Sample Predictive Maintenance Report

Laser Alignment

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October 31, 2006

ABC Company
123 Street
Anywhere, USA

Dear Sir:

Subject: Laser alignment and vibration test of Central Vacuum Blower.

Abstract

ISI was contracted to perform a laser alignment and as-found/left vibration testing on the Central Vacuum Blower. Initial vibration data showed elevated readings mainly in the horizontal plane on the motor and blower. A significant softfoot was found and repaired on the blower and the motor had a loose hold down bolt. A laser alignment was performed and the unit was successfully adjusted to within specifications. Even though the unit had run for over 2 hours before ISI showed up, thermal expansion did not appear to be a factor based on the low discharge piping temperature. The final vibration readings were reduced by about 30%, but remain elevated. Additional troubleshooting revealed the cause to be a structural resonance being excited by the running speed of the motor.

Data and Analysis

Inboard = Drive End bearing closest to the coupling.

Outboard = Non-Drive End bearing on idler end of shaft.

Horizontal = Test Plane parallel to the ground.

Vertical = Test Plane perpendicular to the ground (90 degrees removed from horizontal).

Axial = Test Plane in-line with the shaft.

IPS = Unit of vibration measurement (inches/second).

Table 1: Alignment Data

	Horizontal		Vertical	
	Offset (mils)	**Angle (mils/inch)**	**Offset (mils)**	**Angle (mils/inch)**
As-Found	1.52	0.22	15.92	0.16
As-Left	1.90	0.07	0.6	0.03

Figure 1: Machine Overview

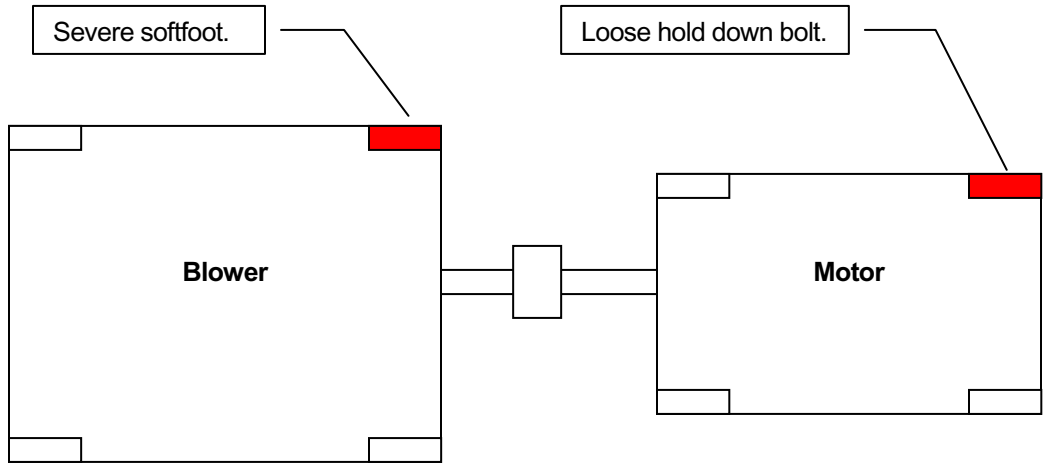


Table 2: Vibration Data

	As-Found (IPS)	As-Left (IPS)
Motor Outboard Horizontal	0.521	0.450
Motor Outboard Vertical	0.131	0.134
Motor Inboard Horizontal	0.371	0.248
Motor Inboard Vertical	0.106	0.077
Motor Inboard Axial	0.162	0.142
Blower Inboard Horizontal	0.477	0.341
Blower Inboard Vertical	0.053	0.057
Blower Outboard Horizontal	0.298	0.192
Blower Outboard Vertical	0.123	0.094
Blower Outboard Axial	0.116	0.101

Notes:

- Identified and repaired a significant softfoot on the blower and loose foot on the motor (see Figure 1).

- The reduction in overall vibration level in Table 2 is due to the change in alignment as recorded in Table 1.

- No bearing defects were noted on either the motor or blower.

- The remaining vibration on the motor and blower is very directional in the horizontal plane. Advanced vibration diagnostics performed in the field detected a natural frequency at 61.25 Hz, which is just above the motor running speed of 59.12 Hz (3547 RPM, see attached Figure 2). This natural frequency indicates that the structure is sensitive to vibration within +/- 15% of 61.25 Hz, which would include motor running speed. As a result, the vibration levels that remain on the motor and blower are not from misalignment or softfoot, but resonance amplification due to structural/base weakness.

Recommendations

1. After the unit is relocated to its new baseplate, recommend checking alignment and performing another baseline vibration test to determine the effect on the structure stiffness and the natural frequency.

2. If vibration levels remain elevated, consult ISI on making structural modifications to the baseplate in order to alter the natural frequency of the system.

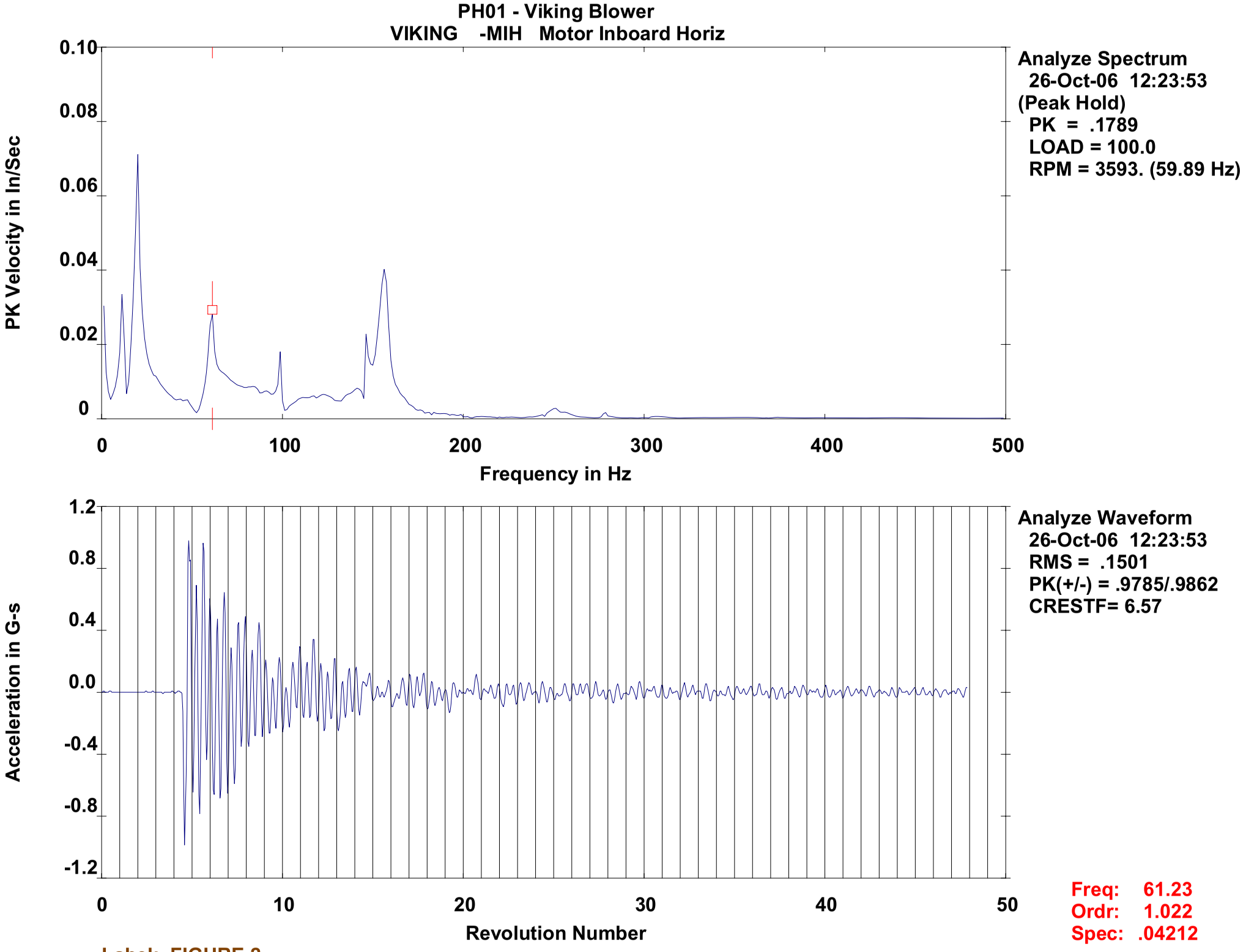
3. Another alternative to making structural modifications is to install a VFD to alter motor running speed away from 61.25 Hz. However, it is important to note that motor speed should not be reduced below 50 Hz as this may excite a natural frequency in the vertical plane at 43 Hz.

4. Continue monitoring this unit on a routine basis using vibration and oil analysis in order to provide early detection of machinery degradation.

Let me know if there are any questions regarding this letter or the analysis in general. Thanks for letting ISI service your facility.

Respectfully,

Frank T. Vereb
Predictive Maintenance Engineer
Instrumentation Services, Inc.



Label: FIGURE 2

Alignment Report - Summary

Report Date: 23-Oct-07

Area: VIBE - Vibration Testing

Equipment: VIKING - Viking Blower

Job Number : 7129-777
Data Taken : 26-Oct-06 20:56:58
Technician : FTV

Notes:
No Notes Entered

Coupling Number : 1
Coupling RPM : 3540
Tolerance Type : Standard
Last Data Taken : 26-Oct-06 11:43:04

Soft Foot:

OK	OK	OK	OK
	FAN	MOTOR	
OK	OK	OK	OK

Number of Readings : 4

Equipment Moves in mils
For Vertical, Up is Positive
For Horizontal, Left is Positive

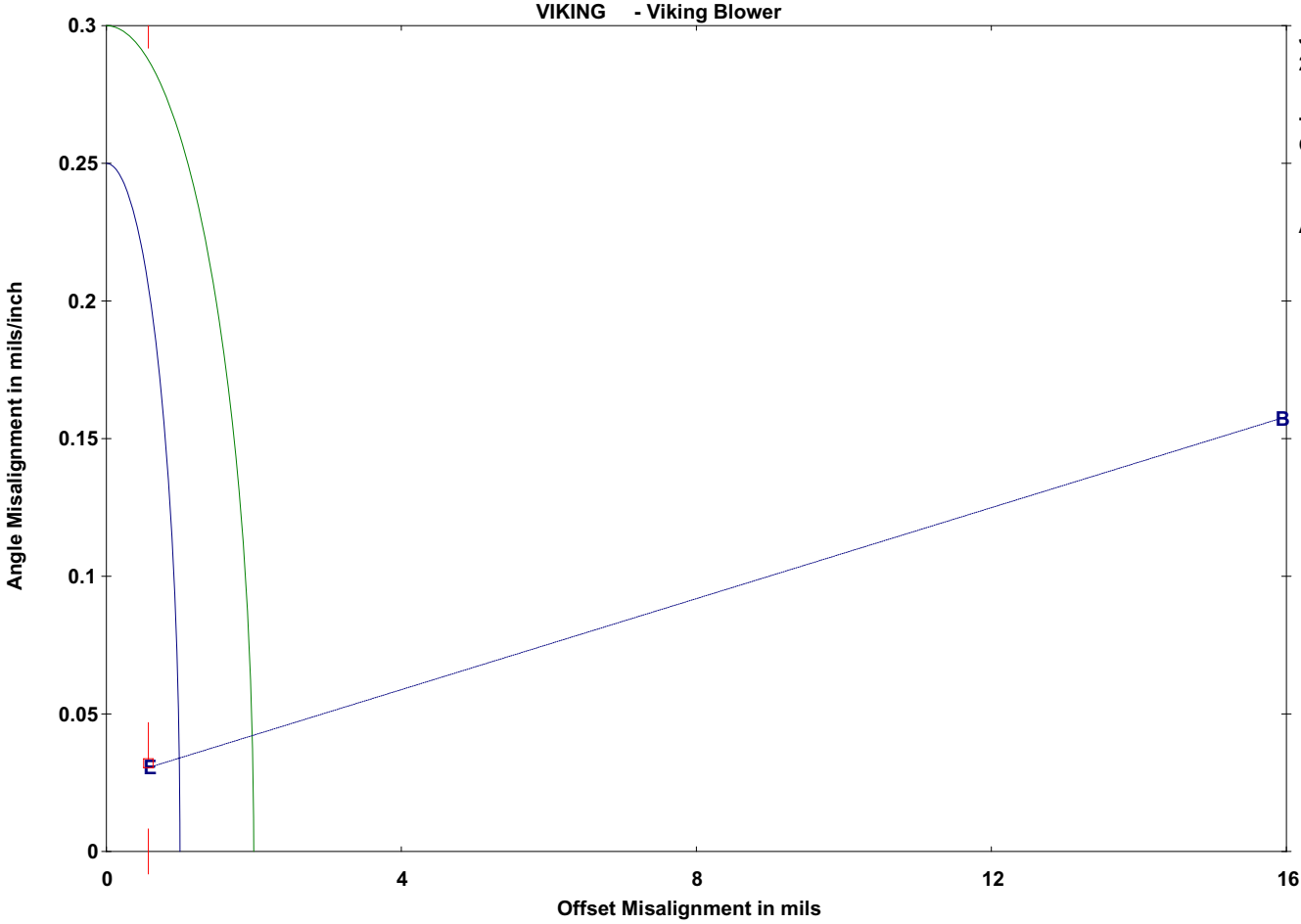
	Vertical				Horizontal			
	FAN		MOTOR		FAN		MOTOR	
Set	OB	IB	IB	OB	OB	IB	IB	OB
1	------	------	14.6	13.1	------	------	-3.4	-5.5
4	------	------	-0.8	-1.1	------	------	-2.5	-3.1

Equipment Misalignment
Offset in mils
Angle in mils/inch

	Vertical			Horizontal		
Set	Offset	Angle	Condition	Offset	Angle	Condition
1	15.9	0.16	Out-of-tol(798)	1.5	0.22	Out-of-tol(106)
4	0.6	0.03	Excellent (30)	1.9	0.07	Acceptable(98)

VIBE - Vibration Testing
VIKING - Viking Blower

VERTICAL



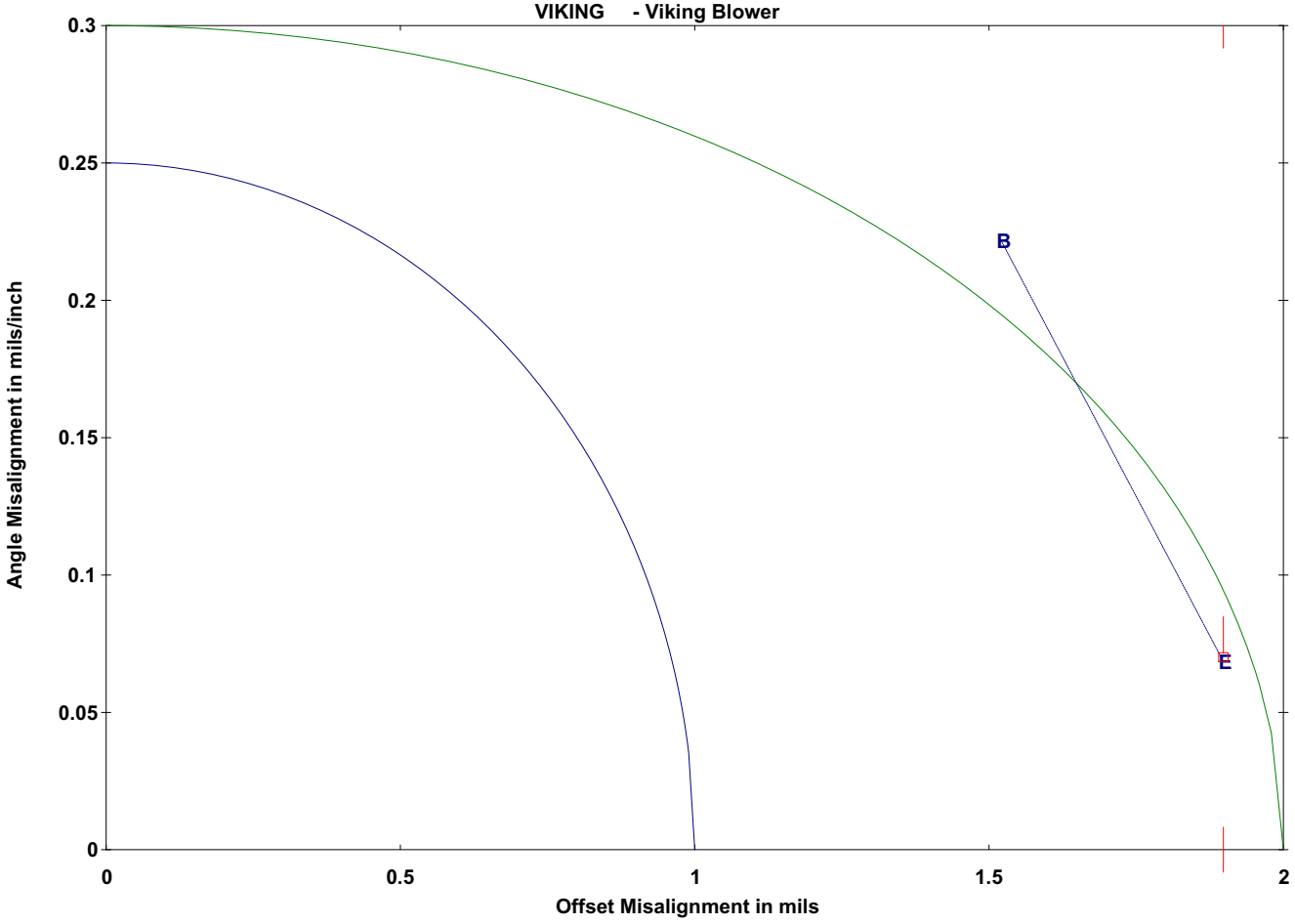
Job Number: 7129-777
26-Oct-06 20:56:58

---- TOLERANCES ----
Offset:
Exc: 1.00 mils
Acc: 2.00 mils
Angle :
Exc: 0.25 mils/inch
Acc: 0.30 mils/inch

MOVE END
OFFS: 0.571
ANGL 0.03044
COND EXC

VIBE - Vibration Testing
VIKING - Viking Blower

HORIZONTAL



Job Number: 7129-777
26-Oct-06 20:56:58

---- TOLERANCES ----
Offset:
Exc: 1.00 mils
Acc: 2.00 mils
Angle :
Exc: 0.25 mils/inch
Acc: 0.30 mils/inch

MOVE END
OFFS: 1.898
ANGL 0.06849
COND ACC