SUPREMECORQ®

Competitive Closure Report

24 Months Results - August 2005

aib
American Institute
of Baking

Accredited
2001-2005

ANSI-RAB QMS ACCREDITED BSI REGISTERED
ISO9001:2000
FM68163

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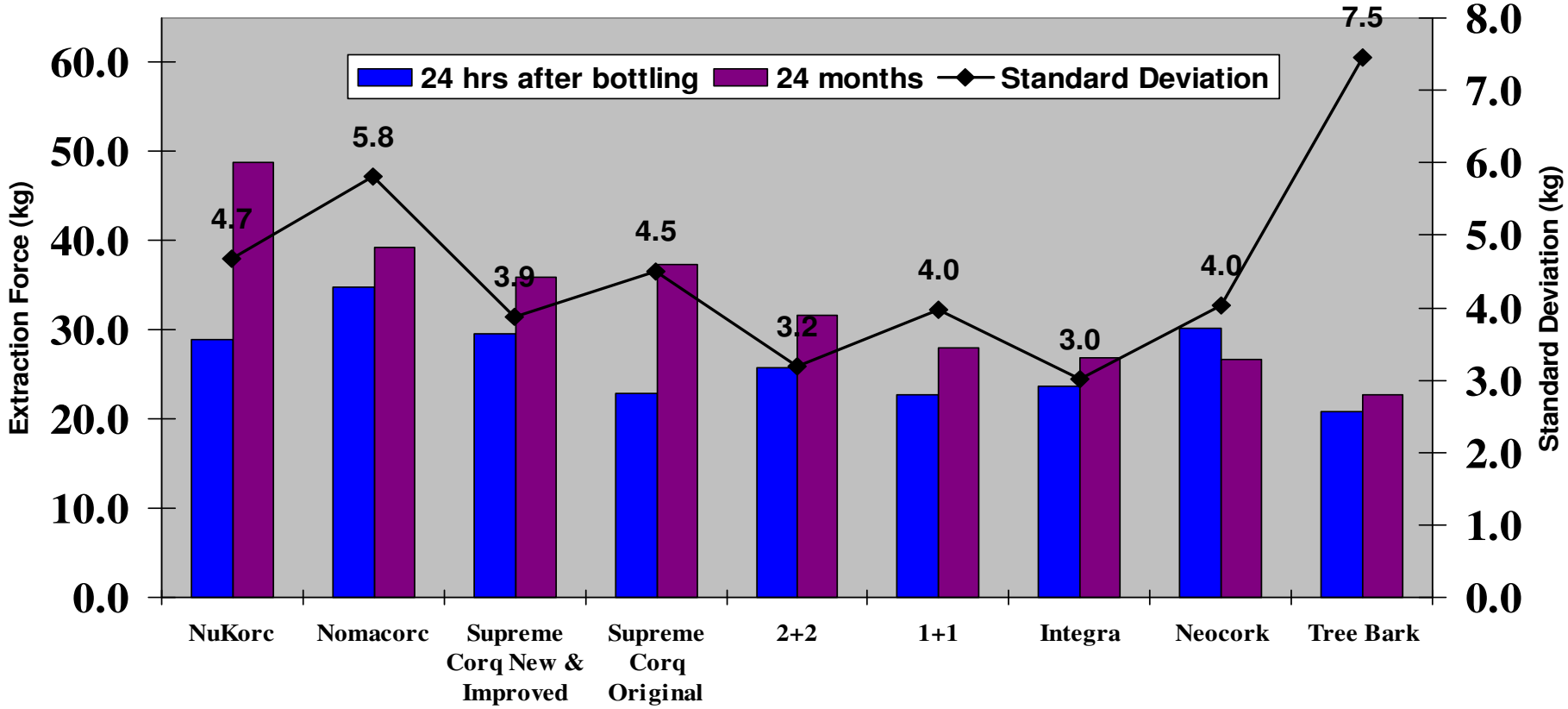
2002-2005

QA INTERNATIONAL UKAS PRODUCT CERTIFICATION
BRC/IoP TECHNICAL STANDARD FOR PACKAGING
QAICL/US/BRC/002

Accredited
2004-2005

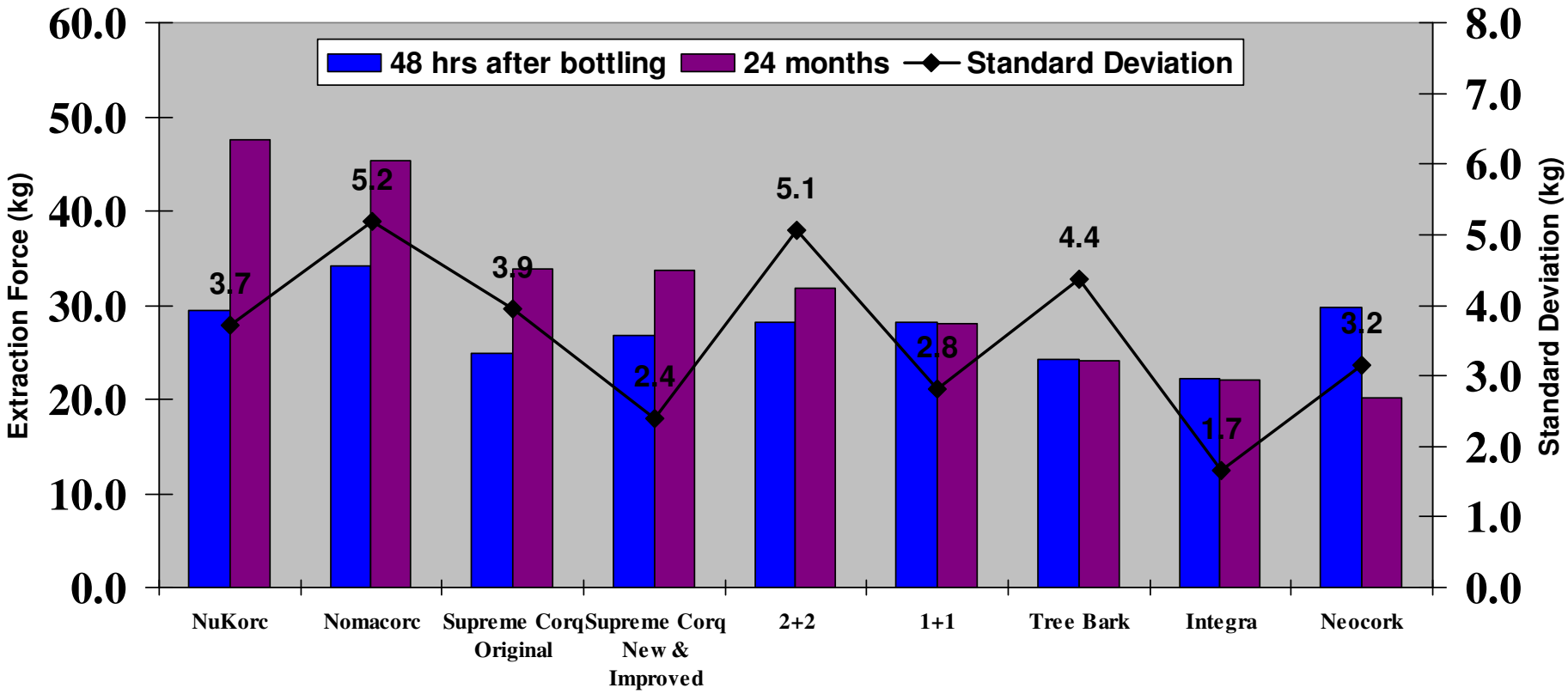
Competitive Closure Performance Results
24 Month Study

Extractions after 24 Months Ambient (73°F/23 °C)



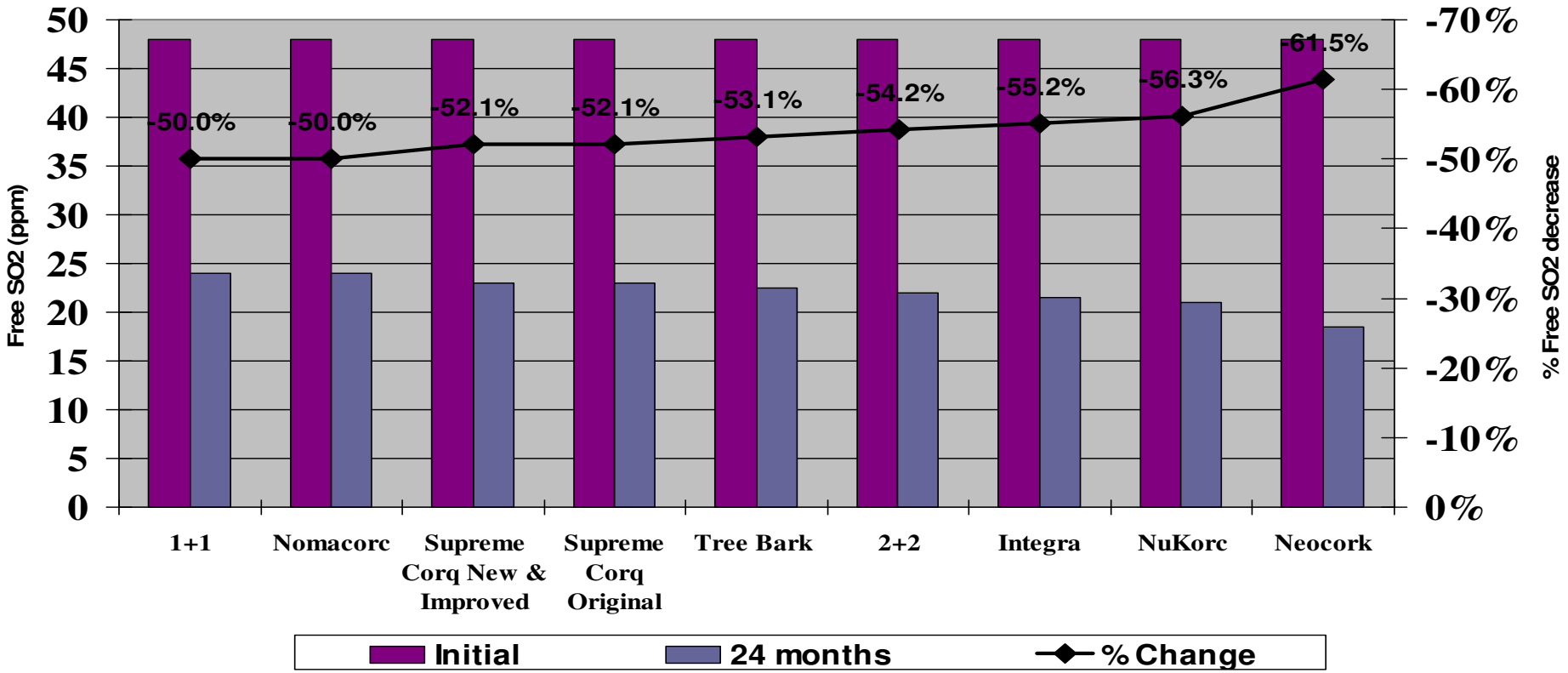
Methodology: Bottled commercial red wine with various closures. Stored all wine horizontally in 55ºF/ 13ºC and 50-75% Relative Humidity (RH) at a controlled wine storage facility. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions. After 24 months the bottles were stabilized to 73ºF/ 23ºC for 24 hours and extraction values were measured using the ISO 9727 method (Dillon TC2 Extraction Unit). In addition, the standard deviation was calculated and averaged.

Extractions after 24 Months - Chilled (43°F/6 °C)



Methodology: Bottled commercial white wine with various closures. Stored all wine horizontally in 55ºF/ 13ºC and 50-75%RH at a controlled wine storage facility. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions. After 24 months, the bottles were chilled to 43ºF/ 6ºC for 24 hours and then the extraction values were measured using the ISO 9727 method (Dillon TC2 Extraction Unit). In addition, the standard deviation was calculated and averaged.

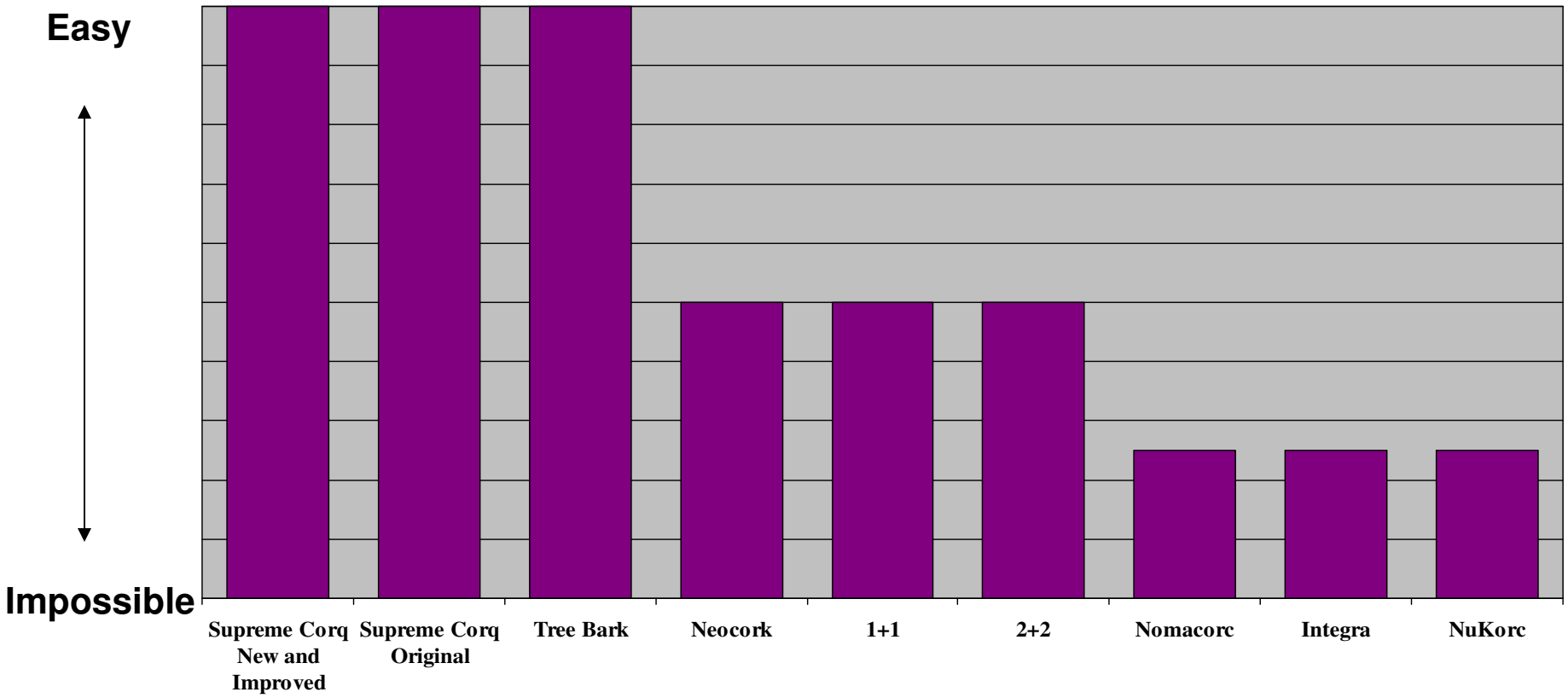
Free SO_2 over Time



Methodology: Bottled commercial wine with various closures. Stored all wine horizontally in 55ºF/13ºC and 50-75%RH at a controlled wine storage facility. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions. After 24 months, the Free SO_2 was measured using the Aeration/Oxidation test method.

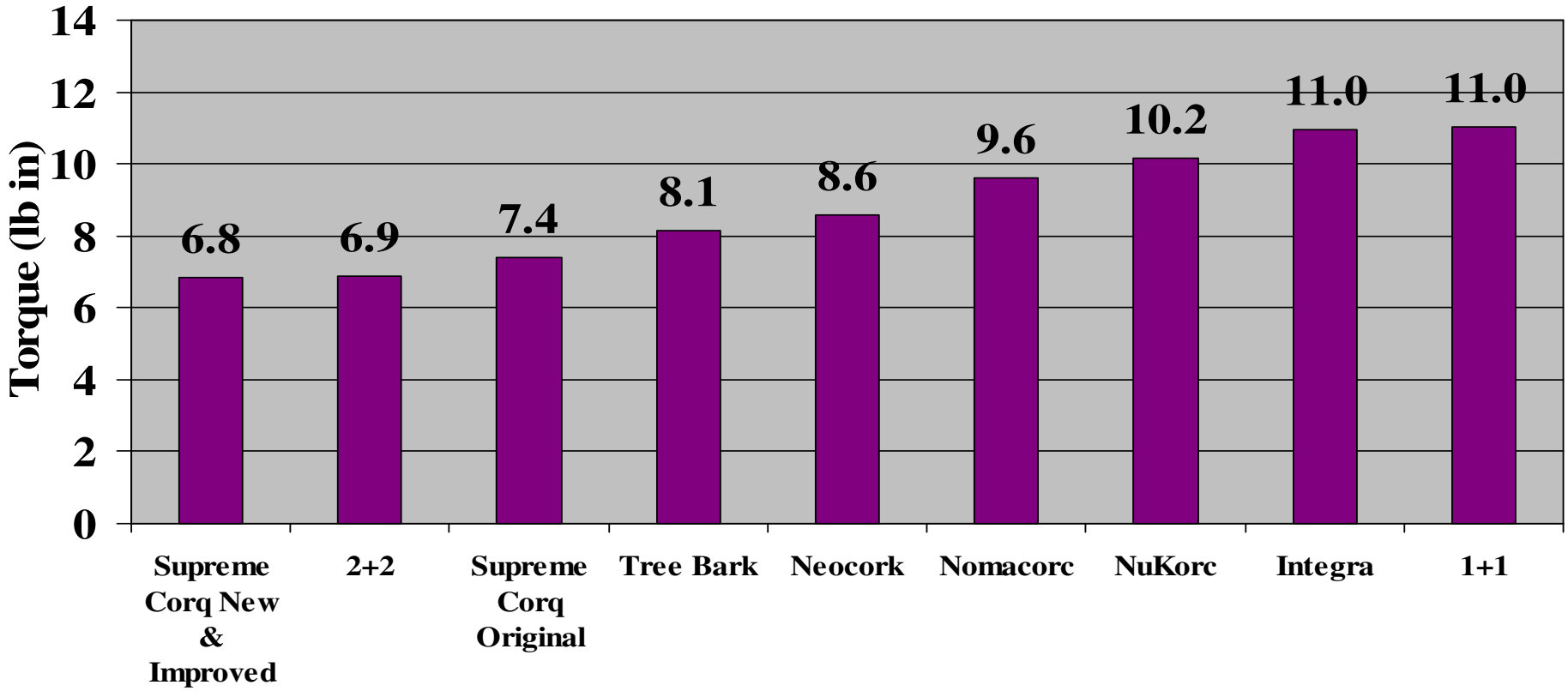
Note: The method used has a maximum variability between independent test results of 3 ppm**.**

Ease of Manual Cork Reinsertion into Bottle (after 90 days at Ambient Temperature*)



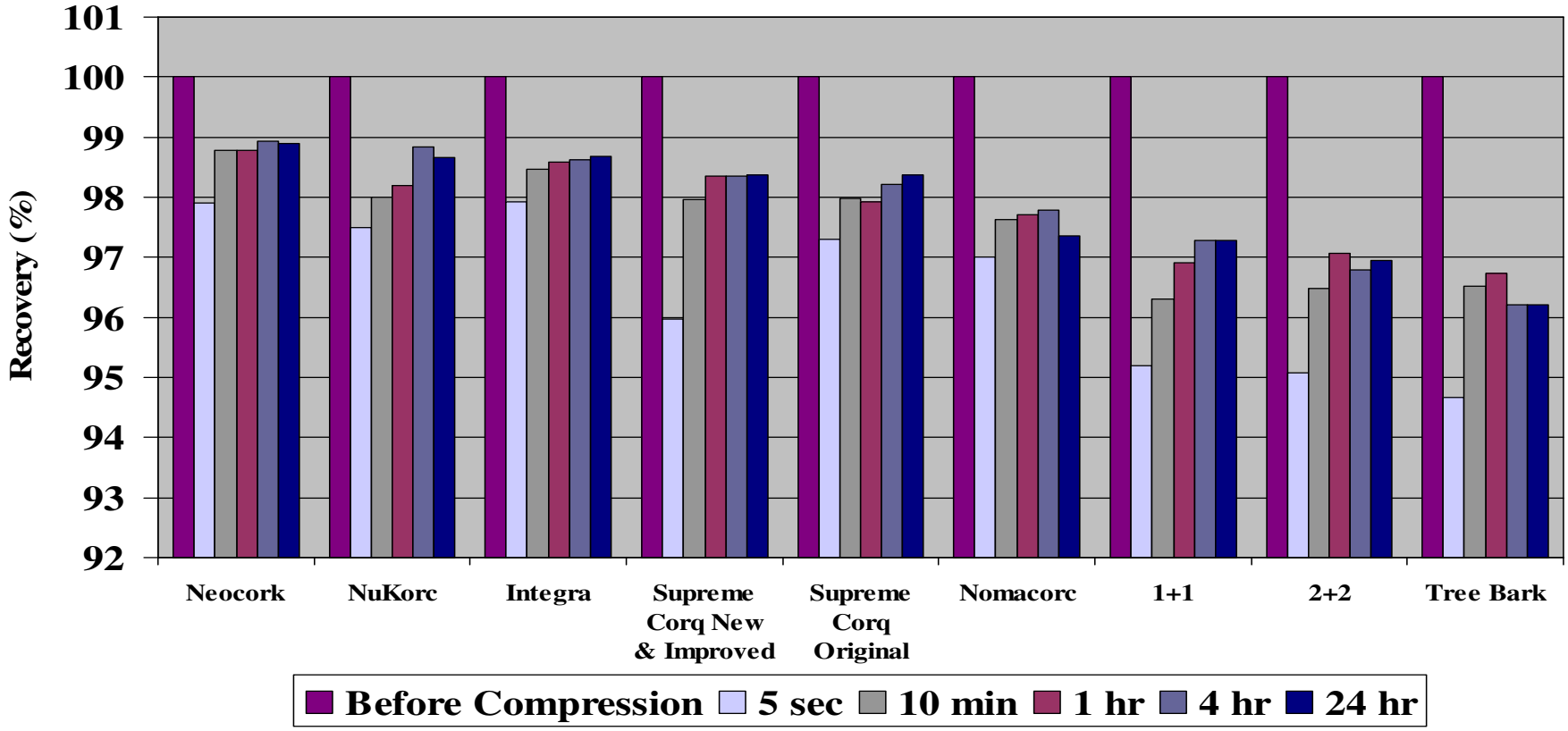
Note: 12 bottles of each closure we used. All wine was stored horizontally at 55ºF/ 13ºc and 50-75% RH at a controlled wine storage facility for 90 days. The closure was extracted and then, after a ½ hour, the closure was reinserted. Rating of Ease of Manual Reinsertion Over Time*methodology per AWRI study (Godden 1999).

Cork Removal from Corkscrew Auger



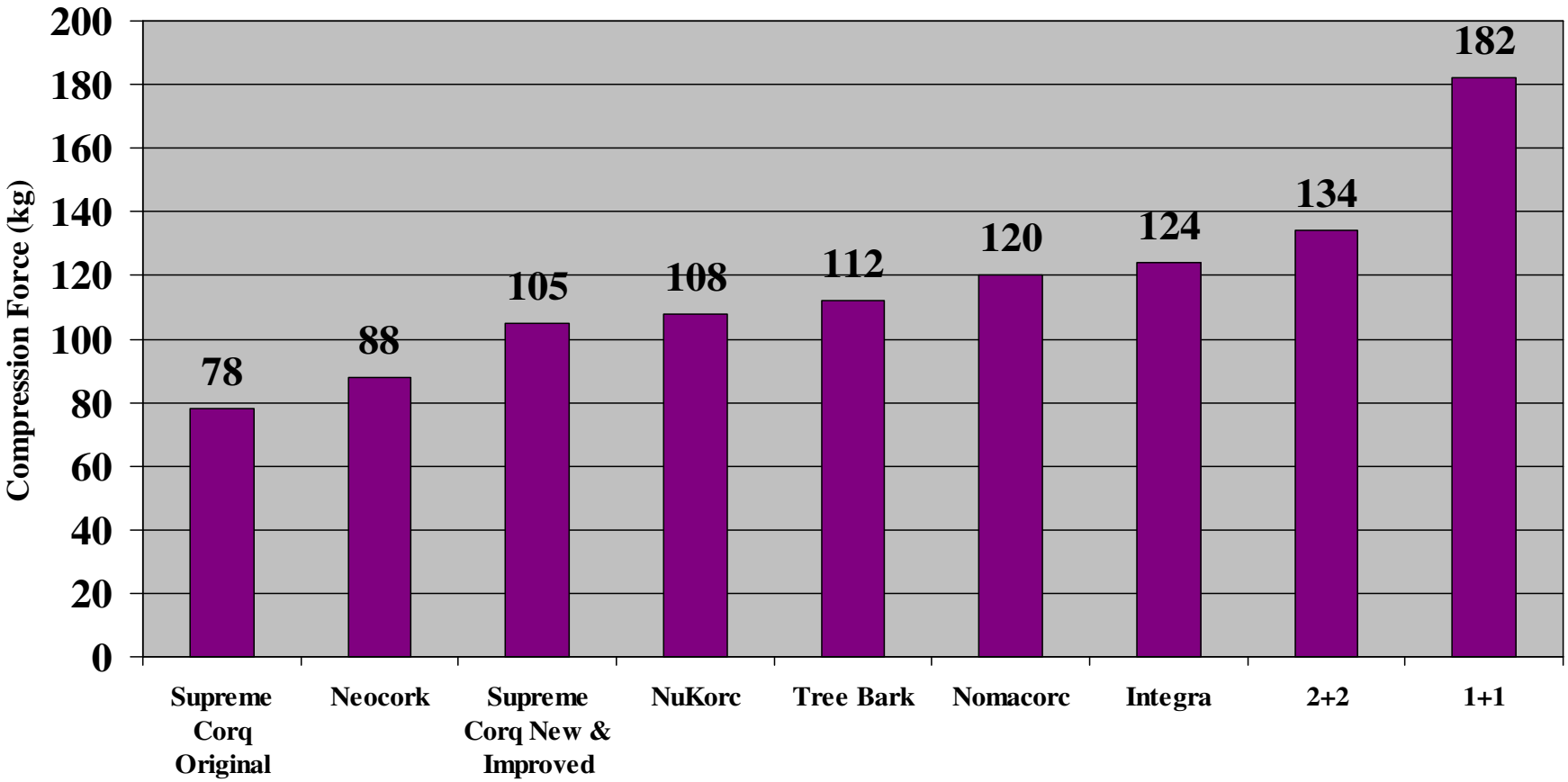
Methodology: Inserted a corkscrew auger through the closure and measured the force required to remove the closure from the auger using a Secure Pak Torque Tester.

Compression Recovery



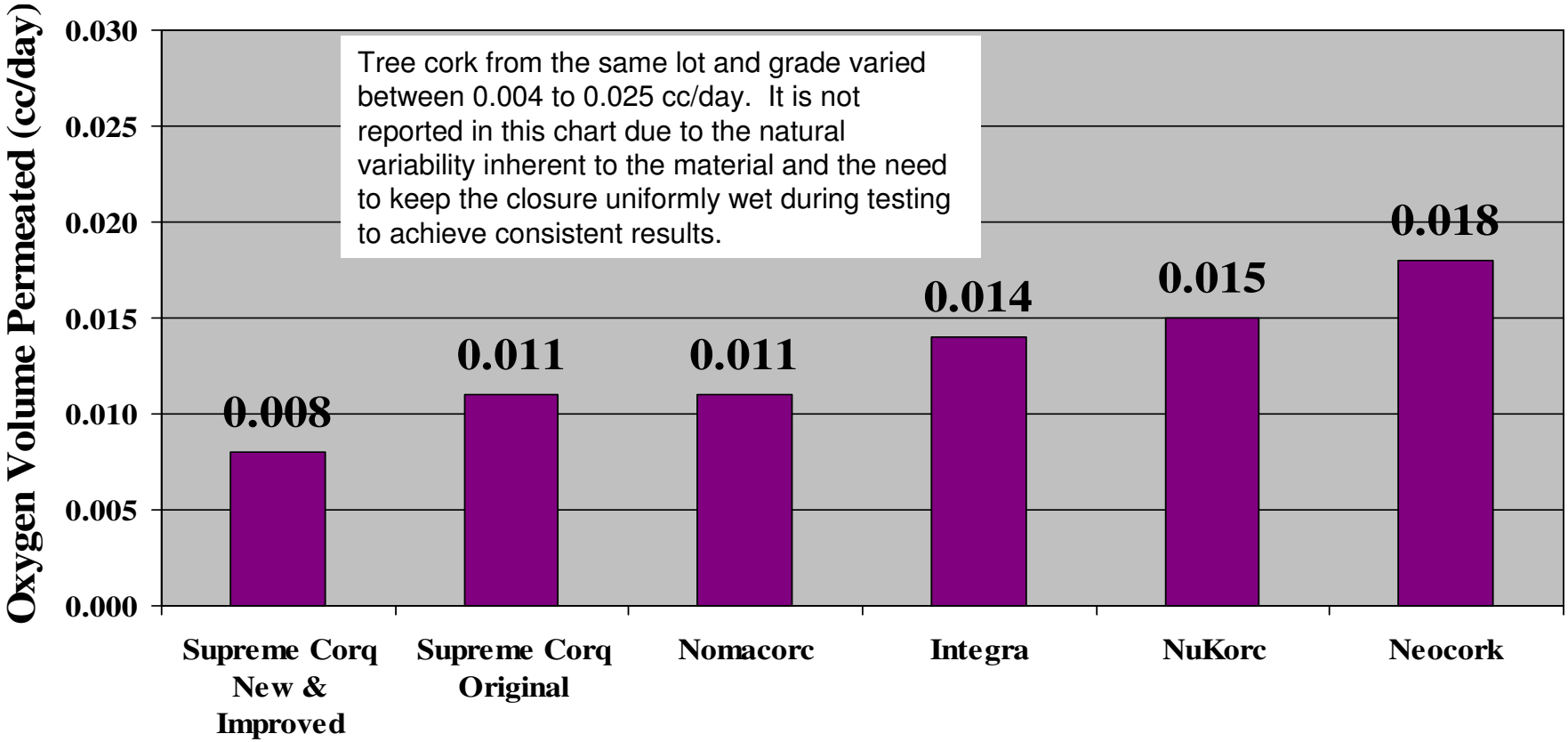
Methodology: Compressed the closure to 15.5 mm using a Bertolaso Semi-Automatic bottler. Measured closure diameter immediately after compression (5 seconds) and at set time interval thereafter (10 minutes, 1hr, 4hr and 24 hr).

Compression Force to 15.5 mm



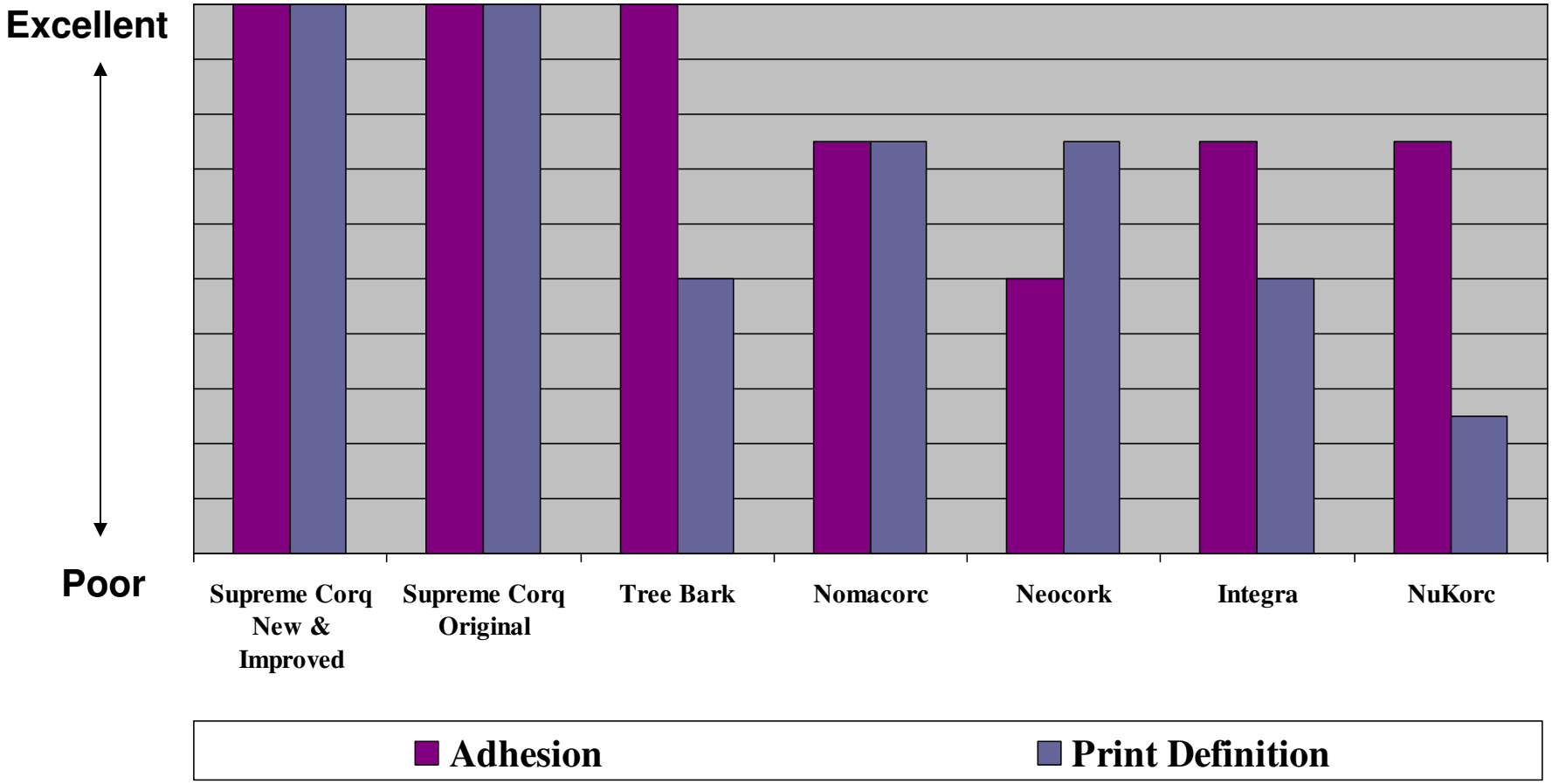
Methodology: Compressed the closures radially to 15.5 mm using a closure compression device. With a load cell, measured force required to compress closures to 15.5 mm.

Oxygen Permeability



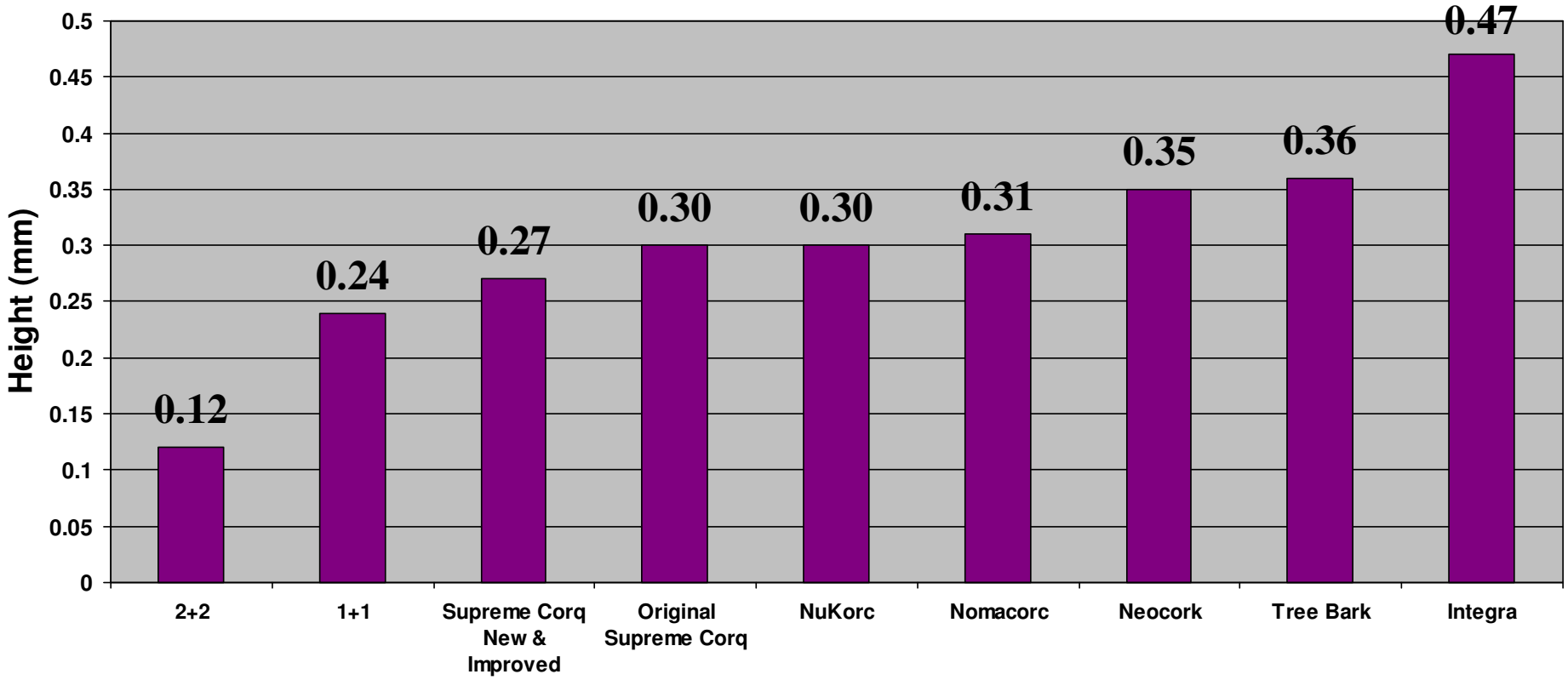
Testing was performed on an Ox-Tran 2/20 (MOCON, Inc.) at Impact Analytical (Midland, Michigan, USA) per ASTM F1307.

Print Adhesion and Resolution



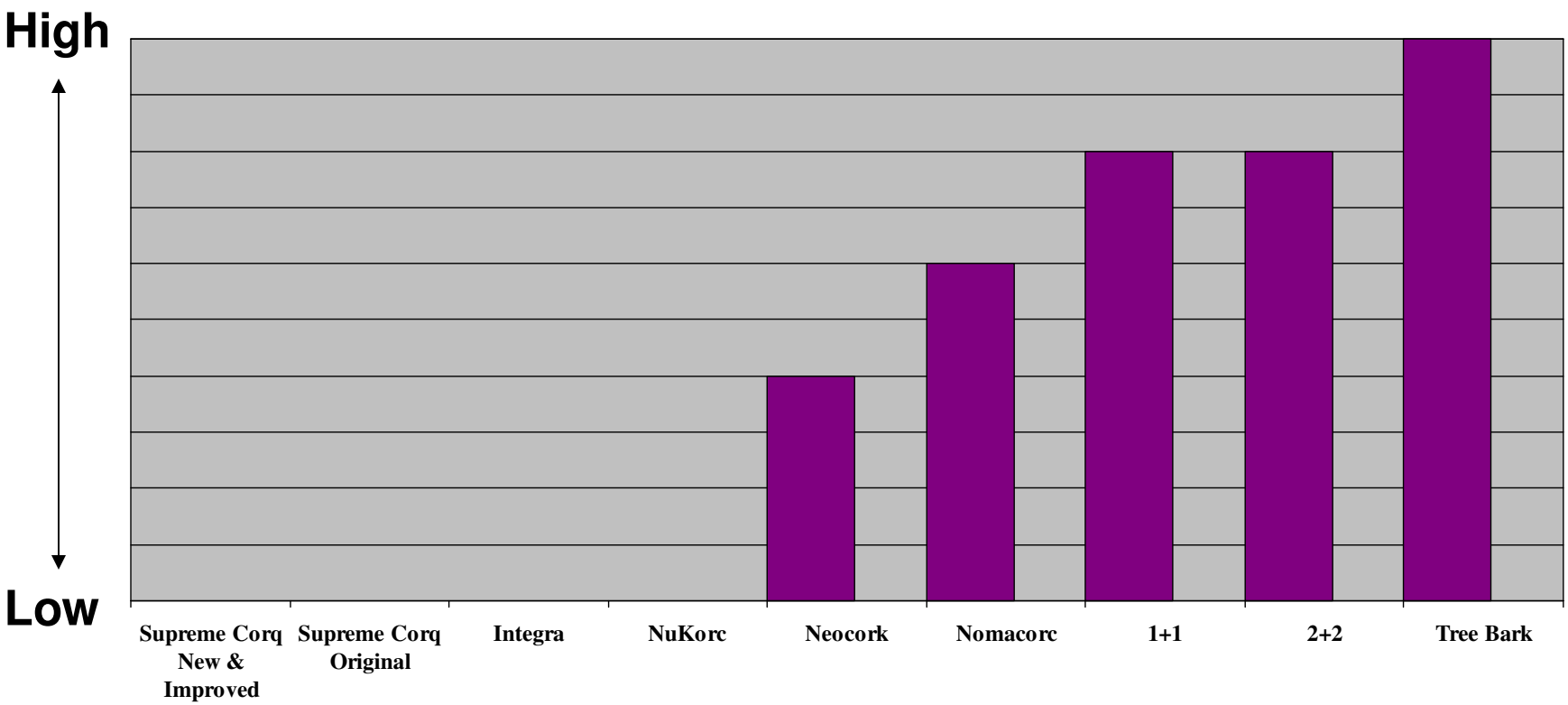
Methodology: Rubbed printed closures with an Everclear alcohol soaked towel and recorded the number of rubs required to begin removing the ink. Visually compared the graphics resolution between closures and rated the clarity and consistency of the print.

Cork Pushing at 100 °F/ 38 °C



Methodology: Bottles were filled with tap water and the closures were inserted into each bottle with a semi-automatic bottler and vacuum at –5 psi (-0.34 bar). The insertion height of each closure was measured before and after incubation for 24 hours vertically at 100°F/38°C.

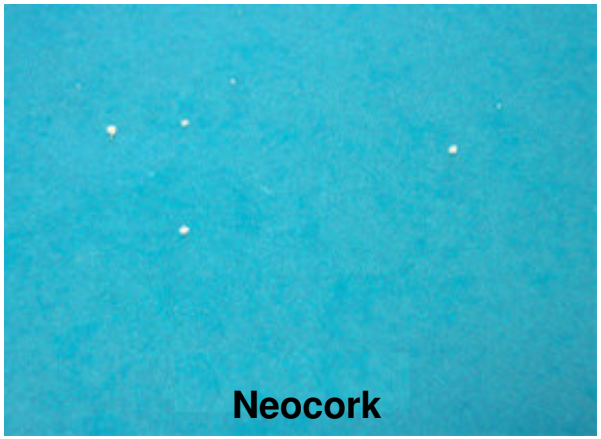
Closure Flaking from Corkscrew Piercing

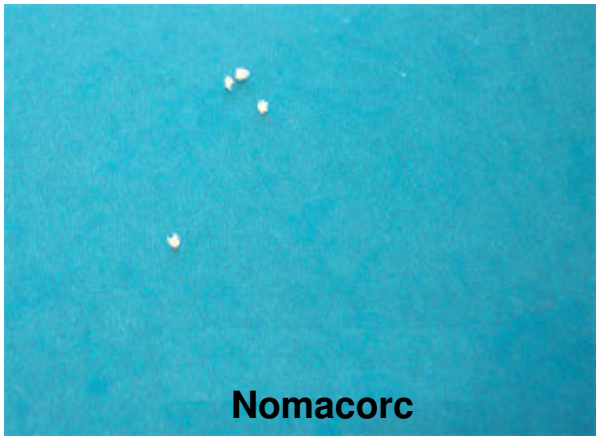


Methodology: 5 closures were pierced with a corkscrew all the way through the length of the closure and the residue produced by the extraction of the corkscrew was collected on a piece of contrasting paper. The flakes or crumbs collected were compared amongst the different closures and rated accordingly.

Closure Flaking with Corkscrew

Pictures





No Flaking: Supreme Corq New and Improved, Supreme Corq Original, Integra, and NuKorc.

Summary of Comparative Closure Results – 24 months

TEST	Unit of measure		Test Condition	Supreme Corq Original		Supreme Corq New & Improved		Nomacorc		NuKork		Neocork		Integra		Tree Bark		1+1		2+2		TEST METHOD
Extractions over time at ambient temperature (73°F/ 23°C)	kg	N	Initial	23	225	30	290	35	342	29	283	30	297	24	232	21	204	23	222	26	252	ISO 9727
			After 24 months	37	367	36	352	39	384	49	478	27	262	27	264	23	222	28	273	32	311	
			Standard Deviation Average	5.2	51	3.9	38	5.8	57	4.7	46	4.0	39	3.0	29	7.5	74	4.0	39	3.2	31	
Extractions over time at chilled temperature (43° F/6°C)	kg	N	Initial	25	244	27	261	34	335	29	288	30	292	22	218	24	238	28	276	28	276	
			After 24 months	34	331	34	330	45	445	48	466	20	198	22	216	24	237	28	275	32	311	
			Standard Deviation Average	3.9	38	2.4	24	5.2	51	3.7	36	3.2	31	1.7	17	4.4	43	2.8	27	5.1	50	
Free SO2 over time	ppm		Initial	48		48		48		48		48		48		48		48		48		Aeration/ Oxidation Method Bottles were on the side for 9 months and then were set upright for the remainder of the test.
			After 6 mo	36.0		33.5		34.5		35.5		34.5		34.0		36.5		34.5		35.5		
			After 9 mo	32.0		31.0		33.0		28.5		28.5		33.0		32.0		32.0		31.5		
			After 12 mo	30.5		32.5		33.0		31.0		28.5		31.5		32.0		32.0		31.5		
			After 24 mo	23.0		23.0		24.0		21.0		18.5		21.5		22.5		24.0		22.0		
Ease of reinsertion	Easy Moderate Difficult Practically Impossible		30 minutes after extraction	Easy		Easy		Practically Impossible		Practically Impossible		Moderate		Practically Impossible		Easy		Difficult		Difficult		Rating of Ease of Manual Reinsertion per AWRI study (Godden 1999)
Corkscrew removal	Torque in lb		Directly after insertion	7.40		6.83		9.60		10.17		8.60		10.97		8.13		11.03		6.87		Electronic Torque Tester, manufactured by Secure Pak, Inc
Compression Recovery	% Recovery after 24 hours			98.4		98.4		97.3		98.7		98.9		98.7		96.2		97.3		96.9		See method in slide 29
Compression Force to 15.5mm	kg			78		105		120		108		88		124		112		182		134		See method in slide 30
Oxygen permeability	cc/package per day			0.011		0.008		0.011		0.015		0.018		0.014								ASTM F1307- Mocon test
Print Quality	Excellent to poor		Adhesion	Excellent		Excellent		Fair		Fair		Poor		Excellent		Fair		Fair		Fair		See method in slide 32
			Definition	Excellent		Excellent		Fair		Poor		Good		Poor		Fair		Fair		Fair		
Pushing	mm		100 F/ 38ºC	0.3		0.27		0.31		0.30		0.35		0.47		0.36		0.24		0.12		See method in slide 33
Flaking	Low to high			Low		Low		Medium high		Low		Medium		Low		Medium low		High		High		See method on slide 34
Neutrality (Flavor effect)	Scalping of chemical compounds		Neutral: Insignificant absorption of oil friendly (non-polar) compounds													Insignificant absorption of water friendly (polar) compounds						Analyzed compounds absorbed by GC/MS
Quality	Audited Quality Accreditations			AIB (2001 to 2005) BRC (2004 to 2005) ISO9001:2000 (2002 to 2005)				BRC(2005) ISO9001:2000		None		None		ISO9002		None		None		None		Independent agency audits 2 times a year

Methodology for Competitive Closure Tests

Extractions after 24 Months Ambient (73 ºF/23 ºC)

- **Objective:**
  - To compare the extraction force of the New and Improved Supreme Corq to the Original Supreme Corq.
- **Methodology:**
  - Bottled commercial red wine with various closures in CETIE specification Bordeaux bottles manufactured by St Gobain.
  - Stored all wine horizontally in 55ºF/ 13ºC and 50-75%RH controlled wine storage facility. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions.
  - After 24 months, the bottles were stabilized at 73ºF/ 23ºC and extraction values were measured at Supreme Corq, LLC. (Kent, Washington, USA) using the ISO 9727 method (Dillon TC^2 Extraction Unit). In addition, the standard deviation was calculated and averaged.
- **Conclusion:**
  - After 24 months, New and Improved Supreme Corq closures had lower extraction values than the Original Supreme Corq.

Extractions over Time- Chilled (43 ºF/6 ºC)

- **Objective:**
  - To compare the extraction force of the New and Improved Supreme Corq to the Original Supreme Corq.
- **Methodology:**
  - Bottled commercial white wine with various closures in CETIE specification Burgundy bottles manufactured by St Gobain.
  - Stored all wine horizontally at 55ºF/ 13ºC and 50-75% RH at a controlled wine storage facility for 9 months. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions.
  - After 24 months the bottles were stored in a refrigerator at 43 ºF/ 6ºC for 24 hours and extraction values were measured at Supreme Corq, LLC. (Kent, Washington, USA) using the ISO 9727 method (Dillon TC2 Extraction Unit). In addition, the standard deviation was calculated and averaged.
- **Conclusion:**
  - After 24 months, New and Improved Supreme Corq closures had lower extraction values than the Original Supreme Corq.

Free SO_2 over Time

- **Objective:**
  - To determine the Free SO_2 retention of various synthetic, manufactured and natural closures.
- **Methodology:**
  - Bottled commercial wine with various closures.
  - Stored all wine horizontally at 55ºF/13ºC and **50-75%** RH at a controlled wine storage facility for 9 months. After 9 months the bottles were turned to an upright position to replicate retail shelf conditions.
  - After 24 months, Free SO_2 was measured at Vinquiry Inc. (Windsor, California, USA) using the Aeration/Oxidation method.
- **Conclusion:**
  - After 24 months, Supreme Corq closures maintained equal levels of Free SO_2 than the tree bark closure tested.

Ease of Manual Cork Reinsertion into Bottle (after 90 days at Ambient Temperature*)

- **Objective:**
  - To compare the ease of manual reinsertion of various synthetic, manufactured and natural closures.
- **Methodology:** (per AWRI study – Godden, 1999)
  - Bottled commercial red wine with various closures.
  - Stored all wine horizontally at 55ºF/ 13ºc and 50-75% RH at a controlled wine storage facility.
  - After 90 days, closures were extracted at Supreme Corq, LLC. (Kent, Washington, USA). After 30 minutes closures were reinserted in each bottle manually. The ease of reinsertion was assessed.
- **Conclusion:**
  - After 90 days, Supreme Corq and tree bark closures (non-technical) were rated as the easiest to reinsert compared to the other closures tested.

Corkscrew Removal from Corkscrew Auger

- **Objective**:
  - To compare force required (torque) to remove various synthetic, manufactured and natural closures from a corkscrew.
- **Methodology**:
  - Inserted a commercially available corkscrew auger (Franmara -Waiters Friend) into the various closures at Supreme Corq, LLC. (Kent, Washington, USA)
  - Measured the force required to remove the closures from the auger using a Secure Pak Torque Tester.
- **Conclusion:**
  - Supreme Corq closures were the easiest to remove from a corkscrew compared to the other closures tested.

Compression Recovery

- **Objective:**
  - To compare the recovery time of various synthetic, manufactured and natural closures following compression.
- **Methodology:**
  - Measured initial closure diameter.
  - Compressed the closures to 15.5 mm using the Bertolaso Semi-Automatic Bottler at Supreme Corq, LLC. (Kent, Washington, USA)
  - Measured the closure diameter immediately after compression (5 seconds) and at set time intervals thereafter (10 minutes, 1 hour, 4 hours and 24 hours).
- **Conclusion:**
  - Supreme Corq closures recovered relatively quickly compared to the other closures tested.

Compression to 15.5 mm

- **Objective:**
  - To compare the force required to compress various synthetic, manufactured and natural closures to 15.5 mm.
- **Methodology:**
  - Compressed the closures radially to 15.5 mm using a closure compression device at Supreme Corq, LLC. (Kent, Washington, USA)
  - With a load cell, measured the force required to compress the closures to 15.5 mm.
- **Conclusion:**
  - Supreme Corq closures require less force to compress to 15.5 mm compared to the other closures tested. This reduces replacement of costly corker-jaw machine parts.

Oxygen Permeability

- **Objective:**
  - To measure the permeability of various synthetic, manufactured and natural closures to oxygen.
- **Methodology:**
  - Testing was performed on an Ox-Tran 2/20 (MOCON, Inc.) at Impact Analytical (Midland, Michigan, USA).
  - Samples were prepared by cutting off the bottoms of wine bottles, inserting the closures and attaching the test equipment.
  - Oxygen transmission through the closures was then measured.
- **Conclusion:**
  - Supreme Corq closures are less permeable to oxygen compared to the other closures tested.

Print Adhesion and Resolution

- **Objective:**
  - To compare the print adhesion and print definition of various synthetic, manufactured and natural closures.
- **Methodology:**
  - **Adhesion**
    - Rubbed printed closures with an Everclear alcohol (96% alcohol) soaked clean commercial towel.
    - Recorded the number of rubs required to begin removing the ink.
  - **Print Definition**
    - Visually compared the graphics resolution between closures.
    - Rated the clarity and consistency of the print.
- **Conclusion:**
  - Supreme Corq closures have the best print adhesion and print definition of the other closures tested.

Cork Pushing

- **Objective:**
  - To compare pushing of various synthetic, manufactured and natural closures.
- **Methodology:**
  - Bottles were filled with tap water to 60 mm below the rim. The closures were installed into each bottle with a semi-automatic bottler (Bertolaso) and vacuum at –5. The insertion height of each closure was measured. The bottles were then placed an incubator for 24 hours vertically at 40 ℃.
  - After 24 hours, the bottles were removed and the final height was measured.
  - The push height is the difference before and after incubation.

$$h_{push} = h_{before} - h_{after}$$

- **Conclusion:**
  - Supreme Corq closures performed better than the other synthetics.

Closure Flaking from Corkscrew Piercing

- **Objective:**
  - To compare the flaking of various synthetic, manufactured and natural closures.
- **Methodology:**
  - 5 unused closures were pierced with a commercially available corkscrew auger (Franmara -Waiters Friend).
  - The corkscrew was inserted all the way through the length of the closure and then removed.
  - The residue produced by the extraction of the corkscrew was collected in a piece of contrasting paper. The flakes or crumbs collected were compared amongst the different closures and rated accordingly.
- **Conclusion:**
  - Supreme Corq closures showed no flaking.