**NOZZLE OPERATION AND CONFIGURATION PROCEDURE**

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**UGEE CHEMICALS LIMITED**

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**1.0 PURPOSE**

To outline the step-by-step procedure for operating spray nozzles in the tower, for detection and clearing nozzle blockages (s), replacement of damaged nozzles, and effecting intended nozzle configuration.

**2.0 SCOPE**

Crutched slurry exiting the Ageing Vessel / Hold Tank is transferred via a series of pumps to spray nozzles to effect atomization in the drying Tower. Occasionally, during slurry spray-drying, undissolved solids and

insoluble foreign matter, e.g. metal chips, and rust particles are transferred, causing nozzle clogging and blockage.

**3.0 TERMS & DEFINITIONS**

Nozzles Configuration: A defined selection and alternation of nozzles operated during the Spray drying process. Nozzle configuration intends to optimize the efficiency of the Spray drying operation whilst maintaining the quality of the Blown powder intermediate.

**4.0 RESPONSIBILITY & AUTHORITY**

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| No. | Position | Description of Responsibility |
| 1. | Control room operator/ Back up | Operates the nozzles, observes the spray pressure indicator on the SCADA during regular spray drying operation, detects blocked nozzles, and communicates to the nozzle room operator to clean the nozzles |
| 2 | **Nozzle Room Operator** | Operates the nozzle on manual mode, maintains the nozzles, and does other tasks as directed by the control room operator. |
| 3. | Tower runner | Supports the nozzle room operations. |

**5.0 POTENTIAL RISK**

**-** Bruise

- Contact with hot surface, slurry, and moist powder

- Splash

- Inhalation of powder

- Skin/Eye irritation

**6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED**

-Heat resistant glove

-Heat resistant Jacket

- Cotton gloves

- Face Shield

**7.0 DESCRIPTION OF ACTIVITIES**

**7.1 MEASURES**

1. Zero impact on the Blown Powder Quality.
2. Pro-active detection and clearing of nozzle blockage to minimize unplanned downtime and PR loss.
3. Zero Safety Incidents.

**7.2 PREPARATION OF NOZZLES FOR TOWER START-UP**

1. Confirm that the Boiler is working and that the steam pressure is greater than or equal to 4 bar on the pressure gauge in the boiler room.
2. Close the six (6) auto valves connecting each nozzle arm to the slurry line. Wear heat-resistant gloves and Face shields.
3. Steam out each nozzle by completely opening the manual valve and connecting the main steam line to the nozzle; do this for each nozzle one after the other. Wear heat-resistant gloves, a jacket, and a face shield.
4. Open the drain valve fitted along the main steam line to discharge liquid condensate. Wear cotton gloves.
5. Flush the spray nozzles one after the other by opening the manual ‘steaming’ valve connecting each nozzle arm to the main steam line. Wear heat-resistant gloves, jacket, and a Face shield.
6. Close the manual valves when the peculiar ‘whistle’ sound signaling steam entry into the Tower is heard. Wear heat-resistant gloves and a Face shield

**7.3** **NOZZLES OPERATION DURING START-UP**

1. Ensure that all the manual slurry valves are in the open position.
2. Open slurry delivery valves to the individual nozzles selected for operation automatically from the SCADA
3. Ensure Nozzle 6 is the first to be opened to avoid dead legs on the nozzle circuit

**7.4** **DETECTING NOZZLE BLOCKAGE DURING SPRAY DRYING OPERATION**.

1. The control room operator observes the spray pressure indicator on the SCADA at intervals during regular spray drying operations. The pressure reading displayed on the SCADA should be relatively constant and within the limit of the prescribed centerline (50 – 80 bar).
2. An increase in spray pressure that is out of centerline for the HPP rpm indicates a blockage in one or more nozzles
3. To check for which nozzle is blocked, open an extra nozzle (one that was not running initially) from the SCADA and close a running nozzle. If the HPP pressure increases, it means that there is no blockage in that nozzle.
4. Repeat Steps **1** to 3for all the running nozzles one at a time. For any of the nozzles being tested, an unchanged or low-pressure value indicates that that nozzle is blocked.
5. Inform the nozzle room operator to clean the blocked nozzle.

**7.5** **NOZZLE CLEANING/ CHANGING DURING SPRAY DRYING OPERATION**:

1. The control room operator notifies the Nozzle room operator of his intentions to clean out or change a nozzle, stating the nozzle number and the replacement nozzle.
2. The control room operator automatically shuts off slurry delivery to the nozzle, which is suspected/determined to be blocked, and informs the nozzle room operator to clean the nozzle.
3. The nozzle room operator drains the steam line from the steam separator in the nozzle room, then the condensate line on the blocked nozzle, and closes afterward. He then opens the manual steam valve connection to the nozzle arm to steam out. Listen for the peculiar ‘whistle’ sound that signals steam discharge through the nozzle orifice into the tower. Wear heat-resistant gloves, jacket, and a Face shield. This operation will bleed/vent off trapped pressure in the nozzle arm.
4. After 90 seconds, close the manual steam valve connecting the nozzle arm and open the quick coupling of the nozzle arm to remove the affected nozzle.
5. Use the C-Spanner to turn the coupling in an anti-clockwise direction to release the nozzle arm. Apply pressure at the insertion point with a rubber-headed mallet. Wear heat-resistant gloves, a Jacket, and a Face shield
6. Remove the nozzle arm serving the blocked nozzle. Wear heat-resistant gloves, a Jacket, and a Face shield.
7. Secure the nozzle arm in the jaws of the provided bench vice. Slowly unscrew the nozzle cap from the nozzle body by turning it in counterclockwise manner till it is completely free. Wear heat-resistant gloves, a Jacket and Face shield.
8. Remove all individual components of the nozzle. Wear heat resistant gloves, Jacket and Face shield.
9. Using the provided water line, wash the component parts of each nozzle with a stream of fresh water. The individual parts to be washed are the Nozzle Orifice and Swirl Chamber. Wear heat resistant gloves, Jacket and Face shield. There are 3 main parts of the nozzle assembly namely, Orifice, whirl chamber and nozzle cap.
10. Use a thin metal piece to remove any bits of foreign matter, metal chips etc jammed in the nozzle orifice and/or swirl chamber
11. Re-assemble the nozzle by reinserting the nozzle tip into the nozzle cap.
12. Place the swirl chamber inside the nozzle cap and hold securely in place by tightening the lock screw.
13. Screw the cap tightly into the nozzle body.
14. Re-attach the nozzle tightly to the nozzle arm by turning it in place in a clockwise manner. The nozzle is perfectly aligned with the threading around the tip of the nozzle arm; the nozzle is fitted securely in place, eliminating the possibility of leaks and nozzle fall-off into the tower. Wear heat-resistant gloves, a Jacket, and a Face shield.
15. Re-insert the nozzle arm into the spray tower through the insertion hole and reattach the nozzle arm to the slurry circuit using the provided steel pole or C-Spanner to turn the nozzle arm release spindle. Wear heat-resistant gloves and a Face shield.
16. The nozzle room operator informs the control room operator when he has finished the cleaning operation

**7.6** **NOZZLES OPERATION DURING SHUTDOWN**:

1. The control room operator sprays until water gets to the nozzle and confirms that there is no powder on the BOT belt
2. The control room operator stops the pumping operations and shuts off all automatic valves linking the operated nozzles to the slurry line and informs the nozzle room operator,
3. The nozzle room operator proceeds to flush all spray nozzle arms and nozzles one after the other using steam (See Section D on the same JSA). Steam is determined to be passing through the respective nozzle arms via observation of a peculiar ‘whistling’ sound, plus a visual check
4. Repeat action steps (**3**) for all six (6) nozzle arms.

**7.7** **NOZZLES CONFIGURATION**:

1. Refer to the Process Centerline Sheet for the configuration of the optimum nozzle per formulation.
2. During regular slurry spray-drying operations, the control room operator opens the specific nozzles as recommended in the Tower start-up and Shutdown procedure.
3. **RELATED DOCUMENTS & RECORDS**

* Training & Qualification
* Model Answers
* Step-up Card

**9.0** **REFERENCES & ATTACHMENTS**

Not Applicable

**Appendix 1**

Not Applicable

**Document History**

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