

Blending Process Guidelines for Line Intake Quality Monitoring

Category: Procedures

Model: BPL-INTAKE-GUIDE

Description: This procedural document describes the process for monitoring line intake blend quality, how to calculate hourly blend dry matter (DM) from load fractions, thresholds for classifying quality deviations, and procedures for logging and responding to such deviations.

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1. Introduction

This document provides comprehensive guidelines for monitoring and ensuring the quality of line intake blends in our production process. It aims to standardize procedures for measuring dry matter (DM) content at the line level, assessing deviation thresholds, and implementing corrective actions promptly. These procedures are critical for maintaining optimal product

quality, ensuring compliance with specifications, and minimizing operational downtimes.

The guidelines are applicable across different production SKUs with varying target dry matter contents, primarily focusing on target DM levels of 21.8% and 22.5%. Accurate measurement, prompt logging, and swift response are integral components of the process to achieve consistent product quality.

2. Equipment Overview

2.1 Line Equipment

The primary equipment involved in the blending process includes:

- **Blend Load Cells:** Measure the load fractions for each raw ingredient arriving at the line.
- **Dry Matter (DM) Monitoring Sensors:** Inline sensors that provide real-time dry matter measurements of the blend.
- **PLC Controllers:** Manage the automation of load weighing and sensor data collection.

2.2 Key Equipment Specifications

Equipment	Rated Throughput	Efficiency Threshold	Maintenance Notes	Error Codes
CUT-2000	8.5 t/h	≥ 85%	Perform daily calibration; replace load cells every 6 months.	DOW-PI-45xx (e.g., DOW-PI-4501)
FRY-XL	6.0 t/h	≥ 80%	Sensor cleaning weekly; perform calibration quarterly.	DOW-PI-45xx

3. Quality Specifications and Targets

Our quality specifications define acceptable ranges for blend dry matter, defect percentages, and other key parameters for each SKU. The critical parameters include:

Parameter	SKU	Target Value	Tolerance / Band	Notes
Dry Matter (DM)	SC-9mm	21.8%	±0.3 percentage points	Target: 21.8% ±0.3% (acceptable range 21.5% – 22.1%)
Defects (e.g., foreign objects)	All SKUs	< 1.0%	Specified per SKU	Ensure defect levels stay within thresholds
Fry Color Range	Standard	Golden Yellow	Color deviation tolerance: 5% variation	Color meters used for verification

Note: The target dry matter for SKUs may be adjusted to 22.5% for specific high-quality products, with a corresponding tolerance.

4. Load Fraction and Dry Matter Calculation

4.1 Load Fraction Measurement

Load fractions are obtained from load cell sensors measuring the weight contribution of each ingredient delivered to the mixer in a given period (typically hourly).

4.2 Calculating Hourly Blend Dry Matter (DM)

The hourly blend dry matter percentage is calculated based on the load fractions and individual ingredient dry matter contents as follows:

$$H\text{-DM} = (\sum (L_i \times DM_i)) / (\sum L_i) \times 100\%$$

Where:

- **H-DM:** Hourly blend dry matter percentage
- **Li:** Load fraction of ingredient i (weight in kg)
- **DMi:** Dry matter percentage of ingredient i

4.3 Example Calculation

Ingredient	Load (kg)	DM %	Compute Li × DMi
Potato Flakes	5000	21.8%	$5000 \times 0.218 = 1090$
Vegetable Oil	1000	100%	$1000 \times 1.00 = 1000$
Salt	50	0%	$50 \times 0 = 0$
Total	6050		$1090 + 1000 + 0 = 2090$

Then, the dry matter percentage is:

$$\text{H-DM} = (2090 / 6050) \times 100\% \approx 34.55\%$$

Note: In this example, the calculated DM exceeds typical targets, indicating the need to adjust ingredient loads or verify sensor accuracy.

5. Monitoring Procedures

5.1 Frequency of Monitoring

Dry matter measurements are taken continuously via inline sensors, with hourly averaged data recorded for analysis. Visual inspections and manual checks are performed at the start of each shift.

5.2 Data Collection and Recording

All readings are logged into the process monitoring system, including load fractions, sensor measurements, and calculated DM values. Data should be timestamped and stored for compliance and trend analysis.

5.3 Verification & Calibration

Sensor calibration should be performed weekly, and system verification checks should be conducted daily to ensure data accuracy.

5.4 Visual and Manual Checks

Operators should verify visual indicators, such as color and defect levels, at least once per shift using standard inspection protocols.

6. Thresholds and Quality Classification

6.1 Dry Matter (DM) Thresholds

Classification	Range of DM %	Remarks
Optimal Quality	21.5% – 22.1%	Meets target within tolerance band
Under-Quality	< 21.5%	Potential dryness issue, potential impacts on product texture
Over-Quality	> 22.1%	Excess moisture, risking spoilage or processing issues

6.2 Defining Deviations

Deviations are classified based on how far the measured DM falls outside acceptable margins:

- **Minor Deviations:** DM within $\pm 0.3\%$ of target, requiring monitoring but no immediate action.
- **Major Deviations:** DM outside $\pm 0.3\%$ band, requiring investigation and correction.

7. Logging Deviations and Response Protocols

7.1 Recording Deviations

All deviations must be logged in the process control system with:

- Timestamp
- Measured DM value
- Load fractions
- Operator remarks
- Corrective actions taken

7.2 Response Procedures

1. **For Minor Deviations:** Continue monitoring; document in logs.
2. **For Major Deviations:** Execute immediate corrective procedures:
 - Stop blending if significant deviations persist.
 - Adjust ingredient loads or sensor calibration as needed.
 - Notify supervisor and document actions.
 - Reassess sensor accuracy and process parameters.
3. **Follow-up:** Verify corrected DM levels before resuming normal

operation.

7.3 Escalation

If deviations recur over three consecutive hours, escalation protocols are initiated, including process review, equipment inspection, and possibly downtime for maintenance.

8. Equipment Maintenance & Error Handling

8.1 Maintenance Schedule

- Daily: Verify sensor cleanliness and calibration status.
- Weekly: Perform detailed inspection and calibration of load cells and sensors.
- Quarterly: Complete comprehensive system checks and component replacements.

8.2 Handling Error Codes

When error codes such as DOW-PI-45xx are detected:

- Refer to the equipment manual section corresponding to the error code.
- Immediately perform system diagnostics following troubleshooting flowcharts.
- Log error occurrences, diagnostics performed, and resolution steps.

8.3 Troubleshooting Examples

Error Code	Symptoms	Root Cause	Resolution Steps
DOW-PI-4501	Sensor not responding	Loose wiring connection	Inspect and secure wiring connection; recalibrate sensor after fixing
DOW-PI-4502	Sensor calibration drift	Sensor age exceeded recommended lifespan	Replace sensor; perform calibration check

9. Troubleshooting Guide

Common Issues and Solutions

Issue	Possible Cause	Proposed Solution
Inconsistent DM readings	Sensor misalignment or contamination	Recalibrate and clean sensors; verify alignment
Unexpected deviations in load fractions	Load cell drift or mechanical loosening	Calibrate load cells; tighten mechanical connections

Flowchart for Troubleshooting

Start with sensor reading discrepancy? → Yes → Check sensor calibration & wiring → Issue resolved? → Yes → Continue monitoring; No → Escalate or replace sensor