APPLICATION // 03

Fill level inspection, cap inspection and seal checks for filling lines

Checks for under-fill and over-fill, missing, crooked or high caps and broken tamper bands, plus induction seal inspection, on bottles, jars, cups and tubs.

TECHNICAL REVIEW: Frank Guo (https://www.linkedin.com/in/frank-g-15b59b57) · REVIEWED 25 SEPTEMBER 2026

Request an assessment for this application

// SHORT ANSWER

Fill level inspection is a camera check, usually against a backlight, that finds under-filled and over-filled containers on the line. The same fill level inspection system can find missing, crooked or high caps, broken tamper bands and visible seal faults such as a missing foil or a creased heat seal. Fill level works on clear or translucent containers with a backlight; opaque containers limit what a camera can see. A visual seal check does not prove a pack is leak-tight. We confirm what your containers allow on real samples first.

// WHAT IT CHECKS

What a fill level and cap inspection system checks

Four checks, often combined in one station. Which you need, and the limits, are set at the sample test.

01 // FILL

Fill level inspection

Finds the liquid line against a backlight and compares it with a minimum and maximum taught from good containers, so under-fill and over-fill are rejected.

NEEDS

A clear or translucent container

02 // CAP

Cap inspection

Missing caps, crooked (cocked) caps and high caps, on screw caps, snap caps and crown caps.

NEEDS

Cap profile visible against the background

03 // BAND

Tamper-evident band

Broken, missing or ridden-up tamper-evident bands, the visible sign of tamper evidence.

NEEDS

Band in view; round containers may need several views

04 // SEAL

Induction and heat seals

Induction seal foil present before capping; heat seals on cups and trays visibly complete, without creases or product in the seal area.

SCOPE

Appearance only, not a leak test

Fill level by container type

CONTAINER	CAMERA FILL CHECK	WHAT TO WATCH

CONTAINER	CAMERA FILL CHECK	WHAT TO WATCH
Clear glass or PET	Usually feasible with a backlight.	Foam, bubbles, condensation and liquid still moving at the camera.
Translucent plastic	Often feasible where the liquid line shows through.	Wall thickness and colour vary; confirmed on your samples.
Tinted glass or plastic	Depends on how much light passes through.	Dark tints can hide the liquid line; confirmed on your samples, sometimes with a different light colour.
Opaque or fully sleeved	Not feasible: a camera cannot see the liquid.	Fill needs another method, such as weighing; caps and seals can still be checked.
Cans and cartons	Not feasible for fill level.	Cap, lid and code checks remain possible.

Empty bottles, jars and preforms are checked before filling, at the base, sidewall and finish: see **empty container and preform inspection**.

// IN YOUR WORDS

What operators report: sensor to detect bottle caps, underfilled bottles, swollen bottles

This is how the common reports from a filling line map to what a fill level and cap inspection station checks, and where a simpler sensor is enough.

WHAT THE LINE REPORTS	WHAT A STATION CHECKS	WHERE IT STOPS

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“Sensor to detect bottle caps”, “proximity sensor for caps”	A photoelectric or proximity sensor confirms a cap is there; a vision sensor or camera also sees whether it is crooked, high or missing its band.	A single presence sensor cannot tell a crooked cap from a good one.
“Crooked or missing bottle caps”	Cap profile from the side against a backlight: missing, cocked and high caps change the outline.	Cap torque cannot be seen; a cap that looks seated can still be loose.
“Underfilled bottles”, “short fill”	Fill level inspection against a backlight on clear or translucent containers, every container.	Opaque containers, full sleeves and cans need weighing, for example a checkweigher, instead.
“Tamper band broken”, “100% inspection of caps and tamper bands”	The band below the cap edge, from two or more side views on round bottles.	A band hidden by a label or sleeve cannot be inspected.
“Poorly sealed or leaking packs”	Visible seal faults: foil missing before capping, heat seals creased or with product in the seal area.	Not a leak test: a seal that looks right can still leak through a fine channel.
“Swollen or blown bottles in the trade”	Only containers already deformed when they pass the camera.	Swelling usually develops after packing, from the product itself; that is a process and hygiene issue, not something a camera at the filler can see.

// LIMITS

Where fill, cap and seal inspection stops

We agree these boundaries before a project starts, so nobody expects the camera to do what it cannot.

✕ Not detectable with a camera

- **Leak-tightness.** A seal that looks complete can still leak. Proving it is sealed needs a leak test.
- **Fill in opaque containers.** The liquid line cannot be seen through opaque walls, full sleeves or cans.
- **Cap torque.** A cap can sit straight and still be under-tightened; torque is checked another way.
- **Vacuum or pressure in the container.** A lid that has not pulled down (a dud) or a bottle that has lost pressure needs a dedicated vacuum or pressure sensor, not a camera.

✓ Works reliably when

- **The container shows the liquid.** Clear or translucent walls, with a backlight behind them.
- **The liquid has settled.** The camera sits where foam and sloshing have calmed, with stable spacing.
- **Limits come from your specification.** Fill and cap limits are taught from agreed good and bad samples.

// METHODS

Fill level inspection system: camera, X-ray, high-frequency or checkweigher

A camera is one of four ways to check fill. Which one fits depends on the container more than on the product.

METHOD	CONTAINERS IT SUITS	STRENGTH	LIMIT	SUPPLIED BY ADDASCAN
Camera with a backlight	Clear and translucent glass or PET; some tinted containers	Sees the liquid line and the cap in the same station	Cannot see through cans, opaque or fully sleeved containers	Yes

METHOD	CONTAINERS IT SUITS	STRENGTH	LIMIT	SUPPLIED BY ADDASCAN
X-ray fill level inspection	Cans, opaque and sleeved containers	Measures through the container wall	Separate equipment with its own safety requirements	No
High-frequency (microwave) fill level inspection	Containers where the product and wall suit the method	No radiation source	Depends on product and container; confirmed by its supplier	No
Checkweigher	Any container	Proves the quantity by mass	Does not show where in the container the product sits	No

addaScan builds camera-based bottle fill level detection. For cans and opaque containers we say so at the first contact: those need X-ray or high-frequency equipment from its specialist suppliers. More on **how the four methods compare**.

// SOUTH AFRICA

Fill control and legal metrology in South Africa

What the regulations say about quantity and sealing, and where a camera fits alongside a checkweigher.

South African rules require the right quantity and a sealed, tamper-evident pack; they do not prescribe how the filler proves it. A fill level and cap inspection station is one of the checks that can support these requirements. It does not replace weighing.

- **Legal Metrology Regulations, regulations 32 and 34:** the tolerances between the marked and the actual quantity are those in SANS 458, and the NRCS may not permit the sale of prepackages that are deficient of the quantity marked.

- **Regulations 137 and 138:** where automatic filling or weighing instruments determine the quantity in prepackages, users outside the “e” mark scheme must take steps that enable them to detect incorrect quantities, and keep records of the checks.
- **Regulation 35:** the “e” quantity mark is defined in SANS 1841 and may only be applied by registered packers; it is a voluntary scheme with its own statistical fill control.
- **Regulation 20 and R146, regulation 9(f):** prepackages must comply with SANS 289, and food labels must state the net contents in SI units.
- **R638 (2018):** prepacked food must be packed so it cannot be removed without the stopper, lid or seal being removed or visibly damaged, which is the purpose of caps, tamper bands and seals.
- **FSSC 22000 version 6, 2.5.9(b):** certified sites need quantity control procedures for unit, weight and volume, including calibration or verification of the equipment used.

According to the NRCS, product that does not conform to the legal metrology requirements must be brought into compliance, or it is confiscated, destroyed or returned.

SOURCES FOR THIS SECTION

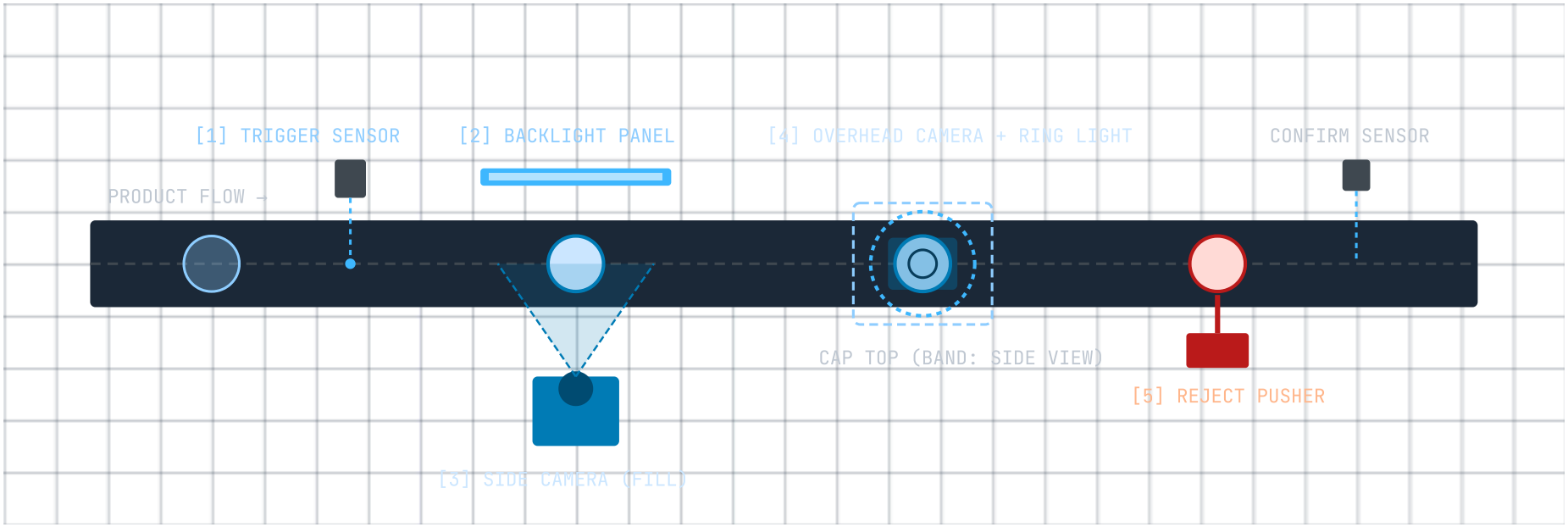
1. Legal Metrology Regulations (GN 877, Government Gazette 41854, 2018), regulations 20, 32, 34, 35, 137 and 138 (https://www.gov.za/sites/default/files/gcis_document/201808/41854gon877.pdf) (gazette, read 2026-09-25)
2. Regulations relating to the labelling and advertising of foodstuffs (R146, 2010), regulation 9(f) (https://globalfoodlaws.georgetown.edu/wp-content/uploads/2021/12/South-Africa_2010.03.01._Regulations-Relating-To-the-Labelling-and-Advertising-of-Foodstuffs_No.-R.-146_EN.pdf) (gazette copy, read 2026-09-25)
3. Regulations governing general hygiene requirements for food premises (R638, 2018) (https://www.gov.za/sites/default/files/gcis_document/201806/41730gon638.pdf) (gazette, read 2026-09-25)
4. FSSC 22000 Scheme Version 6, Part 2, 2.5.9(b) quantity control (https://www.fssc.com/wp-content/uploads/2023/03/FSSC-22000-Scheme-Version-6-.pdf) (scheme document, read 2026-09-25)
5. NRCS legal metrology presentation (enforcement outcomes) (https://www.saeopa.co.za/wp-content/uploads/2024/08/Jaco-Marneweck_Session-1_Speaker-2.pdf) (read 2026-09-25)

// STATION LAYOUT

How a fill and cap station is laid out

Plan view of a typical station with a backlight behind the containers. The real layout follows the site survey.

[Schematic] PLAN VIEW · NOT TO SCALE



[1] Trigger sensor: tells the station a container has arrived.

[2] Backlight: behind the containers, so the liquid line shows as an edge.

[3] Side camera: images fill level and cap profile.

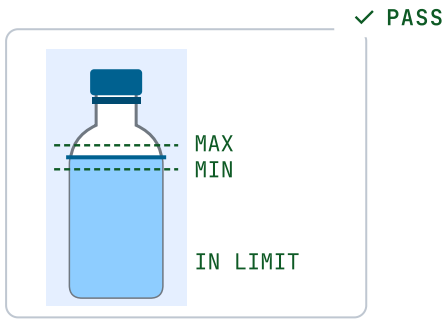
[4] Overhead camera: checks cap presence and the cap top; the tamper band is checked in the side view(s), a foil seal before capping.

[5] Reject: pushes failed containers off; a sensor confirms they left.

// PASS AND REJECT [Illustrative examples]

What a pass and a reject look like

Illustrations, not images from a real line. The fill limits and how much cap tilt is acceptable come from your specification and are set at the sample test.

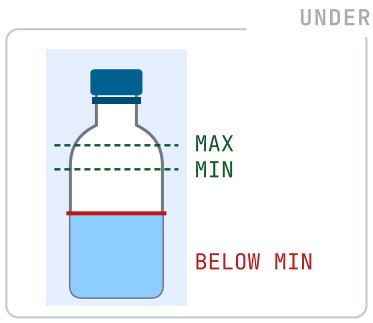


EXAMPLE // PET BOTTLE

Fill and cap correct

Liquid line between the limits, cap present and seated straight.

FILL: IN LIMIT CAP: SEATED

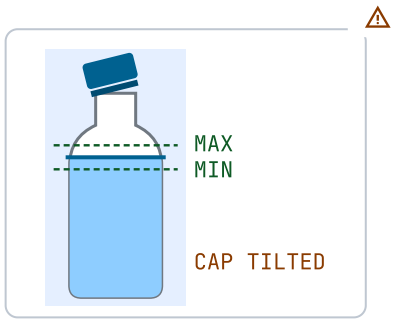


EXAMPLE // PET BOTTLE

Fill below minimum

The liquid line is below the minimum taught from good bottles. The bottle is tracked to the reject.

FILL: ✗ BELOW MINIMUM ACTION: REJECT



EXAMPLE // GLASS BOTTLE

Cap tilted and high

Fill is correct, but the cap outline is tilted and sits above the seated position.

CAP: ✗ TILTED ACTION: REJECT

// LINE INTERFACE

What we need to know about your line

These conditions decide the station design. Each is confirmed on site or during the sample test.

CONDITION	WHAT WE NEED TO KNOW	WHY IT MATTERS	CONFIRMED DURING
Container and cap range	Container materials, colours and shapes, and cap types for every SKU.	Decides whether fill can be seen and how many views caps and bands need.	Sample test
Product behaviour	Foaming, sloshing, hot fill or condensation.	A moving or foamy liquid line needs the camera placed where the surface has settled.	Site survey
Line speed and spacing	Containers per minute and the gap between them.	Sets exposure and trigger; each container must be rejected on its own.	Site survey
PLC and reject	PLC make and model, spare I/O, existing reject.	Full containers need a reject that removes them without toppling the line.	Design review
Environment	Splash, washdown and cleaning routine at the mounting point.	Decides enclosure and mounting of camera and lights.	Site survey

// ACCEPTANCE

How the station is accepted

False rejects and missed defects pull against each other. We define both, and how they are measured, before FAT and SAT.

01 02 03

False reject rate

The share of good containers rejected, measured on agreed good samples at line speed, including normal foam. The acceptable level is agreed per project.

Missed defect rate

The share of faulty containers that pass, measured with seeded under-fills, loose caps and broken bands. The target is set with you.

Written scope

A signed list of what the station checks and what it does not, such as seal appearance but not leak-tightness.

// BEFORE WE START

What to prepare for the sample test

We check your filled and capped containers before proposing a station. We confirm quantities and shipping with you first.

Sample preparation guide

Good samples

Filled, capped and sealed containers for each SKU, covering normal variation.

Defective samples

Under- and over-fills, tilted or high caps, broken bands and bad seals, clearly marked.

Specifications

Container and cap drawings, and the fill limits you work to today.

Line information

Line speed, spacing, PLC make and model, and the reject you have or need.

// FAQ

Fill, cap and seal questions

Can a camera detect underfilled bottles?

Yes, on clear or translucent bottles. A backlight behind the bottle makes the liquid line visible, and the station compares it with limits taught from good bottles. It cannot see the level inside opaque or fully sleeved containers or cans; tinted bottles depend on how much light passes through and are confirmed on samples. Fill height is also not net contents: if you must prove weight or volume, keep your weighing or measuring method.

How are missing or tilted bottle caps detected?

A cap inspection system or bottle cap inspection machine uses a side camera to see the cap profile against a backlight or plain background, so a missing, cocked or high cap shows as a changed outline. A camera from above adds a check for missing or damaged caps. The tamper band sits below the cap edge, so it is checked from the side, usually with two or more side views on round bottles. A foil or induction seal is checked before capping, while it is still visible.

Can visual seal inspection prove a package is leak-tight?

No. A camera-based seal inspection system sees whether a foil is present and whether a heat seal looks complete, creased or contaminated. A seal that looks right can still leak through a fine channel, and cap torque cannot be seen. Proving leak-tightness needs a leak test, which this station does not perform.

Can a vision sensor detect missing bottle caps?

Yes. A vision sensor, a compact camera with simple built-in tools, can check cap presence and often tilt or height from one side view. A plain photoelectric sensor can confirm presence only. When caps, tamper bands and fill level are checked together, or several views are needed, a camera station with a controller is used instead.

Is fill level inspection enough for legal metrology in South Africa?

No, not on its own. Legal metrology is about the quantity in the pack, by mass or volume, within the tolerances of SANS 458. Fill height is an indirect measure that depends on the container. A camera catches under-filled containers on every unit; proving quantity needs weighing or measuring and the check records the regulations ask for.

What about foam and sloshing?

Foam and a moving surface make the liquid line harder to find. The camera is placed where the surface has settled, and foam is included in the good samples so limits allow for it. Whether this is enough is shown at the sample test.

RELATED: Inspection checklists → Product recalls in South Africa → Food & beverage lines → Plastics & packaging → OCR/OCV & code inspection → Empty bottle & preform inspection → Presence & counting → PLC & reject integration → Preparing samples → Cost & budget guide →

LINE SOLUTIONS USING THIS: Juice box straws → Dairy cups → Wine labels → Sachets and pouches → Plastic closures → Paint tins →

COMMON IN THESE INDUSTRIES: Food & beverage → Plastics & packaging →

TYPICALLY BUILT WITH: Vision sensor (HIKROBOT SC1000–SC3000) → Area scan cameras with a vision controller → Smart camera (HIKROBOT SC5000X, SC6000) →

// FILL, CAP AND SEAL

Request an assessment for this application

Tell us about your containers, caps and line, and send good and bad samples. We will tell you what a station can check and where the limits are.

Start application assessment