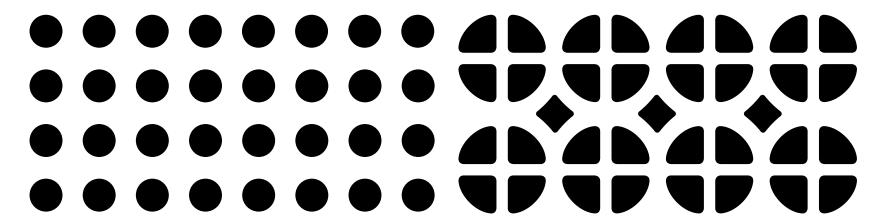
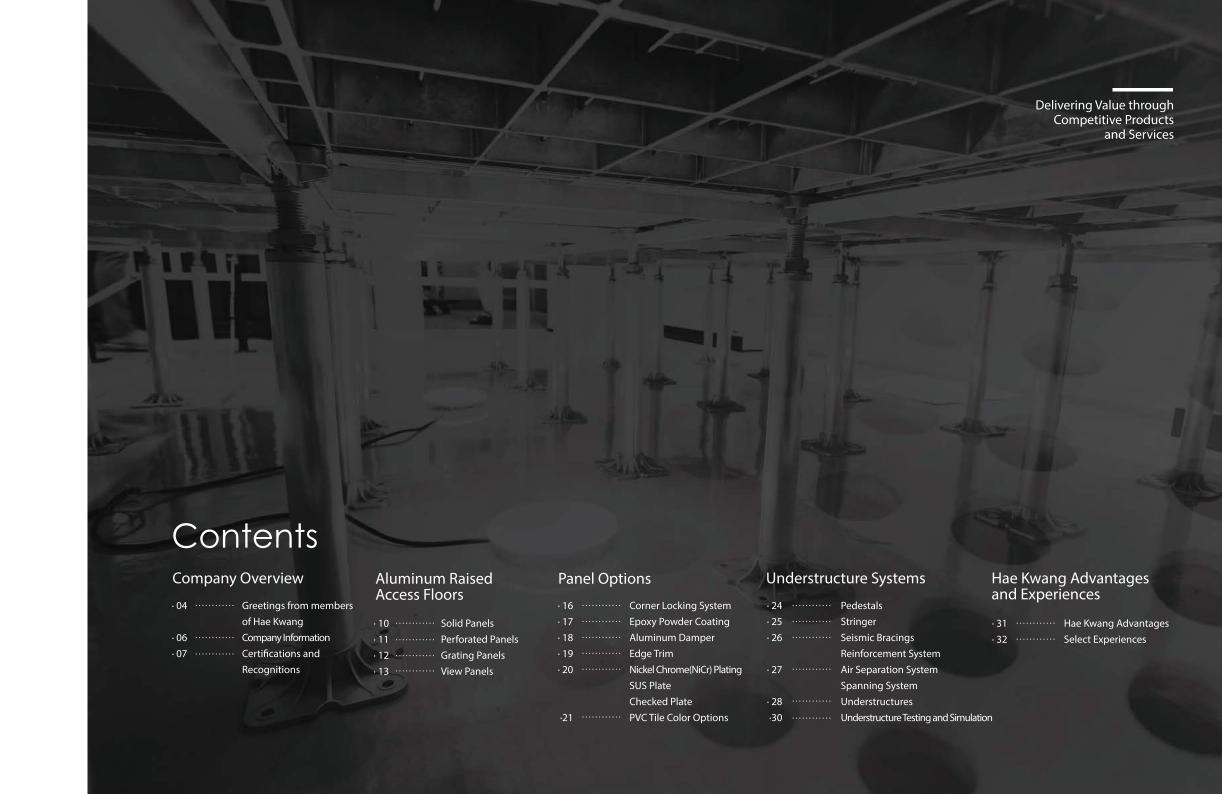


Raised Access Floor Systems





Raised Access Floor Systems



HAE KWANG,

Delivering Value through Competitive Products and Services

Since 1987, Hae Kwang has accumulated technical expertise in designing, manufacturing, and installing Aluminum Raised Access Floors and understructure systems from more than hundreds of cleanroom projects around the world. Our goal is clear. We aim to support the high-tech industry's continuous innovation by proactively meeting the needs of our customers through high-quality and competitive products and services. We are very proud to be a leading supplier of Aluminum Raised Access Floor Systems to major semiconductor and display manufactures around the world, and we will continue our efforts to understand what our current and potential customers need and timely react to provide the best solutions.

Through diverse studies and technology development, Hae Kwang will extend the field of high-tech cleanroom factory-related products and services to respond to changes in the future. We will make an effort to be a leading company and help in the development of our customers.

Thank you very much for your interest in our products and we look forward to building a strong and lasting relationship with you.

- From the executives and staff members of Hae Kwang -



Company Information

Certifications and Recognitions

Company Milestones

1987 06 23	Incorporation
1990 11 13	Selected as a promising small- and medium-sized enterprise
	by the Small & Medium Business Administration of Korea
1998 01 14	Acquired ISO 9001 Quality Management System Certification
1996 11 30	Awarded a \$5 million Export Presidential award
	by the Korean International Trade Association
1997 05 01	Approved as a technical innovation and development business entity
	by the small and Medium Business Administration
1998 11 30	Awarded a \$10 million Export Presidential award
	by the Korean International Trade Association
2000 12 18	Incorporated U.S. subsidiary, HK Techfloor LLC in Phoenix, AZ
2004 11 30	Awarded a \$20 million Export Presidential award by the
	Korean International Trade Association
2007 04 26	Selected as an INNO-BIZ company
2007 07 12	Selected as Innovative Small & Medium Sized Enterprise by INNO-BIZ
2010 04 26	Acquired INNO-BIZ extension certification
2012 01 06	Acquired INNO-BIZ extension certification
2013 09 24	Acquired OHSAS 18001 certification Norway DNV 109274-2012-HSO-KOR-DNV
	Selected as "Global Growth Potential Company" by the Korea Trade Insurance Corporation
2014 05 07	Certified as "Root Technology Company (Specialization in Die Casting)" by the
	Small & Medium Business Administration of Korea

Intellectual Properties

Number of	Patents	Design	Trademarks
Registration in Korea	12	21	6
Registration outside Korea	8	24	6

^{*} Countries including the U.S., Germany, China, and Japan

Major Customers











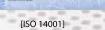












ISO 14001 | 2004 / KS Q ISO 14001 | 2004







[KDB Global Star Certification]







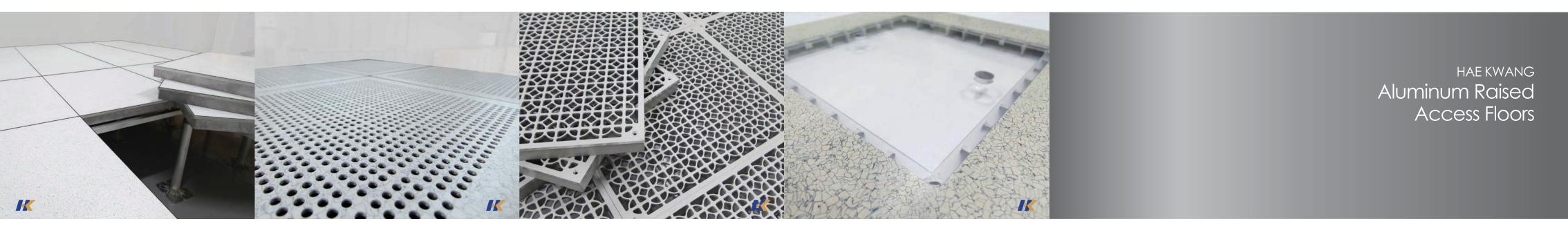
[Certificate of Promising Small and Medium Sized Enterprise]



[Certificate of Root Technology Company (Specialized in Die Castino



[Certificate of Global Growth Potential Company]



Perforated Panels

Advantages

- · Excellent loading capacity: 500~3,000 kgf @ 2 mm deflection (=1,100~6,600 lbf @ 0.08 inch deflection)
- · Precisely manufactured to meet dimensional requirements with minimum tolerance
- · Minimum emission of Volatile Organic Compounds (VOC's)
- Strict quality control to meet electrostatic or conductivity requirements
- · Extremely durable and recyclable

Model	Dimensions & Thickness (with 2T PVC Tile)	Concentrated Load 1/2 Edge	Ultimate Load 1/2 Edge
ABS 650	□ 600 mm x 38~44T	500 kgf	1,250 kgf
ABS 601FL	□ 600 mm x 45~47T	700 kgf	1,400 kgf
ABS 601LC	□ 600 mm x 46~50T	800 kgf	1,600 kgf
ABS 601C	□ 600 mm x 50~51T	900 kgf	2,200 kgf
ABH 602C	□ 600 mm x 40~55T	1,100 kgf	2,200 kgf
ABH 602F1S	□ 600 mm x 50~51T	1,100 kgf	2,500 kgf
ABH 602F1	□ 600 mm x 50~51T	1,300 kgf	3,000 kgf
ABH 602EXR	□ 600 mm x 50~51T	1,400 kgf	3,600 kgf
ABH 602EXC	□ 600 mm x 50~55T	1,500 kgf	3,200 kgf
ABH 2000	□ 600 mm x 50~55T	1,600 kgf	4,000 kgf
ABH 636	□ 600 mm x 50~55T	3,000 kgf	6,000 kgf
ABH 240NSTR	□ 24″x 41~50T	1,500 lbf	4,000 lbf
ABH 240NEXR	□ 24″x 46~50T	2,200 lbf	5,700 lbf
ABH 240STR	□ 24″x 50T	2,600 lbf	5,200 lbf
ABH 240EXR	□ 24″x 50~59T	3,300 lbf	6,600 lbf



Perforated Panels

Hae Kwang's Perforated Panels with 1,296 or 1,024 chamfered holes provide all the features of Solid Panels and nominal air open ratios ranging from 14~26% to meet specific airflow requirements inside cleanrooms. Each Perforated Panel is carefully checked to eliminate any potential contaminants, including adhesive residues.

Advantages

- · Nominal Air open ratios ranging from 14% to 26%
- (=1,100~6,600 lbf @ 0.08 inch deflection)
- · Precisely manufactured to meet dimensional requirements with minimum tolerance
- Minimum emission of Volatile Organic Compounds (VOC's)
- · Excellent loading capacity: 500~3,000 kgf @ 2 mm deflection . Strict quality control to meet electrostatic or
 - conductivity requirements
 - · Extremely durable and recyclable

Model	Dimensions & Thickness (with 2T PVC Tile)	Open Ratio	Concentrated Load 1/2 Edge	Ultimate Load 1/2 Edge
APS 650	□ 600 mm x 38~44T	16, 20%	500 kgf	1,250 kgf
APS 601FL	□ 600 mm x 45~47T	18, 20%	600 kgf	1,200 kgf
APS 601LC	□ 600 mm x 46~50T	14, 16, 18, 22%	700 kgf	1,400 kgf
APS 601C	□ 600 mm x 50~51T	14, 16, 18, 22%	800 kgf	2,000 kgf
APH 602C	□ 600 mm x 40~55T	14, 16, 18, 22%	1,000 kgf	2,200 kgf
PH 602F1S	□ 600 mm x 50~51T	18, 20%	1,000 kgf	2,400 kgf
PH 602F1	□ 600 mm x 50~51T	18, 20%	1,200 kgf	3,000 kgf
H 602EXR	□ 600 mm x 50~51T	14, 16, 18, 22%	1,300 kgf	3,500 kgf
H 602EXC	□ 600 mm x 50~55T	14, 16, 18, 22%	1,400 kgf	3,000 kgf
PH 2000	□ 600 mm x 50~55T	14, 16, 18, 22%	1,600 kgf	3,800 kgf
NPH 636	□ 600 mm x 50~55T	14, 16, 18%	3,000 kgf	6,000 kgf
1 240NSTR	□ 24" x 41~50T	18, 22%	1,500 lbf	4,000 lbf
1 240NEXR	□ 24" x 46~50T	18, 22%	2,200 lbf	5,700 lbf
H 240STR	□ 24" x 50T	14, 16, 18, 22%	2,400 lbf	4,800 lbf
H 240EXR	□ 24″ x 50~59T	14, 16, 18%	3,000 lbf	6,000 lbf

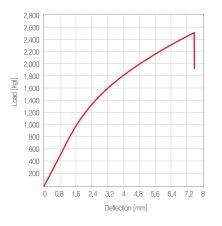
10 HAE KWANG CO., LTD. Raised Access Floor Systems 11

Grating Panels

Hae Kwang's non-directional grating patterns with nominal air open ratios ranging from 51~54% facilitate unrestricted smooth airflow and minimize vibration from rolling loads. Hae Kwang's Grating Panels are ideal for use in air-return chase and ballroom areas.

Advantages

- · Nominal Air open ratios ranging from 51% to 54%
- · Excellent loading capacity: 500~1,000 kgf @ 2 mm deflection (=1,100~2,200 lbf @ 0.08 inch deflection)
- Available with conductive or nonconductive coating
- · Strict quality control to meet electrostatic or conductivity requirements
- · Extremely durable and recyclable



<Sample Testing Result AGH 608 1/2 Edge>

Model	Dimensions & Thickness	Open Ratio	Concentrated Load 1/2 Edge	Ultimate Load 1/2 Edge
AGLS 609	□ 500 mm x 34~41T	51%	500 kgf	1,250 kgf
AGS 609	□ 600 mm x 38~44T	51%	700 kgf	1,750 kgf
AGH 607	□ 600 mm x 45~47T	54%	900 kgf	1,800 kgf
AGH 608	□ 600 mm x 41~42T	51%	1,000 kgf	2,000 kgf
AGS 240	□ 24″x 49~51T	49%	1,540 lbf	3,080 lbf
AGH 240EX	□ 24″x 50~55T	51.5%	2,200 lbf	4,400 lbf
AGH 240UEX	□ 24″x 50~59T	45%	3,300 lbf	6,600 lbf

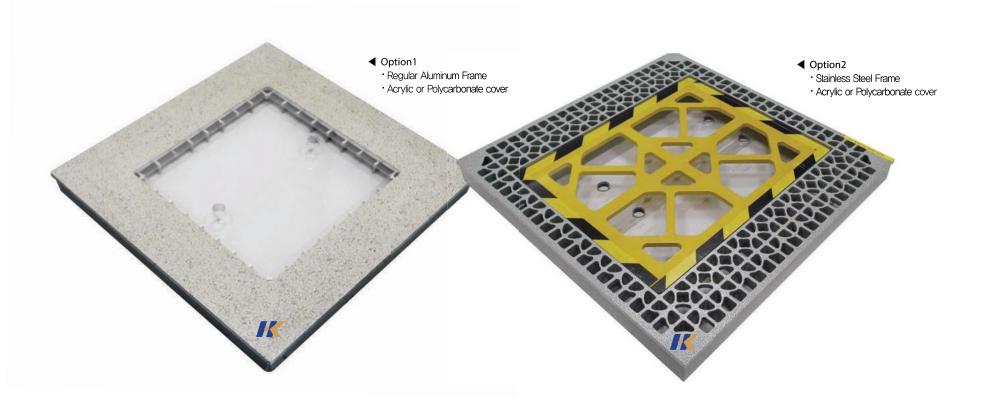
View Panels

View Panels

Manufactured per dimensional specifications of customers, View Panels allow visibility and easy access to gauges, piping, and electrical wiring that run under cleanroom floors.

Advantages

- * Customized acrylic or polycarbonate inserts allow visibility and easy access to under cleanroom floors
- · Can be customized to meet specific loading requirements with regular Aluminum frame or stainless steel frame





HAE KWANG Panel Options

· 16	 Corner Locking System
· 17	 Epoxy Powder Coating
· 18	 Aluminum Damper
· 19	 Edge Trim
· 20	 Nickel Chrome(NiCr) Plating
	SUS Plate
	Checked Plate
. 21	 PVC Tile Color Options

Corner Locking System

Corner Locking System

Corner Locking System affixes the four corners of Aluminum Panels to the pedestal heads with SUS or steel bolts and minimizes movements of and gaps between Aluminum Panels after installation, especially during the tool move-in process.



Epoxy Powder Coating

Epoxy Powder Coating

Epoxy Powder Coating enhances electrical conductivity, chemical resistance, and abrasion resistance of Aluminum Panels.

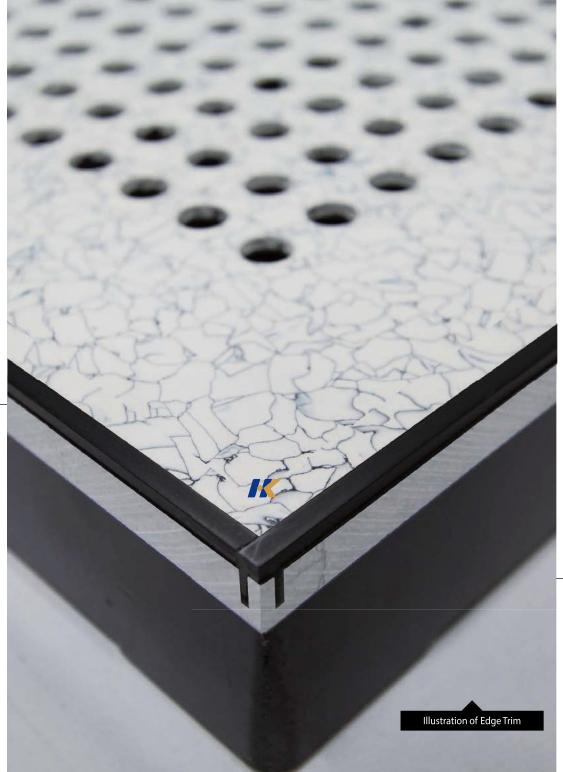


Aluminum Damper



Aluminum Damper

Hae Kwang's Perforated or Grating Panels can be delivered with Aluminum Dampers. Easily adjustable from the top of panels, the Aluminum Dampers allow customers to effectively maintain uniform balancing of airflow inside cleanrooms.



Edge Trim

Edge Trim

PVC trims on the edges of Aluminum Panels can prevent slipperiness and delamination or deformation of PVC tiles.

Nickel Chrome (NiCr) Plating

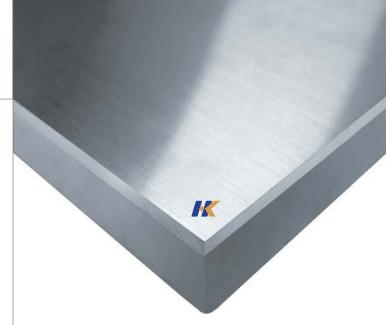


Nickel Chrome(NiCr) Plating

Typically applied to Aluminum Panel installed in tool move-in areas and Automatic Guided Vehicle (AGV) lines inside cleanrooms, Nickel Chrome(NiCr) Plating strengthens panels' resistance to chemicals, corrosion, and abrasion. Moreover, NiCr plating minimizes decoloring and enhances the antistatic features of Aluminum Panels.

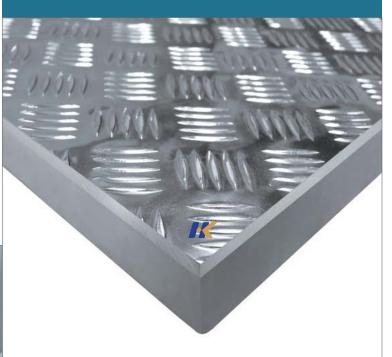
SUS Plate

Mainly installed in Automatic Guided Vehicle (AGV) lines inside cleanrooms, Aluminum Panels attched with SUS Plates have higher loading capacities and stronger resistance to abrasion and decoloring than normal Aluminum Panels.



SUS Plate

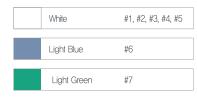
Checked Plate



Checked Plate

Preventing slipperiness and enhancing abrasion resistance of Aluminum Panels, Checked Plates are typically attached on top of Aluminum Panels in areas of heavy foot traffic inside cleanrooms.

PVC Tile Color Options

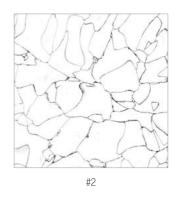


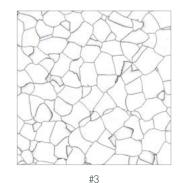
Light Red	#8
Grey	#9
Black	#10

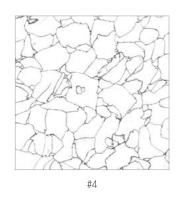
PVC Tile Color Options

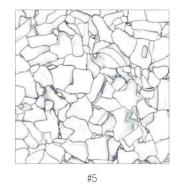
PVC tiles on Aluminum Panels allow for more comfortable walking while controlling electrostatic discharge or electrical conductivity on the floors of cleanrooms. Various color options of PVC tiles provide different interior choices.



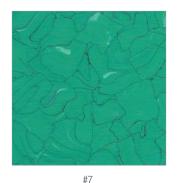


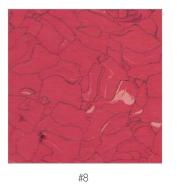
















#10



HAE KWANG Understructure Systems

· 25	 Stringer
∙ 26	 Seismic Bracings
	Reinforcement System
. 27	 Air Separation System
	Spanning System
· 28	 Understructures
. 30	 Understructure Testing and Simulation

Pedestals

Pedestals

Available in Aluminum, steel or combination thereof, Hae Kwnag's custom-designed Pedestals have been proven to meet any axial loading requirements. Moreover, Hae Kwang's Pedestals provide flexibility in height adjustment (typically ≥ ±25 mm).

Strengths and Properties

- · Finished Floor Height (FFH): 160~1,500 mm (6.30~59.06 inch)
- · Axial Loading Capacity: 4,000~15,000 kgf (8,800~33,000 lbf)
- Available in bare Aluminum, electrocoating(e-coating), or Epoxy Powder Coating finishes.

[Head]		
All Hood	U2 Haad	611 Head

[Wire Mesh Pad & Tile]



Type	FFH Height ±25 (mm)	Detailed S	Axial Load (↓5%)	
Aluminium S/D	160~600	Al. Base Plate : Φ113.6 Al. Tube : Φ28.4 Al. Cap : Φ36*14	Al. Bolt : 7/8 Inch Al. Nut : 31*16.5*7/8 Inch Al. Head : 116*116*41.5	4,000 kgf (8,800 lbf)
Aluminium H/D	250~1,000	Al. Base Plate : 150*150 Al. Tube : Ф50.7 Al. Adaptor : Ф50.8*47.3	Al. Bolt : 1 Inch Al. Nut : 35*17.4*1 Inch Al. Head : 116*116*41.5	5,800 kgf (12,500 lbf)
Steel S/D	300~1,000	St. Base Plate : 130*130*3.2T St. Tube : Ф48 St. Top Plate : Ф58*9T	St. Bolt : M16 St. Nut : 27*16T*M16	7,500 kgf (16,500 lbf)
Steel H/D	300~1,500	St. Base Plate : 150*150*3.2T St. Tube : Ф60.5 St. Top Plate : Ф70*9T	St. Bolt: M16 & M20 St. Nut: For M16 — 27*16T*M16 2ea & Locking Nut 1ea For M20 — 29*16T*M20 3ea Al. All Long Head: 116*116*90	M16 8,000 kgf (17,600 lbf) M20 10,000 kgf (22,000 lbf)
H2 Pedestal	215 & 250 (Only)	Al. Base & Tube : 110*110*85 (All-in-one support)	St. Bolt: 1 Inch*120L (Pitch 85) St. Bolt: 1 Inch * 145L (Pitch 110) St. Nut: 1 Inch * 21T Al. H2 Head (1 Inch Steel)	15,000 kgf (33,000 lbf)
H3 Steel S/D Pedestal	250~1,000	St. Base Plate : 130*130*3.2T St. Tube : Φ48 St. Top Plate : Φ58*9T	St. Bolt : 1 Inch *125L St. Nut : 1 Inch * 21T Al. H3 Head (1 Inch Steel)	10,000 kgf (22,000 lbf)
H3 Steel H/D Pedestal	250~1,500	St. Base Plate : 150*150*3.2T St. Tube : Ф60.5 St. Top Plate : Ф70*9T	St. Bolt : 1 Inch *125L St. Nut : 1 Inch * 21T Al. H3 Head (1 Inch Steel)	10,000 kgf (22,000 lbf)

Stringer

Hae Kwang's Aluminum Stringers are offered in two different sizes to be compatible with both 24" and 600 mm Raised Access Floor Systems.

Providing excellent additional lateral support during tool move-in, the Stringers are available in bare Aluminum, electrocoating(e-coating), or Epoxy Powder Coating finishes.





|| Stringer

Seismic Bracings

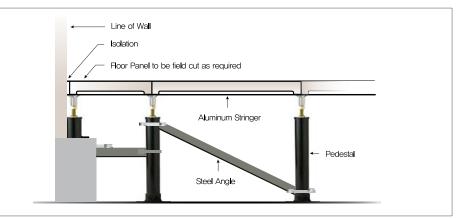
Reinforcement System

Air Separation System

Spanning System

Seismic Bracings

Hae Kwang's Seismic Bracings add strength to Pedestals against lateral forces exerted during tool movie-in or seismic activity. They are typically installed along the inner perimeters or expansion joint areas of cleanrooms.





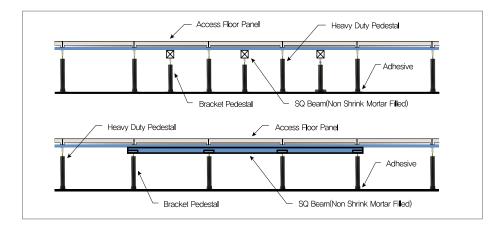
[Type 1 - Aluminum Bracing]



[Type 2 - Turnbuckle]

Reinforcement System

Hae Kwang's Reinforcement System increases the loading capacity of Raised Access Floor Panels installed in areas where heavy tools and equipments are relocated or situated.

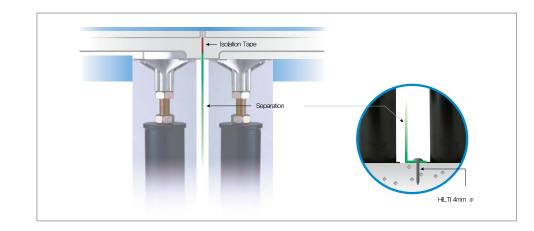


Advantages

- Can be installed without changes in the existing structure
- More Convenient and lower-cost reinforcement system than reinforcement with H-Beam or additional posts.

Air Separation System

Made of galvanized steel or Aluminum sheet with optional electro or Epoxy Powder Coating, Hae Kwang's Air Separation System can effectively segregate air streams under the floor of a cleanroom or between separate cleanrooms with different airflow requirements.

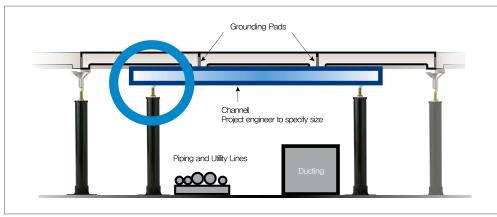


Advantages

* Convenient separation of airflows under the floor without moving or changing the installed Raised Access Floor Panels

Spanning System

Hae Kwang's Spanning System enables the installation of Raised Access Floor Panels while maintaining the same sub-floor level layout for ducting, piping, or utility lines.



Advantages

- · Can be installed without a significant change in the existing structure
- · Easier reinforcement than the conventional square pipe and post systems
- Convenient sub-floor level maintenance

With the second second

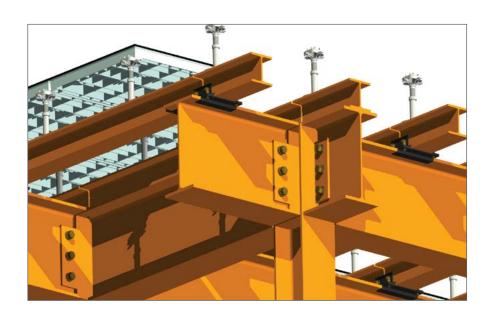


"Pedestal Type"
Understructures

Consists of Main and Sub H-beams, Hae Kwang's customized "Pedestal Type" understructure can provide large subfloor space and uniform loading capacity of more than 1,000 kgf/m² for cleanrooms without a separate return plenum.

Advantages

- · Post Pitch: 600~3,600 mm (23.62~141.73 inch)
- · Finished Floor Height (FFH): 250~3,000 mm (9.84~118.11 inch)
- · Height adjustable ≧ ±25 mm range

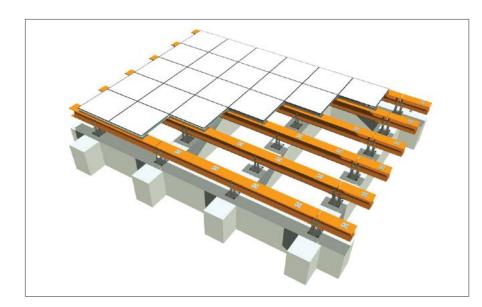


"Flat Pad Type" Understructures

Typically installed on a concrete waffle structure,
Hae Kwang's customized "Flat Pad Type" understructures
allow for the faster installation of a Raised Access Floor
System in cleanrooms with a high loading requirement.
A typical "Flat Pad Type" understructure consists of a
four-bolt-type base plate, sub H-beam, and metal flat pads.

Advantages

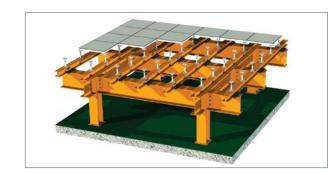
- Post Pitch: 600~3,600 mm (23.62~141.73 inch)
- · Finished Floor Height (FFH): 250~400 mm (9.84~15.75 inch)
- · Convenient and Cost-Efficient



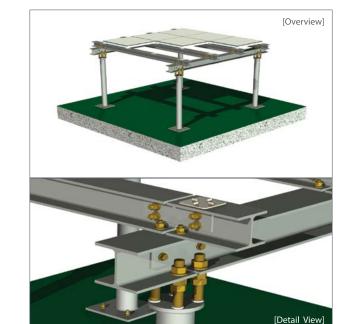




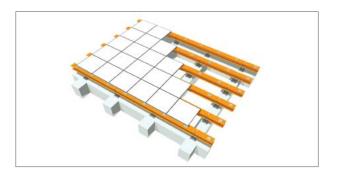




[Single H-Beam + Pedestal Type]



[Double H-Beam + 4Bolt Post + Flat Pad Type]



[Single H-Beam + 4Bolt Stud Post + Flat Pad Type]

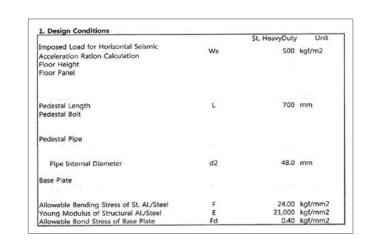
Understructure Testing and Simulation

Hae Kwang Advantages

Understructure Testing System

Via Hae Kwang's customized Understructure Testing System, customers can perform a live loading test on the Mock-up Raised Access Floor Systems that they intend to use in their cleanrooms.

Also, the accumulated testing data and know-how's enable Hae Kwang to help its customers find the optimal Raised Access Floor Systems that meet their needs at minimal costs.



Hae Kwang's Understructure Testing System is...



Structural Calculation

New Structural Design

Recommendation and

Creation of a Database of

Test Results



Structural

Calculation with

Actual Data



Design of the

Optimum Structure







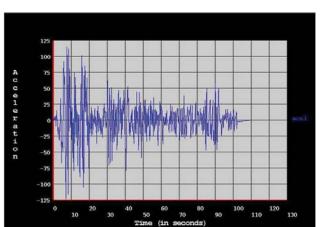


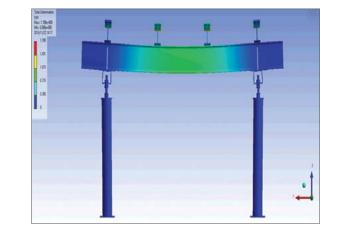
Live Testing

Actual Testing









Aluminum Panels

- · In-house design capabilities
- · Stable and reliable loading capacity to meet individual customers' needs
- · Minimum emission of Volatile Organic Compounds (VOC's)
- · Premium cleanroom products via a "Clean" manufacturing process

Understructures

- · Confirmation of customer's specifications via real-time testing simulations
- · In-house understructure designing capabilities to provide customized solutions

Raised Access Floor System Installations

- · More than 20 years of accumulated installation know-how's
- · Proven installation capability from various semiconductor, display, and data centers around the world











Preferred Supplier of Raised Access Floor System Products

and Services by the Leading Global Customers









30 HAE KWANG CO., LTD. Raised Access Floor Systems 31

Select Experiences

Motorola

Intel Ireland

IMEC 3SUN

Zeiss

Motorola

Mikron

Angstrem T

GULF Pharm

Western Digital Seagate

Showa Denko

Western Digital

Hewlett-Packard Seagate

Texas Instrument

Analog Device

AIN

UMCi

SSMC











Samsung Electronics Samsung Display

LG Display

SK Hynix

StatsChipPAC Korea

Advantest Korea

Shinhan Bank Data Center

POSCO Data Center

USA

Intel

GLOBALFOUNDRIES

Samsung Electronics Austin Texas Instrument

* Taiwan

AUO UMC TSMC

TICP

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BOE Samsung Electronics Xian

SK Hynix

Micro Electronic SAE

Japan

TOSHIBA TMD



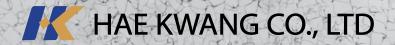
Samsung Electronics

Sembmarine

32 HAE KWANG CO., LTD.

Singapore

Raised Access Floor Systems 33



Locations in Korea

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Business Card