Information To Build On
Engineering • Consulting • Testing

DEPARTMENT OF TRANSPORTATION
PERFORMANCE ORIENTED PACKAGE TESTING
CERTIFICATION

Performed by:

Professional Service Industries, Inc. (PSI)
850 Poplar Street
Pittsburgh, PA 15220
412-922-4000

Testing Performed for:

Pretium Packaging
One Devco Drive
Manchester, PA 17345
717-266-6687 x 7220

Design Qualification Testing of a
UN 4G Fiberboard Box
With (6) One-Liter HDPE Bottles

un

4G/Y13.9/S/**
USA/+BE0729

** Is to be replaced by the year of manufacture

This package is certified for shipment by air.

HMD-64101
CF 05/07/2020

Information To Build On
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REPORT TO:	Pretium Packaging One Devco Drive Manchester, PA 17345	**PROJECT:**	Design Qualification Testing
ATTENTION:	Ms. Linda Becker	**PSI PROJECT NO.:**	0823584-4
DATE:	April 28, 2016	**PSI LAB NO.:**	SPT-60056

Professional Service Industries, Inc. (PSI) is a current DOT UN Third-Party Certification Agency under 49 CFR § 107.403. PSI has performed testing on the referenced project. The results of our tests are presented in the accompanying report.

Our services for this project were performed in accordance with PSI Proposal No. 823-6086-171064 dated February 2, 2016. The proposal included a proposed scope of services, estimated costs, unit rates, and PSI's General Conditions. Authorization to perform this project was in the form of signed acceptance of the aforementioned proposal dated February 3, 2016.

The results contained in this report are related only to the item(s) tested. The pages of this report (including attachments) shall not be reproduced, except in full, without written approval of PSI. All testing was conducted by and under the continuous, direct supervision of Professional Service Industries, Inc.

Please contact us should you have any questions concerning this report.

Respectfully submitted,
Professional Service Industries, Inc.

Denis J. Columbare
Lab Technician, Special Test

Daniel E. John
Manager, Electrical/Special Test

Professional Service Industries, Inc. • 850 Poplar Street • Pittsburgh, PA 15220 • Phone 412-922-4000 • Fax 412-922-4043

SCOPE OF SERVICES

On April 13, 2016, twelve (12) samples of one (1) type of combination packaging were submitted to Professional Service Industries, Inc. (PSI) for Design Qualification Testing. Testing was conducted between April 20, 2016 and April 27, 2016 in general accordance with the performance requirements of the Department of Transportation's Title 49 CFR, Part 178, Subparts L & M, and Part 173.27 and IATA Dangerous Goods Regulations, Section 6.

Paper or fiberboard packagings are conditioned for at least twenty-four (24) hours immediately prior to testing in an atmosphere maintained at 50 ± 2% relative humidity, and at a temperature of 23 ± 2 °C (73 ± 4 °F).

While this packaging was not tested with secondary closures, this packaging is certified for shipment by air when prepared in accordance with the applicable regulations. It is the responsibility of the end user to ensure compliance with the specific requirements of any applicable regulations. 49 CFR 173.27 requires that secondary closures be applied to the inner bottles for shipment by air.

Description of Packaging

The tested packaging was a combination packaging with a singlewall fiberboard outer box containing (6) one-liter HDPE bottles with black polypropylene caps separated by a "Z" style singlewall fiberboard divider (three (3) bottles on each side of divider).

Net weight of package (less fluids): 876.0 grams (1.93 lbs.)

Function of Package

What is the media enclosed = Various PG II liquid media

Where is the packaged being shipped = Foreign and Domestic

Applied variation(s) per 49 CFR (if any) = None Specified

How is the package being shipped (ground, air, etc.) = Ground and Air

Assembly Instructions for the Packages as Tested

(See Appendix A for Photos)

Step #	Description
1	Obtain one (1) outer box (Part #RSH 4922, bottom closed by the manufacturer).
2	Obtain one (1) partition (Part #DIV0230) and fold it on the creases provided, forming a "Z" shape.
3	Place the partition into the box with flaps pointed toward opposite side corners of box.
4	Fill the (6) HDPE one-liter bottles (1 L BULLET ROUND WITH FOOTED BASE) with liquid to be shipped and then torque all caps (38-439 A STOCK ACID CLOSURE) to 35 in·lbs.
5	Place filled bottles in box, (3) on each side of the partition, in upright orientation.
6	Fold the smaller inner top flaps of the outer box in, followed by the larger outer flaps. Close with one (1) piece of 1.88" wide clear tape (Tufflex Xpedx), with the tape centered on the seam where the outer flaps meet, with approximately 2" of overlap on each side of the box.

Section 2 - Package Description:
UN 4G Fiberboard Box with (6) One-Liter HDPE Bottles

Fiberboard Box: (See Appendix B for drawings)

Manufacturer:	York Container (York, PA)
Box Style:	Singlewall Fiberboard -RSC- International Box Code: 0203 Mullen Burst ✓ ECT ____
Part Number:	RSH 4922
Boxmaker's Certification:	MB 275
Outer dimensions cm (in):	26.0 L (10.25) x 17.8 W (7.0) x 28.9 H (11.38)
Inner Dimensions cm (in):	25.2 L (9.91) x 16.9 W (6.66) x 28.0 H (11.04)
Manufacturer's Joint:	1½" Glued, internal overlap
Tare Weight:	380.12 g (0.838 lbs.)
Inner/Outer Flap Spacing:	Meets

Fiberboard Partition: (1) Per Package (See Appendix B for drawing)

Manufacturer:	York Container (York, PA)
Part Number:	DIV 0230
Partition Style:	Singlewall Fiberboard "Z" Fold
Dimensions (unfolded) cm (in):	42.5 L (16.75) x 27.6 W (10.88) x 0.35 T (0.136)
Tare Weight:	49.70 g (0.110 lbs.)

Basis Weights of Box and Partition:

Item	Facing or Corrugation	Location	Basis Weight
Box	Facing	Inner	72.8
	Facing	Outer	73.9
	Corrugation	C-Flute	24.5
Partition	Facing	Inner	28.0
	Facing	Outer	26.7
	Corrugation	C-Flute	22.5

Combined Board Caliper

Box:	4.3 mm (0.169")	4.3 mm (0.169")	4.3 mm (0.169")
Partition:	3.5 mm (0.136")	3.5 mm (0.136")	3.5 mm (0.136")

Combined Board Weight

Box:	181.8 lbs./1000 ft^2
Partition:	86.9 lbs./1000 ft^2

Inner Bottles: (6) Per Package (See Appendix B for drawing)

Manufacturer:	Pretium Packaging (Manchester, PA)	
Part Number:	1 L BULLET ROUND WITH FOOTED BASE	
Manufacturing method:	Blow Molded	
Material:	HDPE	
Capacity	Nominal:	1.12 liters
	Maximum (avg.):	1.14 liters
Dimensions:	Width/Dia. (min)(spout):	3.76 cm (1.48")
	Width/Dia. (max):	8.26 cm (3.25")
	Height (min) (to bottleneck):	23.3 cm (9.19")
	Height (max):	26.8 cm (10.54")
Min thickness:	Bottom:	1.78 mm (0.070")
	Sides:	0.97 mm (0.038")
Average Thickness:	Bottom:	1.78 mm (0.070")
	Sides:	0.97 mm (0.038")
Tare Weight (avg.)	62.59 g (0.138 lbs.)	

Closures: (6) Per Package (See Appendix B for drawing)

Manufacturer:	Berry Plastics (Evansville, IN)	
Part Number:	38-439 A STOCK ACID CLOSURE	
Manufacturing Method:	Injection Molded	
Material:	Polypropylene	
Closure Weight:	10.31 g (0.023 lbs.)	
Thread description:	Full buttress, 4 TPI	
Dimensions:	Diameter:	4.3 cm (1.70")
	Height:	2.6 cm (1.02")
	Thickness (min):	3.0 mm (0.119")
Lining – Glued in:	Material:	Polystyrene Foam
	Diameter:	3.5 cm (1.38")
	Thickness:	1.32 mm (0.052")
	Weight:	0.64 g (0.001 lbs.)

Closing Methods:

Sealing Method for the fiberboard box:	Top flaps were closed by the manufacturer using Tufflex Xpedx 1.88" wide tape. The bottom flaps are sealed across the center seam where the flaps meet with Tufflex Xpedx 1.88" wide clear packaging tape (Camp Hill, PA) with approximately 2" of overlap on both sides of the package
Closing torque of caps for all testing:	35 in-lbs
Tape and Tape Applicator Manufacturer and Style:	Tufflex Xpedx 1.88" wide clear packaging tape (Camp Hill, PA). The bottom flaps were taped with a 3M Matic 800 adjustable case sealer by the manufacturer and the top flaps were taped with a Staples model 10388-cc tape gun.

Additional Test Information

Overall Tare Weight of Package:	0.876 kg (1.93 lbs.)
Test Contents:	Water and RV antifreeze
Specific gravity:	1.0
Minimum Weight of Package as Tested:	7.60 kg (16.76 lbs.)
Authorized Package Gross Weight based on SG 1.95:	13.9 kg (30.64 lbs.)

Section 3 – TESTING

Test Descriptions and Results

Package Preparation – For All Testing

The packages were filled to a minimum of 98% of capacity (see Appendix C for calculation). The inner bottles were inserted as shown in Appendix A.

Drop Test

Test Method: 49 CFR 178.603

Number of Packages Tested – 5

Drop Height – 1.95 meters (Calculation for the drop height is provided in Appendix C)

Testing was conducted to certify the package for PG II liquids with a specific gravity of up to 1.95.

(See Appendix D for photos of the packages after testing).

Conditioning

The packages were conditioned to –18 °C in accordance with 49 CFR 178.603(c). The packages were conditioned for a minimum of 24 hours to ensure the package and contents were at the proper temperature prior to testing. Drop testing was conducted immediately after removing the test package from the conditioning chamber.

RESULTS

Package Number	Package Weight	Orientation	Result
1	7.60 kg	Flat on Bottom	Pass, no damage or leakage observed
2	7.60 kg	Flat on Top	Pass, no damage or leakage observed
3	7.60 kg	Flat on Long Side (dropped on manufacturer's joint)	Pass, no damage or leakage observed
4	7.60 kg	Flat on Short Side (dropped on manufacturer's joint)	Pass, no damage or leakage observed
5	7.60 kg	Top Corner (dropped on manufacturer's joint)	Pass, crushed exterior corner at point of impact, no interior damage or leakage observed

Pass/Fail Criteria

A package is considered to successfully pass the drop tests if for each sample tested: There is no damage to the outer packaging likely to adversely affect safety during transport, there is no leakage of the filling substance from the inner packaging and any discharge from a closure is slight and ceases immediately after impact.

Stacking Test

Test Method: 49 CFR 178.606
Free standing: ✓
Guided Load: —
Packages Tested: 3
Test Duration: 24 hours

The packages were conditioned in accordance with 49 CFR 178.602(d) to 50 ± 2% RH at 23 ± 2 °C for 24 hours.

Stacking Test Weight: 139.8 kg

(See Appendix C for Calculation)
(See Appendix E for photos of the packages after testing)

The stacking test load was applied to the top of the packages by loading each package with 140.6 kg and the load was maintained for 24 hours.

RESULTS:

Package 6	Pass, no damage, no leakage observed
Package 7	Pass, no damage, no leakage observed
Package 8	Pass, no damage, no leakage observed

Note: Stacking stability was not assessed since a guided load test was not performed.

Pass/Fail Criteria

No test sample may leak. There must be no leakage of the filling substance from the inner receptacle, or inner packaging. No test sample may show any deterioration which could adversely affect transportation safety or any distortion likely to reduce its strength, cause instability in stacks of packages, or cause damage to inner packagings likely to reduce safety in transportation.

Vibration Standard

Packages Tested: 3 (tested concurrently)
Test Method: 49 CFR 178.608/ASTM D999-08
Table Motion: Rotary
Duration: 1 Hour
Frequency: 316 rpm

RESULTS

Package 9	Pass, no damage or leakage observed
Package 10	Pass, no damage or leakage observed
Package 11	Pass, no damage or leakage observed

(See Appendix F for photos of the packages after testing)

Pass/Fail Criteria

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.

Cobb Test

Test Method: ISO International Standard 535 as required by 49 CFR 178.516(b)(1).

Samples were taken from the boxes and subjected to a water absorption test in accordance with ISO International Standard 535.

Samples tested: 5

RESULTS

Sample Number	Water Absorption	Pass/Fail
1	118.0 g/m^2	Pass
2	122.0 g/m^2	Pass
3	120.0 g/m^2	Pass
4	119.0 g/m^2	Pass
5	121.0 g/m^2	Pass
Average	**120.0 g/m^2**	**Pass**

Pass/Fail Criteria

An increase in mass of greater than 155 g/m² over the 30 minute duration of the test represents an unacceptable level of water absorption.

Hydrostatic Pressure Test

Test method:	49 CFR 178.605/ASTM D7660-10
Number of containers tested:	3
Test pressure:	100 kPa (15 psi)

(See Appendix G for photos of the bottles after testing)

RESULTS

Sample Number	Pass/Fail
1	Pass, no leakage observed
2	Pass, no leakage observed
3	Pass, no leakage observed

Pass/Fail Criteria

There may be no leakage of liquid from any container after a 30 minute test period for plastic or composite containers or a 5 minute test period for other materials.

Section 4 – CALCULATIONS

See Appendix C for Calculations.

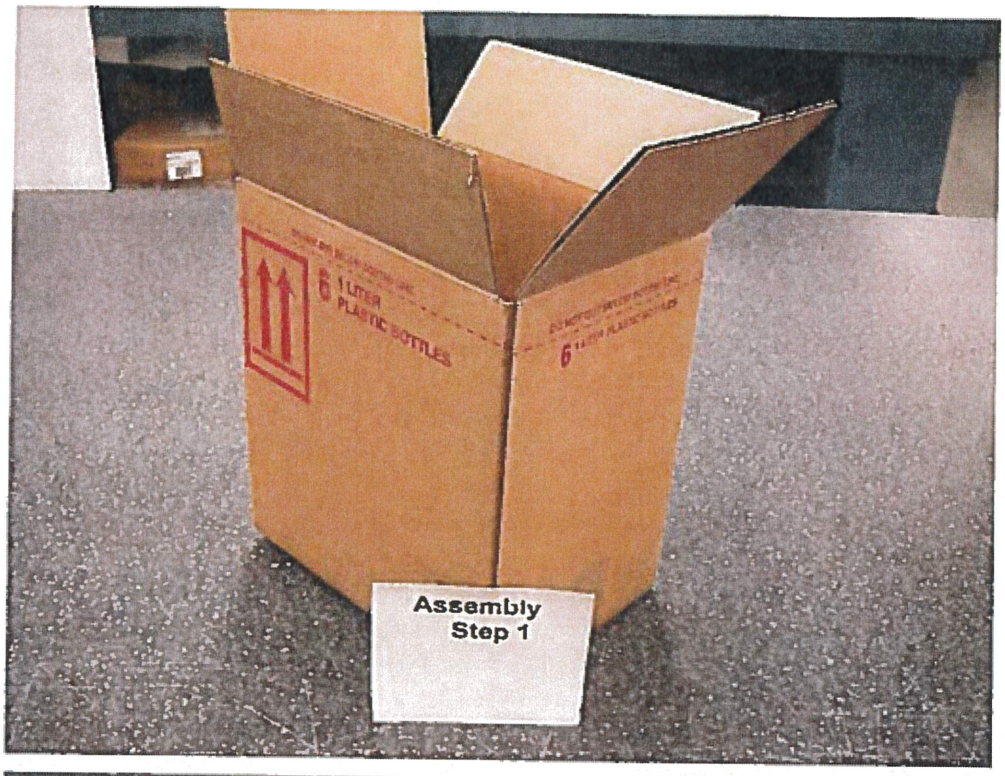
Section 5 – DRAWINGS

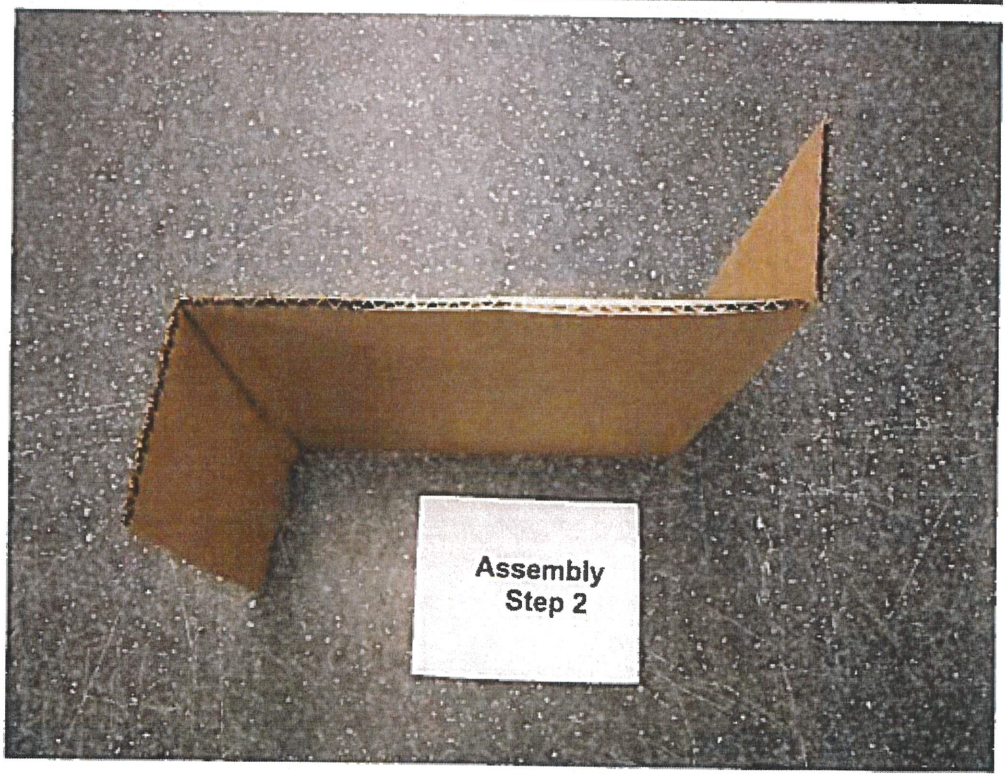
See Appendix B for drawings of the packaging components.

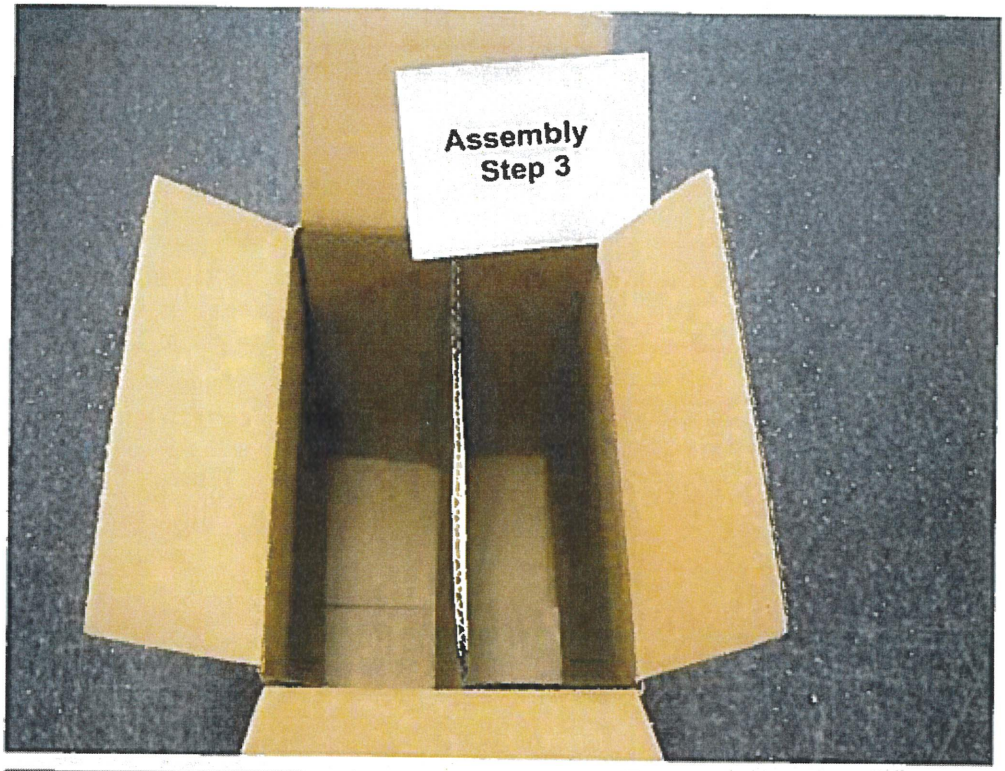
APPENDIX A

PHOTOGRAPHS OF ASSEMBLY

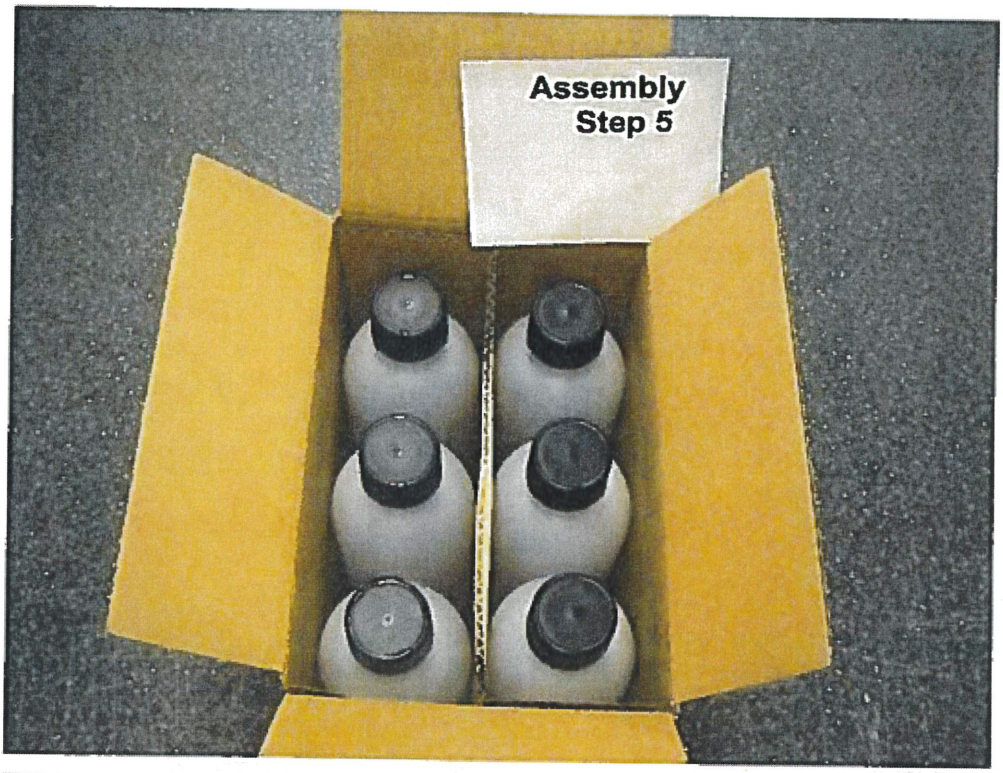
(3 PAGES)

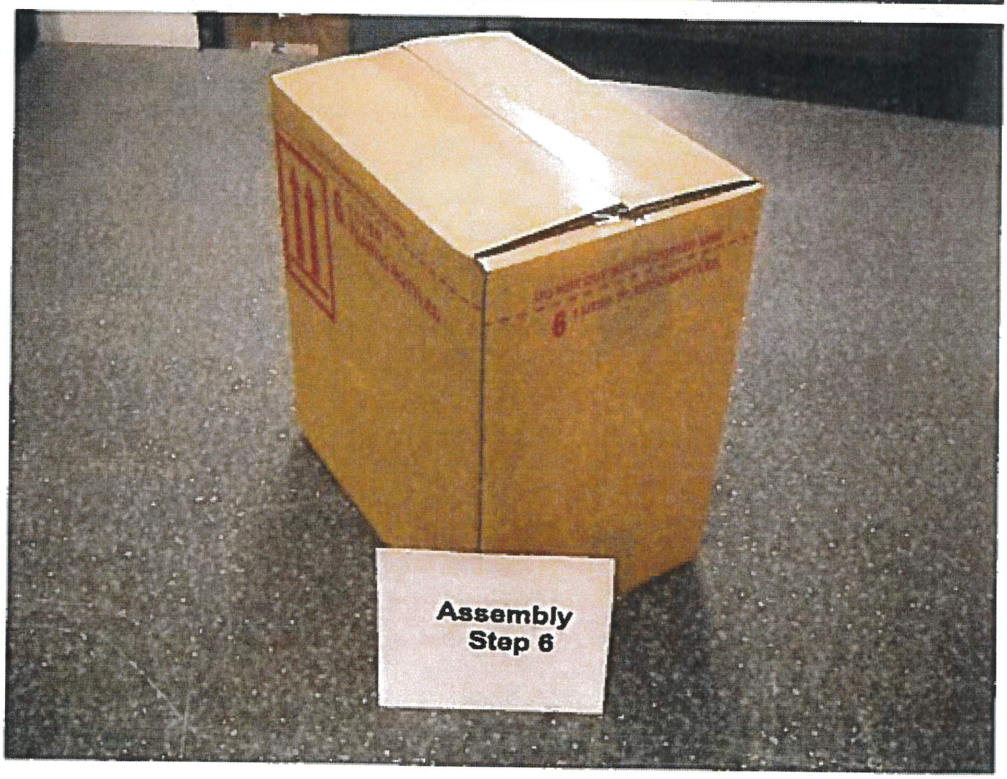

6 1 LITER
PLASTIC BOTTLES
Assembly
Step 1


Assembly
Step 2


Assembly
Step 3


Assembly
Step 4

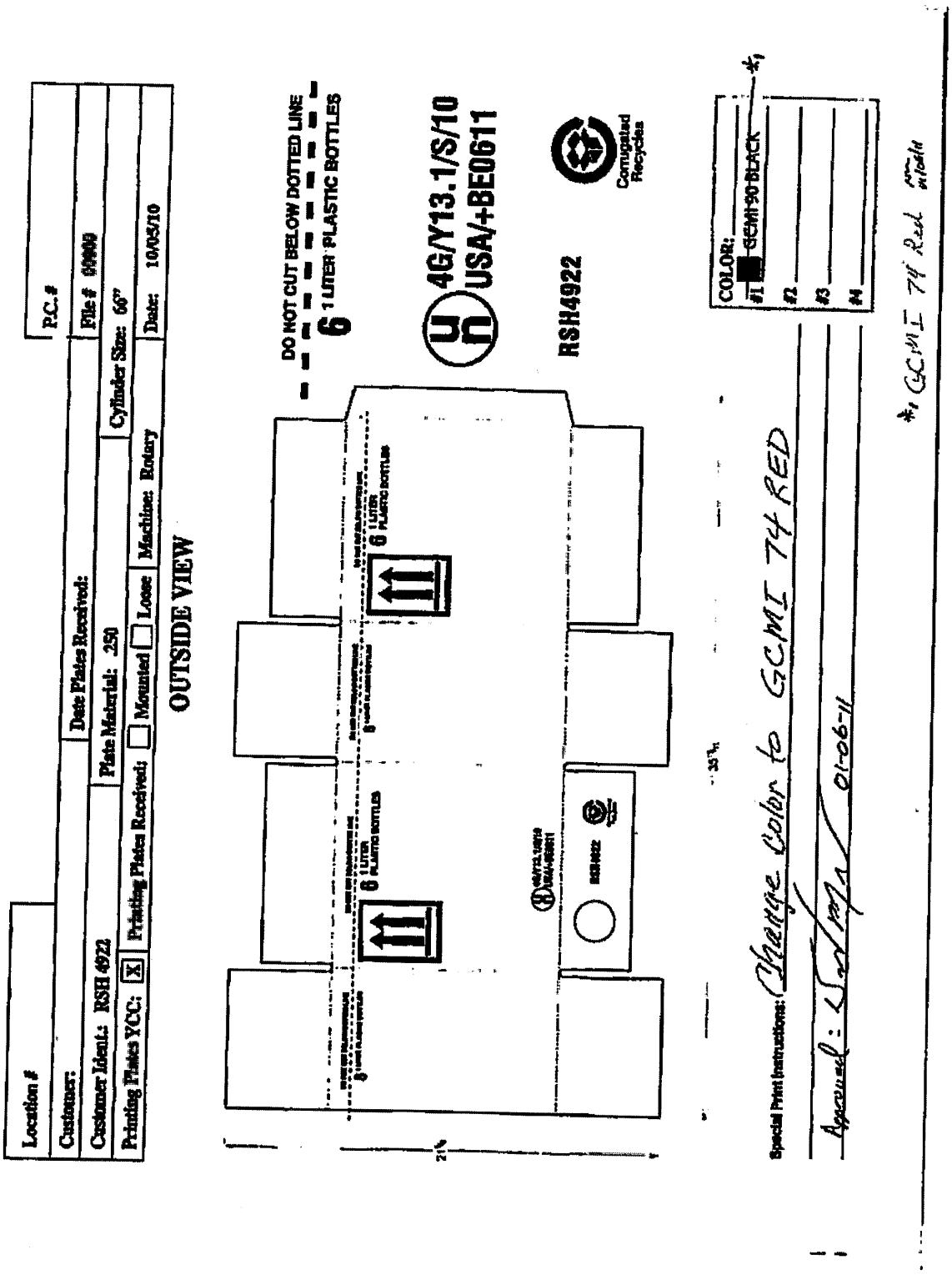

Assembly
Step 5

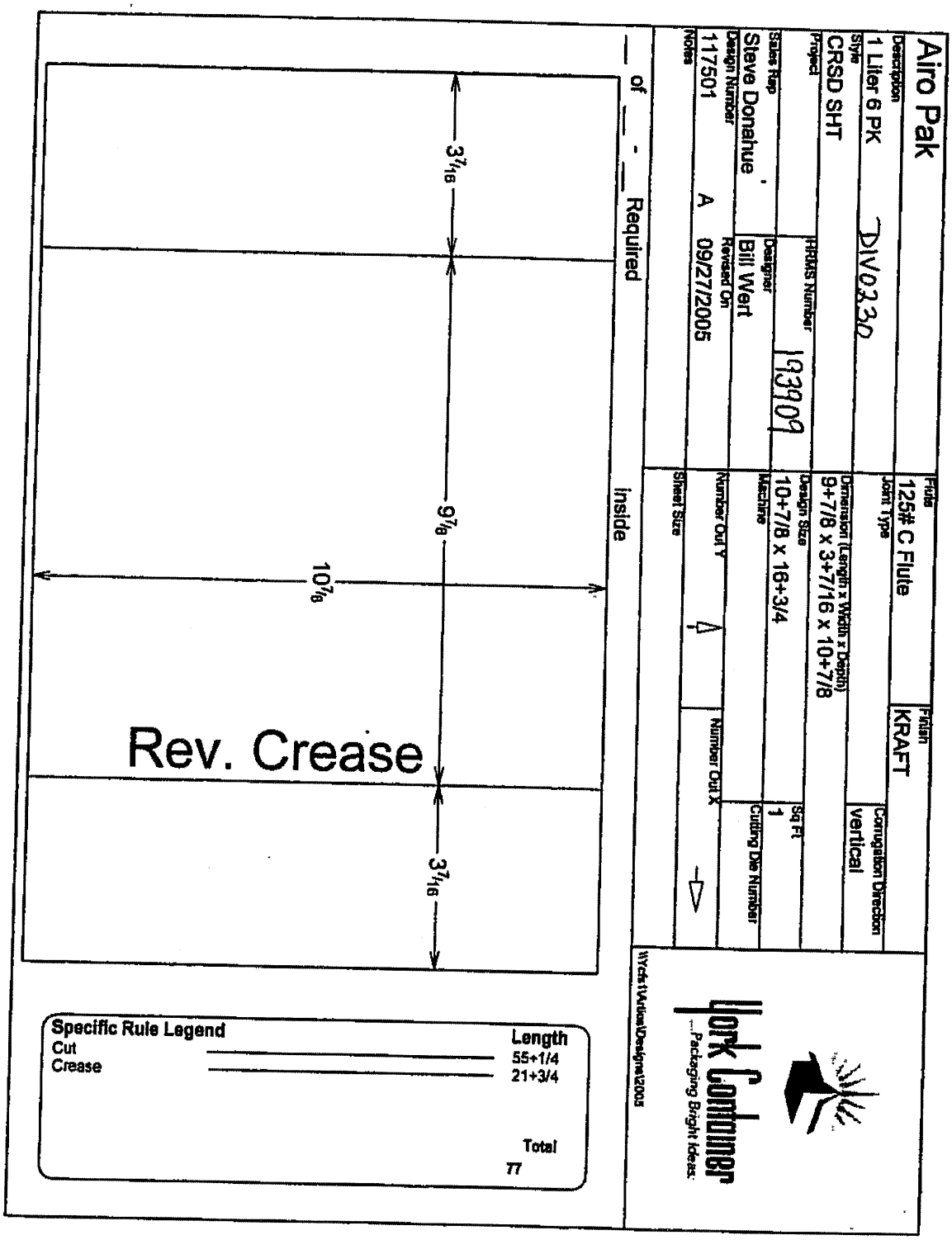

Assembly
Step 6

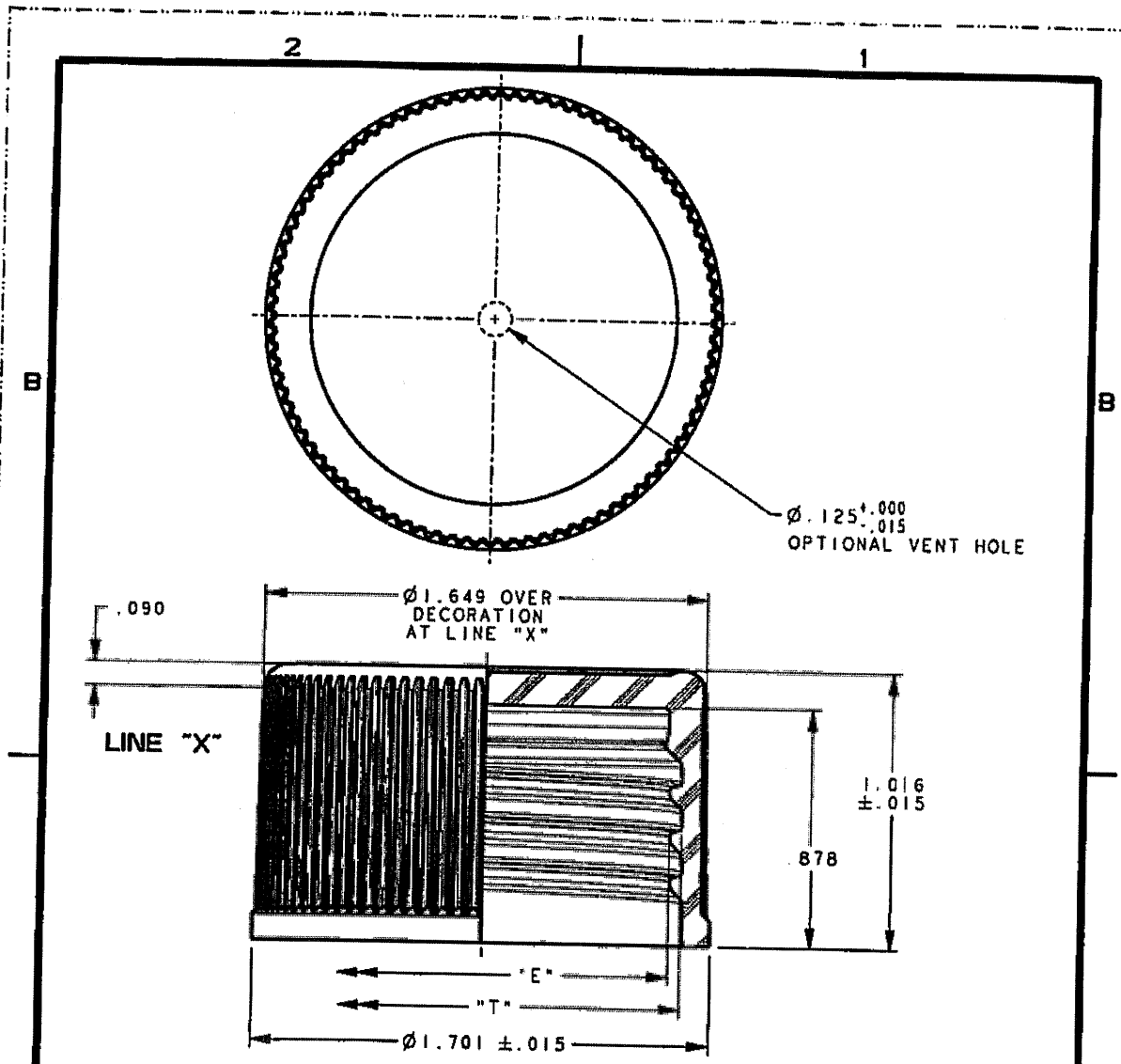
APPENDIX B

DRAWINGS OF PACKAGING COMPONENTS

(5 PAGES)


Location #
Customer:
Customer Ident.: RSH 4922
Printing Plates YCC: X
Printing Plates Received: Mounted Loose
Machine: Rotary
P.C.#
Date Plates Received:
Plate Material: .250
File # 00000
Cylinder Size: 66"
Date: 10/05/10
OUTSIDE VIEW
DO NOT CUT BELOW DOTTED LINE
6 1 LITER PLASTIC BOTTLES
4G/Y13.1/S/10
USA/+BE0611
RSH4922
Corrugated Recycles
COLOR:
#1 GCMI 90 BLACK
#2
#3
#4
Special Print Instructions: Change Color to GCMI 74 RED
Approved: 01-06-11
#1 GCMI 74 Red


Airo Pak
Description
1 Liter 6 PK
DV0230
Style
CRSD SHT
Project
HRMS Number
193909
Sales Rep
Steve Donahue
Designer
Bill Wert
Design Number
117501
Revised On
A
09/27/2005
Notes
Flute
125# C Flute
Joint Type
Dimension (Length x Width x Depth)
9+7/8 x 3+7/16 x 10+7/8
Design Size
10+7/8 x 16+3/4
Machine
Sheet Size
Number Out Y
Number Out X
Finish
KRAFT
Corrugation Direction
vertical
Sq Ft
1
Cutting Die Number
of
Required
inside
3 7/16
9 7/8
10 7/8
3 7/16
Rev. Crease
Specific Rule Legend
Cut
Crease
Length
55+1/4
21+3/4
Total
77
York Container
Packaging Bright Ideas
W:\cts1\Artios\Designs\2005



UNSCREWING LUG IMPRESSIONS TO APPEAR IN BOTTOM SKIRT OF THE CLOSURE

"REFERENCE PRODUCT CENTER FOR CURRENT DRAWING"

DIMENSIONS ARE REPRESENTATIVE ONLY. FINAL SIZES TO BE DETERMINED AFTER PART IS MANUFACTURED.

(F8) = FUNCTIONAL DIMENSION

BERRY PLASTICS CORPORATION AND SUBSIDIARIES
LEADERSHIP BY DESIGN

MATERIAL	POLYPRO	TOLERANCES UNLESS SPECIFIED	DEC. ±.010 DEGREES ±1°
GRAM WEIGHT	10.3 REF ONLY	C18	
Mold No.	PROD. MJ-410-1A	SAMPLE	
SCALE	2:1	DRAWN	E. F. HAFFNER
DATE	9/25/2000	CHECKED	

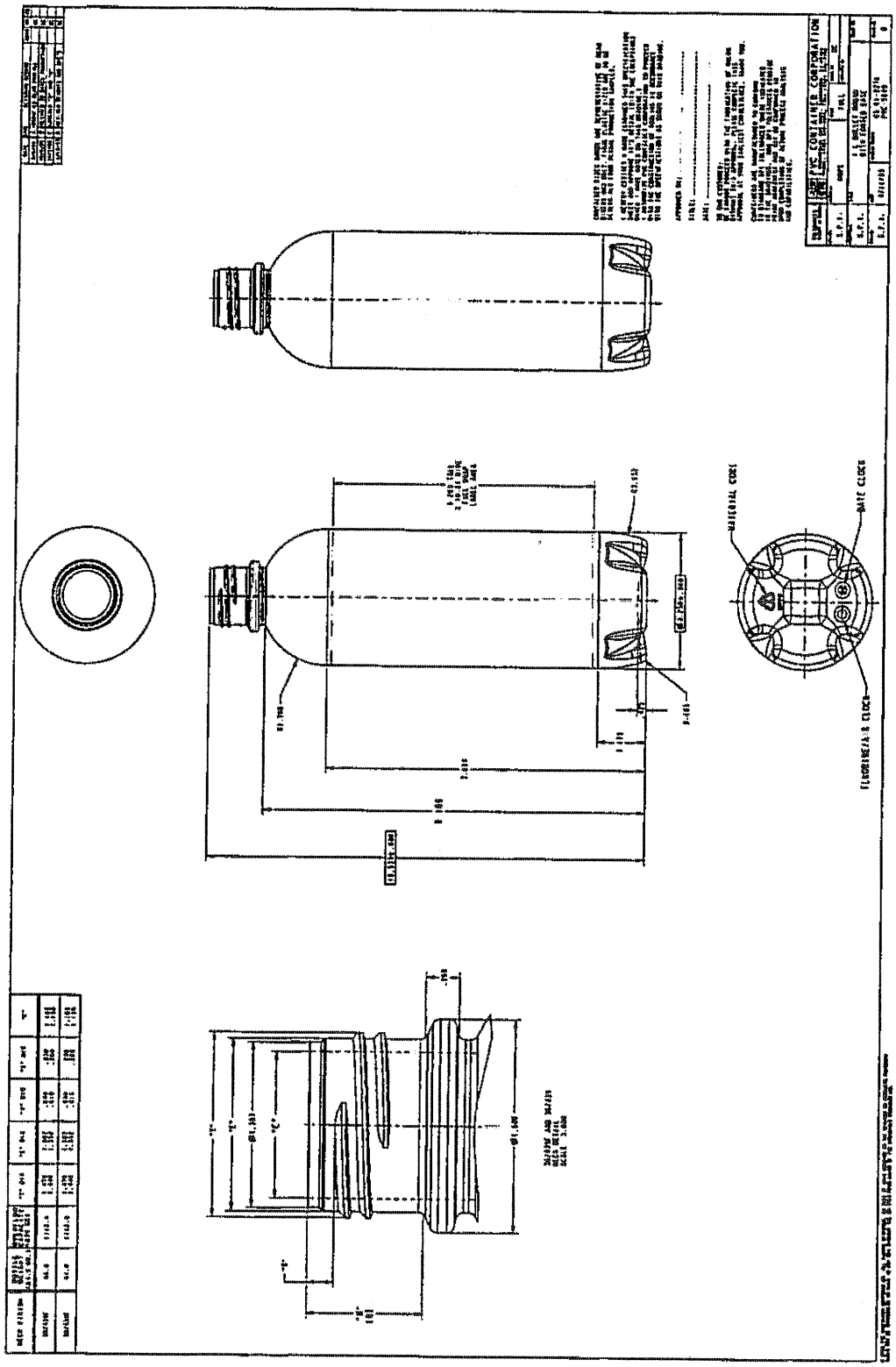
LINE "C" IS .367 DOWN FROM INSIDE TOP.		
"T" at "C"	1.481	±.007
"E" at "C"	1.389	±.007

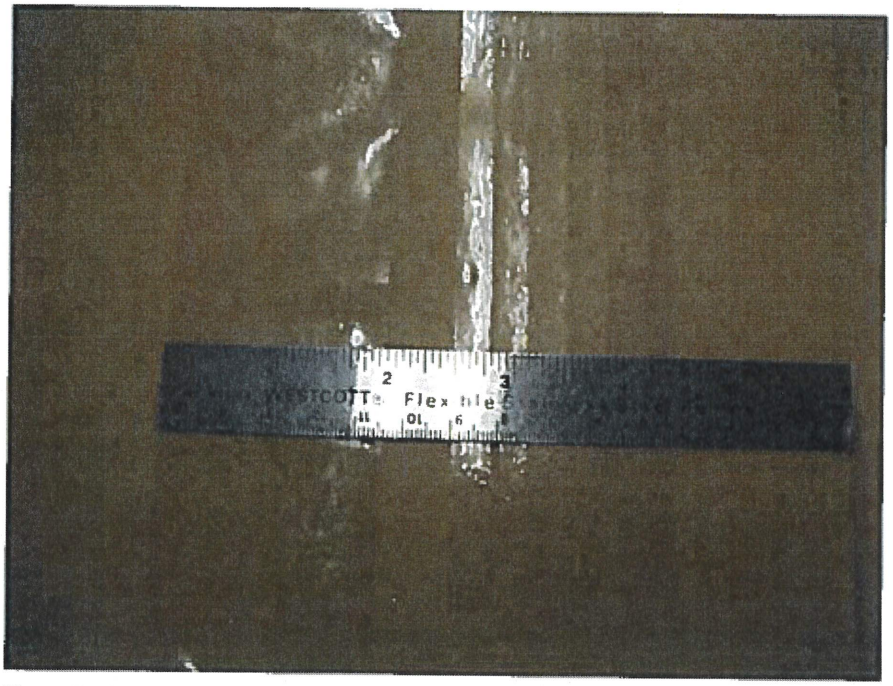
TITLE CUSTOMER DRAWING
38-439 A STOCK
ACID CLOSURE

FOR STOCK

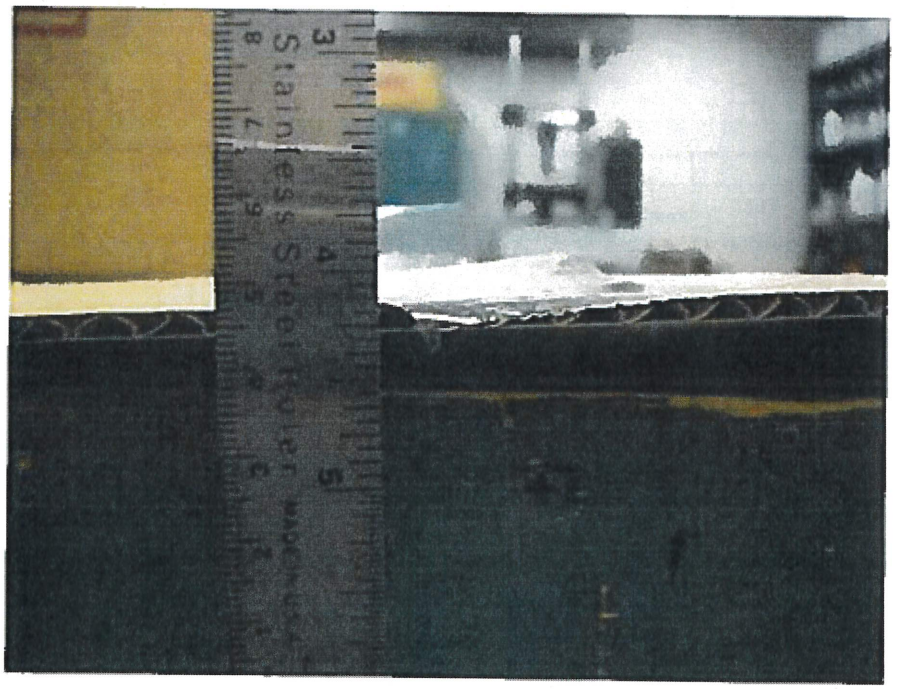
DRAWING NUMBER QIM-317-4937 REVISION A

MODEL NAME: im-317-4937 DIRECTORY: stock/prod





Tape, front and back



Tape, side

APPENDIX C

CALCULATIONS

(1 PAGE)

1. **Weight of test package**

Weight of Box	0.380 kg
Weight of Partition	0.050 kg
Weight of Bottles (6 x 0.0626)	0.376 kg
Weight of Caps w/Liners (6 x 10.95 g)	0.066 kg
Capacity of Bottle	1.14 liters
Weight of tape (2 pcs.)	0.002 kg

Empty Package Weight

Box + Partition + Tape	0.432 kg
Empty Bottles + Caps w/Liners	0.442 kg
Total	0.874 kg

Filled Package Weight

Weight of liquid fill (SG 1.0): 0.98 X 1.14 = 1.12 kg

Weight of Filled Package

0.432 + 0.442 + 6(1.12) = 7.60 kg

2. **Drop Test Height**

Specific Gravity of Certification = 1.95

Packaging Group of Certification = PG II

For PG II SG x 1.0 meters

1.95 x 1.0 meters = 1.95 meters

3. **Marked Weight to Accommodate SG 1.95**

Weight of Fill 6(1.12 kg) x 1.95 =	13.10 kg
Weight of Box + Partition + Tape	0.432 kg
Weight of Bottles + Caps w/Liners	0.442 kg
Marked Weight (rounded down):	13.9 kg

4. **Stack Test Weight**

Load = (n-1)[W+Q(L x S)]

Where:

N = number of containers to reach 3 meters

W= Tare weight of all packaging material

Q= Quantity of Inner Packages

L = Weight of Liquid Fill

S = Maximum Specific Gravity

Package Height = 28.9 cm

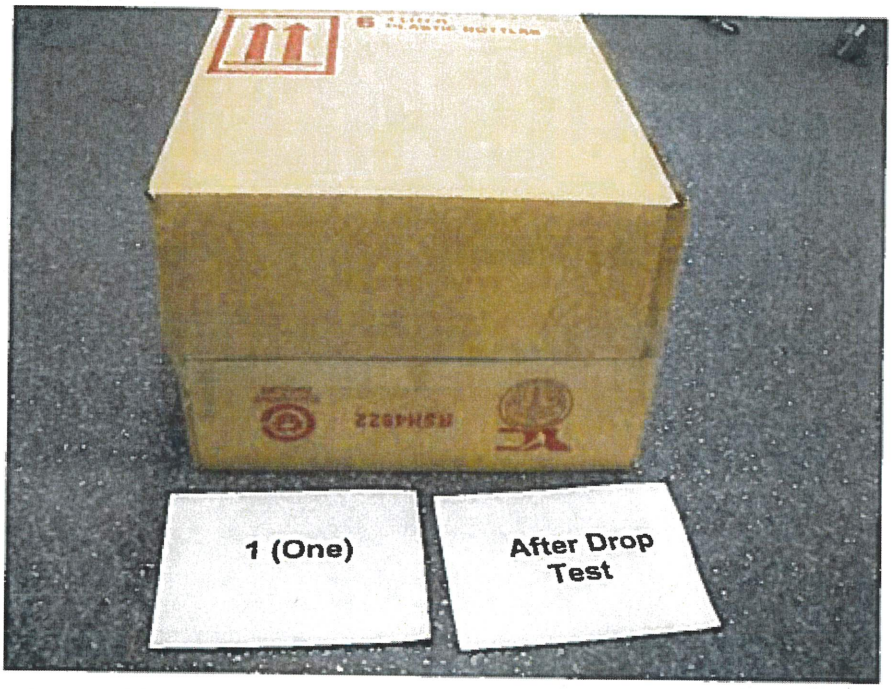
3 meters/0.289 meters = 10.38

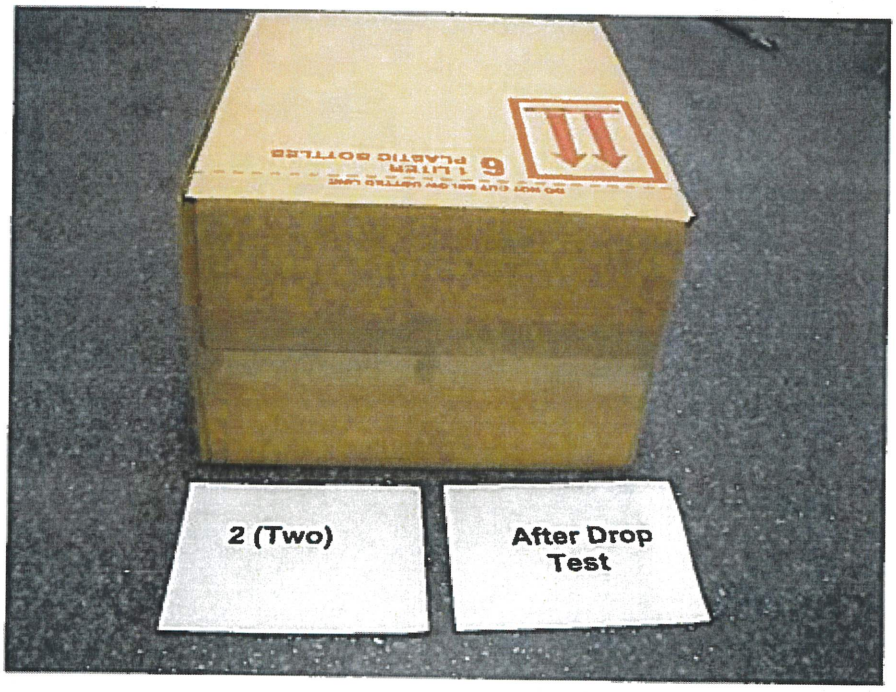
(11-1)[0.874 + 6(1.12 x 1.95)] = 139.8 kg

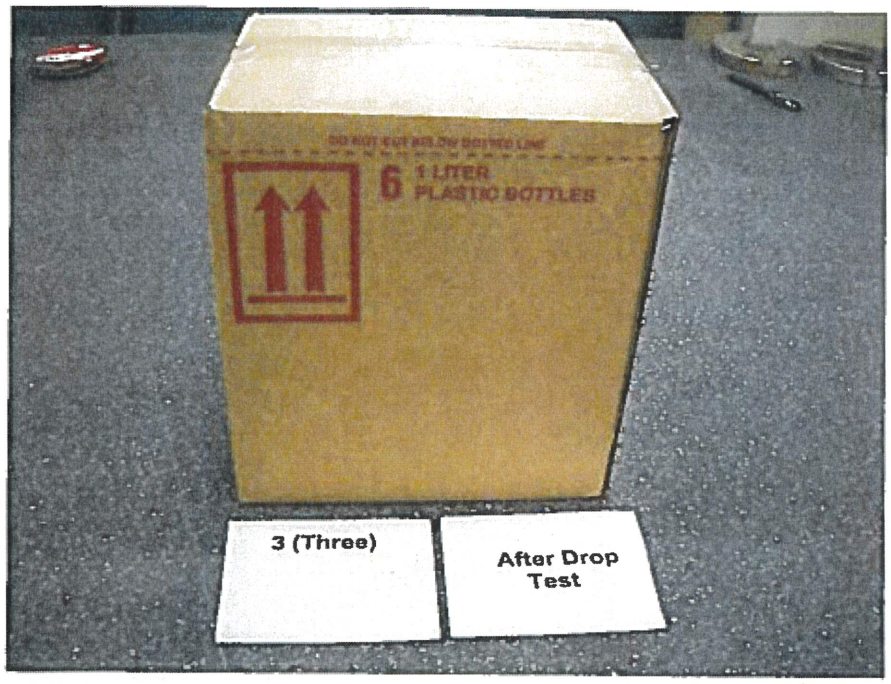
APPENDIX D

PHOTOGRAPHS OF THE PACKAGES AFTER DROP TEST (PACKAGES 1-5)

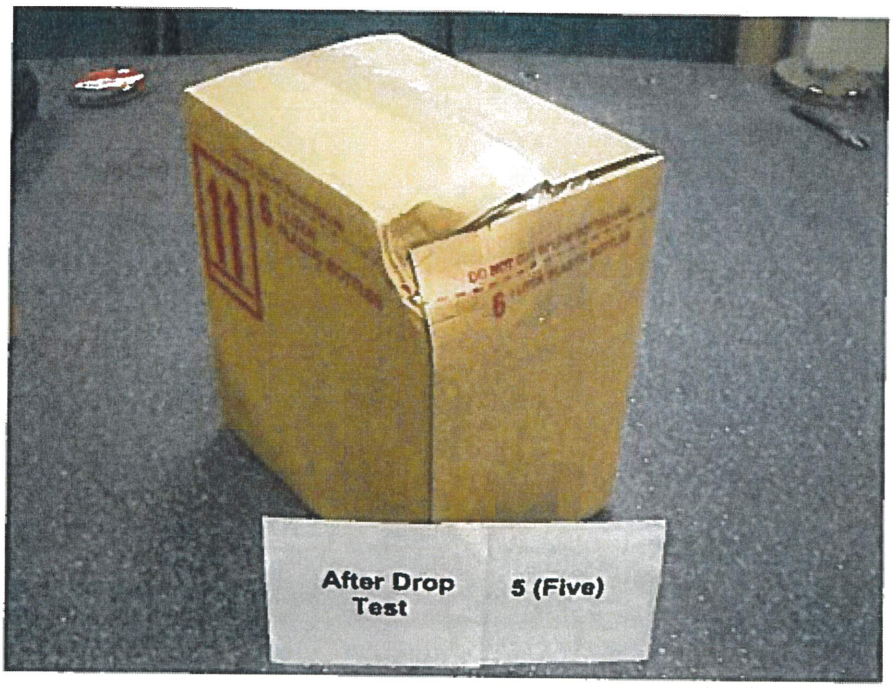
(3 PAGES)


1 (One)
After Drop Test


2 (Two)
After Drop Test


6 1 LITER PLASTIC BOTTLES
3 (Three)
After Drop Test


4 (Four)
After Drop Test


After Drop Test
5 (Five)

APPENDIX E

PHOTOGRAPHS OF THE PACKAGES AFTER STACK TEST (PACKAGES 6-8)

(1 PAGE)


6 (Six)
7 (Seven)
After Stack Test
8 (Eight)

APPENDIX F

PHOTOGRAPHS OF THE PACKAGES AFTER VIBRATION TEST (PACKAGES 9-11)

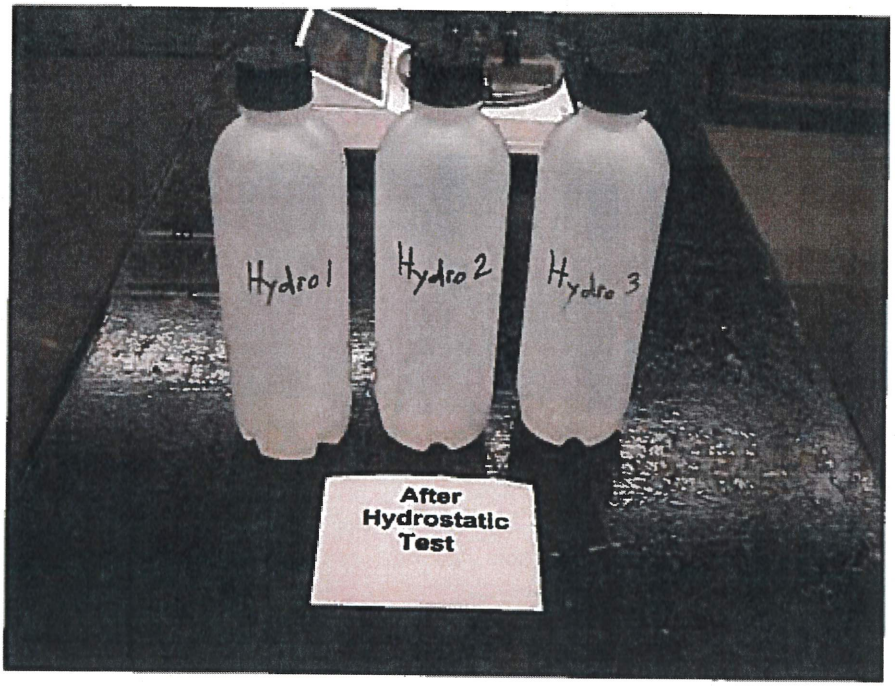
(1 PAGE)


9 (Nine)
10 (Ten)
After Vibration Test
11 (Eleven)

APPENDIX G

PHOTOGRAPHS OF THE BOTTLES AFTER HYDROSTATIC PRESSURE TEST

(1 PAGE)


Hydro 1
Hydro 2
Hydro 3
After
Hydrostatic
Test

APPENDIX H

TEST EQUIPMENT AND INSTRUMENTATION USED IN THE TESTING OF THIS PACKAGING

(1 PAGE)

Instrument or Equipment	Manufacturer	Model Number	Serial Number	Calibration Date
Gram Scale	Ohaus	AV 3102	8028101026	2/25/2016
Electronic Scale	NCI	3820	SRNGA70752	8/03/2015
Vibration Table	LAB	Palletester	111017	N/A
Pressure Gauge	Ashcroft	Q8451	SPT-034	3/13/2016
Thermo Couple Unit	Omega	660	7278	5/19/2015
Drop Tester	Lansmont	PDT-56ED	M-15521	N/A
Mechanical Torque Meter	Tohnichi	2-TM75	504461L	12/01/2015
Shim	McMaster	N/A	SPT-079	8/12/2015
Tape Measure	Stanley	30-464	SPT-080	10/16/2015
Micrometer	Fowler	1-0.001"	SPT-036	3/01/2016

APPENDIX I

ADDITIONAL BOXES CERTIFIED THROUGH SELECTIVE TESTING PROVISIONS

(1 PAGE)

Part Number	Dimensions	
None specified		

APPENDIX J

PHOTOGRAPHS OF PACKAGING COMPONENTS

(1 PAGE)