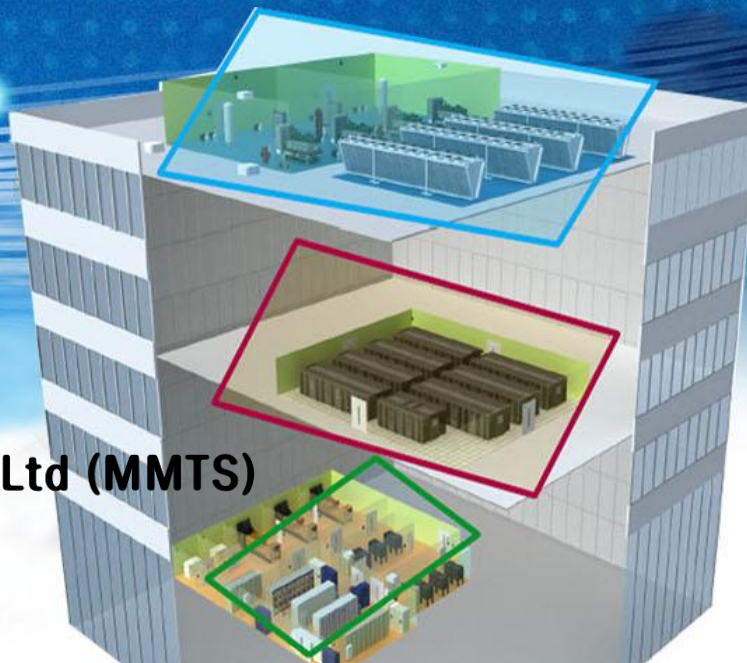
Introduction of earthquake disaster response technology of large-scale IDC center

FEBRUARY. 2017



Mahakali Mechi Technologies & Suppliers Pvt. Ltd (MMTS)

Entire Safe System Co.,Ltd(ESS)

Contents

I SUMMARY

1. **Configuration of the Information Society**
2. Natural disaster threatening the information society

1. Configuration of the Information Society

- Most of modern life has been engaged in computer and communications technology.–Information society
- Information utilization and management are national competitiveness.
- Each individual's ability to utilize information influences the happines of the future.



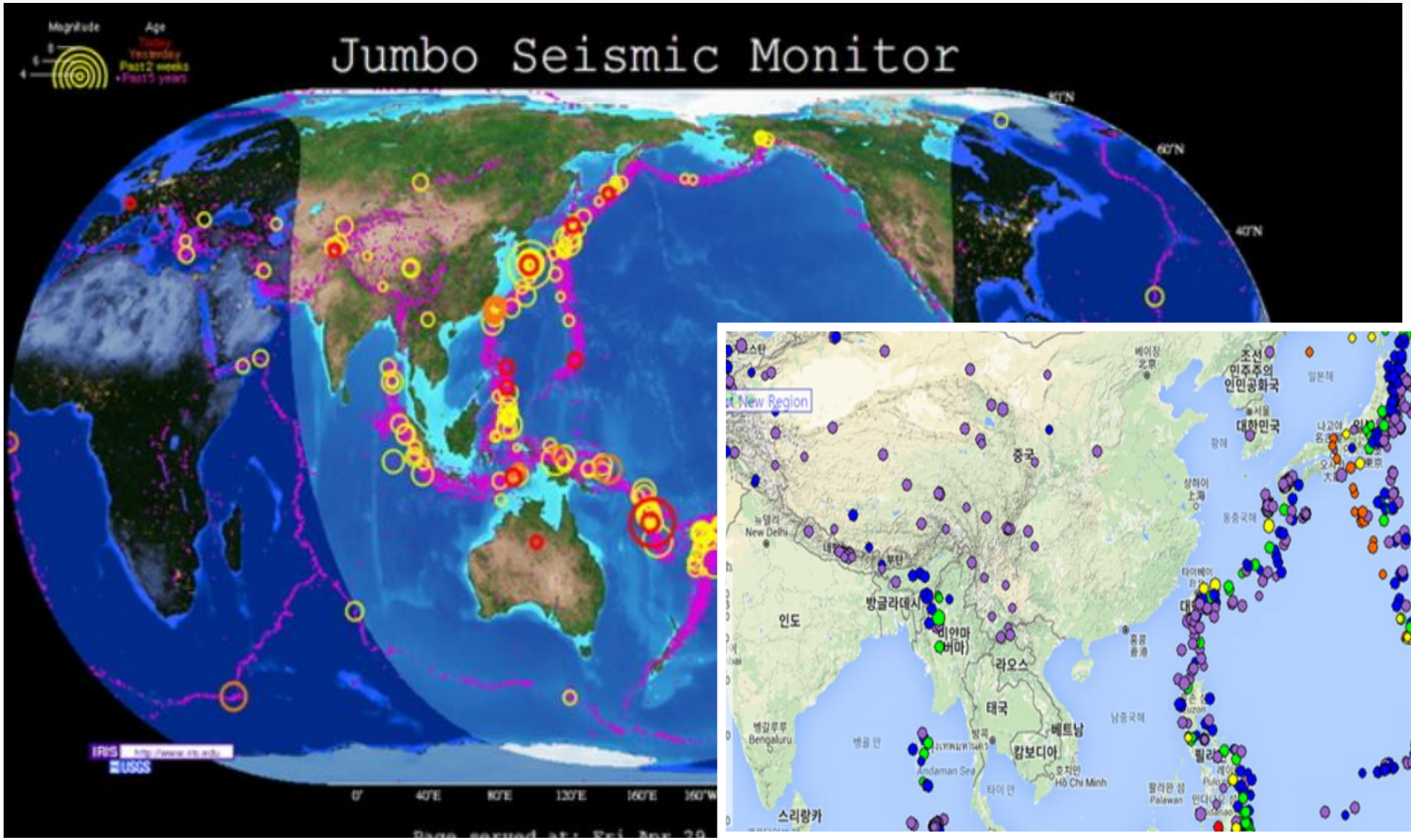









2. Natural disaster threatening the information society



Reference) Examples of information damage caused by natural disasters

Kobe earthquake (issued in 1995, 7.2 A scale)

: Caused damage to 1,700 institutions in japan

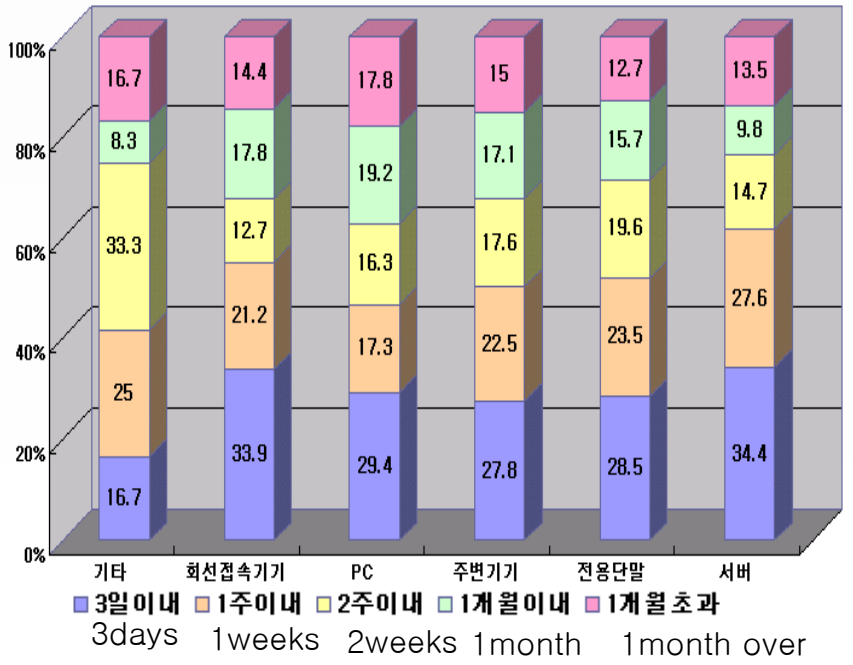
Information and communication system damage

(the main central banking system)

地域	System被害狀況			System被害類型			
	System數	被害數	被害率(%)	顚倒	移動	落下/傾斜	其他
神戶	371	210	56.6	54	103	30	23
大阪	865	167	19.3	8	128	13	18
其他	434	7	1.6	1	4	1	1
計	1670	384	23.0	63	235	44	42

【出處: (財)日本金融情報System Center報告書 1995.11 中間 35號
日本建築學會 :神戶地震被害調査報告書(情報System篇)

Required time for System-specific recovery



➢ **78% of the damage system caused by the falling & Movement**

➢ **About 30% of Information & Communication equipment takes to recover more than 15 days for recovery operations**

II

For the Information society

Stable operation plan of information system

1. Earthquake response technology for Information system
2. Optimization for earthquake response of information system
3. Earthquake response technology of each country for Information system
4. Check items for the earthquake response information system

1. Earthquake response technology for Information system

II

Application of seismic technology

☐ Seismic Installation :

Installation of equipment on the building floor without Access floors

* Build a new center without a access floor : Upper air conditioning, upper tray
* Measures against micro-vibration and review of efficiency of air conditioning

☐ Seismic Access floor :

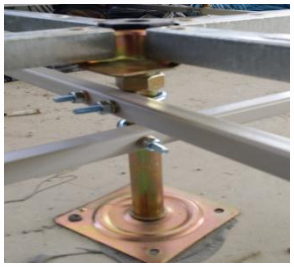
Build a Access floor with seismic resistance

☐ Seismic reinforcement :

Reinforcing the existing Accessfloor

☐ Seismic fixed :

Fixed equipment such as Access floor panels



■It does not prevent vibration from being transmitted to the equipment.

■Need fundamental measures for the conduction or transfer of equipment

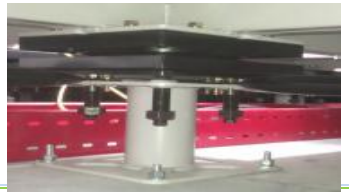
Application of seismic isolation technology

☐ Seismic Isolation Table :

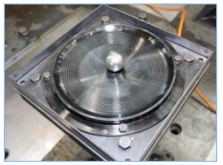
Application of earthquake response device in equipment / rack unit

☐ Seismic isolation Access Floor :

Build up the whole floors with seismic isolation

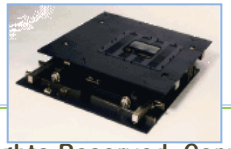


< Types of technology >



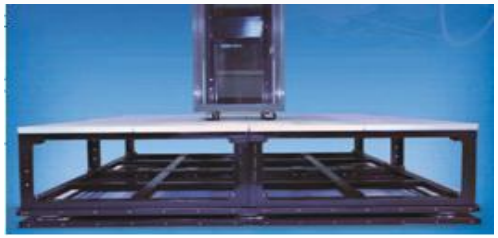
Ball bearing type

LM guide type

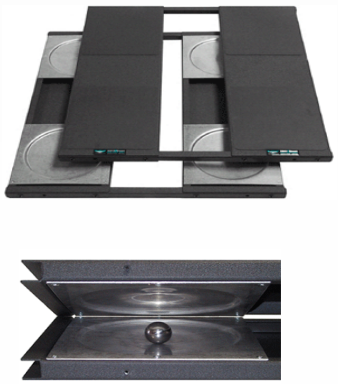
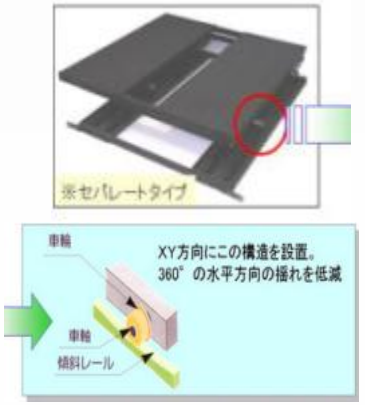
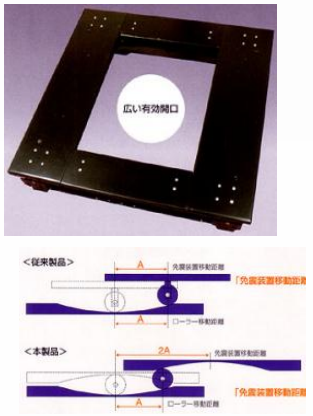


Rail + Roller type

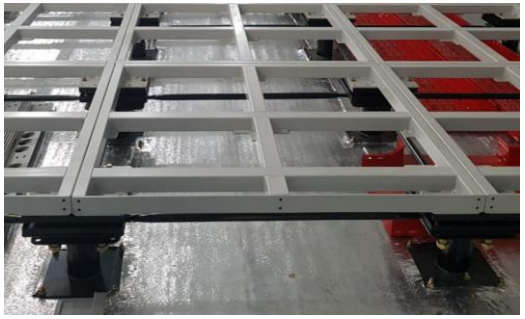
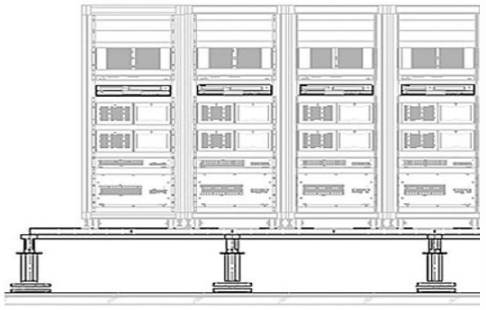
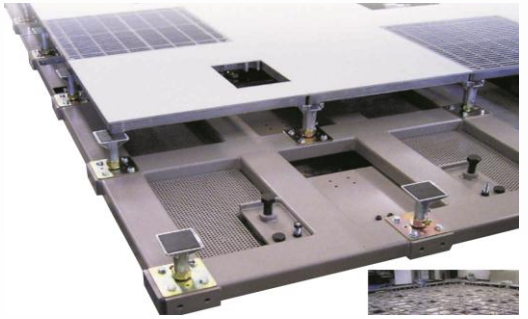
2. Optimization for earthquake response of information system II

the way	Apply to the unit of equipment	Apply to the center in batch
shape		
method	**Seismic Isolation Table**	**Seismic isolation Access Floor**
Time of introduction	**Applied to existing operating system**	**Applied when establishing a new center**
Features	●Easy to apply in units of equipment ●Non-stop installation on existing operating equipment ○Equipment installation, relocation difficulties ○Ensure vibration displacement space for all applicable equipment ○Arranged separately from unapplied equipment ○**Depends on the safety of Access floors**	●Earthquake Responds to All Equipment in the computer center ●High Resilience to High Strength Earthquakes ●Mixed installation with existing Access floor ●Equipment Installation and Relocation convenience (same as the existing floor) ●Ensure a minimum of vibration displacement space ●Using the Access floor as a permanent ○Initial installation period required

3. Earthquake response technology related Information system of each country (1/2)– Seismic Isolation Table II

SP-series (Entire Safe System)	**Iso-Base(USA) Worksaftcompany**	**TCR(JAPAN) AScompany**	**Server Utena(JAPAN) Yacmo company**	**SSI(KOREA) SAMIK THKcompany**
Korea	**USA**	**JAPAN**	**JAPAN**	**JAPAN/KOREA**
• Friction pendulum system **(FPS: Friction pendulum system)**	• Friction pendulum system **(FPS: Friction pendulum system)**	• A kind of friction pendulum system (Cosine rail type)	• A kind of friction pendulum system (Cosine rail type)	• LM guide spring type
				
☞ Excellent durability with cutting ☞ plate Supports aftershocks with self-damping ☞ function Excellent loading capacity: 3.0Ton or more	☞ Durability is poor with pressed plates	☞ Used for light weight ☞ Product price is high	☞ Used for computer servers ☞ Height of equipment is high	☞ Spring elasticity varies depending on load
Samsung Electronics and the Ministry of National Defense	Held a number of sales IBM, Fujitsu, etc.	Used in museums and Art gallery in Japan	Applied to computer server by using roller structure	Applied to some computer rooms and Art gallery

3. Earthquake response technology related Information system of each country (2/2))– Seismic Isolation Access floor II

SP-series (Entire Safe System)	Iso-Base Worksafe company	TCR AScompany
korea	usa	japan
Friction pendulum system **(FPS: Friction pendulum system)**	**Friction pendulum system** **(FPS: Friction pendulum system)**	A kind of friction pendulum system **(**Cosine rail type**)**
		
☞ Excellent durability with cutting plate ☞ Superior mounting capability: 5.0Ton / 1.44m2 or more ☞ Reserves Abundant Delivery Performance ☞ Horizontal adjustment function for various installation environments ☞ The isolation drive is on the upper part, so it is applicable to various environments	☞ Degraded performance under high load with pressed plate ☞ No delivery cases ☞ Installation environment is limited due to the seismic drive part on the lower part.	☞ Rail-type technology causes problems in the home position under high load ☞ No delivery cases ☞ Installation environment is limited due to the seismic drive part on the lower part.
❖ **Samsung Electronics, Ministry of National Defense, KEPCO, many public institutions** ❖ **Overseas applications such as China and Vietnam**	❖ No verification of delivery results	❖ No verification of delivery results

4. Check items for earthquake response

Check items		Check contents	Check Point
Performance	Vibration damping performance	• Damping performance according to seismic intensity (* 1) • Vibration Displacement Performance for Earthquake Response	✓ What is the damping performance against the corresponding earthquake? ✓ What is the response capacity (maximum vibration displacement width) for unexpected large-scale earthquakes?
	Undo recovery performance	• Restoration performance after vibration (* 2)	✓ Exactly come back to the original position to prepare for aftershocks after the vibrations?
	Mounting performance (ability)	• Performance against load variation • Maximum load capacity	✓ What is the maximum load capacity of the equipment in use or the load of future equipment?
Operability	Consider operating environment	• Flammability and availability of volatile materials • Resilience to expansion and additional expansion • Replacement parts unit capacity • Customizing the ability to operate the environment (* 6)	✓ Do not use flammable materials to account for fire accidents? ✓ Is it convenient for equipment expansion? ✓ Is it possible to replace parts after earthquake? ✓ Is it possible to provide an optimized product for operating environment? ✓ Can we ensure continuity of product production?

4. Check items for earthquake response

II

Check items		Check contents	Check Point
durability	Material quality	• Durability against vibration (* 3) • Durability against corrosion, wear and deformation • Use of consumable materials (* 4)	✓ Is it made of materials that are not part replacement due to difficult replacement parts during operation? ✓ Is it a structure that does not have the deformation (performance deterioration) of components even in the case of vertical vibration?
	Structural safety	• Performance maintenance capability (* 5) - Horizontal leveling maintenance of driving part • Whether the design value changes	✓ Is there a self-leveling function since the leveling ability is directly related to the performance? ✓ Does the initial design value change with time and load fluctuation?

Reference) check item of seismic isolation equipment(1/6)

*1) Vibration damping performance

■Characteristics of seismic input of seismic test method of telecommunication facilities 1)

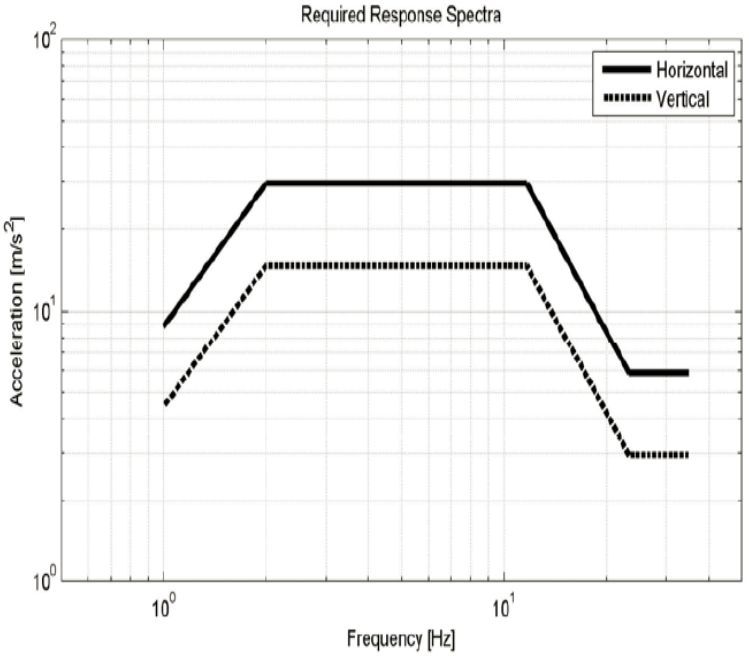


Figure 1. 전기통신설비의 내진 시험방법 요구응답스펙트럼 (2% damping)

Figure1.-Seismic Test Method of Telecommunication Equipment Requirement Response Spectrum(2% damping)

The characteristics of the seismic input of the earthquake-proof test method of telecommunication facilities show the response characteristic as shown in the figure for frequencies from 1 Hz to 35 Hz.

It can be seen that the excitation force is large in the band of 2 ~ 15Hz.

1) Pusan National University Earthquake Disaster Research Center Test (2012-R-073) Input value.

■ SP9000N upper response when tested according to the earthquake test method of telecommunication facilities 2)

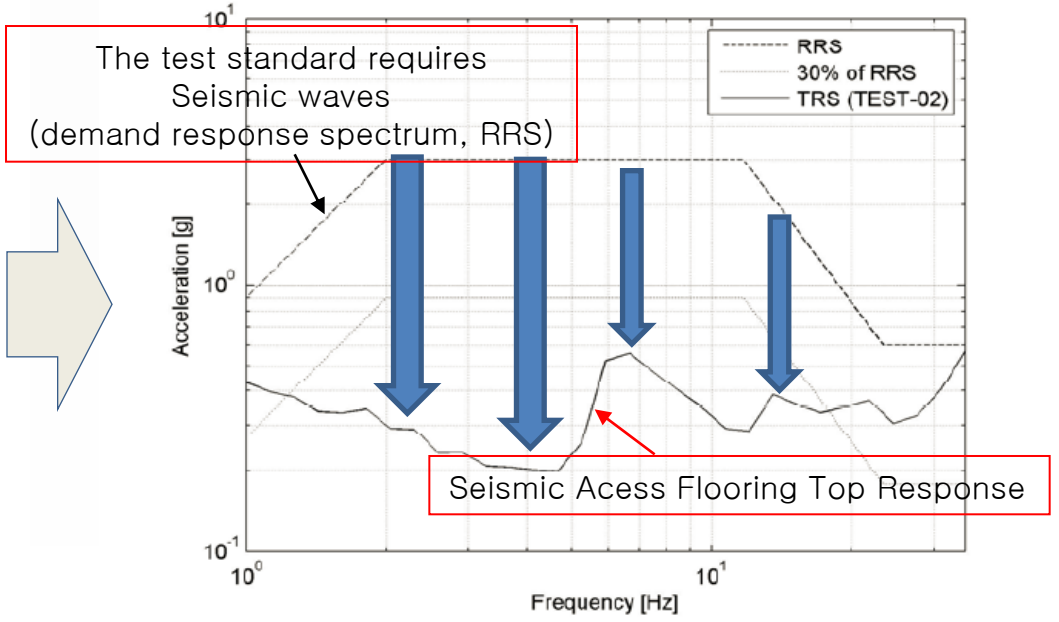


Figure 8. TEST-02 Tested Response Spectra (A2)

Horizontal Two-Direction (X, Y) Response The spectrum response above the SP9000N also shows a decrease in response over all frequency ranges.
The response is not large within the excitation band.
Excellent reduction rate..

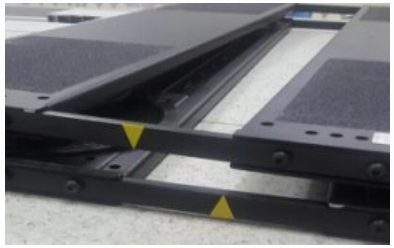
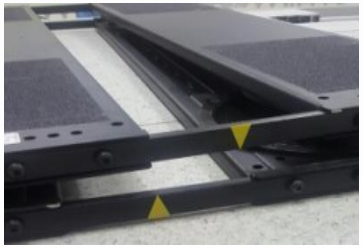
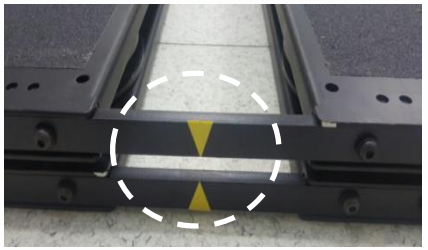
2) Horizontal response value measured at the upper part of the floors at the Pusan National University Earthquake Research Center Test (2012-R-073).

Reference) check item of seismic isolation equipment (2/6)

*2) Home Recovery Performance

☞ Problems when unrestored
- ✓ **Secondary damage in case of aftershocks**
- ✓ Location shift (slip) and collision with unsafe equipment
- ✓ Load unbalance causes conduction or collapse

◯ Seismic Isolation Table

< Vibration caused by the left and right >

< Return to original state after vibration >

◯ Seismic Isolation Access floor

※ Heavy equipment is installed on the seismic isolation equipment,
If the top and bottom of the seismic equipments are exactly matched,
it can show its performance when an earthquake occurs.

※ When the seismic Isolation table is operated from a certain degree or more,
Forced suppression of seismic function may cause malfunction of seismic drive part

※ Due to the compression of the plate and the lack of elasticity of the spring,
If it does not come up, there is a big problem in case of earthquake.

Reference) check item of seismic isolation equipment(3/6)

*3) Durability of seismic Isolation drive part

☞ seismic Isolation drive part :

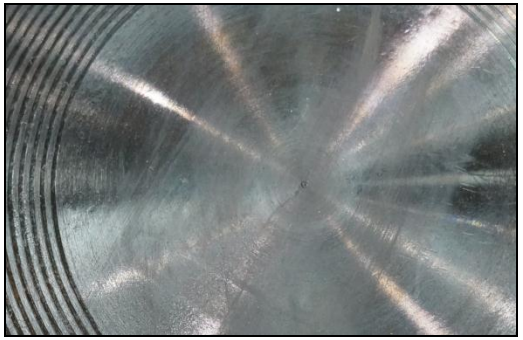
- ✓ Support tens to dozens of tons of loads
- ✓ Long-term use over decades in many years
- ✓ **Up and down vibration correspondence**

➔ Plate durability is the core of seismic Isolation technology

◯ Plate seismic isolation technology should be Cutting process.

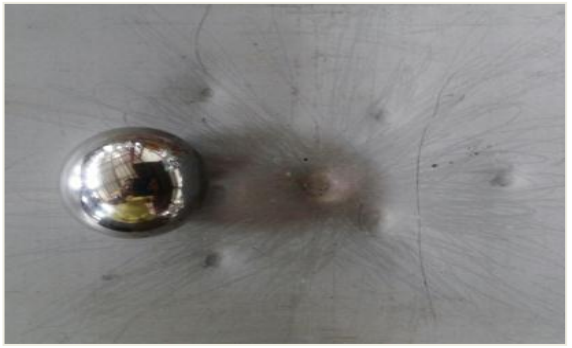
☞ Cutting process : A machining method in which various materials are cut to a predetermined size using a cutting tool such as a bite

[Cutting production plate-SP-Series]



▶ State of the plate after up-and-down vibration in the actual shaking table test - only the operating line of the bearing is displayed

[Press plate production surface]



▷ Plate surface is crushed after vertical vibration

Reference) check item of seismic isolation equipment(4/6)

*4) Material configuration of the Seismic isolator driver

¶ Seismic isolation Equipment Maintenan

† Changing the initial design values

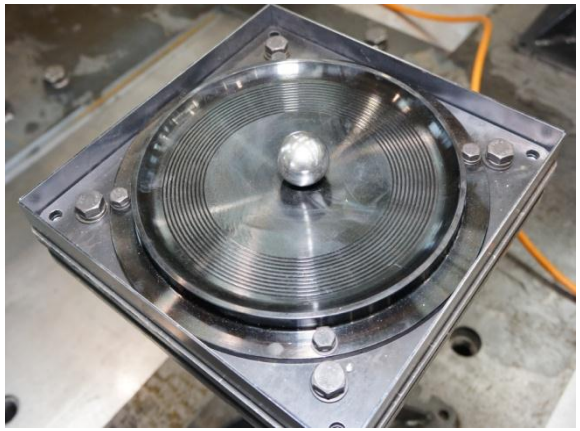
Movement stop of operation equipment is required

¶ No maintenance is required without consumable materials

† Consists of materials with no variation in design value

365 days non-stop equipment operation realization

[Semi-permanent material: **SP-Series**]



▶ Constructed only with plate and bearing, it does not require any maintenance work for long time use

[Examples of consumable materials of seismic equipments]

(Spring for recovery)

(Lubricating oil injection)

▷ For some techniques, when using the lubricating oil and the spring used for a long time, it requires separate maintenance

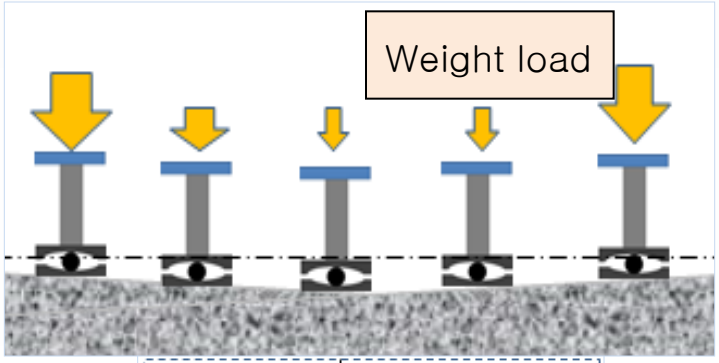
Reference) check item of seismic isolation equipment(5/6)

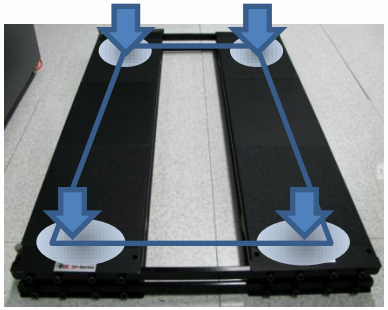
*5) Performance maintenance: Horizontal the drive unit

If it does not match the horizontal and height of each drive

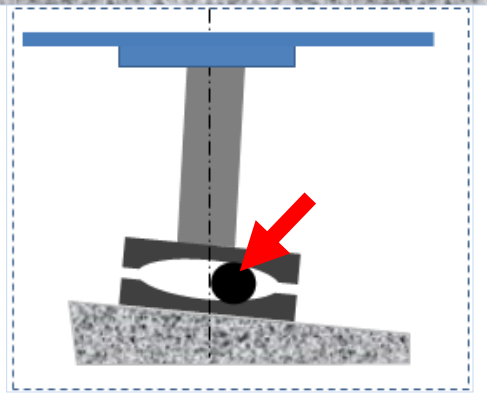
- Distortion occurs when vibration occurs due to offset load between drive parts
- By the weight load, the abrasion occurs in the high part
- Performance degradation due to difference in attenuation ratio between each driving part

This required height and horizontal adjustment of each drive unit

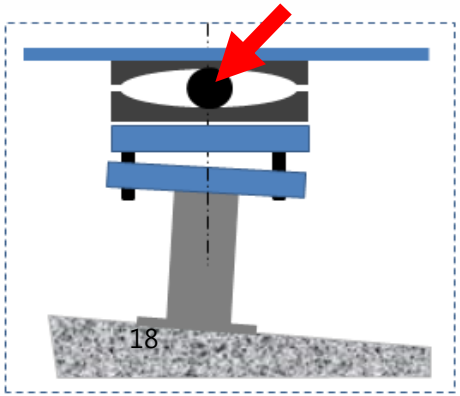




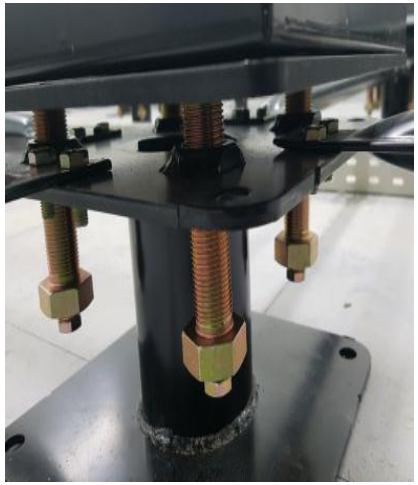
◀ Seismic Isolation tables for four isolator driver must be installed to maintain a horizontal state.



[If there is no leveling function]



[With leveling capability]



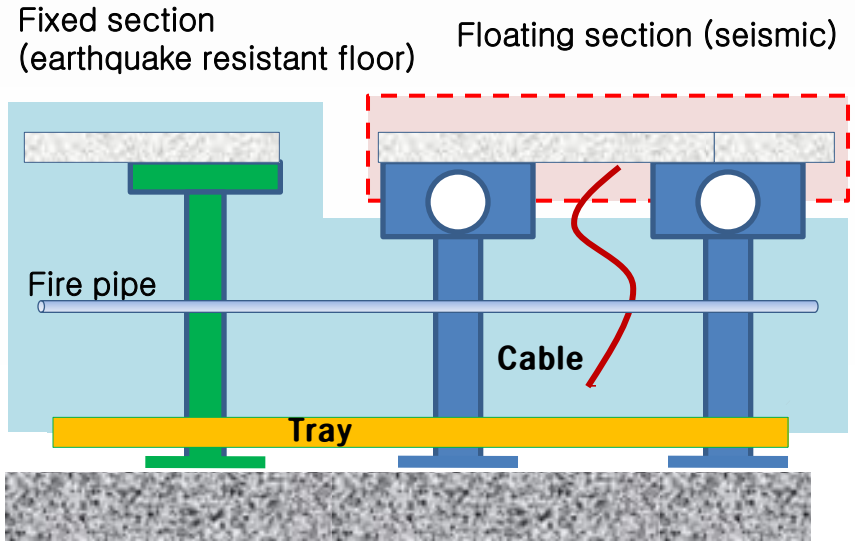
[Horizontal and height adjustment function of SP9000N]

Reference) check item of seismic isolation equipment(6/6)

*6) Operational Environment Response

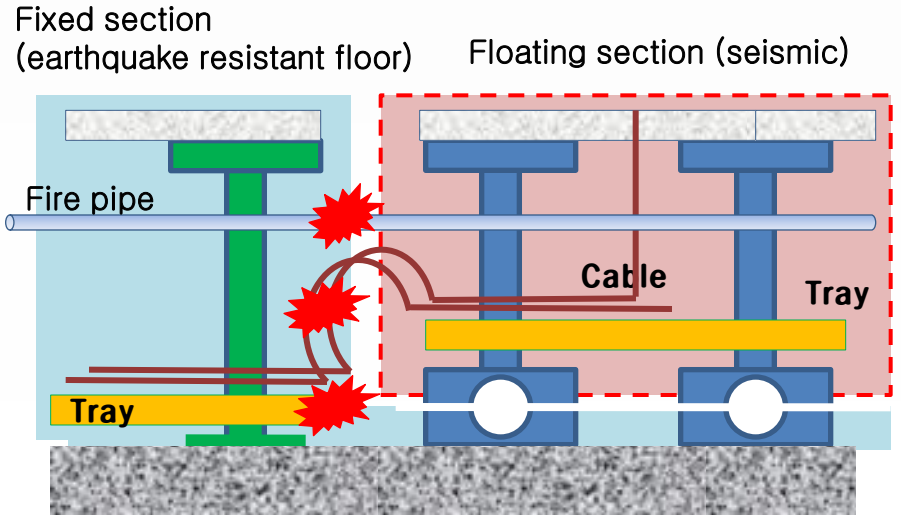
The seismic isolation technique should be installed on the top of the support so that it is designed so that interference does not occur in the lower facilities such as trays, pipes and cables

[SP9000N : Seismic isolation technology is at the top]



▶ No problems with installation of trays, piping, cables, etc. when seismic isolation is installed on top of the access floor support

[Seismic isolation technology is at the bottom]



▷ If seismic isolation technology is installed at the bottom of the Access floor support, From the fixed part (earthquake-resistant double floor) to the floating part (seismic) Tray, piping, etc. should be installed in the space of vibration displacement, Cable must have a separate clearance length

III

ESS Earthquake response technology

1. Company introduction
2. Key products for earthquake response
3. Seismic Isolation tables
   Technical Overview
4. Seismic isolation Access Floor
   Technical Overview

1. Company Introduction (1/2) – Overview

III

Based on technology and trust, ENTIRE SAFE SYSTEM CO., LTD., Which produces cutting edge products and precision machined parts, aims to be a small but robust and honest company to develop with customers and to be happy with customers. I am always working.

Managem objectives	Let's develop with customers as an industry leader

Company Name	ENTIRE SAFE SYSTEM CO., LTD.	In English	Entire Safe System Co.,Ltd.
address	Golden Tower No. 1505 191 Chungjeongno 2-ga, Seodaemun-gu, Seoul [Factory] Gyeongsangnam-do Yangsan Si jang ki teo 46 (junamdong)	Phone number	02-312-1262~1263 /Factory)055-372-1775
		Home page	www.ess-safe.com
CEO	KIM JUN SUNG	Fax No	02-312-1268
Industry	Wholesale / Manufacturing	PRODUCTS	Seismic Isolation equipment & Precision processing products
Company founded	July 27, 2009	number of employees	18 people

Management Policy

-Symbiosis public

-client satisfaction

-Technological innovation

Company mission

Trust and sincerity

Discovering Creativity

Preemption lead

1. Company introduction (2/2)
– Product laboratory system diagram

III

ENTIRE SAFE SYSTEM CO., LTD.

The President KIM JUN SUNG

Institute of Technology

Jeon D M technical director
and 4 others

- ❖ New product development
- ❖ Product design
- ❖ Product simulations
- ❖ Product A / S
- ❖ Product installation / training

Production Factory

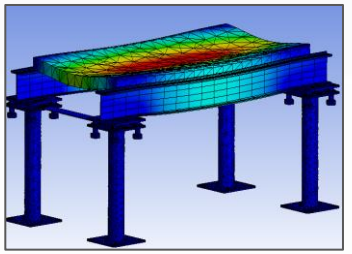
❖ **Product processing**

❖ **Product production**

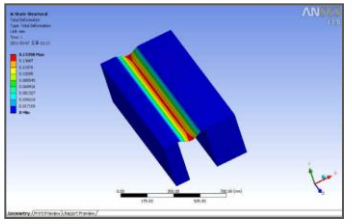
Structural quality verification

Dong-A University

Department of Mechanical Engineering
Jeon Chan Chan, Ph.D.
3 others



❖ Product structure analysis



❖ Product quality inspection

Performance verification

Pusan National University

Earthquake Experiment Center
CHOI H S Doctor of Engineering
2 others

❖ Product performance experiment

❖ Product certificate issued

2. Key products for earthquake response - Information and communication equipment

III

Seismic Isolation tables - SP6000 Series

- Designated by the National Disaster Reduction Technology (NET)
- International Certified Testing Organization (KOLAS) test certification
- Plate and ball bearing method
- Supports 360 ° horizontal vibration
- Self-damping function Cutting plate (patented technology)
- Maintain load over 3,000kg
- Vibration displacement 200mm, product height 76mm
- Vertical fixing and horizontal holding function
- Self-developed and produced to cope with various sizes / loads
- Korea's largest delivery record

Seismic isolation Access Floor - SP9000N Series

- Responds to high-intensity earthquakes of magnitude 9.0 or higher
- International Certified Testing Organization (KOLAS) test validation
- Support 360 ° horizontal vibration and vertical vibration
- 200mm amplitude displacement before and after
- Existing installations can be mixed with the Access floor
- Over 30,000m2 of delivery know-how
- Korea's Ministry of National Defense, National Security Agency, Samsung Electronics

3. Seismic Isolation tables Technical Overview (1/4)

Seismic Isolation Table - SP6000 Series

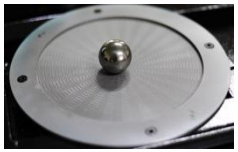
III

☐ Product Configuration

☞ seismic Isolation drive part :

Unit Unit

Set



Plates and ball bearings

Fixed function up and down

☐ Product Features

◯ Excellent durability of Seismic isolation drive

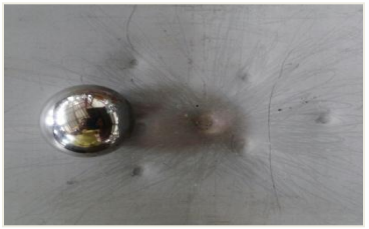
- ✓ Support tens to dozens of tons of loads
- ✓ Long-term use over decades in many years
- ✓ **Up and down vibration correspondence**

➔ Plate durability is the core of seismic Isolation technology

◯ Plate-type seismic isolation technology should be cutting

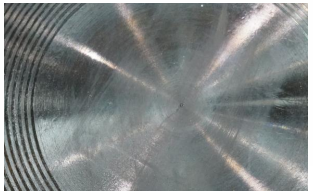
☞ Cutting process : A machining method in which various materials are cut to a predetermined size using a cutting tool such as a bite

[Press plate production]



▷ Plate surface is crushed after vertical vibration

[Cutting production plate : SP-Series]



▶ Status of the plate after a vertical vibrations in real shaking table test

☐ Product coverage

Computer Device	computer, a server, super-computer, network devices, such as mainframes
Communication Equipment	Exchange, transmission termination equipment, the relay apparatus, multiplexing apparatus, the distribution apparatus, a base station transceiver
Storage Devices	Various storage, customer information storage devices, storage devices
Additional Facilities	Substation equipment, rectifiers, backup power equipment (UPS), air-conditioning equipment, constant temperature and humidity chamber, etc

▶ Cutting technique

3. Seismic Isolation tables Technical Overview (2/4)

☐ Product Installation

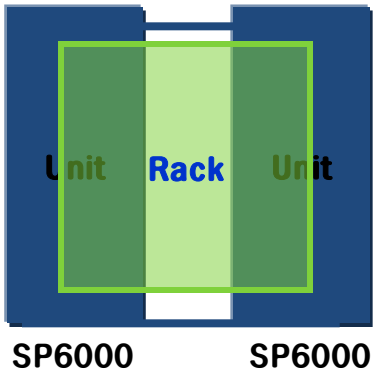
【Single installation type 】

【Continuous installation type 】

【Requirements according to installation type】

【Stand-alone rack installation】

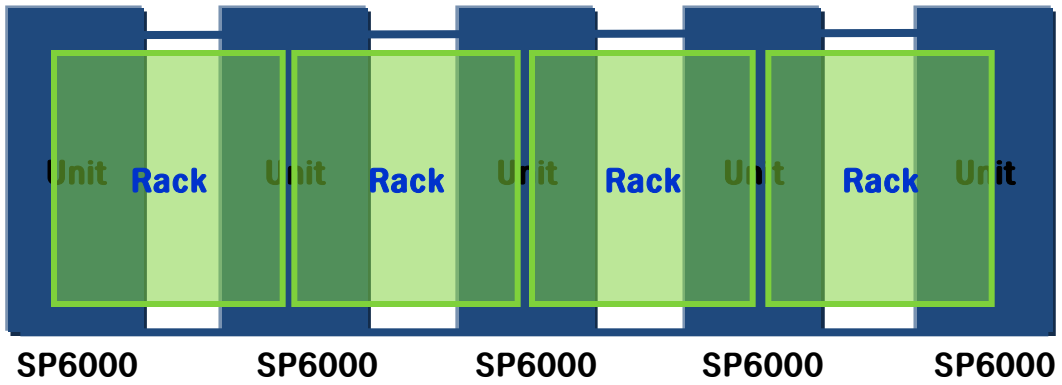
Unit quantity: 2 units
(minimum configuration)



【Continuous rack installation】

Unit quantity: Number of racks + 1

(Example) In caseof 4 racks, 4 + 1 = 5 units



3. Seismic Isolation tables Technical Overview (3/4)

□ Reference Installations

【Department of Defense 】

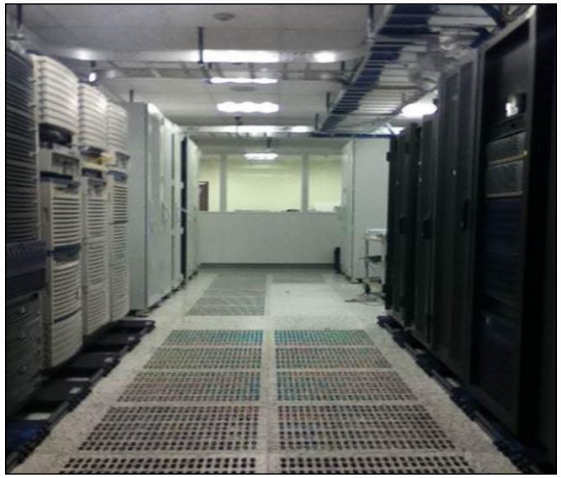
【Chungnam Office of Education 】

Defense Business Agency
National Defense Communications Bureau
Labor Welfare Corporation
Goyang City Hall
Gwangju City Hall
Blue house
Korea Oil Painting Co., Ltd.
Joint Chiefs of Staff
Armed Forces Command
Government Integrated Computing Center (Daejeon)
Government Integrated Computing Center (Gwangju)
Union Steel
Yongin City Resh Ward
Watch Daejeon
Korea Standards Research Institute
Daegu Industrial Accident Rehabilitation Hospital
Seoul Special City Hall
Samsung Thales
Sejong City
Taean County Office
Military Mutual Aid Association
Agricultural and Fishery Food Corporation
Youngju City Hall
Ministry of National Defense / LG CNS
Sejong City Office of Education
Uijeongbu City Hall
Namyangju City Hall
Ministry of Culture, Sports and Tourism
Korea Industrial Human Resources Development Corporation
Chungcheongnam-do Office
Post Office
Sejong City Hall
POSCO (1 hot rolling mill)
Grand Korea Leisure
National Security Department (Sejong)
National Disaster Research Institute (Ulsan)
Korea South-East Power (Pearl)

3. Seismic Isolation tables Technical Overview (4/4)

☐ Reference Installations

【National Security Agency 】



Chungnam Office of Education

Hyundai Cummins engine

Taekwondo Association

Gunpo City Hall

Muju Office

Cheonan City Hall

Asan City Hall

Taean County Office

Promotion Agency

Korea Intellectual Property Corporation

Ministry of Commerce, Industry and Energy

【Defense Business Agency】

Cheongyang County Office

Department of Defense

Iksan City Hall

SK Hynix

Labor Welfare Corporation

Wanju County Office

Korea Tourism Organization

Korea Asset Management Corporation

Sejong City Hall

Korea West Power

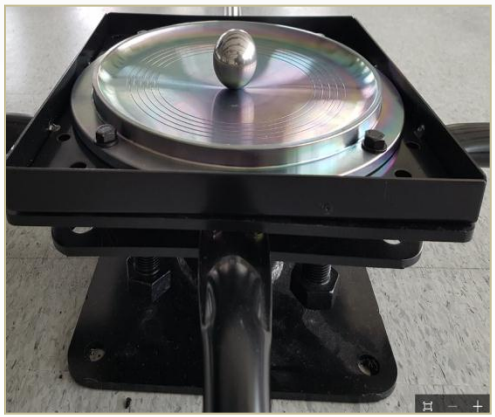
GONGJU City Hall

4. Seismic isolation Access Floor Technical Overview(1/4)

Seismic isolation Access Floor – SP9000N Series

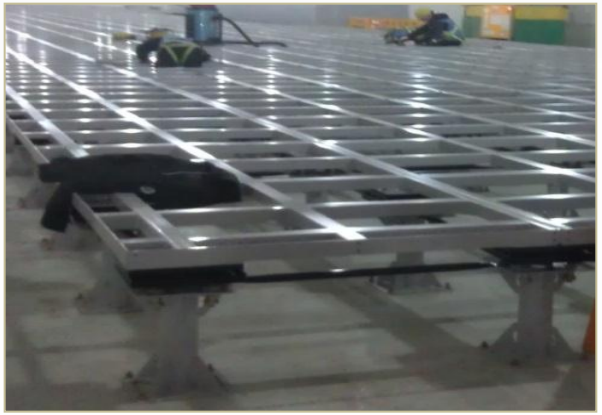
III

☐ Product Configuration

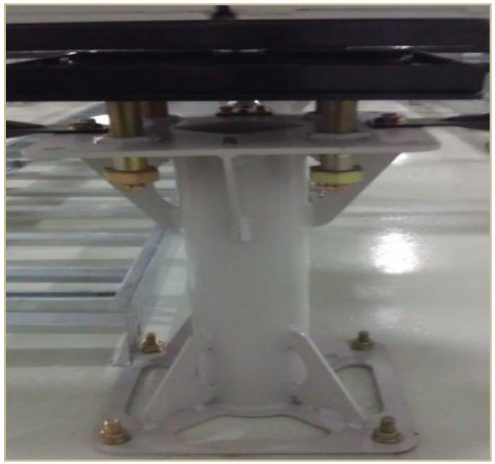


○ Seismic Isolation Unit
– Bearings + Plates

○ Supports & Links
– Secondary reinforcement of seismic support



○ Seismic Isolation Frame
– Composed of 1,200 × 1,200mm



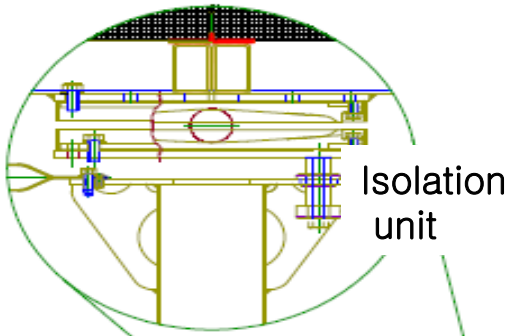
○ Seismic isolation support
– 100 mm diameter pipe

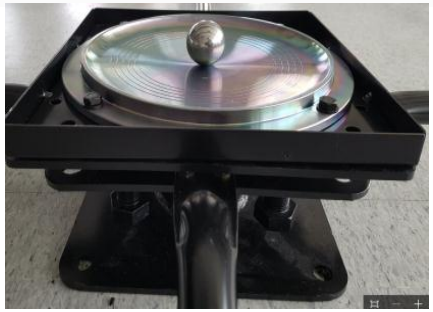
○ Access floor panel
– Use flat back panel

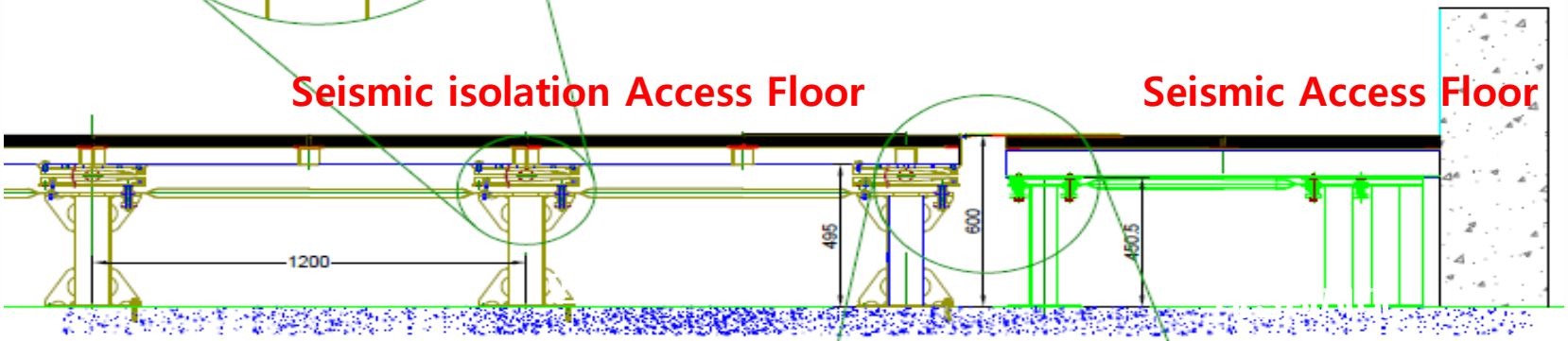
○ Completion of seismic Access double floor

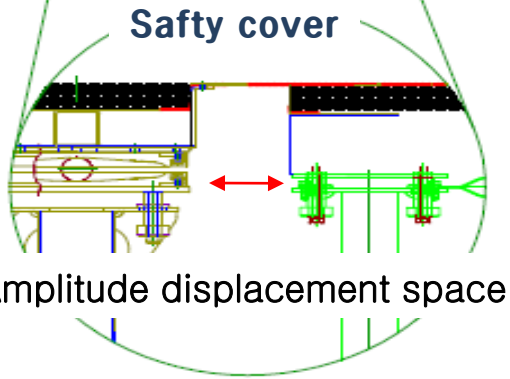
4. Seismic isolation Access Floor Technical Overview(2/4)

☐ Configure product installation









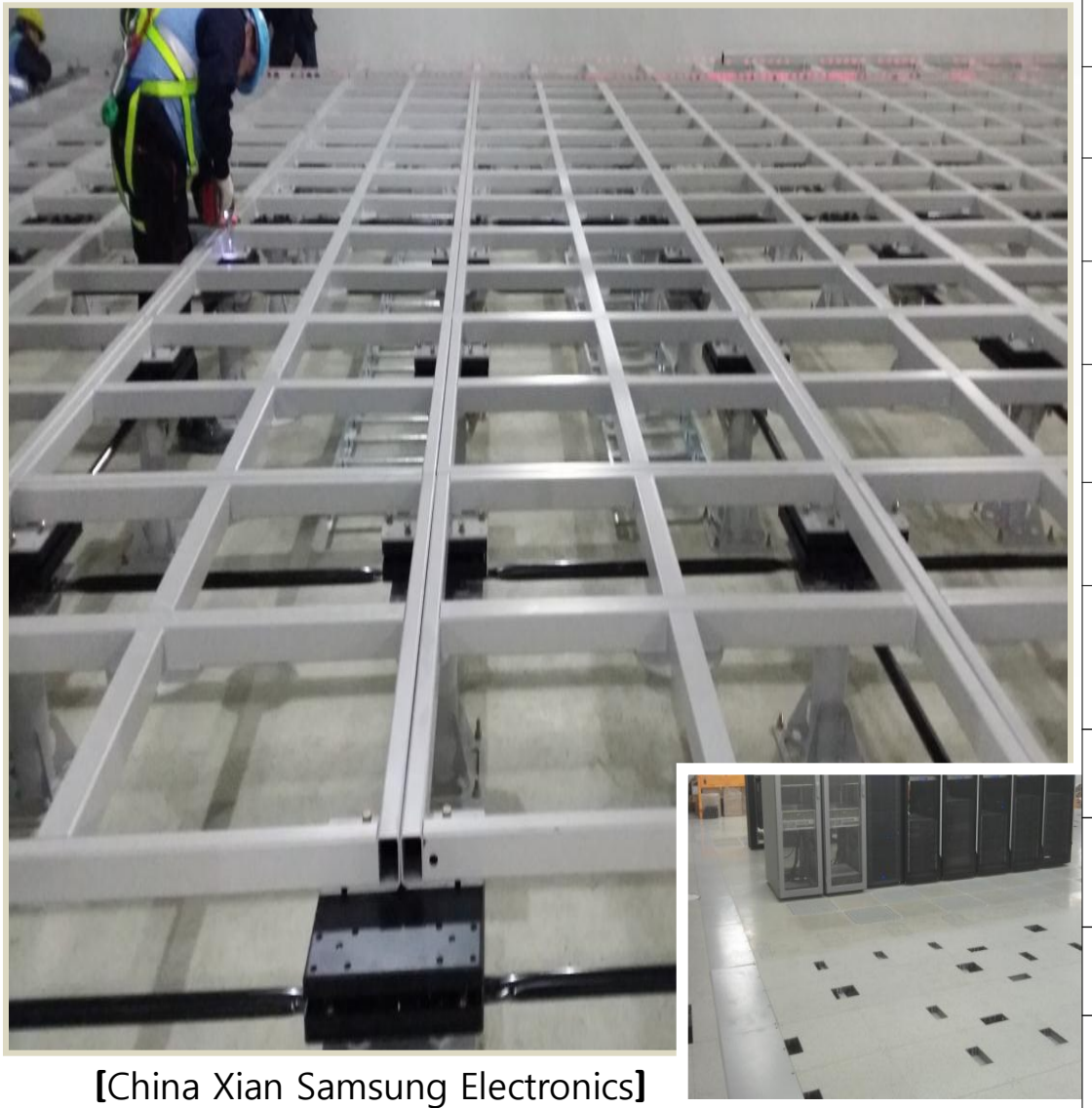
Space that can absorb vibration between seismic and Seismic isolation (displacement amplitude) are essentially required : 200mm or more

4. Seismic isolation Access Floor Technical Overview(3/4)

Seismic isolation Access Floor – SP9000N Series

III

□ Reference Installations



【China Xian Samsung Electronics】

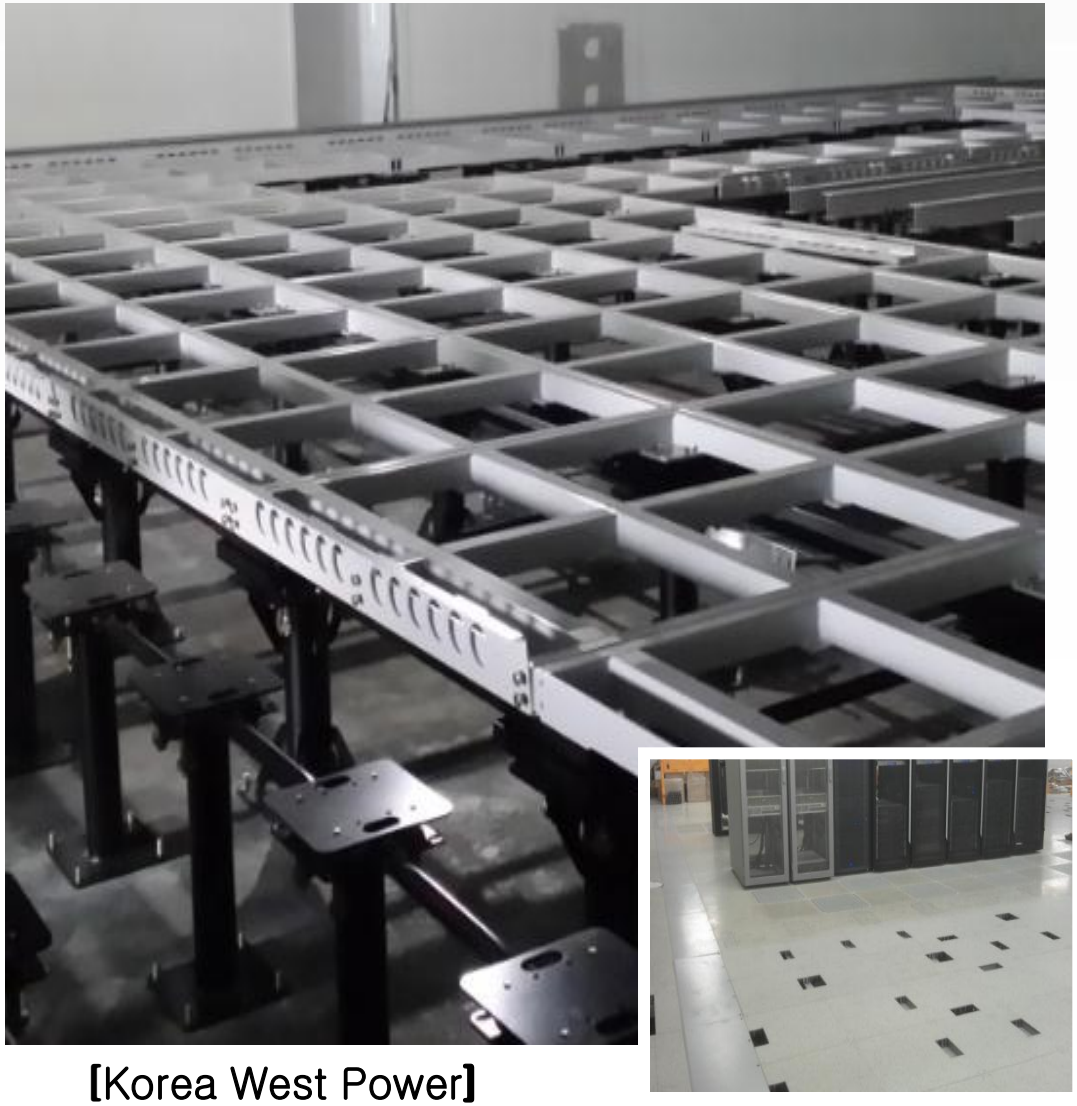
NO	Business name	*ordering organization*	Delivery date	Installation area
1	Hwasung 16-line computer machine room	Samsung Electronics	2011.3	1,485㎡
2	Tangjeong A2 line computer machine room	Samsung Display	2013.1	270 ㎡
3	China's Suzhou plant computer machine room	Samsung Display	2013.2	360 ㎡
4	Onyang plant L3 computer machine room	Samsung Electronics	2013.5	70 ㎡
5	China Xi'an computer factory machinery room	Samsung Electronics	2013.6	710 ㎡
6	Sejong government office relocation project	Ministry of Commerce, Industry and Energy	2013.11	48 ㎡
7	Dongtan line 17 (S3) computer machine room	Samsung Electronics	2014.1	785 ㎡
8	Comprehensive situation room earthquake measures	Cheongyang County Office	2014.3	35㎡
9	New office transfer business	Labor Welfare Corporation	2014.4	24㎡
10	Naju New Company ICT Center	Korea Electric Power	2014.6	1,238 ㎡

4. Seismic isolation Access Floor Technical Overview(3/4)

Seismic isolation Access Floor - SP9000N Series

III

□ Reference Installations



[Korea West Power]

NO	Business name	*ordering organization*	Delivery date	Installation area
11	Established Tangjung A3 line computer center	Samsung Display	2014.8	462㎡
12	Wonju new building transfer business	Korea Tourism Organization	214.12	19.8㎡
13	Establishment of computer center in Vietnam	Samsung Display	2015.2	201.3㎡
14	Establishment of new government computer center	Sejong City	2015.4	21.6㎡
15	Established Taean New Company ICT Center	Korea West Power	2015.5	97.2㎡
16	Coex Center Construction Project	GKL	2015.6	43.2㎡
17	Samsung Electronics backed up the Chinese Xian factory	Samsung Electronics	2015.7	99㎡
18	Comprehensive disaster control room earthquake measures	Gangneung City	2015.8	5.76㎡
19	Computer center earthquake countermeasure	Road Traffic Service	2015.10	21.6㎡
20	Ulsan head office computer room (expansion)	Labor Welfare Corporation	105.10	36.7㎡

4. Seismic isolation Access Floor Technical Overview(4/4)

☐ Reference Installations

【Korea Electric Power Corporation】

NO	Business name	*ordering organization*	Delivery date	Installation area
21	Earthquake core equipment (charging per minute)	SK Telecom	2015.12	3.3㎡
22	Expansion of Vietnam plant (Hanoi)	Samsung Display	2015.12	204㎡
23	Disaster recovery center earthquake measures (Kyeryong center)	Department of Defense	2016.1.4	1,220㎡
24	General Situation Room (Seoul Government Building)	National Security Agency	2016.3.21	17.5㎡
25	Samsung Pyeongtaek P-Project (1st)	Samsung	2016.5.16	406㎡
26	KEPCO Gyeonggi Northern Headquarters	Korea Electric Power	2016.5.24	57.6㎡
27	General Situation Room Server Room (Sejong Government Office)	National Security Agency	2016.5.27	23.0㎡
28	119 General Situation Room (Sejong Government Building)	National Security Agency	2016.9.19	26.1㎡

4. Seismic isolation Access Floor Technical Overview(4/4)

□ Reference Installations

【Korea Electric Power Corporation】

NO	Business name	*ordering organization*	Delivery date	Installation area
30	Samsung Pyeongtaek P-Project (2nd)	Samsung Electronics	2016.8.16	363.0㎡
31	Samsung DSR Room (Head Office))	Samsung Electronics	2016.9.10	336.6㎡
32	Samsung Display (Vietnam)	Samsung Display	2016.10.11	267.3㎡
33	Sangam ICT Center construction project	Korea Housing Finance Corporation	2016.11.19	61.2㎡
34	New office transfer business (Jincheon, Chungbuk)	Korea Educational Development Institute	2016.12.23	78.2㎡
35	National Disaster Research Institute Computer Center (Ulsan)	National Disaster Research Institute	2016.12.24	8.2㎡

5. Seismic performance of products(1/3)

III

☐ US standards : **Telcordia GR63-CORE5.4.1(Issue4,2012) – Earthquake Test(Zone 4)**

Test Standards

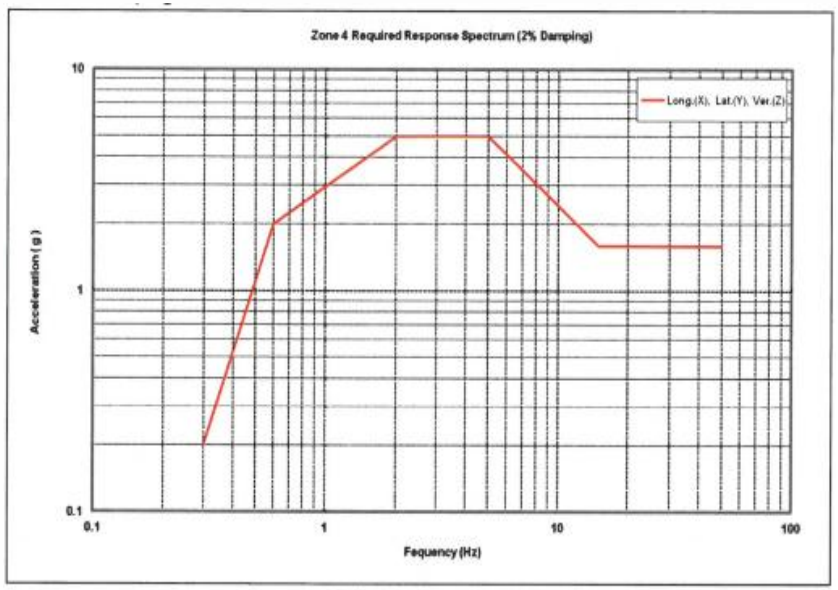


그림 3. 요구응답스펙트럼 (2 % Damping 적용)

표 2. 요구응답스펙트럼

전.후 방향 (X)		좌.우 방향 (Y)		수직 방향 (Z)	
주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)
0.3	0.2	0.3	0.2	0.3	0.2
0.6	2	0.6	2	0.6	2
2	5	2	5	2	5
5	5	5	5	5	5
15	1.6	15	1.6	15	1.6
50	1.6	50	1.6	50	1.6

Test report

Dt&C

(주)디 티 앤 씨
17042 경기도 용인시 처인구 유림로 154 번길 42,(유방동)
Tel : 031-321-2664, Fax : 031-321-0220

1. 성적서 번호 : DRCREL1611-0589
2. 신 청 인
   - 상 호 : ㈜ 엔타이어세이프
   - 주 소 : 경상남도 양산시 장기터 1 길 46 (주남동)
3. 시험성적서의 용도 : 품질 평가용
4. 제품명 / 모델명 : 면진테이블 / SP6000
5. 시험방법 : Telcordia GR-63-CORE 5.4.1 (Issue4, 2012) – Earthquake Test (Zone 4)
6. 시험기간 : 2016 년 11 월 22 일
7. 시험환경 : 온 도 (20 ± 2) °C, 습 도 (42 ± 3) % R.H.
8. 시험결과 : 첨부참조

확인	시험자	기술책임자
	성 명 : 이 영 록 (서명)	성 명 : 조 석 렬 (서명)

이 성적서는 시험의뢰인에 의해 제공된 시료에 한하며, 용도 이외의 사용을 금합니다.

2016 년 11 월 30 일

㈜디 티 앤 씨 대 표 이 사 (인)

시험성적서의 진위여부에 대한 확인이 필요하신 경우에는 report@dtnc.net으로 문의 부탁 드립니다.

TRF-RC-007(00)161110 본 시험성적서는 ㈜디티앤씨의 승인 없이는 복제 및 재발급이 금지됩니다. Pages: 1 / 41

5. Seismic performance of products(2/3)

III

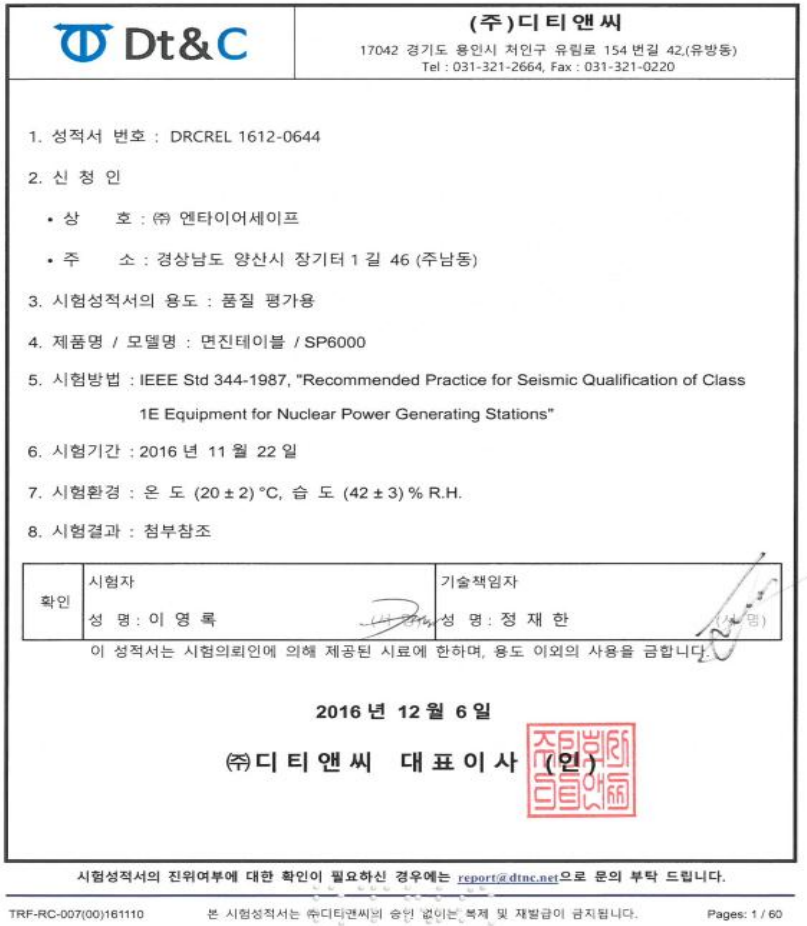
☐ International Atomic Energy Standards : **IEEE Std 344-1987,**

"Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"

Test Standards

OBE (Horizontal)		OBE (Vertical)		SSE (Horizontal)		SSE (Vertical)	
주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)
0.51	0.34	0.51	0.25	0.51	0.59	0.51	0.35
0.68	0.38	1.11	0.36	1.17	0.99	2.80	1.54
0.85	0.43	1.86	0.57	1.31	1.15	3.40	2.48
1.41	0.74	4.20	2.03	3.01	4.73	4.60	2.47
3.03	2.75	7.49	2.02	3.37	7.08	4.99	3.23
3.35	4.60	10.00	4.40	4.50	7.08	6.99	3.23
4.58	4.60	17.51	4.40	4.97	9.50	9.11	4.85
4.92	6.30	18.89	3.69	8.00	9.50	11.55	6.70
8.00	6.30	19.96	3.00	10.00	5.30	19.00	6.70
10.00	3.30	22.98	3.00	17.00	5.30	21.00	4.82
17.00	3.30	26.74	2.44	22.00	2.10	26.00	4.82
25.50	0.90	29.75	1.52	29.32	1.60	31.00	2.41
34.59	0.80	35.57	1.52	50.00	1.40	35.33	2.35
50.00	0.70	39.57	0.78	-	-	39.44	1.55
-	-	50.00	0.71	-	-	50.00	1.42

Test report



Dt&C

(주)디티앤씨
17042 경기도 용인시 처인구 유림로 154 번길 42,(유방동)
Tel : 031-321-2664, Fax : 031-321-0220

1. 성적서 번호 : DRCREL 1612-0644
2. 신 청 인
   - 상 호 : ㈜ 엔타이어세이프
   - 주 소 : 경상남도 양산시 장기터 1 길 46 (주남동)
3. 시험성적서의 용도 : 품질 평가용
4. 제품명 / 모델명 : 면진테이블 / SP6000
5. 시험방법 : IEEE Std 344-1987, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"
6. 시험기간 : 2016 년 11 월 22 일
7. 시험환경 : 온 도 (20 ± 2) °C, 습 도 (42 ± 3) % R.H.
8. 시험결과 : 첨부참조

확인	시험자	기술책임자
	성 명 : 이 영 록	성 명 : 정 재 한

이 성적서는 시험의뢰인에 의해 제공된 시료에 한하며, 용도 이외의 사용을 금합니다.

2016 년 12 월 6 일

㈜디 티 앤 씨 대 표 이 사 (인)

시험성적서의 진위여부에 대한 확인이 필요하신 경우에는 report@dtnc.net으로 문의 부탁 드립니다.

TRF-RC-007(00)161110 본 시험성적서는 ㈜디티앤씨의 승인 없이는 복제 및 재발급이 금지됩니다. Pages: 1 / 60

5. Seismic performance of products(3/3)

III

☐ Korean standards: National Radio Research Institute Announcement No. 2015-14
"Seismic test method of telecommunication facilities"

Test Standards

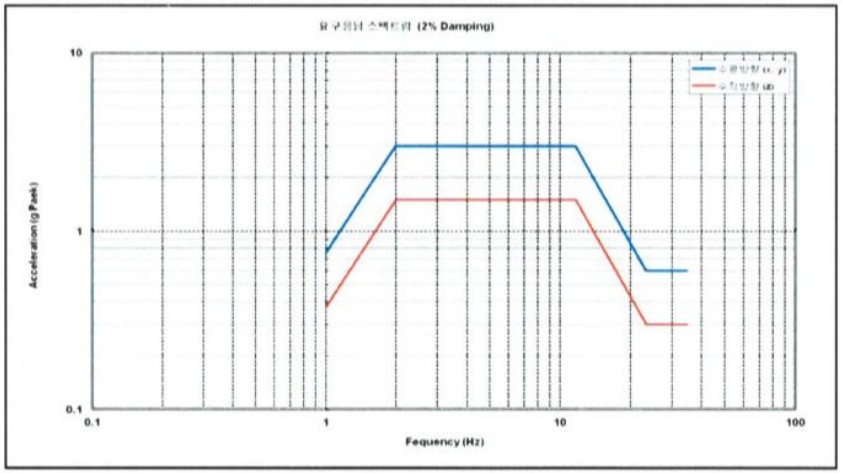


그림 3. 요구응답스펙트럼 (2 % Damping 적용)

Table 2. 요구응답스펙트럼

수평방향		수직방향	
주파수 (Hz)	가속도 (g)	주파수 (Hz)	가속도 (g)
1	0.75	1	0.375
2	3	2	1.5
11.67	3	11.67	1.5
23.33	0.6	23.33	0.3
35	0.6	35	0.3

Test report

진본

(주)디티앤씨
경기도 용인시 처인구 유림로 154번길 42(유방동)
Tel : 031-321-2664, Fax : 031-321-0220

발급번호 : DRCKREL1608-0261(1)
페이지 : (1) / (38) page

KOLAS

1. 신 청 인
• 상 호 : (주) 엔타이어세이프
• 주 소 : 경상남도 양산시 장기터1길 46 (주남동)
2. 시험성적서의 용도 : 품질 및 성능 평가용
3. 제품명 (모델명 / 일련번호) : 면진테이블 (SP6000 / -)
4. 시험기간 : 2016년 8월 8일
5. 시험방법 : 국립전파연구원 공고 제2015-14호 : 전기통신설비의 내진시험 방법
6. 시험환경
• 온 도 : (21 ± 2) °C • 습 도 : (54 ± 3) % R.H.
7. 시험결과 : 본문참조

이 성적서는 시험의뢰인에 의해 제공된 시료에 한하며, 용도 이외의 사용을 금한다.
"*" 표시된 시험결과는 시험기관의 인정범위 밖의 것임을 밝힙니다."

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IV

A Suggestion of Earthquakes Response for the Mid/long term

1. Need to construct Your Backup Center
2. Goal of constructing Backup Center
3. Key factors in constructing Backup Center
4. Skill level of Backup Center
5. Image of Backup center operations
6. Expected effect of constructing Backup Center

1. Need to construct Backup Center

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Large-scale natural disasters (earthquakes) cause damage to information systems and communication equipment. Because of that, the influence and loss that the Nepal central bank receives can influence the bank's durability

Disaster Occur

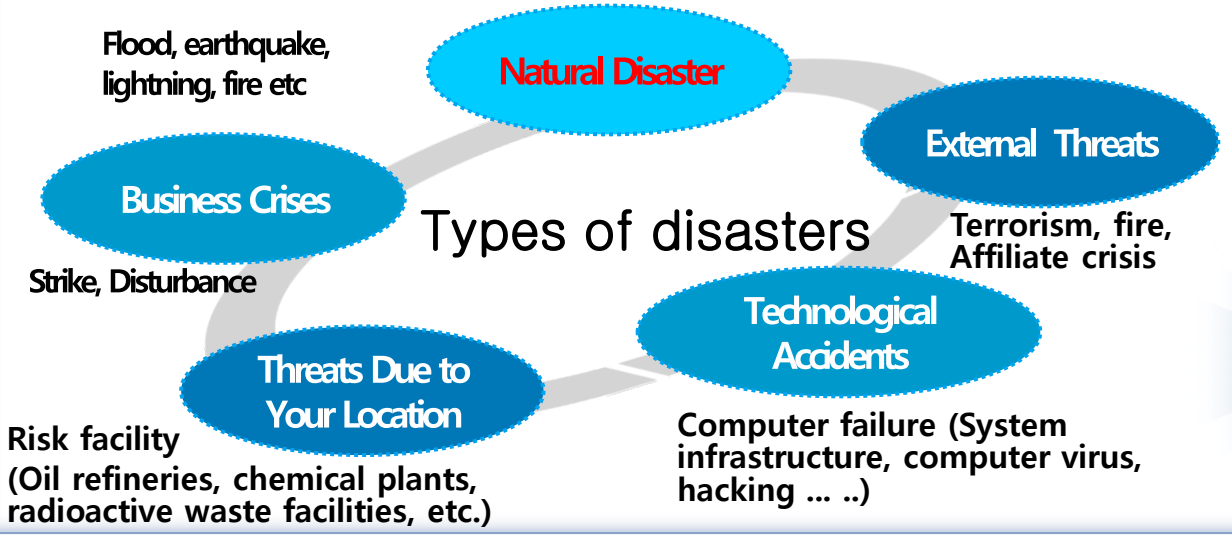
Automated business escalation

Hundreds of kilometers

Central bank(Operations Center)

Central bank(backup center)

■Disaster Factor of Operational Center



2.Goal of constructing Backup center

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By building High Availability Computational Backup Center of Nepal Central Bank, Nepal Central Bank strengthens national competitiveness in the event of a major earthquake, due to the durability of its business and the protection of information assets

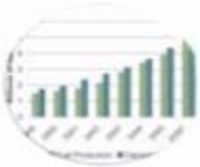
Established Nepal Central Bank Backup Computer Center in preparation for a massive earthquake

Building goal

- Continuous operating operation center in case of disaster by building backup center
- Designed Nepal central bank computing center with scalability and security based on availability and reliability
- Establish stable, cost-effective central bank backup computing center
- Established to meet the standards of high supervisory authority guidelines, legal and earthquake

Architecture

Construct



Capacity

Electricity

Airconditioning

Schedule

Security

Fire fighting

Budget

Integrated Operations

Design and construction for the worst natural disasters

3. Key factors in constructing Backup center

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Level 3+ The central bank backup center is at the level of a computer center that is capable of coping with disasters and providing uninterrupted operation and maintenance. Design based on the basic concepts of availability, scalability, security, and reliability when designing a central bank backup center.

Level 3+ : Non-stop Computer Center(Fault Tolerant Datacenter)

Availability and stability	▪ 99.982% ▪ Maintain down time due to infrastructure less than 1 hour 36 minutes a year
Task Influence	▪ **Levels applicable to management environments that meet 100% availability (24 * 365 operations)** ▪ Apply maintenance work window (MWW) which can maintain maintenance and establish facilities to minimize influence on daily business environment ▪ Adopted when a business impact resulting from an infrastructure failure has a high business impact.
Design goals	▪ **The basic design philosophy is N + 1 (one more than the number required for normal operation)** ▪ **The main system is supported by UPS and power generation facilities and is designed to maintain the building system for a considerable period of time in the event of a power outage through a limited redundant main infrastructure.**
Maintenance	▪ **All infrastructure equipment and distributed systems should be able to be maintained with minimal disruption to major facilities.**

Level 3+ The basic concept of data center design

1 Availability

Providing continuous service

-Implementation based facility for 24/7 non-stop operation

-Reduce business disruptions and maintain service continuity

2 Scalability

Support active response to changes in system environment

-Establish base environment to deal with future expansion

-Establishment of non-stop basis for system expansion

3 Security

Multi-level systematic security system support

-Securing exclusive facilities to prevent the effects of external factors

-Compliance with supervisory agency establishment guidelines

4 Stability

Minimize RISK and support rapid response system

-Built in a distance of 300km or more from the main center

-Implement redundancy and backup system for major facilities

4. Skill level of Backup Center

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The central bank backup center is constructed as a high-tech computer center capable of continuous maintenance in case of failure due to backup configuration.

type	ITEMS		L1	L2	L2+	L3	L3+	L4	Detail
Power plant	Commercial power faucet								Leased lines from different substations
	Water distribution facility								N+1 backup configuration of transformer
	Power trunk line								Power redundancy configuration
	UPS equipment								N+N redundancy configuration of UPS
	Generator facility								UPS and thermo-hygrostat 100% coverage and N+1 backup configuration
HVAC(Airconditioning)	Installation of cooling equipment								More than 25% free capacity design
	Air conditioning piping configuration								Air conditioning piping redundancy configuration
Server equipment room	PDU redundancy								Distribution board and secondary trunk redundancy configuration
	Power equipment dual power connection								Dual power equipment, dual power supply and single power equipment STS connection
	Interior (double seats for seismic isolation)								Built-up seismic double floor that can cope with earthquake
Facility operation	Facility Personnel Working Hours								Establishment of dedicated facilities and 24-hour work
	Non-stop maintenance possible	Power plant							Power plant can be maintained without interruption
		Airconditioning							HVAC can be maintained without interruption
		Plumbing equipment							Piping facility can be maintained uninterruptedly
Risk	Single Point of Failure								The existence of a single obstacle part of the infrastructure (STS etc.)
	Computing equipment Outage								Uninterrupted operation of all computing equipment

※ **Level 1 :** Basic equipment level **Level 2 :** Backing up of infrastructure **Level 3 :** Real-time, non-disruptive maintenance **Level 4 :** Redundant configuration of all infrastructure

5. Image of Backup center operation

IV

Integrated Operations Center

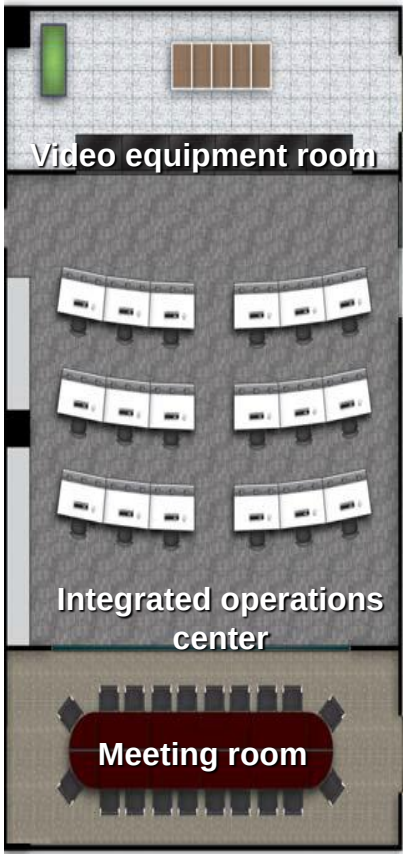
All of the operations center and backup center systems can be integrated into one system for operation and management.

Integrated operation center Central Command Center

- Systematic centralized integrated control system configuration
- Create a 24-hour 365 day commitment environment
- Ergonomic, sensible engineering design

Voice alarm system VAS

- managing various events occurring in computer equipment and infrastructure and being configured to be able to alarm by voice
- Early detection of conditions and shorter propagation time
- Rapid configuration and maintenance of event management system



Wallboard Display *Comprehensive situation system*

- Configuration of situational system for effective response of integrated control
- Eco-friendly LED DLP Cube with easy multi-screen configuration and simple maintenance (70 "2-stage, 6-column configuration)

FMS *Infrastructure facility management system*

- Integrated management and monitoring of distributed infrastructure facilities
- Power, air conditioning, fire fighting, door, CCTV, leak detection, etc.
- Reduce disaster recovery time by quickly responding to failures

KVM *remote access system*

- Remote access of computer equipment through KVM enhances the security of computer equipment and improves the top surface efficiency of computer room

6. Expected effect of constructing Backup Center

IV

It protects all the work of the central bank from earthquake damage and contributes to establishment of central bank position and improvement of national competitiveness

Improve IT service availability

Provide a foundation for improving the availability of IT services

- Establishment of computer center and infrastructure facilities in accordance with international standards
- Reduce business disruptions and maintain service continuity
- **Sufficient response to earthquake disaster**

Establishment of foundation for improvement of IT service through establishment of high availability computer center

Accepting Business Expansion

Accepting IT infrastructure needs as business grows

- Accepting load demand due to expansion of computer equipment
- Securing the basis of information equipment to cope with the rapidly changing market environment
- Establish base environment that can flexibly cope with future expansion

Enhancement of responsiveness for expansion of business and IT growth

Green Data Center

Establishment of foundation for global green IT center construction

- Establish goals, basic requirements, and implementation plan for Green IT Center
- Establish infrastructure to build infrastructure facilities to meet global regulatory environment
- Reduce operating costs through green data center and improve central bank image

Established green IT center through energy efficiency

Thank you !