Title: Operation of Nitrogen Plant			
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1.0 OBJECTIVE:

To lay down a procedure for Operation of Nitrogen Plant.

2.0 SCOPE:

This SOP is applicable for Operation of Nitrogen Plant having capacity 30 NM^3/Hr.

3.0 RESPONSIBILITY:

Operator/Officer/Executive: Engineering.

4.0 ACCOUNTABILITY:

Head - Engineering.

5.0 ABBREVIATIONS:

SOP	Standard Operating Procedure
cm	Centimeter
Hr	Hour
kg	Kilogram
NLT	Not Less Than
NMT	Not More Than
PSA	Pressure Swing Adsorption
ppm	Parts Per Million

6.0 Operation procedure of Nitrogen Plant (30 NM^3/Hr.)

6.1 Check & ensure that power supply is available.

6.2 Check & ensure that all Drain Valves are closed.

6.3 Switch **'ON'** the Main Power Supply Switch to operate nitrogen plant.

6.4 Check and ensure that compressed air is available in air receiver which is equipped with nitrogen plant, which acts as a storage tank for cyclic consumption of air in the downstream system. It should be more than 6.0 Kg/cm2 and record the same in respective prescribed **Annexure- I & II**.

6.5 Air receiver also equipped with an auto drain trap & manual drain valves. Check and ensure the proper working of auto drain trap & manual drain valves.

6.6 Manual drain valve shall be opened manually whenever required to crosscheck the functioning of condensate drain trap.

6.7 Check and ensure that air pressure in Instrument air port is available & It should be more than 6.0 kg/cm^2. It acts as storage vessel for the dry air for optimum operation of PSA unit valves as well as other angle valves as per cycle time.

6.8 Record the air pressure of instrument air port in **Annexure – II.**

6.9 Check and ensure the proper functioning/operation of Solenoid Valve, Pneumatic Actuators and Valves.

6.10 Check and ensure that Pre filter of 5 micron installed on compressed air line after air receiver tank are functioning properly to serve the intended purpose. Gauge installed on pre filter which show the condition of pre filter should show in green range if the needle of gauge observed in red area then replace the filter as per immediate remedial action or when pressure drop across filter observed more than 1.0 kg/cm^2 then replace the filter. 5 µ filter shall be replaced after every six months & whenever required.

6.11 After filtration by 5 micron cartridge filter, compressed air is feeding to PSA towers 1 & 2 alternately as per operation cycle.

6.12 Each set of PSA tower contains the following below mentioned valves:

S.No.	**Description**	**Nitrogen Plant (30 NM^3/Hr.)**	
		PSA Tower- I	**PSA Tower- II**
1.	Air Inlet Valve	PSA-V-1	PSA-V-2
2.	Nitrogen Outlet Valve	PSA-V-7	PSA-V-8
3.	Exhaust Valve	PSA-V-3	PSA-V-4
4.	Top Equalization	PSA-V-6	
5.	Bottom Equalization	PSA-V-5	
6.	Purging Valve	PSA-V-9	

6.13 When Tower – I in adsorption and tower – II in regeneration then valves will operate as per below mention table:

S.No.	**Nitrogen Plant (30 NM^3/Hr.)**			
	PSA tower- I		**PSA tower- I**	
1.	**Open Valve**	**Open Valve**	**Closed Valve**	**Open Valve**
2.	PSA-V-1	PSA-V-11	PSA-V-13	PSA-V-14
3.	PSA-V-7	PSA-V-17		
4.	PSA-V-5 will remains in closed condition			
5.	PSA-V-6 will remains in closed condition			
6.	PSA-V-9 will remains in closed condition			

6.14 When Tower – II in adsorption and tower – I in regeneration then valves will operate as per below mention table:

S.No.	**Nitrogen Plant (30 NM^3/Hr.)**			
	PSA tower- I		**PSA tower- II**	
1.	**Open Valve**	**Closed Valve**	**Open Valve**	**Closed Valve**
2.	PSA-V-3	PSA-V-1	PSA-V-2	PSA-V-4
3.		PSA-V-7	PSA-V-8	
4.	PSA-V-5 will remains in closed condition			
5.	PSA-V-6 will remains in closed condition			
6.	PSA-V-9 will remains in closed condition			

6.15 During Pressure equalization from PSA tower-I to PSA tower- II valves were operated as per below mentioned table:

S.No.	**Nitrogen Plant (30 NM^3/Hr.)**			
	PSA tower- I		**PSA tower- II**	
1.	Open Valve	Closed Valve	Open Valve	Closed Valve
2.		PSA-V-1		PSA-V-2
3.		PSA-V-3		PSA-V-4
		PSA-V-7		PSA-V-8
4.	PSA-V-5 will remains in open condition			
5.	PSA-V-6 will remains in open condition			
6.	PSA-V-9 will remains in closed condition			

6.16 During Pressure equalization from PSA tower-II to PSA tower- I valves were operated as per below mentioned table:

S.No.	**PSA tower- I**		**PSA tower- II**		**PSA tower- I**		**PSA tower- II**	
1.	Open Valve	Closed Valve	Open Valve	Closed Valve	Open Valve	Closed Valve	Open Valve	Closed Valve
2.		PSA-V-1		PSA-V-2		PSA-V-11		PSA-V-12
3.		PSA-V-3		PSA-V-4		PSA-V-13		PSA-V-14
		PSA-V-7		PSA-V-8		PSA-V-17		PSA-V-18
4.	PSA-V-5 will remains in open condition				PSA-V-15 will remains in open condition			
5.	PSA-V-6 will remains in open condition				PSA-V-16 will remains in open condition			
6.	PSA-V-9 will remains in closed condition				PSA-V-19 will remains in closed condition			

6.17 Check and ensure the proper functioning of change over valve for Changeover of PSA tower.

6.18 Record the pressure at PSA tower & it should be more than 6.0 kg/cm2 and record the same in **Annexure –II**.

6.19 **A** flow meter (Rota meter) is installed at the outlet of surge vessel which indicates constantly flow of nitrogen from surge vessel to nitrogen storage tank. It should be not more than 30 NM^3/Hr. in 30 NM^3/Hr. plant. Record the same in prescribed **Annexure -II.**

6.20 Oxygen analyzer is installed at surge vessel to monitor Oxygen content in nitrogen gas generated from PSA Module. It should be not more than 100 ppm in 30NM^3/Hr. plant & not more than 0.5 % in 10NM^3/Hr. plant & record the same in respective **Annexure –I & II** accordingly.

6.21 Dew point analyzer is also installed at surge vessel to monitor moisture content in nitrogen gas generated from PSA Module. It should be not more than -40 °C & record the same in **Annexure – II**.

6.22 Record the value of oxygen & dew point in respective **Annexure – II**.

6.23 After surge vessel, final nitrogen gas is stored in nitrogen storage tank. Check and ensure the pressure at nitrogen storage tank should be less than 5 kg/cm^2 & record the same in respective **Annexure-I & II.**

6.24 Check and ensure that line filter of 0.2 micron installed on nitrogen line are functioning properly to serve the intended purpose. 0.2 micron filter shall be replaced after every six months or whenever pressure drop across filter found more than 1 Kg/cm^2 required.

6.25 STOP procedure :

- Close Outlet Valve of Nitrogen Plant
- Close the Inlet Valve of Air Receiver
- Switch **'OFF'** the power supply from Control Supply

7.0 ANNEXURES:

ANNEXURE No.	TITLE OF ANNEXURE	FORMAT No.
Annexure-I	Operation Record of Nitrogen Plant (30 Nm^3/hr.)	
Annexure-II	Process Flow Diagram Of Nitrogen Plant (30 Nm^3/hr.)	
Annexure – III	Filter Replacement Record	

ENCLOSURE: SOP Training Record

8.0 DISTRIBUTION:

- Controlled Copy No. 01 Quality Assurance
- Controlled Copy No. 02 Engineering
- Master Copy Quality Assurance

9.0 REFERENCES:

Operation Manual

10.0 REVISION HISTORY:

CHANGE HISTORY LOG

Revision No.	Change Control No.	Details of Changes	Reason for Change	Effective Date	Updated By

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ANNEXURE-I
OPERATION RECORD OF NITROGEN PLANT (30 NM^3/Hr.)

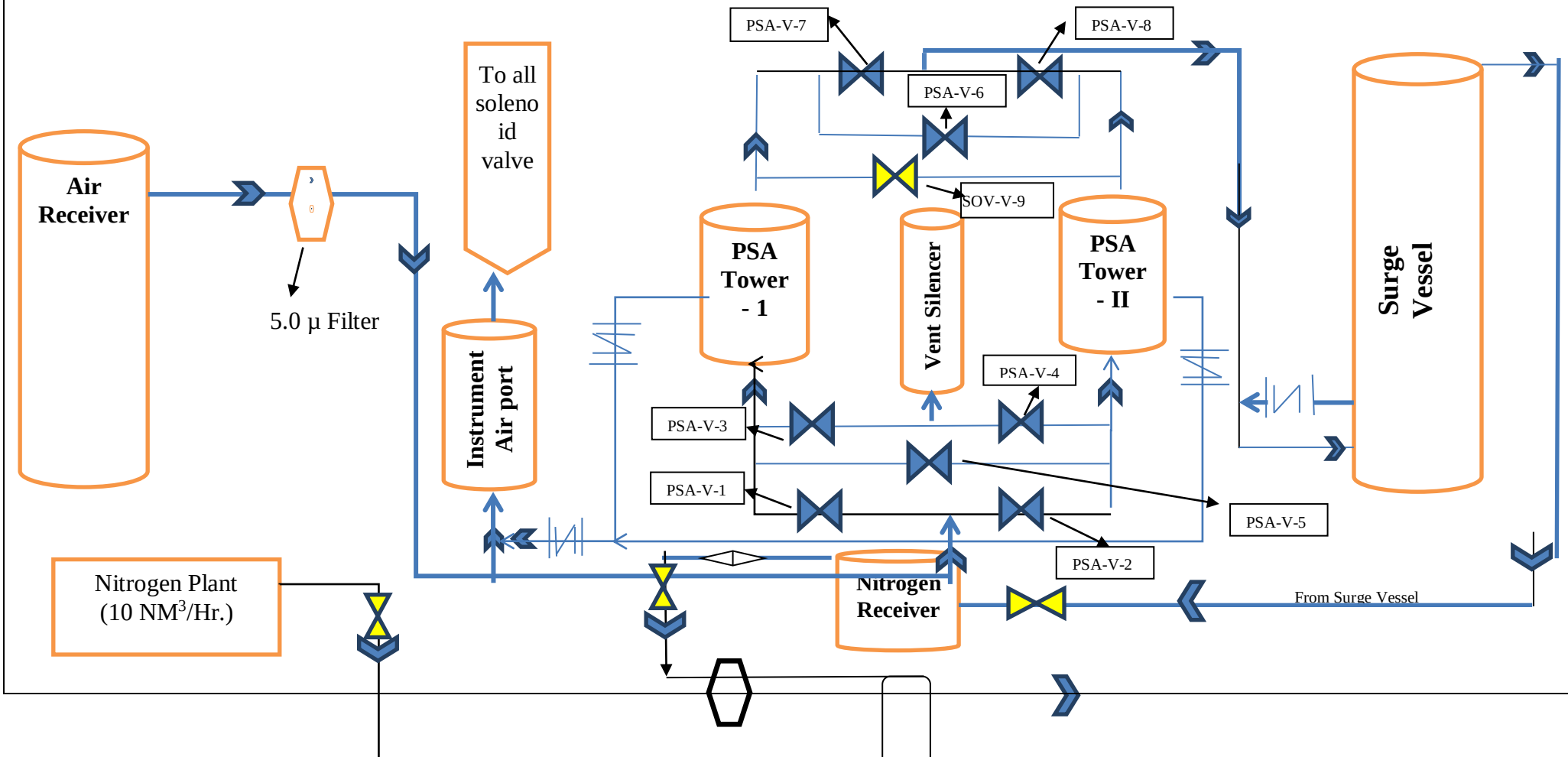
Equipment ID: **Date:**

Start Time	Stop Time	Reading Time	Air Receiver Pressure (NLT 6.0 kg/cm^2)	PSA Tower (NLT 6.0 kg/cm^2)		Surge Tank (NLT: 4 kg/cm^2)	N_2 Flow (NMT: 30 NM^3/ Hr.)	N2 Receiver Tank Pressure (NLT :3 kg/cm^2)	O_2 (NMT: 100ppm)	Dew Point (NMT : -40°C)	ΔP across 0.2 µ filter	Operator (Sign & Date)	Remark
				PSA - I	PSA - II								

Note: One out of two PSA towers pressure will remain at zero while regeneration.

Reviewed By:
Sign & Date

ANNEXURE-II
PROCESS FLOW DIAGRAM OF NITROGEN PLANT (30 NM^3/Hr.)



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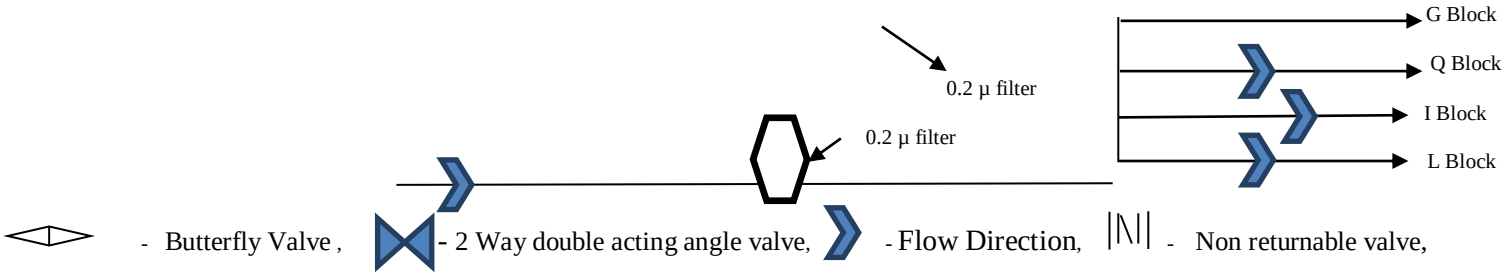

- Butterfly Valve , - 2 Way double acting angle valve, - Flow Direction, - Non returnable valve,

ANNEXURE-III
FILTER REPLACEMENT RECORD

S.No.	Date	Equipment ID	Filter Size	Pressure Across filter			Replaced On	Replacement Due On	Done By Sign & Date	Reviewed By Sign & Date	Remarks
				Before	After	ΔP					