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SUBJECT: Forwards facility reactor building tendon surveillance rept to fulfill requirements of tech spec 4.4.2 re tendon inservice insps.

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DUKE POWER

July 8, 1991

U. S. Nuclear Regulatory Commission
Document Control desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Reactor Containment Building
Tendon Surveillance Report

Gentlemen:

Pursuant to Oconee Nuclear Station Technical Specifications 6.6.3.g, please find attached the Oconee Unit 3 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,

M. S. Tuckman

SGB/

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U. S. Nuclear Regulatory Commission, Region II
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Nuclear Regulatory Commission
Oconee Nuclear Station

A047

OCONEE NUCLEAR STATION
UNIT 3 CONTAINMENT BUILDING
TENDON SURVEILLANCE

SUMMARY

The fifth Containment Building tendon surveillance was performed on Oconee Unit 3 during the EOC12 RFO in March 1991. Tendon wire samples were sent to Duke Power's Applied Science Center for tensile tests. These tests were performed in accordance with Technical Specification 4.4.2. All nine tendons inspected were in satisfactory condition. The shims on both ends of all nine surveillance tendons were replaced. It had been noted on previous containment tendon inspections that the inside hole on the shims for the nine surveillance tendons had a rough irregular surface caused by torch cutting, rather than machining the inside circumference of the shim. After a close inspection of these shims by both site and General Office Engineering it was decided that although the shims were adequately performing their function, an increased margin of safety could be obtained by replacing these shims with ones having machined edges. Machining allowed closer control and produced increased bearing surface area. There were no other significant findings.

DISCUSSION

Nine surveillance tendons were inspected for anchorage condition and tensioned to determine their lift-off force. As discussed above, all nine tendons were detensioned and the shim stacks replaced with a new shim stack the same thickness as the original shim stack. One tendon from each tendon group (hoop, dome, & vertical) had a wire removed to check for signs of corrosion and to take samples for destructive tensile tests. These tendons were then re-stressed and the final lift-off values recorded.

Lift-off forces remain within the acceptable range for all surveillance tendons. Lift-off readings are given on tables 1 & 2. Average lift-off force per wire is given on table 3. Force-time graphs for each tendon and the average force per wire for each tendon are attached to this report.

Except for the shims discussed above, all surveillance tendons 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 4.

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 3 Containment Building post-tensioning system is in satisfactory condition and is capable of continuing to perform its' intended function.

The potential problem with the tendon shims was noted during the last Unit 2 Containment Building tendon surveillance. Since this problem only occurs on the larger diameter surveillance tendons, there is no concern this will effect the ability of the Containment Building post-tensioning system to perform its' intended function. The inside diameter of the shims on the nine surveillance tendons will be looked at closely on the upcoming Unit 1 refueling outage.

As was noted on the last Unit 2 Containment Building tendon report, there were some appreciable differences in the lift-off readings on opposite ends of the same tendon. Detensioning the tendon and using the hydraulic ram to pull the relaxed tendon back and forth inside the tendon sheath resulted in a more equal lift-off force on the opposite ends of the tendon. This would seem to indicate the tendon is hanging up inside the tendon sheath at some point closer to one end of the tendon than the other. Design Engineering is looking at this and considering other possible explanations to determine if this could potentially have any effect on the ability of the tendon to perform its' intended function.

TABLE 1

1991 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 (2) (KIPS)
1D28	6250/6050	720.9/697.4	5050/5800	579.7/667.6	682.5
2D28	5800/5800	667.6	5800/5800	667.9	667.7/667.7
3D28	5900/5750	679.3/661.7	5800/5600	667.9/644.3	653.0
23V14	6250/6150	720.9/709.2	6200/6100	714.5/702.7	706.0
45V16	6050/5850	697.4/673.8	5900/5900	679.3	688.4/676.5
61V16	6150/5600	709.2/644.4	5600/5800	644.2/667.6	656.0
13H9	5400/5800	620.7/667.6	5900/5750	679.9/662.5	665.0
51H9	6200/5850	714.9/674.1	5600/6100	645.0/703.9	680.0/689.0
53H10	5800/5600	667.6/644.2	5900/5600	680.3/645.0	644.6

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. A copy of the tables used is attached.

2. The average force value was determined by averaging the 'as left' value for both ends of the tendon. The tendons that had a wire removed show both an 'as found' and 'as left' average value.

TABLE 2

LIFTOFF FORCES
(KIPS)

TENDON	1975	1980	1983	1987	1991
1D28	672	689	714/706	742/723	682.5
2D28	689	671/678	658/715	723	667.7/667.7
3D28	698	675	681/728	736	653.0
23V14	727	732	745/739	748/742	706.0
45V16	703	659/670	665/702	711	688.4/676.5
61V16	707	700/707	727/704	699	656.0
13H9	674	726	713/713	730/711	665.0
51H9	678	678/760	717/713	691	680.0/689.0
53H10	683	678	697/710	693	644.6

NOTES:

1. All values are the average of the values obtained at each end of the tendon.
2. Double entries are, respectively, the as-found and as-left values for re-tensioned tendons.
3. Lift-off forces prior to 1984 were computed from ram area. No calibration data for these years is available.

TABLE 3

AVERAGE LIFT-OFF FORCE PER WIRE
(kips)

TENDON	# EFFECTIVE WIRES	AVE. FORCE PER WIRE
1D28	91	7.50
2D28	91	7.34
3D28	92	7.10
23V14	91	7.76
45V16	91	7.43
61V16	92	7,13
13H9	91	7.31
51H9	91	7.57
53H10	91	7.08

TABLE 4

TENDON COMPONENT CONDITION

TENDON	WIRES	BUTTONHEADS	WASHERS	SHIMS	BEARING PLATE
1D28	A	A	A	B	B
2D28	A	A	A	B	B
3D28	A	A	A	B	B
23V14	A	A	A	B	B
45V16	A	A	A	B	B
61V16	A	A	A	B	B
13H9	A	A	A	B	B
51H9	A	A	A	A	B
53H10	A	A	A	B	B

CORROSION LEVELS

A Bright metal, No visible oxidation

B Reddish brown color, No pitting

C 0" < Pitting ≤ .003"

D .003" < Pitting ≤ .006"

E .006" < Pitting ≤ .010"

NOTES:

1. Wire inspections can only be performed on tendons that are detensioned and the shims removed.
2. Double entries are for, respectively, the shop end and the field end of the tendon.

DUKE POWER COMPANY

APPLIED SCIENCE CENTER

Materials Analysis Report

Sample No.: 1117 **Station:** Oconee **Unit:** 3
Requestor/Dept.: Fred Linsley, ONS-MES
Principal Investigator: J. M. Shuping
Submitted To: Fred Linsley **Date:** 4-15-91
cc: G. T. Smith, NPD-GO

Equipment Description:
Tensile testing of Unit 3 Surveillance tendons, 51H9, 2D28, 45V16 per ASTM A421 specifications.

Background Information:
The original tendons were sectioned in half creating two specimens for each tendon sample.

Description/Macro-Examination: NA

Fractography: NA

Metallography: NA

Chemistry/Mechanical Testing:

ID/Location	Dia.	% Elong. (10" Gage)	Maximum Load (lbs.)	Ultimate Strength (PSI)
51H9 Field End	.2495	5.8	12,160	248,700
51H9 Field End	.2495	4.4	12,160	248,700
51H9 Middle	.2494	4.3	12,240	250,300
51H9 Middle	.2494	**	12,080	247,300
51H9 Shop End	.2494	5.0	12,000	245,400
51H9 Shop End	.2495	4.2	12,480	255,200
2D28 West Side	.2500	5.3	12,880	262,300
2D28 West Side	.2501	**	12,880	262,200
2D28 Center	.2502	6.0	12,720	258,500
2D28 Center	.2502	5.3	12,640	256,900
2D28 East Side	.2503	6.0	12,640	256,900
2D28 East Side	.2503	6.0	12,640	256,900
45V16 Cut End	.2500	6.7	12,400	252,500
45V16 Cut End	.2501	6.2	12,480	254,200
45V16 Center	.2504	6.7	12,480	253,700
45V16 Center	.2504	6.7	12,400	252,000
45V16 Button End	.2500	**	12,400	252,600
45V16 Button End	.2500	6.0	12,400	252,500

** Specimen broke outside of gage marks.

Conclusions:
All tendons tested exceeded the ASTM A421 minimum strength requirements of 240,000 psi and 4.0% elongation.

Tensile tester calibration sheets are included for your inspection. If the Materials Analysis Lab can be of further assistance, please call.

		Date:
Approved by:	Jody M. Shipping	4/15/91
Reviewed by:	John B. Weigle	4/15/91.

Tinius Olsen

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

Owner LAW ENGINEERING TESTING
Location CHARLOTTE, NC

Verification No.
TMR. 59824
SO. S-25954

Date 6/15/90

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	.33
0 TO 80,000	8,000 TO 80,000	.3
0 TO 160,000	16,000 TO 160,000	.31
0 TO 400,000	40,000 TO 400,000	.4

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.

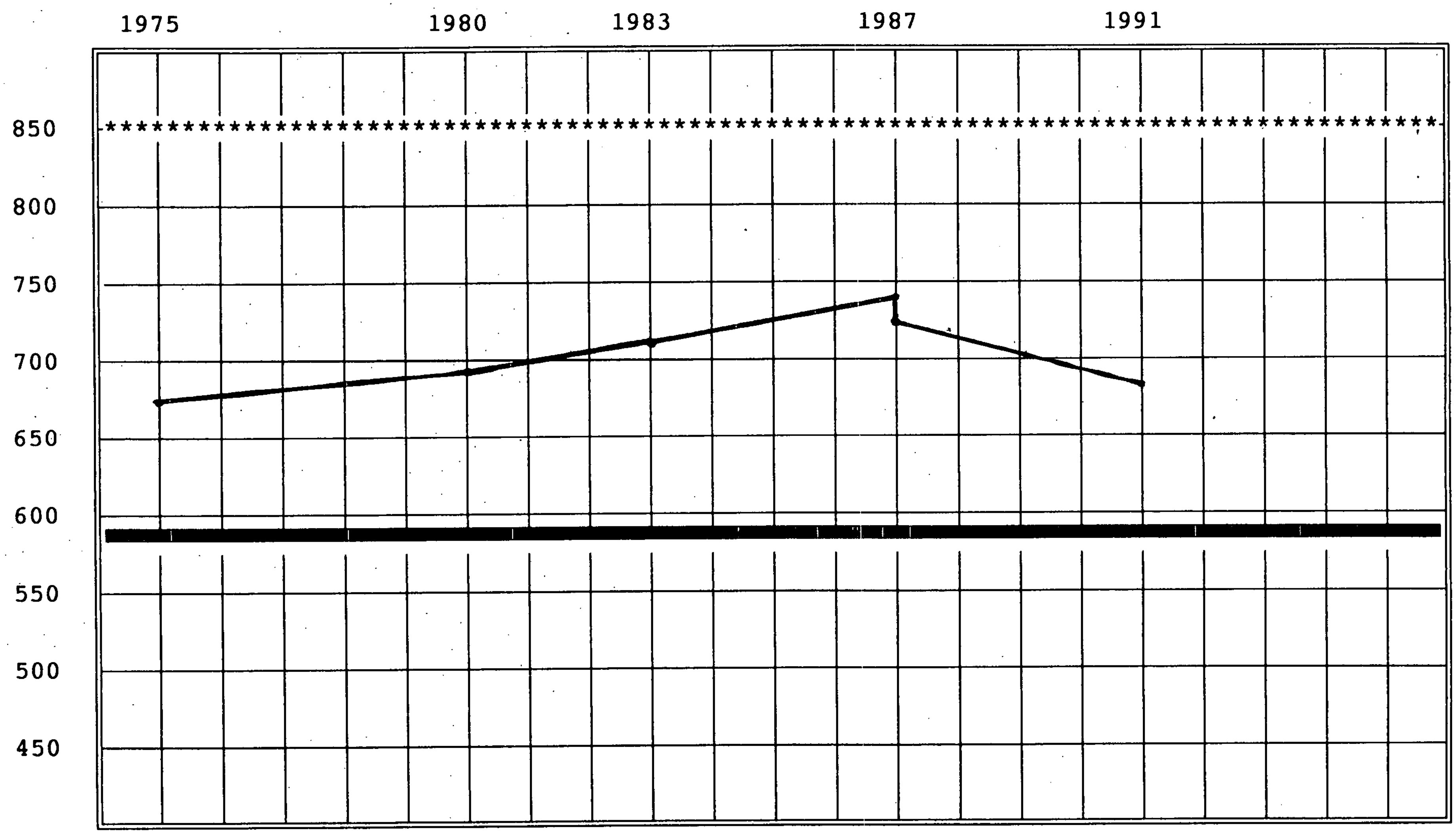
Tinius Olsen Testing Machine Co., Inc.

By B. CAMPBELL

J. MACKIN
SERVICE

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

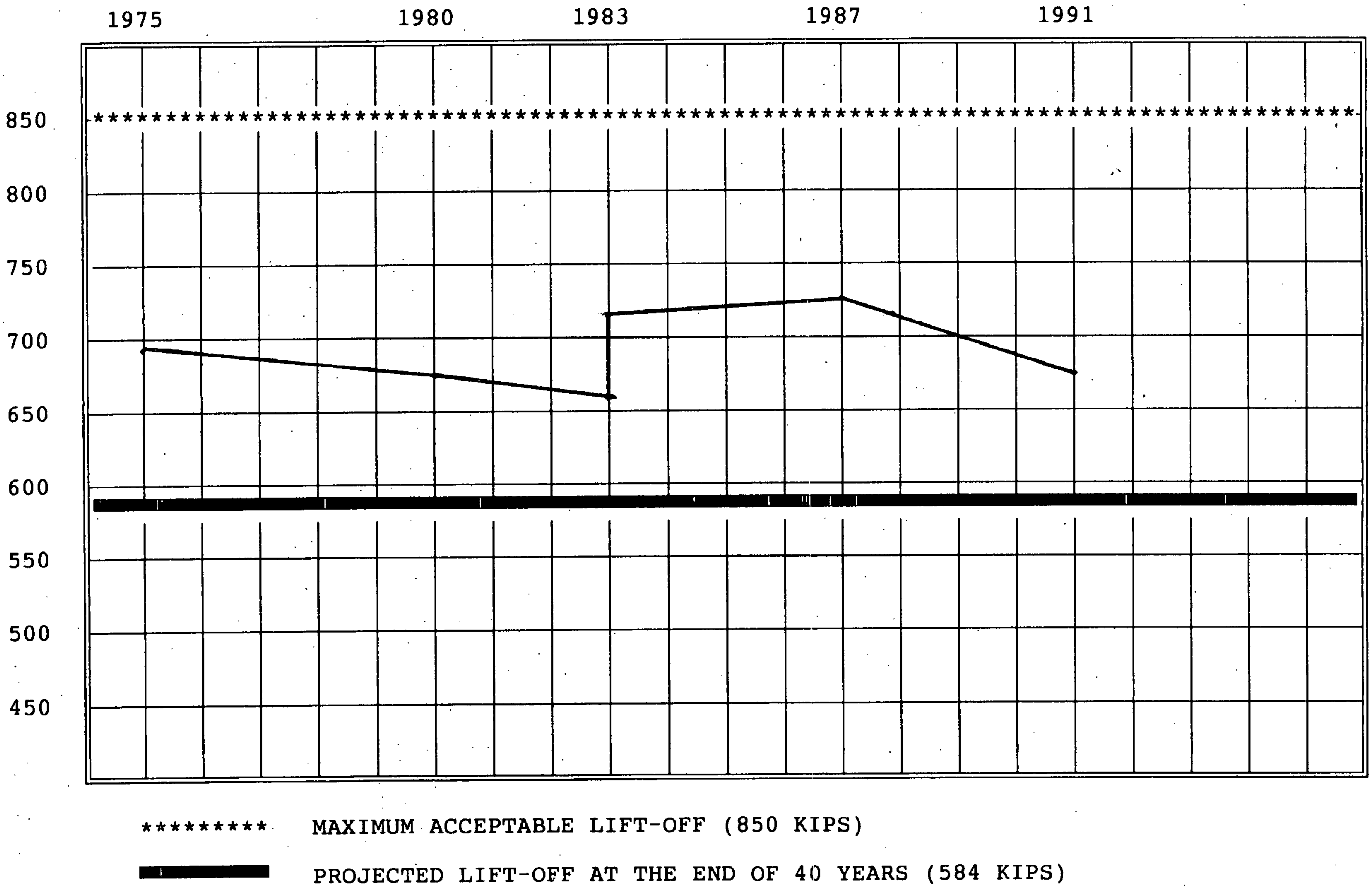
LIFT-OFF FORCE PER TENDON
(KIPS)
1D28



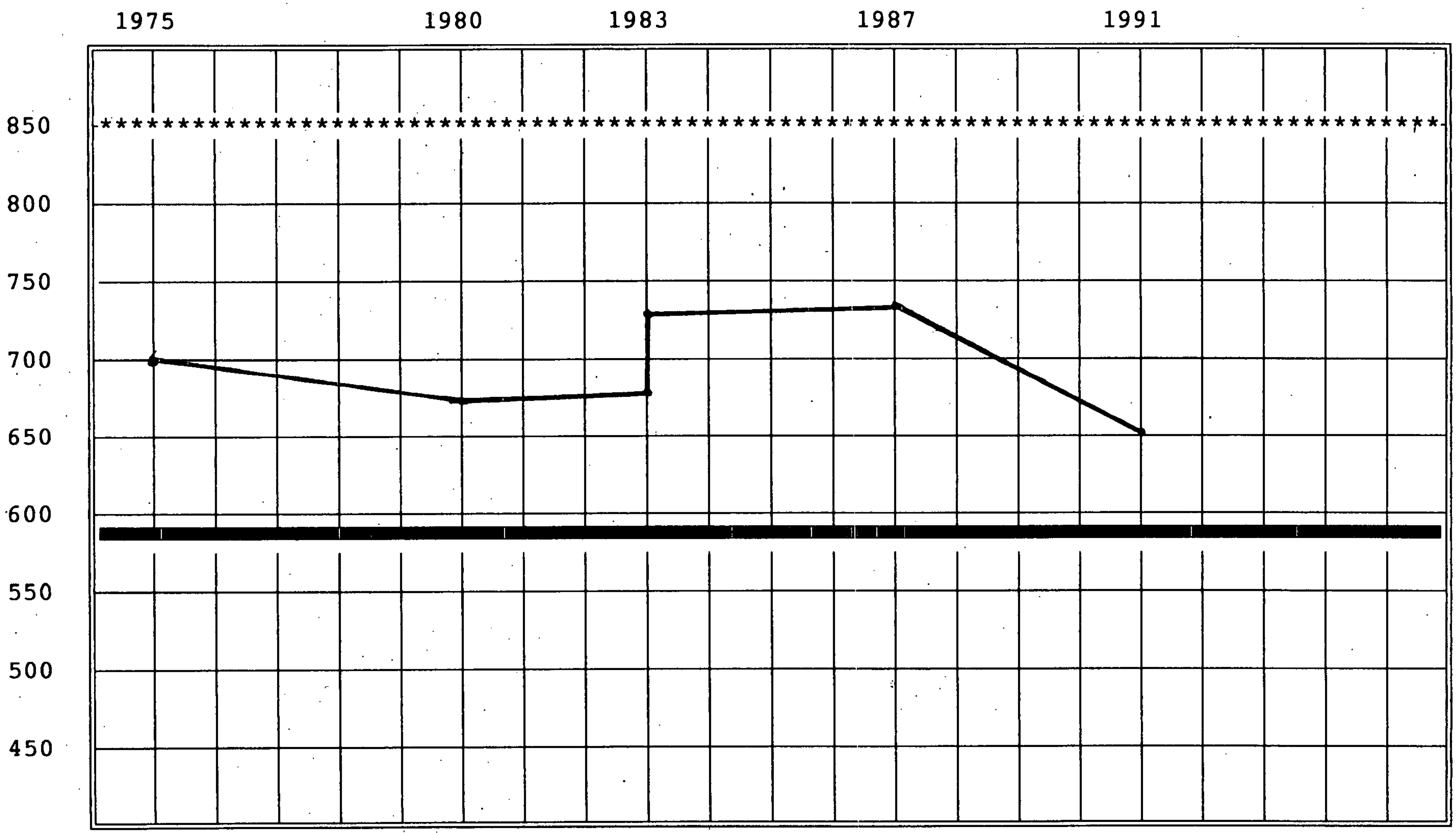
********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

PROJECTED LIFT-OFF AT THE END OF 40 YEARS (584 KIPS)

LIFT-OFF FORCE PER TENDON
(KIPS)
2D28



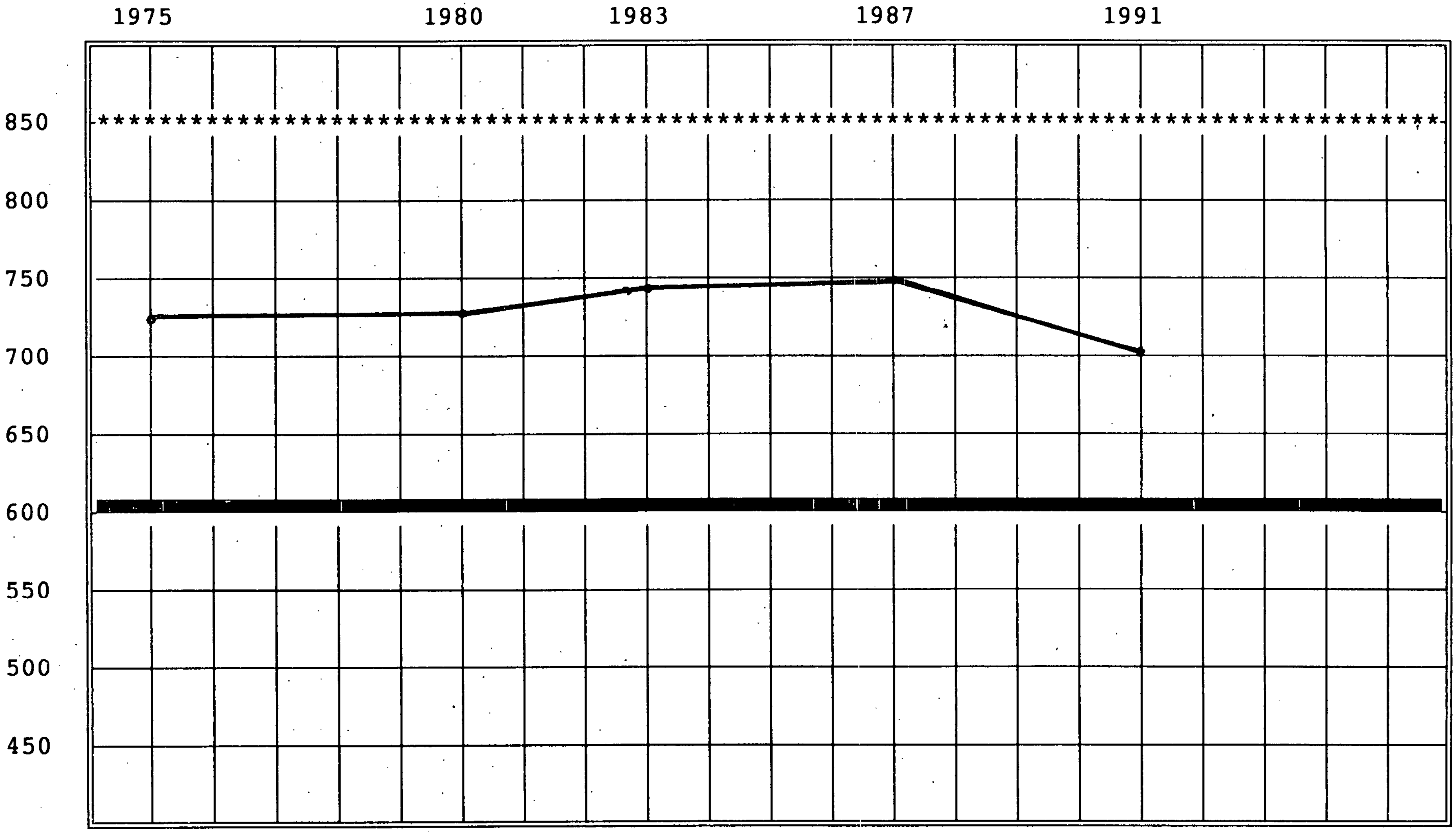
LIFT-OFF FORCE PER TENDON
(KIPS)
3D28



********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

PROJECTED LIFT-OFF AT THE END OF 40 YEARS (584 KIPS)

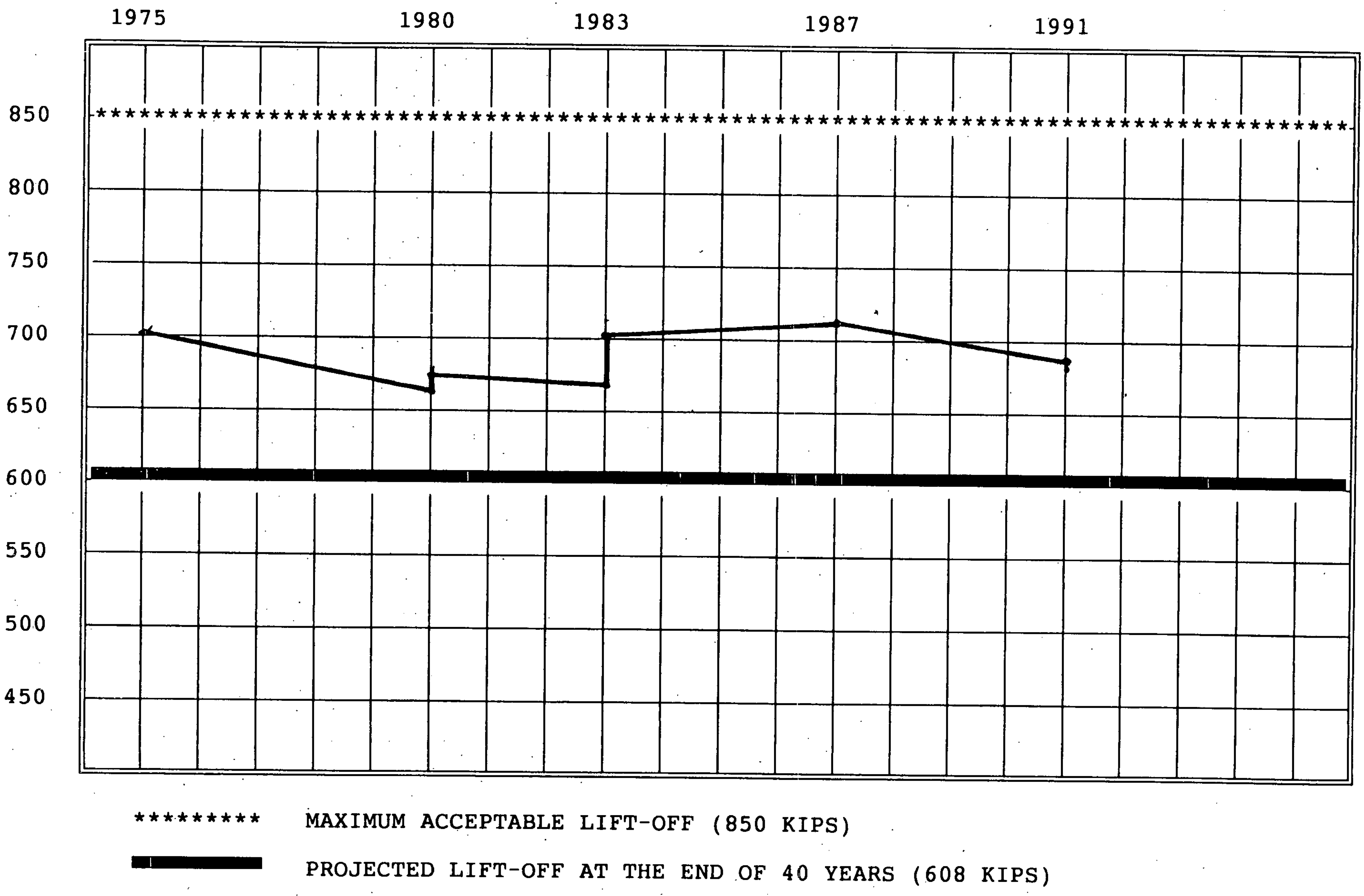
LIFT-OFF FORCE PER TENDON
(KIPS)
23V14



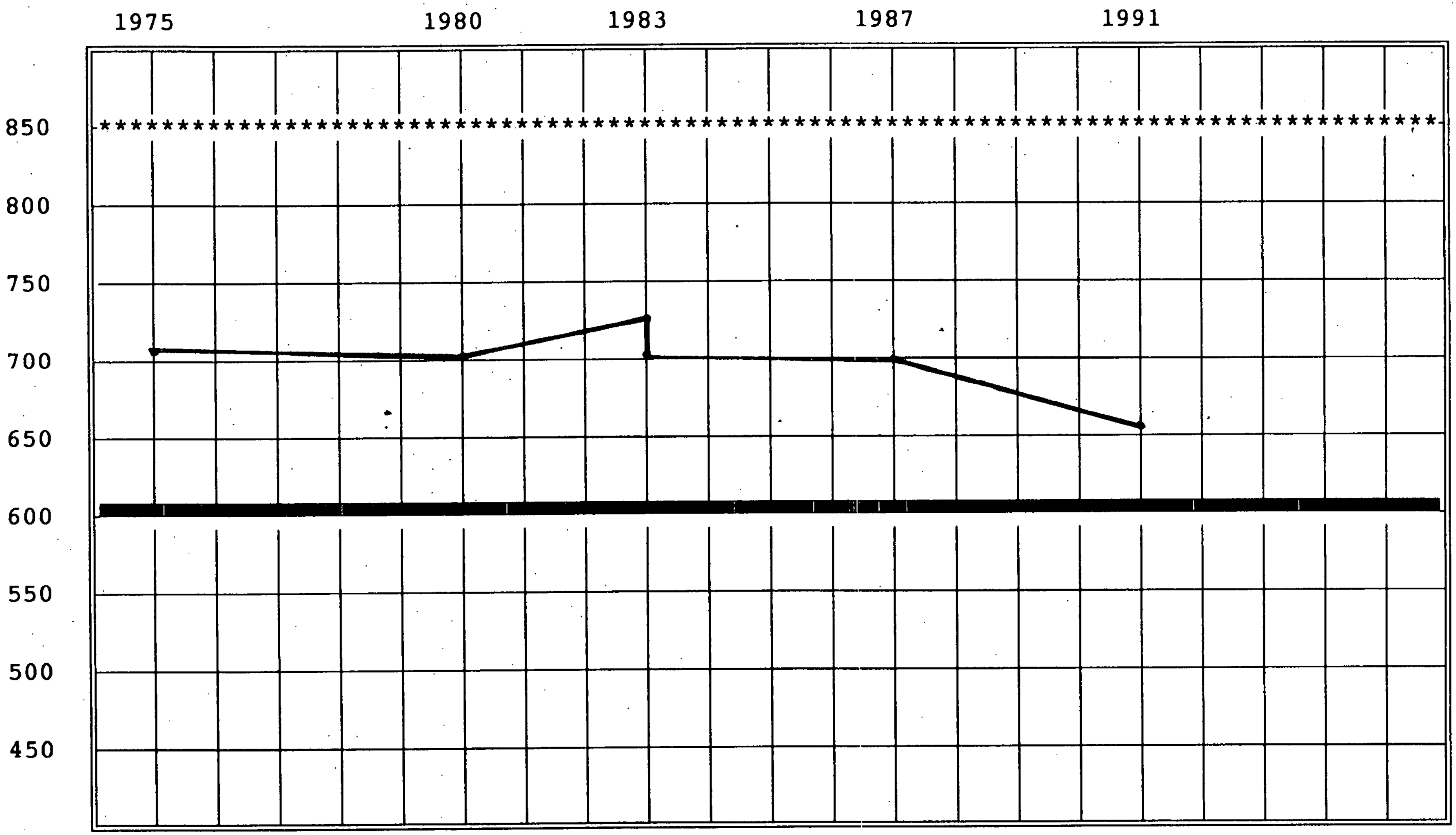
********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

PROJECTED LIFT-OFF AT THE END OF 40 YEARS (608 KIPS)

LIFT-OFF FORCE PER TENDON
(KIPS)
45V16



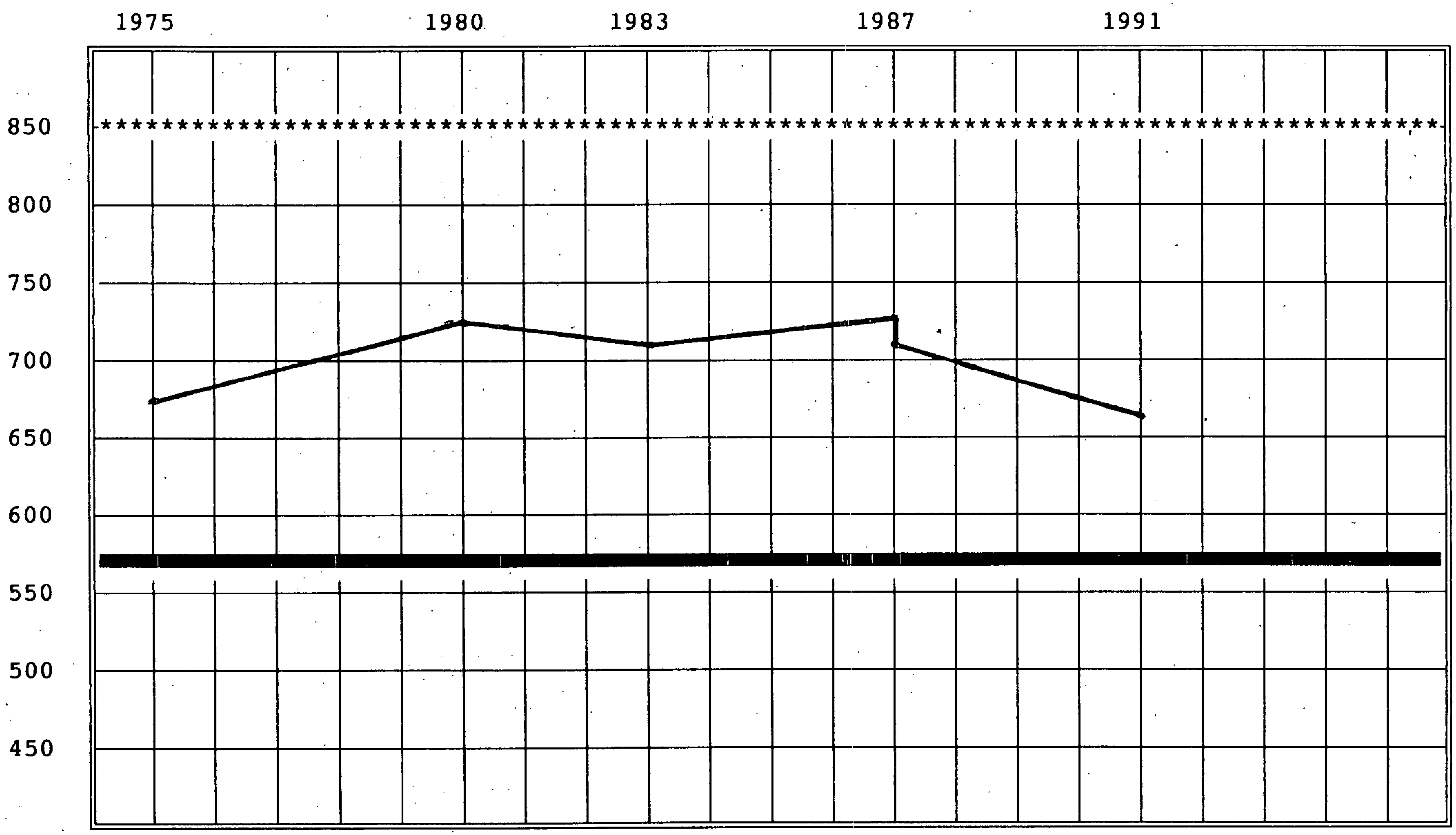
LIFT-OFF FORCE PER TENDON
(KIPS)
61V16



********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

PROJECTED LIFT-OFF AT THE END OF 40 YEARS (608 KIPS)

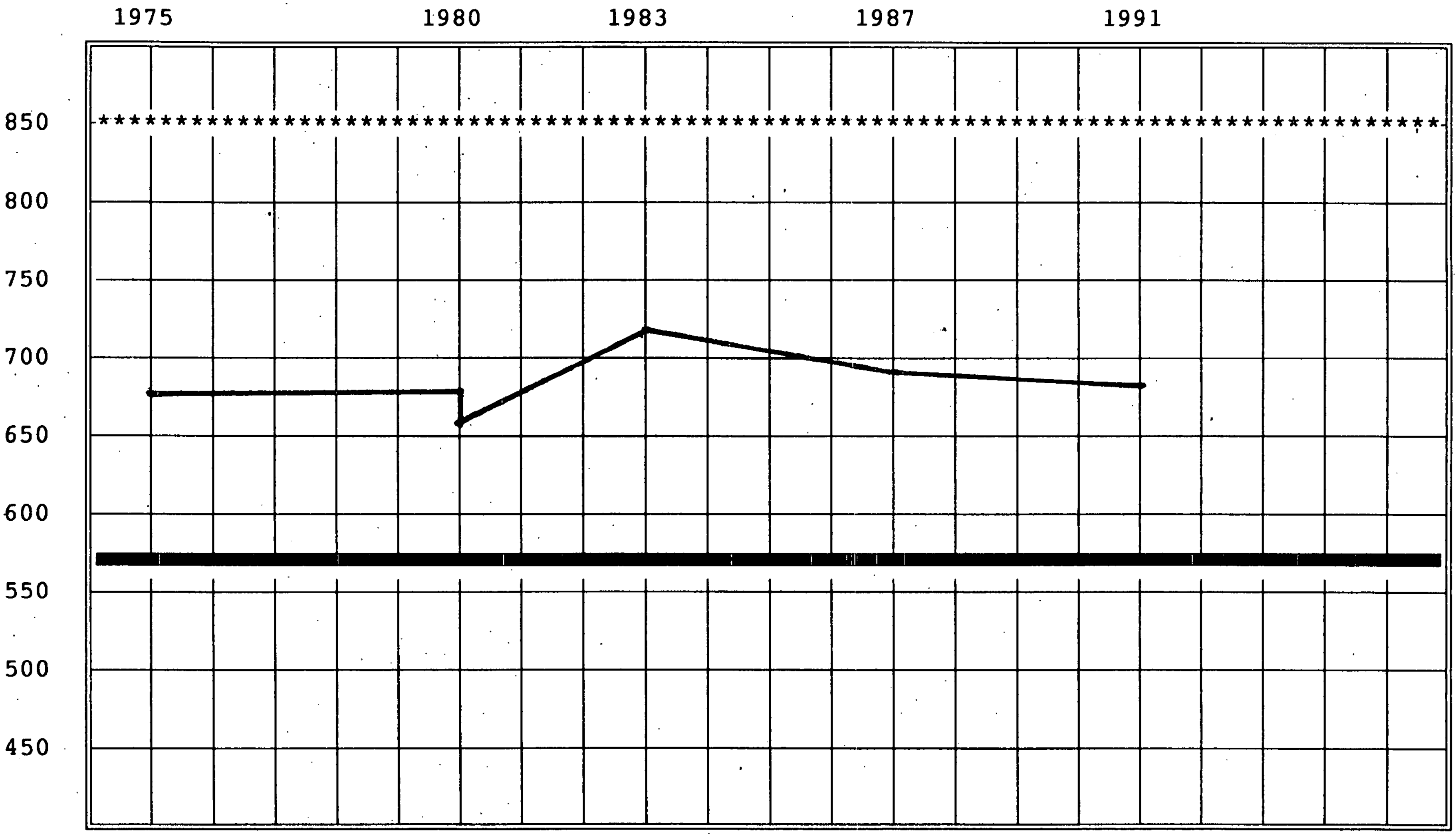
LIFT-OFF FORCE PER TENDON
(KIPS)
13H9



********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

PROJECTED LIFT-OFF AT THE END OF 40 YEARS (574 KIPS)

LIFT-OFF FORCE PER TENDON
(KIPS)
51H9



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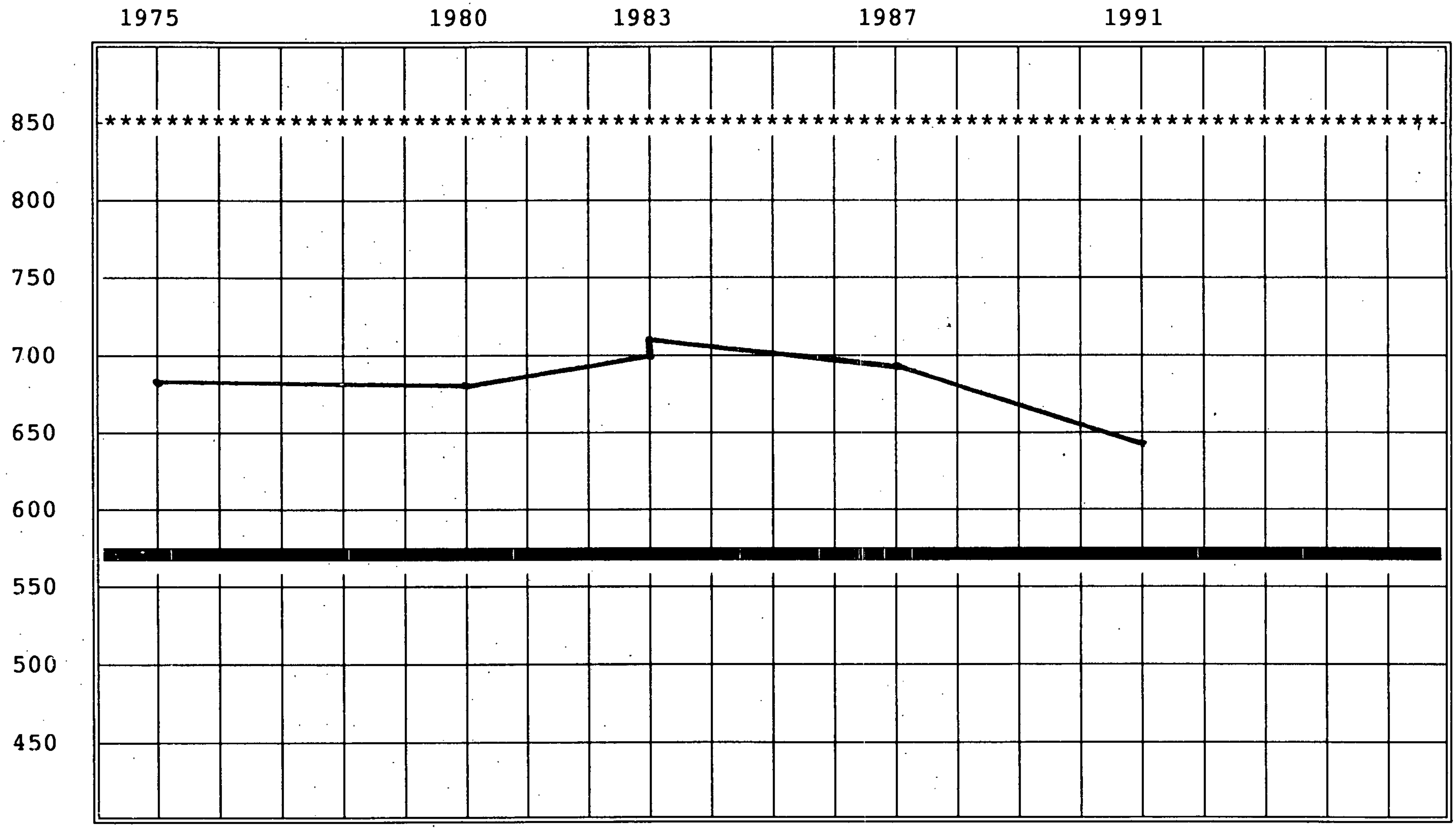
PROJECTED LIFT-OFF AT THE END OF 40 YEARS (574 KIPS)

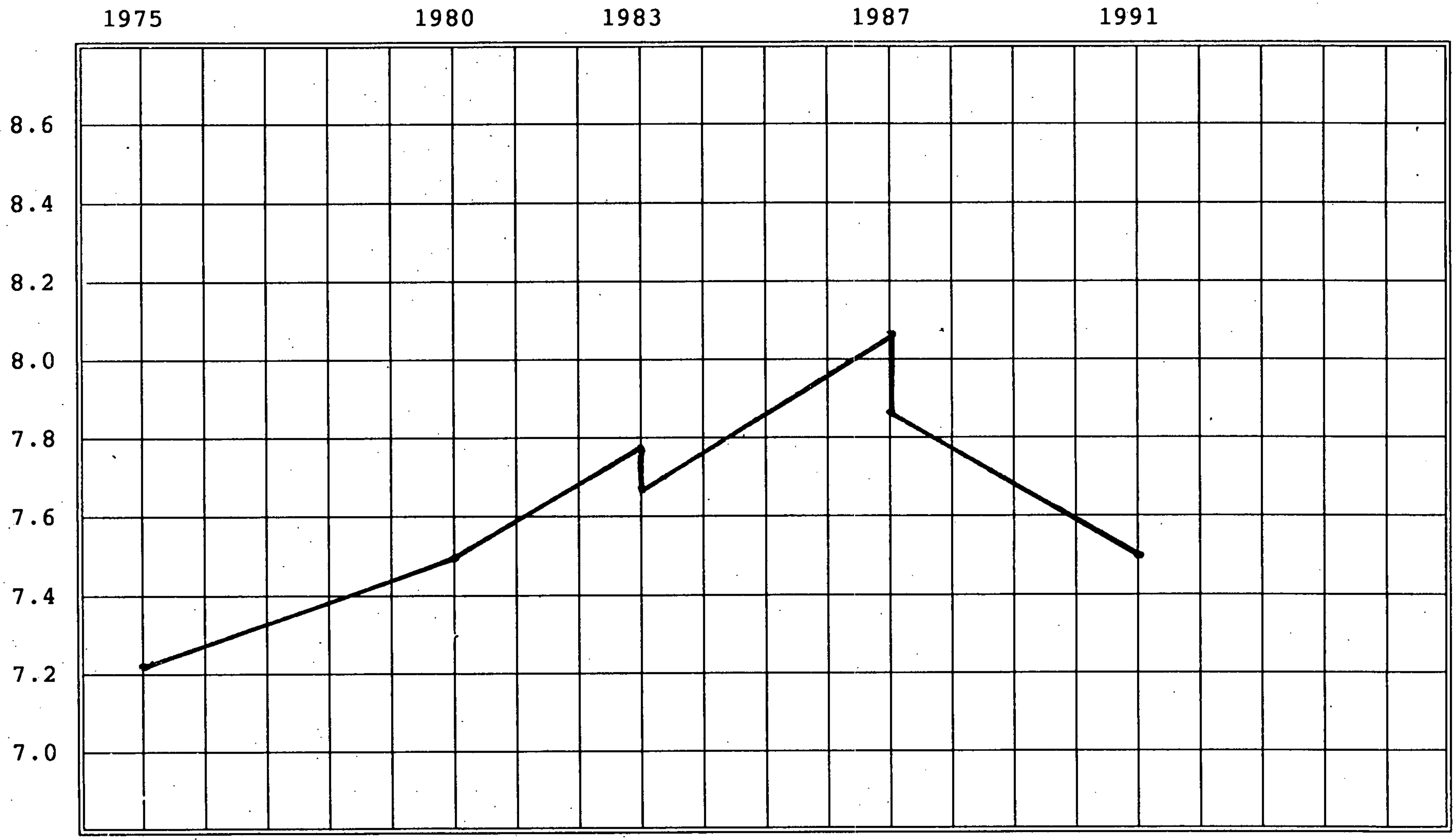
LIFT-OFF FORCE PER TENDON
(KIPS)
53H10



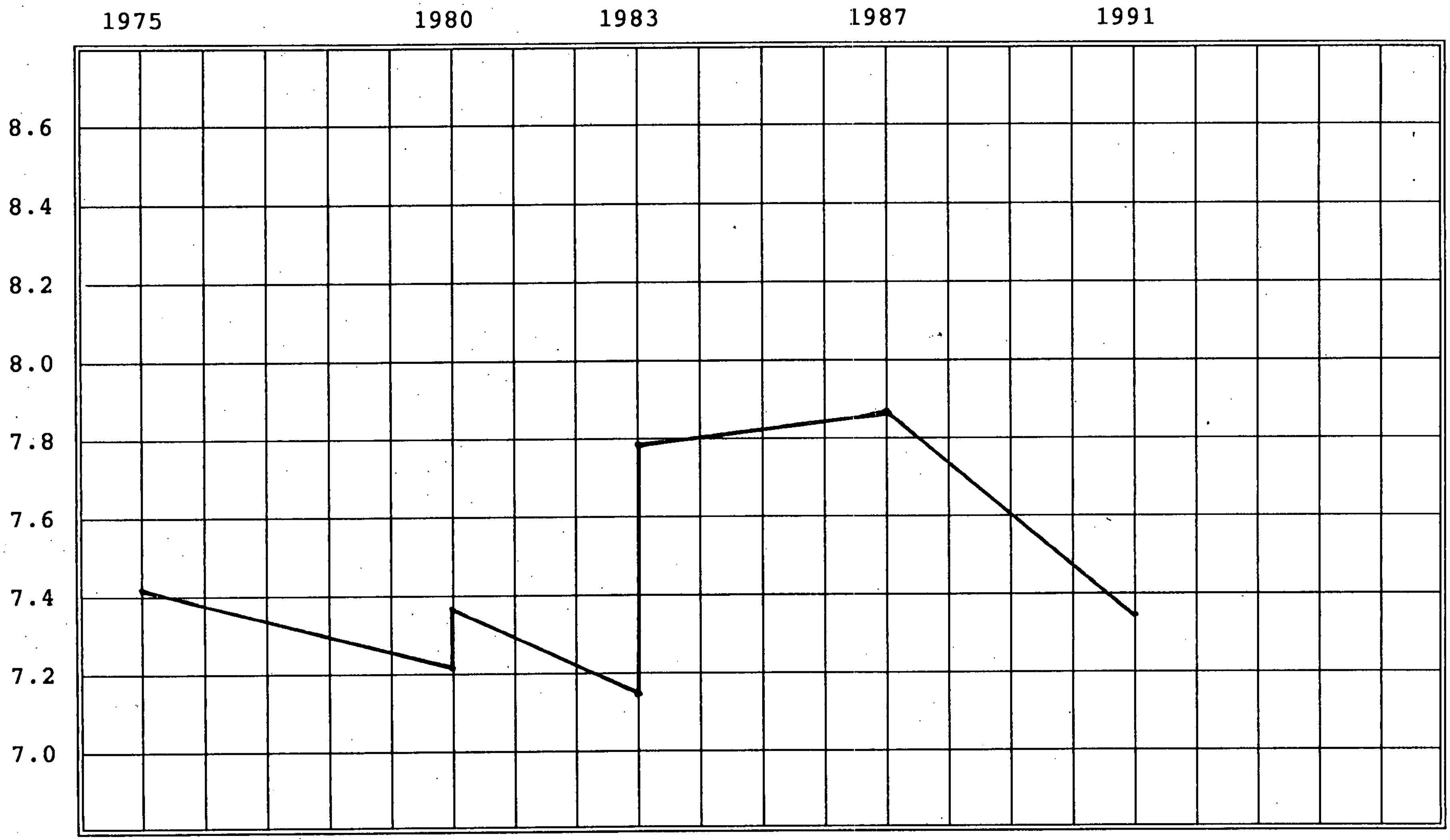
********* MAXIMUM ACCEPTABLE LIFT-OFF (850 KIPS)

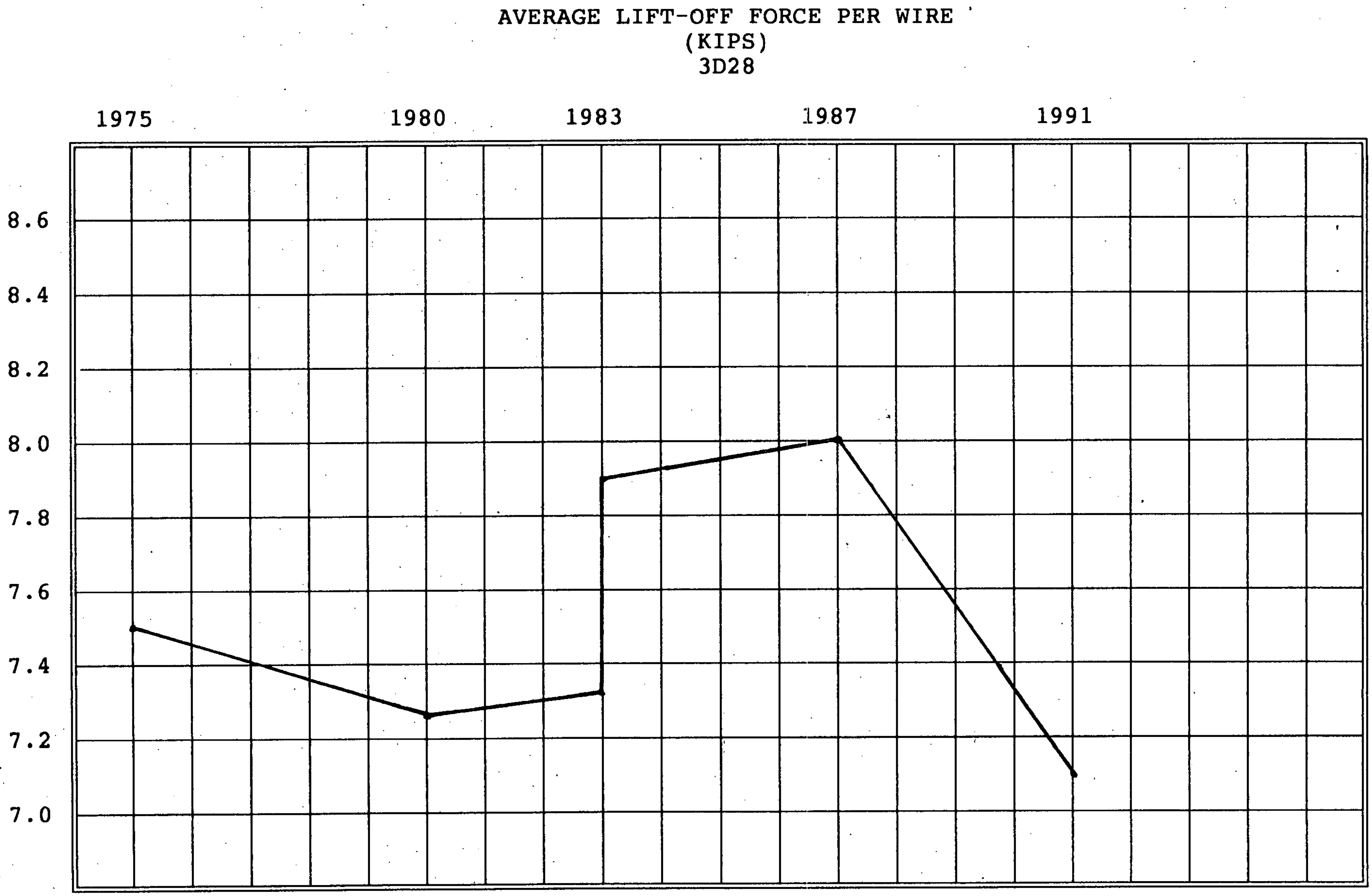
PROJECTED LIFT-OFF AT THE END OF 40 YEARS (584 KIPS)

AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
1D28

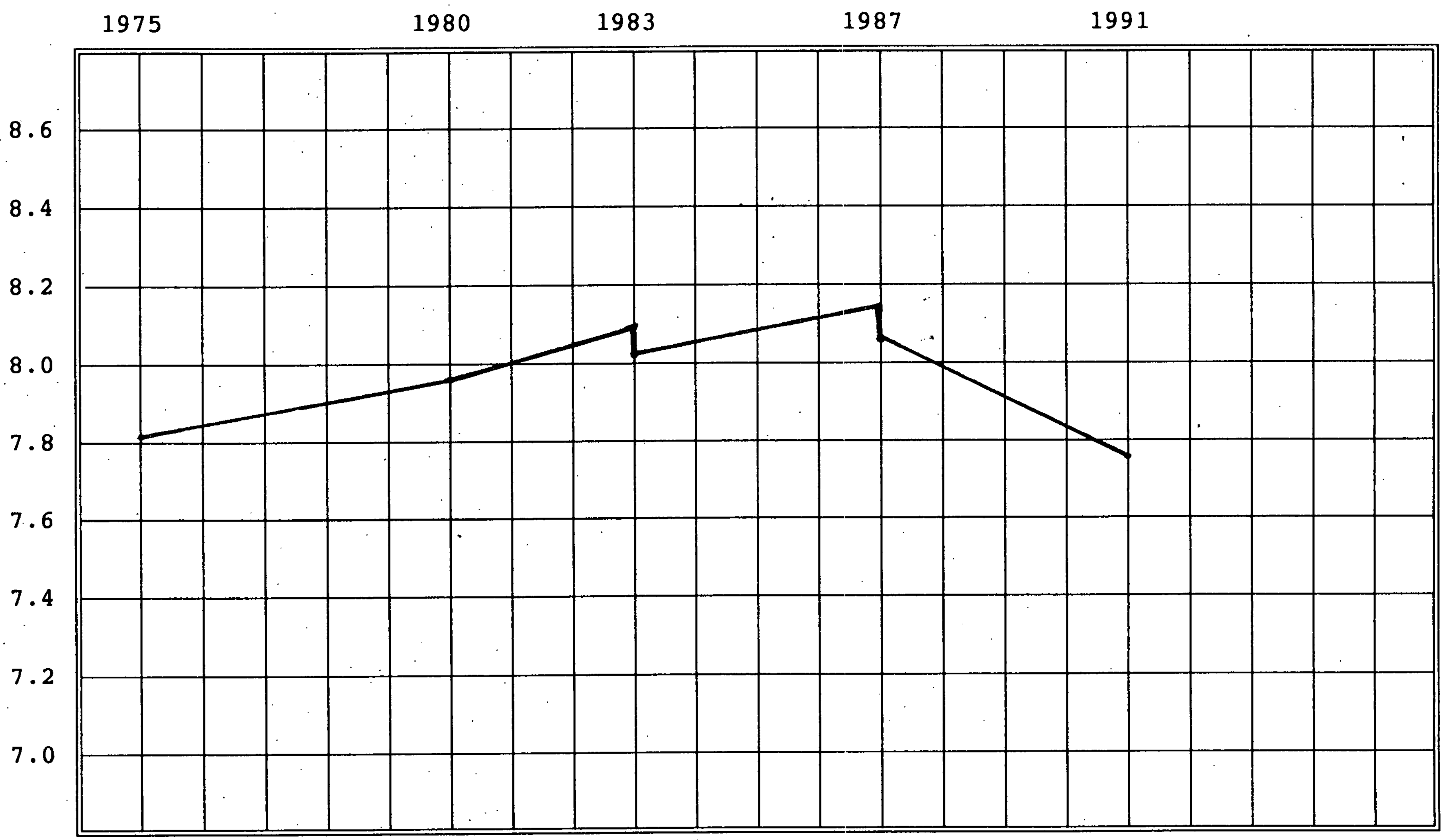


AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
2D28

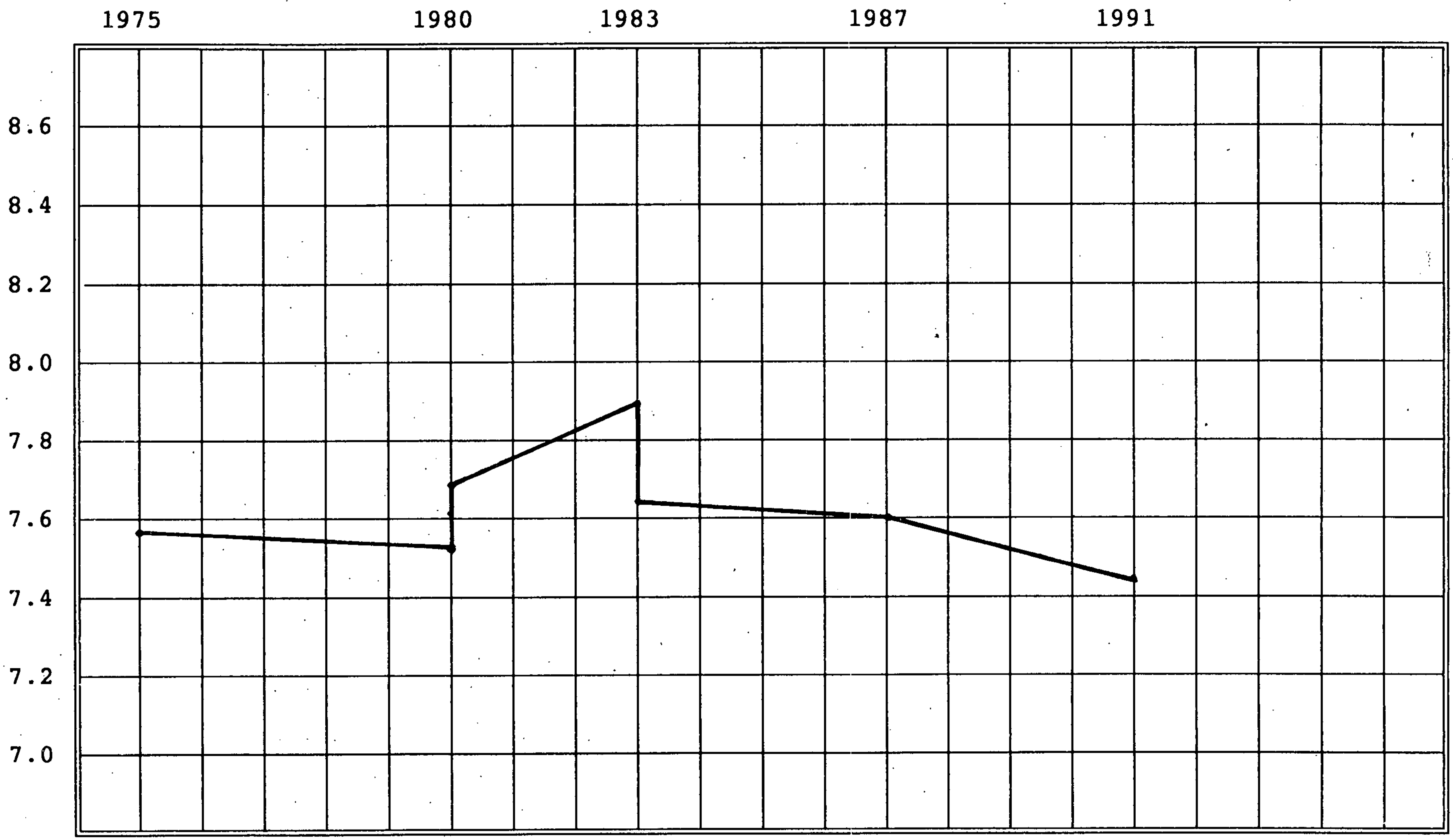


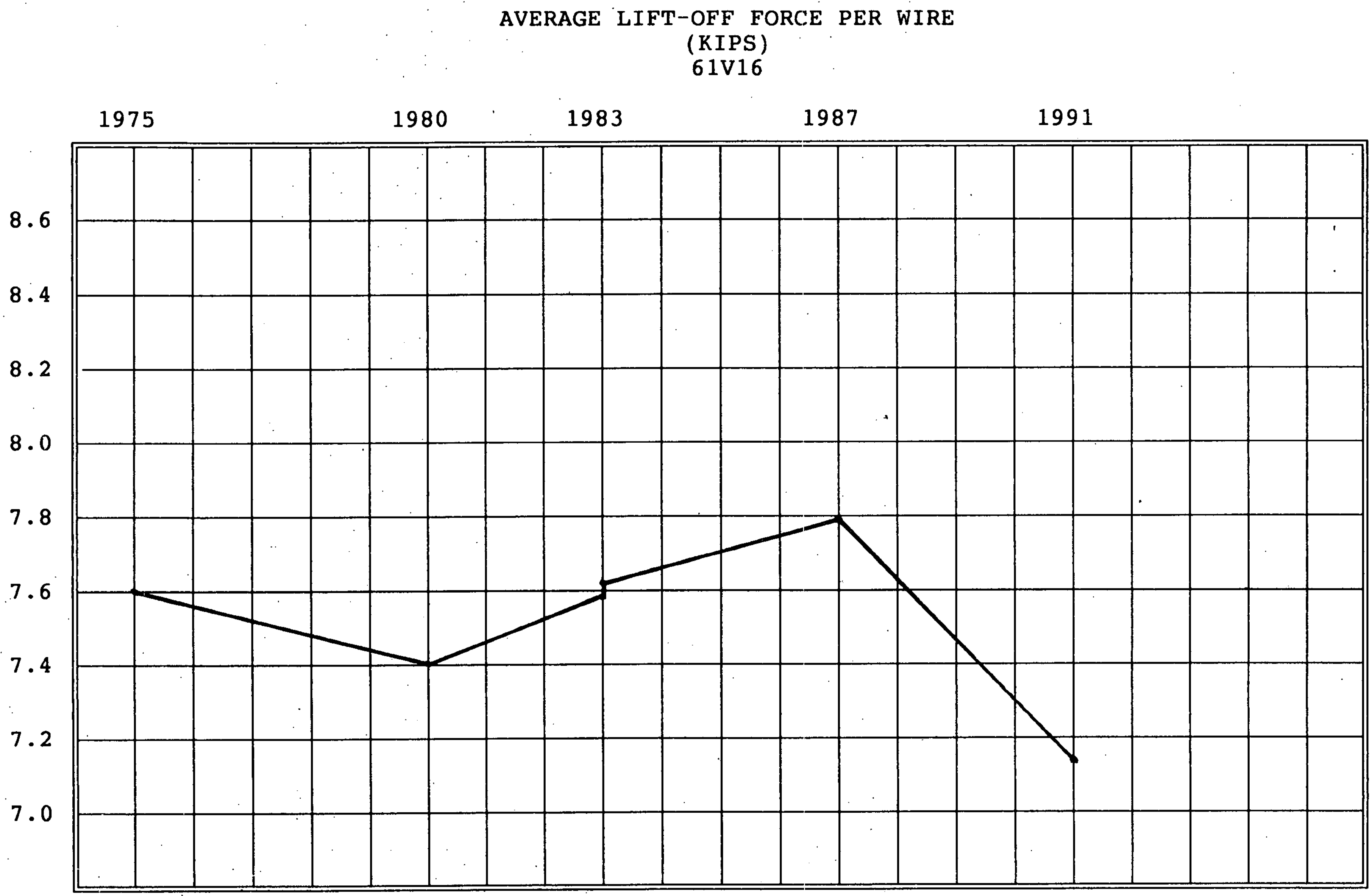

AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
3D28
1975
1980
1983
1987
1991
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0

AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
23V14



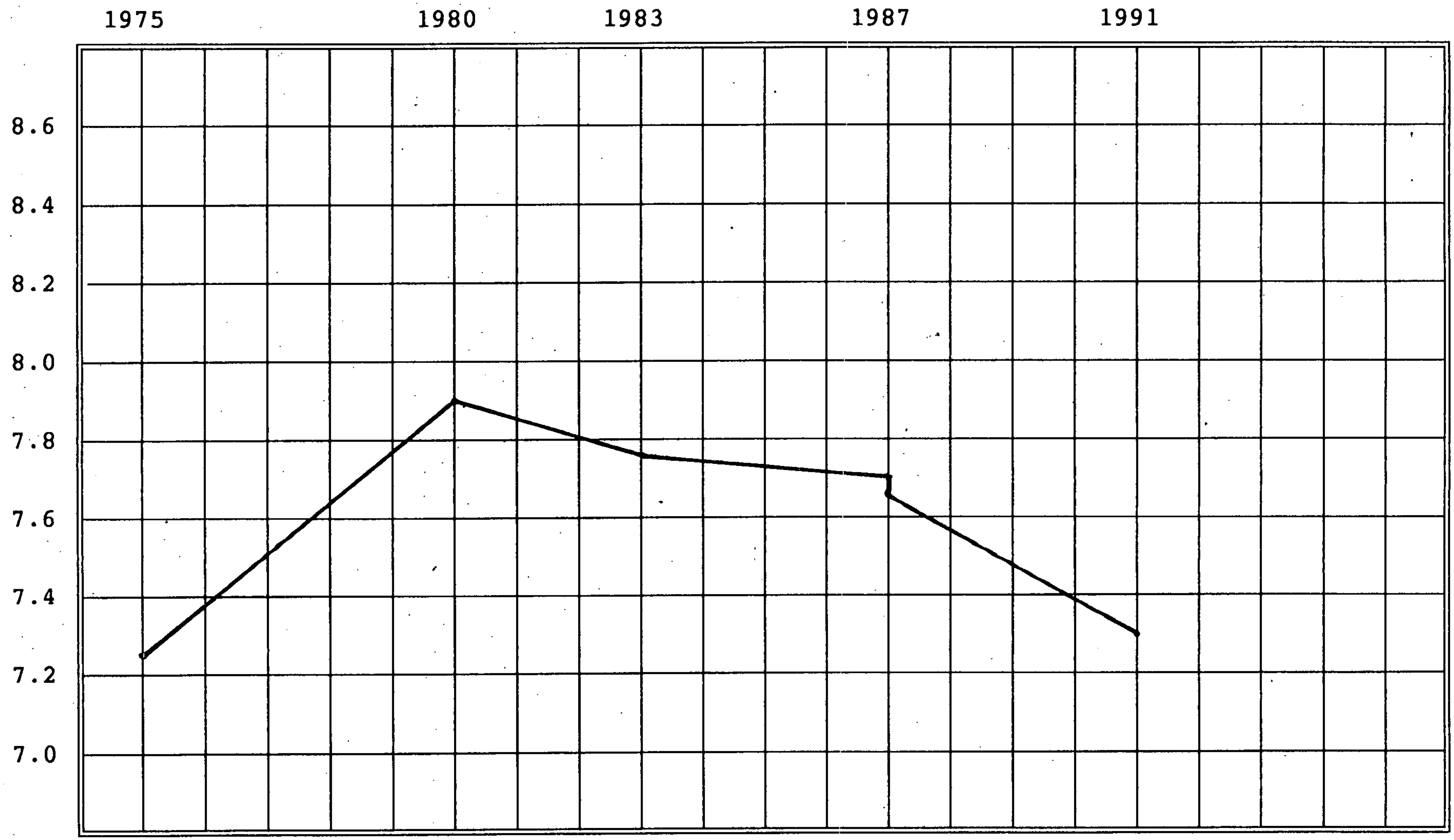
AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
45V16



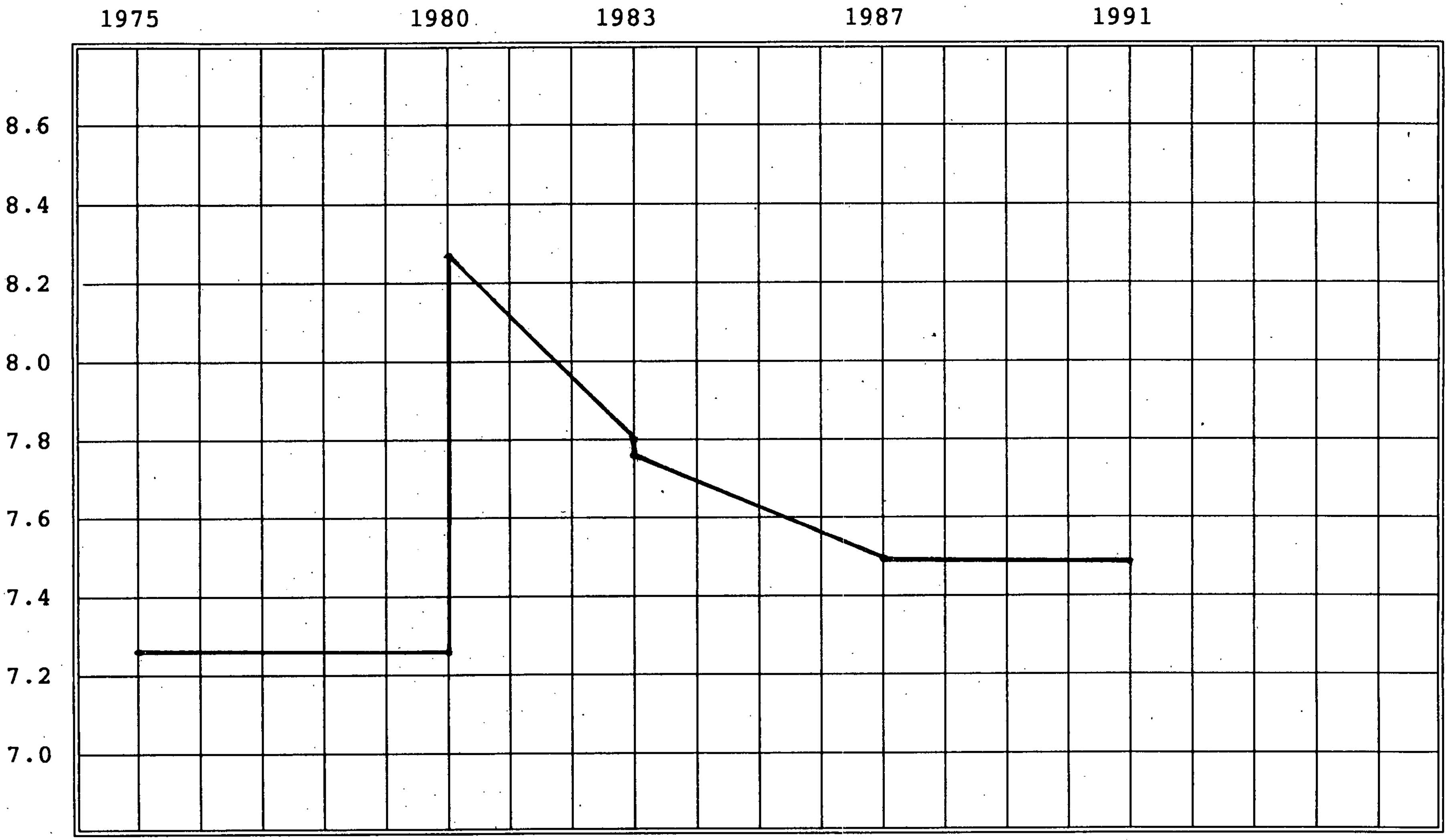


AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
61V16
1975
1980
1983
1987
1991
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0

AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
13H9



AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
51H9



AVERAGE LIFT-OFF FORCE PER WIRE
(KIPS)
53H10