

## Verification Record – LSSBB Tools (Batch 5, Technical Revision)

### Tool ID: LSS-01

Tool Name: Universal Analyzer

#### 1. Verification Objective:

- Validate Cpk/CPL/CPU logic across raw-measurement, known-stats, and defect-based modes.

#### 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.
- Boundary, extreme-case and multi-scenario validation.

#### 3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.
- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

#### 4. Test Evidence:

- Logic: Mean and sigma computed per mode; capability indices  $Cpk = \min((USL-\mu)/(3\sigma), (\mu-LSL)/(3\sigma))$ . Verified across all pathways.

#### 5. Result:

- PASS

#### 6. Issues & Corrective Actions:

- None.

#### 7. Retest Status:

- Pending

#### 8. Signoff:

- Jarryd Giose / 25-02-2026

### Tool ID: LSS-02

Tool Name: Line Balancer Pro

#### 1. Verification Objective:

- Validate takt computation, cycle-time comparison, bottleneck detection, and line-efficiency logic.

## 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

## 3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

## 4. Test Evidence:

- Logic:  $Takt = Available\_Time / Demand$ ;  $Bottleneck = \max(Cycle)$ ;  $Efficiency = (\sum Cycle) / (Stations * Bottleneck)$ . All calculations verified with multi-station scenarios.

## 5. Result:

- PASS

## 6. Issues & Corrective Actions:

- None.

## 7. Retest Status:

- Pending

## 8. Signoff:

- Jarryd Giose / 25-02-2026

## **Tool ID: LSS-03**

Tool Name: M&Q Yield Engine

## 1. Verification Objective:

- Validate RTY, step yield, DPMO and sigma approximations.

## 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.
- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic: Step Yield =  $(\text{Inspected} - \text{Defects}) / \text{Inspected}$ ; RTY =  $\Pi(\text{Step\_Yield})$ ; DPMO =  $\text{Defects} / (\text{Units} * \text{Opportunities}) * 1e6$ . Sigma approximation matched tool implementation.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026

**Tool ID: LSS-04**

Tool Name: OEE Performance Engine

1. Verification Objective:

- Validate availability, performance, quality, and OEE aggregation.

2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.
- Boundary, extreme-case and multi-scenario validation.

3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.
- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic: Availability = Runtime/Planned; Performance = (Ideal\_CT \* Total\_Count)/(Runtime\*60); Quality = Good/Total; OEE = A\*P\*Q. Verified with representative shift data.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026

#### **Tool ID: LSS-05**

Tool Name: Sample Size Validator

1. Verification Objective:

- Validate Z-based sample size equation for means.

2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic:  $n = ((Z\alpha + Z\beta)^2 * \sigma^2) / \delta^2$ . Boundary behaviour and sensitivity curve verified for multiple sigma and delta values.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026

**Tool ID: LSS-06**

Tool Name: Box-Cox Transformer

1. Verification Objective:

- Validate lambda-based transformation including  $\lambda=0$  (natural log).

2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic:  $W = (Y^\lambda - 1)/\lambda$  for  $\lambda \neq 0$ ;  $W = \ln(Y)$  for  $\lambda = 0$ . Histogram and mapping confirmed against manual computation.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026

## Tool ID: LSS-07

Tool Name: SMED ROI Engine

### 1. Verification Objective:

- Validate changeover time reduction ROI and payback model.

### 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

### 3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.
- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

### 4. Test Evidence:

- Logic:  $\text{Monthly\_Hours\_Saved} = (\text{Current} - \text{Target}) * \text{Freq} / 60$ ;  $\text{Annual\_Savings} = \text{Monthly\_Saved} * 12 * \text{Rate}$ ;  $\text{Payback} = \text{Investment} / \text{Monthly\_Savings}$ . Verified across multiple reduction scenarios.

### 5. Result:

- PASS

### 6. Issues & Corrective Actions:

- None.

### 7. Retest Status:

- Pending

### 8. Signoff:

- Jarryd Giose / 25-02-2026

## Tool ID: LSS-08

Tool Name: Kanban Bin Engine

### 1. Verification Objective:

- Validate bin quantity based on Lean/JIT formula.

### 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

### 3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

### 4. Test Evidence:

- Logic:  $N = (\text{Demand} * \text{Lead\_Time} * (1 + \text{Safety}\%)) / \text{Bin\_Capacity}$ . WIP trace and saw-tooth pattern verified analytically.

### 5. Result:

- PASS

### 6. Issues & Corrective Actions:

- None.

### 7. Retest Status:

- Pending

### 8. Signoff:

- Jarryd Giose / 25-02-2026

## **Tool ID: LSS-09**

Tool Name: VA Ratio Analyzer

### 1. Verification Objective:

- Validate TIMWOODS waste aggregation and VA-ratio output.

### 2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

### 3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic:  $Lead\_Time = VA + \Sigma Wastes$ ;  $VA\_Ratio = VA/Lead\_Time$ . Confirmed with controlled waste distributions.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026

**Tool ID: LSS-10**

Tool Name: Pareto Analyzer

1. Verification Objective:

- Validate Pareto 80/20 grouping, ranking and cumulative percent.

2. Test Methods:

- Analytical re-derivation of all formulas and recomputation using independent test vectors.

- Boundary, extreme-case and multi-scenario validation.

3. Acceptance Criteria:

- Numerical agreement with governing equations to expected rounding precision.

- Deterministic behaviour; no divergence under zero, null, or high-variance conditions.

4. Test Evidence:

- Logic: Frequency aggregation  $\rightarrow$  Descending sort  $\rightarrow$   $Cumulative\% = (\Sigma Freq\_i / Total) * 100$ . Verified using multi-category input sets.

5. Result:

- PASS

6. Issues & Corrective Actions:

- None.

7. Retest Status:

- Pending

8. Signoff:

- Jarryd Giose / 25-02-2026