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VTS
Vibration Test Systems
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VG-100

VIBRATION GENERATOR

OPERATION MANUAL

Serial #_______

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General

The VG 100 vibrator is an electrodynamic vibration generator for laboratory and general industrial applications. This unit features a center gap permanent magnet field structure for high efficiency; a linear low stiffness suspension system for low distortion at low frequencies: a single coil armature structure for simplicity, reliability and ease of maintenance; and an overall design which has been optimized for high force output in relation to body size and weight.

Electrodynamic Principle

The electrodynamic principle of a vibration generator is identical to that of a loud speaker. It differs in physical characteristics in the following areas:

1. The vibrator must have a table to which the test specimen can be attached.
2. The table must have a suspension system, which is capable of supporting the weight of a reasonable size test package and resist motions in all directions other than the desired axis of motion.
3. The vibrator is in most instances larger than a speaker because of a requirement for greater forces than can be produced with a single magnet gap end device.
4. The vibrator is designed for forced air-cooling to carry away heat produced at high force output levels.

Magnet Structure

A center gap permanent magnet field structure, utilizing ceramic magnets, is a preferred configuration for small vibrators (40 – 100 lbs. Force).

1. The center gap configuration offers better efficiency (because of lower leakage factors) and higher force for a given coil diameter (associated with a greater gap area) than is economically feasible with a gap end configuration.
2. Ceramic magnets are readily available in the larger sizes because of high volume production for the loudspeaker industry. Permanent magnets eliminate the need for field coils and the associated field power supply; a particular advantage in high cost energy market.

Armature Assembly

A single coil armature (similar to those used in all large vibrators) is used in the VG 100 Vibrator. With this configuration, problems associated with alignment are greatly reduced and there are fewer parts susceptible to failure. The coil length and thickness have been optimized to produce maximum force consistent with acceptable dynamic characteristics. Rectangular wire is used in the coil for better space factor and to match the voltage and current output of available high quality laboratory audio amplifiers.

Armature Suspension System

A linear low stiffness suspension is used at the upper end of the vibrator to reduce acceleration waveform distortion at low frequencies. Auxiliary load support when required is preferable to the irreversible penalty of higher distortion encountered as suspension stiffness is increased. The suspension is composed entirely of beryllium copper spring elements for load support and lateral restraint at the upper end. Urethane elastomers and foam tapes are used to near critically damp the spring elements. This reduces distortion (associated with spring resonances) at high frequencies. A linear bearing (located at the geometric center of the armature coil) is used to guide the lower end of the armature. The high lateral stiffness of this design keeps the coil centered in the air gap, preventing contact, abrasion and consequent failure of the armature coil.

Armature Coil Cooling

Cooling requirements vary with force level at which the vibrator is operated and time duration of operation. Convection cooling is adequate for operation at up to 40 lbs. Force on a continuous basis. The vibrator may be operated at 50 lbs. Force without forced cooling for a period of 30 minutes. Forced cooling such as is provided by the VTS model B-1 Blower should be used for continuous operation above 40 lbs. Force. Room temperature air should be drawn in through the top inlet air filter of the vibrator; down past the tabletop, frame and coil; and out through the bottom of the vibrator. In this manner, the tabletop and test specimen are maintained at room temperature and the vibrator armature frame, coil and magnet structure are most effectively cooled.

System Considerations

Acceleration capability is dependent on the system force (40-100 lbs. Peak) and the total weight of the armature and all items attached to the table.

Acceleration – g peak = <u>System force – lbs peak</u>
Arm wt. + test wt in lbs

Acceleration – g peak = <u>___100 lbs peak______</u>
.66 (arm) = .34 (test item) = 100 g peak

The vibrator may be bolted to a bench or additional inertia mass if desired. For many tests, particularly with lightweight teat packages, the vibrator may be operated on isolation pads.

The amplifiers used in the VTS systems are commercial dual channel audio units. The cable, which is attached to the vibrator, has been terminated to match the amplifier.

Overall system power requirements at idle are extremely low because of the permanent magnet field and the design of the amplifiers. The output transistors do not carry bias current as in other designs. The result at idle, the power dissipation for the vibrator/amplifier combination will not exceed 15-40 watts for the VTS 40-100 systems.

VG-100 Armature Removal Procedure

Step 1:
Remove air inlet filter assembly by pulling up on outer circumference first, and then pull the cover off the armature frame.

Step 2:
Remove the 6-32 button head screws that hold the C-Flexures to the Flat Flexures (2 per flexure assembly). Next remove the screws that hold the C-Flexures to the top plate segments by inserting the Allen wrench through the hole in the top of the C-Flexures (2 per Flexure). Install one 6-32 button head screw and nut finger tight in the upper hole of each C-Flat flexure assembly.

Step 3:
Towards the center of the top plate you will see (2) top plate inserts, held down by ½ inch long 10-32 screws. Remove these screws. You will now need (2) 10-32 by 1 inch long screws to use as jacking screws. Thread the jacking screws into the tap holes on one of the top plate inserts. Using a T handle Allen wrench run the screws down until the top plate insert comes out of the air gap. Repeat the same with the other top plate insert. Once those are removed you should be able to pull the armature up out of the air gap. You may have to reach down in the air gap to pull up the rubber O-Ring in order to remove the armature.

Flexure Replacement

Flexure assemblies should be replaced in complete sets. The only difference between the current carrying flexures and the table grounding flexures are the phenolic spacers used to insulate the current flexures from both the table and the magnet structure. The C- flexure is easily separated from the leaf flexure. The two table grounding leaf flexures may be removed fully assembled from the table. The current flexures require extreme care during removal to avoid damage to the copper flag, which is soldered to the armature coil lead, which in turn is bonded to the side of the frame. The preferred procedure is to separate the flexure stack at the phenolic insulator using a thin screwdriver blade. Take care to leave the copper flag with the table and avoid moving the flag or breaking the bonded joint at the table.

Linear Bearing Replacement

The linear guide bearing may be replaced after the armature has been removed.

First replace the two sections of the top plate insert.
Caution: NEVER SEPARATE UPPER AND LOWER MAGNET SECTIONS WITHOUT REMOVING THE ARMATURE AND THEN REPLACING BOTH SECTIONS OF THE TOP PLATE INSERT.

Remove the base and outer jacket assembly. Invert the magnet structure assembly. Remove two 10-32 nuts holding upper and lower pole pieces together. DO NOT REMOVE the two 10-32 hex socket screws. Remove three hex aluminum standoffs. Separate lower section of magnet structure from upper section. Remove old linear bearing.

Assembly Procedure

All assembly operations are accomplished by reversing the procedures taken up to the point at which reassembly is desired.

Recommended Spare Parts

Complete armature assembly

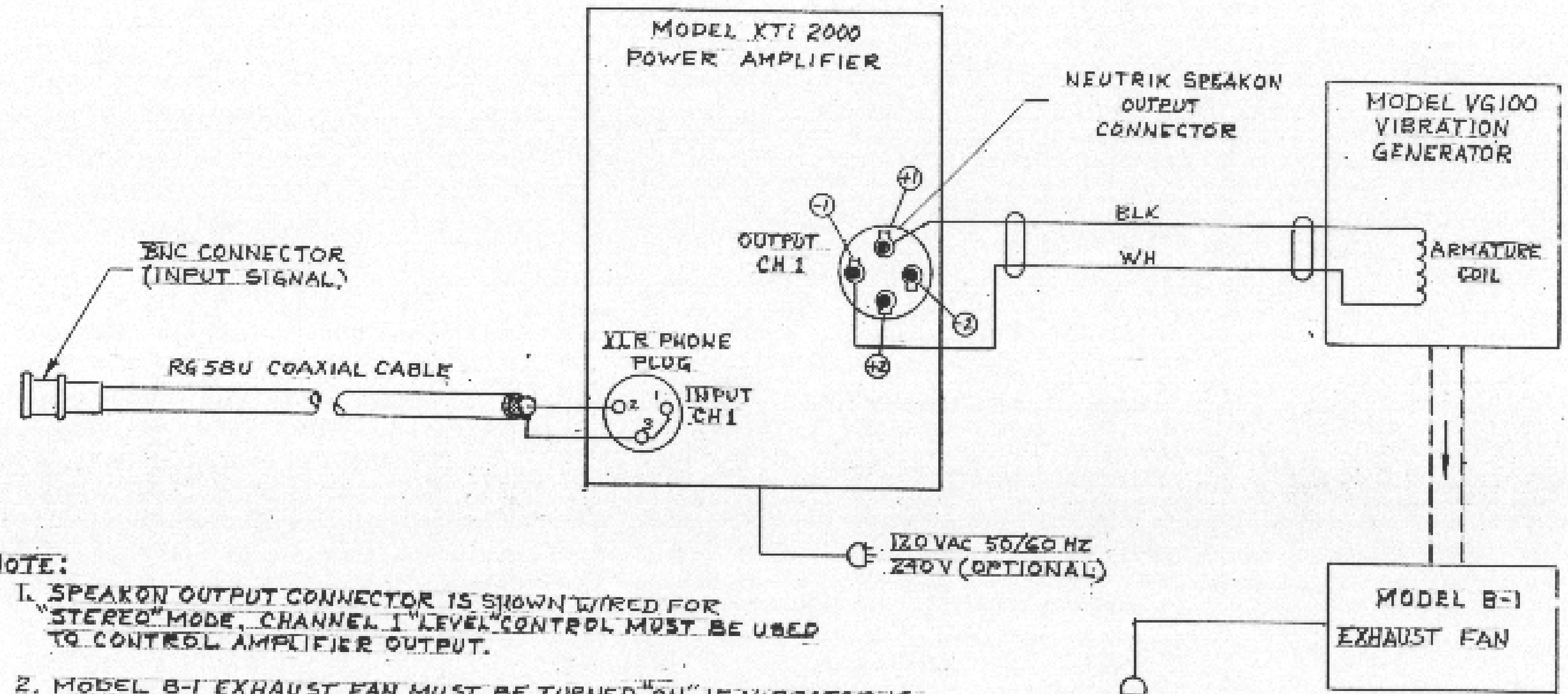
Air Inlet Filter

Leaf Flexure Set

C Flexure Set

Greased Linear Bearing

Bearing Shaft



NOTE:

1. SPEAKON OUTPUT CONNECTOR IS SHOWN WIRED FOR "STEREO" MODE. CHANNEL 1 "LEVEL" CONTROL MUST BE USED TO CONTROL AMPLIFIER OUTPUT.

2. MODEL B-1 EXHAUST FAN MUST BE TURNED "ON" IF VIBRATOR IS OPERATED CONTINUOUS DUTY ABOVE 40 LBF.

3. MODEL XTi AMPLIFIER IS PRESET TO START WITH DSP (DISPLAY SIGNAL PROCESSOR) "OFF" AND THE AMPLIFIER IS AUTOMATICALLY CONFIGURED IN THE "STEREO" MODE. THIS IS THE NORMAL SETUP FOR OPERATING THE SHAKER.

4. REFER TO THE CROWN OPERATION MANUAL SECTION 4 FOR ANY OF THE DSP OPTIONS THAT MIGHT SUIT YOUR OPERATING REQUIREMENTS.

LET.	REVISION	NO.	VTS VIBRATION TEST SYSTEMS AURORA OHIO	Dwn by RS Appr by Date 7/27/06	VTS 80 & VTS 100 VIBRATION SYSTEMS INTERCONNECTING WIRING DIAGRAM	8020104	REV.