Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

4 April 2014

Forty-fifth session Geneva, 23 June – 2 July 2014 Item 4 (c) of the provisional agenda **Listing, classification and packing: miscellaneous**

Packing requirements for UN1873

Additional information (Test Report) relating to ST/SG/AC.10/C.3/2014/57

Transmitted by the Council on Safe Transportation of Hazardous Articles (COSTHA)





UNECE – EUROPEAN AGREEMENT CONCERNING THE INERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR)



4G DROP AND STACK PERFORMANCE TEST EVALUATIONS AND LEAKPROOFNESS AND INTERNAL PRESSURE (HYDRAULIC) EVALUATIONS

1 x 1 Liter Fluorinated Ethylene-Propylene (FEP) Bottle Packaging (Bottles subjected to compatibility testing with Perchloric Acid)

TEST REPORT #: 14-2185 (REV 1)

TESTING PERFORMED FOR:

SEASTAR CHEMICALS, INC. 10005 McDonald Park Road Sidney, BC V8L 5Y2

ATTN: James Scott

TESTING PERFORMED BY:

TEN-E PACKAGING SERVICES, INC.

1666 County Road 74 Newport, MN 55055 Phone: 651-459-0671 Fax: 651-459-1430

Issue Date: March 10, 2104 Revision Date: March 17, 2014



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NOTES AND COMMENTS

Note for Rev. 1: Report 14-2185 dated March 10, 2014 has been updated on March 17, 2014. This report is being revised to update the closure and bottle material descriptions per the client's request

Prior to conducting all performance tests, Seastar Chemicals subjected the 1 Liter Teflon bottles to a 6-month ambient chemical compatibility test with Perchloric Acid in accordance with ADR 2013, 6.1.5.2.5. Refer to Appendix A for the Seastar Chemical Compatibility test report.

At the request of Seastar Chemicals, In addition to the 4G Drop (ADR 2013, 6.1.5.3) and Stacking (ADR 2013, 6.1.5.6) tests, bottles were also subjected to the Leakproofness Test (ADR 2013, 6.1.5.4) and the Internal Pressure (Hydraulic) Test (ADR 2013, 6.1.5.5).



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SECTION I: DISCLAIMER OF WARRANTIES

TEN-E PACKAGING SERVICES, INC. certifies that the previously described testing services have been performed in accordance with standard good laboratory practices and the UNECE European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) Part 6; Chapter 6.1. The results included within this test report relate only to the items tested. ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY THAT THE PACKAGING TESTED IS MERCHANTABLE, FIT FOR A PARTICULAR PURPOSE OR IN COMPLIANCE WITH ANY FEDERAL OR STATE REGULATIONS, ARE DISCLAIMED. In no event shall TEN-E Packaging Services, Inc. liability exceed the total amount paid by Seastar Chemicals, Inc. for services rendered.

In the event of future changes to the above referenced test procedure, it is the responsibility of **Seastar Chemicals, Inc.** to determine whether additional testing or updating of past testing is necessary to verify that the packaging we have tested remains in compliance with those standards.

MANUFACTURER: Seastar Chemicals, Inc.

10005 McDonald Park Road Sidney, BC V8L 5Y2

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Patricia L. Garin Manager, Technical Services TEN-E Packaging Services, Inc. 1666 County Road 74 Newport, MN 55055



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SECTION II: PACKAGING DESCRIPTIONS / COMPONENT DRAWINGS

1 x 1 Liter FEP Bottle Packaging				
ASSEMBLY DRAWING		TEST LEV	ELS	
	Packaging Code D	Designation:	4G	
	Packing Group:		I	
	Specific Gravity:		1.7	
	Internal Pressure:		250 kPa	
	Leakproofness:		30 kPa	
	TE	ST SAMPLE PR	EPARATION	
		(Refer to Sect	tion IV)	
	Overall Packaging	Tare Weight:	654.0 Grar	ns
	Fill Capacity (98%	Maximum Capac	ity):	
	Methanol/Water	r Solution	1,016.4 Gr	ams
	Water		1,055.5 Gr	ams
	Package Test Weig	ght:		
	Methanol/Water	r Solution	1.6 Kg	3.5 Lbs.
	Water		1.7 Kg	3.7 Lbs.
	Authorized Packag	ge Gross Mass:	2.4 Kg	5.2 Lbs.
	CLOSING	G METHODS - IN	INER PACK	AGING
	38mm Closure			
^k	Closure Application	n Torque:	33 In-Lbs.	
* - 2	Equipment:		Torque Me	ter #714
	PFA Neck Plug:		Friction Fit	
	CLO	OSING METHOD	S – SHIPPER	२
(the a single		Top Flap	S:	
A CAL	Туре:	3M #375 Press	ure Sensitive	Box Sealing
\land		Таре		
	Width:	48mm		
	Overlap:	2" Minimum		
	Tape Pattern:	Center Seam		
	Inner Flaps:	Meet		
	Outer Flaps:	Meet		
		Bottom Fla	aps:	
	Туре:	3M #375 Press	ure Sensitive	Box Sealing
		Tape		
	Width:	48mm		
	Overlap:	2" Minimum		
	Tape Pattern:	Center Seam		
	Inner Flaps:	Meet		
\bigvee	Outer Flaps:	Meet		

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COMPONENT INFORMATION

	CLOSURE	DRAWING
Description:	38 mm Threaded Closure	
Material:	ETFE, Natural	
Tare Weight:	15.987 Grams	
Overall Dimensions:		
 Height 	1.228"	
Diameter	1.658"	
Finish Dimensions:	-	
• T	1.488"	
• E	1.414"	
Markings (QC Audit):	Nalgene 38	
Neck Plug		
Material:	PFA	
Tare Weight:	0.899 Grams	
Thickness:	0.011"	
Diameter:	1.316" (Top) 1.001" (Btm)	
Height:	0.330"	
	PLASTIC BOTTLE	
Description:	1 Liter Plastic Bottle	
Material/Pigment:	Fluorinated Ethylene-Propylene (FEP),	
	Natural	
Method of Manufacture:	Blow Molded	
Tare Weight:	163 Grams	
Capacity:	4.01.56	
• Rated		
Overflow	1.077 Liters	
	0.040"	
Height	0.243	
Diameter	3.581	
Thread Dimensions:	4.000"	
	1.40/	
	0.004"	
• Minimum		
Markings (QC Audit):	NALGENE® FEP-C3 32-1000 SPI 7 Recycling Symbol	

TEN-E Packaging Services, Inc.

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ABSORBENT POUCH			DRAWING	
Description:	Plastic I	Bag with Absorbent Material Sewn In		
Material:				
• Bag	Clear Lo	ow Density Polyethylene		
Sleeve	White A	bsorbent Material		
Tare Weight:	298 Gra	ims		
Thickness:				
• Bag	0.00420) ¹		
Sleeve	0.00655	"		
Overall Dimensions:				
Length	26-1/2"		(4) * (
Width	10"			
Sealing Method:	8" Wire	Twist Tie	HY RY & BIN	
Markings (QC Audit):	None			
		SHIPPER		
Description:	Regular	Slotted Container		
Material/Flute	200 I b	Test Single-Wall Natural Kraft Corrugat	ed Fiberboard: C-Flute	
(Inner to Outer):	470 0			
Tare weight:	176 Gra	ims		
	-	DIMENSIONS		
	Measured Dimensions (Outside)			
Length	6-1/4"	6-1/4"		
Width	6-1/4"	<u>6-1/4"</u>		
Height	13"			
Board Callper (Nominal):	0.1025"			
Manufacturer's Joint:	Inside G	Inside Glued 1-1/2" Lap		
Markings (QC Audit):	u 4G / X4.3 / S / 13 SturdeeSeal® n USA / +AA5031 4G / Y6.1 / S / 13		leeSeal®	
		BOX CERTIFICATE		
(A) Corrugated Manufacturer:	Berlin Pa	ackaging	A	
(B) Structure:	Single-V	Vall	HOX CERTIFICATE	
(C) Bursting Test	200 Lbs	. Per Sq. Inch	D BOX MEETS ALL CONSTRUCTION REQUIREMENTS OF AFFLICABLE FREIGHT CLASSIFICATION	
(D) Min comb Wt Facings:	84 Lbs.	Per M Sq. Ft	BUEST ING C LRS PER TEST LRS PER WIN COME LRS PER TT FACINGS M SQ FT	
(E) Size Limit:	75"		SIZE LIMIT E INCHES CEOSS F TT LT F LES.	
(F) Gross Wt Lt:	65 Lbs.			
(G) Location:	Bridgevi	lle, PA		



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SECTION III: TEST PROCEDURES AND RESULTS

DROP TESTS

TES		IATION	TEST CRITERIA	
TEST CONTENTS:	Methano	N/Water Solution (0.963 SG) • The outer packaging of a combinati		
SAMPLE PREPARATION:	Refer to Section II		liable to affect safety during carriage. Inner packagings shall remain	
CONDITIONING:	-18°C (0°	F) Chamber #202	and there shall be no leakage of the	
CONTENTS TEMP.:	-18.7°C		filling substance from the inner	
DROP HEIGHT:	2.55 Met (Refer to	ers (101.0") Section IV)	 A slight discharge from the closure(s) upon impact is not considered to be a failure of the packaging provided no 	
TEST EQUIPMENT:	L.A.B. Ac	cu Drop 160	further leakage occurs.	
	DRC	P ORIENTATIONS AND TEST	(6.1.5.3) RESULTS	
Sample #1: Flat on B	ottom	Sample #2: Flat on Top	*Sample #3: Flat on Long Side	
PASS: No leakage or d	amage.	PASS: No leakage or damage	ge. PASS: No leakage or damage.	
*Sample #4: Flat on Sh	ort Side	*Sample #5: Bottom Corne	er **Sample #1: Top Corner	
PASS: No leakage or d	amage.	PASS: No leakage. Slight deformation at impact corne	er. PASS: No leakage. Slight deformation at impact corner.	
PASS: No leakage or da *Side	amage. and corner	PASS: No leakage. Slight deformation at impact corne drops were conducted to impact	t PASS: No leakage. Slight deformation at impact corner. the manufacturer's joint	

** Flat on Bottom Drop sample was also used for the Top Corner drop.



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STACKING TEST

TEST	INFORMATION	TEST CRITERIA
TEST CONTENTS:	Water*	No test sample shall leak
SAMPLE PREPARATION:	Refer to Section II	 In combination packagings, there shall be no leakage of the filling substance from the inner packaging.
CONDITIONING:	23°C / 50% RH Chamber #231	No test sample shall show any
TEST LOAD APPLIED:	68.0 Kg (150 Lbs) (Refer to Section IV)	affect transport safety or any distortion liable to reduce its strength
TEST DURATION:	24 Hours	or cause instability in stacks of packages.
TEST EQUIPMENT:	Dead Load Weights	(6.1.5.6)

***Note:** Deviation from 6.5.1.6 which requires that for the test in accordance with 6.1.5.2.5 (chemical compatibility), the original filling substance be used.

STACKING TEST SET-UP & RESULTS			
	Sample #	Maximum Deflection After 24 Hours	Results
	6	0"	PASS
4-285	7	0"	PASS
	8	0"	PASS

Comments/Observations: Following the 24-hour stack test, there was no leakage of contents from the test samples and no damage likely to affect the performance of the packaging.

Stacking Stability: Not conducted; required only for guided load tests.



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LEAKPROOFNESS TEST

	TEST INFORMATION	TEST CRITERIA
TEST CONTENTS:	Empty	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	30 kPa	These shell have below
TEST DURATION:	5 Minutes	(6.1.5.4)
AREA OF PRESSURIZATION:	Through the Bottom	
TEST METHOD:	Solution Over Seams	
TEST EQUIPMENT:	Regulated Air Source Digital Pressure Gauge #613	

LEAKPROOFNESS TEST SET-UP AND RESULTS				
	Sample #	Results	Comments/Observations	
The second second	1	PASS		
	2	PASS	All three samples maintained the 30 kPa test pressure for 5-minutes without leakage.	
	3	PASS		



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INTERNAL PRESSURE (HYDRAULIC) TEST

	TEST INFORMATION	TEST CRITERIA
TEST CONTENTS:	Water	
FILL CAPACITY:	Maximum Capacity	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	250 kPa	(6.1.5.5)
TEST DURATION:	30 Minutes	
AREA OF PRESSURIZATION:	Through the Bottom	
TEST EQUIPMENT:	Regulated Water Source	
	Digital Pressure Gauge #613	

VACUUM TEST SET-UP AND RESULTS			
	Sample #	Results	Comments/Observations
	4	PASS	
	5	PASS	All three samples maintained the 250 kPa test pressure for 30-minutes without leakage.
	6	PASS	



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REGULATORY AND INDUSTRY STANDARD REFERENCES

REGULATORY REFERENCES		
TEST	UNECE®	
	ADR 2013 Edition	
Drop:	6.1.5.3	
Stacking:	6.1.5.6	
Leakproofness:	6.1.5.4	
Internal (Hydraulic) Pressure	6.1.5.5	

 ① United Nations Economic Commission for Europe – European Agreement Concerning the International Carriage of Dangerous Goods by Road

INDUSTRY STANDARD REFERENCES					
Drop:	ASTM@ D5276:	Standard Test Method for Drop Test of Loaded Containers by Free Fall			
	ISO© 2248:	Packaging – Complete, Filled Transport Packages – Vertical Impact Test by Dropping			
Stacking:	ASTM@ D4577:	Standard Test Method for Compression Resistance of a Container Under Constant Load			
	ISO© 2234:	Packaging – Complete, Filled Transport Packages – Stacking Test using Static Load			

④ American Society for Testing and Materials (ASTM)

© International Organization for Standardization (ISO)

EQUIPMENT

All inspection, measuring and test equipment that can affect product quality is calibrated and adjusted at prescribed intervals, or prior to use, and is traceable to NIST, using ANSI Z540 as an overall guide for calibration certification.



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SECTION IV: MATHEMATICAL CALCULATIONS

INFORMATION USED FOR CALCULATIONS					
Overall Packaging Tare Weight (PTW):	654.0 Grams				
Overflow Capacity (OFC):		Methanol/Water SG			
Methanol/Water	1,037.1 Grams	SG: 0.963			
Water	1,077.0 Grams				
Number of Inner Packagings (# IP):	1				
Packing Group	I. I.				
Product Specific Gravity (PSG):	1.700				
Packing Group Multiplication Factor (MF):	1.50				
Overall Height of one Package (OH):	13.00 Inches				
Stack Test-# of Samples Tested Simultaneously:	3				
98% OF OVERFLOW					

			Overnow Capacity (OF	C) X 98%
OFC	_ × _	98%	-	
1,037.1	x	98% =	1,016.4 Grams	Methanol/Water
1,077.0	x	98% =	1,055.5 Grams	Water

PACKAGE TEST WEIGHTS								
Overa	Overall Pkg Tare Weight (PTW) + (98% Overflow Capacity (OFC) x # of Inner Pkg (# IP)							
PTW	_ + _	(98% OFC	_	x	# IP)	_		
654	+	1,016.4		x	1	Methanol/Water		
654	+	1,055.5		x	1	Water		
Methanol/Water	:	1.6	Kg		3.5	Lbs.		
Water:		1.7	Kg		3.7	Lbs.		

AUTHORIZED PACKAGE GROSS MASS CALCULATION (APGM)							
Overall Pkg Tare Weight (PTW) + (Product SG (PSG) x 98% Overflow (OFC) x # of Inner Pkg (# IP))							
PTW	+	(PSG	x	98% OFC	x	# IP)	
654	+	1.7	x	1,056	x	1	
		2.4	Kg	5.2	Lbs.		

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DROP HEIGHT Calculation For Product Specific Gravities Exceeding 1.2 Product Specific Gravity (PSG) x Packing Group Multiplication Factor (MF)				
_ x _	MF		Pac	king Group: I
x	1.50		Required Drop Height	Actual Drop Height
	2.55	Meter	100.4 Inches	101 Inches
	Produ X x	Calcula Product Specific x MF x 1.50 2.55	Calculation For Prod Product Specific Gravity (PSC <u>x MF</u> x 1.50 2.55 Meter	DROP HEIGHT Calculation For Product Specific Gravities Exceeding 7 Product Specific Gravity (PSG) x Packing Group Multiplication I x MF Pac x 1.50 Required Drop Height 2.55 Meter 100.4 Inches

	STACKING TEST MINIMUM LOAD CALCULATIONS						
	Num	ber of Packages	in a 3m Hig	gh Stack (118	/ Overall Pkg Height (Ol	H) -1)	
		118	/ Overall H	eight of one l	Pkg (OH) - 1		
(118	/ OH) -1 = #3m HS						
118	1	13.00	-1	=	8.1		
		Stacking T	est Load C	alculation (In	dividual Package)		
	Autho	rized Pkg Gross	Mass (APC	SM) x # of Pkg	g in a 3m High Stack (# 3	m HS)	
APGM	_ × _	# 3m HS					
2.4	x	8.1					
		19.5 Kg)	43.	0 Lbs.		

Stacking Test Load Calculation						
Samp	oles x A	uthorized Pk	g Gross Mas	s (APGM) x # of Pkg in	ı a 3m High Stack (# 3m HS)	
Samples	_ x _	(APGM	x	# 3m HS)		
3	х	2.4	x	8.1		
		58.4	Kg	128.7 Lbs.		



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APPENDIX A: SEASTAR 6-MONTH CHEMICAL COMPATIBLITY TEST REPORT

PERCHLORIC ACID COMPATIBILITY REPORT 27 FEBRUARY 2014

PURPOSE

To condition bottles and closures in accordance with ADR 2013, 6.1.5.2.5.

PARTS and MATERIALS

UN1873 Perchloric acid, assay 67.8% w/w, lot number 2112024

Two litre Teflon[®] fluorinated ethylene propylene (FEP) bottles with ethylene-tetrafluoroethylene (ETFE)

closures and Teflon[®] perfluoroalkoxy (PFA) liners

2.5 litre high density polyethylene (HDPE) bottles with polyethylene closures and polytetrafluoroethylene (PTFE) liners

PROCEDURE FOR CONDITIONING THE FEP BOTTLES

On the 25th of July, 2013, each of the ten 2 litre FEP bottles were filled with two litres of UN1873 Perchloric acid. Each bottle had a PFA liner placed in its opening and was sealed with an ETFE closure using thirty three inch pounds of application torque. The bottles were then immediately inverted for twenty four hours at ambient temperature.

On the 26th of July, 2013, exactly 24 hours after the inversion, the bottles were place right side up and stored at ambient temperature for six months.

On the 27th of January, 2014, the bottles were inverted for twenty four hours at ambient temperature.

On the 28th of January, 2014, the bottles were place right side up and the contents of the bottles were poured out. All the bottles were then tripled rinsed with deionised water.

PROCEDURE FOR CONDITIONING THE HDPE BOTTLES

On the 25th of July, 2013, each of the ten 2.6 litre HDPE bottles were filled with two and a half litres of UN1873 Perchloric acid. Each bottle was sealed with a polyethylene closure containing a PTFE liner using forty five inch pounds of application torque. The bottles were then immediately inverted for twenty four hours at ambient temperature.



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On the 26th of July, 2013, exactly 24 hours after the inversion, the bottles were place right side up and stored at ambient temperature for six months.

On the 27th of January, 2014, the bottles were inverted for twenty four hours at ambient temperature.

On the 28th of January, 2014, the bottles were place right side up and the contents of the bottles were poured out. All the bottles were tripled rinsed with deionised water.

OBSERVATIONS

During the conditioning period, no leaks or odours were discovered.

O3MARCH, ZU14

David MacLeod, AScT

Product Quality Supervisor

Seastar Chemicals Inc.



UNECE – EUROPEAN AGREEMENT CONCERNING THE INERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR)



4G DROP AND STACK PERFORMANCE TEST EVALUATIONS AND LEAKPROOFNESS AND INTERNAL PRESSURE (HYDRAULIC) EVALUATIONS

> 1 x 2.5 Liter HDPE Bottle Packaging (Bottles subjected to compatibility testing with Perchloric Acid)

> > **TEST REPORT #: 14-2186**

TESTING PERFORMED FOR:

SEASTAR CHEMICALS, INC. 10005 McDonald Park Road

Sidney, BC V8L 5Y2

ATTN: James Scott

TESTING PERFORMED BY:

TEN-E PACKAGING SERVICES, INC.

1666 County Road 74 Newport, MN 55055 Phone: 651-459-0671 Fax: 651-459-1430

March 10, 2014



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APPENDIX A: SEASTAR 6-MONTH CHEMICAL COMPATIBLITY TEST REPORT	14

NOTES AND COMMENTS

Prior to conducting all performance tests, Seastar Chemicals subjected the 2.5 Liter HDPE bottles to a 6-month ambient chemical compatibility test with Perchloric in accordance with ADR 2013, 6.1.5.2.5. Refer to Appendix A for the Seastar Chemical Compatibility test report.

At the request of Seastar Chemicals, In addition to the 4G Drop (ADR 2013, 6.1.5.3) and Stacking (ADR 2013, 6.1.5.6) tests, bottles were also subjected to the Leakproofness Test (ADR 2013, 6.1.5.4) and the Internal Pressure (Hydraulic) Test (ADR 2013, 6.1.5.5).



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SECTION I: DISCLAIMER OF WARRANTIES

TEN-E PACKAGING SERVICES, INC. certifies that the previously described testing services have been performed in accordance with standard good laboratory practices and the UNECE European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) Part 6; Chapter 6.1. The results included within this test report relate only to the items tested. ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY THAT THE PACKAGING TESTED IS MERCHANTABLE, FIT FOR A PARTICULAR PURPOSE OR IN COMPLIANCE WITH ANY FEDERAL OR STATE REGULATIONS, ARE DISCLAIMED. In no event shall TEN-E Packaging Services, Inc. liability exceed the total amount paid by Seastar Chemicals, Inc. for services rendered.

In the event of future changes to the above referenced test procedure, it is the responsibility of **Seastar Chemicals, Inc.** to determine whether additional testing or updating of past testing is necessary to verify that the packaging we have tested remains in compliance with those standards.

MANUFACTURER:

Seastar Chemicals, Inc. 10005 McDonald Park Road Sidney, BC V8L 5Y2

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Patricia L. Garin Manager, Technical Services TEN-E Packaging Services, Inc. 1666 County Road 74 Newport, MN 55055



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SECTION II: PACKAGING DESCRIPTIONS / COMPONENT DRAWINGS

1 x 2.5 Liter HDPE Bottle Packaging					
ASSEMBLY DRAWING	TEST LEVELS				
	Packaging Code D	Designation:	4G		
	Packing Group:		I		
	Specific Gravity:		1.7		
	Internal Pressure:		250 kPa		
	Leakproofness:		30 kPa		
	TE	EST SAMPLE PR	EPARATION		
		(Refer to Sec	tion IV)		
<u>(</u>)	Overall Packaging	Tare Weight:	426.0 Gran	ns	
	Fill Capacity (98%	Maximum Capac	ity):		
	Methanol/Water	r Solution	2,434.9 Gra	ams	
	Water		2,528.4 Gra	ams	
	Package Test Wei	ght:			
	Methanol/Water	r Solution	2.8 Kg	6.1 Lbs.	
	Water		2.9 Kg	6.3 Lbs.	
	Authorized Packag	ge Gross Mass:	4.7 Kg	10.3 Lbs.	
	CLOSIN	G METHODS – IN		AGING	
	45mm Closure	_			
	Closure Applicatio	n Torque:	45 In-Lbs.		
	Equipment:		I orque Me	ter #/14	
	CL	OSING METHOD	S – SHIPPER	<	
	Turner		IS:	Day Caaling	
	Type:	JIVI #375 Press	ure Sensitive	Box Sealing	
	Width:	18mm			
	Overlan:	2" Minimum			
	Tane Pattern	Center Seam			
	Inner Flaps	Meet			
	Outer Flaps:	Meet			
		Bottom Fla	aps:		
	Type:	3M #375 Press	ure Sensitive	Box Sealing	
		Tape		5	
	Width:	48mm			
	Overlap:	2" Minimum			
	Tape Pattern:	Center Seam			
	Inner Flaps:	Meet			
	Outer Flaps:	Meet			

TEN E

COMPONENT INFORMATION

	CLOSURE	DRAWING
Description:	45 mm Threaded Closure	
Material:	HDPE, White	
Tare Weight:	9.689 Grams	
Overall Dimensions:		
Height	0.964"	
Diameter	2.013"	
Finish Dimensions:		
• T	1.809"	
• E	1.699"	
Markings (QC Audit):	1451 P SPI 02 PE-HD Recycling Symbol	
Liner		
Material:	PTFE	
Tare Weight:	0.912 Grams	
Thickness:	0.010"	
Diameter:	1.744" (Outside) 1.148" (Inside)	
	PLASTIC BOTTLE	
Description:	2.5 Liter Plastic Bottle with Handle	
Material/Pigment:	High Density Polyethylene	
Method of Manufacture:	Blow Molded	
Tare Weight:	208 Grams	
Capacity:	1	
Rated	2.5 Liters	
Overflow	2.58 Liters	
Overall Dimensions:		
Height	12.131"	
Width	4.378"	
Depth	4.397"	
Thread Dimensions:		
• T	1.627"	
• E	1.743"	
Wall Thickness:		
Minimum	0.043"	
Markings (OC Audit)	2/14	
	SPI "2" HDPE Recycling Symbol	

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	INSERT	DRAWING
Description:	Insert	
Material:	Molded Pulp Slurry	
Tare Weight:	37 Grams	
Overall Dimensions:		
Length	5-1/4"	
Width	5-1/4"	
Height	3.528"	
Markings (QC Audit):	None	
	SHIPPER	
Description:	Regular Slotted Container	
Material/Flute	200 Lb. Test Single-Wall Natural Kraft Corr	rugated Fiberboard; C-Flute
Tare Weight:	165 Grams	
	DIMENSIONS	
	Measured Dime	nsions (Outside)
Length	5-3/4"	· · · · · ·
Width	5-3/4"	
Height	14"	
Board Caliper (Nominal):	0.1370"	
Manufacturer's Joint:	Inside Glued, 1-1/4" Lap	
Markings (QC Audit):	u 4G / X5.1 / S / 13 USA / +AA6703 4/3/13	
	BOX CERTIFICATE	
(A) Corrugated Manufacturer:	Berlin Packaging	A
(B) Structure:	Single-Wall	HON CERTIFICATA
(C) Bursting Test	200 Lbs. Per Sq. Inch	FOX MEETS ALL CONSTRUCTION REQUIREMENTS OF APPLICABLE FREIGHT CLASSIFICATION
(D) Min comb Wt. Facings:	84 Lbs. Per M Sq. Ft	BURSTING C LBS PER SQ INCE HIN COMB TT FACINGS D LBS PER M SQ FF
(E) Size Limit:	75"	SIZE LIMIT L INCHES TELT F LES.
(F) Gross Wt. Lt:	65 Lbs.	
(G) Location:	Bridgeville, PA	U U



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SECTION III: TEST PROCEDURES AND RESULTS

DROP TESTS

TEST	Γ INFO	RMATION	TEST CRITERIA	
TEST CONTENTS:	Metha	nol/Water Solution (0.963 SG)	 The outer packaging of a combination packaging shall not 	
SAMPLE PREPARATION:	Refer	to Section II	exhibit any damage liable to affect safety during carriage. Inner	
CONDITIONING:	-18°C	(0°F) Chamber #202	packagings shall remain completely within the outer	
CONTENTS TEMP.:	-18.3°	С	packaging and there shall be no	
DROP HEIGHT:	2.55 N (Refe	Aeters (101.0") r to Section IV)	 A slight discharge from the closure(s) upon impact is not 	
TEST EQUIPMENT:	L.A.B	Accu Drop 160	packaging provided no further leakage occurs. (6.1.5.3)	
	DRO	OP ORIENTATIONS AND TEST RES	ULTS	
Sample #1: Flat on Botto	om	Sample #2: Flat on Top	*Sample #3: Flat on Long Side	
PASS: No leakage or dama	age.	PASS: No leakage or damage.	PASS: No leakage or damage.	
*Sample #4: Flat on Short Side		-Sample #5: Bottom Corner	Sample #1: Top Corner	
PASS: No leakage or dama	age.	PASS: No leakage. Slight deformation at impact corner.	PASS: No leakage. Slight deformation at impact corner.	

Side and corner drops were conducted to impact the manufacturer's joint

** Flat on Bottom Drop sample was also used for the Top Corner drop.

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STACKING TEST

TES	T INFORMATION	TEST CRITERIA
TEST CONTENTS:	Water*	 No test sample shall leak In combination packagings, there shall be as leakage of the filling
PREPARATION:		substance from the inner
CONDITIONING:	23°C / 50% RH Chamber #231	 No test sample shall show any
TEST LOAD APPLIED:	113.4 Kg (250 Lbs) (Refer to Section IV)	deterioration which could adversely affect transport safety or any distortion liable to reduce its
TEST DURATION:	24 Hours	strength or cause instability in
TEST EQUIPMENT:	Dead Load Weights	stacks of packages. (6.1.5.6)

***Note:** Deviation from 6.5.1.6 which requires that for the test in accordance with 6.1.5.2.5 (chemical compatibility), the original filling substance be used.

STACKING TEST SET-UP & RESULTS					
	Sample #	Maximum Deflection After 24 Hours	Results		
	6	0"	PASS		
H-ZIX6	7	0"	PASS		
	8	0"	PASS		

Comments/Observations: Following the 24-hour stack test, there was no leakage of contents from the test samples and no damage likely to affect the performance of the packaging.

Stacking Stability: Not conducted; required only for guided load tests.



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LEAKPROOFNESS TEST

	TEST INFORMATION	TEST CRITERIA
TEST CONTENTS:	Empty	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	30 kPa	
TEST DURATION:	5 Minutes	(6.1.5.4)
AREA OF PRESSURIZATION:	Through the Bottom	
TEST METHOD: Solution Over Seams		
TEST EQUIPMENT:	Regulated Air Source Digital Pressure Gauge #613	

LEAKPROOFNESS TEST SET-UP AND RESULTS							
	Sample #	Results	Comments/Observations				
	1	PASS					
	2	PASS	All three samples maintained the 30 kPa test pressure for 5 Minutes without leakage.				
64 64 64	3	PASS	g.				



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INTERNAL PRESSURE (HYDRAULIC) TEST

	TEST INFORMATION	TEST CRITERIA
TEST CONTENTS:	Water	
FILL CAPACITY:	Maximum Capacity	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	250 kPa	ю раскаділд may leaк. (6.1.5.5)
TEST DURATION:	30 Minutes	
AREA OF PRESSURIZATION:	Through the Bottom	
TEST EQUIPMENT:	Regulated Water Source Digital Pressure Gauge #613	

VACUUM TEST SET-UP AND RESULTS						
	Sample #	Results	Comments/Observations			
	4	PASS	All three complex maintained the 250 kDa			
	5	PASS	test pressure for 30-Minutes without leakage.			
	6	PASS				



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REGULATORY AND INDUSTRY STANDARD REFERENCES

REGULATORY REFERENCES					
TEST	UNECE®				
	ADR 2013 Edition				
Drop:	6.1.5.3				
Stacking:	6.1.5.6				
Leakproofness:	6.1.5.4				
Internal (Hydraulic) Pressure	6.1.5.5				

 ① United Nations Economic Commission for Europe – European Agreement Concerning the International Carriage of Dangerous Goods by Road

INDUSTRY STANDARD REFERENCES						
Drop:	ASTM@ D5276:	Standard Test Method for Drop Test of Loaded Containers by Free Fall				
	ISO© 2248:	Packaging – Complete, Filled Transport Packages – Vertical Impact Test by Dropping				
Stacking: ASTM@ D4577:		Standard Test Method for Compression Resistance of a Container Under Constant Load				
	ISO© 2234:	Packaging – Complete, Filled Transport Packages – Stacking Test using Static Load				

④ American Society for Testing and Materials (ASTM)

© International Organization for Standardization (ISO)

EQUIPMENT

All inspection, measuring and test equipment that can affect product quality is calibrated and adjusted at prescribed intervals, or prior to use, and is traceable to NIST, using ANSI Z540 as an overall guide for calibration certification.

TEN-E Packaging Services, Inc.

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SECTION IV: MATHEMATICAL CALCULATIONS

INFORMATION USED FOR CALCULATIONS						
Overall Packaging Tare Weight (PTW):	426.0 Grams					
Overflow Capacity (OFC):		Methanol/Water SG				
Methanol/Water	2,484.5 Grams	SG: 0.963				
Water	2,580.0 Grams					
Number of Inner Packagings (# IP):	1					
Packing Group	I. I.					
Product Specific Gravity (PSG):	1.700					
Packing Group Multiplication Factor (MF):	1.50					
Overall Height of one Package (OH):	14.13 Inches					
Stack Test-# of Samples Tested Simultaneously:	3					
98% OF OVERFLOW						

		Overnow Capacity (OFC) x 98%			
OFC	_ x _	98%	-		
2,484.5	x	98% =	2,434.9 Grams	Methanol/Water	
2,580.0	x	98% =	2,528.4 Grams	Water	

PACKAGE TEST WEIGHTS							
Overall Pkg Tare Weight (PTW) + (98% Overflow Capacity (OFC) x # of Inner Pkg (# IP)							
PTW	+_	(98% OFC	_	x	# IP)	_	
426	+	2,434.9		x	1	Methanol/Water	
426	+	2,528.4		x	1	Water	
Methanol/Water:		2.8	Kg		6.1	Lbs.	
Water:		2.9	Kg		6.3	Lbs.	

AUTHORIZED PACKAGE GROSS MASS CALCULATION (APGM)									
Overall Pkg Tare Weight (PTW) + (Product SG (PSG) x 98% Overflow (OFC) x # of Inner Pkg (# IP))									
	PTW	+	(PSG	x	98% OFC	x	# IP)		
	426	+	1.7	x	2,528	x	1		
			4.7	Kg	10.3	Lbs.			

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	Produ	Calcula Ict Specifie	tion For Prod c Gravity (PSG	DROP HEIGHT uct Specific Gravities Exceeding 1 6) x Packing Group Multiplication I	1.2 Factor (MF)	
PSG x MF Packing Group: I						
1.7	x	1.50		Required Drop Height	Actual Drop Heigh	
		2.55	Meter	100.4 Inches	101 Inches	
		2.55	Weter	100.4 inches	TOT Inches	

STACKING TEST MINIMUM LOAD CALCULATIONS										
	Number of Packages in a 3m High Stack (118 / Overall Pkg Height (OH) -1)									
	118 / Overall Height of one Pkg (OH) - 1									
	(118	_ /	OH)	-1	_ =	# 3m HS				
	118	1	14.13	-1	=	7.4				
Stacking Test Load Calculation (Individual Package)										
	Authorized Pkg Gross Mass (APGM) x # of Pkg in a 3m High Stack (# 3m HS)									
APGM x #3m HS										
	4.7	x	7.4							
			34.8	Kg	76	.7 Lbs.				

Stacking Test Load Calculation								
Samples x Authorized Pkg Gross Mass (APGM) x # of Pkg in a 3m High Stack (# 3m HS)								
Samples	_ x _	(APGM	x	# 3m HS)				
3	x	4.7	x	7.4				
		104.4 Kg		230.2	Lbs.			

TEN 2

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APPENDIX A: SEASTAR 6-MONTH CHEMICAL COMPATIBLITY TEST REPORT

PERCHLORIC ACID COMPATIBILITY REPORT 27 FEBRUARY 2014

PURPOSE

To condition bottles and closures in accordance with ADR 2013, 6.1.5.2.5.

PARTS and MATERIALS

UN1873 Perchloric acid, assay 67.8% w/w, lot number 2112024

Two litre Teflon[®] fluorinated ethylene propylene (FEP) bottles with ethylene-tetrafluoroethylene (ETFE)

closures and Teflon[®] perfluoroalkoxy (PFA) liners

2.5 litre high density polyethylene (HDPE) bottles with polyethylene closures and polytetrafluoroethylene (PTFE) liners

PROCEDURE FOR CONDITIONING THE FEP BOTTLES

On the 25th of July, 2013, each of the ten 2 litre FEP bottles were filled with two litres of UN1873 Perchloric acid. Each bottle had a PFA liner placed in its opening and was sealed with an ETFE closure using thirty three inch pounds of application torque. The bottles were then immediately inverted for twenty four hours at ambient temperature.

On the 26th of July, 2013, exactly 24 hours after the inversion, the bottles were place right side up and stored at ambient temperature for six months.

On the 27th of January, 2014, the bottles were inverted for twenty four hours at ambient temperature.

On the 28th of January, 2014, the bottles were place right side up and the contents of the bottles were poured out. All the bottles were then tripled rinsed with deionised water.

PROCEDURE FOR CONDITIONING THE HDPE BOTTLES

On the 25th of July, 2013, each of the ten 2.6 litre HDPE bottles were filled with two and a half litres of UN1873 Perchloric acid. Each bottle was sealed with a polyethylene closure containing a PTFE liner using forty five inch pounds of application torque. The bottles were then immediately inverted for twenty four hours at ambient temperature.

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On the 26th of July, 2013, exactly 24 hours after the inversion, the bottles were place right side up and stored at ambient temperature for six months.

On the 27th of January, 2014, the bottles were inverted for twenty four hours at ambient temperature.

On the 28th of January, 2014, the bottles were place right side up and the contents of the bottles were poured out. All the bottles were tripled rinsed with deionised water.

OBSERVATIONS

During the conditioning period, no leaks or odours were discovered.

O3MARCH, ZU14

David MacLeod, AScT

Product Quality Supervisor

Seastar Chemicals Inc.