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SUBJECT: Forwards reactor containment bldg tendon surveillance rept, per Tech Spec 6.6.3.f.Rept submitted to fulfill requirements of Tech Spec 4.4.2 re tendon inservice insps.

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DUKE POWER

February 8, 1993

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Site
Docket No. 50-269
Reactor Containment Building
Tendon Surveillance Report

Gentlemen:

Pursuant to Oconee Nuclear Station Technical Specification 6.6.3.f, please find attached the Oconee Unit 1 Reactor Building Tendon Surveillance Report. This report is submitted to fulfill the requirements of Technical Specification 4.4.2 regarding tendon inservice inspections.

Very truly yours,

J. W. Hampton

J. W. Hampton

cc: Mr. S. D. Ebneter, Regional Administrator
U. S. Nuclear Regulatory Commission, Region II

Mr. L. A. Wiens, Project Manager
Office of Nuclear Reactor Regulation

Mr. P. E. Harmon
Senior Resident Inspector
Oconee Nuclear Site

A001
1/1

OCONEE NUCLEAR STATION
UNIT 1 CONTAINMENT BUILDING
TENDON SURVEILLANCE # 6

SUMMARY

The sixth Containment Building tendon surveillance was begun on Oconee Unit 1 during the EOC-13 RFO in July 1991. Testing was suspended when the hydraulic jack pulled out of the third hoop tendon tested. After the cause of the failure had been determined and the necessary corrective actions taken, the tendon surveillance was completed during the Unit 1, EOC-14 RFO completed in January, 1993.

The failure of the threads on test tendon 51H9 prevented the attachment of the hydraulic jack to the center of the stressing washer as required for testing. The failure of the threads in no way affected the ability of the stressing washer to perform its' function as an end anchorage point for the tendon. The tendon was, however, taken out of service in order that some destructive testing could be done on the stressing washer to determine the cause of the failure.

The lift-off values on all tendons tested (including 51H9) were within the expected range. The corrosion levels on all of the tendon components were acceptable.

The tensile tests performed on wires removed from tendons 1D28, 23V14, and 51H9 exceeded the ASTM A421 requirements of 240 ksi minimum strength and 4.0% elongation.

As requested by the NRC, three additional tendons that were not part of our normal test sample were also tested. One additional tendon was selected from each tendon group (dome - 1D11, verticle - 45V11, hoop - 26H62). The lift-offs on each of these respective tendons was above the projected value at the end of 40 years for a typical dome, hoop, and verticle tendon (Ref. section 3.8.1.5.1 of Oconee Nuclear Station's FSAR). Corrosion levels on all components of the three were acceptable .

DISCUSSION

While testing the third hoop tendon, the hydraulic jack used to test the tendons pulled out of the middle of the stressing washer. The threads inside the stressing washer failed in shear across the base of the threads. Extensive investigation has been done concerning this matter by Duke Power with input from the NRC and the tendon manufacturer, Prescon. The details of this investigation and the subsequent corrective actions were documented in OEP IN 91-80. An INPO information notice was also submitted to the other utilities on Notepad. The details of that investigation will not be included in this report but are available upon request. As a result of this investigation, a detailed inspection on each anchor head was performed prior to attaching the hydraulic jack and the allowable load that can be applied to the tendon was reduced from 850 kips down to 725 kips. There was also some additional

testing and replacement of parts on the equipment used to do the tendon surveillance.

Lift-off forces remain within the acceptable range for all tendons tested. Lift-off readings are given on table 1. Average lift-off force per wire is given on table 2. Force-time graphs for each regular surveillance tendon and the average force per wire for each tendon are attached to this report. On tendons that did not lift off at the new 725 kip maximum liftoff force, a small upward arrow on the graph shows the liftoff value or force per wire to be somewhere above the value indicated on the graph.

All tendons tested and their components were found to be in good condition. Grease coverage on components was satisfactory. No moisture was detected. No change in grease coloring or condition was noted. No significant change in corrosion level of anchorage components or wires was found. Anchorage and wire conditions are listed on table 3.

Tensile testing performed on wire samples removed from the designated tendons shows all wires exceeded the ASTM A421 minimum requirements of 240,000 psi and 4% elongation. Test results are attached.

CONCLUSIONS

Based on the results of this surveillance, the Unit 1 Containment Building post-tensioning system is in satisfactory condition and is capable of continuing to perform its' intended function.

TABLE 1

1991/1993 LIFT-OFF VALUES

TENDON	LIFT-OFF PRESSURE (PSI) SHOP END	LIFT-OFF FORCE (KIPS) SHOP END	LIFT-OFF PRESSURE (PSI) FIELD END	LIFT-OFF FORCE (KIPS) FIELD END	AVERAGE LIFT-OFF FORCE (KIPS)
1D28	5800	697.1	5600	666.0	681.5
* 2D28	6050	725.0	6050	725.0	725.0
* 3D28	6050	725.0	6050	725.0	725.0
23V14	5800	690.1	5850	703.3	696.7
*45V16	6050	725.0	6050	725.0	725.0
*61V16	6050	725.0	6050	725.0	725.0
31H9	6000/5800	721.7/697.1	6000/5800	716.1/691.5	715.5/694.3
53H10	6100/6250	729.5/747.7	5750/5750	691.0/691.0	710.2/719.4
# 51H9	5800	691.5	5900	709.4	700.4
1D11	5200	617.8	4800	574.0	596.0
45V11	5550	660.0	5050	604.8	632.4
26H62	5200	617.8	5250	629.4	623.6

* These tendons had not lifted off when they reached the maximum allowable force of 725 kips.

\# After these lift-off values had been gotten, the stressing washer on this tendon failed when it was being lifted off to remove the shims.

NOTES: 1. The tendon rams were calibrated using two different gauges. The resultant values were within 0.2%. The more conservative of these two ram-gauge interpolation tables was used to determine these values.

TABLE 2

AVERAGE LIFT-OFF FORCE PER WIRE

TENDON	# EFFECTIVE WIRES	AVE. FORCE PER WIRE
1D28	90	7.58
2D28	92	> 7.88
3D28	91	> 7.97
23V14	90	7.66/7.74
45V16	92	> 7.88
61V16	91	> 7,97
31H9	91	7.90/7.63
53H10	90	7.89/8.00
51H9	91	7.69

> Tendon did not lift off at 725 kips. The force per wire is greater than (>) the value listed.

TABLE 3

TENDON COMPONENT CONDITION

TENDON	WIRES	BUTTONHEADS	WASHERS	SHIMS	BEARING PLATE
1D28	A	A	A	B	B
2D28	N/A	A	A	B	B
3D28	N/A	A	A	B	B
23V14	A	A	A	B	B
45V16	N/A	A	A	B	C
61V16	N/A	A	A	B	B
31H9	A	A	A	B	C
53H10	A	A	A	A	C
51H9	N/A	A	A	B	B
1D11	N/A	A	A	A	A
45V11	N/A	A	A	B	B
26H62	A	A	A	B	B

CORROSION LEVELS

A Bright metal, No visible oxidation

B Reddish brown color, No pitting

C 0" < Pitting $\leq$ .003"

D .003" < Pitting $\leq$ .006"

E .006" < Pitting $\leq$ .010"

NOTES: 1. Wire inspections can only be performed on tendons that are detensioned and the shims removed.

APPLIED SCIENCE CENTER

Metallurgical Analysis Report

Sample No.: 1424 **Station:** Oconee **Unit:** 1
Requestor/Dept.: Fred W. Linsley - ONS Component Eng.
Principal Investigator: Sue Anderson
Submitted To: Fred Linsley **Date:** 1/27/93
cc: Donna R. Keck - Nuclear Services

Equipment Description:
Reactor Building Surveillance tendons 1D28, 23V14

Background Information:
Periodic tensile testing is performed on selected tendons to assure their conformance to ASTM A421 requirements.

Three sections of each 1/4"-diameter tendon were supplied as described in the table below. Each original sample was sectioned in half for testing purposes.

ASTM A421 requires a minimum strength of 240 ksi and 4.0% elongation. A 10.0" gage length was used for calculation of elongation.

ID/Location	Diameter (in)	Percent Elongation	Maximum Load (lb)	Tensile Strength (ksi)
1D28 - Shop end	0.249	**	12,000	246.4
- Shop end	0.248	4.9	12,000	248.4
- Middle	0.249	5.2	11,920	244.8
- Middle	0.248	4.7	12,000	248.4
- Field end	0.248	5.0	12,000	248.4
- Field end	0.249	5.4	12,000	246.4
23V14 - Shop end	0.249	5.0	12,480	256.3
- Shop end	0.249	5.2	12,480	256.3
- Middle	0.249	4.8	12,560	257.9
- Middle	0.249	4.6	12,560	257.9
- Field end	0.249	5.6	12,560	257.9
- Field end	0.249	4.5	12,560	257.9

NOTE: ** indicates specimen broke outside of gage marks

Applicable calibration sheets for the universal testing machine are attached.

Conclusions:
The tendon samples from 1D28 and 23V14 exceeded the strength and elongation requirements for ASTM A421 material.

If the Metallurgy Lab can be of further assistance, please call me at (704) 875-5326.

Approved by: S Anderson **Date:** 1/27/93

Reviewed by: C.R. Hope 1/27/93

PAGE 3, SAMPLE # 1424

TINIUS OLSEN

Machine	400000 Super "L" UTM	**Verification No.**	TMR. 61680
Serial No.	137038	**Service No.**	SO. S28941
Owner	Law Engineering Testing		
Location	Charlotte, NC 28208	**Date**	June 3, 1992

TESTING MACHINE
VERIFICATION CERTIFICATE

This is to certify that the above testing machine has been calibrated by Tinius Olsen Testing Machine Company, Inc. personnel. The verification devices comply with ASTM E74, are traceable to the National Institute of Standards and Technology, and have been verified within two (2) years or less of the above date. The loading ranges of the Testing Machine has been found to conform with the tolerance(s) indicated below.

CAPACITY RANGE POUNDS	LOADING RANGE POUNDS	ACCURACY TOLERANCE PERCENT
0 TO 80,000	8,000 TO 80,000	1.0
0 TO 160,000	16,000 TO 160,000	0.5
0 TO 400,000	40,000 TO 400,000	1.0

Method of verification and listed data are in accordance with ASTM Designation E4, MIL-STD-45662A, other applicable specification, or Tinius Olsen Testing Machine Co., Inc. procedure. For verification details refer to the Calibration Data and Report bearing the same number as this certificate. Report also contains verification dates of devices utilized.

Tinius Olsen Testing Machine Co., Inc.

By C. Robert Tait

C. Robert Tait III, Service Manager

DUKE POWER COMPANY

APPLIED SCIENCE CENTER

Metallurgical Analysis Report

Sample No.: 1181 **Station:** Oconee **Unit:** 1
Requestor/Dept.: Fred Linsley - NPD/ONS MES
Principal Investigator: Sue Anderson
Submitted To: Fred Linsley **Date:** 8/28/91
cc: Gerald T. Smith - NPD/GO

Equipment Description:
Tensile testing of Surveillance Tendon 51H9

Background Information:
Three 36" sections of the tendon were received; each was sectioned in half to provide two specimens for each sample. The results were compared to ASTM A421 requirements for tendon wire.

Results of Mechanical Testing:

Location	Diameter (in)	% Elongation (10" Gage)	Maximum Load (lb)	Ultimate Strength (psi)
Shop End	0.2494	4.9	12,880	263,700
Shop End	0.2494	4.6	12,720	260,400
Middle	0.2495	4.6	12,800	261,800
Middle	0.2495	5.0	12,720	260,200
Field End	0.2496	5.1	12,800	261,600
Field End	0.2496	4.3	12,800	261,600

Conclusions:
All sections of Tendon 51H9 exceeded the ASTM A421 requirements of 240 ksi minimum strength and 4.0% minimum elongation.

The calibration sheet for the tensile testing machine is attached.

If the Metallurgy Lab can be of further assistance, please call me at 875-5326.

Approved by: S Anderson **Date:** 8/28/91

Reviewed by: John B. Weigle 8/28/91

Tinius Olsen

Machine 400,000 LB. DELUXE SUPER "L"
Serial No. 137,038

Owner LAW ENGINEERING INDUSTRIAL SERVICES
Location CHARLOTTE, NC

Verification No.
TMR. 65277
SO. S-27318

Date 6/19/91

TESTING MACHINE VERIFICATION CERTIFICATE

This is to certify that the above testing machine has been calibrated by Tinius Olsen Testing Machine Co., Inc. personnel. The loading ranges have been found to be within the accuracy tolerance(s) indicated below:

Capacity Range POUNDS	Loading Range POUNDS	Accuracy Tolerance PERCENT
0 TO 8,000	800 TO 8,000	.66
0 TO 80,000	8,000 TO 80,000	.5
0 TO 160,000	16,000 TO 160,000	.3
0 TO 400,000	40,000 TO 400,000	.5

Method of verification and listed data are in accordance with ASTM Designation E 4, other applicable specification, or Tinius Olsen Testing Machine Co., Inc. procedure. For verification details, refer to the Testing Machine Calibration Data and Report bearing the same number as this certificate.

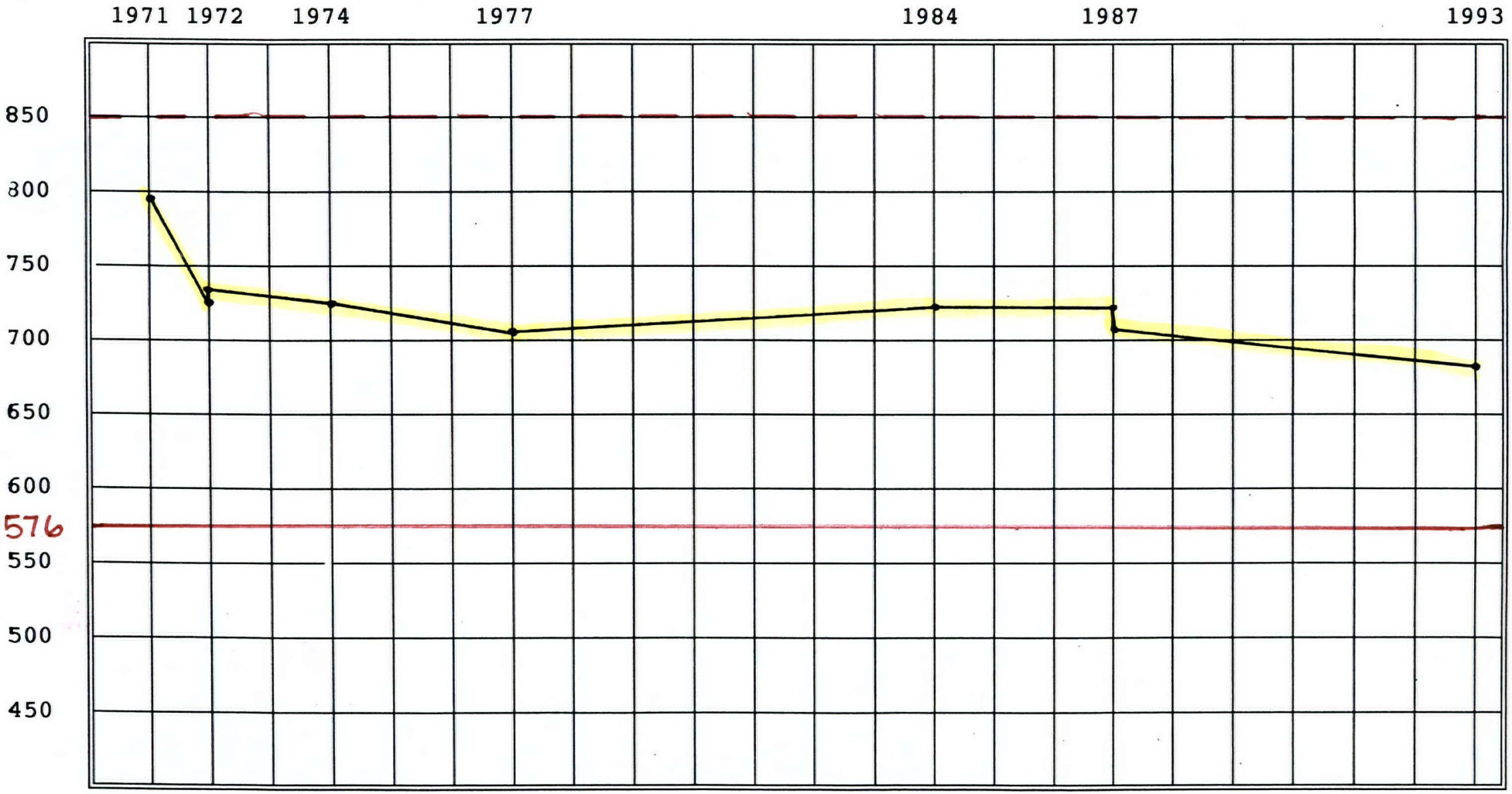
Tinius Olsen Testing Machine Co., Inc.

By W. DIEROLF
J. MACKIN
SERVICE

Tinius Olsen Testing Machine Co., Inc. / Box 429 / Willow Grove, PA 19090

LIFT-OFF FORCE PER TENDON
(KIPS)

ID 28

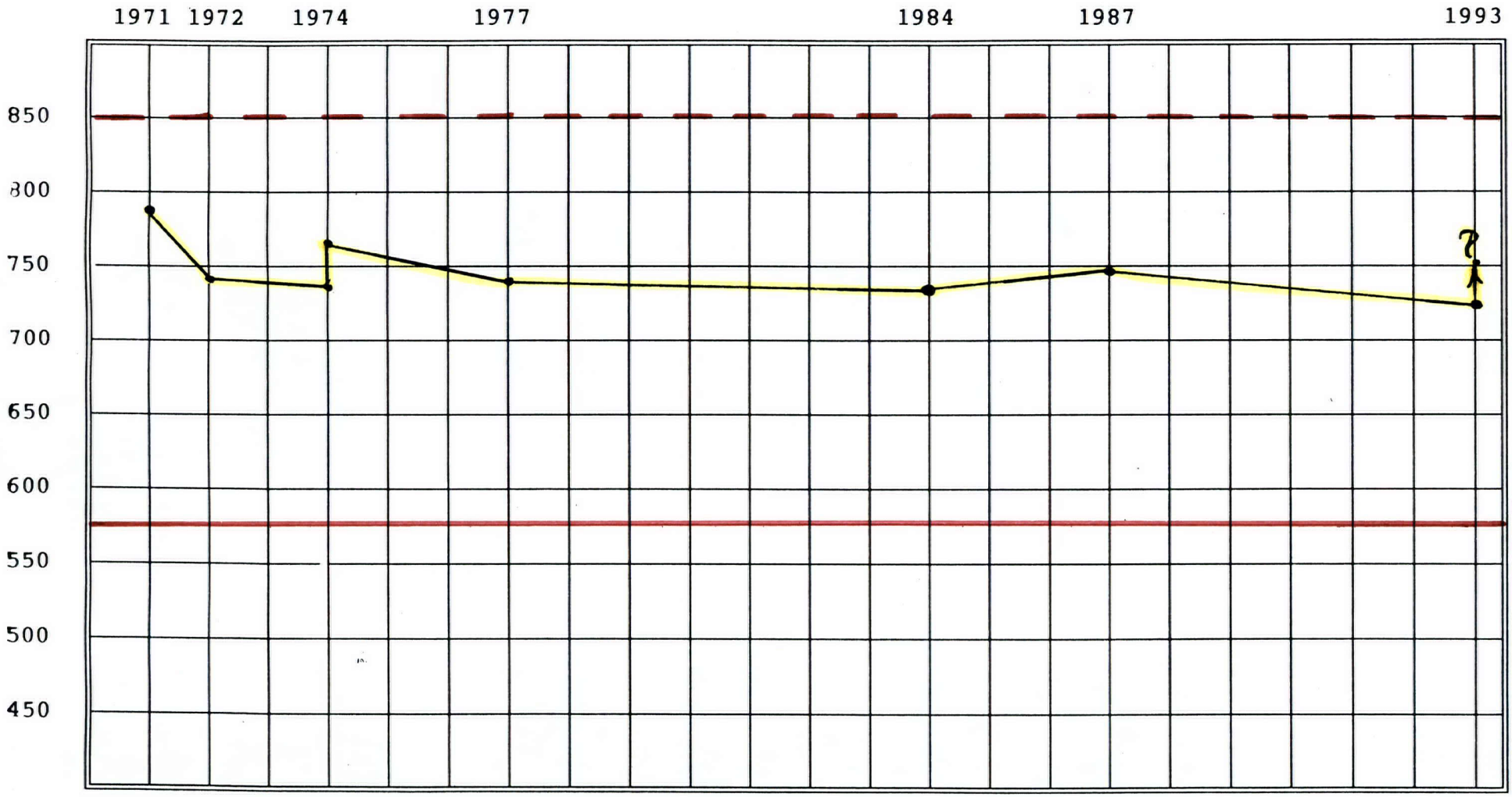


AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

1028

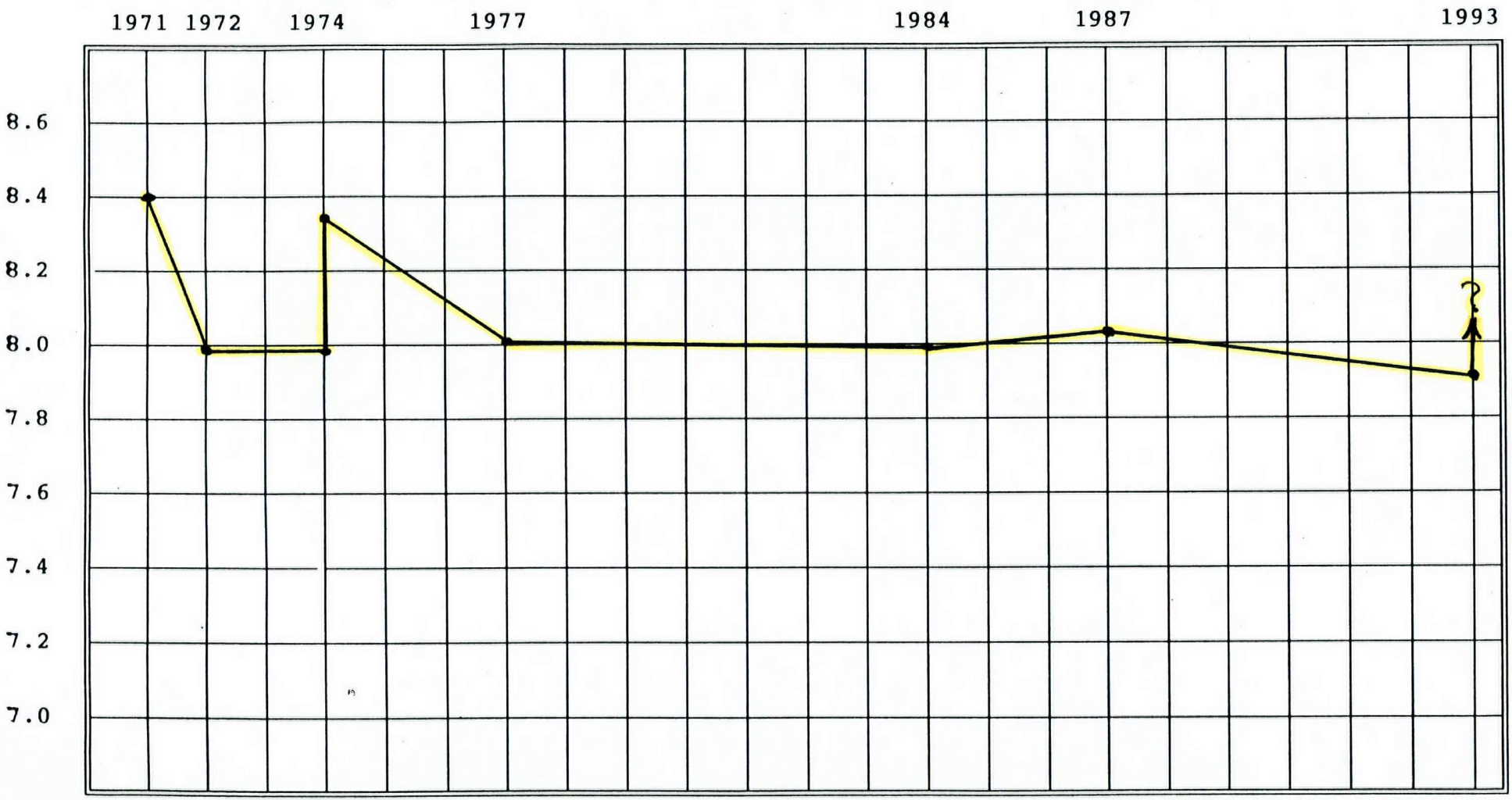
LIFT-OFF FORCE PER TENDON
(KIPS)

2D28



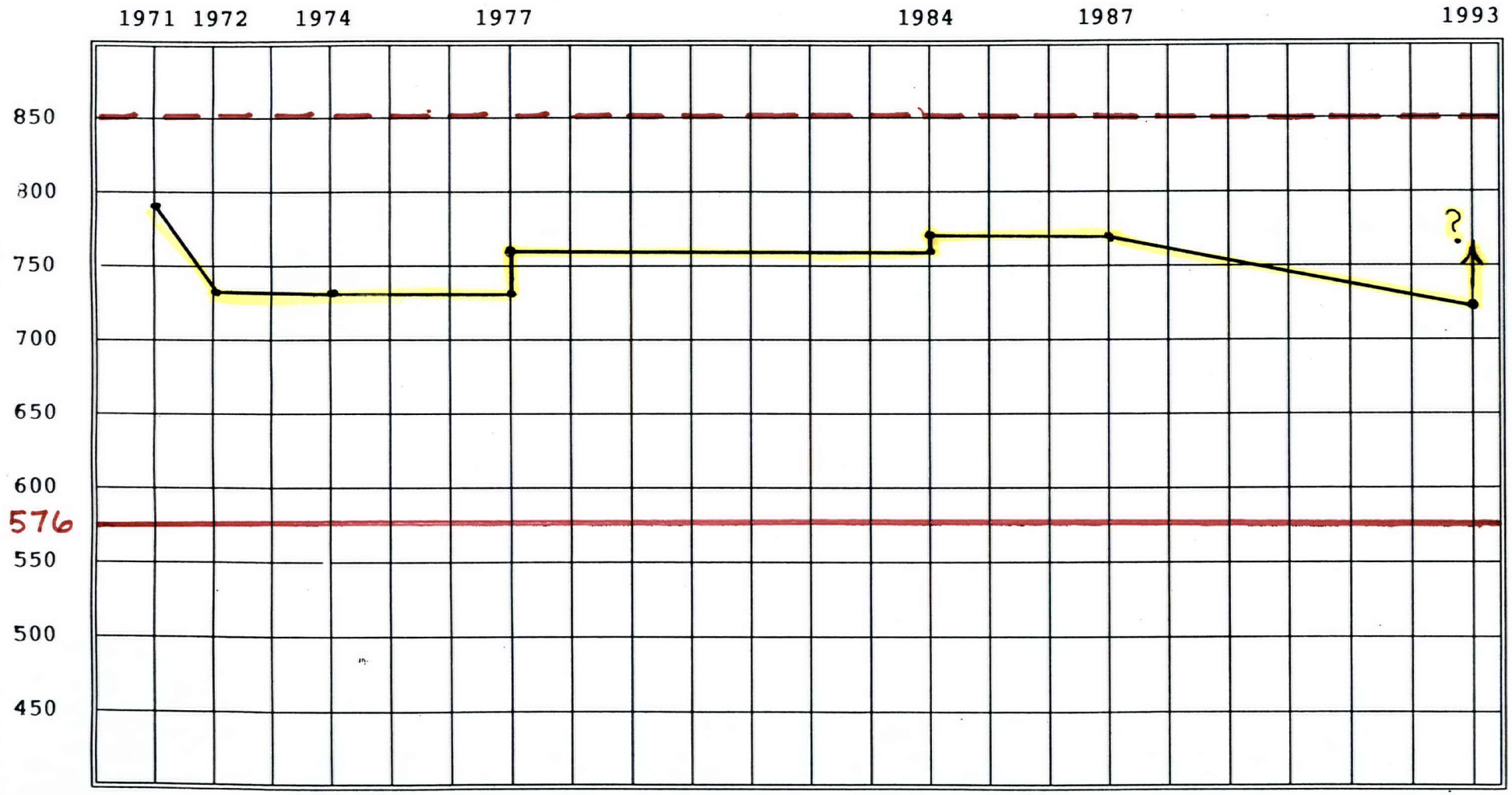
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

2028



LIFT-OFF FORCE PER TENDON
(KIPS)

3D28

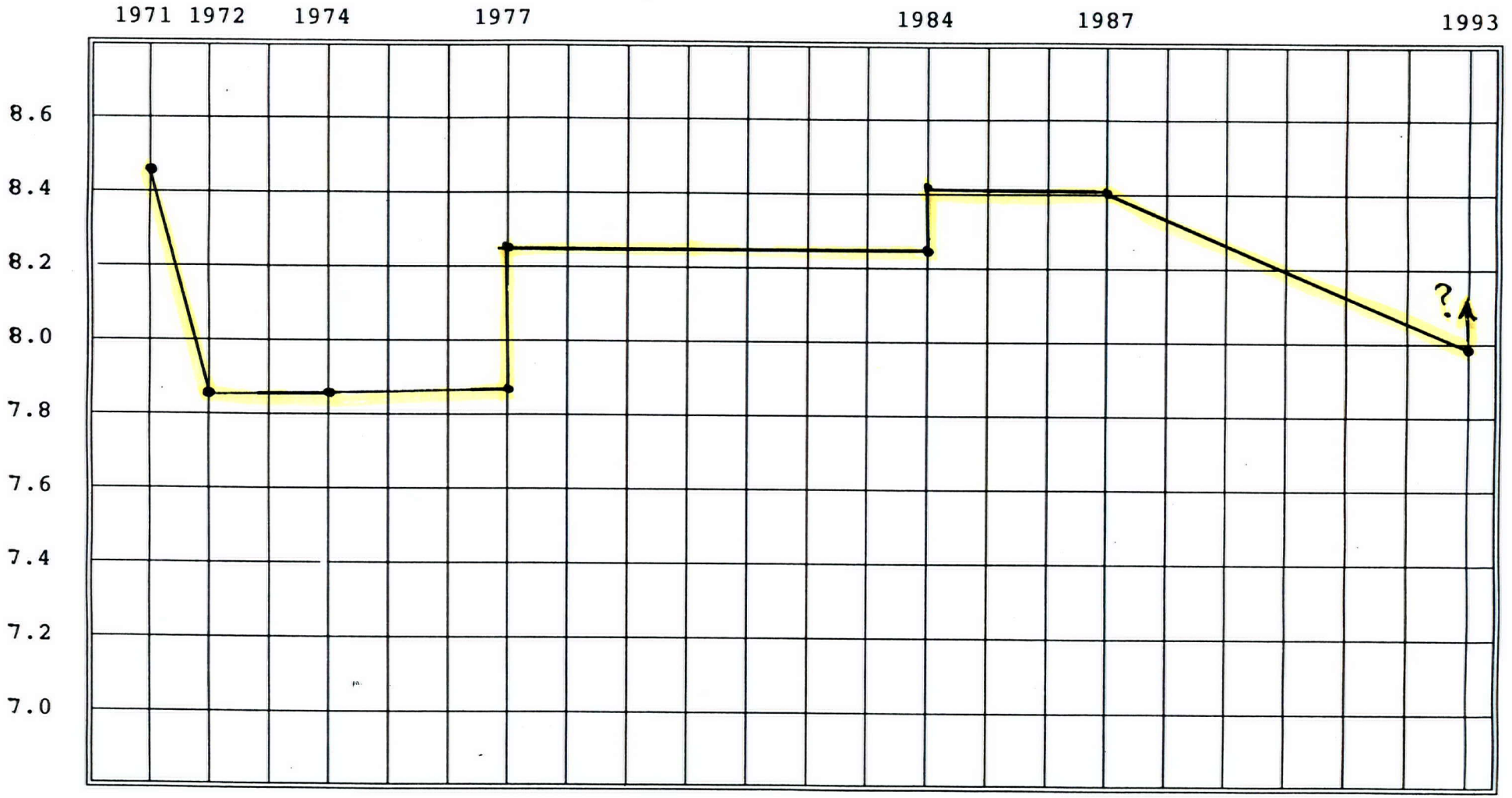


MAXIMUM ACCEPTABLE LIFT-OFF

PROJECTED LIFT-OFF AT THE END OF 40 YEARS

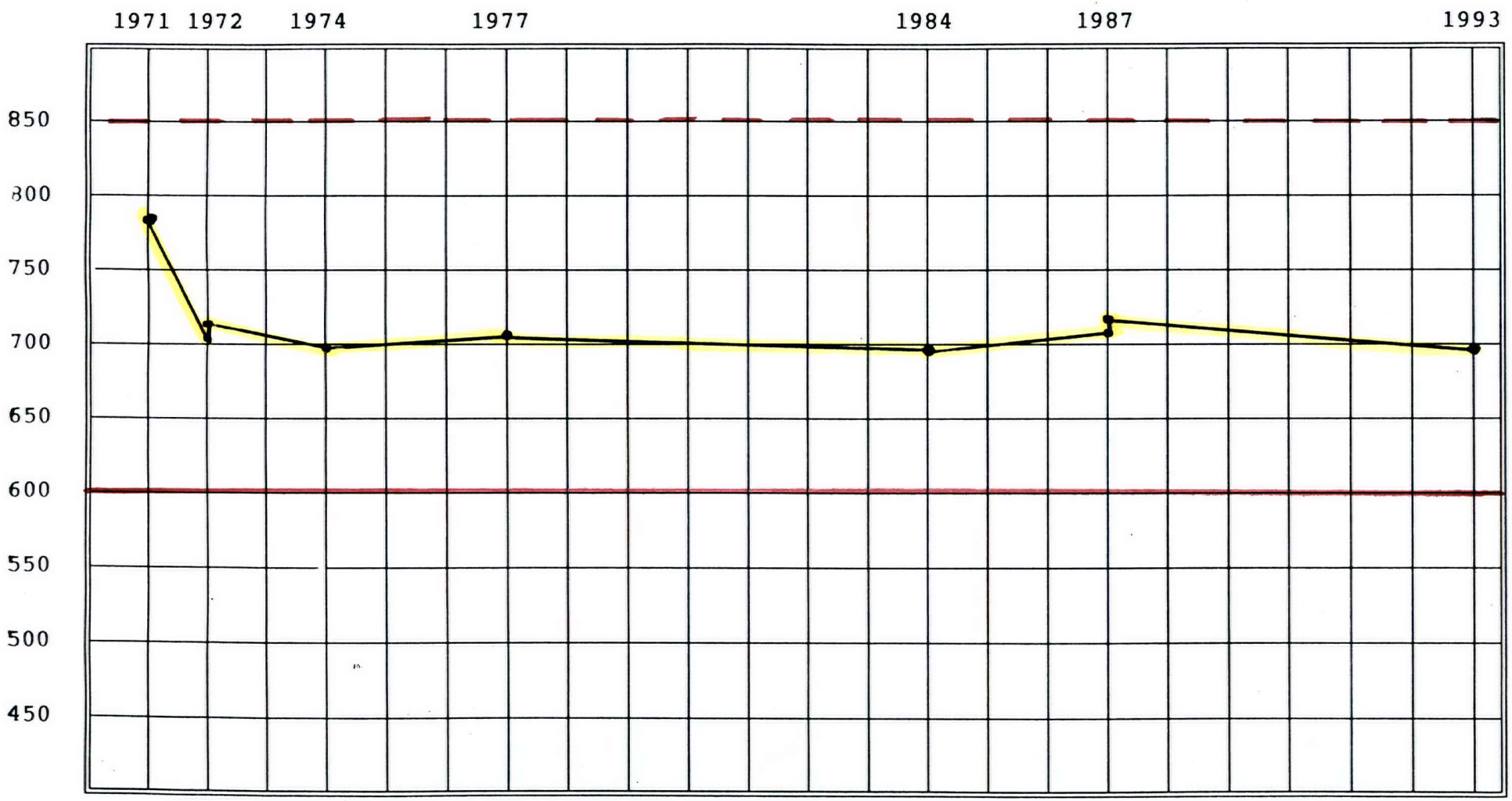
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

3D28



LIFT-OFF FORCE PER TENDON
(KIPS)

23V14

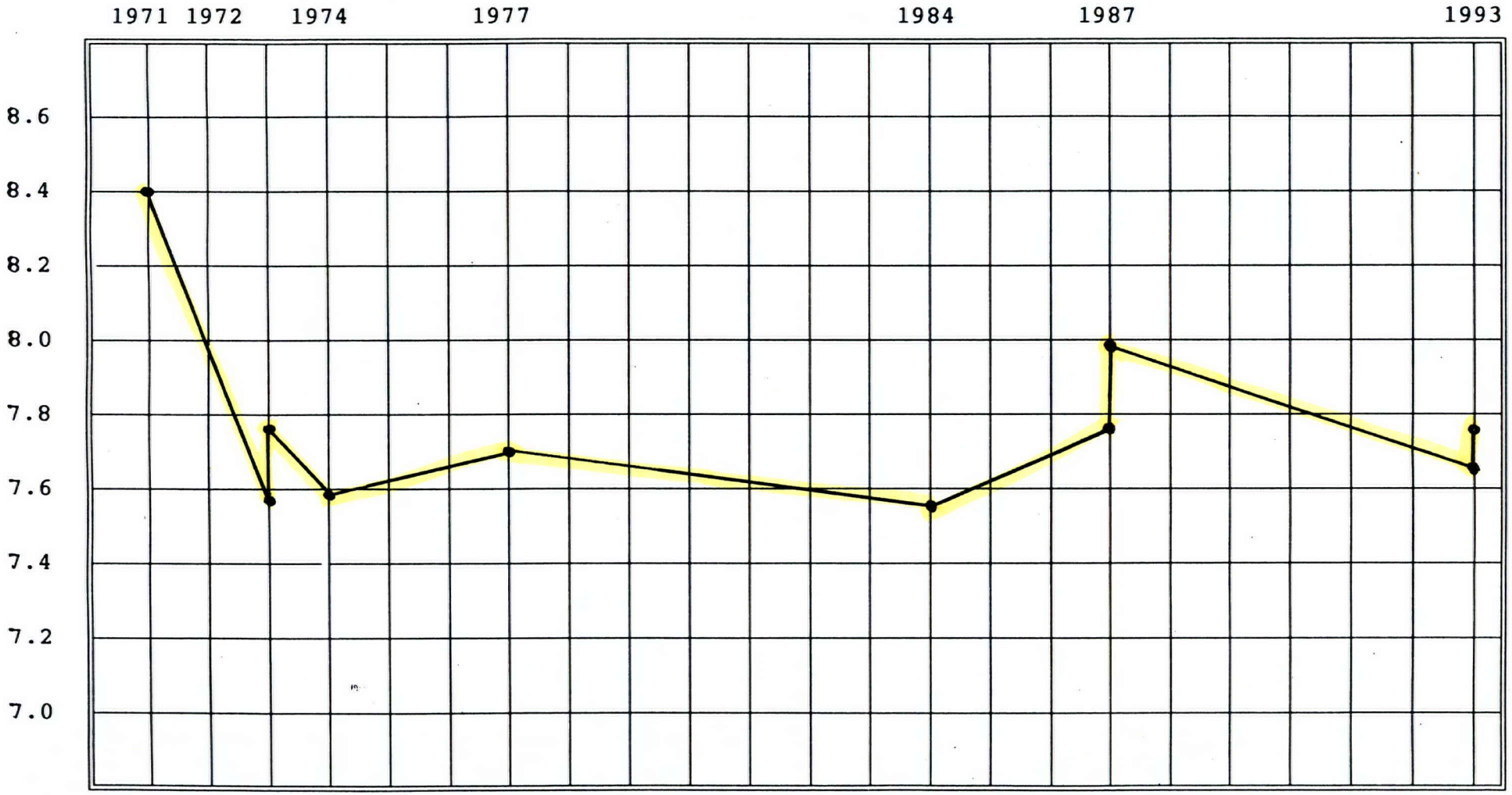


MAXIMUM ACCEPTABLE LIFT-OFF

PROJECTED LIFT-OFF AT THE END OF 40 YEARS

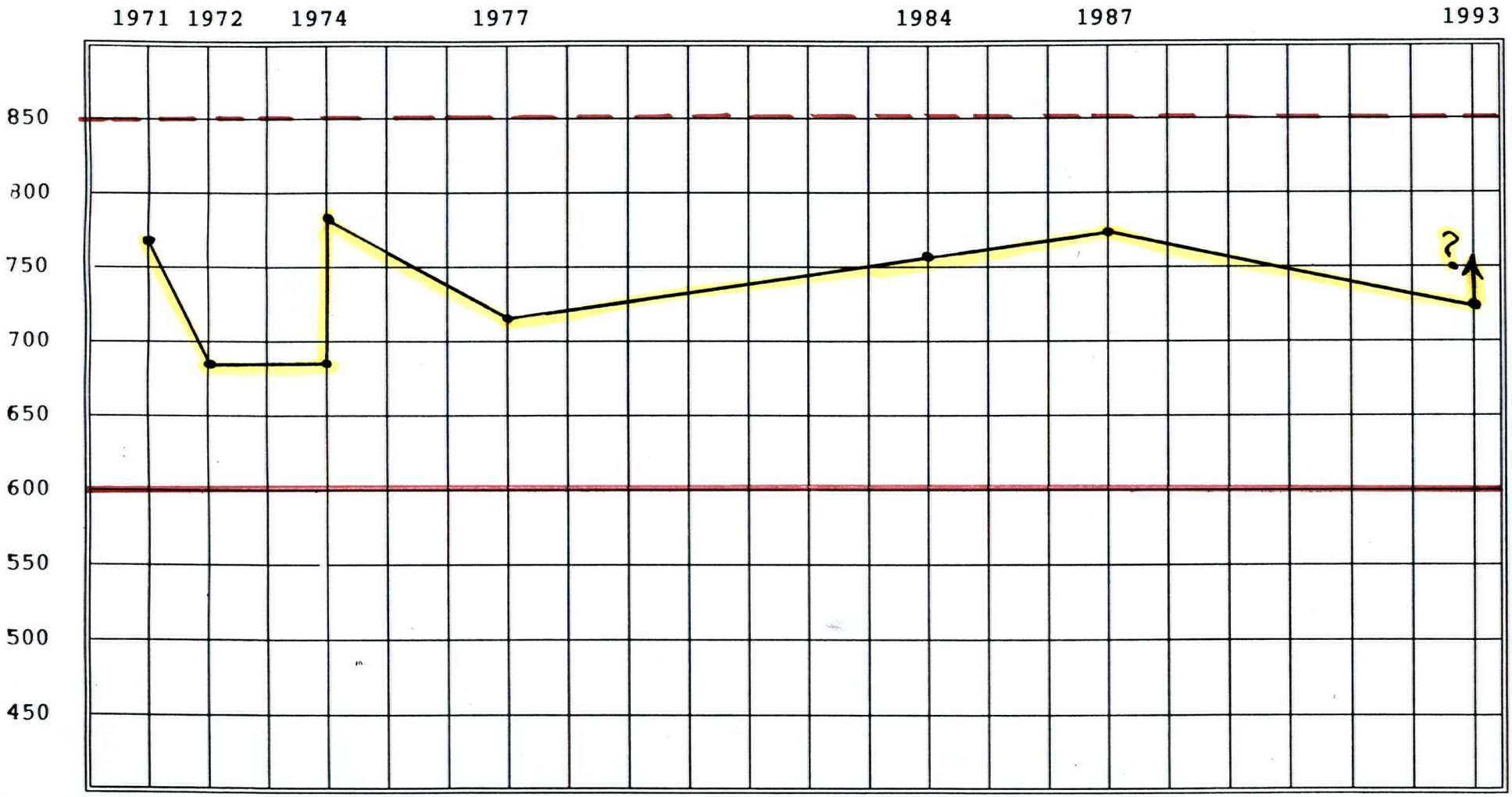
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

23V14



LIFT-OFF FORCE PER TENDON
(KIPS)

45V16



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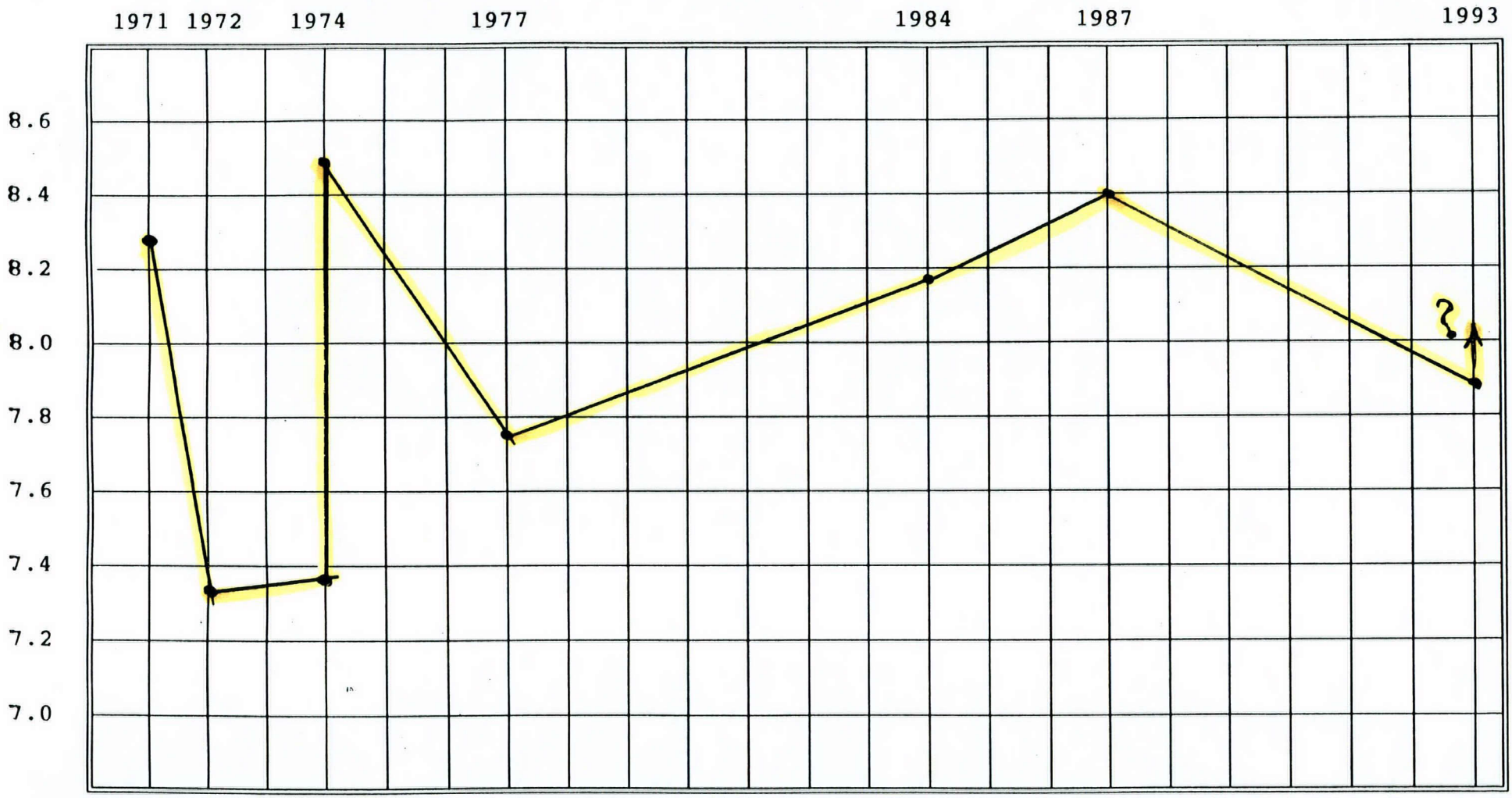
PROJECTED LIFT-OFF AT THE END OF 40 YEARS

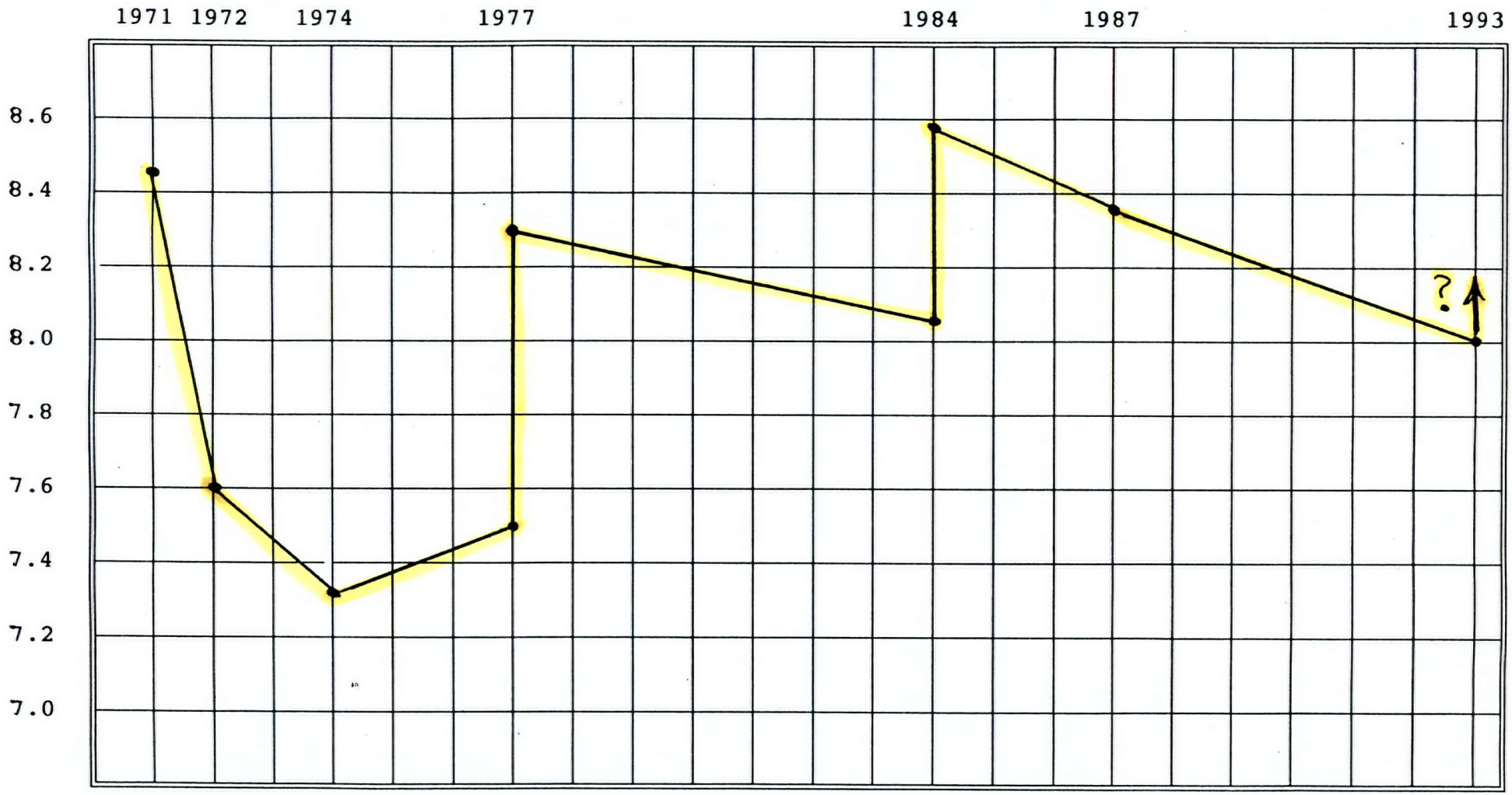
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

45V16



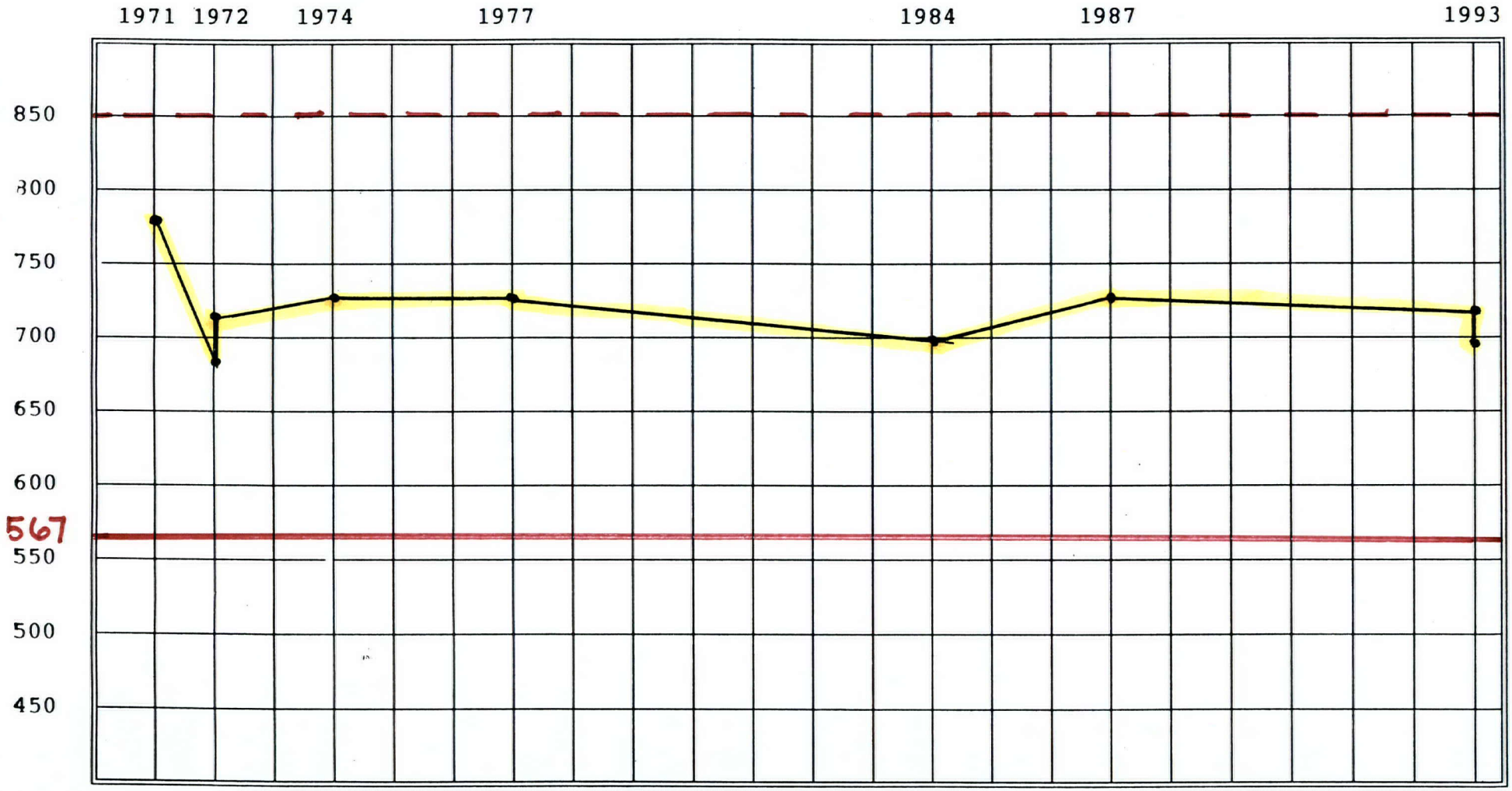
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

61V16



LIFT-OFF FORCE PER TENDON
(KIPS)

31H9



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(KIPS)

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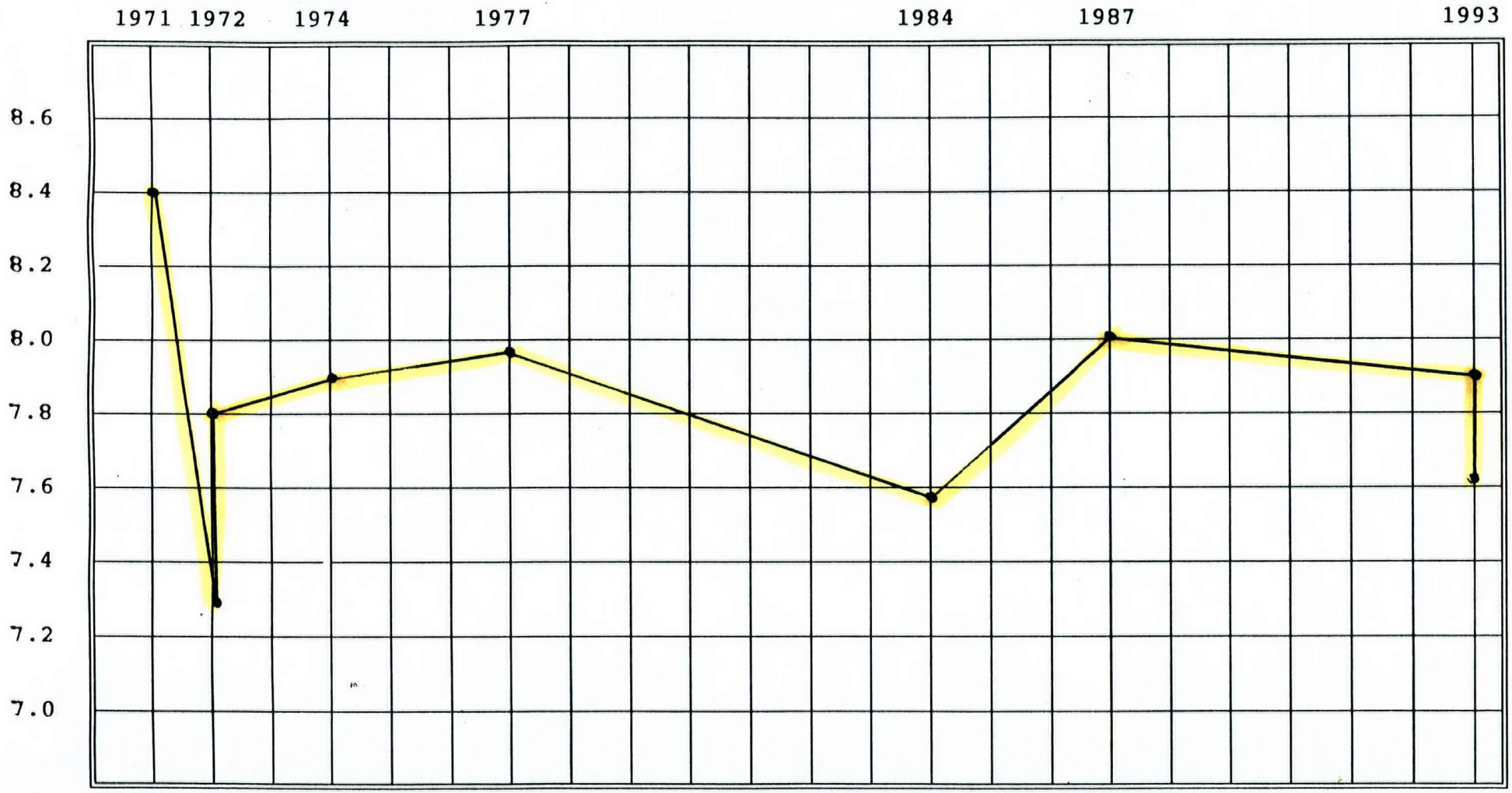
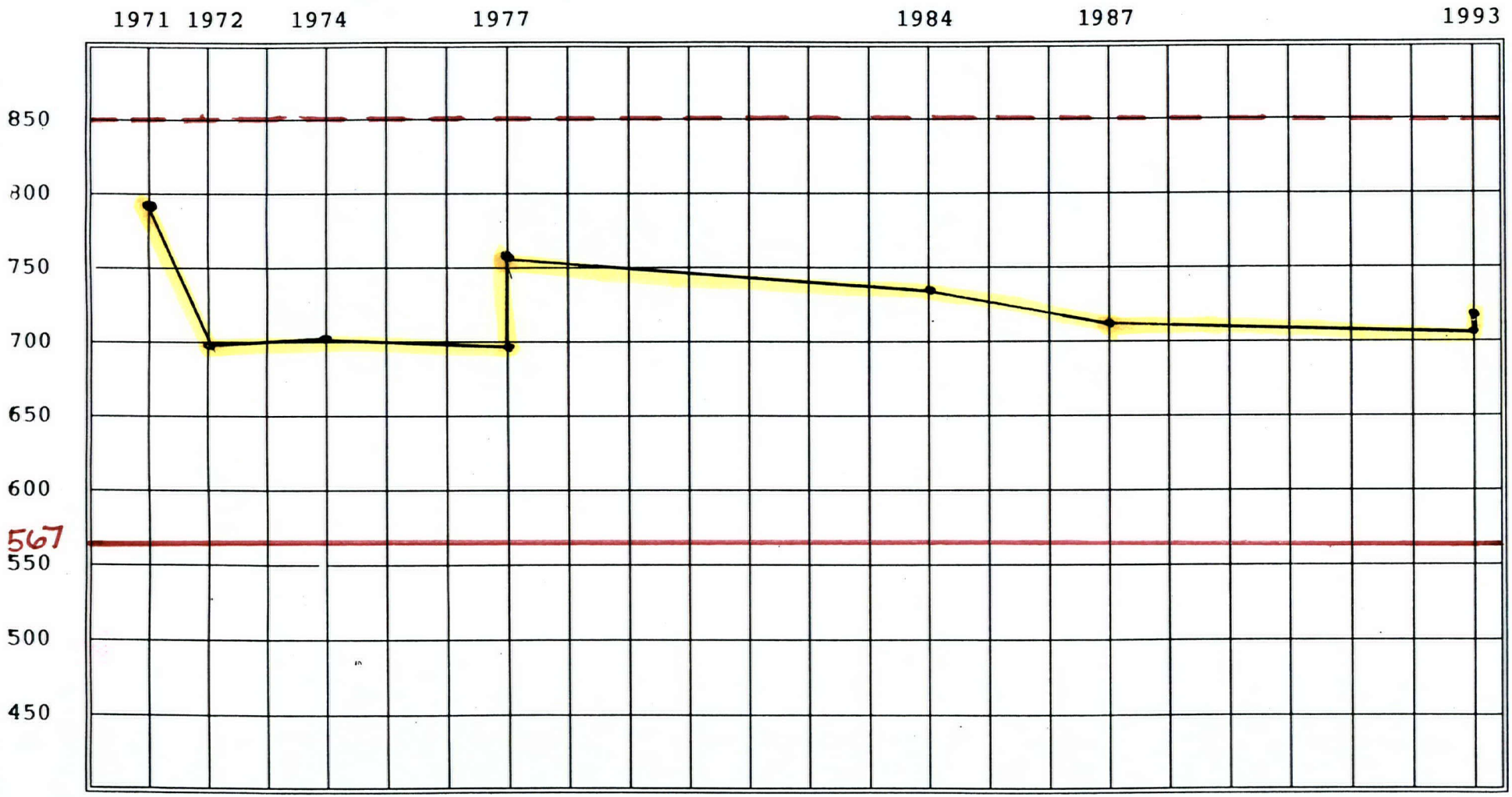


LIFT-OFF FORCE PER TENDON
(KIPS)

53H10

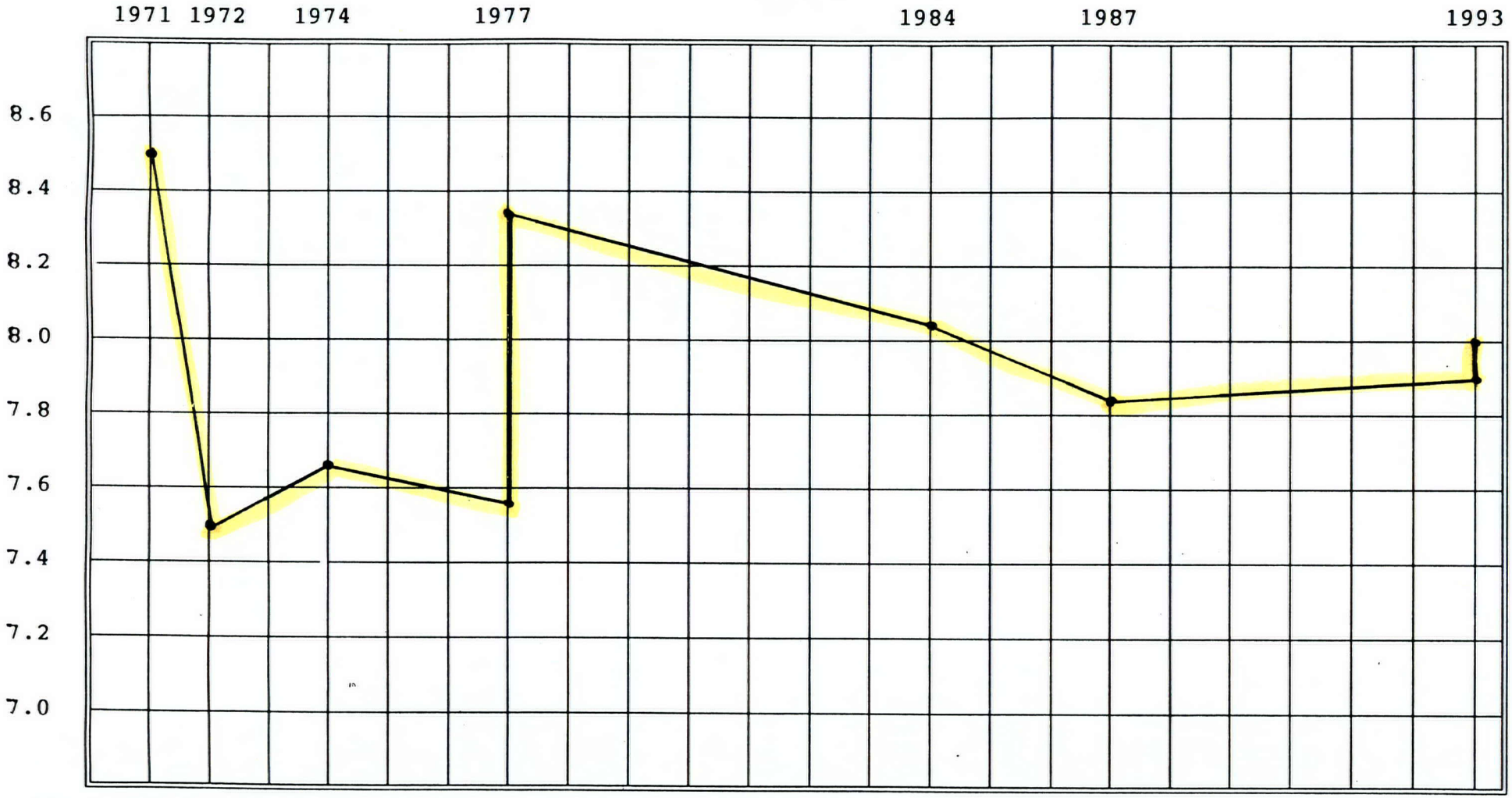


MAXIMUM ACCEPTABLE LIFT-OFF

PROJECTED LIFT-OFF AT THE END OF 40 YEARS

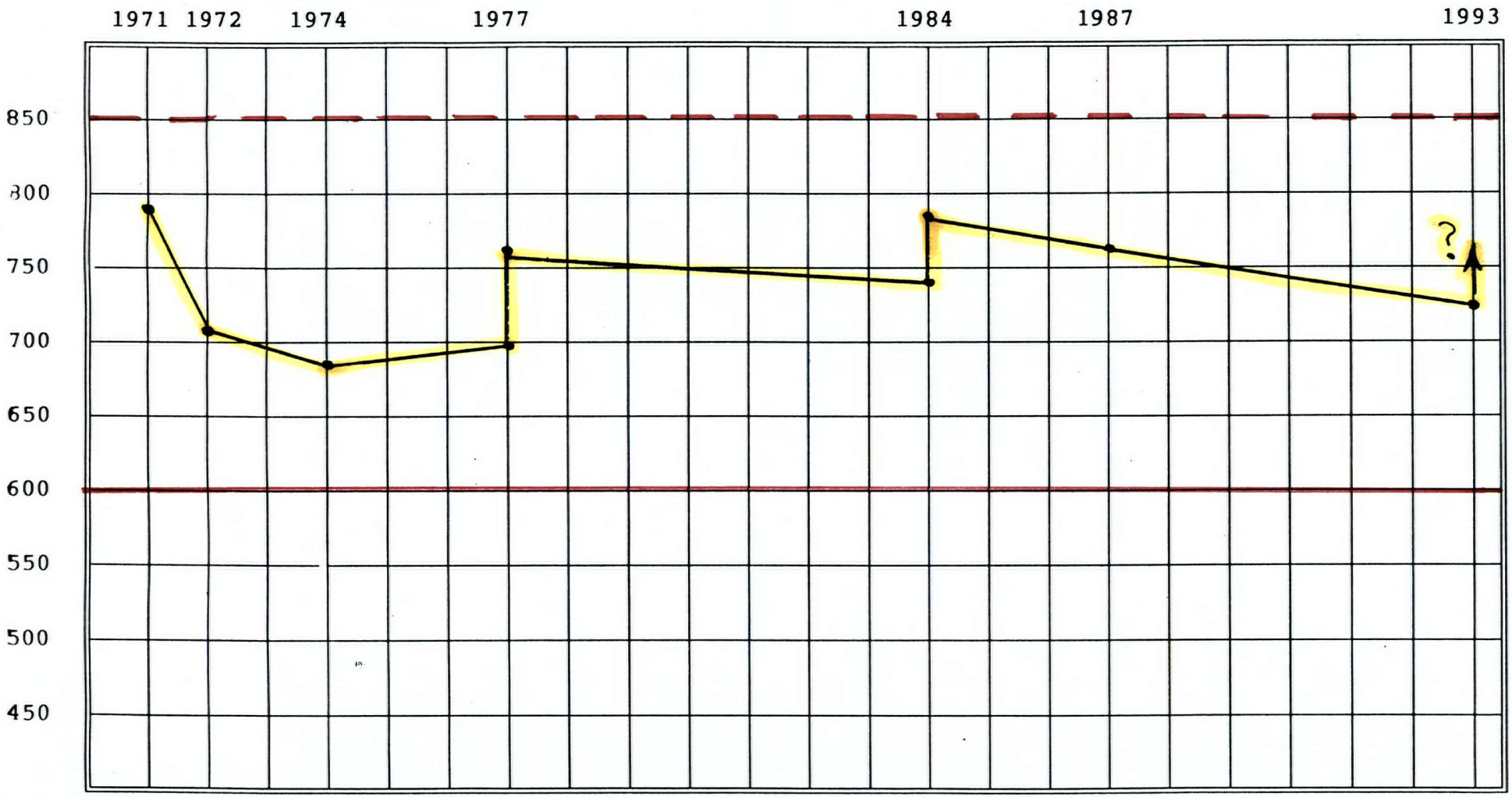
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

53H10



LIFT-OFF FORCE PER TENDON
(KIPS)

61 V 16

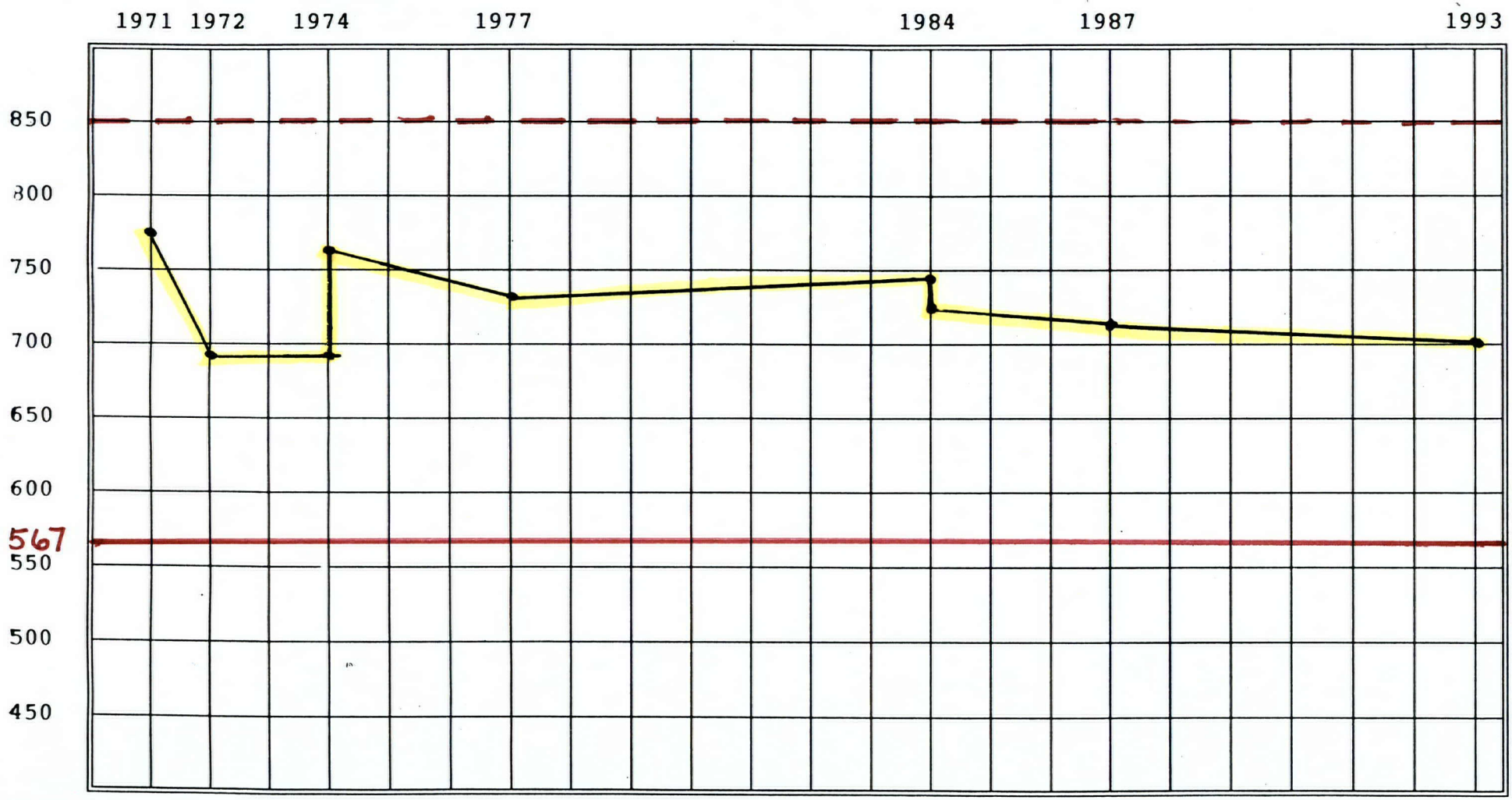


MAXIMUM ACCEPTABLE LIFT-OFF

PROJECTED LIFT-OFF AT THE END OF 40 YEARS

LIFT-OFF FORCE PER TENDON
(KIPS)

15H9



MAXIMUM ACCEPTABLE LIFT-OFF

PROJECTED LIFT-OFF AT THE END OF 40 YEARS

AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)

15H9