Herschel

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EQM Cryostat Operation Report

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1 SUMMARY

This report summarizes the EQM cryostat operation during the EQM test phase in autumn 2005 at EADS Astrium GmbH in Ottobrunn. It starts with the cool down and filling of the cryostat and ends with depletion and warm up. In detail, the following phases are subject of this test report:

- Cool down and filling of the EQM cryostat
- He II production in AXT
- Cryostat operation during 1st phase of the integrated module test (IMT)
- Sorption cooler / leak problem investigations
- Cryostat operation during 2nd phase of instrument tests (IMT, EMC and special investigations)
- Cover flushing for PACS and SPIRE tests
- Warm up to He I temperature, depletion and warm up to ambient



Figure 1-1: Flow Scheme of the EQM He S/S

2 Documents

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	Herschel EQM Cool Down and Filling	HP-2-ASED-TP-0072
AD 02	Herschel EQM AXT He II Production and Top Up	HP-2-ASED-TP-0090
AD 03	Herschel EQM Cover Flushing	HP-2-ASED-TP-0091
AD 04	Herschel EQM Depletion and Warm Up to Ambient	HP-2-ASED-TP-0098
AD 05	Summary Report of Instrument Testing on EQM Level	HP-2-ASED-TR-0092
AD 06	As-Built Configuration List EQM	HP-2-ASED-AB-0003

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	EQM AIT Plan	HP-ASED-PL-0022
RD 02	CVSE Set-up Description	HP-2-ASED-TN-0094
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003
RD 05	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 06	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 07	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 08	IID-A, section 9	SCI-PT-IIDA-04624

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3 TEST REPORT DIGEST

3.1 **Operations**

The following cryostat operations were done:

- Cool down and filling of the EQM cryostat
- He II production in AXT
- Cryostat operation during instrument testing phase 1
- Sorption cooler / leak problem investigations
- Cryostat operation during instrument testing phase 2
- Cover flushing
- Depletion and warm up to ambient

3.2 Test Procedures

HP-2-ASED-TP-0072. Issue 1.0. 28.07.05	Herschel EQM Cool Down and Filling
HP-2-ASED-TP-0090, Issue 1.0, 08.09.05	Herschel EQM AXT He II Production and Top Up
HP-2-ASED-TP-0091, issue 1.0, 15.09.05	Herschel EQM Cover Flushing
HP-2-ASED-TP-0098, issue 1.0, 08.12.05	Herschel EQM Depletion and Warm Up to Ambient

3.3 Test Readiness Reviews

HP-2-ASED-MN-1042, 24.08.05	PLM EQM TRR prior to cool down
HP-2-ASED-MN-1137, 09.12.05	PLM EQM TRR prior to Warm-Up

3.4 Post Test Review

N/A

3.5 Non Conformances

All NCRs issued during EQM testing are listed in the "Summary Report of Instrument Testing on EQM Level", AD 05. The following NCRs were raised in the frame of cryostat operation or had an effect on the cryostat operations:

HP-112000-ASED-NC-1662 HP-113000-ASED-NC-1495 HP-113000-ASED-NC-1675 HP-142220-ASED-NC-1667 HP-142220-ASED-NC-1668 HP-142220-ASED-NC-1759 HP-142220-ASED-NC-1829 HP-150000-ASED-NC-1484 HP-150000-ASED-NC-1683 HP-150000-ASED-NC-1817 HP-151000-ASED-NC-0211 HP-151000-ASED-NC-1319 HP-151000-ASED-NC-1795 HP-151240-ASED-NC-1415

See section 7 for details

3.6 Test Changes (Deviations)

HP-2-ASED-SD-0058, issue 3, issued 04.10.05, status 19.10.05

3.7 Conclusion

The EQM cryostat was successfully operated to support EQM instrument testing in Ottobrunn. All required temperatures could be achieved, however with a higher mass flow.

Main problems during cryostat operation came from the differences between the EQM and PFM built standard. Especially the inexistent thermal anchoring of the cryostat harness called for an unexpected high mass flow through the OBA. In addition the heat loads from the CVV and LO windows were underestimated.

Due to straylight problems the cover had to be cooled to lower temperatures than planned.

All detected problems have been identified and NCRs have been written for non compliances or anomalies.

4 TEST REPORT ANALYSIS

This chapter contains a detailed analysis of the different operation phases. Each section contains a short description, a summary of the cryostat behaviour, deviations and lessons learnt.

Remarks: All times of the graphs below are in UTC, while the times in the log sheets and as-run copies in the annex are in local time.

4.1 Cool Down and Filling

4.1.1 Objective

Objective was the controlled cool down of the Herschel EQM cryostat to 4.2 K and the filling of the Herschel HTT to >98%. Cool-down and filling was started after evacuation and successful leak test in warm conditions. The temperature requirements of instruments as given in the IID-Bs had to be regarded.

4.1.2 Description of Operation

Cool down of the EQM cryostat started on 29.8.05 after five cycles of evacuation and flushing of the He S/S and after installation of the safety valve SV 922.

The HTT was cooled down until 31.8.05. Cooling of the HTT was not limited by a requirement. Cooling down of the AXT and OBA with instrument interfaces lasted until 7.9.05. It was agreed in the TRR that a cooling rate of 5 K/h and gradients between instrument interfaces of 20 K shall be regarded. In order not to exceed these requirements OBA and AXT was cooled down passively most of the time while the HTT was filled with LHe I.

Cool down and filling was completed on 9.9.05. The final HTT level could not be verified because the HTT liquid level probes are not functioning since ISO. However, filling level of the HTT was not relevant for the following EQM tests.

A part of the cool down was done in double shifts. The cool down was interrupted over one weekend because of a bottleneck in the Helium supply.

4.1.3 Summary Test Results / Cryostat Behaviour

The figures below show the cryostat behaviour during cool down. The switching of the Helium flow between HTT/shields and AXT/shields was necessary to avoid a too fast cool down of the AXT and the L0 interfaces which are coupled with the AXT. The effect of the switching onto the AXT temperatures can be seen in Figure 4.1-1.



Figure 4.1-1: Cool Down of Tanks



Figure 4.1-2: Cool down of OBA

4.1.4 Problems, Deviations

The most critical requirement was the restriction of the cooling rate to 5 K/h. This rate was exceeded several times when the AXT and OBA were actively cooled by cold Helium in order to speed up the cooling process.

As an example it can be seen in Figure 4.1-4 in more detail, that the rates were exceeded only for a short time and that the critical temperature (in this case T 207) dropped only about 12 K in that time. The stress which could be caused by such a temperature drop is not regarded as critical. Switching of the Helium flow avoided that the stress became critical.



Cooling Rates - OBA

Figure 4.1-3: OBA Cooling Rates



Figure 4.1-4: OBA Cooling Rates - Details

The OBA internal temperature gradients were all over the time below the required 20 K. However, the temperature gradient between the AXT (L0) and OBA was exceeded some times. Problems occurred mainly during longer non active phases. These short and only slight exceedings are not regarded as critical.



Temperature Gradients - OBA Internal

Figure 4.1-5: OBA Internal Temperature Gradients



Temperature Gradients - AXT vs. OBA

Figure 4.1-6: Temperature Gradients between AXT and OBA

4.1.5 Lessons Learnt

Due to the differences between the EQM and PFM He S/S lessons learnt for PFM are limited. However some observations made on the EQM cool down could help avoiding problems with the cool down of the FM cryostat, when the FM instruments are integrated:

- The OBA reacts quite fast on cold gas flows. It will turn out during cooling the F whether the large HTT reduces this effect. Otherwise, the OBA shall stay in by-pass most of the time. The only way to by-pass the OBA seems to be to cool the HOT instead of the HTT.
- Temperature gradients were exceeded during non active phases. Non-active phases shall be reduced to night breaks only to avoid similar problems on the FM.
- Driving parameter for the overall duration was the temperature gradient requirement from PACS.
- Temperature rates were exceeded when we tried to accelerate the process. Therefore: "keep cool"!

4.2 He II Production and Top Up

4.2.1 Objective

The objective of He II production and top us was to reach an AXT filling level of more than 95 % with T 702/T 703 < 1.8 K. The HTT remained at LHe I conditions and was used to cool the thermal isolation shields.

This activity was repeated each time after refilling the AXT.

4.2.2 Description of Operation

He II production on EQM was done by pumping with the He pumping unit I via V 512 and OBA at the AXT. In order not to overload the pumping unit, pumping speed was limited by means of a throttle valve in the venting line. This valve was opened completely after reaching the λ -point.

He II production on EQM was uncritical and was repeated during the EQM test phase whenever the AXT was refilled.

The Helium pumping unit II was used at ESTEC for the STM TB/TV test. Therefore He II production was done with the pumping unit I only and the He II transfer line could not be used. This was already known before and correct reflected in the test procedure. However, a top up of the AXT could not be performed without the He II transfer line. The final filling level of the AXT was therefore only at about 60 % or less.

The AXT could be filled and cooled down to temperatures of about 1.53 K without any problems.

4.2.3 Summary Test Results / Cryostat Behaviour

He II production and pumping down to below 1.6 K lasted about 5 h. The λ -point was reached after less than 2 h. As said above, a top up was not performed.



Figure 4.2-1: He II Production - AXT Temperatures



Figure 4.2-2: He II Production - AXT Temperatures - Details

4.2.4 Problems / Deviations

He II production on EQM was done without any problems. Later on during testing, He II production was performed with a 23° tilted PLM. The final filling level was therefore further limited to about 50 % or less.

4.2.5 Lessons Learnt

He II production on EQM had to be done completely different to the PFM. Lessons learnt are therefore limited to GSE issues.

It turned out that the pumping with the He pumping unit I had to be throttled as describe above to avoid an overload of the unit. A dedicated valve was installed in the venting line. For FM, a specific valve was ordered and will be installed at the next maintenance of the unit in February 2006.

4.3 Cryostat Operation during Instrument Tests Phase 1

4.3.1 Objective

Objective was to provide the specified L0, L1, L2 and L3 temperatures for the instrument testing.

4.3.2 Description of Operation

The required temperatures were achieved by continuously pumping via V 512 and OBA at the AXT while the thermal shields were cooled from a Helium flow from the HTT.

Helium flow through the OBA was increased by heating the AXT with some hundreds of milliwatt to increase cooling of the instrument interface temperatures.

The required mass flow of about 100 mg/s through the shields was achieved by heating the HTT with about 2 W. A special script was written on the CryoSCOE to automatically switch on and off heater H 101. With script the fixed heater power of 10 W was reduced to about 2 W in average.

4.3.3 Summary Test Results / Cryostat Behaviour

As described above the pumping unit I was continuously pumping at the AXT while the mass flow was increased by heating. In the first week the integrated module tests of HIFI could be successfully performed. Beside the high mass flow no problem with the cryostat occurred.

After HIFI tests the EQM was installed into the test dolly. For this reason the pumping at the CVV was stopped on 16.09.05. Pumping was not restarted because the isolation vacuum did not degrade.

For the further tests the EQM was tilted by 23°. The tilting angle could not be increased due to a problem with the test dolly gearing (see related NCR). Sorption cooler recycling was possible even with a tilting angle of 23°.

Cryostat operation was continued as for HIFI. In addition, the cryostat cover was cooled down for PACS and SPIRE testing. First attempts to perform the IMT of PACS and SPIRE after recycling the sorption coolers failed because the hold time of the coolers was too low. Some investigations were performed by changing the instrument procedures for cooler recycling. The AXT was warmed up to He I temperature to reduce or eliminate a Helium film which could be the cause of the problem. Finally, this test phase was stopped for more detailed investigations (see chapter below).



Figure 4.3-1: Tank Temperatures during HIFI IMT



Level 0 Temperatures

Figure 4.3-2: Level 0 Temperatures during HIFI IMT



Figure 4.3-3: Level 1 Temperatures during HIFI IMT



OBA / Level 2 Temperatures

Figure 4.3-4: OBA / Level 2 Temperatures during HIFI IMT



Figure 4.3-5: Shield Temperatures during HIFI IMT



Tank Temperatures

Figure 4.3-6: Tank Temperatures during PACS IMT (1st attempt)



Figure 4.3-7: Level 0 Temperatures during PACS IMT (1st attempt)



Level 1 Temperatures

Figure 4.3-8: Level 1 Temperatures during PACS IMT (1st attempt)



Figure 4.3-9: OBA / Level 2 Temperatures during PACS IMT (1st attempt)



Shield Temperatures

Figure 4.3-10: Shield Temperatures during PACS IMT (1st attempt)



Figure 4.3-11: Cover Temperatures during PACS IMT (1st attempt)



Figure 4.3-12: Tank Temperatures during SPIRE IMT (1st attempt)



Figure 4.3-13: Level 0 Temperatures during SPIRE IMT (1st attempt)



Level 1 Temperatures

Figure 4.3-14: Level 1 Temperatures during SPIRE IMT (1st attempt)



Figure 4.3-15: OBA / Level 2 Temperatures during SPIRE IMT (1st attempt)



Shield Temperatures

Figure 4.3-16: Shield Temperatures during SPIRE IMT (1st attempt)



Figure 4.3-17: Cover Temperatures during SPIRE IMT (1st attempt)

4.3.4 Problems / Deviations

An unexpected high heat load on the AXT and the OBA with the instruments prevents testing with an orbit representative mass flow rate of 2.5 mg/s. A flow rate of about 25 mg/s was necessary to cool down the thermal links to the instruments to the required temperatures. This was achieved by heating the AXT (see above).

This test phase was stopped on 27.09.05 because the hold time of the sorption coolers was unacceptable low (see next chapter for details).

4.3.5 Lessons Learnt

Cooler recycling was possible with a PLM tilting angle of 23°. Further lessons learnt are addressed in the following chapters.

4.4 Sorption Cooler / Leak Problem Investigations

4.4.1 Objective

Objective of this phase was to investigate the reasons for the unacceptable short cooler hold time and to find a work around solution for performing and completing the EQM test phase.

4.4.2 Description of Operation

The investigations are described and documented in test change HP-2-ASED-SD-0058, issue 3.

Reason for the problem with the sorption coolers was found to be a Helium film between L0 interface from EQM and instrument 0.3 K stage. This Helium leak could be caused by Helium leaks in the system.

The investigation started with a detailed leak test of all parts of the He S/S to identify Helium leaks. The two already known Helium leaks at the ISO HTT (see ISO NCR MB-PLM-045, 06.07.89) and at the filling port / CVV interface (see Herschel NCR NC-1319, 03.08.05) were confirmed. No additional leaks were found.

The leak at the filling port / CVV interface was reduced by filling the gaps around the filling port screws and between filling port and CVV with glue RTV 691 A/B.



Figure 4.4-1: Gluing of Filling Port / CVV Interface (red "paste")

A new procedure to provide the thermal background for instrument testing was established:

- The HTT was pumped down to < 10 mbar to isolate the leak of the ISO HTT
- Shield cooling was provided by external dewars through SV 121, by pass HTT, shields, V 502
- Pump with turbo pump mounted at SV 922 continuously at the isolation vacuum

4.4.3 Summary Test Results / Cryostat Behaviour

The global leak rate at beginning of the investigations was 4.7×10^{-6} mbarl/s, measured with the leak detector connected direct at the CVV airlock SV 922. The HTT was at He I temperature and the AXT at about 1.9 K.

The He S/S was sequentially evacuated. The leak rate of the completely evacuated He S/S was about 2×10^{-8} mbarl/s (HTT and AXT at ~ 40 K). The leak rate increased significantly to ~ 9 x 10⁻⁶ mbarl/s when the filling port (and shield tubing) was flushed with He. It further increased to > 2.7 x 10⁻⁵ mbarl/s when the HTT was filled with He gas.

The leak rate was reduced to $< 6.5 \times 10^{-6}$ mbarl/s after gluing with RTV 691 as described above.

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Mass spectrometer measurements confirmed the leak rate measurements. The partial pressure of He⁴ at begin of the investigations was 3.2×10^{-7} mbar. At the end of the investigation phase the partial pressure of He⁴ was 2.7×10^{-8} mbar with HTT at 150 mbar and the AXT partly filled with He II.

The instrument tests after the investigation phase confirmed the success of the sealing and isolating of the HTT leak. The cooler hold time did not degrade throughout the rest of the EQM test phase.



Figure 4.4-2: Tank Temperatures during Investigations (1st week)



Figure 4.4-3: OBA / Level 2 Temperatures during Investigations (1st week)



Shield Temperatures

Figure 4.4-4: Shield Temperatures during Investigations (1st week)



Figure 4.4-5: Tank Temperatures during Investigations (2nd week)



Figure 4.4-6: OBA / Level 2 Temperatures during Investigations (2nd week)


Figure 4.4-7: Shield Temperatures during Investigations (2nd week)

4.4.4 Problems / Deviations

No additional problems occurred during the investigation phase.

4.4.5 Lessons Learnt

The sorption coolers react quite sensitive even on small amounts of Helium inside the CVV. Even the large areas with adsorbers did not avoid that a Helium film formed at the thermal links. Therefore no Helium leak is tolerable on PFM, even if there is no risk the cryostat itself.

4.5 Cryostat Operation during Instrument Tests Phase 2

4.5.1 Objective

Objective was to provide the specified L0, L1, L2 and L3 temperatures for the instrument testing.

4.5.2 Description of Operation

The required temperatures were achieved by continuously pumping via V 512 and OBA at the AXT while the thermal shields were cooled by a Helium flow from an external dewar through SV 121, by pass the evacuated HTT, then shields and V 502.

Helium flow through the OBA was increased by heating the AXT with some hundreds of milliwatt to improve cooling of the instrument interface temperatures.

In parallel, the cover was cooled for PACS and SPIRE tests (see section 4.6 for details).

All cryostat data were transferred to the I-EGSE.

4.5.3 Summary Test Results / Cryostat Behaviour

The EQM tests were restarted on 19.10.05 with a PACS sorption cooler test.

As described above the pumping unit I was continuously pumping at the AXT while the mass flow through the OBA was increased by heating the tank. Due to the higher mass flow, the AXT had to be refilled each end of the week and pumped down to about 1.65 K over the weekend.

The required temperatures could be provided during instrument testing. The AXT was at ~ 1.65 K during instrument testing. The L0 temperatures were around 1.8 K. The HTT was at about 30 K @ 150 mbar. It was pumped down to less than 20 mbar on 29.10.05 and was kept evacuated until end of the EQM tests.

In this test phase two LHe supply dewars had to be connected permanently to the EQM: one was used to cool the thermal shields and the second one was connected with the cryostat cover cooling loop. The LHe transfer line was recovered according procedure at each exchange of the shield cooling dewar. Exchange of the cover cooling dewar is described in section below,

The turbo pump was continuously pumping at the CVV to help avoiding further problems with the sorption coolers.

The cryostat was operated most of the time in extended single shift. During the last week of testing we organised a double shift for cryostat operation to get most out of the available instrument testing time. An early start of the cryostat team ensured better cryostat stabilities when the instrument teams arrive.



Figure 4.5-1: Tank Temperatures during PACS IMT



Level 0 Temperatures

Figure 4.5-2: Level 0 Temperatures during PACS IMT



Figure 4.5-3: Level 1 Temperatures during PACS IMT



Figure 4.5-4: OBA / Level 2 Temperatures during PACS IMT



Figure 4.5-5: Shield Temperatures during PACS IMT



Figure 4.5-6: Cover Temperatures during PACS IMT



Figure 4.5-7: Tank Temperatures during SPIRE IMT



Figure 4.5-8: Level 0 Temperatures during SPIRE IMT

Herschel



Figure 4.5-9: Level 1 Temperatures during SPIRE IMT



OBA / Level 2 Temperatures

Figure 4.5-10: OBA / Level 2 Temperatures during SPIRE IMT



Figure 4.5-11: Shield Temperatures during SPIRE IMT



Cover Temperatures

Figure 4.5-12: Cover Temperatures during SPIRE IMT



Figure 4.5-13: Isolation Vacuum during SPIRE IMT



Tank Temperatures

Figure 4.5-14: Tank Temperatures during Parallel Mode

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Figure 4.5-15: Level 0 Temperatures during Parallel Mode



Level 1 Temperatures

Figure 4.5-16: Level 1 Temperatures during Parallel Mode



Figure 4.5-17: OBA / Level 2 Temperatures during Parallel Mode



Figure 4.5-18: Shield Temperatures during Parallel Mode



Figure 4.5-19: Cover Temperatures during Parallel Mode



Figure 4.5-20: Isolation Vacuum during Parallel Mode



Figure 4.5-21: Tank Temperatures during PACS IMT



Level 0 Temperatures

Figure 4.5-22: Level 2 Temperatures during PACS IMT



Figure 4.5-23: Level 1 Temperatures during PACS IMT



OBA / Level 2 Temperatures

Figure 4.5-24: OBA / Level 2 Temperatures during PACS IMT



Figure 4.5-25: Shield Temperatures during PACS IMT



Figure 4.5-26: Cover Temperatures during PACS IMT



Figure 4.5-27Isolation Vacuum during PACS IMT



Tank Temperatures

Figure 4.5-28: Tank Temperatures during HIFI EMC Test







Level 1 Temperatures

Figure 4.5-30: Level 1 Temperatures during HIFI EMC Test

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Figure 4.5-31: OBA / Level 2 Temperatures during HIFI EMC Test



Figure 4.5-32: Shield Temperatures during HIFI EMC Test



Figure 4.5-33: Isolation Vacuum during HIFI EMC Test



Tank Temperatures

Figure 4.5-34: Tank Temperatures during PACS EMC Test



Figure 4.5-35: Level 0 Temperatures during PACS EMC Test



Level 1 Temperatures

Figure 4.5-36: Level 1 Temperatures during PACS EMC Test



Figure 4.5-37: OBA / Level 2 Temperatures during PACS EMC Test



Figure 4.5-38: Shield Temperatures during PACS EMC Test







Figure 4.5-40: Tank Temperatures during SPIRE EMC Test



Figure 4.5-41: Level 0 Temperatures during SPIRE EMC Test



Level 1 Temperatures

Figure 4.5-42: Level 1 Temperatures during SPIRE EMC Test



Figure 4.5-43: OBA / Level 2 Temperatures during SPIRE EMC Test



Figure 4.5-44: Shield Temperatures during SPIRE EMC Test



Figure 4.5-45: Cover Temperatures during SPIRE EMC Test



Tank Temperatures

Figure 4.5-46: Tank Temperatures during Thermal Behaviour / Straylight Tests



Figure 4.5-47: Level 0 Temperatures during Thermal Behaviour / Straylight Tests



Level 1 Temperatures

Figure 4.5-48: Level 1 Temperatures during Thermal Behaviour / Straylight Tests



Figure 4.5-49: OBA / Level 2 Temperatures during Thermal Behaviour / Straylight Tests



Figure 4.5-50: Shield Temperatures during Thermal Behaviour / Straylight Tests



Figure 4.5-51: Cover Temperatures during Thermal Behaviour / Straylight Tests



Figure 4.5-52: Tank Temperatures during SPRE EMC Test



Figure 4.5-53: Level 0 Temperatures during SPRE EMC Test



Level 1 Temperatures

Figure 4.5-54: Level 1 Temperatures during SPRE EMC Test



Figure 4.5-55: OBA / Level 2 Temperatures during SPRE EMC Test



Figure 4.5-56: Shield Temperatures during SPRE EMC Test



Figure 4.5-57: Cover Temperatures during SPRE EMC Test



Figure 4.5-58: Isolation Vacuum during SPIRE EMC Test / Start Warm Up

4.5.4 Problems / Deviations

An unexpected high heat load on the AXT and the OBA with the instruments prevents testing with an orbit representative mass flow rate of 2.5 mg/s. The unloaded mass flow rate from the AXT, measured with no additional heat load coming from a heater or the instruments was about 8 mg/s. Due to the new concept, the HTT was at about 30 K instead of 4.2 K. This could be one reason for a higher heat load on the AXT. The high heat load on L1 interfaces and OBA can be explained by the missing thermal anchoring of the harness, by the direct heat load from the warm CVV and through the LO windows.

Adjusting the mass flow by changing the AXT heater power or adjusting the mass flow through the cryostat cover cooling loop caused some temperature variations during instrument testing. In addition temperature variation were caused by interruption of shield cooling or cover cooling because of running out supply dewars Helium supply.

It took some time to learn how to operate the cryostat with the new concept. In combination with some problems with the LHe supply due to the parallel activities (EQM in Ottobrunn and PFM at ESTEC) this caused some temperature inconsistencies.

In addition to the LHe supply problems, the liquid level measurement and pressure control of the Linde dewars type HDS450-EIDP was not running properly. Especially the measurement with the fixed installed liquid level probes of the dewars was unacceptable inaccurate for all dewars. The automated dewar pressure control worked quite fast and reliable, however the dewar pressure measurement on which the control loop based, was not correct on some dewars.

4.5.5 Lessons Learnt

A HTT temperature of about 1.7 K is adequate to achieve the required L0 temperatures. Problems with the L1 and OBA temperatures cannot be transferred to FM because of the different He S/S.

Temperature stability was a major issue of the instruments. In future a briefing shall be hold each morning to inform the cryostat team about instrument constraints but also to inform the instrument teams about cryostat constraints of each day.

The EIDP version of the dewars have to be modified such, that the liquid level measurement of the dewar is reliable.

4.6 Cover Flushing

4.6.1 Objective

Objective of this operation was to cool down the cryostat cover mirror to instrument requested temperatures. After detecting the straylight problem, the cover mirror cooling was used to eliminate straylight from cover.

4.6.2 Description of Operation

A LHe supply dewar was connected via the cryostat cover supply lines to the cover cooling loop. The exhaust of the cooling loop was connected via the cryostat cover exhaust lines to CVSE tubing,

installed in the clean room in Ottobrunn. At the end of this tubing, a flow meter was installed which helped adjusting the mass flow through the cover. An additional overpressure valve was installed in the CVSE lines. A needle valve close to the flow meter helped regulating the flow.

Cryostat cover cooling was started by slightly opening of the cover supply line's needle valve. Fine adjustment was done with the needle valve at the mass flow meter.

Dewar exchange was simplified. The new dewar was placed close to the used dewar. Then the exhaust of the cover flushing line was closed to have an overpressure in the flushing line system. The cover supply line was removed from the used dewar and installed immediately in the new one. Cover flushing was restarted by reopening the exhaust line.

After completing the EQM test phase, the cryostat cover CVSE lines were removed during warm up, when the cover was above 250 K.

4.6.3 Summary Test Results / Cryostat Behaviour

At begin of operation the cover temperature was stabilized at about 80 K for a few hours. Due to the straylight problems the cover was cooled down below 13 K, which was the lowest measurable temperature.

Cryostat cover cooling was continued over night even without supervision of an operator. Thanks to three safety valves, plus the safety valve in the supply dewar, the risk for the FM cryostat cover was extremely low. Cryostat cover cooling over night was necessary to keep a cooler hold time of about 40 h.



Figure 4.6-1: Cover Temperatures at 1st Cover Flushing



Figure 4.6-2: Cover Temperatures at End of Test Phase

4.6.4 Problems / Deviations

Throughout the EQM test phase the cover cooling behaviour degraded and that the cover mirror temperature could not be stabilized below 40 K. It turned out that the isolation vacuum of the cryostat cover supply line degraded over the time. The cryostat cover mirror temperature could be stabilized at less than 20 K over more than one day after recovering the isolation vacuum the cover. Originally, a temperature stability of a couple of minutes at a cover temperature of about 80 K was requested by instruments. This could be achieved all the time. Requests for much longer temperature stabilities at lower temperatures came up during testing.

4.6.5 Lessons Learnt

Cryostat cover temperature stability has to be (re-)defined by the instruments. If a temperature stability of less than 1 K over more than 12 h is also requested for FM testing, the cryostat cover supply line has to be modified. Potential improvements are a more sensitive needle valve with a scale and a heater with temperature sensors in the fill tube.

4.7 Depletion and Warm Up

4.7.1 Objective

Objective was depletion of the EQM tanks and a controlled warm-up of the EQM cryostat from Helium temperature to ambient. The temperature requirements of instruments as given in the IID-Bs had to be regarded.

4.7.2 Description of Operation

The AXT was heated from He II temperatures to He I temperature. After SFTs at He I temperature of SPIRE and PACS, the AXT was depleted by means of the AXT heaters and warm up started.

The cryostat cover flushing was continued at beginning of warm up.

Warming up was supported with a GHe grade 5.0 from a bottle through V 506 - shield 3 ... 1 - V 105 - OBA - V 512. After reaching 80 K in the OBA, GN_2 grade 5.6 was used instead of GHe.

AXT heaters were switched only for short time during warming up not to exceed temperature gradient requirements. Most of the time, warming up was performed passively.

Pumping at the CVV with the turbo pump was continued all over the time. Irregularly mass spectrometers measurements were performed. At the end of the warming up process, the isolation vacuum was broken in steps from 10⁻⁵ mbar to 1 mbar to speed up the

4.7.3 Summary Test Results / Cryostat Behaviour

Depletion and warm up lasted about 4 weeks. Over Christmas break, warming up was done passively. The isolation vacuum was monitored all over the time. Some "peaks" in the isolation vacuum occurred at about 155 K and 185 K. Other peaks in the isolation vacuum measurement could be explained by switching from pumping with the turbo pump to pumping with the pump of the mass spectrometer.



Figure 4.7-1: Temperatures and (Partial-) Pressures during Warm Up



EQM Warm Up - First Days

Figure 4.7-2: Temperatures an (Partial-) Pressures during first days of WU


Figure 4.7-3: Temperatures and (Partial-) Pressure at start of WU



Cover Warm Up

Figure 4.7-4: Temperatures and Pressure at Warm Up of Cover

4.7.4 Problems / Deviations

Except the long duration no problems were detected. The tanks could not be actively heated in order not to exceed temperature gradient requirements between AXT (L0) and OBA (L1 and L2).

4.7.5 Lessons Learnt

The warming up of the EQM cryostat had a quite limited significance for FM due to the differences in the Helium subsystems.

The driving parameters for warming up seem to be the temperature gradient requirements. The limited temperature rates are less critical.

The warming up process can be speed up by breaking the isolation vacuum with GN2 to about 10^{-2} mbar to 1 mbar.

5 CONFIGURATION STATUS

5.1 EQM System Status

At the start of the cryostat operation, the H/W configuration of the components is defined with the "As Built Configuration List" HP-2-ASED-AB-0003, issue 2 and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM was closed, evacuated and leak tested
- The PLM was mated with the SVM simulator
- The PLM/SVM was placed on ground in clean room class 100 000
- The harness (CCH and SIH) was completely integrated, verified and connected with instruments

The cryostat status at start of cryostat operations:

- the He S/S was filled with GN₂ at ambient pressure and ambient temperature
- strap pretensions were about 5 kN
- 16 strap pretension measurement devices were mounted to the strap pretensioners
- CVV is flushed with GN_2 and pumped down to < 10^{-4} mbar

After the first HIFI tests at He II, the PLM/SVM was installed in the test dolly. The EQM was tilted with the test dolly by 23°.

5.2 Instrument Configuration

The instrument FPUs were integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator.

HIFI:

- FPU QM
- FCU DM2
- LOU QM
- LCU DM
- LSU Simulator
- BWG Simulator
- WEH QM
- WHO QM
- HRH QM
- ICU AVM ⇒ exchanged by CFM on 18.10.05 (before EMC test)
- WIH QM
- IF attenuator ⇒ exchanged by IF up converter 18.10.05 (before EMC test)

PACS:

- FPU CQM
- DEC/MEC EM
- BOLC QM1
- DPU AVM ⇒ exchanged by CFM2 on 21.09.05 ⇒ exchanged by AVM on 17.10.05

- SPU AVM
- WIH AVM
- External power supply for BOLC

SPIRE:

- FPU CQM including IFETs
- DPU AVM1
- DCU QM1
- FCU QM1
- WIH
- External power supply

5.3 MGSE Status

The following MGSE items were used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
1	PLM Test Dolly	APCO	CI No. 142 155-01
1	PLM Hoisting device	APCO	CI No. 142 121
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02
	Working platform at the filling airlock		
	General Purpose Hoisting Devices	ASED	
	Set of tools	ASED	

Table 5-1: MGSE Items

5.4 EGSE Status

The following EGSE items were used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM CryoSCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			

Table 5-2: EGSE Items



Figure 5.4-1: EGSE Set-Up

All cryostat instrumentation was monitored from the EQM CryoSCOE and in parallel by the CCS. The cryostat instrumentation was operated by the EQM CryoSCOE in stand alone configuration only.

The CCS provided a part of the cryostat data to the I-EGSE as long as the I-EGSE was switched on.

5.5 CVSE Status

The following CVSE was used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
1	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
	450 I LHe Dewars type HDS 450 -EIPS	Linde		

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
	50 I / 200 bar GHe grade 5.0	Linde	
	Set of mass flow meters	ASED	
	Set of vacuum hoses		
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T	
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T	

Table 5-3: CVSE Items

The filling airlock with SV 121 was mounted onto the CVSE. At beginning of cool down, the turbo pump 'A' (C0711) was mounted to SV 921 airlock and turbo pump 'B' (C0712) was mounted to SV 922 airlock. Turbo pump 'A' was removed during cool down and replaced by the safety valve SV 921.

The ISO external venting line was blinded and leak tested.



Figure 5.5-1: CVSE Configuration

6 TIME RECORD

Performed			Remark		
Start	End	Procedure	Section		
25.08.05	29.08.05	HP-2-ASED-TP-0072	5.1 - 5.4	Preparation of cool down	
29.08.05	31.08.05	HP-2-ASED-TP-0072	5.5	Cool down of HTT	
29.08.05	09.09.05	HP-2-ASED-TP-0072	5.5 - 5.6	Cool down and filling of AXT	
09.09.05	14.09.05	HP-2-ASED-TP-0090	5.1 - 5.4	1 st He II Production in AXT	
13.09.05	27.09.05	n/a		Cryostat operation in test phase 1	
16.09.05	16.09.05	HP-2-ASED-TP-0091	5.1 - 5.3	1 st cover flushing	
05.10.05	19.10.05	HP-2-ASED-SD-0058		Sorption cooler problem investigation / leak tests	
19.10.05	14.12.05	n/a		Cryostat operation in test phase 2	
14.12.05	14.12.05	HP-2-ASED-TP-0098	5.1 - 5.2	Warm up to He I	
15.12.05	15.12.05	HP-2-ASED-TP-0098	5.3	Depletion of AXT	
16.12.05	17.01.06	HP-2-ASED-TP-0098	5.4	Warm-up to ambient	
17.01.06	18.01.06	HP-2-ASED-TP-0098	5.5	Cryostat operation completion	

Table 6-1: Time Record

7 NCR SUMMARY

In the scope of cryostat operation the following NCR's have been raised (only NCR's relevant for cryostat operation are listed):

NCR	Date	Description	Status	Effect on PFM	Remark
HP-112000-ASED-NC-1662	25.10.05	SPIRE EQM cooler recycling failed	closed	Tbd	Problem was caused by Helium leaks in the cryostat. Investigations performed according HP-2-ASED-SD-0058
HP-113000-ASED-NC-1495	20.09.05	PACS EQM cooler recycling failed	closed	Tbd	Problem was caused by Helium leaks in the cryostat. Investigations performed according HP-2-ASED-SD-0058
HP-113000-ASED-NC-1675	03.11.05	Cryostat background radiation measured by PACS much higher than predicted	closed	Tbd	The cryostat cover had to be cooled down to lower temperatures than expected.
					Specific tests to find the source were performed at the end of the EQM test phase 2. (see HP-2-ASED-TR-0092 for details)
HP-142220-ASED-NC-1667	15.07.05	EQM CryoSCOE heater data block in continuous acquisition mode	open	lf not fixed	Only monitoring was blocked; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-142220-ASED-NC-1668	15.07.05	EQM CryoSCOE data shows regular peaks in 'once per minute' acquisition	open	lf not fixed	Data had to be filtered off line; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-142220-ASED-NC-1759	22.11.05	EQM CryoSCOE heater repeated blocking and disabling	open	lf not fixed	Only monitoring was blocked; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE

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NCR	Date	Description	Status	Effect on PFM	Remark
HP-142220-ASED-NC-1829	06.12.05	Very high noise on C100 sensors for EQM CryoSCOE	open	lf not fixed	Data had to be filtered off line; use as is for EQM; a fix was done on the PFM SCOE and worked properly; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-150000-ASED-NC-1484	18.09.05	Temperature gradient requirement during cool down of cryostat partially exceeded	closed	Y	See section 4.1 for details
HP-150000-ASED-NC-1489	21.09.05	Required tilting position of the cryostat via test dolly not secured	closed	N	Due to a problem with the test dolly gear a tilting angle of 30° could not be achieved; position of 23° (sufficient for cooler recycling) was fixed manually
HP-150000-ASED-NC-1683	07.11.05	EQM L1 temperatures higher than expected	closed	Y (tbc)	See section 4.5 for details
HP-150000-ASED-NC-1817	06.12.05	EQM mass flow through OBA from AXT higher than expected	open	Y	See section 4.5 for details
HP-151000-ASED-NC-0211	04.04.04	Internal leakage of safety valve SV121 out of spec	closed	N	Not relevant for EQM testing
HP-151000-ASED-NC-1319	02.08.05	I/F CVV/filling port is not Helium leak tight as requested	closed	Y	Leak tightness improved by gluing (see HP-2-ASED-SD-0058); one of the causes for sorption cooler problem
HP-151000-ASED-NC-1795	28.11.05	EQM cryostat cover temperature instability	open	Y	See section 4.6 for details
HP-151240-ASED-NC-1415	01.08.05	The SV121 plug remains not in safety valve position	closed	Y	Safety function was transferred to valve SV0622 in safety unit

Table 7-1: NCR Summary

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Test Report

8 TEST CHANGE SUMMARY

This paragraph summarizes the major changes of the cryostat operation which have a relevant impact on the performed tests (e.g. change of the test setup, additional test steps or sequences, modification or deletion of test steps or sequences, change of expected values or pass/fail criterias).

All other minor deviations to or adaptations of the integration procedure are hand marked at the respective test step.

Test Change	Issue	Date	Description	Status	Remark
HP-2-ASED-SD-0058	3	04.10.05	Activities to localize Helium leaks, tighten the leaks where possible and verify final status.	performed	Activities were necessary to improve operation of the sorption coolers

Table 8-1: Test Change Summary

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9 AS-RUN PROCEDURE

<u>Test Facilities</u> Astrium OTN, Building 5.0, cleanroom class 100.000

Operation Dates See Time Record in section 6

<u>Test Procedures</u> Integration Procedure for AXT CCH onto AXT HP-2-ASED-TP-0021 Issue 1, Rev. -, 23.07.04 Issue 2, Rev. -, 22.09.04

Integration Sequences Integration of mechanical part Performed Health Check N/A Integration of Cryo Components Performed Integration and Routing of Harness Bundles on AXT Performed Insulation Test Performed Connection of harness to Cryo Components / Location Test Performed Loop-Resistance Test (Verification) Performed Loop-Resistance Test (Final) N/A

Personnel:Test Manager:C. Schlosser / S. IdlerTest Conductors:P. MackCryo./Mech. AIT:A. Runge / J. Schäffler / R. KameterEl. AIT:A. Grasl / R. KameterQA:E. LamprechtEGSE:S. Ilsen

10 ATTACHMENTS

- I. As-Run Copy of the Cool Down and Filling Procedure HP-2-ASED-TP-0072
- II. As-Run Copy of the He II Production & Top Up Procedure HP-2-ASED-TP-0090
- III. As-Run Copy of the Cover Flushing Procedure HP-2-ASED-TP-0091
- IV. As-Run Copy of the Depletion & Warm Up Procedure HP-2-ASED-TP-0098
- V. Test change HP-2-ASED-SD-0058, issue 3
- VI. Copy of filled in Log Sheets 1
- VII. Copy of filled in Log Sheets 2
- VIII. Copy of strap pretension measurements
- IX. Copy of the NCR's

I. As-Run Copy of the Cool Down and Filling Procedure

HP-2-ASED-TP-0072

Procedure

Herschel

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Procedure

Herschel

Issue	Date	Sheet	Description of Change	Release
1	28.07.05	All	initial issue	

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Procedure

Herschel

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1 Scope

1.1 Objective

This test procedure describes the controlled cool down of the Herschel EQM cryostat to 4.2 K and the filling of the Herschel Tanks. Cool-down and filling will be started after evacuation and successful leak test in warm conditions. The temperature requirements have to be regarded, even if CQMs instead of the FM FPUs are integrated in the PLM.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000. (

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1.2 Activity Flow

The activity flow below summarizes the activities to be performed during cool down and filling. Cool down and filling is completed with the steps in section 5.6. Sections 5.7 to 5.9 have to be repeated for each exchange of dewar.

The cool down and filling in coarse steps:

§ 5.1	Check of PLM Status	Configuration check according chapter 3.1 and 3.2 PLM-FM flushed with GN2 Increase of strap pretension to $-10 - 15$ kN Isolation vacuum < 1 x 10^{-4} mbar Valve status check
§ 5.2	Installation of Auxiliary Lines and Components	Installation and leak test of safety line Y0621 Installation and leak test of vent line Y0601/Y0602
§ 5.3	Evacuation and Purging of He S/S	Evacuation of tubing via V 502, V 105 and V 701 Evacuation of HTT Preparation of filling line Flushing of He S/S with GHe Leak test of He S/S Evacuation and flushing with GHe of the He S/S (4 x)
§ 5.4	Installation of Safety Valve SV 922	Installation of SV 922
§ 5.5	Cool down of Cryostat	He S/S evacuated at start of cool down Stop pumping with He II pumping unit Pressurization of He S/S to 1 bar from LHe dewar Cool down to 4.2 K
§ 5.6	Filling of HTT	 Filling of HTT to 100 % Closing and dismounting of airlock to SV 921 Mounting of 50 mg/s flow meter after end of filling Final configuration: HTT filled up to LHe I AXT partly filled with LHe I Venting via V 104, V 701 and V 502
§ 5.7	Night Break	 Establishing of night configuration: Removal of transfer line Venting via V 104, V 701 and V 502 Restart after night configuration

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§ 5.8	Exchange of LHe Dewar	 Removal of transfer line Installation of new dewar and transfer line
§ 5.9	Preparation of LHe I Transfer Line	 Preparations Evacuation of transfer line Flushing of transfer line with GHe
§ 5.10	Installation of Transfer Line	 Installation of transfer line in dewar Installation of transfer line in SV 121 Evacuation and purging of filling airlock Pre-cooling of transfer line

1.3 Requirements

During cool-down the following requirements have to be regarded:

Temperature requirements:

HTT:	∆T103/∆t < 50 K/h
HIFI/(PACS):	Δ T207/ Δ t < 20 K/h (above 50 K for HIFI)
	$\Delta T_{207/\Delta t} < 20$ K/h (above 50 K for PACS; < 5 K defined by PACS not yet agreed by
ASED)	5 K/h see MN-1042
SPIRE/(PACS):	Δ T253 (T255)/ Δ t < 20 K/h (above 50 K for PACS; no requirement from SPIRE)
SPIRE J-FET:	Δ T249 (T251)/ Δ t < 20 K/h (above 50 K; no requirement from SPIRE)

Remark: There are no specific PT1000 temperature sensors to monitor PACS cool down, PT1000 sensors close to HIFI foot and SPIRE foot shall be used instead.

The large tank shall always to be colder than OBA and FPUs:

T 207 - T 701 > 30 K T 253 - T 701 > 30 K

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Keep AXT as long as possible colder than the HTT:

T 103 – T 701 > 30 K

Temperature differences between L0, L1 and L2 shall not exceed 20 K. (HIFI). This requirement can only be controlled by indirect measurements (AXT vs. OBA plate vs. SPIRE L3) or by instrument internal sensors:

|T 701 – T 207| < 20 K |T 207 – T 249 (T 251)| < 20 K |T 701 – T 249 (T 251)| < 20 K (

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2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018

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2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested 🗸
- The PLM is mated with the SVM simulator 🗸
- The PLM/SVM is integrated in the test dolly and placed in clean room class 100 000 V
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- the He S/S is filled with GN₂ at ambient pressure and ambient temperature
- filling airlock with SV 121 is mounted
- Turbo pump 'A' (C0711) mounted to SV 921 airlock for continuous evacuation of the cryostat during cool down
- Turbo pump 'B' (C0712) mounted to SV 922 airlock
- strap pretensions are about 5 kN
- 16 strap pretension measurement devices are mounted to the strap pretensioners
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested \checkmark
- CVV is flushed with GN₂ and pumped down to < 10^4 mbar \checkmark

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Figure 3-1: EQM PLM Helium S/S Flow Schema

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3.3 Set-up



Figure 3-2: General set-up in clean room class 100 000

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Cool down and filling



Figure 3-3: Set-up during cool down and filling

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Figure 3-4: CVSE for cool down and filling

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Figure 3-6: Flow Meter Unit

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4 Conditions

4.1 Personnel

Cool down and filling shall be performed in double shift. Personnel necessary to perform activities according to this present procedures are:

Responsibility	Name / Organisation
Test Manager	") (. Schlosser
Test conductors	") C. Sch (osser
Cryostat Operators	") P. Mack A. Rimge
EGSE Operators	") J. Styn
PA Responsible	», C. Campiecht D. Hendry

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ± 3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

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4.3 General Instructions for Integration

4.3.1 General Safety Requirements, Precautions

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
 - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
 - \circ operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 QA Requirements

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 ESD constraints

No specific ESD precautions have to be regarded during cool down and filling.

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4.3.4 Prerequisites

At least the following tasks have to be successfully completed before start with cryostat cool down:

- TRR has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

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All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 MGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
<u> </u>	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

4.4.2 EGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

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Figure 4-1: EGSE Configuration

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4.4.3 OGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

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4.4.4 Cryo Vacuum Servicing Equipment (CVSE)

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit	BOCE	CI No. 142 310-03	NIA
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 I LHe Dewars type HDS 450 -EIPS	Linde		V
	50 I / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		

Table 4-4: CVSE

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5 Step-by-Step Procedure

5.1 Check of PLM Status

č	A - 41 - 14	Naminal	Actual	Demarks	2	
Step- No.	Activity	Value	Value			
	The following configuration set-up is required prior to start of cool down and filling and shall be checked prior to test:				٢	
5.1.1.1	PLM/SVM installed in test dolly and set-up according Figure 3-2 and Figure 3-3		04	PLM on SVM Cnot in test clocky/	7	
5.1.1.2	16 load cells mounted to the strap pretensioners. Increase strap pretensions and make a printout of strap pretensions	م) عور) عولام - 15 kn	2,74 LN	see grintant	Ż	
5.1.1.3	He S/S flushed with GN ₂ at ambient temperature and pressure; T 103	< 313 K	XSt2		7	
	P 101	0,95 - 1,2 bar	~ 950 mbor			
5.1.1.4	Turbo pump A mounted on upper bulkhead SV 921 interface, turbo pump is running and airlock to isolation vacuum is open		0. Ĺ		7	
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		0.4.		7	
5.1.1.6	Airlock SV 121 installed and leak test of filling port performed. Airlock configured for LHe I transfer line.		0. 2.		2	
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Step- No.	Activity		Nominal Value	Actual Value	Remarks	•	z	
5.1.1.7	Two manometers P0621-1 (0,1-27 in the installed in safety unit and connected	nbar) and P0621-2 (1-1200 mbar) d with the safety line of filling port airlock.		0: <i>h</i> .		-		
5.1.1.8	Safety line Y0621, valves V0621, V 2, safety valve SV0622, vent line Y1 connected with filling airlock and let	0623, manometers P0621-1 and P0621- 0622 and vacuum pump C 1100 ik test performed.				J	\rightarrow	
	A metal gasket must be used at the SV 121!	interface line Y0621 to filling port						
5.1.1.9	Plug of SV 121 is closed - SV 121 is	s activated					5	T
5.1.1.10	Cryo SCOE connected and operation temperature successfully performed	onal - functional test at ambient I.		0.4.		3	$\overline{}$	T
5.1.1.11	Blind flanges installed at external v	ent line and leak tested		0.4.			2	— T
5.1.1.12	 5 g/s mass flow meter installed in the strip chart recorder and the Cryo St 	ie Y0602 vent line and connected with a COE						T
5.1.15	Check valves status: V 102, V 104, V 105, V 502, V 512,	ر V 701, V 702, SV 121	closed		VTOT OPEN D. V707 OPEN D. V702 OPEN D	;;;;		Т
5.1.14	Check isolation vacuum:		< 1 × 10 ⁴ mbar	6. 3. 10 Junta			2	T
5.1.1	P 501 interface at PLM connected	with manometer and leak tested		7		1		
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Step-	Activity	Nominal	Actual	Remarks	٩.	z
No.		Value	Value			
5.1.1.16	Fill out log sheet 1 and 2 - see annex 1				2	
5.1.1.17	Attention: Do not operate liquid level sensors at temperatures above 10 K:				7	
	L 701, L 702 if T 703 > 10 K					
	Do not continuous operate L 701 or L 702 and do not operate L 701 and					
	L 702 at the same time.					



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Components
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Auxiliary L
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5.2 In

		Naminal	Antical	Domarke	N
Step- No.	AGUVILY	Value	Value		
5.2.1.1	Connect GHe supply bottle grade 5.0 with 2 µm filter to valve V0 Figure 3-4 and Figure 3-5	23. See	>		2
5.2.1.2	Connect leak detector to valve V0623 and perform leak test of lin with all connections.	• Y0621	2		2
	Note leak rate	< 1x10 ⁻⁵ mbarl	s		
5.2.1.3	Installation of vent line Y0601 to V 502 (V 502 still closed).				>
	Perform leak rate measurement of Y0601 and not leak rate Check isolation vacuum of venting line Y0601!	< 1x10 ⁻⁵ mbari) 		
5.2.1.4	Connect He pumping unit II via V6 of the flow meter unit with Y06	5	2)
5.2.1.5	Connect venting line to V 512 and - via T-piece - to the inlet of th unit	flow meter	>		2
5.2.1.6	Connect leak tester at the entrance of PLM evacuation line Y067 of backing pump)	3 (upstream	2		>
5.2.1.7	Connect transfer lines to the cover cooling loop according AAE p	ocedure	~		2
5.2.1.8	connect a GHe bottle to the filling line entrance to the cover cool	dool Bi	/		2
5.2.1.9	Connect a laboratory vacuum pump at the exit of the cover cooli	g loop	>		2
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	Z d
5.2.1.10	Perform a leak test of the cover cooling loop and its set-up		5		و
5.2.1.11	Evacuate cover cooling loop to	< 2,5 mbar	`		ع
5.2.1.12	Flush the cover cooling loop with GHe grade 5.0 from bottle to	~ 1 bar	7		æ
5.2.1.13	Repeat steps 5.2.1.11 to 5.2.1.12 5 times		2		¢,
5.2.1.14	Close both cover cooling loop CVSE lines with a plug or a blind cap. Ensure that an over pressure valve is installed in the line.		>		R
5.2.1.15	Fill out log sheets 1 & 2		`		٩_

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5.3 Evacuation and Purging of He S/S

	Activity			Nominal	Actual	Remarks	۵.	Z
No.				Value	Value			
5.3.1	1 st Evacuation Cycle							
5.3.1.1	Open V 701 and V 105				7		د	
5.3.1.2	Check venting line valves clk V1, V2 and V6 of the flow m	sed: eter unit and V0631, V0603	(bypass He-pump-II)	closed	7			
5.3.1.3	Start He-pump II, C0500 Open inlet valve He-pump II Y0601	(V6 of flow meter unit) and	evacuate venting line		\geq			
5.3.1.4	VSAD Open V 502 and evacuate H	le S/S without HTT to P 50'	-	< 245 mbar	2			
5.3.1.5	Check valve status: ・ V 102, 104, V 542, V 76 ・ V 105, V 701, V 562 V/	ف, sv 121 کار , v کسی		closed open	77	0.4.	د	
5.3.1.6	Close V 502. Observe P 10 ⁷ P 101 = P 501 = If no pressure increase at P are closed	1, P 501. 501 and no change at P 10)1 all valves at HTT	approx. 1 bar < 2.5 mbar	Gsomber Szmbar P:enur		7	<u> </u>
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Step-	Activity	Nominal	Actual	Remarks	٩.	z
No.		Value	Value			Τ
5.3.1.7	Open V 501 ⇔ check pressure at P 501 increases. Wait until P 501 remains constant after initial slight increase.			Step not relevant on EQM	\setminus	
5.3.1.8	Open V 502 and V 512 and continue evacuation of He S/S		7		7	
5.3.1.9	Glose V 105, V 701-			when to AxI kept open	7	
	Note P 501		S, 7 mber			
5.3.1.10	Open V 104 and start evacuation of HTT		>		7	_
5.3.1.11	Check valve status:					
	• V 102, V 105, V 704, V 702, SV 121, V 502	closed	7		7	
	 V 104, V 502, V 512, V 105, V 707, V 702 	open	7			
5.3.1.12	Fill out log sheets 1 & 2		>		7	



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Step- No.	Activity	Nominal Value	Actual Value	Remarks	<u>د</u>	7
5.3.1.13	Continue evacuation of He S/S to					
	P 101 approx.	< 50 mb	ar			
	Close V 502 and V 512 and wait for pressure equilibrium to check manometers	nstalled			7	
	Note:			V. 727	•	-
	P 101 (on monitor)			M 4 9 0 0 0 0 1		
	P국601 (on monitor)		10,021	TRW - CS4 WV		
	P 501 (manometer at V 506)		10,1 mbar			·
	Open V 502 and V 512					
5.3.1.14	Open V 105, V 701, V 702 and V 102 and continue evacuation of	He S/S to $< 2.8 \text{ mt}$	AR SiG MAL		7	
5.3.1.15	: Check valve status:					
	• SV 121, V302	closed	2		7	
	 V 102, V 104, V 105, V 502, V 512, V 701, V 702 	open				
5.3.2	Preparation of filling port					
5.3.2.1	Evacuate vacuum line Y0621 and airlock via valve V0621 and lab pump C1100	vac.	7		د.	
5.3.2.2	Close Y0621 (line to vacuum lab. pump)		2		2	
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z z
5.3.2.3	Pressurize line Y0621 and air lock SV 121 with GHe grade 5.0, connected at valve V0623 until P0621 = 1 bar		7		7
5.3.2.4	Repeat evacuation and pressurization of Y0621 and airlock SV 121 two times		>		2
5.3.2.5	Evacuate line Y0621 and airlock SV 121)
5.3.2.6	Close V0621 (line to lab. vac. pump)		>		1
5.3.3	1 st Pressurization Cycle	a needle	value at Vs	21	
5.3.3.1	Close V 502, V,812 and V 104		2		
5.3.3.2	Open SV 121		И.С.	Prenucitation via	7
5.3.3.3	Check valve status:				
	• V 104, V 502, V 512 JV NL1	closed			7
	 V 102, V 105, V 701, V 702, SV 121, V5 12 	open			
5.3.3.4	Pressurize line Y0621 and air lock SV 121 with GHe grade 5.0, connected at valve V0623 until P0621 = 1 bar		950mbar		7
5.3.3.5	Close SV 121				2
5.3.3.6	Close V 102 and V 702				7
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z L
5.3.3.7	Perform leak test of He S/S:				
	He S/S flushed with GHe, close inlet valve to laboratory pump C0730			,	
	• P 901	< 10 ⁴ mbar	ndmi oi c's		
	• P 501	approx. 1 bar	Gg1mpar		7
	• P 101	approx. 1 bar	0120660	raw: 6,402 mV	<u> </u>
	tolerable leak rate < 1×10^{-6} mbar l/s	≤ 1x10 ⁻⁶ mbarl/s	rec. 0 - 2042	BOULTEM- DICUST	
5.3.3.8	After successful leak test close inlet valve to leak tester and open inlet ve to low vacuum stage pump C0730	e			7
5.3.4	Evacuation / Pressurization Cycles				
5.3.4.1	Open V 104		>		7
5.3.4.2	Check valve status:				
	 V 102, V 502, V 512, V 702, SV 121 	closed)		>
	 V 104, V 105, V 701, V 子じて 	open	\$		
5.3.4.3	Open V 502 and V 512		7]
5.3.4.4	Pump down HTT to				7
	P 101 approx. 10 mbar	< 10 mbar	5,2 mbar		
Location	n: 0.7μ PA: $(C, Date)_{f}$ Operator:	N.W Da	te: 268.c5		
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d
5.3.4.5	Close V 502 and V 512		Ś		7
	Note P 501				
5.3.4.6	Close V 104		7		7
5.3.4.7	Open V 102 and V DOZ Le		7		7
5.3.4.8	Evacuate line Y0621 and airlock SV 121		Q- Z	le .	- <u>``</u>
5.3.4.9	Close Y0621 (line to lab. vac. pump)		s Z	(s	<u>ک</u> بر
5.3.4.10	Open SV 121		л.д.	ls	<i>y</i>
5.3.4.11	Check valve status:				
	• V 104, V 502, V 512, J V 12 1 L.	closed	>		7
	 V 102, V 105, V 701, V 702, SV 12T, V512 (G 	open	7		
5.3.4.12	Note P 501 (see 5.3.4.15)		S, Finbar		7
	Fill out log sheet 1 & 2				
5.3.4.13	VS-12 US Pressurize He S/S via valve V0623 and connected GHe supply until P 501		7		7
5.3.4.14	approx. 1 bar absolute $\rho_{VLC} \left(\zeta \right)$ Repeat step 5.3.3.5 – 5.3.4.13 three times (except step 5.3.3.7)		7	agreed by ENA	7

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d	-
5.3.4.15	Note:					_
	-P 501 (V 502 and V 512 closed)	< 50 mbar	4,7 mbar			
	Start date and time of 1st run					
	Stop date and time of 1st run					
	-P 501 (V 502 and V 512 closed)	< 50 mbar	X)	
	Start date and time of 2nd run					
	Stop date and time of 2nd run					
	-P 501 (V 502 and V 512 closed)	< 50 mbar	``			
	Start date and time of 3rd run					
	Stop date and time of 3rd run					
5.3.4.16	Close and block SV 121		7)	
5.3.4.17	, Close V 102 and V 702 Ca		2		Ĵ	
5.3.4.18	3 Open V 104		7		7	
5.3.4.19) Check valve status:					
	• V 102, V 602, V 512, V 702, SV 121 (2	closed)	
	 V 105, V 701, V 702, V502. 	open	2			
						[
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Step- No.	Activity		Nominal Value	Actual Value	Remarks	z L
5.3.4.20	Leak rate measurement					
	Leak detector in line to turbo p	ump. Start leak tester:				
	 calibration of leak tester 					
	 open inlet valve of leak tes 	ter				
	Close inlet valve to low vacuun	r stage pump C0730				
	Note leak rate					
5.3.4.21	Open V 502 and V 512			7		7
5.3.4.22	Pump down He II tank until P 1	01 constant		7)
5.3.4.23	Close V 502 and V 512			j		7
5.3.4.24	Perform P 101 in situ zero cali	station at room temperature				
	Note:					
	P 101 data on synoptic monito					
	P 101 raw data on monitor)
	P 50 eng. data ζ_{c}					
	P 501 raw data (9				-) causianon curve for	
	Pressure measured with exter	nal manometer connected at V 506			Pron and Pton correcte	>
5.3.4.25	Open V 502 and V 512			7	a < د و د در در ا	7
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.3.4.26	Close V104		X	kept open for	د	
5.3.4.27	Close V502 aperv 512 (A			CVJ72 closer by	7	
5.3.4.28	Check valve status:			CX1 · Value/		
	• V 102, V 404, V 502, V 512, V 702, SV 121	closed	2		7	
	 V 105, V 701, V 302, V 404 (C. 	open	7			
5.3.4.29	Fill out log sheet 1 & 2				د	

5.4 Installation of Safety Valve SV 922

Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.4.1.1	Close airlock SV 922 at upper bulkhead and install fixation device. Note P 901/P 902		>		7	
5.4.1.2	Close hand sliding valve behind turbo pump		7		7	
5.4.1.3	Stop turbo pump C0712 and wait until pump rotor stops. (observe revolution counter in low vacuum stage C0730)		>		7	



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Sten-	Activity	Nominal	Actual	Remarks	٩	z
No.		Value	Value			
5.4.1.4	Pressurize air lock with SM_2^{ℓ} (Observe P 901) $(\alpha$				1	
	Disconnect backing valve V0715 from turbo pump C0712. Protect open end of V0715 with blind cap.		2			
5.4.1.5	De-integrate turbo pump C0712 and air lock SV 922 from PLM upper cone		5		>	
5.4.1.6	Install safety valve SV 922 to PLM upper cone. Use special installation device.		~		~	
5.4.1.7	Fixing and marking of screws with tightening torque.		`		١	
	Torque value	6 Nm				

5.5 Cool down of Cryostat

Step- AC		Nominal	Actual	Kemarks	<u> </u>	Z
	CUVIC	Value	Value			
5.5.1 Init	tial Configuration					
			ノリーエウ		7	
5.5.1.1 He	e S/S evacuated to < 20 mbar		noom 11		\uparrow	
5.5.1.2 Sa	ifety valve SV 922 installed.		>		2	



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Step- No.	Activity		Nominal Value	Actual Value	Remarks	z L	
5.5.1.3	Check valve status:						
	 V 102, V 104, V 502, V 512, V,X 	12, SV 121 (s	closed			7	
	• V 105, V 701, V 702 Ca		open				
5.5.1.4	Prepare and install LHe I transfer line	as described in chapters 5.7 to 5.10		>		7	
5.5.1.5	Close V0623. Open V0621.			>		د	Т
5.5.1.6	Continue evacuation of transfer line	< 1mbar		2		2	T
5.5.1.7	Close V0621 and perform leak test o of pressure increase: max. permitted 15min.)	f compression fitting at SV 121. (Method pressure increase < 3 mbar within		7		7	
5.5.1.8	Documentation of pressure increase Note estimated volume for leak rate (at P0621. calculation and calculate leak rate	< 3 mbar	us e	2 3. 10 3 mbach J	2	
5.5.1.9	If compression fitting is tight continue < 1 mbar.	evacuation via V0621 until P0621		7		7	
5.5.1.10	Close V0621, stop lab. vac. pump C	1100 and close inlet valve of He-pump II		> >		7	
5.5.1.11	Remove fixation device and open air	10ck SV 121 10pin V702 (0		7 د		>	
5.5.1.12	Fill out log sheets 1 & 2			7		2	
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d	
5.5.2	Pressurization of He S/S to 1 bar					
5.5.2.1	Open V0211 slowly and fill He-tubing and AXT to about 1 bar absolute at P 501; Observe P 901.		2		7	
5.5.2.2	Measure leak rate in PLM evacuation line Y0673 (Inlet valve to low vacuum stage pump C0730 closed) and document leak rate	< 1x10 ⁶ mbarl/s	~ 2.10 mlar	Jee No NUR	- 7	f
5.5.2.3	Close V0211 (needle valve at transfer line)		>		7	— T
5.5.2.4	Gless V 105.			has to reverse of es	7	
5.5.2.5	Check valve status:					
	 V 102, V 104, V 502, V 512, V 702, V 405 V 701, SV 121, V 105, V 102, V 104, V 316, C 	closed open			7	
5.5.2.6	Move transfer line in SV 121 to lower position		7		7	
5.5.2.7	Note P 501 D0631		960 963		2	
5.5.2.8	Open V 102 and V 702			alredy open	2	

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z L
5.5.2.9	Note P 501		Godunar		
	P0621		106 on Lar		2
	P 101		1,07 Lar		_
5.5.2.10	(if no significant change, sealing at the end of transfer line in fill/vent tube is tight)				2
5.5.2.11	Open V0211 and purge HTT and AXT to approx. 1 bar (measured at P 101)				2
5.5.2.12	Monitor leak rate in PLM evacuation line Y0673 (Inlet valve to low vacuum stage pump C0730 closed) and note leak rate	<1x10 ⁻⁵ mbar I/s)
5.5.2.13	t Close V 102			temains ofth	
5.5.2.14	t Open V 105			already open	7
5.5.2.15	Open V 502 and flush venting line to approx. 1000 mbar at P 501 by opening V0211.				2
	Note P 501	approx. 1 bar	Ostmbar		
5.5.2.16) Check valve status:	pesed			7
	 V 105, V 502, V 701, V 702, SV 121, V 102, V 104 	open			
5.5.2.17	Close V0211 (needle valve at transfer line)		7.		7
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	<u>م</u>	7
5.5.2.18	Open V0631 (bypass at He-pump II, connect vent line to recovery unit)		7		2	
5.5.2.19	Open V 104		7		2	
5.5.2.20	Check valve status: • V 102, V 512, V0211 6. • V 104, V 105, V 502, V 701, V 702, SV 121, V0631, V 105, V 502, V 701, V 702, SV 121, V0631	closed open	57		7	
5.5.2.21	Fill out log sheets 1 & 2 every 30-min		7	data stored in Ingola	7	
5.5.3	Start Cool Down					
5.5.3.1	Install mass flow meter with range 0-5 g/s in bypass of He-pump II, to V0631. (see Figure 3-4) Connect flow meter to exhaust line and connect flow meter with recorder and Cryo SCOE		>		>	
5.5.3.2	Switch on HIFI in standby mode if required by HIFI		Ň	Step can be done later when requested by instrument		
5.5.3.3	Switch on PACS in standby mode if requested by PACS		×	Step can be done later when requested by instrument		
5.5.3.4	Switch on SPIRE in standby mode if requested by SPIRE		Х	Step can be done later when requested by instrument		

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Step-	Activity	Nominal Value	Actual Value	Remarks	<u>ــ</u>	z
5.5.3.5	Start cool down of LHe transfer line and AXT by opening V0211 until:			skipped & T behnes, Lot and LT, LZ 20k!	2	
	T 701 < 150 K					
5.5.3.6	When T 701 < 150 K:					<u> </u>
	close V 702		Ч. д.		2	
	 open V 102 					
5.5.3.7	Start cool down of HTT until final values of:					
	• T101	≈ 4,2 K	412M	7. S. J. S. 13-15	7	
	• T 102	≈ 4,2 K	77.7	2 wed Since)	
	• T106	≈ 4,2 K	4. E H	1. 40.01		
5.5.3.8	Observe pressure requirements during cool down:					
	• P 101	≤ 1,2 bar	Aros bar	wo f working	>	<u></u>
	• P 501	≤ 1,2 bar	gg3 mbar			
	• P 901		2,0 · 15 mber			
	 Leak rate at Y0673 line 					

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Step-	Activity	Nominal Value	Actual Value	Remarks	z L
5.5.3.9	Respect temperature requirements during cool down as defined in 1.3:				
	HTT: ΔT103/Δt	< 50 K/h		Jte records)
	HIFI/(PACS): ΔT207/Δt	< 5 K/h		(above 50 K)	
	SPIRE/(PACS): AT253 (T255)/At	< 20 K/h		(above 50 K)	
	SPIRE J-FET: AT249 (T251)/At	< 20 K/h		(above 50 K)	
	Remark 1: Temperature sensors at SPIRE and HIFI foots are used to monitor PACS.			due ho hongerstere cool down rate reavirements, cool	
	Remark 2: The cool down rate can be controlled by adjusting pressure inside the LHe dewar.			down of axt losted & day, longe	
5.5.3.10	AXT (T 701) shall be as long as possible colder than OBA and FPUs:				7
	T 207 - T 70 8 $ ho$	> 30 K		See records	
	T 253 - T 70 % (≪.	> 30 K			
5.5.3.11	Keep AXT as long as possible 30 K colder than HTT:				7
	т 103 - т 70 § (с	≥ 30 K		(C. 10 C. 19)	

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.5.3.12	Keep temperature differences between L0, L1 and L2 on HIFI below 20 K:					
	ات ۲۰۰ <mark>۶ – ۲ ۲۵۶ ا</mark> رم	< 20 K				
	T 207 – T 249 (T 251)	< 20 K		Jee Read	7	
	T 70 % – T 249 (T 251) (G	< 20 K				
5.5.3.13	Reduce mass flow if temperature gradients or ΔT 's are not correct by reducing the pressure of the LHe dewar!				L	
5.5.3.14	الا T 103 - T 70 3 < 30 K: (د)					
	close V 102			Jee revers		
	 open V 702)	
	until T 103 - T 70 g > 40 K, then: (a)					
	close V 702					
	• open V 102					
5.5.3.15	If the present dewar is not sufficient for obtaining the required temperatures, change LHe supply dewar. See chapters 5.7 to 5.10				2	



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Step-	Activity	Nominal Value	Actual Value	Remarks	4	z
5 .5.3.16	As strap pretension will decrease during cool down, check strap pretension and adjust strap pretension according following procedure in coordination			ree printent	7	
	 nominal value of strap pretension is 15 kN +0/-2 kN on lower straps 			(No. 9-16) (No. 1-8)		
	 nominal value of strap pretension is 13,5 kN +/-2 kN on upper straps 					
5.5.3.17	If pretension decreases to less than approx. 5 KN, increase strap pretension to nominal value. Any changing of the strap pretension has to be done in coordination with alignment measurements.				>	<u> </u>
	make a printout of pretension values before and after each pretension activity to keep strap pretension nominal					
5.5.4	End of Cool Down					
5.5.4.1	Note status at end of cool down:					. <u> </u>
	• T 101	≈ 4,2 K	4,24 K		7	
	• T 70%		225 4 2194			
	• T 20 3					
	• P 101		ma hr 12			
5.5.4.2	Make a printout of the final strap pretensions				2	
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.5.4.3	Close SV 921		h,a.	JV921 Runaly / Spen an decided	د	
5.5.4.4	Check valve status:			m TRR)	
	 V 512, V 702, V0211 (4 	closed				
	 V 102, V 104, V 105, V 502, V 701, SV 121, V0631, V 512, V 304, V 209 	$\ell_{\mathcal{L}}$ open)			
5.5.4.5	Fill out log sheets 1 & 2)		2	

5.6 Filling of HTT

Step- No.	Activity				Nominal Value	Actual Value	Remarks	٩	z	
5.6.1.1	Continue LHe transfer un	tii HTT is completely filled	в					2		
5.6.1.2	Change LHe dewar if the	liquid level in the present	t dewar is b	elow 10 %				\geq		
5.6.1.3	Final values to be reache	d when the LHe level in H	He II tank 1	: %00						
	• T 101				~ 4.2 K	<i>よい、</i>		>	-	
	• T 106				~ 4.2 K	4,2 %		>		
	• P 101				< 1,2 bar	1,1 bar				
5.6.1.4	A quick and significant in pressure oscillations at P	crease of the mass flow r 501 indicates that HTT is	ate in the v s completel	ent line and y filled		7				
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Step- No.	Activity		Nominal Value	Actual Value	Remarks	z L	
5.6.2	End of Filling						
5.6.2.1	Stop transfer by closing V0221(V02	11)		\sim		7	
5.6.2.2	Close V 102			\mathbf{a}		2	
5.6.2.3	Check valve status:					7	
	• V 102, V 512, V 702, V0211		closed	7			
	 V 104, V 105, V 502, V 701, S¹ 	121, V0631, V542 (C	open	2			T
5.6.2.4	Documentation of final values:						
	• T 101		≈ 4,2 K	4,24		2	
	• T 106		≈ 4,2 K	4.2.4			
	• P 101		< 1,2 bar	1,1 bev			
5.6.2.5	Fill out log sheets 1 & 2			7		7	<u> </u>
5.6.2.6	Date:			9.9.05		7	
	AIV:			Jehr			
	QA:					,	
5.6.2.7	Depressurize supply dewar, close V0102	/0101, remove pressurization line, open		2		2	
Locatior	1: A.T	Date: C SC Operator:		ate:			
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d
5.6.2.8	Retract transfer line to upper position in SV 121, close and activate SV 121.		>		7
5.6.2.9	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line		2		7
5.6.2.10	D Remove transfer line from supply dewar, and store the line on the scaffolding		5)
5.6.2.11	1 Mount 60 mbar overpressure one way valve behind V0631		2		2
5.6.2.12	2 Monitor flow rate in vent line.		2		2
	If actual flow rate < 50 mg/sec change mass flow meter to one with a range of 0 - 50 mg/s.				
	Connect flow meter with recorder and Cryo SCOE				
5.6.2.13	3 Dismount airlock and install safety valve SV 921 as described in 5.4		M.q.	airlock and turbo remains moduled see the	
5.6.3	Final Configuration				
5.6.3.1	Check mass flow rate	< 50 mg/s	1, 5m t, 25		2
5.6.3.2	Check valve status:				>
	• V 102, V 512, V 702 (a	closed	7		
	 V 104, V 105, V 502, V 701, SV 121 、	open	`		

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Step- No	Activity	Nominal Value	Actual Value	Remarks	ፈ	z
5.6.3.3	Documentation of final values:				7	\
	• T 101	≈ 4,2 K	4,354			
	• T106	≈ 4,2 K	4,152			
	• P 101	< 1,2 bar	nst working at cold thinks	lee Up Par		
5.6.3.4	Fill out log sheets 1 & 2		2		7	

5.7 Night Configuration

Step- No.	Activity		Nominal Value	Actual Value	Remarks	z L	
	The following activities h to get the cryostat in safe cool down and filling.	ave to be performed at the end of each working day configuration and at begin of the next day to restart					······
	It is useful to go for a nigl	ht break at the end of a dewar.					
5.7.1	Establish Night Con	figuration					
5.7.1.1	Close valve V0211 (or VI	0221) in transfer line and stop LHe flow \checkmark		5	.30, 8 ,	>	
5.7.1.2	Close V 702 (if open)			\$ ~	.20.65		
Location:	2	Date: A. 5. 0, Operator:		ate: 1, 0, 05			
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Step-	Activity	Value	Actual Value	Kemarks		
5.7.1.3	Close V 102 (if open) J			30.8°	2	
5.7.1.4	Check V 104 open, V 105 open 🗸				۲	
5.7.1.5	Reduce pressure in dewar by opening of V0101 \checkmark			30.8.	2	
5.7.1.6	Retract transfer line to upper position in airlock SV 121 h' , \mathcal{A}_{+}	G		1	-	- 1
5.7.1.7	Close airlock SV 121 \mathcal{N}_{c} \mathcal{A}_{c}	Ġ		1		
5.7.1.8	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line.	la la		1		
5.7.1.9	Remove transfer line from supply dewar and prepare it for next use. $\mathcal{N}_{\star}\mathcal{A}_{\star}$	(a				- 1
5.7.1.10	Mount 60 mbar overpressure one way valve behind V0631			D.8,	>	
5.7.1.11	Monitor flow rate in vent line.			.3ak.	7	
	If actual flow rate < 50 mg/sec change mass flow meter to one with a range of 0 - 50 mg/s.					
	Connect flow meter with recorder and Cryo SCOE					T
5.7.1.12	2 Check mass flow rate	< 50 mg/s		. D.d.	>	

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Step-	Activity	Nominal Value	Actual Value	Remarks	z
5 .7.1.13	t Check valve status:			30. R ,	7
	• V 102, V 512, V 702	closed			
	 V 104, V 105, V 502, V 701, SV 121 	open			
5.7.1.14	Fill out log sheets 1 & 2			30.8. 1 day	7
5.7.2	Restart after Night Break				
5.7.2.1	Install second transfer line into a full supply dewar and into SV 121. (see chapter 5.10 for details)		7	2	>
5.7.2.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.10 for details)		J	2	7
5.7.2.3	Close V 104, open V 702		X	W. O. Cer	2
5.7.2.4	Pre-cool the transfer line for at least 3 min. (see chapter 5.10 for details)		X	4.9. <i>G</i>	2
5.7.2.5	Close V0623 and open SV 121 immediate after pre-cooling		, X,	N.S. (9	2
5.7.2.6	Insert transfer line completely into airlock and retract it again about 1 mm.	¥	>		2
5.7.2.7	Fix the compression fitting Open V0211 (or V0221) and restart cool down (filling) of AXT via V 702 and V 105 until T 702 is below 5 K or 30 K below T 103		7		2
L ocation			te:		

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Step-	Activity	Nominal	Actual	Remarks	<u>م</u>	z
No.	•	Value	Value			
5.7.2.8	Open V 102		۲. ۵.		7	<u></u>
	Open V 104					
	Close V 702					
	and continue filling of HTT					



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Dewar
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8. X

Step-	Activity	Nominal	Actual	Remarks	Z d
No.		Value	Value		
5.8.1	General Remarks				
5.8.1.1	The following paragraphs have to be repeated at each dewar exchange		Ĺ,		2
5.8.1.2	Attention: Do not empty dewars completely		>		Ĺ
	Remaining liquid level in dewar shall always be L0101>100 mm				
5.8.1.3	Use leather gloves and protect eyes by glasses when installing or removing transfer line LHe supply dewar.		2		4
5.8.1.4	At each dewar change write down in log sheet:		7	Jer log sheets	د
	dewar No.			0	
	Iiquid level at start				
	Iiquid level at end				
	LHe-consumption				
	 used transfer line 				
5.8.1.5	Fill out log sheets 1 & 2		2		5
5.8.2	Removing Transfer Line				
5.8.2.1	Prepare second transfer line according step 5.9		7		2
Location	1: OTH Date 3.505 Operator: (c)		بې و,		
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z
5.8.2.2	Close valve V0211 (or V0221) in transfer line and stop LHe flow		2)
5.8.2.3	Close V 702 (if open)		wia. Ca	<u>\$</u>	N.
5.8.2.4	Close V 102 (if open)		7-4-4		7
5.8.2.5	Check V 104 open, V 105 open		>	7	7
5.8.2.6	Reduce pressure in dewar, remove pressurization line and open V0101		>		<u>}</u>
5.8.2.7	Retract transfer line to upper position in airlock SV 121		7		2
5.8.2.8	Close airlock SV 121		7		7
5.8.2.9	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line.)	7	2
5.8.2.10) Remove transfer line from supply dewar and prepare it for next use.		>		2
5.8.3	Installation of new Dewar and Transfer Line				
5.8.3.1	Install second transfer line into a full supply dewar and into SV 121. (see chapter 5.10 for details)		2		2
5.8.3.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.10 for details)		2		2
5.8.3.3	Close V 104, open V 702		2		>
Location:	" OT Date, Date, Operator: Jh	S.C	hte: λ.οΣ		
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Step-	Activity	Nominal Value	Actual Value	Remarks	۵.	z
5.8.3.4	Pre-cool the transfer line for at least 3 min. (see chapter 5.10 for details)		7		7	
5.8.3.5	Close V0623 and open SV 121 immediate after pre-cooling		7		7	
5.8.3.6	Insert transfer line completely into airlock and retract it again about 1 mm.		2		7	
	Fix the compression fitting				-	
5.8.3.7	Open V0211 (or V0221) and restart cool down (filling) of AXT via V 702 and V 105 until T 702 is below 5 K		2		7	
5.8.3.8	Open V 102		2		7	
	Open V 104)			
	Close V 702 as needed to cool clow on AXT					
	and continue filling of HTT					



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Line
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Step-	Activity	Nominal Value	Actual Value	Remarks	Z d
ы. 5.9.1	Preparations				
5.9.1.1	Cleaning of inlet filter:		7		Ċ
	 remove the inlet filter from the line 				
	 clean the filter in ultrasonic bath with isopropyl alcohol 				
	 dry the filter with a heat gun 				
	 tie Teflon tape around the filter thread and screw the filter onto the tube 				
5.9.1.2	Description of installations at transfer line - Interfaces at dewar side:		2		7
	 compression fitting 				
	 valve V01 				
	 pressure gauge P01 				
	 flex. line DN25 as connection to vacuum line Y0622 and laboratory pump C1100 				



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Step- No.	Activity		Nominal Value	Actual Value	Remarks	z L	
5.9.1.3	Description of installations at transfer line – Intr	erfaces at PLM side:					
	compression fitting,)		7	
	 valve V02 						
	filter						
	GHe supply						
	pressure reducer DM1						
	flex. line DN4 with a minimum length of 2 I	E					
5.9.1.4	Check that V0211 (or V0221) is open			2		5	
5.9.2	Evacuation of Transfer Line						
5.9.2.1	Close V02 to the GHe bottle			2		7	
5.9.2.2	Start laboratory pump C1100			2		2	
5.9.2.3	Open V01 and evacuate transfer line for 5 min			>		د	
5.9.3	Flushing of transfer line:						
5.9.3.1	Close V01 to the laboratory vacuum pump			2)	
5.9.3.2	Open GHe supply and V02			~		2	
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d
5.9.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar		2		7
5.9.3.4	Flush transfer line for min. 30 s		7		7
5.9.3.5	Close V02		2		7
5.9.3.6	Repeat evacuation / flushing cycle 4 times		7		ζ
5.9.3.7	Flush transfer line during transport to the dewar:		7		2
5.9.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar overpressure		2		د.
5.9.3.9	Disconnect transfer line from V01.		2		2
5.9.3.10	Check/adjust that transfer line is under small overpressure. He flow at open end of transfer line must be noticeable.		2		>



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5.10 Installation of Transfer Line

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Step- No.	Activity			Nominal Value	Actual Value	Remarks	٩	z
5.10.1	Preparation of LHe De	war						
5.10.1.1	Check that the dewar is rele	sased by PA for use on Herschel.			7		7	
5.10.1.2	Check that head of dewar is that the dewar is equipped (EIPS).	s equipped with one feed through with <i>Electronic Internal Pr</i> essurizi	16 mm. Check ing System		Ŋ		λ	
	Fix the blind plug in feed thi	rough 16 mm.						
5.10.1.3	Position 450 I dewar near S mechanism at dewar.	\$V 121 on working platform. Active	ate break		>		7	
5.10.1.4	Establish a clear control are	sa of about 2 m round the dewar			7		r	
5.10.1.5	Open valve V0101 of dewa pressure.	r gently and depressurize to atmo	Spheric		C		>	
5.10.2	Installation of Transfe	r Line into Dewar						
5.10.2.1	Transport the transfer line t necessary)	o the dewar while flushing it with (GHe. (3 persons		7		>	
5.10.2.2	Remove compression fitting DM1 that a slight He flow is	g from transfer line (dewar side) a at open end of transfer line	and check/adjust		2		>	
Location:	072	Date: 5.5.0)	Operator: J_{U}		ate: S.o.5			
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.10.2.3	Remove blind plug 16 mm from head of supply dewar and insert transfer line in the dewar by about 200 mm		2		7	
5.10.2.4	Stop transfer line flushing:		5		7	
	-close V02				1	
	-close DM1 and GHe supply					
5.10.2.5	Push the transfer line slowly in the dewar until stop at filter reaches the bottom of dewar (the filter is equipped with a 100 mm distance pin to avoid that the transfer line is taking LHe from the bottom of the dewar))		2	
5.10.2.6	Close V0211 (or V0221)		2		ζ	
5.10.2.7	Adjust dewar pressure at EIPS to 100 mbar - 200 mbar overpressure as needed during filling activities)		2	
5.10.3	Installation of Transfer Line at SV 121					
5.10.3.1	Check that airlock SV 121 is closed, blocked and at atmospheric pressure		Y		2	
5.10.3.2	Open V0211 (or V0221) slightly		2		7	
	Remove compression fitting with valve V02 from transfer line. Check/adjust GHe flow with V0211 (or V0221) at open end of transfer line					

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	(man	Value	Value	
5.10.3.3 Ren	nove blind plug from SV 121.		\geq	7
Inse	ert transfer line in SV 121 and fix transfer line in upper position.			
Clos	se V0211 (or V0221) immediate.			
5.10.3.4 Tigh	hten compression fitting.		7	2
5.10.3.5 Atte	ention: Don't damage the seal at transfer line when installing transfer line V 121.	0	>	7
5.10.4 <i>Eva</i> (cuation and Purging of Filling Airlock			2
5.10.4.1 Che	sck:		2	
•	transfer line is prepared and installed according steps above			7
•	airlock SV 121 is closed and blocked			
•	pre-cooling valve is closed			
•	dewar overpressure is adjusted to about 200 mbar			
5.10.4.2 Star	rt lab. pump C1100, open valve V0621 and evacuate transfer line for out 5 min		2	7
5.10.4.3 Che	eck P0621< 1 mbar		2	2
Clo	ise valve V0621			

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Step-	Activity	Nominal	Actual	Remarks	۲ ۲	_
No.		Value	Value			
5.10.4.4	Purge line to ambient pressure by opening valve V0211 (or V0221) unti					
	P0621 is at about ambient pressure	1000 mbar	7		د	
	Then close V0211 (or V0221)					
5.10.4.5	Repeat step 5.10.4.2 to 5.10.4.4 two times.		λ		2	
5.10.5	Pre-cooling of Transfer Line			the gradene worky subserting		
5.10.5.1	Open valve V0211 (or V0221)		×.	e	>	
5.10.5.2	Open valve V0623 (pre-cooling valve) and pre-cool transfer line for at le 3 min	ast	. \	Ċ	\$	
5.10.5.3	Observe housing of airlock SV 121:					
	when moisture appears at venting line Y0621:					
	stop cooling		< <u> </u>		<u>\</u>	
	close V0211			r		
5.10.5.4	Close V0623 and observe P0621					
	Release overpressure if P0621	> 1100 mbar		y	>	
5.10.5.5	Dpen SV121		``.	رح	`	
5.10.5.6	Continue with LHe transfer in PLM		·	(د	<u>\</u>	
Location:	: Constant Date of Operator:	loko Da	ite:			
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lssue:	-					
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6 Summary Sheets

6.1 Procedure Variation Summary

	۲	Fest Change	Curr. No.:	
			Date:	
			Page 1	of
Test designation		Test Procedure	Issue	Rev.
		HP-1-RSED-77-Dor	1	
Test step changed		Reason for Change:		
the flow				
SANT NOWUOL	he 2. HAS	Nm		
5,3,1,4 4 -	10 mbc	n.		
5, 1, 6 - 4	nouse	à		
5.3.1.11 chred	U 202 , SUAL	1 1502		
i - open	U 104 1 511	10105 vto1 VtoL		
517.1. 14 NOAL UM	due lo m.	Sa		
5.J. A. AJ 8701	nokad 1 50	1		
5.1.1. 15 PVALA	, USPL d	oned		
5.3.3.1 clae VA	loy only			
5,333 doved V/	104 1502	SUAZI		
51336 UNEVA	102 mly			
is. T. C MING USOL	(200)(202	area		
3,34,2 Dar 115	1701 0700	pla		
5, 3 47 Oph UND2	only			
5.3.4.11 SIAZA de	ul miter	n VIN		
-h - V512 opt	n untead	sv127		
5.3413 V512 m	read you	513		
Ki anangus man	the ma	Redlain no Per	10 53412	# 19 52.42
53,4.28, 5.4. 1,4, 55	1.3,5,5,1.1	10, 5.5.2.5, 5,5.2,16	, 5, 5, 2, 20, 5,	5.3 not +17"
Prepared by:	Resp.	Test Leader A	Project Engineer	
PAQA				
Vinhi				
	I			

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6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
HP- 150000- AIED-NC-1484	Temperature gradient requirement during cool down of created partially caceeded	18 .9.05	
ЦР-151240- ДЈЕО-NC-1415	The SV121 pluy remains not in Jaky value position	1.8.05	

6.3 Sign-off Sheet

	Date	Signature
Test Manager	9.9.05	C. Jam
Test Conductor	9.9.05	- h _
PA Responsible	9,9,05	Jelyn)
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ANNEX Log Sheets

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臣																							
ET 1 for COOL DOWN an		REMARKS																					
OGSHEI																							
Ľ	1	Level Dewar L0101																					
	Ξ	Dewar S/N D0101												-									
		Mass flow																					
		P0621 mbar																					
		P501 mbar																					
		P101 mbar																					
		P901 mbar																					
		SV 121											_			_			ļ	-	╞	ļ	ļ
		V 702						\bot			<u> </u>	_					 	_			\vdash	4	_
	tus	V 701	╨		\downarrow		\perp	_	1_	\perp				\vdash	_	_	_	-	_	-			
	Sta	V 512	_		1	_	+-		+-	_	+	+	╀	-			┢	\vdash			+	+	╂—
	<u> </u> Ve	V 502				+	+	+	+			_	┢	+	+	+		+-	+	┨──		+	\vdash
	>	V 105	_	+	\vdash	\vdash	+-	+-	+	+-	+	+-	╋	+	+-		\vdash	+	+-	-	+		╂──
		V 104	_	+-	-		+	+	+	+-	╀─	+-		+	+	┢			┢	╀	┼─	╋	╋
Σ		V 102			_		+	+	+	+-	+		-	+	+		+-	┢	┝	╂─	+	+	+
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	REMARKS																						
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•	-2. chiold	T443																					
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		208 T2								+ + + + + -													
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000	RPS R	T111																		$\begin{array}{c} + + + + + + + + + + + + + + + + + + +$			
	E H	T106			-																		
1.0.0	DLCM	T101																					
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 Date:
 28.07.05

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		Dep./Comp.	~~~~	Name Stritter Dene	
<u> </u>	Alberti von Mathias Dr.		~	Stritter Rene	
	Barrage Bernhard	AEDTI		Magaan Klaus-Horst Dr.	AOE22
<u> </u>		AUA52		Wagner Klaus	AUEZZ
	Fehringer Alexander	AOE13	<u> </u>		AET 12
	Fricke Wolfgang Dr.	AED 63			AUEZZ
	Geiger Hermann	AOA52		wossner Ulrich	ASE442
		AED11			
	Grasl Andreas	OIN/AE152			
	Grasshoff Brigitte	AE112			4.00
<u> </u>	Hauser Armin	AOE22	<u> </u>		ASP
X	Hendry David	Terma Resid.	<u>X</u>	ESA/ESTEC	ESA
	Hinger Jürgen	AOE22			
	Hofmann Rolf	ASE442		Instruments:	
<u>X</u>	Hohn Rüdiger	AED65		MPE (PACS)	MPE
X	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
<u> </u>	Idler Siegmund	AED432			
X	Ilsen Stijn	Terma Resid.		Subcontractors:	
	Ivády von András	FAE22		Air Liquide, Space Department	AIR
X	Jahn Gerd Dr.	AOE22		Air Liquide, Space Department	AIRS
	Kalde Clemens	APE3		Air Liquide, Orbital System	AIRT
	Kameter Rudolf	OTN/AET52		Alcatel Bell Space	ABSP
	Kettner Bernhard	AET42		Astrium Sub-Subsyst. & Equipment	ASSE
	Knoblauch August	AET32		Austrian Aerospace	AAE
Х	Koelle Markus	AOA53		Austrian Aerospace	AAEM
	Kroeker Jürgen	AED65		APCO Technologies S. A.	APCO
Х	Kunz Oliver Dr.	AOE22		Bieri Engineering B. V.	BIER
X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE
	Lang Jürgen	ASE442		Dutch Space Solar Arrays	DSSA
Х	Langfermann Michael	AOA51		EADS CASA Espacio	CASA
Х	Mack Paul	OTN/AET52		EADS CASA Espacio	ECAS
	Müller Jörg	AOA52		EADS Space Transportation	ASIP
X	Pastorino Michel	ASPI Resid.		Eurocopter	ECD
	Peltz Heinz-Willi	AOE13		European Test Services	ETS
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ
	Platzer Wilhelm	AED22		Linde	LIND
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE
Х	Rühe Wolfgang	AED65		Prototech AS	PROT
Х	Runge Axel	OTN/AET52		QMC Instruments Ltd.	QMC
	Sachsse Bernt	AED21		Rembe, Brilon	REMB
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE
Х	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM
	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE
	Sonn Nico	AOE51		Terma A/S, Herlev	TER
	Steininger Eric	AED44			

II. As-Run Copy of the He II Production & Top Up Procedure

HP-2-ASED-TP-0090

Procedure



Title:

Herschel EQM AXT Helium II Production and Top Up

CI-No:

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151 000

Prepared by:	Herschel Team	Date:	08.09.05
Checked by:	C. Schlosser Ch. du		9.905
Product Assurance:	R. Stritter W. Vaile		12.09.05
Configuration Control:	W. Wietbrock W. With	no R	12.09.05
Project Management:	Dr. W. Fricke Trick	~	R/09/05

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 Issue:
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 Date:
 08.09.05

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1 Scope

1.1 Objective

This test procedure describes the He II production and top up of the Herschel EQM cryostat. The objective of these activities is to reach an AXT filling level of more than 95 % with T 702/T 703 < 1.8 K. The HTT shall be at LHe I conditions and shall have a filling level of at least 40 %.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

This procedure is applicable for each He II production and top-up during the Herschel EQM tests at He II conditions.

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1.2 Activity Flow

The activity flow below summarizes the activities to be performed during He II production and top up. He II production and top up is completed with the steps in section 5.4. Sections 5.5 to 5.8 have to be repeated whenever necessary.

§ 5.1	Preparation of Set-up	Configuration check according table in step 3.1 Liquid level of He II tank > 40 % (estimated value) FM airlock SV 121 installed Installation of auxiliary lines Preparation of transfer lines Preparation of venting lines to He pumping unit I Valve status check
§ 5.2	He II Production in AXT	Check / establish required cryostat configuration Start pumping down of AXT with He pumping unit I Pumping down of the AXT to reach a temperature of T 701 < 2.0 K
§ 5.3	He II Top Up in AXT	Install He I transfer line Top up AXT from LHe I supply while pumping at V 512 Pumping down of AXT to required temperature Repeat process until required temperature at a filling level of > 75 % is reached
§ 5.4	Final Status	 Check and monitor final status: AXT filled and at He II temperature AXT venting via OBA and V 512, He pumping unit I running HTT partly filled with He I HTT venting via shields and V 502
§ 5.5	Night Break	 Establishing of night configuration: Removal of transfer line Venting via V 104 and V 502 Pumping at AXT via V 512 and V 701 Restart after night configuration
§ 5.6	Exchange of LHe Dewar	 Removal of transfer line Installation of new dewar and transfer line
§ 5.7	Preparation of LHe I Transfer Line	 Preparations Evacuation of transfer line
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Flushing of transfer line with GHe

§ 5.8 Installation of Transfer
 Line
 Installation of transfer line in dewar
 Installation of transfer line in SV 121
 Evacuation and purging of filling airlock

1.3 Requirements

During He II production no specific requirements have to be regarded. Final temperatures to be achieved are:

<u>HIFI:</u>		
Level 0:	Detector (T 228):	< 2 K
Level 1:	L1 (T 237):	< 6 K
Level 2:	FPU (T 207, T 208):	< 20 K
PACS:		
Level 0:	Red Detector (T 221):	< 1.75 K
	Blue Detector (T 224):	< 2 K
	Cooler Pump (T 223):	< 2 K
	Cooler Evaporator (T 222):	< 1.85 K
Level 1:	FPU (T 231 T 234, T 242):	2 K - 5 K
Level 2:	OBP near PACS (T 202):	< 16 K
SPIRE:		
Level 0:	Detector (T 225):	< 2 K (< 1.75 K goal)
	Cooler Pump (T 226):	< 2 K
	Cooler Evaporator (T 227):	< 1.85 K (< 1.75 K goal)
Level 1:	FPU (T 235, T 236, T 248):	< 5.5 K (< 3.7 K goal)
Level 2:	OBP near SPIRE (T 254, T 256) T 258):	< 16 K
Level 3:	PM-JFET (T 246, T 251, T 252):	< 20 K
	SM-JFET (T 247, T 249, T 250):	< 20 K

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2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018

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2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

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3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- HTT is partly filled with LHe I
- AXT is partly filled with LHe I
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat
- strap pretensions are about 5 kN
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is pumped down to < 10⁻⁶ mbar

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Figure 3-1: EQM PLM Helium S/S Flow Schema

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3.3 Set-up



Figure 3-2: General set-up in clean room class 100 000

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Cool down and filling



Figure 3-3: Set-up during LHe II Production

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Figure 3-4: CVSE for LHe II Production in AXT

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4 Conditions

4.1 Personnel

Personnel necessary to perform activities according to this present procedure are:

Responsibility	Name / Organisation
Test Manager	.) C. Salmer
Test conductors	*) (, schlosse
Cryostat Operators	*) A. Rhuge
EGSE Operators	*) J. DCnCh
PA Responsible	*) E. Campicht

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ±3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

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4.3 General Instructions for Integration

4.3.1 General Safety Requirements, Precautions

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
 - o operation of safety value: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
 - o operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 QA Requirements

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 ESD constraints

No specific ESD precautions have to be regarded during cool down and filling.

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4.3.4 Prerequisites

At least the following tasks have to be successfully completed before start with cryostat cool down:

- TRR has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

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All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 MGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

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4.4.2 EGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

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Figure 4-1: EGSE Configuration

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4.4.3 OGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

4.4.4 Cryo Vacuum Servicing Equipment (CVSE)

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 I LHe Dewars type HDS 450 -EIPS	Linde		
	50 I / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		

Table 4-4: CVSE

Procedure

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5 Step-by-Step Procedure

5.1 Preparation of Set-Up

Step-	Activity	Nominal	Actual	Remarks	4	7
No.		Value	Value			Τ
	The following configuration set-up is required prior to start of He II production and shall be checked prior to test:					
5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		2		7	
5.1.1.2	Make a printout of current strap pretension	~ 5 kN	7	• • •	_	_
5.1.1.3	He S/S filled with LHe I:					
	HTT LHe temperature T 101	~ 4.2 K	4.31 Ken	4.2%		
	HTT tank pressure P 101 (or P0621)	0.95 - 1.2 bar	1.016 bar	1.034		
	Liquid level in HTT (estimated value)	> 20 %	> 60%	>20% chimaked		
	AXT LHe temperature T 707	~ 4.2 K	7,26 K	4.284		
	AXT tank pressure P701	0.95 - 1.2 bar	1.00 bor	1.04 Jar		
	Liquid level in AXT	> 75 %	59, 1 cm	36,2 cm 154. 6 cm	ⁿ	x 22 X
5.1.1.4	SV 921 installed			2		
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z d	
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		7		2	
5.1.1.6	Airlock SV 121 installed and leak test of filling port performed. Airlock configured for LHe I transfer line.		7		}	
5.1.1.7	Two manometers P0621-1 (0,1-27 mbar) and P0621-2 (1-1200 mbar) installed in safety unit and connected with the safety line of filling port airlock.		7		<u>ں</u>	1
5.1.1.8	Safety line Y0621, valves V0621, V0623, manometers P0621-1 and P0621-2, safety valve SV0622, vent line Y0622 and vacuum pump C 1100 connected with filling airlock and leak test performed.		7		٢	
	A metal gasket must be used at the interface line Y0621 to filling port SV 121!					
5.1.1.9	Plug of SV 121 is closed - SV 121 is activated		V	SV22 CPEN is 10/ch. exiting re	2	
5.1.1.10	Cryo SCOE connected and operational - functional test at ambient temperature successfully performed.		~	ACR.	2	T
5.1.1.11	Blind flanges installed at external vent line and leak tested		7		2	I
5.1.1.12	5 g/s mass flow meter installed in the Y0602 vent line and connected with a strip chart recorder and the Cryo SCOE		7		2	
5.1.1.13	Check configuration of safety unit according Figure 3-4 and Figure 3-5				>	
5.1.1.14	Connect He pumping unit II via V6 of the flow meter unit with Y0601		>	W/O HE FUTT	2	
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Step-	Activity	Nominal Value	Actual Value	Remarks	<u>ר</u>	z
5.1.1.15	Connect venting line from V 512 with pumping line of He pumping unit I		7		7	
5.1.1.16	Check that transfer lines are connected to the cover cooling loop according		~		7	
5.1.1.17	Check valves status:				-	
	 V 104, V 105, V 502, V 512, V 701 	Open	2	Name Control	2	
	 V 102, V 702, SV 121 	Closed	>			
5.1.1.18	Check isolation vacuum:	Q	- /• i	2	د	
	P 901 (P 902)	< 1 x 10° mbar	2.0.10 Why			Τ
5.1.1.19	P 501 interface at PLM connected with manometer and leak tested		7		Ż	
5.1.1.20	Fill out log sheet 1 and 2 - see annex 1		2			
5.1.1.21	Attention: Do not operate liquid level sensors at temperatures above 10 K:		٢		J	
	L 701, L 702 if T 703 > 10 K					
	Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.					

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5.2 He Il Production in AXT

Step- No.	Activity	Nominal Value	Actual Value	Remarks	2	7
5.2.1	Check / Establish Cryostat Configuration					
5.2.1.1	Close V 105 Jou't regen value		7	13.37)	
5.2.1.2	Check valves status:				-	
	 V 104, V 502, V 512, V 701 	Open	γ,		7	
	 V 102, V 105, V 702, SV 121 	Closed	`			
5.2.1.3	Check mass flow via V 502	> 0 mg/s	C/2m2.22	(133me/r	ر .	
	Check mass flow via V 512	> 0 mg/s	0"	Lon L		
5.2.1.4	Check pressures:					
	HTT pressure P 101 (or P0621):	0.95 - 1.2 bar	1.011 har	1.054 bar	2	
	AXT pressure P 701	0.95 - 1.2 bar	1.00 691	1.04Lar		
	GHe exhaust pressure P 501	0.95 - 1.2 bar	107 & bar	×		
5.2.1.5	Fill in log sheets every 1 h minimum		7		ر	
5.2.2	Start He II Production of AXT					
5.2.2.1	Close bypass from He pumping unit 1 to ambient		н.а.		2	
						Γ

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Step- No	Activity	Nominal Value	Actual Value	Remarks	z L	
5.2.2.2	Start water cooling of pumping unit		2		7	
	Check that air pressure is open					
5.2.2.3	Start He-pumping unit 1		\mathbf{i})	
	Note: Pumping speed must be limited to 10 m ³ /h					
	Open inlet valve He-pumping unit 1 (V6 of flow meter unit) and evacuate venting line Y0611					T
5.2.2.4	Note date and time		9.9.03	28.7.05	۷.	T
5.2.25	Check that un-isolated part of suction lines Y0701 and Y0616 are not covered by frost more than approx. 1 m upstream of He pumping units		7	could's water	7	
5.2.2.6	If frost is too close to the pumping units, reduce pump flow rate		۲, ۲	to have to	7	— т
5.2.2.7	Continue pumping down of AXT and note the date and time of A-point			~ 27°C inet	•	
	crossing	Х Г С \		2 ~ 60	7	
	• P 701	< 50 mhar	D.05 h.	0.05		_
<u>.</u>	Note date and time	000	15:21 20.6.6	28.9.05 19:15		
5.2.2.8	Final values to be reached:					
	• T 707	≤ 1.7 K				
	 P 701 	≤ 32 mbar				ı
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Step-	Activity	Nominal	Actual	Remarks	۵.	z
No.		Value	Value			
5.2.2.9	Fill out log sheet 1 and 2				\mathbf{i}	

5.3 He II Top Up in AXT

Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.3.1	Install He I Transfer Line		already done		>	
5.3.1.1	Prepare and install LHe I transfer line as described in chapters 5.5 to 5.8		already		>	
5.3.1.2	Evacuate and flush airlock and transfer line three times as described in chapters 5.5 to 5.8.				~	
5.3.1.3	Pressurize transfer line and filling airlock to about 950 mbar				>	
5.3.2	Top Up with LHe II in AXT					
5.3.2.1	Open SV 121 and insert LHe I transfer line completely		7		$\overline{}$	
5.3.2.2	Check He pumping unit 1 is running and pumping at AXT		7		5	
5.3.2.3	Open V 702		2		/	

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Step-	Activity	Nominal Value	Actual Value	Remarks	2	z
5.3.2.4	Check valve status:					
	 V 102, V 105 	closed	>`		>	
	 V 104, V 502, V 512, V 701, V 702, SV 121 	open	>		·	
5.3.2.5	Open needle valve at LHe I transfer line and fill AXT smoothly		>		>	
5.3.2.6	Observe bath temperature in AXT (T 101)		>		``	
	Stop LHe I transfer by closing the needle valve at transfer line if the temperature at $T\frac{1}{7}$ O_{1} > 2.1 K or if the AXT is full			Fight increased	>	
5.3.2.7	Check liquid level in AXT		>			
5.3.3	Pumping Down of AXT to Required Temperature					
5.3.3.1	Close V 702		>		>	
5.3.3.2	Retract transfer line to upper position and close SV 121		Ч. б.		>	
5.3.3.3	Check valve status:					
	 V 102, V 105, V 702, SV 121 	closed	>		7	
	 V 104, V 502, V 512, V 701, JV A2A 	open	>		_	
5.3.3.4	Pump down AXT until T 707 < 1.7 K		N,62K	pumper and	2	
						ſ
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	4	z
5.3.3.5	Check liquid level in AXT				Ì	
	Not Helium bath temperature in AXT T 707	< 1.7 K	1.52 K		۷	
5.3.4	Complete LHe II Top Up					
5.3.4.1	Repeat steps 5.3.2 and 5.3.3 until AXT has reached the required status:				.)	
	 Helium bath temperature T 307. 	< 1.7 K	1.52K		•	
	Liquid level	> 75 %	Ugy cm	(of 64 cm)		
5.3.4.2	Fill out log sheets 1 & 2		2		٦.	

5.4 Final Status

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	4	z
5.4.1.1	Check and monitor final status at the end of He II production and top up:		2		C.	
5.4.1.2	AXT filled with LHe II and pumped down		2		ა	
5.4.1.3	AXT venting via OBA and V 512, He pumping unit I running		2		J	
5.4.1.4	HTT partly filled with LHe I		2		2	

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z L
5.4.1.5	HTT venting via shields and V 502		\mathbf{r}]
5.4.1.6	Check valve status:		```		7
	 V 102, V 105, V 702 	closed	λ,		
	 V 104, V 502, V 512, V 701, SV 121 	open	7		
5.4.1.7	Depressurize supply dewar, close V0101		>)
5.4.1.8	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line		۲ ۵.	vert intalial	
5.4.1.9	Remove transfer line from supply dewar, and store the line on the scaffolding		۲. م	5	
5.4.1.10	Fill out log sheets 1 & 2		7		7

5.5 Night Configuration

4.9.

z 33 ۵. Page Remarks Actual Value Date: 14.9.05 Nominal Value Jehr to get the cryostat in safe configuration and at begin of the next day to restart The following activities have to be performed at the end of each working day Operator: File: HP-2-ASED-TP-0090_1_0_EQM-AXT-He2ProdTopUp.doc Date: Ny. 9.30 This chapter is only required when top up is ongoing. $^{\prime}$ HP-2-ASED-TP-0090 07N He II top up. Activity 08.09.05 Location: Step-No. Doc. No: Issue: Date:

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Step- No	Activity			Nominal	Actual	Remarks	2	7
5.5.1	Establish Night Cont	figuration						
5.5.1.1	Close valve V0211 (or V0	221) in transfer line and stop l	-He flow					
5.5.1.2	Close V 702							
5.5.1.3	Check V 701 and V 104 o	ben						
5.5.1.4	Reduce pressure in dewa	Ir by opening of V0101						
5.5.1.5	Retract transfer line to up	per position in airlock SV 121						
5.5.1.6	Close airlock SV 121							
5.5.1.7	Remove transfer line frorr and protect open end of tr	n airlock, close compression fit ransfer line.	ting with blind plug					
5.5.1.8	Remove transfer line from	ו supply dewar and prepare it	for next use.					
5.5.1.9	Check valve status:							
	 V 102, V 512, V 702 			closed				
	 V 104, V 105, V 502, 	V 701, SV 121		open				
5.5.1.10	Fill out log sheets 1 & 2							
5.5.2	Restart after Night B	Ireak						
Location.		PA: Date:	Operator:	Da	le:			
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Step-	Activity	Nominal Value	Actual Value	Kemarks	-	z
5 .5.2.1	Install transfer line into a supply dewar and into SV 121. (see chapter 5.8 for details)		$\left(\right)$			
5.5.2.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.8 for details)					
5.5.2.3	Restart activities as described in chapter 5.3		j			

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Procedure

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5.6 Exchange of LHe Dewar

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Step-	Activity			Nominal	Actual	Remarks	d	z
No.				Value	Value			
5.6.1	General Remarks				(
5.6.1.1	The following paragraphs hav	ve to be repeated at each dew	ar exchange					
5.6.1.2	Attention: Do not empty dew	vars completely						
	Remaining liquid level in dew	ar shall always be L0101>100	mm					
5.6.1.3	Use leather gloves and prote- transfer line LHe supply dews	ct eyes by glasses when insta ar.	lling or removing					
5.6.1.4	At each dewar change write c	down in log sheet:						
	 dewar No. 							
	 liquid level at start 							
	 liquid level at end 							
	LHe-consumption							
	 used transfer line 							
5.6.1.5	Fill out log sheets 1 & 2							
5.6.2	Removing Transfer Line	0						
5.6.2.1	Prepare second transfer line	according step 5.7						
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Step- No	Activity			Nominal Value	Actual Value	Remarks	z L	
5.6.2.2	Close valve V0211 (or V0221	I) in transfer line and stop LHe flo	MO		/			
5.6.2.3	Close V 702 (if open)							
5.6.2.4	Close V 102 (if open)							
5.6.2.5	Check V 104 open, V 701 op	en						
5.6.2.6	Reduce pressure in dewar, re	emove pressurization line and op	oen V0101					— T
5.6.2.7	Retract transfer line to upper	position in airlock SV 121						
5.6.2.8	Close airlock SV 121							
5.6.2.9	Remove transfer line from air and protect open end of trans	rlock, close compression fitting w sfer line.	vith blind plug					
5.6.2.10	Remove transfer line from su	upply dewar and prepare it for ne	xt use.					
5.6.3	Installation of new Dew	ar and Transfer Line						
5.6.3.1	Install second transfer line in chapter 5.8 for details)	tto a full supply dewar and into S	V 121. (see					
5.6.3.2	Evacuation and flush the trai chapter 5.8 for details)	nsfer line with GHe grade 5.0 thr	ee times. (see					
5.6.3.3	Close V 104, open V 702							
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.6.3.4	Insert transfer line completely into airlock and retract it again about 1 mm.		\int			
	Fix the compression fitting					-
5.6.3.5	Open V0211 (or V0221) and restart top up as described in chapter 5.3					

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No. No. 5.7.1 Preparations 5.7.1 Preparations 5.7.1.1 Cleaning of inlet filter: 5.7.1.1 6.7.1.1 Cleaning of inlet filter: 6 6.7.1.1 Cleaning of inlet filter from the line 6 6.7.1.1 Cleaning of inlet filter from the line 6 6.7.1.2 Lean the filter with a heat gun 6 6.7.1.2 Description of installations at transfer line - Interfaces at dewar side: 6 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: 6 6.7.1.2 Description of installations at transfer line - Interfaces at dewar side: 6 7.1.2 Description of installations at transfer line - Interfaces at dewar side: 7 6. compression fitting 6 7.1.2 Pressure gauge P01 7 7 7 7 7 7 7 7 7 7 7 7 7 8 7 7 9 7 7 9 7 7 9 7 7 9 7 7 9 7 7 9 7	Activity		Nominal	Actual Value	Remarks	<u>م</u>	7
 5.7.1.1 Cleaning of inlet filter: remove the inlet filter from the line remove the inlet filter from the line clean the filter with a heat bun dry the filter with a heat gun dry the filter with a heat gun tie Teflon tape around the filter thread and screw the filter onto the tube 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	Preparati	Suc		[
 remove the inlet filter from the line clean the filter in ultrasonic bath with isopropyl alcohol dry the filter with a heat gun dry the filter with a heat gun tie Teflon tape around the filter thread and screw the filter onto the tube 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	Cleaning of	inlet filter:					
 clean the filter in ultrasonic bath with isopropyl alcohol dry the filter with a heat gun dry the filter with a heat gun tie Teflon tape around the filter thread and screw the filter onto the tube 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	 remove 	e the inlet filter from the line					
 dry the filter with a heat gun tie Teflon tape around the filter thread and screw the filter onto the tube 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	 clean t 	he filter in ultrasonic bath with isopropyl alcohol					
 tie Teflon tape around the filter thread and screw the filter onto the tube 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	dry the	filter with a heat gun					
 5.7.1.2 Description of installations at transfer line - Interfaces at dewar side: compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	 tie Tefl 	on tape around the filter thread and screw the filter onto the tube					
 compression fitting valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	2 Descriptior	l of installations at transfer line - Interfaces at dewar side:					
 valve V01 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	• compr	ession fitting					
 pressure gauge P01 flex. line DN25 as connection to vacuum line Y0622 and laboratory 	 valve / 	/01					
flex. line DN25 as connection to vacuum line Y0622 and laboratory	• pressr	re gauge P01					
	 flex. lir pump 	le DN25 as connection to vacuum line Y0622 and laboratory C1100					

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Step- No.	Activity			Nominal Value	Actual Value	Remarks	₽	z
5.7.1.3	Description of installations at	transfer line – Interfaces at PLN	M side:					
	 compression fitting, 				/			
	 valve V02 							
	filter							
	GHe supply							
	pressure reducer DM1						· · · · ·	
	flex. line DN4 with a mini	mum length of 2 m			/	-		
5.7.1.4	Check that V0211 (or V0221)) is open						
5.7.2	Evacuation of Transfer	Line						
5.7.2.1	Close V02 to the GHe bottle							
5.7.2.2	Start laboratory pump C1100							
5.7.2.3	Open V01 and evacuate tran:	sfer line for 5 min.						
5.7.3	Flushing of transfer line	, iii						
5.7.3.1	Close V01 to the laboratory v	acuum pump						
5.7.3.2	Open GHe supply and V02							
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Step-	Activity	Nominal	Actual	Remarks	Z d
No.		Aaine			
5.7.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar		(
5.7.3.4	Flush transfer line for min. 30 s				
5.7.3.5	Close V02				
5.7.3.6	Repeat evacuation / flushing cycle 4 times				
5737	Flush transfer line during transport to the dewar:				
5.7.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar				
5.7.3.9	Disconnect transfer line from V01.				
5.7.3.10	Check/adjust that transfer line is under small overpressure. He flow at open				

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5.8 Installation of Transfer Line

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Step- No.	Activity			Nominal Value	Actual Value	Remarks	Z d	
5.8.1	Preparation of LHe Dew	var			ſ			
5.8.1.1	Check that the dewar is relea	ised by PA for use on Herschel.						
5.8.1.2	Check that head of dewar is that the dewar is equipped wi (EIPS).	equipped with one feed through ith <i>Electronic Internal Pressurizi</i> r	16 mm. Check ig System					
5.8.1.3	Play the pling plug in reed thro Position 450 I dewar near SV mechanism at dewar.	ugn to mm. 121 on working platform. Activa	te break					
5.8.1.4	Establish a clear control area	of about 2 m round the dewar						
5.8.1.5	Open valve V0101 of dewar { pressure. ATTENTION: cold gas, use le	gently and depressurize to atmo eather gloves and eye glasses	spheric					
5.8.2	Installation of Transfer	Line into Dewar						
5.8.2.1	Transport the transfer line to necessary)	the dewar while flushing it with G	GHe. (3 persons					
5.8.2.2	Remove compression fitting f DM1 that a slight He flow is a	from transfer line (dewar side) ar at open end of transfer line	nd check/adjust					
Location		PA: Date:	Operator:	Da	te:			
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	Z
5.8.2.3	Remove blind plug 16 mm from head of supply dewar and insert transfer line in the dewar by about 200 mm		C		
5.8.2.4	Stop transfer line flushing: -close V02				
	-close DM1 and GHe supply				
5.8.2.5	Push the transfer line slowly in the dewar until stop at filter reaches the bottom of dewar (the filter is equipped with a 100 mm distance pin to avoid that the transfer line is taking LHe from the bottom of the dewar)				
5.8.2.6	Close V0211 (or V0221)				
5.8.2.7	Adjust dewar pressure at EIPS to 100 mbar - 200 mbar overpressure as needed during filling activities				
5.8.3	Installation of Transfer Line at SV 121				
5.8.3.1	Check that airlock SV 121 is closed, blocked and at atmospheric pressure				
5.8.3.2	Open V0211 (or V0221) slightly Remove compression fitting with valve V02 from transfer line. Check/adjust GHe flow with V0211 (or V0221) at open end of transfer line				

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Step-	Activity		Nominal	Actual	Remarks	N N
No.	1		Value	Value		
5.8.3.3	Remove blind plug from SV 121.			/		
	Insert transfer line in SV 121 and	fix transfer line in upper position.				
	Close V0211 (or V0221) immedia	ate.				
5.8.3.4	Tighten compression fitting.					
5.8.3.5	Attention: Don't damage the sea in SV 121.	al at transfer line when installing transfer li	le			
5.8.4	Evacuation and Purging of	Filling Airlock				
5.8.4.1	Check:					
	 transfer line is prepared and it 	installed according steps above				
	airlock SV 121 is closed and I	blocked				
	 pre-cooling valve is closed 					
	 dewar overpressure is adjust 	ed to about 200 mbar				
5.8.4.2	Start lab. pump C1100, open valv about 5 min	ve V0621 and evacuate transfer line for				
5.8.4.3	Check P0621< 1 mbar					
	Close valve V0621					
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	2	z
5.8.4.4	Purge line to ambient pressure by opening valve V0211 (or V0221) until					
	P0621 is at about ambient pressure	1000 mbar				
	Then close V0211 (or V0221)					
5.8.4.5	Repeat step 5.8.4.2 to 5.8.4.4 two times.					
5.8.4.6	Open SV121					
5847	Continue with LHe transfer in PLM					

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6 Summary Sheets

6.1 **Procedure Variation Summary**

	Т	est Change	Curr. No.: Date: Page 1	of
Test designation	L	Test Procedure	lssue 1	Rev.
Test step changed		Reason for Change:	•	L
			Dubute 1	
Prepared by:	Resp.	lest Leader	Project Engineer	
PA/QA				

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6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
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6.3 Sign-off Sheet

	Date	Signature
Test Manager	14.9.05	C. Jan
Test Conductor	14.9.05	C. Jan
PA Responsible	14.9.05	Compile

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ANNEX Log Sheets

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AXT	Ľ	QA														
HEET 1 for He II Production in /	Sig	AIV														
				 	 					 	 			 _	 	
	REMARKS															
LOG		AXT LL2 cm														
	AXT Cm LL1															
	Mass flow via shields mg/s															
	P516 mbar															
		P0621 mbar														
	P501 mbar															
	P701 mbar															
		P901 mbar														
		SV 121														
		V 702														
	sn	V 701														
	Stat	V 512														
	le 6	V 502														
	Valv	V 105														
	-	V 104						 	-				l			
		V 102		 				<u>†</u>		 		-				
el EQM		Time														
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	atures	OBA	out T236																					
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		HFI	T207 T208																					
		PACS	T202																					
		НТ	F106			-																		
5		CM	101													+					-			\uparrow
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END OF DOCUMENT

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	Name	Dep./Comp.		Name	Dep./Comp.
Х	Alberti von Mathias Dr.	AOE22	X	Stritter Rene	AED11
	Barlage Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
Х	Bayer Thomas	AOA52		Wagner Klaus	AOE22
	Fehringer Alexander	AOE13	X	Wietbrock Walter	AET12
	Fricke Wolfgang Dr.	AED 63		Wöhler Hans	AOE22
	Geiger Hermann	AOA52		Wössner Ulrich	ASE442
	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
X	Hauser Armin	AOE22	X	Alcatel	ASP
X	Hendry David	Terma Resid.	Х	ESA/ESTEC	ESA
	Hinger Jürgen	AOE22			
	Hofmann Rolf	ASE442		Instruments:	
X	Hohn Rüdiger	AED65		MPE (PACS)	MPE
X	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
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X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE
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	Platzer Wilhelm	AED22		Linde	LIND
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE
X	Rühe Wolfgang	AED65		Prototech AS	PROT
Х	Runge Axel	OTN/AET52		QMC Instruments Ltd.	
	Sachsse Bernt	AED21		Rembe, Brilon	REMB
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE
X	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM
	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE
	Sonn Nico	AOE51		Terma A/S, Herlev	TER
	Steininger Eric	AED44			

III. As-Run Copy of the Cover Flushing Procedure

HP-2-ASED-TP-0091

Herschel Procedure **EADS** Astrium vorhing copy start: 16.9.05 **Herschel EQM Cover Flushing** Title: 151 000 CI-No: 15.09.05 Herschel Team Date: Prepared by: 1.05 C. Schlosse Checked by: 5.04.05 R. Stritter Product Assurance: 15.9.05 W. Wietbrock **Configuration Control:** 15/09/05 Dr. W. Fricke **Project Management:**

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1	15.09.05	All	initial issue	

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lssue: Date:

1.0 15.09.05

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1 Scope

1.1 Objective

This test procedure describes the cover flushing activities on the Herschel EQM cryostat. The objective of these activities is to reach the required temperatures for the EQM instrument tests, the Integrated Module Test and the EMC test. The required temperature level will be defined and verified by the instruments during testing. The required temperature stability is regarded as a goal.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

This procedure is applicable for each cover flushing activity.

1.2 Activity Flow

Chapter 5.1 to 5.4 of the activity flow below summarize the activities to be performed during cover flushing. Chapter 5.5 needs only to be performed if the flushing lines needs have to be removed. Chapter 5.6 shall be repeated each time the supply line has to be installed.

§ 5.1	Preparation of Set-up	Configuration check according table in step 3.1 HTT at He I conditions, liquid level > 20 % (estimated value) AXT at He II conditions, liquid level > 20% Check installation of auxiliary lines Preparation of cover flushing lines Installation of cover evacuation line Valve status check
§ 5.2	Cover Flushing	Installation of cover filling line Start cover flushing
§ 5.3	Adjustment of Cover Temperature	Adjust cover temperature according instrument inputs by throttling the flow from supply dewar
§ 5.4	End of cover flushing	Stop flow from dewar Wait for temperatures above 170 K
§ 5.5	Removal of Cover Flushing Lines	Temperatures shall be between 170 K and 303 K Removal of filling line Removal of exhaust line
§ 5.6	Preparation of Supply Line	Preparations Evacuation of transfer line Flushing of transfer line with GHe

1.3 Requirements

Temperature levels and stability requirements will be defined together with the instruments during testing in the range of 25 K to 115 K at a temperature stability of 1K/10 s at 80 K. The temperature uniformity and measurement accuracy is defined in the cryostat cover procurement specification (RD 12).

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2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018
	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003

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2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624
RD 12	Procurement Spec. for Cryostat Cover, Cryostat Baffle and Test Components	HP-2-ASED-PS-0018

2.3 Other Documents

OD #	Document Title	Document Identifier
00.01	Meruel of High Vocuum pumping unit	
0001	Manual of High vacuum pumping unit	
OD 02	Manual of He II pumping unit	

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3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- the HTT is partly filled with LHe I
- the AXT is partly filled with LHe II
- the CC-part of the Cover Supply Line is installed
- the CC-part of the Cover Exhaust Line is installed
- the cover cooling loop is filled with Helium gas at about ambient pressure
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is pumped down to < 10⁻⁶ mbar

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Figure 3-1: EQM PLM Helium S/S Flow Schema

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Figure 3-2: General set-up in clean room class 100 000

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Cool down and filling



Figure 3-3: Set-up during LHe II Operation

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Figure 3-4: CVSE for LHe II Operation

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Figure 3-5: Safety Unit



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4 Conditions

4.1 Personnel

Cover flushing will be performed on request and in single shift. Personnel necessary to perform activities according to this present procedures are:

Responsibility	Name / Organisation
Test Manager	» (Julione
Test conductors	» P. nack
Cryostat Operators	*) P. Made
EGSE Operators	*) R. kometh
PA Responsible	*) 2. (ampierly

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ±3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

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4.3 General Instructions for Integration

4.3.1 General Safety Requirements, Precautions

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
 - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
 - o operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 QA Requirements

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 ESD constraints

No specific ESD precautions have to be regarded during cool down and filling.

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4.3.4 Prerequisites

At least the following tasks have to be successfully completed before start with cover flushing:

- TRR for IMT or EMC test has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

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All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 MGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

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4.4.2 EGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

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Figure 4-1: EGSE Configuration

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4.4.3 OGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

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4.4.4 Cryo Vacuum Servicing Equipment (CVSE)

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 I LHe Dewars type HDS 450 -EIPS	Linde		
	50 I / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W&T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W&T		
1	Cover Supply Line (2 parts)	DeMaCo		
1	Cover Exhaust Line (2 parts)	DeMaCo		

Table 4-4: CVSE

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5 Step-by-Step Procedure

5.1 Check of PLM Status

No	Activity	Value	Actual Valué∽	Relita NS	-
	The following configuration set-up is required prior to start of cover flushing and shall be checked prior to test:				
5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		on 1017 Simulahr		7
5.1.1.2	HTT filled with LHe I:				
	HTT LHe temperature T 101	~ 4.2 K	4.26K		7
	HTT tank pressure P 101 (or P0621)	0.95 - 1.2 bar	1.016 har		
	Liquid level in HTT (estimated value)	> 20 %	~ 35%		
5.1.1.3	AXT filled with LHe II:				
	AXT LHe temperature T 707	< 1.7 K	1.574		7
	AXT tank pressure P701	< 0.05 bar	O. 01 bar		
	Liquid level in AXT	> 20 %	42 cm 2~	60%	
5.1.1.4	SV 921 installed		>		2

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		Nominal	Actual	Domarke	٥	z
Step- No.	AGUVILY	Value	Value		-	
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open				7	
5.1.1.6	Cryo SCOE connected and operational				7	
5.1.1.7	Check configuration of safety unit according Figure 3-4 and Figure 3-5				2	
5.1.1.8	Check He pumping unit I running nominally				7	
5.1.1.9	Check that CC-part of cover supply line and CC-part of cover exhaust line are connected to the cover cooling loop according AAE procedure (AD 03)				7	
5.1.1.10	Prepare CVSE-part of cover supply line according to chapter 5.6				ン	
5.1.1.11	Check that cover cooling loop temperature is between 170 K and 303 K				۲	
	• T601	170 303 K	224K			Τ
5.1.1.12	Install CVSE-part of cover exhaust line:					
	Move CVSE-part of cover exhaust line close to CC-part at CVV				7	
	 Remove blind cap at Johnston coupling 					
	 Install CVSE-part into Johnston coupling of the CC-part 					



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Step- No.	Activity	Nominal Value	Actual Value	Remarks	Z L	z
5.1.1.13	Evacuation and flushing of exhaust line and cooling loop:		>			
	Connect laboratory pump and GHe flushing line with exhaust line				7	
	 Evacuate cooling loop and exhaust line with laboratory pump until pressure < 2 mbar 					
	Flush cooling loop and exhaust line with GHe up to about 1 bar absolute					
	Repeat evacuation/flushing cycle two times					
5.1.1.14	Check valves status:				-	
	 V 104, V 502, V 512, V 701 	Open	>		2	
	 V 102, V 105, V 702, SV 121 	Closed	>			
5.1.1.15	Check isolation vacuum:				7	
	P 901 (P 902)	< 1 × 10 ⁻⁶ mbar	3.0. 10 ⁻⁷ mbu			
5.1.1.16	Fill out log sheet 1 and 2 - see annex 1				7	
5.1.1.17	Attention: Do not operate liquid level sensors at temperatures above 10 K:		1		7	
	L 701, L 702 if T 703 > 10 K		0.4.			
	Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.					



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5.2 Cover Flushing

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	z L	
5.2.1	Installation of Cover Supply Line					
5.2.1.1	Check that CVSE-part of supply line is prepared according section 5.6		2		7	
5.2.1.2	Transport CVSE-part of supply line to the cover and LHe supply dewar while flushing with GHe		>		7	
5.2.1.3	Install CVSE-part of supply line in LHe supply dewar		7		2	
5.2.1.4	Connect CVSE-part of supply line with CC-part of supply line		7		7	
5.2.1.5	Evacuate and flush cover cooling loop and LHe lines with He from dewar three time		7		7	
5.2.1.6	Fill in log sheets every 1 h minimum		during open	tion out	7	
5.2.2	Start Cover Flushing					
5.2.2.1	Start Helium transfer through cover cooling loop by opening the needle valve of the supply line and the exhaust line		2		7	
5.2.2.2	Note date and time		N6.9.05 143		د	
5.2.2.3	Throttle Helium transfer from dewar when T 601 < 80 K		Continued while a sol		2	
5.2.2.4	Fill out log sheet 1 and 2				2	Ì
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5.3 Adjustment of Cover Temperature

Step-	Activity	Nominal	Actual	Remarks	۰.	z
No.		Value	Value			
5.3.1.1	Request from instrument in test desired cover temperature				1	
5.3.1.2	Increase / reduce flow from dewar to achieve requested cover temperature				3	
5.3.1.3	Stabilize cover temperature by regulating the flow from the dewar) ree loguliet	۱	
5.3.1.4	Fill out log sheets 1 & 2			2	`	
5.3.1.5	Repeat steps above for new temperature			ler.	>	

5.4 End of Cover Flushing

Step- No.	Activity		Nominal Value	Actual Value	Remarks	٩	z
5.4.1.1	Close needle valve at CV dewar	/SE-part of supply line to stop Helium transfer from		(hot mevant		
5.4.1.2	Wait until cover temperat	ure T 601 > 170 K	> 170 K		Cry Cour		
5.4.1.3	Close valve at CVSE-par	t of exhaust line			Ruphing was		
5.4.1.4	Observe pressure in exh	aust line	< 1.2 bar		Stand completed	~	
		c			With warm up of	(1)	3
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5.5 Removal of Cover Flushing Lines

Step- No.	Activity	Nominal Value	Actual Value	Remarks	<u>ک</u>	7
	The following activities have to be performed when no further cover flushing activities are foreseen.		$\left(\right)$			
5.5.1	Removal of CVSE-part of Supply Line		/			
5.5.1.1	Wait until cover temperature T 601 and T 602 > 170 K	> 170 K				ľ
5.5.1.2	Check pressure of cover tube	1.0 1.2 bar				
5.5.1.3	Disconnect CVSE-part of supply line from Johnston coupling, close Johnston coupling of CC-part of supply line by blind cap		X/12 Alm	plute		
5.5.1.4	Remove CVSE-part of supply line from dewar, close inlet of dewar					
5.5.1.5	Transport CVSE-part of supply line to CVSE scaffolding and store the line					
5.5.2	Removal of CVSE-part of exhaust line					
5.5.2.1	Wait until cover temperature T 601 and T 602 > 170 K	> 170 K				•
5.5.2.2	Check pressure of cover tube	1.0 1.2 bar				
						Г

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step-	Activity	Nominal	Actual	Remarks	٩	z
<u>lo</u> .		Value	Value			
			(
5.5.2.3	Disconnect CVSE-part of exhaust line from Johnston coupling, close		~			
	Johnston coupling of CC-part of exhaust line by blind cap					
			J			
5.5.2.4	Transport CVSE-part of exhaust line to CVSE scaffolding and store the line					

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Step- No.	Activity			Nominal Value	Actual Value	Remarks	٩	~
5.6.1	Preparations				$\left(\right)$			
5.6.1.1	Cleaning of inlet filter:							
	 remove the inlet filter fror 	m the line						
	clean the filter in ultrason	nic bath with isopropyl alcohol			<u> </u>			
	 dry the filter with a heat ç 	ung			<u> </u>			
	 tie Teflon tape around the 	ie filter thread and screw the filte	er onto the tube					
5.6.1.2	Description of installations at	t transfer line - Interfaces at dew	var side:					
	compression fitting							
	 valve V01 							
	 pressure gauge P01 							
	flex. line DN25 as conne numo C1100	ection to vacuum line Y0622 and	d laboratory					
					V/A (m	y Kelez		
Locatior	:'	PA: Date:	Operator:	Da	te:			
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Step- No.	Activity		Nominal Value	Actual Value	Remarks	<u>م</u>	7
5.6.1.3	Description of installations at CV part side:	VSE-part of supply line – Interfaces at CC-		(
	 compression fitting, 						
	 valve V02 						
	filter			<u> </u>			
	GHe supply			<u> </u>			
	 pressure reducer DM1 			<u> </u>			
	 flex. line DN4 with a minimu 	um length of 2 m					
5.6.1.4	Check that V0211 (or V0221) is	s open					
5.6.2	Evacuation of CVSE-part	t of Supply Line					
5.6.2.1	Close V02 to the GHe bottle						
5.6.2.2	Start laboratory pump C1100			X	A Muylaly		
5.6.2.3	Open V01 and evacuate transfi	er line for 5 min.					
5.6.3	Flushing of CVSE-part of	f Supply Line					
5.6.3.1	Close V01 to the laboratory var	cuum pump					
							ſ
Locatior		PA: Date: Operator:		late:			
:				-	Page	e 32	

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Step- No	Activity	Nominal Value	Actual Value	Remarks	z d
5.6.3.2	Open GHe supply and V02		(
5.6.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar				
5.6.3.4	Flush transfer line for min. 30 s				
5.6.3.5	Close V02				
5.6.3.6	Repeat evacuation / flushing cycle 4 times				
5.6.3.7	Flush transfer line during transport to the dewar:				
5.6.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar overpressure		M	A Munih	
5.6.3.9	Disconnect transfer line from V01.				
5.6.3.10	Check/adjust that transfer line is under small overpressure. He flow at open end of transfer line must be noticeable.		/		

Location:		PA:	Date:	Operator:	Date:		
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6 Summary Sheets

6.1 Procedure Variation Summary

	Т	est Change	Curr. No.: Date: Page 1	of
Test designation	L	Test Procedure	lssue 1	Rev.
Test step changed		Reason for Change:		
Prepared by:	Resp.	Test Leader	Project Engineer	
PA/QA				

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6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
	none		

6.3 Sign-off Sheet

	Date	Signature
Test Manager	16,9.05	C.Jon
Test Conductor	10,9.05	C.Ja
PA Responsible	16.9.05	C. Lempul
	<u> </u>	~~ V

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ANNEX Log Sheets

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	u	QA											
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HEET 1 for COVER FLUSHIN	REMARKS												
LOGS													
	Mass	flow via shields mg/s											
		Liquid level Dewar L0101											
	:	He Dewar S/N D0101											
		P516 mbar											
	P0621 mbar												
		P501 mbar											
		P701 mbar											
		P901 mbar											
		SV 121											
		V 702											1
	tus	V 701											
	Sta	V 512											
1	lve	V 502											
1	Va	V 105											
		V 104											
Σ		V 102											
iel EQ		Time											
Hersch		Date											

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	res in	A 06	6 T2						-								
	peratu	0B/	T23														-
	Tem		T231														_
		SPIRE	T254	 											 		
		HIFI	T208													 	
		PACS	T202														
		ΗH	T106														
MC		DLCM	T101														
Jel EC		Time															
Hersch		Date															

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END OF DOCUMENT

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 Issue:
 1.0

 Date:
 15.09.05

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Procedure

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	Name	Dep./Comp.		Name	Dep./Comp.		
X	Alberti von Mathias Dr.	AOE22	Х	Stritter Rene	AED11		
	Barlace Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65		
×	Baver Thomas	AOA52	*******	Wagner Klaus	AOE22		
	Fehringer Alexander	AOE13	X	Wietbrock Walter	AET12		
	Fricke Wolfgang Dr.	AED 63		Wöhler Hans	AOE22		
	Geiger Hermann	AOA52		Wössner Ulrich	ASE442		
	Gerner Willi	AED11					
	Grasi Andreas	OTN/AET52					
	Grasshoff Brigitte	AET12					
X	Hauser Armin	AOE22	Х	Alcatel	ASP		
X	Hendry David	Terma Resid.	Х	ESA/ESTEC	ESA		
	Hinger Jürgen	AOE22					
	Hofmann Rolf	ASE442		Instruments:			
X	Hohn Rüdiger	AED65	· · · · · · · · · · · · · · · · · · ·	MPE (PACS)	MPE		
X	Huber Johann	AOA52		RAL (SPIRE)	RAL		
	Hund Walter	ASE442		SRON (HIFI)	SRON		
X	Idler Siegmund	AED432					
X	llsen Stijn	Terma Resid.		Subcontractors:			
	lvády von András	FAE22		Air Liquide, Space Department	AIR		
X	Jahn Gerd Dr.	AOE22	******	Air Liquide, Space Department	AIRS		
	Kalde Clemens	APE3		Air Liquide, Orbital System	AIRT		
	Kameter Rudolf	OTN/AET52		Alcatel Bell Space	ABSP		
X	Kettner Bernhard	AET42	*****	Astrium Sub-Subsyst. & Equipment	ASSE		
	Knoblauch August	AET32	******	Austrian Aerospace	AAE		
X	Koelle Markus	AOA53		Austrian Aerospace	AAEM		
	Kroeker Jürgen	AED65		APCO Technologies S. A.	APCO		
X	Kunz Oliver Dr.	AOE22		Bieri Engineering B. V.	BIER		
X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE		
	Lang Jürgen	ASE442		Dutch Space Solar Arrays	DSSA		
Х	Langfermann Michael	AOA51		EADS CASA Espacio	CASA		
X	Mack Paul	OTN/AET52		EADS CASA Espacio	ECAS		
	Müller Jörg	AOA52		EADS Space Transportation	ASIP		
Х	Pastorino Michel	ASPI Resid.		Eurocopter	ECD		
	Peltz Heinz-Willi	AOE13		European Test Services	ETS		
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ		
	Platzer Wilhelm	AED22		Linde	LIND		
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT		
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE		
Х	Rühe Wolfgang	AED65		Prototech AS	PROT		
X	Runge Axel	OTN/AET52		QMC Instruments Ltd.	QMC		
	Sachsse Bernt	AED21		Rembe, Brilon	REMB		
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE		
X	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM		
*****	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN		
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE		
	Sonn Nico	AOE51		Terma A/S, Herlev	TER		
	Steininger Eric	AED44					

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IV. As-Run Copy of the Depletion & Warm Up Procedure

HP-2-ASED-TP-0098

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WORKING COLY AS RUN Herschel EQM Depletion and Warm-Up to Ambient

Title:

CI-No:

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Prepared by:	Herschel Team	Date:	08.12.05
Checked by:	C. Schlosser (1. Jch	.	9.12.05-
Product Assurance	R. Stritter Northand	long	9.12.05.
Configuration Control:	W. Wietbrock W. Willbe	Ą	12.12.05
Project Management:	Dr. W. Fricke Kich		12/12/2005

Distribution:

See Distribution List (last page)

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Issue	Date	Sheet	Description of Change	Release
1	08.12.05	All	initial issue	

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1 Scope

1.1 Objective

This test procedure describes the warming up of the Herschel EQM cryostat to ambient temperatures. The objective of these activities is to reach ambient conditions after completing the EQM test phase. Temperature rates and gradients as required in the IID-B's have to be respected as during cool down phase.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

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1.2 Activity Flow

Chapter 5.1 to 5.5 of the activity flow below summarize the activities to be performed for depletion and warm-up of the EQM cryostat.

§ 5.1	Preparation of Set-up	Configuration check according table in step 3.1 HTT pumped down to < 0.05 bar and at ~ 30 K AXT at He II conditions, no liquid level defined Check CVSE configuration Connect leak detector and mass spectrometer to CVV (for monitoring during warm up to ambient) Valve status check
§ 5.2	Warm-up to He I	Stop pumping at AXT Warm-up of AXT to He I by means of AXT heaters Perform instrument SFTs at He I conditions for procedure validation
§ 5.3	Depletion of AXT	Deplete AXT by means of AXT heaters
§ 5.4	Warm-up of cryostat	Warm-up AXT/OBA with AXT heaters Warm-up of HTT with AXT heaters Adjust AXT and HTT heater power to respect temperature rate and gradient requirements of instruments Ensure "cold trap" by continue shield cooling or cover flushing if needed Stop cover flushing and shield flushing when AXT/OBA is at ambient temperatures (if active)
§ 5.5	Cryostat Operation Completion	Stop heating of AXT and HTT Remove CVSE Check final EQM configuration

1.3 Requirements

During warm-up the following requirements have to be regarded:

Temperature requirements:

HTT: $\Delta T103/\Delta t < 50$ K/hHIFI/(PACS): $\Delta T207/\Delta t < 20$ K/h (above 50 K for HIFI) $\Delta T207/\Delta t < 5$ K/h (above 50 K for PACS)SPIRE/(PACS): $\Delta T253$ (T255)/ $\Delta t < 20$ K/h (above 50 K for PACS; no requirement from SPIRE)

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SPIRE J-FET: ∆T249 (T251)/∆t < 20 K/h (above 50 K; no requirement from SPIRE)

Remark: There are no specific PT1000 temperature sensors to monitor PACS cool down, PT1000 sensors close to HIFI foot and SPIRE foot shall be used instead.

AXT, HTT, OBA shield <u>or</u> cover shall always be colder than the FPUs. FPU temperatures will be represented by the OBA temperature sensors.

Temperature differences between L0, L1 and L2 shall not exceed 20 K. (HIFI). This requirement can only be controlled by indirect measurements (AXT vs. OBA plate vs. SPIRE L3) or by instrument internal sensors:

|T 707 – T 207| < 20 K |T 207 – T 249 (T 251)| < 20 K |T 707 – T 249 (T 251)| < 20 K ĺ

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2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018
AD 03	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003
AD 04	Cover Flushing Procedure	HP-2-ASED-TP-0091

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2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

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3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments
- The EQM tests are finished

3.2 Cryostat Configuration

The cryostat status at start of warm-up shall be:

- the HTT is pumped down to < 0.05 bar and at about 30 K
- the AXT is partly filled with LHe II
- the CC-part of the Cover Supply Line is installed
- the CC-part of the Cover Exhaust Line is installed
- the cover cooling loop is filled with Helium gas
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat (pumping will be stopped for He background measurement)
- the Cryo SCOE is operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is $< 10^{-6}$ mbar

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Figure 3-1: EQM PLM Helium S/S Flow Schema

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3.3 Set-up



Figure 3-2: General set-up in clean room class 100 000

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Cool down and filling



Figure 3-3: Set-up during Cryostat Operation

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Figure 3-4: CVSE for Cryostat Operation

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4 Conditions

4.1 Personnel

Depletion and warm up will be performed in single shift. However heaters will continue to be operated over night. Personnel necessary to perform activities according to this present procedure are:

Responsibility	Name / Organisation		
Test Manager	*) C. Schlosser		
Test conductors	*) C. Schlosrer		
Cryostat Operators	*) A. Runge R. Kameter		
EGSE Operators	*) S. 1(sen		
PA Responsible	*) E. Lamprecht		

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000		
Temperature:	22°C ±3°C		
Pressure:	ambient		
Rel. humidity:	40 % - 65 %		

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4.3 General Instructions for Integration

4.3.1 General Safety Requirements, Precautions

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
 - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
 - o operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 QA Requirements

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 ESD constraints

No specific ESD precautions have to be regarded during depletion and warm up.

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4.3.4 Prerequisites

At least the following tasks have to be successfully completed before start with depletion and warm up:

- PTR for IMT or EMC test has been successfully held to ensure that all tests with the EQM have been completed
- TRR for depletion and warm up has been held
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety

All parts and tools required available and operational

4.4 GSE

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All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 MGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

Procedure

4.4.2 EGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

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Figure 4-1: EGSE Configuration

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4.4.3 OGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	n/a			

Table 4-3: OGSE

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4.4.4 Cryo Vacuum Servicing Equipment (CVSE)

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pump (C0711)	BOCE	Cl No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	Cl No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	Cl No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 I LHe Dewars type HDS 450 -EIPS	Linde		
	50 I / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		
1	Cover Supply Line (2 parts)	DeMaCo		
1	Cover Exhaust Line (2 parts)	DeMaCo		

Table 4-4: CVSE

Procedure

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5 Step-by-Step Procedure

5.1 Check of PLM Status

The following configuration set-up is required prior to warm up and shall be checked prior to test:5.1.1.1PLM/SVM installed in test dolly or standing on SV sin according Figure 3-2 and Figure 3-35.1.1.216 load cells mounted to the strap pretensioners. Stra5.1.1.3HTT pumped down:HTT temperature T 101HTT tank pressure P 101 (or P0621)5.1.1.4AXT partly filled with LHe II:AXT LHe temperature T 707AXT tank pressure P701Liquid level in AXT	Step- No.	Activity	Nominal Value	Actual Value	Remarks	<u>۔</u>	z
 5.1.1.1 PLM/SVM installed in test dolly or standing on SV sin according Figure 3-2 and Figure 3-3 5.1.1.2 16 load cells mounted to the strap pretensioners. Stra 5.1.1.3 HTT pumped down: 5.1.1.3 HTT temperature T 101 HTT temperature T 101 S.1.1.4 AXT partly filled with LHe II: 5.1.1.4 AXT LHe temperature T 707 AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT 		The following configuration set-up is required prior to start of depletion and warm up and shall be checked prior to test:					
 5.1.1.2 16 load cells mounted to the strap pretensioners. Stra 5.1.1.3 HTT pumped down: HTT temperature T 101 HTT tank pressure P 101 (or P0621) 5.1.1.4 AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT 	5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		ter de ces		7	Ŕ
 5.1.1.3 HTT pumped down: HTT temperature T 101 HTT tank pressure P 101 (or P0621) 5.1.1.4 AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT 	5.1.1.2	16 load cells mounted to the strap pretensioners. Strap pretension ~ 5 kN	~ 5 kN	~ shn		2	71
HTT temperature T 101 HTT tank pressure P 101 (or P0621) 5.1.1.4 AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT	5.1.1.3	HTT pumped down:)	
HTT tank pressure P 101 (or P0621) 5.1.1.4 AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT		HTT temperature T 101	~ 30 K	20.64)	
 5.1.1.4 AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT 		HTT tank pressure P 101 (or P0621)	< 0.05 bar	0-05 bar			
AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT	5.1.1.4	AXT partly filled with LHe II:				7	
AXT tank pressure P701 Liquid level in AXT		AXT LHe temperature T 707	< 1.7 K	1.67 H			
Liquid level in AXT		AXT tank pressure P701	< 0.05 bar	0.01 bar			
		Liquid level in AXT	no requirement	17 cm / 7, your	K U°	1	
5.1.1.5 SV 921 installed	5.1.1.5	SV 921 installed		\mathbf{a}		ر	

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.1.1.6	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		2	Pumping shall be switched off for leak measurements	7	
5.1.1.7	Cryo SCOE connected and operational		2		١	
5.1.1.8	Check configuration of safety unit according Figure 3-4 and Figure 3-5		>		>	
5.1.1.9	Check He pumping unit I running nominally		>		2	
5.1.1.10	Check that cover flushing lines are installed and capable of venting during warm up		7		2	
5.1.11	Note cover cooling loop temperature	No requirement	X 8 0 ~		7	
5.1.12	Check valves status: • V 502, V 512, V 701, SV 121 • V 102 V104 V 105 V 702	Open Closed			٦	
5.1.1.13	Check isolation vacuum:		201. t		7	
5.1.1.14	Fill out log sheet 1 and 2 - see annex 1		2		3	

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Step- No	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.1.1.15	5 Attention: Do not operate liquid level sensors at temperatures above 10 K:		7		7	
	L 701, L 702 if T 703 > 10 K					
	Do not continuous operate L 701 or L 702 and do not operate L 701 and					
	L 702 at the same time.					

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Temperatures
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5
Warm-up
5.2

Step-	Activity	Nominal	Actual	Remarks	٩	z
No.		Value	Value			
5.2.1	Warm-up from He II to He I					
5.2.1.1	Close manual valve between V 512 and pumping tube		7		>	
5.2.1.2	Stop He pumping unit I		7		7	
5.2.1.3	Switch on H 702 with 1.5 W and observe temperature increase in AXT		ts:su r		7	
5.2.1.4	Increase H 702 to 10 W on request of cryostat operator to speed up warming up process. Observe AXT temperature and pressure P 512		start Hzon wi	44 104 (f.76) 16:10 COM	7	
5.2.1.5	Open manual valve between V 512 and pumping tube when P 512 > 1 bar and pressurize tube to He pumping unit I		02:tV		د	
5.2.1.6	Connect by-pass of pumping unit with inlet of mass flow unit		7		2	
5.2.1.7	Open by-pass when P 512 > 1 bar and observe mass flow		77:23 2100m1/1 in	נולטאויה ש	7	
5.2.1.8	Stop H 702 and Hfor		17,25	,	2	
5.2.2	Instrument SFT at He I temperatures					
5.2.2.1	Perform HIFI SFT at He I temperature according HIFI procedure		и./д.		7	
5.2.2.2	Perform PACS SFT at He I temperature according PACS procedure		0. 6.		7	
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.2.2.3	Perform SPIRE SFT at He I temperature according SPIRE procedure		o, 4.		5	

5.3 Depletion of AXT

Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.3.1.1	Note liquid level in AXT		LJ = 5,90m	LL2 = 4,6 cm	7	
5.3.1.2	By-pass one way valve		Ly. a.		7	
5.3.1.3	Start H 702 with 10 W and observe mass flow		M.Sn		\mathcal{T}	
5.3.1.4	Reduce H 702 to 1.5 W if mass flow > 2 g/s		2			
	Start H 701 with 10 W if mass flow < 1 g/s		, F			
5.3.1.5	Observe T 707: Depletion is completed when T 707 > 5 K				4	
	Open V105 A avoid propur increase in shiredas dure to clor USAr		17,50		2	

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5.4 Warm-up of Cryostat

Step-	Activity		Z	lominal	Actual	Remarks		z
No.			>	/alue	Value			
5.4.1	Warm-up of AXT/OBA							
5.4.1.1	Increase H 702 to 10 W				already at lob		7	
	Switch on H 701 with 10 W				N 6:45-			
5.4.1.2	Check valves status:							
	 V 502, V 512, V 701, S) V 102, V104, V 405, V 	1721, V105 702, V502, JV121		Open Closed	77		7	
5.4.1.3	Observe temperature rates:							
	НТТ: ΔT LO: ΔT	103/∆t < 50 K/h 207/∆t < 5 K/h			see lisples	(above 50 K) (above 50 K)	7	
	L2: ΔT L3: ΔT	253 (T255)/∆t < 20 K/h 249 (T251)/∆t < 20 K/h				(above 50 K) (above 50 K)		
	Reduce heater power if one	of the requirements is exceeded						
5.4.1.4	Observe temperature gradie	ents:					7	
	T 70 3 - T 207 < 20 K T 207 - T 249 (T 251) < 2	X 2			see los fren	(above 50 K) (above 50 K) (above 50 K)	\$	
	/ug/ = 1 249 (1 251) < 2 Reduce heater power if one	u ۲ • of the requirements is exceeded						
								Γ
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Step- No.	Activity	Nominal Value	Actual Value	Remarks	2	7
5.4.1.5	Make sure that another item in the PLM is always minimum about 10 K colder than the OBA. Cool down cover if it is not the case.		see los free		2	
5.4.1.6	Warming up of AXT/OBA can be supported by flushing the AXT/OBA with warm GHe through SV 121 - V 702 - AXT - V 701 - OBA - V 512 - ambient Switching of visives have to be recorded in the log sheets		V Started 16,12.)(0	7	
5.4.1.7	Switch off H 701 and H 702 when AXT and OBA temperatures are above 293 K		see los he		7	
5.4.1.8	Check isolation vacuum; measure leak rate and take mass spectrum during warming up		man spectrumetre Connectual		7	
5.4.2	Warm-up of HTT/Cryostat			Steps can be performed in parallel to section 5.4.1		
5.4.2.1	Start H 103 and H 104 with 10 W each.		het started	Deformed Pamired	z.	
5.4.2.2	Connect GHe supply to safety unit		9. 1.06	GN2 inited Cltc,	7	
5.4.2.3	Open V 102 and pressurize HTT to \sim 1 bar		no.	Not relevant, 1477		
5.4.2.4	Open V 104		12 1.06	it cled gand	7	
5.4.2.5	Start H 101 and H 102 if cool down rate of the HTT is too low		X			

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Step- No.	Activity	Nominal Value	Actual Value	Remarks	٩	z
5.4.2.6	Warming up of HTT/shields can be supported by flushing the HTT/shields with warm GHe through SV 121 - V 102 - HTT-V 104 - shields - V 502 - ambient by مصحط Switching of valves have to be recorded in the log sheets		7	GN2 WRA Jine	ک	
5.4.2.7 (Check strap pretensions. Reduce strap pretensions to ~ 5 kN when they are > 15 kN		ile record		7	
5.4.3 E	End of Warm-up					
5.4.3.1	Stop cover flushing when AXT/OBA temperatures > 293 K		NG. 12.05 > Cover Jobarts	laket!	7	
5.4.3.2	Warm-up is completed when all cryostat temperatures are above 273 K		1000 warmin	· J.,	7	

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5.5 Cryostat Operation Completion

Cton-	Activity	Nominal	Actual	Remarke	4	z
No.		Value	Value		•	:
5.5.1.1	Switch off heaters H 101, H 102, H 103, H 104, H 701 and H 702		>		2	
5.5.1.2	Wait for temperature equilibrium in the cryostat	285 K ± 10 K	17.1.00		7	
5.5.1.3	Close HTT valves V 102 and V 104 if open		(lox V 104		7	
5.5.1.4	Close AXT valves V 702 and V 701 if open, close by-pass valve V 105		close itor, use		7	
5.5.1.5	Close V 502 and V 512		\checkmark		7	
5.5.1.6	Check valves status:	Closed	7		7	
5.5.1.7	Check cover status: Note temperatures T 601 and T 603		292 o K		7	
5.5.1.8	Make a print out of strap pretensions		2		7	
5.5.1.9	Fill out logsheets 1 & 2		Ń		2	
5.5.1.10	Remove venting line Y0601 from V 502		$\mathbf{\lambda}$		7	
5.5.1.11	Remove AXT/OBA pumping line from V 512		>		7	
5.5.1.12	Remove cover flushing lines according AAE procedure		\checkmark		7	
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Step-	Activity	Nominal	Actual	Remarks	۵.	z
No.		Value	Value			
5.5.1.13	Disconnect strap pretension measurement devices		7		2	
5.5.1.14	Disconnect EGSE harness (to Cryo SCOE and PLM EGSE)		>		$\overline{\ }$	



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6 Summary Sheets

6.1 Procedure Variation Summary

	Т	est Change	Curr. No.: Date: Page 1	of
Test designation		Test Procedure	Issue	Rev.
Test step changed		Reason for Change:	-	
Prepared by:	Resp.	Test Leader	Project Engineer	
PA/QA				

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6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status

6.3 Sign-off Sheet

	Date	Signature
Test Manager	18.1.06	C.Jan
Test Conductor	18.1.06	C. Jan
PA Responsible	18.1.06	G. Illumphil

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ANNEX Log Sheets

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Procedure

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	uf	QA											
	Siç	AIV											
Depletion & Warm Up	REMARKS												
ET 1 for	Cover flushing dewar press.												
GSHE	Mass	flow via cover mg/s											
ΓO	Mass	flow via shields mg/s											
		mass flow via AXT mg/s											
	P516 mbar												
		P0621 mbar											
	P501 mbar												
		P701 bar											
		P101 bar											
		P901 mbar											
		SV 121											
		V 702	Ш										
	tus	V 701											
	Sta	V 512	\square										
	lve	V 502	ЦЦ										
	Va	V 105	\square										
		V 104	ЬЦ										
Σ		V 102	\square	 		 							
iel EQ		Time											
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	[K]	2. hiald	T443											
		1. Vield s	423					 				 		
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	perati	e OB	12											
	Tem		T236											
		0BA in	T231											
		SPIRE T253	T254											
		IRE S	254							 	 			
		L SP	- -		 	 		 	 	 	 	 	 	
		1 HF	T20											
ØΜ		FH	T103											
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END OF DOCUMENT

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 Issue:
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	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22		Schink Dietmar	AED44
	Barlage Bernhard	AED11	Х	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
~	Fehringer Alexander	AOE13		Sonn Nico	AOE51
	Fricke Wolfgang Dr.	AED 65		Steininger Eric	AED32
	Geiger Hermann	AOA52	X	Stritter Rene	AED11
	Gerner Willi	AED11		Suess Rudi	AOA54
	Grasl Andreas	OTN/AOA54		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasshoff Brigitte	AET12		Wagner Klaus	AOE22
Х	Hauser Armin	AOE22	Х	Wietbrock Walter	AET12
Х	Hendry David	Terma Resid.		Wöhler Hans	AOE22
	Hengstler Reinhold	AOA 5		Wössner Ulrich	ASE442
	Hinger Jürgen	AOE22	Х	Alcatel	ASP
	Hofmann Rolf	ASE442	Х	ESA/ESTEC	ESA
Х	Hohn Rüdiger	AED65		Instruments:	
	Hölzle Edgar Dr.	AED44		MPE (PACS)	MPE
	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
X	Idler Siegmund	AED312		Subcontractors:	
X	Ilsen Stiin	Terma Resid.	-	Air Liquide, Space Department	AIR
	Ivády von András	FAE22		Air Liquide, Space Department	AIRS
	Jahn Gerd Dr.	AOE22		Air Liquide, Orbital System	AIRT
	Kalde Clemens	APE3		Alcatel Bell Space	ABSP
	Kameter Rudolf	OTN/AOA54		Astrium Sub-Subsyst. & Equipment	ASSE
	Kettner Bernhard	AET42		Austrian Aerospace	AAE
	Knoblauch August	AET32		Austrian Aerospace	AAEM
	Koelle Markus	AOA53		APCO Technologies S. A.	APCO
	Koppe Axel	AED312		Bieri Engineering B. V.	BIER
X	Kroeker Jürgen	AED65		BOC Edwards	BOCE
	Kunz Oliver Dr.	AOE22		Dutch Space Solar Arrays	DSSA
X	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	CASA
	Lang Jürgen	ASE442		EADS CASA Espacio	ECAS
	Langenstein Rolf	AED15		EADS Space Transportation	ASIP
X	Langfermann Michael	AOA51		Eurocopter	ECD
X	Mack Paul	OTN/AOA54		European Test Services	ETS
	Maute Thomas	AOA52		HTS AG Zürich	HTSZ
	Müller Jörg	AOA52		Linde	LIND
	Müller Martin	AOA53		Patria New Technologies Oy	PANT
	Müller Ralf	FAE22		Phoenix, Volkmarsen	PHOE
	Peltz Heinz-Willi	AOE13		Prototech AS	PROT
	Pietroboni Karin	AED65		QMC Instruments Ltd.	QMC
	Platzer Wilhelm	AED22		Rembe, Brilon	REMB
	Reichle Konrad	AOA52		Rosemount Aerospace GmbH	ROSE
	Reuß Friedhelm	AED62		RYMSA, Radiación y Microondas	RYM
	Rühe Wolfgang	AED6		SENER Ingenieria SA	SEN
x	Runge Axel	OTN/AOA54		Stöhr, Königsbrunn	STOE
	Sachsse Bernt	AED21		Terma A/S, Herlev	TER

V. Copy of the Test Change HP-2-ASED-SD-0058, issue 3

EADS Astrium	SHEET	HP-2-ASED-SD-0058	Page 1 of 18
HERSCHEL H-EPLM	UNELI	lss: 3	

Location :	OTN	Title: Localization	of Leaks in EQM PLM	
Facility :	Laboratory	Model: EQM	Subsystem: PLM EQM	Date: 04.10.05
		Test Conductor:	C. Schlosser	NCR Ref: n/a
CI No	151 000	Prepared By:	C. Schlosser	CIL No:

Scope:

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This procedure covers the activities to localize leaks of the He S/S vs. the isolation vacuum. The content of Helium inside the isolation vacuum has to be decreased to improve the performance of the SPIRE and PACS sorption coolers (see NCR ASED-NC-1513).

EGSE S/W reference and is	ssue	On-Board S/W reference and Issue					
n/a		n/a					
Facilities required:	EGSE: n/a MGSE: n/a Measurement equipme Consumables: glue R	ent: leak detector IV 691 A/B					
Personnel required:	2 AIT eng + crane ope	rator + PA					
Safety and Hazards:	Cold Helium gas evap plug is removed.	orating from He S/S when SV 121					
Constraints:	It must be ensured that decrease. The screws removed!	t the isolation vacuum does not of the filling port must not be					

	No:	Activity	Proc/Drg/Result	Responsible & sign off
	1.	Preparatory Activities	05.10.05	
	1.1	Prepare mass spectrometer: - Connect mass spectrometer and leak tester to SV 922 airlock	ок	
		 Start-up mass spectrometer and leak tester (valve to SV 922 airlock closed) 	ОК	
		 Close SV 922 Open valve from mass spectrometer to SV 922 airlock 	OK OK	
		 Close manual valve behind turbo pump Shut down turbo pump Berform a background leak rate measurement of the set. 	OK	۸٢.
		 Pendifinal background leak rate measurement of the set- up Not pressure in PLM Open SV 922 	5,6 x 10 ⁻⁹ mbarl/s 5,8 x 10 ⁻⁷ mbar 10:44	чсЦ
	1.2	Check background leak rate: – Note current leak rate	4,7 x 10 ⁻⁶ mbarl/s	dell
	1.3	Note current cryostat status: V 102, V 105, V 702 - closed V 104, V 502, V 512, V 701 - open SV 121 in safety position Pressure in AXT and OBA tubing: ~ 0.01 bar Pressure in HTT and shield tubing: ~ 1.0 bar Pressure in cryostat cover tubing: ~ 1.0 bar	OK OK OK P 701 = 0.01 bar P 0621 = 1024 mbar P cover = 958 mbar	lete
	1.4	Reduce pressure in the He S/S by removing the one-way valve	10:52	fell
y .	1.5	Close SV 121 and secure the plug	ОК	Idl
	2.	Leak rate measurement with OBA tubing excluded		

Release AIT:	Release SE:	Release PA/Spafety;	Sign off (PA/QC/Team Leader)
P. Mack	C. Schlosser	E. Lamprechtun	1. Jan

EADS Astrium
HERSCHEL H-EPLM

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No:	Activity	Proc/Drg/Result	Responsible & sign off
2.1	Close V 701	10:57	Sdf
2.2	Evacuate OBA tubing to P 512 < 1 mbar	ОК	Jchl
2.3	Wait 10 min and not leak rate and take a mass spectrum Note pressure in PLM	4,8 x 10 ⁻⁶ mbarl/s 6,6 x 10 ⁻⁷ mbar	Jde
3.	Leak rate measurement with OBA tubing, shield tubing and filling port interface excluded		
3.1	Close V 104 (observe HTT temperature at T 101 < 4.4 K)	ОК	dere
3.2	Close V 502	13:21	Ichl
3.3	Start laboratory pump in safety unit, open SV 121 and evacuate tubing and filling port interface until P 512 < 5 mbar	13:24	Jdfe
3.4	Wait 10 min and not leak rate and take a mass spectrum	4,45 x 10 ⁻⁶ mbarl/s	Jehl
3.5	If leak rate changes significant then further investigations at the filling port interface are necessary -> perform steps in section 8	NA	
4.	Leak rate measurement with OBA tubing, shield tubing, filling port interface and cover tube excluded		
4.1	Evacuate cover tube to P _{CCT} < 1 mbar	13:46	Jal
4.2	Wait 10 min and not leak rate and take a mass spectrum	4,55 x 10 ⁻⁶ mbarl/s	Ichl
5.	Leak rate measurement with OBA tubing, shield tubing, filling port interface, cover tube and AXT excluded		
5.1	Switch on heaters H 701 and H 702 with 10 W each	14:08	Ide
5.2	When P 701 ~ 1 bar: - Close inlet valve of He pumping unit I - Prepare by-pass to flow meter unit (do not open it!) - Open V 701	15:06 OK 15:08	Jehl
5.3	When P516 (at OBA ventline outlet) ~ 1 bar: — Open by pass at pumping unit	ок	Jah
5.4	Continue heating until AXT is empty and at 1 bar Note leak rate and take a mass spectrum	1,45 x 10 ⁻⁵ mbarl/s	left
5.5	Continue heating of AXT until T 708 > 20 K	ок	Jelf
5.6	Stop heaters H 701 and H 702	17:02	She
5.7	Close by pass and start pumping at AXT and OBA until pressure P516 < 1 mbar	ок	Jell
5.8	Wait 10 min and note leak rate	1,0 x 10 ⁻⁵ mbari/s	6Le
6.	Leak rate measurement with OBA tubing, shield tubing, filling port interface, cover tube, AXT and HTT excluded		
6.1	Open V 104	17:42	JM
6.2	Open V 502	17:27	JY
6.4	Switch on heaters H 101, H 102, H 103 and H 104 with 10 W each; stop one or more heaters when mass flow > 2 g/s	06.10.05 07:45	Jul
6.5	Deplete HTT and warm up HTT to T 103 > 20 K, but < 40 K	07.10.05 10:00	HI
6.7	Note leak rates (He ⁴ and He ³) and take mass spectrum	He^{3} : 1,6 x 10 ⁻⁸ mb/s He^{4} : 9 x 10 ⁻⁴ mbarl/s	Johl
6.8	Close and lock SV 121	10:30	lehl

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No:	Activity	Proc/Drg/Result	Responsible & sign off
6.9	Close V 502	10:33	JAN .
6.10	Open V 105 and evacuate HTT and tubing to P 512 < 1 mbar	Start: 10:34	Jell
6.11	Continue heating of HTT until T 103 > 30 K, but < 40 K Stop H 101 and H 102 -> observe tank temperatures	13:41	bl
6.12	Stop H 103 and H 104	13:48	Kll
6.13	Not leak rate when it has stabilized	08.10.05 16:07 1,7 x 10 ⁻⁸ mbarl/s repeated 24 h later: 2,3 x 10 ⁻⁸ mbarl/s	dell
7.	Leak rate measurement of filling port interface and shield tubing		
7.1	Close V 105	09.10.05 15:12	fel
7.2	Close V 104	ок	<i>kr</i>
7.3	Open SV 121 and flush filling port and tubing with He from dewar	ок	Jell
7.4	Wait 10 min and not leak rate	3,5 x 10 ⁻ mbarl/s (increasing)	Le
7.5	Close V 701 Open V 702 and flush the AXT with He from dewar	15:33	Jel (
7.6	Wait 10 min and not leak rate	9,0 x 10 ⁻⁵ mbarl/s (increasing)	Jell
7.7	Close V 702 and evacuate filling port and shield tubing	ок	Lell
7.8	Wait 10 min and not leak rate	6,0 x 10 ⁻⁶ mbarl/s (decreasing)	Jel
7.9	Open V 701 and evacuate AXT	ок	the
7.10	Wait 10 min and not leak rate	5,7 x 10 ⁻⁶ mbarl/s (decreasing as before)	14
7.11	Open V 102, open V 104 and flush the HTT with He from dewar	ок	July
7.12	Wait 10 min and not leak rate	1,9 x 10 ⁻⁶ mbarl/s (increasing)	fbl
7.13	Close V 105, open V 105 and evacuate filling port and shield tubing	ок	Ell
7.14	Wait 10 min and not leak rate	2,0 x 10 ⁻⁶ mbarl/s (increasing) repeated 15 h later: 1,7 x 10-5 mbarl/s (increasing)	, fu
7.15	Close V 105, open V 104 and flush filling port and shield tubing with He from HTT	10.10.05 08:56	Ill
7.16	Wait 10 min and not leak rate	2,7 x 10 ^{-∍} mbarl/s (increasing)	kh
7.17	Open V 502 (check that one way valve is installed	ок	Jel
8.	Sealing of filling port (activity to be released in telecon)	12.10.05	Jehl
8.1	Remove airlock - check that plug of SV 121 stays in place	ОК	Ill
8.2	Prepare plug for filling port tube	ОК	1,W

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No:	Activity	Proc/Drg/Result	Responsible & sign off
8.3	Remove plug of SV 121 and insert immediate plug for filling port tube - Attention : Cold Helium gas is evaporating the filling port!	ОК	del.
8.4	Remove pressure plate	ОК	410
		6,5 x 10 ⁻⁶ mbarl/s	104
8.5	Check the leak rate	(slowly decreasing)	Jar
8.6	volume to reduce Helium content around this interface	steps before	Idf.
8.7	Check leak rate	already covered by steps before	Sell
8.8	Remove the plastic foil	already covered by steps before	Jal
8.9	Seal filling port / CVV interface and screws of filling port with RTV 691 A/B	12.10.05	lohe
8.10	Check leak rate	step skipped	del
8.12	Repeat gluing and leak rate measurement if leak rate doesn't improve	n.a.	JUL
8.13	Mount pressure plate	OK	121
8.14	Remove plug of filling port tube and insert immediate plug of SV 121 Attention : Cold Helium gas is evaporating the filling port!	ОК	Idhl
8.15	Mount airlock	OK	[1]
8.16	Evacuate airlock and flush airlock with GHe 3 x	OK	Idl
8.17	Open SV 121	OK	Idl
8.18	Check leak rate	2,1 x 10 ⁻⁶ mbarl/s	Lehl
9.	Get cryostat back to IMT conditions with HTT evacuated (to isolate the HTT leak) and AXT filled at He II temperatures:		
9.1	Open V 102 and V 104 to cool down HTT to about 5 K	OK	LU
9.1	Close V 102 and V 502 Open V 701 to pump down AXT and HTT	OK	Ida
9.2	Close V 104 (HTT evacuated and isolated)	OK	Johl
9.3	Open V 702 and cool down AXT	OK	JUL
9.4	Fill AXT with LHe II	OK	Sche
9.5	Close V 105 and start He pump I to start He II production in AXT	OK	Jill
9.6	Open V 502 Set transfer line into filling airlock and open SV 121 to cool shields from external dewar (parallel to He II production in AXT)	ОК	felt
9.7	Final status to be reached:	0 16 bar	
	AXT partly filled with LHe II	OK	Ide
	Shield cooling provided by external dewar		

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Logsheet

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05 40 05 40 00	Others inlet we have a flock tester (LT)
05.10.05 10:38	Close milet valve of leak tester (LT)
	Open inlet value of mass spectrometer (MS)
	Take a mass spectrum (partial pressure):
	$He^4 = 3.2 \times 10^{-9} mbar$
	$He^3 = 4.0 \times 10^{-10} mbar$
	$N = 2.2 \times 10^5$ mbar
10:41	Close MS / open L1
	Note background leak rate: 4,7 x 10 mbarl/s
10:44	Open SV 922
10:40	Close LT / open MS
10.49	Tale a more coorting (partial process):
	Take a mass spectrum (partial pressure).
	$He^2 = 3.2 \times 10^{-10}$ mbar
	$He^{3} = 4.0 \times 10^{10} mbar$
	$N_2 = 2.5 \times 10^{-5}$ mbar
10.52	Close SV 121
10.02	
10:55	Close MS / open LT
40.57	
10:57	
11.07	Close LT / open MS
11.07	Take a mass spectrum (partial pressure):
]	late a mass spectrum (partial pressure).
	$He = 3.0 \times 10$ mba
	$He^{2} = 2.2 \times 10^{-2}$ mbar
	$N_2 = 2.3 \times 10^{\circ} \text{ mbar}$
	$p_{MS} = 4.3 \times 10^{-6} \text{ mbar}$
	$p_{\text{ind}} = 6.4 \times 10^{-7} \text{ mbar}$
	Close SV 922 for launch break
13:10	Re-open SV 922
13:21	Close V 502
13:22	Close V 104
13.24	Open SV 121 and evacuate tubing to HTT and through shields
13.24	
13:40	Open MS
	Take a mass spectrum (partial pressure):
	$He^4 = 3.1 \times 10^7 mbar$
	$H_0^3 = 1.2 \times 10^{-10} \text{ mbar}$
	$N_2 = 2,1 \times 10$ mbar
	$p_{MS} = 2.6 \times 10^{\circ}$ mbar
	$p_{isol} = 3.2 \times 10^{\circ} \text{ mbar}$
13:45	Close MS / open LT
13.46	Start evacuation of cover tube
13:59	Close LT / open MS
	Take a mass spectrum (partial pressure):
	$He^4 = 2.8 \times 10^{-7} mbar$
	$He^3 = 1.7 \times 10^{-10} mbar$
	$N = 2.1 \times 10^{-5}$ mbar
	$ \mathbf{v}_2 - \mathbf{z}_1 \mathbf{x} + \mathbf{U}$ (indefinition)
	$p_{MS} = 2,5 \times 10$ mbar
	pisol = 1,0 x 10 * mbar

Release AIT:	Release SE:	Release PA/Safety:	Sign off (PA/QC/Team Leader)
P. Mack	C. Schlosser	E. Lamprecht	

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14:03	Flush	ing cover tube with (GHe to 1 bar		·····			
14:07	Close	Close MS / open LT						
14:08	Start	H 701 and H 702 wit	th 10 W each					
15:06	Close	e inlet valve of He pu	mp l					
15:08	Open	i V 701						
15:15	15:15 Close LT / open MS Take a mass spectrum (partial pressure) - AXT at 4,2 K, 1 bar, OBA tube at 1 bar: $He^4 = 1,2 \times 10^{-6}$ mbar $He^3 = 2,2 \times 10^{-10}$ mbar $N_2 = 2,0 \times 10^{-5}$ mbar $p_{MS} = 2,0 \times 10^{-6}$ mbar							
15:24	Close	MS / open LT						
16:35	AXT Leak	empty; AXT and OB/ rate = 1,45 x 10 ⁻⁵ mt	A tubing at 1 bar barl/s					
16:37	Close Take He ⁴ = $He^3 =$ $N_2 = 2$ $p_{MS} =$	E LT / open MS a mass spectrum (p: 2,0 x 10 ⁻⁶ mbar 2,0 x 10 ⁻¹⁰ mbar 1,9 x 10 ⁻⁵ mbar 2,3 x 10 ⁻⁶ mbar	artial pressure):					
16:45	Close	MS / open LT						
16:50	Close Start	e by-pass at He pump pumping at AXT and	o I -> stop flow I OBA tubing	· · · · ·				
17:02	Switc	h off H 701 and H 70)2					
17:10	Close Take He ⁴ = $He^3 =$ $N_2 = 7$ $p_{MS} =$	e LT / open MS a mass spectrum (pa 5,3 x 10 ⁻⁷ mbar 1,2 x 10 ⁻¹⁰ mbar 1,9 x 10 ⁻⁵ mbar 2,1 x 10 ⁻⁶ mbar 1,5 x 10 ⁻⁶ mbar	artial pressure):					
17:17	Close	MS / open LT						
17:23	Close	SV 121						
17:24	Open	V 104 -> flush shield	d tubing					
17:27	Open	V 502 (one way valv	ve installed)					
17:31	Close Take He ⁴ = He ³ = N_2 = p_{MS} = p_{isol} =	LT / open MS a mass spectrum (pa $6,8 \times 10^{-7}$ mbar $3,2 \times 10^{-11}$ mbar $1,9 \times 10^{-5}$ mbar $2,1 \times 10^{-6}$ mbar $1,2 \times 10^{-6}$ mbar	artial pressure):					
17:33	Close	MS / open LT						
17:35	Start	H 101 with 10 W			<u></u>			
17:37	Close Close	SV 922 (for night br MS an <u>d LT</u>	eak)					

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	Start turbo pump
17:44	Open SV 922
06.10.05 7:45	Remove one-way valve Start H 102 with 10 W
10:38	Start H 103 with 10 W (5 W effective)
11:00	Start H 104 with 10 W (5 W effective)
18:15	Close backing valve of turbo pump Open valve to MS/LT at airlock Open LT -> perform leak test with warming up HTT at 1 bar: $q = 3 \times 10^{-4}$ mbarl/s
18:22	Close LT / open MS Take a mass spectrum (partial pressure) @ T 101 = 9.03 K; T 102 = 8.93 K; T 106 = 4.88 K $He^4 = 2,8 \times 10^{-5}$ mbar $He^3 = 3,7 \times 10^{-9}$ mbar $N_2 = 2,4 \times 10^{-5}$ mbar $p_{MS} = 1,0 \times 10^{-5}$ mbar $p_{isol} = 4,2 \times 10^{-5}$ mbar
18:25	Close valve to MS/LT at airlock
18:26	Close MS
18:28	Switch off H 101 and H 102
18:30	Install one-way valve
07.10.05 09:30	Perform background leak rate measurement of set-up (w/o airlock): He ⁴ : 2,0 x 10 ⁻⁹ mbarl/s He ³ : 2,0 x 10 ⁻⁸ mbarl/s
09:52	Close LT / open MS Take a mass spectrum (partial pressure) of set-up (w/o airlock): He ⁴ = 1,9 x 10 ⁻⁹ mbar He ³ = 1,5 x 10 ⁻¹⁰ mbar N ₂ = 2,0 x 10 ⁻⁵ mbar puts = 6.4 x 10 ⁻⁶ mbar
09:54	Close MS / open LT Close backing valve of turbo pump Stop turbo pump
09:57	Open valve at airlock to MS / LT
10:03	Open MS Take a mass spectrum (partial pressure) of set-up (with airlock): $He^4 = 6.5 \times 10^{-9}$ mbar $He^3 = 1.0 \times 10^{-10}$ mbar $N_2 = 2.0 \times 10^{-5}$ mbar $p_{MS} = 5.8 \times 10^{-6}$ mbar
10:07	Close MS / open LT Perform background leak rate measurement of set-up (with airlock): He ³ : 2,1 x 10 ⁸ mbarl/s
10:09	Open airlock
10:11	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 15 K, 1 bar $He^4 = 3,7 \times 10^5$ mbar $He^3 = 4,7 \times 10^5$ mbar $N_2 = 2,0 \times 10^5$ mbar $p_{MS} = 7,1 \times 10^6$ mbar $p_{isol} = 5,5 \times 10^5$ mbar Switch LT to He ⁴

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10:16	Close Perfo	e MS / open LT orm leak rate measur	ement: 8 x 10 ⁻⁴ m	barl/s increasing				
10:22	Close airlock Close valve to MS / LT at airlock Start turbo pump							
10:26	Open	Open airlock						
10:27	Start	H 101 and H 102 wit	th 10 W each					
10:30	Close	e SV 121						
10:33	Close	e V 502						
10:34	Open	ı V 105, start pumpin	g down HTT					
13:19	Close Close Stop	e airlock e backing valve of tur turbo pump	bo pump					
13:21	Open	valve at airlock to N	IS/LT					
13:25	Open	airlock						
13:41	Switc	h off H 101 and H 10)2					
13:42	Close Take He ⁴ = He ³ = N_2 = p_{MS} = p_{isol} = P 516	a T / open MS a mass spectrum (p: $1,1 \times 10^{-7}$ mbar $1,0 \times 10^{-10}$ mbar $1,6 \times 10^{-5}$ mbar $1,9 \times 10^{-6}$ mbar $3,8 \times 10^{-5}$ mbar 3,000000000000000000000000000000000000	artial pressure) @) HTT at ~ 30 К, р _{нтт} < 100 г	nbar			
13:48	Switc	h off H 103 and H 10)4					
13:53	Close	MS / open LT	- Weg					
14:27	Close Take He ⁴ = $He^3 =$ $N_2 = 2$ $p_{MS} =$ $p_{irol} =$	e LT / open MS a mass spectrum (pa 1,3 x 10 ⁻⁷ mbar 1,0 x 10 ⁻¹⁰ mbar 1,5 x 10 ⁻⁵ mbar 1,8 x 10 ⁻⁶ mbar 3,9 x 10 ⁻⁷ mbar	artial pressure) @	9 HTT at ~ 30 K, p _{HTT} < 50 m	bar			
14:45	Close	MS / open LT rate: 2,5 x 10 ⁻⁶ mbar	l/s					
15:16	Leak	rate: 2,4 x 10 ⁻⁶ mbar	l/s					
15:17	Close Take He ⁴ = $He^3 =$ $N_2 =$ $p_{MS} =$ $p_{isol} =$	e LT / open MS a mass spectrum (pa 1,2 x 10 ⁻⁷ mbar 1,0 x 10 ⁻⁵ mbar 1,9 x 10 ⁻⁶ mbar 3,2 x 10 ⁻⁷ mbar	artial pressure) @) HTT at ~ 30 K, р _{нтт} < 50 m	bar			
15:20	Close Close	e airlock e valve to MS / LT at backing valve of tur	airlock bo and start turbo					
15:24	Open	airlock						
08.10.05 15:36	Close Open Perfo	airlock, close backir valve at airlock to M rm leak test of set-up	ng valve of turbo j IS / LT p and airlock: 3.5	oump, shut down turbo pump x 10 ⁻⁹ mbarl/s)			

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15:50	Close	ET/open MS		<u> </u>		
10.00	Take	a mass spectrum (p	artial pressure) of	set-up (with airlock):		
	He ⁴ =	= 2,4 x 10 ⁻⁹ mbar				
	$He = N_0 = 1$	= 1,8 x 10 mbar 2 2 x 10 ⁻⁵ mbar				
	p _{MS} =	7,5 x 10 ⁻⁶ mbar				
15:53	Close	e MS / open LT				
15:55	Oper Leak	n airlock rate: 1,3 x 10 ⁻⁸ mbai	rl/s (slowly increasi	ng)		
15:58	Close	ELT / open MS				
	Take	a mass spectrum (p - 2.0 × 10 ⁻⁹ mbar	artial pressure) @	H at ~ 35 K, $p_{HTT} < 1 mba$	ar	
	$He^3 =$	= 1.9 x 10 ⁻¹⁰ mbar				
	N ₂ =	1,7 x 10 ⁻⁵ mbar				
	р _{мs} =	4,1 x 10 ^{-°} mbar				
16:01	p _{isol} =	MS/open IT				
10.01	0.030					
16:07	Leak	rate: 1,7 x 10 ⁻⁸ mbai	l/s (slowly increasi	ng)		
16:08	Close	e airlock e valve at airlock to N	/IS / LT, open back	ng valve of turbo pump, sta	rt-up turbo pump	
16:24	Open	airlock	· • •		• • • •	
09.10.05 14:40	Close	airlock, close backi	ng valve of turbo p	ump, shut down turbo pump		
	Open	valve at airlock to N	IS/LT	49		
44.50	Perfo	rm leak test of set-u	p and airlock: 3.6 x	10° mbari/s		
14:53	Take	a mass spectrum (p	artial pressure) of s	et-up (with airlock):		
	He ⁴ =	2,4 x 10 ⁹ mbar				
	He ³ =	2,0 x 10 ⁻¹⁰ mbar				
	$N_2 = 1$	2,1 x 10 ° mbar 8.0 x 10 ⁻⁶ mbar				
15:00		MS / open LT				
					<u></u> <u>.</u>	
15:03	Open	airlock	lle (elewly increasi	29)		
15:05	Close	Tate. 1,9 x 10 mbar	1/5 (SIOWIY INCLEASIN	<u>ig</u>)		
10.00	Take	a mass spectrum (p	artial pressure) @	HTT at ~ 39 K, p _{HTT} < 1 mba	ar	
	He ⁴ =	$He_{1}^{4} = 2,5 \times 10^{9} mbar$				
	He [°] =	1,5 x 10 ^{°°} mbar 7 x 10 ⁻⁵ mbar				
	$D_{MS} =$	4.8 x 10 ⁻⁶ mbar				
	$p_{isol} =$	1,3 x 10 ⁻⁶ mbar	<u></u>	· • • • • • • • • • • • • • • • • • • •		
15:09	Close	MS / open LT				
15:11	Leak	rate: 2,3 x 10 ⁻⁸ mbar	l/s (slowly increasi	ng)		
15:12	Close	V 104				
15:19	Open	SV 121 -> flush fillin	ig port and shield to	ubing with He from dewar to	1 bar	
15:24	Perfo	rm leak test of filling 10 ⁻⁶ mbarl/s (increas	port and shield tub	ing (all other components e	vacuated):	
15:25	Close	LT / open MS				
	Take	a mass spectrum (p	artial pressure) of f	illing port and shield tubing		
	He [*] =	1,1 x 10 ⁻¹ mbar (inc	reasing)			
	$ \mathbf{N}_{2} = 1$	$1.6 \times 10^{-5} \text{ mbar}$				
	р _{мз} =	3,3 x 10 ⁻⁶ mbar				
	p _{isol} =	1,6 x 10 ⁻⁶ mbar				

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15:30	Close MS / open LT Repeat leak test: 3.5 x 10 ⁻⁶ mbarl/s (increasing)							
15:33	Close	Close V 701 Open V 702 -> flush AXT with GHe from dewar						
15:47	Perfo	rm leak test of AXT,fil 10 ⁻⁶ mbarl/s (increasi	lling port and shi	eld tubing (all other compone	ents evacuated):			
15:49	Close Take	ELT / open MS a mass spectrum (pa	rtial pressure) of	AXT, filling port and shield t	ubing			
	He ⁴ =	= 3,8 x 10 ⁻⁷ mbar (incr = 1,0 x 10 ⁻¹⁰ mbar	easing)					
	N ₂ =	1,6 x 10 ⁻⁵ mbar 2 8 x 10 ⁻⁶ mbar						
	p _{isol} =	3,5 x 10 ⁻⁷ mbar						
15:54	Close	MS / open LT at leak test: 9,0 x 10 ^{-e}	mbarl/s (increas	sing)				
15:56	Close	e V 702 uate filling port and sh	nield tubing with I	aboratory pump in safety un	it (AXT at 1 bar)			
16:35	Perfo	rm leak test of AXT (a x 10 ⁻⁶ mbarl/s (decrea	all other compone	ents evacuated - filling port -	~10 mbar):			
16:37	Close	+ LT / open MS						
	Take	a mass spectrum (pa	rtial pressure) of	AXT				
	He'=	3,1 X 10° mbar 1 0 x 10 ⁻¹⁰ mbar						
	$N_0 = 1$	1.5 x 10 ⁻⁵ mbar						
	р _{мз} =	2,3 x 10 ⁻⁶ mbar						
	p _{isol} =	3,2 x 10 ⁻⁶ mbar						
16:44	Close	MS / open LT		- ! }				
	Repe	at leak test: 6,0 x 10°	mbarl/s (decrea	sing)				
16:48	Open		AA I					
16:54	Perfo 5,7 x	rm leak test: 10 ⁻⁶ mbarl/s (decreas	ing - behaviour a	as with filled AXT -> no signif	ficant leak at AXT)			
16:57	Stop Flush	pumping at filling port filling port and shield	tubing with He fi	rom dewar				
16:58	Note 6,0 x	leak rate: <u>10⁻⁶ mbarl/s (increasi</u> i	ng again)	- 10 t				
17:00	Open Open	V 102 V 104 -> flush HTT w	vith He from dew	ar				
17:32	Close	V 102						
17:37	Close	SV 121						
17:39	Perfo 1,7 x	rm leak test of HTT, fi 10 ⁻⁵ mbarl/s (increasi	illing port and sh ng)	ield tubinng (all other compo	nents evacuated):			
17:40	Close	LT / open MS						
	Take	a mass spectrum (pa	rtial pressure) of	AXI				
	не – Не ³ =	1.0×10^{-10} mbar	easing)					
	$N_2 = 1$	1,3 x 10 ⁻⁵ mbar						
	p _{MS} =	2,2 x 10 ⁻⁶ mbar						
	p _{isol} =	3,1 x 10° mbar						
17:44	Close Repe	at leak test: 1,9 x 10 ⁻⁵	mbarl/s (increas	sing)				
17:45	Close	V 104 V 105 -> evecuate fil	ling port and shie	eld tubing				
1748	Perfo	rm leak test of HTT fi	lling port and shi	eld tubing (all other compo	nents evacuated):			
17:40	1,9 x	10 ⁻⁵ mbarl/s						
17.49	Take	a mass spectrum (na	rtial pressure) of	AXT				
	He ⁴ =	9,6 x 10 ⁻⁷ mbar (incre	easing)					
	He ³ =	1,0 x 10 ⁻¹⁰ mbar						
	N ₂ = '	1,4 x 10 ^{-°} mbar						

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······								
	P _{MS} =	[:] 2,1 x 10 ⁻⁶ mbar : 3,3 x 10 ⁻⁶ mbar						
17:52	Close	Close MS / open LT Repeat leak test: 2,0 x 10 ⁻⁵ mbarl/s (slowly increasing)						
17:56	Close	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump						
18:01	Oper	ı airlock						
10.10.05 07:43	Close Oper Perfo	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 5.0 x 10 ⁻⁹ mbarl/s						
07:55	Oper Leak	i airlock rate: 4,1 x 10 ⁻⁶ mbar	l/s (increasing)					
08:46	Close LT / open MS Take a mass spectrum (partial pressure) of HTT (~1,15 bar), all other items are evacuated $He^4 = 6.6 \times 10^{-7}$ mbar (increasing) $He^3 = 1.0 \times 10^{-10}$ mbar $N_2 = 1.4 \times 10^{-5}$ mbar $p_{MS} = 2.6 \times 10^{-6}$ mbar							
08:53	Close	MS / open LT						
08:55	Perfo 1,7 x	rm leak test of HTT (10 ⁻⁵ mbarl/s (slowly i	all other compone ncreasing)	ents evacuated):				
08:56	Close	→ V 105 V 104 and flush fillin	g port and shield	tubing with He from HTT				
09:21	Perfo 2,7 x	rm leak test of HTT, 10 ⁻⁵ mbarl/s	filling port and sh	ield tubing (all other compon	ents evacuated):			
09:23	Close Take He ⁴ = He ³ = N_2 = p_{MS} = p_{isol} =	ET / open MS a mass spectrum (pa 1,2 x 10 ⁻⁶ mbar (incr 1,0 x 10 ⁻¹⁰ mbar 1,4 x 10 ⁻⁵ mbar 2,2 x 10 ⁻⁶ mbar 4,7 x 10 ⁻⁶ mbar	artial pressure) of easing)	HTT, filling port and shield t	ubing			
09:33	Close Repe	MS / open LT at leak test: 2,9 x 10 ⁻¹	⁵ mbarl/s (slowly	increasing)				
09:59	Close Take He ⁴ = He ³ = N_2 = P_{MS} = p_{isol} =	LT / open MS a mass spectrum (pa $1,7 \times 10^{-6}$ mbar (incr $2,0 \times 10^{-10}$ mbar $1,6 \times 10^{-5}$ mbar $1,9 \times 10^{-6}$ mbar $5,3 \times 10^{-6}$ mbar	artial pressure) of easing)	HTT, filling port and shield t	ubing			
10:22	Close	MS / open LT						
10:27	Open	V 502 (one way valv	e installed)					
10:29	Repe	at leak test: 3,8 x 10 ⁻¹	⁵ mbari/s (slowly i	increasing)				
17:30	Repe	at leak test: 7,7 x 10 ⁻¹	⁵ mbarl/s (consta	nt)				
17:40	Close Close	airlock valve at airlock to M	S / LT, open back	king valve of turbo pump, sta	rt-up turbo pump			
17:48	Open	airlock						
11.10.05 09:39	Close	≥ V 502						
09:43	Move Close	transfer line to upper SV 121	r position					
09:45	Open	V 105 -> start evacu	ating HTT					

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	_					
13:10	Close	e airlock, close backir	ng valve of turbo j	oump, shut down turbo pump	0	
	Oper	valve at airlock to M	S/LI sand side ski 2.0	× 10 ⁻⁹ mborl/a		
40.40	Репо	rm leak test of set-up	and alnock: 3,9			
13:16		a mass spectrum (ni	artial pressure) of	HTT (~1 15 bar) all other it	ems are evacuated	
	$\square \square \square \square \square 4$	-1.0×10^9 mbar (incl	artiar pressure) or reasing)	TTTT (-1, 10 bar), an other it		
	$He^3 =$: 1.0 x 10 ⁻¹⁰ mhar	reasing)			
	$N_2 =$	1.7 x 10 ⁻⁵ mbar				
	D _{MS} =	4.7 x 10 ⁻⁶ mbar				
13:18	Close	MS / open LT				
13:21	Oper	airlock				
u	Leak	rate: 1,4 x 10" mbar	l/s (slowly increas	ing)		
13:32	Close	e LT / open MS		UTT (. 4.45 hor) all other it	ama ara avaquatad	
	l ake	a mass spectrum (pa	artial pressure) or	HTT (~1, 15 bar), all other it	ems are evacuated	
	He'=	6,5 x 10 ⁻¹⁰ mbar (inci	reasing)			
	He =	1,0 X 10 mbar 4 4 x 10 ⁻⁵ mbor				
	N ₂	$1,4 \times 10^{-6}$ mbar				
	PMS -	-2.7×10^{-7} mbar				
14:30		MS/open LT			1	
14.00	Leak	rate: 2.4 x 10 ⁻⁷ mbarl	l/s (slowly increas	ina)		
14:32	Close	airlock	<u> </u>			
	Close	valve at airlock to M	IS / LT, open bacl	king valve of turbo pump, sta	art-up turbo pump	
14:40	Open	airlock				
	•					
12.10.05 07:43	Close	airlock, close backir	ng valve of turbo p	pump, shut down turbo pump)	
	Open valve at airlock to MS / LT					
	Perfo	rm leak test of set-up	and airlock: 4,2	x 10 ^{-s} mbarl/s		
07:50	Open	airlock				
08:47	Leak	rate: 4,5 x 10 ⁻⁸ mbarl	/s (slowly increas	ing)		
08:48	Close	ELT / open MS				
	Take	a mass spectrum (pa	artial pressure) He	e S/S evacuated		
	He ⁴ =	2,6 x 10 ⁻⁹ mbar				
	He ³ =	- 1,0 x 10 ^{_10} mbar				
	N ₂ =	1,5 x 10 ^{-°} mbar				
	p _{MS} =	2,4 x 10 ^{°°} mbar				
	p _{isol} =	<u>1,7 x 10°° mbar</u>				
08:55	Close	MS / open LT	/a (alauth :)/	ing)		
	Leak	rate: 4,7 x 10 mbari	is (slowly increas	ing)		
08:56		9 V 104				
00.00	Onen	SV 121 -> flush fillin	g port and shield	tubing with Helium from dew	ar to 1 bar	
09.00			y port and onloid			
	Leak	rate: 6,8 x 10 ⁻⁶ mbarl	/s (increasing)			
09:25	Remo	ve airlock	<u>.</u>		_ • w•	
	Remo	ove SV 121 plug; inst	all dummy plug in	filling port		
	Remo	ve pressure plate				
09:30	Leak	rate: 6,5 x 10 ⁻⁶ mbarl	/s (slowly decreas	sing)		
09:30	Close	LI / open MS	untial processions) -f	filling port and chield tubica	airlock and	
	Take	a mass spectrum (pa	aruai pressure) or	ming port and shield tubing	, allock and	
	press	ure plate removed, a	ii other items are	Evacualeu		
		2,0 X IU MDAF				
		1 / v 10 ⁻⁵ mbor				
	1N2 -	20 x 10 ⁻⁶ mber				
	РМS —	2.0 x 10 mbar 2.8 x 10 ⁻⁶ mbar				
1	i Misol 🗌	z,o x io inbai				

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09.35	Close	MS/openLT					
	Leak	rate: 6,0 x 10 ⁻⁶ mbar	/s (slowly decrea	sing)			
	Rewo	ork at filling port / CV	/ interface with g	lueing using RTV 691 A/B			
15:32	Leak	rate: 2,3 x 10 ⁻⁶ mbar	/s (constant)				
15:33	Close	ELT / open MS		Filling next and shield tubing			
	l ake	a mass spectrum (pa sure plate removed, a	Il other items are	evacuated - after rework	, allock and		
	He ⁴ =	= 1,1 x 10 ⁻⁷ mbar					
	He [°] =	= 1,0 x 10 ^{-7°} mbar 1 8 x 10 ⁻⁵ mbar					
	D _{MS} =	$1,4 \times 10^{-6} \text{ mbar}$					
	p _{isol} =	4,8 x 10 ⁻⁶ mbar					
15:45		e MS / open LT _rate: 2.1 x 10 ⁻⁶ mbarl	//e				
15:48	Close	airlock					
,,,,,,,	Close	e valve at airlock to M	S / LT, open bac	king valve of turbo pump, sta	art-up turbo pump		
15:53	Oper	airlock					
13.10.05 07:41	Close	e airlock, close backir	ng valve of turbo	pump, shut down turbo pum	p		
	Open	valve at airlock to M	S / LT and airlock: 5 x	10 ⁻⁹ mbarl/s			
08.00	Oper	n airlock	and allock. 5 x				
	Leak	rate: 6,9 x 10 ⁻⁷ mbarl	/s (increasing)				
09:14	Leak	rate: 2,2 x 10 ⁻ ° mbarl	/s				
09:18	Close	ET / open MS	74 -				
	Take	a mass spectrum (pa	artial pressure) H	e S/S evacuated			
	$ \text{He}^{3} = 9.2 \times 10^{\circ} \text{ mbar}$						
	$N_2 = 2$	2,0 x 10 ⁻⁵ mbar					
	p _{MS} =	4,7 x 10 ⁻⁶ mbar					
00:31	p _{isol} =	MS/open LT		······································			
09.01	Leak	rate: 2,2 x 10 ⁻⁶ mbarl	/s		• •		
	Re-m	ount pressure plate					
	Re-m	iount airlock Il transfer line					
	Evac	uate/flush airlock and	transfer line 3 x				
	Evac	uate airlock and trans	fer line (laborato	ry pump still pumping)			
11:20	Open	ISV 121 -> evacuate	mung port and sr	neid tubing with laboratory p	unp		
11:35	Flush	filling port and airloc	k with Helium from	m dewar			
12.00	Evac	uate / flush with Heliu rate: 3.2 x 10 ⁻⁶ mbarl	ini 3 x /s at the end of e	vacuation cvcle (tubing, fillin	g port and airlock		
12.00	evaci	uated)_					
12:00	Close	ELT / open MS	17 I	the and of exception evolution	Aubing filling port		
	Take	a mass spectrum (pa pidock evacuated)	artial pressure) at	t the end of evacuation cycle	e (tubing, ming port		
	He ⁴ =	$= 1,1 \times 10^{-7}$ mbar					
	He ³ =	= 1,0 x 10 ⁻¹⁰ mbar					
	N ₂ =	1,8 X 10 ⁻⁶ mbar 2 1 x 10 ⁻⁶ mbar					
	p _{isol} =	1,5 x 10 ⁻⁵ mbar					
12:03	Close	MS / open LT			a nort and airlast		
	Leak	rate: 3,1 x 10 mbarl	is at the end of e	vacuation cycle (tubing, fillin	ig port and almock		
12:05	Flush	shield tubing, filling	port and airlock w	vith He from dewar			
12:09	l pak	rate: 3.2 x 10 ⁻⁶ mbarl	/s at the end of e	vacuation cycle (tubing fillin	o port and airlock		
12:08	flush	ed)		resolution sysic (tabing, iiiii			

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12:09	Close Take and a	e LT / open MS a mass spectrum (pa iirlock flushed)	artial pressure) a	t the end of evacuation cycle	e (tubing, filling port
	He [*] = He ³ =	= 1,2 x 10 ⁻¹ mbar = 1,0 x 10 ⁻¹⁰ mbar			
	N ₂ =	2,0 x 10 ⁻⁶ mbar			
12:12	Close	MS / open LT rate: 3.2 x 10 ⁻⁶ mbarl	/s		
14:44	Repe	at leak rate measure	ment: 4,1 x 10 ⁻⁶ r	nbarl/s	
14:44	Close	ELT / open MS	artial pressure) at	the end of evacuation cycle	(tubina, fillina port
	and a	irlock flushed) 1,7 x 10 ⁻⁷ mbar		· · · · · · · · · · · · · · · · · · ·	(
	He ³ = N ₂ = 2	1,0 x 10 ⁻¹⁰ mbar 2,4 x 10 ⁻⁵ mbar			
	p _{MS} =	2,1 x 10 ⁻⁶ mbar 1.9 x 10 ⁻⁵ mbar			
14.52	Close	MS / open LT rate: 3.2 x 10 ⁻⁶ mbarl	/s		4 - ⁴⁰
14:55	Open	transfer line valve ar	nd insert transfer	line completely and move it	back by ~ 20 mm
15:10	Open Remo Mass	V 502 ove one way valve -> flow increases to ~ 0	start cooling dow	n shields (HTT still closed a	nd evacuated)
15:42	Repe	at leak rate measure	ment: 4,1 x 10 ⁻⁶ r	nbarl/s	
15:42	Close Take and a He ⁴ = He ³ =	LT / open MS a mass spectrum (pa irlock flushed) 1,6 x 10 ⁻⁷ mbar 1.0 x 10 ⁻¹⁰ mbar	artial pressure) al	the end of evacuation cycle	(tubing, filling port
	$N_2 = 2$ $p_{MS} = 2$ $p_{isol} = 2$	$1,3 \times 10^{-5}$ mbar 1,2 x 10 ⁻⁶ mbar 6.4 x 10 ⁻⁷ mbar			
15:53	Close	MS / open LT rate: 3.9 x 10 ⁻⁶ mbarl	/s		
17:10	Repe	at leak rate measurer	ment: 4,7 x 10 ⁻⁶ r	nbarl/s	
17:10	Close Take and a He ⁴ = He ³ =	LT / open MS a mass spectrum (pa irlock flushed) $1,9 \times 10^{-7}$ mbar $1,0 \times 10^{-10}$ mbar	artial pressure) at	the end of evacuation cycle	(tubing, filling port
	$P_{MS} = 1$	1,5 x 10 ⁻⁶ mbar 5 5 x 10 ⁻⁶ mbar			
17:15		MS / open LT			· · · · · · · · · · · · · · · · · · ·
17:17	Open	V 102	<u> </u>		
17:27	Open	V104 when P 101 >	0,95 bar -> cool o	down of HTT to 4.2 K to activ	ate adsorbers
17:40	No flo Close	w when inserting the V 104 VH 104	transfer line com	pletely -> V 104 frozen?	
18:02	Open Stop	V 104 /H 104 -> mass flow	increases -> bloo	ckage removed	
18:23	Close	LT / open MS a mass spectrum (pa	irtial pressure) w	th HTT, filling port, shield tul	oing and airlock

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	flush	ed with Helium, HTT	at 48 K		
	He [*] =	= 5,8 x 10 ⁻ mbar			
	He [°] =	= 1,0 x 10 ⁻¹⁰ mbar			
	$N_2 = 1$	2,4 x 10 ^{°°} mbar			
	P _{MS} =	= 1,8 x 10° mbar			
	p _{isol} =	<u>= 1,8 x 10[~] mbar</u>			
18:30	Close	e MS / open LT			
	Leak	rate: 1,5 x 10° mbar	1/s		
	Insta	ll 76 mbar overpressi	ure valve at dewa	r and keep small Helium flow	v from dewar through
	HTT	running over night			
	Insta	ll one way valve			
18:36	Close	e airlock		time unly of turbo numon of	art un turba numa
	Close	e valve at airlock to iv	157LT, open baci	king valve of turbo pump, sta	an-up turbo pump
18:41	Open	alliock			
					
14:10:05 07:15	Remo	ove one-way valve			
	Incre	ase dewar pressure	a valvo of turbo t	ump, shut down turbo pura	
07:32	Close	e alflock, close backli	ig valve or turbo p ic / i T	bump, shut down turbo pump	J
	Dorfo	rm look tost of set u	n and airlock: 5 v	10 ⁻⁹ mbarl/s	
07.44	Perio	nin leak lest of set-up			
07:41	Open	rato: 5 8 x 10 ⁻⁶ mbar	l/e (increasing)		
07.57	Clear	Tale. 5,6 X TO TIDA	is (increasing)		
07.57		a mass spectrum (n	artial proceure) wi	th HTT filling port shield tul	hing and airlock
	fluch	a mass spectrum (p	atuai pressure) wi st 48 K	artititi, ining port, sincia ta	ong and amoon
		-2.1×10^{-7} mbar			
		- 2, 1 X 10 1100 - 1 0 x 10 ⁻¹⁰ mbar			
	N. =	1 1 v 10 ⁻⁵ mhar			
	n=	2.0×10^{-6} mbar			
		7.6 x 10 ⁻⁷ mbar			
08.07		MS/openIT	<u>.</u> ,		
00.07	Leak	rate: 7.8 x 10 ⁻⁶ mbar	i/s		
08:32	Close	e V 104	· · · · ·		- W 2" .
	Heat	V 104 to 90 K			
08:42	Open	V 104			
16:48	Close	ELT / open MS			
	Take	a mass spectrum (pa	artial pressure) wi	th HTT, filling port, shield tul	oing and airlock
	flushe	ed with Helium, HTT	at 20 K		
	He⁴ =	: 1,7 x 10 ⁻⁶ mbar			
	He ³ =	= 1,0 x 10 ^{_10} mbar			
	$N_2 = 1$	1,3 x 10 ⁻⁵ mbar			
	р _{мs} =	1,4 x 10 [°] mbar			
	p _{isol} ≕	4,2 x 10 ^{°°} mbar	,		
16:55	Close	e MS / open LT			
	Leak	rate: 4,2 x 10° mbar	l/s		()
17:50	Leak	rate starts to decreas	se slowly at a H I	I temperature of ~12 K (both	om paπ)
	q _{max} =	= 4,85 x 10° mbarl/s			
17:53	Close	ELT / open MS			sing and airlack
	Take	a mass spectrum (pa	artiai pressure) wi	to HTT, filling port, shield tur	bing and alnock
			at 12 K		
	He =	1,6 x 10 mbar			
	He ⁻ =				
	$ N_2 = '$	I, IXIU MDar 1 G v 10 ⁻⁶ mbor			
	PMS =	1,0 X IU IIIDal A 6 x 10 ⁻⁶ mbor			
40.00			· · ·		
10:00		rate: 3.0 v 10 ⁻⁵ mbor	l/s		
10.01		at leak rate measure	ment: 2.2 v 10 ⁻⁶ m	harl/s	
10.31	Rehe	at lean rate measure		1561 / C	
18:31	Close	LT / open MS			
	Take	a mass spectrum (pa	artial pressure) wi	th HTT, filling port, shield tul	oing and airlock
	flushe	ed with Helium, HTT :	at7K		

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					· · · · · · · · · · · · · · · · · · ·		
	He⁴ =	= 6,3 x 10 ⁻⁸ mbar (dec	creasing)				
	He ³ =	= 1,0 x 10 ⁻¹⁰ mbar					
	N ₂ =	1,1 x 10 ⁻⁵ mbar					
	р _{мs} =	: 1,2 x 10 ⁻ , mbar					
	p _{isol} =	: 1,5 x 10" mbar					
18:36	Close	e MS / open LT					
	Leak	rate: 1,5 x 10° mbar	l/s				
18:38	Close	e V 701					
40.44	Oper	V 102 -> TIUSH AX I	With Hellum from	dewar	·· · · · · · · · · · · · · · · ·		
18:41	Open		20,95 Dai				
18:45	Close	V 102 -> speed up (
10.45	Ciuse	e v 102 -> speed up					
18:59	Open	V 102					
10.00	Opo.						
19:00	Close	V 702					
	Insta	l one way valve					
			<u>_</u>	×			
19:06	Repe	at leak rate measure	ment: 1,6 x 10 ⁻ n	nbarl/s			
19:06	Close	e LT / open MS		the later filling mant shield to b	ting and sideals		
	Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock						
	flushe	ed with Hellum, HIII	atok				
	$He^{3} = 6.2 \times 10^{-9} \text{ mbar}$						
	$ He^{- \mp 3}, 0 \times 10^{-5}$ mbar						
	$D_{MS} = 1.3 \times 10^{-6} \text{ mbar}$						
		1.5×10^{-7} mbar					
19:10	Close	MS / open LT					
	Leak	rate: 1,8 x 10 ⁻⁶ mbar	l/s				
19:12	Close	airlock					
	Close	valve at airlock to M	IS / LT, open back	<u>king valve of turbo pump, sta</u>	rt-up turbo pump		
19:17	Open	airlock					
15:10:05 18:00	Close	airlock, close backir	ng valve of turbo p	oump, shut down turbo pump			
	Den valve at almock to MS / L I Perform leak test of set-up and airlock: 3.2 x 10 ⁻⁹ mbarl/s						
19:06	Open	airlock	Janu anock. 3,2 /				
10.00	l Leek	rate: 6.0 x 10 ⁻⁶ mharl	l/s (increasing)				
18.18	Close	TT/open MS					
10.10	Take	a mass spectrum (pa	artial pressure) wi	th HTT. filling port. shield tub	ing and airlock		
	flushe	d with Helium, HTT	at 13 K		0		
	He ⁴ =	4,1 x 10 ⁻⁷ mbar					
	He ³ =	1,0 x 10 ⁻¹⁰ mbar					
	$N_2 = 1,1 \times 10^{-5} \text{ mbar}$						
	p _{мs} =	3,1 x 10 ⁻ mbar					
	p _{isol} =	1,4 x 10 ^{-o} mbar		·			
18:25	Close	MS / open LT					
	Leak	rate: 7,8 x 10 mbarl	/S				
		NIS and LI					
		: dillOUK Valvo at airlock to M	S/IT				
	Instal	l line to MS / I T hetw	een electrical and	I manual backing valve of tu	bo pump		
18:55	Close	SV 121	- sit elevenour une				
10.00							
	Open	backing valve of turk	o pump		·		
	Close	manual backing valv	ve of turbo pump				
	Open	valve to MS / LT		<u>^</u>			
	Perfo	rm background meas	surement: 5,3 x 10)" mbarl/s	- 1		
19:07	Start-	up turbo pump		9			
	Perfo	rm background meas	surement: 4,6 x 10) [~] mbarl/s			

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HERSCHEL H-E	EPLM			Iss: 2	
40:42		oideek			
19:13	leak	rate [,] 1 1 x 10 ⁻⁴ mbari	l/s (decreasing)		
19:23	Close	e V 102	"o (ucorodonig)		·····
10:24	Close				
19.24		a mass spectrum (pa	artial pressure) w	ith HTT, filling port, shield tu	oing and airlock
	flushe	ed with Helium, HTT	at 13 K		
	He ⁴ =	$2,2 \times 10^{-6}$ mbar			
	He [°] =	: 7 x 10 '° mbar			
	$1N_2 = 4$	1.5 x 10 ⁻⁵ mbar			
	p _{isol} =	4,3 x 10 ⁻⁸ mbar			
19:29	Close	MS / open LT			
40.00	Leak	rate: 0,9 x 10 ⁻⁺ mbarl	/s		
19:33		valve to MS / L I			
17.10.05			· · · · · · · · · · · · · · · · · · ·		
09:50	Open	SV 121		<u> </u>	
	Open	V 102 -> restart cool	I down of HTT		
11:20	Close	valve at transfer line)		
	Close	e SV 121			
	Close	V 102 V 502			
11:30	Open	V 701 -> start pump	down of AXT and	TTH	
	Leak	rate: 4 x 10 ⁻⁶ mbarl/s	un,		
18 10 05	Close	valve to fore nump			
	Open	valve to MS / LT			
	Leak	rate: 5,4 x 10 ⁻⁵ mbarl	/s		
	Close	LT / open MS			4 7 17
		a mass spectrum (pa	artial pressure) wi	IN He S/S evacuated, HTT a	17 K
	$He^3 =$	1 x 10 ⁻⁹ mbar			
	N ₂ = 1	l,9 x 10 ⁻⁵ mbar			
	p _{MS} =	7,7 x 10 ⁻⁶ mbar			
00.00	p _{isol} =	$4,3 \times 10^{\circ}$ mbar (mea	asurement behind r	l turbo pump)	
08:30	Close	V 104 -> isolate H 11			
08:40	Open	SV 121		\\#*#\\	
	Close	V 105 -> flush tubing	and filling port		
08:50		transfer line			
	Open	V 102 V 105 -> flush AXT			
08:52	Open	V 502 -> cool down a	and fill AXT		
08:54	Take	a mass spectrum (pa	irtial pressure) wi	th filling port, shield tubing a	nd AXT flushed
00.04	HTT	at 7 K, AXT at 50 K		an ninig port, onloid taonig a	iarott nacioa,
	He ⁴ =	6,8 x 10 ⁻⁶ mbar			
	He ³ =	1,1 x 10 ⁻⁹ mbar			
	$ N_2 = 1$,4 x 10 ° mbar			
	PMS =	3,3 x 10 mbar 4,3 x 10 ⁻⁸ mbar (mea	surement behind	turbo pump)	
08:56	Close	MS / open LT		1 1/ ··································	
	Leak	rate: 3,4 x 10 ⁻⁴ mbarl/	/s		
13:45	Close	V 105 V 701 -> cool AVT ⊮			
14.20	Open	<u>v 701 -2 000 AAT VI</u> V 105		<u> </u>	
17.20	Open	by pass at He pump	I> start filling of	AXT	
15:55	End o	f dewar			
	Close	V 702, retract transfe	er line		

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EADS Astrium		ACTIVITY	SHEET	HP-2-ASED-SD-0058	Page 18 of 18		
HERSCHEL H-E	PLM			155. Z			
<u>_</u>		01/404					
	Close	9 SV 121					
16.10	AXT	filling level: 1 1 = 38	$9 \text{ cm} \cdot 1 2 = 614$	cm			
10.10	7001						
	Close	e V 105					
	Close	e ball valve / needle v	alve to He pump	l			
	Close	by pass valve at He	e pump l				
47.00	Resta	art He pump I -> stan	t He II production	IN AX I of abialda from ovtorpol dow	~~		
17.06	New	uewar. open SV 121	and start cooling	of shields from external dew	a		
17:48	Leak	rate: 5.6 x 10 ⁻⁷ mbar	l/s				
17:49	Take	a mass spectrum (p	artial pressure) wi	th filling port and shield tubir	ng flushed, HTT at		
	130 n	nbar and 30 K, AXT I	partly filled and pu	mped down @ 60 mbar, 2,4	К		
		1,3 x 10 ^{°°} mbar					
		1 X 10 mbar 1 4 x 10 ⁻⁵ mbar					
	$n_2 =$	2.3 x 10 ⁻⁶ mbar					
	Disol =	1.9×10^{-8} mbar (me	asurement behind	turbo pump)			
17:59	Close	MS / open LT		······	· · · · · · · · · · · · · · · · · · ·		
	Leak	rate: 5,4 x 10 ⁻⁷ mbar	l/s	L			
18:04	Close	valve to MS / LT					
	Open	valve to fore pump	0.141				
19.10.05	H /Uz	power adjusted to u),3 VV Swar prossure 18/	5 mhor			
	Cover	flushing adjusted, or	dewar pressure	~70 mbar			
09:45	Leak	rate: 9.5 x 10 ⁻⁷ mbar	/s	7011104			
	Louin						
09:46	Take	a mass spectrum (pa	artial pressure) wi	th filling port and shield tubin	g flushed, HTT at		
	150 m	nbar and 30 K, AXT p	partly filled with LF	ie II			
	He =	1,9 x 10 ^{-°} mbar					
		1 x 10 ¹⁵ mbar					
	N ₂ n ₁ =	1,3 X 10 mbai 2 9 x 10 ^{−6} mbar					
	Disol =	6.9 x 10 ⁻⁹ mbar (mea	asurement behind	turbo pump)			
09:55	Close	MS / open LT					
	Leak	rate: <u>8,5 x 10⁻⁷ mbarl</u>	/s				
16:00	Leak	rate: 1,2 x 10 [™] mbarl	/s				
40.00	Taka	a maga anastrum (no	rtial proceure) wit	h filling port and shield tubin	a fluched HTT at		
16:08	150 m	a mass spectrum (pa bar and 30 K - AXT r	artial pressure) with the	la li	y llusileu, n'i i at		
	$He^{4} =$	2 7 x 10 ⁻⁸ mbar	aray mea wan Er				
	$He^{3} = 1 \times 10^{-10} \text{ mbar}$						
	N ₂ = 1	,2 x 10 ⁻⁵ mbar					
	p _{MS} =	2,6 x 10 ⁻⁶ mbar					
	p _{isol} =	7,0 x 10 ⁻⁹ mbar (mea	asurement behind	turbo pump)			
16:12		MS / open L I	10				
16:15	Ciose	valve to MS / LT	15				
10.13	Open	valve to fore pump					
		<u></u>	<u></u>		<u></u>		
	<u> </u>						
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(Company	/	Proj	ect Nar	ne	NCR-No	: HP-11200	0-ASED-NO	-1513		
	ESTEC		HERSO	HEL-PLAN	ICK	Related i	nternal NCI	R-No:			
						Critical It	em:Yes	No X		Revisio	n 1
 						Page 1 o	f6				
				Nonc	onform	ance R	eport				
NCR Title	SPIRE EQM	Cooler recyclin	ig								
NC Item Id	lentification	SPIRE									
Next Highe	er Assembly	HERSCHEL IN	STRUMEN	IS AND TE	LESCOPE	(CFE)					
Drawing N	0					Sr No.	E	QM			
Procedure	No	· · · · · · · · · · · · · · · · · · ·								<u> </u>	
Supplier	RAL					Purchase	Order				
Subsystem	ı					Model	E	QM			
NC Observ Date: 27-S	vation EP-05 Loca	tion: ASEDOTM	1			NC Detec	ted During	Test			
Description	of Nonconform	mance						Re	quirement	s Violated	
time of less than 3 A second n The air lock of IMT,Purr The leak do The second to be attached Customer I	hrs. ecycle was trie < had been clos p was still run: etection was 10 d recycle achie d). NRB to be held	d on 27.09.05 a sed for app 10 d ning following ti 0-4mbit/sec. ved a temp of 0	ifter the cryc lays when the reintegrat .328k but th con ESA)	estat had be ne PLM wa lon. is is not su	een pumpeo s moved to fficient for p	d/evacuated the tilting do verformance	for 3 hrs. olly prior to tests.(Tem	the start			
Initiator: Da	ite, Name and	Signature 27-S	SEP-05 C).Hendry							
Internal NF	RB Disposition	8		-					Classif	ication:	
27.09.05 E	SA,ASP,ASED sider that IMT	,RAL. cannot continue	auntii cooler	recvolina o	an be succ	essfullv			Major	X Mino	
performed a The possibi 1)He 4 lea: temp was in recycling an recycling an 2)He 3 prot The NRB a AI/1 SPIRE AI/2 ASED moming)to Vacuum an Temp,vacu on 29.09.01 reconvence	and a temp bel- le causes of the k causing a He ncreased to 4.2, nd hoid time. Jelem with strap grees 2 parallet to analyse the to heat up AXT remove the He d leak detection um and leak detection um and leak detection after the test.	ow 0.300k can e failure were ik film on the det 2k to remove the or heat switch. a actions. a load curves to f to 4.2k and cc f to 4.2k and cc o film from the d n will be monito etection values ts of this test wi	be achieved lentified as i ector surfac e film and w investigate ontinue pum etector and red. will be asses il be discuss	problems o oling for 24 evaporator ssen prior t	seen during ful in achiev of strap and to 36 hrs (tii surfaces an o a further o ow on NRB	ILT and the ving a good heat switch Il 29.09.05 nd remove to cooler recycl to be	ə he He. le		Custon 27-SEF	ner Notifical 9-05	ion
Ref. to Mol	As										
	c			Сопте	ctive/Preve	ntative Actio	ns		Verifica	ation	
Cause of N	•			1							
Cause of N Ref to Failu	re Report	1	,		· ····			· · ·		1	

Company	Project Name	NCR-No: HP-112000-ASED-NC-	-1513
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:	
		Critical Item:Yes No X	Revision 1
 Nc	onconformance Report	- Continuation Sheet -	
Customer NRB Dispositions (Class	s Maior Only) Ref. to MoMs		Verification
28.09.05 follow on NRB ESA,ASP,A Following the warm up to 4.2k and p during cool down of AXT to 1.6k)a 3 with the following conditions. Evaporator temp 1.75k cover temp app 10 k Vacuum 1.5x10-7 Back ground leak rate 1.3x10-4 During recycling after 2.5 hrs the co Temp started to rise and was 0.318l SPIRE consider this is not acceptab The NRB considers that the heat tra surfaces which causes a film to form This free He probably comes from th has also saturated the absorbers at The NRB considered that the leak ti- by inserting a glue at this I/F. For this activity the airlock and the p to be closed by a dummy plug In the ASED say it is not certain that the gl tightness ASED advise that due to the isolatio For the proposed rework ASED will will identify the materials and proceed	SED.RAL pumping for 36 hrs (20hrs at AXT ter ind cooler recycle was performed oler temp was 0.284k k after 1 hr (temp plots will be attach le to continue with IMT. Insfer is caused by free He flow betw in on the detectors and evaporator. he know leak on the filling port I/F int the bottom of the main tank. ghtness of the filling port/CVV I/F co ressure plate has to be removed and filling port instead of the SV121. uing of the I/F will have an effect on in vacuum there is a risk during the r provide a detailed drawing of the I/F lure to be used AI/ASED 30.09.05.	np 4.2k + 16hrs ed to this NCR) reen cold and warm o the CVV and uld be improved d the He SS has the leak ework operation, and plug and	
In an attempt to remove the He him the AXT will be depleted and warme The warm up/cooldown and filling po It is also considered that even with th possibility that as the absorbers are could still have an effect on the cool ASP will review the load curves and analysis.AI/ASP 29.09.05 Follow on investigations to	and the free he within the cryostatia d to above 20k with continual pumpi of I/F rework is estimated to take 1 v he warm up and rework there is still saturated not all the free He will be r er hold time and operation. temperature profile of the recycling measure the leak rate.	ng instruments) ng. veek. the amoved and and provide an	
A mass spectrometer has been com The turbo pump not effective) The measurements from the mass s Hydrogen =1.6*10-9 He3 =1.3*10-12 He4 =1.0*10-9 Water=1.9*10-8 N2=6.5*10-9 O2=1.4*10-9 The results will be assessed by ASEE	ected to the airlock SV922. The backing valve behind the pump is pectrometer are the following.	ciosed (ie,	
Finally Determined Cause of NC Ref to Failure Report	Corrective/Pre	eventative Actions	
Request for Waiver		Other r	related Documents
Vee No Reference			

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Company ESTEC	Project Name HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-151: Related internal NCR-No:	3
		Critical Item: Yes No X Page 3 of 6	Revision 1
N	onconformance Report	- Continuation Sheet -	
NRB Approval Organization/ Name			
Date, Signature			

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Wednesday October 26 2005 6:0 PM

ESTEC				
	HERSCHEL-PLANCK	Related internal NCR Not		
			Dav	
		Page 4 of 6	Kev	51071
N	onconformance Repor	t - Continuation Sheet	•	
Customer NRB Dispositions (Cla	ss Maior Only) Ref. to MoMs		Verification	
Follow on NRB with ESA, ASP and Status: 2 leaks identified: HTT with 2×10 - 10-5 mbarl/s, in total 4 - 5 \times 10-5 m A first leak test at IMT conditions (H 4,5 \times 10-6 mbarl/s was measured -: rate by a factor of 10. 3,42 m? Grafoil adsorbers are insta 245, rev B. 30.01.1990.	ASED (C. Jewell, M. Pastorino, R. 5 mbarl/s and filling port + shield tub barl/s ITT at 4,2 K and AXT at 1,55 K) a to be the adsorbers were still active and lied in the EQM PLM = 3420 std cm	Hohn, C. Schlosser): ing with 2 x stal leak rate of improved the leak i? (see ISO NCR MB-PLM-		
The rollowing options have been dia 1. Start cool down and get IMT con- cooler test on 13.10.05. 2. Sealing of filling port I/F accordin eak rate by a factor of 2 in best case /F during integration was 3 x 10-6 r 3. Sealing of filling port I/F accordin solating HTT combined with cooling nternal safety line). This is a new p possible at all. Impact on schedule	cussed during the NKB: ditions as fast as possible. Perform g HP-2-ASED-SD-0058 step 8. This e. (remember: measured leak rate on hbarl/s) g HP-2-ASED-SD-0058 step 8, evan g of shields via an external supply (v rocedure and it has to be verified the of option 3 is 2 days.	PACS sorption would improve the of filling port cuating and via cryostat at it is		
ESA request to go as proposed in on the leak rate distinctly, it is the best ASED stated that all thermal require ulfiled (L0, L1 and L2 temperatures allowable leak rate respectively the	ption 3, because, although not know what can be done to for the Instrum ments for Instrument tests on the E) and that there is no requirement s allowable Helium content in the cryv	vn that it reduces ents. QM have been pecifying the ostat.		
SPIRE made similar observations d heir set-up (e.g. leak rate of cryost he problem.	uring FM ILT. SPIRE shall provide i t, temperature characteristics) whe	nformation about n they detected		
After the NRB, ASED PM agrees to s no guarantee that the environment hat measures. The interface betwe eak seal, the screws of the filling po closed see ACD 0059 and MoM HP	follow option 3. However it has to b tal conditions for instrument test ca en filling port and CVV will be sealed rt will be sealed with STYCAST 28 -2-ASED-MN-1096 (The filling port if	e noted that there n be improved by d with a liquid 50 GT. leak has been tightened		
vith glue (RTV 691)).				
Finally Determined Cause of NC	Corrective/P	reventative Actions		
Concernation Network	i 		Other related Desures	
		iference:		165
		······································	N	CR CI

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				Wednesday O	ctober 26 2005 6:0 PM
	Compa ESTEC	ny	Project Name HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-1513 Related internal NCR-No: Critical Item:Yes No X Page 5 of 6	Revision 1
NCR Tre	atment Sequ	No uence / Findln	enconformance Report - C	ontinuation Sheet -	
Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-1	RAL	30-SEP-05	AI/1 SPIRE to analyse the load curves to investigate problems of strap and heat switch		Yes No _X
int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-2	ASED	30-SEP-05	Al/2 ASED to heat up AXT to 4.2k and continue pumping for 24 to 36 hrs	Closed	Yes X No
Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-3	ASED	30-SEP-05	For the proposed rework ASED will provide a detailed drawing of the I/F and plug and will identify the materials and procedure to be used AI/ASED 30.09.05	i.	Yes 🔀 No 🚞
int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-4	ASP	30-SEP-05	ASP will review the load curves and temperature profile of the recycling and provide an analysis.AI/ASP		Yes 🗌 No 🗙

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	Basta of Maria	Wedr	esday October 26 2005 6
Company	Project Name	NCR-No: HP-112000-ASED-NC-	1513
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:	
		Critical Item:Yes No X Page 6 of 6	Revision 1
N	onconformance Report	- Continuation Sheet -	
NCR/NRB Attachments			
Description	Filena	me	Last Updated
1 Graph of 1st SPIRE co	poler recycle SPIRI	E_Cooler_Recycle_1.jp	30-SEP-05 08:42:17

	Description	Filename	Last Updated
2	Graph of 2nd SPIRE cooler recycle	SPIRE_Cooler_Recycle_2.jp	30-SEP-05 08:42:30
	Description	Filename	Last Updated
3	Graph of 3rd SPIRE cooler recycle	SPIRE_Cooler_Recycle_3.jp	30-SEP-05 08:42:44
	Description	Filename	Last Updated
4	As run procedure for leak testing	HP-2-ASED-SD-0058_2-AsRun	10-OCT-05 17:20:07
	Description	Filename	Last Updated
5	Drawing of filling port interface and set-up for I	FillingPort-SetUo.pdf	10-OCT-05 17:22:46

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Distribution List

Herschel

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22	· · · · · · · · ·	Schink Dietmar	AED44
	Barlage Bernhard	AED11	x	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Sonn Nico	AOE51
x	Fricke Wolfgang Dr.	AED 65		Steininger Eric	AED32
	Geiger Hermann	AOA52	x	Stritter Rene	AED11
	Gerner Willi	AED11		Suess Rudi	AOA54
X	Grasl Andreas	OTN/AOA54		Thörmer Klaus-Horst Dr.	OTN/AED65
_/	Grasshoff Brigitte	AET12	-	Wagner Klaus	AOE22
	Hauser Armin	AOE22		Wietbrock Walter	AET12
X	Hendry David	Terma Resid.		Wöhler Hans	AOE22
	Hengstler Reinhold	AOA 5		Wössner Ulrich	ASE442
	Hinger Jürgen	AOE22	X	Alcatel	ASP
	Hofmann Rolf	ASE442	X	ESA/ESTEC	ESA
R	Hohn Rüdiger	AED65		Instruments:	
	Hölzle Edgar Dr.	AED44		MPE (PACS)	MPE
	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
	Idler Siegmund	AED312		Subcontractors:	
	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIR
	lvády von András	FAE22		Air Liquide, Space Department	AIRS
	Jahn Gerd Dr.	AOE22		Air Liquide, Orbital System	AIRT
	Kalde Clemens	APE3		Alcatel Bell Space	ABSP
K	Kameter Rudolf	OTN/AOA54		Astrium Sub-Subsyst. & Equipment	ASSE
	Kettner Bernhard	AET42		Austrian Aerospace	AAE
	Knoblauch August	AET32		Austrian Aerospace	AAEM
	Koelle Markus	AOA53		APCO Technologies S. A.	APCO
	Koppe Axel	AED312		Bieri Engineering B. V.	BIER
X	Kroeker Jürgen	AED65		BOC Edwards	BOCE
	Kunz Oliver Dr.	AOE22		Dutch Space Solar Arrays	DSSA
x	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	CASA
	Lang Jürgen	ASE442		EADS CASA Espacio	ECAS
	Langenstein Rolf	AED15		EADS Space Transportation	ASIP
X	Langfermann Michael	AOA51		Eurocopter	ECD
X	Mack Paul	OTN/AOA54		European Test Services	ETS
	Maute Thomas	AOA52		HTS AG Zürich	HTSZ
	Müller Jörg	AOA52		Linde	LIND
	Müller Martin	AOA53		Patria New Technologies Oy	PANT
	Müller Raif	FAE22		Phoenix, Volkmarsen	PHOE
	Peltz Heinz-Willi	AOE13		Prototech AS	PROT
	Pietroboni Karin	AED65		QMC Instruments Ltd.	QMC
	Platzer Wilhelm	AED22		Rembe, Brilon	REMB
	Reichle Konrad	AOA52		Rosemount Aerospace GmbH	ROSE
	Reuß Friedhelm	AED62		RYMSA, Radiación y Microondas	RYM
x	Rühe Wolfgang	AED6		SENER Ingenieria SA	SEN
X	Runge Axel	OTN/AOA54		Stöhr, Königsbrunn	STOE
	Sachsse Bernt	AED21		Terma A/S, Herlev	TER

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VI. Copy of filled in Log Sheets 1

 Doc. No:
 HP-2-ASED-TR-0118

 Issue:
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 Date:
 20.02.06

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Procedure

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EADS Astrium

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Procedure

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§ હં LOGSHEET 1 for COOL DOWN and FILLING Sign मेंबर 2 Jut. 100 J lan ۶ Jer V Ě <u>A</u> ast. L.K. ch. Ì Ś Pro1 and 234 1PHO1 and 442 REMARKS 3 at them ter ly pressur devar 215 200 225 215 200 215 210 210 30 DOED NOT BY ANT AND AD 1.05 1.0S 1.06 Pler 1,08 701 102 NN5 1.02 -> 20Um la 1254.04 ንይቆ 1 1024 Liquid level Dewar L0101 205 130 ANG 155 レナマ 50 2) 110 ろ 17 0 مكلا ઙ૾ the con 9156 He Dewar S/N D0101 cooldown 9.56 9156 3156 <u>clo. 1</u> 2 3 3 3 2sound 3 ふぐて 406510,87 という 0.04 994 1053 10, 30 t60 294 1053 0,89 Mass flow 0,68 1058 0 21 9/5 1000 1054 4,05 Ó 590 derbar Marune 204 m has 996 ANY64 1062 10201022 1090 P0621 mbar 958 î 7 V#22 0 F O V702 Ŝ 985 395 4.56 P501 mbar 966 <u> 796</u> R02 547 V102 Wehter deves erout 0000 <u>چ</u> 202 105 80 ちのこ 1.06 P101 mbar 80 100 5 Core 200 ≪c≁ rgace 2 1.10 al p 50.10+ 7 1. 15 20-60 2.6.16 33.10 2.0.10 24.70 Clar P901 mbar 07.0 10) 10) te S 0 0 SV 121 0 0 0 Q V 702 J J J U C Q V 701 0 0 Valve Status Ø ٥ 0 V 512 J J لا د L Ú Ú ک. V 502 9 0 Ø ٥ 0 0 Ő 0 V 105 0 Ç б 0 0 ō 0 V 104 Q 0 0 Ð V 102 71.30 E J 0 18-20 0 Herschel EQM 24:00 **10**:30 21:25 21:20 10:00 21tho 20:00 20:30 5:00 8.37 9:00 7.45 Time र प्रमुख्य प्रमुख्य じゴ 6.5 100 ۲: _کو <u>い</u>いい いい 1 39/8/05 24.5 0 <u>|</u> | | | | ーかく ł) 9 1 ļ Date 7 2 3 Э 1

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13.9.05	10:00	4.19	127		2۲.5	27.4	2.56	10.64	26.9	124	30.3	14.9	223	1.63	0.452			7.	
	12:50	ц.	4.15	2.81	A.9.	20.6	2.09	6.33	195	24.9	90.2	16.7	223	1.62	0.451			J.LL	
	Bios	4. 15	4.15	16.5	6.11	17.6	2.25	かした	2.22	24,8	9.06	1481	223	1.12	tz1.0			Ach	
14 2.05	8:20	4,2	4,4	20.64	1316	20,7	2, ST	3,05	20,4	41.9	404.4	4534	227	160	0,45			a	
3	M:B	2,2	4.1	14.4	tΨ	190	2,23	7.7	18,0	251	1092	162.7	222	1.62	0,363			Z	
2	13:20	47	7.5	16,8	h'h	1 22	2.44	6,28	14,9	23,2	39,2	1650	222	165	0,262			ž	
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4	AC: 01	4,2	5.7	217	Mile	RES	2,25	7-0	A6.94	274	AR	451	223	166	0,454			3	
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		Cover	T601	220	1222	222	1694	\ \	いじょ	-	2.551	1	188.17	49.40	211	5944	219	842	02	۲ مل	221.8	172.6	242
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	13:00	١	25,6	10.4	11.6	12,9	3,65	4,61	19.35	20,3	o'śt	126.0	\$15,28	163	0,439	VtZ		121	
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		3. chiold	T463	6. <i>tt</i> 2	s ttz	273.5	2759	2765	8:st2	7.14	280.3	284.1	2.122	42.4	292.8									
		2. Hiold	7443	57.9	56.4	ډر. ح	56.6	56,8	59.4	404	5.00	15.2	80.2	1.16	4.4									
	Z	- - -	23 7	(1 2	נ 2	5.3 2	5 2	2 2	ے 2	2 2	.0 21	8 23	(9 2	3 2	.9 2'									
	res in	- 1 - 1 - 1	14	3 234	- 23ª	22	1 237	3 238	· 24	<u>г</u> и2 :	\$ 258	172	(27/	5 296	2 29					_				
	eratui	OBA	T211	22 7 .	229.5	229.3	232.	234.	~ U Z	2433	222.	5C2 7	269.	290.	294.1	70								
	Temp		7236	١	١	١	1		X	١	\	`	1		\mathbf{X}	10								
		BA I	231	$\overline{\}$	1			1	$\overline{\mathbf{x}}$			、				رى	>							
		S E	2 7	4	8	بە	8	2	4 1	2		00	-	9		4								
		IIdS	T2!	52	1227	229	234.	23	234	i 24.a.	ž	まえ	2(4	2 59	290.	20 10								
		SPIRE	T254	6 92	227 .S	25.6	2718	2334	2349	241.5	1.1×	259.6	265.8	7.662	290.1	tent .								
		HIFI T207	T208	26.4	27.5	28.4	<u>کر</u> ک	2.9	33.9	2.0%	£.3	7.92	4 4	19.5	90.L	1								
K			. 03	7 t:	4.6 2	3 2	3.6 2.	2 8.(5 2	1.2 7	1.2 2	6 9	207	0.01	s ho							-		
EQ		т Т	4	22	2	e 223	, 22	22	0 23	5 24	025	2	57	- 29	62 o	5						<u> </u>		
:hel		Ĭ		7:35	12:05	16.3	7:4	NS:2	16:4	<u>بہ</u>	2	7:31	8: hV	11:5	10:2	4014					L			
lersc		Date		0.1.06			1.1.06			10.1.5		30.05		71.04										
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5 File: HP-2-ASED-TP-0098_1.doc

 Doc. No:
 HP-2-ASED-TP-0098

 Issue:
 1

 Date:
 08.12.05

VIII. Copy of the Strap Pretension Measurements

Strap Pretension before cool down

Projekt: HERSCHEL_EQM_012

Ausdruck: 25.08.2005

25.08.05 11:05

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	4.95	kN
18:	MATH	no. 2	4.41	kN
19 :	MATH	no. 3	5.36	kN
20 :	MATH	no. 4	5.24	kN
21:	MATH	no. 5	5.39	kN
22:	MATH	no. 6	7.32	kN
23:	MATH	no. 7	2.74	kN
24:	MATH	no. 8	4.51	kN
25:	001			Skip
25: 26:	001 MATH	lower no. 9	8.09	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	 8.09 6.92	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	8.09 6.92 5.51	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	8.09 6.92 5.51 7.88	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13	8.09 6.92 5.51 7.88 6.23	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	8.09 6.92 5.51 7.88 6.23 7.46	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	8.09 6.92 5.51 7.88 6.23 7.46 4.86	Skip kN kN kN kN kN kN kN kN

Measurement of Strap Pretension during Cool Down Phase

T103 = 285K

29.08.2005

15:16:49

Schaeffler

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# Kan	Mess-Stelle	Wert	Einheit
17: MATH	upper no. 1	2.71	kN
18: MATH	no. 2	2.28	kN
19: MATH	no. 3	3.19	kN
20: MATH	no. 4	2.97	kN
21: MATH	no. 5	3.17	kN
22: MATH	no. 6	4.57	kN
23: MATH	no. 7	0.94	kN
24: MATH	no. 8	2.53	kN
25: 001			Skip
26: MATH	lower no. 9	5.89	kN
27: MATH	no.10	4.43	kN
28: MATH	no.11	3.25	kN
29: MATH	no.12	5.43	kN
30: MATH	no,13	4.03	kN
31: MATH	no.14	5.56	kN
32: MATH	no.15	2.62	kN
33: MATH	no.16	2.46	kN

Measurement of Strap Pretension during Cool Down Phase

T103=282 K

29.08.2005

15:29:17

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.30	kN
18:	MATH	no. 2	3.02	kN
19:	MATH	no. 3	3.22	kN
20:	MATH	no. 4	2.69	kN
21:	MATH	no. 5	2.45	kN
22:	MATH	no. 6	3.86	kN
23:	MATH	no. 7	2.70	kN
24:	MATH	no. 8	2.17	kN
25:	001			Skip
25: 26:	001 MATH	lower no. 9	 6.50	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	 6.50 4.07	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	 6.50 4.07 3.45	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	6.50 4.07 3.45 5.28	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13	6.50 4.07 3.45 5.28 4.01	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	 6.50 4.07 3.45 5.28 4.01 5.38	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	 6.50 4.07 3.45 5.28 4.01 5.38 2.79	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14 no.15	6.50 4.07 3.45 5.28 4.01 5.38 2.79	Skip kN kN kN kN kN kN

Note: no. 7 readjusted

Measurement of Strap Pretension during Cool Down Phase

T103 = 266K

30.08.2005

07:17:04

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.48	kN
18:	MATH	no. 2	0.79	kN
19 :	MATH	no. 3	1.06	kΝ
20 :	MATH	no. 4	0.40	kN
21:	MATH	no. 5	0.39	kN
22:	MATH	no. 6	1.67	kN
23:	MATH	no. 7	0.62	kΝ
24:	MATH	no. 8	0.48	kN
25:	001			Skip
26 :	MATH	lower no. 9	3.81	kN
27:	MATH	no.10	2.05	kΝ
28:	MATH	no.11	1.43	kN
29 :	MATH	no.12	2.79	kΝ
30:	MATH	no,13	2.17	kN
31:	MATH	no.14	2.99	kN
32:	MATH	no.15	0.99	kΝ
33:	MATH	no.16	0.87	kN

Measurement of Strap Pretension during Cool Down Phase

T103 = 178 K

30.08.2005

20:14:28

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.28	kN
18 :	MATH	no. 2	2.57	kN
19:	MATH	no. 3	2.84	kN
20:	MATH	no. 4	2.58	kN
21:	MATH	no. 5	4.59	kN
22:	MATH	no. 6	2.12	kN
23:	MATH	no. 7	2.33	kN
24:	MATH	no. 8	4.42	kN
25:	001			Skip
25: 26:	001 MATH	lower no. 9	 5.46	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	 5.46 4.93	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	5.46 4.93 4.31	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH	lower no. 9 no.10 no.11 no.12	5.46 4.93 4.31 5.07	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13	5.46 4.93 4.31 5.07 3.43	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	5.46 4.93 4.31 5.07 3.43 5.15	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14 no.15	5.46 4.93 4.31 5.07 3.43 5.15 3.84	Skip kN kN kN kN kN kN

Nate: after readjustment of all straps

Measurement of Strap Pretension during Cool Down Phase

T103 = 159 K

30.08.2005

21:48:28

P. Mack

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# Kan 17∙MΔT⊢	Mess-Stelle	Wert 0.59	Einheit kN
18 MATH		0.71	kN
19 MATH	no. 3	0.96	kN
20: MATH	no. 4	0.69	kN
21: MATH	no. 5	1.89	kN
22: MATH	no.6	0.47	kN
23: MATH	l no.7	0.63	kN
24: MATH	ł no.8	2.01	kN
25: 001			Skip
26: MATH	l lower no. 9	3.19	kN
27: MATH	i no.10	2.77	kN
28: MATH	1 no.11	2.12	kN
29: MATI	i no.12	2.81	kN
30: MATH	i no,13	1.84	kN
31: MATH	t no.14	2.88	kN
32: MATH	i no.15	2.04	kN
33: MATH	H no.16	1.30	kN

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Measurement of Strap Pretension during Cool Down Phase

T103 = 165 K

31.08.2005

07:28:39

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.77	kN
18:	MATH	no. 2	0.89	kN
19:	MATH	no. 3	1.15	kN
20:	MATH	no. 4	0.88	kN
21:	MATH	no. 5	2.34	kN
22:	MATH	no. 6	0.64	kN
23:	MATH	no. 7	0.72	kN
24:	MATH	no. 8	2.43	kN
25:	001			Skip
26:	MATH	lower no. 9	3.50	kN
27:	MATH	no.10	3.06	kΝ
28:	MATH	no.11	2.35	kN
29 :	MATH	no.12	3.10	kN
30:	MATH	no,13	2.06	kN
31:	MATH	no.14	3.15	kN
32:	MATH	no.15	2.24	kN
33:	MATH	no.16	1.42	kΝ

Measurement of Strap Pretension during Cool Down Phase

T101 = 10 K

01.09.2005

09:03:07

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.51	kN
18:	MATH	no. 2	2.22	kN
19:	MATH	no. 3	2.58	kN
20:	MATH	no. 4	1.39	kN
21:	MATH	no. 5	0.70	kN
22:	MATH	no. 6	2.73	kN
23:	MATH	no. 7	1.05	kN
24:	MATH	no. 8	2.52	kN
25:	001			Skip
26:	MATH	lower no. 9	3.00	kN
27:	MATH	no.10	4.02	kN
28:	MATH	no.11	2.52	kN
29:	MATH	no.12	3.03	kN
30:	MATH	no,13	4.17	kN
31:	MATH	no.14	2.53	kN
32:	MATH	no.15	3.63	kN
33:	MATH	no.16	2.80	kN

Measurement of Strap Pretension during Cool Down Phase

T101 = 4.2 K

02.09.2005

12:09:45

J.Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17: 1	MATH	upper no. 1	2.30	kN
18: I	MATH	no. 2	2.06	kN
19: 1	MATH	по. З	2.46	kN
20: 1	MATH	no. 4	1.23	kN
21: 1	MATH	no. 5	0.69	kN
22: 1	MATH	no. 6	2.49	kN
23:	MATH	no. 7	0.92	kN
24:	MATH	no. 8	1.69	kN
25	001			Skip
	~~ .			
26:	MATH	lower no. 9	3.06	kN
26: 27:	MATH MATH	lower no. 9 no.10	3.06 4.09	kN kN
26: 27: 28:	MATH MATH MATH	lower no. 9 no.10 no.11	3.06 4.09 2.59	kN kN kN
26: 27: 28: 29:	MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	3.06 4.09 2.59 3.03	kN kN kN kN
26: 27: 28: 29: 30:	MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13	3.06 4.09 2.59 3.03 4.17	kN kN kN kN kN
26: 27: 28: 29: 30: 31:	MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14	3.06 4.09 2.59 3.03 4.17 2.57	kN KN KN KN KN
26: 27: 28: 29: 30: 31: 32:	MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	3.06 4.09 2.59 3.03 4.17 2.57 3.69	kN kN kN kN kN kN
26: 27: 28: 29: 30: 31: 32: 33:	MATH MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	3.06 4.09 2.59 3.03 4.17 2.57 3.69 2.80	kN KN KN KN KN KN KN

PLM EQM COOL DOWN

Projekt: HERSCHEL_EQM_01

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Ausdruck: 07.09.2005

AXT T208 67k

#	Kan	Wert	Einheit
17:	MATH	2.38	kN
18:	MATH	2.11	kN
19:	MATH	2.12	kN
20:	MATH	1.03	kN
21:	MATH	0.64	kN
22:	MATH	2.52	kN
23:	MATH	0.92	kN
24:	MATH	1.81	kN
~~	004		Chim
25:	001		экір
25: 26:	MATH	3.22	skip kN
25: 26: 27:	MATH	3.22 4.17	skip kN kN
25: 26: 27: 28:	MATH MATH MATH	3.22 4.17 2.67	skip kN kN kN
25: 26: 27: 28: 29:	MATH MATH MATH MATH	3.22 4.17 2.67 3.15	skip kN kN kN kN
25: 26: 27: 28: 29: 30:	MATH MATH MATH MATH MATH	3.22 4.17 2.67 3.15 4.14	skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	MATH MATH MATH MATH MATH MATH	3.22 4.17 2.67 3.15 4.14 2.73	skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	MATH MATH MATH MATH MATH MATH MATH	3.22 4.17 2.67 3.15 4.14 2.73 3.81	5 KD KN KN KN KN KN KN
25: 26: 27: 28: 29: 30: 31: 32: 33:	MATH MATH MATH MATH MATH MATH MATH MATH	3.22 4.17 2.67 3.15 4.14 2.73 3.81 2.92	5 KID KN KN KN KN KN KN KN

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Measurement of Strap Pretension during Cool Down Phase

T 101 = 4.3 K

30.09.2005

14:15:24

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.26	kN
18:	MATH	no. 2	3.10	kN
19:	MATH	no. 3	3.10	kN
20:	MATH	no. 4	1.13	kN
21:	MATH	no. 5	0.41	κN
22:	MATH	no. 6	1.71	kN
23:	MATH	no. 7	0.70	kN
24:	MATH	no, 8	1.71	kN
25:	001			Skip
25: 26:	001 MATH	lower no. 9	3.15	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	3.15 3.61	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	 3.15 3.61 2.07	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	3.15 3.61 2.07 2.93	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13	3.15 3.61 2.07 2.93 4.29	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14	3.15 3.61 2.07 2.93 4.29 2.82	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	3.15 3.61 2.07 2.93 4.29 2.82 4.11	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32: 33:	001 MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	3.15 3.61 2.07 2.93 4.29 2.82 4.11 2.84	Skip kN kN kN kN kN kN kN

Measurement of Strap Pretension during Cool Down Phase

T103 = 28 K

24.10.2005

14:10:05

J. Schäffler

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# Ka	an	Mess-Stelle	Wert	Einheit
17: M	ATH	upper no. 1	1.92	kN
18: M	ATH	no. 2	2.72	kN
19: M	ATH	no. 3	2.93	kN
20: M	ATH	no. 4	0.88	kN
21: M	ATH	no. 5	0.37	ĸN
22: M	ATH	no. 6	1.42	kN
23: M	ATH	no. 7	0.59	kN
24: M	ATH	no. 8	1.86	kN
25: 00	D1			Skip
25:00 26:M	D1 ATH	lower no. 9	2.70	Skip kN
25:00 26: M 27: M	D1 ATH ATH	lower no. 9 no.10	2.70 3.22	Skip kN kN
25: 00 26: M 27: M 28: M	D1 ATH ATH ATH	lower no. 9 no.10 по.11	2.70 3.22 1.78	Skip kN kN kN
25: 00 26: M 27: M 28: M 29: M	D1 ATH ATH ATH ATH	lower no. 9 no.10 no.11 no.12	2.70 3.22 1.78 2.48	Skip kN kN kN kN
25: 00 26: M 27: M 28: M 29: M 30: M	D1 ATH ATH ATH ATH ATH	lower no. 9 no.10 no.11 no.12 no,13	2.70 3.22 1.78 2.48 3.73	Skip kN kN kN kN kN
25: 00 26: M 27: M 28: M 29: M 30: M 31: M	D1 ATH ATH ATH ATH ATH ATH	lower no. 9 no.10 no.11 no.12 no.13 no.14	2.70 3.22 1.78 2.48 3.73 2.31	Skip KN KN KN KN KN
25: 00 26: M 27: M 28: M 29: M 30: M 31: M 32: M	D1 ATH ATH ATH ATH ATH ATH ATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	2.70 3.22 1.78 2.48 3.73 2.31 3.60	Skip KN KN KN KN KN KN

Measurement of Strap Pretension during Cool Down Phase

T103 = 35K

09.11.2005

08:32:36

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	1.87	kN
18:	MATH	no. 2	2.73	kN
19:	MATH	no. 3	2.95	kN
20:	MATH	no. 4	0.88	kN
21:	MATH	no. 5	0.35	kN
22:	MATH	no. 6	1.42	kN
23:	MATH	no. 7	0.57	kN
24:	MATH	no. 8	1.76	kN
-				
25:	001			Skip
25: 26:	001 MATH	lower no. 9	2.67	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	 2.67 3.19	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	2.67 3.19 1.74	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH	lower no. 9 no.10 no.11 no.12	2.67 3.19 1.74 2.49	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13	2.67 3.19 1.74 2.49 3.66	Skip KN KN KN KN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	2.67 3.19 1.74 2.49 3.66 2.31	Skip kN kN kN KN KN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	2.67 3.19 1.74 2.49 3.66 2.31 3.56	Skip kN kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32: 33:	001 MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	2.67 3.19 1.74 2.49 3.66 2.31 3.56 2.36	Skip KN KN KN KN KN KN KN

Measurement of Strap Pretension during Gool Down Phase warm up

T103 = 40 K

16.12.2005

10:58:11

J. Schäffler

# Kan	Mess-Stelle	Wert	Einheit
17: MATH	upper no. 1	2.32	kN
18: MATH	no. 2	1.88	kN
19: MATH	по. З	2.37	kN
20: MATH	no. 4	1.08	kN
21: MATH	no. 5	1.80	kN
22: MATH	no. 6	2.47	kN
23: MATH	no. 7	0.93	kN
24: MATH	no. 8	0.62	kN
25: 001			Skip
26: MATH	lower no. 9	2.88	kN
27: MATH	no.10	3.65	kN
28: MATH	no.11	2.52	kN
29: MATH	no.12	2.69	kN
30: MATH	no,13	3.72	kN
31: MATH	no.14	2.47	kN
32: MATH	no.15	3.45	kN
33: MATH	no.16	2.62	kN

Measurement of Strap Pretension during Gool-Dewn Phase warm up

T103 = 47 K, lower sensors loos

16.12.2005

17:21:05

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.02	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.95	kN
20 :	MATH	no. 4	0.71	kN
21:	MATH	no. 5	0.67	kN
22:	MATH	no. 6	0.13	kN
23:	MATH	no. 7	0.11	kN
24:	MATH	no. 8	0.10	kN
25:	001			Skip
26:	MATH	lower no. 9	0.15	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.06	kN
29 :	MATH	no.12	0.16	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.00	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.1 6	-0.01	kN
Measurement of Strap Pretension during Gool Down Phase

Wain up

HTT = 79,4 K

19.12.2005

16:52:51

# 17: 18: 19: 20: 21: 22: 23: 24: 25: 26: 27: 28: 29: 30:	Kan MATH MATH MATH MATH MATH MATH MATH MATH	Wert 0.15 0.22 0.58 0.59 0.73 0.18 0.15 0.09 0.13 -0.00 0.07 0.17 0.10	Einheit kN kN kN kN kN kN kN kN kN kN kN kN kN
28: 29: 30: 31: 32: 33:	MATH MATH MATH MATH MATH MATH	0.07 0.17 0.10 0.01 0.11 -0.01	k N K K K K K K K

Measurement of Strap Pretension during Geol-Down Phase

T103 = 89,6 K

20.12.2005

15:27:15

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.17	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.73	kN
20:	MATH	no. 4	0.68	kN
21:	MATH	no. 5	0.76	kN
22:	MATH	no. 6	0.23	kN
23:	MATH	no. 7	0.26	kΝ
24:	MATH	no. 8	0.10	kN
25:	001			Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kΝ
31:	MATH	no.14	0.01	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	-0.00	kN

Measurement of Strap Pretension during Goel-Bown Phase

T103 = 98,7 K

21.12.2005

14:01:46

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.18	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.79	kN
20:	MATH	no. 4	0.73	kN
21:	MATH	no. 5	0.77	kN
22:	MATH	no. 6	0.22	kN
23:	MATH	no. 7	0.26	kN
24:	MATH	по. 8	0.10	kN
25:	001			Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.01	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	-0.01	kN

Measurement of Strap Pretension during Cool-Down Phase

basm up

T 103 = 161.3 K

30.12.2005

16:38:00

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Mess-Stelle	Wert	Einheit
upper no. 1	0.18	kN
no. 2	0.26	kN
no. 3	0.95	kN
no. 4	1.09	kN
no. 5	1.30	kΝ
no. 6	0.21	kN
no. 7	0.23	kN
no. 8	0.11	kN
		Skip
lower no. 9	0.14	kN
no.10	-0.00	kΝ
no.11	0.07	kN
no.12	0.17	kNi
no,13	0.10	kN
no.14	0.00	kN
no.15	0.11	kN
no.16	-0.01	kN
	Mess-Stelle upper no. 1 no. 2 no. 3 no. 4 no. 5 no. 6 no. 7 no. 8 lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	Wess-Stelle Wert upper no. 1 0.18 no. 2 0.26 no. 3 0.95 no. 4 1.09 no. 5 1.30 no. 6 0.21 no. 7 0.23 no. 8 0.11 lower no. 9 0.14 no.10 -0.00 no.11 0.07 no.12 0.17 no.13 0.10 no.14 0.000 no.15 0.11 no.16 -0.01

Measurement of Strap Pretension during Geel Bown Phase من مستقفى

T 103 = 188.2 K

03.01.2006

09:46:29

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.34	kN
18:	MATH	no. 2	0.36	kN
19:	MATH	no. 3	0.98	kN
20:	MATH	no. 4	1.25	kN
21:	MATH	no. 5	1.57	kN
22:	MATH	no. 6	0.21	kN
23:	MATH	no. 7	0.29	kN
24:	MATH	no. 8	0.11	kN
25:	001			Skip
26:	MATH	lower no. 9	0.13	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.16	kN
30:	MATH	no,13	0.09	kN
31:	MATH	no.14	0.04	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.02	kN

Measurement of Strap Pretension during Cool Down Phase

warm of

T 103 = 218.9 K

09.01.2006

09:52:49

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	1.74	kN
18:	MATH	no. 2	1.52	kN
19:	MATH	no. 3	2.34	kN
20:	MATH	no. 4	2.45	kN
21:	MATH	no. 5	2.32	kN
22:	MATH	no. 6	2.41	kN
23:	MATH	no. 7	0.65	kN
24:	MATH	no. 8	0.17	kN
OF.	004			Cldm
20:	001			экір
25: 26:	MATH	lower no. 9	0.14	kN
25: 26: 27:	MATH	lower no. 9 no.10	0.14 0.00	kN kN
25: 26: 27: 28:	MATH MATH MATH	lower no. 9 no.10 no.11	0.14 0.00 0.07	kN kN kN
25: 26: 27: 28: 29:	MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	0.14 0.00 0.07 0.17	kN kN kN kN kN
25: 26: 27: 28: 29: 30:	MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13	0.14 0.00 0.07 0.17 0.11	skip kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	0.14 0.00 0.07 0.17 0.11 0.23	skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15	0.14 0.00 0.07 0.17 0.11 0.23 0.12	kN kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32: 33:	MATH MATH MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	0.14 0.00 0.07 0.17 0.11 0.23 0.12 0.00	5 K K K K K K K K K K K K K K K K K K K

Measurement of Strap Pretension during Gool-Down Phase

T 103 = 241.5 K

12.01.2006

07:49:54

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# Kan	Mess-Stelle	Wert	Einheit
17: MATH	l upper no. 1	4.04	kN
18: MATH	l no.2	3.82	kN
19: MATH	l no. 3	4.05	kN
20: MATH	l no. 4	4.79	kN
21: MATH	l no.5	3.53	kN
22: MATH	l no.6	4.52	kN
23: MATH	l no.7	2.48	kN
24: MATH	i no.8	0.79	kN
25: 001			Skip
25:001 26:MATH	l lower no. 9	0.14	Skip kN
25: 001 26: MATH 27: MATH	l lower no. 9 I no.10	0.14 0.01	Skip kN kN
25: 001 26: MATH 27: MATH 28: MATH	l lower no. 9 1 no.10 1 no.11	0.14 0.01 0.07	Skip kN kN kN
25: 001 26: MATH 27: MATH 28: MATH 29: MATH	l lower no. 9 1 no.10 1 no.11 1 no.12	0.14 0.01 0.07 0.17	Skip KN KN KN KN
25: 001 26: MATH 27: MATH 28: MATH 29: MATH 30: MATH	l lower no. 9 no.10 no.11 no.12 no,13	0.14 0.01 0.07 0.17 0.10	Skip kN kN kN kN kN
25: 001 26: MATH 27: MATH 28: MATH 29: MATH 30: MATH 31: MATH	l lower no. 9 no.10 no.11 no.12 no,13 no.14	0.14 0.01 0.07 0.17 0.10 0.72	Skip kN kN kN kN kN kN
25: 001 26: MATH 27: MATH 28: MATH 29: MATH 30: MATH 31: MATH 32: MATH	l lower no. 9 1 no.10 1 no.11 1 no.12 1 no.13 1 no.14 1 no.15	0.14 0.01 0.07 0.17 0.10 0.72 0.12	Skip kN kN kN kN kN kN kN
25: 001 26: MATH 27: MATH 28: MATH 29: MATH 30: MATH 31: MATH 32: MATH 33: MATH	lower no. 9 no.10 no.11 no.12 no.13 no.14 no.15 no.16	0.14 0.01 0.07 0.17 0.10 0.72 0.12 -0.00	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5

Measurement of Strap Pretension during Ceel-Down Phase

T 103 = 273.7 K

13.01.2006

14:16:59

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	7.92	kN
18:	MATH	no. 2	8.14	kN
19:	MATH	no. 3	7.31	kN
20:	MATH	no. 4	8.82	kN
21:	MATH	no. 5	7.10	kN
22:	MATH	no. 6	7.50	kN
23:	MATH	no. 7	6.40	kN
24:	MATH	no. 8	3.86	kN
25:	001			Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.20	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	2.48	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.01	kN

Measurement of Strap Pretension during Geel-Bown Phase

Warm up

T 103 = 288 K

16.01.2006

14:18:23

J. Schäffler

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	10.28	kN
18:	MATH	no. 2	10.45	kN
1 9 :	MATH	no. 3	9.48	kN
20:	MATH	no. 4	11. 05	kN
21:	MATH	no. 5	9.32	kN
22:	MATH	no. 6	9.12	kN
23:	MATH	no. 7	8.78	kN
24:	MATH	no. 8	5.80	kN
2 5 :	001			Skip
25: 26:	001 MATH	lower no. 9	0.14	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	 0.14 0.01	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	0.14 0.01 0.07	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	0.14 0.01 0.07 0.21	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no. 10 no. 11 no. 12 no, 13	0.14 0.01 0.07 0.21 0.10	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH	lower no. 9 no. 10 no. 11 no. 12 no, 13 no. 14	0.14 0.01 0.07 0.21 0.10 4.36	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no. 10 no. 11 no. 12 no. 13 no. 14 no. 15	0.14 0.01 0.07 0.21 0.10 4.36 0.12	Skip kN kN kN kN kN kN

Measurement of Strap Pretension during Gool Down Phase CVV pressuriZation

T103 = 2 88,7 K

16.01.2006

17:38:15

P. Mack

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#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	7.13	kN
18:	MATH	no. 2	7.50	kN
19:	MATH	no. 3	5.64	kN
20:	MATH	no. 4	7.30	kN
21:	MATH	no. 5	6.01	kN
22:	MATH	no. 6	5.00	kN
23:	MATH	no. 7	5.93	kN
24:	MATH	no. 8	5.30	kN
25:	001			Skip
25: 26:	001 MATH	lower no. 9	6.52	Skip kN
25: 26: 27:	001 MATH MATH	lower no. 9 no.10	6.52 8.21	Skip kN kN
25: 26: 27: 28:	001 MATH MATH MATH	lower no. 9 no.10 no.11	 6.52 8.21 6.64	Skip kN kN kN
25: 26: 27: 28: 29:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12	6.52 8.21 6.64 6.76	Skip kN kN kN kN
25: 26: 27: 28: 29: 30:	001 MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13	6.52 8.21 6.64 6.76 7.57	Skip kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31:	001 MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14	6.52 8.21 6.64 6.76 7.57 6.94	Skip kN kN kN kN kN kN
25: 26: 27: 28: 29: 30: 31: 32:	001 MATH MATH MATH MATH MATH MATH	lower no. 9 no.10 no.11 no.12 no,13 no.14 no.15	6.52 8.21 6.64 6.76 7.57 6.94 7.68	Skip kN kN kN kN kN kN

Measurement of Strap Pretension during Cool Down Phase at the end of Ear phase

T 103 = 290.4 K

17.01.2006

11:36:56

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# Kan	Mess-Stelle	Wert	Einheit
17: MATH	upper no. 1	7.15	kN
18: MATH	no. 2	7.54	kN
19: MATH	no. 3	5.75	kN
20: MATH	no. 4	7.28	kN
21: MATH	no. 5	6.03	kN
22: MATH	no. 6	5.12	kN
23: MATH	no. 7	5.98	kΝ
24: MATH	no. 8	5.32	kN
25: 001			Skip
26: MATH	lower no. 9	6.58	kN
27: MATH	no.10	8.23	kN
28: MATH	no.11	6.75	kN
29: MATH	no.12	6.79	kN
30: MATH	no,13	7.60	kN
31: MATH	no.14	7.03	kN
32: MATH	no.15	7.74	kN
33: MATH	no.1 6	7.48	kN

IX. Copy of the NCR's

				Tues	sday February 14 2006 1:3 PM
Company	Project	Name	NCR-No: HP-151	000-ASED-NC	-1795
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL	-PLANCK	Related internal N	CR-No:	
			Critical Item: Yes	X No 🗌	Revision 0
	Ν	onconforma	ince Report		
NCR Title EQM Cryo cover temp in	nstability				
NC Item Identification PLM EQM					
Next Higher Assembly HERSCHEI	PLM EQM				
Drawing No			Sr No.	EQM	
Procedure No SPIRE EMC Test					
Supplier ASED			Purchase Order	SPIRE EMC	Test
Subsystem			Model	EQM	
NC Observation Date: 28-NOV-05 Location: ASED	Otn		NC Detected Duri	ng Test	
Description of Nonconformance				R	equirements Violated
During cryo cover flushing the temper within the Cryo cover flushing circuit Possible cause is that the exhaust lin going to atmosphere. EQM Cryo cover flushing circuit confi	During cryo cover flushing the temperature of the cover became unstable and oscillations were apparent within the Cryo cover flushing circuit piping and the associated metering valves. Possible cause is that the exhaust line is long and the metering vale is right at the end of this line before going to atmosphere.				yo Operations
Initiator: Date, Name and Signature	29-NOV-05 D.He	ndry			
Internal NRB Dispositions					Classification:
Investigations performed. It has been flushing line was bad. Cover tempera the insulation vacuum	n detected that the in ature stabilized at lov	sulation vacuum of v twmperature after	the cover improoving		Major X Minor
Ref. to MoMs					Customer Notification
Cause of NC		Corrective/Preven	tative Actions		Verification
Ref to Failure Report					
Date: Name: Signature:					

		Tuesday February 14 2006 1:3 PM								
Company	Project Name	NCR-No: HP-151	000-ASED-NC-1319							
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	Related internal N	ICR-No:							
		Critical Item: Yes	X No Revision 1							
	Nonconforma	ance Report								
NCR Title I/F CVV to fill./ vent tube	of filling port is not He leaktight as req.									
NC Item Identification PLM EQM										
Next Higher Assembly HERSCHEL	- PLM EQM									
Drawing No		Sr No.	EQM							
Procedure No Cryo integration Leak test										
Supplier APCO/ STOEHR		Purchase Order	Cryo integration leak test							
Subsystem		Model	EQM							
NC Observation Date: 02-AUG-05 Location: ASED	Otn	NC Detected Duri	ng Test							
Description of Nonconformance			Requirements Violated							
During leaktest performed after integration of the upper bulkhead it was detected that the interface CVV upper bulkhead to the fill/ venttube of filling port is not leaktight as required (Helico- flex seal integrated on fill/ venttube of filling port: typ HN 200, outer diameter 132,1; inner diameter 122,3 batch 93766/03/41; Helicoflex on I/F to pressure plate of SV121 is Helicoflex Type: HNV 200 batch 109459/01 Outerdiameter 183,4; Inner diameter 173,6.										
-required leakrate is <10 -8 mbarl/s-1 -actual leakrate is > 10 -5 mbarl/s-1.										
Summary of activities performed in th performance of leaktest:	e frame of assy the I/F fill/ venttube wit	h upper bulkhead a	nd							
-I/F fill/ venttube with upper bulkhead 22Nm torqued. (Helicoflex ring mounted typ acc. to lin	I/F screws mounted first crosswise, the	en 3 times clockwise	ə with							
-Outer diameter of SV121 pressure pl	late reworked to remove dia ~0.1mm ir	n order to enable m	ounting.							
(I/F problem) Pressure plate mounted with	h MA= 6,5Nm (helicoflex seal mounted)								
-Blind plug integrated into the filling p	ort tube									
-First leak test performed from pressu	Ire plate side by using a vacuum clock	but this mounted plu	ug was not							
tight caused by the applied vacuum for	or the He- leak test purpose									
-After this not successful performed le to <1mbar by using the small vacuum	eak test it was decided to evacuate first pump in order to hold the blind plug in	t the line from the V position.	512 side							
-first leak test on 01.08. 18:00 # 18:30) by spraying Ghe into the the mounting	g I/F for SV921/ 922	? promptly							
a significantly leak signal of 10-5 occur	red, the leak test was stopped									
It was also observed that despite app existing	lication of final torque moment that a ga	ap of 0,25 # 0,35mn	n is							
for the applied test set up see appear	1 and 2									
Pomark close out information:	i anu z									
Additional sealing according to HP-2- successfull performed,	ASED-SD_0058 related to NCR HP-2-	ASED-NC-1513								
The Nonconformance is considered a	is closed.									

		Tuesday February 14 2006 1:3 PM							
Company ASTRIUM FRIEDRICHSHAFEN	Project Name HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item:Yes X No Page 2 of 6	Revision 1						
Nonconformance Report - Continuation Sheet -									

02-A	UG-0 &F}00 //t 8]	i a Ed Al B EED KOters	t				EQM integration	n leak test					
Additional in pumping capacity of	Additional information: According to the Linde statement from 17.11.89 to the same problem the total pumping capacity of the adsorbers is equivalent to a leak rate of 1x 10-4 mbar I/s for 9500 h (396days) (ref. 9/2374)												
Initiator: Date, Name and Signature 02-AUG-05 Lamprecht													
Internal NRB Dispositions Classification:													
Internal NR After discus	B held by telects B held by telects B held by telects	on on 02.07.05 ing is proposed	M. Alberti/	M. La	angferr	mann/ T.Bayer/ P. Mack:		Major X Minor					
After discussion the following is proposed: Customer Notification <remove mounted="" plate<="" pressure="" sv121="" td="" the=""> Customer Notification <remove 1="" bulkhead<="" f="" fill="" i="" screw="" td="" tube="" upper="" vent="" with=""> 02-AUG-05 <remount (or="" also="" an="" be="" below="" coated="" cu="" messing)="" screw="" td="" this="" to="" washer="" with="" with<=""> 02-AUG-05 <pre>remount this screw with an cu be washer below (or messing) washer also to be coated with 02-AUG-05 <pre>remount this screw with an cu be washer below (or messing) washer also to be coated with 02-AUG-05 <pre>reform this modification on each of the other 7 screws. <pre>re- torque all 8 screws with MA 28Nm. <pre>remount the pressure plate with MA= 6,5Nm (new helicon-flex seal or o-ring pending inspection tbd?) perform an He leaktest on these mounted interfaces. Official NRB with higher level tbd</pre></pre></pre></pre></pre></remount></remove></remove>													
Cause of N	С				Correc	ctive/Preventative Actions		Verification					
Ref to Failu	re Report												
Date: Name: Signature:	PA 02-AUG-05 M. Langfermann	Engineering 02-AUG-05 T. Bayer	02-AUG-05 M. v. Alberti	02-Al P. Ma	UG-05 ack								

								Tues	day Febr	uary '	14 2006	5 1:3 PM
	npany	EN	Project		NC	R-No: HP-15	51000-ASE	ED-NC-	-1319			
	LEINIGHIGHAI		HEROOHE		Rel	ated internal	NCR-No:					
					Crit	ical Item: Yes	S X No [l	Revisio	n 1
					Pag	je 3 of 6						
		Nonco	nforman	ce Repo	ort - Con	tinuatio	n Shee	et -				
Customer NRB	Dispositions	(Class Majo	r Only)	Ref. to MoM	s				Ver	ificatio	on	
Follow- ON NRB 03.08.05												
The activities in the frame of the performed mounting of "filling port, SV121 pressure plate" has been expressly explained by Paul Mack. The proposal for re-mounting which was distributed with the internal NRB was discussed and was in principal agreed with slight changes as follows. The Follow On Disposition is as follows: 1.) a.)The pressure plate shall be dismounted> closed OK b.) The Helico flex seal shall be inspected after removal> closed OK c.) the outer diameter of the pressure shall be verified> closed OK see LLK												
2. The Fixation so mounted after/ u -Apply a thin laye -Perform first tor -After performan stepwise in cross 26, 28) After the 1 hour and after	 2.The Fixation screws for the filling port shall loosened one by one clockwise and remounted after/ under the following actions: -Apply a thin layer vacuum grease below the screw heads and onto the threads. -Perform first torque with MA 18Nm. -After performance of this activities on all fixation screws the MA shall be increased stepwise in cross direction in steps of 2Nm to the new final torque of 28Nm (20, 22, 24, 26, 28) After the final torque is applied (28Nm) this torque shall be applied again after 1 hour and after 24h> closed OK 											
Re- mount the p Perform an He- I OK= 3x 10-6 mb	ressue plate eak test accoi ar l/s	ding to the te	est set-up as	mentioned ir	n annex 1.							
AI to ASED is to filling port or CV ¹ > closed during sealing areas wh regardingly the N ring groove.	check the NC V sealing groo g review of the here detected. NCR ASED-01	R database& ves areas. Upper bulkh During revie 81 has been	regarding to ead EIDP/ N w of the filling found which	NCRs abou CRs no NCR gport docume threates mir	t surface defe affecting the entatation for imperfecti	ects of e surface of ons on the O) -					
Finally Determin	ed Cause of N	IC		Corrective	e/Preventative	e Actions						
Ref to Failure Re	eport											
Request for Wai	ver		Alei	t				Other	related D	ocum	ients	
Yes 🗌 No 🗌	Reference:		Yes	No 🗌	Reference:							
											NCR	Close Out
											28-O	CT-05
NRB Approval	Chairman											
Organization/	ASED	ASED	ASED	ESA	ESA	ESA	ASED		ED	ASED)	
Name	wi. Langierriidhh	A. Suider	I . WIOUK	O. JEWEII		Pinterkrainer	IVI. V. AIDEI	u 1.E	Dayer		nprechi	
Date, Signature	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	5 03-	AUG-05	03-AL	JG-05	

								Tuesd	ay February	14 2006 1:3 PM		
Con ASTRIUM FRI	n pany Edrichshaf	FN	Proje	ct	Name PLANCK		NCR-No: HP-151000-AS	ED-NC-1	319			
							Related internal NCR-No	:				
							Critical Item: Yes X No			Revision 1		
							Page 4 of 6					
	Nonconformance Report - Continuation Sheet -											
Customer NRB	Dispositions	(Class Major	Only)	F	Ref. to MoMs				Verificati	on		
Follow ON NRB 05.08.05												
The situation after performed re- torque and Repeat of the He- leaktest on the I/F CVV to fill./ vent tube of filling port was discussed and the following disposition was made: -No further activities regarding Re- torque, change of seals etc. shall be performed. -The go- ahead for start of the pumping down of the insulation vacuum as pre- condition for the filling of the cryostat with LHe has been given. -In parallel a rough analysis shall be performed in order to analyse the thermal behaviour of the EQM taking into acount the actual leak rate(s), numbers of and actual conditions of mounted adsorbers, etc.												
Finally Determin	ed Cause of N	IC			Corrective/Pre	event	tative Actions					
Ref to Failure Re	eport											
Request for Wai	ver		AI	lert				Othe	r related Doc	uments		
Yes 🗌 No 🗌	Reference:		Ye	es [No 🗌 Refe	eren	ce:					
								1		NCR Close Out 28-OCT-05		
NRB Approval	Chairman											
Organization/ Name	ASED C. Schlosser	ASED E. Lamprecht	ASED M. v. Alber	rti	ESA C. Jewell							
Date, Signature	05-AUG-05	05-AUG-05	05-AUG-05	5	05-AUG-05							
(1											

				Tuesday Feb	ruary 14 2006 1:3 PM
ASTRI	Compa UM FRIEDRI	NY CHSHAFEN	Project Name HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No:	
				Critical Item:Yes X No Page 5 of 6	Revision 1
		No	nconformance Report -	Continuation Sheet -	
NCR Tre	eatment Seq	uence / Findin	gs / Statements / Actions		
Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-1	Mack	04-AUG-05	 a.) The pressure plate shall be dismounted b.) The Helicoflex seal shall be inspected after removal c.) the outer diameter of the pressur- plate shall be verified. 2. The Fixation screws for the filling port shall loosened one by one clockwise and remounted after/ under the following actions: Apply a thin layer vacuum grease b the screw heads and onto the thread -Perform first torque with MA 18Nm. After performance of this activities on all fixation screws the MA shall be increased stepwise in cross directior in steps of 2Nm to the new final torq of 28Nm (20, 22, 24, 26, 28) After th final torque is applied (28Nm) this torque shall be applied again after 1 hour and after 24h. Re- mount the pressue plate . Perform an He- leak test according to the test set-up as mentioned in anne Al to ASED is to check the NCR data base& regarding to NCRs about surf defects of filling port or CVV sealing grooves areas. 	e er elow ds. e n ue e o xx 1. a- face	Yes 🗶 No 🗌
Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C2-2	C. Schlosse	er 05-AUG-05	In parallel a rough analysis shall be performed in order to analyse the thermal behaviour of the EQM taking into acount the actual leak rate(s), numb of and actual conditions of mounted adsorbers, etc.	ers	Yes 🗶 No 🗌

				Tuesday February 14 2006 1:3 PM								
	Company	Project Name	NCR-No: HP-151000-ASE	D-NC-1319								
ASTRI	UM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	Related internal NCR-No:									
			Critical Item: Yes X No	Revision 1								
			Page 6 of 6									
	Nonconformance Report - Continuation Sheet -											
NCR/NR	ICR/NRB Attachments											
	Description	File	ename	Last Updated								
1	Annex 1	Ar	nnex 1.pdf	04-AUG-05 09:51:44								
	Description	File	ename	Last Updated								
2	Annex 2	Ar	nnex 2.pdf	04-AUG-05 09:52:43								
	Description	File	ename	Last Updated								
3	HP-2-ASED-SD_0058	HF	P-2-ASED-SD_0058.pdf	28-OCT-05 14:22:37								
	Description	File	ename	Last Updated								
4	Annex 4 to NC 1319 Lind	e Fax Ar	nnex 4 to NC1319 .pdf	28-OCT-05 15:29:40								

	Tuesday February 14 2006 1:3 PM											
C	Company		Proje	ct Nan	ne	NCR-No: HP-15	1000-ASED-NC-	0211				
ASTRIUM	I FRIEDRICHS	HAFEN	HERSCH	IEL-PLAN	СК	Related internal	NCR-No:					
						Critical Item: Yes	No X	Revision 0				
						Page 1 of 2						
				Nonc	onforma	ance Report	t					
NCR Title	Internal leaka	ge of SV123 ou	t of spec (IS	O QM SV	123)							
NC Item Ide	entification F	PLM EQM										
Next Higher Assembly HERSCHEL PLM EQM												
Drawing No Sr No. 13076/1												
Procedure I	No HP-2-ASE	D-TP-0001										
Supplier	ASPI					Purchase Order	Pre integration	Test				
Subsystem						Model	EQM					
NC Observation Date: 06-APR-04 Location: Otn NC Detected During Test												
Description	of Nonconform	ance					Re	quirements Violated				
During retes	st of the ISO S	/123 spare valv	e S/N 1307	6/1 it was	found that th	e internal leakrate	is out of					
a.) 1. Test p	performed with	valve closed ou	tlet evacuate	ed, Q: 1x	10 -3 mbar l/) -4 mbar l/s	sec-1						
c.) 3. Test p	performed with	valve closed ou	tlet evacuate	ed, Q: 1x 1 01 is: < 1	10 -3 mbar l/	sec-1						
Required le		IQ 10 1F. 11F-2-	43LD-1F-00	JUT 15. < T		50-1						
Initiator: Da	te, Name and S	Signature 06-A	PR-04 E	Lamprec	ht							
Internal NF	RB Dispositions							Classification:				
Use as is, a to safety.	a since slightly I	higher leakrate	is acceptabl	e for the ⊦	lerschel EQI	И. No impact		Major Minor X				
Ref. to Mol	Иs							Customer Notification				
								06-APR-04				
Ref to Failu	C re Report			Corre	cuve/Prever	itative Actions		verification				
	PA	Engineering										
Date: Name: Signature:	06-APR-04 R. Stritter	06-APR-04 A. Runge	06-APR-04 P. Mack	06-APR-04 A. Knight	06-APR-04 B. Barlage	06-APR-04 E. Lamprecht						

		Tuesda	y February 14 2006 1:3 PM								
Company ASTRIUM FRIEDRICHSHAFEN	Project Name HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-0211 Related internal NCR-No: Critical Item: Yes No X Revision 0 Page 2 of 2									
No	Nonconformance Report - Continuation Sheet -										
NCR/NRB Attachments											
Description	Filename		Last Updated								
1 Annex1 ASED-0211	Annex1 A	SED-0211.pdf	30-JUN-05 09:37:03								

	Tuesday February 14 2006 1:2 PM										
Company	Project	Name	NCR-No: HP-150	000-ASED-NC-	1817						
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL	-PLANCK	Related internal N	ICR-No:							
			Critical Item: Yes Page 1 of 1	X No 🗌	Revision 0						
	Ν	onconforma	ince Report								
NCR Title EQM mass flow through	OBA from AXT high	er that expected									
NC Item Identification HERSCHE	L PLM EQM										
Next Higher Assembly HERSCHE	L SATELITE										
Drawing No			Sr No.	EQM							
Procedure No EQM System level 1	est										
Supplier ASED			Purchase Order	EQM System I	evel Test						
Subsystem			Model	EQM							
NC Observation Date: 06-DEC-05 Location: ASED Otn NC Detected During Test											
Description of Nonconformance For PFM the nominal mass flow is ex- mass flow through the AXT to achieve the requir to the AXT. Without heating the mass flow was n L1/L2 temperatures, these mass flow The measured flows are recorded an	red temperatures for neasured at about 8.9 s were not as expec d have been distribu	/sec, instead for EC L1/L2 was about 2 5 mg/ sec but this d ted. ted for review.	QM Instrument testin 5mg/sec with heati id not achieve the r	Re ng the Ma ng applied required	quirements Violated ss Flow						
Initiator: Date, Name and Signature	06-DEC-05 D.He	ndry									
Internal NRB Dispositions EQM TMM will be checked in the fra ASED propoes to close this NCR Ref. to MoMs	me of the post EQM	rmal work.		Classification: Major X Minor Customer Notification							
Cause of NC Ref to Failure Report		Corrective/Preven	tative Actions		Verification						
Date: Name: Signature:	Ref to Failure Report Date: Name: Signature:										

Tuesday February 14 2006 1:1 PM											
C	ompany		Proje	ct Na	me	NCR-No: HP-150	0000-ASED-NC-1	683			
FRIEDRIC	ASTRIUM	STEC	HERSCH	EL-PLAI	NCK	Related internal N	ICR-No:				
THEDIAC		0120				Critical Item: Yes	X No	Revision 1			
						Page 1 of 4					
				Nond	conforma	ince Report					
NCR Title	EQM L1 temp	eratures highe	r that expecte	ed							
NC Item Identification HERSCHEL PLM EQM, SPIRE, PACS											
Next Higher Assembly HERSCHEL SATELITE, HERSCHEL INSTRUMENTS AND TELESCOPE (CFE), HERSCHEL INSTRUMENTS AND											
Drawing No	I		/ L)			Sr No.	EQM				
Procedure No PACS/SPIRE//Mode IMT											
Supplier	ASED					Purchase Order PACS/SPIRE // Mode IMT					
Subsystem						Model EQM					
NC Observa Date: 07-NO	tion V-05 Locatio	on: ASED OTM	1			NC Detected Duri	ing Test				
Description o	of Nonconform	ance					Rec	uirements Violated			
During PACS test	SPIRE // Mo	de IMT test pre	paration the	AXT hea	ater was incre	ased to 800 mw to	maintain the Cryo	operations			
operating ten maintain stab Subsequent t	nperatures wit bility is 200 to 4 to this the AXT	hin the cryosta 400 mw. F was found to	t L1 tempera	ture rose	e to 6k PACS,	8k Spire , nominal	setting to				
Initiator: Date	e, Name and S	Signature 08-N	IOV-05 D.	Hendry							
Internal NRE	B Dispositions							Classification:			
ASED NRB (08.11.05 on to be review	ved with custo	mer					Major 🔀 Minor 🗌			
Ref. to MoMs	s							Customer Notification 08-NOV-05			
Cause of NC	;			Cor	rective/Prever	tative Actions		Verification			
Ref to Failure	e Report										
Date: ⁰ Name: ¹ Signature:	PA 08-NOV-05 D.Hendry	Engineering 08-NOV-05 S.Idler	08-NOV-05 D.Hendry	08-NOV-0 C.Schloss	5 er						

							1	uesday Feb	ruary	14 2006	6 1:1 PM
Con AST FRIEDRICHS	1pany FRIUM SHAFEN,ESTE	EC	Proje HERSCH	ct Name	NC Rel Crit	R-No: HP-15 ated internal ical Item:Yes ge 2 of 4	NC-1683	1683 Revision 1			
		Nonco	nforma	nce Repo	ort - Con	tinuatio	n Sheet	-			
Customer NRB Dispositions (Class Major Only) Ref. to MoMs ATT 3 of NCR Verification NRB 08.11.05 ESA,ASP,ASED, C.Scharmberg, C.Jewell, A.Heske, J.Rautakoski., W.Pinter-Krainer, G Doubrovik, Verification C.Schlosser, S.Idler, E.Lamprecht, D.Hendry. See Attachment 3 of the NCR Verification											
Finally Determin Ref to Failure Re	ed Cause of N eport	IC		Corrective	e/Preventativ	ventative Actions					
Request for Wain	ver Reference:		A Y	lert es 🗌 No 🗌	Reference:	Other related Documents					
			·				L. L.			NCR 11-N	Close Out OV-05
NRB Approval Organization/ Name Date, Signature	Chairman ASED D.Hendry 10-NOV-05	ASED D.Hendry 10-NOV-05	ASED S.Idler 10-NOV-05	ASED C.Schlosser 10-NOV-05	ESA W.Pinter- Krainer 10-NOV-05	ESA A.Heske 10-NOV-05	ESA C.Scharmberg 10-NOV-05	ESA C.Jewell 10-NOV-05	ESA J.Ra 10-N	utakoski OV-05	

			Tuesda	y February 14 2006 1:1 PM					
Company ASTRIUM FRIEDRICHSHAFEN,ESTEC		Project Name HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-16 Related internal NCR-No: Critical Item:Yes X No Page 3 of 4	83 Revision 1					
Nonconformance Report - Continuation Sheet -									
AS G.I 10-	SP Doubrovik -NOV-05								

				Tues	sday February 14 2006 1:1 PM				
Company Project Name				NCR-No: HP-150000-ASED-NC-1683					
FRIE	ASTRIUM DRICHSHAFEN.ESTEC	IM HERSCHEL-PLANCK		Related internal NCR-No:					
				Critical Item: Yes X No	Revision 1				
				Page 4 of 4					
Nonconformance Report - Continuation Sheet -									
NCR/NR	B Attachments								
	Description		Filename		Last Updated				
1	PACS and SPIRE sensor c cooler rec	lata during first	SPIRE_PA	ACS_Sensors.zip	10-NOV-05 09:20:52				
	Description		Filename		Last Updated				
2	PACS cooler recycle Friday Sat	ƴ (4/11 - Day 308) to	PACS_1st	_Cooler_Recycle_G	10-NOV-05 13:46:26				
	Description		Filename		Last Updated				
3	NRB 08.11.05 Mom		ASED-NC-	-1683 NRB 08.doc	10-NOV-05 15:14:34				

						Tues	day February 14 2006 1:1 PM		
C	Company		Project	Name	NCR-No: HP-150000-ASED-NC-1489				
AF	PCO,ASTRIUM	N	HERSCHEL	-PLANCK	Related internal N				
					Critical Item: Yes	No X	Revision 0		
					Page 1 of 1				
			Ν	onconforma	ince Report				
NCR Title	Required tiltin	g position of the	e cryostat via tra	ansport dolly not se	cured				
NC Item Ide	entification ⊢	IERSCHEL PLI	M EQM, Integrat	ion Dolly					
Next Highe	r Assembly	IERSCHEL SA	TELITE,EQM a	dditional Refurbishe	ed ISO MGSE				
Drawing No)				Sr No.	EQM			
Procedure I	No Prep IMT/	Cooldown							
Supplier	ASED Otr	1			Purchase Order	Prep IMT/Coo	ldown		
Subsystem					Model	EQM			
NC Observ Date: 21-S	r ation EP-05 Locati	on: ASED Otn			NC Detected Duri	ing Test			
Description	of Nonconform	ance				Re	equirements Violated		
For PACS (and SPIRE) IM	T it is necessar	y to tilt the EQN	I by about 30 degre	ee (more than 20 de	egree). The tes	tprocedure		
tilting shoul During tiltin	d be managed g of the cryosta	by the test dolly It with the moto	/ #1. r of the test doll	y, the PLM moved I	back to about 15 de	egree when			
a tilting level of After adjust gear was m consequent During shor blocking. Th performed i order to avo	of about 21 deg ment of this pos loving back to a ily connected ci t investigation p ne blocking can n bid a problems	ree was achiev sition via turning ~15 degree lor yo equipments performed it wa only ensured it with the brake e	red. The EQM w g the transport of wer position cau (T- pumps, ver s detected that t the main brake electronic.	vas installed 200mn container gear hanc used by the proper tiline etc.) this used integrated e is constantly powe	n out of the emphas lweel it was observ weight of the cryost d gear is not fully se ered, which cannot	sis point. ed that the tat and elf be			
Initiator: Da	te, Name and S	Signature 21-S	EP-05 Lamp	precht					
Internal NF	RB Dispositions						Classification:		
As interim s position sha	solution the cryo all be ensured v	ostat shall be til via fixation by u	ted back to its r sing fixation bel	equired position an ts> AI closed	d this		Major Minor X		
Follow ON NRB 27.11.05: C. Schlosser, Lamprecht Due to the fact that the use of the dolly for the required tests, goals was possible after the performed corrective actions have been performed, it is decided to perform not any additional work on the this dolly the final diposition is: use as is						Customer Notification			
Ref. to Mol	Лs			-					
Cause of NC Corrective/Preventative Actions Verification							Verification		
Ref to Failu	re Report		1						
Date: Name: Signature:	PA 21-SEP-05 E. Lamprecht	Engineering 21-SEP-05 P. Mack	21-SEP-05 C. Schlosser						

						Т	uesday February 14 2006 1:0 P	М	
Company Project Name NCR-No: HP-150000-ASED-NC-1484 ASTRIUM FRIEDRICHSHAFEN HERSCHEL-PLANCK Related internal NCR-No:							NC-1484		
					Critical Item: Yes Page 1 of 2	X No	Revision 1		
			N	onconforma	nce Report				
NCR Title	Temp. gradie	nt requirement of	during Cooldow	n of cryostat partial	ly exceeded				
NC Item Ide	entification ⊦	IERSCHEL PLI	M EQM						
Next Highe	r Assembly	HERSCHEL SA	TELITE						
Drawing No)				Sr No.	EQM			
Procedure	No HP-2-ASE	D-TP-0072							
Supplier	ASED				Purchase Order	EQM PLM	Cooldown		
Subsystem					Model	EQM			
NC Observ Date: 18-S	ration EP-05 Locati	on: ASED Otn			NC Detected Dur	ing Test			
Description The temper exceeded at certain ti Required co the flow throug Required te AXT gets too co attachment	Description of Nonconformance Requirements Violated The temperature requirements valid for cooldown of the PLM EQM with integrated instruments have been exceeded Cool Down rate at certain times (see attached graphs). Required cooling rate of 5 K/h above 50 K, calculated over one hour, was exceeded for short time when the flow through the OBA gets too high (see attachment 1). Required temperature gradients between L0, L1, L2 and L3 were exceeded for very short times, when the AXT gets too cold during active cooling and at two non active phases, when the AXT warmed up slowly (see								
Initiator: Da	ite, Name and S	Signature 20-S	EP-05 Lam	orecht/ Schlosser					
Internal NF Internal NR Proposed o	RB Dispositions B 21.09.05: C. disposition is: us	Schlosser, P. N se as is for EQN	/lack, E. Lampr /l, since the req	echt uirement for cooling	g rates has		Classification: Major X Minor		
been exceeded only for a minimal time and the gradients have been exceeded only by less than 50%. Higher level NRB 26.09.05 (tbc). Closeout: Due to the performed IMT tests it is confirmed that no degradation of the instruments have been occured due to the short exceedind of the gradient requirements. ASED Otn proposes to close the NCR with the final disposition Use as is.									
performed	Final disposition	n: Use as is!	,						
Ref. to Mol	Ref. to MoMs								
Cause or NC Corrective/Preventative Actions Verification									
		Engineering							
Date: Name: Signature:	21-SEP-05 E. Lamprecht	21-SEP-05 P. Mack	21-SEP-05 C. Schlosser						

		Тиє	esday February 14 2006 1:0 PM				
Company ASTRIUM FRIEDRICHSHAFEN	Project Name HERSCHEL-PLANCK	Related internal NCR-No: Critical Item: Yes X No Page 2 of 2	C-1484 Revision 1				
Nonconformance Report - Continuation Sheet -							
NCR/NRB Attachments							
Description	Fi	ilename	Last Updated				
1 Temperature Gradients	OBA vs. AXT G	Gradients-AXTvsOBA.pdf	21-SEP-05 10:40:38				
Description	Fi	ilename	Last Updated				
2 OBA cool down rates	OBA cool down rates C		21-SEP-05 10:39:46				

		Tuesday February 14 2006 1:0 PM								
Company	Project Name	NCR-No: HP-142220-ASED-NC-1829								
ASTRIUM	HERSCHEL-PLANCK	Related internal NCR-No:								
		Critical Item: Yes X No Revision 0								
		Page 1 of 2								
	Nonconformance Report									
NCR Title Very high noise on C100	sensors for EQM CRYO SCOE									
NC Item Identification Cryo SCOE										
Next Higher Assembly EPLM EGS	Ξ									
Drawing No		Sr No.								
Procedure No HIFI System Level Te	est Thermal									
Supplier ABSP		Purchase Order HIFI System level Test Thermal								
Subsystem		Model EQM								
NC Observation Date: 06-DEC-05 Location: ASED	OTN	NC Detected During Test								
Description of Nonconformance		Requirements Violated								
The noise on the C100 thermistors is	much too high for the EQM CRYO SC	COE								
From the spec, the accuracies of the 1.6 K to 1.8 K : +/- 1mK Measured 1.8 K to 5.0 K : +/- 10mK Measured 5.0 K to 20.0 K : +/- 100mK Measured	C100 thermistors are : Value : 23.8 mK Value : 60.6 mK ed Value : 1700 mK									
On PFM, a similar NCR was raised so	ome time ago (HP-141200-ASED-NC-	-1434).								
Answer from ABSP on 06/12/2005										
Hello, Stijn										
The fix for this is the same as was done for the PFM SCOE, i.e. replacing the capacitor in the external harness (between the harness screen and the connector chassis) with a short circuit. The capacitor was initially inserted to prevent dc ground loops, and worked OK at AAS-A. However, the noise environments seem to be much higher (possibly due to all of the MGSE) at your facilities.										
The external harness cables which have been made by Astrium, also directly short the screen to the connector bodies at both ends of the cable.										
Regards, Ian										
Initiator: Date, Name and Signature	06-DEC-05 S. ILSEN									
Date: Name: Signature:										

		Tuesda	y February 14 2006 1:0 PM
Company ASTRIUM	Project Name HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-18 Related internal NCR-No: Critical Item: Yes X No Page 2 of 2	829 Revision 0
N	Ionconformance Report -	Continuation Sheet -	
NCR/NRB Attachments			
Description	Filename		Last Updated
1 C100 Noise data	Noise_or	n_C100_sensors.zip	06-DEC-05 17:17:46

			Т	uesday February 14 2006 12:59 PM		
Company	Project Name	NCR-No: HP-142	220-ASED-I	NC-1759		
ASTRIUM	HERSCHEL-PLANCK	Related internal NCR-No:				
		Critical Item: Yes	X No	Revision 0		
		Page 1 of 1				
	Nonconforma	ance Report				
NCR Title CRYO SCOE Heater rep	peated blocking and disabling					
NC Item Identification Cryo SCOE						
Next Higher Assembly EPLM EGS	E					
Drawing No		Sr No.	EQM			
Procedure No PACS EMC						
Supplier ABSP		Purchase Order	PACS EM	с		
Subsystem		Model	EQM			
NC Observation Date: 22-NOV-05 Location: ASED	OTN	NC Detected Dur	ing Test			
Description of Nonconformance				Requirements Violated		
This NCR is related to HP-142220-AS	SED-NC-1667 and HP-142220-ASED-N	NC-1668.		SCOE FW		
On 21/11/05, the heater data acquisit 1667 is	ion blocked (similar to NCR 1667). The	e main difference wi	th NCR			
that the SCOE was in 'once per minut on	te' acquitision mode and not in 'continio	ous mode'. The hea	ter stayed			
however (could be seen from the heli disappeared.	um flow). The SCOE is powered down	and up again and t	he problem			
on 22/11/05 very early in the morning	, the HCMD data acquisition blocked a	gain (0h03m). This	was not			
at that time. Around noon, suddenly the	he heater powered down from itself (co	ould be seen from th	e helium			
Because of the blocking however, the	scoe still indicated the expected powe	er. Some time later	(11h25m),			
heater values went to the default value	ie and the HCDM deblocked from itself.					
The heater is switched on again with	out problems.					
Added on 23/11/2005 by S ILSEN						
After analysis by ABSP the following is concluded: * Reset of heater output most probably related to 'peaks in data' (NCR 1668). Solution is not easy. Workaround could be to switch to continious acquisition (need to solve NCR 1667 before!). Since problem						
occur very often and the cryo scoe cannot be swithced off for a long time currently, more analysis will be done after the EQM phase. For now, ASED personel will monitor the helium flow closely. Closed for EQM, open for PFM.						
Initiator: Date, Name and Signature	22-NOV-05 S. ILSEN					
Date: Name: Signature:						

			Т	uesday February 14 2006 12:59 PM					
Company	Project Name	NCR-No: HP-142	220-ASED-	NC-1668					
ASTRIUM	HERSCHEL-PLANCK	Related internal NCR-No:							
		Critical Item: Yes	X No	Revision 1					
		Page 1 of 1							
Nonconformance Report									
NCR Title EQM CRYO SCOE data shows regular peaks in 'once per minute' acquisition									
NC Item Identification Cryo SCOE									
Next Higher Assembly EPLM EGSE									
Drawing No		Sr No.							
Procedure No HIFI SIH Elev int test									
Supplier ABSP		Purchase Order HIFI SIH Elec Int test							
Subsystem		Model EQM							
NC Observation Date: 15-JUL-05 Location: ASED	OTN	NC Detected During Test							
Description of Nonconformance				Requirements Violated					
In 'once per minute' acquisition mode, the EQM cryo scoe, shows peaks in the data. Every time a new sample is taken (once a minute), the value of a parameter goes to an unrealistic high value (more then a million times then actual value). These wrong values are seen for ~2 seconds. This means that every 60 seconds, the data is corrupted for 2 seconds. These 'wrong' values are also seen in the log files and in the TM data to the CCS.									
In 'continous' acquisition mode, the p	eaks are not seen.								
Remark: sometimes the peaks are much lower then a million times the actual value. Sometimes they stay within									
filter data afterwards.	,,,	,,,,,,,,,,,,,,,,,,,,,							
Initiator: Date, Name and Signature	03-NOV-05 S ILSEN								
Date: Name: Signature:									

		Tuesday February 14 2006 12:59 PM	1						
Company	Project Name	NCR-No: HP-142220-ASED-NC-1667							
ASTRIUM	HERSCHEL-PLANCK	Related internal NCR-No:							
		Critical Item: Yes X No Revision 0							
		Page 1 of 1							
Nonconformance Report									
NCR Title EQM CRYO SCOE heater data block in 'continious acquisition' mode									
NC Item Identification Cryo SCOE									
Next Higher Assembly EPLM EGSE									
Drawing No		Sr No.							
Procedure No HIFI Elec int Test									
Supplier ABSP		Purchase Order HIFI Elec Int Test							
Subsystem		Model EQM							
NC Observation Date: 15-JUL-05 Location: ASED	OTN	NC Detected During Test							
Description of Nonconformance Requirements Violated The EQM cryo scoe has different modes for the acquisition of data from the SCAU boards. SCOE Firm ware In the continious mode (sample every ~2 seconds), the heater data acquisition blocks after about 2 hours of SCOE Firm ware operation. This can be recovered by restarting the SCOE or a 5-minute procedure. This behaviour was also seen for other SCAU boards (for thermistor acquisition). It could however be solved by an update of the firmware of the SCAU boards. The firmware of the heater scau board was not updated since it is not easy accessible. This problem does not occur in 'once per minute' acquisition. This problem does not occur in 'once per minute' acquisition. Heater scau board was not updated									
Initiator: Date, Name and Signature	03-NOV-05 S. ILSEN								
Date: Name: Signature:									

								Tue	aday February 14 2006 12:58 PM	
Company Project Name NCR-No: HP-113000-ASED-NC-1675							-1675			
	ESTEC		HERSCH	EL-PLAN	к	Related internal NCR-No:				
						Critical Ite	m:Yes	X No	Revision 1	
						Page 1 of	2			
				Nonco	onforma	nce Re	port			
NCR Title	NCR Title Cryostat background radiation measured by PACS much higher than predicted									
NC Item Ide	entification P	PACS								
Next Highe	r Assembly	IERSCHEL INS	TRUMENTS	S AND TEL	ESCOPE (CFE)				
Drawing No)					Sr No.		EQM		
Procedure I	No IMT Pt 2									
Supplier	MPI					Purchase	Order	IMT Pt 2		
Subsystem						Model		EQM		
NC Observation NC Date: 03-NOV-05 Location: ASED OTN						NC Detec	ted Duri	ng Test		
Description	of Nonconform	ance						R	equirements Violated	
Cryostat ba PACS IMT are by factor 60 / 4 See analysi Way forwar	ckground radia revealed that cr 18 higher than e is report attache d: Perform addi	tion measured l yostat backgro expected (see P ed itional measure	by PACS mu und signals r ACS analysi ments:	ich higher measured is in attach	than predict by PACS sp ment x).	ed ectrometer	at 88 ?	/ 177 ?m		
NCR update Investigatio MPI are rev 1) Planck-c 2) map in o NCR update The investig MPI are rev	e 09.11.05 n tests have be riewing the resu curve in order to rder to localise e 09.11.05 gation testing ha riewing the resu	en performed s lts. o retrieve the te the straylight so as been perform lts.	ee ACS HP- mperature of burce. ned by ACS	2-ASED-S f the strylic HP-2-ASE	D-0064 and ht source ar D-SD-0067	0067 attac nd and 0064 s	hed. ee attac	ched		
Initiator: Da	te, Name and S	Signature 04-N	OV-05 D.	Hendry						
Internal NR	RB Dispositions								Classification:	
NRB ASED Perform str	,PACS,ESA 04 ay light test acc	.11.05 cording to ASEE	OACS attach	nment 2					Major X Minor	
Ref. to MoMs							Customer Notification 04-NOV-05			
Cause of NC Corrective/Preventative Actions Verification							Verification			
Ref to Failu	re Report				1		1			
Date: Name: Signature:	PA 04-NOV-05 D.Hendry	Engineering 04-NOV-05 S.Idler	04-NOV-05 D.Hendry	04-NOV-05 S.Ilsen	04-NOV-05 H.Feuchtgrub er	04-NOV-05 A.Heske				

				Tue	esday February 14 2006 12:58 PM					
Company Project Name				NCR-No: HP-113000-ASED-N	C-1675					
	ESTEC	HERSCHEL-PLA	NCK	Related internal NCR-No:						
				Critical Item: Yes X No	Revision 1					
				Page 2 of 2						
	Nonconformance Report - Continuation Sheet -									
NCR/I	NRB Attachments									
	Description		Filename		Last Updated					
1	PACS Background radia	ation report from IMT	eqmimt_	background_report.	04-NOV-05 10:48:13					
	Description		Filename		Last Updated					
2	ASED ACS For Stray lig	ht test during 2nd part	ACS_for	_Straylight_Test_o	04-NOV-05 11:07:30					
	Description		Filename		Last Updated					
3	ACS HP-2-ASED-SD-00 investigation te	067 stray light	HP-2-AS	ED-SD-0067 - Speci	10-NOV-05 10:04:40					
								Т	uesday	/ February 14 2006 12:57 PM
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Company Project Name NCR-No: HP-113000-ASED-NC-1495					95					
	ESTEC		HER	SCHEL-PL	ANCK	Relate	Related internal NCR-No:			
						Critica	l Item:Yes	🗌 No 🗙		Revision 2
						Page	1 of 3			
	Nonconformance Report									
NCR Title	NCR Title PACS: Cooler Recycle Failed									
NC Item Ide	entification F	PACS								
Next Highe	r Assembly	IERSCHEL	INSTRUME	INTS AND	TELESCOF	PE (CFE)				
Drawing No)					Sr No				
Procedure	No PACS IMT	г								
Supplier	MPI					Purch	ase Order	PACS IMT	-	
Subsystem	Subsystem Model EQM									
NC Observ Date: 20-S	NC Observation Date: 20-SEP-05 Location: ASED OTN NC Detected During Test									
Description	Description of Nonconformance Requirements Violated									
During the t revise the procedu	first cooler recy	cle in the IM	1T, PACS de	etected that	t this step w	as not succ	essful. PAC	S will	NA	
Initiator: Da	Initiator: Date, Name and Signature 21-SEP-05 S ILSEN									
Internal NF	RB Dispositions									Classification:
PACS shall TRR for Re	I revise the proc start of PACS I	cedure for th	ne cooler op	eration>	closed see H	HP-2-ASED	-MN-1096 -			Major 🗙 Minor 🗌
closeout: Cooler recy close this N changes.	closeout: Cooler recycling tests and IMT tests successfully performed> ASED Otn proposes to close this NCR by Use as is due to the performed and verified hardware and procedure changes.									
Ref. to Mol	Ref. to MoMs									
Cause of NC Corrective/Preventative Ac							ctions			Verification
Ref to Failu	ire Report	1			1					
Date: Name: Signature:	Engineering 24-OCT-05 H. Feuchtgruber	24-OCT-05 S. Idler	24-OCT-05 E. Wiezorrek	24-OCT-05 T. Muller	24-OCT-05 B. Collaudin	24-OCT-05 W. Pinter- Krainer	24-OCT-05 S. Ilsen	24-OCT-05 C. Schlosser		

								luesd	ay ⊦ebruary ⁻	14 2006 12:57 PM
Con	npany STEC		Project HERSCHE	t Name	NC	NCR-No: HP-113000-ASED-NC-1495				
					Rei	Related internal NCR-No:				
					Crit	ical Item: Yes	5 🗌 No [X	Revision 2	
					Paç	Page 2 of 3				
	Nonconformance Report - Continuation Sheet -									
Customer NRB	Dispositions	(Class Majo	r Only)	Ref. to MoM	s HP-2-ASEI	RD-MN-1109			Verificatio	on
NRB part of IMT PTR 04.11.05 Procedure for commanding has been updated. The cryostat filling port leak has been tightened with glue (RTV 691). The cryostat main tank (HTT) has been depleted and evacuated and remained evacuated during instrument testing. The heat shields are cooled instead by helium flushing from an external dewar. With that measures the cooler recycle could be successfully performed. The achieved hold time was approx. 40 h. NCR to be closed.										
Finally Determined Cause of NC Corrective/Preventative Actions										
Ref to Failure Re	eport									
Request for Wai	ver		Aler	t				Other re	elated Docum	nents
Yes 🗌 No 🗌	Reference:		Yes	No Reference:						
										NCR Close Out
									09-NOV-05	
NRB Approval	Chairman									
Organization/ Name	ASED D.Hendry	ASED D.Hendry	ASED S.Idler	ASED S.Ilsen	ESA A.Heske	MPI H. Feuchtgruber	MPI E. Wiezorr	ek		
Date, Signature	09-NOV-05	09-NOV-05 09-NOV-05 09-NOV-05 09-NOV-05 09-NOV-05 09-NOV-05								

Tuesday February 14 2006 12:57 PM **Project Name** Company NCR-No: HP-113000-ASED-NC-1495 ESTEC HERSCHEL-PLANCK Related internal NCR-No: Critical Item: Yes No X Revision 2 Page 3 of 3 Nonconformance Report - Continuation Sheet -**NCR/NRB** Attachments Description Last Updated Filename 27-SEP-05 11:58:18 1 Graphs of cryo scoe data during PACS IMT Data and Graphs PACS IMT (and cool Description Filename Last Updated Graph of 1st PACS cooler recycle PACS_Cooler_Recycle_1.jpg 30-SEP-05 08:41:24 2 Description Last Updated Filename PACS_Cooler_Recycle_2.jpg 30-SEP-05 08:41:40 3 Graph of 2nd PACS cooler recycle Description Last Updated Filename HP-2-ASED-MN-1096 - TRR for Restart of HP-2-ASED-MN-1096 - TRR f 24-OCT-05 16:03:48 4 PACS IMT Description Filename Last Updated IMT restart (Spire and PACS) MOM H-P-ASP-02-NOV-05 15:26:04 5 H-P-ASP-MN-6975 - SPIRE I MN-6975

			Tuesday February 14 2006 12:54 PM					
Company	Project Name	NCR-No: HP-112000-ASED-NC-1662						
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:						
		Critical Item: Yes	X No Revision 0					
		Page 1 of 2						
	Nonconform	ance Report						
NCR Title High correlation betwee	n cryo cover temp and SPIRE L1 temp)						
NC Item Identification SPIRE								
Next Higher Assembly HERSCHE	L INSTRUMENTS AND TELESCOPE	(CFE)						
Drawing No ASED-TR-0101		Sr No.	EQM					
Procedure No								
Supplier RAL		Purchase Order	SPIRE IMT Pt 2					
Subsystem		Model	EQM					
NC Observation Date: 25-OCT-05 Location: ASED	OTN	NC Detected Dur	ring Test					
Description of Nonconformance			Requirements Violated					
Unexpectedly high correlation between cryo cover temperature and SPIRE L1 temperature Cause is currently not understood and needs to be investigated by SPIRE. Temperature plots are attached to this NCR								
Initiator: Date, Name and Signature	02-NOV-05 D.Hendry							
Date: Name: Signature:								

Tuesday February 14 2006 12:54 PM

	Company ESTEC	Project Name HERSCHEL-PLANCK		NCR-No: HP-112000-ASED-NC Related internal NCR-No: Critical Item:Yes X No Page 2 of 2	-1662 Revision 0						
	Nonconformance Report - Continuation Sheet -										
NCR/N	RB Attachments										
	Description		Filename		Last Updated						
1	Cover temperature plot	Cover temperature plot		mperature_25_10_2	02-NOV-05 15:08:00						
	Description F		Filename		Last Updated						
2	Cryo cover temp related t	o L1	CRYOCO	/ER_L1_RELATIONjp	02-NOV-05 15:10:19						
	Description		Filename		Last Updated						
3	Cover + L1 graphs	Cover + L1 graphs		uence_on_L1_SPI	03-NOV-05 18:16:38						
	Description		Filename		Last Updated						
4	PACS-SPIRE with rec. cooler during cover Bi			BumpL1CoverExchange.zip 10-NOV-05 11:47							

						Tuesd	ay February 14 2006 1:4 PM			
C	Company Project Name NCR-No: HP-151240-ASED-NC-1415					415				
ASTRIUM	I FRIEDRICHS	HAFEN	HERSCHEL	-PLANCK	Related internal NCR-No:					
					Critical Item: Yes X No Rev		Revision 0			
					Page 1 of 1					
	Nonconformance Report									
NCR Title The SV121 plug remains not in safety valve position										
NC Item Ide	NC Item Identification ISO QM modified Filling Port (incl SV 121)									
Next Highe	r Assembly C	ryostat Helium	SS							
Drawing No)				Sr No.	01				
Procedure	No HP-2-ASE	D-TP-0072								
Supplier	Stoehr				Purchase Order	EQM PLM Cryo	o Cooldown			
Subsystem					Model	EQM				
NC Observation NC Detected During Test Date: 01-AUG-05 Location: ASED Otn										
Description	Description of Nonconformance Requirements Violated									
During Coo the SV plug of SV	During Cool- down operations according to HP-2-ASED-TP-0072 "1": it was observed several times that the SV plug of SV 121 (S/N 01) remains not in safety position after separation of plug from spindl (if one way valve									
with 60 mba	ar overpressure	is installed dur	ing over night c	configuration)						
Initiator: Date, Name and Signature 01-SEP-05 Lamprecht										
Internal NF	B Dispositions						Classification:			
 As first act via connect 	ions the valve s ion to the SV 0	shall be kept op 622/ YO 621-2	en and the safe line. performed	ety function shall be OK	ensured		Major Minor X			
-Follow ON NRB tbd> closed see below Customer Notification Follow ON NRB 23.09.05: Schlosser, Mack, Lamprecht 01-SEP-05 Final disposition is: Use as is after the safety function was provided via connection to 01-SEP-05 the SV 0622/ YO 621-2 line. The NCR is considered as closed1 01-SEP-05							Customer Notification 01-SEP-05			
Ref. to Mol	/Is									
Cause of N	С			tative Actions		Verification				
Ref to Failu	re Report									
Date: Name: Signature:	PA 01-SEP-05 E. Lamprecht	Engineering 01-SEP-05 A. Runge	01-SEP-05 C. Schlosser							

END OF DOCUMENT

EADS Astrium

Test Report

Herschel

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22	Х	Runge Axel	OTN/AOA54
	Barlage Bernhard	AED11		Schink Dietmar	AED44
	Bayer Thomas	AOA52	Х	Schlosser Christian	OTN/AOA54
	Brune Holger	AOA55		Schmidt Rudolf	FAE22
	Edelhoff Dirk	AED2		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Steininger Eric	AED32
Х	Fricke Wolfgang Dr.	AED 65	Х	Stritter Rene	AED11
	Geiger Hermann	AOA52		Suess Rudi	AOA54
	Gerner Willi	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasl Andreas	OTN/AOA54		Wagner Klaus	AOE22
	Grasshoff Brigitte	AET12		Wietbrock Walter	AET12
Х	Hauser Armin	AOE22		Wöhler Hans	AOE22
Х	Hendry David	Terma Resid.		Wössner Ulrich	ASE442
	Hengstler Reinhold	AOA 52	Х	Alcatel	ASP
	Hinger Jürgen	AOE22	Х	ESA/ESTEC	ESA
	Hofmann Rolf	ASE442		Instruments:	
Х	Hohn Rüdiger	AED65	Х	MPE (PACS)	MPE
	Hölzle Edgar Dr.	AED32	Х	RAL (SPIRE)	RAL
	Huber Johann	AOA52	Х	SRON (HIFI)	SRON
	Hund Walter	ASE442		Subcontractors:	
Х	Idler Siegmund	AED312		Air Liquide, Space Department	AIR
Х	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIRS
	Ivády von András	FAE22		Air Liquide, Orbital System	AIRT
	Jahn Gerd Dr.	AOE22		Alcatel Bell Space	ABSP
	Kalde Clemens	APE3		Astrium Sub-Subsyst. & Equipment	ASSE
	Kameter Rudolf	OTN/AOA54		Austrian Aerospace	AAE
	Kettner Bernhard	AET42		Austrian Aerospace	AAEM
	Knoblauch August	AET32		APCO Technologies S. A.	APCO
Х	Koelle Markus	AOA53		Bieri Engineering B. V.	BIER
	Koppe Axel	AED312		BOC Edwards	BOCE
Х	Kroeker Jürgen	AED65		Dutch Space Solar Arrays	DSSA
	Kunz Oliver Dr.	AOE22		EADS CASA Espacio	CASA
Х	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	ECAS
	Lang Jürgen	ASE442		EADS Space Transportation	ASIP
	Langenstein Rolf	AED15		Eurocopter	ECD
Х	Langfermann Michael	AOA51		European Test Services	ETS
Х	Mack Paul	OTN/AOA54		HTS AG Zürich	HTSZ
	Maute Thomas	AOA52		Linde	LIND
	Much Christoph	AOA53		Patria New Technologies Oy	PANT
	Müller Jörg	AOA52		Phoenix, Volkmarsen	PHOE
	Müller Martin	AOA53		Prototech AS	PROT
	Müller Ralf	FAE22		QMC Instruments Ltd.	QMC
	Peltz Heinz-Willi	AOE13		Rembe, Brilon	REMB
	Pietroboni Karin	AED65		Rosemount Aerospace GmbH	ROSE
	Platzer Wilhelm	AED2		RYMSA, Radiación y Microondas S.A.	RYM
	Reichle Konrad	AOA52		SENER Ingenieria SA	SEN
	Reuß Friedhelm	AED62		Stöhr, Königsbrunn	STOE
X	Rühe Wolfgang	AED6		Terma A/S, Herlev	TER