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PANDA Transient Tests

M3A, M3B & M4 Integral System Test Procedure

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Abstract:

This report details the procedure for conducting PANDA Transient Tests M3A, M3B and M4 specified by GE document 25A5764 Rev.2.

All phases for PANDA operation during the preconditioning processes and the test are described.

Rev.1 -> Rev.2 modifications are marked with a vertical line in the right margin.

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00 Introduction

After Test M3 has been run based on the procedure ALPHA-520 Rev.0 and after modifications of the Test Procedure Rev.1, the current document (ALPHA-520 Rev.2) describes all test phases for Transient Tests M3A, M3B and M4, including preconditioning processes. Assuming that the starting point for the preconditioning is an empty facility at atmospheric conditions, this procedure gives sequences of processes, which do not need to be strickly followed during the preconditioning process, at the discretion of Test Engineer. Required phases are listed in the Checklist and must be recorded when conducted.
The current procedure gives guidance on how to proceed to bring PANDA to the required initial test conditions for a extreme case (from a cold and empty facility). The order of preconditioning sequences may be modified if needed, and single phases may be adapted to the actual conditions. Heating power indicated in preconditioning phases is theoretical and considered as basis for time estimation; the given values correspond to the highest heater performance. Due to PSI electrical power limitation or modification in preconditioning process, the heating power may be reduced.
In any case, the foreseen preconditioning process is to start with the Suppression Chambers conditioning after the facility has been set ready for operation. It continues with the GDCS tank, all PCC/IC condenser pools and the Drywells. Just before test initiation, the RPV is set up to satisfy the required initial conditions. The test is then conducted during 20 hours under automatic power control and without any operator actions except for those actions required to maintain IC and PCC pool levels.
A time estimation for the preconditioning of an empty and cold facility is given for each component in the following table.
Test Plan Specifications are described in the GE document 25A5764 REV.2.

Note: - Since temperatures are given in Kelvin in the Test Plan Specification and in °C in the PANDA DAS, they are indicated in both units in that current procedure.
- Key parameters or key actions are indicated in dark frames to make reading easier during PANDA operation.

Time Estimation

Phase n°	Preconditioning Phases	time
10	Initial Alignment	not estimated
20	RPV Setup for Vessel Preconditioning	5,8 [hour]
30	Suppression Chambers Setup	12,8 [hour]
40	GDCS Heating	1,7 [hour]
50	IC Pool Setup	2,1 [hour]
60	PCC1 Pool Setup	1,9 [hour]
70	PCC2 Pool Setup	1,9 [hour]
80	PCC3 Pool Setup	1,9 [hour]
90	Drywells Setup	1,5 [hour]
100	RPV Initial Conditions Setup for Test	not estimated
110	Test Conditions Setup	not estimated
120	Test	20,0 [hour]
10 to 100	Duration for Preconditioning	29,4 [hour]
10 to 110	Duration for the whole Test	49,4 [hour]

Note: Duration of the phases n° 10, 100 and 110 cannot be estimated; it should not exceed a couple of hours.

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01 Test Configuration and Initial Conditions

The configuration for the Transient Tests includes the RPV, Suppression Chambers, Drywells, GDCS, all PCC condensers and their respective Pools; while the IC condenser is not part of the system for these Tests, nevertheless the IC Pool is included to the Test configuration. The Equalization Lines connecting both Wetwells to the RPV are also not part of the Test configuration and are kept closed. A detailed description of the required configuration is given in the GE document "Test Plan Specification".
An overview of the test configuration is summarized in the list of Test Initial Conditions given in the following. Defined for all components involved for Transient Tests, these Initial Conditions described in the above mentioned GE document are listed below with the respective tolerances.

Note: The current procedure is based on the values given in the Test Initial Conditions List below.

Test Initial Conditions List

RPV (V.RP)

-Total Pressure	MP.RP.1 =	295 [kPa]	±	4 [kPa]
- Mean Fluid Temperature	$T_{F\_mean}(RP)$ =	Σ(MTF.RP.i)/max(i)		with i=1 to 5
	$T_{F\_mean}(RP)$ =	406 [K]	±	2 [K]
- Local Fluid Temperature	MTF.RP.1...5 =	$T_{F\_mean}(RP)$	±	2 [K]
- Water Level	ML.RP.1 =	12,7 [m]	±	0,20 [m]

Drywell 1 and 2 (V.D1 - V.D2)

- Air Partial Pressure		13 [kPa]	±	2 [kPa]
- Mean Gas Temperature	$T_{G\_mean}(D1)$ =	Σ(MTG.D1.i)/max(i)		with i=1 to 6
	$T_{G\_mean}(D2)$ =	Σ(MTG.D2.i)/max(i)		with i=1 to 6
	$T_{G\_mean}(D1)$ =	404 [K]	±	2 [K]
	$T_{G\_mean}(D2)$ =	404 [K]	±	2 [K]
- Local Gas Temperature	MTG.D1.1...6 =	$T_{G\_mean}(D1)$	±	2 [K]
	MTG.D2.1...6 =	$T_{G\_mean}(D2)$	±	2 [K]
- Water Level	ML.D1 =	0 [m]	±	0,10 [m]
	ML.D2 =	0 [m]	±	0,10 [m]

Suppression Chamber 1 and 2 (V.S1 - V.S2)

-Total Pressure	MP.S1 =	285 [kPa]	±	4 [kPa]
	MP.S2 =	285 [kPa]	±	4 [kPa]
- Mean Gas Temperature	$T_{G\_mean}(S1)$ =	Σ(MTG.S1.i)/max(i)		with i=1 to 6
	$T_{G\_mean}(S2)$ =	Σ(MTG.S2.i)/max(i)		with i=1 to 6
	$T_{G\_mean}(S1)$ =	352 [K]	±	2 [K]
	$T_{G\_mean}(S2)$ =	352 [K]	±	2 [K]
- Local Gas Temperature	MTG.S1.1...6 =	$T_{G\_mean}(S1)$	±	2 [K]
	MTG.S2.1...6 =	$T_{G\_mean}(S2)$	±	2 [K]
- Mean Water Temperature	$T_{W\_mean}(S1)$ =	Σ(MTL.S1.i)/max(i)		with i=1 to 6
	$T_{W\_mean}(S2)$ =	Σ(MTL.S2.i)/max(i)		with i=1 to 6
	$T_{W\_mean}(S1)$ =	352 [K]	±	2 [K]
	$T_{W\_mean}(S2)$ =	352 [K]	±	2 [K]
- Local Water Temperature	MTL.S1.1...6 =	$T_{W\_mean}(S1)$	±	2 [K]
	MTL.S2.1...6 =	$T_{W\_mean}(S2)$	±	2 [K]
- Water Level	ML.S1 =	3,8 [m]	±	0,10 [m]
	ML.S2 =	3,8 [m]	±	0,10 [m]

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Test initial Conditions List (cont'd)

GDCS (V.GD)

-Total Pressure	MP.GD =	294 [kPa]	±	4 [kPa]
- Mean Fluid Temperature	$T_{F\_mean}(GD)$ =	Σ(MTF.GD.i)/max(i)		with i=1 to 7
	$T_{F\_mean}(GD)$ =	333 [K]	±	2 [K]
- Local Fluid Temperature	MTF.GD.1...7 =	$T_{F\_mean}(GD)$	±	2 [K]
- Water Level	ML.GD =	0 [m]	±	0,10 [m]

PCC1, 2 and 3 Pools (V.U1 - V.U2 - V.U3)

-Total Pressure	* MP.ENV =	97 [kPa]		
- Mean Water Temperature	$T_{W\_mean}(U1)$ =	Σ(MTL.U1.i)/max(i)		with i=1 to 7
	$T_{W\_mean}(U2)$ =	Σ(MTL.U2.i)/max(i)		with i=1 to 7
	$T_{W\_mean}(U3)$ =	Σ(MTL.U3.i)/max(i)		with i=1 to 19
	* $T_{W\_mean}(U1)$ =	372 [K]	+0/ -4	[K]
	* $T_{W\_mean}(U2)$ =	372 [K]	+0/ -4	[K]
	* $T_{W\_mean}(U3)$ =	372 [K]	+0/ -4	[K]
- Local Water Temperature	MTL.U1.1...7 =	372 [K]	+0/ -4	[K]
	MTL.U2.1...7 =	372 [K]	+0/ -4	[K]
	MTL.U3.1..19 =	372 [K]	+0/ -4	[K]
- Water Level	ML.U1 =	4,4 [m]	±	** 0,3 / 0,2 [m]
	ML.U2 =	4,4 [m]	±	** 0,3 / 0,2 [m]
	ML.U3 =	4,4 [m]	±	** 0,3 / 0,2 [m]

IC Pool (V.U0)

-Total Pressure	* MP.ENV =	97 [m]		
- Mean Water Temperature	$T_{W\_mean}(U0)$ =	Σ(MTL.U0.i)/max(i)		with i=1 to 7
	* $T_{W\_mean}(U0)$ =	372 [K]	+0/ -4	[K]
- Local Water Temperature	MTL.U0.1...7 =	372 [K]	+0/ -4	[K]
- Water Level	ML.U0 =	4,4 [m]	±	** 0,3 / 0,2 [m]

Note: * The pressure and temperature defined for the PCC/IC Pools correspond to saturation values at usual atmospheric pressure at the test site.
** The first given value corresponds to the Test M3A and the second to the M3B Test.

10 Initial Alignment

Before starting any preconditioning process, the facility is set into the specific state which establishes operations from the control room. The configuration is set in order to avoid any unintentional hardware manipulation during testing or preconditioning. The Data Acquisition and Control System must be properly initiated and brought into operation. Valves are aligned in accordance to STARTUP Status, automatic heat power regulation files are loaded and the auxiliary water system is filled to allow pump operation.
Five different preparation phases are needed for the Transient Tests: phase n°11 starting Control and Data Acquisition Systems, phase n°12 for the initial valve set, phase n°13 for the configuration checking, phase n°14 to prepare the automatic heat power regulation and phase n°15 for auxiliary water system filling.

11 Control System and DAS Setup

- Ethernet connection is isolated from PSI network (Unplug Ethernet connector)
- Run Factory Link software on HP-UNIX workstation (cf. Trending System User's Guide)
- Run DAS software (cf. DAS User's Guide)
- Run Factory Link software on PC (cf. Control Syst. User's Guide)
- Switch all local controllers to "external" and "automatic" state

Record on attached checklist

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12 Valve Alignment

- Valve off for pressure difference transmitters
- Set valve positions according to the STARTUP status

Record on attached checklist

13 General Facility Configuraton Check

- Check that the facility configuration corresponds to the required test configuration

Record on attached checklist

14 Prepare Automatic Heat Power Regulation

- Copy PF_TABLE.dec and PF_TABLE.str in C:\FLINK\RECIPE
- Test these two files (RUN program called "TEST" on the PC)

Record on attached checklist

15 Auxiliary Water System Filling

- Fill the Auxiliary Water System

16 Instrument / Zero Check

16.0 - Turn On Oxygen Probes

16.1 - Check Instruments

Transmitter zero check and DAS reading check according to the actual facility state, recording on DAS-Reading Hard-Copy and Trending Plots.

Record on attached checklist

20 RPV Setup for Vessel Preconditioning

As the heat source for the whole preconditioning process, the RPV must be capable of producing steam for vessel heating or providing hot water to the auxiliary system. In order to establish conditions to generate steam, the RPV is first heated to 373K, while most of the air is purged by venting to the atmosphere. Not all air is purged at this temperature, but that does not affect vessel preconditioning. Pure steam conditions are only required for the tests. Then the RPV is heated to about 440K to supply the auxiliary water system heat exchanger.
The RPV water level is set before preconditioning to anticipate evaporation occuring during heating by steam injection; it should reach the required Test water level at the end of the preconditioning process. However in any case it must be lower than the main steam line inlets to avoid water hammer.

21 Water Filling

21.0 Monitor RPV Parameters
- Water Level

Assumption:
ML..RP.1 = 0,0 [m]
M(RPV-water) = 0,00 [ton]

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21.1 Supply water until level reaches 12,7 [m]
Vent Air to the Atmosphere
- Open valve CC.RPV

Auxiliary water system operation
Pump MP.B0D On
ML.RP.1 = 12,7 [m]

MV.B0D = 2,0 [l/s]
M(RPV-water) = 15,00 [ton]
=> time = 7500 [sec]

Pump MP.B0D Off
Fill preheater heating side with water
- Open valve CB.HRH, CB.HFH

21.2 Monitor RPV Parameters
- Water Level ML.RP.1 = 12,7 [m]

22 Heating / Purging

22.0 Monitor RPV Parameters
-Total Pressure Assumptions: MP.RP.1 = 101 [kPa]
- Local Fluid Temperature MTF.RP.1...5 = 283 [K] = 10 [°C]
- Structure temperature MTI.RP.1...3 = 283 [K] = 10 [°C]
- Water Level ML.RP.1 = 12,7 [m]

22.1 Heat until temperature equals 373 [K]
Heaters On
MW.RP.7 = 800 [kW]
MTF.RP.1...5 = 373 [K]
= 100 [°C]

=> ΔT = 90 [K]

M(RPV-water) = 15,00 [ton]
M(RPV-struct) = 8,00 [ton]

=> ΔQ = 5,67 [GJ]
=> ΔQ = 0,36 [GJ]
=> ΔQtot = 6,03 [GJ]
=> time = 7539 [sec]

- Close valve CC.RPV

22.2 Heat until temperature equals 441 [K]
* MTF.RP.1...5 = 441 [K]
= 168 [°C]

=> ΔT = 68 [K]

Note: * Temperature corresponding to the heat exchanger operation: SC's water filling

M(RPV-water) = 15,00 [ton]
M(RPV-struct) = 8,00 [ton]

=> ΔQ = 4,28 [GJ]
=> ΔQ = 0,27 [GJ]
=> ΔQtot = 4,56 [GJ]
=> time = 5696 [sec]

Heater Off

22.3 Monitor RPV Parameters
-Total Pressure MP.RP.1 = 746 [kPa] Psat)
- Local Fluid Temperature MTF.RP.1...5 = 441 [K] = 168 [°C]
- Structure temperature MTI.RP.1...3 = 441 [K] = 168 [°C]
- Water Level ML.RP.1 = 14,1 [m]
M(RPV-water) = 15,00 [ton]

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30 Suppression Chambers Setup

The Test Initial Conditions require a collapsed water level in both Suppression Chambers of 3,8m above the PANDA heater bundle, that corresponds to a water column of 3,8m from the bottom of the Suppression Chamber. The required temperature is a homogeneous temperature of 352K for the pool water as well as for the gas space. The total pressure, considering saturated conditions, is at 285kPa, which includes an air partial pressure of 240kPa.
The Suppression Chambers Setup starts with water filling and pool conditioning (phase n° 31), continues with gas space heating by steam injection keeping 1 bar air partial pressure inside the vessels (phase n° 32). The total pressure is then set up by injecting air with the auxiliary air system (phase n° 33). Phase n° 33 is performed during phases n° 31 and 32.

31 Water Filling

31.0 Monitor SCs Parameters

Assumptions:

-Total Pressure	MP.S1 =	101 [kPa]		
	MP.S2 =	101 [kPa]		
- Local Water Temperature	MTL.S1.1...6 =	283 [K]	=	10 [°C]
	MTL.S2.1...6 =	283 [K]	=	10 [°C]
- Water Level	ML.S1 =	0 [m]		
	ML.S2 =	0 [m]		

31.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	746 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	441 [K]	=	168 [°C]
- Water Level	ML.RP.1 =	14,1 [m]		

Heaters On

MW.RP.7 = 800 [kW]

31.2 Supply water until level reaches 3,8 [m]

Auxiliary water system operation

Pump PC.HFH On

Setup control valve CC.BHA

CC.BCA

	MTL.BHA =	354,5 [K]	=	81 [°C]
	MTL.BCA =	max [K]		

- Open valve CB.S1L

Pump PC.B0D On

ML.S1 = 3,8 [m]	MV.B0D = 2 [l/s]
ML.S2 = 3,8 [m]	M(S1-water) = 42,50 [ton]
	M(S2-water) = 42,50 [ton]
	M(TSL-water) = 7,10 [ton]
	=> time = 46050 [sec]

- Close valve CB.S1L

Pump PC.B0D Off — MV.B0D = 0,0 [l/s]

Pump PC.HFH Off

Heater Off

31.3 SCs Parameters

- Mean Water Temperature	T_{w_mean}(S1) =	352 [K]	=	79 [°C]
	T_{w_mean}(S2) =	352 [K]	=	79 [°C]
- Water Level	ML.S1 =	3,8 [m]		
	ML.S2 =	3,8 [m]		

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32 Gas Space Heating

32.0 Monitor SCs Parameters — Assumptions:

-Total Pressure	MP.S1 =	162 [kPa]		
	MP.S2 =	162 [kPa]		
- Local Gas Temperature	MTG.S1.1...6 =	283 [K]	=	10 [°C]
	MTG.S2.1...6 =	283 [K]	=	10 [°C]
- Structure temperature	MTI.S1.1...9 =	283 [K]	=	10 [°C]
	MTI.S2.1...9 =	283 [K]	=	10 [°C]

32.1 RPV Setup for Steam Injection

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	746 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	441 [K]	=	168 [°C]
- Water Level	ML.RP.1 =	14,1 [m]		

Heaters On

MW.RP.7 = 800 [kW]

32.2 Steam injection

- Open valve CB.S1S, CB.S2S

MTI.S1.1...9 =	352 [K]	=> ΔT =	69 [K]
=	79 [°C]		
MTI.S2.1...9 =	352 [K]		
=	79 [°C]		
M(SCs-struct) =	72,7 [ton]	=> ΔQ =	2,52 [GJ]
M(steam) =	1095 [kg]	=> time =	3148 [sec]

- Close valve CB.S1S, CB.S2S

Heater Off

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	746 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	441 [K]	=	168 [°C]
- Water Level	ML.RP.1 =	13,1 [m]		

32.3 Monitor SCs Parameters

-Total Pressure	MP.S1 =	207 [kPa]		
	MP.S2 =	207 [kPa]		
- Mean Gas Temperature	T_{G_mean}(S1) =	352 [K]	=	79 [°C]
	T_{G_mean}(S2) =	352 [K]	=	79 [°C]
- Mean Water Temperature	T_{W_mean}(S1) =	352 [K]	=	79 [°C]
	T_{W_mean}(S2) =	352 [K]	=	79 [°C]
- Water Level	ML.S1 =	3,8 [m]		
	ML.S2 =	3,8 [m]		

33 Pressurization

33.0 Monitor SCs Parameters

-Total Pressure	MP.S1 =	207 [kPa]
	MP.S2 =	207 [kPa]

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33.1 Air injection until total pressure reachs 285 [kPa]

Auxiliary air supply system operation
Setup control valve CC.B0G.2 MM.B0G = max
- Open valve CB.S1G, CB.S2G, CB.B0G
MP.S1 = 285 [kPa]
M(air) = 360 [kg] => time = 12800 [sec]
- Close valve CB.S1G, CB.S2G, CB.B0G

33.2 Monitor SCs Parameters

-Total Pressure	MP.S1 =	285 [kPa]		
	MP.S2 =	285 [kPa]		
- Mean Gas Temperature	T_{G_mean}(S1) =	352 [K]	=	79 [°C]
	T_{G_mean}(S2) =	352 [K]	=	79 [°C]
- Mean Water Temperature	T_{W_mean}(S1) =	352 [K]	=	79 [°C]
	T_{W_mean}(S2) =	352 [K]	=	79 [°C]
- Water Level	ML.S1 =	3,8 [m]		
	ML.S2 =	3,8 [m]		

40 GDCS Heating

The Test Initial Conditions require a water level in the GDCS tank of 10,7m above the PANDA heater bundle, corresponding to a water level of 0,0m from the bottom of the tank, taking into account a full GDCS Return Line. The required temperature is a homogeneous temperature of 333K for the whole tank, which is achieved by filling with water up to approximately 5m at the required temperature and then draining the tank. The total pressure, under saturated conditions and in equilibrium with the Drywell pressure is at 294kPa, which includes an air partial pressure of 274kPa.
The GDCS Setup starts with structure heating by steam injection (phase n° 41), continues with water filling and pool conditioning, while keeping the vessel isolated, the air is not vented to the atmosphere as long as the total pressure is lower than 10 bars (phase n° 42). The total pressure is then adjusted by injecting air through the auxiliary air system or by venting air to the atmosphere (phase n° 43). That last phase is performed after water has been drained and transferred to the PCC pools.

41 Gas Space Heating

41.0 Monitor GDCS Parameters

	Assumptions:			
-Total Pressure	MP.GD =	101 [kPa]		
- Local Fluid Temperature	MTF.GD.1...7 =	283 [K]	=	10 [°C]
- Structure temperature	MTI.GD.1...6 =	283 [K]	=	10 [°C]
- Water Level	ML.GD =	0 [m]		

41.1 RPV Setup for Steam Injection
Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	746 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	441 [K]	=	168 [°C]
- Water Level	ML.RP.1 =	13,1 [m]		

Heaters On
MW.RP.7 = 800 [kW]

Note: The RPV temperature must be reduced to 436K for the GDCS water filling operation. (see 41.2 & 42.1)

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41.2 Steam injection
- Open valve CB.GDS

MTI.GD.1...6 =	333 [K]	=> ΔT =	50 [K]	
=	60 [°C]			
M(GD-struct) =	5,00 [ton]	=> ΔQ =	0,13 [GJ]	
M(steam) =	54,6 [kg]	=> time =	157 [sec]	

- Close valve CB.GDS

Heater Off

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	669 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	436 [K]	=	163 [°C]
- Water Level	ML.RP.1 =	12,9 [m]		

41.3 Monitor GDCS Parameters

-Total Pressure	MP.GD =	121 [kPa]		
- Local Fluid Temperature	MTF.GD.1...7 =	333 [K]	=	60 [°C]
- Structure temperature	MTI.GD.1...6 =	333 [K]	=	60 [°C]
- Water Level	ML.GD =	0 [m]		

Note: In order to get homogeneous temperature in GDCS, it is filled with water.

42 Water Filling

42.0 Monitor GDCS Parameters

-Total Pressure	MP.GD =	121 [kPa]		
- Local Fluid Temperature	MTF.GD.1...7 =	333 [K]	=	60 [°C]
- Structure temperature	MTI.GD.1...6 =	333 [K]	=	60 [°C]
- Water Level	ML.GD =	0 [m]		

42.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	669 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	436 [K]	=	163 [°C]
- Water Level	ML.RP.1 =	12,9 [m]		

Heaters On

MW.RP.7 = 800 [kW]

42.2 Supply water until level reaches 5,0 [m]

Auxiliary water system operation

Pump PC.HFH On

Setup control valve	CC.BHA	MTL.BHA =	333 [K]	= 60 [°C]
	CC.BCA	MTL.BCA =	max [K]	
Pump PC.B0D On		MV.B0D =	2,9 [l/s]	

- Open valve CB.GDL

ML.GD =	5,0 [m]	M(GD-water) =	14,8 [ton]
		=> time =	5086 [sec]

- Close valve CB.GDL

Pump PC.B0D Off

Pump PC.HFH Off

Heater Off

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42.3 Monitor GDCS Parameters

-Total Pressure	MP.GD =	626 [kPa]		
- Mean Fluid Temperature	T_{F_mean}(GD) =	333 [K]	=	60 [°C]
- Structure temperature	MTI.GD.1...6 =	333 [K]	=	60 [°C]
- Water Level	ML.GD =	5,00 [m]		

43 Pressurization

43.0 See phase n°82
Since the GDCS is full with water, it cannot be pressurized during the phase n° 43.
The GDCS pressurization is performed during phase n°82.

50 IC Pool Setup

The Test Initial Conditions for all PCC Pools and the IC Pool are the same; water level from the top of the PANDA heater bundle is defined at 23,2m, which corresponds to a water level of 4,4m in the pools. In order to anticipate the effect of evaporation during preconditioning, water is filled up to 4,6 m. The end point temperature is near the saturation temperature for atmospheric pressure.
The Pools Setup is performed as follows: water is filled at the highest possible temperature (phase n°51, 61, 71 & 81) and the temperature conditions are adjusted then by circulation through the auxiliary heat exchanger (phase n°111, 112, 113 & 114).

Note: Pools can be connected together and filled at the same time and water circulation can be also performed with connected pools.

51 Water Filling

51.0 Monitor IC Pool Parameters

- Local Water Temperature	MTL.U0.1...7 =	283 [K]	=	10 [°C]
- Water Level	ML.U0 =	0 [m]		

51.1 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	669 [kPa]	(Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	436 [K]	=	163 [°C]
- Water Level	ML.RP.1 =	12,9 [m]		

Heaters On
MW.RP.7 = 800 [kW]

* MTF.RP.1...5 =	447 [K]	=> ΔT =	11 [K]
=	174 [°C]		

Note: * Temperature corresponding to the heat exchanger operation: for IC Pool water filling

MP.RP.1 =	870 [kPa]		
ML.RP.1 =	13,2 [m]		
M(RPV-water) =	15,0 [ton]	=> ΔQ =	0,69 [GJ]
M(RPV-struct) =	8,0 [ton]	=> ΔQ =	0,04 [GJ]
		=> ΔQtot =	0,74 [GJ]
		=> time =	921 [sec]

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51.2 Supply water until level reaches 4,6 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve CC.BHA MTL.BHA = 375 [K] = 102 [°C]
CC.BCA MTL.BCA = max [K]
Pump PC.B0D On MV.B0D = 2,0 [l/s]
- Open valve CB.U0L

ML.U0 = 4,6 [m] M(U0-water) = 13,35 [ton]
=> time = 6676 [sec]

- Close valve CB.U0L

Pump PC.B0D Off
Pump PC.HFH Off
Heater Off

51.3 Monitor IC Pool Parameters
- Mean Water Temperature $T_{w\_mean}(U0)$ = 372 [K] = 99 [°C]
- Water Level ML.U0 = 4,60 [m]

60 PCC1 Pool Setup

For PCC1 Pool Setup refer to description of pools conditioning in phase n°50.

61 Water Filling

61.0 Monitor PCC1 Pool Parameters
- Local Water Temperature MTL.U1.1...7 = 283 [K] = 10 [°C]
- Water Level ML.U1 = 0 [m]

61.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters
-Total Pressure MP.RP.1 = 870 [kPa] Psat)
- Local Fluid Temperature MTF.RP.1...5 = 447 [K] = 174 [°C]
- Water Level ML.RP.1 = 13,2 [m]

Heaters On
MW.RP.7 = 800 [kW]

61.2 Supply water until level reaches 4,6 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve CC.BHA MTL.BHA = 375 [K] = 102 [°C]
CC.BCA MTL.BCA = max [K]
Pump PC.B0D On MV.B0D = 2,0 [l/s]
- Open valve CB.U1L

ML.U1 = 4,6 [m] M(U1-water) = 13,35 [ton]
=> time = 6676 [sec]

- Close valve CB.U1L

Pump PC.B0D Off
Pump PC.HFH Off
Heater Off

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61.3 Monitor PCC1 Pool Parameters

- Mean Water Temperature	$T_{w\_mean}(U1)$ =	372 [K]	=	99 [°C]
- Water Level	ML.U1 =	4,60 [m]		

70 PCC2 Pool Setup

For PCC2 Pool Setup refer to description of pools conditioning in phase n°50.

71 Water Filling

71.0 Monitor PCC2 Pool Parameters

- Local Water Temperature	MTL.U2.1...7 =	283 [K]	=	10 [°C]
- Water Level	ML.U2 =	0 [m]		

71.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	870 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	447 [K]	=	174 [°C]
- Water Level	ML.RP.1 =	13,2 [m]		

Heaters On
MW.RP.7 = 800 [kW]

71.2 Supply water until level reaches 4,6 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve CC.BHA MTL.BHA = 375,5 [K] = 102 [°C]
CC.BCA MTL.BCA = max [K]
Pump PC.B0D On MV.B0D = 2,0 [l/s]
- Open valve CB.U2L
ML.U2 = 4,6 [m] M(U2-water) = 13,35 [ton]
=> time = 6676 [sec]

- Close valve CB.U2L
Pump PC.B0D Off
Pump PC.HFH Off
Heater Off

71.3 Monitor PCC2 Pool Parameters

- Mean Water Temperature	$T_{w\_mean}(U2)$ =	372 [K]	=	99 [°C]
- Water Level	ML.U2 =	4,6 [m]		

80 PCC3 Pool Setup

For PCC3 Pool Setup refer to description of pools conditioning in phase n°50. In that case, the water comes from the GDCS; this phase defines the transfer (of the water used to heat the GDCS tank) from GDCS to PCC3 pool.
After water has been drained, the GDCS is pressurized by air injection (phase n°82).

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81 Water Transfer from GDCS Tank

81.0 Monitor PCC3 Pool Parameters

- Local Water Temperature	MTL.U3.1..19 =	283 [K]	=	10 [°C]
- Water Level	ML.U3 =	0 [m]		

Monitor GDCS Parameters

-Total Pressure	MP.GD =	626 [kPa]		
- Mean Fluid Temperature	T_{F_mean}(GD) =	333 [K]	=	60 [°C]
- Structure temperature	MTI.GD.1...6 =	333 [K]	=	60 [°C]
- Water Level	ML.GD =	5,00 [m]		

81.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	870 [kPa]	Psat)	
- Local Fluid Temperature	MTF.RP.1...5 =	447 [K]	=	174 [°C]
- Water Level	ML.RP.1 =	13,2 [m]		

Heaters On
MW.RP.7 = 800 [kW]

* MTF.RP.1...5 = 444 [K] => ΔT = -3,0 [K]
= 171 [°C]

Note: * Temperature corresponding to the heat exchanger operation: water transfer from GDCS to PCC3 Pool

81.2 Supply water until level reaches 4,6 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve

	MTL.BHA =	375,5 [K]	=	102 [°C]
	MTL.BCA =	max [K]		
Pump PC.B0D On	MV.B0D =	2,0 [l/s]		

- Open valve CB.U3U, CB.GDL
ML.U3 = 4,60 [m] M(U3-water) = 13,35 [ton]
=> time = 6676 [sec]
- Close valve CB.U3U, CB.GDL

Pump PC.B0D Off
Pump PC.HFH Off
Heater Off

81.3 Monitor PCC3 Pool Parameters

- Mean Water Temperature	T_{W_mean}(U3) =	372 [K]	=	99 [°C]
- Water Level	ML.U3 =	4,60 [m]		

Monitor GDCS Parameters

-Total Pressure	MP.GD =	122 [kPa]		
- Mean Fluid Temperature	T_{F_mean}(GD) =	333 [K]	=	60 [°C]
- Structure temperature	MTI.GD.1...6 =	333 [K]	=	60 [°C]
- Water Level	ML.GD =	0,10 [m]		

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	814 [kPa]		
- Local Fluid Temperature	MTF.RP.1...5 =	444 [K]	=	171 [°C]
- Water Level	ML.RP.1 =	13,1 [m]		

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82 GDCS Pressurization

82.0 Monitor GDCS Parameters
-Total Pressure MP.GD = 122 [kPa]

82.1 Air injection until total pressure reachs 294 [kPa]
Auxiliary air supply system operation
Setup control valve CC.B0G.2 MM.B0G = max
- Open valve CB.GDG, CB.B0G
MP.GD = 294 [kPa]
M(air) = 28 [kg] => time = 945 [sec]
- Close valve CB.GDG, CB.B0G

82.2 Monitor GDCS Parameters
-Total Pressure MP.GD = 294 [kPa]
- Mean Fluid Temperature T_{F_mean}(GD) = 333 [K]
- Water Level ML.GD = 0,1 [m]

90 Drywells Setup

The nominal Drywell condition is no water; the atmosphere is a mixture of steam with a small amount of air. The total pressure considered at saturated condition is defined at 294kPa, which includes an air partial pressure of 13kPa. The required temperature being homogeneous in the whole gas space, corresponds to 404K.
The Drywells Setup consists of steam injection to heat the gas space (phase n° 91) and of a depressurization by venting to atmosphere (phase n° 92). In order to get homogeneous temperature in the vessels, air is purged during phase n°91 and 20kg of air is reinjected to the Drywells in order to satisfy the required air partial pessure of 13kPa.
During the heating process, the RPV, used as steam source, is cooled down in order to approach the required test initial conditions - heater power is controlled in order to decrease the RPV temperature.

91 Gas Space Heating

91.0 Monitor Drywell Parameters Assumptions:
-Total Pressure MP.D1 101 [kPa]
MP.D2 101 [kPa]
- Local Gas Temperature MTG.D1.1...6 = 283 [K] = 10 [°C]
MTG.D2.1...6 = 283 [K] = 10 [°C]
- Structure temperature MTI.D1.1...9 = 283 [K] = 10 [°C]
MTI.D2.1...9 = 283 [K] = 10 [°C]
- Water Level ML.D1 = 0,0 [m]
ML.D2 = 0,0 [m]

91.1 Connect Drywells to all PCC Condensers
- Open valve CB.P1F, CB.P2F, CB.P3F

91.2 RPV Setup for Steam Injection
Monitor RPV Parameters
-Total Pressure MP.RP.1 = 814 [kPa]
- Local Fluid Temperature MTF.RP.1...5 = 444 [K] = 171 [°C]
- Water Level ML.RP.1 = 13,1 [m]
Heaters On
MW.RP.7 = 800 [kW]

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91.3 Steam injection (with air purging)

Vent valve opening for air purging

- Open valve CC.BUV, CB.D1V, CB.D2V
- Open valve CB.D1S, CB.D2S

MTI.D1.1...9 =	373 [K]	=> ΔT =	90 [K]
=	100 [°C]		
MTI.D2.1...9 =	373 [K]	=> ΔT =	90 [K]
=	100 [°C]		
M(DWs-struct) =	48,9 [ton]	=> ΔQ =	2,21 [GJ]
M(DWs-steam) =	98 [kg]	=> ΔQ =	0,26 [GJ]
		=> ΔQtot =	2,47 [GJ]
M(steam) =	961 [kg]	=> time =	3084 [sec]

Vent valves are closed when temperature has reached 373K and is steady

- Close valve CC.BUV, CB.D1V, CB.D2V

91.4 Continue Steam Injection (without air purging)

MTI.D1.1...9 =	404 [K]	=> ΔT =	31 [K]
=	131 [°C]		
MTI.D2.1...9 =	404 [K]	=> ΔT =	31 [K]
=	131 [°C]		
M(DWs-struct) =	48,9 [ton]	=> ΔQ =	0,76 [GJ]
M(DWs-steam) =	182 [kg]	=> ΔQ =	0,43 [GJ]
		=> ΔQtot =	1,20 [GJ]
M(steam) =	331 [kg]	=> time =	1494 [sec]

- Close valve CB.D1S, CB.D2S

Heater Off

Note: * During that phase, the RPV, used as heat source for steam injection to the Drywell, is cool down in order to approach the required test initial conditions - heat power is controlled (eventually not used) in order to decrease the RPV temperature.

91.5 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	295 [kPa]		
- Mean Fluid Temperature	T_{F_mean}(RP) =	406 [K]	=	133 [°C]
- Water Level	ML.RP.1 =	12,6 [m]		

Monitor Drywell Parameters

-Total Pressure	MP.D1	281 [kPa]		
	MP.D2	281 [kPa]		
- Local Gas Temperature	MTG.D1.1...6 =	404 [K]	=	131 [°C]
	MTG.D2.1...6 =	404 [K]	=	131 [°C]
- Structure temperature	MTI.D1.1...9 =	404 [K]	=	131 [°C]
	MTI.D2.1...9 =	404 [K]	=	131 [°C]

Monitor PCCs Parameters

-Total Pressure	MP.P1F =	281 [kPa]		
	MP.P2F =	281 [kPa]		
	MP.P3F =	281 [kPa]		
- Local Gas Temperature	MTG.P1.1...9 =	372 [K]	=	99 [°C]
	MTG.P2.1...9 =	372 [K]	=	99 [°C]
	MTG.P3.1...9 =	372 [K]	=	99 [°C]

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92 Pressurization

Both Drywells have been now purged; due to the poolwater temperature, a certain amount of air has been vented to the PCCs satisfying pressure equilibrium between Drywells and PCCs.
The Drywell atmosphere is expected to be pure saturated steam, while the PCCs contain some air. Just before they are pressurized by air injection (phase n°82), Drywells are isolated from the PCCs in order to avoid condensation and let stabilize the pressure.

92.0 Isolate Drywells from PCCs
- Close valve CB.P1F, CB.P2F, CB.P3F

92.1 Monitor Drywell Parameters

-Total Pressure	MP.D1	281 [kPa]		
	MP.D2	281 [kPa]		
- Local Gas Temperature	MTG.D1.1...6 =	404 [K]	=	131 [°C]
	MTG.D2.1...6 =	404 [K]	=	131 [°C]
- Structure temperature	MTI.D1.1...9 =	404 [K]	=	131 [°C]
	MTI.D2.1...9 =	404 [K]	=	131 [°C]

92.3 Air injection until Drywell total pressure increases by 13 [kPa] ± 2 [kPa]
Auxiliary air supply system operation
Setup control valve CC.B0G.2 MM.B0G = max
- Open valve CB.D1G, CB.D2G, CB.B0G
Δ (MP.D1) = 13 [kPa]
Δ (MP.D2) = 13 [kPa]
M(air) = 20 [kg] => time = 741 [sec]
- Close valve CB.D1G, CB.D2G, CB.B0G

92.4 Monitor Drywell Parameters

- Air Partial Pressure		13 [kPa]	±	2 [kPa]
- Local Gas Temperature	MTG.D1.1...6 =	404 [K]	=	131 [°C]
	MTG.D2.1...6 =	404 [K]	=	131 [°C]
- Structure temperature	MTI.D1.1...9 =	404 [K]	=	131 [°C]
	MTI.D2.1...9 =	404 [K]	=	131 [°C]

Monitor PCCs Parameters

-Total Pressure	MP.P1F =	294 [kPa]		
	MP.P2F =	294 [kPa]		
	MP.P3F =	294 [kPa]		
- Local Gas Temperature	MTG.P1.1...9 =	372 [K]	=	99 [°C]
	MTG.P2.1...9 =	372 [K]	=	99 [°C]
	MTG.P3.1...9 =	372 [K]	=	99 [°C]

100 RPV Initial Conditions Setup for Test

After having used the RPV as heat source for vessel preconditioning, it might be at conditions different from these required for test initiation; water level, pressure and temperature may need to be adjusted in order to satisfy the test initial conditions. However, the whole preconditioning anticipates the final state; start conditions are defined in order to get RPV conditions after other vessel preconditioning close to the required test initial conditions for the RPV.
Phase n° 101 starts with a parameter monitoring, which will give the basis for adjusting of RPV conditions.

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101 Adjusting RPV Conditions

101.0 Monitor RPV Parameters

- -Total Pressure
- - Mean Fluid Temperature
- - Water Level

Assumtions:

MP.RP.1 =	295 [kPa]		
T_{F_mean}(RP) =	406 [K]	=	133 [°C]
ML.RP.1 =	12,6 [m]		

101.1 Adjust Test Initial Conditions in RPV

Assuming saturated conditions and a negligible air partial pressure, the pressure is set by adjusting the temperature. Cooling is achieved by supplying cold water and/or by venting steam to the atmosphere. Heating is performed by using RPV heaters. Any required action is allowed to set up the RPV test initial conditions to match the required tolerances (ref. GE document "Test Plan Specification").

110 Test Conditions Setup

PANDA preconditioning has been now performed and the state of the facility is close to that required for test initiation; conditions out of tolerance must be adjusted to the defined values.
The test condition setup starts with the adjustment of both Suppression Chamber (SC) Pools (phase n° 111) and continues with the SCs gas space setup (phase n°112). The GDCS tank is then adjusted to its defined test initial conditions (phase n°113), before adjusting conditions of both Drywells (phase n° 114). The test condition setup continues then with the PCC/IC Pools condition adjustment (phase n° 115, 116, 117 & 118), which can be performed simultaneously. All these phases are not defined in detail, allowing any required action to get the test initial conditions established.

111 Adjusting SC Pools Conditions

111.0 Adjust Test Initial Conditions in Suppression Chamber Pools

After the check of the water temperature and water level, required action to adjust the corresponding parameters are supplying or draining water to satisfy the defined water level, and water circulation through one or the other of the two auxiliary heat exchangers as required to adjust the desired temperature. Any action is allowed to setup the SCs pools test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").

111.1 Monitor SCs Parameters

- Mean Water Temperature
- Local Water Temperature
- Water Level

T_{W_mean}(S1) =	352 [K]	±	2 [K]
=	79 [°C]		
T_{W_mean}(S2) =	352 [K]	±	2 [K]
=	79 [°C]		
MTL.S1.1...6 =	T_{W_mean}(S1)	±	2 [K]
MTL.S2.1...6 =	T_{W_mean}(S2)	±	2 [K]
ML.S1 =	3,8 [m]	±	0,10 [m]
ML.S2 =	3,8 [m]	±	0,10 [m]

Record on attached checklist

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112 Adjusting SC Gas Space Conditions

112.0 Adjust Test Initial Conditions in Suppression Chamber Gas Space

Assuming saturated steam/air mixture, the temperature and the pressure are separately adjusted by steam and air injection. Any required action is allowed to setup the SCs gas space test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").

112.1 Monitor SCs Parameters

-Total Pressure

- Mean Gas Temperature

- Local Gas Temperature

Record on attached checklist

MP.S1 =	285 [kPa]	±	4 [kPa]
MP.S2 =	285 [kPa]	±	4 [kPa]
T_{G_mean}(S1) =	352 [K]	±	2 [K]
=	79 [°C]		
T_{G_mean}(S2) =	352 [K]	±	2 [K]
=	79 [°C]		
MTG.S1.1...6 =	T_{G_mean}(S1)	±	2 [K]
MTG.S2.1...6 =	T_{G_mean}(S2)	±	2 [K]

113 Adjusting GDCS Conditions

113.0 Adjust Test Initial Conditions in GDCS

Assuming saturated steam/air mixture, the temperature and the pressure are separately adjusted by steam and air injection. Any required action is allowed to setup the GDCS test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").

113.1 Monitor GDCS Parameters

-Total Pressure

- Mean Fluid Temperature

- Local Fluid Temperature

- Water Level

Record on attached checklist

MP.GD =	294 [kPa]	±	4 [kPa]
T_{G_mean}(GD) =	333 [K]	±	2 [K]
=	60 [°C]		
MTF.GD.1...7 =	T_{G_mean}(GD)	±	2 [K]
ML.GD =	0,1 [m]	±	0,10 [m]

114 Adjusting DWs Conditions

114.0 Adjust Test Initial Conditions in Drywells

Assuming saturated conditions and an air partial pressure satisfying the required value, the temperature is adjusted by steam injection. Any required action is allowed to setup the Drywells test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").

114.1 Monitor Drywell Parameters

- Air Partial Pressure

- Mean Gas Temperature

	13 [kPa]	±	2 [kPa]
T_{G_mean}(D1) =	404 [K]	±	2 [K]
=	131 [°C]		
T_{G_mean}(D2) =	404 [K]	±	2 [K]
=	131 [°C]		

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114.1 Monitor Drywell Parameters (cont'd)

- Local Gas Temperature
- Structure temperature
- Water Level

MTG_D1.1...6 =	T_{G_mean}(D1)	±	2 [K]	
MTG_D2.1...6 =	T_{G_mean}(D2)	±	2 [K]	
MTI_D1.1...9 =	T_{G_mean}(D1)	±	2 [K]	
MTI_D2.1...9 =	T_{G_mean}(D2)	±	2 [K]	
ML_D1 =	0,0 [m]	±	0,10 [m]	
ML_D2 =	0,0 [m]	±	0,10 [m]	

Record on attached checklist

115 Adjusting IC Pool Conditions

115.0 Adjust Test Initial Conditions in IC Pool

Assuming saturated conditions at atmospheric pressure, the water temperature might be adjusted by water circulation through auxiliary heat exchanger; due to evaporation, the water level might need adjustment by supplying water. Any required action is allowed to setup the PCC/IC Pools test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").
All PCC/IC Pools conditions must be adjusted; that may be perfomed simultaneously by connecting the 4 pools together.

115.1 Set IC Pool Parameters
- Mean Water Temperature
- Local Water Temperature
- Water Level

T_{W_mean}(U0) =	372 [K]	+0/ -4	[K]
=	99 [°C]	+0/ -4	[°C]
MTL_U0.1...7 =	372 [K]	+0/ -4	[K]
ML_U0 =	4,4 [m]	±	** 0,3 / 0,2 [m]

Record on attached checklist

Note: ** The first tolerance corresponds to the Test M3A and the second to the M3B Test.

116 Adjusting PCC1 Pool Conditions

116.0 Adjust Test Initial Conditions in PCC1 Pool

For PCC1 Pool conditions adjustment refer to description of pool conditions adjustment in phase n°115.

116.1 Set PCC1 Pool Parameters
- Mean Water Temperature
- Local Water Temperature
- Water Level

T_{W_mean}(U1) =	372 [K]	+0/ -4	[K]
=	99 [°C]	+0/ -4	[°C]
MTL_U1.1...7 =	372 [K]	+0/ -4	[K]
ML_U1 =	4,4 [m]	±	** 0,3 / 0,2 [m]

Record on attached checklist

Note: ** The first tolerance corresponds to the Test M3A and the second to the M3B Test.

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117 Adjusting PCC2 Pool Conditions

117.0 Adjust Test Initial Conditions in PCC2 Pool

For PCC2 Pool conditions adjustment refer to description of pool conditions adjustment in phase n°115.

117.1 Monitor PCC2 Pool Parameters

- Mean Water Temperature	$T_{W\_mean}(U2)$ =	372 [K]	+0/ -4	[K]
	=	99 [°C]	+0/ -4	[°C]
- Local Water Temperature	MTL_U2.1...7 =	372 [K]	+0/ -4	[K]
- Water Level	ML_U2 =	4,4 [m]	± ** 0,3 / 0,2	[m]

Record on attached checklist

Note: ** The first tolerance corresponds to the Test M3A and the second to the M3B Test.

118 Adjusting PCC3 Pool Conditions

118.0 Adjust Test Initial Conditions in PCC3 Pool

For PCC3 Pool conditions adjustment refer to description of pool conditions adjustment in phase n°115.

118.1 Monitor PCC3 Pool Parameters

- Mean Water Temperature	$T_{W\_mean}(U3)$ =	372 [K]	+0/ -4	[K]
	=	99 [°C]	+0/ -4	[°C]
- Local Water Temperature	MTL_U3.1..19 =	372 [K]	+0/ -4	[K]
- Water Level	ML_U3 =	4,4 [m]	± ** 0,3 / 0,2	[m]

Record on attached checklist

Note: ** The first tolerance corresponds to the Test M3A and the second to the M3B Test.

120 Test

The facility satisfies now the required test initial conditions and must be configured according to the test configuration described in GE document "Test Plan Specification". Due to the relatively quick test initiation, data recording is started (phase n°121) before setting the desired RPV conditions (phase n°122) and before setting the test configuration (phase n°123). That last phase should not affect the PANDA conditions, but in order to assure test initial conditions satisfying the defined tolerances, the duration of all these phases between the test configuration setup (phase n°123.1 to n° 143.9) and the test initiation (phase n°123.10) should not exceed a few minutes (~5min). After test initiation, the test initial conditions must be within the tolerances given in phases n°120 and 122, in order to satisfy the acceptance criteria defined in the GE document "Test Plan Specification". If test initial conditions do not satisfy the above mentioned acceptance criteria, the test is interrupted, the heat power is shut down (phase n° 132.0), the vessels are isolated (phase n° 132.1) and the procedure starts again with the Test Conditions Setup (phase n° 110).
Due to the excessive pressure differences between vessels during the preconditioning, the pressure difference transmitters lineup (valve in) must be performed after the facility has test initial conditions established; it is performed during test configuration setup (phase n°123.7).

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121 Data Recording

121.0 Start Data Recording (At least for 20 hours after test has been initiated)

- Set "Daten-Speich." on HP-1000
- Set "Data recording rate" on HP-1000 (cf. requirement in "Test Plan Specification")

Record on attached checklist

121.1 Record the PANDA-Building temperatures at elevation 0m and 22m

Record on attached checklist

122 Adjusting RPV Conditions

122.0 Adjust Test Initial Conditions in RPV

Assuming saturated conditions and a negligible air partial pressure, the required pressure is set by adjusting the temperature. Any required action is allowed to setup the RPV test initial conditions according to the defined tolerances (ref. GE document "Test Plan Specification").

122.1 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	295 [kPa]	±	4 [kPa]
- Mean Fluid Temperature	$T_{F,mean}$(RP) =	406 [K]	±	2 [K]
	=	133 [°C]		
- Local Fluid Temperature	MTF.RP.1...5 =	$T_{F,mean}$(RP)	±	2 [K]
- Water Level	ML.RP.1 =	12,7 [m]	±	0,20 [m]

Record on attached checklist

123 Configuration Setup and Test Initiation

Since Test M3A and M3B require different configuration, a few specific phases must be performed differently in each case of Test. A phase number with a letter - n°...**A** or n°...**B** - concerns only the corresponding Test M3**A** or M3**B**. Mark A or B, as applicable.

123.0 Setup Automatic Heat Power Regulation

- Set "SCALED OPERATING POWER"
- Set "TRANSIENT START TIME AFT. SCRAM"

Record on attached checklist

123.1**A** **TEST M3A** - Pools isolated from each other

Pools might be already isolated from each other, in that case verify valves are closed

- Close valve CB.U0L, CB.U1L, CB.U2L, CB.U3L
  CB.U0U, CB.U1U, CB.U2U, CB.U3U

Record on attached checklist

123.1**B** **TEST M3B** - Interconnected Pools

- Close valve CB.B1L
- Open valve CB.U0L, CB.U1L, CB.U2L, CB.U3L

Record on attached checklist

123.2 Open GDCS Pressure Equialization lines

- Open valve CB.GP1, CB.GP2

Record on attached checklist

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123.3 Open Main Vent Lines
- Open valve CB.MV1, CB.MV2

Record on attached checklist

123.4 Open GDCS Return Line
- Open valve CB.GRT.2, CB.GRT.1

Record on attached checklist

123.5 Open PCC Vent Lines
- Open valve CB.P1V, CB.P2V, CB.P3V

Record on attached checklist

123.6 Open PCC Condensate Lines
- Open valve CB.P1C, CB.P2C, CB.P3C

Record on attached checklist

123.7 Open PCC Feed Lines
- Open valve CB.P1F, CB.P2F, CB.P3F

Record on attached checklist

123.8 Instrument / Zero Check and Pressure Difference Transmitters Piping Valve In
- Check Instruments as described in phase n°15
- Pressure Difference Transmitters Piping Valve In

Record on attached checklist

123.9 Open Main Steam Lines
- Open valve CB.MS1, CB.M2S
- Open valve CC.MS1, CC.MS2

Record on attached checklist

123.10 Print Valve Status Report every two hours during the Test duration
- Compare to Valve Status for Test Start M3A or Valve Status Report for M3B
- Attach Valve Status Reports to the Checklist

Record on attached checklist

123.11 Check Oxygen for O_2 Probes
- Check oxygen flow which must be at ~10-20% every two hours

Record on attached checklist

123.12 Test Initiation
- Connect Electrical Lines on Schema (click on the lower arrow)
- Select "ACTUAL CALCULATED POWER" - " POWER ON"
- Select "ACTUAL TRANSIENT TIME" - "TRANS. START"

Record on attached checklist

123.13 Check Test Initial Conditions - Acceptance Criteria
- Check parameters as indicated in phases 110 & 122.

Record on attached checklist

123.14 Test Interruption
If the Acceptance Criteria are not satisfied go to phase n° : 132.0 & 132.1
=> phase n° 132.0
=> phase n° 132.1
- Restart procedure with phase n° 110 (Test Conditions Setup)

123.15 VB-Opening Setup
- Set up automatic VB-Opening Control (Process Control System)
- Set up automatic Burst-measurement for VB-Opening (DAS-System)

Record on attached checklist

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123.16A **TEST M3A** - PCC Pool Level Maintenance

Level maintenance in Pools means, in case **M3A**, to keep the water level of each Pool in the domain defined by the nominal level and the specific tolerance. That level maintenance is performed as follows: Pool levels are monitored and when one approachs the lowest acceptable limit ("Lower Warning Level"), water is filled up to higher possible level ("Upper Warning Level"). **Pool levels** are continuously watched on and **separately readjusted** when required. It is expected to readjust levels every two hours during the Test duration; this periode may be different.
"Warning Levels" are inside the domain defined by the Test Initial Conditions and their respective Tolerances, are close to the respective upper and lower limits but are far enough from critical levels in order to anticipate the duration of required level maintenance operations.

Monitor PCC/IC Pool Level during the whole Test Duration

- Water Level	ML.U0 =	4,4 [m]	±	0,3 [m]
	ML.U1 =	4,4 [m]	±	0,3 [m]
	ML.U2 =	4,4 [m]	±	0,3 [m]
	ML.U3 =	4,4 [m]	±	0,3 [m]

- Lower Warning Levels for Water Filling:	ML.U0 =	4,15 [m]
	ML.U1 =	4,15 [m]
	ML.U2 =	4,15 [m]
	ML.U3 =	4,15 [m]

Supply water until upper warning level is reached

Auxiliary water system operation
Pump PC.B0D On
- Open valve CB.DXA, CB.LXA, CB.B0L, CB.B1L
* CB.UnL with n = 0, 1, 2, 3

Note: Pools can be filled **only separatly** !!!
Water filling process applicable to only one pool on the same time !

* Valve name contains an index (n) corresponding to the pool, which level is reajusted.

Monitor PCC/IC Pool Level during the whole Test Duration

- Upper Warning Levels to Stop Water Filling:	ML.U0 =	4,65 [m]
	ML.U1 =	4,65 [m]
	ML.U2 =	4,65 [m]
	ML.U3 =	4,65 [m]

Stop Water Filling
- Close valve * CB.UnL with n = 0, 1, 2, 3
CB.DXA, CB.LXA, CB.B0L, CB.B1L
Pump PC.B0D Off

Monitor PCC/IC Pool Level during the whole Test Duration

- Water Level	ML.U0 =	4,4 [m]	±	0,3 [m]
	ML.U1 =	4,4 [m]	±	0,3 [m]
	ML.U2 =	4,4 [m]	±	0,3 [m]
	ML.U3 =	4,4 [m]	±	0,3 [m]

- Print out valve status report
- Compare to Valve Status Report for Test Start M3A
- Record date and time of water level readjusting process on attached checklist.

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123.16B **TEST M3B** - PCC Pool Level Maintenance

Level Maintenance in Pools means, in case **M3B**, to keep the water level of the **interconnected Pools** in the domain defined by the nominal level and the specific Test tolerance. That level maintenance is performed as follows: Pool levels are monitored and when they approach the lowest acceptable limit ("Lower Warning Level"), water is filled up to higher possible level ("Upper Warning Level"). **Pool levels** are continuously watched on and **simultaneously readjusted** when required. It is expected to readjust levels every two hours during the Test duration; this periode may be different.
"Warning Levels" are inside the domain defined by the Test Initial Conditions and their respective Tolerances, are close to the respective upper and lower limits but are far enough from critical levels in order to anticipate the duration of required level maintenance operations.

Monitor PCC/IC Pool Level during the whole Test Duration

- Water Level	ML.U0 =	4,4 [m]	±	0,2 [m]
	ML.U1 =	4,4 [m]	±	0,2 [m]
	ML.U2 =	4,4 [m]	±	0,2 [m]
	ML.U3 =	4,4 [m]	±	0,2 [m]

- Lower Warning Levels for Water Filling:	ML.U0 =	4,25 [m]
	ML.U1 =	4,25 [m]
	ML.U2 =	4,25 [m]
	ML.U3 =	4,25 [m]

Supply water until upper warning level is reached

Auxiliary water system operation
Pump PC.B0D On
- Open valve CB.DXA, CB.LXA, CB.B0L, CB.B1L

Note: Pools are interconnected and filled **together** !!!

Monitor PCC/IC Pool Level during the whole Test Duration
- Upper Warning Levels to Stop Water Filling:

ML.U0 =	4,55 [m]
ML.U1 =	4,55 [m]
ML.U2 =	4,55 [m]
ML.U3 =	4,55 [m]

- Close valve CB.DXA, CB.LXA, CB.B0L, CB.B1L
Pump PC.B0D Off

Monitor PCC/IC Pool Level during the whole Test Duration
- Water Level

ML.U0 =	4,4 [m]	±	0,2 [m]
ML.U1 =	4,4 [m]	±	0,2 [m]
ML.U2 =	4,4 [m]	±	0,2 [m]
ML.U3 =	4,4 [m]	±	0,2 [m]

- Print out valve status report
- Compare to Valve Status Report for Test Start M3B
- Record date and time of water level readjusting process on attached checklist.

130 End of Test

At the end of 20 hours data recording will be terminated and the test terminated. Phases n° 131 and 132 describe the end of test and facility shut down.

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131 End of Data Recording

131.0 Stop Data Recording (cf DAS User's Guide)
After 20 hours (data recording), test is completed.

131.1 Save Data (cf Control System User's Guide) Record on attached checklist

131.2 Record the PANDA-Building temperatures at elevation 0m and 22m
Record on attached checklist

132 Facility Shut Down

132.0 Stop Heat Power
Heater Off

132.1 Oxygen Probes Shut Off

132.2 Pressure Transmitters Piping Valve Out

132.2 Isolating Vessels

- Close valve CB.MS1, CB.M2S
  CB.P1C, CB.P2C, CB.P3C
  CB.P1V, CB.P2V, CB.P3V
  CB.GRT.2, CB.GRT.1
  CB.MV1, CB.MV2
  CB.U0L, CB.U1L, CB.U2L, CB.U3L

132.3 Valve Alignment

- Set valve positions according to the valve SHUT DOWN status
- Print out valve status report
- Compare to valve status for facility shut down

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200 Checklist

Checklist Transient Test Number: ..... Date:		
Completion of Procedure Phase n°	Date / Time	Signatures Performer / Reviewer
11		
12		
13		
14		
16		
111		
112		
113		
114		
115		
116		
117		
118		
121.0		
121.1	Building Temperatures at 0m: and 22m:	
122		
123.0		
123.1 A / B *		
123.2		
123.3		
123.4		
123.5		
123.6		
123.7		
123.8		
123.9		
123.10		
123.11		

* Mark A or B, as applicable

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Checklist (cont'd)

Transient Test Number: ..... Date: .....

Completion of Procedure Phase n°	Date / Time	Signatures Performer / Reviewer
123.12	Time Test Start:	
123.13		
123.15		
123.16 A / B * a)		
123.16 A / B * b)		
123.16 A / B * c)		
123.16 A / B * d)		
123.16 A / B * e)		
123.16 A / B * f)		
123.16 A / B * g)		
123.16 A / B * h)		
123.16 A / B * i)		
123.16 A / B * j)		
131.1		
131.2	Building Temperatures at 0m: and 22m:	

* Mark A or B, as applicable