

## **The vibration reliability test for motorcycle motor**

### **Purpose**

According to the purpose of vibration test to divide the vibration tests into following types, environmental adaptability test, dynamic strength test, dynamic characteristics test and other purpose vibration test.

#### 1) Environmental Adaptability Test

The objective of the environment adaptability test is to motivate the test object with the vibration environment that could bear in the future, test its adaptability to the environment. The main feature of this test is the more real environment, the better vibration conditions.

#### 2 ) Dynamic Strength Test

The objective of dynamic strength test is to check dynamic strength of the test object, in the corresponding conditions, test whether the object will result in fatigue damage. The test objects of this kind test are mostly structure parts, and the test duration is very long. The test conditions are generally acquired from actual vibration environment.

#### 3 ) Dynamic Characteristics Test

Dynamic test is designed to check the dynamic characteristics of the test object in the experiment. The exciting force of this kind of vibration test can be very small, since exciting force is not related with real vibration environment. But should choose the best excitation positions, at the same time the test points should be as much as possible to acquire accurate test data.

#### 4 ) other purpose vibration test

Some vibration tests have different purposes, like vibration screening test, its purpose is screening the production line parts and components through the vibration, and eliminate the low quality products, so as to improve the whole quality of the products. Vibration conditions of these tests usually have nothing to do with the product environment.

### **The design of the vibration test**

#### 1, Instrumentations

##### 1 ) Vibration shaker

Force: 1000N; Frequency Range: 5~3000Hz

##### 2 ) VENZO Vibration Controller

##### 3 ) One IEPE type transducer, sensitivity is 10mV/g

##### 4 ) Fixture, to clamp the motor on the vibration table

#### 2, Vibration test standard

Motorcycle motor in practice is mainly under low frequency vibration environment, so this

experiment mainly inspects the influence of low frequency vibration environment on the performance of motor. Combined the actual operations with industry standards to determine the frequency range of the vibration test is 10~55Hz, the amplitude peak-peak value is 1.5mm, durability testing time set for 10 cycles per axis.

The vibration test is based on vibration shaker. Motorcycle motor is fixed on the vibration table by fixture, before test to confirm whether the motor is qualified. After the vibration test, inspecting whether motor still meets the requirements of the factory.

### 3, Motor vibration test parameters

| Item  | Content         | Qualified Range                   |
|---|-----------------|-----------------------------------|
| 1   | Rated RPM       | Initial value $\times(1\pm 30\%)$ |
| 2   | Rated Current   | Initial value $\times(1\pm 30\%)$ |
| 3   | Initial Voltage | Initial value $\times(1\pm 10\%)$ |
| 4   | DC resistance   | Initial value $\times(1\pm 20\%)$ |
| Initial value is the initial measured characteristic value. |                 |                                   |

Table 1 Motor vibration test parameters

## Motor vibration test

### 1, the test spot

Firstly, mounted the qualified motor with the fixture, the motor installed by the fixture is transversely fixed on the vibration table. As shown in Figure 1, the motor is fixed on the vibration table.

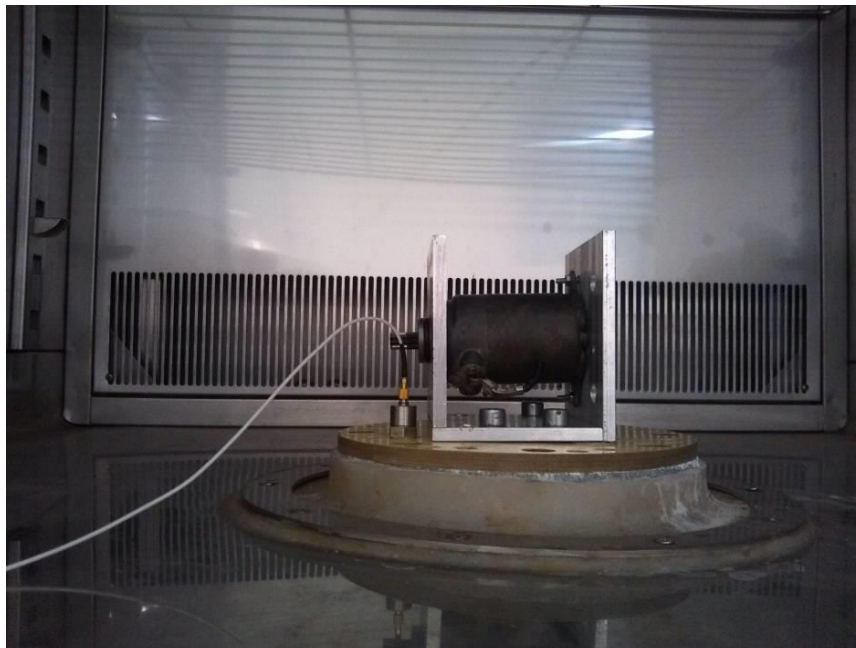


Figure 1, the motor is fixed on the vibration table with transverse direction

This way can be carried out respectively two axis directions vibration test by changing the installation location of the motor. To achieve 3-axis vibration test, the installation method of third axis as shown as Figure 2, the fixture is vertically fixed on the vibration table.



Figure 2 the motor is fixed on the vibration table with vertical direction

## 2, vibration controller operation steps

### 1) Enter into the Start page

Click the VENZO vibration control software VibExpert to enter into the Start Page, select Sine module, as Figure 3.



Figure 3 Start Page

2) Click "System Configuration" to set Shaker Parameters. See Figure 4.

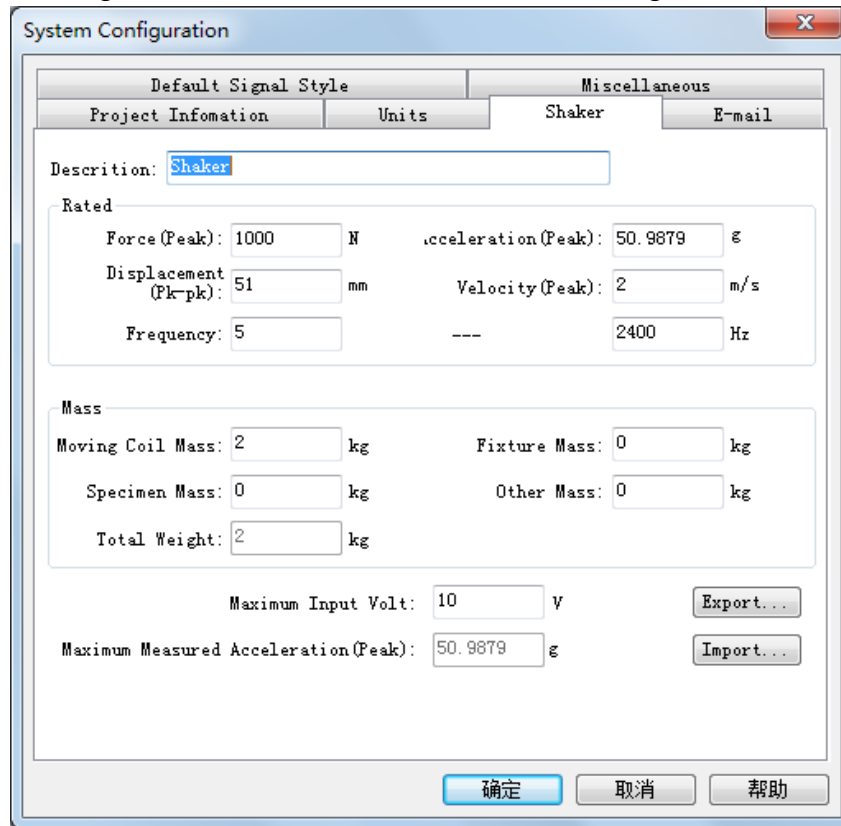


Figure 4

3) Set transducer sensitivity and channel parameters.

Select "Edit Channel" to open dialog as below, set sensor parameters to corresponding channel. At least one channel is selected as control channel. See Figure 5.

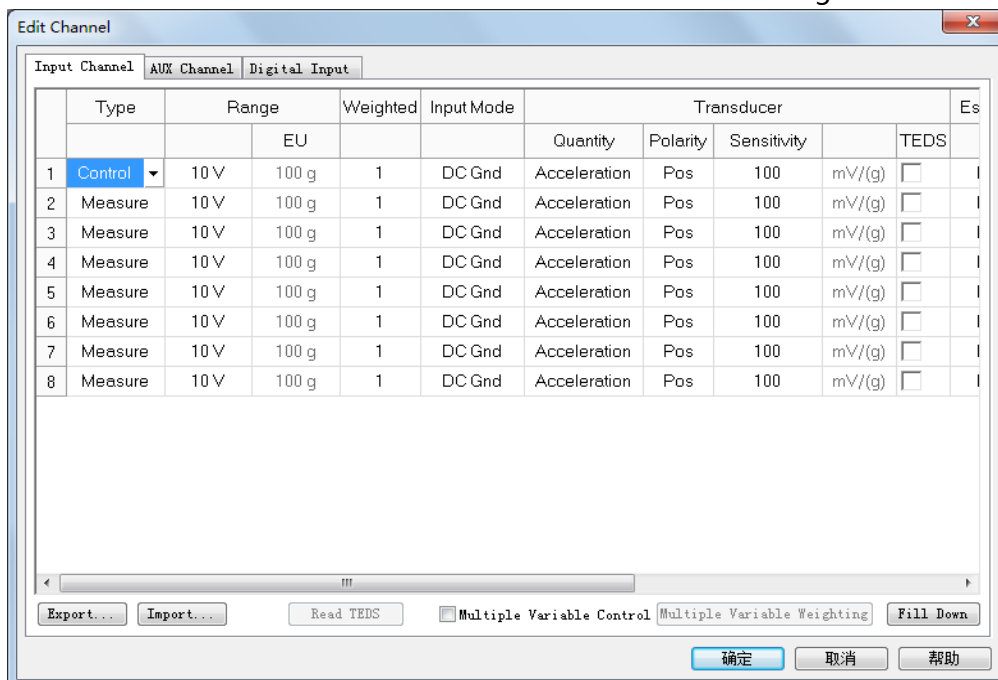


Figure 5 Edit Channel

4) Edit Test

Click "Edit Test" to open dialog as below. According to test requirements, set the frequency range 10-55Hz, test request constant displacement control, the displacement peak-peak value is 1.5mm, sweep number is 10. See Figure 6 and Figure 7.

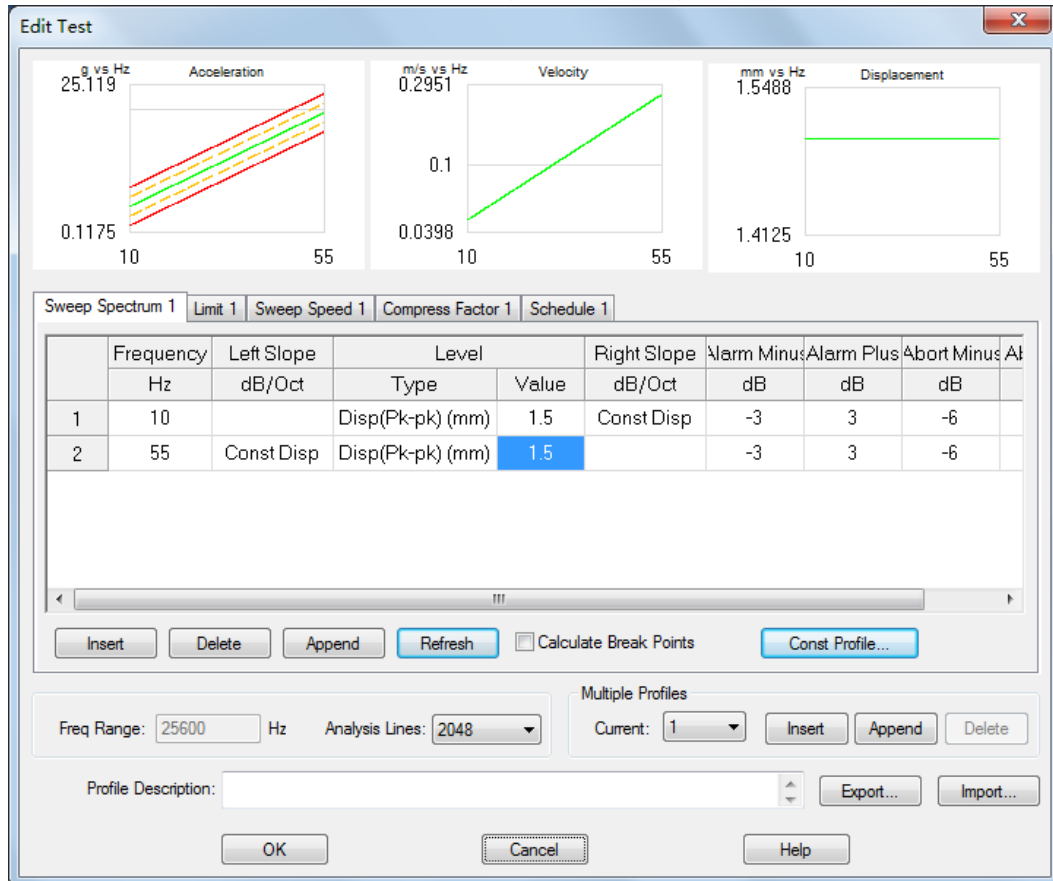


Figure 5 Edit Test

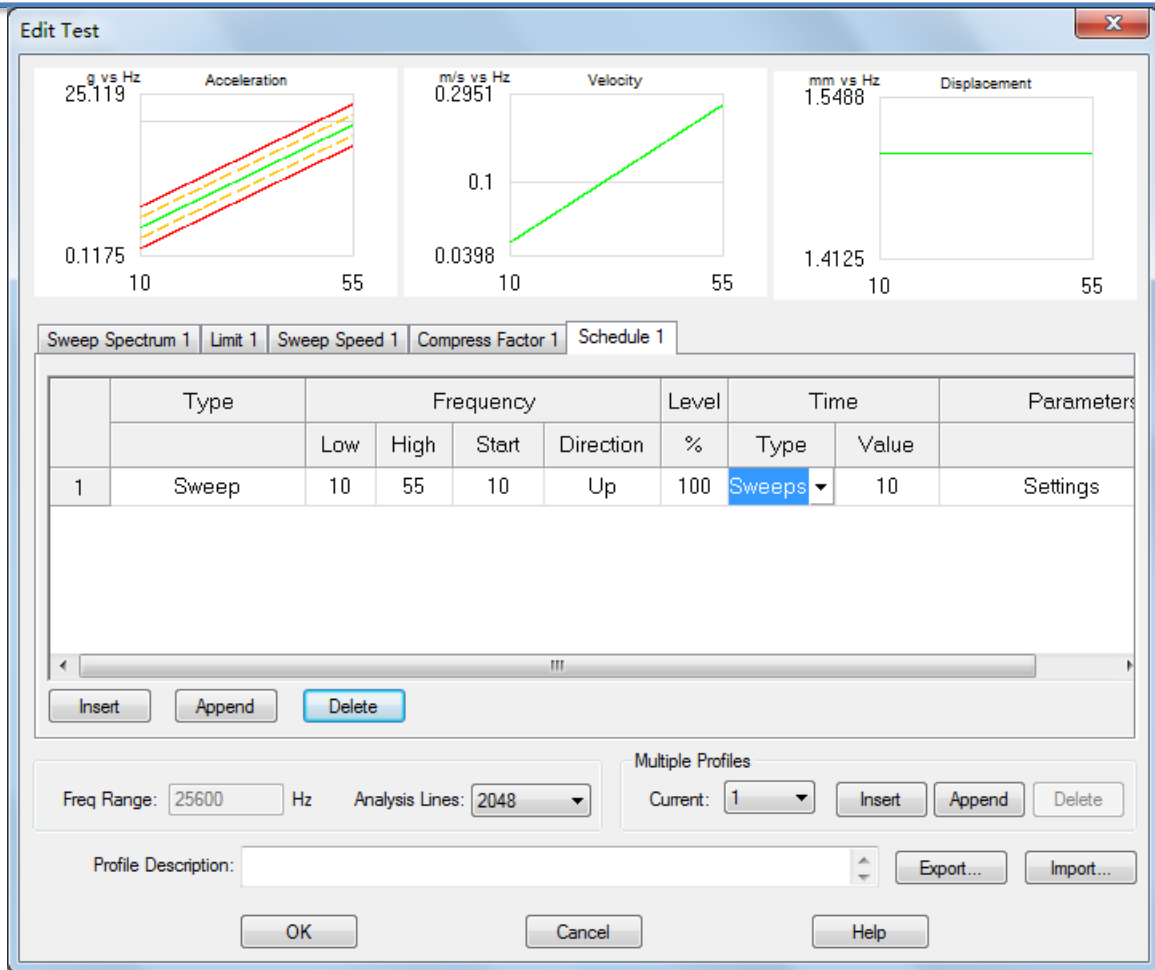


Figure 7 set schedule

5) Check the system connections

From the drive output of the vibration controller, check all connecting cables, ensure all signal lines are connected properly and safely, without potential problems. At the same time, ensure all signal lines without operation wearing in the experiment, use adhesive tape fix all loose cable, but maintain a certain space in order to adapt to the vibration table movement. Maintain good contact between piezoelectric sensor and vibration table.

6) After all above steps, click Start on the VibExpert vibration control software, and then test starts. Waiting for all scheduled test finished, we can do analysis for the test data.

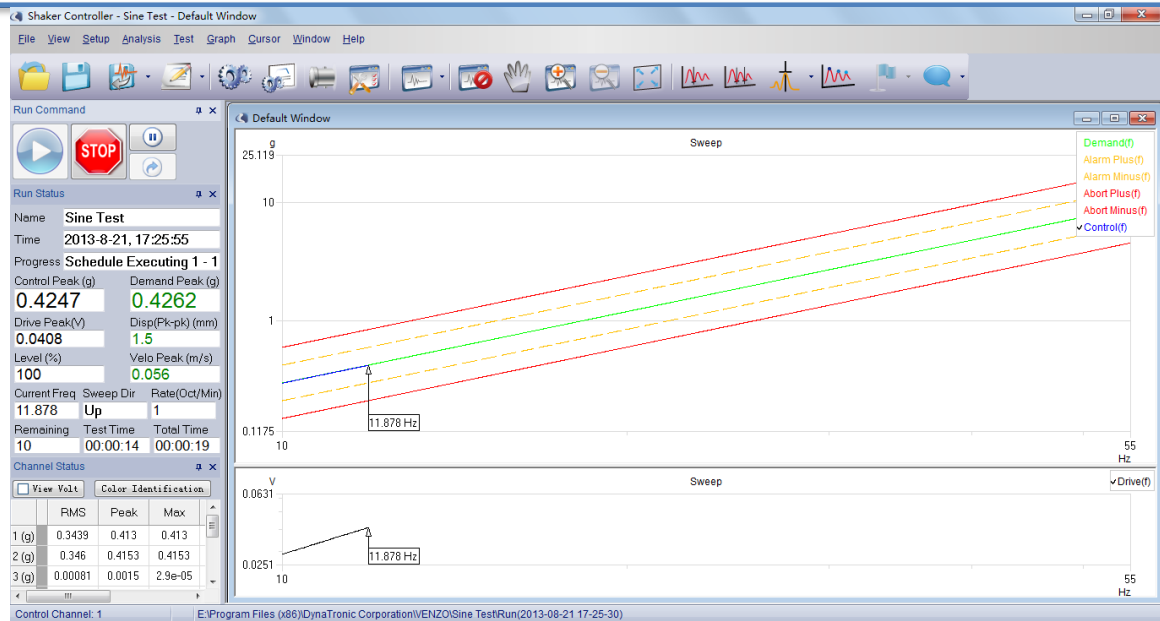


Figure 8 Test

## Test Result

After the vibration test, check all indexes of motor, including the rated RPM, rated current, voltage and DC resistance. The re-inspection result is, the motor still complies with the requirements of factory, and therefore we can deem the motor can meet the requirements of the vibration reliability test.