



KONGSBERG

K-Spice® Generic Training Simulator

Oil & Gas Production Model

Start-Up Procedure



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TABLE OF CONTENTS

1	INTRODUCTION.....	3
2	START-UP PROCEDURE	4
2.1	SEAWATER	4
2.2	COOLING MEDIUM	5
2.3	INLET MANIFOLDS.....	7
2.4	PRODUCTION WELLS	8
2.5	OIL SEPARATION	9
2.6	OIL EXPORT	12
2.7	PRODUCED WATER	13
2.8	OIL PROCESS START-UP	14
2.9	GAS DEHYDRATION	19
2.10	GAS EXPORT	21
2.11	GAS RECOMPRESSION	24
2.12	WATER INJECTION	28

1 Introduction

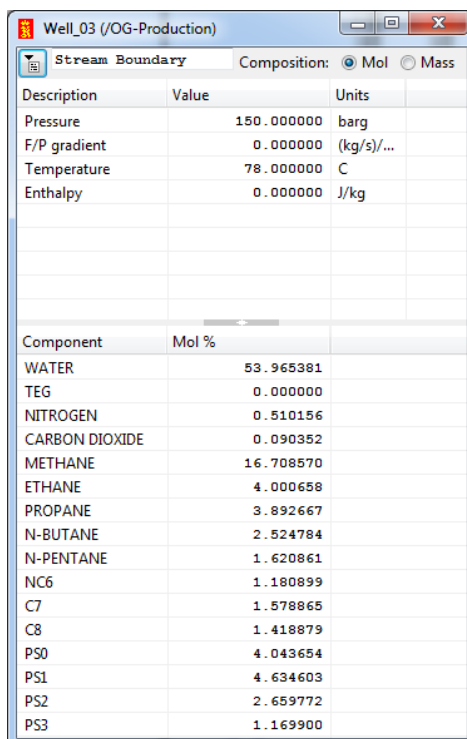
The start up procedure described in this document is based on a cold start-up where the plant has been shut down, drained and depressurised.

Utility systems not simulated in the model are assumed available. Boundary conditions are set with normal operation pressure, temperature and composition.

The following model boundaries are set:

Process System	Boundary Conditions
Wells	Pressure: 150 barg Temperature: 78 degC
Steam Supply	Pressure: 6 barg Temperature: 125 degC
Lean Glycol	Pressure: 40 barg Temperature: 35 degC
Rich Glycol	Pressure: 25 barg Temperature: 35 degC
Drain	Pressure: 0 barg Temperature: 25 degC

Wells composition is shown in figure below:



The screenshot shows a software window titled "Well_03 (/OG-Production)". Inside, there is a "Stream Boundary" tab and a "Composition" section with radio buttons for "Mol" (selected) and "Mass". Below this is a table with columns "Description", "Value", and "Units". The table lists several properties: Pressure (150.000000 barg), F/P gradient (0.000000 (kg/s)/...), Temperature (78.000000 C), and Enthalpy (0.000000 J/kg). Below this table is another table with columns "Component" and "Mol %", listing various chemical components and their mole percentages.

Description	Value	Units
Pressure	150.000000	barg
F/P gradient	0.000000	(kg/s)/...
Temperature	78.000000	C
Enthalpy	0.000000	J/kg

Component	Mol %
WATER	53.965381
TEG	0.000000
NITROGEN	0.510156
CARBON DIOXIDE	0.090352
METHANE	16.708570
ETHANE	4.000658
PROPANE	3.892667
N-BUTANE	2.524784
N-PENTANE	1.620861
NC6	1.180899
C7	1.578865
C8	1.418879
PS0	4.043654
PS1	4.634603
PS2	2.659772
PS3	1.169900

2 Start-up procedure

2.1 Seawater

Step	Action	Comment
A.1	Open Sea Water Inlet Valve 50HV0001	Ensure manual valve 5001MV16 downstream of filter is OPEN
A.2	Open Sea Water Return Valve 50HV1004	Ensure manual valve 5002MV06 downstream of 50HV1004 is OPEN
A.3		Ensure Suction and discharge manual valves for Sea Water Lift Pumps are open 50PA001 A – 5001MV02 & 5001MV10 50PA001 B – 5001MV04 & 5001MV12
A.4	Ensure pump discharge pressure controller 50PC0006 is in MANUAL and 40% Output	
A.5	Set pump minimum flow controller 50FC0005 in MANUAL and 60% Output	Ensure manual valve 5002MV12 upstream of 50FV0005 is OPEN
A.6	Start Sea Water Lift Pump 50PA001A	
A.7	When flow is established put pump minimum flow controller 50FC0005 is in AUTO and ensure that SP=1000 M ³ /hr	Flow controller Set Point is determined automatically by the number of pumps running.
A.8	Adjust 50PC0006 output until discharge pressure is 12.0 barg and put controller in AUTO with a set point of 12.0 barg	Pump will now run with a minimum flow controlled by 50FC0005 and the discharge pressure controlled by 50PC0006
A.9	Sea Water System is now ready for use.	The users of Sea Water will take demand as they are started up.

2.2 Cooling Medium

Step	Action	Comment
B.1	Cooling Medium Cooler 40HB001A: Set temperature controller 40TC0012 in AUTO at SP = 21.0°C	Ensure manual valve 4003MV08 on inlet to cooler on seawater side is OPEN Ensure manual valve 4003MV02 upstream of 40TV0012 is OPEN Ensure manual valves 4002MV02 and 4003MV06 on inlet and outlet of cooler on Cooling Medium side are OPEN
B.2	Cooling Medium Cooler 40HB001B: Set temperature controller 40TC0013 in AUTO at SP = 21.0°C	Ensure manual valve 4003MV14 on inlet to cooler on seawater side is OPEN Ensure manual valve 4003MV10 upstream of 40TV0013 is OPEN Ensure manual valves 4002MV12 and 4003MV12 on inlet and outlet of cooler on Cooling Medium side are OPEN
B.3	Sea Water Pressure Control Set Supply pressure controller as follows: 50PC1008A AUTO 6.0 barg Set Return pressure controller as follows: 50PC1008B MANUAL 30%	Ensure manual valve 5002MV02 upstream of 50PV1008A is OPEN Ensure manual valve 5002MV08 upstream of 50PV1008B is OPEN
B.4	Open Sea Water Supply valve to Cooling Medium Coolers 50HV1001	
B.5	Cooling Medium Expansion Tank 40VL001 Set Make-up pressure controller as follows: 40PC0005A AUTO 2.5 barg Set Over pressure controller as follows: 40PC0005B AUTO 3.0 barg	
B.6		OPEN manual valve 4001MV08 on Nitrogen supply to Cooling Medium Expansion Tank 40VL001 and OPEN manual valve 4001MV14 on Nitrogen vent to atmosphere.
B.7	Make sure there is level in Cooling Medium Expansion Tank 40LV001.	Fill Cooling Medium Expansion 40VL001 Tank to 50% with Water/Glycol mixture by opening manual valve 4002MV10 Close 4002MV10 when level reaches 50%



Step	Action	Comment
B.8		Open Suction and discharge manual valves for Cooling Medium Pumps 40PA001 A – 4002MV01 & 4002MV04 40PA001 B – 4002MV06 & 4002MV08
B.9	Set pump minimum flow controller as follows: 40FC0014 MANUAL 60% OUTPUT	Ensure manual valve 4003MV18 upstream of 40FV0014 is OPEN
B.10	Start Cooling Medium Pump START 40PA001A or 40PA001B	
B.11	Set pump minimum flow controller as follows: 40FC0014 AUTO 1660 m³/hr	Pump will now run with a minimum flow controlled by 40FC0008. The users of Cooling Medium will take demand as they are started up.
B.12		Top up Cooling Medium Tank to 50% if required.
B.13		Cooling Medium System is now ready for use

2.3 Inlet Manifolds

Step	Action	Comment
C.1	RESET All ESD levels RESET PSD 3.0 Total Process Shutdown Override the following trip inputs to: PSD 3.1 Oil Train 20PST2013LL MP Separator Low Pressure 20LST3016LL LP Separator Low Level 20PST3013LL LP Separator Low Pressure 21PST0028LL Oil Export Pipeline Pressure RESET PSD 3.1 Oil Train	
C.2	Override the following trip inputs to PSD 4.1 Test Separator 20PST0013LL Test Separator Low Pressure RESET PSD 4.1 Test Separator	
C.3	Override the following trip inputs to PSD 4.2 HP Separator 20PST1013LL HP Separator Low Pressure RESET PSD 4.2 HP Separator	
C.4	Production Manifold Close Blowdown Valve 13BDV2001 OPEN Pressure Equalising valve 13EV2004 When pressure has equalised OPEN Main Isolating valve 13EV2003 CLOSE Pressure Equalising valve 13EV2004	When differential pressure is lower than 3bar, open Main Isolating Valve.
C.5	Test Manifold Close Blowdown Valve 13BDV2005 OPEN Pressure Equalising valve 13XV2008 When pressure has equalised OPEN Main Isolating valve 13XV2007 Close Pressure Equalising valve 13XV2008	When differential pressure is lower than 2bar, open Main Isolating Valve
C.6	The Inlet manifolds are ready to accept well fluids	

2.4 Production Wells

Step	Action	Comment
D.1	The system will be started up with 2 wells lined up to the Production Manifold, followed by a further one well to the Test Manifold	
D.2	<p>Well 1 Use Trip Overrides if required on Wellhead Low Pressures PSD 5.12</p> <p>Override 13PST0109</p> <p>RESET PSD 5.12 Production Well 1</p> <p>Ensure Choke Valve 13HV0107 is CLOSED Ensure Flow Wing Valve 13EV0105 is CLOSED OPEN Sub Surface Safety Valve 13EV0101 Open Production Master Gate Valve 13EV0102 OPEN 13HV0110 to line well 1 up to Production Manifold</p>	<p>Low pressure will activate on the lining out of the well.</p> <p>Well will be left in this state until the Oil Process is lined up and ready.</p>
D.3	<p>Well 2 Use Trip Overrides if required on Wellhead Low Pressures PSD 5.13</p> <p>Override 13PST0209</p> <p>RESET PSD 5.13 Production Well 2</p> <p>Ensure Choke Valve 13HV0207 is CLOSED Ensure Flow Wing Valve 13EV0205 is CLOSED OPEN Sub Surface Safety Valve 13EV0201 Open Production Master Gate Valve 13EV0202 OPEN 13HV0210 to line well 2 up to Production Manifold</p>	<p>Low pressure will activate on the lining out of the well.</p> <p>Well will be left in this state until the Oil Process is lined up and ready.</p>
D.4	<p>Well 3 Use Trip Overrides if required on Wellhead Low Pressures PSD 5.14</p> <p>Override 13PST0309</p> <p>RESET PSD 5.14 Production Well 3</p> <p>Ensure Choke Valve 13HV0307 is CLOSED Ensure Flow Wing Valve 13EV0305 is CLOSED OPEN Sub Surface Safety Valve 13EV0301 Open Production Master Gate Valve 13EV0302 OPEN 13HV0311 to line well 3 up to Test Manifold</p>	<p>Low pressure will activate on the lining out of the well.</p> <p>Well will be left in this state until the Oil Process is lined up and ready.</p>

2.5 Oil Separation

Step	Action	Comment
E.1	<p>HP Separator 20VA101 Inlets</p> <p>Ensure that the valve on the Condensate return line from 2nd Stage Recompressor Suction Scrubber 23VG102 are isolated - i.e. 23EV1005 CLOSED</p> <p>Ensure Water Return line from Coalescer 20VJ501 is isolated - i.e. valve 20XV5003 CLOSED</p>	Valves will be opened at the appropriate step in the procedure
E.2	<p>HP Separator 20VA101 Outlets</p> <p>Ensure the Produced Water line to HP Hydrocyclone 44CE002 is isolated - i.e. valves 20EV1008 and 20EV1009 CLOSED</p> <p>Ensure Crude line to MP Separator 20VA202 is isolated - i.e. valve 20EV1007 CLOSED</p> <p>Ensure Gas Outlet Line to Gas Dehydration is isolated - i.e. valves 20EV1001 and 20EV1002 are CLOSED</p> <p>CLOSE Blowdown Valve 20BDV1004</p>	<p>Valves will be opened at the appropriate step in the procedure, once liquid levels are established</p> <p>All Gas will be flared until the Gas Compression Train is available</p>
E.3	<p>HP Separator 20VA101 Controllers</p> <p>Set Flare pressure controller as follows: 20PC1014A AUTO 37.0 barg</p>	<p>Control Valves will remain closed until process values approach the settings of the controllers</p> <p>Level controllers will be interlocked in Manual until Safety valves are opened.</p>
E.4	<p>MP Separator 20VA202 Inlets</p> <p>Ensure that the Condensate return line from Gas Dehydration is isolated i.e. - 24EV1005 CLOSED</p> <p>Ensure Vapour line from Test Separator 20VA004 is isolated - i.e. valves 20XV0001 and 20XV0002 CLOSED</p> <p>Ensure Liquid line from Test Separator is isolated - i.e. valve 20XV1007 CLOSED</p>	<p>24EV1005 is tripped OPEN when 2nd Stage Recompressor is tripped but it remains CLOSED until PSD4.15 Dehydration Condensate Discharge is RESET</p> <p>Valves will be opened at the appropriate step in the procedure</p>

Step	Action	Comment
E.5	<p>MP Separator 20VA202 Outlets</p> <p>Ensure Crude line to Crude Heater 20HA401 is isolated - i.e. valve 20XV2007 CLOSED</p> <p>Ensure Gas Outlet Line to 2nd Stage Recompressor Suction Cooler 23HB102 is isolated - i.e. valves 20XV2001 and 20XV2002 are CLOSED</p> <p>CLOSE Blowdown Valve 20BDV2004</p>	<p>Valves will be opened at the appropriate step in the procedure, once liquid levels are established</p> <p>All Gas will be flared until the Gas Compression Train is available</p>
E.6	<p>MP Separator 20VA202 Controllers</p> <p>Set Flare pressure controller as follows: 20PC2014A AUTO 9.3 barg</p>	<p>Control Valves will remain closed until process values approach the settings of the controllers</p> <p>Oil level controller 20LC2015 will be interlocked in Manual until Safety valve 20XV2007 is opened.</p>
E.7	<p>Crude Oil Heater 20HA401 Line Up</p> <p>Oil Side: Ensure Inlet valve 20XV4001 is CLOSED Ensure Outlet valve 20XV4002 is CLOSED Ensure Bypass valve 20XV4000 is OPEN Ensure Blowdown Valve 20BDV4003 is OPEN</p> <p>Steam Side: Ensure Inlet valve 55XV1001 is CLOSED Ensure Outlet valve 55XV1002 is CLOSED Ensure Vent valve 55HV1005 is OPEN</p>	<p>Heater will be bypassed until enough Crude Oil Flow is available to place a heat load on the Steam system.</p>
E.8	<p>LP Separator Inlets 20VA303</p> <p>Ensure Condensate Return line from 1st Stage Recompressor Suction Scrubber 23VG101 is isolated - i.e. valve 23XV1002 CLOSED</p> <p>Ensure Reject Oil line from Hydrocyclones 44CE002 and 44CE003 is isolated - i.e. valve 44XV0001 CLOSED</p>	<p>Valves will be opened at the appropriate step in the procedure</p>
E.9	<p>LP Separator 20VA303 Outlets</p> <p>OPEN pressurising valve 20EV3008 on the liquid outlet to the Coalescer</p> <p>OPEN main isolating valve 20EV3007 When Main Valve is completely open CLOSE pressurising valve 20EV3008</p> <p>Ensure Gas Outlet Line to 1st Stage Recompressor Suction Cooler 23HB101 is isolated - i.e. valves 20XV3001 and 20XV3002 are CLOSED</p> <p>CLOSE Blowdown Valve 20BDV3004</p>	<p>Pressure Equalising valve MUST be opened for 2 minutes before the Main Isolating Valve can be opened.</p> <p>All Gas will be flared until the Gas Compression Train is available</p>

Step	Action	Comment
E.10	LP Separator 20VA303 Controllers Set Flare pressure controller as follows: 20PC3014A AUTO 2.0 barg Set Oil level controller as follows: 20LC3015 MANUAL 0% OUTPUT	Control Valves will remain closed until process values approach the settings of the controllers
E.11	Coalescer 20VJ501 OPEN Equalising valve to LP Separator 20EV5001 CLOSE Blowdown Valve 20BDV5004 Ensure Transformer 20ET501 is OFF Ensure water outlet line is isolated 20XV5002 CLOSED	Transformer will be energised when coalescer is liquid filled Valves will be opened and pumps started at the appropriate step in the procedure, once liquid levels are established
E.12	Test Separator 20VA004 Outlets Ensure the Produced Water line to Test Hydrocyclone 44CE003 is isolated - i.e. valves 20EV0008 and 20EV0009 CLOSED Ensure Crude line to MP Separator 20VA202 is isolated - i.e. valve 20XV1007 is CLOSED Ensure Gas Outlet Line to Gas Dehydration is isolated - i.e. valves 20EV0010 and 20EV0011 are CLOSED Ensure Gas Outlet Line to MP Separator 20VA202 is isolated - i.e. valves 20XV0001 and 20XV0002 are CLOSED CLOSE Blowdown Valve 20BDV0004	Valves will be opened at the appropriate step in the procedure, once liquid levels are established All Gas will be flared until the Gas Compression Train is available
E.13	Test Separator 20VA004 Controllers Set Flare pressure controller as follows: 20PC0014A AUTO 37.0 barg Ensure that 20PC0014B is in Manual and Output = 0%	Control Valves will remain closed until process values approach the settings of the controllers Level controllers will be interlocked in Manual until Safety valves are opened.
E.14	Oil Train is now ready to receive well fluids	

2.6 Oil Export

Step	Action	Comment
F.1	Oil Booster Pumps 21PA002A & B Ensure Oil Booster Pumps 21PA002A & B are lined up.	
F.2	Crude Oil Cooler 21HB001 Set Temperature controller as follows: 21TC0023 AUTO 58.0°C	Ensure Crude Oil Cooler is lined up and by-pass closed
F.3	Oil Export Pumps 21PA001A & B Ensure Oil Export Pumps are lined up CLOSE Blowdown Valve 21BDV0003 on pump discharge CLOSE Blowdown Valve 21BDV0005 pipeline inlet Ensure Export Pipeline is isolated - 21XV0001 and 21EV0002 are CLOSED	
F.4	Storage System Set Tank Inlet pressure controller as follows: 22PC0004 AUTO 4.0 barg	
F.5	Ensure the Oil Export Valve 22HV0004 is Closed Ensure that a Storage Tank is lined up and available to accept Crude Oil Tank 22TB001A inlet valve 22HV0001 OPEN Tank 22TB001B inlet valve 22HV0002 CLOSED Tank 22TB001C inlet valve 22HV0003 CLOSED	
F.6	Oil Export System is now ready for use	

2.7 Produced Water

Step	Action	Comment						
G.1	Ensure Reject Oil Outlet from Hydrocyclones line is isolated with 44XV0001 CLOSED							
G.2	<p>Produced Water Degassing Drum 44VD001</p> <p>Ensure Produced Water outlet line valve 44XV1001 is CLOSED</p> <p>Degassing Drum Water level controllers should be set as follows:</p> <table> <tr> <td>44LIC1004A</td><td>MANUAL</td><td>0% OUTPUT</td></tr> <tr> <td>44LIC1004B</td><td>AUTO</td><td>60 %</td></tr> </table> <p>Put Degassing Drum Oil level controller 44LIC1008 in AUTO</p>	44LIC1004A	MANUAL	0% OUTPUT	44LIC1004B	AUTO	60 %	<p>Ensure Produced Water Booster Pumps are lined up</p> <p>Produced Water from the Degassing Drum will be disposed of to Sea until Water Injection Pumps are available.</p> <p>The Oil Level Control is an On/Off control</p>
44LIC1004A	MANUAL	0% OUTPUT						
44LIC1004B	AUTO	60 %						
G.3	Produced Water System is now available to accept fluids from the HP and Test Separators							

2.8 Oil Process Start-up

Step	Action	Comment
H.1	Well 1 OPEN Flow Wing Valve 13EV0105 OPEN Choke Valve 13HV0107 approximately 20% Remove if Overrides on PSD 5.12	Monitor all associated pressures and temperatures upstream and downstream of the choke and in Production Manifold
H.2	HP Separator 20VA101 As pressures and levels increase carry out the following: Once pressure is above trip point of 20PST1013LL remove Trip Override (PSD4_2)	
H.3	As pressure increases in HP Separator, Choke Valve 13HV0107 can be opened steadily to 60%	
H.4	Well 2 OPEN Flow Wing Valve 13EV0205 OPEN Choke Valve 13HV0207 slowly to approximately 20% Remove if Overrides on PSD 5.13	Monitor all associated pressures and temperatures upstream and downstream of the choke and in Production Manifold
H.5	Reset PSD 3.3 Produced Water Treatment Once water level in HP Separator is above trip point of 20LST1017LL , OPEN 20EV1009 to pressurise the HP hydrocyclone When Hydrocyclone is pressurised then OPEN main isolation valve 20EV1008 . CLOSE 20EV1009 pressurising valve. Set Water level controller as follows: 20LC1018 AUTO 40.0%	Note that this requires the pressure in the Degassing vessel to be greater than 0.0 barg or 44PST1006LL has to be overridden Pressurising Valve has to be open for 2min before Main Valve can be Opened. Main Valve has to be fully open

Step	Action	Comment
H.6	<p>HP Separator 20VA101</p> <p>When healthy level is achieved on Crude Oil side then OPEN 20EV1007 on the liquid outlet to the MP Separator</p> <p>Put HP Oil Level Controller 20LC1015 to AUTO and Setpoint = 50%</p>	Safety valve needs to be fully Open
H.7	<p>MP Separator 20VA202</p> <p>As fluid flows into the MP Separator and pressures and levels increase carry out the following: Once pressure is above trip point of 20PST2013LL remove Override at PSD3.1</p>	
H.8	<p>When healthy level is achieved on Crude Oil side then OPEN 20XV2007 on the liquid outlet to the Crude Oil Heater / LP Separator</p> <p>Put MP Oil Level Controller 20LC2015 to AUTO and Setpoint = 50%</p>	Safety valve needs to be fully Open
H.9	<p>PW Degassing Drum</p> <p>When healthy level is achieved on PW Degasser Drum then Reset PSD4.8 And OPEN 44XV1001</p> <p>Ensure Water level controllers are as follows: 44LIC1004A MANUAL 0% (to Injection) 44LIC1004B AUTO 60% (to Sea)</p> <p>OPEN 44XV0001 on Reject Oil line from Hydrocyclones</p> <p>Set Pressure Differential Ratio controller at HP Hydrocyclone 44CE002 as follows: 44PDC0003 AUTO 1.8</p>	Remember to line up pipes
H.10	<p>LP Separator 20VA303</p> <p>As fluid flows into the LP Separator and pressures and levels increase carry out the following: Once pressure is above trip point of 20PST3013LL Remove Override at PSD3.1</p>	

Step	Action	Comment
H.11	<p>Coalescer 20VJ501</p> <p>Crude will then flow into the Coalescer and will fill the vessel completely due to the equalising line via 20EV5001 being open.</p> <p>Once the vessel is liquid filled the Transformer 20ET501 can be energised.</p> <p>Once a water level is established, isolation valves 20XV5002 and 20XV5003 can be opened.</p> <p>Set Water level controller as follows: 20LC5009 AUTO 50%</p> <p>RESET PSD 4.9 Coalescer Water Return Pump A RESET PSD 4.10 Coalescer Water Return Pump B</p> <p>Start 20PG501A or 20PG501B</p>	
H.12	<p>Crude Oil Booster Pumps 21PA002A & B</p> <p>Once satisfactory levels are achieved in LP Separator and Coalescer then START Crude Oil Booster Pump 21PA002A or 21PA002B</p> <p>Pump will run in minimum flow operation</p>	Remember to line up pumps
H.13	<p>Crude Oil Export Pumps 21PA001A & B</p> <p>Once Crude Oil Booster pump is running, RESET PSD 5.1 and PSD 5.2</p> <p>START Crude Oil Export Pump 21PA001A or 21PA001B.</p> <p>Pump will run in minimum flow operation and at minimum speed</p>	Remember to line up pumps
H.14	<p>Crude Oil Export</p> <p>Once Crude Oil Export pump is running OPEN 21EV0002 and 21XV0001.</p> <p>Set Oil level controller as follows: 20LC3015 AUTO 50.0%</p> <p>Ensure Crude Oil Cooler responds to the increases in temperature of the export flow.</p> <p>Once Pipeline pressure is above trip point of 21PST0028LL remove Trip Override at PSD3.1</p>	
H.15	<p>Increase production by Opening Choke Valve 13HV0207 at Well02 to 60%</p>	

Step	Action	Comment
H.16	Test Separator Start Up - Well 3 OPEN Flow Wing Valve 13EV0305 OPEN Choke Valve 13HV0307 approximately 20% Remove if Overrides on PSD 5.14	Monitor all associated pressures and temperatures upstream and downstream of the choke and in Test Manifold
H.17	Test Separator 20VA004 As pressures and levels increase carry out the following: Once pressure is above trip point of 20PST0013LL remove Trip Override at PSD4.1 Once water level in Test Separator is above trip point of 20LST0017LL , OPEN 20EV0009 to pressurise the HP hydrocyclone When Hydrocyclone is pressurised then OPEN main isolation valve 20EV0008 Set Water level controller as follows: 20LC0018 AUTO 40% When healthy level is achieved on Crude Oil side then OPEN 20XV1007 on the liquid outlet to the MP Separator Put Level Controller 20LC0015 in AUTO and Setpoint = 50% Set Pressure Differential Ratio controller at Test Hydrocyclone 44CE003 as follows: 44PDC0004 AUTO 1.8	Note that this requires the pressure in the Degassing vessel to be greater than 0.0 barg or 44PST1006LL has to be over-ridden and PSD 3.3 Produced Water Treatment Plant has to be reset. Pressurising Valve has to be open for 2min before Main Valve can be Opened. As the levels approach the set points of the level controllers ensure that the control valves start to open.
H.18	As pressure increases in Test Separator, Choke Valve 13HV0307 can be opened steadily to 60%	Monitor all pressures, flows and levels throughout the Oil Train. System should be left to stabilise until the Gas Compression Train is available
H.19	Crude Oil Heater 20HA401 Start up Suppress the following Trip: 55PDST1007LL MP Steam / Crude Differential Pressure Crude Side: CLOSE Crude Blowdown Valve 20BDV4003 OPEN Crude Outlet valve 20XV4002 OPEN Crude Inlet valve 20XV4001 CLOSE Crude Bypass Valve 20XV4000	



Step	Action	Comment
H.20	LP Steam Supply: OPEN Condensate Outlet valve 55XV1002 Set temperature controller to: 20TC4008 MANUAL 10.0% OPEN Main Steam Inlet valve 55XV1001 CLOSE Vent valve 55HV1005 Remove Suppressed Trip 55PDST1007LL	
H.21	When system is warmed up Set temperature controller as follows: 20TC4008 AUTO 72.0°C	

2.9 Gas Dehydration

Step	Action	Comment
I.1	<p>Override the following trip inputs to PSD 3.2 Gas Compression</p> <p>27PST0013LL Gas Export Compressor Low Discharge Pressure</p> <p>27PST0012LL Gas Export Compressor Low Suction Pressure</p> <p>RESET PSD 3.2 Gas Compression</p>	This is required to allow HP Separator Gas Offtake valves to be opened
I.2	<p>CLOSE Gas Dehydration Inlet Scrubber 24VG101 Blowdown valve 24BDV1001</p> <p>CLOSE TEG Contactor 24VB101 Blowdown valve 24BDV0001</p> <p>CLOSE Gas Export Compressor 27KA001 Blowdown valve 27BDV0007</p>	
I.3	<p>Gas Dehydration Inlet Cooler 24HH101</p> <p>Set Temperature controller as follows: 24TC1009 AUTO 30.0°C</p>	Remember to line up Cooler
I.4	OPEN Dehydration System Pressurising valve 20EV1002 on HP Separator Gas Outlet	
I.5	<p>Once pressure has equalised across the Dehydration System Pressurising valve 20EV1002 then</p> <p>OPEN 20EV1001 Main Isolating Valve on HP Separator Gas Outlet and close pressurising valve.</p> <p>When pressure is established at Gas Export System Remove Trip Override at PSD3.2</p>	
I.6	<p>Now lean Glycol can be introduced to the Contactor 24VB101 as follows:</p> <p>Ensure Contactor 24VB101 pressure is greater than 5 barg.</p> <p>OPEN 24XV0003 on Inlet to Contactor 24VB101 Put lean Glycol Flow Controller: 24FC0006 AUTO 6m3/h</p>	Glycol will now flow to the Contactor



Step	Action	Comment
I.7	Once Glycol level in base of Contactor 24VB101 exceeds the trip point of 24LST0008LL rich Glycol outlet valve is ready to open. OPEN 24XV0004 and set Rich Glycol level controller as follows: 24LC0006 AUTO 50%	

2.10 Gas Export

Step	Action	Comment
J.1	Before we start Gas Export we need more gas from wells. Open Well 7 and 8 as previous described for Well 1, 2 and 3, with chokes positions slowly up to 60% opening.	
J.2	Override the following trip inputs to PSD 4.5 Gas Export 27PST1015LL Gas Export Cooler Low Pressure RESET PSD 4.5 Gas Export	
J.3	RESET PSD 5.5 Gas Export Compressor Driver	
J.4	Set the following controllers: Export Compressor Speed Control System 27PC0011A AUTO 32.0 barg 27PC0011B AUTO 158.0 barg HP Separator 20PC1014B AUTO 34.0 barg Export Compressor Anti-Surge Control System Set Suction Pressure Anti- Surge controller as follows: 27PC0011AS AUTO 30.0 barg Set Discharge Pressure Anti- Surge controller as follows: 27PC0011BS AUTO 160.0 barg	These controllers, are fed to a LOW SIGNAL selector, whose output controls the speed of the Gas Compressor Driver These controllers are fed to a HIGH SIGNAL selector, whose output controls the position of the Anti-surge control valve
J.5	Start Compressor 27KA0001M	Figure 1. Monitor transmitters
J.6	Gas Export Cooler 27HH101 Close 27BDV1003 Gas Export System Blowdown valve Set Gas Export Pressure limiting controller as follows: 27PC1009 MANUAL 20% OUTPUT Set Gas Export temperature controller as follows: 27TC1012 AUTO 50.0°C	
J.7	OPEN Bypass valve to Gas Export Cooler 27XV0002	

Step	Action	Comment
J.8	<p>Once pressure has equalised OPEN Main Valve to Gas Export Cooler 27XV0001, Then Close the by-pass valve 27XV0002.</p> <p>Once pressure is above trip point of 27PST1015LL remove Trip Override on PSD4.5</p> <p>Gas Export Compressor StartUp is now completed</p>	
J.9	<p>Once gas export compressor discharge pressure (27PT0011B) is within 5 barg of the Gas Export Pipeline Pressure (27PST1015) then OPEN 27EV1001 Pipeline Isolation Valve.</p> <p>Export Gas Flow is monitored by 27FT1014.</p>	
J.10	<p>When excess levels develop in the Gas Dehydration Inlet Scrubber 24VG101</p> <p>RESET PSD 4.15 OPEN 24XV1004 Condensate Outlet OPEN 24EV1005 Condensate back to MP Separator</p> <p>Gas Dehydration Inlet Scrubber 24VG101</p> <p>Set Level controller as follows: 24LC1007 AUTO 50%</p>	<p>Reset Valve if Signal Failure</p> <p>Level Control Interlocked when 24XV1004 is not Open</p>
J.11	<p>Test Separator Gas to Gas Dehydration</p> <p>OPEN Pressurising Bypass valve on Test Separator 20EV0011</p> <p>OPEN Main Gas Outlet valve on Test Separator 20EV0010</p> <p>CLOSE Pressurising Bypass valve on Test Separator 20EV0011</p> <p>Put Pressure controller as follows: 20PC0014B AUTO 35barg</p>	
J.12	<p>Set Gas Export Pressure limiting controller as follows: 27PC1009 AUTO 151barg</p>	
J.13	<p>When excess levels develop in the TEG Contactor 24VB001 (Condensate section)</p> <p>OPEN 24XV0005 Contactor Condensate Outlet</p> <p>Set Level controller as follows: 24LC0007 AUTO 50%</p>	



Step	Action	Comment
J.14	<p>When excess levels develop in the Gas Export Compressor Suction Scrubber 27VG101</p> <p>OPEN 27XV1002 Condensate Outlet</p> <p>Set Level controller as follows: 27LC1007 AUTO 55%</p>	<p>Normally no liquid is condensed in the Gas Export Compressor Suction Scrubber.</p>

2.11 Gas Recompression

Step	Action	Comment
K.1	<p>Override the following trip inputs: PSD 4.3 Gas Recompression Train</p> <p>23PST1016LL 1st Stage Recompressor Low Discharge Pressure 23PST1015LL 1st Stage Recompressor Low Suction Pressure 23PST0021LL 2nd Stage Recompressor Low Discharge Pressure 23PST0020LL 2nd Stage Recompressor Low Suction Pressure</p> <p>RESET PSD 4.3 Gas Recompression Train</p> <p>RESET PSD 5.3 1st Stage Recompressor Driver</p> <p>RESET PSD 5.4 2nd Stage Recompressor Driver</p>	
K.2	<p>CLOSE 23BDV0003 1st Stage Recompressor 23KA001 Blowdown valve</p>	
K.3	<p>LP Separator 20VA303</p> <p>Set Compression Pressure controller as follows: 20PC3014B MANUAL 0% Output</p>	This ensures the compressor to start at minimum speed
K.4	<p>1st Stage Recompressor Suction Cooler 23HB101</p> <p>Set temperature controller as follows: 23TC1010 AUTO 30.0°C</p>	Remember to line up Cooler
K.5	<p>1st Stage Recompressor Speed Control System</p> <p>Set Suction Pressure Speed controller as follows: 23PC0014A AUTO 0.6 barg</p> <p>Set Discharge Pressure Speed controller as follows: 23PC0014B AUTO 8.0 barg</p>	These controllers, together with LP Separator Pressure Controller 20PC3014B (set at 1.3 barg) are fed to a LOW SIGNAL selector, whose output controls the speed of the Compressor Electric Motor Driver
K.6	<p>1st Stage Recompressor Anti-Surge Control System</p> <p>Ensure Suction Pressure Anti-Surge controller is as follows: 23PC0014AS AUTO 0.4 barg</p> <p>Ensure Discharge Pressure Anti-Surge controller is as follows: 23PC0014BS AUTO 9.0 barg</p>	These controllers are fed to a HIGH SIGNAL selector, whose output controls the position of the Anti-surge control valve

Step	Action	Comment
K.7	<p>OPEN 20XV3002 Pressurising valve from LP Separator 20VA303</p> <p>Once pressure has equalised OPEN 20XV3001 Main Isolating valve from LP Separator 20VA303</p> <p>CLOSE 20XV3002 Pressurising valve from LP Separator 20VA303</p>	
K.8	Once pressure is greater than trip points of 23PST0016LL and 23PST0015LL remove Trip Overrides at PSD4.3	
K.9	CLOSE 23BDV0006 2 nd Stage Recompressor 23KA002 Blowdown valve	
K.10	<p>MP Separator 20VA202</p> <p>Set Compression Pressure controller as follows: 20PC2014B MANUAL 0% Output</p>	This ensures the compressor to start at minimum speed
K.11	<p>2nd Stage Recompressor Suction Cooler 23HB102</p> <p>Set temperature controller as follows: 23TC1020 AUTO 30.0°C</p>	
K.12	<p>2nd Stage Recompressor Speed Control System</p> <p>Set Suction Pressure Speed controller as follows: 23PC0019A AUTO 6.0 barg</p> <p>Set Discharge Pressure Speed controller as follows: 23PC0019B AUTO 36.0 barg</p>	These controllers, together with MP Separator Pressure Controller 20PC2014B (set at 7.3 barg) are fed to a LOW SIGNAL selector, whose output controls the speed of the Compressor Electric Motor Driver
K.13	<p>2nd Stage Recompressor Anti-Surge Control System</p> <p>Set Suction Pressure Anti- Surge controller as follows: 23PC0019AS AUTO 4.5 barg</p> <p>Set Discharge Pressure Anti- Surge controller as follows: 23PC0019BS AUTO 39.0 barg</p>	These controllers are fed to a HIGH SIGNAL selector, whose output controls the position of the Anti-surge control valve
K.14	<p>OPEN 20XV2002 Pressurising valve from MP Separator 20VA202</p> <p>Once pressure has equalised OPEN 20XV2001 Main Isolating valve from MP Separator 20VA202</p> <p>CLOSE 20XV2002 Pressurising valve from MP Separator 20VA202</p>	
K.15	Once pressure is greater than trip points of 23PST0021LL and 23PST0020LL remove Trip Overrides at PSD4.3	



Step	Action	Comment
K.16	START 2nd Stage Recompressor 23KA002	
K.17	Once discharge pressure is within 2.0 bar of the HP Separator 20VA101 pressure then: OPEN 23EV0002 2 nd Stage Recompressor 23KA002 Discharge valve. Set Compression Pressure controller as follows: 20PC2014B AUTO 7.3 barg	
K.18	Once level in the 2 nd Stage Recompressor Suction Scrubber 23VG102 is above the trip point of 23LST1019 . RESET PSD 4.12 2nd Stage ReCompr Condensate Return Pumps On 2nd Stage ReCompressor Suction Scrubber Condensate outlet OPEN 23EV1005 Common Discharge valve OPEN 23XV1004 Common Suction valve OPEN 23XV1006 Minimum Flow Isolation valve Set Level controller as follows: 23LC1018 AUTO 50% START condensate Pump 23PA102A or 23PA102B	This might trip when opening valves due to filling liquid into lines. Redo procedure until system liquid filled. Remember to line up pump
K.19	Once 2 nd Stage Recompressor 23KA002 has settled down START 1st Stage Recompressor 23KA001	
K.20	Once discharge pressure is within 2.0 bar of the MP Separator 20VA202 pressure OPEN 23XV0001 1 st Stage Recompressor 23KA001 Discharge valve Set Compression Pressure controller as follows: 20PC3014B AUTO 1.3 barg	



Step	Action	Comment
K.21	<p>Once level in the 1st Stage Recompressor Suction Scrubber 23VG101 is above the trip point of 23LST1012</p> <p>RESET PSD 4.11 1st Stage Recompressor Condensate Return Pumps</p> <p>On 1st Stage Recompressor Suction Scrubber Condensate outlet</p> <p>OPEN 23XV1002 Common Discharge valve OPEN 23XV1001 Common Suction valve OPEN 23XV1003 Minimum Flow Isolation valve</p> <p>Set Level controller as follows: 23LC1011 AUTO 50%</p> <p>START Condensate Pump 23PA101A or 23PA101B</p>	<p>This might trip when opening valves due to filling liquid into lines. Redo procedure until system liquid filled.</p> <p>Remember to line up pump</p>
K.22	<p>Once 1st Stage Recompressor 23KA001 has settled down:</p> <p>RESET PSD 4.13 Closed Flare Opening</p> <p>CLOSE 43XV0002A on line from Flare Drum to Flare Stack and OPEN 43EV0001 on line from Flare Drum 43VD001.</p>	<p>All flare gas will now be delivered to Compressor instead of Flare Tip</p>
K.23	<p>The number of wells that are flowing can now be slowly increased to the design flow rate:</p> <p>Approximately: Oil Production rate = 1000 m3/h Gas Production rate = 850 m3/h</p>	<p>About 11 Production Wells at 75% Choke Opening, and 2 at 60% Choke Opening</p>

2.12 Water Injection

Step	Action	Comment
L.1	Sea Water System must be running and stable.	
L.2	Water Injection Deaerator 51VH201 Set Level controller as follows: 51LC2002 MANUAL 5% OUTPUT OPEN 51HV1001 upstream of Filter 51CA101 As level reaches 50% set Level controller as follows: 51LC2002 AUTO 50% Start Vacuum System is and observe vacuum in Deaerator Tower 51VH201 is approximately 0.5 bara	Vacuum system is set by ON/OFF button in Operator Interface
L.3	Water Injection Booster Pumps 51PA301A & B Set Discharge Pressure controller as follows: 51PC3005 MANUAL 0% OUTPUT Set Pump Minimum Flow controller as follows: 51FC3004 MANUAL 40% OUTPUT	Remember to line up pumps Line to the sea.
L.4	START Water Injection Booster Pump 51PA301A or 51PA301B Set Pump Minimum Flow controllers as follows: 51FC3004 AUTO 300.0 m³/hour Set Discharge Pressure controller as follows: 51PC3005 MANUAL 100% OUTPUT	Pump will run in minimum flow operation with discharge returning to sea.
L.5	RESET PSD 4.17 Water Injection Override the following trip inputs: PSD 4.17 Water Injection Pump A 51FST3008LL Water Injection Pump A Low Suction Flow RESET PSD 4.17 Water Injection Pump A Override the following trip inputs: PSD 4.18 Water Injection Pump B 51FST3009LL Water Injection Pump B Low Suction Flow RESET PSD 4.18 Water Injection Pump B	



Step	Action	Comment
L.6	Water Injection Pumps 51PA302A Set Pump Minimum Flow controller as follows: 51FC3006 MANUAL 65% OUTPUT	Remember to line up pump
L.7	START 51PA302A Water Injection Pump Pump will run in minimum flow operation with discharge returning to sea. Set Pump Minimum Flow controller as follows: 51FC3006 AUTO 210.0 m³/hour	
L.8	To Pressurise up to Water Injection Choke Valves OPEN the following valves: 17HV2001 17HV2101 17HV2201 OPEN 51HV3016 Pressurising valve for Water Injection manifold Once pressure has been equalised then OPEN 51HV3014 Main Discharge valve and CLOSE 51HV3016	
L.9	Set Sea Water Pressure controller as follows: 50PC1008B AUTO 6.5 barg	Sea Water to Sea
L.10	Water Injection Well 20 Override the following trip inputs: PSD 5.31 Water Injection Well 20 17PST2007LL 17PST2005LL RESET PSD 5.31 Water Injection Well 20 Ensure Choke Valve 17HV2003 is CLOSED Ensure Flow Wing Valve 17EV2006 is CLOSED OPEN 17EV2010 Sub Surface Safety Valve OPEN 17EV2009 Injection Master Gate Valve OPEN 17EV2006 Flow Wing Valve Set Choke Controller as follows: 17HV2003 MANUAL 15% Once flow has stabilised set Choke Controller to an opening to give the required injection rate as measured by 17FT2002 Remove Trip Overrides on PSD 5.31	Approximately 300m ³ /hr at about 50% open



Step	Action	Comment
L.11	Water Injection System is now in use and Produced Water Injection can start	
L.12	RESET PSD 4.19 Produced Water Booster Pump A RESET PSD 4.20 Produced Water Booster Pump B	
L.13	Produced Water Degassing Drum 40VD101 Set level controller as follows: 44LC1004A AUTO 48%	Ensure pipes and pumps are lined up
L.14	Produced Water Injection Cooler 44HB101 OPEN 50HV1002 on Sea Water supply to Produced Water Injection Cooler 44HB101 Set temperature controller as follows: 44TC1016 AUTO 64.0°C	Ensure Cooler is lined up
L.15	Produced Water Booster Pumps 44PA101A/B Set Water Injection Booster Pump Discharge Pressure controller as follows: 51PC3002 AUTO 8.0 barg START 44PA101A Produced Water Booster Pump A Water will now be pumped to the suction of the Water Injection Pumps under the level control of 44LC1004A	Ensure pipes and pumps are lined up
L.16	Increase Water Injection rates to desired values	