

GREENHILL GAS TURBINE
INSPECTION 2002

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Arrived onsite June 5th, with Rolls Royce representative Leo Dell to investigate the vibration problem with the gas generator. The unit has a history of operating with higher than normal vibration levels on the jet, dating back to the early 1990's, when the Craftman vibration monitor was replaced with an IRD unit. A review of the engine history and a general inspection of the unit was carried out.

General Inspection

The exterior of the air intake plenum and the filter housing is rusted and requires cleaning /sand blasting to remove loose scale and paint chips and the surface primed and painted. See photo 1. The interior of the filter housing is in good condition, the floor of the plenum could use some touch up paint in places. (see photo 2)

The exhaust stack needs to be replaced. The interior perforated plate has been repaired and patched in several places and the thermal insulation is non existent in places causing the exterior paint to blister.(see photo 3)The steel silencer supports are corroded with section of the supports missing. Heavy scale, rust and support steel was found on the interior exhaust flange(see photo 4). The exhaust volute is in good shape.

The perforated plate on the power turbine plenum door needs to be repaired. (see photo 5)

The unit was test run and vibration signatures taken at 5, 10 & 14.8 megawatt intervals. The unit limited at 14.8 Mw on EGT limit. Several test were carried out to determine cause of the problem. There was some discrepancy in the calculated EGT and the Ave EGT quantities. The flex I/O cards monitoring the EGT's were configured for type J thermocouples and should have been configured for type K TC's. The T6 limit had been set too low thus limiting the unit prematurely, this limit was adjusted to 720 deg c.

The engine burners were removed and inspected and returned to service. The engine supports and auxiliary attachments were inspected for any visible signs of wear or rubbing that may result in increased engine vibration levels. The PT cooling air pipe was shown in the Curtis Wright manuals as having a flexible coupling spanning the exhaust bellows, this was not installed on our unit. The pipe had a rigid mount thus restricting the expansion of the bellows during operation. A flexible coupling was installed in the pipe, vibration readings taken after the modification did not show any significant improvement in the engine vibration levels. The intake plenum door had very little clearance between the lower half of the door and the engine casing. This clearance was reduced when the engine was aligned last year. The doors were modified to increase this clearance to eliminate any possible vibration form the plenum doors being introduced onto the engine casing. The exhaust volute spring packs were adjusted to the correct preload 1585 ft/lbs and re installed.

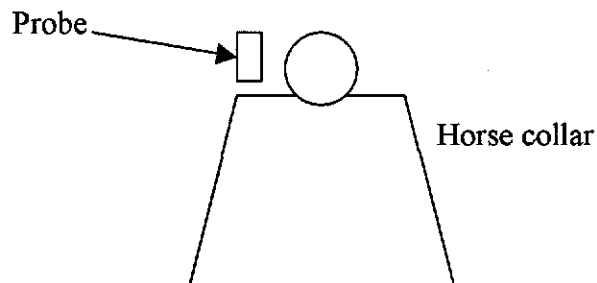
The cable connector on Alternator bearing end A vibration probe was loose and required seating. The historical trend 1 dated 6/12/02 shows the noise introduced in the signal as a result of the loose cable connector. Trend 2 taken on the 13th shows a dramatic improvement in the signal and reduced vibration levels after tightening the connector.

The vibration signatures taken on the gas generator showed first order and second order components of both the LP compressor & the HP compressor spools. The overall vibration levels were high with average readings at 15 Mw of 16 mm/sec and peak reaching 24.6 mm/sec. The highest levels were recorded during loading, 30 mm/sec, this was transient condition that settled out when the load was constant. Full load readings taken at 20 Mw showed an overall average of 19.6 mm/sec with maximum of 23.5 mm/sec. Spectral analysis at full load, (20 Mw) showed first and second order components of both HP & LP shafts with the larger component being HP compressor 1x @6.63 mm/sec, 2x @5.72 mm/sec(See data sheets A1 to A3

Power Turbine vibration signatures were taken at 5Mw intervals, test results showed only first order components most likely due to a slight mass unbalance of the power turbine rotor. The overall average @ 20 Mw was 5.29 mm/sec, FFT analysis on this showed the major component at 1x. (4.39 mm/sec @ 3600 rpm) See data sheet A6 & A7

Gas Generator Front Support

Probe was placed on the front horse collar support and readings taken at full load, average 4.55 mm/sec FFT 4.30 @ 3600 rpm or PT speed. See data sheet A4



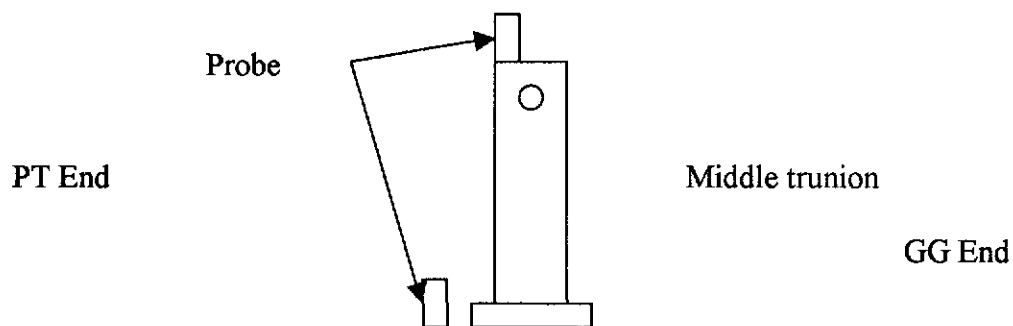
Middle Trunion Supports

Probe placed on the bearing cap and on the skid at the base of the trunion

Cap average 4.44 mm/sec. FFT 4.22mm/sec @ 3600rpm

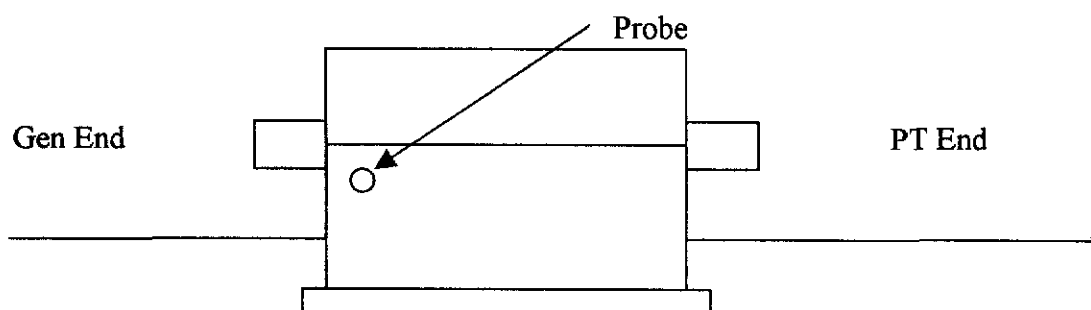
Skid FFT 4.18 mm/sec @ 3600 rpm. See data sheet A5

The FFT shows a 4.18 mm/sec vibration component being transmitted through the skid from the power turbine. See data sheet Gas Generator Trunion Support 20 Mw



Clutch Box

Probe mounted on the clutch housing Average 2.26 mm/sec. FFT 1.87 mm/sec at 3600 rpm and 1.15mm/sec at 7200. Levels are well below acceptable limits .See data sheets A11 & A12



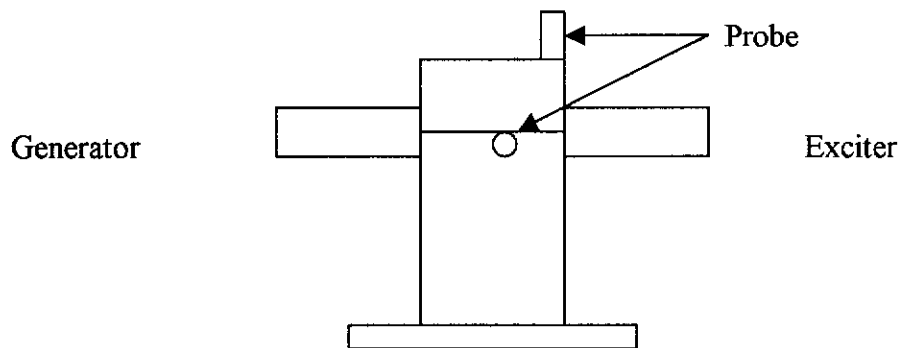
Exciter Bearing

Readings were taken with the probe was placed on the top of the bearing housing and on the split line of the cap. See data sheets A8 to A10

Bearing top Average 4.26 mm/sec at 19.5 Mw. FFT 4.1 mm/sec at 3600 rpm

Split Line Average 10.0 mm/sec at 19.5 Mw. FFT 9.60mm/sec @ 3600 rpm

The split line vibration levels are well above the alarm level set for this bearing of 6.5 mm/sec . There was no phase shift in the vibration from the generator end to the exciter end of the bearing cap . A check of the phase on the bearing support resulted in no significant phase shift to indicate a soft foot or mechanical looseness. See data sheets A13 to A16



August 28

Testing resumed, on August 28th, the following work was completed.

The thrust and counter thrust thermocouples were replaced with type thermocouple extension cable . The pads were drilled and the TC'S cemented in place (see photo 6)

The intake plenum doors and gaskets were modified to increase the clearance between the casing and the doors.

The GG vibration probe was relocated to the HP compressor flange as per Fern Eng recommendation PIB 1020A.

The pilot exciter bearings were replaced and a new drive coupling installed.

Power Turbine gas path inspection and Gas Generator alignment check was completed by Fern Engineering

The fuel tanks were replaced with 2 new tanks

The unit was started and the engine vibration monitored with the probe mounted on the HP compressor flange. Two spikes were evident during acceleration; these were most likely HP & LP critical speeds. See data sheet A17. The unit tripped on gas generator high vibration. One spike was recorded with an average level of 37.4 mm/sec and maximum reaching 41.2 mm/sec.

The probe was returned to original position on the LP casing, engine levels were recorded. There was no significant change in engine vibration levels. See data sheets A21 to A23.

A new mounting bracket was installed on the HP flange to accept the test probe, keeping the permanently mounted probe on the LP flange. The unit was started and data recorded from the test probe. Slightly higher engine levels are present at the HP flange, average overall at 18 Mw 23.9 mm/sec maximum of 25.4 mm/sec. The highest levels were experienced during run up and loading. The spectral analysis showed only first order HP component of 14.03 mm/sec with an insignificant LP component. See data sheet A18.

Engine History

The engine was sent to Rolls Wood Group for repair after the engine plenum fire in 1998, a review of the engine build log and report supplied by RWG showed most of the damage to be concentrated around the HP section of the engine. The first engine tests resulted in an HP turbine shroud failure, and the engine was returned to the shop for repair. The acceptance testing continued on December 12 1998 and the unit was rejected due to high engine vibration which at the time was attributed to HP unbalance. 10.8 mm/sec @ 6450 rpm. The unit was returned to the shop for repair. Testing resumed in March with final acceptance on March the 5th. Engine vibration levels were recorded at 9.24 mm/sec @ 6450 rpm. RWG spec is 10.0 mm/sec.

Conclusion

The engine alignment was reviewed by Fern Engineering and deemed to be satisfactory with all bearing & support clearances within spec. There are no external components with exception of the power turbine introducing any vibration into the engine casing . Testing done after the modifications showed no reduction in engine vibration levels. The power turbine component introduced in the casing does contribute to the overall engine level but is minimal compared to the HP component .

Engine testing to date seems to point to the HP compressor as being the root cause of the high engine vibration. The spectral analysis shows a high first order component likely a balance problem with the HP spool. The LP component was not apparent at the HP flange probably due the proximity of the probe to the LP spool and the signal dampened through the LP & HP casings. Analysis of the data taken from the probe at the LP flange also shows a higher HP component than LP component .

6/12/02
3:27:12

Historical Trend

UNIT
1

Print

Previous

Menu

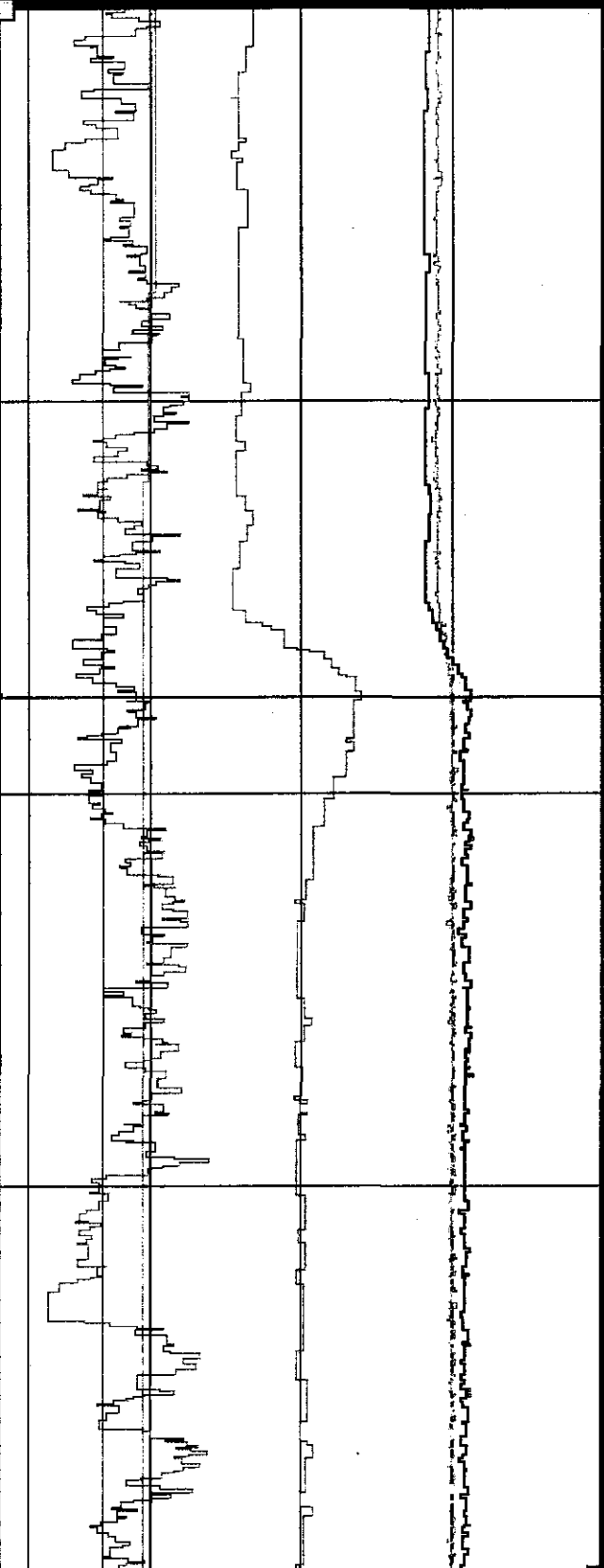
Tag Unit

-+

? Help

37.5
25.0
25.0
25.0
25.0
10000.0
36.0

0.0
0.0
0.0
0.0
0.0
0.0
-36.0



10:40:16 AM

10:50:17 AM

Full

Date/Time

Day

10.0 min

Day

Day

Current

Utilities

Start Times

Stop / SD Times

Open Trend Group

Left Scooter
10:44:39.888
6/12/02

Value Between
Scooters

Right Scooter
10:50:16.000
6/12/02

- V39VGG_01 GG Vibration, MM/SEC
- V39VTV_01 Power Turbine Vibration, MM/SEC
- V39VVC3_01 Clutch Box Vibration, MM/SEC
- V39VVC4_01 Alternator Bearing End A Vibration, MM/SEC
- V39VVC2_01 Exciter Bearing Vibration, MM/SEC
- V199N1_1_01 GG N1-1 Speed, RPM
- V199N2_1_01 GG N2-1 Speed, RPM
- V95MW_01 Generator MW

22.50	22.50	19.21
5.94	5.94	5.94
1.19	1.19	1.19
5.67	8.71	5.68
4.32	4.32	4.32
7501.16	7627.44	7532.11
20.27	20.57	19.61
	Max	
	Min	
	Avg	
	Dev	

Probability of Failure vs. Power Flow Out of Alarm

LSFA002_01

Unit1

ALM

A R

6/13/02
1:24:12

Historical Trend

UNIT
1

Print
Tag Unit

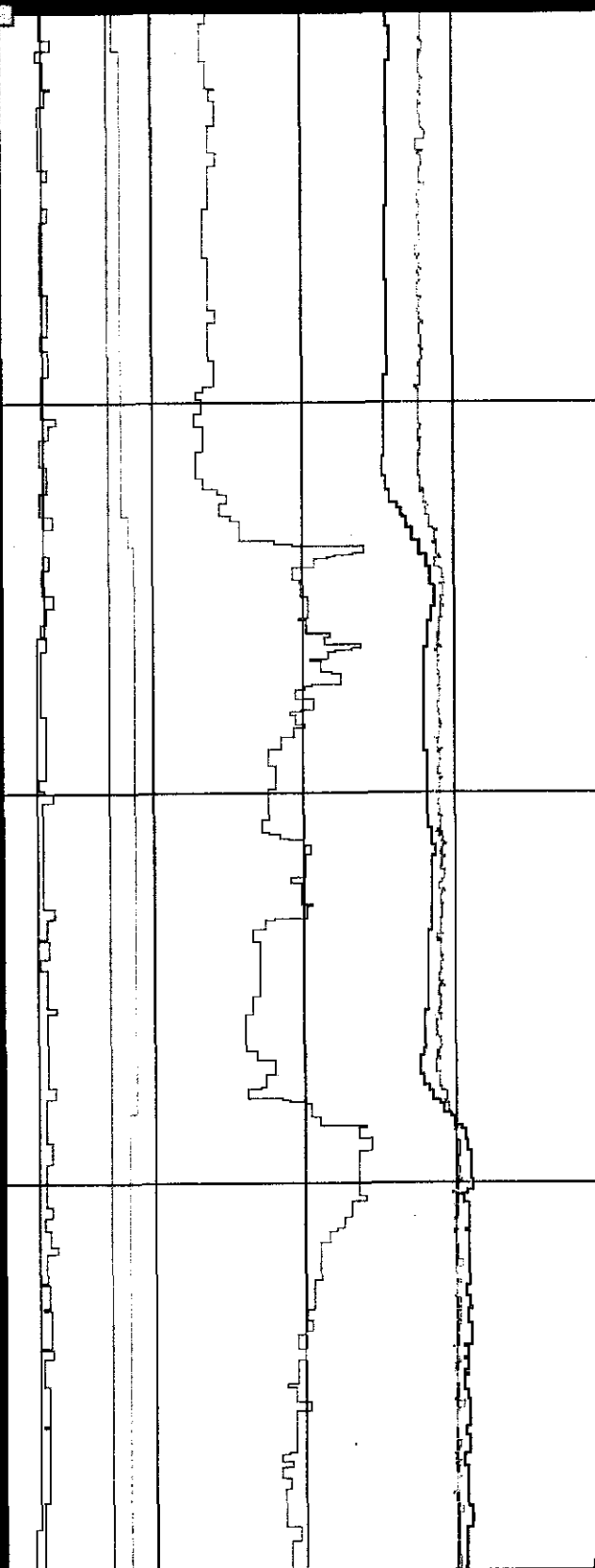
Previous



Menu
Help

37.6
25.0
25.0
25.0
25.0
10000.0
36.0

0.0
0.0
0.0
0.0
0.0
0.0
-36.0



1:14:09 PM

1:24:10 PM

Full Date/Time Day Stop / SD Open Trend Group 10.0 min

Utilities Start Times Stop / SD Open Trend Group

V39VCG_01 GG Vibration, MM/SEC
V39VTV_01 Power Turbine Vibration, MM/SEC
V39VC3_01 Clutch Box Vibration, MM/SEC
V39VG4_01 Alternator Bearing End A Vibration, MM/SEC
V39VC2_01 Exciter Bearing Vibration, MM/SEC
V199N1_1_01 GG N1-1 Speed, RPM
V199N2_1_01 GG N2-1 Speed, RPM
V35MW_01 Generator MW

Left Scooter
1:14:09.000
6/13/02

Value Between
Scooters

Right Scooter
1:24:09.000
6/13/02

12.87	22.96	17.38
4.71	5.54	6.22
1.68	1.68	1.17
1.63	2.22	1.55
4.44	4.44	4.44
6996.52	7632.29	7491.38
10.26	20.23	19.35

Property of Rolls Royce 3 Temp High Alarm

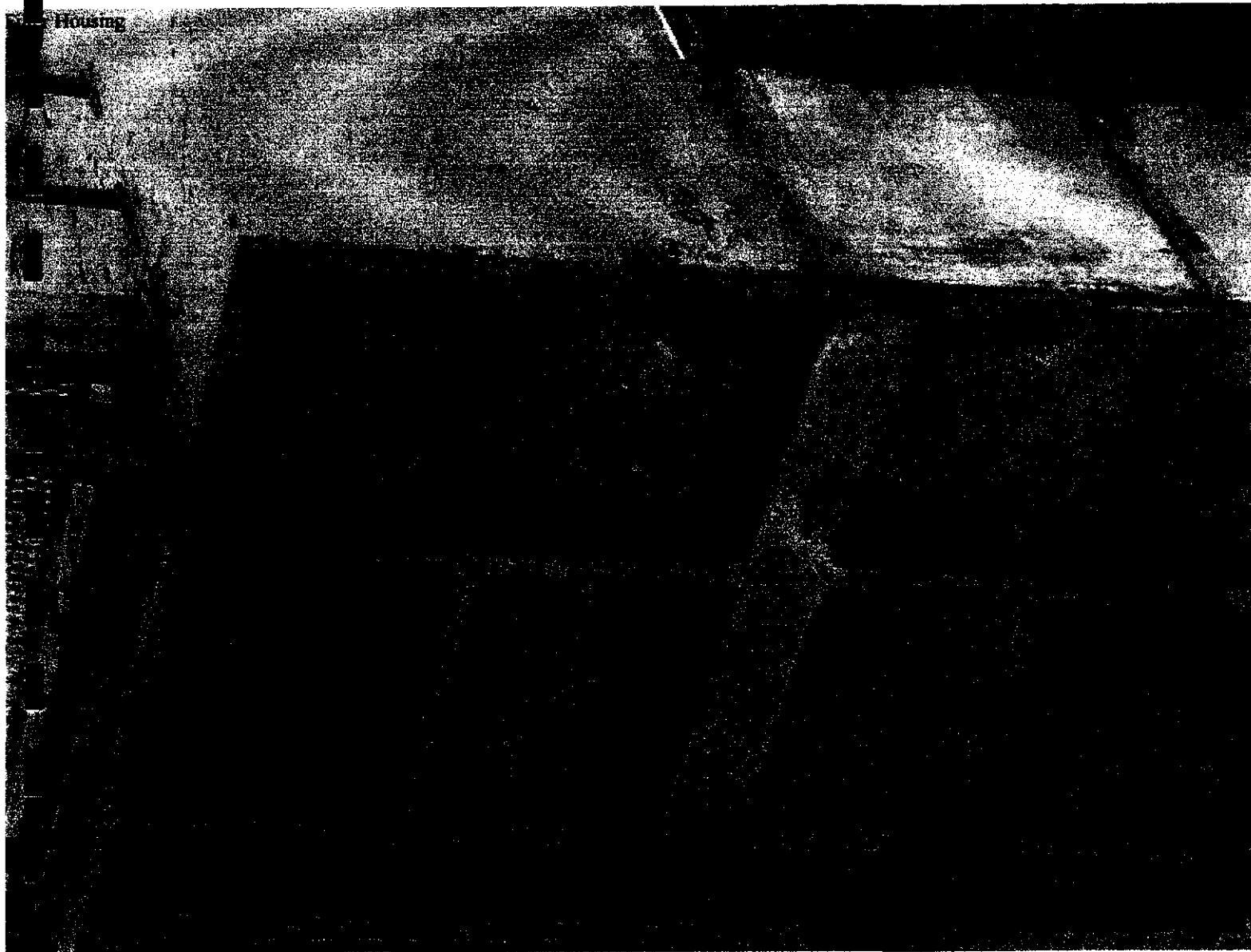
LAL062_01

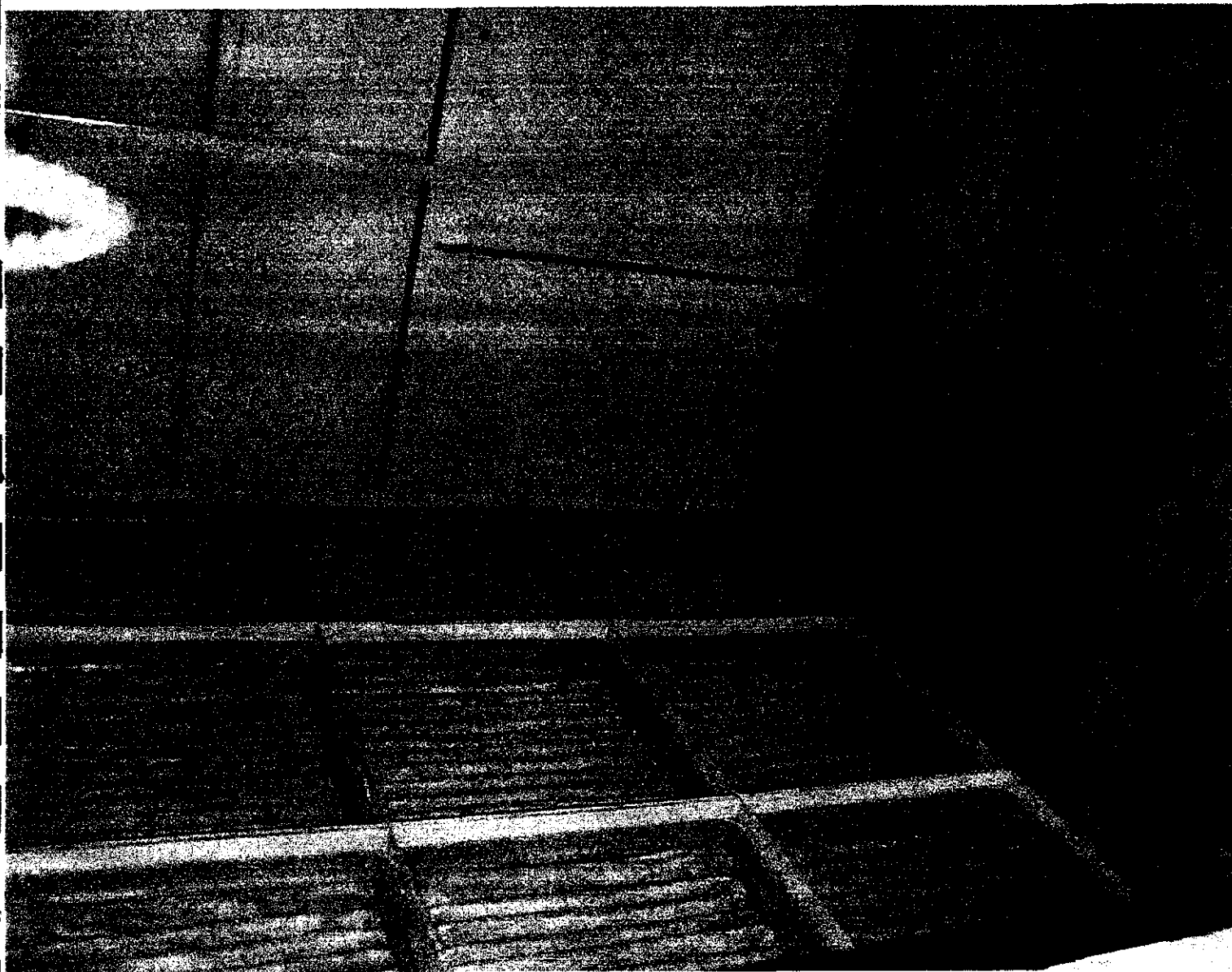
Unit1

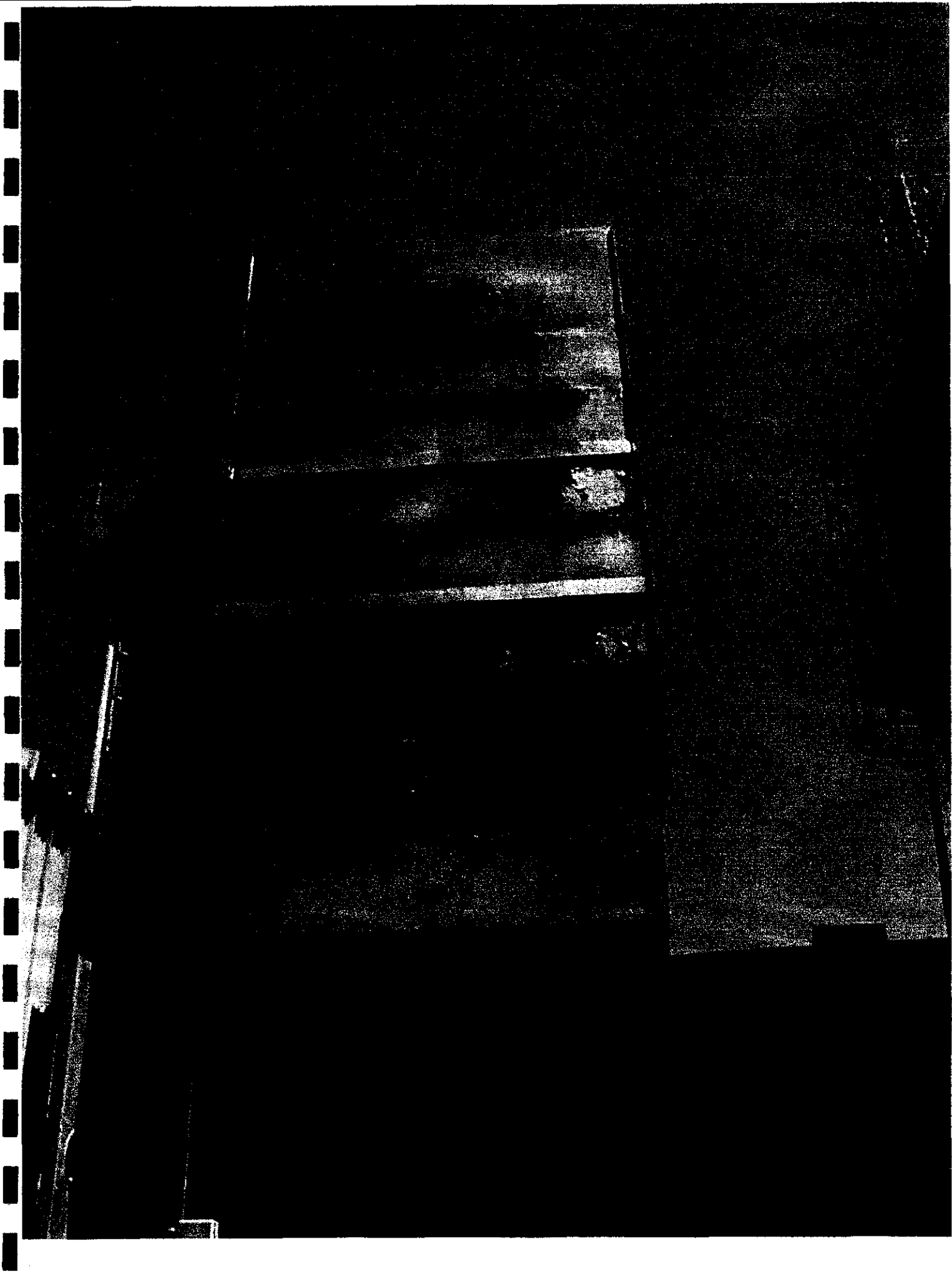
ALM

A R

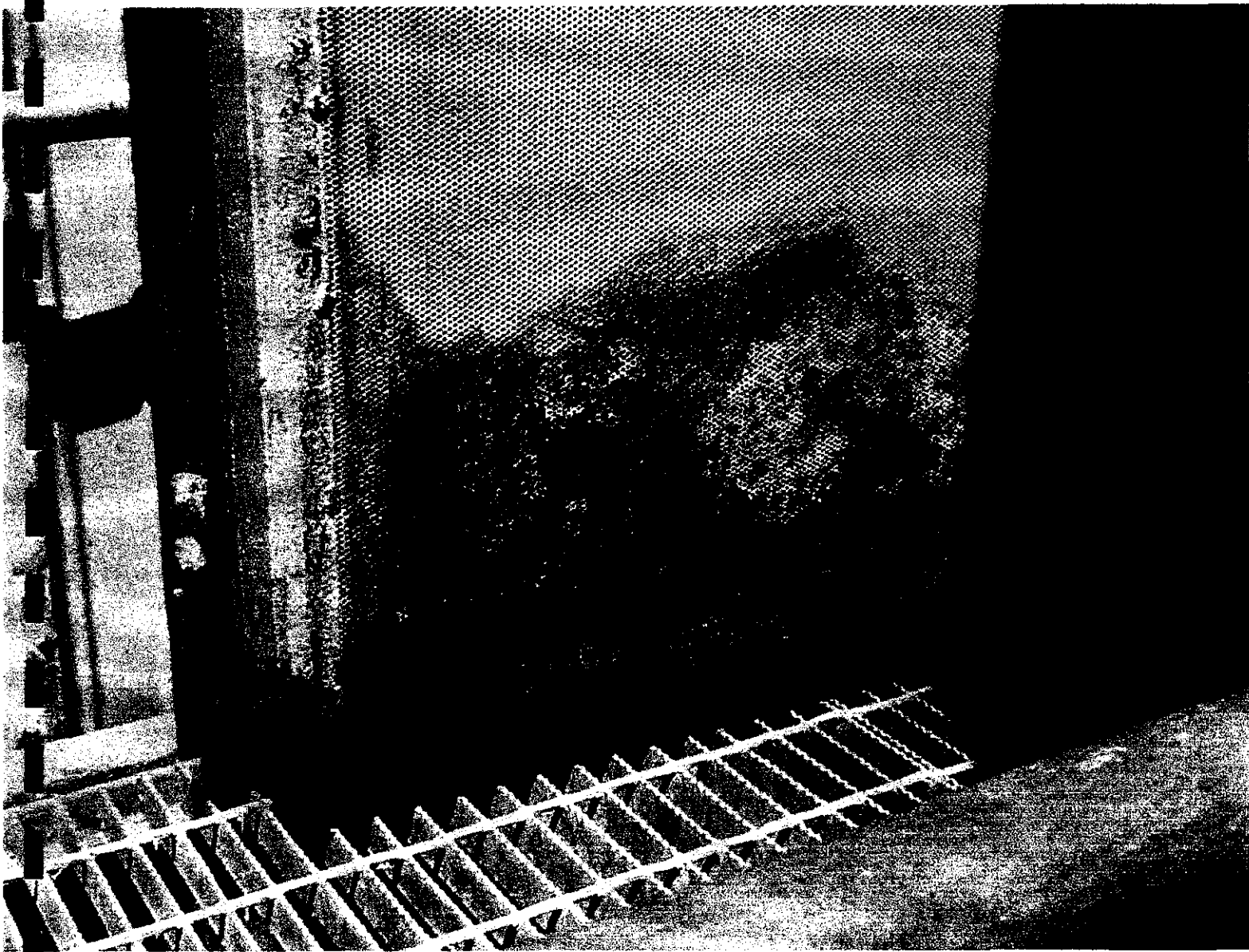
Housing

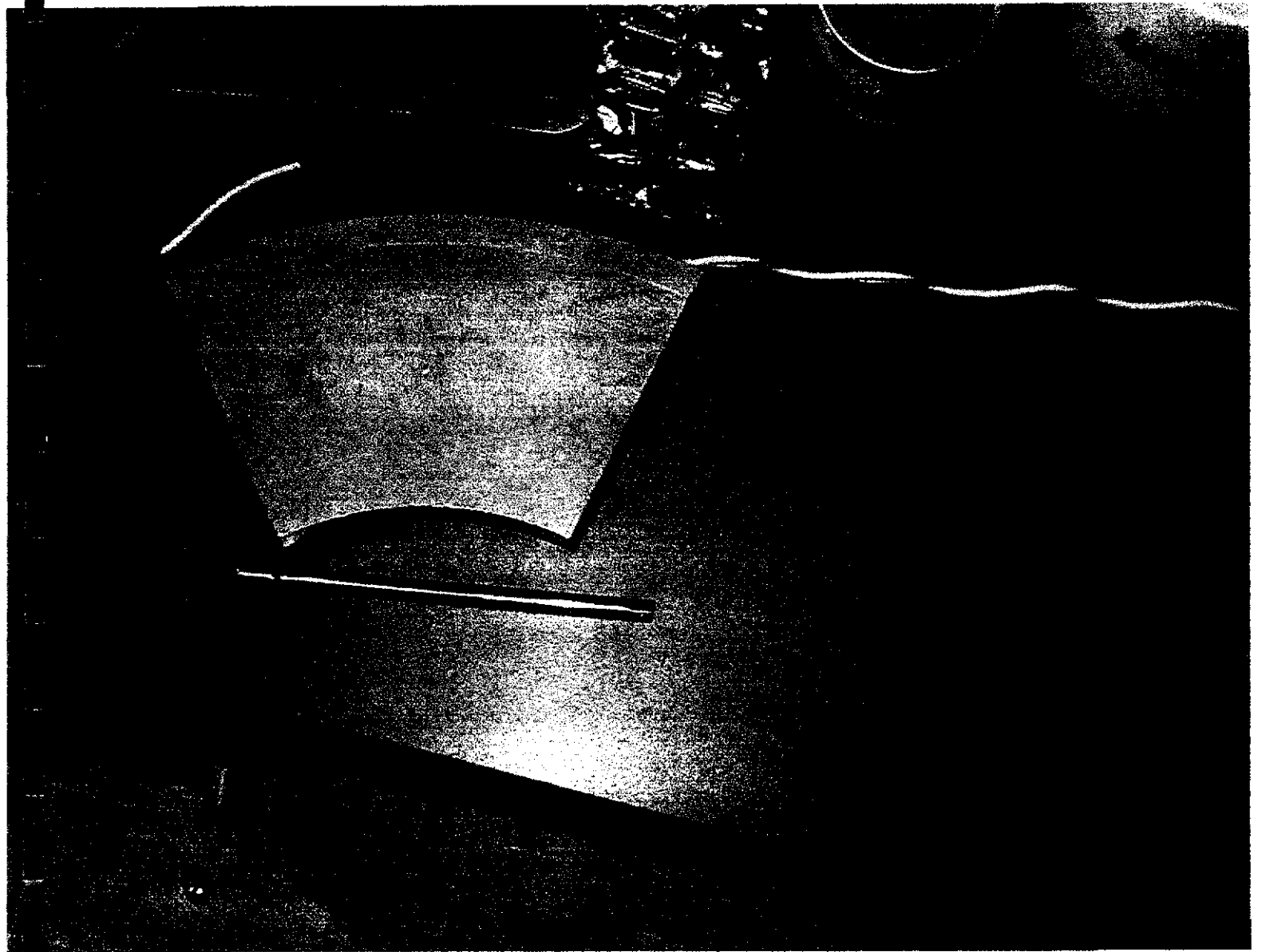


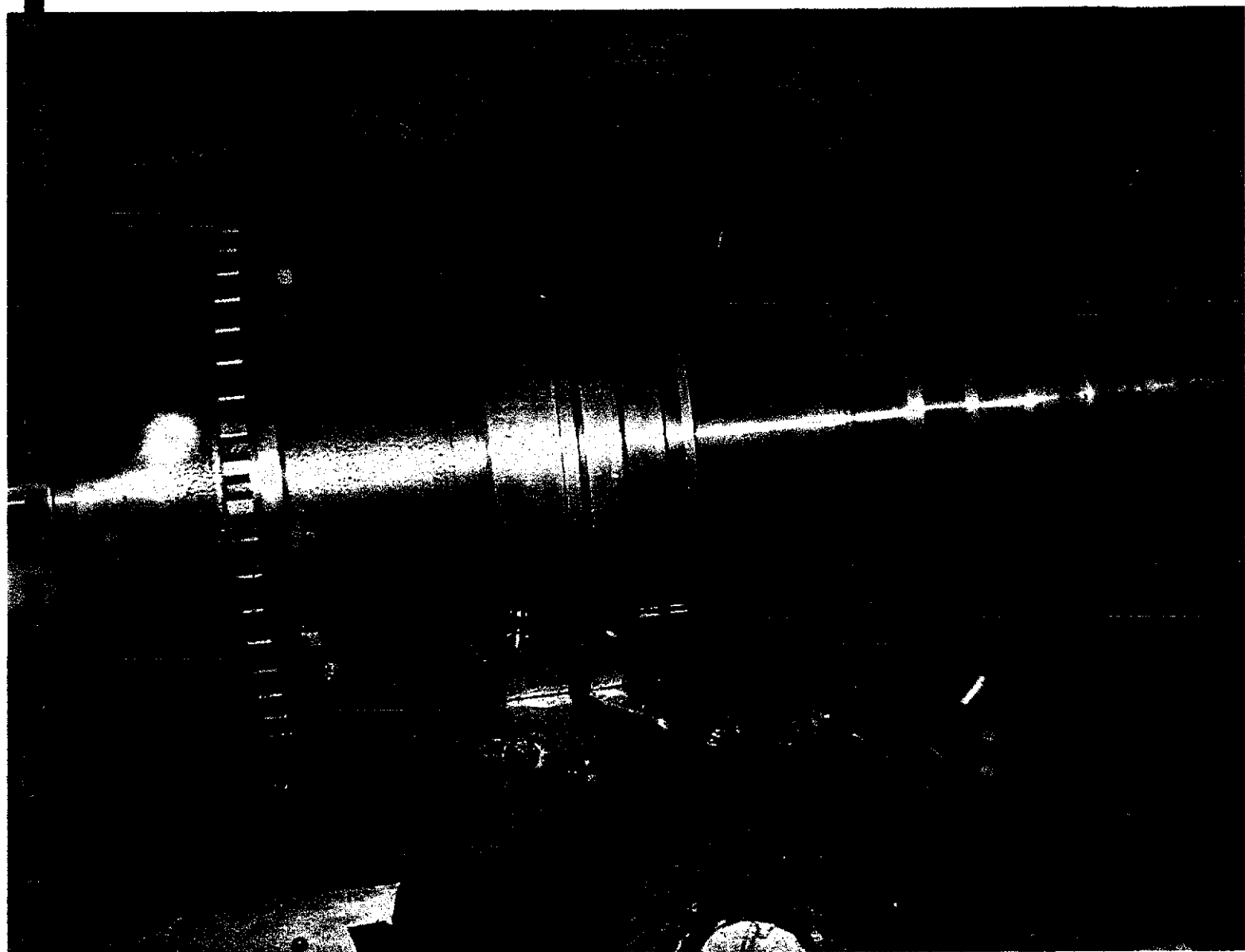


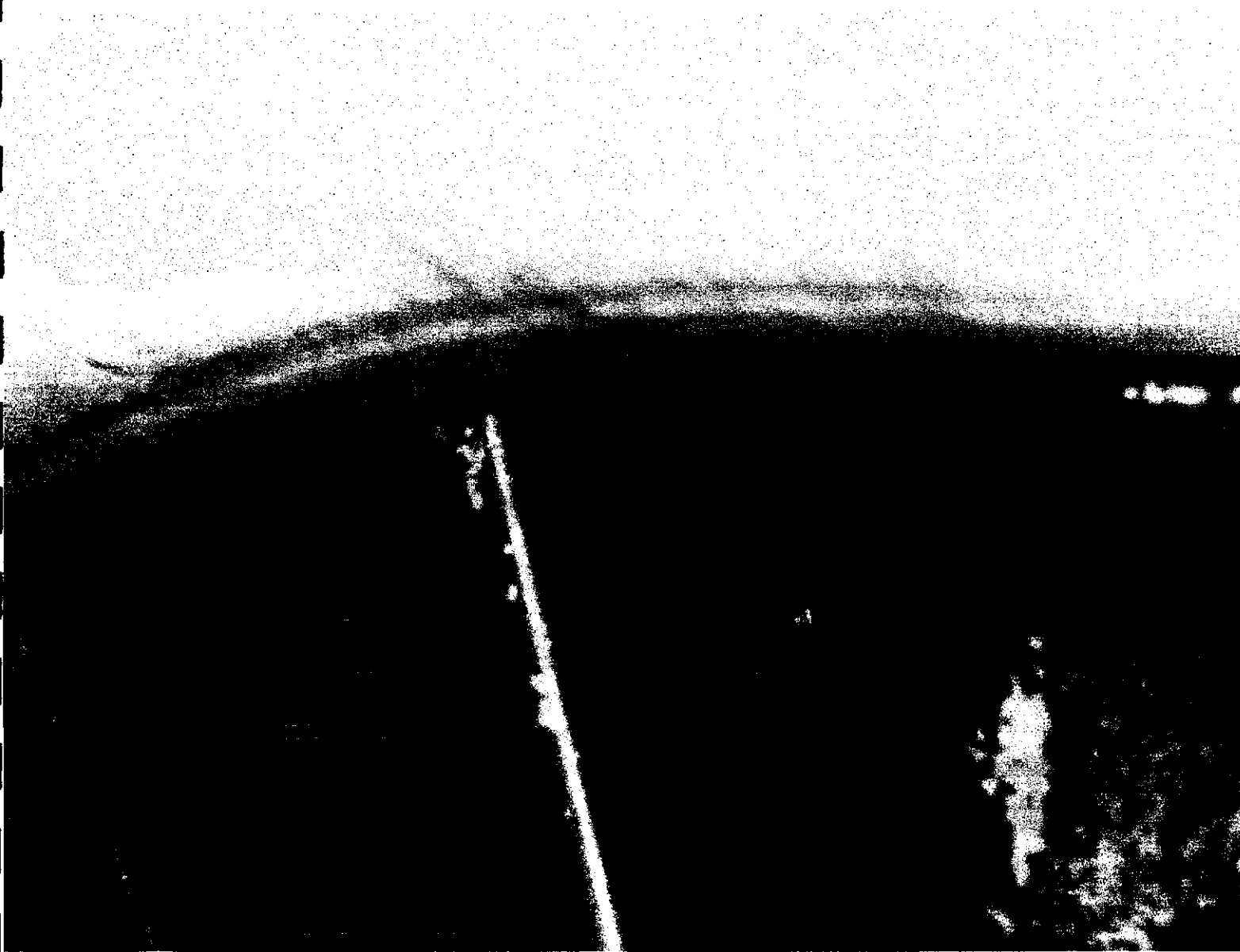


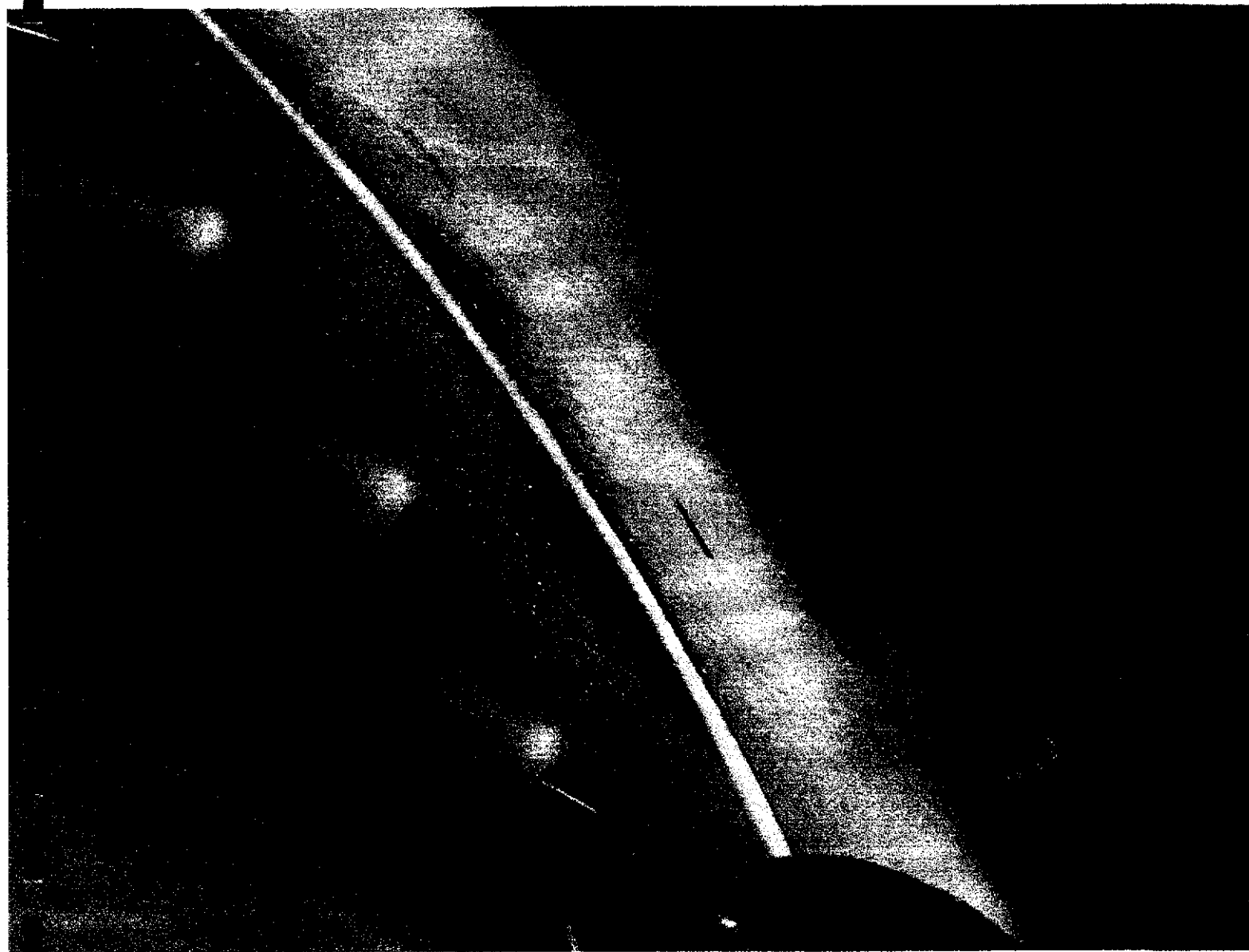












June 12/02

Gas Gen

N1 6154

20 MW

N2 7551

MACHINE: IRD 895
RPM: 7000

INSPECTION CODE:

POS: A

DIR: H

KEYPAD: ALPHA

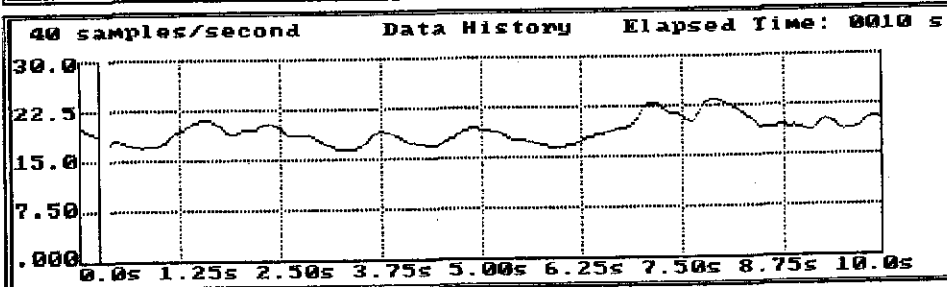
DATE: 12-08-01
TIME: 15:54:22

FUNCTION: Analysis - Data History

NOTES: GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History	
Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 18.9
average = 19.6
minimum = 18.9
maximum = 23.5

A1

June 12/02

Gas Gen 20 MW N1 6159
N2 7551

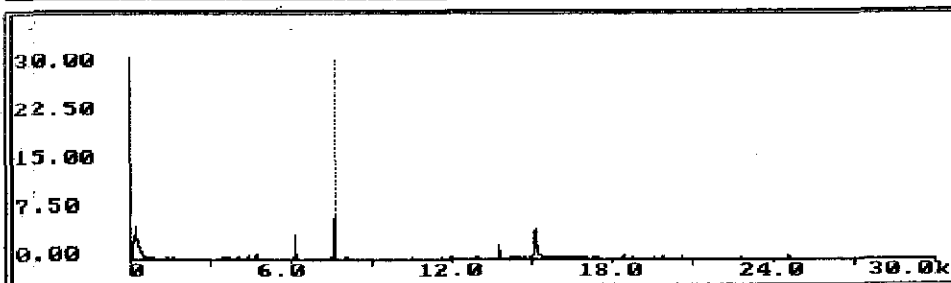
MACHINE: IRD 895 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-08-01
TIME: 15:53:33

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clean
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings

Ampl 30.0
Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
7650 CPM
Cursor Amplitude
6.63 mm/sec

<Enter> to Exit

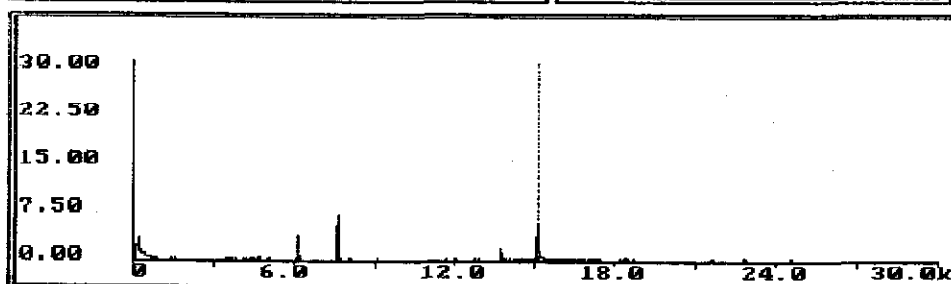
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RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-08-01
TIME: 15:56:45

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clean
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings

Ampl 30.0
Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
15150 CPM
Cursor Amplitude
3.72 mm/sec

<Enter> to Exit

A2

Gas Gen

15 MW

N1 5770

N2 7272

June 12/02

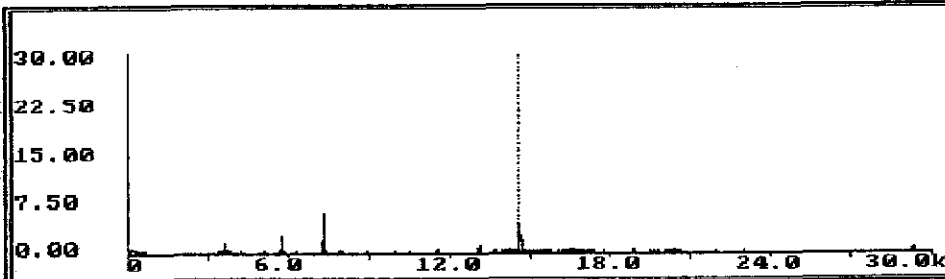
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RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-08-01
TIME: 15:46:16

NOTES:GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings
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Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
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Cursor Amplitude
4.64 mm/sec

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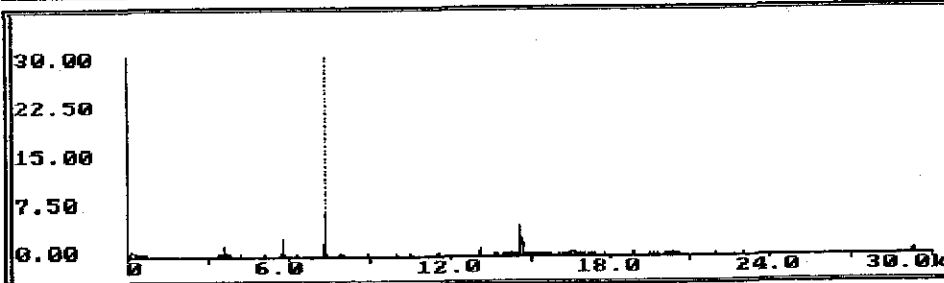
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RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-08-01
TIME: 15:45:52

NOTES:GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings
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Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
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Cursor Amplitude
6.02 mm/sec

<Enter> to Exit

loading to 15 MW

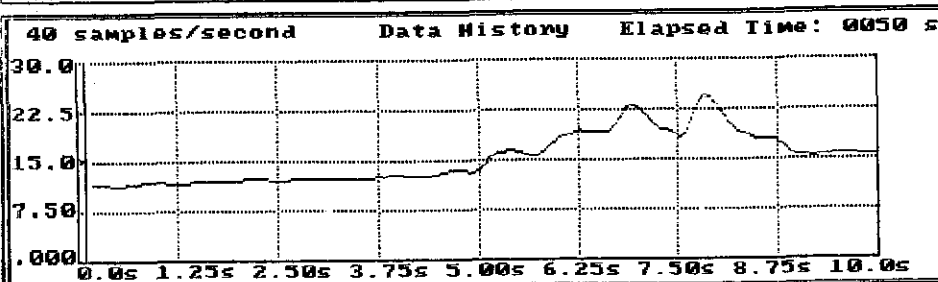
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RPM:7000 INSPECTION CODE: FUNCTION: Analysis - Data History

DATE: 12-08-01
TIME: 15:44:22

NOTES:GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit

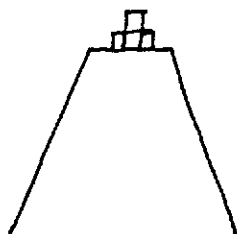


Data History
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Units mm/sec
Period 00:06:40
Rate 40
Filter Out

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minimum = 15.4
maximum = 24.6

A3

605 Grv Horse Collar Probe mounted
on the top of leg 20 MW



N1 6154

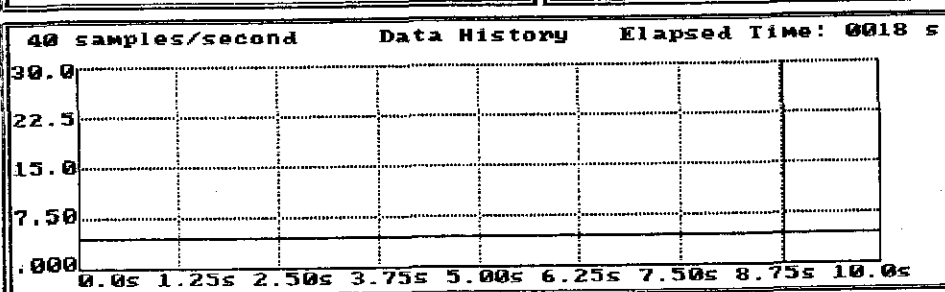
N2 7551

MACHINE:IRD 885 POS:A DIR:H KEYPAD:ALPHA DATE: 12-08-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:59:51

NOTES:GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History
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Units mm/sec
Period 00:06:40
Rate 40
Filter Out

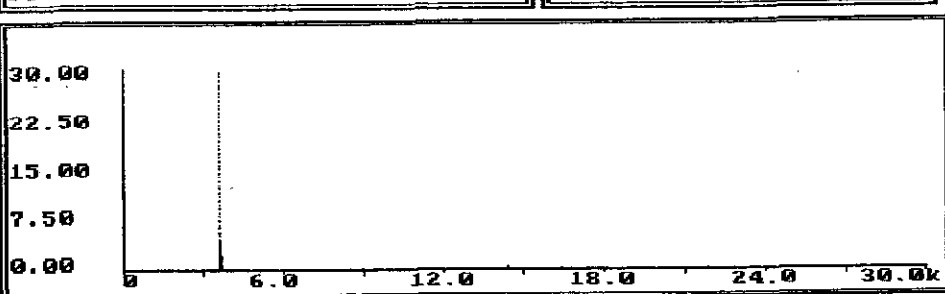
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maximum = 4.59

MACHINE:IRD 885 POS:A DIR:H KEYPAD:ALPHA DATE: 12-08-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:00:54

NOTES:GHR GT AND PT
GT B
PT A

STO Stone CLR Clean
Pause for Disp Options
<2> for True Zoom

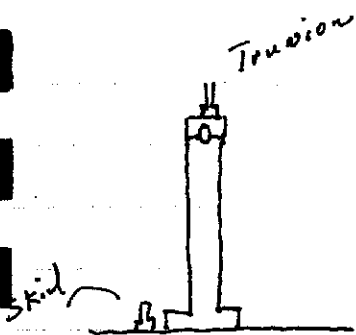
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FFT Settings
Ampl 30.0
Units mm/sec
FFT Lines 800
FFT Avgs 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
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Cursor Amplitude
4.30 mm/sec

<Enter> to exit



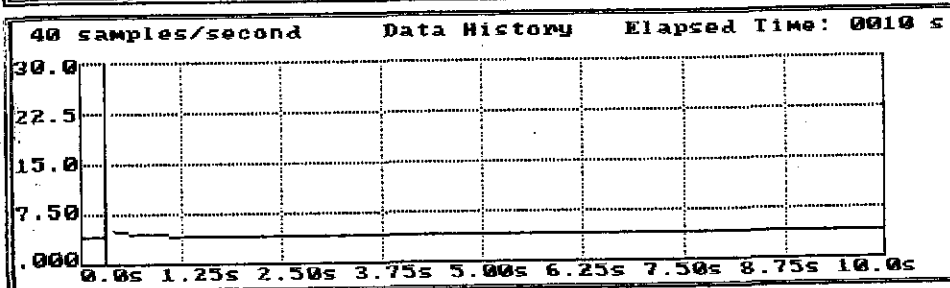
Gas Gen Trunion Support 20 MW
N1 6159 N2 7551

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 16:02:23

NOTES: GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History	
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Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

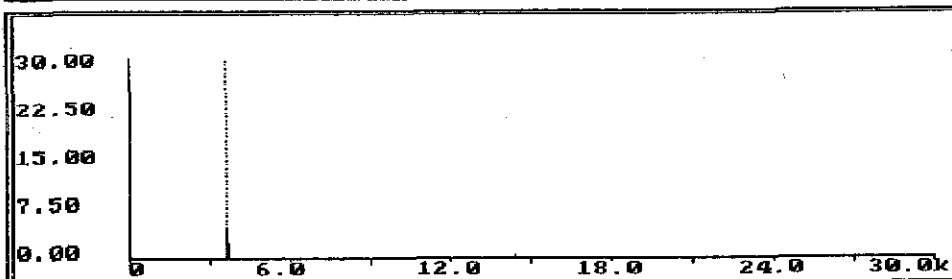
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average = 4.44
minimum = 4.42
maximum = 4.44

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:03:23

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings	
Ampl	30.0
Units	mm/sec
FFT Lines	800
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
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Cursor Amplitude
4.22 mm/sec

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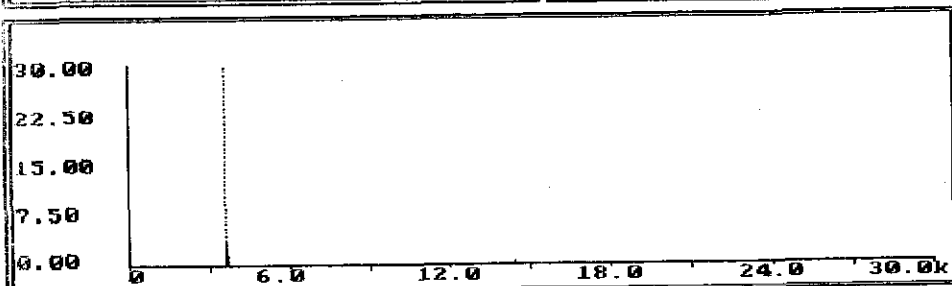
Skid Probe placed rear of the support

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:04:32

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings	
Ampl	30.0
Units	mm/sec
FFT Lines	800
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
4.18 mm/sec

<Enter> to Exit

AS

June 12/02

Power Turbine

N1 6154

20 MW

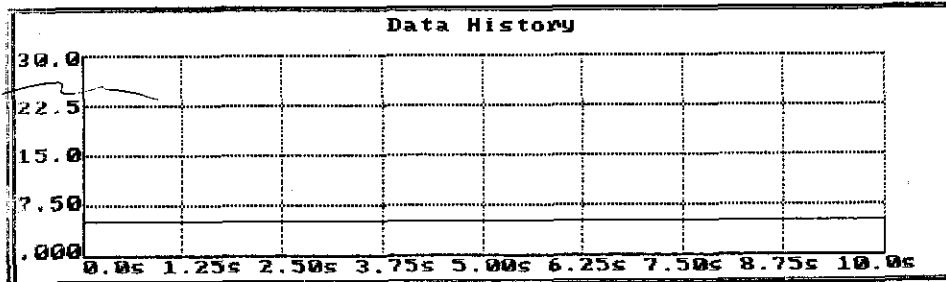
N2 7551

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:53:03

NOTES: GHR GT AND PT
GT B
PT A

** PAUSE **
Use left/right arrow
keys to review data.

<Enter> to exit



Data History
Ampl 30.0
Units mm/sec
Period 00:06:40
Rate 40
Filter Out

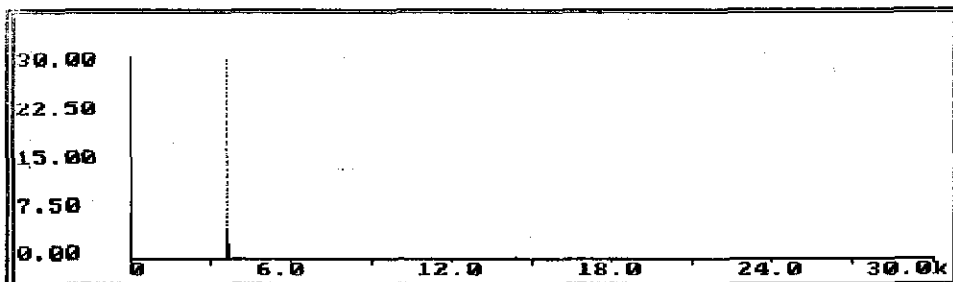
current = 5.31
average = 5.29
minimum = 5.27
amplitude = 5.31
time (s) 0.03

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 15:57:54

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings
Ampl 30.0
Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
4.39 mm/sec

<Enter> to exit

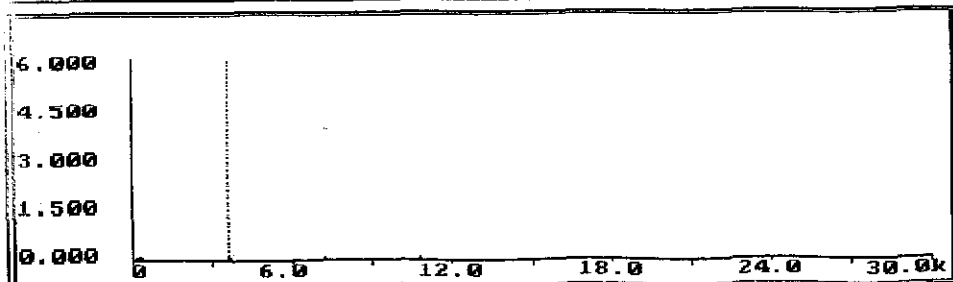
Power Turbine Skid 20 MW

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-08-01
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:10:27

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings
Ampl 6.00
Units mm/sec
FFT Lines 800
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
0.188 mm/sec

<Enter> to exit

Power Turbine 15 MW

June 12/02

N1 5752

N2 7260

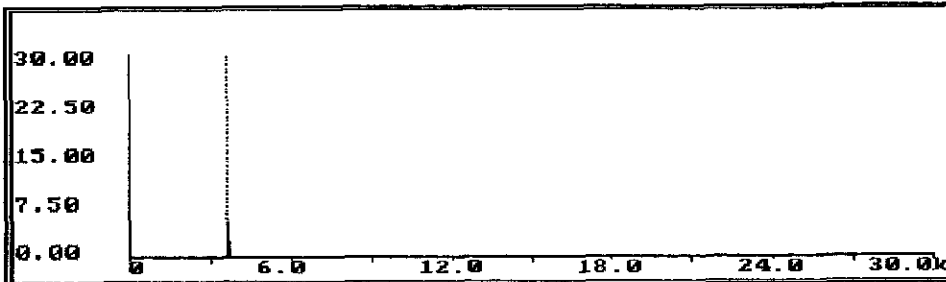
MACHINE: IRD 895 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-08-01
TIME: 15:47:43

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings

Ampl 30.0
Units mm/sec
FFT Lines 800
FFT Aves 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
5.00 mm/sec

<Enter> to Exit

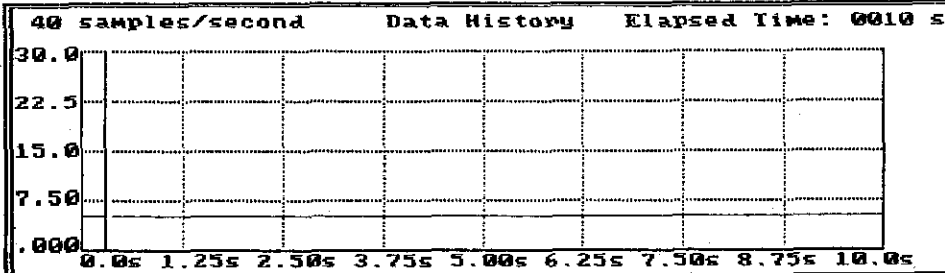
MACHINE: IRD 895 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History

DATE: 12-08-01
TIME: 15:48:27

NOTES: GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit

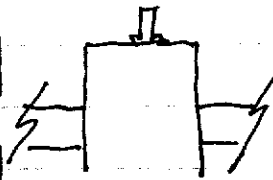


Data History

Ampl 30.0
Units mm/sec
Period 00:00:40
Rate 40
Filter Out

current = 5.31
average = 5.29
minimum = 5.27
maximum = 5.37

Ecciter Bearing 19.5 MW June 12/02



Exciter Probe placed on the top bearing cap

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-07-01
TIME: 17:18:41

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

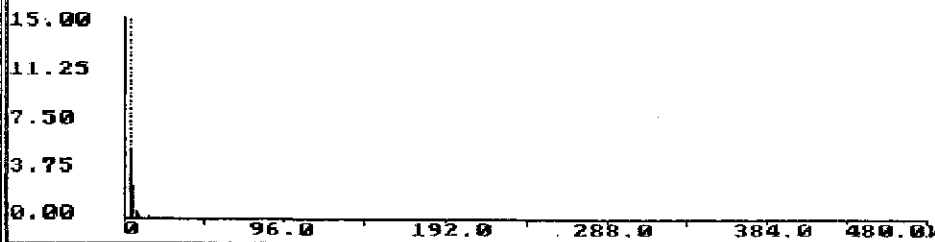
<Enter> to exit

FFT Settings

Ampl 15.0
Units mm/sec
FFT Lines 800
FFT Avgs 8
Fmax 480000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
5.12 mm/sec

<Enter> to exit



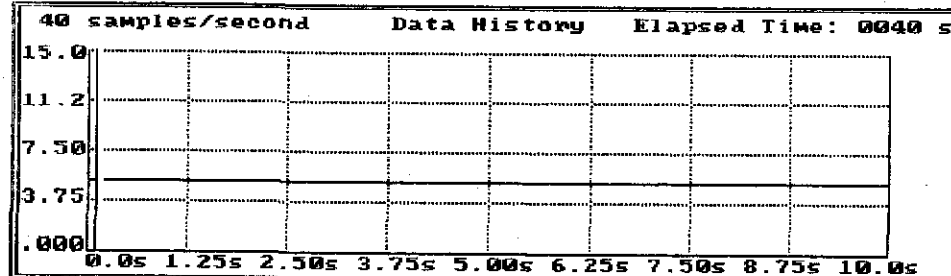
MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History

DATE: 12-07-01
TIME: 17:17:37

NOTES: GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History

Ampl 15.0
Units mm/sec
Period 00:06:40
Rate 40
Filter Out

current = 5.27
average = 5.28
minimum = 5.26
maximum = 5.34

Exciter Bearing 12.5 MW

June 12/02



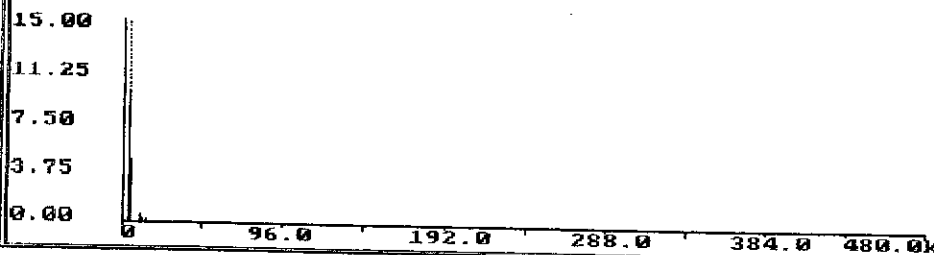
MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - FFT

DATE: 12-07-01
TIME: 17:12:04

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings

Ampl 15.0
Units mm/sec
FFT Lines 800
FFT Avgs 8
Fmax 480000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
360.0 CPM
Cursor Amplitude
9.68 mm/sec

<Enter> to exit

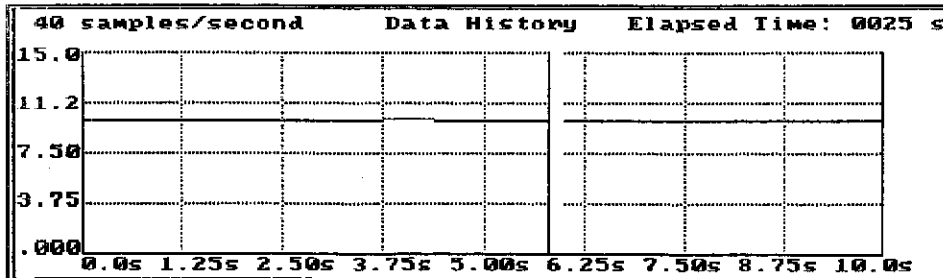
MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History

DATE: 12-07-01
TIME: 17:11:03

NOTES: GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



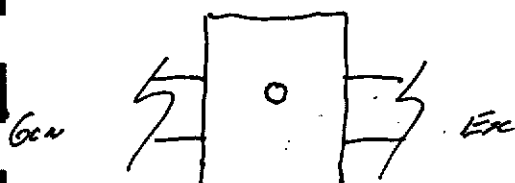
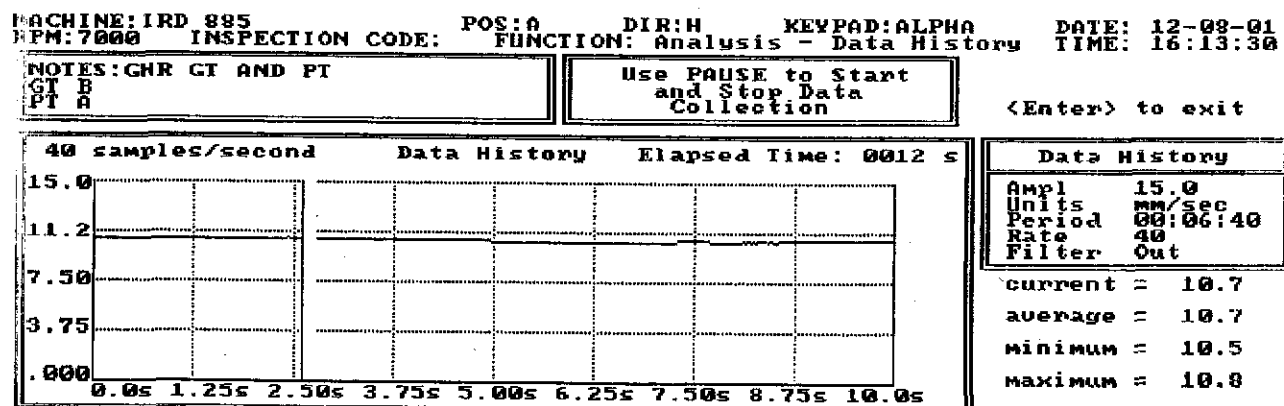
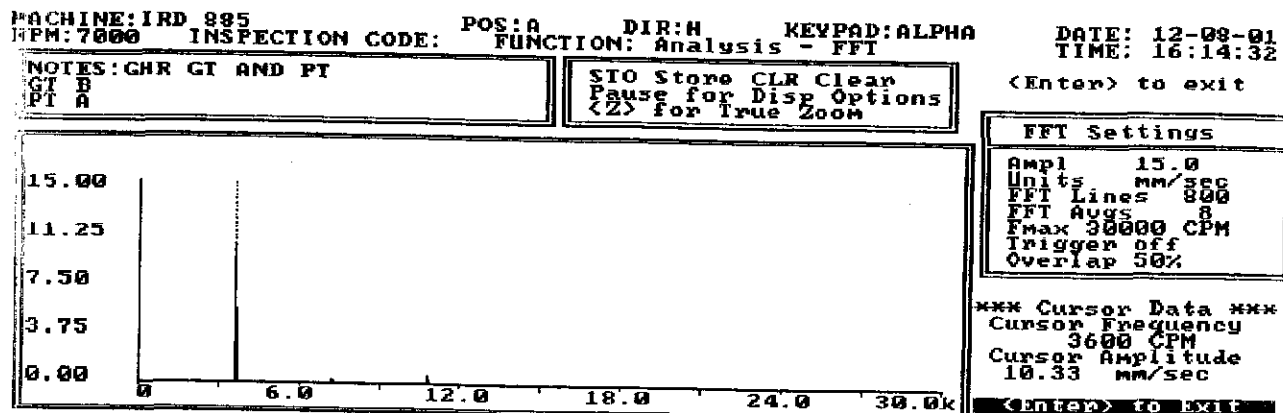
Data History

Ampl 15.0
Units mm/sec
Period 00:06:40
Rate 40
Filter Out

current = 10.0
average = 10.0
minimum = 9.94
maximum = 10.0

Exciter Bearing
10 MW

June 18/02



A10

Clutch Housing

19.5 MM

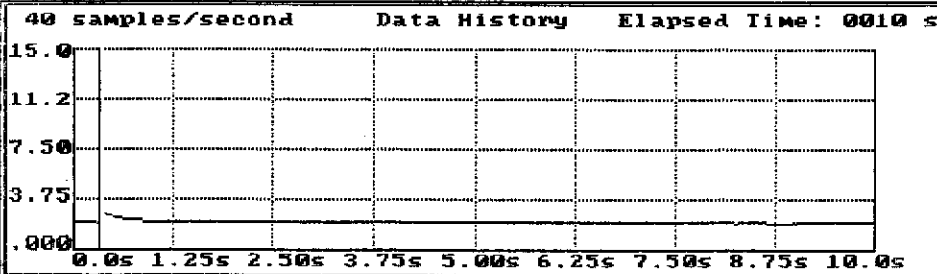
June 12/02

MACHINE:IRD 985 POS:A DIR:H KEYPAD:ALPHA DATE: 12-07-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 17:14:14

NOTES:GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History	
Ampl	15.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

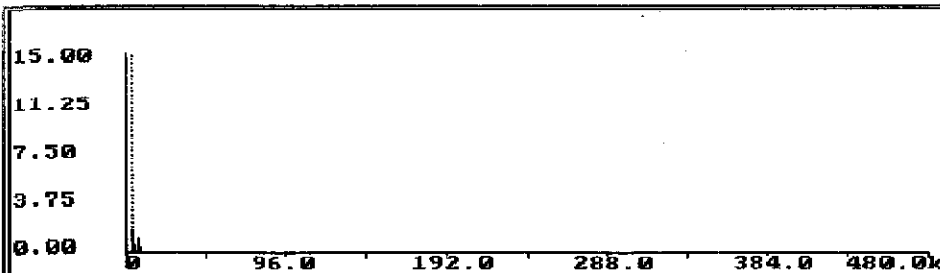
current = 2.10
average = 2.11
minimum = 2.09
maximum = 2.11

MACHINE:IRD 985 POS:A DIR:H KEYPAD:ALPHA DATE: 12-07-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 17:15:30

NOTES:GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit

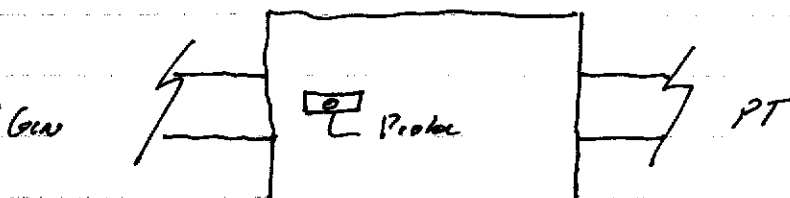


FFT Settings

Ampl	15.0
Units	mm/sec
FFT Lines	800
FFT Avgs	8
Fmax	480000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
1.53 mm/sec

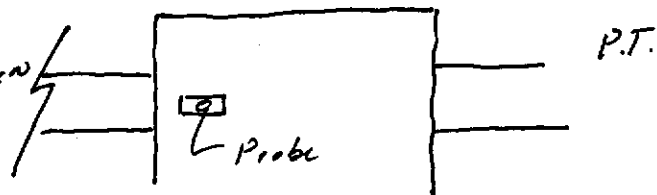
<Enter> to Exit



All

Electrical Gen Club 1307c

Unit 20MW

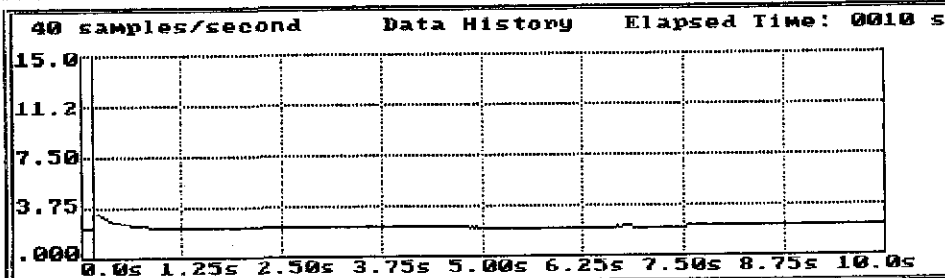


MACHINE:IRD 885 POS:A DIR:H KEYPAD:ALPHA DATE: 12-08-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 16:15:40

NOTES:GHR GT AND PT
GT B
PT A

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History

Ampl	15.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

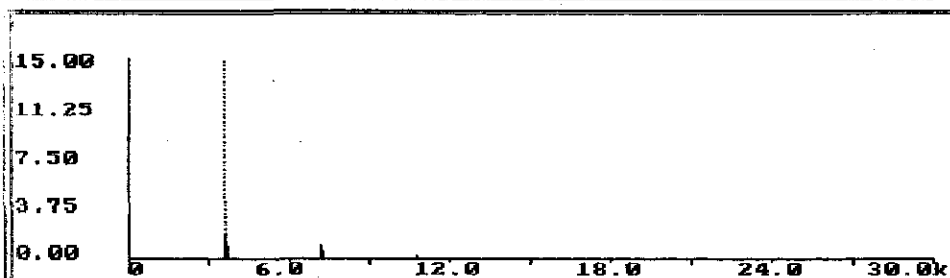
current = 2.29
average = 2.26
minimum = 2.22
maximum = 2.29

MACHINE:IRD 885 POS:A DIR:H KEYPAD:ALPHA DATE: 12-08-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:16:33

NOTES:GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



FFT Settings

Ampl	15.0
Units	mm/sec
FFT Lines	800
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
1.87 mm/sec

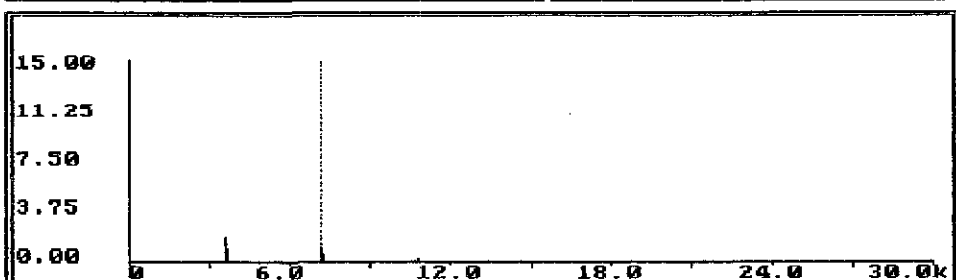
<Enter> to Exit

MACHINE:IRD 885 POS:A DIR:H KEYPAD:ALPHA DATE: 12-08-01
RPM:7000 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:16:33

NOTES:GHR GT AND PT
GT B
PT A

STO Store CLR Clear
Pause for Disp Options
<2> for True Zoom

<Enter> to exit



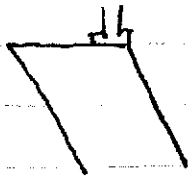
FFT Settings

Ampl	15.0
Units	mm/sec
FFT Lines	800
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
7200 CPM
Cursor Amplitude
1.15 mm/sec

<Enter> to Exit

Pilot Exciter Support June 13/02



MACHINE: IRD 995 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

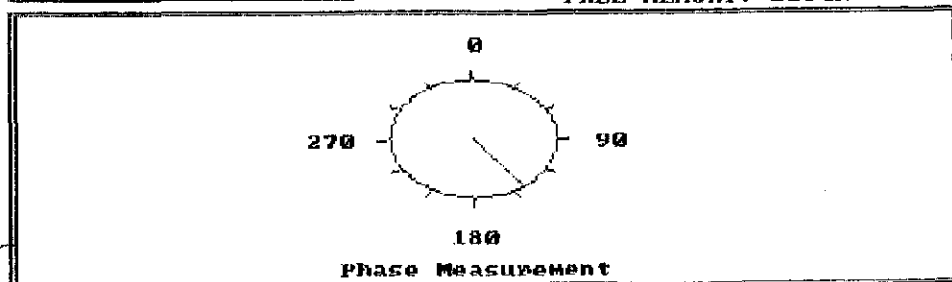
DATE: 12-09-01
TIME: 18:04:26

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clean

INPUT CHANNEL: A-970
FREE MEMORY: 1084K

<Enter> to exit



Phase	
Filter BW Broad	
Ampl	15.0
Units	mm/sec

RPM 3597 CPM
PHASE 143 DEG
AMPL 6.219 mm/sec
RANGE 15.0

MACHINE: IRD 995 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

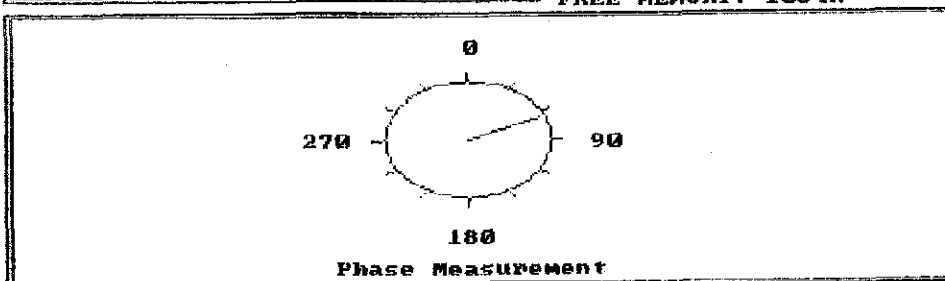
DATE: 12-09-01
TIME: 18:05:37

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clean

INPUT CHANNEL: A-970
FREE MEMORY: 1084K

<Enter> to exit

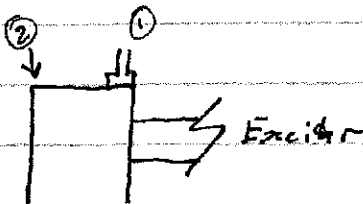


Phase	
Filter BW Broad	
Ampl	15.0
Units	mm/sec

RPM 3599 CPM
PHASE 66 DEG
AMPL 6.752 mm/sec
RANGE 15.0

Probe placed on the side of the support

Exciter Bearing



Position 1

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

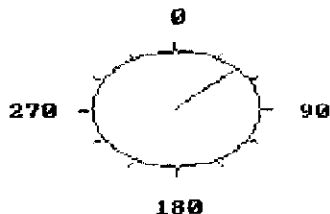
DATE: 12-09-01
TIME: 18:00:43

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear

INPUT CHANNEL: B-970
FREE MEMORY: 1084K

(Enter) to exit



Phase Measurement

Phase		
Filter	BW	Broad
Ampl	15.0	
Units	mm/sec	

RPM 3596 CPM
PHASE 47 DEG
AMPL 4.008 mm/sec
RANGE 15.0

Position 2

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

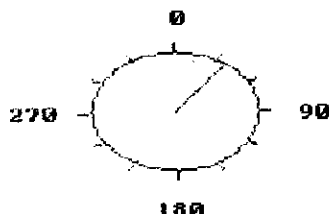
DATE: 12-09-01
TIME: 17:59:26

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear

INPUT CHANNEL: A-970
FREE MEMORY: 1084K

(Enter) to exit



Phase Measurement

Phase		
Filter	BW	Broad
Ampl	15.0	
Units	mm/sec	

RPM 3597 CPM
PHASE 39 DEG
AMPL 3.719 mm/sec
RANGE 15.0

Top of Exciter Stator

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

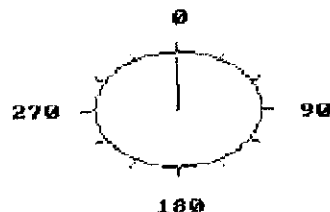
DATE: 12-09-01
TIME: 18:02:10

NOTES: GHR GT AND PT
GT B
PT A

STO Store CLR Clear

INPUT CHANNEL: A-970
FREE MEMORY: 1084K

(Enter) to exit



Phase Measurement

Phase		
Filter	BW	Broad
Ampl	15.0	
Units	mm/sec	

RPM 3597 CPM
PHASE 358 DEG
AMPL 4.089 mm/sec
RANGE 15.0

Ecciter Scoring

Jun 13/02

MACHINE: IRD 895 POS: A DIR: H KEYPAD: ALPHA
RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase

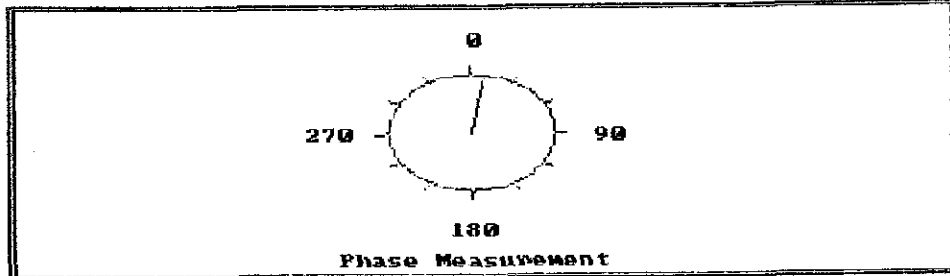
DATE: 12-09-01
TIME: 18:13:15

NOTES: GHR GT AND PT
GT B
PT A

SIO Store CLR Clean

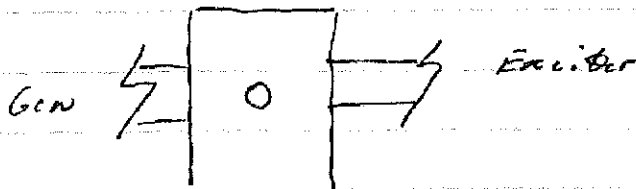
INPUT CHANNEL: B-970
FREE MEMORY: 1884K

<Enter> to exit



Phase	
Filter BW Broad	
Ampl	15.0
Units	mm/sec

RPM 3599 CPM
PHASE 10 DEG
AMPL 8.960 mm/sec
RANGE 15.0



AIS

Sum 13/02

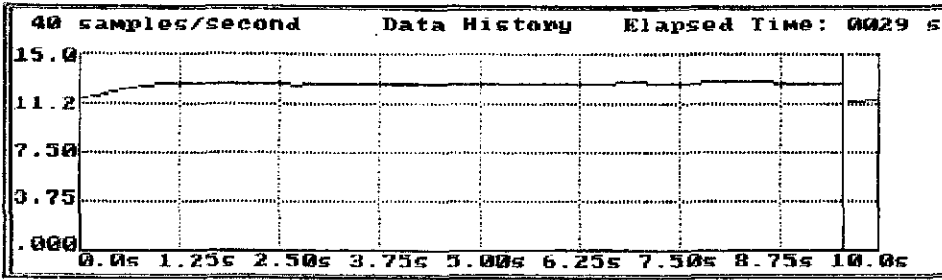
Exciter Stator Frame

MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-09-01
 RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 17:54:38

NOTES: GHR GT AND PT
 GT B
 PT A

Use PAUSE to Start
 and Stop Data
 Collection

<Enter> to exit



Data History	
Ampl	15.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 12.8
 average = 12.9
 minimum = 11.9
 maximum = 12.9

Probe on Exciter Bearing Cap Top

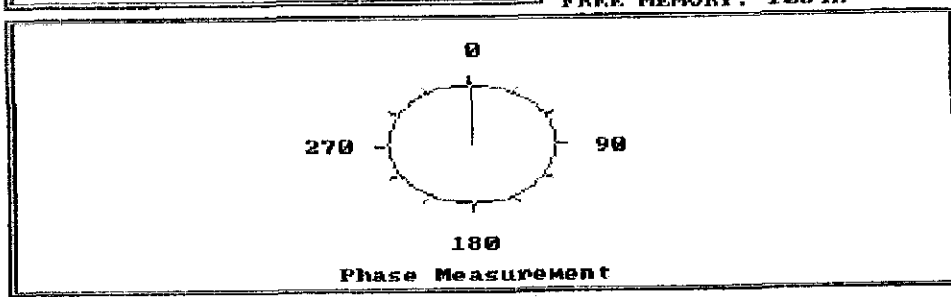
MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-09-01
 RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase TIME: 17:55:54

NOTES: GHR GT AND PT
 GT B
 PT A

STO Store CLR Clear

INPUT CHANNEL: B-970
 FREE MEMORY: 1084K

<Enter> to exit



Phase	
Filter BW Broad	
Ampl	15.0
Units	mm/sec

RPM 3599 CPM
 PHASE 1 DEG
 AMPL 11.314 mm/sec
 RANGE 15.0

Probe on Exciter Stator Frame Top

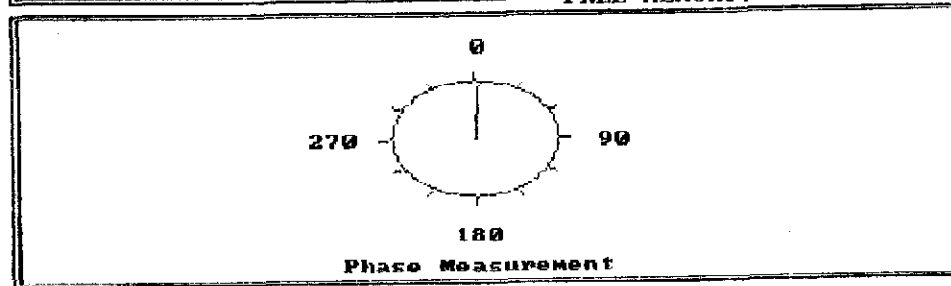
MACHINE: IRD 885 POS: A DIR: H KEYPAD: ALPHA DATE: 12-09-01
 RPM: 7000 INSPECTION CODE: FUNCTION: Analysis - Phase TIME: 17:56:51

NOTES: GHR GT AND PT
 GT B
 PT A

STO Store CLR Clear

INPUT CHANNEL: A-970
 FREE MEMORY: 1084K

<Enter> to exit



Phase	
Filter BW Broad	
Ampl	15.0
Units	mm/sec

RPM 3597 CPM
 PHASE 3 DEG
 AMPL 11.687 mm/sec
 RANGE 15.0

Aug 28/02

Probe located HP Flange

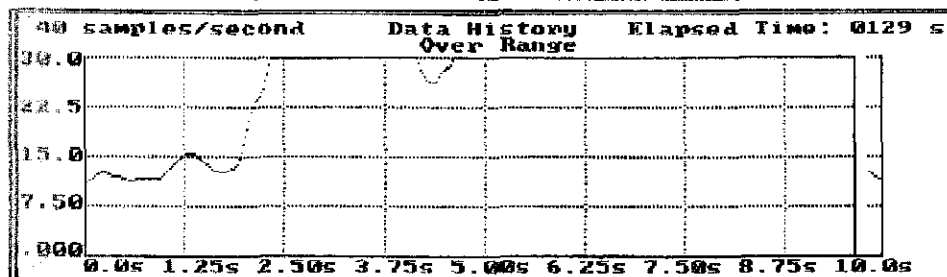
During run up

MACHINE: CHR GG POS: A DIR: H KEYPAD: ALPHA DATE: 02-24-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 19:13:02

NOTES: CHR GG PROBE RELOCATED
3902 TESTING

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History

Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 39.6
average = 37.4
minimum = 33.6
maximum = 41.2

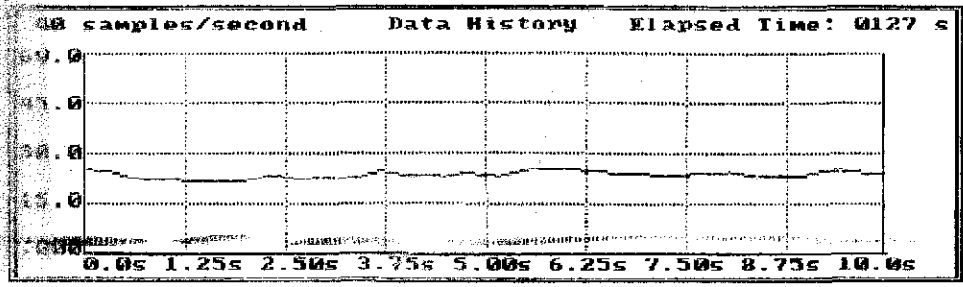
Experienced 2 peaks during acceleration most
likely the critical speeds of the LP & HP spools.

A17

Aug 29 102

HP Flange 18 MW

MACHINE:GHR CG POS:A DIR:H KEYPAD:ALPHA DATE: 02-25-02
RPM:0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 16:21:33
NOTES:GHR CG PROBE HP CASE FLANG
902 TESTING Use PAUSE to Start and Stop Data Collection
<Enter> to exit



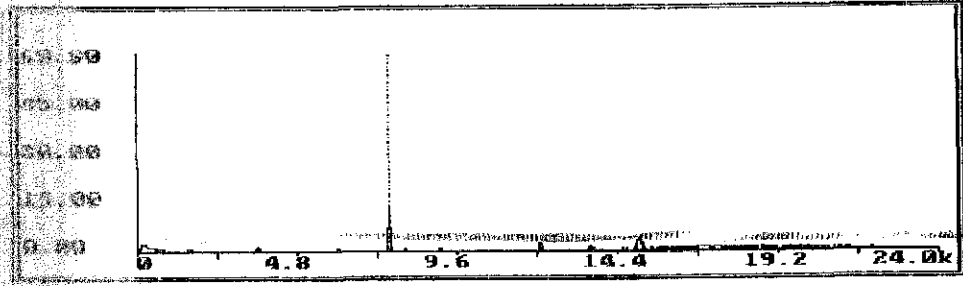
Data History

Ampl	Auto
Units	mm/sec
Period	00:06:40
Rate	48
Filter	Out

current = 24.3
average = 23.9
minimum = 21.7
maximum = 25.4

1st order HP

MACHINE:GHR CG POS:A DIR:H KEYPAD:ALPHA DATE: 02-25-02
RPM:0 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 16:28:17
NOTES:GHR CG PROBE HP CASE FLANG
902 TESTING SIO Store CLR Clear Pause for Disp Options <2> for True Zoom
<Enter> to exit



FFT Settings

Ampl	60.0
Units	mm/sec
FFT Lines	400
FFT Avg	8
Fmax	24000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency 7560 CPM
Cursor Amplitude 14.03 mm/sec
<Enter> to exit

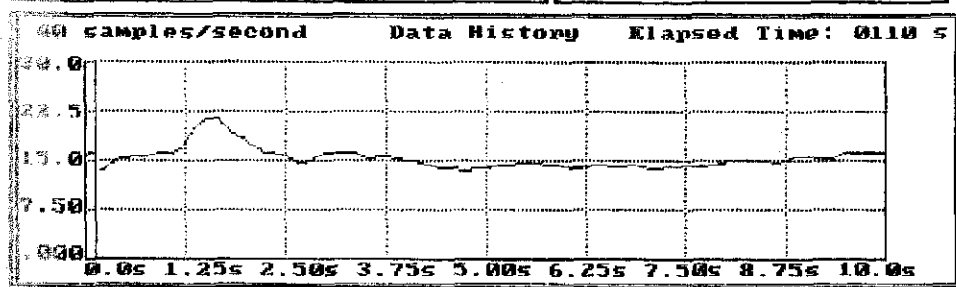
A18

Aug 29/02

Probe placed on the HP Compensator
Flange

Run up

MACHINE: CHR CG POS: A DIR: H KEYPAD: ALPHA DATE: 02-25-02
 RPM: 0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:41:22
 NOTES: CHR CG PROBE HP CASE FLANG Use PAUSE to Start and Stop Data Collection
 1902 TESTING <Enter> to exit



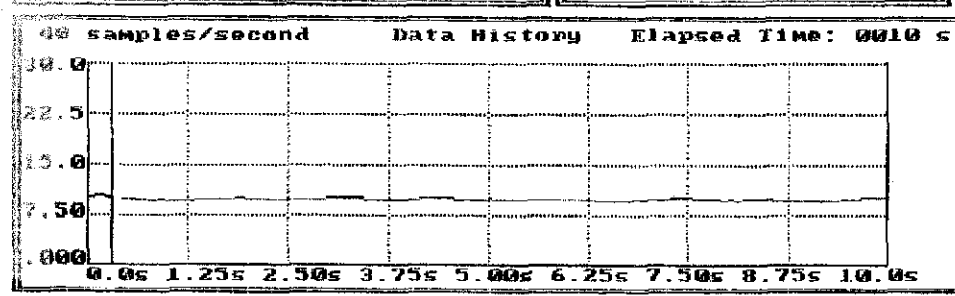
Data History

Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 16.3
 average = 15.9
 minimum = 13.6
 maximum = 21.6

HP Flange 2.0 MW

MACHINE: CHR CG POS: A DIR: H KEYPAD: ALPHA DATE: 02-25-02
 RPM: 0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:37:07
 NOTES: CHR CG PROBE HP CASE FLANG Use PAUSE to Start and Stop Data Collection
 1902 TESTING <Enter> to exit



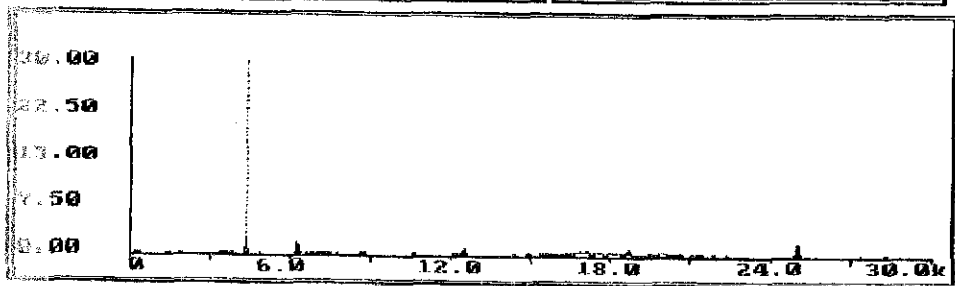
Data History

Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 10.4
 average = 9.99
 minimum = 9.64
 maximum = 10.5

HP Flange 2.0 MW

MACHINE: CHR CG POS: A DIR: H KEYPAD: ALPHA DATE: 02-25-02
 RPM: 0 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 15:38:30
 NOTES: CHR CG PROBE HP CASE FLANG STO Store CLR Clear
 1902 TESTING Pause for Disp Options <2> for True Zoom <Enter> to exit



FFT Settings

Ampl	30.0
Units	mm/sec
FFT Lines	400
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

Cursor Data
 Cursor Frequency 4350 CPM
 Cursor Amplitude 2.49 mm/sec
 <Enter> to Exit

A19

Aug 29/02

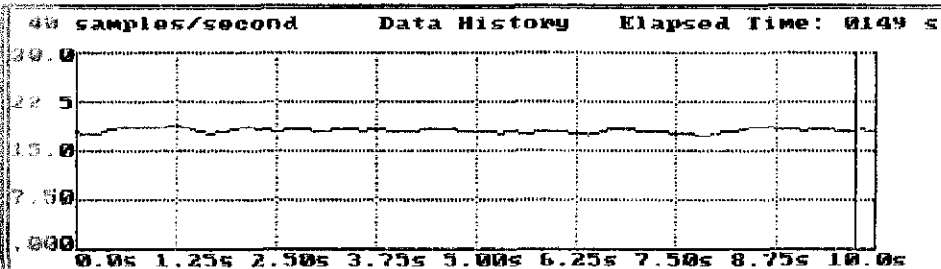
HP Flange 10 MW

MACHINE: GHR CG POS: A DIR: H KEYPAD: ALPHA DATE: 02-25-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:42:19

NOTES: GHR CG PROBE HP CASE FLANG
1002 TESTING

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History

Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out
current	= 18.5
average	= 18.1
minimum	= 17.5
maximum	= 19.0

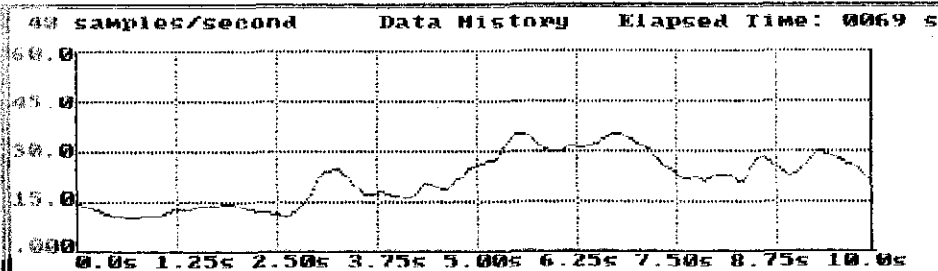
loading

MACHINE: GHR CG POS: A DIR: H KEYPAD: ALPHA DATE: 02-25-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 15:34:35

NOTES: GHR CG PROBE HP CASE FLANG
1002 TESTING

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit



Data History

Ampl	60.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out
current	= 21.4
average	= 23.6
minimum	= 10.4
maximum	= 30.3

A20

Probe located on 7th
LP Compressor Flange

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20 MIN

111 - 6705

N2 = 7584

MACHINE: CHR GC
RPM: 0

INSPECTION CODE:

POS: A

DIR: H

KEYPAD: ALPHA

DATE: 02-24-02

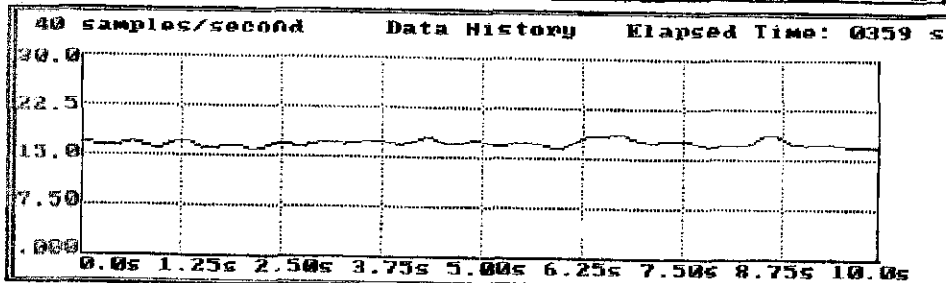
FUNCTION: Analysis - Data History

TIME: 20:29:39

NOTES: CHR GC PROBE RELOCATED
2002 TESTING

Use PAUSE to Start
and Stop Data
Collection

(Enter) to exit



Data History

Ampl	30.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 16.9
average = 17.6
minimum = 16.1
maximum = 10.7

1st order LP

MACHINE: CHR GC
RPM: 0

INSPECTION CODE:

POS: A

DIR: H

KEYPAD: NUMERIC

DATE: 02-24-02

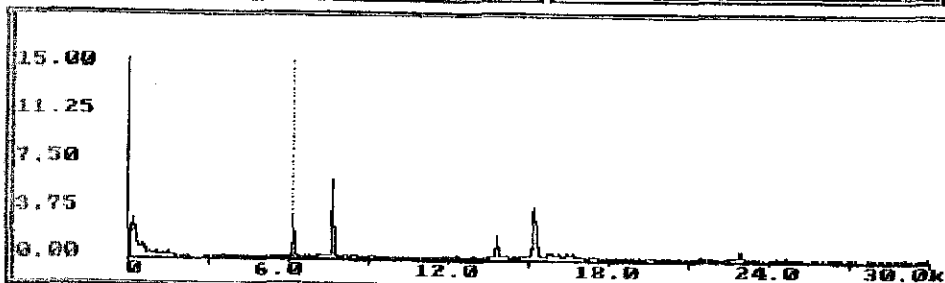
FUNCTION: Analysis - FFT

TIME: 20:32:43

NOTES: CHR GC PROBE RELOCATED
2002 TESTING

STO Store CLR Clear
Pause for Disp Options
(2) for True Zoom

(Enter) to exit



FFT Settings

Ampl	15.0
Units	mm/sec
FFT Lines	400
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
6150 CPM
Cursor Amplitude
3.30 mm/sec

(Enter) to exit

1st order HP

MACHINE: CHR GC
RPM: 0

INSPECTION CODE:

POS: A

DIR: H

KEYPAD: NUMERIC

DATE: 02-24-02

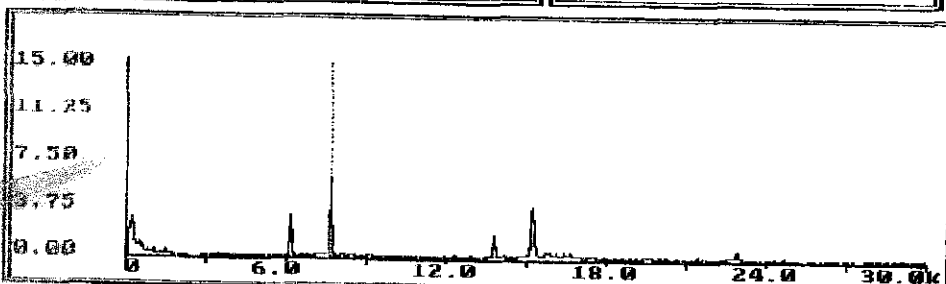
FUNCTION: Analysis - FFT

TIME: 20:32:12

NOTES: CHR GC PROBE RELOCATED
2002 TESTING

STO Store CLR Clear
Pause for Disp Options
(2) for True Zoom

(Enter) to exit



FFT Settings

Ampl	15.0
Units	mm/sec
FFT Lines	400
FFT Avg	8
Fmax	30000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
7650 CPM
Cursor Amplitude
6.03 mm/sec

(Enter) to exit

A 21

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Probe located LP Flange
20 MW

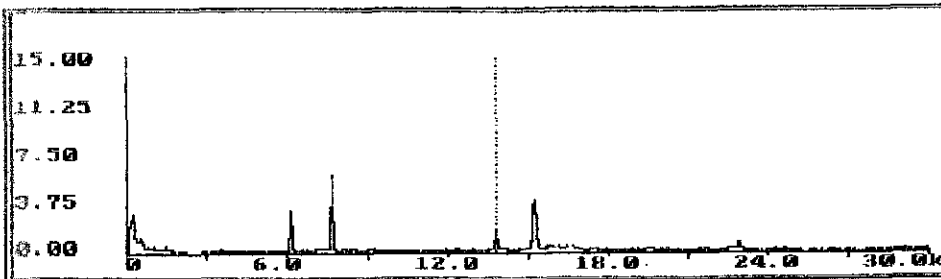
2nd order LP

MACHINE: GHR CC POS: A DIR: H KEYPAD: NUMERIC DATE: 02-24-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 20:31:17

NOTES: GHR GG PROBE RELOCATED
2002 TESTING

STO Stone CLR Clear
Pause for Disp Options
(2) for True Zoom

(Enter) to exit



FFT Settings

Ampl 15.0
Units mm/sec
FFT Lines 400
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
13800 CPM
Cursor Amplitude
1.99 mm/sec

(Enter) to exit

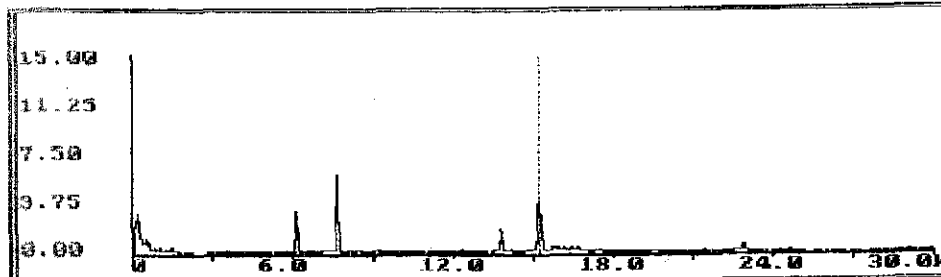
2nd order HIP

MACHINE: GHR CC POS: A DIR: H KEYPAD: NUMERIC DATE: 02-24-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 20:31:44

NOTES: GHR GG PROBE RELOCATED
2003 TESTING

STO Stone CLR Clear
Pause for Disp Options
(2) for True Zoom

(Enter) to exit



FFT Settings

Ampl 15.0
Units mm/sec
FFT Lines 400
FFT Avg 8
Fmax 30000 CPM
Trigger off
Overlap 50%

*** Cursor Data ***
Cursor Frequency
15225 CPM
Cursor Amplitude
4.67 mm/sec

(Enter) to exit

A22

Aug 28/02

Exide Bearing

Probe located on the top cap
70 MM

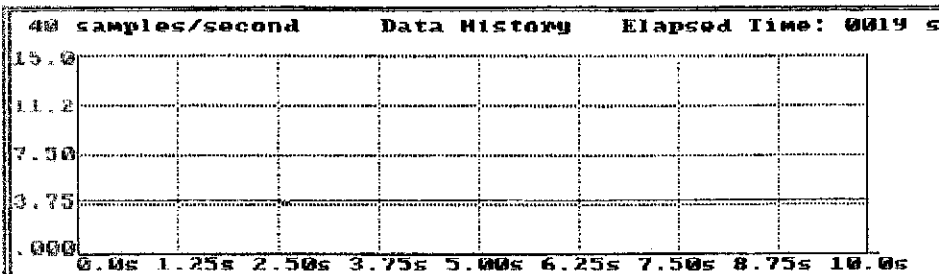
MACHINE: GHR CC POS: A DIR: H KEYPAD: ALPHA DATE: 02-24-02
RPM: . INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 20:40:00

NOTES: GHR EX PROBE RELOCATED

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit

2002 TESTING



Data History	
Ampl	15.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 4.11
average = 4.09
minimum = 4.05
maximum = 4.12

Probe located on the split line

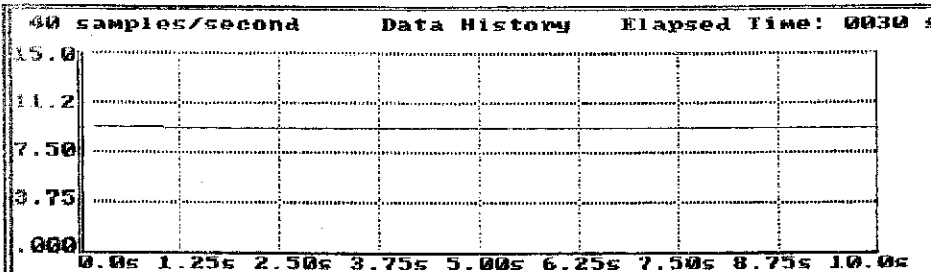
MACHINE: GHR CC POS: A DIR: H KEYPAD: ALPHA DATE: 02-24-02
RPM: . INSPECTION CODE: FUNCTION: Analysis - Data History TIME: 20:41:01

NOTES: GHR EX PROBE RELOCATED

Use PAUSE to Start
and Stop Data
Collection

<Enter> to exit

2002 TESTING



Data History	
Ampl	15.0
Units	mm/sec
Period	00:06:40
Rate	40
Filter	Out

current = 9.34
average = 9.34
minimum = 9.32
maximum = 9.47

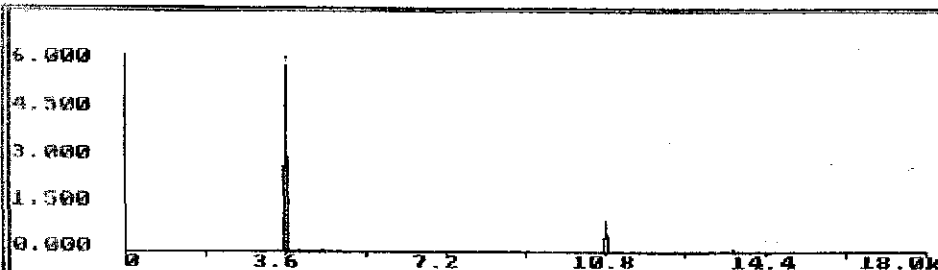
MACHINE: GHR CC POS: A DIR: H KEYPAD: NUMERIC DATE: 02-24-02
RPM: 0 INSPECTION CODE: FUNCTION: Analysis - FFT TIME: 20:42:29

NOTES: GHR EX PROBE RELOCATED

STO Store CLR Clean
Pause for Disp Options
<2> for True Zoom

<Enter> to exit

2002 TESTING



FFT Settings	
Ampl	6.00
Units	mm/sec
FFT Lines	400
FFT Avg	8
Fmax	10000 CPM
Trigger	off
Overlap	50%

*** Cursor Data ***
Cursor Frequency
3600 CPM
Cursor Amplitude
5.668 mm/sec

<Enter> to Exit