IS MACHINES · FORMING · JOB CHANGES

IS PRODUCTION & MAINTENANCE.

> "The IS production is the cornerstone where everything materialises... All spotlights are on us!"

Empakglass's IS Machines & Production department provides its partners with technical support that ranges from the initial installation project to the everyday operation and troubleshooting.

Our goal is to give our partners the tools to become the problem solver, and to build the IS production efficiency themselves.

That is why we prepare and help our partners to analyse, plan and perform, on a consistent and standardised basis, all the tasks that lead, at the end of the day, to pallets filled with containers that meet the filler's quality requirements. Collaboration and communication with the other departments is fundamental for an optimal flow of information.

FORMING & JOB CHANGES.

FORMING AND GLASS CONDITIONING

1. Understand how the different forehearth designs work and influence the operation and the thermal homogeneity of the gob.
2. Set up the proper operation according to the riser, working end and gob temperatures for the required pull.
3. Prepare the forehearths for a job change with different weights and operating temperatures: forehearth set-ups.
4. Forehearth refractory and burner preventive maintenance.
5. When to change orifice rings, revolving tubes, plungers and stirrers: accessories and standard wear rate.
6. Troubleshooting glass defects generated in forehearths (blisters and stones), using the Troubleshooting Manual for a faster assessment of the cause.

JOB CHANGES

1. Understand the influence of a job change and start-up on the overall performance of a glass plant.
2. Influence of production planning on the total monthly job change time: the Job Change Index (JCI) and KCR.
3. Main objective: reduce the non-production time (t1) caused by job changes and improve the ramp-up time (t2), by doing it right the first time.
4. Identify the areas and factors that influence job change time and coordinate them into improvement modules with a defined team.
5. Organise the job on / job off meetings and collect and use the necessary data.
6. Gob ready before the end of the IS mechanical job change (forehearth, feeder and delivery systems ready).
7. The proper gob for each specific job, and the factors that take most time in making it.
8. Standard procedure for orifice ring changes; the “Team Gob” objective control datasheet; gob and process data collection.
9. Job change SMED, and all components (IS accessories, tools, moulds…) ready and in proper condition before the job change stop.

MAINTENANCE & START-UP.

IS MAINTENANCE

1. Establish the procedures for good and consistent IS maintenance.
2. Minimise IS machine interruptions due to accessory failure.
3. Preventive maintenance plan for IS parts: every accessory on the machine in good condition.
4. Standardise the IS accessories and components.
5. Controlled and scheduled preventive check-up of all IS accessories (neck ring arms, holders…).
6. Assess the containers and related accessories in use on the existing IS lines.
7. The importance of standardised, defined mould design set-ups.

IS PRODUCTION START-UP

1. Get all IS sections under glass as fast as possible after the IS mechanical job change.
2. Optimise the “cold run” set-up (without glass).
3. Change all transport components (pushers…) before the start-up under glass.
4. Transport quality: no bottles falling on the conveyors to the lehr.
5. Reduce, step by step, the minutes between the first gob in the first section and all sections at 90% PTM: the job change index in action.
6. Fast defect identification and correction during start-up; troubleshooting the most common defects of each plant.
7. Standard procedure for the start-up of IS machines.
8. Hot end coating set-up and control; lehr set-up and control.







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BATCH · FURNACES · GLASS CONDITIONING

BATCH & FURNACE.

> "The best way to sum up a good B&F operation is to keep a low profile in the everyday operation, by being sure that it fully supports the hot end."

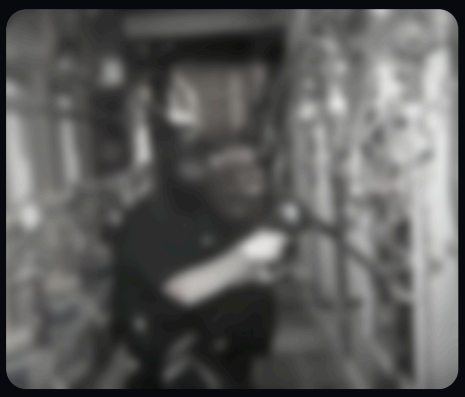
Although not as visible as IS production and glass mould design, the Batch & Furnaces operation is paramount in the global process of producing glass.

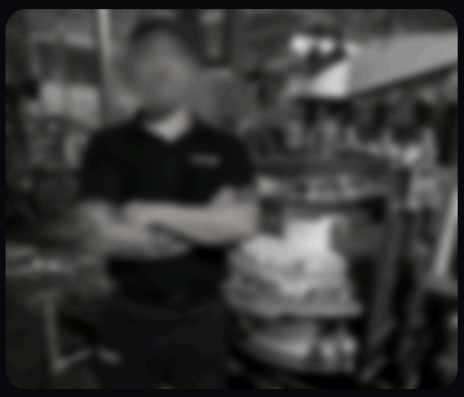
Because of the specificity of this step (raw materials, energy consumption and installation amortisation), it is the major contributor to the total specific cost of a glass container. That makes it decisive for a glass plant's competitiveness on a given target market, which also changes during a furnace campaign (usually around a decade).

FROM PROJECT TO OPERATION.

Empakglass's B&F department provides its partners with technical support that ranges from the initial installation project to the everyday operation. Our goal is to produce glass at the lowest possible cost, with the required quality, to maximise both the installation lifetime and the IS production efficiency.

That is why we prepare and help our partners to analyse and improve the furnace operation consistently, and to push for permanent maintenance and repair of the installation.





INSTALLATION PROJECT SUPPORT

We assist the client, according to the requirements, on the type and design of the installations needed: batch installation, furnace, working end and forehearths, and the support equipment such as transformers and ventilation.

OPERATION AND ECONOMICAL SUPPORT

On an already running installation, we start with an audit to determine whether the glass composition in use is both economical and suited to the company's product mix and furnace operation. We also focus on training the teams that handle the furnace every day.

The objective is clear: maximise furnace lifetime and reduce energy consumption, through consistent standardisation of the operation and through furnace inspection and maintenance.

OPTIMISE. TRAIN. SIMULATE.

OPTIMISATION PROCEDURES

Energy costs are not cheap anywhere, and the only thing we can expect is a constant increase. With very low or no investment, many improvements can be made to the furnace operation. They reduce the energy needed to produce the same amount of glass, in the same conditions, or even increase furnace output.

TRAINING PROGRAMME

Understanding the chemistry of glass production, and why installations are built the way they are, gives the teams in a glass plant the background to operate this equipment.

The objective of the training programme is to give our partners the maximum knowledge so they become fully independent in the everyday running of a B&F installation.

SOFTWARE PACKAGES

With day-to-day experience in running batch and furnaces, Empakglass has developed a range of software packages that give the user better decision-making tools:

1. Batch & glass properties simulator
2. Furnace operation simulator
3. Working end & forehearth simulator

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COLD END · QUALITY · INSPECTION

QUALITY CONTROL & INSPECTION.

> "The modern quality philosophy in glass container manufacturing must incorporate a 'right first time' attitude..."

This attitude may not automatically result in perfect containers every time but, correctly applied at each stage of manufacture, it minimises the production of substandard goods.

It also highlights the areas of production where they occur, which makes a good standard of production efficiency attainable and helps contain manufacturing costs.

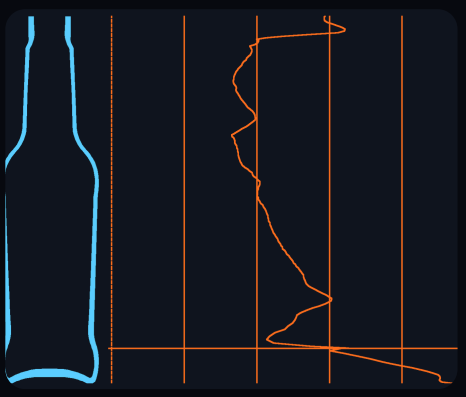
Prevention is the best way to make sure the customer does not receive substandard goods or service. Investment in preventing quality failures protects the customer and pays dividends in lower costs of waste, errors, re-work and checking.

THREE AREAS OF CONTROL.

Process control and quality assurance in glass container manufacturing take place in three main areas:

1. Pre-production quality assurance;
2. Quality assurance and quality control during production;
3. Quality assurance and quality control in the laboratory.







BEYOND MANUFACTURING CONTROLS

In the glass container factory the quality philosophy is not confined to manufacturing controls. It also covers other areas of good manufacturing practice, such as essential hygiene controls.

Some control points in the process are more serious than others. The most critical points are identified through HACCP (Hazard Analysis Critical Control Point) type analyses. These not only determine the critical points, but also the design, type and application of the appropriate control and monitoring procedures.

Empakglass provides integrated support services that embody this approach to quality, for glass producers, fillers, sellers (distributors) and suppliers.

HOW WE SUPPORT YOU.

Our cold end and quality control department supports our partners in the following areas.

IN COURSE OF PRODUCTION

1. Cold end SOPs
2. Quality control SOPs
3. Line flow optimisation and audits
4. Inspection machine tooling development
5. Process control methods
6. Statistical analysis
7. Container technical specification datasheets
8. Gauge design & construction
9. AQL determination according to product specifications
10. Packing development and optimisation

RISK ANALYSIS AND CLAIMS

1. Production line risk assessment based on proven technical expertise
2. Advisory services for risk mitigation
3. Technical expertise in claims investigation
4. Independent analysis of the causes of claims

TRAINING PROGRAMMES.

Empakglass offers five training programmes for the glass packaging industry, delivered at your plant or at our office.

GLASS CONTAINER TECHNOLOGY · 3 DAYS – 24 HOURS

1. Introduction
2. Glass containers standards and nomenclature
3. Glass
4. Process overview
5. Batch
6. Melting
7. Glass conditioning
8. Forming
9. Hot end coating
10. Annealing
11. Cold end coating
12. Inspection and quality control
13. Palletizing, shrink wrapping and warehousing
14. Container requirements

COLD END & QUALITY CONTROL · 4 DAYS – 32 HOURS

1. Introduction
2. Glass
3. Strength of glass
4. Upstream process overview
5. Surface treatments
6. Quality assurance
7. Inspection procedures
8. Automatic inspection
9. Quality laboratory tests
10. Palletizing, shrink wrapping and warehousing
11. Cold end job changes
12. Basic food safety
13. Container requirements

AUDITS, FOOD SAFETY & BREAKAGE.

GLASS CONTAINER PLANTS AUDITS · 2 DAYS – 16 HOURS

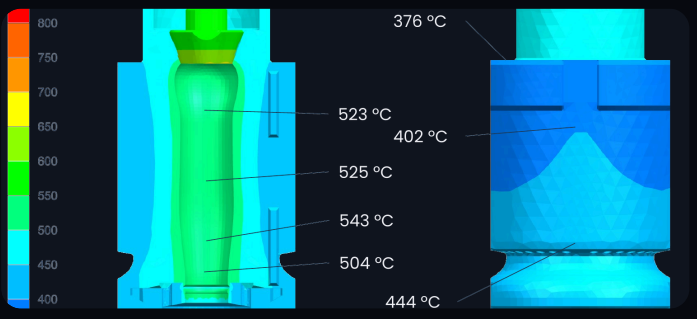
1. Overview
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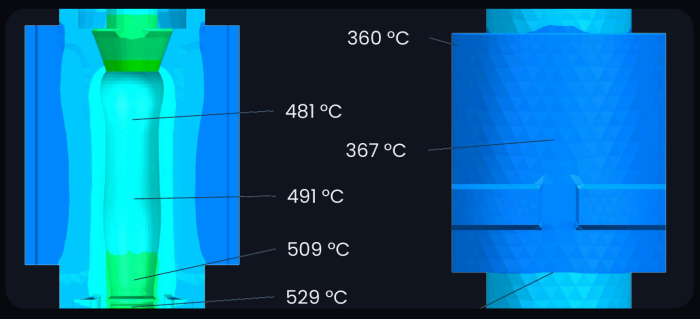
FOOD SAFETY FOR GLASS CONTAINER PLANTS (ISO 22000 AND FSSC 22000) · 3 DAYS – 24 HOURS

1. Introduction to food safety management systems
2. Hazard analysis and critical control point (HACCP) system
3. Prerequisite programs (PRPs)
4. Hazard control accordingly with ISO 22000
5. ISO 22000 requirements
6. FSSC 22000 additional requirements
7. ISO 9001 vs ISO 22000 / FSSC 22000

BREAKAGE ANALYSIS · 1.5 DAYS – 12 HOURS

1. Strength of glass
2. Fractography





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MOULDSHOP · OPERATIONS · COST CONTROL

MOULDSHOP MAINTENANCE.

> "The mouldshop is, conceptually, the main supplier and an extension of IS production. It should be a self-sufficient operational unit that costs less than an outsourced equivalent."

For an IS machine to run properly, the moulding components must be dimensionally and physically in accordance with the glass mould design specifications. In the real world nothing lasts forever, so mouldshop personnel are constantly required to assess whether components can stay in production.

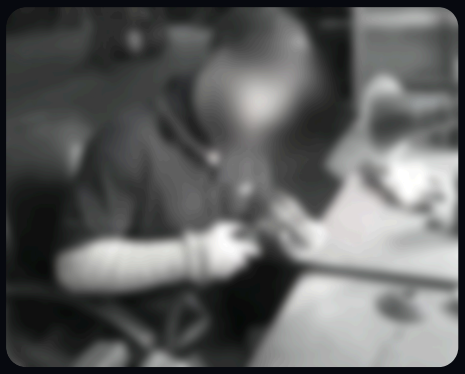
By correlating glass and mould dimensions, and through good maintenance and organisational practices, mould lifetime can be maximised, costs reduced and ordering patterns anticipated, which lowers the risk of late acquisitions.

A SELF-SUFFICIENT UNIT.

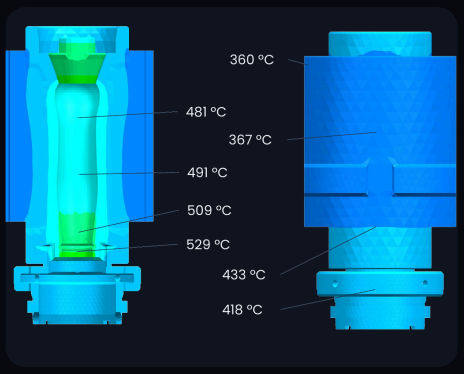
At Empakglass we treat the glass mouldshop as a self-sufficient operational unit that, compared with an equivalent outsourced operation, must cost less and so justify its existence.

The financial management of this department carries a very relevant share of the total specific cost of producing glass. It must always be kept under scrutiny and be a driving force for lower prices in mould purchases from the plant's main mould suppliers.

Empakglass's mouldshop department therefore provides partners with technical support that ranges from the installation project and layouts, through the everyday operation, to a financial approach.







INSTALLATION PROJECT SUPPORT

We assist the client on the type and design of the required installations, and in identifying the equipment needed to guarantee the everyday production operations.

SOFTWARE DEVELOPMENT

Software for analysing the daily operation, and as a cost-effective control tool, gives the mouldshop manager a clear picture of the operation. It is also a very effective tool for KPI analysis.

OPERATION & TRAINING.

THE OPERATION AND ECONOMICAL SUPPORT

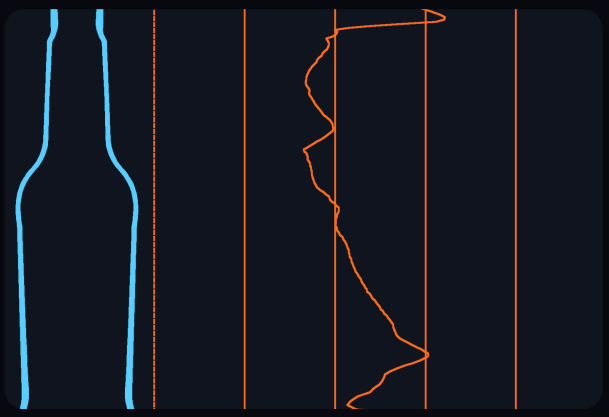
1. On an already running installation we start with an audit to determine whether the mouldshop methods and procedures used in the daily operation are technically and economically efficient.
2. Prepare the teams on how to handle the mould equipment every day.
3. Maximise mould component lifetime, reduce the impact of problems in production, and reduce the cost per tonne of glass produced.

TRAINING

Understanding why certain procedures must be followed in the mouldshop is the main goal of the training programme. We give our partners as much knowledge as possible, so they can run the everyday operation independently. Topics include:

- Standard operating procedures for mould repair and maintenance
- Types of materials, castings and surface hardening
- Important dimensions and clearances for each moulding component
- The correlation between mould dimensions and the corresponding glass dimensions: moulding component lifespan





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PARISON DESIGN · FORMING SIMULATION · COOLING

MOULD EQUIPMENT DESIGN.

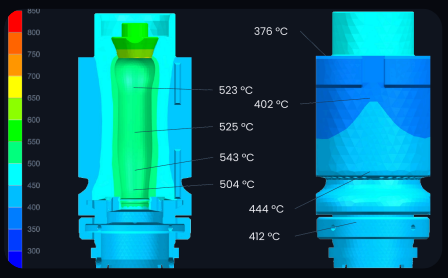
> "DRIFT (do it right first time) and OTIF (on time, in full delivery) are our priorities."

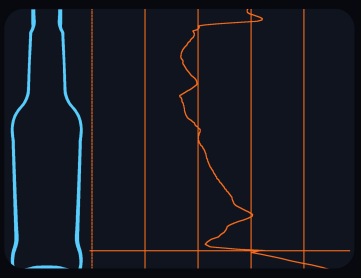
Today's competitive pressures require companies to use every tool at their disposal. Process simulation is unquestionably instrumental in cost, quality and delivery improvements.

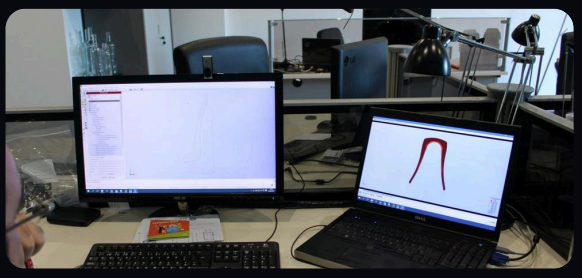
After the final container design approval, FEA technology is fundamental to predict the final glass wall thickness distribution, taking into account the correct parison design, the production process, the glass composition and the IS machinery used (delivery system, cooling system and machine timing).

The Empakglass approach gives our customers a higher starting point at a very early production stage. This reduces the number of trials needed before sampling approval for final production.

FROM DESIGN TO COOLING.







PARISON DESIGN & CONTAINER FORMING SIMULATION

1. Develop the appropriate parison design for your specific container, guiding you to an optimised and even glass thickness.
2. Simulate and assess the forming process based on your current or newly developed parison designs, guiding you to the optimal shape.
3. Perform lightweighting trials on your containers, avoiding the traditional trial-and-error approach.

IS MACHINE VARIABLES

- Orifice ring diameter
- Scoop, trough and deflector sizes
- Blank side assembly variables
- Blow side assembly variables

MOULD EQUIPMENT DRAWINGS

- Blank mould, blow mould, neck ring, baffle
- Loading funnel, plunger, cooling tubes
- Thimble, bottom plate...

MOULD COOLING DEVELOPMENT & ANALYSIS

Designing the most appropriate cooling schemes on:

1. Blank and blow moulds;
2. Neck rings;
3. Optimising the plunger cooling tube design for P&B and NNP&B;
4. Reducing thermal defects.

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EMPAK GLASS SOLUTIONS

SERVICES & TRAINING

FEA · STRESS ANALYSIS · EMPAKTOR

PRODUCT DEVELOPMENT.

> "Most businesses today must commit to fast response and good quality (OTIF). To bridge the gap between concept and production, technology is perhaps the most powerful tool."

Empakglass's mould design department uses the latest FEA technology to help fillers, distributors and glass plants develop the most optimised container, in terms of design and physical characteristics, for a given filling line speed and end-customer requirements.

By applying this technology and know-how at a very early stage, Empakglass avoids the traditional trial-and-error approach. The studies highlight all the critical design features that can compromise container performance.

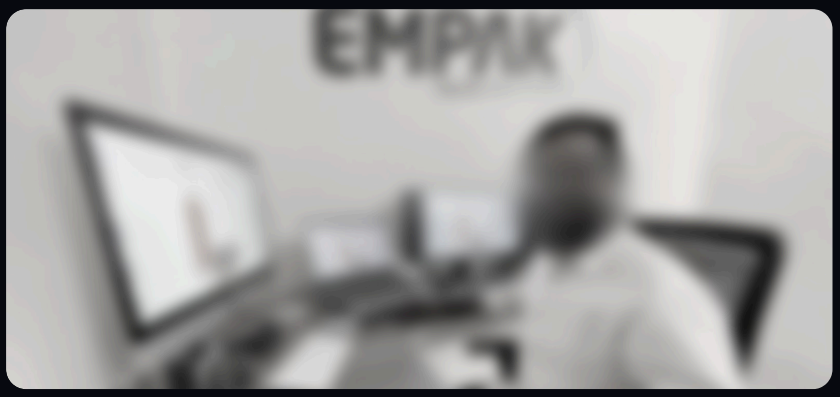
The results can also feed the risk analysis studies that fillers normally perform before launching a new product on the market.

STRESS ANALYSIS & CONCEPT.

STRESS ANALYSIS

By calculating the stress levels of a container under vertical load, internal pressure and filling line impact, we determine its resistance and suggest design changes to optimise its performance.

- **"To what extent is my container resistant?"** Stress levels under vertical load, internal pressure and line impact.
- **"Why is my container breaking?"** We assess the causes of load failures and guide the actions needed for a good quality standard.
- **"Is my lightweight container resistant enough for these loads?"** The latest FEA technology helps you reach a safe lightweight container.





BRIDGING THE GAP BETWEEN CONCEPT AND PRODUCTION

1. Bridge the gap between marketing and final design solutions.
2. Shorten the time between concept and first production run.
3. Collaborate with mould manufacturers to speed up the development of new products.

3D RENDERING FOR YOUR BRAND

1. Support marketing with realistic images using 3D rendering technology.
2. Develop professional-looking catalogues and websites.

EMPAKTOR & TRAINING.

SOFTWARE DEVELOPMENT: THE EMPAKTOR SUITE

1. The EmpakTOR Suite is engineering software that lets designers analyse the forming of glass containers and understand their mechanical behaviour under static and dynamic loads.
2. The user simulates the production processes on a computer, instead of going back to shop-floor trial and error.
3. It has proven extremely effective on a wide range of round container shapes.
4. It covers all production processes and uses the exact customer glass composition.
5. It is currently available only for consulting, training and contract simulation on a project basis.

TRAINING

At Empakglass we believe knowledge only has value if it is used and shared. On this principle we developed the most complete mould design / product development training available to the industry, covering:

1. Introduction and goals of this seminar
2. Mould design department tasks
3. How glass influences the mould design
4. IS timing
5. BB production process
6. WMPB production process
7. NNPB production process
8. Weight control
9. Container development
10. Exploring design with the filling line layout
11. Lightweighting as a case of container iterations
12. General rules for equipment development
13. **BB parison design rules** (with several real case examples)
14. **WMPB design rules** (with several real case examples)
15. **NNPB design rules** (with several real case examples)
16. **Mould equipment components**; 16.1 Mould design limits and restrictions (looking into the MD Manual); 16.2 Using the Mould Design Manual for a particular IS machine
17. **Blank side and blow side cooling**
18. **Material specifications** and their influence on performance
19. **Edge metallisation**

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TRAINING & SUPPORT PROGRAMMES

MOULD DESIGN / PRODUCT DEVELOPMENT.

> We combine the strength of technology with knowledge and experience, so that our customers gain an edge over the competition in the glass packaging industry.

Choosing strategic partners is a key factor in any business, which is why EMPAKGLASS is the right partner for you.

Training and support programmes. Detailed training plan prepared by the mould design department.

THE TRAINING.

THE MOULD DESIGN / PRODUCT DEVELOPMENT TRAINING COVERS

1. **Product development:** knowing what the containers are used for, and creating a design that improves and optimises line performance.
2. **Definition of the production process** and the rules of parison design.
3. **Interaction of the mould parts:** knowing the limits of the machine and choosing the right assembly.

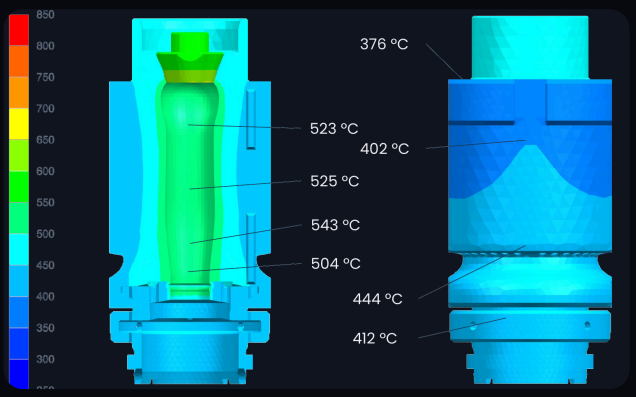
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working days, combining theory and practice

Real cases

Participants are encouraged to bring their real case scenarios to test us



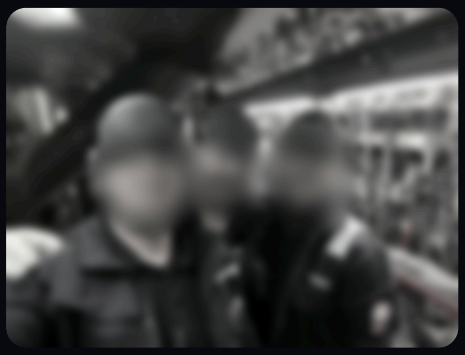


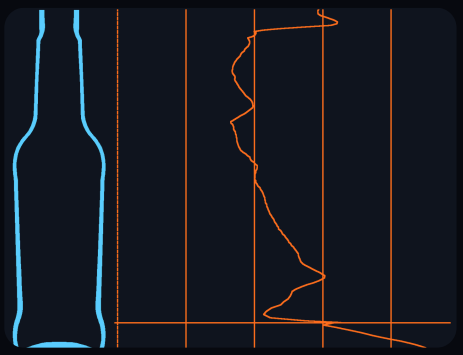
NOTES

1. For customers starting out in the glass industry, additional training days should be considered.
2. The training combines practical and theoretical work. We encourage participants to bring their real case scenarios to test us.

CONTENTS (1/2).

1. Introduction and goals of this seminar
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12. General rules for equipment development







CONTENTS (2/2).

PARISON DESIGN RULES, EQUIPMENT AND COOLING

13 **BB parison design rules** (with several real case examples)

14 **WMPB design rules** (with several real case examples)

15 **NNPB design rules** (with several real case examples)

16 **Mould equipment components**
16.1 Mould design limits and restrictions (looking into the MD Manual)
16.2 Using the Mould Design Manual for a particular IS machine

17 **Blank side and blow side cooling**

18 **Material specifications** and their influence on performance

19 **Edge metallisation**

Your plant

The training can be held at the customer's site

Our office

or at the Empakglass premises

Quote

Basic costs are defined and adapted to your requirements

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TRAINING PROGRAMMES · GLASS CONTAINER INDUSTRY

GLASS CONTAINER TECHNOLOGY.

> "From the batch house to the pallet: five programmes to build real know-how in your team."

Empakglass training programmes combine theory with practical, plant-based experience, and can be adapted to the audience and held at your plant or at our office.

They cover the whole container manufacturing process, quality control and inspection, plant audits, food safety and breakage analysis.

TRAINING PROGRAMMES.

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GLASS CONTAINER TECHNOLOGY · 3 DAYS – 24 HOURS

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12. Inspection and quality control
13. Palletizing, shrink wrapping and warehousing
14. Container requirements

COLD END & QUALITY CONTROL · 4 DAYS – 32 HOURS

1. Introduction
2. Glass
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4. Upstream process overview
5. Surface treatments
6. Quality assurance
7. Inspection procedures
8. Automatic inspection
9. Quality laboratory tests
10. Palletizing, shrink wrapping and warehousing
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AUDITS, FOOD SAFETY & BREAKAGE.

GLASS CONTAINER PLANTS AUDITS · 2 DAYS – 16 HOURS

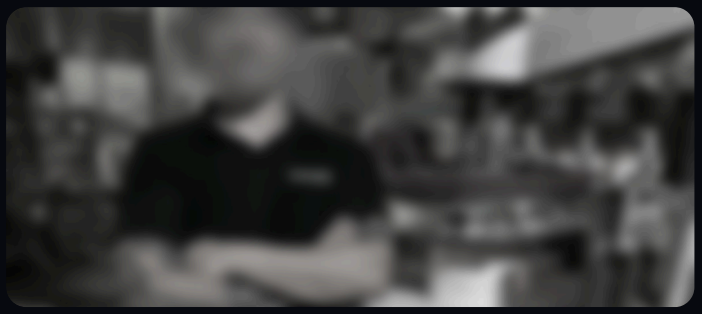
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9. Inspection and quality control
10. Palletizing, shrink wrapping and warehousing

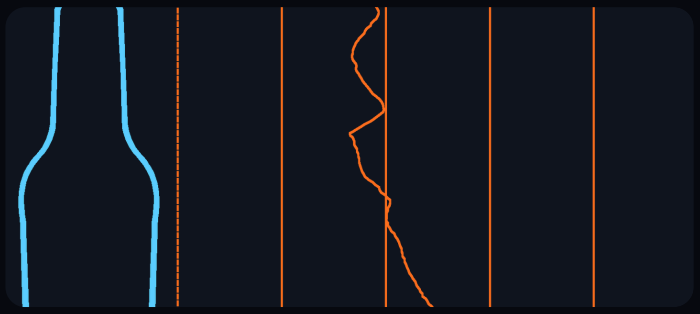
FOOD SAFETY FOR GLASS CONTAINER PLANTS (ISO 22000 AND FSSC 22000) · 3 DAYS – 24 HOURS

1. Introduction to food safety management systems
2. Hazard analysis and critical control point (HACCP) system
3. Prerequisite programs (PRPs)
4. Hazard control accordingly with ISO 22000
5. ISO 22000 requirements
6. FSSC 22000 additional requirements
7. ISO 9001 vs ISO 22000 / FSSC 22000

BREAKAGE ANALYSIS · 1.5 DAYS – 12 HOURS

1. Strength of glass
2. Fractography





TALK TO OUR TEAM

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www.empakglass.com

TRAINING PROGRAMME · 4 DAYS · 32 HOURS

COLD END & QUALITY CONTROL TRAINING.

"Cold end & quality control"

Developed for professionals working in quality control and the cold end, this programme builds a solid understanding of glass as a material, how it fails, and how to inspect, control and assure container quality.

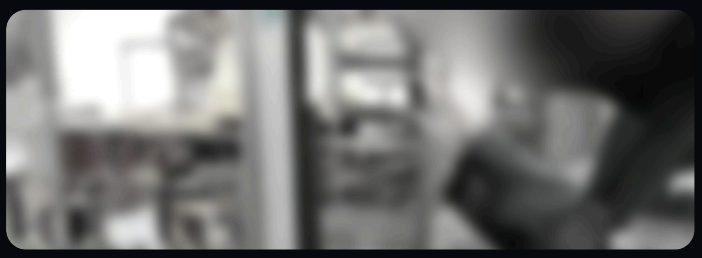
Delivered at your plant or at our office, adapted to your audience and combining theory with practical examples.

PROGRAMME CONTENTS.

Duration: **4 days – 32 hours**.

PROGRAMME CONTENTS · 4 DAYS – 32 HOURS

1. Introduction
2. Glass
3. Strength of glass
4. Upstream process overview
5. Surface treatments
6. Quality assurance
7. Inspection procedures
8. Automatic inspection
9. Quality laboratory tests
10. Palletizing, shrink wrapping and warehousing
11. Cold end job changes
12. Basic food safety
13. Container requirements





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TRAINING PROGRAMME · 2 DAYS · 16 HOURS

GLASS CONTAINER PLANTS AUDITS.

> "Glass container plants audits"

A structured walk through every stage of container manufacturing, from batch to warehouse, to learn how to audit a plant process by process and identify opportunities for improvement.

Delivered at your plant or at our office, adapted to your audience and combining theory with practical examples.

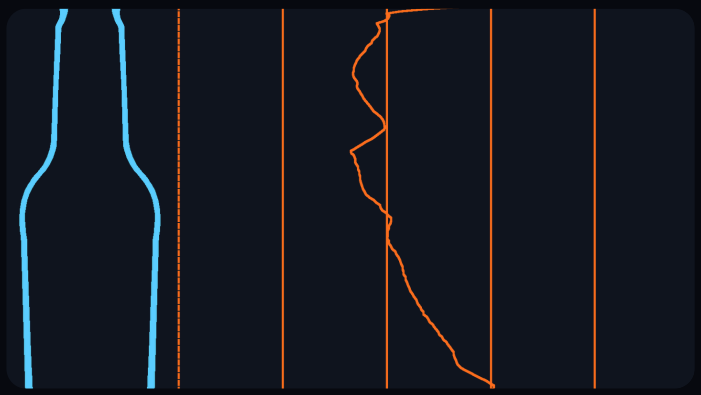
PROGRAMME CONTENTS.

Duration: **2 days – 16 hours**.

PROGRAMME CONTENTS · 2 DAYS – 16 HOURS

1. Overview
2. Batch
3. Melting
4. Glass conditioning
5. Forming
6. Hot end coating
7. Annealing
8. Cold end coating
9. Inspection and quality control
10. Palletizing, shrink wrapping and warehousing





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TRAINING PROGRAMME · 3 DAYS · 24 HOURS

FOOD SAFETY FOR GLASS CONTAINER PLANTS.

"Food safety (ISO 22000 and FSSC 22000)"

Covers the food safety management requirements that apply to glass container plants, from HACCP and prerequisite programmes to ISO 22000 and the additional FSSC 22000 requirements.

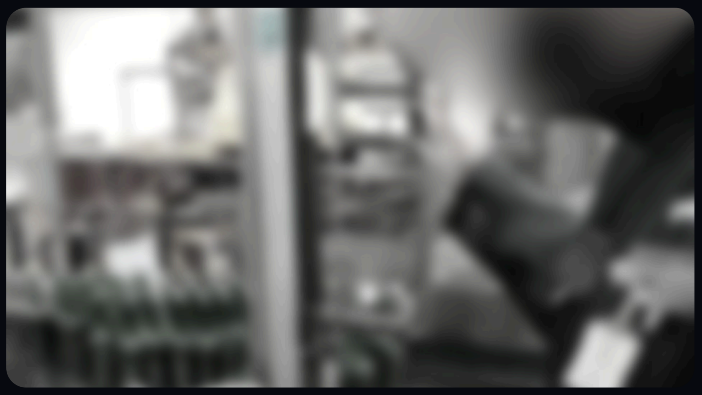
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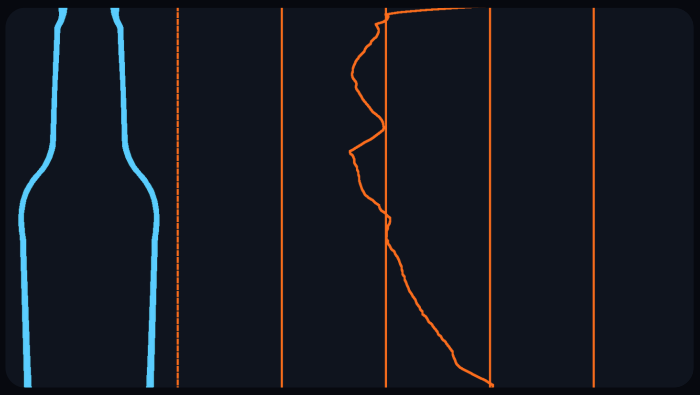
PROGRAMME CONTENTS.

Duration: **3 days – 24 hours**.

PROGRAMME CONTENTS · 3 DAYS – 24 HOURS

1. Introduction to food safety management systems
2. Hazard analysis and critical control point (HACCP) system
3. Prerequisite programs (PRPs)
4. Hazard control accordingly with ISO 22000
5. ISO 22000 requirements
6. FSSC 22000 additional requirements
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TRAINING PROGRAMME · 1.5 DAYS · 12 HOURS

BREAKAGE ANALYSIS.

> "Breakage analysis"

Understand why containers break. The programme links the strength of glass with fractography, so the origin and cause of a failure can be identified and corrected.

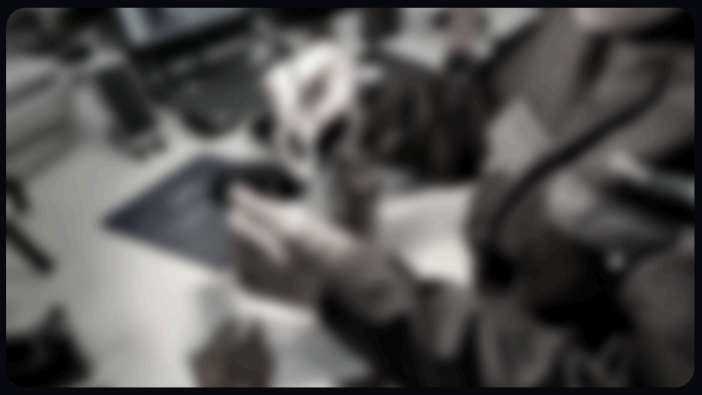
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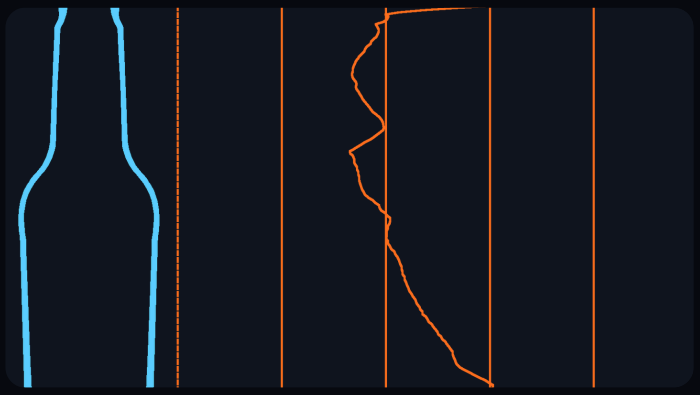
PROGRAMME CONTENTS.

Duration: **1.5 days – 12 hours**.

PROGRAMME CONTENTS · 1.5 DAYS – 12 HOURS

1. Strength of glass
2. Fractography





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