

Recovery from a decontamination heater stuck ON failure
File: H_CRP_SYS_DECH.xls
Author: E. Picallo

Herschel/Planck



Procedure Summary

Objectives

Recovery procedure in case of a heater stuck ON failure on M1 or M2 during decontamination, due to new strategy at 170K (HPS#1,6,10,15,17 shall be switched OFF by MOT/EAT if the median temperature for M1 or M2 is higher than 200K)

The recovery action consist in determining which M1 or M2 HCS remains stuck ON and reactivate the healthy heater lines to continue the telescope decontamination.

Summary of Constraints

With the current decontamination thresholds set at 170K/171K:
- If a Heater stuck ON on M1 -> M1 will raise to ~250K while M2 is controlled at 170K. The gradient of 50K between M1 and M2 is exceeded.

- If a Heater stuck ON on M2 -> M2 will raise to ~310K while M1 is controlled at 170K. The gradient of 50K between M1 and M2 is exceeded.

When the decontamination is ON and regulating, the temperature of M1 and M2 must not be above $170+50=220$ K. The monitoring temperature is set to 200K to get a margin wrt 220K.

In case of M2 heater failure, only the remaining heater line shall be used to continue the decontamination on M2 (as M2 is hot redundant 1/2)

In case of M1 heater failure, another M1 heater line could be activated due to the 3/7 lines redundancy. However, since the use of other heater lines is not covered neither by FDIR nor by the existing contingency procedures, it is recommended to use only the two healthy lines from #4, #6 and #7. The use of two lines for M1 is considered enough for a decontamination at 170K even in case of warm-up restart.

Spacecraft Configuration

Start of Procedure

HPS#1,6,10,15,17 OFF
Decontamination function started

End of Procedure

Decontamination function started

Reference File(s)

Input Command Sequences

Output Command Sequences

HRVDECH

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Referenced Displays

ANDs **GRDs** **SLDs**
 ZAZ9J999
 ZAZ7L999
 ZAZ7K999

Configuration Control Information

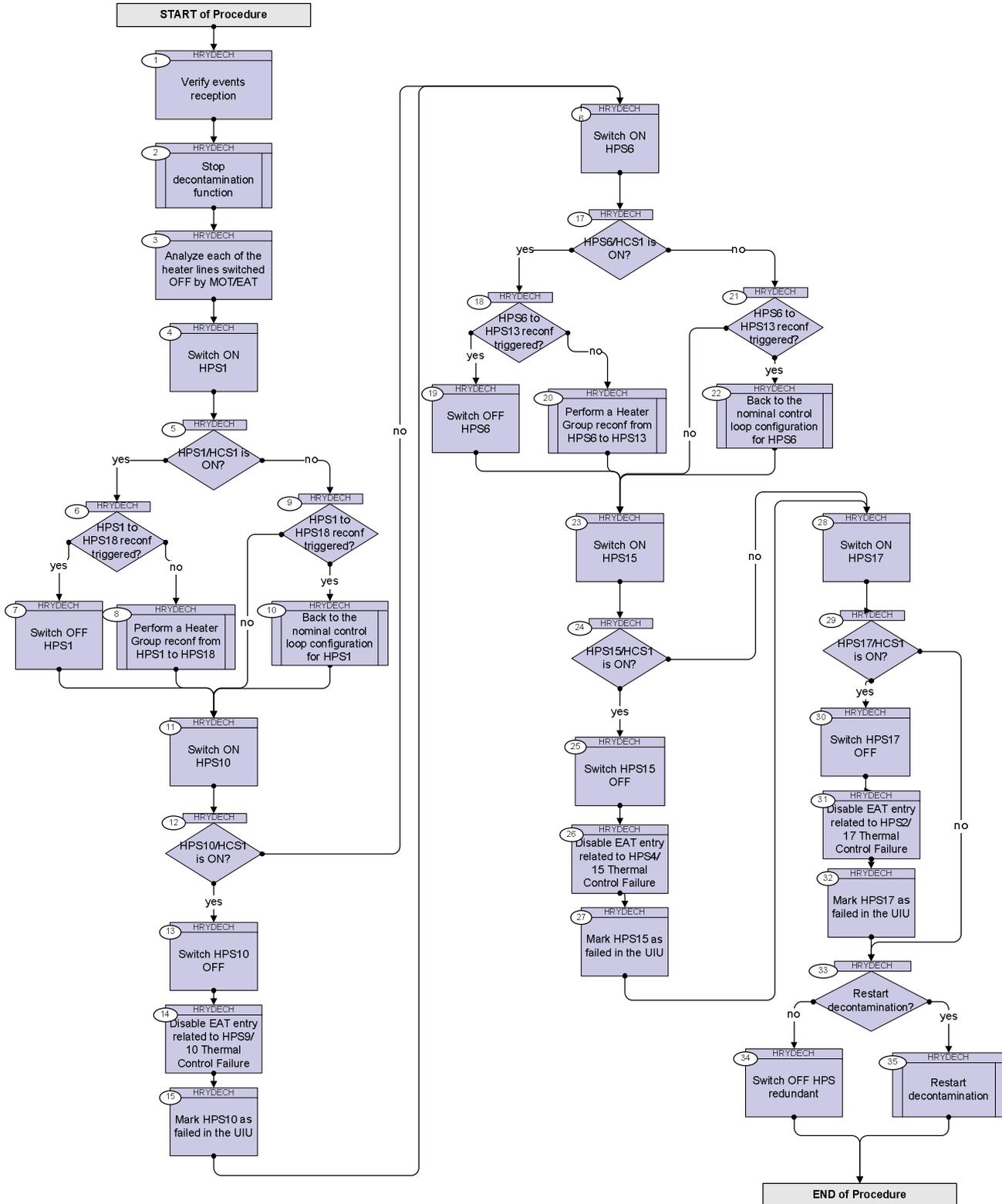
DATE	FOP ISSUE	VERSION	MODIFICATION DESCRIPTION	AUTHOR	SPR REF
22/04/09	2.3	1	Created	E. Picallo	

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Procedure Flowchart Overview



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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
Beginning of Procedure				
<p>TC Seq. Name : HRYDECH (RecoveryDecontHTR ON) Recovery from a decontamination heater stuck ON failure</p> <p>TimeTag Type: N Sub Schedule ID: <input type="checkbox"/></p>				
1		Verify events reception		Next Step: 2
1.1		If M1 heater line failure		<input type="checkbox"/>
		<p>In case of a M1 heater line failure (i.e. M1 median temperature has exceeded 200K) the following 5 events shall be received indicating that HPS#1,6,10,15,17 have been switched OFF:</p> <p>Evt_Mot_MonId_0xA010 Evt_Mot_MonId_0xA011 Evt_Mot_MonId_0xA012 Evt_Mot_MonId_0xA013 Evt_Mot_MonId_0xA014</p>		
1.2		If M2 heater line failure		<input type="checkbox"/>
		<p>In case of a M2 heater line failure (i.e. M2 median temperature has exceeded 200K) the following 5 events shall be received indicating that HPS#1,6,10,15,17 have been switched OFF:</p> <p>Evt_Mot_MonId_0xA018 Evt_Mot_MonId_0xA019 Evt_Mot_MonId_0xA01A Evt_Mot_MonId_0xA01B Evt_Mot_MonId_0xA01C</p>		
2		Stop decontamination function		Next Step: 3
		Call procedure H_CRP_SYS_DECM to stop decontamination function		
		Execute Procedure: H_CRP_SYS_DECM Start/Stop Decontamination heating function		
3		Analyze each of the heater lines switched OFF by MOT/EAT		Next Step: 4

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		<p>The analysis will consist in switching ON each HPS and check the status of the corresponding HCS.</p> <p>Since the decontamination function has been stoped, the HCS status should be OFF. Otherwise, it indicates a heater line stuck ON failure and a recovery action is needed.</p>		
3.1		<i>If M1 heater line failure</i>		<input type="checkbox"/>
		<p>If the FDIR was triggered due to the M1 median temperature exceeding the monitoring limit, it could indicate that one of the three M1 heaters lines is stuck ON: M1 heater line 4 (HPS 17 HCS 1 R) M1 heater line 6 (HPS 15 HCS 1 R) M1 heater line 7 (HPS 06 HCS 1 N)</p>		
3.2		<i>If M2 heater line failure</i>		<input type="checkbox"/>
		<p>If the FDIR was triggered due to the M2 median temperature exceeding the monitoring limit, it could indicate that one of the two M2 heaters lines is stuck ON: M2 heater line 1 (HPS 01 HCS 1 N) M2 heater line 2 (HPS 10 HCS 1 R)</p>		
4		<i>Switch ON HPS1</i>		Next Step: 5
		Execute Telecommand <div style="text-align: right;">PcdSwOnHps1</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- --</div> Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,5) switch On HPS 1	DCC01170	
		Verify Telemetry <div style="text-align: center;">GRP1_HPS_STS WM12G565</div>	= ON	AND=ZAZ9J999
5		<i>HPS1/HCS1 is ON?</i>		Next Step: yes 6 no 9
		Verify Telemetry <div style="text-align: center;">Decon1_G1H1_S WM11A565</div>	= ON	AND=ZAZ9J999
6		<i>HPS1 to HPS18 reconf triggered?</i>		Next Step: yes 7 no 8

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Herschel/Planck



Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Procedure: H_CRP_TCS_CLR Configuration check after thermal control loop failure		
7		Switch OFF HPS1		Next Step: 11
		Execute Telecommand TC Control Flags : Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 1	PcduswOffHps1 DCD27170 GBM IL DSE --Y -- --	
		Verify Telemetry GRP1_HPS_STS WM12G565	= OFF	AND=ZAZ9J999
8		Perform a Heater Group reconf from HPS1 to HPS18		Next Step: 11
		Execute Procedure: H_CRP_TCS_HCNR Heater Group reconfiguration after failure of the Nominal one		
9		HPS1 to HPS18 reconf triggered?		Next Step: no 11 yes 10
		Execute Procedure: H_CRP_TCS_CLR Configuration check after thermal control loop failure		
10		Back to the nominal control loop configuration for HPS1		Next Step: 11
		Execute Procedure: H_CRP_TCS_CLRB Roll back after thermal control loop on board reconfiguration		
11		Switch ON HPS10		Next Step: 12

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 File: H_CRP_SYS_DECH.xls
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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand PcduswOnHps10 TC Control Flags : GBM IL DSE --Y -- --- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,5) switch On HPS 10	DCC10170	
		Verify Telemetry GRP10_HPS_STS WM62G565	= ON	AND=ZAZ9J999
12		HPS10/HCS1 is ON?		Next Step: yes 13 no 16
		Verify Telemetry Decon2_G10H1_S WM61A565	= ON	AND=ZAZ9J999
13		Switch HPS10 OFF		Next Step: 14
		Execute Telecommand PcduswOffHps10 TC Control Flags : GBM IL DSE --Y -- --- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 10	DCD36170	
		Verify Telemetry GRP10_HPS_STS WM62G565	= OFF	AND=ZAZ9J999
14		Disable EAT entry related to HPS9/10 Thermal Control Failure		Next Step: 15
		Execute Telecommand DisableActions Command Parameter(s) : N_Repetition DH041170 APID_for_EAT_TC DH236170 EventId DH146170 TC Control Flags : GBM IL DSE --Y -- --- Subsch. ID : 10 Det. descr. : TEMPLATE Disable Actions TC(19,5)	DCT85170	1 <dec> (Def) CDMS (Def) 8093 <hex>
14.1		Send TC(19,6) to acquire the detection list		□

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 File: H_CRP_SYS_DECH.xls
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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand ReptEvtActTable TC Control Flags : Subsch. ID : 10 Det. descr. : TEMPLATE Report The contents of the event/action table TC(19,6) GBM IL DSE --Y -- ---	DCT86170	
		Verify that the action HPS9_Th_Cntrl_Failure 0x8093 is disabled		
15		Mark HPS10 as failed in the UIU		Next Step: 16
		Execute Telecommand MarkFailUnitB_Hps10 TC Control Flags : Subsch. ID : 10 Det. descr. : Fdir Mark Failed Unit B HPS10, TC(8,4,116,21) GBM IL DSE --Y -- ---	DC53H170	
		Verify Telemetry Hps10FailSts DEG40170	= Failed	AND=ZAZ7L999
16		Switch ON HPS6		Next Step: 17
		Execute Telecommand PcduswOnHps6 TC Control Flags : Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,5) switch On HPS 6 GBM IL DSE --Y -- ---	DCC06170	
		Verify Telemetry GRP6_HPS_STS WM42G565	= ON	AND=ZAZ9J999
17		HPS6/HCS1 is ON?		Next Step: yes 18 no 21
		Verify Telemetry Decon7_G6H1_S WM41A565	= ON	AND=ZAZ9J999
18		HPS6 to HPS13 reconf triggered?		Next Step: yes 19 no 20

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Procedure: H_CRP_TCS_CLR Configuration check after thermal control loop failure		
19		Switch OFF HPS6		Next Step: 23
		Execute Telecommand PcduswOffHps6 TC Control Flags : GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 6	DCD32170	
		Verify Telemetry GRP6_HPS_STS WM42G565	= OFF	AND=ZAZ9J999
20		Perform a Heater Group reconf from HPS6 to HPS13		Next Step: 23
		Execute Procedure: H_CRP_TCS_HCNR Heater Group reconfiguration after failure of the Nominal one		
21		HPS6 to HPS13 reconf triggered?		Next Step: yes 22 no 23
		Execute Procedure: H_CRP_TCS_CLR Configuration check after thermal control loop failure		
22		Back to the nominal control loop configuration for HPS6		Next Step: 23
		Execute Procedure: H_CRP_TCS_CLRB Roll back after thermal control loop on board reconfiguration		
23		Switch ON HPS15		Next Step: 24

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 File: H_CRP_SYS_DECH.xls
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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand PcduswOnHps15 <i>TC Control Flags :</i> GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,5) switch On HPS 15	DCC15170	
		Verify Telemetry GRP15_HPS_STS WM82H565	= ON	AND=ZAZ9J999
24		HPS15/HCS1 is ON?		Next Step: yes 25 no 28
		Verify Telemetry Decon6_G15H1_S WM81G565	= ON	AND=ZAZ9J999
25		Switch HPS15 OFF		Next Step: 26
		Execute Telecommand PcduswOffHps15 <i>TC Control Flags :</i> GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 15	DCD41170	
		Verify Telemetry GRP15_HPS_STS WM82H565	= OFF	AND=ZAZ9J999
26		Disable EAT entry related to HPS4/15 Thermal Control Failure		Next Step: 27
		Execute Telecommand DisableActions <i>Command Parameter(s) :</i> N_Repetition DH041170 APID_for_EAT_TC DH236170 EventId DH146170 <i>TC Control Flags :</i> GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : TEMPLATE Disable Actions TC(19,5)	DCT85170	1 <dec> (Def) CDMS (Def) 8043 <hex>
26.1		Send TC(19,6) to acquire the detection list		□

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Herschel/Planck



Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand <div style="text-align: right;">ReptEvtActTable</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- --</div> Subsch. ID : 10 Det. descr. : TEMPLATE Report The contents of the event/action table TC(19,6)	DCT86170	
		Verify that the action HPS4_Th_Cntrl_Failure 0x8043 is disabled		
27		Mark HPS15 as failed in the UIU		Next Step: 28
		Execute Telecommand <div style="text-align: right;">MarkFailUnitB_Hps15</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- --</div> Subsch. ID : 10 Det. descr. : Fdir Mark Failed Unit B HPS15, TC(8,4,116,21)	DC48H170	
		Verify Telemetry <div style="text-align: right;">Hps15FailSts DEG60170</div>	= Failed	AND=ZAZ7K999
28		Switch ON HPS17		Next Step: 29
		Execute Telecommand <div style="text-align: right;">PcduSwOnHps17</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- --</div> Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,5) switch On HPS 17	DCC17170	
		Verify Telemetry <div style="text-align: right;">GRP17_HPS_STS WM92H565</div>	= ON	AND=ZAZ9J999
29		HPS17/HCS1 is ON?		Next Step: yes 30 no 33
		Verify Telemetry <div style="text-align: right;">Decon4_G17H1_S WM91G565</div>	= ON	AND=ZAZ9J999
30		Switch HPS17 OFF		Next Step: 31

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Herschel/Planck



Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand <i>TC Control Flags :</i> <i>Subsch. ID : 10</i> Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 17 <div style="text-align: right;"> PcduswOffHps17 </div>	DCD43170	
		Verify Telemetry <div style="text-align: right;"> GRP17_HPS_STS WM92H565 </div>	= OFF	AND=ZAZ9J999
31		Disable EAT entry related to HPS2/17 Thermal Control Failure		Next Step: 32
		Execute Telecommand <i>Command Parameter(s) :</i> <div style="text-align: right;"> N_Repetition DH041170 APID_for_EAT_TC DH236170 EventId DH146170 </div> <i>TC Control Flags :</i> <i>Subsch. ID : 10</i> Det. descr. : TEMPLATE Disable Actions TC(19,5) <div style="text-align: right;"> DisableActions </div>	DCT85170 1 <dec> (Def) CDMS (Def) 8023 <hex>	
31.1		Send TC(19,6) to acquire the detection list		<input type="checkbox"/>
		Execute Telecommand <i>TC Control Flags :</i> <i>Subsch. ID : 10</i> Det. descr. : TEMPLATE Report The contents of the event/action table TC(19,6) <div style="text-align: right;"> ReptEvtActTable </div>	DCT86170	
		Verify that the action HPS2_Th_Cntrl_Failure 0x8023 is disabled		
32		Mark HPS17 as failed in the UIU		Next Step: 33

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Step No.	Time	Activity/Remarks	TC/TLM	Display/ Branch
		Execute Telecommand <div style="text-align: right;">MarkFailUnitB_Hps17</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- ---</div> Subsch. ID : 10 Det. descr. : Fdir Mark Failed Unit B HPS17, TC(8,4,116,21)	DC46H170	
		Verify Telemetry <div style="text-align: right;">Hps17FailSts DEG68170</div>	= Failed	AND=ZAZ7K999
33		Restart decontamination?		Next Step: no 34 yes 35
34		Switch OFF HPS redundant		Next Step: END
		Switch OFF the redundant HPS involved in the decontamination: HPS 17 -> M1 heater line 4 HPS 15 -> M1 heater line 6 HPS 10 -> M2 heater line 2 NOTE: if the failed heater line correspond to one of these Heater Groups, the HPS shall already be OFF as part of the recovery in the steps before.		
		Execute Telecommand <div style="text-align: right;">PcduswOffHps10</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- ---</div> Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 10	DCD36170	
		Verify Telemetry <div style="text-align: right;">GRP10_HPS_STS WM62G565</div>	= OFF	AND=ZAZ9J999
		Execute Telecommand <div style="text-align: right;">PcduswOffHps15</div> TC Control Flags : <div style="text-align: right;">GBM IL DSE --Y -- ---</div> Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 15	DCD41170	
		Verify Telemetry <div style="text-align: right;">GRP15_HPS_STS WM82H565</div>	= OFF	AND=ZAZ9J999

Recovery from a decontamination heater stuck ON failure
 File: H_CRP_SYS_DECH.xls
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		Execute Telecommand PcduswOffHps17 <i>TC Control Flags :</i> GBM IL DSE --Y -- -- Subsch. ID : 10 Det. descr. : PCDU:TC(8,4,112,3) switch Off HPS 17	DCD43170	
		Verify Telemetry GRP17_HPS_STS WM92H565	= OFF	AND=ZAZ9J999
35		Restart decontamination		Next Step: END
		Call procedure H_CRP_SYS_DECC to restart the telescope decontamination.		
		Before restarting the decontamination, the heater masks have to be modified depending on the failed heater line as follows:		
35.1		<i>If M2 heater line 1 is failed</i>		<input type="checkbox"/>
		Modify heater masks as follows: M1 mask ON : lines 4, 6 and 7 M1 mask OFF: lines 3, 5, 8 and 9 M2 mask ON : line 2 M2 mask OFF: line 1		
35.2		<i>If M2 heater line 2 is failed</i>		<input type="checkbox"/>
		Modify heater masks as follows: M1 mask ON : lines 4, 6 and 7 M1 mask OFF: lines 3, 5, 8 and 9 M2 mask ON : line 1 M2 mask OFF: line 2		
35.3		<i>If M1 heater line 4 is failed</i>		<input type="checkbox"/>
		Modify heater masks as follows: M1 mask ON : lines 6 and 7 M1 mask OFF: lines 3, 4, 5, 8 and 9 M2 mask ON : lines 1 and 2 M2 mask OFF: none		
35.4		<i>If M1 heater line 6 is failed</i>		<input type="checkbox"/>

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		Modify heater masks as follows: M1 mask ON : lines 4 and 7 M1 mask OFF: lines 3, 5, 6, 8 and 9 M2 mask ON : lines 1 and 2 M2 mask OFF: none		
35.5		<i>If M1 heater line 7 is failed</i>		□
		Modify heater masks as follows: M1 mask ON: lines 4 and 6 M1 mask OFF: lines 3, 5, 7, 8 and 9 M2 mask ON: lines 1 and 2 M2 mask OFF: none		
		Execute Procedure: H_CRP_SYS_DECC Restart telescope decontamination		
End of Procedure				