

Interface Control Document TEST CELL SYSTEM : CENTER STACK STRUC

Interface Document: NSTXU_1-1-3-3_IC_105

REVISION 0

October 21, 2019

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Test Cell - Center Stack Structure ICD

Interface Document: NSTXU_1-1-3-3_IC_087

REVISION 0

June 17, 2019

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National Spherical Torus Experiment Upgrade

Interface Control Document

TEST CELL SYSTEM: CENTER STACK STRUCTURE

NSTX-U-ICD-TCS-CSS-0

Revision 0

May 24, 2018

Change Record

Revision	Date	Description of Change
0	May 24, 2019	Initial Release

References

- [1] GENERAL REQUIREMENTS DOCUMENT, NSTX-U-RQMT-GRD-001-01.
- [2] SYSTEM REQUIREMENTS DOCUMENT, Test Cell, NSTX-U-RQMT-SRD-010-02.
- [3] SYSTEM REQUIREMENTS DOCUMENT, VACUUM VESSEL AND INTERNAL HARDWARE, NSTX-U-RQMT-SRD-004-01.

1. Purpose

This document describes the various interfaces between the following subsystems: Test Cell System and the Center Stack Structure. The interface locations and boundaries that connect the Test Cell System to the Center Stack Structure are identified based on different interface types.

2. Scope

The Test Cell consists of the platforms, cable trays, racks, penetrations, floor, and crane. The Center Stack Structures include the Center Stack Casing, Pedestal, PF-1a Support Structures, PF-1b Support Structures, and PF-1c Support Structures. The interfaces in this ICD focus on pedestal mounted to the floor. The scope of this document addresses any defined interfaces between these identified system elements.

3. Responsibilities

The interfaces are managed between the following organizations:

- Test Cell
- VVIH
- Systems Engineering and Integration

4. Interfaces

Interface requirements in the following sections are identified with a requirement number, ICD, followed by a number [ICD-TCS-CSS-X] where “X” is a sequential count beginning with 001, TCS represents Test Cell System, and CSS represents Center Stack Structure. There is also a unique identifier for all interfaces in the format [#####-#####-X]. The identifier is a concatenation of two level 5 WBS values and the interface type. This is followed by an interface description and a list of references. References provide evidence pertaining to interfaces and include but are not limited to drawings, calculations, or specifications. References also include a reference to a paragraph that identifies the set of interface definitions.

4.1. Interface Types

The top-level interface types are defined in Table 1. Within each heading there are sub-headings to address any special sub-elements that need consideration. For example, the Mechanical has four sub-elements that need to be addressed: Structural, Spatial, Location, and Wall/Floor Penetration. For those interface types with sub-interfaces there are corresponding sub-sections.

Table 1. Interface Types.

Heading	Abbreviation	Name
4.2	Me	Mechanical
4.3	Ep	Electrical Power
4.4	Si	Signal
4.5	Di	Diagnostics
4.6	Gf	Gas/Fluid
4.7	Va	Vacuum
4.8	Sw	Software
4.9	Th	Thermal
4.10	Pe	Plasma/Eddy/Halo Current

Table 2 provides the N2 Diagram identifying all the interfaces for NSTX-U while Table 3 provides the specific details of the interface.

Table 2. N2 Diagram Interface types.

Plasma Facing Components	Me,Th,Pe		Me,Th,Va,Pe						Me	Me	Me,Pe		Me			
	In Vessel Structure	Me,Di,Pe			Th			Me,Th,Pe	Me		Me,Di,Pe			Di		
		Vacuum Vessel Structure	Me		Me,Va	Me	Me	Me,Th,Pe	Me	Me,Va	Me,Di,Va		Si	Di,Si		
		Va	Centerstack Structure			Va,Th	Me,Gf	Me	Me					Di		
		Me	Me,Th,Ep	Magnets			Gf	Me			Di		Si	Di		
Si		Va			Heating Systems		Gf	Th		Me		Gf,Si	Si	Si	Si	
					Si,Va,Me,Sw	Vacuum Pumping System		Si	Si	Gf,Si	Si		Si,Va	Si	Si	
				Gf,Si			Coolant System	Gf				Gf,Sw	Si,Sw	Si		
	Th,Gf	Ep,Di,Th,Va	Ep,Gf,Th,Pe		Si		Si	Bakeout System							Si,Me	
			Gf,Va		Ep	Gf,Si			Gas Delivery System	Me	Va		Si,Sw	Si	Si	
		Gf				Si,Gf,Va			Gf	Wall Conditioning System			Si,Sw	Si	Si	
		Me,Va	Me,Va	Me	Me	Gf,Si	Gf			Va,Ep	Diagnostics		Si,Sw	Si	Si	Si
				Ep	Ep	Ep	Ep	Ep	Ep	Ep	Ep	Power Systems	Si	Ep,Si	Ep,Si,Di,Gf	Ep
					Si					Me,Si	Si		Centralized Instrumentation and Control	Si,Me		
										Sw		Si	Si,Sw	Integrated Machine Operations		
								Ep							Operations & Safety Systems	
Me		Me	Me	Me	Me	Me		Me	Me	Me	Me	Me	Me	Me	Me,Ep	D-Site Locations (Test Cell)

Table 3. Callout.

Center Stack Structure	
Me	Test Cell System

The remainder of this document addresses each of the interfaces. Note the template includes a paragraph heading for each interface and a table for each interface type. In the event there is no interface, the table will remain blank with a blank row.

The following paragraphs in Section 4 address each of the interfaces, and Section 5 addresses any off-project interfaces. Off-project interfaces are those external interfaces that interact with the NSTX-U system.

4.2. Mechanical Interfaces

This paragraph addresses any type of mechanical interfaces that include a structural, spatial, location dependent interfaces or areas where penetrations into a wall or floor are required. These are identified independently as interface parameters will likely be different.

4.2.1. Structural Interfaces

This identifies any interfaces between system elements that require a structural interface. This could be based on various forces placed on the system and by the system.

Identifier	Interface	References
1.8.1.1.8-1.1.3.3.7-S	The pedestal sits on the test cell floor.	See Paragraph 4.2.1.1, Drawing DC1563
1.8.1.1.8-1.1.3.3.7-S	Gravity, seismic loads, and global torques are transferred from the pedestal to the NTC floor.	See Paragraph 4.2.1.2

4.2.1.1. Pedestal to Test Cell Floor

Interface Notes:

- As part of the MCS FDR, the drawings will most likely be updated or new drawing developed.

ICD-TCS-CSS-001: The pedestal rests on the floor of the D-Site. Floor anchors pierce into the floor, holding the pedestal in place. The details for the floor anchors may be found in drawing DC1563.

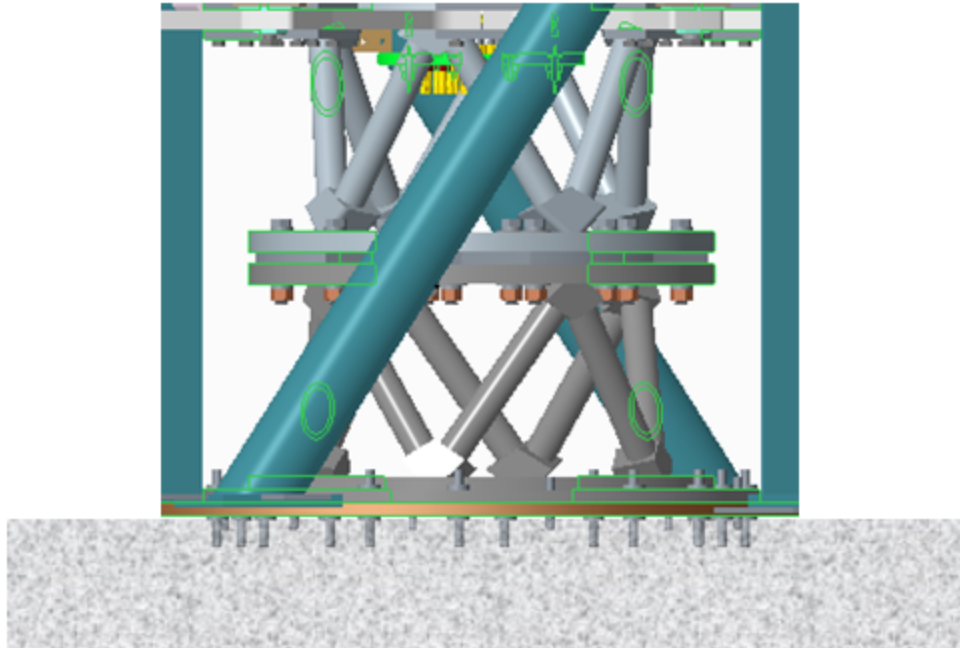


Figure 1. Pedestal Mounted to Floor

4.2.1.2. Pedestal Loads Transferred to Floor

Interface Notes:

- Loads developed in the Machine Core Structure are transferred to the floor via the pedestal.

ICD-TCS-CSS-002: Calculations will be developed by the FDR this is where the various loads will be presented.

4.2.2. Spatial Interface

This identifies any interfaces between the system elements pertaining to spatial restrictions or constraints.

Identifier	Interface	References
N/A		

4.2.3. Location Interfaces

This identifies any interfaces between the system elements that have any particular dependencies on element location or location constraints.

Identifier	Interface	References
N/A		

4.2.4. Wall/Floor Penetration Interfaces

This identifies any interfaces between the system elements any penetrations or modifications to the wall or floor of the D-Site building. The anchor bolts that hold the pedestal to the floor penetrate into the floor.

Identifier	Interface	References
N/A		

4.3. Electrical Power Interfaces

This identifies any interfaces between the system elements requiring AC, DC, rectification, or power conditioning.

Identifier	Interface	References
N/A		

4.4. Signal Interfaces

This identifies any interfaces between the system elements and signals that are used to either send or receive control information or data. It explicitly includes the type of physical interface such as Ethernet or Fiber Optic or any specific protocols.

Identifier	Interface	References
N/A		

4.5. Diagnostic Interfaces

This identifies any interfaces between the system elements with any instrumentation or diagnostic equipment to collect performance data.

Identifier	Interface	References
N/A		

4.6. Gas/Fluid Interfaces

This paragraph has two different types of interfaces: Gas and Fluid.

4.6.1. Gas Interfaces

This identifies any interfaces between the system elements that use any type of gas (e.g., He).

Identifier	Interface	References
N/A		

4.6.2. Fluid Interfaces

This identifies any interfaces between the system elements that use any type of fluid (e.g., ionized water).

Identifier	Interface	References
N/A		

4.7. Vacuum Interfaces

This identifies any interfaces between the system elements that pertain to the Vacuum.

Identifier	Interface	References
N/A		

4.8. Software Interfaces

This identifies any interfaces between the system elements that use software that may exchange interfaces with other software components. This includes application programming interfaces (APIs) or any other exchange of information between different software applications.

Identifier	Interface	References
N/A		

4.9. Thermal Interfaces

This identifies any interfaces between the system elements that pertain to Thermal characteristics.

Identifier	Interface	References
N/A		

4.10. Plasma Interfaces

This paragraph has two different types of interfaces: Plasma and Eddy/Halo Current.

4.10.1. Plasma Interfaces

This identifies any interfaces between the system elements with the Plasma.

Identifier	Interface	References
N/A		

4.10.2. Eddy/Halo Current Interfaces

This identifies any interfaces between the system elements with the Eddy/Halo Currents.

Identifier	Interface	References
N/A		

5. Off-Project Interfaces

The off-project interfaces are components that are not specifically part of the NSTX-U system. They may include external systems and interfaces where the program has little control on part of the interface. They are provided for completeness.

There are no external interfaces.