



National Institute for Occupational Safety and Health
National Personal Protective Technology Laboratory
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Procedure No. TEB-APR-STP-0417-CBRN	Revision: 0.0	Date: 26 August 2011
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DETERMINATION OF FLAMMABILITY AND HEAT RESISTANCE,
CBRN AIR-PURIFYING ESCAPE RESPIRATORS, STANDARD
TESTING PROCEDURE (STP)

1. PURPOSE

This test establishes the procedure for ensuring that the level of protection provided by the *Determination of CBRN Flammability And Heat Resistance, Escape Respirators Standard Testing Procedure* submitted for Approval, Extension of Approval, or examined during Certified Product Audits meet the certification requirements set forth in *42 CFR Part 84, Subpart G, Section 84.63(a)(c)(d)*; Volume 60, Number 110, June 8, 1995 and the *Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Air- Purifying Escape Respirator* Dated September 30, 2003, or *Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Self-Contained Escape Respirator* Dated September 30, 2003

2. GENERAL

This STP describes the *Determination of CBRN Flammability and Heat Resistance, Escape Respirators Standard Testing Procedure* in sufficient detail that a person knowledgeable in the appropriate technical field can select equipment with the necessary resolution, conduct the test and determine whether the product passes the test.

3. EQUIPMENT/MATERIAL

The list of necessary test equipment and materials follows:

- 3.1. Flammability test rig. INSPEC International Ltd.
- 3.2. Propane tank
- 3.3. Stopwatch
- 3.4. Mineral insulated thermocouple probe, 1.5 mm diameter
- 3.5. Measuring device for length

Approvals: First Level	Second Level	Third Level	Fourth Level

4. TESTING REQUIREMENTS AND CONDITIONS

- 4.1. This test procedure is only valid if the respirator system has first completed NIOSH Standard Test Procedure entitled *Durability Conditioning Process For Environmental, Transportation And Rough Handling Use Conditions On Chemical Biological Radiological Nuclear (CBRN) Respiratory (RPD) Standard Conditioning Procedure (SCP)*, CET-APRS-STP-CBRN-311.
- 4.2. All measuring equipment must be in calibration during testing. Calibration shall be performed using a method traceable to the National Institute of Standards and Technology (NIST).
- 4.3. Any laboratory using this procedure to supply certification test data to NIOSH will be subject to the provisions of the NIOSH Supplier Qualification Program (SQP). This program is based on the tenets of *ISO/IEC 17025, the NIOSH Manual of Analytical Methods* and other NIOSH guidelines. An initial complete quality system audit and follow on audits are requirements of the program. Additional details of the Program and its requirements can be obtained directly from the Institute.
- 4.4. Precision and accuracy (P&A) must be determined for each instrument in accordance with laboratory procedures and NIOSH/NPPTL guidance. Sound practice requires, under *NIOSH Manual of Analytical Methods*, demonstrating a tolerance range of expected data performance of a plus or minus 25% of a 95% confidence interval of the stated standard requirement. NIOSH/NPPTL P&A tolerance can be higher but not lower.
- 4.5. Compressed gas cylinders must meet all applicable Department of Transportation requirements for cylinder approval as well as retesting / requalification.
- 4.6. Normal laboratory safety practices must be observed. This includes safety precautions described in the current NIOSH Pittsburgh Health and Safety Program.
 - 4.6.1. Safety glasses and lab coats must be worn at all times.
 - 4.6.2. Workbenches must be maintained free of clutter and non-essential test equipment.
- 4.7. A class ABC fire extinguisher must be present inside the room when flame testing is to be performed.
- 4.8. **Please refer to Material Safety Data Sheets and the NIOSH Health and Safety Manual for the proper protection and care in handling, storing, and disposing of the chemicals and gases used in this procedure.**

5. PROCEDURE

- 5.1. Fit the respirator to the headform on the flammability test rig.
- 5.2. Adjust the headform rotation speed to a linear speed of 60 ± 5 mm/sec, measured at the

flame position.

- 5.2.1. Choose the one burner that will be used for this test.
- 5.2.2. Linear speed is adjusted using the variable motor speed control.
- 5.2.3. Start the rotation of the headform and time one complete revolution.
- 5.2.4. Use table 1 and appropriate burner to establish that the correct linear speed is set.

		Linear Speed (cm/sec)	Time for one complete Revolution (sec)			
			Burner Number (see figure 1)			
			1	2 or 6	3 or 5	4
Acceptable Speed Range	Max	6.5	40.6	39.4	34.0	28.8
	Target	6.0	44.0	42.7	36.9	31.2
	Min	5.5	48.0	46.6	40.2	34.0

Table 1 – Flame Test Speed Calibration

- 5.3. Adjust the headform until the distance between the top of the burner and the lowest part of the facepiece which is to pass through the flame is 20 ± 5 mm. Rotate the headform away from the flame area.
- 5.4. Close the air vent on the burner. Turn on the propane cylinder and adjust the pressure reducer to approximately 2 psi. Light the flame and adjust the flow control valve to give a flame height of 40 ± 4 mm above the burner top.
- 5.5. Place the tip of the thermocouple probe at a point 20 ± 2 mm above the flame tip. The flame temperature shall be 800 ± 50 °C. If the flame temperature does not fall in the specification adjust the pressure reducer to 2.1 psi.
- 5.6. Have a stopwatch ready to time any flame that develops.
- 5.7. Rotate the headform and begin the test. The component or material being tested shall pass through the flame only once.
- 5.8. Repeat the test until all components and materials on the exterior of the system have been tested.

6. PASS/FAIL CRITERIA

- 6.1. The criterion for passing this test is set forth in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d).
- 6.2. This test establishes the standard procedure for ensuring that:

84.63 Test requirements; general.

- (a) Each respirator and respirator component shall when tested by the applicant and by the Institute, meet the applicable requirements set forth in subparts H through L of this part.
- (b) In addition to the minimum requirements set forth in subparts H through L of this part, the Institute reserves the right to require, as a further condition of approval, any additional requirements deemed necessary to establish the quality, effectiveness, and safety of any respirator used as protection against hazardous atmospheres.
- (c) Where it is determined after receipt of an application that additional requirements will be required for approval, the Institute will notify the applicant in writing of these additional requirements, and necessary examinations, inspections, or tests, stating generally the reasons for such requirements, examinations, inspections, or tests.

6.3. Three complete escape systems will be evaluated. The test will be repeated until all components and materials on the exterior of the system are tested. No components shall be tested more than once.

6.4. For the escape respirator no component of the respirator shall have an after- flame greater than 5seconds.

6.5. No component of the escape respirator shall drip, melt, or develop a visible hole.

7. RECORDS/TEST SHEETS

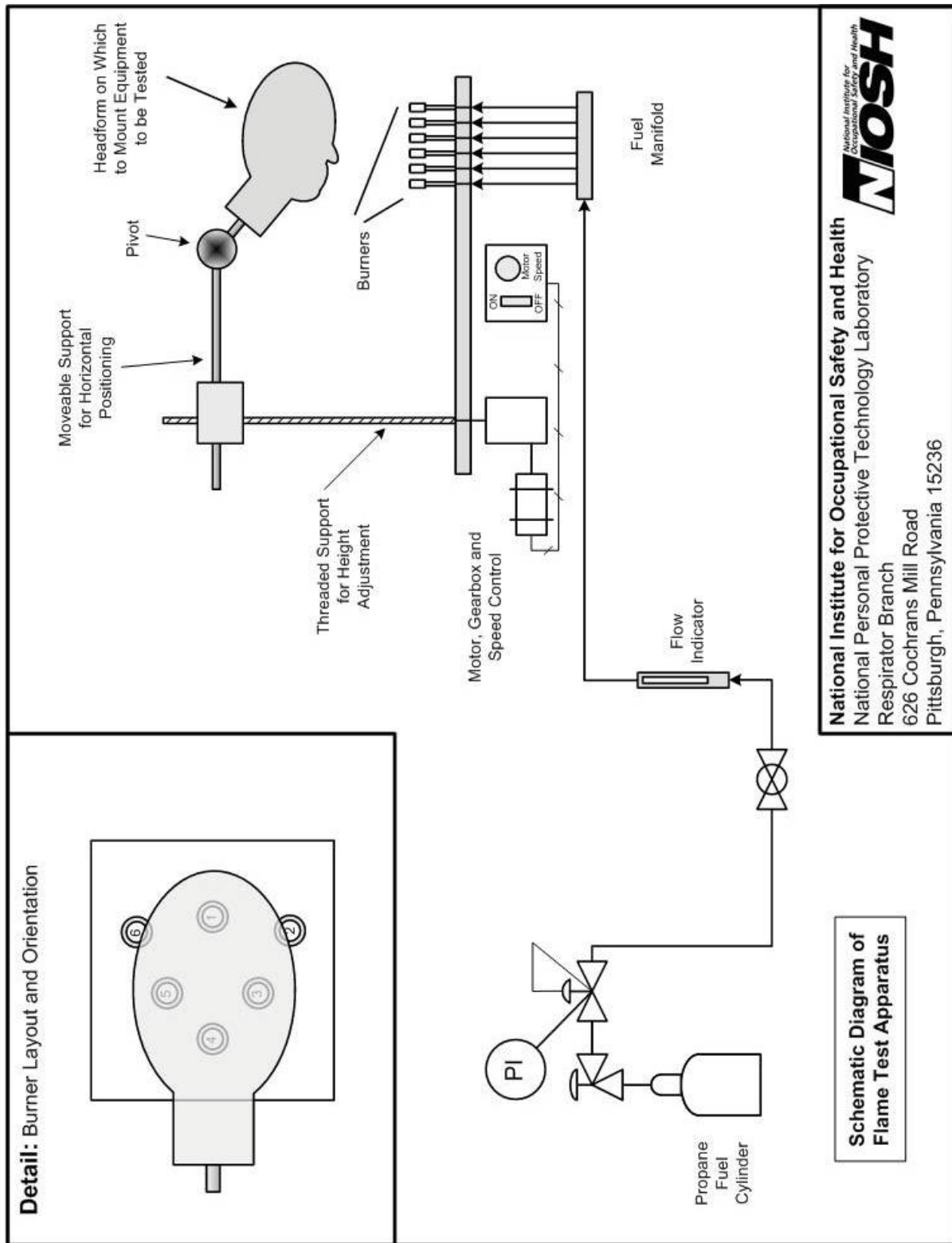
7.1. Record the test data in a format that shall be stored and retrievable.

8. ATTACHMENTS

8.1. Figure 1 – Schematic diagram of flame test apparatus

8.2. Worksheet 1 – Flame Test Data Sheet

Attachment 8.1: Figure 1 - Schematic diagram of flame test apparatus



Attachment 8.2: Worksheet 1- Flame Test Data Sheet

Flame Test Data Sheet
TEB-CBRN-STP-0417-CBRN

Task Number: _____ Company: _____

Description: _____

Test Date: _____ Test Time: _____ Respirator # _____

Burner #	Time of one revolution (sec)	Temperature of flame (°C)	
List component / material tested		Results (holes, melted, flame w/time, exc.)	

Test Date: _____ Test Time: _____ Respirator # _____

Burner #	Time of one revolution (sec)	Temperature of flame (°C)	
List component / material tested		Results (holes, melted, flame w/time, exc.)	

Test Date: _____ Test Time: _____ Respirator # _____

Burner #	Time of one revolution (sec)	Temperature of flame (°C)	
List component / material tested		Results (holes, melted, flame w/time, exc.)	

Test Operator _____

Revision History

Revision	Date	Reason for Revision
0.0	26 August 2011	New document