REPORT NO. TR 871

DATE 13 April 1984

TEST REPORT 871

A SIMULATED 40 YEAR SERVICE LIFE TEST

FOR A PSA-3 SHOCK ARRESTOR

WITH 2 TO 3% FRICTION

FROM

PACIFIC SCIENTIFIC

KIN-TECH DIVISION

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ADMINISTRTIVE DATA

PURPOSE OF TEST

To determine the long term effects of a 40 year life cycle test of a PSA-3, P/N 1801106-05 shock arrestor with high (2 - 3% of rated load) friction. A typical year of life for a unit consists of 1,000 cycles at 80% stroke and a 2 mm/sec average velocity. The unit was subjected to an acceptance test, measuring the acceleration at rated load, lost motion, and drag force. The above sequence of tests were repeated periodically during the test.

MANUFACTURER

PACIFIC SCIENTIFIC COMPANY, KIN-TECH DIVISION
1346 S. State College Boulevard
Anaheim, CA 92803

MANUFACTURER'S TYPE OR MODEL No.

P/N 1801106-05 MODEL PSA-3 - S/N 20956

APPLICABLE DOCUMENTS

PSCo Drawing 1801106-05

PSCo Acceptance Test Procedure I.T. 524, Rev. T

ADMINISTRATIVE DATA Continued

QUANTITY OF ITEMS TESTED

One (1) P/N 1801106-05 Shock Arrestor, S/N 20956 was used for the test program. The unit was selected at random from a production lot. The test unit was built in accordance with ASME Boiler and Pressure Vessel Code Section III, Subsection NF, 1974 Edition, S74 Addenda through 1980 Edition, S82 Addenda, Code Cases 1644-4 through 1644-8 and N249-1 and -2. The test unit was subjected to all of the required tests.

TEST COMPLETION DATE

March 29, 1984

TEST CONDUCTED BY

PACIFIC SCIENTIFIC COMPANY
Kin-Tech Division
Anaheim, CA 92803

SECURITY CLASSIFICATION OF ITEMS

Unclassified

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EQUIPMENT LIST

TEST	EQUIPMENT	ACCURACY	CALIBRATION DATE	CALIBRATION PERIOD
Dimensional Examination	Standard Micrometers Height Gages, etc.	(Data on file in Quality Control Dept)		
Dynamic Load	Mts. Load Cycling Machine Model 311,31, S/N 416 Lebow Load Cell Model 661.023A-02, S/N 999	±.05%	7/21/83	12 Months
Dynamic Load	C.L. Collins Corp. Linear Motion Transducer Model LMT 12911, S/N 19479	±1%	----	Daily
Velocity Transducer	Celesco Transducer Prods. DV-301-20A F P/N D301020-00, S/N A01797	±.25%	3/01/84	4 Months
X-Y Recorder	Hewlett Packard 7044B, S/N 2047A00133	±.2% of full scale	3/22/84	4 Months

CERTIFICATION

I, the undersigned, being a registered Professional Engineer in the State of California, competent in the testing and evaluation of Mechanical Shock Arrestors, certify that this report truly and accurately presents results of tests performed in accordance with the approved test procedures.

Certified by R. F. Whitney

Quality Engineer
State of California
Registration No. 1919
Date 4-12-84

1.0 ACCEPTANCE TESTS

1.1 Requirements

The test unit was examined and tested to the acceptance requirements of I.T. 524. The snubber must limit the acceleration to .02 g maximum. The drag force of the snubber shall not exceed 60 Lbs (1% of rated load) in both direction of travel. The unit's lost motion allowable shall be .040 in maximum.

1.2 Procedure

1.2.1 Acceleration test

A constant load of 6,000 Lbs was applied to the Shock Arrestor while measuring the unit's velocity. The unit's velocity is plotted against time. The constant slope portion of the recording, $\frac{\Delta V}{\Delta T}$, is the acceleration of the shock arrestor. The test was repeated for both tension and compression load.

1.2.2 Lost Motion Test

Since the unit's inertia mass cannot be fixed on the MTS machine, an alternate dynamic lost motion test was used. The unit is vibrated at low load at 3 Hz. The load is gradually increased to 6,000 Lbs value and an oscilloscope recording is made of the unit's displacement versus the load. The vertical straight portion of the recording is the lost motion.

ACCEPTANCE TESTS Continued

1.2.3 Drag Force Test

The unit's drag force was measured both in extension and retraction. A continuous load recording was made for about 80% of the unit travel approximately at 1/2 inch away from the fully extended and fully retracted positions. The velocity was controlled at 2 mm/sec.

1.3 Results

The unit's acceleration and lost motion were below the maximum allowable limits. The friction or drag force was at 150 Lbs (2.5% of rated load) at the start of the life test.

2.0 LIFE CYCLE TESTS

2.1 Requirements

2.1.1 The unit was stroke cycled for 5,000 cycles at 2 mm/sec to simulate thermal piping movement in a power plant.

LIFE CYCLE TESTS Continued

2.2 Procedure

2.2.1 Stroke Cycling Tests

The unit was placed in a hydraulic extension/retraction cycling machine. The stroke limits were adjusted for an 80% stroke. The average stroking speed was adjusted to 2.0 mm/sec. An event counter was used to count the number of strokes. The cycling was continued for a total of 40,000 cycles. At approximately every 5,000 cycles the test was interrupted to conduct functional tests.

2.3 Results

The lost motion and acceleration changed very little during the life test.

The acceleration was measured at the start of the life test and again at 30,000 cycles and at the end of the 40,000 cycles test.

The friction was 150 Lbs at the start of the life test and became less as the test progressed. After 40,000 cycles the friction was 83 Lbs. (Refer to Figures 1, 2 and 3.)

FIGURE 1

ACCELERATION VS YEARS OF LIFE CYCLING

PSA-3, P/N 1801106-05, S/N 20956

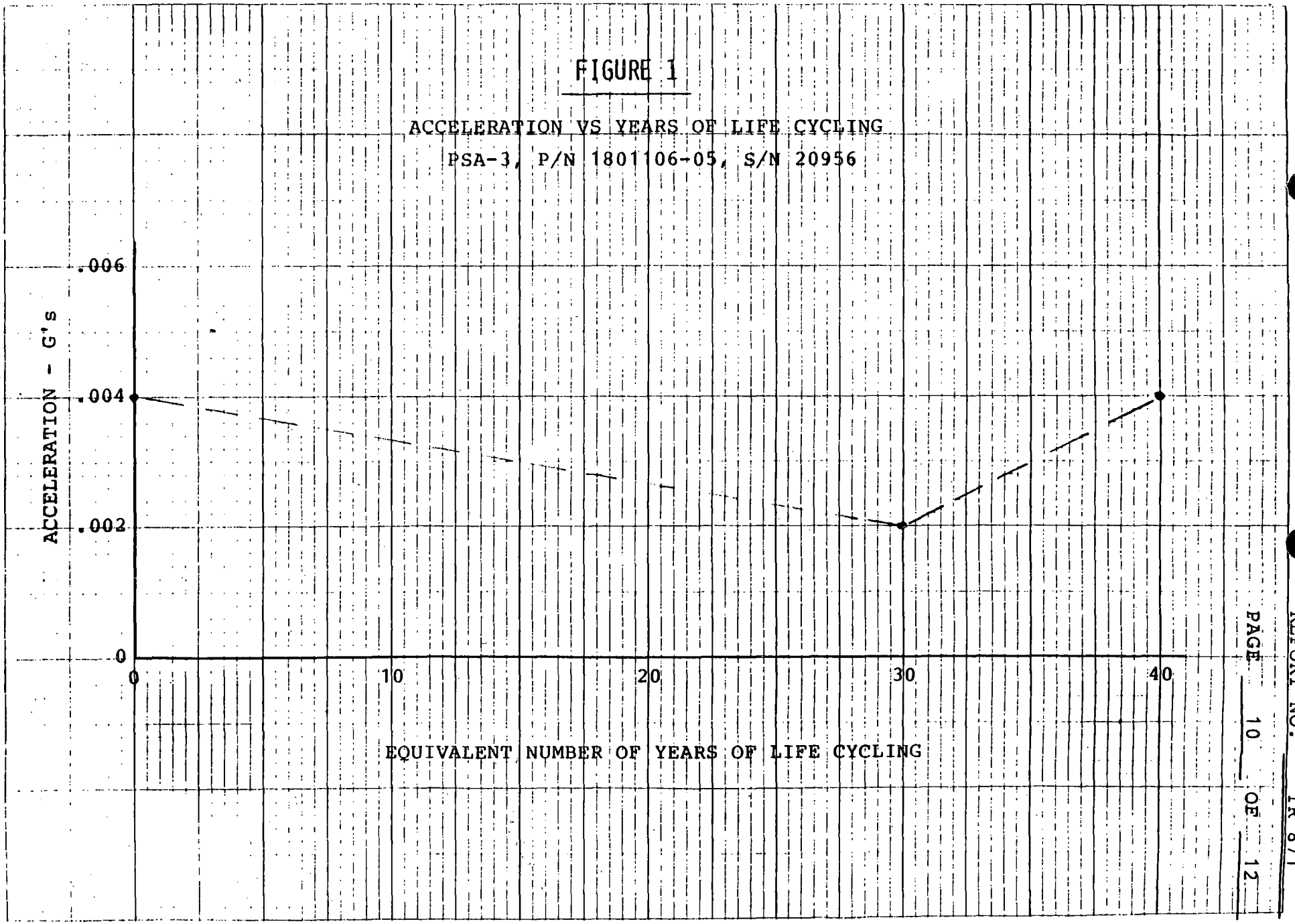
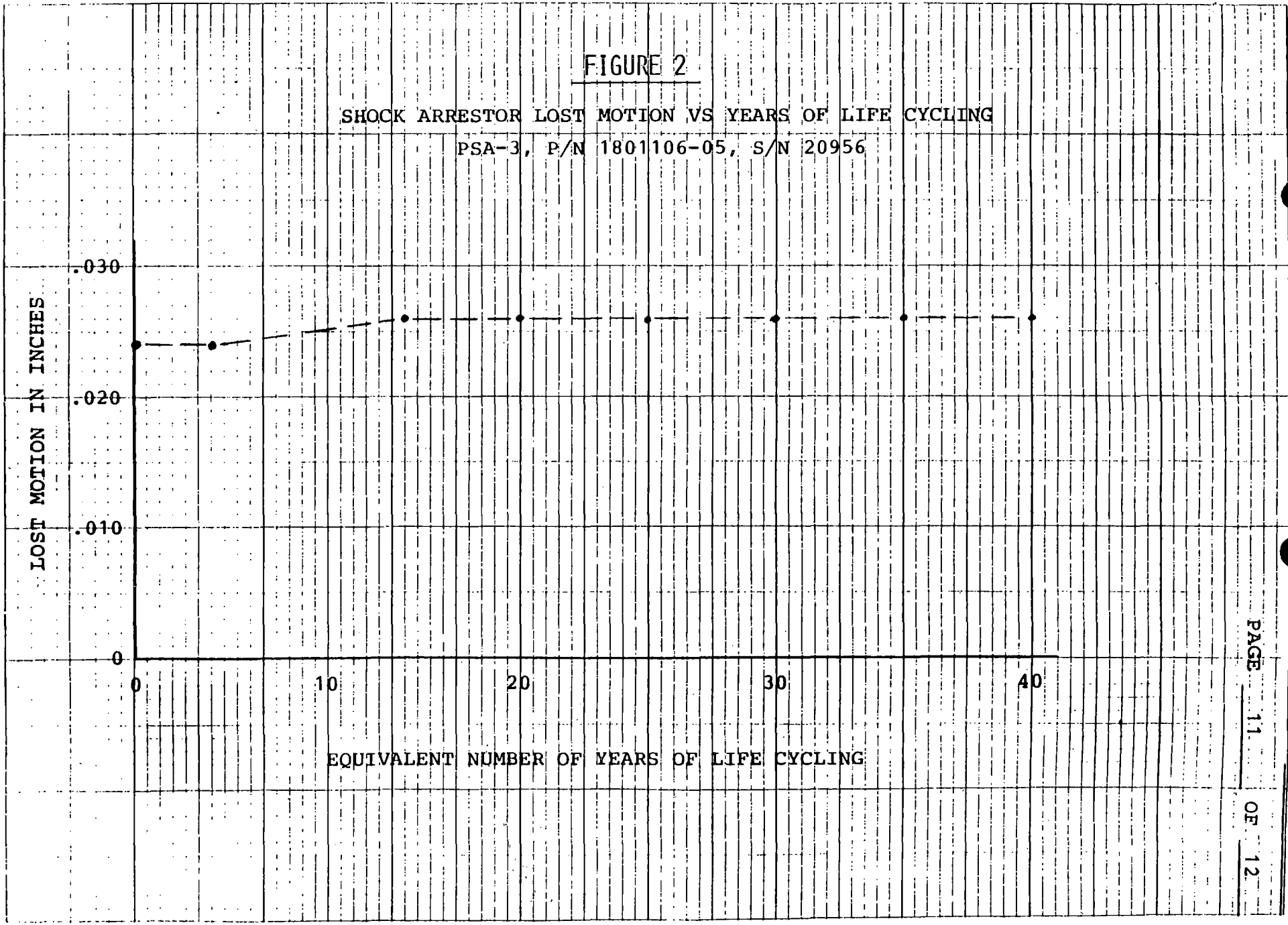
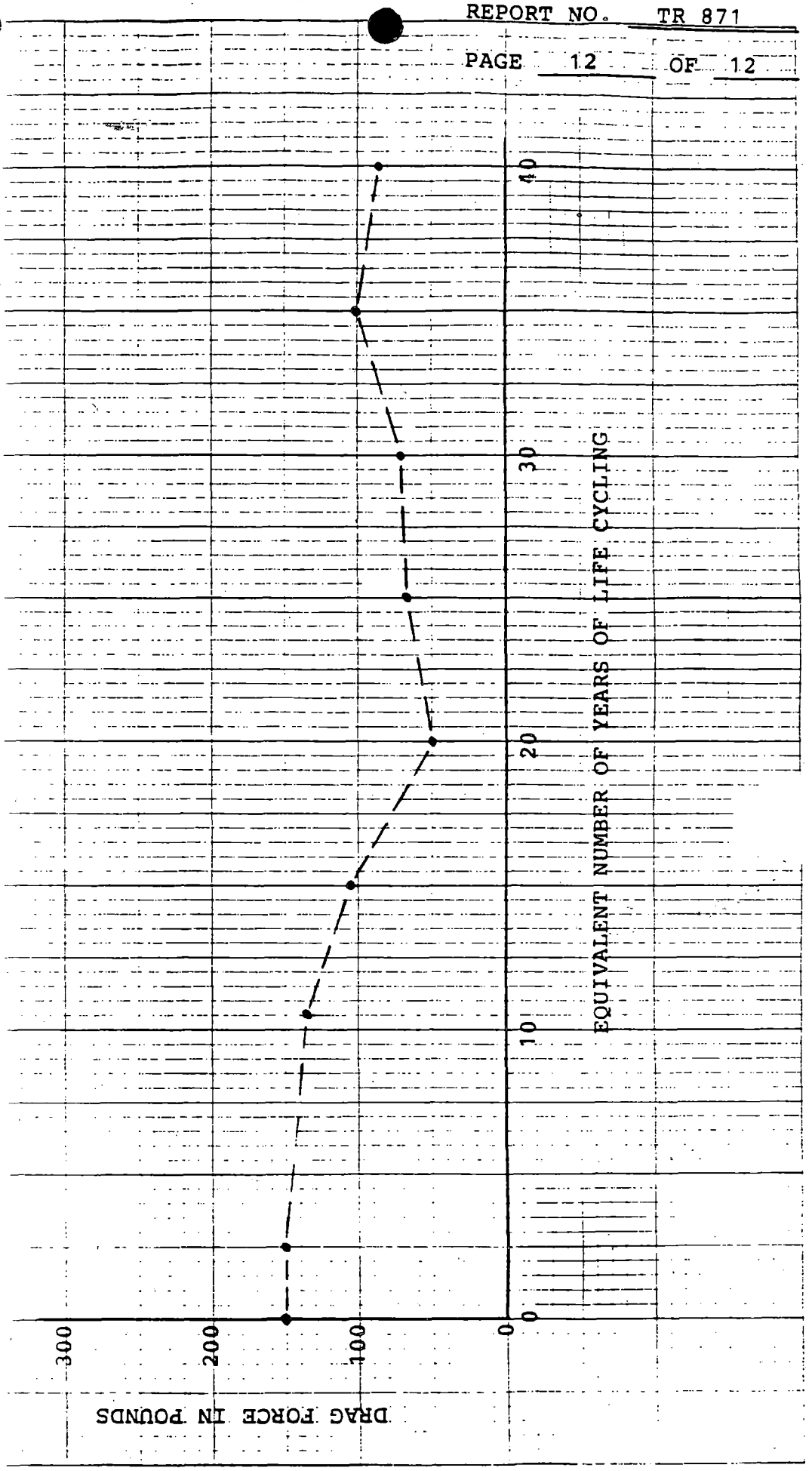


FIGURE 2

SHOCK ARRESTOR LOST MOTION VS YEARS OF LIFE CYCLING

PSA-3, P/N 1801106-05, S/N 20956




EQUIVALENT NUMBER OF YEARS OF LIFE CYCLING
0
10
20
30
40
DRAG FORCE IN POUNDS
300
200
100
0