INTERIM REPORT

Accession No. ____________

Contract Program or Project Title:

The Application of the Internal Friction Nondestructive Evaluation Technique for Detecting Incipient Cracking of Bypass Lines and Pipes in Boiling Water Reactor Piping Systems

Subject of this Document:

Same as above

Type of Document:

Monthly progress report

Author(s)

L. L. Yeager

Date of Document:

Sept. 17, 1979

Responsible NRC Individual and NRC Office or Division:

J. Muscara
Metallurgy & Materials ResearchBranch
Division of Reactor Safety Research

This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

INTERIM REPORT

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DAEDALEAN ASSOCIATES, INC.

ENGINEERING, DESIGN AND ANALYSIS SERVICES

17 September 1979

Dr. Joseph Muscara
Nuclear Regulatory Commission
Division of Reactor Safety Research
Mail Station 1130SS
Washington, D. C. 20555

Dear Dr. Muscara:

Enclosed are two copies of the fifteenth progress report for Contract No. NRC-04-78-242 covering the reporting period from 18 August to 14 September 1979.

If you have any questions concerning the enclosed information, please do not hesitate to contact us.

Sincerely,

DAEDALEAN ASSOCIATES, Inc.

Larry L. Yeager
Technical Director
Material Systems Division

Enclosures

cc: Accessions Unit

NRC Research and Technical Assistance Report

1325 332

DAEDALEAN ASSOCIATES, Incorporated

PROGRESS REPORT NO. 15

THE APPLICATION OF THE INTERNAL FRICTION NONDESTRUCTIVE EVALUATION TECHNIQUE FOR DETECTING INCIPIENT CRACKING OF BYPASS LINES AND PIPES IN BOILING WATER REACTOR PIPING SYSTEMS

Submitted to:

Nuclear Regulatory Commission
Division of Reactor Safety Research
Washington, D. C. 20555

Contract Number
NRC-04-78-242

Report of Progress During the Period
18 August 1979 to 14 September 1979

September 1979

1325 333

THE APPLICATION OF THE INTERNAL FRICTION NONDESTRUCTIVE EVALUATION TECHNIQUE FOR DETECTING INCIPIENT CRACKING OF BYPASS LINES AND PIPES IN BOILING WATER REACTOR PIPING SYSTEMS

PROGRESS DURING THE REPORTING PERIOD

During this reporting period, pipe specimen Number 3 was cycled to failure at the Battelle Northwest Laboratory PDL. Pipe specimen Number 3 failed on the seventy-sixth tensile load cycle during the increasing load stage. First internal friction damping indications of incipient cracking were noted during load cycle 12. Five resonant frequencies were monitored with both accelerometers. Figures 1 through 15 show the measured specific damping capacities for each accelerometer at the various resonant frequencies.

Pipe specimen Number 3 was tensile stressed to 150% of yield from the beginning. Therefore, the initial phase of ram seating appears to have required only two load cycles. As seen in Figures 1 through 6, the specific damping capacity values for resonant frequencies of ∿1800 Hz and ∿2250 Hz indicated increased internal friction to those vibrational modes between load cycles 12 and 30, indicating incipient crack formation. Vibration at resonant frequencies of ∿4300 Hz and ∿4800 Hz saw increased damping due to dislocation propagation during the 30 load cycles just prior to failure (Figures 7 through 12).

Pipe specimen Number 4 is presently being stress cycled and monitored at Battelle. It is anticipated that this pipe specimen should fail between 200 and 300 load cycles.

Present schedule indications for instrumenting the Zion 1 Nuclear Power Station feedwater lines are October 10 to 15, 1979.

SUMMARY OF IMPORTANT TRIPS, CONFERENCES, MEETINGS AND BRIEFINGS

From August 13, 1979 through August 18, 1979, Mr. Bruce Jachowski of DAI monitored the internal friction damping of pipe specimen Number 3 at Battelle Northwest Laboratories.

UNANTICIPATED TECHNICAL OR MANAGEMENT PROBLEMS

None

ANTICIPATED PROBLEMS

None

REQUIREMENTS FOR CHANGES IN KEY PERSONNEL

None

1325 335

ANTICIPATED COST AND COMPLETION SCHEDULE

Because of the delay incurred in SCC testing at Battelle Northwest and instrumentation problems at the Dresden Nuclear Facility, a three month extension of the present phase has been granted with no additional costs to be incurred by the U. S. Nuclear Regulatory Commission.

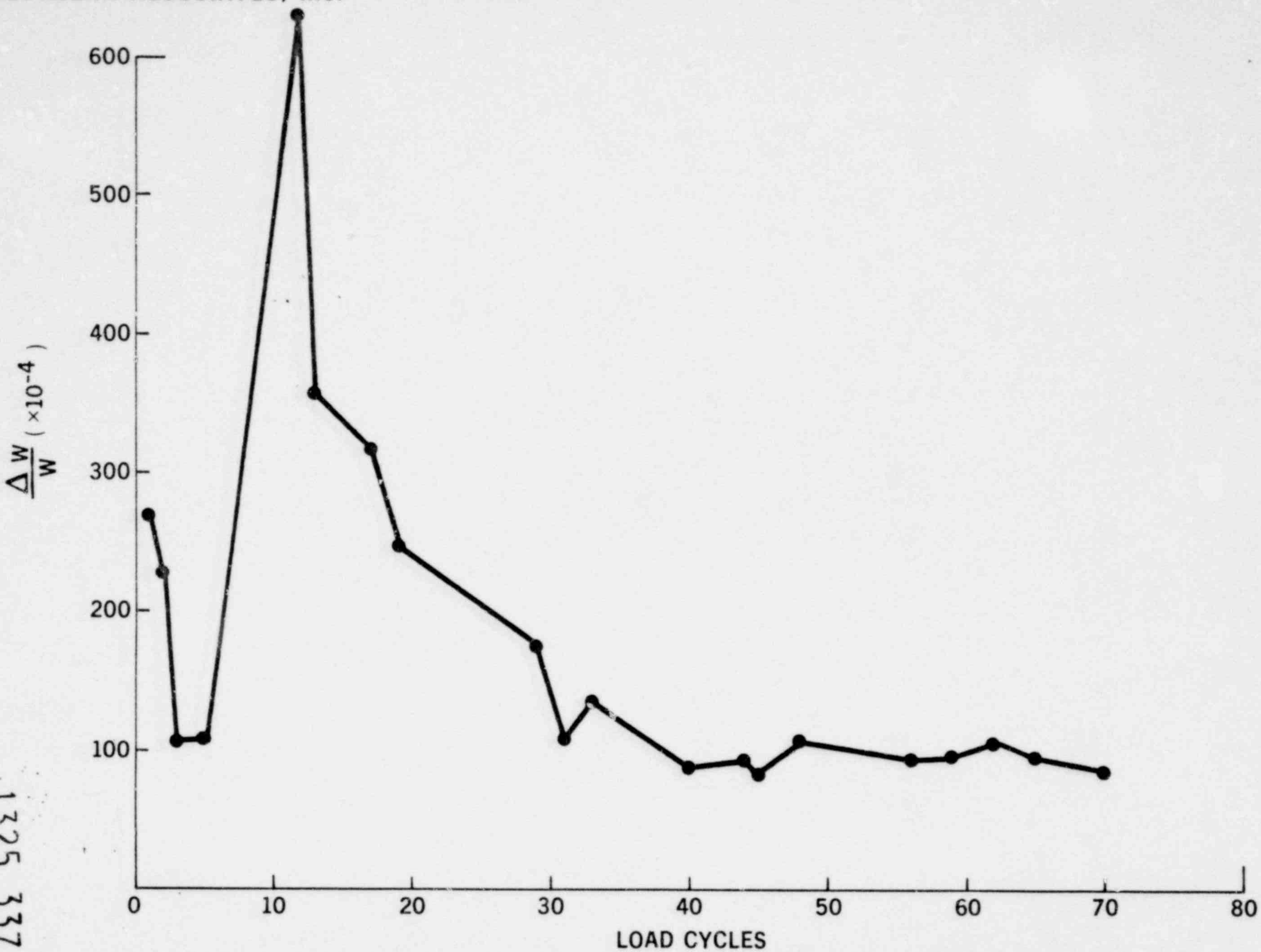

FIGURE 1 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO. 3, ACCELEROMETER A-1 AT 1770HZ, RAMS AT MAXIMUM LOAD

1325 337

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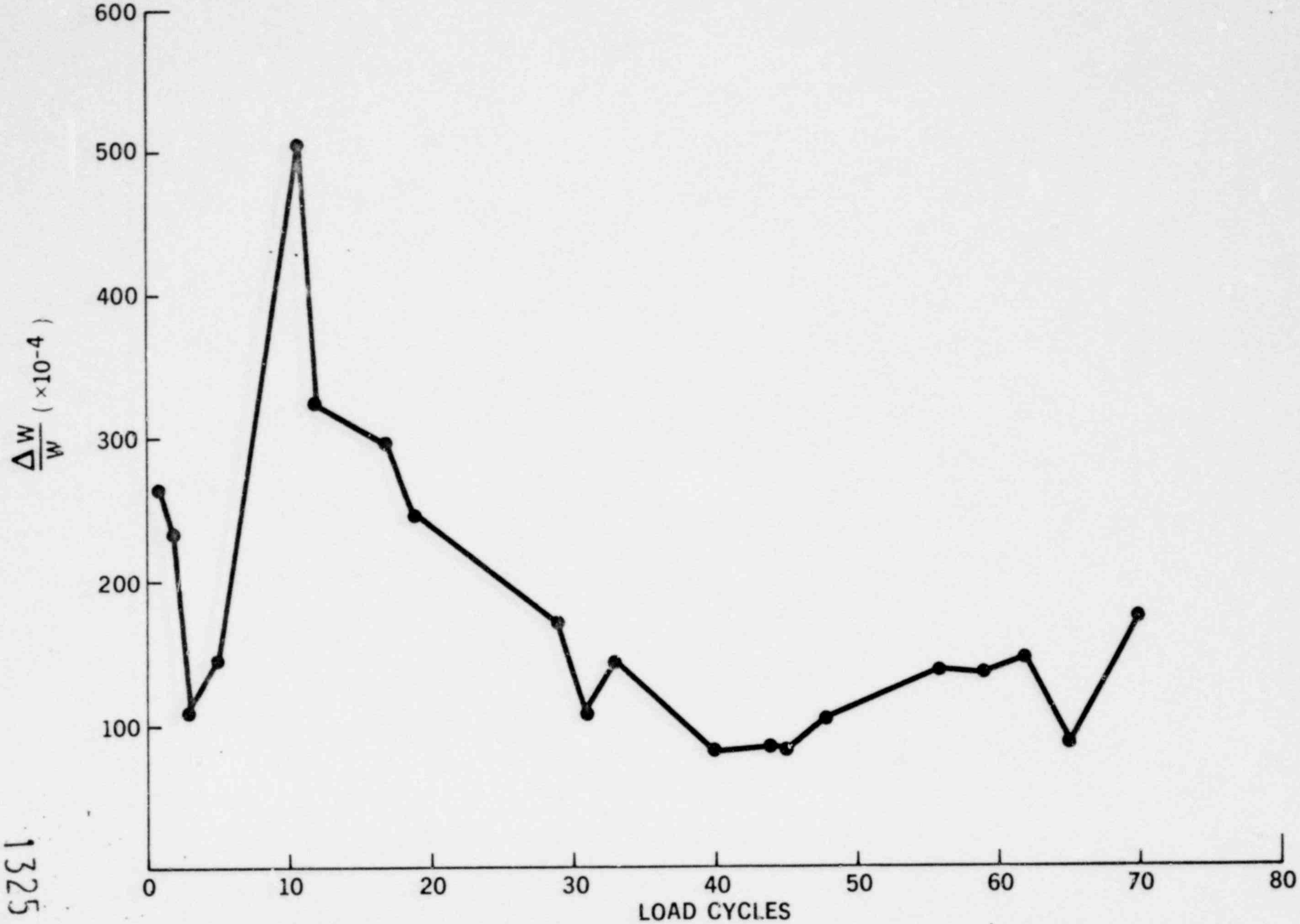

FIGURE 2 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO. 3, ACCELEROMETER A-2 AT 1785HZ, RAMS AT MAXIMUM LOAD

1325 338

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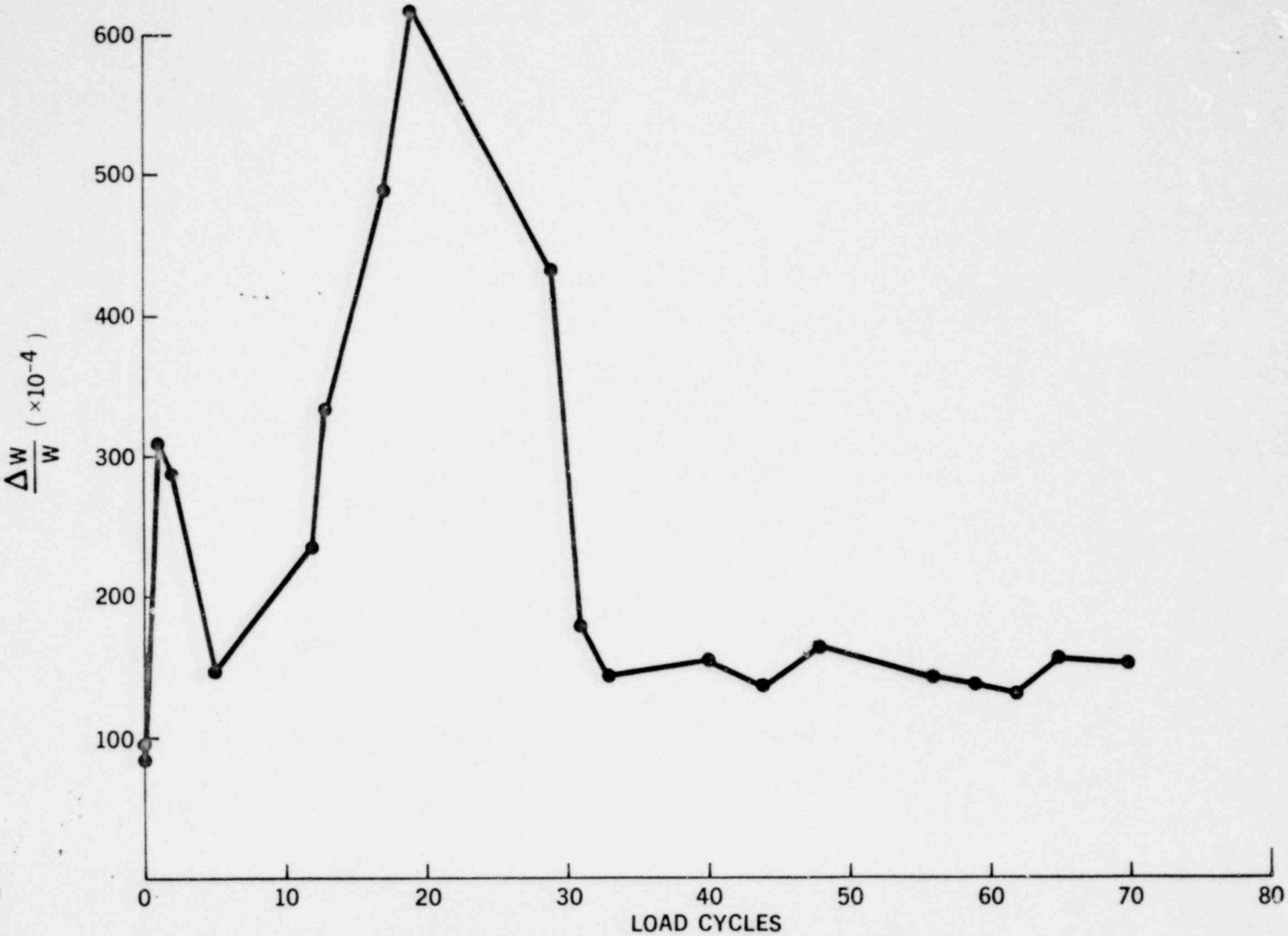

FIGURE 3 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-1 AT 1800HZ, RAMS AT MINIMUM LOAD

1325 339

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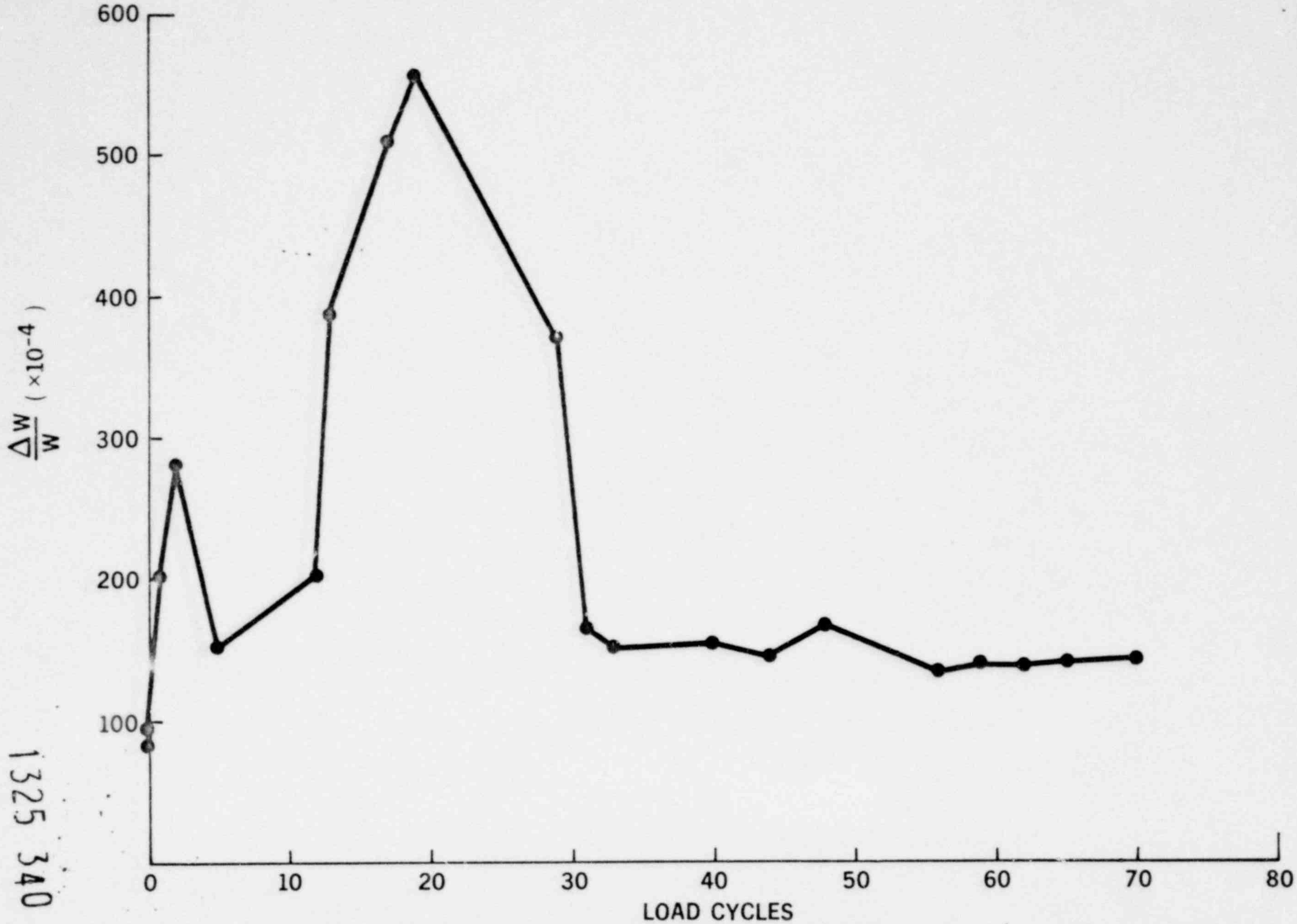

FIGURE 4 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIFIC SPECIMEN NO.3, ACCELEROMETER A-2 1770HZ AT, RAMS AT MINIMUM LOAD

1325 340

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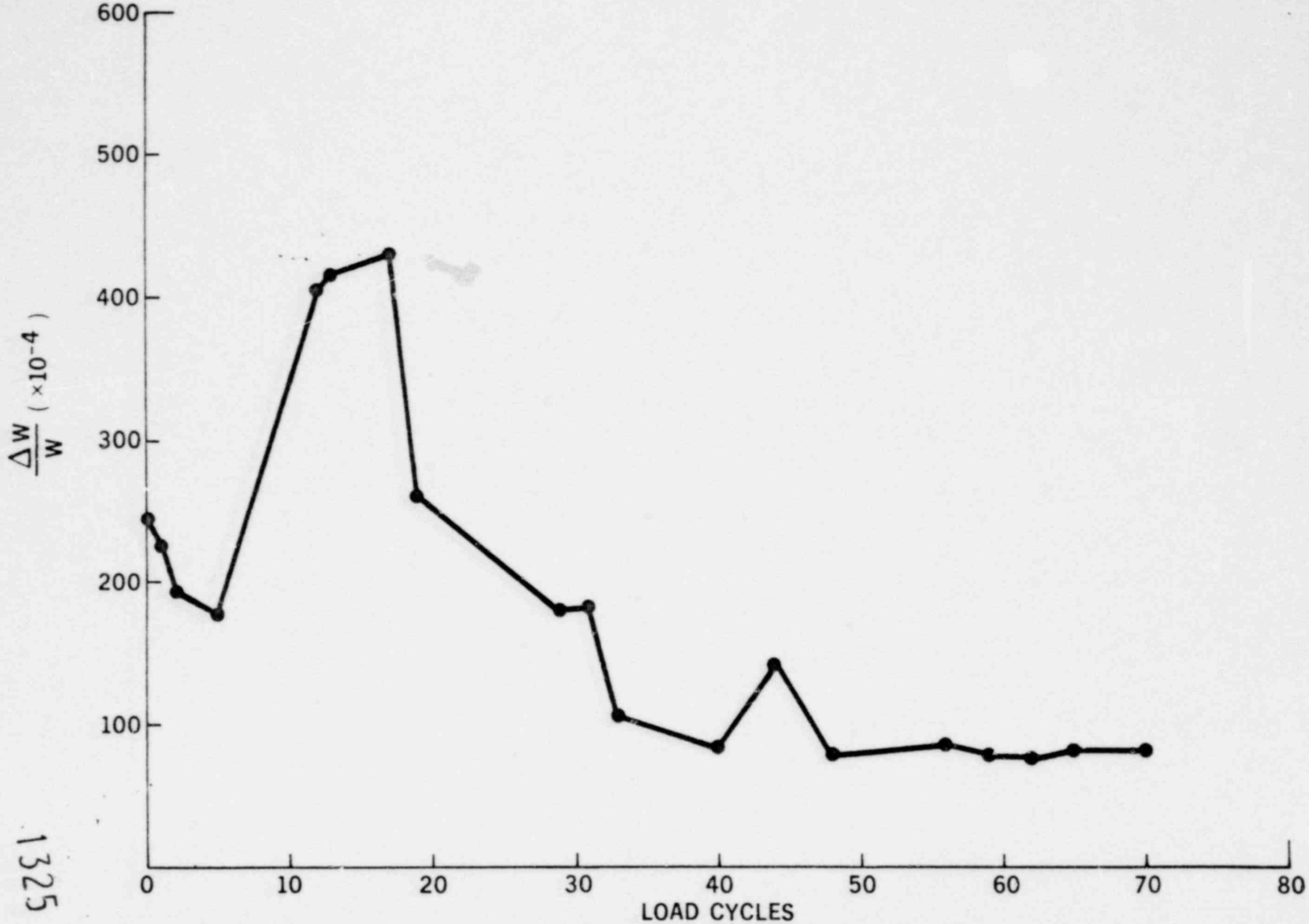

FIGURE 5 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3. ACCELEROMETER A-1 AT 2240HZ, RAMS AT MINIMUM LOAD

1325 341

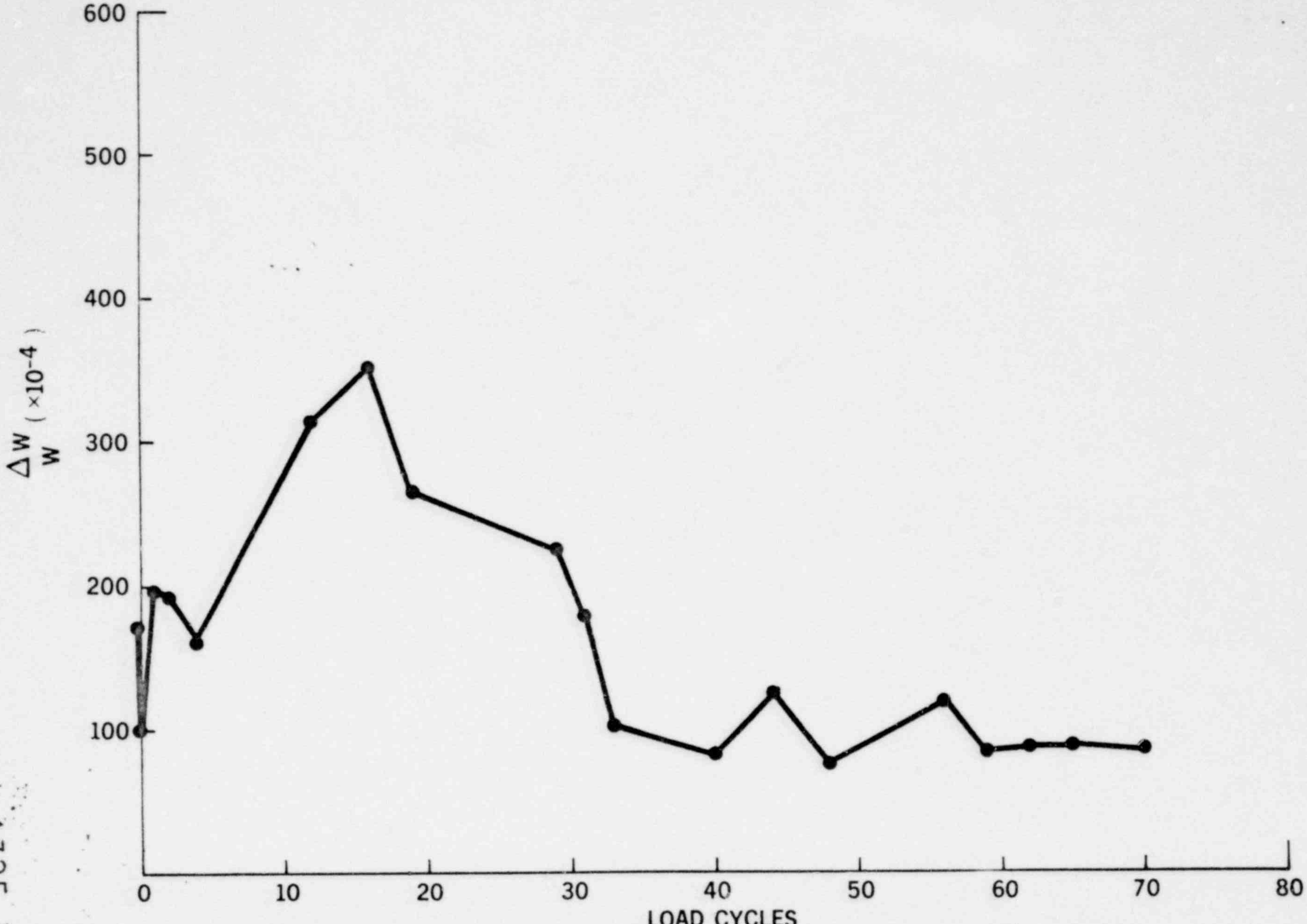

FIGURE 6 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3. ACCELEROMETER A-2 AT 2250HZ, RAMS AT MINIMUM LOAD

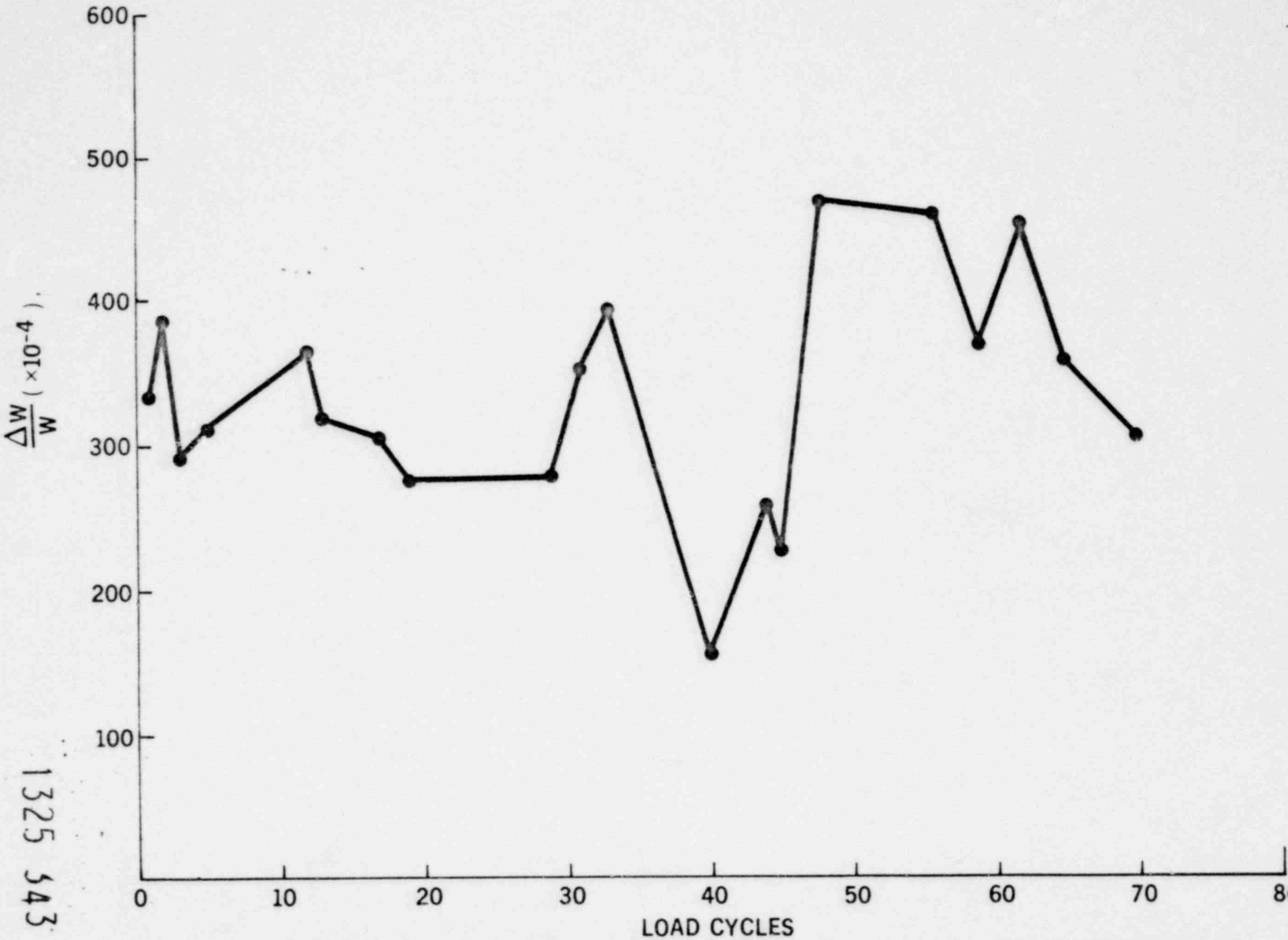

FIGURE 7 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3. ACCELEROMETER A-1 AT 4310HZ, RAMS AT MAXIMUM LOAD

1325 343

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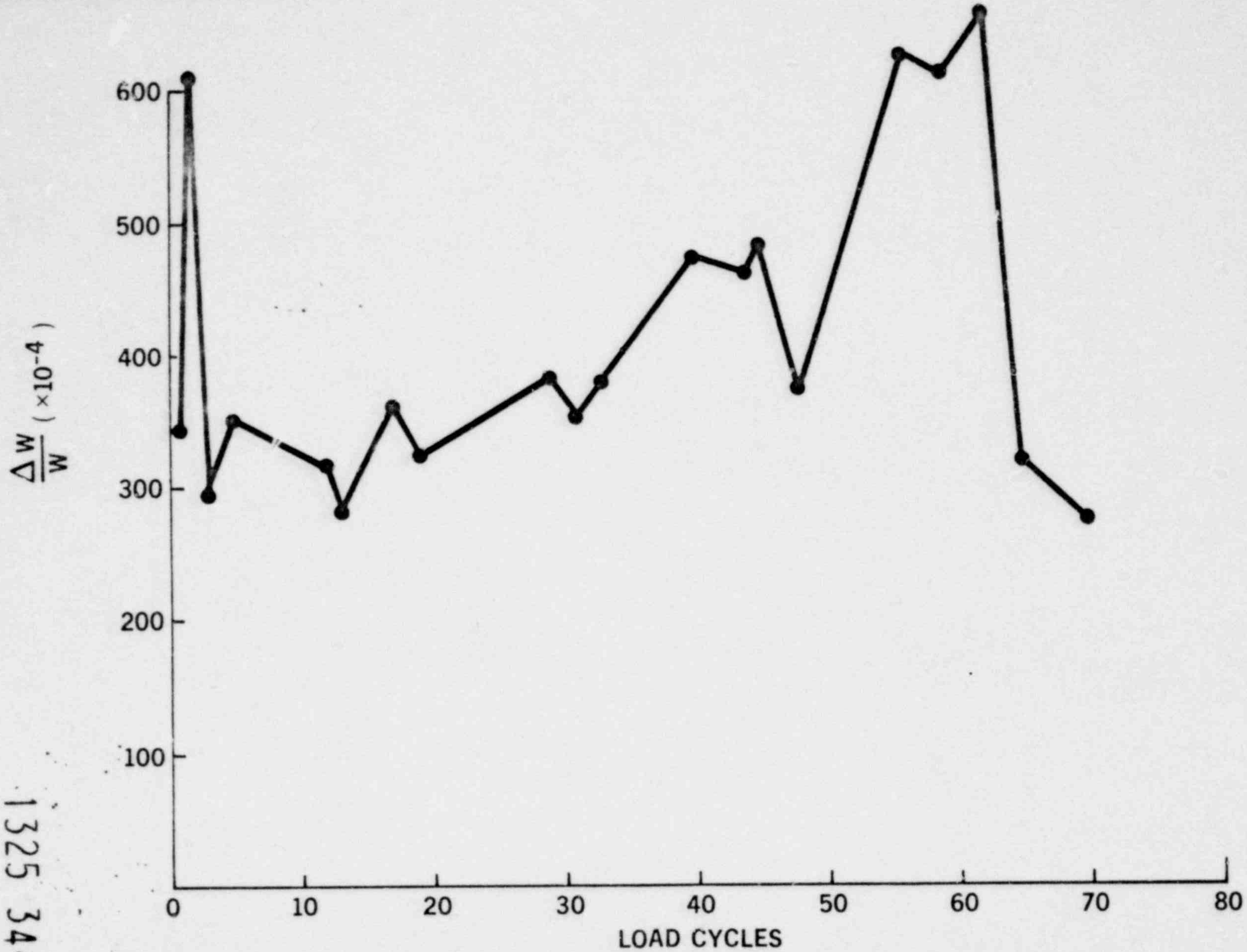

FIGURE 8 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-2 AT 4315HZ, RAMS AT MAXIMUM LOAD

1325 344

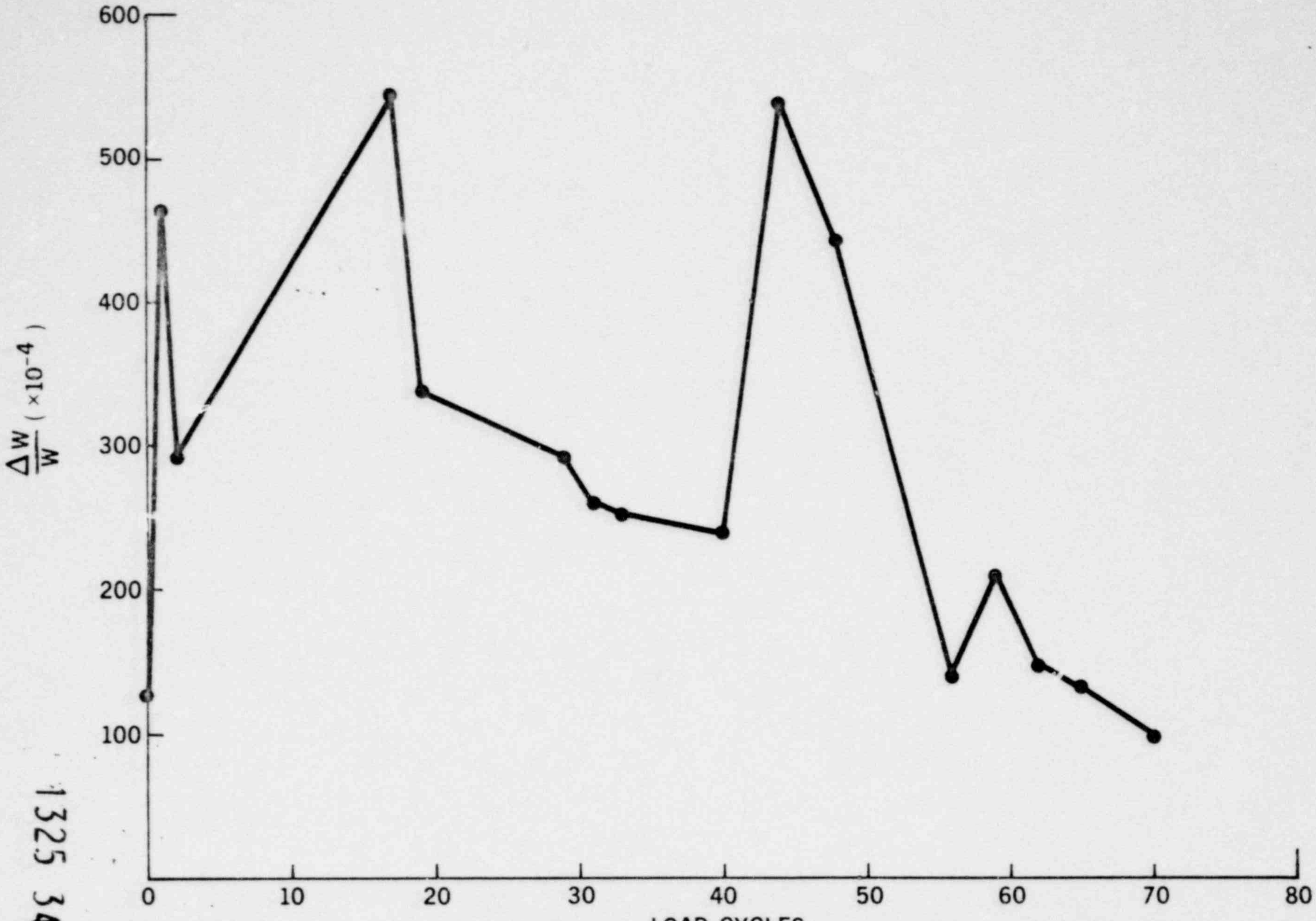

FIGURE 9 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3. ACCELEROMETER A-1 AT 4800HZ. RAMS AT MINIMUM LOAD

1325 345

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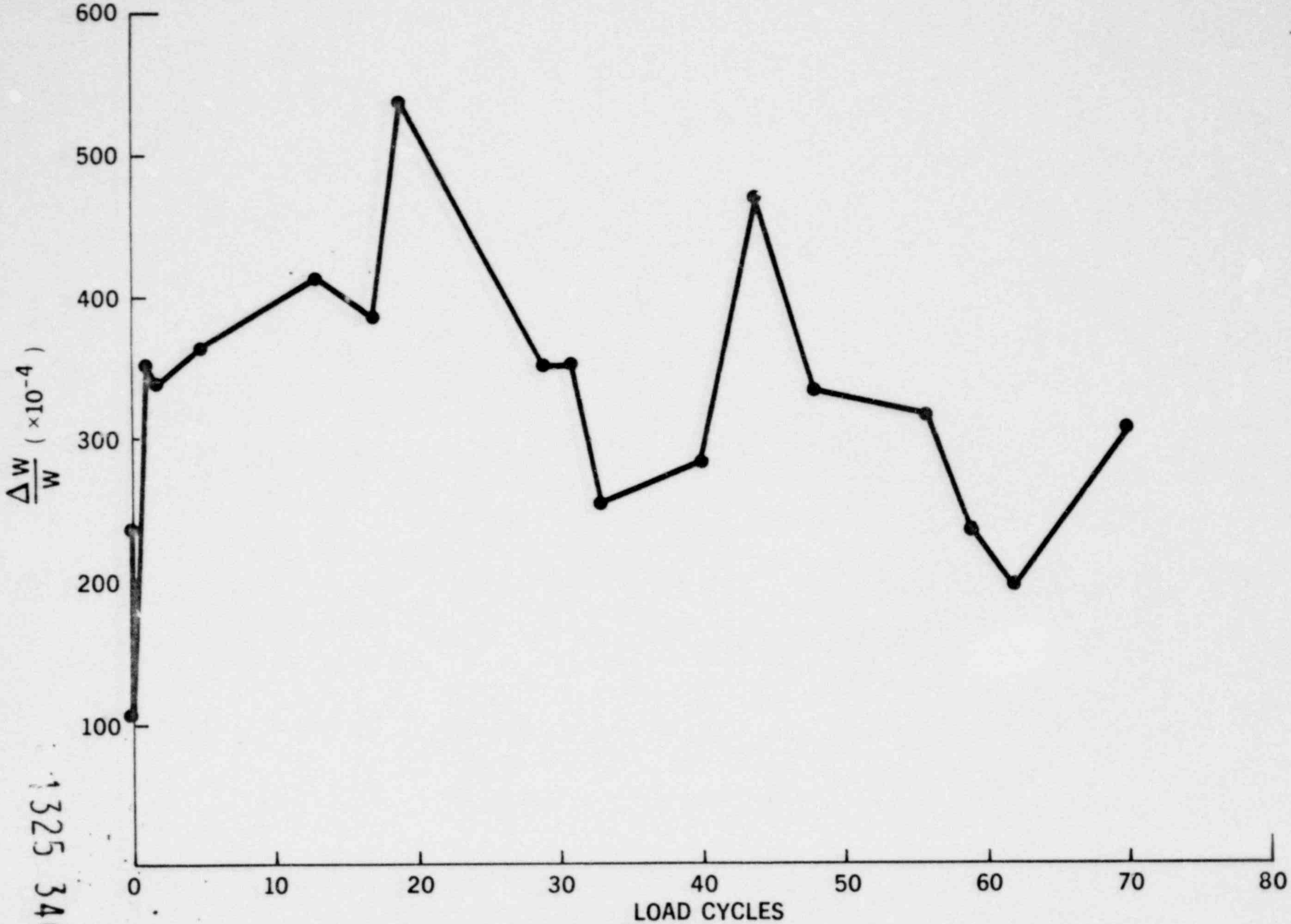

FIGURE 10 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3. ACCELEROMETER A-2 AT 4800HZ. RAMS AT MINIMUM LOAD

1325 346

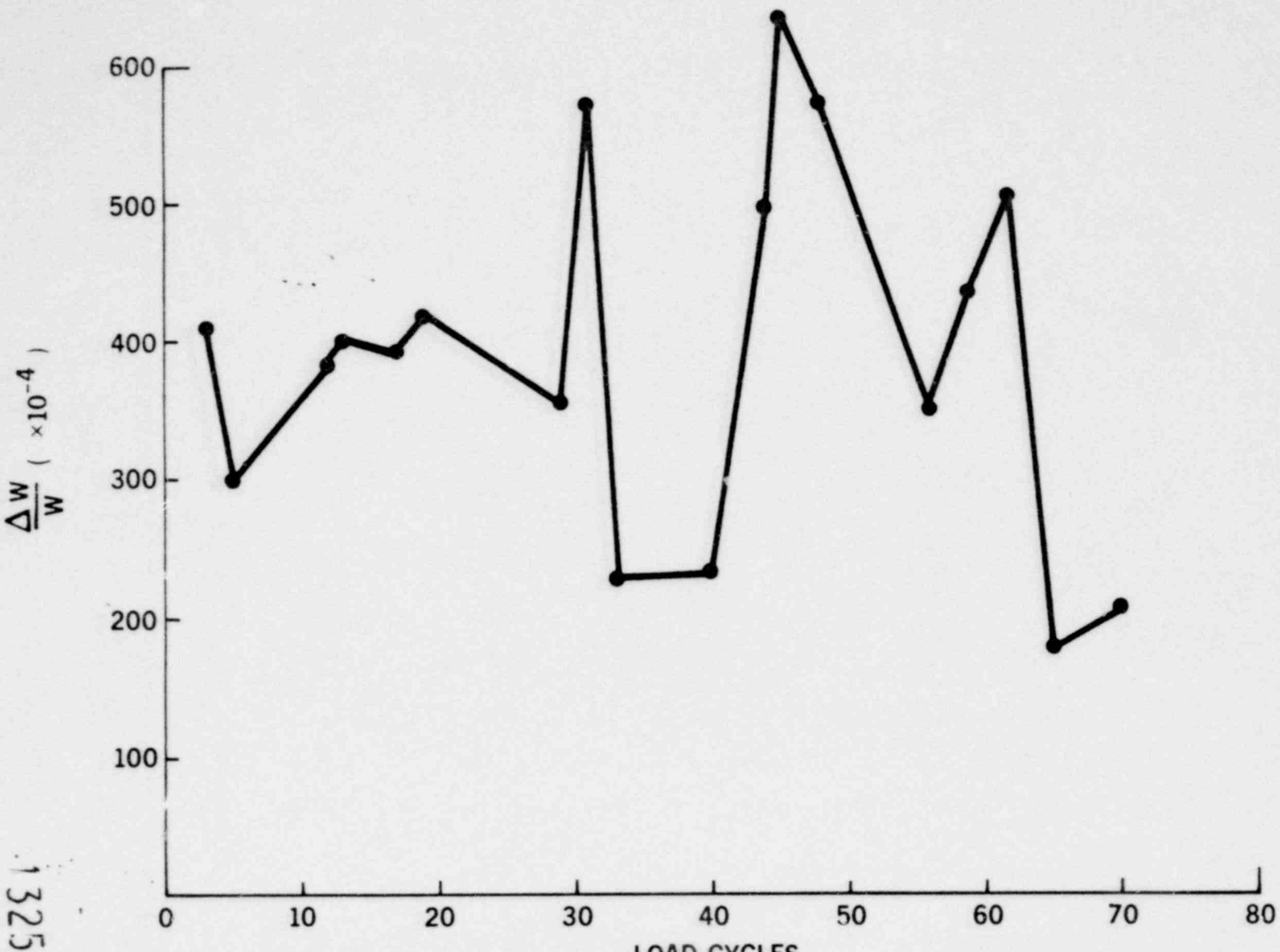

FIGURE 11 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-1 4803HZ, RAMS AT MAXIMUM LOAD

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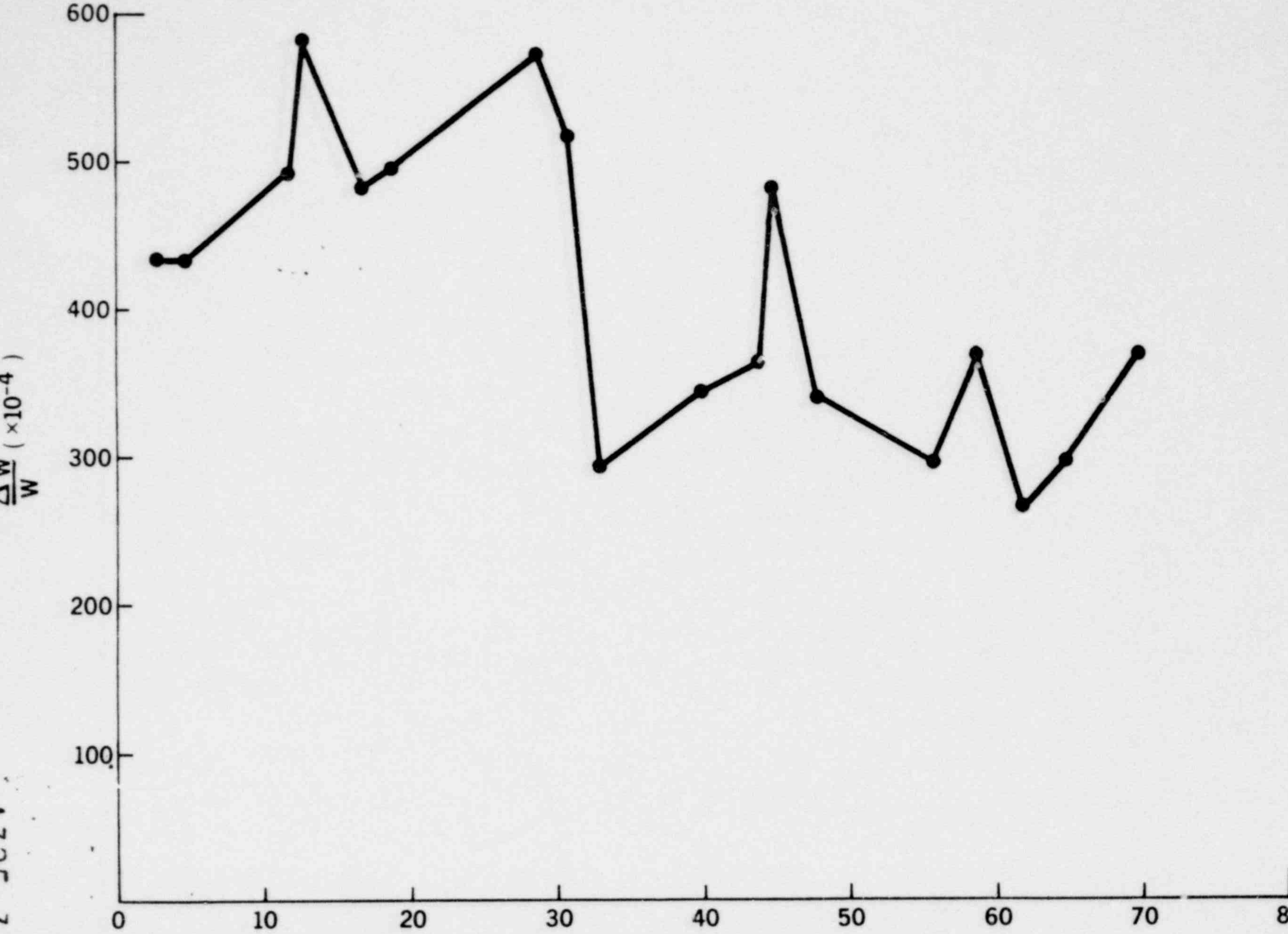

FIGURE 12 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-2 AT 4800HZ, RAMS AT MAXIMUM LOAD

1325 348

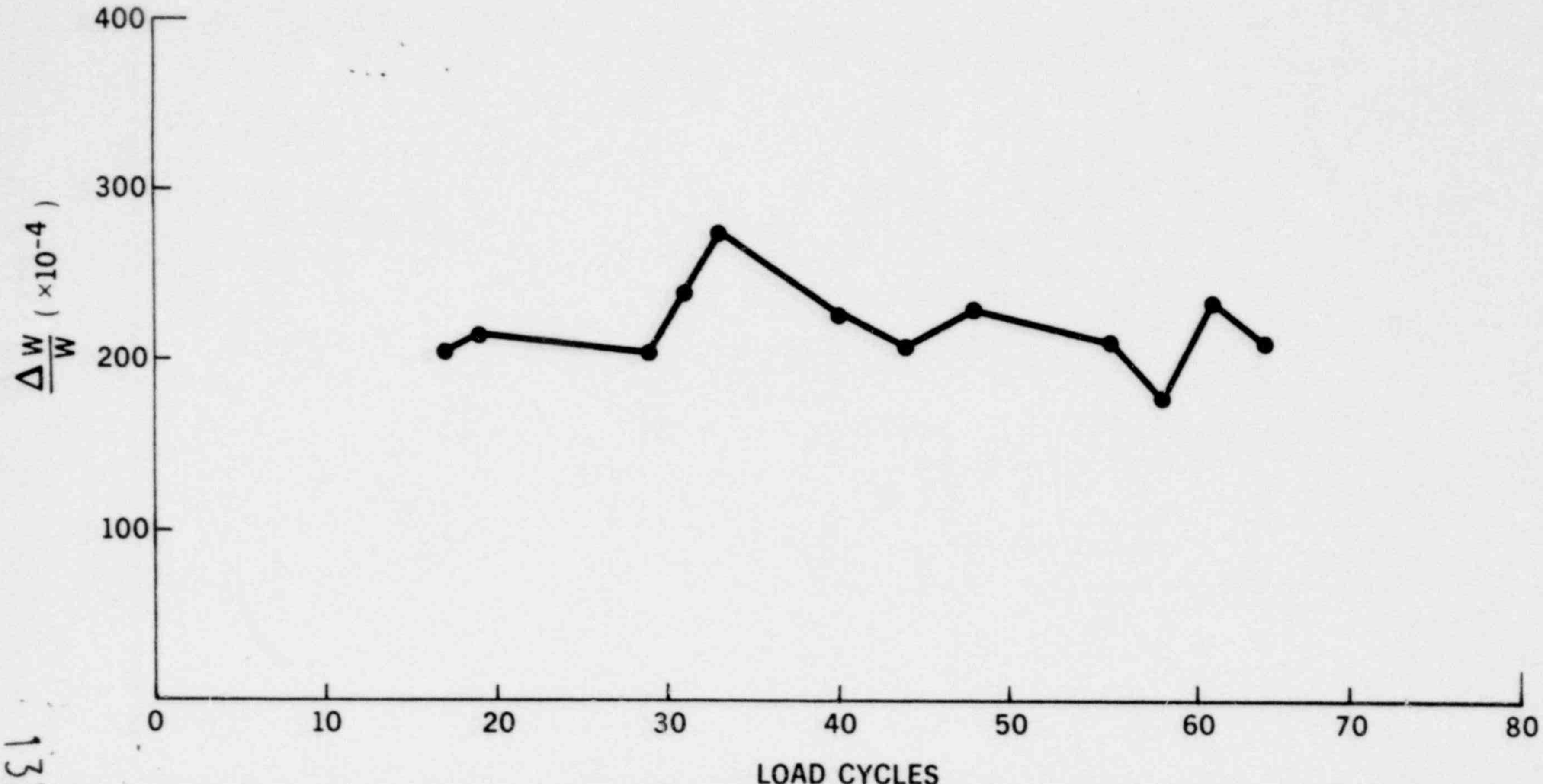

FIGURE 13 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-1 AT 5850HZ, RAMS AT MINIMUM LOAD

1325 342

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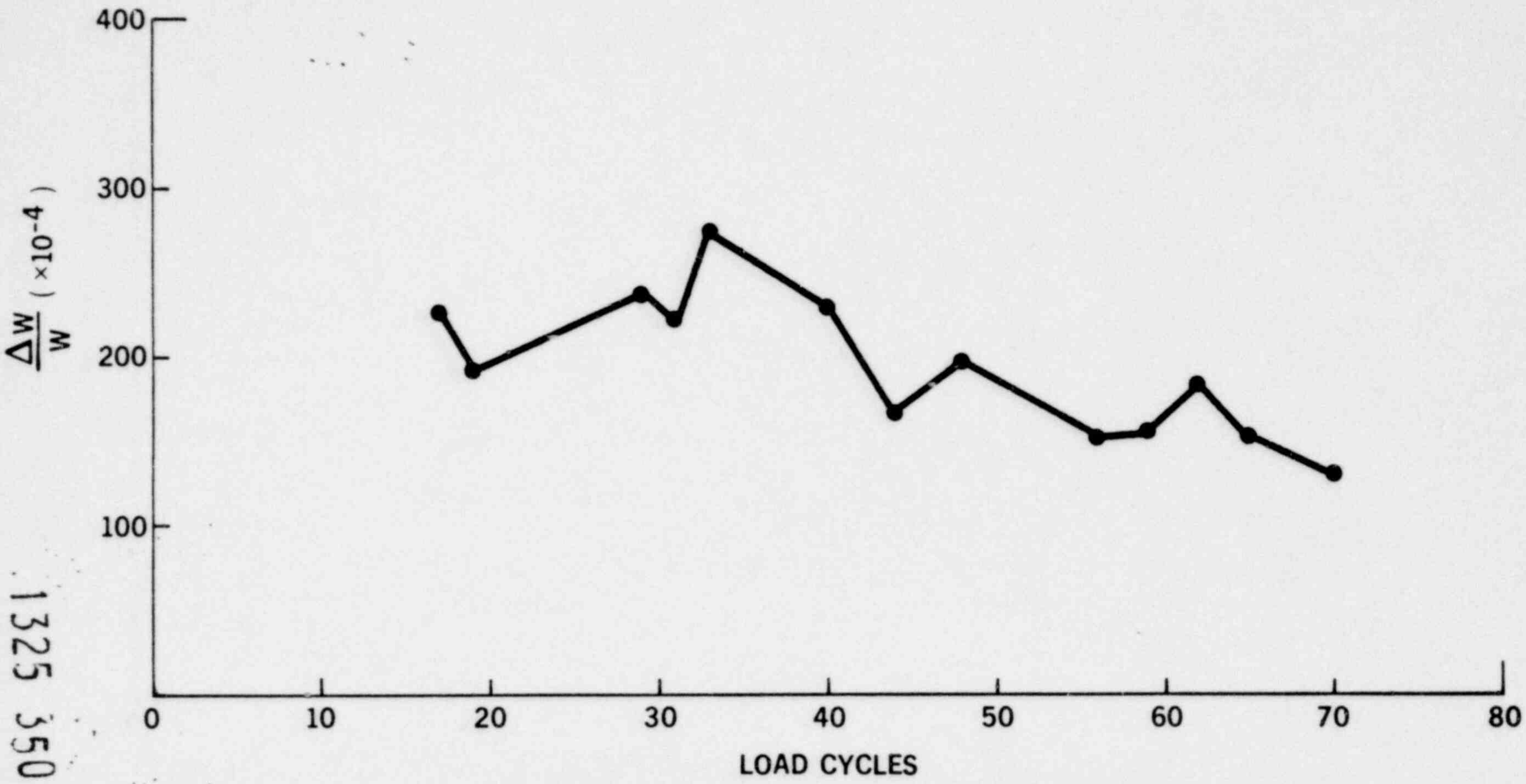

1325 350

FIGURE 14 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-2 AT 5850HZ, RAMS AT MINIMUM LOAD

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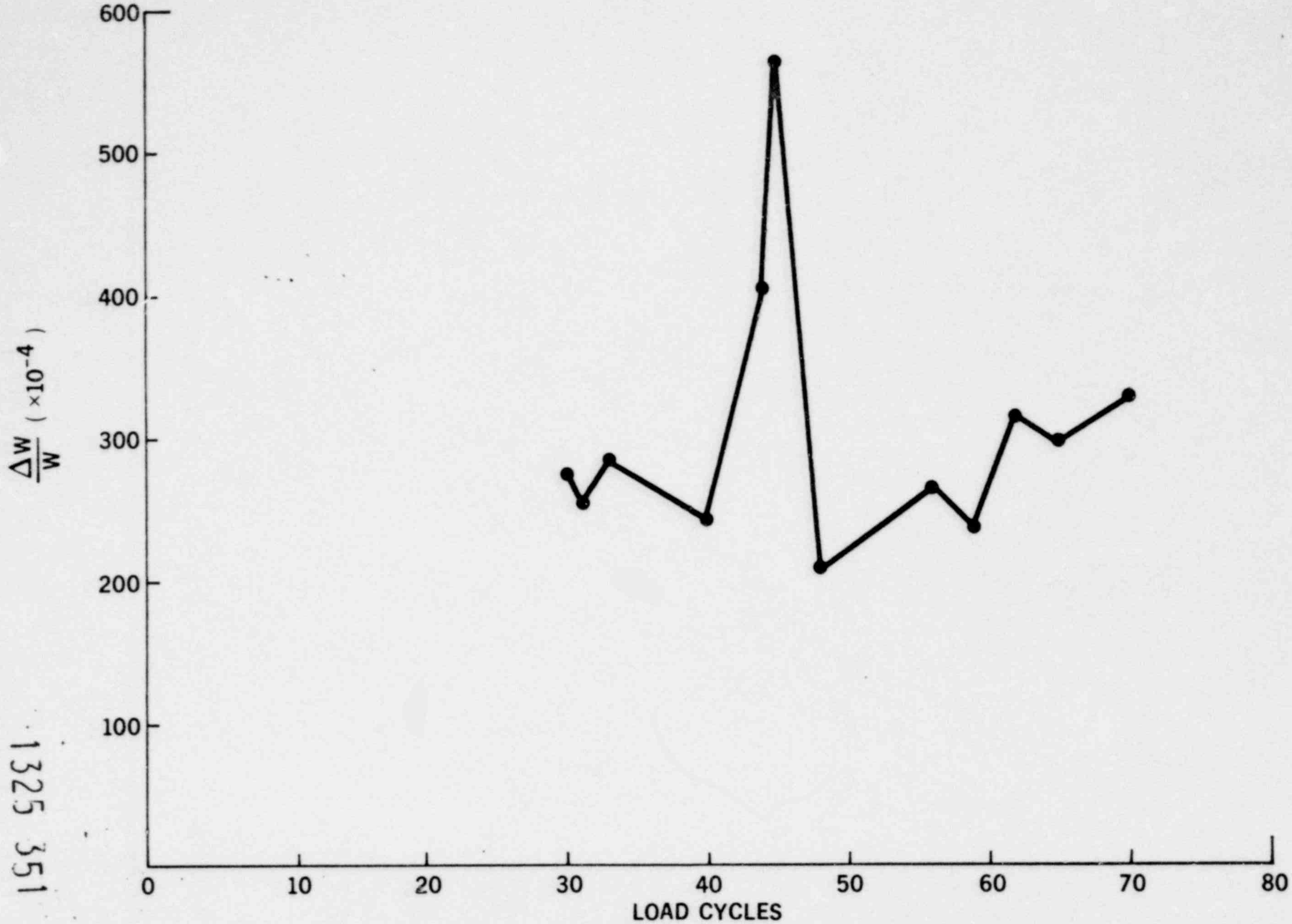

FIGURE 15 SPECIFIC DAMPING CAPACITY VERSUS LOAD CYCLE FOR SCC SPECIMEN NO.3, ACCELEROMETER A-1 AT 5850HZ, RAMS AT MAXIMUM LOAD

1325 351