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| ICD-R PCool\_Target Intermediate Cooling |
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|  | Name | Title |
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# Introduction

This document is referred to from document **ESS-0005826 ICD Fluid Systems - Target Systems** [2] in accordance with [1].

Three heat exchangers are included in system 1010. A temperature sensor and 3 water circulation pumps are included in Target Intermediate cooling system thus signals and water flanges are interfaces described.

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Figure 1 Interfaces included in this document marked in red

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Figure 2 Heat exchangers secondary side flanges interfaces and signal interfaces.

Red= interfaces, Black = 1010, Blue = Intermediate cooling

# 2. INTERFACE agreement

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| --- | --- |
| **Description** | **Reference** |
| Signal interfaces  Note that the signals does not go directly between the two systems but via the Process Control system | Section 2.1 |
| Physical connection interfaces | Section 2.2 |

## 2.1 Signal interfaces

| ID | **1010-400** | **Intermediate systems status** |
| --- | --- | --- |
| **Requirement** | A status signal (ready for operation) from Target Intermediate cooling system to Target helium cooling systems | |
| **Rationale/Reference** | This signal is needed for Target helium cooling systems to secure that the Target Intermediate cooling system is ready to receive the cooling power, and for early alert in case of failure | |

| ID | **1010-401** | **Temperature in the return water** |
| --- | --- | --- |
| **Requirement** | Process value; temperature in the return water from heat exchanger W01 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-402** | **Water flow control set point W001** |
| --- | --- | --- |
| **Requirement** | Water flow control set point through heat exchanger W01 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-403** | **Water flow control set point, W002** |
| --- | --- | --- |
| **Requirement** | Water flow control set point through heat exchanger W02 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-404** | **Water flow control set point, W003** |
| --- | --- | --- |
| **Requirement** | Water flow control set point through heat exchanger W03 | |
| **Rationale/Reference** | To fulfil basic functions | |

## Physical connection interfaces, water pipe flanges

| ID | **1010-451** | **Pipe flange water inlet W001** |
| --- | --- | --- |
| **Requirement** | Inlet 55±2°C, max 2.5 MPa\*, Max normal flow 10 kg/s, Flange; Steel quality normal stainless austenitic, DN80, PN32 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-452** | **Pipe flange water outlet W001** |
| --- | --- | --- |
| **Requirement** | Outlet max 120°C, max 0.2MPa, Max normal flow 10 kg/s, Flange; Steel quality normal stainless austenitic, DN80, PN16 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-453** | **Pipe flange water inlet W002** |
| --- | --- | --- |
| **Requirement** | Inlet 55±2°C, max 0.2MPa. Max normal flow 7 kg/s, Flange; Steel quality normal stainless austenitic, DN80, PN16 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-454** | **Pipe flange water outlet W002** |
| --- | --- | --- |
| **Requirement** | Outlet max 120°C, max 0.2MPa, Max normal flow 7 kg/s, Flange; Steel quality normal stainless austenitic, DN80, PN16 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-455** | **Pipe flange water inlet W003** |
| --- | --- | --- |
| **Requirement** | Inlet 35±2°C, max 0.2MPa. Max normal flow 5 kg/s, Flange, Steel quality normal stainless austenitic, DN80, PN16 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-456** | **Pipe flange water outlet W003** |
| --- | --- | --- |
| **Requirement** | Outlet max 120°C\*\*, max 0.2MPa, Max normal flow 5 kg/s, Flange; Steel quality normal stainless austenitic, DN80, PN16 | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-457** | **Heat power normal maximum W001** |
| --- | --- | --- |
| **Requirement** | Transferred normal maximum heat power 1500kW | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1010-458** | **Heat power normal maximum W002** |
| --- | --- | --- |
| **Requirement** | Transferred normal maximum heat power 1000kW | |
| **Rationale/Reference** | To fulfil basic functions0 | |

| ID | **1010-459** | **Heat power normal maximum W003** |
| --- | --- | --- |
| **Requirement** | Transferred normal maximum heat power 750kW | |
| **Rationale/Reference** | To fulfil basic functions | |

| ID | **1046-100** | **Heat exchangers barrier resistance to tritium diffusion** |
| --- | --- | --- |
| **Requirement** | The heat exchangers barrier, between primary and secondary side, resistance to limit the diffusion of tritium to maximum XXX mol/m2\*s | |
| **Rationale/Reference** | Requirement for allowance to discharge water from the target intermediate water cooling to the city sewage system, and internal ESS requirement that this water shall be clean enough to discharge to the city sewage system at least twice/year not exceeding the total limit for ESS by a certain percentage.  Since tritium is present in Target Primary cooling loop, a certain diffusion flux of tritium will pass the barrier in the heat exchangers to the water side. With a 0.5mm thick barrier, the flux is 1.0E-13 mol/m2\*s [5], and resulting amount tritium after one year of operation is ≈1.7 mg/y with a radiation of 413 GBq/m3. | |

(\*) If heat exchanger 1 is configured as concurrent the inlet water will meet the surface at up to 250°C.

(\*\*) During normal operation the temperatures are below 100°C.

# References

[1] ESS-0002917 Interface Management Plan

[2] ESS-0012524 SDD-req. Target Helium Cooling

[3] ESS-0012527 SDD-sol. Target Helium Cooling

[4] TDR (Technical Design Report)

[5] ESS-0054291; One dimensional permeation of tritium through a thin stainless steel plate. Y. Lee, March 29, 2016

List of Abbreviations

| Abbreviation | Definition |
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# Document Revision history

| Version | Reason for revision | Date |
| --- | --- | --- |
| 1.0 | New document (using new template) | 2015-04-16 |
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