APPLICATION // 07

Empty bottle inspection and PET preform inspection

Base, sidewall and finish checks on empty glass and PET bottles and jars, and gate and body checks on PET preforms, before filling or blowing.

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Request an assessment for this application

// SHORT ANSWER

Empty bottle inspection is a camera check of each empty bottle or jar before filling, at the base, the sidewall and the finish; on PET preforms the gate and body are checked before blow moulding. It finds chips, cracks that catch the light, deformation and opaque foreign objects. Each position needs its own view and lighting. It is weakest on clear liquid residue and on cracks that do not reflect light, and it cannot see into opaque containers. We confirm what is visible on your containers first.

// WHAT IT CHECKS

Inspection positions for empty bottle and preform inspection

Four positions, each with its own camera and lighting. Most lines need two or three, chosen from the faults that matter to you.

01 // BASE

Base

Foreign objects, dirt, glass and base damage, lit from below.

NEEDS

Container lifted or carried by side-grip belts

02 // SIDEWALL

Sidewall

Stones, bubbles, dirt, scuffs and misshapen containers, seen against a backlight.

NEEDS

Several views around the container

03 // FINISH

Finish and neck

Chips, cracks and uneven sealing surfaces that would stop a cap sealing.

NEEDS

Ring light and a view down onto the mouth

04 // PREFORM

Preform gate and body

Gate holes, long gates, black specks, bubbles, haze and short shots: the core checks of a PET preform inspection system.

NEEDS

Handling that shows the gate and turns the body

Why one camera is not enough

A camera sees one side of a round container. The far side, the shoulder and the base each need another view, so stations add cameras or mirrors, or turn the container or preform in front of the camera.

// HOW IT WORKS

How an empty bottle inspection machine works

An empty bottle inspection machine runs the same sequence at every position. A light is fixed for each view: a diffuse light under the base, a backlight behind the sidewall and a ring light over the

and decides to reject

The empty bottle inspection working principle behind glass bottle inspection and PET bottle inspection, from light to reject.

finish. Each container is imaged as it passes, turned or carried by side-grip belts where the base must be seen.

In each image the software looks at defined zones. A foreign object or dirt shows as a dark spot in a bright base; a chip breaks the bright ring of the finish; a deformed bottle changes the outline. Limits for the size and contrast of these deviations are taught from good containers and checked with real defect samples.

If any position fails, the container is marked. An encoder lets the PLC or vision controller follow it by position to the reject, so the right bottle is removed when the line changes speed, and a confirmation sensor raises an alarm if it did not leave. A bottle inspection system for filled product works the same way, with different views.

// IN YOUR WORDS

Returnable glass bottles: chips, foreign objects and residue

How bottling plants describe the problem, what an empty bottle inspection station checks, and where it stops.

WHAT THE LINE REPORTS	WHAT A STATION CHECKS	WHERE IT STOPS
“Glass fragments, chipped or dirty bottles”	Base and finish cameras find opaque objects, dirt and chips that break the light pattern; the sidewall camera finds what shows against the backlight.	Clear glass slivers lying flat, and anything in an opaque container, can be missed.

WHAT THE LINE REPORTS	WHAT A STATION CHECKS	WHERE IT STOPS
“Foreign matter in returned glass bottles”, “container cleanliness before filling”	Opaque foreign objects, labels and dirt on the base and sidewall of washed returnable bottles.	A thin film of clear residual liquid often looks empty; plan a dedicated residue sensor if that is the risk.
“Hair or fibres inside the bottle”	Dark fibres against the base or backlight when they lie in view and are thick enough for the resolution.	Fine or clear fibres, and fibres against the wall in the far side, are often not visible.
“Fallen or misshapen bottles on the conveyor”	Outline and height checks reject fallen, tilted and deformed containers before the filler.	Handling faults upstream still need fixing; the camera only removes the result.
“The empty bottle inspector rejects good bottles because of scratches”	Limits and lighting tuned so scuffs on returnable glass pass and real defects fail, tested on your own worn bottles.	Heavily scuffed bottle stock always raises the false reject rate; see the false reject guide.

// DEFECT LIST

Empty glass bottle defect detection: common glass bottle defects and which view finds them

Plants ask for a list of glass bottle defects and whether a camera finds each one. This is the list we work from on a bottling line; the sample test on your bottles settles each row.

GLASS BOTTLE DEFECT	WHICH VIEW FINDS IT	CAN A CAMERA FIND IT?	WHERE IT STOPS

GLASS BOTTLE DEFECT	WHICH VIEW FINDS IT	CAN A CAMERA FIND IT?	WHERE IT STOPS
Chip on the finish (lip or thread)	Finish view from above, ring or dome light	Usually, when the chip changes the outline or reflection of the finish	Very small chips are proven on your bottles before they are promised
Crack or check in the finish	Finish view with low-angle or dedicated light	Often, depending on how the crack faces the light	A crack that runs in line with the view can stay invisible
Crack in the sidewall	Two or more sidewall views, or rotation in front of one camera	When it reflects or blocks the light	Hairline cracks and cracks hidden behind embossing are not guaranteed
Glass fragment, straw or cigarette end on the base	Base view with light from below	Yes, when it shows against the base	Objects stuck high on the inside wall need a sidewall view
Dirt or residue on the inside	Base and sidewall views	Visible residue, yes	A thin film of clear liquid is hard to see; residual liquid is often checked by a separate method
Scuffing on returnable bottles	Sidewall views	Yes; whether it is a reject is a limit you set	Heavy scuffing can hide other faults in the same area
Wrong or foreign bottle	Sidewall and top views	When shape, height, colour or embossing differs	A foreign bottle identical to yours in every visible feature

GLASS BOTTLE DEFECT	WHICH VIEW FINDS IT	CAN A CAMERA FIND IT?	WHERE IT STOPS
Stones, seeds or blisters in the glass	Sidewall views	Larger inclusions, sometimes	Inclusion inspection belongs to the glass maker’s cold-end inspection machines
Wall thickness and strength	—	No	Needs non-visual testing; a camera does not test strength

This is inspection of empty glass bottles on the filling line. New bottles are inspected at the glassworks by cold-end inspection machines, which are dedicated equipment from glass-machine suppliers; addaScan does not build those. For returnable crates before the washer, see **crate inspection**.

// CONTAMINATION LIMITS

What a camera can and cannot see inside an empty container

Contamination is why most plants ask, and where the limits matter most.

CONTAMINATION OR FAULT	CAN A CAMERA SEE IT?	WHERE IT STOPS
Opaque objects and dirt	Usually: they block the light.	Very small or pale objects are confirmed on samples.
Clear liquid residue	Often not: a thin clear film looks like an empty base.	Dedicated empty-bottle inspectors add non-camera sensors for this.
Cracks in glass	When the crack reflects or bends light to the camera.	A hairline crack at the wrong angle can pass.

CONTAMINATION OR FAULT	CAN A CAMERA SEE IT?	WHERE IT STOPS
Specks and bubbles in the wall	Yes, in clear glass or PET against a backlight.	Not in opaque, dark or fully sleeved containers.

× Not detectable with a camera

- **Inside opaque containers.** Dark, opaque or sleeved containers block the light.
- **Strength and leak-tightness.** A camera does not test burst pressure, wall thickness or sealing.

✓ Works reliably when

- **Light passes through.** Clear or lightly tinted glass and PET, shielded from daylight.
- **Handling is stable.** Containers are spaced, gripped or turned the same way each time.

// EVIDENCE

What you can check before you ask us

How feasibility is decided on your own samples, and the published budgets of complete line solutions that use this check.

ENGINEERING METHOD

How a sample test is judged

Samples
Good samples that show normal variation, and defective samples for each defect you need to catch, including borderline ones.

Imaging
Imaged under candidate lighting and optics; what is, and is not, visible is recorded.

BUDGET MODEL

Installed budgets of line solutions that use this check

Returnable crates
R 250 000 – R 1 370 000

Basis

Acceptance
False rejects and missed defects are agreed in writing and measured at FAT and SAT.

Outcome
A written feasibility conclusion with example images, before any proposal.

`The method used on every project; not a measured result.`

How to prepare inspection samples →

Indicative budget for a typical application, in rand, excluding VAT, as at 2 October 2026, low to high configuration. A firm price follows the sample test.

`Each figure is for a complete station on that line, not a price for this check on its own.`

All line solutions with budgets →

`// SOUTH AFRICA`

Foreign matter rules and empty containers

Where empty bottle inspection fits in a food safety plan in South Africa.

The hygiene regulations R638 (2018) define contamination to include foreign matter, and require light fittings to be protected to prevent glass contamination of food (R638 gazette). FSSC 22000 version 6 (2.5.11(d)) asks certified sites to decide, through a risk assessment, whether foreign-body detection equipment is needed and which type (FSSC 22000 Version 6). Empty container inspection is one control that can come out of that assessment, alongside cleaning, rinsing and the site's glass policy. Neither document requires a camera.

SOURCES FOR THIS SECTION

1. 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)`

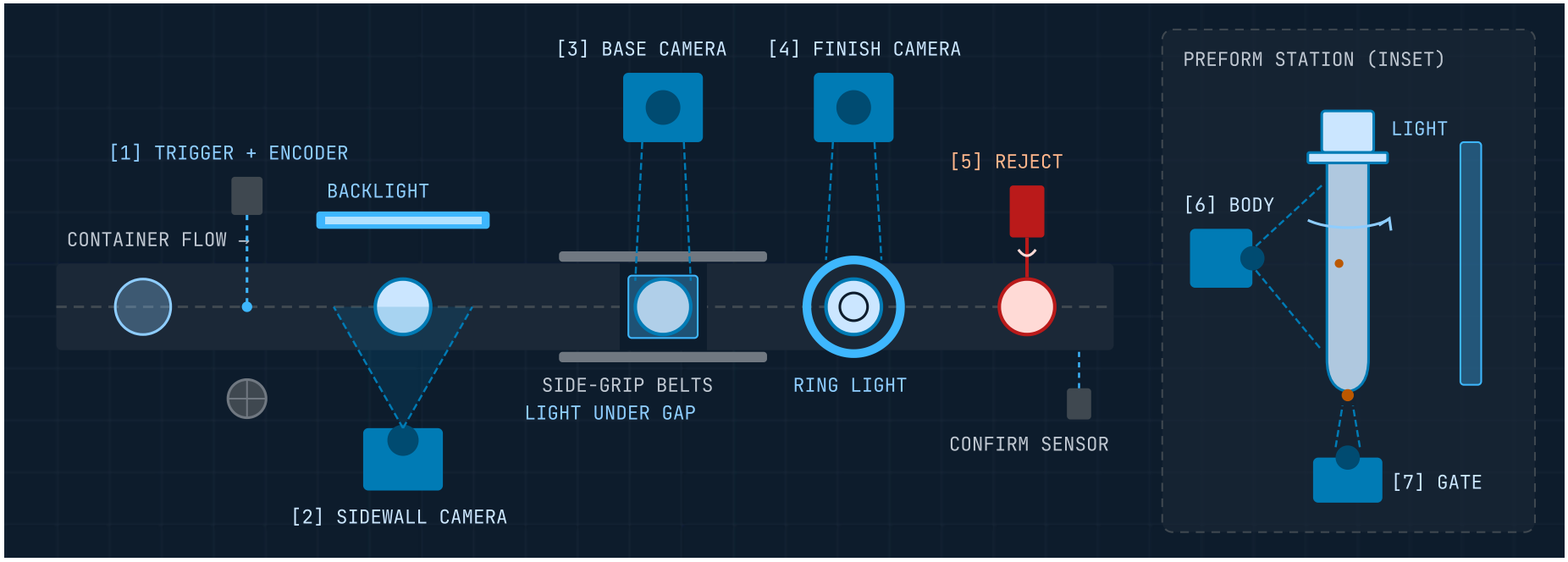
2. FSSC 22000 Scheme Version 6, Part 2, 2.5.11(d) foreign matter management (https://www.fssc.com/wp-content/uploads/2023/03/FSSC-22000-Scheme-Version-6-.pdf) (scheme document, read 2026-09-25)

// STATION LAYOUT

How an empty container station is laid out

Plan view of a typical station, with a preform station inset. The real layout follows your handling.

[Schematic] PLAN VIEW · NOT TO SCALE



[1] Trigger + encoder: marks each container and tracks its position.

[2] Sidewall camera: looks through the container against a backlight.

[3] Base camera: side-grip belts carry the container over a light.

[4] Finish camera: ring light shows chips on the sealing surface.

[5] Reject: removes failed containers; a sensor confirms it.

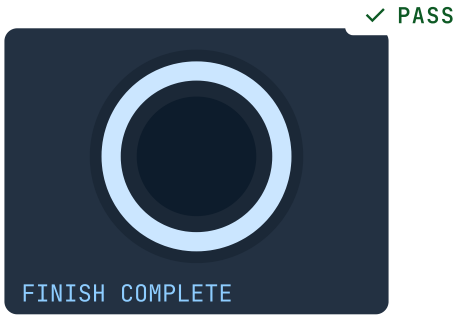
[6] Preform body: backlit view while the preform turns.

[7] Preform gate: camera views the closed end and injection point.

// PASS AND REJECT [Illustrative examples]

What a pass and a reject look like

Illustrations, not images from a real line. Which faults count, and how small, is agreed with you on real containers during the sample test.

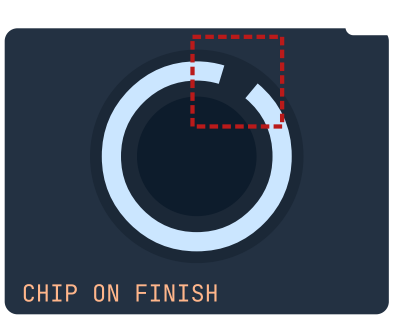


EXAMPLE // GLASS BOTTLE FINISH

Finish complete

The sealing surface shows as an even, unbroken ring under the ring light.

FINISH: IN LIMIT ACTION: PASS



EXAMPLE // GLASS BOTTLE FINISH

Chip on the finish

A break in the bright ring shows a chip that could stop the cap sealing.

FINISH: ✗ CHIP ACTION: REJECT



EXAMPLE // JAR BASE

Foreign object on base

The opaque object blocks the base light and is found. The clear liquid beside it barely shows.

BASE: ✗ OBJECT ACTION: REJECT

// HIGH-SPEED REJECT

Removing the right container at line speed

An encoder on the conveyor lets the PLC or vision controller track each container by position, not time, so the reject fires on the right one when the line changes speed. The air jet, pusher or diverter is chosen for the container, and a confirmation sensor raises

an alarm if a failed container did not leave.

CONDITION	WHAT WE NEED TO KNOW	WHY IT MATTERS	CONFIRMED DURING
Container range	Glass, PET or HDPE; colours; new or returnable; every format.	Decides which positions are feasible.	Sample test
Handling	Conveyor, star wheel, side-grip belts, rollers or hopper.	Base, gate and all-round views need gripping, lifting or turning.	Site survey
Speed and spacing	Containers per minute and how evenly they arrive.	Sets exposure and whether each container can be rejected on its own.	Site survey
PLC and reject	PLC make and model, spare I/O, existing reject.	Glass must leave without breaking or toppling its neighbours.	Design review

// ACCEPTANCE

How the station is accepted

Agreed before FAT and SAT.

01 02 03

False reject rate

Good containers rejected, measured on agreed samples that cover normal variation.

Missed defect rate

Defective containers that pass, measured with known defects at each position.

Test containers

Marked containers with known faults, run at shift start or changeover to show each position still detects.

// EVIDENCE

What an empty container station can take on, and how fast it must decide

Dedicated inspectors compared, a timing example, preform inspection roles and acceptance statistics.

Camera station or dedicated empty bottle inspector?

Dedicated empty bottle inspectors combine cameras with sensors a camera station does not have. HEUFT, for example, describes optical base inspection for low-density foreign objects such as film, cigarette ends and insects; finish and thread inspection for defects, cracks and rust rings; a 360° sidewall inspection with up to eight views and the bottle rotated between stations; and residual liquid detection that finds lye by high frequency and oil or varnish by infrared, at up to 84,000 bottles per hour (HEUFT InLine II IS). Those are the vendor’s statements. The table shows which checks a camera station can take on.

CHECK	HOW IT IS DONE	POSSIBLE WITH A CAMERA STATION?	NOTE
Base: opaque foreign objects, glass, dirt	Camera with light from below	Yes	HEUFT names film, cigarette ends and insects as low-density objects its optical base inspection finds

CHECK	HOW IT IS DONE	POSSIBLE WITH A CAMERA STATION?	NOTE
Finish and thread: chips, cracks, rust rings	Camera with ring or angled light from above	Yes, where in view	Dedicated machines add separate finish and thread optics
Sidewall: inclusions, cracks, contamination	Cameras against a backlight, several views	Partly: the views you can afford	HEUFT describes up to eight views covering more than 360°, with the bottle rotated by servo
Residual caustic lye	High-frequency sensor	No	A non-camera sensor; part of dedicated inspectors
Residual oil or varnish	Infrared sensor	No	A non-camera sensor; part of dedicated inspectors

The practical consequence for returnable glass in South Africa: if residual caustic or liquid is a real risk after the washer, a camera station alone is not the answer. Where the risk is foreign objects, chips and damaged finishes on a slower line or on non-returnable containers, a camera station is often the proportionate choice.

Worked example: time per container and tracking to the reject

At 36,000 bottles per hour, ten bottles pass each second, so each has 100 ms for imaging and the decision. With bottles touching at a 100 mm pitch, the conveyor runs at about 1 m/s. If the reject sits 1.5 m after the cameras, about 15 bottles are between camera and reject at any time, which is why each result is tracked by an encoder and shift register rather than by a timer. Figures are arithmetic on the stated assumptions.

BOTTLES PER HOUR	BOTTLES PER SECOND	TIME PER BOTTLE	CONVEYOR SPEED AT 100 MM PITCH	BOTTLES BETWEEN CAMERA AND A REJECT 1.5 M AWAY

BOTTLES PER HOUR	BOTTLES PER SECOND	TIME PER BOTTLE	CONVEYOR SPEED AT 100 MM PITCH	BOTTLES BETWEEN CAMERA AND A REJECT 1.5 M AWAY
18,000	5	200 ms	0.5 m/s	15 bottles
36,000	10	100 ms	1.0 m/s	15 bottles
60,000	about 16.7	60 ms	about 1.5 m/s	about 17 bottles (90 mm pitch)

Preforms: inline or sample inspection?

Preform inspection is offered both as 100 % inline inspection behind the moulding machine and as laboratory sample inspection of detailed quality features; INTRAVIS, for example, lists an inline system at 72,000 preforms per hour and a laboratory system at up to 1,200 per hour (INTRAVIS brochure). A line station from addaScan sits in the first group: gate, specks, bubbles and short shots on every preform; dimensions such as neck ovality are a measurement task and stay with the laboratory or a dedicated gauge.

Light and acceptance

Base and sidewall checks use transmitted light: a backlight shows the container as a silhouette in which opaque objects block the light, and shadowless light evens out the bright and dark patches of moulded glass (HIKROBOT light catalogue, glossary). Acceptance uses your own containers with real faults placed in them. A run of 100 seeded containers with no misses bounds the miss rate for that fault at about 2.6 % with 95 % confidence, using the Wilson method in NIST's handbook (NIST e-Handbook, 7.2.4.1); the claim tightens as challenge passes accumulate in production.

SOURCES FOR THIS SECTION

1. HEUFT InLine II IS empty bottle inspection: base, finish and thread, 360° sidewall, residual liquid by high frequency and infrared (https://heuft.com/en/product/beverage/empty-containers/empty-bottle-inspection-heuft-inline-ii-is) `(vendor page, read 2026-10-27)`
2. INTRAVIS preform inspection brochure: 100 % inline, offline sorting and laboratory sample inspection (https://api.petnology.com/fileadmin/user_upload/redakteure/comPETence_center/INTRAVIS/Downloads2022/intravis-preforms-information-brochure-EN.pdf) `(vendor brochure, read 2026-10-27)`
3. HIKROBOT Light Source Catalogue 2025 Q3, glossary pp.76–79 (backlight, shadowless, low-angle light) (https://www.hikrobotics.com/en2/source/vision/video/2025/7/21/Light%20Source%20Catalog_ENG_2025Q3_v2.pdf#page=77) `(vendor catalogue, read 2026-10-27)`
4. NIST/SEMATECH e-Handbook, 7.2.4.1 Confidence intervals for a proportion (https://www.itl.nist.gov/div898/handbook/prc/section2/prc241.htm) `(NIST, read 2026-10-27)`

`// BEFORE WE START`

What to prepare for the sample test

We image your containers at each position before proposing a station.

Sample preparation guide

Good containers
Containers or preforms that pass today, across colours and moulds.

Defective containers
Each fault to catch, including borderline ones, marked.

Container drawings
Drawings or photos of every format that runs.

Line information
Speed, handling, PLC make and model, existing reject.

`// FAQ`

Empty container and preform questions

What is the working principle of an empty bottle inspector?

Each inspection position lights the empty container in a fixed way and images it. The software compares brightness patterns, edges and dark spots in defined zones with limits taught from good containers. A container that fails at any position is tracked to the reject by position and removed; a sensor confirms it left.

What is an EBI, or electronic bottle inspection machine?

EBI is the bottling name for an electronic bottle inspection machine, also called an empty bottle inspector: it checks each empty bottle before the filler, at the base, the sidewall and the finish. The camera principles are the ones on this page. Which inspection positions a line needs, and whether a camera station on the existing conveyor can cover them, is decided from your faults and the sample test.

Can a camera find glass fragments in an empty bottle?

Often, if the fragment lies on the base or sits against the backlight and blocks or bends light. A clear sliver lying flat can be almost invisible. The sample test uses real fragments in your bottles to show what is caught.

Where on an empty bottle or jar can a camera inspect?

At the base, the sidewall and the finish (sealing surface and neck), each with its own camera and lighting. Which positions you need depends on the faults that reach your filler or your customers.

Can a camera detect residual liquid in an empty bottle?

Only sometimes. Coloured or cloudy liquid can show at the base, but a thin film of clear water or caustic solution often looks empty. If residue is a real risk on returnable bottles, plan a dedicated sensor for it.

Can machine vision find cracks in glass bottles?

Many, yes: cracks that reflect or bend light show up bright under angled light. A fine crack that sends no light to the camera can be missed. The station does not test pressure resistance or leak-tightness.

What can preform inspection find?

Gate holes and long gates, black specks, bubbles, haze, colour deviation, short shots and neck-finish damage, if each area is lit and in view. Neck diameter and ovality are measurement tasks, covered on the dimensional measurement page.

How are rejects handled when containers run close together?

Each container is tracked from camera to reject, usually with an encoder, so timing follows speed changes. An air jet, pusher or diverter removes it, and a confirmation sensor checks that it left.

Should preforms be checked at the moulding machine or before blowing?

Either works. At the moulding machine, faults show while the cause is still running. Before the blow moulder, bad preforms are removed before they become bottles. The deciding factor is usually where handling already presents preforms one by one.

Fill level, cap & seal → Surface defect detection → Dimensional measurement → Plastics & packaging →

RELATED: Food & beverage lines → PLC & reject integration → Reducing false rejects → Machine vision lighting → How we deliver →

LINE SOLUTIONS USING THIS: Returnable crates → Returnable glass bottle inspection →

COMMON IN THESE INDUSTRIES: Food & beverage →

TYPICALLY BUILT WITH: Area scan cameras with a vision controller → 3D laser profiling →

// EMPTY CONTAINERS & PREFORMS

Request an assessment for this application

Tell us which containers you run and which faults matter. We will tell you which positions can be inspected and where the limits are.

Start an assessment