AD2-I20-A046

Large Vibration Test Facility

Advanced Engineering Services Co., Ltd.

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1 Introduction

This users' manual is to provide necessary information to the users of Large Vibration Test Facility (referred to as "this facility" hereafter) located in Spacecraft Integration and Test Building.

This facility is used for simulating the vibration environment on spacecraft imposed by a launch vehicle during launch or during flight, for the purposes of verifying the structural strength of a test specimen (■abbreviated as TS hereafter) or the durability of mounted equipment, as well as understanding their vibration characteristics.

2 Brief Overview of this Facility

This facility is used for simulating the vibration environment on a launch vehicle and a spacecraft imposed during launch, for the purposes of understanding its durability and vibration characteristics. The facility consists of a shaking system, a control system, a facility base system, utility equipment, a data acquisition system, and a communication system for operation. The shaking system has horizontal and vertical vibration tables.

The horizontal and vertical vibration tables respectively possess one and four electrodynamic shakers, and are designed for assuring the excitation force, precision-improved excitation ability, higher reliability, etc., required of a facility designated for spacecraft tests.

The measuring control room on the second floor enables remote controlling of the systems including sine/random wave vibration controlling of the vibration tables, which can be partially automatic.

2.1 System Outline

This facility consists of the following systems (1) ~ (6.) Its bird's eye view and system diagram are shown in Figures 2-1 and 2-2, respectively.

(1) Shaking system

The shaking system is the drive source of this facility, consisting of electrodynamic shakers, vibration tables, horizontal/vertical device power supplies, an air pressure supply, an oil supply device, and a cooling device.

Activation of those devices, selection of excitation axes, and detection of abnormalities are all conducted at a "facility controller."

(a) Electrodynamic shakers

There are five of them, one of which is for the horizontal vibration table, and four are for the vertical vibration table.

The electrodynamic shakers generate force from the current flowing through the conductors in the DC magnetic field.

(b) Horizontal/vertical vibration tables

A TS is mounted on them. They are both 3m×3m in size, and made of aluminum alloy.

(c) Horizontal/vertical device power supplies

These devices supply EP necessary for the armatures, exciting coils, and demagnetizing coils of the electrodynamic shakers. They also have a back-up function in case of power failure.

(d) Air pressure supply

This device supplies air to the neutral support air springs of the electrodynamic shakers and the vertical vibration table.

(e) Oil supply device

This device supplies oil to the static pressure bearing on the lower part of the horizontal vibration table, the center bearing and joint of the vertical vibration table, and the static pressure bearings of the electrodynamic shakers.

(f) Cooling device

This device supplies a necessary amount of cooling water to the armatures and exciting coils of the electrodynamic shakers, and to the oil supply device.

(2) Control system

The control system controls the electrodynamic shakers the way the excitation levels of the vibration tables form the specified excitation spectrum distribution, while remotely controlling and monitoring this facility. It consists of a shaking controller and a facility controller.

(a) Shaking controller

The shaking controller performs safe operation of various excitation controlling necessary for spacecraft tests, by transmitting control command signals to the shaking system, while receiving the feedback signals from a TS and the vibration tables to control excitation spectrums, sweeps, notches, abort, etc., during a vibration test.

It adopts a mean control method, that is, the vibration amplitudes of the shakers are controlled by bringing the average of the vibration responses among all the controlling points to the target value.

This device enables the controlling of sine/random wave vibration test levels, and the limit controlling of the significant measurement points on a TS.

(b) Facility controller

The facility controller performs remote centralized operation of this facility, puts various statuses on screens, monitors and records the ongoing states of this facility during a test, in the measuring control room, to confirm the maintenance of normality with this

facility to protect it from damage.

(3) Facility base system

The facility base system supports the reaction force from the shakers, to prevent the propagation of harmful vibration to the surrounding facilities including the building itself.

The vibration propagation level on the floor 30m away from the center of a vibration table in the building is 0.008 m/s^2（0.0008G）or less.

(a) Isolated base

The isolated base supports the loads from the vibration tables, shakers, and a TS, as well as the excitation force from the shakers, then transmits the loads to the supporting base after damping the excitation force using its own mass and resilient isolators.

(b) Supporting base

The supporting base supports the static/dynamic loads from the shaking system facilities, isolated base, etc., and evenly spreads the loads.

(c) Work floor

There is a work floor to fill the gap between the supporting base and the isolated base, which has enough endurance for handling satellites and executing test-related work. The load capacities of the work floors are distinguished by the identification tapes which show the load sections according to the range of heavy loads. Refer to section 4.4 for details.

(4) Utility equipment

(a) ITV facility

The operation statuses of a TS, the test room, and the power amplifier room can be monitored in the measuring control room.

① The monitor cameras can be remotely controlled in the measuring control room.
② The test room has two color monitor cameras installed.
③ The monitored situations can be recorded in a DVD recorder (with built-in HDD.)
④ The ITV facility is connected to the “Test Facilities Administration Room” on the third floor in SITE via LAN.

(b) Display board

A display board is located in the test room to help workers get hold of the test statuses.

① It shows test statuses (STAND-BY, PRE-LEVEL, FULL-LEVEL)
② It shows excitation frequencies (only for sine wave vibration)
③ It shows excitation duration (only for random wave vibration)

(5) Data acquisition system

The data acquisition system measures, analyzes, and saves the vibration response data of

a TS. The system is basically structured as below.

(a) Analogue signal processing section

In this section, sensor outputs (400 chs for acceleration, 100 chs for strain) are amplified by the isolation amplifier dedicated to the section.

(b) Digital signal processing section

In this section, sensor output signals are measured by the data acquisition computer as digital data, which is then analyzed and saved by the data analysis computer.

Furthermore, limit controlling on several significant measurement points in random/sine wave vibration can be executed at this section by choosing channels (up to 50 chs) on the patch panel that are to be branched into the vibration controller.

(c) Data medium PC

The analysis data converted into universal files by the data analysis computer can be read out by the data medium PC, and saved in FD, CD-R, etc.

(6) Communication system for operation

This system consists of a wired paging system and a wireless radio communication device (paging) which help the mutual communication between test-concerned personnel and the command broadcasting during the operation of the facility, the preparatory work on a TS before a test, etc. The usage purposes of each communication system are shown below.

(a) Wireless radio communication device

① Group call

The individual call enables the radio communication for summons and conversations between a command station and a paging, or between pagings.

Up to nine pagings are available, provided one of them is borrowed from the 1600m^3 Acoustic Test Facility. Please note that three are occupied by the facility operation company during a test and therefore the remaining six are available to users.

Also, up to three groups of independent calls are possible.

② Out-of-range warning

Mobile terminals give alarm when one moves out of the service area (where radio wave is out of reach) while talking.

(b) Wired communication device

① Extension call

One can choose any call number on the telephone to communicate.

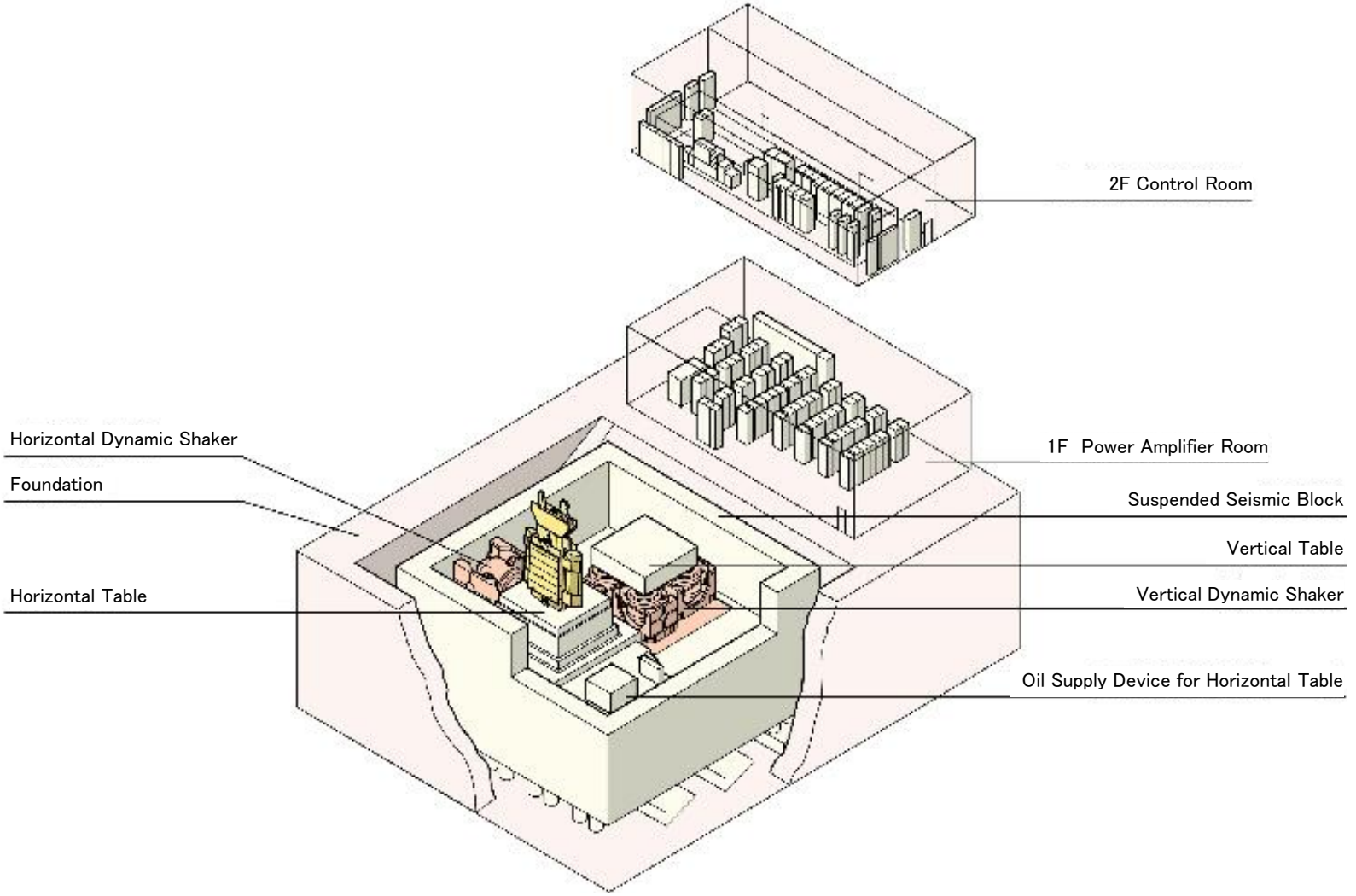


Figure 2-1 Bird's Eye View on Large Vibration Test Facility

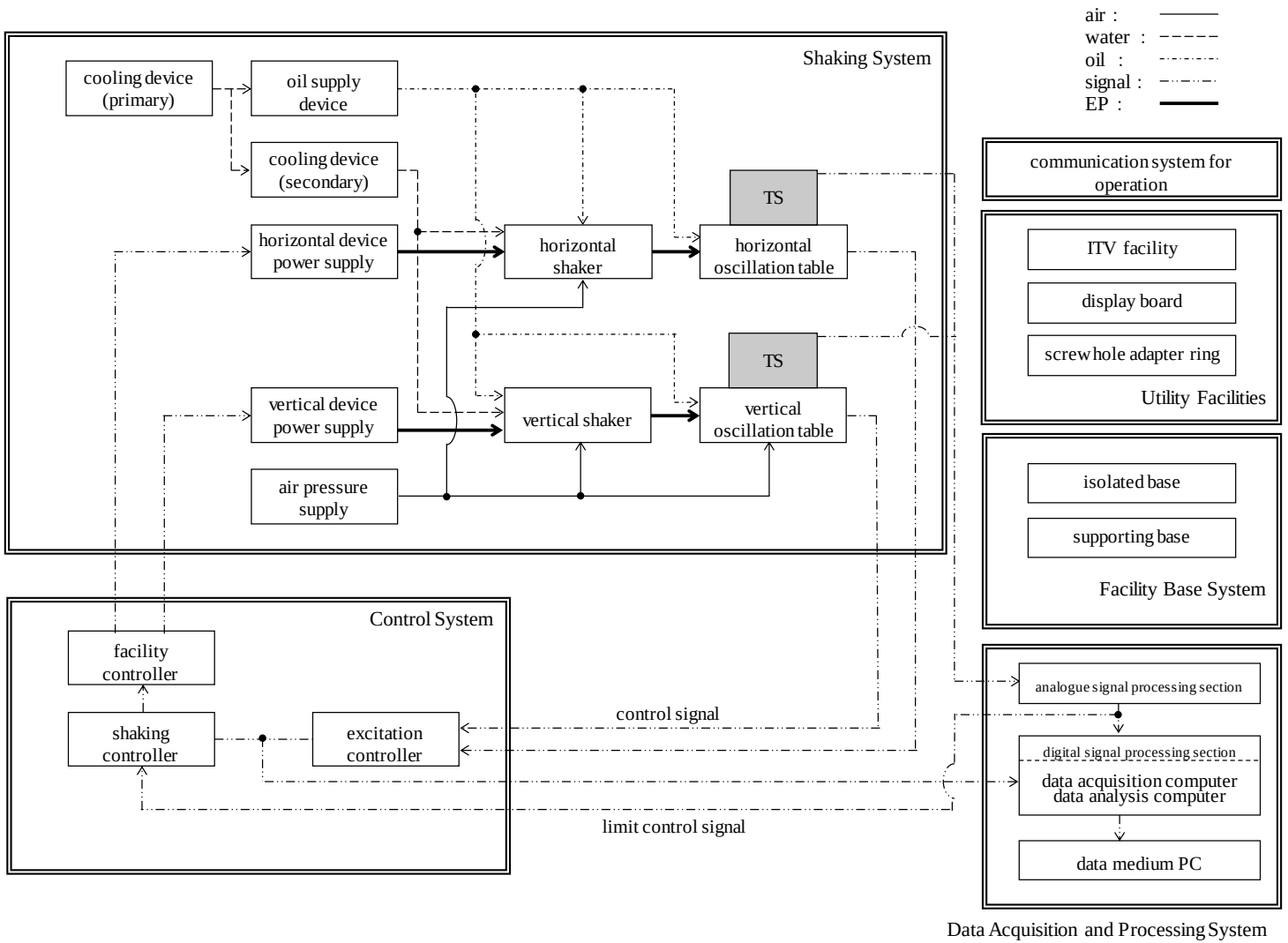


Figure 2-2 System Diagram

2.2 Main Specifications

2.2.1 Shaking System

The specifications of the shaking system in this facility are shown below.

(1)	Excitation system	electrodynamic uni-axial type shaker
(2)	Vibration direction	uni-axial excitation to horizontal or vertical axis
(3)	Maximum load mass	8,000 kg
(4)	Allowable overturning moment	horizontal vibration: 980 kN･m (100 tonf･m) Note) Ask us for more detail, because the allowable levels differ depending on the mounted areas of jigs. vertical vibration: 156.8 kN･m (16 tonf･m)
(5)	Allowable eccentric moment	horizontal vibration: 98 kN･m (10 tonf･m) (moment around the vertical axis) vertical vibration: 78.4 kN･m (8 tonf･m)
(6)	Dimensions of vibration tables	3m×3m□
(7)	Height of vibration tables	about 30 cm from the upper planes of the tables to the floor of the vibration test room (when the tables are in neutral positions.)
(8)	Cleanliness of test room	ISO class 8 (class 100,000)
(9)	Excitation waveform	sine wave (Up/Down sweep, Up-Down sweep), random wave
(10)	Excitation ability	sine wave: horizontal 9.8 m/s^2 (1G) (when 8,000 kg is loaded) vertical 15.6 m/s^2 (1.6G) (when 8,000 kg is loaded) random wave: 4.9 m/s^2 rms (0.5 Grms) for horizontal/vertical (when 8,000 kg is loaded)

(11) Maximum acceleration

The maximum accelerations of the shaker with and without the load of 8,000 kg are shown in Figures 2-3 and 2-4.

$$\alpha = \frac{F}{M1 + M2} \times k$$

α = maximum acceleration (m/s^2)

F = excitation ability

horizontal: 245,000 N (25 tonf)

vertical: 784,000 N (80 tonf)

M1 = mass of movable part

horizontal: 2,872 kg

vertical: 11,000 kg

M2 = mass of TS (kg)

k = operational factor

horizontal: 0.8

vertical: 0.7

Note) Please make arrangements with the personnel in charge at the Test Facilities Administration Room concerning the Max. acceleration for a TS with large mass.

(12) Maximum velocity: 40 cm/s

(13) Maximum displacement: ±12.7 mm

(14) Minimum control level: sine wave: 0.49 m/s^2 (0.05G) (5 ~ 100Hz) (unloaded)
random wave: 0.98 m/s^2 rms (0.1 G rms) (5 ~ 200Hz)

(15) Noise level: 0.49 m/s^2 (0.05G) or less

(16) Acceleration distribution on vibration tables: within ±15% (unloaded)

(17) Acceleration waveform strain: within 10% (unloaded)

(18) Transverse motion: within 15% (unloaded, 5 ~ 100Hz) (crosstalk motion)

2.2.2 Control System

The specifications of the control system in this facility are shown below.

(1) Sine wave

(a) Frequency range	5 ~ 100Hz
(b) Number of input channels	control channel: within 4 chs facility (drive, rotation moment): 5 chs limit channel (branching from data acquisition device): within 50 chs
(c) Control method	One of maximum level, minimum level, average level, or RMS is to be chosen.
(d) Level calculation method	One of RMS, peak level, or tracking filter is to be chosen for both controlling and data acquisition.
(e) Sweep method	linear sweep, logarithmic sweep
(f) Measurement channel	frequency spectrum, transfer function
(g) Target level setting	fixed displacement/velocity/acceleration, or acceleration-acceleration (slope) can be pre-set (up to 100 breakpoints)
(h) Limit setting	fixed displacement/velocity/acceleration, or acceleration-acceleration (slope) can be pre-set (up to 50 breakpoints)
(i) Data output	target spectrum, upper/lower limit alarm, upper/lower limit abort, transfer function, control average, the frequency/drive/error spectrums of each control channel and measurement channel
(j) Protective function	control alarm/abort, limit abort, detection of open channels, abort by external signals, manual abort, channel overload

(2) Random wave

(a) Frequency range	5 ~ 200Hz
(b) Number of input channels	control channel: within 4chs facility (drive, rotation moment): 5chs limit channel (branching from data acquisition device): within 50 chs
(c) Frequency resolution	100, 200, 400, 800, 1600, 3200 lines
(d) Control method	One of maximum level, minimum level, or average level is to be chosen.

(e)	Output waveform	true random wave
(f)	Measurement channel	frequency spectrum, transfer function
(g)	Target level setting	fixed displacement/velocity/acceleration, or acceleration-acceleration (slope) can be pre-set (up to 100 breakpoints)
(h)	Limit setting	fixed displacement/velocity/acceleration, or acceleration-acceleration (slope) can be pre-set (up to 40 breakpoints)
(i)	Data output	target spectrum, upper/lower limit alarm, upper/lower limit abort, transfer function, control average, the frequency/drive/error spectrums of each control channel and measurement channel
(j)	Protective function	control alarm/abort, limit abort, detection of open channels, abort by external signals, manual abort, channel overload

2.2.3 Data Acquisition and Processing System

(1) Measurement accuracy / number of measurement points

The measurement accuracy and the number of measurement points for each kind of signals are shown in Table 2-1.

Table 2-1 Acceleration/Strain/Facility Signals Measurement Accuracy and Number of Measurement Points

name of data	total measurement accuracy ±（%F.S）	the number of measurement points	
acceleration	3.4	400	charge amplifier: Model 428 (manufactured by Endevco)
strain	2.2	100	strain amplifier: Model 436 (manufactured by Endevco)
facility signals	3.4	6 6	control signals COLA signals

(2) Contents of data analysis

The following analyses and functions are possible.

(a) Waveform display
(b) PSD analysis
(c) Auto power spectrum analysis
(d) Response curve (sine wave) analysis
(e) FFT analysis
(f) Transfer function analysis
(g) Coherence analysis
(h) Cross-spectrum density analysis
(i) Autocorrelation function analysis
(j) Histogram analysis
(k) Crosscorrelation function analysis
(l) Mode analysis (modal analysis and animation display)

(3) Time for post-excitation quick look processing and analysis processing

The up/down sweep for sine wave vibration modes (response curve analysis, transfer function analysis) of all the measurement points (500 chs) can be output in about three hours.

(4) Consecutive data acquisition time

Recording of data for up to fifteen minutes is possible when using 500 chs per one test.

(5) Sampling rate

sine wave: 12.8 kHz (5 kHz × 2.56 times)
random wave: 1.28 kHz (250Hz × 5.12 times)

(6) Low-path filter

A low-path filter of 400Hz is applied at the analogue signal processing section.

(7) Power failure protective measures

The system can stay in the energized state for eight minutes after power failure takes place, owing to an uninterruptible power supply (CVCF.) Power failure is coped with during that period.

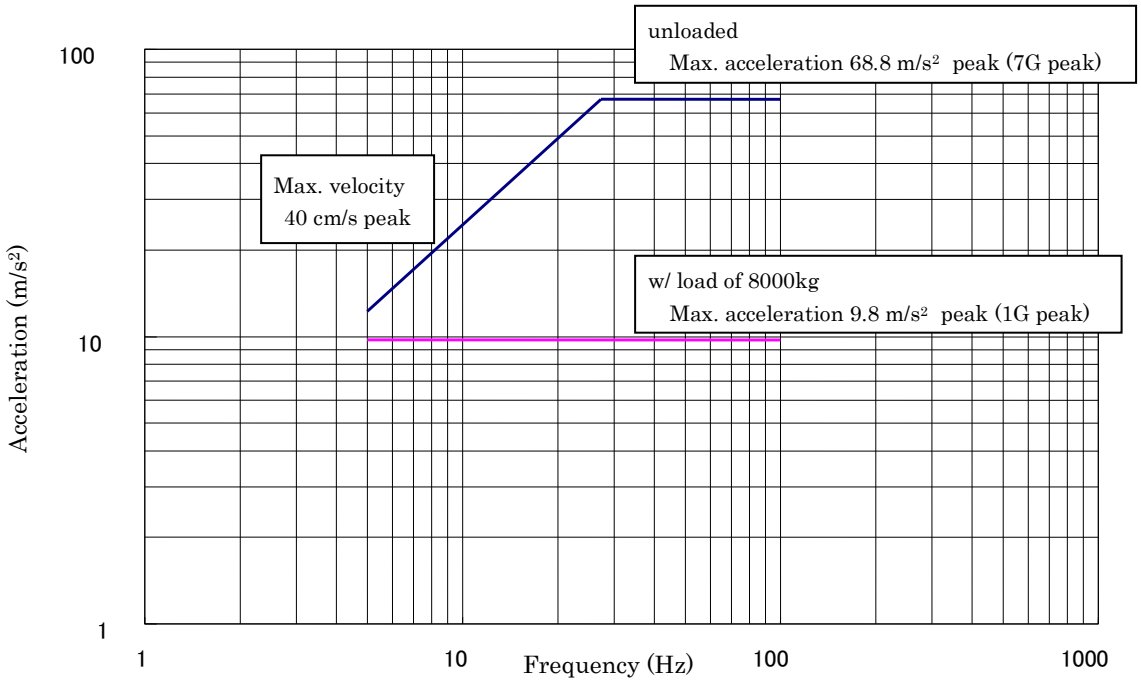


Figure 2-3 Maximum Acceleration (Horizontal Vibration Table)

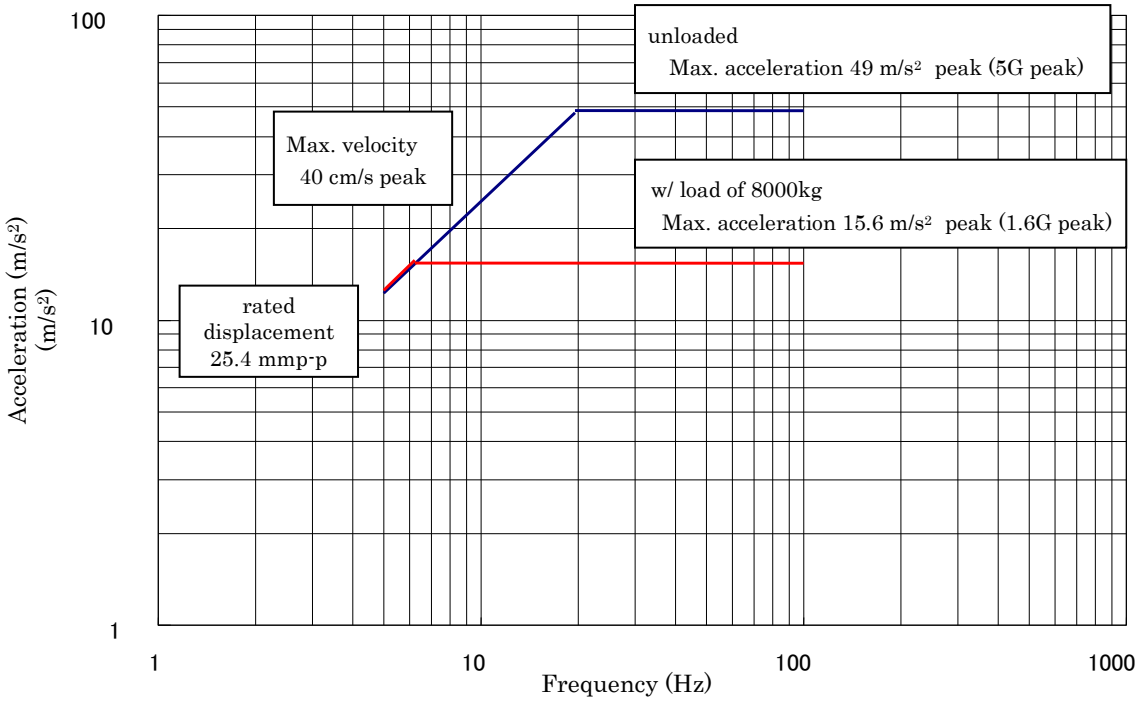


Figure 2-4 Maximum Acceleration (Vertical Vibration Table)

3 User I/F

3.1 Layout in Test Room

The layout drawing of the test room is shown in Figure 3-1.

3.2 Layout in Measurement and Control Room

The layout drawing of the measurement and control room is shown in Figure 3-2.

3.3 Device I/Fs

(1) Hole patterns of screw hole conversion rings and on vibration tables

The hole patterns of screw hole conversion rings and on the vibration tables are shown in Figure 3-3 ~ 3-7.

If a test jig for an I/F is necessary between a vibration table and a TS, it is to be prepared by users. In case users intend to mount a PAF on a vibration table, please contact us in advance, because that may require a “screw hole conversion ring” in between.

(2) Data acquisition system

(a) Acceleration measurement

The accelerometers mounted on a TS are to be connected to the relay section of the data acquisition device, so called the “patch panel”, in the test room, via low-noise cables.

(b) Strain measurement

The strain gauges mounted on a TS are to be connected to the bridge box terminal in the test room. The specifications of the bridge box are shown below.

① Model number	DB-120S3-8 (Kyowa Electronic Instruments Co., Ltd)	
② Input strain gauge	1-gauge method	120Ω
	2-gauge method	120Ω (active dummy method 60 ~ 1,000Ω)
	4-gauge method	60 ~ 1,000Ω
③ Connection terminal	gauge-clamp type terminal (viz. a wire rod is inserted while a control lever is being pushed, and fixed by letting the lever go.)	

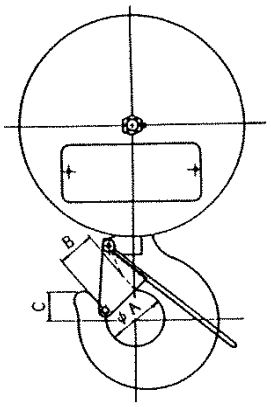
* The input method is chosen by switching the slide switch.

(3) Test room crane

The specifications of the test room crane are shown in Table 3-1.

Table 3-1 Specifications of Test Room Crane

capacity	model#	velocity (low/high)			height below hook	hook size
		travel	traverse	hoist		
10,000 (kg)	X-Y	1/10	1/10	0.5/5	16 (m)	A: 115 (mm) B: 90 (mm) C: 63 (mm)



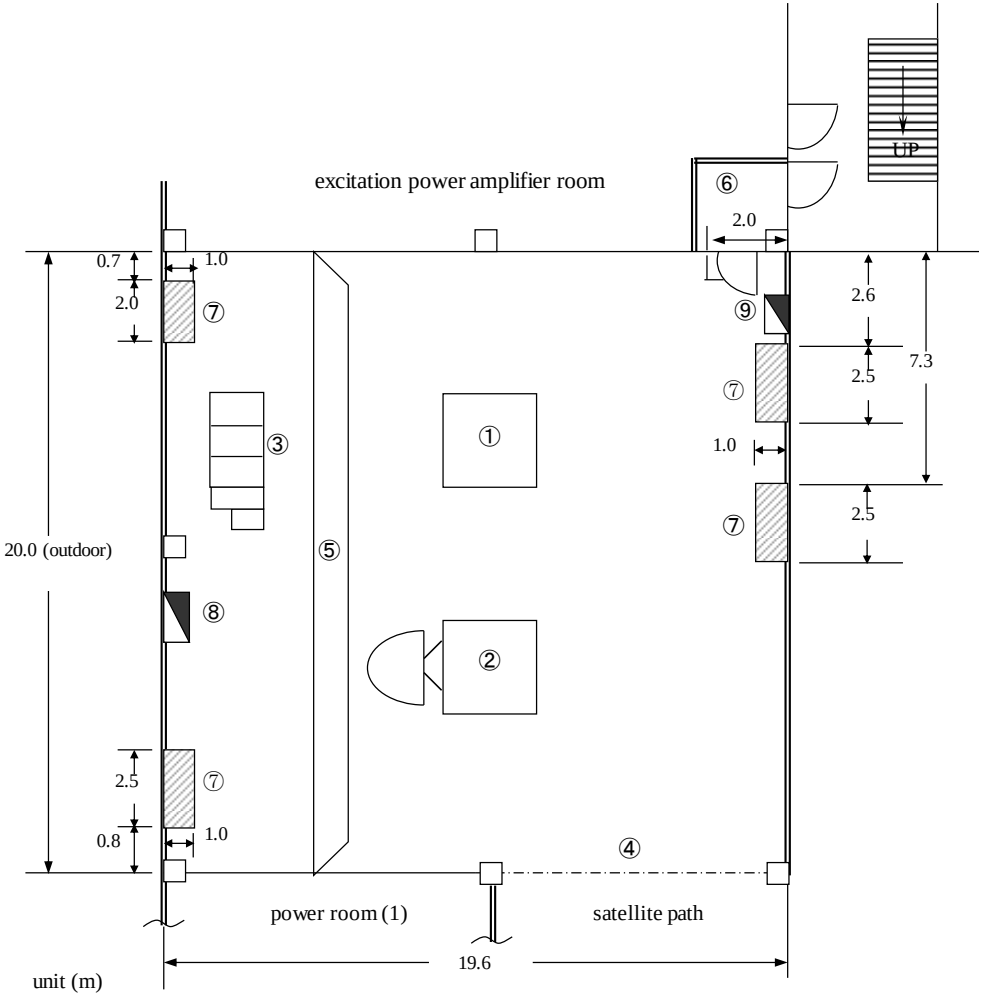
(4) Test room shutter

When a TS is carried in and out of the test room, the shutter facing the satellite path is to be left open.

dimensions of shutter: 8.3m (width) × 14m (height)

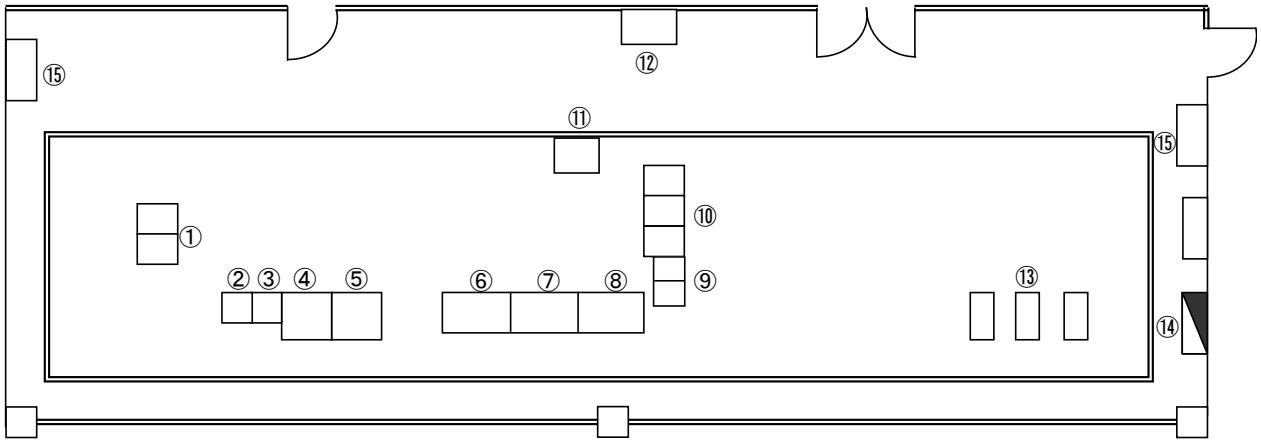
(5) Items related to power supplies

The distribution boards for tests available to users are listed in Table 3-2, while the installation sites of distribution boards and sockets available to users are shown in Figures 3-10 and 3-11.



No.	name
①	vertical oscillation table
②	horizontal oscillation table
③	data acquisition and processing device relay section
④	shutter
⑤	crane
⑥	air shower
⑦	air conditioner inlet
⑧	distribution board (PA-1-D)
⑨	distribution board (PA-1-E)

Figure 3-1 Layout Drawing of Test Room



No.	name
①	phase controller
②	network printer for facility controller
	network printer for shaking controller
③	ITV device
④	facility controller
⑤	shaking controller
⑥	analog signal processing section computer
⑦	data acquisition computer
⑧	data analysis computer
⑨	patch panel
⑩	digital signal processing section
⑪	network printer
⑫	data medium PC
⑬	uninterruptible power supply
⑭	distribution board
⑮	air conditioner

Figure 3-2 Layout Drawing of Measurement and Control Room

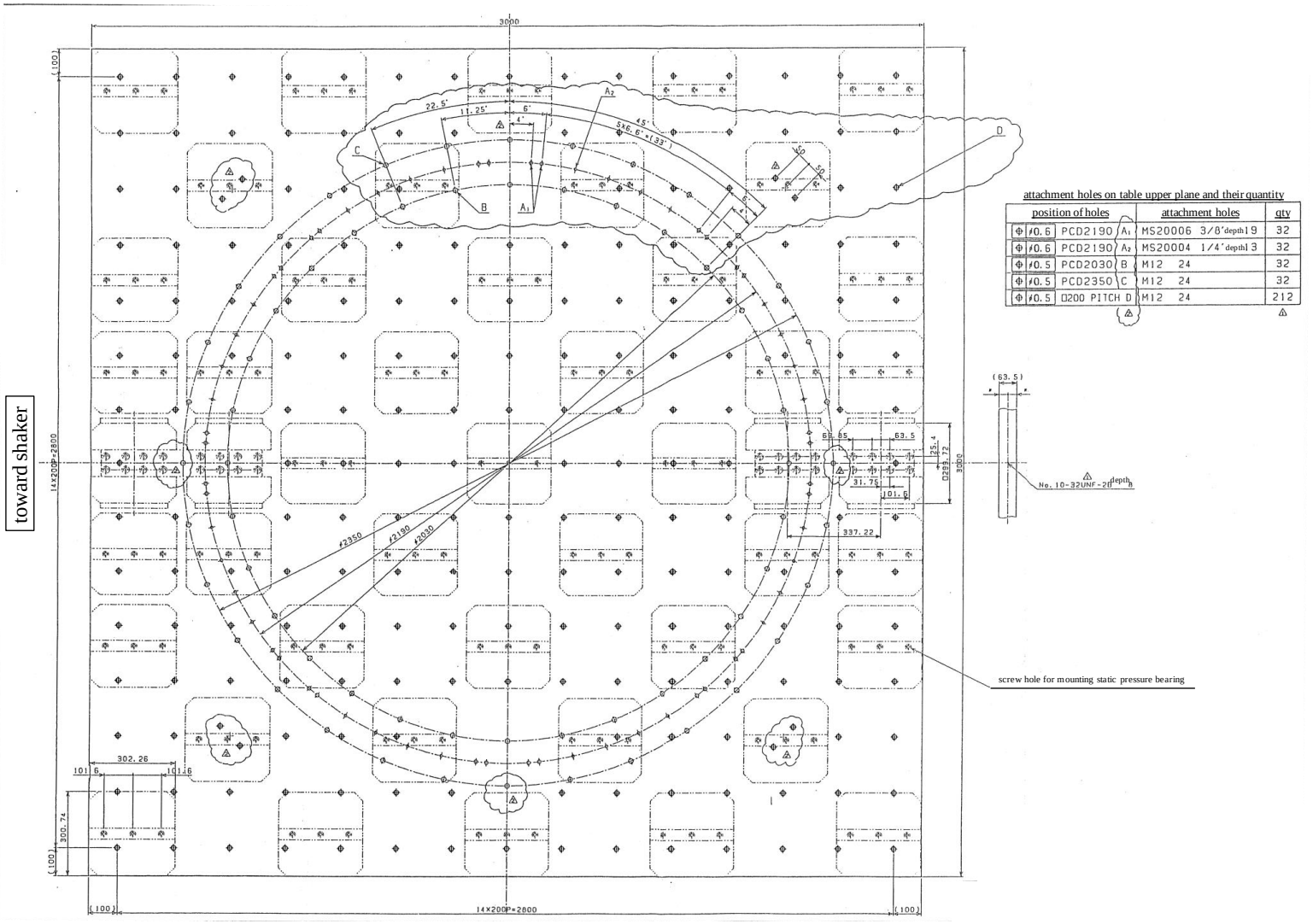
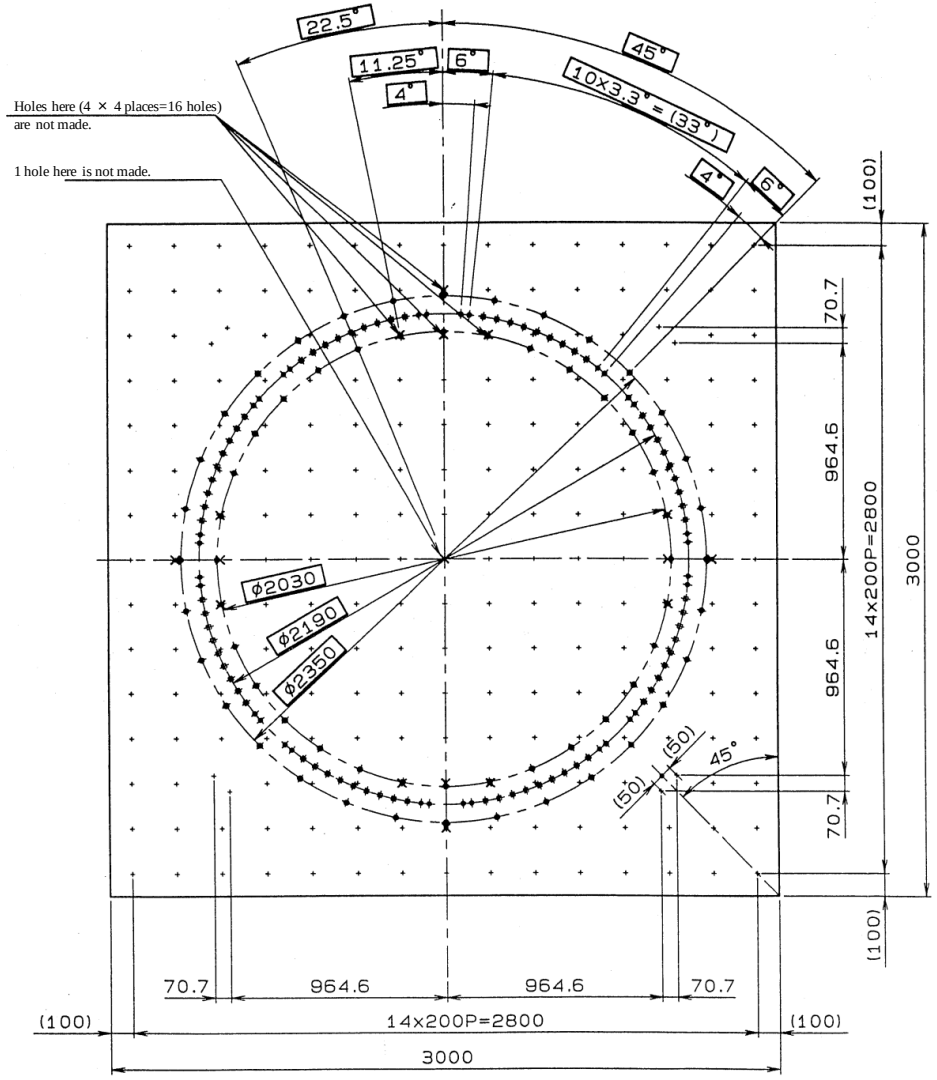


Figure 3-3 Hole Pattern on Vibration Table (Horizontal Vibration Table)



attachment holes on table upper plane and their quantity

position of holes			size of attachment holes	qty
⊕	ϕ0.6	PCD2190 ⊕ symbol	3/8-24 UNF ＊19	32
⊕	ϕ0.6	PCD2190 ⊕ symbol	1/4-28 UNF ＊13	72
⊕	ϕ0.5	PCD2030 ◆ symbol	M12 ＊24	32
⊕	ϕ0.5	PCD2350 ◆ symbol	M12 ＊24	32
⊕	ϕ0.5	□200 + symbol	M12 ＊24	212

＊ = depth

Figure 3-4 Hole Pattern on Vibration Table (Vertical Vibration Table)

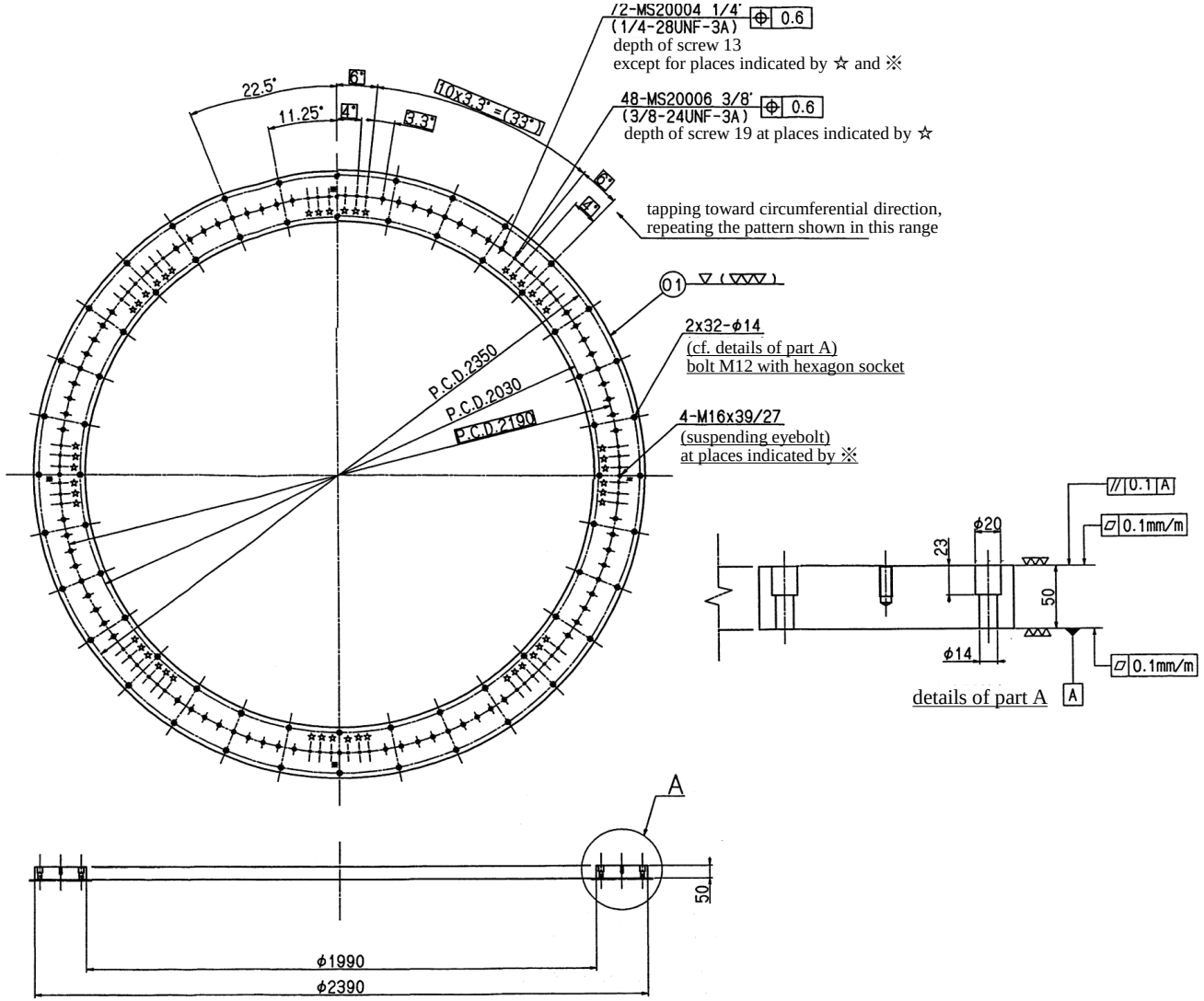
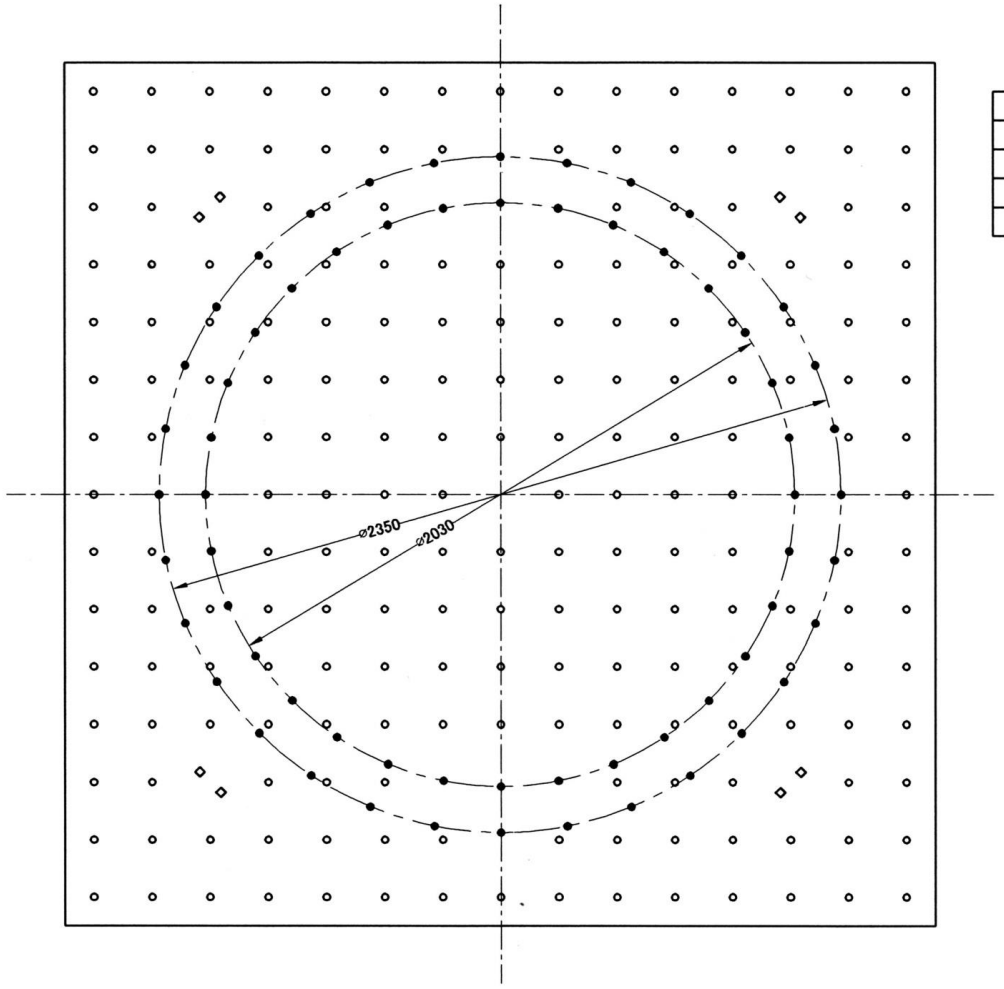


Figure 3-5 Hole Pattern on Vibration Table (Screw Hole Conversion Ring for Vertical Vibration Table)



hole position of M12		qty
○	□200 PITCH	204
•	PCD2030	32
•	PCD2350	32
◇	others	8

(note) where □200-pitch holes and either PCD 2030 or PCD 2350 holes overlap with each other, the holes of PCD 2030 and PCD 2350 are preferentially made.

Figure 3-6 Extracted Diagram of M12 Hole Pattern on Horizontal/Vertical Vibration Tables

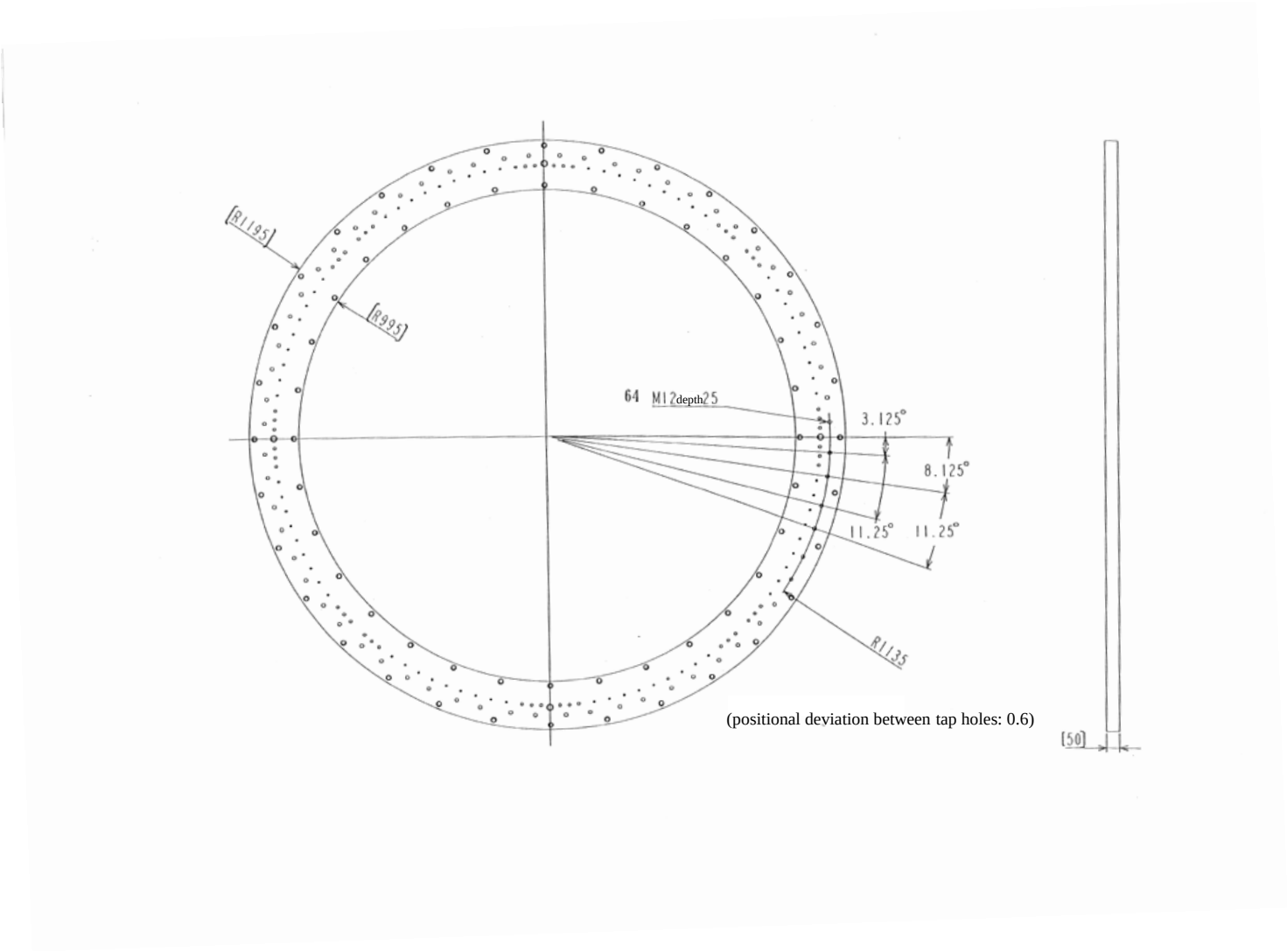
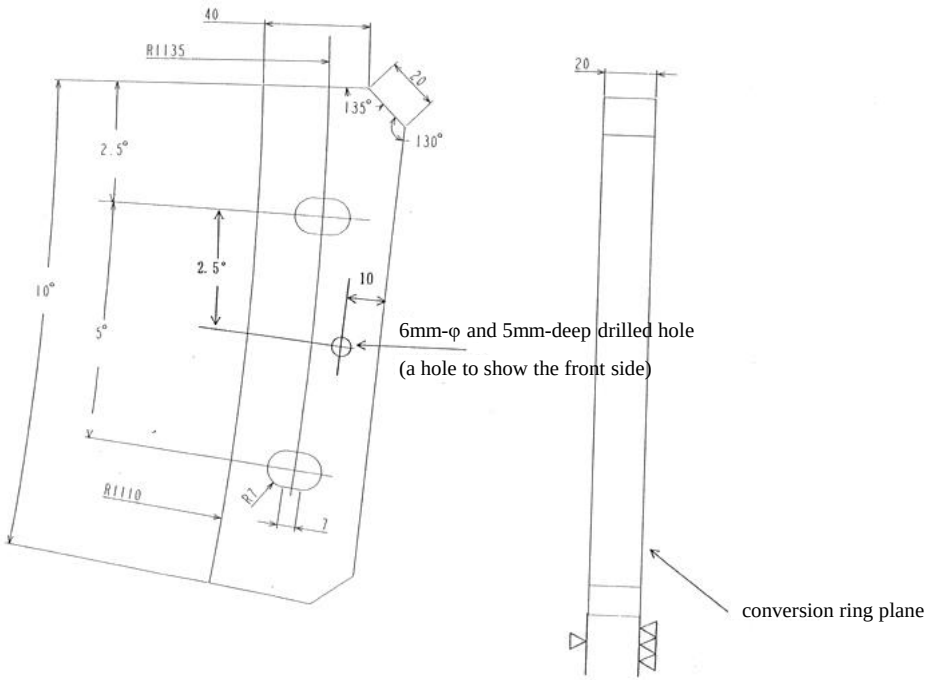


Figure 3-7 Hole Pattern on Vibration Table (Screw Hole Conversion Ring for Horizontal Vibration Table)



Note) This stopper is adoptable as an antiskid device for PAF1666MA or the equivalent size of PAF during horizontal excitation. Refer to “4.4 Special Notes (11)” in section 4.4 for how to mount the stopper on a screw hole conversion ring designed for the horizontal vibration table.

Figure 3-8 Diagram of Stopper on Screw Hole Conversion Ring for Horizontal Vibration Table

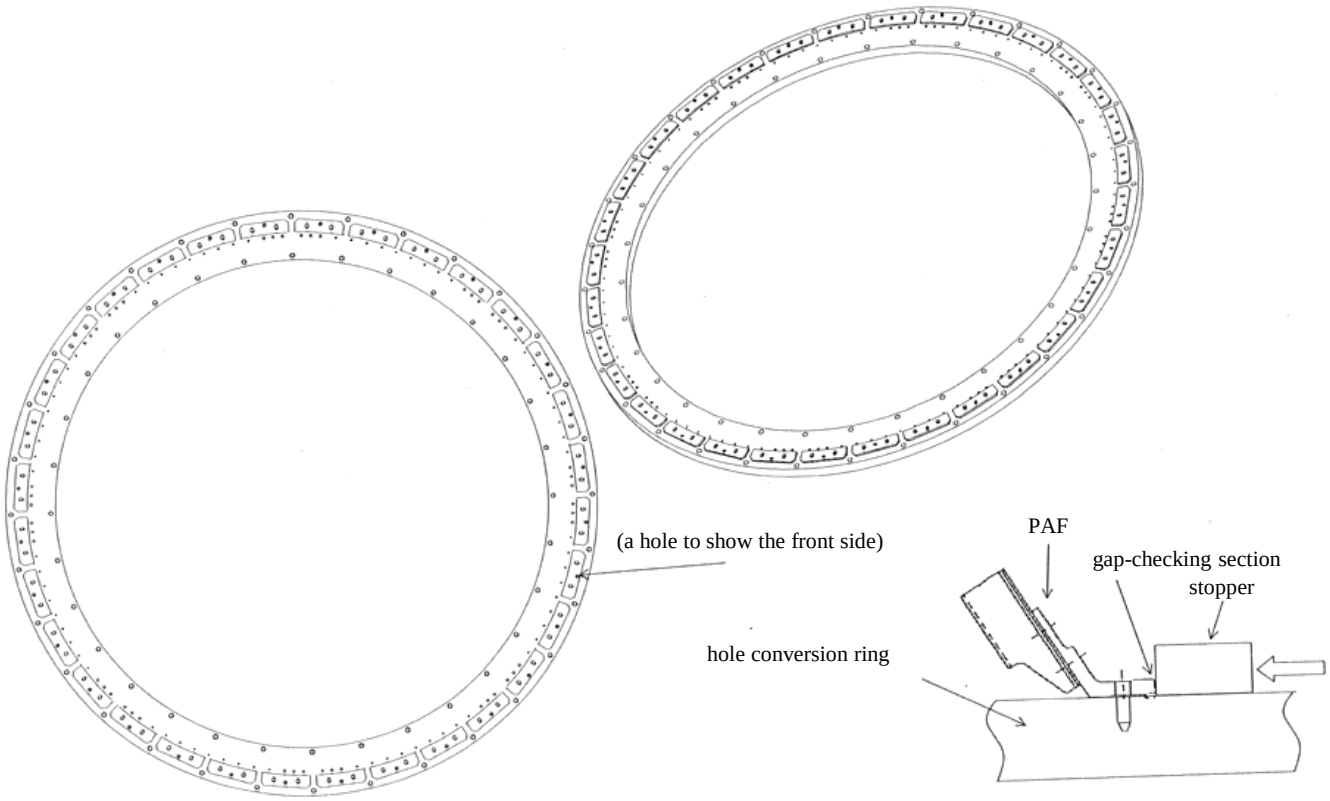


Figure 3-9 Assembly Drawing of Stopper on Screw Hole Conversion Ring for Horizontal Vibration Table

Table 3-2 List of Distribution Boards for Tests

name				PA-1-D	
installation site				vibration test room	
No.	specifications of breaker			sign of breaker*	notes
	the number of phases × voltage	rating	capacity (kVA)		
1	3φ × 210V	MCB3P 50／50 AT	12	Ⓕ Ⓖ Ⓘ	
			10.4	Ⓗ	
2	1φ × 210V	MCB2P 100／75 AT	12.5	Ⓑ Ⓔ	
3	1φ × 210V	MCB2P 50／50 AT	8.5	Ⓒ Ⓓ	
			8	Ⓐ	
4	1φ × 100V	MCB2P 50／50 AT	4	ⓕ	
			3	ⓓ ⓖ ⓡ	
5	1φ × 100V	MCB2P 50／30 AT	3	ⓗ	
			2	ⓘ ⓙ	
			1	ⓚ ⓛ	
6	1φ × 100V	MCB2P 50／20 AT	1.5	ⓞ ⓟ	
			1	ⓔ ⓜ ⓝ	
type of earth wire				type C	

name				PA-1-E	
installation site				vibration test room	
No.	specifications of breaker			sign of breaker*	notes
	the number of phases × voltage	rating	capacity (kVA)		
1	3φ × 210V	MCB3P 50／50 AT		5	
2	1φ × 100V	MCB2P 50／50 AT	3	7	
3	1φ × 115V	MCB2P 50／20 AT		Ⓒ Ⓓ	
type of earth wire				type C	

name				PA-2-C	
installation site				control room	
No.	specifications of breaker			sign of breaker*	notes
	the number of phases × voltage	rating	capacity (kVA)		
1	1φ × 115V	MCB2P 50／20 AT		Ⓒ Ⓓ	
2	1φ × 100V	MCB2P 50／50 AT	1.5	⑦	
		MCB2P 50／20 AT		ⓘ ⓙ ⑧	
type of earth wire				type C	

* sign of breaker

It refers to the signs of the breakers set on distribution boards. The breakers with the same symbol are distinguished by colors or capital/small letters, which are symbolized as follows in the table above.

○…… black, capital letter
◯ …… black, small letter
□…… orange, capital letter

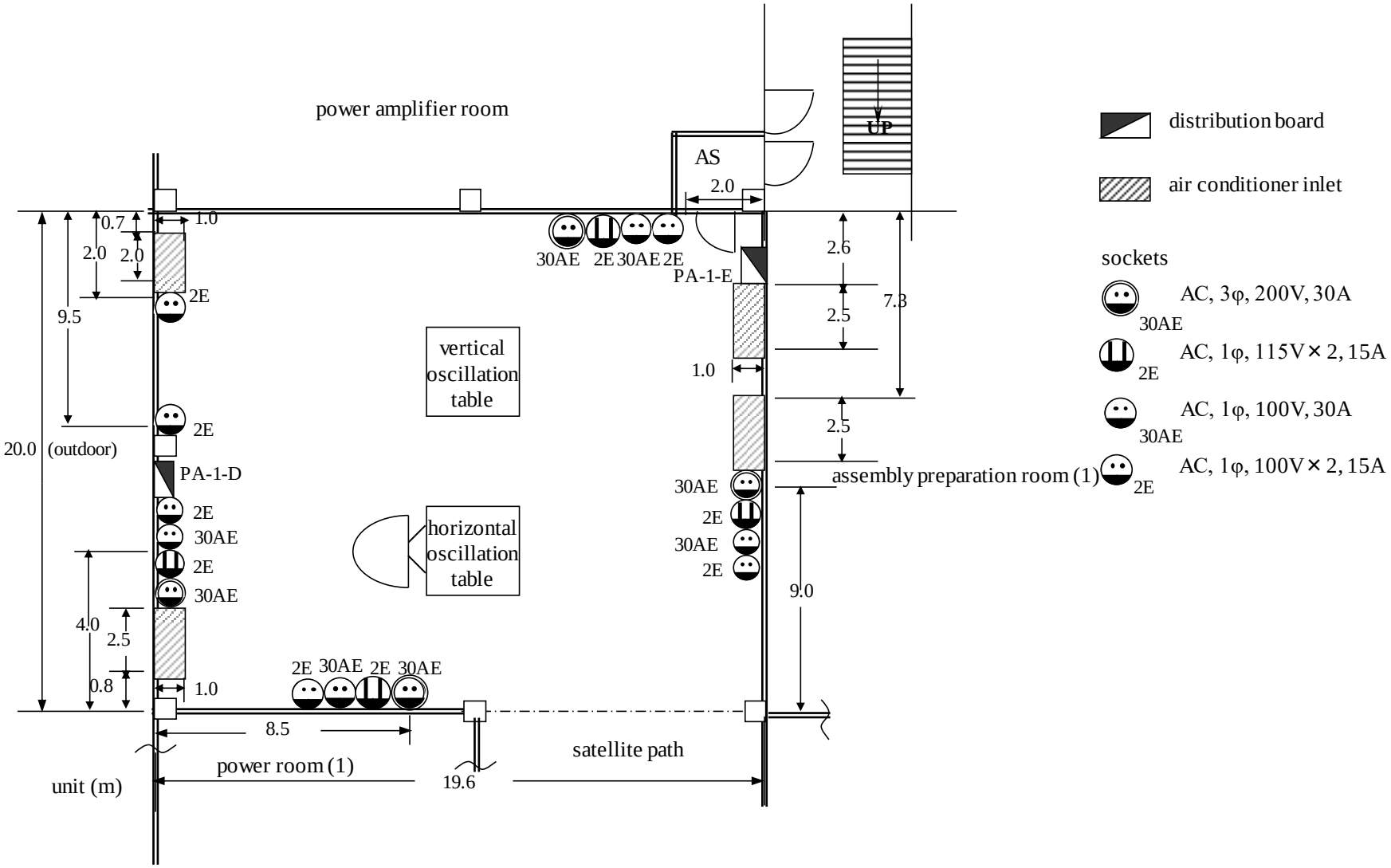
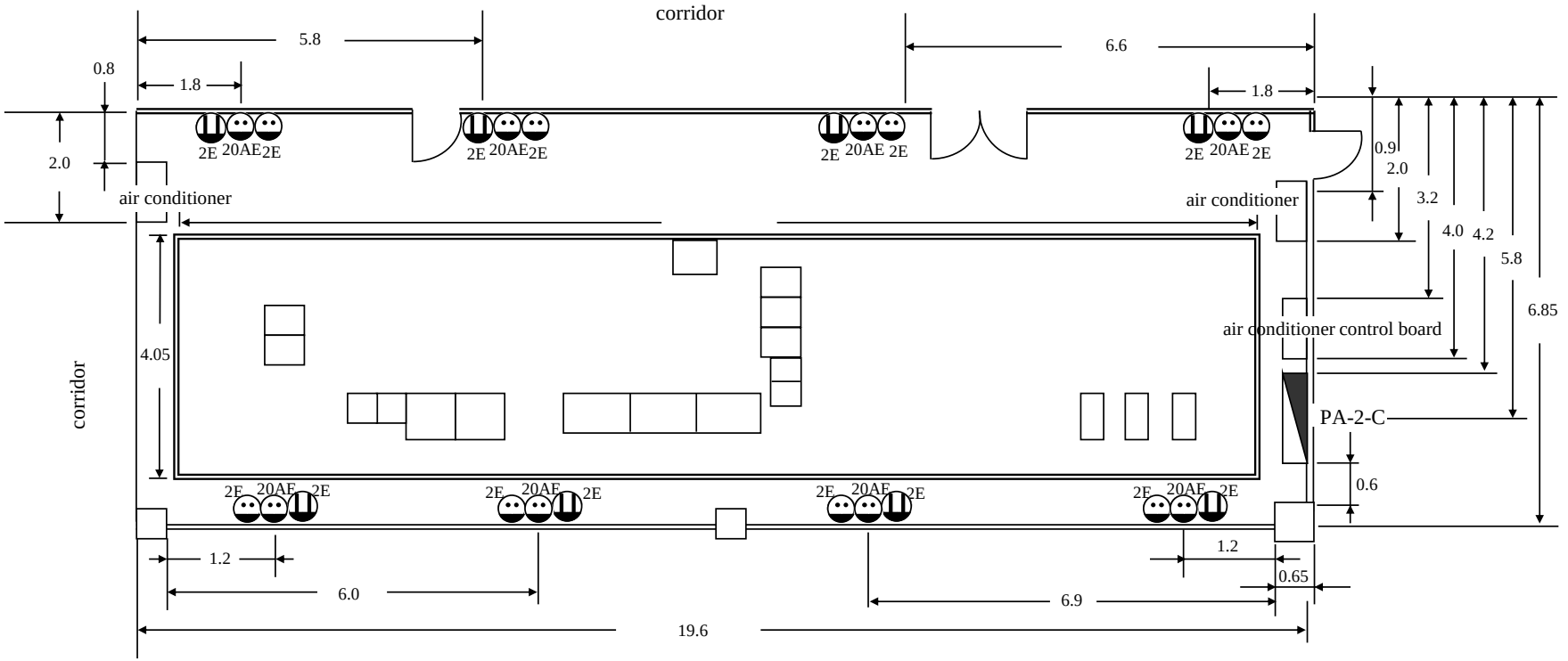


Figure 3-10 Configuration of Distribution Boards and Sockets (Vibration Test Room)



Each socket is connected to the distribution board PA-2-C.

unit: m

2E AC, 1φ, 115V × 2, 15A

20AE AC, 1φ, 100V, 20A

2E AC, 1φ, 100V × 2, 15A

distribution board

Figure 3-11 Configuration of Distribution Boards and Sockets (Measurement and Control Room)

4 Execution of Tests

4.1 Test-related Procedure

The flow of test-related work procedure is shown in Figure 4-2. Refer to “4.4 Special Notes” for the execution of tests.

(1) Kickoff meeting

A kickoff meeting is held so that the staff of Advanced Engineering Services Co., Ltd. (called AES hereafter) and users can together confirm test purposes and what are installed in this facility to see if their performances can satisfy users’ purposes.

Users are to prepare a “test implementation plan”, a “test conditions requisition sheet (to be submitted at K/O)”, etc.

(2) Task briefing (pre-test meeting)

A task briefing is held for the final checking on test purposes and the status of facilities, etc., in preparation for performing a test. Its main purpose is to discuss the changes made after the kickoff meeting.

(3) Rental of acceleration sensors, etc.

Users can rent acceleration sensors and low-noise cables to be used for tests from AES, whenever possible. In that case, make arrangements in advance and clarify your request in a test implementation plan, etc.

(4) Installation of TS

Pay enough attention to the withstand load of the work floor, etc. (cf. 4.4 “Work Floor”), during the installation of a TS into the facility.

(5) Excitation of jig

Upon users’ request, the staff of AES checks the safety of the vibration property of the test jig manufactured by users, before a test is performed on a TS. In that case, the jig is excited following the same procedures as in the actual test on the TS.

(6) Mounting of TS

When mounting a TS onto a vibration table, pay full attention not to damage the dust-proof cover surrounding the table.

(7) Connection of measurement sensor

The measurement sensor mounted on a TS is connected to the patch panel in the vibration test room. In addition, the connection is checked for its normality on the data acquisition computer in the control room on the 2nd floor.

(8) Vibration test

A TS is actually excited. Refer to section 4.2 for more details.

(9) Task review (post-test meeting)

The final evaluation on the achievements of test purposes is performed at the end of the test. Users are to prepare a “newsboard” or the like which indicates the test results of a TS.

(10) Dismounting of TS

A TS is dismounted from the vibration table after the post-test meeting. When doing so, pay enough attention not to damage the dust-proof cover surrounding the table.

(11) Removal of TS and cleaning of test room

When carrying a TS out of the test room, pay close attention to the withstand load of the work floor, etc. Also, users are to clean the test room or other areas used during the test after the removal of a TS.

(12) Saving of test data

The data acquired during a test is recorded in DVD and kept by AES.

4.2 Test Procedure

The test procedure for vibration tests using this facility is shown in Figure 4-3, and each work in the operation sequence is explained below.

(1) Setting of test parameters

Each parameter for the controller is set.

(2) Activation of power supplies for horizontal/vertical devices

After moving a vibration table from the waiting position to the neutral position, the power supplies for the horizontal/vertical devices are activated.

(3) Loop checking

Low-level excitation is loaded in the tested excitation frequency band for random wave vibration or at an arbitrarily-chosen frequency for sine wave vibration to confirm that noise measurement by the control system and the control system itself have a closed loop. Neither data acquisition nor limit control can be performed during loop checking.

(4) Start of pretest

Excitation starts to be applied at lower levels than for the actual test. The excitation levels for a pretest can be arbitrarily chosen as long as they are higher than the minimum control level.

(5) Checking of signals from data acquisition system

The measurement signals of a TS are checked on the data acquisition computer in the control room on the 2nd floor.

(6) Start of data acquisition and full test

The data acquisition computer starts acquiring data. Following that, a full test is started.

(7) End of test/data acquisition

The application of excitation ends when the pre-set test is completed. Then, the data acquisition computer stops acquiring data.

(8) Cutoff of power supplies for horizontal/vertical devices

The power supplies for the horizontal/vertical devices are cut off. Then, the vibration table is moved from the neutral position back to the waiting position.

(9) Data analysis

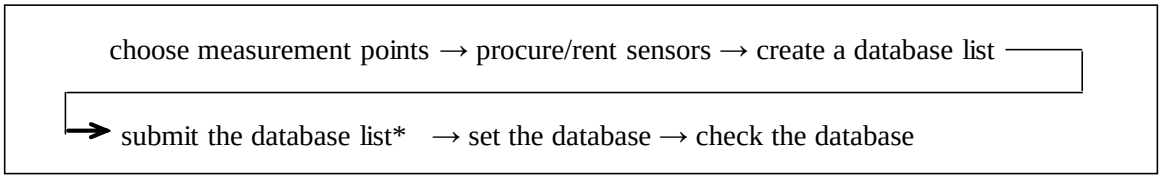
The acquired data is analyzed. The analysis designation is to be informed to us in the “data acquisition/analysis conditions sheet” in Appendix C.

4.3 Requisition of Test Conditions

Users are to submit conditions requisition sheets as follows so that a vibration test can be smoothly performed without errors. A “test conditions requisition sheet” and an “data acquisition/analysis conditions sheet” are distributed to users before the execution of a test.

(1) Data acquisition database

In the data processing facility, the conditions required for data acquisition and analysis (viz. sensitivity of measurement sensors, etc.) are compiled into a database, which therefore is to be created and ready before starting a test. The flow of producing a database is shown in Figure 4-1.



*submission of database list

Figure 4-1 Flow of Database Creation

The format and input example of the database list are shown in Appendix D “data acquisition database”.

(2) Test conditions requisition sheet

A “test conditions requisition sheet” in Appendices A, B is to be filled in with vibration test level conditions and submitted.

(3) Data acquisition/analysis conditions sheet

A “data acquisition/analysis conditions sheet” in Appendix C is to be filled in with the conditions for data acquisition during a test and analysis for measurement points, and submitted.

4.4 Special Notes

Especially important matters to take into account for performing a vibration test in this facility are shown below.

(1) Work floor

The work floor has three load-restricted areas. The division of the areas is shown in Figure 4-4.

The rubber tires of a lifting dolly, etc., can be scorched into the work floor, and therefore require protective measures for the floor, e.g., laying a board beneath them. Furthermore, the rubber slab laid between the building floor and the foundation of a shaker is not completely flat. Users are therefore to pay attention to its uneven surface when moving a dolly, etc., across it, or not to leave an object there for a long time.

(2) Flatness/surface roughness of jig

The I/F plane of a jig to the vibration table is to be manufactured the way it has a flatness of within 0.1 mm/m and a surface roughness of 12.5S(▽▽) or less.

(3) Mounting on vibration table

(a) Application of crane

The crane (10t) of this facility is to be operated by personnel who have a crane operator's license.

(b) Attachment bolt

When mounting a jig, etc., on a vibration table, bolts made of metal other than stainless steel (high-tensile bolts are recommended) are to be used, and the tightening torque is to be based on the levels shown in Table 4-1. Also, users are to be careful not to leave scratches, etc., on the vibration table surface, so as to keep its flatness.

Table 4-1 Tightening Torque and Reference of Respective Bolt

adopted bolt	tightening torque	reference
for M12	68.65 N・m	700 kgf・cm
for 1/4 UNF	10.3 N・m	105 kgf・cm
for 3/8 UNF	37.27 N・m	380 kgf・cm

(4) Mounting operations of acceleration sensors

When mounting acceleration sensors on a vibration table, put masking tape (kapton, etc.) on the table, glue aluminum blocks, and use insulated studs.

(5) Heat run

The heat run time necessary for the system is about 30 minutes after the activation of power. That time is to be included when planning a test schedule.

(6) Length of low-noise measurement cables

A low-noise cable is to be 10m or longer, because the charge amplifier for data acquisition is fixed at a place about 10m away from the center of the vibration table.

Also, a cable is to be long enough so that a TS can be turned 90° when applying horizontal vibration, or moved onto a vertical vibration table when applying vertical vibration.

(7) Wearing helmet

The workers and observers in the test room are to wear a helmet and safety shoes (to be prepared by users) during crane operations and a test.

(8) Cleanliness control

The cleanliness in the test room is controlled to keep ISO class 8 (class 100,000.) Therefore, users are to wear a clean garment (to be prepared by users) when entering the room.

(9) Facility's response in protective function operation

A normal shutdown function (which takes about 0.3 seconds before shutdown) is adopted in the protective function operation, for the sake of protecting a TS.

(10) Cautions during excitation

During excitation, one is to stay clear of the excitation direction. At the same time, the test room shutters are to be left open by 2m or more, for the purpose of securing an evacuation passage.

(11) Procedure of fixing a stopper onto the screw hole conversion ring for horizontal vibration table

(a) Clean the contact plane of PAF and the mounting plane of a stopper with IPA, after checking that they

have no burrs, scratches, or foreign substances.

(b) Provisionally fasten M12 bolts (with washers) on the stopper the way it fits the hole pattern on the screw hole conversion ring, while pushing it against PAF. (cf. Figures 3-7~3-9.)

(c) Tap the side of the stopper using a plastic hammer, etc., to push it against PAF, and fasten the bolts. The tightening torque for M 12 bolts is to be 49 N･m (500 kgf･cm.)

(d) Make sure that the minimum gap between PAF and each stopper is 0.0 mm.

(e) Up to 32 stoppers can be set. The components of the stoppers are shown in Table 4-2.

Table 4-2 Constituent Parts of Stopper

item	qty	material	mass
stopper	32	SUS（303）	1.61 kg／piece
M12 bolt	64	SCM (chrome molybdenum steel)	30.9g／piece
M12 washer	64	SUS	－

(12) A sine wave vibration test at the constant frequency can be manually conducted. In that case, however, excitation duration may not be precise due to manual operation; therefore, if requirement calls for highly accurate excitation duration, its feasibility is to be checked in advance.

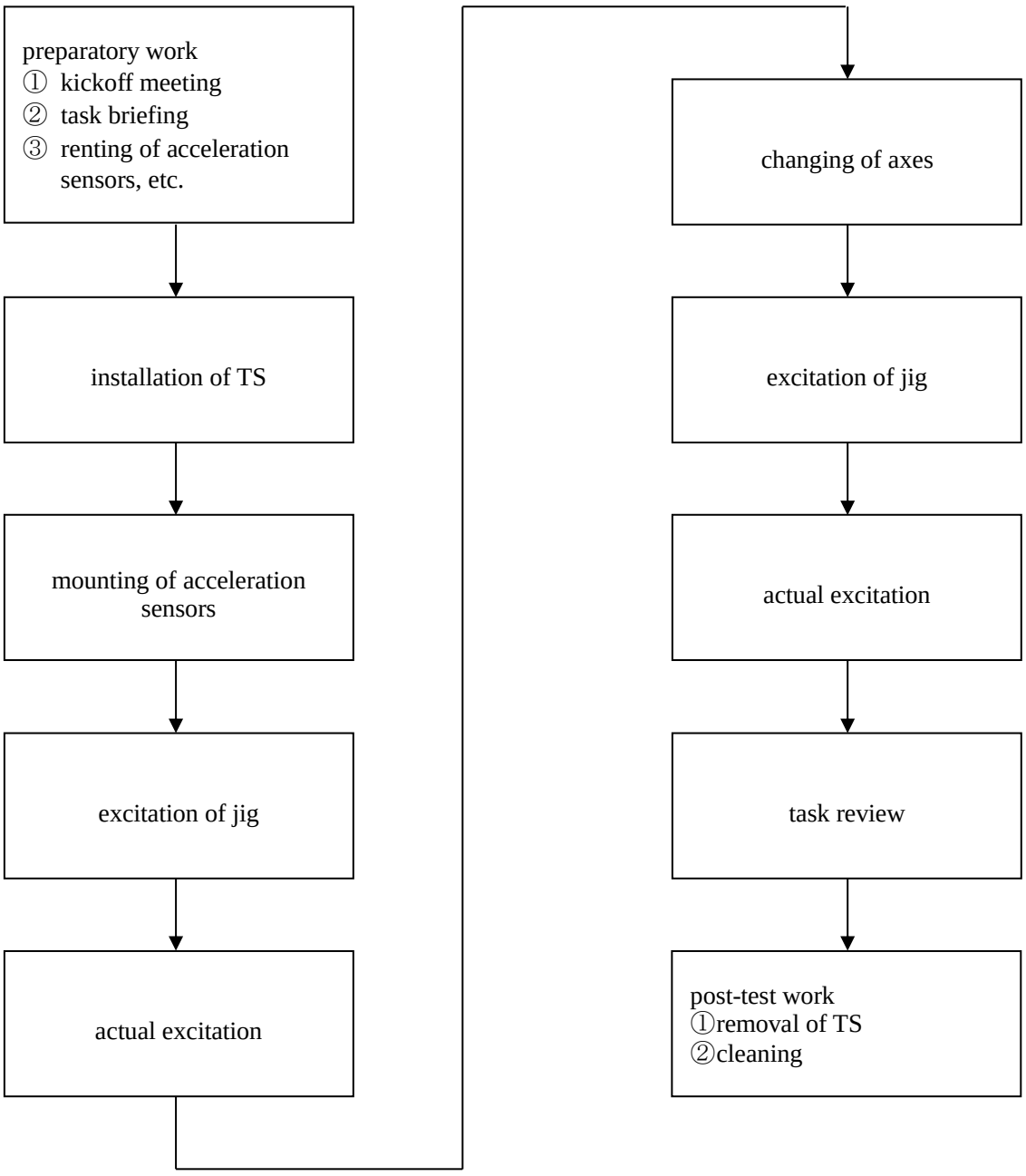


Figure 4-2 Test-related Work Flow

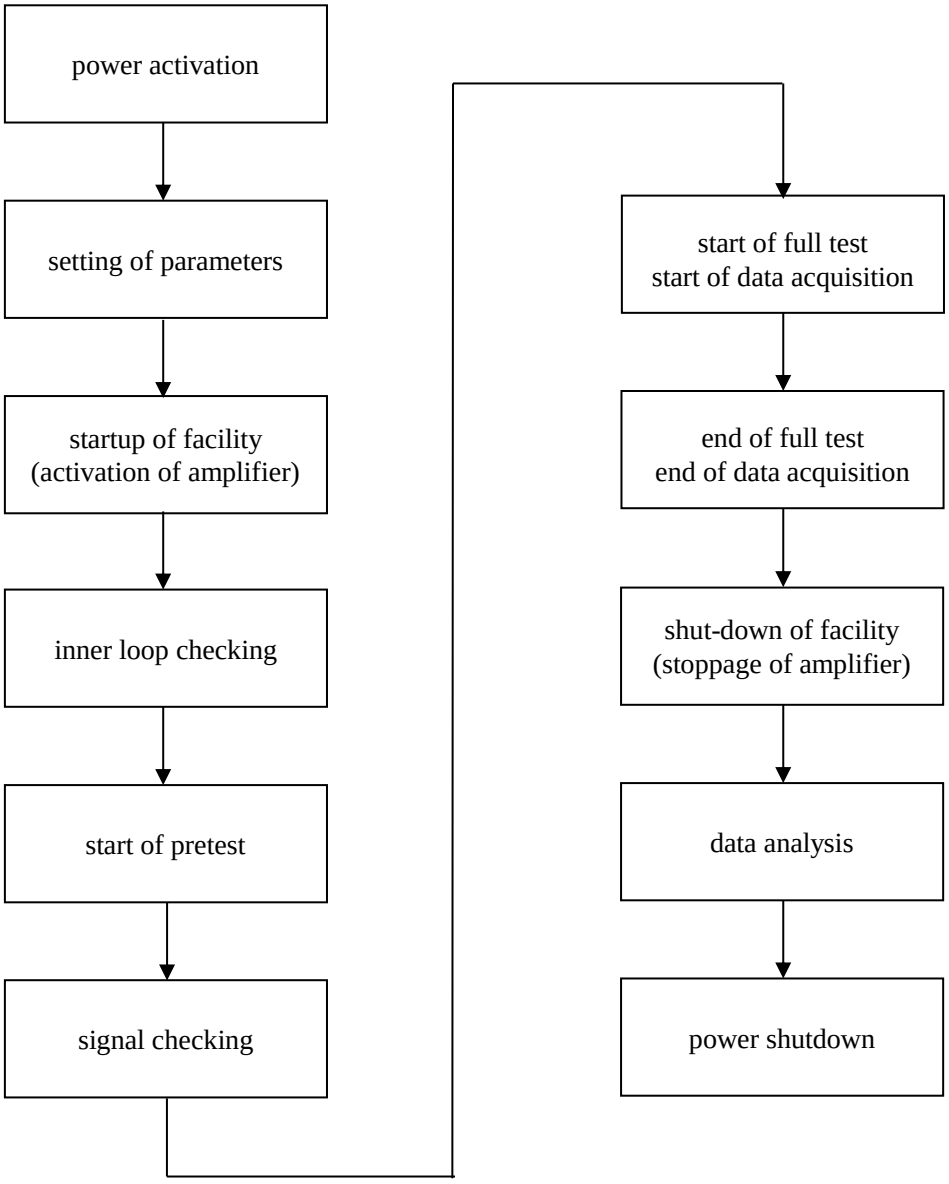
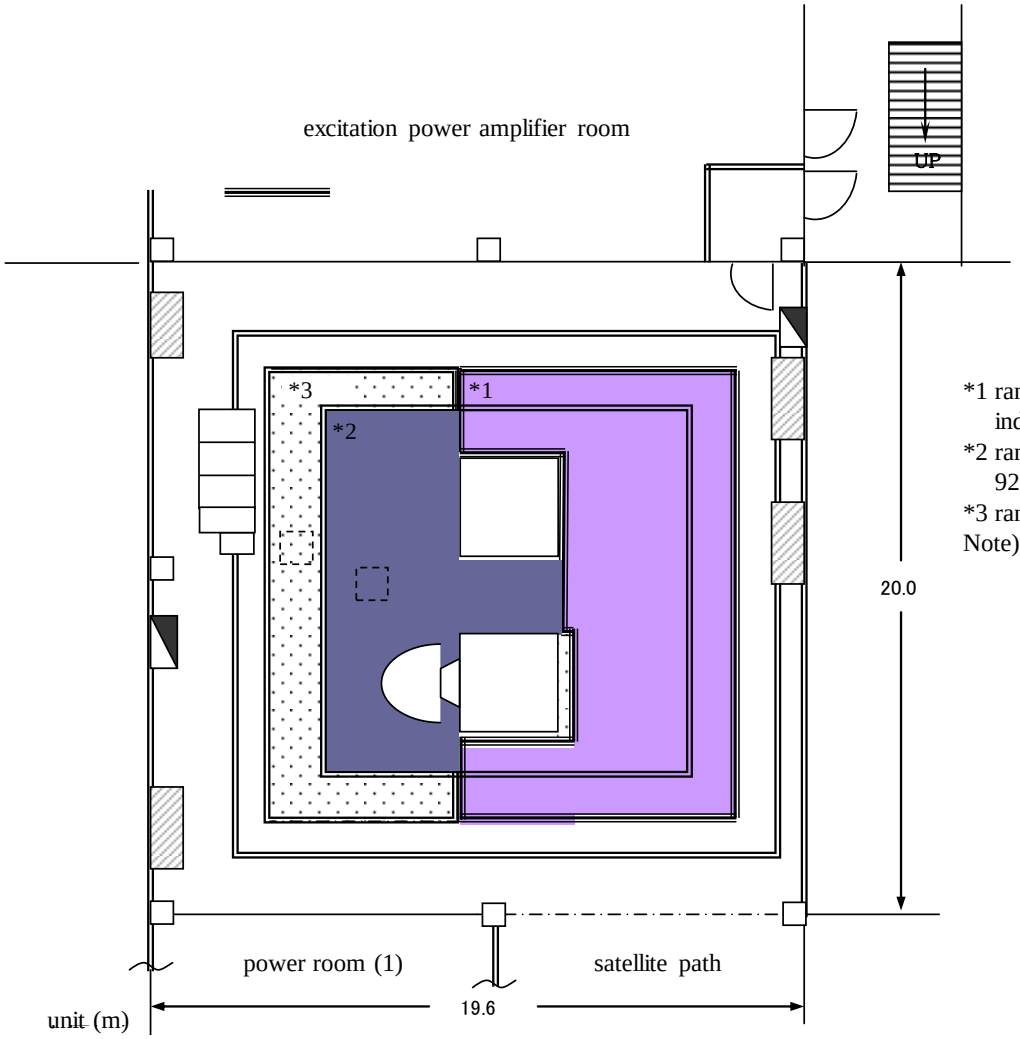


Figure 4-3 Test Flow



*1 range for withstand load 20,000 kg (wheel load: 5,000 kg): indicated with yellow tapes on the work floor
*2 range for withstand load 3,700 kg (distributed load) and load 925 kg (wheel load):
*3 range for withstand load 300 kg (distributed load):
Note) withstand load 190 kg/cm^2 for other areas (same as on the satellite path)

Figure 4-4 Work Floor

Appendix A Test Conditions Requisition Sheet
(to be submitted at K/O)

Test Conditions Requisition Sheet (to be submitted at K/O)

COMMON

name of test			notes
name of test item			
number of control chs	ch		up to 4 chs
number of limit chs	ch		up to 50 chs
number of measurement chs	acceleration: ch / strain: ch		acceleration: max. 400 chs, strain: max 100 chs
oscillation direction (Check either vertical or horizontal.)	axis X	☐vertical ☐horizontal	
	axis Y	☐vertical ☐horizontal	
	axis Z	☐vertical ☐horizontal	
environmental requirements for test item in clean room	temperature: humidity: cleanliness:		【air conditioning conditions in test room (reference)】 temperature: 23±3℃ humidity: 45±15% cleanliness: ISO CLASS 8 (CLASS 100,000)
test item mass	kg		Maximum load mass is to be determined based on the specifications of the vibration table.
jig mass	kg		
position of CG	X = mm		CG position is to be of a test item and a jig combined (from the center on the upper plane of the vibration table.)
	Y = mm		
	Z = mm		
inertia moment	kg/m^2		
oscillation waveform and analysis condition	RANDOM	☐PSD ☐autopower spectrum ☐transfar function/coherence	Check the targeted analysis.
	SINE （☐UP/☐ DOWN）	☐acceleration response ☐transfer function	
application of PAF	☐applied ・ ☐not applied		

SINE

setting of control parameters		notes
upper limit oscillation frequency	Hz	frequency range: 5 ~ 100Hz
lower limit oscillation frequency	Hz	
oscillation-starting frequency	Hz	
setting of sweep-starting direction (Check either one of them.)	☐Up ☐Down	
sweep mode (Check one of them.)	☐Linear ☐Log ☐Integer	
number of sweeps	times	setting for # of oscillation cycles ex. "2" for Up-Down sequence
sweep rate	Oct/min ・ Hz/sec	1 ~ 4 Oct/min

setting of control levels						
frequency Hz	segment type	lev el*	lower limit alarm level: dB	upper limit alarm level: dB	lower limit abort level: dB	upper limit abort level: dB
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+
	☐displacement ☐rate ☐acceleration ☐Log-Line		-	+	-	+

* unit of levels: displacement: $mm_{p\text{-}p}$, velocity: m/s, acceleration: m/s^2 (with G)

RANDOM

setting of control parameters		notes
upper limit oscillation frequency	Hz	frequency range: 5～200Hz
lower limit oscillation frequency	Hz	
test time	: :	hh : mm : ss
frequency line	200 others ( )	

setting of control levels							
overall RMS	m/s^2 rms (Grms)						
frequency Hz	level $(m/s^2)^2/Hz$ (G^2/Hz)	left inclination dB/oct	right inclination dB/oct	upper limit alarm level dB	lower limit alarm level dB	upper limit abort level dB	lower limit abort level dB
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-
	(G^2/Hz)			+	-	+	-

Appendix B Test Conditions Requisition Sheet
(to be submitted at test)

Excitation Conditions Requisition Sheet (1)

SINE

final check	
TS	OP

TS Name	
Test Name	
File Name	

CONTROL PARAMETERS

Sweeps	
Control Spectrum	☐Avg ・ ☐Min ・ ☐Max ・ ☐RMS
Test Level	ー dB
Level Increment	dB
Sweep Mode	☐Linear ・ ☐Log ・ ☐Integer
Sweep Rate	☐oct/min ・ ☐Hz/sec

SWEEP/COMPRESSION TABLE

segment	frequency	compression
1	Hz	%
2	Hz	%
3	Hz	%
4	Hz	%
5	Hz	%

REFERENCE TABLE

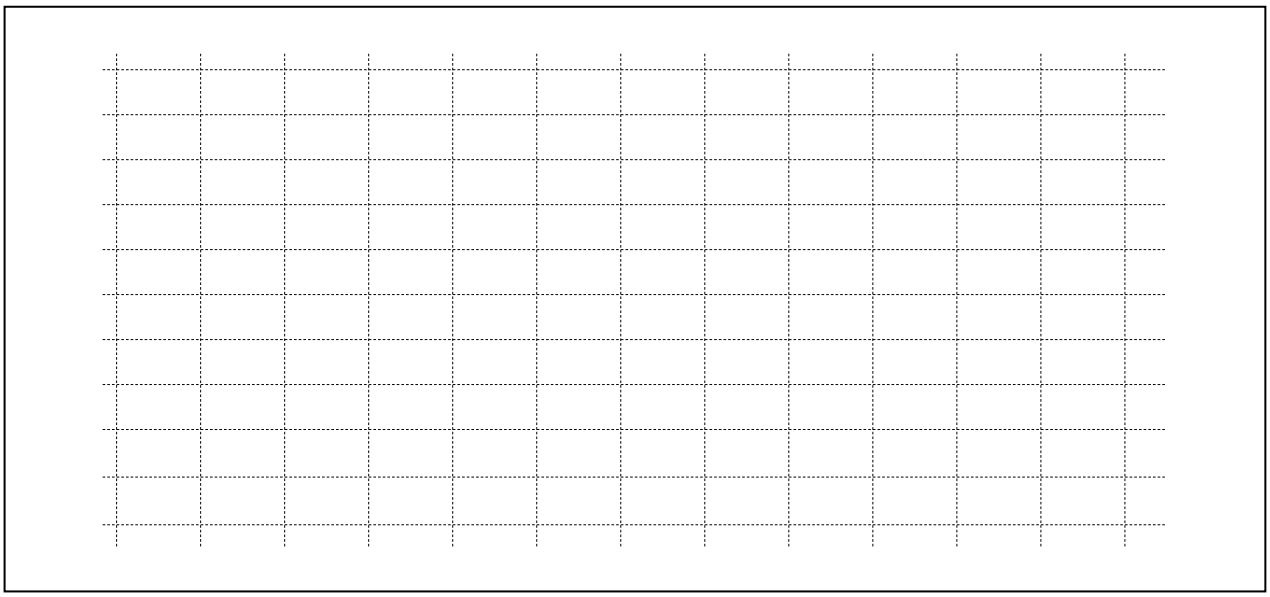
REFERENCE PARAMETERS

Sweep-starting Direction	☐Up ・ ☐Down
Minimum Frequency	Hz
Maximum Frequency	Hz
Frequency Points	1,000

Excitation Conditions Requisition Sheet (2) (1/)

SINE

EXCITATION PATTERN DIAGRAM (reference)



REFERENCE TABLE

segment #	frequency	segment type	value *	-alarm (dB)	+alarm (dB)	-abort (dB)	+abort (dB)
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line		- dB	+ dB	- dB	+ dB
2	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
3	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
4	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
5	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
6	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
7	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
8	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
9	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
10	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
11	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
12	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB
13	Hz	☐ Disp・☐ Vel・☐ Acc・☐ Log-Line		- dB	+ dB	- dB	+ dB

14	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
15	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
16	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
17	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
18	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
19	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
20	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB

*unit of levels: displacement : mm_{p-p}, velocity : m/s, acceleration : m/s^2

Excitation Conditions Requisition Sheet (2) (2/2)

SINE

REFERENCE TABLE

segment #	frequency	segment type	value *	-alarm (dB)	+alarm (dB)	-abort (dB)	+abort (dB)
21	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
22	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
23	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
24	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
25	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
26	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
27	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
28	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
29	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
30	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
31	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
32	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
33	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
34	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
35	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
36	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
37	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
38	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
39	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
40	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
41	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
42	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
43	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
44	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
45	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
46	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
47	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
48	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
49	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB
50	Hz	☐ Disp · ☐ Vel · ☐ Acc · ☐ Log-Line		- dB	+ dB	- dB	+ dB

*unit of levels: displacement : mm_{p-p}, velocity : m/s, acceleration : m/s^2

Excitation Conditions Requisition Sheet (3) (1/)

SINE

LIMIT PROFILE TABLE

PROFILE TABLE 1 (for facility rotation moment)

No.	frequency	type	value
1	100 Hz	☐Disp・☐Vel・☑Acc・☐Log-Line	43
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	3 dB		

PROFILE TABLE 2

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 3

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 4

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set for the entire profile.

Excitation Conditions Requisition Sheet (3) (2/)

SINE

LIMIT PROFILE TABLE

PROFILE TABLE 5

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 6

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 7

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 8

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (3) (3/)

SINE

LIMIT PROFILE TABLE

PROFILE TABLE 9

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 10

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 11

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 12

No.	frequency	type	value
1	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
2	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
3	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
4	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
5	Hz	☐Disp・☐Vel・☐Acc・☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (3)

(/)

SINE

LIMIT PROFILE TABLE

PROFILE TABLE ____

No.	frequency	type	value
1	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
2	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
3	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
4	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
5	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	type	value
1	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
2	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
3	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
4	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
5	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	type	value
1	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
2	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
3	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
4	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
5	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	type	value
1	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
2	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
3	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
4	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
5	Hz	☐Disp･☐Vel･☐Acc･☐Log-Line	
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (4)

SINE

SAFETY PARAMETERS

ALARM/ABORTS

Minimum Frequency	Hz
Maximum Frequency	Hz
Reference CSL Threshold	dB
CSL Count Threshold	

LOOP CHECK

Noise Threshold	30 mVrms
Frequency	Hz
Maximum Drive	mVrms

DRIVE SIGNAL

Maximum Drive	Vpeak

Excitation Conditions Requisition Sheet (5) (1/)

SINE

CHANNEL TABLE

channel				sensitivity	profile #	processing mode
No	A/D No	label	type			
1	—		CTL	mV/(m/s²)	—	☐BB RMS・☐Fundamental・☐BB PEAK
2	—		CTL	mV/(m/s²)	—	☐BB RMS・☐Fundamental・☐BB PEAK
3	—		CTL	mV/(m/s²)	—	☐BB RMS・☐Fundamental・☐BB PEAK
4	—		CTL	mV/(m/s²)	—	☐BB RMS・☐Fundamental・☐BB PEAK
5	—	current1	AUX	4.1 mV/(m/s²)	—	☑BB RMS・☐Fundamental・☐BB PEAK
6	—	current2	AUX	4.1 mV/(m/s²)	—	☑BB RMS・☐Fundamental・☐BB PEAK
7	—	current3	AUX	4.1 mV/(m/s²)	—	☑BB RMS・☐Fundamental・☐BB PEAK
8	—	current4	AUX	4.1 mV/(m/s²)	—	☑BB RMS・☐Fundamental・☐BB PEAK
9*	—	moment	☐AUX・☐LIMIT	100 mV/(m/s²)		☑BB RMS・☐Fundamental・☐BB PEAK
10			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
11			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
12			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
13			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
14			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
15			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
16			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
17			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
18			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
19			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
20			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
21			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
22			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
23			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
24			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
25			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
26			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
27			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
28			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
29			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK
30			☐AUX・☐LIMIT	mV/(m/s²)		☐BB RMS・☐Fundamental・☐BB PEAK

* LIMIT, Profile Number=1, for vertical excitation. AUX, for horizontal excitation.

Excitation Conditions Requisition Sheet (5) (2/2)

SINE

CHANNEL TABLE

channel				sensitivity	profile #	processing mode
No.	A/D No.	label	type			
31			☐AUX・☐ LIMIT	mV/(m/s^2)		☐BB RMS・☐Fundamental・☐BB PEAK
32			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
33			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
34			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
35			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
36			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
37			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
38			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
39			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
40			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
41			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
42			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
43			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
44			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
45			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
46			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
47			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
48			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
49			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
50			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
51			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
52			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
53			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
54			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
55			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
56			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK
57			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS・☐ Fundamental・☐ BB PEAK

58			☐ AUX ▪ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS ▪ ☐ Fundamental ▪ ☐ BB PEAK
59			☐ AUX ▪ ☐ LIMIT	mV/(m/s^2)		☐ BB RMS ▪ ☐ Fundamental ▪ ☐ BB PEAK

Excitation Conditions Requisition Sheet (6)

SINE

H(f) Table

H(f)pair	response channel	reference channel	H(f)pair	response channel	reference channel
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		
10			40		
11			41		
12			42		
13			43		
14			44		
15			45		
16			46		
17			47		
18			48		
19			49		
20			50		
21			51		
22			52		
23			53		
24			54		
25			55		
26			56		
27			57		
28			58		
29			59		
30					

DOCUMENTATION

display text	

Example of Excitation Conditions Requisition Sheet - SINE (1/3)

No	item	explanation	range
1	TS Name	Fill in the space with the name of the TS.	
2	Test Name	Fill in the space with the name of the test the way its content can be understood.	
3	File Name	Set the name of the parameter file.	within 24 alphanumerics
	CONTROL PARAMETERS		
4	Sweeps	Set the number of excitation cycles. ex. Set "2" for sequential Up-Down sweep.	1 or more
5	Control Spectrum	Choose an excitation control method. (Check one of the alternatives below.) Avg: average control among control channels Min: minimum level control among control channels Max: maximum level control among control channels RMS: square root control of RMS among control channels	
6	Test Level	Set the pre-test level, at which control signals and measurement signals are checked.	
7	Level Increment	It denotes the step-up levels to shift from the pre-test level to the full-test level.	
8	Sweep Mode	Choose an excitation sweep method. (Check one of the alternatives below.) Linear: linear sweep Log: logarithmic sweep Integer: step sine	
9	Sweep Rate	Set the sweep rate and choose the unit (Check either one.)	
10	Sweep/Compression Table	The compression speed can be changed for each frequency band. 5 ~ X Hz: 50% X ~ 100 Hz: 30% (recommended)	X denotes the frequency following which input level becomes constant; usually around 20 Hz. (Max. 200%)
	REFERENCE TABLE		
11	Sweep Direction	Choose the sweep direction. (Check either one.)	
12	Minimum Frequency	Set the lower-limit excitation frequency.	5 or higher
13	Maximum Frequency	Set the upper-limit excitation frequency.	100 or lower

Example of Excitation Conditions Requisition Sheet - SINE (2/3)

No	item	explanation	range
14	Frequency Points	Set the number of display data points on the display.	fixed at 1,000
15	Excitation Pattern Diagram (reference)	Draw the excitation (control) pattern diagram.	
16	Frequency	Set the frequencies at breakpoints.	
17	Segment Type	Choose the segment type. (Check one of the alternatives.) Disp: fixed displacement (mm_{p-p}) Vel: fixed velocity (m/s) Acc: fixed acceleration (m/s^2) Log-Line: slope acceleration (m/s^2)	
18	Value	Input levels using the unit chosen under the "segment type" above.	
19	－Alarm (dB)	Set the minus alarm level.	
20	＋Alarm (dB)	Set the plus alarm level.	
21	－Abort (dB)	Set the minus abort level.	
22	＋Abort (dB)	Set the plus abort level.	
	PROFILE TABLE		
23	Frequency	Set the frequencies at breakpoints.	
24	Type	Choose the type. (Check one of the alternatives.) Disp: fixed displacement (mm_{p-p}) Vel: fixed velocity (m/s) Acc: fixed acceleration (m/s^2) Log-Line: slope acceleration (m/s^2)	
25	Minimum Frequency	Set the minimum frequency in the frequency band to which limiting is applied.	
26	Maximum Frequency	Set the maximum frequency in the frequency band to which limiting is applied.	
27	Abort Level	Set the abort level for the entire profile. (Individual setting of abort level for each number is not possible.)	
	SAFETY PARAMETERS		
28	Minimum Frequency	Set the minimum frequency in the frequency band to which alarm and abort are applied.	"lower-limit excitation frequency" is usually chosen.
29	Maximum Frequency	Set the maximum frequency in the frequency band to which alarm and abort are applied.	"upper-limit excitation frequency" is usually chosen.

Example of Excitation Conditions Requisition Sheet -SINE (3/3)

No	item	explanation	range
30	Reference CSL Threshold	Set the lower-limit control level in comparison to the reference level, where abort is triggered due to signal loss.	
31	CSL Count Threshold	Set the threshold count of successive CSL excess over the control abort levels (upper/lower limits), where abort in excitation is triggered.	1 ~ 254 usually, "1."
32	Loop Check Noise Threshold	Set the allowable noise level for the phase before starting loop checking.	1 ~ 1,000 mVrms usually, "30mVrms."
33	Frequency	Set the excitation frequency for loop checking.	5 ~ 200 Hz
34	Maximum Drive	Set the upper-limit excitation drive voltage for loop checking.	10 ~ 3,300 mVrms
35	Drive Signal Maximum Drive	Set the upper-limit maximum drive voltage for full-level excitation.	0.01 ~ 10 Vpeak
	CHANNEL TABLE		
36	Channel A/D No.	Fill in the space with the A/D No. of the measurement system charge amplifier.	
37	Channel Label	Set the name of the channel label.	within 15 alphanumerics
38	Channel Type	Choose the type of channels. (Check one of the alternatives below.) AUX: measurement channel LIMIT: limit channel	
39	Sensitivity	Set the charge amplifier calibration levels	10 ~ 10,000 mV/(m/s^2)
40	Profile Number	Set the profile numbers of limit channels.	1 ~ 50
41	Processing Mode	Choose how to calculate amplitude. (Check one of the alternatives below.) BB RMS: calculation based on RMS of all frequency components up to 23 kHz Fundamental: calculation based on the traveling band-pass filter applied BB PEAK: calculation based on the peaks of drive signals each time they are fed back	"Fundamental" is usually chosen for controlling.
	H(f) Table	"the number of acquisition channels － 1" is settable.	
42	Response Channel	Set the response channel for transfer function analysis.	The channel # in the CHANNEL TABLE is to be filled in this blank.
43	Reference Channel	Set the reference channel for transfer function analysis. When "0" is chosen, average-based analysis can be performed. In that case, phase data is not available.	
	DOCUMENTATION		
44	Display Text	Set the title the way the content of excitation can be	within 64

		understood. The title is indicated (printed) with analysis data.	alphanumerics

Excitation Conditions Requisition Sheet (1)

RANDOM

final check	
TS	OP

TS Name	
Test Name	
File Name	

CONTROL PARAMETERS

Test Time (hhh:mm:ss)	: :
Degrees of Freedom	☐240 ・ ☐other（ ）
Control Spectrum	☐Avg / ☐Min / ☐Max
Start Level	－ dB
Initial Test Level	－ dB
Level Increment	dB

REFERENCE TABLE

REFERENCE PARAMETERS

Minimum Frequency	Hz
Maximum Frequency	Hz
Frequency Lines	☐240 ・ ☐other（ ）
Overall RMS	m/s^2 rms

Excitation Conditions Requisition Sheet (2)

RANDOM

EXCITATION PATTERN DIAGRAM (reference)

REFERENCE TABLE

breakpoint	frequency	value	slope	-alarm (dB)	+alarm (dB)	-abort (dB)	+abort (dB)
1	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
2	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
3	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
4	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
5	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
6	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
7	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
8	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
9	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB
10	Hz	$(m/s^2)^2/Hz$	dB/oct	- dB	+ dB	- dB	+ dB

Excitation Conditions Requisition Sheet (3) (1/)

RANDOM

LIMIT PROFILE TABLE

PROFILE TABLE 1

break point	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 2

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 3

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 4

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (3) (2/)

RANDOM

LIMIT PROFILE TABLE

PROFILE TABLE 5

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 6

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 7

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 8

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (3) (3/)

RANDOM

LIMIT PROFILE TABLE

PROFILE TABLE 9

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 10

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 11

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE 12

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (3)

(/)

RANDOM

LIMIT PROFILE TABLE

PROFILE TABLE ____

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

PROFILE TABLE ____

No.	frequency	value	slope
1	Hz	$(m/s^2)^2/Hz$	dB/oct
2	Hz	$(m/s^2)^2/Hz$	dB/oct
3	Hz	$(m/s^2)^2/Hz$	dB/oct
4	Hz	$(m/s^2)^2/Hz$	dB/oct
5	Hz	$(m/s^2)^2/Hz$	dB/oct
Minimum Frequency	Hz		
Maximum Frequency	Hz		
Abort Level	dB		

Note) Only one abort level can be set per the entire profile.

Excitation Conditions Requisition Sheet (4)

RANDOM

SAFETY PARAMETERS

ALARM/ABORTS

RMS Alarm	dB
RMS ABORT	dB
Control Signal Loss	Standard
Alarm Lines	
Abort Lines	

LOOP CHECK

Noise Threshold	30 mVrms
Maximum Drive	mVrms

DRIVE SIGNAL

Drive Clipping	3.0 Sigma

Excitation Conditions Requisition Sheet (5) (1/)

RANDOM

CHANNEL TABLE

channel				sensitivity	profile #	RMS abort	RMS abort level
No.	A/D No	label	type				
1	–		CTL	mV/(m/s^2)	–	☐Yes・☐No	
2	–		CTL	mV/(m/s^2)	–	☐Yes・☐No	
3	–		CTL	mV/(m/s^2)	–	☐Yes・☐No	
4	–		CTL	mV/(m/s^2)	–	☐Yes・☐No	
5	–	current 1	AUX	4.1 mV/(m/s^2)	–	☐Yes・☐No	
6	–	current 2	AUX	4.1 mV/(m/s^2)	–	☐Yes・☐No	
7	–	current 3	AUX	4.1 mV/(m/s^2)	–	☐Yes・☐No	
8	–	current 4	AUX	4.1 mV/(m/s^2)	–	☐Yes・☐No	
9	–	moment	AUX	100 mV/(m/s^2)	–	☐Yes・☐No	
10			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
11			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
12			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
13			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
14			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
15			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
16			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
17			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
18			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
19			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
20			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
21			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
22			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
23			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
24			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
25			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
26			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
27			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
28			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	

29			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐ No	
30			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐ No	

Excitation Conditions Requisition Sheet (5) (2/2)

RANDOM

CHANNEL TABLE

channel				sensitivity	profile #	RMS abort	RMS abort level
No.	A/D No	label	type				
31			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes ・ ☐ No	
32			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
33			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
34			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
35			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
36			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
37			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
38			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
39			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
40			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
41			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
42			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
43			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
44			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
45			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
46			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
47			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
48			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
49			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
50			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
51			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
52			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
53			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
54			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
55			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
56			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
57			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	

58			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	
59			☐ AUX ・ ☐ LIMIT	mV/(m/s^2)		☐Yes・☐No	

Excitation Conditions Requisition Sheet (6)

RANDOM

H(f) Table

H(f) pair	response channel	reference channel	H(f) pair	response channel	reference channel
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		
10			40		
11			41		
12			42		
13			43		
14			44		
15			45		
16			46		
17			47		
18			48		
19			49		
20			50		
21			51		
22			52		
23			53		
24			54		
25			55		
26			56		
27			57		
28			58		
29			59		
30					

DOCUMENTATION

display text	

Example of Excitation s Conditions Requisition Sheet – RANDOM (1/3)

No	item	explanation	range
1	TS Name	Fill in the space with the name of the TS.	
2	Test Name	Fill in the space with the name of the test the way its content can be understood.	
3	File Name	Set the name of the parameter file.	within 24 alphanumerics
	CONTROL PARAMETERS		
4	Test Time (hhh:mm:ss)	Set the full-level test time.	
5	Degrees of Freedom	Set DOF.	240 (recommended)
6	Control Spectrum	Choose an excitation control method. (Check one of the alternatives below.) Avg: average control among control channels Min: minimum level control among control channels Max: maximum level control among control channels	
7	Start Level	Set the level at which average control is started.	-30 ~ 0 dB
8	Initial Test Level	Set the pre-level, at which control signals and measurement signals are checked.	bigger than the start level
9	Level Increment	It denotes the step-up levels to shift from the pre-test level to the full-test level.	
	REFERENCE TABLE		
10	Minimum Frequency	Set the lower-limit excitation frequency.	5 or higher
11	Maximum Frequency	Set the upper-limit excitation frequency.	200 or lower
12	Frequency Lines	Set the number of control lines (viz. frequency resolution)	200 (recommended)
13	Overall RMS	Fill in the space with the RMS of the pre-set excitation pattern.	
14	Excitation Pattern Diagram (reference)	Draw the excitation (control) pattern diagram.	
15	Frequency	Set the frequencies at breakpoints.	
16	Value/Slope	Set the PSD level or the gradient of slope.	
17	－Alarm (dB)	Set the minus alarm level.	
18	＋Alarm (dB)	Set the plus alarm level.	
19	－Abort (dB)	Set the minus abort level.	
20	＋Abort (dB)	Set the plus abort level.	
	PROFILE TABLE		
21	Frequency	Set the frequencies at breakpoints.	

Example of Excitation Conditions Requisition Sheet – RANDOM (2/3)

No	item	explanation	range
22	Value/Slope	Set the PSD level or the gradient of slope.	
23	Minimum Frequency	Set the minimum frequency in the frequency band to which limiting is applied.	
24	Maximum Frequency	Set the maximum frequency in the frequency band to which limiting is applied.	
25	Abort Level	Set the abort level for the entire profile. (Individual setting of abort level for each breakpoint is not possible.)	
	SAFETY PARAMETERS		
26	RMS Alarm	Set the alarm level for RMS.	0 or higher
27	RMS Abort	Set the abort level for RMS.	0 or higher
28	Control Signal Loss	Set the control signal loss. Choose one from Off/Low/Standard. Off: invalid Low: abort at -3 dB Standard: abort at -6 dB	Standard is usually chosen.
29	Alarm Lines	Set the number of alarm lines.	1 or more
30	Abort Lines	Set the number of abort lines.	1 or more
	Loop Check		
31	Noise Threshold	Set the allowable noise level for the phase before starting loop checking.	1 ~ 1,000 mVrms usually, “30 mVrms.”
32	Maximum Drive	Set the upper-limit excitation drive voltage for loop checking.	10 ~ 3,300 mV
	DRIVE SIGNAL		
33	Drive Clipping	Set the clipping.	fixed at 3.0 Sigma
	CHANNEL TABLE		
34	Channel A/D No.	Fill in the space with the A/D No. of the measurement system charge amplifier.	
35	Channel Label	Set the name of the channel label.	within 15 alphanumerics
36	Channel Type	Choose the type of channels. (Check one of the alternatives below.) AUX: measurement channel LIMIT: limit channel	
37	Sensitivity	Set the sensitivity of the charge amplifiers for each channel.	10 ~ 10,000 mV/(m/s^2)
38	Profile Number	Set the profile numbers of limit channels.	1 ~ 50

Example of Excitation Conditions Requisition Sheet – RANDOM (3/3)

No	item	explanation	range
39	RMS Abort	Either set or choose RMS abort for each channel. (Check one alternative.)	
40	RMS Abort Level	Input RMS abort level if “YES” is chosen for the item “RMS abort.”	
	H(f) Table	“the number of acquisition channels － 1” is settable.	
41	Response Channel	Set the response channel for transfer function analysis.	The channel # in
42	Reference Channel	Set the reference channel for transfer function analysis. When “0” is chosen, average-based analysis can be performed. In that case, phase data is not available.	the CHANNEL TABLE is to be filled in this blank.
	DOCUMENTATION		
43	Display Text	Set the title the way the content of excitation can be understood. The title is indicated (printed) with analysis data.	within 64 alphanumerics

Appendix C Data Acquisition/Analysis Conditions Sheet

Data Acquisition/Analysis Conditions Sheet

final check	
TS	OP

1. test name*1: _____

2. excitation waveform: ☐RANDOM ・ ☐SINE （☐UP ・ ☐DOWN ・ ☐UP-DOWN）

3. data acquisition conditions:

3.1 channel information ＞＞＞ refer to data acquisition database list

3.2 sampling frequency (as below)

analysis frequency (upper-limit data acquisition freq.) × sample rate multiplier (multiplication)		sampling frequency	frame size
SINE	5,000 × 2.56	12,800Hz	4,096
RANDOM	250 × 5.12	1,280Hz	1,024

4. analysis conditions

- ☐ response curve shown in data acquisition/analysis conditions sheet - 1
- ☐ PSD/auto power spectrum shown in data acquisition/analysis conditions sheet - 2
- ☐ transfer function/coherence shown in data acquisition/analysis conditions sheet - 3

Data Acquisition/Analysis Conditions Sheet 1

1. name of analysis: response curve analysis

2. analysis range

☐ UP ☐ DOWN ☐ UP－DOWN

3. processing mode: fundamental

4. analysis channel

4.1 response channel

☐ ALL

☐ A/D No_____

5. graph display designation

5.1 X-axis scale (frequency)

upper limit_____Hz

lower limit_____Hz

☐ logarithm ☐ linear

5.2 Y-axis scale

upper/lower scale: ☐AUTO ☐fixed upper limit_____

lower limit_____

☐logarithm ☐linear

Data Acquisition/Analysis Conditions Sheet 2

1. name of analysis: PSD / auto power spectrum
   - ☐ PSD
   - ☐ auto power spectrum

2. analysis range
   2.1 time
   - ☐ entire full-level time
   - ☐ from ( ) sec. to ( ) sec. after the start of full level.
   - ☐ others: from_____to_____

3. window
   - ・Hanning (“Hanning” is usually chosen for analysis.)
   - ・Hamming
   - ・Blackman
   - ・Harris
   - ・None

4. the number of average operations*2: _____

5. analysis channel
   5.1 response channel
   - ☐ ALL
   - ☐ A/D No_____

6. graph display designation
   6.1 X-axis scale (frequency)
   - upper limit_____Hz
   - lower limit_____Hz
   - ☐ logarithm ☐ linear

   6.2 Y-axis scale
   - upper/lower scale: ☐AUTO ☐fixed upper limit_____
   - lower limit_____
   - ☐logarithm ☐linear

Data Acquisition/Analysis Conditions Sheet 3

1. name of analysis: transfer function analysis / coherence
   - ☐ transfer function analysis
   - ☐ coherence

2. analysis range
   - 2.1 time
     - ☐ entire full-level time
     - ☐ from ( ) sec. to ( ) sec. after the start of full level.
     - ☐ others: from_____to_____

3. window (only for random excitation)
   - ・Hanning (“Hanning” is usually chosen for analysis.)
   - ・Hamming
   - ・Blackman
   - ・Harris
   - ・None

4. the number of average operations*2: _____

5. analysis channel
   - 5.1 reference channel*3
     - A/D No._____ (name of signals:_____)
   - 5.2 response channel
     - ☐ ALL
     - ☐ A/D No_____

6. graph display designation
   - 6.1 X-axis scale (frequency)
     - upper limit_____Hz
     - lower limit_____Hz
     - ☐ logarithm ☐ linear
   - 6.2 Y-axis scale (amplification ratio of transfer function)
     - upper/lower scale: ☐AUTO ☐fixed upper limit_____
       lower limit_____
     - ☐logarithm ☐linear

Data Acquisition/Analysis Conditions Sheet 4

1. name of analysis: waveform display

2. analysis range

2.1 time

- ☐ entire full-level time
- ☐ from ( ) sec. to ( ) sec. after the start of full level.
- ☐ others: from_____to_____

3. analysis channel

3.1 response channel

- ☐ ALL
- ☐ A/D No_____

4. scale

4.1 X axis (time-series axis)
- ☐ auto scale
- ☐ time: _____sec ～ _____sec
- ☐ others: _____ ～ _____

4.2 Y axis (amplitude)
- ☐ auto scale
- ☐ others: _____ ～ _____

5. others

5.1 print format

- ☐ 1 channel / sheet
- ☐ ____channels / sheet

5.2 grid

- ☐ ON (with additional lines)
- ☐ OFF (only gridlines, with no additional lines)

Special Notes for Data Acquisition/Analysis Conditions Sheet

No	item	special note
*1	test name	within 24 letters with alphanumerics, underlines, and hyphens
*2	the number of average operations	the number of average operations $\leqq$ $\dfrac{\text{sampling frequency (Hz)} \times \text{analysis time}}{\text{frame size}}$
*3	reference channel	When performing transfer function analysis, the A/D No. and signal name of the reference channel used as the standard are to be specified.

Appendix D Data Acquisition Database (Instruction and Example)

Please fill out the sheets following the examples and instructions in this Appendix, and submit it to us prior to the execution of the test.

data acquisition database list (acceleration) sheet Test Name:

A/D No.	name of position	measurement ID sensor direction (polarity) +−	acceleration sensor information model #	 S/N	 sensitivity (pC/m/s^2)	full scale (m/s^2/fs)	limit ch#
A/D Ch #	Remark	Position	Model Number	Serial Number	Sensitivity (mV or pcC/EU)	FS Input Range (EU)	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
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38							
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40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

data acquisition database list (strain) sheet Test Name:

A/D No.	name of position	measurement ID	strain gauge information			
		sensor direction (polarity) +−	model#	gauge factor		
A/D Ch #	Remark	Position	Model Number	Gauge Factor	Sensitivity (mV or pcC/ EU)	FS Input Range (EU)
401						
402						
403						
404						
405						
406						
407						
408						
409						
410						
411						
412						
413						
414						
415						
416						
417						
418						
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433						
434						
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437						
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439						
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441						
442						
443						
444						
445						
446						
447						
448						
449						
450						

Example of Data Acquisition Database List

Data Acquisition Database List (acceleration) Sheet (1/ 1) Test Name: TEST1

A/D No.	name of position	measurement ID	acceleration sensor information			full scale	limit channel#
		sensor direction (polarity)+ −	model#	S/N	sensitivity (pC/m/s^2)	(m/s^2/fs)	
A/D Ch#	Remark	Position	Model Number	Serial Number	Sensitivity (mV or pC/EU)	FS Input Range (EU)	
1	Mon1	+1X	224C	A70P	1.23	10	5
2	Mon2	+1Y	224C	A72L	1.24	10	6
3	REF1	+1Z	224C	A75M	1.25	10	7

<explanation for the information to be filled in the acceleration database list>

A/D Ch#	acceleration: 1 ~ 400
Remark	within 29 letters with alphanumerics, hyphens, underbars, spaces, etc. (capital/small letters discriminable)
Position	polarity (＋,－)＋11 or fewer numbers＋direction (X, Y, Z)
Model Number	model number of acceleration sensor
Serial Number	serial number of acceleration sensor
Sensitivity (mV or pC/EU)	sensitivity of acceleration sensor
FSInputRange (EU)	m/s^2 range
Limit Channel	The channel # in the CHANNEL TABLE of the excitation conditions requisition sheet is to be filled in this blank.

data acquisition database list (strain) sheet Test Name: TEST1

A/D No.	name of position	measurement ID	strain gauge information			
		sensor direction (polarity) +-	model#	gauge factor		
A/D Ch#	Remark	Position	Model Number	Gauge Factor	Sensitivity (mV/EU)	FS Input Range
401	1C		KFG-5-120-C1-11	2.09	2612.5	0.00382
402	1T		KFG-5-120-C1-11	2.09	2612.5	0.00382

<explanation for the information to be filled in the strain database list>

A/D Ch#	strain: 401 ~ 500
Remark	within 29 letters with alphanumerics, hyphens, underbars, spaces, etc. (capital/small letters discriminable)
Model Number	model number of strain gauge
Gauge Factor	gauge factor of strain gauge
Sensitivity (mV/EU)	Sensitivity = 1 / (4 / (5 × Gauge Factor))
FS Input Range	FS Input Range = 10 / Sensitivity