PPE CASE

Personal Protective Equipment Conformity Assessment Studies and Evaluations

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

Kansas City, Missouri Fire Department Request for MSA Firehawk® M7 model, 4500 psi units with NIOSH Approval Numbers TC-13F-550CBRN and TC-13F-549CBRN (July 27, 2016)

As part of the ***National Institute for Occupational Safety and Health (NIOSH), Fire Fighter Fatality Investigation and Prevention Program (FFFIPP)***, the National Personal Protective Technology Laboratory (NPPTL) agreed to examine and evaluate five self-contained breathing apparatus (SCBA) units identified as MSA Firehawk® M7 model, 4500 psi. Four units were identified as 45 minute units and one as a 30 minute unit. All of the units were labeled by the fire department with the identifiers that were on each pressure reducer assembly. The units will be referred to by that system throughout the report.

NIOSH evaluated five SCBA units used by fire fighters involved in a fatal event. The SCBAs were not found to contribute to the fatalities.
A qualified service technician should always inspect, repair, test, clean, and replace damaged components of any SCBA involved in an incident before it may be returned to service.

This SCBA status investigation was assigned the NIOSH Task Number 20619. The NIOSH Division of Safety Research (NIOSH DSR) and the Kansas City Fire Department were advised that NIOSH NPPTL would provide a written report of the inspections and any applicable test results.

All SCBA units, contained in cardboard shipping boxes, were delivered to the NIOSH facility in Morgantown, West Virginia on October 30, 2015. Once the boxes containing the units arrived, the units were taken to the H building and locked in the evidence cage located in laboratory 1513. The inspection was conducted on the unit marked LAE318676 on January 6, 2016, the units marked LAE312422 and LAE313526 on January 11, 2016, and the units marked LAE318722 and LAE320911 on January 12, 2016. The units remained locked in the evidence cage until the testing evaluations.

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.

Investigator Information

The self-contained breathing apparatus (SCBA) performance tests were conducted by Jeremy Gouzd, Karis Kline, Angie Andrews, Jay Tarley, and Jay Parker. The SCBA inspections were performed and this report was written by Jay Tarley, Jeremy Gouzd, and Karis Kline. The investigators are part of the Morgantown Testing Team, Evaluation and Testing Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Morgantown, West Virginia.

NIOSH Task Number 20619

SCBA Inspection

The units were removed from their packaging in the Testing Lab 1513 and inspected on January 6, 11, and 12, 2016 by Jay Tarley and Karis Kline of NPPTL. The five SCBAs were identified as the Kansas City Fire Department SCBA units LAE312422, LAE313526, LAE318676, LAE318722, and LAE320911. These SCBA units were extensively examined, component by component, in the condition received to determine the conformance of each unit to the NIOSH-approved configuration. The units were identified as MSA Firehawk® M7 model, 4500 psi. Four units were identified as 45 minute units with NIOSH Approval Number TC-13F-550CBRN and one as a 30 minute unit with NIOSH Approval Number TC-13F-549CBRN. The visual inspection process was documented photographically. Once all of the inspections were completed, the SCBA units were repackaged and placed back in the secure evidence cage in laboratory 1513.

The complete SCBA inspection is summarized in **Appendix I**. The condition of each major component of the SCBA that was photographed with a digital camera is contained in **Appendix III**.

SCBA Testing

The purpose of the testing was to determine the conformance of each 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 of each SCBA to the National Fire Protection Association (NFPA) Airflow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 2013 Edition.

NIOSH SCBA Certification Tests (in accordance with the performance requirements of 42 CFR 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, 2013 Edition):

7. Airflow Performance Test [Chapter 7, 7-1.1]

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

Summary and Conclusions

Five SCBA units were submitted to NIOSH NPPTL for evaluation by NIOSH DSR for the Kansas City, Missouri Fire Department. The SCBA units were delivered to NIOSH on October 30, 2015 and extensively inspected on January 6, 11, and 12, 2016. The five units were identified as MSA Firehawk® model M7, 4500 psi. Four units were identified as 45 minute units with NIOSH Approval Number TC-13F-550CBRN and one unit was a 30 minute unit with NIOSH Approval Number TC-13F-549CBRN. Unit LAE318676, worn by the victim, suffered damage. The low-pressure hose was slit, making the unit unable to be tested. The corresponding cylinder suffered extensive damage to the fiber wrapping and was also deemed untestable. The overall condition of the other four units were fair to good and exhibited normal signs of wear and tear. All 45 minute units were tested with the cylinder corresponding to unit LAE318722.

All SCBAs delivered included a cylinder. During the inspection of the SCBA cylinders, the air cylinder on Unit LAE320911 had a manufacture date of 06/05. Under the applicable U.S. Department of Transportation (DOT) exemption, air cylinders are required to be hydro tested

every five years. The last hydrostatic testing date was 03/2011. Therefore, a hydrostatic test would need to take place before the last day of 03/2016. Because the cylinder was out of date for hydrostatic testing, it was determined that it was not safe to pressurize during the tests run on 06/2016. The cylinders on units LAE312422, LAE313526, and LAE318676 were deemed unsafe to pressurize due to damage. The tests were run with an appropriate cylinder from unit LAE318722.

Unit LAE313526 did not come with a specified corresponding facepiece. The overall condition was fair to good with some dirt and debris. The rib of the backframe was broken just above the connection to the Personal Alert Safety System (PASS) control assembly. The cylinder with the unit had level two damage with gouges and dents throughout the bottle. Level two damage affects the fiberglass composite layer of the cylinder. This damage exposes the fiberglass composite layer and may further exhibit fraying of the exposed fiberglass composite. The cylinder was received closed with roughly 3800 psi in the bottle. This unit passed the NIOSH tests and NFPA airflow test.

Unit LAE312422 had a corresponding facepiece and cylinder. The facepiece was used for all NIOSH tests, but switched for the NFPA airflow test with a facepiece of the same model number. The submitted facepiece was scratched and dirty with a ripped head harness near the crown area. The overall condition was poor and dirty. There was damage to the interior side of the reducer. The high-pressure lines were very dirty with dirt on the threads and a ripped cover at the attachment point of the quick fill. Gauge lenses on the PASS were dirty with debris inside under the screen. The lower left corner of the backframe was broken off at the lumbar attachment, and the cylinder had debris in the threads. This unit passed the NFPA airflow test and NIOSH rated service time tests. However, this unit failed the positive pressure test and gas flow test for the 500 psi.

Unit LAE318676 could not be run through the testing since there was a hole in the low-pressure line just past the high-pressure reducer.

Unit LAE318722 had a corresponding cylinder, but did not have a facepiece. An equivalent facepiece was used for all tests on this unit. The overall condition of this unit was good with some minimal dye sublimation on the right shoulder strap. The cylinder was received closed with 4000 psi showing in the bottle. The cylinder showed normal wear, but the overall condition was good and testable. This unit passed all NIOSH tests and NFPA airflow test.

Unit LAE320911 was received with a corresponding facepiece and cylinder, but both were replaced with an equivalent cylinder and facepiece for all testing on this unit. The overall condition of the unit was fair. The temple strap was broken at the attachment points, the mask mounted regulator (MMR) had many scratches. The unit turned on, but the PASS did not turn on. The PASS control module operated with new batteries. The frame was broken at the first stage regulator and at the bottom right side by the PASS control module. The cylinder provided was closed with 3000 psi left in the bottle. The cylinder hydrostatic test date was out of the acceptable range to test. The bottle was deemed unsafe to be pressurized.

In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. The SCBA units remained locked in the evidence cage until directed to return to the Kansas City Fire Department.

If these units are to be placed back in service, the SCBAs must be repaired, tested, cleaned, and any damaged components must be replaced and inspected by a qualified service technician, including such testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer. Typically a flow test is required on at least 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 may 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.
- All SCBA units, even those not involved in an incident, should undergo a flow test on an annual basis at a minimum.

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/sub-NPPTL.html to receive email notifications relevant to PPE.

For more information related to personal protective equipment, visit the NIOSH website 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)
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Appendix I

SCBA Inspection Report

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem
Incoming Inspection Report Summary

Task Number:	TN-20619 Unit LAE318676	**Requestor:**	NIOSH DSR for the Kansas City Fire Department
Date Received:	October 30, 2015		
Date Inspected:	January 6, 2016	**Description:**	Fatality
Manufacturer:	MSA Firehawk®	**Inspected by:**	Jay Tarley and Karis Kline
Approval Number:	TC-13F-550CBRN	**SCBA Type:**	Open-Circuit, Pressure-Demand

The SCBA was received in a cardboard box (refer to **Figures 1-3** in **Appendix III**).

Contact Agency: NIOSH Division of Safety Research for the Kansas City Fire Department.

As received:

- Cylinder included and full.
- Bypass closed.
- Mask mounted regulator (MMR) locked in to facepiece.
- Facepiece included and regulator housing attached to mask.

Components and Observations

NOTE: All references to "right" or "left" are from the user's perspective.

Facepiece (refer to **Figures 4-8** in **Appendix III**):

Facepiece assembly; Ultra Elite, Medium

Other markings: #260 on lens retaining ring

- Overall condition: dirty, scratched, soiled with body fluid.
- Lens and rings in place.
- Lens appeared to be in good condition, but covered in blood.
- Lens retaining ring intact.
- Hairnet dirty but in good shape.
- Additional markings on lens 01-01-640 (aftermarket scribe).

MMR and HUD (refer to **Figures 9-13** in **Appendix III**):
MMR Firehawk® 10047601 CBRN
Other MMR markings: A0AE319527 TS 10g3315
SN: B061002046

- HUD was dislodged.
- Secured to low-pressure line.
- Bypass closed and dirty.
- Inside flange had some scratches.
- Sealing area was dirty, marking 10077030.
- Regulator could be attached and removed.
- Locking assembly functioned.

Low-pressure Line (refer to **Figures 14-16** in **Appendix III**):
Number: 3Q11

- Damaged/cut just after reducer.
- Secured at all attachments points.
- No Quick Disconnect.
- Line ran through the shoulder strap to the reducer.

Pressure Reducer Assembly (refer to **Figure 17** in **Appendix III**):
Markings/numbers: 10051240, HP INLAE3186676 TS

- Barcode marking was present.
- Overall condition was fair to good but dirty with scratches.
- All air-line connections were secure.
- Broken away from pack frame.

High-pressure Line & Cylinder Attachment (refer to **Figures 18-20** in **Appendix III**):

- Overall condition was good.
- Cylinder attachments thread clean, threads on and off, O-ring in place.
- Relief valve 10036292 4500 psi.
- High-pressure Quick-Fill, 12511- cover, 10038031.
- Eaton FD17-1002-10-0.

Console Assembly PASS Version (refer to **Figures 21-24** in **Appendix III**):
Console P/N: 3029222 SEI Label 10090747
Model#: 7-2183-1

- Overall condition was dirty with scratches.
- Lines good shape-pressure/electrical.
- Gauge lens was partially readable.
- Protective casing slightly dirty.
- SEI label attached NFPA 1982.
- Has a Quick-Fill port, 12511- cover, 10038031.

PASS Control Module (refer to **Figures 25-26** in **Appendix III**):
Part Number: 10099818
Other numbers/markings: RPN10069330
FCC ID: P93-10075346
Firehawk® M7

- Overall condition was good shape.
- Held securely to backframe.
- Wire connection connected to PASS device.
- Wire to backframe and ran to console assembly, backframe broke and wire not secure.
- Top left attachment broken away from frame.
- Electrical line had some physical damage but intact.

Backframe Assembly (refer to **Figures 27-32** in **Appendix III**):
P/N: 10084687
Other markings: DFT-3 tested
SN: LAE318676 Other: 7-2180-1
NIOSH label: TC-13F-549CBRN
NFPA 1981, 2007 edition

- Overall fair to good condition, cracked/broken frame, dirty.
- Shoulder straps were attached to the frame.
- Cylinder strap missing.
- Frame busted/broken at first stage and on side of frame.
- Frame cracked above right waist attachment.

Straps & Buckles (refer to **Figures 33-34** in **Appendix III**):

- Overall strap condition was dirty with some dye sublimation.
- One shoulder strap attachment broken from frame.
- Hose lines and wires passed through shoulder straps.
- All adjustable buckles moved and held in place.

- Waist area buckle latched and released.
- Left side of lumbar broken away from frame.

Cylinder & Valve Assembly (refer to **Figures 35-38** in **Appendix III**):

Some DOT and other information:

DOT-SP-10915-4500

TC-SU-5134-310

OM97959

Cylinder M/N: 7-1348-1

MSA logo visible Luxfer REE: 116

L65M-1 Manufacture date: 9/11 45 Minute, 4500 PSI

SN: 3031-241

- Overall condition was fair to good as there are some surface scratches and dirt present.
- Gauge was readable.
- Threads ok – no corrosion.
- As received, cylinder valve closed with approximately 3000 psi.
- Rubber bumper at base on cylinder valve was in good condition,
- Carbon fiber unraveling.

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem
Incoming Inspection Report Summary

Task Number:	TN-20619 Unit LAE312422	**Requestor:**	NIOSH DSR for the Kansas City Fire Department
Date Received:	October 30, 2015		
Date Inspected:	January 11, 2016	**Description:**	Fatality
Manufacturer:	MSA Firehawk®	**Inspected by:**	Jay Tarley and Karis Kline
Approval Number:	TC-13F-550CBRN	**SCBA Type:**	Open-Circuit, Pressure-Demand

The SCBA was received in a cardboard box (refer to **Figures 1-6** in **Appendix IV**).

Contact Agency: NIOSH Division of Safety Research for the Kansas City Fire Department.

As received:

- Cylinder included and empty.
- Bypass closed.
- Two facepieces included separately.
- Facepiece included separately and regulator housing not connected.

Components and Observations

NOTE: All references to "right" or "left" are from the user's perspective.

Two facepieces and a helmet were packaged separately with this unit. They were not identified to be with any specific unit.

Facepiece 1 (refer to **Figures 7-9** in **Appendix IV**):
Facepiece assembly; Ultra Elite, Medium

Other markings: "Mesh" ID on side; "other" marking on facepiece retaining ring, marking on lower left attachment point: 7-935-7

- Overall condition was fair, dirty, and scratches.

- MMR port dislodged from lens retaining ring.
- Lens appeared to be in good condition, but dirty.
- Flange of lens retaining ring cracked on upper left side.
- Hairnet dirty, but in good shape.
- HUD not present.

Facepiece 2 (refer to **Figures 10-13** in **Appendix IV**)
Facepiece assembly; Ultra Elite, Large
Other markings: 04-11-002 on lens retaining ring, lower left attachment point marking: 7-935-6

- Overall condition was good but dirty.
- Lens and rings okay, scratched and dirty.
- Lens appeared to be in good condition, but scratched and dirty.
- Hairnet dirty and ripped on crown strap sleeve.
- HUD present:
    - MN: 10114403
    - SN: B061001948

MMR (refer to **Figures 14-15** in **Appendix IV**):
MMR Firehawk ®10047601 CBRN
Other MMR markings: 10g3315, A0AE318486 FS
HUD M/N: 10114403 S/N: B071002970

- Secured to low-pressure line.
- Bypass closed; knob slightly dirty.
- Inside flange was dirty, no scratches.
- Sealing area was dirty.
- Regulator could be attached and removed.
- Locking assembly functioned.

Low-pressure Line (refer to **Figure 16** in **Appendix IV**):
Number: 3Q11

- Overall condition was good, but dirty.
- Secured at all attachments points.
- No Quick Disconnect.
- Line ran through the shoulder strap to the reducer.

Pressure Reducer Assembly (refer to **Figures 17-18** in **Appendix IV**):
Markings/numbers: 10051240, HP LAE312422 FS

- Barcode marking present.
- Overall condition fair to good but dirty, scratches.
- All air-line connections secure.
- Broken away from pack frame.
- Damage to interior side of reducer, deep abrasion.

High-pressure Line & Cylinder Attachment (refer to **Figures 19-21** in **Appendix IV**):

- Overall condition fair to good, very dirty.
- Cylinder attachments thread dirty, threads on and off, O-ring in place.
- Relief valve 711/10036292 4500 psi.
- High-pressure Quick-Fill, 12511-cover ripped at attachment point, 10038031.
- Eaton FD 17-10020-10 02-10-04

Console Assembly PASS Version (refer to **Figures 22-23** in **Appendix IV**):

Console P/N: UNREADABLE SEI Label 10085251

- Overall condition good but slightly dirty.
- Lines good shape-pressure/electrical.
- Gauge lens partially readable.
- Protective casing slightly dirty.
- SEI label attached NFPA 1982.
- Digital readout screen dirty with debris under screen.

PASS Control Module (refer to **Figures 24-25** in **Appendix IV**):

Part Number: 10083225

- Overall condition good.
- Top bolts disconnected from back frame, bottom secure.
- Wire connection connected to PASS device.
- Wire to backframe and runs to console assembly.
- Unreadable MSA sticker on left speaker.

Backframe Assembly (refer to **Figures 26-28** in **Appendix IV**):

P/N: unreadable; other markings: DFT-3 tested

SN: LAE312422 Other: none

NIOSH label: TC-13F-549CBRN

NFPA 1981, 2007ed.

- Overall poor condition.
- Shoulder straps were attached to the frame.
- Cylinder strap connected.
- Frame busted/broken at first stage and on side of frame.

Straps & Buckles (refer to **Figures 29-33** in **Appendix IV**):

- Overall strap condition dirty with some dye sublimation.
- One shoulder strap attachment broken from frame.
- Hose lines and wires passed through shoulder straps.
- All adjustable buckles moved and held in place.
- Waist area buckle latched and released.
- Lumbar strap in fair condition with some dirt.

Cylinder & Valve Assembly (refer to **Figures 34-38** in **Appendix IV**):

Some DOT and other information:
DOT-SP-10915-4500
TC-SU-5134-310
ON98260
Cylinder M/N: 7-1348-1
MSA logo visible Luxfer REE: 116
L65M-1 Manufacture date: 09/11 45 Minute, 4500 PSI

- Overall condition fair to good as there are some surface scratches and dirt present.
- Gauge is readable.
- Threads ok, debris in threads.
- As received cylinder valve open with no air remaining.
- Rubber bumper at base on cylinder valve in good condition.
- Rehydro label present: 09/11.
- Cylinder had gouges in it.
- Pressure relief valve #1011 7500PSId.
- Nick in fiber wrap.

Auxiliary Hose EBSS:

None.

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem
Incoming Inspection Report Summary

Task Number:	TN-20619 Unit LAE313526	**Requestor:**	NIOSH DSR for the Kansas City Fire Department
Date Received:	October 30, 2015		
Date Inspected:	January 11, 2016	**Description:**	Fatality
Manufacturer:	MSA Firehawk®	**Inspected by:**	Jay Tarley and Karis Kline
Approval Number:	TC-13F-550CBRN	**SCBA Type:**	Open-Circuit, Pressure-Demand

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

Contact Agency: NIOSH Division of Safety Research for the Kansas City Fire Department.

As received:

- Cylinder included and 3800psi.
- Bypass half open.
- Facepiece not included.

Components and Observations

NOTE: All references to "right" or "left" are from the user's perspective.

Facepiece:

No facepiece included.

MMR (refer to **Figures 5-6** in **Appendix V**):

MMR Firehawk® 10047601 CBRN Other MMR markings: 10g3315, A0AE317351 FS

- Secured to low-pressure line.
- Bypass half open and dirty.
- Inside flange has some scratches, dirty.
- Sealing area is dirty with scratches.
- Locking assembly does function.

Low-pressure Line (refer to **Figures 7** in **Appendix V**):

Number: 4Q10

- Good condition.
- Secured at all attachments points.
- No Quick Disconnect.
- Line runs through the shoulder strap to the reducer.

Pressure Reducer Assembly (refer to **Figures 8-9** in **Appendix V**):

Markings/numbers: 10051240, HP IN LAE313526 TS

- Barcode marking is present.
- Overall condition is fair to good, but dirty.
- All air-line connections are secure.
- Attached to backframe.

High-pressure Line & Cylinder Attachment (refer to **Figures 10-13** in **Appendix V**)

- Overall condition is good, dirty.
- Cylinder attachments thread clean, threads on and off, O-ring in place.
- High-pressure Quick-Fill, 12511-cover, 10038031.
- Eaton FD17-1002-10-04.
- Alarms stem: 0037312.
- Unknown number: AE317039.

Console Assembly PASS Version (refer to **Figures 14-16** in **Appendix V**):

Console P/N: 3029222 SEI Label 10085918

Model#: 7-2183-1

- Overall condition is dirty.
- Lines good shape-pressure/electrical.
- Gauge lens is partially readable.
- Protective casing slightly dirty.
- Has a Quick -ill port FD17-1002-10-04, 12511-- cover, FD 171064-04

PASS Control Module (refer to **Figures 17** in **Appendix V**):

Part Number: 10099818

Other numbers/markings: RPN10069330

FCC ID: P93-10075346

Firehawk® M7

- Overall condition is good shape.
- Held securely to backframe.

- Wire connection connected to PASS device.
- Wire to backframe and runs to console assembly.

Backframe Assembly (refer to **Figures 18-21** in **Appendix V**):
NIOSH label: TC-13F-549CBRN

- Overall fair to good condition, dirty.
- Shoulder straps were attached to the frame.
- Cylinder good, functional.
- Rib of frame broken just above connection to pass control assembly.

Straps & Buckles (refer to **Figures 22** in **Appendix V**):

- Overall strap condition is dirty with no dye sublimation.
- Hose lines and wires pass through shoulder straps.
- All adjustable buckles move and hold in place.
- Waist area buckle latches and releases.
- Lumbar strap condition good with some dirt.

Cylinder & Valve Assembly (refer to **Figures 23-25** in **Appendix V**):
Some DOT and other information:
DOT-SP-10915-4500
TC-SU-5134-310
ON 98963
Cylinder M/N: 7-1348-1
MSA logo visible Luxfer REE: 116
L65M-1 Manufacture date: 11/11 45 Minute, 4500 PSI
SN: not present

- Overall condition is fair to good as there are some gouges and dents and dirt present.
- Gauge is readable.
- Threads ok – no corrosion.
- As received cylinder valve closed with approximately 3800 psi.
- Rubber bumper at base on cylinder valve is in good condition.
- Rehydro label present: 11/11.
- Cylinder has scratches.
- Relief valve MSA 11-11 7500 psi.

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem
Incoming Inspection Report Summary

Task Number:	TN-20619 Unit LAE318722	**Requestor:**	NIOSH DSR for the Kansas City Fire Department
Date Received:	October 30, 2015		
Date Inspected:	January 12, 2016	**Description:**	Fatality
Manufacturer:	MSA Firehawk®	**Inspected by:**	Jay Tarley and Karis Kline
Approval Number:	TC-13F-550CBRN	**SCBA Type:**	Open-Circuit, Pressure-Demand

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

Contact Agency: NIOSH Division of Safety Research for the Kansas City Fire Department.

As received:

- Cylinder included and 4000 psi.
- Bypass closed.
- Facepiece not included.
- PASS device worked when bottle was turned on.
- Extra cylinder strap present.

Components and Observations

NOTE: All references to "right" or "left" are from the user's perspective.

Facepiece:

No facepiece included.

MMR (refer to **Figures 5-6** in **Appendix VI**):

MMR Firehawk® 10047601 CBRN Other MMR markings: A0AE319563 FS

- Secured to low-pressure line.
- Bypass closed, knob slightly dirty and scratched.
- Inside flange dirty, normal wear and tear, 10077030 on inside flange.
- Sealing area is dirty.

- Locking assembly does function.
- No HUD/facepiece present.

Low-pressure Line (refer to **Figure 7** in **Appendix VI**):
Number: 3Q11

- Overall condition is good.
- Secured at all attachments points.
- No Quick Disconnect.
- Line runs through the shoulder strap to the reducer.

Pressure Reducer Assembly (refer to **Figure 8** in **Appendix VI**):
Markings/numbers: 10051240, HP LAE318722 FS

- Barcode marking is present.
- Overall condition is good, but dirty.
- All airline connections are secure.

High-pressure Line & Cylinder Attachment (refer to **Figures 9-10** in **Appendix VI**):
Markings: 804382

- Overall condition is great, very clean.
- Cylinder attachments thread clean, threads on and off, O-ring in place.
- Relief valve 711/10036292 4500 psi.
- High-pressure Quick-Fill cover: 10038031; On Quick-Fill: FD17 1002-10-04.
- Bell SN: 10037312, 9AE 319256FS.

Console Assembly PASS Version (refer to **Figures 11-14** in **Appendix VI**):
Console P/N: 3029222 SEI Label 10085251
Unknown Number: 10085919

- Overall condition is good but slightly dirty.
- Lines good shape-pressure/electrical.
- Gauge lens is readable, dirty.
- Protective casing slightly dirty.
- SEI label attached NFPA 1982, 2007 edition.
- Quick-Fill is present: FD17 1002-10-04.

PASS Control Module (refer to **Figures 15** in **Appendix VI**):
Part Number: 10083225
Other numbers/markings: RPN10069330

Partial Unknown: P8R-1175
FCC ID: P93-10075346

- Overall condition is good shape.
- Held securely to backframe.
- Wire connection connected to PASS device.
- Wire to backframe and runs to console assembly

Backframe Assembly (refer to **Figures 16-17** in **Appendix VI**):
P/N: NONE
Other markings: 7-2180-1
Manufacture date: Nov. 2, 2010
NIOSH label: TC-13F-549CBRN
NFPA 1981, 2007ed.

- Overall good condition, no bends/cracks in wire frame.
- Shoulder straps were attached to the frame.
- Cylinder strap latch is in good condition, functional.

Straps & Buckles (refer to **Figure 18** in **Appendix VI**):

- Overall strap condition is good but barely dirty.
- Hose lines and wires pass through shoulder straps.
- Lumbar strap in good condition.
- All adjustable buckles move and hold in place.
- Waist area buckle latches and releases.
- Right side straps showing slight dye sublimation

Cylinder & Valve Assembly (refer to **Figures 19-22** in **Appendix VI**):
Some DOT and other information:
DOT-SP-10915-4500
TC-SU-5134-310
ON99488
Cylinder M/N: 7-1348-1
Other: "R1"
MSA logo visible/ readable Luxfer REE: 116
L65M-1 Manufacture date: 11/11 45 Minute, 4500 PSI
SN: 3031-239

- Overall condition is good as there are some surface scratches and dirt present.
- Gauge is readable.
- Threads ok – no corrosion.
- As received cylinder valve partially open with approximately 4000 psi.

- Rubber bumper at base on cylinder valve is in good condition.
- Rehydro label present: 11/1.
- Cylinder has normal scratches.
- Stamp on neck of bottle: 559; on relief valve: 7500 psi MSA 1211.

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem
Incoming Inspection Report Summary

Task Number:	TN-20619 Unit LAE320911	**Requestor:**	NIOSH/DSR for the Kansas City Fire Department
Date Received:	October 30, 2015		
Date Inspected:	January 12, 2016	**Description:**	Fatality
Manufacturer:	MSA Firehawk®	**Inspected by:**	Jay Tarley and Karis Kline
Approval Number:	TC-13F-549CBRN	**SCBA Type:**	Open-Circuit, Pressure-Demand

The SCBA was received in a cardboard box (refer to **Figures 1-3** in **Appendix VII**).

Contact Agency: NIOSH Division of Safety Research for the Kansas City Fire Department.

As received:

- Cylinder included and roughly 3000 psi.
- Bypass closed.
- MMR locked in to facepiece.
- Facepiece included and regulator housing attached to mask.
- Low air alarm working.

Components and Observations

NOTE: All references to "right" or "left" are from the user's perspective.

Facepiece (refer to **Figures 4-8** in **Appendix VII**):
Facepiece assembly: Ultra Elite, Medium
Other Markings: "the Kid" in red on lens retaining ring, 10033115 on MMR port, 1-01-717 on lens retaining ring, 7395-4 on facepiece seal
Model sticker 7-935-703

- Overall condition is dirty, scratches and dusty with body fluid on inside.
- Lens and rings decent.
- Lens appears to be in good condition, fluid inside.
- Lens retaining ring intact.

- No HUD.
- Hairnet dirty, but in good shape, “T2 RIT” in marker.
- Temple straps broken at attachment points.

MMR (refer to **Figures 9-11** in **Appendix VII**):
MMR Firehawk® 10047601 CBRN A0AE319562TS

- Secured to low-pressure line.
- Bypass closed and dirty.
- Inside flange has no scratches and appears in good condition.
- Sealing area is in good condition, marking 10077030.
- Regulator can be attached and removed.
- Locking assembly does function.
- Quick Disconnect present.
- MMR has a lot of scratches.

Low-pressure Line (refer to **Figures 12-14** in **Appendix VII**):
Number: 4Q10

- Secured at all attachments points.
- Quick disconnect present and intact.
- Line runs through the shoulder strap to the reducer.
- Test port included.

Pressure Reducer Assembly (refer to **Figures 15-16** in **Appendix VII**):
Markings/numbers: 10051240, LAE 320911 FS

- Barcode marking is present.
- Overall condition is fair to good but dirty, scratches.
- All airline connections are secure.
- Broken away from backframe.

High-pressure Line & Cylinder Attachment (refer to **Figures 17-19** in **Appendix VII**):

- Overall condition is good, slight scratches.
- Cylinder attachments thread clean, threads on and off, O-ring in place.
- Relief valve 10036292 4500 psi, stamp 0611.
- High-pressure Quick-Fill cover, 10038031; PN 804382; Partial # 0711 on nut of HPQF.
- Eaton FD17-1002-10-04.
- Marking at bell attachment 10037312 9AE 320374FS.

Console Assembly PASS Version (refer to **Figures 20-21** in **Appendix VII**):
Console P/N: 10085919 SEI Label 10085251

Model#: 7-2183-1

- Overall condition is fair.
- Lines good shape-pressure/electrical.
- Gauge lens is readable.
- Protective casing slightly dirty, normal wear and tear.
- SEI label attached NFPA 1982, 2007 edition
- Has a Quick-Fill port - cover was off, 8511 carved-cover, FD 17 10064-04.
- Turned unit on, PASS did not turn on, replaced batteries and PASS worked.

PASS Control Module (refer to **Figures 22-23** in **Appendix VII**):
Part Number: Not Readable
Other numbers/markings: Not Readable
FCC ID: Not Readable
Fire Hawk M7

- Overall condition is good.
- Held securely to back frame.
- Wire connection connected to PASS device.
- Wire to back frame and runs to console assembly.

Backframe Assembly (refer to **Figures 24-26** in **Appendix VII**):
P/N: 10084687; Other markings: DFT-3 tested
SN: LAE320911 Other: 7-2180-1 Model # Unreadable
NIOSH label: TC-13F-548CBRN
NFPA 1981, 2007ed.
Stamps: November 2, 2010

- Overall fair, cracked/broken frame, dirty.
- Frame broken at the first stage regulator and broken at the PASS control module on the bottom right.
- Shoulder straps were attached to the frame.
- Cylinder strap intact.

Straps & Buckles (refer to **Figures 27-29** in **Appendix VII**):

- Overall strap condition is dirty with some dye sublimation.
- Shoulder strap attachment connected both sides.
- Hose lines and wires pass through shoulder straps.
- All adjustable buckles move and hold in place.

- Waist area buckle latches and releases.
- Left side of lumbar broken away from frame.
- Fall restraint belt included with straps and buckles.

<u>Cylinder & Valve Assembly</u> (refer to **Figures 30-35** in **Appendix VII):**

Some DOT and other information:
DOT-SP-10915-4500
TC-SU-5134-310
OK77238
Cylinder M/N: 7-947-1
MSA logo visible Luxfer REE: 78
L-45M-1 Manufacture date: 6/05 30 Minute, 4500 PSI
SN: 3031-238

- Overall condition is fair to good as there are some surface scratches and dirt present.
- Gauge is readable.
- Threads great condition.
- As received cylinder valve closed with approximately 3000 psi.
- Rubber bumper at base on cylinder valve is in good condition.
- Gauge readable.
- Rehydro/inspection date: 3/11.

Appendix II

SCBA Test Results

National Personal Protective Technology Laboratory, Evaluation and Testing Branch

SCBA Test Report

Task Number:	TN-20619
Manufacturer:	MSA Firehawk® M7
NIOSH Approval Number:	LAE318722, LAE312422, LAE313526, LAE318676 all TC-13F-550CBRN LAE320911 is TC-13F-549CBRN
Tests Performed by:	Karis Kline, Jeremy Gouzd, Angie Andrews, Jay Parker, and Jay Tarley
Report written by:	Karis Kline
Date of Report:	7/27/2016

I. Background

All SCBA units, contained within brown FedEx boxes, were delivered to the NIOSH facility in Morgantown, West Virginia on October 30, 2015. The units were taken to the lower floor of lab 1513 for secured storage. The inspections for these units were conducted on the following dates:

- LAE318676 - January 6, 2016
- LAE313526 - January 11, 2016
- LAE312422 - January 11, 2016
- LAE318722 - January 12, 2016
- LAE320911 - January 12, 2016

All units were stored under lock until the time of the performance tests.

Five SCBA units were submitted to NIOSH NPPTL for evaluation by the NIOSH DSR for the Kansas City Fire Department. Four of the five units were identified as MSA Firehawk® model M7 45 minute 4500 PSI SCBA (NIOSH approval number, TC-13F-550CBRN). Unit LAE320911 was identified as MSA Firehawk® M7 30 Minute 4500 PSI SCBA (NIOSH approval number, TC-13F-549CBRN). Unit LAE318676 was deemed untestable due to a leak in the high-pressure line. The cylinder provided with this unit was also deemed untestable, due to fraying fiber-wrap. The cylinder included with Unit LAE313526 was deemed untestable due to level two damage to the exterior as depicted in appendix III. It was replaced with the useable cylinder from LAE318722. A NIOSH stock MSA facepiece was used as there was no corresponding facepiece confirmed for the unit.

A series of performance tests were conducted on the following dates:

- LAE318722 - June 3, 2016
- LAE320911 - June 8, 2016
- LAE312422 - June 8, 2016
- LAE313526 - June 9, 2016
- LAE318676 - June 15, 2016 (deemed untestable for all tests during rated service time test)

II. Test Outlines

1. POSITIVE PRESSURE TEST – NIOSH Test Procedure No. 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:

All Units:

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) is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece.

Results – All units tested met all of the test requirements except LAE312422, which failed the Positive Pressure Test.

Unit LAE318722	
Inhalation Breathing Resistance (INWC)	**0.00**
Pass/Fail:	**Pass**
Unit LAE320911	
Inhalation Breathing Resistance (INWC)	**0.05**
Pass/Fail:	**Pass**
Unit LAE312422	
Inhalation Breathing Resistance (INWC)	**-0.05**
Pass/Fail:	**Fail**
Unit LAE313526	
Inhalation Breathing Resistance (INWC)	**0.15**
Pass/Fail:	**Pass**

2. RATED SERVICE TIME TEST – NIOSH Test Procedure No. 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 is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece. The breathing machine is run until the inhalation portion of the breathing curve falls below the minimum requirement.

Results – All four testable units passed Rated Service Time Test.

Test Notes: The measured service times for all of the units (adjusted to correspond with the recorded breathing cycles) were more than the rated service times of 30 or 45 minutes. The PASS functioned during the test on all units except LAE320911 in which the PASS batteries were proven dead during inspection. The SCBAs did not go negative on inhalation but maintained positive pressure in the facepiece at the same level.

Unit LAE318722	
Measured Service Time:	**Minutes Seconds** **48 80**
Pass/Fail:	**PASS**

Unit LAE320911	
Measured Service Time:	**Minutes Seconds** **34 85**
Pass/Fail:	**PASS**

Unit LAE312422	
Measured Service Time:	**Minutes Seconds** **49 64**
Pass/Fail:	**PASS**

Unit LAE313526	
Measured Service Time:	**Minutes Seconds** **51 85**
Pass/Fail:	**PASS**

LAE318676 was deemed untestable due to carbon fiber unraveling.

3. STATIC PRESSURE TEST – NIOSH Test Procedure No. 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 is fitted to an anthropometric head for testing. A pressure tap in the head is connected to a calibrated manometer. Full cylinder pressure is applied to the unit at zero flow and a reading from the manometer is recorded.

Results - Tested on the corresponding dates for the four testable units as stated in the overview, all four SCBAs met the test requirement. The facepiece provided with unit LAE313526 could not be used due to damage and was replaced with a stock MSA facepiece.

Unit LAE318722	
Facepiece Static Pressure (INWC):	**0.87**
Pass/Fail:	**Pass**

Unit LAE320911	
Facepiece Static Pressure (INWC):	**0.80**
Pass/Fail:	**Pass**

Unit LAE312422	
Facepiece Static Pressure (INWC):	**1.03**
Pass/Fail:	**Pass**

Unit LAE313526	
Facepiece Static Pressure: (inches of water column)	**1.12**
Pass/Fail:	**Pass**

4. GAS FLOW TEST – NIOSH Test Procedure No. 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 is connected to a manometer for determining when the pressure inside the facepiece is at zero. A mass flow meter is connected in line between the anthropometric head and an adjustable vacuum source to measure flow. The SCBA cylinder is replaced by a test stand which is adjusted initially to full cylinder pressure. The vacuum source is adjusted during the test to maintain the desired pressure inside the facepiece. Once the proper facepiece pressure has stabilized, a flow reading is recorded. The procedure is then repeated with the test stand adjusted to 500 psi.

Results - Tested on the corresponding dates for the four testable units as stated in the overview, three of the four passed the Gas Flow Test. Unit LAE312422 failed the test at 500 psi. The facepiece provided with unit LAE313526 could not be used due to damage and was replaced with a stock MSA facepiece.

Unit LAE318722		
Applied Pressure	**Airflow (liters per minute)**	**Pass/Fail**
4500 psi	**302.99**	**Pass**
500 psi	**249.19**	**Pass**

Unit LAE320911		
Applied Pressure	**Airflow (liters per minute)**	**Pass/Fail**
4500 psi	**325.65**	**Pass**
500 psi	**243.53**	**Pass**

Unit LAE312422		
Applied Pressure	**Airflow (liters per minute)**	**Pass/Fail**
4500 psi	**277.51**	**Pass**
500 psi	**164.24**	**Fail**

Unit LAE313526		
Applied Pressure	**Airflow (liters per minute)**	**Pass/Fail**
4500 psi	**311.49**	**Pass**
500 psi	**280.34**	**Pass**

5. EXHALATION RESISTANCE TEST – NIOSH Test Procedure No. 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 is mounted on an anthropometric head form. A probe in the head form is connected to a slant manometer for measuring exhalation breathing resistance. The airflow through the apparatus is adjusted to a rate of 85 liters per minute and the exhalation resistance is recorded.

Results – Tested on the corresponding dates for the four testable units as stated in the overview, all four units passed the Exhalation Resistance Test.

Unit LAE318722	
Exhalation Breathing Resistance (INWC):	**1.63**
Static Pressure (INWC):	**0.87**
Difference (INWC):	**0.76**
Pass/Fail:	**Pass**
Unit LAE320911	
Exhalation Breathing Resistance (INWC):	**1.91**
Static Pressure (INWC):	**0.80**
Difference (INWC):	**1.11**
Pass/Fail:	**Pass**
Unit LAE312422	
Exhalation Breathing Resistance (INWC):	**1.75**
Static Pressure (INWC):	**1.03**
Difference (INWC):	**0.72**
Pass/Fail:	**Pass**

Unit LAE313526	
Exhalation Breathing Resistance (INWC):	**1.92**
Static Pressure (INWC):	**1.12**
Difference (INWC):	**0.80**
Pass/Fail:	**Pass**

6. REMAINING SERVICE LIFE INDICATOR TEST – NIOSH Test Procedure No. 124 42 CFR Part 84 Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)

Requirement:
Each remaining service life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced within a range of 20 to 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 25% ± 2% of the rated service time or pressure.*

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

Results – All units passed the Remaining Service Life Indicator test. The test requirement is 25% ± 2%.

Testing Notes:
All four SCBA units contained two alarms: a mechanical "bell" alarm and the electric light indicator on the PASS console that changes from green to red when activated. The mechanical and electric alarms worked for all four testable units.

Required range is between 1035 and 1215 psi. The facepiece was replaced on unit LAE313526 due to damage

Unit LAE318722		
Run #	Mechanical Alarm Point (psi)	Electrical Alarm Point (psi)
1.	1175	1040
2.	1180	1040
3.	1180	1040
4.	1180	1020
5.	1180	1040
6.	1180	1040
Avg.	1179	1036
Pass/Fail	Pass	Pass

Unit LAE320911		
Run #	Mechanical Alarm Point (psi)	Electrical Alarm Point (psi)
1.	1110	1050
2.	1110	1050
3.	1120	1050
4.	1120	1050
5.	1120	1050
6.	1120	1050
Avg.	1116.67	1050
Pass/Fail	Pass	Pass

Unit LAE312422		
Run #	Mechanical Alarm Point (psi)	Electrical Alarm Point (psi)
1.	1120	1060
2.	1120	1080
3.	1120	1080
4.	1130	1060
5.	1130	1080
6.	1130	1080
Avg.	1125	1073
Pass/Fail	Pass	Pass

Unit LAE313526		
Run #	Mechanical Alarm Point (psi)	Electrical Alarm Point (psi)
1.	1110	1070
2.	1110	1060
3.	1120	1070
4.	1120	1050
5.	1110	1040
6.	1120	1070
Avg.	1115	1060
Pass/Fail	Pass	Pass

7. NFPA AIRFLOW PERFORMANCE TEST

NFPA 1981 (1997 Edition) Reference: Chapter 5. Performance Requirements, Chapter 5-1.1

Requirement:

SCBA shall be tested for airflow performance as specified in Section 6-1, Airflow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in (0.0mm) water-column and nor greater than 3.5 in (89 mm) above ambient pressure from the time the test begins until the time the test is concluded.

Procedure:

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

Results – SCBA LAE318676 was untestable. All testable units passed except unit LAE320911 Failed.

Test Notes – On all units, PASS unit was functional. HUD was functional. Alarm systems were functional.

Unit LAE318722	
Maximum Facepiece Pressure (INWC):	**2.50**
Minimum Facepiece Pressure (INWC):	**0.50**
Pass/Fail:	**PASS**

Unit LAE320911	
Maximum Facepiece Pressure (INWC):	**2.60**
Minimum Facepiece Pressure (INWC):	**-0.10**
Pass/Fail:	**FAIL**

Unit LAE312422	
Maximum Facepiece Pressure (INWC):	**2.60**
Minimum Facepiece Pressure (INWC):	**0.20**
Pass/Fail:	**PASS**

Unit LAE313526	
Maximum Facepiece Pressure (INWC):	**2.65**
Minimum Facepiece Pressure (INWC):	**0.50**
Pass/Fail:	**PASS**

III. Disposition:

Following testing, the SCBA units were returned to the package in which they were shipped to NIOSH and placed in secured storage. The units were then removed from secured storage and transported to the MSA labs to conduct a download of the data loggers. The units were then placed back into secured storage until they were shipped back to the fire department.

The results of all tests are summarized in Tables One through Eight.

TABLE ONE – Summary of NIOSH Test Results LAE318722

Task Number:	20619
Unit Identifier:	LAE318722
Manufacturer:	MSA
NIOSH Approval Number:	TC-13F-550CBRN
Tests Performed By:	Jay Parker, Jeremy Gouzd, Karis Kline
Dates of Tests:	June 3, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	0.00 INWC	**X**	
2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	48 min 40 s	**X**	
3. STATIC PRESSURE TEST Reference: Subpart H, § 84.91 (d)	≤ 1.50 INWC	0.87 INWC	**X**	
4a. GAS FLOW TEST (at Full Cylinder Pressure) **Reference:** Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	302.99 lpm	**X**	
4b. GAS FLOW TEST (at 500 psi) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	249.19 lpm	**X**	
5. EXHALATION RESISTANCE TEST **Reference:** Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	1.63 INWC	**X**	
6a. REMAINING SERVICE LIFE INDICATOR TEST (Mechanical Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1179 psi	**X**	
6b. REMAINING SERVICE LIFE INDICATOR TEST (Electronic Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1036 psi	**X**	

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

TABLE TWO – Summary of NFPA Test Results LAE318722

TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7a. NFPA AIRFLOW PERFORMANCE **Reference**: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.5 INWC	**X**	
7b. NFPA AIRFLOW PERFORMANCE **Reference:** NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	0.5 INWC	**X**	

TABLE THREE – Summary of NIOSH Test Results LAE320911

Task Number: 20619

Unit Identifier: LAE320911

Manufacturer: MSA

NIOSH Approval Number: TC-13F-549CBRN

Tests Performed By: Jay Parker, Angie Andrews, Jeremy Gouzd, Karis Kline

Dates of Tests: June 8, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	0.05 INWC	**X**	
2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	34 min 85 s	**X**	
3. STATIC PRESSURE TEST **Reference:** Subpart H, § 84.91 (d)	≤ 1.50 INWC	0.80 INWC	**X**	
4a. GAS FLOW TEST (at Full Cylinder Pressure) **Reference:** Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	325.65 lpm	**X**	
4b. GAS FLOW TEST (at 500 psi) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	243.53 lpm	**X**	
5. EXHALATION RESISTANCE TEST **Reference:** Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	1.11 INWC	**X**	

6a. REMAINING SERVICE LIFE INDICATOR TEST (Mechanical Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1116.67 psi	**X**	
6b. REMAINING SERVICE LIFE INDICATOR TEST (Visual Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1050 psi	**X**	

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

TABLE FOUR – Summary of NFPA Test Results LAE320911

TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7a. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.6 INWC	**X**	
7b. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	-0.1 INWC		**X**

TABLE FIVE – Summary of NIOSH Test Results LAE312422

Task Number: 20619

Unit Identifier: LAE312422

Manufacturer: MSA

NIOSH Approval Number: TC-13F-550CBRN

Tests Performed By: Jay Parker, Jeremy Gouzd, Karis Kline

Dates of Tests: June 8, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	-0.05 INWC		**X**

2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	49 min 64 s	**X**	
3. STATIC PRESSURE TEST Reference: Subpart H, § 84.91 (d)	≤ 1.50 INWC	1.03 INWC	**X**	
4a. GAS FLOW TEST (at Full Cylinder Pressure) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	277.51 lpm	**X**	
4b. GAS FLOW TEST (at 500 psi) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	164.24 lpm	**X**	
5. EXHALATION RESISTANCE TEST Reference: Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	0.72 INWC	**X**	
6a. REMAINING SERVICE LIFE INDICATOR TEST (Bell Alarm) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1125 psi	**X**	
6b. REMAINING SERVICE LIFE INDICATOR TEST (Visual Alarm) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1073.33 psi	**X**	

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

TABLE SIX – Summary of NFPA Test Results LAE312422

TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7a. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.6 INWC	**X**	
7b. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	0.2 INWC	**X**	

TABLE SEVEN – Summary of NIOSH Test Results LAE313526

Task Number: 20619

Unit Identifier: LAE313526

Manufacturer: MSA

NIOSH Approval Number: TC-13F-550CBRN

Tests Performed By: Jay Parker, Angie Andrews, Jeremy Gouzd, Karis Kline

Dates of Tests: June 9, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	0.15 INWC	**X**	
2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	51 min 85 s	**X**	
3. STATIC PRESSURE TEST Reference: Subpart H, § 84.91 (d)	≤ 1.50 INWC	1.12 INWC	**X**	
4a. GAS FLOW TEST (at Full Cylinder Pressure) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	311.49 lpm	**X**	
4b. GAS FLOW TEST (at 500 psi) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	280.34 lpm	**X**	
5. EXHALATION RESISTANCE TEST Reference: Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	0.80 INWC	**X**	
6a. R EMAINING SERVICE LIFE INDICATOR TEST (Bell Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1115 psi	**X**	

6b. REMAINING SERVICE LIFE INDICATOR TEST (Visual Alarm) **Reference:** Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psi	1060 psi	**X**	

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

TABLE EIGHT – Summary of NFPA Test Results LAE313526

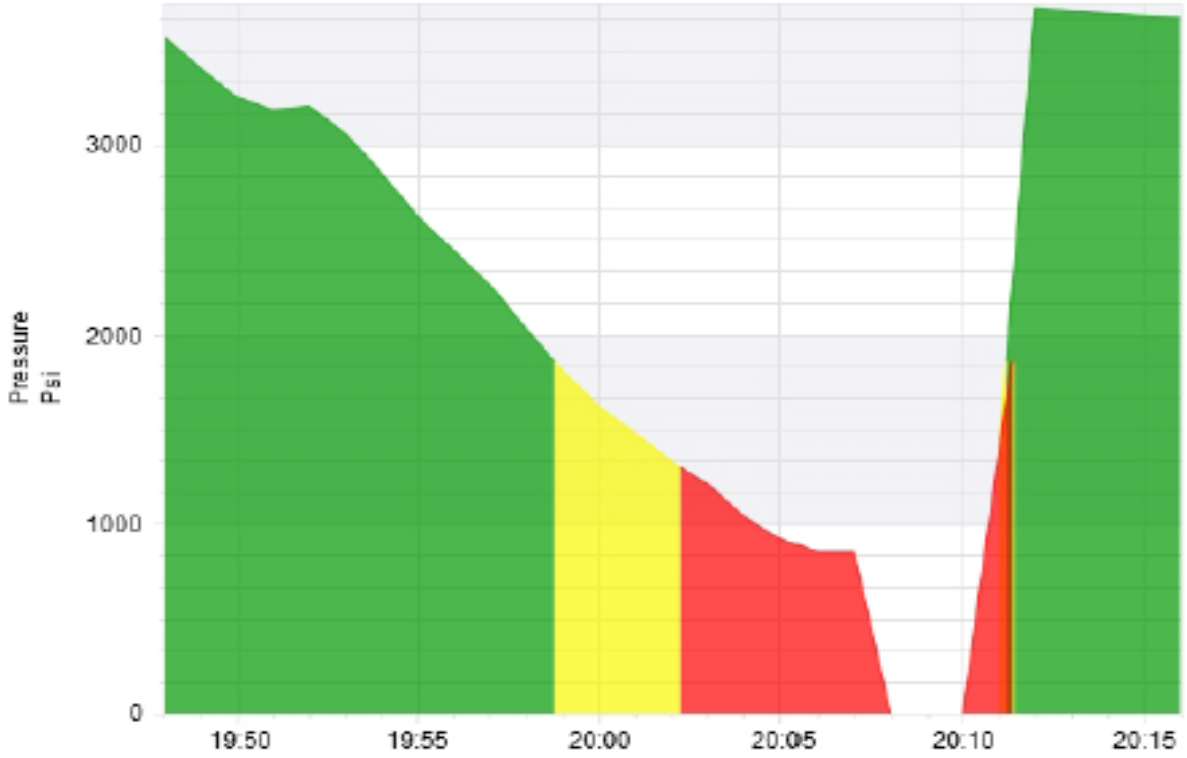
TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7a. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.65 INWC	**X**	
7b. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	0.5 INWC	**X**	

Data Logger Information

- **LAE318722**

PASS device incident log

alphaSCOUT:	11182253	**Incident Start:**	10/12/2015 7:48 PM
TAG User:		**Incident End:**	10/12/2015 8:16 PM
TAG Team:			



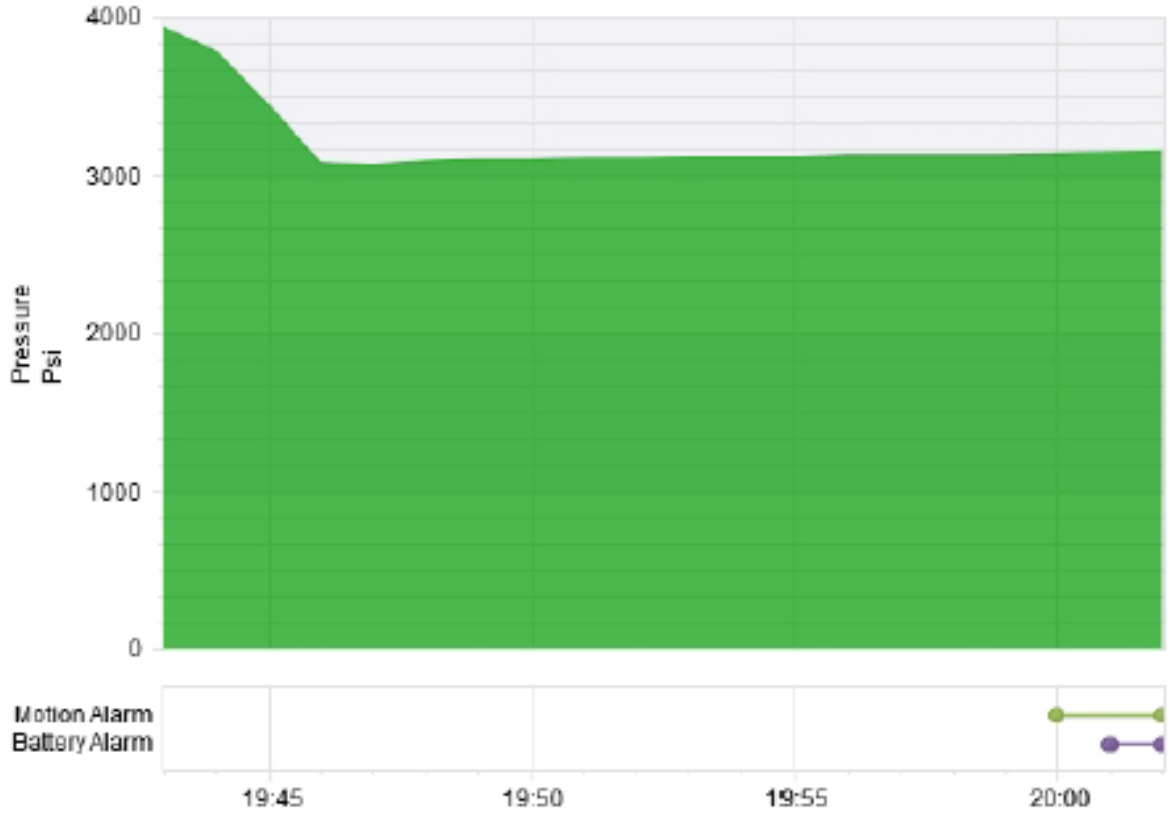
Data Logger Information

- **LAE320911**

PASS device incident log

alphaSCOUT: 11182342
TAG User:
TAG Team:

Incident Start: 10/12/2015 7:43 PM
Incident End: 10/12/2015 8:02 PM

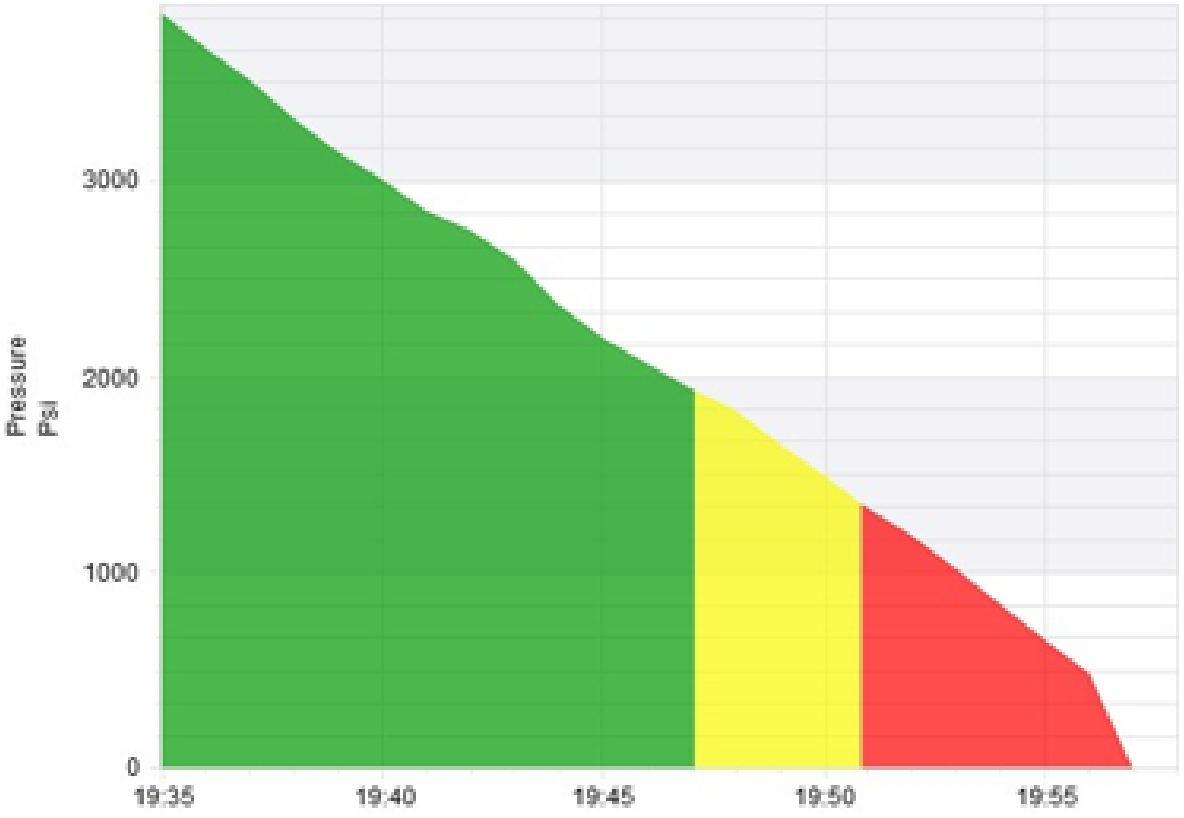


Data Logger Information

- **LAE312422**

PASS device incident log

alphaSCOUT:	11182477	Incident Start:	10/12/2015 7:35 PM
TAG User:		Incident End:	10/12/2015 7:58 PM
TAG Team:			



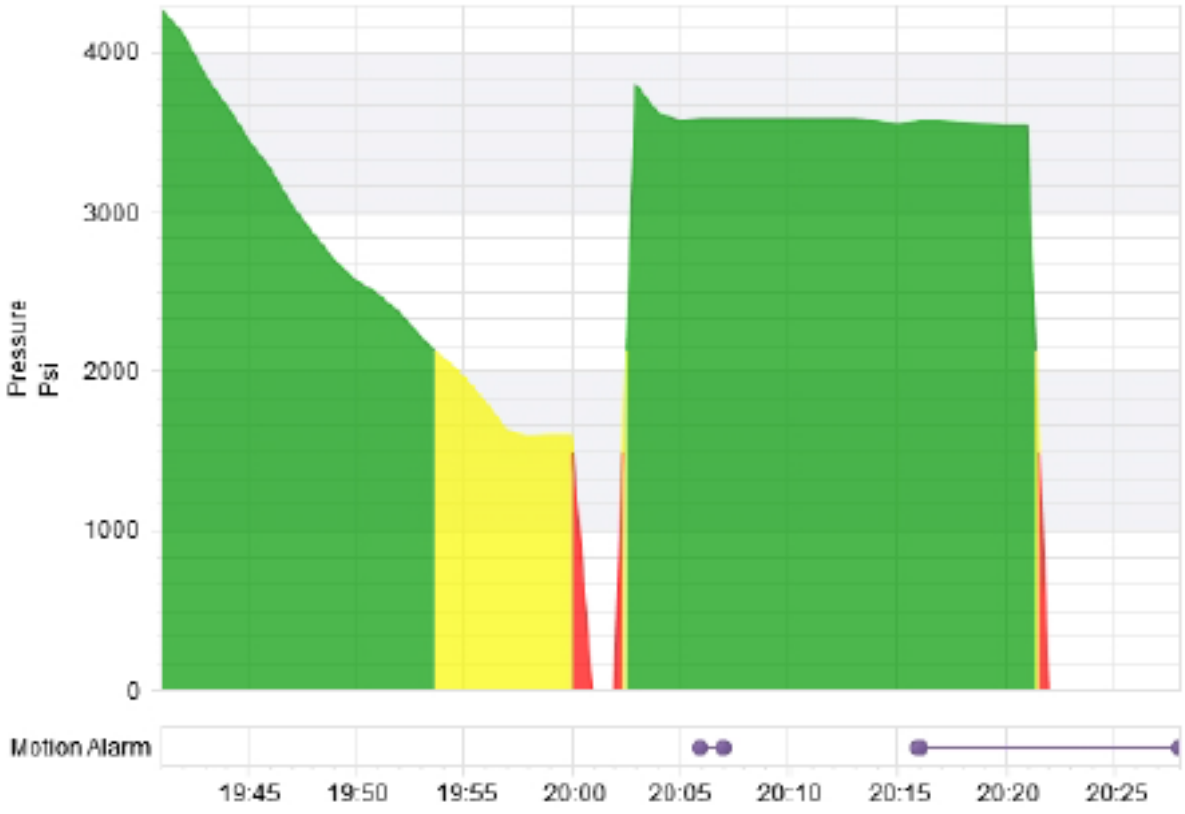
Data Logger Information

- **LAE313526**

PASS device incident log

alphaSCOUT: 11182345
TAG User:
TAG Team:

Incident Start: 10/12/2015 7:41 PM
Incident End: 10/12/2015 8:28 PM

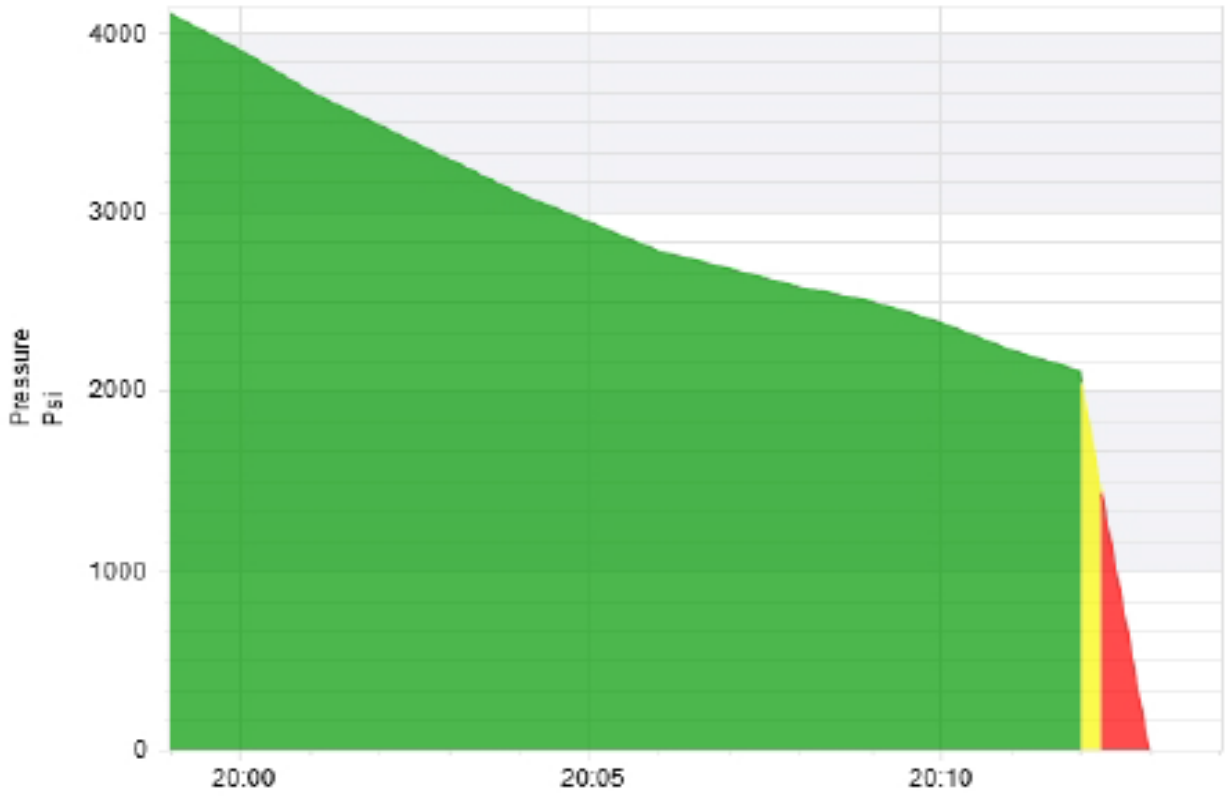


Data Logger Information

- **LAE318676**

PASS device incident log

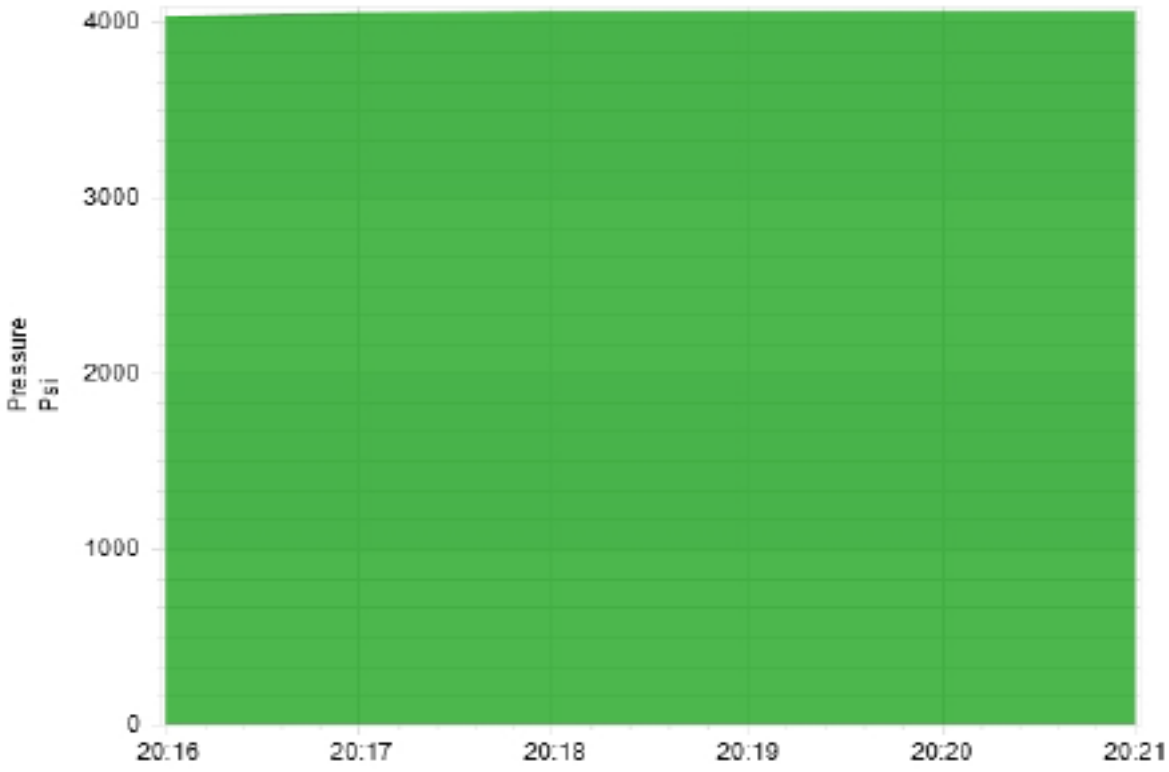
alphaSCOUT:	10181824	**Incident Start:**	10/12/2015 7:59 PM
TAG User:		**Incident End:**	10/12/2015 8:14 PM
TAG Team:			



PASS device incident log

alphaSCOUT: 10181824
TAG User:
TAG Team:

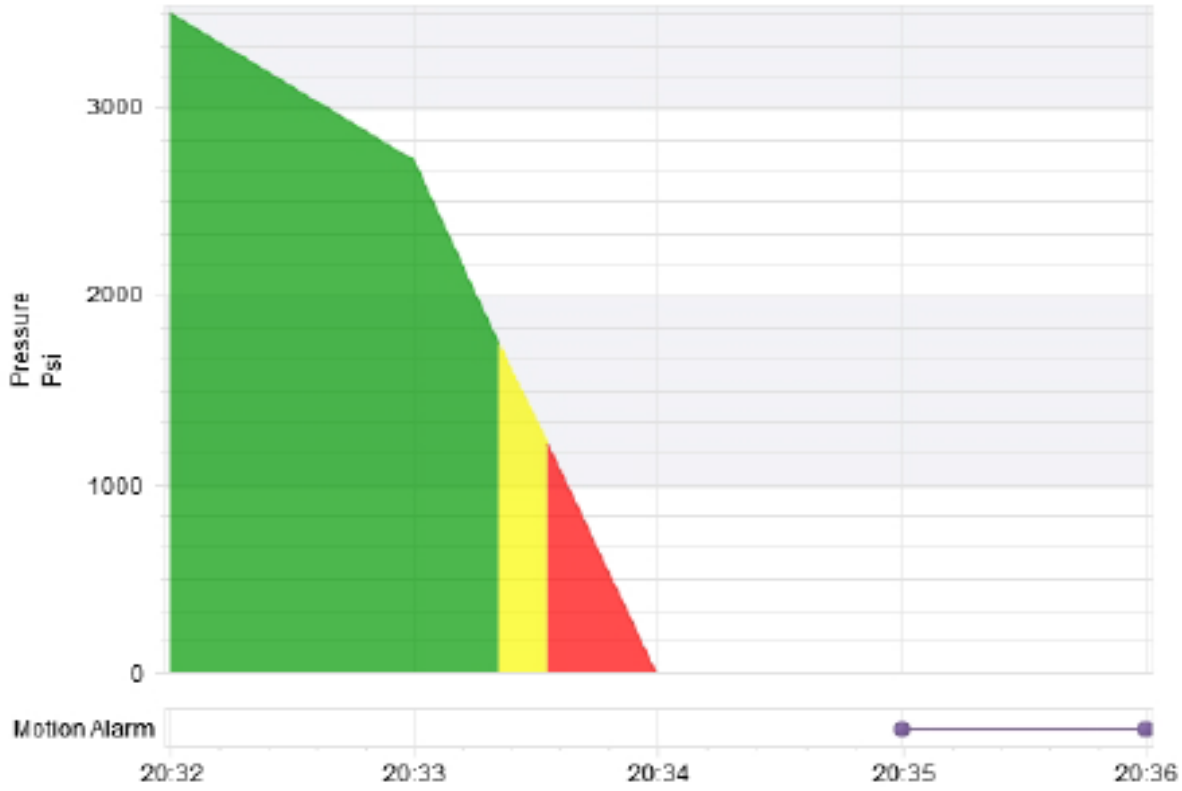
Incident Start: 10/12/2015 8:16 PM
Incident End: 10/12/2015 8:21 PM



PASS device incident log

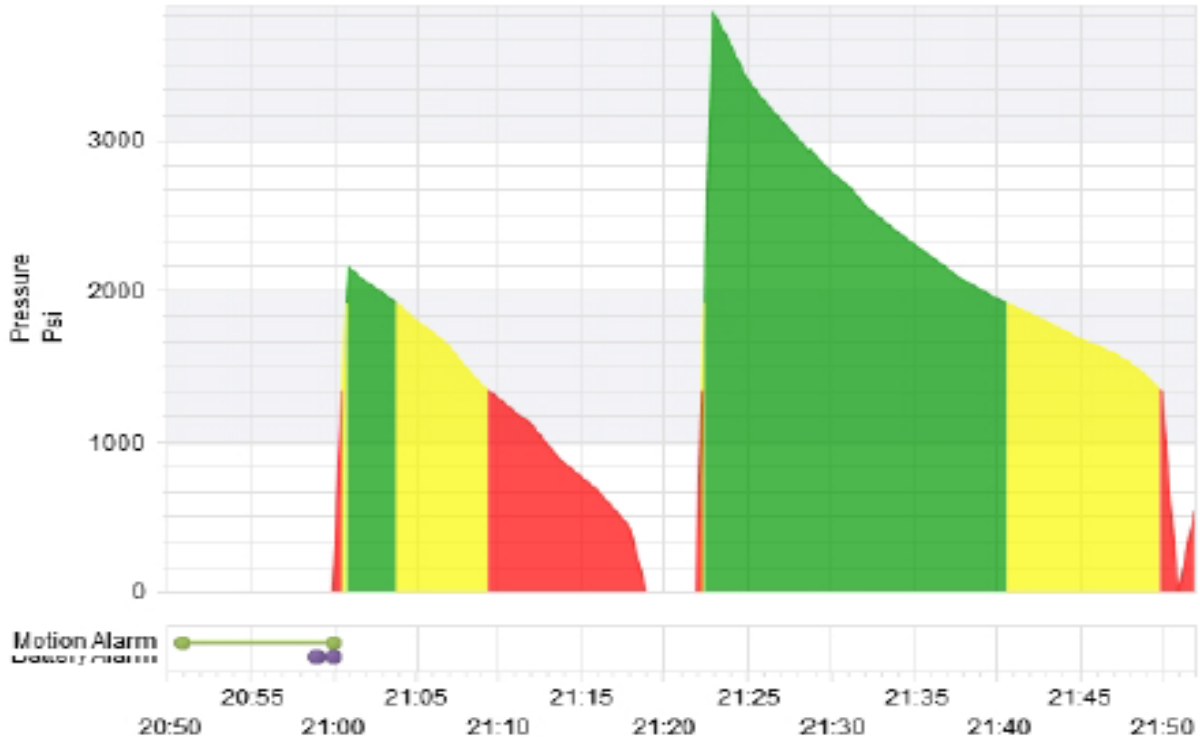
alphaSCOUT: 10181824
TAG User:
TAG Team:

Incident Start: 10/12/2015 8:32 PM
Incident End: 10/12/2015 8:36 PM



PASS device incident log

alphaSCOUT:	10181824	**Incident Start:**	10/12/2015 8:50 PM
TAG User:		**Incident End:**	10/12/2015 9:52 PM
TAG Team:			



Air Sampling Information

AIR/GAS QUALITY REPORT & CERTIFICATE

The air/gas analyzed on 05/19/16 satisfies the guidelines for

CGA D, NFPA 1500 (G-7.1, '13)

NIOSH

KANSAS CITY TN-20619
MORGANTOWN, WV

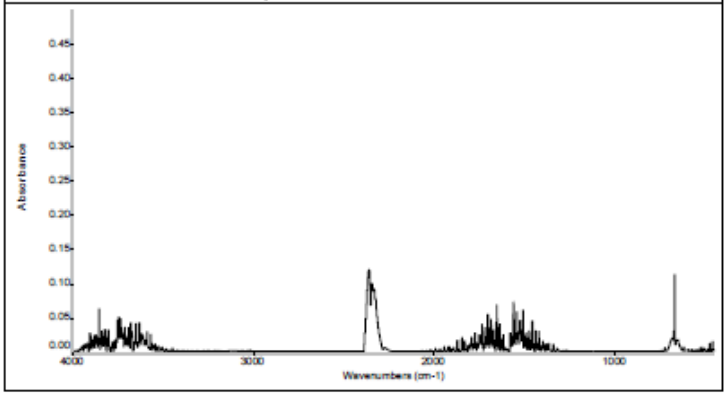
Client ID: NA Agent ID: SUSQ17730 SUSQUEHANNA FIRE EQUIPMENT CO.

Kit #: 320265 Frequency: Single

Analytes	05/19/16 305117.SPA	Range
Oxygen (%)	21.0	19.5-23.5
Carbon Dioxide (ppm)	227.07	1000
Carbon Monoxide (ppm)	<1	10
Water Vapor (ppm)	18.31	24
Dew Point (F)	-67	-65
Oil/Part. (mg/m3)	<1	.5
Unknowns	ND	NA
Odor	ND	None

Results: Sample Meets Standard

Spectral Readout - 305117.SPA



IMPORTANT: This air/gas or substance was tested ONLY against a specified standard and may contain undetected items which are beyond the purpose or scope of this analysis. More extensive testing can be conducted upon request. This does NOT guarantee the condition nor safe application of the analyzed air/gas or substance. Results reported relate only to the items tested. This report shall not be reproduced except in full, without the consent of Lawrence Factor, Inc. Methods used: FTIR, GC, electrochemical, microgravimetry, and sniffing. Estimated Measurements of Uncertainty values for the reported analytes are available upon request. This report / certificate is not issued for an unbounded duration. Kit#: 320265 - Frequency: Single - Date Recieved: 05/17/16 - Issue ID: LF305117 - Page 1 of 1

Endorsement / President

Endorsement / Lab Director

4740 NW 157 St. Miami Lakes, FL 33014 - Ph: 305.430.0550 - Fax: 305.430.0864 - info@lawrence-factor.com - www.Lawrence-Factor.com

X-zam Laboratories

Appendix III

SCBA Inspection Report
Unit LAE318676

Figure 1: Cardboard box containing SCBA

Figure 2: SCBA unit as received

Figure 3: Unit out of plastic, as received

Figure 4: Overview of facepiece

Figure 5: Mask mounted regulator (MMR) attached to facepiece

Figure 6: Inside flange of MMR

Figure 7: Overview of hairnet

Figure 8: Inside of facepiece

Figure 9: HUD is dislodged from facepiece

Figure 10: HUD Removed from facepiece to display markings (left side)

Figure 11: HUD removed from facepiece to display markings (right side)

Figure 12: MMR

Figure 13: Inside flange, MMR

Figure 14: Low-pressure hose

Figure 15: Low-pressure connection

Figure 16: Low-pressure line at reducer connection

Figure 17: Pressure reducer assembly

Figure 18: High-pressure hose and cylinder attachment

Figure 19: Cylinder attachment overview and relief valve with bell assembly

Figure 20: Quick-Fill port overview

Figure 21: PASS console

Figure 22: Back of PASS console, SEI label

Figure 23: Additional Quick-Fill port on console

Figure 24: Overview of Quick-Fill port on console

Figure 25: PASS control module

Figure 26: Label on side of PASS control module

Figure 27: Identifying markings on backframe

Figure 28: Overview of backframe

Figure 29: Damage to right rib of backframe

Figure 30: Labels inside of pack, damage to left side

Figure 31: Damage/cracking to back frame at PASS control module connection

Figure 32: Labels on backframe

Figure 33: Overview of straps and buckles

Figure 34: Broken lumbar attachment

Figure 35: Overview of cylinder label

Figure 36: Fraying in fiberglass coat

Figure 37: Cylinder gauge is readable and threads clean

Figure 38: Cylinder threads

Appendix IV

SCBA Inspection Report
Unit LAE312422

Figure 1: Cardboard box containing SCBA

Figure 2: SCBA unit as received

Figure 3: Two facepieces, one helmet, and SCBA unit out of box

Figure 4: Identifying markings

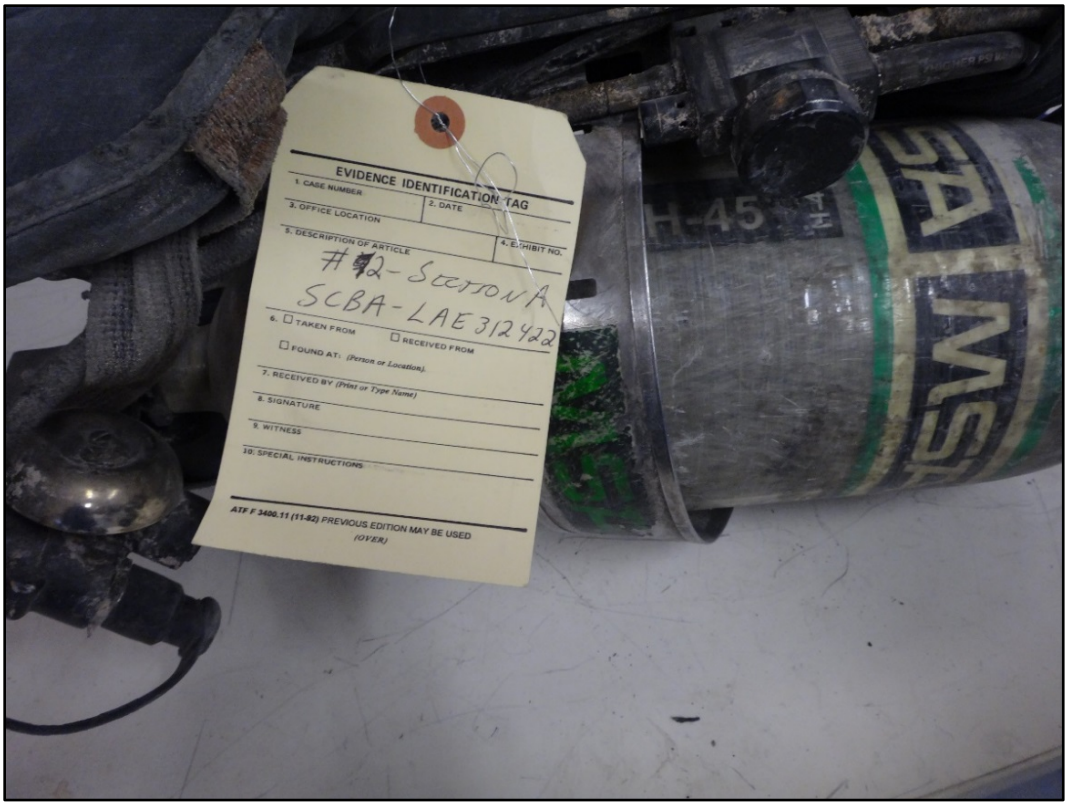


Figure 5: Tag attached to unit as received

Figure 6: Helmet and two facepieces out of paper

Figure 7: Overview of facepiece one

Figure 8: Damage to upper left corner of lens retaining ring

Figure 9: Inside of facepiece one, HUD is not present

Figure 10: Overview of facepiece two

Figure 11: Inside view of facepiece two

Figure 12: HUD inside of facepiece two

Figure 13: Overview of facepiece two

Figure 14: Mask mounted regulator (MMR)

Figure 15: Inside flange, MMR

Figure 16: Low-pressure hose

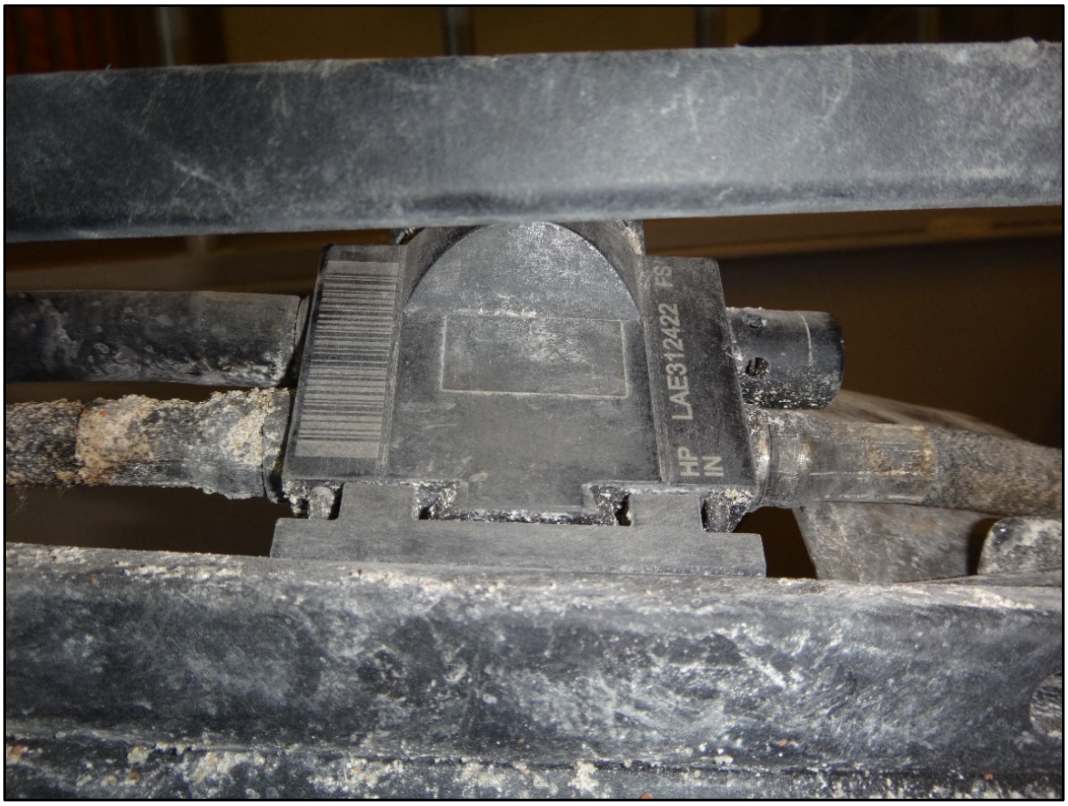


Figure 17: Pressure reducer assembly

Figure 18: Interior view of pressure reducer assembly

Figure 19: High-pressure hose and cylinder attachment

Figure 20: Cylinder attachment overview and relief valve with bell assembly

Figure 21: Quick-Fill port on cylinder attachment

Figure 22: PASS console

Figure 23: Back of PASS console, SEI label

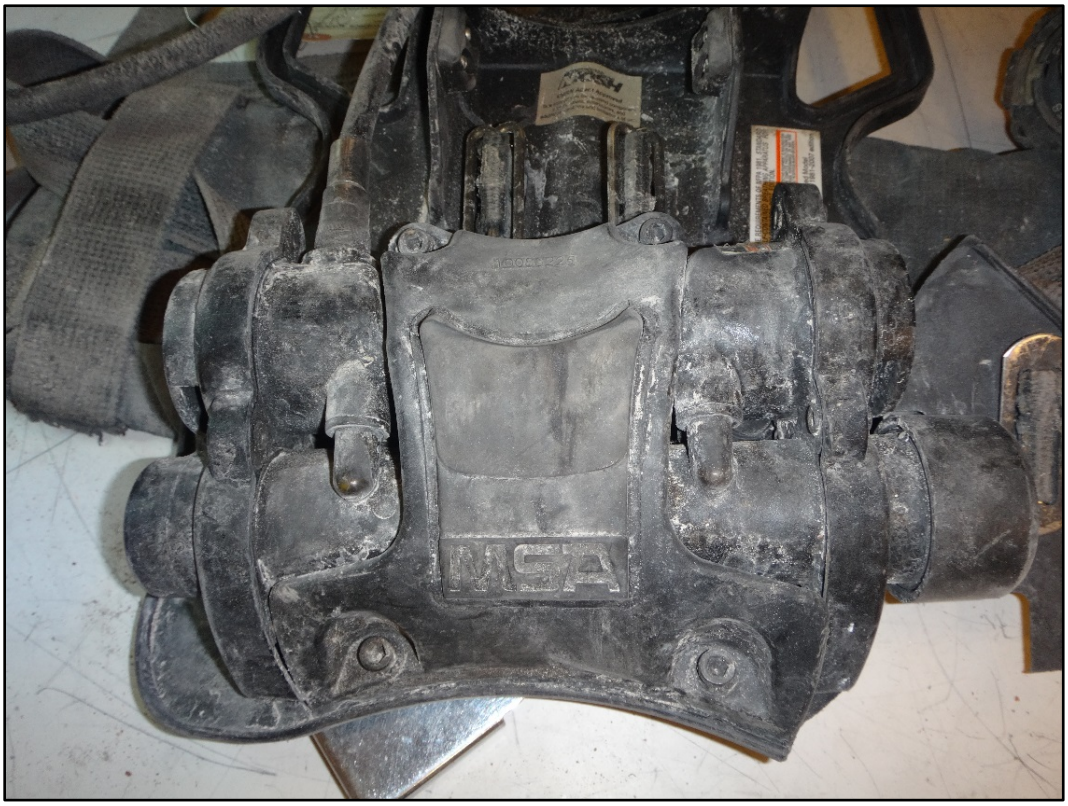


Figure 24: PASS control module

Figure 25: Label on side of PASS control module

Figure 26: Overview of pack assembly

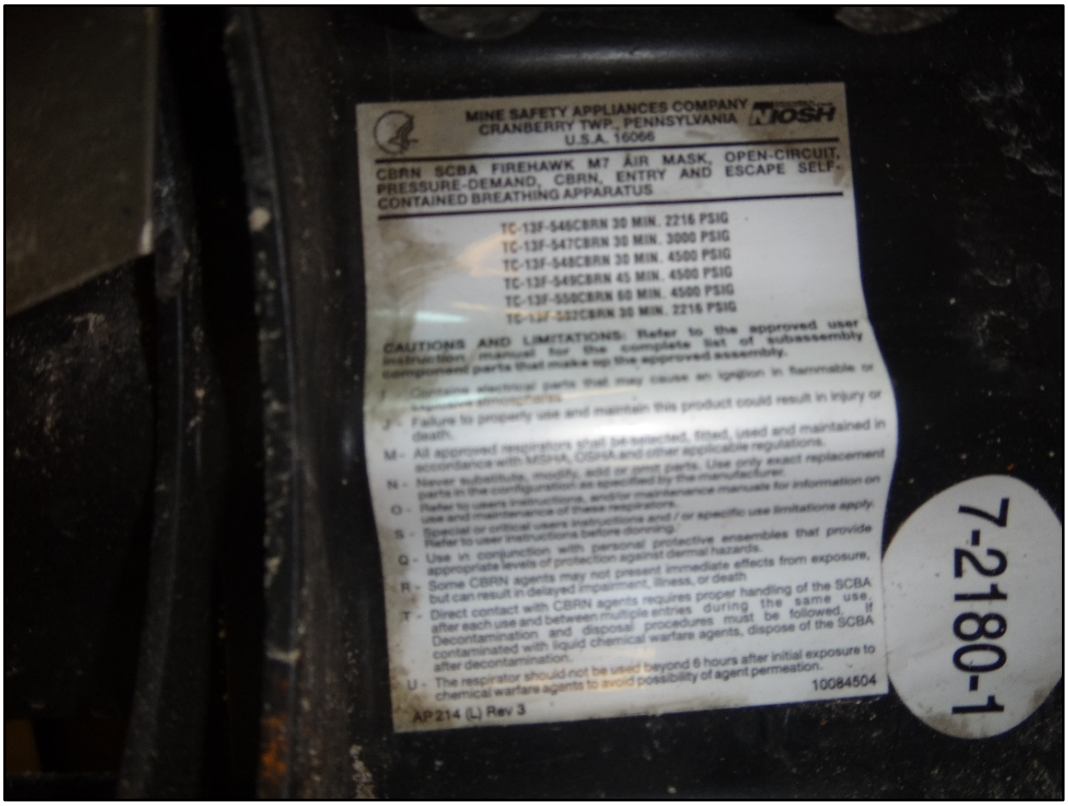


Figure 27: Labels inside of pack

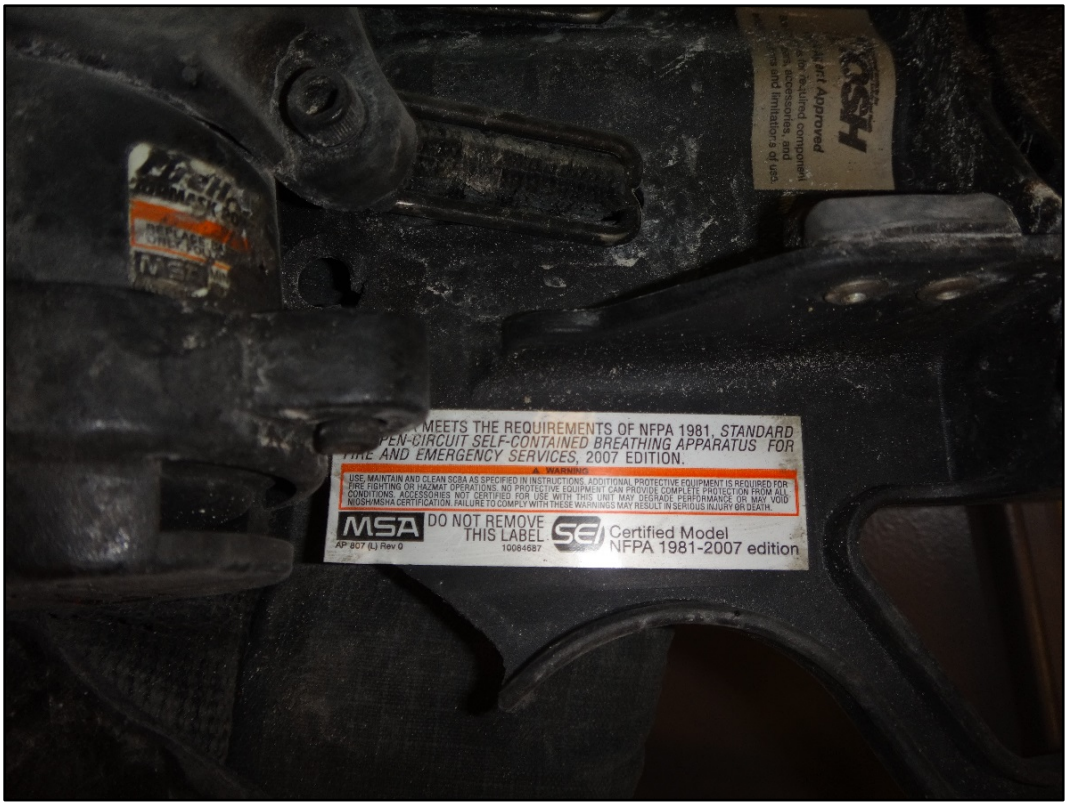


Figure 28: Labels on backframe

Figure 29: Overview of straps and buckles

Figure 30: Damage to pack at bottom right corner

Figure 31: Ripped attachment on lumbar strap

Figure 32: Attachment point for cylinder strap

Figure 33: Identifying markings on inside of backframe

Figure 34: Overview of cylinder

Figure 35: Overview of cylinder label

Figure 36: Cylinder gauge is readable

Figure 37: Cylinder threads

Figure 38: Damage to cylinder coating

Appendix V

SCBA Inspection Report
Unit LAE313526

Figure 1: Cardboard box containing SCBA

Figure 2: SCBA unit as received

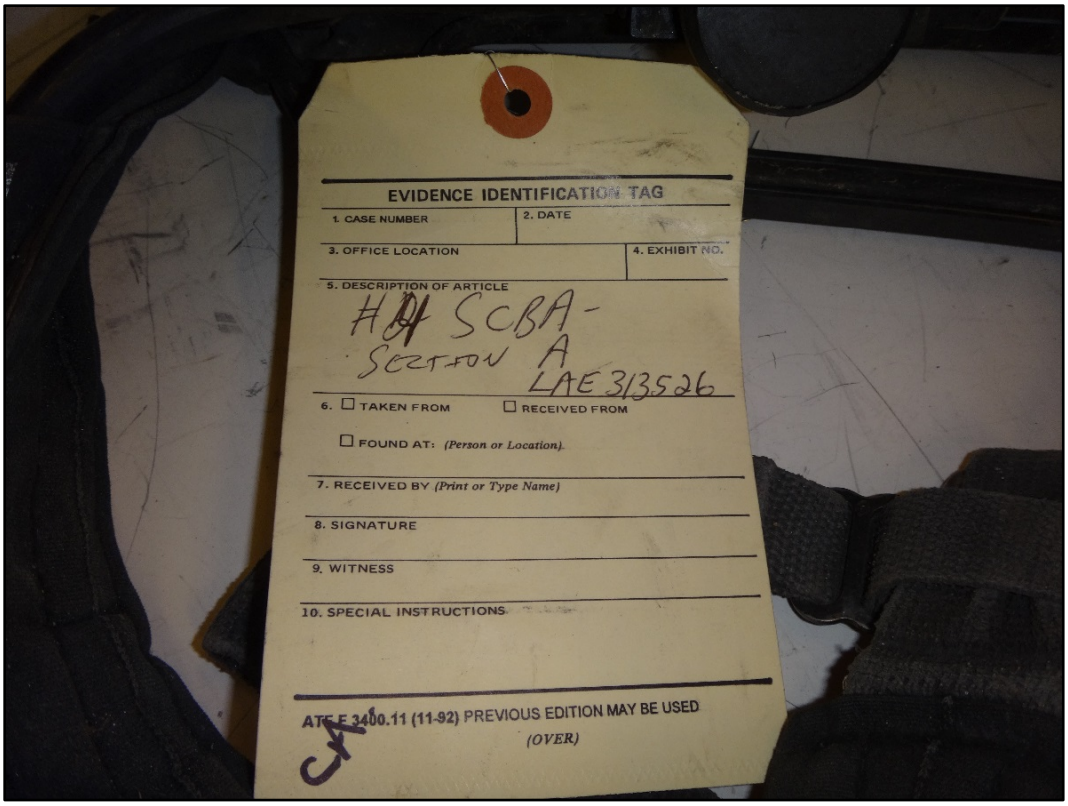


Figure 3: Tag attached to unit as received

Figure 4: Unit out of paper, as received

Figure 5: Mask mounted regulator (MMR)

Figure 6: Inside flange, MMR

Figure 7: Low-pressure connection

Figure 8: Pressure reducer assembly

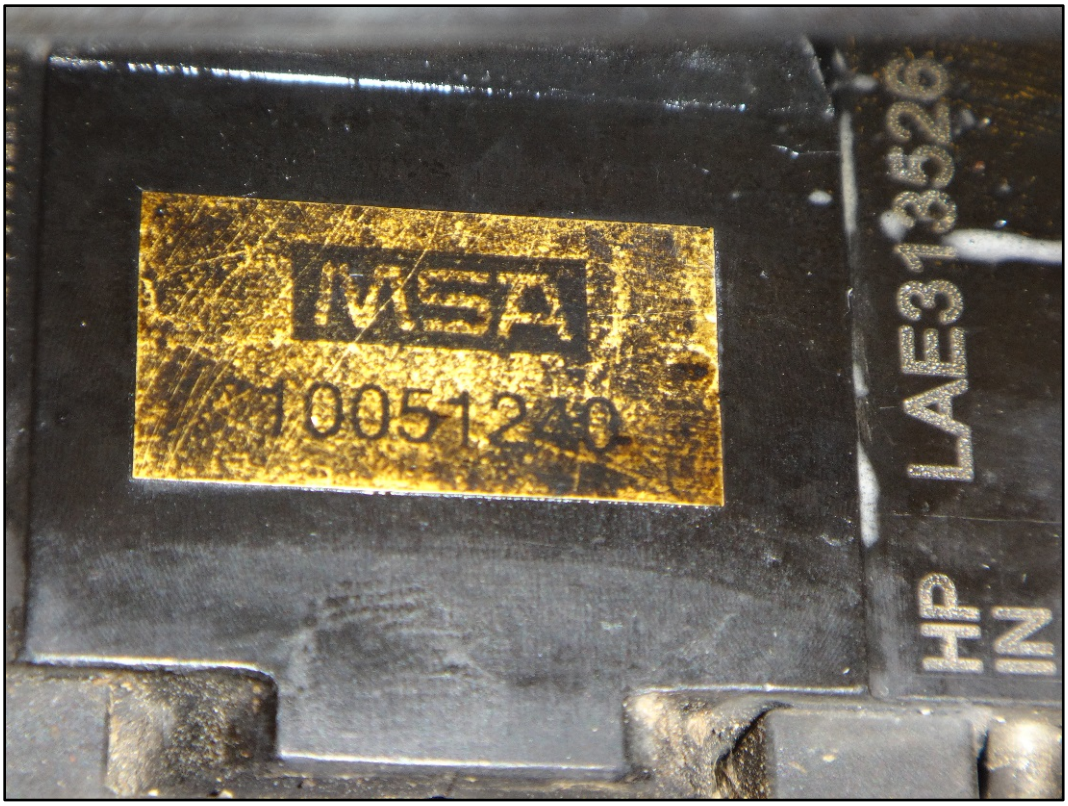


Figure 9: MSA label on reducer

Figure 10: Cylinder attachment overview and relief valve with bell assembly

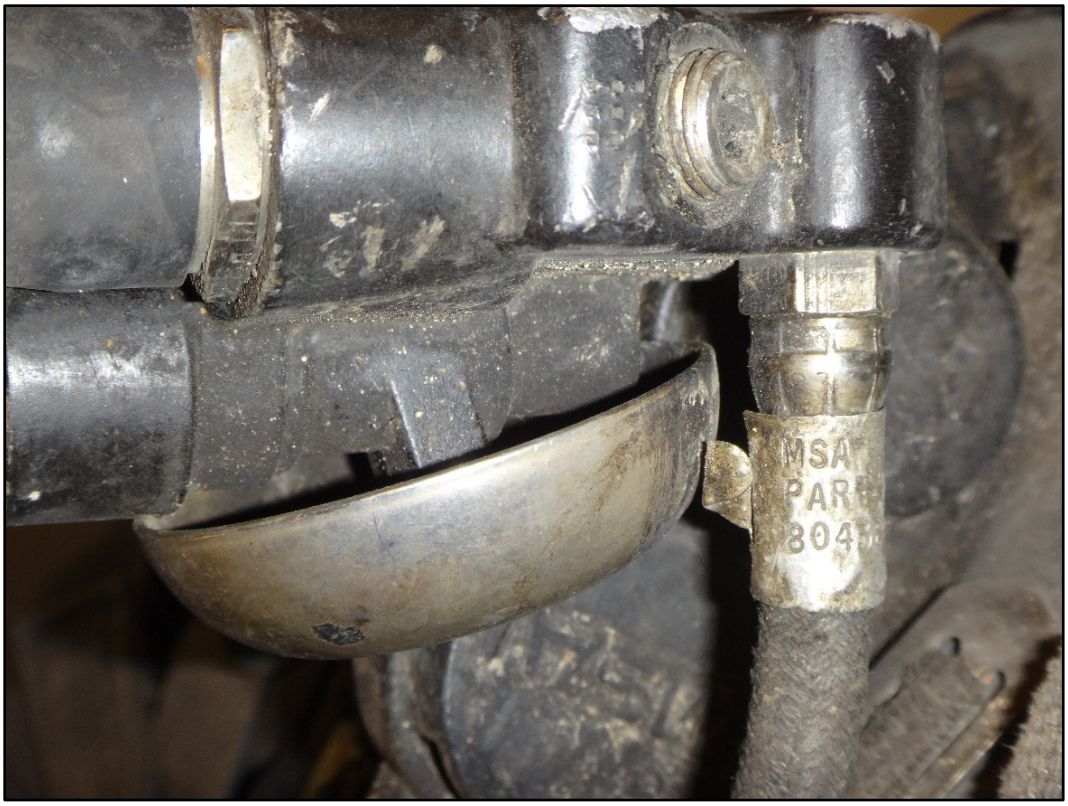


Figure 11: MSA part number

Figure 12: MSA part numbers

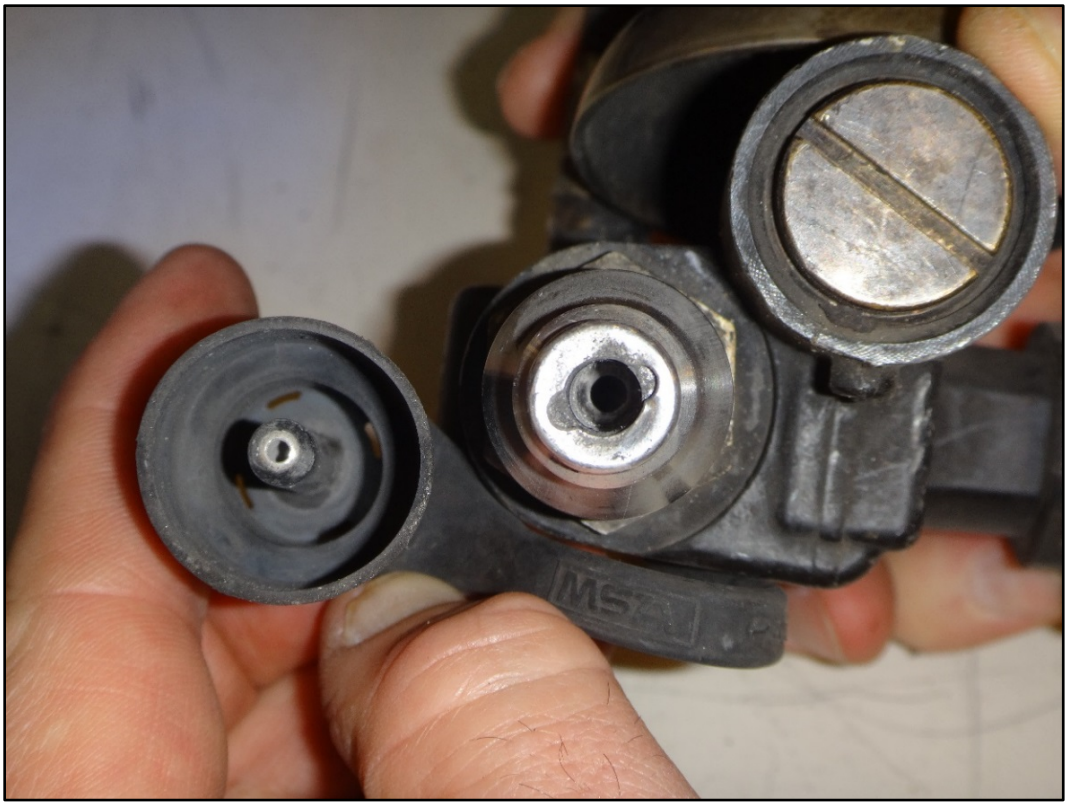


Figure 13: Quick-Fill port on cylinder attachment overview

Figure 14: PASS console

Figure 15: Back of PASS console, SEI label missing

Figure 16: Additional Quick-Fill port on console

Figure 17: PASS control module

Figure 18: Overview of pack

Figure 19: MSA label inside pack

Figure 20: NIOSH label inside of pack

Figure 21: Broken rib of back

Figure 22: Overview of buckles and straps

Figure 23: Gauge on cylinder connection

Figure 24: Overview of cylinder

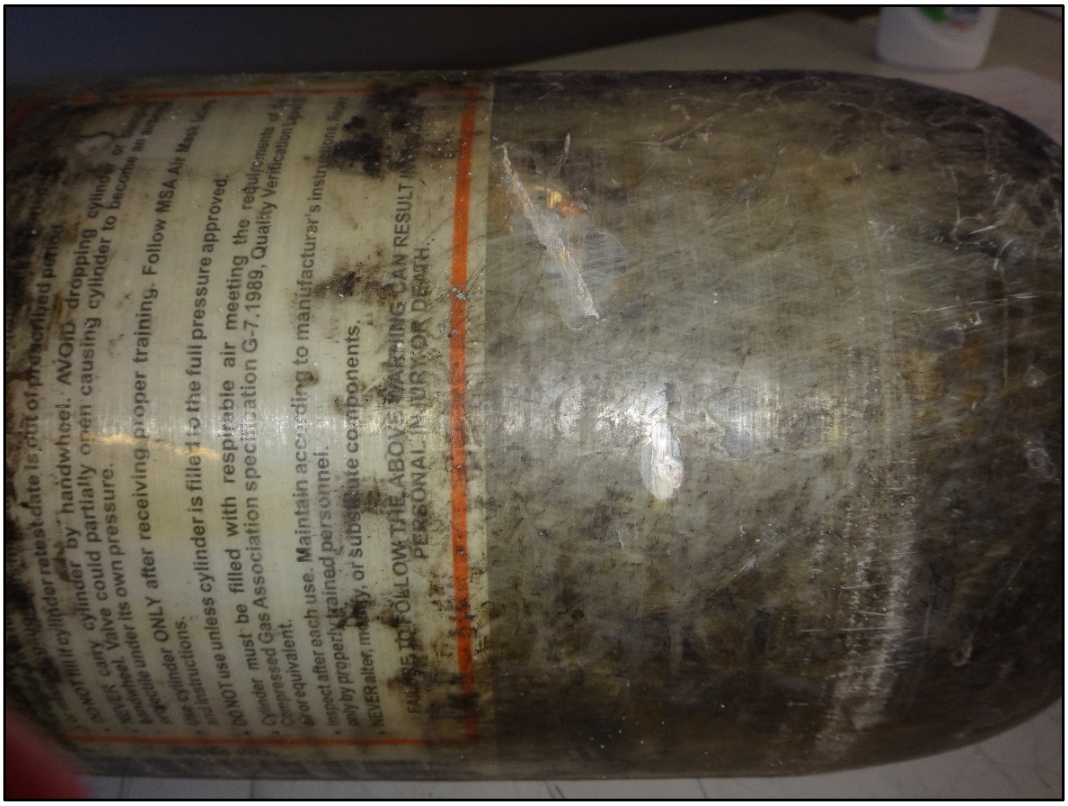


Figure 25: Damage to cylinder

Appendix VI

SCBA Inspection Report
Unit LAE318722

Figure 1: Cardboard box containing SCBA

Figure 2: SCBA unit as received

Figure 3: Unit out of paper, as received

Figure 4: Extra cylinder strap included

Figure 5: Mask mounted regulator (MMR)

Figure 6: Inside flange, MMR

Figure 7: Low-pressure line

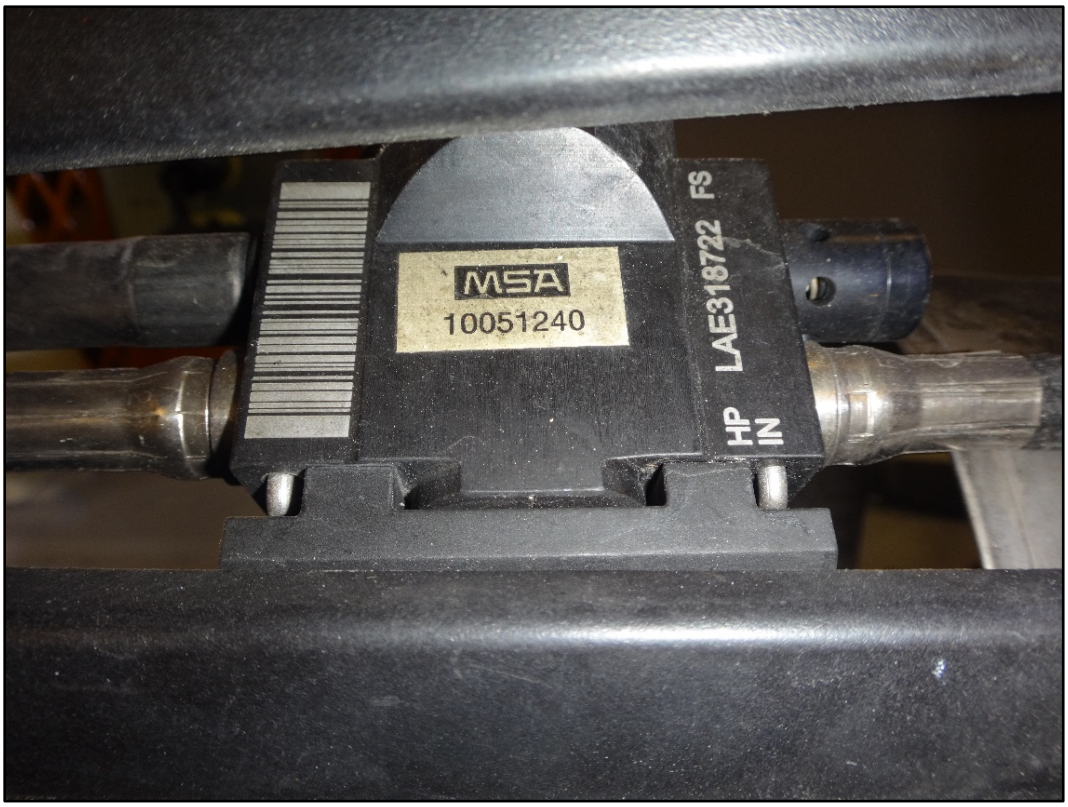


Figure 8: Pressure reducer assembly

Figure 9: Cylinder attachment overview and relief valve with bell assembly

Figure 10: Quick-Fill port on cylinder attachment overview

Figure 11: PASS console

Figure 12: Back of PASS console

Figure 13: Active PASS console

Figure 14: Additional Quick-Fill port on console

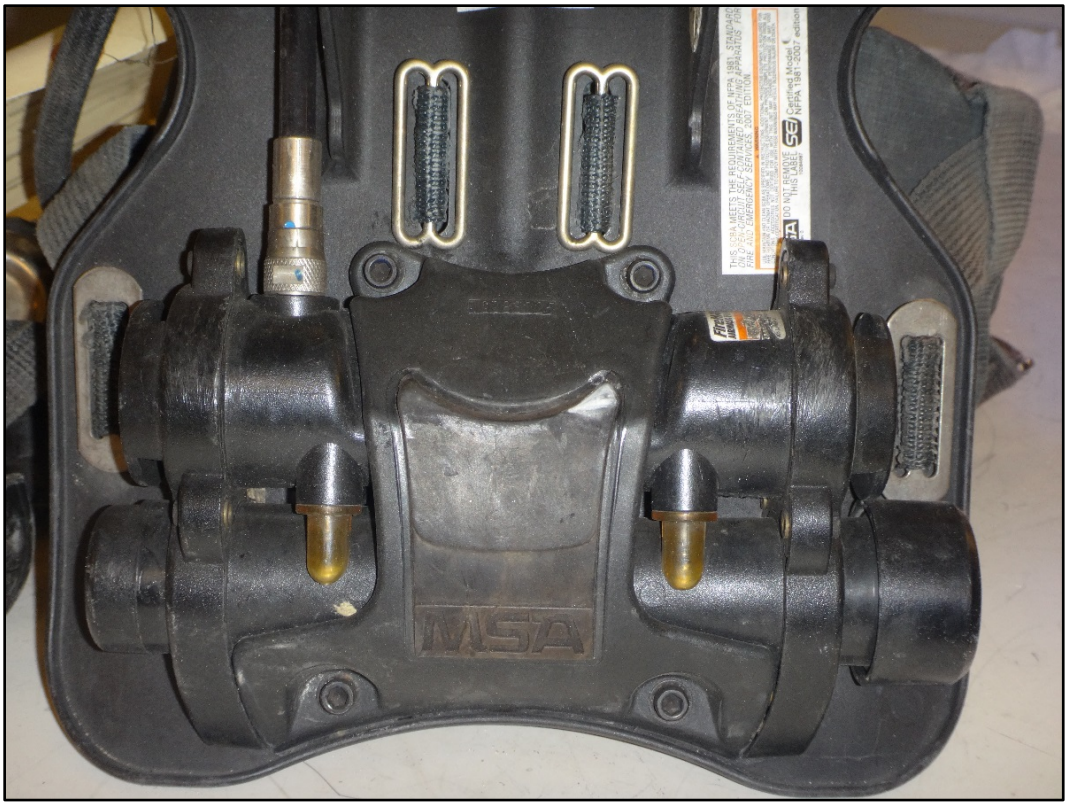


Figure 15: PASS control module

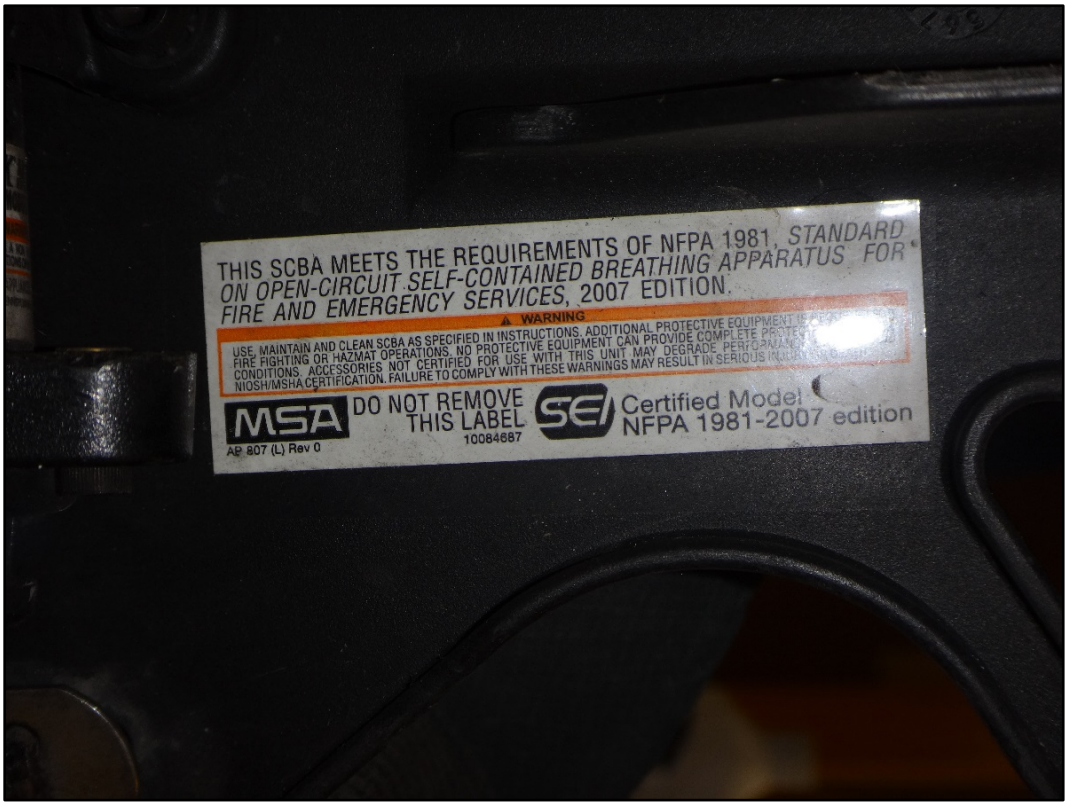


Figure 16: MSA label inside pack

Figure 17: NIOSH label inside of pack

Figure 18: Overview of buckles and straps

Figure 19: Gauge on cylinder connection

Figure 20: Overview of cylinder

Figure 21: Threads on cylinder attachment

Figure 22: Cylinder identifier

Appendix VII

SCBA Inspection Report
Unit LAE320911

Figure 1: Cardboard box containing SCBA

Figure 2: SCBA unit as received

Figure 3: Unit out of paper, as received

Figure 4: Overview of facepiece

Figure 5: Broken hairnet attachment, upper left corner of facepiece

Figure 6: Broken hairnet attachment, upper right corner of facepiece

Figure 7: Red markings "the Kid"

Figure 8: Inside view of facepiece, no HUD

Figure 9: Mask mounted regulator (MMR)

Figure 10: Inside flange, MMR

Figure 11: Bypass

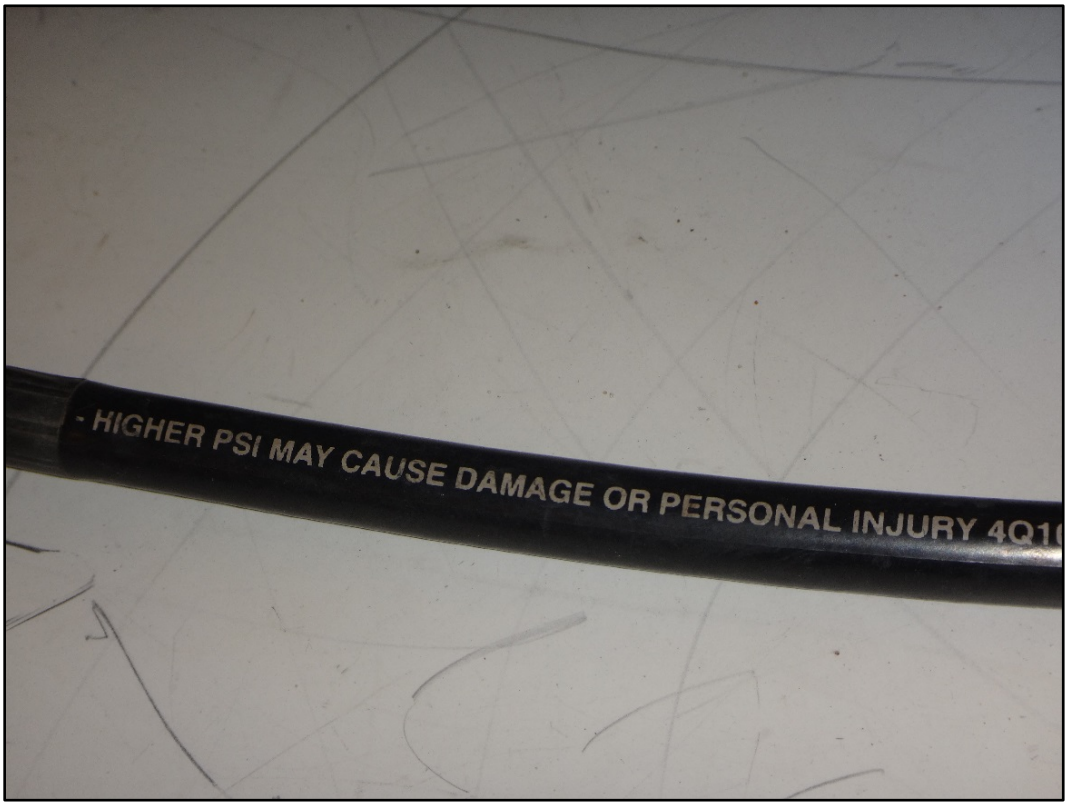


Figure 12: Low-pressure hose

Figure 13: Low-pressure line to connection

Figure 14: Low-pressure connection with and without cover

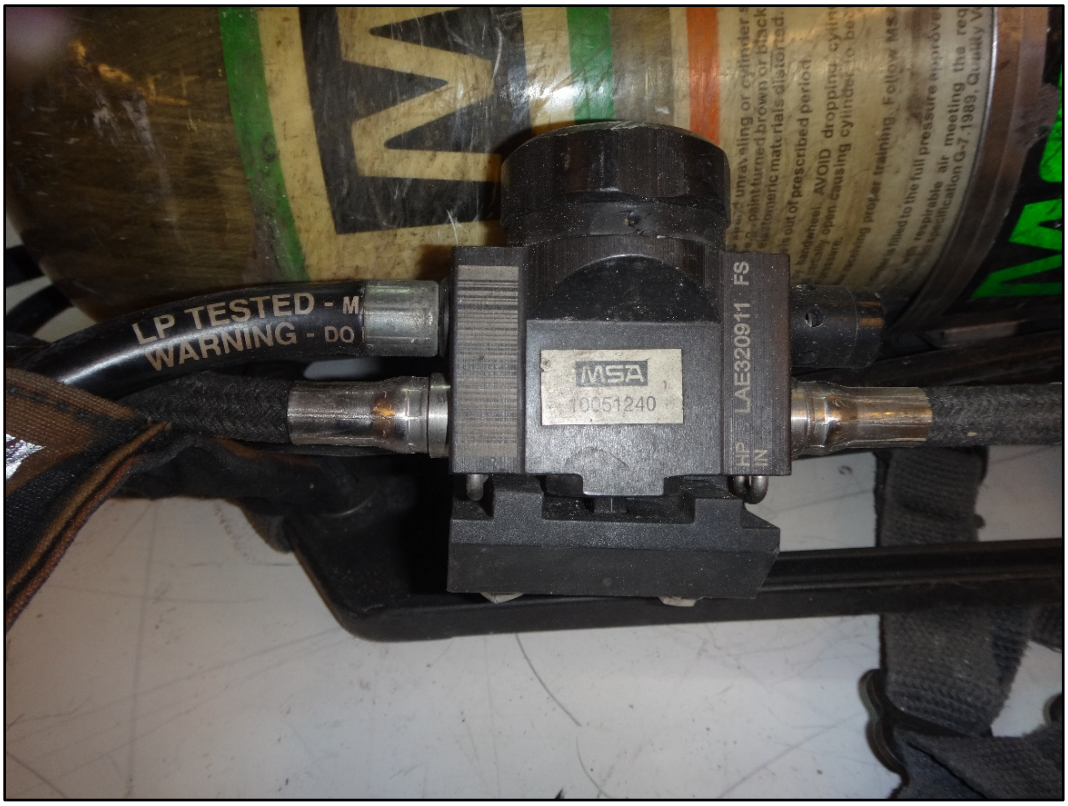


Figure 15: Pressure reducer assembly

Figure 16: Pressure reducer assembly damage

Figure 17: High-pressure hose and cylinder attachment

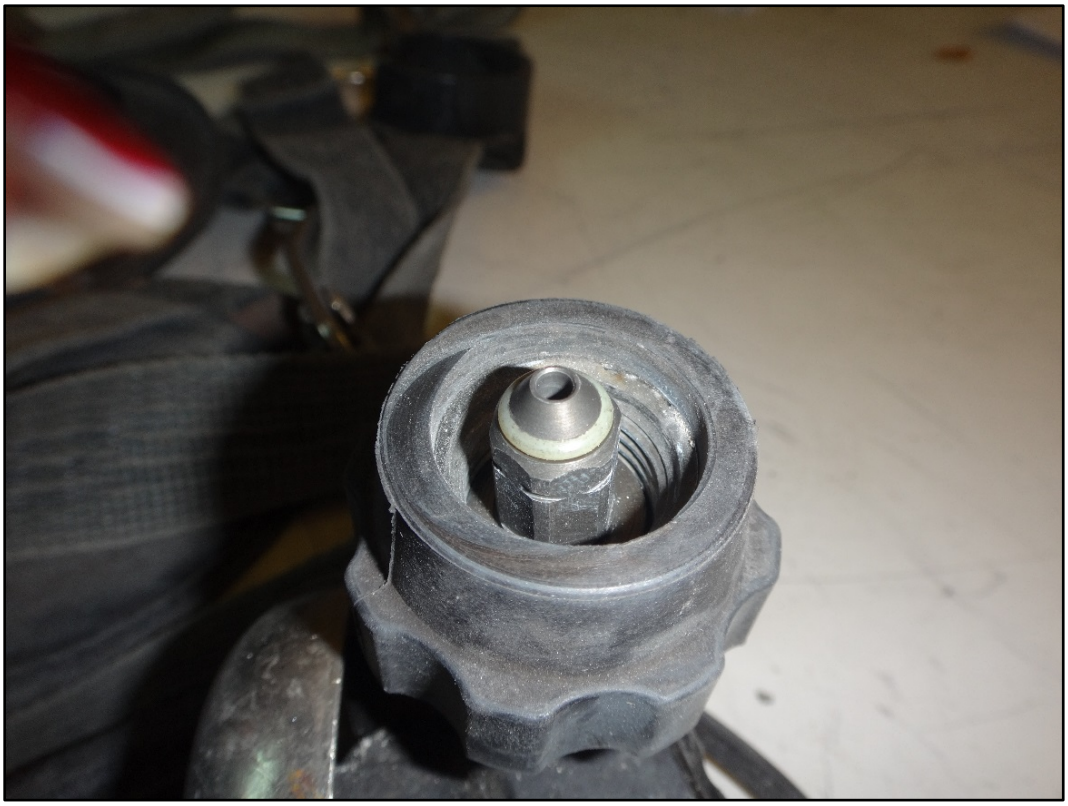


Figure 18: Cylinder attachment overview with O-ring present

Figure 19: Quick-Fill port overview

Figure 20: PASS console

Figure 21: Back of PASS console, SEI label

Figure 22: Overview of pack, PASS control module

Figure 23: Damaged label on PASS control module

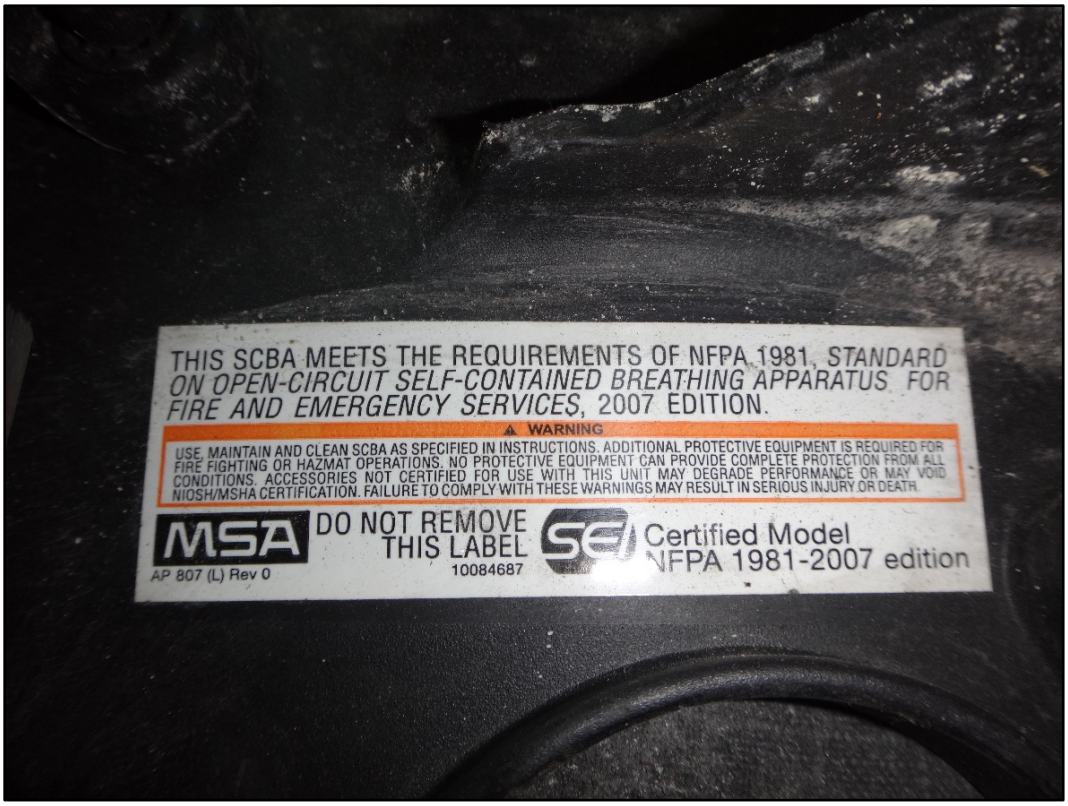


Figure 24: MSA label on pack

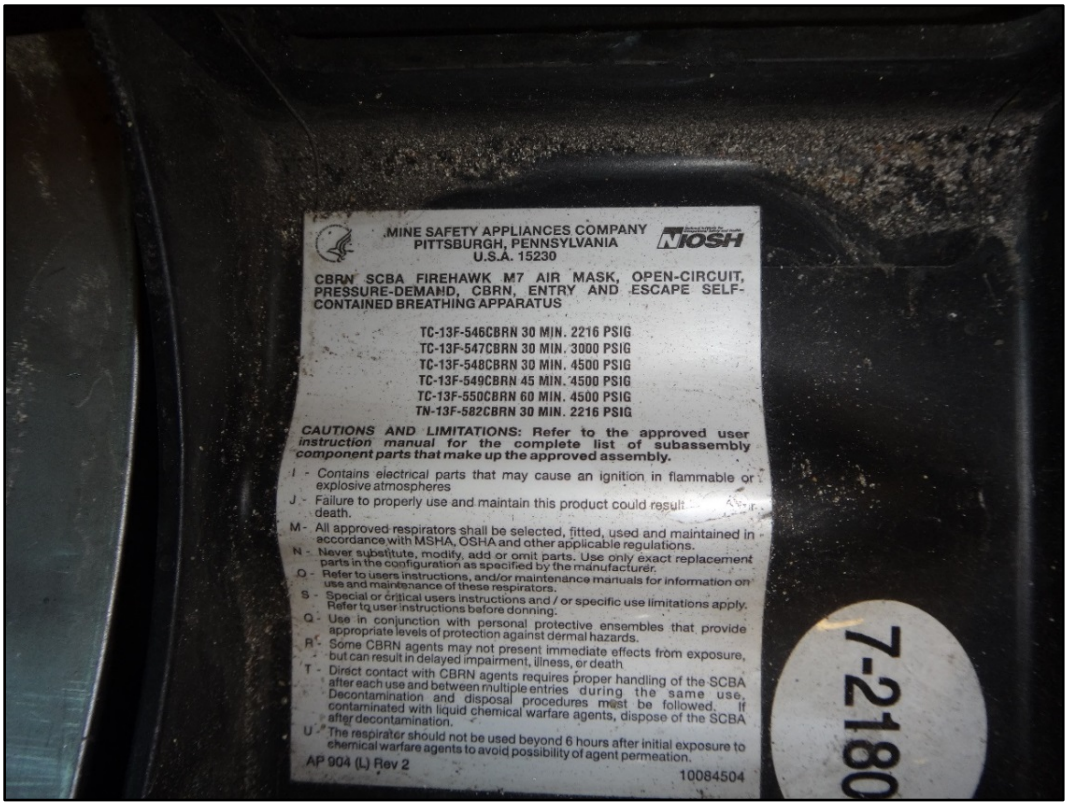


Figure 25: NIOSH label on interior of pack

Figure 26: Manufacture date stamp

Figure 27: Overview of straps and buckles

Figure 28: Broken lumbar attachment

Figure 29: Fall restraint belt

Figure 30: Overview of cylinder

Figure 31: Identifying markings and cylinder information

Figure 32: Hydrostatic test date

Figure 33: Cylinder gauge

Figure 34: Overview of cylinder threads

Figure 35: Damage through clear coat/fiber wrap in cylinder