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IMPACT TEST REPORT

Flexitank Disposable Bulk Packaging System for Non-Hazardous Liquid in a 20' ISO Container - COFC – Environmental Packaging Technologies

NOTE: THIS TEST REPORT DOES NOT CONSTITUTE APPROVAL OR DISAPPROVAL OF THE EQUIPMENT, METHOD OR MATERIAL TESTED

TEST REPORT: FI 3-09

May 28, 2009

Report by:
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SUBJECT: **Flexitank Disposable Bulk Packaging System for Non-Hazardous Liquid in a 20' ISO Container - COFC – Environmental Packaging Technologies**

SYNOPSIS: An impact test was conducted to evaluate a disposable bulk packaging system for shipment of non-hazardous liquid in 20' ISO containers. Environmental Packaging Technologies flexitank type system has a maximum capacity of 6,340 US gallons and consists of tube constructed multiple ply ultra high tensile ethylene co-polymer membranes (2). A multi-layer secondary containment liner is installed between the container walls and the flexitank and supported by the upper lashing rings. The flexitank is then fitted into a standard 20' ISO marine container and filled with approximately 5,300 US gallons of liquid while being secured with a bulkhead system consisting of a five of steel tubes pre-formed into arcs and a 8 mm plastic fluted dunnage sheet. This method successfully completed impact testing.

BACKGROUND: Mr. Michael Sims, Environmental Packaging Technologies, requested an impact test be conducted to evaluate the performance of a disposable bulk packaging system secured inside a 20' ISO container with the Big Red Flexitank™ and a bulkhead system consisting of five steel tubes preformed into arcs and a 8mm plastic fluted dunnage sheet.

The bottom discharge flexitank is intended as a single trip disposable packaging system for non-hazardous bulk liquids and is fitted into a standard 20' ISO container for a one-way bulk liquid transport system. The flexitank is constructed of 2 plies of ultra high tensile ethylene co-polymer membranes and a woven polyethylene outer. Tank Model # 20CBMBSF having dimensions of ~10'x20' and a maximum capacity of approximately 6,340 gallons was used during testing. The flexitank is fitted with one 3" filling/discharging PE male cam lock equipped with ball valve.

Impact testing was conducted at the Transportation Technology Center, Pueblo, CO on April 28, 2009.

Those in attendance during testing were:

Mr. Michael Simms, Environmental Packaging Technologies
Mr. Don Reilly, Environmental Packaging Technologies
Mr. Roger Goose, Environmental Packaging Technologies
Mr. Shane Sims, Environmental Packaging Technologies
Mr. Mike Sandoval AAR/TTCI

TEST LOAD: The test load was in container GESU 3637872 22G1 having a light weight of 4,850 lbs. and a maximum payload capacity of 62,350 lbs. The test container was loaded on the B-end of flat car TTWX 190074 having 15” end of car cushion units. The anvil string was four empty cars having a combined lightweight of ~269,100 lbs.

The test load consisted of one Environmental Packaging Technologies “Big Red Flexitank™”, Tank Model #20CBMBSF having dimensions of ~10’x20’ with a nominal capacity of approximately 6,340 gallons. The 20’ container was cleaned and checked for any protruding material that could puncture the flexitank. Each welded seam inside the container was covered with duct tape. The multi layer Barrier Wear Sleeve liner was installed prior to fitting the flexitank and attached to the upper lashing rings. The flexitank was secured inside the 20’ container to the upper corner lashing rings and with a bulkhead consisting of five preformed arched tubular steel bars (manufactured by a proprietary process that rolls and welds 17 gauge steel) with dimensions of approximately 93” wide x 58” high with an 8mm plastic fluted sheet facing the interior of the load. The bulkhead was installed horizontally across the rear of the container and the five steel tubes extending into the recessed container bull board slots on both sides of the container were secured in place with Velcro straps. The flexitank was then filled with 5,300 US gallons of water using a calibrated water meter. Total approximate weight of the water filled “Big Red Flexitank™” and container was 47,250 lbs.

The Barrier Wear Sleeve liner also has an additional flap attached at the front of the tank which is then secured to the upper center lashing rings to prevent the flexitank from surging over the top of the bulkhead system.

Two pneumatic dunnage airbags (3’ x 16’ @ 1.0 psi) were placed on top of the flexitank to help reduce surging of the liquid in the flexitank.

The anvil string consisted of four empty railcars: MP 582911, CR 433432, DRGW 60971 and DRGW 60932 having a combined weight of approximately 269,100 lbs. Handbrakes were set on the first and last standard draft gear car in the anvil string.

RESULTS:

Impact Target Speed	Actual Speed	#1 Top Bulkhead Tube	#2 Bulkhead Tube	#3 Center Bulkhead Tube	#4 Bulkhead Tube	#5 Bottom Bulkhead Tube
Distance to door empty		12"	12 ¼"	12 ¼"	12 ¼"	12"
Distance to door after 5,300 gallons		12"	11 3/8"	11 3/8"	11 ½"	11 ½"
4.0 mph	3.9 mph	12"	11 ¾"	11 3/8"	11 ½"	11 ½"
6.0 mph	5.8 mph	12"	11 ¾"	11 3/8"	11 ½"	11 ½"
6.0 mph	6.0 mph	12"	11 ¾"	11 3/8"	11 ½"	11 ½"
Reverse 6.0 mph	6.0 mph	12"	11 ¾"	11 3/8"	11 ½"	11 ½"

CONCLUSION: The bulkhead securement system and flexitank successfully completed the impact testing. No movement of the bulkhead was noted during impact testing. This particular system was tested with both doors open.

DISCUSSION: The bulkhead system and flexitank performed as intended and restricted the entire flexitank and bulkhead from coming into contact with the doors during impacts. The two pneumatic dunnage bags laid across the top of load seemed to have no influence on reducing the surging effects of the liquid. The pneumatic dunnage bags were askew on top of the tank and were not in contact with the top of the container. The additional flap that is from the secondary liner and secured at the upper center lashing rings performed as intended, keeping the flexitank from surging over the top of the bulkhead. The proponent would like to pursue a Rail Simulation Test on the Vibration Test Unit (VTU) at the Transportation Technology Center, Inc. in Pueblo Colorado in the near future.

TTCI would like to thank Environmental Packaging Technologies for their assistance in conducting this test.

Mike Sandoval
Sr. Engineer
Damage Prevention and Loading Services

PHOTOGRAPHS



**Photo #1
Barrier Wear Sleeve Liner Installation**



**Photo #2
Big Red Flexitank™ Installation**

PHOTOGRAPHS



**Photo #3
Flexitank Installation**



**Photo #4
Bulkhead Installation**

PHOTOGRAPHS



Photo #5
Flexitank Ready for Water



Photo #6
5,300 US Gallons Being Added to the Big Red Flexitank™

PHOTOGRAPHS



**Photo #9
Pneumatic Dunnage**



**Photo #10
Pneumatic Dunnage**

PHOTOGRAPHS



Photo #11
Bulkhead Interface to Bull Board Slots