

**TITLE: STANDARD TEST PROCEDURE (STP) FOR CONDUCTING THE  
TEMPERATURE-PRESSURE SPRAY IGNITION TEST USED FOR THE  
APPROVAL OF FIRE-RESISTANT HYDRAULIC FLUIDS**

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## **1.0 PURPOSE**

- 1.1. This document establishes MSHA's Standard Test Procedure (STP) for Conducting the Temperature-pressure Spray Ignition Test Used for the Approval of Fire-resistant Hydraulic Fluids.
- 1.2. The purpose of the test is to force hydraulic fluid heated to 150°F ( $\pm 5$ F) and at 150 psi through an atomizing nozzle to produce a spray. The spray is then subjected to three different ignition sources for 1 minute each at 18", 24" and 36" from the spray nozzle.

## **2.0 SCOPE**

This document applies to all applications for MSHA approval of Fire-resistant Hydraulic Fluids (FRHF) and audits of involving MSHA approved FRHFs.

## **3.0 REFERENCES**

- 3.1. This document supersedes CDS document ASTP4013 (undated).
- 3.2. 30 CFR, Part 35, Subpart A & B

## **4.0 DEFINITIONS**

Fire-resistant hydraulic fluid - means a fluid of such chemical composition and physical characteristics that it will resist the propagation of flame.

## **5.0 TEST EQUIPMENT**

- 5.1. The equipment used to conduct the temperature-pressure spray ignition test consists of the following components: a pumping unit, a spray gallery, three ignition devices and a stopwatch (see Photos in Appendix).

### **5.1.1. The Pumping Unit**

- 5.1.1.1. The pumping unit consists of a 5-gallon reservoir with a 1 HP electric motor gear driven pump attached. The pumping unit is equipped with the necessary hoses and valves to direct the hydraulic fluid through an adjustable pressure regulator that is set at 150 psi for spraying.

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- 5.1.1.2. A 110-Volt immersion heater controlled by a solid state electronic SCR power controller and driver capable of maintaining the fluid at 150°F ± the spray nozzle.
- 5.1.1.3. A 110-Volt solenoid valve, normally closed, actuated by an electric timer capable of a 0-60 sec. operation.
- 5.1.1.4. An atomizing round-spray nozzle having a discharge orifice of 0.012" diameter and capable of discharging 3.28 gallons of water per hour at an angle of 90° and at a pressure of 150 psi. The spray nozzle is mounted on the wall of the spray gallery.
- 5.1.1.5. A thermocouple connection with a digital display and a 0-300 psi pressure gauge mounted on the spray gallery near the nozzle to constantly monitor the temperature and pressure of the spray (150°F and 150 psi).
- 5.1.1.6. A hydraulic hose and 3-way valve located near the solenoid to direct the fluid from the spray position to the recirculate position. In the recirculate position the fluid is continuously cycled from the reservoir to the nozzle valve and back to the reservoir tank to reheat.

#### 5.1.2. **The Spray Gallery**

- 5.1.2.1. The spray gallery consists of a stainless steel sink (3" wide, 5' long and 6" deep) mounted on adjustable legs for drainage. The stainless steel sink is marked at 18", 24", and 36" from the tip of the nozzle in order to assist in the placement of each ignition device (kerosene trough, propane torch, and arching device) during the test.
- 5.1.2.2. The stainless steel hood is 3'6" wide and 6'6" long with a 6" facade that tapers to a 12" diameter exhaust duct.
- 5.1.2.3. The exhaust fan is a 1 HP 2,000 rpm backward type centrifugal fan capable of 2,200 CFM air flow at 1" SP and is mounted on the roof.

#### 5.1.3. **The Ignition Devices**

- 5.1.3.1. A propane torch (Benzomatic or equivalent) attached to a 14.1 oz. propane cylinder. The tip of the torch has a ½" I.D. blow-torch head

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that produces a 5" long outer blue flame and a 1" long inner light blue flame when the gas valve is fully opened.

5.1.3.2. An arcing device in which a continuous arc is produced by a 12,000 volt transformer across a 1/2" gap in the electrodes.

5.1.3.3. The metal trough is 20" long, 2" wide, and 2" deep and has a hinged lid. The trough is filled with cotton waste and soaked with approximately 50 ml of kerosene which when ignited will produce a flame 4-6" in height along the width of the trough during the test.

**5.1.4. The Timer**

5.1.4.1. A stopwatch to measure the length of burn time, if any, of the sprayed hydraulic fluid.

**6.0 TEST SAMPLES**

See Section 7.0 of this Procedure.

**7.0 PROCEDURES**

7.1. Prior to beginning the test the investigator should complete the appropriate information on the Temperature Pressure Spray Ignition Test Sheet (see Figure 1).

7.2. The hydraulic fluid to be tested is poured into the reservoir, the valves positioned to recirculate the fluid from the reservoir to the nozzle valve and back to the reservoir tank. The pump and the heater should be set at 150°F and turned on. When the fluid has reached 150°F, one of the ignition devices is placed in the sink at the 18" mark. The exhaust fan should be turned on and the valves set to direct the spray to the nozzle.

7.3. The timer can then be activated for a 60-second spray at the 18" mark. Usually one or two 60-second sprays with no ignition devices are performed prior to the testing in order to clean the hydraulic hose lines and to allow the temperature to equilibrate.

7.4. After a 60-second spray with each ignition device at the 18" mark, the valves are repositioned in order to recirculate the fluid back into the reservoir tank.

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Using this testing sequence the test is then repeated at the 24" and 36" marks with each of the ignition devices in the spray for 60-seconds.

#### 7.5. Maintenance

7.5.1. After test completion, the pump unit, spray gallery, and ignition devices must be drained and cleaned. Cleaning and draining the pump system after each test will reduce maintenance costs and down time.

#### 7.6. Test Modifications

7.6.1. Since all possible materials / products, compositions, physical properties, and applicable methods cannot be foreseen, MSHA reserves the right to modify the above test procedures.

### 8.0 TEST DATA

See Section 9.0 of this Procedure.

### 9.0 PASS/FAIL CRITERIA

The pass/fail test criteria as defined by 30 CFR, Subpart B, Section 35.21 states:

"If the test procedures do not result in an ignition of any sample of fluid or if an ignition of a sample does not result in flame propagation for a time interval not exceeding 6 seconds at a distance of 18" or more from the nozzle tip to the center of each ignition device, the fluid will be considered fire-resistant according to the test requirements of this section."

Record the "Pass" or "Fail" tests results on the Temperature Pressure Spray Ignition Test Sheet (see Figure 1).

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Temperature Pressure Spray Ignition Test Sheet

<b>Temperature Pressure Spray Flammability Test: 30 CFR, Part 35, Section 35.21</b>						
PAR (or MSRS):						
Company:			Approval No.			
Trade Name:			Water Content			
Hydraulic Fluid Type:			Pressure (p.s.i.)			
Tested By:			Pump Unit			
Date:			Nozzel			
Pass/Fail Results						
Ignition Source	Nozzel Temp.	Distance from nozzel	Ignition yes/no	Propagation yes/no	Burn Time (seconds)	
Open Flame		18"				
Open Flame		24"				
Open Flame		36"				
Electric Arc		18"				
Electric Arc		24"				
Electric Arc		36"				
Propane Torch		18"				
Propane Torch		24"				
Propane Torch		36"				
<b>Maximum Burning Time Allowed: 6 seconds</b>						

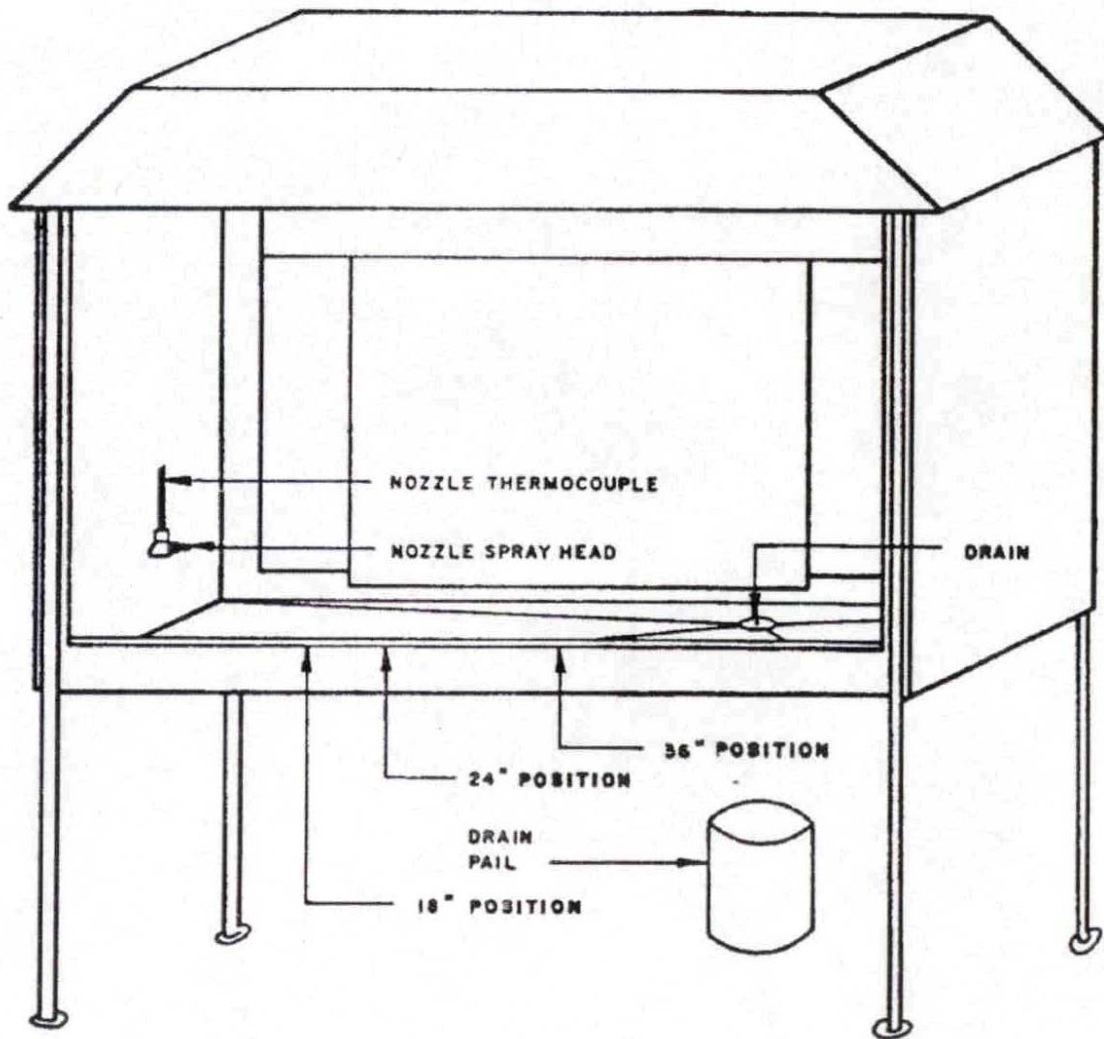
Figure 1

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Appendix



Drawing of Spray Gallery

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Appendix

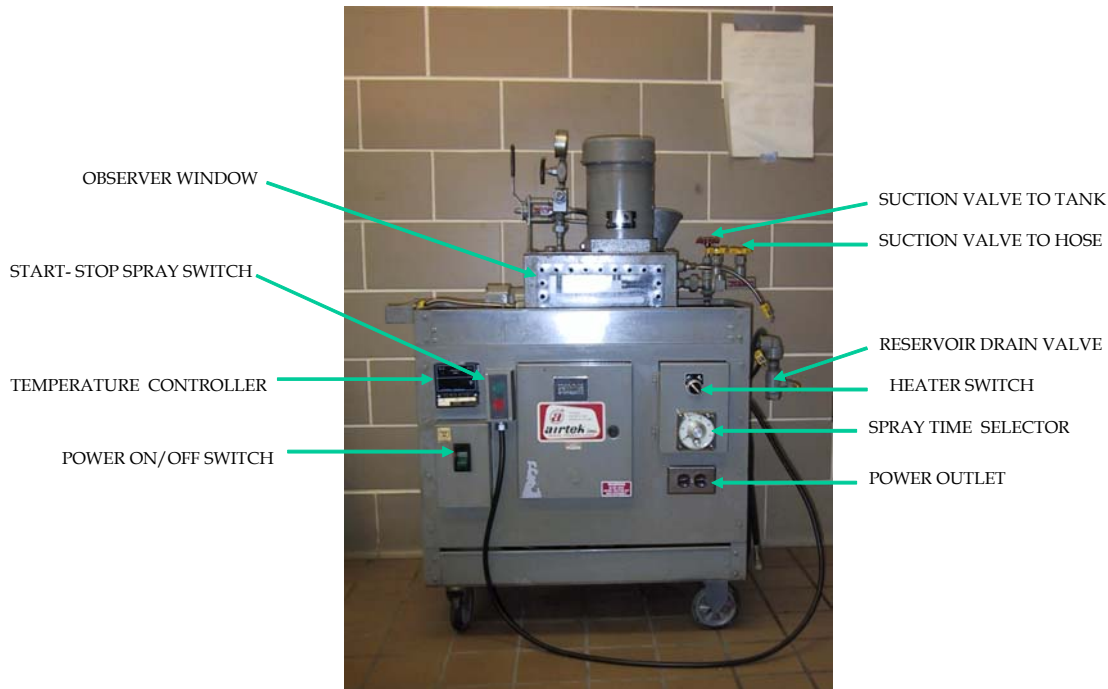


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Appendix

# Spray Unit 3 (front)





Appendix

# Spray Unit 3 Setup



FRONT VIEW OF SETUP



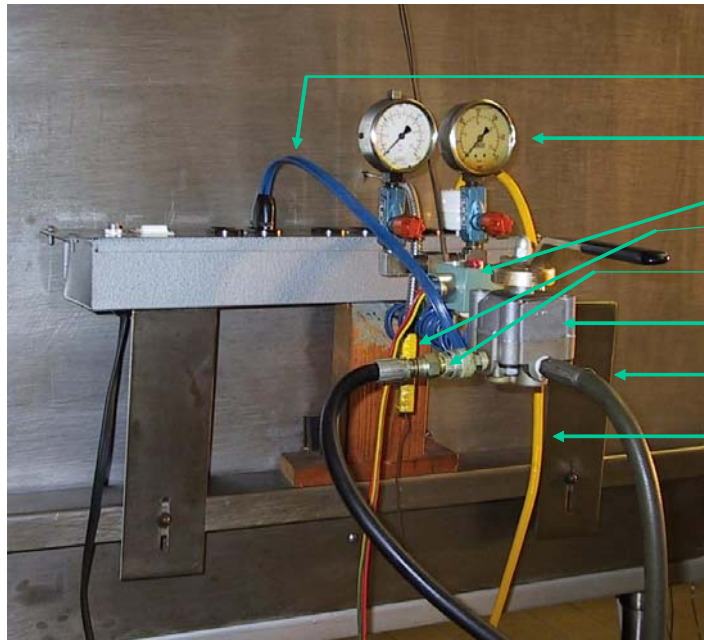
BACK VIEW OF SETUP

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# Test Gallery Connections



HEATER TAPE POWER CORD

PRESSURE GAUGES  
SOLENOID VALVE

NOZZLE THERMOCOUPLE PLUG CONNECTION

SRAY UNIT CONNECTION

RECIRCULATING VALVE

RECIRCULATING HOSE

SOLENOID VALVE POWER CORD

RECIRCULATING VALVE POSITIONS

SPRAY

OFF

RECIRCULATE

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# Spray Unit 3 (left side)

