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AUTH.NAME AUTHOR AFFILIATION
FITZPATRICK,E.E Indiana Michigan Power Co. (formerly Indiana & Michigan Ele
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SUBJECT: Provides revised relief request from provisions of ASME Section XI for containment spray pump.

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Indiana Michigan
Power Company
500 Circle Drive
Buchanan, MI 49107 1395

INDIANA MICHIGAN POWER

June 27, 1997

AEP:NRC:0969BD

Docket Nos.: 50-~~515~~ 315
50-~~516~~ 316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Donald C. Cook Nuclear Plant Units 1 and 2
REQUEST NO. 1 - REVISED RELIEF REQUEST FOR THE
THIRD TEN YEAR INTERVAL PUMP IN-SERVICE TEST PLAN

The purpose of this letter is to provide a revised relief request from the provisions of ASME section XI for the containment spray pump. By letter AEP:NRC:09691M, dated June 12, 1996, we submitted the relief requests for the pump third ten year interval in-service test plan. By letter dated May 27, 1997, the NRC denied the relief request for the containment spray pump, stating insufficient information had been provided in the original request.

The revised relief request with additonal supporting information is submitted in the attachment to this letter.

Sincerely,

E E Fitzpatrick

E. E. Fitzpatrick
Vice President

vlb

Attachment

c: A. A. Blind
A. B. Beach
MDEQ - DW & RPD
NRC Resident Inspector
J. R. Padgett

A047 1/1

010054

ATTACHMENT TO AEP:NRC:0969BD

REQUEST NO. 1 - REVISED RELIEF REQUEST
THIRD TEN-YEAR INTERVAL PUMP IN-SERVICE TEST PLAN

REQUEST NO. 1 - REVISED RELIEF REQUEST
THIRD TEN-YEAR INTERVAL PUMP IN-SERVICE TEST PLAN

TITLE: Containment Spray Pump Vibration Limits

UNIT APPLICABILITY: Units 1 and 2

PUMP NAME: Containment Spray

PUMP NUMBER(S): PP-009

SYSTEM: Containment Spray (CTS)

FLOW DIAGRAM: 5144 ASME CLASS: 2

PUMP FUNCTION: Provide cooling water flow to spray the containment atmosphere in a LOCA or steamline break.

RELIEF TYPE: Compliance with code requirements is impractical.

ASME CODE TEST REQUIREMENT REFERENCE:

OMa-1988, Part 6, Table 3a
Ranges for Vibration Test Parameters

CODE REQUIREMENT DESCRIPTION:

(For centrifugal pumps ≥600 rpm)
Acceptable range ≤2.5 vibration reference value (Vr)
Alert range >2.5 Vr to 6 Vr or >0.325 in/sec
Required action range >6 Vr or >0.70 in/sec

BASIS FOR CODE COMPLIANCE BEING IMPRACTICAL

Limitation of the containment spray system (CTS) test circuitry and design of this type of pump both affect indicated performance to such an extent compliance with the absolute maximum values for the alert, and action ranges shown in table 3a of the code, would be impractical due to the significant redesign and modifications required to reduce vibration.

These pumps are single stage vertical 8x12x24 double volute/double suction, and are equipped with an impeller having only four vanes. They are not closed coupled, but all bearings are located up in the driver, above the sleeve type coupling used to connect the drive shaft. This configuration results in a relatively high reinforced vibration response at the corresponding vane pass frequency equal to 4x running speed, 7200 cpm, which dominates the overall vibration amplitude.

The spectral data taken during the last year (figures 1 through 5) illustrate the actual measurements at all five data points for the unit 1 east CTS pump, and represent a typical velocity spectra. The manufacturer has confirmed this performance is to be expected given the test conditions described below.

Prior to implementation of the third ten year interval testing program that began on July 1, 1996, these pumps were tested in accordance with the summer addenda to the 1983 edition of ASME code section XI. That edition of the code required a displacement be

measured in one direction normal to the shaft and only at the inboard bearing. The acceptance criterion was a multiple of the normal reference, and no absolute maximum value existed. The detailed vibration data required by OMa-1988 during the third ten year interval were not required. Thus, the corresponding vibration history is available only for the past year.

Contributing to this high level of overall vibration amplitude is the referenced point of test being limited to only 725 gpm due to a 3" pipe restricting flow back to the refueling water storage tank (RWST). Inherently, tests performed at a flow rate less than 25% of the pump's best efficiency point exhibit some hydraulic instability (NRC bulletin 88-04). The impeller's discharge angle does not match the stationary angle of either volute, thus producing high interactive forces between the two, causing resultant vibrations to be transmitted up the drive shaft and into the motor. These vibrations, which are high at low flow rates, are not indicative of a defective pump and would not be present at this level with the pump operating at its design point during a design basis accident.

The original design has performed reliably with no failures since initially placed into service over twenty-one years ago. However, the following three modifications were evaluated to obtain code compliance by reducing the overall level of pump vibration: 1) installing a different impeller having an odd number (five) of vanes; 2) installing an additional set of radial bearings on the drive shaft between the coupling and the pump's stuffing box extension; or 3) increasing the diameter of the recirculation pipe back to the RWST to allow the in-service testing to be performed at a higher flow rate. Each option was considered to be extensive and would require an extended outage to be installed. However, as noted earlier, the amplitude of the vibrations is a function of the pump operating at low flow and is not indicative of a defective pump. Although these changes would be expected to improve the test data taken at 725 gpm, they would not affect the capability of the pumps to provide adequate flow under accident conditions.

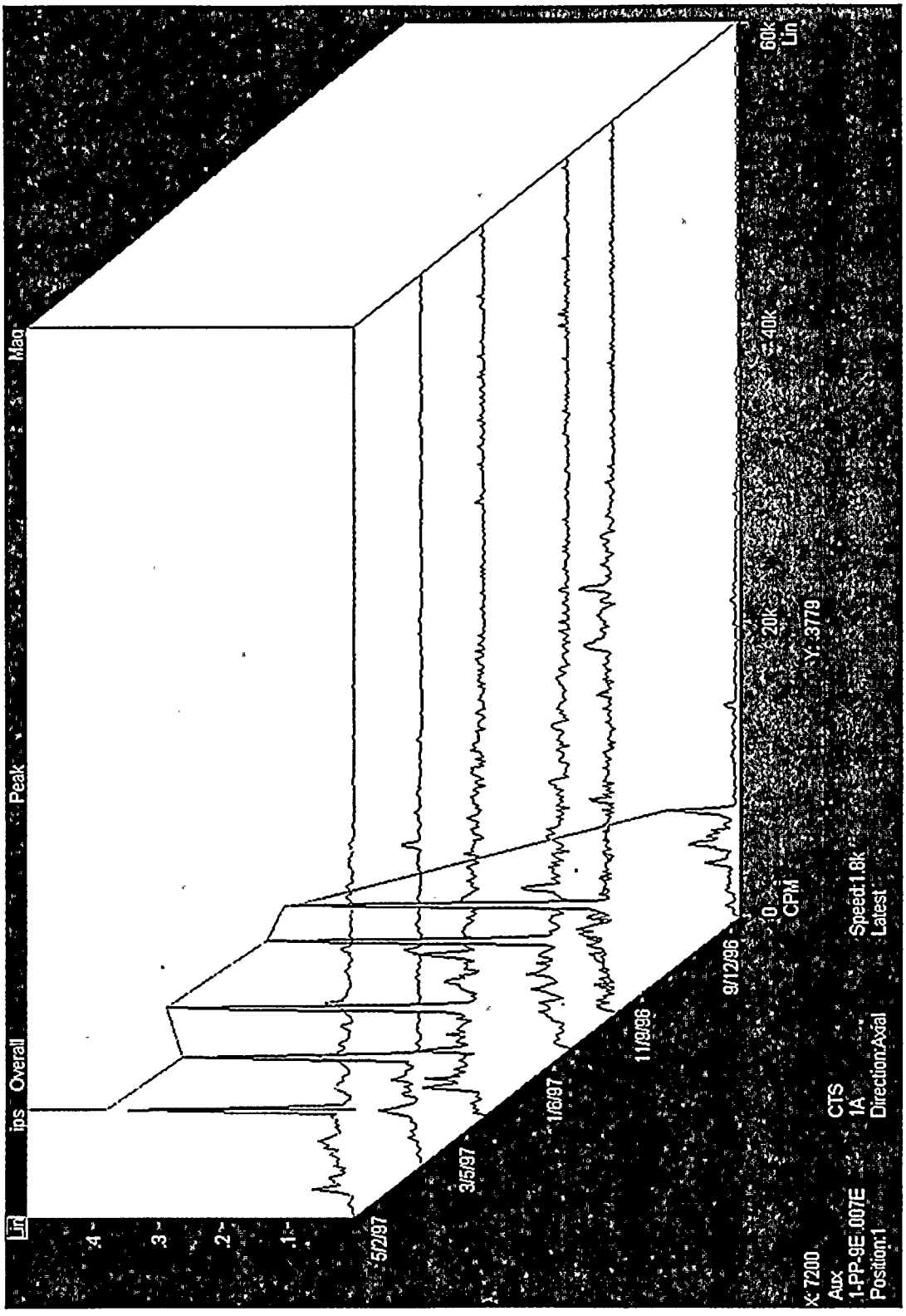
PROPOSED ALTERNATE TESTING

Acceptable range ≤2.0 Vr
Alert range >2.0 Vr to 4.0 Vr or 1.2 in/sec
Required action range >4 Vr or 2.0 in/sec

BASIS THAT THE ALTERNATE TESTING YIELDS ACCEPTABLE LEVELS OF QUALITY AND SAFETY

Although the maximum absolute values for the alert and action ranges have been increased to account for the normally high vane pass frequency response shown in figures 1 through 5, the corresponding multiplication factor(s) applied to the reference value have been reduced. This is being done to invoke an earlier analyses and evaluation of incremental deviations to performance as required by the "Acceptance Criteria", described within section 6.1 of the code, thus representing a conservative application of section 2.1, "Detection of Change". Analyzing performance more stringently for smaller deviations from the reference value satisfies the necessary standards for quality and safety required to verify operational readiness based on the best available in-service test.

The phenomenom that causes the high vibration at low flow rates is well known (NRC Bulletin 88-04), and during an accident, the pumps will operate at higher flow rates where the vibration levels are lower.


Lin
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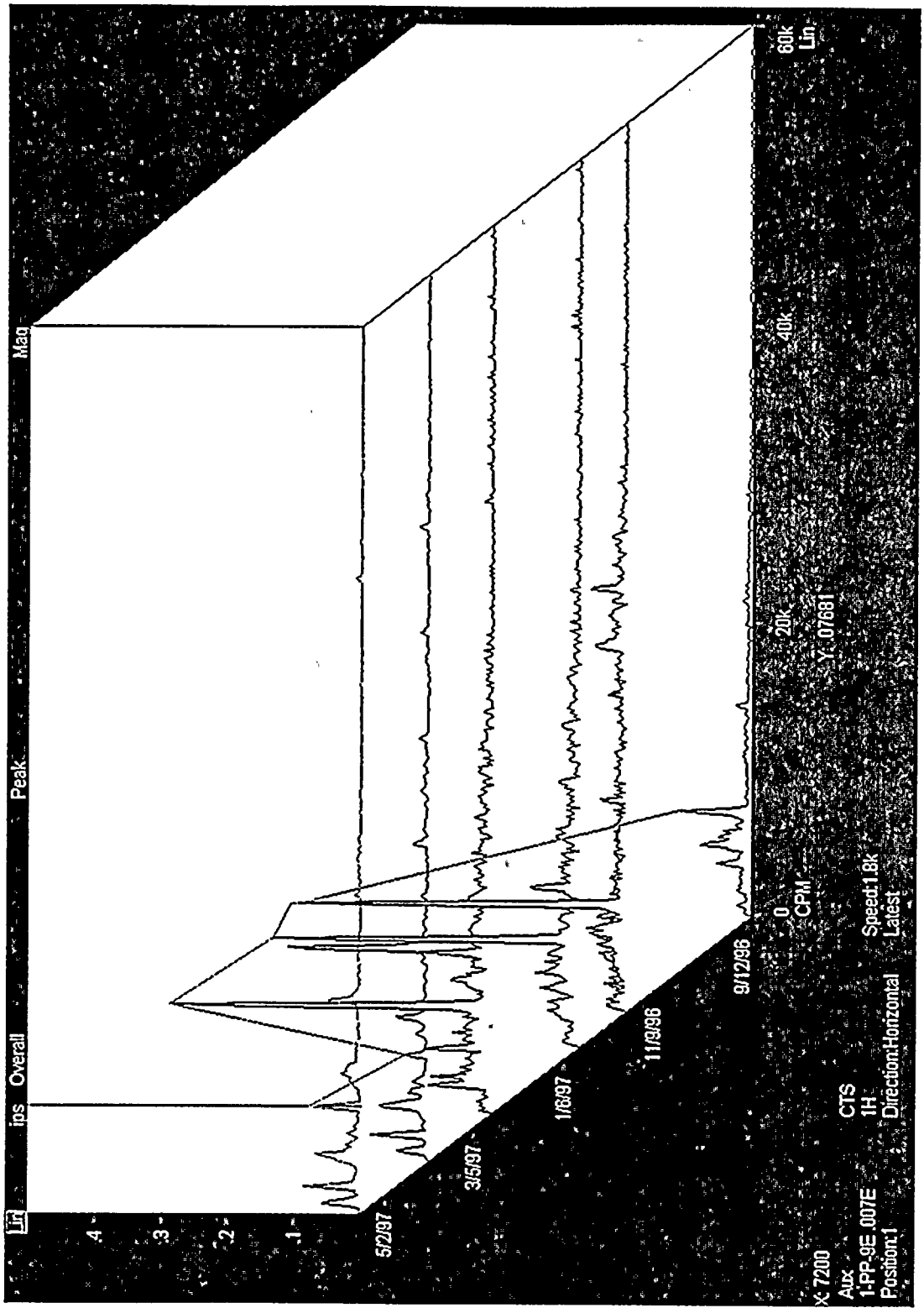
CPM
20k
40k
60k
Lin
Y: 3779
X: 7200
Aux
1-PP-9E 007E
Position:1
CTS
1A
Direction:Axial
Speed:1.8k
Latest

Figure 1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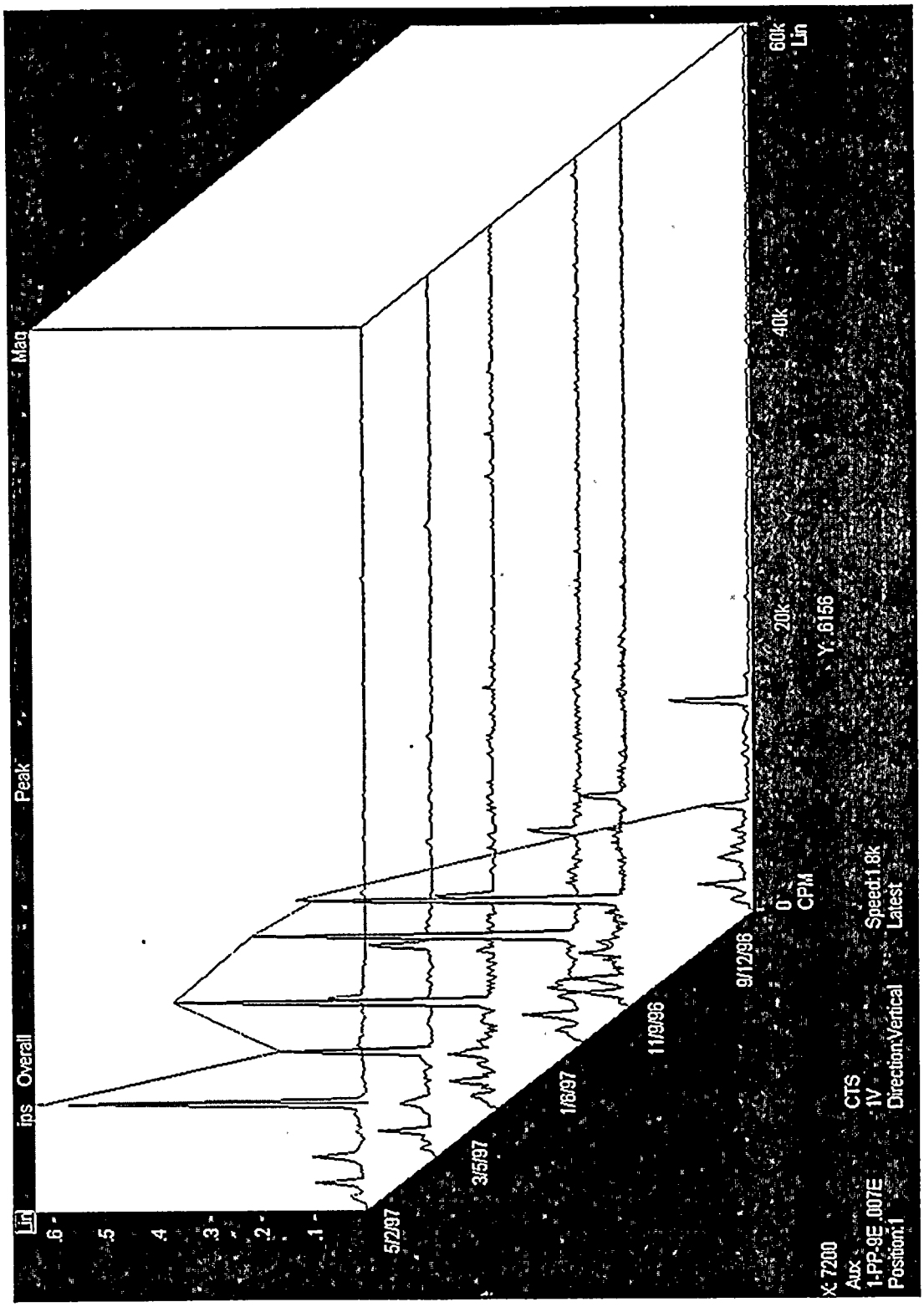
11/9/96
9/12/96
0
CPM
Speed:1.8k
Latest
60k
Lin
40k
20k
Y: 07681
X: 7200
Aux
1-PP-9E_007E
Position:1
CTS
1H
Direction:Horizontal

Figure 2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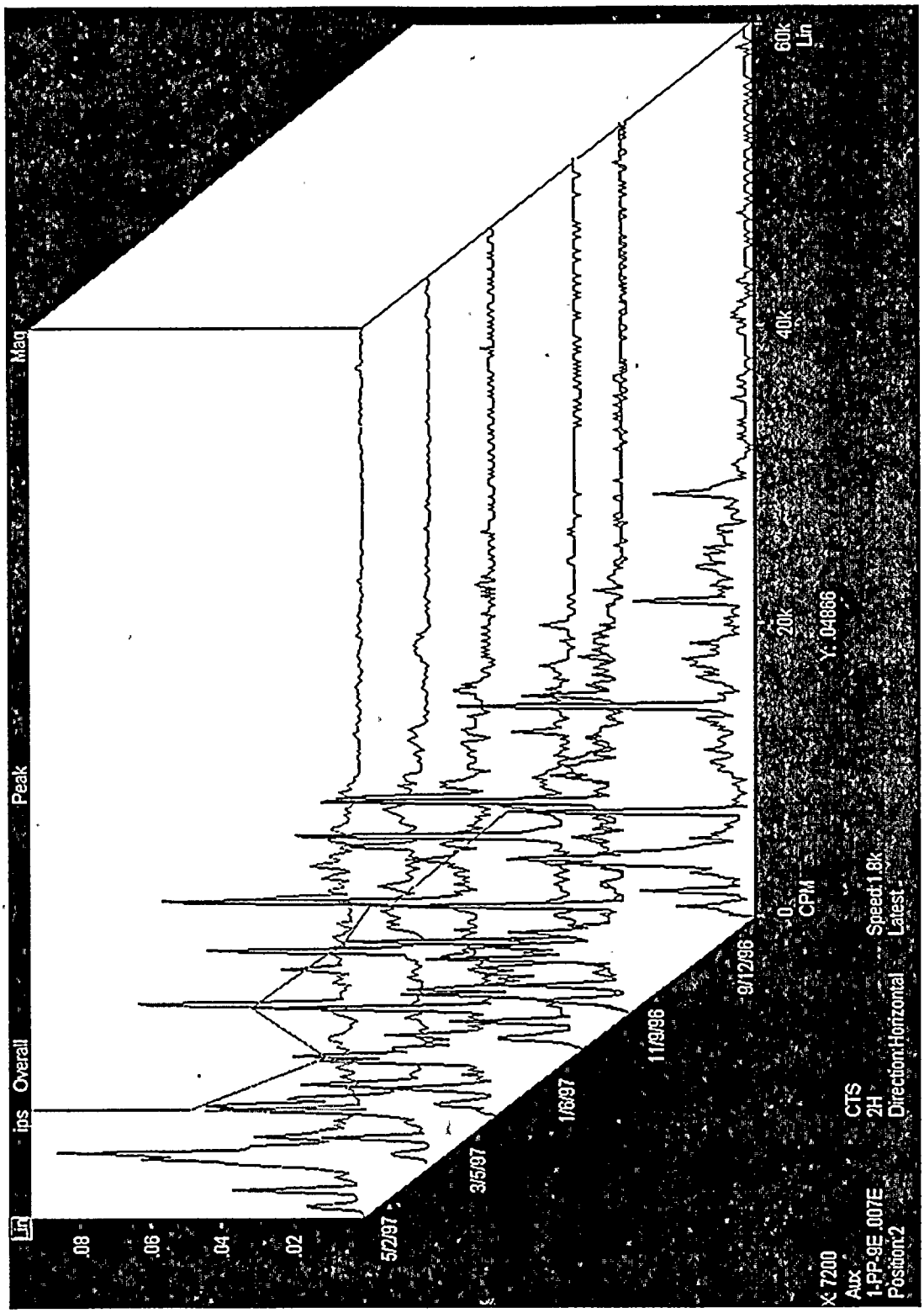
3/5/97
1/8/97
11/9/96
9/12/96
0
CPM
20k
40k
60k
Lin
Y: 6156
X: 7200
Aux
1-PP-9E_007E
Position:1
CTS
IV
Direction:Vertical
Speed:1.8k
Latest

Figure 3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Overall
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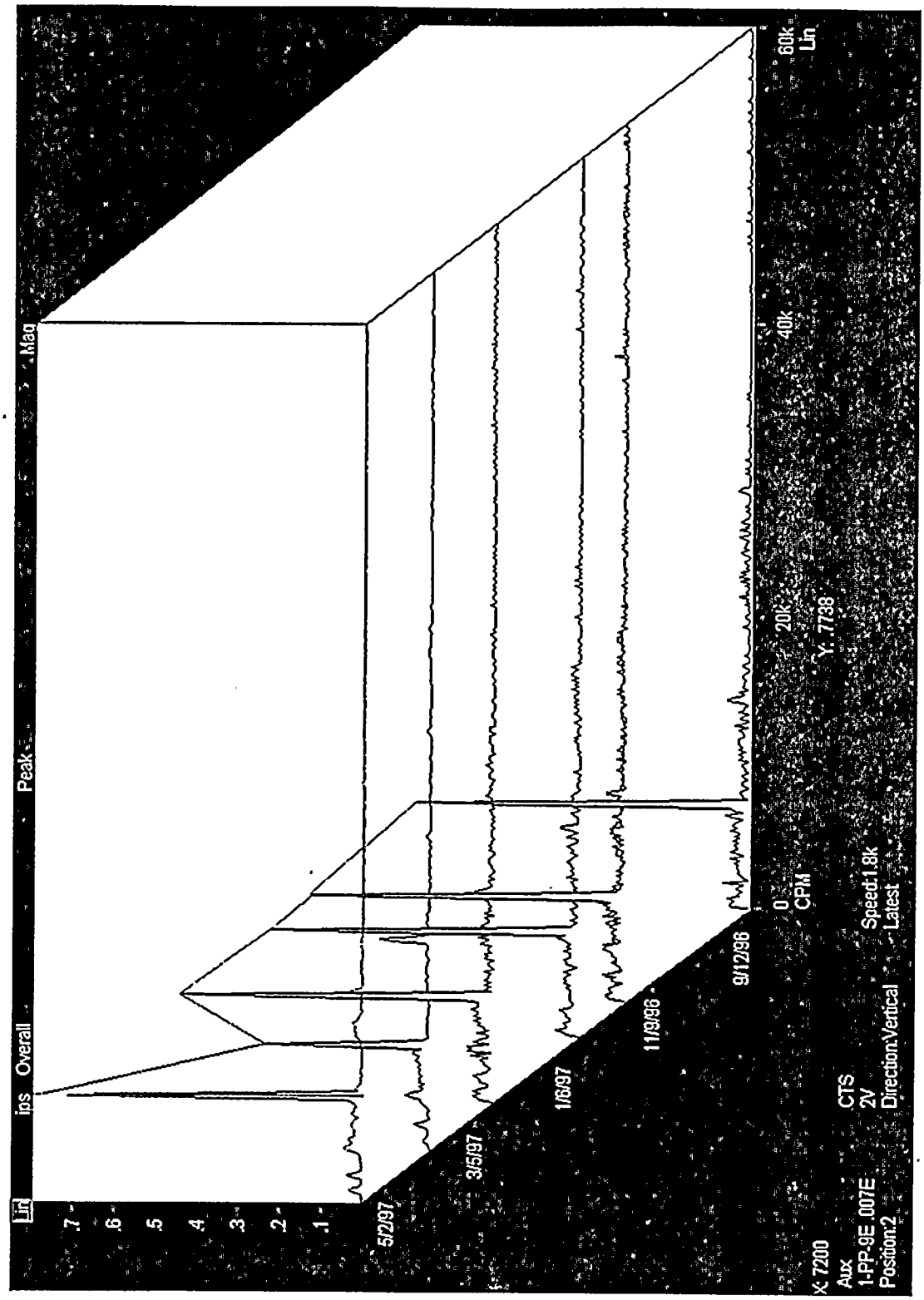
Max
.08
.06
.04
.02
5/2/97
3/5/97
1/6/97
11/9/96
9/12/96
0
CPM
20k
40k
60k
Lin
Y: .04866
X: 7200
Aux
1-PP-9E .007E
Position:2
CTS
2H
Direction:Horizontal
Speed:1.8k
Latest

Figure 4


Lin
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Overall
Peak
Max
.7
.6
.5
.4
.3
.2
.1
5/2/97
3/5/97
1/6/97
11/9/96
9/12/96
0
CPM
20k
40k
60k
Lin
Y: 7738
X: 7200
Aux
1-PP-9E .007E
Position:2
CTS
2V
Direction:Vertical
Speed:1.8k
Latest

Figure 5