ASBSD-TDR-64-5

32 p

STRUCTURAL INTEGRITY, ACCELERATED CORROSION AND FLOW CAPACITY TESTS OF PARKER AIRCRAFT COMPANY VALVE, CHECK, ONE-INCH, AIRBORNE, FUEL

PARKER PART NUMBER 2630014

BO/A PART NUMBER 27-02402-5

WYLE LABORATORIES

EL SEGUNDO, CALIFORNIA

TEST REPORT

14985

DDC
JUN 5 1964
TISIA E

CONTRACT NO. AF04(694)-253

JANUARY 1964

PREPARED FOR

AIR FORCE BALLISTIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
NORTON AIR FORCE BASE
SAN BERNARDINO, CALIFORNIA

FOREWORD

THIS REPORT DESCRIBES THE TEST PROCEDURES USED AND THE TEST RESULTS OBTAINED FROM STRUCTURAL INTEGRITY, ACCELERATED CORROSION AND FLOW CAPACITY TESTS CONDUCTED ON TWO, ONE-INCH FUEL CHECK VALVES DESIGNED AND MANUFACTURED BY PARKER AIRCRAFT COMPANY. THE TEST PROGRAM WAS AUTHORIZED BY AIR FORCE CONTRACT NUMBER AF04(694)-287 AND WAS CONDUCTED AS REQUIRED BY TEST DIRECTIVE NUMBER 21. THE AIR FORCE BALLISTIC SYSTEMS DIVISION SPONSORED THE PROGRAM. TESTING WAS PERFORMED AT WYLE LABORATORIES, EL SEGUNDO, CALIFORNIA.

THE FOLLOWING PERSONNEL DIRECTED THE PROGRAM:

BALLISTIC SYSTEMS DIVISION:	LT. COL. G. M. ROBERTS BSBRG
SPACE TECHNOLOGY LABORATORIES:	L. JAHNSEN W. SCHAAL
WYLE LABORATORIES:	PAUL M. TURKHEIMER PROGRAM MANAGER WALTER FRLY TEST ENGINEER

ABSTRACT

THE PURPOSE OF THIS TEST PROGRAM WAS TO DETERMINE THE STRUCTURAL INTEGRITY, RESISTANCE TO STRESS CORROSION CRACKING AND FLOW CAPACITY OF THE PARKER AIRCRAFT COMPANY FUEL CHECK VALVES, GD/A PART NUMBER 27-02402-5, (PARKER PART NUMBER 2630014).

TWO UNITS WERE SUBMITTED FOR TESTING. THE TEST PROGRAM CONSISTED OF DIAMETER MEASUREMENTS, ACCELERATED CORROSION, FLOW CAPACITY AND BURST PRESSURE TESTS.

A 30-DAY ACCELERATED CORROSION TEST CAUSED SEVERE CORROSION OF THE BODY BASE METAL; BUT, THERE WAS NO EVIDENCE OF STRESS CORROSION CRACKING.

THE PRESSURE DROP WAS 5.2 PSI (ALLOWABLE IS 9 PSI) AT A WATER FLOW RATE OF 70 GPM.

THE BURST PRESSURE OF A UNIT FREE OF CORROSION WAS 5100 PSIG. A UNIT PREVIOUSLY SUBJECTED TO A 30-DAY ACCELERATED CORROSION TEST DEMONSTRATED A BURST PRESSURE OF 3650 PSIG. MINIMUM REQUIRED BURST PRESSURE IS 2400 PSIG.

A DETAILED DESCRIPTION OF ALL TESTS AND RESULTS, INCLUDING A LIST OF EQUIPMENT EMPLOYED IN THE PERFORMANCE OF THE TEST PROGRAM, IS PRESENTED IN THIS REPORT.

THIS REPORT HAS BEEN REVIEWED AND APPROVED FOR WYLE LABORATORIES:

PAUL H. TURKHEIMER
PROGRAM MANAGER

THIS REPORT HAS BEEN REVIEWED AND APPROVED BY THE COMMANDER:

MITCHEL HAIFTCH
LT. COL. USAF
CHIEF, PROPULSION
TECHNOLOGY DIVISION

TABLE OF CONTENTS

	PAGE NUMBER
FOREWORD	I
ABSTRACT	II
TABLE OF CONTENTS	III
SUMMARY	1
CONCLUSIONS AND RECOMMENDATIONS	2
INTRODUCTION	3
DESCRIPTION OF TEST SPECIMEN	4
REQUIREMENTS, PROCEDURES AND RESULTS	5
TABLE NUMBER 1	10
FIGURE NUMBER 1	11
FIGURE NUMBER 2	12
PHOTOGRAPH NUMBER 1	13
PHOTOGRAPH NUMBER 2	14
PHOTOGRAPH NUMBER 3	15
PHOTOGRAPH NUMBER 4	16
TEST CONDITIONS AND TEST EQUIPMENT	17
APPENDIX A	20- 28
REPORT DISTRIBUTION LIST	29

SUMMARY

TWO FUEL CHECK VALVE ASSEMBLIES HAVE BEEN SUBJECTED TO THE TEST PROGRAM DESCRIBED IN THIS REPORT. THE VALVE ASSEMBLIES WERE PARKER AIRCRAFT COMPANY PART NUMBER 263001-[illegible] (GD/A PART NUMBER 27-02402-[illegible]).

UNIT 1 WAS SUBJECTED TO A FLOW CAPACITY TEST AND A BURST PRESSURE TEST. THE FLOW CAPACITY TEST DEMONSTRATED THAT THE UNIT HAS A NET PRESSURE DROP OF 5.2 PSID AT A WATER FLOW RATE OF 70 GPM. THE [illegible] ALLOWED PRESSURE DROP IS 9 PSID AT THE RATED FLOW OF 70 GPM OF WATER. THE BURST PRESSURE AT ROOM TEMPERATURE WAS [illegible]00 PSIG. THE UNIT FAILED WHEN THE CIRCUMFERENTIAL WELD RUPTURED, ALLOWING THE BODY IN THE THREADED AREA TO ENLARGE RADIALLY, DECREASING THE THREAD ENGAGEMENT. SUBSEQUENTLY, THE BODY AND CAP SEPARATED IN THE AXIAL DIRECTION. A LOCAL CRACK OCCURRED IN THE WELD AT 2[illegible]00 PSIG AS EVIDENCED BY EXTERNAL LEAKAGE.

UNIT 2 WAS SUBJECTED TO AN ACCELERATED CORROSION TEST AND A BURST PRESSURE TEST. DURING THE 30-DAY ACCELERATED CORROSION TEST THERE WAS NO EVIDENCE OF EXTERNAL LEAKAGE AT THE PROOF PRESSURE OF 1600 PSIG, AND IT WAS ASSUMED THAT NO STRESS CORROSION CRACKING OCCURRED. CORROSION OF BASE MATERIAL WAS SEVERE AT LOCATIONS WHERE THE SURFACE FINISH WAS DAMAGED BY NORMAL HANDLING; E.G., WHERE WRENCHES WERE APPLIED TO THE BODY HEX. THE WELD FILLER MATERIAL SURFACE SHOWED UNIFORM CORROSION WITH NO PITTING. THE BURST PRESSURE FOLLOWING THE ACCELERATED CORROSION TEST WAS 3550 PSIG. FAILURE OCCURRED IN THE SAME MANNER AS DESCRIBED ABOVE. A LOCAL CRACK OCCURRED IN THE WELD AT AN INTERNAL PRESSURE OF 2200 PSIG AS EVIDENCED BY EXTERNAL LEAKAGE.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

THE FLOW CHARACTERISTICS OF THE UNIT WERE SATISFACTORY. THE PRESSURE DROP ACROSS THE VALVE AT A FLOW RATE OF 70 GPM OF WATER WAS 5.2 PSID. THE ALLOWABLE PRESSURE DROP IS 9.0 PSID AT 70 GPM.

THE STRUCTURAL INTEGRITY OF THE UNIT WAS SATISFACTORY. THE BURST PRESSURES OF BOTH UNITS (ONE TYPE OF CORROSION, THE OTHER SUBJECTED TO A 30-DAY ACCELERATED CORROSION TEST) WERE IN EXCESS OF THE SPECIFICATION REQUIREMENTS OF 2400 PSIG.

STRESS CORROSION CRACKING APPEARED TO BE ABSENT AS DEMONSTRATED BY NO EXTERNAL LEAKAGE AFTER A 30-DAY ACCELERATED CORROSION TEST.

RECOMMENDATIONS

NONE.

INTRODUCTION

TWO FUEL CHECK VALVES, GD/A PART NUMBER 27-02402-5 (PARKER PART NUMBER 2630014), WERE SUBJECTED TO STRUCTURAL INTEGRITY, FLOW CAPACITY AND ACCELERATED CORROSION TESTS IN ACCORDANCE WITH TEST DIRECTIVE NUMBER 21 OF AIR FORCE CONTRACT NUMBER AF04(694)-287.

THE VALVE ASSEMBLIES WERE DESIGNED AND MANUFACTURED BY PARKER AIRCRAFT COMPANY, LOS ANGELES, CALIFORNIA. THE VALVE ASSEMBLIES ARE A REDESIGN OF GD/A PART NUMBER 27-02403-1 (PARKER PART NUMBER 1111-595729), WHICH EMPLOYED A TEFLON SEALING ELEMENT BETWEEN BODY AND CAP. IN THE REDESIGNED UNIT, THE SEALING ELEMENT WAS ELIMINATED AND A STRAIGHT THREAD WELD REPLACED THE SEAL BETWEEN THE BODY AND CAP.

THE INTENT OF THE PROGRAM WAS TO INVESTIGATE THE FLOW CHARACTERISTIC, SUSCEPTIBILITY TO STRESS CORROSION CRACKING AND STRUCTURAL INTEGRITY OF THE REDESIGNED VALVE ASSEMBLY.

THE TEST PROCEDURES UTILIZED IN THIS PROGRAM ARE OUTLINED IN WYLE LABORATORIES TEST PROCEDURE NUMBER 0315, REVISION A, DATED DECEMBER 3, 1963, ATTACHED TO THIS REPORT AS APPENDIX "A".

DESCRIPTION OF TEST SPECIMENS

PART NAME: VALVE, CHECK, ONE-INCH, AIRBORNE, FUEL.

MANUFACTURER: PARKER AIRCRAFT COMPANY, LOS ANGELES, CALIF.

PARKER PART NUMBER: 2630014

GD/A PART NUMBER: 27-02402-5

NUMBER OF UNITS SUBMITTED FOR TESTING: TWO

THE UNITS WERE IDENTIFIED AS FOLLOWS:

UNIT	PARKER SERIAL NUMBER	GD/A SERIAL NUMBER
1	101	3050006
2	103	3050005

REQUIREMENTS, PROCEDURES AND RESULTS

EXAMINATION OF PRODUCT (BOTH UNITS)

UPON RECEIPT, THE TWO UNITS WERE VISUALLY INSPECTED TO DETERMINE IF SHIPPING AND HANDLING HAD CAUSED ANY DAMAGE THAT WOULD RENDER THE UNITS UNSUITABLE FOR TESTING. BOTH UNITS WERE FOUND TO BE FREE OF DAMAGE.

ARBITRARILY, THE UNITS WERE IDENTIFIED AS UNIT 1 AND UNIT 2 FOR TESTING PURPOSES. THE WRAP-AROUND [illegible] WAS REMOVED FROM BOTH UNITS AND THE BODY DIAMETERS WERE MEASURED AT FOUR DIFFERENT LOCATIONS AS IDENTIFIED BY [illegible] A THROUGH D ON FIGURE 1 OF APPENDIX A. BOTH UNITS WERE THEN SUBJECTED TO AN INTERNAL HELIUM PRESSURE OF 1600 PSIG (PROOF PRESSURE) FOR A PERIOD OF TEN MINUTES. DURING THIS PERIOD, THE UNITS WERE OBSERVED FOR EXTERNAL LEAKAGE BY SUBMERSION IN ISOPROPYL ALCOHOL. NO LEAKAGE WAS OBSERVED. AFTER THE INTERNAL PRESSURE WAS RETURNED TO ATMOSPHERIC PRESSURE, THE BODY DIAMETERS WERE MEASURED AGAIN. THE MEASURED DIAMETERS ARE TABULATED IN TABLE 1 UNDER CONDITIONS, "AS RECEIVED" AND "FOLLOWING PROOF PRESSURE." THE UNITS DID NOT DEFORM AS A RESULT OF THE PROOF PRESSURE TEST. SLIGHT CHANGES IN DIAMETERS ARE DUE TO MEASURING TOLERANCES.

REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

FLOW CAPACITY TEST (UNIT 1)

UNIT 1 WAS SUBJECTED TO THE FLOW CAPACITY TEST DESCRIBED IN APPENDIX A, PARAGRAPH 6.2.

THE TEST RESULTS ARE GRAPHICALLY PRESENTED IN FIGURE 1.

AT A WATER FLOW RATE OF 70 GPM, THE PRESSURE DROP WAS DETERMINED TO BE 5.2 PSID.

REQUIREMENTS, PROCEDURES AND RESULTS (CONT)

ACCELERATED CORROSION TEST (UNIT 2)

FOLLOWING EXAMINATION OF PRODUCT, UNIT 2 WAS SUBJECTED TO THE ACCELERATED CORROSION TEST DESCRIBED IN APPENDIX A, PARAGRAPH 6.3. THIS TEST IS SIMILAR TO THE STRESS-CORROSION CRACKING TEST DESCRIBED IN SPECIFICATION MIL-A-22771A(ASG), PARAGRAPH 4.6.5.1.

THE UNIT WAS SUBJECTED TO THE CORROSION-DRYING CYCLE FOR A PERIOD OF 30 DAYS. FROM THE 15TH DAY OF EXPOSURE TO COMPLETION OF THE TEST, A HELIUM LEAKAGE TEST AT PROOF PRESSURE OF 1000 PSIG WAS CONDUCTED DAILY. NO EXTERNAL LEAKAGE WAS DETECTED.

SURFACE DISCOLORATION DUE TO CORROSION WAS NOTICED AFTER A FEW DAYS OF EXPOSURE AT PLACES WHERE SURFACE COATING WAS IMPERFECT, OR DAMAGED BY HANDLING SUCH AS APPLICATION OF WRENCHES TO HEX. THE WELD FILLER MATERIAL LOST ITS ORIGINAL SURFACE COATING AFTER A FEW DAYS OF EXPOSURE.

AT THE COMPLETION OF TESTING, VISUAL INSPECTIONS SHOWED SEVERE CORROSION OF THE HEX OF BOLT AND CAP, AND UNIFORM SURFACE CORROSION OF THE WELD FILLER MATERIAL. PHOTOGRAPHS NUMBERS 1 AND 2 DEPICT THE UNIT AFTER 15 AND 30 DAYS OF EXPOSURE TO ACCELERATED CORROSION, RESPECTIVELY. STRESS-CORROSION CRACKING APPEARED TO BE ABSENT AS EVIDENCED BY NO EXTERNAL HELIUM LEAKAGE.

REQUIREMENTS, PROCEDURES AND RESULTS (CON'T)

BURST PRESSURE TEST (UNIT 1)

FOLLOWING THE FLOW CAPACITY TEST, UNIT 1 WAS SUBJECTED TO THE BURST PRESSURE TEST DESCRIBED IN APPENDIX A, PARAGRAPH 6.4.1

POST YIELD TYPE STRAIN GAUGES WERE ATTACHED TO THE VALVE BODY OUTER SURFACE AS SHOWN IN FIGURE 1 OF APPENDIX A. THE INTERNAL PRESSURE VERSUS STRAIN RELATION AS EVALUATED FROM RECORDINGS IS SHOWN IN FIGURE 2.

DURING THE FIRST PHASE OF THE BURST PRESSURE TEST, THE INTERNAL PRESSURE WAS INCREASED FROM ZERO TO 2400 PSIG, SHOWN AS POINT A ON FIGURE 2. YIELDING OCCURRED AT THE LOCATIONS OF GAUGES 1 AND 2 (OVER THREADED PORTIONS OF BODY). THE PRESSURE WAS REDUCED TO ZERO PSIG, (POINT B OF FIGURE 1) AND A RESIDUAL STRAIN OF 780 MICROINCHES/INCH WAS RECORDED ON GAUGES 1 AND 2 WHICH IS COMPARABLE TO THE MEASURED INCREASE IN DIAMETER (TABLE 1). NO YIELDING OCCURRED ON GAUGES 3 AND 4.

FOR THE SECOND PHASE OF THE BURST PRESSURE TEST, THE STRAIN GAUGE RECORDING SCALE WAS CHANGED IN ANTICIPATION OF A LARGE STRAIN. THIS ARRANGEMENT DID NOT PERMIT ACCURATE READOUT BELOW 3300 MICROINCHES/INCH.

THE UNIT WAS REPRESSURIZED FROM ZERO TO 2800 PSIG WHEN LEAKAGE OCCURRED FROM A LOCALIZED AREA AT THE WELD AND PREVENTED FURTHER INCREASE IN PRESSURE WITH THE HYDRAULIC EQUIPMENT USED. THE PRESSURE WAS DECREASED TO ATMOSPHERIC PRESSURE AND THE SYSTEM CHANGED TO A PRESSURIZED GAS SOURCE TO OVERCOME THE EXISTING LEAKAGE. THE UNIT WAS REPRESSURIZED, AND AT AN INTERNAL PRESSURE OF 5100 PSIG, THE WELD RUPTURED AND THE CAP SEPARATED FROM THE BODY. IMMEDIATELY PRIOR TO FAILURE, A STRAIN OF 7100 MICROINCHES/INCH WAS RECORDED ON GAUGES 1 AND 2 (POINT C OF FIGURE 2). THE BODY ENLARGED IN A BELL MOUTH FASHION AT THE WELDED END. THE DIAMETER MEASUREMENT TAKEN AFTER RUPTURE CANNOT BE CONSIDERED RELIABLE. PHOTOGRAPH NUMBER 3 DEPICTS THE BODY AND CAP OF THE RUPTURED UNIT.

REQUIREMENTS, PROCEDURES AND RESULTS (CON'T)

BURST PRESSURE TEST (UNIT 2)

FOLLOWING THE ACCELERATED CORROSION TEST, UNIT 2 WAS SUBJECTED TO THE BURST PRESSURE TEST, DESCRIBED IN APPENDIX A, PARAGRAPH 6.4.2.

AS A RESULT OF THE CORRODED SURFACE, THE ATTACHMENT OF STRAIN GAUGES AND THE MEASUREMENT OF DIAMETERS WERE NOT PRACTICABLE.

THE UNIT WAS SLOWLY PRESSURIZED WITH HYDRAULIC FLUID FROM ZERO TO APPROXIMATELY 2200 PSIG WHEN LEAKAGE OCCURRED AT A LOCALIZED AREA OF THE WELD AND PREVENTED FURTHER PRESSURE INCREASE WITH THE HYDRAULIC EQUIPMENT USED. THE UNIT WAS CONNECTED TO AN ACCUMULATOR AND PRESSURIZED TO 2400 PSIG. THIS PRESSURE WAS MAINTAINED FOR A PERIOD OF ONE MINUTE AND THEN REDUCED TO ZERO. DURING A SUBSEQUENT REPRESSURIZATION WITH GAS, THE WELD RUPTURED AND THE CAP SEPARATED FROM THE BODY AT A PRESSURE OF 3650 PSIG. PHOTOGRAPH NUMBER 4 IS AN AXIAL VIEW OF THE RUPTURED PARTS.

TABLE NUMBER 1

PARKER AIRCRAFT COMPANY
VALVE, CHECK, ONE-INCH, AIRBORNE, FUEL
GD/A PART NUMBER 27-02402-5

DIAMETER MEASUREMENTS

		* DIAMETER (INCHES)			
UNIT	TEST	A	B	C	D
1	AS RECEIVED	1.8708	1.8707	1.8703	1.8704
1	FOLLOWING PROOF (1600 PSI)	1.8703	1.8703	1.8697	1.8700
1	FOLLOWING BURST (2400 PSIG)	**	1.8718	1.8692	**
1	FOLLOWING DESTRUCTIVE BURST (5100 PSIG)	**	1.8853	1.8695	**
2	AS RECEIVED	1.8714	1.8712	1.8717	1.8715
2	FOLLOWING PROOF (1600 PSIG)	1.8712	1.8710	1.8715	1.8714

NOTES: * FOR DIAMETER LOCATION, SEE FIGURE 1 OF APPENDIX A.

** LOCATION COVERED BY STRAIN GAGES

DIAMETER VARIATION OF 0.0005 INCH OR LESS ARE MOST LIKELY DUE TO MEASURING INACCURACIES.

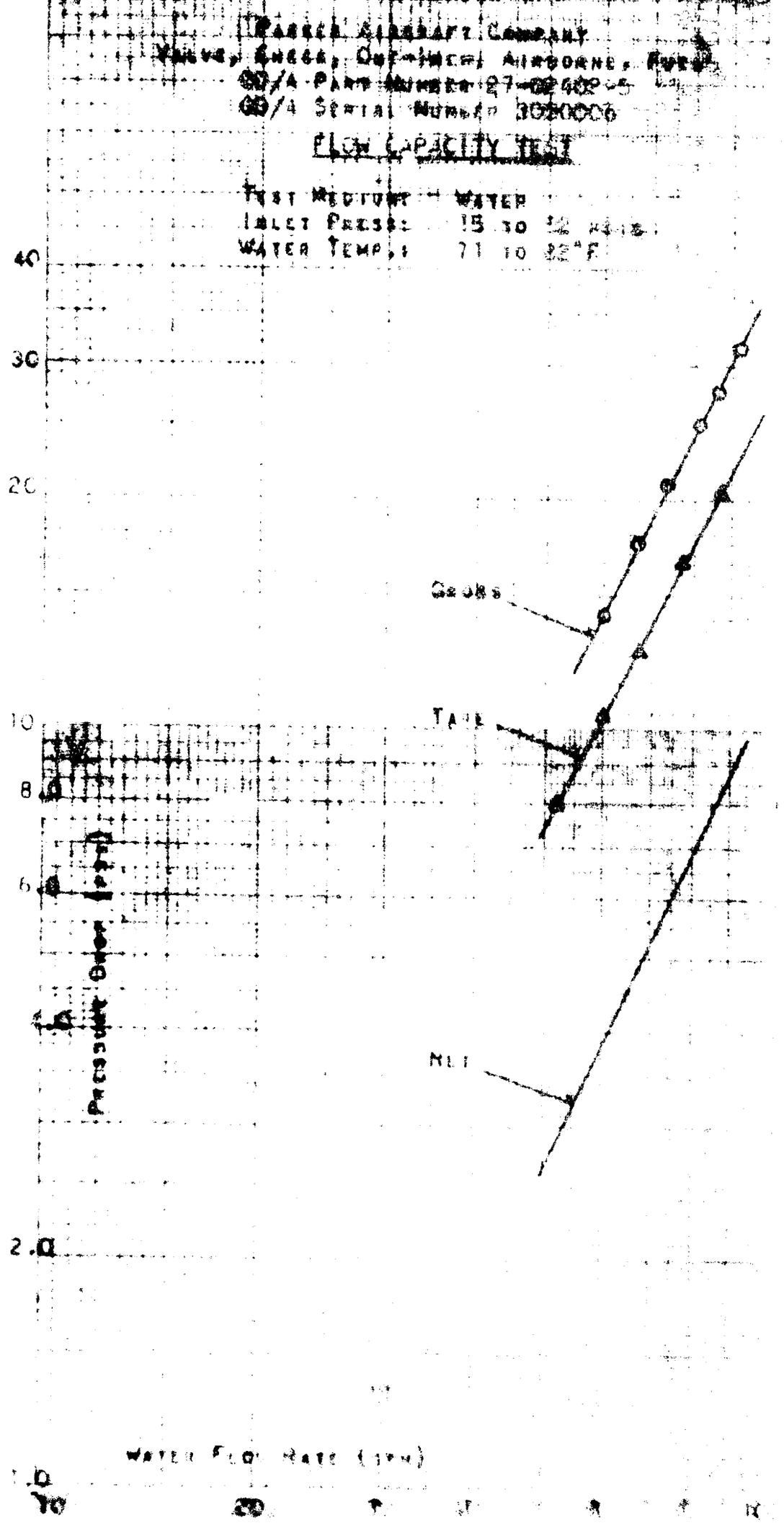
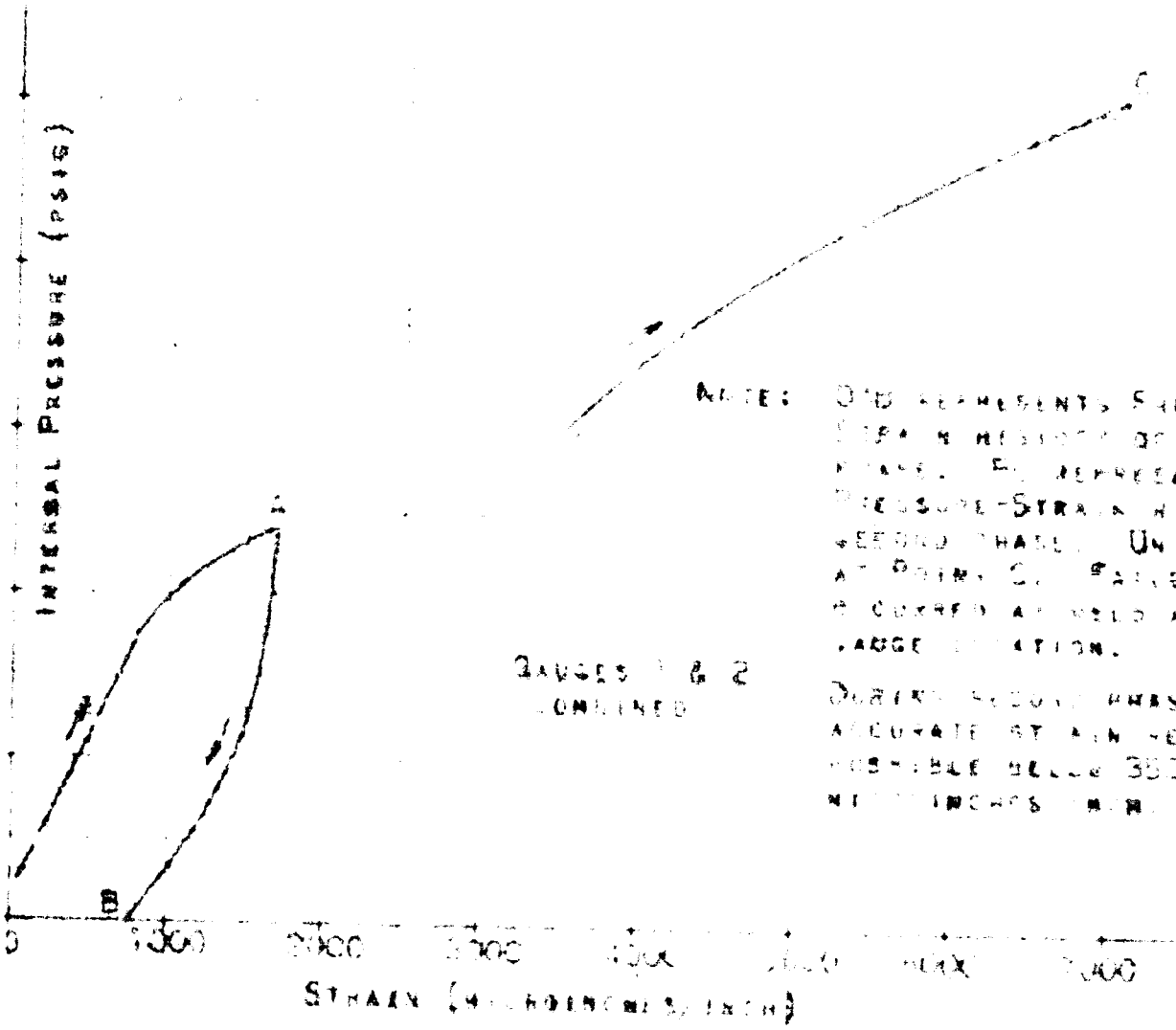

PARKER AIRCRAFT COMPANY
VALVE, CHECK, OUT-BOARD AIRBORNE, FUEL
GD/A PART NUMBER 27-
GD/A SERIAL NUMBER 3080006
FLOW CAPACITY TEST
TEST MEDIUM - WATER
INLET PRESS: 15 TO
WATER TEMP.: 71 TO °F
40
30
20
10
8
6
4
2.0
1.0
Pressure Drop (psi)
GROSS
TARE
NET
WATER FLOW RATE (gpm)
10
20

FIGURE NUMBER 2

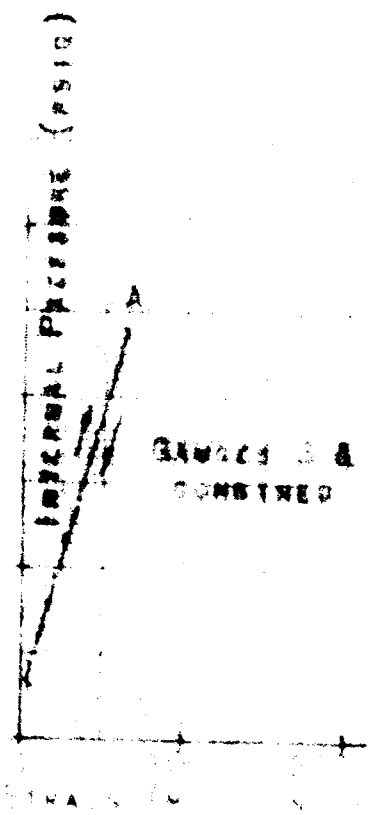
PARKER AIRCRAFT COMPANY
VALVE, CHECK, ONE-INCH, AIRBORNE, FUEL
OD/A PART NUMBER P2-5P402-5
OD/A SERIAL NUMBER [illegible]

BURST PRESSURE (PSI) (UNIT 1)



NOTE: [illegible] REPRESENTS PRESSURE-STRAIN HISTORY OF FIRST PHASE. [illegible] REPRESENTS PRESSURE-STRAIN HISTORY OF SECOND PHASE. UNIT FAILED AT POINT C. FAILURE OCCURRED AT WELD AND NOT AT GAUGE LOCATION.

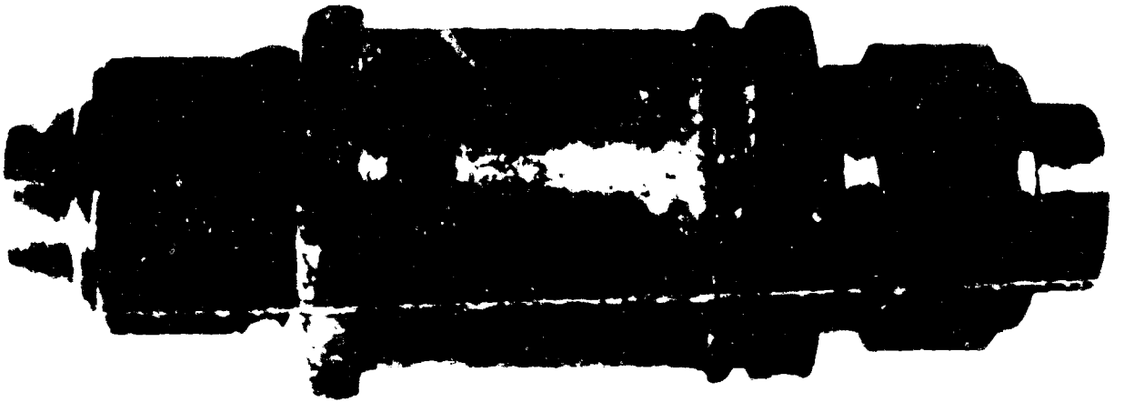
DURING SECOND PHASE NO ACCURATE STRAIN READOUT WAS POSSIBLE BELOW 3500 MICROINCHES/INCH.



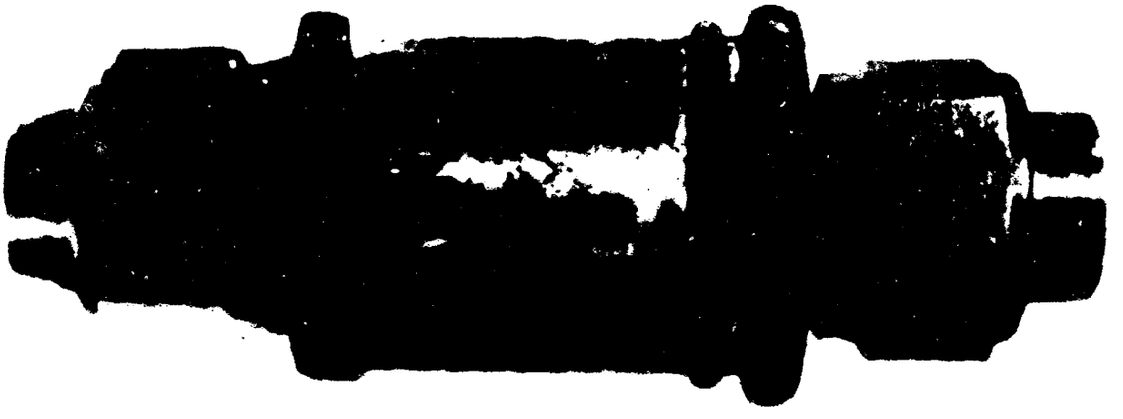
NOTE: [illegible] REPRESENTS PRESSURE-STRAIN HISTORY OF FIRST PHASE. DURING SECOND PHASE OF BURST TEST, NO ACCURATE STRAIN READOUT WAS OBTAINED.

LOWER PHOTOGRAPH SHOWS
OPPOSITE SIDE OF UPPER PHOTOGRAPH

PHOTOGRAPH NUMBER 1
PARKER AIRCRAFT COMPANY
VALVE, CHECK, ONE-INCH AIRBORNE, FUEL
GD/A PART NUMBER 27-02402-5
ACCELERATED CORROSION TEST
UNIT 2 AFTER 15 DAYS OF EXPOSURE



LOWER PHOTOGRAPH SHOWS
OPPOSITE SIDE OF UPPER PHOTOGRAPH



[illegible] NUMBER
[illegible] COMPANY
[illegible] NEWARK, [illegible]
[illegible] PART NUMBER [illegible]-[illegible]400-5
ACCELERATED CORROSION TEST
[illegible] AFTER 30 DAYS OF EXPOSURE

PHOTOGRAPH NUMBER 5
PARKER AIRCRAFT COMPANY
VALVE, CHECK, ONE-INCH AIRBORNE, FUEL
GD/A PART NUMBER 27-02402-5
BURST PRESSURE TEST, UNIT 1

[illegible]
[illegible]
VALVE, CHECK, [illegible]
30/[illegible] PART NUMBER [illegible]
BURST PRESSURE TEST, UNIT [illegible]

TEST CONDITIONS AND TEST EQUIPMENT

TEST MEDIA

BUREAU OF MINES, GRADE A HELIUM WAS USED FOR THE PROOF PRESSURE TEST DURING EXAMINATION OF PRODUCT AND ALL SUBSEQUENT LEAKAGE TESTS.

TAP WATER AT APPROXIMITELY ROOM TEMPERATURE WAS USED DURING THE FLOW CAPACITY TEST.

HYDRAULIC OIL PER MILITARY SPECIFICATION MIL-H-5606A WAS USED FOR THE BURST PRESSURE TEST

ISOPROPYL ALCOHOL WAS USED AS A SUBMERSION LIQUID FOR DETECTING EXTERNAL LEAKAGE.

AMBIENT CONDITIONS

ALL TESTS WERE CONDUCTED WITH THE UNIT STABILIZED AT PREVAILING LABORATORY TEMPERATURE OF 75±5°F.

INSTRUMENTATION AND EQUIPMENT

Apparatus	Manufacturer and Model	Description	Wyle Number
Examination of Product			
Micrometer	Starrett T2RL	1-2 inch	6470
Pressure Gage	Ashcroft 1279-D	0-2000 psi	G1288
Flow Capacity Test			
Flowmeter	A.O. Smith S/N 163184	0-150 gpm	-
Differential Pressure Gage	Barton 227	0-60 psi	4217
Pressure Gage	Ashcroft 1279-D	0- 50 psi	3806
Stop Watch	Compass	0-60 sec. 0-15 min.	6532
Temperature Bridge	Leeds & Northrup 8693	-100F to +500F	2250
Accelerated Corrosion Test			
Test Chamber	Wyle	Automatic	9503
Pressure Gage	Ashcroft 1279-D	0-2000 psig	G1288
Burst Pressure Test			
Pressure Gage	Ashcroft 1279-D	0-5000 psig	4445
Pressure Gage	Ashcroft 1279-D	0-10,000 psig	4483

INSTRUMENTATION AND EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	WYLE NUMBER
BLAST PRESSURE TEST (CONTINUED)			
PRESSURE TRANSDUCER	STATHAM P10ATE	0-5,000 PSI	2076
STRAIN GAGE	B-L-H PA-3	POST YIELD TYPE	-
RECORDER	SANBORN 156-1008J	6 CHANNEL	2083
DECADE RESISTOR	GENERAL RADIO 1432P	0-1 MEGOHM	2083

WYLE LABORATORIES

TEST PROCEDURE NO. 2315

DATE 6 NOVEMBER 1963

TEST DIRECTIVE NO. 21

JOB NUMBER 33021

REVISION A
3 DECEMBER 1963

BSD-TDR-64-5
PAGE 70

TEST PLAN
FOR
STRUCTURAL INTEGRITY, ACCELERATED CORROSION AND FLOW CAPACITY TESTS
OF
PARKER AIRCRAFT COMPANY
VALVE, CHECK, ONE-INCH, AIRBORNE, FUEL
PARKER PART NUMBER 2630014
GD/A PART NUMBER 27-02402-5
FOR
AIR FORCE BALLISTIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
NORTON AIR FORCE BASE, SAN BERNARDINO, CALIFORNIA
CONTRACT NUMBER AF04(694)-287

APPROVED BY _____ FOR _____

APPROVED BY _____ FOR _____

APPROVED BY _____ FOR _____

APPROVED BY _____ FOR WYLE LABORATORIES

APPROVED BY _____ FOR WYLE LABORATORIES

PREPARED BY _____ WYLE LABORATORIES

REVISIONS

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L	DESCRIPTION OF CHANGES
A	12/3/63	4, 5, 6, 7, 8,			GENERAL REVISION PER CUSTOMER'S REQUEST.

COPYRIGHT BY WYLE LABORATORIES. THE RIGHT TO REPRODUCE, COPY, EXHIBIT OR OTHERWISE UTILIZE ANY OF THE MATERIAL CONTAINED HEREIN WITHOUT THE EXPRESS PRIOR PERMISSION OF WYLE LABORATORIES IS PROHIBITED. THE ACCEPTANCE OF A PURCHASE ORDER IN CONNECTION WITH THE MATERIAL CONTAINED HEREIN SHALL BE EQUIVALENT TO EXPRESS PRIOR PERMISSION.

TABLE OF CONTENTS

		PAGE NUMBER
TITLE PAGE		1
TABLE OF CONTENTS		2
1.0	INTRODUCTION	3
2.0	REFERENCES	3
3.0	DESCRIPTION OF TEST SPECIMEN	3
4.0	TEST OUTLINE	4
5.0	TEST CONDITION AND INSTRUMENTATION	4
6.0	TEST PROCEDURE	5
6.1	EXAMINATION OF PRODUCT (UNITS 1 & 2)	5
6.2	FLOW CAPACITY TEST (UNIT 1)	5
6.3	ACCELERATED CORROSION TEST (UNIT 2)	6
6.4	BURST PRESSURE TEST (UNITS 1 & 2)	7
FIGURE 1 -	STRAIN GAGE LOCATION AND DIAMETER MEASUREMENT	8
FIGURE 2 -	FLOW CAPACITY TEST SETUP	9

1.0 INTRODUCTION

THE PURPOSE OF THIS TEST PLAN IS TO DESCRIBE THE TEST METHODS TO BE EMPLOYED IN INVESTIGATING STRESS CORROSION CRACKING AND STRUCTURAL INTEGRITY OF SPECIFIC VALVES. THE TESTS ARE INTENDED TO YIELD INFORMATION RELATING TO STRESS CORROSION CRACKING, FLOW CAPACITY AND PRESSURE VERSUS STRAIN RELATION BEYOND PROOF PRESSURE. THE TEST PLAN IS BASED ON TEST DIRECTIVES PER REFERENCE 2.1.

2.0 REFERENCES

2.1 TEST DIRECTIVE NUMBER 21, CONTRACT AF04(694)-287.

2.2 PARKER DRAWING NUMBER 2630014, REVISION A

2.3 MIL-A-22771A(ASG) DATED 10 JANUARY 1963

TITLE: "ALUMINUM-ALLOY FORGINGS, HEAT TREATED"

3.0 DESCRIPTION OF TEST SPECIMEN

PART NAME: VALVE, CHECK, 1-INCH, AIRBORNE, FUEL
GD/A PART NUMBER: 27-02402-5
PARKER PART NUMBER: 2630014
MANUFACTURER: PARKER AIRCRAFT COMPANY
A DIVISION OF PARKER-HANNIFIN CORPORATION
5827 W. CENTURY BLVD.
LOS ANGELES 45, CALIFORNIA

COMMENTS: ABOVE UNIT IS A REDESIGN OF PARKER PART NUMBER 1111-895729, GD/A PART NUMBER 27-02405-1.

4.0 **TEST OUTLINE**

TWO TEST SPECIMENS SHALL BE SUBJECTED TO THE FOLLOWING TESTS IN THE SEQUENCE LISTED BELOW:

		PROC. PARAGRAPH REF.
4.1	UNIT 1	
4.1.1	EXAMINATION OF PRODUCT	PARAGRAPH 6.1
4.1.2	FLOW CAPACITY TEST	PARAGRAPH 6.2
4.1.3	BURST PRESSURE TEST	PARAGRAPH 6.4.1
4.2	UNIT 2	
4.2.1	EXAMINATION OF PRODUCT	PARAGRAPH 6.1
4.2.2	ACCELERATED CORROSION TEST	PARAGRAPH 6.3
4.2.3	BURST PRESSURE TEST	PARAGRAPH 6.4.2

5.0 **TEST CONDITION AND INSTRUMENTATION**

5.1 **ATMOSPHERIC CONDITION**

UNLESS OTHERWISE SPECIFIED ALL TESTS SHALL BE PERFORMED AT AN AMBIENT PRESSURE OF 30.0±1.0 INCHES OF MERCURY ABSOLUTE, AN AMBIENT TEMPERATURE OF 70±20°F AND A RELATIVE HUMIDITY OF 50±20%.

5.2 **TEST MEDIUM**

THE TEST MEDIA ARE CALLED OUT UNDER EACH TEST PARAGRAPH AND ARE AS FOLLOWS:

HELIUM - BUREAU OF MINES, GRADE A
WATER - TAP WATER AT ROOM TEMPERATURE
HYDRAULIC OIL - PER MILITARY SPECIFICATION MIL-H-5606A (A)

5.3 **INSTRUMENTATION**

ASHCROFT BOURDON TUBE GAUGE OF SUITABLE RANGE, ACCURACY ±0.5% FS
STATHAM PRESSURE TRANSDUCER PG10TC-SM-350, 0-5000 PSIG
A.O. SMITH TOTALIZING FLOWMETER MODEL S-35 (A)
MERCURY MANOMETER, 0-15 PSIG
SANBORN OSCILLOGRAPH, MODEL 154-1008
STARRET MICROMETER, 1 TO 2 INCH RANGE
BALDWIN-LIMA-HAMILTON BONDED STRAIN GAGE, TYPE PA-2
POST YIELD TYPE (MAXIMUM STRAIN 10%)

TEST PROCEDURE

EXAMINATION OF PRODUCT (UNIT 1 AND 2)

EACH UNIT SHALL BE VISUALLY INSPECTED AND MARKED FOR IDENTIFICATION. THE NAMEPLATE SHALL THEN BE REMOVED. THE BODY OUTSIDE DIAMETER SHALL BE MEASURED AND RECORDED TO THE NEAREST [illegible] USING A MICROMETER AT THE LOCATIONS SHOWN IN FIGURE 1 OF THIS TEST PROCEDURE. AN INTERNAL HELIUM PRESSURE OF 100 PSIG SHALL BE APPLIED TO THE OUTLET PORT AND THE EXTERNAL LEAKAGE OBSERVED WITH AN APPROVED LEAK DETECTING LIQUID FOR A PERIOD OF NOT LESS THAN 10 MINUTES. THE BODY OUTSIDE DIAMETER SHALL BE REMEASURED AND RECORDED PER FIGURE 1. (A)

FLOW CAPACITY TEST (UNIT 1)

5.2.1 THE UNIT SHALL BE INSTALLED AS SHOWN IN FIGURE [illegible] AND SUBJECTED TO A WATER FLOW TEST IN THE FREE FLOW DIRECTION. WATER FLOW SHALL BE ESTABLISHED AT APPROXIMATELY FIVE EQUAL INCREMENTS BETWEEN [illegible] GPM AND [illegible] GPM. AT EACH FLOW INCREMENT, THE PRESSURE DROP ACROSS THE UNIT (GROSS ΔP), THE WATER FLOW RATE AND WATER TEMPERATURE SHALL BE MEASURED AND RECORDED.

5.2.2 THE UNIT SHALL THEN BE REMOVED FROM THE TEST SETUP AND AN ANALOGOUS UNION SHALL BE UTILIZED TO CONNECT THE UPSTREAM AND DOWNSTREAM PIPE SECTIONS. THE ABOVE FLOW TEST SHALL BE REPEATED. THE RESULTING PRESSURE DROP IS CONSIDERED TO BE THE SYSTEM OR TARE PRESSURE DROP.

[illegible].3 THE GROSS PRESSURE DROP MINUS THE TARE PRESSURE DROP AT EQUAL FLOW RATES IS CONSIDERED TO BE THE NET PRESSURE DROP OF THE TEST SPECIMEN. (A)

[illegible].4 THE RESULTS SHALL BE PLOTTED ON APPROPRIATE LOGARITHMIC GRAPH PAPER.

(A)

6.0 TEST PROCEDURE (CONTINUED)

6.3 ACCELERATED CORROSION TEST (UNIT 2)

6.3.1 THE SPECIMEN SHALL BE SUBJECTED TO A STRESS-CORROSION CRACKING TEST SIMILAR TO THAT DESCRIBED IN REFERENCE 2.3, PARAGRAPH 4.6.6.1.

6.3.2 THE TEST SPECIMEN, UNPRESSURIZED AND WITH BOTH PORTS SEALED, SHALL BE EXPOSED TO A SOLUTION OF 3-1/2% (BY WEIGHT) OF NaCL IN WATER, AT ROOM TEMPERATURE, BY ALTERNATE IMMERSION IN THE SOLUTION AND EXPOSURE TO AIR. THE EXPOSURE CYCLE SHALL CONSIST OF A 10 MINUTE IMMERSION IN THE SOLUTION FOLLOWED BY A 0 MINUTE AIR DRYING PERIOD.

6.3.3 THE IMMERSION-DRYING CYCLE SHALL BE REPEATED FOR A PERIOD OF THIRTY DAYS, OR UNTIL EXTERNAL LEAKAGE OCCURS, WHICHEVER IS EARLIER.

6.3.4 AFTER 15 DAYS EXPOSURE TO ACCELERATED CORROSION TEST, AND EACH 24 HOUR PERIOD THEREAFTER, THE UNIT SHALL BE EXAMINED AND TESTED DURING THE DRYING PERIOD AS FOLLOWS:

REMOVE UNIT FROM CHAMBER. VISUALLY EXAMINE FOR SURFACE CHANGES AND CRACKS. APPLY AN INTERNAL HELIUM PRESSURE OF 1600 PSIG TO THE OUTLET PORT AND OBSERVE FOR EXTERNAL LEAKAGE WITH AN APPROVED LEAK DETECTING LIQUID FOR A PERIOD OF NOT LESS THAN 10 MINUTES.

IF LEAKAGE IS APPARENT, A DYE PENETRANT INSPECTION SHALL BE CONDUCTED. THE CUSTOMER SHALL BE INFORMED IMMEDIATELY OF THE RESULTS. DURING THE ACCELERATED CORROSION TESTS, PHOTOGRAPHS SHALL BE TAKEN AT SUITABLE INTERVALS TO DEPICT PROGRESSIVE CHANGES IN THE BODY EXTERNAL SURFACE.

TEST PROCEDURE (CONTINUED)

BURST PRESSURE TEST (UNITS AND)

UNIT 1

BONDED STRAIN GAUGES OF THE FOIL TYPE SHALL BE ATTACHED TO THE BODY OUTSIDE DIAMETER WITH A SPECIAL ADHESIVE AT THE LOCATIONS SHOWN IN FIGURE . THE FLAPPER SHALL BE LOCKED IN A PARTIALLY OPEN POSITION, AND THE OUTLET PORT CAPPED. THE UNIT SHALL BE COMPLETELY FILLED WITH HYDRAULIC OIL. (A)

IF THE INLET PORT CONNECTED TO A HYDRAULIC PRESSURE SOURCE, THE INTERNAL PRESSURE SHALL BE SLOWLY (APPROX. PSI/SEC) INCREASED FROM ZERO TO PSIG AND HELD AT PSIG FOR ONE MINUTE. THE INTERNAL PRESSURE SHALL THEN BE DECREASED TO ZERO PSIG AT THE SAME RATE (APPROX. PSI/SEC). WHILE AT ZERO PSIG, THE BODY OUTSIDE DIAMETER SHALL BE MEASURED AT LOCATIONS AND SHOWN IN FIGURE . (A)

THE INTERNAL PRESSURE SHALL BE INCREASED SLOWLY (APPROX. PSI/SEC) FROM ZERO PSIG UNTIL THE UNIT RUPTURES OR TO PSIG, WHICHEVER OCCURS FIRST. IF THE UNIT RUPTURES, THE STRAIN GAUGES SHALL BE REMOVED AND PHOTOGRAPHS SHALL BE TAKEN TO DEPICT THE RUPTURE. IF NO RUPTURE OCCURS, THE PRESSURE SHALL BE DECREASED SLOWLY (APPROX. PSI/SEC) FROM PSI TO ZERO PSIG. THE STRAIN GAUGES SHALL BE REMOVED AND THE BODY OUTSIDE DIAMETER MEASURED AT LOCATIONS , , AND SHOWN IN FIGURE .

THROUGHOUT THE TEST, WHEN THE UNIT IS PRESSURIZED, THE INTERNAL PRESSURE AND THE OUTPUT OF THE STRAIN GAUGES SHALL BE RECORDED CONTINUOUSLY ON A MINGRAPH OSCILLOGRAPH (CHART SPEED SEC). INTERNAL PRESSURE VERSUS STRAIN SHALL BE GRAPHICALLY PLOTTED.

UNIT 2

DUE TO THE EXPOSURE TO SALT SOLUTION THE SURFACE FINISH IS EXPECTED TO BE UNSUITABLE FOR ATTACHMENT OF STRAIN GAUGES. FOR THIS REASON THE BURST PRESSURE TEST OF PARAGRAPH SHALL BE REPEATED WITHOUT THE STRAIN MEASUREMENT WHICH WILL BE TAKEN.

THROUGHOUT THE TEST, WHEN THE UNIT IS PRESSURIZED, THE INTERNAL PRESSURE SHALL BE RECORDED CONTINUOUSLY ON A MINGRAPH OSCILLOGRAPH (CHART SPEED SEC).

6.0 TEST PROCEDURE (CONTINUED)

6.4 BURST PRESSURE TEST (UNITS 1 AND 2)

6.4.1 UNIT 1

BONDED STRAIN GAUGES OF THE POST YIELD TYPE SHALL BE ATTACHED TO THE BODY OUTSIDE DIAMETER WITH A SPECIAL ADHESIVE AT THE LOCATIONS SHOWN IN FIGURE 1. THE FLAPPER SHALL BE BLOCKED IN A PARTIALLY OPEN POSITION, AND THE OUTLET PORT CAPPED. THE UNIT SHALL BE COMPLETELY FILLED WITH HYDRAULIC OIL. WITH THE INLET PORT CONNECTED TO A HYDRAULIC PRESSURE SOURCE, THE INTERNAL PRESSURE SHALL BE SLOWLY (APPROX. 50 PSI/SEC) INCREASED FROM ZERO TO 2400 PSIG AND HELD AT 2400 PSIG FOR ONE MINUTE. THE INTERNAL PRESSURE SHALL THEN BE DECREASED TO ZERO PSIG AT THE SAME RATE (APPROX. 50 PSI/SEC). WHILE AT ZERO PSIG, THE BODY OUTSIDE DIAMETER SHALL BE MEASURED AT LOCATIONS B AND C SHOWN IN FIGURE 1. THE INTERNAL PRESSURE SHALL BE INCREASED SLOWLY (APPROX. 50 PSI/SEC) FROM ZERO PSIG UNTIL THE UNIT RUPTURES OR TO 5000 PSIG, WHICHEVER OCCURS FIRST. IF THE UNIT RUPTURES, THE STRAIN GAUGES SHALL BE REMOVED AND PHOTOGRAPHS SHALL BE TAKEN TO DEPICT THE RUPTURE. IF NO RUPTURE OCCURS, THE PRESSURE SHALL BE DECREASED SLOWLY (APPROX 50 PSI/SEC) FROM 5000 PSIG TO ZERO PSIG. THE STRAIN GAUGES SHALL BE REMOVED AND THE BODY OUTSIDE DIAMETER MEASURED AT LOCATIONS A, B, C, AND D SHOWN IN FIGURE 1. (A)

THROUGHOUT THE TEST WHEN THE UNIT IS PRESSURIZED, THE INTERNAL PRESSURE AND THE OUTPUT OF THE STRAIN GAUGES SHALL BE RECORDED CONTINUOUSLY ON A SANBORN OSCILLOGRAPH (CHART SPEED 2.5 MM/SEC). INTERNAL PRESSURE VERSUS STRAIN SHALL BE GRAPHICALLY PLOTTED.

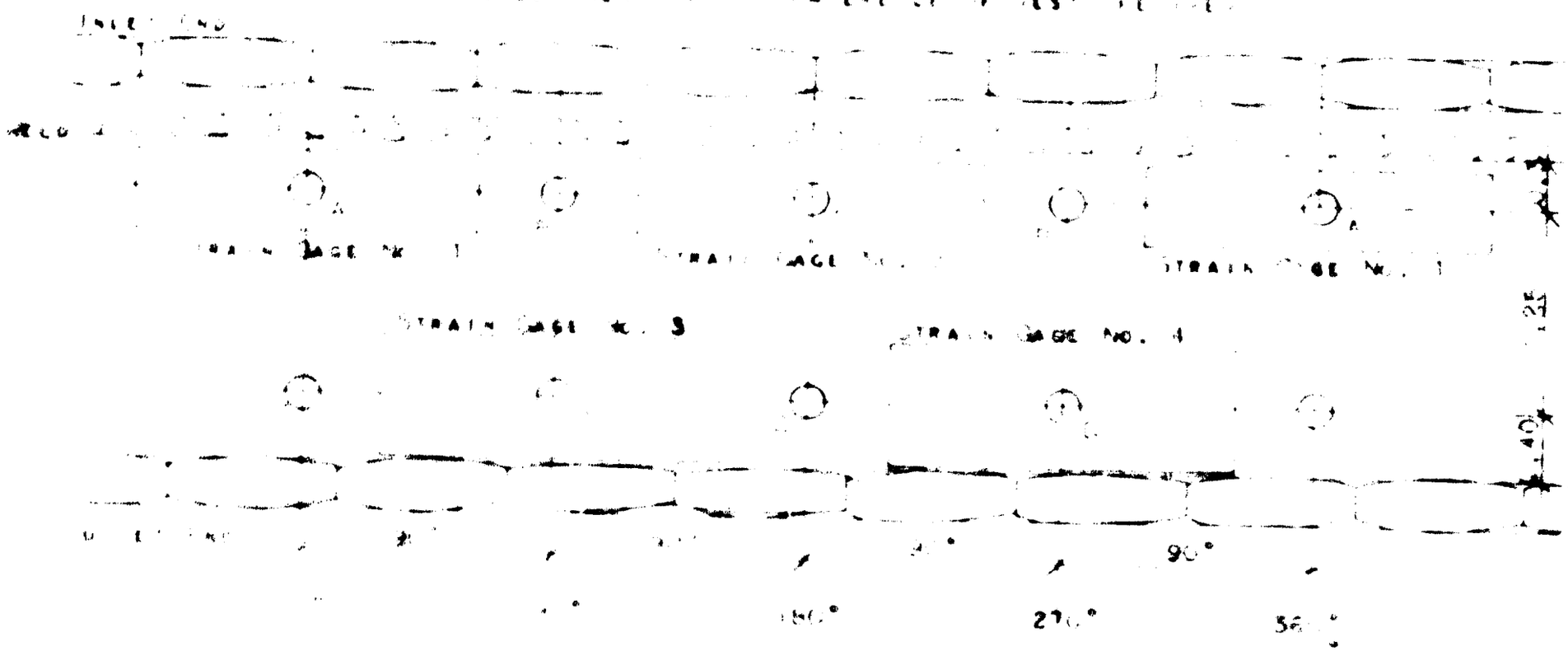
6.4.2 UNIT 2

DUE TO THE EXPOSURE TO SALT SOLUTION THE SURFACE FINISH IS EXPECTED TO BE UNSUITABLE FOR ATTACHMENT OF STRAIN GAUGES. FOR THIS REASON THE BURST PRESSURE TEST OF PARAGRAPH 6.4.1 SHALL BE REPEATED EXCEPT THAT NO STRAIN MEASUREMENT WILL BE TAKEN.

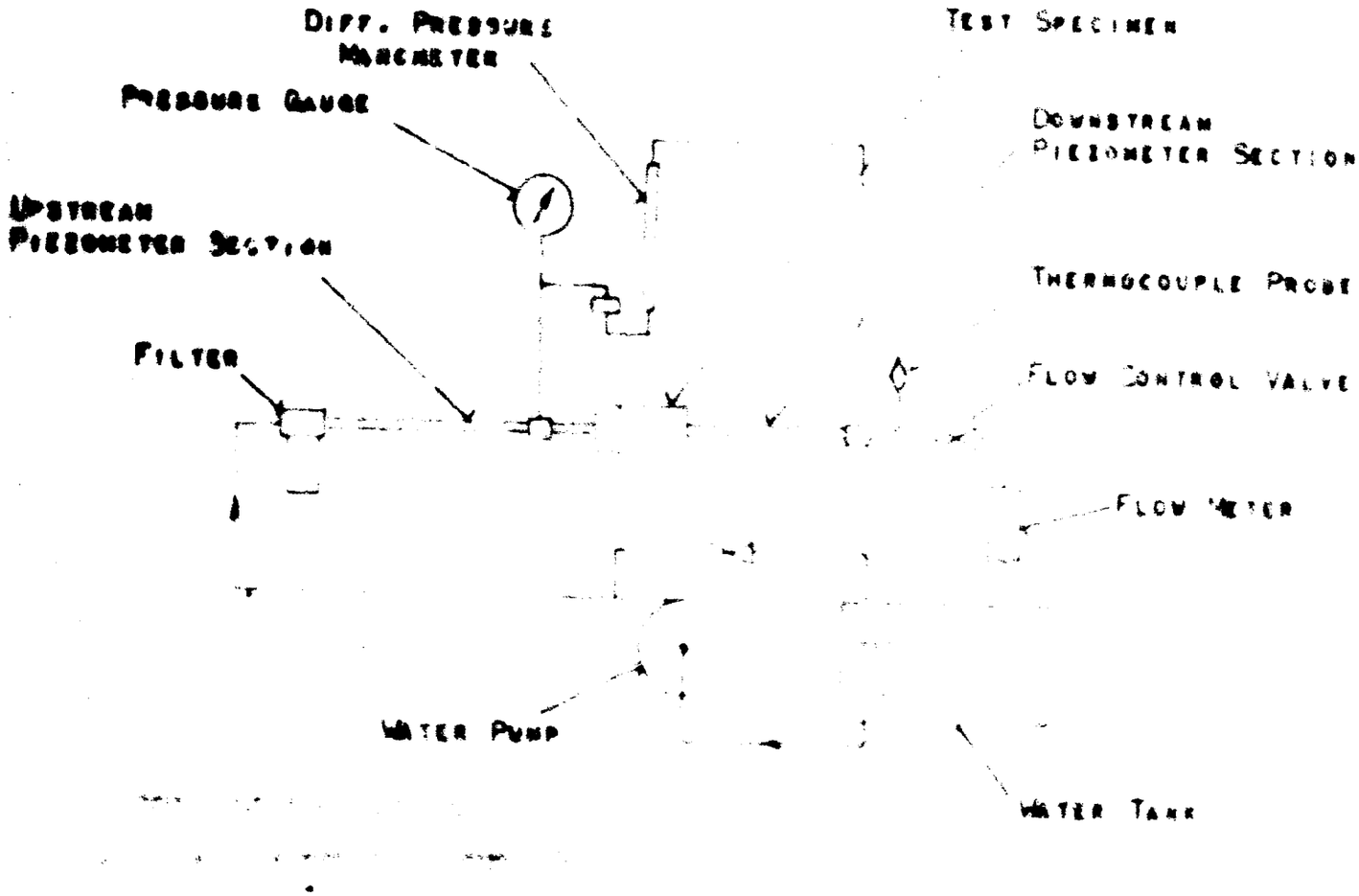
THROUGHOUT THE TEST WHERE THE UNIT IS PRESSURIZED, THE INTERNAL PRESSURE SHALL BE RECORDED CONTINUOUSLY ON A SANBORN OSCILLOGRAPH. (CHART SPEED 2.5 MM/SEC).

FIGURE

STRAIN GAGE LOCATIONS
AND
DIAMETER MEASUREMENT



STRAIN GAGES NO. 1 AND NO. 2 COMBINED IN ONE BRIDGE CIRCUIT.
STRAIN GAGES NO. 3 AND NO. 4 COMBINED IN ONE BRIDGE CIRCUIT.
A, B, AND C DESIGNATE LOCATIONS OF DIAMETER MEASUREMENT.

FIGURE 2

FLOW CAPACITY TEST SETUP