OSi PI End-of-Line Quality Metrics and Defect Rates

Category: Reference

Model: OSI-PI-QA-2025

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1. Introduction

This document provides a comprehensive overview of the end-of-line quality metrics utilized within the operational framework of the production

facilities. It consolidates data derived from line equipment manuals and Process Safety Standards (PSS) quality specifications collected over the past six months. The primary focus is on defect rates, including blemish or defect percentages and fry color classifications, alongside thresholds for quality acceptance, corrective procedures, and the implications of deviations.

This reference aims to assist quality engineers, line operators, and management personnel in understanding, monitoring, and improving product quality consistency, ensuring compliance with safety and product standards, and minimizing rework or downgrading due to quality deviations.

2. Scope and Purpose

The scope of this document spans all primary frying lines, including but not limited to models such as CUT-2000, FRY-XL, and associated equipment. It encompasses:

- Operational parameters including throughput capacity and efficiency thresholds
- Defect metrics like blemish rates and fry color classes
- Error codes for maintenance and troubleshooting
- Quality targets for key parameters such as dry matter %, defect %, and fry color range
- Procedures for quality monitoring and deviation management

The document's purpose is to standardize quality assessment procedures, define acceptable thresholds, and facilitate rapid response to deviations, thereby maintaining product uniformity and compliance with customer and regulatory standards.

3. Line Equipment Overview

The production lines include various interconnected equipment modules designed to optimize processing and quality control. Below are key equipment features and their specifications:

Equipment Model	Rated Throughput	Efficiency Threshold	Key Error Codes

Blemish/ Defect Rate	1.4 – 2.2	3.0	Exceeding 3% indicates increased defect prevalence, requiring investigation

Maintaining defect rates below the upper control limits ensures product consistency and minimizes rework costs.

Additional Parameters:

Parameter	Target	Acceptance Tolerance
Dry Matter % (Sample Size: SC-9mm)	21.8%	±0.3 percentage points
Fry Color Class	Median 2-3	±1 class

6. Fry Color Classification and Measurement

Fry color classification follows standardized visual and instrumental measurement protocols:

Color Classification System

- Class 1: Very light golden
- Class 2: Light golden
- Class 3: Medium golden
- Class 4: Dark golden
- Class 5: Very dark, approaching burnt

Median fry color in production typically falls within classes 2–3, which ensures consumer appeal without overcooking or undercooking.

Measurement Methodology

1. Use calibrated colorimeter or spectrophotometer following calibration

against standard color charts.
2. Record the color value and assign the class based on established thresholds.
3. Aggregate data daily to identify shifts or deviations from median target.

Visual assessment by trained personnel complements instrumental methods for quality assurance.

7. Quality Acceptance Thresholds

The following thresholds are established for qualification of the product at the end of the line:

- **Blemish Rate:** ≤ 2.2%
- **Fry Color Class:** Median within classes 2–3
- **Dry Matter Content:** 21.8% ± 0.3%

Operational procedures dictate that if any of these thresholds are exceeded, immediate attention is required, and reprocessing or downgrading actions are initiated.

Example Scenario:

If a batch exhibits a blemish rate of 2.5%, exceeding the threshold, a detailed investigation must be conducted, including inspection of equipment, raw material quality, and process parameters.

8. Implications of Deviations from Standards

Deviations may lead to several operational consequences:

- **Rework:** Products are reprocessed to meet quality standards, increasing labor and material costs.
- **Downgrading:** Products are classified as lower grade and may be diverted from premium sales channels.
- **Line Downtime:** Significant deviations trigger production halts for calibration or maintenance.
- **Customer Complaints and Regulatory Non-Compliance:** Consistent deviations risk customer dissatisfaction and regulatory

sanctions.

To mitigate these risks, adherence to established thresholds and proactive monitoring are essential.

9. Measurement and Monitoring Procedures

Routine measurement involves the following steps:

1. Sampling: Collect representative samples at regular intervals, typically every hour.
2. Inspection: Conduct visual and instrumental assessment of fry color and surface blemishes.
3. Data Logging: Record measurements in a centralized database with timestamp and operator ID.
4. Trend Analysis: Utilize control charts (e.g., p-charts for blemish rate, XR charts for fry color) to visualize trends and detect early shifts.

Automated systems integrate sensor data for continuous monitoring, with alarm thresholds set according to the specified limits.

Key Performance Indicators (KPIs)

- Blemish rate trend over time
- Average fry color class
- Throughput efficiency
- Error code frequency

10. Error Codes and Maintenance

Prompt resolution of error codes is vital for maintaining quality standards. Key error codes include:

Error Code	Description	Potential Causes	Recommended Action
DOW-PI-455x	Degradation of oil quality sensor	Sensor fouling, wiring issue	Perform sensor calibration or replace sensor

ERR-CH-0024	Chiller malfunction affecting fry color	Cooling system failure, refrigerant leak	Inspect chiller, re-establish refrigerant levels

Preventive maintenance includes scheduled calibration, sensor cleaning, and system inspections complying with manufacturer guidelines.

Training operators on interpreting error codes accelerates troubleshooting and reduces downtime.

11. Quality Specifications and Target Parameters

Comprehensive quality specifications for the final product include:

Parameter	Target Value	Acceptance Tolerance
Dry Matter % (SC-9mm sample)	21.8%	±0.3%
Blemish/Defect Percentage	≤ 2.2%	N/A
Fry Color Class	Median 2–3	±1 class

These parameters are validated through both in-line sensors and batch sampling with routine quality audits.

Compliance with these targets ensures adherence to customer specifications and regulatory standards.

12. Downgrading and Rework Protocols

When product quality deviates beyond acceptable thresholds, the following protocols are implemented:

Rework Procedures

- Reprocessing: Products with blemish rates marginally above thresholds (< 3%) may be reprocessed if technically feasible.
- Segregation: Samples are isolated to prevent cross-contamination before reprocessing.
- Documentation: All rework activities are recorded with reasons, actions taken, and personnel involved.

Downgrading Criteria

- Products exceeding blemish percentage or fry color thresholds by significant margins are downgraded.
- Downgraded products are either diverted to secondary markets or utilized for processing where visual defects are acceptable.
- All downgrading decisions are documented, and affected batches are flagged for root cause analysis.

Preventive Measures

- Regularly calibrate sensory and instrumental assessment tools.
- Maintain clean processing environments to minimize blemishes.
- Perform routine equipment checks and preventive maintenance to reduce defect occurrences.

13. Appendices

Appendix A: Sample Data Collection Form

Batch ID	Date	Blemish Rate (%)	Fry Color Class	Dry Matter (%)	Operator
2023-09-001	2023-09-15	1.8	2	21.9	John Doe
2023-09-002	2023-09-15	2.3	3	Jane Smith	

Appendix B: References and Standards

- ISO 9001:2015 Quality Management Systems
- Internal Quality Standard Document QSD-OS-2023
- Calibration procedures for colorimeters, as per manufacturer guidelines