187060

COMPRESSED GAS ASSOCIATION, INC.

4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923
(703) 788-2700 ■ Fax: (703) 961-1831 ■ E-mail: cga@cganet.com ■ Web Site: www.cganet.com

September 4, 2002

Docket Management System
U.S. Department of Transportation
Room PL 401,
400 Seventh Street, S.W.
Washington, DC 20590-0001

Subject: RSPA-01-10373 (HM-220D) -17

Gentlemen:

This letter represents an appeal by the Compressed Gas Association (CGA) to Docket RSPA-01-10373 (HM-220D) as required by 49 CFR §§ 106.110 and 106.115.

The CGA, founded in 1913, represents over one-hundred and fifty member companies world wide in the development and promotion of safety standards and safe practices in the industrial gas industry. The Association represents all facets of the industry – manufacturers, distributors, suppliers, and transporters. Through the committee system CGA creates technical specifications, safety standards, training and educational materials; and also works with government agencies to formulate responsible regulations and standards and to promote compliance with these regulations.

CGA members produce, market, and distribute industrial gases and cryogenic liquids such as carbon dioxide, ethylene, hydrogen, nitrogen, nitrous oxide, and oxygen as well as various specialty gases, many classified as poison gases. Accordingly our members have a strong interest in domestic and international regulations governing these products.

CGA can find no justification for an effective date just over sixty days from the initial notice in the Federal Register. NPRM HM-220 was open for over three years before it was finally withdrawn. HM-220D was issued as a Final Rule and provided no opportunity for public comment. To expect compliance of final rule HM-220D in such a short time is unreasonable. This Final Rule should be withdrawn and converted to a Notice of Proposed Rulemaking (NPRM) with sufficient time to review and comment on the proposal.

A brief review of this final rule by some of our members revealed the following significant issues that must be addressed:

§171.6(e). Some of what concerns our members is not what is in HM-220D as much as what is not. For instance, the 1994 issue of CGA publication C-3 is referenced in §171.6(e) of this rulemaking. CGA updated this publication in 2000 and again in 2002.

In addition, the volumetric expansion test contained in our publication C-1 is often referred to by DOT Enforcement during an audit but C-1 is not referenced in this rulemaking.

§173.301(f)(2). This section is particularly onerous to CGA and its members. In today's technology it is not possible to assure the PRD is in communication with the vapor phase. In liquefied compressed gas it is common practice to ship cylinders and tubes in a horizontal position. To design, test, implement and distribute a PRD that would at all times be in communication with the vapor phase would require several years and, considering the confined space in which the PRD would be contained, may not be practical or even possible.

If allowed to take effect this rule will, on October 1, 2002, outlaw millions of cylinders, many already in transit, with virtually no increase in safety. While the cost of such an action may be calculated it can not be done in so short a time frame. Considering it will affect the fire protection Industry, the refrigerant gas industry, Specialty Gas and Electronics Industries to name a few industries that control millions of cylinders it is not difficult to estimate the cost of compliance to be in tens of millions of dollars and possibly cause some companies to cease operations.

Further, tests were conducted by CGA, with DOT's participation, during the late 1970's validating the CGA formulas presently listed in CGA Pamphlet S-1.1 indicating PRD's were sufficient to relieve the cylinder (in the liquid phase) during a bonfire test. Due to the size of the report, over 130 pages, this report will be forwarded to RSPA under separate cover.

§173.301(f)(3). This section requires all PRDs in the DOT 3 series cylinders have a set pressure with a tolerance of "plus zero minus 10%" of test pressure. This requirement does not take into account that some PRDs are fuse metal devices designed to function in excess heat and at a point unrelated to the cylinder's test pressure.
We believe the more correct wording would be: "For DOT 3, 3A, 3AA, 3AL, 3AX, 3AAX, 3B or 3BN cylinder, from the first requalification due on and after October 1, 2002, the set pressure of the pressure relief device incorporating a CG-1, CG-4 or CG-5 pressure relief device shall not exceed the test pressure with a tolerance of plus zero to

Minus 10%. This requirement does not apply if a CG-2, CG-3, CG-7 or CG-9 device is used on the aforementioned cylinders".

§173.301(g)(1). The fifth sentence should be changed to read as follows:
"Each cylinder must be individually equipped with a pressure relief device as required in paragraph (f) of this section, except that pressure relief devices on manifolded horizontal cylinders, which are mounted on a motor vehicle or in a framework, may be selected as to type, location and quantity according to the lowest marked pressure limit of an individual cylinder in the manifolded unit, provided the pressure relief devices selected for the manifolded unit have been tested in accordance with CGA Pamphlets S-1.1 and S-7".

This revision would allow tube trailer and tube container manufacturers to assemble the equipment using a common type of safety relief device with the same pressure setting.

§173.301(h). This section is ambiguous. We believe RSPA intended to exempt MC and B type cylinders in acetylene service. However, the wording in this section implies all acetylene cylinders do not require valve protection. We believe this section must be rewritten to be clearly understood.

§173.302(b)(1). Elastomers and other non-metallic components are used in the sealing and operation of valves used in oxygen service. If this rulemaking takes effect as written it would create a major disruption in the supply of medical oxygen to hospitals and medical professionals. We believe it was the intent of RSPA to specify the metallic requirements similar to our recommendations in CGA publication V-9. This section should be rewritten as follows:
"Each valve body or the metallic portions of a valve that may come in contact with the oxygen being transported in the cylinder must be constructed of brass or stainless steel".

§177.840(a)(1). This new section requiring that all PRDs be ported in the vapor phase of the cylinder will have a very serious negative impact. The compressed gas industry physically can not comply with this requirement. See our comments on §173.301(f)(2).

§180.211(a) and (b). It is unclear if the intent of this section is to apply the same guideline for repairing newly manufactured cylinders as is required for non-manufacturers who repair old cylinders. This needs to be clarified.

These comments were provided after only a brief review. We believe there may be other issues not as apparent as these in HM-220D that could have a serious impact on the gas industry. The Compressed Gas Association believes this rulemaking represents a major change in the regulations requiring a much more thorough review and can not

stress enough that Final Rule HM-220D must be withdrawn and reissued as a Notice of Proposed Rulemaking (NPRM) with a 120 to 180 day comment period.

The CGA respectfully appreciates the opportunity to present this appeal and looks forward to a favorable response from RSPA.

Very truly yours,
COMPRESSED GAS ASSOCIATION

R. J. McGrath
Technical Manager

GAS
500 FIFTH AVENUE • NEW YORK N.Y. 10110 • (212) 354-1130

TEST OF CYLINDERS EQUIPPED WITH PURPOSELY UNDERSIZED PRESSURE RELIEF DEVICES

SUPPLEMENT

TO

FIRE TEST DATA IN SUPPORT

OF

S-1.1 FORMULAE

OCTOBER 24, 1979

REVISED 1/15/81

TABLE OF CONTENTS

A. Introduction

B. Summary

C. Data Package and Fire Test Background Information

1. Data Point G

2. Data Point K

3. Data Point W

A. INTRODUCTION

This document supplements the report titled "Fire Test Data In Support of S-1.1 Formulae". Whereas that report summarized successful fire tests applicable to cases where the valve safety devices were sized to minimum S-1.1 requirements, this document covers cases where purposely undersized safety devices resulted in cylinder ruptures. It is planned that this supplemental document becomes a repository for fire test data associated with cylinder ruptures. There is strong evidence to show herein that fire tests resulting in cylinder ruptures have been due to improperly sized safety devices; i.e., devices sized below S-1.1 requirements.

B. SUMMARY

Data Point G - A 125 lb. W_c cylinder ruptured. It was equipped with two valves which together were capable of protecting about 64 lb. W_c per S-1.1.

Data Point K - A 50 lb. cylinder ruptured, it was equipped with one valve capable of protecting 31.2 lbs. W_c per S-1.1.

Data Point W - A 50 lb. cylinder ruptured with a valve capable of protecting 35.2 lbs. W_c per S-1.1. Paragraph 4.8. Significantly this test was repeated by a successful follow-up test using a Condon valve #64-666A designed to meet S-1.1 requirements. This test is reported as Data Point 6 on Page 69 of "Fire Test Data In Support of S-1.1 Formulae".

125 Lb. Disposable - Fire Test

February 10, 1969

File

R. B. Schaefer

L95, R. Jernberg, B of E - C. Schultz

At the Bureau of Explosive lab, in Rahway, an initial fire test was completed February 6, 1969 unsuccessfully. It is our conclusion the cylinder was not equipped with adequate safety venting area. We further opine that thin wall vessels may require more venting capability than conventional types, because localized heating in a fire is more possible due to the thin wall and poorer heat dissipation, which if followed by localized annealing and premature burst.

Specimen tested was 125.2 lb. water capacity cylinder of nominal minimum wall 0.063 inches per WPS drawing A10669 equipped with 1 vapor to 1 liquid (diptube) nylon valve per Superior 6405 which have a rated flow capacity capable of handling about 31.2 lb. water capacity. Cylinder was charged at 125 lb. net with R22. It had been pretested at 350 psi and estimated burst was to be about 750.

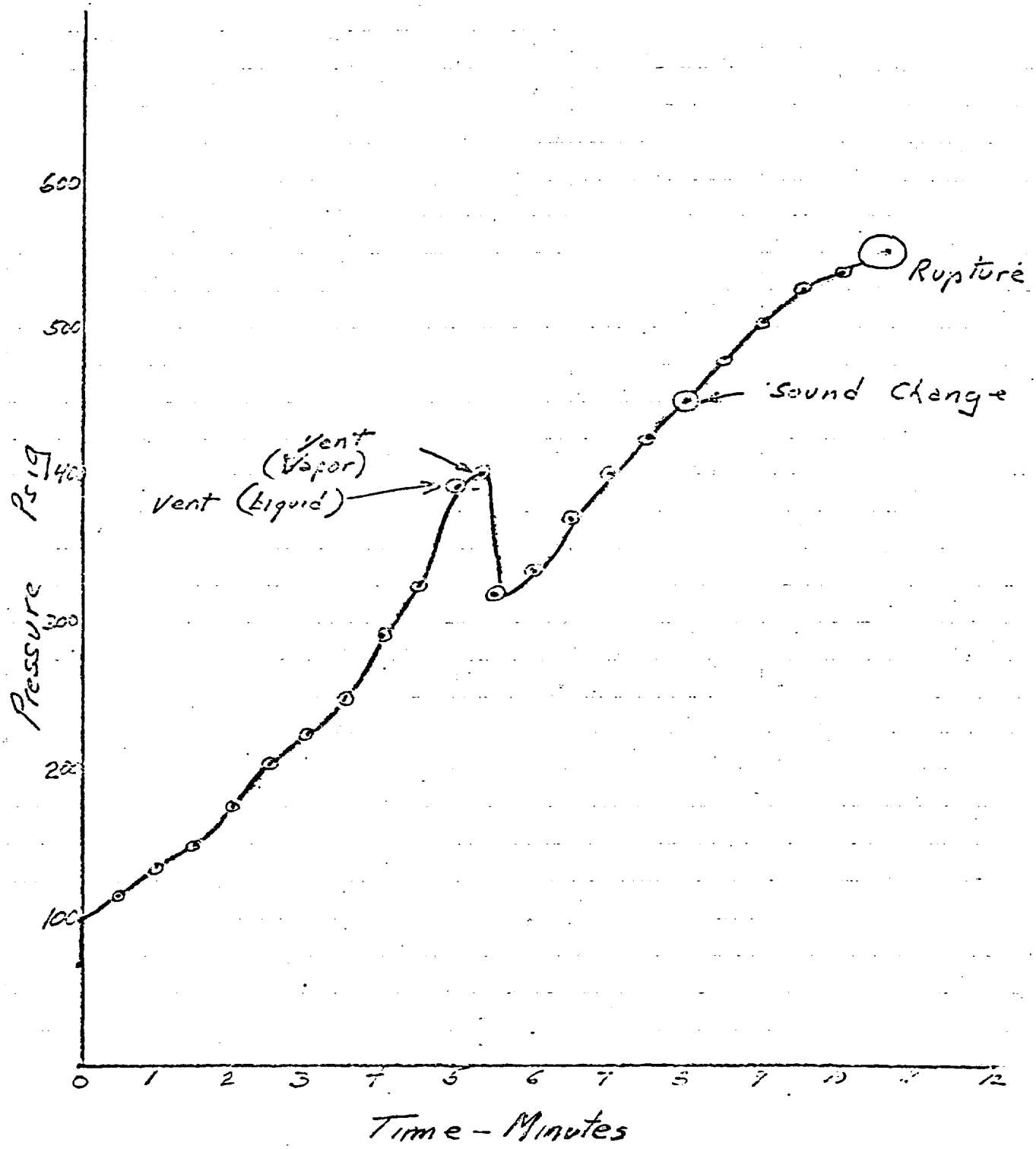
Test Set Up - Standard B of E fire test in explosion proof test. Approximately 2 cubic feet of kindling and a gallon of kerosine. Cylinder was gauged through a valve barely cracked open to a 1,000 lb. gauge located approximately 50 feet away.

Results - See pressure plot SK RBS 2669A. Cylinder ruptured at about 550 psi bursting into three pieces. Both valves were functioning fully at about 400 psi, but were inadequate to keep the pressure from rising. They operated for 5½ minutes, and we believe the safety operating parts blew out at 450 psi.

SK RBS 2669 is a gauge survey of the cylinder parts. The burst started at point 11 and was a normal burst for this type of tank.

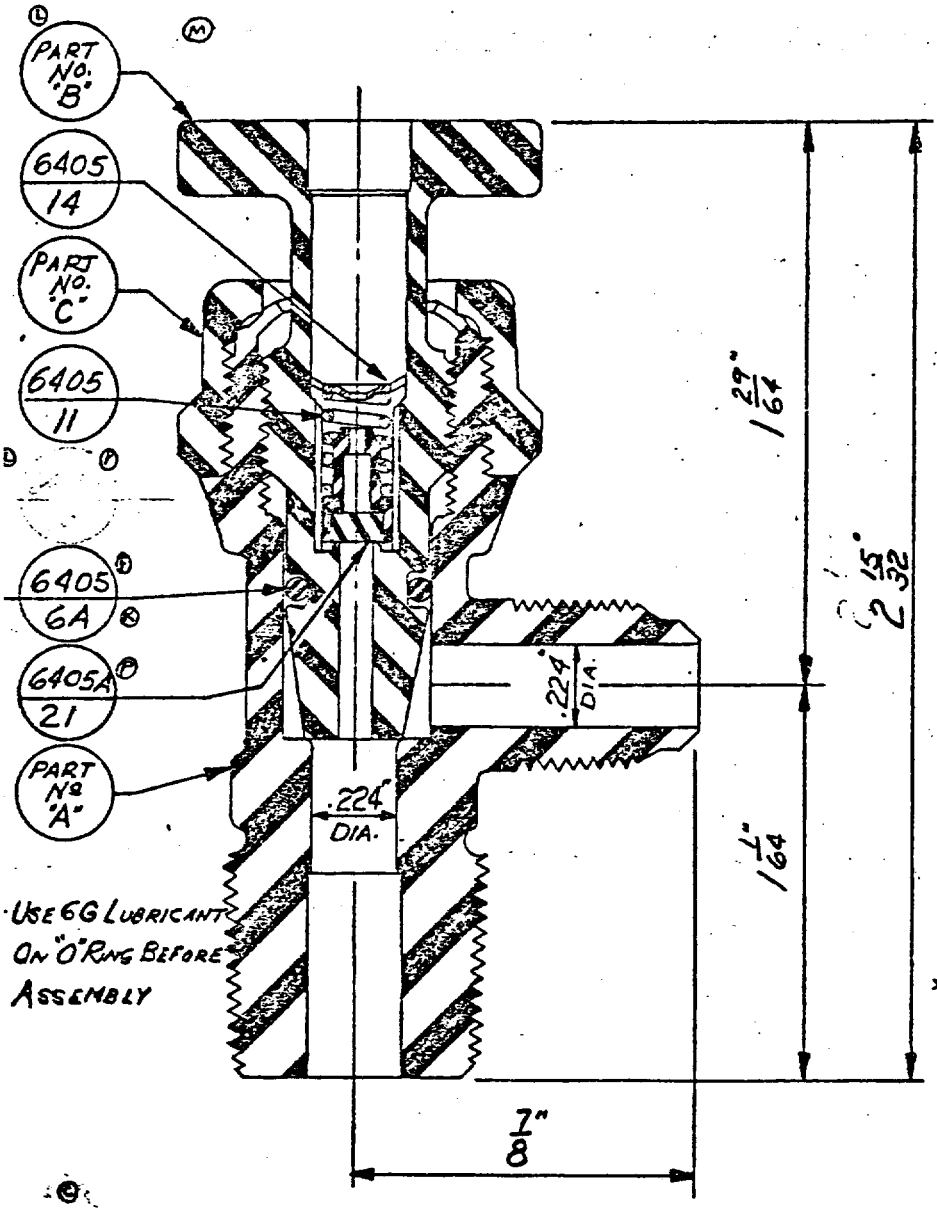
A.B. Schaefer, R. Jernberg, E. Hinderson, C. Schultz 125# CYNR 2/6/6 A

Temp 40°F

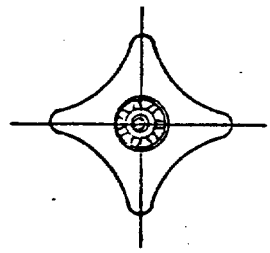


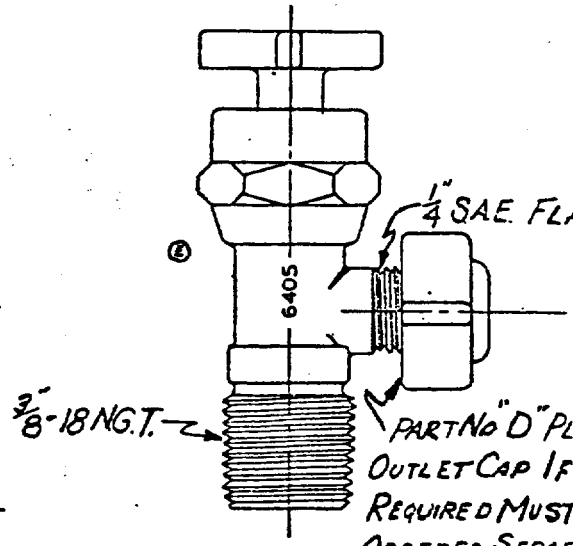
6405-G	GREEN	P6405-1G	P6405A-2G	P6405-3G	6405-20G
6405-BK	BLACK	P6405-1BK	P6405A-2BK	P6405-3BK	9002-20BK Ⓜ
6405-R	RED	P6405-1R	P6405A-2R	P6405-3R	———

Ⓟ P6405A-21 SUB ASSEMBLY INCLUDES PARTS 6405A-13 & 6405-17



NOTE:
VALVE TO BE SHIPPED IN OPEN POSITION





ACTUAL SIZE

Ⓔ TYPE SD 84 SAFETY DEVICE (DWG. No. 1955) APPROVED BY BUREAU OF EXPLOSIVES LETTER, 272-1-611, BA-730, W-D, DATED OCT. 9, 1967 FOR CYLINDERS CONTAINING LIQUEFIED COMPRESSED GAS HAVING A MAXIMUM WATER CAPACITY OF 31.2 POUNDS

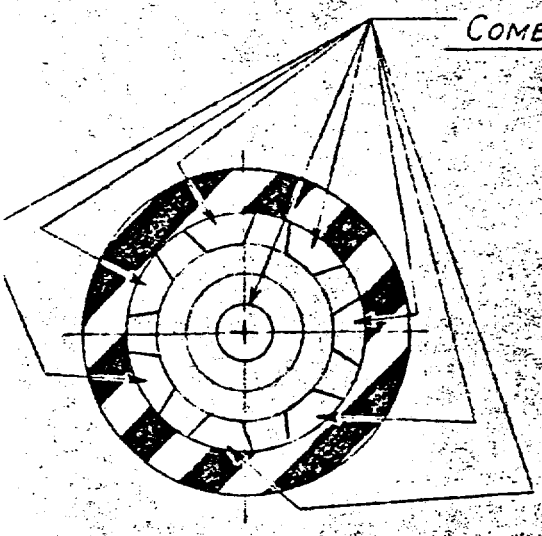
PATENT PENDING

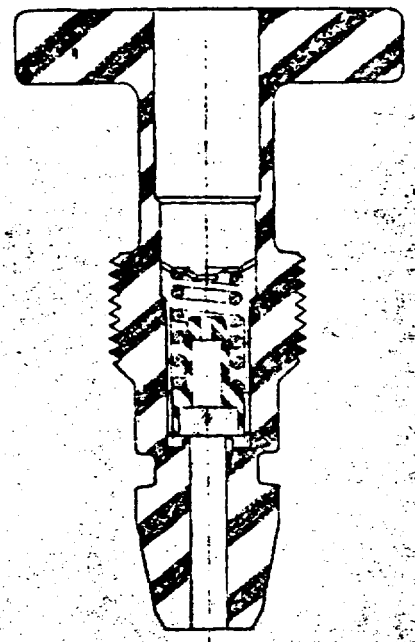
Ⓔ SAFETY DEVICE SETTING 360-480 P.S.I.

LERANCE FOR DIMENSIONS HER THAN THOSE SPECIFIED	**SUPERIOR VALVE COMPANY** WASHINGTON, PA.	DRAWN BY G. ALBERT	DATE 7-6-67	DRAWING NO. 6405
DIA. LENGTH	PLASTIC VALVE FOR 25# THROW AWAY REFRIGERANT CONTAINERS	CH'KD. BY WRY	SCALE 24"/1'-0"	
CIMAL ± .002 ± .005				
ACTIONAL ± .005 ± .010		PART NO. OR CATALOG NO. SEE TABLE		

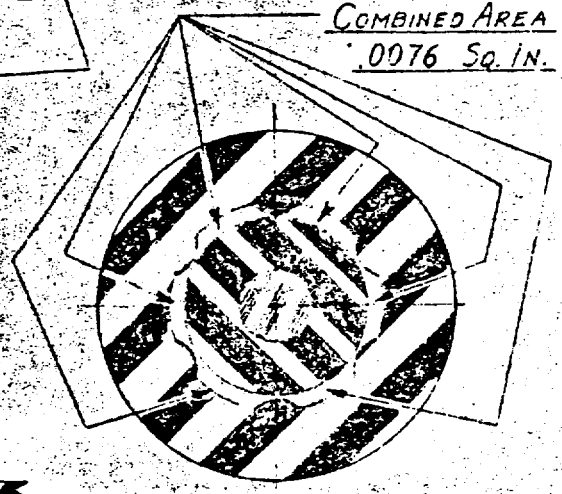
REVISIONS

D	ADDED SUB ASSY. 6405A-21 Removed 6405A-13 6405-17	DATE		DATE		DATE		DATE		DATE	

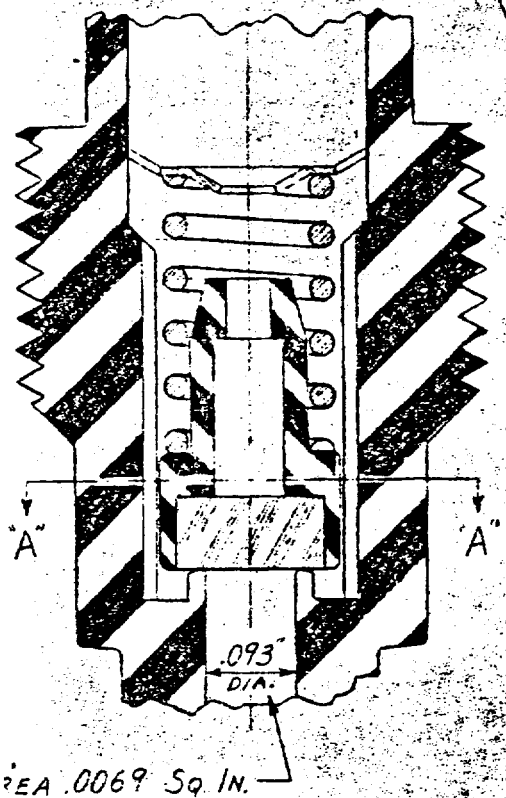




SCALE 2X1



SECTION A-A



STYLE	INITIAL LEAK P.S.I. (MIN.)	DISCHARGE CAPACITY C.F.M.	FLOW RATING PRESSURE P.S.I.G.	RESEAL P.S.I. (MIN.)
SD84-360	360	47.57	430	336

(A) TYPE SD84 SAFETY DEVICE APPROVED BY BUREAU OF EXPLOSIVES LETTER, 272-1-611, BA-730, W-D, DATED OCT. 9, 1967 FOR CYLINDERS CONTAINING LIQUEFIED COMPRESSED GAS HAVING A MAXIMUM WATER CAPACITY OF 31.2 POUNDS

ERANCE FOR DIMENSIONS ER THAN THOSE SPECIFIED

	DIA.	LENGTH
IMAL	± .002	± .005
CTIONAL	± .005	± .010

SUPERIOR VALVE COMPANY
WASHINGTON, PA.

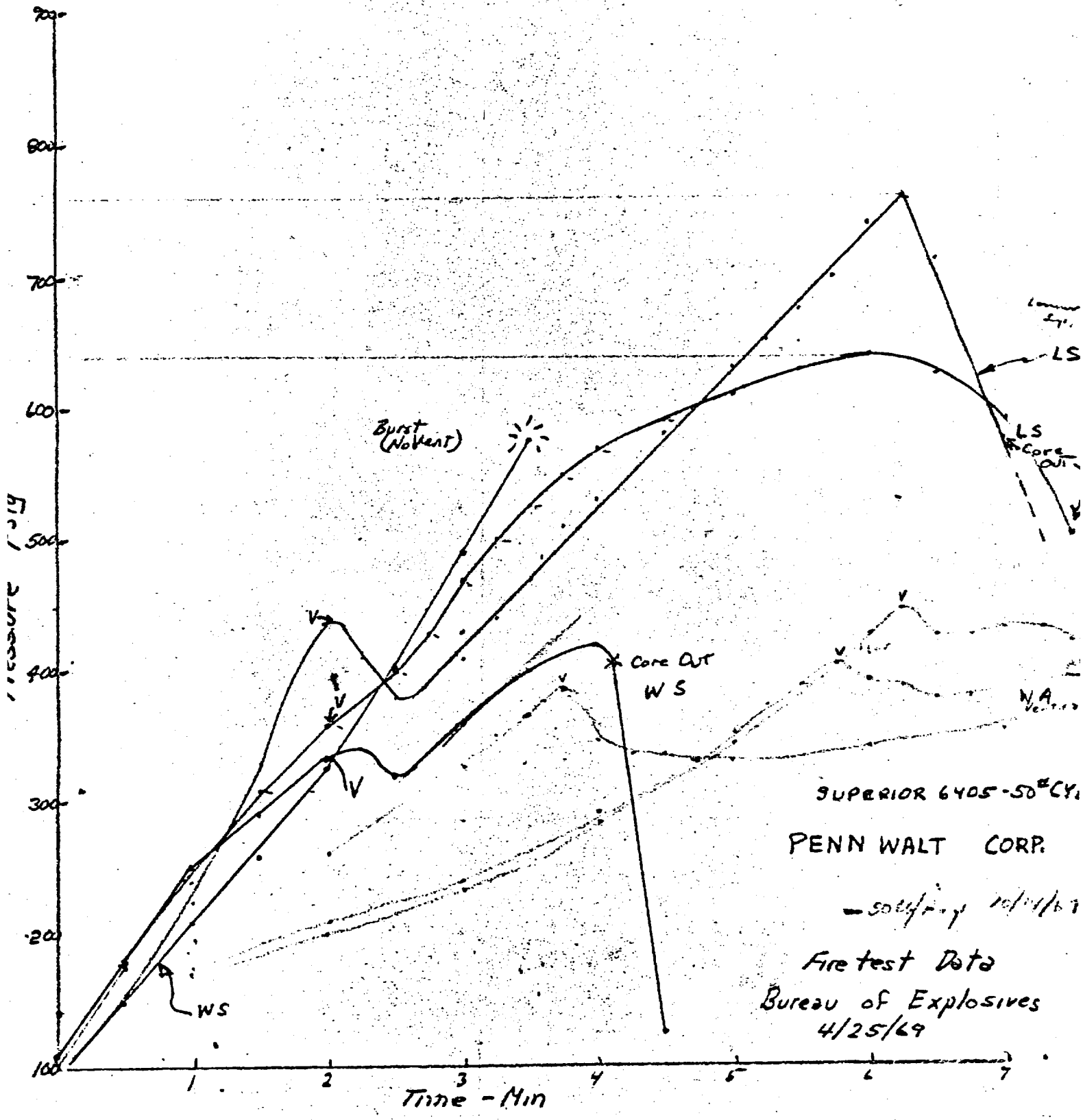
TYPE SD84 SAFETY DEVICE

DRAWN BY	DATE	DRAWING NO.
H. HOLLIS	9-13-67	1955
CH'KD. BY	SCALE	
[illegible]	5X1	

PART NO. OR CATALOG NO.

REVISIONS

TE	ADDED APPROVAL NOTE	DATE		DATE		DATE		DATE		DATE



900
800
700
600
500
400
300
200
100
1
2
3
4
5
6
7
Time - Min
Burst (No Vent)
V
Core Out
W S
WS
LS
LS
Core Out
SUPERIOR 6405-50# CY
PENN WALT CORP.
Fire test Data
Bureau of Explosives
4/25/69

HARTFORD (203) 246-6621
ENFIELD (203) 749-7441
WINDSOR LOCKS [illegible]

TEST & INSPECTION REPORT

AKO, INC.

A OK TESTING DIVISION
A OK BALANCING DIVISION
E S WHITE TIMING DEVICES DIVISION

P.O. BOX 989
HARTFORD, CONNECTICUT 06101

PLANT LOCATION BROAD BROOK ROAD ENFIELD CONN 06082

COMPLETE TESTING AND INSPECTION SERVICE

MASS, FORCE, TORQUE, HYDROSTATIC FLOW, PHYSICAL, PROOF TESTING
MASS SPECTROMETRY LEAK DETECTION, STATIC & DYNAMIC BALANCING
SCALE & DYNAMOMETER, CALIBRATION, FLUORESCENT PENETRANT & NDT TESTING

CHARGE TO: Pessure Pak, Inc.
25 Skinner St.
East Hampton, Conn.

SHIP TO:

LAB#	YOUR REFERENCE NO.	SHIPPED FROM	VIA	SHIPMENT COMP	SHIPMENT PART	DATE	INV. DATE
514	R. Jernberg	Enfield, Ct	truck	X		9-27-79	

QUANTITY	PART NO.	DESCRIPTION
1		Safety Relief Valve

PARTS CONFORMING _____
PARTS NOT CONFORMING _____

METHOD USED:

Relief valve was flow tested @ 450 PSI inlet pressure using a standard sonic flow nozzle to measure flow rate.

RESULTS:

The flow rate was 25.3 SCFM. (or 27 CFM 495psia)

EQUIPMENT USED:

Flow Dyne .0251 nozzle

The above parts have been carefully tested in accordance with above methods. This inspection is limited to defects disclosed from above method only. OUR LIABILITY NOT TO EXCEED COST OF RE-INSPECTION OR RE-TEST.

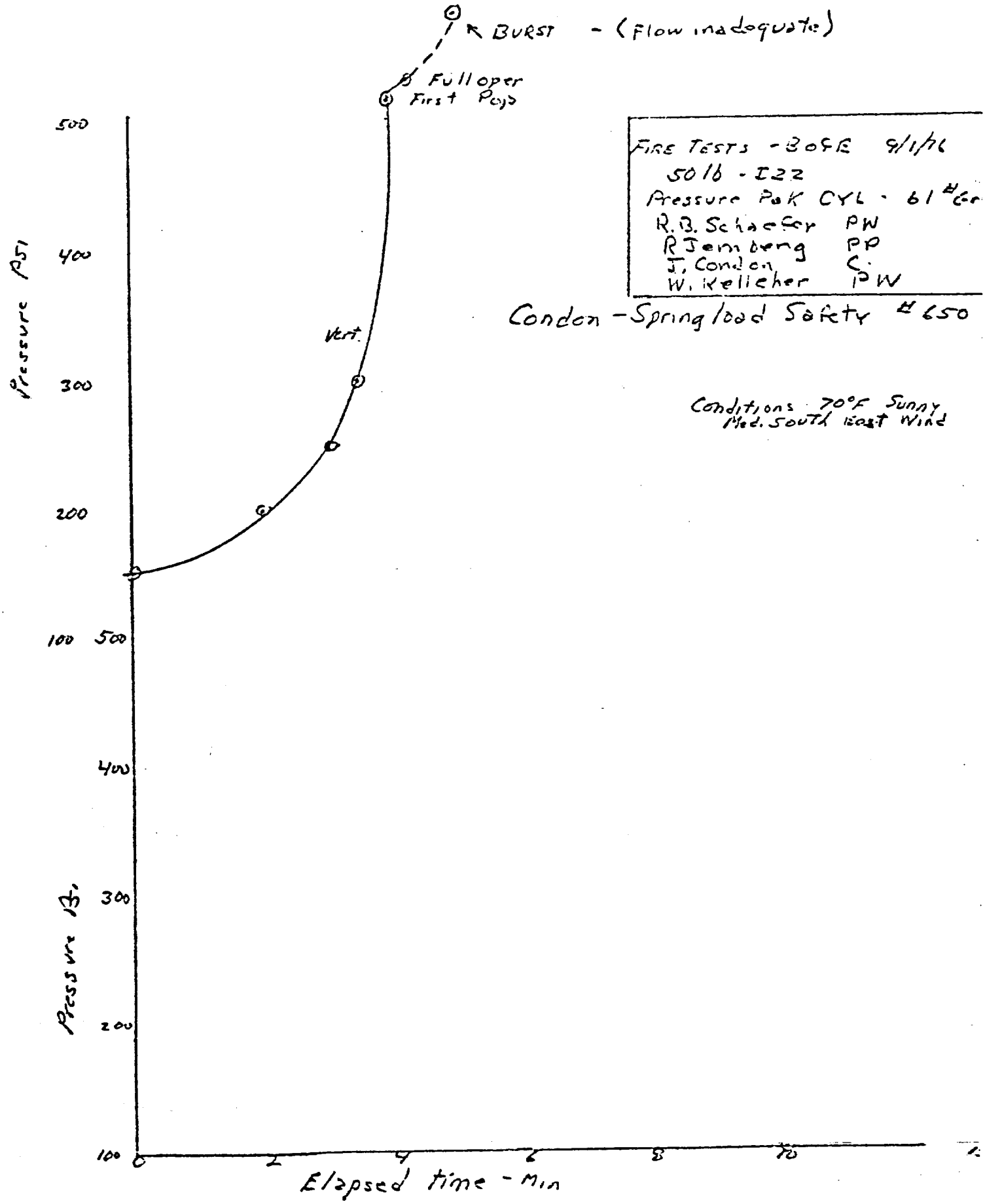
RESPECTFULLY SUBMITTED,

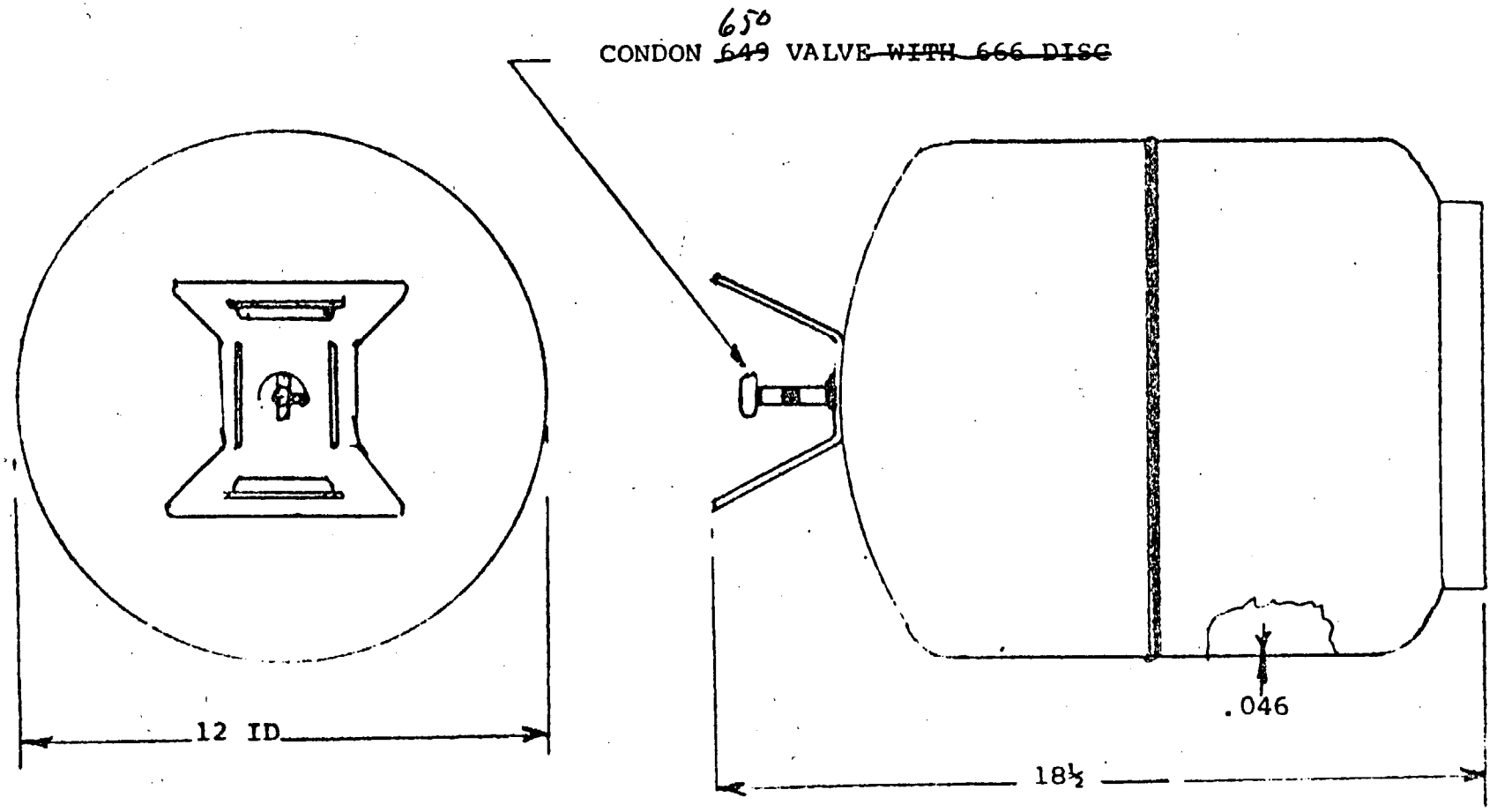
Subscribed and sworn to before me
this ..... day of ..... 19.....

(Seal)

Certification No. 20403

[signature]


BURST - (Flow inadequate)
Full oper
First Pop
Vert.
Fire Tests - B of E 9/1/76
50 lb - I22
Pressure Pak CYL - 61 # Cr
R. B. Schaefer PW
R Jemberg PP
J. Condon C
W. Kelleher PW
Condon - Spring load Safety # 650
Conditions 70°F Sunny
Med. South East Wind
Pressure PSI
500
400
300
200
100
Pressure lb.
500
400
300
200
100
0
2
4
6
8
10
Elapsed time - Min



DOT39-NRC 260/325 M1002
CAPACITY 53.25 LBS. WATER MIN.
SERVICE PRESSURE 260 PSI
TEST PRESSURE 325 PSI
BURST PRESSURE 650 PSI MIN.
FINISH: ONE COAT ENAMEL

PRESSURE-PAK CONTAINER, INC.
East Hampton, CT 06424

DR.: RHS	SCALE ¼	DATE 9/21/71	PART # 92371

TITLE:
50 lb. W/C DISPOSABLE CYLINDER

MATERIAL:
AL. KILLED AISI 1010 STEEL

PENNWALT

FORM 1025

SUBJECT Bureau of Explosives Tests - Isotron 50-Lb.

DATE September 3, 1976

TO FILE

FROM R. B. Schaefer

IN REPLY TO

COPIES TO H45, M30, D10
Jim Condon, Condon Mfg. - Bob Jernberg, Pressure Pak

At the Bureau of Explosives in Raritan Industrial Park on September 1, a series of tests were made to see if we could qualify the Condon Steel Valve for flow and performance. The attached chart shows the results of the test which shows inadequate flow on the spring loaded version; but excellent performance on the diaphragm type. In view of our interests in having a secondary source on an adequate valve, we have asked Condon to continue to work on the spring load type but would like to get a trial lot of the diaphragm style for commercial experimental work.

Safety devices have not been a problem nor have they had bad experience in their testing rigs.

RBS/ms
Attach.

GAS
500 FIFTH AVENUE • NEW YORK, N.Y. 10110 • [illegible]

FIRE TEST DATA IN SUPPORT OF S-1.1 FORMULAE

October 30, 1978
(Original)

November 13, 1978
(Revised)

December 11, 1978
(Revised)

November 1, 1980
(Revised)

LIST OF PHOTOGRAPHS

Negative Number	Page Number	Description
3	8	Eclipse Fire Engine Company, wheel type burner unit with fire brick cylinder support installed
4	8	Burner unit with secondary wind deflector installed
6	9	Spark Igniter being installed thru base assembly
8	9	Center chimney assembly installed
10	10	Top chimney section and downdraft deflector installed
11	10	Lower insulation, two flue gas and two cylinder surface T/C's, Spark Igniter and propane fuel line installed
12	11	Braided steel cable blast mats fully installed
13	11	Dummy 20 lb. CO_2 cylinder before instrumentation check-out dry run
14	11	Dummy cylinder after dry run
15	12	Test assembly (rear right), propane fueling cylinder (right foreground), instrumentation van (left center)
16	12	4BA-240 Propane Fueling Cylinder with Brooks Flowmeter and Fisher LP Gas Regulator
17	13	Brown Potentiometer with calibration balance for automatic pressure readout; 0-6000 psi Helicoil Visual Readout Pressure Gage (0-2000 psi gage not shown) with 0-5000 psi Teledyne Pressure Transducer (0-1000 psi Transducer not shown) and attached pressure bleed-off valve
18	13	Minimite II Thermoelectric T/C Visual Readout Potentiometer with 4 channel switchover box
23	18	DOT 3AA, 2015 psig, Linde Type "S" Cylinder (N_2) before start of Test-3
24	18	Cylinder after Test-3
138-7	25	Luxfer DOT E-6498 Aluminum Cylinder and Fire Test Apparatus Used by Luxfer (From previous tests)

A. INTRODUCTION

This document contains fire test data whose purpose is to support and validate the pressure relief device flow equations of CGA Pamphlet S-1.1 in the proposed revised 1978 version. These equations have been used successfully for over 30 years where properly applied.

The flow requirements computed from these equations are for compressed gases. Where the gas is liquefied then the computed flow must be doubled; i.e., liquefied gases must have double the flow capacity for a given cylinder water capacity.

In the past some fire tests have been run with undersize pressure relief devices. This was done knowingly in an effort to determine the maximum cylinder capacity for a specific pressure relief device. In these cases, maximum cylinder capacity was indicated by cylinder rupture. These types of tests are not to be confused with those tests designed to validate S-1.1 equations. The validation tests were performed with relief devices sized to the minimum allowed by S-1.1 equations for the cylinders and contained gases on which they are installed. The test data herein is for such applications.

Fire tests have been performed to date by the following methods:

1. Gasoline open pan
2. Bureau of Explosives, wood/kerosene bonfire
3. Chimney controlled gas

The chimney type test has been selected as the standard type fire test because it provides the greatest control over test performance and maximizes reproducibility of test conditions. While there are a number of factors that

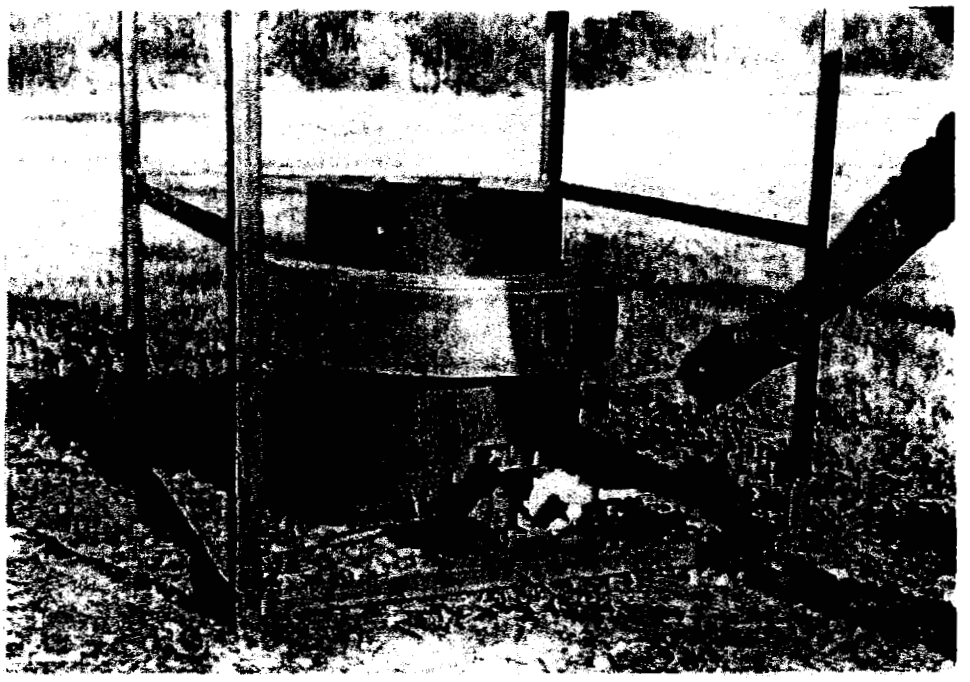
FIRE TESTS REQUIRED TO VALIDATE S-1.1 FORMULAE

TABLE 1

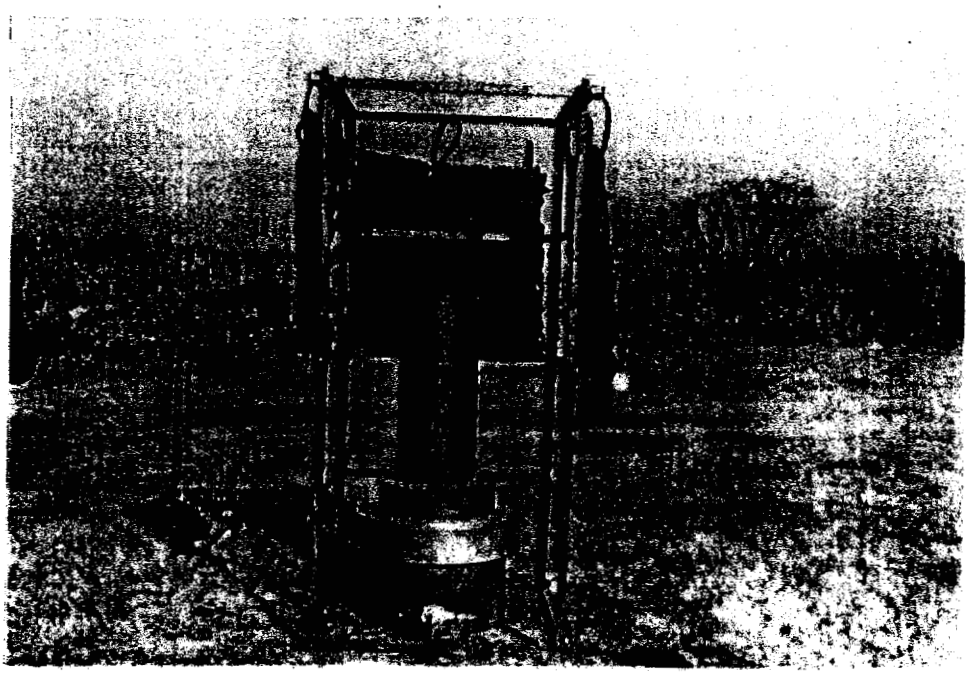
CASE	S-1.1 PARA. VALIDATED	STATE OF GAS		PRESSURE		CONTAINER TYPE						REMARKS
		LIQ.	NON LIQ.	HIGH	LOW	4L	DOT 39 STL.	3A, 3AA	3E TYPE	4E	4B, 4BA	
* 1A	4.5		X	X			See Note (a)	X				Validated by Data Point 1
1B	4.5		X	X					X			Validated by Data Point 2
2	4.5, 4.7		X		X							Not required; Temp./Press. combination cannot exceed 2 times factor built into S-1.1 for liquefied gases
* 3A	4.6	X		X				X				Validated by Data Point 3
* 3B	4.6	X		X					X			Validated by Data Point 4
4A	4.6, 4.8	X			X						X	Validated by Data Point 5 and 11
4B	4.6, 4.8	X			X		X					Validated by Data Points 6, 7 and 8
* 4C	4.6, 4.8	X			X					X		Validated by Data Point 9
5	4.9	X			X	X						Cryogenic; Validated by Data Point 10

NOTES: (a) Not required because DOT 39 limited to size; always 2.5 times required flow provided because the maximum size of DOT 39 cylinders is 10 lbs. and the S-1.1 equations require provisions for a 25 lb. capacity.

* - Tests run at Bureau of Explosives on 10/11/78 and 10/12/78.

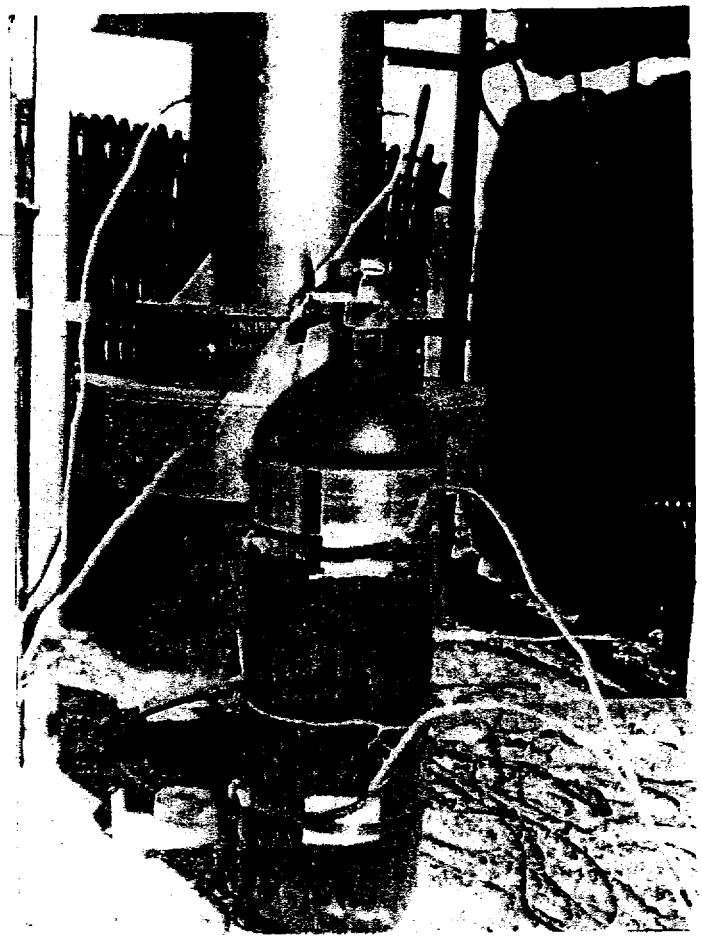


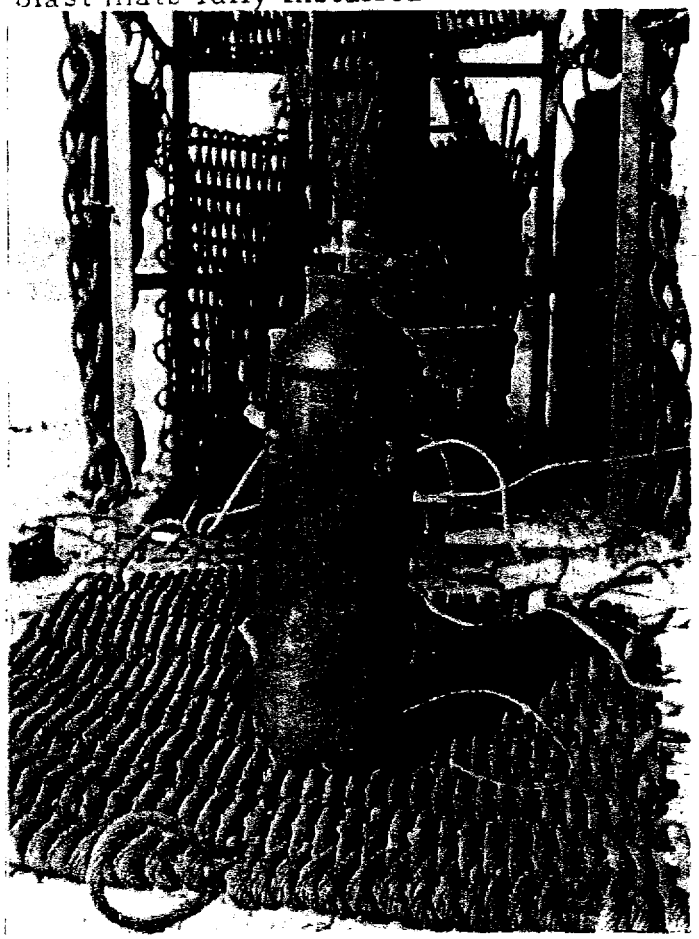
6 Spark Igniter being installed thru base assembly



8 Center chimney assembly installed

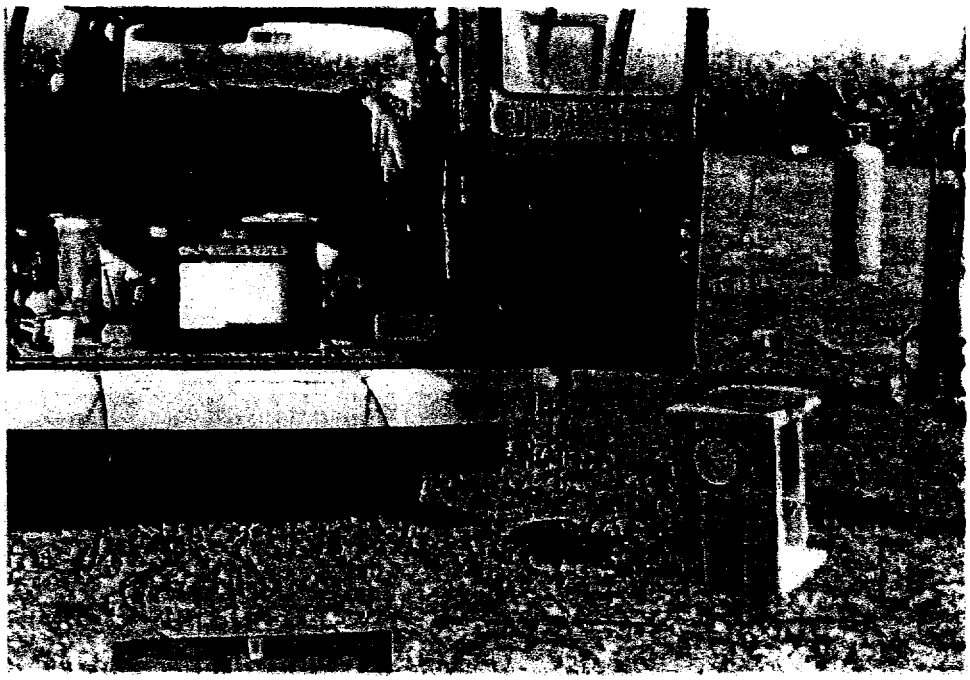
12 Braided steel cable blast mats fully installed





13 Dummy 20 lb. CO_2 cylinder before instrumentation check-out dry run

14 Dummy cylinder after dry run



17 Brown Potentiometer with calibration balance for automatic pressure readout; 0-6000 psi Helicoil Visual Readout Pressure Gage (0-2000 psi gage not shown) with 0-5000 psi Teledyne Pressure Transducer (0-1000 psi Transducer not shown) and attached pressure bleed-off valve

18 Minimite II Thermoelectric T/C Visual Readout Potentiometer with 4 channel switchover box

DATA PACKAGE

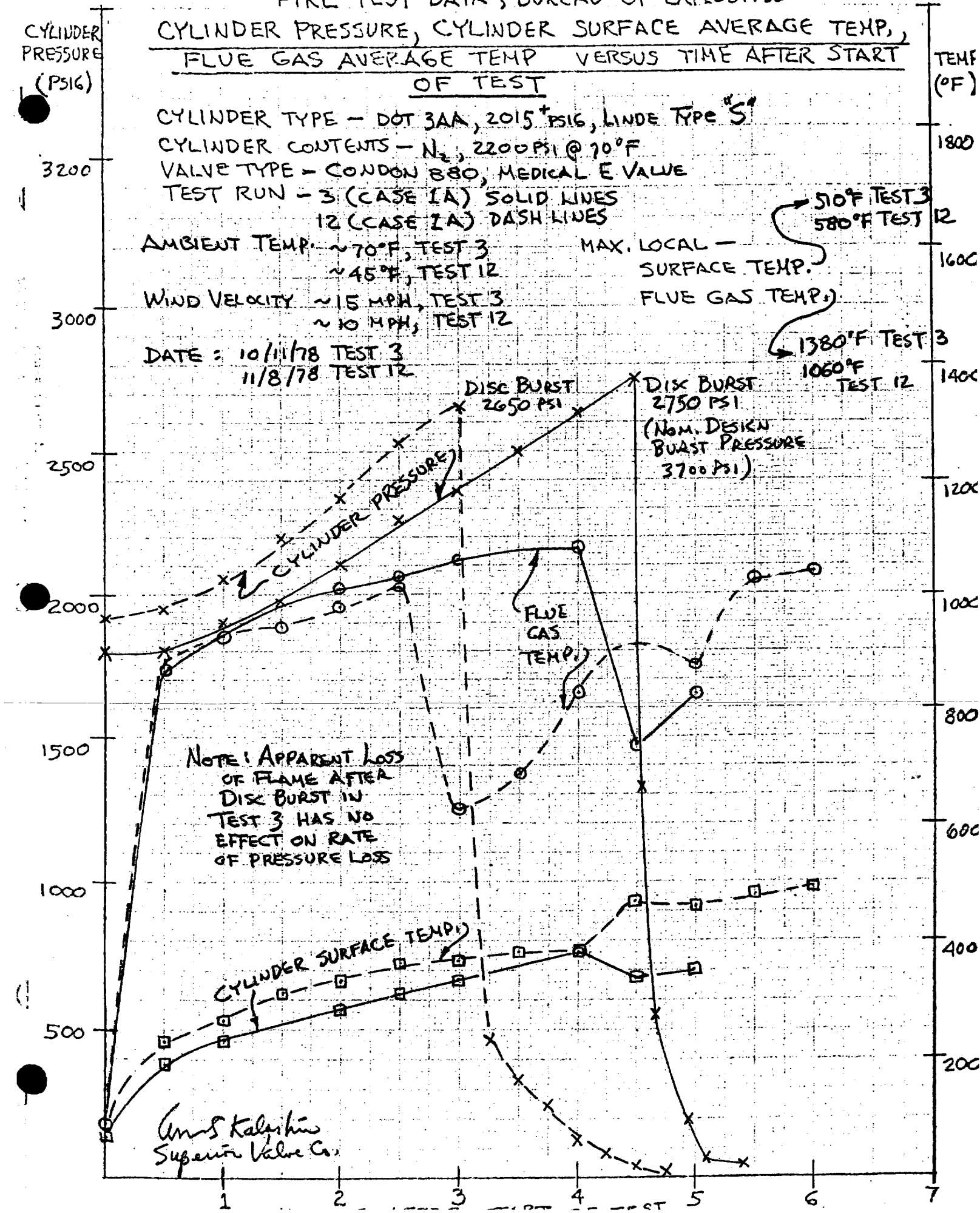
AND

FIRE TEST BACKGROUND INFORMATION

FOR

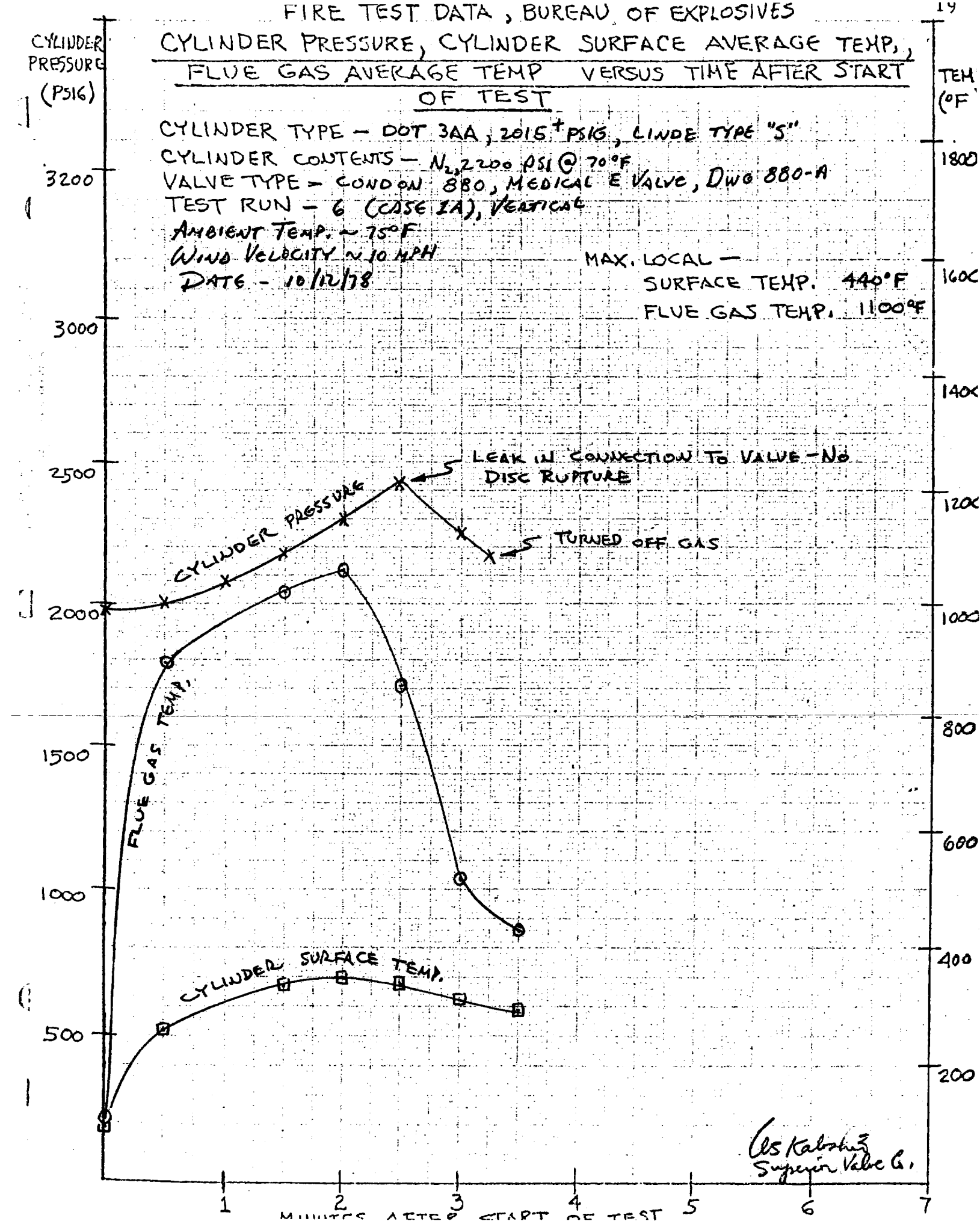
DATA POINT 1

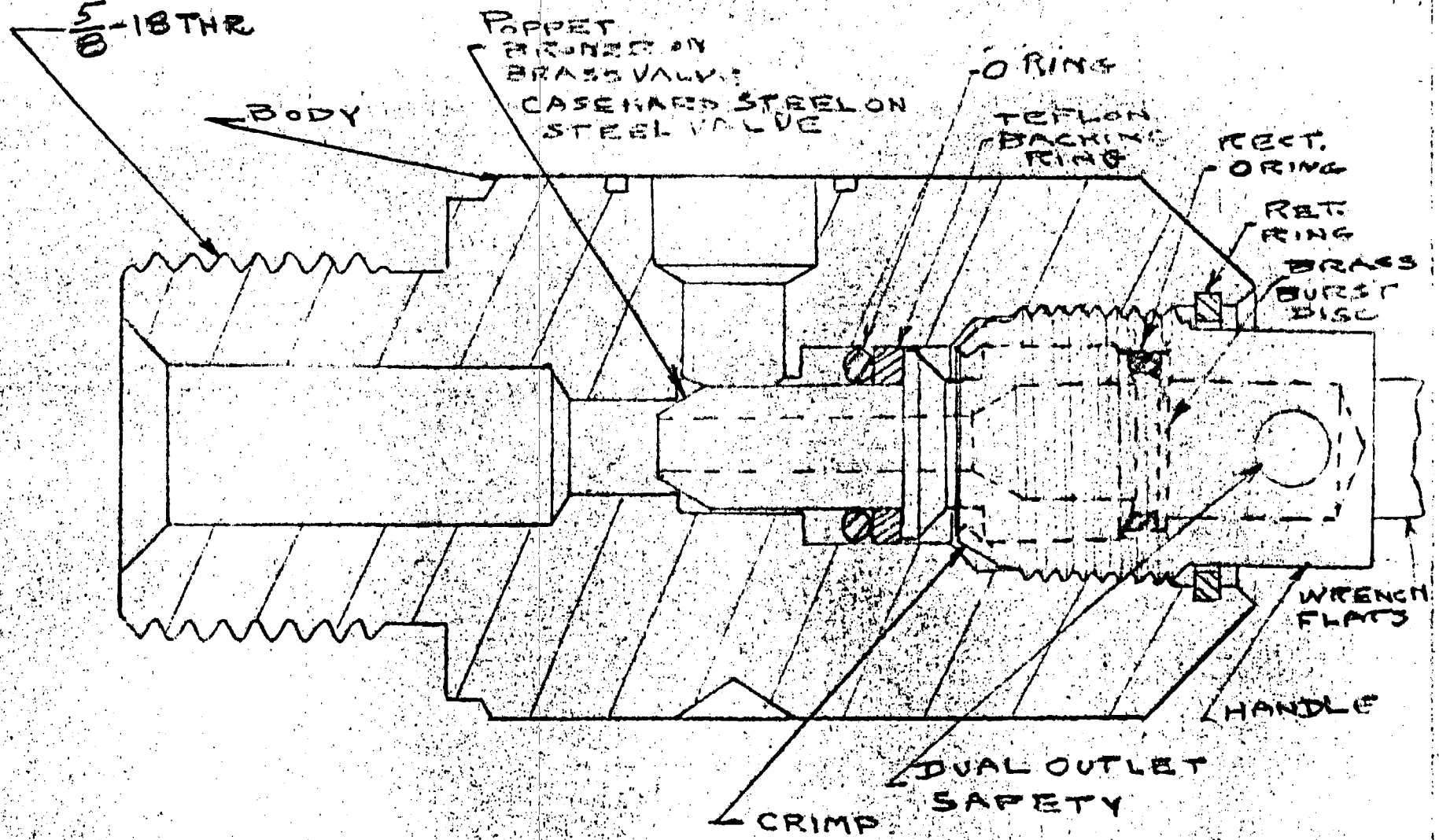
NON-LIQUEFIED, HIGH PRESSURE GAS IN 3A OR 3AA CYLINDER (CASE 1A OF TABLE 1)


FIRE TEST DATA, BUREAU OF EXPLOSIVES
CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST
CYLINDER TYPE – DOT 3AA, 2015+ PSIG, LINDE TYPE "S"
CYLINDER CONTENTS – N2, 2200 PSI @ 70°F
VALVE TYPE – CONDON 880, MEDICAL E VALVE
TEST RUN – 3 (CASE 1A) SOLID LINES
12 (CASE 2A) DASH LINES
AMBIENT TEMP. ~70°F, TEST 3
~45°F, TEST 12
WIND VELOCITY ~15 MPH, TEST 3
~10 MPH, TEST 12
DATE: 10/11/78 TEST 3
11/8/78 TEST 12
MAX. LOCAL – SURFACE TEMP.
FLUE GAS TEMP.
510°F TEST 3
580°F TEST 12
1380°F TEST 3
1060°F TEST 12
DISC BURST 2650 PSI
DISC BURST 2750 PSI (NOM. DESIGN BURST PRESSURE 3700 PSI)
CYLINDER PRESSURE
FLUE GAS TEMP.
CYLINDER SURFACE TEMP.
NOTE: APPARENT LOSS OF FLAME AFTER DISC BURST IN TEST 3 HAS NO EFFECT ON RATE OF PRESSURE LOSS
CYLINDER PRESSURE (PSIG)
TEMP (°F)
3200
3000
2500
2000
1500
1000
500
1800
1600
1400
1200
1000
800
600
400
200
1
2
3
4
5
6
7
Superior Valve Co.

FIRE TEST DATA, BUREAU OF EXPLOSIVES

CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST





PRESSURE PAK INC. E. HAMPTON CONN.		
SALE 5:1	880 SAFETY	DATE 2-9-72
MAT. BRASS OR STEEL.		
MED. E. VALVE		DWG 71877

DATA PACKAGE

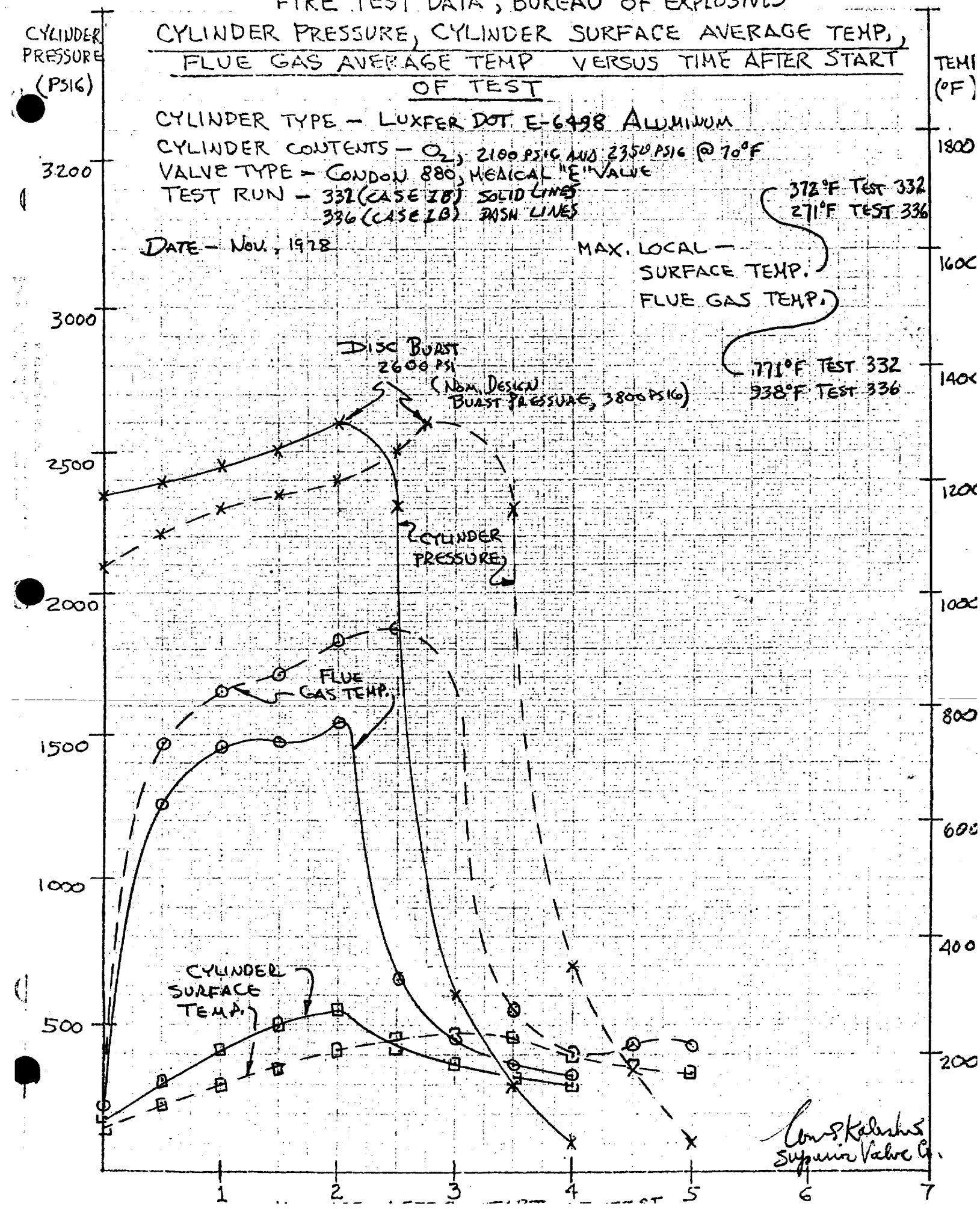
AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 2

NON-LIQUEFIED, HIGH PRESSURE GAS IN 3E TYPE CYLINDER (CASE 1B OF TABLE 1)


FIRE TEST DATA, BUREAU OF EXPLOSIVES
CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST
CYLINDER TYPE – LUXFER DOT E-6498 ALUMINUM
CYLINDER CONTENTS – O_2, 2100 PSIG AND 2350 PSIG @ 70°F
VALVE TYPE – CONDON 880, MEDICAL "E" VALVE
TEST RUN – 332 (CASE 1B) SOLID LINES
336 (CASE 1B) DASH LINES
DATE – NOV., 1978
CYLINDER PRESSURE (PSIG)
TEMP (°F)
3200
3000
2500
2000
1500
1000
500
1800
1600
1400
1200
1000
800
600
400
200
372°F TEST 332
271°F TEST 336
MAX. LOCAL – SURFACE TEMP.
FLUE GAS TEMP.
771°F TEST 332
938°F TEST 336
DISC BURST 2600 PSI
(NOM. DESIGN BURST PRESSURE, 3800 PSIG)
CYLINDER PRESSURE
FLUE GAS TEMP.
CYLINDER SURFACE TEMP.
1
2
3
4
5
6
7
Superior Valve Co.

BONFIRE TEST DATA

TEST NO. 332 CYLINDER TYPE N150 SERIAL NO. CC 7946 DATE 11/8/78

PROPANE BURNER - MIN ORIFICE PRESSURE PAK VALVE #71877

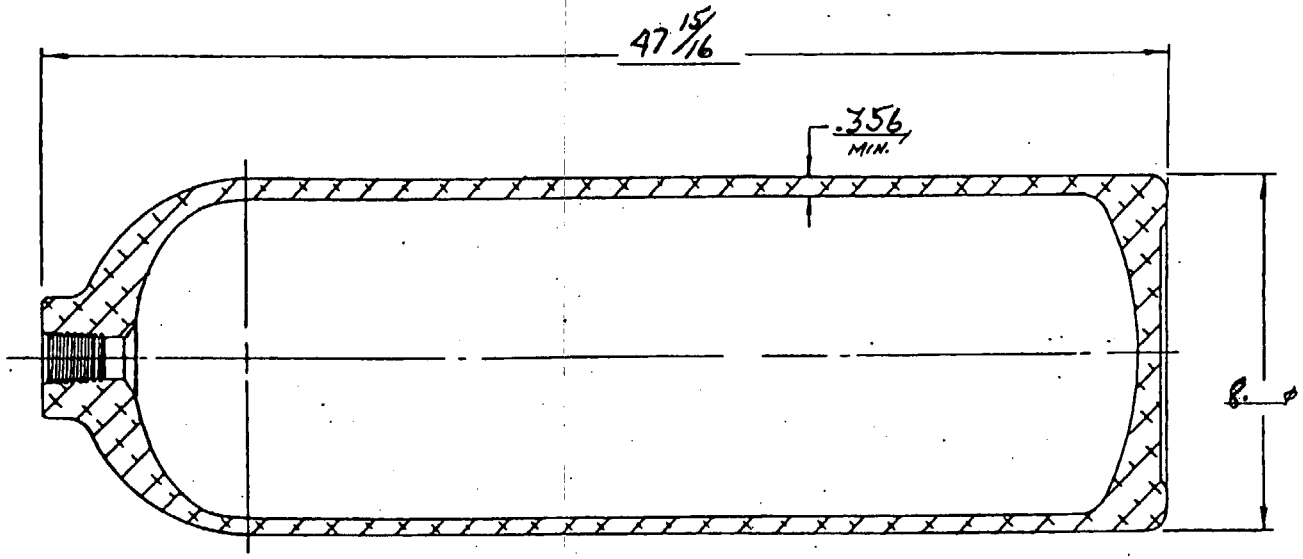
Elapsed Time	Pressure psi	TEMPERATURE OF Valve STACK	Valve	Cyl. Center	Cyl. Bottom	REMARKS
0:0	2350	110	86	91	95	
0:30	2400	628	98	120	190	
1:00	2450	729	108	138	274	
1:30	2500	738	118	158	336	
2:00	2600	771	130	177	372	
~~2:02~~ 2:30	2300	331	120	167	271	SR
3:00	600	228	107	155	216	
3:30	300	182	108	142	180	
4:00	100	167	111	136	167	V - 2'
4:30						
5:00						
5:30						
6:00						
6:30						
7:00						
7:30						
8:00						Loading 2850psi O_2
8:30						
9:00				SR Safty Relief		
9:30				V Vent Tem		
10:00						

BONFIRE TEST DATA

EST NO. 336 CYLINDER TYPE N150 SERIAL NO. SD176 DATE 11/9/78

PROPANE BURNER- MIN ORIFICE Pressure PAK VALVE #71877

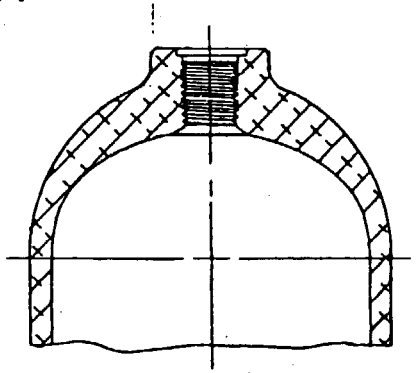
Elapsed Time	Pressure psi	TEMPERATURE OF Valve (STACK)	Valve	Cyl. Center	Cyl. Bottom	REMARKS
0:0	2100	118	68	76	79	
0:30	2200	734	104	104	129	
1:00	2300	824	118	135	165	
1:30	2350	855	132	140	201	
2:00	2400	914	158	162	251	
2:30	2500	938	171	176	271	
2:44 ~~3:00~~	2600	–	–	–	–	* S.R.
3:30	2300	276	121	202	255	
4:00	700	202	107	181	222	
4:30	350	222	107	164	200	
5:00	100	210	109	150	187	** V – 2' 16"
5:30						
6:00						
6:30						
7:00						
7:30						
8:00						Loading 2100psi O_2
8:30						
9:00						
9:30				* SR Safty Relief		
10:00				** V Vent Time		



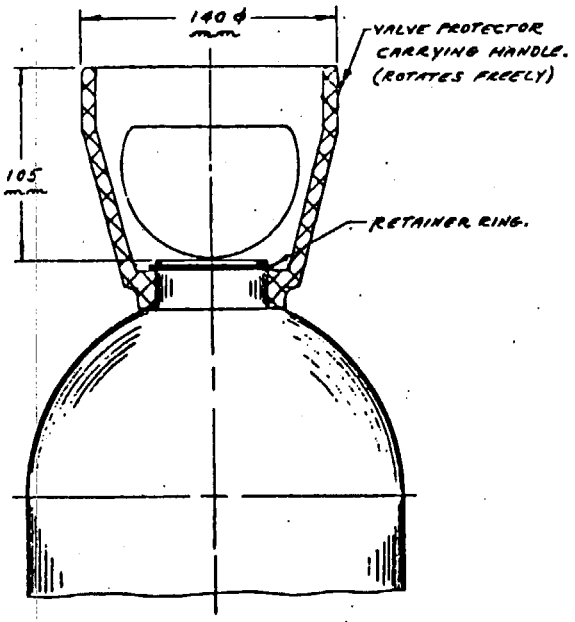
NOTES:

1. Cylinder to meet DOT Permit 6498
2. Capacity: 150 cu.ft. at 2015 psi water vol.= 1800 cu.in. min.
3. Test Pressure 3360 psig
4. Service Pressure 2015 psi

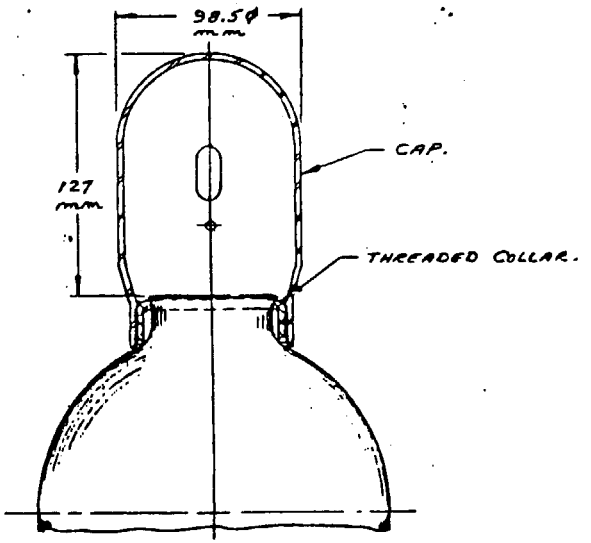
THREAD 1.125-12 UNF



STYLE 1



STYLE 2



STYLE 3

ITEM	QUAN.	DESCRIPTION

LUXFER USA LIMITED

RIVERSIDE, CALIFORNIA

SCALE	LIMITS ON DIM. UNLESS OTHERWISE SPECIFIED	BREAK ALL SHARP EDGES UNLESS NOTED	PER ASSEM.
	ANGULAR ± 1°		PER ASSEM.
DATE	FRACTIONAL ± 1/16	125 FINISH UNLESS NOTED	FINAL ASSEMBLY NAME & NO.
DRAWN BY	DECIMAL .XX ± .01 .XXX ± .005		
APPROVED	USED FOR/ON PART OR SUB-ASSEMBLY NAME & NUMBER: FOR COMPRESSED GAS		
SHEET OF	NAME: ALUMINUM CYLINDER	NUMBER: C-N150-7C	REV.

REF.	CHANGE	BY	DATE
A			

Luxfer USA Limited
1995 Third Street, Riverside, California 92507
Mail: P.O. Box 5300 — 92517
Telephone 714-684-5110 TWX 910-332-1755

November 14, 1978

Mr. Bill Kalaskie
Superior Valve Company
2200 North Main Street
Washington, PA 15301

Dear Bill:

Enclosed please find the following:

1. Bonfire Test Data Sheets - Tests 331, 332, 335, 336
2. Propane Burner Sketch
3. Pressure Pak Valve Drawing
4. Blueprints C50 and N150
5. Photograph of Propane Burner and Cylinder From Previous Test.

Bob Jernberg says you should have a drawing and test report of his valve used on the Linde cylinder. The flow report should be 9.75 cfm.

For your time temperature curves you will have to use Test Numbers 335 and 336, as we did not record any data on the other two tests after the safety functioned.

As added information we ran an experimental fuzible safety with a flow rating of 6.7 cfm in a wood bonfire and it safely vented 2000 psi of N_2 in an N150 cylinder in 2 minutes.

Let me know if there is anything missing.

Sincerely,

G. H. Waite,
Project Manager

GHW:td

DATA PACKAGE

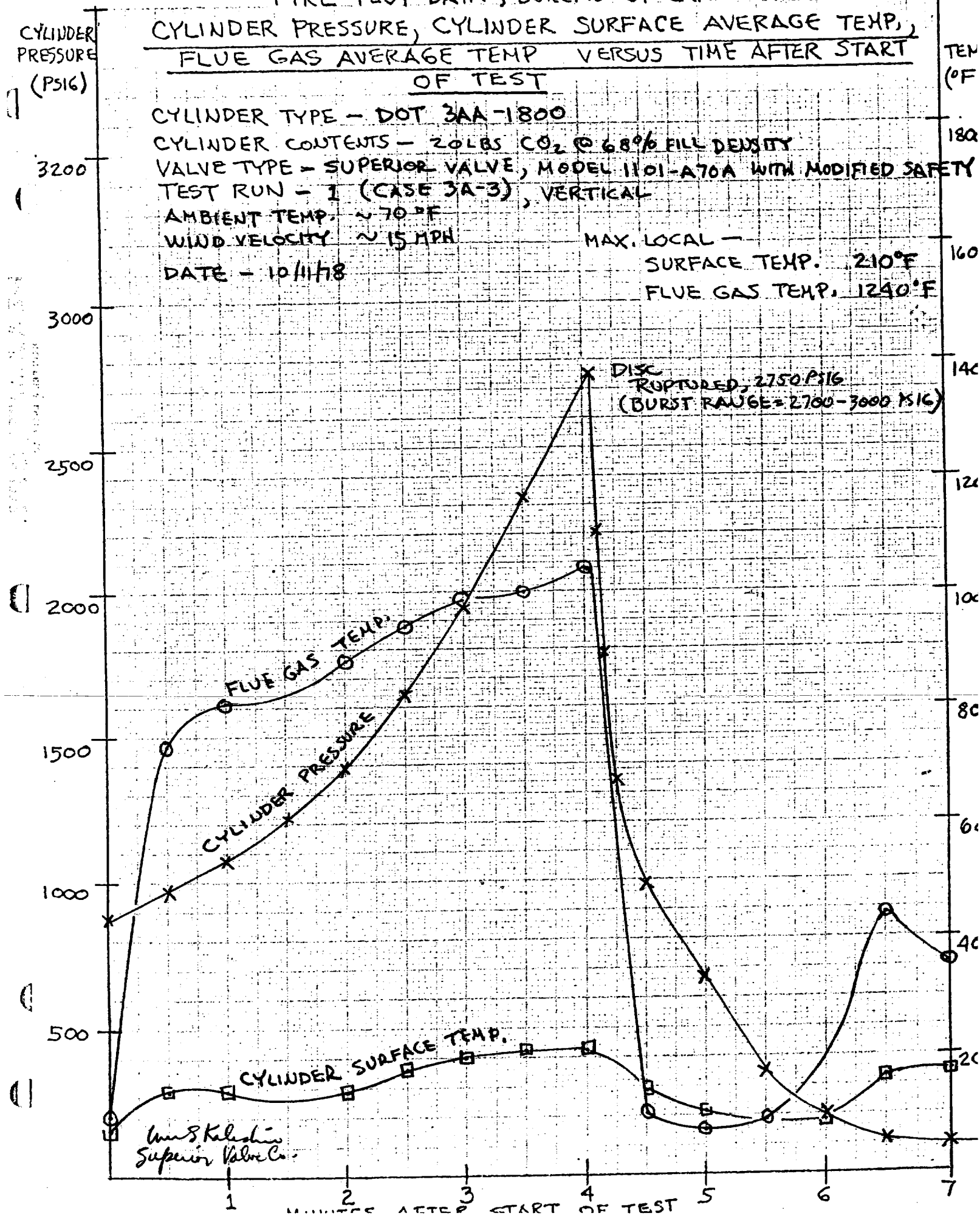
AND

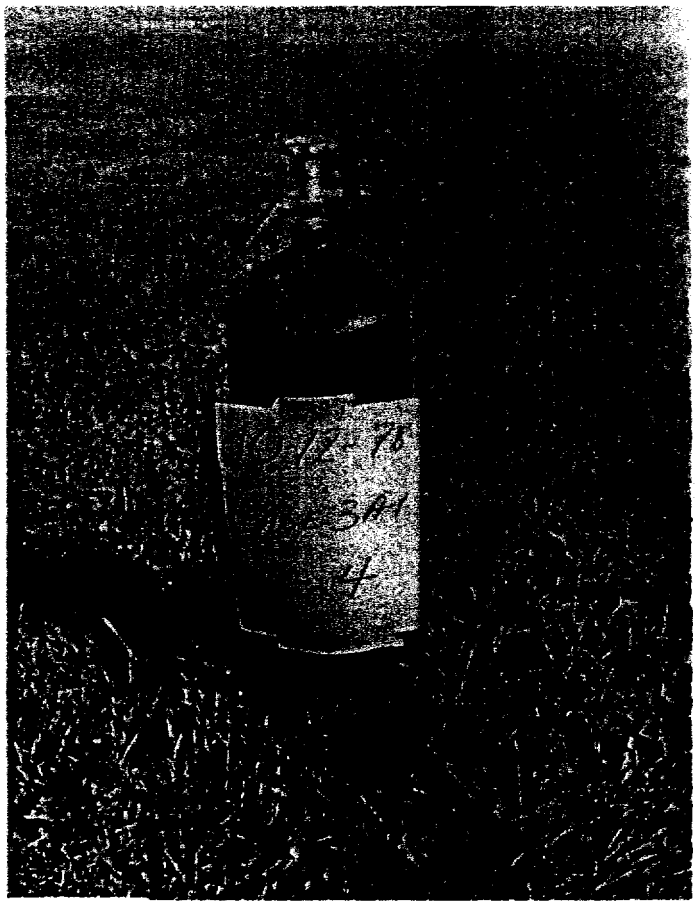
FIRE TEST BACKGROUND INFORMATION

FOR

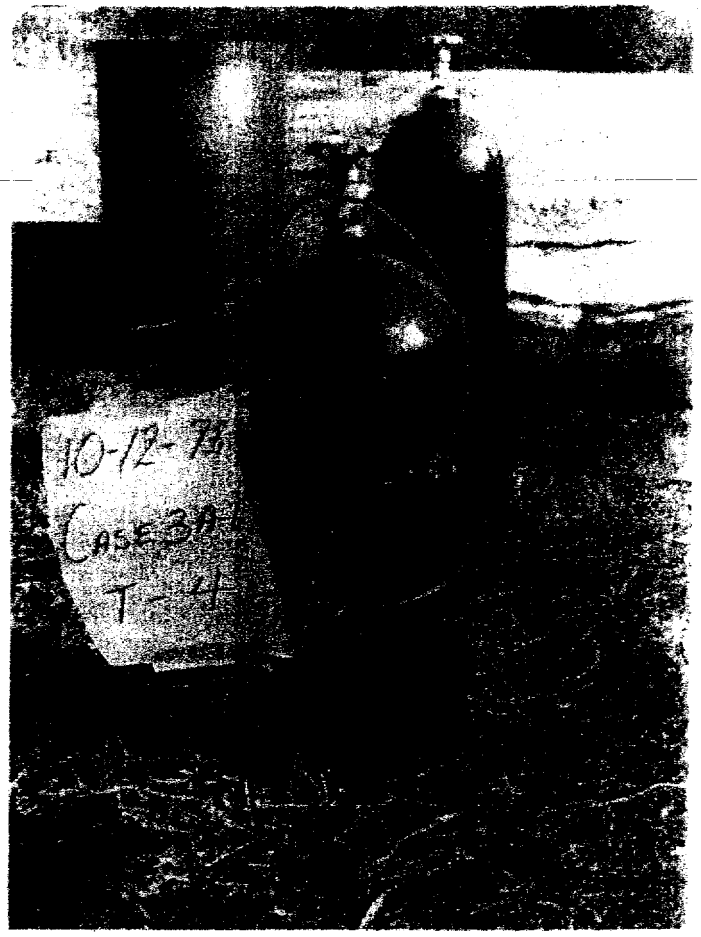
DATA POINT 3

LIQUEFIED, HIGH PRESSURE GAS IN 3A OR 3AA CYLINDER (CASE 3A)


FIRE TEST DATA, BUREAU OF EXPLOSIVES
CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST
CYLINDER TYPE – DOT 3AA-1800
CYLINDER CONTENTS – 20 LBS CO_2 @ 68% FILL DENSITY
VALVE TYPE – SUPERIOR VALVE, MODEL 1101-A70A WITH MODIFIED SAFETY
TEST RUN – 1 (CASE 3A-3), VERTICAL
AMBIENT TEMP. ~70 °F
WIND VELOCITY ~15 MPH
DATE – 10/11/78
MAX. LOCAL –
SURFACE TEMP. 210°F
FLUE GAS TEMP. 1240°F
CYLINDER PRESSURE (PSIG)
TEM (°F
3200
3000
2500
2000
1500
1000
500
180
160
140
120
100
80
60
40
20
DISC RUPTURED, 2750 PSIG
(BURST RANGE = 2700-3000 PSIG)
FLUE GAS TEMP.
CYLINDER PRESSURE
CYLINDER SURFACE TEMP.
1
2
3
4
5
6
7
MINUTES AFTER START OF TEST
Superior Valve Co.



25 DOT 3AA, 1800 Kidde Cylinder (CO_2) before start of Test-4



26 Cylinder after Test-4

Walter Kidde & Company, Inc.
Belleville Aerospace and Commercial Operations
Belleville, New Jersey, 07109, U.S.A.

COMPRESSED GAS ASSOCIATION
DOCKET 77-12

FIRE TEST PROGRAM ON COMPRESSED GAS CYLINDERS AND PRESSURE RELIEF DEVICES FOR VALIDATION OF FORMULAS IN CGA PAMPHLET S-1.1

CASE NO. 3A

Date September 29, 1978

By: Charles F. Willms
Charles F. Willms, P.E.
Sr. Project Manager
Fire Protection Systems

CALCULATIONS

1. Water Capacity of Cylinder (Wc)

$$Wc = 825\ in^3 \times \frac{1\ Gal.\ H_2O}{231\ in^3} \times \frac{8.328\ lb.}{Gal.\ H_2O} = 29.74\ lb.\ Water$$

2. Pressure Relief Flow Area (Ref. S-1.1, par. 4.5; 4.6)

$$A = 2\ (0.00012)\ Wc = 0.00024\ (29.74) = 0.0071\ sq.\ in.$$

3. Minimum Required Flow Capacity of Pressure Relief Device (Ref. S-1.1, par. 4.5; 4.6)

$$Qa = 2\ (0.154)\ Wc$$
$$= 0.308\ (29.74)$$
$$= 9.16\ SCFM\ Air$$

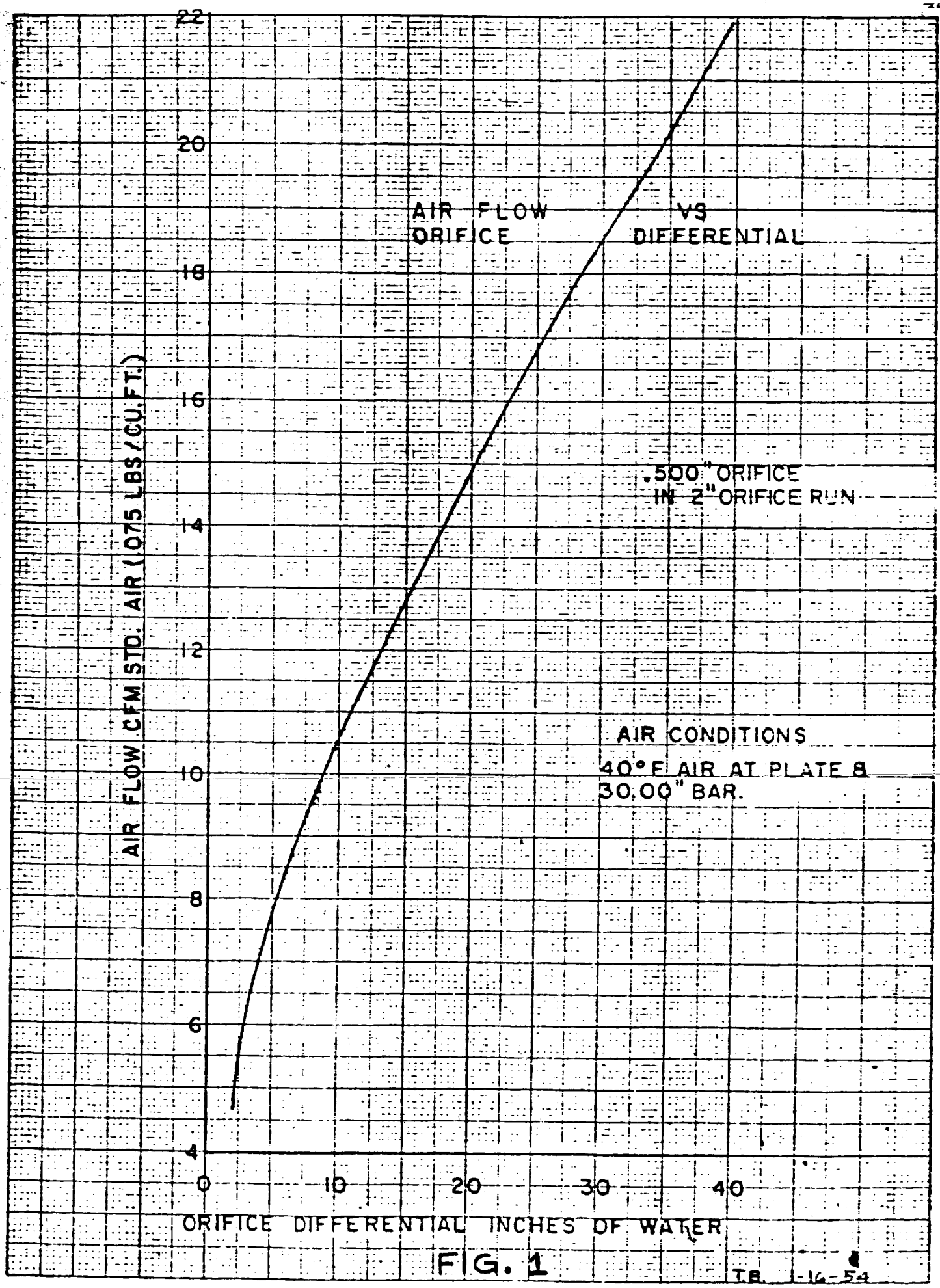
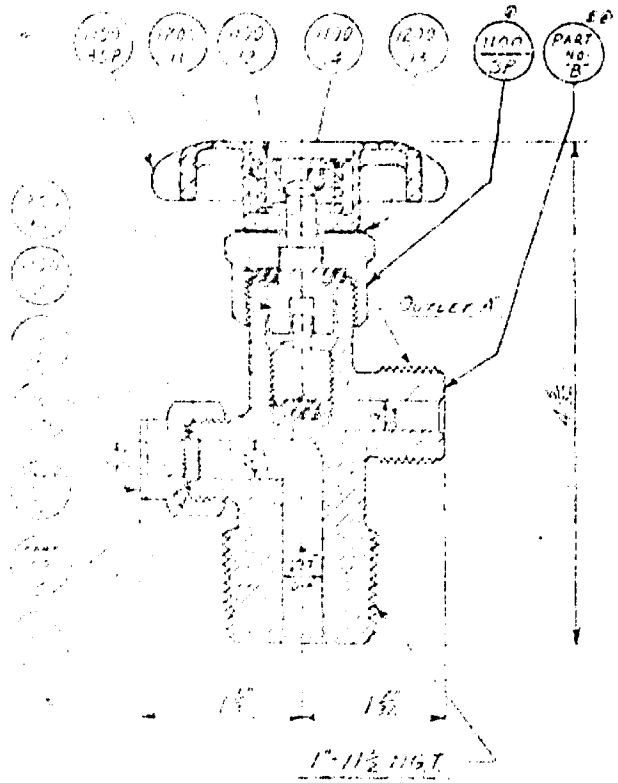


FIG. 1

T.B. 1-16-54



REPORT ALL ERRORS TO ENGINEERING DEPARTMENT

DO NOT SCALE THIS DRAWING

ALL RIGHTS OF DESIGN OR INVENTION RESERVED

TOLERANCE FOR DIMENSIONS OTHER THAN THOSE SPECIFIED

	DECIMAL	FRACTIONAL
DIA.	±.005	±.005
LENGTH	±.005	±.010
OVERALL	±.005	±.010

REVISIONS

READ DOWN

[illegible]

OUTLET AND SAFETY DEVICE SPECIFICATIONS ⟶ PART NUMBERS

CATALOG NUMBER	OUTLET "A" GAS (C.G.A.) CLASSIFICATION	OUTLET "A" C.G.A. No. AND THREAD SIZE	PART No. "B"	SAFETY DEVICE PART NUMBER "C"	SAFETY DEVICE SAFETY NOT STAMPING	SAFETY DEVICE CYLINDER SERVICE PRESSURE	SAFETY DEVICE PART NUMBER "D"	SAFETY DEVICE SAFETY DISC MARKING
1101M-A70A	* CARBON DIOXIDE	C.G.A. No. 320 .825" 14NGO R.H.-EXT.	1101 1-AP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-A70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-A70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C
1101M-C70A	OXYGEN (INDUSTRIAL OR MEDICAL)	C.G.A. No. 540 .903" 14NGO R.H.-EXT.	1101 1-CP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-C70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-C70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C
1101M-CC70A	OXYGEN-CO_2 (MIX) HELIUM-OXYGEN (MIX)	C.G.A. No. 250 .745 14NGO R.H.-EXT.	1101 1-CCP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-CC70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-CC70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C
1101M-E70A	ETHANE, ETHYLENE, HELIUM (ALT.)	C.G.A. No. 350 .825 14NGO L.H.-EXT.	1101 1-EP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-E70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-E70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C
1101M-Z70A	AIR (BREATHING)	C.G.A. No. 1340 .825" 14NGO R.H.-EXT.	1101 1-ZP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-Z70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-Z70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C
1101M-NO70A	* NITROUS OXIDE	C.G.A. No. 1320 .825" 14NGO R.H.-EXT.	1101 1-NOP	1250 14 AP	3000 P.S.I.	1800	[illegible]	S-A
1101M-NO70B				1250 14 BP	3360 P.S.I.	2015	[illegible]	S-B
1101M-NO70C				1250 14 CP	3775 P.S.I.	2265 2400	[illegible]	S-C

[illegible] SAFETY DEVICE [illegible] 70, ENG. No. 1919 ON FILE WITH [illegible] EXPLOSIVES, THEIR LETTER OF OCT. 5, 1954 [illegible], BEING SATISFACTORY FOR I.C.C. 3A AND [illegible] CYLINDERS HAVING WATER CAPACITIES NOT EXCEEDING [illegible] CHARGES WITH COMPRESSED GASES OTHER THAN LIQUEFIED [illegible], POISONOUS, OR FLAMMABLE GASES TO A PRESSURE [illegible] OF THEIR MARKED SERVICE PRESSURE.

* CAUTION:
I.C.C. REGULATIONS DO NOT PERMIT 10% OVERFILLING OF CO_2 & NITROUS OXIDE. IN ADDITION THESE GASES BEING LIQUEFIED CAN ONLY BE USED WITH CYLINDERS HAVING A MAXIMUM WATER CAPACITY OF 156#

FINISH - CHROME PLATED

NOTE:
HIGHER RATED SAFETY DISCS AVAILABLE FOR MARKING PRESSURES UP TO 3500 P.S.I.

PRESSURE SEAL CYLINDER VALVE FOR COMPRESSED GASES, 1" NGT INLET TYPE CG-1 SAFETY (RUPTURE DISC)

SUPERIOR VALVE COMPANY
WASHINGTON, PA.

DRAWN BY	APPROVED	DRAWING NO.
[illegible]	[illegible]	1101MS
DATE 11-4-72	SCALE FULL	
CHECKED BY [illegible]	CATALOG NO. SEE TABLE	PART NO.

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

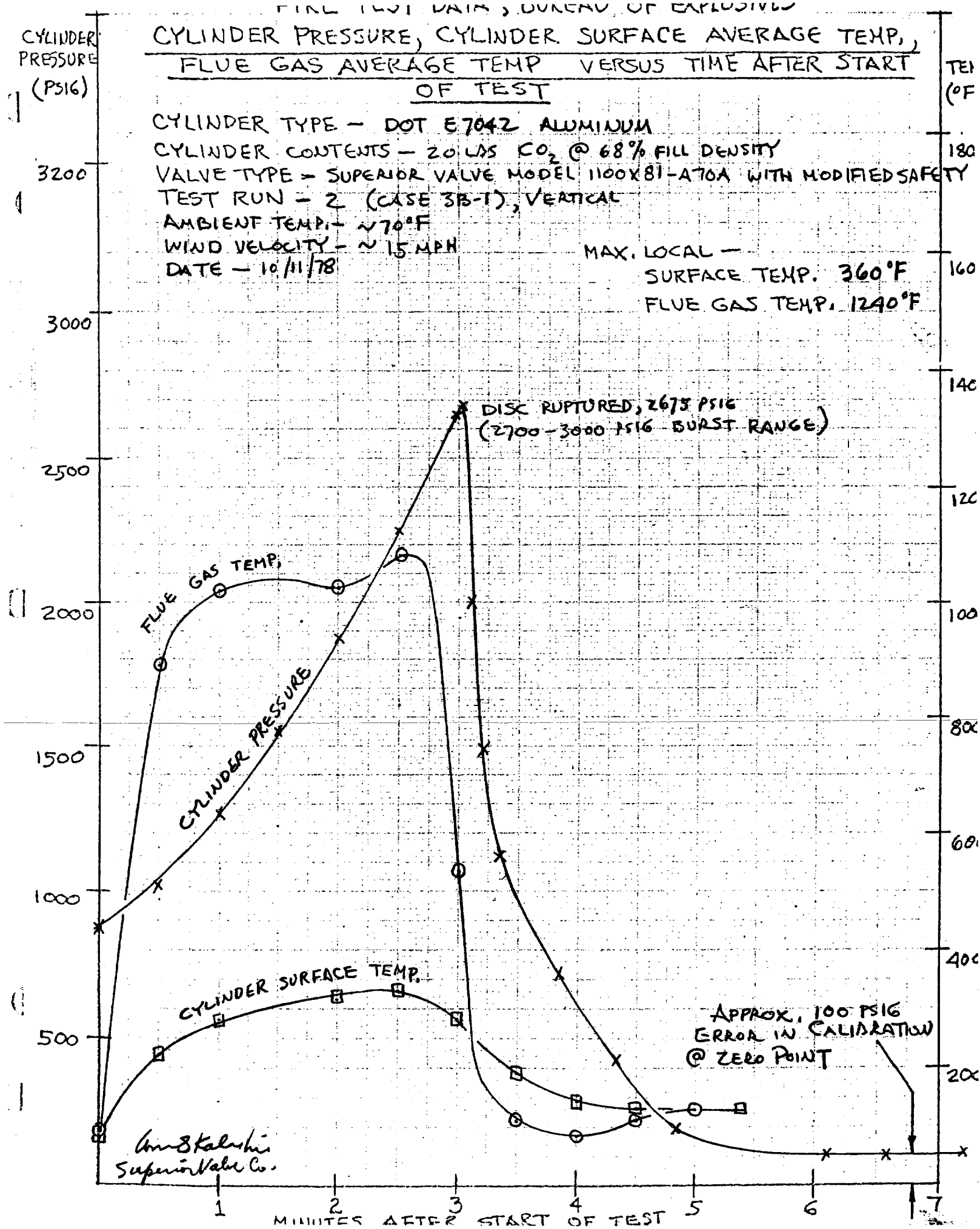
FOR

DATA POINT 4

LIQUEFIED, HIGH PRESSURE GAS IN 3E TYPE CYLINDER (CASE 3B)

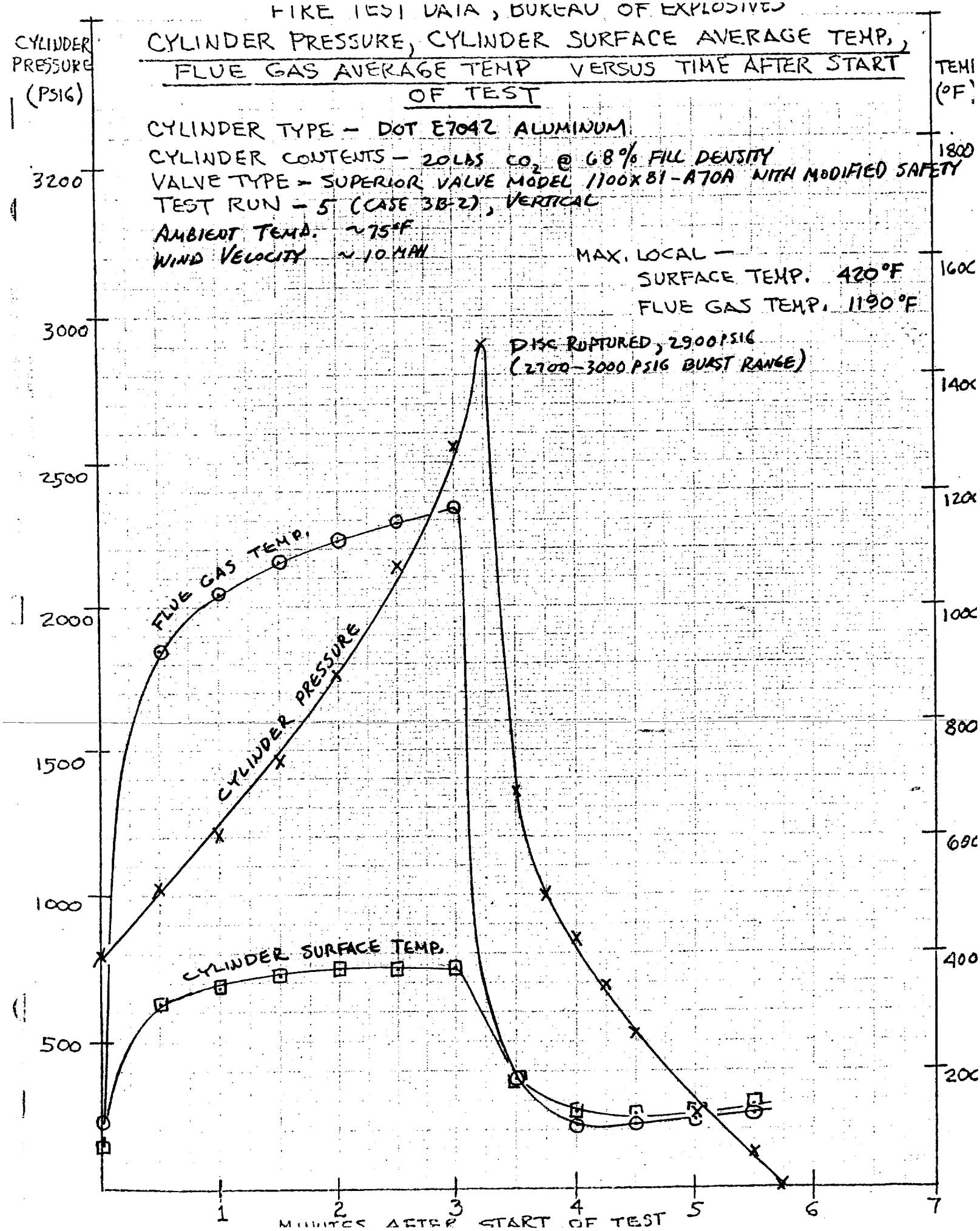
FIRE TEST DATA, BUREAU OF EXPLOSIVES

CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST



FIRE TEST DATA, BUREAU OF EXPLOSIVES

CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP, FLUE GAS AVERAGE TEMP VERSUS TIME AFTER START OF TEST



Walter Kidde & Company, Inc.
Belleville Aerospace and Commercial Operations
Belleville, New Jersey, 07109, U.S.A.

COMPRESSED GAS ASSOCIATION
DOCKET 77-12

FIRE TEST PROGRAM ON COMPRESSED GAS CYLINDERS AND PRESSURE RELIEF DEVICES FOR VALIDATION OF FORMULAS IN CGA PAMPHLET S-1.1

CASE NO. 3B

Date September 29, 1978

By: Charles F. Willms
Charles F. Willms, P.E.
Sr. Project Manager
Fire Protection Systems

CALCULATIONS

1. Water Capacity of Cylinder (Wc)

$$Wc = 825\ in^3 \times \frac{1\ Gal.\ H_2O}{231\ in^3} \times \frac{8.328\ lb.}{Gal.\ H_2O} = 29.74\ lb.\ Water$$

2. Pressure Relief Flow Area (Ref. S-1.1, par. 4.5; 4.6)

$$A = 2\ (0.00012)\ Wc = 0.00024\ (29.74) = 0.0071\ sq.\ in.$$

3. Minimum Required Flow Capacity of Pressure Relief Device (Ref. S-1.1, par. 4.5; 4.6)

$$Qa = 2\ (0.154)\ Wc$$
$$= 0.308\ (29.74)$$
$$= 9.16\ SCFM\ Air$$

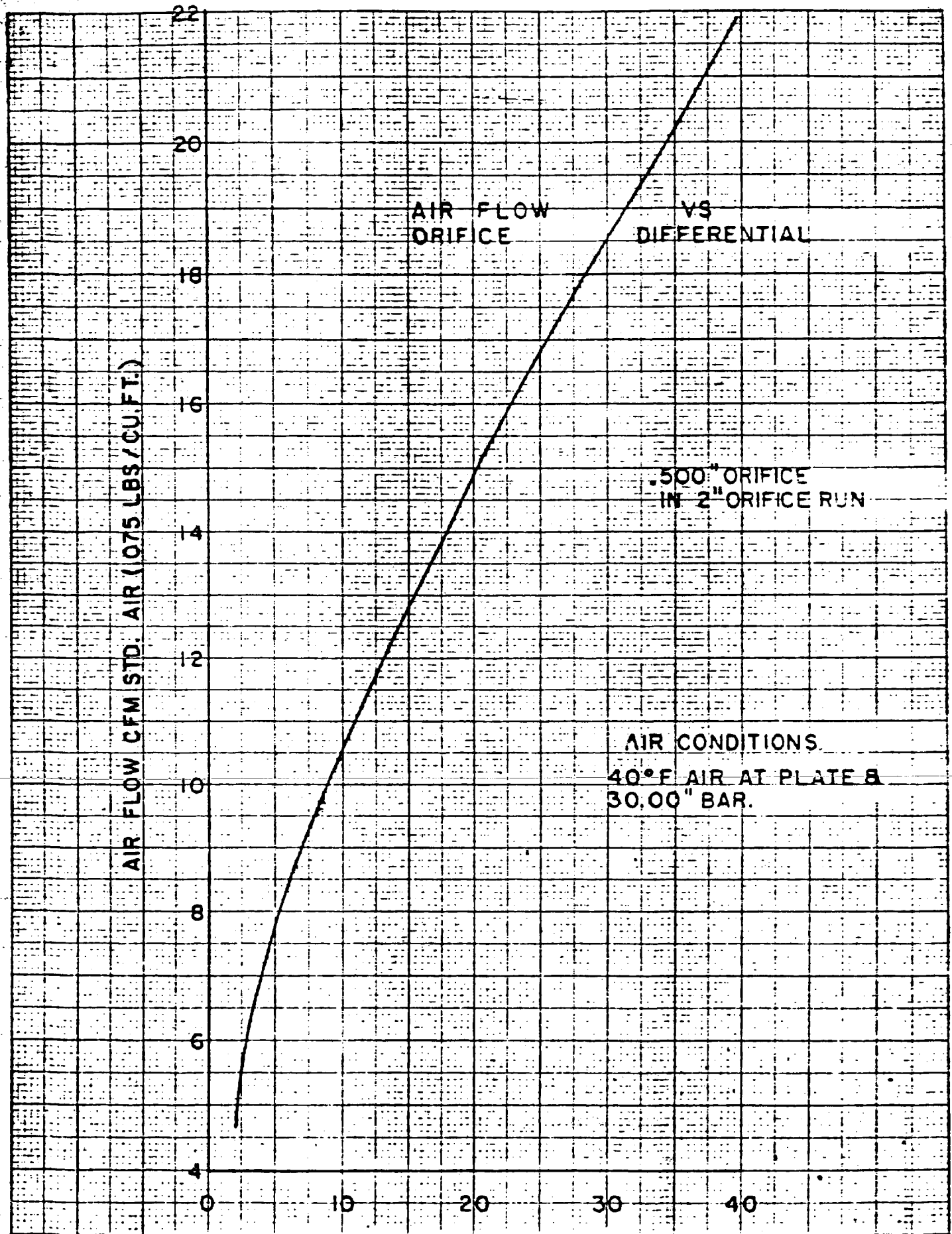


FIG. 1

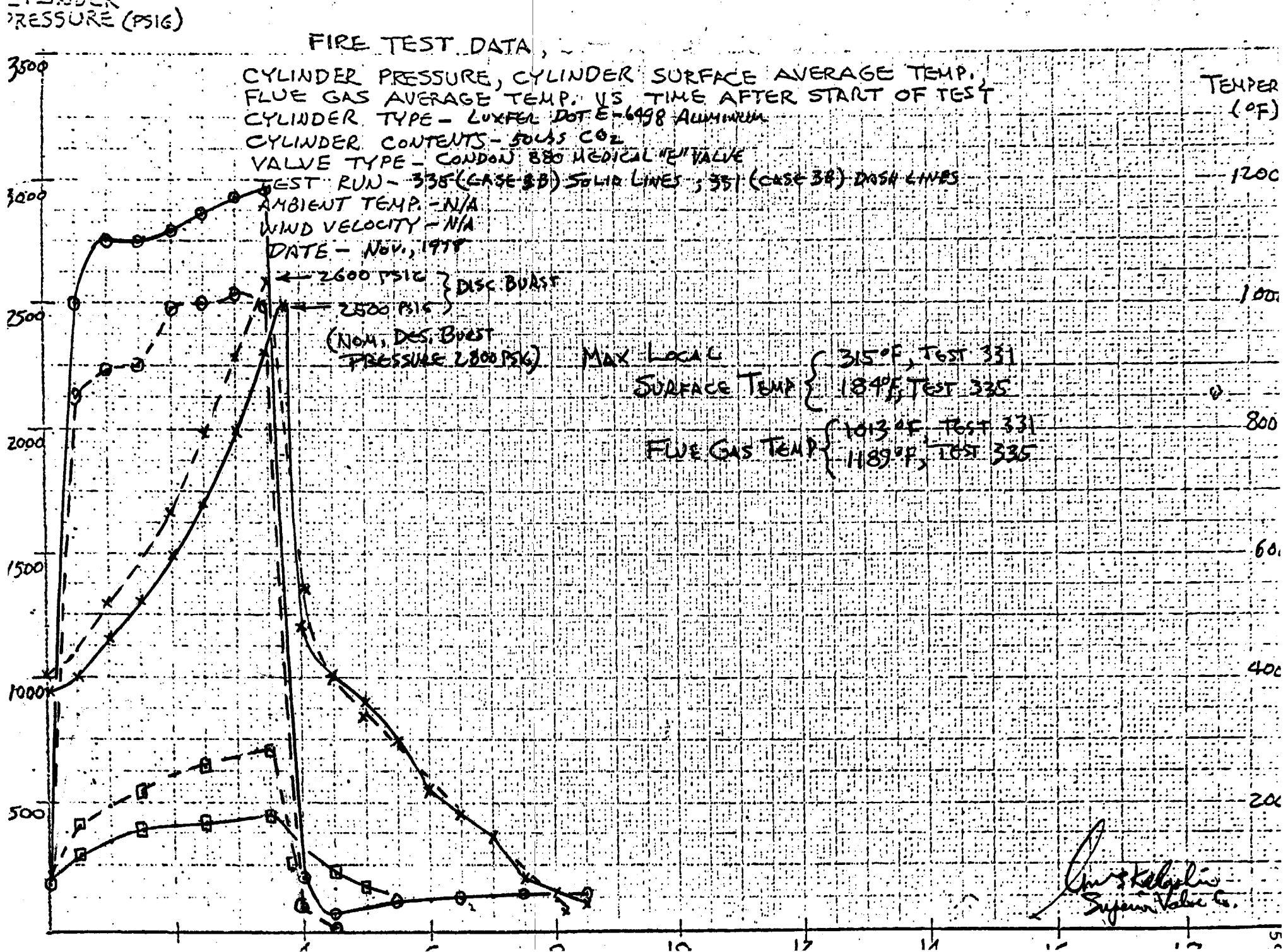
T.B. 1-16-54

THIS CATALOG NUMBER, 1100X81-A70A, CONSISTS OF AN 1100X15-A70A VALVE SHIPPED WITH A P1100X15-20W-90 "O"-RING AND INSTRUCTION SHEET BL-X118 (ONE INSTRUCTION SHEET PER CARTON).
THE "O"-RING SIZE IS 216 (1.109" I.D. X .139" DIA. SECTION) IT IS IDENTIFIED BY A SINGLE WHITE DOT AND PACKAGED IN A PLASTIC BAG.
EACH CARTON OF VALVES WILL INCLUDE ONE BAG OF "O"-RINGS, THE QUANTITY OF WHICH IS DETERMINED BY THE NUMBER OF VALVES IN THE CARTON.

TOLERANCE FOR DIMENSIONS OTHER THAN THOSE SPECIFIED			SUPERIOR VALVE COMPANY WASHINGTON, PA.	DRAWN BY	DATE	DRAWING NO.
	DIA.	LENGTH	BRASS CO_2 PRESSURE SEAL CYL. VALVE FOR ALUMINUM CYLINDERS WITH 1¼"-12 UNF-2A CYLINDER THREAD	HOLLIS	4-22-77	1100X81S
	± .002	± .005		CH'KD. BY	SCALE	
FRACTIONAL	± .005	± .010				PART NO. OR CATALOG NO. 1100X81-A70A

REVISIONS

DATE		DATE		DATE		DATE		DATE		DATE	


CYLINDER PRESSURE (PSIG)
FIRE TEST DATA
CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP.
FLUE GAS AVERAGE TEMP. VS TIME AFTER START OF TEST
CYLINDER TYPE - LUXFER DOT E-6498 ALUMINUM
CYLINDER CONTENTS - 50LBS CO2
VALVE TYPE - CONDON 880 MEDICAL "E" VALVE
TEST RUN - 335 (CASE 3B) SOLID LINES ; 331 (CASE 3B) DASH LINES
AMBIENT TEMP. - N/A
WIND VELOCITY - N/A
DATE - NOV., 1978
2600 PSIG
2500 PSIG
DISC BURST
(NOM. DES. BURST PRESSURE 2800 PSIG)
MAX LOCAL SURFACE TEMP
315°F, TEST 331
184°F, TEST 335
FLUE GAS TEMP
1013°F, TEST 331
1189°F, TEST 335
TEMPER (°F)
3500
3000
2500
2000
1500
1000
500
1200
1000
800
600
400
200
Superior Valve Co.

BONFIRE TEST DATA

EST NO. 335 CYLINDER TYPE CS0 SERIAL NO. SD181 DATE 11/9/78

PROPANE BURNER - MIN ORIFICE PRESSURE PAK VALVE # 71877

Elapsed Time	Pressure psi	TEMPERATURE OF Valve (Stack)	Valve	Cyl. Center	Cyl. Bottom	REMARKS
0:0	950	66	64	67	67	
0:30	1000	1004	82	115	115	
1:00	1150	1105	96	130	140	
1:30	1300	1099	111	145	153	
2:00	1500	1117	126	155	163	
2:30	1700	1144	143	164	172	
3:00	2000	1171	158	173	177	
*3:30	2300	1189	175	183	184	*SR
3:45	2500	—	—	—	—	
4:00	1200	83	101	112	129	
4:30	1000	27	83	81	88	
5:00	900	35	73	63	67	
5:30	750	41	62	58	56	
6:00	550	44	53	56	47	
6:30	450	47	46	54	37	
7:00	350	51	42	53	28	
7:30	200	52	41	51	21	
8:00	150	55	40	50	13	
8:30	100	55	40	49	5	**V - 4' 45"
9:00						Loading 50 Lb CO_2
9:30				*SR Safty Relief		
10:00				**V Vent Time		

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 5

LIQUEFIED, LOW PRESSURE GAS IN 4B OR 4BA CYLINDER (CASE 4A)

At request of Chief Engineer Felix Smist of Sherwood Selpac, 120 Church St., Lockport, New York 14094, in connection with member plant inspection May 30, 1974, the following fire tests were made on farm property of Customer Service Representative Russell L. Metcalf, just outside Lockport, N. Y.

Three (3) DOT 4BW240 cylinders marked to indicate 238 pounds water capacity, Serial Nos. A00643E, A00642E, and A00644E, manufactured 12-73, containing 100 lbs. propane, and equipped with SHERWOOD SELPAC SAFETY VALVE PV-435-375.

Type of Fire..... Wood-Kerosene

Observers..... Felix Smist, Chief Engineer, Sherwood Selpac
Russell L. Metcalf, Customer Service, Sherwood Selpac
Fred Banach, Fireman, Hartland Fire Co.
Chuck Fuller, Fireman, Hartland Fire Co.
C. L. Hines, Senior Inspector, Bureau of Explosives

Test Number	#1	#2	#3
Position of Cylinder	Vertical-Valve Up	Horizontal Valve in Liquid Phase	Horizontal Valve in Vapor Phase
Fire started	10:10 AM	10:50 AM	11:12 AM
Time at which Valve Opened	10:26 AM	10:58 AM First flame about 30 feet maximum length; lasted about 1 minute.	11:17 AM First flame about 30 feet maximum length; lasted 45 seconds.
Other Valve Reliefs	10:28 AM 10:29 AM 10:30 AM 10:31 AM 10:31½ AM 10:34 AM 10:35 AM 10:36 AM 10:39 AM	10:59 AM 11:01 AM 11:03 AM	11:19 AM 11:21 AM 11:22 AM 11:23 AM 11:24 AM 11:25 AM 11:25½ AM 11:26 AM 11:27 AM
Fire extinguished and cylinder definitely empty.....	10:43 AM	11:06 AM	11:31 AM

Copy of Sherwood Selpac drawing dated 7-69 of valve PV-435-375 attached.

Pictures of tests attached.

ASSOCIATION OF
AMERICAN RAILROADS
OPERATIONS AND MAINTENANCE DEPARTMENT · BUREAU OF EXPLOSIVES
AMERICAN RAILROADS BUILDING · WASHINGTON, D.C. 20036 · 202/293-4048

R. R. MANION
Vice-President

R. M. GRAZIANO
Director

272-1-621
SLF-RM
July 8, 1974

Mr. Felix Smist, Chief Engr.
Sherwood Selpac-A Hill Acme Co.
120 Church St.
Lockport, N.Y. 14094

Dear Mr. Smist:

Reference your request for Bureau of Explosives Approval of Sherwood Selpack Safety Valve PV-435-375.

Be advised that this letter will constitute Bureau of Explosives approval of Valve PV-435-375, for use on DOT 4BW 240 Cylinders containing liquefied Petroleum Gas, maximum capacity 238 pounds water.

If we may be of further service, please advise.

Very truly yours,

S. L. Fastenau for
R. M. Graziano
Director

cc: C. L. Hines, Sr. Inspector

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 6

LIQUEFIED, LOW PRESSURE GAS IN DOT 39

CYLINDER (CASE 4B)

FLOW RATES FOR SAFETY DEVICES FOR DOT-39 VESSELS

The attached test data report from AKO Laboratories on a CGA-1 safety relief device, and a fire test on the same device, are an attempt to correlate the required flow rate as indicated by the formulas in S-1.1, paragraph 4.5 and 4.6, with the actual results obtained in a fire test on a device with a known flow rate.

For purposes of the comparison, a DOT-39 vessel of approximately 50 pounds, Wc, non-insulated, was selected. It was equipped with a CGA-1 safety device, unbacked. It was filled by weight, according to regulations, with R-22 refrigerant gas. The cylinder had a water capacity of 53.25 pounds. The safety device cross sectional diameter is .125".

The formula for non-liquified gas per CGA S-1.1, paragraph 4.5 is:

Qa = [illegible]

From the above:

Qa = [illegible]

Qa = [illegible] cu. ft./min. @ 100 psi test pressure.

A liquified gas, paragraph 4.6 of CGA S-1.1 requires:

8.2 [illegible] = 16.2 cu. ft./min.

The attached report from AKO Laboratories shows a flow rate of 18.9 cu. ft./min.* This is actually 2.3 times the flow rate required for a non-liquified gas. However, the graph of the pressures taken during the fire test indicate that a rate of 2 times would have also been sufficient.

The origin of air flow capacity requirement docket #595, revision 1950, paragraph 1.1 states: The cross sectional area of a safety discharge channel of safety devices used with non-liquified gasses must be at least .00012 sq. in. for each pound of cylinder water capacity. Per paragraph 2.1 for liquified gases, the cross sectional area must be .00024 sq. in. or twice that required for non-liquified gases.

From the above, the required cross sectional area of the safety device would be:

.00024 (53.25) = .013 sq. in.

* LESS 15% = 16.1

...ION OF
...MERICAN RAILROADS
...ONS AND MAINTENANCE DEPARTMENT · BUREAU OF EXPLOSIVES
...CENTER · BUILDING 817 · EDISON, NEW JERSEY 08817 · 201/225-1618

CHEMICAL LABORATORY REPORT

...ZIANO
...and Chief Inspector

...CHANG
...Chemist

File Number 272-1

Laboratory Number 65007

Laboratory Date Sept. 1, 1976

FIRE TESTS ON COMPRESSED GAS CYLINDERS AND SAFETY VALVES

LAB NO: 65007

TESTED FOR: Pennwalt Corporation

CYLINDER:

SIZE 18 1/8"H x 12"D

MFG. Pennwalt Corporation

DOT SPEC 39

LOADING Isotron 22 (Refrigerant)

SAFETY VALVE Condon Dwg. No. 64-666A

TESTS:

TYPE OF FIRE Wood/kerosene Fire

OBSERVERS Mr. R. B. Schaefer of Pennwalt Corp., Mr. J. R. Condon of Condon Manufacturing Co., Inc., Mr. R. Jenberg of Pressure Park and Bureau Personnel.

TEST NUMBER	#1	#2	#3
POSITION OF CYLINDER	Vertical-valve up	Horizontal	Horizontal
TIME AT WHICH VALVE OPENED		1'54"	3'17"
TEST RESULT	Cylinder emptied at 9'58"	cylinder emptied at 8'27"	cylinder emptied at 15'3"

...MPLIES WITH SECTION 173.34(d) The cylinder safety relief device system does comply with the requirement of Section 173.34(d) of the DOT Regulations.

...essure vs. time for all tests are listed in the attached table.

W. S. Chang
Chief Chemist

Pressure (psi)	Time	Pressure (psi)	Time	Pressure (psi)	Time
200	1'15"	250	48"	250	1'15"
250	1'53"	300	1'7"	300	1'36"
300	2'15"	400	1'36"	400	2'20"
360	2'36"	450	1'54"(VO)	460	2'45"
450	2'59"	325	2'50"	520	----
420	3'13"(VO)	340	3'13"	420	3'17"(VO)
500	4'38"	350	3'50"	340	4'9"
525	6'36"	350	4'46"	250	5'6"
420	7'36"	250	6'13"	200	6'7"
200	8'30"	200	7'5"	150	7'41"
0	9'58"(CE)	100	7'46"	100	10'23"
		0	8'27"	75	12'24"
				0	15'3"(CE)

VO= Valve Open

CE= Cylinder Emptied

A.K.O
SINCE 1923

AVERY, KRETZMER, OLCOTT, INC.

P.O.BOX 988
HARTFORD, CONNECTICUT 06101
PLANT LOCATION: BROAD BROOK ROAD, ENFIELD, CONN. 06082

COMPLETE TESTING AND INSPECTION SERVICE

MASS, FORCE, TORQUE, HYDROSTATIC FLOW, PHYSICAL, PROOF TESTING
MASS SPECTROMETRY LEAK DETECTION, STATIC & DYNAMIC BALANCING
SCALE & DYNAMOMETER, CALIBRATION, FLUORESCENT PENETRANT & NDT TESTING

CHARGE TO: Condon Mfg. Co., Inc.
310 Verge Street
Springfield, Mass. 01129

SHIP TO:

UR LAB #	YOUR REFERENCE NO.	SHIPPED FROM	VIA	SHIPMENT COMP	SHIPMENT PART	DATE	INV. DATE
14877	Jim Condon	Enfield, Conn.	yt	X		8-25-77	

QUANTITY	PART NO.	DESCRIPTION
1	649 with 666 Disc	Valve Assy.

PARTS CONFORMING _____
PARTS NOT CONFORMING _____

METHOD USED:

Valve assemblys were installed in an air flow rig with flow rates being precisely measured using critical flow nozzles. Inlet pressure to valve assembly was maintained @ 100 PSIG or 114.7 PSIA Knowing the size of the critical flow nozzle and its inlet pressure, flow can be calculated in lb./min.

RESULTS:

649 Valve Assy.- @ 100 PSIG, W= 1.38 lb/min, P=.0728 lb/Ft^3 ATM., therefore Flow rate 18.95 Ft^3/min.

Should be @ 100 PSIa ∴ Flow is 16.25

EQUIPMENT USED:

Critical Flow Nozzles:
S/N 7496 .070 Dia.
S/N 7861 .091 Dia.

Pressure Gages- 0-125 PSI CM 9164
0-100 PSI USG S/N 1

The above parts have been carefully tested in accordance with above methods. This inspection is limited to defects disclosed from above method only. OUR LIABILITY NOT TO EXCEED COST OF RE-INSPECTION OR RE-TEST.

RESPECTFULLY SUBMITTED,

Certification No. 15096

R. Navone
51J Inspector

(Seal) Subscribed and sworn to before me this ..... day of ..... 19 .....

..... Notary Public

My commission expires .....

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 7

LIQUEFIED, LOW PRESSURE GAS IN DOT 39

CYLINDER (CASE 4B)

BUREAU OF EXPLOSIVES

ASSOCIATION OF AMERICAN RAILROADS

REPORT FROM CHEMICAL LABORATORY

T. C. GEORGE, DIRECTOR AND CHIEF INSPECTOR

C. W. SCHULTZ, CHIEF CHEMIST

FILE NUMBER 272-8

LABORATORY NUMBER 60447

EDISON, N. J., March 14, 1969 196

Fire Test on Cylinder

PENNSALT CHEMICALS CORPORATION

A cylinder of compressed gas was brought to the laboratory by Mr. Robert Schaefer of Pennsalt Chemicals Corporation of Philadelphia, Pa.

The cylinder was identified as Worcester A-10669 and was rated at 125 pounds water capacity. Details of materials, construction etc. are shown on the attached specification sheets.

The cylinder was equipped with two Superior #6408 valves, each said to be approved for 55 pound water capacity cylinders. One valve opened directly into the cylinder and the other was attached to an eduction tube which extended close to the bottom of the vessel.

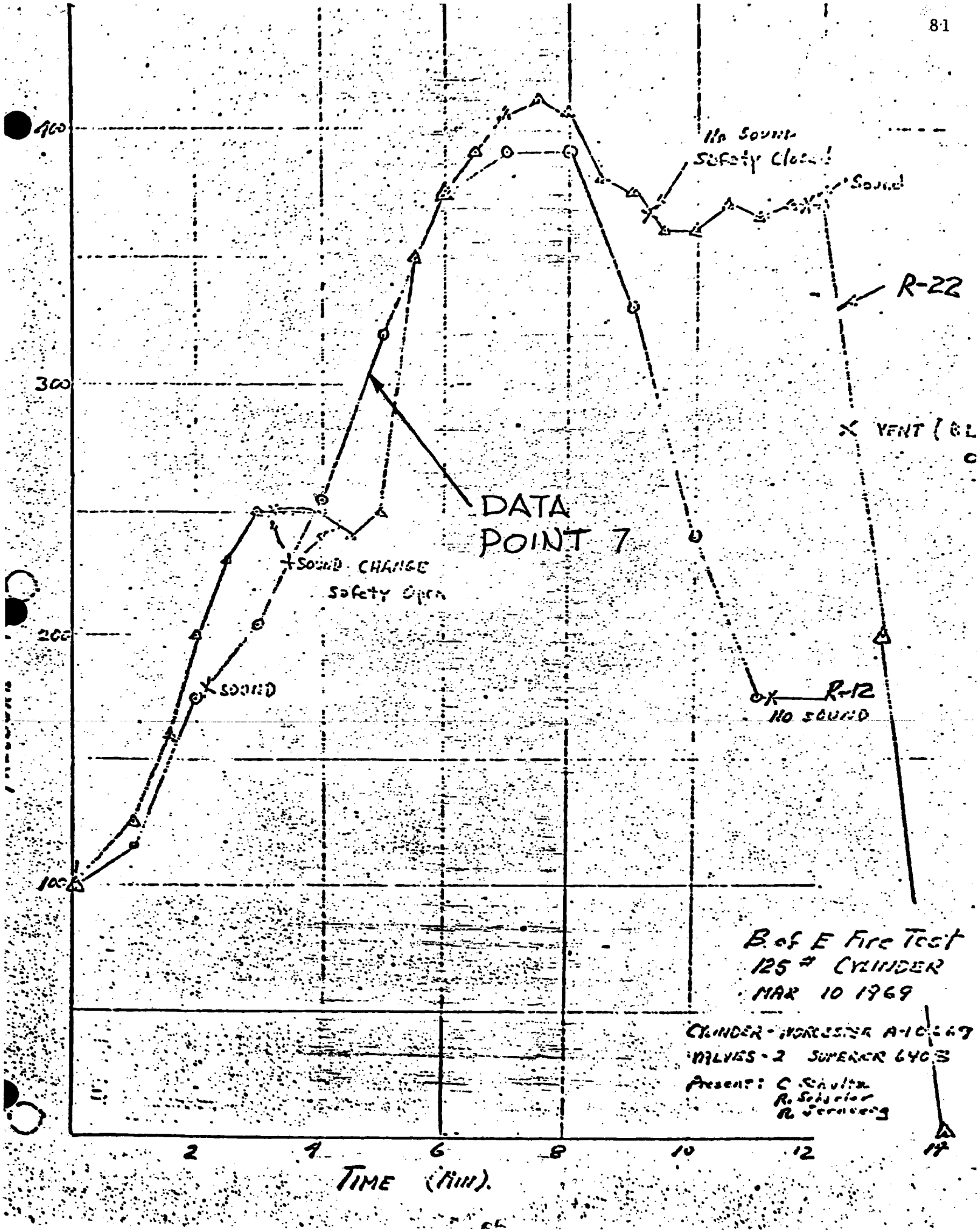
The cylinder was charged to a filling density of 116 percent with Isotran 12 (dichlorodifluoromethane).

During the testing a pressure gage was attached to the vapor valve by means of 100 feet of 1/4" copper tubing.

The cylinder was placed in an upright position in the steel mesh cage on the testing grounds and a wood-kerosene fire kindled around and beneath it.

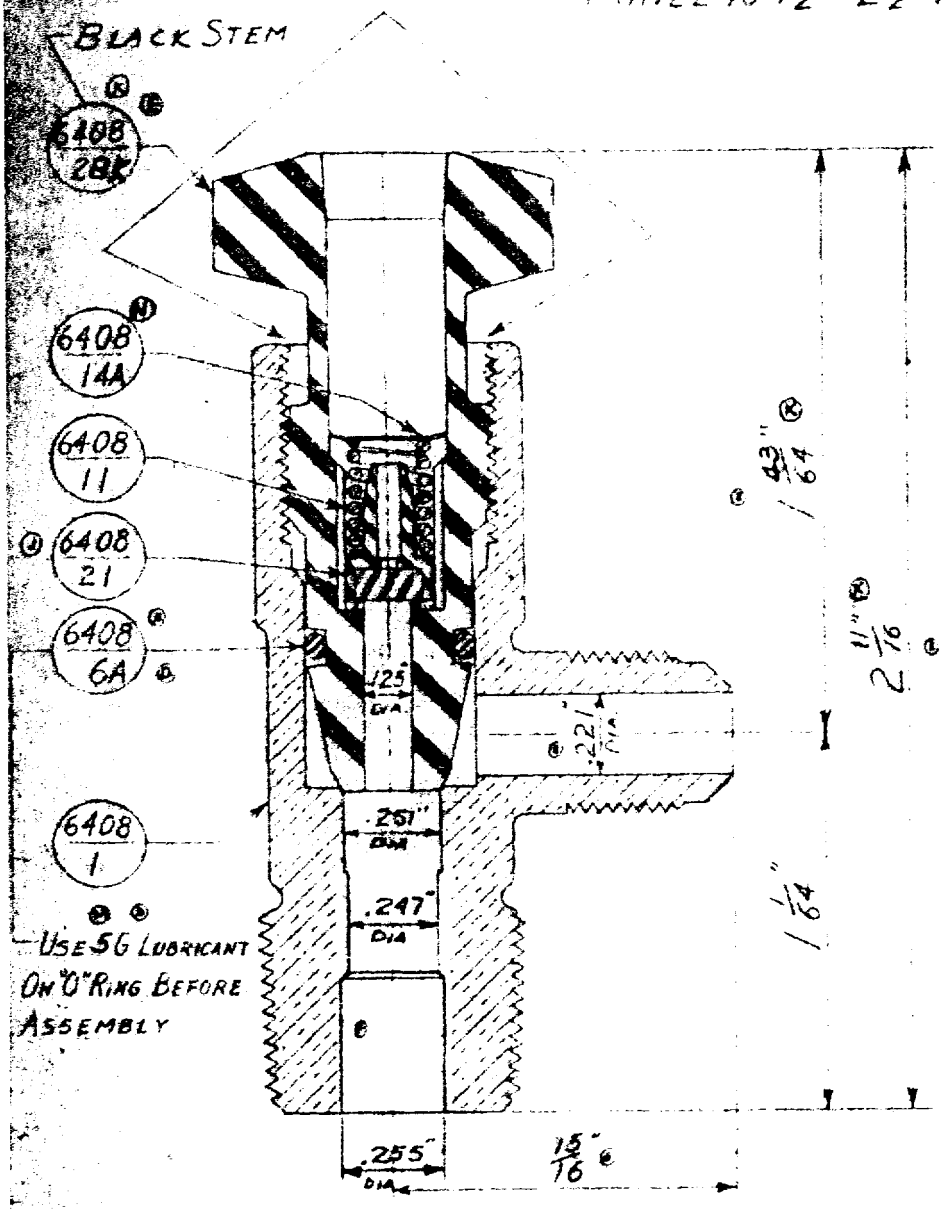
Two minutes after the fire was ignited there was the sound of escaping gas. The cylinder was empty 9 minutes later.

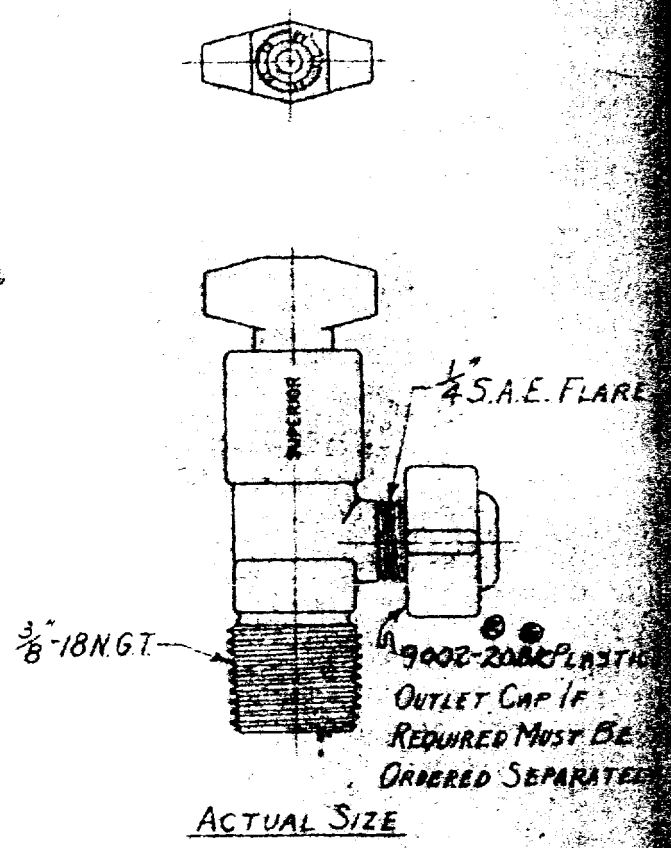
The maximum pressure of 390 psig was reached 8 minutes after the fire was started. A pressure time curve is shown on the attached sheet.


400
300
200
100
2
4
6
8
10
12
14
TIME (MIN).
No Sound
Safety Closed
Sound
R-22
VENT
DATA
POINT 7
SOUND CHANGE
Safety Open
SOUND
R-12
No SOUND
B of E Fire Test
125 # CYLINDER
MAR 10 1969
CYLINDER - WORCESTER A-10669
VALVES - 2 SUPERIOR 6403
Present: C Schultz
R. Schuler
R. Jernberg

SUB ASSEMBLY P6408-21, INCLUDES PARTS P6408-13, P6408-17

PEEN THREAD ADEQUATELY AFTER ASSEMBLY FOR LOCKING EFFECT TO INSURE AGAINST INADVERTANT STEM REMOVAL. PEENING OPERATION TO LIMIT TRAVEL TO 1½ - 2½ TURNS FROM CLOSED POSITION.





ACTUAL SIZE

TYPE SD 85 SAFETY DEVICE (DWG. NO. 1956) APPROVED BY BUREAU OF EXPLOSIVES LETTER 272-1-611, BA-768, W-D, DATED MARCH 4, 1968 FOR CYLINDERS CONTAINING LIQUIFIED COMPRESSED GAS HAVING A MAXIMUM WATER CAPACITY OF 55.6 POUNDS

PATENT 3,554,227

SAFETY DEVICE SETTING 360-480 P.S.I.

TOLERANCE FOR DIMENSIONS OTHER THAN THOSE SPECIFIED DIA. LENGTH DECIMAL ± .002 ± 005 FRACTIONAL ± .005 ± 010	**SUPERIOR VALVE COMPANY** WASHINGTON, PA. REFRIGERANT VALVE FOR 25 & 50# THROW AWAY CONTAINERS	DRAWN BY H. HOLLIS DATE 12-7-67 CH'KD. BY SCALE 24"=1'-0" PART NO. OR CATALOG NO. 6408BK	DRAWING NO. 6408	

REVISIONS

N	P	Q	R	S	T
DATE Feb 72 — 6408-14A WAS 6408-14	DATE	DATE	DATE	DATE	DATE

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 8

LIQUEFIED, LOW PRESSURE GAS IN DOT 39

CYLINDER (CASE 4B)

BUREAU OF EXPLOSIVES

ASSOCIATION OF AMERICAN RAILROADS

REPORT FROM CHEMICAL LABORATORY

T. C. GEORGE, DIRECTOR AND CHIEF INSPECTOR

C. W. SCHULTZ, CHIEF CHEMIST

FILE NUMBER 272-8

LABORATORY NUMBER 60448

EDISON, N. J., March 14, 1939

Fire Test on Cylinder

PENNSALT CHEMICALS CORPORATION

A cylinder of compressed gas was brought to the laboratory by Mr. Robert Schaefer of Pennsalt Chemicals Corporation of Philadelphia, Pa.

The cylinder, valves and test procedure were identical with those reported under Laboratory Number 60447.

The cylinder in this case was charged to a filling density of 94 percent with Isotron 22(monochlorodifluoromethane).

The maximum pressure of 410 psig was reached about 7 1/2 minutes after the fire was started and the cylinder took 14 minutes to empty.

As in the previous test, the bottom part of the vessel gave evidence of having been heated very strongly while the upper part which contained the valves still had undiscolored paint on it. In this test the plastic inner part of the valve attached to the eduction tube melted out.

The cylinder tested complied with §173.34(d) of the Department of Transportation Regulations.

C. W. Schultz

(JAD)

Division

Package Spec. No. 19-113X
Date Modified 6/18/70 88
Reason

CONTAINER TYPE	Steel Cylinder - 125 Lb. Disposable
CAPACITY	125 Lb. Nominal Nominal W_c-130 Lb. Overflow 3,600 cu. in
OUTER PACKAGE	(If Any)
REF. SPEC	UFC Rule _____ Net Wt. Limit _____ DOT # 6024
PHYSICAL SPECS	Dimensions: Inside Length (or Diam.) 15-1/4 Width Heigh Overall 24-1/ (ma Body 21-3/ Tare Wt: 32 lb. Min. Thickness .062 Export Cube: _____ cu. ft.

MATERIALS & CONSTRUCTION (Burst test, Plies, Ga., etc.)
Girth-welded drawn shells of aluminum killed low carbon (.09 Max.) ste to meet all construction, testing, and marking requirements as per ske on reverse and CGA proposed specification 39, except size. Cylinder m be clean, dry, and free from any foreign material. Min. Burst pressur to be 650 psi average 750-800. Cylinder must be capable of withstand a 3 ft. drop in any position onto solid concrete when 98% full of wate without damage to valves. Each cylinder as filled for shipment must b submersion or tested by equally efficient means without evidence of leakage.

~~CLOSURE~~ VALVES	For Refrigerant *LATER IDENTIFIED AS 640Bx4 Superior XP784* with thread outlet seal SSW 1604-167X Each valve equipped with safety relief set at 390-520 ps and fuse plug with total flow capable of preventing cyli rupture in standard B of E fire.
LINING	
PRINTING MARKING	Rubber or metal stamp lot No. as follows: 041667-1 (Mo., Day, Yr., lot) on handle.
PAINTING	Paint one coat gloss white, green, or other color per ord Decorate by silk screen or label as per order
PACKING	TL CL Miscellaneous

TYPICAL PRODUCTS

USED AT

SUPERIOR VALVE COMPANY
2200 NORTH MAIN ST., WASHINGTON, PA. 15301

August 13, 1970

Mr. Robert B. Schaefer
Manager, Packaging
Pennwalt Corporation
Pennwalt Building
Three Parkway
Philadelphia, Pa. 19102

Dear Bob:

Attached is a copy of our drawing 6408X4 (8/11/70), showing the valve and dip tube we recently supplied to you for your 125# refrigerant containers.

Also, attached is a copy of our drawing 1958 (8/11/70) illustrating our type SD 87 safety device which is the fusible metal safety only. The attached copy of the Bureau of Explosives' letter dated August 3, 1970, gives approval of this device.

When used in your particular application, the combined safety capacities of our 6408 spring-loaded safety and the new poured-in fusible metal safety gives a combined water capacity of 137#. This means that the container can hold a total of 143.85# of Refrigerant 22 or 163# of Refrigerant 12.

If you have any questions regarding this please let us know.

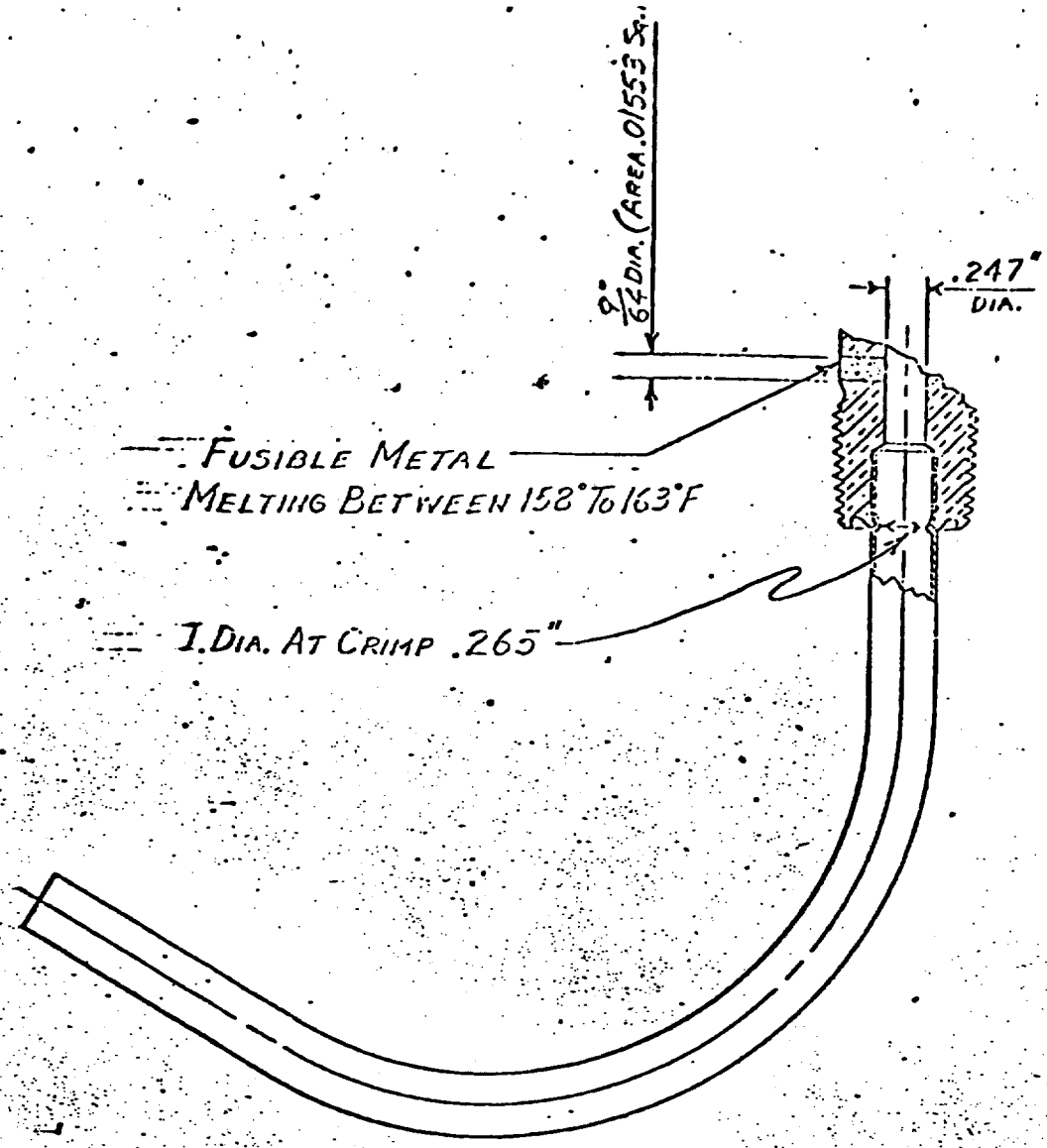
Very truly yours,

F. N. Robson
Vice President - Sales

rgd/Y

Encls.

TELEPHONE: AREA CODE 412-225-0000



TYPE S.D. 87 SAFETY DEVICE (DWG. NO. 1958 ON FILE WITH BUREAU OF EXPLOSIVES, FILE 272-1-61; BA-1029 DATED AUG. 3, 1970 FOR USE ON LIQUIFIED COMPRESSED GAS CYLINDERS HAVING WATER CAPACITIES NOT EXCEEDING 81.4 POUNDS

FOR DIMENSIONS NOT THOSE SPECIFIED	SUPERIOR VALVE COMPANY WASHINGTON, PA.	DRAWN BY H. HOLLIS	DATE 7-17-70	DRAWING NO.
DIA. ± .002 ± .005 LENGTH ± .005 ± .010	TYPE S.D. 87 SAFETY DEVICE	CH'KD. BY	SCALE FULL	1958
		PART NO. OR CATALOG NO.		

REVISIONS

DATA PACKAGE

AND

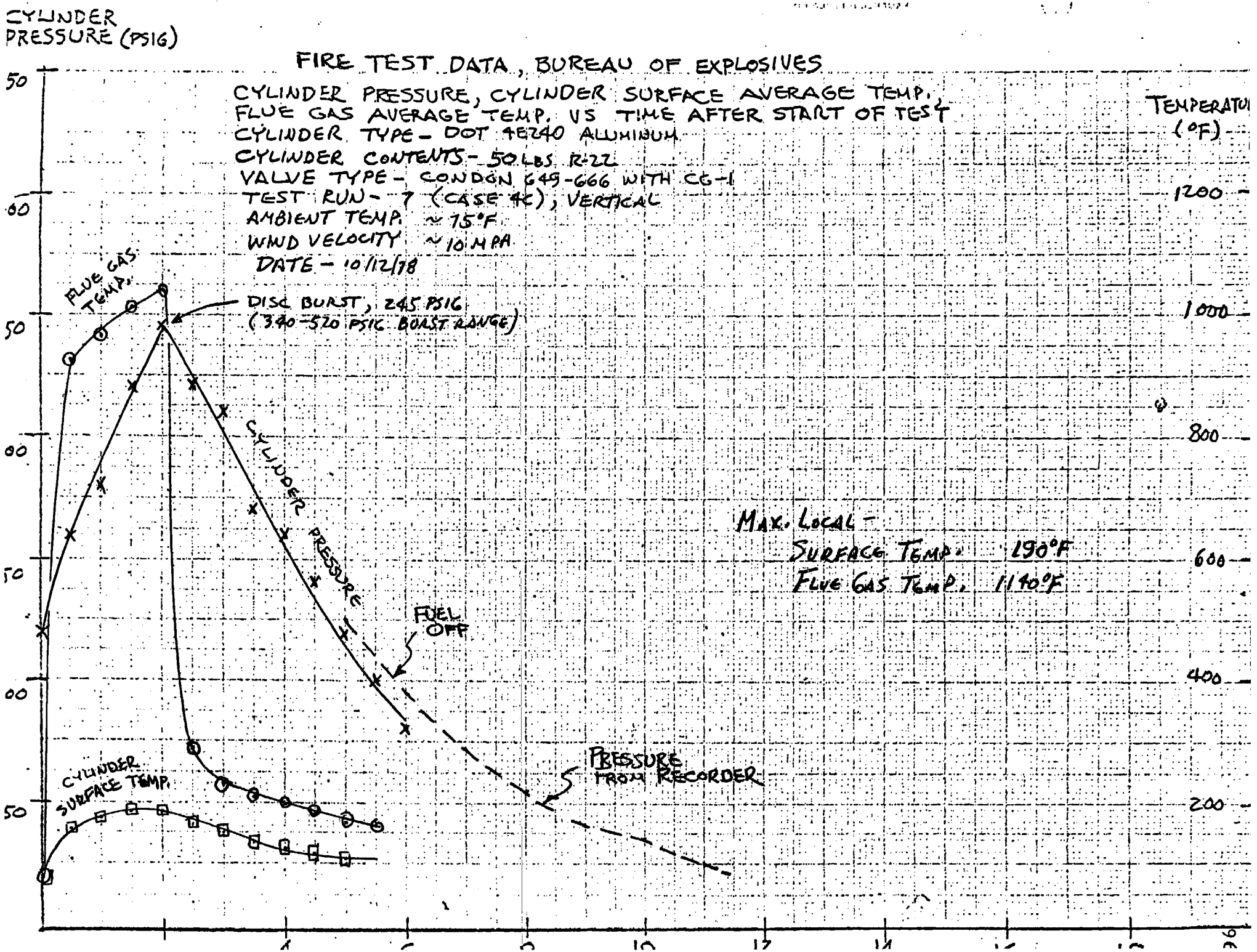
FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 9

LIQUEFIED, LOW PRESSURE GAS IN 4E

CYLINDER (CASE 4C)

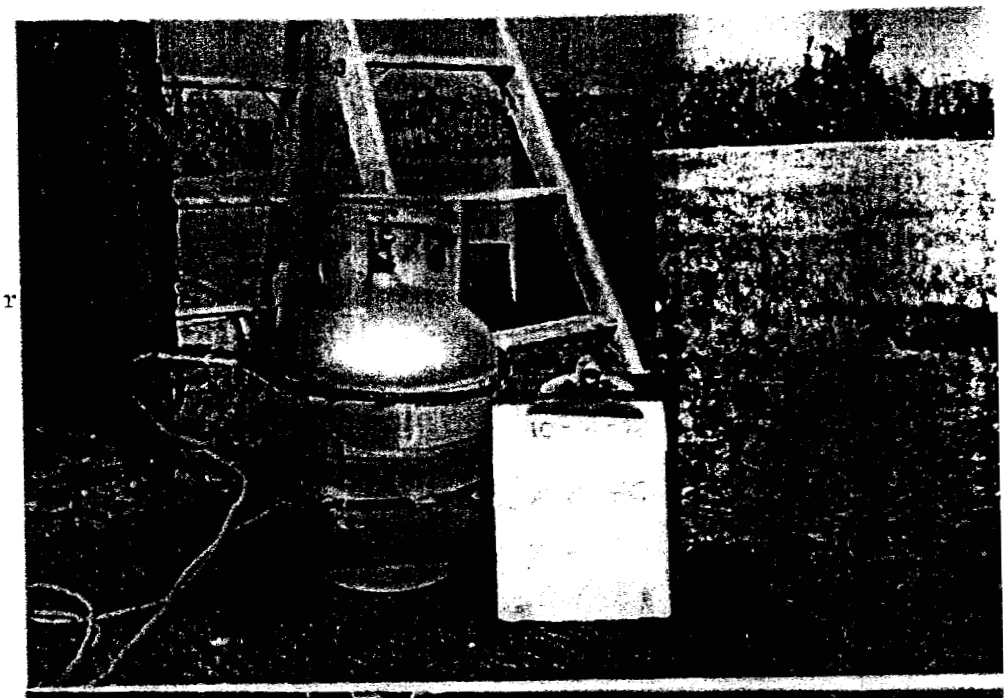

CYLINDER PRESSURE (PSIG)
FIRE TEST DATA, BUREAU OF EXPLOSIVES
CYLINDER PRESSURE, CYLINDER SURFACE AVERAGE TEMP., FLUE GAS AVERAGE TEMP. VS TIME AFTER START OF TEST
CYLINDER TYPE - DOT 4E240 ALUMINUM
CYLINDER CONTENTS - 50 LBS R-22
VALVE TYPE - CONDON 649-666 WITH CG-1
TEST RUN - 7 (CASE 4C), VERTICAL
AMBIENT TEMP. ~75°F
WIND VELOCITY ~10 MPH
DATE - 10/12/78
FLUE GAS TEMP.
DISC BURST, 245 PSIG
(340-520 PSIG BURST RANGE)
CYLINDER PRESSURE
FUEL OFF
PRESSURE FROM RECORDER
CYLINDER SURFACE TEMP.
MAX. LOCAL -
SURFACE TEMP. 190°F
FLUE GAS TEMP. 1140°F
TEMPERATU
(°F)
1200
1000
800
600
400
200

31

DOT 4E240 Aluminum Cylinder

(Worthington), R-22

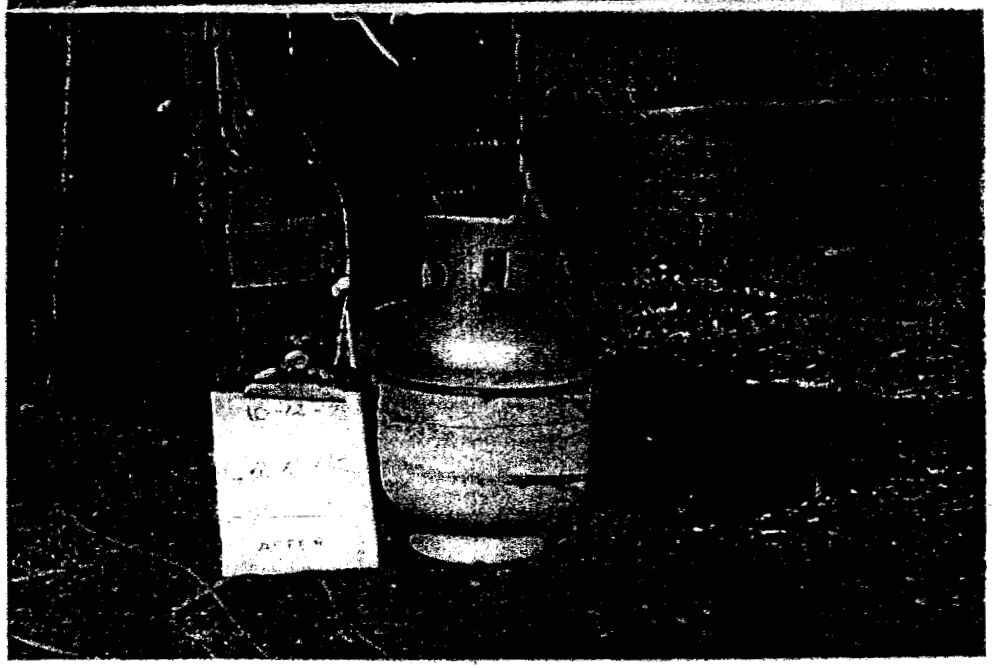
before start of Test-7



32

Cylinder after Test-7

(Note frosted surface)



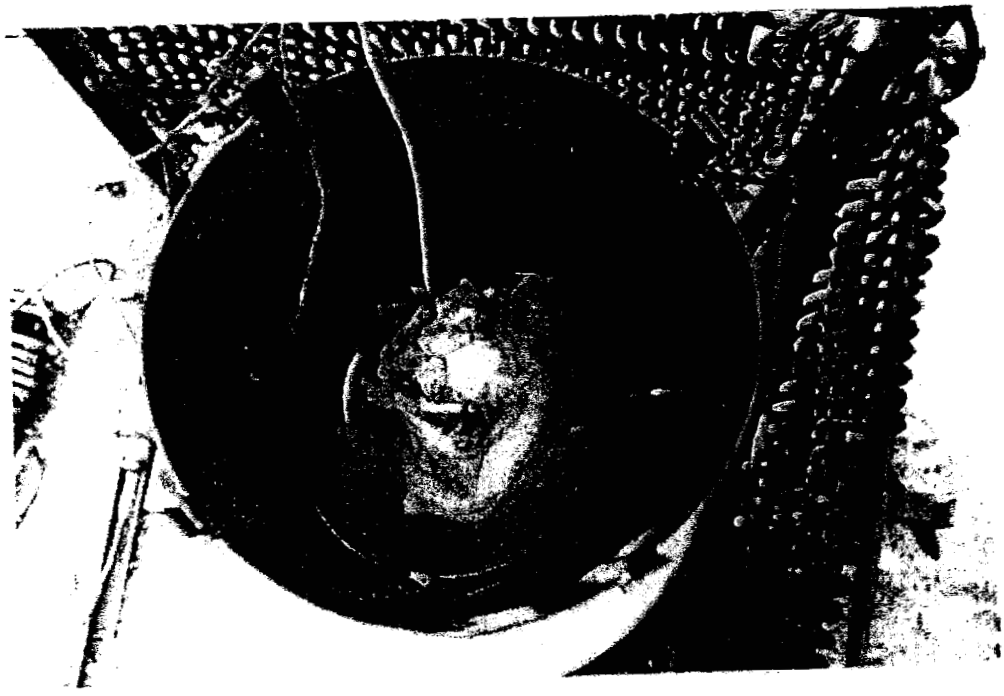
33

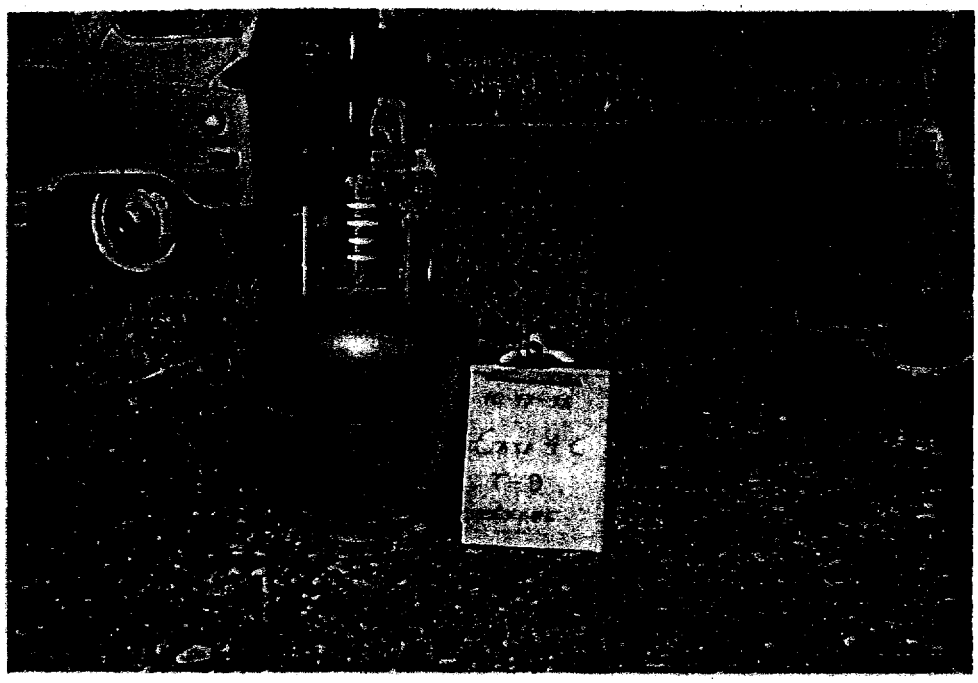
Looking down chimney

before Test-8 on insulation

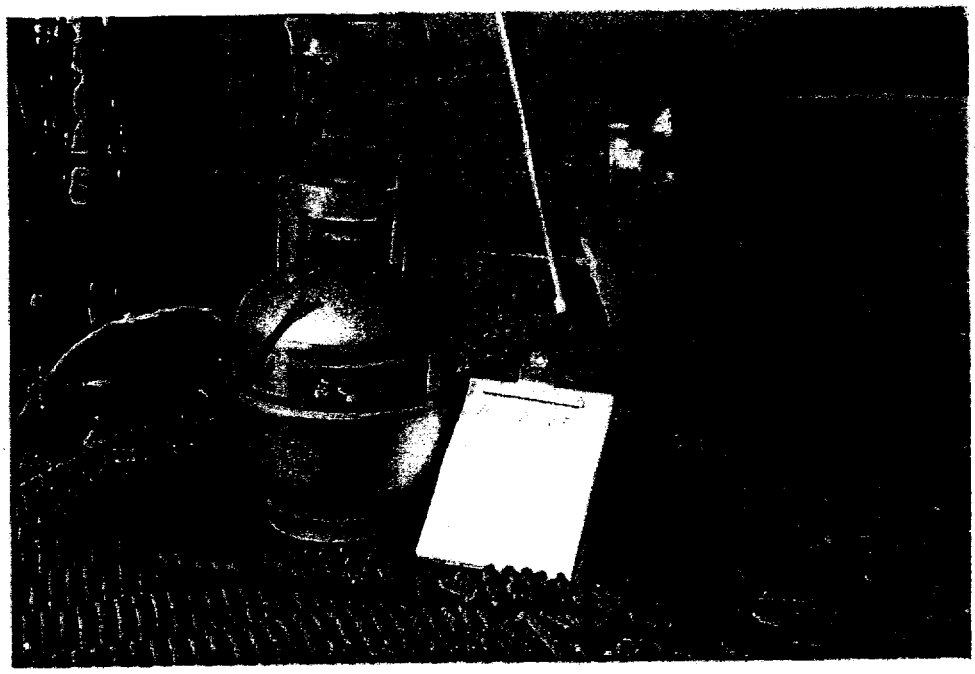
used in attempt to shroud

exhausting R-22 during test

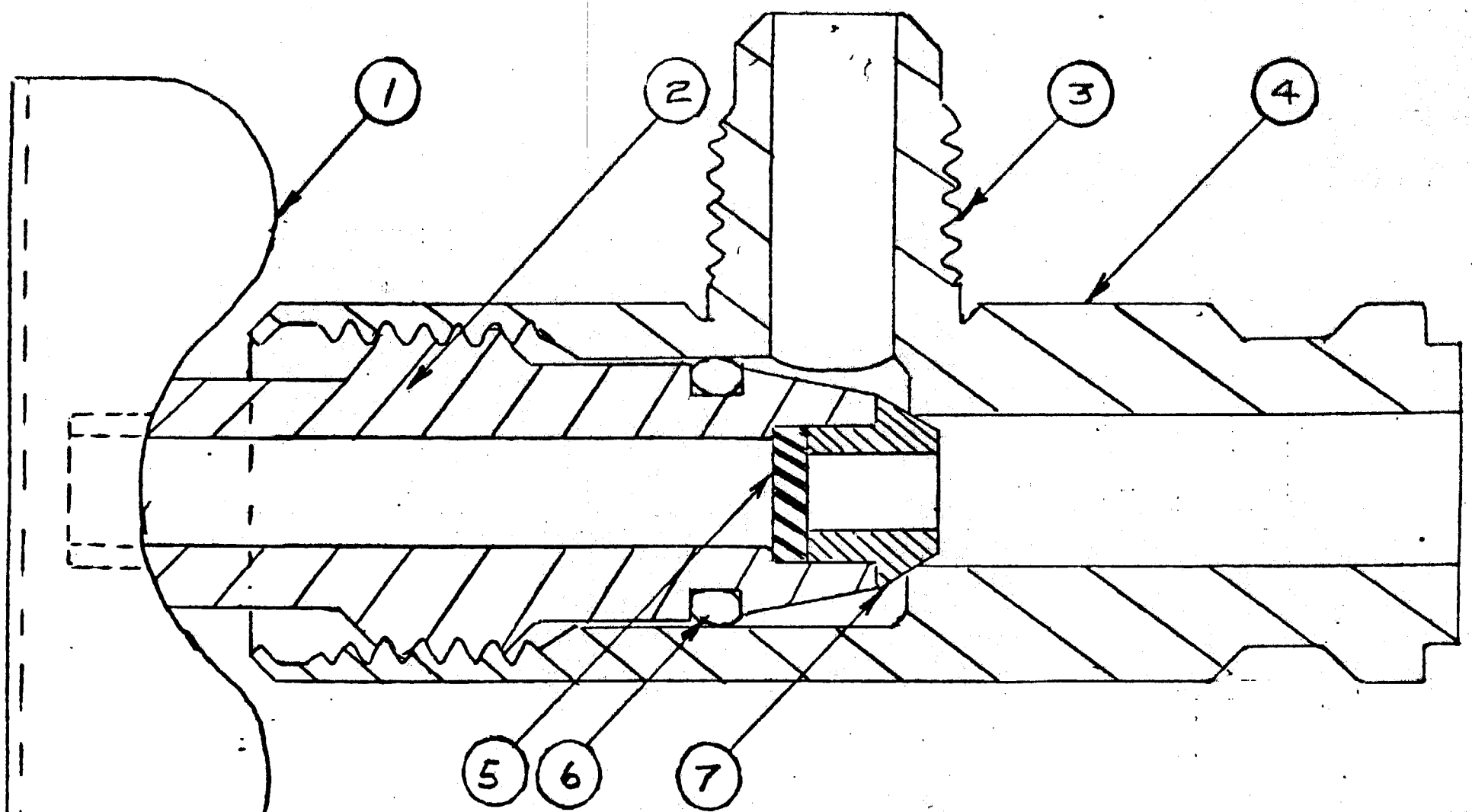




35 DOT 4E240 Aluminum Cylinder (Worthington), R-22, before start of Test-9 with baffle around valve



36 Cylinder after Test-9 (Note surface not frosted)



1. HANDLE
2. STEM
3. PORT
4. BODY
5. DISC SAFETY
6. STEM SEAL
7. SEAT CONE

PRESSUR PAK CONTAINER CO.
25 SKINNER ST. E. HAMPTON CONN

SCALE		DATE 3-3-96
NONE		RHJ

STEEL VALVE & STEM

#666 SAFETY

DWG. 3176

202

DATA PACKAGE

AND

FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 10

LOW PRESSURE, CRYOGENIC GAS IN 4L

CYLINDER (CASE 5)

COMMITTEE CORRESPONDENCE

COMMITTEE CGA Safety Device

SUBJECT: Fire Test of Insulated Cylinder with Aluminum Jacket

TO: W. Kalaski

ADDRESS WRITER CARE OF:

Union Carbide Corporation
Linde Division
Old Saw Mill River Road
Tarrytown, N.Y. 10591

DATE: November 10, 1978

cc: F. Huber, Jr.
R. O. Tribolet

Dear Bill:

Attached per your request are the following:

1. 10 copies each of Photos 337-72 and 345-72 showing the cylinder before and after fire test.

NOTE: A 1/16" aluminum disk x 17-1/4" diameter was placed above the piping (except for the valve stem) prior to fire test. Note that the entire aluminum jacket and shroud melted during the fire test, as well as a portion of the insulation. The stainless steel inner vessel was intact after the fire test.

2. 10 copies of Photo 350-72 showing piping after fire test. Note that all but the inlet part of the CG-1 device is missing.

3. 10 copies of a plot of pressure versus time for the test. Temperature readings were not recorded for this gasoline-on-water pan fire.

4. 10 copies of B77-LIN-024. Rated burst pressure was 175 psi @ 72F.

I am also enclosing the copy of the October 30, 1978 Fire Test Data.

Paul E. Loveday

Paul E. Loveday

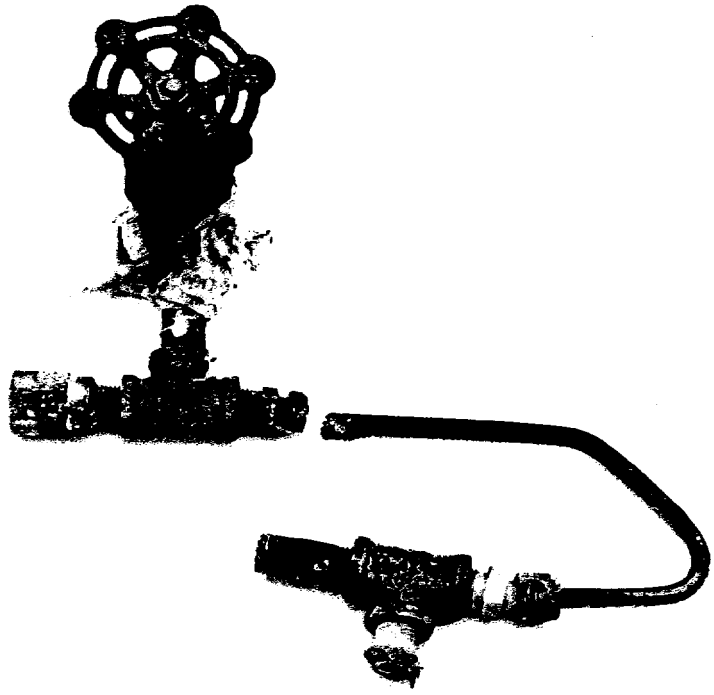
PEL/mbb

337-72

345-72

337-72 DOT 4L, Aluminum Cylinder, Insulated (Liquefied O_2) before start of test

345-72 Cylinder after test



350-72

350-72 Piping after test

COMMITTEE CORRESPONDENCE

COMMITTEE CGA Safety Device

SUBJECT: Data re Insulated Cylinder Fire Test Point 19

TO: William Kalaskie

ADDRESS WRITER CARE OF:

Union Carbide Corporation
Linde Division
Old Saw Mill River Road
Tarrytown, N.Y. 10591

DATE: September 27, 1978

cc: R. O. Tribolet

Attached in support of the Point 19 fire test are the following:

1. The Appendix A forms including test data.
2. BS&B Drawing 77-LIN-024.

It should be noted that the cylinder tested was not stamped as a DOT-4L cylinder, since it had an aluminum jacket. As expected, substantial deterioration of the jacket occurred during the test, as well as some deterioration of the insulation.

The cylinder contained 38 lbs. of pressurized liquid oxygen at the start of the test. The initial pressure was 42 psig, and increased to a maximum of 65 psig during the fire test. (Water capacity of cylinder was 42 lbs.).

The most restrictive flow area of the CG-1 device was 1/4 inch diameter, providing an area of 0.0491 sq. inches.

Based on the latest S-1.1 Revision approved by the CGA Safety Device Committee there are several options by which the device can be qualified. By 4.9.2(e), the fire test result shows that the full-scale cylinder has adequate protection with the CG-1 device used. An alternate approach is to size the device per 4.9.2(a):

$$Qa = Gu\ A^{0.82} = 60(4.0)^{0.82} = 189 \text{ CFM}$$

Converting to the area required:

$$* \ a = q^1m \sqrt{Sg(T)}/260P^1$$

where: a = required flow area, in.^{2}
q^1m = flow rate, CFM at 60F and 14.7 psia.
Sg = specific gravity of gas relative to air.
T = temperature, R.
p^1 = pressure, psia.

$$a = 189 \sqrt{1(520)}/260(189.7)$$
$$= 0.0874 \text{ in.}^2$$

In the Appendix A summary, please disregard the Minimum Required Flow, since the requirements of paragraph 4.6 of the 1969 Edition of S-1.1 were applied.

Contact me if you need additional information.

Paul E. Loveday

PEL/mbb

Paul E. Loveday

*Formula from BS&B Publication No. 77-650.

APPENDIX A (Continued)

TEST DATA

This Form is suitable for Test Data using Orifice Meters.

Test Medium - Air Air or Name of Gas _____ Specific Gravity _____

Molecular Weight 28.96 Ratio of Specific Heats (k) 1.40

ITEM	SAMPLES	1	2	3
		BS & B		
1.	Start to Discharge Pressure—psig.			
2.	Resealing Pressure—psig.			
3.	Frangible Disc—Bursting Pressure—psig.	180	190	188
4.	Fusible Plug—Yield Temperature—degrees F.			
5.	Flow Rating Pressure—psia. (psig + 14.7)	189.7	189.7	189.7
6.	Orifice Diameter—Inches	.6518	.6518	.6518
7.	Meter Pipe—Inside Diameter—Inches	2.067	2.067	2.067
8.	Orifice Factor (For Flow in CFM.) See Table 3	1.4519	1.4519	1.4519
9.	Constant (Item 8 x $\sqrt{\text{Item 5}}$)	19.997	19.997	19.997
10.	Differential Pressure— $\sqrt{\text{Inches Water}}$	7.0	7.0	7.04
11.	Flow Temperature—degrees F.	67	67	67
12.	Temperature Correction Factor. See Table 2.	.9933	.9933	.9933
13.	Supercompressibility Factor (Air = 1.0)	.995	.995	.995
14.	Gas Constant Ratio(*).	1	1	1
15.	Flow (Items 9 x 10 x 12 x 13 x 14)	138.3	138.8	139.14
16.	AVERAGE FLOW AT 60 F and 14.7 psia 138.75 CFM			

(*) Gas constant ratio for air = 1.0; for other than air = 356/Gas Constant (C). See Figure. 1.

DATA PACKAGE

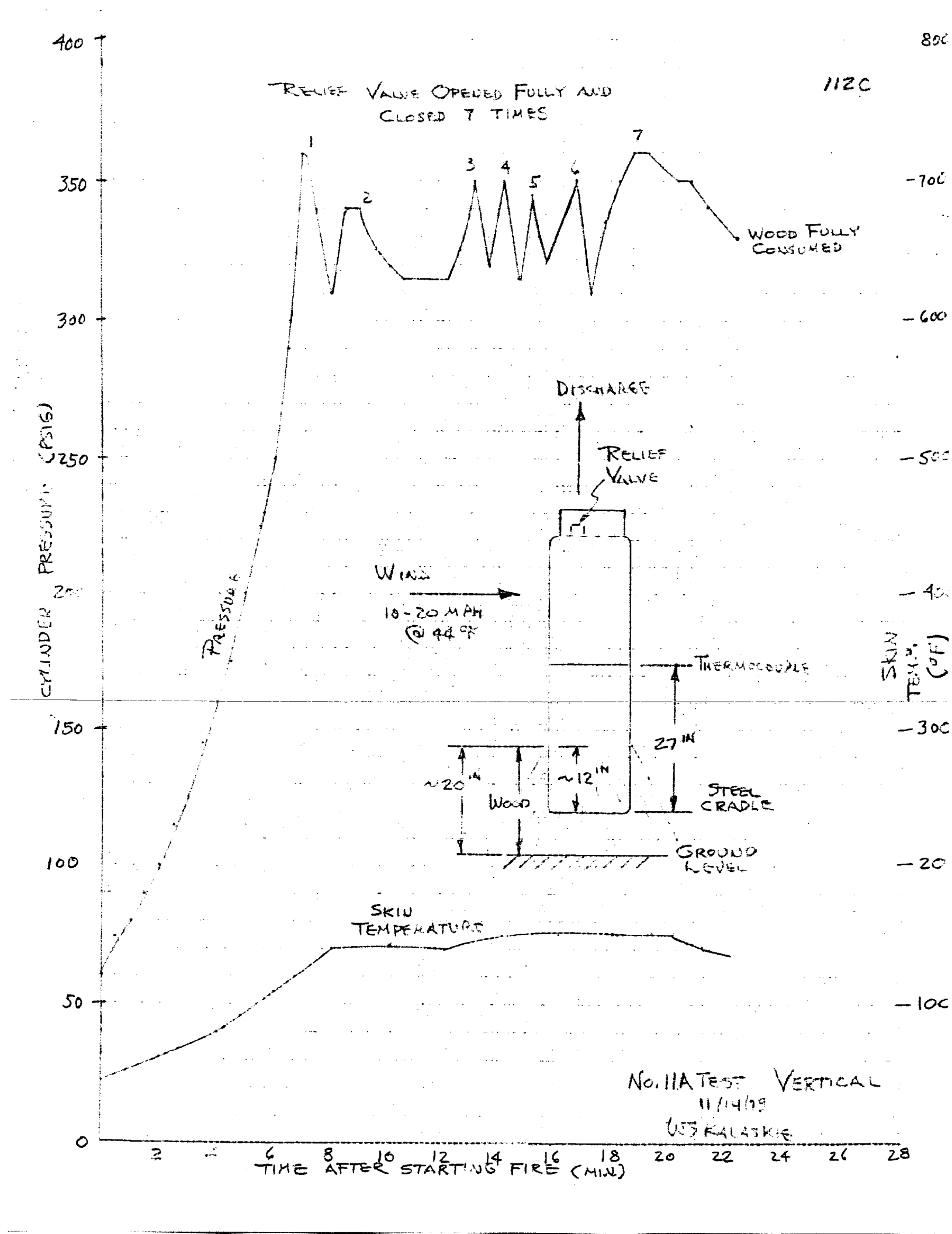
AND

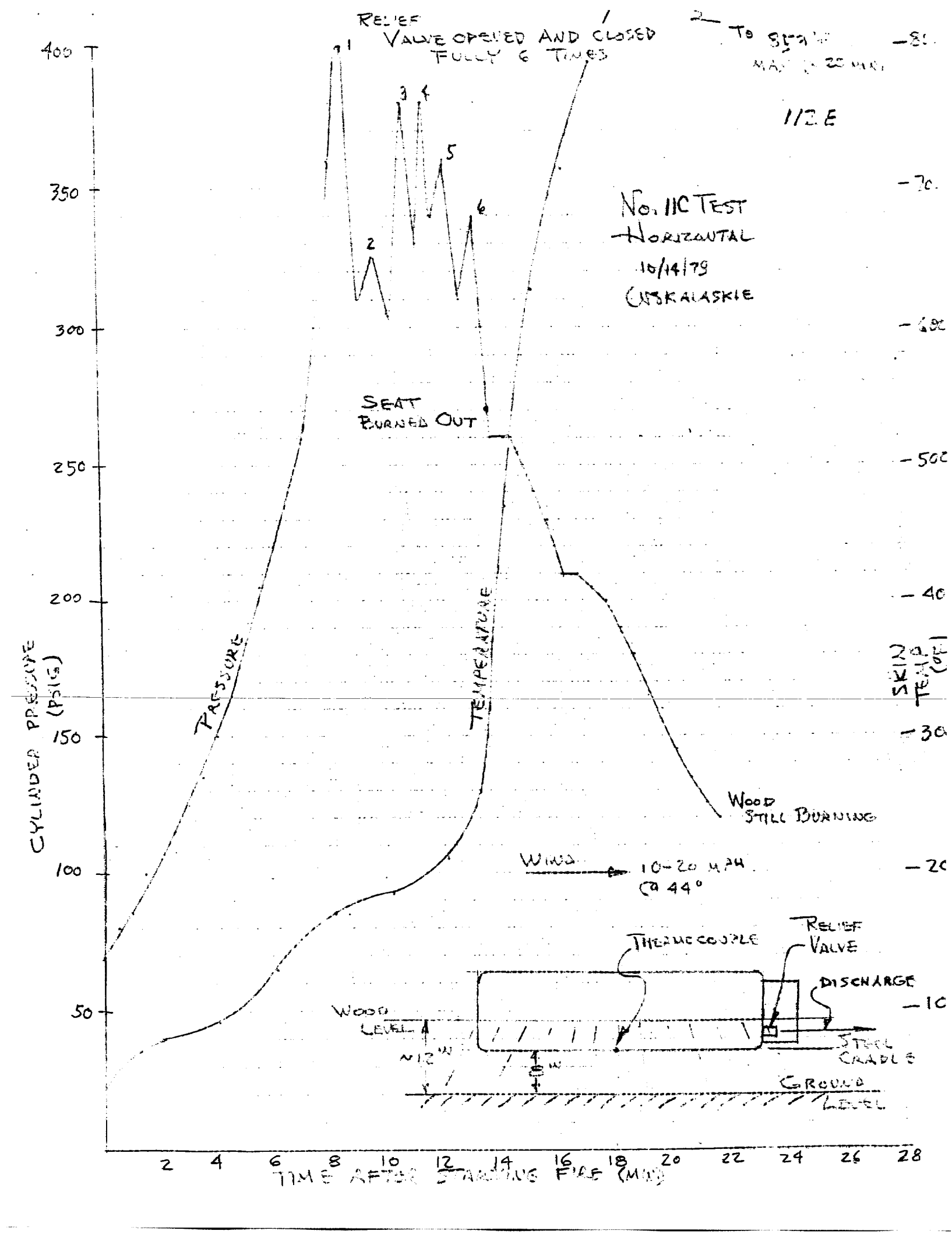
FIRE TEST BACKGROUND INFORMATION

FOR

DATA POINT 11

LIQUEFIED, LOW PRESSURE GAS IN DOT 4BW240 CYLINDER (CASE 4A)


112C
RELIEF VALVE OPENED FULLY AND CLOSED 7 TIMES
1
2
3
4
5
6
7
WOOD FULLY CONSUMED
DISCHARGE
RELIEF VALVE
WIND
10-20 MPH @ 44°F
THERMOCOUPLE
27 IN
~20 IN
~12 IN
WOOD
STEEL CRADLE
GROUND LEVEL
PRESSURE
SKIN TEMPERATURE
CYLINDER PRESSURE (PSIG)
SKIN TEMP. (°F)
400
350
300
250
150
100
50
0
800
700
600
500
400
300
200
100
2
6
8
10
12
14
16
18
20
22
24
26
28
TIME AFTER STARTING FIRE (MIN)
No. 11A TEST VERTICAL
11/14/79
USS KALASKIE

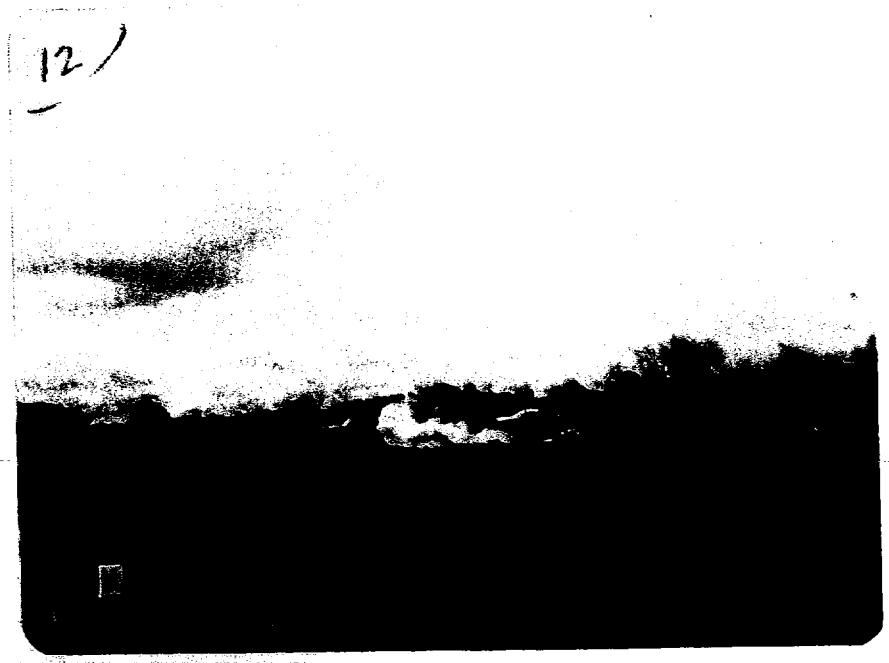


RELIEF VALVE OPENED AND CLOSED FULLY 6 TIMES
1
2
3
4
5
6
112 E
No. 11C TEST
HORIZONTAL
10/14/79
(NSKALASKIE
SEAT BURNED OUT
PRESSURE
TEMPERATURE
WOOD STILL BURNING
WIND 10-20 MPH @ 44°
THERMOCOUPLE
RELIEF VALVE
DISCHARGE
WOOD LEVEL
~12"
8"
STEEL CRADLE
GROUND LEVEL
CYLINDER PRESSURE (PSIG)
SKIN TEMP (°F)
TIME AFTER STARTING FIRE (MIN)
400
350
300
250
200
150
100
50
2
4
6
8
10
12
14
16
18
20
22
24
26
28

Test 11A

Relief Device Actuating

For First Time



Test 11B

Relief Device Actuating

For First Time

Test 11C

Relief Device Actuating

For First Time

SUPERIOR VALVE COMPANY
Washington, Pa. 15301

Date NOVEMBER 12, 1979
Catalog or Model No. 435A
Sherwood Selpac Special Relief Valves for 100 lb Propane Cylinders

TEST DATA

This Form is suitable for Test Data using Orifice Meters.

Test Medium - Air

Specific Gravity 1.0

ITEM	SAMPLES 1	2	3
1. Start to Discharge Pressure—psig.	380	381	
2. Resealing Pressure—psig.	350	353	
3. Frangible Disc—Bursting Pressure—psig.	—	—	
4. Fusible Plug—Yield Temperature—degrees F.	—	—	
5. Barometric Pressure—psia.	14.4	14.4	
6. Flow Rating Pressure—psia. (psig + Item 5)	494.4	494.4	
7. Orifice Diameter—Inches	.8130	.8130	
8. Meter Pipe—Inside Diameter—Inches	3.068	3.068	
9. Flow Pen Reading—Units	7.36	7.59	
10. Chart Factor (For Flow in CFM)—CFM/Unit	50	50	
11. Assumed Flowing Pressure for which Orifice was Bored—psia.	494.4	494.4	
12. Pressure Correction Factor = $\sqrt{\frac{\text{Item 6}}{\text{Item 11}}}$	1.0000	1.0000	
13. Flow Temperature Pen Reading—°F	44	42	
*14. Temperature Correction Factor to 60° F	1.0158	1.0178	
**15. Flow (Items 9 x 10 x 12 x 14)—SCFM.	373.8	386.3	
16. AVERAGE FLOW AT 60° F and 14.7 psia.			

* Flow Temperature Correction Factor taken from Page 281, Principles and Practice of Flow Meter Engineering by L. K. Spink.

** Density Correction, Supercompressibility and Gas Constant Factors for Air = 1.0

ASSOCIATION OF
AMERICAN RAILROADS
OPERATIONS AND MAINTENANCE DEPARTMENT · BUREAU OF EXPLOSIVES
RARITAN CENTER · BUILDING 817 · EDISON, NEW JERSEY 08817 · 201/225-1618

CHEMICAL LABORATORY REPORT

R. M. GRAZIANO
Director and Chief Inspector

W. S. CHANG
Chief Chemist

File Number 272-1-206
Laboratory Number 67019
Laboratory Date January 16, 1980

FIRE TESTS ON COMPRESSED GAS CYLINDERS AND SAFETY VALVES

Lab No: 67019

Tested For: Sherwood Selpac, Lockport, NY -

Cylinder:

Size 14 3/4"(OD) x 49½"(H)

Mfg. Lee Cylinders

DOT Spec. 4BW240

Loading 100 lbs. Liquefied Petroleum Gas (Propane) (239# Water Capacity)

Safety Valve Sherwood Selpac Dwg. No. PV 435A (Relief Valve was specifically sized to meet Pamphlet 51.1 for 239# Water Capacity

Tests:

Type of Fire Kerosene/Wood

Observers Felix Smist, Sherwood Selpac, W. S. Kalaskie, Superior Valve, Robert Jernberg, Pressure Pak, C. L. Hines, Sr. Inspector (B of E).

Test Number	1	2	3
Position of cylinder.	Vertical (Valve Up)	Horizontal	Horizontal
Time at which valve opened.	7 min. 30 sec.	6 min. 30 sec.	8 min. 30 sec.
Test Result Cylinder emptied at	22-23 min.	13 min.	17 min. 30 sec.

Complies with Section 173.34(d) Yes

W. S. Chang
Chief Chemist

E. CONCLUSIONS

1. Since all pressure relief devices were intentionally sized to the minimum allowed by S-1.1 formulae with no test failures, the test results show that the formulae are valid regardless of state of gas, high or low pressure, metallurgy and method of fabrication.
2. Chimney fires are reproducible and controllable.
3. It is necessary that the fire be maintained for any gas after actuation of the relief device until the pressure is negligible or until ten minutes has elapsed.

F. RECOMMENDATIONS

1. * Provisions must be made to ensure that the fire is maintained after relief device actuation.
2. * Provisions must be made to ensure good reproducible reignition in the event the fire is extinguished before the test is completed.
3. * Two of the four thermocouples specified in the fire test procedure should be attached to the cylinder to record surface temperature at two elevations. The remaining two should be located diametrically opposite in the flue gas stream. This is preferable to all four thermocouples being located in the flue gas.
4. * The surface thermocouples should be insulated from the flue gas.
5. CGA Pamphlet S-1.1 should be used, by reference of CFR-49 171.7 as a means for selecting and sizing pressure relief devices.

* These recommendations were implemented during these fire tests.