

Minimising Voids:7.5kg fish block production

Summary

A void is a 'Hole' or 'Pit', containing air or ice, within a fish block, generally seen in the surface of the block . Voids are undesirable because they affect the final weight and appearance of a portion produced from the block. This document, based on information provided by Beck Pack Systems A/S summarises the common causes of voids in frozen fish blocks and makes recommendations to minimise their occurrence.

Product Specification

Depending on product availability and market demand blocks may be made from fillets, fish pieces or mince, a combination of these. The incidence of voids must be contained to the lowest possible level and will ideally be zero.

- Blocks made only from fillets tend to have more voids in their surface than those containing mince or smaller fish pieces.
- Fillets placed randomly or "jumbled" are likely to produce a block with less voids than when the fillets are neatly placed in the liner
- When packing fillets as opposed to mince, pieces etc, voids may be elongated rather than round.
- When switching from one product to another e.g. from fillets to mince, a number of changes to production methods will be necessary.

Dimensions for European-Standard fish blocks are:

	Frame Inside	Block Overall	Block Tolerances
Length	485 mm	482 mm	+/- 1.0 mm
Width	255 mm	254 mm	+/- 1.0 mm
Height	59 mm	62.7 mm	+/- 0.9 mm

98% of all blocks should be:-

- longer than 480 mm,
- wider than 252 mm
- higher than 60.9 mm.

None must be:-

- shorter than 479 mm,
- narrower than 251 mm
- Lower than 60 mm.
- Average weight all blocks 7484g +/- 55g
- 98% must be > 7400g
- None less than 7300g



Frozen blocks should not normally exceed 4mm above frame height.

A typical, block void specification may require:

- No more than three voids per block ; approx. void size 1.9mm x 0.3mm deep
- Rejection when voids reach up to 30 mm diameter or 5 - 10mm

Raw Material

Different species of fish have varying firmness of flesh and muscle tissues. Differences also occur seasonally and geographically within a particular species. Many fish show a marked variance in physiological condition between pre- and post-spawning periods. Hence, their weight / volume ratios vary with the flesh density, which affects the carton loading.

- Freezing fish in rigor can result in poor blocks
- The fresher the product, the firmer and more elastic it's cell structure. In other words it becomes harder to 'squeeze' the same weight of fish into a block. Thus a higher than 'normal' plate pressure may be needed to press it into an acceptable homogeneous block, but probably with less overfill.

Older fillets, or product, may require less pressure because of their loss in cell elasticity but may exude more fluids. This 'packing density' is also affected by the elapsed time since the fish was caught; the temperature of the flesh at packing; and whether the fish has been previously frozen.

Frozen fish that is semi, or completely, thawed before packing into blocks will exhibit different characteristics from fresh fish. Even the means and speed of thawing can have an effect on the overall block production methods and final results.

- Ensure that all product is thoroughly drained before packing. Sufficient draining time should be allowed on the filleting line so that there is no surface moisture on the flesh when it reaches the packing area. If polyphosphate is being used, the flesh should have no visible surface moisture when the coating or injection is complete.

Block Preparation

Frames

Frames may be singles or doubles, with fixed or loose bottoms, in stainless steel or aluminium, or a combination of both. Some processors use sheet plastic bases which are removed from the plate freezer once the frame is in position, and before freezing starts. This allows maximum contact between the block liner and the plates, thus minimising freezing time



To make good fish blocks you need strong straight frames to hold the fish block liner or fish block carton in the correct shape during freezing in a plate freezer. The photo above shows three different aluminium freezing frame profiles. Left to right they are the "XU" (strongest), the "E" and the "U" (less strong). Most modern processing factories and vessels use the "XU" for its strength and longevity.

- Fish blocks, which later on are to be cut up to "fish fingers"/fish portions, are normally frozen in frames of XU-profile, as they keep the dimensions better and last longer.
- It is important that frames are clean, square and flat. If they are not flat the freezer plates will create uneven pressures on the blocks and other frames.
- It is of great importance that the frames are strong and precisely sized, having sharp edges. The inside length and width of new frames should be within +/- 0.5 mm to guarantee frozen blocks of the correct size and the required sharp edges.
- Regardless of whether U-profile, E-profile or XU-profile frames are used, the frames must from time to time be brought to a workshop to be aligned and checked with a dial meter

Cartons

The quality of the fish blocks strongly depends on the cartons where fish products are to be frozen. The effect of the cartons on the product quality is of vital importance

rather than of general consideration. The purpose of the cartons is to protect the fish blocks from the time of packing until the cartons are removed from the frozen fish blocks:

- The carton height is typically 60mm with a frame height of 59mm after freezing the block will expand to 63mm
- The liner surface must be dry before packing commences. If it is wet on the outside it will transfer moisture to the freezer plates. Water droplets on the inside will encourage the formation of voids
- The coating of the inner surface of the cartons must give the fish blocks a completely smooth surface, with an absolute minimum of air pockets.

Further, the coating must ease the removal of the cartons from the fish blocks and assure that no cardboard pieces remain on the fish blocks. However, the cartons must also stick to the fish blocks to prevent dehydration and freezing burns. Further, the inner surface must have a sufficient porosity to absorb the humidity necessary to protect the fish blocks against dehydration during storage.

Blocks should contain only the product - i.e. no polythene or other packaging materials; foreign objects, added water, etc

Overfill

- If there is too little product to properly fill the cartons, when under pressure, voids will occur.

- Care is required to fill all corners of the carton

The most experienced block producers are said to use only 40g [1.4 oz] overfill. However many block producers are using up to 100g [3.5ozs]. In some situations 100g -200g [3.5 - 7 oz.] is quite acceptable to produce a block of the required standard. As an initial guide, trial with an average of 50 - 100g [1.75 - 3.5oz].

The degree of overfill will depend on include; type of product [mince, fillets, pieces]; product quality; the actual species; fresh or pre-frozen fish; stand time before freezing; and to some extent to the methods of processing and packing.

- An overfill of 150g may be necessary with layered fillets, whereas 50g might be sufficient with the same product when 'random' or 'jumble' packed or fresh fish
- It is important to observe that the carton must be at least 1mm higher than the frame to obtain a certain pressure of the carton during freezing

Temperatures

Product temperature will ideally be about 0° - 4°c [35.5°F -39°F] when the fish is packed. As with all fish or food processing it is important that the product stays below temperatures at which bacteria easily multiply. [e.g. in some specifications you may find that product temperatures exceeding 8° c [46.5°F] during processing, and prior to freezing, constitute a reject situation]

The room temperature has a direct effect on a product's temperature as it moves through

the process chain. This is no doubt the reason most premises are moving to temperature controlled processing and packing rooms.

Stand time

Stand time may vary quite significantly from one product to another and should be one of the first parameters checked when changing product or when voids start to occur.

The amount of stand time allowed will vary with the ambient and product temperatures, the type and quality of product, and the product wetness or moisture content.

- Do not start to freeze blocks too soon after packing. There must be sufficient time for the proper absorption of fluids by the liner. This function is important as it is this absorption which ultimately helps protect the block against dehydration and freezer burn. It also helps complete and easy removal of the liner from the block.

Conversely if the stand time is too long the liner may become soft and weakened by excessive fluid up-take.

To avoid an unacceptable increase in product temperature it may be desirable to stand product, awaiting freezing, in a chilled area rather than in the packing room or a non-refrigerated lobby.

- Typically, blocks may stand for 20 minutes to 2 hours [depending on the operation] between packing and the start of freezing. If for only a short time, the loaded frames can be stacked, about 4 to 6 frames high. This helps consolidate the block,

expel air, etc. If the packed blocks are to stand for a longer period [say 1½ hours] it is better not to stack them but place them individually on racks. This will help to prevent excessive fluid loss, due to compression.

- Fresher fish requires a longer standing time
- If the loaded liners / frames have stood for only a short time try applying plate pressure for five minutes before starting the freeze cycle

Freezing

Fish blocks are most commonly frozen in horizontal plate freezers and may be handled manually or by automatic systems. Freezing will have a major impact on the thawed fish characteristics and final block quality, whether. Frozen immediately or some time after catching, the speed of freezing is critical taken slowly or quickly through the critical zone; to what initial core temperature; held at what storage temperatures and subject to what temperature fluctuations.

Some operators clean between loads hence the plates are above 0°C when loaded. Conversely some have the plates to temperature before loading; this introduces significant risk of ice or drip forming an uneven surface on the plates or frames and shell freezing, leading to block deformation and voids

- Do not load product directly into a freezer, which is switched off but the plates are still below 0° c, surface freezing of the block will start. This allows the slow freezing of liquids and

product on the surface of the block, encouraging the formation of voids.

- Fish should be frozen as soon as possible after processing to maintain optimum freshness quality
- The fish should be frozen as rapidly as possible to minimise large ice crystals formation which will be detrimental to quality
- Typical freezer settings are:-
Evaporating temperature -38 ° C to -40° C [-36°F to -40°F] giving a plate surface temp of -34 ° C [-29°F] or lower. Freezing blocks to a core temperature, on break out, of -18°c [0°F] or lower should take 1¼ - 2½ hours given ice-free plates and good contact on all surfaces. If blocks are removed from the freezer prematurely further changes in block shape may occur during sub-zero storage.
- Plates must be free of ice and any other objects before loading and freezing otherwise uneven pressures and block temperatures occur.
- A steady plate pressure is ideal and the use of pulse-operating plate freezers [especially in the early stages of freezing] is not recommended.
- Insufficient pressure exerted by the plates allows the formation of ice, voids, and swelling etc. within the block. If the block bulges too much one remedy is to increase plate pressure.



- Plate pressure which is too high may cause excessive loss of fluids and damage to the flesh structure. It may also cause deformation of the freezing frames.

Pressures are often expressed in two ways, i.e. the 'system pressure' or 'plate pressure'. System pressure relates to the operating pressure within the freezer's hydraulic system.

Plate pressure normally relates to the downwards vertical force exerted by a plate on to the product below it.

- Sometimes plates are operated between 0.25 - 0.5 bar [3.7 - 7.4 psi]. We generally work on a plate pressure of 1 bar [15 psi.] which translates to a system pressure of 70 - 75 bar [1000 - 1100 psi]. A system pressure of 900 - 1200 psi. seems to be a good working range. Variations will occur in the actual pressure exerted on a block. This is influenced by the number of blocks per station; the number of stations; the hydraulic ram size and hydraulic pump capacity.

- A practical example is a 10 station horizontal plate freezer [i.e. 11 plates] with plate size 1500mm x 1100 mm. System pressure has been increased to 102 bar [1500 psi] from about 1050 psi with a consequent reduction in numbers of voids. [1 bar = 14.7 psi]
- The block core must be at least -18oC (corresponding to a surface temperature of -30oC) before removal, otherwise the block will expand and deform in frozen storage

Block Storage

Blocks should be stored at -28°C to maintained blocks held for a maximum period of 6 months

Contacts & further information

- R. Watson – Seafish – r_watson@seafish.co.uk
- Beck Pack Systems A/S. – <http://www.beck-liner.com>
- A full range of business and technical information is available from the Seafood Information Network <http://sin.seafish.org>