Standard Operating Procedure: Packaging Labeler Line

Model: Krones Contiroll HS Labeler System

Document ID: SOP-LABELER-001
Equipment ID: LABELER-01, LABELER-02, LABELER-03, LABELER-04
Version: 1.0
Effective Date: January 16, 2026
Classification: Critical Equipment
Location: Enterprise B / Site1 / Packaging / LabelerLine01-04

Quick Reference for AI Agents

Equipment Type: High-Speed Rotary Labeler with Case Packer
Criticality Level: HIGH - Production Critical
MQTT Topic Path: `Enterprise B/Site1/packaging/labelerline{01–04}/`
Key Metrics: OEE, Label Accuracy, Throughput Rate, Defect Count
Common Issues: Label misalignment, adhesive failure, case jam, sensor errors

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1. Equipment Overview

1.1 Purpose

The Packaging Labeler Line applies pressure-sensitive labels to filled bottles, verifies label placement, seals cases, and prepares products for palletizing. Each line consists of a Labeler, Packager (case packer), and Sealer working in sequence.

1.2 Equipment Specifications

Specification	Value
Model	Krones Contiroll HS
Manufacturer	Krones AG
Labeling Speed	200-400 bottles/minute
Label Types	Wrap-around, Front/Back, Neck
Bottle Range	200ml - 2000ml
Label Accuracy	±0.5mm placement
Case Packer Speed	25-40 cases/minute
Case Formats	6, 12, 24 pack configurations
Power Requirements	480V, 3-phase, 60Hz, 35kW

Specification	Value
Air Requirements	6 bar, 200 Nm³/h

1.3 Line Components

Component	Asset ID	Function	MQTT Path
Labeler	43	Apply labels to bottles	`.../labelerline01/labeler/`
Packager	45	Pack bottles into cases	`.../labelerline01/packager/`
Sealer	46	Seal and close cases	`.../labelerline01/sealer/`

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2. Safety Requirements

2.1 Personal Protective Equipment (PPE)

PPE Item	Required For	Standard
Safety Glasses	All operations	ANSI Z87.1
Steel-toe Boots	All operations	ASTM F2413
Hearing Protection	When machine running	NRR 25+
Cut-resistant Gloves	Label roll changes	ANSI A2+

2.2 Lockout/Tagout (LOTO) Points

LOTO Point	Location	Energy Type
Main Disconnect	Control Cabinet	Electrical 480V
Pneumatic Isolation	Air manifold	Pneumatic 6 bar
Conveyor Isolation	Drive motor	Electrical

2.3 Safety Interlocks

Interlock	Condition	Action
Guard Door	Open	Machine stop
E-Stop	Activated	Immediate stop
Low Air Pressure	<5 bar	Controlled stop
Label Out	Roll empty	Alarm, speed reduction

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3. Operating Procedures

3.1 Pre-Startup Checklist

```
□ 1. Verify LOTO removed and equipment released
□ 2. Check label roll inventory (minimum 2 rolls)
□ 3. Verify air pressure: 6 bar
□ 4. Inspect label applicator head for residue
□ 5. Check case blank supply
□ 6. Verify correct label SKU loaded
□ 7. Confirm work order in system
□ 8. Check all guards in place
□ 9. Test emergency stops
□ 10. Verify vision system calibrated
```

3.2 Startup Procedure

1. **Power On** - Turn main disconnect ON, wait for PLC init (30 sec)
2. **Recipe Selection** - Select product/label combination on HMI
3. **Label Threading** - Thread label web through applicator
4. **Calibration** - Run 10 test bottles, verify placement
5. **Production Start** - Press START, monitor first 50 bottles

3.3 Normal Operation Monitoring

Key Parameters to Monitor:

Parameter	MQTT Topic	Normal Range	Warning	Critical
Rate Actual	`.../labeler/metric/input/rateactual`	250-280/min	<240	<200
Rate Standard	`.../labeler/metric/input/ratestandard`	260/min	N/A	N/A
OEE	`.../labeler/metric/oee`	>90%	85-90%	<85%
Availability	`.../labeler/metric/availability`	>95%	90-95%	<90%
Performance	`.../labeler/metric/performance`	>95%	90-95%	<90%
Quality	`.../labeler/metric/quality`	>99%	98-99%	<98%
Count Infeed	`.../labeler/processdata/count/infeed`	Increasing	Stalled	N/A
Count Outfeed	`.../labeler/processdata/count/outfeed`	Increasing	Stalled	N/A
Count Defect	`.../labeler/processdata/count/defect`	<0.5%	0.5-1%	>1%
State	`.../labeler/processdata/state/name`	Running	Idle	Down

4. Troubleshooting Guide

4.1 Common Problems and Solutions

Problem: Label Misalignment

Symptoms:

- Labels placed off-center
- Labels skewed or rotated
- Inconsistent placement

Diagnostic Steps:

```
1. Check label roll tension → Adjust if loose
2. Inspect guide rollers → Clean or replace worn
3. Check bottle spacing → Verify infeed timing
4. Inspect applicator pad → Replace if worn
5. Verify vision system → Recalibrate if needed
6. Check label adhesive → Verify temperature
```

MQTT Indicators:

- `countdefect` increasing
- `quality` metric dropping

Resolution Actions:

Root Cause	Action	Time Est.
Loose tension	Adjust tensioner	5 min
Worn pad	Replace applicator pad	15 min
Vision drift	Recalibrate camera	20 min
Wrong label	Verify SKU, reload	10 min

Problem: Case Packer Jam

Symptoms:

- Cases not forming properly
- Bottles backing up
- Packager stopped

Diagnostic Steps:

```
1. Check case blank supply → Refill if empty
2. Inspect case forming area → Clear any debris
3. Check bottle count sensor → Clean sensor
4. Verify case format setting → Match to product
```

```
5. Check vacuum cups → Replace if worn
6. Inspect conveyor timing → Adjust if needed
```

Resolution Actions:

Root Cause	Action	Time Est.
Empty blanks	Reload case blanks	5 min
Debris jam	Clear and restart	10 min
Sensor dirty	Clean sensor	5 min
Vacuum leak	Replace cups	20 min

Problem: Label Adhesive Failure

Symptoms:

- Labels peeling off
- Labels not sticking
- Bubbles under labels

Diagnostic Steps:

```
1. Check bottle surface → Must be dry and clean
2. Check label adhesive type → Match to bottle material
3. Check application temperature → 18–25°C optimal
4. Check application pressure → Adjust roller pressure
5. Inspect label roll storage → Check humidity exposure
```

4.2 Alarm Code Reference

Code	Priority	Description	Immediate Action
L001	HIGH	Label roll empty	Replace roll
L002	MEDIUM	Label low warning	Prepare new roll
L003	HIGH	Misalignment detected	Check applicator
L004	CRITICAL	E-stop activated	Investigate
P001	HIGH	Case jam	Clear jam
P002	MEDIUM	Case blanks low	Refill
P003	HIGH	Bottle backup	Check downstream
S001	HIGH	Sealer fault	Check tape/glue

4.3 Detailed Error Code Resolution Procedures

L001 - Label Roll Empty (HIGH Priority)

Trigger Condition: Label roll sensor detects end of roll

Root Causes:

- Roll consumed during production
- Roll splice failed
- Sensor triggered prematurely

Step-by-Step Resolution:

```
1. Machine will stop labeling (bottles bypass unlabeled)
2. Acknowledge alarm on HMI
3. Open label station guard door
4. Remove empty roll core:
   a. Release tension arm
   b. Slide core off spindle
   c. Dispose of core properly
5. Load new label roll:
   a. Verify correct SKU on roll label
   b. Slide roll onto spindle (check direction)
   c. Thread label web through:
      - Tension dancer
      - Guide rollers
      - Peel plate
      - Applicator head
   d. Attach to take-up spindle
6. Set tension:
   a. Adjust dancer to middle position
   b. Set pre-tension to 2-3 N
7. Close guard door
8. Press RESET then START
9. Verify first 10 labels applied correctly
```

Label Roll Specifications:

- Core diameter: 76mm (3")
- Max roll diameter: 400mm
- Label gap: 3mm ±0.5mm
- Web width: Match bottle circumference

L003 - Misalignment Detected (HIGH Priority)

Trigger Condition: Vision system detects label position error >2mm

Root Causes:

- Label web tracking off
- Applicator timing drift
- Bottle position variation
- Vision system calibration drift

Step-by-Step Resolution:

```
1. Machine continues but flags bottles for inspection
2. Check vision system display:
   - HMI → Vision → Live View
   - Note deviation direction (left/right/high/low)
3. For LEFT/RIGHT deviation:
   a. Check label web tracking
   b. Adjust edge guide: Loosen, center web, retighten
   c. Check label roll mounted straight
4. For HIGH/LOW deviation:
   a. Check bottle height consistency
   b. Adjust applicator height:
      - HMI → Setup → Applicator → Height
      - Adjust in 0.5mm increments
   c. Check bottle handling star wheel
5. If deviation random:
   a. Check applicator pad condition
   b. Check vacuum on applicator (should be -0.5 bar)
   c. Check label adhesive activation
6. Recalibrate vision if needed:
   a. HMI → Vision → Calibration
   b. Run 10 test bottles
   c. Verify all within ±1mm
7. Clear alarm and resume
```

Quality Check: Inspect rejected bottles - determine if relabel or scrap

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P001 - Case Jam (HIGH Priority)

Trigger Condition: Case not detected at expected position within timeout

Root Causes:

- Case blank misfeed
- Case not erected properly
- Bottle count incorrect
- Conveyor jam

Step-by-Step Resolution:

```
1. Machine stops case packer section
2. Labeler may continue (bottles accumulate)
3. Open case packer guard
```

```
4. Identify jam location:
   - Case magazine: Blanks stuck
   - Erector: Case not opening
   - Loading zone: Bottles/case misaligned
   - Discharge: Case stuck on conveyor
5. For MAGAZINE jam:
   a. Remove stuck blanks
   b. Fan remaining blanks (may be stuck together)
   c. Check blank quality (warped/damaged)
   d. Reload magazine
6. For ERECTOR jam:
   a. Remove partially formed case
   b. Check vacuum cups (should grip firmly)
   c. Check forming plates alignment
   d. Run empty cycle to test
7. For LOADING ZONE jam:
   a. Remove bottles and case
   b. Check bottle count sensor
   c. Verify case size matches bottle count
   d. Check bottle spacing
8. Clear jam completely
9. Close guard
10. Press RESET then START
11. Monitor next 5 cases
```

Prevention: Check case blank quality each shift, replace damaged blanks

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P003 - Bottle Backup (HIGH Priority)

Trigger Condition: Accumulation sensor blocked for >30 seconds

Root Causes:

- Downstream equipment stopped
- Case packer running slow
- Conveyor fault
- Sensor blocked by debris

Step-by-Step Resolution:

```
1. Labeler will slow down or stop
2. Check downstream status:
   - Is case packer running?
   - Is sealer running?
   - Is palletizer accepting cases?
3. If downstream stopped:
   a. Identify and resolve downstream issue first
   b. Labeler will auto-resume when backup clears
4. If downstream running but slow:
   a. Check case packer speed setting
```

```
   b. May need to reduce labeler speed to match
   c. HMI → Speed → Reduce by 10%
5. If conveyor fault:
   a. Check conveyor motor status
   b. Check for jammed bottles on conveyor
   c. Check conveyor belt tension
6. If sensor issue:
   a. Clean accumulation sensor
   b. Check sensor alignment
   c. Test sensor: Block/unblock, verify response
7. Once backup cleared:
   a. Alarm auto-clears
   b. Gradually increase speed to normal
```

Capacity Planning: Labeler max 280/min, Case packer max 30 cases/min (12-pack = 360 bottles/min capacity)

S001 - Sealer Fault (HIGH Priority)

Trigger Condition: Sealer not completing cycle or tape/glue fault

Root Causes:

- Tape roll empty
- Glue tank empty
- Tape not adhering
- Sealer heads misaligned

Step-by-Step Resolution:

```
1. Cases will stop at sealer
2. Check sealer type (TAPE or GLUE):

FOR TAPE SEALER:
   a. Check tape roll - replace if empty
   b. Check tape threading through heads
   c. Check tape tension (should be taut)
   d. Check cutting blade (replace if dull)
   e. Check pressure rollers (clean if sticky)

FOR GLUE SEALER:
   a. Check glue tank level - refill if low
   b. Check glue temperature (should be 160-180°C)
   c. Check glue nozzles for clogs
   d. Check glue pattern on test case
   e. Clean nozzles if pattern incomplete

3. For both types:
   a. Check case flap folders
   b. Verify case size setting matches actual
```

```
   c. Check sealer head alignment
4. Run test case manually:
   a. HMI → Sealer → Manual Cycle
   b. Inspect seal quality
5. Clear alarm and resume
```

Glue Specifications: Hot melt adhesive, 160-180°C, 2 beads per flap **Tape Specifications:** 48mm width, pressure-sensitive, min 20N/25mm adhesion

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5. Preventive Maintenance

5.1 Daily Tasks (Operator)

```
□ Clean label applicator head
□ Check label roll inventory
□ Inspect guide rollers
□ Clean vision system lens
□ Verify case blank supply
□ Document any issues
```

5.2 Weekly Tasks (Maintenance)

```
□ Lubricate conveyor chains
□ Check belt tensions
□ Inspect vacuum cups
□ Test safety interlocks
□ Clean all sensors
□ Review alarm history
```

5.3 Monthly Tasks

```
□ Replace applicator pads
□ Calibrate vision system
□ Check motor current draw
□ Inspect electrical connections
□ Verify PLC backup
```

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6. MQTT Data Points for Monitoring

```
{
  "equipment": "labelerline01",
  "location": "Enterprise B/Site1/packaging/labelerline01",
```

```
  "components": {
    "labeler": {
      "assetId": 43,
      "displayName": "Labeler",
      "assetTypeName": "WorkCenter",
      "metrics": {
        "oee": "Enterprise
B/Site1/packaging/labelerline01/labeler/metric/oee",
        "availability": "Enterprise
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        "performance": "Enterprise
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        "quality": "Enterprise
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        "rateActual": "Enterprise
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        "rateStandard": "Enterprise
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      "processData": {
        "state": "Enterprise
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        "stateCode": "Enterprise
B/Site1/packaging/labelerline01/labeler/processdata/state/code",
        "countInfeed": "Enterprise
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        "countOutfeed": "Enterprise
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        "rateInstant": "Enterprise
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      }
    },
    "packager": {
      "assetId": 45,
      "displayName": "Packager",
      "assetTypeName": "WorkCenter",
      "basePath": "Enterprise B/Site1/packaging/labelerline01/packager/"
    },
    "sealer": {
      "assetId": 46,
```

```
        "displayName": "Sealer",
        "assetTypeName": "WorkCenter",
        "basePath": "Enterprise B/Site1/packaging/labelerline01/sealer/"
      }
    }
  }
```

7. Performance Targets

Metric	Target	Minimum
OEE	>92%	85%
Availability	>95%	90%
Performance	>96%	92%
Quality	>99.5%	98%
Label Accuracy	±0.5mm	±1.0mm
Throughput	260/min	220/min

Document Control

Version	Date	Author	Changes
1.0	2026-01-16	Engineering	Initial release