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SUBJECT: Provides addl info on relief from provisions of ASME section XI for containment spray pump for third ten-year interval pump IST plan.Description of proposed change & interim relief request enclosed.

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MA 98

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INDIANA MICHIGAN POWER

March 3, 1998

AEP:NRC:0969BJ

Docket Nos.: 50-315
50-316

U.S. Nuclear Regulatory Commission
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Gentlemen:

Donald C. Cook Nuclear Plant Units 1 and 2
RELIEF REQUEST FOR THE THIRD TEN YEAR
INTERVAL PUMP IN-SERVICE TEST PLAN
ADDITIONAL INFORMATION

The purpose of this letter is to provide additional information on a relief from the provisions of ASME section XI for the containment spray pump. By letter AEP:NRC:0969AM, dated June 12, 1996, we submitted a relief request for the third ten year interval pump inservice 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. By letter AEP:NRC:0969BD, dated June 27, 1997, we submitted a revised relief request as directed by the safety evaluation report.

On January 13, 1998, and February 9, 1998, discussions were held with members of your staff regarding inservice testing of the containment spray pumps. As a result of those conversations, it was agreed that we would request interim relief until the next scheduled refueling outage for each unit while we assess proposed pump modifications. Attachment 1 to this letter describes the proposed change, and attachment 2 contains the interim relief request.

Sincerely,

E. E. Fitzpatrick
Vice President

/jen

Attachment

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

A047 1/1

ATTACHMENT 1 TO AEP:NRC:0969BJ

PROPOSED CONTAINMENT SPRAY PUMP MODIFICATION
AND INTERIM RELIEF REQUEST

Introduction

This submittal is made in response to a request for additional information regarding containment spray (CTS) pump vibration acquired during inservice tests (ISTs) performed in accordance with part 6 of OM(a)-1988. It also is intended for this submittal to docket a request for interim relief from the ranges for vibration test parameters contained within table 3a of the code.

Background

The original description of Cook Nuclear Plant's third ten year IST program was submitted in our letter AEP:NRC:0969AM, dated June 12, 1996. The NRC provided a safety evaluation report (SER) for this program on May 27, 1997 (TAC nos. M95721, M95722, M95890, and M95891), wherein the subject relief request P-1 was denied. We subsequently revised this relief request as directed by the SER, and submitted our letter AEP:NRC:0969BD on June 27, 1997.

Request for Interim Relief

During a January 13, 1998, telephone conversation with members of your staff, we were requested to supply additional justification for the relief request. Subsequently, on February 9, 1998, we agreed to submit an interim relief request and assess proposed changes to the pumps that would reduce vibration. The relief is requested until the next scheduled refueling outage for each unit.

Design Change Proposal

The root cause for the relatively high level of vibration is a four-vane impeller rotating in a double volute casing having minimal clearance (called "B" gap) between the impeller's outside diameter and tongue of each volute. This, together with the test loop flows being limited to less than 25% of the pump's best efficiency, causes excessive reactionary forces and vibration to develop at vane pass frequency.

Increasing the "B" gap clearance to at least 5% will virtually eliminate the reactionary forces at vane pass, and consequently reduce the overall level of vibration dramatically. This will be accomplished by machining the pump casing volutes, trimming the existing impeller, or changing out the impeller.

We are aware that this type of design change will influence the hydraulic capacity of these pumps. Because the only test possible in situ on site is at low flow, the original equipment manufacturer, Byron Jackson (now known as Flowserve Corp.), has been contracted to perform the same modification on an identical spare being shipped to their service center in California. Flowserve will also perform a full flow test at its facility on this assembly after it has been modified in order to certify its design rating. The results of the full flow test performed at the Flowserve facility will be applied to the pumps modified in place at the plant.

During the assessment of the design change, we are requesting that we be granted interim relief until the next scheduled refueling outage for each unit. The basis for the request and our conclusion that the proposed alternate test provides adequate assurance of pump operational readiness are contained in attachment 2. The

interim relief will allow us to ship a spare pump to the vendor, perform the modification, test the pump, and assess the modification's effectiveness.

ATTACHMENT 2 TO AEP:NRC:0969BJ

INTERIM CONTAINMENT SPRAY PUMP RELIEF REQUEST
FOR THE THIRD TEN YEAR INTERVAL
PUMP INSERVICE TEST PLAN

REQUEST NO. 1 - INTERIM 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 present 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, vibration data are provided for the period May 2, 1997, through September 12, 1997.

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 are not expected to be present at this level with the pump operating at its design point during a design basis accident.

Reducing the test vibration levels will require a pump modification, and a program to increase the pump's "B" gap is in progress. Interim relief is requested in order to modify a spare pump, test the pump, and assess the modification's effectiveness.

PROPOSED ALTERNATE TESTING

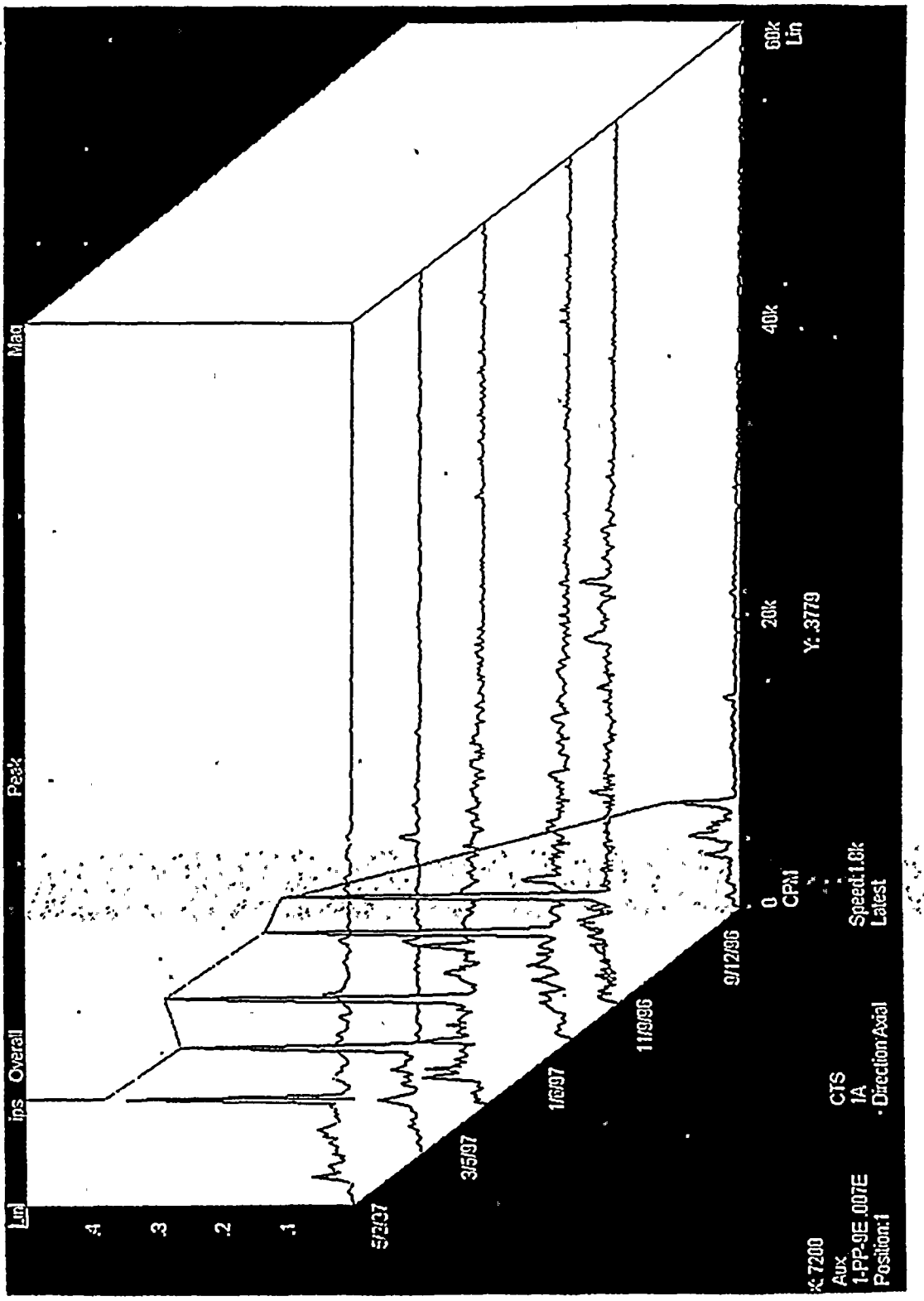
The following criteria will be used during the period of interim relief.

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 analysis 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 inservice test.

The phenomenon 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.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20k
40k
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Aux
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Position:1

Figure 1

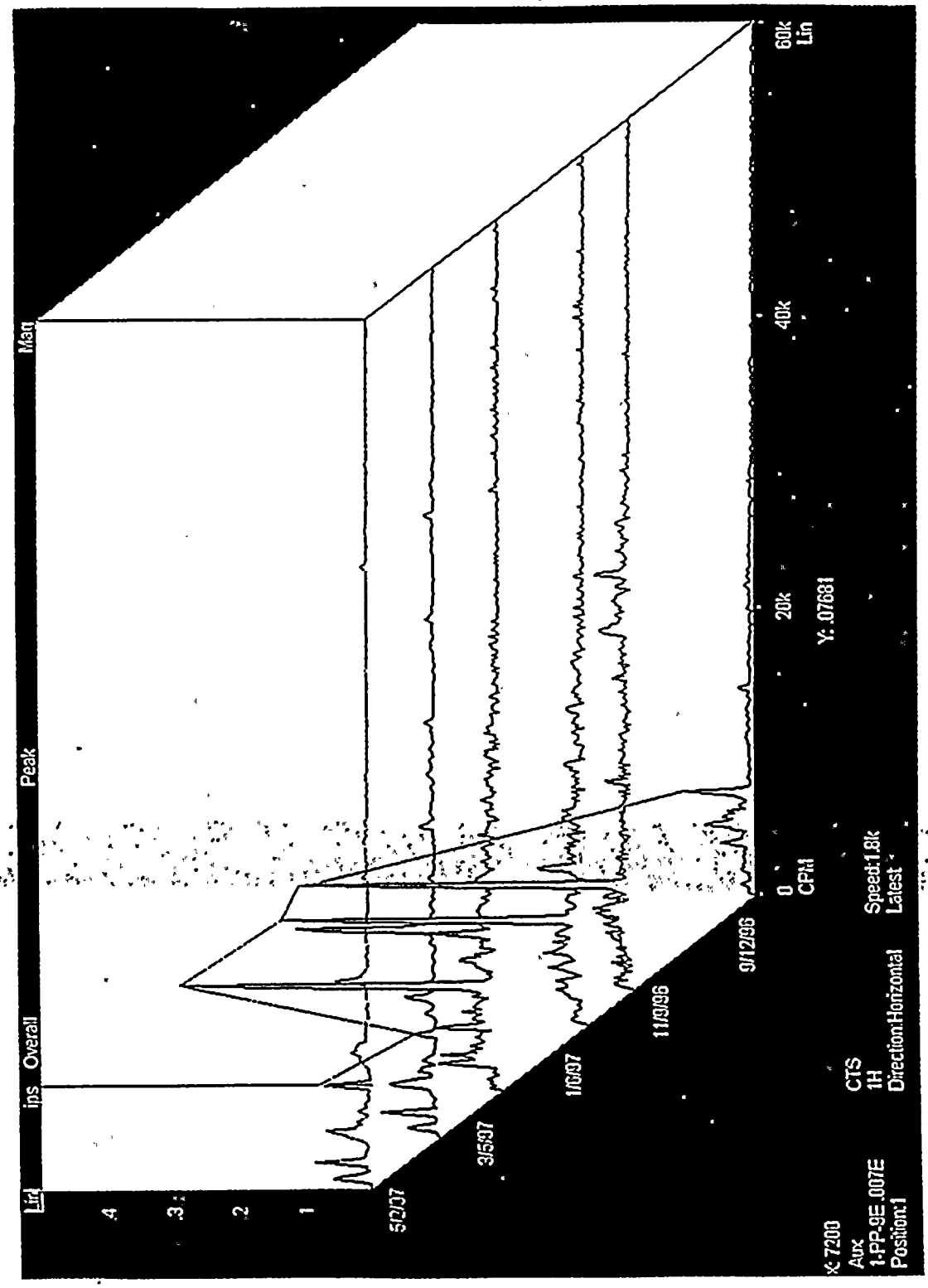
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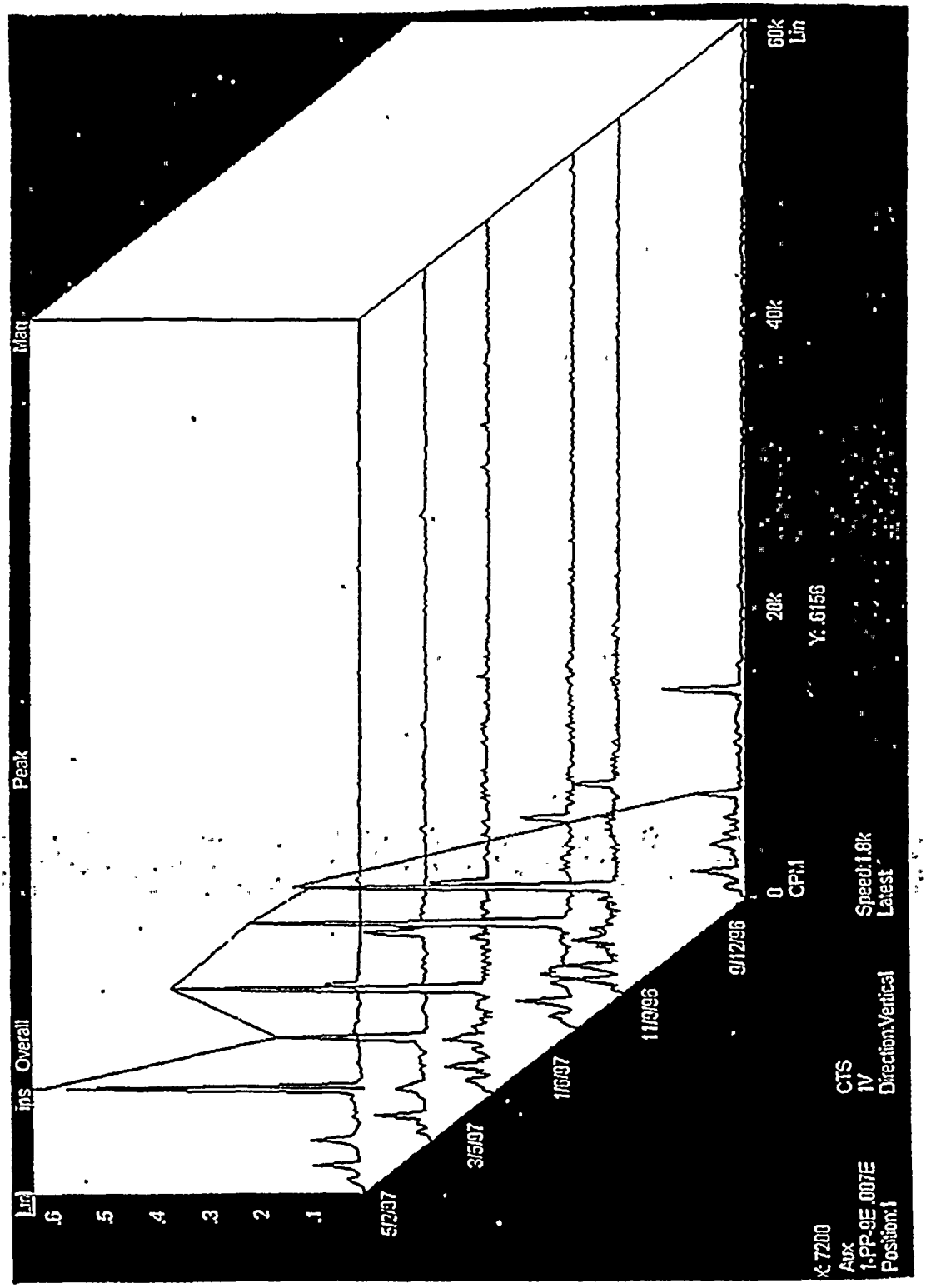
Figure 2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CPI:1
Speed:1.8k
Latest
CTS
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Direction:Vertical
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Aux
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Position:1
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40k
60k
Lin
Y: .6156

Figure 3

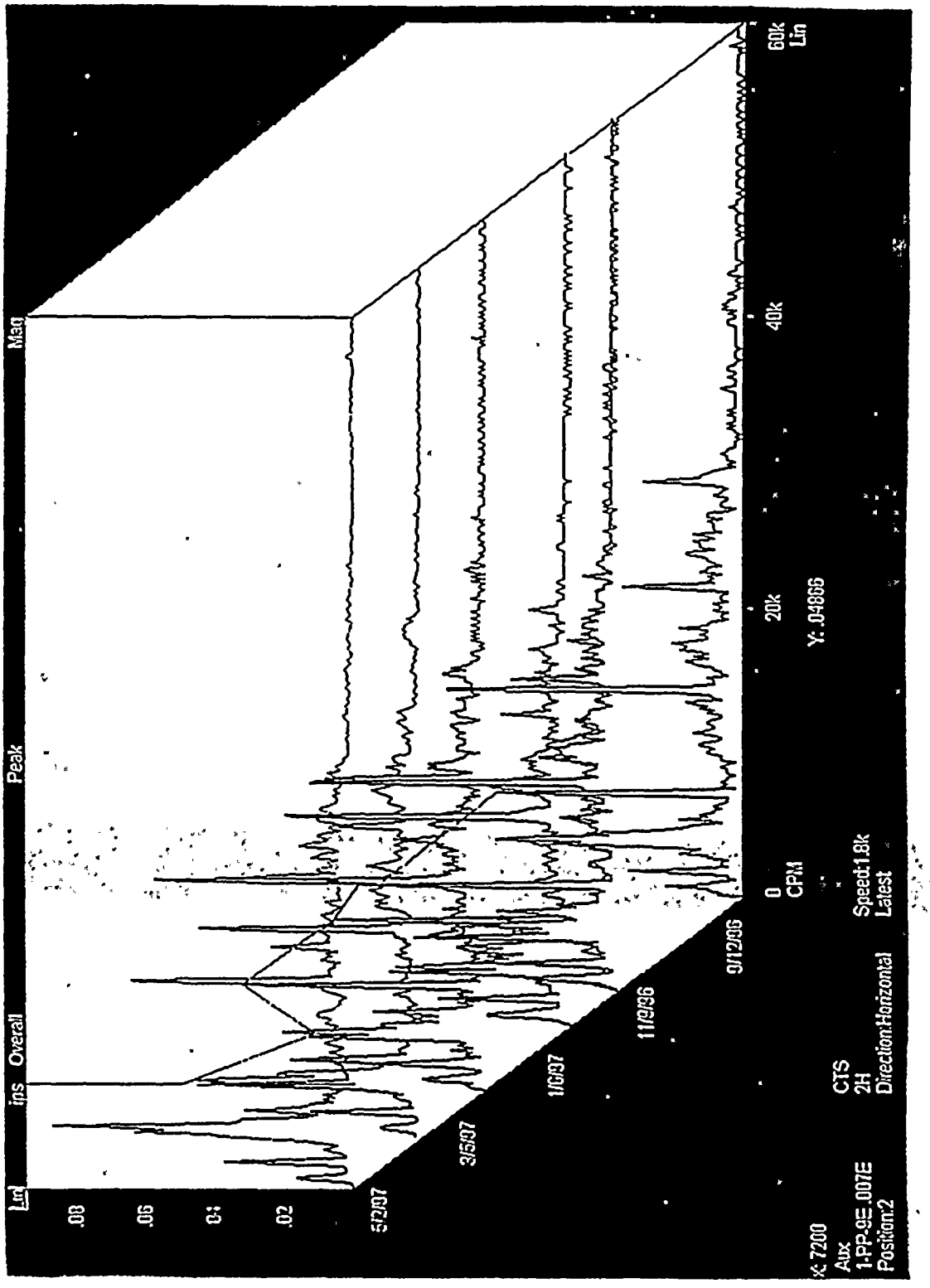
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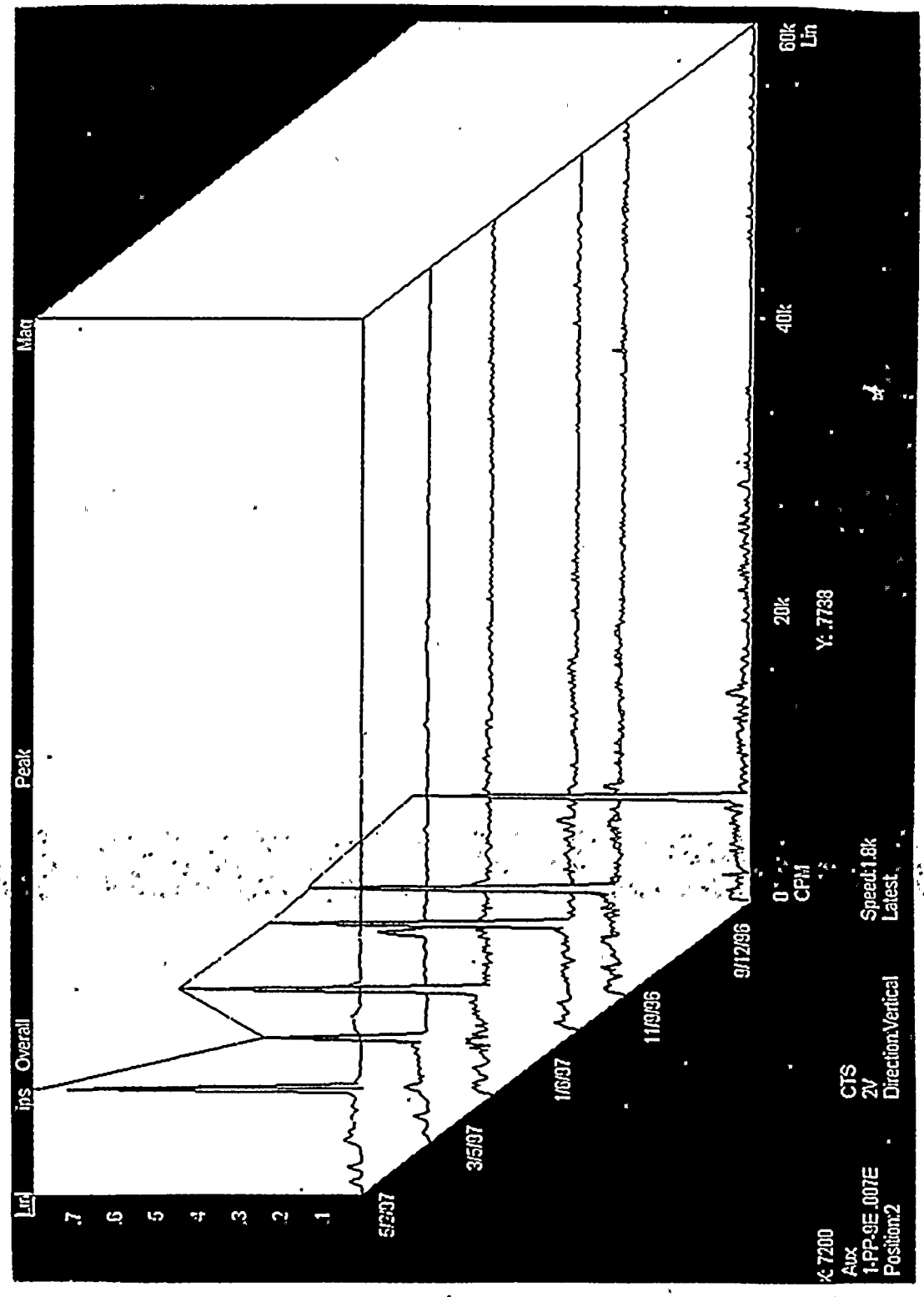
Figure 4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Position:2
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Figure 5