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PANDA Transient Tests

M6/8 Integral System Test Procedure

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Abstract:

This report details the procedure for conducting PANDA Transient Tests M6/8 specified by GE document 25A5788 Rev.0.

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

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00 Introduction

This procedure for Transient Test M6/8 describes all test phases 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. 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 IC/PCC pools, IC condenser and the Drywells. Just before test initiation, the RPV is set up to satisfy the required initial conditions. The test is then conducted under automatic power control and with specific operator actions during the test in order to satisfy the test objectives. These actions depending on the system behaviour are associated to conditions, which will be checked in accordance to test procedure phases described further. A test course in function of different/divers scenarios is given at phase n°210 in order to make clear when operator actions must be conducted.
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 25A5788 REV.0.

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 the current procedure.
- Idem for pressures which appear in kPa in the Test Plan Specification and in bar in the PANDA DAS; they are also indicated in two units in the 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	5,2 [hour]
30	Suppression Chambers Setup	12,8 [hour]
40	GDCS Heating	2,6 [hour]
50	IC Pool Setup	2,0 [hour]
60	PCC1 Pool Setup	2,0 [hour]
70	PCC2 Pool Setup	2,0 [hour]
80	PCC3 Pool Setup	2,0 [hour]
90	IC Condenser Setup	not estimated
100	Drywells Setup	1,5 [hour]
110	RPV Initial Conditions Setup for Test	not estimated
120	Test Conditions Setup	not estimated
130	Test	~ 10,0 [hour]
10 to 120	Duration for Preconditioning	30,0 [hour]
10 to 140	Duration for the whole Test	~ 40,0 [hour]

Note: Duration of phases n°10, 90,110 & 120 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 Test M6/8 includes the RPV, Suppression Chambers, Drywells, GDCS, all IC/PCC condensers and their respective pools, and the Drywell to Suppression Chamber Leakage Bypass line. The Equalization Lines connecting both Wetwells to the RPV are not part of the system and kept closed.
A detailed description of the required configuration is given in the Test Plan.
The initial conditions described in the above mentioned G.E document are listed below with the respective tolerances.

Note: The current procedure is based on the values given in the following List.

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 =	12,70 [m]	±	0,20 [m]

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

- Air Partial Pressure	MPG.D1.1 =	13 [kPa]	±	2 [kPa]
	MPG.D2.1 =	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 =	0,00 [m]	±	0,10 [m]
	ML.D2 =	0,00 [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 =	3,80 [m]	±	0,10 [m]
	ML.S2 =	3,80 [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]	±	4 [K]
- Local Fluid Temperature	MTF.GD.1...7 =	$T_{F\_mean}(GD)$	±	4 [K]
- Water Level	ML.GD =	0,00 [m]	±	0,10 [m]

IC, PCC1, PCC2 and PCC3 Pools (V.U0 - V.U1 - V.U2 - V.U3)

-Total Pressure	* MP.ENV =	97 [kPa]		
- Mean Water Temperature	$T_{W\_mean}(U0)$ =	Σ(MTL.U0.i)/max(i)		with i=1 to 7
	$T_{W\_mean}(U1)$ =	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
	* $T_{W\_mean}(U0)$ =	372 [K]	+0/ -4	[K]
	* $T_{W\_mean}(U1)$ =	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.U0.1...7 =	$T_{W\_mean}(U0)$	±	2 [K]
	MTL.U1.1...7 =	$T_{W\_mean}(U1)$	±	2 [K]
	MTL.U2.1...7 =	$T_{W\_mean}(U2)$	±	2 [K]
	MTL.U3.1..19 =	$T_{W\_mean}(U3)$	±	2 [K]
- Water Level	ML.U0 =	4,80 [m]	±	0,20 [m]
	ML.U1 =	4,80 [m]	±	0,20 [m]
	ML.U2 =	4,80 [m]	±	0,20 [m]
	ML.U3 =	4,80 [m]	±	0,20 [m]

Note: * The pressure and temperature defined for the IC/PCC Pools correspond to saturation values at usual atmospheric pressure at the test site.

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 setup, 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 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 - Refernce Gas and Probe Heaters

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 415K 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]

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

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Auxiliary water system operation
Pump MP.B0D On — MV.B0D = 2 [l/s]
ML.RP.1 = 12,7 [m] — M(RPV-water) = 15,01 [ton]
=> time = 7505 [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 = 12,70 [m]

22 Heating / Purging

22.0 Monitor RPV Parameters
-Total Pressure — Assumptions: MP.RP.1 = 97 [kPa] = 0,97 [bar]
- 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 = 12,70 [m]

22.1 Heat until temperature equals 373 [K]
Heaters On
MW.RP.7 = 800 [kW]
MTF.RP.1...5 = 373 [K] — => ΔT = 90 [K]
= 100 [°C]
M(RPV-water) = 15,01 [ton] — => ΔQ = 5,67378 [GJ]
M(RPV-struct) = 8,00 [ton] — => ΔQ = 0,36 [GJ]
=> ΔQtot = 6,04 [GJ]
=> time = 7544 [sec]

- Close valve CC.RPV

22.2 Heat until temperature equals 415 [K]
* MTF.RP.1...5 = 415 [K] — => ΔT = 42 [K]
= 142 [°C]

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

M(RPV-water) = 15,01 [ton] — => ΔQ = 2,65 [GJ]
M(RPV-struct) = 8,00 [ton] — => ΔQ = 0,17 [GJ]
=> ΔQtot = 2,82 [GJ]
=> time = 3521 [sec]

Heaters Off

22.3 Monitor RPV Parameters
-Total Pressure — MP.RP.1 = 388 [kPa] = 3,88 [bar]
- Local Fluid Temperature — MTF.RP.1...5 = 415 [K] = 142 [°C]
- Structure temperature — MTI.RP.1...3 = 415 [K] = 142 [°C]
- Water Level — ML.RP.1 = 13,7 [m]
M(RPV-water) = 15,01 [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 =	97 [kPa]	=	0,97 [bar]
	MP.S2 =	97 [kPa]	=	0,97 [bar]
- Local Water Temperature	MTL.S1.1...6 =	283 [K]	=	10 [°C]
	MTL.S2.1...6 =	283 [K]	=	10 [°C]
- Water Level	ML.S1 =	0,00 [m]		
	ML.S2 =	0,00 [m]		

31.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	13,72 [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 — MTL.BHA = 354,5 [K] = 81 [°C]

CC.BCA — MTL.BCA = max [K]

- Open valve CB.S1L, CB.S2L

Pump PC.B0D On — MV.B0D = 2 [l/s]

ML.S1 = 3,8 [m] — M(S1-water) = 42,50 [ton]

ML.S2 = 3,8 [m] — M(S2-water) = 42,50 [ton]

M(TSL-water) = 7,10 [ton]

=> time = 46050 [sec]

- Close valve CB.S1L, CB.S2L

Pump PC.B0D Off — MV.B0D = 0 [l/s]

Pump PC.HFH Off

Heaters 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 =	3,80 [m]		
	ML.S2 =	3,80 [m]		

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32 Gas Space Heating

32.0 Monitor SCs Parameters — Assumptions:

-Total Pressure	MP.S1 =	156 [kPa]	=	1,56 [bar]
	MP.S2 =	156 [kPa]	=	1,56 [bar]
- 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 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	13,72 [m]		

Heaters On

MW.RP.7 = 800 [kW]

32.2 Steam injection

- Open valve CB.B1S, 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]
ΔM(steam) =	1095 [kg]	=> time =	3148 [sec]

- Close valve CB.B1S, CB.S1S, CB.S2S

Heaters Off

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

32.3 Monitor SCs Parameters

-Total Pressure	MP.S1 =	201 [kPa]	=	2,01 [bar]
	MP.S2 =	201 [kPa]	=	2,01 [bar]
- 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 =	3,80 [m]		
	ML.S2 =	3,80 [m]		

33 Pressurization

33.0 Monitor SCs Parameters

-Total Pressure	MP.S1 =	201 [kPa]	=	2,01 [bar]
	MP.S2 =	201 [kPa]	=	2,01 [bar]

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33.1 Air injection until total pressure reaches 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] = 2,85 [bar]
ΔM(air) = 62 [kg] => time = 2073 [sec]

- Close valve CB.S1G, CB.S2G, CB.B0G

33.2 Monitor SCs Parameters

-Total Pressure	MP.S1 =	285 [kPa]	=	2,85 [bar]
	MP.S2 =	285 [kPa]	=	2,85 [bar]
- 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 =	3,80 [m]		
	ML.S2 =	3,80 [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 5,5m at the required temperature and then draining the tank. The total pressure in GDCS, under saturated conditions and in equilibrium with the Drywell pressure is at 294kPa, which includes an air partial pressure of 274kPa.
The GDCS Setup consits of heating by water filling (phase n° 41) and pressurization by air injection (phase n° 42). Filling and draining processes are performed with the GDCS vent valve open. The total pressure is then adjusted by injecting air by mean of the auxiliary air system or by venting air to the atmosphere (phase n° 42). That last phase is performed after water has been drained and transferred to the PCC pools.

41 Water Filling

41.0 Monitor GDCS Parameters Assumptions:

-Total Pressure	MP.GD =	97 [kPa]	=	0,97 [bar]
- 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 =	0,00 [m]		

41.1 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

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

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

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41.2 Supply water until level reaches 5,5 [m]

Setup control valve CC.BUV
- Open valve CB.GDV

Auxiliary water system operation
Pump PC.HFH On
Setup control valve CC.BHA MTL.BHA = 335 [K] = 62 [°C]
CC.BCA MTL.BCA = max [K]
Pump PC.B0D On MV.B0D = 2 [l/s]
- Open valve CB.GDL
ML.GD = 5,5 [m] M(GD-water) = 16,4 [ton]
=> time = 8195 [sec]

- Close valve CB.GDL
Pump PC.B0D Off
Pump PC.HFH Off
Heaters Off

41.3 Monitor GDCS Parameters

-Total Pressure	MP.GD =	97 [kPa]	=	0,97 [bar]
- 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 =	5,50 [m]		

42 Pressurization

42.0 See phase n°82
Since the GDCS is full with water, it cannot be pressurized during the phase n°42.
The GDCS pressurization is performed at phase n°82.

50 IC Pool Setup

The Test Initial Conditions for all IC/PCC Pools are the same; water level from the top of the PANDA heater bundle is defined at the maximum possible level (23,6m), which corresponds to a water level of 4,8m in the pools. The end point temperature is near the saturation temperature for actual 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 water circulation through the auxiliary heat exchanger (phase n°125, 126, 127 & 128).

Note: Pools can be connected together and filled simultaneously; water circulation might also be performed simultaneously with interconnected 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 =	0,00 [m]		

51.1 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

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

Note: The RPV temperature indicated here is a basis for the water filling operation; it might be lower than indicated.

51.2 Supply water until level reaches 4,9 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve CC.BHA MTL.BHA = 375 [K] = 62 [°C]
CC.BCA MTL.BCA = max [K]
Pump PC.B0D On MV.B0D = 2 [l/s]
- Open valve CB.U0L

ML.U0 = 4,9 [m] M(U0-water) = 14,22 [K]
=> time = 7111 [sec]

- Close valve CB.U0L
Pump PC.B0D Off
Pump PC.HFH Off
Heaters Off

51.3 Monitor IC Pool Parameters
- Mean Fluid Temperature $T_{w\_mean}(U0)$ = 372 [K] = 99 [°C]
- Water Level ML.U0 = 4,90 [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 = 0,00 [m]

61.1 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters
-Total Pressure MP.RP.1 = 388 [kPa] = 3,88 [bar]
- Local Fluid Temperature MTF.RP.1...5 = 415 [K] = 142 [°C]
- Water Level ML.RP.1 = 12,75 [m]

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

Note: The RPV temperature indicated here is a basis for the water filling operation; it might be lower than indicated.

61.2 Supply water until level reaches 4,9 [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 [l/s]
- Open valve CB.U1L

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ML.U1 = 4,9 [m] M(U1-water) = 14,22 [ton]
=> time = 7111 [sec]

- Close valve CB.U1L

Pump PC.B0D Off
Pump PC.HFH Off
Heaters Off

61.3 Monitor PCC1 Pool Parameters
- Mean Water Temperature $T_{W\_mean}(U1)$ = 372 [K] = 99 [°C]
- Water Level ML.U1 = 4,90 [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 = 0,00 [m]

71.1 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters
- Total Pressure MP.RP.1 = 388 [kPa] = 3,88 [bar]
- Local Fluid Temperature MTF.RP.1...5 = 415 [K] = 142 [°C]
- Water Level ML.RP.1 = 12,75 [m]

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

71.2 Supply water until level reaches 4,9 [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 [l/s]
- Open valve CB.U2L

ML.U2 = 4,9 [m] M(U2-water) = 14,22 [ton]
=> time = 7111 [sec]

- Close valve CB.U2L

Pump PC.B0D Off
Pump PC.HFH Off
Heaters Off

71.3 Monitor PCC2 Pool Parameters
- Mean Water Temperature $T_{W\_mean}(U2)$ = 372 [K] = 99 [°C]
- Water Level ML.U2 = 4,90 [m]

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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).

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 =	0,00 [m]		

Monitor GDCS Parameters

-Total Pressure	MP.GD =	97 [kPa]	=	0,97 [bar]
- 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 =	5,50 [m]		

81.1 RPV Setup for Heat Exchanger Operation

Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

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

Note: The RPV temperature indicated here is a basis for the water filling operation; it might be lower than indicated.

81.2 Supply water until level reaches 4,9 [m]
Auxiliary water system operation
Pump PC.HFH On
Setup control valve MTL.BHA = 375,3 [K] = 102 [°C]
MTL.BCA = max [K]
Pump PC.B0A On MV.B0A = 2 [l/s]
- Open valve CB.B0L, CB.LXA, CB.AXU
CB.U3U, CB.GDL
ML.U3 = 4,90 [m] M(U3-water) = 14,22 [ton]
=> time = 7111 [sec]
- Close valve CB.U3U, CB.GDL
CB.B0L, CB.LXA, CB.AXU
Heaters Off
Pump PC.B0A Off
Pump PC.HFH Off

Isolate GDCS from atmosphere
- Close valve CC.BUV, CB.GDV

81.3 Monitor PCC3 Pool Parameters

- Mean Water Temperature	T_{W_mean}(U3) =	372 [K]	=	99 [°C]
- Water Level	ML.U3 =	4,90 [m]		

Monitor GDCS Parameters

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-Total Pressure	MP.GD =	97 [kPa]	=	0,97 [bar]
- 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 =	0,00 [m]		
Monitor RPV Parameters				
-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

82 GDCS Pressurization

82.0 Monitor GDCS Parameters

-Total Pressure	MP.GD =	97 [kPa]	=	0,97 [bar]

82.1 Air injection until total pressure reaches 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] = 2,94 [bar]

ΔM(air) = 38 [kg] => time = 1255 [sec]

- Close valve CB.GDG, CB.B0G

82.2 Monitor GDCS Parameters

-Total Pressure	MP.GD =	294 [kPa]	=	2,94 [bar]
- Mean Fluid Temperature	T_{F_mean}(GD) =	333 [K]		
- Water Level	ML.GD =	0,00 [m]		

90 IC Condenser Setup

In order to allow IC operation with non-condensable gas inventory as low as possible at the test initiation, the condenser must be purged and brought into pure steam conditions. Phase n°91 describes how the air is purged from IC condenser.

91 IC Condenser Purging

91.0 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Mean Fluid Temperature	T_{F_mean}(RP) =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		
Monitor IC Parameters				
-Total Pressure	MP.I1F = ~	200 [kPa]	=	2,00 [bar]
- IC Drum Temperatures	MTG.I1.1..2 =	372 [K]	=	99 [°C]
- Center Line Temperatures	MTG.I1.3...9 =	372 [K]	=	99 [°C]
Monitor SCs Parameters (V.S1)				
-Total Pressure	MP.S1 =	285 [kPa]	=	2,85 [bar]
- Mean Gas Temperature	T_{G_mean}(S1) =	352 [K]	=	79 [°C]

91.1 IC Purging

- Open valve CB.I1F
- Monitor IC Pressure MP.I1F = ~ 388 [kPa] = 3,88 [bar]
- Open IC Vent & Drain Valves after pressure has stabilized: CB.ILV, CB.I1C

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- IC Drum Temperatures	MTG.I1.1..2 =	415 [K]	=	142 [°C]
- Close valve CB.I1V, CB.I1C				
- Close valve CB.I1F		Record on attached checklist		

91.2 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Mean Fluid Temperature	T_{F_mean}(RP) =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	13 [m]		

Monitor IC Parameters

-Total Pressure	MP.I1F =	100 [kPa]	=	1,00 [bar]
- IC Drum Temperatures	MTG.I1.1..2 =	372 [K]	=	99 [°C]
- Center Line Temperatures	MTG.I1.3...9 =	372 [K]	=	99 [°C]

Monitor SCs Parameters

-Total Pressure	MP.S1 =	285 [kPa]	=	2,85 [bar]
- Mean Gas Temperature	TG_mean(S1) =	352 [K]	=	79 [°C]

100 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° 101) and of a depressurization by venting to atmosphere (phase n° 102). In order to get homogeneous temperature in the vessels, air is purged during phase n°101 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.

101 Gas Space Heating

101.0 Monitor Drywell Parameters

		Assumptions:		
-Total Pressure	MP.D1 =	97 [kPa]	=	0,97 [bar]
	MP.D2 =	97 [kPa]	=	0,97 [bar]
- 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 =	0,00 [m]		
	ML.D2 =	0,00 [m]		

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

101.2 RPV Setup for Heat Exchanger Operation
Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	388 [kPa]	=	3,88 [bar]
- Local Fluid Temperature	MTF.RP.1...5 =	415 [K]	=	142 [°C]
- Water Level	ML.RP.1 =	12,75 [m]		

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

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101.3 Steam injection (with air purging)

Vent valve opening for air purging

- Open valve CC.BUV, CB.D1V, CB.D2V
- Open valve CB.B1S, 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]
ΔM(steam) =	1073 [kg]	=> time =	3084 [sec]

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

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

101.4 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]
ΔM(steam) =	520 [kg]	=> time =	1494 [sec]

- Close valve CB.B1S, CB.D1S, CB.D2S

Heaters Off

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

101.5 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	295 [kPa]	=	2,95 [bar]
- Mean Fluid Temperature	T_{F_mean}(RP) =	406 [K]	=	133 [°C]
- Water Level	ML.RP.1 =	11,35 [m]		

Monitor Drywell Parameters

-Total Pressure	MP.D1 =	281 [kPa]	=	2,81 [bar]
	MP.D2 =	281 [kPa]	=	2,81 [bar]
- 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]	=	2,81 [bar]
	MP.P2F =	281 [kPa]	=	2,81 [bar]
	MP.P3F =	281 [kPa]	=	2,81 [bar]
- 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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102 Pressurization

Both Drywells have now been purged and heated up to 404K; since the three PCCs were connected to the Drywells and due to the PCC pool temperature (~370K), a certain amount of air has been vented to the PCCs satisfying pressure equilibrium between Drywells and PCCs.
The Drywell, which atmosphere is considered as being under almost pure steam condition, is pressurized by air injection. In order to avoid condensation in the PCCs and let stabilize the Drywell pressure, the PCCs are isolated for the pressurization process.

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

102.1 Monitor Drywell Parameters

-Total Pressure	MP.D1 =	281 [kPa]	=	2,81 [bar]
	MP.D2 =	281 [kPa]	=	2,81 [bar]
- 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]

102.3 Air injection until Drywell total pressure increases by 13 [kPa]
Auxiliary air supply system operation
Setup control valve CC.B0G.2 MM.B0G = max
- Open valve CB.D1G, CB.D2G, CB.B0G

MPG.D1.1 = 13 [kPa]
MPG.D2.1 = 13 [kPa]

ΔM(air) = 21 [kg] => time = 778 [sec]

- Close valve CB.D1G, CB.D2G, CB.B0G

102.4 Monitor Drywell Parameters

- Air Partial Pressure	MPG.D1.1 =	13 [kPa]		
	MPG.D2.1 =	13 [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]

110 RPV Initial Conditions Setup for Test

After having used the RPV as heat source for vessel preconditioning, it might be under conditions differing from these required for test initiation; water level, pressure and temperature may need to be adjusted in order to satisfy the test initial conditions.
Phase n° 111 starts with a parameter monitoring, which will give the basis for RPV condition adjustement.

111 Adjusting RPV Conditions

111.0 Monitor RPV Parameters Assumtions:

-Total Pressure	MP.RP.1 =	295 [kPa]	=	2,95 [bar]
- Mean Fluid Temperature	T_{F_mean}(RP) =	406 [K]	=	133 [°C]
- Water Level	ML.RP.1 =	11,35 [m]		

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111.1 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 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 with the required tolerances (see phase 01).

120 Test Conditions Setup

PANDA preconditioning has now been 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° 121) and continues with the SCs gas space setup (phase n°122). The GDCS tank is then adjusted to its defined test initial conditions (phase n°123), before adjusting conditions of both Drywells (phase n° 124). The test condition setup continues with the IC/PCC Pools condition adjustment (phase n° 125, 126, 127 & 128), which can be performed simultaneously. All these phases are not defined in detail, allowing any required action to get the test initial conditions established.

121 Adjusting SC Pools Conditions

121.0 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 (see phase 01).

121.1 Monitor SCs Parameters

- Mean Water Temperature	$T_{w\_mean}(S1)$ =	352 [K]	±	2 [K]
	=	79 [°C]		
	$T_{w\_mean}(S2)$ =	352 [K]	±	2 [K]
	=	79 [°C]		
- 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 =	3,80 [m]	±	0,10 [m]
	ML.S2 =	3,80 [m]	±	0,10 [m]

Record on attached checklist

122 Adjusting SC Gas Space Conditions

122.0 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 (see phase 01).

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122.1 Monitor SCs Parameters

-Total Pressure	MP.S1 =	2,85 [bar]	±	0,04 [bar]
	MP.S2 =	2,85 [bar]	±	0,04 [bar]
- Mean Gas Temperature	T_{G_mean}(S1) =	352 [K]	±	2 [K]
	=	79 [°C]		
	T_{G_mean}(S2) =	352 [K]	±	2 [K]
	=	79 [°C]		
- Local Gas Temperature	MTG.S1.1...6 =	T_{G_mean}(S1)	±	2 [K]
	MTG.S2.1...6 =	T_{G_mean}(S2)	±	2 [K]

Record on attached checklist

123 Adjusting GDCS Conditions

123.0 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 (see phase 01).

123.1 Monitor GDCS Parameters

-Total Pressure	MP.GD =	2,94 [bar]	±	0,04 [bar]
- Mean Fluid Temperature	T_{F_mean}(GD) =	333 [K]	±	4 [K]
	=	60 [°C]		
- Local Fluid Temperature	MTF.GD.1...7 =	T_{F_mean}(GD)	±	4 [K]
- Water Level	ML.GD =	0,00 [m]	±	0,10 [m]

Record on attached checklist

124 Adjusting DWs Conditions

124.0 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 (see phase 01).

124.1 Monitor Drywell Parameters

- Air Partial Pressure	MPG.D1.1 =	13 [kPa]	±	2 [kPa]
	MPG.D2.1 =	13 [kPa]	±	2 [kPa]
- Mean Gas Temperature	T_{G_mean}(D1) =	404 [K]	±	2 [K]
	=	131 [°C]		
	T_{G_mean}(D2) =	404 [K]	±	2 [K]
	=	131 [°C]		
- Local Gas Temperature	MTG.D1.1...6 =	T_{G_mean}(D1)	±	2 [K]
	MTG.D2.1...6 =	T_{G_mean}(D2)	±	2 [K]
- Structure temperature	MTI.D1.1...9 =	T_{G_mean}(D1)	±	2 [K]
	MTI.D2.1...9 =	T_{G_mean}(D2)	±	2 [K]
- Water Level	ML.D1 =	0,00 [m]	±	0,10 [m]
	ML.D2 =	0,00 [m]	±	0,10 [m]

Record on attached checklist

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125 Adjusting IC Pool Conditions

125.0 Adjust Test Initial Conditions in IC Pool

For all pools, water temperature adjustment is performed by water circulation through the auxiliary heat exchanger and level adjustment by supplying water from the demineralized water tank. Any required action is allowed to setup the IC/PCC pools test initial conditions according to the defined tolerances (see phase 01).
Since all IC/PCC pool initial conditions are the same, they may be adjusted simultaneously by connecting the four pools together.

125.1 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 =	$T_{w\_mean}(U0)$	±	2	[K]
ML.U0 =	4,80	[m]	±	0,20 [m]

Record on attached checklist

126 Adjusting PCC1 Pool Conditions

126.0 Adjust Test Initial Conditions in PCC1 Pool

For PCC1 Pool conditions adjustment refer to description of phase n°125.

126.1 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 =	$T_{w\_mean}(U1)$	±	2	[K]
ML.U1 =	4,80	[m]	±	0,20 [m]

Record on attached checklist

127 Adjusting PCC2 Pool Conditions

127.0 Adjust Test Initial Conditions in PCC2 Pool

For PCC2 Pool conditions adjustment refer to description of phase n°125.

127.1 Monitor PCC2 Pool Parameters

- Mean Water Temperature
- Local Water Temperature
- Water Level

$T_{w\_mean}(U2)$ =	372	[K]	+0/ -4	[K]
=	99	[°C]	+0/ -4	[°C]
MTL.U2.1...7 =	$T_{w\_mean}(U2)$	± 2		[K]
ML.U2 =	4,80	[m]	±	0,20 [m]

Record on attached checklist

128 Adjusting PCC3 Pool Conditions

128.0 Adjust Test Initial Conditions in PCC3 Pool
For PCC3 Pool conditions adjustment refer to description of phase n°125.

128.1 Monitor PCC3 Pool Parameters

- Mean Water Temperature
- Local Water Temperature
- Water Level

$T_{w\_mean}(U3)$ =	372	[K]	+0/ -4	[K]
=	99	[°C]	+0/ -4	[°C]
MTL.U3.1..19 =	$T_{w\_mean}(U3)$	±	2	[K]
ML.U3 =	4,80	[m]	±	0,20 [m]

Record on attached checklist

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130 Test

The facility satisfies now the required test initial conditions and must be configured according to the test configuration described in GE Test Plan. Due to the relatively quick test initiation, data recording is started (phase n°131) before setting the desired RPV conditions (phase n°132) and before setting the test configuration (phase n°133). That last phase should not affect the FANDA 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°133.1 to n° 133.9) and the test initiation (phase n°133.10) should not exceed a few minutes (~5min). Before test initiation, just before phase n° 133.9, the test initial conditions must be within the tolerances given in all n°120 and n°132 phases, in order to satisfy the acceptance criteria defined in phase 01. If test initial conditions do not satisfy the above mentioned acceptance criteria, the test is interrupted, the heat power is shut down (phase n° 143.0), the vessels are isolated (phase n° 143.3) and the procedure starts again with the Test Conditions Setup (phase n° 120).
Due to the excessive pressure differences between vessels during the preconditioning, the pressure difference transmitters valve-in must be performed after the test initial conditions have been established; it is performed during test configuration setup (phase n°133.8).

131 Data Recording

131.0 Start Data Recording
- Set "Daten-Speich." on HP-1000
- Set "Data recording rate" on HP-1000 / High Scan Rate: 1/2 Hz

Record on attached checklist

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

132 Adjusting RPV Conditions

132.0 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 (see phase 01).

132.1 Monitor RPV Parameters

-Total Pressure	MP.RP.1 =	2,95 [bar]	±	0,04 [bar]
- 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 =	12,70 [m]	±	0,20 [m]

Record on attached checklist

133 Configuration Setup and Test Initiation

Before test initiation the PANDA facility is partly configured; all valves which must be lined up are open, except both main steam line valves and the IC feed and drain line valves. These last lineup processes are included in the test initiation phase; they are perfomed at phases n°133.11

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133.0 Setup Automatic Heat Power Regulation
- Set "SCALED OPERATING POWER"
- Set "TRANSIENT START TIME AFT. SCRAM" Record on attached checklist

133.1 Isolate Pools
Pools might be already isolated, in that case verify that the following 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

133.2 Open GDCS Pressure Equialization lines
- Open valve CB.GP1, CB.GP2 Record on attached checklist

133.3 Open Main Vent Lines
- Open valve CB.MV1, CB.MV2 Record on attached checklist

133.4 Open GDCS Return Line
- Open valve CB.GRT.2, CB.GRT.1 Record on attached checklist

133.5 Open PCC Vent Lines
- Open valve CB.P1V, CB.P2V, CB.P3V Record on attached checklist

133.6 Open PCC Condensate Lines
- Open valve CB.P1C, CB.P2C, CB.P3C Record on attached checklist

133.7 Open all PCC Feed Lines
- Open valve CB.P1F, CB.P2F, CB.P3F Record on attached checklist

133.8 Instrument / Zero Check and Pressure Difference Transmitters Piping Valve In
- Pressure Difference Transmitters Piping Valve In
- Check instruments as described in phase n°16
Record on attached checklist

133.9 Open Main Steam Lines
- Open valve CB.MS1, CB.MS2 Record on attached checklist

133.10 Heat Power Setup
- 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

133.11 Connect IC Condenser after steam flow through MSLs has just started
- Open valve CB.I1F Record on attached checklist
- Monitor IC Pressure MP.I1F
- Open IC Drain Valve after pressure has stabilized: CB.I1C
Record on attached checklist

133.12 Within **5 minutes after IC valve in**, vent the IC for 5 minutes through the lower vent
- Open valve CB.ILV Record on attached checklist

133.13 After **5 minutes of venting**, close the IC lower vent
- Close valve CB.ILV Record on attached checklist

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133.14 Print Valve Status Report every two hours during the Test duration
- Compare to Valve Status for Test M6/8
- Attach Valve Status Reports to the Checklist

Record on attached checklist

133.15 Check O_2 Probes
- Check every two hours, the oxygen flow which must be at ~10-20%
- Check every two hours, the probe temperature which must be at ~695 °C

Record on attached checklist

133.16 Check Test Initial Conditions - See if Acceptance Criteria were reached before Test Initiation
- Check parameters as indicated in phases n°120 & n°132.

Record on attached checklist

133.17 Test Interruption
If the Acceptance Criteria were not satisfied before test start, conduct phases n°142.0 & 142.3
=> phase n° 142.0
=> phase n° 142.3
- Restart procedure with phase n° 110 (Test Conditions Setup)

133.18 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

133.19 At **4 hours after test start**, establish the bypass leakage path.

- Open valve CB.VL1

Record on attached checklist

133.20 At **6 hours after test start**
Check condition of IC operation and perform 133.21a) or 133.21b) as applicable

Monitor IC Parameters

- IC Drum Temperatures	MTG.I1.1..2 = ...
- Center Line Temperatures	MTG.I1.3...9 = ...
- Water Level	ML.U0 = ...
- Local Water Temperature	MTL.U0.1...7 = ...

If the **IC** is still **in operation** perform phase n°**133.21a)**
or
If the **IC** has **shutdown** because of air accumulation, perform phase n°**133.21b)**

Record on attached checklist

133.21a) Terminate IC operation by closing the feed and drain valves and continue test for 4 hours or until pressure reaches 4 bars.
- Close valve CB.I1F, CB.I1C

Record on attached checklist

At **10 hours after test start**, terminate the test.
- Conduct phase n°140

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133.21b) Continue the test

After 4 hours of bypass leakage operation with the IC shutdown, or when pressure reaches 4 bars, open the IC vent line and continue the test for 2 additional hours or until pressure reaches 4,3 bars.

- Open valve CB.ILV — Record on attached checklist

After **2 additional hours**, terminate the test
- Conduct phase n°140

140 End of Test

At the completion of phase 133.21a) or 133.21b), as applicable, data recording may be terminated (phase n°141), and the test performance declared complete.
The facility shutdown is described at phase n°142.

141 End of Data Recording

141.0 Stop Data Recording (cf DAS User's Guide) — Record on attached checklist
After specific criteria have been reached, the test is terminated and data recording stopped.

141.1 Save Data (cf DAS User's Guide) — Record on attached checklist

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

142 Facility Shut Down

142.0 Stop Heat Power
Heaters Off

142.1 Oxygen Probes Shut Off

142.2 Pressure Transmitters Piping Valve Off

142.3 VB-Opening Setup
- Disable automatic VB-OPening Control (Process Control System)

142.4 Isolating Vessels

Check that the following valves are closed :

CB.I1F, CB.I1C
CB.ILV
CB.VL1
CB.MS1, CB.MS2

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CB.P1F, CB.P2F, CB.P3F
CB.P1C, CB.P2C, CB.P3C
CB.P1V, CB.P2V, CB.P3V
CB.GRT.2, CB.GRT.1
CB.MV1, CB.MV2
CB.GP1, CB.GP2

142.5 Valve Alignment

- Set valve positions according to the valve STARTUP status
- Print out valve status report
- Compare the printed out valve status report to valve STARTUP status

142.6 - Set "Data recording rate" on HP-1000 / Low Scan Rate: $2*10^{-3}$ Hz

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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		
91		
121		
122		
123		
124		
125		
126		
127		
128		
131.0		
131.1	Building Temperatures at 0m: and 22m:	
132		
133.0		
133.1		
133.2		
133.3		
133.4		
133.5		
133.6		
133.7		
133.8		
133.9		
133.10	Time of Test Start	

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Checklist (cont'd)

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

Completion of Procedure Phase n°	Date / Time	Signatures Performer / Reviewer
133.11		
133.12		
133.13		
133.14		
133.15		
133.16		
133.18		
133.19		
133.20		
133.21a) **133.21b)**		
141.0		
141.1		
141.2	Building Temperatures at 0m: and 22m:	

* Mark **a)** or **b)**, as applicable

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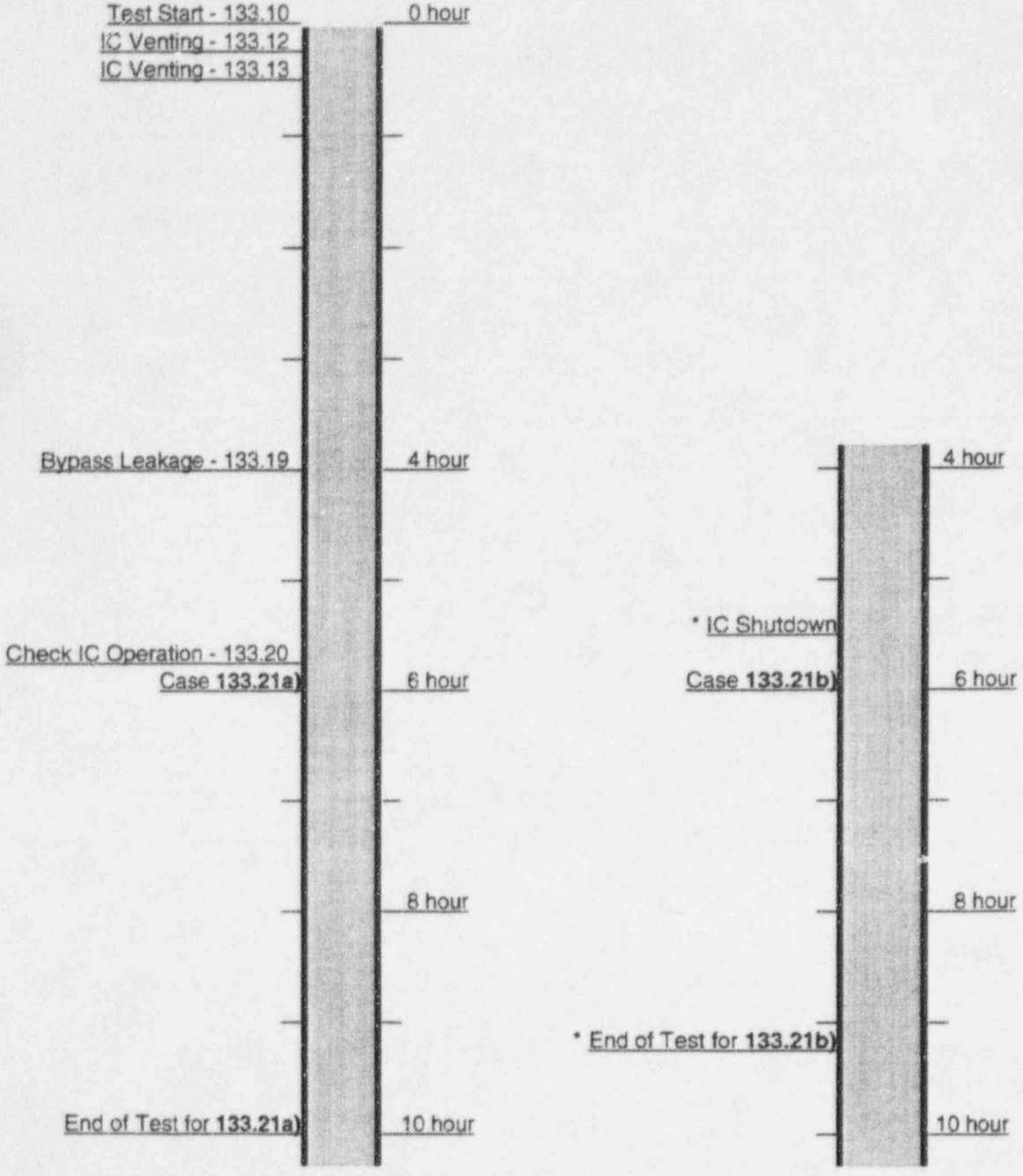
210 Test Course



* Events which are not scheduled, might happen before or later