I/M 412537-154

Vitec

MACHINERY PROTECTION INSTRUMENTATION

OPERATION AND MAINTENANCE OF

MODEL 653A VIBRATION METER AND BEARING TESTER

REV"B" 05/28/93

VITEC MODEL 653A INSTRUCTION SHEET

(SUPPLEMENT TO MODEL 652A I/M 412537-153)

GENERAL

The Vitec Model 653A Vibration and Bearing Meter is designed to accomplish all vibration reading functions as described in the Model 652A Manual enclosed, plus the additional feature of being able to detect possible up-coming anti-friction bearing and gear problems. Please refer to the Model 652A Manual for standard vibration readings in the acceleration, velocity, and displacement modes.

The principle of operation of the Bearing Test mode of the 653A Meter is quite simple. It is a commonly accepted fact that faulty bearings* and gears generate a high frequency vibration signal that can be 20 to 50 times(or more) the rotating speed of the machine. The Bearing Test Mode of the Model 653A allows the user to measure this high frequency component of vibration, while ignoring the lower frequencies of vibration normally associated with common problems such as unbalance, misalignment, etc.

PROCEDURE

1. It is recommended that vibration readings be taken in the acceleration, velocity and displacement modes prior to taking readings in the bearing test mode. This procedure will bring attention to unacceptable vibration levels due to common problems noted above.

2. Turn the mode switch to the "Bearing Test" position and tune the "RPM" dial to the rotating speed of the machine being tested. The meter will then indicate only the high frequency component of vibration normally associated with faulty gears or bearings.** The higher the reading, the higher the destructive energy that is being generated by these high frequency problems.

3. The following values taken in the bearing test mode can be used as a "rough" estimate of the bearing condition. Do <u>not</u> use these values as absolute values,

as the bearing geometry (inner to outer race diameter ratio, shaft size, rolling element type, rolling element size, etc.) can affect these values.

Bearing New: .3 to .6 G's
Bearing in service, good: .5 to 1.0 G's
Bearing with defects: 1.5 to 2.5 G's
Bearing shutdown: 3 to 6 G's
Bearing failure: 8 to 12 G's

4. Although the above values are only general, absolute values for a certain size and type of bearing in a specific machine can be determined by accurately recording a history of the "Bearing Test" values of vibration until a visual inspection of the bearing is done. The condition of the bearing can then be referenced to the "Bearing Test" readings, and can be used as a gage for evaluating the condition of the bearing for future readings.

Should you have any questions concerning the use of the Model 653A Vibration Meter and Bearing Tester, feel free to contact Michael S. Troyan at the Vitec office at any time (1-800-321-6384).

Note: * All referral to "Bearings" include only anti-friction type bearings (ball, roller, tapered roller, etc.)

** In the Bearing Test mode, the Model 653A will filter out all vibration frequencies up to the fifth harmonic of the speed set on the "RPM" dial.

EXAMPLES

The following data represents readings taken on bearings with various defects. The bearings were mounted in a test fixture so that the predominant cause of vibration was due to the bearing only.

BRG	CONDITION	ACCEL. G's	VEL. In/Sec	DISPL. Mils	BRG TEST G's
A	New	.10	.06	1.40	.10
B	Narrow nicks in outer race	1.95	.08	1.50	1.8
C	Wide groove outer race/ ball nicks	2.50	.09	1.34	2.3
D	Good used brg.	.12	.05	1.30	.12
E	Defective Ball/ Groove in race	1.30	.08	1.71	..90
F	Excessive Clearances	4.18	.13	1.4	3.9
G	Good used brg.	.12	.05	1.3	.12

It is obvious from the above examples that the displacement mode of measurement is entirely in-effective in detecting bearing problems. The velocity mode indicates a relative difference between good and bad bearings, but not a signficant difference. The bearing test mode, however, shows bad bearing readings of up to 40 times larger than readings taken on a good bearing. (e.g. Bearing F vs. Bearing A)
NOTE: Because the defective bearings were the only major cause of vibration, the G's readings are approx-imately the same as the bearing test mode of measure-ment. When other problems exist, such as unbalance, this will not be the case.

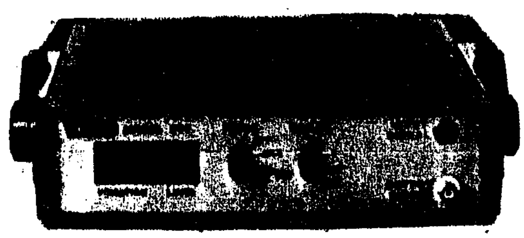
Vitec

MACHINERY PROTECTION INSTRUMENTATION

23600 Mercantile Road, Cleveland, Ohio 44122

OPERATION AND MAINTENANCE OF

MODEL 652A VIBRATION METER



REV"B" 05/28/93

CONTENTS

1st Important Notice

Because of the high sensitivity of this unit over wide frequency range, (5 Hz to 10,000 Hz, 300 to 600,000 CPM) the following is highly recommended for all displacement (mils) readings.

1. Use the 20, or 200 mils range. The 2 mil range should only be used on finely balanced equipment, or in a laboratory environment.

2. Use the magnetic pickup clamp, or the 1/4"-28 stud mount provision in bottom of pickup to mount the pickup on the machine being tested. Hand-held pickup readings taken with pencil probe may be erratic.

2nd Important Notice

This instrument is equipped with rechargeable nickel cadmium batteries.

CAUTION: Do not recharge batteries until "LO BATT" indication appears on the display.

1. You can use the instrument for approximately 2 hours after "LO BATT" appears on the display before readings become unacceptable.

2. If readings become unacceptable the instrument can be used with battery charger connected.

3. Do not use any other battery charger than the one which is supplied with your instrument.

RECEIVING AND HANDLING

PRODUCT WARRANTY

The Vitec Model 652A is warranted to be free from defects in material and workmanship for a period of one year from the date of shipment to the original user or 18 months from date of shipment by company to buyer, whichever period is shorter. Damage in shipment, abuse, and misuse, are not part of this warranty.

Claims of defects in this apparatus must be submitted to the company in writing in the above mentioned time period. The buyer shall be responsible for all transpotation charges.

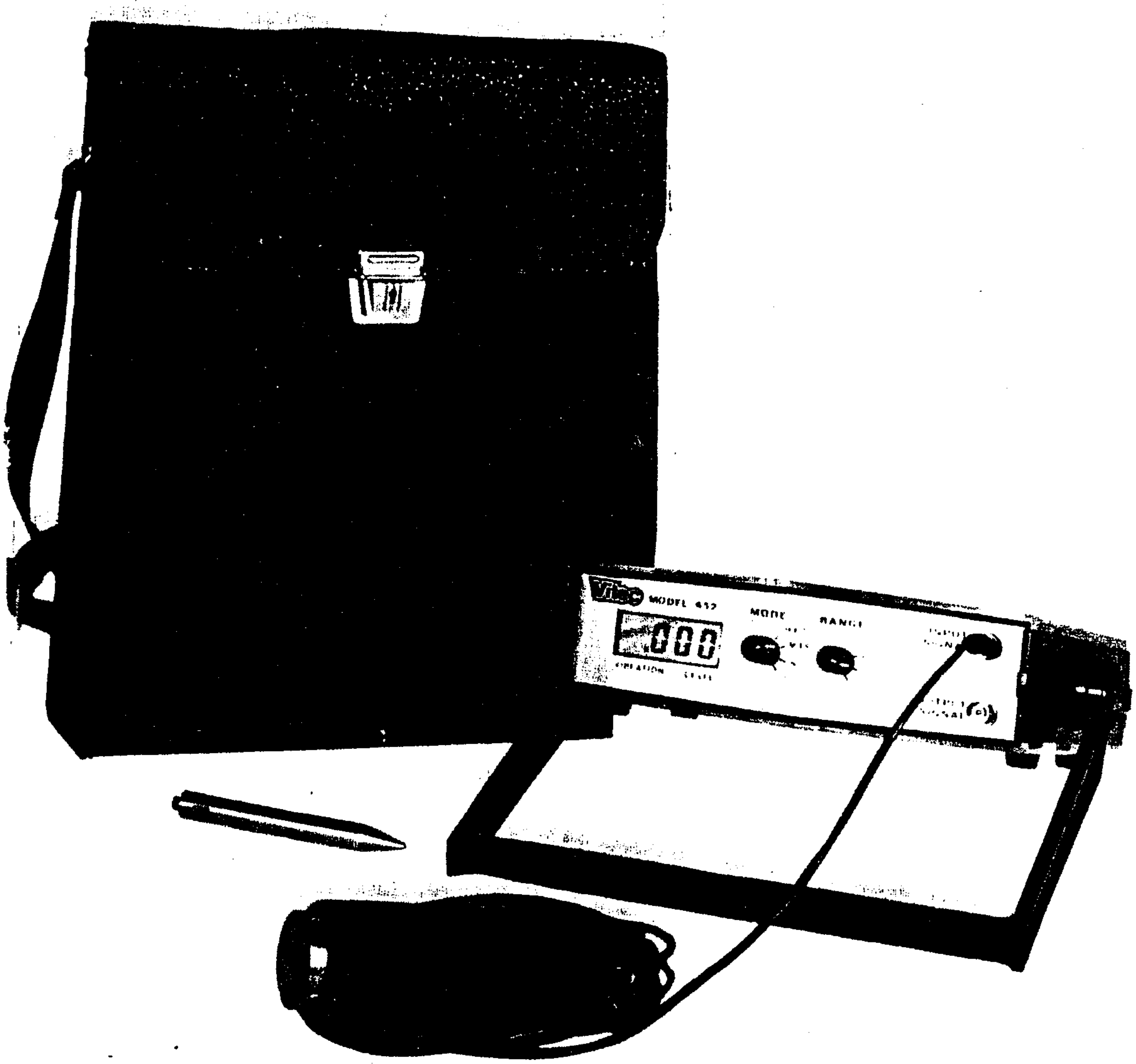
ACCEPTANCE

Vitec terms of sale are F.O.B. point of origin. Freight prepaid. Thoroughly inspect this shipment before accepting from the transportation company. If any of the packaging is damaged or the quantity listed in the bill of lading or express receipt is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. Request him to make an inspection. Claims for loss or damage in shipment may not be deducted from the Vitec invoice, nor may payment of the Vitec invoice be withheld awaiting adjustment of such claims since the carrier guarantees safe delivery.

If damage or loss has incurred to your shipment and the situation is urgent, contact the nearest Vitec District Office for assistance.

INTRODUCTION

This manual has been prepared to instruct operating personnel in the proper operation, application, and maintenance of the Vitec Model 652A Vibration Meter (Figure 1). In order to obtain maximum usage from the instrument the contents of this manual should be studied thoroughly.



Your Vitec Model 652A Vibration Meter Kit Includes:

Model 652A Vibration Meter
Accelerometer Pickup, Model 4071
5 Ft. Pickup Cable
Pencil Probe & Magnetic Clamp
Leatherette Carrying Case
Shoulder Strap, 54" Lg.
Batteries (8) AA Ni-Cad, Rechargeable
Battery Charger
Instruction Manual

The Model 652A Vibration Meter is simple to use, and should present no problems to the operator. Any repairs or service should be performed only by qualified personnel or by a Vitec service representative.

DESCRIPTION

GENERAL

The Vitec Model 652A Vibration Meter (fig. 2) is a portable instrument intended for general purpose vibration measurements. The unit is ideally suited for performing in-plant product testing, machinery start-up and checkout, and in preventive maintenance programs.

A light weight leatherette carrying case is included with the instrument. The Model 652A can be used without removing it from the carrying case. The case also provides storage space for the transducer, cable, and associated accessories.

The Model 652A responds to vibration units of displacement (mils), velocity (inches/second), and acceleration (G's). The meter used with its associated high output accelerometer is capable of making accurate vibration measurements over a frequency range of 300 CPM to 60,000 CPM (cycles per minute).

The basic controls necessary for operation of the Model 652A are front panel mounted. The meter has a carrying handle which can also be used as an instrument prop. To adjust the handle, simply pull out on both sides of the handle at the pivot point and adjust to the desired angle. WARNING: forcing the handle in either direction will result in damage to the adjusting mechanism.

The Model 652A is powered by (8), AA, 1.2 V, Ni-Cad batteries located on the rear plate battery pack assembly along with the battery charger jack.

VIBRATON LEVEL READOUT (fig. 2)

The vibraton level is easily read on the large LCD (Liquid Crystal Display) on the face of the meter. The meter will read out directly in mils, inches/sec. or G's depending upon the setting of the mode switch. The direct readout display eliminates the need for multiple scales or scale multipliers. Should the vibraton level be higher than the range selected, the last three digits of the display will be blanked out to indicate an "over ranged" condition.

The LCD display also provides a "Lo Batt" display in the upper left hand corner of the display when the batteries are low and should be recharged. Readings can, however, be taken for approximately 2 hours after the "Lo Batt" indication first appears. Use of the unit beyond this period may result in faulty or incorrect readings.

MODE SWITCH (fig. 2)

The mode switch selects the mode of vibration to be measured. The vibration can be measured in acceleration, velocity, or displacement (refer to application section). Merely turn the selector switch to the mode desired.

The "Off" position of this switch shuts off power to the instrument (the instrument must be in this position when not being used to prevent battery drain).

RANGE SWITCH (fig. 2)

The range switch selects the full scale range for the vibration mode being measured, and causes the decimal point to be located on the display accordingly.

NOTE: If no prior readings or typical levels are available it is advisable to start in the G's mode, 200 range, and select lower ranges as needed until the display reading is 010 or more. (For purposes of this step, ignore decimal placement).
Use of this procedure will help to eliminate over range errors.

OUTPUT JACK (fig. 2)

The Model 652A has a BNC type connector on the front panel which provides an A.C. signal representative of the actual A.C. vibration signal. The output is uncalibrated, but it is representative of the actual wave form seen by the transducer.

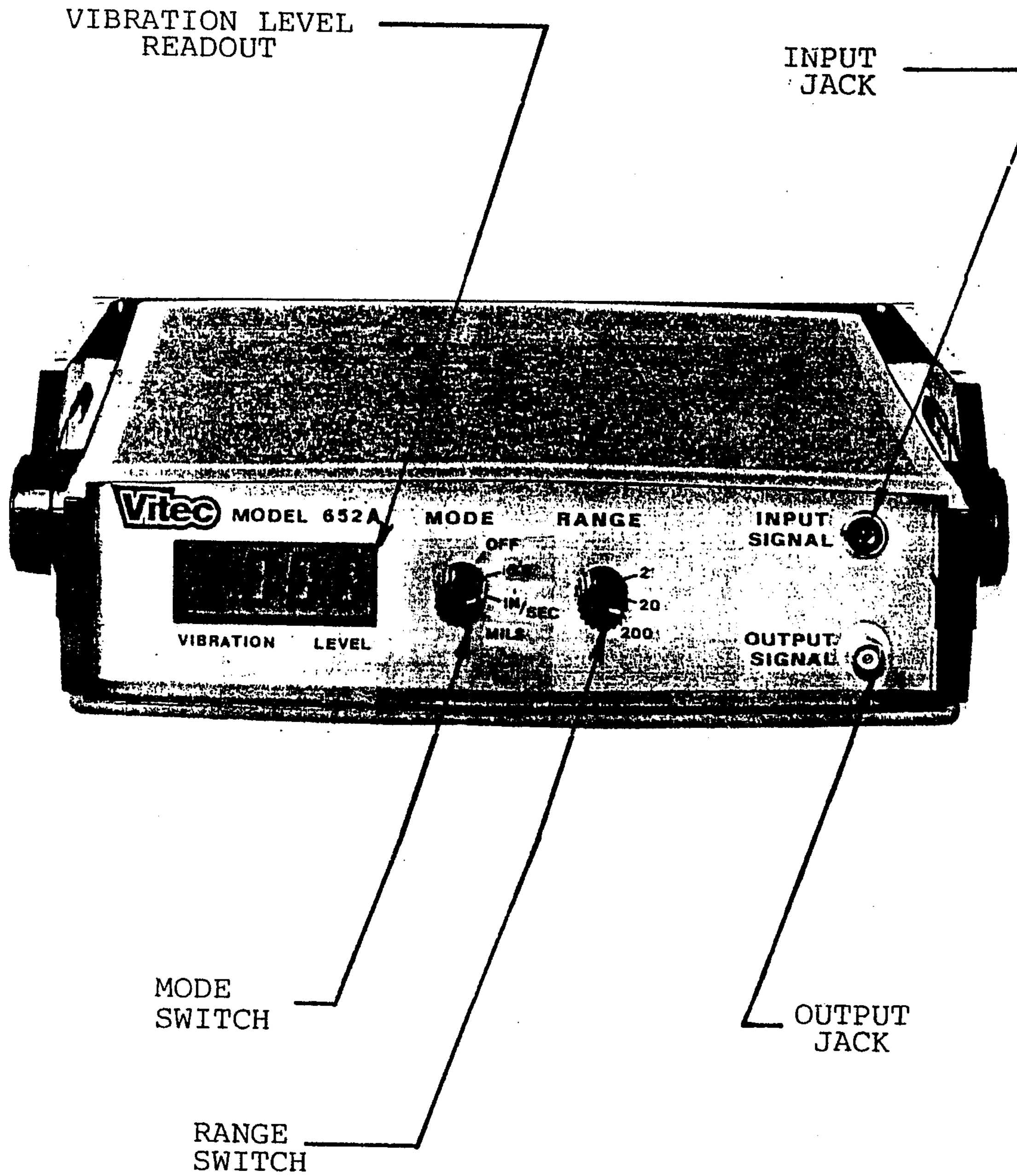

VIBRATION LEVEL
READOUT
INPUT
JACK
Vitec MODEL 652A
MODE
RANGE
INPUT
SIGNAL
OFF
IN/SEC
MILS
2
20
200
VIBRATION LEVEL
OUTPUT
SIGNAL
MODE
SWITCH
OUTPUT
JACK
RANGE
SWITCH

Figure 2

IMPORTANT: Because of the high sensitivity accelerometer used with the Model 652A Meter, the selection of the proper range position is very important in order to obtain accurate readings.

To assure proper range position, a reading should be first obtained in the G's mode. This range position will establish the lowest range that can be used in the velocity or displacement mode. Of course, higher ranges can always be used, and can, in fact, verify that the proper minimum range selected was correct.

"INPUT SIGNAL" JACK

The input signal jack on the front panel receives a 1/4" phone plug (heavy duty), which is used to feed the transducer signal into the system.

NOTE: In order to assure data integrity, plug must be fully inserted.

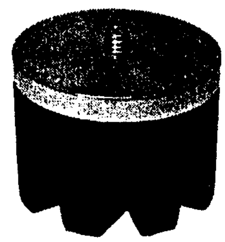
VIBRATION TRANSDUCER (Pickup)

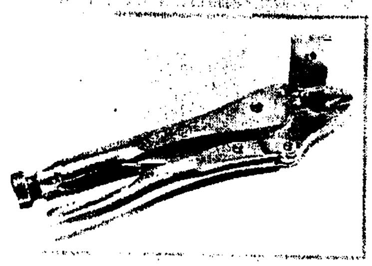
The transducer, (pickup), converts the mechanical vibration being measured into an electrical signal which is transmitted to the vibration meter. The high sensitivity accelerometer used with the Model 652A provides very accurate measurements over a wide range of frequency measurements,(300 to 60,000 CPM).
Note: Specially calibrated Model 652A meters are available to measure frequencies as low as 120 CPM.

The 1/4-28 x 1/4" deep tapped hole in the bottom of the transducer is provided for installation purposes. To assure accurate and repeatable readings, a 1/4-28 stud (i.e. a 1/4-28 x 1/2 setscrew, available from local supplies) should be installed in the bearing cap or other monitoring site, so that the transducer may be quickly and rapidly installed when measurements are to be taken.

The pencil probe or magnetic mount supplied with the instrument may be used for non-precision or survey type measurements. A vice-grip type clamp is also available as an optional accessory for similar applications.

Magnetic Pickup Clamp replaces pencil probe on pickup for "hands off" accurate readings.





UNIVERSAL VISE GRIP CLAMP

Allows for direct clamping of accelerometer or velocity pick-up to surface being measured.

.... P/N 602885-11RB

Vibration History Chart
Preprinted forms for recording vibration levels for predictive maintenance (form 412512-110).

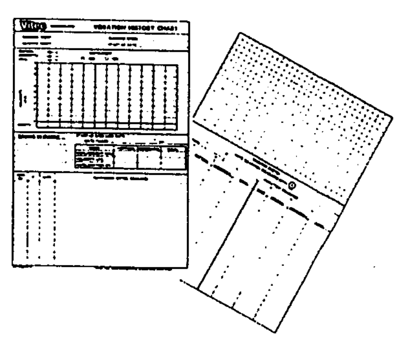


Figure 3

SPECIFICATIONS

Modes:	Displacement, Velocity, Acceleration
Full Scale Ranges:	0-2, 20, 200 in all three modes
Accuracy:	± 5% from 5 to 1000 Hz (300-60,000 rpm) Note: Specially calibrated units available for ± 5% 2-1000 Hz (120-60,000 cpm)
Meter:	Large easy to read LCD digital display
Pickup:	Piezoelectric accelerometer with 5 ft. long cable
Batteries:	8-AA, Ni-Cad Rechargeable batteries
Battery Life:	Approximately 40 hrs. "LO BATT" appears in LCD display when battery level gets low.
A.C. Output:	Front panel output jack provides a non-calibrated A.C. signal proportional to mode and range selected
Operating Temp:	33°F to 150°F
Weight:	4.5 Lbs. including carrying case and pickup

OPTIONAL ACCESSORIES

Several accessories are available to make the Model 652A Meter easier to use: They are:

UNIVERSAL VISE GRIP CLAMP (fig. 3) allows for direct clamping of accelerometer to surface being measured. Ideal for clamping pickup to non-magnetic or irregular surfaces. Ask for P/N 602885-11RB.

VIBRATION HISTORY CHART (fig. 3) is a preprinted form for recording vibration levels for predictive maintenance. Ask for form 412512-110

TYPICAL APPLICATIONS

1. Preventive Maintenance - Probably the most useful application of this instrument. When used to make periodic measurements, data comparisons can be made which will detect an increasing trend in vibration. Thus, further investigation can be made to determine the exact nature of the problem area. (A useful tool for complete analysis and/or dynamic balance is the Vitec Balance Analyzer).

2. Field Service - With a few simple measurements, a field service engineer can determine the amount of vibration. This can avoid costly shutdown to inspect parts needlessly.

3. Incoming Inspection - Vibration tolerances are often included in specifications for purchased parts to prevent excess vibration in final products. The Model 652A is ideally suited for receiving or assembly line inspection.

4. Final Assembly Test - Vibration tests on finished products can be made prior to shipment to assure compliance with production quality standards.

OPERATIONAL DETAILS

GENERAL

One of the primary uses for the Model 652A Vibration Meter is to measure machinery vibration over a period of time. An increasing trend in the amount of vibration detected is a good indication that the machine will soon need repairs because of bearing wear, loose or worn internal parts, or a general condition of unbalance. Early scheduling of such repairs will often result in avoiding costly, non-scheduled down-time caused by failure of a defective component.

If vibration exceeds allowable limits, the machine should definitely be inspected for the cause of trouble.

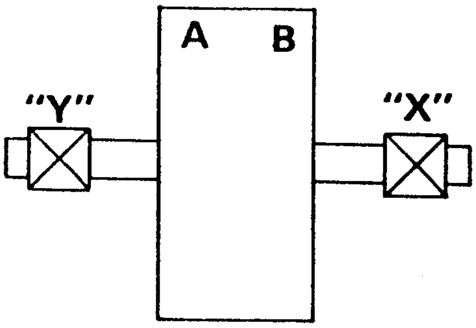
The best point on a machine to measure vibration is on the bearing housing. If bearing housings are not readily accessible, place the pickup on a nearby associated support or structure. See Figure 4 examples.

Keep in mind, however, that excessive vibration detected at a bearing housing may not mean that the cause is a faulty bearing. For example, a loose rotor component in a motor or generator can result in vibration that would be transmitted along the rotor shaft to the bearing housing.

VIBRATION TOLERANCES

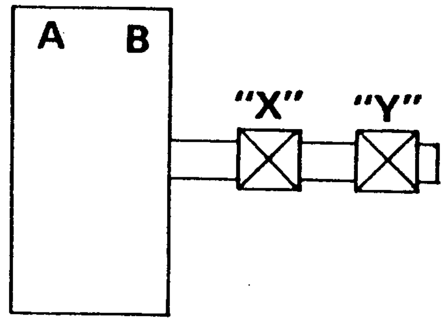
The allowable limit of vibration which can be tolerated in a machine depends on many factors, including:

1. The product desired from the machine. (grinding and finishing)
2. Stiffness of the bearing supports and the base.
3. Alignment of the couplings and bearings.
4. Operating speed as related to resonance and critical speed.
5. Transmitted vibration from other sources.



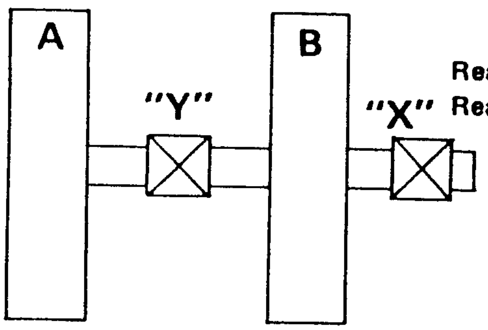
SUSPENDED ROTOR

Readings taken for Plane "A" at Bearing "Y".
Readings taken for Plane "B" at Bearing "X".



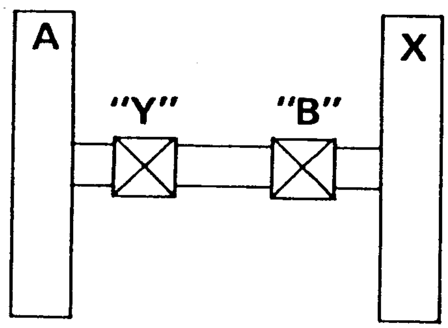
OVERHUNG ROTOR

Readings taken for Plane "B" at Bearing "X".
Readings taken for Plane "A" at Bearing "Y".



COMBINATION OVERHUNG SUSPENDED ROTOR

Readings taken for Plane "A" at Bearing "Y".
Readings taken for Plane "B" at Bearing "X".



DOUBLE OVERHUNG ROTOR

Readings taken for Plane "A" at Bearing "Y".
Readings taken for Plane "B" at Bearing "X".

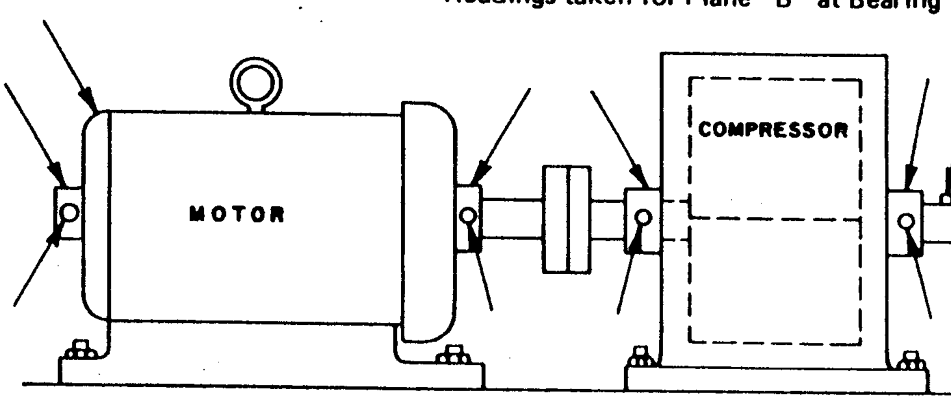


Figure 4. Points for Measuring Vibration (Example).

Machine products tested satisfactorily for allowable vibration limits during manufacture may offer different results when the same tests are performed under actual field installation and operating conditions. For this reason, it is sometimes difficult for a manufacturer to supply standard allowable limits of vibration for each item delivered. However, tentative guides can be set up for certain types of machinery listing vibration tolerances as a standard for comparison.

Effective guidelines for your particular applications can only be established through your own experience.

TAKING MEASUREMENTS

Hold the pickup probe against the machine . . . preferably the bearing housings. Take readings with the pickup in both vertical and horizontal plane with respect to the machine. An axial measurement is also recommended if obtainable. Record readings for future reference.

Be sure to apply enough pressure to the pickup to maintain solid contact with the machine and to prevent the probe from chattering. The pickup should be held perpendicular to the rotating shaft of the machine. Be very careful to take successive or future readings for trending or comparison at the same exact location on the machine. Readings taken at different points on the machine being measured cannot be used for measuring changes in vibration levels.

NOTE: Although the pencil probe is most useful for spot-checking and diagnostic survey applications, it is more generally advisable to use a mounting stud, for purposes of long term history and analytical work.

MEASURING DISPLACEMENT

Measuring vibration in the peak-to-peak displacement mode results in detection of actual physical displacement or movement of the surface to which the pickup is attached. The vibration is measured in mils pk. to pk. (1 mil = .001").

MEASURING VELOCITY

Measuring vibration in the peak velocity mode results in detection of the rate of change of displacement. This vibration is measured in terms of peak velocity or in/sec. peak. Refer to Figure 4a example.

Velocity is a function of both displacement and frequency, and therefore will have additional sensitivity to higher frequency vibration. For example, a 1 mil displacement will have the same vibration meter reading at 1000 cpm as at 10,000 cpm. The velocity for 1 mil at 1000 cpm is .052 in/sec, while at 10,000 cpm, the velocity is .52 in/sec, or 10 times larger. (The latter being a truer indication of force).

MEASURING ACCELERATION

Measuring vibration in the peak acceleration mode results in detection of the rate of change of velocity, or how fast a surface is accelerating with respect to a fixed reference. The acceleration is measured in terms of peak acceleration or G's. One G = 386 inches/Sec^2.

The acceleration mode of measurement is especially effective in detecting small displacement, high frequency vibration such as would be produced by anti-friction bearings, gears, etc. For example -- a very small displacement of .01 mils (.00001") occurring at 60,000 cpm produces an acceleration signal of .51 G's. Obviously a .00001" signal is hard to measure, but a .51 G signal would be very easy to measure.

CROSSOVER FREQUENCY ANALYSIS

"Cross-over Frequency" analysis gives an easy indication of how a machine is performing.

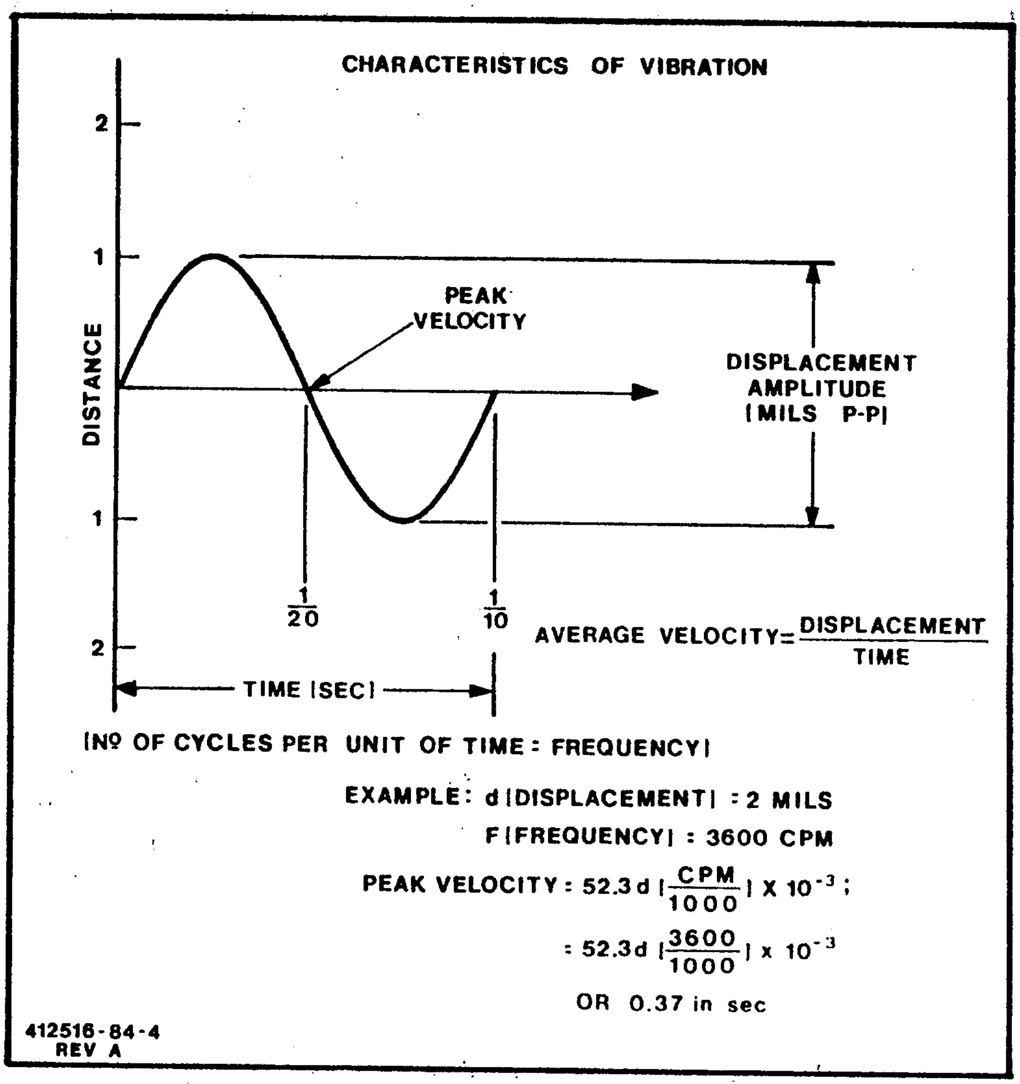

CHARACTERISTICS OF VIBRATION
2
1
DISTANCE
1
2
PEAK VELOCITY
DISPLACEMENT AMPLITUDE (MILS P-P)
1/20
1/10
AVERAGE VELOCITY= DISPLACEMENT / TIME
TIME (SEC)
(Nº OF CYCLES PER UNIT OF TIME: FREQUENCY)
EXAMPLE: d (DISPLACEMENT) = 2 MILS
F (FREQUENCY) : 3600 CPM
PEAK VELOCITY : 52.3 d (CPM/1000) X 10-3 ;
= 52.3d (3600/1000) x 10-3
OR 0.37 in sec
412516-84-4
REV A

Figure 4a

First, measure the "broad band" measurement of mils. Without changing the location of the pickup, take a reading in velocity (in inches per second). Now use the nomograph printed (fig.5) to see where these points "cross-over".

If the cross-over point had been higher than rotational (2mils and 0.6 in/sec, for example, which gives a cross-over frequency of approximately 5500 cpm), there would probably be looseness or possible misalignment. This is because the wave form of the vibration would not be a sine wave but instead would be a distorted shape having high frequency harmonics. This condition is much more harmful to the machine than the simple sine wave motion.

If the cross-over point is lower than rotational speed, such items as oil whip (foaming) or structural resonance may be the cause. These are also more potentially damaging than plain imbalance.

A rule-of-thumb says that if the cross-over frequency is greater or lesser than rotational frequency (plus or minus 10%) further investigation using a Vitec Analyzer should be done.

A similar cross-over analysis using acceleration and displacement will indicate and be more sensitive to problems of a high frequency nature.

CIRCUIT DESCRIPTION

The Model 652A uses four amplifier stages. A6, in conjunction with the range switch, determines the operating range of the instrument. A5 is an A.C. integrator curcuit, which integrates the acceleration signal to obtain velocity. A3 is also an A.C. integrator, which integrates the velocity signal to obtain displacement. A 5 Hz, 12 db high pass filter A4 precedes the displacement integrator to reduce the noise when measuring displacement. Amplifier A1B is a voltage buffer providing low impedance A.C. output for the BNC front plate signal.

U1 is a true RMS to D.C. converter which supplies the input signal to the A/D converter, U1 (Located on the display board). U1 is an A/D converter and LCD driver chip which drives LCD1 (Also located on the display board).

U3 in conjuction with the range switch establishes the decimal point for the LCD display.

U2 is a low voltage sensing circuit which automatically senses the low voltage condition of the batteries and displays a "LO BATT" condition on the LCD. Typical battery life is approximately 40 hours.

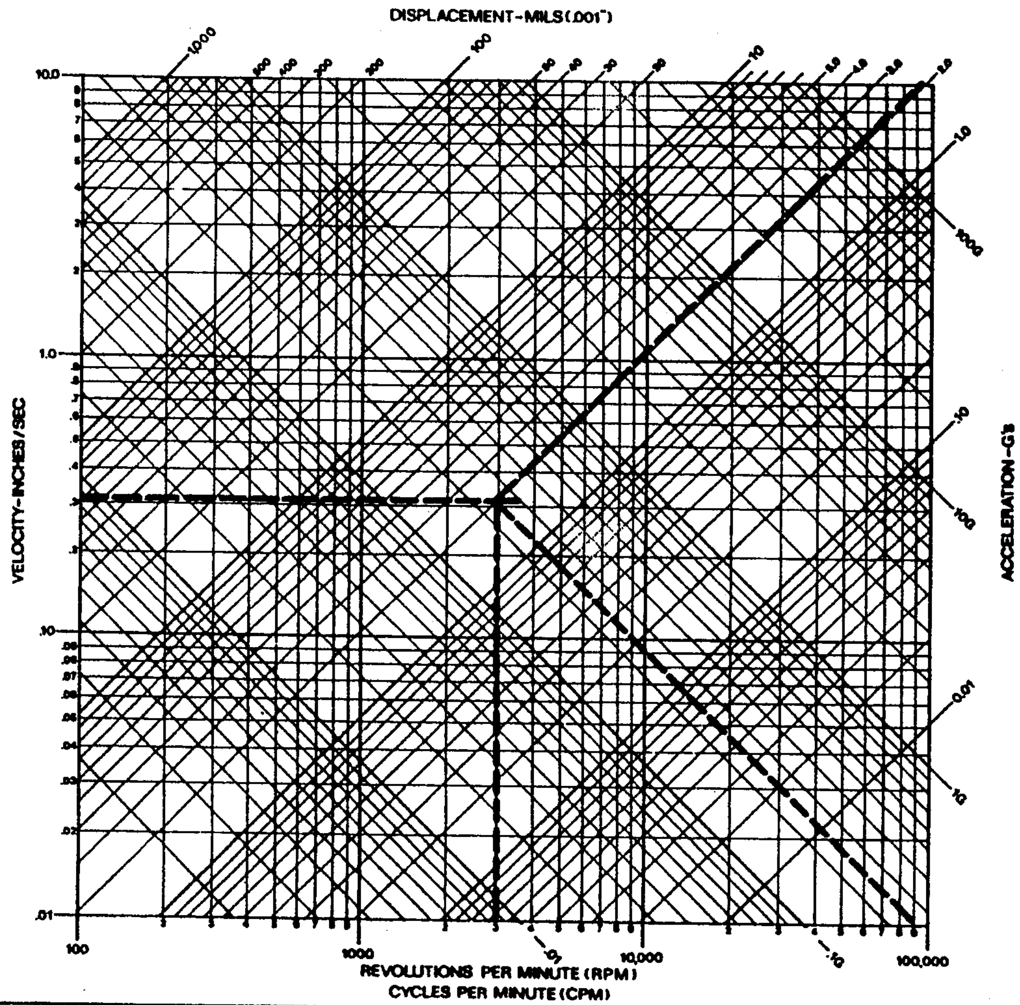
CHECKING CALIBRATION

The calibration of the Accelerometer can only be verified on a shaker table, consult factory.

The calibration of the M652A and M653A can be checked by removing the Accelerometer from the cable and applying a 70.7 MV RMS signal at 100 Hz to Pin "C" of the cable plug, using Pin "A" for signal common. Turn Mode switch to "G's", reading should be 1G. Turn Mode switch to "IN/SEC", reading should be .614 IN/SEC. Turn Mode switch to "MILS", reading should be 1.96 MILS. If your instrument does not give you these readings, consult factory.

Sample: Shaft Speed is 3000 RPM
Displacement Reading is 2 mils
Velocity Reading is 0.3 in/sec.

Go from left to right across the 0.3 in/sec until it crosses the 2.0 mil line. From the point where they cross, go straight down and read the CPM. In this case, it is about 3000 CPM. Since this is almost shaft speed, it is probably the result of unbalance.



CONVERSION FORMULAS

Symbols:

- D = Displacement: Inches peak to peak
- d = Displacement: Mils peak to peak
- V = Velocity: Inches per second peak
- A = Acceleration: G's peak
- Hz = Cycles per second
- CPM = Cycles per minute

$D = 0.318 \frac{V}{Hz}$

$D = 19.607 \frac{A}{(Hz)^2}$

$V = \pi (Hz)(D)$

$V = 61.440 \frac{A}{Hz}$

$A = 0.051 (Hz)^2 (D)$

$A = 0.016 (V)(Hz)$

$d = (1.910)(10^4) \frac{V}{CPM}$

$d = (7.059)(10^7) \frac{A}{(CPM)^2}$

$V = (5.236)(10^{-5})(CPM)(d)$

$V = (3.696)(10^3) \frac{A}{CPM}$

$A = (1.417)(10^{-8})(CPM)^2 (d)$

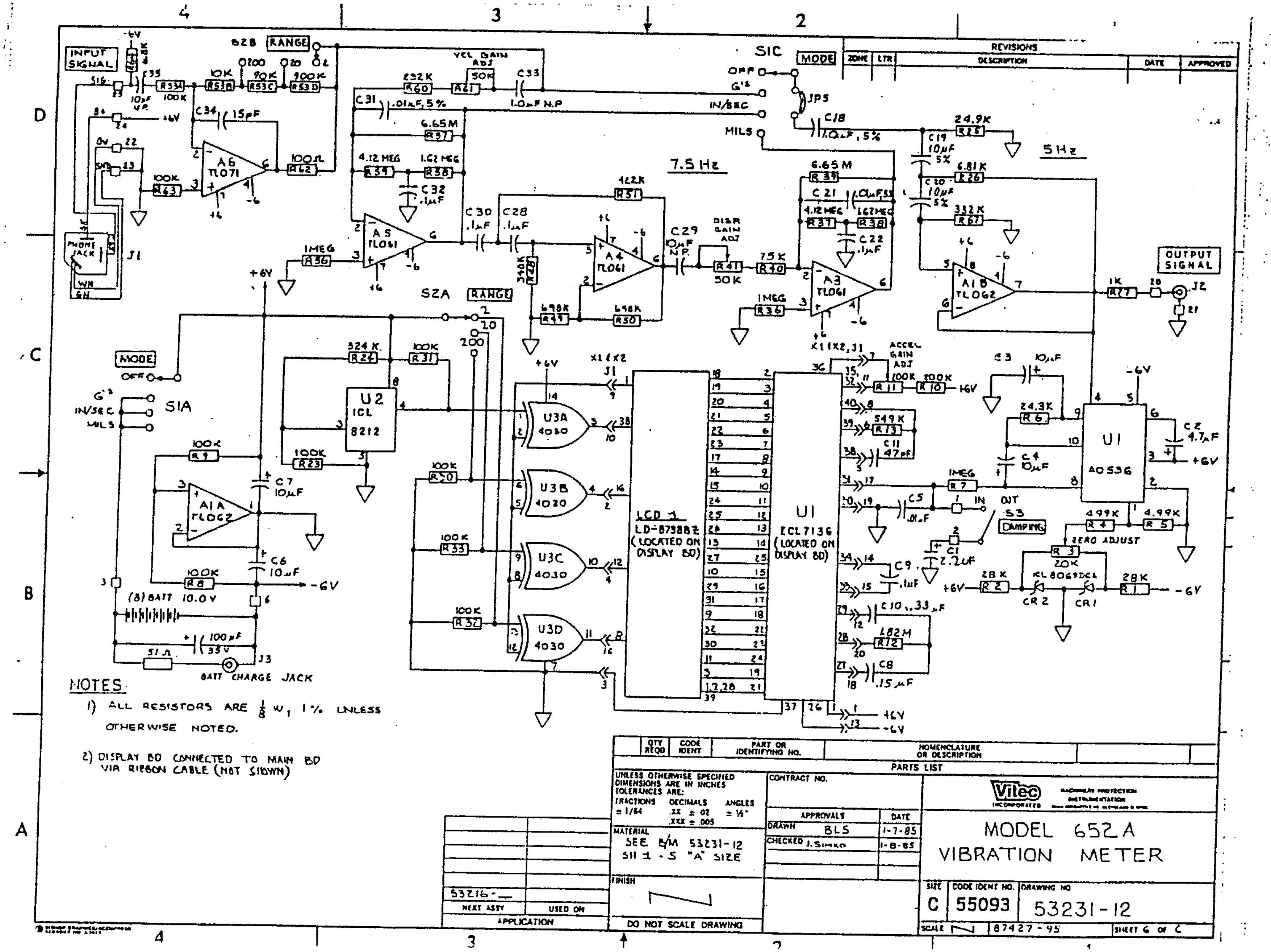
$A = (2.704)(10^{-4})(CPM)(V)$

EXAMPLE: 2.00 Mils at 3000 RPM

By Chart V = 0.3 inches per second
A = 0.25 G's

By Formula $V = (5.236)(10^{-5})(3000)(2.00) = 0.31$ inches per second
$A = (1.417)(10^{-8})(3000)^2(2.00) = 0.26$ G's

Figure 5 Vibration Nomograph


NOTES
1) ALL RESISTORS ARE 1/8 W, 1% UNLESS OTHERWISE NOTED.
2) DISPLAY BD CONNECTED TO MAIN BD VIA RIBBON CABLE (NOT SHOWN)
INPUT SIGNAL
OUTPUT SIGNAL
RANGE
MODE
DAMPING
ZERO ADJUST
7.5 Hz
5 Hz
LCD 1 LD-B7388Z (LOCATED ON DISPLAY BD)
U1 ICL7136 (LOCATED ON DISPLAY BD)
BATT CHARGE JACK
REVISIONS
PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
MATERIAL SEE B/M 53231-12 SH 1 - 5 "A" SIZE
DO NOT SCALE DRAWING
APPROVALS
DRAWN BLS 1-7-85
CHECKED J.SIMKO 1-8-85
Vitec
MODEL 652A VIBRATION METER
C 55093 53231-12
87427-95
SHEET 6 OF 6

Vitec INCORPORATED — VIBRATION HISTORY CHART

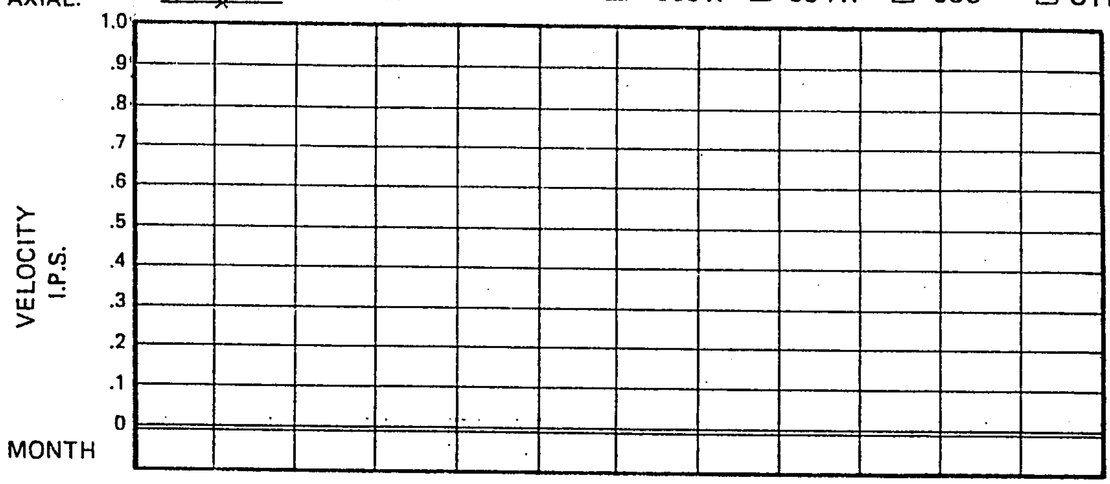
MACHINE IDENT: ______________________ RUNNING SPEED ______________________

BEARING IDENT: ______________________ START-UP DATE ______________________

VERTICAL: —●—
HORIZONTAL: —○—
AXIAL: —×—

INSTRUMENT

☐ 651 A ☐ 652 A ☐ 653 A ☐ 654 A ☐ 655 ☐ OTHER



REMARKS ON STARTUP

START-UP BASE LINE DATA

DATE TAKEN ______________________ BY ____________

MODE	VERTICAL	HORIZONTAL	AXIAL
DISPLACEMENT MILS			
VELOCITY I.P.S.			
ACCELERATION G's			

NOTE NO.	BY	DATE	REFERENCE NOTES, REMARKS.

P/N 412512-110, REV "A"

VITEC, INC., 23600 MERCANTILE, CLEVELAND, OHIO 44122

MACHINE SKETCH

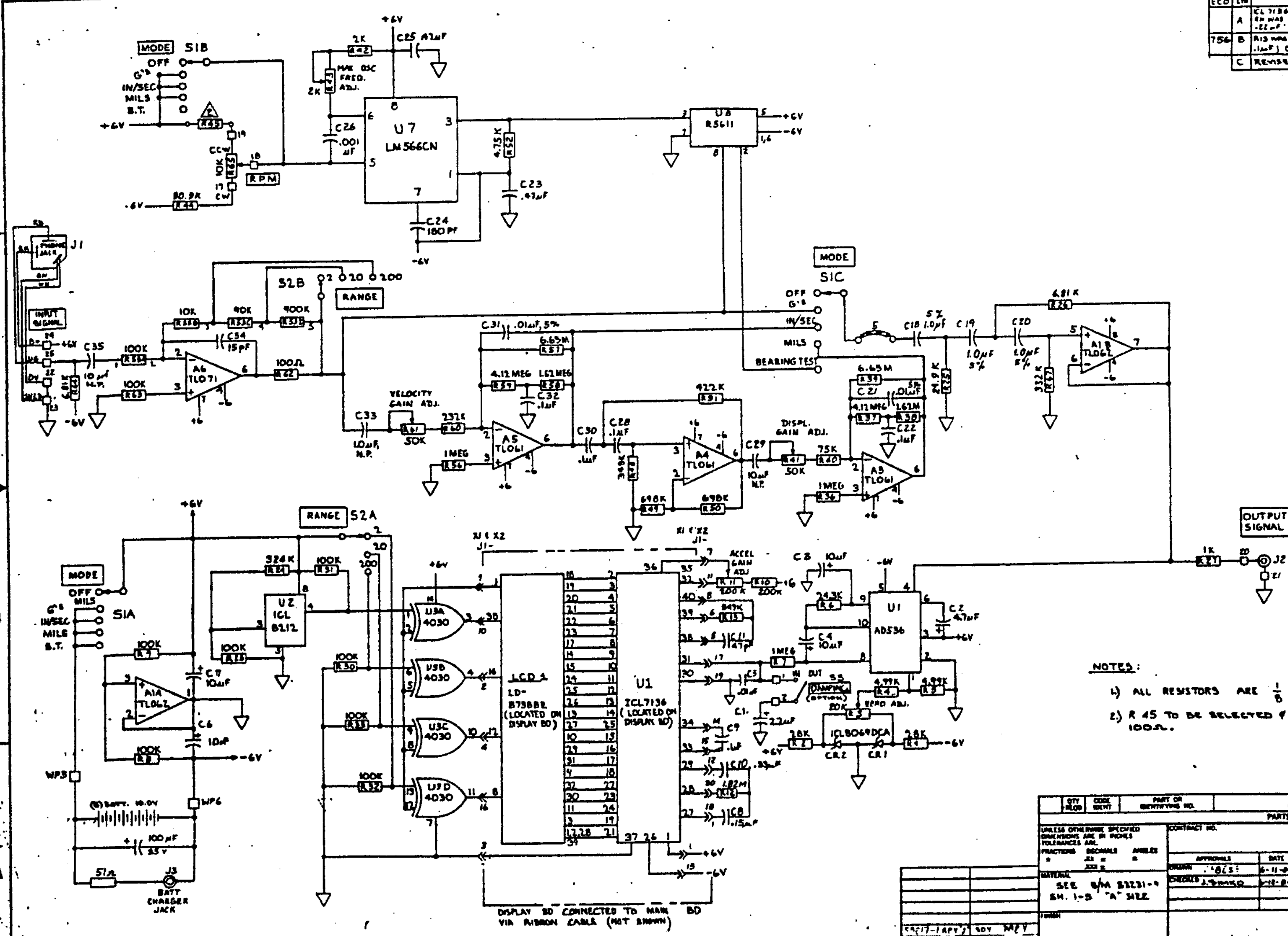
NOTE BEARINGS MEASURED WITH ①

BEARING: ______________

VIBRATION READINGS

DATE	VERTICAL	HORIZONTAL	AXIAL	DATE	VERTICAL	HORIZONTAL	AXIAL

ECO	LTR	DESCRIPTION	DATE	APPROVED
	A	ICL7136 (U1) WAS ICL 7126. R10 WAS 20K, R11 WAS 10K, R12 WAS 475K, C8 WAS .22μF, C10 WAS .047μF	10-3-84	J.S.
756	B	R13 WAS 100K; C8 WAS .015μF; C10 WAS .1μF; C11 WAS 180pF	1-3-85	J.S.
	C	REVISED NOTE 2; R45 WAS 372Ω	1-29-85	J.S.



NOTES:

1) ALL RESISTORS ARE $\frac{1}{8}$ W., 1% UNLESS OTHERWISE NOTED.

2) R 45 TO BE SELECTED & INSTALLED BY TEST. NOMINAL VALUE 100Ω.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ±, DECIMALS .XX ±, .XXX ±, ANGLES ±

MATERIAL: SEE S/M 53231-9 SH. 1-5 "A" SIZE

DO NOT SCALE DRAWING

PARTS LIST

DRAWN: "BCS" 6-11-84

CHECKED: J. Sweeney 6-18-84

Vitec

MODEL 653A VIBRATION METER W/ BEARING TEST

D 55093 53231-9

Vitec

MACHINERY PROTECTION
INSTRUMENTATION

23600 Mercantile Road, Cleveland, Ohio 44122