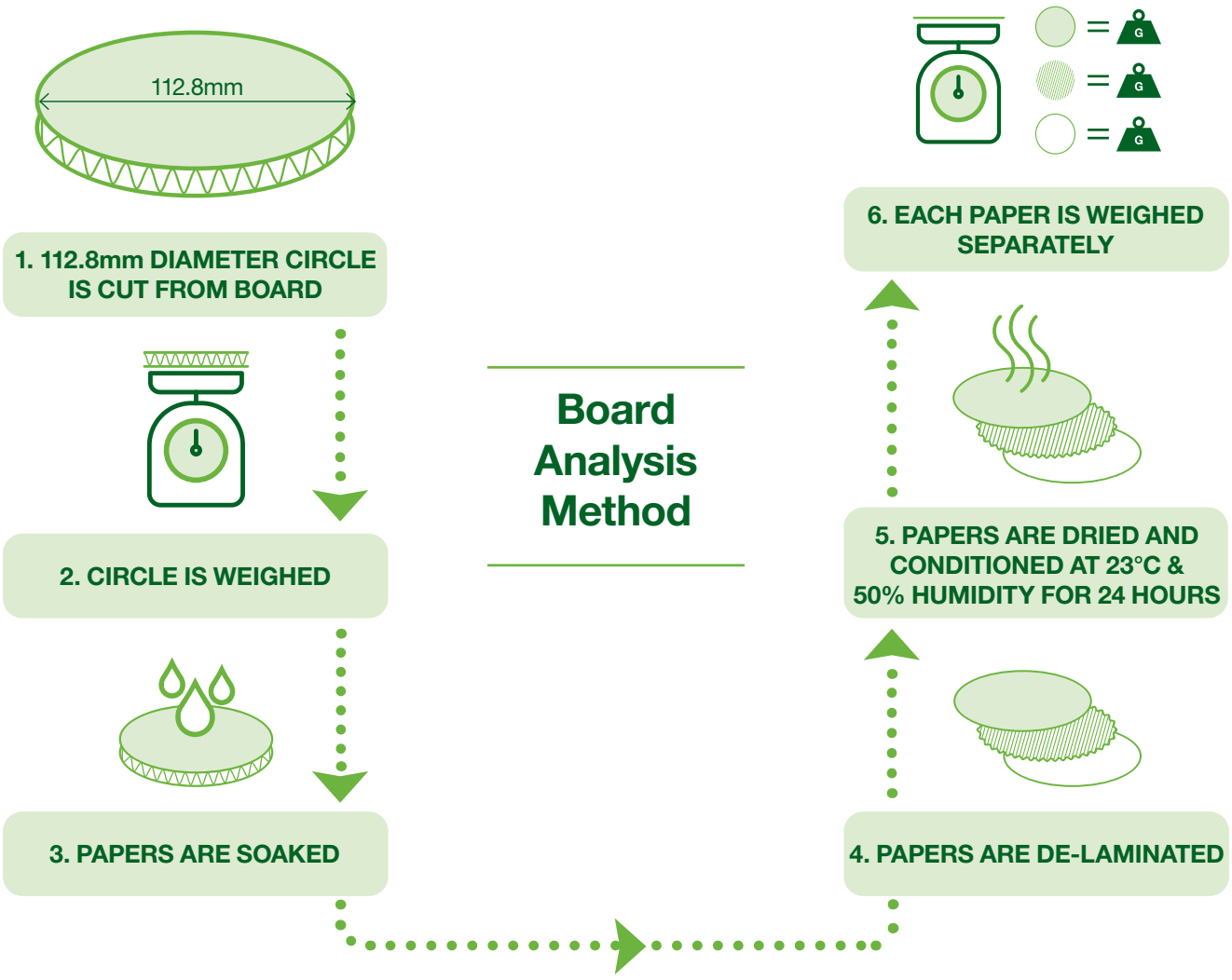
Assessing board grade, using the board analysis method



Process tests:

- Weight of corrugated board
- Thickness of corrugated board
- Weight of the component papers of corrugated board after separation

Information that can be ascertained from the process includes:

- Grammage of the papers
- Flute take up and therefore calliper
- An indication of the paper type

Board Analysis Limitations

Once the full board analysis process has taken place it is difficult to determine exact paper type, eg. testliner 1,2,3.

This is demonstrated by differences in paper attributes, which have a significant effect on the board and box performance. The following tables illustrate the resulting differences between suppliers selling the same board grade, with paper from different paper sources.

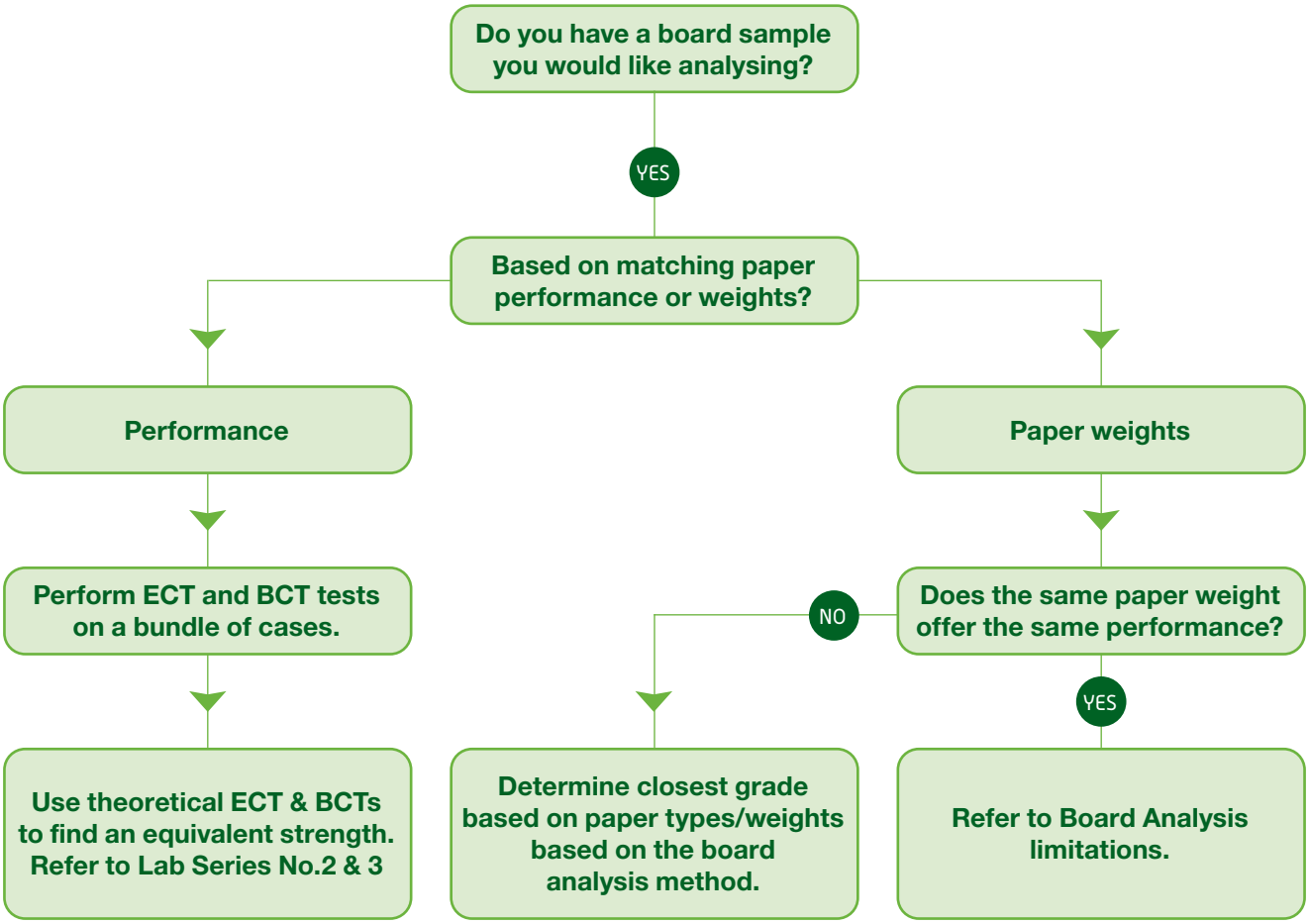
% Diff	ECT	BCT
Supplier 1	0%	0%
Supplier 2	~-1.5%	~-1.5%
Supplier 3	~-2.7%	~-2.7%

% Diff	ECT	BCT
Supplier 1	0%	0%
Supplier 2	~-2%	~-2%
Supplier 3	~-2.9%	~-2.9%

* These are approximate hypothetical figures, not based on tested values or actual results.

Due to the varying paper sourcing methods of board manufacturers, the results from the board analysis method will not necessarily match the same board grade ran by another board manufacturer.
A more reliable method:

Gather a minimum of 12 cases that can be performance tested to assist the board manufacturer with suggesting an equivalent board grade.



How does paper performance contribute to box performance?

Performance, runability and convertability of corrugated packaging are to a large extent defined by paper properties. Physical paper properties are of most interest to board performance.

SCT

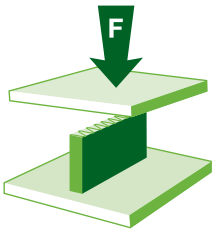
Short Span Compression Test

Compression Strength of Paper

∝

ECT

Edge Compression Test



Compression Strength of Board

Tensile Stiffness

Tensile Stiffness of Paper

∝

Bending Stiffness

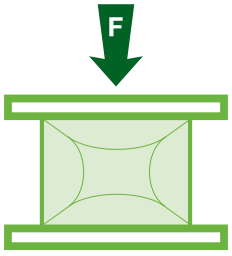
Bending Stiffness of Board

(Single Wall bends easier than Double Wall)

∝ ∝

BCT

Box Compression Test

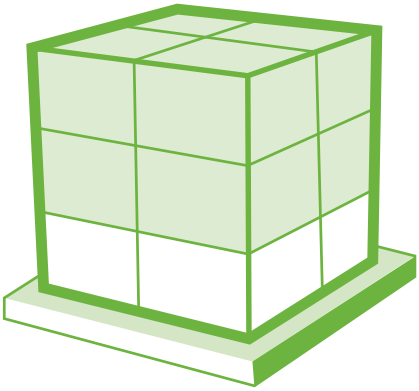


Both ECT and Bending Stiffness contribute to total Box Compression Strength

* ∝ is directly proportional to

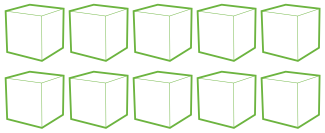
F = force

What is BCT?



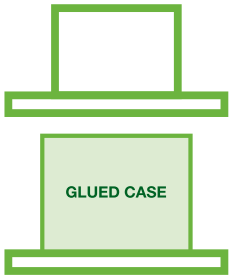
Box Compression Test (BCT)

- Used to assess the compression strength of a glued corrugated case
- Determine a maximum load a box can withstand when palletised



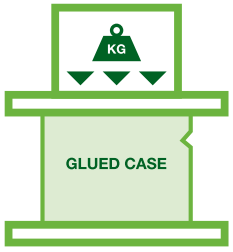
1

AT LEAST 10 RANDOMLY SELECTED CASES ARE TESTED ACCORDING TO ISO187



2

BOX IS MADE UP AND CENTRALLY PLACED ON THE TESTING MACHINE



3

WEIGHT IS APPLIED UNTIL THE BUCKLING POINT IS MET

4

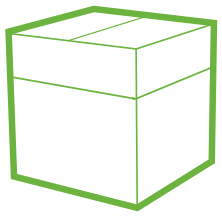
THE MAXIMUM BCT MEASUREMENT IS RECORDED IN KG

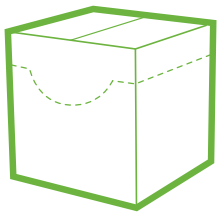
Box Compression Test Limitations

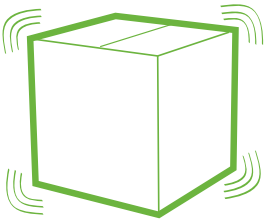
- Die cuts and Multi Depth Scores are first points of weakness on the case, which significantly reduce results
- Boxes are tested within lab conditions and do not reflect the actual conditions the boxes could be subjected to
- Doesn't take into account the dramatically reduced stacking strength caused by even a small stacking misalignment, which is common during distribution see Lab Series No.4

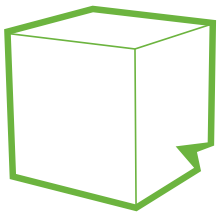
board 24 LAB SERIES
The knowledge to get the most from your board choices

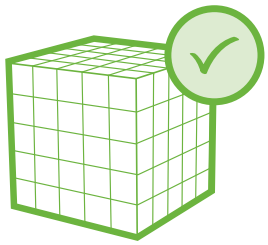
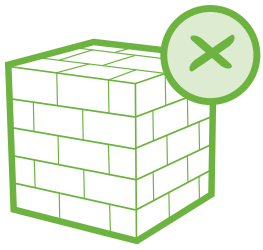
Factors that can cause a loss of box compression strength performance by up to 80%

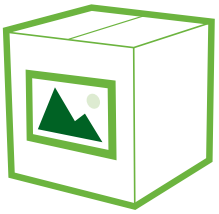

MULTI DEPTH SCORES

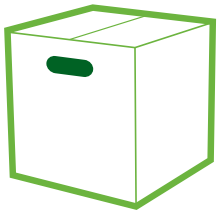

PERFORATIONS

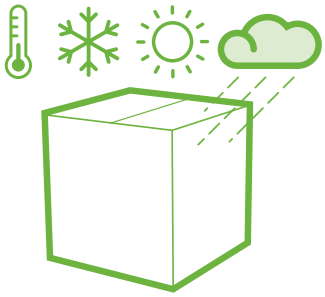

VIBRATIONS IN TRANSIT


DAMAGE

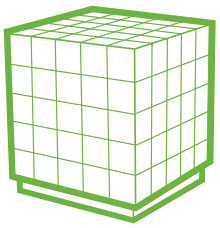


COLUMN V's BRICK STACKING

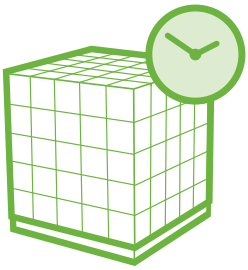

PRINTING


HAND HOLES


MOISTURE, HUMIDITY, TEMPERATURE


DISTANCE EXPORT V's IMPORT


OVERHANG


STORAGE TIME

		COMPRESSION LOSS
Storage time under load		10 days (37% loss)
		30 days (40% loss)
		90 days (45% loss)
		180 days (50% loss)
Relative humidity under load (cyclicle RH variation further increases compressive loss)		50% (0% loss)
		60% (10% loss)
		70% (20% loss)
		80% (32% loss)
		90% (52% loss)
		100% (85% loss)
Pallet Patterns	Columnar (aligned)	0% loss
	Columnar (misaligned)	10 – 15% loss
	Interlocked	40 – 60% loss
	Overhang	20 – 40% loss
	Pallet deck-board gap	10 – 25% loss
	Excessive handling	10 – 40% loss
	Head space in container	10 – 20% loss

www.richbox.com/about_boxes/target_compression.asp

Conclusion:

Paper attributes can be used to predict case performance to an extent. Key considerations should include: case length:width:depth ratios, palletisation, logistics and environment.

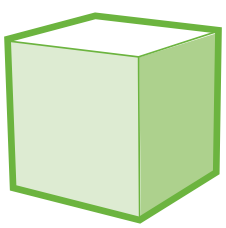
Case size ratios matter

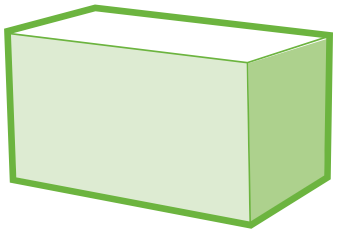
Typically theoretical Box Compression Test (BCT) performance is reliant upon the McKee formula, which uses the perimeter of the case rather than the individual length:width:depth measurements. This can have a significant effect upon the BCT performance.

The McKee formula would calculate the below examples, with the same perimeter, to have the same BCT value. However due to the length to width ratio, this is not the case.

Example:

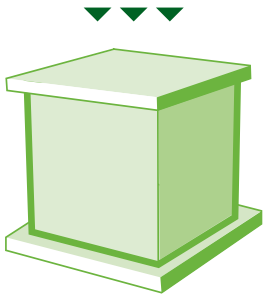
Square Case
300x300x300

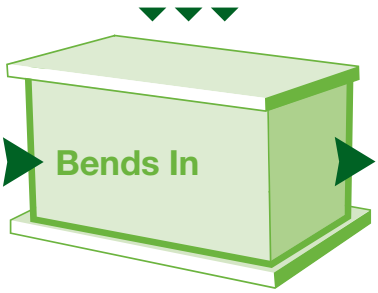




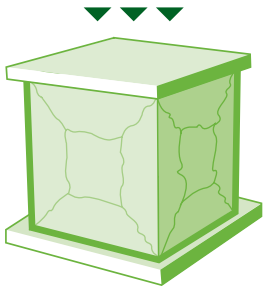
Retangular Case
400x200x300

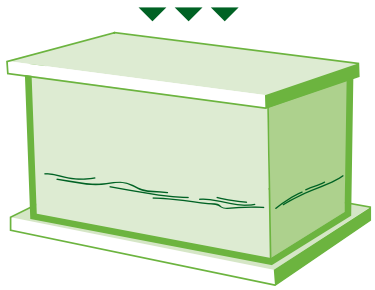
Square Cases Increases load bearing





Buckling is evenly distributed



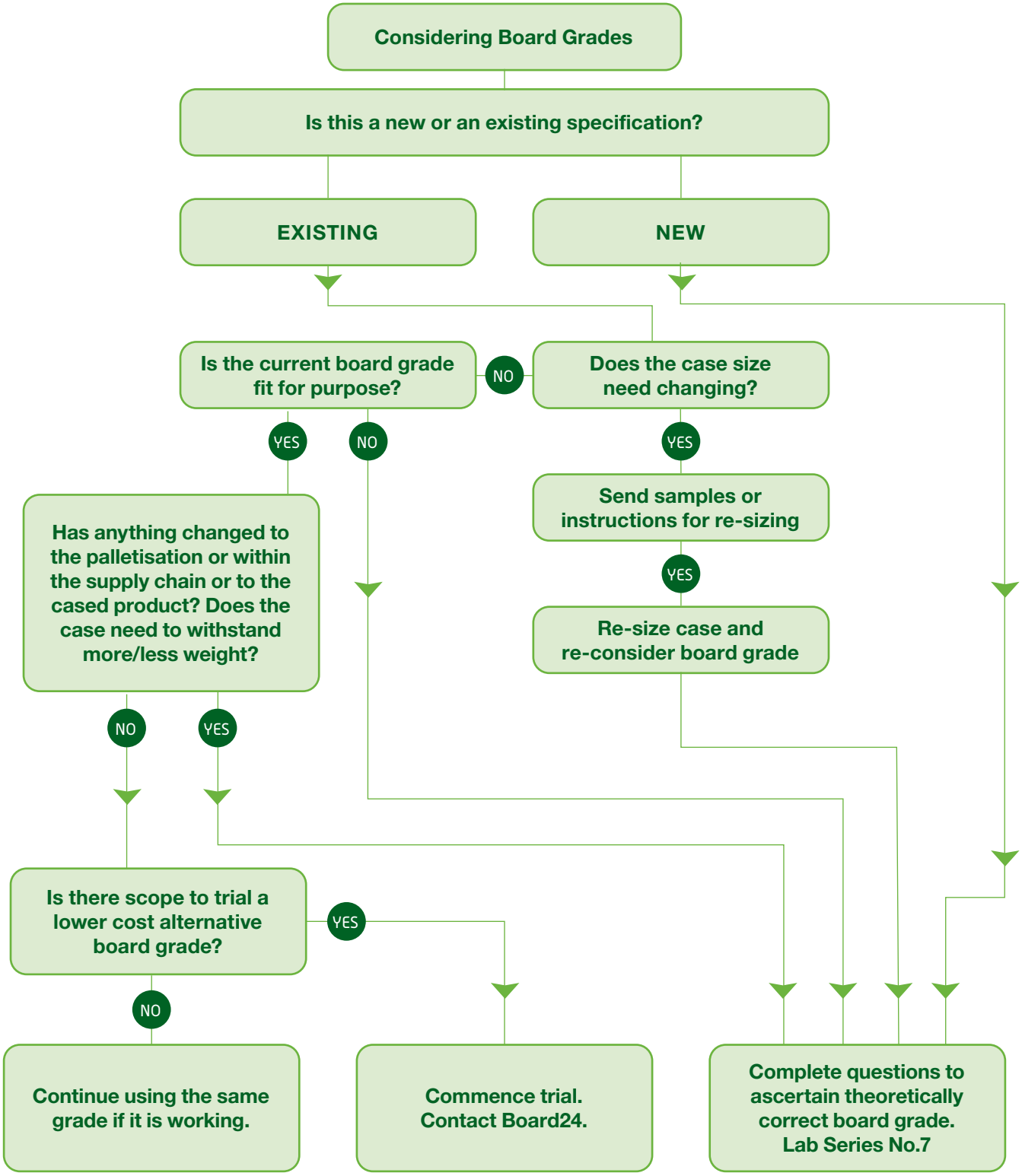


First point of buckling sooner than a squarer case

Results	BCT - 250kg	BCT - 150kg

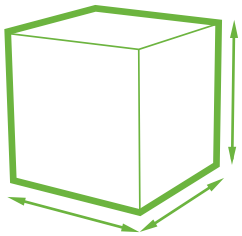
* These are approximate hypothetical figures, not based on tested values or actual results.

Assessing an appropriate board grade



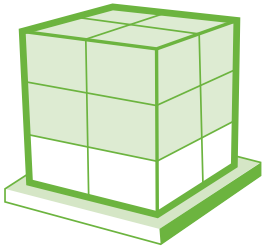
Important supply chain considerations for box performance

To help establish the required Box Compression Strength of a case, there are a number of questions to answer.

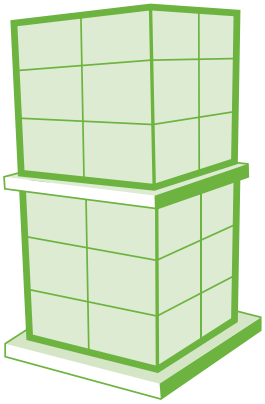


Case size/shape?

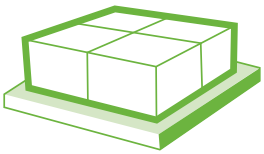
Weight of box once full?



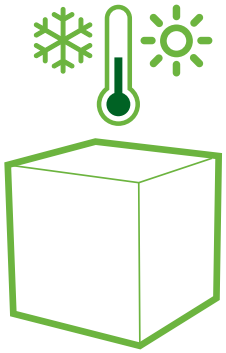
Number of layers per pallet?



Are pallets double stacked?

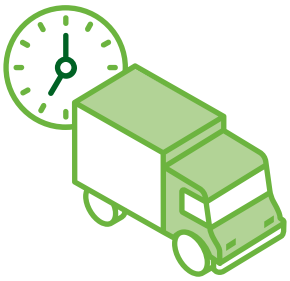


Number of cases per layer?



Are cases stored in ambient conditions or a freezer?

How long are cases stored for?



How long can the cases be travelling for?

Number of print colour and coverage?

Some of the above points assist the calculation of the case performance and others help establish the safety factor, which attempts to appreciate climatic and environmental effects within the supply chain.

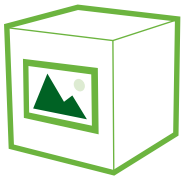
A full list of questions to determine a theoretically performing board grade can be gained by contacting Board24.

Changing flutes

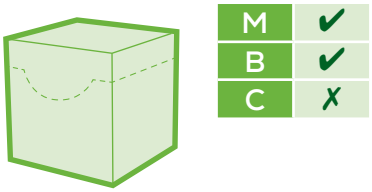
Changing the board flute type offers two key benefits:

PERFORMANCE + LOGISTICS = COMMERCIAL BENEFIT

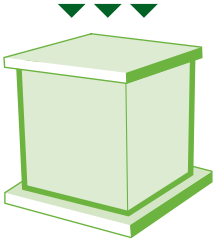
Performance Benefits



ENHANCED PRINT FINISH

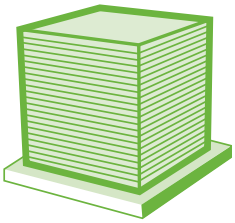


IMPROVED PERFORMANCE TEAR



STRONGER BOX COMPRESSION TEST

Logistic Benefits



PALLET QUANTITY

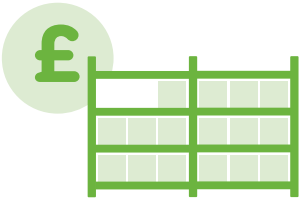
IMPROVED LOADFILL

REDUCED WAREHOUSE FOLK LIFT MOVEMENT

Commercial Benefits

LOWER BOARD COSTS

LOWER DELIVERY COSTS



LOWER STORAGE COSTS