



Lightweight containers – Keykeg

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■ Customer:

- Lightweight containers
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- Introduction/Question
- Approach and assumptions
- Samples
- Results
- Conclusions
- Recommendations

- Appendix
 - Test procedures used



- **Keykeg is a new concept: Using a PET container for holding fluids under pressure. The first product probably will be beer. The concept uses a corrugated outer packaging for protection and strength. Two concepts are tested: the 20 and 30 liter variant.**
- **Goal of these tests is to analyze the performance of this in a European supply chain during transport and storage.**

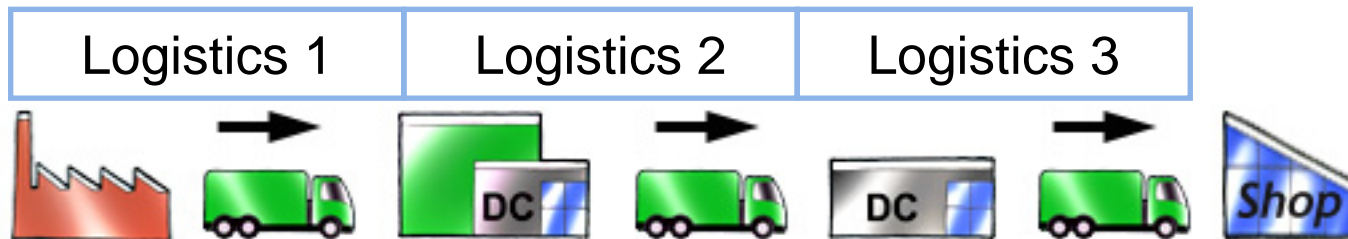


Approach and assumptions



Tests performed	Details		
	Conditions	Duration	Test parameters
Conditioning	23°C/80%RH	72 hours	
Storage simulation			ISO 12.048 Duration 5 minutes 20L Load: 14400N 30L load: 16500N (tested 1 stacked, accounted for 2 stacked)
Vibration table (transport simulation)	23°C/50%RH	1 hour	ASTM 4169 Truck assurance level II 80% - 0.44g, stacked.
Incline plane stability (handling simulation)			Impact test on pallet. Sides of impact: 2, long and short side (turn after impact) Carriage travel: 0.35 m (impact speed 1.0 m/s)

■ Description of the supply chain



Supply chain	Storage			Transport		
	Stacked	Conditions (°C/RH)	Duration (weeks)	Length (km)	Stacked	Conditions (°C/RH)
Logistics 1	1/1	Normal	1	150 Truck	1/1	normal
Logistics 2	1/1	normal	1	10000 Sea	1/1	normal
Logistics 3	1/1	normal	4	1000 Truck	1/1	normal

- Keykeg containers filled with water at the DC with 20L and 30L (note: without the closing lid)
- Total box weight 20.5kg (20L) or 31kg (30L)
- Pallet consists of 3 layers, 6 boxes a layer, column stacked, bundled with stretch foil. BB-corrugated sheets between layers. Wooden sheet between pallets
- Pallets stacked, for the 30L only 2 layers on upper pallet because of height restrictions of test equipment.
- Dimensions:
 - 20 L – 35x38cm Width x Height
 - 30 L – 39x44cm Width x Height



- **No bulging or serious deformations. Some minor bulging observed around the hand holes.**
- **Compression:**
 - Pallet 20L: 23 mm displacement
 - Pallet 30L: 24 mm displacement
- **Displacement is caused by the crushing of intermediate BB-flute sheets. This results in a nestling effect, creating more stability of the pallet.**

- **20 L – no deformation, stable.**
- **Note:**
 - After 1.5 hours the upper pallet shifted/moved from the lower pallet, resulting in high forces on two containers on the side. These forces did not cause additional deformation.
 - In practice pallets will be close to each other preventing this kind of movement.
 - Creating a better connection between the pallets (foil around 2 pallets?) can be considered.



- 30 L – no deformation, stable
- Less movement possible because of better pallet fit.
- Like with the 20L wood between upper pallet and containers beneath is crucial for dispersing the load applied.



- **20 L tested with one pallet, 3 layers and 4 layers**
 - Almost no movement of layers; some movement of upper layer. Low deformation on impact side along hand holes.
 - Clear movement between pallets expected when stacked

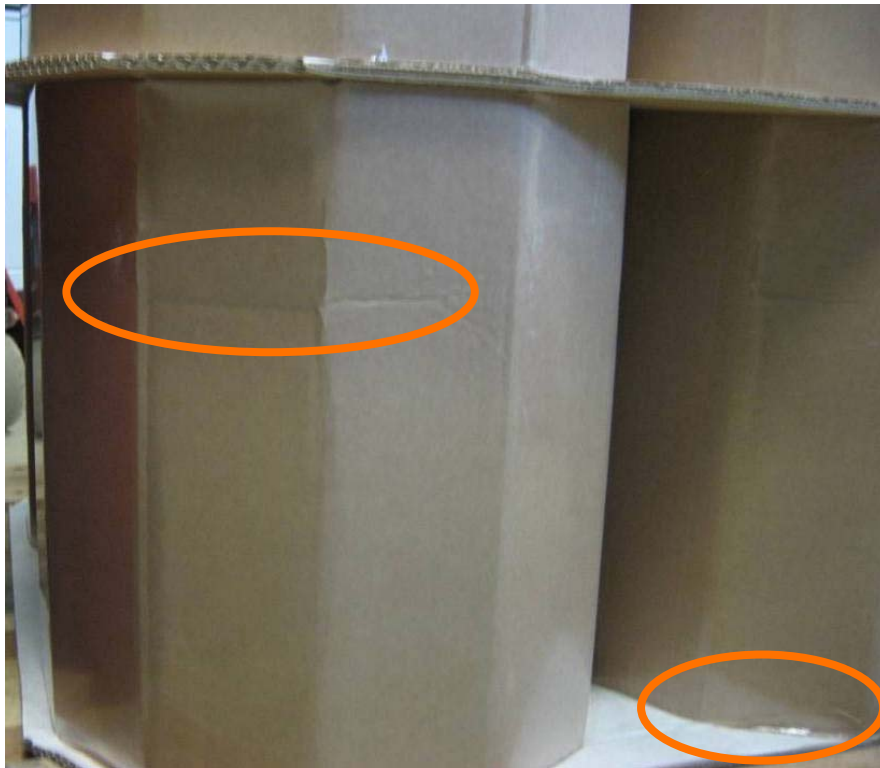


- 30 L was tested likewise as the 20 L

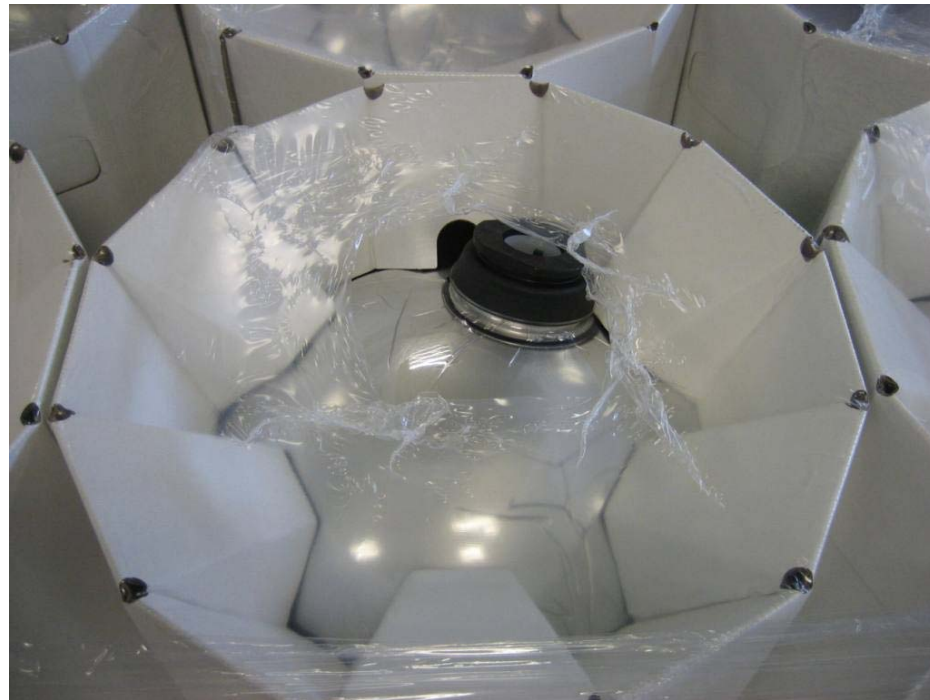


- Containers want to slide into the container underneath. The BB-flute sheets have to prevent this.

- **Only slight deformations, no impact on stability:**
 - Along hand holes
 - Along bottom, pressed into the sheets
 - Similar deformations for the 20L and the 30 L



- On upper layers, the sphere has moved, probably during vibration testing – the tap moved to the outside borders of the pallet not in the impact direction. No movement was observed on lower layers



- **Both the 20L and the 30L have shown to withstand the chain simulations.**
- **Important are the BB-flute sheets which keep the whole configuration stable.**
- **Hand holes are the weakest spots, practice has to point out to which extend they are used and to which extend they create problems.**
- **Moving of the tap will be less in practice due to the closing lid. This makes the sphere higher, resulting in better clamping between the containers.**

- **When thinking of downgrading the sheets (between containers), some risks will be taken. Before downgrading it is key to know conditions in practice.**
- **Sheets must be clearly bigger as the container area in order for them to functions properly.**

Appendix

Test procedures used



- **Test descriptions:**
- **ASTM D 4169**
Packaging - “Standard practice for performance testing of shipping containers and systems”
- **ASTM D 4728**
Packaging - “Standard test method for random vibration testing of shipping containers” Closed loop-automatic control; Random vibrations
- **ASTM D 5277**
Packaging - “Standard Test Method for Performing Programmed Horizontal Impacts Using an Inclined Impact Tester”
- **ISO 187**
Paper, board and pulps - “Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples”
- **ISO 12048**
Packaging - Complete, filled transport packages - “Compression and stacking test using a compression tester”