

**UNITED NATIONS / DOT
PERFORMANCE CERTIFICATION**



1A1 PERFORMANCE TESTS

**55 Gallon Tight Head Reconditioned Drums
(1.1 / 0.8 / 1.1 mm) with Steel Plugs**

TEST REPORT #: 09-3253-1

TESTING PERFORMED FOR:

MITCHELL CONTAINER SERVICES, INC.
226 Highway 43 South
Saraland, AL 36571

ATTN: Randy Speights

TESTING PERFORMED BY:

TEN-E Packaging Services, Inc.
1666 County Road 74
Newport, MN 55055
Phone: (651) 459-0671
Fax: (651) 459-1430

February 10, 2010

TABLE OF CONTENTS

Section I: CERTIFICATION.....3

Sections II & V: PACKAGING DESCRIPTION / COMPONENT DRAWINGS4

COMPONENT INFORMATION.....5

Section III: TEST PROCEDURES AND RESULTS8

DROP TESTS.....8

LEAKPROOFNESS TESTS.....9

HYDROSTATIC PRESSURE TEST10

STACKING TESTS.....11

REPETITIVE SHOCK VIBRATION TESTS.....12

REGULATORY AND INDUSTRY STANDARD REFERENCES13

Section IV: MATHEMATICAL CALCULATIONS.....14

NOTES AND COMMENTS

- Testing was conducted on 1.1 / 0.8 / 1.1 reconditioned 55 gallon tight head steel drums to determine if the design is capable of meeting the UN performance tests.
- The testing for this design was based on Packing Group II, 1.4 specific gravity and a hydrostatic pressure rating of 250 kPa.
- Drums were submitted from several drum manufacturers with packagings meeting the design type specification.
- Drums were originally manufactured in the USA and marked by the original manufacturer to UN 1A1 performance standards in accordance with 49 CFR 178.601(g)(8)

SECTION I: CERTIFICATION

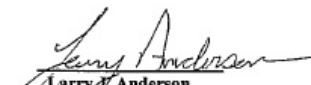
55 Gallon Tight Head Reconditioned Drums (1.1 / 0.8 / 1.1 mm) with Steel Plugs

TEN-E PACKAGING SERVICES, INC. has subjected the packaging referenced above to the Performance Oriented packaging Standards of the DEPARTMENT OF TRANSPORTATION'S TITLE 49 CFR. Section 178. It is the responsibility of the end user to determine authorization for use under the applicable regulations. The use of other packaging methods or components other than those documented in this report may render the testing conducted invalid.

SUMMARY OF PERFORMANCE TESTS

UN /DOT TEST	CFR REFERENCE	TEST LEVEL	TEST CONTENTS	TEST COMPLETED	TEST RESULTS
Drop	178.603	1.4m	Water	January 8, 2010	PASS
Leakproofness	178.604	20 kPa – 5 Min.	Empty	January 8, 2010	PASS
Hydrostatic	178.605	250 kPa – 5 Min.	Water	January 19, 2010	PASS
Stacking	178.606	2,721.6 Kg/ 24 Hours	Water	January 11, 2010	PASS
Vibration	178.608	4.08 Hz – 1 Hr.	Water	January 7, 2010	PASS
TEST REPORT NUMBERS:			09-3253, 08-3228		

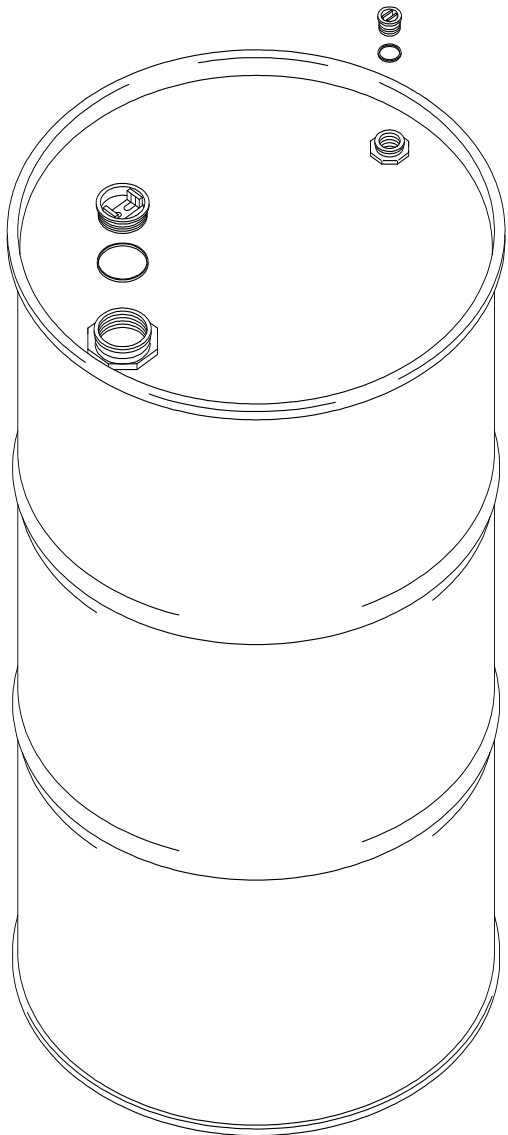
ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY THAT THE PACKAGING TESTED IS MERCHANTABLE OR FIT FOR A PARTICULAR PURPOSE, ARE DISCLAIMED. In no event shall TEN-E Packaging Services, Inc. liability exceed the total amount for services rendered



Larry Anderson
Manager, Technical Services
TEN-E Packaging Services, Inc.
1666 County Road 74
Newport, MN 55055

SECTIONS II & V: PACKAGING DESCRIPTION / COMPONENT DRAWINGS

55 Gallon Tight Head Reconditioned Drums (1.1 / 0.8 / 1.1 mm) with Steel Plugs

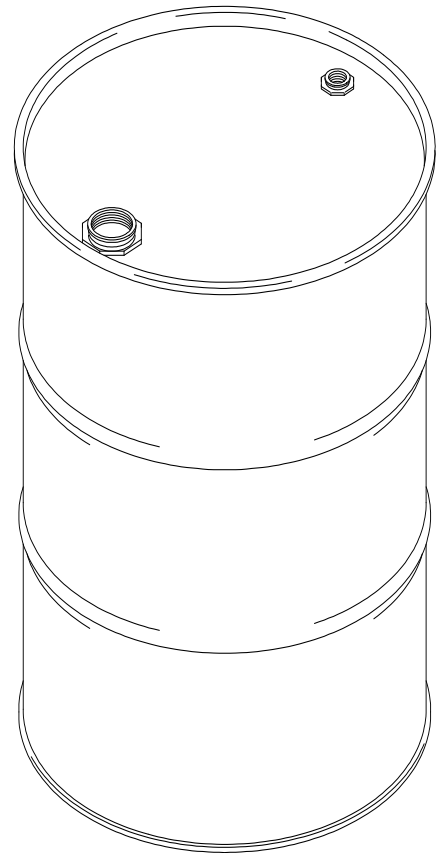
ASSEMBLY DRAWING	TEST LEVELS		
	Test Type:	UN Performance Verification	
	Packaging Code Designation:	1A1	
	Packing Group:	II	
	Specific Gravity:	1.4	
	Hydrostatic Pressure	150 kPa/ 250 kPa	
	TEST SAMPLE PREPARATION (Refer to Section IV)		
	Overall Packaging Tare Weight:	15.1 Kg	
	Fill Capacity (98% Maximum Capacity): Water	215.5 Kg	
	Package Test Weight: Water	230.6 Kg	(508.3 Lbs.)
	Authorized Package Gross Mass:	316.8 Kg	(698.4 Lbs.)
CLOSING METHODS			
2" NPT Threaded Plug:			
Application Torque	22 Ft-Lbs		
Equipment:	Torque Wrench #740		
3/4" NPT Threaded Plug:			
Application Torque	9 Ft-Lbs		
Equipment:	Torque Wrench #740		

COMPONENT INFORMATION

2" NPS PLUG		Drawing
Design:	2" NPS Threaded Plug	
Number/Location:	1 – Top Outer Radius	
Material:	Steel	
Tare Weight:	62.890 Grams	
Overall Dimensions:		
• Height	0.607"	
• Diameter	2.408"	
Finish Dimensions:		
• T	2.298"	
• E	2.219"	
Markings (QC Audit):	Proseal 10	
GASKET		
Description:	Polyethylene Gasket, Natural	
Tare Weight:	1.225 Grams	
Thickness:	0.115"	
Diameter:	2.348"	

3/4" NPS PLUG		Drawing
Design:	3/4" NPT Threaded Plug	
Number/Location:	1 – Top Outer Radius	
Material:	Steel	
Tare Weight:	19.102 Grams	
Overall Dimensions:		
• Height	0.543"	
• Diameter	1.105"	
Finish Dimensions:		
• T	1.009"	
• E	0.928"	
Markings (QC Audit):	Tite Seal	
GASKET		
Description:	Gray Polyethylene Gasket	
Tare Weight:	0.436 Grams	
Thickness:	0.106"	
Diameter:	1.125"	

TIGHT HEAD METAL				Drawing
Manufacturer: Various Manufactures. Markings on file with TEN-E				
Description:	55 Gallon Tight Head Metal Drum with (1) 2" and (1) 3/4" threaded opening in top head			
Material:	Steel			
	Top	Sidewall	Bottom	
	See the following page for wall thickness values			
• Thickness:	1.1 mm	0.8 mm	1.1 mm	
• Coating:	Black Painted Exterior			
• Lining:	None			
Tare Weight:	15.241 Kg (33.6 Lbs)			
Capacity:				
• Rated	55 Gallons			
• Overflow	219.9 Kg (58.10 Gallons)			
Drum Construction				
Top Chime:				
Type	Fabricated Round-Style Chime			
• Number of Plies (if box or round)	2			
Side Seam:	Welded			
Bottom Chime:				
• Type	Fabricated Round-Style Chime			
• Number of Plies (if box or round)	2			
Rolling Hoops:				
• Number	2			
Distance Between Hoops				
• Top and 1st Hoop Center	11-3/4"			
• 1st and 2nd Hoop	11-3/8"			
2" Opening Finish Dimensions:				
• T	2.331"			
• E	2.248"			
• Height	0.549"			
3/4" Opening Finish Dimensions:				
• T	1.038"			
• E	0.952"			
• Height	0.451"			
Drum Overall Dimensions				
Top Diameter	22.907"			
Bottom Diameter	22.867"			
Height	34-3/8"			
Markings (QC Audit):				
A variety of markings appeared on the randomly selected drums used for testing. The drum markings are on file with TEN-E Packaging Services, Inc.				



WALL THICKNESS PROFILE (Measured)

Below are the wall thickness values for the drums submitted for testing

Sample I.D.	Top Head		Drum Body		Bottom Head	
	Inches	mm	Inches	mm	Inches	mm
#1	0.044	1.118	0.036	0.914	0.043	1.092
#2	0.045	1.143	0.032	0.813	0.044	1.118
#3	0.043	1.092	0.031	0.7847	0.041	1.041
#4	0.043	1.092	0.032	0.813	0.041	1.041
#5	0.043	1.092	0.031	0.787	0.041	1.041
#6	0.045	1.143	0.033	0.838	0.043	1.092
#7	0.044	1.118	0.034	0.864	0.043	1.092
#8	0.045	1.143	0.034	0.864	0.042	1.067
#9	0.048	1.219	0.034	0.864	0.046	1.168
#10	0.048	1.219	0.032	0.813	0.045	1.143
#11	0.045	1.143	0.034	0.864	0.044	1.118
#12	0.044	1.118	0.032	0.813	0.043	1.092
#13	0.045	1.143	0.032	0.813	0.044	1.118
#14	0.045	1.143	0.032	0.813	0.042	1.067
#15	0.045	1.143	0.031	0.787	0.042	1.067
#16	0.043	1.092	0.033	0.838	0.043	1.092
#17	0.043	1.092	0.031	0.787	0.043	1.092
#18	0.043	1.092	0.033	0.838	0.043	1.092


NOTE: The markings for all of the above samples are on file with TEN-E Packaging Services, Inc.

SECTION III: TEST PROCEDURES AND RESULTS


DROP TESTS

TEST INFORMATION		CRITERIA FOR PASSING THE TEST
TEST CONTENTS:	Water	<ul style="list-style-type: none"> For packaging containing liquid, each packaging does not leak when equilibrium has been reached between the internal and external pressures. For removable head drums for solids, the entire contents are retained by an inner packaging (e.g., a plastic bag) even if the closure on the top head of the drum is no longer sift proof. 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:	Ambient	
DROP HEIGHT:	1.4 Meters (56.0") (Refer to Section IV)	
TEST EQUIPMENT:	Quick Release Hook Mechanism	

DIAGONAL TOP CHIME DROP TEST SET UP AND RESULTS

	Sample #	Results	Comments/Observation
	14	PASS	No leakage. Slight deformation at point of impact.
	4	PASS	No leakage. Slight deformation at point of impact.
	10	PASS	No leakage. Slight deformation at point of impact.


FLAT ON SIDE DROP TEST SET UP AND RESULTS

	Sample #	Results	Comments/Observation
	7	PASS	No leakage. Slight deformation at point of impact.
	6	PASS	No leakage. Slight deformation at point of impact.
	1	PASS	No leakage. Slight deformation at point of impact.

LEAKPROOFNESS TESTS

TEST INFORMATION		CRITERIA FOR PASSING THE TEST
TEST CONTENTS:	Empty	<ul style="list-style-type: none"> 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 Top Head	
TEST EQUIPMENT:	Regulated Air Source Pressure Monitoring Gauge	


LEAKPROOFNESS TEST SET-UP & RESULTS

	Sample #	Results	Comments/Observation
	8	PASS	All three samples maintained the 20 kPa test pressure for 5 minutes without leakage.
	9	PASS	
	13	PASS	

HYDROSTATIC PRESSURE TEST

TEST INFORMATION		CRITERIA FOR PASSING THE TEST
TEST CONTENTS:	Water	<ul style="list-style-type: none"> For each test sample, there is no leakage of liquid from the package. (§178.605)
FILL CAPACITY:	Maximum Capacity	
CLOSURE APPLICATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST PRESSURE:	150kPa (21.75 psi) followed by 250 kPa (36.25 psi)	
TEST DURATION:	5 Minutes each pressure	
AREA OF PRESSURIZATION:	Through the Top Head	
TEST EQUIPMENT:	Regulated Water Source DCT Digital Pressure Gauge	


HYDROSTATIC PRESSURE TEST SET-UP & RESULTS

	Sample #	150 kPa Results	250 kPa Results	Comments / Observations
	16	PASS	PASS	All three samples maintained the 150 Kpa and 250 kPa test pressures for 5 minutes at each pressure without leakage.
	17	PASS	PASS	
	18	PASS	PASS	

STACKING TESTS


TEST INFORMATION		CRITERIA FOR PASSING THE TEST
TEST CONTENTS:	Water	<ul style="list-style-type: none"> No test sample may leak. No test sample may show any deterioration that could adversely affect transport safety or any distortion liable to reduce the package's strength or cause instability in stacks of packages. (§178.606)
SAMPLE PREPARATION:	Refer to Section II	
CONDITIONING:	Ambient	
TEST LOAD APPLIED:	2,721.6 Kg (6,000.0 Lbs.) (Refer to Section IV)	
TEST DURATION:	24 Hours	
TEST EQUIPMENT:	Dead Load Weights/Guided Load Fixtures	

STACKING TEST SET-UP & RESULTS

	Sample #	Maximum Deflection After 24 Hours	Results
	2	0"	PASS
	5	0"	PASS
	11	0"	PASS
Stacking Stability:		Not conducted; required only for guided load tests.	

REPETITIVE SHOCK VIBRATION TESTS

TEST INFORMATION		CRITERIA FOR PASSING THE TEST
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. <ul style="list-style-type: none"> • A package 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 that is liable to reduce packaging strength. (\$178.608)
SAMPLE PREPARATION:	Refer to Section II	
CONDITIONING:	Ambient	
TABLE DISPLACEMENT:	1"	
TEST FREQUENCY:	4.083 Hz	
TEST DURATION:	1 Hour	
TEST EQUIPMENT:	Vertical motion using L.A.B. 6000 Transportation Simulator	

VIBRATION TEST SET-UP & RESULTS			
	Sample #	Results	Comments/Observation
	2	PASS	No leakage or damage.
	5	PASS	
11	PASS		

REGULATORY AND INDUSTRY STANDARD REFERENCES

REGULATORY REFERENCES

TEST	49 CFR ^① 2009 Edition	UN ^② 16th Edition	IMDG ^③ 2008 Edition	ICAO ^④ 09-10 Edition	IATA ^⑤ 51st Edition
Drop:	178.603	6.1.5.3	6.1.5.3	6; 4.3	6.3.3
Leakproofness:	178.604 178; Appendix B(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	5.0.2.7

- ① United States Department of Transportation Code of Federal Regulations (CFR) Title 49, Transportation, Parts 100-199
- 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 Goods by Air (ICAO)
- ⑤ International Air Transport Association (IATA) Dangerous Goods Regulations

INDUSTRY STANDARD REFERENCES

Drop:	ASTM ^⑥ D5276:	Standard Test Method for Drop Test of Loaded Containers by Free Fall
	ISO ^⑦ 2248:	Packaging – Complete, Filled Transport Packages – Vertical Impact Test By Dropping
Stacking:	ASTM ^⑥ D4577:	Standard Test Method for Compression Resistance of a Container Under Constant Load
	ISO ^⑦ 2234:	Packaging – Complete, Filled Transport Packages – Stacking Tests using Static Load
Vibration:	ASTM ^⑥ D999:	Standard Test Method for Vibration Testing of Shipping Containers
	ISO ^⑦ 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 Package Tare Weight (PTW):	15.1 Kg
Overflow Capacity (OFC):	
Water	219.9 Kg
Packing Group	II
Product Specific Gravity (PSG):	1.4
Packing Group Multiplication Factor (MF):	1.00
Nesting Height of one Package (NH):	35.25
Stack Test-# of Samples Tested Simultaneously:	3

98% OF OVERFLOW

Overflow Capacity (OFC) x 98%

$$\frac{\text{OFC}}{219.9} \times \frac{98\%}{98\%} = 215.5 \text{ Kg} \quad \text{Water}$$

PACKAGE TEST WEIGHTS

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

$$\frac{\text{PTW}}{15.1} + \frac{98\% \text{ OFC}}{215.5} = 230.6 \text{ Kg} \quad 508.3 \text{ Lbs. Water}$$

CALCULATED PACKAGE GROSS MASS (CPGM)

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

$$\frac{\text{PTW}}{15.1} + \frac{(\text{PSG})}{1.4} \times \frac{98\% \text{ OFC}}{215.5} = 316.8 \text{ Kg} \quad 698.4 \text{ Lbs.}$$

DROP HEIGHT				
Calculation For Product Specific Gravities Exceeding 1.2				
Product Specific Gravity (PSG) x Packing Group Multiplication Factor (MF)				
<u>PSG</u>	x	<u>MF</u>	Packing Group: II	
1.4	x	1.00	<u>Required Drop Height</u>	<u>Actual Drop Height</u>
		1.40 Meter	55.1 Inches	56 Inches

STACK TEST MINIMUM LOAD CALCULATIONS				
Number of Packages in a 3m High Stack (118 / Nesting Height (NH) -1)				
118 / Nesting Height of one Pkg (NH) - 1				
<u>(118</u>	/	<u>NH)</u>	-1	= <u># 3m HS</u>
118	/	35.25	-1	= 2.3
Stack Test Load Calculation (Individual Package)				
Calculated Pkg Gross Mass (CPGM) x # of Pkg in a 3m High Stack (# 3m HS)				
<u>CPGM</u>	x	<u># 3m HS</u>		
316.8	x	2.3		
		728.6 Kg	1,606.3 Lbs.	

Stack Test Load Calculation				
Samples x Calculated Pkg Gross Mass (CPGM) x # of Pkg in a 3m High Stack (# 3m HS)				
<u>Samples</u>	x	<u>(CPGM</u>	x	<u># 3m HS)</u>
3	x	316.8	x	2.3
		2,185.9 Kg	4,819.0 Lbs.	