TEN-E Packaging Services, Inc.

UNITED NATIONS / DOT PERFORMANCE CERTIFICATION

GREIF

3H1 PERIODIC RETEST

20 Liter Plastic Stackable Jerrican with (2) Openings

TEST REPORT #: 24-NC30007

(un) 3H1 / Y1.8 / 150 / **
USA / +CQ9827

**Insert the year packaging is manufactured

TESTING PERFORMED FOR:

GREIF
275 Chambers Drive
Homerville, GA

ATTN: Allen Jones

TESTING PERFORMED BY:

TEN-E PACKAGING SERVICES, INC.
2101 Shore Street
High Point, NC 27263
Phone: 336-803-4878
Fax: 336-804-5074

May 1, 2024

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NOTES AND COMMENTS

The testing of this design is intended to cover alternate designs provided the selective testing provisions of DOT Title 49 CFR §178.601(g)(3) are met. In addition, smaller versions of this design may be authorized based on the definition of a different design type under 49 CFR §178.601(c)(4)(v) which states that a different design type does not include packagings which differ from the design type only in their lesser design height.

SECTION I: CERTIFICATION

Periodic Retest of the Greif
20 Liter Plastic Stackable Jerrican with (2) Openings

TEN-E Packaging Services, Inc. is a current DOT UN Third-Party Certification Agency under §107.403 and certifies that the **Greif** packaging referenced above has passed the standards of the DEPARTMENT OF TRANSPORTATION'S TITLE 49 CFR; Performance Oriented Packaging Standards, Section 178. This package is also certified under IMDG, ICAO/IATA Regulations and the UN Recommendations on the Transport of Dangerous Goods. It is the responsibility of the end user to determine authorization for use under these regulations. The use of other packaging methods or components other than those documented in this report may render this certification invalid.

SUMMARY OF PERFORMANCE TESTS

UN / DOT TEST	49 CFR REFERENCE	TEST LEVEL	TEST CONTENTS	TEST COMPLETED	TEST RESULTS
Drop	178.603	1.8 m	PPG/Water Solution	April 30, 2024	PASS
Leakproofness	178.604	20 kPa – 5 Minutes	Empty	May 1, 2024	PASS
Hydrostatic	178.605	150 kPa - 30 Minutes	Water	May 1, 2024	PASS
Stacking	178.606	272.2 Kg – 28 Days	Water	April 17, 2024	PASS
Vibration	178.608	4.3 Hz – 1 Hour	Water	May 1, 2024	PASS

TEST REPORT NUMBERS:	24-NC30007, 18-NC30021
UN MARKING: (CFR 49 – 178.503)	(un) 3H1 / 1.8 / 150 / ** USA / +CQ9827
PACKAGING IDENTIFICATION CODE:	3H1 - Non-Removable Head Jerrican (178.509)
PERFORMANCE STANDARD:	Y (Packaging meets Packing Group II and III tests)
MAXIMUM PRODUCT SPECIFIC GRAVITY:	1.8
HYDROSTATIC TEST PRESSURE:	150 kPa
YEAR OF MANUFACTURE:	** Insert year the packaging is manufactured
STATE AUTHORIZING THE MARK:	USA
PACKAGING CERTIFICATION AGENCY:	(+CQ) TEN-E Packaging Services, Inc. (High Point, NC CAA #2015050020)
THIRD PARTY PACKAGING IDENTIFICATION:	+CQ9827
PERIODIC RETEST DATE:	May 1, 2025

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY THAT THE PACKAGING TESTED IS MERCHANTABLE OR FIT FOR A PARTICULAR PURPOSE, ARE DISCLAIMED. In no event shall TEN-E Packaging Services, Inc. liability exceed the total amount paid by **Greif** for services rendered. In the event of future changes to the above referenced test standards, it is the responsibility of **Greif** 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:

Greif
275 Chambers Drive
Homerville, GA 31634

Brent Weber
Project Manager
TEN-E Packaging Services, Inc.
2101 Shore Street
High Point, NC 27263

SECTIONS II & V: PACKAGING DESCRIPTIONS / COMPONENT DRAWINGS

20 Liter Plastic Stackable Jerrican with (2) Openings

ASSEMBLY DRAWING

TEST LEVELS

Certification Type:	Periodic Retest	
Packaging Code Designation:	3H1	
Packing Group:	II	
Specific Gravity:	1.8	
Internal Pressure:	150	

TEST SAMPLE PREPARATION
(Refer to Section IV)

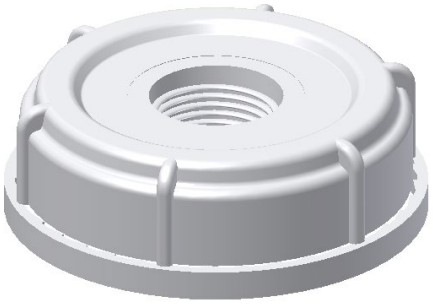
Overall Packaging Tare Weight:	1.2 Kg	
Fill Capacity (98% Maximum Capacity):		
Propylene / Glycol	22.0 Kg	
Water	21.4 Kg	
Package Test Weight:		
Propylene / Glycol	23.2 Kg	51.1 Lbs.
Water	22.6 Kg	49.8 Lbs.
Authorized Package Gross Mass:	39.7 Kg	87.5 Lbs.

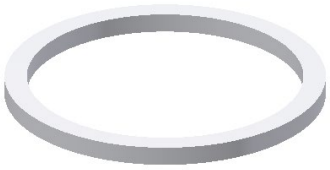
CLOSING METHODS

(1) PlastiCap 70 Screw Cap Closure:	
Application Torque:	180 In-Lbs.
Equipment:	Torque Wrench #E702
(1) 21mm Threaded Vent Closure:	
Application Torque:	24 In-Lbs.
Equipment:	Torque Wrench E705

COMPONENT INFORMATION

70 mm CLOSURE (SC-76RTE)		DRAWING
Manufacturer: Rieke Corporation, Auburn, IN		
Description:	70 mm Threaded Tamper-Evident Screw Cap with 3/4” Thread Reducer	
Number/Location:	1 / Refer to Drawing	
Material:	Polyethylene, Natural	
Tare Weight:	28.2 Grams	
Overall Dimensions:		
• **Height**	25.9 mm ± 0.50 mm (1.02” ± 0.02”)	
• **Diameter**	84.4 mm ± 0.50 mm (3.32” ± 0.02”)	
Thread:		
• **Type**	70 mm	
• **Style**	Buttress	
Thread Dimensions:		
• **T**	72.1 mm ± 0.50 mm (2.84” ± 0.02”)	
• **E**	66.8 mm ± 0.50 mm (2.63” ± 0.02”)	
• **Thread Pitch**	6 TPI, 0.167 Pitch	
Markings (QC Audit):	Rieke ® OPEN 24 CLOSE TIGHT SC-.76 70MM 6TPI	
GASKET		
Material:	Flat GK98W EPDM Gasket, White	
Tare Weight:	2.68 Grams	
Thickness:	0.114”	
Diameter:	2.528”	





21 mm VENT ACCESS CLOSURE (ENG-00-039500 a)		DRAWING
Manufacturer: Bericap GmbH & Co., Budenheim, Germany		 
Description:	21 mm Threaded Vent Closure	
Quantity:	1	
Material:	Polypropylene, White	
Tare Weight:	2.314 grams	
Overall Dimensions:		
• **Height**	24.40 mm ± 0.30 mm (0.961” ± 0.012”)	
• **Diameter**	30.40 mm ± 0.39 mm (1.197” ± 0.015”)	
Thread:		
• **Type**	21 mm	
• **Style**	Buttress	
Thread Dimensions:		
• **T**	21.30 mm ± 0.15 mm (0.839” ± 0.006”)	
• **E**	17.10 mm ± 0.15 mm (0.673” ± 0.006”)	
Markings (QC Audit):	02 01	
LINER		
Description:	PE ALKOzell 400 PE Liner	
Tare Weight:	0.182 grams	
Thickness:	2 mm (0.079”)	
Diameter:	16.7 mm (0.658”)	
Markings (QC Audit):	None	

20 L PLASTIC JERRICAN (P-2125)		DRAWING
Manufacturer: Lee Container, Homerville, GA		
Description:	20 Liter Stackable Plastic Jerrican	
Quantity:	1	
Material:	High Density Polyethylene, Natural	
Method of Manufacture:	Blow Molded	
Tare Weight:	1,192 Grams	
Capacity:		
• **Rated**	20 Liters	
• **Overflow**	22,062 mL	
Overall Dimensions:		
• **Length**	11.500” ± 0.120”	
• **Width**	9.500” ± 0.110”	
• **Height**	15.750” ± 0.110”	
70 mm Opening Thread Dimensions:		
• **T**	2.777” ± 0.015”	
• **E**	2.577” ± 0.015”	
21 mm Vented Access Thread Dimensions:		
• **T**	0.819” ± 0.008”	
• **E**	0.626” ± 0.008”	
Wall Thickness:		
• **Nominal**	0.100”	
Handle:		
• **Style**	Integrated, Hollow	
• **Number/ Location**	1 / Refer to Drawing	
• **Material**	High Density Polyethylene	
Markings (QC Audit):	(u n) 3H1 / Y1.8 / 150 / 24 USA / +CQ9827 Lee Logo 20L 4/24 SPI “2” HDPE Recycling Symbol	

SECTION III: TEST PROCEDURES AND RESULTS

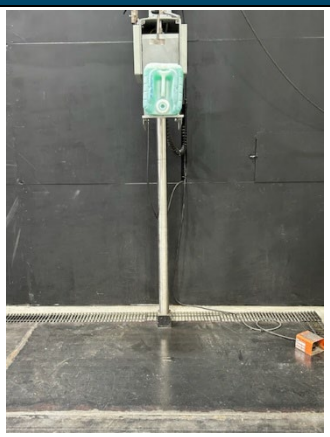
DROP TESTS

TEST INFORMATION		TEST CRITERIA
TEST CONTENTS:	PPG/Water Solution (1.03 SG)	• For packaging containing liquid, each packaging does not leak when equilibrium has been reached between the internal and external pressures. • Any discharge from a closure is slight and ceases immediately after impact with no further leakage. (§178.603)
SAMPLE PREPARATION:	Refer to Section II	
CONDITIONING:	-18ºC (0ºF) Chamber #E201	
TEST CONTENTS TEMP.:	-18.8°C (-1.8°F)	
DROP HEIGHT:	1.8 Meters (71”) (Refer to Section IV)	
TEST EQUIPMENT:	L.A.B. Accu Drop 160 #301	

DIAGONAL TOP CHIME ON 70MM CLOSURE DROP TEST SET-UP AND RESULTS

Sample #	Results	Comments/Observations
1	PASS	No leakage. Slight deformation at point of impact.
2	PASS	No leakage. Slight deformation at point of impact.
3	PASS	No leakage. Slight deformation at point of impact.

FLAT ON SIDE ON 70MM CLOSURE DROP TEST SET-UP AND RESULTS



Sample #	Results	Comments/Observations
4	PASS	No leakage. Slight deformation at point of impact.
5	PASS	No leakage. Slight deformation at point of impact.
6	PASS	No leakage. Slight deformation at point of impact.

LEAKPROOFNESS TEST

TEST INFORMATION		TEST CRITERIA
TEST CONTENTS:	Empty	• A packaging passes the test if there is no leakage of air from the packaging. (§178.604)
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	20 kPa	
TEST DURATION:	5 Minutes	
AREA OF PRESSURIZATION:	Through the Sidewall	
TEST EQUIPMENT:	Regulated Air Source #: E607 Digital Pressure Gauge #: E613	

LEAKPROOFNESS PRESSURE TEST SET-UP AND RESULTS

Sample #	Results
10	PASS
11	PASS
12	PASS

Comments/Observations:
All three samples maintained the 20 kPa test pressure for 5 minutes without leakage

HYDROSTATIC PRESSURE TEST

TEST INFORMATION		TEST CRITERIA
TEST CONTENTS:	Water	• For each test sample, there is no leakage of liquid from the package. (§178.605)
WATER TEMPERATURE:	17.4°C (63.3°F)	
FILL CAPACITY:	Maximum Capacity	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	150 kPa	
TEST DURATION:	30 Minutes	
AREA OF PRESSURIZATION:	Through the Sidewall	
TEST EQUIPMENT:	Regulated Water Source #: E607 Digital Pressure Gauge #: E613	

HYDROSTATIC PRESSURE TEST SET-UP AND RESULTS

Sample #	Results
13	PASS
14	PASS
15	PASS

Comments/Observations:
All three samples maintained the 150 kPa test pressure for 30 minutes without leakage.

STACKING & STACKING STABILITY TESTS

TEST INFORMATION		TEST CRITERIA
TEST CONTENTS:	Water	• No test sample may leak. • There can be no deterioration that could adversely affect transport safety or any distortion liable to reduce the package's strength, cause instability in stacks of packages, or cause damage to inner packagings that is likely to reduce safety in transport. (§178.606)
SAMPLE PREPARATION:	Refer to Section II	
CONDITIONING:	40°C (104°F) Chamber #201	
TEST LOAD APPLIED:	272.2 Kg (600.0 Lbs.) (Refer to Section IV)	
TEST DURATION:	28 Days	
TEST EQUIPMENT:	Guided Load Fixture w/ Dead Load Weight	

STACKING TEST SET-UP & RESULTS

Sample #	Maximum Deflection After 28 Days	Results
7	1-3/8"	**PASS**
8	1-1/2"	**PASS**
9	1-1/2"	**PASS**

Comments/Observations: Following the 28-day 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 TEST SET-UP & RESULTS

Results	CRITERIA FOR PASSING THE TEST
PASS	• In guided load tests, stacking stability must be assessed after test completion. • Two filled packagings of the same type must be placed on the test sample. • The stacked packages must maintain their position for one hour. (§178.606)

For stack stability, TEN-E places the filled samples one on top of the other. The bottom sample is rotated to the top until all three samples have been subjected to stacking stability for one hour each.

VIBRATION TEST

TEST INFORMATION		TEST CRITERIA
TEST CONTENTS:	Water	• Immediately following the period of vibration, each package must be removed from the platform, turned on its side and observed for any evidence of leakage. • A packaging passes the vibration test if there is no rupture or leakage from any of the packages. • No test sample should show any deterioration which could adversely affect transportation safety or any distortion liable to reduce packaging strength. (§178.608)
SAMPLE PREPARATION:	Refer to Section II	
CONDITIONING:	Ambient	
TABLE DISPLACEMENT:	1”	
TEST FREQUENCY:	4.3 Hz	
TEST DURATION:	1 Hour	
TEST EQUIPMENT:	Vertical motion using L.A.B. V4000 Vibration System #E503	

VIBRATION TEST SET-UP AND RESULTS

Sample #	Results	Comments/Observations
16	**PASS**	No leakage or damage.
17	**PASS**	
18	**PASS**	

REGULATORY AND INDUSTRY STANDARD REFERENCES

REGULATORY REFERENCES					
TEST	**49 CFR①**	**UN②**	**IMDG③**	**ICAO④**	**IATA⑤**
	October 2023 Edition	**23rd Edition**	**2022 Edition**	**2023-2024 Edition**	**65th Edition**
Drop:	178.603	6.1.5.3	6.1.5.3	6;4.3	6.3.3
Leakproofness:	178.604 & 178 Appendix B (2) & (3)	6.1.5.4	6.1.5.4	6;4.4	6.3.4
Hydrostatic Pressure:	178.605	6.1.5.5	6.1.5.5	6;4.5	6.3.5
Stacking:	178.606	6.1.5.6	6.1.5.6	6;4.6	6.3.6
Vibration:	178.608	---	---	4;1.1.1 & 4;1.1.4	5.0.2.7

① United States Department of Transportation Code of Federal Regulations (CFR) Title 49, Transportation, Parts 100-185
② The United Nations Recommendations on the Transport of Dangerous Goods – Model Regulations (UN – Orange Book)
③ International Maritime Dangerous Goods Code (IMDG)
④ Technical Instructions for the Safe Transport of Dangerous Good by Air (ICAO)
⑤ International Air Transport Association (IATA) Dangerous Goods Regulations

INDUSTRY STANDARD REFERENCES		
Drop:	ASTM⑥ D5276:	Standard Test Method for Drop Test of Loaded Containers by Free Fall
	ASTM⑥ D7790:	Standard Test Method for the Preparation of Plastic Packagings Containing Liquids for United Nations (UN) Drop Testing
	ISO⑦ 2248:	Packaging – Complete, Filled Transport Packages – Vertical Impact Test by Dropping
Hydrostatic Pressure:	ASTM⑥ D7660:	Standard Guide for Conducting Internal Pressure Tests on United Nations (UN) Packagings
Stacking:	ASTM⑥ D8409:	Standard Guide for Conducting Stacking Tests on UN Packagings Using Guided or Unguided Loads
	ASTM⑥ D4577:	Standard Test Method for Compression Resistance of a Container Under Constant Load
	ISO⑦ 2234:	Packaging – Complete, Filled Transport Packages – Stacking Test using Static Load
Vibration:	ASTM⑥ D999:	Standard Test Method for Vibration Testing of Shipping Containers
	ISO⑦ 2247:	Packaging – Complete, Filled Transport Packages – Vibration Test at Fixed Low Frequency

⑥ American Society for Testing and Materials (ASTM)
⑦ 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.

SECTION IV: MATHEMATICAL CALCULATIONS

INFORMATION USED FOR CALCULATIONS

Overall Packaging Tare Weight (PTW):	**1.2 Kg**
Overflow Capacity (OFC):	
Propylene/Glycol	**22.4 Kg**
Water	**21.8 Kg**
Packing Group	**II**
Product Specific Gravity (PSG):	**1.8**
Packing Group Multiplication Factor (MF):	**1.00**
Nesting Height of one Package (NH):	**15.50 Inches**
Stack Test-# of Samples Tested Simultaneously:	**0**

98% OF OVERFLOW

Overflow Capacity (OFC) x 98%

OFC	x	98%				
22.4	x	98% =	**22.0 Kg**	**48.5 Lbs.**	**Propylene/Glycol**
21.8	x	98% =	**21.4 Kg**	**47.2 Lbs.**	**Water**

PACKAGE TEST WEIGHT

Overall Pkg Tare Weight (PTW) + 98% Overflow Capacity (OFC)

PTW	+	98% OFC =					
1.2	+	22.0	**23.2**	**Kg**	**51.1**	**Lbs.**	**Propylene/Glycol**
1.2	+	21.4	**22.6**	**Kg**	**49.8**	**Lbs.**	**Water**

CALCULATED PACKAGE GROSS MASS (CPGM)

Overall Pkg Tare Weight (PTW) + (Product SG (PSG) x 98% Overflow (OFC))

PTW	+	(PSG	x	98% OFC)
1.2	+	1.8	x	21.4
		39.7 Kg		**87.5 Lbs.**

DROP HEIGHT

Calculation For Product Specific Gravities Exceeding 1.2

Product Specific Gravity (PSG) x Packing Group Multiplication Factor (MF)

PSG	x	MF			Packing Group:	II
1.8	x	1.00		Required Drop Height		Actual Drop Height
		1.80	**Meter**	**70.9 Inches**		**71 Inches**

STACK TEST MINIMUM LOAD CALCULATIONS

Number of Packages in a 3m High Stack (118.2 / Nesting Height (NH) -1)

118.2 / Nesting Height of one Pkg (NH) - 1

(118.2	/	NH)	-1	=	# 3m HS
118.2	/	15.50	-1	=	6.6

Stack Test Load Calculation (Individual Package)

Calculated Pkg Gross Mass (CPGM) x # of Pkg in a 3m High Stack (# 3m HS)

CPGM	x	# 3m HS
39.7	x	6.6
		262.1 Kg
		577.8 Lbs.