

MULTI-STIFFENER

- constructability
- economic feasibility
- safety

※ This product was developed by the Korea Occupational Safety and Health Agency to prevent industrial accidents



산업재해예방

안전보건공단



Shortcut to JIHO blog



JIHO Co., Ltd.

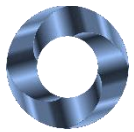
2-3, Gimhae-daero 991beon-gil, Hallim-myeon,
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TEL. 055-339-5147 . FAX. 055-339-5148

E-MAIL : jihold316@naver.com

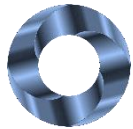
HOMEPAGE : www.ji-ho.co.kr

MULTI-STIFFENER



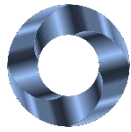
economic feasibility

- Easy to install
- Eradication of Stiffener non-construction cases
- Length-adjustable versatility



constructability

- non-contact welding
- Reusable
- No need for high-quality personnel



safety

- Anyone can reinforce when deformation occurs
- Pre-removal of hazards such as fire, explosion, electric shock

※ This product was developed by the Korea Occupational Safety and Health Agency to prevent industrial accidents

Patent application number : 10-2016-0012328 Date of application : 2016. 02. 01.
An apply Institution : Korea Safety & Health Agency



DEVELOPMENT BACKGROUND AND PURPOSE

○ Construction site technical support continues to cause **deformation** of **earth barrier** facilities or subsidence of background

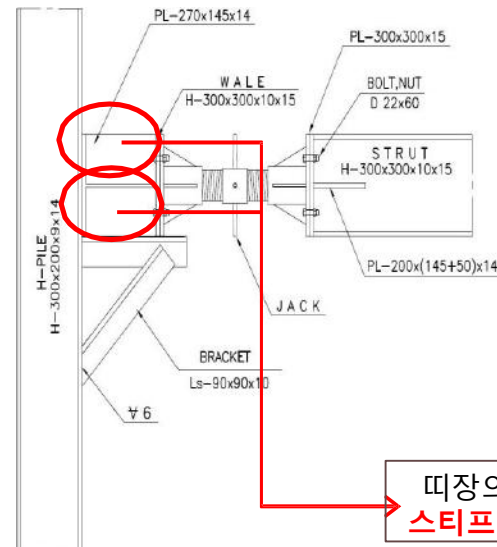
→ Major cause : **Failure to comply** with design drawings
[**Not installed** stiffener of waling, **Over excavation**, etc.]

○ **Concentrated in load** of **waling** Stiffener installation is important, but there are repeated cases of non-installation due to inconvenience of **construction and cost reduction**.

▶ **Low cost and safety ↑, Versatility ↑**

Easy to construct

Product development and distribution required



띠장의
스티프너

Current Stiffener of waling Problems with Installation



Risk of welding operation itself ↑
electric shock, fire explosion,
occupational illness
[welding scar, muscular skeletal disease
etc.]



Constructability ↓

- Work takes **more time** than **non welding**
- **Upward welding** is difficult, **Damage to the skin** due to welding fire during work

Economic Feasibility ↓



- **Unreusable**, Unable to change location
→ Economic Feasibility ↓
- Labor costs by **experienced welders** ↑,
Labor costs due to **long hours** ↑



← 스티프너(Stiffener)

$$\text{작용 총토압}(P_A) = \frac{1}{2} \times K_A \times \gamma \times H^2$$

$$\text{토압 작용위치} = \frac{1}{3} \times H$$

* 작용 총토압(P_A) ∝ 굴착심도(H) 제곱에 비례

Φ : 흙의 마찰각
γ : 흙의 단위중량
 K_A : 주동토압계수

매우 위험!!

총토압 P_A

H : 굴착깊이

Strut

총토압 증가율

1m 추가 굴착: 36.1%
2m 추가 굴착: 77.8%
3m 추가 굴착: 125.0%

<스티프너(Stiffener) 미설치 시 흙막이가시설 붕괴 메카니즘>

Strut(버팀보) 축하중 증가 → 띠장의 전단응력 증가 → 띠장의

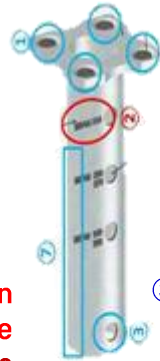
국부좌굴 발생 → 띠장의 변형 및 전단파괴 → Strut 편심 발생 →

스크류잭 파괴 → 흙막이가시설 무너짐



[Photo] Waling Deformation Cases

MULTI-STIFFENER DESIGN



①: A magnet for the prevention of falling off due to its own weight (4 each of the top and bottom plates)[Safety Design]

②: Installation length by inner tube hole Indication (Displaying Size Numbers) [Ergonomic design]

④: Length-adjustable fixing pin loss prevention hardware (Split pin function, for loss prevention) [Safety design]

③: A hole that is the smallest size for storage [Practical Design]

⑤: Safety Guide Design for Moving Direction according to Rotation Direction [Ergonomic Design]

⑦: Hole orientation retention function groove for fixing pin installation

(Exterior convex form, inner tube concave shape)

[Ergonomic Design]

⑥: Cautionary label (Indicate the product model name, manufacturer, year and month of production, allowable load, compliance requirements at installation, disposal standards, etc. to guide the safety management of the multi-stiffener) [Safety design]

Stiffener ver.1

■ waling and stiffener standard the present situation (example)

No	waling size	Stiffener size	Note
1	H-250×250×9×14	PL-220×120×14	primarily used standard in construction and civil engineering Sites
2	H-300×200×9×14	PL-270×95×14	
3	H-300×300×10×15	PL-270×145×14	
4	H-300×305×15×15	PL-270×145×14	
5	H-350×350×12×19	PL-312×169×14	
6	H-440×300×11×18	PL-404×144×14	Some Underground Road Sites
7	H-700×300×13×24	PL-652×143×14	

※ If the size of the waling is significantly larger than the general standard, a long member of the inner tube can be manufactured and used, when used for reinforcement other than the waling, it can be custom-made by selecting the optimal cross section after structural review in consideration of the application, load, and specification.

MULTI-STIFFENER DESIGN



①: A magnet for the prevention of falling off due to its own weight (4 each of the top and bottom plates)[Safety Design]



③: Maximum load higher than 1st stiffener (Used for subway construction, etc.) [Safety Design]

②: Safety Guide Design for Moving Direction according to Rotation Direction [Ergonomic Design]

④: Prevent hand separation when working with one hand external diameter. [Practical Design]

⑤: Cautionary label (Indicate the product model name, , year and month of production, allowable load, compliance requirements at installation, disposal standards, etc. to guide the safety management of the multi-stiffener) [Safety design]

Stiffener ver.2

※ The stiffener can be manufactured from 250 to 450 and can be custom-made after structural review in consideration of the purpose, load, and standard.

ANALYSIS DATA SUCH AS ADVANTAGES OF MULTI-STIFFENER



■ Advantages over weldable stiffener

■ Economic Feasibility, Constructability, Excellent safety

- Reusable by non welding, Economic feasibility due to no need for high-quality personnel. ↓
- Easy to install, Can be eradicated non-installed case stiffener
- Fast reinforcement for anyone when deformation occurs
- Length adjustable versatility ↑
- There is no welding work, fire explosion and electric shock hazards are eliminated in advance

■ Advantages over non weldable stiffener

■ Low production cost, easiest construction so economical Feasibility ↑

■ Easy for length adjustment so versatility ↑

■ Short working time, low risk of falling during work ↓

■ Safety Guide Design for Moving Direction according to Rotation Direction so human error ↓

Working time ↓, breakage of hardware ↓

■ Analysis of Welded Stiffener Installation Cost

No.	waling Size	Stiffener Size	Materials costs	Labor costs	Total	note
1	H-300x300x10x15	PL-270x145x14	7,500 won	13,500 won	21,000 won	Private site of order
2	H-300x305x15x15	PL-270x145x14	13,500 won	19,000 won	32,500 won	00City site of order

■ Comparison of working hours and labor costs based on how stiffener is installed

Sortation	Working hours	Labor costs	Labor costs/100per
Welding stiffener	20minute/per (3 per hour, 24 per day)	Welder: 250,000 won/day	1,040,000 won (100ea:4.16day)
Multi-stiffener (non-welding)	1 minute/per	Ordinary worker: 160,000 won/day	33,000 won

■ Economic Analysis Cases

00 Industry / 00 Underpass Site (Public order: 1.2 km in extension, 8,000 required stiffeners)

- Budget savings: KRW 60,000,000
(welding: KRW 260,000 → Multi-Stiffener: KRW 200,000)

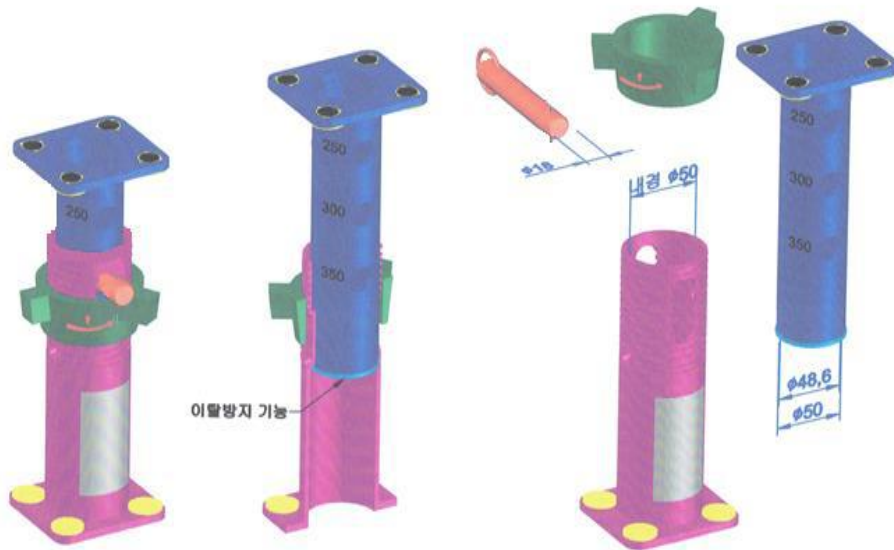
※ Welding stiffener: 8,000 pieces x 32,500 won = 260,000 won,
Multi-Stiffener ver.1 : 8,000 pieces x 25,000 won = 200,000 won

Economic efficiency is high due to additional budget savings when considering multi-stiffener reuse and minimum cost expediting.

ANALYSIS DATA SUCH AS ADVANTAGES OF MULTI-STIFFENER

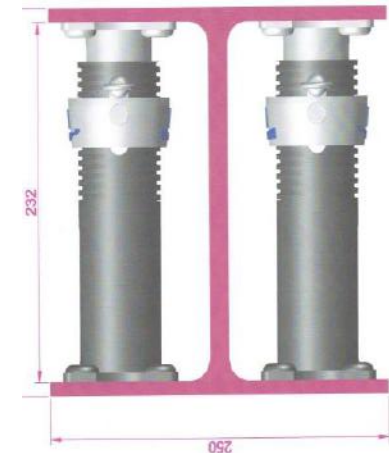


■ Drawing for Multi-Stiffener Fabrication



■ How to Install Multi-Stiffener

- (1) Check the length imprinted on the inner pipe to conform to the specification of the waling
- (2) Insert the length adjustment pin to operate the pin escape prevention device
- (3) Install at the appropriate location on the waling
 - If you have a bolt : Insert external pipe into Bolt [M22]
 - Without bolts: Stiffener's magnet attached to the flange of the waling
- (4) Fine length adjustment by hand using length adjusting female screws
- (5) Install the stiffener close to the waling and hit it once with a hammer to prevent it from falling off



CONSULTATION RESULTS

■ Expert and Field Officer Advisory Results

- ▶ 2015.09.24 : Construction Safety Team's own meeting
 - Competitive in terms of constructability and economic feasibility.
- ▶ 2015.10.06~10.20 : Expert advice
 - Consultation Results of Structural Engineers and Soil Engineers at the Industrial Complex Headquarters : Constructability and Economic feasibility ↑
 - Consultation results of Pukyong National University soil professor and advisory committee member : Constructability and Economic feasibility ↑
- ▶ 2015.10.07~11.30 : Meeting with construction site officials
 - Contribute to cost reduction by enabling VE when checking safety and quality control by institutions
 - Expected to actively reflect design changes
- ▶ 2015.10.27: Job Invention Report [Management Planning Office of the Corporation]
- ▶ 2015.11.23: Request for structural safety review [Busan Headquarters → Industrial Complex Headquarters Construction Disaster Prevention Office]
- ▶ 2015.12.11: Structural safety review results "Structural safety" [Research by structural experts at Industrial Complex Headquarters]
- ▶ 2020.07.07: Meeting with Doosan Engineering and Musung Construction Silent Construction Officials
"Quick construction reduces construction costs and improves structural safety"



■ Results of Structural Safety Review by Structural Engineers at Headquarters [2015.12.11]

- ▶ Review cross-sectional specifications
 - Internal and external thickness: Inner pipe [T=2.6 mm or more], Exterior [T=2.0 mm]
 - Thickness of support pin: T=17 mm
- ▶ Multi-Stiffener's action maximum axial force is 100KN. It can be installed on the upper and lower parts of the waling to further resist the axial force of 200KN.

Sortation	Maximum stress	Allowable stress	Result
Inner pipe axial stress	121.4MPa	133.0MPa	O.K
External pipe axial stress	121.1MPa	133.0MPa	O.K
Base plate bending stress	41.1MPa	140MPa	O.K
Base plate bending stress	49.3MPa	140MPa	O.K
Supporting pinshear stress	82.0AMPa	88MPa	O.K

- ▶ Safety can be secured by additional installation in order to resist larger axial forces due to ground conditions or depth.

CONSULTATION RESULTS



■ 00 Underpass Field Interview Results

- It is **easier to install** than the existing method, so it **will be actively used in production**
- It's a **strength** because it can be reinforced by **anyone immediately in case of deformation of the band**.
- The site takes about 8,000 stiffeners, **so we hope to produce them early and hope to be selected as a pilot site for multi stiffener**.
- **Labor cost savings: KRW 80.56 million**
[Welding: KRW 83.2 million → Multi-stiffener: KRW 2.64 million]
- * Welding stiffener: 8,000 pieces x 10,400 won = 83.2 million won,
Multi-Stiffener: 8,000 items x 330 won = 2.64 million won

■ 00Tunnel Field Interview Results

- The idea is **groundbreaking**, why did we never think of this until now?
- It is more **reliable in safety verification and quality control** at the industrial complex, and we request the design change to Busan City, the client of the order, and we want to actively use it.
- **Economic** because it can be reused
- **Reduce cost** because it can be installed by ordinary people who are not welding experts
- In the end, the installation time is shortened compared to the conventional welding method, **which is advantageous for minimum cost expediting**.

■ 00road site [underpass site] interview results

- Want to use it as a future VE [Value Engineering] idea

$$VE = F / C$$

* F: Function, C: Cost

- When applied during the design stage, it is expected to contribute to disaster prevention and budget reduction
- With the patent right in the industrial complex, it will be more reliable in quality control.
- **Multi-Stiffener** is a product that **meets the economic, construction, and safety** desired by the construction site, which is a consumer, and greatly contributes to **enhancing the status of the industrial complex** and the client by preventing construction accidents and improving economic feasibility.

ACCREDITED AGENCY EXAMINATION



Beam Mounting Test : Multi-Stiffener Mounting Test on 300x300x10x15x400L Beam

Authorized agency request : 2016.02.04.

Result: No more than 1,470KN.

Request: Korea Institute for Living Environment Testing

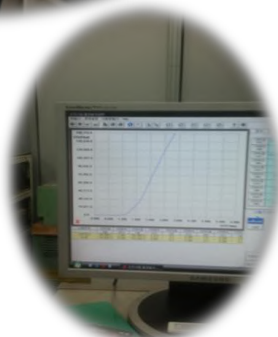
**Sample : Multi-stiffener350
(350 Beam Assembly Point Set and Test)**

Korea Occupational Safety & Health Agency requires more than 10 Ton of buckling load for single multi-stiffener products.

Authorized agency request : 2016.03.31.

Result: No more than 1,470KN.

Request: Korea Institute for Living Environment Testing



KCL 시험성적서

1. 발주처명 : KT-010007
2. 제품명 : 시험성적서
3. 시험일자 : 2016년 04월 05일 ~ 2016년 04월 05일
4. 시험장소 : KCL (한국건설환경시험연구원)
5. 시험종류 : 시험성적서 (시험)
6. 시험대상 : (1) 350 Beam Assembly Point Set and Test

7. 시험결과
7.1 시험결과
7.2 시험결과

2016년 04월 05일
한국건설환경시험연구원
한국건설환경시험연구원 (KCL) (KCI 인증기관)
한국건설환경시험연구원 (KCL) (KCI 인증기관)



KCL 시험성적서

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한국건설환경시험연구원 (KCL) (KCI 인증기관)

DAEWOO ENGINEERING&CONSTRUCTION TECHNOLOGY RESEARCH INSTITUTE EXAMINATION



Sample : H-Beam

Sample : H-Beam with multi-stiffener

시험성적서

DAEWOO ENGINEERING & CONSTRUCTION TECHNOLOGY RESEARCH INSTITUTE
 3440-000 경기도 수원시 영통구 수암로 123번길 20
 TEL : 031-250-1234 FAX : 031-250-1234

발행처 : 1.1000.0200-010
 제1판 (1.1)판

1. 시험 목적
 - 구조 용도 : 일반주택의 구조용
 - 목적 : 일반주택의 구조용 강재의 강도 시험
 - 시험대상 : 일반주택의 구조용 강재

2. 시험 목적의 목적 : 일반주택의 구조용 강재의 강도 시험

3. 시험 목적의 목적 : 일반주택의 구조용 강재의 강도 시험

4. 시험대상 : 일반주택의 구조용 강재

5. 시험대상 : 일반주택의 구조용 강재

6. 시험대상 : 일반주택의 구조용 강재

7. 시험대상 : 일반주택의 구조용 강재

시험항목	시험대상	시험결과	비고
항복강도	677.17	1.25	항복강도 시험 결과
인장강도	677.17	1.43	인장강도 시험 결과
항복강도	677.17	1.25	항복강도 시험 결과

8. 시험결과 그래프

Maximum load : **677.17KN**
 (the average value)



<photo1> Before the compression test



<photo2> After the compression test

시험성적서

DAEWOO ENGINEERING & CONSTRUCTION TECHNOLOGY RESEARCH INSTITUTE
 3440-000 경기도 수원시 영통구 수암로 123번길 20
 TEL : 031-250-1234 FAX : 031-250-1234

발행처 : 1.1000.0200-010
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1. 시험 목적
 - 구조 용도 : 일반주택의 구조용
 - 목적 : 일반주택의 구조용 강재의 강도 시험
 - 시험대상 : 일반주택의 구조용 강재

2. 시험 목적의 목적 : 일반주택의 구조용 강재의 강도 시험

3. 시험 목적의 목적 : 일반주택의 구조용 강재의 강도 시험

4. 시험대상 : 일반주택의 구조용 강재

5. 시험대상 : 일반주택의 구조용 강재

6. 시험대상 : 일반주택의 구조용 강재

7. 시험대상 : 일반주택의 구조용 강재

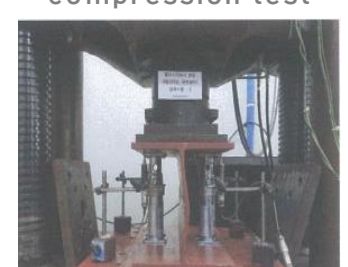
시험항목	시험대상	시험결과	비고
항복강도	1379.35	2.00	항복강도 시험 결과
인장강도	1379.35	2.13	인장강도 시험 결과
항복강도	1379.35	2.17	항복강도 시험 결과

8. 시험결과 그래프

Maximum load : **1379.35KN**
 (the average value)



<photo1> Before the compression test



<photo2> After the compression test

Date of request : 2020. 07. 15.
 examination period : 2020. 07. 21. ~ 24.

An examination institution : Daewoo Engineering & Construction Technology Research Institute

DAEWOO ENGINEERING&CONSTRUCTION TECHNOLOGY RESEARCH INSTITUTE EXAMINATION



Sample : Multi-stiffener ver.1

시험성적서

대우건설기술연구원
R&D 4000 영등포구 영등포구 우동로 127길 20
Tel: 02-200-1251, Fax: 02-200-1166

발주처명: LSIL, Q002-017
제시처 (1) 3월 20

1. 시험 목적
- 구조 공학 : 주석회사 지음
- 주 소 : 중앙 공학사 시험관 설계도면(제1~3)
- 시험목적 : 2021. 10. 07

2. 시험대상 시험물 : 멀티스틸러(높이 270mm, 도장명: MG 2505) (주석회사 지음)

3. 시험방법 : 2021. 10. 07

4. 시험장소 : 공학시험 (2021. 10. 07)

5. 시험재료 : 주석회사 (주석회사 지음)

6. 시험결과 : 평균 : (106.33 ± 0.00) N, 최대값 : (106.33) N

시험물	최대하중 (N)	최대변위 (mm)	비고
멀티스틸러(높이 270mm)-1	107.5	14.85	
멀티스틸러(높이 270mm)-2	106.4	13.93	
멀티스틸러(높이 270mm)-3	107.1	15.44	
평균	106.33	14.73	

7. 시험결과
- 시험결과 : 주석회사 지음

8. 시험결과
- 시험결과 : 주석회사 지음

9. 시험결과
- 시험결과 : 주석회사 지음

10. 시험결과
- 시험결과 : 주석회사 지음

11. 시험결과
- 시험결과 : 주석회사 지음

12. 시험결과
- 시험결과 : 주석회사 지음

13. 시험결과
- 시험결과 : 주석회사 지음

14. 시험결과
- 시험결과 : 주석회사 지음

15. 시험결과
- 시험결과 : 주석회사 지음

16. 시험결과
- 시험결과 : 주석회사 지음

17. 시험결과
- 시험결과 : 주석회사 지음

18. 시험결과
- 시험결과 : 주석회사 지음

19. 시험결과
- 시험결과 : 주석회사 지음

20. 시험결과
- 시험결과 : 주석회사 지음

2021. 10. 12

주석회사 대우건설 (인)

Maximum load : **106.33KN**
(the average value)

Date of request : 2021. 10. 07.
examination period : 2021. 10. 12.

An examination institution : Daewoo Engineering & Construction Technology Research Institute

대우건설기술연구원
R&D 4000 영등포구 영등포구 우동로 127길 20
Tel: 02-200-1251, Fax: 02-200-1166

발주처명: LSIL, Q002-017
제시처 (1) 3월 20

1. 시험 목적
- 구조 공학 : 주석회사 지음
- 주 소 : 중앙 공학사 시험관 설계도면(제1~3)
- 시험목적 : 2021. 10. 07

2. 시험대상 시험물 : 멀티스틸러(높이 270mm, 도장명: MG 2505) (주석회사 지음)

3. 시험방법 : 2021. 10. 07

4. 시험장소 : 공학시험 (2021. 10. 07)

5. 시험재료 : 주석회사 (주석회사 지음)

6. 시험결과 : 평균 : (99.80 ± 0.00) N, 최대값 : (99.80) N

시험물	최대하중 (N)	최대변위 (mm)	비고
멀티스틸러(높이 270mm)-1	97.5	14.85	
멀티스틸러(높이 270mm)-2	101.6	13.93	
멀티스틸러(높이 270mm)-3	100.2	15.44	
평균	99.8	14.73	

7. 시험결과
- 시험결과 : 주석회사 지음

8. 시험결과
- 시험결과 : 주석회사 지음

9. 시험결과
- 시험결과 : 주석회사 지음

10. 시험결과
- 시험결과 : 주석회사 지음

11. 시험결과
- 시험결과 : 주석회사 지음

12. 시험결과
- 시험결과 : 주석회사 지음

13. 시험결과
- 시험결과 : 주석회사 지음

14. 시험결과
- 시험결과 : 주석회사 지음

15. 시험결과
- 시험결과 : 주석회사 지음

16. 시험결과
- 시험결과 : 주석회사 지음

17. 시험결과
- 시험결과 : 주석회사 지음

18. 시험결과
- 시험결과 : 주석회사 지음

19. 시험결과
- 시험결과 : 주석회사 지음

20. 시험결과
- 시험결과 : 주석회사 지음

2022. 09. 08

주석회사 대우건설 (인)



<photo1> Before the compression test



<photo2> After the compression test

시험성적서

대우건설기술연구원
R&D 4000 영등포구 영등포구 우동로 127길 20
Tel: 02-200-1251, Fax: 02-200-1166

발주처명: LSIL, Q002-017
제시처 (1) 3월 20

1. 시험 목적
- 구조 공학 : 주석회사 지음
- 주 소 : 중앙 공학사 시험관 설계도면(제1~3)
- 시험목적 : 2022. 09. 08

2. 시험대상 시험물 : 멀티스틸러(높이 270mm, 도장명: MG 2505)

3. 시험방법 : 2022. 09. 08

4. 시험장소 : 공학시험 (2022. 09. 08)

5. 시험재료 : 주석회사 (주석회사 지음)

6. 시험결과 : 평균 : (99.80 ± 0.00) N, 최대값 : (99.80) N

시험물	최대하중 (N)	비고
멀티스틸러(높이 270mm)-1	97.5	
멀티스틸러(높이 270mm)-2	101.6	
멀티스틸러(높이 270mm)-3	100.2	
평균	99.8	

7. 시험결과
- 시험결과 : 주석회사 지음

8. 시험결과
- 시험결과 : 주석회사 지음

9. 시험결과
- 시험결과 : 주석회사 지음

10. 시험결과
- 시험결과 : 주석회사 지음

11. 시험결과
- 시험결과 : 주석회사 지음

12. 시험결과
- 시험결과 : 주석회사 지음

13. 시험결과
- 시험결과 : 주석회사 지음

14. 시험결과
- 시험결과 : 주석회사 지음

15. 시험결과
- 시험결과 : 주석회사 지음

16. 시험결과
- 시험결과 : 주석회사 지음

17. 시험결과
- 시험결과 : 주석회사 지음

18. 시험결과
- 시험결과 : 주석회사 지음

19. 시험결과
- 시험결과 : 주석회사 지음

20. 시험결과
- 시험결과 : 주석회사 지음

2022. 09. 07

주석회사 대우건설 (인)

Maximum load : **99.80KN**
(the average value)

Date of request : 2022. 09. 08.
examination period : 2022. 10. 06.



<photo1> Before the compression test



<photo2> After the compression test

DAEWOO ENGINEERING&CONSTRUCTION TECHNOLOGY RESEARCH INSTITUTE EXAMINATION



Sample : Multi-Stiffener ver.2

Date of request : 2020. 11. 18.

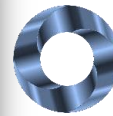
examination period : 2020. 11. 23.

**Maximum load : 250.30KN
(the average value)**

**An examination institution
: Daewoo Engineering &
Construction Technology
Research Institute**

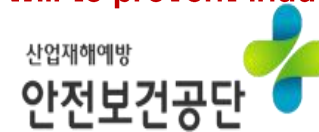
시험성적서

대우건설기술연구원 우440-800 경기도 수원시 장안구 수일로 123번길 20 (Tel : 031-250-1251, Fax : 031-250-1164)		성적서번호 : LSSL-Q2020-029 페이지 (1 / 1 총 3)	
1. 시험명 : 산악안전보안연구용, 주석회사 지호 * 주 소 : 울산광역시 중구 중가로 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1018, 1020, 1022, 1024, 1026, 1028, 1030, 1032, 1034, 1036, 1038, 1040, 1042, 1044, 1046, 1048, 1050, 1052, 1054, 1056, 1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072, 1074, 1076, 1078, 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1138, 1140, 1142, 1144, 1146, 1148, 1150, 1152, 1154, 1156, 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 1200, 1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220, 1222, 1224, 1226, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1242, 1244, 1246, 1248, 1250, 1252, 1254, 1256, 1258, 1260, 1262, 1264, 1266, 1268, 1270, 1272, 1274, 1276, 1278, 1280, 1282, 1284, 1286, 1288, 1290, 1292, 1294, 1296, 1298, 1300, 1302, 1304, 1306, 1308, 1310, 1312, 1314, 1316, 1318, 1320, 1322, 1324, 1326, 1328, 1330, 1332, 1334, 1336, 1338, 1340, 1342, 1344, 1346, 1348, 1350, 1352, 1354, 1356, 1358, 1360, 1362, 1364, 1366, 1368, 1370, 1372, 1374, 1376, 1378, 1380, 1382, 1384, 1386, 1388, 1390, 1392, 1394, 1396, 1398, 1400, 1402, 1404, 1406, 1408, 1410, 1412, 1414, 1416, 1418, 1420, 1422, 1424, 1426, 1428, 1430, 1432, 1434, 1436, 1438, 1440, 1442, 1444, 1446, 1448, 1450, 1452, 1454, 1456, 1458, 1460, 1462, 1464, 1466, 1468, 1470, 1472, 1474, 1476, 1478, 1480, 1482, 1484, 1486, 1488, 1490, 1492, 1494, 1496, 1498, 1500, 1502, 1504, 1506, 1508, 1510, 1512, 1514, 1516, 1518, 1520, 1522, 1524, 1526, 1528, 1530, 1532, 1534, 1536, 1538, 1540, 1542, 1544, 1546, 1548, 1550, 1552, 1554, 1556, 1558, 1560, 1562, 1564, 1566, 1568, 1570, 1572, 1574, 1576, 1578, 1580, 1582, 1584, 1586, 1588, 1590, 1592, 1594, 1596, 1598, 1600, 1602, 1604, 1606, 1608, 1610, 1612, 1614, 1616, 1618, 1620, 1622, 1624, 1626, 1628, 1630, 1632, 1634, 1636, 1638, 1640, 1642, 1644, 1646, 1648, 1650, 1652, 1654, 1656, 1658, 1660, 1662, 1664, 1666, 1668, 1670, 1672, 1674, 1676, 1678, 1680, 1682, 1684, 1686, 1688, 1690, 1692, 1694, 1696, 1698, 1700, 1702, 1704, 1706, 1708, 1710, 1712, 1714, 1716, 1718, 1720, 1722, 1724, 1726, 1728, 1730, 1732, 1734, 1736, 1738, 1740, 1742, 1744, 1746, 1748, 1750, 1752, 1754, 1756, 1758, 1760, 1762, 1764, 1766, 1768, 1770, 1772, 1774, 1776, 1778, 1780, 1782, 1784, 1786, 1788, 1790, 1792, 1794, 1796, 1798, 1800, 1802, 1804, 1806, 1808, 1810, 1812, 1814, 1816, 1818, 1820, 1822, 1824, 1826, 1828, 1830, 1832, 1834, 1836, 1838, 1840, 1842, 1844, 1846, 1848, 1850, 1852, 1854, 1856, 1858, 1860, 1862, 1864, 1866, 1868, 1870, 1872, 1874, 1876, 1878, 1880, 1882, 1884, 1886, 1888, 1890, 1892, 1894, 1896, 1898, 1900, 1902, 1904, 1906, 1908, 1910, 1912, 1914, 1916, 1918, 1920, 1922, 1924, 1926, 1928, 1930, 1932, 1934, 1936, 1938, 1940, 1942, 1944, 1946, 1948, 1950, 1952, 1954, 1956, 1958, 1960, 1962, 1964, 1966, 1968, 1970, 1972, 1974, 1976, 1978, 1980, 1982, 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018, 2020, 2022, 2024, 2026, 2028, 2030, 2032, 2034, 2036, 2038, 2040, 2042, 2044, 2046, 2048, 2050, 2052, 2054, 2056, 2058, 2060, 2062, 2064, 2066, 2068, 2070, 2072, 2074, 2076, 2078, 2080, 2082, 2084, 2086, 2088, 2090, 2092, 2094, 2096, 2098, 2100, 2102, 2104, 2106, 2108, 2110, 2112, 2114, 2116, 2118, 2120, 2122, 2124, 2126, 2128, 2130, 2132, 2134, 2136, 2138, 2140, 2142, 2144, 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2478, 2480, 2482, 2484, 2486, 2488, 2490, 2492, 2494, 2496, 2498, 2500, 2502, 2504, 2506, 2508, 2510, 2512, 2514, 2516, 2518, 2520, 2522, 2524, 2526, 2528, 2530, 2532, 2534, 2536, 2538, 2540, 2542, 2544, 2546, 2548, 2550, 2552, 2554, 2556, 2558, 2560, 2562, 2564, 2566, 2568, 2570, 2572, 2574, 2576, 2578, 2580, 2582, 2584, 2586, 2588, 2590, 2592, 2594, 2596, 2598, 2600, 2602, 2604, 2606, 2608, 2610, 2612, 2614, 2616, 2618, 2620, 2622, 2624, 2626, 2628, 2630, 2632, 2634, 2636, 2638, 2640, 2642, 2644, 2646, 2648, 2650, 2652, 2654, 2656, 2658, 2660, 2662, 2664, 2666, 2668, 2670, 2672, 2674, 2676, 2678, 2680, 2682, 2684, 2686, 2688, 2690, 2692, 2694, 2696, 2698, 2700, 2702, 2704, 2706, 2708, 2710, 2712, 2714, 2716, 2718, 2720, 2722, 2724, 2726, 2728, 2730, 2732, 2734, 2736, 2738, 2740, 2742, 2744, 2746, 2748, 2750, 2752, 2754, 2756, 2758, 2760, 2762, 2764, 2766, 2768, 2770, 2772, 2774, 2776, 2778, 2780, 2782, 2784, 2786, 2788, 2790, 2792, 2794, 2796, 2798, 2800, 2802, 2804, 2806, 2808, 2810, 2812, 2814, 2816, 2818, 2820, 2822, 2824, 2826, 2828, 2830, 2832, 2834, 2836, 2838, 2840, 2842, 2844, 2846, 2848, 2850, 2852, 2854, 2856, 2858, 2860, 2862, 2864, 2866, 2868, 2870, 2872, 2874, 2876, 2878, 2880, 2882, 2884, 2886, 2888, 2890, 2892, 2894, 2896, 2898, 2900, 2902, 2904, 2906, 2908, 2910, 2912, 2914, 2916, 2918, 2920, 2922, 2924, 2926, 2928, 2930, 2932, 2934, 2936, 2938, 2940, 2942, 2944, 2946, 2948, 2950, 2952, 2954, 2956, 2958, 2960, 2962, 2964, 2966, 2968, 2970, 2972, 2974, 2976, 2978, 2980, 2982, 2984, 2986, 2988, 2990, 2992, 2994, 2996, 2998, 3000, 3002, 3004, 3006, 3008, 3010, 3012, 3014, 3016, 3018, 3020, 3022, 3024, 3026, 3028, 3030, 3032, 3034, 3036, 3038, 3040, 3042, 3044, 3046, 3048, 3050, 3052, 3054, 3056, 3058, 3060, 3062, 3064, 3066, 3068, 3070, 3072, 3074, 3076, 3078, 3080, 3082, 3084, 3086, 3088, 3090, 3092, 3094, 3096, 3098, 3100, 3102, 3104, 3106, 3108, 3110, 3112, 3114, 3116, 3118, 3120, 3122, 3124, 3126, 3128, 3130, 3132, 3134, 3136, 3138, 3140, 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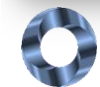
Multi-Stiffener is a product made up of a joint development by JIHO Co., Ltd. and the Korea Occupational Safety & Health Agency.

It contains the will to prevent industrial accidents.



※ This product was developed to prevent industrial accidents by the Korea Occupational Safety & Health Agency.

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Patent application date : 2016.02.01.



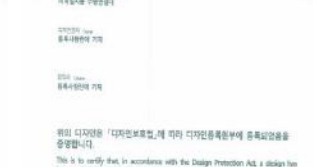
Multi-stiffener with workability, versatility, and economic feasibility of a unwelded method that dramatically improves the stiffener, which is a reinforcement of the construction site's earth barrier.

Reduce the cost of the earth barrier construction by minimum cost expediting through the improvement of workability.

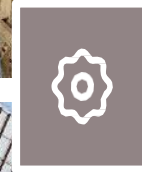
Prevention of construction accidents by eliminating the risk of welding work (electricity, fire, explosion, Musculoskeletal disorder)

Easy to construct, anyone can install,
low cost and secure product





FIELD PHOTOGRAPHS FOR ROOM USE



DELIVERY PERFORMANCE STATUS

No.	constructor	Site	supplier
1	Samsung C&T	Jinju Apartment in Gangnam	Jeil Construction Co., Ltd Sambu Construction Co., Ltd
2	Hyundai E&C	Jamsil Apartment Reconstruction	CF Construction Co., Ltd
3	GS E&C	Jai Apartment in Jin-gu, Busan	AT Construction Co., Ltd
4	Lotte E&C	Lotte Castle in Buam-dong, Busan	Taekwang Development
5	Doosan E&C	Doosan We've the Zenith in Beomil-dong, Busan	Musung Construction Co., Ltd
6	Doosan E&C	Hughes Hotel in Daeyeon-dong, Busan	Musung Construction Co., Ltd
7	Daewoo E&C	Daewoo Prugio in Andong, Gimhae	Ilchang Construction
8	Lotte E&C	Lotte Castle in Hwaseong, Gyeonggi-do	Woosung Construction
9	HDC	Underground Road in Masan	Ilsung Engineering
10	IS Dongseo	W Apartment in Daegu	Taewoon Construction
11	Hyundai Engineering	Tower Knowledge Center	Suppotec Co., Ltd.
12	KCC E&C	Comprehensive sewage treatment facilities	Daeshin CND
13	Lotte E&C	Lotte Castle in Guri, Gyeonggi-do	Jinwoo Co., Ltd.
14	Samsung C&T	Gangnam Apartment Reconstruction	Sambu Construction Co., Ltd
15	Samsung Engineering	Jamsil Apartment Reconstruction	CF Construction Co., Ltd Sambu Construction Co., Ltd
16	HDC	Subway construction in Masan	Ilsung Construction
17	Doosan E&C	Doosan We've the Zenith in Jangyu	Samji Construction
18	HDC	Subway construction in Incheon	Heungjin Construction

No.	constructor	Site	supplier
19	Daewoo E&C	Prugio Apartments	ILJUNG Construction
20	Hyundai E&C	I'Park in Ulsan	Hanjoo E&C Co., Ltd
21	CJ logistics	Daycare Center in Suwon	Sunjeoung Co., Ltd
22	IS Dongseo	Deokhwa District Knowledge Center	SamHyeon Co., Ltd
23	Yoosung Co.	Maven Hotel in Seoul	Yusung Construction
24	HL D&I Halla	Halla Vivaldi	Daeho Construction
25	Shinhwa E&C	Logistics Center in Yangsan	KR Construction
26	Hanhwa	Hanwha Forena	Suppotec Co., Ltd.
27	Koaroo	Core Mall in Ulsan	Taewoo Construction
28	Samsung C&T	Samsung Daycare Center	CF Construction Co., Ltd
29	IS Dongseo	Deokhwa District in Daegu	Taekwang Development
30	KOLON Hanulche	Haneulchae in Gimhae	Jibyoung Construction
31	Sinsung	Panam Station Renee Blue Opistel	Jeong Construction
32	IS Dongseo	Deokhwa District in Ulsan	Taehyong Construction
33	SK Ecoplant	SK View in Jungnang District	Jeil Co., Ltd.
34	Samsung C&T	Samsung Electro-Mechanics in Sejong City Sewage Treatment Plant in Gwangyang	Gwangjin Construction
35	Bomi E&C	Distribution Center in Namyangju	Bomi E&C
36	Samsung Engineering	Sewage Treatment Plant in Godeok-dong	Shinhwa P&C



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Patent application number : 10-2016-0012328

※ EASY LENGTH ADJUSTMENT
AND EASY TO INSTALLY

MULTI-STIFFENER