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SUMMARY REPORT

Flash and Fire Test

Evaluation of the Behavior of Nonmetallic Materials in Hydrogen

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MANNED SPACECRAFT CENTER
WHITE SANDS TEST FACILITY
LAS CRUCES, NEW MEXICO

Document No.: TR-196-002

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SUMMARY REPORT

Flash and Fire Test

Evaluation of the Behavior of Nonmetallic Materials in Hydrogen

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1.0 INTRODUCTION

This test report is the second in a series of reports describing the results of the tests conducted to evaluate the behavior of nonmetallic materials in hydrogen. This report summarizes the results of the flash and fire test (Test D) outlined in Test Plan TP-WSTF-196. The flash and fire test is utilized to evaluate the tendency of heated materials to ignite in a hydrogen atmosphere when subjected to an ignition source. The test is conducted using the standard WSTF flash and fire test apparatus. The test represents a hydrogen parallel to a hazard condition known to exist in oxygen systems. In this study performed for the NASA Aerospace Safety Research and Data Institute (ASRDI) and NASA WSTF, ten nonmetallic materials were evaluated to establish baseline data on the behavior of nonmetallic materials in hydrogen and to characterize on an initial basis one mode of material failure considered to be a factor pertinent to the safe use of a material in hydrogen.

2.0 SUMMARY

During January through March 1972, ten nonmetallic materials were evaluated for their flash and fire points in hydrogen. The tests were conducted using the basic MSC-PA-D-67-13 procedure as outlined in Test Directive TD-MIS-006, Revision B. None of the materials evaluated exhibited a flash or fire point in either helium or hydrogen up to a temperature of 600°F. Two of the materials, polyvinylchloride and cellulose acetate butyrate, were thermally effected by the tests in both test media. Several of the materials including polyvinylchloride and cellulose acetate butyrate exhibited the "halo" phenomenon during the tests at temperatures over 250°F.

3.0 TEST MATERIALS

3.1 Test Specimens: The following nonmetallic materials were examined by the flash and fire test:

WSTF I.D. No.	Material
71-2992	FEP Teflon
71-3071	TFE Teflon
71-3072	15% Glass-Filled TFE Teflon

WSTF I.D. No.	Material
71-3073	High Density Polyethylene
71-2977 (cast at WSTF)	RTV-90 Silicone Rubber
72-3393 (purchased in sheet form)	RTV-90 Silicone Rubber
71-3070	Viton A
71-3074	Nylon 6
71-2978	PRC Polyurethane
71-3075	Polyvinylchloride
71-3198	Cellulose Acetate Butyrate

3.2 Test Gases: The test gases utilized in this series of tests conformed to the following requirements:

Gas	Requirements
Helium	MSFC Spec 364B
Nitrogen (purge gas)	MSFC Spec 234A
Oxygen	Mil-P-25508D
Hydrogen	High Purity Grade (99.9%)

4.0 TEST FIXTURE/SPECIMEN DESCRIPTION

A diagram of the flash and fire test apparatus is shown in Figure 1. The test apparatus has an internal volume of approximately 0.5 liter and holds the specimen in an aluminum specimen cup (1). A glass chimney (2) is used between the cup and the spark electrodes (3) to prevent spark arc over to the cup. The chimney is also used to direct the specimen off-gas products past the spark electrodes. The height of the electrodes is adjustable to maintain the electrodes 0.75 $\pm$ .025 inches above the specimen. The spark electrodes are freshly sharpened for each test and adjusted to a spark gap of 0.062 $\pm$ .01 inch. An asbestos washer (4) prevents heat sinking of the specimen by the stainless steel test chamber (5). A 1500 watt heater (6) is coiled around the cup and is insulated from the test chamber with an asbestos liner. A dual element thermocouple (7) monitors the cup temperature and provides the control temperature signal to the temperature rate controller (8). The spark generator (9) applies the

spark high voltage across the high voltage chamber feedthroughs (10). The spark energy is approximately 75 millijoules applied over a duration of approximately four milliseconds. The temperature rate controller (8) applies sufficient heater power to the heater coil (6) through the heater power feedthroughs (11) to maintain a 25 $\pm$ 5°F per minute temperature rise rate over the test temperature range. A port (12) and one opposite it are used to fill and purge the test fixture.

Flash and fire occurrence may be monitored visually through the glass viewport (13) or electronically by the photoelectric cell detector (14) and storage oscilloscope (15) arrangement. The flash and fire occurrences are detected by the photocell detector through a quartz rod (16). The quartz rod is mounted in a glass rod which penetrates the viewport through a Teflon feedthrough bushing (17).

Figure 2 is a photograph showing the flash and fire apparatus set up in the WSTF hydrogen test facility. The television camera adjacent to the test fixture was used to remotely monitor the test progress during oxygen checkout and helium baseline tests.

The materials for all tests conducted in this phase of the program were configured as cubes weighing approximately 0.5 gram. All materials except RTV-90 and PRC polyurethane specimens are cleaned to the requirements of MSC-00066, Method CP-5, to reduce or minimize hydrocarbon contamination.

5.0 GENERAL TEST PROCEDURE

The tests were conducted in duplicate using both GHe (baseline) and GH_2 as the test medium. The test procedure consisted of the basic steps listed below (refer to Appendix A for the detailed test procedure). The test procedure was qualified through a series of oxygen checkout tests performed using hexaethylbenzene as the standard test material.

1. Place sample in aluminum specimen cup (refer to Figure 1).

2. Place glass chimney on specimen cup.

3. Install and adjust electrodes to obtain a spark gap of 0.062 $\pm$ .01 inch.

4. Adjust specimen holding fixture to provide a .750 $\pm$ .025 inch spacing between the specimen and the electrodes.

5. Install photocell and cover top of fixture with aluminum foil to exclude light (for H_2 tests only).

6. Connect all electrical and instrumentation leads.

7. Connect pressure and vent lines.

8. Turn on spark generator and verify operation of the generator (one spark every 10 seconds).

9. Pressurize the test fixture to 37 $\pm$ 5 psia and perform a leak check.

10. Purge the test fixture with GHe for two minutes.

11. Purge the test fixture with the test medium (either GHe or GH_2) for ten minutes.

12. Pressurize the test fixture to 25 $\pm$ 2 psia with the test medium.

13. Initiate spark generator (one spark/10 seconds nominal) and temperature programming (25°F/minute nominal) after the specimen has been soaked in the test medium for ten minutes.

14. Monitor the temperature profile.

15. Monitor photocell output for flash and fire points.

16. Terminate the test when the fire point has been determined or the maximum test temperature (600°F) has been obtained.

17. Purge the test fixture and perform a post-test visual examination of the test specimen.

6.0 TEST RESULTS

6.1 System Checkout Tests: In order to verify the performance of the system, a group of checkout tests were performed using oxygen as the test medium at a pressure of 16.5 $\pm$ .5 psia. The tests used reagent grade hexaethylbenzene as the standard material.

Table I summarizes the test data. The data were obtained using a purge technique for establishing the test atmosphere in the

test fixture and the laboratory standard evacuation technique. Both techniques gave an average fire point of 465°F (hexaethylbenzene does not exhibit a flash point under the test conditions used). This value compares favorably with the 462°F average value obtained by the laboratory using a different set of equipment.

6.2 Gaseous Helium and Hydrogen Tests: Table II is a tabular summary of the pertinent flash and fire data obtained on the ten nonmetallic materials tested during this phase of the program. A complete listing of the test data is given in Appendix B. Table II lists the initial and final test vessel pressure, the average heating rate, and the end temperature along with remarks describing the sample at the end of the test. No material was found to exhibit either a flash or fire point when subjected to the test in GH_2 up to a temperature of 600°F (315°C).

Two materials, polyvinylchloride and cellulose acetate butyrate, were significantly changed as a result of the tests conducted in both test mediums (GHe or GH_2). These two materials were probably changed as a result of the high temperatures experienced during the tests. Several of the materials at temperatures over 250°F exhibited the "halo" phenomenon as observed on the photocell output oscilloscope. The "halo" phenomenon is commonly observed in standard ASTM flash and fire tests conducted on oils and lubricants and in material flash and fire tests conducted at WSTF in oxygen.

Figures 3 and 4 illustrate typical test data recorded during the tests. Examination of the photocell output trace shows several peaks which are larger than previous peaks. The increase in peak height with no change in the general shape of the peak is typical of the "halo" effect. The cause of the "halo" effect is not clearly understood and is not exhibited by all materials. The "halo" effect is probably due to a flash reaction occuring under conditions which limit its propagation to a full flash. For example, it may be due to the presence of an incorrect fuel/oxidizer mixture, insufficient ignition energy, or incorrect conditions of temperature and pressure. It is interesting to note that in both helium and hydrogen, the specimens of cellulose acetate butyrate and polyvinylchloride were significantly changed and that these tests indicated the "halo" effect at higher temperatures but failed to show the typical flash and fire points. Apparently some type of reaction occurred that was not detected by the photocell. This detection limitation may be due to the wavelength sensitivity of the detector and its components. The

detector use is sensitive primarily to visible light and is not particularly good for the detection of ultraviolet light given off by many typical chemical reactions.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The flash and fire tests indicated that none of the ten non-metallic materials evaluated exhibited a reaction up to a temperature of 600°F in hydrogen. Two materials, polyvinyl-chloride and cellulose acetate butyrate, were significantly changed in both the baseline and hydrogen tests. These two materials and several others exhibited the "halo" effect during the tests. The role of the "halo" phenomenon is not clearly understood but may be a precursor to a flash reaction.

If 600°F is not considered to be a sufficiently high test temperature, it is recommended that the tests be repeated on the materials (TFE Teflon, FEP Teflon, RTV-90, and 15% Glass-Filled TFE Teflon) that exhibited a reaction in the reaction propagation test (Test E, TP-WSTF-196) up to a temperature of 1000°F or another appropriate maximum temperature. This group of tests would provide a desirable complement to the reaction propagation tests perhaps lending some insight into the reaction mechanism observed during the reaction propagation tests. It is recommended that any additional tests be conducted using a test fixture modified to permit the detection of ultraviolet as well as visible light. This revision would permit better detection of the reactions or events that occur within the test fixture.

8.0 DISTRIBUTION

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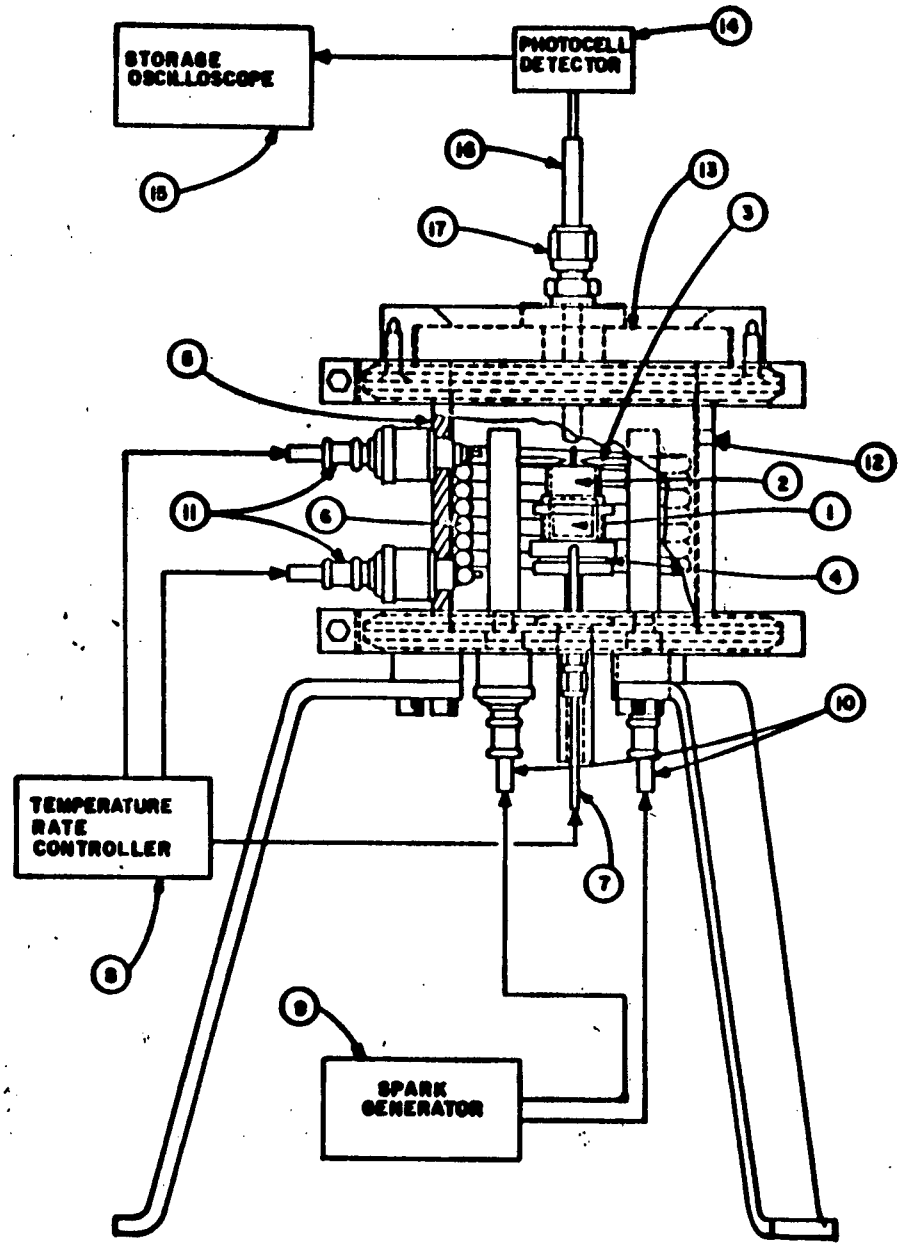

Figure 1 WSTF Flash and Fire Point Test Apparatus and Control System

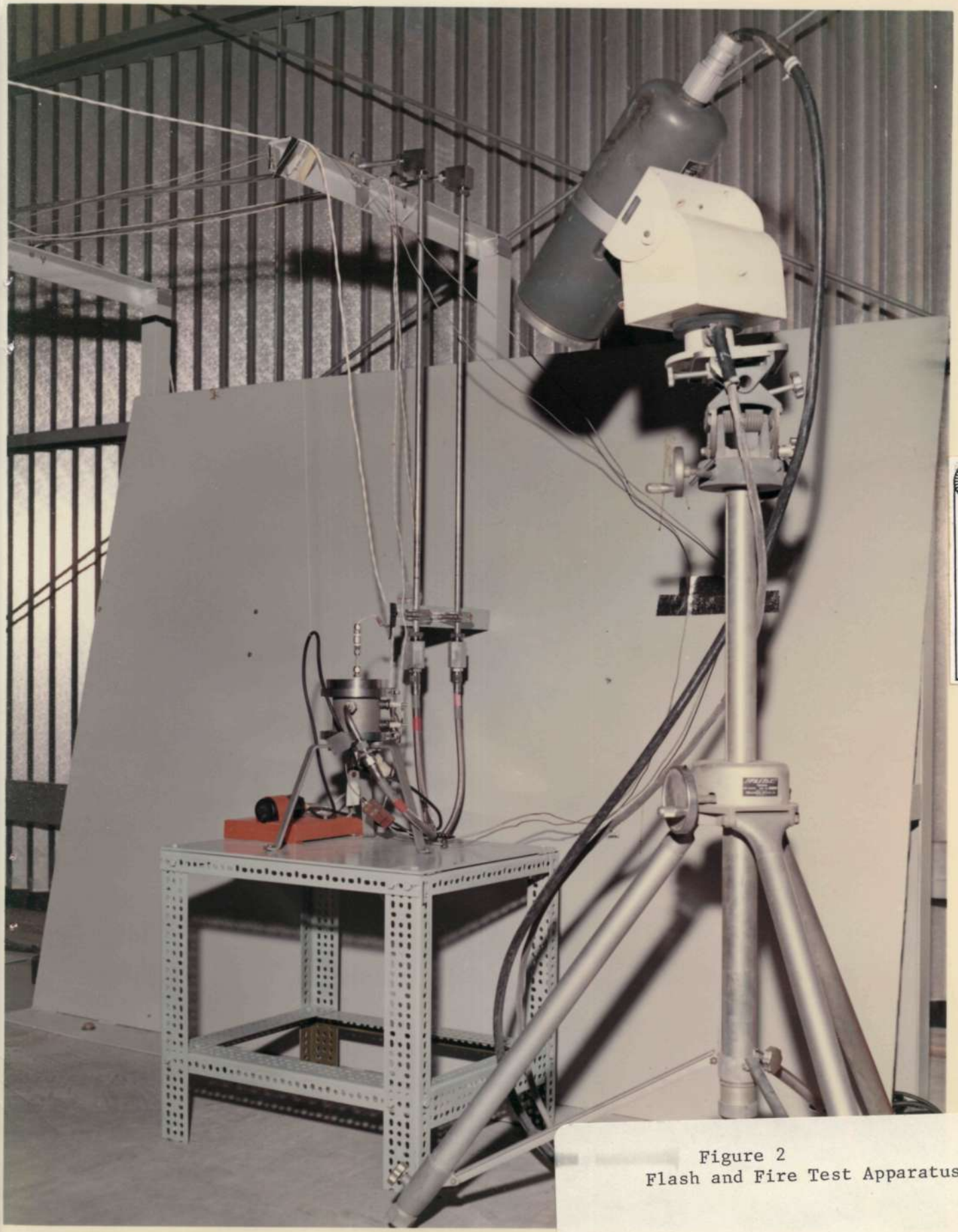

Figure 2
Flash and Fire Test Apparatus

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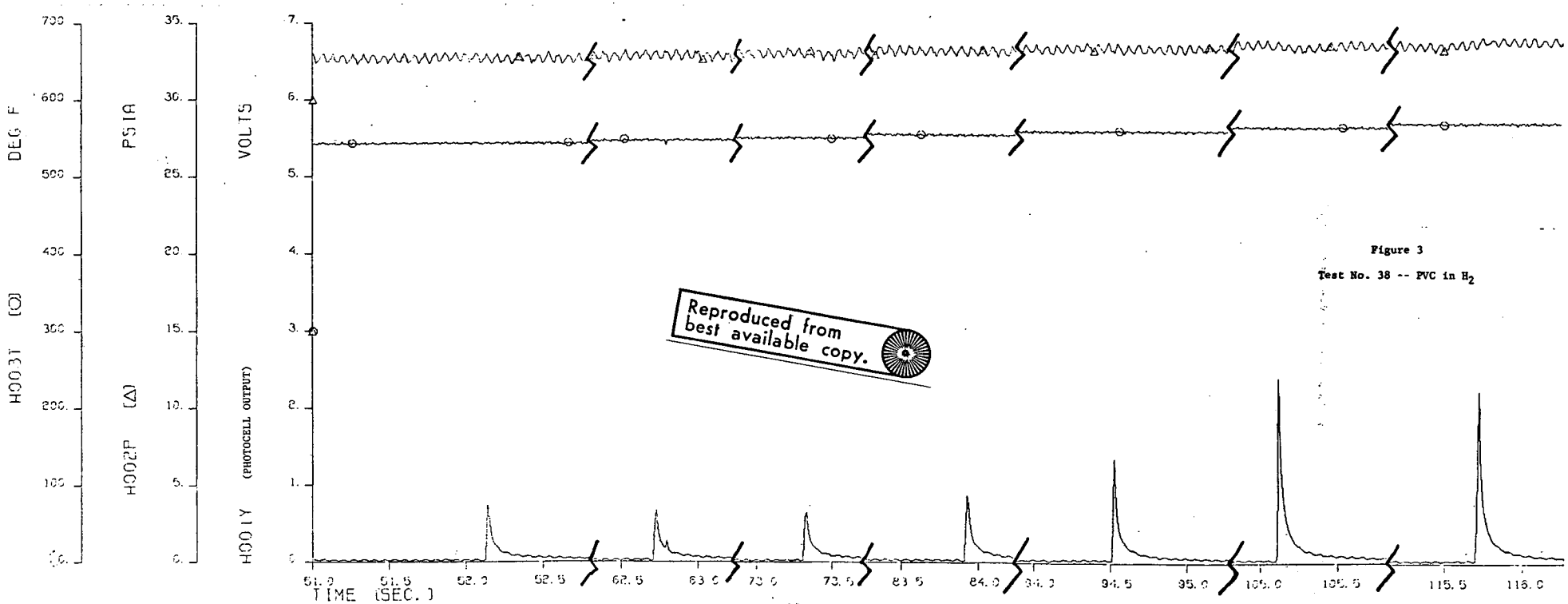

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Figure 3

Test No. 38 -- PVC in H_2

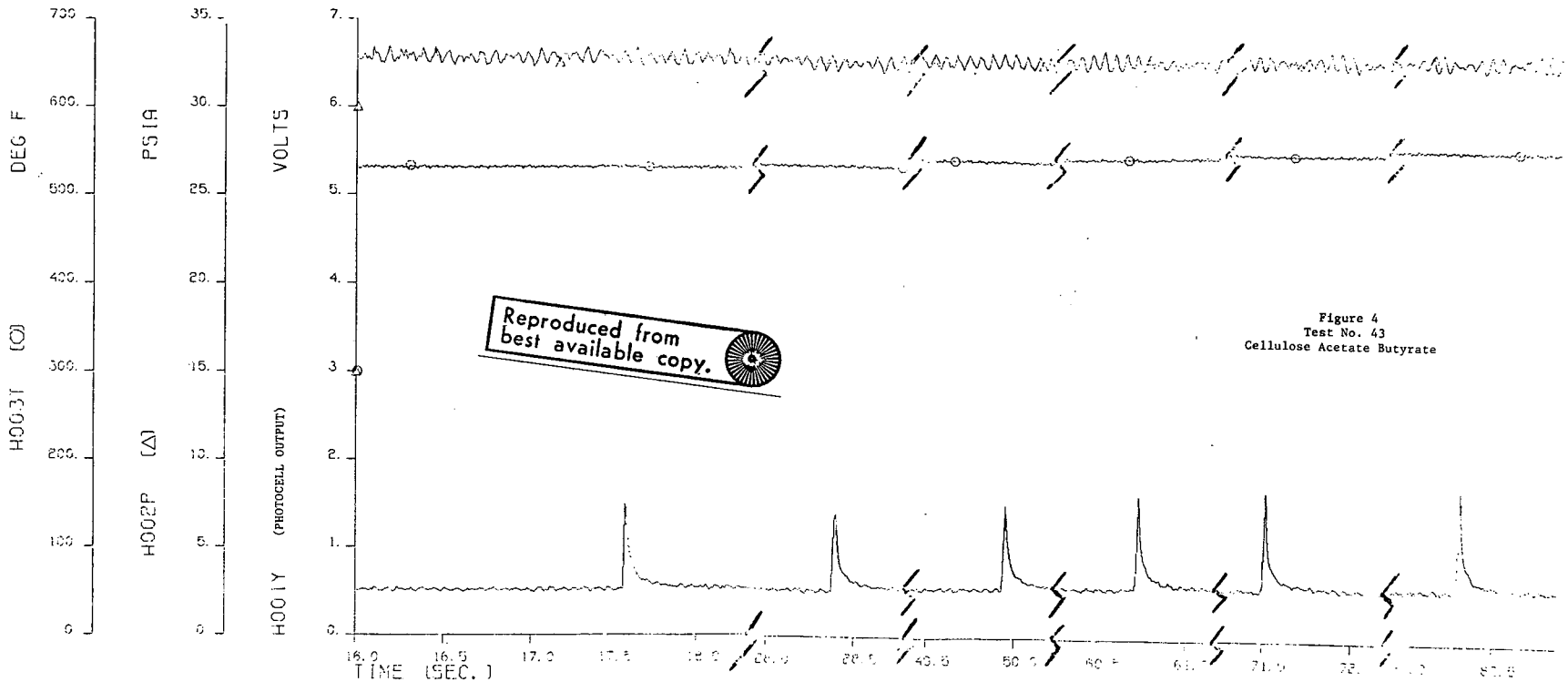

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Figure 4
Test No. 43
Cellulose Acetate Butyrate

TABLE I

Summary of Flash and Fire Checkout Tests

Test Medium: Oxygen at 16.5 ± .5 psia
Test Material: Hexaethylbenzene

Test No.	Method used to Fill Test Fixture	Average Heating Rate (°F/min.)	Fire Point (°F)
1	Purge	26.4	462
2	Purge	28.0	473
3	Purge	28.0	472
4	Purge	30.5	457
5	Purge	28.5	460
			Avg = 465 ± 5
6	Evacuation	29.7	483
7	Evacuation	25.4	457
8	Evacuation	24.0	457
			Avg = 465 ± 11

TABLE II

Flash and Fire Test

GHe Tests (Baseline)

WSTF I.D. No.	Material Name	Test No.	Initial Pressure (psia)	Average Heating Rate (°F/min)	End Temperature (°F)/ End Pressure (psia)	Remarks
71-3198	Cellulose Acetate Butyrate	28	25.5	23.5	500/29.5	Sample expanded to fill cup-moderate amount of plastic residue
		29	25.5	23.4	*500/28	
		53	24.5	23.5	*600/29	Sample expanded to fill cup-plastic residue
		48	25.0	24.2	*600/29	Sample expanded to fill cup-brown residue
71-3074	Nylon-6	27	25.0	25.0	500/30	
		18	24.8	24.2	500/29.6	
71-3073	Polyethylene	17	24.8	21.4	500/28.5	Sample expanded approximately double size-large quantity of brittle residue.
		25	25.1	24.1	500/29.7	Sample melted - large quantity of plastic residue
71-2992	FEP Teflon	16	24.8	24.9	500/29.9	
		26	25.1	22.8	500/29.0	
71-3072	TFE Teflon 15% Glass-Filled	15	24.8	23.1	500/28.5	
		23	25.4	23.3	500/29.3	
71-3070	Viton-A	14	25.4	24.0	500/29.6	
		19	25.7	24.0	500/31.6	
71-2978	PRC Polyurethane	21	25.1	24.5	500/30.2	Expanded to fill cup-large quantity of plastic residue.
		13	24.8	24.3	500/29.9	Expanded to fill cup-large quantity of plastic residue.
71-3071	TFE Teflon	22	25.4	21.5	500/29.3	
		11	24.8	23.7	500/29.3	

Table II (continued)

WSTF I.D. No.	Material Name	Test No.	Initial Pressure (psia)	Average Heating Rate (^{o}F/min)	End Temperature (^{o}F)/ End Pressure (psia)	Remarks
71-3075	PVC	24	25.1	26.2	500/30.4	Expanded above cup-large quantity of plastic residue.
		10	24.8	25.5	500/30.4	Expanded above cup-large quantity of brittle residue.
		49	25.0	*22.3	600/30.0	Expanded above cup-large quantity of brittle residue.
		51	26.0	*23.0	600/32.0	Expanded above cup-large quantity of brittle residue.
71-2997	RTV-90	20	26.0	21.8	500/30.2	
		12	26.0	20.8	500/29.6	
GH_2 Tests						
71-3198	Cellulose Acetate Butyrate	42	25.1	22.4	*600/30	Sample melted-large amount of brittle residue.
		43	26.2	23.5	*600/33	Sample melted-large amount of brittle residue.
71-3074	Nylon-6	41	25.4	23.9	600/31	Sample melted to shape of cup.
		46	25.2	22.9	600/30	Sample melted to shape of cup.
71-3073	Polyethylene	40	27.0	21.0	*600/31.5	Sample melted-large amount of hard plastic residue.
		56	24.0	22.9	*600/30	Sample melted.
71-2992	FEP Teflon	35	24.3	22.9	600/28.5	Sample melted slightly-large amount of plastic residue.
		55	24.5	24.9	600/31.0	Sample melted slightly.
71-3072	TFE Teflon 15% Glass-Filled	39	25.4	22.9	600/30.5	
		45	25.4	26.1	600/32.0	
71-3070	Viton-A	36	23.7	24.9	600/30.0	
		54	24.0	21.8	*600/29.0	

Table II (continued)

WSTF I.D. No.	Material Name	Test No.	Initial Pressure (psia)	Average Heating Rate (°F/min)	End Temperature (°F)/ End Pressure (psia)	Remarks
71-2978	PRC Polyurethane	52	25.0	22.9	600/31.0	Sample melted.
		34	24.8	23.7	600/30.0	Sample melted-large amount of plastic residue
71-3071	TFE Teflon	31	24.8	24.1	600/32.0	
		30	26.2	23.9	500/34.0	
71-3075	PVC	38	26.0	23.8	*600/34.5	Large amount of brittle residue.
		37	24.8	22.2	*600/33.0	Large amount of brittle residue.
71-2977	RTV-90	32	24.0	23.3	600/28.5	
		33	26.0	23.1	600/31.5	
72-3393	RTV-90	47	25.0	26.1	*600/31.5	
		50	25.0	25.3	600/31.0	

* Photocell output exhibited "halo" effect at higher temperatures (>250°F).

APPENDIX A

Flash and Fire Test - Test D

Test Preparation Sheet No.: 3HYD-046(R)

TPS Short Title: Perform Flash and Fire Tests - Test D

Reason for Work: To determine compatibility of materials.

Item No.	Description
	NOTE: Extreme caution will be exercised when performing the following steps. Hydrogen gas may be present in system or hydrogen leaks may occur during testing.
	NOTE: This TPS is open ended, and will remain open until cancelled.
	NOTE: All personnel shall obtain Test Conductor's permission before changing any valve position status.
1.	Verify that TPS 3-DAS-066R has been completed and that DAS is ready.
2.	Verify with QA there are no constraints to testing.
3.	Verify TPS-3-HYD-044(R) (Daily Setup) is complete.
4.	Thoroughly clean all items in the manner specified:
	a. Glass, view port, chimney, sample container - water and scouring powder Type I. Rinse with water only and wipe dry.
	b. Quartz rod - Water, scouring powder Type I and a nylon brush; wipe dry.
	c. Cup support, pedestal, etc. - Water, scouring powder Type I, wire brush, steel wool; wipe dry.
	d. Tungsten spark gap points - Clean sufficiently with steel wool or an abrasive cloth to produce a shiny surface.
	NOTE: Spark gap points to have .004" radius at tip.

Item No.	Description
	CAUTION: Use no solvents nor soaps for cleaning operation.
5.	Mount flash and fire fixture on Stand 1 base.
6.	Connect thermocouple and verify operational by confirming ambient temperature of the day at DAS on H003T.
7.	Place sample in the crucible and mount crucible on stand inside chamber.
8.	Place glass chimney upon the crucible inside the chamber.
9.	Place the glass insulators over the electrode stands.
10.	Install the points (tungsten) and adjust the spark gap to 0.062 $\pm$ 0.010 inches.
11.	Adjust the crucible holding fixture such that the points are 0.750 $\pm$ 0.025 inches from the top of the sample.
12.	Place the heater over the base plate and secure.
13.	Place quartz rod seal in place in center of view port and adjust by positioning the seal tip directly over and approximately 1/4" above the spark gap.
14.	Install upper and lower Marmon clamps to connect view port and base plate to heater.
14a.	Cover top of fixture with heavy duty aluminum foil to exclude light.
15.	Connect heater leads to fixture.
	NOTE: Remove terminal covers from cables.
16.	Connect spark leads to fixture.
	NOTE: Remove terminal covers from cables.

Item No.	Description
17.	Remove union between stand pressure and vent flex hoses.
18.	Connect pressure and vent flex hoses to fixture.
19.	Torque per WS-10.
19a.	Perform Steps 44, 45, and 46.
20.	On C14-602, Bay 2 switch panel, turn on spark generator (switch ID. "S-GEN").
21.	On C14-608, Bay 1, place power switch OFF, and heater switch OFF.
22.	At the terminal room 2 equipment area, turn on circuit breaker 10 in panel "2 DCC."
23.	At the Building 328 J-box N60-5, verify that the spark generator and heater control units are connected to the a-c power outlets in this J-box bay. CAUTION: The spark plugs mounted on the bottom of the chamber have approximately 20,000 volts at the time of each spark.
24.	Turn spark generator on. Check for spark.
25.	At C14-602, bay 2 panel, turn spark generator switch S-GEN off.
26.	Again select the "auto" position on the spark generator.
27.	Open SV-2, pressurize fixture to 37 $\pm$ 5 psia as indicated on H-002P, then close SV-2. NOTE: SV-2 shall be cycled as required to stabilize fixture pressure for leak check.
28.	Perform leak check of fixture as follows: a. Record H-002P on log sheet. b. Wait five minutes.

Item No.	Description
	c. Record H-002P on log sheet.
	NOTE: Leak rate shall not exceed _____ psia per five minute period. If leak rate exceeds specification, perform following steps for repair. If leak rate is within tolerance allowed, proceed to Step 35 for test continuation.
29.	Determine location of leak.
30.	Verify closed SV-2.
31.	Open SV-3, vent fixture to minimum as indicated on H-002P, then close SV-3.
32.	Repair leak. Retorque as required per specification WS-10.
33.	Repeat Step 27 to pressurize fixture.
34.	Repeat Step 28 for fixture leak check.
35.	Verify closed SV-2.
35a.	Open SV-15 and SV-17 as required to vent system, then close SV-15 and SV-17.
35b.	Open SV-23 and adjust PR-1 to indicate approximately 15 $\pm$ 5 psig on G-34, then close SV-23.
36.	Open Building 328 for hydrogen testing. Disconnect electrical power to buildings and connect ground cables.
	NOTE: Test Conductor's option for all other testing.
37.	If hydrogen gas is to be test media, slowly open H_2 K-bottle outlet valve, and adjust regulator PR-40 for approximately 13 $\pm$ 5 psig as indicated on G-42.
38.	Place TS-302 in an amber condition and make appropriate announcement.
	NOTE: All personnel clear TS-302 area for testing.

Item No.	Description
38a.	Place Building 328 in a red condition.
39.	Open SV-3 and SV-2, purge for 2 minutes then close SV-2 and SV-3.
40.	Open or verify open SV-23 or SV-25, whichever is applicable. NOTE: Turn arm key on for SV-25 valve cycle.
40a.	Open SV-1, adjust PR-40 to indicate 25 ± 5 psia on H-002P, then close SV-1.
41.	Open SV-3 and SV-1; purge for 10 minutes, then close SV-3.
42.	When H-002P indicates 25 ± 2 psia, close SV-1. NOTE: Perform Step 48 10 ± 1 minutes after completion of Step 42.
43.	Close SV-23 or SV-25, and arm key off.
44.	Set up the Hughes Memo-Scope in the Building 300 control center as follows: a. Dual trace or wideband pre-amp plug is installed and check that channel selection corresponds to input cable termination. Select vertical sensitivity of one volt per division and d-c normal coupling (this may be varied later as test data dictates). b. Connect SYNC cable to SYNC input and select one millisecond normal sweep, with storage threshold at normal. Again, these controls may be varied to obtain suitable spark display. c. Confirm that the input cable H-001Y is connected to the Bristol bay 6 patch panel location "T/C Channels" input Channel 1. The SYNC PULSE is to be connected in the same area, channel 3. d. Turn on scope power and adjust controls as required to display spark signal during test.

Item No.	Description
45.	Confirm that Bristol 6 has been set up as follows: Channel 1 - 40% Cal - 37.5 div. (H002P) 30% Cal - 75.0 div. Channel 2 - 40% Cal = 45.0 div. (H003T) 80% Cal = 83.2 div. NOTE: Tolerance is ± 0.5 div. At Test Conductor's direction, start Bristol 6 at slow speed.
46.	If analog tape recorders are required for any runs, confirm that they are set up for recording per TPS 3-DAS-034(R), and that pretest calibrations have been recorded. NOTE: Start and stop analog recorders only at Test Conductor's direction following pretest calibration.
47.	Confirm that TV is operational (if required) and that screen display is satisfactory to the TC.
48.	On the C14-602, bay 2, place spark generator switch on and verify spark on oscilloscope.
49.	Adjust the vertical sensitivity and horizontal sweep on oscilloscope to display a spike of one or two vertical divisions each time the sparking apparatus is discharged. NOTE: The first two or three sparks are normally of much greater amplitude than after stabilization. It is best not to adjust the scope controls until at least five sparks have occurred. Amplitude adjustments may be made at the operator's discretion.
50.	Place heater and power switch in C14-608, bay 1, to ON. The heater-on lamp and pre-heat lamp should blink at approximately two-second intervals.
51.	Place heater start switch on.

Item No.	Description
	NOTE: The white pre-heat lamp should turn on and remain lighted for approximately 30 seconds. At this time, the white pre-heat lamp and green ready lamp should go out. The red running lamp should now light and remain on until completion of the test.
52.	Verify that Bristol 6 is operating and thermocouple (H003T) indicates temperature increase of 25°F/minute. Monitor increase during test. NOTE: The test can be terminated at any time by operating the Reset switch. The heater must be allowed to cool before beginning the test again if automatic heater control is required.
53.	Record flash point and fire point on attached log sheet. Annotate Bristol chart at these points: Flash point: The flash point is the lowest temperature at which the application of an electric spark causes the mixture of the flammable vapor emitted by the material sample and the test atmosphere to produce a sudden brief flash at the surface of the material. This flash will be detected electronically by an appreciable change in the amplitude and width of the spike displayed on the oscilloscope. Fire Point: The fire point is the lowest temperature at which the application of an electric spark causes the mixture of flammable vapor emitted by the material sample and the test atmosphere to produce a self-sustaining glow which exists for an appreciable length of time. NOTE: With more volatile materials, the flash point and fire point may occur simultaneously.
54.	If no fire occurs, continue the test until a temper- of 600 ± 10°F is indicated on H-003T and then terminate the test.
55.	Place the C14-608 Bay 1 heater switch to OFF position, and heater control power to OFF.

D

Item No.	Description
56.	On C14-602 console, bay 2, turn spark generator switch "S-GEN" to OFF.
57.	Turn Bristol 6 chart drive to OFF, down-load paper-annotating test number and date; and deliver to Test Conductor.
58.	Turn off Hughes Memo-Scope after last sequence of the day.
59.	At direction of Test Conductor, down-load magnetic tapes from analog recorders, if used, and deliver to Data Analysis with a copy of the time log, layout sheet, and reduction instructions.
60.	Purge test fixture as follows: a. Open SV-23. b. Open SV-3 and SV-1; purge for approximately two minutes; then close SV-23 and SV-1. c. Open SV-2, purge for approximately one minute, then close SV-2 and SV-3.
	FINAL PURGE
	NOTE: To be perfomred only after all testing is completed and when hydrogen is used as test media.
61.	Open SV-23.
62.	Open SV-3, SV-10, and SV-17.
63.	Open SV-1, SV-8, and SV-15; purge for approximately five minutes; then close SV-1, SV-8, and SV-15.
64.	Close SV-23.
65.	Open SV-2, SV-9, and SV-16; purge for approximately two minutes; then close SV-2, SV-9, and SV-16.
66.	Close SV-3, SV-10, and SV-17 when H-002P, H-004P, and H-007P indicate minimum.

Item No.	Description
	FINAL SHUTDOWN
67.	Place TS-302 in amber and make appropriate announcements.
68.	Close H_2 K-bottle valve if applicable.
69.	At Building 328 place spark generator switch OFF. Discharge fixture at spark plugs.
70.	Carefully disconnect stand pressure and vent flex hoses from fixture.
	NOTE: Test Conductor option.
71.	Connect pressure and vent flex hoses with a union.
	NOTE: Test Conductor option.
72.	Remove fiber optics from fixture.
73.	Disconnect thermocouple, heater leads, and spark leads from fixture.
	NOTE: Install terminal covers on leads.
	NOTE: Test Conductor option.
74.	Release hold-down clamps and remove heater and sample crucible.
	CAUTION: Use asbestos gloves while removing hot fixture components.
75.	Place sample crucible and sample material in a plastic bag and annotate with sample ID number and date.
76.	Record all test data on attached log sheet.
77.	Select auto or single fire mode on C14-602 console, bay 2, as required during set-up or testing.
	NOTE: Single fire mode to be used as backup for auto mode.

APPENDIX B

10 A

TPS No. 3 11 YD 01(V)

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-3075-A TEST # 10

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 36.6 +5 MIN 36.6

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 30.4

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

Expanded Sample material above cup.

Average heater rate 25.5°F/MIN.

G.E. Wilson 12/13/71

BY: G.E. Wilson

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-3071-A TEST # 11

MAT'L NAME TFE Teflon

TEST CONDITIONS: LEAK RATE = H-002P 37.2 +5 MIN 37.2

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.499

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.3

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

No change in sample.

Average heater rate 23.7 °F/MIN.

G. E. Wilson 12/13/71 BY: G. E. Wilson

Page 2 of
TPS No. 3-HYD-016(R)

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-2977-A TEST # 12

MAT'L NAME RTV Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 37.2 +5 MIN

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (26.0)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.6

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

No change in sample.

Average heater rate 20.8°F/MIN.

G. E. Wilson 12/13/71

BY: G. E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-2978-A TEST # 13

MAT'L NAME PRC Polyurethane

TEST CONDITIONS: LEAK RATE = H-002P 36.6 +5 MIN 36.6

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.501

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.9

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear Yellow TO Clear yellow

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - BRITTLE FLAKY (PLASTIC) OTHER

COLOR - Clear yellow

COMMENTS:

Sample expanded to cup size + bubbled.

Average heater rate 24.3 °F/MIN.

G. E. Wilson 12/13/71 BY: G. E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-3070-A TEST # 14

MAT'L NAME Viton A

TEST CONDITIONS: LEAK RATE = H-002P 36.3 +5 MIN 36.3

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.6

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

No change in sample.

Average heater rate 24.0 °F/MIN.

G. E. Wilson 12/13/71 BY: G E Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 1/7/72

WSTF I.D # 71-3072-A TEST # 15

MAT'L NAME TFE Teflon - 15% Glass

TEST CONDITIONS: LEAK RATE = H-002P 36.6 +5 MIN 36.6

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA. (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 28.5

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Redish Brown TO Redish Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Redish Brown

COMMENTS:

No sample changes

Average heater rate 23.1 °F/MIN.

G. E. Wilson 12/13/71 BY: G. E. Wilson 12/13/71

TPS No. 3-HYD-016(R)

FLASH AND FIRE TEST

DATE 1/10/72

WSTF I.D # 71-2992-A TEST # 16

MAT'L NAME FEP Teflon

TEST CONDITIONS: LEAK RATE = H-002P 36 +5 MIN 36

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.9

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear White TO Clear White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Clear White

COMMENTS:

No change in Sample.

Average heater rate 24.9°F/MIN.

G.E. Wilson 12/13/71

BY: G.E. Wilson

FLASH AND FIRE TEST

DATE 1/10/72

WSTF I.D # 71-3073-A TEST # 17

MAT'L NAME Polyethylene

TEST CONDITIONS: LEAK RATE = H-002P 36.9 +5 MIN 36.9

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.500

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 28.5

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - (BRITTLE) FLAKY PLASTIC OTHER

COLOR - White

COMMENTS: Sample expanded approximately double size.

Average heater rate 21.4° F/MIN.

G. E. Wilson 12/13/71 BY: G. E. Wilson [illegible] 12/13/71

FLASH AND FIRE TEST

DATE 1/10/72

WSTF I.D # 71-3074-A TEST # 18

MAT'L NAME Nylon

TEST CONDITIONS: LEAK RATE = H-002P 36.9 +5 MIN 36.9

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.6

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Whitish Yellow TO Whitish Yellow

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Whitish Yellow

COMMENTS:

Sample melted slightly.

Average heater rate 24.2° F/MIN.

G. E. Wilson 12/13/71 BY: G. E. Wilson

FLASH AND FIRE TEST

DATE 1/11/72

WSTF I.D # 71-3070-B

TEST # 19

MAT'L NAME Viton A

TEST CONDITIONS: LEAK RATE = H-002P 37.2 +5 MIN 37.2

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.7)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.503

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 31.6

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

No change in sample.

Average heating rate 24.0°F/MIN.

tape start 095132 stop 100140

G.E. Wilson 12/13/71

BY: G.E. Wilson 12/13/71

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TPS No. 3-11YD-016(R)

FLASH AND FIRE TEST

DATE 1/11/72

WSTF I.D # 71-2977-B TEST # 20

MAT'L NAME RTV Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 36.6 +5 MIN 36.6

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (26.0)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 30.2

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

No change in sample.

Average heating rate 21.8° F/MIN

Tape start 110729 Stop 111705

J.E. Wilson 12/13/71

BY: J E Wilson

J.E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/11/72

WSTF I.D # 71-2978-B TEST # 21

MAT'L NAME PRC Polyurathane

TEST CONDITIONS: LEAK RATE = H-002P 37.2 +5 MIN 37.2

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.1)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 30.2

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear Yellow TO Clear Yellow

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Clear yellow

COMMENTS:

Sample expanded + bubbled to shape of cup.

Average heating rate 24.5 °F/MIN.

Tape Start 130158 Stop 131102

G.E. Wilson 12/13/71

BY: G E Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 1/11/72

WSTF I.D # 71-[illegible] 3071-13 TEST # 22

MAT'L NAME TFE teflon

TEST CONDITIONS: LEAK RATE = H-002P 36.3 +5 MIN 36.3

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.3

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

No change in samples

average heating rate 21.5°F/MIN

Tape Start 140732 Stop 141714

S.E. Wilson 12/13/71

BY: S.E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/11/72

WSTF I.D # 71-3072-B TEST # 23

MAT'L NAME Teflon 15% Glass

TEST CONDITIONS: LEAK RATE = H-002P 37.5 +5 MIN 37.5

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.3

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Redish Brown TO Redish Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Redish Brown

COMMENTS:

No change in Sample.

Average heating rate 23.3°F/MIN.

Tape Start 150727 Stop 151737

G.E. Wilson 12/13/71

BY: G.E. Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 1/12/72

WSTF I.D # 71-3075-B TEST # 24

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 36.6 +5 MIN 36.3

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.1)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 30.4

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black | TO Brownish Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - BRITTLE FLAKY (PLASTIC) OTHER

COLOR - Brownish black.

COMMENTS:

Sample expanded larger than cup and bubbled.

Average heating rate 26.2 °F/MIN.

Tape Start 090636 Stop 091310

G.E. Wilson 12/13/71

BY: G.E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/12/72

WSTF I.D # 71-3073-B TEST # 25

MAT'L NAME Polyethylene

TEST CONDITIONS: LEAK RATE = H-002P 37.2 +5 MIN 36.9

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.1)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.500

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°F

FINAL PRESSURE (psia) 29.655

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

Sample melted slightly.

AVERAGE HEATING RATE = 24.1 °F/MIN

TAPE START 10:11:05, STOP 10:21:18

G.E. Wilson 12/13/71

BY: G E Wilson 12/13/71

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TPS No. 3-11YD-01(R)

FLASH AND FIRE TEST DATE 1/12/72

WSTF I.D # 71-2992-B TEST # 26

MAT'L NAME FEP teflon

TEST CONDITIONS: LEAK RATE = H-002P 36.0 +5 MIN 36.0

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.1)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.496

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear White TO Clear White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Clear White

COMMENTS:

No change in sample

Average heater rate 22.8 °F/MIN

Tape Start 111834 Stop 112853

G. E. Wilson 12/13/71 BY: G E Wilson

[illegible] 12/13/71

TPS No. 3 11 YP-016(R)

FLASH AND FIRE TEST

DATE 1/12/72

WSTF I.D # 71-3074--B TEST # 27

MAT'L NAME Nylon

TEST CONDITIONS: LEAK RATE = H-002P 37.7 +5 MIN 37.5

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA

SOAK TIME 10 MINUTES (25)

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 30

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

No change in sample.

Average heater rate 25 °F/MIN

Tape Start 130227 Stop 130743

G. E. Wilson 12/13/71 BY: G E Wilson 12/13/71

FLASH AND FIRE TEST

DATE 1/12/72

WSTF I.D # 71-3198-FA TEST # 28

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H-002P 36 +5 MIN 36

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25.5)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/8" x 3/4" = 2 parts

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 29.5

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear TO Clear

QUANTITY OF RESIDUE - NONE SMALL MODERATE ~~LARGE~~ GEN

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER Hard.

COLOR - Clear

COMMENTS: Sample expanded to shape of cup and bubbled.

Average heater rate 23.5°F/MIN.
Tape Start 140918 Stop 141915

G.E. Wilson 12/13/71

BY: G E Wilson

[illegible] 12/13/71

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TPS No. 3-11YD-096(R)

FLASH AND FIRE TEST

DATE 1/12/72

WSTF I.D # 71-3198-B TEST # 29

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H-002P 36 +5 MIN 36

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA

SOAK TIME 10 MINUTES (25.5)

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/8" x 3/4" = 2 parts

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 500°

FINAL PRESSURE (psia) 28

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear TO Clear

QUANTITY OF RESIDUE - NONE SMALL (MODERATE) LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY (PLASTIC) OTHER Hard

COLOR - Clear

COMMENTS:

Sample expanded + bubbled.

Average heater rate 23.4°F/MIN.
Tape Start 151510 Stop 152412
H.E. Wilson 12/13/71

BY: H.E. Wilson

[illegible] 12/13/71

TPS No. [illegible]

FLASH AND FIRE TEST

DATE 11/26/72

WSTF I.D # 71-3071-C TEST # 30

MAT'L NAME TFE Teflon

TEST CONDITIONS: LEAK RATE = H-002P 33.1 +5 MIN 33.1

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (26.2)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.502

FLASH POINT (°F) 500°

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 506°

FINAL PRESSURE (psia) 34 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

No Change in sample.

COLOR - White

COMMENTS:

Avg Heating Rate 23.9°F/min.

Tape on 142238 tape off 143235

G.R. Wilson 12/13/72 BY: G.R. Wilson

F

Page [illegible] of
TPS No. 3 [illegible]

FLASH AND FIRE TEST

DATE 3/1/72

WSTF I.D # 71-3071-D TEST # 31

MAT'L NAME ~~71-3071-D~~ TFE Teflon

TEST CONDITIONS: LEAK RATE = H-002P 30.49 +5 MIN 30.49

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.496

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°

FINAL PRESSURE (psia) 32PSIA.

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

No Sample change.

Average Heating Rate 24.1 F/Min.

Tape Start Tape Stop

[illegible] 12/13/71 BY: [illegible]

FLASH AND FIRE TEST

DATE 3/9/72

WSTF I.D # 71-2977-C TEST # 32

MAT'L NAME RTV-Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 20.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA

SOAK TIME 10 MINUTES (24.0)

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.508

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 28.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

No change in sample

Average heating rate 23.3° F/min.

G.E. Wilson 12/13/71

BY: G.E. Wilson 12/13/71

FLASH AND FIRE TEST

DATE 3/9/72

WSTF I.D # 71-2977-D TEST # 33

MAT'L NAME RTV-Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 30.4 +5 MIN 30.4

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (26.0)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

No change in sample

Average heating rate 23.14°F/min.

G.E. Wilson 12/13/71 BY: G.E. Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 3/9/72

WSTF I.D # 71-2978-C TEST # 34

MAT'L NAME PRC Polyurethane

TEST CONDITIONS: LEAK RATE = H-002P 30.4 +5 MIN 30.4

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear Yellow TO Orange

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - BRITTLE FLAKY (PLASTIC) OTHER

COLOR - Orange

COMMENTS:

Sample melted + bubbled.

Average heating rate 23.7°F/min.

G.E. Wilson 12/13/71 BY: G.E. Wilson

FLASH AND FIRE TEST

DATE 3/1/72

WSTF I.D # 71-2992-C

TEST # 35

MAT'L NAME FEP Teflon

TEST CONDITIONS: LEAK RATE = H-002P 30.4 +5 MIN

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.3)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 28.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO Clear

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER Hard

COLOR - Clear

COMMENTS:

Sample melted slightly.

Average heating rate ~~189°F/min~~ 22.89°F/min.

D.E. Wilson 12/13/71 BY: D.E. Wilson

FLASH AND FIRE TEST

DATE 3/10/72

WSTF I.D # 71-3070-C TEST # 36

MAT'L NAME Viton A

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (23.7)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.503

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

No change in sample.

average heating rate 24.9°F/Min.

G. E. Wilson 12/13/71 BY: G E Wilson [illegible] 12/13/71

FLASH AND FIRE TEST

DATE 3/10/72

WSTF I.D # 71-3075-C TEST # 37

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.503

FLASH POINT (°F) 580-595 °F

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600 °F

FINAL PRESSURE (psia) 33 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - (BRITTLE) FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

Sample resembles ash in consistency.

Average heating rate 22.2 °F/min.

G. E. Wilson 12/13/71 BY: G E Wilson [illegible]

FLASH AND FIRE TEST

DATE 3/10/72

WSTF I.D # 71-3075-D TEST # 38

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (26.0)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) 522° - 600° F

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 34.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black - Blackish Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - (BRITTLE) FLAKY PLASTIC OTHER

COLOR - Black - Blackish Brown.

COMMENTS:

Sample resembles ash in consistency

average heater rate 23.8°F/min.

Tape Start 131011 Tape Stop 131830

G. E. Wilson 12/13/71 BY: G E Wilson 12/13/71

FLASH AND FIRE TEST

DATE 3/10/72

WSTF I.D # 71-3072-C TEST # 39

MAT'L NAME TFE - Teflon - 15% Glass

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Reddish Brown TO Reddish Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Reddish Brown

COMMENTS:

No change in sample

Average heating rate 22.9 °F/min.

G. E. Wilson 12/13/71 BY: G E Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 3/10/72

WSTF I.D # 71-3073-C TEST # 40

MAT'L NAME Polyethylene

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (27.0)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) None

FIRE POINT (°F) None

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31.5

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - BRITTLE FLAKY (PLASTIC) OTHER Hard

Sample expanded + melted

COLOR - White

COMMENTS:

Average Heating rate 21.0 °F/min

G. E. Wilson 12/13/71 BY: G E Wilson

[illegible] 12/13/71

FLASH AND FIRE TEST

DATE 3/13/72

WSTF I.D # 71-3074-C TEST # 41

MAT'L NAME Nylon

TEST CONDITIONS: LEAK RATE = H-002P 3017 +5 MIN

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

Sample melted to shape of cup.

Average heating rate 23.85 °F/min.

G. E. Wilson 12/13/71 BY: G E Wilson 12/13/71

FLASH AND FIRE TEST

DATE 3/13/72

WSTF I.D # 71-3198-C TEST # 4-2

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H-002P 30.7 +5 MIN

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25.1)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4" 2 piece

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) 570° increase in spark intensity by 50%

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear TO Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Brown

COMMENTS:

Sample melted + bubbled.

Average heating rate 22.42° F/min.

G. E. Wilson 12/13/71 BY: G E Wilson 12/13/71

Page [illegible] of
TPS No. 3-11YD-016(R)

FLASH AND FIRE TEST

DATE 3/13/72

WSTF I.D # 71-3198-D EST # 43

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H [illegible]P 30.7 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (26.2)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4" 2 pieces

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) Spark intensity increased gradually during test by 180%.

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 33 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM ~~[illegible]~~ Clear TO Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Brown

COMMENTS:

Sample melted + bubbled.

Average heating rate 23.55 °F/Min.

Tape start 132731 Tape Stop 133520

G. E. Wilson 12/13/71

BY: G E Wilson

[illegible] 12/13/71

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TPS No. 3 HYD-041(R)

FLASH AND FIRE TEST

DATE 3/13/72

WSTF I.D # 71-3074-D

TEST # 44

MAT'L NAME Nylon

TEST CONDITIONS: LEAK RATE = H-002P 31.0 +5 MIN 30.7

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.8)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) _____

FIRE POINT (°F) _____

FINAL TEMPERATURE (°F) _____

FINAL PRESSURE (psia) _____

POST TEST OBSERVATIONS:

DISCOLORATION - FROM _____ TO _____

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - _____

COMMENTS: Test aborted, Spark generator failed to operate.

G. E. Wilson 12/13/71

BY: G. E. Wilson

3-HYD-046(R)

FLASH AND FIRE TEST DATE 3/16/72

WSTF I.D # 71-3072-D TEST # 45

MAT'L NAME TFE Teflon - 15% Glass

TEST CONDITIONS: LEAK RATE = H-002P 31.05 +5 MIN 31.05

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25.4)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.496

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°

FINAL PRESSURE (psia) 32 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Reddish Brown TO Reddish Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Reddish Brown

COMMENTS:

No change in sample,

Average heating rate 26.10 °/min

Tape Start 101636 Tape Stop 102430

G.E. Wilson 12/13/71 BY: G.E. Wilson

3-HYD-046(R)

FLASH AND FIRE TEST

DATE 3/16/72

WSTF I.D # 71-3074-E TEST # 46

MAT'L NAME Nylon

TEST CONDITIONS: LEAK RATE = H-002P 31.05 +5 MIN 31.05

ATMOSPHERE PURGE Helium PRESSURE 30 ±5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25.2)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4

SAMPLE WEIGHT (Grams) 0.502

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO Yellowish White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Yellowish White

COMMENTS:

Sample bubbled and expanded to cup size.

Average heating rate 22.95°F/min

Tape Start 112540 Tape Stop 113250

S.E. Wilson 12/15/71

BY: S.E. Wilson

3-HYD-046(R)

FLASH AND FIRE TEST DATE 3/16/72

WSTF I.D # TR-3393-A TEST # 47

MAT'L NAME Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 32 +5 MIN 32

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.497

FLASH POINT (°F) approx. 200 percent increase in spark during test

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600° F

FINAL PRESSURE (psia) 31.5 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

Sample did not change.

Average heating rate 26.11 °F/min.

G.E. Wilson 12/15/71 BY: G.E. Wilson

3-HYD-046(R)

FLASH AND FIRE TEST

DATE 3/16/72

WSTF I.D # 71-3198-F TEST # 48

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H-002P 33 +5 MIN 33

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4" 2 pieces

SAMPLE WEIGHT (Grams) 0.497

FLASH POINT (°F) 90% increase in spark during test.

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600° F

FINAL PRESSURE (psia) 29 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear TO Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Brown

COMMENTS:

Sample expanded and bubbled

Average heating 24.21 °F/min.

G.E. Wilson 12/13/71 BY: G.E. Wilson

FLASH AND FIRE TEST

FLD NO. 3-HYD-046(R)

DATE 3-16/72

WSTF I.D # 71-3075-E TEST # 49

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 33 +5 MIN 33

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (25 PSIA)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.496

FLASH POINT (°F) 550° spark increased 100% to completion of test

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600° F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

Sample expanded + bubbled.

Average heating rate 22.31 °F/min.

G.E. Wilson 12/13/71

BY: G.E. Wilson

3-HYD-046 (R)

FLASH AND FIRE TEST DATE 3/17/72

WSTF I.D # 72-3393-B TEST # 50

MAT'L NAME Silicone Rubber

TEST CONDITIONS: LEAK RATE = H-002P 3210 +5 MIN 3210

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (25)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.504

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Red TO Red

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Red

COMMENTS:

Sample did not change.

Average heating rate 25.35°F/min

Tape Start 095551 Tape Stop 100417

G.E. Wilson 12/15/71

BY: GE Wilson

3-HYD-046(R)

FLASH AND FIRE TEST

DATE 3/17/72

WSTF I.D # 71-3075-F TEST # 51

MAT'L NAME PVC

TEST CONDITIONS: LEAK RATE = H-002P 3210 +5 MIN 3210

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (26)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) 550° spark increased 100% to completion of test.

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 32 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE (LARGE)

CONSISTENCY OF RESIDUE - (BRITTLE) FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS:

Sample expanded & bubbled.

Average heating rate 23.05 °F/min.

Tape start 105700 tape Stop 110640

G.E. Wilson 12/13/71

BY: G E Wilson

3-HYD-046(R)

FLASH AND FIRE TEST DATE 3/17/72

WSTF I.D # 71-2978-D TEST # 52

MAT'L NAME PRC Polyurethane

TEST CONDITIONS: LEAK RATE = H-002P 32.0 +5 MIN 32.0

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) None

FIRE POINT (°F) None

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear Yellow TO Yellow

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Yellow

COMMENTS:

Sample melted + bubbled.

Average heating rate 22.9 °F/min.

[illegible] 12/[illegible] BY: [illegible] Wilson

3- HYD-046(R)

FLASH AND FIRE TEST

DATE 3/17/72

WSTF I.D # 71-3198-F TEST # 53

MAT'L NAME Cellulose Acetate Butyrate

TEST CONDITIONS: LEAK RATE = H-002P 32.10 +5 MIN 32.0

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Helium PRESSURE 25 ± 2 PSIA (24.5)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.500

FLASH POINT (°F) 470° sparks increased 80% during duration test

FIRE POINT (°F) None

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 29 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Clear TO Brown

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Brown

COMMENTS:

Sample expanded + bubbled.

Average heating rate 23.52 °F/min.

Tape Start 140600 Tape Stop 141315

J.E. Wilson 12/13/71 BY: JE Wilson

3-HYD-046(R)

FLASH AND FIRE TEST DATE 3/17/72

WSTF I.D # 71-3070-D TEST # 54

MAT'L NAME Viton A

TEST CONDITIONS: LEAK RATE = H-002P 3210 +5 MIN 3210

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24 PSIA)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.505

FLASH POINT (°F) None

FIRE POINT (°F) None

FINAL TEMPERATURE (°F) 600° F

FINAL PRESSURE (psia) 29 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM Black TO Black

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Black

COMMENTS: Sample did not change.

average heating rate 21.8 °F/min.

Tape start 15 11 22 Tape Stop 15 19 10

BY: G. Wilson

3-HYD-046(R)

FLASH AND FIRE TEST

DATE 3/20/72

WSTF I.D # 71-2992-D TEST # 55

MAT'L NAME FEP Teflon

TEST CONDITIONS: LEAK RATE = H-002P 31.6 +5 MIN 31.6

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24.5)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.498

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 31 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM ~~Clear~~ White TO Clear

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - Clear

COMMENTS:

Sample melted slightly.

average heating rate 24.9 °F/min

Tape start 092809 Tape Stop 093456

G.E. Wilson 12/15/71

BY: G.E. Wilson

3-HYD-096(R)

FLASH AND FIRE TEST

DATE 3/20/72

WSTF I.D # 71-3073-D TEST # 56

MAT'L NAME Polyethylene

TEST CONDITIONS: LEAK RATE = H-002P 32.0 +5 MIN 32.0

ATMOSPHERE PURGE Helium PRESSURE 30 ± 5 PSIG

ATMOSPHERE TEST Hydrogen PRESSURE 25 ± 2 PSIA (24)

SOAK TIME 10 MINUTES

TEST SAMPLE DESCRIPTION:

SAMPLE SIZE LXWXH (In.) 1/4" x 1/4" x 1/4"

SAMPLE WEIGHT (Grams) 0.495

FLASH POINT (°F) NONE

FIRE POINT (°F) NONE

FINAL TEMPERATURE (°F) 600°F

FINAL PRESSURE (psia) 30 PSIA

POST TEST OBSERVATIONS:

DISCOLORATION - FROM White TO White

QUANTITY OF RESIDUE - NONE SMALL MODERATE LARGE

CONSISTENCY OF RESIDUE - BRITTLE FLAKY PLASTIC OTHER

COLOR - White

COMMENTS:

Sample melted & expanded

Average heating rate 22.95 °F/min.

Tape Start 104445 Tape Stop 105240

G.E. Wilson 12/[illegible]

BY: G.E. Wilson