TITLE: REACTOR OPERATION

1.0 **PURPOSE:**

To lay down the procedure for operation of reactor

2.0 **SCOPE:**

This procedure is applicable for Reactor operation, application of utilities, charging, unloading of material to the reactor at Discovery.

3.0 **RESPONSIBILITY:**

It is the responsibility of the personnel performing the operation of reactor

4.0 **Definitions:** Nil

5.0 **PROCEDURE :**

5.1 **Reactor Operation**

5.1.1 Before the start the reactor, check the reactor lamp for working condition, bottom valve shall be in closed condition, No oil leakage from gear box

5.1.2 Switch ON the reactor by pressing the PUSH button and check for any abnormal sound from motor and gear box.

5.1.3 Stop the reactor by pressing the PUSH button and ensure reactor is stopped.

5.1.4 Check the utility supply required for Reactor, Heat Exchanger and receivers

5.1.5 Check temperature, Vacuum, Pressure gauge and safety valve on Jacket are in calibrated condition.

5.1.6 Ensure all other valves are closed and vent is in open condition

5.1.7 If the reactor is Glass lined reactor (GLR). Do not use any metal accessories.

5.1.8 To prevent the static electricity in GLR, during spraying of solvents, insert earth cable

5.1.9 If there is any scaling observed on the surface of glass lined reactor use only PP scrappers for removal of scale

5.1.10 Do not use metal rods to de-choke the bottom valve of GLR. Use Vacuum technique / PP rod or Teflon rod.

5.1.11 Never allow thermal shocks to the Glass lined vessels like sudden cooling or sudden heating.

5.2 **Solid material charging.**

5.2.1 Check the name of the material to be charged in the BPR and verify the labels on the container along with weights and ensure the material is approved.

5.2.2 Open the manhole of the reactor and ensure the stirrer to be ON condition, if any instruction to be followed for particular raw material about stirring need to follow as per requirement defined in the respective BPR.

5.2.3 Wear personnel protective equipment like gloves, goggles etc.. and if any special precaution to be taken while charging the material like nitrogen blanketing to the reactor the same shall be followed.

5.2.4 Read Material safety data sheet (MSDS) and wear necessary PPE.

5.2.5 The personnel involved in the charging operations shall take care to avoid physical contact with the materials being charged by the use of safety gloves

5.2.6 Open the containers and untie the bags and ensure all other reactors, tanks and material bags are in closed condition

5.2.7 Charge the material into the reactor through the manhole while the stirring is on by using scoop.

5.2.8 Close the manhole after the completion of charging.

5.2.9 Clean the outer surface of the equipment with cloth and any spillage the same shall be collected and shall be disposed.

5.2.10 Enter the details of charging in the Batch Production Record after completion of charging.

5.3 **Liquid Materials charging**

5.3.1 Check whether the material to be charged is approved

5.3.2 Measure the liquid with suitable Dip rod / Measuring jar /level indicator and enter the details in the respective batch record.

5.3.3 **If Liquid charging by Vacuum:**

5.3.3.1 Close all the valves connected to the reactor like vent valve, charging line valve, condenser vent valve and any other nozzles connected to reactor.

5.3.3.2 Apply vacuum directly to the reactor, if reactor has directly connected to General vacuum.

5.3.3.3 If reactor does not have connection vaccum, apply vaccum to the reactor through receiver, which connected to reactor condensers.

5.3.3.4 Ensure receiver is empty and close the receiver vent valve. Open the receiver vacuum valve.

5.3.3.5 Apply vacuum to the receiver and ensure vacuum is created in reactor.

5.3.3.6 Connect the hose pipe to the reactor charging line and clamp it.

5.3.3.7 Keep the hosepipe into the container dipping into the liquid.

5.3.3.8 Open the charging line valve and transfer the material from container/ drum into the reactor.

5.3.3.9 Close the suction line valve of the reactor, once transferring is comple**te**d.

5.3.3.10 Close the vacuum valve of receiver after completely loading the liquid material and release the vacuum through receiver vent.

5.3.3.11 Enter the details of charging and the in-house batch number of the liquid raw material charged in the batch production record. The details recorded should be counter checked by a second person.

5.3.4 If liquid charging through pumping.

5.3.4.1 Connect the pump delivery line to reactor charging line

5.3.4.2 Ensure the suction line of pump is connected to receiver / tank from which liquid shall be transferred.

5.3.4.3 Open the receiver/ tank bottom valve and open charging line of the reactor.

5.3.4.4 Switch on the pump and ensure the liquid material is transferred to the reactor

5.3.4.5 Once the transfer is completed, switch off the pump and close the reactor charging line and tank bottom valve.

5.3.4.6 If liquid charging through charging tank:

5.3.4.7 Connect the line from charging tank to the reactor charging nozzle.

5.3.4.8 Open the valve of the charging tank bottom and reactor charging valve and transfer the material through gravity.

5.3.4.9 Once the transfer is completed close both the valves.

5.3.5 **If liquid charging by N2 pressure:**

5.3.5.1 Ensure the transfer of the raw material in to the reactor

5.3.5.2 Ensure the availability of nitrogen cylinders.

5.3.5.3 Open the Cap of the container

5.3.5.4 Fix the blowleg in to the container

5.3.5.5 Slowly apply the nitrogen to the container to increase the pressure.

5.3.5.6 Observe the liquid transferring in to reactor.

5.3.5.7 After completion of the liquid in to reactor stop the nitrogen pressure from cylinder.

5.3.5.8 Enter the details in Batch Production Record.

5.4 **Reflux**

5.4.1 **By using Steam**

5.4.1.1 Check whether the manhole bolts are tight and keep the condenser vent in open condition.

5.4.1.2 Keep the reflux line valve in open condition

5.4.1.3 Close water outlet of the condenser, open the inlet of the condenser, open the water to vent out the air gaps.

5.4.1.4 Close the vent valve and open the outlet valve.

5.4.1.5 Close all inlet and outlet valves and ensure the reactor jacket is empty by opening the jacket unloading valve and vent valve.

5.4.1.6 Connect the jacket unloading line to RT unloading point to collect the steam condensate

5.4.1.7 Close the jacket vent and slowly open the steam valve and apply the steam to reactor jacket.

5.4.1.8 Ensure that jacket pressure gauge is in working condition and with in the calibration status.

5.4.1.9 Raise the temperature as per process requirement and ensure the condensate is collected in view glass of condenser.

5.4.1.10 Slightly close the reactor jacket out let valve and ensure only steam condensate is drained.

5.4.1.11 Do not open valve fully as steam would escape completely as resulted mass temperature does not raise due to lack sufficient pressure in the jacket.

5.4.1.12 Enter the details in the Batch Production Record.

5.4.2 **By using hot water**

5.4.2.1 Check whether the manhole bolts are tight and keep the condenser vent valve is in open condition.

5.4.2.2 Keep the reflux line valve in open condition

5.4.2.3 Close water outlet of the condenser, open the inlet of the condenser, open the water to vent out the air gaps.

5.4.2.4 Close the vent valve and open the outlet valve.

5.4.2.5 Close all inlet and outlet valves and ensure the reactor jacket is empty by opening the jacket unloading valve and vent valve.

5.4.2.6 Ensure the hot water tub is filled with water and raise the temperature water by applying steam to water.

5.4.2.7 Raise the temperature as per requirement and ensure the hot water pump is in running condition pressure is maintained.

5.4.2.8 Close the jacket unloading valve and open the hot water line.

5.4.2.9 Fill the jacket with hot water and close the vent and open outlet of the hot water.

5.4.2.10 Ensure that jacket pressure gauge is in working condition and with in the calibration status.

5.4.2.11 Raise the temperature as per process requirement and ensure the condensate is collected in view glass of condenser.

5.4.2.12 Slightly close the reactor jacket out let valve and ensure only steam condensate is drained.

5.4.2.13 Do not open valve fully as steam would escape completely as resulted mass temperature does not raise due to lack sufficient pressure in the jacket.

5.4.2.14 Enter the details in the Batch Production Record.

5.5 **Distillation**

5.5.1 **Vacuum distillation**

5.5.1.1 Close all the valves connected to the reactor like vent valve, charging line valve, condenser vent valve and any other nozzles connected to reactor.

5.5.1.2 Close water /Brine outlet of the condenser, open the inlet of the condenser, open the water to vent out the air gaps.

5.5.1.3 Close the vent valve condenser and open the outlet valve of R.T water / Brine.

5.5.1.4 Ensure the vacuum pumps, vacuum trap for empty and water level in the vacuum sump is sufficient and jet valves are in open condition.

5.5.1.5 Ensure the vacuum trap is empty by opening the bottom valve

5.5.1.6 Switch ON the vacuum pump

5.5.1.7 Ensure the vacuum gauge is calibrated and in working condition

5.5.1.8 Ensure receiver is empty by opening the bottom valve and close the bottom valve.

5.5.1.9 Open the vacuum line valve, which is connected to the respective receiver of the reactor and apply vacuum to the receiver and ensure the vacuum is created in the reactor by observing the pressure gauge.

5.5.1.10 Apply steam / hot water to the reactor jacket and raise the temperature of the mass as defined in the respective BPR.

5.5.1.11 After reaching the desired temperature, ensure the distillate is collected through view glass of condenser.

5.5.1.12 Distill out the required quantity of solvent as per the BPR

5.5.1.13 Once distillation is completed, close the condenser outlet and release the vacuum by applying the nitrogen to the reactor.

5.5.1.14 Switch OFF the vacuum pump and release the vacuum in the receiver by opening the vent of the receiver and unload the solvent in to containers through bottom valve.

5.5.2 **Atmospheric distillation:**

5.5.2.1 Ensure the reactor at which distillation to be carried out

5.5.2.2 Apply steam / Hot water to the reactor jacket

5.5.2.3 Apply the R.T / Brine to the condensers

5.5.2.4 Open the vent valve of the condenser

5.5.2.5 Close all other valves of the rector

5.5.2.6 Raise the temperature and distill the mass.

5.6 **Nitrogen blanketing.**

5.6.1 During the charging of materials like solvents/ hygroscopic materials/ explosive materials nitrogen blanketing shall be applied to the reactor

5.6.2 Close all valve of the reactor

5.6.3 Ensure the availability of nitrogen cylinders

5.6.4 Check the status of the cylinder and bring the cylinder to the reactor / Manifold

5.6.5 Ensure the regulated is connected to cylinder

5.6.6 Open the regulator slowly and ensure the nitrogen is passing out

5.6.7 Connect the flexible hose from nitrogen cylinder / nitrogen point to the reactor and slowly open the nitrogen.

6.0 **FORMATS / ANNEXURE(S):** Nil.

7.0 **CHANGE HISTORY:**

Revision No.	Effective Date	Details of Revision	Ref. CCF No.
00	01.01.2009	New SOP is introduced	----
01	01.06.2014	Revised as per current SOP No system & more clarity	----
02	01.01.2017	Procedure elaborated and SOPs, PD-003-01, PD-004-02, PD-005-01, PD-006-01, PD-007-01, PD-008-01, PD-029-01 PD-030-01 and PD-045-01 are merged in this SOP.	PD-CRF-024/16
03	01.01.2018	SOP format changed make to inline with SOP-QA-001-05.	CCF/GEN/17035