		TEST REPORT Testing Services Group 816 Whitney Drive Lapeer, MI 48446 (810) 245-1600		Customer Report Number: N/A	
Customer: Richard Barone VP-TPR2 36 Plains Rd Essex, CT 06426 {o}860-767-TPR2(8772) {f}860-767-8779 {c}203-858-8099 www.tpr2.com			[FOR CUSTOMER USE]		TSG Report Number 8C0156-1.1, 8C0156-2.1, 8C0156-3.1, 8C0156-4.1 and 8C0156-5.1B
Title:	55 STBD FWD ISO 21487 and ABYC H33 Tank Testing				
Test:	ISO 21487 7.1.2 & 7.1.3 Hydraulic Pressure Test (5.0-hours) / ABYC H33.21.5.1 Pressure Impulse Test Set-Up / ABYC H33.21.5.2 Pressure Impulse Test ABYC H33.21.1 Static Pressure Test / ABYC H33.20.6 General Installation Fire Test (> 50-gallon) / ABYC H33.20.6.8 Diesel Used				
Tech: Mike Seamen / Dan Kolacz / James Walker			Report Date: July 6, 2009		
Author: Debra Peavyhouse, Technical Writer			Approval: Michael S. Popovich, Operations Director		
Date:			Date:		

Objective:

"1 Scope

This International Standard establishes requirements for design and test of petrol and diesel fuel tanks for internal combustion engines that are intended to be permanently installed in small craft of up to 24 m length of hull. For installation requirements, ISO 10088 applies."

-International Standard ISO 21487, First Edition 2006-12-15. Small Craft – Permanently installed petrol and diesel fuel tanks

Items Tested:

Description (include characterization)	Model	Customer ID	TSG ID	Date Received
Fiberglass Fuel Tank coated with TPR2 F1ER in tumescent coating 18 mil aft (new)	55 STBD FWD	N/A	8C0156-01	March 2009

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Results:

Preconditioning:

SAMPLE INFORMATION			PRECONDITIONING SOAK PARAMETERS			RESULTS	
TSG ID	Customer ID	Test Date	Test Medium / Test Capacity	Test Temperature (°C)	Duration (days)	Days Completed	Technician Observations
8C0156-01	N/A	4/11/09-5/11/09	Fuel C / 270-gallon	> / = 21.1	> 30	30	N/A
TEST NOTES:							
➤ N/A							

ISO 21487:2006 Section 7.1.2 Leakage Testing: PRE-PRESSURE IMPULSE TESTING

SAMPLE INFORMATION			TEST PARAMETERS			RESULTS	
TSG ID	Customer ID	Test Date	Test Medium	Maximum Internal Tank Pressure (PSI)	Duration (minutes)	Was there any evidence of a pressure RISE or DROP within the 5.0-minutes? (YES / NO)	Were there any signs of leakage when a leak detection method such as soapy water spray was employed after leakage testing? (YES / NO)
8C0156-01	N/A	5/11/09	Air	3.0 (20.68-kPa)	5.0	NO	NO
TEST NOTES:							
➤ N/A							

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Results: Continued

ISO 21487:2006 Section 7.1.3 Hydraulic Pressure / Strength Testing: PRE-PRESSURE IMPULSE TESTING

SAMPLE INFORMATION			TEST PARAMETERS			RESULTS
TSG ID	Customer ID	Test Date	Test Medium	Maximum Internal Tank Pressure (PSI)	Duration (hours)	Was there any evidence of a tank shell crack and/or leak? (YES / NO)
8C0156-01	N/A	5/11/09	Air	3.0 (20.68-kPa)	5.0	NO
TEST NOTES:						
➤ N/A						

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Results: Continued

ABYC H33.21.5 Pressure Impulse Test:

SAMPLE INFORMATION			TEST PARAMETERS				RESULTS	
TSG ID	Customer ID	Test Date	Test Medium / Test Capacity	Test Temperature (°C)	Pressure Impulse Cycle	Duration (cycles)	Total Cycles Completed	Any signs of leaks, permanent deformation or other signs of failures? (YES / NO)
8C0156-01	N/A	5/29/09-6/5/09	Water / 270.0-gallons	21.1 to 26.7	0.0-PSI to +3.0-PSI to 0.0-PSI at a rate of < 15 cycles/minute	25,000	25,000	NO
TEST NOTES:								
➤ N/A								

ABYC 33.21.1 Static Pressure Test:

SAMPLE INFORMATION			TEST PARAMETERS				RESULTS
TSG ID	Customer ID	Test Date	Test Medium	Test Temperature (°C)	Maximum Internal Tank Pressure (PSI)	Duration (minute)	Was there any evidence of leakage after 1.0-minute under pressure? (YES / NO)
8C0156-01	N/A	6/9/09	Air	Laboratory Ambient	3.0 – 4.5 (20.68 – 31.03 kPa)	1.0	NO
TEST NOTES:							
➤ N/A							

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Results: Continued

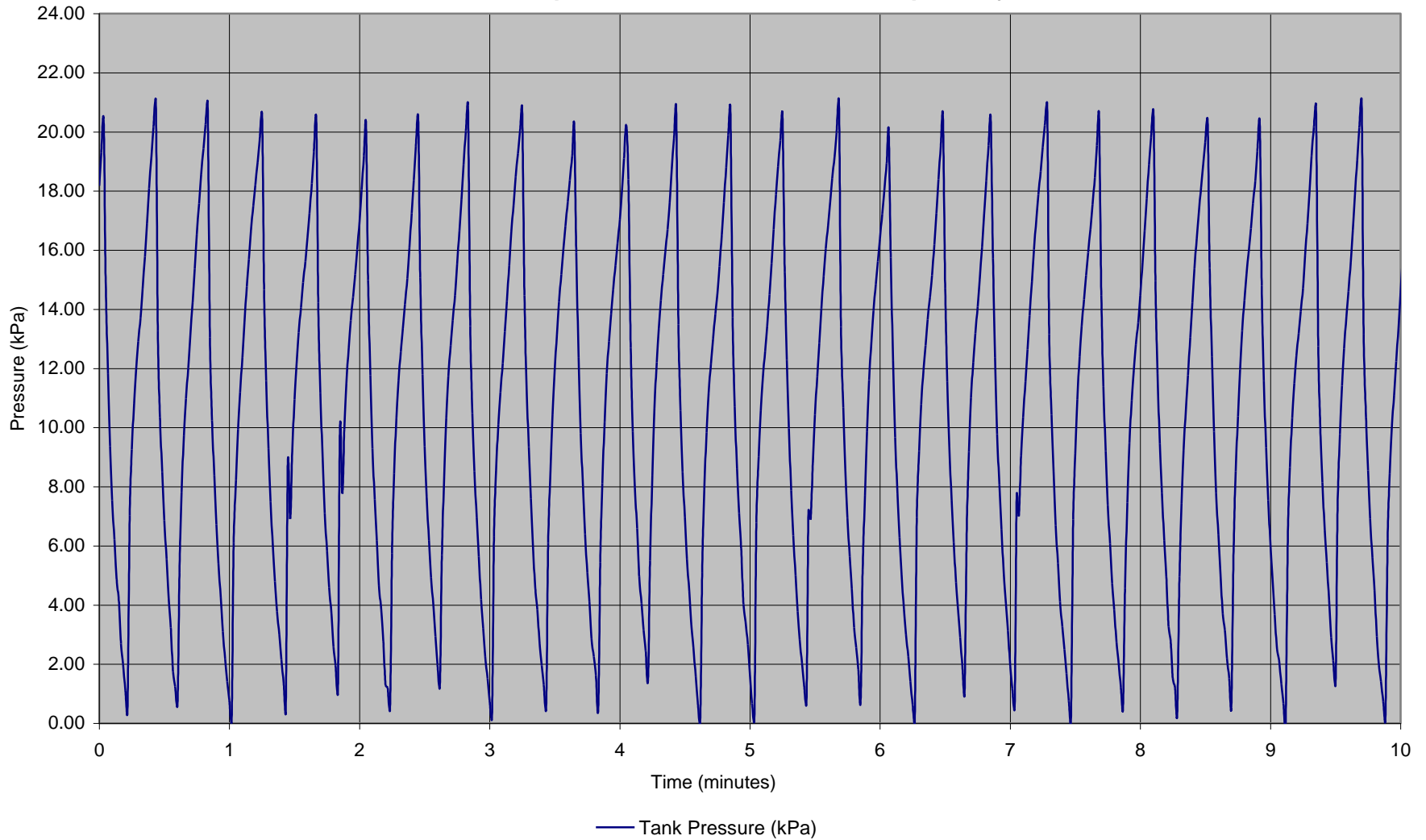
ABYC 33.20.6 Test Method for Fuel Tank Fire Test:

SAMPLE INFORMATION			TEST PARAMETERS					RESULTS	
			FIRE TEST PARAMETERS			POST-FIRE TEST LEAK CHECK			
TSG ID	Customer ID	Test Date	Test Medium / Test Capacity	Flame Temperature within 1-inch of Component	Duration (minutes)	Test Medium	Aerostatic Tank Pressure (PSI)	Any signs of leakage during or after the flame test? (YES / NO)	Any signs of leakage during the post-flame test leak check? (YES / NO)
8C0156-01	N/A	7/1/09	Diesel / 67.5-gallons	> 1200°F (>648.89°C)	2 ½	Air	0.25 (1.75 kPa)	NO	NO
TEST NOTES:									
➤ N/A									

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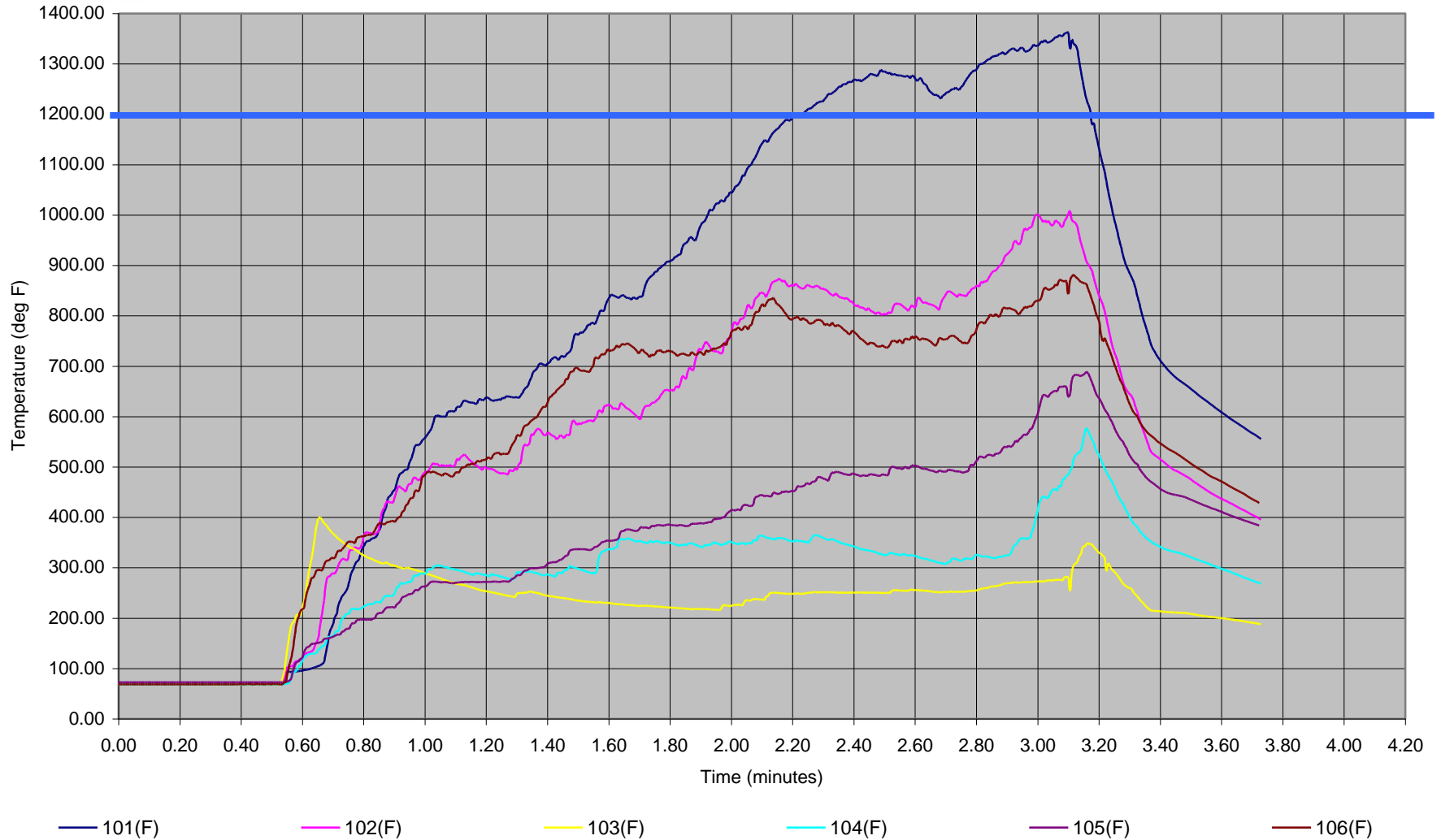
55 STBD FWD ISO 21487 and ABYC H33 Tank Testing
ABYC H33.21.5.2 Pressure Impulse Test - 8C0156-1.1_2.1_3.1_4.1_5.1A
Component #8C0156-01
10-minute snapshot of the 25,000 Pressure Impulse Cycles



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55 STBD FWD ISO 21487 and ABYC H33 Tank Testing
ABYC H33.20.6 General Installation Fire Test - 8C0156-1.1_2.1_3.1_4.1_5.1A
Component #8C0156-01
Thermocouple Temperature vs. Time



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Test Procedure:

- Reference TSG Test Specifications 8C0156-1.1, 8C0156-2.1, 8C0156-3.1, 8C0156-4.1, 8C0156-5.1A and Customer Test Procedure ABYC H33, Revision Level 7/2005, Revision Date 7/2005

Tank shall soak at ambient for 30 days filled with fuel C before testing begins.

Fuel C can be stored for use in future testing.

7.1 Hydraulic pressure test

7.1.1 General

WARNING — Take care not to exceed the maximum static test pressure. Do not use solutions containing ammonia for testing.

7.1.2 & 3 Leakage test

Each test fuel tank shall be internally tested with a hydraulic pressure with all its accessories. The test pressure shall be the greatest of

20 kPa;

1,5 times the highest hydrostatic pressure to which the tank may be subjected in service (maximum fill-up height above tank top).

This pressure shall be maintained for 5 h.

During this time, the tank shell shall not crack or leak; however, it may be permanently deformed.

Take set up pictures

33.21.5 Pressure Impulse Test

Fuel tanks of 25 gallons capacity and more shall not leak, or show signs of permanent deformation, or other signs of failure following 25,000 cycles of pressure-impulse.

33.21.5.1

The Fuel tank sample, filled to capacity with water, shall be mounted using support, chocks, or hangers, either furnished with the tank, or intended to be used in a boat installation.

33.21.5.2

Attach the fuel tank to a regulated source of pressure of air, nitrogen or water.

The control mechanism of the pressure source is then to be set to cause the pressure in the sample, measured at its top most surface, to vary from zero to three to zero psig (0 to 21 to 0 kPa) at a rate of not more that 15 cycles per minute.

Take set up pictures for report.

Tank shall not leak or show signs of permanent deformation or other signs of failure following 25,000 cycles.

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Test Procedure: Continued

- Reference TSG Test Specifications 8C0156-1.1, 8C0156-2.1, 8C0156-3.1, 8C0156-4.1, 8C0156-5.1A and Customer Test Procedure ABYC H33, Revision Level 7/2005, Revision Date 7/2005

33.20.6 General Fire Test

The fuel tank sample is to be supported in a test enclosure, as shown by H-24 FIGURE 1, if the fuel tank is intended for below deck installation, or in a test enclosure, as shown in H-24 FIGURE 2, if the tank is intended for above deck installation. See page 4.

33.20.6.3

The side supports of the fuel tank sample are to be spaced to support the fuel tank ends, and at each fuel tank baffle, and are to be formed to maintain the fuel tank sample two inches (50.8 mm) away from the inside surface of the simulated hull side panel.

33.20.6.4

The supports for the bottom of the fuel tank sample are to be located in the same manner as the side supports, and are to be formed to maintain the fuel tank sample three inches (76.2 mm) above the inside surface of the enclosure.

33.20.6.5

The fuel tank sample is to be secured to the test enclosure by steel straps. The top of the test enclosure shall be formed so that the maximum fuel tank's sample setback does not exceed two inches (50.8 mm), and the clearance between the top of the test enclosure and the top of the fuel tank sample is not less than seven inches (177.8 mm), not more than 34 inches (863.6 mm).

33.20.6.6

The area of the enclosure beneath the fuel tank sample is to serve as the fuel reservoir, and shall be formed so that the surface of the test fuel extends six inches (152.4 mm) beyond the fuel tank sample ends, and two inches (50.8 mm) beyond the front surface of the fuel tank sample. The reservoir shall be made leak proof, and shall be capable of containing sufficient fuel to burn for a period of 2-1/2 minutes.

33.20.6.7

The fuel tank sample, and all connecting piping and fittings, shall be checked for leakage, and three psi aerostatic pressure applied to the fuel vent. Following the pressure test, the pressure shall be released, and the tank vent left open to simulate a normal condition. The size of the fuel tank sample vent shall be determined by the size of the vent fitting provided by the manufacturer.

33.20.6.8 & 9

The fuel tank sample is to be filled to one-quarter rated capacity with Diesel fuel, and all openings capped or plugged, except for the fuel tank vent that is to be extended without traps, outside the fire test areas.

33.20.6.10

N-Heptane shall be poured in to the reservoir in accordance with H-33.20.5.7.

H-33.20.5.7

N-Heptane shall be poured into all crevices and liquid traps in which fuel could collect in the boat, assuming a leak anywhere in the fuel system. If possible, the amount of fuel in each liquid trap shall be sufficient to burn for a period of 2-1/2 minutes

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Test Procedure: Continued

- Reference TSG Test Specifications 8C0156-1.1, 8C0156-2.1, 8C0156-3.1, 8C0156-4.1, 8C0156-5.1, 8C0156-6.1A and Customer Test Procedure ABYC H24, Revision Level 7/2007, Revision Date 7/2007

33.20.6.11

The test method described in H-33.20.7 shall be used.

33.20.7.1

The area in which the test is to be conducted is to be free from draft, but shall have provision for a free inflow of air during the test. The test shall be conducted as follows:

33.20.7.2

The N-Heptane in the hull section, or in the test enclosure, shall be ignited and permitted to burn for a continuous period of 2-1/2 minutes. The temperature within one inch of the component must be at least 1200F (648C) some time within the 2-1/2 minute test.

33.20.7.3

At the end of the 2-1/2 minute test period, any continued burning is to be extinguished.

33.20.7.4

Following the test, the fuel tank sample shall be examined for leakage and then drained, and pressure checked with ¼ psi (1.75 kPa) of aerostatic pressure. This pressure shall be applied gradually by means of a suitable regulator so as not to strain the tank due to pressure surge. The tank fails the test if leakage is detected in the tank shell using a means other than the pressure drop method.

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Test Photograph:



33.21.5 Pressure Impulse Test Set-Up

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Test Photograph: Continued



33.20.6 Fuel Tank Fire Test Set-Up

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Test Photograph: Continued



33.20.6 Fuel Tank Fire Test Set-Up

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Test Photograph: Continued



33.20.6 Fuel Tank Fire Post-Test

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Test Photograph: Continued



33.20.6 Fuel Tank Fire Post-Test

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Test Photograph: Continued



33.20.6 Fuel Tank Fire Post-Test

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Instruments Used:

Instrument No.	Description	Cal Date	Due Date
20908	Flow Meter	3/4/09	9/4/09
20576	Data Acquisition System	6/10/08	6/10/09
20579	Multiplexer Card	5/20/09	5/20/10
30093	Pressure Transducer	10/21/08	10/21/09
20629	Pressure Gage	1/6/09	1/6/10
30595	Stopwatch	10/29/07	10/29/10
20576	Data Acquisition System	6/24/09	6/24/10
20725	Data Card	4/22/09	4/22/10
30624	Stopwatch	8/7/08	8/7/10
20629	Pressure Indicator	1/6/09	1/6/10

Observations/Irregularities:

- N/A

Disposition of Tested Materials:

- Held for Customer disposition.

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Revision Level(s):

Release Level	Description	Date
A	RELEASE	7/6/09
B	Revised Customer Name and Items Tested Description and added Revision Page	1/26/11

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