

Interoffice Communication

To Safety Contacts
From C. H. Klunick - Safety - Houston
Date May 7, 1979
Subject Check of Fresh Air Breathing Equipment

Three firefighters died recently fighting a fire in Lubbock, Texas. They were wearing self-contained breathing apparatus, and although not in the immediate area, it is supposed the regulator diaphragms were split or punctured. MESA and NIOSH certify this equipment. No death reports confirming the cause of death have been issued to date.

The accident emphasizes the need to check this type of equipment on a regular basis. We strongly recommend that all Conoco self-contained breathing equipment be inspected in accordance with the manufacturer's instructions. Air pack equipment should be checked before and after each use, in addition to the manufacturer's recommended scheduled check.

Employee lives depend on the reliability of self-contained breathing apparatus. Over the years these units have provided personnel protection to employees that have had to carry out work assignments in potentially hazardous atmospheres. The design and construction have improved considerably over the years. Use of this type of apparatus has never resulted in a Conoco fatality, however, experiences of others emphasizes the continuing requirement of adequate training and proper maintenance.

Information available indicates the equipment used by the firemen was Scott Air, series 900014 or 900000. The 900014 is a demand type unit. This data has not been confirmed.

Training programs are available for inspection, maintenance and use of this type of equipment from both Scott and MSA.



C. H. Klunick
Manager of Safety

ad

17

SPECIAL NOTE

The cylinders used in these tests are the property of NIOSH. The Lubbock, Texas cylinders were not useable due to extreme leakage i.e., on 2 out of 3 of the Lubbock cylinders, duration was reduced to 2 to 3 minutes.

*Self
respirator*

TESTS OF SELF CONTAINED BREATHING APPARATUS

RECEIVED FROM LUBBOCK, TEXAS

FIRE DEPARTMENT

APRIL 1979

Division of Safety Research
National Institute for Occupational Safety and Health
Center for Disease Control
Department of Health, Education, and Welfare

SAL 000057378

SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) tested three Scott self-contained breathing apparatus (models II and IIA Air-Paks and Presur-Paks) and a regulator from a fourth Scott self-contained breathing apparatus, to determine their Bureau of Mines (BOM) or Mine Safety and Health Administration (MSHA)/NIOSH approval status. These apparatus and the regulator were sent to NIOSH at Morgantown, West Virginia, by Chief Foster of the Lubbock, Texas Fire Department. The apparatus were identified as having been worn at a fire scene by three fire fighters who died at that fire scene on March 25, 1979. The regulator was taken from an inservice piece of fire apparatus which may not have been on the fire scene. NIOSH examined the apparatus and regulator, as received, and found that critical parts were missing, damaged, and/or defective. The apparatus and regulator were tested and failed to meet several applicable requirements of BOM and MSHA/NIOSH respirator approval regulations (Title 30 Code of Federal Regulations: BOM Schedule 13E and MSHA/NIOSH Part 11).

The apparatus as received by NIOSH were considered to be in an unapproved condition. In each case, several repairs, replacements, and/or adjustments would be required to meet the applicable conditions of BOM or MSHA/NIOSH approval.

SAL 000057379

INTRODUCTION

Three Lubbock, Texas, fire fighters died at a fire scene on March 25, 1979. These fire fighters were equipped with Scott Model II and IIA Air-Pak and Presur-Pak self-contained breathing apparatus, approved by the Bureau of Mines (BOM) or by the Mine Safety and Health Administration (MSHA)/National Institute for Occupational Safety and Health (NIOSH). Chief Foster of the Lubbock, Texas, Fire Department asked NIOSH, on April 13, 1979, to examine and test the subject apparatus. The apparatus were received by NIOSH on April 23 and April 24, 1979, together with the separate regulator. They were tested for conformance with applicable BOM and MSHA/NIOSH respirator approval requirements.

DESCRIPTION OF APPARATUS

The apparatus and regulator consisted of the following assemblies (identified by NIOSH assigned numbers):

NIOSH
Assigned
Number

Description

- 1 This apparatus assembly bore a TC-13F-39 MSHA/NIOSH approval label on the backplate/harness subassembly. It was also equipped with a P/N 800212-00 pressure-demand regulator (S/N 57-10 1183), a cylinder (72621 BV HT 2-54, 1-63, 9-73 3AA-1800/ stenciled "LUBBOCK FD") and valve subassembly, and a facepiece (EM 13-E-08).
- 2 This apparatus assembly bore a TC-13F-40 MSHA/NIOSH approval label on the backplate/harness subassembly and was marked "47". It was also equipped with a P/N 800212-00 pressure-demand regulator (S/N 87-30 0658/ marked "47"), a cylinder (T79535 HT 2-76 SP 6498 2216/ stenciled "LFD" and "LUBBOCK FIRE DEPT" and valve subassembly, and a facepiece (1Q78/ marked "47").
- 3 This apparatus assembly bore a EM-13E-08 BOM approval label on the backplate/harness subassembly (stenciled "LFD"). It was also equipped with a demand regulator (S/N 55201 marked EM-13E-08), a cylinder (35641 DF HT 7-68+ 3AA 2015/ stenciled "LFD") and valve subassembly, and a facepiece (BM-13E-08/ stenciled "LFD" and marked "21").
- 4 This regulator subassembly consisted of a P/N 800212-00 pressure-demand regulator (S/N 47-21 0663) with diaphragm in place. This

regulator may be part of the MSHA/NIOSH TC-13F-40 approved assembly. A separate regulator diaphragm was in an envelope enclosed in the bag with the separate regulator.

Each of the above apparatus assemblies 1, 2, and 3 were found upon examination to differ from the applicable BOM and MSHA/NIOSH approved assembly in one or more aspects. The variations from approved status are detailed in Table 1.

In addition, each of the apparatus assemblies and regulator subassembly were found upon examination to have missing, damaged, and/or defective parts when compared with BOM and MSHA/NIOSH record material. These discrepancies and defects and other observations concerning the apparatus and subassembly are detailed in Table 2.

In summary, the three apparatus were expected to be demand and pressure-demand units of types approved by the Bureau of Mines and the Mine Safety and Health Administration/National Institute for Occupational Safety and Health. The apparatus identified by NIOSH Number 1 bore a MSHA/NIOSH TC-13F-39 approval label. This approval was issued for a demand-type 30 minute compressed-air self-contained breathing apparatus. NIOSH Number 1 apparatus, however, was equipped with a pressure-demand instead of a regular demand regulator and a pressure demand instead of a regular demand facepiece. It also had a low capacity cylinder (1800 psig/40 cubic feet) instead of the higher capacity cylinder (2216 psig/45 cubic feet) approved for use with the TC-13F-39 apparatus.

The apparatus identified by NIOSH Number 2 bore a MSHA/NIOSH TC-13F-40 approval label. This approval was issued for a pressure-demand type 30-minute compressed-air self-contained breathing apparatus. The apparatus identified by NIOSH Number 3 bore a BOM BM-13E-08 approval label. This approval was issued for both a demand type and a pressure demand type 30-minute compressed-air self-contained breathing apparatus. Except for variations in subassembly markings, both NIOSH Number 2 apparatus and NIOSH Number 3 apparatus were assembled with the correct subassemblies. The variations listed in Table 1 and the discrepancies and defects listed in Table 2 were cause for a NIOSH decision that none of the apparatus, as received from Lubbock, Texas, were in an approved condition.

APPARATUS TESTS

To further evaluate the assemblies and the subassembly regulator received from Lubbock, Texas, NIOSH personnel of the Division of Safety Research, Testing and Certification Branch, Respirator Section, conducted a series of performance tests. These tests were directed by Richard Ronk, Chief, Respirator Section, assisted by Samuel Terry, Phillip Arnett, Thomas John, and Nancy Carlock. NIOSH tests were begun

Table 1.--Variations of Lubbock, Texas, Apparatus from BOM or MSHA/NIOSH Approved Apparatus Assembly.

<u>NIOSH Assigned Number</u>	<u>Subassembly</u>	<u>BOM or MSHA/NIOSH Approved Apparatus Subassembly</u>	<u>Lubbock, Texas Apparatus Subassembly</u>
1	Backplate/ harness	800020-04 TC-13F-39	TC-13F-39
	Regulator	800013-00/(demand)	800012-00 (pressure-demand) ^{a/}
	Cylinder and valve	800010-00, -10, -02, or -12 (2216 psi)	(1800 psi) ^{a/}
	Facepiece	801450-13 or 17042	BM-13E-08 ^{a/}
2	Backplate/ harness	800020-04 TC-13F-40	TC-13F-40
	Regulator	800212-00 or 800212-03	800212-00
	Cylinder and valve	800010-00, -10, -02, or -12 (2216 psi)	(2216 psi)
	Facepiece	801500-15 or 40577	(not marked)
3	Backplate/ harness	BM-13E-08	BM-13E-08
	Regulator	BM-13E-08	BM-13E-08
	Cylinder and valve	(2015 psi)	(2015 psi)
	Facepiece	BM-13E-08	BM-1308

^{a/} Incorrect part.

Table 2.—Discrepancies and Defects Found on and Observations Concerning
Lubbock, Texas, Apparatus Compared with BOM and MSHA/NIOSH
Record Material.

NIOSH
Assigned

Number	Subassembly	Discrepancies, Defects and Observations
1	Backplate/harness	Rivet torn through belt at buckle end. Frayed strap. Holes through belt material Waist strap missing.
	Regulator	Diaphragm has 1/2 inch by 1/8 inch hole at 10 o'clock. Regulator cover stained at 10 o'clock. Regulator spring stained. Diaphragm stained at vents and at hole. Regulator cover stained at vents Retaining ring exterior stained. High-pressure ring seal to cylinder con- nection is cracked and leaks.
	Cylinder and valve assembly	Material protruding from male coupling at threads of cylinder gage. Gage bezel cracked. Cylinder valve chain lock missing. Cylinder gage screws loose. Material extruding from safety relief on cylinder. Cylinder gage at 0 psig.
	Facepiece	Dirt covering inside facepiece surface. Wire support broken inside breathing tube. Two screws missing from exhalation valve housing.
2	Backplate/harness	Waist strap missing.
	Regulator	Screw holding mainline valve lock is loose. Top screw of front housing cover of regulator at breathing tube connection is bent and loose. Diaphragm and regulator cover shows staining at vents. High-pressure cylinder seal screw and gasket are loose.
	Cylinder and valve	High-pressure leak at cylinder connection. Cylinder pressure gage guard missing. Cylinder gage at 0 psig.

Table 2:--Continued.

	Facepiece	Facepiece lens surface inside dirty. Breathing tube inner wire support broken in two places. Chin seal portion of facepiece is dirty.
3	Backplate/harness	Waist strap missing. Strap tearing at buckle.
	Regulator	Rubber sleeve at clamp of breathing tube to regulator connection has cracks. Screw for mainline valve lock is loose, rendering lock ineffective. Bottom screw of regulator housing cover missing at breathing tube connection side Regulator gage bezel and lens missing. Top screw of regulator housing cover at breathing tube connection side is bent. Diaphragm has 3 inch by 1/16 inch hole and is pulled away from retaining ring at 5:45 and 7:30. Diaphragm is stained at vent. Cover is stained at 5:45 and 7:30. One cover screw is missing. One cover screw is bent. High-pressure ring seal to cylinder connection is missing.
	Cylinder and valve	Cylinder knob locking pin is unlocked. Cylinder gage at 800 psig.
	Facepiece	Inside lens surface dirty. Lens retaining ring dented in several place. Exhalation valve dirty on both sides. Facepiece rubber tearing at left head strap molded retainer support. Facepiece rubber is cracking at right head strap molded retainer support.
4	Regulator	Mainline valve lock inoperable. High-pressure hose cut and gouged. Ring seal missing from high pressure cylinder seal connection.

Table 2.--Continued.

Screws holding back cover housing of
regulator are loose.
Gage bezel is cracked.
High-pressure leak at cylinder connection.
Regulator cover shows staining at vents.
Diaphragm regulator not stained.

Diaphragm in envelope shows staining around
3/16 inch by 1/6 inch hole and two additional
spots at 30 degrees and 60 degrees from hole.
Regulator plate spring shows staining at
vents and about 30 degrees from vent.
Demand valve deflector cracked.

1/ Clock locations observed with regulator outlet at top and regulator
cover toward viewer.

on April 23, 1979, and were completed on May 11, 1979. Except for the sodium chloride penetration tests, all tests were conducted as prescribed in BOM Schedule 13E for the EM-13E-08 type of apparatus and as prescribed in MSHA/NIOSH 30 CFR Part 11 for the TC-13F-39 and TC-13F-40 types of apparatus. For the sodium chloride penetration test, the regulators were placed in the center of a test hood which is approximately 36 inches high and 36 inches in circular diameter. The regulators were challenged with a sodium chloride aerosol of approximately 0.6 micrometer mass median aerodynamic diameter at a concentration of approximately 15 mg NaCl/cubic meter. The aerosol was generated by a Frontier Enterprises, Inc., FE 560A nebulizer and measured by a flame photometer. The method is discussed further in "A Guide to Industrial Respiratory Protection" (NIOSH 76-189). Because of the condition of the apparatus as received from Lubbock, Texas, and the desire to not disturb the contents of the Lubbock cylinders, the following tests were performed using the indicated parts. The NIOSH parts were taken from laboratory stock used for approval and check testing of Scott apparatus and were pre-tested for satisfactory operation.

	Backplate/ harness	Regulator	Cylinder and valve	Facepiece
Sodium chloride penetration	NIOSH	Lubbock	NIOSH	NIOSH
Isomyl acetate penetration	NIOSH	Lubbock	NIOSH	NIOSH
Exhal Resist.	NIOSH	Lubbock	NIOSH	Lubbock
Inhal resist.	NIOSH	Lubbock	NIOSH	Lubbock
Static press.	NIOSH	Lubbock	NIOSH	Lubbock
Gas flow	NIOSH	Lubbock	NIOSH	N/A
Service time	NIOSH	Lubbock	NIOSH	NIOSH
Remaining service time indicator	NIOSH	Lubbock	NIOSH	NIOSH

A list of all the tests performed by NIOSH, the BOM Schedule 13E and MSHA/NIOSH 30 CFR Part 11 references, the applicable performance level requirements, and the observed performance levels, are shown in Table 3. The performance failures are marked (*) in Table 3.

Table 3. --Performance Testing by NIOSH from 4-23-79 to 5-11-79, of Lubbock, Texas, Self-Contained Breathing Apparatus, Demand (d) and Pressure-Demand (pd).

Type of test	NIOSH Assigned Number	BOM or MSHA/NIOSH Reference	Required Performance Level	Observed Performance Level
NaCl penetration	1	MSHA/NIOSH special	<0.002% expected	14% (d) <0.002% (pd)
	2	do.	do.	0.0039% (d) <0.002% (pd)
	3	do.	do.	7.77% (d)
	4	do.	do.	<0.002% (d and pd as received) 7.69% (d with diaphragm from envelope) 0.00523% (pd with diaphragm from envelope)
Isoamyl acetate penetration	1	MSHA/NIOSH 11.85-19	No detectable leakage	large leak (d)*
	2	do.	do.	Test not performed.
	3	BOM 11.32	do.	Very large leaks (d)*
	4	MSHA/NIOSH 11.85-19	do.	Test not performed because diaphragm was not original.
Exhalation resistance 85 lpm	1	MSHA/NIOSH 11.85-6	≤ 1 " H ₂ O (d) ≤ 2 " H ₂ O above static/ ≤ 3.5 " H ₂ O total (pd)	Too high for test equipment (pd)
	2	do.	do.	4.85" H ₂ O (pd)*
	3	BOM 11.21 (d) (2)	do.	0.65" H ₂ O (d)
	4	MSHA/NIOSH 11.8.6	do.	3.15" H ₂ O as received* 2.1" H ₂ O w/diaphragm from envelope (pd)

Exhalation resistance at breathing machine airflows	1	MSHA/NIOSH 11.85-5	N/A	14.1" H ₂ O (d) 14.1" H ₂ O (pd)
	2	do.	N/A	6.44" H ₂ O (d) 5.82" H ₂ O (pd)
	3	BOM 11.21 (d) (2)	N/A	1.16" H ₂ O (d)
	4	MSHA/NIOSH 11.85-5	N/A	1.04" H ₂ O (d) as received 2.6" H ₂ O (pd) as received 1" H ₂ O (d) with diaphragm from envelope 3" H ₂ O (pd) with diaphragm from envelope
Inhalation resistance	1	MSHA/NIOSH 11.85-5	<1.25" H ₂ O (d) >0" H ₂ O (pd)	-2.91" H ₂ O (d)* 0.83" H ₂ O spike (pd)
	2	do.	do.	3.95" H ₂ O (d)* -1.45" H ₂ O (pd)*
	3	BOM 11.21 (d) (2)	do.	1.12" H ₂ O (d)
	4	MSHA/NIOSH 11.85-5	do.	1.95" H ₂ O (d) as received -0.42" H ₂ O spike (pd) as received * 2" H ₂ O (d) * with diaphragm from envelope >0" H ₂ O (pd) with diaphragm from envelope
Static pressure	1	MSHA/NIOSH 11.85-6	>0< 1.5 H ₂ O (pd)	1.37" H ₂ O (pd)
	2	do.	do.	1.04" H ₂ O (pd)
	3	N/A	N/A	N/A
	4	do.	do.	0.91" H ₂ O (pd) as rec'd 1.05" H ₂ O (pd) with diaphragm from envelope

Table 3. -Continued.

Gas flow	1	MSHA/NIOSH 11.85-8	>200 lpm at full pressure and 500 psi	142 lpm full* 310 lpm 500 psi (pd)
	2	do.	do.	110 lpm full* 112 lpm 500 psi*(pd)
	3	BOM 11.21 (d)(3)	do.	182 lpm full* 200 lpm 500 psi (d)
	4	MSHA/NIOSH 11.85-8	do.	118 lpm full * 180 lpm 500 psi (pd)*
Service time	1	MSHA/NIOSH 11.85-10	30 minutes	20.3 minutes *
	2	do.	do.	30.9 minutes
	3	BOM 11.21(d)(4)	do.	Not measured because decrease in service time would not be expected for demand unit.
	4	MSHA/NIOSH 11.85-10	do.	31.9 minutes
Remining service time indicator	1	MSHA/NIOSH 11.82	Operates be- tween 22.5 and 24 minutes	16.3 minutes**
	2	do.	do.	23.2 minutes
	3	BOM 11.21(c)(6)	do.	not measured
	4	MSHA/NIOSH 11.82	do.	25.3 minutes*

* Indicates failure to meet applicable BOM or MSHA/NIOSH performance requirements.

** Remaining service time indicator operated at 80% of observed service time (20.3 minutes).

During the tests described in Table 3, NIOSH personnel made the following general observations:

1. Apparatus and regulator with damaged or displaced diaphragms, i.e., NIOSH numbers 1, 3, and 4 (with diaphragm in envelope), showed excessive penetration when operated in the demand mode.
2. All apparatus had airflow less than 200 lpm required at full cylinder pressure.
3. Apparatus with dirt in facepiece, i.e. NIOSH number 1 and 2 showed excessive exhalation resistance.
4. Excessive inhalation resistances of NIOSH numbers 1 and 2 indicated possible regulator interior misadjustment, dirt, or damage.
5. Operation of remaining service time indicators was outside MSHA/NIOSH specifications on NIOSH numbers 1 and 4, indicating misadjusted, dirty, or damaged alarm.

CONCLUSIONS

On the basis of the physical examination and performance testing of the three self-contained breathing apparatus and one regulator, as received from the Lubbock, Texas, Fire Department on April 23 and 24, 1979, NIOSH has determined that the subject apparatus do not meet the applicable requirements of BOM Schedule 13E or MSHA/NIOSH 30 CFR Part 11.

In each instance, several repairs, replacements, and/or adjustments would be required to meet the requirements of BOM or MSHA/NIOSH approval. However, it must be stated that NIOSH has no information concerning the exact condition of the apparatus before or at the time of use at the fire scene on March 25, 1979. All NIOSH observations are limited to the condition of the apparatus as received by NIOSH.