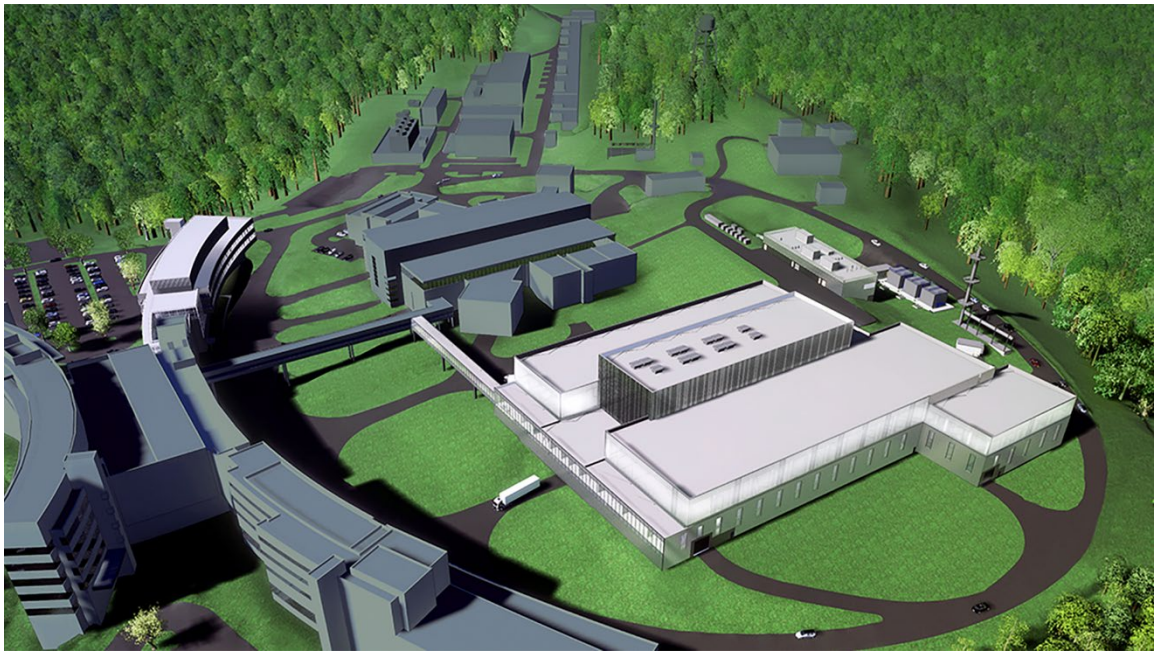
S03060000-SRD10000

Second Target Station (STS): Vessel Systems Requirements



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March 2025

OAK RIDGE National Laboratory
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Second Target Station Project

Second Target Station (STS) Vessel Systems Requirements

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March 2025

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Second Target Station (STS) Vessel Systems Requirements		ISSUE DATE: March 2025
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Revision	Description
00	Initial Release

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DEFINITIONS

Shall, must, will, may, and should are used to define each individual requirement. The definitions of these terms are as follows:

- *Shall* – is a requirement that is binding and must be implemented
- *Must* – is an absolute, binding alternative to "shall" or "requirement"
- *Will* – is used to inform intent or declaration of purpose
    - This is not a requirement; the author must use the word 'shall' to indicate that a requirement is binding and must be implemented
- *May* – is used to indicate a desire or goal of a requirement
    - This can also be interpreted 'as nice to have' and is not binding
- *Should* – is used to indicate a desire or goal of a requirement
    - This can also be interpreted 'as nice to have' and is not binding

"Not" is used in combination with the above terms to indicate the opposite; that is, "shall not" and "must not" describe prohibitions.

Vessel Systems Requirements

1 General Requirements

General requirements for Vessel Systems.

CodeBeamer reference: S.03.06-7174

1.1 Accept Proton Beam

The Vessel and internal Shielding shall allow greater than 99.9% of the proton beam profile delivered by the Accelerator Systems to reach the Target Assembly unobstructed.

NOTE 1: Beam profile and other characteristics relevant to hardware will depend on beam area and beam position as defined in S01020500-ISXXXXX.

CodeBeamer reference: S.03.06-6121

Upstream References (1)

S.03-1028	Accept Beam from Accelerator

1.2 Radiation Shielding

The Core Vessel and internal shielding shall be capable of limiting radiation exposure in areas accessible to personnel during beam-on and beam-off operations in accordance with the STS Radiation Safety Policy and Plan.

CodeBeamer reference: S.03.06-6130

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

1.3 Stainless Steel Temperature Limit

Vessel Systems stainless steel structures should have a maximum operating temperature of 200 C.

CodeBeamer reference: S.03.06-7181

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

1.4 Carbon Steel Temperature Limit
Vessel Systems nickel plated carbon steel structures should have a maximum operating temperature of 200 C.

CodeBeamer reference: S.03.06-7182

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

1.5 Lifetime
All vessel systems components shall be life of the facility components having a lifetime greater than or equal to 40 years with the following exceptions:
1. Gamma Gate assembly
2. Thermocouples and associated wiring
3. Vacuum and water replaceable seals

Note: Exceptions will be governed by the maintenance and lifetime criteria for perishable components (Requirement 1.9)

CodeBeamer reference: S.03.06-7183

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

1.6 Water Leak Rates
All Vessel Systems water boundaries shall be designed to mitigate water leaks.

Note: Leak testing with water is not practical, leak rates to be verified via helium leak testing with an anticipated acceptance criteria of of 1x10^-6 mbar-l/s or less.

CodeBeamer reference: S.03.06-7184

Upstream References (1)

S.03-1033	Yearly Operating Hours

1.7 Pressure Bearing Component Design Criteria
All Vessel Systems water cooled shielding, CV beltline and CV shall be designed per the STS Design and Fabrication of Pressure and Vacuum Systems (S01020000-PC0007).

CodeBeamer reference: S.03.06-7185

Upstream References (1)

S.03-1035	Safe Operation

1.8 Piping Design Criteria

All Vessel Systems water piping shall be designed and fabricated to ASME B31.3.

CodeBeamer reference: S.03.06-7186

Upstream References (1)

S.03-1035	Safe Operation

1.9 Maintenance and Lifetime Criteria - Perishable Components

All components shall meet one (or more) of the following criteria:

1. Non-replaceable components shall be designed and constructed with a negligible chance of failure beyond the life of the facility.
2. Components that are designed for the life of the facility but have a chance of failure shall be designed and constructed to permit replacement.
3. Components with expected minimum lifetime of 5000 hours shall be replaceable in 1400 hours or less.
4. Components with expected minimum lifetime of 2500 hours shall be replaceable in 250 hours or less.
5. Components with expected minimum lifetime of 500 hours shall be replaceable in 72 hours or less.
6. Components with expected minimum lifetime of 192 hours shall be replaceable in 16 hours or less.

Note: The criteria above give a high confidence level in meeting the availability requirement

CodeBeamer reference: S.03.06-7674

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

2 Safety Requirements

Requirements derived from the Preliminary Hazzard Analysis Report.

CodeBeamer reference: S.03.06-6599

2.1 Core Vessel Pressure Relief

The Core Vessel shall maintain an internal pressure of less than +7.35 PSIG.

Note: A pressure relief system with burst disc shall be designed to ensure that +7.35 PSIG is not exceeded.

Note: Pressure limit determined by Proton Beam Window per Interface Sheet S01020500-IST10217.

PHAR References:
AIC3-3, AIC3-5, AIC3-9, AIC3-10, AIC7-1, BG7-8, BG7-9a, BG7-9b, CMS1-1, CMS2-1, CMS2-2a, CMS2-2b, CMS4-1, CMS4-2, CMS4-4, CW3-1d, CW3-3a, CW3-3b, CW3-10, TS3-2, TS3-3, TS3-4, TS3-5, TS3-6, TS3-7, TS3-8, TS3-10, TS3-12, VS1-1, VS2-1a, VS3-2

CodeBeamer reference: S.03.06-7047

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.2 Core Vessel Leak Collection

The Core Vessel shall collect water leaks inside the vessel and route to a drain port near the bottom of the vessel that connects to Process Systems drain line of the same diameter.

Note: Sizing of the drain line is the responsibility of Process Systems.

PHAR References:
AIC3-3, AIC3-4, AIC3-5, AIC3-7, AIC3-9, AIC3-10, AIC7-1, BG7-8, BG7-9a, BG7-9b, BG7-12, CMS1-1, CMS2-1, CMS2-2a, CMS2-2b, CMS3-4, CMS3-5, CMS4-1, CMS4-2, CMS4-4, CMS7-1, CMS7-3, CMS7-5, CMS7-6, CMS7-7, CW3-1a, CW3-1b, CW3-1d, CW3-2a (Credited), CW3-2b, CW3-3a, CW3-3b, CW3-7a, CW3-7b, CW3-10, GW2-3, HB2-2, HPV3-9, LCS1-1, LCS2-1, LCS3-1, LCS3-2, LCS3-3, LCS4-1, RH3-5, TS3-2 (Credited), TS3-3 (Credited), TS3-4, TS3-5, TS3-7 (Credited), TS3-8, TS3-10, TS3-12 (Credited), VS2-2, VS3-1

CodeBeamer reference: S.03.06-7048

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.3 Vacuum Port

The Core Vessel shall have a vacuum port that connects to a vacuum system.

Note: Vacuum nozzle size may be determined in collaboration with other systems to accommodate maintenance ventilation and connection to a Hydrogen-safe release stack.

PHAR References:
AIC3-3, AIC3-4, AIC3-5, AIC3-9, AIC3-10, AS3-2, BG3-2, BG7-8, BG7-9a, BG7-9b, BG7-11, BG7-12, CMS1-1, CMS2-1, CMS2-2a, CMS2-2b (Credited), CMS2-2C, CMS3-4, CMS3-5, CMS3-6, MCS3-7, CMS4-1, CMS4-2, CMS4-4, CMS7-1, CMS7-3, CMS7-5, CMS7-6, CMS7-7, CW3-1a, CW3-1b, CW3-1d, CW3-2a, CW3-2b, CW3-3a, CW3-3b, CW3-7a, CW3-7b, CW3-10, GW3-12, HB2-2, ISB3-1, RH3-11, TS3-2, TS3-3, TS3-4, TS3-5, TS3-6, TS3-7, TS3-8, TS3-9, TS3-10, TS3-12, VS1-1 (Credited), VS1-2, VS2-1a (Credited), VS2-1b, VS2-2, VS3-1, VS3-2

CodeBeamer reference: S.03.06-7049

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.4 Core Vessel Pressure Range

Core Vessel shall be designed to operate in a range of full vacuum to +15 psig per the STS Design and Fabrication of Pressure and Vacuum Systems (S01020000-PC0007).

PHAR References:
AIC3-3, AIC3-4, AIC3-5, AIC3-9, AIC3-10, AS3-2, BG3-2, BG7-8, BG7-9a, BG7-9b, BG7-11, BG7-12, CMS1-1, CMS2-1, CMS2-2a, CMS2-2b (Credited), CMS2-2C, CMS3-4, CMS3-6, MCS3-7, CMS4-1, CMS4-2, CMS4-4, CMS7-6, CW3-1a, CW3-1b, CW3-1d, CW3-2a, CW3-2b, CW3-3a, CW3-3b, CW3-7a, CW3-7b, CW3-10, HB2-2, TS3-2, TS3-3, TS3-4, TS3-5, TS3-6, TS3-7, TS3-8, TS3-9, TS3-12, VS1-1 (Credited), VS2-1a (Credited), VS2-2, VS3-1, VS3-2

CodeBeamer reference: S.03.06-7052

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.5 Non-flammable Materials
Core Vessel and Core Vessel shielding components shall be made of non-flammable materials where practical.

Note: Small volumes (<0.01%) of elastomers will be used for vacuum and water seals within Vessel Systems scope.

PHAR References:
BG1-1, BG6-9 (Credited), BG7-1a, BG7-11, CMS2-2C, CMS7-3, CW3-2a, CW3-2b, VS1-1, VS1-2, VS2-1a, VS2-1b

CodeBeamer reference: S.03.06-7053

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.6 Target Temperature Limit during Facility Fire
Core Vessel shielding shall keep target temperature below 800C under reasonable fire conditions.

PHAR References:
BG1-1, BG6-9 (Credited), BG7-1a, BG7-11, CMS7-3, CMS7-5, CMS7-7 (Credited), CW3-2a, CW3-2b

CodeBeamer reference: S.03.06-7054

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.7 Impact Damage Protection
The Monolith steel shielding shall protect the Target feet and Moderator Reflector Assembly from physical impact damage when the Target System is installed and in operational configuration.

Note: Monolith steel shielding does not protect Moderator Reflector Assembly or target feet that have been removed from their home positions within the monolith.

Note: Monolith steel shielding provides less protection when removable shielding is not in place during maintenance activities.

PHAR References:
BG6-6, BG6-7, BG6-9 (Credited), BG6-10, BG7-4, CMS2-5, HB2-2, HB2-3, RH3-1, RH3-2, RH3-5

CodeBeamer reference: S.03.06-7055

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.8 Protect Cryogenic Transfer Lines
Vessel Systems shall not permit the Core Vessel or shielding within the Core Vessel to cause the Moderator Reflector Assembly or cryogenic transfer lines to release Hydrogen under SDC2 seismic conditions.

PHAR References:
BG7-1a (Credited), BG7-2, BG7-11 (Credited), BG7-12, CMS4-2, CMS7-1, CMS7-5 (Credited), CMS7-7 (Credited)

CodeBeamer reference: S.03.06-7056

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.9 Core Vessel Anchoring
The Core Vessel shall be anchored in such a way to limit motion of the Core Vessel base flange relative to the floor to < 0.1 mm under SDC Level 2 seismic loads.

PHAR References:
BG7-2, BG7-12, CMS7-1, CMS7-3, CMS7-5

CodeBeamer reference: S.03.06-7057

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.10 Core Vessel Environment
Core Vessel shall maintain an inert environment (≤1 torr vacuum or ≤ 700 torr helium) under normal operating conditions

Note: The Core Vessel environment will extend to the Nozzle Extensions accommodating the Instrument Systems Monolith Inserts. Vacuum pumping and instrumentation is in the scope of Target Vacuum Systems, but Vessel Systems and interfacing components that make up the vacuum boundary must be capable of maintaining the required pressure, i.e. to hold leak rates low enough to maintain the required pressure.

PHAR References:
AIC3-3, AIC3-4, AIC3-5, AIC3-9, AIC3-10, AS3-2, BG3-2, BG7-8, BG7-9A, BG7-9B, BG7-11, BG7-12, CMS1-1, CMS2-1, CMS2-2A, CMS2-2b (Credited), CMS2-2C, CMS3-4, CMS3-6, CMS3-7, CMS4-1, CMS4-2, CMS4-4, CMS7-1, CMS7-3, CMS7-5, CMS7-6, CMS7-7, CW3-1A, CW3-1B, CW3-1D, CW3-2A, CW3-2B, CW3-3A, CW3-3B, CW3-7A, CW3-7B, CW3-10, GW3-12, HB2-2, ISB3-1, RH3-11, TS3-2, TS3-3, TS3-4, TS3-5, TS3-6, TS3-7, TS3-8, TS3-9, TS3-10, TS3-12, VS1-1 (Credited), VS1-2, VS2-1A (Credited), VS2-1B, VS2-2, VS3-1, VS3-2

CodeBeamer reference: S.03.06-7058

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.11 Core Vessel Negative Pressure with Hatches Removed

Core Vessel shall have an exhaust port that provides negative pressure when Core Vessel lid hatches are removed.

PHAR References:
CMS2-2C (Credited), RH3-1, RH3-2, RH3-4, RH3-5, RH3-6, RH3-7, RH3-8, RH3-9, RH3-10, RH3-11, RH3-21, RH3-22, RH3-24, RH3-25, RH3-26, RH3-27, VS3-3

CodeBeamer reference: S.03.06-7059

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.12 Radiation Shielding Performance

Vessel Systems design, along with the other Target Systems components in the Monolith and Target Drive Room, shall not prevent necessary operations in the high bay due to radiation dose.

PHAR References:
RH4-7 (Credited), RH4-8 (Credited), RH4-9, RH4-10 (Credited), VS4-1 (Credited)

CodeBeamer reference: S.03.06-7060

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

2.13 Non-LOF Water-Cooled Component Connections

All water-cooled components that are not considered permanent shall have flanged connections that are broken for component removal.

PHAR References:
RH3-17, RH3-18, RH3-20

CodeBeamer reference: S.03.06-7063

Upstream References (2)

S.03-1035	Safe Operation
S.03-3009	Maintenance & Lifetime Criteria

2.14 Target Protection during LOCA

Core Vessel shielding shall assist in maintaining target temperatures below 800 C in a loss of cooling event.

Note: The shielding acts as a thermal sink that helps maintain target temperatures of < 800 C during a loss of cooling event

Note: LOCA to be performed by the Target Assembly group with input from Vessel Systems on shielding configuration.

PHAR References:
RG7-8, BG7-9A, BG7-9B, BG7-12, CMS7-1, CMS7-3, CMS7-5 (Credited), CMS7-6, CMS7-7 (Credited), TS3-2, TS3-3, TS3-5, TS3-6, TS3-7

CodeBeamer reference: S.03.06-7064

Upstream References (2)

S.03-1036	Radiation Safety
S.03-1035	Safe Operation

2.15 Temperature Monitoring

All vessel systems water cooled components should have thermocouples that monitor component temperature.

PHAR References:
CMS2-2C, CW3-1D, VS1-1, VS1-2, VS1-1A, VS1-1B, VS3-1

CodeBeamer reference: S.03.06-7065

Upstream References (2)

S.03-1035	Safe Operation
S.03-1036	Radiation Safety

3 VS-Target Assembly Interface

Requirements derived from Interface Sheet S01020500-IST10209

CodeBeamer reference: S.03.06-7117

3.1 Mechanical Load Support

Vessel Systems shall support the gravitational, imbalance, seismic and segment replacement loads imparted by the target assembly per Interface Sheet S01020500-IST10209 within the deflection limits specified in drawing S03000000-M8U-8800-A10001 at the physical locations specified in drawing S03020000-M8U-8800-A10000.

CodeBeamer reference: S.03.06-7118

Upstream References (1)

S.03.02-1482	Imposed forces

3.2 Limiting Ring Integration

Vessel Systems shall provide an interface including a mating face and tapped hole pattern to secure Target Assembly's limiting ring to the Layer 1 Core Vessel shielding. The interfacing dimensions are shown in drawing S0302000-M8U-8800-A10000.

Note: Currently missing from Interface Sheet S01020500-IST10209, will be added during next revision.

CodeBeamer reference: S.03.06-7119

Upstream References (1)

S.03.02-2840	Seismic Deflection

3.3 Limiting Ring Mechanical Support

Vessel Systems shall not allow horizontal motion of the portion of the target shaft that contacts the limiting ring in excess of xxxx under a 40 kN seismic side load imparted on the limiting ring by the target shaft.

Note: Currently missing from Interface Sheet S01020500-IST10209, will be added during next revision.

CodeBeamer reference: S.03.06-7120

Upstream References (1)

S.03.02-2840	Seismic Deflection

3.4 Target Segment Access

Vessel Systems shall allow access to a single target segment within 8 hours per Interface Sheet S01020500-IST10209.

NOTE 1: The clock starts when the Core Vessel is vented and stops when the Target Segment is exposed for removal.

NOTE 2: Driven by Target Segment requirement dictating time allotted for Segment replacement.

CodeBeamer reference: S.03.06-7121

Upstream References (1)

S.03.02.03-1504	Segment Replacement Time

3.5 Target Segment Personnel Access

Vessel Systems components shall allow space for personnel and tooling access to the target segment mounting hardware for removal, repair and reinstallation of target segments per Interface Sheet S01020500-IST10209.

CodeBeamer reference: S.03.06-7123

Upstream References (1)

S.03.02.03-1504	Segment Replacement Time

3.6 Target Segment Installation Guidance

The Core Vessel Shielding shall provide mechanical boundaries that ensure proper engagement of the target segment to the target shaft when a target segment is installed per Interface Sheet S01020500-IST10209.

CodeBeamer reference: S.03.06-7124

Upstream References (1)

S.03.02.03-1504	Segment Replacement Time

3.7 Shielding for Target Segment Removal and Installation

Vessel Systems shall allow for hands-on maintenance at the top of the target segment with the target removable shield block removed.

Note: A gamma gate assembly is moved into place after removable shield block removal to provide radiation protection during hands-on target maintenance.

CodeBeamer reference: S.03.06-7125

Upstream References (1)

S.03.02.03-1504	Segment Replacement Time

3.8 Target Shaft Bottom Support

Vessel Systems shall allow for the full 16,000 kg mass of the target assembly to rest on the bottom Core Vessel shield block without contacting the Moderator Reflector Assembly per Interface Sheet S01020500-IST10209.

CodeBeamer reference: S.03.06-7127

Upstream References (1)

S.03.02.02-1611	Shaft Maintenance Support

3.9 Target Assembly Seal

Vessel Systems shall provide a seal interface for the Target Assembly per Interface Sheet S01020500-IST10209 and drawing S03020000_G8U-8800-A10000.

CodeBeamer reference: S.03.06-7128

Upstream References (1)

S.03.02-1480	Leak Rate

4 VS-CMS Interface

Requirements derived from Interface Sheet S03000000-IST10010.

CodeBeamer reference: S.03.06-7115

4.1 Hydrogen Transfer Line Nozzle

Vessel Systems shall provide a nozzle in the side wall of the CV for the hydrogen transfer line per interface sheet S03000000-IST10010.

CodeBeamer reference: S.03.06-7136

Upstream References (1)

S.03.03.01-6102	Hydrogen Transfer Line Routing Requirement - Credited

4.2 Hydrogen Transfer Line Clearance

Vessel Systems shall provide ≥ 25mm of clearance between Vessel Systems hardware and the transfer line per interface sheet S03000000-IST10010.

CodeBeamer reference: S.03.06-8048

Upstream References (1)

S.03.03.01-6102	Hydrogen Transfer Line Routing Requirement - Credited

4.3 Hydrogen Transfer Line Support

Vessel Systems shall provide features in the top of the core vessel shielding stack to accommodate hydrogen transfer line supports designed and provided by CMS per Interface Sheet S03000000-IST10010.

CodeBeamer reference: S.03.06-8049

Upstream References (1)

S.03.03.01-6102	Hydrogen Transfer Line Routing Requirement - Credited

4.4 Hydrogen Transfer Line Welding Access

Vessel Systems shall provide appropriate welding access to the hydrogen transfer lines during MRA installation via removable hatches in the CV lid and removable shielding above the transfer lines per Interface Sheet S0300000-IST10010.

CodeBeamer reference: S.03.06-8050

Upstream References (1)

S.03.03.01-2397	Hydrogen Transfer Line Construction Requirement

5 VS-MRA Interface

Requirements derived from Interface Sheet S03000000-IST10009
CodeBeamer reference: S.03.06-7116

5.1 MRA Cooling Water Connections

Vessel Systems shall provide water supply and return lines that connect the Moderator Reflector Assembly water inlet and outlet flanges to the appropriate nozzles in the Core Vessel side wall per Interface Sheet S03000000-IST10009.

CodeBeamer reference: S.03.06-7137

Upstream References (1)

S.03.04-2347	MRA Replacement Requirement

5.2 MRA Cooling Water Line Tie-Downs

Vessel Systems will provide mounting features to accommodate Moderator Reflector Assembly water line tie-downs per Interface Sheet S03000000-IST10009.

CodeBeamer reference: S.03.06-7138

Upstream References (1)

S.03.04-2994	MRA Deflections Requirement

5.3 MRA Access

Vessel Systems shall allow access to the Moderator Reflector Assembly within 8 hours per Interface Sheet S03000000-IST10009.

Note: The clock starts when the removal of the Moderator Reflector Assembly access hatch in the Core Vessel lid begins and stops when the Moderator Reflector Assembly is exposed for removal.

CodeBeamer reference: S.03.06-7139

Upstream References (3)

S.03.04-2347	MRA Replacement Requirement
S.03.04-3590	MRA Installation Requirement
S.03.04-3589	MRA Removal Requirement

5.4 MRA Alignment Features

Vessel Systems shall provide mounting features in the Core Vessel shielding for mounting of the Moderator Reflector Assembly canoe sphere alignment system as described in Interface Sheet S03000000-IST10009.

CodeBeamer reference: S.03.06-7404

Upstream References (1)

S.03.04-2374	MRA Boundary Requirement

5.5 MRA Support

Vessel Systems shall support the loads imparted by the Moderator Reflector Assembly while maintaining the alignment tolerances specified in Interface Sheet S03000000-IST10009.

CodeBeamer reference: S.03.06-7405

Upstream References (1)

S.03.04-2994	MRA Deflections Requirement

6 VS-MRA-Target Interface

Requirements derived from Interface Sheet S01020500-IST10205

CodeBeamer reference: S.03.06-7406

6.1 Position and gaps

Vessel Systems shall ensure that all hardware adjacent to the Target and Moderator Reflector Assembly conforms to the positions and gaps outlined in Interface Sheet S01020500-IST10205.

CodeBeamer reference: S.03.06-7407

Upstream References (2)

S.03-1035	Safe Operation
S.03-1478	Hydrogen Boundary interactions

6.2 Positional deviations

Vessel Systems shall ensure that all hardware adjacent to the Target and Moderator Reflector Assembly does not deviate beyond the Vessel Systems tolerance allotment per Interface Sheet S01020500-IST10205.

Note: Anticipated deviations include manufacturing, alignment, seismic, thermal and pressure induced.

CodeBeamer reference: S.03.06-7408

Upstream References (2)

S.03-1478	Hydrogen Boundary interactions
S.03-1035	Safe Operation

7 VS-AIC Interface

Requirements derived from Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7140

7.1 Proton Beam Window Shielding Sealing Interface

Vessel Systems shall provide a sealing surface for the proton beam window shielding that is capable of achieving a <10^-4 Torr l/s leak rate.

CodeBeamer reference: S.03.06-7141

Upstream References (1)

S.03.05.02-7858	PBW Core Vessel Environment

7.2 Target Viewing Periscope Alignment Holes

Vessel Systems shall provide mounting holes in the Core Vessel Shielding for mounting of the Target Viewing Periscope canoe sphere alignment system in the locations described in Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7144

Upstream References (1)

S.03.05-5732	AIC Measure Beam on Target

7.3 Target Viewing Periscope Support

Vessel Systems shall support the loads imparted by the Target Viewing Periscope assembly while maintaining the alignment tolerances specified in Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7145

Upstream References (1)

S.03.05-5732	AIC Measure Beam on Target

7.4 Target Viewing Periscope Vacuum Flange

Vessel Systems will provide a flange seal mounting interface in the Core Vessel Lid as specified in Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7146

Upstream References (1)

S.03.05.03-3800	TVP Vacuum Leak Rate

7.5 Target Viewing Periscope Keep-Out Zones

Vessel Systems shall provide openings in the Core Vessel Shielding per Interface Sheet S01020500-IST10217

NOTE: Decomposes from TVP requirement 5445 to ensure that the Target Viewing Periscope can view the Target Segment without obstruction.

CodeBeamer reference: S.03.06-7147

Upstream References (1)

S.03.05.03-5445	TVP Viewing Target Segments

7.6 Target Viewing Periscope Doghouse Mounting

Vessel Systems shall provide features in the Core Vessel lid for mounting of the Target Viewing Periscope doghouse per Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7149

Upstream References (1)

S.03.05.03-7412	TVP Limit Radiation Exposure - High Bay

7.7 Target Viewing Periscope 3rd Mirror Mounting

Vessel Systems shall provide features in the Core Vessel lid for mounting of the Target Viewing Periscope 3rd mirror assembly per Interface Sheet S01020500-IST10217.

CodeBeamer reference: S.03.06-7151

Upstream References (1)

S.03.05-5732	AIC Measure Beam on Target

7.8 Target Viewing Periscope Position and Gaps

Vessel Systems shall ensure that all hardware adjacent to the Target Viewing Periscope conforms to the positions and gaps outlined in Interface Sheet S01020500-IST10217.

Note: Currently missing from Interface Sheet S01020500-IST10217, will be added during next revision.

CodeBeamer reference: S.03.06-7685

Upstream References (1)

S.03.05.03-7412	TVP Limit Radiation Exposure - High Bay

7.9 Positional Deviations

Vessel Systems shall ensure that all hardware adjacent to the Target Viewing Periscope does not deviate beyond the Vessel Systems tolerance allotment per Interface Sheet S01020500-IST10217

Note: Anticipated deviations include manufacturing, alignment, seismic, thermal and pressure induced.

Note: Currently missing from Interface Sheet S01020500-IST10217, will be added during next revision.

CodeBeamer reference: S.03.06-7686

Upstream References (1)

S.03.05-5732	AIC Measure Beam on Target

8 VS-Process Systems Interface

Requirements derived from Interface Sheet S03000000-IST10004.

CodeBeamer reference: S.03.06-7154

8.1 Utility Nozzle Connections

Vessel Systems shall provide utility nozzles in the sidewall of the Core Vessel that allow cooling water and helium gas provided by Process Systems to enter the Core Vessel. Vessel Systems shall provide the interfacing locations of all Core Vessel beltline utility waterlines. The sizes and locations of all utility nozzles and water connections are specified in Interface Sheet S03000000-IST10004.

CodeBeamer reference: S.03.06-7155

Upstream References (1)

S.03.09-6115	Cooling Services

8.2 Cooling Water Requirements

Vessel Systems will provide the required cooling water specifications for all water cooled components within Vessel Systems scope to Process Systems per Interface Sheet S03000000-IST10004.

CodeBeamer reference: S.03.06-7156

Upstream References (1)

S.03.09-6115	Cooling Services

8.3 Target Water Line Support

Vessel Systems will support target water line support assemblies on top of the Core Vessel lid per Interface Sheet S03000000-IST10004.

CodeBeamer reference: S.03.06-7159

Upstream References (1)

S.03.09-6115	Cooling Services

8.4 Pressure Drop

Vessel Systems water cooled components should have pressure drops less than 103.4 kPa (15 PSI) at 30.3 L/min (8 gpm) per cooling line.

CodeBeamer reference: S.03.06-7187

Upstream References (1)

S.03.09-6115	Cooling Services

8.5 Water Boundary Pressure

Vessel Systems water cooled components shall have a MAWP of 500 kPa.

Note: Pressure relief devices will be specified to ensure that the MAWP is not exceeded at the shield block locations.

CodeBeamer reference: S.03.06-7188

Upstream References (1)

S.03.09-6115	Cooling Services

9 VS-Remote Handling Interface

Requirements derived from Interface Sheet S03000000-IST10006.

CodeBeamer reference: S.03.06-7161

9.1 Removable Component Lifting Interfaces

Vessel Systems shall provide lifting interfaces for all removable Vessel Systems components per Interface Sheet S03000000-IST10006.

CodeBeamer reference: S.03.06-7162

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

9.2 Gamma Gate Control

Vessel Systems shall provide power and control requirements for the gamma gate linear actuator to Remote Handling per Interface Sheet S03000000-IST10006.

CodeBeamer reference: S.03.06-7163

Upstream References (1)

S.03-1035	Safe Operation

10 VS-Vacuum Systems Interface

Requirements derived from Interface Sheet S03000000-IST10008.

CodeBeamer reference: S.03.06-7614

10.1 Vacuum Pumping Performance

The Core Vessel shall be capable of maintaining an operating pressure of ≤1 torr.

CodeBeamer reference: S.03.06-7615

Upstream References (1)

S.03-3009	Maintenance & Lifetime Criteria

10.2 Operability with Water Leaks

Vacuum Systems shall be able to operate with a small internal water leak per Interface Sheet S03000000-IST10008.

CodeBeamer reference: S.03.06-7617

Upstream References (1)

S.03-1033	Yearly Operating Hours

11 VS-Instrument Systems Interface

Requirements derived from Vessel Systems to Conventional Facilities Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7164

11.1 Monolith Insert Clearance

Vessel Systems shall provide gaps between the monolith inserts and the Core Vessel technical components (nozzle extensions, Core Vessel beltline and Core Vessel internal shielding) per Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7165

Upstream References (1)

S.03-1030	Number of Beamlines

11.2 Monolith Insert Interfacing Component Tolerances

Vessel Systems shall maintain dimensional tolerances of monolith insert interfacing components (nozzle extensions, Core Vessel beltline and Core Vessel internal shielding) per Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7166

Upstream References (1)

S.03-1029	Peak Brightness

11.3 Monolith Insert Sealing

Vessel Systems shall provide a flanged sealing interface at the rear of each nozzle extension that corresponds to the Monolith Insert geometry per Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7167

Upstream References (1)

S.03-1029	Peak Brightness

11.4 Monolith Insert Support

Vessel Systems shall mechanically support the monolith inserts while maintaining the tolerances described in Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7168

Upstream References (1)

S.03-1029	Peak Brightness

11.5 Monolith Insert Installation Support

Vessel Systems shall support the Monolith Inserts during the installation process without plastic deformation per Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7169

Upstream References (1)

S.03-1029	Peak Brightness

11.6 Neutron Flight Path to Monolith Inserts

Vessel Systems shall provide clearance within the Core Vessel Shielding to ensure an unobstructed path between the monolith insert windows and the moderator per Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7170

Upstream References (1)

S.03-1029	Peak Brightness

11.7 Monolith Insert Seal Leak Rate

Vessel Systems shall accommodate the monolith insert rear seal leak rates specified in Interface Sheet S01020500-IST10025.

CodeBeamer reference: S.03.06-7171

Upstream References (1)

S.03-1029	Peak Brightness

11.8 Monolith Insert Over Pressurization Protection

Vessel Systems shall ensure that the monolith inserts are not subjected to a positive pressure greater than XXXXX per Interface Sheet S01020500-IST10025.

Note: This is not currently captured in the interface sheet, but I suggested to Pete that he add it.

CodeBeamer reference: S.03.06-7172

Upstream References (1)

S.03-1033	Yearly Operating Hours

12 VS-Integrated Controls Interface

Requirements derived from Interface Sheet S01020500-IST10128

CodeBeamer reference: S.03.06-7173

12.1 Vessel Systems Temperature Monitoring

Vessel Systems should include devices for monitoring the temperature of all cooled shield blocks as well as the cooled Core Vessel beltline per Interface Sheet S01020500-IST10128.

CodeBeamer reference: S.03.06-7178

Upstream References (1)

S.03-1035	Safe Operation

12.2 Thermocouple Wiring

Vessel Systems shall provide pin-out IDs for all temperature monitoring device connections to the hermetic feedthroughs per Interface Sheet S01020500-IST10128.

CodeBeamer reference: S.03.06-7179

Upstream References (1)

S.03-1035	Safe Operation

12.3 Hermetic Electrical Feedthroughs

Vessel Systems shall provide and install hermetic feedthroughs allowing thermocouple signal transfer out of the Core Vessel per Interface Sheet S01020500-IST10128.

CodeBeamer reference: S.03.06-7180

Upstream References (1)

S.03-1035	Safe Operation