

Power Systems - Wall Conditioning System Interface Control Docum

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National Spherical Torus Experiment Upgrade

Interface Control Document

POWER SYSTEMS: WALL CONDITIONING SYSTEM

NSTX-U-PWR-WCS-ICD-0

**Revision 0
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Change Record

Revision	Date	Description of Change
0	September 9, 2019	Initial Release

References

[1] GENERAL REQUIREMENTS DOCUMENT, NSTX-U-RQMT-GRD-001-01

[2] SYSTEM REQUIREMENTS DOCUMENT, POWER SYSTEMS NSTX-U-RQMT-SRD-006-01.

[3] SYSTEM REQUIREMENTS DOCUMENT, AUXILIARY SYSTEMS, NSTX-U-RQMT-SRD-005-01.

1. Purpose

This document describes the various interfaces between the following subsystems: Power Systems and the Wall Conditioning Systems. The interface locations and boundaries that connect the Power Systems to the Wall Conditioning Systems are identified based on different interface types.

2. Scope

The Power Systems consists of the AC Power, AC/DC Conversions, DC Rectifiers, and control and protection. The Wall Conditioning System consists of Glow Discharge Cleaning, the Trimethylboron (TMB) System, and the Li Evaporator (LITER). The scope of this document addresses any defined interfaces between these identified system elements.

3. Responsibilities

The interfaces are managed between the following organizations:

- Power Systems
- Wall Conditioning Systems
- Systems Engineering and Integration

4. Interfaces

Interface requirements in the following sections are identified with a requirement number, ICD followed by a number [ICD-123-456-X] where X is a sequential count beginning with 001, 123 represents Power Systems and 456 represents Wall Conditioning Systems. There is also a unique identifier for all interfaces in the format [#####-#####-X]. The identifier is a concatenation of two level 5 SBS values and the interface type. This is followed by an interface description and a list of references. References provide evidence pertaining to interfaces include but are not limited to drawings, calculations, or specifications. Reference 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 Structures	Me,Di,Pe			Th			Me,Th,Pe	Me		Me,Pe			Di		
		Vacuum Vessel Structure			Me,Va	Me,Va	Me	Me,Th,Pe	Me	Me,Va	Me,Di,Va		Si	Di,Si		
		Va	Centerstack Structures			Va,Th	Me,Gf	Me	Me					Di		
		Me	Me,Th,Ep	Magnets				Me			Di		Si	Di	Me	
Si		Me,Va			Heating Systems		Gf	Th		Me		Si	Si	Si	Si	
					Si,Va,Me,Sw,Gf	Vacuum Pumping System		Si	Si	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			Me,Gf,Si		Gas Delivery System	Gf	Va			Si,Sw		Me	
		Gf				Si,Gf,Va		Me	Wall Conditioning System				Si,Sw		Si	
		Me,Va	Me,Va	Me	Me	Gf,Si	Gf		Va,Ep	Diagnostics			Si,Sw	Si	Si,Me	Si
				Ep	Ep	Ep	Ep	Ep	Ep	Ep	Ep	Power Systems	Ep,Si	Ep,Si	Me,Ep,Si,Di,Gf	Ep
					Si				Me,Si	Si		Centralized Instrumentation and Control	Si,Me			
												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

Wall Conditioning System	
Ep	Power Systems

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
N/A		

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.

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
1.5.1.2- 1.3.5.1.1-P	Electrical power for glow discharge systems	See Paragraph 4.3.1, EA1500
1.5.1.2- 1.3.5.2-P	Electrical power for dTMB system	See Paragraph 4.3.2, Drawing EA3518
1.5.1.2- 1.3.5.3-P	Electrical power for LITER system	See Paragraph 4.3.3, Drawing 4BA149, AE6001
1.5.1.2- 1.3.5.4-P	Electrical power for the granule injector	See Paragraph 4.3.4, 4BA042

Interface Notes:

- Interface is currently defined in the available documentation and at a future point will be verified by on-site walkthrough.

4.3.1. Power – Glow Discharge Systems

ICD-PWR-WCS-001: Glow Discharge power from LP-504 CKT -20 top CTC-EE-449 as shown in drawing EA1500 sheet 316. The AB1 and AB-2 Glow discharge starter also provide power from CKT2 to Innotec Power supplies after passing through transformer.

ICD-PWR-WCS-002: The voltage is 120 VAC and current of 20A and is interfaced using wire connections from C as shown in EA1500 sheets 316. The Starter share a power source and use 208 VAC and a current of 50 A.

4.3.2. Power - dTMB

ICD-PWR-WCS-003: dTMB Power is routed from LP-471 (CKT-26 and CKT-30) and runs through conduit 21218A to as shown in drawing EA3518.

ICD-PWR-WCS-004: The voltage is 120 VAC and the current is 20A and is interfaced 90 degree male plug to an APC UPS.

4.3.3. Power – LITER

ICD-PWR-WCS-005: LITER Power is provided from LP-473 CKT 13 as defined in Drawing 4BA149. Drawing AE6001 sheet 10 provides a family tree for LITER controls.

ICD-PWR-WCS-006: The voltage is 120 VAC and the current is 50A per Drawing 4BA149.

4.3.4. Power – Granular Injector

ICD-PWR-WCS-007: Granular Injector Rack power is routed from LP-484, Ckt-09 as shown in drawing 4BA042.

ICD-PWR-WCS-008: The voltage is 120 VAC and the current is 20A.

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		
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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.