Title: **Integrated Test Procedure for the Herschel FM TB/TV Test**

CI-No: 100 000

Prepared by:	G. Jahn	Date:	07.11.2008
Checked by:	J. Kroeker		7.11.2008
Product Assurance:	R. Stritter		07.11.08
Configuration Control:	W. Wietbrock		14/11/2008
Project Management:	W. Fricke		14/11/2008

Approved by TAS-F: D. Montet

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
Draft 1	11.01.08	All	First Issue	
Draft 2	07.08.08	All	Update for Spec Iss. 4 (to be issued)	
Draft 4	31.10.08		ETS comments on Draft 2 (received by mail on 09.08.08) implemented in AD list, TP-A and TP-L	
			TAS-F comments implemented:	
			New AD24	
		H.1.2	SVM TCS heater lines table updated	
			ESA comments implemented:	
		5.1	TMM correlation deleted	
		H1.1	PPS tilting 1° above immersion value	
		TP-A	Max tilt angle determined by tilting test	
		TP-B	Global leak test setup check introduced	
		TP-K	SOVT2 introduced	
			Global leak measurements introduced	
		TP-L	IST replaced by SFT2	
			General:	
			Wording updates	
			Updates due to Test Spec Iss.5 changes	
Draft 6	05.11.08	Annex C	Test heater list introduced	
		Annex I	Loading of alarm limits defined	
		TP-A	Expected timing for LSS preparation included	
			VG measurement after LSS 5m door closure	
		TP-B	HIFI in Standby during SVM TB cold	
		TP-K	TV Hot sequence refined in ITP	
			TT&C test call from ITP introduced	
1	07.11.08	Annex A	Warning and alarm limit list included	
		Annex I	SVM test heater settings according to [AD25]	
		TP-G	SVM TCS go-ahead required before cooler recycling in SVM TB	
		TP-H	Ensure that S/C is vertical before starting HIFI SFTs	

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1 Scope

This document contains the integrated test procedure (ITP) for performing the Herschel FM TB/TV test, i.e. a step by step procedure including the activities on the test object as well as on the test facility and data handling side.

It is to be used in combination with the thermal tests leading procedure [AD5] which contains the descriptive part of the test procedure and also gives the relation to other thermal test activities.

2 Documentation and Abbreviations

Applicable documents (AD) are defined as being documents which are needed to complete the work, they are considered as being integral part of this document, as far as specifically called-up. In case of contradictions between contents of the applicable documents and the current document, the statements given in the current document supersede the applicable document.

The following documents in their latest issue are applicable to this test procedure:

2.1 Applicable Documents

[AD1] Unit Switching Status, HP-1-ASPI-TN-0386 Iss. 2

[AD2] Herschel EGSE SAT and Instruments Procedure for the SAT TB/TV Testing, HP-2-ASED-PR-0236

[AD3] Test Specification for Herschel Instruments FM Tests performed at satellite level, HP-2-ASP-TS-1083 Iss.2

[AD4] Herschel FM TV/TB Test Specification, H-P-2-ASP-TS-0997 Iss.5

[AD5] Herschel FM Thermal Test Leading Procedure, HP-2-ASED-TP-0200

[AD6] Generic Emergency Procedure in case of alarm during a test campaign, HP-2-ETS-PR-0002 Iss.1, ETS/PROC/SAF/00/002

[AD7] Emergency Shut Down Procedure for ETS operated Test Facilities, HP-2-ETS-PR-0044 Iss.1, ETS/GPRO/MECH/044

[AD8] Launch Autonomy Test Procedure for FM, HP-2-ASED-TP-0201

[AD9] HIFI Power on for IST & TV, SRON-G-HIFI-PR-2007-017_1.5.3

[AD10] HIFI Step-by-Step Test Procedure for FM TB/TV, SRON-G/HIFI/PR/2007-024, 1.23

[AD11] HIFI power-up and power-down procedures for IST and TV tests, HP-2-SRON-PR-0029 Iss. 1.8

[AD12] HIFI mode transitions, HP-2-SRON-PR-0028 Iss. 1.1

[AD13] PACS Step-by-Step Test Procedure for FM TB/TV PACS-ME-TP-021_2.8

[AD14] SPIRE Step-by-Step Test Procedure for FM TB/TV, SPIRE-RAL-PRC-3042, issue 1.0

[AD15] (deleted)

[AD16] ATC health check procedure, HP-2-ASED-TP-0211

[AD17] S/C Transfer and Mechanical Integration in LSS, HP-2-ASED-PR0131

[AD18] Electrical Integration and Check-Out for TB/TV Test, HP-2-ASED-RP-, tbi

[AD19] Herschel EGSE Commissioning Procedure, HP-2-ASED-PR-0069

[AD20] CVSE Set up for FM TV/TB Test, HP-2-ASED-PR-0126

[AD21] Procedure for HACS Setup and Measurements in LSS, HP-2-TER-MA-0001

[AD22] Herschel Videogrammetry Test – Scale Bar Installation Procedure, TEC-TCE/2008.42/ACZ/*/

[AD23] Videogrammetry System, Hardware/Software Manual, Videogrammetry-TCE-EDO-080808-TN-01-01

[AD24] MLI / Thermal Test Equipment Setup Procedure, HP-2-ASED-PR-0115

[AD25] Herschel FM Thermal Test guide line H-P-2-ASP-TN-178 Iss.1

[AD26] Herschel FM TV/TB Emergency procedures, H-P-2-ASP-TS-1704 iss. 1

[AD27] Herschel PFM: Helium II Production And Top Up Procedure, HP-2-ASED-TP-0083

[AD28] TTC Execution test procedure, HP-2-ASED-TP-0245 Iss.1

[AD29] SOVT2 Test procedure, tbi

[AD30] Global Leak Test Procedure, MU1H07_AA

2.2 Reference Documents

[RD1] HACS operation manual

[RD2] Videogrammetry operation manual

[RD3] H-EPLM Instrumentation Plan for FM TB/TV Test, HP-2-ASED-PL-0054

[RD4] Herschel / Planck - Herschel SVM - FM TV/TB Test Thermocouples Location, HP-4-AI-TN-0135_2

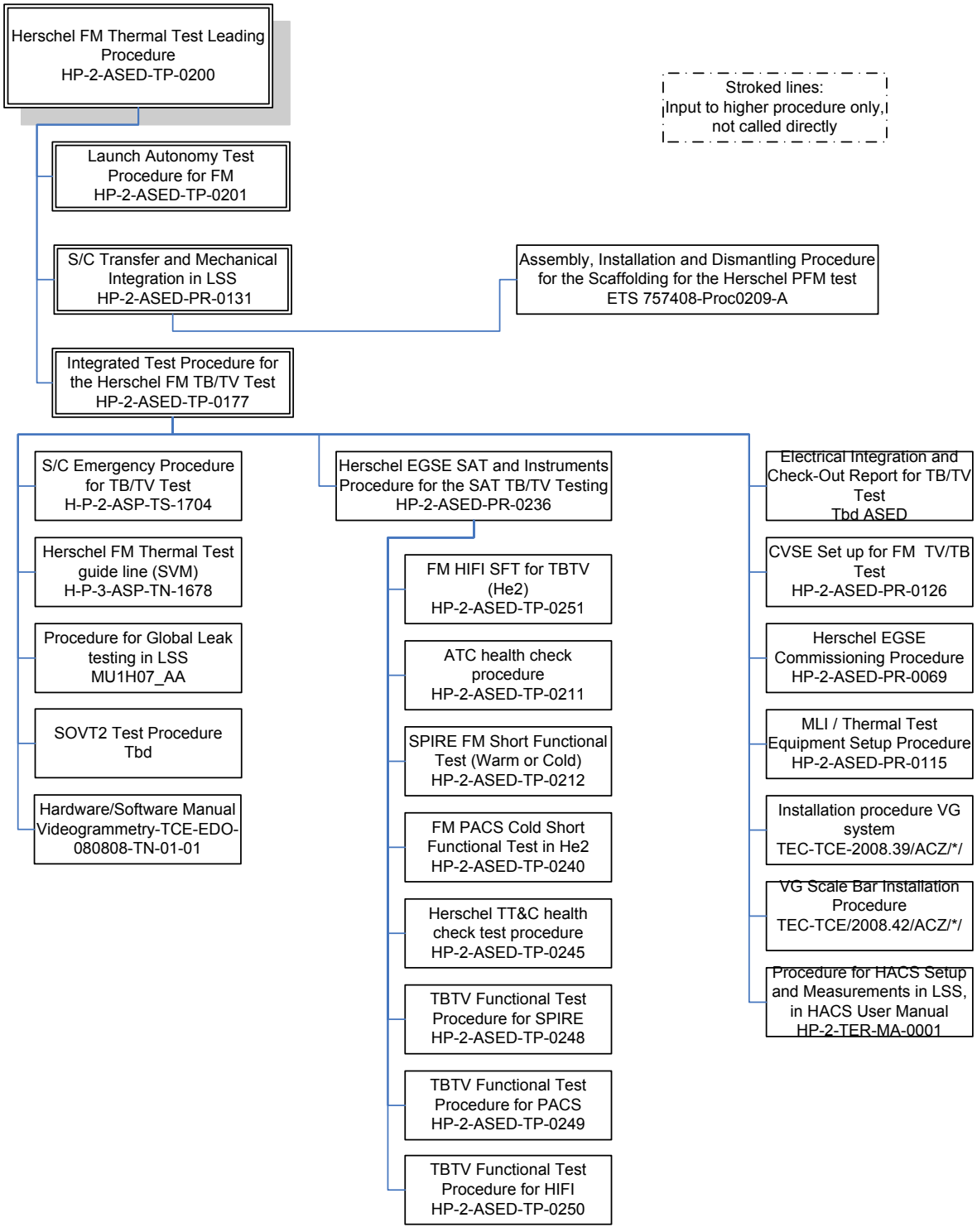


Figure 1: Procedure tree

2.3 Abbreviations

AIT	Assembly, Integration and Test
ASED	EADS Astrium ED (Friedrichshafen)
CCS	Central Check-out System
CVSE	Cryo-Vacuum Support Equipment
CVV	Cryostat Vacuum Vessel
DGMM	Detailed Geometrical Mathematical Model
DLCM	Direct Liquid Content Measurement Device
DTMM	Detailed Thermal Mathematical Model
EGSE	Electrical Ground Support Equipment
E-PLM	Extended Payload Module
ETS	European Test Services
FDH	Facility Data Handling
FPU	Focal Plane Unit
GHe	Gaseous Helium
HACS	Herschel Alignment Camera System
He	Helium
HOT	Helium I Tank
HSS	Herschel Sunshield / Solar Generator
HSS-TCR	HSS Thermal Control Rig
HTT	Helium II Tank
HVP	High Vacuum Pump
IR	Infra-red
ITP	Integrated Test Procedure
LAN	Local Area Network
LEOP	Launch and Early Orbit Phase
LHe	Liquid Helium
LN2	Liquid Nitrogen
LOU	Local Oscillator Unit
LSS	Large Space Simulator
NCR	Non-Conformance Report
OBA	Optical Bench Assembly
OBP	Optical Bench Plate
ORS	Operation Request Sheet
PLC	Programmable Logic Controller
PPB	PentaPrism Block
PPS	Passive Phase Separator
PROPOS	Programmable Power Supplies
PTR	Post Test Review
S/C	Spacecraft
SCOE	Special Check-Out Equipment
SIH	Scientific Instrument Harness
SPAD	Specimen Access Device
STM	Structural / Thermal Model

TAS	Thales Alenia Space
TB	Thermal Balance
tbc	to be confirmed
tbd	to be defined
tbi	to be issued
TD	Thermal Dummy
TDH	Thermal Data Handling
TMM	Thermal Mathematical Model
TRB	Test Review Board
TRP	Temperature Reference Point
TRR	Test Readiness Review
TSMU	Transportation Stimuli and Monitoring Unit
TTA	Thermal Test Adapter
TV	Thermal Vacuum
TVQM3	Test Valve (LHV Qualification Model 3)
VDG	Videogrammetry
VTF	Vacuum Feed-Through
VLD	Vertical Lifting Device
VSS	Vertical Support Stand

3 Requirements to be verified

Refer to section 1.2 of [AD4]

4 Configuration

The specimen configuration is described in the thermal tests leading procedure, refer to [AD5].

4.1 EGSE configuration

Instruments checkout

The instruments checkout area is located in room FR001.

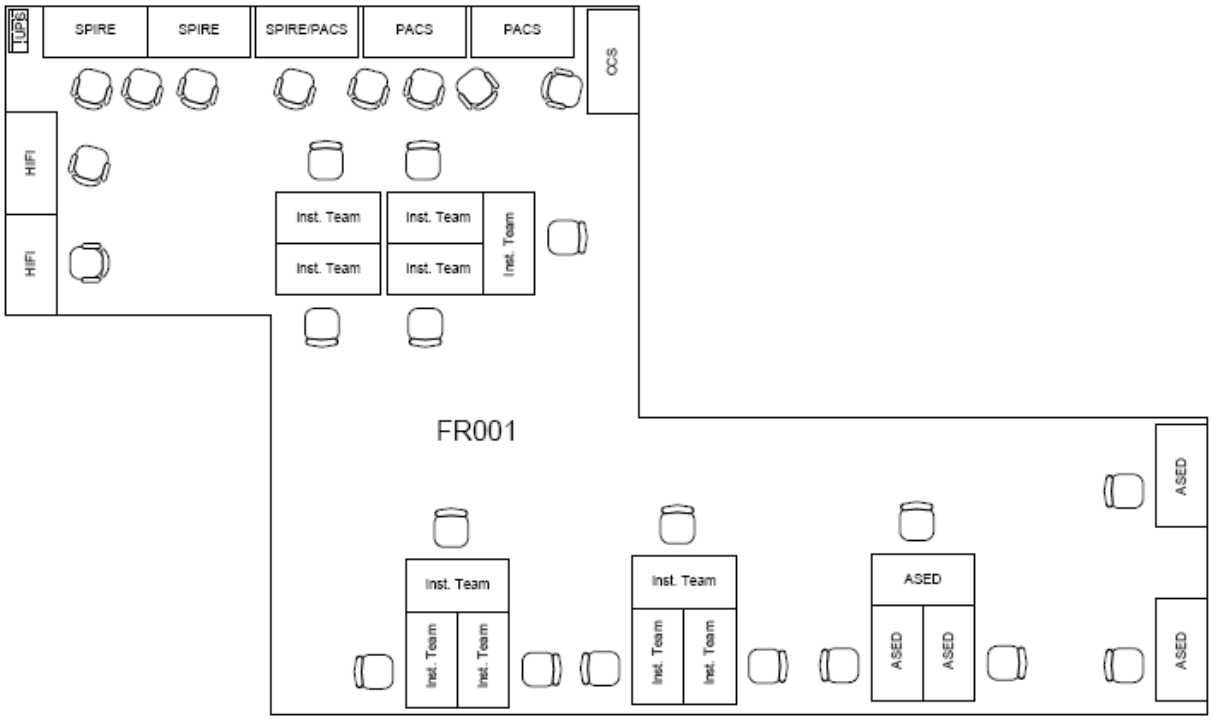


Figure 2: Instruments checkout area sketch

HIFI-IEGSE	3 Workstations
PACS-IEGSE	3 Workstations
SPIRE-IEGSE	3 Workstations

IEGSE Firewall 1 PC

1 Fax machine (tbc)

All IEGSE Workstations are interconnected via a special VLAN (IEGSE-VLAN).

This VLAN is available also at Herschel S/C C/O and the LSS test floor.

The Firewall PC creates the bridge to the institutes via a 2nd network interface to the internet.

LSS test floor

On the LSS test floor will be :

- SAS SCOE (3 racks) + desktop controller
- Battery SCOE (1 rack) + desktop controller
- TTC SCOE (1 rack) + desktop controller
- ACMS SCOE (1 rack) + desktop controller
- STR UTE (1 rack)
- TMTC DFE (1 rack)
- Cryo SCOE (1 rack) + desktop controller
- NDIU-lite (1 rack)
- 2 x CCS workstations (1 x PLM, 1 x SVM)
- 1 x CCS-Lite workstation (xmgrace PLM)
- 3 STAMP PCs (1 x PLM, 1 x SVM, 1 x Alarms)
- 4 Dynaworks workstations (1 x SVM, 1 x PLM, 1x facility data, 1 x ESA observer)
- 1 Fax machine (tbc)

The rest of the S/C check-out equipment remains in the check-out area.

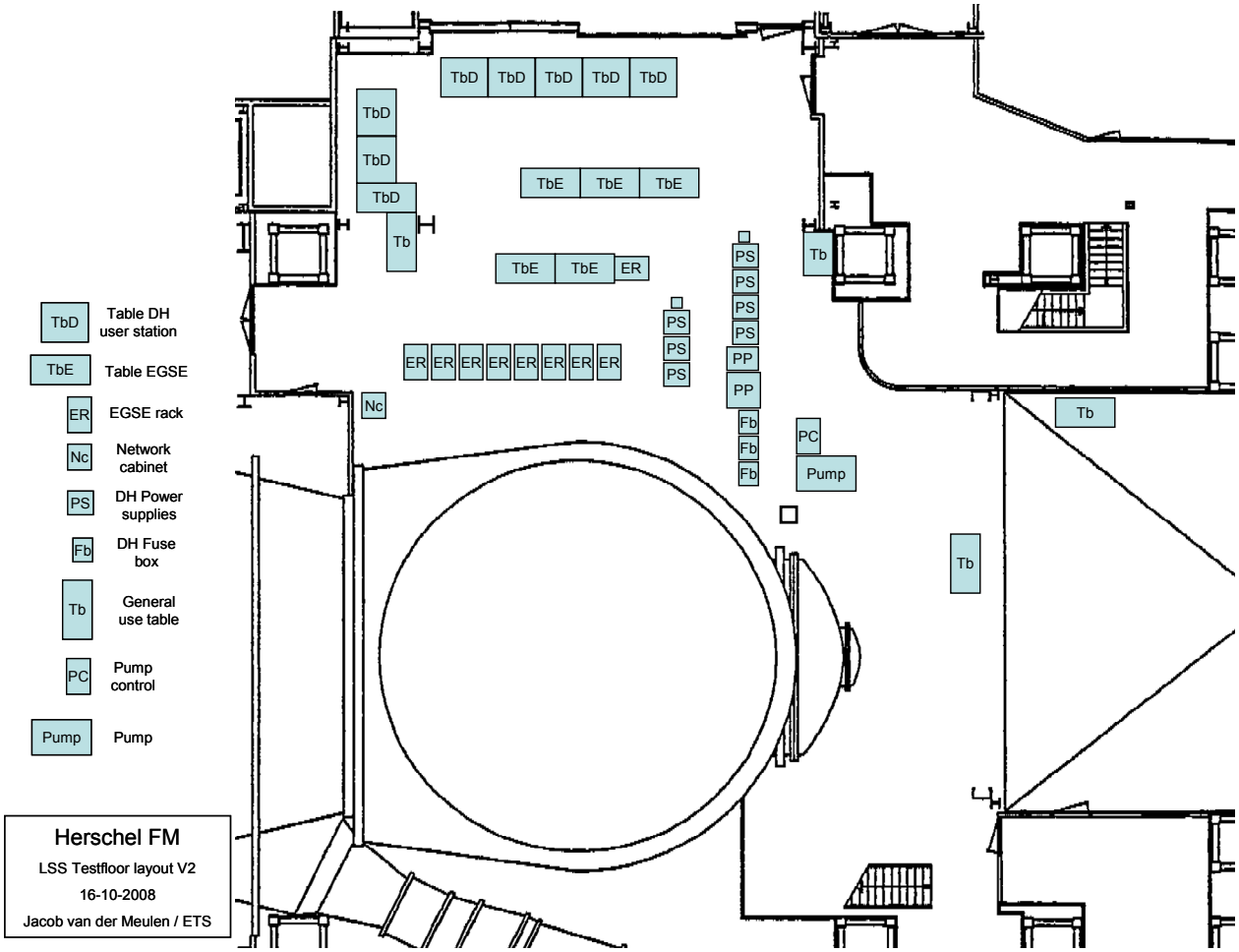


Figure 3: LSS test floor sketch

S/C checkout

The rest of the S/C checkout equipment remains in the S/C checkout area.

5 Test Criteria

5.1 Stability Criteria

Steady-state is reached when the equilibrium temperature sensors (TDH temperature sensors, SCOE Pt1000 and C100 sensors) fulfil the following criteria:

$$\Delta Val = | Val_{average,\ tp} - Val_{average,\ tp\ -\ \Delta t} | < Threshold$$

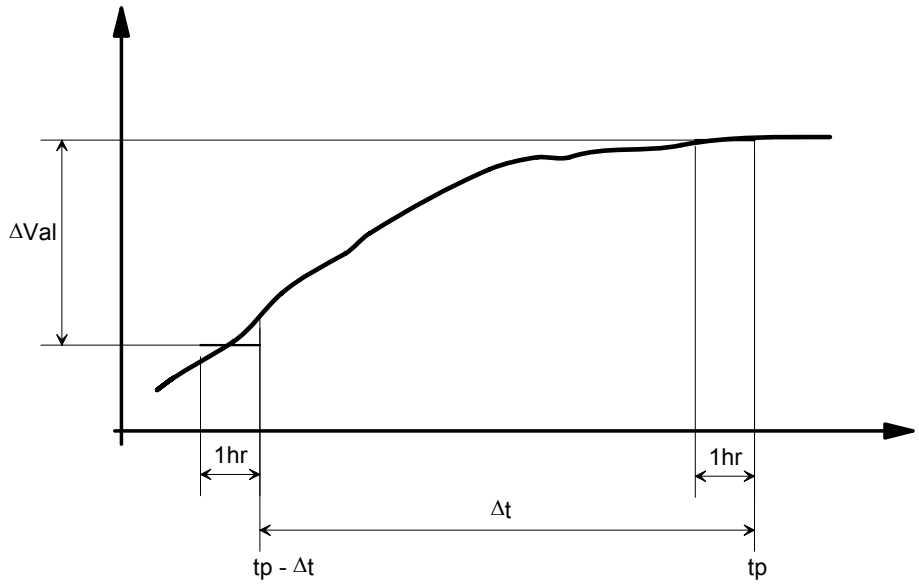
$Val_{average,\ tp}$ Value averaged over 1 hour, averaging begins 1 hr before present time tp

$Val_{average,\ tp\ -\ \Delta t}$: Value averaged over 1 hour, averaging begins at Δt +1 hr and ends at Δt before present time tp

With

Value	Δt	Threshold
SVM temperature	8 hrs	1 K
Temperature of CVV	24 hrs	0.3 K

The equilibrium criterion illustrated in the following figure shall be checked continuously via the LSS TDH and the Cryo SCOE, respectively.



6 Summary Sheets

6.1 Non Conformance Report (NCR) Summary

NCR - No.	NCR - Title	Date	Open / Closed	PA sig.

6.2 Sign-off Sheet

	Date	Signature
Test Director		
Test Conductor		
PA Responsible		
ESA Representative		

Annex A Sensor Warning and Alarm Limits

The warning and alarm limits for all flight sensors are managed by the CCS. No special test limits have been defined, the flight values are applicable.

No warning and alarm limits shall be implemented for the test sensors which are not mentioned in the tables below

A.1 TDH Sensor Warning and Alarm Limits

The complete list of predefined alarm limits is available to ETS and on test floor.

PLM and test equipment alarm limits are shown in the table below. Refer to [AD25] for a list of the different SVM alarm limits sets.

Number	Name	Low alarm [K]	Low warning [K]	High warning [K]	High alarm [K]	Extrapolation range [hh:mm:ss]	Low slope [K/min]	High slope [K/min]	Alarm on UNDEFINED	Entropy threshold
4001	PLM_SVTS_TC_SVM-TS-Face-pY	125	130	313	318					
4002	PLM_SVTS_TC_SVM-TS-Face-mY	125	130	313	318					
4010	PLM_SVTS_TC_SVM-TS-Strut-pY-lower	125	130	313	318					
4011	PLM_SVTS_TC_SVM-TS-Strut-pY-upper	125	130	313	318					
4012	PLM_SVTS_TC_SVM-TS-Strut-pY-face	125	130	313	318					
4020	PLM_SVTS_TC_SVM-TS-Strut-mZ-lower	125	130	313	318					
4021	PLM_SVTS_TC_SVM-TS-Strut-mZ-upper	125	130	313	318					
4022	PLM_SVTS_TC_SVM-TS-Strut-mZ-face	125	130	313	318					
9000	EQU_HACS_TC_mZ-radiator	243	248	313	318					

Number	Name	Low alarm [K]	Low warning [K]	High warning [K]	High alarm [K]	Extrapolation range [hh:mm:ss]	Low slope [K/min]	High slope [K/min]	Alarm on UNDEFINED	Entropy threshold
9001	EQU_HACS_TC_mZ-electronics	243	248	323	333	00:10:00				
9010	EQU_HACS_TC_pZ-radiator	243	248	313	318					
9011	EQU_HACS_TC_pZ-electronics	243	248	323	333	00:10:00				
8002	EQU_RIG_TC_HSS-Rig-lower-py-l2	250	270	377	382					
8102	EQU_RIG_TC_HSS-Rig-lower-mid-l2	250	270	377	382					
8212	EQU_RIG_TC_HSS-Rig-lower-my-r2	250	270	377	382					
8004	EQU_RIG_TC_HSS-Rig-lower-py-l4	250	270	377	382					
8104	EQU_RIG_TC_HSS-Rig-lower-mid-l4	250	270	377	382					
8214	EQU_RIG_TC_HSS-Rig-lower-my-r4	250	270	377	382					
8302	EQU_RIG_TC_HSS-Rig-upper-py-l2	185	190	323	328					
8402	EQU_RIG_TC_HSS-Rig-upper-mid-l2	185	190	323	328					
8512	EQU_RIG_TC_HSS-Rig-upper-my-r2	185	190	323	328					
8304	EQU_RIG_TC_HSS-Rig-upper-py-l4	185	190	323	328					
8404	EQU_RIG_TC_HSS-Rig-upper-mid-l4	185	190	323	328					
8514	EQU_RIG_TC_HSS-Rig-upper-my-r4	185	190	323	328					
8305	EQU_RIG_TC_HSS-Rig-upper-py-l5	185	190	323	328					
8406	EQU_RIG_TC_HSS-Rig-upper-mid-l6	185	190	323	328					
8515	EQU_RIG_TC_HSS-Rig-upper-my-r5	185	190	323	328					
8318	EQU_RIG_TC_HSS-Rig-upper-py-r8	185	190	323	328					
8408	EQU_RIG_TC_HSS-Rig-upper-mid-l8	185	190	323	328					
8508	EQU_RIG_TC_HSS-Rig-upper-my-l8	185	190	323	328					
8701	EQU_Rig_TC_Support-pY	280	288	336	340					
8702	EQU_Rig_TC_Support-pZ1	280	288	336	340					
8703	EQU_Rig_TC_Support-pZ2	280	288	336	340					
8704	EQU_Rig_TC_Support-mY	280	288	336	340					

Number	Name	Low alarm [K]	Low warning [K]	High warning [K]	High alarm [K]	Extrapolation range [hh:mm:ss]	Low slope [K/min]	High slope [K/min]	Alarm on UNDEFINED	Entropy threshold
39800	C_EQU_THA_TC_9800- Sk06-J05 connector	-55	-50	100	105					
39810	C_EQU_THA_TC_9810-signal harness close to SK06	-55	-50	100	105					
39801	C_EQU_THA_TC_9801-SK02-J0 connector	-55	-50	100	105					
39811	C_EQU_THA_TC_9811-signal harness close to SK02	-55	-50	100	105					
39821	C_EQU_THA_TC_9821-signal cable nom	-55	-50	100	105					
39831	C_EQU_THA_TC_9831-signal cable red	-55	-50	100	105					
39806	C_EQU_THA_TC_9806-TGC waveguide	-55	-50	100	105					
39816	C_EQU_THA_TC_9816-Coax cable	-55	-50	100	105					
39826	C_EQU_THA_TC_9826-coax cable nom S/C side	-55	-50	100	105					
39846	C_EQU_THA_TC_9846-coax cable nom lss side	-55	-50	100	105					
39836	C_EQU_THA_TC_9836-coax cable red SC side	-55	-50	100	105					
39856	C_EQU_THA_TC_9856-coax cable red lss side	-55	-50	100	105					
39804	C_EQU_THA_TC_9804-umb cable nom	-55	-50	100	105					
39814	C_EQU_THA_TC_9814-umb cable red	-55	-50	100	105					
39802	C_EQU_THA_TC_9802- umbilical bracket -Z	-55	-50	100	105					
39812	C_EQU_THA_TC_9812-umbilical cable close to -Z bracket	-55	-50	100	105					
39803	C_EQU_THA_TC_9803- Sk01A-J02 connector	-55	-50	100	105					
39813	C_EQU_THA_TC_9813- power harness close to SK01A	-55	-50	100	105					
39823	C_EQU_THA_TC_9823-pwr cable nom	-55	-50	100	105					
39833	C_EQU_THA_TC_9833-pwr cable red	-55	-50	100	105					
39807	C_EQU_THA_TC_PLM-Test-harness-upper-pY	-180	-175	105	110					
39808	C_EQU_THA_TC_PLM-Test-harness-upper-pZ	-180	-175	105	110					
39817	C_EQU_THA_TC_PLM-Test-harness-lower-pY	-180	-175	105	110					
39818	C_EQU_THA_TC_PLM-Test-harness-lower-pZ	-180	-175	105	110					

Number	Name	Low alarm [K]	Low warning [K]	High warning [K]	High alarm [K]	Extrapolation range [hh:mm:ss]	Low slope [K/min]	High slope [K/min]	Alarm on UNDEFINED	Entropy threshold
2310	LOU_RAD_TC_rad-heater-control	90	95	145	150					
2320	LOU_SUP_TC_mZ	90	95	145	150					
2321	LOU_SUP_TC_pZ	90	95	145	150					

Annex B Wiring Lists for TDH Sensors

The wiring lists in the following section include the TDH instrumentation with exception of the HSS-TCR thermocouples and heaters, for which the wiring lists are defined by ETS.

The wiring list for the TDH test heaters is given in Section 5.2, Table 5.2.1.

B.1 Pt100 Sensors

The complete Pt100 sensor harness is thermally anchored to the Spin Box Shroud.

Refer to [RD3] for detailed lists.

B.2 Thermocouples

Refer to [RD3] for detailed lists.

Annex C Verification of Test Heaters

There is a two-step method to verify the test heater lines at test site (check-outs shall also be performed during integration):

Resistance measurement at the test heater power supply interface rack on the test floor. This rack interfaces the test heater lines coming from the LSS and the test heater power supply and monitoring part of the TDH system. Using an Ohm-meter, the total resistance (i.e. heater plus cable) of each test heater line can be measured, but only if the relevant power supply is disconnected. The measured values shall be filled into the “circuit R on connector” column of table 5.2-1.

As soon as a test heater power connector has been plugged in at the spin box plug dome all affected heater circuits shall be powered up to approx. 20% of the maximum allowed current for each circuit (see table 5.2-1). The total resistance measured by the power supply shall be filled into the “circuit R on PS” column of table 5.2-1. It shall be verified that the derived total resistance (heaters and cable) is greater than the resistance expected only for the heaters:

$$R_{total} = \frac{U_{measured}}{I_{measured}} = R_{cable} + R_{Heaters} > R_{Heaters}$$

If not, the expected heater resistance obviously is wrong and shall be verified.

In order to verify the proper operation of every heater, all test heater lines shall be successively powered up to the specified current during 30 minutes (duration can be shortened or lengthened, depending on the thermal response). During these tests, the power consumption and current in each line shall be measured, and the temperatures of all relevant thermocouples shall be recorded. The temperature at each heater location or unit will be monitored by means of a reference temperature sensor.

After completion of this verification it shall be checked once again that all heater circuits are switched off!

Maximum allowed current values as listed in Table 5.2-1 are the maximum currents I_{max} allowed by the heater itself or the LSS power pins of the respective heater line. They supersede the current range of the selected power supply and shall be used as current limits of the respective test heater lines.

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
CVV_05_LB-mY	5	5A-4	13,14	10.57			80	2.751	33.21	249	SSP240	1300	
CVV_06_LC-pZ	6	5A-4	1, 2	10.98			140	3.571	44.56	250	SSP240	1005	
CVV_07_UC-pZ	7	5A-4	3, 4	10.40			90	2.942	35.01	251	SSP240	1004	
CVV_08_UB-mZ	8	5A-4	11,12	7.93			110	3.724	35.12	252	SSP240	1101	
CVV_09_Rad-lower-mY	9	5A-3	11, 12	12.48			100	2.831	39.57	253	SSP240	2011	
CVV_10_Rad-upper-mY	10	5A-3	1, 2	9.98			130	3.609	41.43	254	SSP240	1107	
CVV_11_Rad-lower-mZ	11	5A-3	3, 4	12.48			100	2.831	39.57	255	SSP240	2113	
CVV_12_Rad-upper-mZ	12	15A-1	5, 6	7.13			180	5.025	40.85	256	SSP240	1104	
CVV_13_Rad-lower-pY	13	5A-3	5, 6	12.48			100	2.831	39.57	257	SSP240	2214	
CVV_14_Rad-upper-pY	14	5A-3	7, 8	9.98			130	3.609	41.43	258	SSP240	1103	
CVV_15_UB-HSIF-mZ	15	5A-3	9, 10	7.93			110	3.724	35.12	259	SSP240	1102	
LOU_16_rad-lower	16	5A-4	7, 8	11.65			90	2.779	36.55	260	SSP240	2310	
LOU_17_rad-upper	17	5A-4	9, 10	11.65			90	2.779	36.55	261	SSP240	2310	
CVV_23_LC_pZ	23	5A-3	13, 14	12.50			100	2.828	39.60	262	SSP240	1302	
CVV_24_LC_pZ	24	5A-3	15, 16	12.50			100	2.828	39.60	263	SSP240	1005	

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
CVV_25_UC_pZ	25	5A-4	5,6	12.48			100	2.831	39.57	264	SSP240	1000	
CVV_35_LB-pY	35	5A-4	15, 16	10.57			80	2.751	33.21	265	SSP240	1301	
IRRIG_63_support	63	15A-3	5,6	14.80	15.1		100	2.599	41.07	266	SSP240	8702	
IRRIG_64_support_red	64	15A-3	7,8	14.80	15.1		100	2.599	41.07	328	SSP240	8702	
SVM_ACC_Py_L1	70	5A-1	1, 2	208.00	214		30	0.380	79.56	267	SSP240		
SVM_Battery_Py_L2	71	5A-1	3, 4	200.00	197		31	0.394	79.33	268	SSP240		
SVM_CDMU_pY_L3	72	5A-1	5, 6	100.00	110		64	0.800	81.20	269	SSP240		
SVM_PCDU_pY_L4	73	5A-1	7, 8	33.33	34		192	2.400	83.60	270	SSP240		
SVM_SPIRE_mZ_L5	74	5A-1	9, 10	104.00	108		61	0.766	80.80	271	SSP240		
SVM_HIFI-2_mYmZ_L6	75	5A-5	1, 2	69.33	72		92	1.152	81.59	272	SSP240		
SVM_DECMEC_pYmZ_L7	76	5A-2	1, 2	138.70	141		46	0.576	80.74	273	SSP240		
SVM_BOLC_pYmZ_L8	77	5A-2	3, 4	118.90	122		53	0.668	80.38	274	SSP240		
SVM_RWS_mYpZ_L9	78	5A-5	3, 4	28.57	30		224	2.800	84.20	275	SSP240		
SVM_HIFI-1_mYpZ_L11	79	5A-5	7, 8	46.80	48		136	1.705	82.34	276	SSP240		
SVM_HIFI-1_mYmZ_2_L10	80	5A-5	5, 6	31.30	32		205	2.559	83.94	277	SSP240		

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
SVM_red_ACC_Py_L1	90	5A-1	11, 12	208.00	215		30	0.380	79.56	278	SSP240		
SVM_red_Battery_Py_L2	91	5A-1	13, 14	200.00	198		31	0.394	79.33	279	SSP240		
SVM_red_CDMU_pY_L3	92	5A-1	15, 16	100.00	100		64	0.800	81.20	280	SSP240		
SVM_red_PCDU_pY_L4	93	5A-1	17, 18	33.33	34		192	2.400	83.60	281	SSP240		
SVM_red_SPIRE_mZ_L5	94	5A-1	19, 20	104.00			61	0.766	80.80	282	SSP240		
SVM_red_HIFI-2_mYmZ_L6	95	5A-5	09, 10	69.33			92	1.152	81.59	283	SSP240		
SVM_red_DECMEC_pYmZ_L7	96	5A-2	5, 6	138.70			46	0.576	80.74	284	SSP240		
SVM_red_BOLC_pYmZ_L8	97	5A-2	7, 8	118.90	123		53	0.668	80.38	285	SSP240		
SVM_red_RWS_mYpZ_L9	98	5A-5	11, 12	28.57			224	2.800	84.20	286	SSP240		
SVM_red_HIFI-1_mYmZ_L10	99	5A-5	13, 14	31.20			136	2.088	68.27	287	SSP240		
SVM_red_HIFI-1_mYpZ_2_L11	100	5A-5	15, 16	46.80			204	2.088	100.84	288	SSP240		
panel +Y+Z -TTC lamp 1	101	5A-2	9, 10	31.25			200	4.000	56.00	289	SSP240		
panel +Y+Z -TTC lamp 1 offset	101	5A-2	9, 10	31.25			200	4.000	56.00	290	SSP240	(Setpoint other PS)	
panel +Y+Z -TTC lamp 2	102	5A-2	11, 12	31.25			200	4.000	56.00	291	SSP240		

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
panel +Y+Z -TTC lamp 2 offset	102	5A-2	11, 12	31.25			200	4.000	56.00	292	SSP240	(Setpoint other PS)	
panel +Y+Z -TTC lamp 3	103	5A-2	13, 14	31.25			200	4.000	56.00	293	SSP240		
panel +Y+Z -TTC lamp 3 offset	103	5A-2	13, 14	31.25			200	4.000	56.00	294	SSP240	(Setpoint other PS)	
panel +Y+Z -TTC lamp 4	104	5A-2	15, 16	31.25			200	4.000	56.00	295	SSP240		
panel +Y+Z -TTC lamp 4 offset	104	5A-2	15, 16	31.25			200	4.000	56.00	296	SSP240	(Setpoint other PS)	
TTAS enclosure -STR lamp 1	105	15A-2	5,6	31.25			200	4.000	54.00	297	SSP240		
TTAS enclosure -STR lamp 1 offset	105	15A-2	5,6	31.25			200	4.000	54.00	298	SSP240	(Setpoint other PS)	
TTAS enclosure -STR lamp 2	106	15A-2	7,8	31.25			200	4.000	54.00	299	SSP240		
TTAS enclosure -STR lamp 2 offset	106	15A-2	7,8	31.25			200	4.000	54.00	300	SSP240	(Setpoint other PS)	
Harness coax nom	107	5A-2	17, 18	59.90			100	1.292	79.33	301	SSP240	39826	
Harness coax red	108	5A-2	19, 20	48.60			120	1.571	78.72	302	SSP240	39836	

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
deleted	109	1A-1	5 ,6	0.00			0	#DIV/0!	#DIV/0!	303	SSP240		
deleted	110	1A-1	7, 8	0.00			0	#DIV/0!	#DIV/0!	304	SSP240		
Harness signal nom	111	1A-1	9, 10	104.90			38	0.602	64.64	305	SSP240	39821	
Harness signal red	112	1A-1	11, 12	104.50			38	0.603	64.52	306	SSP240	39831	
TTAS	113	15A-2	9, 10	14.00			240	4.140	62.11	307	SSP240	9101	
TTAS_red	114	15A-2	11, 12	14.00			240	4.140	62.11	329	SSP240	9102	
Harness umb nom	115	1A-1	1, 2	126.60			48	0.616	79.49	308	SSP240	39804	
Harness umb red	116	1A-1	3, 4	120.80			50	0.643	79.33	330	SSP240	39814	
Harness power nom	117	1A-1	5, 6	85.70			70	0.904	79.71	309	SSP240	39823	
Harness power red	118	1A-1	7, 8	85.80			70	0.903	79.76	331	SSP240	39833	
IRRIG_23_1st_row_pY	123	B5/2 1A-7 IR-RIG-1	1, 2	40.00			100	1.581	63.25	310	SSP240	8002	
IRRIG_24_1st_row_mid	124	B5/2 1A-7 IR-RIG-1	5, 6	40.00			100	1.581	63.25	311	SSP240	8102	
IRRIG_25_1st_row_mY	125	B5/2 1A-7 IR-RIG-1	9, 10	40.00			100	1.581	63.25	312	SSP240	8212	
IRRIG_26_2nd_row_pY	126	B5/2 1A-7 IR-RIG-1	13, 14	40.00			100	1.581	63.25	313	SSP240	8004	

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
IRRIG_27_2nd_row_mid	127	B5/2 1A-7 IR-RIG-1	17, 18	40.00			100	1.581	63.25	314	SSP240	8104	
IRRIG_28_2nd_row_mY	128	B5/2 1A-7 IR-RIG-1	21, 22	40.00			100	1.581	63.25	315	SSP240	8214	
IRRIG_29_3rd_row_pY	129	B5/2 1A-7 IR-RIG-1	25, 26	40.00			100	1.581	63.25	316	SSP240	8302	
IRRIG_30_3rd_row_mid	130	B5/2 1A-7 IR-RIG-1	29, 30	40.00			100	1.581	63.25	317	SSP240	8402	
IRRIG_31_3rd_row_mY	131	B5/2 1A-7 IR-RIG-1	33, 34	40.00			100	1.581	63.25	318	SSP240	8512	
IRRIG_32_4th_row_pY	132	B5/2 1A-8 IR-RIG-2	1, 2	40.00			100	1.581	63.25	319	SSP240	8304	
IRRIG_33_4th_row_mid	133	B5/2 1A-8 IR-RIG-2	5, 6	40.00			100	1.581	63.25	320	SSP240	8404	
IRRIG_34_4th_row_mY	134	B5/2 1A-8 IR-RIG-2	9, 10	40.00			100	1.581	63.25	321	SSP240	8514	
IRRIG_37_5th_row_pY	137	B5/2 1A-8 IR-RIG-2	13, 14	53.33			77	1.202	64.08	322	SSP240	8305	
IRRIG_38_5th_row_mid	138	B5/2 1A-8 IR-RIG-2	17, 18	40.00			100	1.581	63.25	323	SSP240	8406	
IRRIG_39_5th_row_mY	139	B5/2 1A-8 IR-RIG-2	21, 22	53.33			77	1.202	64.08	324	SSP240	8515	
IRRIG_40_6th_row_pY	140	B5/2 1A-8 IR-RIG-2	25, 26	36.09			26.6	0.859	30.98	325	SSP240	8318	
IRRIG_41_6th_row_mid	141	B5/2 1A-8 IR-RIG-2	29, 30	53.33			77	1.202	64.08	326	SSP240	8408	

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
IRRIG_42_6th_row_mY	142	B5/2 1A-8 IR-RIG-2	33, 34	36.09			26.6	0.859	30.98	327	SSP240	8508	
IRRIG_43_1st_row_pY_red	143	B5/2 1A-7 IR-RIG-1	3, 4	40.00			100	1.581	63.25	332		8002	
IRRIG_44_1st_row_mid_red	144	B5/2 1A-7 IR-RIG-1	7, 8	40.00			100	1.581	63.25	333		8102	
IRRIG_45_1st_row_mY_red	145	B5/2 1A-7 IR-RIG-1	11, 12	40.00			100	1.581	63.25	334		8212	
IRRIG_46_2nd_row_pY_red	146	B5/2 1A-7 IR-RIG-1	15, 16	40.00			100	1.581	63.25	335		8004	
IRRIG_47_2nd_row_mid_red	147	B5/2 1A-7 IR-RIG-1	19, 20	40.00			100	1.581	63.25	336		8104	
IRRIG_48_2nd_row_mY_red	148	B5/2 1A-7 IR-RIG-1	23, 24	40.00			100	1.581	63.25	337		8214	
IRRIG_49_3rd_row_pY_red	149	B5/2 1A-7 IR-RIG-1	27, 28	40.00			100	1.581	63.25	338		8302	
IRRIG_50_3rd_row_mid_red	150	B5/2 1A-7 IR-RIG-1	31, 32	40.00			100	1.581	63.25	339		8402	
IRRIG_51_3rd_row_mY_red	151	B5/2 1A-7 IR-RIG-1	35, 36	40.00			100	1.581	63.25	340		8512	
IRRIG_52_4th_row_pY_red	152	B5/2 1A-8 IR-RIG-2	3, 4	40.00			100	1.581	63.25	341		8304	
IRRIG_53_4th_row_mid_red	153	B5/2 1A-8 IR-RIG-2	7, 8	40.00			100	1.581	63.25	342		8404	
IRRIG_54_4th_row_mY_red	154	B5/2 1A-8 IR-RIG-2	11, 12	40.00			100	1.581	63.25	343		8514	

Heater circuit name	Circuit No.	Connec-tor for power	Pins for power	Heater circuit resistance	Circuit R on connector	Circuit R on PS	Max P allowed [W]	Max I allowed [A]	Max U allowed [V]	ESTEC PS number	PS Type	Control sensor / virtual	Check ok
IRRIG_57_5th_row_pY_red	157	B5/2 1A-8 IR-RIG-2	15, 16	53.33			77	1.202	64.08	344		8305	
IRRIG_58_5th_row_mid_red	158	B5/2 1A-8 IR-RIG-2	19, 20	40.00			100	1.581	63.25	345		8405	
IRRIG_59_5th_row_mY_red	159	B5/2 1A-8 IR-RIG-2	23, 24	53.33			77	1.202	64.08	346		8515	
IRRIG_60_6th_row_pY_red	160	B5/2 1A-8 IR-RIG-2	27, 28	36.09			26.6	0.859	30.98	347		8318	
IRRIG_61_6th_row_mid_red	161	B5/2 1A-8 IR-RIG-2	31, 32	53.33			77	1.202	64.08	348		8408	
IRRIG_62_6th_row_mY_red	162	B5/2 1A-8 IR-RIG-2	35, 36	36.09			26.6	0.859	30.98	349		8508	

Table 5.2-1: Verification of Test Heater Lines

Annex D End-of-Phase Reporting

The print-outs, plots and reports listed in the following section will be provided as inputs to the TRB at the end of each test phase.

D.1 TDH Data

1. Printout of all temperature and power setting data at end of phase
2. Plots of relevant temperatures and power settings for complete phase
   - TC / Pt list as appropriate
   - PS list as appropriate

D.2 CCS Data

1. Printout of all temperature and power setting data at end of phase
2. Printout of all valve states, pressure, mass flow and level probe values (if available) at end of phase
3. Plots of relevant sensor readings and power settings for complete phase
   - TC / Pt list as appropriate
   - Mass flow, pressures, consumed mass
   - PS list as appropriate
4. Evaluation of HTT filling level

D.3 CVSE status

Pumps status

Gas meter reading

Safety unit status

CVSE valves status

D.4 Operations / Deviations / NCRs

ORS list

Procedure variations list

NCR list

Annex E HACS Integration and Operation Procedure

E.1 HACS Mechanical Integration

- For transport and storage the cameras are mounted onto a dummy LOU support which is mounted on an aluminium baseplate. The complete assembly is covered by a Perspex cover. To avoid any potential problems with static electricity, mounting or dismounting of the perspex cover shall be performed under electrostatic safe conditions only.
- Installation of the camera head onto the LOU support structure is a very delicate operation that shall be done with extreme care. The spacing between the LOU PPB Pentaprism Block) and the optics module housing is only 5mm so that extreme care shall be taken not to damage the LOU PPB.
- Place the camera head on the LOU baseplate and insert the M5 bolts (4x). Two persons are needed.
- Insert the dowel pins (2x) using the installation tool and tighten the screws.

E.2 HACS electrical Integration

E.2.1 Light Source Installation

- Ensure that the power rail pigtail is not connected to 220V
- Connect the 10 meter fiber pigtails to the VFT's. Thread the outer barrel only lightly finger tight! Over tightening the barrel will not improve signal transmission and could cause permanent damage. To remove, unthread the barrel and gently pull straight out.
- Connect the two vacuum and cryogenic compatible 18 meter fiber cables to the +/- z cameras. Connect the other ends to the VFT's. Please note that there are two vacuum fibres, one for the +z and one for the –z camera (clearly marked as such), which are not interchangeable. Further, it shall be noted which side on the fibre shall be coupled to the VFT connector and which side shall be coupled to the camera. Identification of the 4 ends of the vacuum fibres is as follows:

	+z	-z
Camera end	+z HAC	-z HAC
VFT end	+z VFT	-z VFT

- Connect the two RS-232 pigtails to the control PC as shown in the next figure.

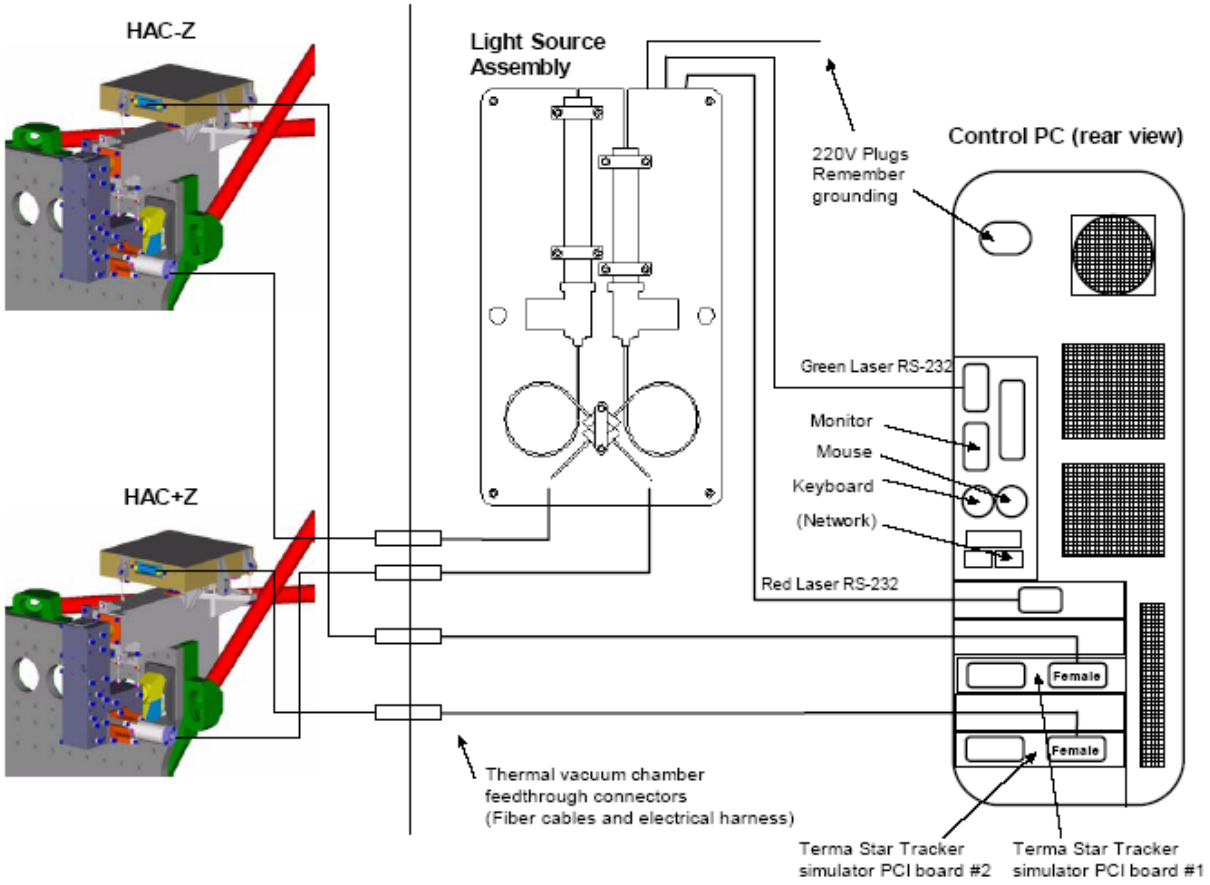


Figure 4: HACS installation

E.2.2 Control H/W Installation

- Connect a power cable to the PC and the supplied 220V power rail (part of the light source assembly. See Figure 1.2-1
- Connect a power cable to the PC monitor and the supplied 220V power rail (part of the light source assembly).
- Connect the PC monitor, mouse and keyboard.
- Connect the ambient electrical harness to the two PCI boards as shown in Figure 1.2-1. Connect the other end to the applicable pre-mounted VFT's.
- Connect the vacuum and cryogenic compatible electrical harness to the +/-z camera's. Connect the other ends to the VFT's.
    - o To avoid the electrical harness from acting as a heat sink during cold testing, it shall be wrapped in MLI starting at the camera connector over a length of at least 6 meter.
    - o Mechanical supporting of the electrical harness shall be implemented such that negligible strain on the connector of the electronics module results for all temperature conditions.

- Connect the power rail pigtail (from the light source assembly) to 220V.

E.2.3 Activation

- Power on the lasers (On /off buttons are located on the light source assembly).
- Power on the HACS control PC and activate the HACS control S/W by double- clicking on the HACS controle software icon on the PC desktop.
- Power on the cameras. This can be done automatically by running the command schedule that is loaded at start-up. Select “Command”-“Execute Schedule” and press “Start”.
- Open the CHU Housekeeping window by selecting “View”-“CHU Housekeeping”. Verify that camera voltages and power consumptions are going to nominal values as shown in Figure 1.2-2.

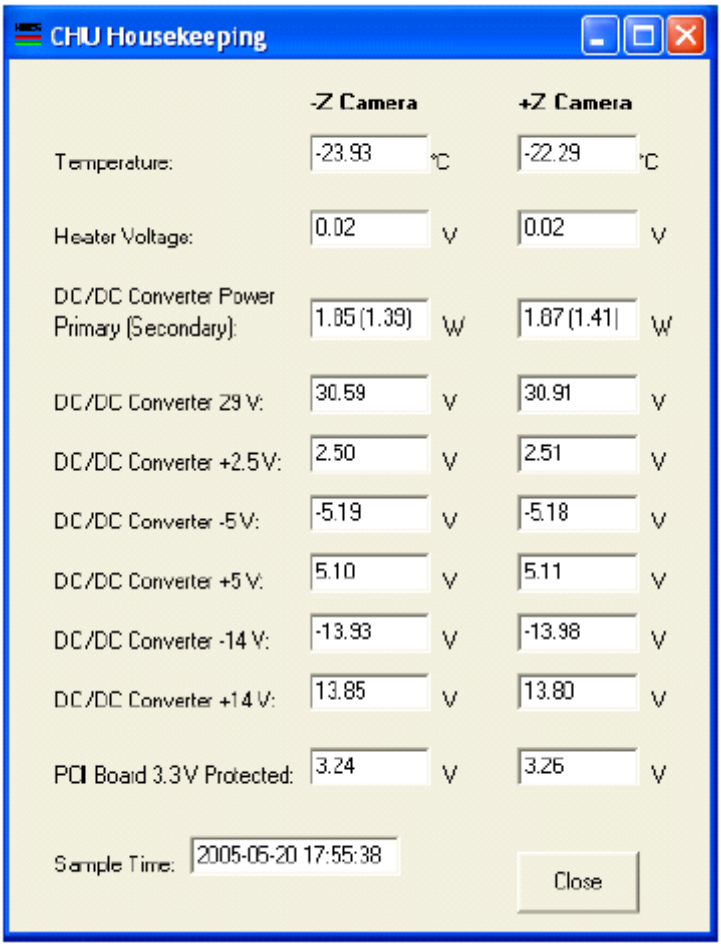


Figure 5: Housekeeping Parameters

A healthy camera has voltages within ±5% of the nominal values and a primary DC/DC concerter power consumption at approximately 1.7W.

E.2.4 Adjust Laser and Image Settings

Laser adjustment shall be made for all four laser / camera combinations. An example is given here for the green laser and the –z Camera.

- Activate the green laser by selecting “Command”-“light Source Attenuation”. Use the default laser attenuation (1950 steps), select “Green Laser” and press “Execute”.
- Take an image by selecting “Command”-“”Image Window Dump”. Select “Dump from –z Camera” and use default values for integration time and image dimensions. Press “Execute”.
- Inspect the image visually by selecting “View”-“Image”. The image should show one reference spot close to the centre of the CCD and one image measurement spot.
- Inspect the spots by double-clicking on them and thus activating the Matrix Viewer. The pixel values in the spots should not be saturated (see User Manual section 7.2.2).
  If more than two pixels in a spot are saturated (DN of 16383), try and reduce the laser power, for example to 1930 steps and take a new image.
- Check that the software can identify the spots correctly. This is done by selecting “Command”-“Raw Spot Detection” and press “Execute”. The Raw Spot Detection-Latest Results window will become visible. The window shows the CCD coordinates foe the identified reference and measurement spot together with spot intensity and size.
  • If Raw Spot detection fails with the message “To many Sub-Spots”, increase the used Threshold Delta Value as described in the User manual section 7.3.3 and do the Raw Spot Detection again.
  • If only one spot is identified, measurement spot is most likely out of range. This can be further investigated by reducing the Threshold Delta Value and do the Raw Spot Detection again.

E.3 Perform Measurements

Having identified the image integration time and laser attenuation parameters, the actual measurements can be performed. For a full set of translation and rotation measurements four images are required, a green laser image taken with the –z camera, a green laser image taken with the +z camera, a red laser image taken with the –z camera and a red laser image taken with the +z camera.

E.3.1 Manually

For each measurement the following is performed:

- Adjust laser settings as described in chapter 1.2.4
- Perform an “Image Window Dump” for each camera as described in chapter 1.2.4.
- Perform “Raw Spot Detection” for each camera and laser as described in chapter 1.2.4.
- The HACS control software will temporarily save the raw spot detection results from the four images. To get the actual measurements select “Command”-“Rotation / Translation Calculation”
- The Rotation / Translation command window is opened
- The results are displayed in the Measurement view (Figure) and in the Graph view (Figure 1.3-2).

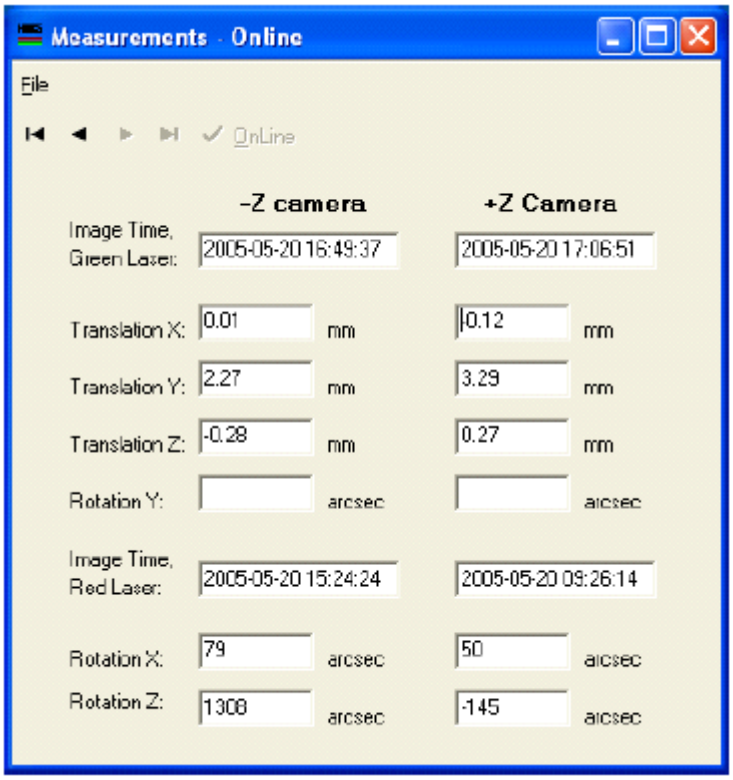


Figure 6: Measurement View

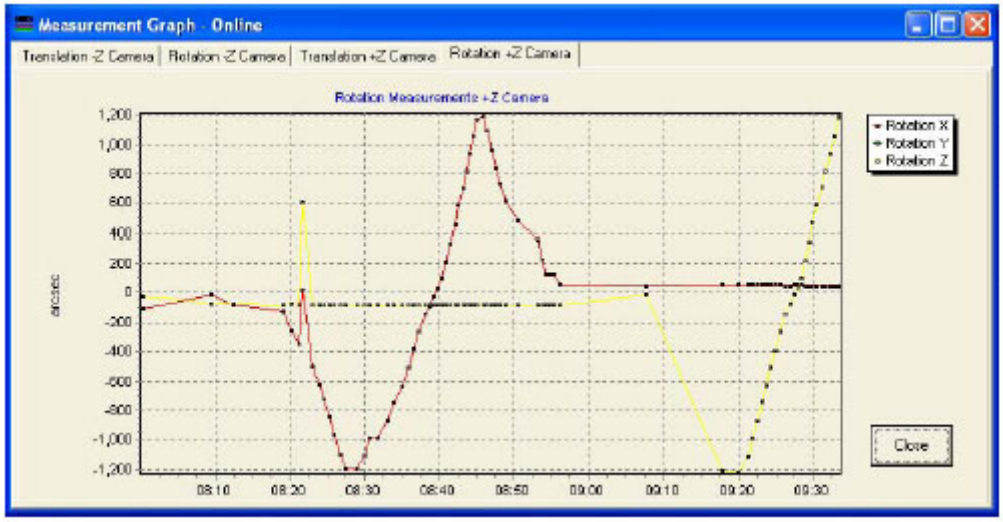


Figure 7: Graph View

E.3.2 Automatically

The HACS control software includes a command scheduler that makes it possible to execute HACS commands automatically. The schedule can contain up to 1000 commands to be executed within 300 hours. It is possible to re-start the schedule execution automatically with a user defined period between schedule execution times.
Automatically measurements can be performed by using the scheduler as follows:

- Open the Edit Schedule window by selecting “Edit”-“Schedule”
- Load the measurement schedule file “measurement.dat” by selecting “File”-“Load Schedule”
- Close the Edit Schedule window by pressing “Close”
- Start the schedule by selecting “Command”-“ExecuteSchedule”. Click the “Cyclic Execution” check box if measurements shall be performed at regular intervals. Start the measurement by pressing “Start”.

E.4 Deactivation

Power off the cameras and move both lasers to the home position as follows:

- Click on the CHU Power On/Off button. The CHU Power On/Off window is opened.
- Deactivate both cameras
- Click on the Light Source attenuation button. The light Source attenuation window is opened.
- An attenuation value of 0 steps moves both lasers to the home position.
- Verify in the Housekeeping window that camera voltages and power consumptions go to zero.

E.5 Operational Constraints

The HACS camera applicable temperature range is outlined below.

Hot Operational	Cold Operational	Cold Start-up	Cold Non-Operational	Hot Non-Operational
+60°C	-35°C	-35°C	-40°C	+70°C

Compliance to the temperature limits is mandatory in order not to damage the camera electronics. At ambient temperature and vacuum conditions the cameras can be operated at a 50% duty cycle (50% of the time on, 50% off) increasing to 100% at an ambient temperature of -40°C. The built-in temperature control will switch-off the cameras in case they become too warm.

In the unlikely event that the control PC breaks down during testing, then the following steps must be performed:

1. Power off the PC and light source assembly
2. Disconnect the camera electrical harness from the two PC PCI boards
3. Connect the supplied heater plug 26-pin connector to the camera electrical harness pigtails
4. Connect the heater plug red (+) and Black (-) banana plugs to a +10V DC power supply. The DC power supply must be capable of supplying in total 2*2.5 = 5W
5. Switch on the +10V DC power supply
6. Monitor the camera temperatures via the additional thermo-couplers under LSS responsibility and insure that the temperatures do not drop below -35°C

Annex F Form Sheets

The following form sheets will be used during the test:

ORS: An Operation Request Sheet will be issued whenever specific actions are to be taken as planned in the ITP (e.g. test phase transition, valve status change…) in order to guarantee traceability.

PVS: Procedure Variation Sheets will be issued when a deviation from the planned test sequence as defined in the ITP has to be performed.

The Test Conductor Data Sheet gives an overview of the overall test timeline.

OPERATION REQUEST SHEET	No.:

Title:

From

☐ Thermal ☐ Shift leader ☐ LSS Control

☐ CCS ☐ …….... ☐ Data Handling

Name:

To

☐ Thermal ☐ Shift leader ☐ LSS Control

☐ CCS ☐ …….. ☐ Data Handling

Action:

Reason:

Date to be executed	Time to be executed		Test Phase:
	UTC	Local	Test step:
Executed Date:	**Executed Time:**		**Sign.:**
	UTC	Local	

Approval:

Shift Leader	PA

	Procedure Variation Sheet	Curr. No.: Date: Page: of

Test designation	Test Procedure	Issue
Herschel FM TB/TV	HP-2-ASED-TP-0177	1

Test step changed	Reason for Change

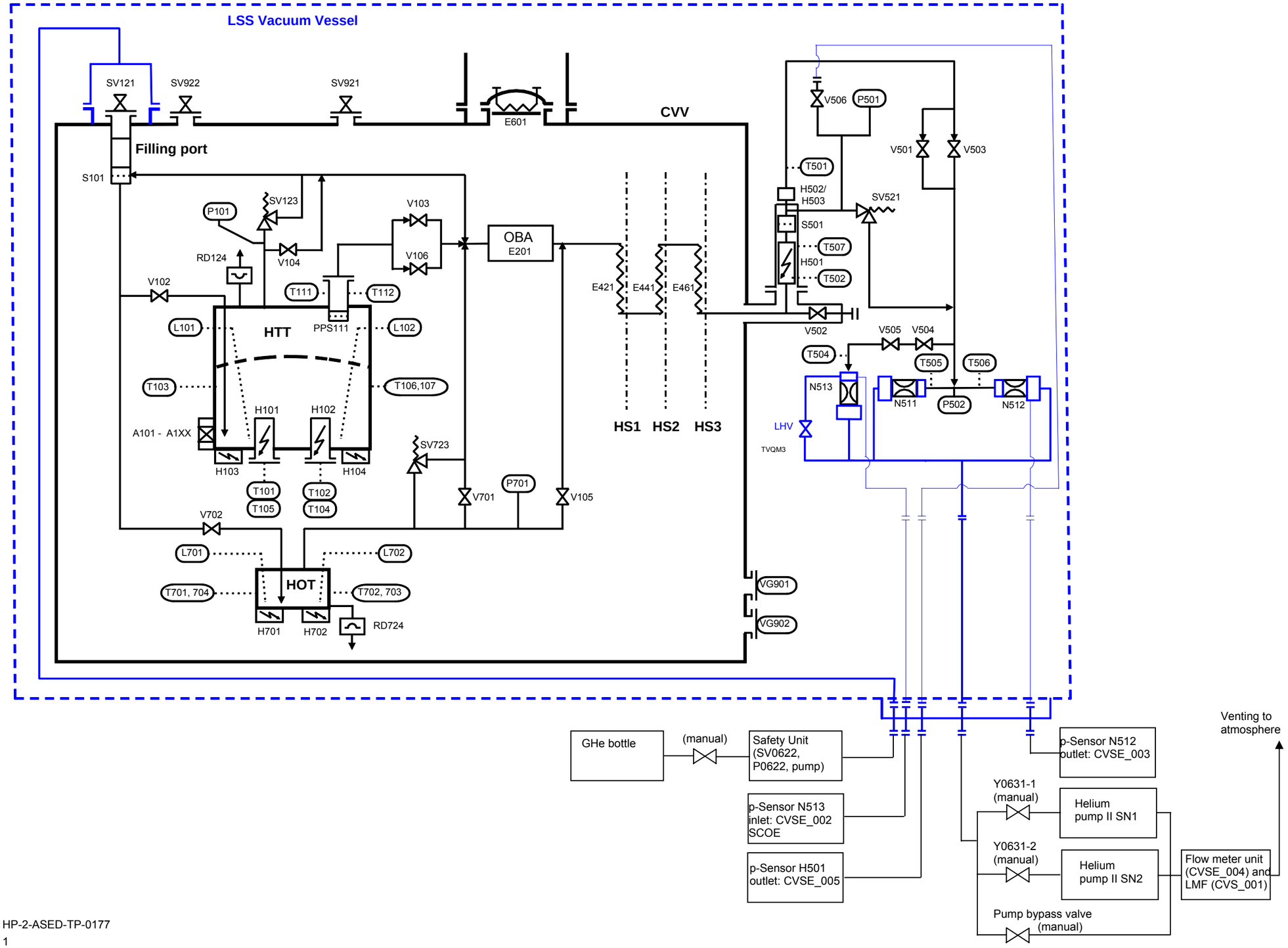
Prepared by:	Test Conductor	Project Engineer
PA/QA	Test Director	Customer

TEST CONDUCTOR DATA SHEET

Herschel FM TB/TV Test

Test Phase	Expected Duration (hrs)	Actual	
		Date & Time of TP start (UTC)	Duration (hrs)
TP-A - Functional tests and S/C preparation	350		
TP-B - LEOP and SVM Cold	148		
TP-C - PLM Rapid Cool-Down and SVM heat-up	56		
TP-D – TV Phase HIFI 0-1	11		
TP-E – Combined Instruments TV	8		
TP-F – HIFI TV Test 2	28		
TP-G – SPIRE TV and SVM TB Hot	48		
TP-H – HIFI TV Test 3	53		
TP-I – PACS TV Test	32		
TP-J – HIFI TV Test 4	78		
TP-K – SVM TV HOT	48		
SOVT2 at end of TP-K	120		
TP-L - Recovery to Ambient	72		
Test end	-		-
Total Test Time	1052		
Total Test Time (from start of LEOP)	702		

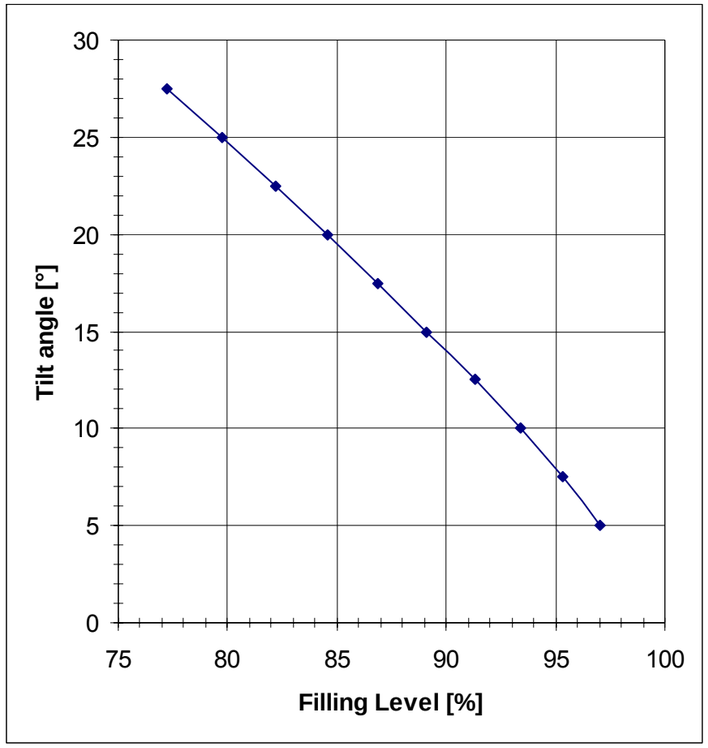
Annex G Helium flow chart and CVSE instrumentation



Annex H Data tables

H.1.1 Tilting Angles for PPS Operation

HTT filling level / %	Nominal tilt angle
97.9	3.5
97.6	4
97	5
95.3	7.5
93.4	10
91.3	12.5
89.1	15
86.9	17.5
84.6	20
82.2	22.5
79.75	25
77.2	27.5



The tilting angles given in the table above represent the calculated values for immersion of the porous plug in the bulk liquid. To guarantee safe operation of the PPS, the tilt angle shall be adjusted to 1° above the immersion values on a daily basis (maximum He consumption via PPS per day is 0.5% fill level, i.e. less than 1°).

H.1.2 SVM TCS heater lines cycling control table

Fill in the following table to trace cycling of SVM TCS heater lines:

Note : BEWARE OF THE CONFUSION TCS LINE NUMBER / LOOP INDEX

TCS line number (ref. H-PAI-TN-0069)	Loop Index	**Location**	Heater's location Herschel	THM 1	THM 2	THM 3	**measured reference**	Control Loop Class	Nominal Heater HPS(HCS)	Redundant Heater HPS(HCS)	TCS line number (ref. H-PAI-TN-0069)	**Test phase**	**Cycling date / time**	**Remarks**
Spare	1		Decontamination Heating 1	N/A	N/A	N/A	ThermAvgTemp001	N/A	1(1)	18(1)	Spare			
Spare	7		Decontamination Heating 3	N/A	N/A	N/A	ThermAvgTemp007	A	2(1)	17(1)	Spare			
Spare	12		Propellant tanks	THM-52	THM-100	N/A	ThermAvgTemp012	A	2(6)	17(6)	Spare			
Spare	19		Decontamination Heating 5	N/A	N/A	N/A	ThermAvgTemp019	A	4(1)	15(1)	Spare			
Spare	31		Decontamination Heating 7	N/A	N/A	N/A	ThermAvgTemp031	A	6(1)	13(1)	Spare			
Spare	49		Decontamination Heating 8	N/A	N/A	N/A	ThermAvgTemp049	A	9(1)	10(1)	Spare			
TcsLine01	6	**+Y+Z**	XPND1	THM-49	THM-97	THM-145	ThermAvgTemp006	A	1(6)	18(6)	TcsLine01			
TcsLine02	2	**+Y+Z**	XPND2	THM-50	THM-98	THM-146	ThermAvgTemp002	A	1(2)	18(2)	TcsLine02			
TcsLine03	38	**+Y**	BATTERY (*)	THM-51	THM-99	THM-147	ThermAvgTemp038	A	7(2)	12(2)	TcsLine03			
TcsLine05	11	**+Y-Z**	FPSPU / FPDPU	THM-53	THM-101	THM-149	ThermAvgTemp011	A	2(5)	17(5)	TcsLine05			
TcsLine06	13	**+Y-Z**	FPBOLC	THM-54	THM-102	THM-150	ThermAvgTemp013	A	3(1)	16(1)	TcsLine06			
TcsLine07	14	**+Y+Z**	CRS1	THM-55	THM-103	THM-151	ThermAvgTemp014	A	3(2)	16(2)	TcsLine07			
TcsLine08	15	**+Y-Z**	FPDECMEC	THM-56	THM-104	THM-152	ThermAvgTemp015	A	3(3)	16(3)	TcsLine08			
TcsLine09	16	**RCS**	PIPES	THM-57	THM-105	THM-153	ThermAvgTemp016	A	3(4)	16(4)	TcsLine09			
TcsLine10	17	**-Z**	CCU/HSDCU/HSFCU	THM-58	THM-106	THM-154	ThermAvgTemp017	A	3(5)	16(5)	TcsLine10			
TcsLine11	5	**RCS**	PIPES	THM-59	THM-107	THM-155	ThermAvgTemp005	A	1(5)	18(5)	TcsLine11			
TcsLine12	20	**-Y-Z**	FHWOV	THM-60	THM-108	THM-156	ThermAvgTemp020	B	4(2)	15(2)	TcsLine12			
TcsLine13	43	**-Y-Z**	FHHRV	THM-61	THM-109	THM-157	ThermAvgTemp043	A	8(1)	11(1)	TcsLine13			
TcsLine14	53	**STR 1 Pr. Baf.**	STR 1 Primary Baffle	THM-62	THM-110	THM-158	ThermAvgTemp053	A	9(5)	10(5)	TcsLine14			
TcsLine15	27	**-Y-Z**	FHWEV/FHICU	THM-63	THM-111	THM-159	ThermAvgTemp027	A	5(3)	14(3)	TcsLine15			
TcsLine16	39	**-Y**	FHWOH	THM-64	THM-112	THM-160	ThermAvgTemp039	B	7(3)	12(3)	TcsLine16			
TcsLine17	40	**-Y**	FHWEH	THM-65	THM-113	THM-161	ThermAvgTemp040	A	7(4)	12(4)	TcsLine17			
TcsLine18	26	**-Y**	FHHRH	THM-66	THM-114	THM-162	ThermAvgTemp026	A	5(2)	14(2)	TcsLine18			
TcsLine19	48	**-Y**	FHLCU/FHIFH	THM-67	THM-115	THM-163	ThermAvgTemp048	A	8(6)	11(6)	TcsLine19			
TcsLine20	52	**-Y**	FHLSU	THM-68	THM-116	THM-164	ThermAvgTemp052	A	9(4)	10(4)	TcsLine20			
TcsLine21	36	**-Y+Z**	RWL2	THM-69	THM-117	THM-165	ThermAvgTemp036	A	6(6)	13(6)	TcsLine21			
TcsLine22	32	**-Y+Z**	RWL4	THM-70	THM-118	THM-166	ThermAvgTemp032	A	6(2)	13(2)	TcsLine22			
TcsLine23	33	**-Y+Z**	RWL1	THM-71	THM-119	THM-167	ThermAvgTemp033	A	6(3)	13(3)	TcsLine23			
TcsLine24	34	**-Y+Z**	RWL3	THM-72	THM-120	THM-168	ThermAvgTemp034	A	6(4)	13(4)	TcsLine24			
TcsLine25	54	**TANKS**	TANK+Y	THM-73	THM-121	THM-169	ThermAvgTemp054	A	9(6)	10(6)	TcsLine25			
TcsLine26	50	**TANKS**	TANK-Y	THM-74	THM-122	THM-170	ThermAvgTemp050	A	9(2)	10(2)	TcsLine26			
TcsLine27	37	**STAR**	STAR TRACKER	THM-75	THM-123	THM-171	ThermAvgTemp037	B	7(1)	12(1)	TcsLine27			

TCS line number (ref. H-PAI-TN-0069)	Loop Index	**Location**	Heater's location Herschel	THM 1	THM 2	THM 3	**measured reference**	Control Loop Class	Nominal Heater HPS(HCS)	Redundant Heater HPS(HCS)	TCS line number (ref. H-PAI-TN-0069)	**Test phase**	**Cycling date / time**	**Remarks**
		TRAC.												
TcsLine28	35	**-Y-Z**	FHIFV	THM-76	THM-124	THM-172	ThermAvgTemp035	A	6(5)	13(5)	TcsLine28			
TcsLine29	22	**20 N TH**	FCV A1A	THM-77	THM-125	THM-173	ThermAvgTemp022	A	4(4)	15(4)	TcsLine29			
TcsLine30	23	**20 N TH**	FCV C2A	THM-78	THM-126	THM-174	ThermAvgTemp023	A	4(5)	15(5)	TcsLine30			
TcsLine31	41	**20 N TH**	FCV C1A	THM-79	THM-127	THM-175	ThermAvgTemp041	A	7(5)	12(5)	TcsLine31			
TcsLine32	42	**20 N TH**	FCV A2A	THM-80	THM-128	THM-176	ThermAvgTemp042	A	7(6)	12(6)	TcsLine32			
TcsLine33	51	**20 N TH**	FCV C4A	THM-81	THM-129	THM-177	ThermAvgTemp051	A	9(3)	10(3)	TcsLine33			
TcsLine34	44	**20 N TH**	FCV C3A	THM-82	THM-130	THM-178	ThermAvgTemp044	A	8(2)	11(2)	TcsLine34			
TcsLine35	45	**RCS**	PIPES	THM-83	THM-131	THM-179	ThermAvgTemp045	A	8(3)	11(3)	TcsLine35			
TcsLine36	46	**STR 2 Pr. Baf.**	STR 2 Primary Baffle	THM-84	THM-132	THM-180	ThermAvgTemp046	A	8(4)	11(4)	TcsLine36			
TcsLine37	47	**RCS**	PIPES	THM-85	THM-133	THM-181	ThermAvgTemp047	A	8(5)	11(5)	TcsLine37			
TcsLine38	18	**Gyro**	GYRO	THM-86	THM-134	THM-182	ThermAvgTemp018	A	3(6)	16(6)	TcsLine38			
TcsLine39	3	**20 N TH**	FCV A1B	THM-87	THM-135	THM-183	ThermAvgTemp003	A	1(3)	18(3)	TcsLine39			
TcsLine40	4	**20 N TH**	FCV C2B	THM-88	THM-136	THM-184	ThermAvgTemp004	A	1(4)	18(4)	TcsLine40			
TcsLine41	8	**20 N TH**	FCV C1B	THM-89	THM-137	THM-185	ThermAvgTemp008	A	2(2)	17(2)	TcsLine41			
TcsLine42	9	**20 N TH**	FCV A2B	THM-90	THM-138	THM-186	ThermAvgTemp009	A	2(3)	17(3)	TcsLine42			
TcsLine43	10	**20 N TH**	FCV C4B	THM-91	THM-139	THM-187	ThermAvgTemp010	A	2(4)	17(4)	TcsLine43			
TcsLine44	28	**20 N TH**	FCV C3B	THM-92	THM-140	THM-188	ThermAvgTemp028	A	5(4)	14(4)	TcsLine44			
TcsLine45	21	**RCS**	PIPES	THM-93	THM-141	THM-189	ThermAvgTemp021	A	4(3)	15(3)	TcsLine45			
TcsLine46	24	**RCS**	PIPES	THM-94	THM-142	THM-190	ThermAvgTemp024	A	4(6)	15(6)	TcsLine46			
TcsLine47	29	**RCS**	PIPES	THM-95	THM-143	THM-191	ThermAvgTemp029	A	5(5)	14(5)	TcsLine47			
TcsLine48	30	**RCS**	PT/LV1/LV2/LF	THM-96	THM-144	THM-192	ThermAvgTemp030	A	5(6)	14(6)	TcsLine48			
TcsLine49	25	**+Y+Z**	CRS2	THM-12	THM-20	THM-36	ThermAvgTemp025	A	5(1)	14(1)	TcsLine49			

H.1.3 Test heater settings

SVM test heaters – Refer to [AD25] for test heater settings

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type
SVM_ACC_Py_L1	70	208.00	30	30	0.380	0.380	267	SSP240		Manual
SVM_Battery_Py_L2	71	200.00	31	31	0.394	0.394	268	SSP240		Manual
SVM_CDMU_pY_L3	72	100.00	64	64	0.800	0.800	269	SSP240		Manual
SVM_PCDU_pY_L4	73	33.33	192	192	2.400	2.400	270	SSP240		Manual
SVM_SPIRE_mZ_L5	74	104.00	61	61	0.766	0.766	271	SSP240		Manual
SVM_HIFI-2_mYmZ_L6	75	69.33	92	92	1.152	1.152	272	SSP240		Manual
SVM_DECMEC_pYmZ_L7	76	138.70	46	46	0.576	0.576	273	SSP240		Manual
SVM_BOLC_pYmZ_L8	77	118.90	53	53	0.668	0.668	274	SSP240		Manual
SVM_RWS_mYpZ_L9	78	28.57	224	224	2.800	2.800	275	SSP240		Manual
SVM_HIFI-1_mYpZ_L11	79	46.80	136	136	1.705	1.705	276	SSP240		Manual
SVM_HIFI-1_mYmZ_2_L10	80	31.30	205	205	2.559	2.559	277	SSP240		Manual
SVM_red_ACC_Py_L1	90	208.00	30	30	0.380	0.380	278	SSP240		Manual
SVM_red_Battery_Py_L2	91	200.00	31	31	0.394	0.394	279	SSP240		Manual
SVM_red_CDMU_pY_L3	92	100.00	64	64	0.800	0.800	280	SSP240		Manual
SVM_red_PCDU_pY_L4	93	33.33	192	192	2.400	2.400	281	SSP240		Manual
SVM_red_SPIRE_mZ_L5	94	104.00	61	61	0.766	0.766	282	SSP240		Manual
SVM_red_HIFI-2_mYmZ_L6	95	69.33	92	92	1.152	1.152	283	SSP240		Manual
SVM_red_DECMEC_pYmZ_L7	96	138.70	46	46	0.576	0.576	284	SSP240		Manual
SVM_red_BOLC_pYmZ_L8	97	118.90	53	53	0.668	0.668	285	SSP240		Manual
SVM_red_RWS_mYpZ_L9	98	28.57	224	224	2.800	2.800	286	SSP240		Manual
SVM_red_HIFI-1_mYmZ_L10	99	18.70	136	136	2.697	2.697	287	SSP240		Manual
SVM_red_HIFI-1_mYpZ_2_L11	100	31.30	204	204	2.553	2.553	288	SSP240		Manual
panel +Y+Z -TTC lamp 1	101	31.25	200	200	4.000	4.000	289	SSP240		Fixed voltage
panel +Y+Z -TTC lamp 1 offset	101	31.25	200	200	4.000	4.000	290	SSP240	(Setpoint other PS)	Formula voltage
panel +Y+Z -TTC lamp 2	102	31.25	200	200	4.000	4.000	291	SSP240		Fixed voltage
panel +Y+Z -TTC lamp 2 offset	102	31.25	200	200	4.000	4.000	292	SSP240	(Setpoint other PS)	Formula voltage
panel +Y+Z -TTC lamp 3	103	31.25	200	200	4.000	4.000	293	SSP240		Fixed voltage
panel +Y+Z -TTC lamp 3 offset	103	31.25	200	200	4.000	4.000	294	SSP240	(Setpoint other PS)	Formula voltage
panel +Y+Z -TTC lamp 4	104	31.25	200	200	4.000	4.000	295	SSP240		Fixed voltage

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type
panel +Y+Z -TTC lamp 4 offset	104	31.25	200	200	4.000	4.000	296	SSP240	(Setpoint other PS)	Formula voltage
TTAS enclosure -STR lamp 1	105	31.25	200	200	4.000	4.000	297	SSP240		Fixed voltage
TTAS enclosure -STR lamp 1 offset	105	31.25	200	200	4.000	4.000	298	SSP240	(Setpoint other PS)	Formula voltage
TTAS enclosure -STR lamp 2	106	31.25	200	200	4.000	4.000	299	SSP240		Fixed voltage
TTAS enclosure -STR lamp 2 offset	106	31.25	200	200	4.000	4.000	300	SSP240	(Setpoint other PS)	Formula voltage

PLM warm-up heaters

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type	Mode A
CVV_05_LB-mY	5	10.57	80	80	2.751	2.751	249	SSP240	1300	Thermostatic current	293 K
CVV_06_LC-pZ	6	10.98	140	140	3.571	3.571	250	SSP240	1005	Thermostatic current	293 K
CVV_07_UC-pZ	7	10.40	90	90	2.942	2.942	251	SSP240	1004	Thermostatic current	293 K
CVV_08_UB-mZ	8	7.93	110	110	3.724	3.724	252	SSP240	1101	Thermostatic current	293 K
CVV_09_Rad-lower-mY	9	12.48	100	100	2.831	2.831	253	SSP240	2011	Thermostatic current	293 K
CVV_10_Rad-upper-mY	10	9.98	130	130	3.609	3.609	254	SSP240	1107	Thermostatic current	293 K
CVV_11_Rad-lower-mZ	11	12.48	100	100	2.831	2.831	255	SSP240	2113	Thermostatic current	293 K
CVV_12_Rad-upper-mZ	12	7.13	180	180	5.025	5.025	256	SSP240	1104	Thermostatic current	293 K
CVV_13_Rad-lower-pY	13	12.48	100	100	2.831	2.831	257	SSP240	2214	Thermostatic current	293 K
CVV_14_Rad-upper-pY	14	9.98	130	130	3.609	3.609	258	SSP240	1103	Thermostatic current	293 K
CVV_15_UB-HSIF-mZ	15	7.93	110	110	3.724	3.724	259	SSP240	1102	Thermostatic current	293 K
LOU_16_rad-lower	16	11.65	90	90	2.779	2.779	260	SSP240	2310	Thermostatic current	293 K
LOU_17_rad-upper	17	11.65	90	90	2.779	2.779	261	SSP240	2310	Thermostatic current	293 K
CVV_23_LC_pZ	23	12.50	100	100	2.828	2.828	262	SSP240	1302	Thermostatic current	293 K
CVV_24_LC_pZ	24	12.50	100	100	2.828	2.828	263	SSP240	1005	Thermostatic current	293 K
CVV_25_UC_pZ	25	12.48	100	100	2.831	2.831	264	SSP240	1000	Thermostatic current	293 K
CVV_35_LB-pY	35	10.57	80	80	2.751	2.751	265	SSP240	1301	Thermostatic current	293 K

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type	Mode A

Infrared Rig heaters

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type	Mode A	Mode B	Mode C
IRRIG_63_support	63	14.80	100	100	2.599	2.599	266	SSP240	8702	Thermostatic current	293 K	333 K	333 K
IRRIG_64_support_red	64	14.80	100	100	2.599	2.599	328	SSP240	8702	Thermostatic current	293 K	333 K	333 K
IRRIG_23_1st_row_pY	123	40.00	100	100	1.581	1.581	310	SSP240	8002	Thermostatic current	**293 K**	**373 K**	**373 K**
IRRIG_24_1st_row_mid	124	40.00	100	100	1.581	1.581	311	SSP240	8102	Thermostatic current	293 K	373 K	373 K
IRRIG_25_1st_row_mY	125	40.00	100	100	1.581	1.581	312	SSP240	8212	Thermostatic current	293 K	373 K	373 K
IRRIG_26_2nd_row_pY	126	40.00	100	100	1.581	1.581	313	SSP240	8004	Thermostatic current	293 K	373 K	373 K
IRRIG_27_2nd_row_mid	127	40.00	100	100	1.581	1.581	314	SSP240	8104	Thermostatic current	293 K	373 K	373 K
IRRIG_28_2nd_row_mY	128	40.00	100	100	1.581	1.581	315	SSP240	8214	Thermostatic current	293 K	373 K	373 K
IRRIG_29_3rd_row_pY	129	40.00	100	100	1.581	1.581	316	SSP240	8302	Thermostatic current	**193 K**	**293 K**	373 K
IRRIG_30_3rd_row_mid	130	40.00	100	100	1.581	1.581	317	SSP240	8402	Thermostatic current	193 K	293 K	373 K
IRRIG_31_3rd_row_mY	131	40.00	100	100	1.581	1.581	318	SSP240	8512	Thermostatic current	193 K	293 K	373 K
IRRIG_32_4th_row_pY	132	40.00	100	100	1.581	1.581	319	SSP240	8304	Thermostatic current	193 K	293 K	373 K
IRRIG_33_4th_row_mid	133	40.00	100	100	1.581	1.581	320	SSP240	8404	Thermostatic current	193 K	293 K	373 K
IRRIG_34_4th_row_mY	134	40.00	100	100	1.581	1.581	321	SSP240	8514	Thermostatic current	193 K	293 K	373 K
IRRIG_37_5th_row_pY	137	53.33	77	77	1.202	1.202	322	SSP240	8305	Thermostatic current	193 K	293 K	373 K
IRRIG_38_5th_row_mid	138	40.00	100	100	1.581	1.581	323	SSP240	8406	Thermostatic current	193 K	293 K	373 K
IRRIG_39_5th_row_mY	139	53.33	77	77	1.202	1.202	324	SSP240	8515	Thermostatic current	193 K	293 K	373 K
IRRIG_40_6th_row_pY	140	36.09	26.6	26.6	0.859	0.859	325	SSP240	8318	Thermostatic current	193 K	293 K	373 K
IRRIG_41_6th_row_mid	141	53.33	77	77	1.202	1.202	326	SSP240	8408	Thermostatic current	193 K	293 K	373 K
IRRIG_42_6th_row_mY	142	36.09	26.6	26.6	0.859	0.859	327	SSP240	8508	Thermostatic current	193 K	293 K	373 K
IRRIG_43_1st_row_pY_red	143	40.00	100	100	1.581	1.581	332		8002	Thermostatic current	**293 K** [1)]	**373 K** [1)]	373 K [1)]
IRRIG_44_1st_row_mid_red	144	40.00	100	100	1.581	1.581	333		8102	Thermostatic current	293 K [1)]	373 K [1)]	373 K [1)]
IRRIG_45_1st_row_mY_red	145	40.00	100	100	1.581	1.581	334		8212	Thermostatic current	293 K [1)]	373 K [1)]	373 K [1)]
IRRIG_46_2nd_row_pY_red	146	40.00	100	100	1.581	1.581	335		8004	Thermostatic current	293 K [1)]	373 K [1)]	373 K [1)]
IRRIG_47_2nd_row_mid_red	147	40.00	100	100	1.581	1.581	336		8104	Thermostatic current	293 K [1)]	373 K [1)]	373 K [1)]
IRRIG_48_2nd_row_mY_red	148	40.00	100	100	1.581	1.581	337		8214	Thermostatic current	293 K [1)]	373 K [1)]	373 K [1)]
IRRIG_49_3rd_row_pY_red	149	40.00	100	100	1.581	1.581	338		8302	Thermostatic current	**193 K** [1)]	**293 K** [1)]	373 K [1)]
IRRIG_50_3rd_row_mid_red	150	40.00	100	100	1.581	1.581	339		8402	Thermostatic current	193 K [1)]	293 K [1)]	373 K [1)]
IRRIG_51_3rd_row_mY_red	151	40.00	100	100	1.581	1.581	340		8512	Thermostatic current	193 K [1)]	293 K [1)]	373 K [1)]
IRRIG_52_4th_row_pY_red	152	40.00	100	100	1.581	1.581	341		8304	Thermostatic current	193 K [1)]	293 K [1)]	373 K [1)]
IRRIG_53_4th_row_mid_red	153	40.00	100	100	1.581	1.581	342		8404	Thermostatic current	193 K [1)]	293 K [1)]	373 K [1)]
IRRIG_54_4th_row_mY_red	154	40.00	100	100	1.581	1.581	343		8514	Thermostatic current	193 K [1)]	293 K [1)]	373 K [1)]

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type	Mode A	Mode B	Mode C
IRRIG_57_5th_row_pY_red	157	53.33	77	77	1.202	1.202	344		8305	Thermostatic current	193 K 1)	293 K 1)	373 K 1)
IRRIG_58_5th_row_mid_red	158	40.00	100	100	1.581	1.581	345		8405	Thermostatic current	193 K 1)	293 K 1)	373 K 1)
IRRIG_59_5th_row_mY_red	159	53.33	77	77	1.202	1.202	346		8515	Thermostatic current	193 K 1)	293 K 1)	373 K 1)
IRRIG_60_6th_row_pY_red	160	36.09	26.6	26.6	0.859	0.859	347		8318	Thermostatic current	193 K 1)	293 K 1)	373 K 1)
IRRIG_61_6th_row_mid_red	161	53.33	77	77	1.202	1.202	348		8408	Thermostatic current	193 K 1)	293 K 1)	373 K 1)
IRRIG_62_6th_row_mY_red	162	36.09	26.6	26.6	0.859	0.859	349		8508	Thermostatic current	193 K 1)	293 K 1)	373 K 1)

1) Redundant IR Rig heaters to be used only in case of failure of nominal heater line.

Test equipment heaters

Heater circuit name	Circuit No.	Heater circuit resistance	Max P [W]	Max P allowed [W]	Max I [A]	Max I allowed [A]	ESTEC PS number	PS Type	Control sensor / virtual	Control type	Mode A
Harness coax nom	107	59.00	100	100	1.302	1.302	301	SSP240	39826	Thermostatic current	20 °C
Harness coax red	108	49.00	120	120	1.565	1.565	302	SSP240	39836	Thermostatic current	20 °C
Harness signal nom	111	110.00	38	38	0.588	0.588	305	SSP240	39821	Thermostatic current	20 °C
Harness signal red	112	110.00	38	38	0.588	0.588	306	SSP240	39831	Thermostatic current	20 °C
TTAS	113	14.00	240	240	4.140	4.140	307	SSP240	9101	Thermostatic current	20 °C
TTAS_red	114	14.00	240	240	4.140	4.140	329	SSP240	9102	Thermostatic current	20 °C
Harness umb nom	115	110.00	55	55	0.707	0.707	308	SSP240	39804	Thermostatic current	20 °C
Harness umb red	116	110.00	55	55	0.707	0.707	330	SSP240	39814	Thermostatic current	20 °C
Harness power nom	117	85.70	70	70	0.904	0.904	309	SSP240	39823	Thermostatic current	20 °C
Harness power red	118	85.80	70	70	0.903	0.903	331	SSP240	39833	Thermostatic current	20 °C

Annex I Integrated Step-by-Step Procedure

The following chapter contains the Integrated Step-by-Step Test Procedure. Each section describes a complete test phase and is subdivided in a first overview sheet, followed by a table for the test steps in four columns, to be performed by the shift leader / TCS, CCS, ETS TDH and ETS LSS control, respectively. The test steps table for each phase contains three sections, to be performed at the beginning, during and at the end of the phase.

Test steps can be referenced by an unambiguous identifier, e.g. TP-A-1-T10, which is composed of the test phase (TP-A-), the beginning (1-), during (2-) or end (3-) identifier, the TCS (T), CCS (C), TDH (D) or LSS control (L) identifier and the sequential number.

The test phases nomenclature used in the current ITP is not in line with the phase definition in the test spec [AD4]. To guarantee traceability, the respective phase number from the test spec is annotated in the first column of the step by step procedure below, identified as “TS #x” where x represents the [AD4] phase number.

The “maximum predicted Power” values of the test heaters in the tables below are maximum powers during the complete test, not for the individual phase.

I.1 Functional tests and S/C preparation

Phase	**TP-A – Functional tests and S/C preparation**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	260	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Final setup and check-out of test equipment (CVSE, CCS, TDH, test MLI, videogrammetry, HACS) • Check of SVM TCS (ATC) • S/C tilting verification • Dry-run of TB/TV functional procedure • Cryostat preparation to achieve representative initial conditions for LEOP simulation: HTT He II top-up, pump-down and Thermal Shields cooling from external dewar, followed by a non-cooled phase to increase the TS1 temperature and HTT / HOT heating to target launch condition. • Videogrammetry measurement under ambient and vacuum conditions				

End of Phase Condition	• Cryostat in launch conditions:
	  • Fill level 96% -0/+2%
	  • HTT temperature < 1.947 K
	  • HOT temperature < 35 K
	  • OBA temperature < 49.4 K
	  • Shield 1 temperature < 100.6 K
	  • Shield 2 temperature < 144 K
	  • Shield 3 temperature < 208 K (212 K tbc)
	• SVM in launch mode
	• LSS closed and pumped down, ready for cool-down of shrouds				

Important Remarks	Mechanical S/C installation in the LSS is covered by [AD17] which is executed before the current ITP. Completion of electrical [AD18], CCS [AD19], CVSE [AD20], HACS [AD21], videogrammetry [AD23] and thermal setup [AD24] are covered by detailed procedures which are called from the current procedure. Final check-out activities will be performed in parallel to the activities defined here below. After installation in the LSS, He II production and top-up will be performed [AD27]. The functional dry-run will be based on a red-lined version of the TB/TV functional procedure. The expected duration for the dry run is 5 days. The Dry Run scope extends to: • SVM: launch mode, TB-COLD, TV-COLD, TB-HOT, TV-HOT. • Decontamination: LOU baffle, Telescope. • PLM: LEOP, Rapid Cool Down. • Instrument tests. The following operations shall not be rehearsed during the Dry Run, but the demonstration of their feasibility shall be demonstrated before chamber closure: • PLM valve operations. • Nozzle switching. The LOU N2 purge line shall be removed as late as possible. During / after chamber evacuation, the S/C will be switched off to avoid exceeding maximum acceptance temperatures on the power panel units. Although this phase comprises mainly preparations for the actual TB/TV test, **it is important to keep the planned sequence and duration** in order to reach the representative launch conditions, especially the HTT, HOT and Thermal Shield 1 temperatures, at the end of the phase.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

	Based on STM1 experience, the expected duration for LSS operations from beginning of scaffolding removal to readiness for shrouds cool-down is ~51 hrs. Planned sequence after end of He operations: He II top-up CVSE removal while pumping on V502 1. End of He operations 2. Preparation for TB/TV (**Facility preops) - 8 hours (2 pers)** in parallel: Removal of CVSE helium setup **(ASED – 8 hrs, 6 pers)** 2. Removal of He tower by crane **- 1 hour (3 pers)** 3. Removal of scaffolding, level A&B&C&D by crane (**ETS will make it's possible to remove the maximum items by hands**) **- 9 hours (4 pers)** 4. Removal of basic scaffolding (partly by crane) - **8 hours (4 pers)** 5. Installation of MLI patches on supports, **bottom and lower cylinder - 3 hours (2 pers)** 6. Installation of VDG scalebar 2 **hours** (according to A. Cozzani) 7. Flying Dutch man for MLI on VDG flange **- 1/2 hour 2 (pers)** 8. Cleaning of main (C1) and auxiliary chamber (C2) + shroud 3 - **2 hours (2 pers)** 9. CP1 leak detection **- 1 hour (2 pers)** 10. Moving of the LSS lid over the chamber **+ removal of the top lid trolley 1 hour (3 pers)**+ removal of telescope foil, Astrium activity –**(1 hr, 10 pers)** 11. Closure of the Top lid - **1 hour (3 pers)** 12. Closure of the 5 m door + leak check - **2 hours (2 pers)** 13. Perform VDG measurement to verify correct operation - 1 hr 13. 5 m door barriers removal in the basement for pumping unit installation **- 1/2 hour (1 pers)** 14. Check motion system tilt operations **(both side) - 1 hour (2 pers)** 15. Witness plate & QCM installation **- 1 hour** 16. Closure of the man door & Start pumping down - **1 hour** 17. Estimate duration of the pumping down **- 6 hours** 18. LSS leak check flanges - **2 hours** 19. Start cool down The overall expected duration from end of He operations to readiness for shrouds cool-down is thus 52 hrs. According to TMM predictions, the Thermal Shields cooling has to be stopped not earlier than 55 hrs before the launch simulation, i.e. sufficient margins have to be foreseen for unexpected events in the sequence after the end of shields cooling. The available time span can be extended to ~61 hrs by HTT pumping (mass flow ~10 mg/s) for 1 day at the end of the shields cooling. TP-A covers the test spec phases TS #0 and TS #1, and part of TS #2

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation	FACILITY		Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-A-1 start of phase	1. **Cryo Valve States:** (unchanged) V102: closed V104: closed V103: closed V106: closed V701: closed V702: closed V105: closed V501: open V503: open V504: open V505: open TV QM3: closed 2. Helium venting via V502 / CVSE or via opening V501/V503 on request of Cryo Engineer	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-A - Functional tests and S/C preparation 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS Alarm Limits:** keep predefined CCS alarm limits throughout test 6. **CCS data logging:** Start script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"**; acquisition interval 30 sec. 7. **SVM state and active PM**: CDMS: Launch / A ACMS: S.By / A TT&C / XPND: OFF 8. **Instrument states:** PACS: OFF SPIRE: OFF HIFI: OFF	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-A - Functional tests and S/C preparation 3. **Alarm Limits:** alarms off 4. **Acquisition Interval:** 2 m 5. **TDH Test Heaters:** all off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: ambient C2 shroud: ambient 3. **Pressure:** ambient 4. **Spin Box:** Temperature: ambient Tilt angle: 0° 5. **5m door and Cover:** open LSS status before S/C transfer: • MLI curtain installed • MLI patches installed (except on supports, bottom and lower cylinder parts, to be installed after scaffolding dismounting) • VDG system installed (except scale bar) • TTA installed • IR rig installed, connected and checked out (heaters and sensors) • Scaffolding up to level C installed, including He dewar tower	
TP-A-2 during phase TS #0	1. Initialise parallel activities for finalization of S/C installation in LSS as defined in the respective detailed procedures: electrical [AD18] (including CCS and TDH harness, TDH sensor and heaters checkout) ok at: ……... / ……...				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation			Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	CCS [AD19] ok at: …….. / …….. CVSE [AD20] ok at: …….. / …….. HACS [AD21] (including functional check) ok at: …….. / …….. videogrammetry [AD22], [AD23] ok at: …….. / …….. thermal setup [AD24] ok at: …….. / …….. 2. When CCS and electrical setup is completed: Give go-ahead to start ATC health check and functional dry-run 5. When Cryo-SCOE setup is completed: Perform Cryo-SCOE SFT ok at: …….. / …….. 6. Check synchronization of CCS and Facility clocks: Clock offset (> 0 means CCS shows later time than TDH): offset: …….. 7. Perform cryostat preparation activities in parallel to all other activities up to end of TP-A-2: He II production and top-up acc. to [AD27] to HTT filling level 96% (-0/+2%) at 1.7±0.01 K	3. Upon go-ahead from shift leader: Execute section 8.0 of [AD2]. 4. Start TB/TV dry-run according to red-lined functional test procedure (ACS HP-2-ASED-SD-0434)			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation			Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	8. Determine filling level of HTT (L101 / L102): HTT filling level: …….. 9. Determine required tilt angle for PPS start-up using table in section Annex H: Required tilt angle: …….. 10. **Perform KIP for go-ahead to stop Thermal Shields cooling** and start of uncooled preparation phase: Confirm closure of all preparation activities started in TP-A-2-T1 confirmed at: …….. / …….. 11. Confirm successful closure of functional dry run 12. Check He pumps 13. Check for open work or blocking points before LSS closure and pump-down 14. Call Key Point Meeting to give go-ahead. go-ahead at: …….. / …….. 17. Stop thermal shields cooling from external dewar. stopped at: …….. / …….. 18. Remove external shield cooling CVSE, attach SV121 catcher, safety line and V502 blind cap 19. Remove LOU N2 purge line 20. Perform leak test of LSS internal safety line 21. Request PA to perform visual inspection 22. Request LSS to remove scaffolding	15. At end of TB/TV dry run: Switch SVM to Launch Mode: Perform section 8.0.2 of [AD2]. 16. Perform final checks acc. to section 8.1 of [AD2]		23. Upon request of shift leader: Remove scaffolding and integrate MLI patches on supports, bottom	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation		Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING / LSS CONTROL	
			and lower cylinder	
	24. Open pump inlet valves to initiate **helium tubing evacuation** pump opened at **T_pump =** …….. / ……...			
	25. Request CCS to **open external valves** V501 and V503 **at T_pump + 320 s.** New cryo valve states: Open: V501, V503, V504, V505 Closed: V103, V106, V105, V102, V104, V701, V702, TVQM3 ok at …….. / ……...	27. On request of shift leader: Open external valves V501 and V503		
	26. Monitor HST pressures P501, P502 to verify tubing evacuation to pressure below 10 mbar before T_pump + 1240 sec ok at …….. / ……...			
	28. Open HTT outlet valve V104 and nozzle bypass valve TVQM3 (SPARE1) to start **pumping on HTT.** New cryo valve states: Open: V104, V501, V503, V504, V505 , TVQM3 Closed: V103, V106, V105, V102, V701, V702 ok at …….. / ……...	30. On request of shift leader: Open valves V104 and TVQM3 (SPARE1)		
	29. Continue pumping on HTT for ~1 day, target mass flow rate ~10 mg/s. Pumping duration tbc during test by test conductor, depending on achieved mass flow rate.			
	31. Close external vent line valves V501/V503, HTT outlet valve V104, and nozzle bypass valve TVQM3 to **stop pumping on HTT.** New cryo valve states: Open: V504, V505 Closed: V103, V106, V105, V102, V104, V701, V702, V501, V503, TVQM3 ok at …….. / ……... (Note: Helium tubing system is at underpressure from now on!)	32. On request of shift leader: Close valves V501/V503, V104 and TVQM3 (SPARE1)		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation			Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	34. Fill in **planned time** for following activities: • (Delayed) launch simulation planned at (55 hrs after end of TS cooling): Planned T0 = ……... / ……... • Start of HTT heating planned at (T0 - 4 hrs): ……... / ……... • 1st switch-on of SPIRE LPU is not perfomed (27hrs before T0): ……n/a……... • 2nd switch-on of SPIRE LPU planned at (2hrs before T0): ……... / ……... 37. Request LSS to move and close cover 38. Remove telescope protective foil before closure 42. Request LSS to perform **Videogrammetry** measurement acc. to [AD23] 44. When 5m door is closed: Move helium pumping units 2 to basement (for nominal operation) and install vent-line to LSS flange on port A9 (in parallel to next activities); perform leak tests 45. Monitor HTT and Thermal Shields temperatures throughout non-cooled phase. Check for possible deviations wrt predictions and update planning for launch simulation (T0) accordingly.		43. Perform Videogrammetry measurement acc. to [AD23]	33. Integrate VDG scale bar (as early as possible) 35. Clean chamber 36. Report readiness for LSS cover closure 39. Move LSS cover above LSS and suspend cover to crane 40. Close LSS cover after protective foil removal 41. Close 5m door	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation			Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	46. Keep helium gas with pressure ~50 mbar above ambient in safety line until start of chamber cool-down				
TS #1	47. Request LSS to perform tilting tests. During tilting to +Y down (positive tilt), observe PPS temperatures T111/T112 and record tilt angles: Return to vertical orientation after tilting verification. Time Observation Tilt angle …… …… …….. …… …… …….. …… …… …….. …… …… ……..			48. On request and under control of shift leader: Perform tilting tests to +Y and –Y. Max. foreseen tilt angle: +/-20° max. +Y tilt angle: …….. max. –Y tilt angle: …….. Note: These measured max angles must not be exceeded throughout the test! Return to vertical orientation after verification.	
TS #2a	49. Switch off HACS to avoid overheating ok at: …….. / …….. 50. Switch off VG902 before LSS pump-down to avoid ESD/corona effect: ok at: …….. / …….. 51. Request TDH to load SVM alarm limits T2	52. Execute section 8.2.1 of [AD2]	53. Load alarm limits: General LOU SVM: T0	54. Install witness plates	
TS #2b	55. Request LSS to **start pump down**: latest time (launch simulation -8 hrs): …….. / …….. started at (date / time): …….. / ……..			56. Close man door 57. Pre-operations and switch ON instructions performed Ok at date / time: ……. / …….. 58. Confirm facility ready to start test Ok at date / time: ……. / …….. 59. On request of test conductor, start	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation	FACILITY		Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
				pumping down LSS chamber according to LSS procedure : ETS/INST/THER/211	
TS #2e	60. Monitor SVM temperatures. Expect exceedance of acceptance temperature limits on SVM power panel units 8 hrs after begin of pump down. If warning limits are reached: request Test Director decision to switch off S/C. S/C off at: ……... / ……...	61. On request of test director: Execute section 8.2.5 of [AD2] to switch off S/C		62. Switch on door signs. Ok at date / time: ……. / …….	
TS #2f	63. Initiate S/C switch ON 5 hrs before planned launch simulation. S/C switch on planed at: ……... / ……... 64. Request TDH to load SVM alarm limits T2	65. 5 hrs before planned launch simulation: Execute section 8.2.6 of [AD2] to switch on S/C 66. Start new CCS session.	67. Load alarm limits as defined in **Annex A**: General LOU SVM: T1	68. Install on doors the red warning notices. Ok at date / time: ……. / …….. 69. Ask security to change to safety configuration 3. Ok at date / time: ……. / …….. 70. Start chamber interseal pumps. Ok at date / time: ……. / …….. 71. Open V7. ……. / …….. 72. Fill in pump down sheet. Ok at date / time: ……. / …….. 73. Start pumping with all CPS pumps. Ok at date / time: ……. / …….. 74. Open mass spectrometer valves (D7, B10). Ok at date / time: ……. / …….. 75. Start the two 20K cryo-pumps. Ok at date / time: ……. / …….. 76. When chamber pressure is 12 mbar, start roots 4. Ok at date / time: ……. / …….. 77. When chamber pressure reaches	

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

Step	Phase:	TP-A – Functional tests and S/C preparation	FACILITY		Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
				1x10-1. start Motion System interseal pumps and auxiliaries Ok at date / time: …….. / …….. 78. Start SNSE sectional flushing. Ok at date / time: …….. / …….. 79. Switch ON the 4 TM pumps at 5x10-2.mbar Ok at date / time: …….. / …….. 80. At 2x10-2 mbar, close V7 and cool down CP1. Ok at date / time: …….. / …….. 81. At 5x10-3 mbar open the 4 TM pumps HV valves …….. / …….. 82. Verify nominal operation of the 4 TM pumps. …….. / …….. 83. Cool down CP2. …….. / …….. 84. Stop roots 4 and CPS pumps. …….. / …….. 85. Start HP GN2 system.Mirror temp. 26º C. …….. / …….. 86. Switch ON mass spectrometers. …….. / …….. 87. Perform an He leak check on the 5m door shroud. …….. / …….. 88. Perform an He leak check on the MS shroud. …….. / …….. 89. Perform a leak check on flanges B2, B3, B4, B5, B6, B7, B10, A9, E11, E12, C2, C6.	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-A – Functional tests and S/C preparation	FACILITY		Remarks / NCR
	Test Floor: TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
				……. / …….. 90. If the 20K cryo-pumps are ready, open the VW 100 valves of cryo No 1 and No 2. ……. / …….. 91. Ask the Data Handling to set an alarm on the chamber pressure (1x10-5 mbar). ……. / …….. 92. Ask the Data Handling to set an alarm on CP1 and CP2 at -170º C. ……. / …….. 93. Start MS heater foils. ……. / …….. 94. Inform shift leader that pump down is completed	
TP-A-3 end of phase	1. Check Cryo Valve states at end of preparation phase: Open: V504, V505 Closed: V102, V104, V103, V106, V105, V701, V702, V501, V503, TVQM3 2. Verify that end-of-phase conditions are reached	1. Prepare EOP reports as defined in **Annex D** 2. Store CCS data (tables and rec files) on CD ROM Fill in: Date / Time of end: …….. / ……..			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.2 TP-B – LEOP and SVM Cold

Phase	**TP-B - LEOP and SVM Cold**	**Type:**	transient	**S/C Attitude**	**Tilt /° :** 0 at beginning, to be adjusted during phase
Expected Duration / hrs	148	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Cool-down LSS shrouds (RT to LN2) • Verify safe PPS start-up and operation • Simulate the PLM in-orbit cool-down after launch • Confirm PLM TMM predictions of temperature peak in HTT • Verify PPS margin wrt peak temperature • Perform alignment measurements using the HACS • Verify the SVM pre-launch and launch sequence • Validate the SVM thermal control design changes between STM and FM configuration • validate the SVM thermal Mathematical Model (TMM) in steady state and transient conditions • validate the SVM thermal control design concept and thermal performances				
End of Phase Condition	• HTT temperature decreasing after peak value (T101. T102, T104, T105 drift < 0 for 30 min) • PPS temperature margin checked • SVM TB-Cold conditions				
Important	Lift-off simulation to be initiated when the cryostat launch conditions are reached • Fill level 96% -0/+2% • HTT temperature < 1.947 K • HOT temperature < 35 K • OBA temperature < 49.4 K • Shield 1 temperature < 100.6 K • Shield 2 temperature < 144 K • Shield 3 temperature < 208 K (212 K tbc) HTT / HOT heating to be performed before lift-off simulation to reach the HTT / HOTS target temperature of 1.947 K at the same time (tbc during test). The launch sequence has to be followed closely, especially the time from external valves V501/V503 opening to PPS start-up, comprising opening of V103/V106 and tilting the S/C to immerse the PPS in the HTT liquid contents.. To operate correctly, the PPS shall be located 0 to 30 mm below the liquid surface. This is achieved by tilting the S/C by 1 (one) more degree when the PPS has already started. Correct operation of the PPS is confirmed when the temperature at the PPS outlet is lower than the temperature within the HTT, i.e. T111 & T112 < T101, T102, T104, T105 SVM is switched from Launch Mode to Safe Mode, where a cold stabilization phase is performed, including the observation of TCS heater line cycling (to be recorded in section H.1.2) and the verification of the RCS design by tuning of test heaters The SVM is then switched to NOM mode, and the thermal stability is achieved in the various instrument prime / standby modes: • HIFI prime (check STB to prime switching),PACS/SPIRE OFF, wait for stabilisation • HIFI prime),PACS/SPIRE stand-by, wait for stabilisation • HIFI prime (control law dynamic verification), PACS/SPIRE stand-by, modify control law set point to check the dynamic response, wait for stabilisation After the stability phases, and near to the end of the PLM LEOP phase, the SVM cold TV part is performed including SVM unit functional tests and instrument SFTs. TP-B covers the test spec phases TS #2 (end) and TS #3 – TS #5.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-B - LEOP and SVM Cold CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
TP-B-1 start of phase	1. **Cryo Valve States:** (unchanged) V102: closed V104: closed V103: closed V106: closed V701: closed V702: closed V105: closed V501: closed V503: closed V504: open V505: open TV QM3: closed 2. Request TDH to switch on test heaters	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-B - LEOP and SVM Cold 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Restart script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"**; acquisition interval 30 sec. 6. **SVM state and active PM**: LAM acc. to Sec. 3 of [AD1] CDMS: Launch / A ACMS: S.By / A TT&C / XPND: OFF 7. **Instrument states:** PACS: OFF SPIRE: OFF HIFI: OFF	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-B - LEOP and SVM Cold 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A**: General LOU SVM: T1 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** **Switch on test heaters** TTAS 293K Test harness 293K SVM: Off IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: ambient C2 shroud: ambient 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: ambient SB shroud: ambient Tilt angle: 0° 5. **5m door and Cover:** closed	
TP-B-2 during phase (TS#2c)	1. Request ETS to perform Videogrammetry measurement acc. to [RD2] 2. Start VG902 measurements 3. Verify He pumps status 6. **Extrapolate OBA and thermal shields temperatures** to **update planned T0** (launch simulation to be performed when cryostat launch conditions are reached, see above). Updated planned T0 = ……... / ……... 7. Extrapolate HTT temperature to updated T0. Extrapolated HTT temp. at planned T0 = ……..K		4. perform Videogrammetry measurement acc. to [RD2]	5. Be prepared to adjust tilt angle immediately on request of test conductor, independently from cool-down sequence	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-B - LEOP and SVM Cold CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	8. Extrapolate HOT temperature to updated T0. Extrapolated HOT temp. at planned T0 = ……..K 9. If extrapolated **HTT** temperature is below 1.947 K: switch on / off H103 / H104 **to reach target temperature** at planned T0. Additional HTT temperature slope for 10 W heater power is ~28 mK/hr. Expected heating power and duration **=** ……W.. / ……min.. 10. **Switch on** H103 / H104 heaters: total power: ……W Switched on at …….. / ……... 11. **Switch off** H103 / H104 heaters: Switched off at …….. / ……... HTT temperature: ……K				
TS #2g	12. Request CCS to perform 2nd switch-ON of SPIRE LPU at (**2hrs before delayed launch simulation**): planned at …….. / ……... (Note: Switch-off planned after 3.5 hrs. LPU duration shall not exceed the planned time!)	13. Perform 2nd switch-ON of SPIRE LPU at (2hrs before delayed launch simulation): Perform Section 8.2.7 of [AD2] ok at …….. / ……... (Note: Switch-off planned after 3.5 hrs. LPU duration shall not exceed the planned time!) switch-off planned at …….. / ……...			
	14. When TS1 average is at **100.6 K**: Verify that cryostat is at launch condition as defined above				
TS #2g	**15. Start launch simulation sequence**				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

Step	Phase:	TP-B - LEOP and SVM Cold	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TS#2h	16. Request LSS to start shrouds cool-down 19. Note time stamp for lift-off simulation: ”lift-off” at **T0 =** …….. / …….. 20. **Open external valves** V501 and V503 **at T0 + 320 s.** New cryo valve states: Open: V501, V503, V504, V505 Closed: V103, V106, V105, V102, V104, V701, V702, TVQM3 ok at …….. / …….. 21. **Open PPS valves** V103 and V106 **at T0 + 1240 s.** New cryo valve states: Open: V103, V106, V501, V503, V504, V505 Closed: V105, V102, V104, V701, V702, TVQM3 ok at …….. / …….. 25. Request CCS to disable Gyro / STR continuity check for tilting 27. Request LSS to tilt S/C to perform **PPS start-up at T0 + 1494 s** ok at …….. / …….. 29. Verify cryo valve states at end of PPS start-up: Open: V103, V106, V501, V503, V504, V505 Closed: V102, V104, V105, V701, V702, TVQM3 30. Verify that vent line heaters H501 / H502 are off 33. 30 min after end of tilting: Request CCS to enable	17. Execute section 8.2.8 of [AD2] to simulate launch phase and separation. **Perform switching of helium valves V501 & V502, V103 & V106 only upon explicit go-ahead from shift leader** 26. On request of shift leader: disable Gyro / STR continuity check acc to section xxxgyrodis of [AD2]. 34. On request of shift leader: enable Gyro / STR continuity		18. On request of shift leader: start cool-down operation acc. to applicable procedure: ETS/INST/THER/328 22. Set LN2 tank pressure to 2 bar …….. / …….. 23. Check LN2 tank level: it must be above 50000 l. Transfer LN2 from another tank if level is below 50000 l. …….. / …….. 24. Check that all pumps are in nominal conditions. …….. / …….. 28. On request of shift leader: **Immediately adjust tilt angle**, rotation around S/C Z axis, –telescope moves to the left as seen from 5m door (independent from cool-down sequence). Tilt direction: **+** Tilt speed: 1°/min 31. Cool down C1+C2 sections (use LN2 pump 1 A). Ok at date / time: …….. / …….. 32. Verify nominal cool down of all shrouds. Ok at date / time: …….. / ……..	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
	Gyro / STR continuity check	check acc to section xxxgyroen of [AD2].			
TS #2i	35. Monitor PPS temperature drop (ok if T111 < T101) 36. Monitor HTT temperature & pressure, PPS temperature gradient, and mass flow rate	37. Switch OFF SPIRE LPU (1.5 hrs after delayed launch): Perform Section 8.2.9 of [AD2] ok at …….. / ……..		38. Establish LN2 circulation in C1+C2. Ok at date / time: …….. / ……..	
TS #2j	39. Adjust pressure in SV121 safety line to 55±5 mbar using the dedicated pump in the safety unit to avoid helium flow through SV121 when CVV is cold and O-ring gets leaky. Pressure will decrease to ~20 mbar with decreasing temperature in safety line. Ok at date / time: …….. / …….. 40. Keep pressure in safety line at HTT saturated vapour pressure ±3 mbar until CVV is recovered to ambient temperature (check on a daily basis, no adjustments foreseen). 41. In parallel to next steps; When CVV temperature is below 210 K: Verify that alignment target is visible to HACS Ok at date / time: …….. / …….. 42. Start HACS measurements acc. to [RD1] (continue in next test phases until CVV reaches equilibrium temperature) 45. Call Key Point Meeting for end of SVM LEOP mode. Ok at date / time: …….. / ……..	43. After LPU switch off, start SVM LEOP mode: Perform Section 8.2.10 of [AD2] for mode transition.		44. Verify: - Chamber pressure is < 1 x 10^{-5} mbar - Chamber temperature is ≤100 K - GS position is 0° (S/C -Z to collimator mirror)	
TS #3a	46. Request TDH to load SVM alarm limits T2 47. Request TDH to set SVM test heaters acc. to [AD25]	48. **Transition to System Safe Mode**: Perform Section 8.3.1 of [AD2] for transition to CDMS survival.	49. Load alarm limits as defined in **Annex A**: General LOU SVM: T2 50. Set SVM test heaters acc. to SVM TCS request		
TS #3b	51. Monitor HTT filling level by integration of mass flow	53. Perform Section 8.3.2 of [AD2] for transition to ACMS		54. On request of shift leader:	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
	measurements and **adjust tilting angle every 24 hours** acc. to section H.1.1 (1° above table value); fill in section I.2.1. Note: Gyro/STR continuity check to be disabled before tilting operations, re-enable after 30 min!	survival.		Perform daily adjustment of tilt angle	
	52. Monitor overall temperatures and test heater duty cycles. Adjust heater settings if necessary.				
	55. Monitor SVM temperatures and adjust test heater power as appropriate		56. Adjust test heater settings on request of thermal team during cool-down and stabilization		
	57. Verify that all SVM TCS heater lines have switched during SVM cold phases. Fill in table in section H.1.2 throughout TP-B				
TS #3c	58. Monitor SVM equilibrium temperature sensors and SVM TCS heater duty cycles	61. Perform Section 8.3.3 of [AD2] for Safe Mode stabilization.			
	59. Continue **SVM safe mode until stability criteria** are fulfilled: Temperature drift <1°C/8 hrs for all SVM structure sensors. Reached at date / time: …….. / ……..				
	60. Call Key Point Meeting for **end of SVM safe mode phase**: go-ahead at date / time: …….. / ……..				
TS #3d	**62. Request CCS to start transition sequence to SVM TB cold**	63. On TCS request: Transition to SAM: Perform section 8.3.4 of [AD2]			
TS #3e		64. Perform section 8.3.5 of [AD2] for transition to CMDU Nom			
TS #3f		65. Perform section 8.3.6 of [AD2] for transition to ACMS OCM			
TS #3g		66. Perform section 8.3.7 of [AD2] for transition to ACMS SCM			
TS #3h		67. Perform section 8.3.8 of [AD2] for CDMS reconfiguration B to A			
TS #3i		68. Perform section 8.3.9 of [AD2] for ACC reconfiguration B to A			
TS #3j		69. Perform section 8.3.10 of [AD2] for TTC reconfiguration to A			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-B - LEOP and SVM Cold CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
TS #3k		70. Perform section 8.3.11 of [AD2] for transition to CMDS nom			
TS #3l		71. Perform section 8.3.12 of [AD2] for transition to ACMS OCM			
TS #3m		72. Perform section 8.3.13 of [AD2] for transition to ACSM SCM			
		73. Start new CCS session			
TS #4a	74. Request TDH to set SVM test heaters acc. to [AD25] 75. Request TDH to load SVM alarm limits T3		76. Set SVM test heaters acc. to SVM TCS request Load alarm limits as defined in **Annex A**: General LOU SVM: T3		
TS #4b	77. Start SVM TB cold phase: **HIFI Standby1 mode 1** 78. Continue SVM TB Cold **HIFI Standby1 mode 1** until stability criteria are fulfilled: Temperature drift <1°C/8 hrs for all SVM structure sensors. Reached at date / time: …….. / ……..	79. Perform section 8.4.1 of [AD2] to start SVM TB cold HIFI Standby1 mode 1 (PACS and SPIRE off) 80.			
TS #4c TS #4d	81. Start SVM TB cold **HIFI prime mode 2** 82. Request TDH to load SVM alarm limits T4 83. Continue SVM TB Cold HIFI Standby1 mode 2 until stability criteria are fulfilled: Temperature drift <1°C/8 hrs for all SVM structure sensors. Reached at date / time: …….. / ……..	84. Switch PACS and SPIRE to STB, HIFI remains in Standby1 mode: Perform Section 8.4.3 of [AD2] for mode transition	85. Load alarm limits as defined in **Annex A**: General LOU SVM: T4		
TS #4e	86. Request TDH to increase power on HIFI panels to simulate attitude change 87. Continue SVM TB Cold HIFI 2 mode until stability criteria are fulfilled: Temperature drift <1°C/8 hrs for all SVM structure sensors. Reached at date / time: …….. / ……..		88. Set SVM test heaters acc. to SVM TCS request		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	89. Call Key Point Meeting for **end of SVM TB cold phase**: go-ahead at date / time: …….. / ……... Signature: ……..				
	90. **In parallel to SVM TB and TV cold phase**: Continue **PLM LEOP simulation up to step TP-B-T96**. 91. Predicted time for HTT temperature peak is T0+~117 hrs. HTT peak temperature: ……..K. Reached at date / time: …….. / ……... 92. Large nozzle switch-off to be performed 24 hrs after HTT peak temperature. Large nozzle switch-off planned at: Planned at date / time: …….. / ……...				
	93. Close external vent line valves V504 and V505 to **switch off large nozzle**. New cryo valve states: Open: V103, V106, V501, V503 Closed: V102, V104, V105, V701, V702, V504, V505, TVQM3 ok at …….. / ……... 95. Continue LEOP simulation for 4 hrs to verify HTT temperature decrease with small nozzles ok at …….. / ……...	94. Close external vent line valves V504 and V505 on TCS request			
	96. End of PLM LEOP simulation sequence				
	97. Open external vent line valves V504 and V505 to	99. Open external vent line valves V504 and V505 on TCS			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	activate large nozzle. New cryo valve states: Open: V103, V106, V501, V503, V504, V505 Closed: V102, V104, V105, V701, V702, TVQM3 ok at …….. / ……..	request			
	98. Perform **verification of PPS margin** wrt max. bath temperature: Heat HTT to max(2.1 K; peak temperature + 25 mK). Expected HTT temperature slope for 10 W heater power is ~18 mK/hr				
	100. Switch on H103 to 10W on Cryo SCOE	102. On TCS request: switch on H103, Power 10 W			
	101. Monitor PPS temperature sensors T111, T112 and HTT DLCM sensors T101, T102, T104, T105. Liquid break-through is indicated by a sudden increase of the PPS outlet sensors. break-through at HTT temperature: ……..K. observed at …….. / ……..				
	103. When HTT target temperature is reached: switch off H103 (even if no liquid break-through has occurred)	104. On TCS request: switch off H103			
	105. **Perform PPS sensors cross-check**:	108. On TCS request: close V103 and V106			
	106. Close PPS valves V103 / V106 to flood PPS and determine temperature sensors offset. New cryo valve states: Open: V501, V503, V504, V505 Closed: V103, V106, V102, V104, V105, V701, V702, TVQM3 ok at …….. / ……..				
	107. Wait for stable reading of T111 / T112				
	109. Request CCS to disable Gyro / STR continuity check for tilting	110. On request of shift leader: disable Gyro / STR continuity check acc to section xxxgyrodis of [AD2].			
	111. Request LSS to return to vertical S/C orientation			112. On request of shift leader:	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
	vertical at …….. / …….. 113. Request CCS to enable Gyro / STR continuity check 30 min after end of tilting: 115. Perform **pressure sensors cross-check** 116. Close both manual He pump inlet valves Y0631 (including needle valves). 117. Wait for stable readings (below svp) on all pressure sensors P502, P501, CVSE_002, CVSE_003, CVSE_005 118. Record P506 analogue pressure reading: P506: ……..mbar Date / time: …….. / …….. 119. Open HTT outlet valve V104 to get svp reference value. New cryo valve states: Open: V104, V501, V503 , V504, V505 Closed: V103, V106, V102, V105, V701, V702, TVQM3 ok at …….. / …….. 120. 122. Wait for stable readings on all pressure sensors P502, P501, CVSE_002, CVSE_003, CVSE_005 123. Record P506 analogue pressure reading: P506: ……..mbar Date / time: …….. / …….. 124. Record gas meter reading: Gas meter: ……..m³ 125. Open both manual He pump inlet valves Y0631 to **restart pumping on HTT**.	114. On request of shift leader: enable Gyro / STR continuity check acc to section xxxgyroen of [AD2]. 121. On TCS request: open V104		**Return S/C to vertical.** Tilt speed: 1°/min	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	126. Measure HTT contents via LLP: L101/L102 reading: ……..% 128. SVM TV Cold phase to be delayed to end together with end of PLM LEOP phase. Expected SVM TV cold duration is 48 hrs. Wait until T0 + 72 hrs (tbc during test) before starting TV cold phase 129. Request TAS-F to **check Global Leak Test setup** by calibrated leak acc. to [AD30]; no waiting time, continue immediately with next steps. 130. Verify that coldest SVM equipment sensor is at cold predicted level including margins (values tbd by TASF) coldest equipment sensor: …… Temperature: ……. ok at ……/…….	127. On TCS request: Perform HTT Liquid Level Probes measurement (L101/L102) 131. Start new CCS session			
TS #5a	132. **In parallel to PLM LEOP phase:** Request CCS to **start SVM TV cold phase**. 133. Request TDH to change SVM test heaters mode acc. to [AD25]	134. On shift leader request: Start SVM TV cold, switch instruments to Stand By: Perform section 8.5.1 of [AD2]	135. Set SVM test heaters acc. to SVM TCS request		
TS #5b	136. Request TDH to load SVM alarm limits T5	137. Load TCT table “TCT 3 TV_COLD 5b-5f” 138. Perform section 8.5.2 of [AD2] for TV cold TT&C cell / A	139. Load alarm limits as defined in **Annex A**: General LOU SVM: T5		
TS #5c	140. Request TDH to load SVM alarm limits T6	141. Perform section 8.5.3 of [AD2] for TV cold TT&C cell / B	142. Load alarm limits as defined in **Annex A**: General LOU SVM: T6		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TS #5d		143. Perform section 8.5.4 of [AD2] for TV cold Power cell / A			
TS #5e		144. Perform section 8.5.5 of [AD2] for TV cold Power cell / B			
TS #5f		145. Perform section 8.5.6 of [AD2] for TV cold RW cell and STR1			
TS #5g		146. Load TCT table “TCT 4 TV_COLD 5g-5o, 6-9”			
		147. Perform section 8.5.7 of [AD2] for TV cold RW cell and STR2			
TS #5h	148. Request TDH to change SVM test heaters mode acc. to [AD25]	150. Inform TCS to change SVM test heaters mode	152. Set SVM test heaters acc. to SVM TCS request		
		151. Perform section 8.5.8 of [AD2] for TV cold HIFI cells / A			
	149. Request TDH to load SVM alarm limits T4		153. Load alarm limits as defined in **Annex A**: General LOU SVM: T4		
TS #5i		154. Perform section 8.5.9 of [AD2] for TV cold HIFI cells / B			
TS #5j		155. Perform section 8.5.10 of [AD2] for TV cold PACS cell / A			
TS #5k		156. Perform section 8.5.11 of [AD2] for TV cold PACS cell / B			
TS #5l		157. Perform section 8.5.12 of [AD2] for TV cold SPIRE cell / A			
TS #5m		158. Perform section 8.5.13 of [AD2] for TV cold SPIRE cell / B			
TS #5n	159. Note: During the lock threshold test and the TC threshold test, the commandability and observability of the S/C can be lost for up to 3 hours.	160. Perform section 8.5.14 of [AD2] for TT&C test			
TS #5o	161. Wait for end of PLM LEOP phase.				
	162. End of SVM TV cold sequence				
	163. Verify that all SVM TCS heater lines have cycled.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-B - LEOP and SVM Cold			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
TP-B-3 end of phase	1. Verify that end-of-phase conditions are reached: • PLM LEOP finished • SVM TV-cold finished 3. Convene Key Point Meeting	2. Prepare EOP reports as defined in Annex D 4. Store CCS data (tables and rec files) on CD ROM 5. Fill in: Date / Time of end: ……... / ……...			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.2.1 Tilt Angle Adjustment during TP-B - LEOP and SVM Cold

Date	Time	Tilt angle

I.3 TP-C – PLM Rapid Cool-Down and SVM heat-up

Phase	**TP-C - PLM Rapid Cool-Down and SVM heat-up**	**Type:**	transient	**S/C Attitude**	**Tilt /° : 0** at beginning, to be adjusted during phase to immerse PPS
Expected Duration / hrs	56	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Bring HTT to required instrument TV temperature as quickly as possible and stabilize L0/L1/L2 temperatures • Verify PPS margin wrt maximum mass flow rate at HTT temperature 2.05 K • Bring SVM to hot case temperatures • Perform DLCM operation • Measure HTT contents with LLP (initial measurement performed at end of previous phase)				
End of Phase Condition	• HTT temperature ~1.85 K • HTT temperature drift < 0.21 K/hr • L1 temperature drift < 0.21 K/hr • L2 temperature drift < 0.54 K/hr				
Important	During RC, when HTT has reached 2.05K (tbc), perform PPS maximum flow rate verification using the nozzles bypass and pump inlet valve adjustment, starting from almost closed pump inlet to fully open to simulate decreasing external vent line flow impedance. TP-C covers the test spec phase TS #6.				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

Step	Phase:	TP-C – PLM Rapid Cool-Down and SVM heat-up	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-C-1 start of phase	1. **Cryo Valve States:** (unchanged) V102: closed V104: open V103: closed V106: closed V701: closed V702: closed V105: closed V501: open V503: open V504: open V505: open TV QM3: closed	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-C - PLM Rapid Cool-Down and SVM heat-up 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Restart script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"**; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-C - PLM Rapid Cool-Down and SVM heat-up 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: >0° (unchanged) 5. **5m door and Cover:** closed	
TP-C-2 during phase; TS #6a	1. Switch instruments to STB	2. Switch FPUs to STB: Perform Section 8.6.1 of [AD2]			
TS #6c	3. Request CCS to perform DLCM and LLP measurement L101/L102 reading: ……/……%	4. On TCS request: Execute DLCM measurements acc. to section 8.6.3 of [AD2]			
	5. Open nozzle bypass valve TVQM3 to **initiate HTT rapid cool-down.** New cryo valve states: Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702 ok at ……... / ……...	8. Open nozzle bypass valve TVQM3 (SPARE1 on Cryo-SCOE)			
	6. Monitor HTT, OBA, TS temperatures and mass flow rate. Perform PPS mass flow rate margin test when HTT is at 2.05 K (step TP-C-2-T13)				
	7. If mass flow rate exceeds 100 mg/s, operate pump inlet valves to limit mass flow to 100 mg/s maximum (to avoid undershoot in thermal shields temperatures)				
TS #6b	9. Request TDH to set SVM test heaters acc. to [AD25]		11. Set SVM test heaters acc. to SVM TCS request		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-C – PLM Rapid Cool-Down and SVM heat-up			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	10. Request TDH to switch to TTAS-B test heater settings		12. Switch TTAS test heaters to mode TTAS-B		
	13. When HTT has reached 2.05 K: **Verify PPS mass flow rate margin**				
	14. Monitor PPS operation (T101, T112 vs. T101, T102, T104, T105) throughout check				
	15. Close both manual He pump inlet ball valves Y0631, keeping one needle valve fully open				
	16. Open PPS outlet valves V103 & V106, close HTT outlet V104. New cryo valve states: Open: V103, V106, V501, V503, V504, V505, TVQM3 Closed: V104, V102, V105, V701, V702 ok at …….. / ……..	18. On TCS request: Open valves V103 and V106; close valve V104			
	17. Wait for 10 min to dry out PPS				
	19. Request CCS to disable Gyro / STR continuity check for tilting	20. On request of shift leader: disable Gyro / STR continuity check acc to section xxxgyrodis of [AD2].			
	21. Inform LSS to expect rising LSS pressure due to temperature rise on test tubing				
	22. Request LSS to tilt S/C for PPS immersion. Assess expected tilt angle from section H.1.1. required tilt angle: ……..			23. On request of shift leader: **adjust tilt angle**, rotation around S/C Z axis, –telescope moves to the left. Tilt direction: **+** Tilt speed: 1°/min	
	24. Monitor PPS temperature drop (ok if T111 < T101)				
	25. Verify correct PPS operation for 10 min				
	26. Increase mass flow rate slowly by slow opening of pump inlet ball valve Y0631 while monitoring PPS operation				
	27. If PPS outlet temperature rises: Note maximum achieved mass flow rate before break-through: max mass flow: ……..mg/s				
	28. Continue until pump inlet valves are fully open				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-C – PLM Rapid Cool-Down and SVM heat-up			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	29. Close PPS outlet valves V103 / V106, flooding the PPS; New cryo valve states: Open: V501, V503, V504, V505, TVQM3 Closed: V103, V106, V104, V102, V105, V701, V702 ok at …….. / ……...	30. On TCS request: close valves V103 and V106			
	31. **End of PPS margin verification, resume HTT rapid cool-down**				
	32. Open HTT outlet V104; new cryo valve states: Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702 ok at …….. / ……...	33. On TCS request: close valve V104			
	34. Request LSS to return to 0° tilt angle vertical at …….. / ……...			35. On TCS request: return to vertical position (0° tilt) Tilt speed: 1°/min	
	36. Request CCS to enable Gyro / STR continuity check 30 min after end of tilting:	37. On request of shift leader: enable Gyro / STR continuity check acc to section xxxgyroen of [AD2].			
	38.				
	39. Monitor HTT, OBA, TS temperatures and mass flow rate.				
	40. If mass flow rate exceeds 100 mg/s, operate pump inlet valves to limit mass flow to 100 mg/s maximum (to avoid undershoot in thermal shields temperatures)				
	41. Continue rapid cool-down until HTT temperature (T101, T102, T104, T105) is <1.85 K				
	42. Determine filling level of HTT (L101/L102): HTT filling level: ……/……...%	44. On TCS request: perform liquid level probes measurement			
	43. **End of rapid HTT cool-down**.				
	45. Inform LSS to expect rising LSS pressure due to				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-C – PLM Rapid Cool-Down and SVM heat-up CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
TS #6d	temperature rise on test tubing 46. Adjust mass flow rate to 4.05±0.1 mg/s (equilibrium mdot) by closing He pump inlet ball valves and partial opening of needle valves. 47. Request TDH to perform **videogrammetry measurement** 49. Wait until temperature and stability criteria are fulfilled; adjust mass flow rate if necessary: • HTT temperature < 1.85 K; drift < 210 mK / 1h • Level 1 temperature < 5 K; drift < 210 mK / 1h • Level 2 temperature < 12 K; drift < 540 mK / 1h		48. On TCS request: perform videogrammetry measurement		
TP-C-3 end of phase	1. Verify that end-of-phase conditions are reached: • HTT rapid cool-down finished • 3. Fill in: Date / Time of end: …….. / …….. 4. Convene TRB	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.4 TP-D – TV Phase HIFI 0-1

Phase	**TP-D – TV Phase HIFI 0-1**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0 to -20
Expected Duration / hrs	11	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Measure chopper speed • Measure the mixer I.V curves • Measure noise added by the IF chain • Optimize diplexer position for LO coupling + coarse VD2				
End of Phase Condition	• HIFI tests completed				
Important	Throughout the instruments TV test phases, the spacecraft will remain tilted to -20° to allow cooler recycling, and to maintain stable conditions as far as possible. After the initial stabilization phase and a first planned adjustment on the second day, the mass flow from the HTT is left drifting as long as the HTT temperature slope does not exceed ±3 mK/day. TP-D covers the test spec phase TS #7.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-D – TV Phase HIFI 0-1			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	LSS CONTROL	
TP-D-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-D – TV Phase HIFI 0-1 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Restart script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"**; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-D – TV Phase HIFI 0-1 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0° 5. **5m door and Cover:** closed	
TP-D-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase. 6. Request CCS to disable Gyro / STR continuity check for tilting 8. Request LSS to tilt S/C to -20° to enable cooler recycling. -20° reached at ……... / ……...	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase. 7. On request of shift leader: disable Gyro / STR continuity check acc to section xxxgyrodis of [AD2].		9. On request of shift leader: **adjust tilt angle to -20°** for instruments testing (telescope moves to the right as seen from 5m door) Tilt speed: 1°/min (Notes: - S/C remains at -20° tilt angle throughout instruments testing phase - Do not exceed the maximum tilt angle determined in the tilting verification!)	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-D – TV Phase HIFI 0-1 CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	10. Request CCS to enable Gyro / STR continuity check 30 min after end of tilting:	11. On request of shift leader: enable Gyro / STR continuity check acc to section xxxgyroen of [AD2].			
		12. HIFI team: implement CUS update with new safety tables (tbc by HIFI)			
TS #7a	13. Request CCS to perform **HIFI TV phase 0-1** sequence	14. Perform **HIFI TV phase 0-1** acc. to section 8.7of [AD2].			
TS #7b		15. Switch HIFI to stand-by mode acc. to section 8.7 of [AD2]. (if not already included in previous script??)			
TP-D-3 end of phase	1. Verify that end-of-phase conditions are reached:	2. Prepare EOP reports as defined in **Annex D**			
	3. Fill in: Date / Time of end: ……... / ……...	5. Store CCS data (tables and rec files) on CD ROM			
	4. Convene Key Point Meeting				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.5 TP-E – Combined Instruments TV

Phase	**TP-E – Combined Instruments TV**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	8	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Activities have been deleted from this test phase. Wait for HIFI readiness for next phase				
End of Phase Condition	• HIFI ready for next phase				
Important	TP-E covers the test spec phase TS #8.				

Step	Phase:	TP-E – Combined Instruments TV	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-E-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-E – Combined Instruments TV 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-E – Combined Instruments TV 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: mode H (tbd) IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-E-2 during phase TS #8a	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase. 6. Wait for 8 hours / HIFI to prepare next test phase	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase.			
TP-E-3 end of phase	1. Fill in: Date / Time of end: ……... / ……...	3. Store CCS data (tables and rec files) on CD ROM			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-E – Combined Instruments TV			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	2. Convene Key Point Meeting				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.6 TP-F – HIFI TV Test 2

Phase	**TP-F – HIFI TV Test 2**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	28 (acc. to [AD4]; 18 acc. to [AD10])	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Optimize diplexer position for signal coupling from diplexer scans with hot/cold • Get fine LOU VD2 optimum for mixer pumping from vector scans				
End of Phase Condition	• SPIRE/PACS combined tests completed				
Important	TP-F covers the test spec phase TS #9.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-F – HIFI TV Test 2	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-F-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-F – HIFI TV Test 2 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"** running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-F – HIFI TV Test 2 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: mode H (tbd) IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-F-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase. 6. Perform planned adjustment of mass flow rate to reduce HTT temperature drift 24-48 hrs after first adjustment (tbc during test)	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase. 7. HIFI team: implement updated look-up table for diplexer, IF2 drain currents, LOU VD2 (tbc by HIFI)			
TS #9a	8. Request CCS to perform **HIFI test 2** sequence	9. Perform **HIFI test 2sequence** acc. to section 8.9 of [AD2].			
TS #9b		10. Switch HIFI to stand-by mode acc. to section 8.9 of [AD2]. (if not already included in previous script)			
TP-F-3 end of	1. Verify that end-of-phase conditions are reached:	2. Prepare EOP reports as defined in **Annex D**			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-F – HIFI TV Test 2			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
phase	3. Fill in: Date / Time of end: …….. / …….. 4. Convene Key Point Meeting	5. Store CCS data (tables and rec files) on CD ROM			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.7 TP-G – SPIRE TV and SVM TB Hot

Phase	**TP-G – SPIRE TV and SVM TB Hot**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	48	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Perform functional/performance test on SPIRE • SVM TB Hot test STR validation (2 STRs in parallel) • STR validation (2 STRs in parallel)				
End of Phase Condition	• SPIRE tests completed				
Important	The SPIRE TV test sequence consist of the following steps (not given in chronological sequence below): • Cooler recycle (automatic) • Photometer Thermal Control (PTC) Headroom Characterisation • Photometer Thermal Control (PTC) Verification • PCAL Photometer Characterisation • SCAL Photometric Verification • PCAL Spectrometer Characterisation • Photometer scan mode POF5 • Photometer chop/jiggle mode POF2 • SPEC high resolution mode SOF1 Simulation • 300 mK Stage Decontamination • Photometer Ambient Background Verification • Spectrometer Ambient Background Verification Cryo Cooler recycling shall not be performed during the SVMT TB HOT DTCP mode. Expected cooler hold time is 21 hrs. TP-G covers the test spec phase TS #10.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-G – SPIRE TV and SVM TB Hot	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-G-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-G – SPIRE TV and SVM TB Hot 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Restart script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" Acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-G – SPIRE TV and SVM TB Hot 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: mode H (tbd) IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-G-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase.	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase.			
TS#10a	6. Request CCS to perform **SPIRE TV** sequence 8. **In parallel** to SPIRE TV test: start transition to **SVM hot case** and stabilization in DTCP mode 9. Request TDH to set SVM test heaters acc. to [AD25]	7. Perform **SPIRE TV sequence** acc. to section 8.10.1 of [AD2]. Request go-ahead from SVM TCS before performing cooler recycling.	10. Set SVM test heaters acc. to SVM TCS request		
TS#10b	11. Request CCS to start SVM TB DTCP phase. No cryo cooler recycling shall be performed during the TB DTCP phase. 12. Request TDH to load SVM alarm limits T6	13. On TCS request: Start SVM TB for STR1 and STR2 together: Perform section 8.10.2 of [AD2]. Note: SPIRE must remain in PHOT mode throughout this TB phase	14. Load alarm limits as defined in **Annex A**: General LOU SVM: T6		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-G – SPIRE TV and SVM TB Hot CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	15. Monitor SVM temperatures, **wait for stabilization** ok at ……/……. 16. Request TDH to set SVM test heaters acc. to [AD25]		17. Set SVM test heaters acc. to SVM TCS request		
TS#10c	18. Request CCS to start SVM TB for STR1 and STR2 together 20. Monitor SVM temperatures, **wait for stabilization** ok at ……/…….	19. On TCS request: Start SVM TB hot DTCP mode: Perform section 8.10.3 of [AD2]. Note: SPIRE must remain in PHOT mode throughout this TB phase			
TS#10d	21. Request TDH to load SVM alarm limits T4 24. Request TDH to set SVM test heaters acc. to [AD25]	22. Switch SPIRE to stand-by mode acc. to section 8.10.4 of [AD2]. (if not included in previous script)	23. Load alarm limits as defined in **Annex A**: General LOU SVM: T1 25. Set SVM test heaters acc. to SVM TCS request		
TP-G-3 end of phase	1. Verify that end-of-phase conditions are reached: 3. Fill in: Date / Time of end: …….. / …….. 4. Convene Key Point Meeting	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.8 TP-H – HIFI TV Test 3

Phase	**TP-H – HIFI TV Test 3**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	53 (47 acc. to HIFI)	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Performance test 5 frequencies per subband • Standing wave test • Tsys survey • Spur survey with diplexer scans (embedded in Tsys) (needs stable LOU temperature) • LO purity M1,2 sweep 3b, 7b • IF stability				
End of Phase Condition	• HIFI TV phase 3 tests completed				
Important	At the end of the HIFI test sequence, the IR rig heaters are switched to HOT mode (if PLM external stability criterion is met) TP-H covers the test spec phase TS #11.				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

Step	Phase:	TP-H – HIFI TV Test 3	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-H-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-H – HIFI TV Test 3 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-H – HIFI TV Test 3 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode A, cold	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-H-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase.	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase.			
		6. HIFI team: implement updated look-up table for diplexer, IF2 drain currents, LOU VD2 (tbc by HIFI)			
TS#11a	7. Request CCS to perform **HIFI test 3** sequence	8. Perform **HIFI test 3sequence** acc. to section 8.11 of [AD2].			
TS#11b		9. Switch HIFI to stand-by mode acc. to section 8.11 of [AD2]. (already included in previous script??)			
	10. When PLM external equilibrium conditions (CVV drift < 0.3 K / 24 hrs) are reached, • Ensure that HACS measurements are performed for end of PLM-Ext-Cold phase				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-H – HIFI TV Test 3 CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	• Request go-ahead from Test Director to switch to PLM-EXT-HOT mode (IR rig heaters to mode B): go-ahead at date / time: ……... / ……... Signature: ……... 11. Request TDH to switch IR Rig test heaters to mode B (Note: This switching shall not be performed immediately before or during HIFI tests due to possible conflict with LOU stability req!!!)		12. On TCS request: Switch IR Rig test heaters to mode B		
TP-H-3 end of phase	1. Verify that end-of-phase conditions are reached: 3. Fill in: Date / Time of end: ……... / ……... 4. Convene Key Point Meeting	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.9 TP-I – PACS TV Test

Phase	**TP-I – PACS TV Test**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	32	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• PACS instrument functional / performance tests				
End of Phase Condition	• PACS tests completed				
Important	The PACS TV test sequence consists of the following major elements: • PACS FDIR Verification • Chopper Controller Parameter Verification and Determination • Grating Controller Parameter Verification and Determination • Full Functional Test • PACS Reference Mission Scenario • Short Performance Test • Red Bolometer Tuning • AOT Test • Test of Redundant PACS Instrument TP-I covers the test spec phase TS #12.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-I – PACS TV Test	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-I-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-I – PACS TV Test 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-I – PACS TV Test 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode B, hot	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-I-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase.	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase.			
TS#12a	6. Request CCS to perform **PACS TV test** sequence	7. Perform **PACS TV sequence** acc. to section 8.12 of [AD2].			
TS#12b		8. Switch PACS to stand-by mode acc. to section 8.12 of [AD2].			
TP-I-3 end of phase	1. Verify that end-of-phase conditions are reached: 3. Fill in:	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-I – PACS TV Test			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	LSS CONTROL	
	Date / Time of end: ……... / ……... 4. Convene Key Point Meeting				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.10 TP-J – HIFI TV Test 4

Phase	**TP-J – HIFI TV Test 4**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	78 (88 acc. to HIFI)	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Stability verification • LCU ripple test: Take 10ms mixer currents (embedded ini stability) • AOT test				
End of Phase Condition	• HIFI TV phase 4 tests completed				
Important	TP-J covers the test spec phase TS #13.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-J – HIFI TV Test 4	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-J-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-J – HIFI TV Test 4 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-J – HIFI TV Test 4 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode B, hot	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-J-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase.	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase. 6. HIFI team: implement updated frequency switch values from the standing wave tests (tbc by HIFI)			
TS#13a	7. Request CCS to perform **HIFI test 4** sequence	8. Perform **HIFI test 4 sequence** acc. to section 8.13 of [AD2].			
TS#13b		9. Switch HIFI to stand-by mode acc. to section 8.13 of [AD2]. (if not included in previous script)			
TP-J-3 end of phase	1. Verify that end-of-phase conditions are reached: 3. Fill in:	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-J – HIFI TV Test 4	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
	Date / Time of end: ……... / ……... 4. Convene Key Point Meeting				

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

I.11 TP-K – SVM TV HOT

Phase	**TP-K – SVM TV HOT**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** -20
Expected Duration / hrs	48 +120 SOVT2	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Perform Videogrammetry measurement • Perform DLCM and LLP measurement • Perform SVM unit functional tests • Perform SFT on instruments • Perform CCU testing • Perform helium vent line dp measurements with big and small nozzles and PPS operation • Warm up telescope using decontamination heaters, and verify cycling • Warm up LOU baffle and verify decontamination heaters • Perform RCS global leak test				
End of Phase Condition	• Telescope heaters cycling • LOU baffle heaters cycling • SVM functional tests completed				
Important	At the end of the telescope heater verification, the telescope decontamination heaters will be kept ON (at the end of the telescope decontamination verification) during the recovery to ambient. TP-K covers the test spec phase TS #13c and TS #14.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-K – SVM TV HOT	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-K-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V103, V106, V102, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-K – SVM TV HOT 3. Start new section in Log Book 4. Fill in: Date / Time of start: …….. / …….. 5. **CCS data logging:** Keep script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl**" running from previous phase; acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-K – SVM TV HOT 3. **Alarm Limits:** Keep alarm limits as defined in **Annex A** 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** unchanged TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode B, hot	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: -20° 5. **5m door and Cover:** closed	
TP-K-2 during phase	1. Monitor temperatures and test heater settings 2. Monitor HTT temperature and mass flow rate; manually adjust mass flow rate if HTT temperature drift exceeds ±3 mK/day throughout phase. 3. Monitor PLM external equilibrium temperature sensors throughout phase to detect end of PLM external hot stabilization (CVV drift < 0.3 K / 24 hrs). Equilibrium at date / time: …….. / …….. 6. Request CCS to disable Gyro / STR continuity check for tilting 8. Request LSS to return S/C to vertical orientation vertical at …….. / …….. 10. Request CCS to enable Gyro / STR continuity check 30 min after end of tilting:	4. Start new CCS session 5. Monitor HK data. Inform shift leader and instruments teams of any red out-of-limit values throughout phase. 7. On request of shift leader: disable Gyro / STR continuity check acc to section xxxgyrodis of [AD2]. 11. On request of shift leader: enable Gyro / STR continuity check acc to section xxxgyroen of [AD2].		9. On TCS request: return to vertical position (0° tilt) Tilt speed: 1°/min	
TS#13c	12. Request TDH to perform **videogrammetry measurement**		13. On TCS request: perform videogrammetry measurement		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
TS#14a	14. Request CCS to measure HTT contents using L101/L102 HTT filling level: …… % 15. Determine required tilt angle for PPS operation from section H.1.1. Required tilt angle: …….. 17. Request CCS to perform DLCM measurement 19. Request TDH to set SVM test heaters acc. to [AD25]	16. On TCS request: Perform LLP measurement acc to section ???? of [AD2] 18. On TCS request: Perform DLCM measurement acc to section 8.14.1 of [AD2]	20. Set SVM test heaters acc. to SVM TCS request		
TS#14b	21. In parallel to SVM TV hot and decontamination heater verification: **Perform He pressure drop tests** (including sensors cross-check) as defined below up to step TP-K-B-72. 22. Record gas meter reading: Gas meter: ……..m³ 23. Disconnect gas meter (to reduce mass flow oscillations) ok at date / time: …….. / ……... 24. Close valve TVQM3. New cryo valve states: Open: V104, V501, V503, V504, V505 Closed: V103, V106, V102, V105, V701, V702, TVQM3 ok at …….. / ……... 26. Fully open He pump inlet ball valves Y0631, close needle valves to measure with high mass flow (**PPS bypass**) 27. Measure flow through small and large nozzles (PPS bypass): Wait for stable readings on all pressure sensors P502, P501, CVSE_002, CVSE_003, CVSE_005 28. Record P506 analogue pressure reading: P506: ……..mbar Date / time: …….. / ……...	25. On TCS request: Close valve TVQM3 (SPARE1 on CryoSCOE)			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	29. Close valve V505 to measure small nozzles. New cryo valve states: Open: V104, V501, V503, V504 Closed: V102, V103, V106, V105, V701, V702, V505, TVQM3 ok at …….. / ……... 30. Wait for stable readings on all pressure sensors P502, P501, CVSE_002, CVSE_003, CVSE_005 31. Record P506 analogue pressure reading: P506: ……..mbar Date / time: …….. / ……...	32. On TCS request: Close valve V505			
	33. Open PPS valve V103 and close HTT outlet V104 to measure small nozzles with low mass flow (**gas pumping through PPS**). New cryo valve states: Open: V103, V501, V503, V504 Closed: V104, V102, V106, V105, V701, V702, V505, TVQM3 ok at …….. / ……... Note: very small mass flow is expected when pumping gas through PPS. 34. Wait for stable readings on all pressure sensors, P502, P501, CVSE_002, CVSE_003, CVSE_005 35. Record P506 analogue pressure reading: P506: ……..mbar Date / time: …….. / ……...	36. On TCS request: Open valve V103, close valve V104			
	37. Open V505 to measure small and large nozzles with low mass flow (gas pumping through PPS). New cryo valve states: Open: V103, V501, V503, V504, V505 Closed: V104, V102, V106, V105, V701, V702, TVQM3 ok at …….. / ……... 38. Wait for stable readings on all pressure sensors, P502,	40. On TCS request: Open valve V103, close valve V104			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	P501, CVSE_002, CVSE_003, CVSE_005 39. Record P506 analogue pressure reading: P506: ……..mbar Date / time: ……. / ……... 41. Skip pressure drop measurements with PPS operating (i.e. go to step TPK-2-T53) if required tilt angle is above maximum allowed angle (PPS operation not possible) 42. Before S/C tilting: request CCS to disable the GYR/STR continuity check	43. On request of shift leader: disable the GYR/STR continuity check acc to section xxxgyrodis of [AD2]		45. On TCS request: Adjust tilt angle, rotation around S/C Z axis, S/C X towards S/C -Y. Tilt direction: **+** Tilt speed: 1°/min	
	44. Pressure drop **measurements with PPS operating**: Request LSS to tilt to required tilt angle 46. Verify PPS operation: T111 < T101 47. Measure small and large nozzles with nominal mass flow (PPS operating): Wait for stable readings on all pressure sensors, P502, P501, CVSE_002, CVSE_003, CVSE_005 48. Record P506 analogue pressure reading: P506: ……..mbar Date / time: ……. / ……... 49. Close V505 to measure small nozzles with nominal mass flow (PPS operating). New cryo valve states: Open: V103, V501, V503, V504 Closed: V104, V102, V106, V105, V701, V702, V505, TVQM3 ok at ……. / ……... 50. Wait for stable readings on all pressure sensors, P502, P501, CVSE_002, CVSE_003, CVSE_005 51. Record P506 analogue pressure reading: P506: ……..mbar	52. On TCS request: close valve V505			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	Date / time: …….. / ……... 53. **Perform sensors cross-check**: Record safety line pressure during cross check to get hint on pressure relaxation time across SV121 54. Close PPS valve V103 to flood PPS and determine temperature sensors offset. New cryo valve states: Open: V501, V503, V504 Closed: V102, V103, V106, V104, V105, V701, V702, V505, TVQM3 ok at …….. / ……... 55. Wait for stable reading of T111 / T112 57. Request LSS to return to 0° tilt angle vertical at …….. / ……... 59. Close both manual He pump inlet valves Y0631 (incl. needle valves). 60. Wait for stable readings on all pressure sensors, P502, P501, CVSE_002, CVSE_003, CVSE_005 61. Record P506 analogue pressure reading: P506: ……...mbar Date / time: …….. / ……... 62. Open HTT outlet valve V104 to get svp reference value. New cryo valve states: Open: V104, V501, V503, V504 Closed: V102, V103, V106, V105, V701, V702, V505, TVQM3 ok at …….. / ……... 63. Wait for stable readings on all pressure sensors, P502, P501, CVSE_002, CVSE_003, CVSE_005 64. Record P506 analogue pressure reading: P506: ……...mbar	56. On TCS request: close valve V103 65. On TCS request: open valve V104		58. On TCS request: return to vertical position (0° tilt) Tilt speed: 1°/min	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	Date / time: …….. / ……...				
	66. Open large nozzle valve V505 and nozzle bypass TVQM3. New cryo valve states: Open: V104, V501, V503, V504, V505, TVQM3 Closed: V102, V103, V106, V105, V701, V702 ok at …….. / ……...	69. On TCS request: open valve V505 and valve TVQM3 (SPARE1 on CryoSCOE)			
	67. Open both manual He pump inlet valves Y0631 to re-start pumping via HTT outlet and small nozzles. Adjust mass flow to 4.0±0.5 mg/s				
	68. Reconnect Gas meter ok at …….. / ……...				
	70. 30 min after last S/C tilting with ACMS in SCM mode: request CCS to enable the GYR/STR continuity check	71. On request of shift leader: enable the GYR/STR continuity check acc to section xxxgyroen of [AD2]			
	72. **End of pressure drop measurements sequence** (independent from SVM TV hot sequence)				
	73. Verify that warmest SVM equipment sensor is at hot predicted level including margins (-0/+5°C, tbc) coldest equipment sensor: …… Temperature: …… ok at ……/…….				
	74. In parallel to SVM TV hot and pressure drop measurements: Perform **LOU decontamination verification sequence** as defined below up to step TP-K-B-90.				
TS#14c	75. Verify / set maximum temperature thresholds for LOU heater lines 1, 2 and 3 to Tmin=220 K, Tmax=230 K.	76. Perform section 8.14.3 of [AD2] to verify / set maximum temperature thresholds for LOU heater lines 1, 2 and 3 Tmin=220 K, Tmax=230 K.			
TS#14d	77. Switch on LOU decontamination heater lines 1 and 2	79. Perform section 8.14.4 of [AD2] to switch ON LOU decontamination heater lines 1 and 2			

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	78. Wait for LOU heater line cycling (2 times OFF/ON) ok at ……/……				
TS#14e	80. Switch OFF LOU decontamination heater lines 1 and 2 81. Wait for 2 hours	82. Perform section 8.14.5 of [AD2] to switch OFF LOU decontamination heater lines 1 and 2			
TS#14f	83. Select LOU heater lines 1 + 3	84. Perform section 8.14.6 of [AD2] to select LOU heater lines 1 + 3			
TS#14g	85. Switch on LOU decontamination heater lines 1 and 3 86. Wait for LOU heater lines cycling (2 times OFF/ON) ok at ……/……	87. Perform section 8.14.7 of [AD2] to switch ON LOU decontamination heater lines 1 and 3			
TS#14h	88. Switch OFF LOU decontamination heater lines 1 and 3	89. Perform section 8.14.8 of [AD2] to switch OFF LOU decontamination heater lines 1 and 3			
	90. End of LOU decontamination verification sequence	91.			
TS#14i	92. In parallel to LOU heater verification and pressure drop measurements Request CCS to perform **SVM TV Hot** sequence. Initiate Telescope decontamination sequence (step TP-K-B-120) 24hrs before expected end of SVM TV hot 93. Request TDH to load SVM alarm limits T6	94. Perform **SVM TV Hot**, TT&C CELL-B acc. to sections 8.14.9 to 8.14.10 of [AD2].	95. Load alarm limits as defined in **Annex A**: General LOU SVM: T6		
TS#14j	96. Request TDH to load SVM alarm limits T5	97. Load TCT table “TCT 7 TV_HOT 14j-14m” 98. Perform TT&C Cell/A acc. to section 8.14.11 of [AD2]	99. Load alarm limits as defined in **Annex A**: General LOU SVM: T5		
TS#14k		100. Perform TV Hot, Power Cell /B acc. to section 8.14.?? of [AD2]			
TS#14l		101. Perform TV Hot, Power Cell /A acc. to section 8.14.12 of			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-K – SVM TV HOT			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
		[AD2]			
TS#14m		102. Perform TV Hot, RW cell + STR 2 acc. to section 8.14.?? of [AD2]			
TS#14n		103. Load TCT table “TCT 8 TV_HOT 14n”			
		104. Perform TV Hot, RW cell + STR 1 acc. to section 8.14.13 of [AD2]			
	105. Ensure that S/C is vertical before starting HIFI SFTs. ok at ……/……	106.			
TS#14p	107. Request TDH to set SVM test heaters acc. to [AD25]	108. Perform TV Hot, HIFI Cell /A acc. to section 8.14.15 of [AD2]	109. Set SVM test heaters acc. to SVM TCS request		
TS#14q		110. Perform TV Hot, HIFI Cell /B acc. to section 8.14.16 of [AD2]			
TS#14r		111. Perform TV Hot, PACS Cell /A acc. to section 8.14.17 of [AD2]			
TS#14s		112. Perform TV Hot, PACS Cell /B acc. to section 8.14.18 of [AD2]			
TS#14t		113. Perform TV Hot, SPIRE Cell /A acc. to section 8.14.19 of [AD2]			
TS#14u		114. Perform TV Hot, SPIRE Cell /B acc. to section 8.14.20 of [AD2]			
TS#14v	115. Request CCS to switch off instruments	116. Perform instruments switch-off acc. to section 8.14.21 of [AD2]			
	117. End of SVM TV hot sequence				
TS#14w	**118. TT&C test sequence**	119. Perform TT&C test sequence acc. to section 8.14.22 of [AD2]			
	120. During SVM TV hot sequence, 24 hrs before expected end of SVM TV hot: **Start Telescope decontamination heater verification** (expected duration ~20 hrs)				
TS#14o	121. Apply Telescope decontamination heater line mask to disable lines 5 and 9	123. Perform section ???? of [AD2] to disable Telescope decontamination heater lines 5 and 9	124. Load alarm limits as defined in **Annex A**:		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-K – SVM TV HOT CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	122. Request TDH to load SVM alarm limits T4		General LOU SVM: T4		
	125. Switch on Telescope decontamination heaters	126. Perform section ???? of [AD2] to switch ON Telescope decontamination heaters (lines 5 and 9 remain OFF)			
	127. Wait for cycling of at least 3 telescope decontamination heater lines ok at ……/……				
	128. Remove Telescope decontamination heater line mask to enable lines 5 and 9 in addition	129. Perform section ???? of [AD2] to enable Telescope decontamination heater lines 5 and 9 (all lines enabled)			
	130. Wait for stability of average telescope temperature: slope < 3°C/day for two consecutive minima (heater switch on) and two consecutive maxima (heater switch off) ok at ……/……				
	131. End of **Telescope decontamination** sequence (Note: Telescope decontamination is kept ON for Warm-up)	132. (Note: Telescope decontamination is kept ON for Warm-up)			
	133. Request TAS-F to initiate **Global Leak measurements** acc. to [AD30]; continue with next steps				
	134. After end of SVM TV Hot sequence: **Initiate SOVT2 test sequence**				
	135. Before S/C tilting: request CCS to disable the GYR/STR continuity check	136. On request of shift leader: disable the GYR/STR continuity check acc to section xxxgyrodis of [AD2]			
	137. Request LSS to tilt S/C to -20° tilt angle for instrument cooler recycling 20° reached at …….. / ……..			138. On TCS request: tilt S/C to -20°. Tilt speed: 1°/min	
	139. 30 min after last S/C tilting with ACMS in SCM mode: request CCS to enable the GYR/STR continuity check	140. On request of shift leader: enable the GYR/STR continuity check acc to section xxxgyroen of [AD2]			
		Open Issues to be clarified:			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-K – SVM TV HOT			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
		• SVM configuration at beginning of SOVT • SVM test heater settings • Responsibilities • …			
	141. Give go-ahead **to perform SOVT2** test acc. to [AD29]. 142. Wait for completion of SOVT2 test (expected duration 5d)				
	143. Before S/C tilting: request CCS to disable the GYR/STR continuity check	144. On request of shift leader: disable the GYR/STR continuity check acc to section xxxgyrodis of [AD2]			
	145. Request LSS to return to 0° tilt angle vertical at …….. / ……...			146. On TCS request: return to vertical position (0° tilt) Tilt speed: 1°/min	
	147. 30 min after last S/C tilting with ACMS in SCM mode: request CCS to enable the GYR/STR continuity check	148. On request of shift leader: enable the GYR/STR continuity check acc to section xxxgyroen of [AD2]			
	149. End of SOVT2 test sequence				
TP-K-3 end of phase	1. Verify that end-of-phase conditions are reached: 3. Fill in: Date / Time of end: …….. / …….. 4. Convene Key Point Meeting	2. Prepare EOP reports as defined in **Annex D** 5. Store CCS data (tables and rec files) on CD ROM			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

I.12 TP-L - Recovery to Ambient

Phase	**TP-L - Recovery to Ambient**	**Type:**	Transient	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	72	**TTAS I/F**	20°C	+Z to collimator mirror	
Objective	• Warm-up of S/C external surfaces to ambient temperature • Warm-up of LSS shrouds • Re-pressurization of LSS				
End of Phase Condition	• LSS ready to open chamber				
Important	Warm-up of the S/C is initiated by electrical test heaters. The LSS shroud temperatures are to be kept 10°C colder than the external S/C parts to avoid contamination. The S/C will be switched off during the warm up (when the maximum temperatures allowed on the power panel units is reached, PCDU likely to trigger first). The S/C will be switched ON later, once repressurisation is made. The Telescope decontamination heaters are kept ON for warm-up. During the repressurization, special care has to be taken to check for indication of a possible air leak into the CVV. Indications are sudden temperature rise of the CVV internal components (Thermal Shields, Optical Bench, HTT, Mass flow). Emergency procedure is to re-evacuate the LSS in case of leak indication. IST testing of the S/C is foreseen to be performed during the recovery phase after the go-ahead from TB/TV test director. These tests are performed under control of the IST test procedure.				

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
TP-L-1 start of phase	1. **Cryo Valve States:** (unchanged) Open: V104, V501, V503, V504, V505, TVQM3 Closed: V102, V103, V106, V105, V701, V702	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-L - Recovery to Ambient 3. Start new section in Log Book 4. Fill in: Date / Time of start: ……... / ……... 5. **CCS data logging:** Restart script "**K102999ECVT035_ASDGEN_SCOE_CCU_LOG.tcl"** acquisition interval 30 sec.	1. **Main Title:** Herschel FM TB/TV Test 2. **Subtitle:** TP-L - Recovery to Ambient 3. **Alarm Limits:** Load alarm limits as defined in **Annex A**: General LOU SVM: T2 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** TTAS 293K (tbc) Test harness 293K (tbc) SVM: unchanged IR rig: mode B, hot	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $<10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0° 5. **5m door and Cover:** closed	
TP-L-2 during phase TS#15b	1. Switch on PLM warm-up test heaters 2. Continuously perform HACS measurements during CVV warm-up. 3. Monitor temperatures and test heater settings 4. Monitor HTT temperature and mass flow rate 5. Monitor PLM external temperature sensors throughout phase to verify warm-up heaters operation 8. Gradually reduce SVM test heater power acc. to [AD25]. 10. Give go-ahead to CCS to **start SFT2 testing under control of SFT2 test procedure and under responsibility of the SFT2 test team. Thermal and S/C responsibility remains with TB test team until opening of chamber**. Monitor SVM temperature throughout warm-up and switch off the SVM if upper acceptance warning limits are reached	6. Start new CCS session 11. On go-ahead of TCS: Start SFT2 testing under control of SFT2 test procedure. Be prepared to switch off SVM in case of temperature acceptance limits violation.	7. Switch on PLM warm-up test heaters (mode B, target temperature 293 K) 9. Set SVM test heaters acc. to SVM TCS request		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
	12. Keep ~20 mbar pressure in LSS internal safety line 13. When minimum external temperature (virtual sensors) is >120 K, request LSS to **initiate warm up of shrouds**. 14. Monitor CVV test heater harness temperature. Reduce test heater power if necessary to keep harness temperature below 110°C (383 K)		15. Remove shroud temperature alarm limits	16. On request of test conductor: stop C1 LN2 mode and open V001 (keep C2 in LN2 mode). ……. / ……. 17. Drain C1. ……. / ……. 18. Set mirror temperature at 40ºC. ……. / ……. 19. Start C1 VTC mode to bring C1 shrouds at ambient temperature. ……. / ……. 20. While S/C temperature below 20°C (tbc – was 0°C for STM2): Keep shrouds 10 K below minimum external S/C temperature (virt sensor) 21. When C1 shrouds are stabilised at ambient temperature, stop C1 VTC mode. ……. / ……. 22. Prepare facility for C2 draining. ……. / ……. 23. Stop LN2 pump and stop C2 LN2 mode. ……. / ……. 24. Start C2 draining mode. ……. / ……. 25. When draining is finished, open V084 and V 085 on	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
				the LN2 pump local cabinet. ……. / …….. 26. Start C2 warm-up mode, gas temperature set point 30ºC. ……. / …….. 27. When C2 shrouds are at ambient temperature, stop C2 warm up. ……. / …….. 28. Start C1 and C2 warm-up to stabilized shrouds at ambient temperature. (Switch on W10) ……. / …….. 29. When C1 and C2 are stabilized at ambient temperature, inform customer that LSS is ready for re-pressurisation. ……. / ……..	
	30. When **ambient temperature is reached** on structure and MLI average sensors: Check that manual SV121 pressurization valve is closed. Increase pressure in LSS internal safety line to 1050 mbar from pressurized He gas bottle Ok at date / time: ……... / ……... 31. Switch off VG902 Switched off at date / time:……... / ……... 32. Switch off HACS Switched off at date / time:……... / ……... 33. Request TDH to perform **Videogrammetry** measurement acc. to [AD23]		34. Perform Videogrammetry measurement acc. to [AD23]		

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase: TCS, CVSE, Cryo	TP-L - Recovery to Ambient CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	Remarks / NCR
	35. Check He background in LSS vacuum 36. If a significant He background is found: • **Do not initiate LSS repressurization**. • Inform test director / conductor 38. Monitor HTT, OBA and TS1, TS2, TS3 temperatures and He mass flow rate during re-pressurisation to **detect possible indication of CVV air leak**. In case of sudden increase, request LSS to stop pressurization and start re-pumping the LSS vacuum immediately.			37. Check He background in LSS vacuum 39. Be prepared to immediately stop chamber re-pressurisation and re-start pumping immediately on TCS request.	
TS#16a	40. Request LSS to **initiate repressurisation** up to 80 mbar 41. Switch on H501 to control external vent line temperature to 293 K.	42.	43. Remove pressure and cryo panel temperature alarm limits	44. On TCS request start chamber re-pressurisation. …….. / ……... 45. Ask DH to disable alarms on chamber pressure and cryo-panels temperature. …….. / ……... 46. Switch off vacuum gauge RG 1102. …….. / ……... 47. Close mass spectrometer valves. …….. / ……... 48. Switch off mass spectrometers. …….. / ……... 49. Close VV 100 valves of cryopumps 1&2. …….. / ……... 50. Close turbo pump HV valves. …….. / ……... 51. Stop turbopumps.	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
				……. / …….. 52. Start chamber repressurisation with GN2 (250 mbar/h). ……. / …….. 53. Decrease mirror temperature to 26ºC. ……. / …….. 54. At 1 mbar, stop MS interseal pump. ……. / …….. 55. At 80 mbar, stop chamber repressurisation 56. Inform TCS shift leader	
	57. At 80 mbar, check HTT, OBA, TS1, TS2, TS3 temperatures and He mass flow rate again for possible indications of CVV air leak 58. Request LSS to continue re-pressurisation			59. On TCS request, continue with chamber repressurisation with GN2 (250 mbar/h). ……. / …….. 60. At 100 mbar, stop CP1 and CP2. ……. / …….. 61. At ambient pressure, stop facility interseal pumps. ……. / …….. 62. Stop MS auxiliaries. ……. / …….. 63. Stop C1 and C2 warm-up mode. ……. / …….. 64. Notify to test director that chamber is at atmospheric pressure. ……. / ……..	

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient			Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	FACILITY DATA HANDLING	FACILITY LSS CONTROL	
				65. Stop SUSI HP GN2 sub-system. …….. / ……...	
	66. Switch OFF all test heaters		67. Switch OFF all test heaters		
TS#16b	68. Request ETS to perform **videogrammetry** measurement		69. On TCS request: perform **videogrammetry** measurement		
TS#16c	70. Request ETS to open 5m man door			71. On test director request, open 5-m man door. …….. / ……...	
	72. Request ETS to open top lid			73. Install in front of man door the sign : NITROGEN DANGER DO NOT ENTER	
				74. On test director request, open top lid (release pressure first). …….. / ……...	
	75. Transfer of S/C responsibility to SFT2 / AIT team			76. Open 5-m door. …….. / ……...	
				77. **WARNING** : PROHIBIT ACCESS TO CHAMBER UNTIL OXYGEN CONTENT CHECK HAS BEEN PERFORMED. …….. / ……...	
	78. Collect contamination samples and witness plates				
	79. Install Telescope contamination protection cover				
	80. Request LSS to install basic scaffolding				
	81. S/C removal from LSS according to AIT directions			82. On TCS/AIT request: install basic scaffolding	
TP-L-3 end of phase	1. Verify that end-of-phase conditions are reached	2. Prepare EOP reports as defined in **Annex D**			

Test location:	Shift leader:	PA / QA:	Date:
ETS / LSS			

Step	Phase:	TP-L - Recovery to Ambient	FACILITY		Remarks / NCR
	TCS, CVSE, Cryo	CCS: Instruments, PLM, SVM	DATA HANDLING	LSS CONTROL	
	3. Fill in: Date / Time of end: ……... / ……...	4. Store CCS data (tables and rec files) on CD ROM			

E N D O F T E S T

Test location: ETS / LSS	Shift leader:	PA / QA:	Date:

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Baldock Richard	FAE12	X	Sonn Nico	ASG51
X	Barlage Bernhard	AED13	X	Steininger Eric	AED321
	Bayer Thomas	ASA42	X	Stritter Rene	AED11
	Brune Holger	ASA45		Suess Rudi	OTN/ASA44
	Chen Bing	HE Space	X	Theunissen Martijn	DSSA
X	Davis William	Captec	X	Vascotto Riccardo	HE Space
	Edelhoff Dirk	AED21	X	Wagner Klaus	ASG23
	Fehringer Alexander	ASG15	X	Wietbrock Walter	AET12
X	Fricke Wolfgang Dr.	AED 65	X	Wöhler Hans	ASG23
	Geiger Hermann	ASA42	X	Wössner Ulrich	ASE252
X	Grasl Andreas	OTN/ASA44	X	Zumstein Armin	AED15
	Grasshoff Brigitte	AET12			
X	Hamer Simon	Terma			
X	Hanka, Erhard	FI522			
X	Hendrikse Jeffrey	HE Space			
X	Hendry David	Terma			
	Hengstler Reinhold	ASA42			
X	Hinger Jürgen	ASG23			
X	Hohn Rüdiger	AED65			
	Hopfgarten Michael	AET32			
X	Huber Johann	ASA42			
	Hund Walter	ASE252			
X	Idler Siegmund	AED312			
	Ivády von András	FAE12			
X	Jahn Gerd Dr.	ASG23			
X	Jolk Matthias	AET1	X	ESA/ESTEC	ESA
	Klenke Uwe	ASG72	X	Thales Alenia Space Cannes	TAS-F
X	Kölle Markus	ASA43	X	Thales Alenia Space Torino	TAS-I
	König Werner	AET32			
X	Koppe Axel	AED312			
X	Kroeker Jürgen	AED65		**Instruments:**	
X	La Gioia Valentina	Terma	X	MPE (PACS)	MPE
X	Lang Jürgen	ASE252	X	RAL (SPIRE)	RAL
X	Langenstein Rolf	AED15	X	SRON (HIFI)	SRON
X	Langfermann Michael	ASA41			
	Leitermann Stefan	AET12			
X	Liberatore Danilo	Rhea		**Subcontractors:**	
X	Martin Olivier	Altec		Austrian Aerospace	AAE
X	Maukisch Jan	ASA43		Austrian Aerospace	AAEM
X	Much Christoph	ASA43		BOC Edwards	BOCE
X	Müller Martin	ASA43		Dutch Space Solar Arrays	DSSA
	Pietroboni Karin	AED65		EADS Astrium Sub-Subsyst. & Equipment	ASSE
	Reichle Konrad	ASA42		EADS CASA Espacio	CASA
X	Runge Axel	OTN/ASA44		EADS CASA Espacio	ECAS
	Saal Christoph	External		European Test Services	ETS
X	Schink Dietmar	AED321		Patria New Technologies Oy	PANT
X	Schmidt Thomas	AED15		SENER Ingenieria SA	SEN
	Schweickert Gunn	ASG23		Thales Alenia Space, Antwerp	TAS-ETCA