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ROBCO WHITE PAPER

Why Using North American Made Crucible Lid Seals is the Smart Choice over Cheaper Imported Types

Comparison Testing of Imported Braided E-glass Rope versus 100% North American Made Robco 1600 when used as Crucible Lid Seals in the Aluminium Industry

Photo courtesy of Rio Tinto Alcan

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Abstract

We tested samples of imported braided E-glass lid seal versus Robco 1600 to determine performance variance. Testing indicates superiority of the Robco 1600. Here are the findings.

Introduction

Robco has been producing various types of braided crucible lid seals for usage in the aluminium industry for decades. End-users repeatedly reported a noticeable difference in longevity (as much as 200%) of the Robco seals versus products available from low cost producers located in Europe, Asia, South America, etc. We wanted to quantify why our products lasted longer and performed better by testing physical performance.

Both types of products tested appeared to be similar:

- Reported to be made of E-glass
- Braided using a similar translok method
- Material density was within 1.5 %

We developed a testing sequence to simulate usage on an operating crucible.

Testing Sequence

Testing Equipment	ADMET 1232ACK Universal Tester, Paragon Kiln Oven
Samples tested	25mm and 30 mm square dense braided rope with no mineral coating : Compare imported products versus Robco 1600 100% NAFTA content
Testing Sequence	1. On Universal Tester, compress 25mm and 30mm rope samples by 25% and then release 2. Perform this test cycle three times to measure Compression Set and Recovery *(reference "before heating" on graphs)* 3. Expose rope samples to a temperature excursion from 21º to 760ºC (1400ºF) 4. Leave samples exposed for a total of four hours to ensure complete thermal soaking 5. Photograph products after heating 6. On Universal Tester, compress sample by 25% then release 7. Perform this test cycle three times to measure Compression Set and Recovery *(reference "after heating" on graphs)* 8. Measure and compare

Thermal Exposure

The thermal exposure of 760ºC (1400ºF) damaged all samples, as this temperature is theoretically beyond the maximum recommended for E-glass. This temperature exposure was used as it is a common possibility during tapping operations, where molten aluminium is at 960ºC (1760ºF).

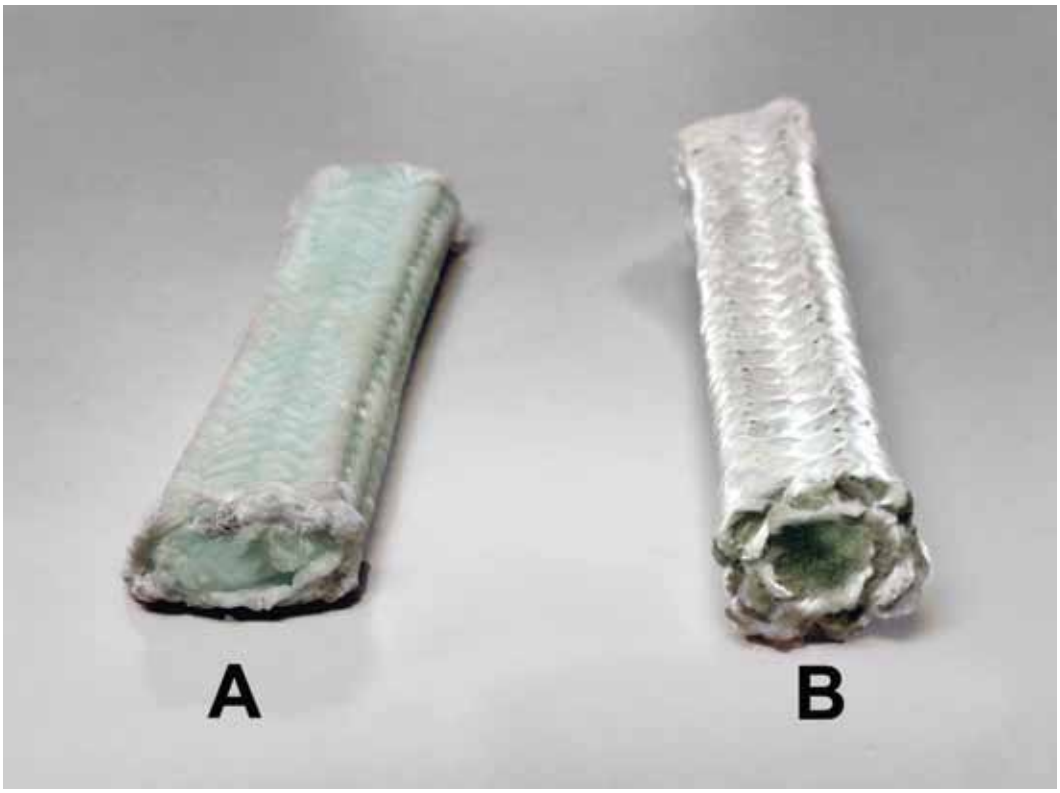


figure 1.

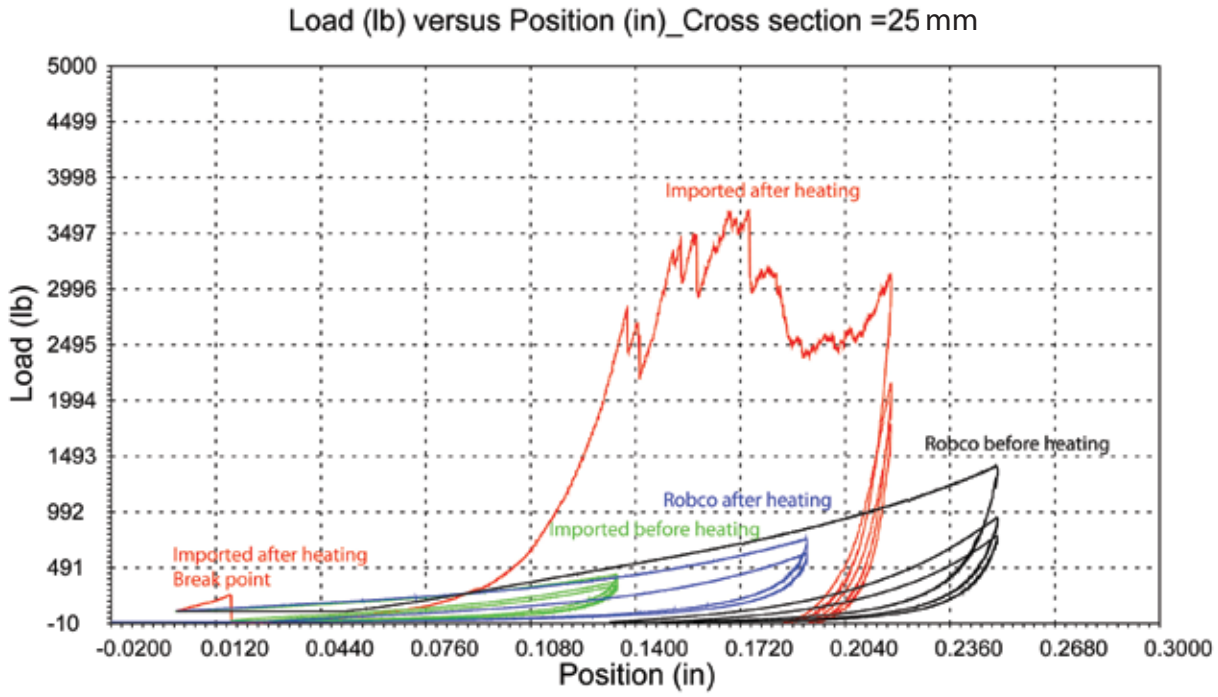
Results

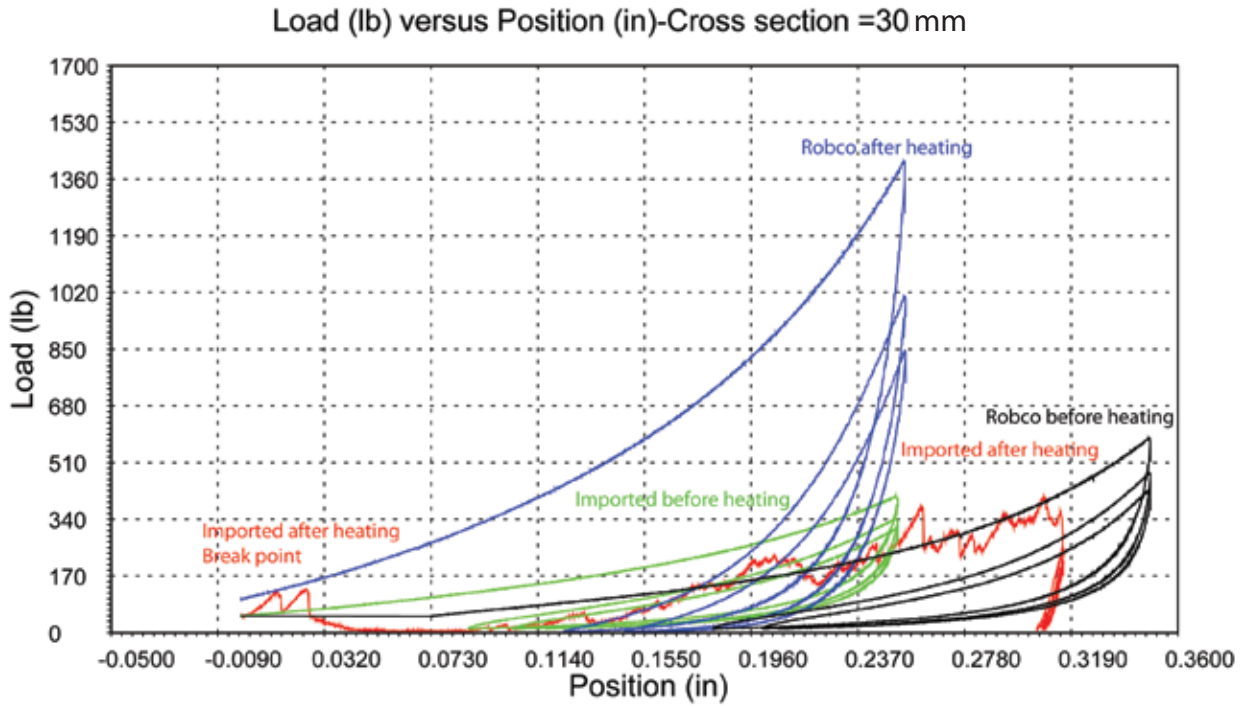
25 mm square Imported Product (A) collapsed and was basically vitrified. See Figure I.

25 mm square Robco 1600 (B) remained somewhat flexible although it had clearly started to harden and crystallize.

Compression / Recovery Test

25 mm and 30 mm samples were tested using three compression and release cycles to measure mechanical recovery. The following graphics show testing of both samples "before heating" and "after heating."


Load (lb) versus Position (in)_Cross section =25 mm
Load (lb)
5000
4499
3998
3497
2996
2495
1994
1493
992
491
-10
-0.0200
0.0120
0.0440
0.0760
0.1080
0.1400
0.1720
0.2040
0.2360
0.2680
0.3000
Position (in)
Imported after heating
Robco before heating
Robco after heating
Imported before heating
Imported after heating
Break point


Load (lb) versus Position (in)-Cross section =30 mm
Load (lb)
1700
1530
1360
1190
1020
850
680
510
340
170
0
-0.0500
-0.0090
0.0320
0.0730
0.1140
0.1550
0.1960
0.2370
0.2780
0.3190
0.3600
Position (in)
Robco after heating
Robco before heating
Imported after heating
Imported before heating
Imported after heating
Break point

Imported samples required higher initial load compression. "After heating" testing demonstrates that the imported samples had completely vitrified. As samples were compressed, they quickly shattered under load. There was no recovery.

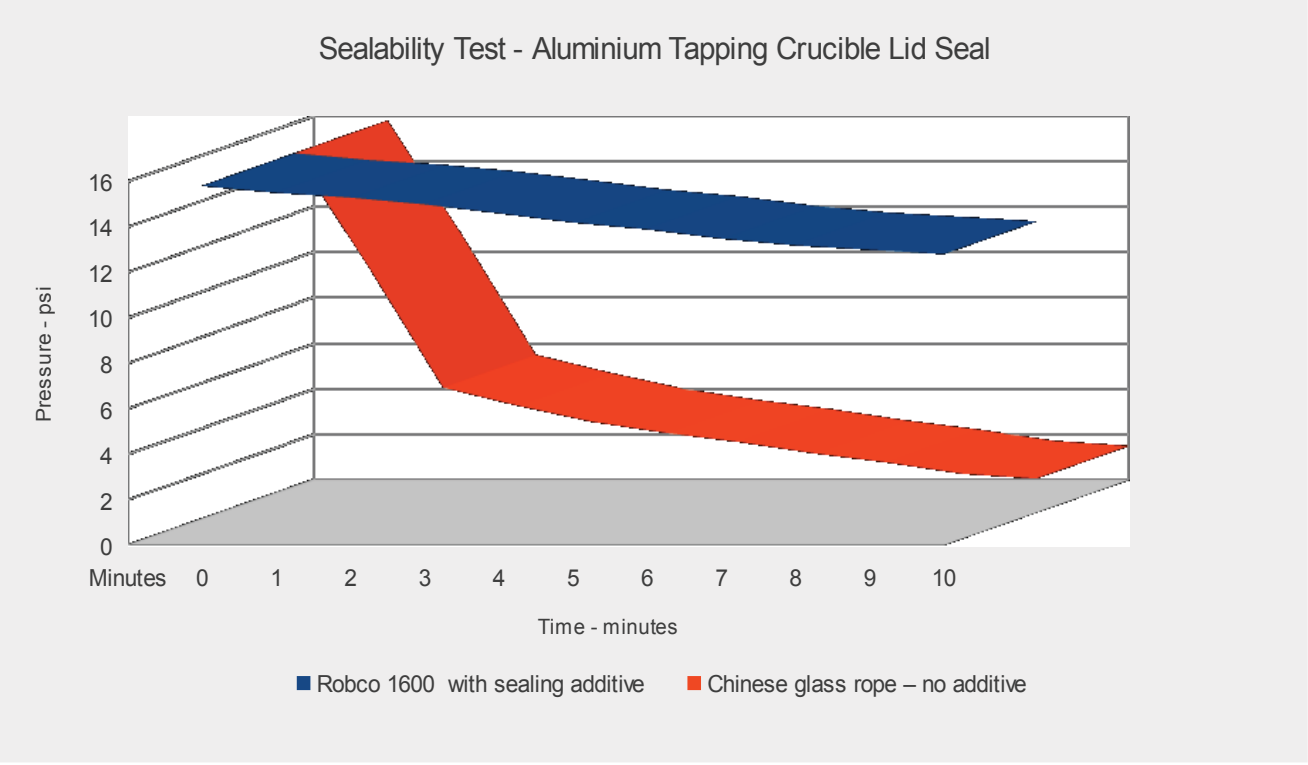
Robco 1600 "before heating" samples were softer initially and required less load compression, although the density of all samples was within 1.5%. "After heating" the Robco product still demonstrated fair resilience.

Sealability

We also measured sealability of Robco 1600 with a non-obstructive coating versus Chinese imported high-density rope.

It is to be expected to get leakage through braided glass fibers, even if densified under bolt load. The test demonstrated that Robco's non intrusive coating will greatly improve sealability, retain vacuum, without the negative effects of joints that are fully coated or saturated with silicone.

The test was performed using a positive pressure of 16 psi, to replicate vacum condisitons and a compressive load of 3300 psi. See result below.



Conclusion

User experience and testing tend to demonstrate that by incorporating higher quality materials and an improved braiding method, Robco 1600 provides better sealing performance of lids found on aluminium tapping crucibles.

The province of Quebec, Canada, where Robco's headquarters is located, is known worldwide for its know-how in aluminium smelting. Robco has been braiding fluid sealing devices since 1923 as well as specializing in the production of high temperature resistant materials since the late 1950's. The superior performance of the Robco crucible lid seals is no coincidence.

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After years of research and design, Robco has engineered a lid seal gasket that will last **3 times longer than** other seals on the market.

- Made of **high-temperature, abrasion-resistant** yarns
- **High density** to prevent over-compression
- Surface treated to **prevent aluminium** from **sticking** and **ripping** the surface
- Saturated with mineral compound to make the seal **airtight**
- Class III IARC: All materials are **safe** and free of asbestos **and** refractory ceramic fibers

Economical:1600 Lid Seal

- Special braiding method provides **extended life** over standard braided glass gaskets
- **High density** braid to prevent over-compression
- Mineral treatment to **prevent sticking**
- Class III IARC: All materials are **safe** and free of asbestos **and** refractory ceramic fibers

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