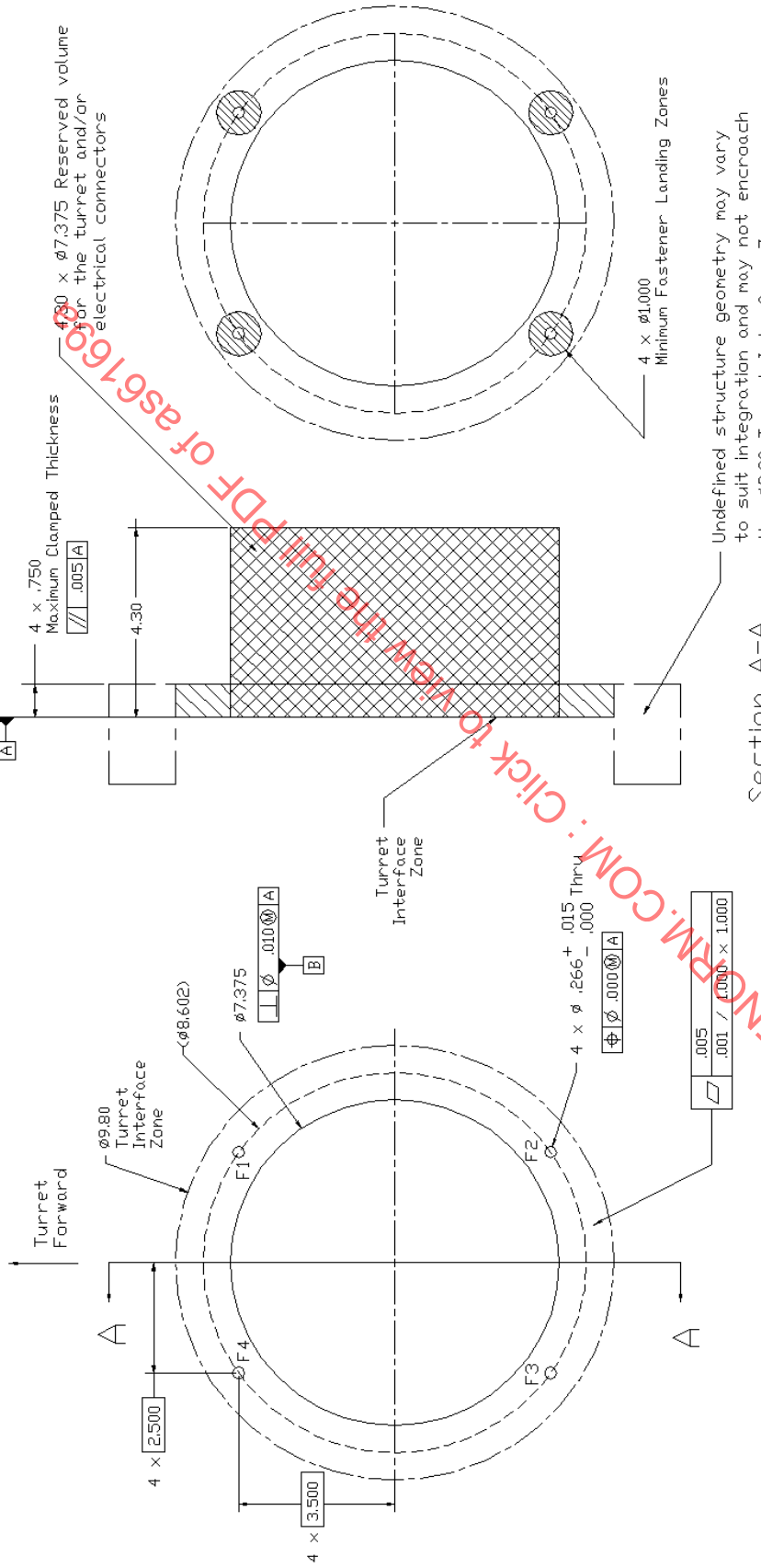

FIGURE 16 - PLATFORM INTERFACE FOR TURRET CLASS IV, 6.0 INCHES < $\varnothing_T$ ≤ 7.0 INCHES, WITH ACCESS HOLE

4.1.4 Turret Side of the Mechanical Interface

The turret side of the mechanical interface shall be compatible with the appropriate platform side of the Mechanical Interface per the defined Turret Class and turret class configurations in 3.1.

4.2 Connectors

4.2.1 Electrical Connectors

4.2.1.1 Electrical Connector Egress

4.2.1.1.1 Turret Class I Electrical Connectors

Turret Class I shall have top egress electrical connectors or side egress electrical connectors.

4.2.1.1.2 Turret Class II Electrical Connectors

Turret Class II shall have top egress electrical connectors or side egress electrical connectors.

4.2.1.1.3 Turret Class III Electrical Connectors

Turret Class III shall have top egress electrical connectors or side egress electrical connectors.

4.2.1.1.4 Turret Class IV Electrical Connectors

Turret Class IV shall have top egress electrical connectors or side egress electrical connectors.

4.2.1.2 Electrical Connector Location

Electrical connector spacing shall be in accordance with MIL-STD-1472.

NOTE: The present version of AS6169 only addresses the placement of the side egress electrical connectors to a maximum installation arc and top egress electrical connectors to a maximum installation diameter. The present version of AS6169 does not allocate specific areas or ordering of individual electrical connectors. The exact placement of any specific electrical connector may be anywhere within the defined allocation of the turret. It is recommended that the platform provide enough slack so that the cables have enough flexability or an umbilical cable is used to connect to the turret's electrical connectors anywhere within the installation definition. It is recommended to refer to Appendix G for additional guidance on this topic.

4.2.1.2.1 Side Egress Electrical Connectors

####### 4.2.1.2.1.1 Turret Class I Side Egress Electrical Connectors

Turret Class I side egress electrical connectors shall be on the turret side of the mechanical interface.

For Turret Class I side egress electrical connectors, the centerline axis of the electrical connector shall be parallel to the mechanical interface datum (Datum A in Figures 6 and 7) within 2 degrees.

Turret Class I side egress electrical connectors shall remain inboard of the maximum turret diameter allowed by Turret Class I, ∅23.0 inches.

Turret Class I side egress electrical connectors shall be positioned such that the centerline axis of the electrical connector remains within a zone defined by the maximum turret diameter allowed by Turret Class I, ∅23.0 inches, and are within the radial zone ±60 degrees from the turret's fore and aft centerline. The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class I shall be centered to the fastener features for F5 and F8 on the turret side of the mechanical interface, as illustrated in Figure D1 in Appendix D.

The centerline axis of the Turret Class I side egress electrical connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.1.2.1.2 Turret Class II Side Egress Electrical Connectors

Turret Class II side egress electrical connectors shall be on the turret side of the mechanical interface.

For Turret Class II side egress electrical connectors, the centerline axis of the electrical connector shall be parallel to the mechanical interface datum (Datum A in Figures 8 and 9) within 2 degrees.

Turret Class II side egress electrical connectors shall remain inboard of the maximum turret diameter allowed by Turret Class II, ∅19.0 inches.

Turret Class II side egress electrical connectors shall be positioned such that the centerline axis of the electrical connector remains within a zone defined by the maximum turret diameter allowed by Turret Class II, ∅19.0 inches, and are within the radial zone ±60 degrees from the turret's fore and aft centerline. The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class II shall be centered to the fastener features for F4 on the turret side of the mechanical interface, as illustrated in Figure D2 in Appendix D.

The centerline axis of the Turret Class II side egress electrical connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.1.2.1.3 Turret Class III Side Egress Electrical Connectors

Turret Class III side egress electrical connectors shall be on the turret side of the mechanical interface.

For Turret Class III side egress electrical connectors, the centerline axis of the electrical connector shall be parallel to the mechanical interface datum (Datum A in Figures 10 and 11) within 2 degrees.

Turret Class III side egress electrical connectors shall remain inboard of the maximum turret diameter allowed by Turret Class III, ∅13.0 inch.

Turret Class III side egress electrical connectors shall be positioned such that the centerline axis of the electrical connector remains within a zone defined by the maximum turret diameter allowed by Turret Class III, ∅13.0 inches, and are within the radial zone ±60 degrees from the turret's fore and aft centerline. The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class III shall be centered to the fastener features for F4 on the turret side of the mechanical interface, as illustrated in Figure D3 in Appendix D.

The centerline axis of the Turret Class III side egress electrical connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.1.2.1.4 Turret Class IV Side Egress Electrical Connectors

Turret Class IV side egress electrical connectors shall be on the turret side of the mechanical interface.

For Turret Class IV side egress electrical connectors, the centerline axis of the electrical connector shall be parallel to the mechanical interface datum (Datum A in Figures 12, 13, or 15) within 2 degrees.

Turret Class IV side egress electrical connectors shall remain inboard of the maximum turret diameter allowed by Turret Class IV, ∅9.0 inches.

Turret Class IV side egress electrical connectors shall be positioned such that the centerline axis of the electrical connector remains within a zone defined by the maximum turret diameter allowed by Turret Class IV, ∅9.0 inches, and are within the radial zone ±60 degrees from the turret's fore and aft centerline.

4.2.1.2.1.4.1 Turret Class IV General Configuration Side Egress Electrical Connectors

The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class IV General Configuration shall be centered to the fastener feature for F3 on the turret side of the mechanical interface, as illustrated in Figure D4 in Appendix D.

4.2.1.2.1.4.2 Turret Class IV 7.0 inches < $\varnothing_T$ ≤ 9.0 inches Side Egress Electrical Connectors

The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class IV shall be centered to the fastener features for F2 and F3 on the turret side of the mechanical interface, as illustrated in Figure D5 in Appendix D.

4.2.1.2.1.4.3 Turret Class IV 6.0 inches < $\varnothing_T$ ≤ 7.0 inches Side Egress Electrical Connectors

The radial zone ±60 degrees from the turret's fore and aft centerline for Turret Class IV shall be centered to the fastener features for F2 and F3 on the turret side of the mechanical interface, as illustrated in Figure D5 in Appendix D.

4.2.1.2.2 Top Egress Electrical Connectors

4.2.1.2.2.1 Turret Class I Top Egress Electrical Connectors

For Turret Class I top egress electrical connectors, the centerline axis of the electrical connector shall be perpendicular to the mechanical interface datum (Datum A in Figure 7) within 2 degrees, facing outward from the turret.

Turret Class I top egress electrical connectors shall remain entirely inboard of the area defined by a ∅11.5 inches centered to the Turret Class I bolt circle.

4.2.1.2.2.2 Turret Class II Top Egress Electrical Connectors

For Turret Class II top egress electrical connectors, the centerline axis of the electrical connector shall be perpendicular to the mechanical interface datum (Datum A in Figure 9) within 2 degrees, facing outward from the turret.

Turret Class II top egress electrical connectors shall remain entirely inboard of the area defined by a ∅10.5 inches centered to the Turret Class II bolt circle.

4.2.1.2.2.3 Turret Class III Top Egress Electrical Connectors

For Turret Class III top egress electrical connectors, the centerline axis of the electrical connector shall be perpendicular to the mechanical interface datum (Datum A in Figure 11) within 2 degrees, facing outward from the turret.

Turret Class III top egress electrical connectors shall remain entirely inboard of the area defined by a ∅6.0 inches centered to the Turret Class III bolt circle.

4.2.1.2.2.4 Turret Class IV Top Egress Electrical Connectors

Turret Class IV shall have Configuration B top egress electrical connectors, defined in Figure 5b, or Configuration C top egress electrical connectors, defined in Figure 5c.

4.2.1.2.2.4.1 Turret Class IV Configuration B Top Egress Electrical Connectors

For Turret Class IV Configuration B top egress electrical connectors, the centerline axis of the electrical connector shall be perpendicular to the mechanical interface datum (Datum A in Figures 14 or 16) within 2 degrees, facing outward from the turret.

Turret Class IV top egress electrical connectors shall remain entirely inboard of the area defined by a ∅5.0 inches centered to the bolt circle pattern.

4.2.1.2.2.4.2 Turret Class IV Configuration C Top Egress Electrical Connectors

For Turret Class IV Configuration C top egress electrical connectors, the centerline axis of the electrical connector shall be parallel to the mechanical interface datum (Datum A in Figures 14 or 16) within 2 degrees.

Turret Class IV Configuration C top egress electrical connectors shall remain inboard of the maximum turret diameter allowed by Turret Class IV, ∅9.0 inches.

Turret Class IV Configuration C top egress electrical connectors shall be positioned such that the centerline axis of the electrical connector remains within a zone defined by the maximum turret diameter allowed by Turret Class IV, ∅9.0 inches, and are within the radial zone ±60 degrees from the turret's fore and aft centerline, facing turret aft.

4.2.1.3 Electrical Connector Major Keyway

The major (large) keyway of the D38999 connectors for the turret shall be positioned in the 12 o'clock position. For Electrical connector configurations for a turret without an ECU, the major keyway of the D38999 connector shall be in accordance with AS6129.

4.2.1.3.1 Major Keyway for Electrical Connectors with the Centerline Axis Perpendicular to the Mechanical Interface Datum

4.2.1.3.1.1 Turret Class I Major Keyway for Electrical Connectors with the Centerline Axis Perpendicular to the Mechanical Interface Datum

For Turret Class I the major keyway for electrical connectors with a centerline axis perpendicular to the mechanical interface datum (Datum A in Figure 6 or Figure 7) shall be parallel to turret forward to ± 5 degrees with the 12 o'clock pointing in the same direction as turret forward.

NOTE: The configuration for the major keyway for electrical connectors with the centerline axis perpendicular to the mechanical interface datum is shown in Figure 17.

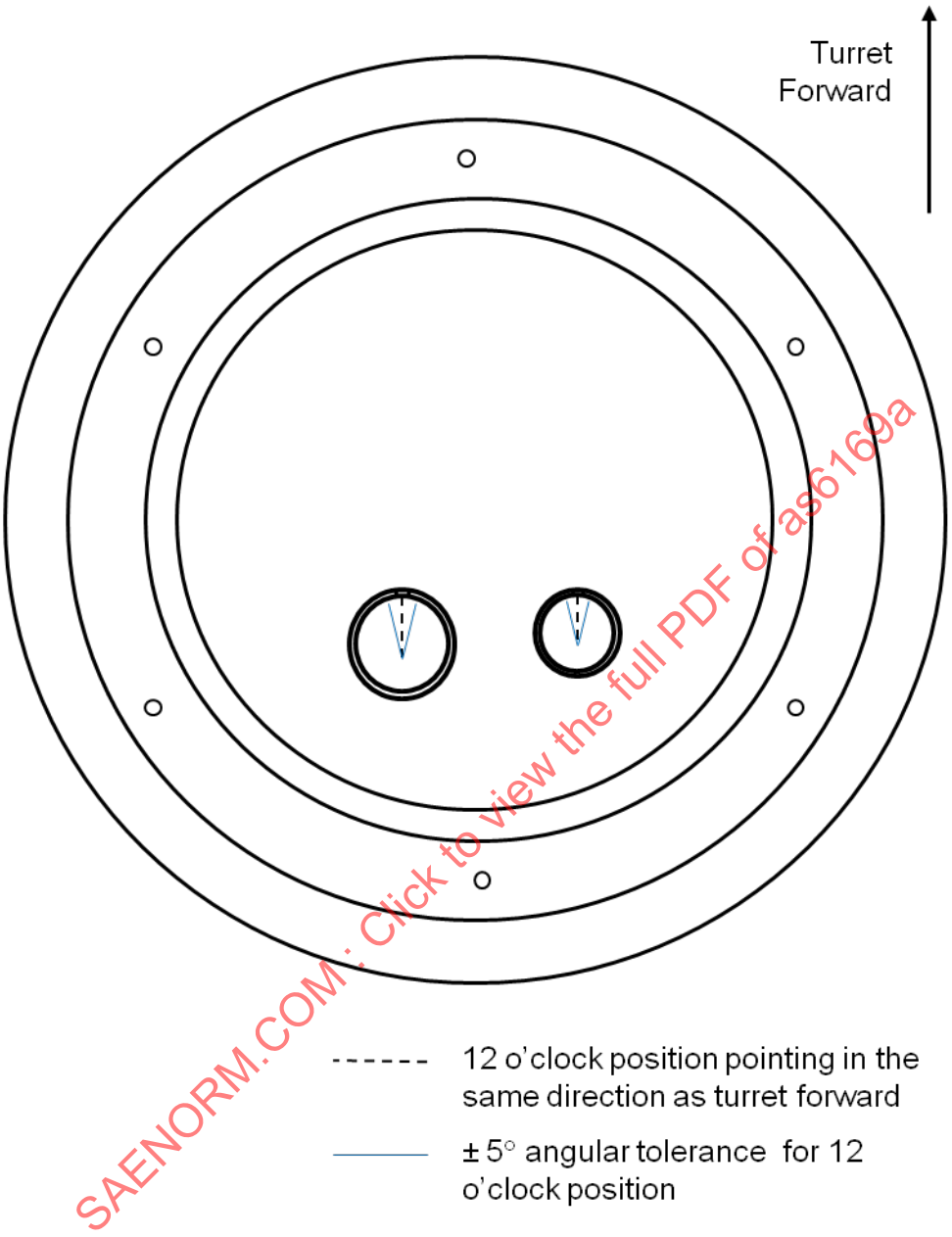

FIGURE 17 - CONFIGURATIONS FOR MAJOR KEYWAYS FOR ELECTRICAL CONNECTORS WITH THE CENTERLINE AXIS PERPENDICULAR TO THE MECHANICAL INTERFACE DATUM

4.2.1.3.1.2 Turret Class II Major Keyway for Electrical Connectors with the Centerline Axis Perpendicular to the Mechanical Interface Datum

For Turret Class II the major keyway for electrical connectors with a centerline axis perpendicular to the mechanical interface datum (Datum A in Figures 8 or 9) shall be parallel to turret forward to ± 5 degrees with the 12 o'clock pointing in the same direction as turret forward.

4.2.1.3.1.3 Turret Class III Major Keyway for Electrical Connectors with the Centerline Axis Perpendicular to the Mechanical Interface Datum

For Turret Class III the major keyway for electrical connectors with a centerline axis perpendicular to the mechanical interface datum (Datum A in Figures 10 or 11) shall be parallel to turret forward to ± 5 degrees with the 12 o'clock pointing in the same direction as turret forward.

4.2.1.3.1.4 Turret Class IV Major Keyway for Electrical Connectors with the Centerline Axis Perpendicular to the Mechanical Interface Datum

For Turret Class IV the major keyway for electrical connectors with a centerline axis perpendicular to the mechanical interface datum (Datum A in Figures 12, 13, 14, 15, or 16) shall be parallel to turret forward to ± 5 degrees with the 12 o'clock pointing in the same direction as turret forward.

4.2.1.3.2 Major Keyway for Electrical Connectors with the Centerline Axis Parallel to the Mechanical Interface Datum

4.2.1.3.2.1 Turret Class I Major Keyway for Electrical Connectors with the Centerline Axis Parallel to the Mechanical Interface Datum

For Turret Class I the major keyway for electrical connectors with a centerline axis parallel to the mechanical interface datum (Datum A in Figures 6 or 7), shall be perpendicular to the mechanical interface datum (Datum A in Figures 6 or 7) to ± 5 degrees with 12 o'clock pointing towards the mechanical interface.

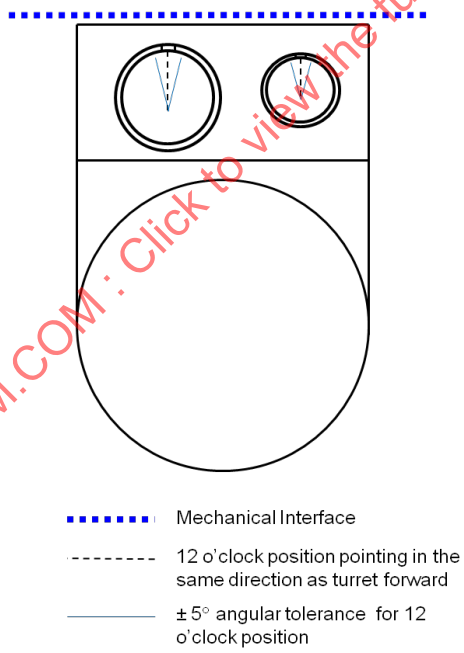

FIGURE 18 - CONFIGURATIONS FOR MAJOR KEYWAYS FOR ELECTRICAL CONNECTORS WITH THE CENTERLINE AXIS PARALLEL TO THE MECHANICAL INTERFACE DATUM

4.2.1.3.2.2 Turret Class II Major Keyway for Electrical Connectors with the Centerline Axis Parallel to the Mechanical Interface Datum

For Turret Class II the major keyway for electrical connectors with a centerline axis parallel to the mechanical interface datum (Datum A in Figures 8 or 9), shall be perpendicular to the mechanical interface datum (Datum A in Figures 8 or 9) to ± 5 degrees with 12 o'clock pointing towards the mechanical interface.

4.2.1.3.2.3 Turret Class III Major Keyway for Electrical Connectors with the Centerline Axis Parallel to the Mechanical Interface Datum

For Turret Class III the major keyway for electrical connectors with a centerline axis parallel to the mechanical interface datum (Datum A in Figures 10 or 11), shall be perpendicular to the mechanical interface datum (Datum A in Figures 10 or 11) to ± 5 degrees with 12 o'clock pointing towards the mechanical interface.

4.2.1.3.2.4 Turret Class IV Major Keyway for Electrical Connectors with the Centerline Axis Parallel to the Mechanical Interface Datum

For Turret Class IV the major keyway for electrical connectors with a centerline axis parallel to the mechanical interface datum (Datum A in Figures 13, 14, 15, or 16), shall be perpendicular to the mechanical interface datum (Datum A in Figures 13, 14, 15, or 16) to ± 5 degrees with 12 o'clock pointing towards the mechanical interface.

4.2.2 Environmental Connector

4.2.2.1 Environmental Connector Characteristics

NOTE: The present version of AS6169 does not address technical specifications associated with environmental connectors. Section 4.2.2.1 is a placehold for future revisions of this standard.

4.2.2.2 Environmental Connector Egress

4.2.2.2.1 Turret Class I Environmental Connector

When Turret Class I requires environmental connectors, the turret shall have side egress environmental connectors.

4.2.2.2.2 Turret Class II Environmental Connector

When Turret Class II requires environmental connectors, the turret shall have side egress environmental connectors.

4.2.2.2.3 Turret Class III Environmental Connector

When Turret Class III requires environmental connectors, the turret shall have side egress environmental connectors.

4.2.2.3 Side Egress Environmental Connectors

4.2.2.3.1 Turret Class I Side Egress Environmental Connectors

Turret Class I side egress environmental connectors, the centerline axis of the environmental connector shall be parallel to the mechanical interface datum (Datum A in Figures 6 and 7) within 2 degrees.

Turret Class I side egress environmental connectors shall remain inboard of the maximum turret diameter allowed by Turret Class I, ∅23.0 inches.

Turret Class I side egress environmental connectors shall be positioned such that the centerline axis of the environmental connector remains within a zone defined by the maximum turret diameter allowed by Turret Class I, ∅23.0 inches, and are within the radial zone ±22.5 degrees from the turret's lateral centerline, as illustrated in Figure E1 in Appendix E. The radial zone ±22.5 degrees from the turret's lateral centerline shall be centered to the fastener feature for F3 and F4 on the turret side of the mechanical interface.

The centerline axis of the Turret Class I side egress environmental connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.2.3.2 Turret Class II Side Egress Environmental Connectors

Turret Class II side egress environmental connectors; the centerline axis of the environmental connector shall be parallel to the mechanical interface datum (Datum A in Figures 8 and 9) within 2 degrees.

Turret Class II side egress environmental connectors shall remain inboard of the maximum turret diameter allowed by Turret Class II, ∅19.0 inches.

Turret Class II side egress environmental connectors shall be positioned such that the centerline axis of the environmental connector remains within a zone defined by the maximum turret diameter allowed by Turret Class II, ∅19.0 inches, and are within the radial zone ±22.5 degrees from the turret's lateral centerline, as illustrated in Figure E2 in Appendix E. The radial zone ±22.5 degrees from the turret's lateral centerline shall be centered to the fastener feature for F2 and F3 on the turret side of the mechanical interface.

The centerline axis of the Turret Class II side egress environmental connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.2.3.3 Turret Class III Environmental Connector

Turret Class III side egress environmental connectors; the centerline axis of the environmental connector shall be parallel to the mechanical interface datum (Datum A in Figures 10 and 11) within 2 degrees.

Turret Class III side egress environmental connectors shall remain inboard of the maximum turret diameter allowed by Turret Class III, ∅13.0 inches.

Turret Class III side egress environmental connectors shall be positioned such that the centerline axis of the environmental connector remains within a zone defined by the maximum turret diameter allowed by Turret Class III, ∅13.0 inches, and are within the radial zone ±22.5 degrees from the turret's lateral centerline, as illustrated in Figure E3 in Appendix E. The radial zone ±22.5 degrees from the turret's lateral centerline shall be centered to the fastener feature for F2 and F3 on the turret side of the mechanical interface.

The centerline axis of the Turret Class III side egress environmental connectors shall be parallel, ±2 degrees, to the radial line originating from the center of the bolt circle, facing outward radially from the center of the bolt circle.

4.2.2.4 Environmental Connector Spacing

Environmental connector spacing shall be in accordance with MIL-STD-1472.

4.3 Bulkhead

4.3.1 Bulkhead Feedthrough for Electrical Connectors

4.3.1.1 Turret Class I Bulkhead Feedthrough for Electrical Connectors

If the integration of the EO/IR Turret Class I sensor into a platform requires cables to pass through a bulkhead, the platform shall provide six provisions for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, J5, and J6 as defined in AS6129 for Turret Class I.

The interface dimensions for the for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, J5, and J6 shall be in accordance with 4.3.21 and 4.3.2.2.

4.3.1.2 Turret Class II Bulkhead Feedthrough for Electrical Connectors

If the integration of the EO/IR Turret Class II sensor into a platform requires cables to pass through a bulkhead, the platform shall provide six provisions for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, J5, and J6 as defined in AS6129 for Turret Class I.

The interface dimensions for the for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, J5, and J6 shall be in accordance with 4.3.2.1 and 4.3.2.2.

4.3.1.3 Turret Class III Bulkhead Feedthrough for Electrical Connectors

If the integration of the EO/IR Turret Class III sensor into a platform requires cables to pass through a bulkhead, the platform shall provide five provisions for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, and J5 as defined in AS6129 for Turret Class I.

The interface dimensions for the for flange mount or jam nut bulkhead feedthroughs for the electrical connectors J1, J2, J3, J4, and J5 shall be in accordance with 4.3.2.1 and 4.3.2.2.

4.3.2 Bulkhead Feedthrough Mounting Dimensions

4.3.2.1 Bulkhead Feedthrough Mounting Dimensions for Electrical Connectors for J1, J2, J3, J4, and J6

The dimensions for the flange mount or jam nut bulkhead feedthroughs for the shell size of the electrical connectors J1, J2, J3, J4, and J6 defined in AS6129 Turret Class I shall be in accordance with Figure 11 of MIL-DTL-38999L with Amendment 2 dated 10 May 2012.

4.3.2.2 Bulkhead Feedthrough Mounting Dimensions for Electrical Connectors for J5

The dimensions for the jam nut bulkhead feedthrough for the electrical connector J5 defined in AS6129 Turret Class I shall be in accordance to Figure 1 of MIL-PRF-55339/34A dated 10 January 2005.

4.4 Configuration Nomenclature

Configurations from this standard will be identified by the following field configuration nomenclature

AS6169 Field 01 – Field 02 – Field 03 – Field 04

The fields are defined in Table 4.

TABLE 4 - CONFIGURATION NOMENCLATURE

Field	Field Name	Field Requirement	Field Table or Figure Number
01	Turret Class	01 ≡ Turret Class I 02 ≡ Turret Class II 03 ≡ Turret Class III 04 ≡ Turret Class IV	Table 2
02	Access Hole	AH ≡ Access Hole on Platform Side of the Mechanical Interface NA ≡ No Access Hole on Platform Side of the Mechanical Interface	Table 3
03	Electrical Connector Egress Configuration	A ≡ Side Egress Electrical Connectors B ≡ Top Egress Electrical Connectors Perpendicular to the Mechanical Interface C ≡ Top Egress Electrical Connectors Parallel to the Mechanical Inteface	Figure 5 (5a to 5d)
04	Environmental Connector	SE ≡ Side Egress NA ≡ Not applicable	NA

BEGIN EXAMPLES

Example 01: **AS6169 02-NA-A-NA**

Class II Turret with
- No access hole on the platform side of the Mechanical Interface
- Side egress electrical connectors
- No environmental connector

Example 02: **AS6169 01-AH-B-SE**

Class I Turret with
- An access hole on the platform side of the Mechanical Interface
- Electrical connectors on the top egress perpendicular to the mechanical interface
- An environmental connector located on the side of the turret

Example 03: **AS6129 04-AH-C-NA**

Class IV Turret with
- An access hole on the platform side of the Mechanical Interface
- Electrical connectors on the top egress parallel to the mechanical interface
- No environmental connector

END EXAMPLES

5. NOTES

5.1 A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY SAE SUBCOMMITTEE AS-1C, AVIONIC SUBSYSTEMS OF
COMMITTEE AS-1, AIRCRAFT SYSTEMS & SYSTEMS INTEGRATION

APPENDIX A - DEFINITION OF THE DIAMETER OF TURRETED EO/IR SENSOR

The diameter of the Turret is defined as the best fit circle between the outer edges of the yoke containing the elevation bearings, as shown in Figure A1.

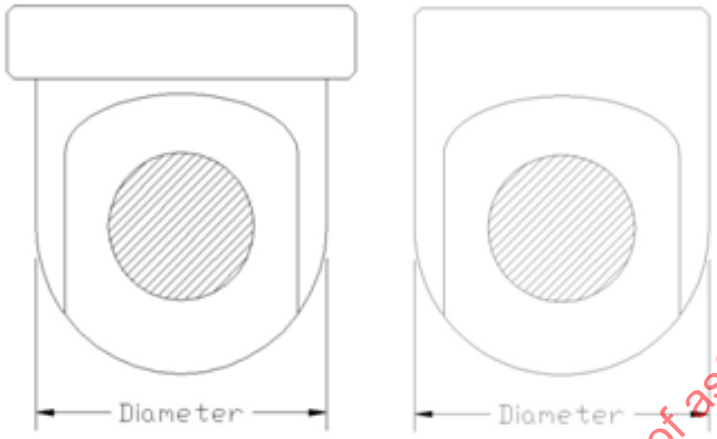

FIGURE A1 - EXAMPLES OF TURRET DIAMETER

The diameter of the Turret is not defined by any other view or geometry that may have additional or larger sub-systems, such as (but not limited to) additional sub-system electronics or an extended/larger optical sub-system, that are larger or smaller than the best fit circle containing the outer edges of the yoke containing the elevation bearings, as shown in Figure A2.

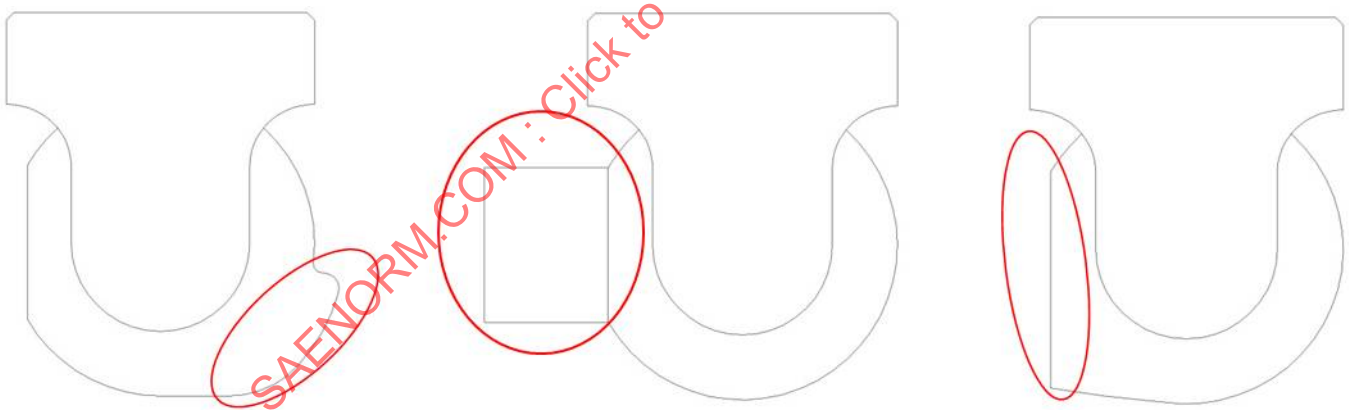

FIGURE A2 - EXAMPLES OF WHAT THE DIAMETER DOES NOT INCLUDE

APPENDIX B - BOLT CIRCLE CLARIFICATION IN DRAWINGS

The drawings of Figures B1 through B5 are of Class II with an access hole and used for clarification only.

NOTE: If a discrepancy exists between any figure in Appendix B and a figure in Section 4 of Detailed Requirements, the figure in Section 4 shall take precedence.

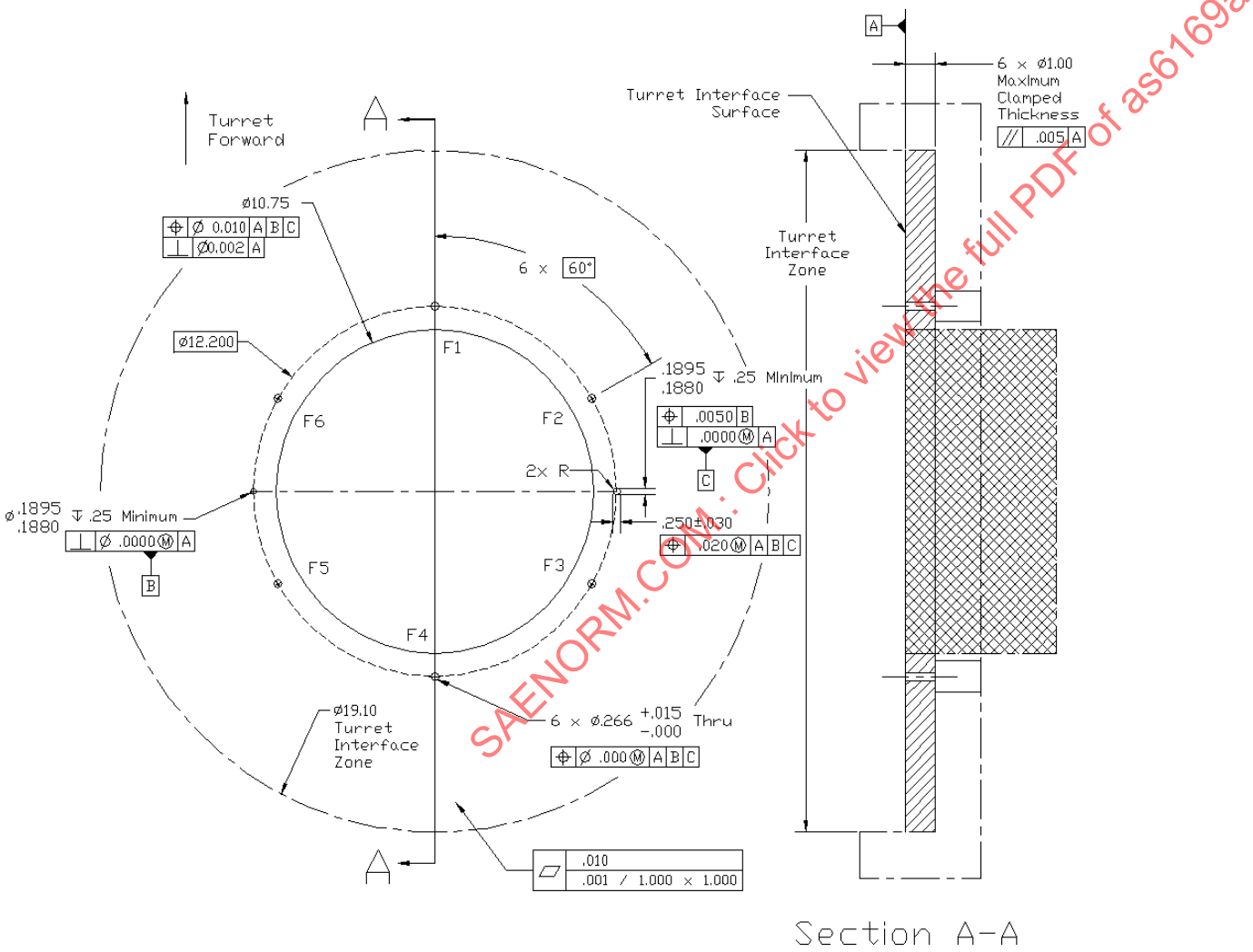

FIGURE B1 - PLATFORM INTERFACE, TURRET CLASS II, ACCESS HOLE CLARIFICATION EXAMPLE

The mechanical interface was designed with six ∅0.266 inch through holes for ¼-28 fasteners, and one dowel pin hole and one dowel pin slot for two optional 3/16 inch dowel pins, as shown in Figures B1 and B2. Figure B2 isolates these thru holes, dowel pin hole, and dowel pin slot from Figure B1.

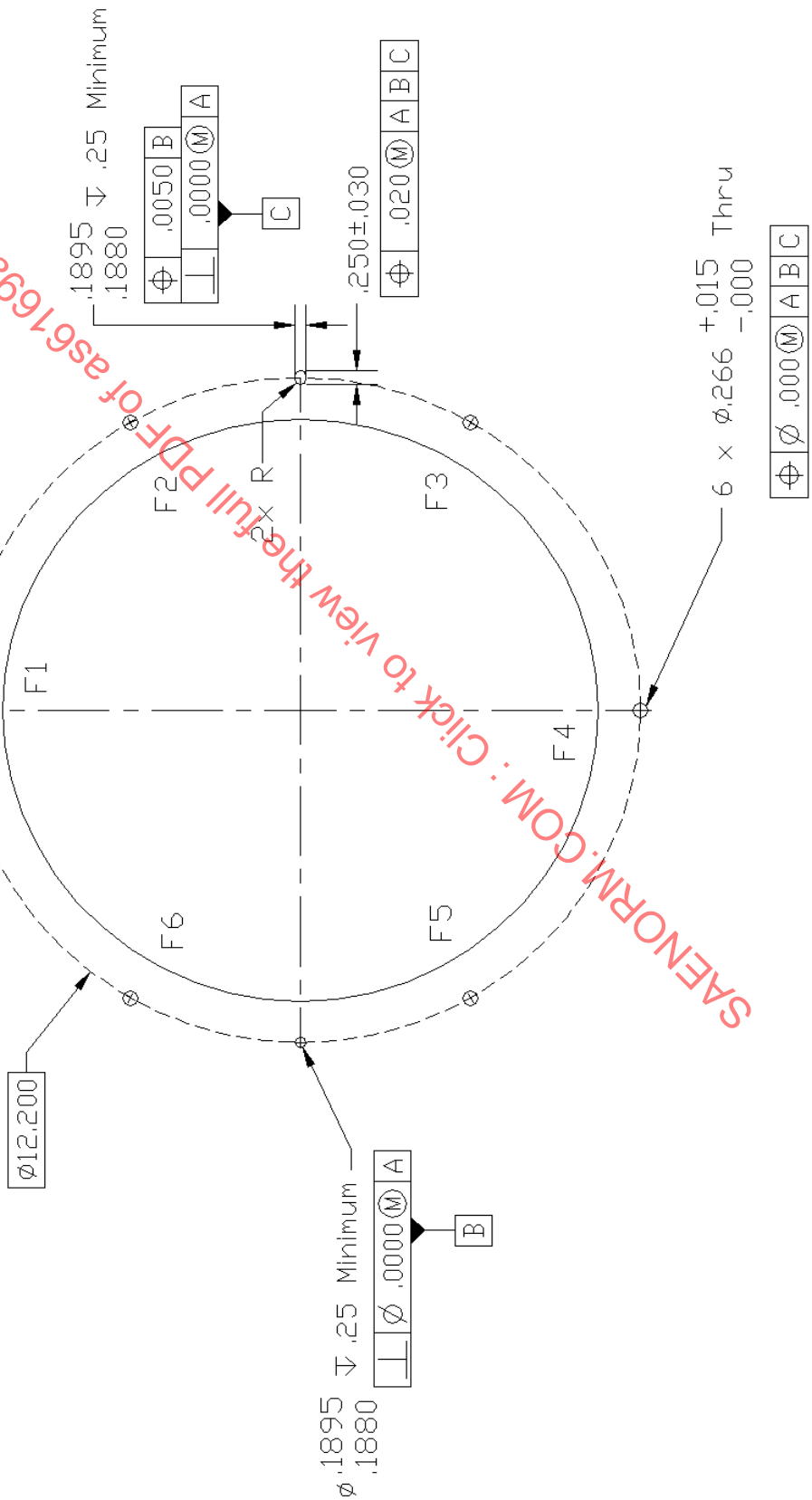

FIGURE B2 - ISOLATED DETAILS FROM PLATFORM INTERFACE, TURRET CLASS II, ACCESS HOLE EXAMPLE

The nomenclature of "(6) x ∅0.266 (+0.015, -0.000) Through" was designed for six (6) ¼-28 fasteners as depicted in Figure B3.

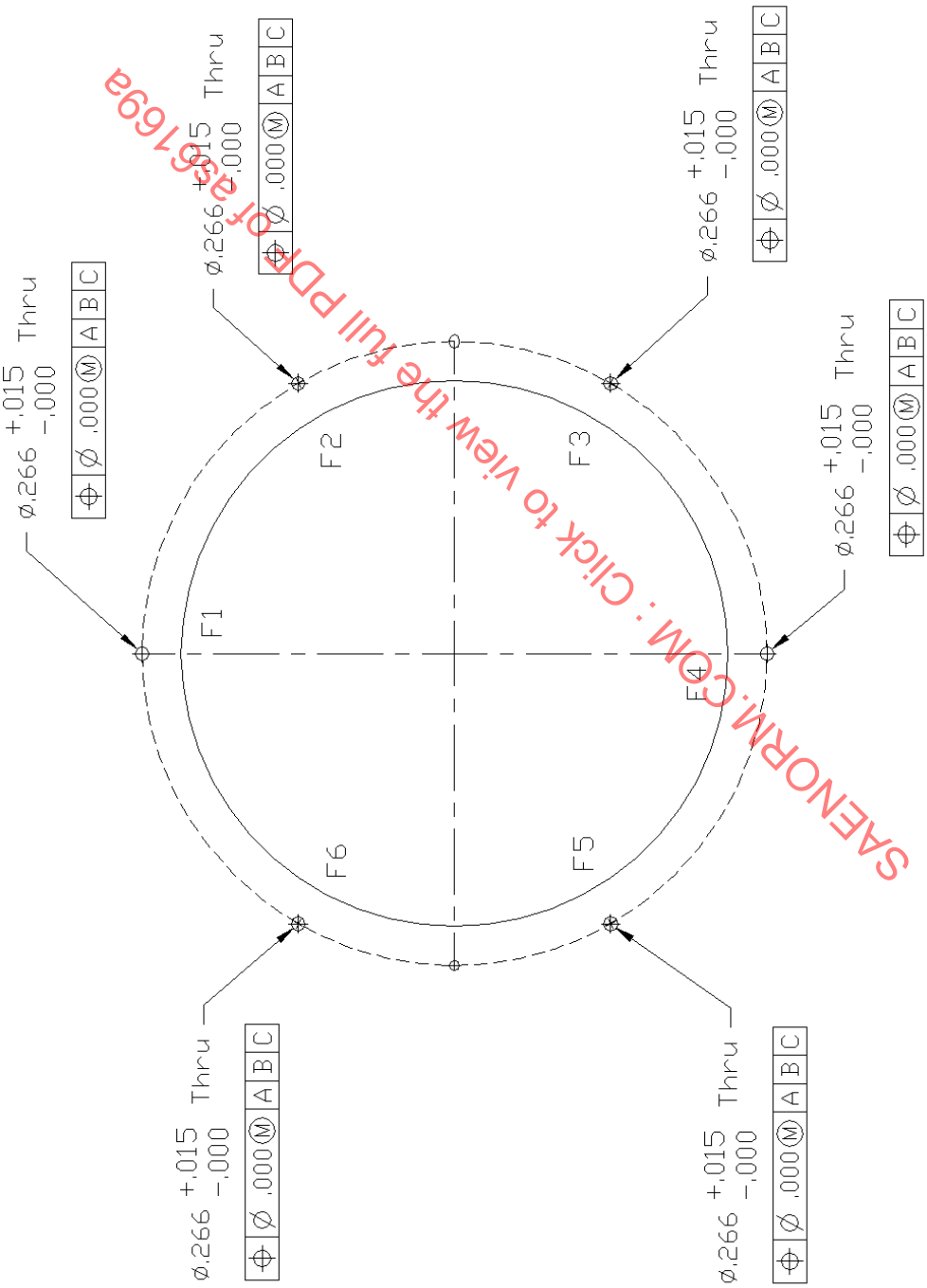

FIGURE B3 - SPECIFYING SIX THRU HOLES FROM PLATFORM INTERFACE, TURRET CLASS II, ACCESS HOLE EXAMPLE

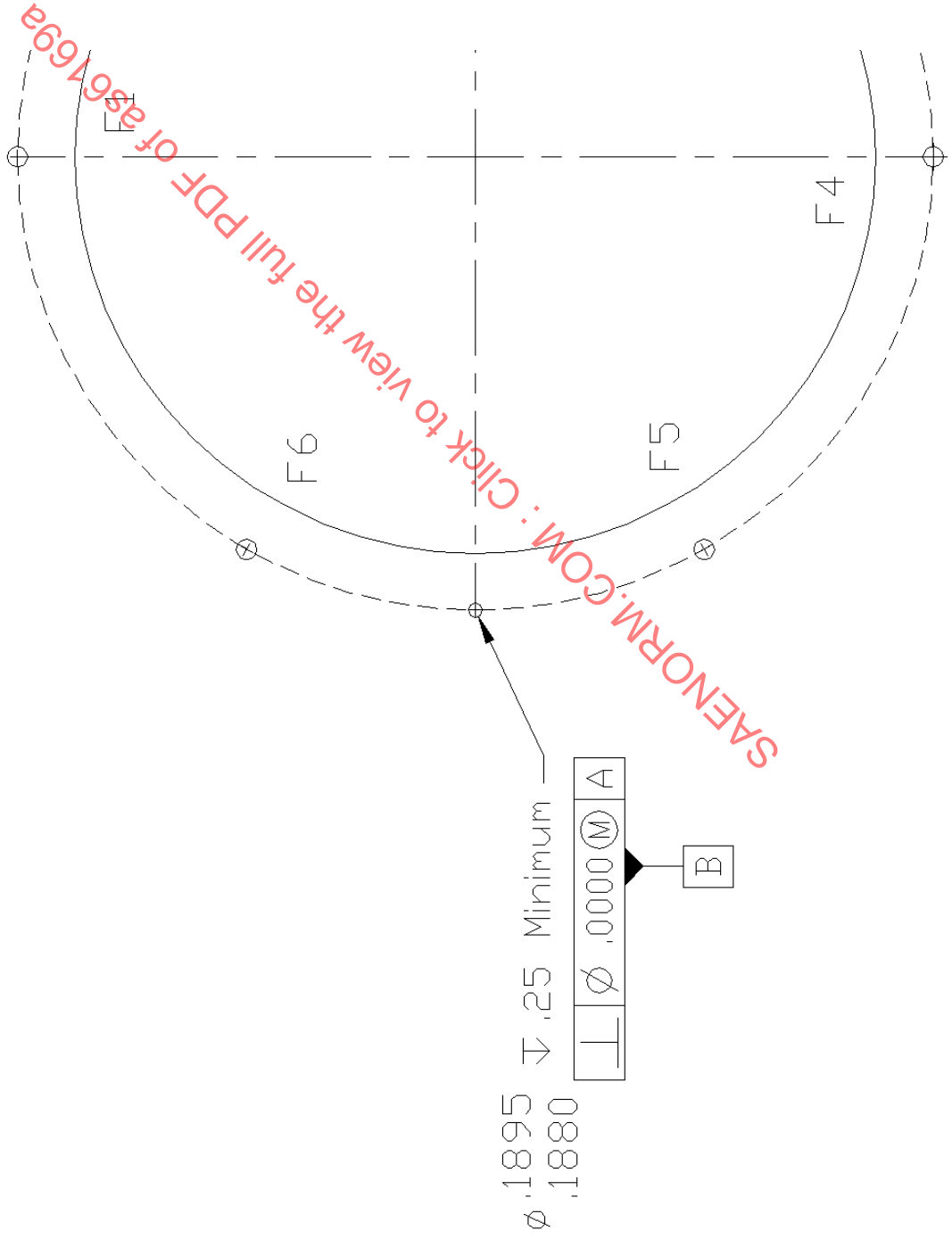

FIGURE B4 - DOWEL PIN HOLE FROM PLATFORM INTERFACE, TURRET CLASS II, ACCESS HOLE EXAMPLE

Optional dowel pins can be used on the turret side of the mechanical interface and mate with the dowel pin hole and dowel pin slot in the platform side of the mechanical interface. See Appendix G for additional rational on dowel pins. One recessed hole (for a dowel pin attached to a turret) was chosen to be used as a datum (Datum B) and can be used to assist in aligning the turret to the platform, as shown in Figure B4.

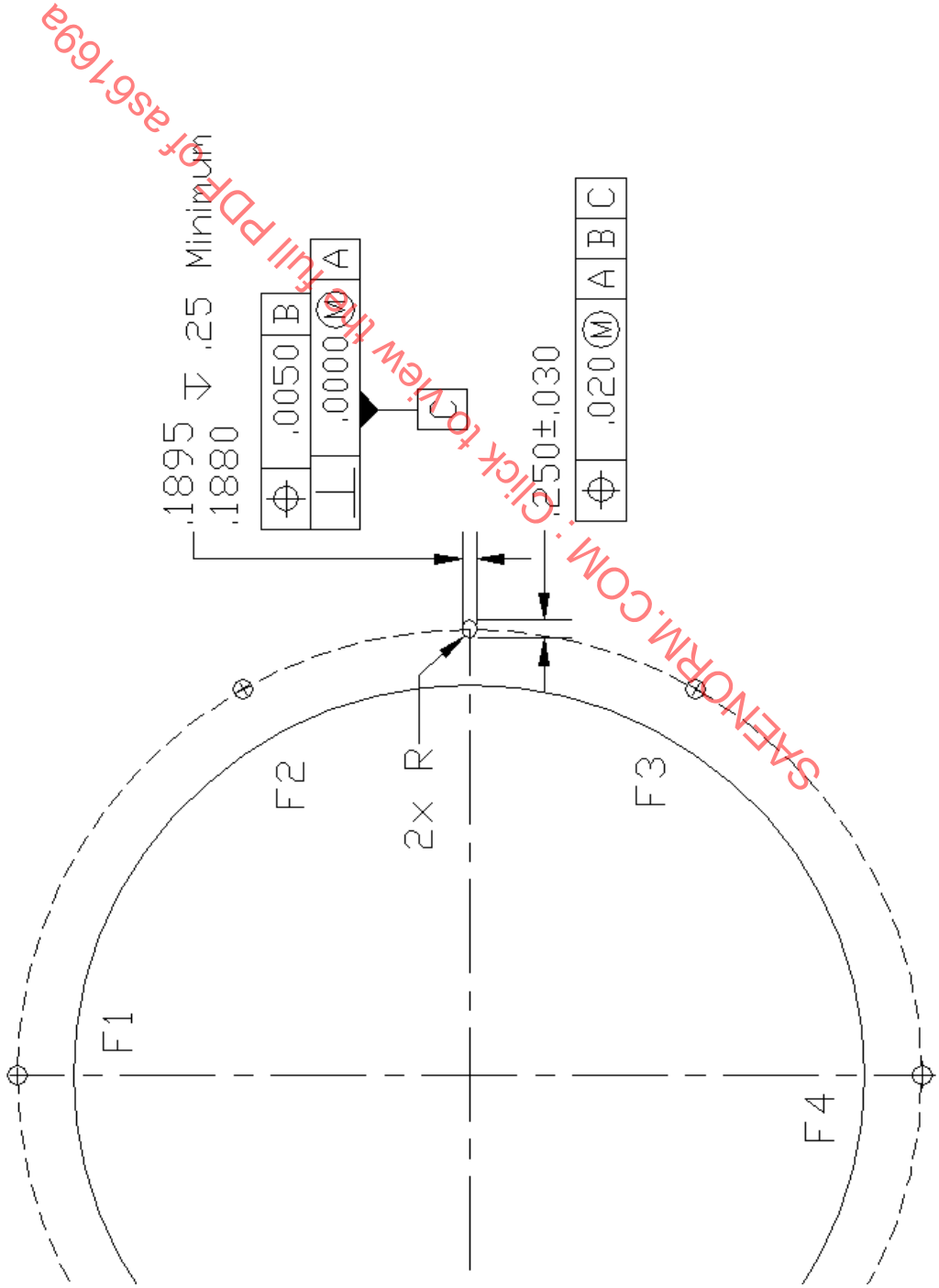

FIGURE B5 - DOWEL PIN SLOT FROM PLATFORM INTERFACE, TURRET CLASS II, ACCESS HOLE EXAMPLE

An additional dowel pin slot illustrated in Figure B5 was chosen to be used as an additional datum (Datum C) and also can be used to assist in aligning the turret to the platform. This secondary dowel pin aligns to a slot due to the stack of tolerances associated with manufacturing and assembly.

APPENDIX C - FASTENER DESIGNATION FOR THE MECHANICAL INTERFACE

NOTE: If a discrepancy exists between any figure in Appendix C and a figure in Section 4 of Detailed Requirements, the figures in Section 4 shall take precedence.

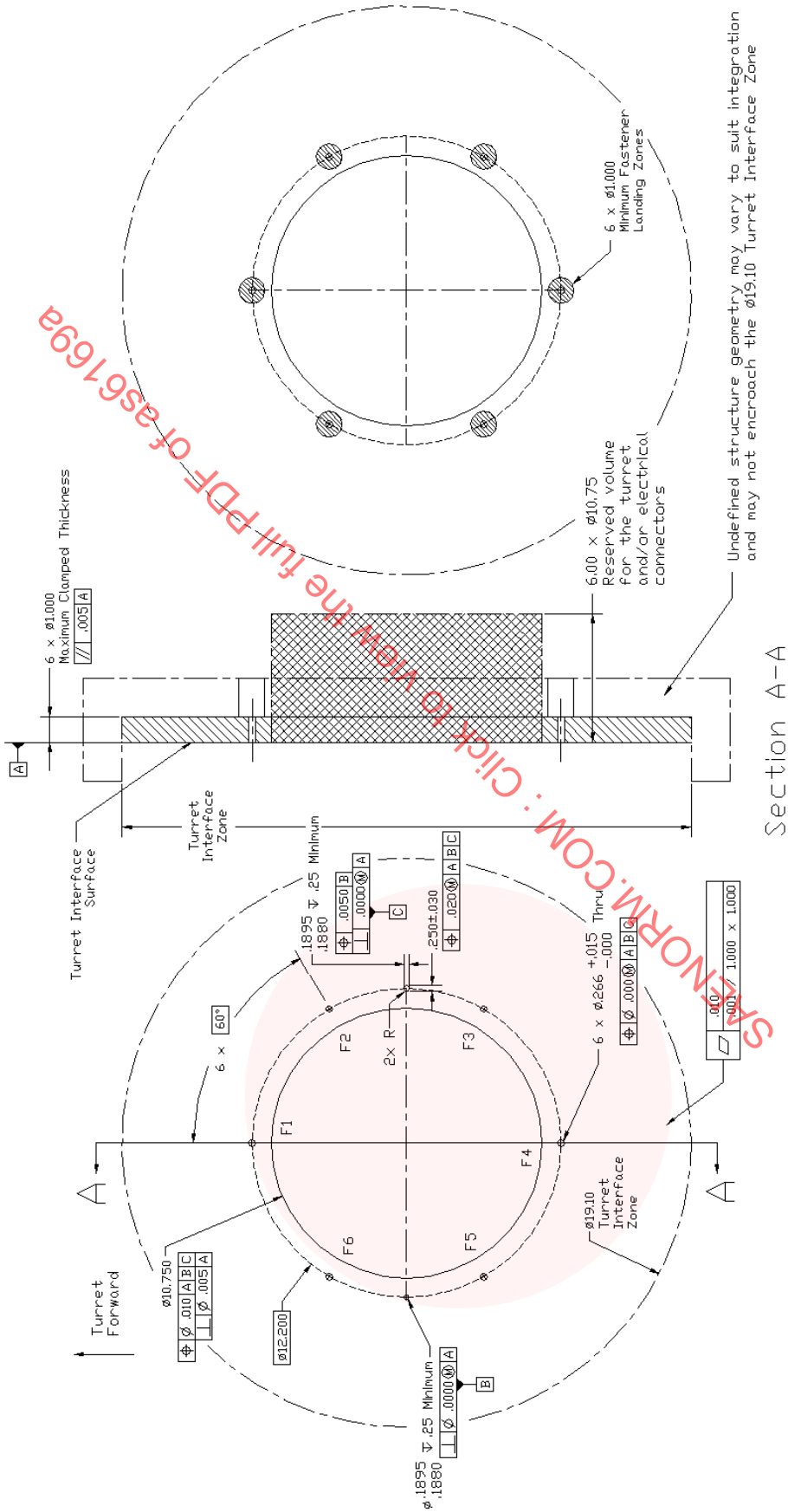

FIGURE C1 - TURRET INTERFACE SURFACE HIGHLIGHTED, TURRET CLASS II, ACCESS HOLE EXAMPLE

Figure C2 highlights the fastener numbers (F#), reference the turret interface surface view from the drawing in 4.1.3, as highlighted below in Figure C2. It is recommended that the fastener numbers be referenced in setting Turret Forward to Aircraft Forward as well as to the turret's coordinate reference frame. It is also recommended that the fastener numbers be referenced in analysis such as Crash Safety.

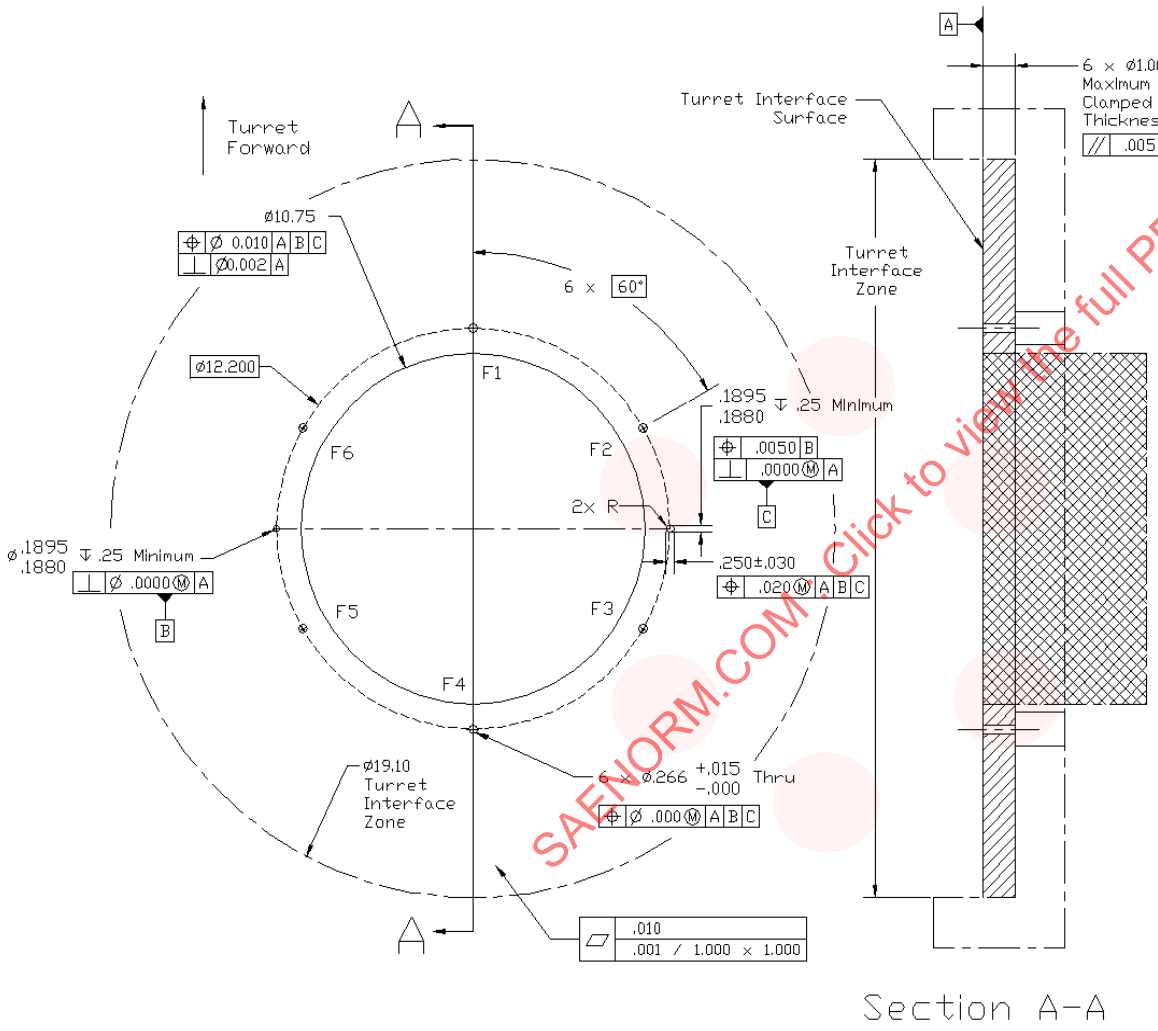

FIGURE C2 - FASTENER DESIGNATION IN TURRET CLASS II, ACCESS HOLE EXAMPLE

APPENDIX D - 120 DEGREE ANGULAR SWEEP FOR SIDE EGRESS ELECTRICAL CONNECTORS

NOTE: If a discrepancy exists between any figure in Appendix D and a figure in Section 4 of Detailed Requirements, the figures in Section 4 shall take precedence.

Figures D1 through D5 in Appendix D define the location of the electrical connectors side egress, 120 degree angular sweep, and reference the turret interface surface view from the drawing in 4.1.3.

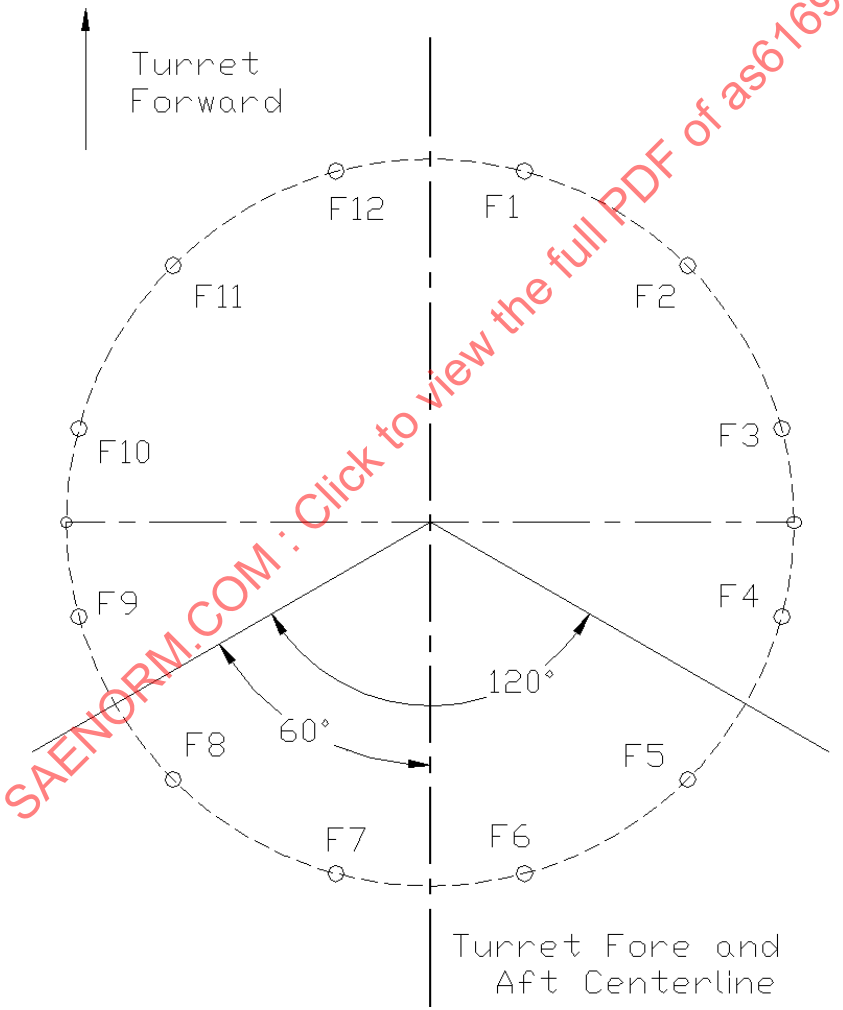

FIGURE D1 - TURRET CLASS I, ELECTRICAL CONNECTORS SIDE EGRESS, 120 DEGREE ANGULAR SWEEP

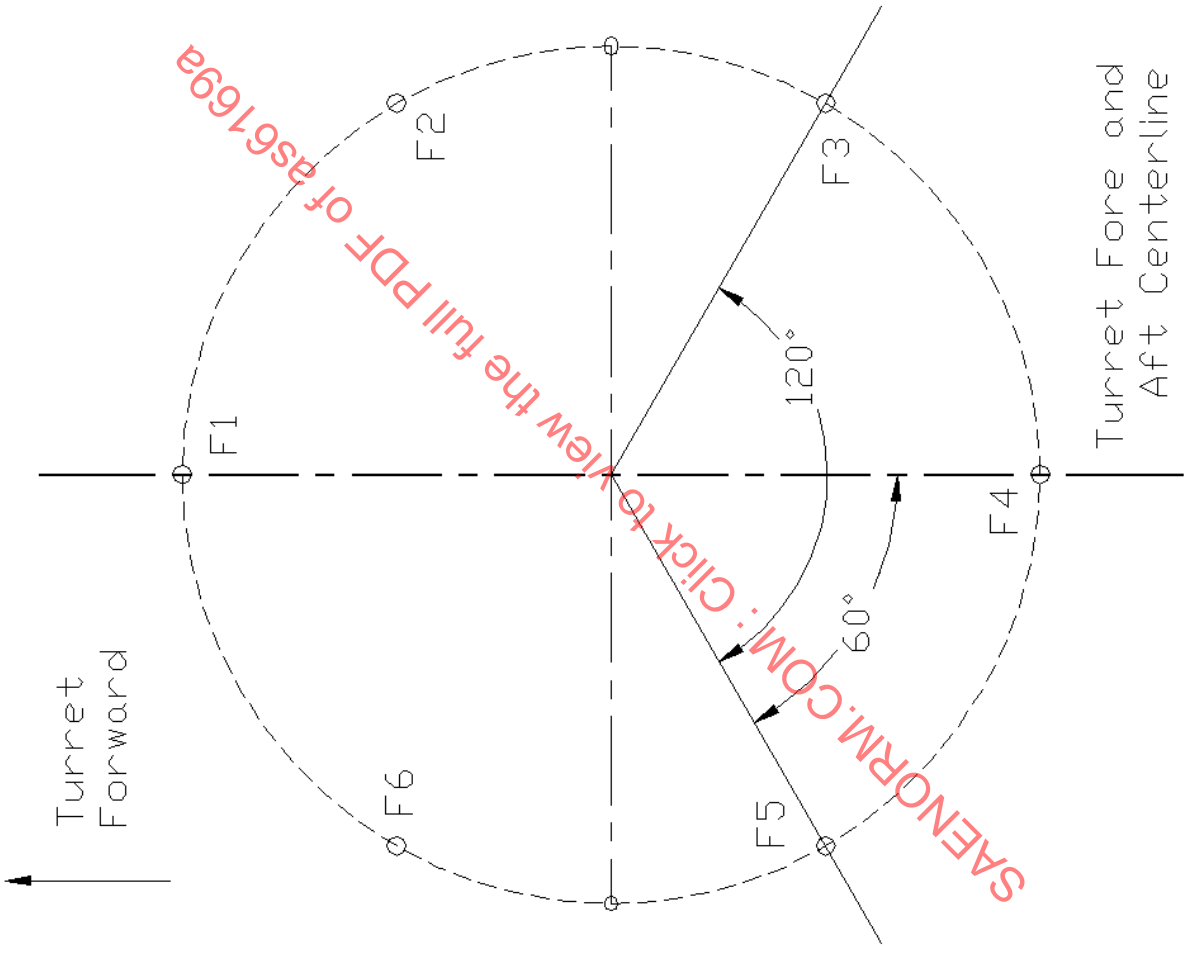

FIGURE D2 - TURRET CLASS II, ELECTRICAL CONNECTORS SIDE EGRESS, 120 DEGREE ANGULAR SWEEP

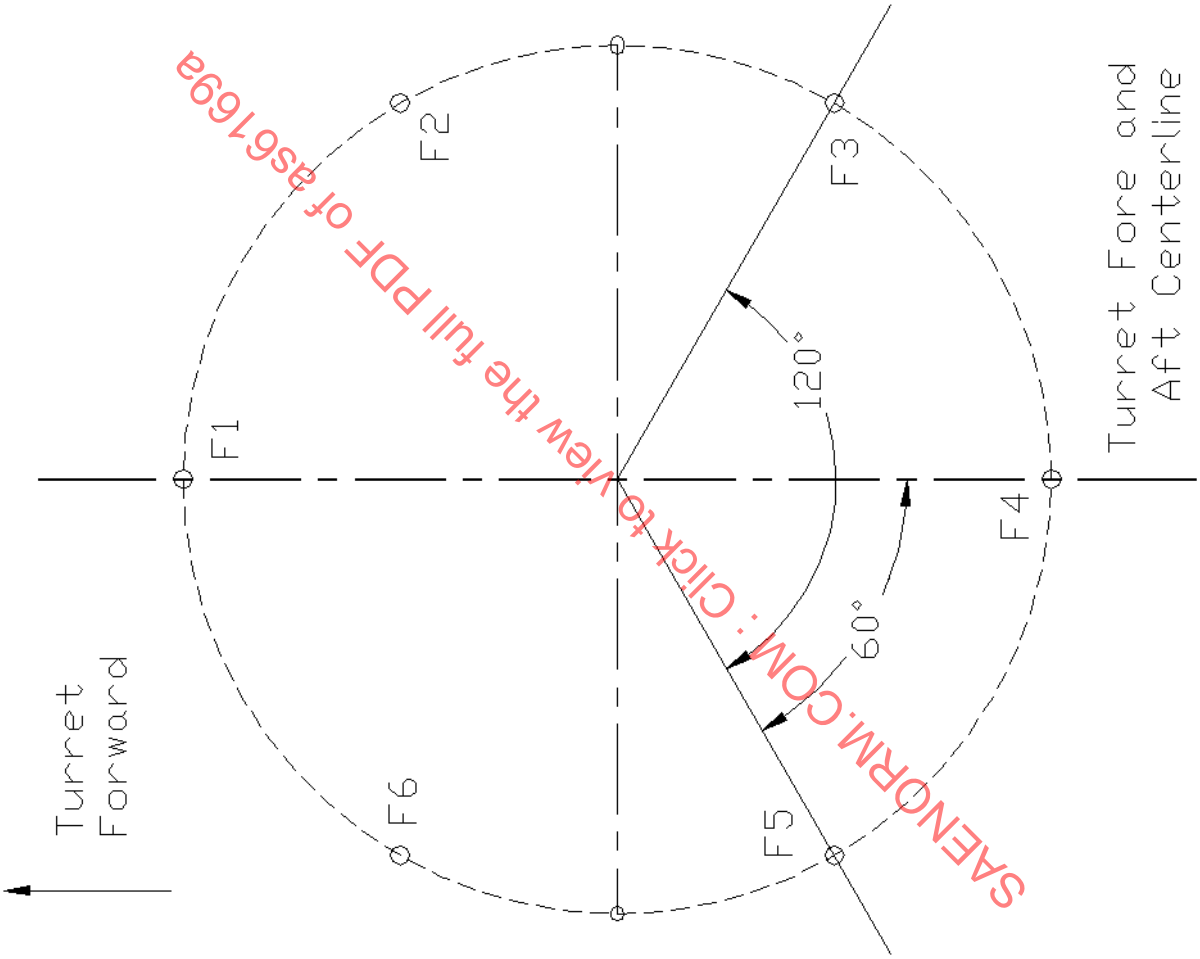

FIGURE D3 - 3 TURRET CLASS III, ELECTRICAL CONNECTORS SIDE EGRESS, 120 DEGREE ANGULAR SWEEP

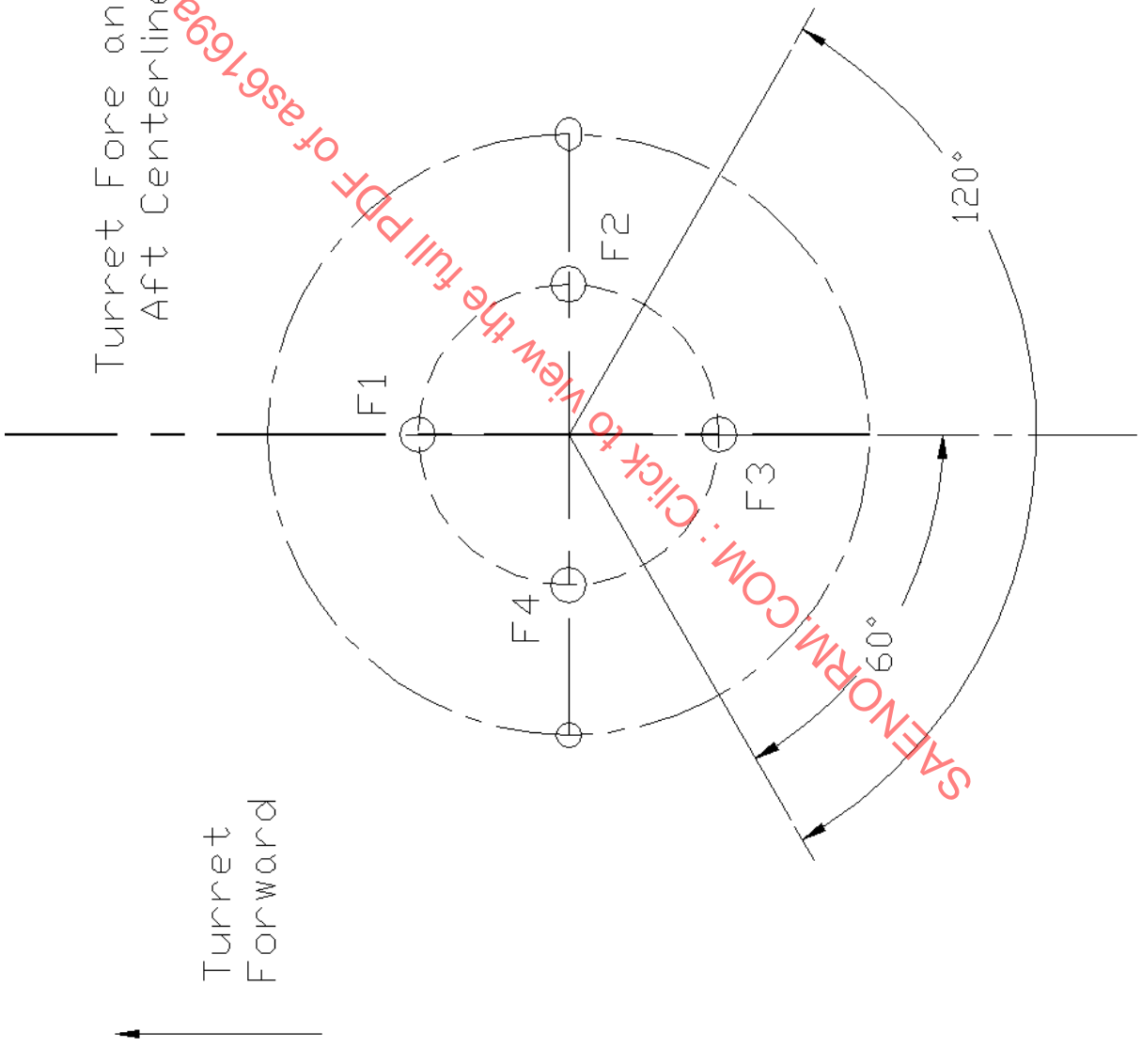

FIGURE D4 - TURRET CLASS IV, ELECTRICAL CONNECTORS GENERAL CONFIGURATION SIDE EGRESS, 120 DEGREE ANGULAR SWEEP

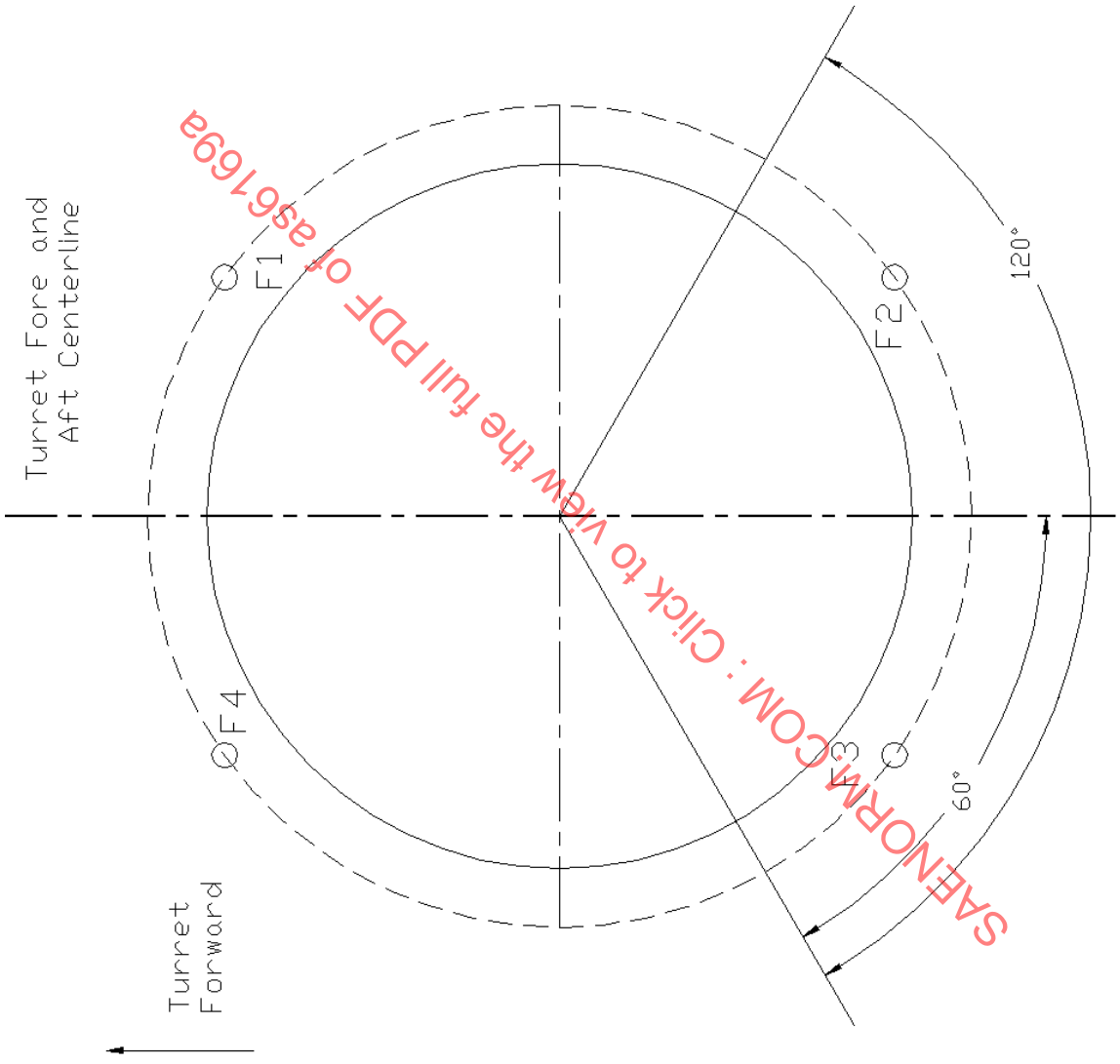

FIGURE D5 - TURRET CLASS IV ELECTRICAL CONNECTORS, 7.0 INCHES < $\varnothing_T$ ≤ 9.0 INCHES AND 6.0 INCHES < $\varnothing_T$ ≤ 7.0 INCHES, 120 DEGREE ANGULAR SWEEP

APPENDIX E - 45 DEGREE ANGULAR SWEEP FOR ENVIRONMENTAL CONNECTORS

If a discrepancy exists between any figure in Appendix E and a figure in Section 4 of Detailed Requirements, the figures in Section 4 shall take precedence.

Figures E1 through E3 define the top diameter allocation or side 45 degree angular sweep, and reference the turret interface surface view from the drawing in 4.1.3.

NOTE: For side egress of environmental connectors in this situation, it is likely that they are protected from the wind stream.

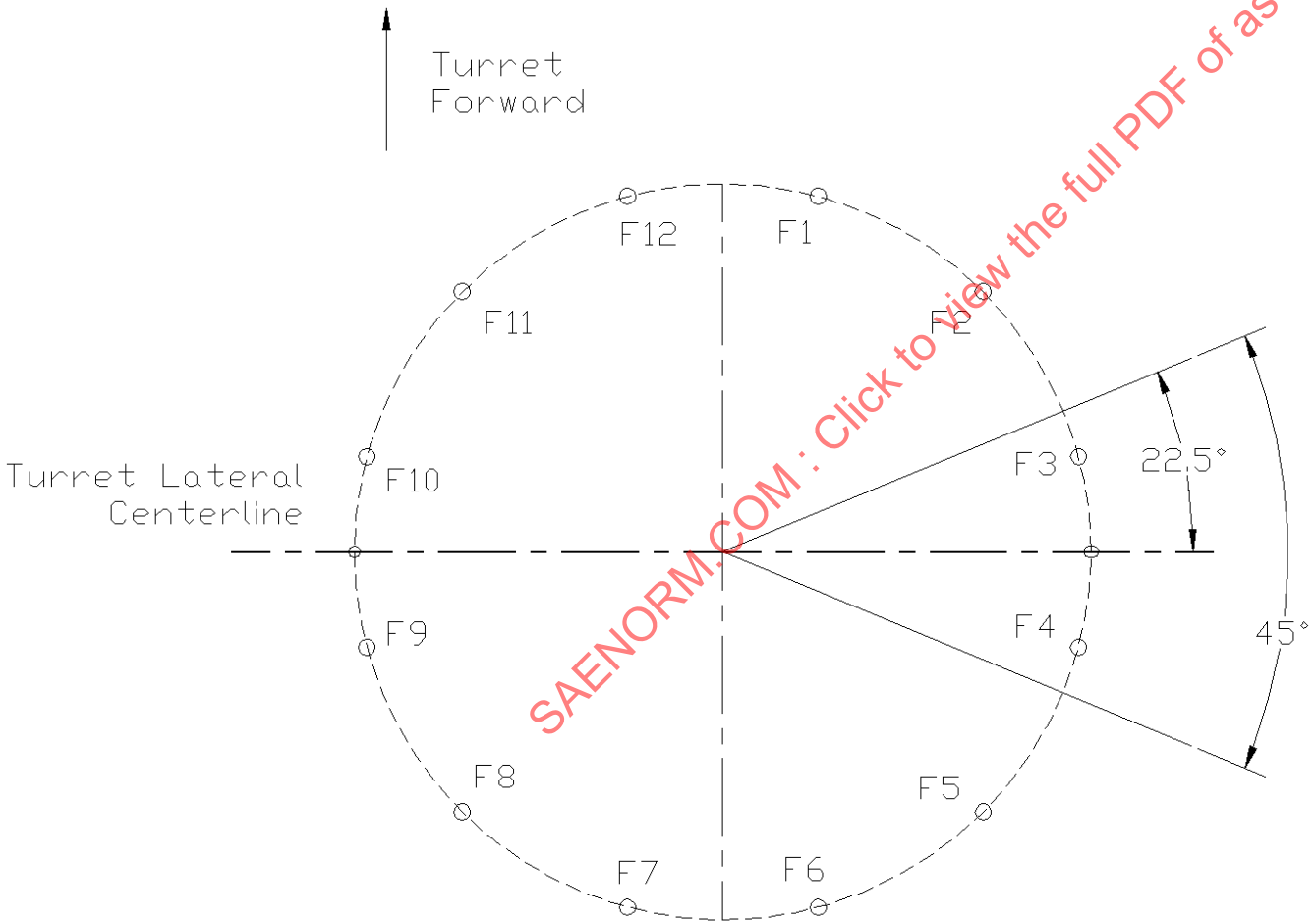

FIGURE D1 - TURRET CLASS I, ENVIRONMENTAL CONNECTOR SIDE EGRESS 45 DEGREE ANGULAR SWEEP

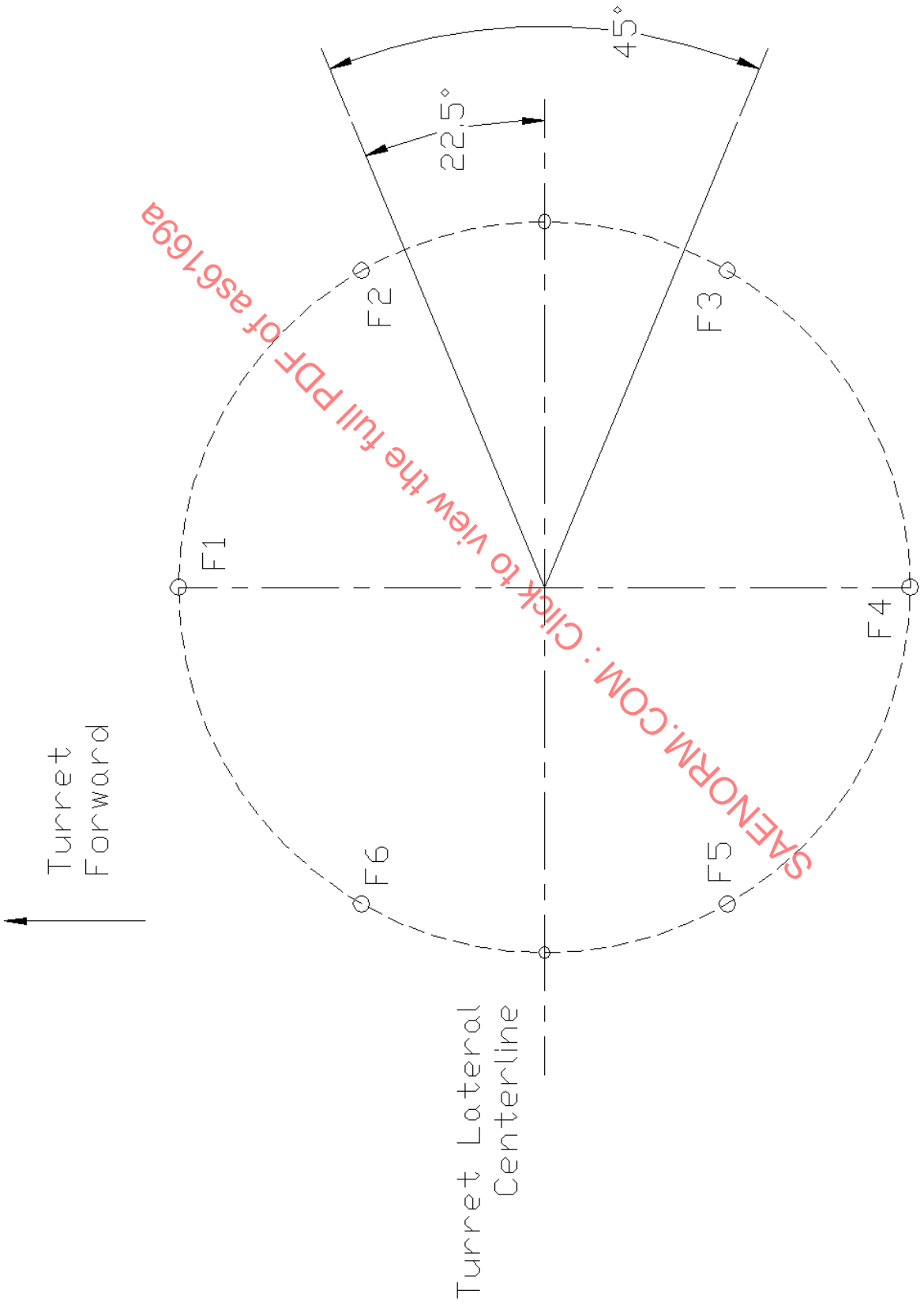

FIGURE E2 - TURRET CLASS II, ENVIRONMENTAL CONNECTOR 45 DEGREE ANGULAR SWEEP