Verification & Calibration SOP

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PURPOSE:

To describe stepwise outline for an In-process Verification & Calibration checks of Load Cells and Flowmeters for precision in Raw Material addition and drive consistent process and product quality.

SCOPE:

The scope of the SOP covers the verification and calibration of load cells and flow meters.

RESPONSIBILITY:

- **Calibration system owner:** Develops the calibration standards, owns the calibration checklist folders, does weekly review of the systems and reports completion and compliance to the department leaders.
- **Line Technical Planner:** Extracts calibration tasks from SAP into 24-hour planner, plans a qualified person for the task, provides procedure and checklist for the calibration operator doing the task, collects the filled checklist as an evidence that the task has been completed, archives the checklist in the calibration folder.
- **E&I / Qualified Calibration Operator**: Calibrates load cells and carry out other calibration checks as scheduled on SAP. He also fills the calibration check sheet and submits it to the line technical planner.
- **MSG Process Leader:** solely responsible for Lever arm factor calibration of Admix feeder
- **Control room Operator:** Supports calibration operators during calibration check and calibration of crutcher, ageing vessel, flow meters, and signs off calibration checklist for the calibration checks done in his shift if applicable.
- **Admix Operator:** signs off calibration checklist for calibration done in his shift
- **Sat Laboratory Analyst:** Carry out calibration checks on analytical weighing scales as planned on SAP

Potential Hazard

Slip, awkward body position, chemical splash in the eyes, chemical contact with hand, powder inhalation, ergonomics

PERSONAL PROTECTIVE EQUIPMENT (PPE):

SOP OWNER	HSE APPROVAL	QA APPROVAL	AUTHORISATION
08-June-23			
Musa Nasiru Date:	Adedoyin Adebiyi Date: 08-June-2023	Olujide Alawode Date: 08/June/23	Nadeeb Daramola Date: 08-June 2023

- Cotton Hand gloves
- Safety boot
- Latex gloves
- Chemical gloves
- Enzyme hand gloves
- Safety glasses
- 3M nose mask

Procedure:

CRUTCHER

This calibration check is to be carried out monthly by a qualified calibration operator and some supporting personnel for the purpose of lifting

1. Prior to commencement of the Calibration check, wear the recommended PPE's namely cotton and latex hand gloves, safety glasses, safety boots, 3M nose mask. Ensure that carrying of weights greater than 15kg by one person will be avoided. Ensure that dead weights are lifted safely
2. TO ENSURE ACCURATE WEIGHT MEASUREMENTS, ensure there are no imposed weights and weight dampeners resting on the Crutcher vessel by doing the inspections highlighted in the calibration check sheet (Attachment 2)
3. Ensure the immediate area around each of the three load cells is free of debris and obstructions.
4. Control room Operator shall stop all raw material additions both manual and automatic into the Crutcher.
5. Control room Operator shall turn the Crutcher 'Operations Mode' to 'Manual' mode.
6. Wait till the Initial weight of the Crutcher contents displayed on the Crutcher weight Indicator (Scale 1 on the IND 780 controller on level 0m)) stabilizes. A stabilization time of 30 seconds is recommended.
7. Record Initial weight (> 1,500 Kilograms) of the Crutcher contents in the provided Calibration Check sheet (Attachment 2).
8. Place 300-kilogram standard weights on top of the Crutcher- wear cotton hand gloves, safety boots and ensure that weight greater than 15kg is not lifted by only one person. The standard weights should be spaced apart as far as possible.
9. Record the gross weight (Initial weight + net standard weight) in the provided Calibration Check sheet.
10. Repeat Steps 7 and 8 adding another 300 kilograms.
11. Record the final gross weight displayed on the Weight Indicator.
12. Determine the error of the Crutcher Load Cell measurement for the two data gotten from this exercise using the formula below:

$$\% \text{ Deviation} = \frac{\text{Expected Weight} - \text{Measured weight}}{\text{Expected Weight}} \times 100\ \%$$

13. Target limits for % deviation is +/-1%.
14. If measurements are in compliance with the target limits, the Crutcher Load Cells are OK.

15. If measurements are without compliance of the target limits, proceed to full calibration following Crutcher and Ageing Vessel IND780 Calibration Job Aid (MSG Job Aid 081.01)

AGEING VESSEL

Calibration of the Ageing vessel takes the same procedure and technique as the Crutcher Vessel stated above. Refer to Crutcher and Ageing Vessel IND 780 Calibration Job Aid (MSG Job Aid 081.01)

Ageing vessel load cells are connected to scale 2 of IND 780 controller on level 0m.

See attachment 3 for the check sheet for ageing vessel calibration

BP Weighing Hopper and BP Reblend Weighing Hopper

CALIBRATION CHECK

1. Conduct the inspection highlighted in the calibration check sheet. Wear safety boots, safety glasses, cotton hand gloves, latex hand gloves and 3M nose mask.
2. If all inspection items are ok, record the initial reading of the vessel indicated on the IND 780 controller.
3. Place a standard weight of 100 kilograms on the BP weighing hopper. Wear safety boots, cotton hand gloves.
4. Record the total weight of the vessel indicated on the controller.
5. Calculate the % deviation using the formula below:

$$\text{Deviation} = \frac{\text{Expected Weight} - \text{Measured weight}}{\text{Expected Weight}} \times 100\ \%$$

6. If % deviation is within +/-1%, then the load cell calibration is ok. If not, proceed to span calibration.
7. Repeat the steps 1 to 6 for the BP Reblend weigh hopper

ZERO CALIBRATION

This calibration is to be done anytime BP Hopper load cell calibration check goes out of limit

1. Empty the hopper, clean out every powder build up in it and ensure it is free from any imposed weight. Wear cotton hand gloves, safety glasses and 3M nose mask.
2. Press menu key on the IND 780 Controller
3. Select the required scale
4. Select calibration menu.
5. Press ZERO CAL button
6. Press START button while ensuring that there is no disturbance around the vessel
7. The controller restarts the scale
8. Press exit to view the reading of the scale (0kg).

SPAN CALIBRATION USING DEAD WEIGHT.

1. Prior to commencement of the Calibration process, wear the recommended Cotton hand gloves.

2. TO ENSURE ACCURATE WEIGHT MEASUREMENTS, ensure there are no imposed weights and weight dampeners resting on top the Admix hopper by conducting the inspection checks highlighted in the check sheet.
3. Ensure the immediate area around each of the three load cells is free of debris and obstructions.
4. Empty the BP weighing Hopper.
5. Press menu to access the calibration menu of the IND 780.
6. Select span calibration
7. Input the value of the test weight into the required field (the test weight is usually the operating range of the load cell)
8. Apply dead weight on the hopper equal to the imputed test weight.
9. Press start to begin the calibration process
10. The IND 780 controller displays the status of the span calibration at the end
11. Press exit and remove the dead weights.

ADMIX WEIGHING BELTS, LIW FEEDERS, ENZYMES FEEDERS STATIC CALIBRATION CHECK

This check is to be carried out by the Admix runner or the Admix Mechanical Leader

1. Ensure that the weighing belt/LIW load cell is clean and free of buildup.
2. Check the initial reading of the scale on the HMI and record in the calibration check sheet.
3. Place the standard weight on the load cell calibration point.
4. Record the final value indicated on the HMI.
5. Calculate the % error of the load cell using the following formula:

$$\% \text{ Error} = \frac{\text{Expected Weight} - \text{Measured weight}}{\text{Expected Weight}} \times 100\ \%$$

6. If % error is within +/-1%, then the load cell calibration is ok. If not, proceed to lever arm factor calibration and then dynamic calibration.

Lever Arm Factor Calibration

This is the calibration of weigh belt, loss in weight feeders and enzyme feeders which is to be done only when calibration checks done on the feeders go out of limit.

Refer to LIW feeder Calibration Job Aid (MSG Job Aid 018.0) for L18 LIW feeder calibration

Refer to Enzyme Feeder Calibration Job Aid (MSG Job Aid 017.0) for L21 Enzyme feeder calibration

ADMIX FEEDER DYNAMIC CALIBRATION CHECK

Dynamic calibration check is to be carried out anytime a major maintenance is carried out on the feeder. Calibration of the feeder load cell is also regarded as major maintenance. It is also to be led by the admix PE or admix PM Mech. Leader. The task requires 3 people for it to be done

1. Prepare the items needed for the exercise (A receptacle, stop watch, checklist, weighing scale).
2. Remove the flexible connector at the out-feed chute of the feeder.
3. One personnel is required to place the receptacle at the out feed of the feeder to catch the material and measure the actual weight (material receiver).
4. Another personnel is also required to operate the stop watch and coordinate (coordinator).
5. Another personnel is required to operate the feeder at the instruction of the coordinator (operator).
6. The operator starts the feeder and waits for the coordinator's instruction
7. The coordinator waits for the material flow rate to be balanced before saying 'GO' and starting the stopwatch
8. The operator takes and records the initial weight on the OP12 HMI and starts the feeder immediately and the material receiver puts the receptacle in the material flow to collect the material (All these must happen at the same time).
9. When 60 seconds is reached the coordinator says 'STOP'. The operator immediately takes the final weight value and the material receiver immediately removes the receptacle from the flow of material.
10. The operator records the final value and the material receiver measures and record the actual weight of the received material
11. Percentage error is calculated using the formula below:

    %Error = [(Actual weight – Indicated weight difference)] *100%/actual weight

    % Error must not be more than 1%

    Indicated weight difference = Initial weight – Final weight
12. Repeat steps 7 to 11 for at least 3 times for each dynamic calibration.

WEIGHING SCALE

The weighing scale calibration check for the satlab is to be carried out daily by a satlab operator or a control room operator.

1. Clean the Scale to be free from any form of dirt to ensure accurate measurement.
2. Checks that the calibration sticker is in place and still valid
3. Ensure the scale is properly balanced using the level glass attached to the scale to achieve this.

4. Press the Zero buttons on the scale terminal (*Display should read 0 Kg*).
5. Place a Standard weight on the scale Platform.
6. Wait for 5 seconds.
7. Record the value of the displayed weight on the verification sheet (*Should be within +/- 1 % of standard weight applied).*
8. Lift Standard weight off the scale platform (*Display should return to 0 kg*).
9. Repeat step 4 to 7.
10. If measurements are in compliance with the target limits, the Scale Load Cells is OK.
11. If measurements are without compliance of the target limits, inform the QA Leader.

FLOW METER CALIBRATION CHECK

The flow meter calibration check is to be carried out as per SAP schedule by qualified persons.

1. Get all materials required for the task
2. Put on the PPE's – Latex gloves, cotton gloves, safety glasses, safety shoes
3. Put a bucket under the drain valve
4. Drain the material from the pipeline
5. Close the isolation valve on the pipeline
6. Open the calibration drain valve
7. Record the totalized value L1 displayed on the flow meter
8. Tare a calibration bucket
9. Put the calibration bucket under the drain valve
10. Start the pump for I minute and stop it
11. Record the final totalized value L2 of the flow meter
12. Calculate the expected value SP=L2-L1
13. Put the received material on the tare weighing scale
14. Record the actual value PV displayed on the weighing scale
15. Calculate the % Error DV = (SP-PV)100/SP

There will be monthly zero drift check for the following flow meters:

HLAS ODOS flow meter, Caustic ODOS flow meter, Perfume Flow meter, Crutcher silicate flow meter and Crutcher HLAS flow meter.

List of Equipment requiring Calibration Check

All equipment requiring calibration verification will be checked using their respective job aids by qualified personnel. The list of the equipment and frequency of checks is given below.

See the attachment for the corresponding procedures.

S/N	EQUIPMENT NAME	FREQUENCY
1	CRUTCHER LOAD CELL	3 MONTHS

2	AGEING VESSEL LOAD CELL	3 MONTHS
3	BP WEIGHING HOPPER	3 MONTHS
4	BP REBLEND WEIGHING HOPPER	3 MONTHS
5	BP WEIGH BELT STATIC CALIBRATION BP WEIGH BELT STATIC CALIBRATION	1 WEEKLY 6 MONTHS
6	BP REBLEND WEIGH BELT STATIC CALIBRATION BP REBLEND WEIGH BELT STATIC CALIBRATION	1 WEEKLY 6 MONTHS
7	AC BASE BRABENDER LIW STATIC CALIBRATION	3 MONTHS
8	SULPHATE BRABENDER LIW STATIC CALIBRATION	3 MONTHS
9	PERCARBONATE BRABENDER LIW STATIC CALIBRATION	3 MONTHS
10	MCAS BRABENDER LIW STATIC CALIBRATION	3 MONTHS
11	RED SOAP BRABENDER LIW STATIC CALIBRATION	3 MONTHS
12	FP REBLEND WEIGH BELT STATIC CALIBRATION	3 MONTHS
13	BH BASE BRABENDER LIW STATIC CALIBRATION	3 MONTHS
14	SEA (PURE OXYGEN) BRABENDER LIW STATIC CALIBRATION	3 MONTH
15	BR 15 STATIC CALIBRATION	3 MONTHS
16	CMC 70% STATIC CALIBRATION	3 MONTHS
17	PREFERENZ PS 8.4% STATIC CALIBRATION	3 MONTHS
18	CAPLISO FEEDER STATIC CALIBRATION	3 MONTHS
19	HEPMC FEEDER STATIC CALIBRATION	3 MONTHS
20	TAED FEEDER STATIC CALIBRATION	3 MONTHS
21	AE1S FEEDER STATIC CALIBRATION	3 MONTHS
22	ODOS HLAS FM STATIC CALIBRATION	3 MONTHS
23	ODOS NAOH FM STATIC CALIBRATION	3 MONTHS
24	CRUTCHER CAUSTIC FM STATIC CALIBRATION	3 MONTHS
25	CRUTCHER HLAS FM STATIC CALIBRATION	3 MONTHS
26	PERFUME FM STATIC CALIBRATION	3 MONTHS
27	SILICATE TRANSFER (TO DAY TANK) FM STATIC CALIBRATION	3 MONTHS
28	CAUSTIC TRANSFER (TO DAY TANK) FM STATIC CALIBRATION	3 MONTHS
29	HLAS TRANSFER (TO DAY TANK) FM STATIC CALIBRATION	3 MONTHS
30	NON- IONIC FM STATIC CALIBRATION	3 MONTHS
31	RV BASE FM STATIC CALIBRATION	3 MONTHS
32	SATLAB WEIGHIMG SCALES	DAILY
33	L12/L24 BAR CODE SCANNERS VERIFICATION	6 MONTHS
34	PWS TEMPERATURE SENSOR	12 MONTHS
35	SILICATE TEMPERATURE SENSOR	12 MONTHS
36	SILICATE TEMPERATURE SENSOR	12 MONTHS
37	HLAS TEMPERATURE SENSOR	12 MONTHS

38	BFS TEMPERATURE SENSOR	12 MONTHS
39	PERCARBONATE TEMPERATURE SENSOR	12 MONTHS
40	MANUAL PRESSURE GUAGES (by external vendor)	12 MONTHS

After calibration verification is done, the required checklist will be filled by the person the verification was assigned to and submitted to the line technical planner who will file it in the department calibration folder.

The calibration system owner will conduct a monthly review of the calibration folder to check completed calibrations vs planned calibrations and escalate any gaps for proper planning

Definitions

Crutcher: The Crutcher is a Cylindrical Stainless-Steel vessel fitted with a dished bottom located on Level 6.00 m. Its ancillaries include an Agitator motor driving an Agitator comprised of horizontal baffles fitted to a solid shaft, manholes serving as in-feed chutes for solid and liquid raw materials, vapors extraction chute and vapors extraction fan, Load cells, an automatic discharge valve, solid materials (Carbonate and Sulphate) in-feed chutes and a local Control Panel.

Ageing Vessel: The aging vessel is a cylindrical vessel with a dished bottom. Just like the Crutcher vessel, it is located on level 6.00 m just beside the crutcher vessel. It has an in-feed slurry line from the crutcher vessel. Its content is discharged through the high-pressure line to the tower. It consists of the following: load cell, an automatic discharge valve and an agitator motor

BP Weighing Hoppers: The BP weighing hoppers are located on top of the BP weighing belt and BP reblend belt on L18. They are placed on load cells. Powder is fed into the hoppers through the extraction belts on L18.

Weighing Belt Feeders: These feeders are equipped with load cells at a point in their frame that is referred to as weighing bridge. One of them is installed on L18 for dozing FP reblend during Admix operation, the other two are installed on L15 for dozing blown powder and blown powder reblend.

Loss in weight feeders: These feeders are mounted on load cells to measure material dose rate by measuring the rate at which the feeders lose weight. They are installed in L18 to dose materials for admix operation and enzymes.

Admix Weighing Hopper: These hoppers are conical vessels that are mounted at discharge end of the base powder bin extraction belt. They feed the weighing belts during the continuous process of the Admix operation. They are mounted on load cells to enable visualization of their content.

Flow meters: These instruments are used for continuous measurement of rate at which bulk liquid materials are being dosed in the various processes.

Qualified Persons: These are personnels that have been trained and qualified on this SOP. They should be at proficiency level 3 on the verification and calibration step up card.

MEASURES: No variability in the result of material being weighed on the load cell.

BP: Blown powder

SCADA: Supervisory Control and Data Acquisition System

OP 12: Operating Panel

LIW: Loss in weight

HMI: Human Machine Interface

E&I: Electrical and Instrumentation Technician

REASON FOR UPDATE

VERSION 0: New SOP

VERSION 1: a) Correction of target weights for feeder calibration checklists

b) Inclusion of 4th eye check in calibration checklists

End of Procedure

SOP Related Attachments
Attachment 1 – Admix BP hopper load cell Static calibration report sheet. Attachment 2 - Crutcher load cell static calibration report sheet. Attachment 3 - Ageing vessel load cell static calibration report Sheet Attachment 4 – Enzyme feeder load cell static calibration report Sheet Attachment 5 – LIW L1 feeder load cell static calibration report Sheet Attachment 6 – LIW L2 feeder load cell static calibration report Sheet Attachment 7 – Flow meters calibration Sheet Attachment 8 – DV99 Skid Calibration Sheet Attachment 09 – Step up Card Attachment 10 – Training and Qualification Sheet Attachment 11 – Model Answers Attachment 12 - LIW Feeder Dynamic Calibration Sheet Attachment 13 - Calibration Schedule Attachment 14 - Bar Code Scanner Verification Checklist Attachment 15 - Enzyme Feeder Calibration Job Aid Attachment 16 - LIW Feeder Calibration Job Aid