■ 산업안전보건법 시행규칙 [별지 제10호의 5서식]

심사결과 통지서

신청인	사업장명	(주)KITO	사업장관리번호	2010E110010
	사업자등록번호	010-E1-10010	대표자 성명	KITO YOSHIO
	소재지	2000,Tsuijiarai,Showa-Cho,Nakakoma-Gun,Yamanashi,Japan		

안전인증대상기계・기구명	호이스트		
형식(규격)	KD-ER2-015	용량(등급)	1.5 ton

「산업안전보건법」 제34조 및 같은 법 시행규칙 제58조의4제4항에 따라 실시한

[ ] 예비심사

[■] 서면심사

[ ] 기술능력 및 생산체계 심사 결과가 [■] 적 합 [ ] 부적합 함을 통지합니다.

[ ] 개별 제품심사

[ ] 형식별 제품심사

2014년 05월 09일

인증심사원 최 창 일 (서명 또는 인) 최창일

조 준 기 (서명 또는 인) 조준기

한국승강기안전기술원 이사장

■ 산업안전보건법 시행규칙 [별지 제10호의 6서식]

제 CG-2014-1029 호

안 전 인 증 서

(사업장명) **키토코리아**

(소 재 지) **경기 안성시 서운면 동촌리 안성제4 일반산업단지 E블럭 6-1**

위 사업장에서 제조하는 아래의 품목이 「 산업안전보건법 」 제34조 및 같은 법 시행규칙 제58조의4제4항에 따른 안전인증 심사결과 안전 · 보건기준에 적합하므로 안전인증표시의 사용을 인증합니다.

품 목 : 호이스트

형식(용량): KD-ER2-015(1.5 ton)

인증번호 : 14-CG2AC-1029

인증기준 : 위험기계 · 기구 의무안전인증기준 (고용노동부고시 제2012-33호)

인증조건 : 산업안전보건법 "제34조 준수"

2014년 06월 10일

한국승강기안전기술원 이사장

【별지 제4호서식】

동 일 형 식 일 람 표

<table>
<tr><td>사업장명</td><td colspan="2">KITO CORP.</td><td>개정일자
및 번호</td><td>2014.04.29</td><td>인증번호</td><td></td></tr>
<tr><td colspan="2">형식 및 모델번호</td><td colspan="3">동일형식 항목 및 내역</td><td rowspan="2" colspan="2">비고</td></tr>
<tr><td>형식번호</td><td>모델번호</td><td>동일형식
항목1</td><td>동일형식
항목2</td><td>동일형식
항목3</td></tr>
<tr><td rowspan="16">KD-ER2-
015</td><td>KITO-ER2D015S-S</td><td rowspan="16">Lift max 30m

권상모타 1.8kW
.S : 5.4m/min
.IS: 5.3/0.9m/min
Inverter
control</td><td rowspan="16">횡행모터 0.4kW
.S : 24m/min
.L: 12m/min
.IS:24/4m/min
.IL:12/2m/min</td><td rowspan="8">전기Trolley 결합
type</td><td rowspan="16" colspan="2"></td></tr>
<tr><td>KITO-ER2D015S-L</td></tr>
<tr><td>KITO-ER2D015S-IS</td></tr>
<tr><td>KITO-ER2D015S-IL</td></tr>
<tr><td>KITO-ER2D015IS-S</td></tr>
<tr><td>KITO-ER2D015IS-L</td></tr>
<tr><td>KITO-ER2D015IS-IS</td></tr>
<tr><td>KITO-ER2D015IS-IL</td></tr>
<tr><td>KITO-C-ER2D015S-S</td><td rowspan="8">전기Trolley 결합
Clean type</td></tr>
<tr><td>KITO-C-ER2D015S-L</td></tr>
<tr><td>KITO-C-ER2D015S-IS</td></tr>
<tr><td>KITO-C-ER2D015S-IL</td></tr>
<tr><td>KITO-C-ER2D015IS-S</td></tr>
<tr><td>KITO-C-ER2D015IS-L</td></tr>
<tr><td>KITO-C-ER2D015IS-IS</td></tr>
<tr><td>KITO-C-ER2D015IS-IL</td></tr>
</table>

서면심사필
2014 .05. 09
한국승강기안전기술원

제 2012-BJ-0009 호

안 전 인 증 서

정호엔지니어링

경기도 광명시 노온사동 440-5

위 사업장에서 제조하는 아래의 품목이 산업안전보건법 제34조 및 같은 법 시행규칙 제58조의4제4항에 따른 안전인증 심사 결과 안전 · 보건기준에 적합하므로 안전인증표시의 사용을 인증합니다.

품 목

양중기용 과부하방지장치

형식 · 모델/용량 · 등급/인증번호

형식·모델	용량·등급	인증번호
JDL-100	J-2	12-AV2BJ-0009

인 증 기 준

방호장치 의무안전인증 고시(고용노동부고시 제2010-36호)

인 증 조 건

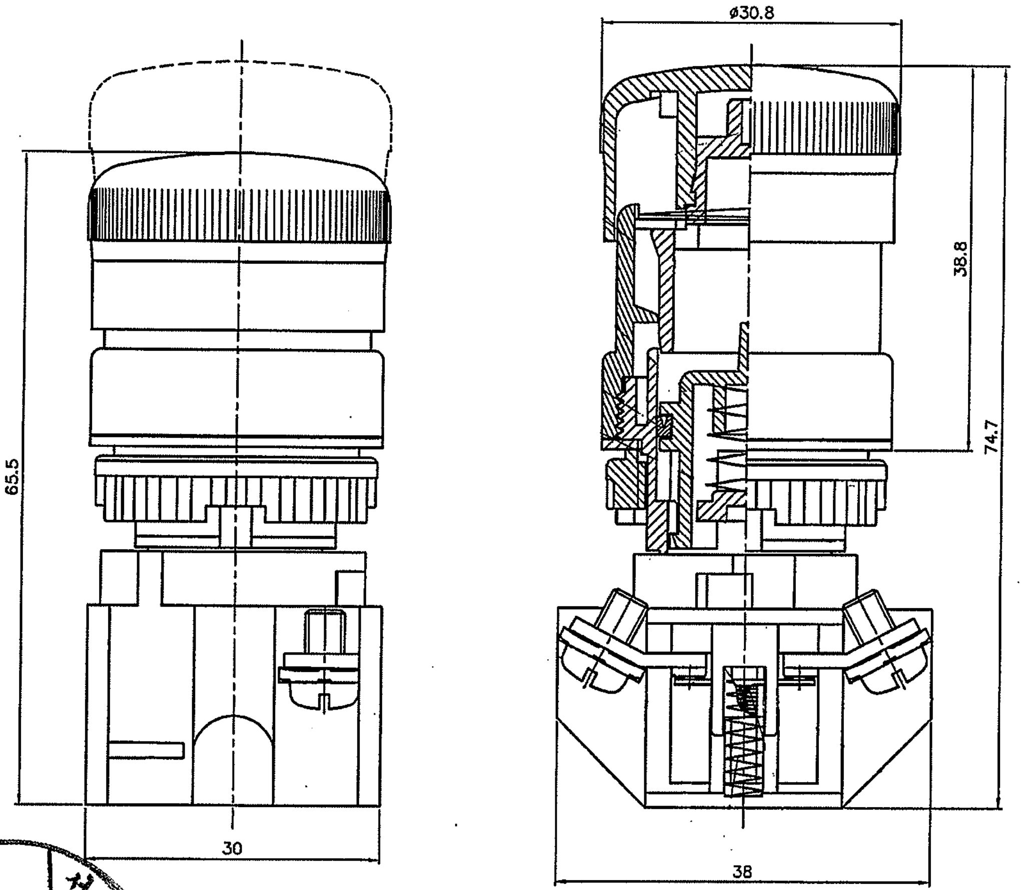
아래 주소에서 생산되는 제품에 한함.

정호엔지니어링, 경기도 광명시 노온사동 440-5

2012년 06월 11일

한국산업안전보건공단 이사장

2014. 05. 09
한국승강기안전기술원

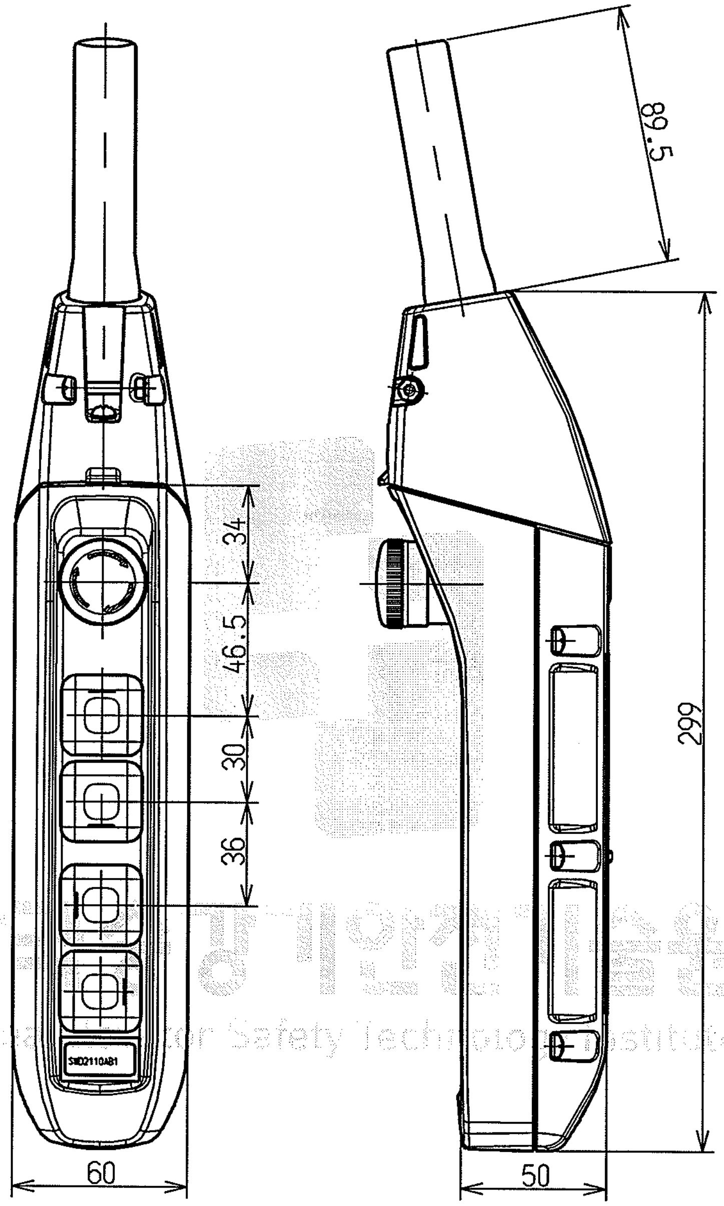


一般公差	0.2~30mm: ±0.2	30.1~60mm: ±0.3	60.1~300mm: ±0.5		模具材質		模具處理		模具孔數		單位	mm	材質	圖號	T2−BKH
天得科技股份有限公司 TEND TECHNOLOGY CO.,LTD.	最新修正		品保	品保部 95.05.24 林建宏	核准	研發部 95.05.24 鐘健誌	核對	研發部 95.05.24 周欽祥	繪圖	設計課 95.05.24 吳宗達	比例	2:1	表面處理	品名	T2 BKH 連鎖開關
	前次修正										投影法	⊕◁	顏色		

2/T2/BKH/T2-BKH.dwg

版序：A

Revision	Incidence	Description	Date	Charge	Approved



The lifting and lowering push buttons are marked with ⇑⇓ for single speed or ⇞⇟ for dual speed.

The traveling push buttons are marked with E W or N S depending on the installed direction.

	NOTE	MATERIAL		CODE	
⑥		NOS./UNIT		NAME	5p Pendant control station MXX subassembly
⑤					
④					
③					
②					
①					

Date issued	APPROVED	H.FURIYA 09.04.21	CHECKED	T.HATANO 09.04.21	DESIGNED	KOBAYASHI 09.04.21	DRAWN	KOBAYASHI 09.04.21	SCALE	-	DWG.NO.	SWD2XX0A

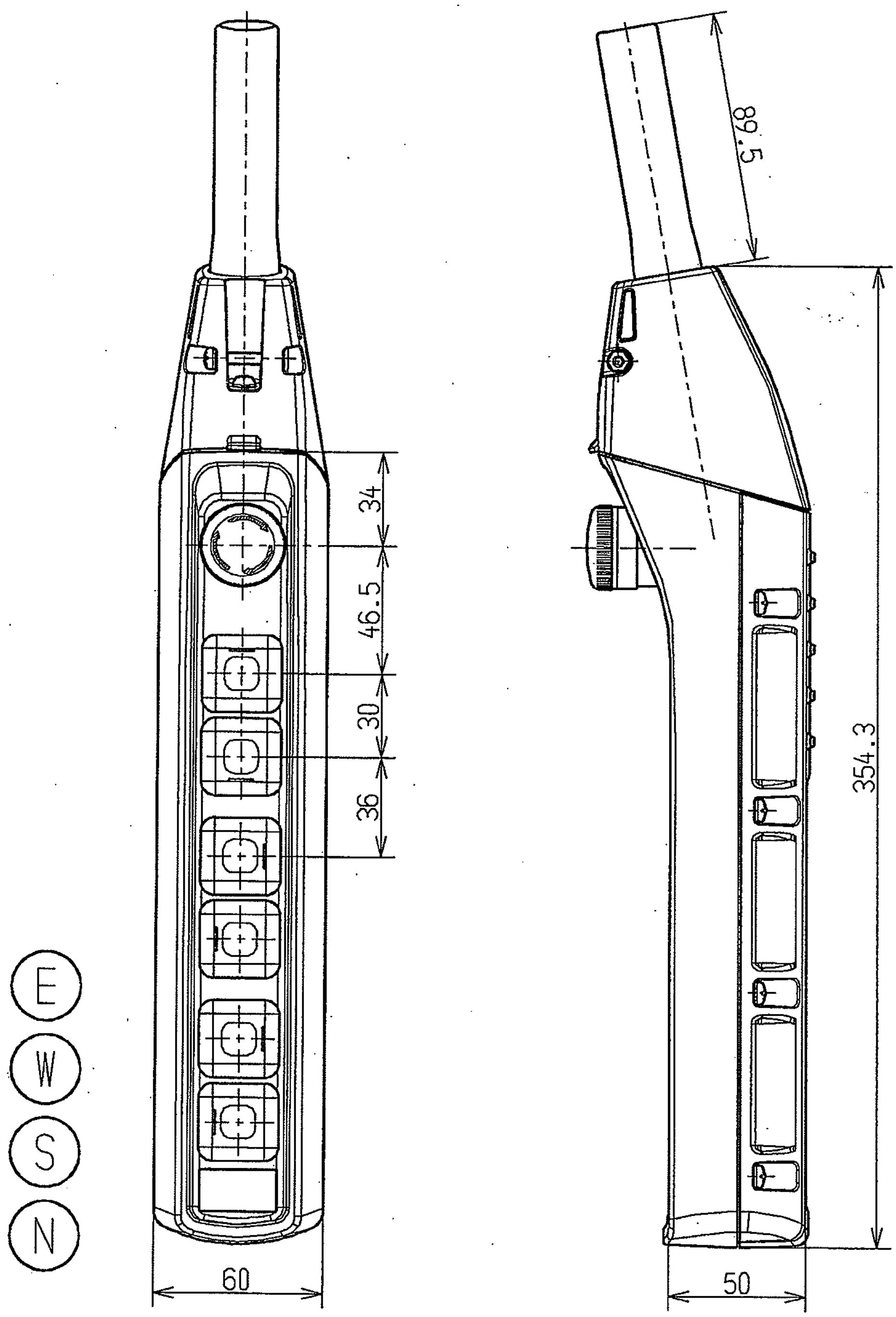
KITO CORPORATION

서면심사필
2014.05.09
한국승강기안전기술원

UNIT: mm

様式:04KH-N001DA

Revision	Incidence	Description	Date	Charge	Approved



⑥	
⑤	
④	
③	
②	
①	
Date issued	

NOTE

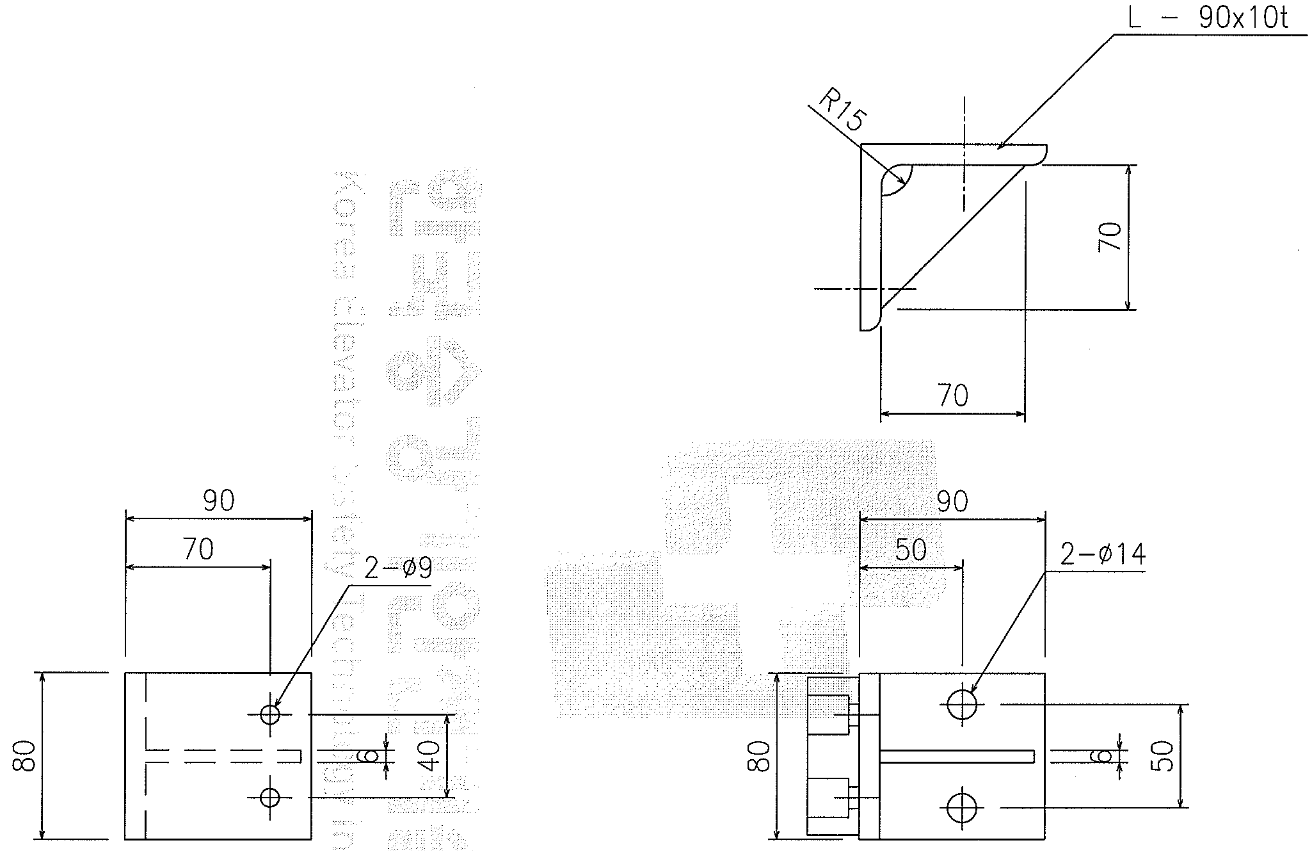
MATERIAL	
NOS./UNIT	
CODE	
NAME	[illegible]point Pendant control station MXXX subassembly
DWG.NO.	SWD2XXXAA

APPROVED	CHECKED	DESIGNED	DRAWN	SCALE
ISHIKAWA 08.02.08	FURIYA 08.02.08	KOBAYASHI 08.02.08	KOBAYASHI 08.02.08	-

면심사필 2014.05.09 한국승강기안전기술원

KITO CORPORATION

UNIT: mm

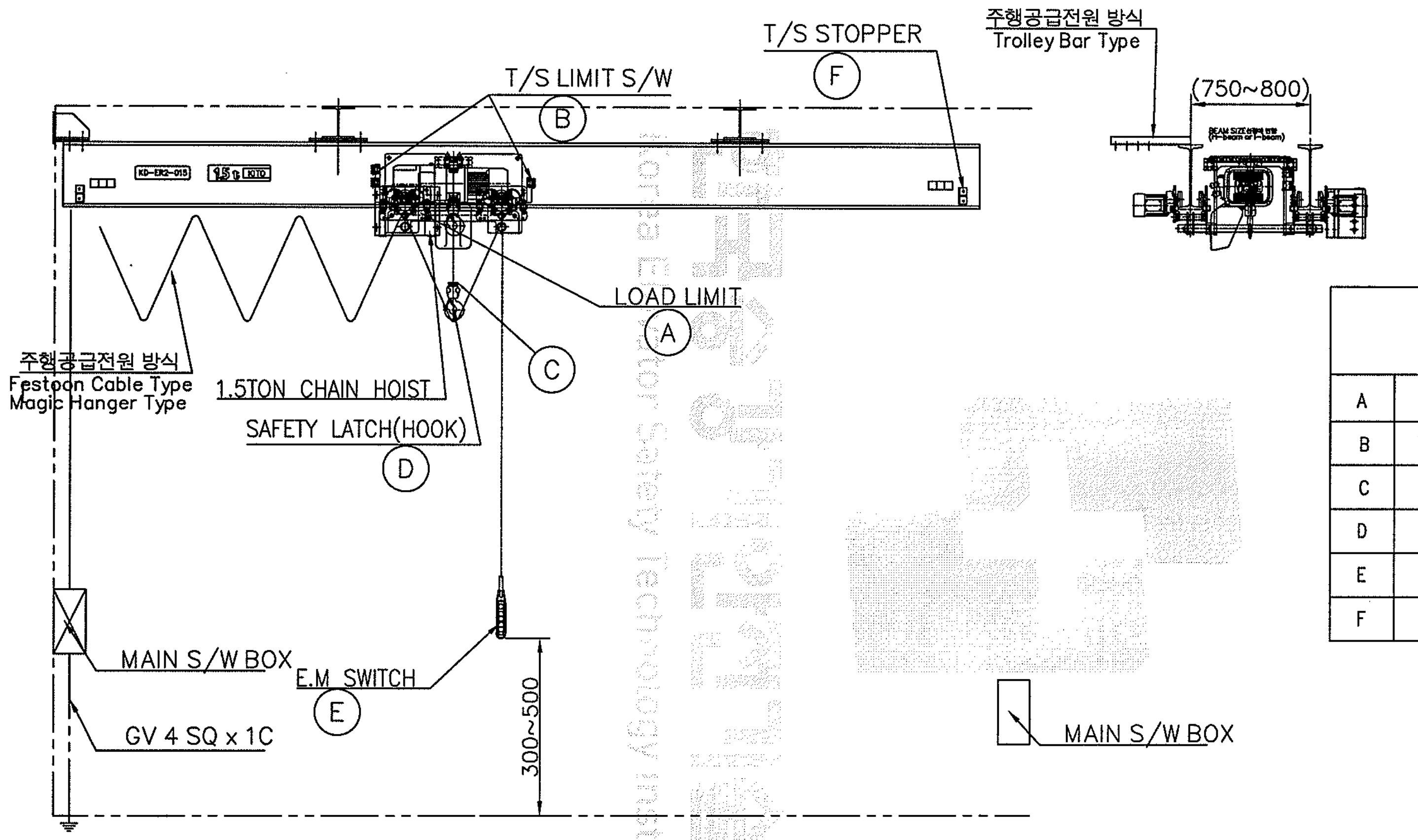


No	Part Name	Description	Mat'l	Unit	Q'ty	Weight (Kg)	Remark
TITLE			SS400		4		대전방지
	STOPPER – traversing						
Part No.	STOPPER				SCALE		
DWG No.					REV.		

APPROVED	CHECKED	DESIGNED	DRAWN
J. S. CHO	J. S. CHO	W.H.EUN	W.H.EUN

(주)KITO KOREA

REV.	CONTENTS	DATE	DRAWN	APPRO-VED



	SPECIFICATION		
A	LOAD LIMIT	1	1.5TON USE
B	T/S LIMIT S/W	2	
C	UPPER LIMIT S/W	1	1.5TON USE
D	SAFETY LATCH(HOOK)	1	1.5TON USE
E	E.M SWITCH	1	PB 305
F	T/S STOPPER	2	MACHINE

W⇔E

방향표지판

NOTE

1. 점검설비는 현장여건에 맞추어 설치한다.
2. 사용설명서를 제공한다.

承認 APPROVED	検図 CHECKED	設計 DESIGNED	製図 DRAWN	名称 TITLE	1.5t MONO RAIL HOIST SAFETY DRAWING
J.S.CHO	J.S.CHO	EUN.WON HEE	EUN.WON HEE	製造番号 CODE	尺度 SCALE
株式会社 キトー KITO CORP				図番 DWG.NO.	MONO RAIL 0 — 変更回数 REV.

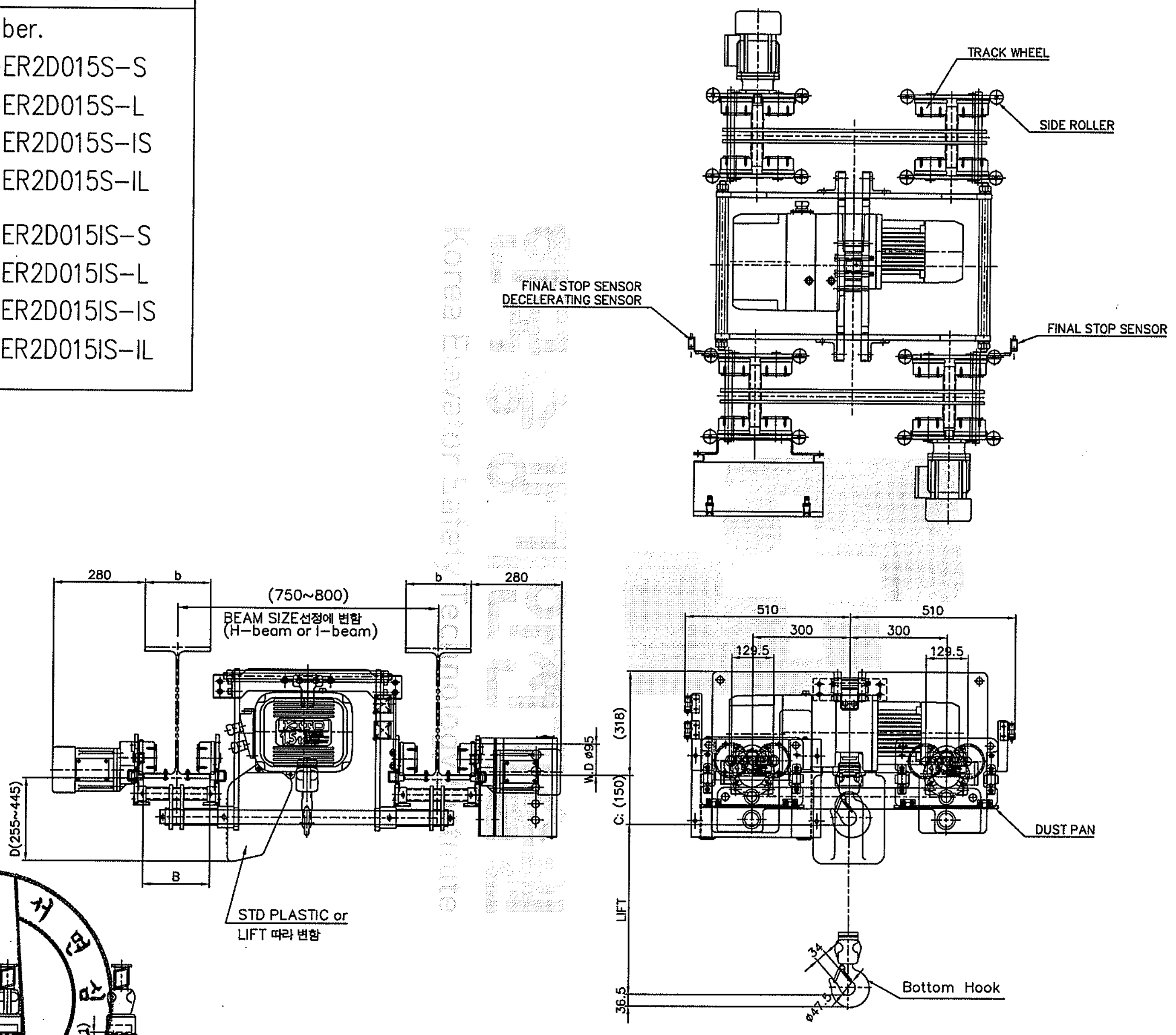
改訂 REV.	数 QTY	内容 CONTENTS	年.月.日 DATE	担当 DRAWN	承認 APPROVED

형식번호 : KD-ER2-015

형식번호 : KD-ER2-015

Model number.

- KITO-C-ER2D015S-S
- KITO-C-ER2D015S-L
- KITO-C-ER2D015S-IS
- KITO-C-ER2D015S-IL
- KITO-C-ER2D015IS-S
- KITO-C-ER2D015IS-L
- KITO-C-ER2D015IS-IS
- KITO-C-ER2D015IS-IL



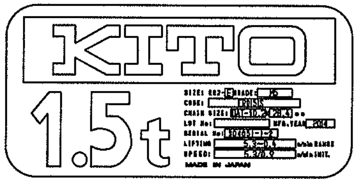
諸元表 Particulars		
基本本体 Size		ER2-E
定格荷重 Nominal Capacity		1.5t
揚程 Lift		5m(Max 30m)
チェーンサイズ Chain size		ø10.2 x 1
レール下面よりフックまでの最小距離 : C Min. Headroom		150 mm
相・電圧 Phase・Voltage		3ø 220(208)V 60Hz 380,440V 60Hz
モータ出力・反復定格・等級 Motor Output Duty Rating Classification — 巻上モータ for Lifting	S	1.8kW x 4P
	IS	
横行モータ for Traversing	L,IL	0.4kW x 4P x 2EA
	S,IS	
巻上速度 Lifting Speed	S	5.4 m/min
	IS	5.3/0.9 m/min
横行速度 Traversing Speed	IL	12/2 m/min
	IS	24/4 m/min
	L	12 m/min
	S	24 m/min
押ボタンコード長さ : L Push Button Cord		5m(Max 30m)
キャブタイヤ給電ケーブル長さ Length of Power Supply Cable		(2) m
レール下面よりチェーンバケットまでの寸法 : D Chain Container Distance from Bottom of Beam		255mm ~ MAX (445)mm

Beam Width(150~200)	150	175	200
適用レール巾 : B Flange Width	154mm	179mm	204mm

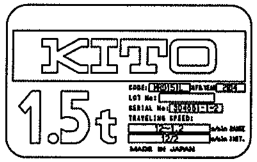
質量 Mass	Approx 355kg
塗装色 Painting Color	Munsell 7.5YR7/14

NOTE

1. 자바라 옵션
2. DUST PAN 옵션



Name Plate For Chain Hoist



Name Plate for Trolley

改訂 REV.	数 QTY	内容 CONTENTS	年.月.日 DATE	担当 DRAWN	承認 APPROVED

承認 APPROVED	検図 CHECKED	設計 DESIGNED	製図 DRAWN
			W.H.E

株式会社 キトー KITO CORP

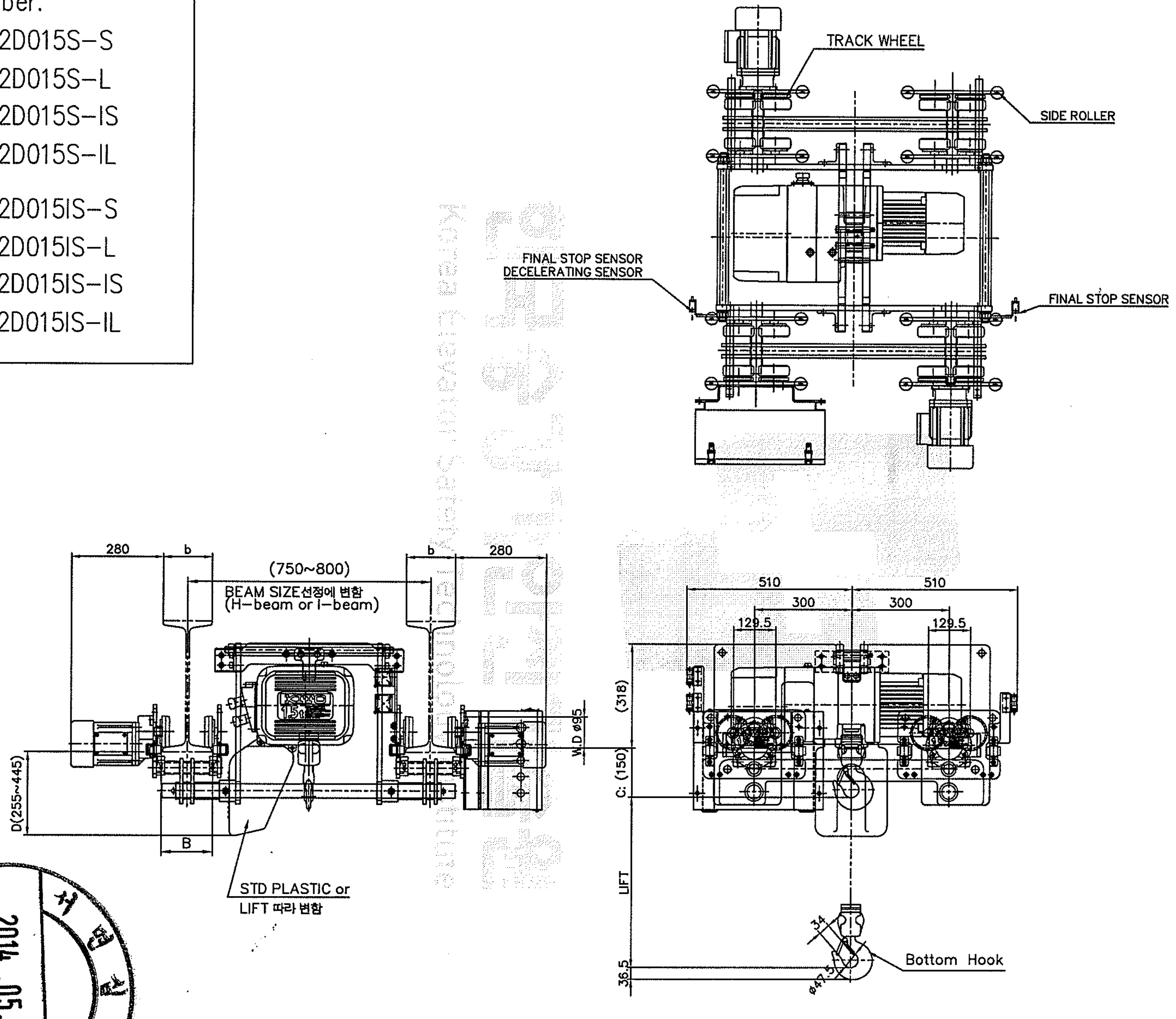
名称 TITLE	1.5t ER2M SERIES ELECTRIC CHAIN HOIST WITH MOTORIZED TOROLLEY		
製造番号 CODE		尺度 SCALE	NOT
図番 DWG.NO.	KK-ER2-015-A-001	変更回数 REV.	0

서면심사 2014.05.09 한국승강기안전기술원

형식번호 : KD-ER2-015

Model number.

- KITO-ER2D015S-S
- KITO-ER2D015S-L
- KITO-ER2D015S-IS
- KITO-ER2D015S-IL
- KITO-ER2D015IS-S
- KITO-ER2D015IS-L
- KITO-ER2D015IS-IS
- KITO-ER2D015IS-IL

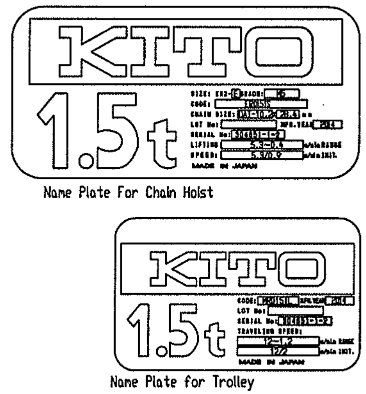


諸元表 Particulars		
基本本体 Size		ER2-E
定格荷重 Nominal Capacity		1.5t
揚程 Lift		5m(Max 30m)
チェーンサイズ Chain size		ø10.2 x 1
レール下面よりフックまでの最小距離 : C Min. Headroom		150 mm
相・電圧 Phase・Voltage		3ø 220(208)V 60Hz 380,440V 60Hz
モータ出力・反復定格・等級 Motor Output Duty Rating Classification — 巻上モータ for Lifting	S	1.8kW x 4P
	IS	
横行モータ for Traversing	L,IL	0.4kW x 4P x 2EA
	S,IS	
巻上速度 Lifting Speed	S	5.4 m/min
	IS	5.3/0.9 m/min
横行速度 Traversing Speed	IL	12/2 m/min
	IS	24/4 m/min
	L	12 m/min
	S	24 m/min
押ボタンコード長さ : L Push Button Cord		5m(Max 30m)
キャブタイヤ給電ケーブル長さ Length of Power Supply Cable		(2) m
レール下面よりチェーンバケットまでの寸法 : D Chain Container Distance from Bottom of Beam		255mm ~ MAX (445)mm

Beam Width(150~200)	150	175	200
適用レール巾 : B Flange Width	154mm	179mm	204mm

質量 Mass	Approx 355kg
塗装色 Painting Color	Munsell 7.5YR7/14

NOTE
1. 지바라 옵션
2. DUST PAN 옵션



承認 APPROVED	検図 CHECKED	設計 DESIGNED	製図 DRAWN
			W.H.E

株式会社 キトー KITO CORP

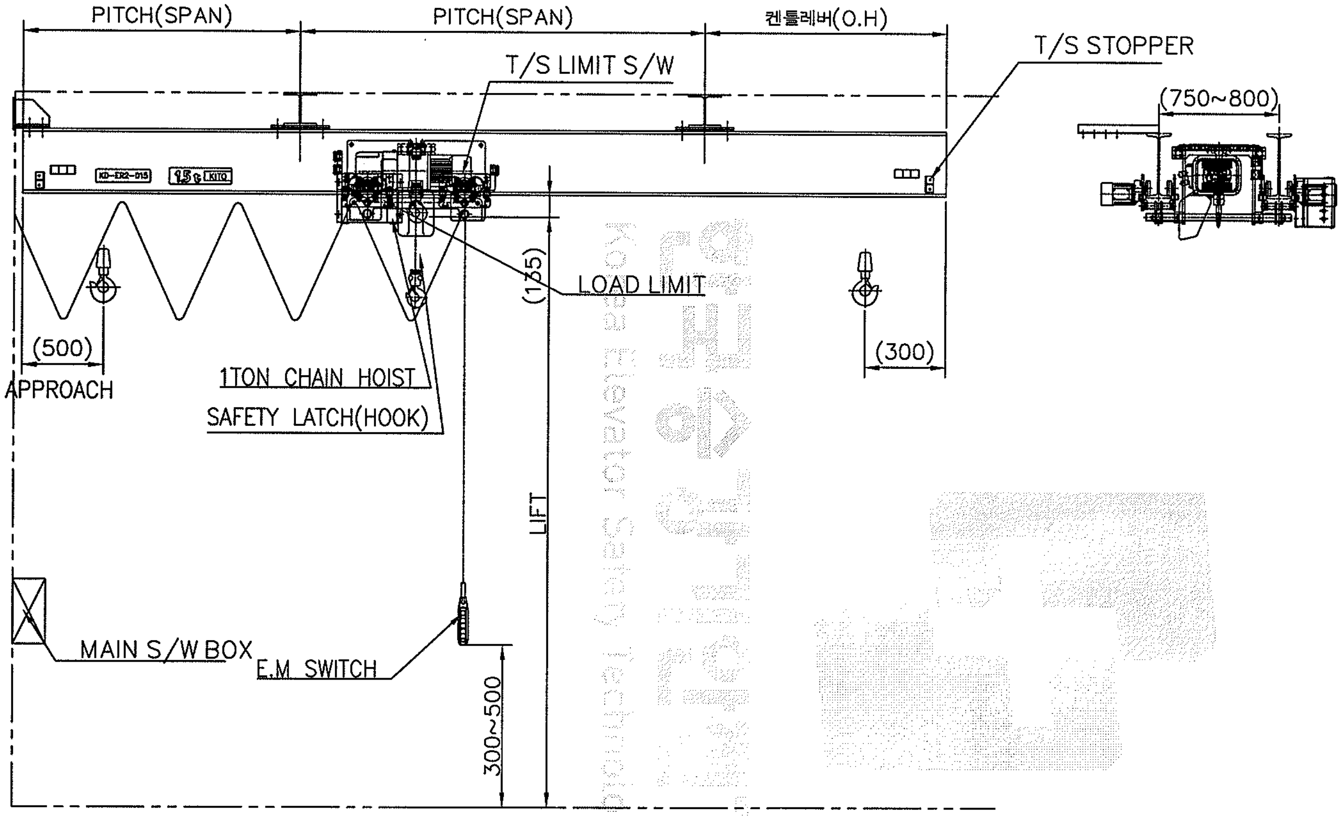
名称 TITLE: 1.5t ER2M SERIES ELECTRIC CHAIN HOIST WITH MOTORIZED TOROLLEY

製造番号 CODE | 尺度 SCALE: NOT

図番 DWG.NO.: KK-ER2-015-A-002 | 変更回数 REV.: 0

改訂 REV. | 数 QTY | 内容 CONTENTS | 年.月.日 DATE | 担当 DRAWN | 承認 APPROVED

2014 .05. 09



SPECIFICATION		
BEAM 규격	PITCH	O.H
I-300x150x10/18.5	9.5 m	3.5 m
I-350x150x9/15	10 m	3.9 m
I-400x150x10/18	11 m	4.5 m
I-350x150x12/24	11 m	4.5 m
I-400x150x12.5/25	12.5m	5 m
H-300x150x6.5/9	7.5 m	2.8 m
H-350x175x7/11	10 m	3.5 m
H-400x200x8/13	11 m	4.5 m
H-450x200x9/14	12 m	5 m
LOAD CHAIN	10.2mm X 1	
LIFT	Max 30m	

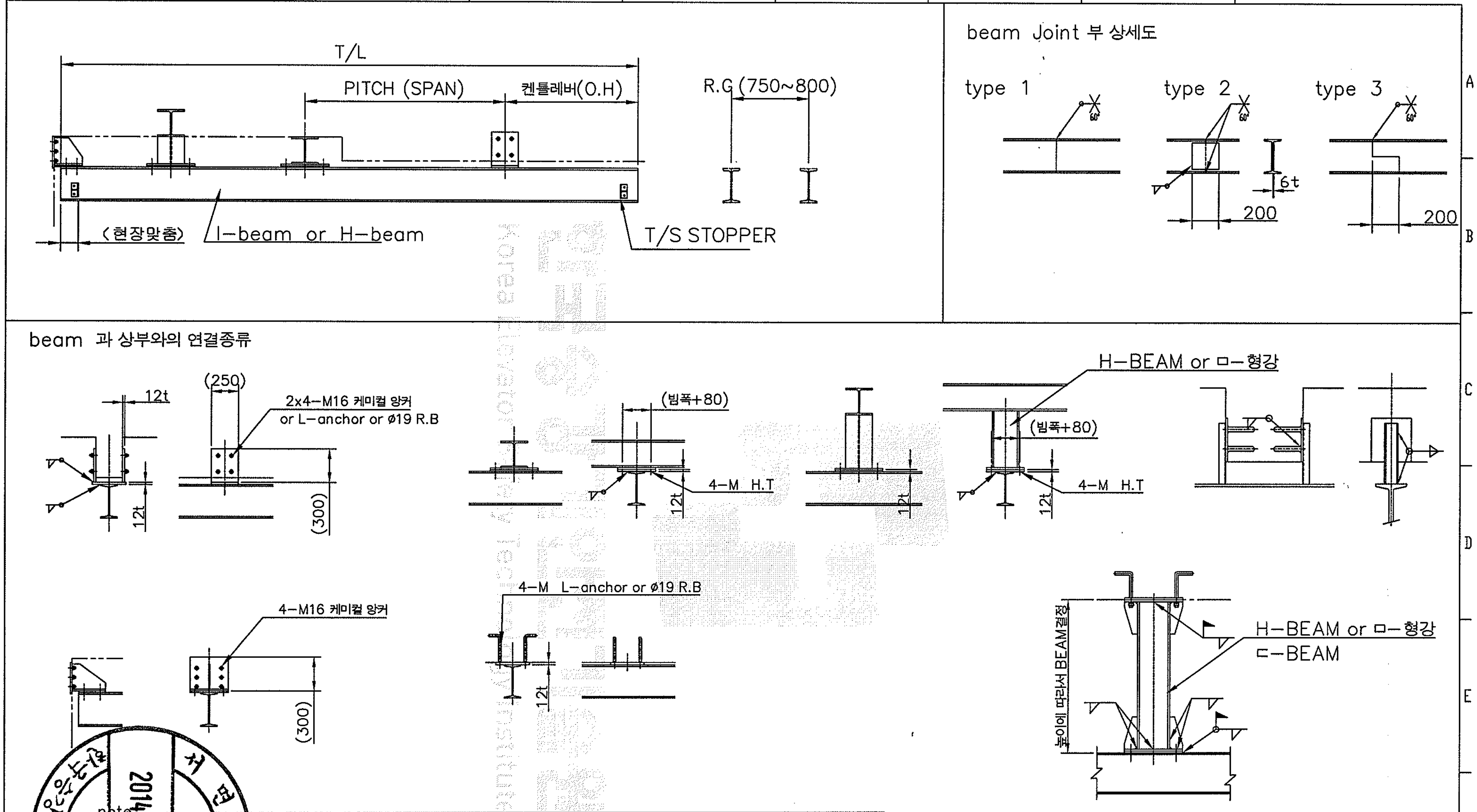
NAME PLATE

정 격 하 중	1.5 ton
전기 설비 정격	V
제 조 자	
제 조 년 월	20 . .
안전인증 표시	KCs
형 식 번 호	KD-ER2-015
제 조 번 호	

형식번호 : KD-ER2-015	형식번호 : KD-ER2-015
Model number.	Model number.
KITO-C-ER2D015S-S	KITO-ER2D015S-S
KITO-C-ER2D015S-L	KITO-ER2D015S-L
KITO-C-ER2D015S-IS	KITO-ER2D015S-IS
KITO-C-ER2D015S-IL	KITO-ER2D015S-IL
KITO-C-ER2D015IS-S	KITO-ER2D015IS-S
KITO-C-ER2D015IS-L	KITO-ER2D015IS-L
KITO-C-ER2D015IS-IS	KITO-ER2D015IS-IS
KITO-C-ER2D015IS-IL	KITO-ER2D015IS-IL

承認 APPROVED	検図 CHECKED	設計 DESIGNED	製図 DRAWN	名称 TITLE	1.5t MONO RAIL HOIST GENERAL ASSEMBLY-1
J.S.CHO	J.S.CHO	EUN.WON HEE	EUN.WON HEE	製造番号 CODE	尺度 SCALE
株式会社 キトー KITO CORP				図番 DWG.NO.	MONO RAIL 1 — 変更回数 REV.

改訂 REV.	数 QTY	内容 CONTENTS	年.月.日 DATE	担当 DRAWN	承認 APPROVED



note
bolt 재원
H.T.B M14,M16,M18,M20일때 : 브라켓트당 4개 이상 사용한다.

용접재원
각장은 높이 5일때 용접길이 L=60mm이상
각장은 높이 6일때 용접길이 L=50mm이상
각장은 높이 7일때 용접길이 L=40mm이상

특기사항
1. 지시없는 용접부는 얇은모재의 70%로 용접한다.

承認 APPROVED	検図 CHECKED	設計 DESIGNED	製図 DRAWN	名称 TITLE	1.5t MONO RAIL HOIST GIRDER BEAM
J.S.CHO	J.S.CHO	EUN.WON HEE	EUN.WON HEE	製造番号 CODE	尺度 SCALE
株式会社 キトー KITO CORP				図番 DWG.NO. MONO RAIL- D1	変更回数 REV.

改訂 REV.	数 QTY	内容 CONTENTS	年.月.日 DATE	担当 DRAWN	承認 APPROVED

4. 전 기 도 면

1) ELECTRICAL SPECIFICATION

2) SYMBOL LIST

3) 배선배관도 & 접지계통도

4) 전기회로도

5) PANEL 관련도

LOAD SUMMARY 1 (ER2-015IS-IL/IS)

*POWER SOURCE　: AC 3Φ 220(208)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	11.2 (A)	6 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 17.7 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 17.7 * 1.25 = 22.1 A

*POWER SOURCE　: AC 3Φ 380(440)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	5.1 (A)	5 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 10.6 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 10.6 * 1.25 = 13.2 A

LOAD SUMMARY 2 (ER2-015IS-L/S)

*POWER SOURCE : AC 3Φ 220(208)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	11.2 (A)	6 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 17.7 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 17.7 * 1.25 = 22.1 A

*POWER SOURCE : AC 3Φ 380(440)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	5.1 (A)	4.4 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 10 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 10 * 1.25 = 12.5 A

LOAD SUMMARY 3 (ER2-015S-IL/IS)

*POWER SOURCE : AC 3Φ 220(208)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	8.4 (A)	6 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 14.9 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 14.9 * 1.25 = 18.6 A

*POWER SOURCE : AC 3Φ 380(440)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	4.6 (A)	5 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 10.1 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 10.1 * 1.25 = 12.6 A

LOAD SUMMARY 4 (ER2-015S-L/S)

*POWER SOURCE : AC 3Φ 220(208)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	8.4 (A)	6 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 14.9 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 14.9 * 1.25 = 18.6 A

*POWER SOURCE : AC 3Φ 380(440)V

OBJECT	HOISTING	TRAVERSING	CONTROL CIRCUIT
MOTOR OUTPUT	1.8KW x 4P	0.4KW x 4P x 2SET	
FULL LOAD CURRENT	4.6 (A)	4.4 (A)	0.5 (A)

*크레인 하중상태를 HOIST의 정격 LOAD의 100(%)를 사용했을때를 기준으로 작성하였음.

*** NOMAL 전류값 ***

권상과 횡행시 : HOISTING + TRAVERSING + CONTROL CIRCUIT = 9.5 A

*** PEAK 전류값 ***

K= NAMAL 전류치가 50A미만일때 1.25, 50A이상일때 1.1적용

NOMAL 전류값 * K = 9.5 * 1.25 = 11.8 A

ROTATING MACHINE

- SYNCHRONOUS GENERATOR, 3-PHASE
- AC INDUCTION MOTOR, 3-PHASE
  * N : NORMAL DUTY
  S : STAND-BY
- DC MOTOR

LIGHTNING ARRESTERS

- LA : LIGHTNING ARRESTER
  SA : SURGE ARRESTER
  SS : SURGE SUPPRESSOR
- DISCHARGE COUNTER

INSTRUMENT TRANSFORMERS

- CURRENT TRANSFORMER
- ZERO PHASE CURRENT TRANSFORMER
- POTENTIAL TRANSFORMER

CIRCUIT BREAKERS

- POWER CIRCUIT BREAKER, FIXED TYPE
  GCB : SF6 GAS CIRCUIT BREAKER
  VCB : VACUUM CIRCUIT BREAKER
  ACB : AIR CIRCUIT BREAKER
- POWER CIRCUIT BREAKER, DRAWOUT TYPE

- CIRCUIT BREAKER, FIXED TYPE
  MCCB : MOULDED CASE CIRCUIT BREAKER
  MCB : MINIATURE CIRCUIT BREAKER
- CIRCUIT BREAKER, DRAWOUT TYPE
- WITHDRAWABLE INTERCONNECTOR
- CIRCUIT BREAKER, MANUALLY OPERATED FIXED TYPE WITH THERMAL & MAGNETIC TRIP
- CIRCUIT BREAKER, MANUALLY OPERATED FIXED TYPE WITH MAGNETIC TRIP ONLY
- CIRCUIT BREAKER, MANUALLY OPERATED DRAWOUT TYPE WITH THERMAL & MAGNETIC TRIP
- CIRCUIT BREAKER, MANUALLY OPERATED FIXED TYPE WITH THERMAL & MAGNETIC TRIP AND RESIDUAL CURRENT RELEASE

SWITCHES

- DISCONNECTOR SWITCH, SINGLE THROW MANUALLY OPERATED
- LOAD BREAK SWITCH, SINGLE THROW MANUALLY OPERATED,
- EARTHING SWITCH, SINGLE THROW MANUALLY OPERATED
- DISCONNECTOR SWITCH, SINGLE THROW MOTOR OPERATED
- EARTHING SWITCH, SINGLE THROW MOTOR OPERATED
- VACUUM CIRCUIT SWITCH
- FUSED DISCONNECTOR SWITCH
- FUSE-SWITCH
- LIMIT SWITCH (MAKE CONTACT)
- LIMIT SWITCH (BREAK CONTACT)
- PUSH BUTTON, NORMALLY OPEN MOMENTARY CONTACT
- PUSH BUTTON, NORMALLY CLOSED MOMENTARY CONTACT
- PUSH BUTTON, NORMALLY OPEN PUSH TO LOCK, RELEASED BY KEY
- MANUAL SELECTOR SWITCH (LOCKED)

CONTACTORS AND STARTERS

- AUX. CONTACT, NORMALLY OPEN WHEN MAIN SWITCHING DEVICE IS DE-ENERGIZED
- AUX. CONTACT, NORMALLY CLOSED WHEN MAIN SWITCHING DEVICE IS DE-ENERGIZED
- MAGNETIC CONTACTOR, ELECTRICALLY OPERATED
- EOCR — COMBINATON STARTER, FULL VOLTAGE, NON-REVERSING, DRAWOUT TYPE, WITH ELECTRICALLY OPERATED CONTACTORS, WITH MAGNETIC MOTOR CIRCUIR BREAKER, BUILT IN ELECTRONIC OVER-CURRENT RELAY WITH ADJUSTABLE TRIP RATING
- COMBINATON STARTER, FULL VOLTAGE, NON-REVERSING, FIXED TYPE, WITH ELECTRICALLY OPERATED CONTACTORS, WITH MAGNETIC MOTOR CIRCUIT BREAKER, BUILT IN THERMAL OVER-CURRENT RELAY WITH ADJUSTABLE TRIP RATING

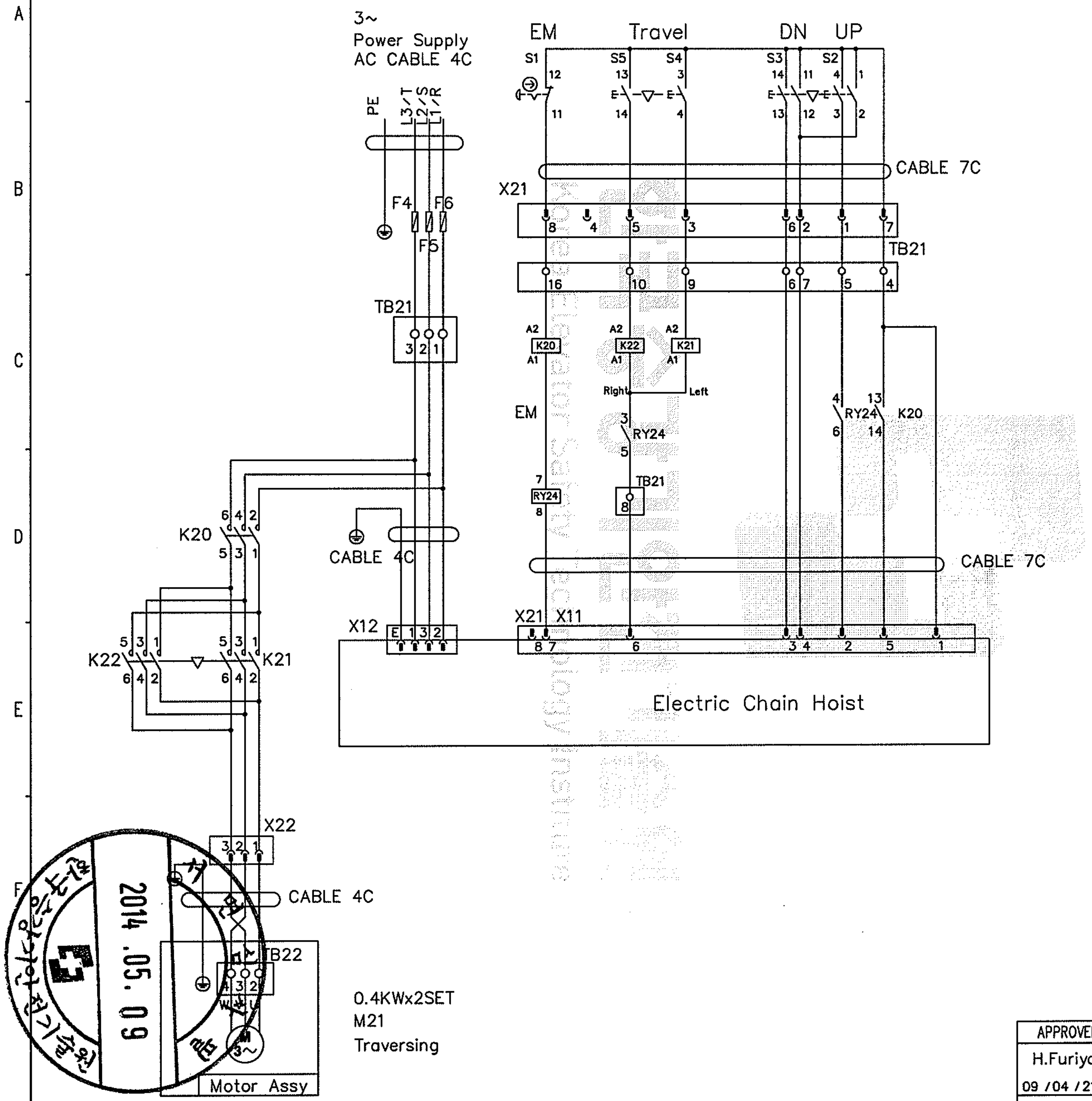
GRAPHIC SYMBOLS

- GENERAL OPERATING COIL
- CAPACITOR
- CAPACITOR VOLTAGE TRANSFORMER(CVT)
- RESISTOR
- DIODE

- CONTROLLED RECTIFIER
- DC-DC CONVERTER
- RECTIFIER, BATTERY CHARGER
- DC-AC INVERTER
- BATTERY BANK
- ELECTRIC HEATER, INDICATE 1* OR 3* AND kW RATING. UNLESS OTHERWISE SPECIFIED, TO BE REGARDED AS 1*.
- EARTHING CONNECTION
- DISCONNECTION LINK
- CROSSING OF CONDUCTORS NOT CONNECTED
- OR — JUNCTION OF CONDUCTORS OR WIRES
- BUS DUCT
  SPB : SEGREGATED PHASE BUS DUCT
  IPB : ISOLATED PHASE BUS DUCT
- CABLE HEAD AND CABLE CONNECTION
- AS — AMMETER SWITCH
- VS — VOLTMETER SWITCH
- SIGNAL LAMP
  * R = RED, G = GREEN, W = WHITE, C = CYAN, Y = YELLOW, B = BLUE, A = AMBER

APPROVED	CHECKED	DESIGNED	SYMBOL LIST	
			CODE	SCALE —
KITO CORP.			DWG.NO. SYMBOL LIST	DATE

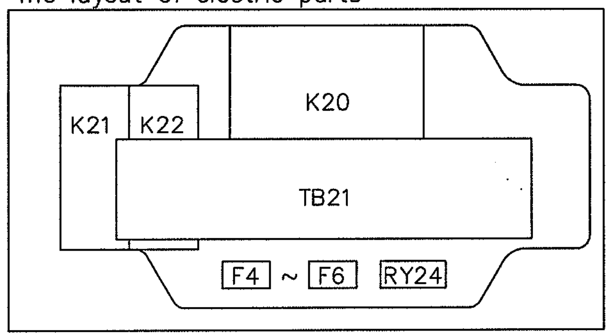
. 1속형 hoisting/. 1속형 traversing



전선 색상

Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지

The layout of electric parts

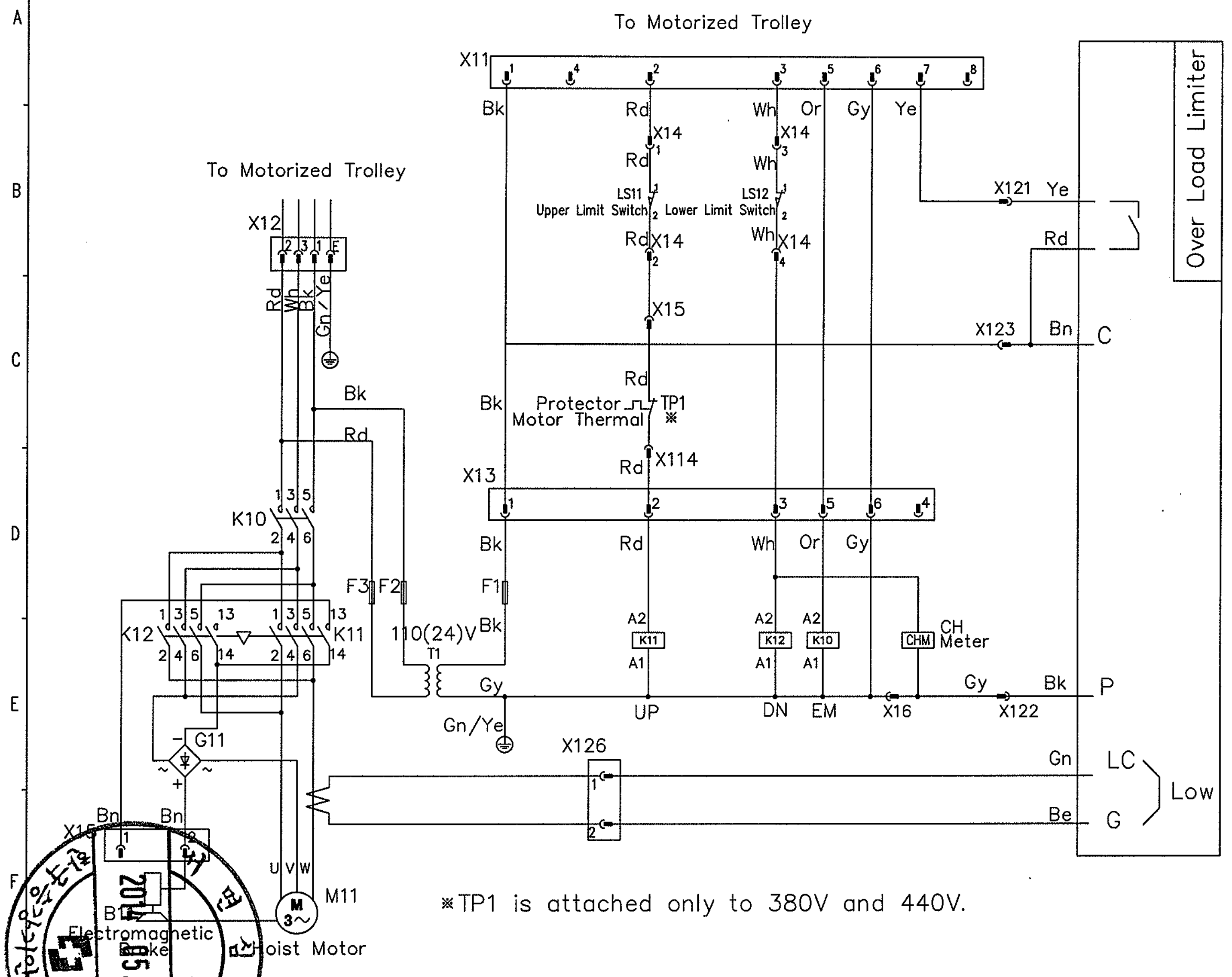


특수 공구(+,육각)을 사용하여
개방구 쪽은 제외

APPROVED	CHECKED	DESIGNED	Traversing 1speed Wiring Diagrm			
H.Furiya 09 /04 /21	H.Hatano 09 /04 /21	K.Miwa 09 /04 /21	CODE		SCALE	—
KITO CORP			DWG.NO.	SEWG3DDOL01	DATE	

UNIT : mm

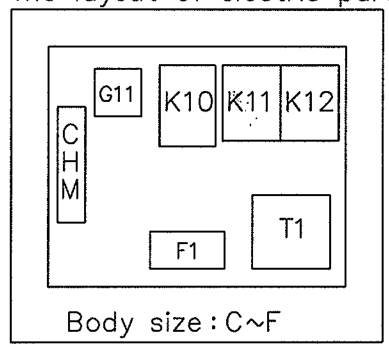
2014 .05. 09
한국승강기안전기술원



※TP1 is attached only to 380V and 440V.

전선 색상
Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지

The layout of electric parts



Body size : C~F

특수 공구(+, 육각)을 사용하여 개방구 쪽은 제외

For MR connection

APPROVED	CHECKED	DESIGNED
H.Furiya 09 /04 /21	T.Hatano 09 /04 /21	K.Miwa 09 /04 /21
KITO CORP		

Hoisting 1speed Traversing Wiring Diagrm

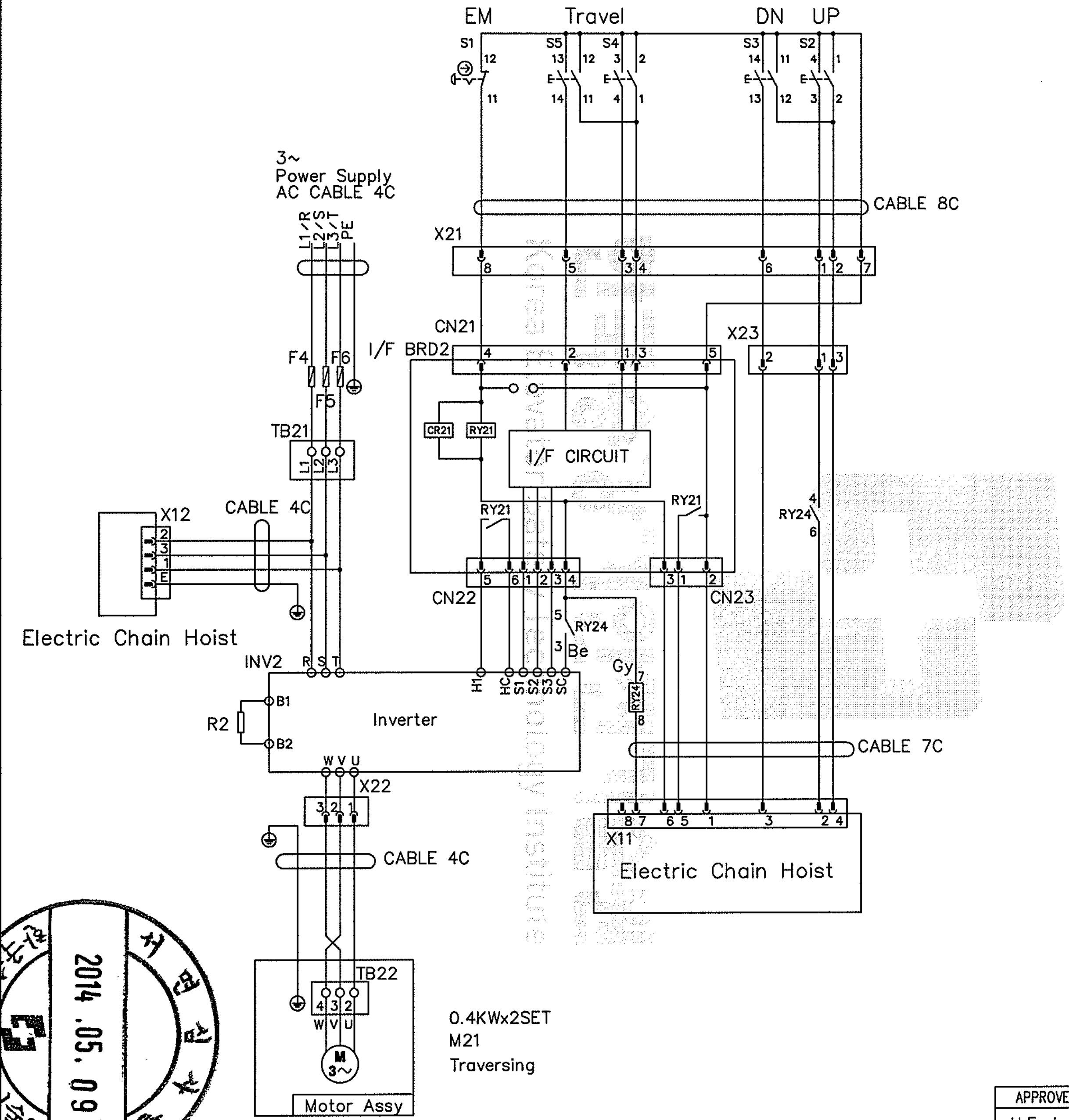
CODE		SCALE	—
DWG.NO.	SEWG3100L01_MR	DATE	

UNIT : mm

2014. 05. 09

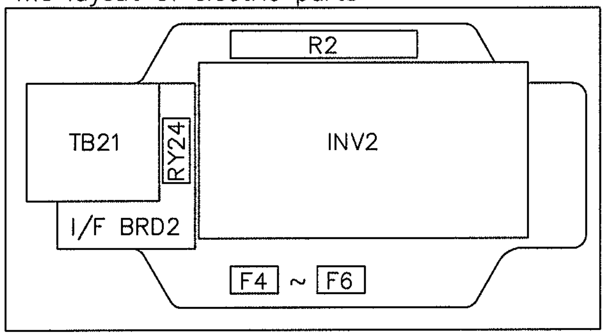
44

. 1속형 hoisting/. 2속형 traversing



전선 색상
Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지

The layout of electric parts

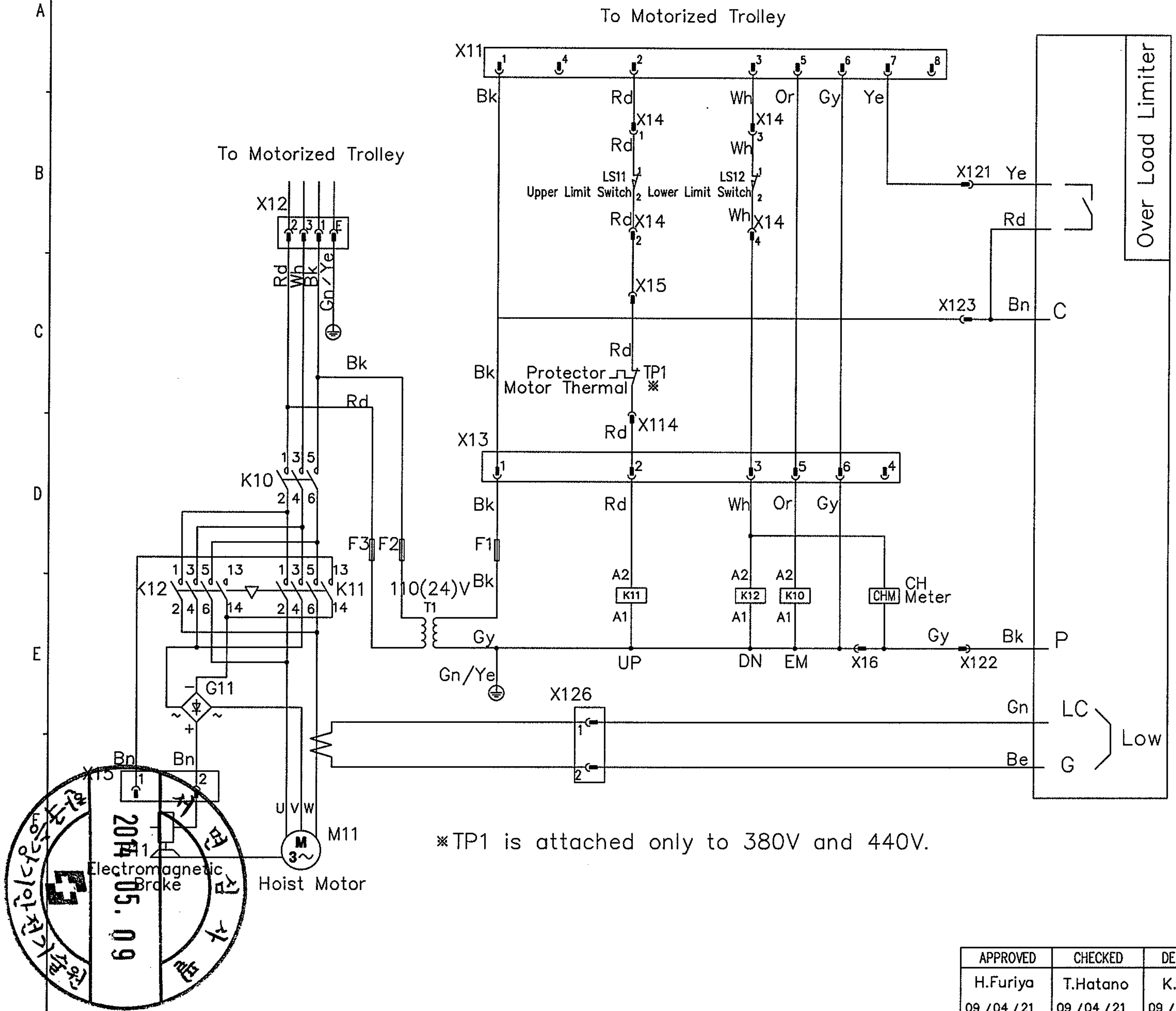


특수 공구(+, 육각)을 사용하여
개방구 쪽은 제외

APPROVED	CHECKED	DESIGNED
H.Furiya	H.Hatano	K.Miwa
09 /04 /21	09 /04 /21	09 /04 /21
KITO CORP.		

Traversing 2speed Wiring Diagrm			
CODE		SCALE	—
DWG.NO.	SEWG3DD0L01	DATE	

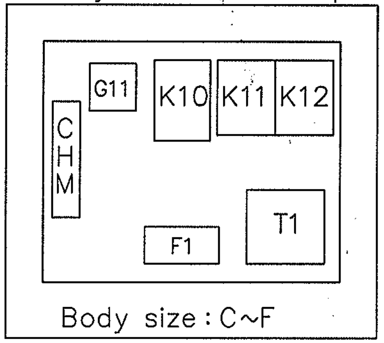
UNIT : mm



※TP1 is attached only to 380V and 440V.

전선 색상
Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지

The layout of electric parts



Body size : C~F

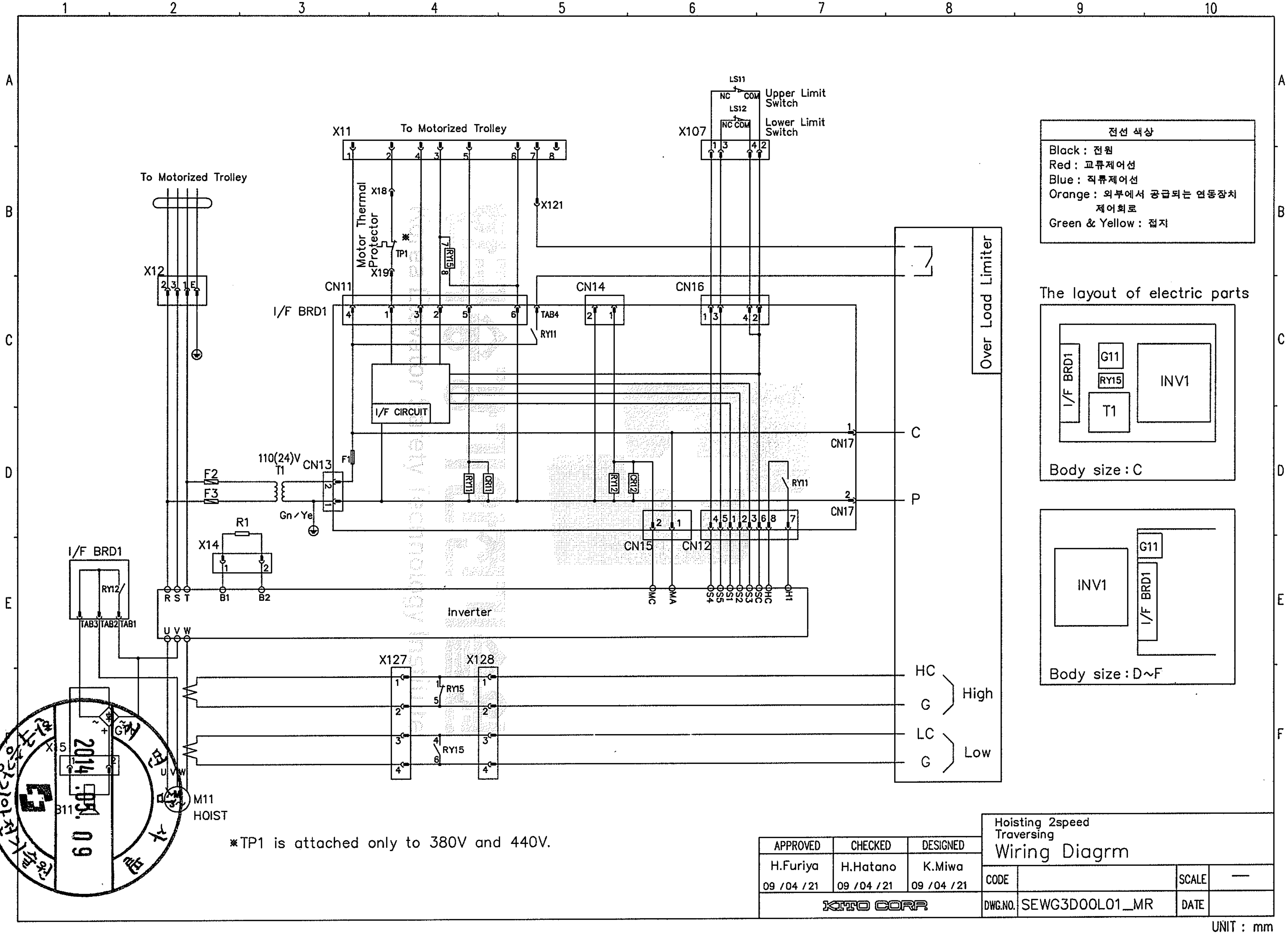
특수 공구(+, 육각)을 사용하여
개방구 쪽은 제외

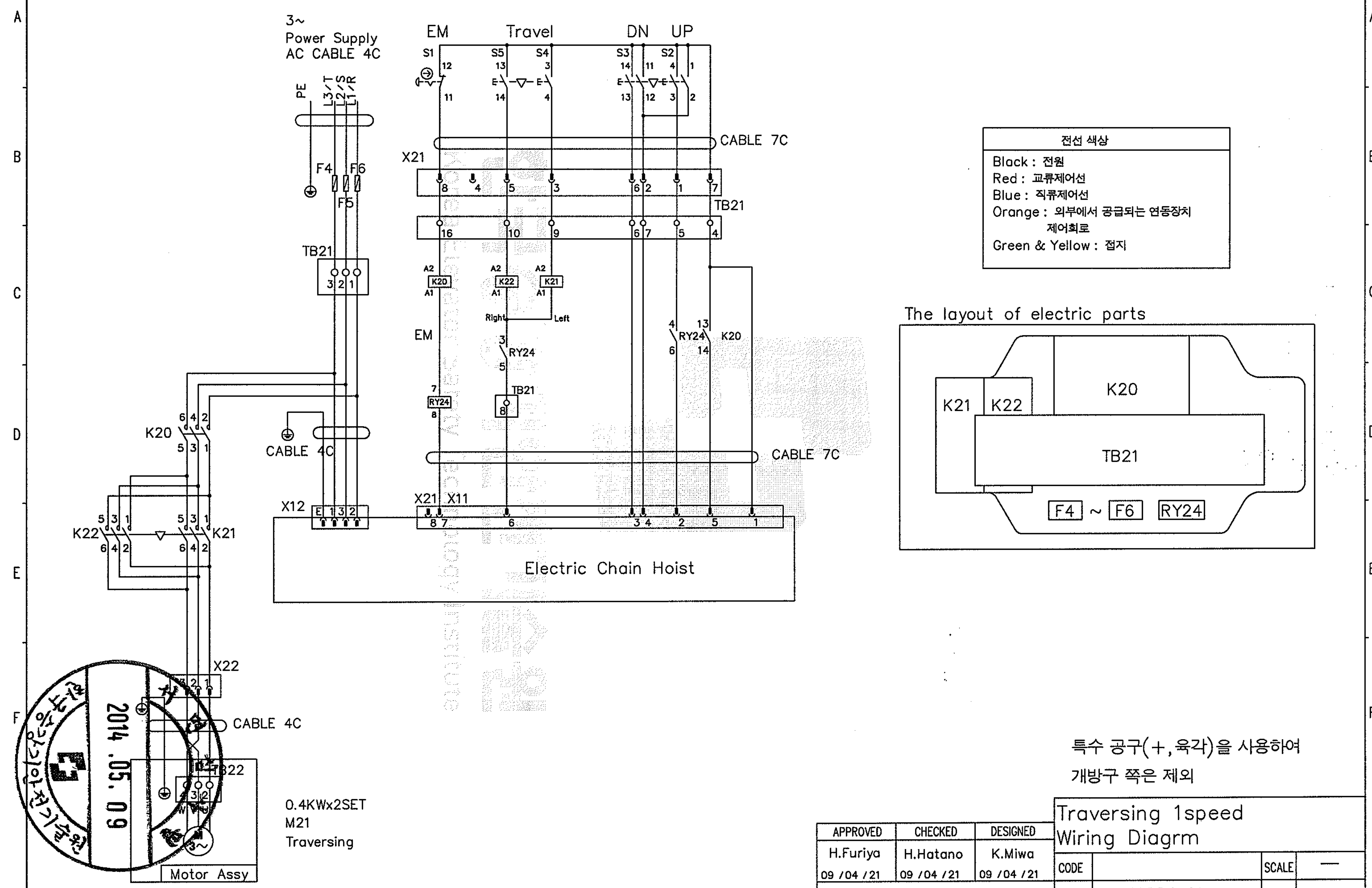
For MR connection

APPROVED	CHECKED	DESIGNED	Hoisting 1speed Traversing Wiring Diagrm	
H.Furiya 09 /04 /21	T.Hatano 09 /04 /21	K.Miwa 09 /04 /21	CODE	SCALE —
KITO CORP			DWG.NO. SEWG3100L01_MR	DATE

UNIT : mm

. 2속형 hoisting/. 1속형 traversing


전선 색상
Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지
The layout of electric parts
Body size : C
Body size : D~F
INV1
G11
RY15
T1
I/F BRD1
Over Load Limiter
To Motorized Trolley
Upper Limit Switch
Lower Limit Switch
Motor Thermal Protector
I/F CIRCUIT
Inverter
HC
G
High
LC
Low
M11
HOIST
110(24)V
Gn/Ye
※TP1 is attached only to 380V and 440V.
APPROVED
CHECKED
DESIGNED
H.Furiya
H.Hatano
K.Miwa
09 /04 /21
KITO CORP.
Hoisting 2speed
Traversing
Wiring Diagrm
CODE
SCALE
DWG.NO. SEWG3D00L01_MR
DATE
UNIT : mm



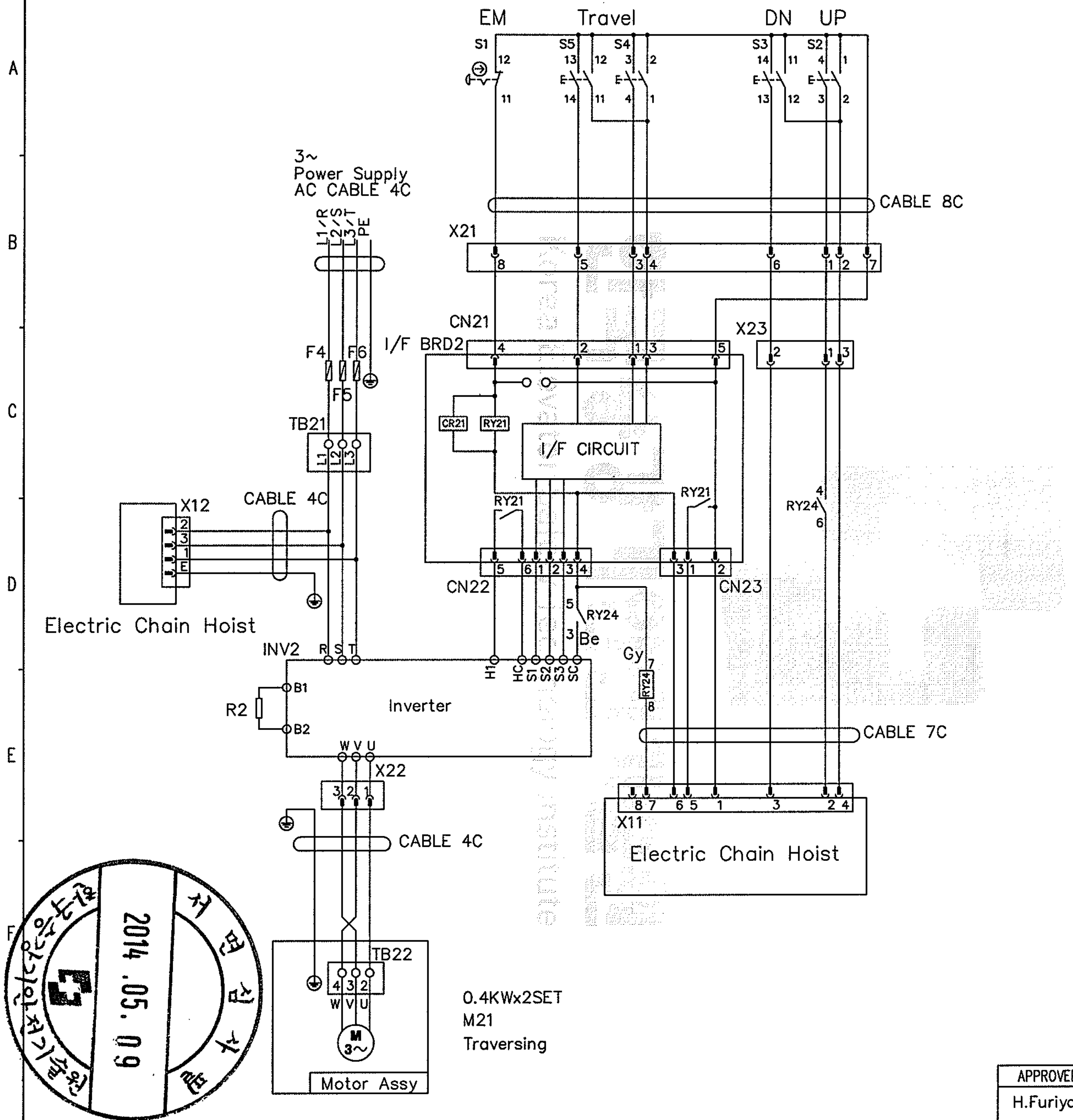
특수 공구(+,육각)을 사용하여
개방구 쪽은 제외

APPROVED	CHECKED	DESIGNED
H.Furiya	H.Hatano	K.Miwa
09 /04 /21	09 /04 /21	09 /04 /21
KITO CORP.		

Traversing 1speed Wiring Diagrm			
CODE		SCALE	—
DWG.NO.	SEWG3DD0L01	DATE	

UNIT : mm

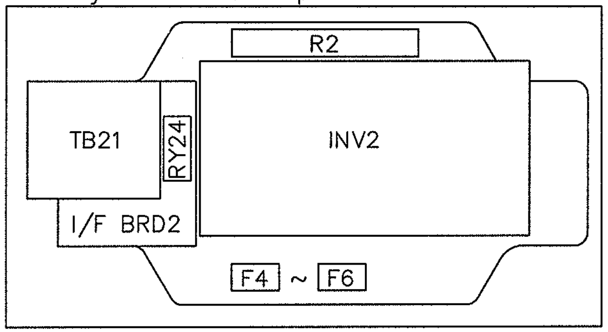
. 2속형 hoisting/. 2속형 traversing



전선 색상

Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지

The layout of electric parts



특수 공구(+,육각)을 사용하여
개방구 쪽은 제외

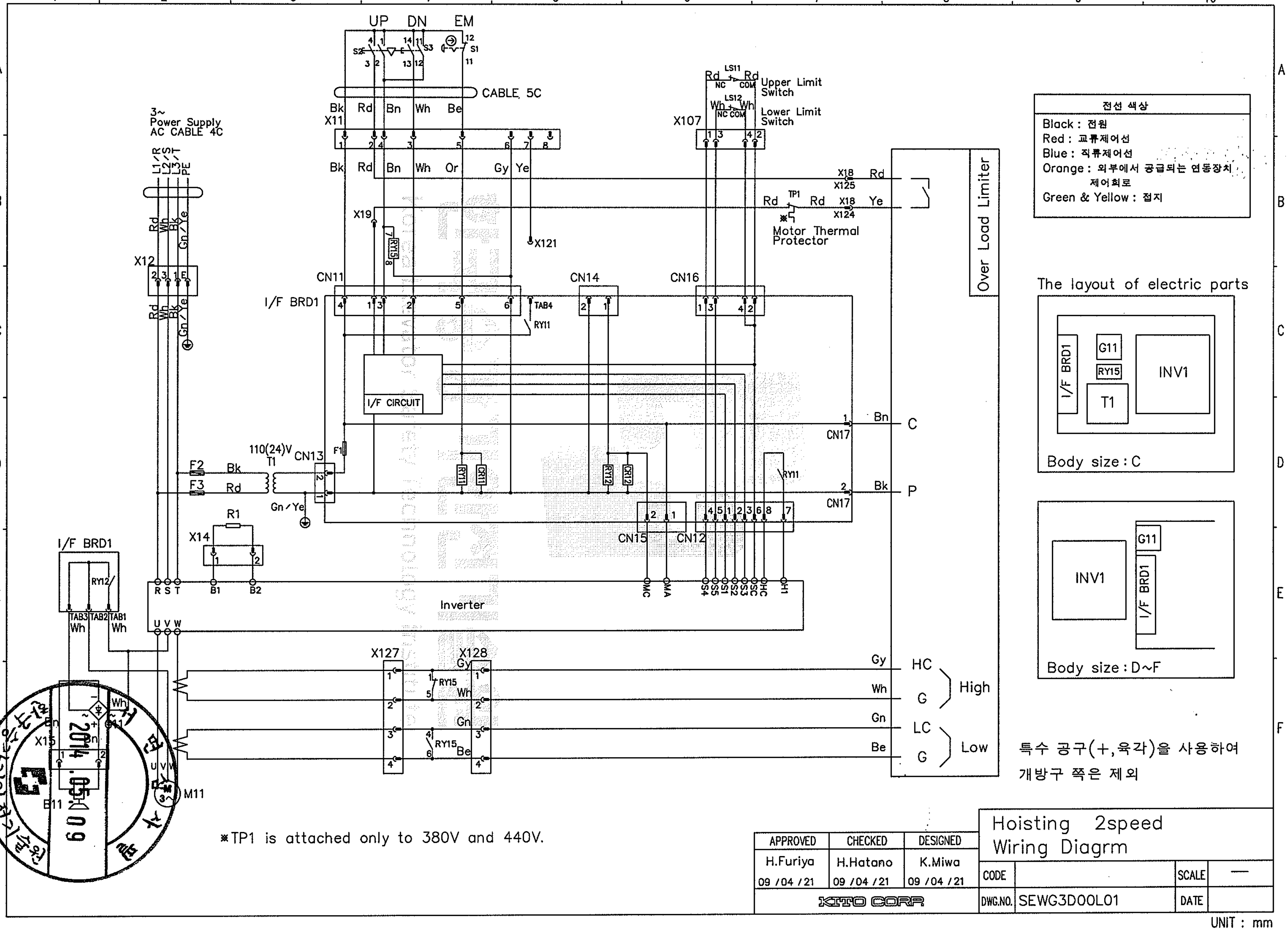
APPROVED	CHECKED	DESIGNED
H.Furiya	H.Hatano	K.Miwa
09 /04 /21	09 /04 /21	09 /04 /21

KITO CORP.

Traversing 2speed
Wiring Diagrm

CODE		SCALE	—
DWG.NO.	SEWG3DD0L01	DATE	

UNIT : mm


UP DN EM
CABLE 5C
3~ Power Supply AC CABLE 4C
L1/R L2/S L3/T PE
X11 X12 X14 X19 X107 X121 X127 X128
CN11 CN12 CN13 CN14 CN15 CN16 CN17
I/F BRD1
I/F CIRCUIT
110(24)V T1
Upper Limit Switch
Lower Limit Switch
TP1
※Motor Thermal Protector
Over Load Limiter
Inverter
High
Low
전선 색상
Black : 전원
Red : 교류제어선
Blue : 직류제어선
Orange : 외부에서 공급되는 연동장치 제어회로
Green & Yellow : 접지
The layout of electric parts
Body size : C
Body size : D~F
특수 공구(+,육각)을 사용하여
개방구 쪽은 제외
※TP1 is attached only to 380V and 440V.
Hoisting 2speed
Wiring Diagrm
APPROVED H.Furiya 09 /04 /21
CHECKED H.Hatano 09 /04 /21
DESIGNED K.Miwa 09 /04 /21
KITO CORP
CODE
SCALE —
DWG.NO. SEWG3D00L01
DATE
UNIT : mm
2014 .05 09

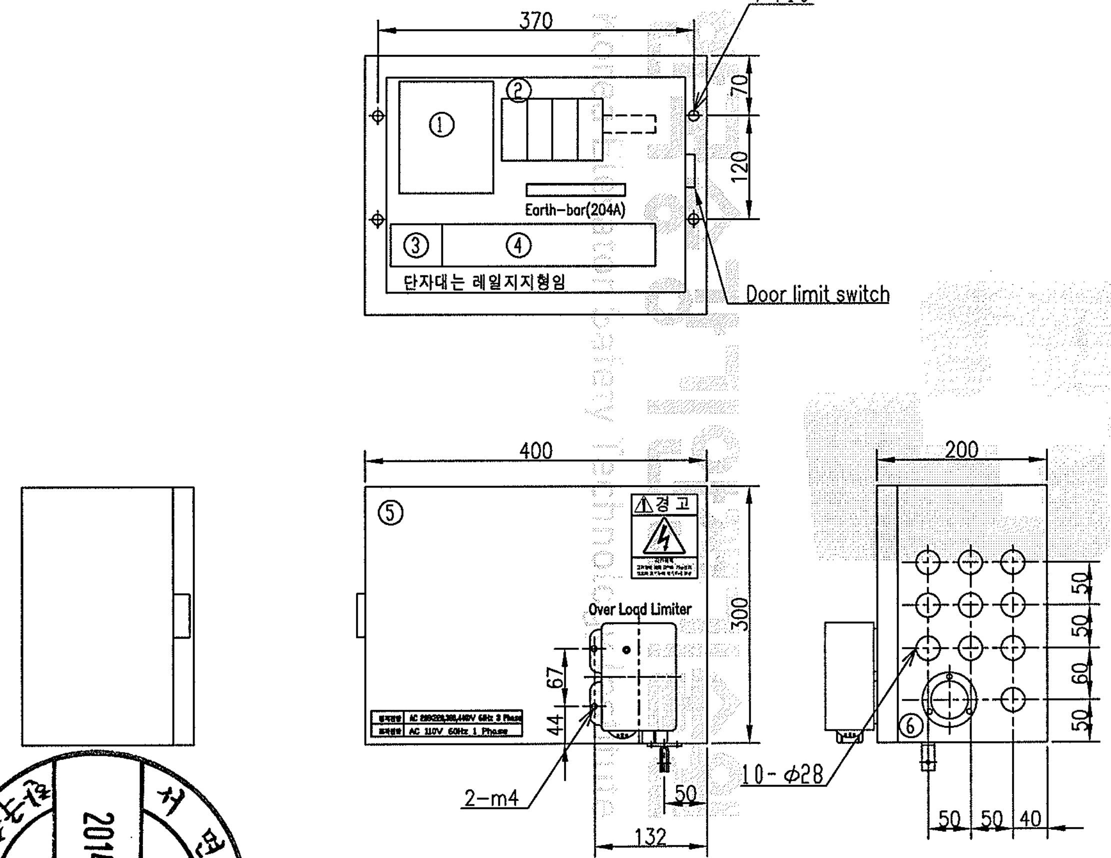
압착단자는 전부 절연피복 부착타입을 사용할것

工番	製作数量	納期

削り加工普通許容差 JIS B0405 中級		
0.5以上	6以下	±0.1
6をこえ	30	±0.2
30	120	±0.3
120	400	±0.5
400	1000	±0.8
1000	2000	±1.2
2000	4000	±2.0

塗装色 : 먼셀넘버 5Y7/1 (메이커 표준색)
設定機器 : 인버터

반내기기 배치도



番号	機器番号	名称	形式	メーカ	個数	備考
1	INV2	인버터	FRN1.5C1S-2J21	富士	1	
2		릴레이	HH54P-L (AC24V)	富士	4	
		소켓	TP514X1	富士	4	
3		단자대	TX20 (4P)	春日	1式	커버부착형
4		단자대	TX10S (30P)	春日	1式	커버부착형
5		함	CH20-43A	日東	1	
6		Door limits switch	KH-9015-HL	KOINO		
7						
8						
9						
10						

단자대 배열

TX20(4P)

R2	S2	T2	E

TX10S (30P)

UT	VT	WT	E	CM	X3A	X3	T100	R100	OLL	TX	RX	OL	UPA	UP
DN	HI	TFB	TFA	TRB	TRA	THA	TH	T100	T100	R100	R100			

Note.

1) 외함 개방 시 충전 부분이 차단되도록 한다.

記事		材質	-	製造番号	303910
		質量	-	名称	セツゾクハコ
承認 齊藤 10.10.8	検図 鈴木 10.10.8	設計 細田 10.10.8	製図 -	尺度 NOT	図番 303910-35011

改訂	数	内容	年月日	設計	承認

株式会社 キトー　様式 025C-06　三角法 単位: mm

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CABLE 구성도 및 사양 – 권상 용량 1.8kw

CABLE SPECIFICATION FOR ER2

NO	ITEM	TYPE	ER2 015
			SIZE
①	Main Power Line(owner scope)	VCT	4sq x 4C
②	Push Button Switch	VCT	1.25sq x 8C
③	Loas Limit	VCT	0.75sq x 8C
④	Power Line for ER	VCT	2sq x 4C
⑤	Control Line for ER	VCT	1.25sq x 6C
⑥	Traversing Motor With Earth	VCT	1.25sq x 4C

(3Φ 220(208)V / 380V / 440V 60Hz)

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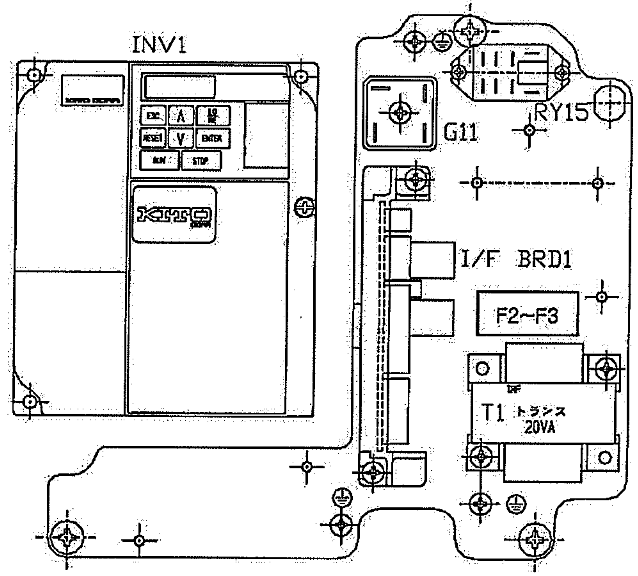
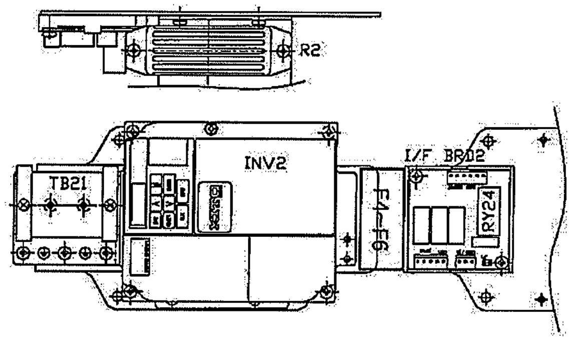
55

. 호이스트 CONTROL BOX 배치도 (ER2 015 IS-IL/IS)

HOISTING CONTROL BOX



TRAVERSING CONTROL BOX

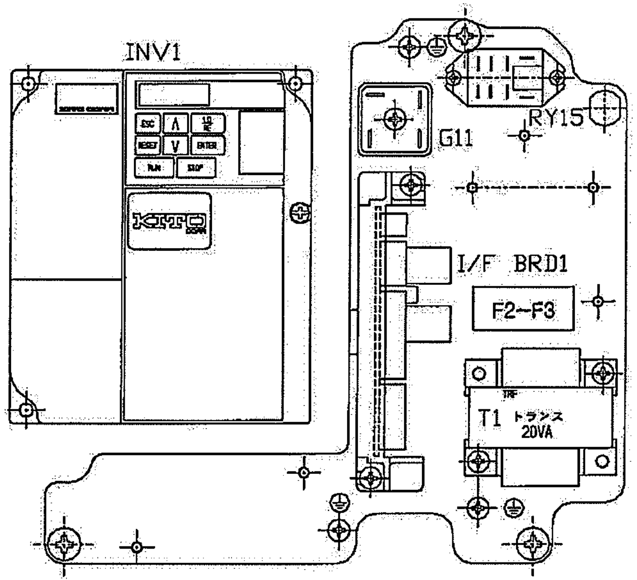


ENCLOSURE : HOIST BODY – IP55
PUSH BUTTON – IP65

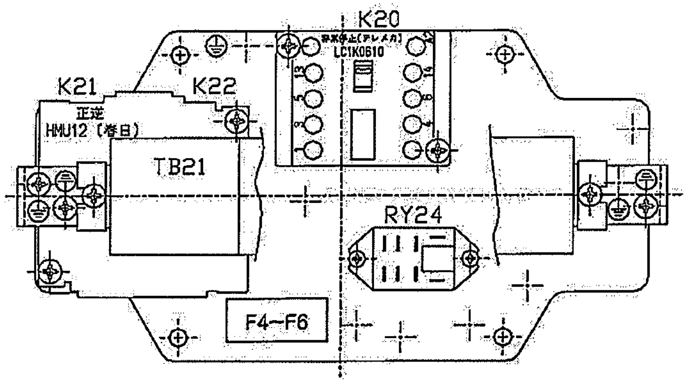
MARK	DESCRIPTION	TYPE OF MODEL			Q'TY	MAKER	REMARKS
		220V	380V	440V			
INV1	INVERTER	V1000	V1000	V1000	1	YASKAWA	UP/DOWN
T1	TRANSFORMER	220V/24V 20VA	380V/24V 20VA	440V/24V 20VA	1	KITO	CONTROL CIRCUIT
G11	BRIDGE DIODE	S15VB60	S15VB60	S15VB60	1	SHINDENGEN	
I/F BRD1	INTERFACE BOARD	10~15A	10~15A	10~15A	1	KITO	
F2~F3	GLASS FUSE	10A	10A	10A	2	FUJI	
F4~F6	GLASS FUSE	20A	20A	20A	3	FUJI	
RY15	RELAY	24V	24V	24V	1	OMRON	HIGH/LOW
INV2	INVERTER	V1000	V1000	V1000	1	YASKAWA	RIGHT/LEFT
I/F BRD2	INTERFACE BOARD	10~15A	10~15A	10~15A	1	KITO	
RY24	RELAY	24V	24V	24V	1	OMRON	EMERGENCY STOP
TB21	TERMINAL BOARD 21	10~15A	10~15A	10~15A	1	KITO	

. 호이스트 CONTROL BOX 배치도 (ER2 015 IS-L/S)

HOISTING CONTROL BOX



TRAVERSING CONTROL BOX

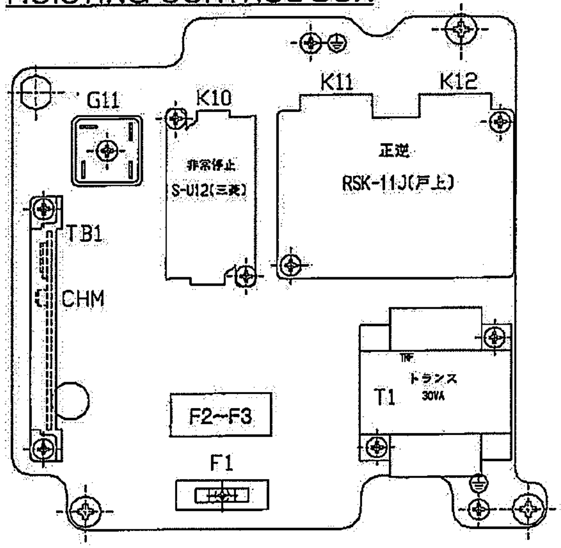


ENCLOSURE : HOIST BODY – IP55
PUSH BUTTON – IP65

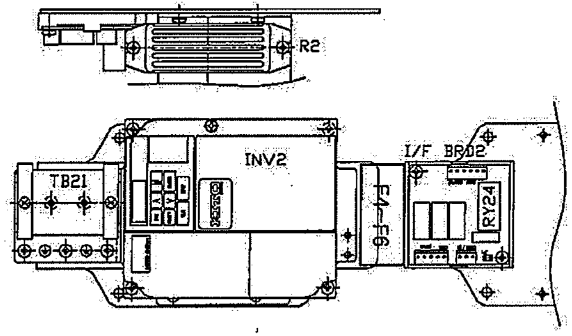
MARK	DESCRIPTION	TYPE OF MODEL			Q'TY	MAKER	REMARKS
		220V	380V	440V			
INV1	INVERTER	V1000	V1000	V1000	1	YASKAWA	UP/DOWN
T1	TRANSFORMER	220V/24V 20VA	380V/24V 20VA	440V/24V 20VA	1	KITO	CONTROL CIRCUIT
G11	BRIDGE DIODE	S15VB60	S15VB60	S15VB60	1	SHINDENGEN	
I/F BRD1	INTERFACE BOARD	10~15A	10~15A	10~15A	1	KITO	
F2~F3	GLASS FUSE	10A	10A	10A	2	FUJI	
F4~F6	GLASS FUSE	20A	20A	20A	3	FUJI	
RY15	RELAY	24V	24V	24V	1	OMRON	HIGH/LOW
K20	MAGNET CONTACTOR	LC1K0610B7	LC1K0610B7	LC1K0610B7	1	TELEMECANIQUE	EMERGENCY STOP
K21,K22	MAGNET CONTACTOR	HMU12	HMU12	HMU12	1	KASUGA	RIGHT/LEFT
RY24	RELAY	24V	24V	24V	1	OMRON	EMERGENCY STOP
TB21	TERMINAL BOARD 21	10~15A	10~15A	10~15A	1	KITO	

. 호이스트 CONTROL BOX 배치도 (ER2 015 S-IL/IS)

HOISTING CONTROL BOX



TRAVERSING CONTROL BOX

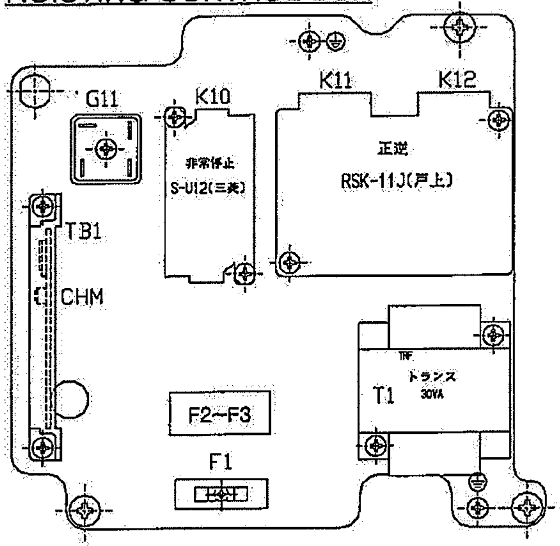


ENCLOSURE : HOIST BODY – IP55
PUSH BUTTON – IP65

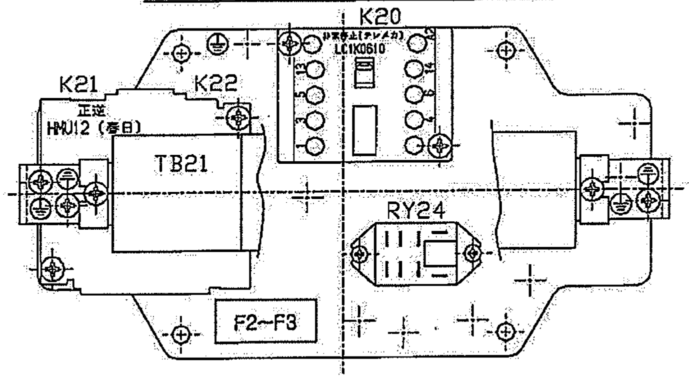
MARK	DESCRIPTION	TYPE OF MODEL			Q'TY	MAKER	REMARKS
		220V	380V	440V			
K10	MAGNET CONTACTOR	S-U12	S-U12	S-U12	1	MITSUBISHI	EMERGENCY STOP
K11,K12	MAGNET CONTACTOR	RSK-11J-S95	RSK-11J-S95	RSK-11J-S95	1	TOGAMI	UP/DOWN
T1	TRANSFORMER	220V/24V 30VA	380V/24V 30VA	440V/24V 30VA	1	KITO	CONTROL CIRCUIT
F1	GLASS FUSE	2A	2A	2A	1	FUJI	
F2~F3	GLASS FUSE	10A	10A	10A	2	FUJI	
F4~F6	GLASS FUSE	20A	20A	20A	3	FUJI	
G11	BRIDGE DIODE	S15VB60	S15VB60	S15VB60	1	SHINDENGEN	
TB	TERMINAL BOARD	10~15A	10~15A	10~15A	1	KITO	
CHM	COUNTER HOUR METER	ECP91CHAA1-3	ECP91CHAA1-3	ECP91CHAA1-3	1	OTEC	사용회수, 시간 기록
INV2	INVERTER	V1000	V1000	V1000	1	YASKAWA	RIGHT/LEFT
I/F BRD2	INTERFACE BOARD	10~15A	10~15A	10~15A	1	KITO	
RY24	RELAY	24V	24V	24V	1	OMRON	EMERGENCY STOP
TB21	TERMINAL BOARD 21	10~15A	10~15A	10~15A	1	KITO	

. 호이스트 CONTROL BOX 배치도 (ER2 015 S-L/S)

HOISTING CONTROL BOX

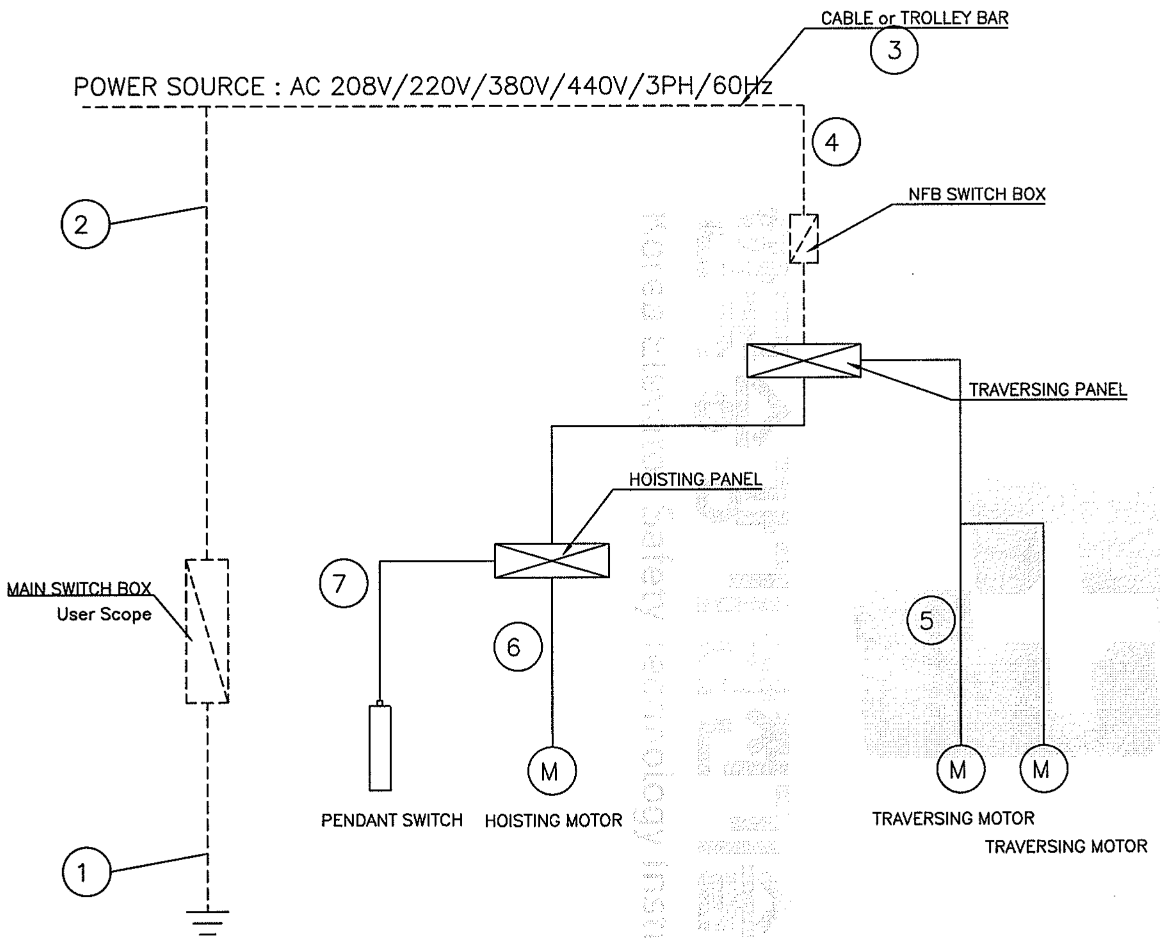


TRAVERSING CONTROL BOX



ENCLOSURE : HOIST BODY – IP55
PUSH BUTTON – IP65

MARK	DESCRIPTION	TYPE OF MODEL			Q'TY	MAKER	REMARKS
		220V	380V	440V			
K10	MAGNET CONTACTOR	S-U12	S-U12	S-U12	1	MITSUBISHI	EMERGENCY STOP
K11,K12	MAGNET CONTACTOR	RSK-11J-S95	RSK-11J-S95	RSK-11J-S95	1	TOGAMI	UP/DOWN
T1	TRANSFORMER	220V/24V 30VA	380V/24V 30VA	440V/24V 30VA	1	KITO	CONTROL CIRCUIT
F1	GLASS FUSE	2A	2A	2A	1	FUJI	
F2~F3	GLASS FUSE	10A	10A	10A	2	FUJI	
F4~F6	GLASS FUSE	20A	20A	20A	3	FUJI	
G11	BRIDGE DIODE	S15VB60	S15VB60	S15VB60	1	SHINDENGEN	
TB	TERMINAL BOARD	10~15A	10~15A	10~15A	1	KITO	
CHM	COUNTER HOUR METER	ECP91CHAA1-3	ECP91CHAA1-3	ECP91CHAA1-3	1	OTEC	사용회수, 시간 기록
K20	MAGNET CONTACTOR	LC1K0610B7	LC1K0610B7	LC1K0610B7	1	TELEMECANIQUE	EMERGENCY STOP
K21,K22	MAGNET CONTACTOR	HMU12	HMU12	HMU12	1	KASUGA	RIGHT/LEFT
RY24	RELAY	24V	24V	24V	1	OMRON	EMERGENCY STOP
TB21	TERMINAL BOARD 21	10~15A	10~15A	10~15A	1	KITO	



접지설비 시공방법

1. 전동기의 외함,제어반 등은 접지를 해야 하며 그 접지저항은 다음의 규정을 따른다

접지공사		
3종 접지공사	400V 이하	100 Ω이하
특3종 접지공사	400V 이상	10 Ω이하

단,방폭지역은 전압관계없이 10 Ω이하일것

2. 접지전용 Trolley Duct 및 전선은 당해 전기기기, 기구에 대하여 충분한 용량과 전기적,기계적인 강도를 가져야 함.
3. 접지선이 외상을 받을 우려가 있는 경우는 전선관, 합성수지관 등과 함께 사용한다
4. 접지공사는 지표면에서 최저 75cm이상의 깊이에 접지봉을 박고 접지봉에는 접지동판을 연결한다.

CABLE 종류 및 굵기

NO	FROM	CABLE SPEC.	Earth Cable
1	Main Earth Line	VCT 4SQx1C	User Scope(1Core)
2	Main Power Sorce	VCT 4SQ x 4C	User Scope(1Core)
3	Trolley bar or Festoon cable	60A x 4P or	User Scope(1Core)
4	Main Power Sorce	VCT 4SQ x 4C	User Scope(1Core)
5	Traversing Motor	VCT 1.25SQ x 6C	(G-1Core)
6	Hoist Motor	VCT 2SQ x 4C	(G-1Core)
7	Push Button Switch	VCT 1.25SQ x 8C	(G-1Core)
8			

APPROVED	CHECKED	DESIGNED	DRAWN
M.Fukasawa	I.Iinuma	A.Shimura	---
11.07.20	11.07.20	11.07.20	

REV. | QTY | CONTENTS | DATE | DRAWN | APPROVED

KITO CORPORATION

TITLE 1.5t MOTORIZED-4점식 케이블 구성도 및 접지계통도

MDL. 942513 | SCALE NOT

DWG. NO. 3NNU942513 | REV. 0

허용 최대 SPAN 적용표 (I-BEAM, H-BEAM)

PROJECT NAME : KD-ER2-015
RATED LOAD : 1.5 ton
DESCRIPTION : LIFT(max) 30 m

NO.	I-BEAM-SIZE (B*H*t1*t2)	Ix cm4	Iy cm4	Zx cm3	Zy cm3	A cm2	Wb kg/m	Wh ton	Wg ton	Wg1 ton	L cm	L1 cm	L2 cm	b cm	E kg/cm²	Φ	Ψ	Σσ1 (TON/cm²)	Σσ2 (TON/cm²)	Σσ3 (TON/cm²)	Σσ4 (TON/cm²)	δ1<L/800->O.K δ1	δ1<L/800->O.K L/800	δ2<L1/500->O.K δ2	δ2<L1/500->O.K L1/500	결 과
I - BEAM																										
1	300x150x10/18.5t	12700	886	849	118	83.47	65.5	0.355	0.622	0.229	950	350	30	60	2100000	1.11	1.1	0.477	0.570	0.669	0.726	0.882	1.188	0.4259	0.70	O.K
2	350x150x9/15t	15200	702	870	93.5	74.58	58.5	0.355	0.585	0.228	1000	390	30	60	2100000	1.11	1.1	0.500	0.667	0.791	1.143	0.844	1.250	0.5049	0.78	O.K
3	400x150x10/18t	24100	864	1200	115	91.73	72	0.355	0.792	0.324	1100	450	30	60	2100000	1.11	1.1	0.432	0.609	0.690	1.155	0.779	1.375	0.5255	0.90	O.K
4	350x150x12/24t	22400	1180	1280	158	111.1	87.2	0.355	0.959	0.392	1100	450	30	60	2100000	1.11	1.1	0.414	0.546	0.559	0.784	0.900	1.375	0.5818	0.90	O.K
5	400x150x12.5/25t	31700	1240	1580	165	122.1	95.8	0.355	1.198	0.479	1250	500	30	60	2100000	1.11	1.1	0.429	0.532	0.677	0.880	1.025	1.563	0.5946	1.00	O.K
H - BEAM																										
6	300x150x6.5/9t	7210	508	481	67.7	40.8	32	0.355	0.24	0.09	750	280	30	60	2100000	1.11	1.1	0.556	0.729	0.777	0.898	0.626	0.938	0.3353	0.56	O.K
7	350x175x7/11t	13500	984	771	112	62.91	49.4	0.355	0.494	0.173	1000	350	30	60	2100000	1.11	1.1	0.538	0.606	0.826	0.740	0.909	1.250	0.3900	0.70	O.K
8	400x200x8/13t	23500	1740	1170	174	83.37	65.4	0.355	0.719	0.294	1100	450	30	60	2100000	1.11	1.1	0.404	0.559	0.470	0.711	0.774	1.375	0.5320	0.90	O.K
9	450x200x9/14t	32900	1870	1460	187	95.43	74.9	0.355	0.899	0.375	1200	500	30	60	2100000	1.11	1.1	0.384	0.533	0.485	0.777	0.776	1.500	0.5494	1.00	O.K

- Ix X축의 단면 2차모멘트
- Iy Y축의 단면 2차모멘트
- Zx X축의 단면계수
- Zy Y축의 단면계수
- A BEAM의 단면적
- Wb BEAM의 단위중량
- Wh HOIST 자중
- Wg GIRDER 자중
- Wg1 켄틀레버 GIRDER 자중
- L SPAN-PITCH내 LENGTH
- L1 켄틀레버 LENGTH
- L2 HOOK APPROACH
- b WHEEL BASE OF HOIST
- E 종탄성계수
- Φ = M 작업계수
- Ψ = F 정하중계수

1. PITCH내 Σσ1 = (PITCH내 계산응력) < 1.279 TON/CM^2 이하일 경우 "O.K" (SS400,용접효율 80%적용,풍하중 115%적용)
작업시 풍하중을 고려 허용응력에 115% 적용 1391 * 80%(용접효율)*115%(작업시 풍하중) = 1279 KG/CM^2

2. 작업시 켄틀레버 Σσ2 = (켄틀레버 계산응력) < 1.600 TON/CM^2 이하일 경우 "O.K"(SS400,풍하중 115%적용)
작업시 풍하중을 고려 허용응력에 115% 적용 1391 * 115%(작업시 풍하중) = 1600 KG/CM^2
(켄틀레버 용접부위 없음)

3. 휴지시 PITCH내 Σσ3 = (PITCH내 계산응력) < 1.447 TON/CM^2 이하일 경우 "O.K" (SS400,풍하중 130%적용)
휴지시 풍하중을 고려 허용응력에 130% 적용 1391 *80%*130%(휴지시 풍하중) = 1447 KG/CM^2

3. 휴지시 켄틀레버 Σσ4 = (켄틀레버 계산응력) < 1.808 TON/CM^2 이하일 경우 "O.K" (SS400,풍하중 130%적용)
휴지시 풍하중을 고려 허용응력에 130% 적용 1391 * 130%(휴지시 풍하중) = 1808 KG/CM^2
(켄틀레버 BEAM 연결부위 없음)

4. δ1 = (PITCH내 처짐량) < L / 800 이하일 경우 "O.K"
δ2 = (켄틀레버 처짐량) < L1 / 500 이하일 경우 "O.K"

5. AREA CLASSIFICATION : IN DOOR or OUT DOOR

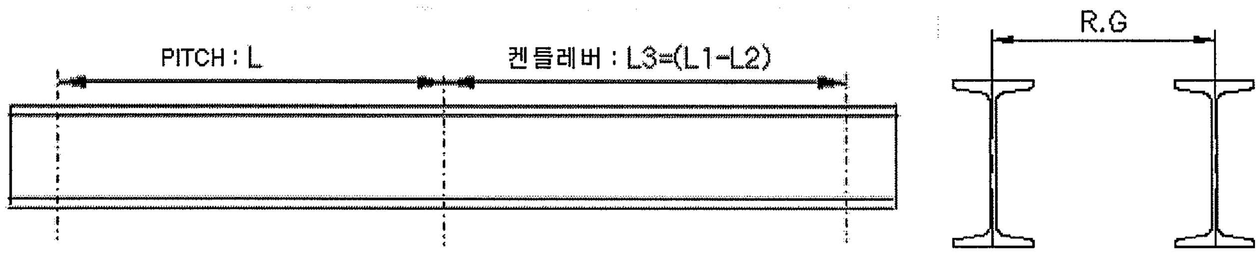
서면심사 2014 .05. 09 기안전기술원

1. I-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	950	cm
.켄틸리버	--------------------	L1=	350	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	0.622	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.229	ton
.I-BEAM SIZE	--------------------	300x150x10/18.5t		
		Ix =	12700	cm^4
		Iy =	886	cm^4
		Zx =	849	cm^3
		Zy =	118	cm^3
		A =	83.47	cm^2
		Wb =	65.5	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE I-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(950-60/2)^2/(4*950)

= 252.2 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(350−30) = 362.39 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.622*950 / 8 = 81.987 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.229*350 / 2 = 44.48 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 334.2 ton.cm

Mmax2 = Mh2 + Mt2 = 406.9 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 M

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x9.5x0.25x19.9x1.7 = 89 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.4 =1.11x3.5x0.25x19.9x1.4 = 27 kg

$$M_{FGG} = \frac{0.089 \times 950}{8} + \frac{0.027 \times 350}{2} = 5.844 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.027 \times 350}{2} = 4.725 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 950 / 4 = 4037.5 kg.cm = 4.0375 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 350 = 5950 kg.cm = 5.95 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 5.844+4.0375= 9.882 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 4.725+5.95= 10.675 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 334.2 / 849 = 0.394 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 406.9 / 849 = 0.479 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 9.8815 / 118 = 0.084 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 10.675 / 118 = 0.090 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.477

0.477 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.570

0.570 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x9.5x0.25x158x1.7 = 708 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.4 =1.11x3.5x0.25x158x1.4 = 215 kg

$$MM_{G1} = \frac{0.708x950}{8} - \frac{0.215 \times 350}{2} =$$ 46.45 ton.cm

$$MM_1 = \frac{0.215 \times 350}{2} =$$ 37.625 ton.cm

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 MM_{H0}= 137 x 950 / 4= 130150 KG.CM = 32.5375 ton.cm

*켄틀레버 MM_{H1}= 137 x 350 = 47950 KG.CM = 48.[illegible] ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$	46.45 + 32.5375 =	78.9875 ton.cm
$MM_4 = MM_1 + MM_{H1} =$	37.625 + 48 =	85.63 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$	78.9875 / 118 =	0.669 ton/cm^2	< 1.447	ton/cm^2--O.K
$\Sigma\sigma 4 = MM_4 / Zy =$	85.625 / 118 =	0.726 ton/cm^2	< 1.808	ton/cm^2--O.K

PITCH내	휴지시 응력 1391 x 80% x130% =	1447 ton/cm^2
켄틀레버는 용접부 없음	휴지시 응력 1391 x 130% =	1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.6212\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2604\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.882 cm

RATIO : D3/L = 1/ 1078 < 800 ------- O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.3799\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0460\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.4259 cm

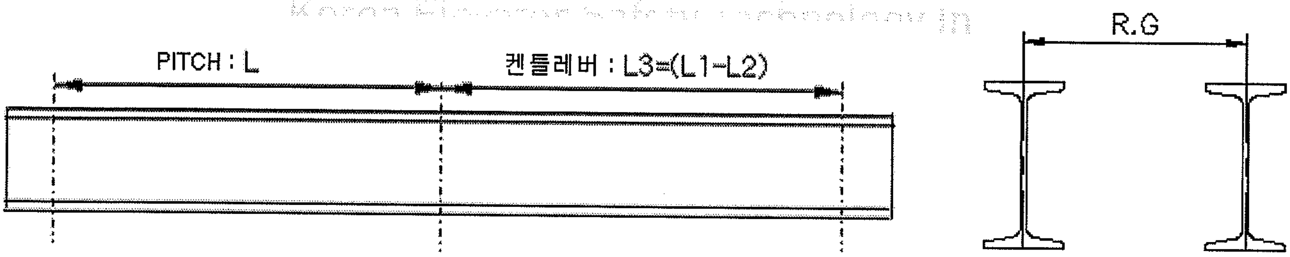
RATIO : D3/L = 1/ 822 < 500 ------- O.K

2. I-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	1000	cm
.켄틸리버	--------------------	L1=	390	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	0.585	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.228	ton
.I-BEAM SIZE	--------------------	350x150x9/15t		
		Ix =	15200	cm^4
		Iy =	702	cm^4
		Zx =	870	cm^3
		Zy =	93.5	cm^3
		A =	74.58	cm^2
		Wb =	58.5	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE I-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1000-60/2)^2/(4*1000)

= 266.4 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(390-30) = 407.69 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.585*1000 / 8 = 81.169 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.228*390 / 2 = 49.35 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 347.6 ton.cm

Mmax2 = Mh2 + Mt2 = 457 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 M

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x10x0.25x19.9x1.7 = 94 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.6 =1.11x3.9x0.25x19.9x1.6 = 34 kg

$M_{FGG} = \frac{0.094 \times 1000}{8} - \frac{0.034 \times 390}{2} =$ 5.12 ton.cm

$M_{FG1} = \frac{0.034 \times 390}{2} =$ 6.63 ton.cm

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 1000 / 4 = 4250 kg.cm = 4.25 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 390 = 6630 kg.cm = 6.63 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 5.12+4.25= 9.370 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 6.63+6.63= 13.260 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 347.6 / 870 = 0.400 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 457 / 870 = 0.525 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 9.37 / 93.5 = 0.100 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 13.26 / 93.5 = 0.142 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.500

0.500 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.667

0.667 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x10x0.25x158x1.7 = 745 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.6 =1.11x3.9x0.25x158x1.6 = 274 kg

$$MM_{G1} = \frac{0.745 \times 1000}{8} - \frac{0.274 \times 390}{2} = \quad 39.695 \text{ ton.cm}$$

$$MM_{1} = \frac{0.274 \times 390}{2} = \quad 53.43 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 1000 / 4= 137000 KG.CM = 34.25 ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 390 = 53430 KG.CM = 53.4 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 39.695 + 34.25 = 73.945 ton.cm

$MM_4 = MM_1 + MM_{H1} =$ 53.43 + 53.4 = 106.83 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 73.945 / 93.5 = 0.791 ton/cm^2 < 1.447 ton/cm^2--O.K

$\Sigma\sigma 4 = MM_4 / Zy =$ 106.83 / 93.5 = 1.143 ton/cm^2 < 1.808 ton/cm^2--O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2

켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.6054\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2386\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.844 cm

RATIO : D3/L = 1/ 1185 < 800 ------- O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4519\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0530\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.5049 cm

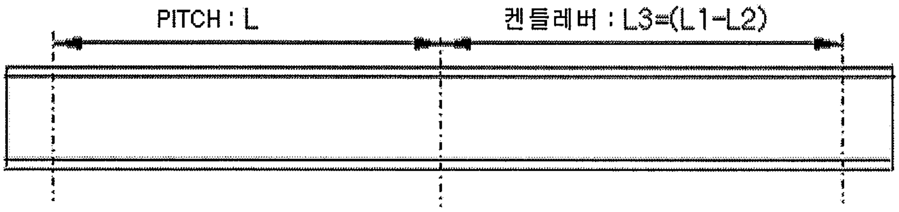
RATIO : D3/L = 1/ 772 < 500 ------- O.K

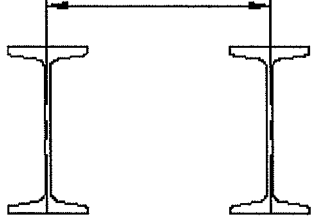
3. I-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	1100	cm
.켄틸리버	--------------------	L1=	450	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	0.792	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.324	ton
.I-BEAM SIZE	--------------------	400x150x10/18t		
		Ix =	24100	cm^4
		Iy =	864	cm^4
		Zx =	1200	cm^3
		Zy =	115	cm^3
		A =	91.73	cm^2
		Wb =	72	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN





2. ONE SIDE I-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1100-60/2)^2/(4*1100)

= 294.7 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(450-30) = 475.64 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.792*1100 / 8 = 120.879 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.324*450 / 2 = 80.92 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 415.6 ton.cm

Mmax2 = Mh2 + Mt2 = 556.6 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 M

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x11x0.25x19.9x1.7 = 103 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.6 =1.11x4.5x0.25x19.9x1.6 = 40 kg

$$M_{FGG} = \frac{0.103 \times 1100}{8} - \frac{0.04 \times 450}{2} = 5.163 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.04 \times 450}{2} = 9 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 1100 / 4 = 4675 kg.cm = 4.675 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 450 = 7650 kg.cm = 7.65 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 5.163+4.675= 9.838 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 9+7.65= 16.650 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 415.6 / 1200 = 0.346 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 556.6 / 1200 = 0.464 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 9.838 / 115 = 0.086 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 16.65 / 115 = 0.145 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.432

0.432 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.609

0.609 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x11x0.25x158x1.7 = 820 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.6 =1.11x4.5x0.25x158x1.6 = 316 kg

$$MM_{G1} = \frac{0.82x1100}{8} - \frac{0.316 \times 450}{2} = 41.65 \text{ ton.cm}$$

$$MM_{1} = \frac{0.316 \times 450}{2} = 71.1 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 1100 / 4= 150700 KG.CM = 37.675 ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 450 = 61650 KG.CM = 61[illegible] ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 41.65 + 37.675 = 79.325 ton.cm

$MM_4 = MM_1 + MM_{H1} =$ 71.1 + 61.7 = 132.80 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 79.325 / 115 = 0.690 ton/cm^2 < 1.447 ton/cm^2--O.K

$\Sigma\sigma 4 = MM_4 / Zy =$ 132.8 / 115 = 1.155 ton/cm^2 < 1.808 ton/cm^2--O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2

켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.5082\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2712\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.779 cm

RATIO : D3/L = 1/ 1411 < 800 ------- O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4526\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0729\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.5255 cm

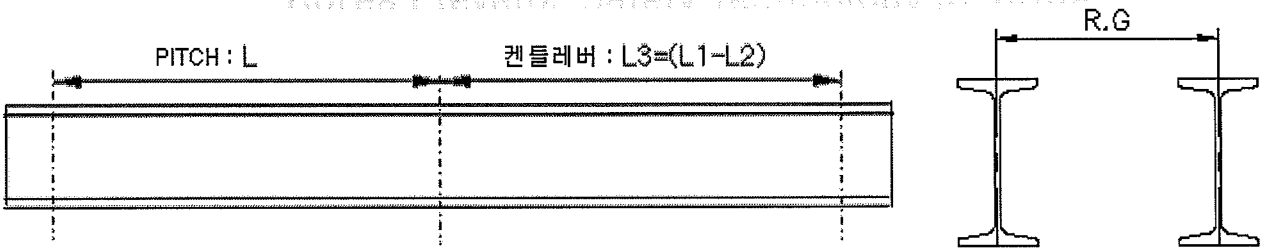
RATIO : D3/L = 1/ 856 < 500 ------- O.K

4. I-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	----------------------------------	Q =	1.5	ton
.SPAN (PITCH)	----------------------------------	L=	1100	cm
.켄틸리버	----------------------	L1=	450	cm
.TROLLEY WHEEL BASE	----------------------	B=	60	cm
.WEIGHT OF HOIST	----------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	----------------------	Wg=	0.959	ton
.켄틸리버의 GIRDER 무게	----------------------	Wg1=	0.392	ton
.I-BEAM SIZE	----------------------	350x150x12/24t		
		Ix =	22400	cm^4
		Iy =	1180	cm^4
		Zx =	1280	cm^3
		Zy =	158	cm^3
		A =	111.1	cm^2
		Wb =	87.2	kg/m
.HOOK APPROACH	----------------------	L2=	30	cm
탄성계수	----------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	----------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	----------------------	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE I-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1100-60/2)^2/(4*1100)

= 294.7 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(450-30) = 475.64 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.959*1100 / 8 = 146.367 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.392*450 / 2 = 97.9 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 441 ton.cm

Mmax2 = Mh2 + Mt2 = 573.5 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 M

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x11x0.25x19.9x1.7 = 103 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.4 =1.11x4.5x0.25x19.9x1.4 = 35 kg

$$M_{FGG} = \frac{0.103 \times 1100}{8} - \frac{0.035 \times 450}{2} = 6.288 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.035 \times 450}{2} = 7.875 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG} =$ 17 x 1100 / 4 = 4675 kg.cm = 4.675 ton.cm

*켄틀레버 풍하중

$M_{FH1} =$ 17 x 450 = 7650 kg.cm = 7.65 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 6.288+4.675= 10.963 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 7.875+7.65= 15.525 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 441 / 1280 = 0.345 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 573.5 / 1280 = 0.448 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 10.963 / 158 = 0.069 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 15.525 / 158 = 0.098 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.414

0.414 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.546

0.546 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x11x0.25x158x1.7 = 820 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.4 =1.11x4.5x0.25x158x1.4 = 276 kg

$$MM_{G1} = \frac{0.82 \times 1100}{8} - \frac{0.276 \times 450}{2} = 50.65 \text{ ton.cm}$$

$$MM_{1} = \frac{0.276 \times 450}{2} = 62.1 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 1100 / 4= 150700 KG.CM = 37.675 ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 450 = 61650 KG.CM = 61.7 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 50.65 + 37.675 = 88.325 ton.cm

$MM_4 = MM_1 + MM_{H1} =$ 62.1 + 61.7 = 123.80 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 88.325 / 158 = 0.559 ton/cm^2 < 1.447 ton/cm^2---O.K

$\Sigma\sigma 4 = MM_4 / Zy =$ 123.8 / 158 = 0.784 ton/cm^2 < 1.808 ton/cm^2---O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2

켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.5467\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.3533\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.900 cm

RATIO : D3/L = 1/ 1222 < 800 ------ O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4869\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0949\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.5818 cm

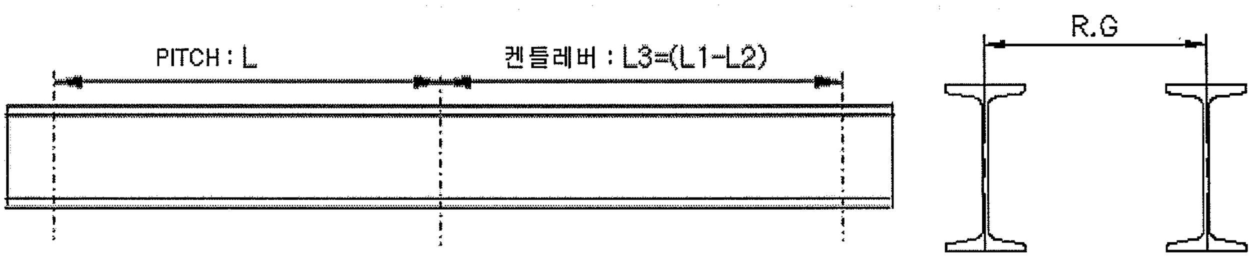
RATIO : D3/L = 1/ 773 < 500 ------ O.K

5. I-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	1250	cm
.켄틸리버	--------------------	L1=	500	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	1.198	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.479	ton
.I-BEAM SIZE	--------------------	400x150x12.5/25t		
		Ix =	31700	cm^4
		Iy =	1240	cm^4
		Zx =	1580	cm^3
		Zy =	165	cm^3
		A =	122.1	cm^2
		Wb =	95.8	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE I-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1250-60/2)^2/(4*1250)

= 337.1 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(500−30) = 532.26 ton.cm

4. 자중에 의한 BENDING MOMENT(I−BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*1.198*1250 / 8 = 207.778 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.479*500 / 2 = 132.92 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 544.9 ton.cm

Mmax2 = Mh2 + Mt2 = 665.2 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 m

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x12.5x0.25x19.9x1.7 = 117 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.4 =1.11x5x0.25x19.9x1.4 = 39 kg

$M_{FGG} = \frac{0.117x1250}{8} - \frac{0.039 \times 500}{2} =$ 8.531 ton.cm

$M_{FG1} = \frac{0.039 \times 500}{2} =$ 9.75 ton.cm

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 1250 / 4 = 5312.5 kg.cm = 5.3125 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 500 = 8500 kg.cm = 8.5 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 8.531+5.3125= 13.844 ton.cm

*켄틀레버

$M_{HC1} = M_{FG1} + M_{FH1}$ = 9.75+8.5= 18.250 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 544.9 / 1580 = 0.345 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 665.2 / 1580 = 0.421 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 13.8435 / 165 = 0.084 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 18.25 / 165 = 0.111 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.429

0.429	<	1.279	ton/cm^2	☞	O.K

Σσ2 = σv2+σv4= 0.532

0.532	<	1.6	ton/cm^2	☞	O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 $q = M \times \sqrt[4]{h} = 67.5 \times \sqrt[4]{30} =$ 158.0 kg/㎡

$M = V^2 / 30 =$ 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x12.5x0.25x158x1.7 = 932 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.4 =1.11x5x0.25x158x1.4 = 307 kg

$$MM_{G1} = \frac{0.932 \times 1250}{8} - \frac{0.307 \times 500}{2} = 68.875 \text{ ton.cm}$$

$$MM_{1} = \frac{0.307 \times 500}{2} = 76.75 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 MM_{H0}= 137 x 1250 / 4= 171250 KG.CM = 42.8125 ton.cm

*켄틀레버 MM_{H1}= 137 x 500 = 68500 KG.CM = 68.5 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 68.875 + 42.8125 = 111.6875 ton.cm
$MM_4 = MM_1 + MM_{H1} =$ 76.75 + 68.5 = 145.25 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 111.6875 / 165 = 0.677 ton/cm^2 < 1.447 ton/cm^2--O.K
$\Sigma\sigma 4 = MM_4 / Zy =$ 145.25 / 165 = 0.880 ton/cm^2 < 1.808 ton/cm^2--O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2
켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내
1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.5669\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.4577\ cm$$

3) TOTAL DEFLECTION

.δ1 = D1+ D2 = 1.025 cm

RATIO : D3/L = 1/ 1220 < 800 ------- O.K

* 켄틀레버
1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4822\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.1124\ cm$$

3) TOTAL DEFLECTION

.δ2 = D1+ D2 = 0.5946 cm

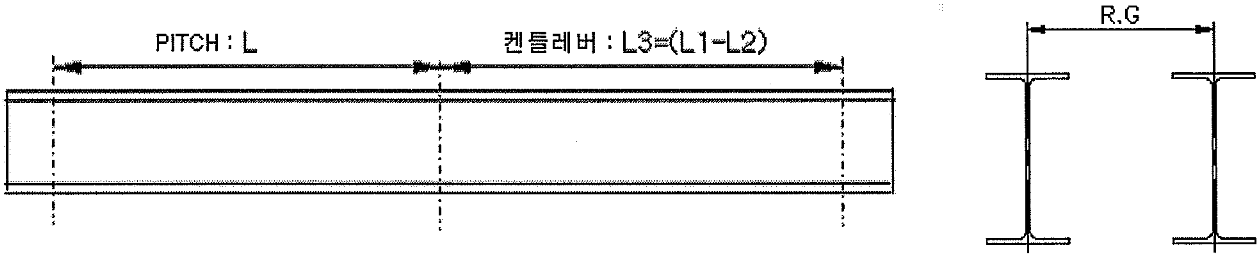
RATIO : D3/L = 1/ 841 < 500 ------- O.K

6. H-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	750	cm
.켄틸리버	--------------------	L1=	280	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	0.24	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.09	ton
.H-BEAM SIZE	--------------------	300x150x6.5/9t		
		Ix =	7210	cm^4
		Iy =	508	cm^4
		Zx =	481	cm^3
		Zy =	67.7	cm^3
		A =	40.8	cm^2
		Wb =	32	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE H-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(750-60/2)^2/(4*750)

= 195.7 ton.cm

2) 캔틸라버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(280-30) = 283.12 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.24*750 / 8 = 24.975 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.09*280 / 2 = 13.99 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 220.7 ton.cm

Mmax2 = Mh2 + Mt2 = 297.1 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 m

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x7.5x0.25x19.9x1.6 = 66 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.3 =1.11x2.8x0.25x19.9x1.3 = 20 kg

$$M_{FGG} = \frac{0.066 \times 750}{8} + \frac{0.02 \times 280}{2} = 3.388 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.02 \times 280}{2} = 2.8 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 750 / 4 = 3187.5 kg.cm = 3.1875 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 280 = 4760 kg.cm = 4.76 ton.cm

7. COMBINED MOMENT

*PITCH내

M_{HCG}= M_{FGG} + M_{FHG} = 3.388+3.1875= 6.576 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 2.8+4.76= 7.560 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 220.7 / 481 = 0.459 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 297.1 / 481 = 0.618 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 6.5755 / 67.7 = 0.097 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 7.56 / 67.7 = 0.112 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.556

0.556 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.729

0.729 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x7.5x0.25x158x1.6 = 526 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.3 =1.11x2.8x0.25x158x1.3 = 160 kg

$$MM_{G1} = \frac{0.526x750}{8} - \frac{0.16 \times 280}{2} = 26.9125 \text{ ton.cm}$$

$$MM_1 = \frac{0.16 \times 280}{2} = 22.4 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 750 / 4= 102750 KG.CM = 25.6875 ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 280 = 38360 KG.CM = 38.4 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 26.9125 + 25.6875 = 52.6 ton.cm

$MM_4 = MM_1 + MM_{H1} =$ 22.4 + 38.4 = 60.80 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 52.6 / 67.7 = 0.777 ton/cm^2 < 1.447 ton/cm^2--O.K

$\Sigma\sigma 4 = MM_4 / Zy =$ 60.8 / 67.7 = 0.898 ton/cm^2 < 1.808 ton/cm^2--O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2

켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.5384\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.0871\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.626 cm

RATIO : D3/L = 1/ 1199 < 800 ------ O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.3190\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0163\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.3353 cm

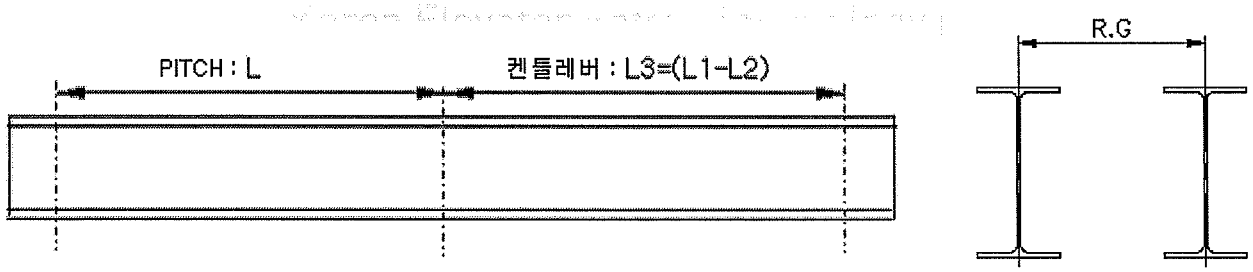
RATIO : D3/L = 1/ 835 < 500 ------ O.K

7. H-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	Q =	1.5	ton
.SPAN (PITCH)	L=	1000	cm
.켄틸리버	L1=	350	cm
.TROLLEY WHEEL BASE	B=	60	cm
.WEIGHT OF HOIST	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	Wg=	0.494	ton
.켄틸리버의 GIRDER 무게	Wg1=	0.173	ton
.H-BEAM SIZE	350x175x7/11t		
	Ix =	13500	cm^4
	Iy =	984	cm^4
	Zx =	771	cm^3
	Zy =	112	cm^3
	A =	62.91	cm^2
	Wb =	49.4	kg/m
.HOOK APPROACH	L2=	30	cm
탄성계수	E=	2100000	kg/㎠
동하중 계수(작업계수)	M(Φ)=	1.11	
정하중 계수(충격계수)	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE H-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1000-60/2)^2/(4*1000)

= 266.4 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(350−30) = 362.39 ton.cm

4. 자중에 의한 BENDING MOMENT(I−BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.494*1000 / 8 = 68.543 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.173*350 / 2 = 33.61 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 334.9 ton.cm

Mmax2 = Mh2 + Mt2 = 396 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 m

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x10x0.25x19.9x1.7 = 94 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.3 =1.11x3.5x0.25x19.9x1.3 = 25 kg

$$M_{FGG} = \frac{0.094 \times 1000}{8} - \frac{0.025 \times 350}{2} = 7.375 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.025 \times 350}{2} = 4.375 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

M_{FHG}= 17 x 1000 / 4 = 4250 kg.cm = 4.25 ton.cm

*켄틀레버 풍하중

M_{FH1}= 17 x 350 = 5950 kg.cm = 5.95 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG}$ = 7.375+4.25= 11.625 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 4.375+5.95= 10.325 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 334.9 / 771 = 0.434 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 396 / 771 = 0.514 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 11.625 / 112 = 0.104 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 10.325 / 112 = 0.092 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.538

0.538	<	1.279	ton/cm^2	☞	O.K

Σσ2 = σv2+σv4= 0.606

0.606	<	1.6	ton/cm^2	☞	O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 $q = M \times \sqrt[4]{h}$ = $67.5 \times \sqrt[4]{30}$ = 158.0 kg/㎡

$M = V^2 / 30$ = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.7 =1.11x10x0.25x158x1.7 = 745 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.3 =1.11x3.5x0.25x158x1.3 = 199 kg

$$MM_{G1} = \frac{0.745 \times 1000}{8} - \frac{0.199 \times 350}{2} = 58.3 \text{ ton.cm}$$

$$MM_{1} = \frac{0.199 \times 350}{2} = 34.825 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 MM_{H0}= 137 x 1000 / 4= 137000 KG.CM = 34.25 ton.cm

*켄틀레버 MM_{H1}= 137 x 350 = 47950 KG.CM = 48.0 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 58.3 + 34.25 = 92.55 ton.cm

$MM_4 = MM_1 + MM_{H1} =$ 34.825 + 48 = 82.83 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 92.55 / 112 = 0.826 ton/cm^2 < 1.447 ton/cm^2---O.K

$\Sigma\sigma 4 = MM_4 / Zy =$ 82.825 / 112 = 0.740 ton/cm^2 < 1.808 ton/cm^2---O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2

켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.6816\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2269\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.909 cm

RATIO : D3/L = 1/ 1101 < 800 ------- O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.3573\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0327\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.3900 cm

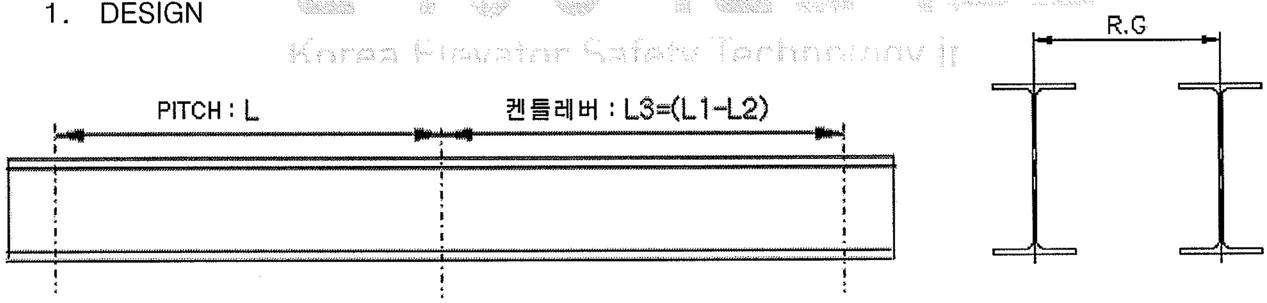
RATIO : D3/L = 1/ 897 < 500 ------- O.K

8. H-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	Q =	1.5	ton
.SPAN (PITCH)	L=	1100	cm
.켄틸리버	L1=	450	cm
.TROLLEY WHEEL BASE	B=	60	cm
.WEIGHT OF HOIST	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	Wg=	0.719	ton
.켄틸리버의 GIRDER 무게	Wg1=	0.294	ton
.H-BEAM SIZE	400x200x8/13t		
	Ix =	23500	cm^4
	Iy =	1740	cm^4
	Zx =	1170	cm^3
	Zy =	174	cm^3
	A =	83.37	cm^2
	Wb =	65.4	kg/m
.HOOK APPROACH	L2=	30	cm
탄성계수	E=	2100000	kg/㎠
동하중 계수(작업계수)	M(Φ)=	1.11	
정하중 계수(충격계수)	F(Ψ)=	1.10	

1. DESIGN



2. ONE SIDE H-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1100-60/2)^2/(4*1100)

= 294.7 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(450-30) = 475.64 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.719*1100 / 8 = 109.737 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.294*450 / 2 = 73.43 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 404.4 ton.cm

Mmax2 = Mh2 + Mt2 = 549.1 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 m

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x11x0.25x19.9x1.6 = 97 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.4 =1.11x4.5x0.25x19.9x1.4 = 35 kg

$M_{FGG} = \dfrac{0.097 \times 1100}{8} - \dfrac{0.035 \times 450}{2} =$ 5.463 ton.cm

$M_{FG1} = \dfrac{0.035 \times 450}{2} =$ 7.875 ton.cm

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 1100 / 4 = 4675 kg.cm = 4.675 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 450 = 7650 kg.cm = 7.65 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 5.463+4.675= 10.138 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 7.875+7.65= 15.525 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 404.4 / 1170 = 0.346 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 549.1 / 1170 = 0.469 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 10.138 / 174 = 0.058 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 15.525 / 174 = 0.089 ton/㎠

9. 합성 응력

Σσ1 =	σv1+ σv3=	0.404					
		0.404	<	1.279	ton/cm^2	☞	O.K
Σσ2 =	σv2+σv4=	0.559					
		0.559	<	1.6	ton/cm^2	☞	O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x11x0.25x158x1.6 = 772 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.4 =1.11x4.5x0.25x158x1.4 = 276 kg

$$MM_{G1} = \frac{0.772x1100}{8} - \frac{0.276 \times 450}{2} = 44.05 \text{ ton.cm}$$

$$MM_{1} = \frac{0.276 \times 450}{2} = 62.1 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 1100 / 4= 150700 KG.CM = 3[illegible]75 ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 450 = 61650 KG.CM = 61.7 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$	44.05 + 37.675 =	81.725 ton.cm
$MM_4 = MM_1 + MM_{H1} =$	62.1 + 61.7 =	123.80 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$	81.725 / 174 =	0.470 ton/cm^2	< 1.447	ton/cm^2--O.K
$\Sigma\sigma 4 = MM_4 / Zy =$	123.8 / 174 =	0.711 ton/cm^2	< 1.808	ton/cm^2--O.K

PITCH내	휴지시 응력 1391 x 80% x130% =	1447 ton/cm^2
켄틀레버는 용접부 없음	휴지시 응력 1391 x 130% =	1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.5212\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2525\ cm$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.774 cm

RATIO : D3/L = 1/ 1422 < 800 ------- O.K

* 켄틀레버

1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4641\ cm$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0679\ cm$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.5320 cm

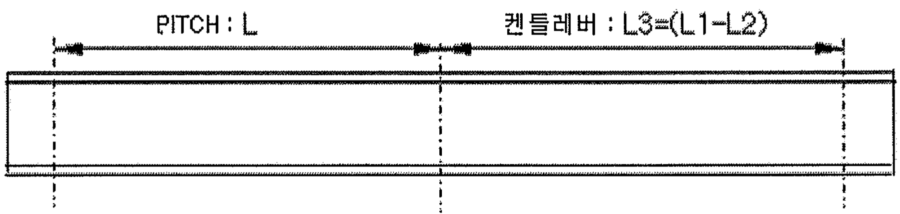
RATIO : D3/L = 1/ 846 < 500 ------- O.K

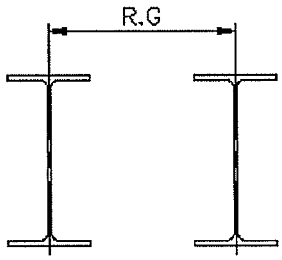
9. H-BEAM 최대허용 가능 SPAN 계산

1. SPECIFICATION

.정격하중	------------------------------	Q =	1.5	ton
.SPAN (PITCH)	------------------------------	L=	1200	cm
.켄틸리버	--------------------	L1=	500	cm
.TROLLEY WHEEL BASE	--------------------	B=	60	cm
.WEIGHT OF HOIST	--------------------	Wh=	0.355	ton
.PITCH내의 GIRDER 무게	--------------------	Wg=	0.899	ton
.켄틸리버의 GIRDER 무게	--------------------	Wg1=	0.375	ton
.H-BEAM SIZE	--------------------	450x200x9/14t		
		Ix =	32900	cm^4
		Iy =	1870	cm^4
		Zx =	1460	cm^3
		Zy =	187	cm^3
		A =	95.43	cm^2
		Wb =	74.9	kg/m
.HOOK APPROACH	--------------------	L2=	30	cm
탄성계수	--------------------	E=	2100000	kg/㎠
동하중 계수(작업계수)	--------------------	M(Φ)=	1.11	
정하중 계수(충격계수)	--------------------	F(Ψ)=	1.10	

1. DESIGN





2. ONE SIDE H-BEAM에 작용하는 하중

P = (Q + Wh)/2 = (1.5 + 0.355)/2 = 0.93 ton

3. 수직하중에 의한 BENDING MOMENT

1) PITCH 지점내 BENDING MOMENT

Mh1 = F x M x P x (L-B/2)^2 / (4 x L)

= 1.11*1.1*0.9275*(1200-60/2)^2/(4*1200)

= 323.0 ton.cm

2) 캔틸리버 BENDING MOMENT

Mh2 = F x M x P x L3

= 1.11*1.1*0.9275*(500-30) = 532.26 ton.cm

4. 자중에 의한 BENDING MOMENT(I-BEAM)

1) PITCH 지점내 BENDING MOMENT

Mt1 = F x Wg x L / 8 =1.11*0.899*1200 / 8 = 149.684 ton.cm

2) 캔틸리버 BENDING MOMENT

Mt2 = F x Wg1 x L1 / 2 =1.11*0.375*500 / 2 = 104.06 ton.cm

5. 수직하중에 의한 최대 BENDING MOMENT

Mmax1 = Mh1 + Mt1 = 472.7 ton.cm

Mmax2 = Mh2 + Mt2 = 636.3 ton.cm

6. 풍하중에 의한 수평하중의 BENDING MOMENT

(1) GIRDER에 의한 수직 풍하중

작업시 V=16m/s , q = 19.9 kg/㎡ h(최고양정) = 30 m

작업시 $q = 8.5 \times \sqrt[4]{h} = 8.5 \times \sqrt[4]{42} =$ 19.9 kg/㎡

H=(GIRDER높이) 0.25 m

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x12x0.25x19.9x1.6 = 106 kg

켄틀레버 풍하중 = F x L1 x H x q x 1.4 =1.11x5x0.25x19.9x1.4 = 39 kg

$$M_{FGG} = \frac{0.106 \times 1200}{8} - \frac{0.039 \times 500}{2} = 6.15 \text{ ton.cm}$$

$$M_{FG1} = \frac{0.039 \times 500}{2} = 9.75 \text{ ton.cm}$$

(2) HOIST에 의한 풍하중

* 작업시

HH= 1.0 m HB= 0.65 m

풍하중 = F x HB x HH x q x 1.2 =1.11x0.65x1x19.9x1.2 = 17 kg

*PITCH내 풍하중

$M_{FHG=}$ 17 x 1200 / 4 = 5100 kg.cm = 5.1 ton.cm

*켄틀레버 풍하중

$M_{FH1=}$ 17 x 500 = 8500 kg.cm = 8.5 ton.cm

7. COMBINED MOMENT

*PITCH내

$M_{HCG} = M_{FGG} + M_{FHG} =$ 6.15+5.1= 11.250 ton.cm

*켄틀레버

M_{HC1}= M_{FG1} + M_{FH1} = 9.75+8.5= 18.250 ton.cm

8. BENDING STRESS

A. VERTICAL BENDING STRESS

1. PITCH 내

σv1= Mmax1/Zx= 472.7 / 1460 = 0.324 ton/㎠

2. 켄틀레버

σv2= Mmax2/Zx= 636.3 / 1460 = 0.436 ton/㎠

B. 수평 최대 응력

1. PITCH 내

σv3= M_{HCG}/Zy= 11.25 / 187 = 0.060 ton/㎠

2. 켄틀레버

σv4= M_{HC1}/Zy= 18.25 / 187 = 0.098 ton/㎠

9. 합성 응력

Σσ1 = σv1+ σv3= 0.384

0.384 < 1.279 ton/cm^2 ☞ O.K

Σσ2 = σv2+σv4= 0.533

0.533 < 1.6 ton/cm^2 ☞ O.K

용접효율 : 80% 응력1391x80% x 115%= 1.279 ton/cm^2

켄틀레버는 용접부 없음 1391*작업시1.15(풍하중포함) = 1.600 ton/cm^2

10. 휴지시 풍하중에 의한 BENDING MOMENT

휴지시 V=45m/s , q = 158.0 kg/㎡ h(최고양정) = 30 m

휴지시 q = M x $\sqrt[4]{h}$ = 67.5 x $\sqrt[4]{30}$ = 158.0 kg/㎡

M= V² /30 = 67.5

*휴지시 풍하중에 의한 수평하중

PITCH내 풍하중 = F x L x H x q x 1.6 =1.11x12x0.25x158x1.6 = 842 kg

켄틀레버에대한 풍하중 = FxL1xHxqx1.4 =1.11x5x0.25x158x1.4 = 307 kg

$$MM_{G1} = \frac{0.842 \times 1200}{8} - \frac{0.307 \times 500}{2} = \quad 49.55 \text{ ton.cm}$$

$$MM_1 = \frac{0.307 \times 500}{2} = \quad 76.75 \text{ ton.cm}$$

HOIST에 대한 풍하중=FxHBxHHxqx1.2 =1.11x0.65x1x158x1.2 = 137 kg

*PITCH내 $MM_{H0=}$ 137 x 1200 / 4= 164400 KG.CM = 4[illegible] ton.cm

*켄틀레버 $MM_{H1=}$ 137 x 500 = 68500 KG.CM = 68.5 ton.cm

* COMBINED MOMENT

$MM_2 = MM_{G1} + MM_{H0} =$ 49.55 + 41.1 = 90.65 ton.cm
$MM_4 = MM_1 + MM_{H1} =$ 76.75 + 68.5 = 145.25 ton.cm

* BENDING STRESS

$\Sigma\sigma 3 = MM_2 / Zy =$ 90.65 / 187 = 0.485 ton/cm^2 < 1.447 ton/cm^2--O.K
$\Sigma\sigma 4 = MM_4 / Zy =$ 145.25 / 187 = 0.777 ton/cm^2 < 1.808 ton/cm^2--O.K

PITCH내 휴지시 응력 1391 x 80% x130% = 1447 ton/cm^2
켄틀레버는 용접부 없음 휴지시 응력 1391 x 130% = 1808 ton/cm^2

11. DEFLECTION OF GIRDER

* PITCH 내
1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L)^3}{48xEx\ Ix} = 0.4833 \text{ cm}$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{5 \times Wgx\ L^3}{384 \times E \times Ix} = 0.2928 \text{ cm}$$

3) TOTAL DEFLECTION

$.\delta 1 = D1 + D2 =$ 0.776 cm

RATIO : D3/L = 1/ 1546 < 800 ------ O.K

* 켄틀레버
1) DUE TO RATED & TROLLEY LOAD

$$.D1 = \frac{(Q+Q2)/2x(L1-L2)^3}{3xEx\ Ix} = 0.4646 \text{ cm}$$

2) DUE TO DEAD LOAD

$$.D2 = \frac{Wg1x\ L1^3}{8 \times E \times Ix} = 0.0848 \text{ cm}$$

3) TOTAL DEFLECTION

$.\delta 2 = D1 + D2 =$ 0.5494 cm

RATIO : D3/L = 1/ 910 < 500 ------ O.K

SUSPENSION MONORAIL 볼트 및 용접강도계산

1.볼트로 고정시의 강도계산

* 허용 최대 SPAN 및 하중은 최악의 조건으로 계산한다.
(허용 최대 스판 12.5 M, 400x150x12.5/25t, HOIST자중 : 355 KG)

.Q = RATED LOAD=	1500 KG
.Q1=HOIST SELF WEIGHT=	355 KG
.Q2=I-BEAM WEIGHT =	1198 KG

BOLT 재질 :	H.T.B 9.8 이상 사용할것	
BOLT 허용전단응력 :	2100	KG/CM^2

M14 일때 do=	1.1835 CM	n=	4.4
M16 일때 do=	1.3835 CM	n=	5.2
M18 일때 do=	1.5294 CM	n=	4.8
M20 일때 do=	1.7294 CM	n=	5.1

. n = 유효산수(산수*80% 너트1종너트사용

P = 1.14*(Q+Q1)/2 + 1.1* Q2/2
= 1.14*(1500+355)/2 + 1.1* 1198/2
= 1716 KG

(σa = 2100 KG/CM^2)

1)인장(전단)강도 : $\sigma = P/A$; $\sigma = \dfrac{4 \times P}{\pi \times do^2 \times Z}$ $* \ Z = \dfrac{4 \times P}{\pi \times do^2 \times \sigma}$

M16 일때 $Z = \dfrac{4 \times P}{\pi \times do^2 \times \sigma} = \dfrac{4x1716}{835\text{^}2 \times 2100} =$ 0.54 개

M18 일때 $Z = \dfrac{4 \times P}{\pi \times do^2 \times \sigma} = \dfrac{4x1716}{294\text{^}2 \times 2100} =$ 0.44 개

M20 일때 $Z = \dfrac{4 \times P}{\pi \times do^2 \times \sigma} = \dfrac{4x1716}{294\text{^}2 \times 2100} =$ 0.35 개

2)접촉 면압 강도 (σa = 400 KG/CM^2)

$\sigma = \dfrac{4 \times P}{\pi \times (d^2 - do^2) \times Z \times n}$; $Z = \dfrac{4 \times P}{\pi \times (d^2 - do^2) \times \sigma \times n}$

M14 일때 $Z = \dfrac{4x1716}{\pi \times (1.4\text{^}2 - 1.1835\text{^}2) x400 \times 4.4} =$ 2.22 개

M16 일때 $Z = \dfrac{4x1716}{\pi \times (1.6\text{^}2 - 1.3835\text{^}2) x400 \times 5.2} =$ 1.63 개

M18 일때 $Z = \dfrac{4x1716}{\pi \times (1.8\text{^}2 - 1.5294\text{^}2) x400 \times 4.8} =$ 1.26 개

M20 일때 $Z = \dfrac{4x1716}{\pi \times (2\text{^}2 - 1.7294\text{^}2) x400 \times 5.1} =$ 1.06 개

. do = 골경, P=브라켓 한 개에 작용하는 하중, Z = 볼트수
. n = 유효산수(산수*80%), 너트1종너트사용

3)따라서 다음과 같이 적용한다

H.T.B M14,M16,M18, M20일때 : 브라켓트당 4개 이상 사용한다.

2. I-빔을 용접시공으로 고정시의 강도계산

* 허용 최대 SPAN 및 하중은 최악의 조건으로 계산한다.
(허용 최대 스판 12.5 M, 400x150x12.5/25t, HOIST자중 : 355 KG)

.Q = RATED LOAD=	1500 KG	(h : 용접두께
.Q1=HOIST SELF WEIGHT=	355 KG	L : 용접길이)
.Q2=I-BEAM WEIGHT =	1198 KG	

1) 용접이음부 인장강도 계산 (용접두께 : 45° 용접부위)

$$\sigma = \frac{1.414 \times P}{h * L} \; ; \; (\sigma a = 1200\ KG/CM^2) \qquad L = \frac{1.414 \times P}{h * \sigma}$$

(1) h 가 5일때

$$L = \frac{1.414x1716}{0.5\ \ x\,1200} = \quad 4.04\ \ CM = \quad 40.4\ \ mm$$

(2) h 가 6일때

$$L = \frac{1.414x1716}{0.6\ \ x\,1200} = \quad 3.37\ \ CM = \quad 33.7\ \ mm$$

(3) h 가 7일때

$$L = \frac{1.414x1716}{0.7\ \ x\,1200} = \quad 2.89\ \ CM = \quad 28.9\ \ mm$$

2) 적용

h = 5일때, 한 브라켓트당 용접길이 L = 60mm 이상 용접한다.

h = 6일때, 한 브라켓트당 용접길이 L = 50mm 이상 용접한다.

h = 7일때, 한 브라켓트당 용접길이 L = 40mm 이상 용접한다.

6. FOR REFERENCE

1) LOAD CHAIN 시험성적서

2) MOTOR DATA SHEET

3) HOIST 사용설명서(operation manual)

KITO CORPORATION

Date: 2009/04/14

Certificate of Compliance

We certify that the ER2 protection degrees conform to the IP rating as follows:

Hoist body - IP55 based on JIS C 4034-5, “Rotating electrical machines – Part5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)”.

Push button - IP65 based on JIS C 0920, “Tests to prove protection against ingress of water and degrees of protection against ingress of solid objects for electrical equipment".

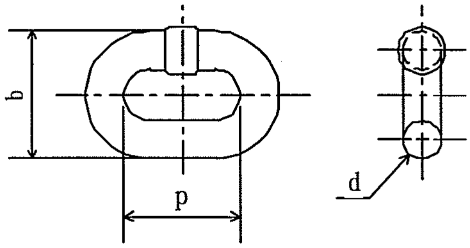
Technical Control Group

Certificate No.: FK070214
Date of Issue: 2008.03.21

Test Certificate

Messrs.

Commodity: NC Load Chain
C o d e : KER102
Lot No. : —
Quantity: — line(s)



1. Material: Manganese Alloy Steel

2. Dimensions

	d	p	b
Specified	10.2mm ±0.4	$28.4\text{mm}\ ^{+0.56}_{0}$	Max. 35.7mm
Result	Good	Good	Good

3. Breaking test

	Breaking load	Total ultimate elongation
Specified	Min. 131 (kN)	Min. 10 (%)
Result	Good	Good

4. Manufacturing Proof force test (Test load: 81.7 kN)

	Permanent elongation
Specified	0.25 (%)
Result	Good

General judgment: Satisfactory

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Nakakoma-gun, Yamanashi, JAPAN

Quality Assurance Group
Quality Assurance Depertment
Development & Technology Division
K. Kishimoto (Manager)

Certificate No.: MM080011e
Date of Issue: 2009/3/4

Messrs. __________

Motor Test Report for Electric Chain Hoist

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. : -

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ	1.8kW	4P	60%ED	220(208)V	60Hz

Full load characteristics

Voltage Frequency		220V 60Hz
Load	%	100
Current	A	8.4
Speed	rpm	1620

Insulation class E

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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Quality Assurance Group
Quality Assurance Department
Development & Technology Division
M. Ogihara (Manager)

Certificate No.: MM070011e
Date of Issue: 2008/03/21

Messrs. ____________

Motor Test Report for Electric Chain Hoist

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. :

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ	1.8kW	4P	60%ED	380 - 440V	60Hz

Full load characteristics

Voltage Frequency		380 - 440V 60Hz
Load	%	100
Current	A	4.6
Speed	rpm	1610

Insulation class B

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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Quality Assurance Depertment
Development & Technology Division
(Manager)
K. Kishimoto

Certificate No.: MM080011f

Date of Issue: 2009/3/4

Messrs.

Motor Test Report for Electric Chain Hoist

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. : -

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ	1.8kW	4P	40/20%ED	220(208)V	Speed Control by Inverter

Full load characteristics

Voltage Frequency	220V Speed Control by Inverter
Load %	100
Current A	11.2
Speed rpm	~

Insulation class E

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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Certificate No.: MM070011f

Date of Issue: 2008/03/21

Messrs. ____________

Motor Test Report for Electric Chain Hoist

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. :

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ	1.8kW	4P	60%ED	380 - 440V	Speed Control by Inverter

Full load characteristics

Voltage Frequency		380 - 440V Speed Control by Inverter
Load	%	100
Current	A	5.1
Speed	rpm	~

Insulation class B

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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Certificate No.: MM080012a

Date of Issue: 2009/3/4

Messrs. ____________

Motor Test Report for Electric Trolley

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. : -

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ-T	0.4kW	4P	40%ED	220(208)V	60Hz

Full load characteristics

Voltage Frequency		220V 60Hz
Load	%	100
Current	A	3.0
Speed	rpm	1685

Insulation class E

The above characteristics are obtained from calculation where the motor is assembled with an electric trolley and the trolley is subjected to full load

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M. Ogihara (Manager)

Certificate No.: MM070013a
Date of Issue: 2008/03/21

Messrs. ____________

Motor Test Report for End Carriage

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. :

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ-T	0.4kW	4P	40%ED	380 - 440V	60Hz

Full load characteristics

Voltage Frequency	380 - 440V 60Hz
Load %	100
Current A	2.2
Speed rpm	1670

Insulation class B

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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Certificate No.: MM080012b
Date of Issue: 2009/3/4

Messrs. ____________

Motor Test Report for Electric Trolley

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. : -

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ-T	0.4kW	4P	27/13%ED	220(208)V	Speed Control by Inverter

Full load characteristics

Voltage Frequency	220V Speed Control by Inverter
Load %	100
Current A	3.0
Speed rpm	~

Insulation class E

The above characteristics are obtained from calculation where the motor is assembled with an electric trolley and the trolley is subjected to full load

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Certificate No.: MM070013b

Date of Issue: 2008/03/21

Messrs. ____________

Motor Test Report for End Carriage

Motor type : Three phase squirrel cage type induction motor.

Manufacturer : Yasukawa Electric Mfg. Co.

Production No. :

Rating

Model	Output	Pole	Intermittent Rating	Voltage	Frequency
IBQ-T	0.4kW	4P	40%ED	380 - 440V	Speed Control by Inverter

Full load characteristics

Voltage Frequency	220 – 230V Speed Control by Inverter
Load %	100
Current A	2.5
Speed rpm	~

Insulation class B

The above characteristics are obtained from calculation where the motor is assembled with an electric chain hoist and the hoist is subjected to full load

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