

구 매 규 격 서

COMMODITY DESCRIPTION

품목번호 Item No.	관세분류번호 HSK No.	정부품분류번호(8자리) Korean Government Commodity Classification Code(eight-digit)	품 명 Description	단위 Unit	수량 Q'ty
1	9024.80.9099		단축진동시험기 (1 DOF Vibration Shaker)	System	1

I. 용도(End-user's Use)

1. The equipment is feasible to conduct vibration test of products exposed to vibration and climatic environment. The equipment should be feasible to conduct various types of vibration tests. i.e. vibration fatigue test, vibration shock test, road load simulation etc.
2. The equipment must be capable to test required by KS R1034 test specification .
3. The equipment can conduct the test for 1 DOF vibration test in all directions. i.e. x,y,z
4. The equipment can conduct vibration test and climatic test simultaneously.
5. The vibration and climatic condition can be controlled automatically and manually.
6. Environmental chamber must be feasible to test with vertical table and horizontal slip table.
7. Space module of environmental chamber must have removable chamber floor design

II. 성능 및 규격(Performance and Specification)

■ Shaker

1. Electro Dynamic Shaker with Slip Table
 - Vertical Pneumatic Load Support
 - Sine/Random Force : 7,000 kfg (68kN) 이상
 - Max Shock Force: 14,000 kgf (137kN) 이상
 - Frequency Range : DC-2,500 Hz 이상
 - Stroke : 51 mm / 63.5 mm (Sine · Random/Shock) 이상
 - Effective Moving Mass : 64 kg 이상
 - Max. Static Payload : 1,000 kg 이상
 - Max. Velocity : 1.8 m/s
 - Max. Acceleration (Bare Table) : 981 m/s² 이상
 - Armature Diameter : 480 mm
 - Shaker Size : approx. 1605 x 1130 x 1315 mm (WxDxH)
 - Grid Pattern : 16 Stainless Steel M12 Insert, 8 on ϕ 200/8 on ϕ 400
 - Stray Flux Density : 10 gauss 이하
 - Internal Load Support
 - Air Isolated Trunnion
 - Degauss Coil
 - Geared Aided Rotation (Chain Wheel Reducer)
 - Servo Control Console : Automatic Armature Centering

2. Power Amplifier

- Amplifier Output : 66 kVA 이상
- Signal-Noise-Ratio : 65 dB @ 100 Vrms Output 이상
10 k Input termination with rated resistive load
- DC Stability : Less than 0.05% of Full output V with 10% change in line V
- Total Harmonic Distortion (@Rated) : From DC to 500 Hz Less than 0.5%
From 500 to 5,000 Hz Less than 1%
- Input Drive : 4 Vrms into 10 k for full output (120 Vrms)
- Amplifier Frequency Response : DC to 2,000 Hz - \pm 1.5 dB
DC to 2,800 Hz - \pm 2.5 dB
- Switch Frequency : 112 kHz
- Max. Output Voltage : 120 Vrms
- Max. Output Current per module :
50 Arms / 150 Arms (Continuous/Transient)
- Amplifier Efficiency : 90% 이상
- Dimension: approx. 500 x 800 x 2070 mm (LxWxH)
- Weight : approx. 810 kg (Uncrated)

3. Slip Table

- Type : Uni-Base Guide Oil Film Table
- Drive Bar : approx. 19.7 kg, Magnesium material
- Table Usable Size : 1000 x 1000 mm 이상
- V-Groove Bearing : Two
- Slip Plate : Magnesium, 50 T, approx.145 kg

4. Cooling Blower with Silencer

- Power Requirements : 30 kW
- Cooling Blower with 6m of Flexible hose

5. Head Expander

- Material : Magnesium
- Size : Top 800x800 mm & 40 T, Bottom ϕ 480mm, Height : 210mm
- Resonant Frequency : 2,000 Hz (Usable) 이상
- Weight : appr. 80 kg
- Th. Wall : 8 on ϕ 8" & 8 on ϕ 16"

6. Vibration Controller(H/W)

- 8 Analog Inputs & 1 Drive Channel & AUX Channel
Aux. channel output must be had COLA, Differential Output, Constant Amplitude-Phase Output Control & Constant Amplitude-Frequency Offset Control functions.

- 450MHz DSP Processing : DSP Response Time must be less than 5 ms.
- 204.8 kHz Sampling Rate
- Without Grounding Problem : Floating Ground Reduces Design
- No-Fan, No-Noise
- 1 GB Internal Flash Memory Stores Test Configurations
- Coupling :
 - AC, DC, Charge, IEPE & TEDS
 - The Charge Amplifier must be integrated in Vibration Controller.
 - All coupling must be selected by S/W per channel.
 - 8 Ch. IEPE/Charge input channels must be in one box.
- Input / Output Dynamic Range: 135 dB / 130 dB 이상
- Interface to PC : Ethernet
 - Ethernet connection removes Elec. Grounding problem.
 - User can do wireless control by ethernet.
- Multiple Profiles Test
- Independent Analysis Lines in Sine Tones & Random Narrow Bands.
- SNR : 100 dB 이상
- 160 dB / Anti-Aliasing Filter
 - 24-bit ADC/DAC, 130 dB Dynamic Range
- Input Impedance : 1 MOhm (Single-Ended), 2 MOhm (Differential)
- Max. Input Voltage : +/- 36 Vpeak without damage
- Input Channels Crosstalk : - 100 dB @ 1kHz 이하
- Input / Output Channel Crosstalk : - 90 dB 이하
- Harmonic Distortion : - 100 dB 이하
- Input Signal Type : Charge, Voltage & High-Integrated

7. Vibration Control and Analysis(S/W)

- Basic S/W Analysis Functions:
 - FFT Analysis, FRF, Historic Signal Analysis, Signal Calculation, Waterfall Analysis,
 - Multi-Layer Password Security System, Off-Line View, E-mail Report After Test
- It must be had independent analysis lines in sine tones & random narrow band Functions.
- Lissajous Display
- Word & PDF Report Functions.
- FDR mode not to lose data from PC.
- Transient Functions:
 - Shock Response Analysis
 - Force / Deflection Analysis
 - Rotational Shock Analysis
- Sine:
 - Frequency Range 0.01 Hz ~ 51.2 KHz

Phase Tracking Functions

Block Size : Higher than 4096

Dwell Points : Higher than 80

Step Sine : Cycle on/off for user specified time at discrete frequencies

Linear or Logarithmic frequency step rates

Sine on Sine Tones : Higher than 16

Dynamic Range 95 dB 이상

Digital Tracking Filter – Proportional Band is Selectable 1%~100% of Output Hz

- Random:

Frequency Range : DC ~ 40 kHz

Resolution : Higher than 25,600 lines

Loop Time : Less than 10 ms

Kurtosis : Kurtosis control allows a non-Gaussian distribution to be used in random test

Multi-Variable Control should be possible by combined control with displacement & acceleration.

Dynamic Range : 90 dB 이상

Typical Loop Time : 100 ms 이하

Degrees of Freedom : Up to 12736 DOF

Control Accuracy : ± 1 dB @ 99% confidence within 200 DOF

Control Strategies : Weighted Averaging, Max, & Min.

Drive Clipping : 2 ~ 6 sigma

Breakpoint : Unlimited Frequency/Amplitude Breakpoints edit with slope (dB/Octave) automatic calculations.

Profile View : Profile graphics shown and updated as profile is created.

Automatic listing of RMS acceleration and displacement values for profile.

Profile operating levels are compared to the shaker parameter table.

Abort/Alarm : High & Low profile limits a specified independently at each breakpoint in dB with respect to reference.

Level Schedule : Number of Levels – 400

Sine-on-Random : Perform up to 16 sine tones superimposed on the background random spectrum.

Random-on-Random : Perform up to 16 narrow spectral bands superimposed on the broad random background spectrum

Sine-on-Sine : Perform up to 16 sine tones superimposed on a sine background

Sine and Random on Random : Analog sine sweeps and narrow band Gaussian random dwells/sweeps on wide band Gaussian random distribution.

- Shock:

Sampling Frequency Range : 20 Hz ~ 51.2 kHz in 36 stages

Frame Time : Higher than 800 sec

SRS Frequency Range : Higher than 20 kHz
SRS Test must be suitable in according with MIL-STD-810 Method 516.6 Procedure I.
Block Size : 256 ~ 16384 points or automatically optimized
Wave Type : Half-Sine, Haver sine, Initial & final peak sawtooth, triangle rectangle and trapezoid
Negative Pulse : Pulses can be in negative direction
Averaging : Pulsed can be averaged for the control
Pulse Duration : 0.05ms ~ 100,000 ms
Pulse Compensation : Both pre-pulse and post-pulse compensation is performed.
Double sided for min, displacement and full use of shaker stroke.
Choice of Harmonic Rectangular, Rectangular and Half Sine compensation pulses.
Pre-pulse and pose-pulse amplitudes settings are a percentage of the demand peak acceleration
Criterion : ISO, MIL-STD 810F requirements and/or a percentage of demand waveform amplitude.
Profile View : Profile graphics shown and updated as profile is created.
Profile operating levels are compared to the shaker prameter table.
Loop Transfer Function : Automatic calculation during system equalization or recall FRF from disk.
Filtering : User defined desired frequency for low pass filtering
Delay Between Pulses : User set unlimited > 0
Shock Response Spectrum
Synthesis Type : PostMax, NegMax & AbsMax.
Fractional Octave : 1/1 ~ 1/48 Octave
Damping Raito : 01 ~ 1 0 0
Wavelet Initialize : Specify Half Cycles, & Max. Duration
Compensation : DC Remove, HP Filter
Data Process : Remove DC, LP & HP Filter
Wave Type : Sine, Sine Beat, Chirp, White Noise & Imported Wave

- FDR (Field Data Replication) :

Data Import : Import waveforms from Waveform Editor with measured Time Data
Waveform Editor :
Pre-stored Profiles on SD RAM : band-limited random, white noise, sine & chirp
Compensation : HP & LP Filter, DC Removal, Acceleration DC Removal
Profile Re-scale : Magnitude or Polarity adjustment by applying a profile scale factor to each data point of th p=profile
Data Format : Binary, UFF Binary, UFF Test, Text (S-y) & Text (y)
Sampling Frequency Range : 20 Hz ~ 51.2 kHz in 36 stages
Test & Level Scheduling : Test can be set to reproduce the waveform for a specified duration

- Mixed Modes :

Mixed mode must be had to Sweep and Sweep invert in SoR, RoR & SRoR.

Mixed mode must be had independent analysis lines in sine tones.

a. Sine on Random

Up to 16 sine tones superimposed on the background random spectrum

Sine Tones : 1 ~ 16 sine tones configurable independently

Frequency of Sine Tone : can be in or out of wide band random

Lines : 3200

Test & Level Scheduling : Tests can be scheduled to run a user-defined length of time

Spectrum level can be scaled by specified dB-Level, % or scaled for a specified RMS Acceleration.

Level schedules can be entered to run various durations at different acceleration levels

Configurable Safety Limits : To protect test article & shaker system, configurable acceleration limits, line limits and drive limits can be set by user.

Control input is also verified against shaker acceleration & displacement limits

b. Random on Random

Random Tones : Up to 16 independent narrow spectral bands, sweep back-and-forth between frequencies at a user-programmable rate

Test & Level Scheduling : Tests can be scheduled to run a user-defined length of time

Spectrum level can be scaled by specified dB-Level, % or scaled for a specified RMS Acceleration.

Configurable Safety Limits : To protect test article & shaker system, configurable acceleration limits, line limits and drive limits can be set by user.

Control input is also verified against shaker acceleration & displacement limits

Sine & Random on Random

Tones : Up to 16 sine tones and 16 narrow spectral bands independent amplitude or profile for each band parameters in each band are all user programmable.

Test & Level Scheduling : Compliant with SoR and RoR

Configurable Safety Limits : Protect test article and shaker system, configurable acceleration limits and be set by users.

Control input is also verified against shaker acceleration & displacement limits.

- Auxiliary Applications :

- ▶ Kurtosis Control : Allows a none-Gaussian Distribution
- ▶ Notching and Limiting Control
- ▶ THD(Total Harmonic Distortion) Detection

- Test Report Generation :

Easy one click generation of Word/PDF report, report layout can be customized to suit user requirements.

- Off-Line View

Standard with all control applications

- Hardware Calibration

Automatic H/W Calibration can be completed using the calibration S/W with full calibration report.

■ Chamber

1. General requirements for climatic chamber:

- Test space module in removable chamber floor design
- Floor element to use climatic test without vibration, including sealing system
- Two shelves (stainless steel materials, each shelf can loaded 35kg weight)
- Floor element for vertical vibration, including sealing system vertical
- Floor element for horizontal vibration, including sealing system for slip-table
- Floor element for head-expander(800x800mm), including sealing system
- Test cabinet movable left-right hand side
- Test space module adjustable in height via electrical spindle drive
- Test chamber conform to the shaker- type
- Operating panel with colour display LCD.
- Touch panel with easy menu-guided operation
- Error display in plain text
- Defined keys for elementary functions of the installation such as start/stop, fixed-value / automatic operation, interruption, light, etc.
- Maintenance-free capacitive humidity measuring system
- Potential-free contact for malfunction signal
- Interface RS 232
- 2 digital Out, potential-free, to switch test specimen ON/OFF
- Adjustable software-temperature-limiter min./max.
- 2 Entry ports \varnothing 125 mm, 1x on the right, 1x on the left
- Door lockable, opening to the top
- Test chamber light switched via operation panel
- Low-noise refrigerating unit
- International standards are fulfilled
- Operating instruction

2. Temperature tests:

- Temperature range -70°C to +180 °C

- Temperature fluctuation $\leq \pm 0.5$ K temporally
- Temperature change rate Heating: 5 K/min.
- Temperature change rate Cooling: 5 K/min.
- * Temperature change rate according to IEC 60068-3-5 measured in the supply air stream.
- Heat compensation appr. 4500 W at +20°C

3. Climatic tests:

- Temperature range +10 °C to +95 °C
- Humidity range 10 % to 95 % rel. humidity
- Dew point range* +5 °C to +88 °C
- Temperature fluctuation ± 0.5 K temporally
- Humidity fluctuation ± 1 to ± 3 % rel. humidity, temporally

4. Dimensions:

- Test space capacity 1700 liter or more.
- Test space 1200 x 1200 x 1200 mm (W x D x H)
- Floor hole \varnothing max. 1060 mm
rectangular: 1100 x 1100 mm

5. Data for installation and operation:

- Nominal voltage 380 V +6/-10 %, 3/N, 60 Hz
- Nominal power ≤ 26 kW
- Nominal current ≤ 40 A
- Acoustic pressure level:
< 68 dB(A), measured in a distance in accordance to DIN EN ISO 3744 of 1 metre from front
- Weight approx. 2500 kg net

6. Design

- Test space stainless steel grade 1.4301
- Test space module:
Adjustable in height via electrical spindle drive system. Operating via separate control panel. push buttons enables automatically movement to different positions of the test space module.
- Refrigerating unit:
Water cooled, low noise fully-hermetic refrigeration unit, continuous performance adjustment via electronic monitoring and control system. Chloride free refrigerants are used in a hermetically sealed refrigeration cycle. Refrigerants R 404 A / R 23
- Floor element for vertical vibration:
Removable, with round hole for shaker head, floor hole max. $\varnothing 960$ mm, floor element to be fixed at the test space with quick clamps, flexible sealing system for combination with head extender
- Floor element for horizontal vibration:

Removable, with rectangular hole for slip table with max. 1000 x 1000 mm, floor element to be fixed at the test space with quick clamps, flexible sealing system for adaption to thermal barrier

- Floor element to use climatic chamber only.

Removable, sealing system and no leakage during climatic test

- Floor element for head-expander(800x800mm) including sealing system

7. Control

- 32-bit controller
- Operating panel ergonomically integrated in the front
- digital display of temperature
- digital display of RH humidity
- 3 analogue channels visible at the same time,
- Error report
- Graphic curve progressions
- Easy input of test programs
- Graphic program preview
- Control PC with control S/W

III. 기타 조건(Remarks)

1. Inspection:

1st: Before shipment at manufacturing site(Shaker only)

Factory final inspection for 1 week, 1 person. All related cost will be included.

2nd: After installation at customer site.

2. Training :

1st: after installation at customer site.

2nd: 2 months later from first training.

3. The verification for the following performance should be presented separately with the real test

4. Delivery: F.O.B 6 months from contract date

5. Payment: 80% after shipping, 20% after acceptance

6. Manual: 2 copies of operation in English and Korean

7. Warranty: Shaker 2 years, Shaker Controller 3 years, Chamber 2 years after issued F.A.

8. Supplier should support all related utility connection.

9. After installation, final test examination report should be submitted with a test check list.

10. Introduction material of a supplier and a manufacturer with recent brochures.