Nationaal Lucht- en Ruimtevaartlaboratorium

National Aerospace Laboratory NLR

AMS Tracker Thermal Control Subsystem

TTCS Requirements Verification Matrix FM H/W

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Document change log

Change Ref.	*Section(s)*	*Issue 1.0*
-	All	Initial issue
Change Ref.	*Section(s)*	*Issue 2.0*
	Added PW-06	Power of Ground accumulator heater
	Added LP-33	Ground accumulator alarm proper functioning
	Added LP-34	Tracker alarm proper functioning
Change Ref.	*Section(s)*	*Issue 2.0*
	Section 2	Verifications updated and added
Change Ref.	*Section(s)*	*Issue 3.0*
	Page 3	Abbreviations added
	Sections	All verifications added

Abbreviations

TBS	To Be Scanned
TBF	To Be Filled
TBU	To Be Updated
TBW	To Be Written

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Summary

This document presents the TTCS requirements verification matrix for FM Hardware.

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(26 pages in total)

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1 Scope of the document

The objectives of the document are:

- List the TTCS requirements for mission success
- List the verification methods for each requirement
- List the verification responsible

The document will be provided to the AMS02 integration team and AMS Thermal working group. The document will be updated accordingly.

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The Matrix contains the following information:

1. **Requirement ID**

   Each requirement has an unique identifier with format TTCS-TY-XX

   in which TY is the type of requirement and XX the identification number. The following types are used:

   PE: Performance

   ME: Mechanical

   PW: Power

   EV: Environmental

   IN: Integration

2. **Requirement description**

   Describes the requirement and if necessary its objective.

3. **TTCS Responsible**

   - the following companies are included

   SYSU, AMS, UG, CAST, PDT, CGS, BE, Space Cryomagnetics, Jacobs Sverdrup, INFN and NLR.

   In some cases two parties are responsible. In the matrix will be mentioned who is responsible for what part.

4. **Verification Method and level**

   The verification of a safety aspect can be performed by the following methods:

   D = Review of Design

   T = Test

   A = Analysis

   I = Inspection

   S = Similarity

   P = Review of Procedure

   N/A = Not Applicable

   NTBT = Not To Be Tracked

   The verification can be performed at component level (APS, DPS, Pump, Accumulator) at box level, TTCS level or at AMS integrated level.:

   CL = Component Level

   BL = Box level

   TTCS = TTCS level

   AMS = AMS integrated level

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2 Requirements Verification Matrix (FM Hardware)

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
	Functional Performance		**N/A**	**TTCS**	**N/A**	**N/A**	
	Loop Performance		**N/A**	**TTCS**	**N/A**	**N/A**	
LP-01	Evaporator temperature stability < 3 K per orbit	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-02	Tracker Cooling Capacity P ≥ 154 W	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-03	Performance at Environmental Extremes (Tracker operational) • Cold orbits T_{HB} > - 12 °C • Hot orbits T_{HB} < + 25 °C	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-04	Performance at Environmental Extremes (Tracker non-operational) • Cold orbits T_{HB} > - 20 °C • Hot orbits T_{HB} < + 40 °C	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-05	Accumulator set-point rate change • Increase (1 K/min TBC) • Decrease (0.5 K/min TBC)	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0 Page 29,59,81,97,117, 145	0.59-0.78 K/min 0.06-0.25 K/min
LP-06	Mass flow rate adjustments	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-07	TTCS Start-up in cold conditions T_{HB} > - 20 °C	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-04-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM QM

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-08	TTCS Start-up in hot conditions $T_{HB} < + 40$ °C	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-08b	TTCS supercritical and vapour start-up	NLR/SYSU	T	CL Pump/ TTCS QM Perf. Test			
LP-09	Flawless TTCS operation during Tracker start-up in cold conditions	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-10	Flawless TTCS operation during Tracker start-up in hot conditions	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-11	Flawless Tracker shutdown in cold conditions	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM
LP-12	Flawless Tracker shutdown in hot conditions	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM 3D-lay-out QM

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-13	Pressure drop µ-g operation • < 150 mbar @ 1g/s hot • < 850 mbar @ 4g/s hot • < 150 mbar @ 1g/s cold • < 850 mbar @ 4g/s cold	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-04-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM QM
LP-14	Pressure drop ground test (3-D) operation • Able to start in cold case (pressure head required) • Able to start in hot case (pressure head required)	SYSU	T	TTCS EM Perf. Test	AMSTR-SYSU-TPR-012-iss1.0	AMSTR-SYSU-TRP-010-iss1.0	EM 3D-lay-out
LP-15	Extreme gradient operation • Highest positive T-gradient (orbit) • Highest negative T-gradient (orbit)	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-04-iss1.0 AMSTR-SYSU-TRP-010-iss1.0	EM EM EM 3D-lay-out

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-16	Show flawless operation at 50% Tracker heater imbalance	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-02-iss2.0 AMSTR-SYSU-TPR-012-iss1.0 AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-05-iss1.0 AMSTR-SYSU-TRP-04-iss1.0 AMSTR-SYSU-TRP-010-iss1.0 AMSTR-SYSU-TRP-016-iss2.0	EM EM EM 3D-lay-out QM
LP-16b	Show flawless operation while switching Tracker segments	SYSU	T	TTCS QM Perf. Test	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-17a	TTCS Cleanliness box No metallic particles	Box integrators	P	CL Pump Accumulator CL HX CL APS/DPS	N/A AMS02-CAST-TTCS-ACC-DR-002 AMSTR-NLR-PR-056-Iss2 (HX) N/A Cleaning after transport	5059-113 SN-01 and 02 CoC 5059-113 SN-03 and 04 CoC AMSTR-CAST-TN-002 ADP Accu AMSTR-NLR-PR-056_ HX_Cleaning_Procedure_HX-FM1 AMSTR-NLR-PR-056_ HX_Cleaning_Procedure_HX-FM2 AMSTR-SYSU-VER-001_iss01 AMSTR-NLR-PR-075	Details on request Details on request
LP-17b	TTCS Cleanliness tubes No metallic particles	Tubes integrator	P	CL tubes	AMSTR-NLR-PR-008-iss04	AMSTR-NLR-PR-039-Transport_Tube_Results.xls	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-17c	TTCS Cleanliness condensers No metallic particles	AIDC	P	CL condenser	AMSTR-NLR-PR-039_Iss01	AMSTR-NLR-PR-039_040_FM1_FM4_condenser_tube_He_and_cleaning_records.zip	
LP-18a	TTCS Cleanliness box Non-metallic particles	Box integrator	P	TTCS Box integration	AMSTR-NLR-PR-008-iss03	AMSTR-NLR-PR-008__iss03_TTCB_S_cutting procedure_filled_sheets AMSTR-NLR-PR-008__iss03_TTCB_P_cutting procedure_filled_sheets FM_QM_Box_tube_Cleaning_check_08_01_2009_iss01.xls FM1_FM2__Pre_heater_Cleaning_check_08_01_2009_iss01.xls	Part sheets not filled (decided to perform a cleanliness check)
LP-18b	TTCS Cleanliness tubes Non -metallic particles	Tubes integrator	P	CL tubes	AMSTR-NLR-PR-008-iss04	AMSTR-NLR-PR-039-Transport_Tube_Results.xls	
LP-18c	TTCS Cleanliness (condensers) Non-metallic particles	AIDC	P	CL condenser	AMSTR-NLR-PR-039_Iss01	AMSTR-NLR-PR-039_040_FM1_FM4_condenser_tube_He_and_cleaning_records.zip	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-19	TTCS Leak Tightness < $1x10^{-7}$ mbar.l/s	SYSU/NLR	T	AMS	AMSTR-NLR-PR-025-Iss01 AMSTR-NLR-PR-074_TTCS_Pinch_and_close_procedure	AMSTR-NLR-PR-025_TTCB_He_leak_test_filled_sheets.zip Pre-vibr, Post-vibr, Pre-TV, Pre_EMI, CERN (added will be TTCS-loops prior to filling) AMSTR-NLR-PR-074-filled-sheets-P (TBF) AMSTR-NLR-PR-074-filled-sheets-S (TBF)	
LP-20	Accumulator level	NLR	A(&T)	TTCS	Background documents Verification via LP-19 & fill accuracy IN-01	AccuLoop content Primary issue7_3.xls AccuLoop content Secondary issue7_3.xls	Explaining document might be needed. Verif. by LP-19 and IN-01

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
	Control Scenarios		**N/A**	**TTCS**	**N/A**	**N/A**	
LP-22	Accumulator control • Control heater control • Emergency heater control	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0 Deleted from design	AMSTR-SYSU-TRP-016-iss2.0 TTCS-SYSU-TEST-TRP-017-1.0-TTCS_Control_optimization.pdf Deleted from design	
LP-23	Pre-heater control • Proper control in operating range	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0 (use TTCE_Data_Type3.pdf to understand control)	
LP-24	Start-up heater control • Proper control in operating range	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-25	Cold orbit heater control • Proper control in operating range	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-26	Pump inlet temperature subcooling margin safeguard • Proper function at limits	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-27	Tracker Temperature too low safeguard • Proper function	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-28	APS/DPS Operation in Loop • Accuracy	SYSU	T	TTCS	APS AMSTR-SYSU-TPR-016-iss1.0 DPS AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0 AMSTR-SYSU-TRP-016-iss2.0 AMSTR-NLR-TN-057_1.0_TTCB_S_DPS_Noise_Test_Summary.pdf	Only indicative measuring possible due to hydraulic vibration noise
LP-29	Pump Cooling in Loop • Housing T-check	SYSU	T	TTCS	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0 (See pump start-up in vapour phase)	
LP-30	Liquid Line Heaters • Continuous on • Start-up behaviour (RC)	SYSU	T	AMS	AMSTR-NLR-PR-058_TTCS_LSS_procedure (TBW)	AMSTR-NLR-TR-009_TTCS_LSS_Test_Report (TBW)	
LP-31	OHP Experiment on operation	SYSU	NTBT		Deleted from design		

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Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-32	Thermal Switch location $T_{Operation} < T_{Switch}$ (no power cut during operation) TS accumulator control heater	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-33	Ground accumulator heater alarm proper functioning	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-34	Tracker alarm proper functioning	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-35	Pre-heater health guard proper functioning (non-operational)	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-36	Low pumps speed alarm proper functioning	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	N/A yet	
LP-37	Flawless switch between TTCE-A and TTCE-B	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-38	Thermal switch temperature check: Cold orbit heater (non-operational pump)	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
LP-39	Thermal switch temperature check: Start-up heater (non-operational pump)	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-40	Thermal switch temperature check: Peltier elements (non-operational pump)	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
LP-41	Thermal switch temperature check: Flight Accu heaters (non-operational pump)	SYSU	T	TTCS QM	AMSTR-SYSU-TPR-016-iss1.0	AMSTR-SYSU-TRP-016-iss2.0	
	Mechanical Requirements						
ME-01	Box Mass	Box Integrator	T	BL	ATS1225-TTCS-090908-01_TTCS_TTCB_Installation-R0	Filled ATS	
ME-02	Tubing Mass	INFN	T	CL	ATS1225-TTCS090701-01	ATS1225-TTCS090701-01-Appendix_tube_details.xls	
ME-03	Proof Pressure 1.5 x MDP MDP =160 bar --> 240 bar	Box Integrator NLR	T	BL TTCS	AMSTR-NLR-PR-026_TTCB_Proof_pressure_test_procedure_iss02	AMSTR-NLR-PR-026_TTCB FM-P_Proof pressure test sheet.pdf AMSTR-NLR-PR-026_TTCB FM-S_Proof pressure test sheet.pdf	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
ME-04	Volume Check (Secondary and Primary loop)	SYSU	T	TTCS	AMSTR-SYSU-PR-024 FM_TTCB_Filling_and_venting_ procedure Iss02	AMSTR-SYSU-PR-024 FM_TTCB_sheets (TBF)	
	Power Consumption		**N/A**	**TTCS**	**N/A**	**N/A**	
PW-01	Power Consumption Pump in loop	SYSU	T	(CL) TTCS	Tests are to verify the specs in AMSTR-NL-TN-010_Iss4_Pump_Requirements	5059-113 SN-01 and 02 CoC Data 5059-113 SN-03 and 04 CoC Data	Procedure details are to be collected directly at PDT in view of ITAR
PW-02	Pre-heater power consumption	SYSU	T	CL BL BL	AMSTR-SYSU-PR-015_Pre-heater_incoming_outgoing_inspe ction_procedure AMSTR-NLR-PR-028_TTCB_functional_check_vi bration_procedure TTCS-SYSU-TEST-TPR-017-1.0 TTCB LIMITED FUCTIONAL CHECK PROCEDURE .doc	AMSTR-SYSU-PR-015_Pre-heater_FM-P&FM-S_Inc_Inspec_sheets.pdf AMSTR-NLR-PR-028_TTCB_filled sheets (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_SERMS (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_CERN (TBS)	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
PW-03	Cold orbit heater power consumption	SYSU	T	BL BL	TTCS-SYSU-TEST-TPR-017-1.0 TTCB LIMITED FUCTIONAL CHECK PROCEDURE .doc	TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_SERMS (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_CERN (TBS)	
PW-04	Start-up heater power consumption	SYSU	T	BL	TTCS-SYSU-TEST-TPR-017-1.0 TTCB LIMITED FUCTIONAL CHECK PROCEDURE .doc	TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_SERMS (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_CERN (TBS)	
PW-05	Liquid line heater power consumption	SYSU	T	BL	AMSTR-NLR-PR-043-Iss05 Condenser heaters installation procedure	AMSTR-NLR-PR-043-filled_sheets (TBF)	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
PW-06	Flight Accumulator heater power consumption	SYSU	T	CL	AMSTR-AIDC-PR-016 Accu incoming & outgoing inspection_Latest	AMSTR-AIDC-PR-016 Accu_Inc_Ins_Pros_FMP-After_Heater_Rework.pdf AMSTR-AIDC-PR-016 Accu_Inc_Ins_Pros_QM-After_Heater_Rework.pdf	
				BL	AMSTR-NLR-PR-028_TTCB_functional_check_vibration_procedure	AMSTR-NLR-PR-028_TTCB_P_Functional_Check_Vibr_filled_sheets (TBS) AMSTR-NLR-PR-028_TTCB_S_Functional_Check_Vibr_filled_sheets (TBS)	
					TTCS-SYSU-TEST-TPR-017-1.0 TTCB LIMITED FUCTIONAL CHECK PROCEDURE .doc	TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_SERMS (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_CERN (TBS)	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
PW-07	OHP heater power consumption		NTBT				Deleted from design
PW-08	Ground Accumulator heater power consumption	SYSU	T	BL	TTCS-SYSU-TEST-TPR-017-1.0 TTCB LIMITED FUCTIONAL CHECK PROCEDURE .doc	TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_SERMS (TBS) TTCS-SYSU-TEST-TPR-017-1.0_filled_sheets_CERN (TBS)	
	Environment and Interfaces						
	Mechanical						
EV-01	Mechanical Interface • bolt pattern base plate • bolt pattern components	SYSU	T	BL (CL)	ET5998-06-DRP-TTCB-PRIMARY-FM_REV14_2009_09_17 ET5998-08-DRP-TTCB-SECONDARY-FM_REV1_2009_09_17.zip		
EV-02	Random Vibrations	INFN (QM)	T	BL	AMSTR-NLR-PR-30_3_0_TTCB_FM_Vibration_test_procedure	VIBRPT64-1-121-S3023R.pdf VIBRPT64-2-121-S3023R.pdf	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
EV-03	Sinusoidal Vibrations	INFN (QM)	T	BL	AMSTR-NLR-PR-30_3_0_TTCB_FM_Vibration_test_procedure	VIBRPT64-1-121-S3023R.pdf VIBRPT64-2-121-S3023R.pdf	
EV-04	Steady state acceleration	INFN (QM)	T	BL	AMSTR-NLR-PR-30_3_0_TTCB_FM_Vibration_test_procedure	VIBRPT64-1-121-S3023R.pdf VIBRPT64-2-121-S3023R.pdf	
EV-05	Shocks	INFN (QM)	T	BL	N/A	N/A	
	Electrical						
EV-06	EMC Requirements	INFN (QM)	T	BL	AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_iss01 AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_PartB__iss02.pdf		

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
EV-07	Radiation Susceptibility	SYSU/MIT	R	CL	AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_iss01 AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_PartB__iss02.pdf	AMSTR-NLR-TR-008_2_0_TTCB_P_EMI_EMC_Test_Report (TBU)	
EV-08	Common Mode Susceptibility	SYSU/MIT	R	CL	AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_iss01 AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_PartB__iss02.pdf	AMSTR-NLR-TR-008_2_0_TTCB_P_EMI_EMC_Test_Report (TBU)	
EV-09	Susceptibility to electrostatic discharge	SYSU/MIT	R	CL	AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_iss01 AMSTR-NLR-PR-029_TTCB_EMC_EMI_procedure_PartB__iss02.pdf	AMSTR-NLR-TR-008_2_0_TTCB_P_EMI_EMC_Test_Report (TBU)	

1	2	4	5	6	7	8	9
Requirement ID	Requirement Description	TTCS Responsible	Verification Method		Documents		Results
TTCS-			Method	Level/ Phase	Executing Document	Reporting Document	RFW/Deviations
	Integration						
IN-01	Fill accuracy shall be checked during filling	SYSU	T	AMS	AMSTR-SYSU-PR-024_FM_TTCB_Filling_and_venting_procedure_iss1_1.doc	AMSTR-SYSU-PR-024_FM_TTCB_Filling_and_venting_sheets (TBF)	
IN-02	Check System closure (pinch and weld)	NLR	I	AMS	AMSTR-NLR-PR-074 TTCS Pinch and close procedure (TBW)	AMSTR-NLR-PR-074 TTCS Pinch closure fille sheets (TBF)	
IN-03	TTCS Box MLI shall be mounted after filling	NLR/AMS	I	AMS	ATS by CGS	ATS by CGS	
IN-04	TTCE ground test heater cable shall be disconnected	NLR/AMS	I	AMS	ATS1225-TTCS-091007-01_TTCS_GROUND_Cable_disconnection (TBW)	Filled ATS (TBF)	

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