Nitish Industrial Machinery Diagnostics Centre Private Limited

Deals in: (A HOUSE OF CONDITION MONITORING & RENEWABLES ENERGY, TURBINE TROUBLESHOOTING & BALANCING)

(ENGINEERING SERVICES, CONSULTANCY & CONTRACTS)

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Ref: NIMDC/2018/51/2
DATE 12.04.2018

TO.
SHRI. M. IQBAL
SUPERINTENDING ENGINEER O&M-I,
RAJIV GANDHI THERMAL POWER PLANT (RGTPP),
HARYANA POWER GENERATION CORPORATION LIMITED
HPGCL, KHEDAR
VILLAGE KHEDAR, HISAR
HARYANA, PIN - 125121

Subject :-High Vibration Spikes Problem of TG#1 (BRG #9) OF RGTPP

Dear Sir,

Thanking you for giving an opportunity to NIMDC Pvt Ltd to carryout study on High Vibration spikes problem of TG#1 (BRG#9) which was initially observed on 4th Jan 2018 and reoccurred on 7th April 2018. The steady state and transient vibration data recorded during the events by the on-line system alongwith operation parameters were analyzed in detail and our recommendations are enclosed in the report for your kind information and necessary action please.

With kind Regards,

Yours Sincerely

12/4/2018

(C.G.Porwal)
Chairman & Managing Director
NIMDC PVT. LTD.

Copy for kind information pl
SHRI. V. K. SETHI
CHIEF ENGINEER,
RAJIV GANDHI THERMAL POWER PLANT (RGTPP),
HARYANA POWER GENERATION CORPORATION LIMITED
HPGCL, KHEDAR
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HARYANA, PIN - 125121

For kind information P).
Shri V. K. Seth:
Chief Engineer.
HISAR.

STUDY REPORT

ON

UNIT TG#1 HIGH VIBRATION SPIKE AT BEARING NO #9

Prepared By

"Nitish Industrial Machinery Diagnostics Centre Private Limited"

9th April to 10th April 2018

Rajiv Gandhi Thermal Power Project (RGTPP),
Khedar, Hisar

REPORT ON TG#1

Subject:-VIBRATION SPIKES AT RGTPP TG #1 AT BRG NO#9

1.0 INTRODUCTION:-Rajiv Gandhi Thermal Power Station is located at Khedar in Hisar district of Haryana. The installed capacity of RGTPP is 2 X 600 MW (1200 MW). The Unit#1 and Unit#2 have been commissioned on 24th August 2010 and 1stMarch 2011 respectively. TG #1 comprises of several turbine casings and rotors (HP/IP, 2LPs, Generator and Exciter) which are supported by seven journal bearings along with an additional journal bearing provided for the main exciter as shown in Figure no 1.

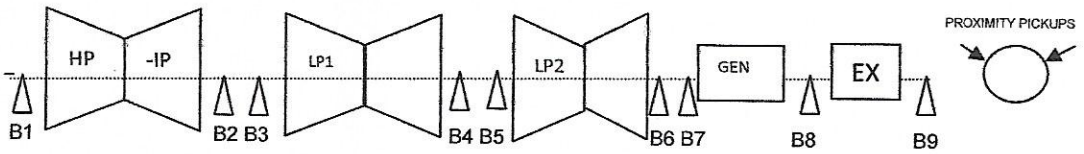


Figure No 1

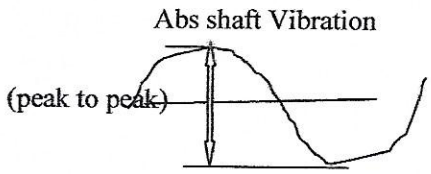
Turbine generator (600 MW) comprises of nine pressure-lubricated bearings and is having on-line absolute shaft vibration pickups (installed at 90 degree apart) on each bearing for monitoring of steady state and transient vibration data.

Vibration Limits for Operations

The vibration limits for "turbine control settings" for vibration limits, as stipulated by OEM, are as follows:-

Vibration Limits (Pk-Pk) ↕

- ✓ 0.07mm for satisfactory operation
- ✓ 0.127mm-for alarm
- ✓ 0.254mm-for trip



2.0 CHRONOLOGICALINCIDENTS

i) On 4th Jan 2018:

The Unit experienced high vibration spikes at BRG No #9 in the X and Y directions. The vibration data recorded at 596 MW at 3004 rpm at 10.00 hrs which are as follows.

	B1	B2	B3	B4	B5	B6	B7	B8	B9
Shaft vibration X/Y	NA/69	104/105	44/35	42/39	82/53	55/53	25/26	19/18	>250*/250*
Babbitt Metal Temp (L/R)	76/83	87/85	76/72	74/78	56/33	74/85	60/62	61/63	76/72

The unit did not trip in spite of high vibration spike at BRG No #9, because of the time delay provided for 3 seconds in the tripping circuits.

Corrective Action

As a corrective action, connectors of extension cables of vibration probes installed at BRG# 9X / 9Y checked for connection healthiness.

ii) On 7th April 2018

At 10.28 hrs high vibration spike was observed at BRG No #9 again in both the directions and persisted less than (3) seconds and the unit did not trip. But at 13.03 hrs, the high vibration spikes at BRG #9 reoccurred and persisted for the longer periods and caused tripping. The vibration readings recorded, prior to the tripping, at 415 MW at 2997 rpm, are as follows –

Bearings	B1	B2	B3	B4	B5	B6	B7	B8	B9
Shaft vibration X/Y	NA/NA	95/94	44/29	46/38	90/62	63/50	34/48	24/15	37/49
Babbitt Metal Temp (L/R)	71/79	86/84	72/68	72/75	53/33	69/82	58/60	59/60	74/69

*All bearings absolute shaft vibrations were within the limits and loaded adequately.

Corrective Action

Since high vibration spike beyond tripping limits at BRG #9 in the both (X/Y) directions was persisted more than three seconds, the unit tripped on high vibration protection.

Again, as a corrective measures –

i) Connectors of extension cables of vibration probes installed at BRG#9 (X/Y) were checked for healthiness & found ok.

ii) Earthing of field cables at panel side also checked and found ok.

iii) The Machinery protection card (MPC 4) and input/output card (IOC-4T) of BRG #9 sensor signal were replaced.

The machine was rolled again and re-synchronized.

iii) On 7th April 2018

The vibration readings recorded, after the replacement of BRG No #9 (MPC4 /IOC-4T) card, at 325MW at 2990 rpm at 22.20 hrs are as follows –

Bearings	B1	B2	B3	B4	B5	B6	B7	B8	B9
Shaft vibration X/Y	13/11	84/87	45/38	40/40	88/38	58/38	35/28	32/36	37/40
Babbitt Metal Temp (L/R)	73/79	88/86	72/68	74/77	56/33	70/84	59/62	61/61	76/72

iv)) On 9th April 2018

The final vibration readings recorded at 380 MW / 2991 rpm at 13.45 PM **(Annex-I)**are as follows –

Bearings	B1	B2	B3	B4	B5	B6	B7	B8	B9
Shaft vibration X/Y	X/Y	91/93	44/33	45/38	89/61	63/53	40/23	30/19	36/48
Babbitt Metal Temp (L/R)	71/78	88/84	70/63	72/73	55/-	63/81	58/60	59/59	73/69
Return oil temperature deg C	60	63	58	59	60	58	56	57	63

Seal oil temperature 53 deg C ; Generator Hot /Cold gas temperature 39.3/38.1 deg C

3. OBSERVATIONS AND ANALYSIS

NIMDC expert's team have observed the following points

✓ At any occasion, when high vibration spikes at bearing# 9, high vibration or spike was not observed in any other bearings. The shaft & pedestal vibration data taken at all bearings were found normal.

- ✓ No changes in load/frequency and turbine parameters were noticed during the incidents.
- ✓ The bearing babbitt metal and drain oil temperatures were found normal at all occasions.
- ✓ No variations in excitation voltage and current were noticed during the high spikes periods **(Annex-II).**
- ✓ The steady data & transient data format (Orbit/Bode /Spectrum) were studied & analyzed and found to be normal. The bode plot/coast down taken by on line system revealed no abnormality in the machine. The bode plot and orbit plot are enclosed at **(Annex-III** & **Annex-IV** respectively.
- ✓ The dip in gap voltages of shaft vibration sensors were experienced on 4thJan 2018 as well as on 7th April 2018, prior to the high vibration spikes observed. Interestingly, dips in gap voltage were not observed at the instant of high vibration spikes. **(Annex-V)**

4. CONCLUSION:

The based on the above observations following points were concluded

i) The observation in BRG#9 is standalone having no consequential change in any other bearings.

ii) No relationship could be established with any operational parameters with BRG#9 high vibration spikes .

iii) There is no relationship between dip in gap voltages and vibration spikes. Refer **(Annex-V)**

iv) No electrical parameters are causing the subject abnormality (high vibration spikes) .Refer **(Annex-II).**

v) It is obvious from the data that there is no mechanical side abnormality and the repeated incidents of high vibration spikes could be spurious. This may be due to malfunctioning and erratic behavior of cards. Stray current due to transient earthing of control cables cannot be ruled out.

Stray current refers to the electricity flow via buildings, ground or equipment due to electrical supply system imbalances or wiring flaws. It refers to an existence of electrical potential that can be found between objects that should not be subjected to voltage.

Often, small voltages are gauged between grounded materials that exist in distant places because of ordinary current flow within the power system. On the other hand, large voltages can be a sign of a faulty electrical system. Due to this stray voltage there is a flow of definite current between two objects that ideally should not have any voltage difference between them. This current is known as stray current. Stray current may become a dangerous for personnel and equipments.

5. **Probable causes of the incidents are;**

i) The malfunction of the Machinery protection card.

ii) Transient earthing of control cable of vibration pickup of bearing #9

6. **Recommendations.**

i) The MPC card has to be changed. Incidentally, these two cards have already been changed on 7th April 2018 before rerolling of the turbines.

iii) Gap voltage should be monitored weekly and should be corroborated with card malfunctioning.

iv) The vibration proximity probe control cable & conduit to be changed at the earliest opportunity.

v) Separate conduit should be used for BRG # 9 X and 9Y extension cables.

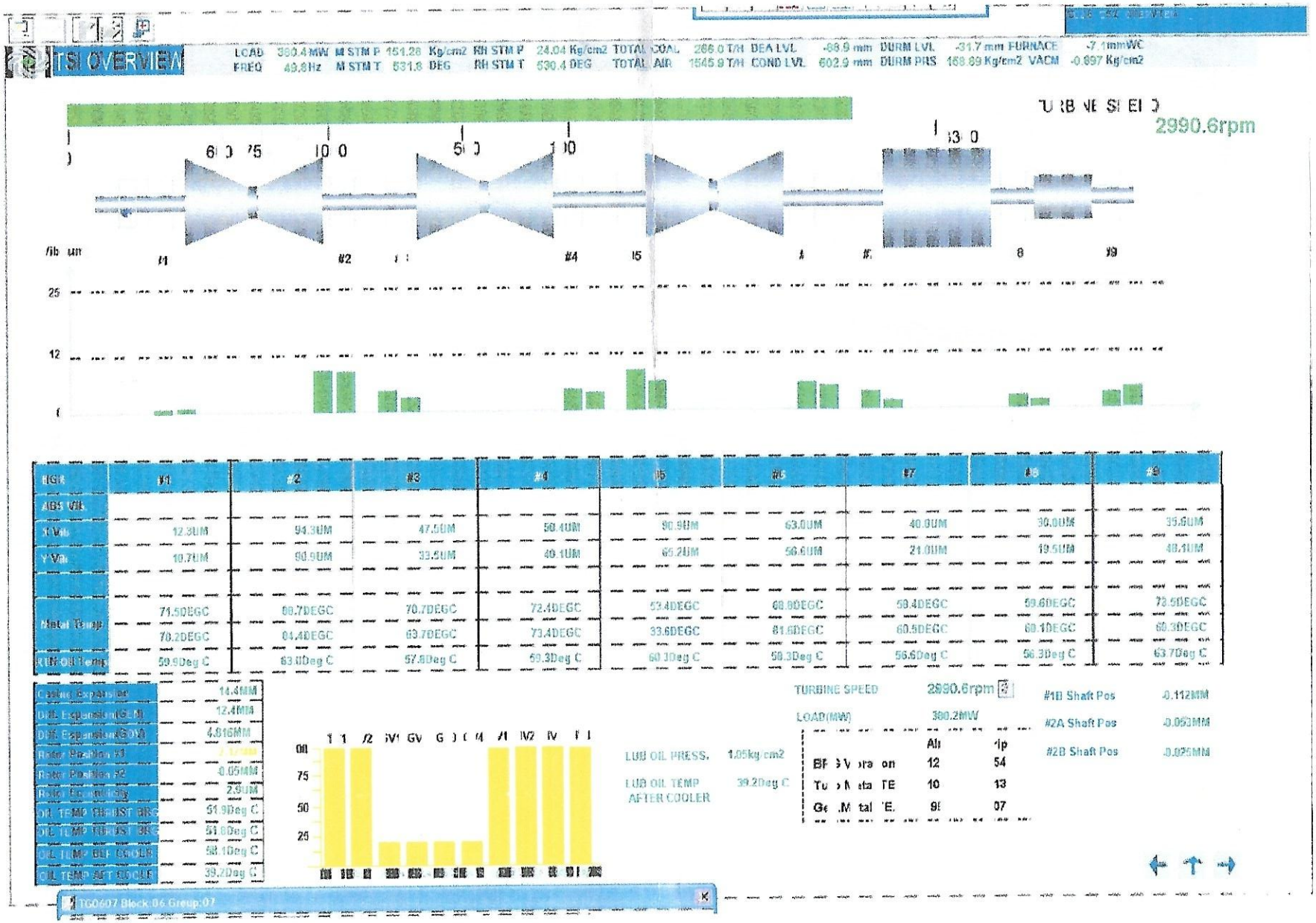
vi) Detachable connectors should be used to ensure the healthiness of the connection between the two control cables (integral and extension cables).

12/4/2018

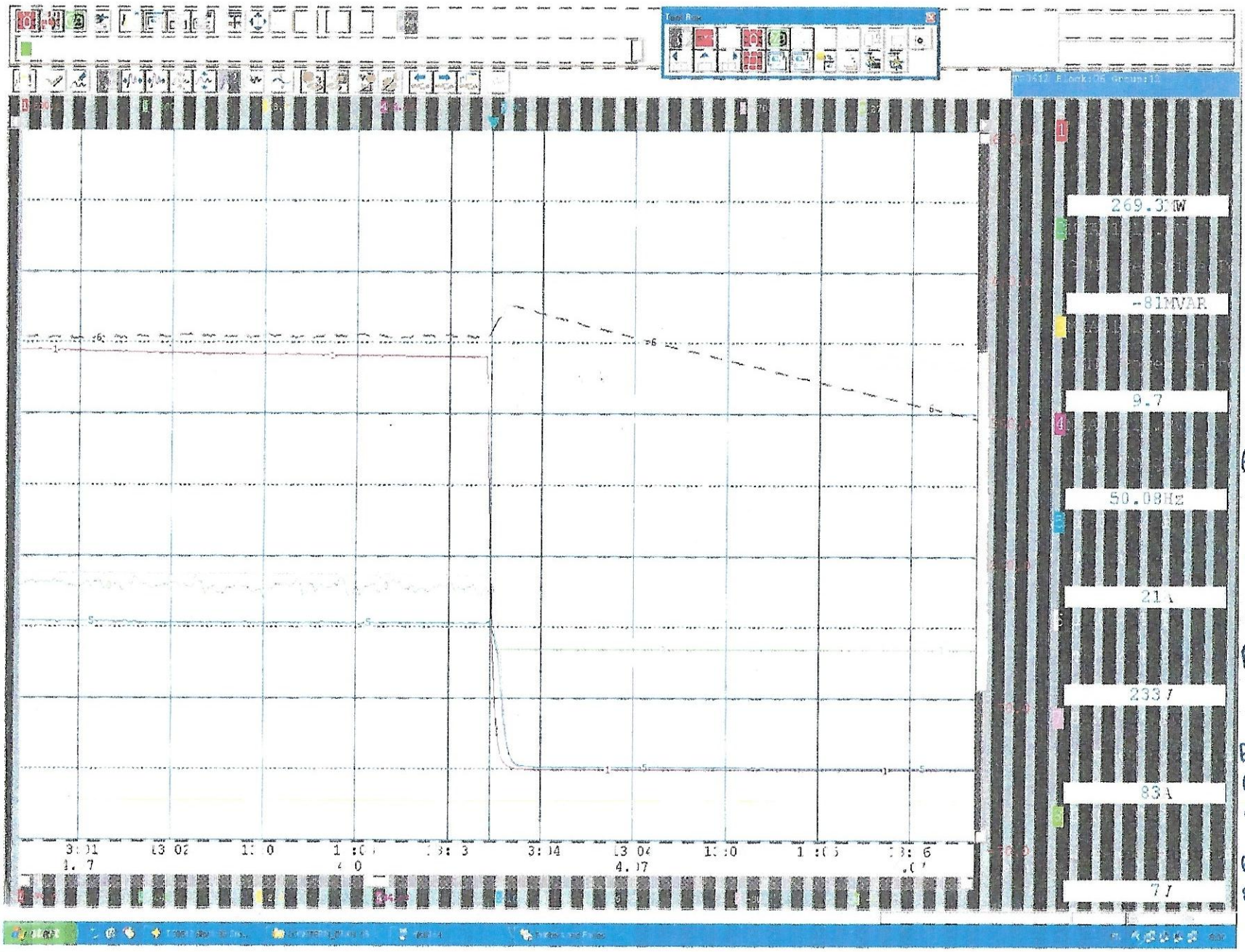
(CHANDRA GUPT PORWAL)
NIMDC PVT LTD

ANNEX -I

9/4/2018 - 1345 PM



ANNEX-II



Load

MVAR

Powerfacto

Frequency

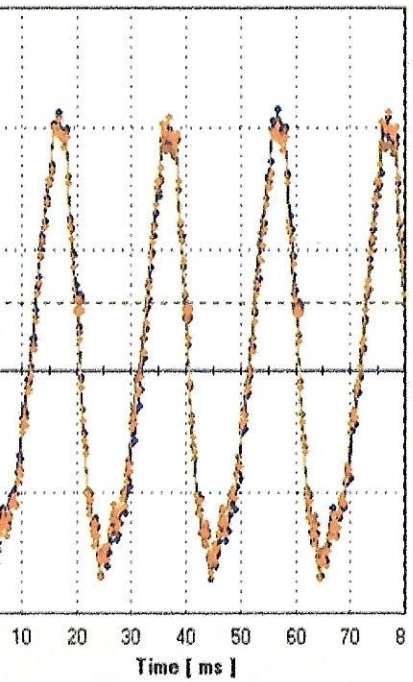
PMG Curren

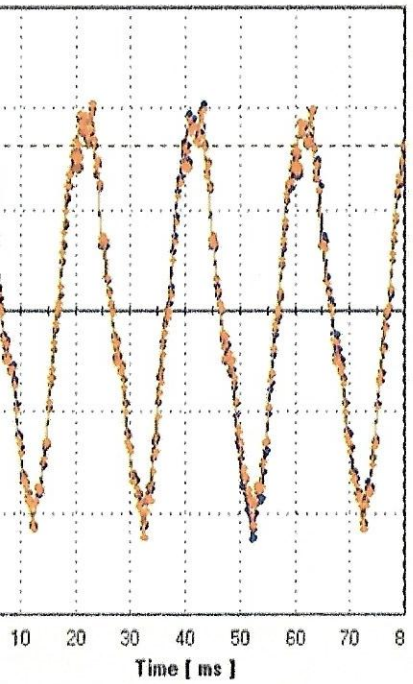
PMG Current

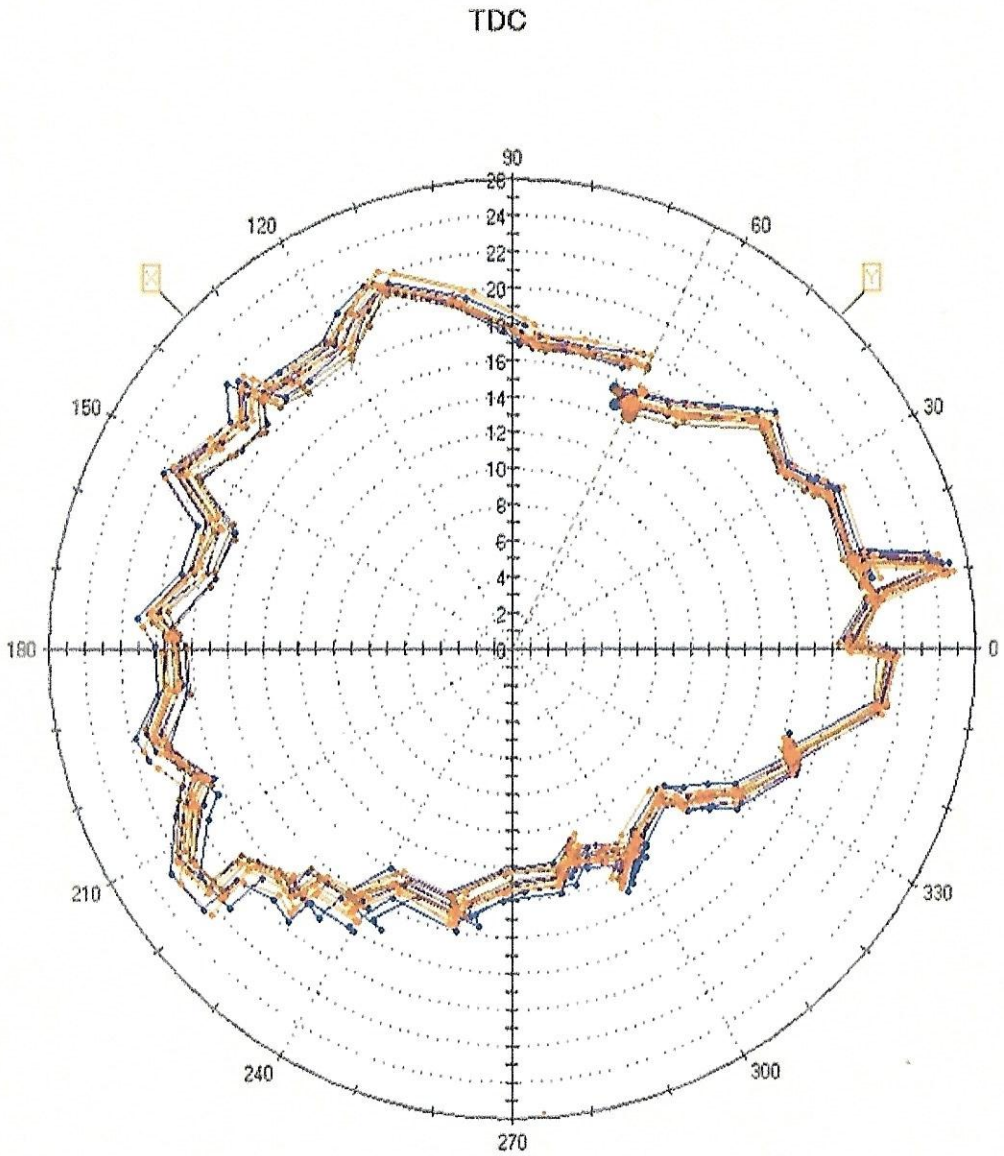
Exciter Excitation Current,

Exciter Excitatio Voltage,

View Tools Privileges Window Help







Orbit

Legend

Point	Time
9-Orbit	2018-04-07 10:25:00
9-Orbit	2018-04-07 10:35:00
9-Orbit	2018-04-07 10:40:00

Name	Value
Station	MAIN
Machine	STG
Rotation	Clockwise

X - probe

Point :	#9 SV-X
Time :	79.69 ms
Amplitude (X) :	5.62 µm

Y - probe

Point :	#9 SV-Y
Time :	79.69 ms
Amplitude (Y) :	16.35 µm

Orbit

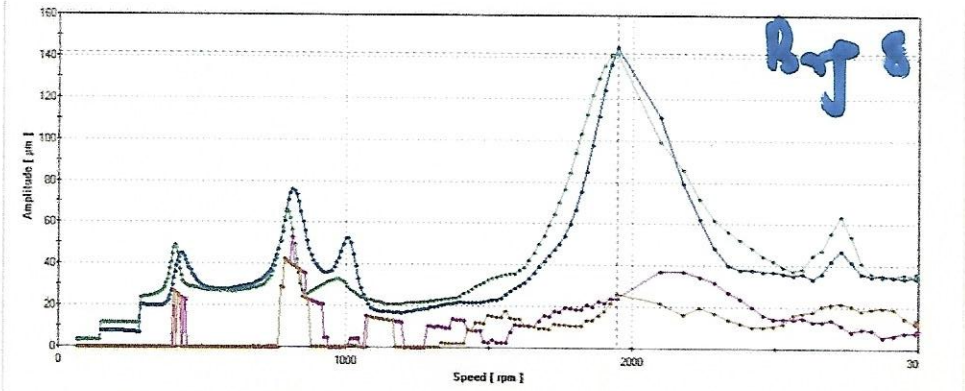
Point :	#9-Orbit
Phase :	63.98 °
Amplitude :	17.29 µm

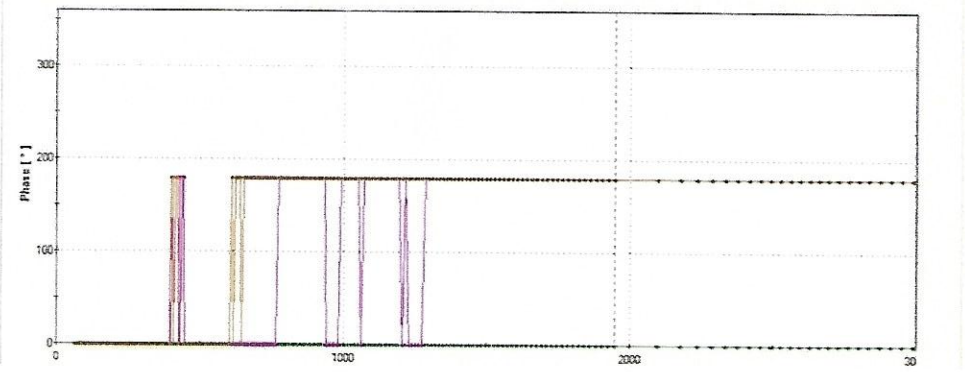
Axial - III

NUM

Rundown - Amax - IV

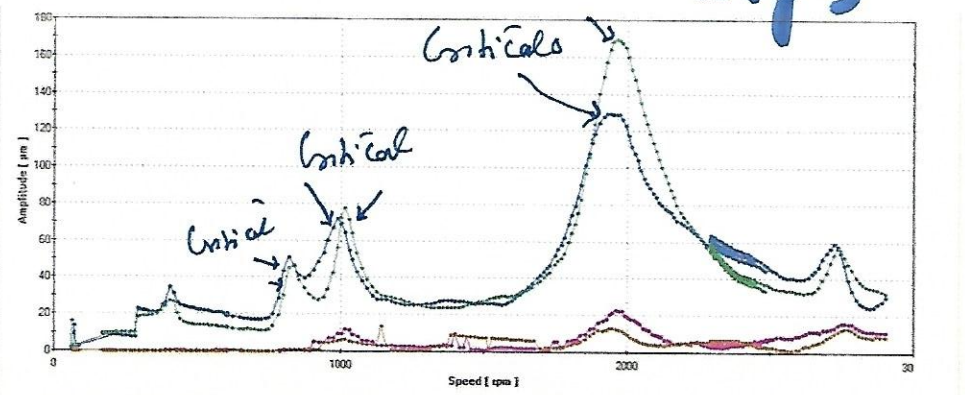
Brg 8

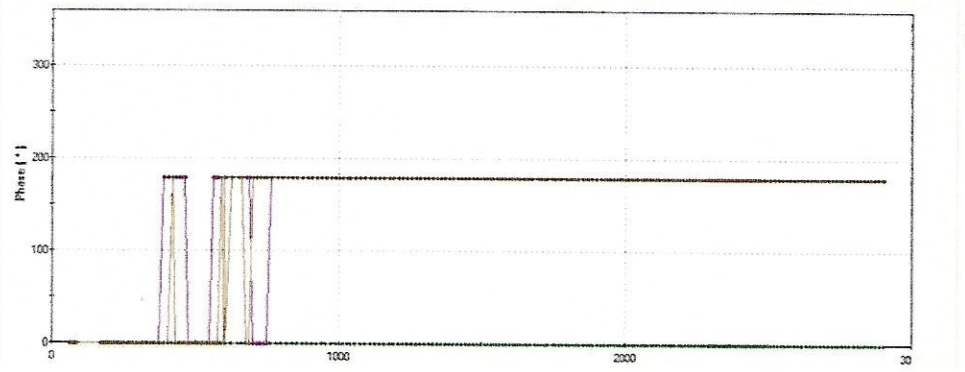




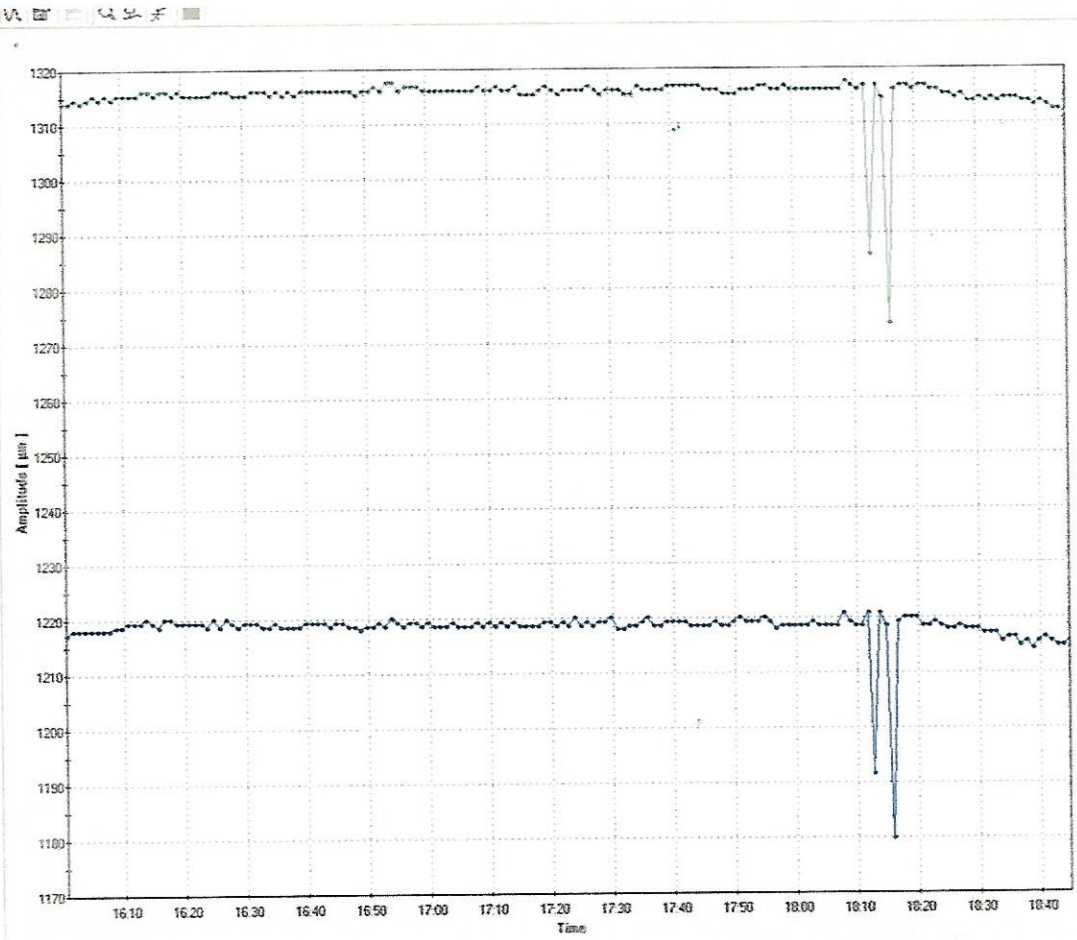
Name	Value
Station	MAIN
Machine	STG
Point	#8 SV Y OVR (peak-peak)
Time	2018-04-07 22:19:52
State	RUNDOWN
Amplitude	
Speed	1944 rpm
Amplitude	141.7 µm peak-peak
Phase	
Speed	1944 rpm
Phase	0 °

Brg 9

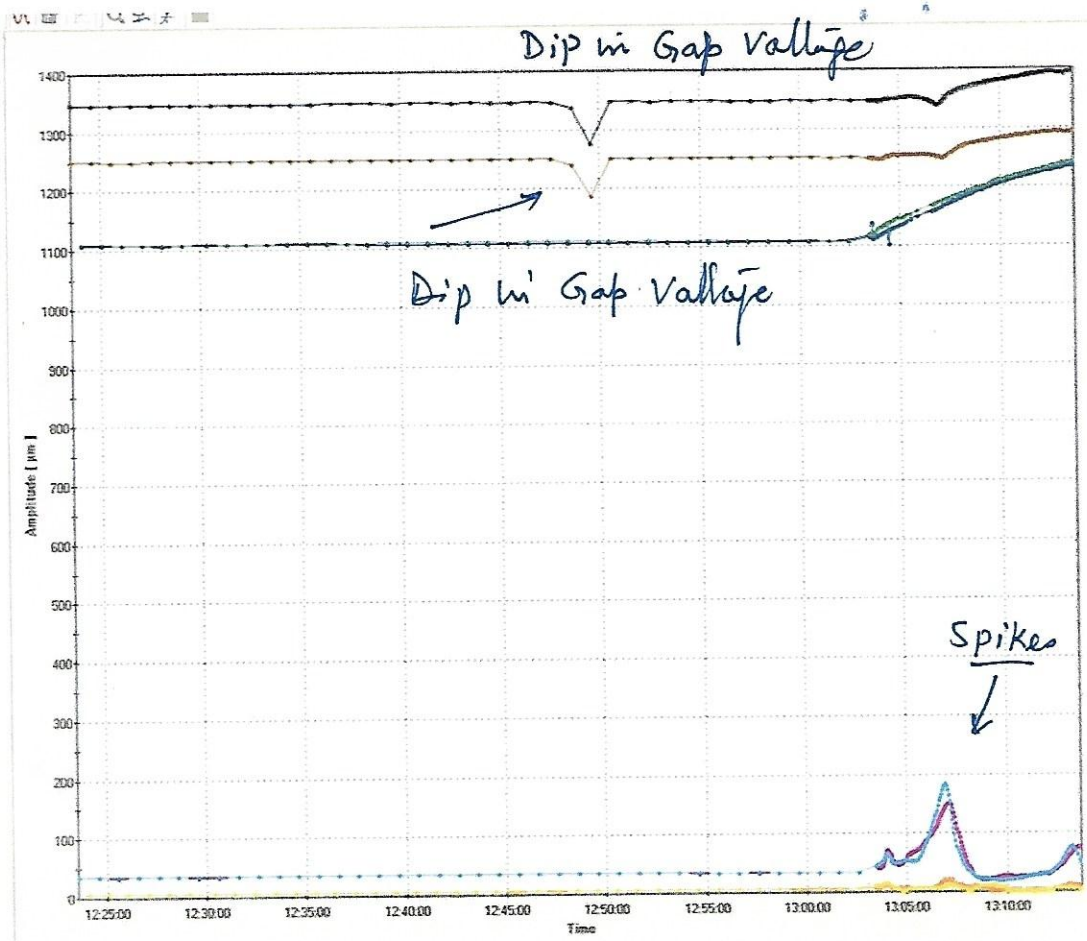




Name	Value
Time	2018-04-07 20:38:36
State	RUNUP
Amplitude	
Speed	
Amplitude	
Phase	
Speed	
Phase	


Trend
Legend
Line
Point
#9 SV-X GAP (DC MAIN
#9 SV-Y GAP (DC MAIN
Amplitude [µm]
Time
16:10
16:20
16:30
16:40
16:50
17:00
17:10
17:20
17:30
17:40
17:50
18:00
18:10
18:20
18:30
18:40
Name
Value
From
2018-01-04 16:00:00
To
2018-01-04 18:45:00
Historic Trend
Time
Amplitude

Bog (no) 9


Dip in Gap Voltage
Dip in Gap Voltage
Spikes
Trend
Legend
Line
Point
#8 SV-X GAP (DC MAIN
#8 SV-Y GAP (DC MAIN
#9 SV-X OVR (peeMAIN
#9 SV-X GAP (DC MAIN
#9 SV-Y OVR (peeMAIN
#9 SV-Y GAP (DC MAIN
#9 CV-X OVR (peeMAIN
#9 CV-Y OVR (peeMAIN
Amplitude [µm]
Time
12:25:00
12:30:00
12:35:00
12:40:00
12:45:00
12:50:00
12:55:00
13:00:00
13:05:00
13:10:00
Name
Value
From
2018-04-07 12:23:25
To
2018-04-07 13:13:43
Historic Trend
Time
Amplitude