ICD PCool_Target

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	Name	**Title**
Owner	Jens Harborn	Work unit leader - Target Cooling
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1. INTRODUCTION

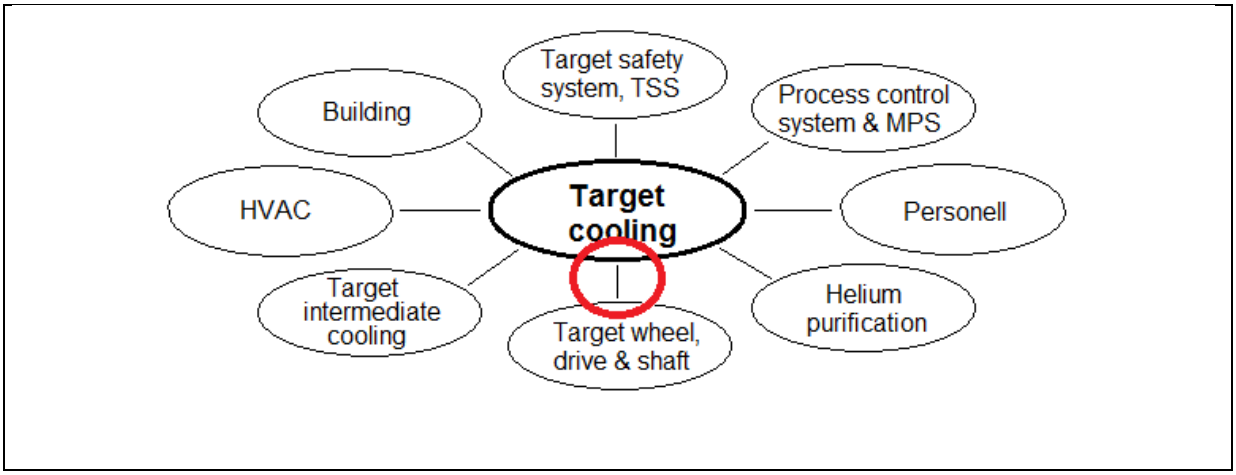

Figure 1. Interfaces included in this document marked in red

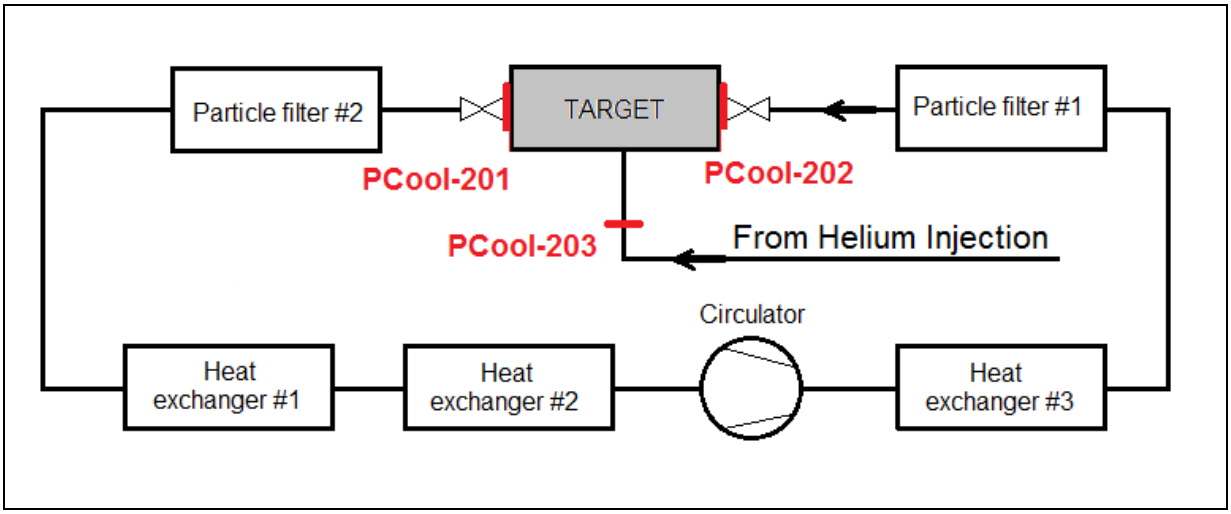

Figure 2. Flange interfaces id numbers and locations

2. INTERFACE AGREEMENT

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
Requirements put on target wheel	Section 2.3
General process values and parameters	Section 2.4
Cooling media purity requirements (particles < 5 µm, chemical and radiological purity)	ESS-0030664

2.1 Signal interfaces

ID	PCool-200	Cooling power order
Requirement	An order signal from Target wheel to PCool to set a fixed cooling helium flow	
Rationale/Reference	When e.g. the proton beam it shut off an increased cooling may be needed to remove the decay heat from the tungsten blocks	

2.2 Physical connection interfaces

ID	PCool-201	Pipe flange with flow to target
Requirement	Stainless steel* DN200, PN16, max temp 150°C**, operational pressure 1.00 MPa, Flow rate max 3.0 kg/s. Maximum leakage rate 10mg/h***.	
Rationale/Reference	To fulfil basic functions	

ID	PCool-202	Pipe flange with flow from target
Requirement	Stainless steel* DN250, PN16, max temp 250°C**, operational pressure 1.00 MPa. Maximum leakage rate 10mg/h***.	
Rationale/Reference	To fulfil basic functions	

ID	PCool-203	Pipe flange with seal flow to/from target
Requirement	Stainless steel* DN20, PN16, max temp 50°C, operational pressure 1.00 MPa. Maximum leakage rate 5mg/h***.	
Rationale/Reference	To fulfil basic functions.	

(*) Steel quality normal stainless austenitic; general requirement for all pipe parts and fittings
(**) To secure tightness even if abnormal situation
(***) To comply with the over-all maximum leakage rate for Target cooling systems [2]

2.3 Requirements put on target wheel

ID	PCool-204	Maximum amount of particles formed
Requirement	Maximum amount of particles formed during 5000h of normal operation is 3.5kg	
Rationale/Reference	To put an upper limit for the total amount of particles to be handled by the filters	

ID	PCool-205	Maximum pressure drop over Target
Requirement	Total pressure drop from target inlet flange to target outlet flange shall be maximum 90 kPa at nominal helium flow of 3kg/s and 40 °C inlet to target	
Rationale/Reference	To put an upper limit of 150 kPa; 90(target wheel and shaft) + 60(PCool circuit) for the circulators to achieve	

2.4 General process values and parameters

ID	Wheel-200	Heat removal power
Requirement	Continuous heat removal of minimum 3.0 MW	
Rationale/Reference	Based on top level target design decision and proton beam power decision. Machine safety, basic function.	

ID	Wheel-201	Cooling media
Requirement	Helium as cooling media	
Rationale/Reference	Based on ESS top level decision, according to TDR page 225	

ID	Wheel-202	Cooling media maximum normal flow
Requirement	Helium maximum normal flow rate is 3.0 kg/s	
Rationale/Reference	Based on reliability and costs, limited creep and thermal loads on systems, including thermal dilatation of the Target Wheel during operation; if lower flow the outlet temperature will be higher or the inlet temperature must be lower to fulfil requirement Wheel-200, also refer to requirement Wheel-203.	

ID	Wheel-203	Cooling media temperature values
Requirement	Lowest allowed temperature of helium in to target 20°C. Maximum temperature of helium in to target 55°C. Maximum temperature of helium out from the target 250°C.	
Rationale/Reference	Based on ESS top level decision according to TDR page 225. Basic functions. Above stated limits the inlet temperature to not lower than 20°C but *lowest possible* is limited by the cooling water temperature in system Target Intermediate cooling. The requirement maximum temperature of helium out from the target is limiting the helium flow not below approximately 3.0 kg/s at full proton beam power.	

ID	Wheel-204	Maximum operational pressure
Requirement	Maximum allowed operational pressure 1.1MPa (11 bar)	
Rationale/Reference	Based on engineering judgment by the target division [1], [3]. Basic functions, cost, safety.	

ID	Wheel-205	Minimum operational pressure
Requirement	Minimum operational pressure 0.7 MPa (7 bar)	
Rationale/Reference	Based on engineering judgment by the target division [1]. Basic functions, cost.	

ID	Wheel-206	Pipe connections adapted for plug removal
Requirement	The pipe connections to / from the target wheel shall have pipe parts to be disassembled to enable target plug removal	
Rationale/Reference	(discussed at the interface meeting Francois, Ulf, Kristoffer 14-11-04)	

ID	Wheel-207	Seal gas mass flow
Requirement	Seal buffer gas mass flow shall be in the range of 5 – 100 mg/h	
Rationale/Reference	Depends on the final target rotational seal solution. The pressure in the seal gas pipe needs to be adopted for a certain flow.	

ID	Wheel-208	Seal gas maximum temperature
Requirement	Seal buffer gas temperature shall be maximum 50 °C	
Rationale/Reference	Depends on the final target rotational seal solution	

ID	Wheel-209	Concentration of particulates
Requirement	Cooling media maximum concentration of particulates >= 5 µm shall be 1 ppb	
Rationale/Reference	To limit the erosion effects on the target	

REFERENCES

1. TDR (ESS Technical Design Report)
2. ESS-0012524 SDD-req. Target Helium Cooling
3. ESS-0012362 Decision basis for the pressure in the Target Helium Cooling System

LIST OF ABBREVIATIONS

Abbreviation	Definition

DOCUMENT REVISION HISTORY

Version	Reason for revision	Date
1.0	New document (using new template)	2015-04-16
3	ID Wheel.207 - 5 – 100 mg/s changed to 5 – 100 mg/h	2016-07-04