OASTHOUSE CAN INFORMATION

This is collated from information provided by AMP-E

You should always use Oasthouse Contact as your first contact for all can questions and enquiries

1.1 Introduction

These guidelines were put together as a proposal for checking and improvement for existing systems. However, it also contains information on replacement and new installations.

The beverage can manufactured from tin plate or aluminium using the deep drawing and ironing process, together with the related aluminium ring-pull-tab, has a large number of advantages compared to other packages such as

- high resistance to compression and breakage,
- light and gas impermeability, high heat transmission values,
- minimal weight.

The can bodies are manufactured from rolled tin plate or aluminium sheets. This metal thickness is retained in the profiled dome, while the cylindrical section is ironed out. The current average weights for cans including ends are available from your local CTS contact. Despite the weight reduction, high strength values are still achieved. Shape changes and material improvements enable further weight reductions.
The decoration is applied to the can cylinder including the body neck, either:

- with roller coating and subsequent printing or
- direct printing on the metal surface with transparent finishing varnish.

The dome protection is roller or spray-coated to produce good mobility in the filling line and as a corrosion protection.
The entire inner surface of the can is spray-coated:

- to prevent corrosion and
- to avoid metal absorption into the filled products.

The end is produced from aluminium coil roller-coated on both sides, whereby the outer coating layer is interrupted by the subsequent notching of the opening score. The ring-pull opening tab consists of an uncoated aluminium alloy as standard.
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1.2 Camera Guidelines

1.2.1 General information

Inside camera inspection systems have the focus to detect and reject, particles, damaged or deformed cans, which may influence filling or filling line performance and seaming. Camera systems are installed in the filling line before the rinser and check the quality of cans:

- From can manufacturer's camera until palletizer,
- Pallet transport, warehousing and handling,
- Customer de-palletizer,
- Customer mass conveyor.

Cans are mass produced article, which could show a level of imperfections due to the above supply chain impacts.

1.2.2 Guideline for camera rejection level

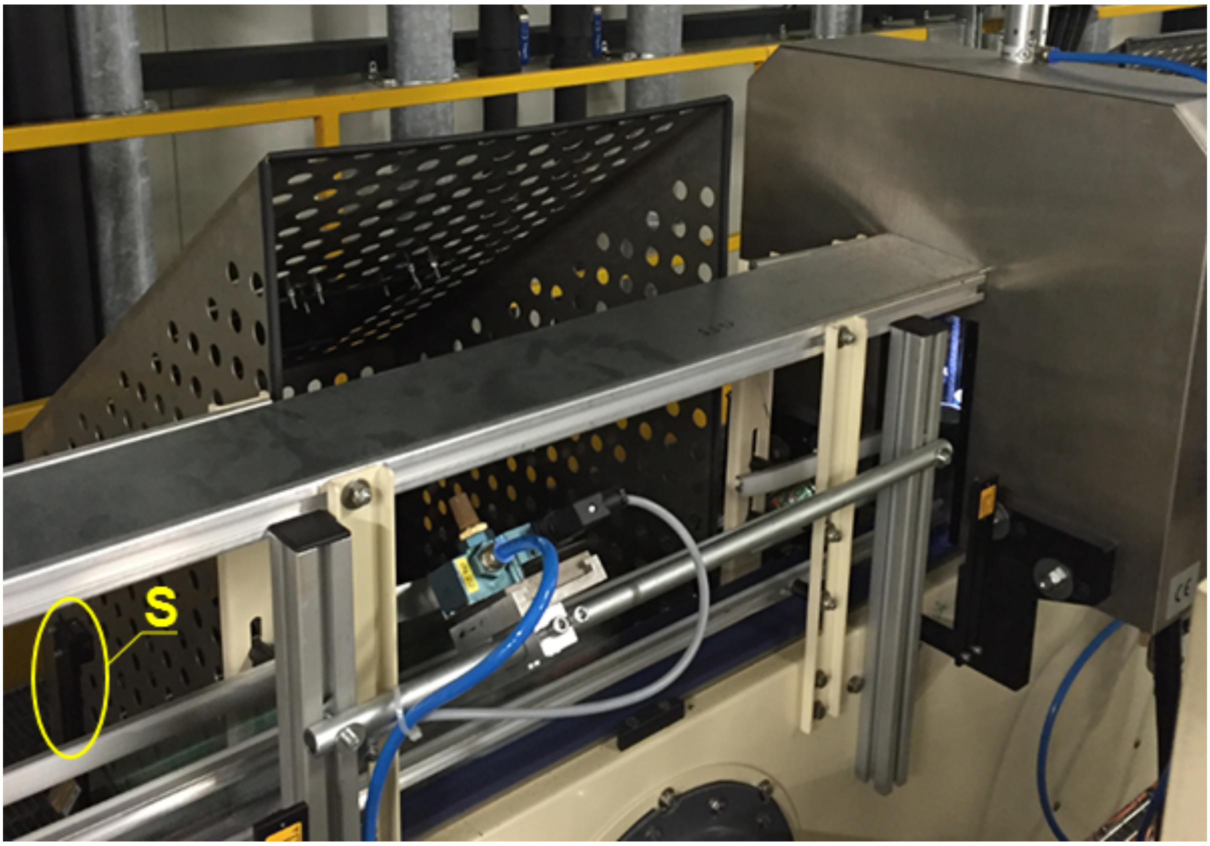
Discussion steps:

- Discussion about acceptable and not acceptable defects.
- Agreement of sensitivity/settings of the inspection system.
- Agreement of camera checks (e.g. test cans) and maintenance.
- Analyses of camera detection percentage rate.
- Check log files of camera controller to review user actions.
- Analyses from rejected cans (good and bad cans).
- Discussion of rejection acceptance.

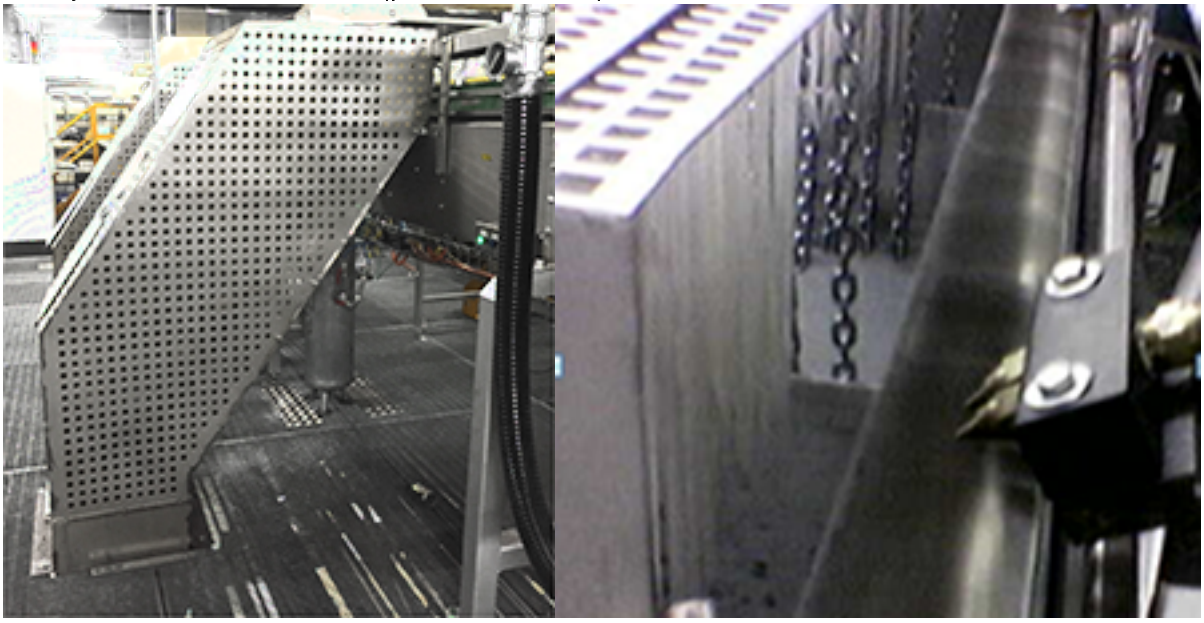
1.2.3 Camera requirements

- Installation e.g. can to can gap, stable conveyor belt, vacuum/magnetic support, trigger sensors (light beam), encoder etc.
- Settings for different sizes, can materials, inside lacquer types etc.
- Free from foreign light reflection e.g. lamps, window (sunlight) etc.
- Cleanliness and maintenance intervals of camera e.g. lens cleanliness, conveyor belt wear etc.
- Sensitivity review after rejection monitoring.
- Camera should not reject good cans, find the right setting.
- AMP-E has a lots of experience in camera technology and processing, advise on camera setting could be offered through your Oasthouse contact.

Soft rejection for correct detection analyses e.g. protection with chute design, foam material etc.

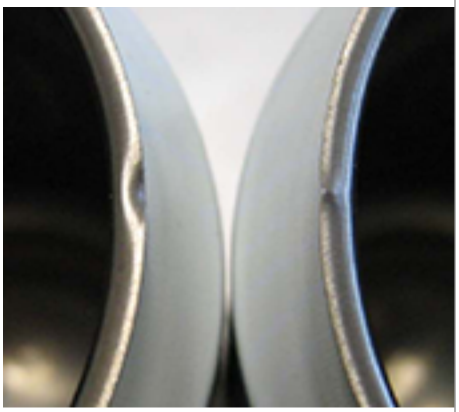
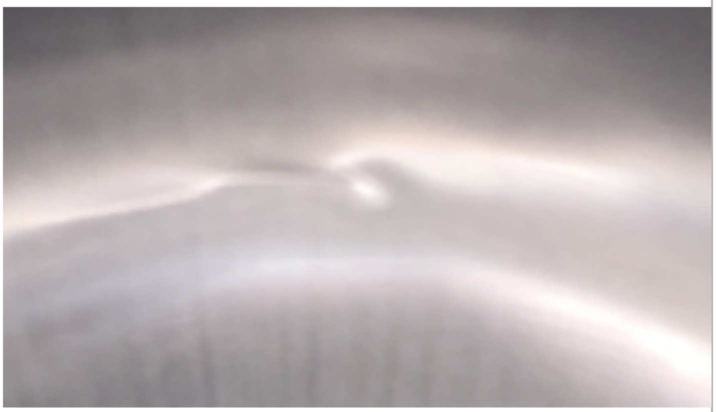


S: Rejection control sensor (police function)



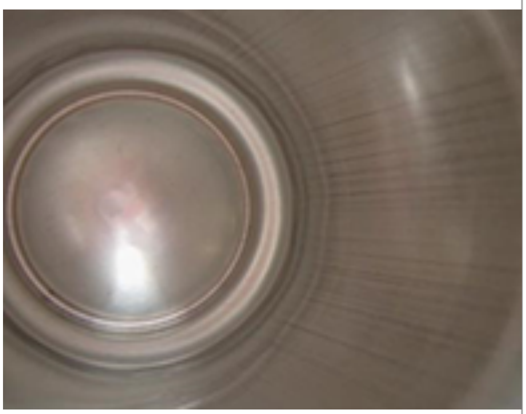
1.2.4 Defect examples for rejection

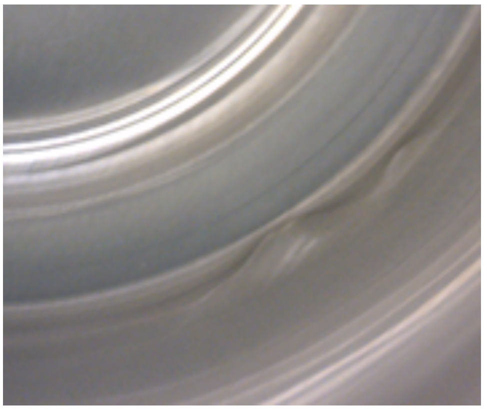
	
Dents width >10 mm	Wrinkled neck (pleats) longer >8 mm

	
Damaged flange >1.5 mm	Wrinkles >10 mm

1.2.5 Can samples for release

- Samples with visual aspects which have **No** quality influence.
- These are good cans.
- Camera settings have to release (accept) this examples.

Draw black marks (punch marks)	Different lacquer types (e.g. NexGen)
	
Body Maker and Cupper traceability marks	Example for a slight dent with a big inside reflection

1.2.6 Camera check

Each camera needs to be checked on a regular basis for verifying the camera ability regarding the right settings to detect and reject defective cans.
Settings to be set for each can size and material:

- Use prepared test cans for sensitivity check, rejection or release (see samples),
- Use strong deformed cans for right can rejection,
- Create camera checks, cleaning and maintenance intervals.

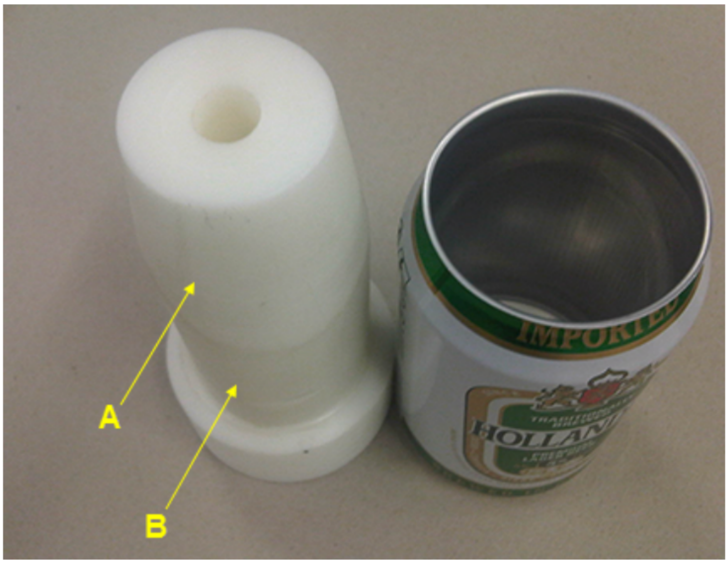
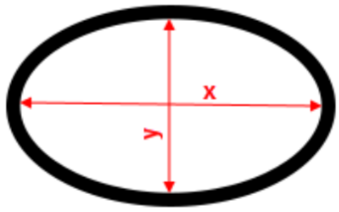
1.2.7 Example for test cans

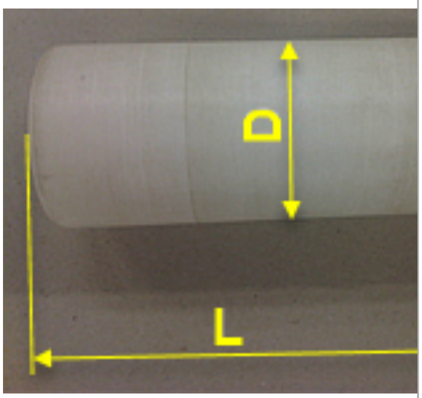
Ovality released test cans

- Specification ovality: max. 2 mm.
- Cans with higher values must be rejected.

Flange damages test cans

- Specification: max. 1.5 mm flange damaged.
- Cans with higher values must be rejected.

	
Oval shape mandrel for 202 Neck	**Detail B:** Mandrel conical (**A**) and oval shaped 202 Neck: x = 51.4 mm, y = 53.4 mm

		
202 Mandrel 330 ml 330 ml (sleek) 500 ml	D = ø 52.3 mm L = 102.5 mm L = 134.4 mm L = 155.3 mm	

Test cans with dots inside for each size and material

Use dots with appr. 3 mm size.Example positions:

- dome,
- mid wall,
- flange.

Dot's colour must be black.

1.2.8 Camera efficiency verification

- Place the test cans on mass conveyor for camera so that they will run through at normal production speed.
- Monitor the camera rejection bin to insure that all test cans are rejected.
- Monitor the camera screen to insure that all test cans are rejected because of the defect and not regarding other issues.
- Confirm that all test cans have been rejected. If any got by, go after seamer to get out them and change the sensitivity of the camera.
- Enter results (pass/fail) into a form sheet with date and time and if necessary document the new settings (what was changed, date, time).
- Evaluate the new settings.

If the customer found a peak or higher can rejection they have to do a defect analysis and if possible a cause analysis (e.g. supplier, transport etc. related).
Oasthouse and AMP-E needs following information/samples for root cause analysis:

- Spoilage rate during which time,
- Camera detection information/position (e.g. lower side wall),
- Images from camera where the detection area is marked,
- Log file of the camera,
- Rejected samples (good and bad cans),
- Pallet tickets from the concerned pallets.

1.2.9 Customer camera spoilage rate

Customer camera spoilage include:

- Supplier production related not acceptable defects,
- Supplier transport handling,

- Customer warehousing and transport handling,
- Customer camera wrong settings,
- Customer camera cleanness and maintenance.

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1.3 Empty Can and End Handling

1.3.1 Storage/Stacking

Cans are packed in layers on pallets, whereby dividing layers of solid cardboard are used between the individual can layers, as well as at the bottom on the pallet and on the top layer. With a top-frame and securing straps a stable transport unit is produced.
Ends are packed in paper bags which are then stacked in layers on pallets. A paper loop laid between the layers and straps of plastic and/or stretch foil secure the packing unit.
Can and end pallets are preferably delivered to the filling plant by lorry, where they are unloaded with forklift trucks for storage or transported directly to the filling system.
Can pallets - 2600 to 2900 mm high depending on loading - can easily be stacked 4-high due to the low weight and the high vertical strength of the cans. To prevent transport damage of the thin-walled can cylinders, the following rules must be observed:

- Forks on the forklift trucks must be shorter than the pallet width.
- Never touch the packing unit with vertical fork ends or protective screens; if necessary spacer blocks need to be added to the forks.
- Warehouse halls must be dust-free, dry and adequately ventilated; the formation of condensed water must be prevented.
- To avoid contamination never store cans and ends near glass, chemicals, mineral oil products or aromatic compounds.

End pallets - these pallets can be stored to a maximum of two pallet high and not more than 3800 mm. It is advisable to allow 750 mm around the pallets so access can be given to review the pallet tickets.
Can pallets, top-frames and intermediate layers are packing materials on loan from Oasthouse and AMP-E and will be reused - which requires them to be handled carefully.
For return transport to Oasthouse:

- returnable pallets must always have a top-frame fitted
- layer pads must be centred on the can pallet, loaded approx. 500 mm high with an empty can pallet laid on top and then secured with at least 2 straps
- all returnable packaging must be returned in the same good condition as when supplied.

To avoid contamination never store returnable packaging near glass, chemicals, mineral oil products or aromatic compounds.

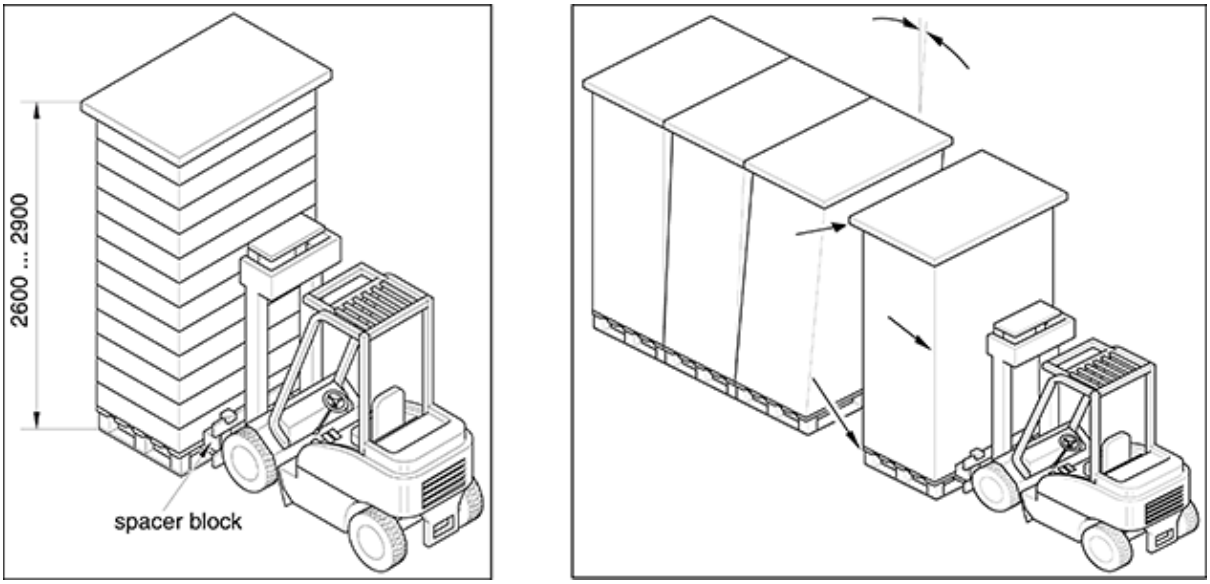

Fig. 1: Transport with forklift truck

1.3.2 Depalletising and transporting

Important: Before feeding into the filling system, all cans damaged in transport must be removed from the pallets.

This action will:

- prevent any disruptions in the can filling line empty-can transport system and in the filler/seaming machines,
- prevent increased metal absorption or even corrosion, as the inner coating film can become cracked at sharp radius points on the cans.

  Dents may never be pressed back!

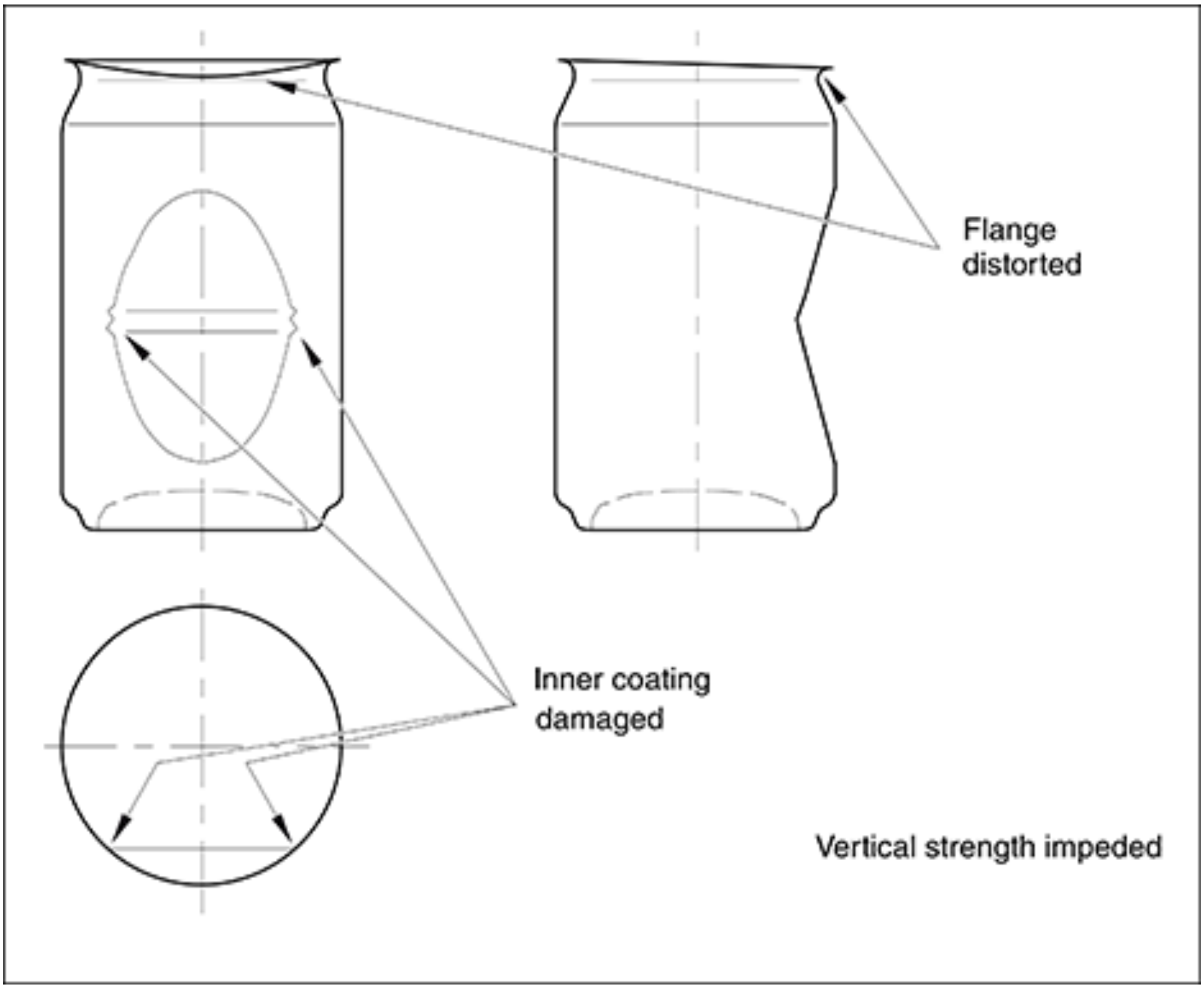

Fig. 2: Transport damage to cans

The unloading chute of the depalletiser should be equipped with adjustable side-walls or, alternatively, with side walls that can be adjusted in a parallel direction. The equipment for lifting off the top-frame and placing it on the previous unloaded pallet should also be installed in this unloading chute. Layer pad grippers mounted at the rear of the depalletising system will prevent layer pads from being damaged.

All means of transport (mats, hinged belts, cables) should be made of plastic to protect the rim coating and retain the can mobility and corrosion protection.

Conveyors must be designed to be as wide as possible up to the point of can separation in order to realise the lowest possible filling line empty can transport speeds. Side rails should be manufactured from plastic or, where steel side-guides are used, covered with a plastic cover to protect the can decoration.

Wherever there is direct pressure on the can side-wall from the conveyor side-guides, e.g. by deflectors in the can separation section, the side-guide rails must be positioned relative to the strongest parts of the can:

- as close as possible to the bottom of the can body in the area just above the can dome transition,
- as close as possible to the top of the can body, just below the neck formation. The top-rail must be adjustable to adapt to differing can heights.

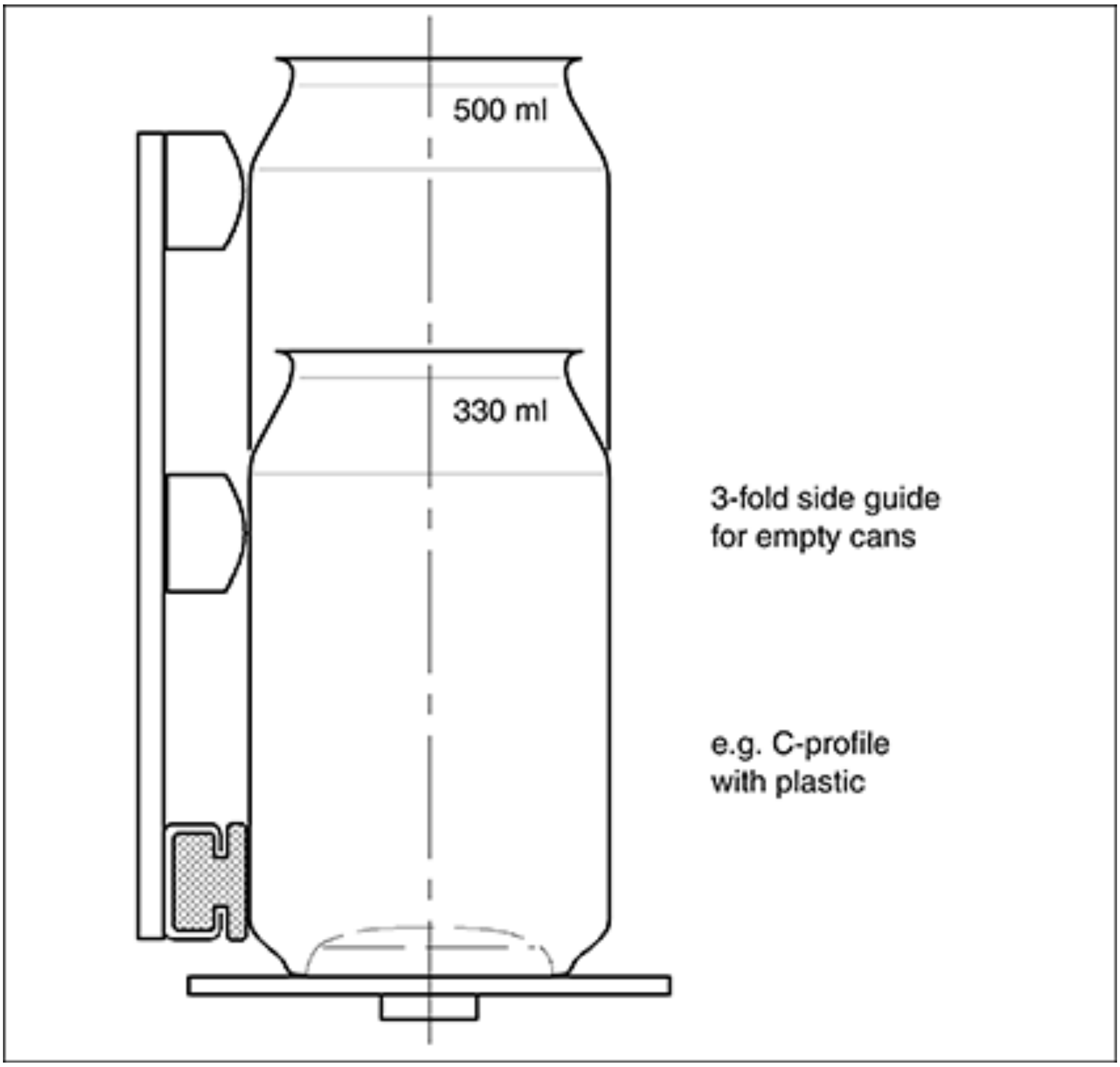

Fig. 3: Positioning of the side guides on the filling line transportation system

Stationary transfer units between transport segments - so-called dead plates - must be designed to be as narrow as possible and, preferably, manufactured from a plastic material. Where metal dead-plates are used, these must be chrome-plated with a polished surface. Metal dead-plates must never consist of a material that contains copper due to the danger of corrosion contamination.

Where single file empty can transport is unavoidable, e.g. by means of an aerial cableway system, this should be carried out in several sections and should also include can gaping control. During this single file can transport operation, without a can gaping control, an “accordion” effect on the empty cans will result. This will induce an unacceptably high noise level and will create the possibility of can damage.

Where elevators are unavoidable, vacuum transfer conveyors are recommended.

Fallen cans will be ejected from this empty can transport system:

- on to waste conveyors by means of a vacuum or magnetic transfer system,
- on single-track conveyors fitted with a chicane, i.e. slight deflections to the fallen cans with the lower side-guide rail removed.

1.3.3 Empty can rinsing/washing

Conveyor lubricant must not be applied to any empty can conveying systems.
Empty can rinsers must be designed as gravity rinsers, with an elevation angle that is below 30°. The can should be rotated through 135° for rinsing out. The can is then guided with the open end facing downwards (180°) for the best possible drainage. The side-guide rails in the rinser must be plastic-covered to protect the can body and riding edge, however the guide on the open can side must remain metallic, i.e. must be of polished or chrome-plated steel. For a higher system output (>1000 cans/min), it is advisable to tilt the spraying nozzles in the running direction (+15°) to eliminate the braking effect of the empty can spray jet.
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1.4 Can Filling

During can filling, a number of mechanical influences can affect the can:

- The can stop on the filling machine infeed should preferably be set to a position near the transition to the floor. On the filling machine infeed, the can stop and the star wheels made from plastic have proven to be the most effective means of preventing can damage.
- The filler infeed elements (star wheel or chain belts) must ensure that the cans are conveyed at the centre under the filling valve. The external guide rails and the plate for the lifting elements should preferably be made of plastic. The plates for the lifting elements made of metal must be chromed.
- The axial pressure of the valves on the can flange must be set so that it does not lead to any mechanical damage and the can must be sealed properly.
- The seals may not exhibit any excessive wear (erosions, indentations, brittleness).

Non-compliance with the above-mentioned points could lead to the following faults:

- Damage to the can flange, which could cause faulty seams.
- Kinks in the can wall, which could have a negative effect on the barrier properties of the inside coating. This can lead to corrosion and thus accompanying perforation and/or a metallic off-taste.

The required filling accuracy, e.g. from legal stipulations such as the directive for finished packaging, and correct handling of the product can be implemented with various filling principles and valve designs. Overfilling will limit the can performance. This is because, a result of the reduced headspace, the guaranteed internal pressure load capacity is reached faster or even exceeded during a rise in temperature (pasteurization, transport and storage). This leads to a higher load on the seam and, in extreme cases, will cause the end or the base to bulge.

Controlled filling and seaming conditions can influence the amount of oxygen added to a beverage. In addition to changing the beverage properties, oxygen primarily influences the corrosive effect of the product. A high oxygen content significantly accelerates corrosion processes. Therefore, many beverage filling companies and industry associations define a specification of a total of 2 ml of air in filled cans. The air content can also still be determined very reliably a long time after filling using the Zahm & Nagel method.

In the beverage filling industry, the state of technology also includes determining the oxygen content of a beverage. With the aid of electrochemical or visual sensors, the total packaging oxygen (TPO) can be determined in a variety of ways. If this occurs directly after filling and before any heat treatment, the TPO can be correlated with the specification of 2 ml of air/can.

Taking into account the gas laws for perfect gases, 0.6 mg TPO per can corresponds to 2 ml of total air. This value serves as the reference point and is to be understood as a recommendation.

The careful transport of cans through the filler and on the transport belt to the seamer must be ensured. The carry-over table between the filling and seaming machine should be made of plastic. When adding a lubricant to the transfer belt, ensure that the product does not become contaminated.

1.4.1 Filling conditions

To maintain a perfect product for the market, the following filling and seaming parameters must be observed.

Topic	Parameter	Specifications
Filling conditions	Filling level	Nominal filling volume ±2.4 ml: 1σ ±4.7 ml: 2σ ±7.0 ml: 3σ
	Air content/oxygen	For carbonated soft drinks and beer: • less than 2 ml total air content in the packaging or a Total Packaging Oxygen (TPO) of 0.6 mg oxygen per can directly after seaming. For non-carbonated beverages with liquid nitrogen injection: • less than 2 % of oxygen in the headspace or a TPO of 0.6 mg oxygen per can directly after seaming. For wine: • 1.5 - 3 ml air or TPO of 0.5-0.9 mg oxygen per can. Remark: See table in chapter 4.7.5 to convert 0.6 mg O_2 or 2 ml air per can to TPO in ppb.
	CO_2 content	To determine the maximum CO_2 level the temperature during heat-treatment or storage temperatures must be observed. The correlation between temperature and internal pressure for carbonated beverages is shown in the graph in Chapter 4.9.4. It is advised to ensure a minimum pressure of 0.8 bar at 5 °C to be able to stack filled pallets 3-high. In case it is not possible for technological reasons

Topic	Parameter	Specifications
		avoid stacking 3-high. In this case is recommended to consult our CTS team. The following can be considered: • additional LN_2 pressure might enable to stack 3-high. • compensation with stronger secondary packaging.
	LN_2 content	For all still drinks, incorporating usual pasteurization conditions the pressure must be between 1.5 and 3.5 bar max.. These pressure values are valid till end of the shelf life to ensure safe stackability. For products to be sterilized: with accurate filling, the maximum LN_2 pressure is 1 bar. If additional overpressure (counterpressure) in the retort can be applied a higher liquid nitrogen pressure will be possible. Please contact our CTS team for support. For more detailed information about LN_2 fillings please see chapter 4.6.
	Maximum pressure	See internal pressure resistance of the can
Seaming conditions	Seam width	The specification corresponds to the calculated average value for the seam width. Individual limit values may not be exceeded.
	Seam gap	<0.10 mm, setpoint 0.05 mm
	Seam integrity	Ardagh recommends seaming roll profiles.

Topic	Parameter	Specifications
	Ends used	Only ends with HOS compound placement. When using Ardagh cans with NexGen lacquer, Ardagh ends have to be used.
Pasteuriser conditions	pH values, alkalinity, chloride, sulphate, nitrate	Chapter 4.9.2
Drying conditions	Residual water	Chapter 4.11
Transport/Storage conditions	Correct packaging	Chapter 4.15
	Maximum temperature monitoring	Chapter 4.17

1.4.2 Explanation of specification for filling volume

It is important the overfilling is prevented.
A) FILLING TECHNOLOGY
To fill the beverage can, two different filling technologies are basically used:

- Volumetric filling machine ® greater accuracy in relation to the filling volume,
- Mechanical or level filling machine ® reduced accuracy compared to volumetric filling machines.

B) STATISTICS FOR FILLING ACCURACY
As the filling level accuracy corresponds to normal distribution, the expected accuracy can be described via the standard deviation "σ". "σ" is the positive or negative deviation from the expected value of randomly taken samples. This means:
68.3% of filled cans are within the nominal range of $\pm 1\sigma$
95.5% of filled cans are within the nominal range of $\pm 2\sigma$
99.7% of filled cans are within the nominal range of $\pm 3\sigma$
The filling machine manufacturers specify a uniform standard value for all can sizes. This is based on mechanical filling technology and the 500 ml can with ø66, as these are the most unfavourable conditions. All other filling technologies and standard can formats result in higher accuracy as a result of their geometry.
The standard deviation σ is specified by the filling machine manufacturer.
The filling level accuracy of a level filling machine is described by the filling level - that of a volumetric machine in terms of volume. According to the specifications of filling machine manufacturers, the accuracy of the existing technology is as follows:

1σ = 0.6 mm (modern level filling machine)
1σ = 0.8 mm (older level filling machine)
1σ = 1.5 ml (volumetric filling machine)

C) CAN GEOMETRY

With a level filling machine, different can geometries have different effects on the filling accuracy. The following parameters have an effect:

- Can diameter - the smaller the diameter, the higher the accuracy,
- Freeboard (only for cans ø66/ø52/ø52) - the smaller the freeboard, the greater the accuracy,
- Freeboard specification - cans with the above specification have a greater accuracy.

D) THREE-SIGMA CONCEPT FOR FILLING LEVEL

To keep complexity to a minimum, we created the specification based on the greatest inaccuracy to be expected:

- older level filling machine,
- 500 ml can ø66/ø52/ø52 (211/202/202).

The following table shows the filling deviation at 1 - 3σ.

500 ml Can ø66 (211), Neck ø52 (202), Freeboard = 14.0 mm

	Freeboard [mm]	Deviation [mm]	Delta V [ml]	Volume [ml]
nominal	14.0	0.0	- - -	500.0
1σ	13.2	-0.8	±2.4	502.4
2σ	12.4	-1.6	±4.7	504.7
3σ	11.6	-2.4	±7.0	507.0

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1.5 Nitro Can Filling

The empty Nitro Can is purged with gas (carbon dioxide CO_2 or nitrogen N_2). This is done to remove oxygen from the Widget prior to filling. This is normally carried out during the filler's pre-pressure and snift cycles at the start of the filling operation.

After the can is filled with a product saturated with CO_2 or N_2. Liquid Nitrogen (LN_2) is dosed into the can prior to seaming.

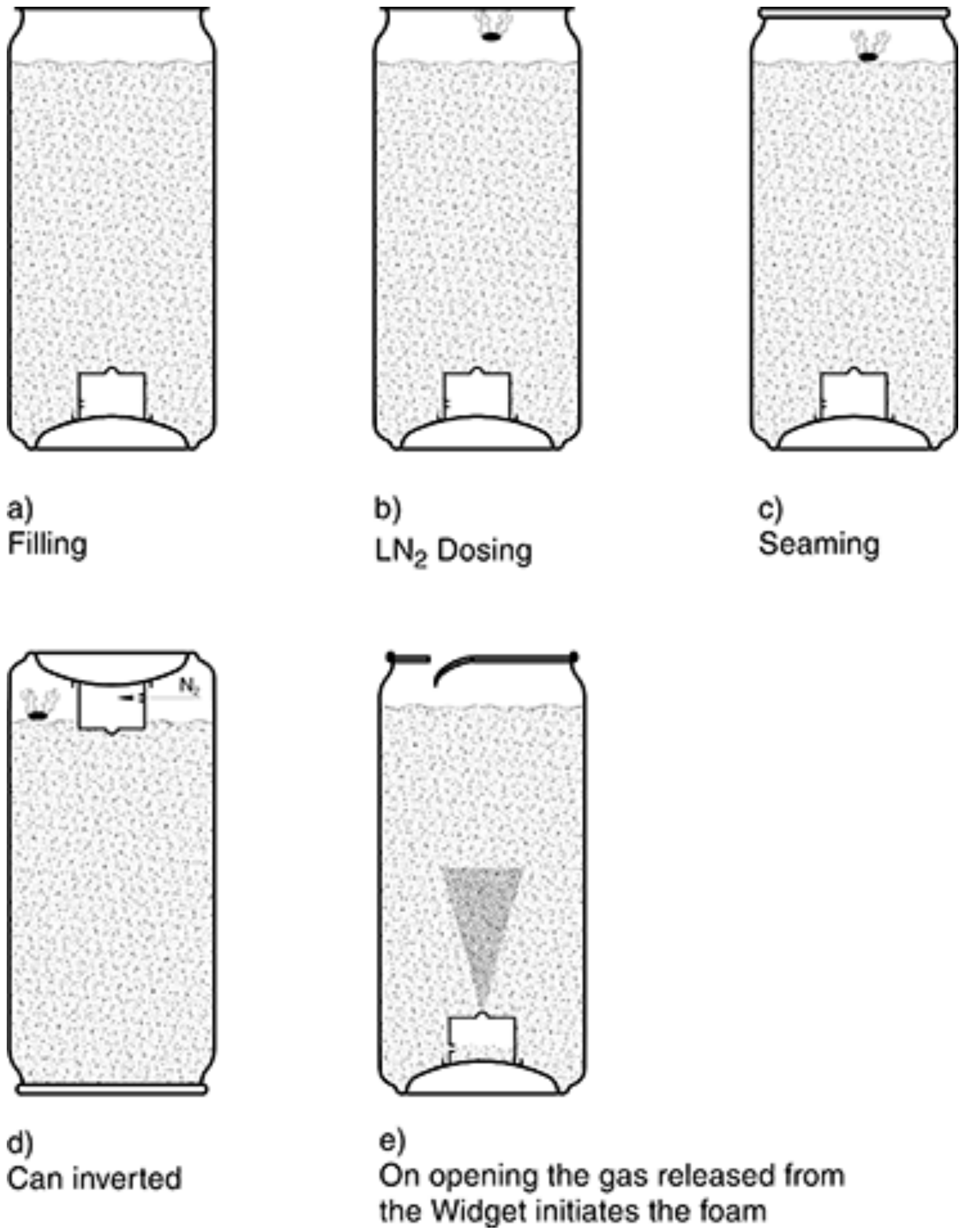
Immediately following dosing of LN_2 the liquid starts to 'boil' off and hence creates internal can pressure once seamed.

The new filled can MUST be inverted immediately after seaming so the LN_2 will then 'charge' the Widget.

The can will then stabilise during the Pasteurising or Retorting process.

The Can is now ready for a long shelf life and supply to the consumer.

Typical CO_2 levels 2 - 3 g/l for Draught flow products.



The requirements for Widget filling are

- Low CO_2 or N_2 products
- Can with a Widget
- Volumetric filler
- Liquid Nitrogen Dosing machine
- Internal pressure measurement system

Please see useful data for additional information.

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1.6 Liquid Nitrogen

With non-carbonated beverages, the bubble breaker uses nitrogen gas and then a liquid nitrogen dosing device is installed as close to the seamer as possible. The LN_2 machine adds a measured droplet to each can. Following seaming this droplet boils off inside the can and produces a stable pressurized can.

Nitrogen dosing may be employed prior to the seaming operation for still or lightly carbonated products. This improves the rigidity of the can and for in Widgetted cans it improves the foaming of the product.

Since a gas mixture in sealed cans can cause extremely high-pressure readings during the heat treatment it is highly recommended to contact our CTS team for advice.

Liquid nitrogen dosing helps to reduce oxygen but is not enough to replace under-cover-gassing!

The internal pressure must be in the limits of the recommendations mentioned in the table of chapter 4.4.1.

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1.7 Seaming

1.7.1 Principle

The can double seaming machine is an important, if not the most important machine on the can filling line. It fulfils several functions and consists of the following elements:

1.7.2 Machine drive

The drive motor has the required total output of the filling and seaming machines. An unit, the so-called IN MOTION TIMER, is located on the filling machine drive shaft.
Can handling synchronisation, i.e. the jolt-free transfer of the filled cans by the fingers on the transfer chain, is carried out with the help of this device.

1.7.3 End feed separator

The ends stacked within each other are loaded into the end separating system. During the transfer to the seamer the cans are detected by a sensor, which opens the stop of the separator. A separating knife separates off an end and the attached screw removes it from the stack and transfers it to a pocket on the end turret. Fingers then push the end through the guideways on to the open end of the filled can.

1.7.4 Can/End centring and under-cover gassing

The filled cans are transferred by the cogs of the transfer chain into the centring pockets of the central and end turret and guided into the centre of the can lifter. In the process, the can assumes the rotation of the lifter. In the centre it then turns synchronised. When the two centring turrets enclose the centred can body, the fed-in end lies approx. 4 mm above the can rim. A gas stream (with carbonated beverages CO_2, with non-carbonated beverages N_2) flows into the empty space in the can through openings in the end/gassing turret in order to force out the air present there.
A bubble breaker can be connected to the control fitting for the control of the gas pressure and flow volume. It is mounted above the can transfer unit before the seamer infeed and destroys large air-filled bubbles on the beverage surface.

1.7.5 Oxygen level in the headspace

A low oxygen level in the can is important for maintaining a long shelf life of the product, at the same time reducing the possibility of corrosion on can and end to a considerable extent.
The under-cover-gassing must be adjusted in such a way that at nominal filling:
For carbonated products, the amount of air according Zahm & Nagel and for non-carbonated products the headspace gas must be below the recommendations mentioned in the table of chapter 4.4.1.
In case overpressure in the can is achieved with liquid nitrogen for none carbonated products, under-cover-gassing remains necessary in order to reach the desired oxygen percentage.

Conversion 0.6 mg O_2 or 2 ml air per can to TPO in ppb

Can size:	2ml air = 0.6 mg O_2/can TPO O_2 in ppb/litre.
150 ml	4000 ppb
187 ml	3200 ppb
200 ml	3000 ppb
250 ml	2400 ppb
330 ml	1800 ppb
355 ml	1700 ppb
375 ml	1600 ppb
440 ml	1400 ppb
470 ml	1300 ppb
500 ml	1200 ppb
530 ml	1100 ppb
568 ml	1050 ppb

4.7.6 Saltwater Test for UCG

Under-Cover-Gassing (UCG) system performance to be measured by the Salt Water Test which measures, in each of the seamers stations, the volume of residual air (oxygen) in the can headspace. The results are significant only for the seamer speed, and corresponding gas flow setting (CO_2 or N_2), at which the test was run.
Cans (one for each seamer station) are filled at nominal level with (de-aerated) salt water solution which absorbs and releases a minimum of air.
After the seaming operation is complete, the residual air or oxygen is measured by:

- Zahm-Nagel method with CO_2 under-cover-gassing. Bubbling the air through a caustic solution to remove contained CO_2. The remaining gas is residual air that is free of CO_2. Its volume, in millilitres, is measured by using a burette which has a calibrated chamber at its top. The amount of air must be less than 0.4 ml.
- Oxygen analyser with N_2 under-cover-gassing. Measuring the oxygen in the residual air. The amount of oxygen must be less than 0.4%.

1.7.7 Seaming process

The lifter moves the can into the end with a cam and brings both together under the seaming head. An adjustable spring in the lifter determines the force with which the can and end are joined together (can holding-chuck pressure).
During lifting the end leaves its guide path and is lightly pressed onto the can rim by a hold-down (ejector head), which is also cam-controlled. The seaming head rotates and is synchronised with the can lifter.
The double seam is created by 2 rotating seaming rollers, which are guided one after another onto the end with cam-controlled levers.

- The seaming roller of the 1st operation rolls the end curl under the can flange. The length of the end hook and the seaming gap are affected by its adjustment.
- The seaming roller on the 2nd operation (closing roller) presses the seal together tightly. Its adjustment determines the final seam width and the seam strength.

The spring force (can holding-chuck pressure) in the can lifter determines the length of the body hook.
Following seaming the can is lowered again, whereby the ejector head supports the detachment of the can from the seaming head.
This large number of guide elements

- transfer chain
- can guides
- end guideways
- turrets

and the drive elements

- end separator
- can lifter
- ejector
- seaming rollers and heads with their roller bearings, springs, cams and cam rollers

must be checked and maintained regularly to ensure a damage free operation with the cans and ends. For this purpose, the manufacturer's operating and maintenance regulations must be observed and special adjustment gauges and tools are required. Regular seam checks and visual inspections provide information on the condition and/or necessary corrections.

1.7.8 Seamer adjustment & double seam

See "Seaming process".

1.7.9 Double Seam specifications to include seamer tooling information

See "Seaming process".
Edition/Date: 1/2022-07-01

1.8 Filled Can Handling

1.8.1 Transportation/Conveying

The same requirements apply for all filled can conveyors as for empty cans, i.e. means of transport (hinged chains, wide conveyor mats and side guides of plastic, dead plates of plastic or chrome-plated metal etc.). Due to the release of carbon dioxide or liquid nitrogen evaporation, a sufficient interior pressure is built up during or directly after seaming of the cans, which is the reason why no special requirements are placed on the side railing design here. Approx. 80 mm high full-wall or profile guides are sufficient in this case.

Directly following seaming the cans must be rinsed. It is preferable to use the empty can rinser waste water for this purpose. In systems with a pasteuriser or can warmer, this protects the water quality from enrichment with the product. On systems without this device, the salt content of the rinsing water may not exceed the following values:

- Chloride <10 mg/l
- Sulphate <15 mg/l
- Nitrate <15 mg/l

The cans must then be rotated through 180° and routed through the pasteuriser or warmer in this position. On systems without these units, the cans should be transported standing on the end for at least 30 seconds. This drives product out of incorrectly seamed cans, and these are then automatically rejected by the subsequent filling check.

On fast-running individual conveyor belts and separators, belt lubrication with a small concentration of corrosion-free lubricants must be provided. The infeed conveyors to the packaging machines should preferably remain dry or only be sparingly “lubricated” with water.

Edition/Date: 1/2022-07-01

1.9 Pasteurisation

1.9.1 Pasteurisation/Can warming

Continuous plastic mats have proven themselves as an efficient means of transport. Together with the matching comb deadplates, these ensure a gentle push-in and push-out of the cans in the pasteuriser. The step-back drive of the traditional bottle pasteuriser results in a large number of tipped-over cans when the packing pattern in not complete, especially with 500 ml cans with the new (down gauged) end of 52 mm diameter. Side guides must be manufactured from plastic or designed with a plastic coating to protect the decoration.

1.9.2 Pasteurisation water quality recommendations

Particular attention must be paid to the water quality. Additives for preventing the formation of slime and algae, as well as for adjusting the pH, may not contain any corrosive components for both metals - steel and aluminium. In the heating zones the pH must be adjusted to between 6.5 and 7.5.
A setting which is too acidic leads to corrosion on the exposed metal surfaces and the decoration; in the alkaline range >7.5 there is a danger in conjunction with a high water hardness of pasteurisation water blackening

- on the can dome with aluminium cans,
- on the uncoated ring pull on the ends.

It is recommended that corrosion inhibitors, pH and water-hardness stabilisers be added to the water of the heat-up and heat maintenance zones.

- Alkalinity: as low as possible,
- Chloride: (sum of chloride and bromide if present), sulphate and nitrate each less than 50 ppm. Since the values do not meet the MPE specifications regarding stress corrosion, the ends need to be rinsed with water meeting MPE specifications (chloride levels should be <10 ppm and sulphates and nitrates <15 ppm), after leaving the pasteuriser.

Ensure salt free rinsing after pasteurisation once pasteuriser water is not according to MPE recommendations and drying of filled cans.
For more detailed information please have a look to the “Filling Line Can Handling Best Practices” at “Related documents”.

1.9.3 Internal can pressure versus pasteurisation temperatures

The carbon dioxide content, temperature, filling and heat dwell time are decisive for the pressure development during pasteurisation or warming. The resulting balance pressure can be determined from tables in the technical literature or with corresponding slide rules. It may not exceed the guaranteed 620 kPa pressure stability of the cans and ends. With carbonised refreshing beverages, the balance pressure is achieved after the selected temperature is reached, however for beer not until after approx. 30 - 45 minutes. As the dwell time in the heating zone is usually only approximately 10 - 15 minutes, and the balance state has therefore not yet been reached, only a pressure of approx. 50 kPa lower is achieved. If this “bonus” is utilised for higher carbonisation, it must be ensured that during a longer standstill the system is automatically switched over to a temperature reduction. Modern pasteurisers are equipped with a PU controller with automatic temperature reduction. **It is not sufficient to just switch off the pumps**. Exceeding the pressure presents a danger of bulging of can bottoms and/or ends. To determine and monitor the actual pressure development, it is advisable to use a combined temperature and internal pressure measuring device.

1.9.4 Pasteuriser temperature

If higher temperatures than 75°C are required then please contact your local CTS department.

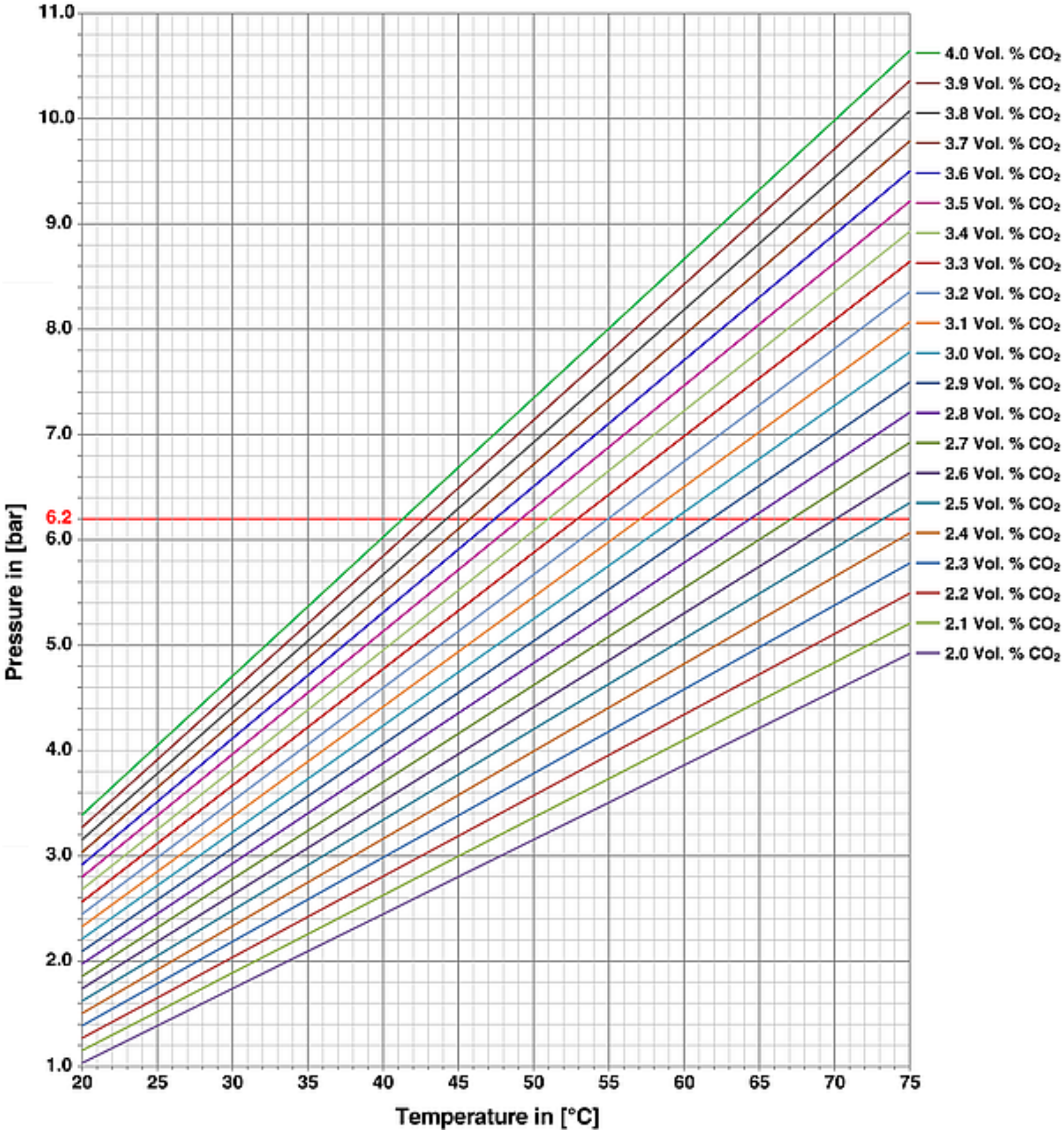

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Fig. 4: Relationship to internal pressure between CO_2 content and temperature (Based on empirical data with carbonated water.)

The following must be pointed out:

- The relation in Fig. 4 only is valid for a single gas system. Increased air values in the can or the addition of N_2/LN_2 will increase the internal pressure significantly.
- The filling level (volume of headspace) has a significant impact to the pressure development in beverage cans. Over filling accompanies with increasing the internal pressure measures of the system.
- During pasteurization, the equilibrium pressure usually, ins not reached. Depending to the circumstances the peak pressure will be 0.2 to 0.6 bar lower.

Edition/Date: 1/2023-09-04

1.10 Retort and Sterilisation

1.10.1 Retort

AMP-E has developed cans and ends for products which require a retort process. These products being coffee, tea, flavoured milk, plant-based milk, with alcohol etc.
Our can and end sizes include:

- Slim cans in 150 ml, 200 ml and 250 ml format,
- Sleek cans in 330 ml format,
- standard cans in 500 ml format,
- ends ø50 (200) and ø52 (202),

together with appropriate ends to fit with the can.
By working with you our customer we can discuss, trial and test your product to ensure correct retort capabilities are met to bring your product to market.
Further and full details can be obtained through your local Oasthouse contact and any technical assistance can be obtained from CTS via your Oasthouse contact.

1.10.2 Sterilisation

Products with a pH >4.2 have to be sterilised.
AMP-E has more than 20 years experience with sterilisation of 2 piece cans in several sterilisation systems.
AMP-E has also developed aseptic filling as an alternative for sterilisation.
Cans with special lacquers are used which are qualified at temperatures up to 125°C.
Sterilisation can be done in continuous or batch systems, in steam, full-water or hot water spray, with or without rotating.
Particular attention must be paid to the water quality. Additives for preventing corrosion and the formation of slime and algae may not contain any corrosive components for both metals - steel and aluminium. In the heating zones the pH must be adjusted to between 6.5 and 7.5.
A setting which is too acidic leads to corrosion on the exposed metal surfaces and the decoration; in the alkaline range >7.5 there is a danger in conjunction with a high water hardness of blackening

- on the can dome with aluminium cans,
- on uncoated ring-pull on the ends.

It is recommended to add corrosion inhibitors, pH and water-hardness stabilisers to the water of the heat-up and heat maintenance zones.
Please contact AMP-E via your Oasthouse contact when you consider to sterilise, as we will be pleased to give advice and support on:

- The pressure during sterilisation in relation to filling level and liquid nitrogen dosing.
- Heatdistribution measurement in retort and product.
- Where to fill, in what system, and the shelf life of the products.

Please contact your local CTS for this.
Edition/Date: 1/2022-07-01

1.11 Filled Can and End Drying

The drying of the cans and ends is extremely important for the further treatment, e.g. ink jet coding, and packing for a wide variety of distribution channels. Residual water or moisture may lead to:

- corrosion/discolouration of the end ring-pull and stress corrosion in the end score, especially with cans packed in foil wrap.
  (Not only the packaging tray and foil, but also pallet securing systems with shrink or stretch foil must be viewed similarly. No ventilation, i.e. no post-production drying, takes place in such packaging),
- dampening of the cardboard packaging and separation of the packaging glue,
- formation of rust on steel cans, especially on the bottom can rim,
- damage to the ink date coding.

On filling systems that Pasteurise or Warm the cans, the following installation is recommended:

- Blowing out of the can dome and the can body, with an air blowing system (low pressure, high volume), directly following the Pasteuriser/Warmer treatment.
- Following can reinversion, blowing out of the end with compressed air by means of a wide nozzle with a narrow slit (“air knife”) or multi-channel nozzle, positioned laterally to the can running direction.

Ensure salt free rinsing after Pasteurisation once pasteuriser water is not according to MPE recommendations and drying of filled cans.

Residual moisture evaporates due to the heat content of the cans up to the final packing operation.

On systems without Pasteurisers/Warmers (cold or room-temperature filling), blowing out with compressed-air with a wide nozzle and subsequent blowing off with hot air by means of a fan is recommended, i.e.

- 1x on the can dome before reinverting the filled can and
- 1x on the end side shortly before final packing to minimise condensation from the surrounding area.

Drying guidelines for residual water:

- max. 3 mg per can end,
- max. 20 mg per can body,
- max. 6 mg per can dome.

Edition/Date: 1/2022-07-01

1.12 Stress and Secondary Corrosion

1.12.1 Stress corrosion prevention

The stress corrosion on the scoring line of aluminium beverage pull-open end is a long-familiar phenomenon which can lead to major damage under unfavourable conditions. Stress corrosion is defined in the BCME booklet. Crack formation with an inter-crystalline or trans-crystalline course in metals under the simultaneous effect of certain corrosion media and tensile stress.
Three factors can lead to stress corrosion:
a) Soiling in the scored line and moisture
Water residues from rinsing off or from the pasteuriser/warmer, especially chlorides and sulphates, but also residues of stock lubricants, at a simultaneous high moisture level and high temperatures can lead to stress corrosion.
b) Temperature
High temperatures can promote stress corrosion in two ways: On the one hand, in conjunction with residues and moisture, and on the other hand due to the higher interior pressure load on the end resulting at higher temperatures, and therefore to tensile stress on the scored line.
c) Time
It is clear that the effect of the factors named in 1 and 2 increases the danger of stress corrosion the longer the cans are subjected to those factors.
When all conditions favourable to stress corrosion are present, this can occur within a very short time. This type of weakening of the residual wall in the scored line causes the drink opening (self-opening) to burst out at a considerably lower interior pressure than the guaranteed minimum of 6.2 bar.
Foil-wrapped packing units are therefore the least suitable for export.

1.12.2 Corrosion prevention recommendation

This disadvantage is even more critical when can damage along the distribution channel cannot be excluded. While product leaking out is absorbed and transported to the outside by pure cardboard and can evaporate or dry, it is distributed over all other cans in the packing unit in the foil pack. Acids form due to the presence of oxygen and micro-biological processes (beer: ethanoic acid) or the effects of acid increase and secondary corrosion results on the bottoms of the undamaged cans. If cans with secondary damage then leak, product escapes from the side foil opening and subsequent damage results in the packs of the pallet or the pallet stack located below (pyramid effect).

1.12.3 Stress corrosion avoidance, The Wipe & Dry Process

In the beverage industry containers for beverages usually contaminated by residues of the filled product due to the filling and seaming process. In spite of following processes like pasteurisation and sterilisation or an other method (e.g. direct process of washing) residues of liquids remain at the container. Thus it appears that the residues of liquids

have to be removed by drying separately.
This is done both for hygienic and technical reasons.
The 3 essential reasons are:

- necessary application of ink to the container (e.g. production codes, best before date or refund code);
- hygienic reasons since residual moisture fosters the creation and growth of microorganisms;
- formation of corrosion (after the containers are packed, e.g. in foil, the residual moisture leads to corrosion, which impairs the functional features and has a disadvantageous effect on the appearance of the containers).

The state of the art is to remove the liquid on the containers in an more or less uncontrolled manner by means of a air jet (partly heated air) that is emitted from fans at high speed.
By using the "Wipe and Dry" system the residual moisture can be removed from the container by controlled mechanical separation and then returned to a recycling process.
This involves the use of specially shaped and arranged rotating brushes that carry the liquid. The system is characterised in particular by the fact that separation of the liquid from the container is carried out both mechanically by brushing it away and through adhesion of the liquid to the brush hairs.
The efficiency of this system can be increased by means of special air nozzles, the so-called "air knives", which move the liquid from complex geometries that are difficult to access for brush hairs into the rotating brushes in a targeted manner. Another unit, called a stripper here, separates the liquid from the brush. This is achieved, on the one hand, through the centrifugal force of the rotating brushes that moves the liquid to the outer end of the brush hairs and also through the tension of the brush hairs that builds up and suddenly drops again on the stripper, thus counteracting the adhesion of the liquid to the brush hairs. An additional unit, the so-called "catcher for expelled liquids", takes up the liquid removed from the brush by means of the stripper, collects it and discharges it in a controlled manner, thus enabling return to a recycling system.
This system leads to an efficient, cost-saving and environmentally sound process.
Furthermore, the process has to be set up such that integration, maintenance and trouble-free operation of the predominantly mechanical system reduce the commissioning, repair and in particular the operating costs for the bottler through the high efficiency of the simply designed, compact and resource-saving system with regard to production down time, energy consumption and recycling of the liquid inputted into the process - in contrast to the systems employed today, which operate mainly with hot air. A special mechanical and electrical control management system guarantees a continuous and failure-free container transportation process concerning e.g. fallen containers.
Edition/Date: 1/2022-07-01

1.13 Filled Can Coding (Best before/Sell by date)

Coding of the cans, i.e. specification of the minimum shelf life date, is legally specified and must be implemented. In addition, data for the product traceability may also be printed on the cans.

The most common method is ink jet printing on the can dome. The installation of these devices in the empty can transport, i.e. between the separation of the empty cans after depalletising and the rinser infeed, is recommended. The inks dry very quickly and resist the subsequent cold or hot-water empty can rinsing system.

When printing the filled cans in the wet area, a well-functioning compressed-air blow-off system must be installed directly before the can coder.

Laser printers are suitable for coding on to the decoration. With steel cans the intensity must be set so that the protective coating (lacquer and/or galvanising) on the cans is not damaged, otherwise there is a distinct possibility of corrosion on the filled cans.

Edition/Date: 1/2022-07-01

1.14 Filled Level Control

The fill level inspection is also legally specified for compliance with the regulations of the finished packaging ordinance. As the can is not a measuring container as defined by law, the common fill-level measuring devices with gamma rays are not informative enough on their own. For the detection and rejection of underfilled cans, their measuring accuracy (by calibrating with sample cans) is sufficient. To comply with and monitor the mean value requirement, additional tests are required, e.g. with volume measurement by means of weight checks.

To also detect leaking cans, the fill-level measuring device must be installed after filled can reinversion. When measuring inverted cans, there is a danger of incorrect measurement due to reflections on the can dome.

On systems with a large buffer capacity between the filling/seaming machines and final filled can packing, e.g. pasteurisers, it is advisable to install a second device directly behind the double seamer. This provides early information regarding can filler performance and will also prevent large quantities of rejected cans.

Edition/Date: 1/2022-07-01

1.15 Packing

The following are commonly used as filled can transportation packs:

- half-boxes,
- full boxes and
- trays or foil-packs

in which the cans are packed either loose or as multi-packs. If no special customer requirements apply, the selection should be made a follows:

- half-boxes for short-distance transport,
- trays or foil-packs for short and medium-distance transport,
- full boxes for export, especially to tropical countries.

The cans must be absolutely dry for all packing types. Residual moisture will activate the corrosive ingredients in the cardboard packaging, especially chlorides and sulphates, which no longer comply with the requirements according to the German standard DIN 53110 initiated as a part of the use of recycled materials regulations. When transporting and storing in a damp environment (unheated halls in winter) and container shipping, there is a danger of condensed water forming. In half-boxes this dries quickly due to the good ventilation provided; in full boxes it is absorbed, distributed over larger areas and evaporates. In foil-wrapped packs or trays, there is virtually no ventilation. Needling or puncturing holes in the foil is ineffective, as these holes are covered again by the adjacent packaging units. Residual moisture or condensed water on the can body concentrates on the can dome and may cause corrosion. On the end the double foil produces hermetic sealing; residual water or moisture with a high salt content results in:

- oxidation of the end ring-pull tab and
- stress corrosion in the end score line.

Edition/Date: 1/2022-07-01

1.16 Palletising

With disposable pallets, attention should be paid to both sufficient stability and the residual moisture of the new wood. It should be less than 20%.
Reusable pallets must be free of foreign substances (chemicals, mineral oil products, glass fragments etc.) and must not be damaged. Protruding nails or screws are especially critical.
The packing pattern must be smaller than the basic pallet dimensions so that no packs extend over the pallet edges. Pallet securing systems with stretch or shrink foil should have larger openings to enable ventilation.
Edition/Date: 1/2022-07-01

1.17 Storage and Distribution/Shipment

Filled cans have a high stability and easily permit stacking of pallets 3 high - provided they are stacked gently (not dynamically) and with contact over the entire surface. To prevent impact damage from angled stacking, it is advisable to use plywood or hardboard intermediate layers. When stacking in rows, a few centimetres should be maintained in the lengthwise and breadthwise directions. Warehouses should be clean and dry, well ventilated and frost-free.

During loading and transport, it requires a guarantee that no contact with sharp-edged metal parts occur, as these can damage the thin-walled can cylinder.

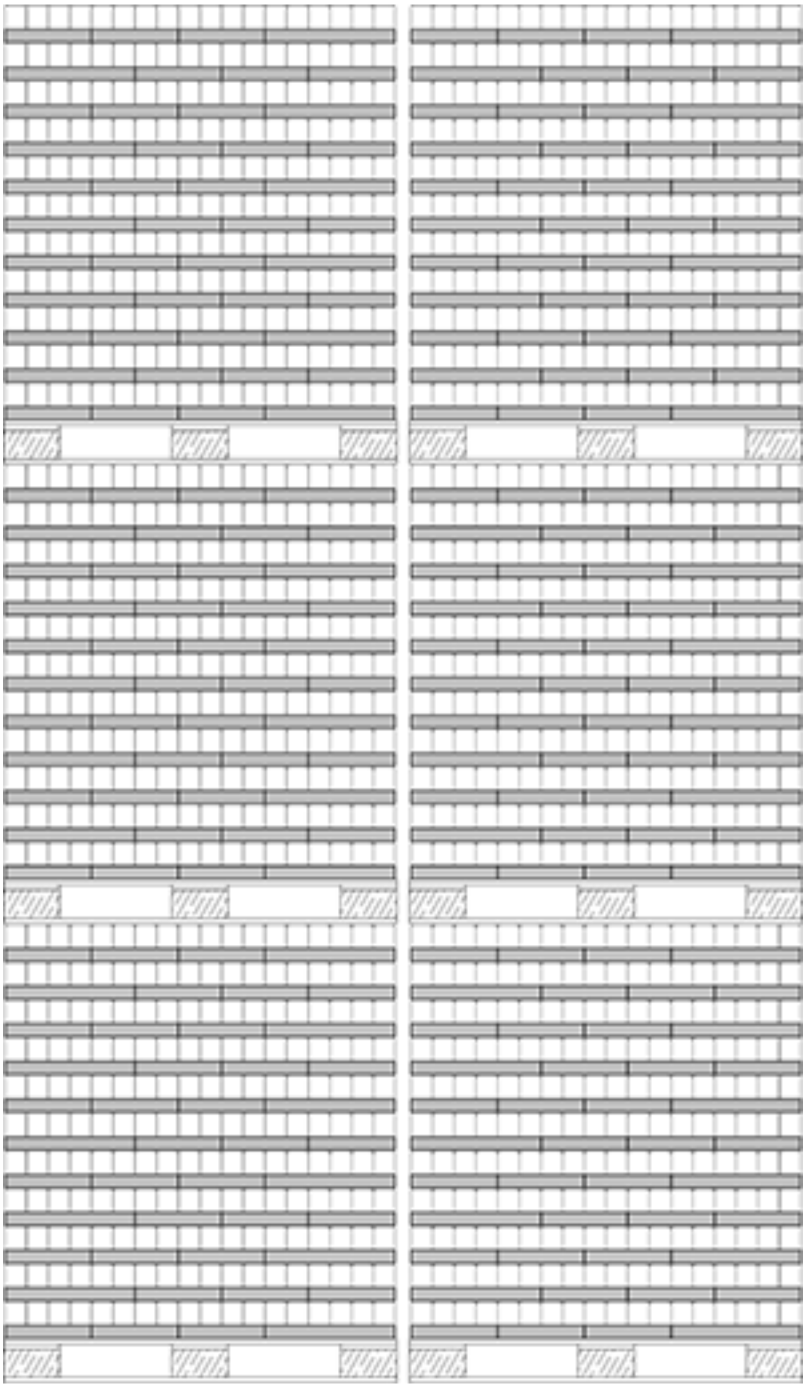
Containers are usually used for long-distance exports. Here special attention must be paid to correct stacking. Hollow spaces must be filled, e.g. with so-called airbags. Due to the lack of ventilation, it is especially important to ensure the lowest possible inclusion of moisture, i.e. the wooden floor of the container must be dry and free of chemicals, and the pallets used must be produced of wood with a low residual moisture level (less than 20%).

A high moisture level results in damage to the glued areas of the cardboard materials and corrosion of the cans and ends during transport, especially in the case of major temperature differences between day and night, and with it alternation between evaporation and re-condensation.

In case of longer storage in external depots, it must be ensured that the Depot Personnel are familiar with the required careful package handling methods.

To prevent subsequent damage, it is advisable to include the most important rules in the official language of each country with every shipment:

- Check each shipment for damage on delivery.
- Sort out wet packing units immediately.
- Do not feed cans from wet packing units back into the system.
- Use fork-lift trucks that have the correct fork lengths.
- Stack a maximum of 3 product pallets as shown if the internal pressure resistance meets the agreed minimum pressure.
  500 ml x 8 layers
  330 ml x 11 layers
  Regional variations apply, contact your local CTS Manager.



- Maintain distances between the stacks.
- Provide walking space for inspection between the stacking rows.
- Check stocks regularly.
- Never cover pallet stacks with tarpaulins.
- Never store cans in a damp or wet environment, or in direct sunlight, near heating systems or near chemicals etc.

Edition/Date: 1/2022-07-01

1.18 Container Handling

1.18.1 Container selection

- Check for weather proofing.
- Check floor for water strains.
- No light opening in the container and no small holes.
- Reject - containers with protruding bolts.
- Reject - containers with protruding nails in deck boards.
- Ensure deck clean, free from grit and broken glass, etc.
- Do not use containers used for aromatic substances.
- Do not use containers used for corrosive substances (acid, fertilisers, etc.).
- Use containers of pre specified sizes. Otherwise, where there is space after loading, sufficient packing must be used to prevent movement of load during transport.

1.18.2 Trays used for container transport

- Good quality corrugated board.
- Use high slide trays.
- Fully shrink wrap sides/top and bottom.
- Trays are glued and not stapled.
- Do not pack wet cans.

1.18.3 Container loading

Note: AMP do not recommend container "stuffing" with loose tray's: Will be used as "set-up" for access during stacking.

- Do not throw trays by stack up.
- Trays need to stacked out of line.
- Forestall touching of the trays with the container wall.
- Similarly during subsequent customs inspection.
- Rapid spread of secondary corrosion.
- Movement in transit:
  - Use hand truck to stow pallets.
  - Do not "shunt" pallets along deck.
  - Remove any tray's exhibiting damaged cans.
  - Ensure board to board contact.
  - Secure rear pallets to container deck.
  - Use air bags to prevent pack movements.

1.18.4 Container unloading

- Attend Customs inspection if containers are to be unloaded.
- Observe all good handling practices.
- Remove from quay-side immediately upon customs clearance.

Edition/Date: 1/2022-07-01

2.1 Explanatory Notes for Seam Control

Double Seam Quality is the fillers responsibility.

2.1.1 Critical parameters

The critical parameters must always be achieved. See in this chapter for details. Other parameters are a guide to maintaining critical parameters.

2.1.2 Evaluation frequency

- A 1st operation seam check should be carried out at least once a week or after a Seamer setting.
- The 2nd operation/finished seam should be evaluated by the use of sectioning equipment at least once every 8 hours for line speeds up to 1500 cpm, and every 4 hours for line speeds above 1500 cpm.
- Re-checks should be carried out if machine disruption has taken place or if the component supply source has changed.

2.1.3 Other important guidelines

- The Seam specifications identify nominal values and tolerance ranges, these nominal values must be targeted when carrying out a seam adjustment and/or tooling replacement.
- It is important that the 1st operation is set to the recommended specifications.
- Refer to set up sheet for measurement parameters.
- Final appraisal of the seam should be based on visual examination of a “torn down” and “sectioned” seam, and achievement of the critical parameters.
- Free Space is the difference between actual seam thickness and the calculation of:
  (3x measured end thickness) + (2x nominal can flange thickness).
- Should any of the parameters measure outside of specification, a second can from the same seaming station (or stations) should be evaluated before any adjustments are made to the Seamer.
- Caution:
  As a part of the seam evaluation, regardless of the 2nd operation dimensions, close inspection of the body wall impression should be carried out.
  On Aluminium cans, body wall fracture may occur if this impression is too deep.
- To determine the correct seam thickness calculation, refer to the “Nominal seam thickness table”, reference section 5.1.5 Nominal seam thickness.
- Seam thickness can only be evaluated in conjunction with tightness rating and free space.
- The seamer tooling must be able to provide a complete seam within AMP-E and BCME specifications.
- Seaming chuck coatings can vary by manufacturer therefore AMP-E only recommend a textured seaming chuck.

- Some fillers run Aluminium and Steel cans on the same filling line. AMP-E recommend a quick change cam to be fitted on the seamer (adjustable cam 2nd operation) for optimum seam results between the two materials.
- The specifications and procedures contained in these documents should be considered as the minimum acceptable requirements.

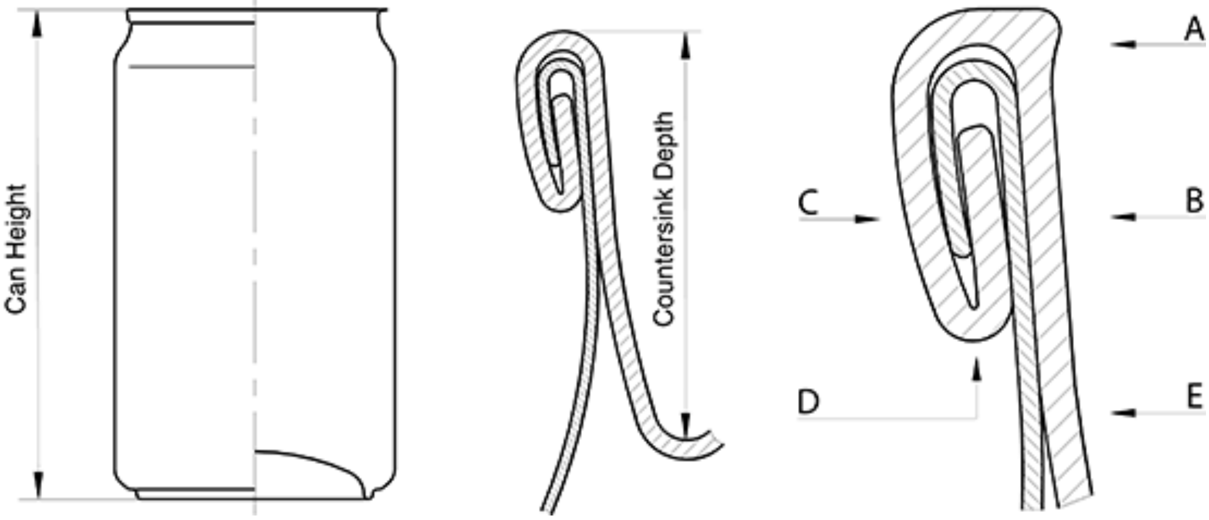
Local conditions may require (or permit) tighter tolerances to be applied.
CRITICAL PARAMETERS MUST ALWAYS BE MAINTAINED

1.1.4 Visual evaluation of seam

Seam control should begin with visual evaluation. This is the only way to quickly establish signs of early wear, gross mis adjustment or damage to seamer tooling.
A visual check by the line operator to be carried out every ½ hour.
The following points should be checked several times a day and results should be recorded on the Seam Control sheet in the space marked “visual check”.
The potential defects have been classified as A, B, C, D and E as follows:

A	Top inside edge of seam	Sharp or rough edge
B	Seam area of countersink wall	Dents or bulges
C & D	Bottom of seam outside of can	Cuts or cracks, metal slivers or fines
E	Countersink wall	Damage or material build up due to worn or defective chucks

Can height and countersink depth are measurements of less importance and the recommendation is once per day only.
When measuring the can height and countersink depth, the can must be without internal pressure.
The can must be emptied or vented prior to being measured with a pre-set dial gauge.



5.1.5 Nominal seam thickness

ø50 (200) and ø52 (202)

		Nominal flange thickness (Compound allowance" +0.13)														
		0.110	**0.115**	**0.120**	**0.125**	**0.130**	**0.135**	**0.140**	**0.145**	**0.150**	**0.155**	**0.160**	**0.165**	**0.170**	**0.175**	**0.180**
Actual end material thickness (with lacquer)	**0.190**	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06
	0.195	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08
	0.200	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09
	0.205	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11
	0.210	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12
	0.215	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14
	0.220	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15
	0.225	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17
	0.230	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18
	0.235	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20
	0.240	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21
	0.245	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23
	0.250	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24
	0.255	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26
	0.260	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27
	0.265	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29
	0.270	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30
	0.275	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32
	0.280	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33
	0.285	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
	0.290	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36
	0.295	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38
	0.300	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39

2.1.6 Freespace

This is a calculation of the difference between the actual seam thickness, and the calculated seam thickness of 3x End plus 2x Body only, with no allowance for compound.
As an allowance of 0.13 mm is used for compound in calculating seam thickness in the matrix table, the free space target should be 0.13 ±0.05 mm.
This used in conjunction with seam thickness is a useful guide to assessing tightness rating.

2.1.7 Tolerance range for seam thickness

For a given nominal seam thickness, the actual thickness may vary due to variation in metal thickness, lacquer thickness and compound thickness.

For this reason a tolerance range should be set on the seam control sheet.
Variation happens when cans and ends from different suppliers are used.
In any case, however, the seam thickness tolerance range for all seaming stations must not exceed ±0.05 mm of the nominal calculated thickness.
On each can peripheral measurements of the seam thickness should not vary in excess of 0.05 mm. Variation on a single can should also not exceed 0.05 mm.
The nominal seam thickness should be calculated using the measured end thickness, and the can flange thickness specified by the can supplier.
The final criteria for acceptance is that the critical parameter of tightness rating must be maintained along with the other critical parameters.

2.1.8 Body hook butting

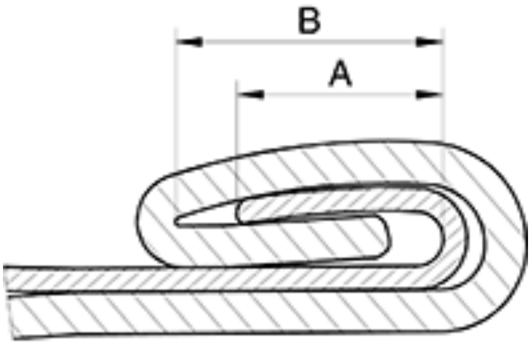
Body hook butting expressed as a percentage A/B x 100 and can be worked out by reference to the table.
This table is only valid for double seams with a nominal gap of 0.07 mm.

Example for 202		Body hook length										
		1.85	1.80	1.75	1.70	1.65	1.60	1.55	1.50	1.45	1.40	
Seam length	2.65	86	83	81	78	76	73	71	68	66	63	no go area Fe and Al
	2.60	88	86	83	81	78	75	73	70	67	65	
	2.55	90	88	85	83	80	77	75	72	69	66	
	2.50	93	90	88	85	82	79	77	74	71	68	
	2.45	95	93	90	87	85	82	79	76	73	70	
	2.40	98	96	93	90	87	84	81	78	75	72	
		no go area Fe: 92 - 100%										
		no go area Al: 97 - 100%										

Judgement of the seam made from individual measurements entered in the seam control sheet, even when they are all within the tolerances, is often not enough by itself. There are borderline situations, such as:

Body hook - minimum	Body hook - maximum
Seam length - maximum	Seam length - minimum

Under these conditions **B**ody **H**ook **B**utting (BHB) expressed in % will determine the quality of the seam.



A/B x 100%

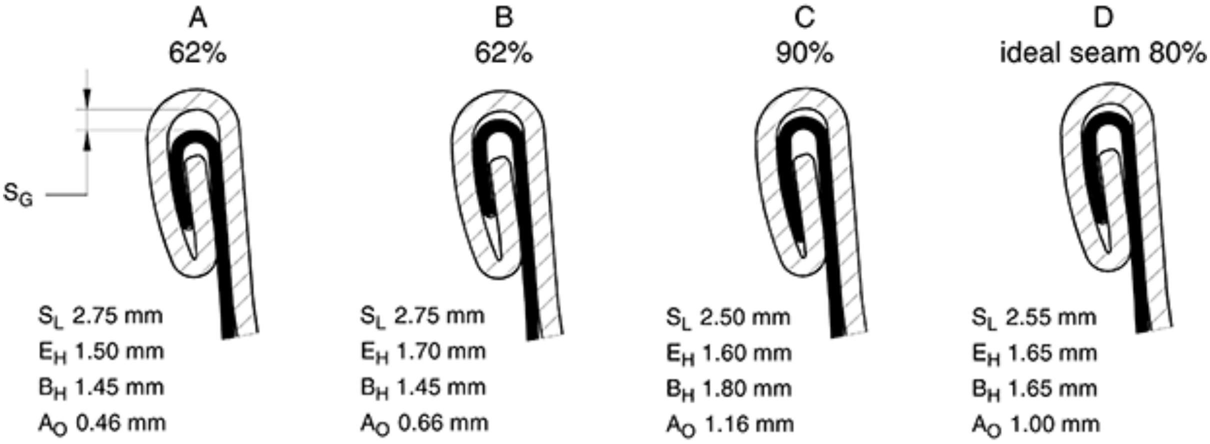
(BHB) recommended limited

200:	72 - 97% for Aluminium
202:	72 - 97% for Aluminium 72 - 92% for Steel

The three seam cross sections A, B, and C are of double seam which dimensionally are all within tolerance but in which the body hook butting is outside the recommended values and therefore the seams are not good.

Example A:	Long seam - Short body hook - Excessive seam gap Elevated inside pressure such as during pasteurisation can cause movement within the seam. A large seam gap also permits product ingress which could result in product spoilage.
Example B:	Long seam - Long end hook A longer end hook will prevent end of body hook to reach low enough inside the seam to make contact with the compound which is necessary for good seal.
Example C:	Short seam - Long body hook Tho long body hook will press against the bottom of the end hook cutting through the compound. In extreme cases cracks may develop and the seaming wall may burst.
Example D:	Ideal seam; shows 80% body hook butting Ideal seam formation, balanced hooks, mid-range seam length and body hook butting and good overlap. Take care that the seam in the lower region is tightly clamped.

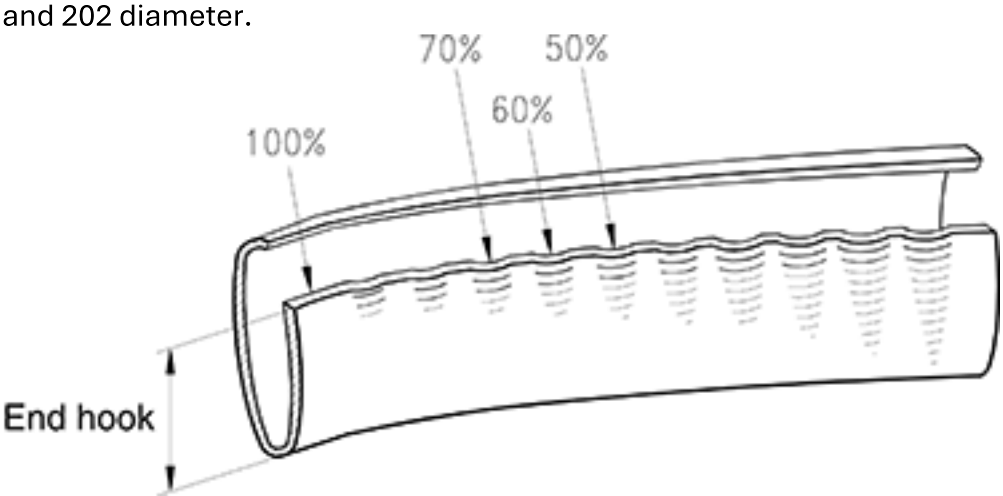
Example:



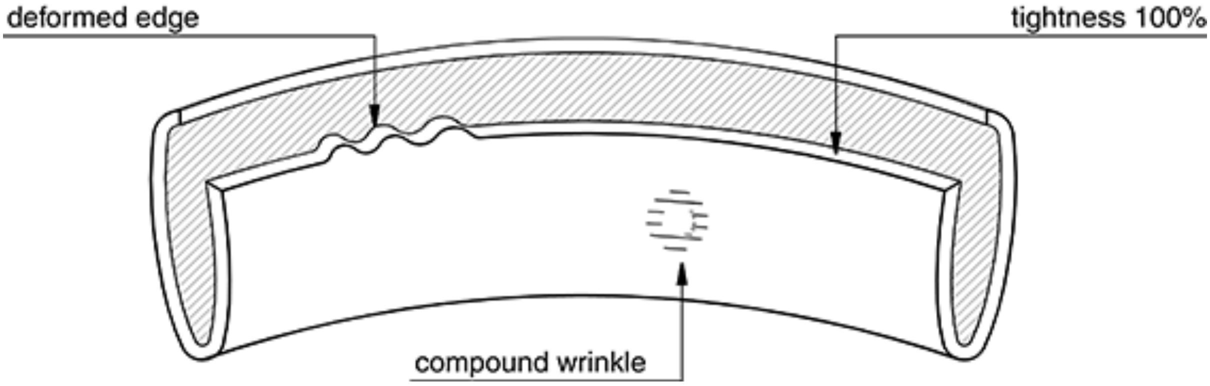
S_L = Seam length E_H = End hook B_H = Body hook A_O = Actual overlap S_G = Seam gap

2.1.9 Tightness rating

The wrinkle free length of the end hook is an indication of the seam tightness. Tightness rating is the wrinkle free length of the end hook expressed as a percentage of the total end hook. It cannot be measured. It must be visually estimated. Tightness rating is a critical parameter of seam quality. A minimum rating is wrinkle free on 200 and 202 diameter.



Note: Evaluation should be carried out on the worst part of the end hook!
Example of illustration:
Tightness rating 100% - Smooth end hook - Even cut edge
Tightness rating from 90% - End hook deformed by wrinkles - Cut edge wavy
If the seaming roll setting is too tight, the end hook will show edge deformation (see figure below). In extreme circumstances, the seaming wall may burst in case of a Steel can/Aluminium end combination or the body wall may be excessively impressed or cut through in case of an Aluminium can/Aluminium end combination. A wrinkle caused by compound is recognized by a dimpled end hook with a straight cut edge.



The seam must be opened or torn down for this check.
Tightness rating is not the only indication of a good seam; all critical parameters must comply with specification.
Edition/Date: 1/2022-07-01

2.2 Seamer Adjustment and Procedure

Refer to closing machine (seamer) manufacturers manual for set-up procedure.

2.2.1 Pin gauge height

The formula for calculating the pin gauge height is explained on the following page.
The pin height measurement remains constant, irrespective of container substrate.

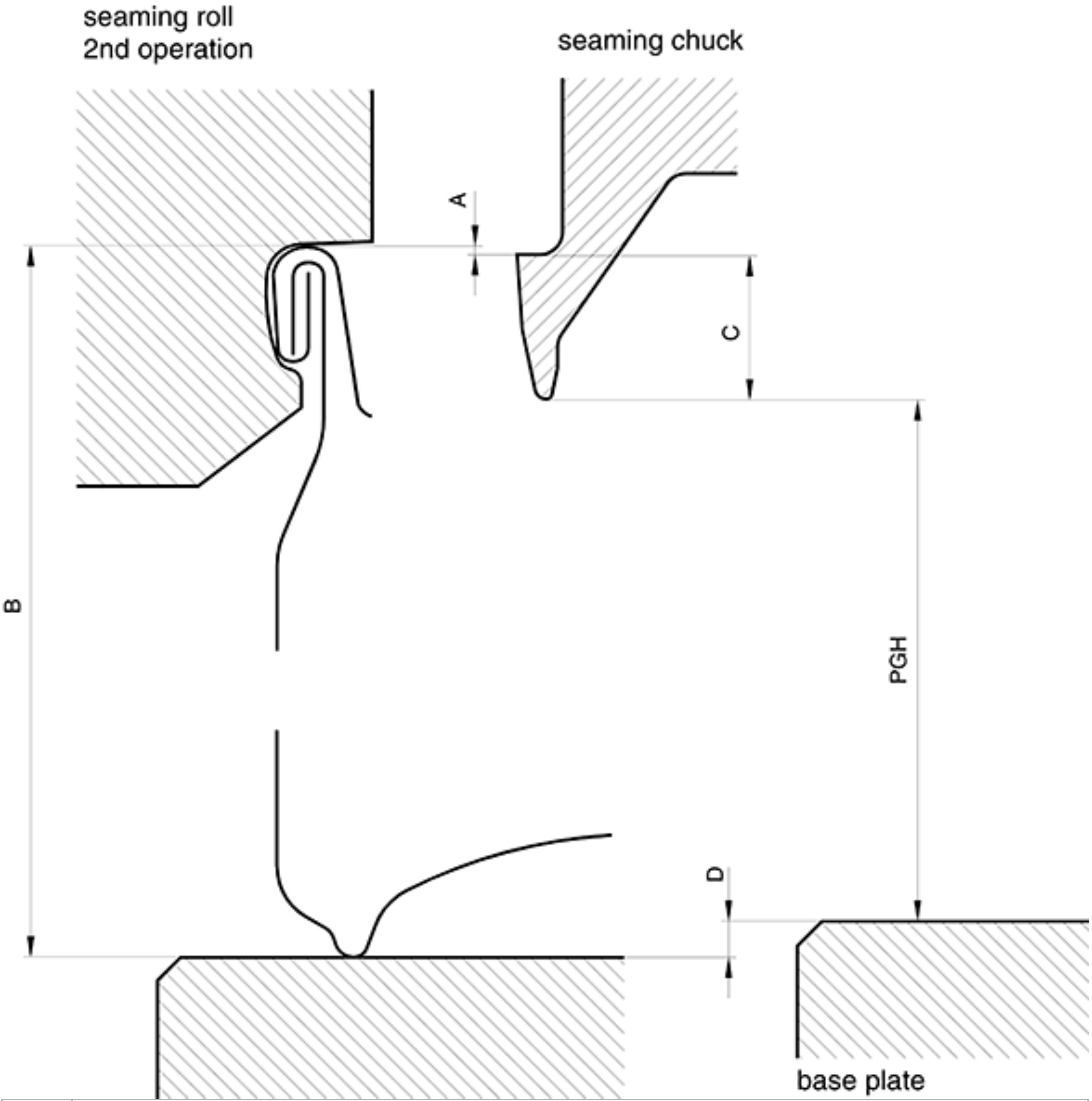
2.2.2 Base plate pressure

Refer to closing machine manual for specific base plate pressure targets relative to can body types.

Note:	It is important to note that the base plate pressure will differ according to can substrate.
Guideline:	As a guideline the base pressure will be set lower for aluminium cans.

1st Operation setup

Seam thickness	200 and 202	SR 202-1A	2.10 ±0.05 mm
	202	SR 202-1B	1.95 ±0.05 mm
Countersink depth	200		6.60 ±0.07 mm
	202		6.86 ±0.07 mm



A:	Height difference between seaming chuck height and average of seamed countersink depth A = 0.05
B:	Finished can height
C:	Seaming chuck height
D:	Base plate deflection at end of 1st operation = refer to Seamer Manufacturers recommendations

The formula for calculating **P**in **G**auge **H**eight equals: **PGH** = B-(A+C+D)
Edition/Date: 1/2022-07-01

3 .1 Quality

3.1.1 Cans

- Graphic number.
- Customers product number (by request).
- Production information as set out in this specification manual.

3.1.2 Ends

- Production information as set out in this specification manual.

3.1.3 Pallet tickets

Provide additional details of:

- Pallet number,
- Quantity on pallet,
- Time of production,
- Other information as requested by the customer.

3.1.4 Filling code (Customer)

- Including time of filling must be printed on every can.

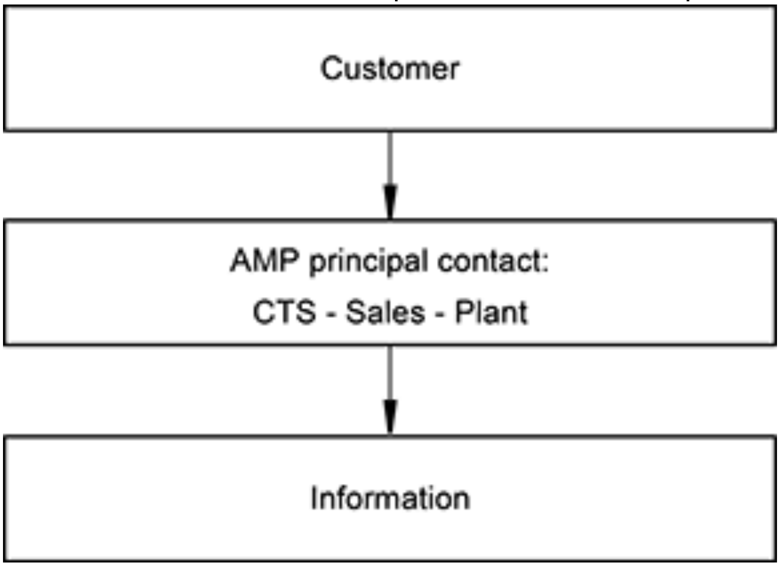
It is important, that the customer maintains a log of pallet number and time of its issue to the line. This is essential in order to localise production batches in the event of subsequent product investigation and to assist both parties to implement corrective actions.

For good tracing of cans and ends the customer must mark the date and time (for instance with a date/time printer) when the can and end pallets are brought into the filling section in addition to relying on the identification marking on the cans and ends.

Edition/Date: 1/2022-07-01

3.2. Customer Non-Conformance Procedure

The procedure below shows the non-conformance process. This process must be adhered to enable AMP-E to provide Oasthouse a positive response in a timely manner.



To enable AMP-E to process the non-conformance specific information is required and must be provided to your Oasthouse Contact:

- Pallet ticket details,
- Samples of the non conforming product,
- A complete description of the non conforming product and the fault found,
- The number of components affected,
- Total quantity of affected empty pallets on site,
- Total quantity of pallets of any filled product.

Timing for responses:

- AMP-E will issue an official acknowledgement to state an initial investigation has been started on this non conformance. This acknowledgement will be returned to the customer via e-mail.
- Within 30 days A full report will be issued from the original AMP-E manufacturing plant. This will state the cause of the non conformance and the resulting corrective action.

Note: Some more complex non conformances will require special laboratory analysis. This will extend the response time. In this case an interim report will be issued by the original manufacturing plant and will show timings of when a full report will be issued by Oasthouse provided by the AMP-E Business Service Centre Bonn.

3.2.2 Inside Spray Specifications

Aluminium Can & End

Filling Good/Can Type	Enamel Rating
Beer	20 mA average/40 mA max. individual

Filling Good/Can Type	Enamel Rating
Soft drinks	2.0 mA average/17 mA max. individual

Steel Can

Filling Good/Can Type	Enamel Rating
Beer	5.0 mA average/10 mA max. individual
Soft drinks	0.5 mA average/2.0 mA max. individual

3.2.3 AQL - Visual aspects

Minor defects - AQL 10
These are small defects which are easily detectable but which do not make the product unsuitable as packaging material.
Major defects - AQL 1.5
These are striking defects which damage the appearance of the product but which do not substantially affect the utility of the product.
Critical - A defects - AQL 0.065
Defects which make the product unsuitable and/or cause disturbance during handling at the customer. These defects decrease the aesthetically aspect of the can.
Critical - B - AQL 0 (Fundamental)
Defects which may be harmful to the safety or health of the consumer or which are not in accordance with legislation.

3.2.4 AQL - General

Since the method of determining and along with that the “measuring results” of visual aspects is rather subjective and therefore may lead to differences in interpretation, it is necessary to describe the standard and/or have pictures of samples available (border samples).
Not all defects have to be (or can be) treated in this way. Through training it is possible to judge by analogy available samples.

3.2.5 Shelf life of empty Cans and Ends

The shelf life of unused empty can bodies is 24 months and unused ends 36 months if stored under ambient conditions in warehouses.
The shelf life of unused empty NexGen can bodies is 24 months and unused NexGen ends 24 months if stored under ambient conditions in warehouses.
The shelf life of unused empty NexGen cans for filling with water products is 12 months if stored on cardboard layer pads.

The shelf life of unused empty NexGen cans for filling with water products is 12 months if stored on plastic layer pads.
The shelf life of unused NexGen ends for filling with water products is 24 months.

3.3. Change of Cans and Ends

AMP-E will inform Oasthouse about any changes to the can and end that could influence the filling line efficiency or product.
AMP-E will ensure that changes to container specification are implemented in accordance with each customers specific procedure.

3.3.2 New or reformulated beverages (Beverage Corrosivity Test (BCT))

If a new or reformulated product is to be filled in cans, AMP-E will judge pending on the Bev form information if BCT is needed before granting a warranty of product/container corrosion stability (no undue metal-pick-up during warranted storage time).
The following procedure makes it possible to assess product/corrosion stability within 2-12 weeks.
Following the incoming Bev form/test/analysis AMP-E can give a written recommendation, dependent on these Bev form information or test results:

- If all of these information/tests results are positive, AMP-E will approve the can for the product tested for a storage time of up to 12 months.
- Should the results prove to be negative, AMP-E will not guarantee the corrosion stability of product and container and will subsequently advise against using cans for the product.

Procedure

- If you wish to fill a new product please notify your Oasthouse contact, preferably customer care.
- Your Oasthouse contact will send you the new Bev form, or download it from this site.
- Please fill out all the information required by the Bev form and send back to your contact.
- Your Oasthouse contact will respond based on the details on the Bev form to say if a product warranty can be offered without testing or if a test will still be required.
- If a test is required your contact will ask for either 1, 5 or 10 litres of finished product to be sent
- The Lab will write a certificate for each beverage (independent of test or not).
- The certificate will be mailed to you by your original Oasthouse contact.
- Pure beer (with and without alcohol) remains an exception as we do not test beers. In case it is not clear to you if your new beverage is a beer or not please contact us.

The Form "Customer Request Form for a New Beverage Test (BevForm)"
The information on the Bev Form is an important precondition to reduce the lead time per beverage.
For more detailed information please have a look to the "BevForm, CEN-PC03-FO-0001" and some explanations at "Related documents".

ArdaghMetalPackaging

Customer Request Form for a New Beverage Test (BevForm)

Division to be filled in by AMP (Sales, Customer Care, CTS)		
☐ Trading Germany (Central Europe & Retail)	☐ Trading Netherlands (Benelux)	☐ Trading UK (UK & Ireland)
☐ Trading France (South-Western Europe, Middle East & Africa)	☐ Trading Poland (North-Eastern Europe)	☐ Ardagh Devision (Brazil & United States)
Date		
Requested by (contact person within Ardagh)		
Customer contact person		
Copy of warranty certificate send to		

Details Customer	
Brand owner *	
Filling location	

Details Beverage		
Beverage/Brand name *		
Formulation code *		
Beverage category *	Beer/non-alcoholic Beer	☐
	Beer-Mix/Strong Beer	☐ specify:
	Lemonade/Cola/Diet Drink	☐
	Ice Tea/Tea products	☐
	Isotonic	☐
	Energy	☐
	Juice/Nectar	☐
	Fermented products (e.g. Kombucha, Kefir etc.)	☐ specify:
	Alcoholic Mix	☐ - (ABV V%)
	Hard Seltzer incl. alcohol base	☐ - (ABV V%)
	Pure Water/Water & Flavor	☐ specify:
	Cider	☐
	Wine/Wine Based/Wine Mix	☐ specify:
	Dairy/Coffee/Coffee & Milk	☐ specify:
	Supplements (CBD, Vitamins etc.)	☐ specify:

Processing			
	Yes	No	Amount
CO_2 *	☐	☐	
LN_2 *	☐	☐	
Tunnel pasteurization **	☐	☐	
Sterilization **	☐	☐	
Flash pasteurization	☐	☐	
	Temperature [°C] *		
	Time [minutes] *		

* mandatory data ** In-Can heat treatment

ArdaghMetalPackaging

Customer Request Form for a New Beverage Test (BevForm)

Acid and pH of ready product			
Total acid as citric acid *	mg/l	pH *	

Special Compounds of ready product		
	Amount [mg/l]	No information available
Free SO_2 *		
Total SO_2 *		
Chloride (Product mix-water) *		☐
Chloride (Beverage formulation) *		☐
Copper *		☐

Individual Acids			
	Yes	No	Amount [mg/l]
Citric acid	☐	☐	
Phosphoric acid	☐	☐	
Tartaric acid	☐	☐	
Lactic acid	☐	☐	
Malic acid	☐	☐	
Acetic acid	☐	☐	
Oxalic acid	☐	☐	

Additives				
	Yes	No	Amount [mg/l]	
Natural sweeteners other than Sugar	☐	☐		
Artificial preservative	☐	☐		if yes, which
Artificial colours	☐	☐		if yes, which
Artificial sweeteners	☐	☐		if yes, which

Catalogue of ingredients/declaration

Remarks/Special Requirements

Shipment address
Ardagh Metal Packaging Holdings Germany GmbH Laboratory - Samples for BCT Friedrich-Wöhler-Straße 51 53117 Bonn Germany Please add a copy of this form to sample delivery!

* mandatory data ** In-Can heat treatment

ArdaghMetalPackaging

Customer Request Form for a New Beverage Test (BevForm)

CUSTOMER DISCLAIMER

The Customer understands that the mandatory data are the basis for the evaluation of the beverage's corrosivity and may not be checked.
The Customer will indemnify, defend and hold harmless AMP from and against all liabilities, costs, damages, claims, and expenses incurred by AMP in relation to any claim, including claims raised by third parties against AMP, that might arise as a result of incorrect mandatory data.
The Customer herewith confirms the accurateness of all data supplied.

Customer

Name: ____________________ Position: ____________________

Date: ____________________ Signature: ____________________

* mandatory data ** In-Can heat treatment

BevForm

The information we require

- Your Oasthouse contact responsible for this communication,
- Your details and filling location,
- Your brand name,
- The formulation code for traceability reasons,
- Beverage category for a more precise risk assessment,
- Carbonisation in combination with pasteurisation to cross check if it is realistic to fill,
- Heat Treatment, as this can impact the internal coating,

- Special compound → all are critical to a certain degree - the combination to other characteristics is important,
- Acid and pH → critical parameter,
- Individual acids → interaction depend on acid composition,
- Catalogue of ingredients → helps/supports the for risk assessment,
- Shipping address if samples are required.