

# PPE CASE



## *Personal Protective Equipment Conformity Assessment Studies and Evaluations*

### **Evaluation of a Self-Contained Breathing Apparatus for Potential Contribution to a Fatal Event in the Fire Service**

Valley Springs, South Dakota Fire Department  
Request for Dräger ND2 PSS100 Unit

As part of the **National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program**, the National Personal Protective Technology Laboratory (NPPTL) agreed to examine and evaluate a self-contained breathing apparatus (SCBA) identified as a Dräger ND2 PSS100 30 minute, 2216 psi unit.

This SCBA status investigation was assigned NIOSH Task Number 20855. The Valley Springs Fire Department and the NIOSH Division of Safety Research (DSR) were advised that NPPTL would provide a written report of the inspection and any applicable test results.

The SCBA unit was sealed as delivered to DSR at the NIOSH facility in Morgantown, WV on April 29, 2016. The unit was transported to Lab H1513, for secured storage. The SCBA unit was removed from secured storage for inspection on July 5, 2016 and was placed back into secured storage until the day of performance testing on July 7, 2016.

*NIOSH evaluated an SCBA used by a fire fighter involved in a fatal event. The SCBA was not found to contribute to the fatality. A qualified service technician must inspect, repair, test, clean, and replace damaged components of any SCBA involved in an incident before it may be returned to service.*

## Disclaimer

The purpose of Respirator Status Investigations is to determine the conformance of each respirator to the NIOSH approval requirements found in Title 42, *Code of Federal Regulations*, Part 84. A number of performance tests are selected from the complete list of Part 84 requirements and each respirator is tested in its “**as received**” condition to determine its conformance to those performance requirements. Each respirator is also inspected to determine its conformance to the quality assurance documentation on file at NIOSH.

In order to gain additional information about its overall performance, each respirator may also be subjected to other recognized test parameters, such as National Fire Protection Association (NFPA) consensus standards. While the test results give an indication of the respirator’s conformance to the NFPA approval requirements, NIOSH does not actively correlate the test results from its NFPA test equipment with those of certification organizations which list NFPA-compliant products. Thus, the NFPA test results are provided for information purposes only.

Selected tests are conducted only after it has been determined that each respirator is in a condition that is safe to be pressurized, handled, and tested. Respirators whose condition has deteriorated to the point where the health and safety of NIOSH personnel and/or property is at risk will not be tested.

# NIOSH Task Number 20855

## Investigator Information

The SCBA performance tests were conducted by Jeremy Gouzd, Karis Kline, Angie Andrews, and Jay Tarley of the Morgantown Testing Team (MTT), Evaluation and Testing Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Morgantown, West Virginia.

## SCBA Inspection

The unit was removed from its packaging in Lab H1513 and inspected on July 5, 2016 by Jay Tarley, Karis Kline, Angie Andrews, and Jeremy Gouzd of the MTT at NPPTL. The unit was identified as a Dräger ND2 PSS100 30 minute, 2216 psi unit with NIOSH Approval Number TC-13F-512CBRN and as the unit submitted by the NIOSH Division of Safety Research for the Valley Springs Fire Department. The SCBA unit was visually examined, component by component, in the condition received to determine the conformance of the unit to the NIOSH-approved configuration. The visual inspection process was documented by photographs. Once the inspection was completed the SCBA unit was repackaged and placed back in the secured storage.

The complete SCBA inspection is summarized in **Appendix I**. Photos of the SCBA components are included in **Appendix III**.

## SCBA Testing

The purpose of the testing was to determine conformance of the SCBA to the approval performance requirements of Title 42, *Code of Federal Regulations*, Part 84 (42 CFR 84). Further testing was conducted to provide an indication of the conformance to the National Fire Protection Association (NFPA) Air Flow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 Edition.

**NIOSH SCBA Certification Tests** (in accordance with the performance requirements of 42 CFR Part 84):

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]
6. Remaining Service Life Indicator Test (low air alarm) [§ 84.83(f)]

**National Fire Protection Association (NFPA) Tests** (in accordance with NFPA 1981, 1997 Edition):

7. Airflow Performance Test [Chapter 5, 5.1.1]

**Appendix II** contains the complete NIOSH test report for the SCBA. **Tables ONE and TWO** summarize the NIOSH and NFPA test results.

## Summary and Conclusions

The SCBA unit was submitted to NIOSH NPPTL by the Valley Springs Fire Department for evaluation. The SCBA unit was delivered to NIOSH on April 29, 2016 and extensively inspected on July 5, 2016. The unit was identified as a Dräger ND2 PSS100 30 minute, 2216 psi unit with NIOSH Approval Number TC-13F-512CBRN. The unit worn by the victim was provided with its corresponding cylinder and facepiece which were used for all testing. The unit suffered some heat damage and was in overall poor condition. Burns were found on all of the straps, the pressure reducer, and the console. The hose leading to the PASS was burned through the rubber casing, exposing the inner liner. The facepiece lens was burned and melted.

In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. The SCBA unit was returned to secured storage pending return to the Valley Springs Fire Department.

If the unit is to be placed back in service, the SCBA must be repaired, tested, cleaned and any damaged components replaced and inspected by a qualified service technician, including testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer. A flow test is required on an annual basis, at a minimum.

## Actions to be taken by the Fire Departments with SCBAs Involved in an Incident

- Any SCBA unit involved in an incident should not be placed back in service until the SCBA has been repaired, tested, cleaned, and any damaged components replaced and inspected by a qualified service technician, including such testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer.
- For all SCBA units, even those not involved in an incident, must undergo a flow test on at least an annual basis.

## **Actions the PPE Users, Selectors, and Purchasers May Take to Further Protect Themselves and Others from Hazards**

- Sign up for NPPTL’s Listserv at <http://www.cdc.gov/niosh/npptl/> to receive email notifications relevant to PPE.

For more information related to personal protective equipment, visit the [NIOSH NPPTL website](http://www.cdc.gov/niosh/npptl/) [www.cdc.gov/niosh/npptl](http://www.cdc.gov/niosh/npptl/)

To receive documents or other information about occupational safety and health topics, contact NIOSH:

Telephone: 1–800–CDC–INFO (1–800–232–4636)

TTY: 1–888–232–6348

CDC INFO: [www.cdc.gov/info](http://www.cdc.gov/info)

Or visit the NIOSH website at [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting [www.cdc.gov/niosh/eNews](http://www.cdc.gov/niosh/eNews)

# Appendix I

## SCBA Inspection Report



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

## Respirator Field Problem Incoming Inspection Report Summary

<b>Task Number:</b> TN-20855	<b>Requestor:</b> Valley Springs Fire Department
<b>Date Received:</b> April 29, 2016	
<b>Date Inspected:</b> July 5, 2016	<b>Description:</b> Fatality
<b>Manufacturer:</b> Dräger	<b>Inspected by:</b> Jay Tarley, Jeremy Gouzd, Karis Kline
<b>Approval Number:</b> TC-3ALM 153 Luxfer	<b>SCBA Type:</b> Open-Circuit, Pressure-Demand

The SCBA was received in a cardboard box (refer to **Figures 1-4** in **Appendix III**).

Contact Agency: Valley Springs Fire Department

**As received:** (refer to **Figures 5-6** in **Appendix III**)

- An empty cylinder was included with the valve slightly open.
- Bypass was open.
- Facepiece was included in same bag as unit.
- Mask mounted regulator (MMR) was locked into facepiece, but unattached from the unit at Quick Disconnect.

### **Components and Observations**

NOTE: All references to “right” or “left” are from the user’s perspective.

**1. Facepiece:** (refer to **Figures 7-11** in **Appendix III**)

Facepiece rim assembly marking: Dräger Panorama NOVA EPDM

Other Markings: #4052956; ARUC-1136

- Overall condition was dirty, covered in debris.
- Lens and rings dirty. Covered with debris, melted.
- Hairnet dirty, but in good condition. Top a little melted.
- Nosecup not fully attached, loose at top; # on nosecup R52822.

**2. MMR with Heads-up Display (HUD): (refer to **Figures 12-13** in **Appendix III**)**

HUD P/N: 4056743

HUD S/N: 011115

- HUD included and intact.
- Secured to low pressure line.
- Bypass open, covered in normal dirt.
- Inside flange had no scratches and appeared to be in good condition.
- Sealing area was clean; no number found.
- Regulator could be attached and removed.
- Locking assembly functioned, but was very damaged by heat.
- Quick Disconnect present.
- MMR disconnect present.

**3. Low Pressure Line: (refer to **Figures 14-15** in **Appendix III**)**

Number: R2103403104

- Quick Disconnect present.
- Disconnected from MMR line at Quick Disconnect.
- Line ran through the shoulder strap to the pressure reducer.
- Nick in low pressure line (from MMR).

**4. 4.5 Pressure Reducer Assembly: (refer to **Figures 16-17** in **Appendix III**)**

- Barcode marking present, but unreadable (melted).
- Overall condition was poor. Outside casing melted.
- All airline connections were secure.
- Connected to belt.

**5. High Pressure Hose and Cylinder Attachment: (refer to **Figures 18-22** in **Appendix III**)**

High pressure hose assembly marking: R2103403/04

Quick-Fill valve marking: Eaton FD17-1002-10-04

- Overall condition fair but dirty.
- Cylinder attachments thread, threads on and off, “O” ring was in place (seated and fully intact), clean.
- Relief valve good.
- Equipped with a high pressure Quick-Fill.
- 2 lines; parts for 3:
  - One line to first stage regulator (pressure reducer).
  - One line to PASS module.

**6. PASS Control Module: (refer to **Figures 23-25** in **Appendix III**)**

Model#: illegible

- Overall condition poor; burned.
- Gauge lens was unreadable.
- Protective casing slightly dirty; normal wear, fair to poor, some cracking.
- SEI label was unreadable.
- Hose leading to PASS burned through outer rubber casing, exposing inner liner.
- Unknown if PASS turns on due to pressure line.
- Gauge lens melted.

**7. Backframe Assembly: (refer to **Figures 26-28** in **Appendix III**)**

P/N: 3352054

S/N: BRUC-4956

NIOSH label: TC-13F-512CBRN

NFPA 1981, 2002ed.

Other Markings: name label on back left shoulder

- Overall condition fair; melted on corner edges.
- Shoulder straps attached to the frame.
- Cylinder strap intact.

**8. Straps and Buckles: (refer to **Figures 29-34** in **Appendix III**)**

- Overall strap condition poor with burns on all straps.
- Shoulder strap attachment connected both sides.
- Hose lines and wires passed through shoulder straps.
- All adjustable buckles did not adjust.
- Waist area buckle latched but did not release.
- Damage to plastic latch on cylinder strap; could not adjust strap.

**9. Cylinder and Cylinder Valve Assembly: (refer to **Figures 35-39** in **Appendix III**)**

DOT-3AL-2216

TC-3ALM 153 Luxfer

DG-201742

Hydrostatic date: 5/15

30 Minute, 2216 psi

1225A on bottom of bottle

Cylinder valve P/N: 4054841

Valve assembly P/N: H237C

- Overall condition good, with some surface dirt.
- Gauge is readable.
- Threads are immaculate.
- Rubber bumper in good condition.

# Appendix II

## SCBA Test Results



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

## SCBA Test Report

**Task Number:** TN-20855  
**Manufacturer:** Dräger  
**NIOSH Approval Number:** TC-13F-512CBRN  
**Tests Performed by:** Karis Kline, Jeremy Gouzd, Angie Andrews, and Jay Tarley  
**Report written by:** Jeremy Gouzd  
**Date of Report:** August 3, 2016

### I. Background

On April 29, 2016, an SCBA unit from the Valley Springs Fire Department was delivered to the NIOSH facility in Morgantown, West Virginia. The unit was initially removed from the packaging in Lab H1513 and inspected on July 5, 2016 by Karis Kline, Jeremy Gouzd, Angie Andrews, and Jay Tarley of the NPPTL Morgantown Testing Team (MTT). The SCBA was visually examined, component by component, in the condition received to determine the conformance of the unit to the NIOSH-approved configuration. The unit was identified as a Dräger ND2 PSS100 30 minute, 2216 psi unit with NIOSH Approval Number, TC-13F-512CBRN, and as the unit submitted by the Valley Springs Fire Department. The visual inspection process was documented with photographs.

### II. Test Outlines

- 1. POSITIVE PRESSURE TEST – NIOSH Standard Test Procedure Number 120, 42 CFR Part 84**  
**Reference:** Subpart H, § 84.70 (a)(2)(ii)

**Requirement:**

*The pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.*

**Procedure:**

A breathing machine with a 622 kg-m/min cam operating at 24 RPM with a 40 liter per minute flow rate (115 liters per minute peak flow) was connected to an anthropometric head for cycling. A pressure tap in the head was connected to a transducer which in turn connected to a strip chart recorder for determining the pressure in the facepiece.

**Results:** The unit was tested on July 7, 2016 and met the test requirement. The cylinder and facepiece provided were used for testing.

**Test Notes:** The inhalation breathing resistance did not become negative during the test. The PASS unit did not function.

<b>Inhalation Breathing Resistance: (inches of water column)</b>	<b>0.11</b>
<b>Pass/Fail:</b>	<b>Pass</b>

**2. RATED SERVICE TIME TEST – NIOSH Standard Test Procedure Number 121, 42 CFR Part 84 Reference:** Subpart F, § 84.53 (a) and Subpart H, § 84.95 (a) and (b)

**Requirement:**

*Service time will be measured while the apparatus is operated by a breathing machine as described in § 84.88. The open-circuit apparatus will be classified according to the length of time it supplies air or oxygen to the breathing machine. Classifications are listed in § 84.53.*

**Procedure:**

A breathing machine with a 622 kg-m/min cam operating at 24 RPM with a 40 liter per minute flow rate was connected to an anthropometric head for cycling. A pressure tap in the head was connected to a transducer which in turn connected to a strip chart recorder for determining the pressure in the facepiece. The breathing machine was run until the inhalation portion of the breathing curve fell below the minimum requirement.

**Results:** The unit was tested on July 7, 2016 and met the test requirement.

**Test Notes:** The measured service times for the unit (adjusted to correspond with the recorded breathing cycles) were more than the rated service times of 30 minutes. The PASS unit did not function during the test on the unit. The SCBA did not go negative on inhalation but maintained positive pressure in the facepiece at the same level.

	<b>Minutes</b>	<b>Seconds</b>
<b>Measured Service Time:</b>	<b>34</b>	<b>3</b>
<b>Pass/Fail:</b>	<b>Pass</b>	

**3. STATIC PRESSURE TEST – NIOSH Standard Test Procedure Number 122, 42 CFR Part 84 Reference: Subpart H, § 84.91 (d)**

**Requirement:**

*The static pressure (at zero flow) in the facepiece shall not exceed 38 mm. (1.5 inches) water column height.*

**Procedure:**

The facepiece was fitted to an anthropometric head for testing. A pressure tap in the head was connected to a calibrated manometer. Full cylinder pressure was applied to the unit at zero flow and a reading from the manometer was recorded.

**Results:** Tested on July 7, 2016. The SCBA met the test requirement.

<b>Facepiece Static Pressure: (inches of water column)</b>	<b>0.88</b>
<b>Pass/Fail:</b>	<b>Pass</b>

**4. GAS FLOW TEST – NIOSH Standard Test Procedure Number 123, 42 CFR Part 84 Reference: Subpart H, § 84.93 (b) and (c)**

**Requirement:**

*The flow from the apparatus shall be greater than 200 liters per minute when the pressure in the facepiece of demand apparatus is lowered by 51 mm. (2 inches) water column height when full container pressure is applied. Where pressure demand apparatus are tested, the flow will be measured at zero gage pressure in the facepiece.*

**Procedure:**

A pressure tap in the anthropometric head was connected to a manometer for determining when the pressure inside the facepiece reaches zero. A mass flow meter was connected in line between the anthropometric head and an adjustable vacuum source to measure flow. The SCBA cylinder was replaced by a test stand which was adjusted initially to full cylinder pressure. The vacuum source was adjusted during the

test to maintain the desired pressure inside the facepiece. Once the proper facepiece pressure stabilized, a flow reading was recorded. The procedure was then repeated with the test stand adjusted to 500 psi.

**Results:** Tested on July 7, 2016. The SCBA met the test requirement.

Applied pressure	Airflow (liter per minute)	Pass/Fail
2216 psi	433	Pass
500 psi	422	Pass

**5. EXHALATION RESISTANCE TEST – NIOSH Standard Test Procedure Number 122, 42 CFR Part 84 Reference:** Subpart H, § 84.91 (c)

**Requirement:**

*The exhalation resistance of pressure-demand apparatus shall not exceed the static pressure in the facepiece by more than 51 mm. (2 inches) water column height.*

**Procedure:**

The facepiece was mounted on an anthropometric head form. A probe in the head form was connected to a slant manometer for measuring exhalation breathing resistance. The airflow through the apparatus was adjusted to a rate of 85 liters per minute and the exhalation resistance recorded.

**Results:** Tested on July 7, 2016. The SCBA met the test requirement.

<b>Exhalation Breathing Resistance: (inches of water column)</b>	<b>2.09</b>
<b>Static Pressure: (inches of water column)</b>	<b>0.88</b>
<b>Difference: (inches of water column)</b>	<b>1.21</b>
<b>Pass / Fail:</b>	<b>Pass</b>

**6. REMAINING SERVICE LIFE INDICATOR TEST – NIOSH Standard Test Procedure Number 124, 42 CFR Part 84 Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.83 (c)

**Requirement:**

*Each remaining service life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced to a minimum of 25 percent of its rated service time or pressure.*

This requirement is modified under § 84.63(c) as follows: *For apparatus which do not have a method of manually turning off remote gage in the event of a gage or gage line failure the remaining service life indicator is required to be set at a minimum of 25% of the rated service time or pressure.*

**Procedure:**

A calibrated gauge was connected in line between the air supply and the first stage regulator. The unit was then allowed to gradually bleed down. When the low air alarm was activated, the pressure on the gauge is recorded. This procedure was repeated six times. The average of the six readings was calculated and recorded.

**Results:** Tested on July 7, 2016. The SCBA didn't pass the test requirements.

**Testing Notes:** The SCBA unit contained two alarms—a mechanical “whistle” alarm and the electric light indicator on the PASS console that changed from green to red when activated. The mechanical alarm was recognized through air movement, but NO audible whistle sounded, therefore it FAILED the test. The electronic alarm could not sound due to bad batteries rendering the PASS console inoperable. Therefore, the unit FAILED the test.

Run #	Mechanical Alarm Point (psi)	Electronic Alarm Point (psi)
1	510	
2	520	
3	530	
4	530	
5	540	
6	530	
Average	570	N/A
Pass/Fail	Fail	Fail

**7. NFPA AIR FLOW PERFORMANCE TEST NFPA 1981 (1997 Edition) Reference:**

Chapter 5, Performance Requirements, Section 5.1.1, Airflow Performance.

**Requirement:**

*SCBA shall be tested for air flow performance as specified in Section 6.1, Airflow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in. (0.0 mm) water column nor is greater than 3½ in. (89 mm) water column above ambient pressure from the time the test begins until the time the test concluded.*

**Procedure:**

The required equipment specified in the NFPA standards was used to conduct the test on this unit. A pressure tap in the head was connected to a transducer which in turn was connected to a flatbed chart recorder for determining the pressure in the facepiece.

**Results:** The SCBA passed this test.

**Test Notes:** Even though the NFPA facepiece pressure was within specs, the PASS did not function. The mechanical and electrical alarms did not function as well. There was air movement detected for the audible whistle but no whistle. When the power was restored to the unit, the PASS operated as designed.

<b>Maximum Facepiece Pressure: (inches of water column)</b>	<b>3.1</b>
<b>Minimum Facepiece Pressure: (inches of water column)</b>	<b>0.45</b>
<b>Pass/Fail:</b>	<b>Pass</b>

**III. Disposition:**

Following testing, the SCBA unit was returned to the package it was received in and placed in secured storage. The unit was removed from secured storage on May 10, 2016 and a download of the data logger information was conducted by a representative from Dräger in Lab H1513, only to find there wasn't any data available for the date of the incident.

**The results of all tests are summarized in Tables One and Two.**

**TABLE ONE – Summary of NIOSH Test Results**

**Task Number:** 20855  
**Manufacturer:** Dräger  
**NIOSH Approval Number:** TC-13F-512CBRN  
**Tests Performed By:** Jeremy Gouzd, Karis Kline, Angie Andrews, and Jay Tarley  
**Dates of Tests:** July 7, 2016

TEST / 42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
<b>1. POSITIVE PRESSURE TEST Reference:</b> Subpart H, § 84.70 (a)(2)(ii)	≥0.0 INWC	0.11 INWC	X	
<b>2. RATED SERVICE TIME TEST Reference:</b> Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	34 min 3 s	X	
<b>3. STATIC PRESSURE TEST Reference:</b> Subpart H, § 84.91 (d)	<1.5 INWC	0.88 INWC	X	
<b>4a. GAS FLOW TEST (at Full Cylinder Pressure) Reference:</b> Subpart H, § 84.93 (b) and (c)	≥ 200 LPM	433 LPM	X	
<b>4b. GAS FLOW TEST (at 500 psi) Reference:</b> Subpart H, § 84.93 (b) and (c)	≥ 200 LPM	422 LPM	X	
<b>5. EXHALATION RESISTANCE TEST Reference:</b> Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	1.21 INWC	X	
<b>6a. REMAINING SERVICE LIFE INDICATOR TEST (mechanical alarm) Reference:</b> Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 510 and 598 psi	527 psi		X
<b>6b. REMAINING SERVICE LIFE INDICATOR TEST (electronic alarm) Reference:</b> Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 510 and 598 psi	N/A		X

**NOTE: The Positive Pressure Test and Rated Service Life Test are run simultaneously.**

**TABLE TWO – Summary of NFPA Test Results**

<b>TEST / REFERENCE</b>	<b>STANDARD</b>	<b>RESULT</b>	<b>PASS</b>	<b>FAIL</b>
<b>7a. NFPA AIR FLOW PERFORMANCE</b> <b>Reference:</b> NFPA 1981 (1997 Edition), Chapter 5.1.1	≤ 3.50 INWC Exhalation Resistance	3.1 INWC	<b>X</b>	
<b>7b. NFPA AIR FLOW PERFORMANCE</b> <b>Reference:</b> NFPA 1981 (1997 Edition), Chapter 5.1.1	≥ 0.00 INWC Inhalation Resistance	0.45 INWC	<b>X</b>	

# Appendix III

## SCBA Inspection Report

Figure 1: Cardboard box containing SCBA.  
Figure 2: Identifying markings on box.  
Figure 3: Identifying markings on box.  
Figure 4: One facepiece and SCBA unit out of box in bag.  
Figure 5: SCBA unit, facepiece, and cylinder out of bag.  
Figure 6: SCBA unit, facepiece, and disconnected MMR.  
Figure 7: Top view of facepiece.  
Figure 8: View of HUD, damage to lens from inside view, loose nosecup.  
Figure 9: Outside facepiece identifying markings.  
Figure 10: Inside facepiece identifying markings.  
Figure 11: Inside facepiece identifying markings.  
Figure 12: MMR disconnected.  
Figure 13: Inside flange of MMR.  
Figure 14: Low pressure hose with damage.  
Figure 15: Another view of the low pressure hose with damage.  
Figure 16: Pressure reducer assembly front view.  
Figure 17: Interior view of pressure reducer assembly.  
Figure 18: High pressure hose and cylinder attachment.  
Figure 19: Cylinder attachment threads overview.  
Figure 20: Quick-Fill port on cylinder attachment.  
Figure 21: Cylinder attachment with relief valve.  
Figure 22: Ports from cylinder attachment.  
Figure 23: Damage to high pressure line to PASS console.  
Figure 24: Top view of PASS console.  
Figure 25: Back of PASS console and unreadable SEI label.  
Figure 26: Inside of backframe.  
Figure 27: Identifying markings on inside of backframe.  
Figure 28: Back view of backframe and labels.  
Figure 29: Straps and buckles.  
Figure 30: Damage to pack at bottom right corner.  
Figure 31: Damage to left shoulder strap.  
Figure 32: Shoulder straps.  
Figure 33: Waist strap.  
Figure 34: Damage to cylinder strap.  
Figure 35: Top view of cylinder.  
Figure 36: Top view of cylinder label.  
Figure 37: Cylinder gauge is readable. View of threads.  
Figure 38: Identifying markings on cylinder.  
Figure 39: Identifying markings on bottom of cylinder.



Figure 1: Cardboard box containing SCBA.



Figure 2: Identifying markings on box.



Figure 3: Identifying markings on box.



Figure 4: One facepiece and SCBA unit out of box in bag.



**Figure 5: SCBA unit, facepiece, and cylinder out of bag.**



**Figure 6: SCBA unit, facepiece, and disconnected MMR.**



**Figure 7: Top view of facepiece.**



**Figure 8: View of HUD, damage to lens from inside view, loose nosecup.**



**Figure 9: Outside facepiece identifying markings.**



**Figure 10: Inside facepiece identifying markings.**



**Figure 11: Inside facepiece identifying markings.**



**Figure 12: MMR disconnected.**



**Figure 13: Inside flange of MMR.**



**Figure 14: Low pressure hose with damage.**



**Figure 15: Another view of the low pressure hose with damage.**



**Figure 16: Pressure reducer assembly front view.**



**Figure 17: Interior view of pressure reducer assembly.**



**Figure 18: High pressure hose and cylinder attachment.**



**Figure 19: Cylinder attachment threads overview.**



**Figure 20: Quick-Fill port on cylinder attachment.**



**Figure 21: Cylinder attachment with relief valve.**



**Figure 22: Ports from cylinder attachment.**



**Figure 23: Damage to high pressure line to PASS console.**



**Figure 24: Top view of PASS console.**



**Figure 25: Back of PASS console and unreadable SEI label.**



**Figure 26: Inside of backframe.**



**Figure 27: Identifying markings on inside of backframe.**



**Figure 28: Back view of backframe and labels.**



**Figure 29: Straps and buckles.**



**Figure 30: Damage to pack at bottom right corner.**



**Figure 31: Damage to left shoulder strap.**



**Figure 32: Shoulder straps.**



**Figure 33: Waist strap.**



**Figure 34: Damage to cylinder strap.**



**Figure 35: Top view of cylinder.**



**Figure 36: Top view of cylinder label.**



**Figure 37: Cylinder gauge is readable. View of threads.**



**Figure 38: Identifying markings on cylinder.**



**Figure 39: Identifying markings on bottom of cylinder.**