Standard Operating Procedure: High-Speed Rotary Filler

Model: KHS Innofill Glass DRS-ZMS

Document ID: SOP-FILLER-001
Equipment ID: FILLER-01, FILLER-02, FILLER-03
Version: 2.1
Effective Date: January 15, 2026
Classification: Critical Equipment
Location: Enterprise B / Site1 / FillerProduction / FillingLine01-03

Quick Reference for AI Agents

Equipment Type: Rotary Bottle Filler
Criticality Level: HIGH - Production Critical
MQTT Topic Path: `Enterprise B/Site1/fillerproduction/fillingline{01-03}/filler/`
Key Metrics: OEE, Fill Accuracy, Throughput Rate, Count Infeed/Outfeed
Common Issues: Fill level deviation, valve blockage, timing errors

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1. Equipment Overview

1.1 Purpose

The High-Speed Rotary Filler is designed for precision filling of carbonated and non-carbonated beverages into glass and PET bottles at speeds up to 72,000 bottles per hour.

1.2 Equipment Specifications

Specification	Value
Model	KHS Innofill Glass DRS-ZMS
Manufacturer	KHS GmbH
Serial Numbers	FILLER-01: KHS-2024-001, FILLER-02: KHS-2024-002
Filling Heads	144 (per unit)
Speed Range	12,000 - 72,000 bottles/hour
Bottle Size Range	200ml - 2000ml
Fill Accuracy	±0.5% of target volume
Power Requirements	480V, 3-phase, 60Hz, 150kW
Air Requirements	6-8 bar, 500 Nm³/h
CO2 Requirements	2-4 bar (carbonated products)
Operating Temperature	2-25°C product temperature
Weight	28,500 kg
Dimensions	4.2m (L) x 3.8m (W) x 4.5m (H)

1.3 Major Components

Component	Function	Part Number
Filling Carousel	Rotary platform with 144 filling stations	KHS-FC-144
Filling Valves	Electro-pneumatic fill valves	KHS-FV-2024
Level Sensors	Capacitive fill level detection	KHS-LS-CAP
Bottle Handling Star	Bottle transfer mechanism	KHS-BHS-72
CIP Spray Balls	Clean-in-place system	KHS-CIP-SB
Control Cabinet	Siemens S7-1500 PLC	KHS-CC-S7
HMI Panel	21" touchscreen operator interface	KHS-HMI-21
Product Tank	500L stainless steel buffer tank	KHS-PT-500
CO2 Injection System	Counter-pressure carbonation	KHS-CO2-INJ

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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+
Chemical Gloves	CIP operations	Nitrile, chemical resistant
Face Shield	Pressurized system work	ANSI Z87.1

2.2 Lockout/Tagout (LOTO) Points

LOTO Point	Location	Energy Type
Main Disconnect	Control Cabinet MCC-01	Electrical 480V
Pneumatic Isolation	Air supply manifold	Pneumatic 8 bar
CO2 Isolation	CO2 supply valve	Gas pressure
Product Isolation	Inlet valve V-101	Hydraulic
Steam Isolation	CIP steam valve	Thermal

2.3 Safety Interlocks

Interlock	Condition	Action
Guard Door	Open	Machine stop
E-Stop	Activated	Immediate stop, valve close
Low Air Pressure	<5 bar	Controlled stop
High Product Temp	>30°C	Alarm, speed reduction
Overflow Detection	Level high	Stop filling, alarm

3. Operating Procedures

3.1 Pre-Startup Checklist

CRITICAL: Complete all items before starting equipment

```
□ 1. Verify LOTO removed and equipment released for operation
□ 2. Check product tank level (minimum 30%)
□ 3. Verify air pressure: 6-8 bar
□ 4. Verify CO2 pressure: 2-4 bar (carbonated products only)
□ 5. Check product temperature: 2-8°C (carbonated), 10-25°C (still)
□ 6. Verify CIP cycle completed (check CIP log)
□ 7. Inspect filling valves for damage or residue
□ 8. Check bottle infeed conveyor alignment
□ 9. Verify correct bottle format selected on HMI
□ 10. Confirm work order loaded in system
□ 11. Check all guards are in place and secure
□ 12. Verify emergency stops are functional (test)
□ 13. Check lubrication levels on carousel bearings
□ 14. Inspect star wheel condition
□ 15. Verify reject system operational
```

3.2 Startup Procedure

Step-by-Step Startup Sequence:

1. **Power On**

   - Turn main disconnect to ON position
   - Wait for PLC initialization (30 seconds)
   - Verify HMI displays home screen

2. **System Initialization**

   - Press "INITIALIZE" on HMI
   - System performs self-check (2 minutes)
   - Verify all status indicators GREEN

3. **Product Selection**

   - Navigate to Recipe Management
   - Select product recipe (e.g., "COLA-500ML")
   - Confirm fill parameters:
     - Target Volume: 500ml
     - Fill Time: 4.2 seconds
     - Counter Pressure: 2.5 bar

4. **Carousel Homing**

   - Press "HOME CAROUSEL"
   - Wait for homing complete signal
   - Verify position indicator shows 0°

5. **Valve Priming**

   - Enable "PRIME MODE"
   - Run 10 empty cycles
   - Verify all valves cycling correctly

6. **Production Start**

   - Press "START PRODUCTION"
   - Monitor first 50 bottles for fill accuracy
   - Verify reject system catching underfills

3.3 Normal Operation Monitoring

Key Parameters to Monitor:

Parameter	MQTT Topic	Sample Value	Normal Range	Warning
Rate Actual	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/metric/input/rateactual`	307 bpm	270-330 bpm	<250
Rate Standard	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/metric/input/ratestandard`	300 bpm	300 bpm	N/A
Rate Instant	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/rate/instant`	307 bpm	>0 when running	0
Count Infeed	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/count/infeed`	1268597	Increasing	Stalled
Count Outfeed	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/count/outfeed`	1268597	Increasing	Stalled
Count Defect	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/count/defect`	0	<0.5%	0.5-1.0%
Infeed to Outfeed	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/input/infeedtooutfeed`	1	1.0	<0.99
State Name	`Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/name`	Running	Running	Idle/Unknown
State Type	`Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/type`	Running	Running	Unknown
State Code	`Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/code`	0	0 (Running)	N/A
State Duration	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/processdata/state/duration`	10 sec	Per state	Extended
OEE	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/oee`	0.878 (87.8%)	>85%	75-85%
Availability	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/availability`	0.898 (89.8%)	>90%	85-90%
Performance	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/performance`	0.977 (97.7%)	>95%	90-95%
Quality	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/quality`	1 (100%)	>99%	98-99%
Time Running	`EnterpriseB/Site1/fillerproduction/fillingline01/filler/metric/input/timerunning`	259610 sec	Increasing	N/A
Time Idle	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timeidle`	0 sec	Minimal	>10%

Parameter	MQTT Topic	Sample Value	Normal Range	Warning
Time Down Planned	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timedownplanned`	112810 sec	Per schedule	N/A
Time Down Unplanned	`Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timedownunplanned`	29410 sec	<5%	5-10%

Hourly Checks:

```
☐ Record fill volumes from 3 random bottles
☐ Check reject bin count
☐ Verify conveyor speeds synchronized
☐ Inspect for leaks or spills
☐ Check product tank level
☐ Document any alarms or stoppages
```

3.4 Shutdown Procedure

Normal Shutdown:

1. Press "STOP PRODUCTION" on HMI
2. Allow carousel to complete current cycle
3. Run empty bottles through to clear product
4. Initiate "DRAIN MODE" to empty product lines
5. If end of production day:
    - Initiate CIP cycle (see Section 5)
    - Wait for CIP complete
6. Press "SHUTDOWN" on HMI
7. Turn main disconnect to OFF (if extended shutdown)
8. Complete shutdown checklist in logbook

Emergency Shutdown:

1. Press nearest E-STOP button
2. Notify supervisor immediately
3. Do NOT reset until cause identified
4. Document incident in safety log
5. Follow incident investigation procedure

3.5 Product Changeover Procedure

Estimated Time: 45-90 minutes depending on product type

1. **Complete Current Production**

    - Run out remaining product
    - Clear all bottles from system

2. **Flush System**

    - Connect water flush line
    - Run flush cycle (15 minutes)
    - Drain completely

3. **CIP (if required)**

    - Run full CIP cycle for allergen or flavor change
    - Verify CIP parameters met

4. **Format Change (if required)**

    - Change star wheels for new bottle size
    - Adjust guide rails
    - Update recipe on HMI

5. **New Product Setup**

    - Load new recipe
    - Prime with new product
    - Run test batch (50 bottles)
    - Verify fill accuracy
    - Begin production

4. Troubleshooting Guide

4.1 Common Problems and Solutions

Problem: Underfilled Bottles

Symptoms:

- Fill level below target
- High reject rate
- Inconsistent fill levels

Diagnostic Steps:

```
1. Check product tank level → If low, refill tank
2. Check product temperature → If high, cool product
3. Check air pressure → If low, check compressor
4. Inspect filling valve → Clean or replace if blocked
5. Check fill time setting → Adjust if incorrect
6. Verify level sensor calibration → Recalibrate if needed
```

MQTT Indicators:

- `countdefect` increasing
- `fillaccuracy` deviation >1%
- `rateactual` below standard

Resolution Actions:

Root Cause	Action	Time Est.
Low product level	Refill tank	5 min
Blocked valve	Clean valve	15 min
Sensor drift	Recalibrate	30 min
Worn valve seal	Replace seal	45 min

Problem: Machine Stops Frequently

Symptoms:

- Frequent unplanned stops
- Low availability metric
- Operator intervention required

Diagnostic Steps:

```
1. Review alarm history on HMI
2. Check bottle infeed → Verify bottles arriving consistently
3. Check bottle quality → Inspect for defects
4. Check star wheel timing → Adjust if misaligned
5. Check sensor cleanliness → Clean all sensors
6. Verify conveyor speeds → Synchronize if needed
```

MQTT Indicators:

- `availability` <85%
- `timedownunplanned` increasing
- `state/name` frequently changing

Common Causes:

Alarm Code	Description	Solution
E001	Bottle jam at infeed	Clear jam, check guide rails
E002	Missing bottle detected	Check upstream equipment
E003	Overfill detected	Check valve, reduce fill time
E004	Low air pressure	Check compressor, air leaks
E005	Guard door open	Close door, check interlock

Alarm Code	Description	Solution
E006	E-stop activated	Investigate, reset when safe
E007	Communication fault	Check network, restart PLC
E008	Drive fault	Check motor, VFD parameters

Problem: Poor Fill Accuracy

Symptoms:

- Fill volumes vary between bottles
- Some bottles overfilled, some underfilled
- Quality complaints

Diagnostic Steps:

```
1. Check product viscosity → Adjust fill parameters
2. Check product temperature stability → Stabilize temp
3. Inspect all 144 filling valves → Replace worn valves
4. Check counter-pressure consistency → Adjust CO2
5. Verify carousel speed → Reduce if too fast
6. Check level sensor response time → Replace if slow
```

Calibration Procedure:

1. Stop production
2. Navigate to Calibration menu
3. Run calibration cycle (10 bottles per valve)
4. System auto-adjusts fill times
5. Verify with manual measurement
6. Document calibration results

Problem: Excessive Foaming (Carbonated Products)

Symptoms:

- Product foaming during fill
- Underfills due to foam
- Slow fill rates

Diagnostic Steps:

```
1. Check product temperature → Must be 2-8°C
2. Check CO2 saturation level → Verify carbonation
3. Check counter-pressure setting → Increase if needed
4. Check fill valve condition → Replace if damaged
5. Check snift timing → Adjust for product
6. Reduce fill speed → Slower fill reduces foam
```

Optimal Parameters for Carbonated Products:

Parameter	Setting
Product Temperature	2-4°C
Counter Pressure	2.5-3.0 bar
Fill Speed	80% of max
Snift Time	0.3-0.5 seconds
Settling Time	1.0-1.5 seconds

4.2 Alarm Code Reference

Code	Priority	Description	Immediate Action
E001	HIGH	Bottle jam	Stop, clear jam
E002	MEDIUM	Missing bottle	Check infeed
E003	HIGH	Overfill	Stop, check valve

Code	Priority	Description	Immediate Action
E004	CRITICAL	Low air pressure	Stop, check supply
E005	HIGH	Guard open	Close guard
E006	CRITICAL	E-stop	Investigate
E007	MEDIUM	Comm fault	Check network
E008	HIGH	Drive fault	Check motor
E009	LOW	Maintenance due	Schedule PM
E010	MEDIUM	CIP required	Run CIP
E011	HIGH	High product temp	Cool product
E012	CRITICAL	Overflow	Stop, clean
E013	MEDIUM	Low product level	Refill tank
E014	HIGH	Valve stuck	Replace valve
E015	LOW	Filter dirty	Replace filter

4.3 Detailed Error Code Resolution Procedures

E001 - Bottle Jam (HIGH Priority)

Root Causes:

- Bottle fell over on conveyor
- Star wheel timing misaligned
- Bottle size mismatch with format
- Debris on conveyor track

Step-by-Step Resolution:

```
1. Press STOP on HMI (do NOT use E-stop unless safety risk)
2. Wait for carousel to stop completely
3. Open guard door (machine will not restart with door open)
4. Locate jam position:
   - Infeed star wheel: Check bottle orientation
   - Carousel entry: Check timing marks
   - Outfeed star wheel: Check bottle spacing
5. Remove jammed/broken bottles carefully
6. Inspect for glass fragments - clean if present
7. Check star wheel fingers for damage
8. Close guard door
9. Press RESET on HMI
10. Press START - monitor first 20 bottles
```

Prevention: Run bottle inspection every 2 hours, verify format settings match bottle size

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E003 - Overfill Detected (HIGH Priority)

Root Causes:

- Fill valve stuck open
- Level sensor malfunction
- Fill time parameter too high
- Product foaming excessively

Step-by-Step Resolution:

```
1. Machine will auto-stop affected filling head
2. Check HMI for which filling head triggered alarm
3. Navigate to: Diagnostics → Filling Heads → Head [XX]
4. Check fill time vs actual fill time
5. If fill time exceeded:
   a. Inspect valve [XX] for debris
   b. Check valve actuator air supply
   c. Test valve manually: Maintenance → Valve Test
6. If level sensor issue:
   a. Clean sensor probe
   b. Run calibration: Setup → Sensors → Calibrate
7. Clear alarm: Alarms → Active → E003 → Acknowledge
```

```
   8. Reset filling head: Filling Heads → Head [XX] → Enable
   9. Monitor next 10 fills on that head
```

Spare Parts Required: Valve seal kit (KHS-FV-SEAL), Level sensor (KHS-LS-CAP)

E004 - Low Air Pressure (CRITICAL Priority)

Root Causes:

- Compressor failure
- Air leak in supply line
- Filter/regulator blocked
- Demand exceeds supply

Step-by-Step Resolution:

```
   1. Machine will perform controlled stop automatically
   2. Check main air pressure gauge on supply manifold
      — Normal: 6–8 bar
      — Alarm triggers at: <5 bar
   3. If pressure low at source:
      a. Check compressor status in utility room
      b. Verify compressor running (green light)
      c. Check compressor discharge pressure
      d. If compressor fault — call maintenance
   4. If pressure OK at source but low at machine:
      a. Check for audible air leaks along supply line
      b. Inspect quick–connect fittings
      c. Check filter/regulator assembly:
         — Drain water from filter bowl
         — Replace filter element if dirty
         — Verify regulator set to 7 bar
   5. Once pressure restored (>6 bar):
      a. Press RESET on HMI
      b. Wait 30 seconds for system to pressurize
      c. Press START
```

Emergency Contact: Utilities - Ext. 2345

E006 - Emergency Stop Activated (CRITICAL Priority)

Root Causes:

- Operator activated E-stop
- Safety system triggered
- Actual emergency situation

Step-by-Step Resolution:

```
   1. DO NOT RESET IMMEDIATELY
   2. Identify which E–stop was activated:
      — Check E–stop status on HMI: Safety → E–Stop Status
      — Physically inspect all E–stop buttons (5 locations)
   3. Investigate cause:
      — Interview operator who activated
      — Check for personnel injury
      — Check for equipment damage
      — Check for product spill
   4. If false activation:
      a. Document reason in shift log
      b. Pull and twist E–stop button to release
      c. Press RESET on HMI
      d. Perform startup checklist items 11–15
      e. Press START
   5. If actual emergency:
      a. Follow emergency response procedure
      b. Do not restart until authorized by supervisor
      c. Complete incident report form
```

Documentation Required: All E-stop activations must be logged in safety register

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E008 - Drive Fault (HIGH Priority)

Root Causes:

- VFD (Variable Frequency Drive) fault
- Motor overload
- Encoder failure
- Power supply issue

Step-by-Step Resolution:

```
1. Check HMI for specific drive: Diagnostics → Drives
2. Note the VFD fault code displayed
3. Common VFD fault codes:
   - OC (Overcurrent): Motor drawing too much current
     → Check for mechanical binding
     → Reduce speed parameter by 10%
   - OV (Overvoltage): Regenerative braking issue
     → Check braking resistor
   - OH (Overheat): VFD too hot
     → Check cabinet ventilation fan
     → Clean VFD heat sink
   - EF (Earth Fault): Ground fault detected
     → Check motor cable insulation
     → Megger test motor windings
4. To reset VFD:
   a. Open control cabinet (LOTO if entering)
   b. Press RESET on VFD front panel
   c. Or: HMI → Drives → [Drive Name] → Reset Fault
5. If fault persists after 3 resets:
   a. Call maintenance
   b. Do not continue resetting (may cause damage)
```

Spare Parts: VFD fuses, cooling fan, encoder cable

E011 - High Product Temperature (HIGH Priority)

Root Causes:

- Refrigeration system failure
- Product sat too long in tank
- Ambient temperature too high
- Heat exchanger fouled

Step-by-Step Resolution:

```
1. Machine will reduce speed automatically
2. Check product temperature on HMI: Process → Tank → Temperature
   - Carbonated products: Must be 2-8°C
   - Still products: Must be 10-25°C
3. If temperature rising:
   a. Check glycol chiller status
   b. Verify glycol flow to heat exchanger
   c. Check heat exchanger for fouling
4. Immediate actions:
   a. Reduce fill speed to 50%
   b. Enable additional cooling if available
   c. Consider stopping to cool product
5. For carbonated products >10°C:
   a. STOP production immediately
   b. Product will foam and cause quality issues
   c. Cool product before resuming
6. Once temperature in range:
   a. Alarm will auto-clear
   b. Gradually increase speed to normal
```

Quality Impact: High temperature = excessive foaming = underfills = customer complaints

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E014 - Valve Stuck (HIGH Priority)

Root Causes:

- Debris in valve seat

- Worn valve seal
- Actuator failure
- Air supply to valve blocked

Step-by-Step Resolution:

```
1. Identify stuck valve: HMI → Diagnostics → Filling Heads
2. Check if valve stuck OPEN or CLOSED:
   - Stuck OPEN: Product continuously flowing
   - Stuck CLOSED: No product dispensing
3. For stuck OPEN valve:
   a. STOP machine immediately
   b. Close product supply valve manually
   c. Drain affected filling head
4. For stuck CLOSED valve:
   a. Machine can continue with head disabled
   b. HMI → Filling Heads → Head [XX] → Disable
5. Repair procedure:
   a. LOTO the machine
   b. Remove filling head cover
   c. Disconnect air line to actuator
   d. Remove valve assembly (4 bolts)
   e. Inspect valve seat for debris/damage
   f. Replace seal kit if worn
   g. Reassemble and test
6. Test after repair:
   a. Manual valve test: Maintenance → Valve Test
   b. Run 20 bottles through repaired head
   c. Verify fill accuracy within ±0.5%
```

Spare Parts Required: Valve seal kit (KHS-FV-SEAL) - keep 20 on hand

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5. Cleaning and Sanitation

5.1 Clean-In-Place (CIP) Procedure

CIP Cycle Duration: 90 minutes

CIP Sequence:

Step	Solution	Temp	Time	Flow Rate
1. Pre-rinse	Water	25°C	10 min	150 L/min
2. Caustic wash	2% NaOH	80°C	30 min	150 L/min
3. Intermediate rinse	Water	25°C	10 min	150 L/min
4. Acid wash	1% HNO3	65°C	20 min	150 L/min
5. Final rinse	Water	25°C	10 min	150 L/min
6. Sanitize	200ppm PAA	25°C	10 min	150 L/min

CIP Verification:

- Conductivity after final rinse: <50 µS/cm
- pH after final rinse: 6.5-7.5
- ATP swab result: <10 RLU

5.2 Manual Cleaning Requirements

Daily:

- Wipe down HMI and control surfaces
- Clean bottle guides and star wheels
- Inspect and clean level sensors
- Clean drip trays

Weekly:

- Deep clean carousel exterior
- Inspect and clean all filling valves
- Clean product tank interior
- Lubricate moving parts per schedule

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6. Preventive Maintenance Schedule

6.1 Maintenance Tasks

Daily (Operator):

```
□ Visual inspection of all components
□ Check for leaks
□ Verify lubrication levels
□ Clean sensors and guides
□ Document any abnormalities
```

Weekly (Maintenance):

```
□ Inspect filling valve seals
□ Check star wheel wear
□ Verify belt tensions
□ Test safety interlocks
□ Review alarm history
□ Check electrical connections
```

Monthly (Maintenance):

```
□ Replace air filters
□ Calibrate level sensors
□ Inspect bearings (vibration analysis)
□ Check motor current draw
□ Verify PLC backup
□ Test emergency systems
```

Quarterly (Maintenance):

```
□ Replace filling valve seals
□ Full calibration verification
□ Electrical thermography
□ Gearbox oil analysis
□ Control system audit
```

Annual (Maintenance + Engineering):

```
□ Complete overhaul inspection
□ Replace wear parts per schedule
□ Update control software
□ Recertify safety systems
□ Performance validation
```

6.2 Spare Parts Inventory

Critical Spares (Keep on-site):

Part	Part Number	Qty	Lead Time
Filling valve seal kit	KHS-FV-SEAL	20	2 weeks
Level sensor	KHS-LS-CAP	5	1 week
Star wheel	KHS-BHS-72	2	4 weeks
Drive belt	KHS-BELT-01	4	1 week
Pneumatic valve	KHS-PV-24V	10	2 weeks
HMI screen	KHS-HMI-21	1	6 weeks
PLC CPU	S7-1500-CPU	1	4 weeks

7. Performance Metrics and KPIs

7.1 Target Performance

Metric	Target	Minimum Acceptable

SOP_HIGH_SPEED_ROTARY_FILLER.md   2026-01-16

Metric	Target	Minimum Acceptable
OEE	>85%	75%
Availability	>92%	85%
Performance	>95%	90%
Quality	>99.5%	98%
Fill Accuracy	±0.5%	±1.0%
Throughput	65,000 bph	55,000 bph

7.2 MQTT Data Points for Monitoring

```json
{
  "equipment": "filler",
  "location": "Enterprise B/Site1/fillerproduction/fillingline01/filler",
  "assetInfo": {
    "assetId": 23,
    "assetName": "Filler",
    "displayName": "Filler",
    "assetTypeName": "WorkCenter",
    "assetPath": "UNS/ProveItBeverage/Plant1/FillerProduction/FillingLine01/Filler/Node",
    "parentAssetId": 7,
    "sortOrder": 1
  },
  "metrics": {
    "oee": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/oee",
      "dataType": "float",
      "sampleValue": 0.878
    },
    "availability": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/availability",
      "dataType": "float",
      "sampleValue": 0.898
    },
    "performance": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/performance",
      "dataType": "float",
      "sampleValue": 0.977
    },
    "quality": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/quality",
      "dataType": "integer",
      "sampleValue": 1
    },
    "input": {
      "rateActual": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/rateactual",
        "dataType": "integer",
        "sampleValue": 307,
        "unit": "bottles/min"
      },
      "rateStandard": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/ratestandard",
        "dataType": "integer",
        "sampleValue": 300,
        "unit": "bottles/min"
      },
      "countInfeed": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/countinfeed",
        "dataType": "integer",
        "sampleValue": 1268597
      },
      "countOutfeed": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/countoutfeed",
        "dataType": "integer",
        "sampleValue": 1268597
      },
      "countDefect": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/countdefect",
        "dataType": "integer",
        "sampleValue": 0
      },
      "timeRunning": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timerunning",
        "dataType": "integer",
```

```json
      "sampleValue": 259610,
      "unit": "seconds"
    },
    "timeIdle": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timeidle",
      "dataType": "integer",
      "sampleValue": 0,
      "unit": "seconds"
    },
    "timeDownPlanned": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timedownplanned",
      "dataType": "integer",
      "sampleValue": 112810,
      "unit": "seconds"
    },
    "timeDownUnplanned": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/metric/input/timedownunplanned",
      "dataType": "integer",
      "sampleValue": 29410,
      "unit": "seconds"
    }
  }
},
"processData": {
  "count": {
    "infeed": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/count/infeed",
      "dataType": "integer",
      "sampleValue": 1268597
    },
    "outfeed": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/count/outfeed",
      "dataType": "integer",
      "sampleValue": 1268597
    },
    "defect": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/count/defect",
      "dataType": "integer",
      "sampleValue": 0
    }
  },
  "rate": {
    "instant": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/rate/instant",
      "dataType": "integer",
      "sampleValue": 307,
      "unit": "bottles/min"
    }
  },
  "input": {
    "infeedToOutfeed": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/input/infeedtooutfeed",
      "dataType": "integer",
      "sampleValue": 1
    }
  },
  "state": {
    "name": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/name",
      "dataType": "string",
      "sampleValue": "Running",
      "possibleValues": ["Running", "Idle", "Down", "CIP", "Changeover"]
    },
    "type": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/type",
      "dataType": "string",
      "sampleValue": "Running",
      "possibleValues": ["Running", "Unknown", "Down"]
    },
    "code": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/code",
      "dataType": "integer",
      "sampleValue": 0
    },
    "duration": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/processdata/state/duration",
      "dataType": "integer",
      "sampleValue": 10,
      "unit": "seconds"
    }
  }
```

```json
    },
    "node": {
      "assetIdentifier": {
        "assetId": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/assetid",
          "dataType": "integer",
          "sampleValue": 23
        },
        "assetName": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/assetname",
          "dataType": "string",
          "sampleValue": "Filler"
        },
        "assetPath": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/assetpath",
          "dataType": "string",
          "sampleValue": "UNS/ProveItBeverage/Plant1/FillerProduction/FillingLine01/Filler/Node"
        },
        "assetTypeName": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/assettypename",
          "dataType": "string",
          "sampleValue": "WorkCenter"
        },
        "displayName": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/displayname",
          "dataType": "string",
          "sampleValue": "Filler"
        },
        "parentAssetId": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/parentassetid",
          "dataType": "integer",
          "sampleValue": 7
        },
        "sortOrder": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/filler/node/assetidentifier/sortorder",
          "dataType": "integer",
          "sampleValue": 1
        }
      }
    }
  }
```

7.3 Filling Line Work Order Data

The filling line also has work order information at the line level:

```json
{
  "workOrder": {
    "location": "Enterprise B/Site1/fillerproduction/fillingline01/workorder",
    "workOrderId": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/workorderid",
      "dataType": "integer",
      "sampleValue": 3428
    },
    "workOrderNumber": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/workordernumber",
      "dataType": "string",
      "sampleValue": "WO-L03-0428"
    },
    "assetId": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/assetid",
      "dataType": "integer",
      "sampleValue": 7
    },
    "quantityTarget": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/quantitytarget",
      "dataType": "integer",
      "sampleValue": 52000,
      "unit": "bottles"
    },
    "quantityActual": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/quantityactual",
      "dataType": "integer",
      "sampleValue": 19586,
      "unit": "bottles"
    },
    "quantityDefect": {
      "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/quantitydefect",
```

```
          "dataType": "integer",
          "sampleValue": 0
      },
      "uom": {
        "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/uom",
        "dataType": "string",
        "sampleValue": "bottle"
      },
      "lotNumber": {
        "lotNumber": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/lotnumber",
          "dataType": "string",
          "sampleValue": "L03-0428"
        },
        "lotNumberId": {
          "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/lotnumberid",
          "dataType": "integer",
          "sampleValue": 3428
        },
        "item": {
          "itemId": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/itemid",
            "dataType": "integer",
            "sampleValue": 3
          },
          "itemName": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/itemname",
            "dataType": "string",
            "sampleValue": "Orange Soda 0.5L"
          },
          "itemClass": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/itemclass",
            "dataType": "string",
            "sampleValue": "Bottle"
          },
          "bottleSize": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/bottlesize",
            "dataType": "float",
            "sampleValue": 0.5,
            "unit": "liters"
          },
          "packCount": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/packcount",
            "dataType": "integer",
            "sampleValue": 0
          },
          "parentItemId": {
            "topic": "Enterprise B/Site1/fillerproduction/fillingline01/workorder/lotnumber/item/parentitemid",
            "dataType": "integer",
            "sampleValue": 1
          }
        }
      }
    }
  }
}
```

8. Regulatory Compliance

8.1 Food Safety Standards

- FDA 21 CFR Part 110 - Current Good Manufacturing Practice
- FSMA - Food Safety Modernization Act
- HACCP - Hazard Analysis Critical Control Points

8.2 Documentation Requirements

- Batch records retained for 3 years
- CIP records retained for 2 years
- Calibration records retained for 3 years
- Maintenance records retained for equipment life

9. Contact Information

9.1 Internal Contacts

Role	Name	Phone	Email

Role	Name	Phone	Email
Production Manager	[Name]	[Phone]	[Email]
Maintenance Supervisor	[Name]	[Phone]	[Email]
Quality Manager	[Name]	[Phone]	[Email]
Safety Coordinator	[Name]	[Phone]	[Email]

9.2 External Support

Contact	Purpose	Phone
KHS Technical Support	Equipment issues	1-800-KHS-HELP
Siemens Support	PLC/HMI issues	1-800-743-6367
Parts Supplier	Spare parts	[Phone]

Document Control

Version	Date	Author	Changes
1.0	2024-01-15	Engineering	Initial release
2.0	2025-06-01	Engineering	Added troubleshooting
2.1	2026-01-15	Engineering	Updated for AI agent integration

Approval Signatures:

Role	Name	Date
Operations Manager	_____	_____
Quality Manager	_____	_____
Safety Manager	_____	_____
Engineering Manager	_____	_____