



Hydrate Remediation Skid Operating Procedure

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1 INTRODUCTION

1.1 General

The Hydrates Remediation (HR) Skid is designed to be used in the event of hydrate formation in a Subsea Tree or Flow Line Jumper during production operations that creates a blockage. The HR skid is ROV operated, deployable from any vessel with a crane or lifting capacity and downline capacity for the designated water depth.

The HR skid has the capability to depressurize the production piping to 200 psig or less at a water depth of up to 8,000 feet. The HR skid is capable of pumping methanol, which can be routed through the production piping in either direction, and is derived from the existing subsea production distribution system, normally pressurized to 3000 psi.

1.2 Purpose

The purpose of this document is to provide the operations procedures for the HR skid with the different modes of operation (i.e., pressure and vacuum).

1.3 Abbreviations and Definitions

Table 1.3-1 provides a listing of abbreviations which may be utilized in this procedure.

Table 1.3-1: Abbreviations & Definitions

Abbreviations and Definitions	
HR	Hydrate Remediation
ROV	Remotely Operated Vehicle
SID	Subsea Intelligent Display



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2 SPECIFICATIONS

2.1 General Specifications

Table 2.1-1 and Table 2.1-2 provide a listing of general specifications referring to the HR skid, ROV and HR skid pump.

Table 2.1-1: HR Skid Specifications

Measurements	Quantity/Units
Length	4'
Width	4'
Height	13'-5"
Weight in Air	1380 lbs (empty)
Weight in Water	900 lbs
Reservoir Volume (each)	34 gallons

Table 2.1-2: ROV & Pump Requirements

Measurements	Quantity/Units
ROV Input Pressure	1100 psi
ROV Inlet Flow	12 gpm
Pump Intensification Ratio	12:1
Pump Output Pressure	3000 psi
Pump Output Flow	2.5 gpm



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3 HYDRATE REMEDIATION SKID COMPONENTS

3.1 General Layout

All operations will be carried out via ROV. ROV operated ball valves are used to control the HR skid circuit while the ROV's hydraulic supply powers the skid intensifier pump. The downstream pressure and vacuum differential pressure are displayed on the gauge panel. Figure 3.1-1 and 3.1-2 display the general layout of the HR skid.



Figure 3.1-1: Hydrate Remediation Skid (Front)



Figure 3.1-2: Hydrate Remediation Skid (Side)

There are four (4) basic sections of the HR skid:

- Gauge Panel;
- Ball Valve Panel;
- ROV Interface Panel;
- Reservoir Housings.



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3.2 Gauge Panel

There are two gauges on the gauge panel displayed in Figure 3.2-1. The SID gauge (left), displays ambient pressure when the HR skid is deployed subsea. In “Vacuum Mode” the pump will pull a vacuum and the SID gauge will read a lower pressure as the vacuum is increasing. The pressure gauge (right) shows the output pressure of the HR skid pump.



Figure 3.2-1: Gauge Panel

3.3 Ball Valve Panel

The Ball Valve Panel, shown in Figure 3.3-1, displays the four (4) quarter turn ball valves. Each ball valve opens or closes the path to the skid reservoirs. Each ball valve is numbered for the reservoir it is in line with. Example BV-1 is connected to reservoir one (1).

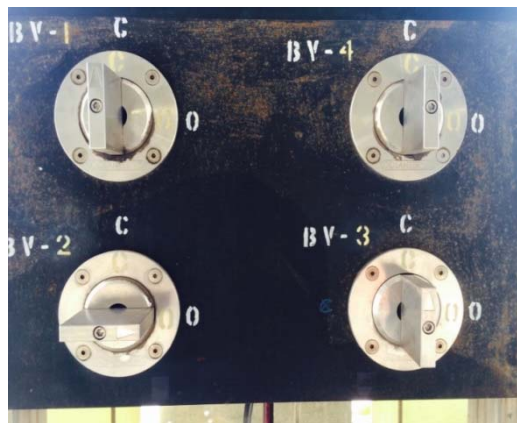


Figure 3.3-1: Ball Valve Panel

3.4 ROV Interface Panel

The ROV Interface Panel is equipped with a female hot stab receptacle, as shown in Figure 3.4-1. The ROV will be equipped with a 17 H male hot stab. The ROV Interface Panel is equipped with three (3) ball valves and two (2) three way valves.

- BV-6
- BV-7
- BV-9
- 3W-1
- 3W-2

The valve positions determine the mode of the HR skid, for vacuum or pressure, through the male hot stab on the ROV. BV-6 and BV-7 isolate the Intensifier Pump from the circuit downstream. This will allow the ROV to lock in pressure or vacuum. 3W-1 and 3W-2 allow one pump to be used on this skid.



Figure 3.4-1: ROV Interface Panel

3.5 HR Skid Reservoir Housings

The HR skid is equipped with four (4) reservoir housings, all contained within the HR skid frame. The reservoirs are designed to contain methanol and other controlled fluids. There are three (3) primary reservoirs, listed in the following, intended for the fluid(s) that will be injected.

- Reservoir 1 (R1)
- Reservoir 2 (R2)
- Reservoir 3 (R3)

The spare reservoir, listed in the following, is intended for accepting fluid/waste returns through the ROV during injection operations.

- Reservoir 4 (R4)

The primary HR skid reservoirs will be filled with the injection fluids from a tote tank before deployment. When filling the reservoirs the pistons will move to the bottom of the reservoirs indicating full capacity. Figure 3.5-1 shows an image of the reservoir housing on the HR skid and the one half (1/2) inch non-collapsible hose that connects the HR skid to the 17 H hot stab.



Figure 3.5-1: Reservoir Housing & Non Collapsible Hose

3.6 Operating Components

Figure 3.6-1 displays the components required to operate the HR skid.

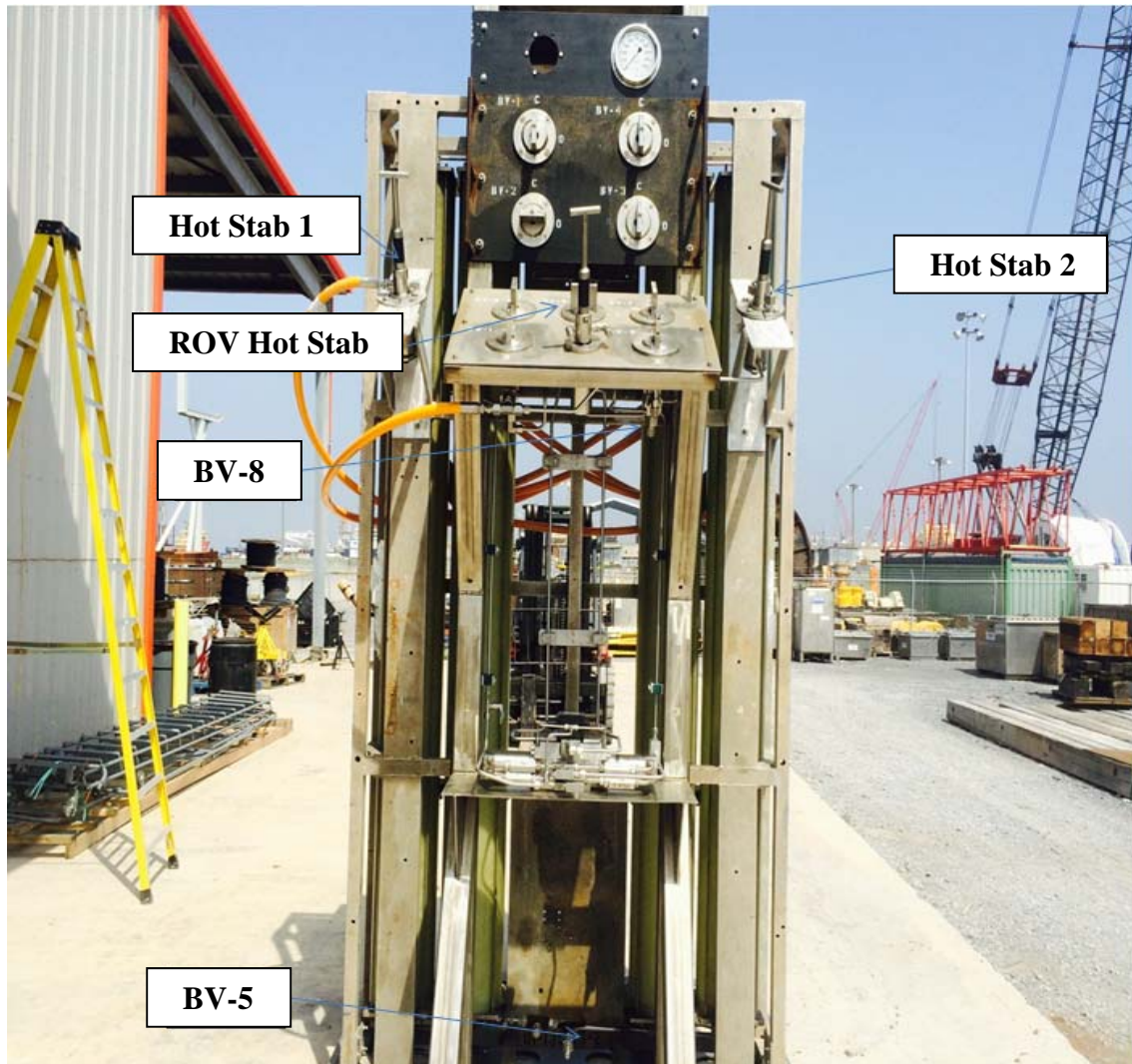


Figure 3.6-1: Hydrate Remediation Skid



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4 OPERATING PROCEDURES

4.1 Reservoir Fill

The HR Skid is configured for the capability to be filled with a single type of fluid or multiple types of fluids in the primary reservoirs. This section details the procedures necessary for filling the reservoirs depending on the fluid configuration that will be used for operations.

4.2 Single Fluid Filling Procedure

Table 4.2-1 details the procedure steps and valve configurations required for filling the HR skid reservoirs with a single fluid for operations.

Table 4.2-1: Single Fluid Filling Procedure

Task Number	Task Description	Verified (initial)	
		SSI	Client
1.	Connect the transfer pump hose to BV-8 valve.		
2.	OPEN BV-8 valve.		
3.	Set the following valves in the OPEN position: <ul style="list-style-type: none"> • BV-1 valve; • BV-2 valve; • BV-3 valve; • BV-5 valve. 		
4.	Set the following valves in the CLOSED position: <ul style="list-style-type: none"> • BV-4 valve; • BV-6 valve; • BV-7 valve; • BV-9 valve. 		
5.	Set valve 3W-1 in POSITION 3 .		
6.	Set valve 3W-2 in POSITION 2 .		



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4.3 Multiple Fluid Filling Procedures

The option is available to insert multiple fluids in the HR skid reservoirs as the work scope requires. Table 4.3-1 details the steps and valve configurations required for filling the HR skid reservoirs with three (3) different fluids for operations.

Table 4.3-1: Three (3) Fluids Filling Procedure

Task Number	Task Description	Verified (initial)	
		SSI	Client
1.	Connect the transfer pump hose to BV-8 valve.		
2.	OPEN BV-8 valve.		
3.	Set the following valves in the OPEN position: <ul style="list-style-type: none"> • BV-1 valve; • BV-5 valve. 		
4.	Set the following valves in the CLOSED position: <ul style="list-style-type: none"> • BV-2 valve; • BV-3 valve; • BV-4 valve; • BV-6 valve; • BV-7 valve; • BV-9 valve. 		
5.	Set valve 3W-1 in POSITION 3 .		
6.	Set valve 3W-2 in POSITION 2 .		



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Task Number	Task Description	Verified (initial)																																					
		SSI	Client																																				
7.	<p>Verify all valves are set correctly according to the following table:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Valve</th> <th>Position</th> <th>Verified (initial)</th> </tr> </thead> <tbody> <tr><td>BV-1</td><td>Open "O"</td><td></td></tr> <tr><td>BV-2</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-3</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-4</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-5</td><td>Open "O"</td><td></td></tr> <tr><td>BV-6</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-7</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-8</td><td>Open "O"</td><td></td></tr> <tr><td>BV-9</td><td>Closed "C"</td><td></td></tr> <tr><td>3W-1</td><td>Position 3</td><td></td></tr> <tr><td>3W-2</td><td>Position 2</td><td></td></tr> </tbody> </table> <p>SSI responsible person signs off confirming correct valve position.</p> <p>SSI Representative: _____ (Print) : _____ (Signature)</p> <p>Date: _____ Time: _____</p>	Valve	Position	Verified (initial)	BV-1	Open "O"		BV-2	Closed "C"		BV-3	Closed "C"		BV-4	Closed "C"		BV-5	Open "O"		BV-6	Closed "C"		BV-7	Closed "C"		BV-8	Open "O"		BV-9	Closed "C"		3W-1	Position 3		3W-2	Position 2		N/A	N/A
Valve	Position	Verified (initial)																																					
BV-1	Open "O"																																						
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BV-6	Closed "C"																																						
BV-7	Closed "C"																																						
BV-8	Open "O"																																						
BV-9	Closed "C"																																						
3W-1	Position 3																																						
3W-2	Position 2																																						
8.	Fill reservoir one (1) by starting the transfer pump.																																						
9.	<p>Once reservoir one (1) is full, stop the transfer pump.</p> <p> Verify the piston is all the way down, this will provide visual confirmation that the reservoir is full.</p>																																						
10.	<p>Set the following valves in the CLOSED position:</p> <ul style="list-style-type: none"> • BV-8 valve; • BV-1 valve. 																																						
11.	Disconnect the transfer pump hose from BV-8 valve.																																						




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		SSI	Client
18.	Once reservoir two (2) is full, stop the transfer pump.  <i>Verify the piston is all the way down, this will provide visual confirmation that the reservoir is full.</i>		
19.	Set the following valves in the CLOSED position: <ul style="list-style-type: none"> • BV-2 valve; • BV-8 valve. 		
20.	Disconnect the transfer pump hose from BV-8 valve.		
21.	Flush the transfer pump hose to remove chemical residue.		
22.	Connect transfer pump to third designated fluid.		
23.	Connect transfer pump hose to BV-8.		
24.	Set the following valves in the OPEN position: <ul style="list-style-type: none"> • BV-3 valve; • BV-8 valve. 		



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Task Number	Task Description	Verified (initial)																																					
		SSI	Client																																				
25.	<p>Verify all valves are set correctly according to the following table:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Valve</th> <th>Position</th> <th>Verified (initial)</th> </tr> </thead> <tbody> <tr><td>BV-1</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-2</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-3</td><td>Open "O"</td><td></td></tr> <tr><td>BV-4</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-5</td><td>Open "O"</td><td></td></tr> <tr><td>BV-6</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-7</td><td>Closed "C"</td><td></td></tr> <tr><td>BV-8</td><td>Open "O"</td><td></td></tr> <tr><td>BV-9</td><td>Closed "C"</td><td></td></tr> <tr><td>3W-1</td><td>Position 3</td><td></td></tr> <tr><td>3W-2</td><td>Position 2</td><td></td></tr> </tbody> </table> <p>SSI responsible person signs off confirming correct valve position.</p> <p>SSI Representative: _____ (Print) : _____ (Signature)</p> <p>Date: _____ Time: _____</p>	Valve	Position	Verified (initial)	BV-1	Closed "C"		BV-2	Closed "C"		BV-3	Open "O"		BV-4	Closed "C"		BV-5	Open "O"		BV-6	Closed "C"		BV-7	Closed "C"		BV-8	Open "O"		BV-9	Closed "C"		3W-1	Position 3		3W-2	Position 2		N/A	N/A
Valve	Position	Verified (initial)																																					
BV-1	Closed "C"																																						
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BV-4	Closed "C"																																						
BV-5	Open "O"																																						
BV-6	Closed "C"																																						
BV-7	Closed "C"																																						
BV-8	Open "O"																																						
BV-9	Closed "C"																																						
3W-1	Position 3																																						
3W-2	Position 2																																						
26.	Start the transfer pump.																																						
27.	<p>Once reservoir three (3) is full, stop the transfer pump.</p> <p> <i>Verify the piston is all the way down, this will provide visual confirmation that the reservoir is full.</i></p>																																						
28.	<p>Set the following valves in the CLOSED position:</p> <ul style="list-style-type: none"> • BV-3 valve; • BV-8 valve. 																																						
29.	Disconnect the transfer pump hose from BV-8 valve.																																						






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Task Number	Task Description	Verified (initial)	
		SSI	Client
3.	<p>Install Hot Stab 1 in receptacle as shown in the following figure.</p> 		
4.	<p>Install Hot Stab 2 in receptacle as shown in the following figure.</p>  <p>Hot Stab 2 has two (2) functions.</p> <p>1. Used as a dummy hot stab when the HR skid will be using Reservoir four (4) only for fluid/waste return.</p> <p>2. Used to interface a larger storage bladder when the SOW requires more fluid/waste return than Reservoir 4 has capacity for.</p> 		



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		SSI	Client
8.	Crane pays out to land the HR skid in the target landing box with ROV assistance to achieve the desired heading.		
9.	Once the skid is on the bottom the ROV will disconnect the crane from the HR skid.		
10.	ROV removes Hot Stab 1 from the receptacle.		
11.	ROV flies away from the skid, stretching out the Hot Stab 1 hose and allowing slack.		
12.	<p>ROV installs Hot Stab 1 into the required receptacle on the designated subsea structure, as directed by the Client Representative.</p> <p>Client Representative signs off confirming that the correct subsea structure has been engaged.</p> <p>Client Representative: _____ (Print) : _____ (Signature)</p> <p>Date: _____ Time: _____</p>	N/A	N/A
13.	<p>If the waste is going to be re-routed, the ROV grabs the second end of Hot Stab 2.</p> <p><i>If the fluid is going through BV-9, a jumper hose will be required to connect the HR skid to a subsea bladder. In this event a second hose & hot stab would be installed on the HR skid. One end would be in the same location as Hot Stab 2 and the second end would be zip tied to the frame.</i></p>		
14.	ROV flies away from the skid, stretching out the Hot Stab 2 hose and allowing slack.		
15.	ROV installs Hot Stab 2 into the required receptacle on the designated subsea bladder, as directed by the Client Representative.		







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		SSI	Client
2.	Set the following valves in the OPEN position, as needed: <ul style="list-style-type: none"> • BV-1 valve; • BV-2 valve; • BV-3 valve.  <i>Valves BV-1, BV-2 and BV-3 will be set based on the reservoir fluid configuration.</i>		
3.	Set valve 3W-1 in POSITION 3 .		
4.	Set valve 3W-2 in POSITION 2 .		
5.	Set the following valves in the CLOSED position: <ul style="list-style-type: none"> • BV-4 valve; • BV-8 valve; • BV-9 valve.  <i>Insure ROV pressure going to Hot Stab is set to 1100 psi and the Flow is set at 12 GPM.</i>		



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Task Number	Task Description	Verified (initial)																																					
		SSI	Client																																				
6.	<p>Verify all valves are set correctly according to the following table and fill out the position for BV-1, BV-2 and BV-3:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Valve</th> <th>Position</th> <th>Verified (initial)</th> </tr> </thead> <tbody> <tr> <td>BV-1</td> <td>_____</td> <td></td> </tr> <tr> <td>BV-2</td> <td>_____</td> <td></td> </tr> <tr> <td>BV-3</td> <td>_____</td> <td></td> </tr> <tr> <td>BV-4</td> <td>Closed "C"</td> <td></td> </tr> <tr> <td>BV-5</td> <td>Open "O"</td> <td></td> </tr> <tr> <td>BV-6</td> <td>Open "O"</td> <td></td> </tr> <tr> <td>BV-7</td> <td>Open "O"</td> <td></td> </tr> <tr> <td>BV-8</td> <td>Closed "C"</td> <td></td> </tr> <tr> <td>BV-9</td> <td>Closed "C"</td> <td></td> </tr> <tr> <td>3W-1</td> <td>Position 3</td> <td></td> </tr> <tr> <td>3W-2</td> <td>Position 2</td> <td></td> </tr> </tbody> </table> <p>SSI responsible person signs off confirming correct valve position.</p> <p>SSI Representative: _____ (Print) : _____ (Signature)</p> <p>Date: _____ Time: _____</p>	Valve	Position	Verified (initial)	BV-1	_____		BV-2	_____		BV-3	_____		BV-4	Closed "C"		BV-5	Open "O"		BV-6	Open "O"		BV-7	Open "O"		BV-8	Closed "C"		BV-9	Closed "C"		3W-1	Position 3		3W-2	Position 2		N/A	N/A
Valve	Position	Verified (initial)																																					
BV-1	_____																																						
BV-2	_____																																						
BV-3	_____																																						
BV-4	Closed "C"																																						
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4.7 Vacuum Procedures Mode

Table 4.7-1 provides the procedural tasks required to set the vacuum mode on the HR skid.

Table 4.7-1 Vacuum Mode Procedures

Task Number	Task Description	Verified (initial)	
		SSI	Client
13.	Set the following valves to the OPEN position: <ul style="list-style-type: none"> • BV-6 vale; • BV-7 valve; • BV-5 valve. 		
14.	Set valve 3W-1 in POSITION 2 .		
15.	Set valve 3W-2 in POSITION 3 .		
16.	Set the following valves in the CLOSED position: <ul style="list-style-type: none"> • BV-1 valve; • BV-2 valve; • BV-3 valve; • BV-8 valve. 		
17.	Determine where returns will go based on total volume discharge.  Total expected discharged volume in gallons : _____		
18.	If there will be less than 34 gallons discharged, set the following valves: <ul style="list-style-type: none"> • BV-4 valve to OPEN; • BV-9 valve to CLOSE. 		
19.	If there will be more than 34 gallons discharged, set the following valves: <ul style="list-style-type: none"> • BV-4 valve to CLOSE; • BV-9 valve to OPEN.  If fluid is going through BV-9, a jumper will be required to connect the HR skid to a subsea bladder.		



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5 MAINTENANCE

5.1 Rinsing and Flushing

After the HR skid is used it must be cleaned for storage. The steps to flush the skid for storage are provided in table Table 5.1-1.

Table 5.1-1: Maintenance Procedures

Task Number	Task Description	Verified (initial)	
		SSI	Client
1.	After use, HR skid should be thoroughly rinsed with fresh water.		
2.	Fill the reservoirs with fresh water and run skid in pressure mode to flush all the piping and valves.		
3.	Close BV-5 valve.		
4.	Install protective cap.		
5.	For long term storage wrap the entire skid with black heat wrap to protect the reservoirs from direct sunlight.		