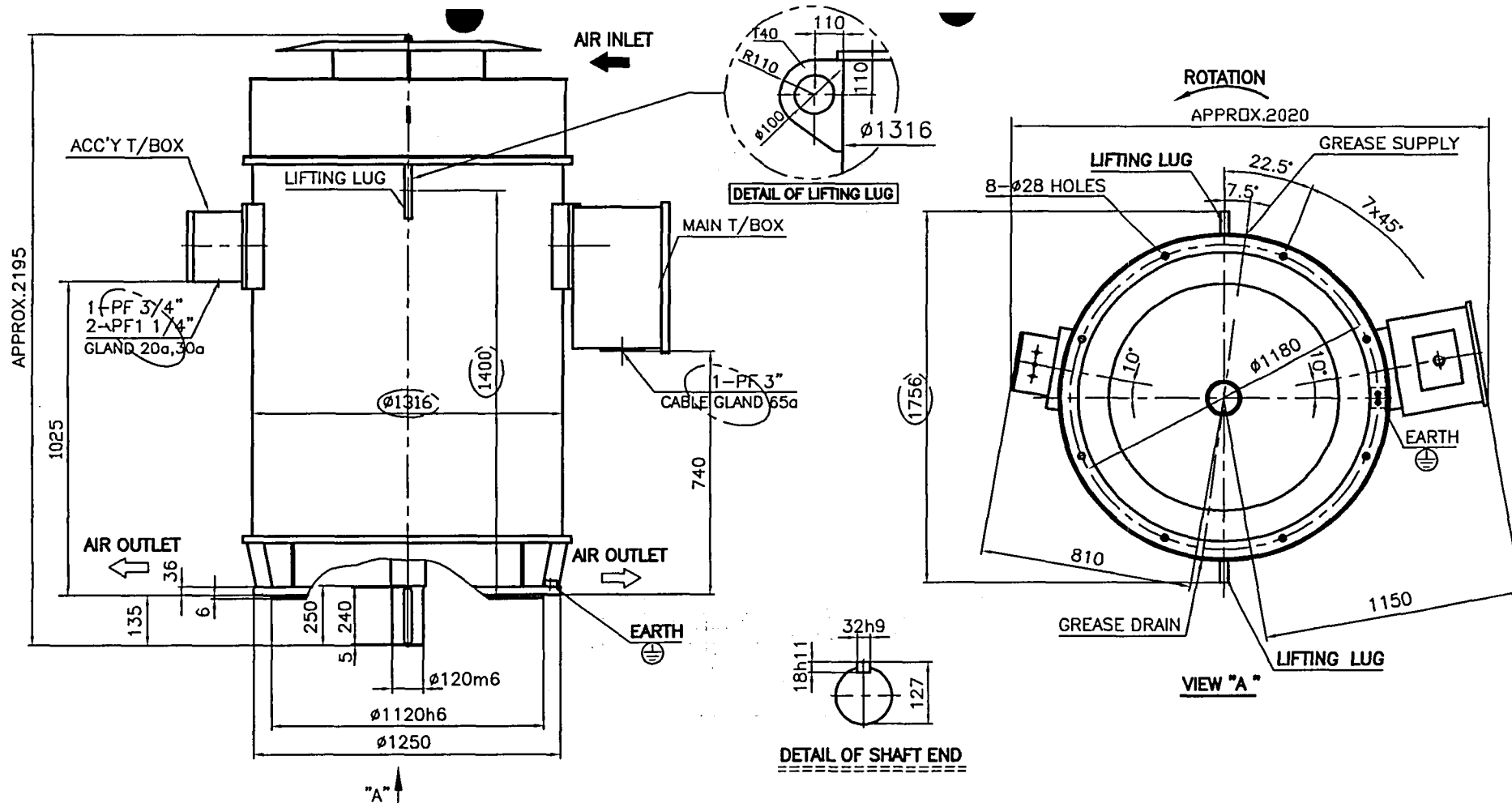


PLAN HISTORY																																			
DATE	REV NO	DESCRIPTION	DWN	CHKD	APPD																														
2004 07.05	A	* SUBMITTED TO OWNER FOR APPROVAL.	백학순 7/5	+	[Signature]																														
		* ISSUED FOR WORKING.																																	
2005 1.17	△	* APPROVED BY OWNER.	백학순 1/17	+	[Signature]																														
		* ISSUED FOR CONSTRUCTION.																																	
2005 9.29		* ISSUED AS FINISHED PLAN (4.4437)	백학순 9/29	+	[Signature]																														
STAMP AREA			FINISHED PLAN MAERSK WILLOW 4 4 3 7 IMO 9303546 HO (V) - 4 2 ☐ FOR WORKING ☒ FOR CONST. ☐ FOR REVISION																																
IMO 9303546 DAE 4437 HO (V) - 4			<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="2">도면배포선</th> </tr> <tr> <th>배 부 치</th> <th>부 수</th> </tr> </thead> <tbody> <tr><td>구조설계 (1)팀</td><td>1</td></tr> <tr><td>선장배관설계팀</td><td>1</td></tr> <tr><td>전장설계팀</td><td>1</td></tr> <tr><td>기장설계 (1)팀</td><td>1</td></tr> <tr><td>외장 (2)팀 (선장)</td><td>1</td></tr> <tr><td>외장 (2)팀 (기장)</td><td>1</td></tr> <tr><td>외장(2)팀 (PE선장)</td><td>1</td></tr> <tr><td>기계외장팀 (기계2)</td><td>1</td></tr> <tr><td>시운전팀 (선장)</td><td>1</td></tr> <tr><td>외장품질경영팀</td><td>1</td></tr> <tr><td>자재지원팀</td><td>1</td></tr> <tr><td>소립 2팀</td><td>1</td></tr> <tr><td>합 계</td><td>12</td></tr> </tbody> </table> ☐ FOR WORKING ☒ FOR CONST. ☐ FOR REVISION			도면배포선		배 부 치	부 수	구조설계 (1)팀	1	선장배관설계팀	1	전장설계팀	1	기장설계 (1)팀	1	외장 (2)팀 (선장)	1	외장 (2)팀 (기장)	1	외장(2)팀 (PE선장)	1	기계외장팀 (기계2)	1	시운전팀 (선장)	1	외장품질경영팀	1	자재지원팀	1	소립 2팀	1	합 계	12
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소립 2팀	1																																		
합 계	12																																		
PROJ. NO. 4437/38/41		PROJECT A.P MOLLER 45,000 M ² PURE CAR/TRUCK CARRIER																																	
APPD BY [Signature] CHKD BY [Signature] DWN BY 백학순 (H. S. BAEK) 9/5 (TEL : 4264) KTE & HYUNDAI		TITLE V/D OF SIDE THRUSTER																																	
DEPT. HULL OUTFITTING DESIGN TEAM		DATE 2004.07.05	SCALE AS SHOWN	DWG DV4040001	REV NO. △																														

FOR FINAL <table><tr><td>2</td><td>05.09.12</td><td colspan="4">FOR FINAL</td></tr><tr><td>1</td><td>04.11.25</td><td colspan="4">FOR WORKING</td></tr><tr><td>0</td><td>04.06.23</td><td colspan="4">FOR APPROVAL</td></tr><tr><td>NO.</td><td>DATE</td><td colspan="4">DESCRIPTION</td></tr><tr><td colspan="6">CHANGE OF ALTERATION</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>04.11.25</td><td>K.S.KIM</td><td>--</td><td>K.S.KIM</td><td>K.J.KANG</td></tr><tr><td>NO.</td><td>DATE</td><td>REVD BY</td><td>CHKD BY</td><td>CHKD BY</td><td>APPD BY</td></tr><tr><td colspan="5">REVISIONS</td><td>DWG.NO.</td></tr></table>						2	05.09.12	FOR FINAL				1	04.11.25	FOR WORKING				0	04.06.23	FOR APPROVAL				NO.	DATE	DESCRIPTION				CHANGE OF ALTERATION																														1	04.11.25	K.S.KIM	--	K.S.KIM	K.J.KANG	NO.	DATE	REVD BY	CHKD BY	CHKD BY	APPD BY	REVISIONS					DWG.NO.	MESSRS : DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD	
						2	05.09.12	FOR FINAL																																																																							
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REVISIONS					DWG.NO.																																																																										
SHIP NO. : DSME / H4437-8,H4441																																																																															
TITLE : SPECIFICATION OF THREE PHASE INDUCTION MOTOR 1400KW x 6P x 6600V - BOW THRUSTER																																																																															
HYUNDAI HEAVY INDUSTRIES CO., LTD ELECTRO ELECTRIC SYSTEMS																																																																															
APPROVED BY K.J.KANG																																																																															
CHECKED BY -----																																																																															
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DESIGNED BY K.S.KIM																																																																															
CLASS DNV																																																																															
DATE 2004-03-12																																																																															
APP - 4RPH093-095																																																																															

Y U N D A I				DATA SHEET				RFQ. No.		Rev. No.		
Heavy Industries Co., Ltd.				Three Phase Induction Motor				[]		[0]		
Project Name		DSME / H4437-8.H4441				Project No.		4RPH093-5		Item No.		
R A T I N G		1400 KW 6 P 6600 V 60 Hz				Q'ty		1 Set/Ship				
GENERAL DATA						TECHNICAL DATA						
Applicable Standard		IEC.DNV				Rotor Type		SQUIRREL CAGE				
Designation of Driven Machine		BOW THRUSTER				Starting Method		AUTO T/R 65% TAP				
Frame No.		630				Current	Rated		146.5		A	
Insulation		HLA7 636-66Y					Starting (*)		600		%	
Ingress Protection Degree		TEAAC - IP 44				Torque	Rated		1148.8		kg-m	
Ventilation-Cooling Method		V10 - IC511					Starting (*)		90		%	
Installation		INDOOR					Break Down (*)		200		%	
Hazard Classification		NON-HAZARDOUS.NON-SEISMIC				Efficiency	100 % Load		95.0		%	
Insulation Class		F										
Temp. Rise(Resistance method)		75 °C										
Ambient Temperature		45 °C				Power Factor	100 % Load		0.880			
Altitude		UP TO 1000 METER										
Humidity		90 %										
Duty-Service Factor		S2 / 1.0 (30 Min.)				Rated Speed		1187 rpm				
Number of consecutive starts		COLD: 2 / HOT: 1				Load GD ² (**)		89 kg-m ²				
Electrical Design		NEMA DESIGN B				Motor GD ²		275 kg-m ²				
Coupling Method		DIRECT				Direction of Rotation		REFER TO OUTLINE DWG				
Shaft Extension		SINGLE				Location of Main Terminal Box		REFER TO OUTLINE DWG				
Bearing	Type		ANTI-FRICTION				Paint Colour (Munsell No.)		10 GY 8/4			
	D.E / N-D.E No.		6226C3 / 7322B				Motor Weight (Approx.)		5100 kg			
	Lubrication		GREASE				Sound Pressure Level - mean value, measured at 1 meter distance from mo-					
Internal Thrust		NOT APPLICABLE				- dB(A)						
ACCESSORIES												
WINDING TEMP. DETECTOR (PT 100 ohm):2EA/PHASE SPACE HEATER : 220V, 630W, 1 PHASE ** SPARE PART *** BEARING (6226C3+7322B) : 1 SET / SHIP Rs = 0.97%, Rr = 2.77%, Xm = 16.97% Starting Power Factor : 23.2% Starting Current at Auto TR 65% TAP : 371.4 A Starting KVA at Auto TR 65% TAP : 4245.7 KVA						Vibration		3.8 mm/sec. (Peak)				
						Witness Test		DNV				
						SUBMITTAL DRAWING						
OUTLINE DIMENSION DRAWING NO. : HM-070565												
MAIN TERMINAL BOX DRAWING NO. : 3M-049656												
ACC'Y TERMINAL BOX DRAWING NO. : 3M-025056												
ACC'Y T/B WIRING DIAGRAM AWG. NO.: 4M-047000												
GENERAL ASSEMBLY DRAWING NO. : 2M-070472												
MAIN NAME PLATE DRAWING NO. : 4M-052647												
SPARE PART LIST DRAWING NO. : 4M-056186												
Note : Others not mentioned in this specification shall be in accordance with HHI standard. Above technical data are only design values and shall be guaranteed with tolerance of applicable standard.						Date	Prepared	Checked	Checked	Approved		
						K.S.KIM	20040623	---	K.S.KIM	K.J.KANG		



THREE PHASE INDUCTION SQUIRREL CAGE ROTOR MOTOR

TYPE	OUTPUT	POLE	VOLTS	FREQ.	PROT.	INS CLASS	SYN. RPM	MOUNT	TOTAL WIGHT	BEARING	
										D.E	N-D.E
HLA7 636-66Y	1400 KW	6 P	6600 V	60 HZ	IP44	F	1200 RPM	V 10	5100 KG	6226C3	7322B

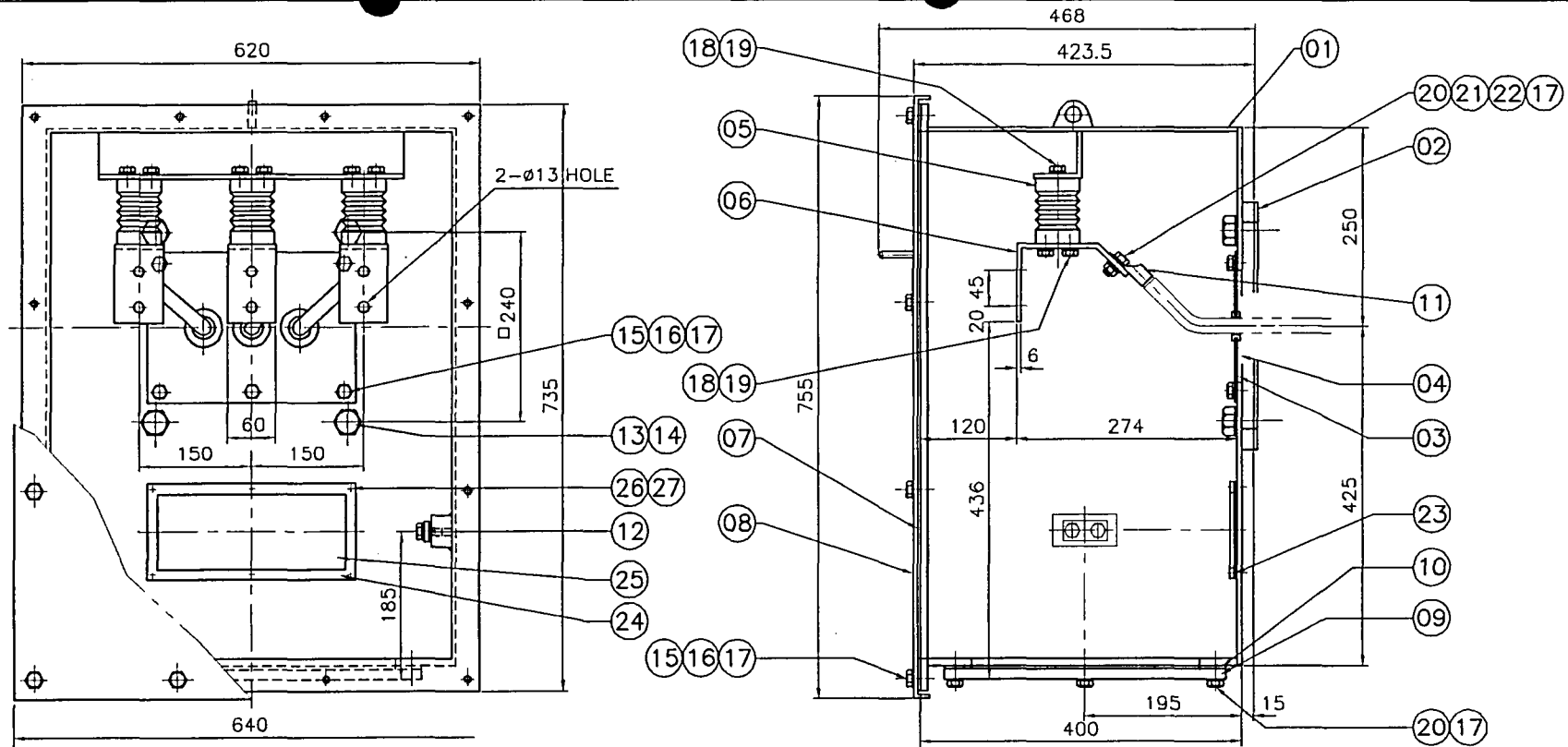
NOTE

1. THIS MOTOR IS DESIGNED TO BE OPERATED IN ARROW DIRECTION.
2. EXTERNAL THRUST : NOT APPLICABLE

▽	50S
▽▽	12.5S
▽▽▽	3.2S
▽▽▽▽	0.4S

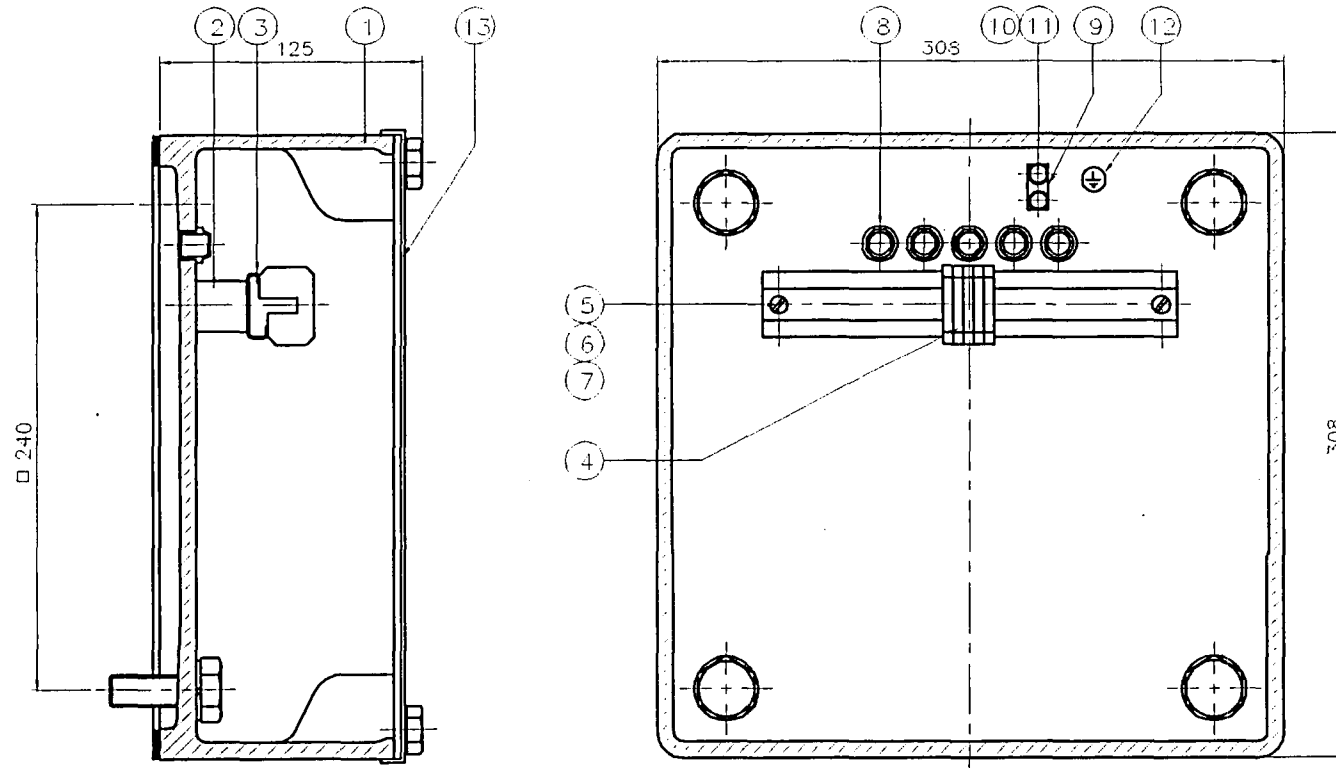
								일반가공공차		일반제공공차	
								1-4	±0.1	6-30	±0.5
2	2004.11.22	REV. OF OWNER COMMENT	K. S. KIM	----	K. S. KIM	K. J. KANG		4-18	±0.2	30-120	±0.8
1	2004.07.09	REV. OF ROTATION (C.W → C.C.W)	K. S. KIM	----	K. S. KIM	K. J. KANG		18-63	±0.3	120-315	±1.2
								63-250	±0.5	315-1000	±2.0
REV	DATE	CONTENTS	REV'D BY	CHK'D BY	CHK'D BY	APP'D BY		250-	±0.8	1000-	±3.0
	1	2	3			4				5	

Q'TY	DESCRIPTION		MATERIAL	DIMENSION		WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	mm	SUBJECT	HLA7 636-66Y		CAD PROJ. FILE S/A3(1-15)		
CHKD BY	K. S. KIM	SCALE	NON SCALE	TITLE OUTLINE DIMENSION DWG.					
CHKD BY	—	PROJEC'N	3 각 (3rd Angle)						
DSND BY	KIM KWANG SDO	DATE	2004-06-23						
 HYUNDAI HEAVY INDUSTRIES CO., LTD. INDUSTRIAL & POWER SYSTEMS				REF. NO			Sheet No. of		
				DWG NO	HM-070565		Revision No. 2		



8	SPRNG WASHER	SUP3					27	3	TERMINAL LUG	CU							11
8	HEX. BOLT	S45C					26	1	PACKING	N.B.R							10
1	PRESSURE DIAPHRAGM	BRASS					25	1	GLAND PLATE	SS400							9
1	SUPPORT COVER	SS400					24	1	TERMINAL BOX COVER	SS400							8
1	PACKING	N.B.R					23	1	PACKING	N.B.R							7
3	HEX. NUT	S45C					22	3	CONNECTOR	CuBB1-1/2H							6
6	PLAIN WASHER	BRASS					21	3	INSULATOR	EPOXY							5
11	HEX. BOLT	S45C					20	3	CABLE GROMMET	N.B.R.							4
12	SPRING WASHER	SUP3					19	1	CABLE HOLDER	E.G.P							3
12	HEX. BOLT	S45C					18	1	PACKING	N.B.R							2
29	SPRING WASHER	S45C					17	1	TERMINAL BOX BODY	SS400							1
18	PLAIN WASHER	SS41					16	Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.		
18	HEX. BOLT	S45C					15	APPD BY	K. J. KANG	UNIT	MM	SUBJECT	CAD PROJ FILE T-BOX-M\3N049656				
4	SPRING WASHER	SUP3					14	CHKD BY	K. S. KIM	SCALE	NONE	TITLE TERMINAL BOX ASS'Y					
4	HEX. BOLT	S45C					13	CHKD BY		PROJEC'N	3 2 (3rd Angle)						
1	EARTH TERMINAL ASS'Y						12	DSND BY	KIM KWANG SOO	DATE	2002.02.04						REF. NO.

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY									
1															



1	TERMINAL BOX COVER	SPCC					13	2	BOLT	S45C								5
1	EARTHING MARK	-					12	-	TERMINAL BLOCK	-								4
2	SPRING WASHER	SUP3					11	2	RAIL	AL								3
2	HEX. BOLT	S45C					10	1	SUPPORT RING	N.B.R								2
1	EARTHING TERMINAL	-					9	1	TERMINAL BOX BODY	FC250								1
5	GROMMET	N.B.R					8	QTY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.			
2	PLAIN WASHER	SPCC					7	APPD BY	K. J. KANG	UNIT	MM	SUBJECT	STANDARD		T-BOX-AX\3M006560			
2	SPRING WASHER	SUP3					6	CHKD BY	K. S. KIM	SCALE	NONE	TITLE						

ACC'Y TERMINAL BOX ASS'Y

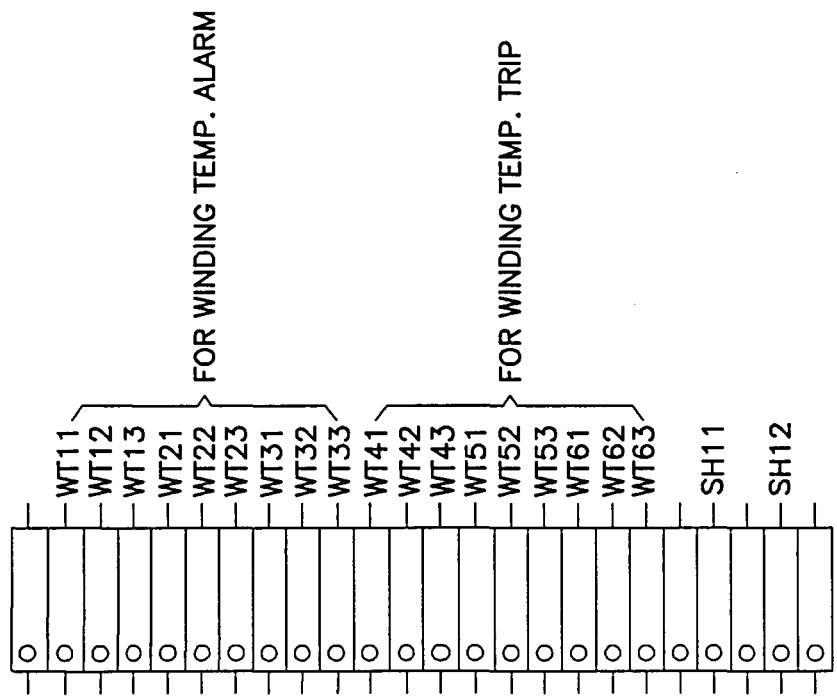


REV	DATE	CONTENTS	REV BY	CHKD BY	CHKD BY	APPD BY
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2						
3						
4						
5						
6						
7						
8						
9						

REF. NO		Sheet No. of	
DWG NO	3M-025056	Revision No.	0

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HYUNDAI HEAVY INDUSTRIES CO., LTD.

1	2	3	4
REV	DATE	CONTENTS	REVD BY



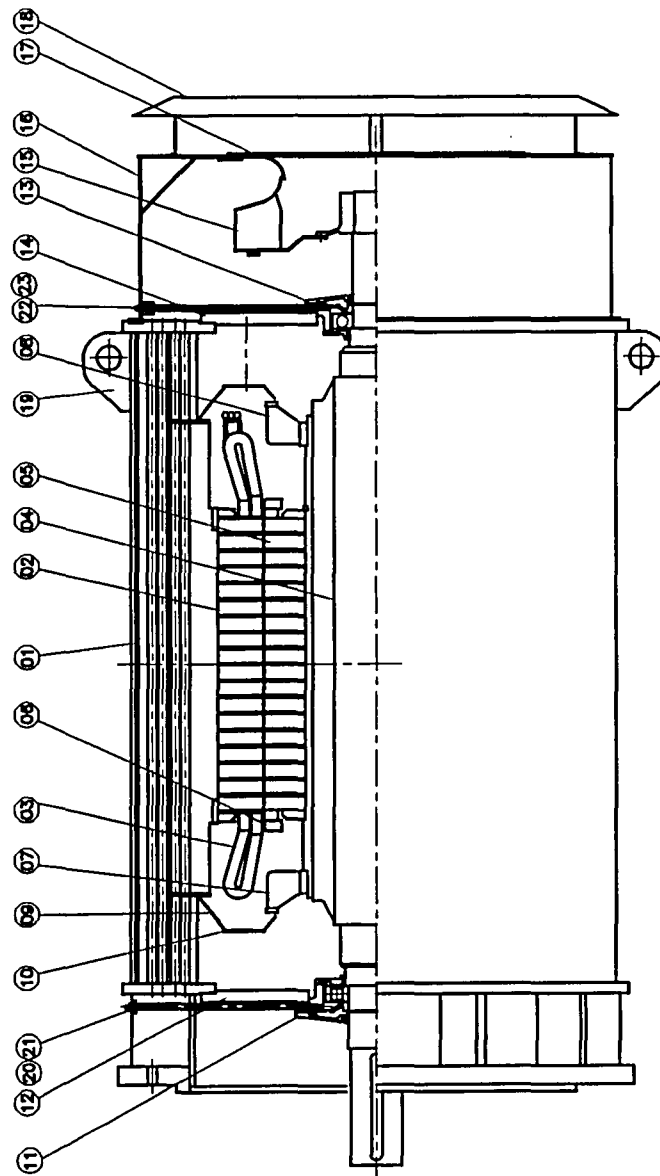
NOTE

- 1) WT11,12,13/41,42,43 ; Winding temp. sensor (U) – Pt 100 ohm
- 2) WT21,22,23/51,52,53 ; Winding temp. sensor (V) – Pt 100 ohm
- 3) WT31,32,33/61,62,63 ; Winding temp. sensor (W) – Pt 100 ohm
- 4) SH11,12 ; Space heater

*** WTD SETTING POINT (AMBIENT TEMP. : 45°C)

WINDING	
ALARM	TRIP
130 °C	140 °C

Q'TY	DESCRIPTION		MATERIAL	DIMENSION		WEIGHT	PART NO.	REMARK	NO.
APPD BY	H. H. LEE	UNIT	MM	SUBJECT				CAD PROJ \ \ FILE \	
CHKD BY	J. S. PARK	SCALE	NONE					WIR-DIAG\4K047000	
CHKD BY	_____	PROJEC'N	3 각법(3rd Angle)	TITLE ACC'Y TERMINAL BOX WIRING DIAGRAM					
DSND BY	KIM KWANG SOO	DATE	2004.06.23						
 HYUNDAI HEAVY INDUSTRIES CO., LTD. INDUSTRIAL & POWER SYSTEMS				REF. NO				Sheet No.	of
				DWG NO	4M-047000			Revision No.	



1	GREASE DRAIN ASS'Y	S.G.P				23
1	GREASE SUPPLY ASS'Y	S.G.P				22
1	GREASE DRAIN ASS'Y	S.G.P				21
1	GREASE SUPPLY ASS'Y	S.G.P				20
2	LIFTING LUG	MILD STEEL (SS400)				19
1	CANOPY ASS'Y	MILD STEEL (SS400)				18
1	END COVER ASS'Y	MILD STEEL (SS400)				17
1	FAN COVER ASS'Y	MILD STEEL (SS400)				16
1	OUTER FAN ASS'Y	MILD STEEL				15
1	END SHIELD ASS'Y(N-D.E SIDE)	MILD STEEL				14
1	BEARING ASS'Y(N-D.E SIDE)	CAST IRON				13
1	END SHIELD ASS'Y(D.E SIDE)	MILD STEEL (SS400)				12
1	BEARING ASS'Y(D.E SIDE)	CAST IRON				11
2	FIXING SUPPORT ASS'Y	MILD STEEL (SS400)				10
2	AIR GUIDE ASS'Y	E.C.P				9
1	INNER FAN ASS'Y(N-D.E SIDE)	MILD STEEL (SS400)				8
1	INNER FAN ASS'Y(D.E SIDE)	MILD STEEL (SS400)				7
1	ROTOR BAR ASS'Y	CU				6
1	ROTOR CORE ASS'Y	SI-STEEL				5
1	SHAFT ASS'Y	FORGING STEEL				4
1	STATOR COIL ASS'Y	CU				3
1	STATOR CORE ASS'Y	SI-STEEL				2
1	FRAME ASS'Y	MILD STEEL (SS400)				1
Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK NO.

APPD BY	K. J. KANG	UNIT	MM	SUBJECT	HLA7.(V10)	G-ASS'Y1R000810
CHKD BY	K. S. KIM	SCALE	NS	TITLE	GENERAL ASSEMBLY	
DSND BY	KIM KWANG SOO	DATE	1999.12.17	REF. NO	OWG NO	1M-000810
				Revision No.	of 0	

REV	DATE	CONTENTS	REV'D BY	CHK'D BY	APPD BY

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REV	DATE	CONTENTS		REVD BY	CHKD BY	Q.P CHK	APPD BY

HYUNDAI

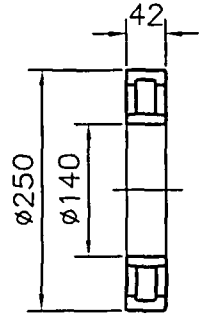
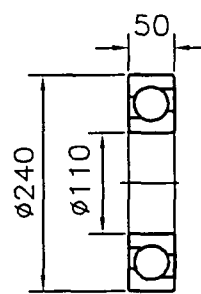
3~INDUCTION MOTOR

TYPE :

KW	P	V	AMP	HZ
FR. NO.	IP	S.F	RPM	
SQUIRREL CAGE		CODE LETTER		
RATING		EFF.	COSØ	
INS. CLASS	AMB. TEMP.	°C	TEMP.RISE	°C
SPACE HEATER : 1Ø,		V,	W	
BRG.(D.E/N-D.E)			WT.	KG
SERIAL NO.				
MFG DATE :			MADE IN KOREA 4M-052647	

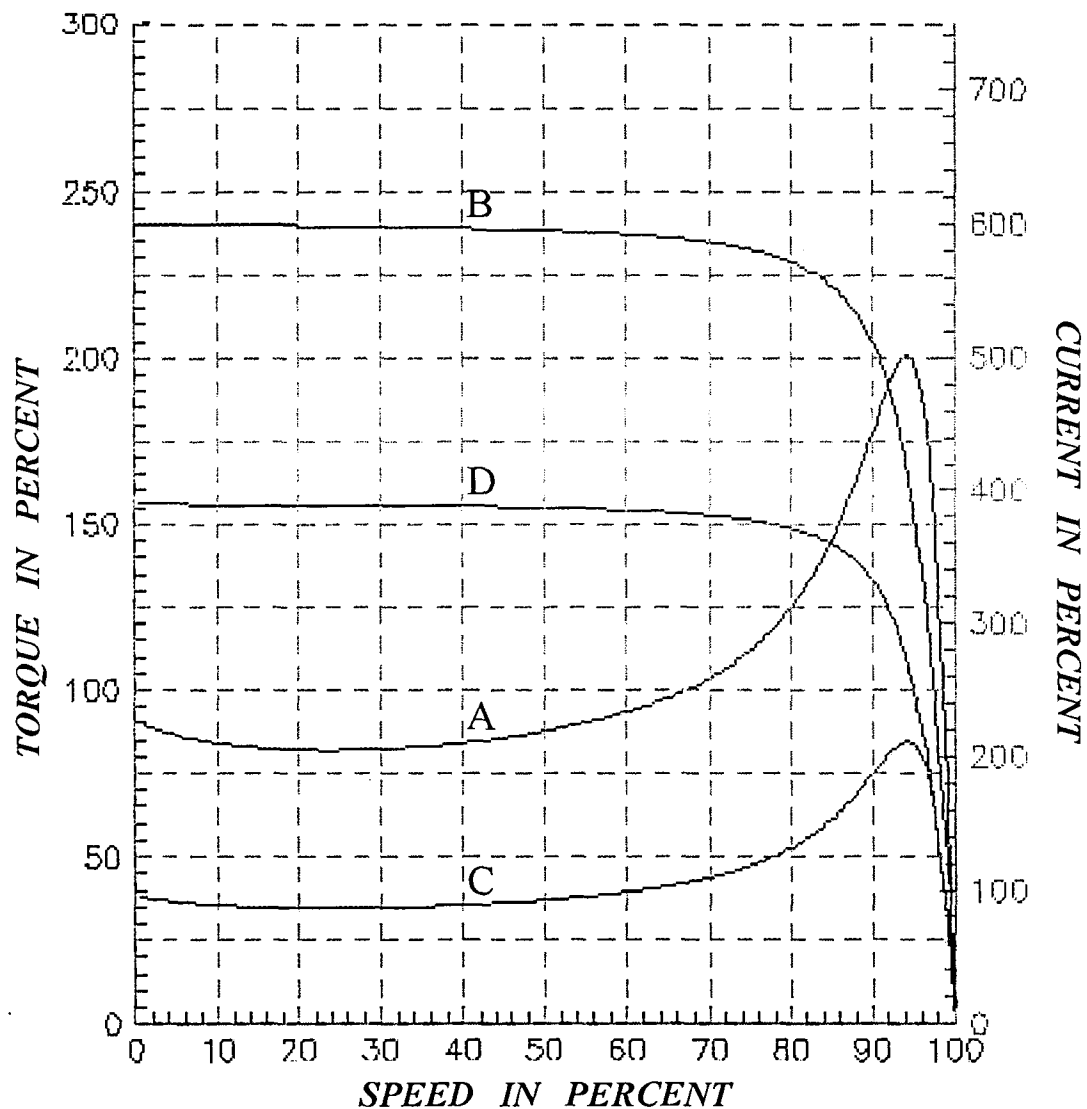
ALL DRAWINGS IS TO BE IN ACCORDANCE WITH THE PERMISSION OF HHI.
MAYBE REPRODUCED WITHOUT THE PERMISSION OF HHI.

HEAVY INDUSTRIES CO., LTD.

SPARE PART LIST FOR INDUCTION MOTOR						
SPEC		1050KW x 6P STERN THRUSTER				
ITEM NO	NAME OF PARTS	OUTLINE DIMENSION	QUANTTITY			REMARK
			WORKING		SPARE	
			PER MOTOR	PER SHIP	PER SHIP	
1	ROLLER BEARING		1	1	1	NU228M
2	ANGULAR CONTACT BALL BEARING		1	1	1	#7322B

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	MM	SUBJECT	-	BRG-AS02\4R056187	
CHKD BY	K. S. KIM	SCALE	NONE	TITLE	SPARE PART LIST		
CHKD BY	—	PROJEC'N	3 rd Angle				
DSND BY	KIM KWANG SOO	DATE	2004.06.23				
 HYUNDAI HEAVY INDUSTRIES CO., LTD. INDUSTRIAL & POWER SYSTEMS				REF. NO	Sheet No. of		
				DWG NO	4M-056187		
					Revision No. 0		

 HYUNDAI	SPEED-TORQUE & CURRENT CURVE		CURVE NO.				
			STC- 4RPM164				
MOTOR TYPE :	HLA7 634-64Y	1050	KW	6	P	60	HZ
RATED TORQUE :	863.0	kg.m	RATED SPEED :	1185	RPM		
GD ² OF MOTOR :	160	kg.m ²	VOLTAGE :	440	V		
GD ² OF LOAD :	66.3	kg.m ²	RATED CURRENT :	1648.0	A		



NOTE : A: SPEED-TORQUE CURVE AT RATED VOLTAGE
 B: SPEED-CURRENT CURVE AT RATED VOLTAGE
 C: SPEED-TORQUE CURVE AT 65 % RATED VOLTAGE
 D: SPEED-CURRENT CURVE AT 65 % RATED VOLTAGE

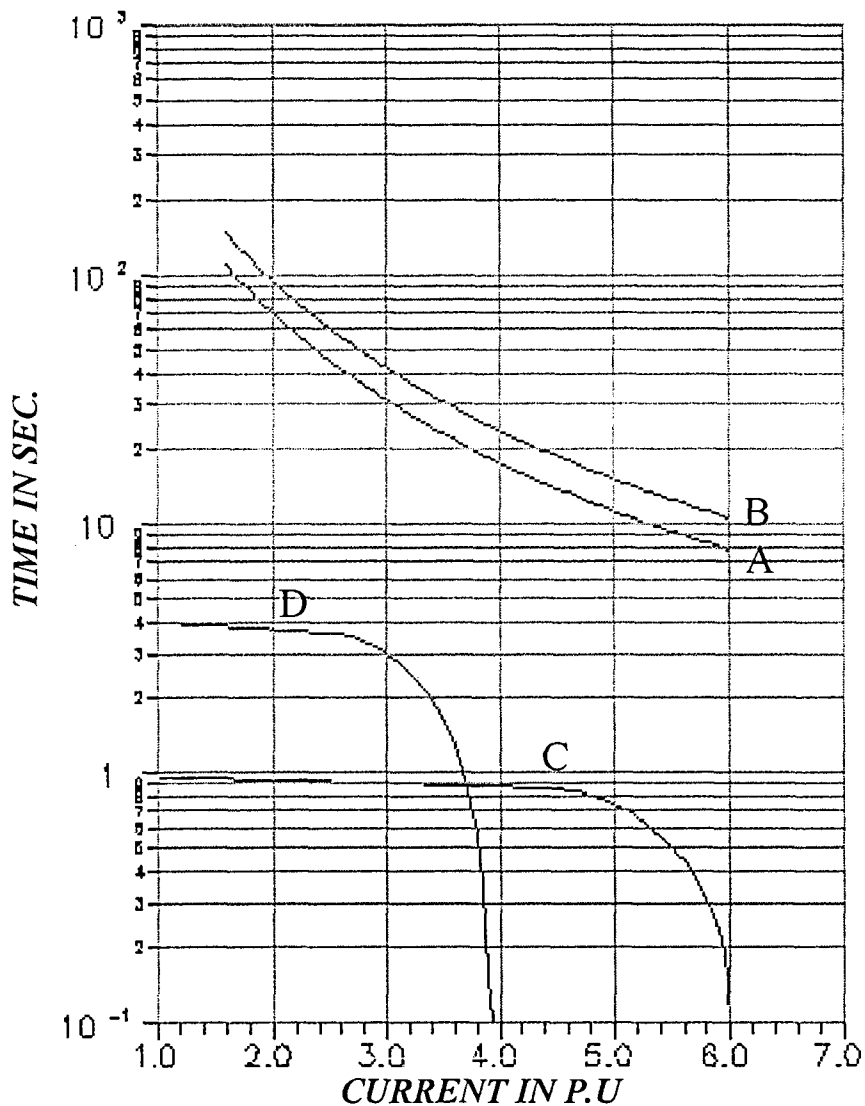
REMARK.	REV.	CONTENTS	DATE	DSN	CHK	APPD
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	1					
	0	ORIGINAL ISSUE	2004-06-23	S.M.LEE	Y.S.KIM	H.H.LEE



THERMAL LIMIT & TIME CURRENT CURVE

CURVE NO.
TLC- 4RPM164

MOTOR TYPE :	HLA7 634-64Y	1050	KW	6	P	60	HZ
RATED TORQUE :	863.0	kg.m	RATED SPEED :	1185	RPM		
GD ² OF MOTOR :	160	kg.m ²	VOLTAGE :	440	V		
GD ² OF LOAD :	66.3	kg.m ²	RATED CURRENT :	1648.0	A		

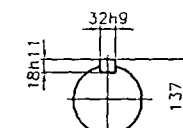
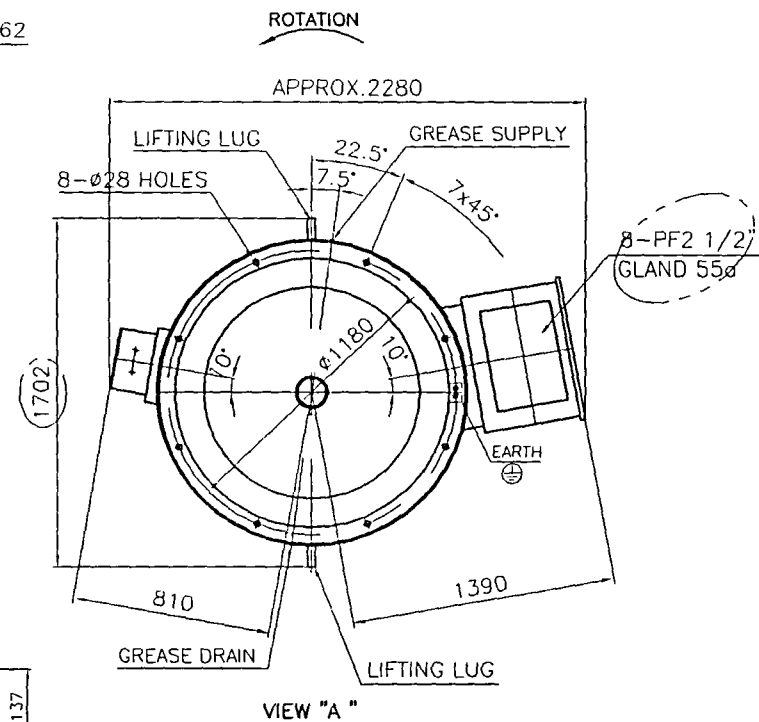
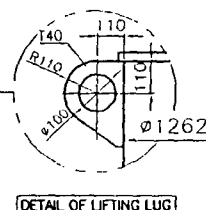
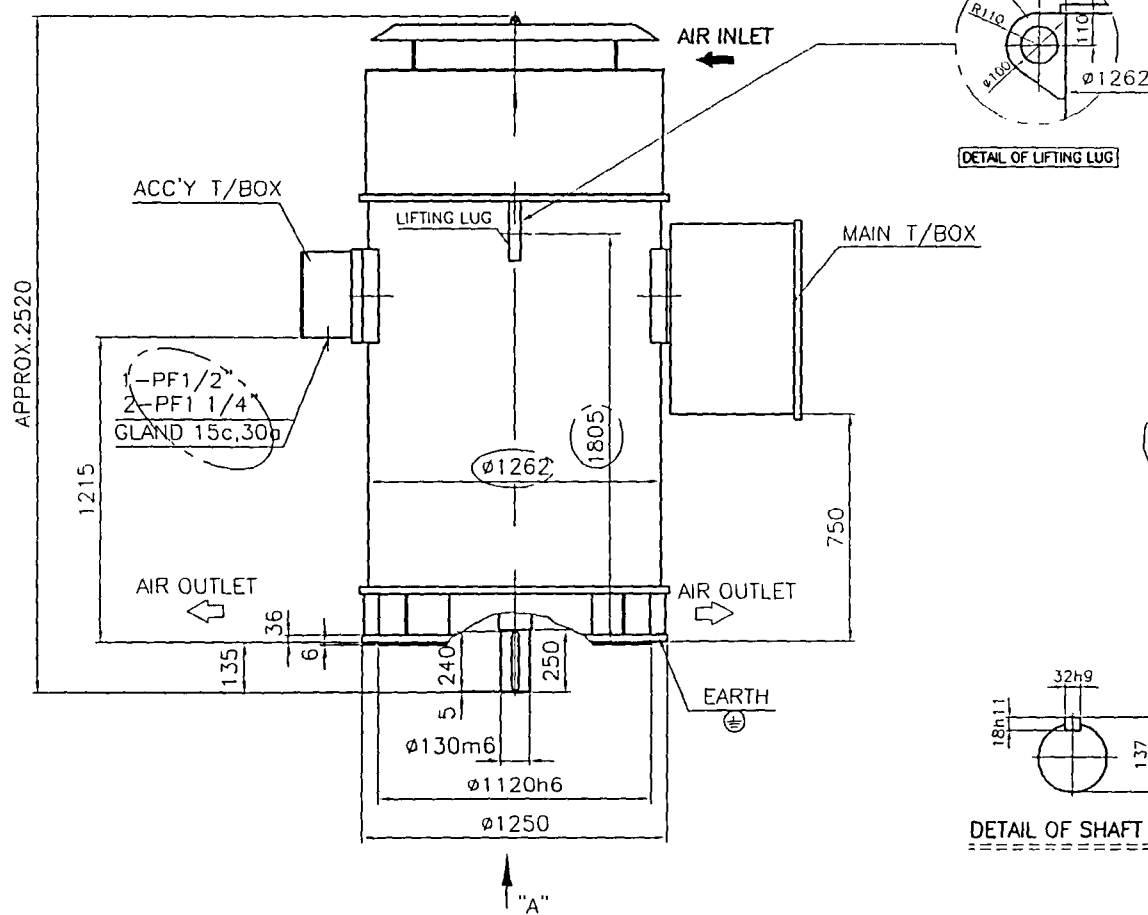


NOTE :
A: THERMAL LIMIT CURVE AT HOT CONDITION
B: THERMAL LIMIT CURVE AT COLD CONDITION
C: TIME - CURRENT CURVE AT RATED VOLTAGE
D: TIME - CURRENT CURVE AT 65% RATED VOLTAGE

REMARK.	REV.	CONTENTS	DATE	DSN	CHK	APPD
	2					
	1					
	0	ORIGINAL ISSUE	2004-06-23	S.M.LEE	Y.S.KIM	H.H.LEE

FOR FINAL						MESSRS : DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD																																											
						SHIP NO. : DSME / H4437-8,H4441																																											
						TITLE : SPECIFICATION OF THREE PHASE INDUCTION MOTOR 1050KW x 6P x 440V - STERN THRUSTER																																											
						 H Y U N D A I HEAVY INDUSTRIES CO., LTD ELECTRO ELECTRIC SYSTEMS																																											
						APPROVED BY K.J.KANG																																											
						CHECKED BY -----																																											
						CHECKED BY K.S.KIM																																											
						CHECKED BY -----																																											
						DESIGNED BY K.S.KIM																																											
<table><tr><td>2</td><td>05.09.12</td><td colspan="4">FOR FINAL</td></tr><tr><td>1</td><td>04.11.25</td><td colspan="4">FOR WORKING</td></tr><tr><td>0</td><td>04.06.23</td><td colspan="4">FOR APPROVAL</td></tr></table>						2	05.09.12	FOR FINAL				1	04.11.25	FOR WORKING				0	04.06.23	FOR APPROVAL																													
2	05.09.12	FOR FINAL																																															
1	04.11.25	FOR WORKING																																															
0	04.06.23	FOR APPROVAL																																															
<table><tr><td>NO.</td><td>DATE</td><td colspan="4">DESCRIPTION</td></tr><tr><td colspan="6">CHANGE OF ALTERATION</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>04.11.25</td><td>K.S.KIM</td><td>--</td><td>K.S.KIM</td><td>K.J.KANG</td></tr></table>						NO.	DATE	DESCRIPTION				CHANGE OF ALTERATION																														1	04.11.25	K.S.KIM	--	K.S.KIM	K.J.KANG	CLASS DNV	
NO.	DATE	DESCRIPTION																																															
CHANGE OF ALTERATION																																																	
1	04.11.25	K.S.KIM	--	K.S.KIM	K.J.KANG																																												
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NO.	DATE	REVD BY	CHKD BY	CHKD BY	APPD BY																																												
REVISIONS																																																	
						DWG.NO. APP - 4RPM164-166																																											

Y U N D A I			DATA SHEET			RFQ. No.		Rev. No.		
Heavy Industries Co., Ltd.			Three Phase Induction Motor			[]		[0]		
Project Name		DSME / H4437-8.H4441			Project No.		4RPM164-6		Item No.	
R A T I N G		1050 KW 6 P 440 V 60 Hz			Q'ty		1 Set/Ship			
GENERAL DATA					TECHNICAL DATA					
Applicable Standard		IEC.DNV			Rotor Type		SQUIRREL CAGE			
Designation of Driven Machine		STERN THRUSTER			Starting Method		AUTO T/R 65% TAP			
Frame No.		630			Current	Rated		1648.0 A		
Type		HLA7 634-64Y				Starting (*)		600 %		
Enclosure-Protection Degree		TEAAC - IP 44			Torque	Rated		863.0 kg-m		
Construction-Cooling Method		V10 - IC511				Starting (*)		90 %		
Location		INDOOR				Break Down (*)		200 %		
Sea Classification		NON-HAZARDOUS.NON-SEISMIC			Efficiency	100 % Load		95.0 %		
Insulation Class		F								
Temp. Rise(Resistance method)		75 °C								
Ambient Temperature		45 °C			Power Factor	100 % Load		0.880		
Altitude		UP TO 1000 METER								
Humidity		90 %								
Service Factor		S2 / 1.0 (30 Min.)			Rated Speed		1185 rpm			
Number of consecutive starts		COLD: 2 / HOT: 1			Load GD² (**)		66.3 kg-m²			
Electrical Design		NEMA DESIGN B			Motor GD²		160 kg-m²			
Coupling Method		DIRECT			Direction of Rotation		REFER TO OUTLINE DWG			
Shaft Extension		SINGLE			Location of Main Terminal Box		REFER TO OUTLINE DWG			
Bearing	Type	ANTI-FRICTION			Paint Colour (Munsell No.)		10 GY 8/4			
	D.E / N-D.E No.	NU228M / 7322B			Motor Weight (Approx.)		5500 kg			
	Lubrication	GREASE								
Internal Thrust		NOT APPLICABLE			Sound Pressure Level - mean value, measured at 1 meter distance from mo-				- dB(A)	
ACCESSORIES										
1) WINDING TEMP. DETECTOR (PT 100 ohm):2EA/PHASE					Vibration		3.8 mm/sec. (Peak)			
2) SPACE HEATER : 220V, 630W, 1 PHASE					Witness Test		DNV			
*** SPARE PART ***					SUBMITTAL DRAWING					
1) BEARING (NU228M+7322B) : 1 SET / SHIP * Rs = 0.82%, Rr = 2.68%, Xm = 16.61% * Starting Power Factor : 22.2 % * Starting Current at Auto TR 65% TAP : 4177.7 A * Starting KVA at Auto TR 65% TAP : 3183.8 KVA					OUTLINE DIMENSION DRAWING NO. : HM-070571 MAIN TERMINAL BOX DRAWING NO. : 3M-045160 ACC'Y TERMINAL BOX DRAWING NO. : 3M-025056 ACC'Y T/B WIRING DIAGRAM AWG. NO.: 4M-047000 GENERAL ASSEMBLY DRAWING NO. : 1M-000810 MAIN NAME PLATE DRAWING NO. : 4M-052647 SPARE PART LIST DRAWING NO. : 4M-056187					
Note : Others not mentioned in this specification shall be in accordance with HHI standard. Above technical data are only design values and shall be guaranteed with tolerance of applicable standard.					Date	Prepared	Checked	Checked	Approved	
					K.S.KIM	20040623	---	K.S.KIM	K.J.KANG	



THREE PHASE INDUCTION SQUIRREL CAGE ROTOR MOTOR

TYPE	OUTPUT	POLE	VOLTS	FREQ.	PROT.	INS CLASS	SYN. RPM	MOUNT	TOTAL WEIGHT	BEARING	
										D.E	N-D.E
HLA7 634-64Y	1050 KW	6 P	440 V	60 HZ	IP44	F	1200 RPM	V 10	5500 KG	NU228M	7322B

NOTE

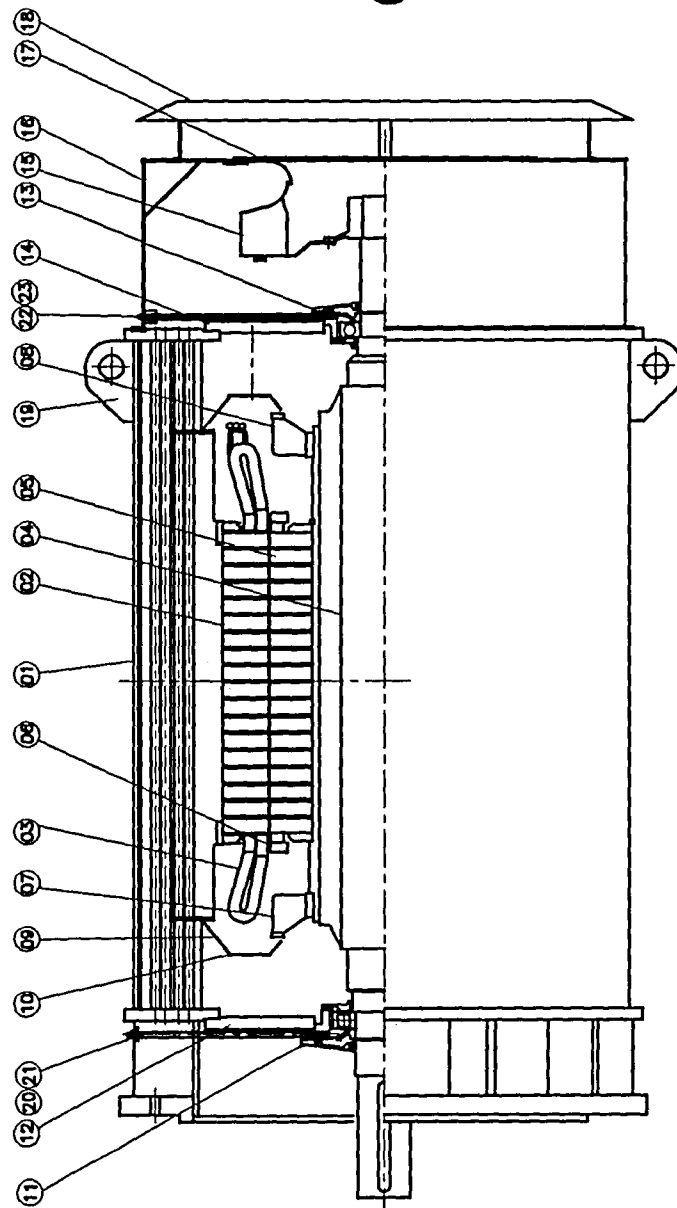
- EXTERNAL THRUST : NOT APPLICABLE
- THIS MOTOR IS DESIGNED TO BE OPERATED IN ARROW DIRECTION.

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	mm	SUBJECT	HLA7 634-64Y	DWG SIZE	A3 (1:20)
CHKD BY	K. S. KIM	SCALE	NON SCALE	TITLE	OUTLINE DIMENSION DWG.		
CHKD BY	—	PROJEC'N	3 각법(3rd Angle)	REF. NO	Sheet No. of		
DSND BY	KIM KWANG SOO	DATE	2004-06-23	DWG NO	HM-070571	Revision No.	2



REV	DATE	CONTENTS	REV'D BY	CHK'D BY	CHK'D BY	APPD BY
2	2004.11.22	REV. OF OWNER COMMENT	K. S. KIM	---	K. S. KIM	K. J. KANG
1	2004.07.09	REV. OF ROTATION (C.W → C.C.W)	K. S. KIM	---	K. S. KIM	K. J. KANG

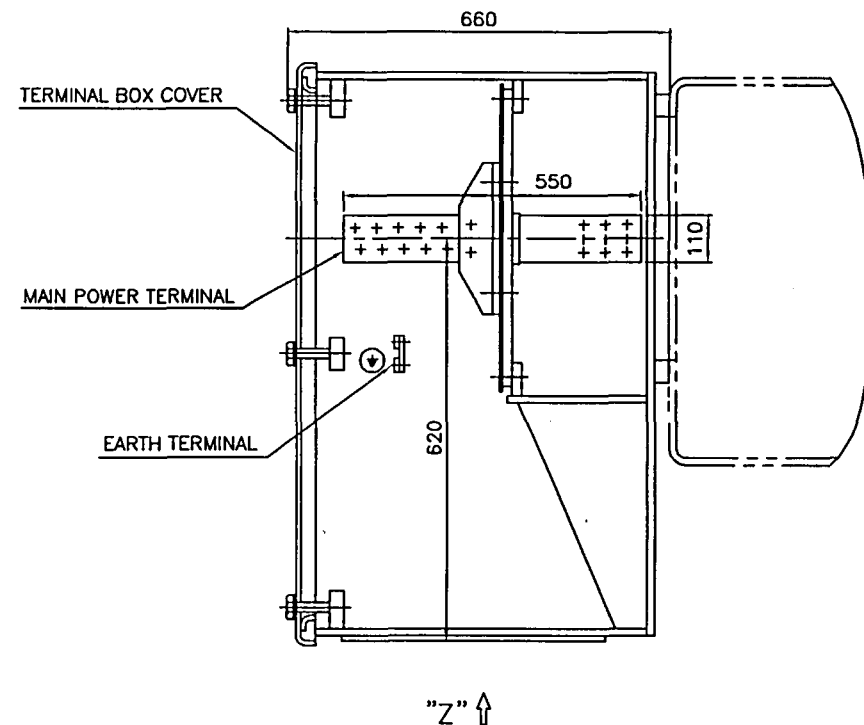
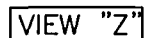
일반기공급차	일반기공급차
1-4 ±0.1	6-30 ±0.5
4-18 ±0.2	30-120 ±0.8
18-63 ±0.3	120-315 ±1.2
63-250 ±0.5	315-1000 ±2.0
250- ±0.8	1000- ±3.0



1	GREASE DRAIN ASSY	S.G.P				23
1	GREASE SUPPLY ASSY	S.G.P				22
1	GREASE DRAIN ASSY	S.G.P				21
1	GREASE SUPPLY ASSY	S.G.P				20
2	LIFTING LUG	MILD STEEL (SS400)				19
1	CANOPY ASSY	MILD STEEL (SS400)				18
1	END COVER ASSY	MILD STEEL (SS400)				17
1	FAN COVER ASSY	MILD STEEL (SS400)				16
1	OUTER FAN ASSY	MILD STEEL				15
1	END SHIELD ASSY(N-D.E SIDE)	MILD STEEL				14
1	BEARING ASSY(N-D.E SIDE)	CAST IRON				13
1	END SHIELD ASSY(D.E SIDE)	MILD STEEL (SS400)				12
1	BEARING ASSY(D.E SIDE)	CAST IRON				11
2	FIXING SUPPORT ASSY	MILD STEEL (SS400)				10
2	AIR GUIDE ASSY	E.G.P				9
1	INNER FAN ASSY(N-D.E SIDE)	MILD STEEL (SS400)				8
1	INNER FAN ASSY(D.E SIDE)	MILD STEEL (SS400)				7
1	ROTOR BAR ASSY	CU				6
1	ROTOR CORE ASSY	SI-STEEL				5
1	SHAFT ASSY	FORGING STEEL				4
1	STATOR COIL ASSY	CU				3
1	STATOR CORE ASSY	SI-STEEL				2
1	FRAME ASSY	MILD STEEL (SS400)				1

QTY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK NO.
APPD BY	K. J. KANG	UNIT	MM	SUBJECT	HLA7.(V10)	0-ASSY.1M000810
CHKD BY	K. S. KIM	SCALE	NS	TITLE	GENERAL ASSEMBLY	
CHKD BY		PROJEC'TN	3 rd Angle	REF. NO	Sheet No. of	
DSND BY	KIM KWANG SOO	DATE	1999.12.17	DWG NO	1M-000810	Revision No. 0

HYUNDAI
ELECTRICAL ENGINEERING CO., LTD.



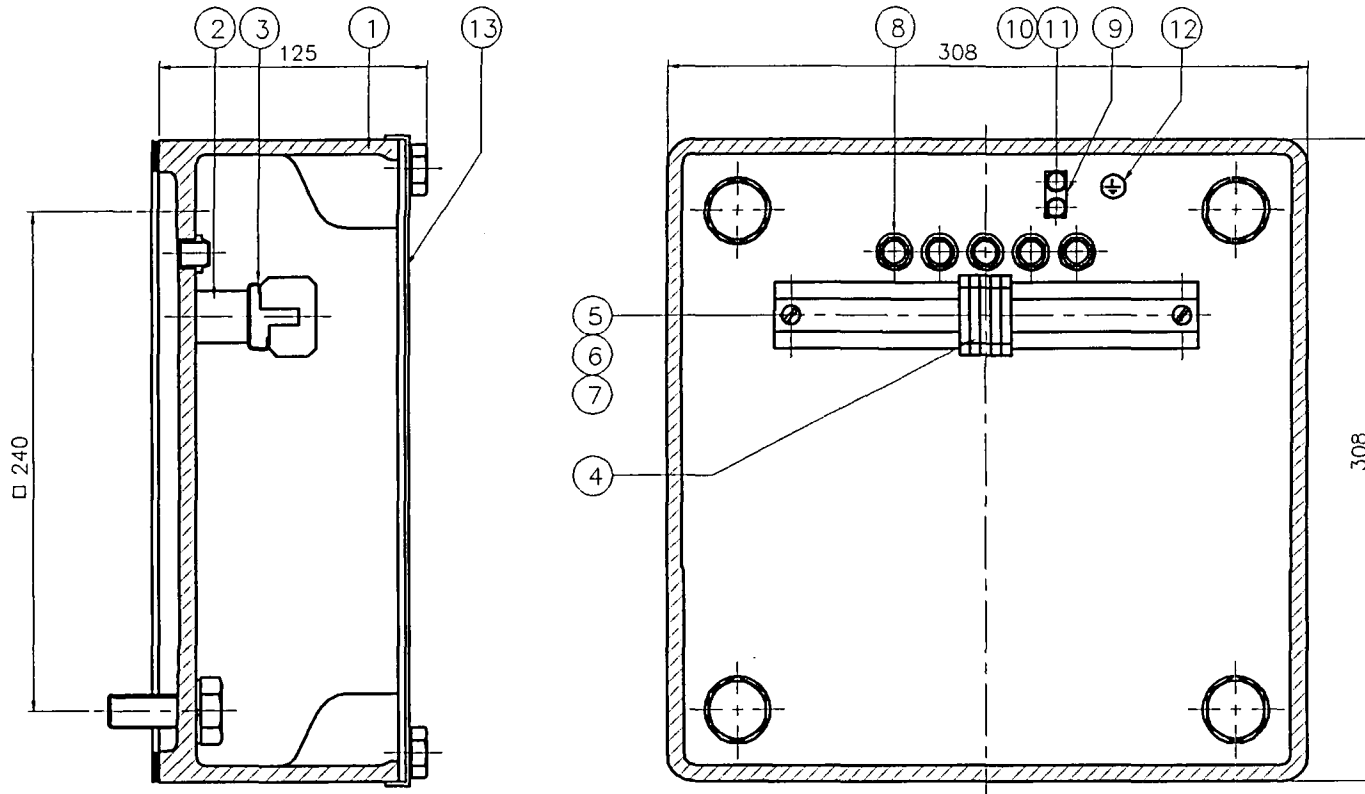
** MAIN POWER CABLE GLAND : 8-55a

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	MM	SUBJECT	CAD PROJ # \ FILE # T-BOX-M\3R045160		
Q.P CHK	K. S. KIM	SCALE	NONE				
CHKD BY	---	PROJEC'N	3 차설(3rd Angle)				
DSND BY	KIM KWANG SOO	DATE	2003.02.18				
				TITLE TERMINAL BOX ASSEMBLY			
 HYUNDAI ELECTRICAL ENGINEERING CO., LTD.				REF. NO		Sheet No.	of
				DWG NO	3M-045160	Revision No.	0

REV	DATE	CONTENTS	REV'D BY	CHKD BY	Q.P. CHK	APPO BY	
1		2	3			4	

THIS DRAWING IS PROPRIETARY TO HHI. NO PART OF THIS DRAWING
MAY BE REPRODUCED WITHOUT THE PERMISSION OF HHI.

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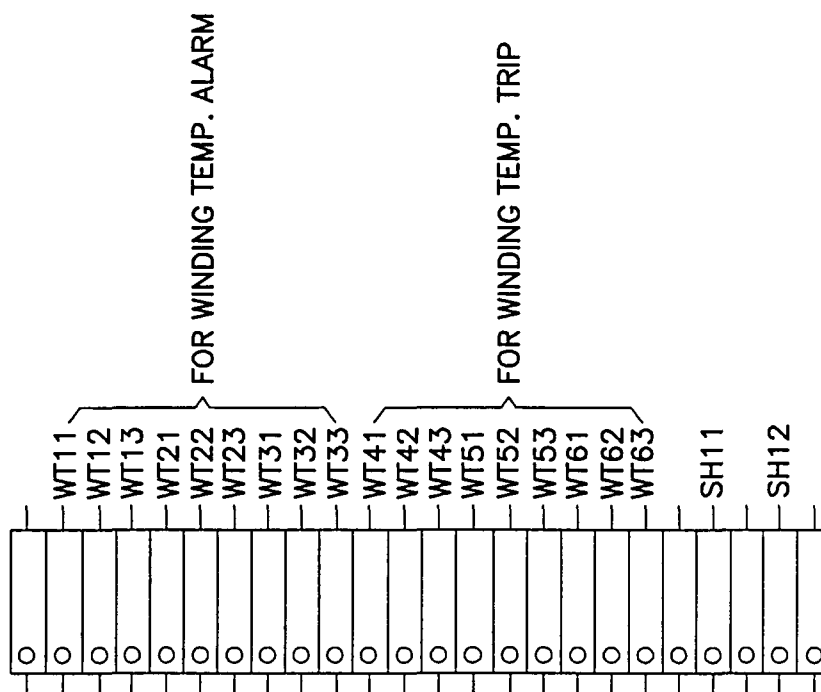
1	TERMINAL BOX COVER	SPCC					13	2	BOLT	S45C					5
1	EARTHING MARK	-					12	-	TERMINAL BLOCK	-					4
2	SPRING WASHER	SUP3					11	2	RAIL	AL					3
2	HEX. BOLT	S45C					10	1	SUPPORT RING	N.B.R					2
1	EARTHING TERMINAL	-					9	1	TERMINAL BOX BODY	FC250					1
5	GROMMET	N.B.R					8	Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
2	PLAIN WASHER	SPCC					7	APPD BY	K. J. KANG	UNIT	MM	SUBJECT	STANDARD	T-BOX-AX\3M006562	
2	SPRING WASHER	SUP3					6	CHKD BY	K. S. KIM	SCALE	NONE	TITLE	ACC'Y TERMINAL BOX ASS'Y		
								OSND BY	KIM KWANG SOO	PROJEC'N	3rd Angle	DATE	2002.07.10	REF. NO	Sheet No. of

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
1						
2						
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6						
7						
8						
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HYUNDAI
HEAVY INDUSTRIES CO., LTD.
INDUSTRIAL & POWER SYSTEMS

REF. NO
DWG NO
3M-025056
Sheet No. of
Revision No. 0

		2	3	4		
REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY



NOTE

- 1) WT11,12,13/41,42,43 ; Winding temp. sensor (U) – Pt 100 ohm
- 2) WT21,22,23/51,52,53 ; Winding temp. sensor (V) – Pt 100 ohm
- 3) WT31,32,33/61,62,63 ; Winding temp. sensor (W) – Pt 100 ohm
- 4) SH11,12 ; Space heater

*** WTD SETTING POINT (AMBIENT TEMP. : 45°C)

WINDING	
ALARM	TRIP
130 °C	140 °C

Q'TY	DESCRIPTION		MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	H. H. LEE	UNIT	MM	SUBJECT	TITLE ACC'Y TERMINAL BOX WIRING DIAGRAM		CAD PROJ ㄱ \ FILE ㄱ	
CHKD BY	J. S. PARK	SCALE	NONE				WIR-DIAG\4K047000	
CHKD BY	_____	PROJEC'N	3 ㄱ (3rd Angle)					
DSND BY	KIM KWANG SOO	DATE	2004.06.23					
 HYUNDAI HEAVY INDUSTRIES CO., LTD. INDUSTRIAL & POWER SYSTEMS				REF. NO			Sheet No. of	
				DWG NO	4M-047000		Revision No.	

1		2		3		4	
REV	DATE	CONTENTS		REVD BY	CHKD BY	Q.P CHK	APPD BY

**HYUNDAI**

3~INDUCTION MOTOR TYPE :

KW	P	V	AMP	HZ
FR. NO.	IP	S.F	RPM	
SQUIRREL CAGE		CODE LETTER		
RATING		EFF.	COSØ	
INS. CLASS		AMB. TEMP.	°C	TEMP.RISE °C
SPACE HEATER : 1Ø, V, W				
BRG.(D.E/N-D.E)			WT.	KG
SERIAL NO.				
MFG DATE :			MADE IN KOREA 4M-052647	

1	NAME PLATE		SUS304	t0.8				1
---	------------	--	--------	------	--	--	--	---

Q'TY	DESCRIPTION		MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	MM	SUBJECT	INDUCTION MTR(SQUIRREL)		NAME-PTE\4M052647	
Q.P CHK	K. S. KIM	SCALE	1/1	TITLE NAME PLATE				
CHKD BY	—	PROJEC'N	3rd Angle					
DSND BY	KIM KWANG SOO	DATE	2002.02.15					

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HEAVY INDUSTRIES CO., LTD.

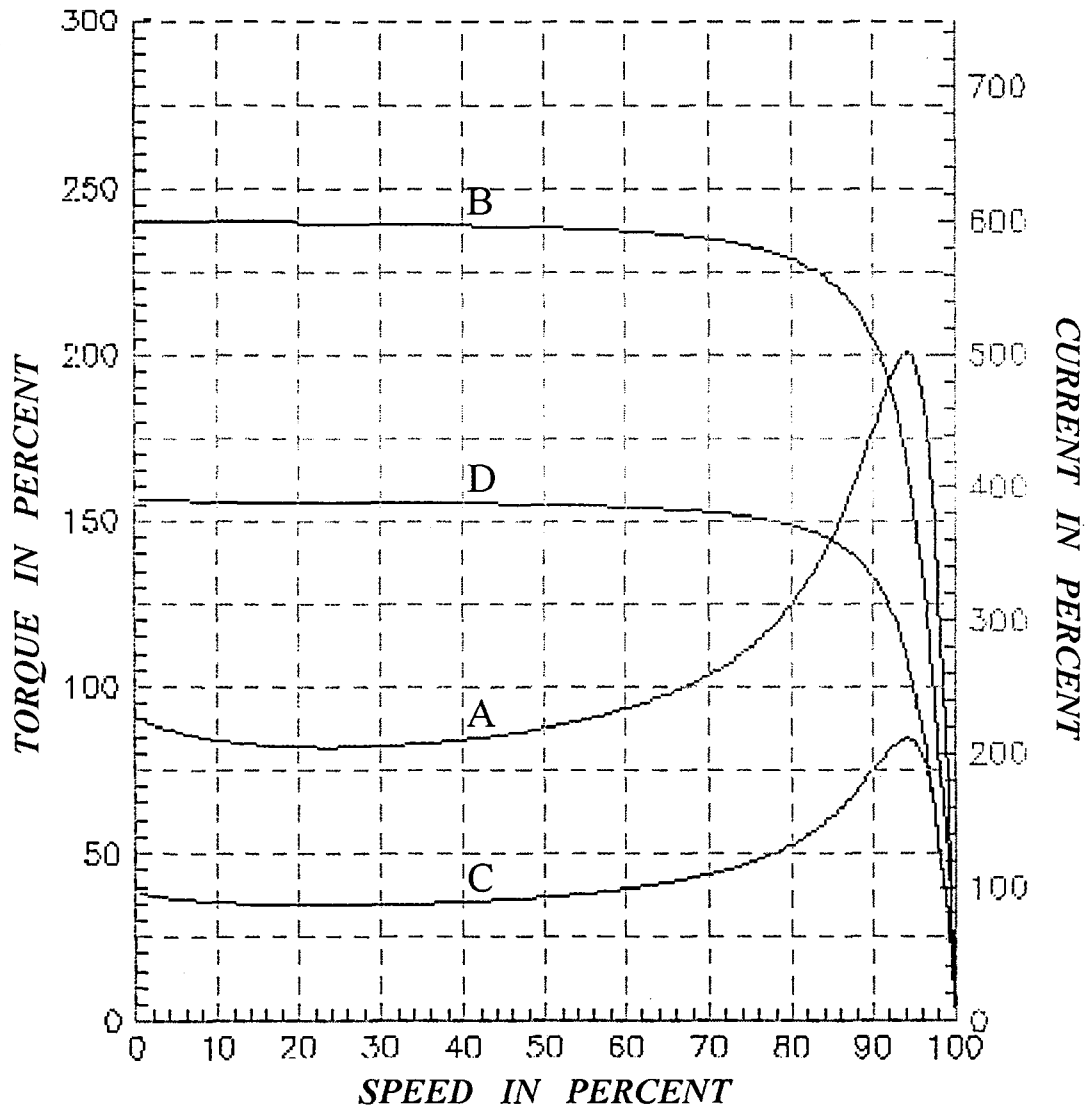
REF. NO		Sheet No.	of
DWG NO	4M-052647	Revision No.	1

1	2	3	4
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SPARE PART LIST FOR INDUCTION MOTOR						
SPEC		1400KW x 6P BOW THRUSTER				
ITEM NO	NAME OF PARTS	OUTLINE DIMENSION	QUANTITY			REMARK
			WORKING		SPARE	
			PER MOTOR	PER SHIP	PER SHIP	
1	BALL BEARING	Technical drawing of a ball bearing. The outer diameter is 40, the inner diameter is 130, and the total width is 230.	1	1	1	#6226C3
2	ANGULAR CONTACT BALL BEARING	Technical drawing of an angular contact ball bearing. The outer diameter is 50, the inner diameter is 110, and the total width is 240.	1	1	1	#7322B

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	K. J. KANG	UNIT	MM	SUBJECT	-	CAD PROJ ㄱ \ FILE ㄱ	
CHKD BY	K. S. KIM	SCALE	N/S			BRG-AS02\4R056186	
CHKD BY	—	PROJEC'N	3 ㄱ (3rd Angle)	TITLE	SPARE PART LIST		
DSND BY	KIM KWANG SOO	DATE	2004.06.23				
 HYUNDAI HEAVY INDUSTRIES CO., LTD. INDUSTRIAL & POWER SYSTEMS				REF. NO		Sheet No.	of
				DWG NO	4M-056186	Revision No.	0

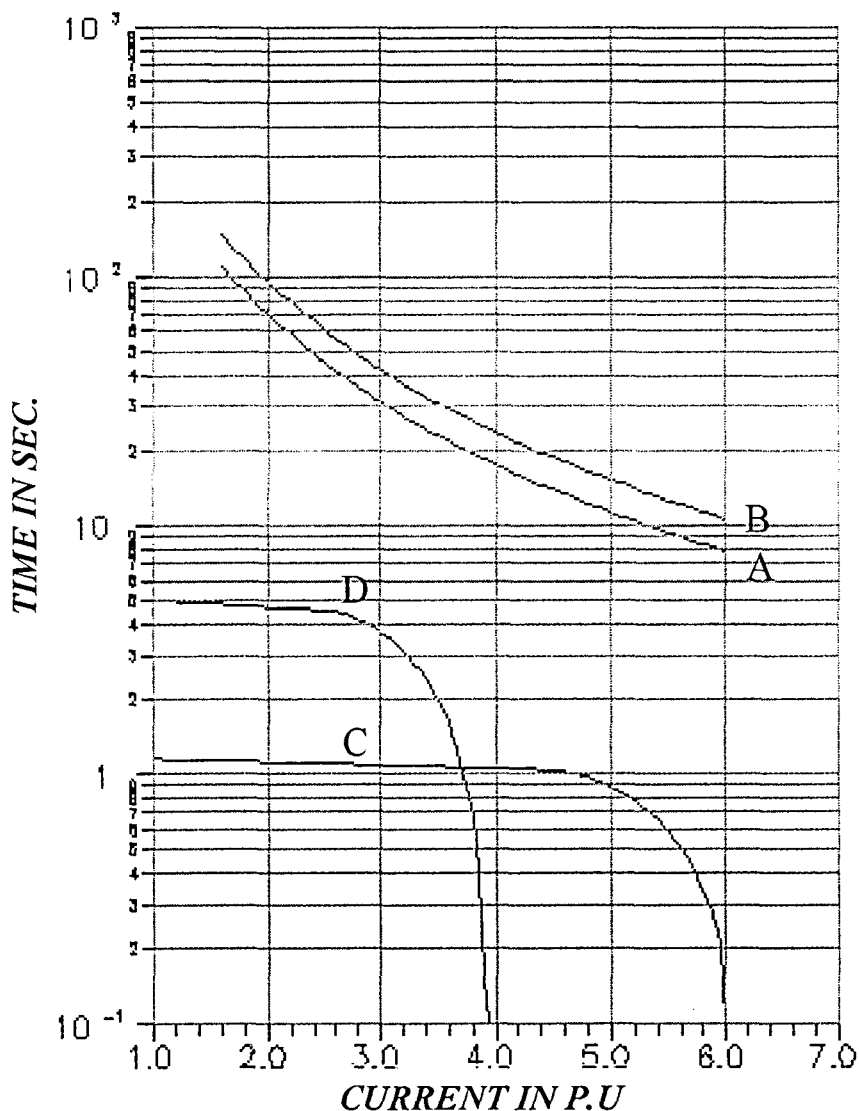
		SPEED-TORQUE & CURRENT CURVE				CURVE NO.	
						STC- 4RPH093	
MOTOR TYPE : HLA7 636-66Y		1400 KW		6 P	60 HZ		
RATED TORQUE : 1148.8 kg.m		RATED SPEED :		1187 RPM			
GD ² OF MOTOR : 275 kg.m ²		VOLTAGE :		6600 V			
GD ² OF LOAD : 89.0 kg.m ²		RATED CURRENT :		146.5 A			



NOTE : A: SPEED-TORQUE CURVE AT RATED VOLTAGE
 B: SPEED-CURRENT CURVE AT RATED VOLTAGE
 C: SPEED-TORQUE CURVE AT 65 % RATED VOLTAGE
 D: SPEED-CURRENT CURVE AT 65 % RATED VOLTAGE

REMARK.	REV.	CONTENTS	DATE	DSN	CHK	APPD
	2					
	1					
	0	ORIGINAL ISSUE	2004-06-23	S.M.LEE	Y.S.KIM	H.H.LEE

	THERMAL LIMIT & TIME CURRENT CURVE	CURVE NO. TLC- 4RPH093
MOTOR TYPE : HLA7 636-66Y	1400 KW 6 P 60 HZ	
RATED TORQUE : 1148.8 kg.m	RATED SPEED : 1187 RPM	
GD² OF MOTOR : 275 kg.m ²	VOLTAGE : 6600 V	
GD² OF LOAD : 89.0 kg.m ²	RATED CURRENT : 146.5 A	



NOTE :
 A: THERMAL LIMIT CURVE AT HOT CONDITION
 B: THERMAL LIMIT CURVE AT COLD CONDITION
 C: TIME - CURRENT CURVE AT RATED VOLTAGE
 D: TIME - CURRENT CURVE AT 65% RATED VOLTAGE

REMARK.	REV.	CONTENTS	DATE	DSN	CHK	APPD
	2					
	1					
	0	ORIGINAL ISSUE	2004-06-23	S.M.LEE	Y.S.KIM	H.H.LEE

**BOW & STERN
THRUSTER
TCT-220 / 200**

KTE - NAKASHIMA

**KTE CO.,LTD.
MECHATRONICS DIVISION**

www.kte.co.kr

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1. INSTRUCTION MANUAL
FOR THRUSTER CONTROL SYSTEM

2. REMOTE CONTROL SYSTEM

3. HYD. PUMP STARTER &
LOCAL CONTROL BOX

4. SPARE PARTS & TOOLS LIST
4-1. ELECTRIC PART

5. NOTE

INSTRUCTION MANUAL (VER 1.1)

KT - TCS Thruster Control System

August 2005



KTE Co., Ltd

1497-11, Songjeong-Dong, Gangseo-Gu,
Busan 618-270, Korea

Tel : +82-51-265-0255 Fax : +82-51-265-0250

KTE	USER'S MANUAL OF Thruster Control System (KT - TCS)	REV	PAGE : 2 OF 43
			DOCU. NO :

-Contents-

1. Introduction
 - 1.1. Use
 - 1.2. Basic specifications
2. System construction
 - 2.1. The whole system construction
 - 2.2. Terminal block diagram (1)
 - 2.3. Terminal block diagram (2)
 - 2.4. Terminal block diagram (3)
 - 2.5. Hardware construction
3. Main functions
 - 3.1. Auto blade angle control (follow up)
 - 3.2. Change control position
 - 3.3. Manual control
 - 3.4. Auto load control
 - 3.5. Communication and analog output for VDR
4. System operations
 - 4.1. Adjusting command value
 - 4.2. Adjusting feedback value
 - 4.3. Setting parameter
5. Layout drawing
 - 5.1. Front panel
 - 5.2. External diagram
6. Operating flow charts
 - 6.1. Normal operation
 - 6.2. Change control position
 - 6.3. Auto load control
7. Parameter adjust unit
 - 7.1 LCD display
 - 7.2 Explanations for each key
 - 7.3 Changing over to another address
 - 7.4 Changing value of each parameters
- # Appendix : system parameter

KTE	USER'S MANUAL OF Thruster Control System (KT - TCS)	REV	PAGE : 3 OF 43
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1. Introduction

1.1. Use

This manufacture is a private controller of the thruster which is used when a ship enters or leaves a port. the main functions of the manufacture are to detect control input, feedback value, and to control blade angle of the thruster with the most optimal condition by follow up control algorithm

Control command is done by port wing, stb'd wing as well as W/H, and the action is done with the command of related control position, which can be changed simply by operating a button.

Each parameter which is necessary to control can be identified and changed with parameter setting equipment.

1.2. Basic Specifications

1.2.1. Main control panel (Bow / Stern)

1) Standard specifications

- Supply voltage : DC 24V
- Current : 3A
- Temperature range : 0℃ ~ 70℃
- Output contact : 10A (250VAC) for magnet contact
2A (30VDC) for signal output

2) Main control board

- 8 bit micro-controller
- Digital dimmer

3) Input specifications

- Digital input : 20 channel
- Analog input : 7 channel
- Control dial : potentionmeter 2K ohms

KTE	USER'S MANUAL OF Thruster Control System (KT - TCS)	REV	PAGE : 4 OF 43
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4) Output specifications

- Indication lamp
 - For alarm : 12
 - For information : 7
 - For indication : 9
 - For pitch : bar Indication
 - For current : decimal (with pitch indicating by mode switch)
- Contact output : 2 channel (for S/V operation)
13 channel (for signal output)
- Alarm contact output :
 - System failure contactor.
 - Power failure contactor.
- Analog output
 - 2 Channel (for wing analog meter)
- For VDR (Voyage Data Recorder)
 - Command signal : -10V ~ +10V
 - Feedback signal : -10V ~ +10V
 - Thruster run signal : On/Off contactor
 - RS-485 communication

1.2.2. Wing control panel (Bow & Stern)

1) Input specifications

- Digital input : 2 channel x 2
- Analog input : 2 channel x 2
- Control Dial : Potentiometer 2K ohms x 2

2) Output specifications

- S/W output : 2 channel (for signal output) x 2
- Analog output : 1 channel (for command) x 2

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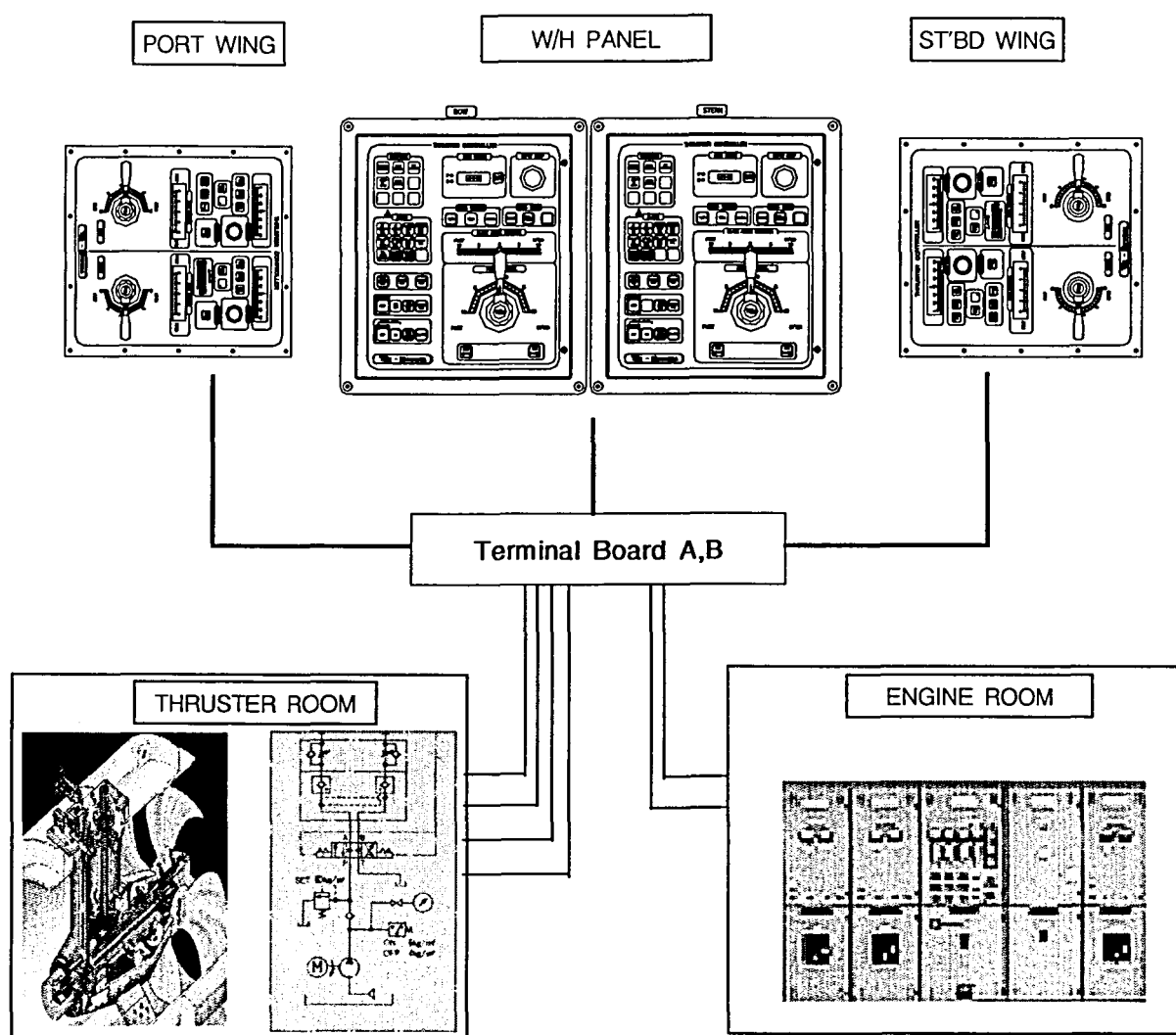
3) Indication lamp

- For alarm : 3 x 2
- For information : 1 x 2
- For indication : 1 x 2
- For pitch : bar Indication x 2
- For current : ammeter Indication x 2

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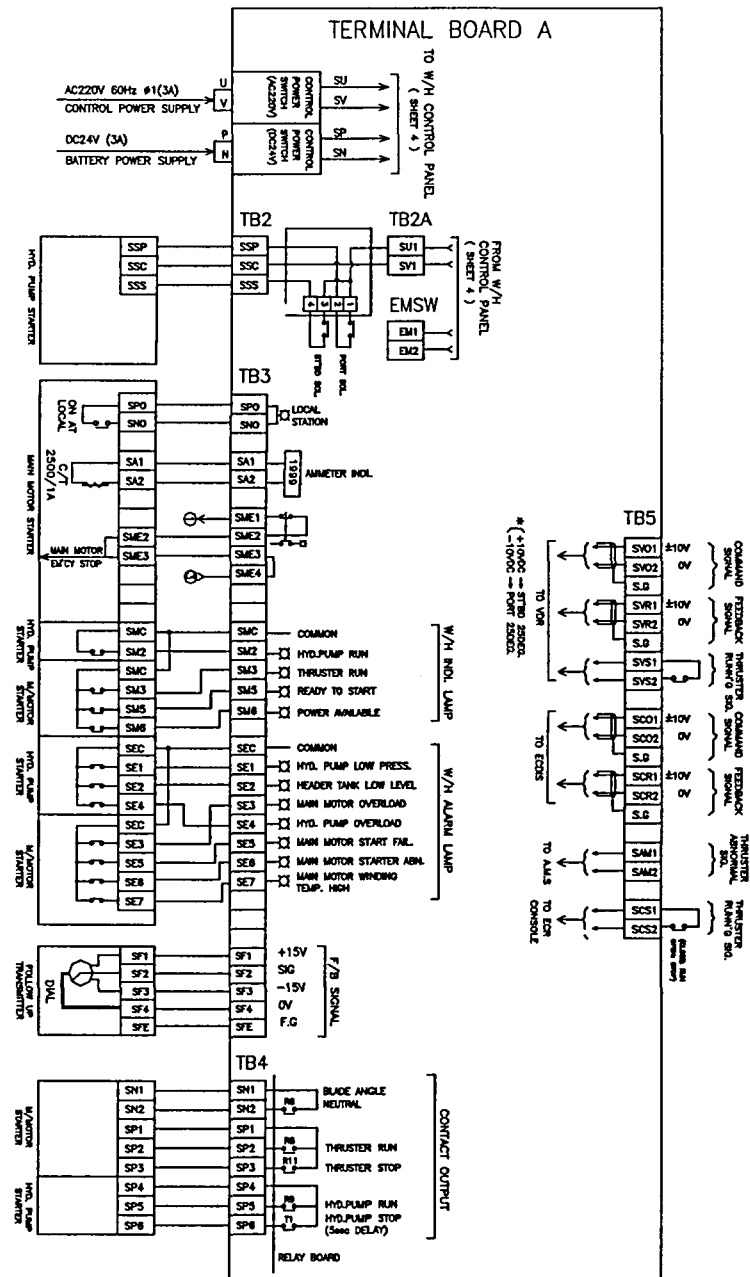
2. System construction

2.1. The whole system construction (Bow / Stern)

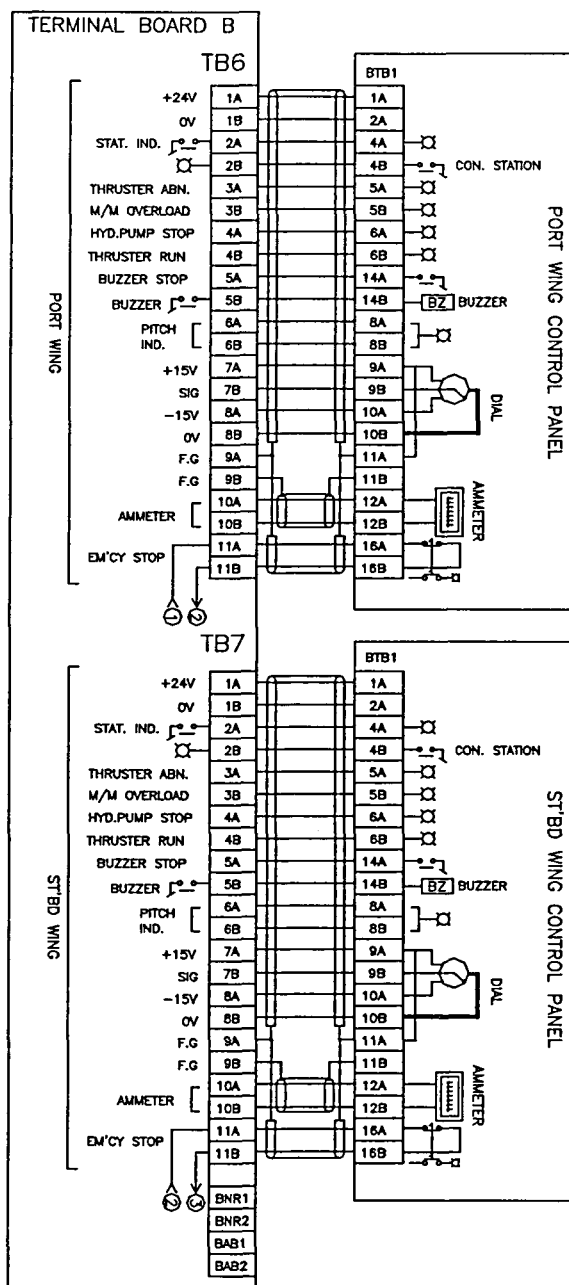


2.2. Terminal block diagram (1)

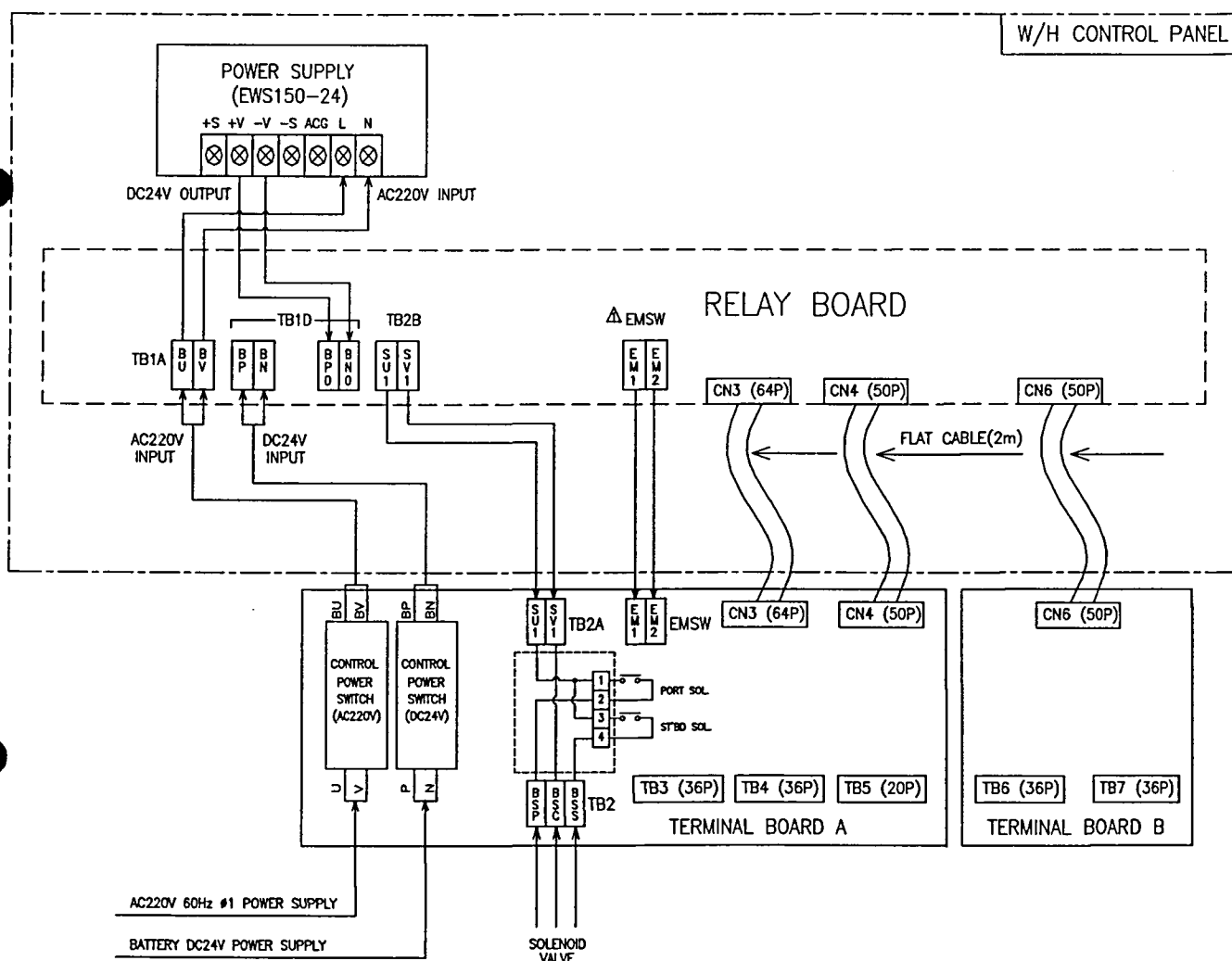
- Stern



2.3. Terminal block diagram (2) - (Bow / Stern)



2.4. Terminal block diagram (3) – (Bow / Stern)



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2.5. Hardware construction

2.5.1. Main control panel

1) CPU board :

This board uses 8-bit micro-controller in order to control digital input, digital output, and analog in/out. This is composed of CPU, memory, etc.

2) Analog board :

This board is composed of hybrid. IC, analog input circuit. this includes volume resistors to tune offset and gain for 5-channel analog inputs.

3) I/O board :

This is for digital input/output. It is consist of relay and etc.

4) Display board :

This board is located in front of the case, and composed of various indication lamps, buttons, dial for command input, blade angle indicator, ampere meter, etc.

5) Mother board :

This board is connected with CPU board directly. This is supply DC power to system.

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2.5.2. Wing control panel

1) Display & mother board :

This board is located in front of the case, and composed of various indication lamps, buttons, dial for command input, blade angle indicator, ampere meter, etc.

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3. Main functions

3.1. Auto blade angle control (follow up control)

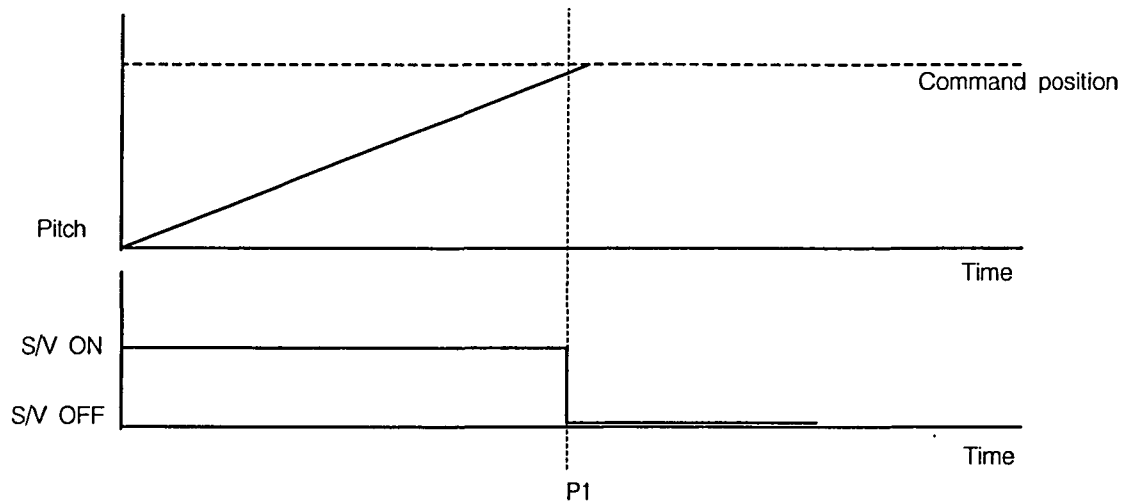
Main function of this system is to control blade angle with command value. That is to say, this system controls blade angle automatically with command, when follow up control algorithm is used. If feedback value becomes close to command value, this system doesn't transmit S/V control signal constantly, but pulse signal with constant time interval, and feedback value can reach the objective value quickly without overflowing command value. Users have to set parameters with parameter setting equipment in advance, and it is possible to set parameters properly per characteristics of every ship.

The kinds and contents of related parameters are as follows.

- Follow up start gab : data to decide starting point of follow up control
(Starting point of follow up control = command value - follow up start gab)
- Follow up S/V on time : when follow up control, S/V active time
- Follow up S/V off time : when follow up control, S/V inactive time
- Dead band zone : if each parameter and data are in this range when they are compared, they are regarded as same values.
(applied items : neutral, command & feedback, command change over comparison)

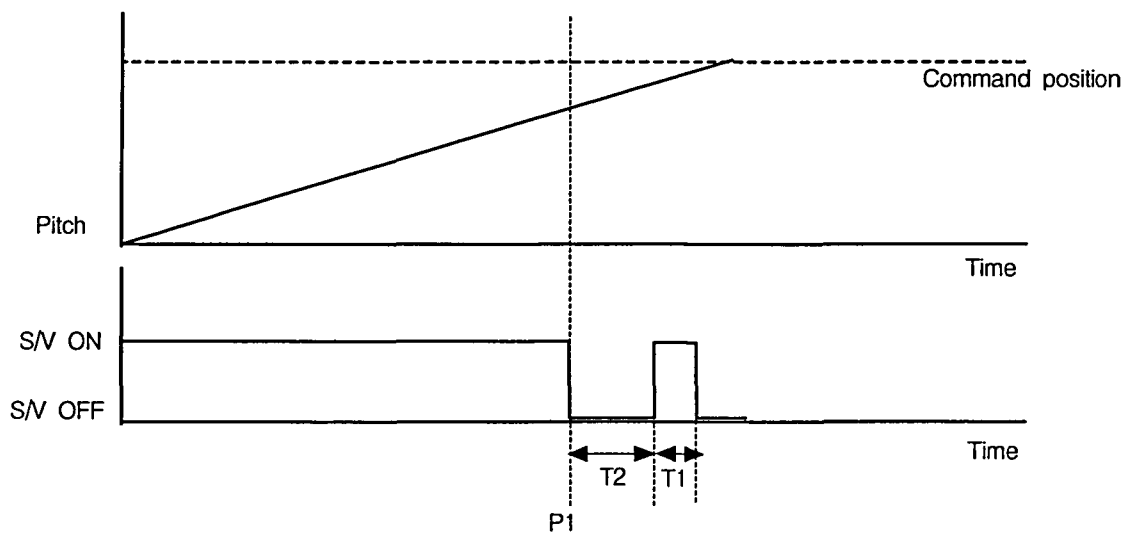
All parameters can be identified and changed with parameter setting equipment, and operating method for parameter setting equipment can be referred in another manual.

1) Interval time chart (when P1 is compatible)



P1 : follow up start position (= command position - follow up start gab)

2) Interval time chart (when P1 is too long)



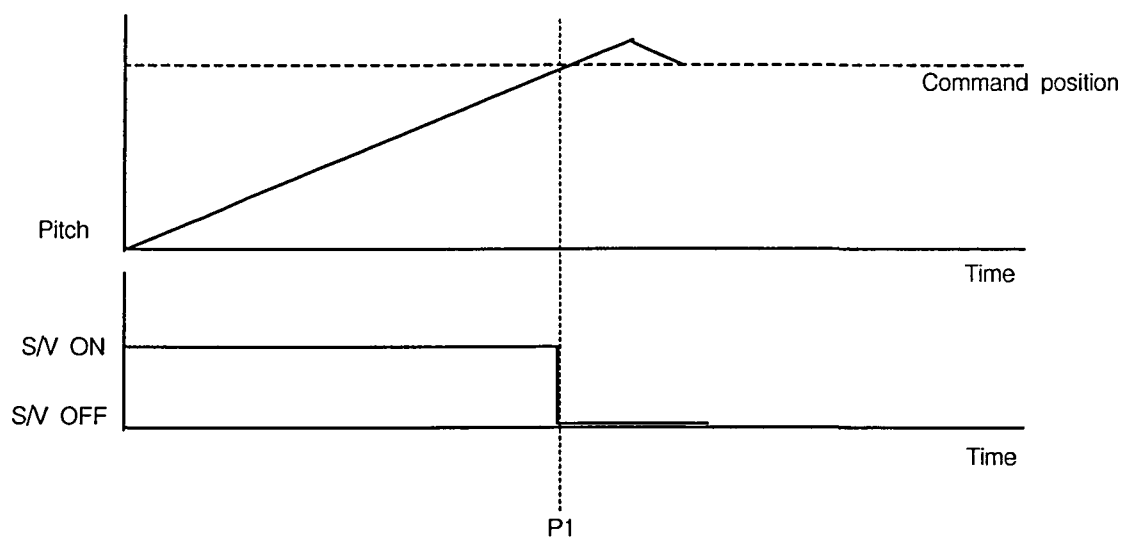
T1 : When follow up control, S/V active time

T2 : When follow up control, S/V inactive time

P1 : follow up start position (= command position - follow up start gab)

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3) Interval time chart (when P1 is too short)



P1 : follow up start position (= command position - follow up start gab)

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3.2. Change control position

1) Change position from W/H to wing

Position can be changed to wing by pushing "CHANGE OVER" button in wing control panel. If once button is pushed, wing control station lamp in W/H control panel starts flickering, and buzzer starts ringing in the form of pulse. when command value of wing control panel corresponds with feedback value, control position is turned to wing completely and wing control station lamp becomes steady state.

Moreover, if W/H control station button is pushed in flickering state, then all motions are canceled and return to previous state.

Process of the motions is as follows

CONDITION			ACTION	REMARK
W/H	WING	FEEDBACK		
- Command : Port 7.0	- Command : Zero	- Position : Port 7.0		
	- Push on wing control button		- W/H : Flickering wing lamp - Wing : Flickering wing lamp & buzzer on	
- Push on W/H control button			- W/H : Wing lamp off - Wing : Wing lamp off & buzzer off	Cancelled
	- Push on wing control button		- W/H : Flickering wing lamp - Wing : Flickering wing lamp & buzzer on	
	- Command : Port 7.0	- Position : Port 7.0	- W/H : W/H lamp off - Wing : Wing lamp go to steady & buzzer off	Ack.

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2) Change position from wing to W/H

To change control position from wing condition state to W/H is equal to previous one, and process of the motions is as follows

CONDITION			ACTION	REMARK
W/H	WING	FEEDBACK		
- Command : Zero	- Command : Port 7.0	- Position : Port 7.0		
- Push on W/H control button			- W/H : Flickering W/H lamp & buzzer on	
	- Push on wing control button		- W/H : W/H lamp off & buzzer off	Cancelled
- Push on W/H control button			- W/H : Flickering W/H lamp & buzzer on	
- Command : Port 7.0		- Position : Port 7.0	- W/H : W/H lamp go to steady wing lamp off & buzzer off - Wing : wing lamp off	Ack.

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3.3. Manual control (Non-follow up control)

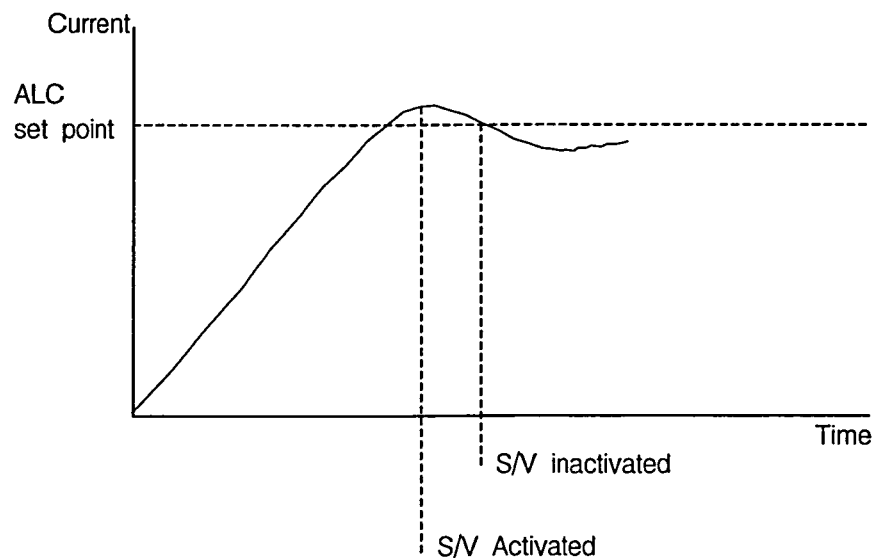
In this system, blade angle can be basically controlled by means of recognizing angle that users input with CPU and controlling automatically with follow up control algorithm, and another operation isn't necessary.

But, users must operate manually in case of not being controlled automatically because of difficulties in CPU or related components. for manual operation, users must pull Non-follow button in W/H control panel, when all control signals transmitted from CPU board are blocked forcedly and users can control directly with the button below control dial

3.4. Auto load control

This is for protecting overload in follow up operation, and controlled automatically by PI control depend on ALC set point.

If main motor actual load is more than preset load in follow up condition, the blade angle is automatically reduced to the angle of preset load.



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3.5. Communication and analog output for VDR

In this system, there are communication port(Serial / RS-485) and 2 analog output, 1 digital output.

- Command signal : -10V ~ +10V
- Feedback signal : -10V ~ +10V
- Thruster run signal : on/off contactor
- RS-485 communication

4. System operations

4.1. Adjusting command value

In this system, 3 command values transmitted from W/H, port wing, st'bd wing are used. each input value is voltage value transmitted from potentiometer located in the inside, and converted into digital value by A/D converter.

A/D converter provides 12-bits resolution, and $-10V \sim +10V$ voltage range basically corresponds to $0 \sim 4095$ digital value. but, there may be a few differences due to position of potentiometer or variable resister value of circuit. Therefore, zero and min/max value should be set in advance by means of adjusting position of potentiometer and offset, gain resister of circuit.

Data which should be set in advance in relation to command input are position of control dial (potentiometer), voltage, A/D conversion value, and angle. Values set for each item and allowed tolerance of error are as follows

No	Control dial	Voltage	A/D Count	Angle
1	Port max. position	-10 V	0 ~ 10	up to 30.0°
2	Zero position	0 V	2043 ~ 2053	0
3	St'bd max. position	+10 V	4086 ~ 4095	up to 30.0°

The methods to set data are as follows

- Stick parameter setting equipment on control unit, and input maximum angle.
- Set address for parameter setting equipment to indicate A/D count value.
- Put the position of control dial to port max. position
- Adjust offset, gain, position of potentiometer for A/D count to be in tolerance.
- In the same way, set zero position and st'bd max. position
- Set address for parameter setting equipment to indicate angle.
- Identify position and angle of control dial
- Save A/D count value to the address of parameter setting equipment

4.2. Adjusting feedback value

Adjusting feedback value is equal to that of command, and 2 positions for data identification are added in order to heighten accuracies of data.

No	Control dial	A/D Count	Angle
01	Feedback PORT 25	0 ~ 20	Port 25 degree
02	Feedback PORT 20	309 ~ 419	Port 20 degree
03	Feedback PORT 15	809 ~ 829	Port 15 degree
04	Feedback PORT 10	1218 ~ 1238	Port 10 degree
05	Feedback PORT 5	1628 ~ 1648	Port 5 degree
06	Feedback Zero	2038 ~ 2058	Zero
07	Feedback STBD 5	2447 ~ 2467	STBD 5 degree
08	Feedback STBD 10	2857 ~ 2877	STBD 10 degree
09	Feedback STBD 15	3266 ~ 3286	STBD 15 degree
10	Feedback STBD 20	3676 ~ 3696	STBD 20 degree
11	Feedback STBD 25	4075 ~ 4095	STBD 25 degree

4.3. Setting parameter

Parameters in this system are saved at the memory in W/H control panel, and loaded when power is supplied initially. setting and identifying each parameter are accomplished with another parameter setting equipment.

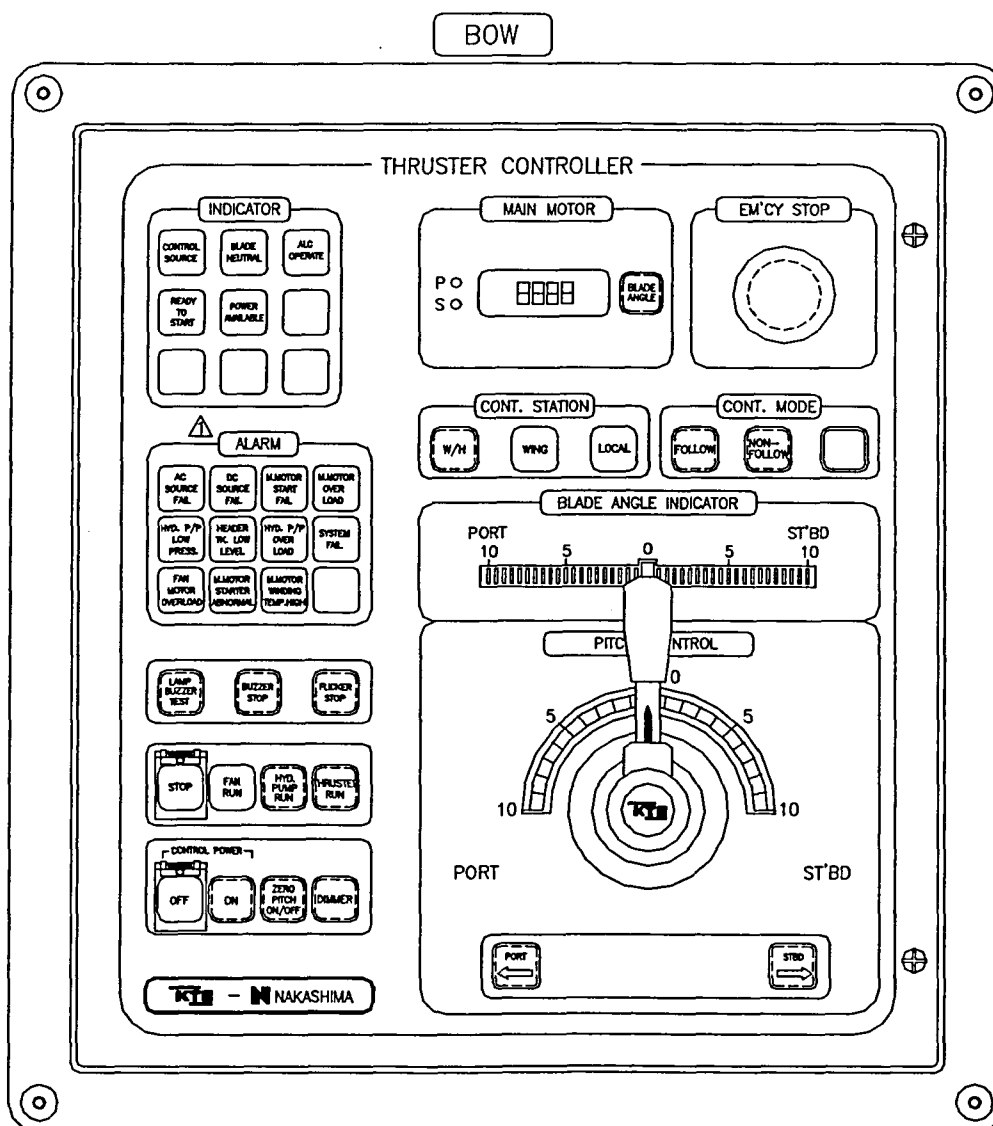
Refer appendix if you want to know the kinds and contents of parameters in system.

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5. Layout drawing

5.1. Front panel

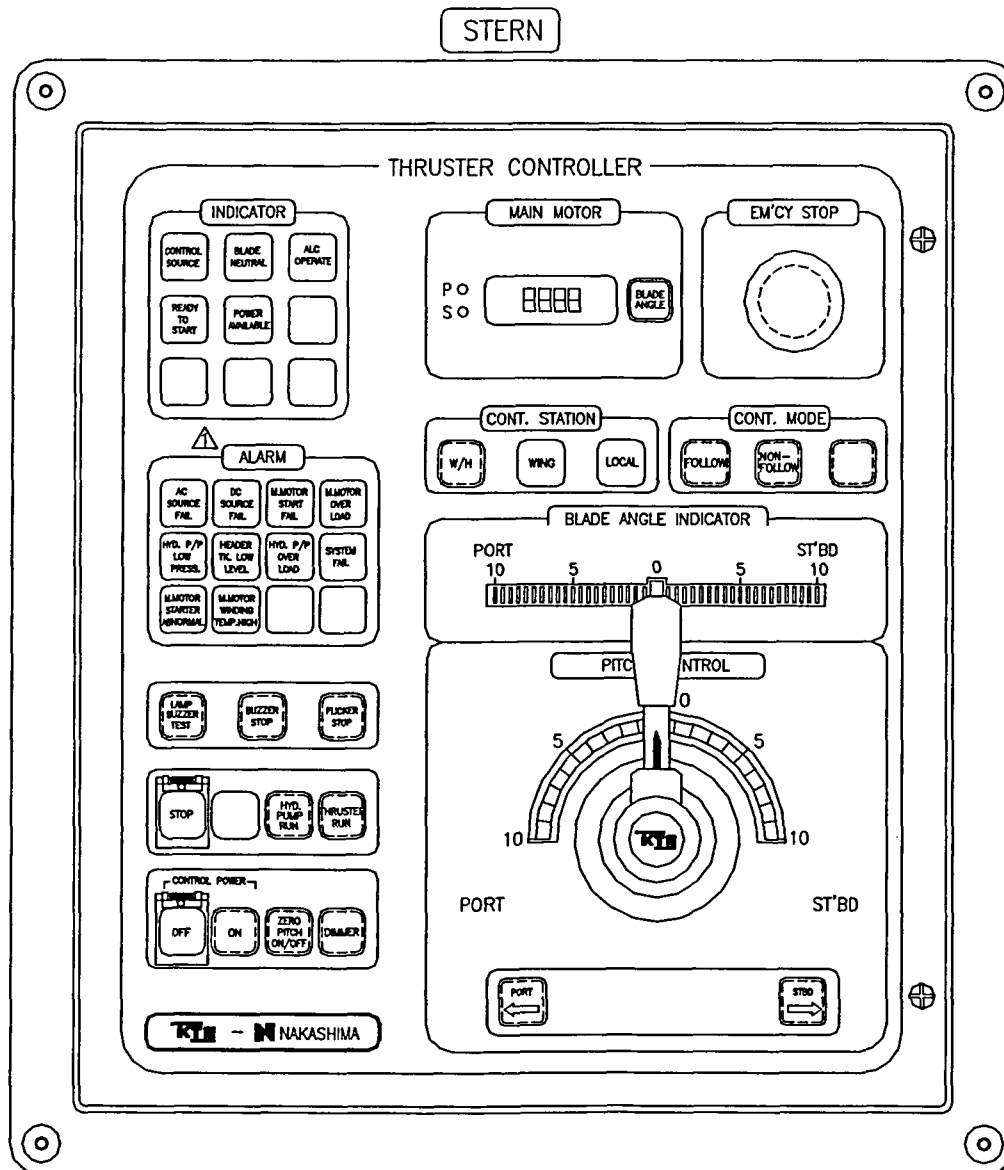
1) W/H control panel (Bow)



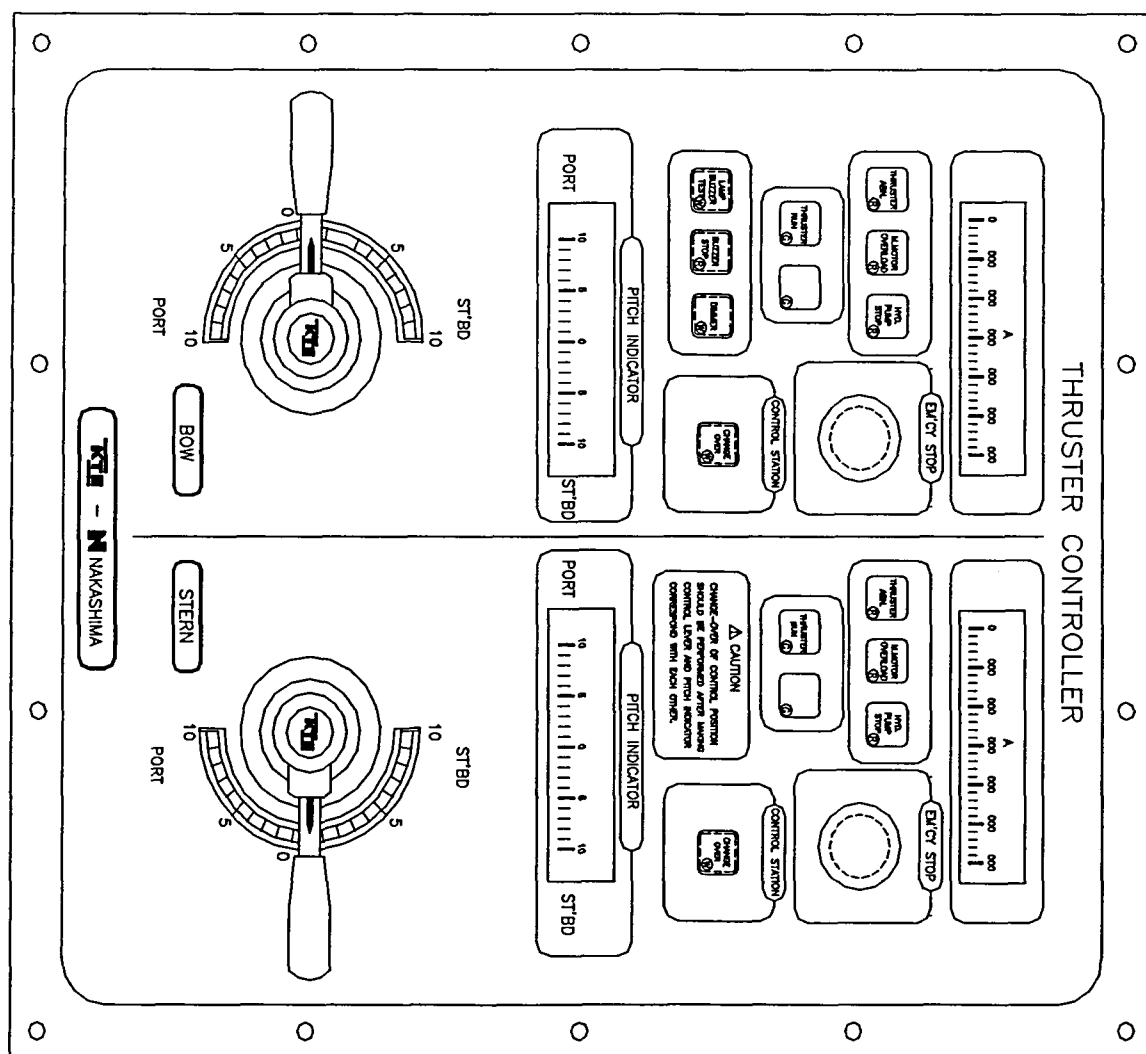
5. Layout drawing

5.1. Front panel

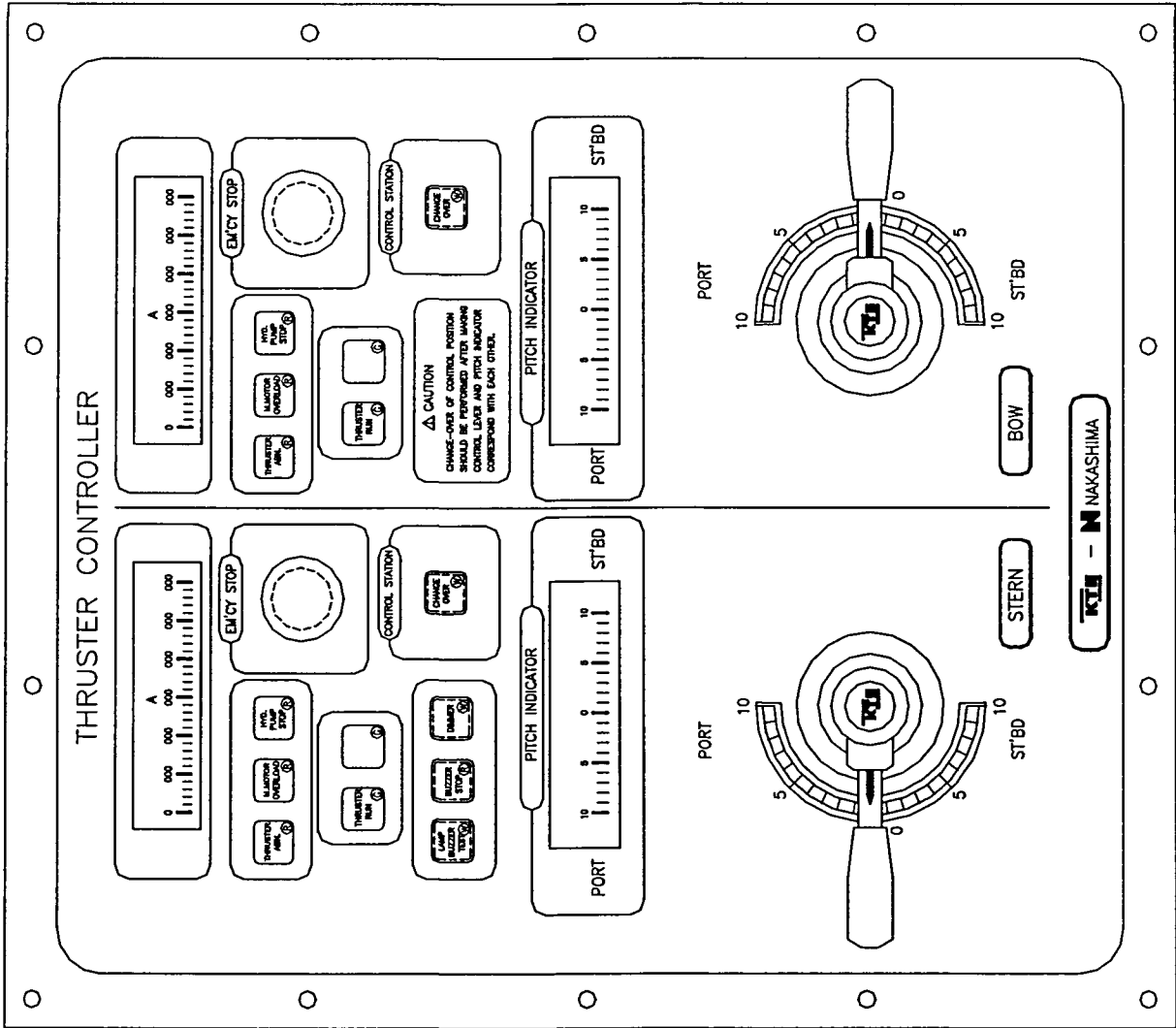
1) W/H control panel (Stern)



2) Wing control panel
- port wing



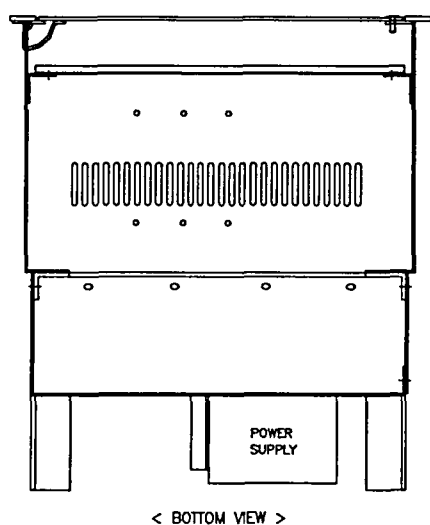
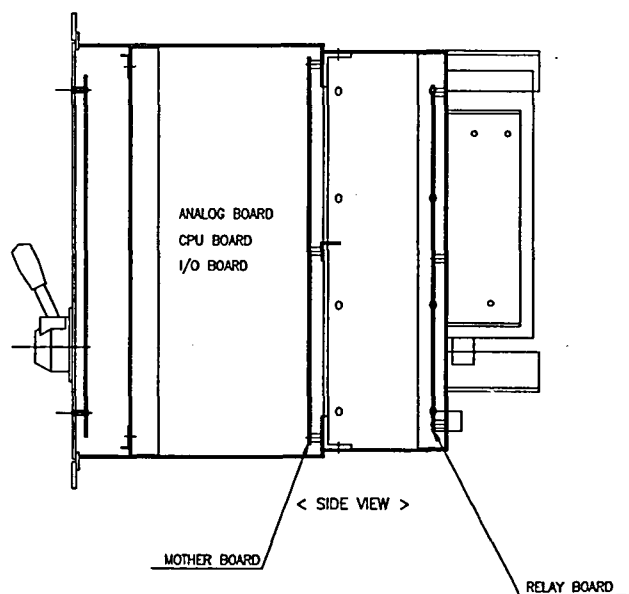
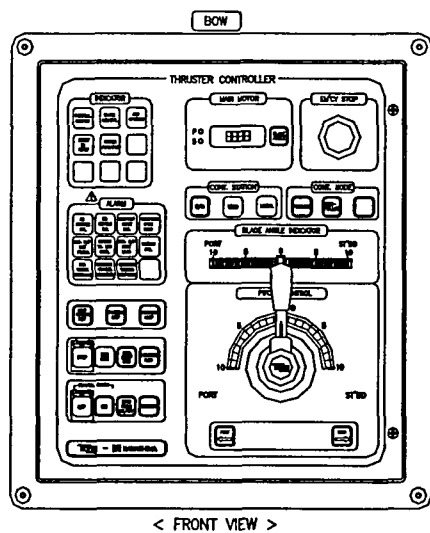
- Stb'd wing

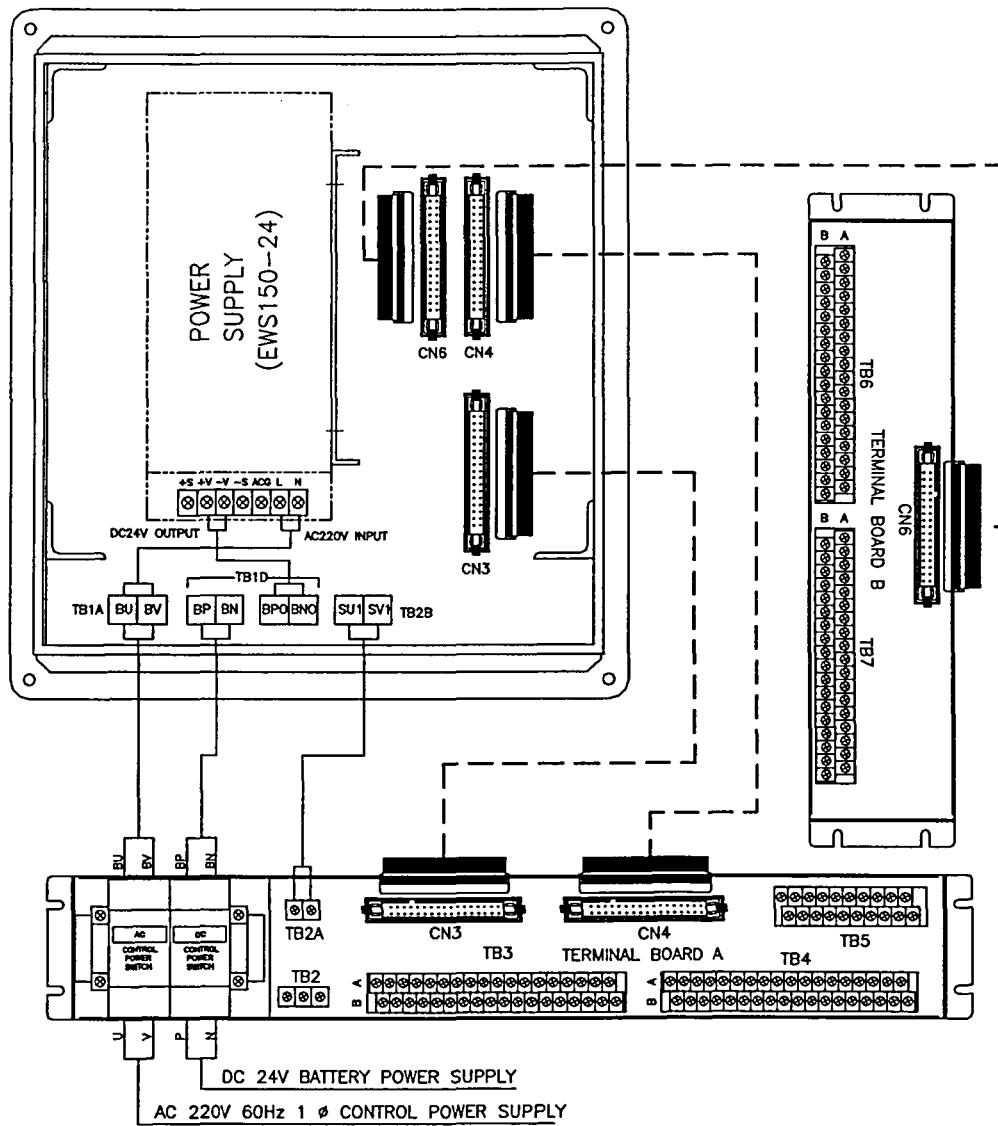


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5.2. External diagram

1) W/H control panel (Bow / Stern)

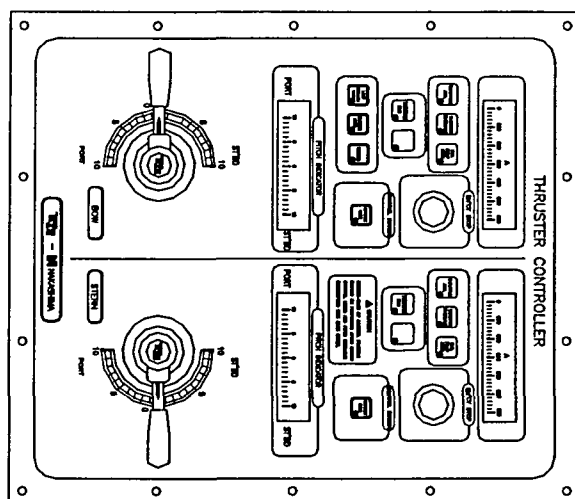




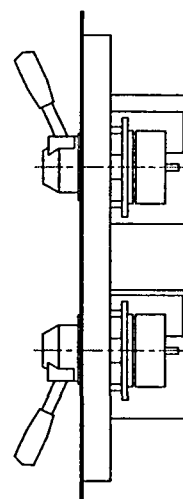
< REAR VIEW >

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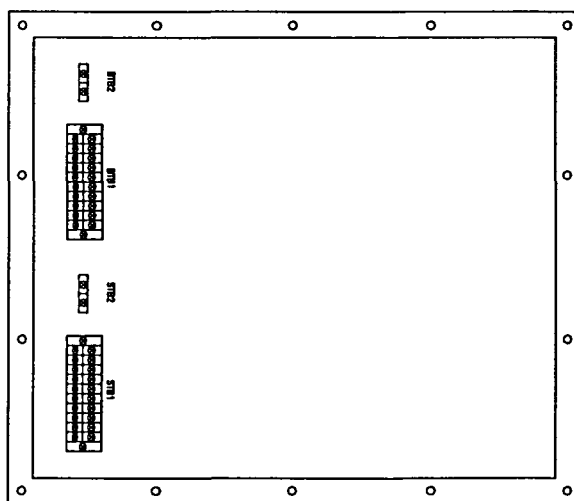
2) Wing control panel (port)



< FRONT VIEW >



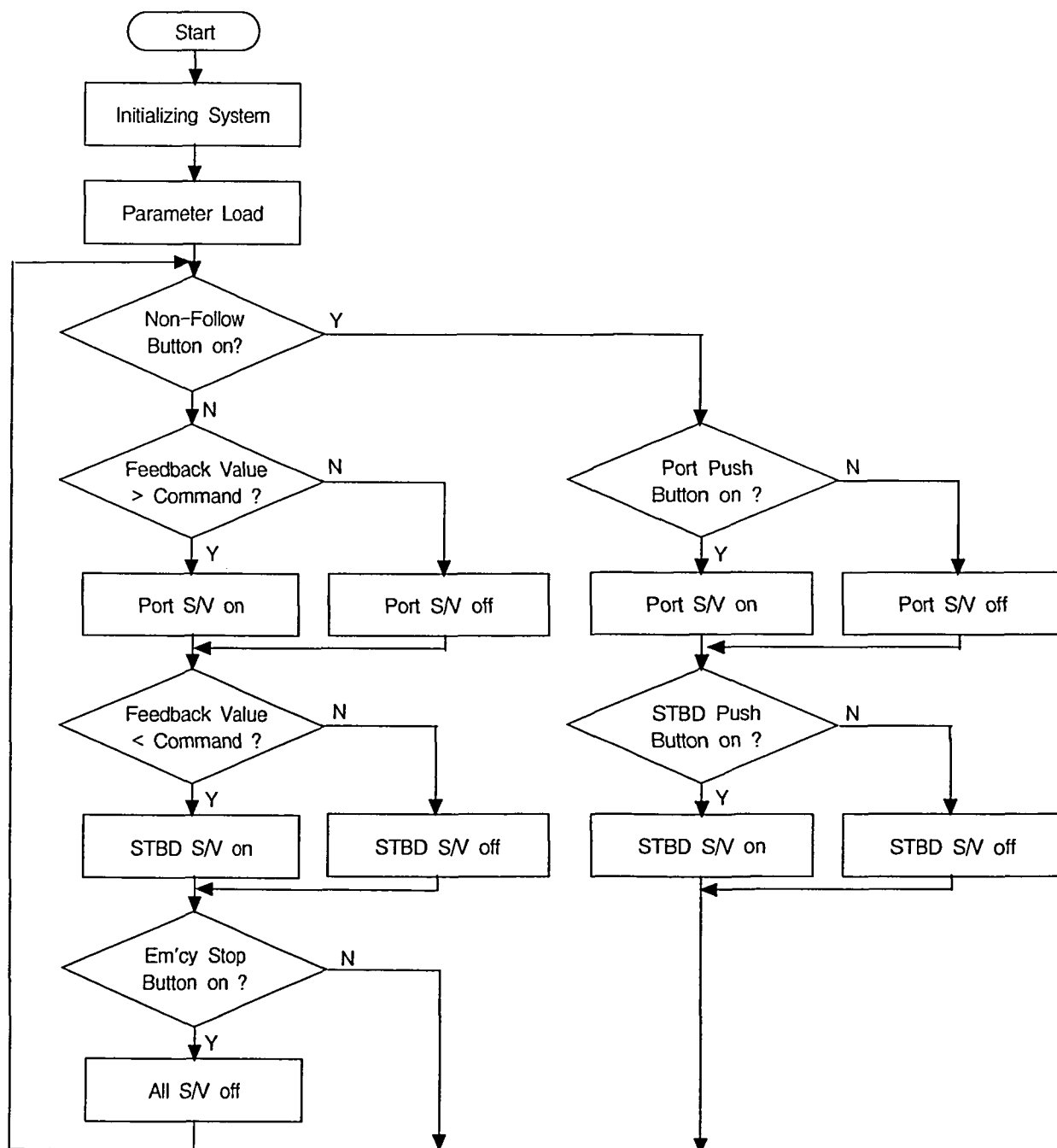
< SIDE VIEW >



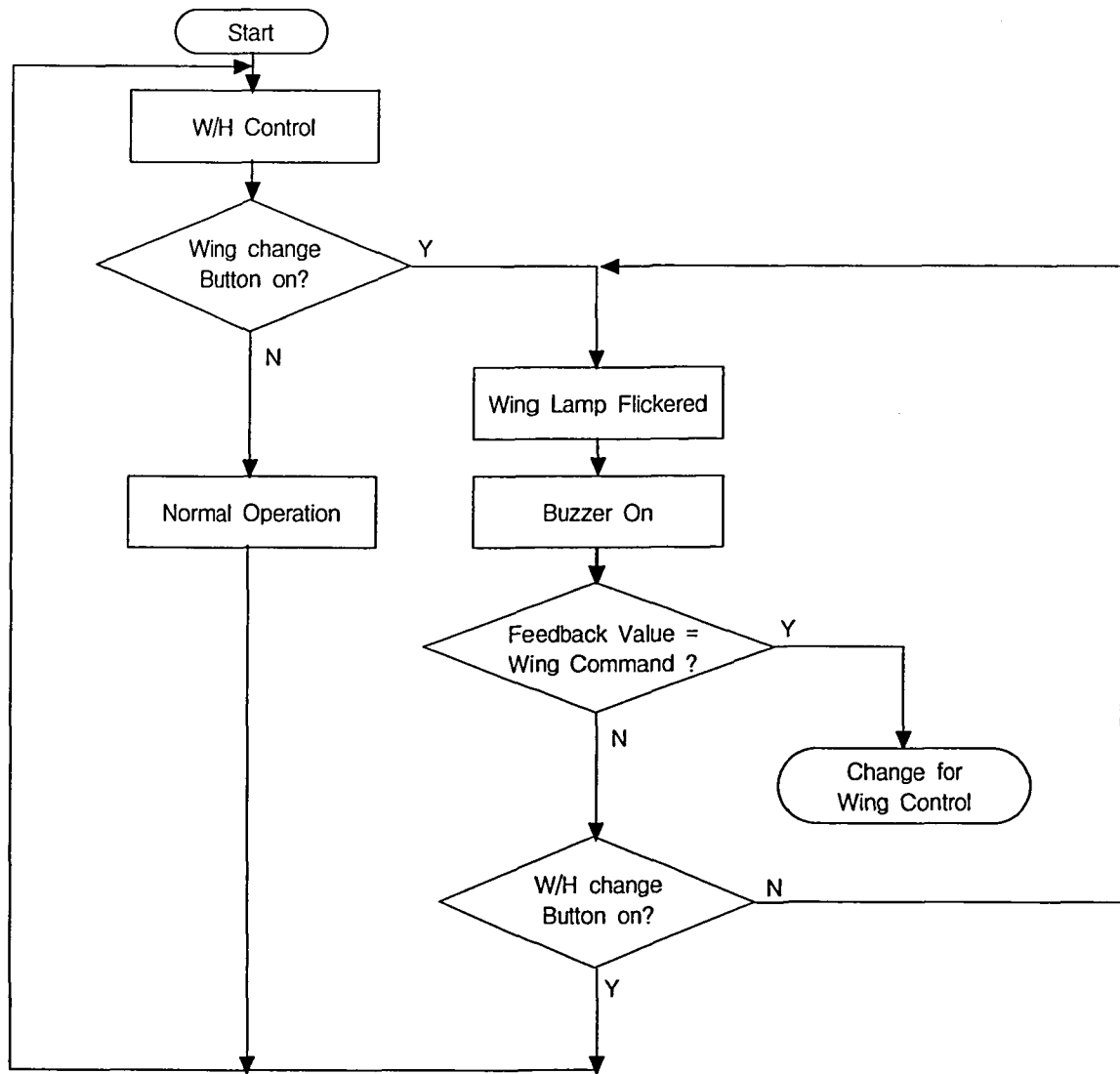
< REAR VIEW >

6. Operating flow charts

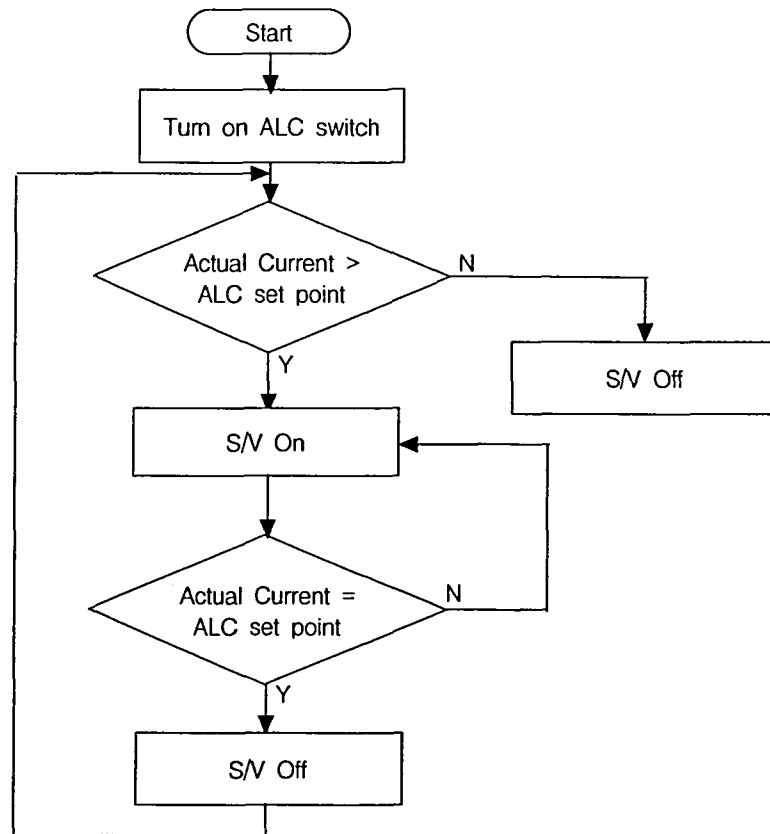
6.1. Normal operation



6.2. Change Control Position



6.3. Auto load control



7. Parameter adjust unit

7.1 LCD display

1) Setting parameter mode

```

> S[00] : 00000
  S[01] : 00000
  S[02] : 00000
  No :      DATA :

```

- " > " : Cursor which is indicate position of address
- " S " : It means that each parameters are available to be set
- " [xx] " : It means address
- " 00000 " : It means value of each address
- " No : " : This is area of inputting address
- " DATA : " : This is area of inputting value

2) Monitoring parameter mode

```

> M[00] : 00000
  M[01] : 00000
  M[02] : 00000
  No :      DATA :

```

- " > " : Cursor which is indicate position of address
- " M " : It means that each parameters are available to be monitored
- " [xx] " : It means address
- " 00000 " : It means actual value of each address
- " No : " : This is area of inputting address
- " DATA : " : It is not available in this mode

7.2 Explanations for each key

Name	Information
	Numeric "0"
	Numeric "1"
	Numeric "2"
	Numeric "3"
	Numeric "4"
	Numeric "5"
	Numeric "6"
	Numeric "7"
	Numeric "8"
	Numeric "9"
	It is used for setting data
	It is used for entering data or address
	It is used for moving cursor to increase address
	It is used for moving cursor to decrease address
	It is used for changing over to parameter setting mode
	It is used for changing over to parameter monitoring mode

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7.3 Changing over to another address

1) Method by using "up/down" arrow key

- Press "up arrow" key to increase address
- Press "down arrow" key to decrease address

2) Method by numeric key

- Press address number that you want to move
- That number is displayed at "No" area
- Press "ENT" key to change over

7.4 Changing value of each parameters

- It is available in "setting parameter" mode
- Press address number that you want to change
- That number is displayed at "No" area
- Press "ENT" key to change over
- Press "SET" key
- Press available value for each parameter
- Press "ENT" key to change value
- If value is not useful, parameter will not changed

Appendix. system parameters

1) Setting parameter & value

Address	Function	Range	Unit	Remark
S [00]	W/H command full scale	0 ~ 300	Degree x 10	
S [01]	W/H command port 10	0 ~ 20	A/D	
S [02]	Not used	-	-	※
S [03]	W/H command zero	2038 ~ 2058	A/D	
S [04]	Not used	-	-	※
S [05]	W/H command st'bd 10	4075 ~ 4095	A/D	
S [06]	Port wing command full scale	0 ~ 300	Degree x 10	
S [07]	Port wing command port 10	0 ~ 20	A/D	
S [08]	Not used	-	-	※
S [09]	Port wing command zero	2038 ~ 2058	A/D	
S [10]	Not used	-	-	※
S [11]	Port wing command st'bd 10	4075 ~ 4095	A/D	
S [12]	STBD wing command full scale	0 ~ 300	Degree x 10	
S [13]	STBD wing command port 10	0 ~ 20	A/D	
S [14]	Not used	-	-	※
S [15]	St'bd wing command zero	2038 ~ 2058	A/D	
S [16]	Not used	-	-	※
S [17]	St'bd wing command st'bd 10	4075 ~ 4095	A/D	

◎ Remark

Have no any effect if a data was set or indicator on the above " ※ " address

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Address	Function	Range	Unit	Remark
S [18]	Feedback full scale	0 ~ 300	Degree x 10	
S [19]	Feedback port 25	0 ~ 20	A/D	
S [20]	Feedback port 20	309 ~ 419	A/D	
S [21]	Feedback port 15	809 ~ 829	A/D	
S [22]	Feedback port 10	1218 ~ 1238	A/D	
S [23]	Feedback port 5	1628 ~ 1648	A/D	
S [24]	Feedback zero	2038 ~ 2058	A/D	
S [25]	Feedback st'bd 5	2447 ~ 2467	A/D	
S [26]	Feedback st'bd 10	2857 ~ 2877	A/D	
S [27]	Feedback st'bd 15	3266 ~ 3286	A/D	
S [28]	Feedback st'bd 20	3676 ~ 3696	A/D	
S [29]	Feedback st'bd 25	4075 ~ 4095	A/D	
S [30]	Neutral zone	0 ~ 300	Degree x 10	
S [31]	Dead band zone	0 ~ 300	Degree x 10	
S [32]	Change over Interlock On/Off	0 or 1	0 : On 1 : Off	
S [33]	Change over Interlock zone	0 ~ 300	Degree x 10	
S [34]	Port max. limit	0 ~ 300	Degree x 10	
S [35]	St'bd max. limit	0 ~ 300	Degree x 10	
S [36]	Follow up start gab	0 ~ 300	Degree x 10	
S [37]	Follow up S/V on time	1 ~ 2500	SEC x 10	
S [38]	Follow up S/V off time	1 ~ 2500	SEC x 10	

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Address	Function	Range	Unit	Remark
S [39]	Auto load control limit	0 ~ 2000	A	
S [40]	Auto load control proportional gain	0 ~ 300	Degree × 10	
S [41]	Auto load control integral gain	1 ~ 2500	SEC × 10	
S [42]	Load value full	0 ~ 2000	A	
S [43]	Maximum dimmer value	0 ~ 255	D/A	
S [44]	Minimum dimmer value	0 ~ 255	D/A	
S [45]	Dimmer sensitivity value	0 ~ 10	0 : Fast 1 : Slow	
S [46]	Fan & hyd. pump off delay time	0 ~ 50	SEC	
S [47]	Zero pitch function On/Off	0 or 1	0 : Off 1 : On	
S [48]	Portable function On/Off	0 or 1	0 : Off 1 : On	
S [49]	W/H pitch Indicator offset	0 ~ 1024	D/A	
S [50]	W/H pitch indicator gain	0 ~ 1024	D/A	
S [51]	W/H ampere indicator offset	0 ~ 1024	D/A	
S [52]	W/H ampere indicator gain	0 ~ 1024	D/A	
S [53]	Wing pitch indicator offset	0 ~ 1024	D/A	
S [54]	Wing pitch indicator gain	0 ~ 1024	D/A	
S [55]	Wing ampere indicator offset	0 ~ 1024	D/A	
S [56]	Wing ampere indicator gain	0 ~ 1024	D/A	
S [57]	Command output offset for VDR	0 ~ 1024	D/A	
S [58]	Command output gain for VDR	0 ~ 1024	D/A	
S [59]	Feedback output offset for VDR	0 ~ 1024	D/A	
S [60]	Feedback output gain for VDR	0 ~ 1024	D/A	

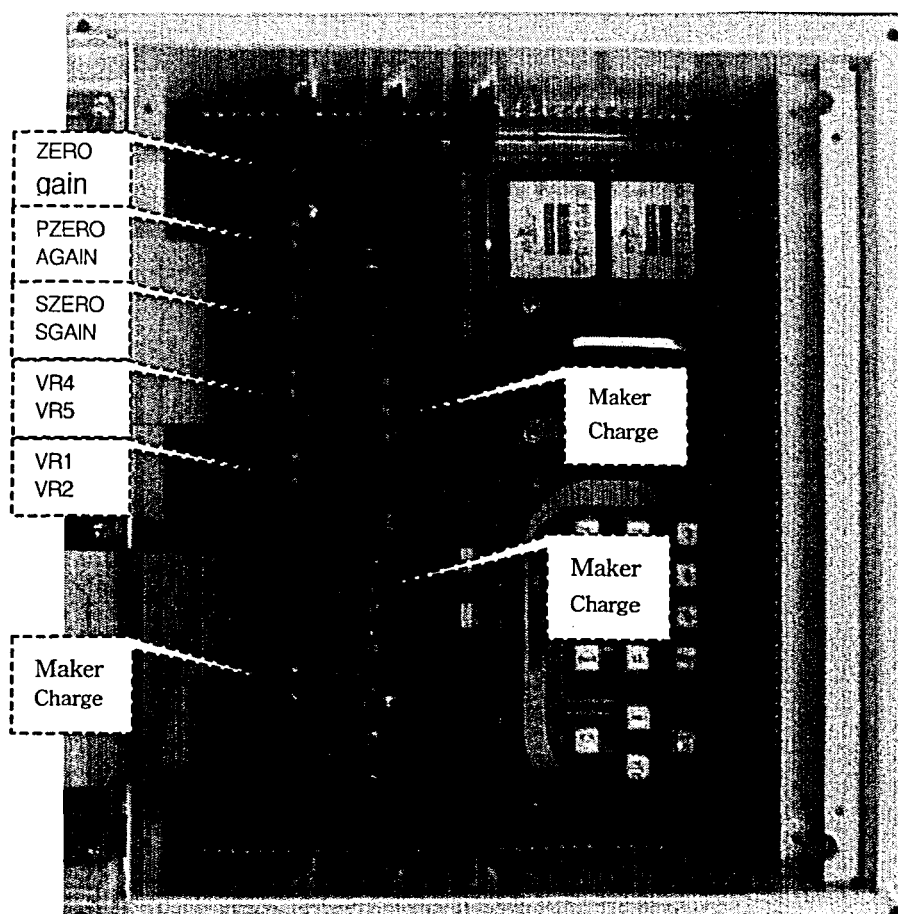
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2) Monitoring parameter & value

Addresses	Function	Range	Unit	Remark
M [00]	W/H command A/D value	0 ~ 4095	A/D	
M [01]	W/H command degree	0 ~ 300	Degree x 10	
M [02]	port command A/D value	0 ~ 4095	A/D	
M [03]	port command degree	0 ~ 300	Degree x 10	
M [04]	St'bd command A/D Value	0 ~ 4095	A/D	
M [05]	St'bd command degree	0 ~ 300	Degree x 10	
M [06]	Feed back A/D Value	0 ~ 4095	A/D	
M [07]	Feed back degree	0 ~ 300	Degree x 10	
M [08]	Over load value	0 ~ 2000	Ampere	
M [09]	Over load A/D value	2048 ~ 4095	A/D	
M [10]	Non-follow port max. limit	0 ~ 100	V × 10	minus voltage
M [11]	Non-follow st'bd max. limit	0 ~ 100	V × 10	plus voltage

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3) W/H Control panel Internal arrangement

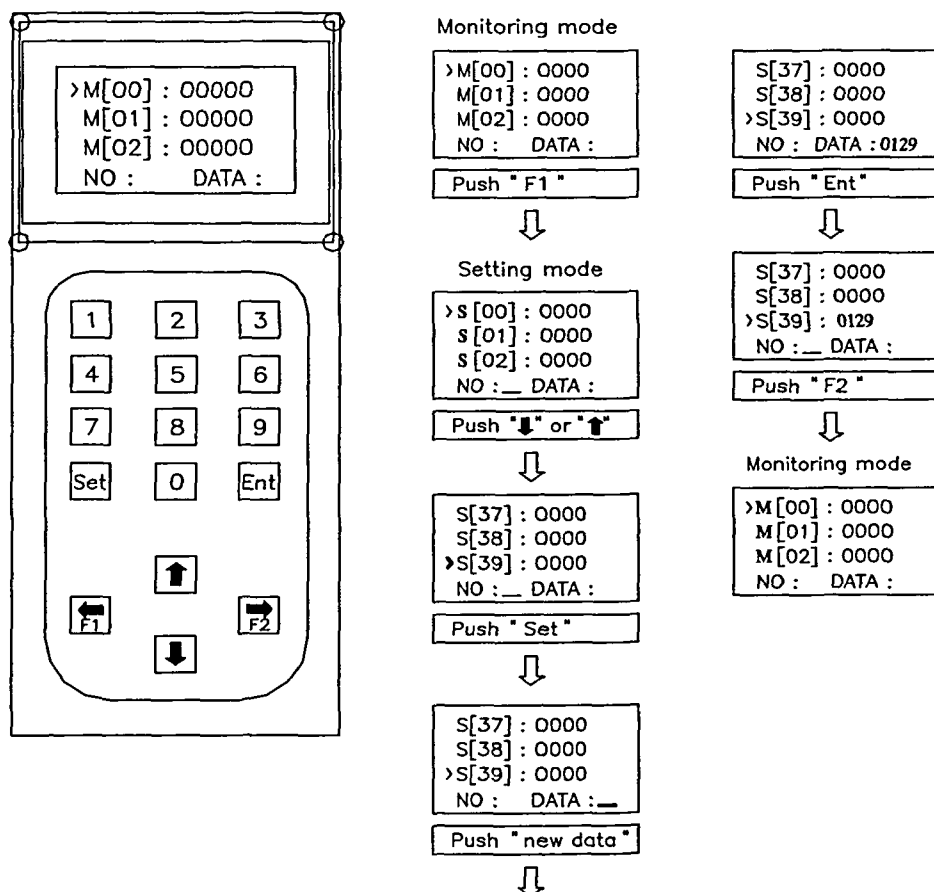


4) Method of changing a data by keyboard

1. Procedure of keyboard operation

Push **F1** ⇒ Change to setting mode ⇒ Select an equivalent parameter
 by cursor (**↑** or **↓**) ⇒ Push **SET** ⇒ Input new data ⇒ Push **ENT** ⇒
 Finish of adjustment ⇒ Push **F2** ⇒ Change to monitoring mode

2. Appearance of keyboard



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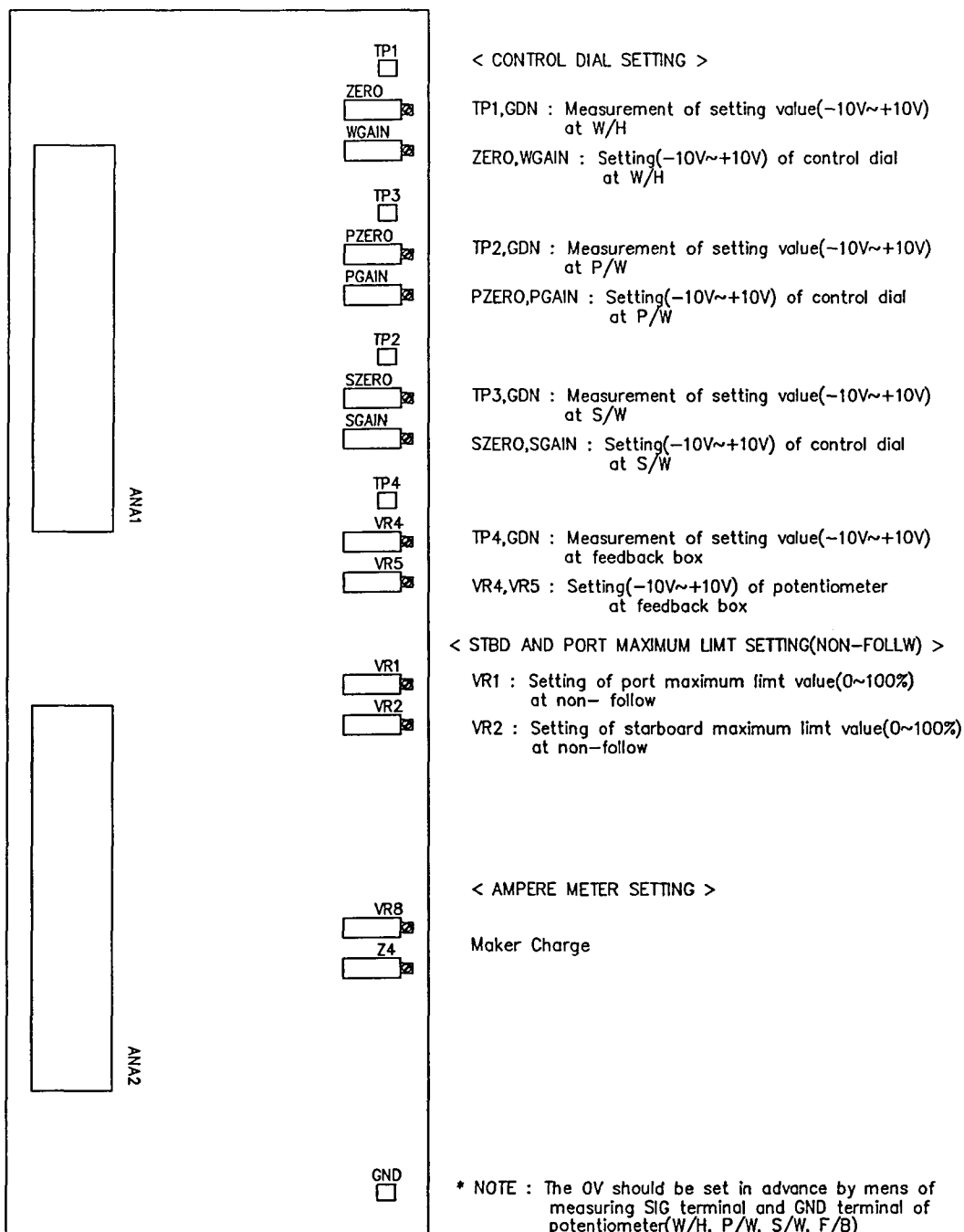
5) Trouble shooting

Trouble	Check point	Place	Result	Cause/Remedy
A. AC source fail.	Check AC source input	Terminal board A U, V	0 VAC	Check wire for source
			220 VAC	Consult with maker
B. DC source fail.	Check DC source input	Terminal board A P, N	0 VDC	Check wire for source
			24 VDC	Consult with maker
C. W/H dial is not effective	Measure voltage of potentiometer in W/H dial. (Port 10 : -10 VDC St'bd 10 : +10 VDC)	Analog board GND, TP1	Abnormal	Check potentiometer and cable connection
			Normal	Consult with maker
D. Port wing dial is not effective	Measure voltage of potentiometer in port wing dial. (Port 10 : -10 VDC St'bd 10 : +10 VDC)	Analog board GND, TP3	Abnormal	Check potentiometer and cable connection
			Normal	Consult with maker
E. St'bd wing dial is not effective	Measure voltage of potentiometer in st'bd wing dial. (Port 10 : -10 VDC St'bd 10 : +10 VDC)	Analog board GND, TP2	Abnormal	Check potentiometer and cable connection
			Normal	Consult with maker
F. Feedback is not effective	Measure voltage of potentiometer in feedback box. (Port 10 : -10 VDC St'bd 10 : +10 VDC)	Analog board GND, TP4	Abnormal	Check potentiometer and cable connection (feedback box)
			Normal	Consult with maker
G. Change over is not available	Check that control dial position agrees with the actual blade angle. (In the case there is an interlock for the agreement)	Para. M[01] M[03] M[05] M[07]	Agree	Consult with maker
			Disagree	Check interlock

KTE	USER'S MANUAL OF Thruster Control System (KT - TCS)	REV	PAGE : 42 OF 43
			DOCU. NO :

Trouble	Check Point (CP)	Place	Result	Cause / Remedy
H. Follow up control is not available.	1. When port button is pressed, measure contact of relay for port solenoid during non-follow up control	TB2 BSP,BSC	Close	Consult with maker
			Open	Check wiring between TB2 BSP,BSC and solenoid valve
	2. When st'bd button is pressed, measure contact of relay for st'bd solenoid during non-follow up control	TB2 BSS,BSC	Close	Consult with maker
			Open	Check wiring between TB2 BSS,BSC and solenoid valve
I. Non-follow up control is not available.	Is follow up control available?	TB2 BSP,BSC TB2 BSS,BSC	Available	Consult with maker
			Not available	Check 'H' of list
J. ALC does not function.	1) Connect an am-meter between TB4 18A,18B with thruster stopped, and then check that the current value is the same as the design value after starting thruster. (Before removing the am-meter, stop thruster)	TB3 BA1, BA2	Same as designed value.	Consult with maker
			There is a difference.	Check CT.
			0 A.	Check wiring between TB3 BA1,BA2 and CT for looseness. Check CT.
K. W/H dimmer is not available.	Is setting date of parameter right ?	Para. M[43] M[44] M[45]	Available	Consult with maker
			Not available	Adjust parameter

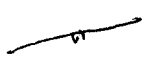
6) Analog board comp.



DAEWOO SHIPBUILDING &
MESSRS : MARINE ENGINEERING CO., LTD.

HNo. 4437/4438/4441

BOW & STERN THRUSTER REMOTE CONTROL SYSTEM

DRAWING No.	KTM-0037		APPROVED	G. H. Kim
DATE	JULY 1. 2004	FILE NAME: D4437	CHECKED BY	B. K. Son
 KTE Co., Ltd. 1497-1, Songjeong-Dong, Gangseo-Gu, Busan 618-270, Korea Tel : +82-51-265-0255 Fax : +82-51-265-0250			CHECKED BY	
			DESIGNED BY	S. H. OH (오상호)

PLAN HISTORY

[illegible]

HISTORY

BOW & STERN THRUSTER REMOTE CONTROL SYSTEM

INSTRUCTION MANUAL

– Micro Computer Type –

1. Outline of system

This system is so designed that bow thruster (Controllable Pitch Propeller type) is controlled by means of follow-up control by the maneuvering dial which is located on W/H control panel and the both wing control panels.

2. Electric source

AC 220V 60Hz ø1

DC 24V battery power supply (for back up alarm system)

3. Constitution of the control system

1) Wheel house control panel : ---2 (Bow, Stern)

(with power supply)

2) Both wing control panel : ---2 (Bow & Stern)

3) Terminal board : ---2 sets (Bow, Stern)

4) Follow up transmitter : ---2 (Bow, Stern)

4. General description of the system

1) Change-over control position

Change-over can be carried out within matching zone between the existing position and the position to be changed by pushing change-over switch on W/H control panel and both wing control box. the switch lamp will be flickering with alarm sounding when the position was out of range.

2) Pitch control

When operating the maneuvering dial, the difference of position between the potentiometer incorporated in the maneuvering dial and that attached to feedback box transmitter results.

The voltage resulted from the difference of position is amplified and excites the solenoid valve in the hydraulic unit.

Therefore, the blade of CPP begins shifting in the direction ordered by the maneuvering dial.

At the same time, the potentiometer connected to the blade by means of link and chain begins turning too and when its position corresponds to the position of potentiometer in the maneuvering dial, the voltage will be appeared and the solenoid valves is energized.

Thus the blade of CPP follows up the pitch ordered by the maneuvering dial.

3) ALC (Automatic Load Control)

When the main motor load signal exceeds the predetermined value which is set by ALC setting dial, the pitch will be automatically reduced, with a consequent reduction in load ALC setting level. The ALC lamp will be lit up at that time.

Therefore, if the main motor load lightens, the pitch will be automatically increased to the value commanded by the maneuvering dial.

This function will be canceled by the switch 「ON/OFF」 which was attached on a control panel.

4) Ten-Key board

This system is composed of micro computer type. So, it is possible to adjust necessary limits and functions by Ten-Key Board.

Please refer to detailed methods for adjustment that were prepared on remote control system instruction manual.

5. Specification of W/H controller

1) General

(1) Power supply : DC 24V, AC 220V 60Hz 1ø

(2) Power consumption (Current) : 3.0A/24V

(3) Main CPU : 8 Bits micro-processor

2) Control power switch

AC 220V, DC24V 「ON-OFF」 switch

3) Blade angle control dial under FOLLOW control mode

Control dial position is shown as a scale notch 「Port 10-5-0-5-10 STBD」.

The scale of control dial is illuminated by LED equipped inside the control panel.

4) Blade angle control push button under NON-FOLLOW control mode

These two push buttons 「PORT」 / 「STBD」 are only possible under NON-FOLLOW mode. A button was operated by push, relevant solenoid valve will be energized.

The blade angle could be changed because this mode is not computer control.

5) Blade angle indicator

Actual blade angle is indicated by a LED lamp.

Port side : Red STBD side : Green

6) Main motor ampere meter

Main motor ampere is indicated by four digit number.

During press the push button of meter side, blade angle indicated (00.0 : three figures) .

* Please supply AC 0-1A signal from starter panel "CT".

7) Thruster operation switches : 「STOP, FAN RUN, PUMP RUN, THRUSTER RUN」

The thruster will be stopped when the 「STOP」 switch was pushed and then FAN/PUMP will be stopped after 2 secs with stop order by STOP button.

8) Control station

The control position will be changed when the 「W/H」 push button was pushed under wing control station. The lamp will be steady condition with completion of change-over. If a control dial were not matched, the lamp will be flickered.

The control change-over is impossible at that time.

9) Zero pitch mode switch

Equipped in W/H control unit.

When this button is pushed, all control unit is turned off and a blade pitch is kept in zero position automatically.

In this mode, only 「HYD.PUMP RUN」, 「BLADE NEUTRAL」, 「PORT/STBD」 lamps are activated.

If press 「ZERO PITCH ON/OFF」 push button, come out in this mode.

10) Dimmer switch

The LED lamp will be adjusted by 「Up(↑)/Down(↓)」 push button switch.

11) Control mode (FOLLOW/NON-FOLLOW)

The control mode will be changed by pushing FOLLOW/NON-FOLLOW.

The control is possible by 「NON-FOLLOW」 when the micro computer (CPU) was out of order.

12) Lamp / buzzer test push button

All lamp light up and buzzer sounds when pressing 「LAMP BUZZER TEST」 push button.

13) Buzzer stop push button

Used to stop alarm buzzer and alarm lamp.

14) Flicker stop push button

Used to stop flickering lamp.

15) Alarm buzzer

Equipped inside of control panel.

16) Emergency stop push button

This push button is independent of micro computer and locking type with crossbar. The contact signal will be opened when it was pushed.

17) Indication lamp

◎ Max. number of general indication lamps : 25 pcs

◎ Max. number of alarm lamps (spare 4 pcs): 12 pcs

Alarm mode is according to KTMS. This alarm circuit is independent of control circuit (micro computer CPU abnormal).

6. Specification of wing controller

1) Blade angle control dial

Control dial position is shown as a scale notch 「Port 10-5-0-5-10 STBD」.

The scale of control dial is illuminated by LED equipped inside the control panel.

2) Blade angle indicator (analog apperance)

Actual blade angle is indicated by an analog meter.

And 10 notch indicate the rated maximum blade angle position.

◎ Indi.scale : 10-5-0-5-10

◎ Port side : Red ◎ STBD side : Green

3) Main motor ampere meter (analog apperance)

Main motor ampere is indicated by an analog meter.

* Please supply AC 0-1A signal from starter panel "CT".

4) Control station

The control position will be changed when the 「CHANGE-OVER」 push button on the each wing controller was pushed under relevant control station.

The lamp will be steady condition with completion of change-over. If a control dial were not matched, the lamp will be flickered. The control change-over is impossible at that time.

5) Dimmer switch

The LED lamp will be adjusted by dimmer push button.

6) Thruster run lamp

This lamp will be indicated during main motor run.

7) Alarm lamp

Two alarms were prepared as 「THRUSTER ABNORMAL」 / 「M.MOTOR OVERLOAD」

8) Lamp / buzzer test push button

All lamp light up and buzzer sounds when depress 「LAMP BUZZER TEST」 push button.

9) Buzzer stop push button

Used to stop alarm buzzer and alarm lamp.

10) Emergency stop push button

This push button is independent of micro computer and locking type with crossbar. The contact signal will be opened when it was pushed.

7. Signals for VDR interface

- Analog Output : 4 Channel

1) Bow thruster pitch command signal ($\pm 10\text{VDC}$)

($-10\text{VDC} \rightarrow \text{PORT } 25 \text{ DEG}$, $+10\text{VDC} \rightarrow \text{STBD } 25 \text{ DEG}$.)

2) Bow thruster pitch feedback signal ($\pm 10\text{VDC}$)

($-10\text{VDC} \rightarrow \text{PORT } 25 \text{ DEG}$, $+10\text{VDC} \rightarrow \text{STBD } 25 \text{ DEG}$.)

3) Bow thruster status signal (ON/OFF)

(Thruster running signal $\rightarrow$ Close : RUN, Open : STOP)

8. Pitch to zero system

During voyage of the vessel, sometimes the propeller is rotated by the tide (the seawater coming into the thruster tunnel) and the pitch is moved out of the zero position. In this situation, the hydraulic pump automatically will be started and the pitch is kept in zero. When blade angle returns to zero position, hydraulic pump and solenoid valve will be stopped after preset time.

This mode is operated independently from normal mode by pushing of this mode select button on W/H control panel.

Other unrelated lamps except followings shall not be caused under zero pitch mode.

1) Ind.lamp of zero pitch mode

2) Ind.lamp of blade neutral

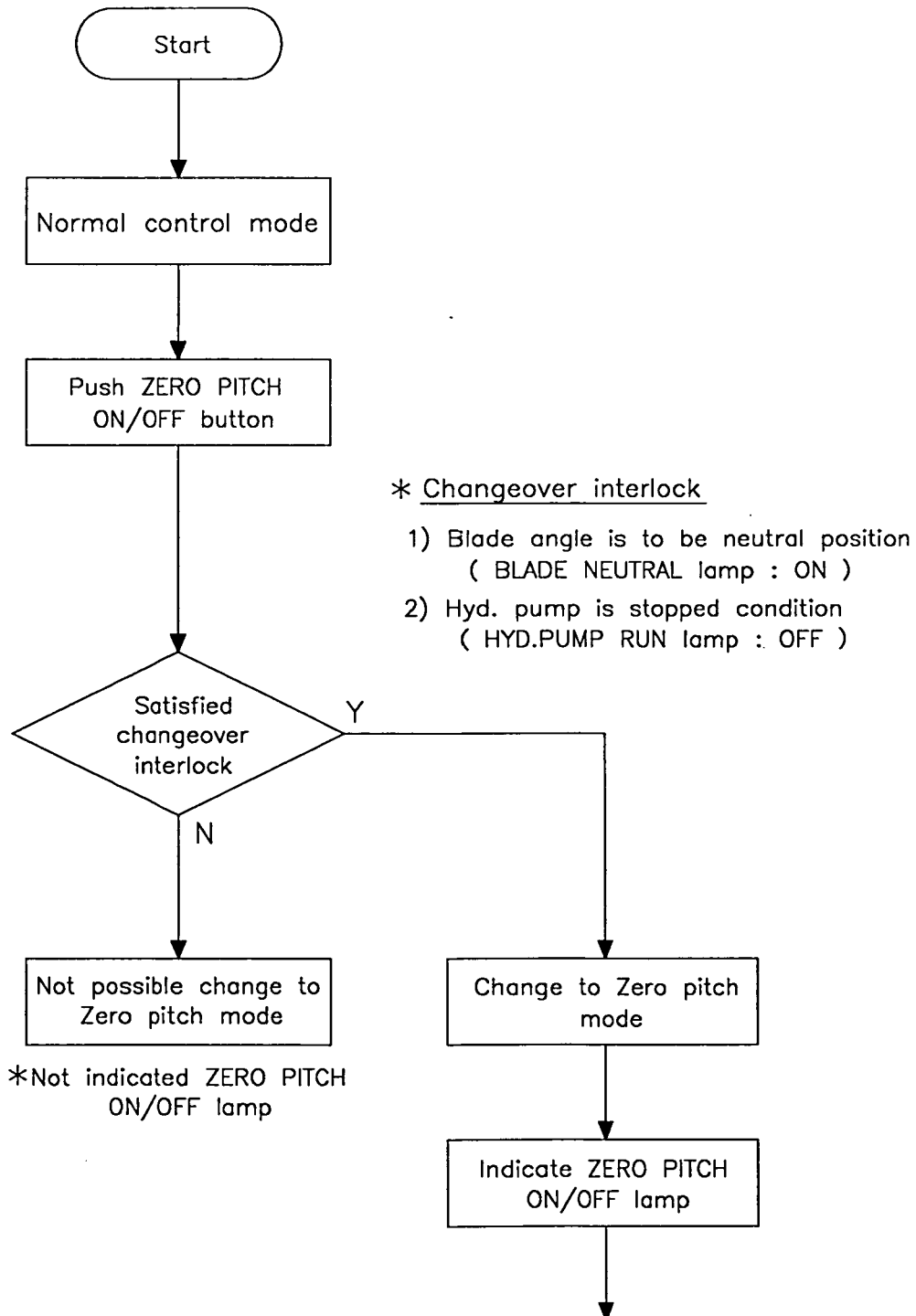
3) Ind.lamp of hyd. pump run

4) Ind.lamp of acting solenoid valve

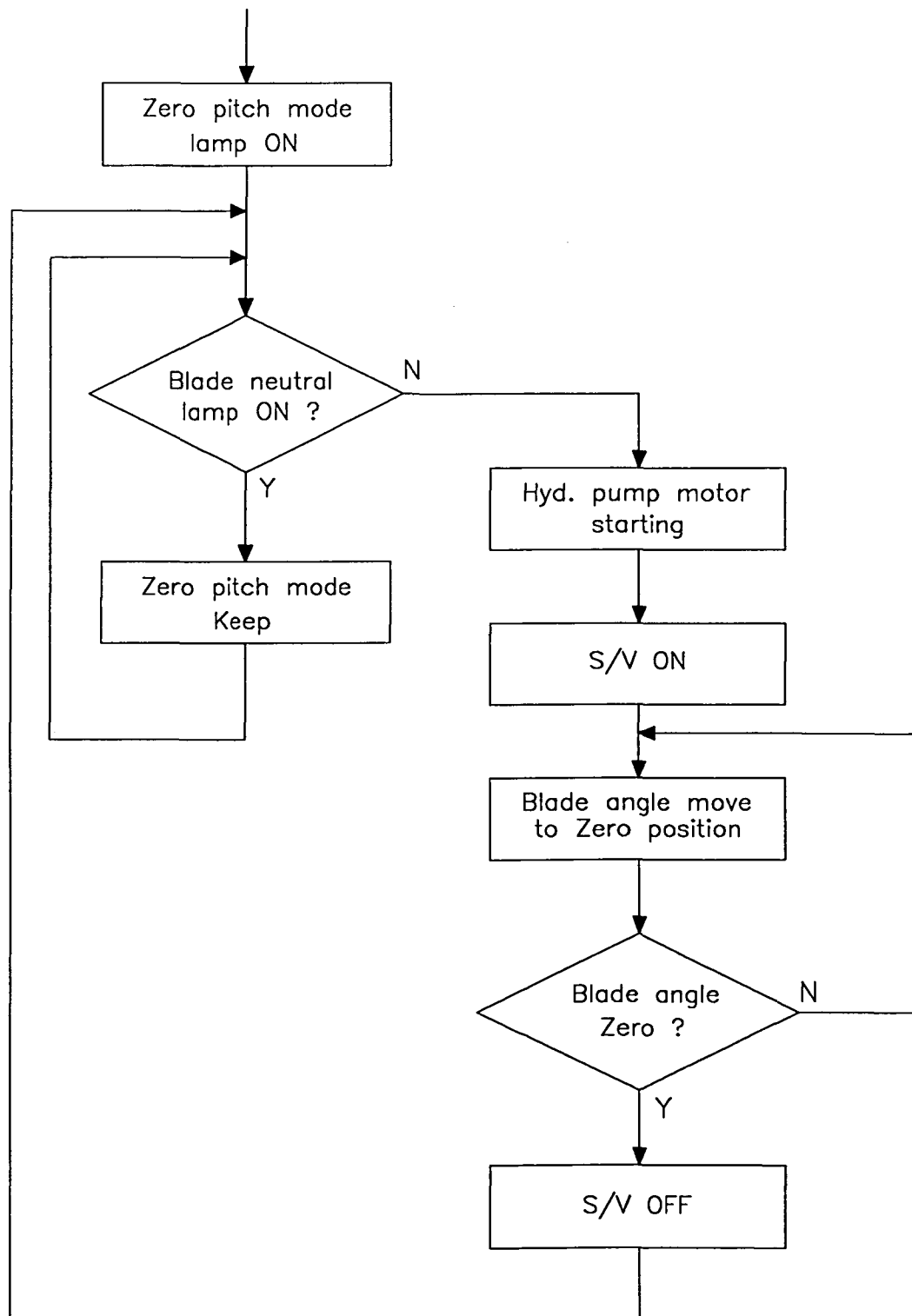
5) Alarm lamps

1) Zero Pitch Mode Blockdiagram

(1) Changeover to Zero pitch mode



(2) Operation on Zero pitch mode

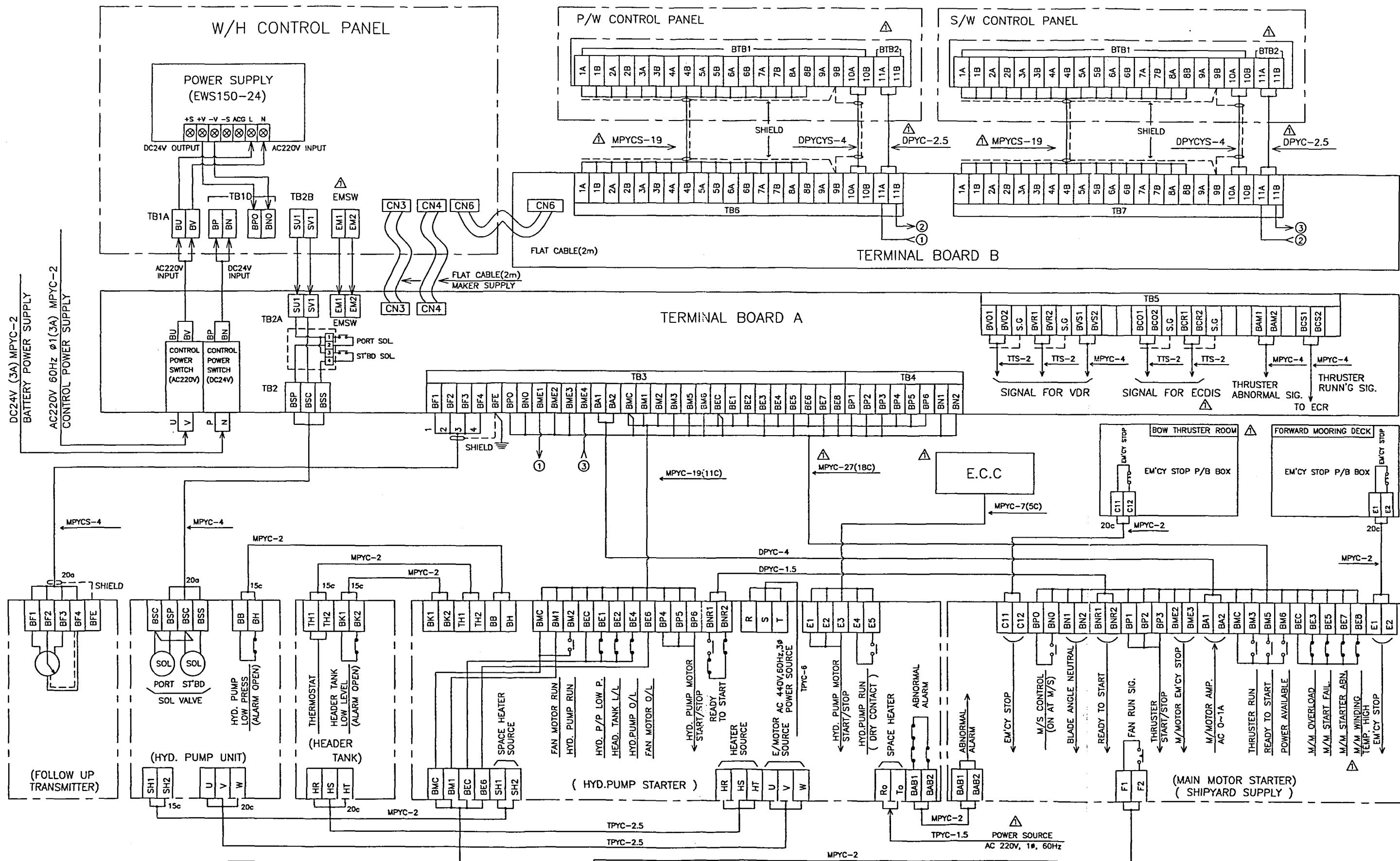


* To be surely pushed ZERO PITCH ON/OFF button again for returning of normal mode

REMOTE CONTROL						
OWNER		A.P. Moller		HNO. 4437/4438/4441		
MESSRS		DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.		CLASS DNV		
POWER SOURCE		AC 220V , 1ø 60 Hz, DC 24V		AMBIENT TEMP 45°C		
(INNER : MAKER'S STANDARD)		KT-TCS-C (W/H)		MUNSELL N3.0 SEMI-POLISHED 2SETS/SHIP		
		KT-TCS-C (WING)		MUNSELL N3.0 SEMI-POLISHED 2SETS/SHIP		
		TERMINAL BOARD A,B		MUNSELL N3.0 SEMI-POLISHED 2SETS/SHIP		
		FEEDBACK BOX		7.5 BG 7/2 2SETS/SHIP		
LETTER OF NAME PLATE		ENGLISH		MATERIAL OF NAME PLATE PHENOLIC		
DRAWING & DOCUMENT		ENGLISH		EARTHING WITH		
SIGNAL LAMP		24V 1.2W		FUSE (CELLO-LITE)		
OVERLOAD PROTECTOR						
MOLDED CASE CIRCUIT BREAKER						
CAPACITY						
COLOR OF CABLE CAP		U ----- RED P ----- RED V ----- WHITE N ----- BLUE W ----- BLUE				
INTERNAL WIRING		MAIN CIRCUIT : 660V SCP 2.0SQ CONT CIRCUIT : 660V SCP 1.25SQ OR 0.75SQ				
CABLE LEAD-IN						
REMARKS						
HNO.		4437/4438/4441				
ORDER NO.		KTM-04022/023/024				
MACH NO.		W/H CONT. : A0103-04 / A0119-04 / A0135-04 WING CONT. : A0104~5-04 / A0120~1-04 / A0136~7-04 FEEDBACK BOX : A0103-01-04 / A0119-01-04 / A0135-01-04				
R E V		TITLE			DRAW No.	
		GENERAL SPECIFICATION			KTM-0037-01-0	
					DISK No.	
					D4437G1	
					SHEET No. 1	

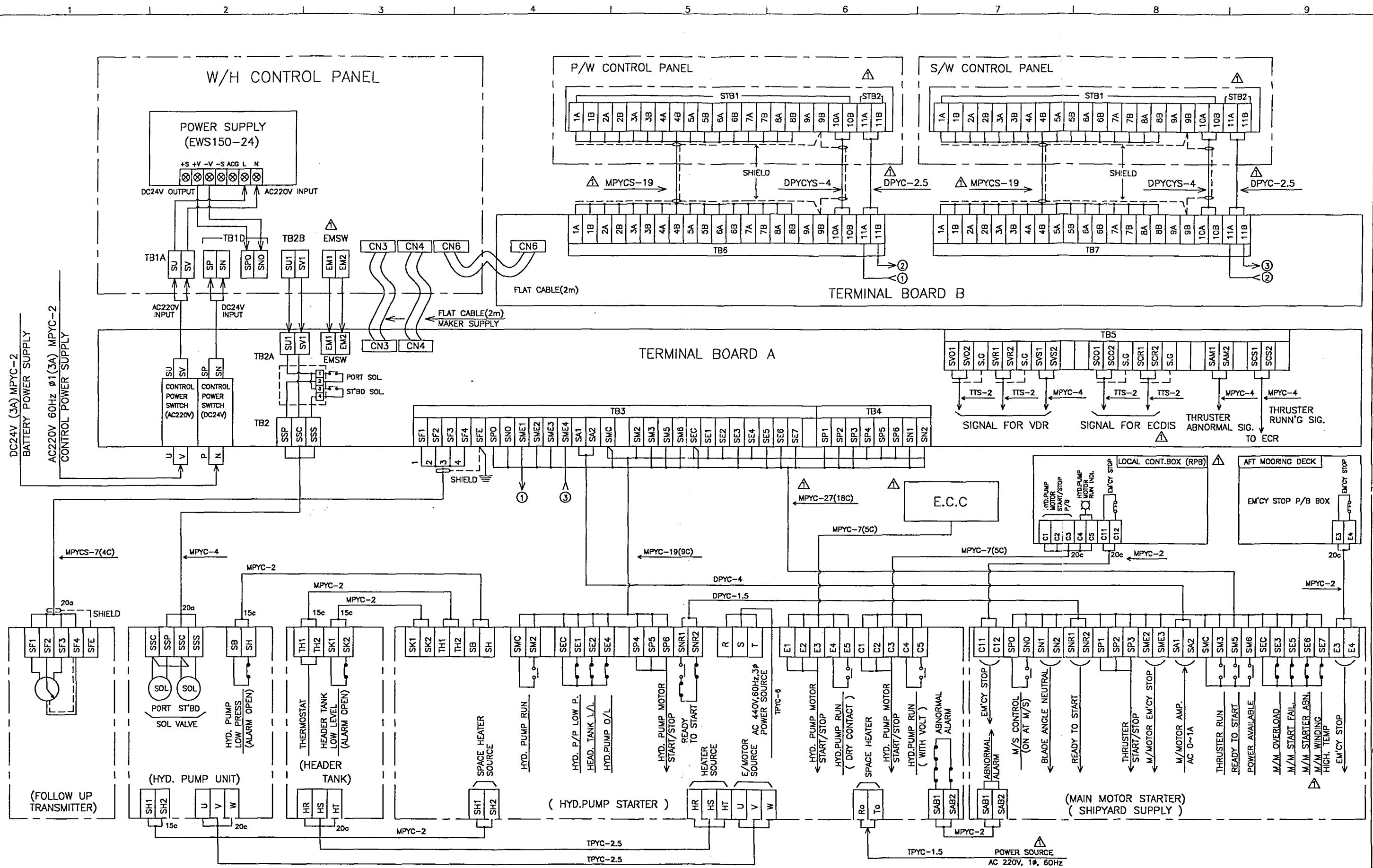
No.	NAME	TYPE	SPECIFICATION	REMARK	QT'Y	MAKER
1	CONTROL POWER SWITCH	C60N, 6N	2P, 6A		4	MERLIN GERIN
2	W/H THRUSTER CONTROLLER	KT-TCS-C			2	KTE
3	WING THRUSTER CONTROLLER	KT-TCS-C			2	KTE
4	TERMINAL BOARD	A , B			4	KTE
5	POWER SUPPLY	EWS150-24	AC220V/DC24V 151W		2	LAMBDA
6	CONTROL LEVER 				6	ELESA
7	EM'CY STOP P/B	704-062.2	1a1b	WITH LOCK	6	EAO
		704-925.0		PROTECTIVE COVER	6	EAO
8	SIGNAL LAMP	700-00.2	24V, 1.2W		6	EAO
9	ANALOG METER FOR MAIN MOTOR	TME-60C			4	TSURVGA
10	ANALOG METER FOR PITCH INDICATOR	TME-80B			4	TSURVGA
11	FOLLOW UP TRANSMITTER	TCT-220/200			2	KTE
12						
13						
14						
15						
16						
17						
18						

R E V		2004.12.15	TITLE PARTS LIST		DRAW No. KTM-0037-02-1	
					DISK No. D4437P1	SHEET No. 2



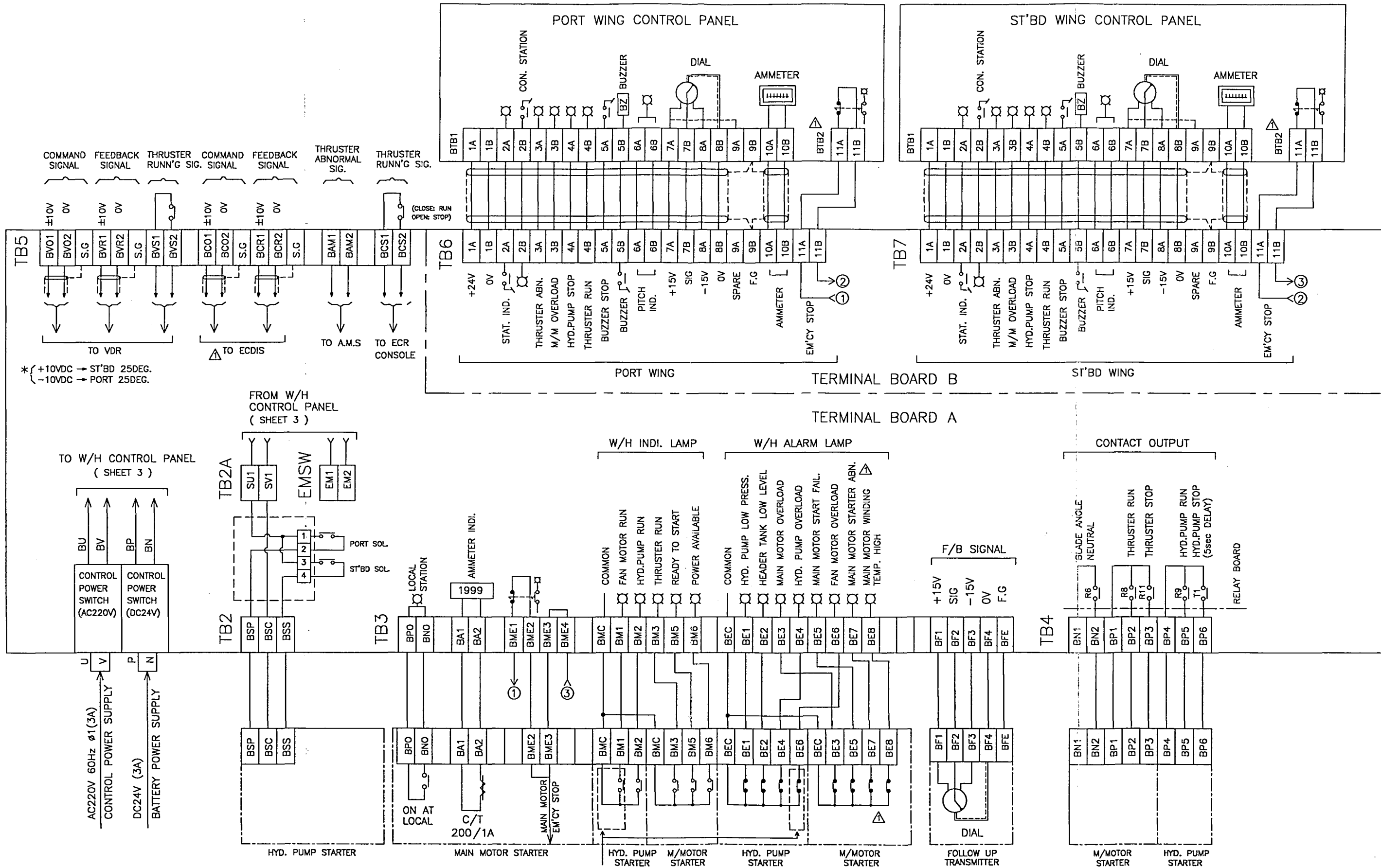
REV	2004.12.15	TITLE BOW THRUSTER REMOTE CONTROL SYSTEM WIRING DIAGRAM 1	DRAW No. KTM-0037-03-01	
			DISK No. D4437BC1	SHEET 3

KTE



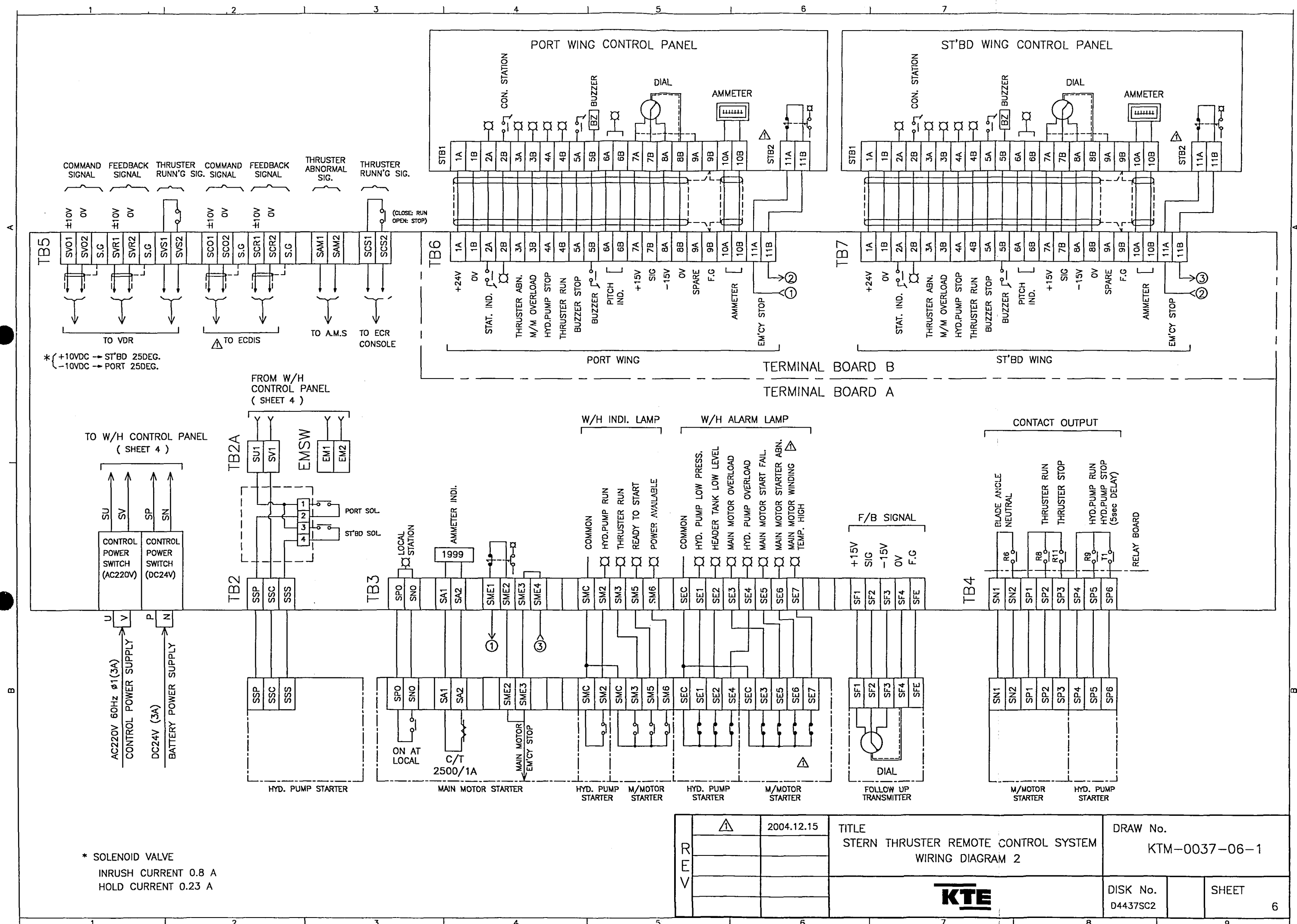
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			DISK No. D4437SC1	SHEET 4

KTE

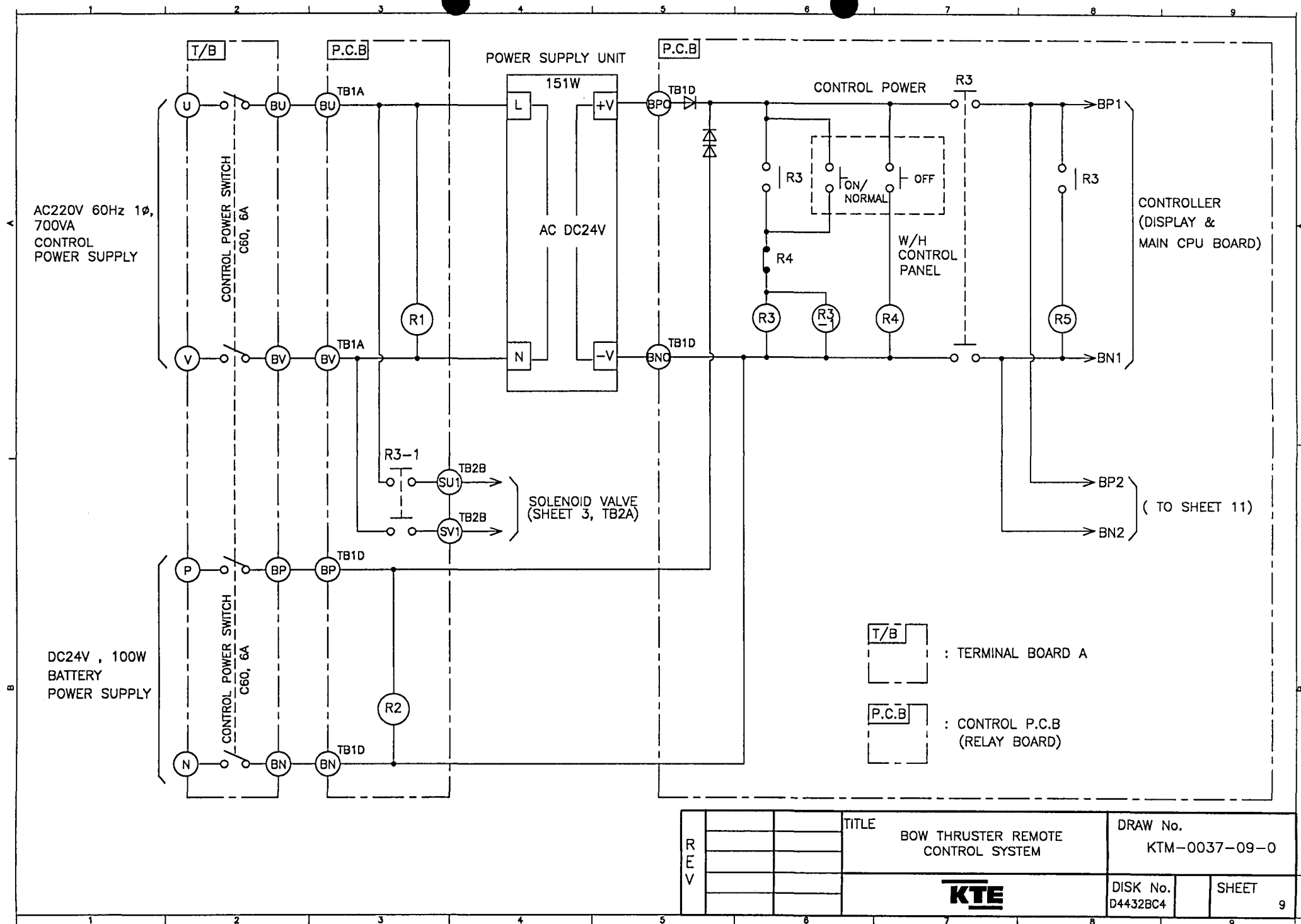


* SOLENOID VALVE
INRUSH CURRENT 0.8 A
HOLD CURRENT 0.23 A

REV	△	2004.12.15	TITLE BOW THRUSTER REMOTE CONTROL SYSTEM WIRING DIAGRAM 2		DRAW No. KTM-0037-05-1	
					DISK No. D4437BC2	SHEET
			KTE			
						5



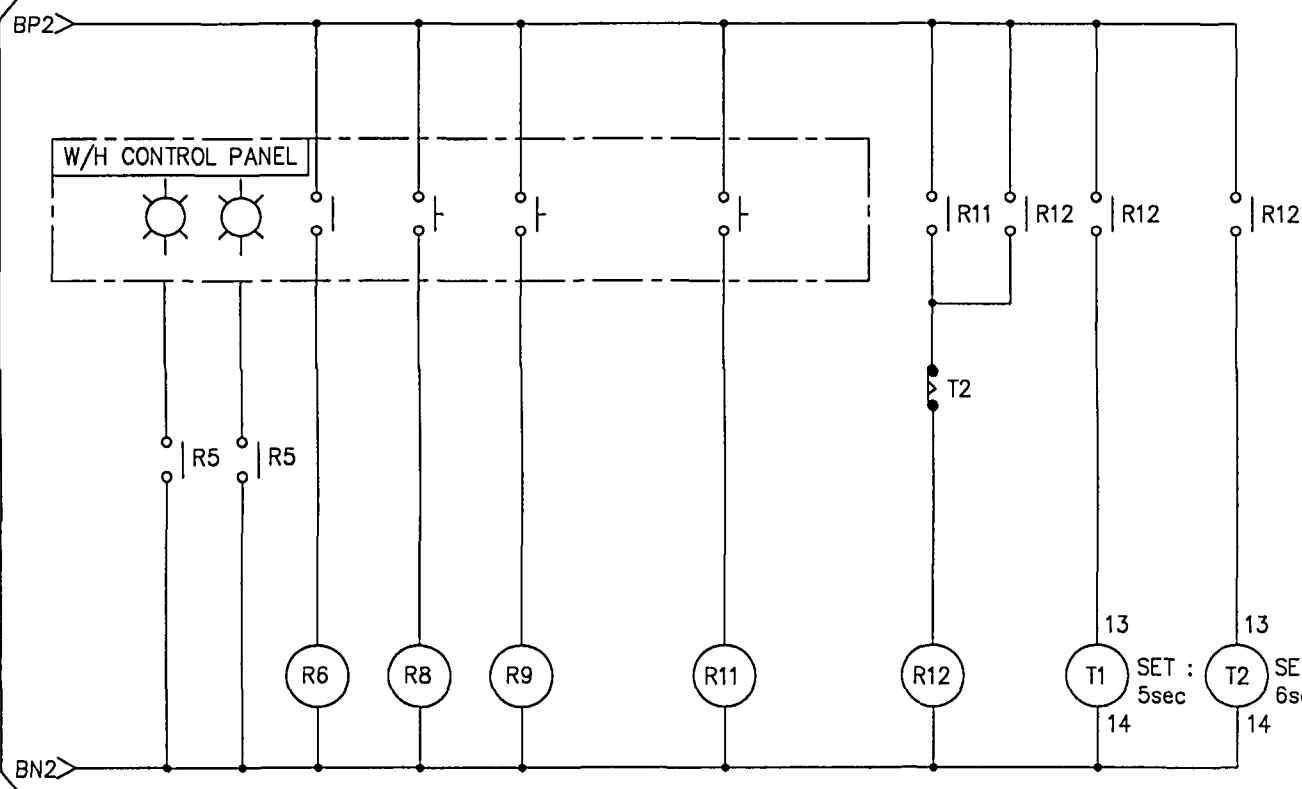
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			DISK No. D4437SC2	SHEET 6



R E V			TITLE BOW THRUSTER REMOTE CONTROL SYSTEM	DRAW No. KTM-0037-09-0	
				DISK No. D4432BC4	SHEET 9
			KTE		

RELAY BOARD

CONTROL POWER ON
CONTROL SOURCE
BLADE ANGLE NEUTRAL
THRUSTER MOTOR RUN
HYD. PUMP RUN
THRUSTER STOP
HYD. PUMP STOP (5sec DELAY)



FROM SHEET 9

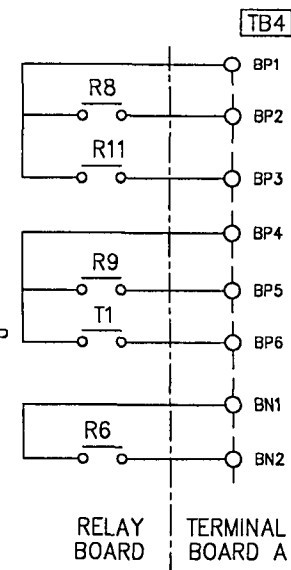
THRUSTER RUN

THRUSTER STOP

HYD. PUMP RUN

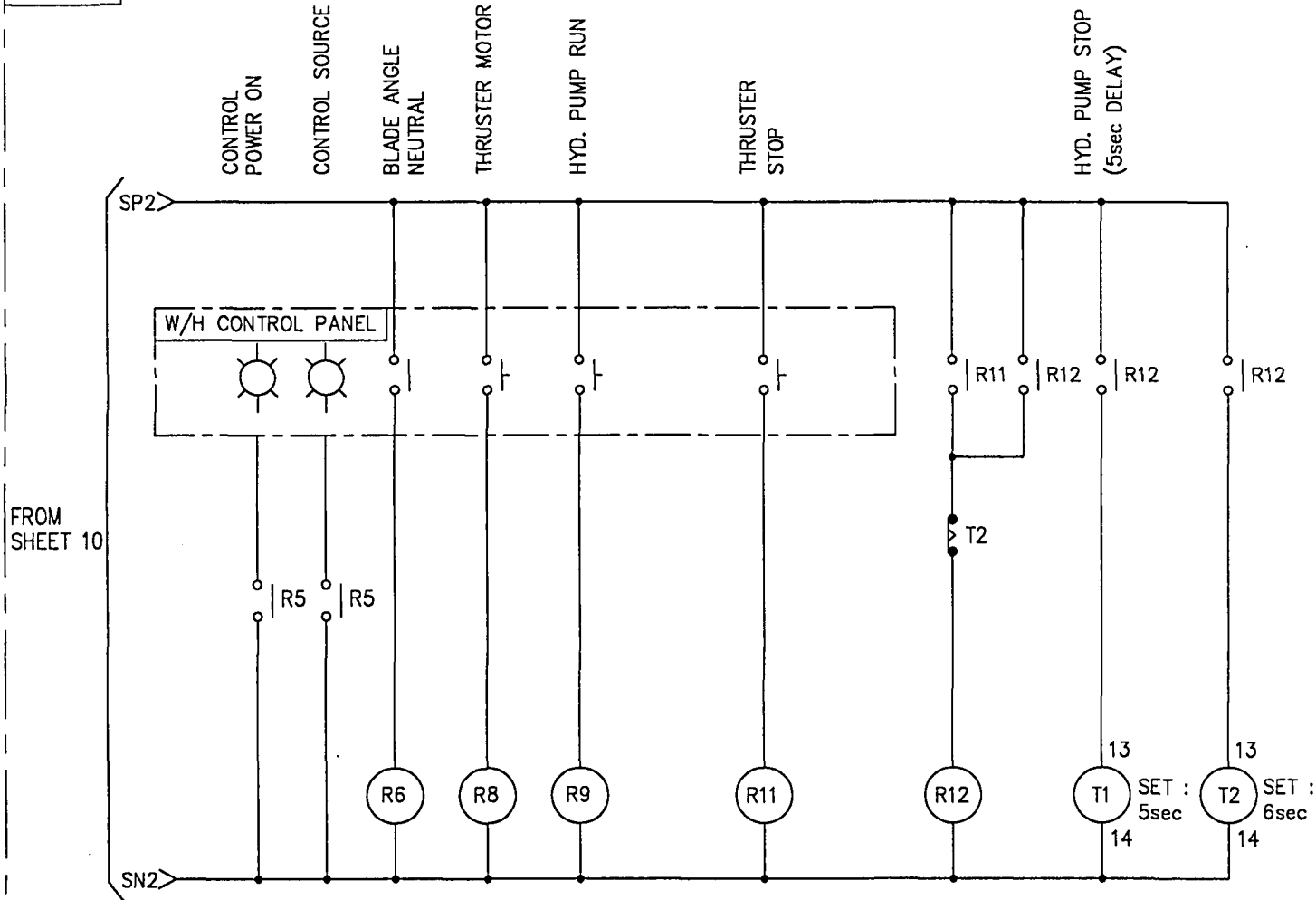
HYD. PUMP STOP (5sec DELAY)

BLADE ANGLE NEUTRAL

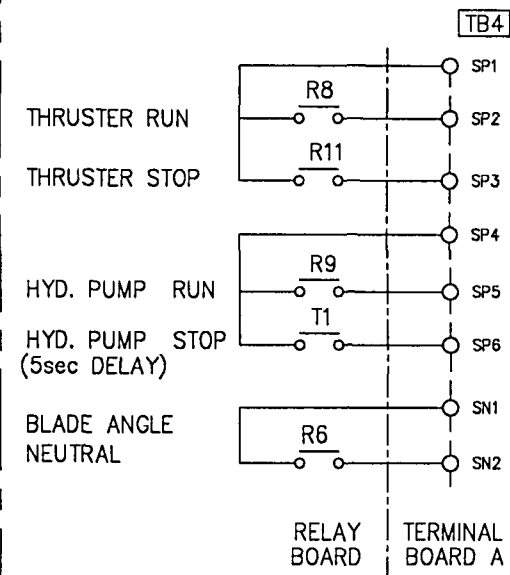


REV			TITLE	BOW THRUSTER REMOTE CONTROL SYSTEM	DRAW No. KTM-0037-11-0
			KTE	DISK No. D4437BC5	SHEET 11

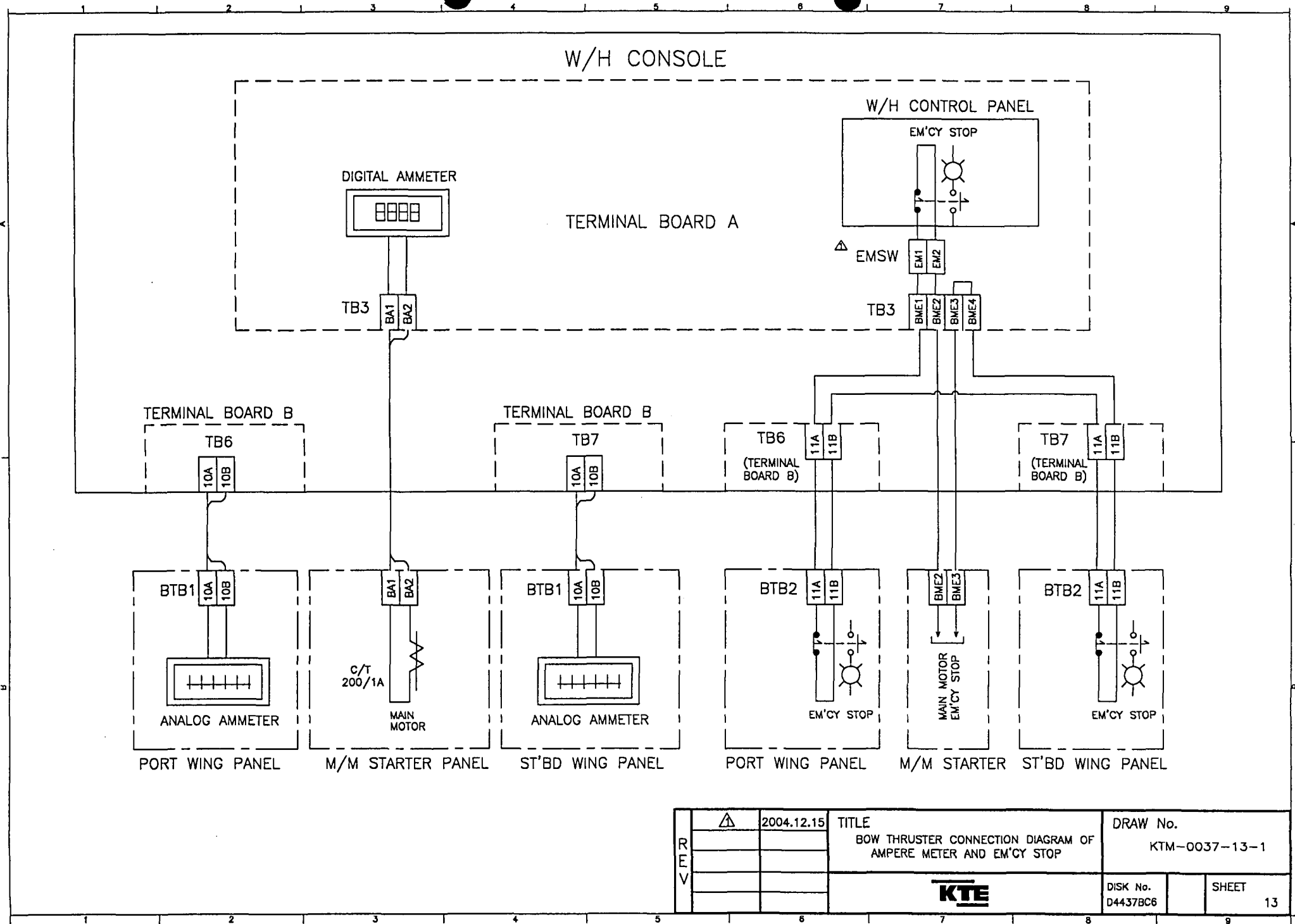
RELAY BOARD



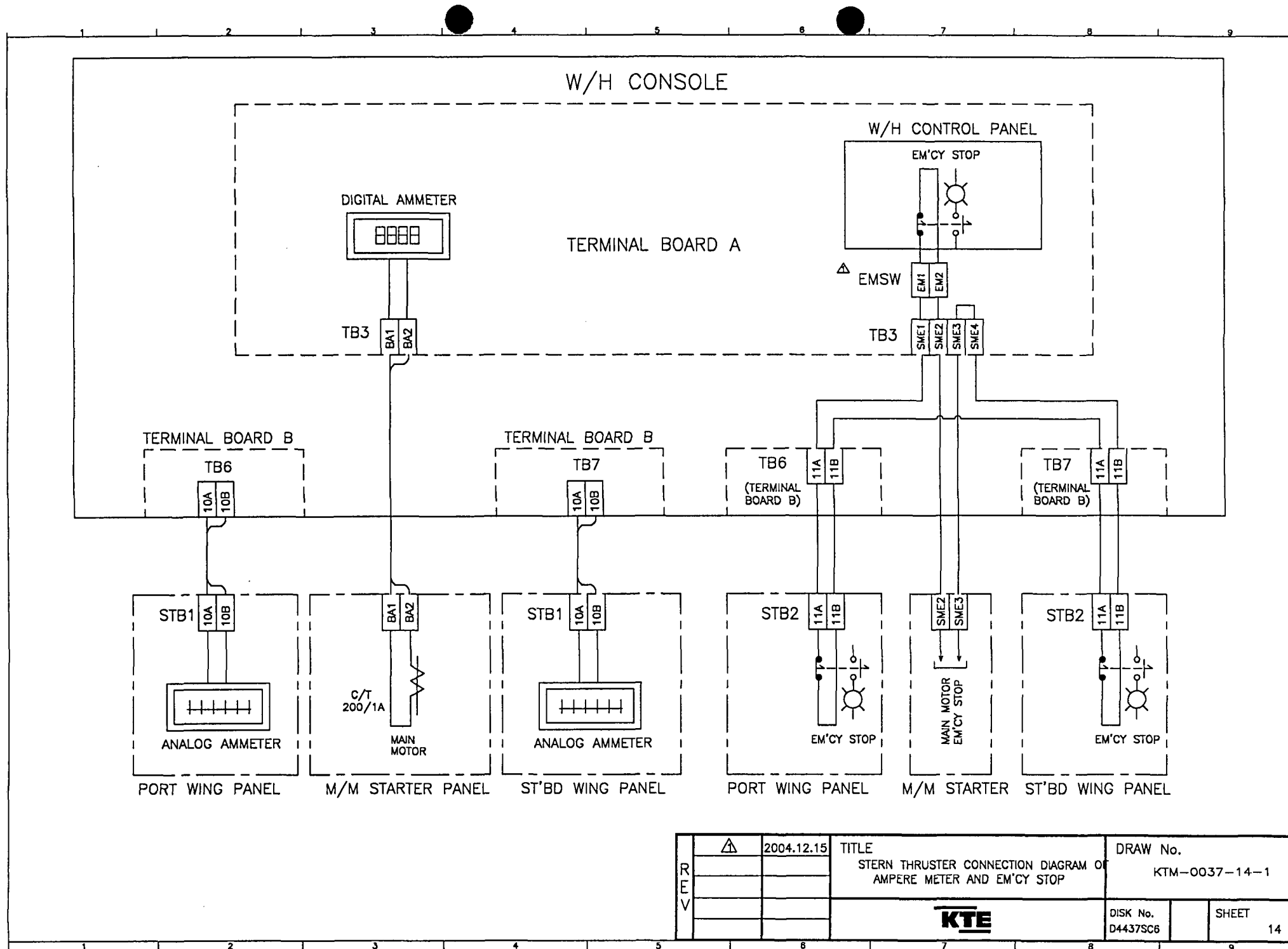
FROM SHEET 10



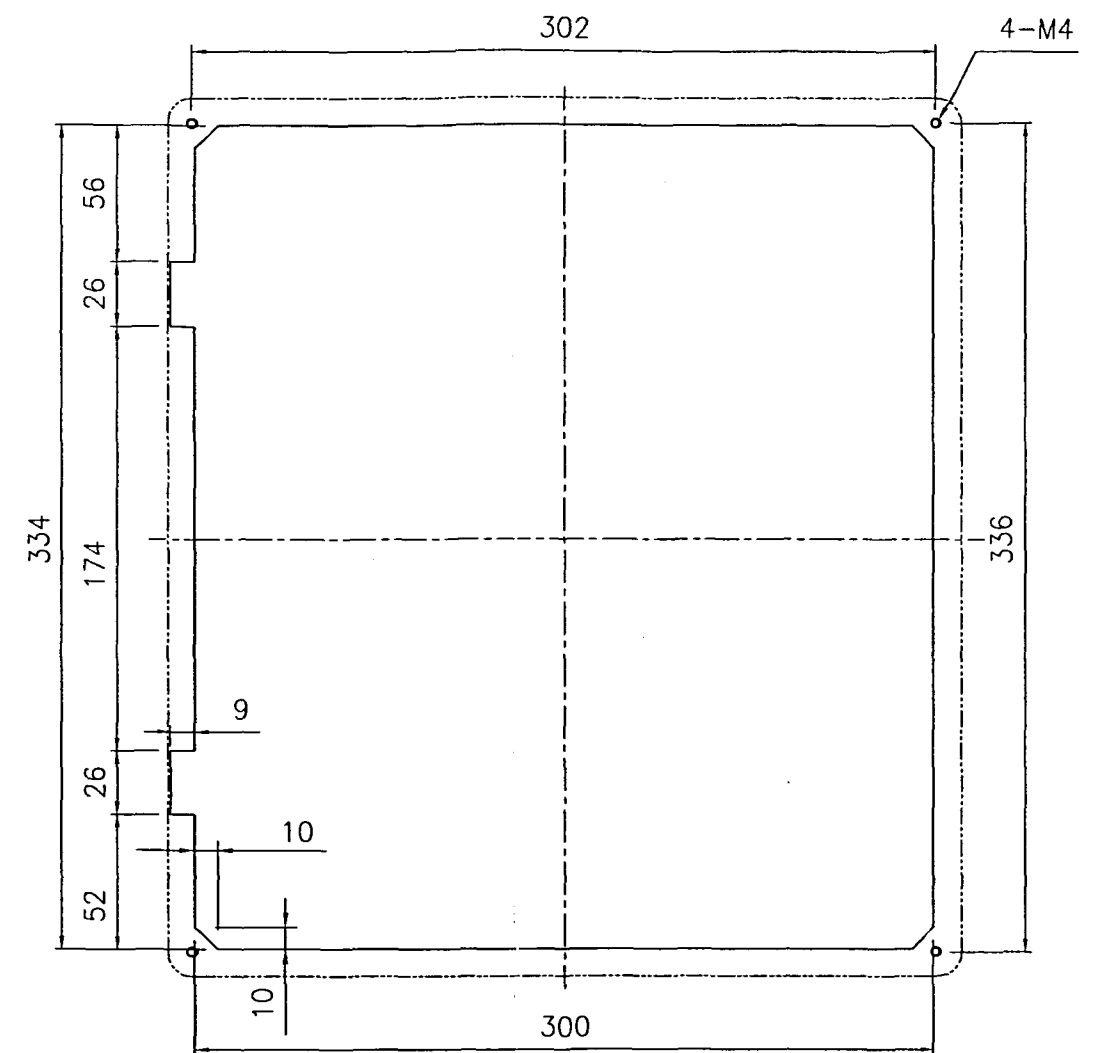
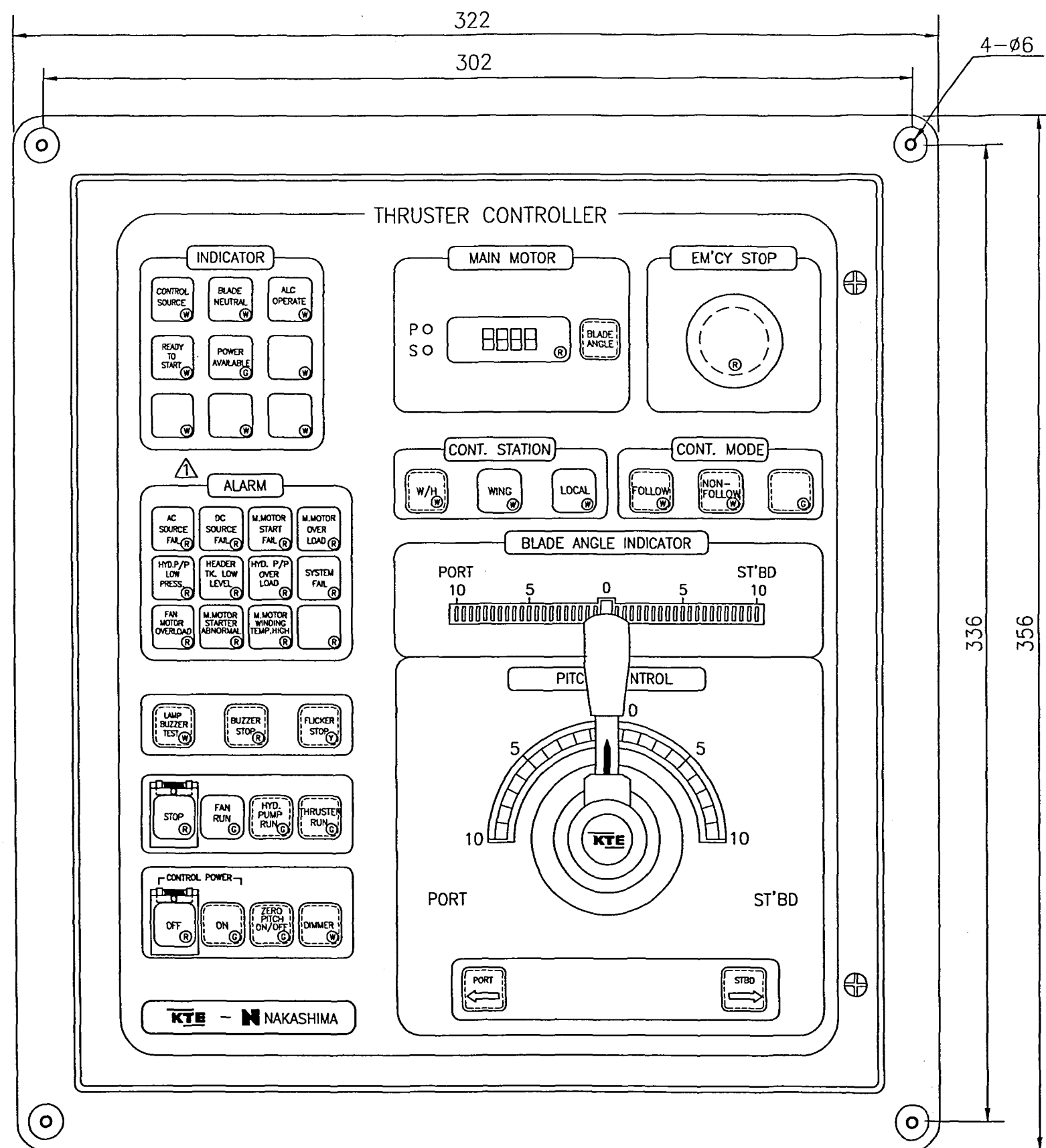
REV		TITLE STERN THRUSTER REMOTE CONTROL SYSTEM	DRAW No. KTM-0037-12-0	
			DISK No. D4437SC5	SHEET 12
			KTE	



R E V	△	2004.12.15	TITLE BOW THRUSTER CONNECTION DIAGRAM OF AMPERE METER AND EM'CY STOP	DRAW No. KTM-0037-13-1	
				DISK No. D4437BC6	SHEET 13
			KTE		



REV	△	2004.12.15	TITLE STERN THRUSTER CONNECTION DIAGRAM OF AMPERE METER AND EM'CY STOP	DRAW No. KTM-0037-14-1	
				DISK No. D4437SC6	SHEET 14
			KTE		



PANEL CUT DWG.

NOTE

1. COLOR OF FRONT FILM & PANEL SURFACE : MUNSELL N3.0 SEMI-POLISHED
2. COLOR OF PANEL INSIDE : MUNSELL N3.0 SEMI-POLISHED

- : INDICATOR LAMP
- : PUSH BUTTON WITH LAMP
- ⊙ : PUSH LOCK WITH LAMP

3. COLOR OF INDICATOR & PUSH BUTTON

Ⓜ : WHITE

ⓖ : GREEN

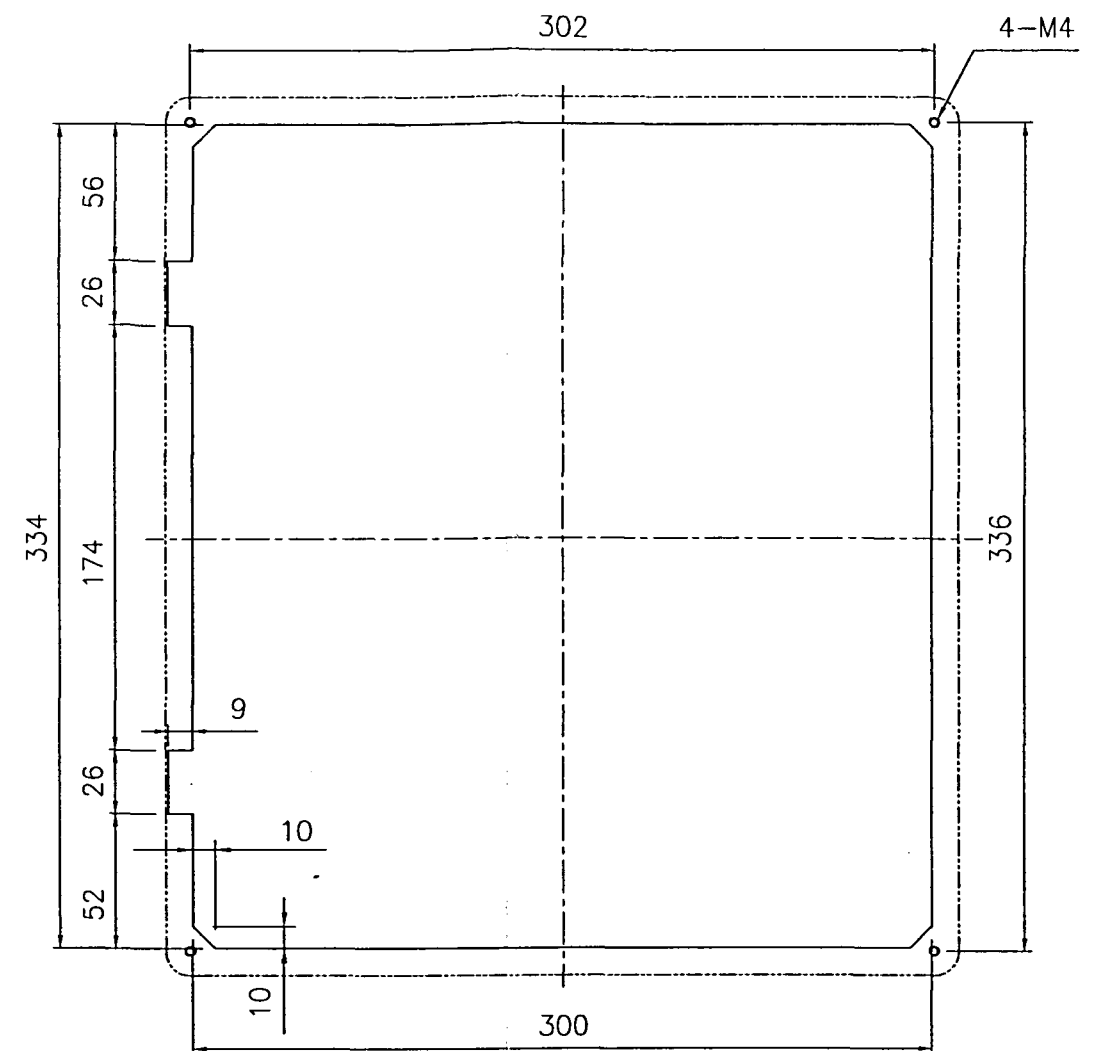
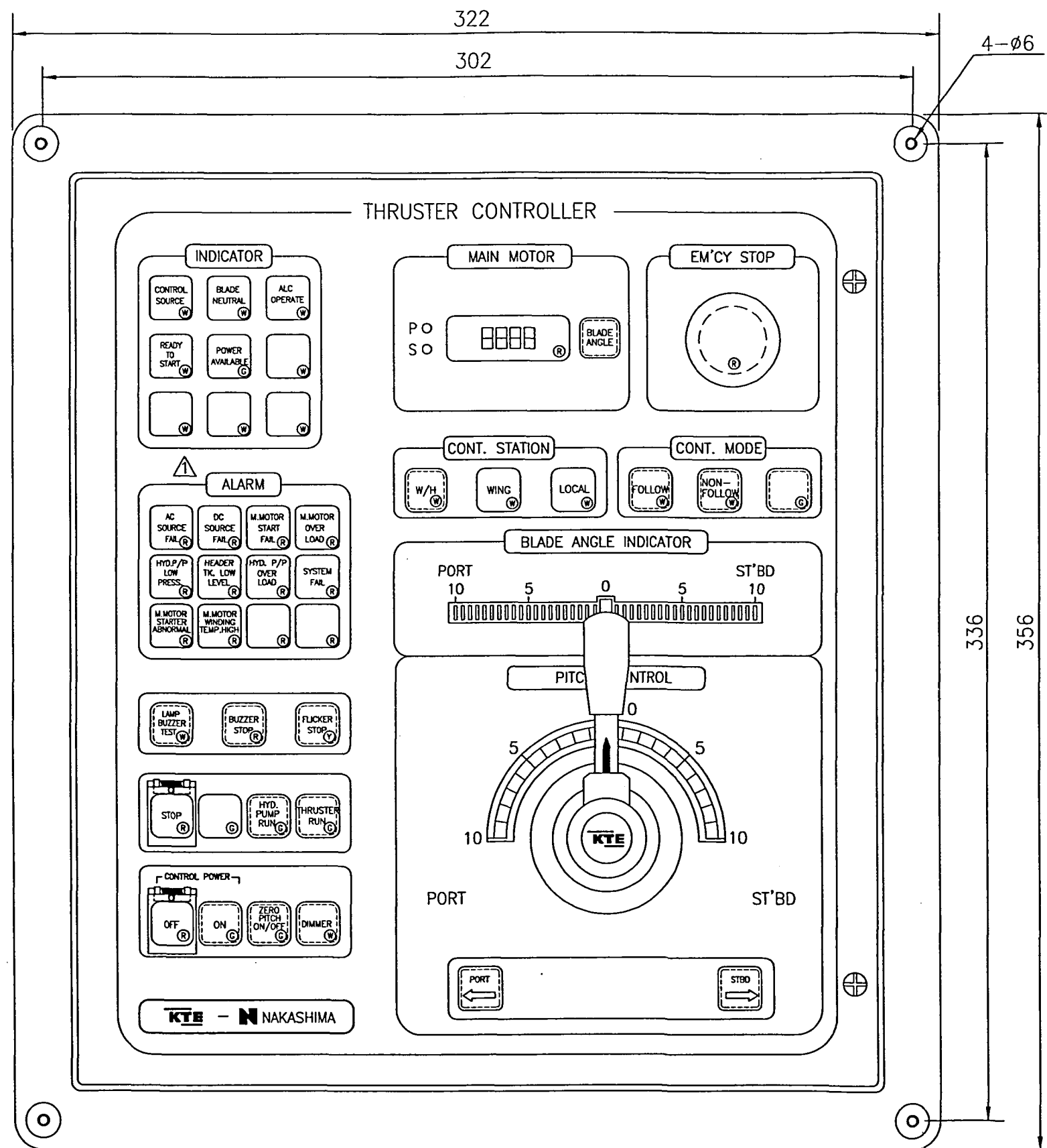
Ⓡ : RED

Ⓨ : YELLOW



: PROTECTION COVER

R E V	△	2004.12.15	TITLE	BOW THRUSTER W/H CONTROL PANEL (PANEL CUT DWG.)	DRAW No. KTM-0037-17-1	
					DISK No.	SHEET
					D4437B02	17
				KTE		



PANEL CUT DWG.

NOTE

1. COLOR OF FRONT FILM & PANEL SURFACE : MUNSELL N3.0 SEMI-POLISHED
2. COLOR OF PANEL INSIDE : MUNSELL N3.0 SEMI-POLISHED

- ☐ : INDICATOR LAMP
- ☐ : PUSH BUTTON WITH LAMP
- ☐ : PUSH LOCK WITH LAMP

3. COLOR OF INDICATOR & PUSH BUTTON

(W) : WHITE

(G) : GREEN

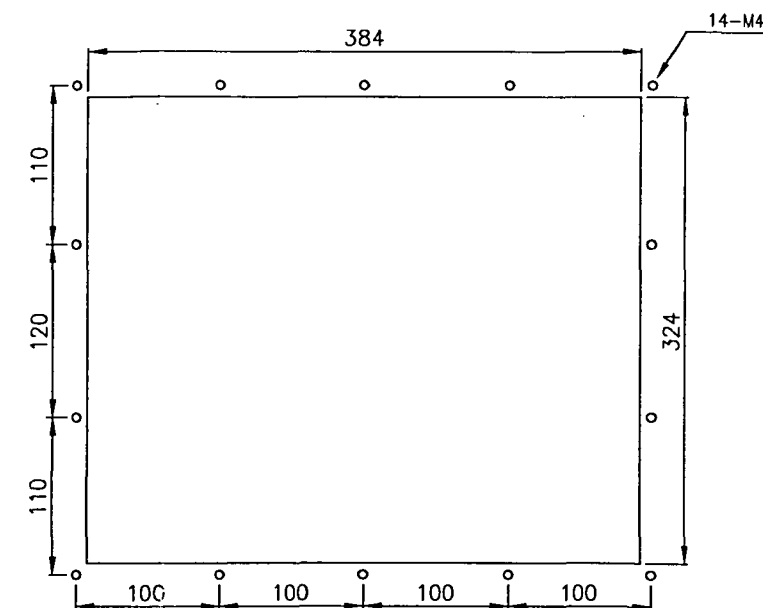
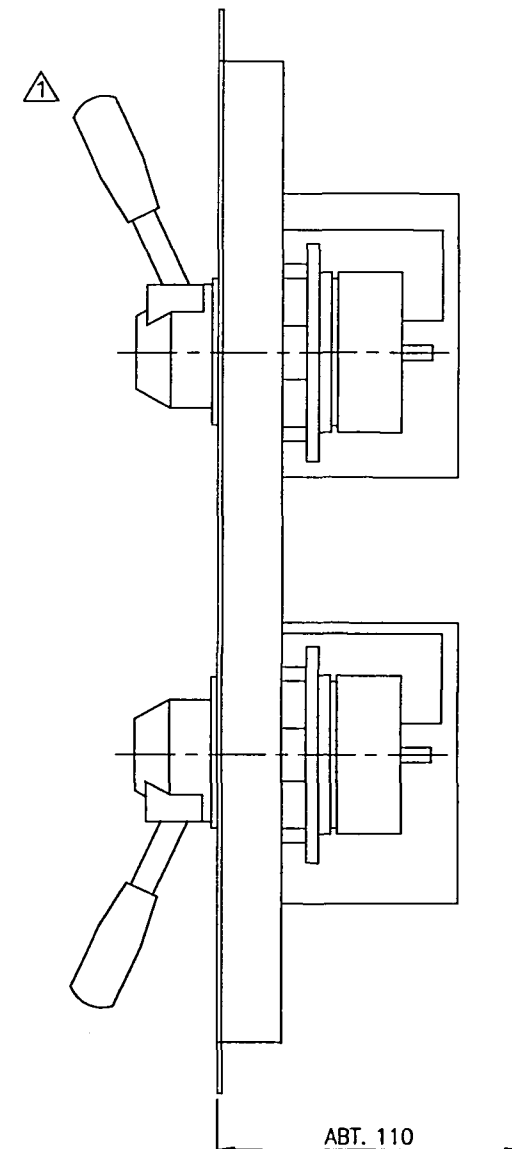
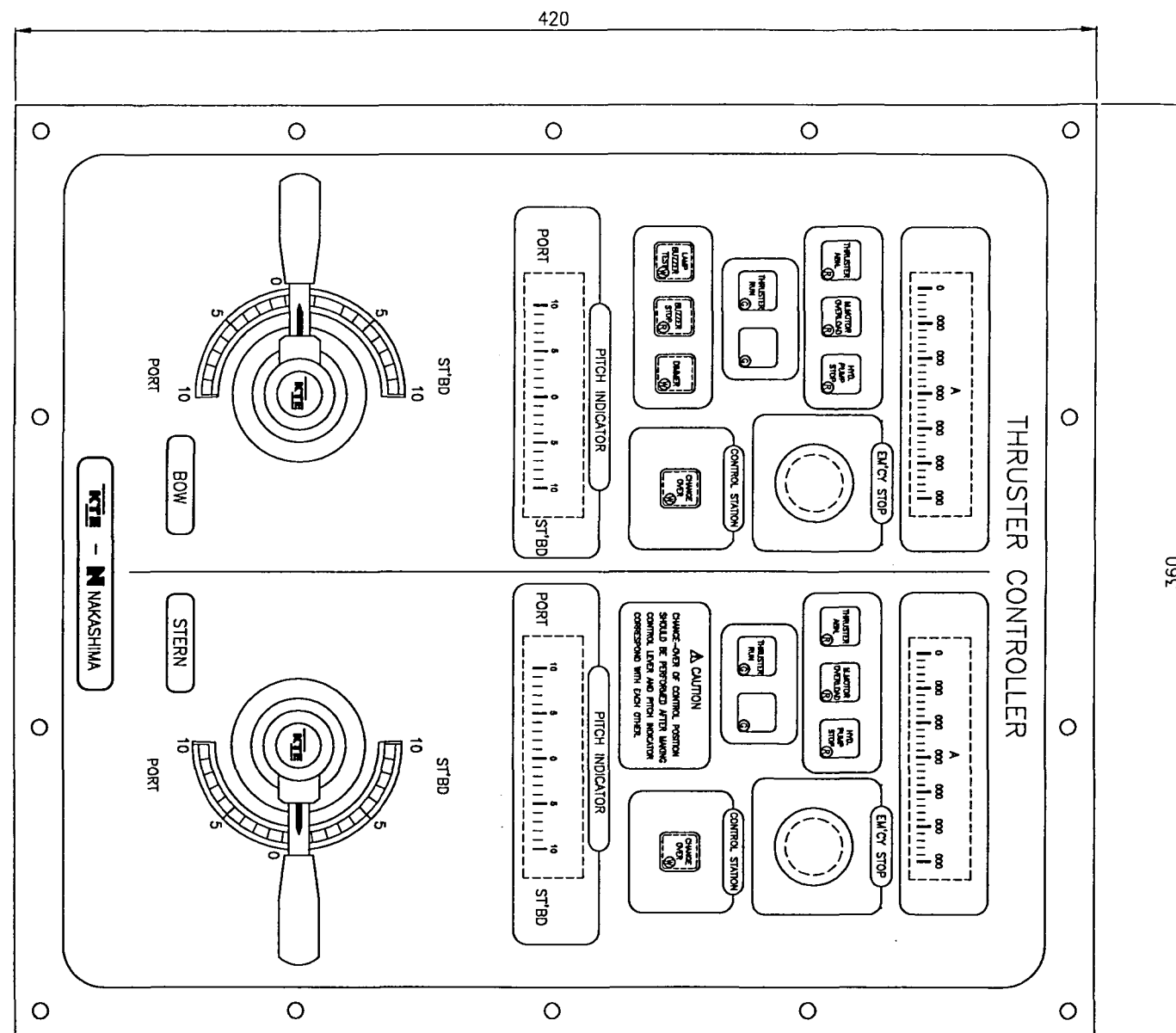
(R) : RED

(Y) : YELLOW



: PROTECTION COVER

R E V	△	2004.12.15	TITLE STERN THRUSTER W/H CONTROL PANEL (PANEL CUT DWG.)	DRAW No. KTM-0037-18-1	
				DISK No. D4437SD2	SHEET 18
			KTE		

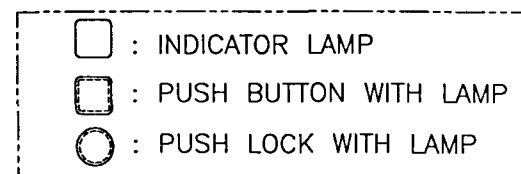


PANEL CUT DWG.

NOTE

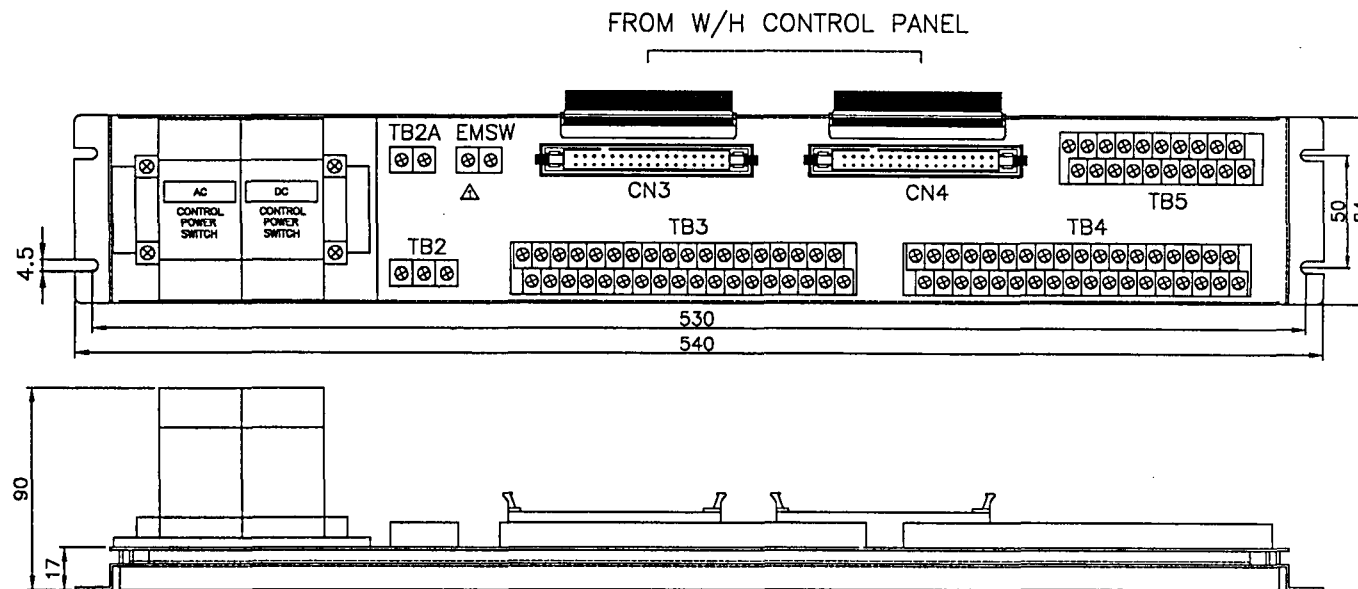
1. COLOR OF FRONT FILM & PANEL SURFACE : MUNSELL N3.0 SEMI-POLISHED
2. COLOR OF CONTROLLER CASE : MUNSELL N3.0 SEMI-POLISHED
3. COLOR OF INDICATOR & PUSH BUTTON

(W) : WHITE (R) : RED (G) : GREEN

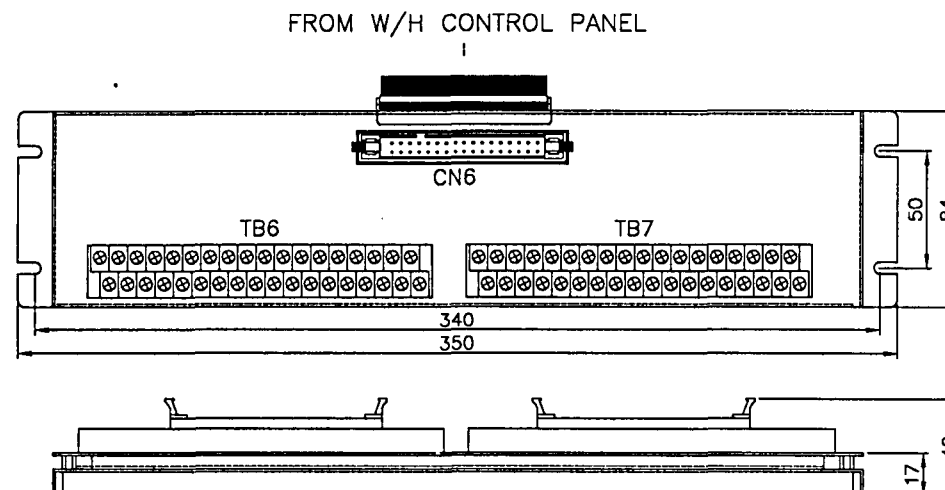


REV	△	2004.12.15	TITLE BOW & STERN THRUSTER PORT WING CONTROLLER	DRAW No. KTM-0037-19-1		
				DISK No. D4437PD3	SHEET 19	
			KTE			

TERMINAL BOARD A



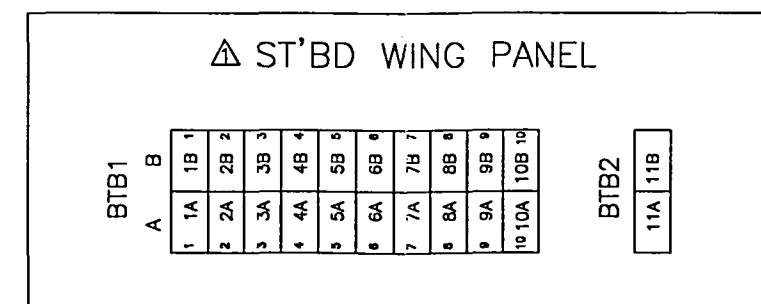
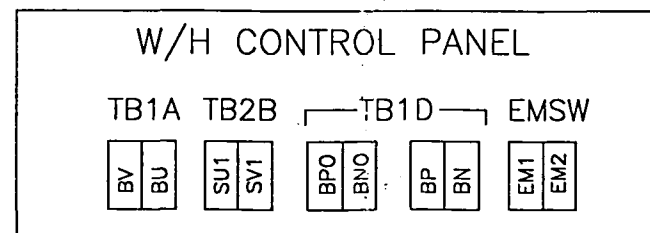
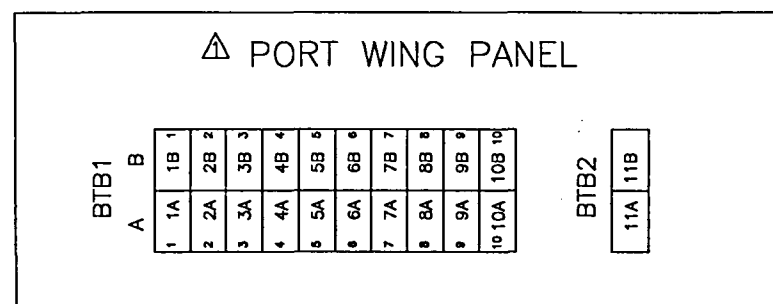
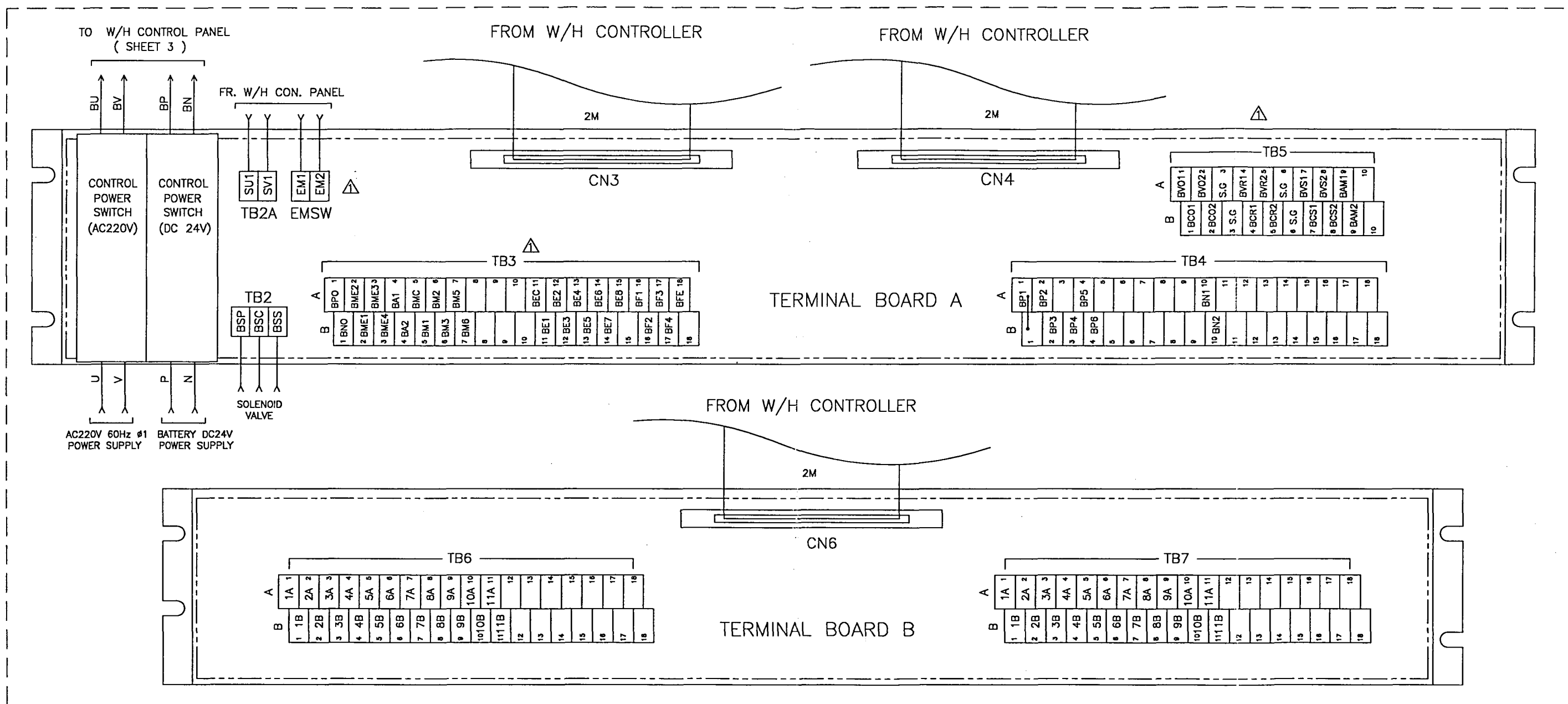
TERMINAL BOARD B



" THIS TERMINAL BOARD SHALL BE INSTALLED INSIDE OF THE CONSOLE STAND "

REV	△	2004.12.15	TITLE		DRAW No.		
			BOW/STERN THRUSTER		KTM-0037-21-1		
			TERMINAL BOARD A,B				
					DISK No.		SHEET
					D4437BD4		
						21	

TERMINAL BOARD



REV	△	2004.12.15	TITLE	BOW THRUSTER TERMINAL ARRANGEMENT	DRAW No.	
					KTM-0037-22-1	
			KTE		DISK No.	SHEET
					D4437BTB1	22

The diagram illustrates the internal wiring of a control panel, organized into two main sections: **TERMINAL BOARD A** (top) and **TERMINAL BOARD B** (bottom).

Power and Control Inputs:

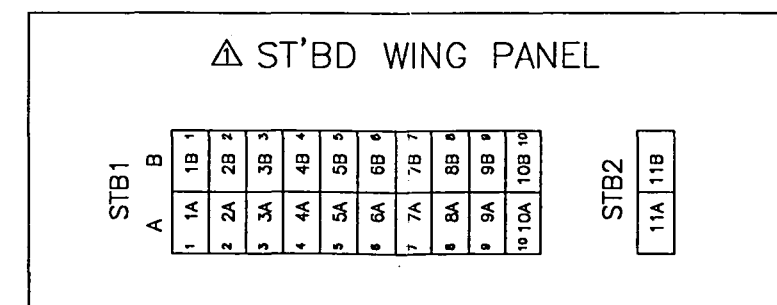
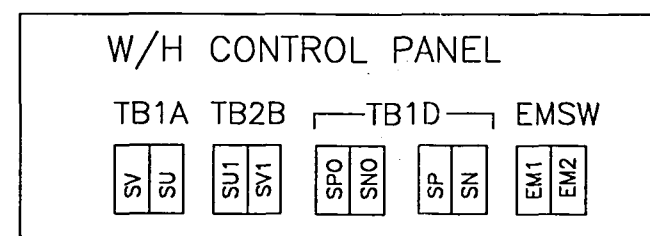
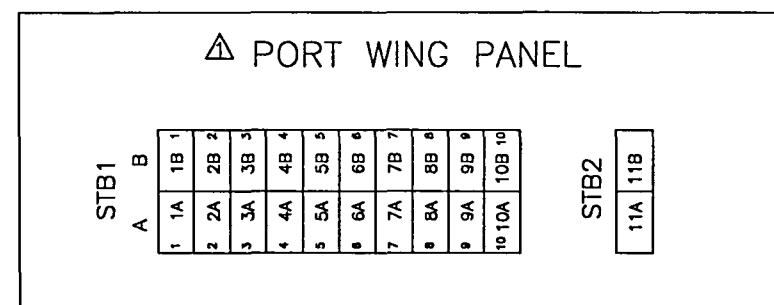
- AC220V 60Hz #1 POWER SUPPLY:** Connected to terminals U, V, and W.
- BATTERY DC24V POWER SUPPLY:** Connected to terminals P and N.
- SOLENOID VALVE:** Connected to terminals S, S, and S.
- CONTROL POWER SWITCH (AC220V):** Controls the AC supply.
- CONTROL POWER SWITCH (DC 24V):** Controls the DC supply.

Terminal Boards and Connections:

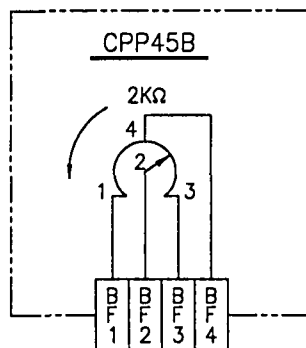
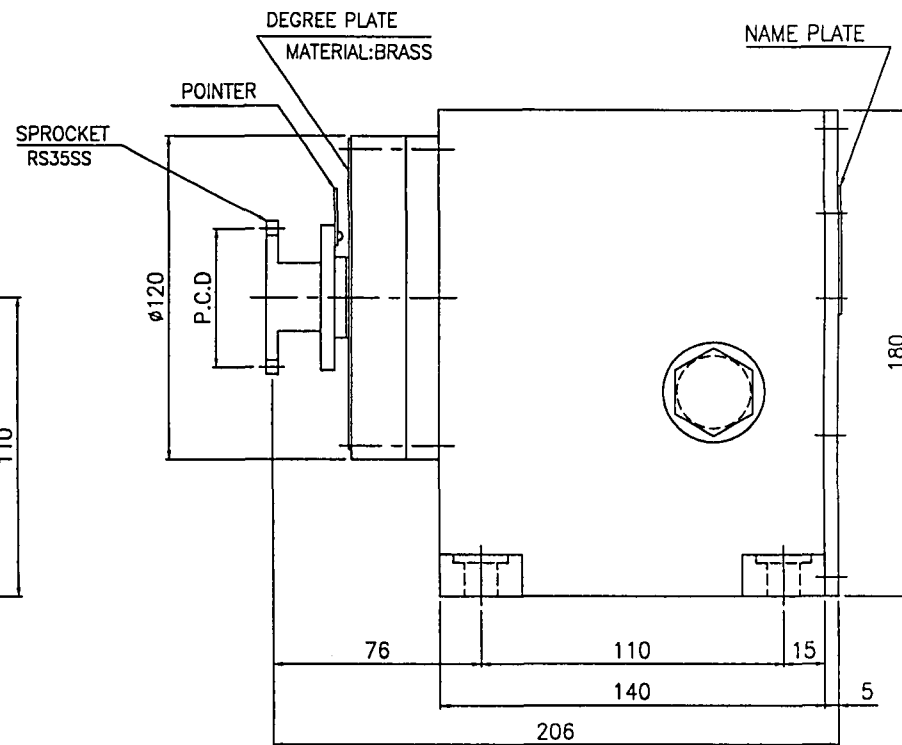
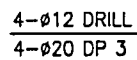
- TERMINAL BOARD A:**
 - Row A:** SP1, SP2, SP3, SP4, SP5, SP6, SP7, SP8, SP9, SP10, SP11, SP12, SP13, SP14, SP15, SP16, SP17, SP18.
 - Row B:** SPO1, SPO2, SPO3, SPO4, SPO5, SPO6, SPO7, SPO8, SPO9, SPO10, SPO11, SPO12, SPO13, SPO14, SPO15, SPO16, SPO17, SPO18.
- TERMINAL BOARD B:**
 - Row A:** 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A, 9A, 10A, 11A, 12, 13, 14, 15, 16, 17, 18.
 - Row B:** 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, 9B, 10B, 11B, 12, 13, 14, 15, 16, 17, 18.

Other Components and Connections:

- FROM W/H CONTROLLER:** Connections to CN3, CN4, and CN6.
- TO W/H CONTROL PANEL (SHEET 4):** Connections for SU, SV, SW, and SN.
- FR. W/H CON. PANEL:** Connections for Y, Y, Y, and Y.
- EMS:** Connections for EM1 and EM2.
- SPV:** Connections for SPV1 and SPV2.
- SV:** Connections for SV1 and SV2.
- SW:** Connections for SW1 and SW2.
- SN:** Connections for SN1 and SN2.

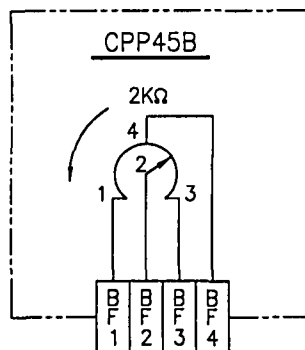
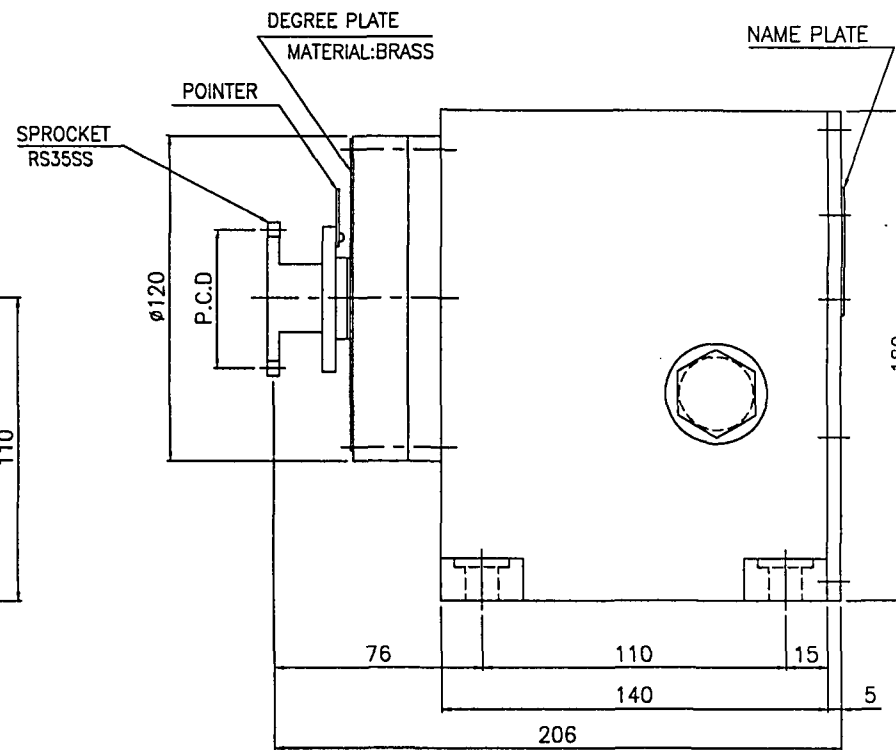
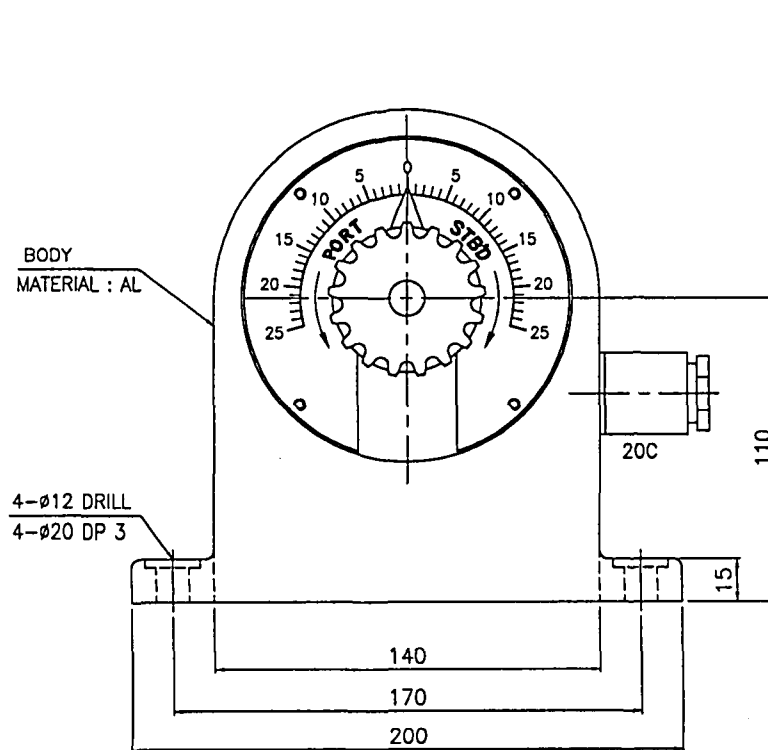


R E V	△	2004.12.15	TITLE	DRAW No.		
			STERN THRUSTER	KTM-0037-23-1		
			TERMINAL ARRANGEMENT			
				DISK No.		SHEET
				D4437STB1		23



TCT-220		± 56		±25.77		15		45.81		±140.15	
TYPE		STROKE(mm)		PITCH ANGLE		NT		P.C.D		SHAFT REVO.(DEG)	
						SPROCKET(RC35-9T)					
SCALE		1/1				TITLE.	BOW THRUSTER FOLLOWUP TRANSMITTER LAY-OUT DWG.				
DATE		2001. 11. 10									
DISK No.		D4437FB									
APP'D		CHECK	CHECK	DESIGN							
						DWG. NO.	KTM-0037-24-0			SHEET NO. 24	
KTE											

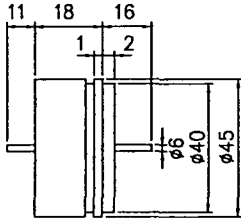
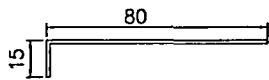
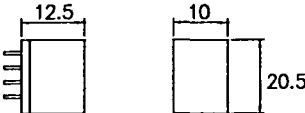
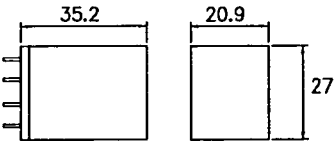
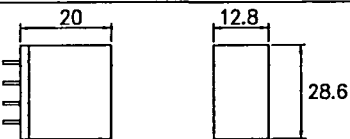
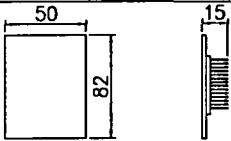
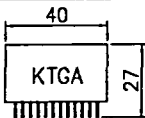
△	
△	
△	
△	



REVOLUTION RATIO. SPROCKET : POT. = 1:1

PAINT COLOR	WORK NO.	WORK SHIP	APP'D	CHECK	CHECK	DESIGN	TITLE.	DWG. NO.	SHEET NO.
7.5 BG 7/2							STERN THRUSTER FOLLOWUP TRANSMITTER LAY-OUT DWG.	KTM-0037-25-0	25

KTE

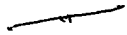
HNO		4437/4438/4441					
U S E		BOW/STERN THRUSTER REMOTE CONTROL SYSTEM					
ITEM NO	NAME OF PART	OUTLINE	QUANTITY			REMARKS	
			WORKING		SPARE		
			PER SET	PER VESS			
1	POTENTIOMETER		6	6	1	MIDORI CPP-45B 4TAP	
2	1.5mm HEXAGON RENCH				1		
3	CONTROL RELAY		24	24	3	⚠ NAIS DS2E-M-DC24V	
4	CONTROL RELAY		4	4	1	HANKUK RELAY HR705-4PL. DC24V	
5	CONTROL RELAY		18	18	2	NAIS JW2SN-DC24V	
6	COMMON CARD		2	2	2	KT COMM. CARD	
7	HYBRID IC		20	20	2	KT ALARM. CARD	
8							
9							
REV	⚠	2004.12.15	TITLE SPARE PARTS LIST			DRAW No. KTM-0037-26-1	
						DISK No. D4437SP1	SHEET No. 26

11

DAEWOO SHIPBUILDING &
MESSRS : MARINE ENGINEERING CO.,LTD

HNo. 4437/4438/4441

HYD.PUMP STARTER & LOCAL CONTROL BOX
FOR BOW/STERN THRUSTER

DRAWING No.	KTM-0038		APPROVED	G. H. Kim
DATE	JULY 1. 2004	FILE NAME: D4437H	CHECKED BY	B. K. Kim
 KTE Co., Ltd. 1497-1, Songjeong-Dong, Gangseo-Gu, Busan 618-270, Korea Tel : +82-51-265-0255 Fax : +82-51-265-0250			CHECKED BY	
			DESIGNED BY	S. H. OH (오상호)

PLAN HISTORY

[illegible]

HISTORY

HYD.PUMP STARTER FOR BOW/STERN THRUSTER

SHIP OWNER	A.P. Moller		HNO.	4437/4438/4441																					
KIND OF SHIP	45,000m ² PCTC		CLASSIFICATION	DNV																					
PAINT COLOR (MUNSELL No.)	OUTSIDE : N-7.5(light gray) INSIDE : MAKER STANDARD		AMBIENT TEMP.	45° C																					
DRAWING & DOCUMENT	ENGLISH		MATERIAL OF NAME PLATE	PHENOLIC																					
CABLE LEAD-IN	LOWER PORTION : COAMING TYPE																								
SIGNAL LAMP	BA9s, 24V 2W																								
OVERLOAD PROTECTOR	THERMAL TYPE ; 2 PHASE WITH AMBIENT TEMPERATURE COMPENSATION (MANUAL RESETTNG SYSTEM)																								
SOURCE CAPACITY	MAIN POWER	AC 440 V 3 Ø 60 Hz																							
	CONTROL CIRCUIT	AC 220V / 20V, 1Ø, 60Hz																							
DEVISION	HYD.PUMP STARTER FOR BOW THRUSTER			1 SET																					
	HYD.PUMP STARTER FOR STERN THRUSTER			1 SET																					
	LOCAL CONTROL BOX FOR BOW THRUSTER			1 SET																					
	LOCAL CONTROL BOX FOR STERN THRUSTER			1 SET																					
	EM'CY STOP PUSH BUTTON BOX FOR FORWARD AND AFT MOORING DECK			1 SET																					
BUS BAR	MATERIAL	COPPER (SURFACE : TIN COATING)																							
	IDENTIFICATION OF POWER	R (U) (Z) RED P : RED S (V) (X) WHITE N : BLUE T (W) (Y) BLUE *EARTH WIRE : GREEN & YELLOW																							
	PHASE ARR'G OF BUS BAR	<table border="0"> <tr> <td>PHASE (R) (U)</td><td>POLE (P)</td><td colspan="3">*VIEWING FROM PANEL FRONT</td></tr> <tr> <td>PHASE (S) (V)</td><td></td><td>LEFT</td><td>TOP</td><td>FRONT</td></tr> <tr> <td>PHASE (T) (W)</td><td>POLE (N)</td><td>↓</td><td>↓</td><td>↓</td></tr> <tr> <td></td><td></td><td>RIGHT</td><td>BOTTOM</td><td>REAR</td></tr> </table>					PHASE (R) (U)	POLE (P)	*VIEWING FROM PANEL FRONT			PHASE (S) (V)		LEFT	TOP	FRONT	PHASE (T) (W)	POLE (N)	↓	↓	↓			RIGHT	BOTTOM
PHASE (R) (U)	POLE (P)	*VIEWING FROM PANEL FRONT																							
PHASE (S) (V)		LEFT	TOP	FRONT																					
PHASE (T) (W)	POLE (N)	↓	↓	↓																					
		RIGHT	BOTTOM	REAR																					
INTERNAL WIRING	MAIN CIRCUIT : 660V SCP (MORE THAN 2.0mm ²) CONT. CIRCUIT : 660V SCP (or SYP) 1.25mm ² 660V SCP (or SYP) 0.75mm ² (LESS THAN 50V)																								
REMARK																									
HULL No.	4437	4438	4441																						
ORDER No.	KTM-04022	KTM-04023	KTM-04024																						
MACHINERY No.	BOW	A0102-04	A0118-04	A0134-04																					
	STERN	A0110-04	A0126-04	A0142-04																					

R E V		TITLE GENERAL SPECIFICATION	DRAW No. KTM-0038-01-0		
			DISK No. D4437S1		
			SHEET No. 1		

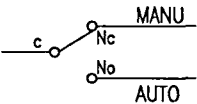
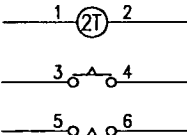
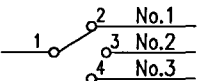
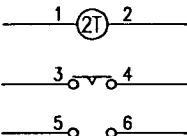
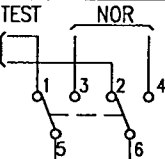
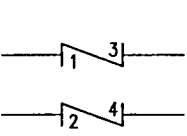
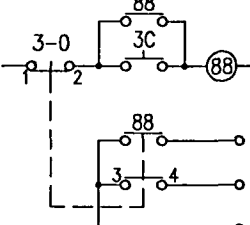
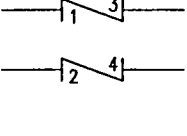
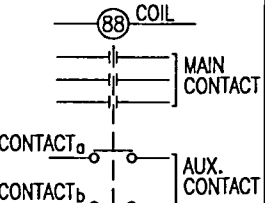
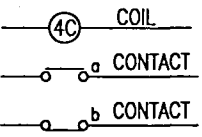
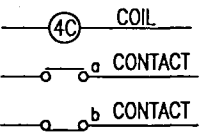
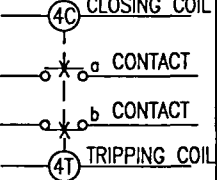
210x297(mm)

MANUFACTURER	TYPE	RATED CURRENT (A)	RATED VOLTAGE (AC,DC)	RATED BREAKING CURRENT (KA)
GOULD	A5Y1-11	1	500V	100
	A5Y3-11	3	500V	100
	A5Y5-11	5	500V	100
	A5Y10-11	10	500V	100
	A5Y15-11	15	500V	100
	A5Y20-11	20	500V	100
	A5Y25-11	25	500V	100
	A5Y30-11	30	500V	100
	A5Y40-11	40	500V	100
	A5Y50-11	50	500V	100
	A5Y60-11	60	500V	100
MANUFACTURER	TYPE	RATED CURRENT (A)	RATED VOLTAGE (AC,DC)	RATED BREAKING CURRENT (KA)
SB FUSE CO., LTD.	1-SB-1	1	AC500V	100
			DC250V	50
	1-SB-3	3	AC500V	100
			DC250V	50
	1-SB-5	5	AC500V	100
			DC250V	50
	1-SB-10	10	AC500V	100
			DC250V	50
	1-SB-15	15	AC500V	100
			DC250V	50
	1-SB-20	20	AC500V	100
			DC250V	50
	1-SB-25	25	AC500V	100
			DC250V	50
	1-SB-30	30	AC500V	100
			DC250V	50
	1-SB-40	40	AC500V	100
			DC250V	50
	1-SB-50	50	AC500V	100
			DC250V	50
	1-SB-60	60	AC500V	100
			DC250V	50

R E V			TITLE BREAKING CAPACITY LIST OF FUSE	DRAW No. KTM-0038-02-0		
			KTE	DISK No. D4437S2		SHEET No. 2

BASIC SYMBOLS			SWITCH GEAR ACCESSORIES		
SYMBOL	DESCRIPTION		SYMBOL	DESCRIPTION	
	ONE CONDUCTOR OR A GROUP OF SEVERAL CONDUCTORS			DISCONNECTING SWITCH OR MOULDED CASE CIRCUIT BREAKER	
	TWO CONDUCTORS (MULTILINE REPRESENTATION)			MOULDED CASE CIRCUIT BREAKER (WITH SHUNT TRIP COIL)	
	TWO CONDUCTORS (SINGLE-LINE REPRESENTATION)				
	n CONDUCTORS (SINGLE-LINE REPRESENTATION)				
	CROSSING WITHOUT ELECTRICAL CONNECTION				
	BRANCH OF CONDUCTORS			UNDER VOLTAGE TRIPPING COIL OF CIRCUIT BREAKER	
	JUNCTION OF CONDUCTORS				
	RESISTANCE OR RESISTOR			SWITCH (GENERAL) SINGLE THROW	
	RESISTOR WITH MOVING CONTACTOR GENERAL SYMBOL			SWITCH (GENERAL) DOUBLE THROW	
	INDUCTANCE OR INDUCTOR		TERMINALS		
	CAPACITANCE, CAPACITOR				
	RELAY COIL, GENERAL SYMBOL			TERMINAL MARK	
	HULL CONNECTION (EARTH)			CABLE NO	
	BELL			CABLE SIZE	
	BUZZER			TERMINAL	
	MECHANICAL COUPLING GENERAL SYMBOL			JOINT TERMINALS	
	SWITCH, GENERAL SYMBOL			EQUIPMENT OF OUTSIDE	
	THREE POLE SWITCH, SINGLE REPRESENTATION			EQUIPMENT OF OTHER UNIT	
	CHANGE OVER CONTACT BREAK BEFORE MAKE		POWER & RELAY CONTACT		
	MAKE BEFORE BREAK CONTACT (OVER LAP CONTACT)				
	CONTACTOR NORMALLY OPEN (MAIN)				CONTACT(GENERAL) OF MANUAL CONTACT
	CONTACTOR NORMALLY CLOSE (MAIN)				MANUALLY OPERATED AUTO RESET CONTACT
	MAKE CONTACTOR (a CONTACTOR) GENERAL SYMBOL				MANUALLY OPERATED AUTO RESET CONTACT(WITH LOCKING DEVICE)
	BREAK CONTACTOR (b CONTACTOR) GENERAL SYMBOL				MECHANICAL CONTACT
	FUSE				HAND-RESET CONTACT (THERMAL RELAY)
	GENERATOR				RELAY CONTACTOR OR AUX. SWITCH CONTACTOR
	MOTOR				CONTACTOR WITH TIME LIMIT OPERATION (ON DELAY TYPE)
	SINGLE-PHASE TRANSFORMER WITH SEPARATOR WINDINGS				CONTACTOR WITH TIME LIMIT OPERATION (OFF DELAY TYPE)
	AUTO-TRANSFORMER THREE PHASE				LATCHING RELAY CONTACT
	CURRENT TRANSFORMER			GANG SWITCH MANUALLY OPERATED RESIDUAL CONTACT	
	SEMICONDUCTOR DIODE OR RECTIFIER GENERAL SYMBOL			C CONTACTOR	
	VOLTMETER			CONTROL SWITCH(CAM TYPE) OR CONTROLLER CONTACT	
	AMMETER				
	INSULATION RESISTANCE METER				
	RUNNING HOUR METER				
	INDICATING LAMP				
REV			TITLE		DRAW No.
			BASIC SYMBOL		KTM-0038-03-0
					DISK No.
					SHEET No. 3

GRAPHICAL SYMBOLS FOR ELECTRICAL APPARATUS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CHANGEOVER SWITCH MANU : (1-2) ON, (1-3) OFF AUTO : (1-2) OFF, (1-3) ON		TIME RELAY (ON DELAY TYPE) IN PUT ON OFF (1-2) ON OFF (3-4) ON OFF (5-6) ON OFF 7 SET TIME
	CHANGEOVER SWITCH No.1 : (1-2) ON, (1-3) (1-4) OFF No.2 : (1-3) ON, (1-2) (1-4) OFF No.3 : (1-4) ON, (1-2) (1-3) OFF		TIME RELAY (OFF DELAY TYPE) IN PUT ON OFF (1-2) ON OFF (3-4) ON OFF (5-6) ON OFF 7 SET TIME
	TEST SWITCH FOR SEQUENCE TEST NORMAL NORMAL : (3-5) (4-6) ON (1-5) (2-6) OFF TEST : (1-5) (2-6) ON (3-5) (4-6) OFF		CONTROL SWITCH (CAM SWITCH) 1 NOTCH (1-3) ON, (2-4) OFF 2 NOTCH (1-3)(2-4) OFF 3 NOTCH (1-3) OFF, (2-4) ON
	STOP ALARM SIGNAL WHEN MANUAL STOP (1-2) SLOW ACTION (3-4) QUICK ACTION		OVERCURRENT RELAY MANUAL RESET TYPE
	MAIN MAGNETIC CONTACTOR		AUTO RESET TYPE
	AUXILIARY RELAY		KEEP (LATCHING) RELAY WHEN (4C) IS ENERGIZED 'a. CONTACT IS KEPT ON 'b. CONTACT IS KEPT OFF WHEN (4T) IS ENERGIZED 'a. CONTACT IS KEPT OFF 'b. CONTACT IS KEPT ON

R E V		TITLE	GRAPHICAL SYMBOLS FOR ELECTRICAL APPARATUS	DRAW No.		
				KTM-0038-04-0		
		KTE		DISK No.		SHEET
				D4437S4		No. 4

CONNECTION OF AUX. RELAYS

TYPE	CONNECTION	CONT.	TYPE	CONNECTION	CONT.	TYPE	CONNECTION	CONT.	TYPE	CONNECTION	CONT.
H3CR-G8EL (TIME RELAY)		2a+1a	H3BA-N (TIME RELAY)		2c	HMR10		(3A+1a1b) + (3A+1a1b)			
MY		4c	SDV-F (VOLTAGE SENSOR)			SH-4/V		2a1b	CAD326()		3a2b
B-A65		3B+2a	S-N12		3A+2a	SRC50-2F/X		3a3b	LAD-N226		2a2b
HMX22 HMT22		2a2b	HMC20		3A+1a1b	SC-05		3A+2a	SC-1N~ SC-16N		3A+2a2b
HAB22		2a2b	HAB22		2a2b	SZ-A22		2a2b			

REV		TITLE		DRAW No.	
		CONNECTION OF AUX. RELAYS		KTM-0038-05-0	
		KTE		DISK No.	SHEET
				D4437S5	No. 5

CONTROL DEVICE NUMBERS & AN INDEX AND SUFFIX LETTERS

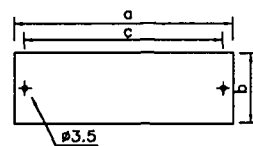
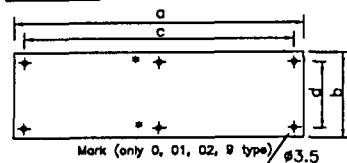
No.	DESIGNATION	No.	DESIGNATION	SYMBOL	NAME	SYMBOL	NAME	SYMBOL	NAME	SYMBOL	NAME
2	TIME DELAY STARTING OR CLOSING RELAY	70	RHEOSTAT	A	ALTERNATOR	F	FAILURE	N	NEGATIVE POLE	S	STT STARTER
3	CONTROL SWITCH	72	DC CIRCUIT BREAKER OR MAGNETIC CONTACTOR		AMMETER		FORWARD		NEUTRAL		SV SOLENOID VALVE
4	MAIN CONTACTOR OR RELAY	75	BREAKING DEVICE		AUTOMATIC		FREQUENCY				SW SEA WATER
5	STOP SWITCH OR RELAY	77	LOAD LIMIT DEVICE		ANN ANNUNCIATOR		FUSE		OFF(OPEN)		
6	START CONTACTOR OR SWITCH	80	DC UNDER VOLTAGE RELAY		AS AMMETER TRANSFER SWITCH		FS FLOAT SWITCH		ON(CLOSE)		TEMPERATURE
8	CONTROL SOURCE SWITCH	81	GOVERNOR DRIVING DEVICE	B	AUX AUXILIARY	G	GENERATOR	O	OPEN	T	TIME
9	FIELD REVERSING DEVID	83	SELECTIVE CONTACTOR SWITCH OR RELAY				GROUND FAULT		OPERATION		TRANSFOMER
10	SEQUENCE SWITCH	84	VOLTAGE RELAY				HEATER		OCR OVER CURRENT RELAY		TRIPPING
11	TEST SWITCH OR RELAY	86	BLOCKING RELAY		BATTERY		HIGH				TB TERMINAL BLOCK, TERMINAL BOARD
12	OVER SPEED SWITCH OR RELAY	88	MAGNETIC CONTACTOR OR SIWTH FOR GENERAL MACHINE		BUS-BAR	H	HOLDING		POSITIVE POLE		TH THERMAL RELAY
14	LOW SPEED SWITCH OR RELAY	89	DISCONNECTING SWITCH ISOLATOR	C	BEL BELL		HW HOT WATER	P	POWER	U	TC TORGGLE SWITCH
18	ACCELERATING OR DECELERATING DEVICE	90	AUTOMATIC VOLTAGE REGULATOR		BZ ELECTRIC BUZZER				PRESSURE		
19	STARTING TO RUNNING TRANSITION RELAY	91	AUTOMATIC POWER REGULATOR OR POWER RELAY						PRIMARY		
20	SOLENOID VALVE	94	TRIP-FREE CONTACTOR RELAY			I	INNER PART		PF POWER FUSE		UP
23	THERMOSTAT TEMPERATURE CONTROL RELAY	95	AUTOMATIC FREQUENCY REGULATOR OR FREQUENCY RELAY				INSTANT		PS PREESSURE SWITCH	V	VACUUM
25	SYNCHRONISM CHECK DEVICE			D	CLOSE		ILLUMINATING LAMP	Q	PT POTENTIAL TRANSFORMER		VOLTAGE
26	TEMPERATURE RELAY FOR STATIC APPARATUS				COOLING	L	ITER INTERLOCK				VR VOLTAGE REGULATOR
27	A.C UNDER VOLTAGE RELAY				COMMON				Q OIL		VS VOLTMEETER CHANGE-OVER SWITCH
28	ALARM DEVICE				CLOSING COIL		LAMP	R	RAISE	W	WATT
29	FIRE EXTINGUISHING DEVICE				CONTROL		LIMIT		RESISTOR		WATER
30	ANNUNCIATOR OR CONDITION OF APPARATUS			E	CONDENSER	M	LOAD		REVERSE		
33	POSITION SWITCH OR DETECTOR				CH CHARGE		LOCKING		RESET		AUXILIARY
34	MOTOR OPERATED SEQUENCE SWITCH				COS CHANGE-OVER SWITCH		LOW		RT RECTIFIER	X	NORMAL INPUT
40	FIELD SWITCHING DEVICE				CP CAUTION PLATE		LS LIMIT SWITCH	S	RIGHT		
42	RUNNING CONTACTOR OR SWITCH				CT CURRENT TRANSFORMER		LVS LEVEL SWITCH		RUN		AUXILIARY
43	CHANGE OVER SWITCH, CONTACTOR OR RELAY FOR CONTROL CIRCUIT			F	DIRECT	N				Y	INVERSE INPUT
47	OPEN OR REVERSE PHASE VOLTAGE RELAY				DISCHARGE		MOTOR				
48	OVERDUE DETECT RELAY				DECELERATION		MANUAL		SWITCH	Z	AUXILIARY
49	TEMPERATURE RELAY FOR ROTARY MACHINE				DIODE		MAGNETIC		SECONDARY		BUZZER
51	AC OVER-CURRENT RELAY OR OVER-CURRENT GROUND RELAY				DOWN	O	MAIN		SHORT		ZCT ZERO PHASE SEQUENCE CURRENT TRANSFOMER
52	AC CIRCUIT BREAKER OR CONTACTOR			G	EMERGENCY		METER		START	Ø	PHASE
59	AC OVER VOLTAGE RELAY				EXCITOR		MC MAGNETIC CONTACTOR		STOP		DIAMETER
62	TIME DELAY STOPPING OR OPERATING RELAY				EL EARTH LAMP		MCCB MOLDED CASE CIRCUIT BREAKER		STR STARTING RELAY		
63	PRESSURE SWITCH OR RELAY				EMERGENCY STOP		MCS MOLDED CASE SWITCH		SL SIGNAL LAMP, PILOT LAMP		
65	GOVERNOR				EARTH TEST TRANSFER SWITCH						
66	FLASHER RELAY			H		P					
67	AC DIRECTIONAL POWER RELAY OF DIRECTIONAL GROUND RELAY										
69	FLOW RELAY										

R E V			TITLE	DRAW No.
			CONTROL DEVICE NUMBERS & AN INDEX AND SUFFIX LETTERS	KTM-0038-06-0
			KTE	DISK No. D4437S6
				SHEET No. 6

No.	SYMBOL	PART	TYPE	SPECIFICATION	REMARK	Q'TY	MAKER
1	52	MOLDED CASE SWITCH	HBS-63C	60/30A	FIXED	2	HYUNDAI
2	88	MAGNETIC CONTACTOR	SC-5-1	AC220V 60Hz		2	FUJI ELEC.
3	2-1	MAGNETIC CONTACTOR	SC-05	AC220V 60Hz		4	FUJI ELEC.
	2			AC220V 60Hz			
4	51	THERMAL RELAY	TR-5-1N	9-13A	SET : 10.3A	2	FUJI ELEC.
	51-1	THERMAL RELAY	TR-ON	2.2-3.4A	SET : 2.6A	2	FUJI ELEC.
5	23X,33X,63X 33Y,63Y,4X 51X,5X	CONT. RELAY	CAD-326M7	AC220V 60Hz	3a2b	16	TELEMECANIQUE
6	33Y,63Y, 51X,4X	AUX. RELAY	CAD-N226	AC220V 60Hz	2a2b	8	TELEMECANIQUE
7	33T,63T	TIME RELAY	H3BA-N	AC220V 60Hz	WITH SOCKET	4	OMRON
8	A	AMMETER	BE-48	0-20-60A		2	RISESUN
9	WL	PILOT LAMP	XB5-AV61		BA9s, 24V, 2W	2	TELEMECANIQUE
10	RL	PILOT LAMP	XB5-AV64		BA9s, 24V, 2W	6	TELEMECANIQUE
11	BL 	PILOT LAMP	XB5-AV66		BA9s, 24V, 2W	2	TELEMECANIQUE
12	OL	PILOT LAMP	XB5-AV65		BA9s, 24V, 2W	2	TELEMECANIQUE
13	3-11L	PUSH BUTTON	XB5-AA35			2	TELEMECANIQUE
14	3-11R 	PUSH BUTTON	XB5-AA25			2	TELEMECANIQUE
15	3C	PUSH BUTTON	XB5-AW3365	WITH LAMP	BA9s, 24V, 2W	2	TELEMECANIQUE
16	3-0	PUSH BUTTON	XB5-AA45			2	TELEMECANIQUE
17	SHS1,SHS2	SELECTOR SWITCH	XB5-AD25			6	TELEMECANIQUE
18	T	TRANSFORMER	200VA	AC440/0-20-220V	1ø, 60Hz	2	KOC ELEC.
19	F1,F2,F3	FUSE	SB-C1	3A	WITH BASE	6	SB FUSE
20	F4,F5,F6,F7 	FUSE	SB-C1	1A	WITH BASE	8	SB FUSE
21	RHM	RUN HOUR METER	TH148S	AC 220V		2	NAIS
22							
23							

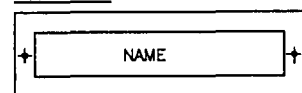
R E V		2004.12.15	TITLE		DRAW No.		
			PARTS LIST		KTM-0038-07-1		
					DISK No.		SHEET
					D4437S7		No. 7

(1) SIZE

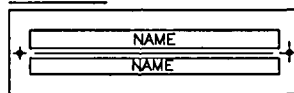


(2) MODEL

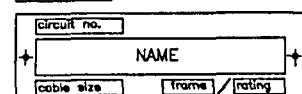
Type : A



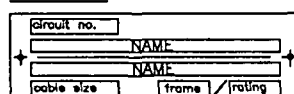
Type : B



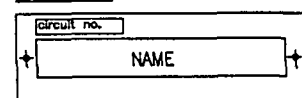
Type : C



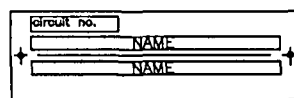
Type : D



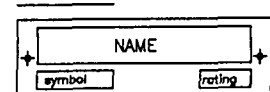
Type : L



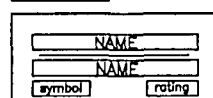
Type : M



TYPE : G



Type : JH



(3) LETTER EXAMPLE

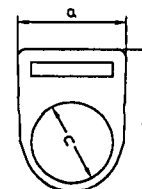
CIRCUIT No.: P0101, F123, C1, M19
CABLE SIZE : TPYC-80
FRAME : 60, 100, 225, 250, 400, 1600
RATING : 15A, 400A, INST1000A

type	a	b	c	d	t
0	315	63	300	50	3
01	400	63	380	50	3
02	250	63	235	50	3
1	45	10	38	-	2
2	50	12	43	-	2
3	50	20	43	-	2
4	63	16	53	-	2
5	63	25	53	-	2
6	90	25	80	-	2

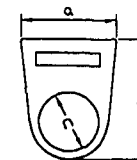
1. MATERIAL : PHENOLIC
2. GROUND : WHITE
3. LETTER : BLACK (RATING:RED)
4. "AH", "GH", "JH" Type : adhesive Type

type	a	b	c	d	t
7	100	31	90	-	2
8	100	45	90	-	2
9	200	50	190	40	3
10	40	12	-	-	2
11	33	16	-	-	2
12	50	30	43	-	2
13	80	25	70	-	2
14	90	30	80	-	2

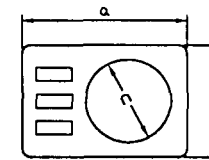
TYPE : CL



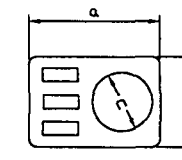
TYPE : CLA



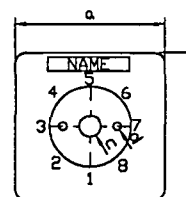
TYPE : 06A



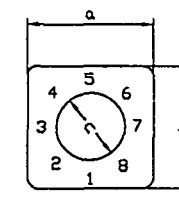
TYPE : 04A



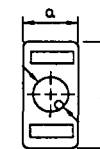
TYPE : DMI



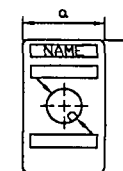
TYPE : DM4



TYPE : TG1



TYPE : TG2



(4) LETTER EXAMPLE

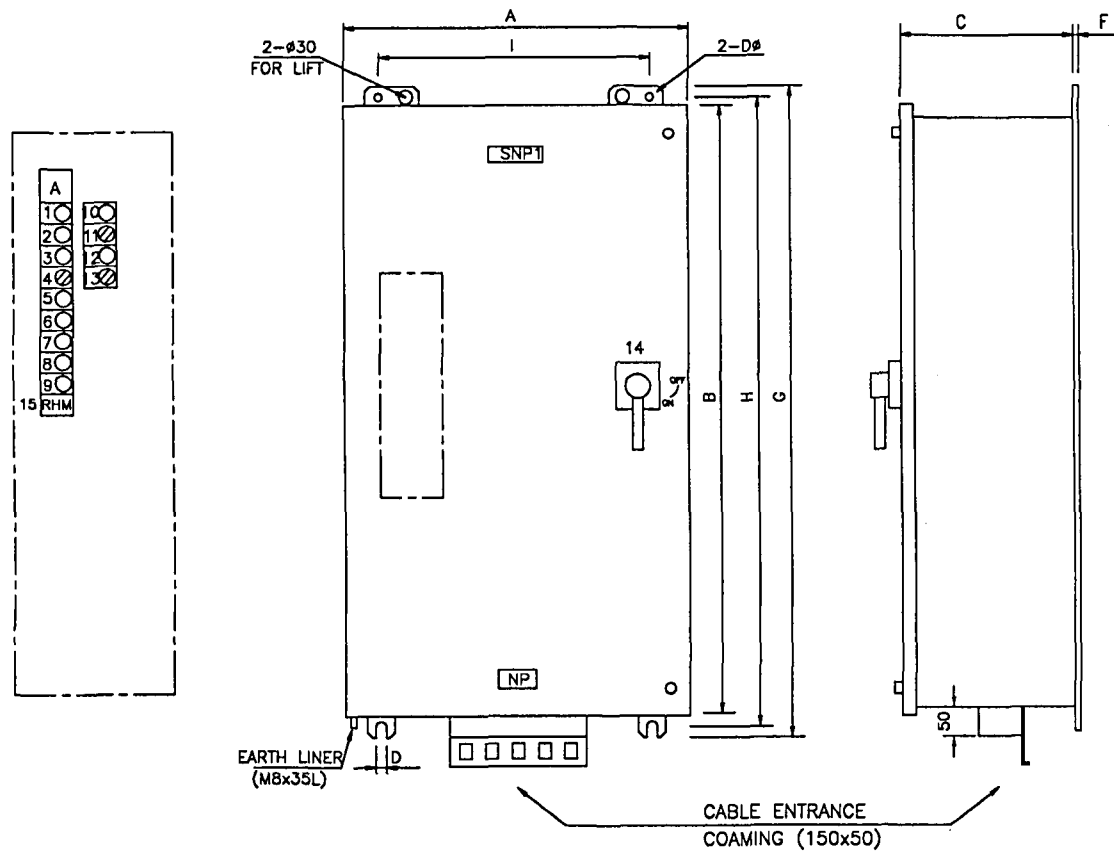
1. APPLICATION : CL, 06A, DMI, DM4
2. MATERIAL : ALUMINUM
3. LETTER : BLACK

(5) LETTER EXAMPLE

1. APPLICATION : CLA, 04A, TG1, TG2
2. MATERIAL : PHENOLIC
3. GROUND : WHITE
4. LETTER : BLACK

type	a	b	c(φ)	d(φ)			REMARK
CL	42	53	30	-			
CLA	35	45	23	-			
06A	60	42	31	-			
04A	48	34	23	-			
DMI	55	55	8	3			
DMJ	45	45	25	-			
TG1	20	40	13	-			
TG2	30	50	13	-			

REV	TITLE		DRAW No.	
	NAME PLATE MODEL		KTM-0038-08-0	
	KTE		DISK No.	SHEET
			D4437S8	No. 8



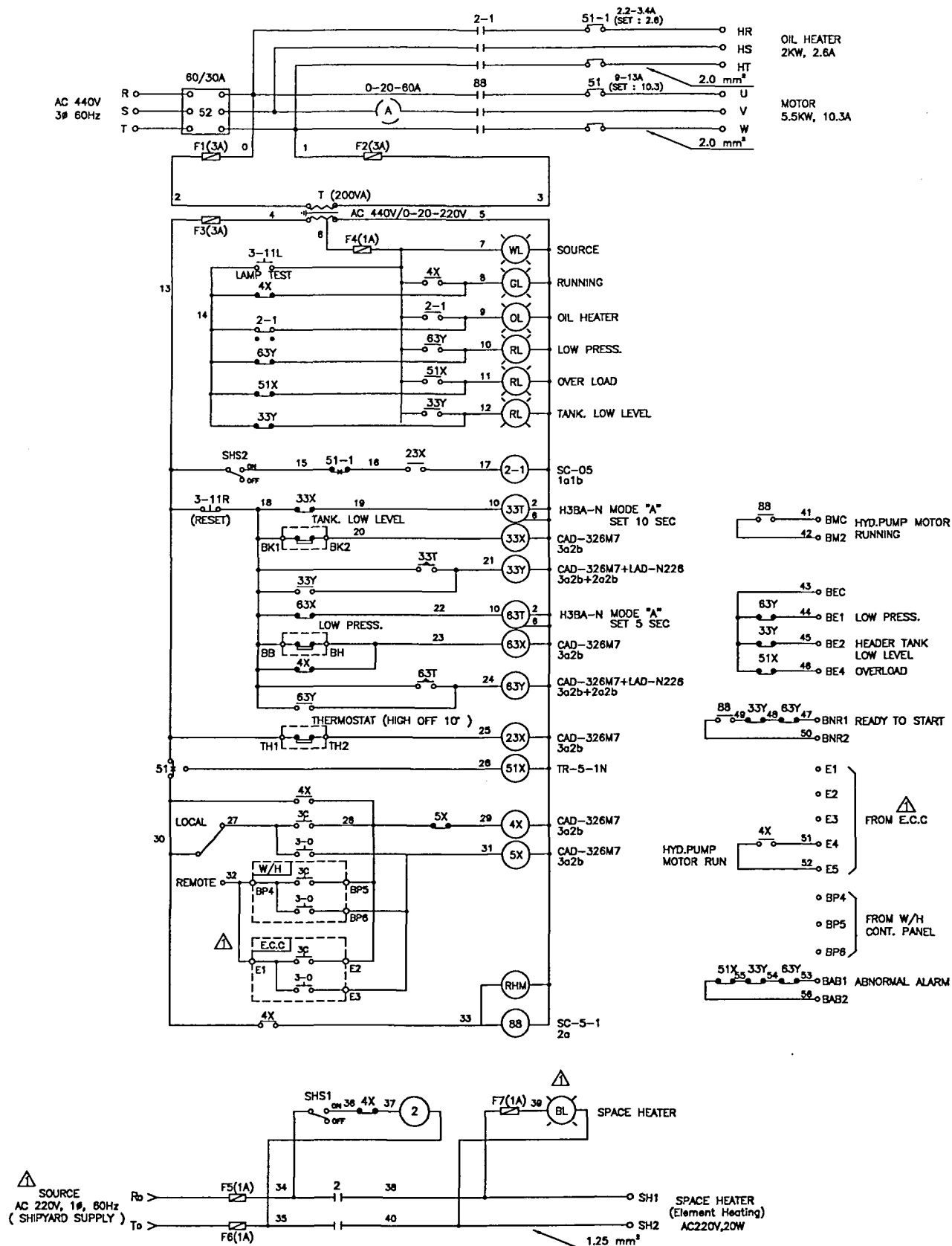
USE	NO	DIMENSION								WT	COAMING SIZE
		A	B	C	D	F	G	H	I		
	05	280	330	205	12	6	380	350	200	15	100x50
	06	280	430	205	12	6	480	450	200	20	100x50
	08	330	530	205	12	6	590	550	200	25	100x50
	10	380	530	205	15	6	590	550	200	35	100x50
	14	430	580	205	15	6	640	600	300	40	100x50
	18	480	730	205	15	6	790	750	300	60	150x50
	19	530	830	255	15	6	890	850	350	70	150x50
	20	530	930	255	15	6	990	950	350	80	150x50
	23	530	930	305	15	6	990	950	350	90	150x50
	24	530	1030	305	15	6	1090	1050	350	110	150x50
	25	580	1030	255	15	6	1090	1050	350	90	250x50
	26	580	1030	305	15	6	1090	1050	350	105	250x50
	27	580	1230	305	19	6	1290	1250	350	115	250x50
	28	580	1430	305	19	6	1490	1450	350	125	250x50
	29	580	1630	305	19	6	1690	1650	350	135	250x50

A	AMMETER				
1	SOURCE	W	11	OIL HEATER(ON-OFF)	
2	RUNNING/START	G	12	SPACE HEATER	B
3	STOP	R	13	SPACE HEATER(ON-OFF)	
4	LOCAL-REMOTE	B	14	DOOR	
5	OVER LOAD	R	15	RUNNING HOUR METER	
6	LOW PRESS.	R	16		
7	LOW LEVEL	R	17		
8	LAMP TEST	B	18		
9	RESET	B	19		
10	OIL HEATER	O	20		

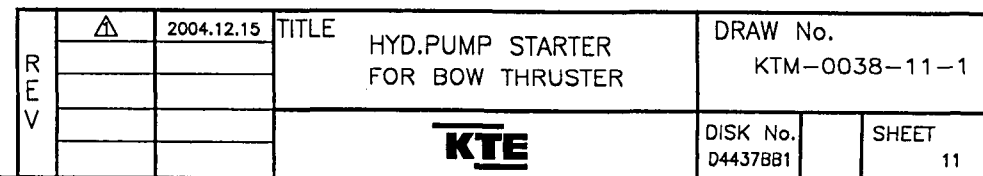
NAME PLATE TYPE : 04A, SNP1,2-7A

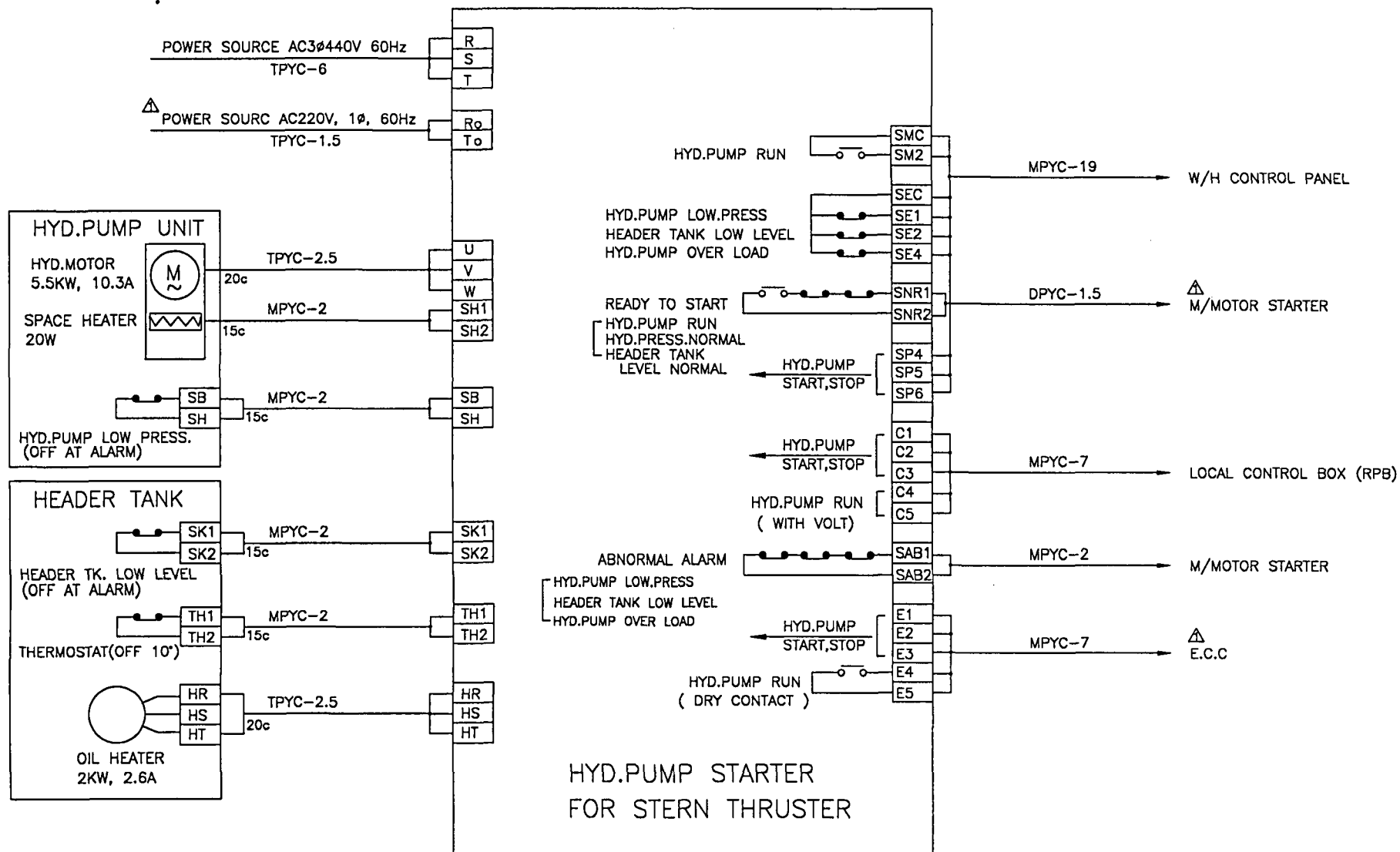
	ITEM No.	STARTER NAME
SNP1	1	HYD.PUMP STARTER FOR BOW THRUSTER
SNP1	2	HYD.PUMP STARTER FOR STERN THRUSTER
ENCLOSURE	☐ IP22 ☐ IP23 ☒ IP44	

REV	2004.12.15	TITLE	DRAW No.	
		HYD.PUMP STARTER FOR BOW/STERN THRUSTER	KTM-0038-09-1	
		KTE	DISK No.	SHEET
			D443701	No. 9

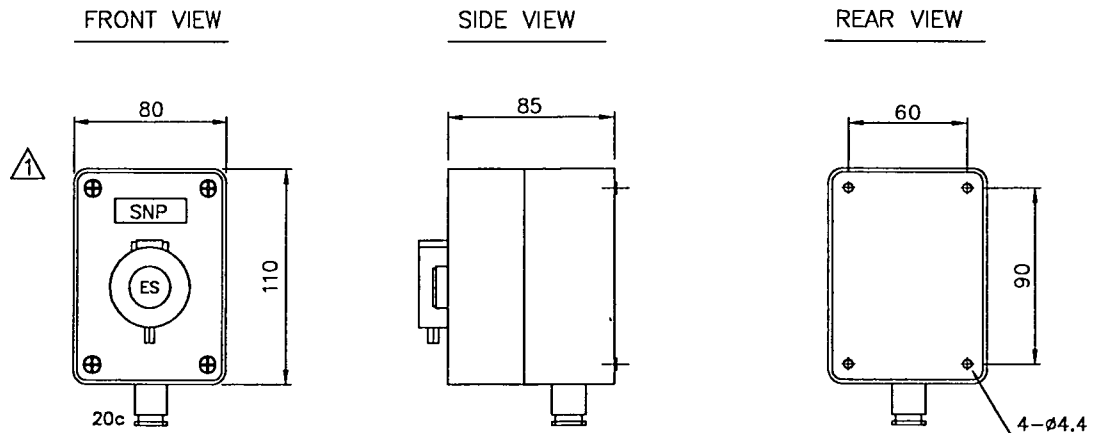


R E V	△	2004.12.15	TITLE	CONNECTION DIAGRAM (HYD.PUMP STARTER FOR BOW THRUSTER)	DRAW No. KTM-0038-10-1		
					DISK No.		SHEET
					D4437BD1		10





REV	△	2004.12.15	TITLE	HYD.PUMP STARTER FOR STERN THRUSTER		DRAW No. KTM-0038-13-1	
			KTE		DISK No. 04437SB1	SHEET 13	

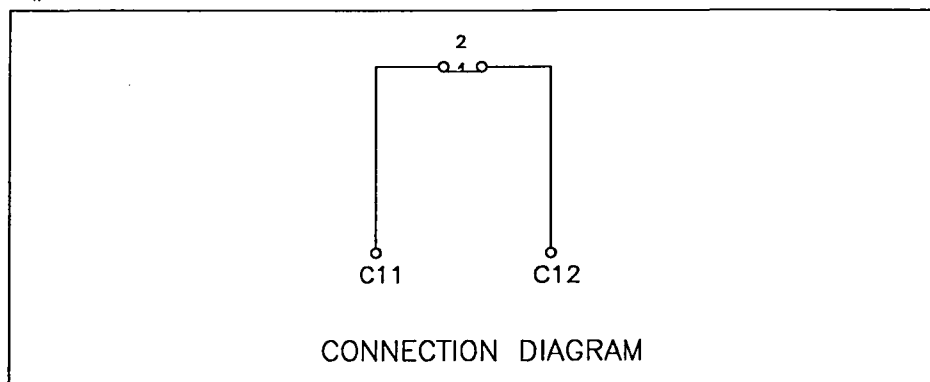


NOTE

1. COLOR : MAKER STANDARD (GRAY)
2. MATERIAL : ACRYLONITRILE
BUTADIENE STYRENE
(NON-INFLAMMABLE)
3. WEIGHT : 0.5KG

1	RUNNING/START	G
2	STOP	R

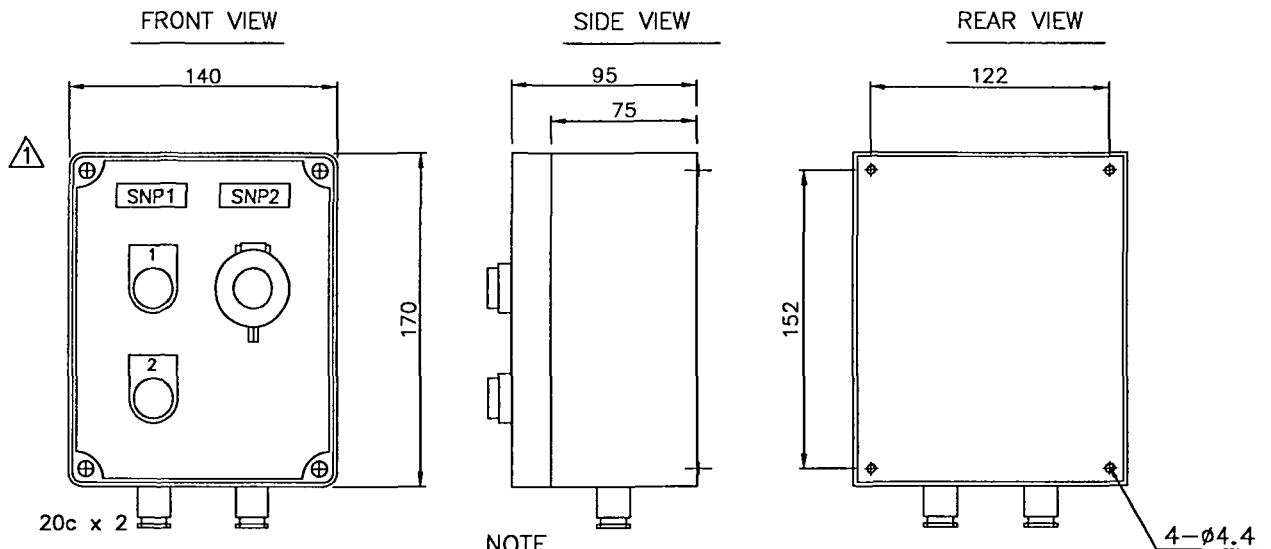
#1



NAME PLATE TYPE : 2A

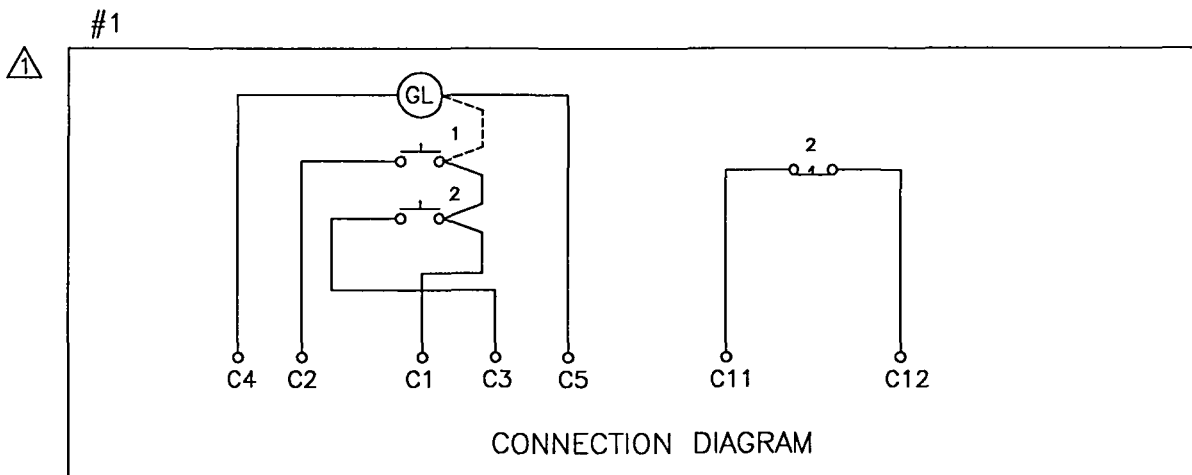
No.	SYM.	NAME	SETS	CABLE GLAND	CONN. DIA.	P.B W/LAMP		LOCK P.B		ENCLOS. PROTEC.
						GREEN	Q'T	RED	Q'T	
1	SNP	EM'CY STOP FOR BOW THRUSTER	1	20C	#1			XB5-AH45	1	IP56

REV	⚠	2004.12.15	TITLE LOCAL CONTROL BOX (RPB) FOR BOW THRUSTER	DRAW No. KTM-0038-14-1		
			KTE	DISK No. D4437RPB		SHEET 14



1	RUNNING/START	G
2	STOP	R

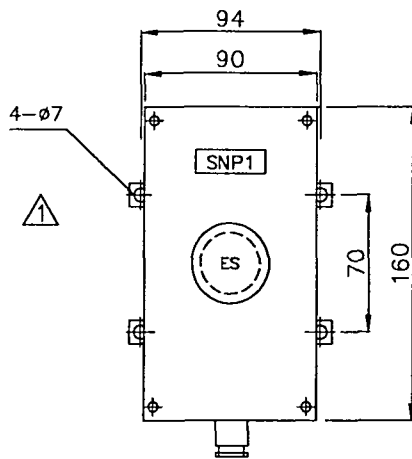
1. COLOR : MAKER STANDARD (GRAY)
2. MATERIAL : ACRYLONITRILE
BUTADIENE STYRENE
(NON-INFLAMMABLE)
3. WEIGHT : 0.95KG



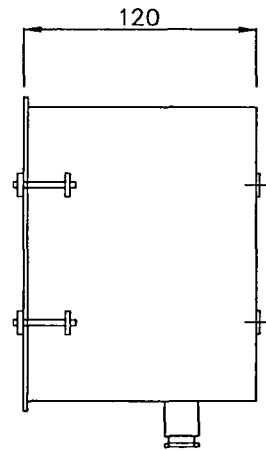
NAME PLATE TYPE : 2A

No.	SYM.	NAME	SETS	CABLE GLAND	CONN. DIA.	P.B W/LAMP		P.B		LOCK P.B		ENCLOS. PROTEC.
						GREEN	Q'T	RED	Q'T	RED	Q'T	
1	SNP1	HYD. OIL PUMP	1	20C	#1	XB5-AW 3365	1	XB5-AA45	1			IP56
	SNP2	EM'CY STOP FOR STERN THRUSTER								XB5-AH45	1	

REV	△	2004.12.15	TITLE	DRAW No.
			LOCAL CONTROL BOX (RPB) FOR STERN THRUSTER	KTM-0038-14-1-1
			KTE	DISK No.
				D4437RPB
				SHEET
				14-1



FRONT VIEW

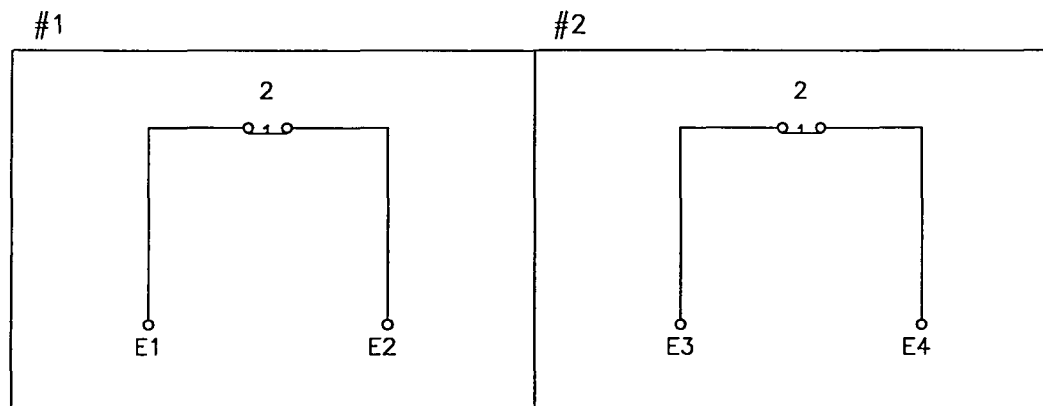


SIDE VIEW

1	RUNNING/START
2	STOP

NOTE

1. COLOR : RED
IN AN EMERGENCY
BREAK THE GLASS
AND PUSH THE BUTTON
2. MATERIAL : STEEL PLATE
3. WEIGHT : 1.7KG

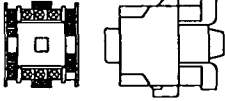
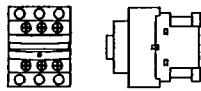
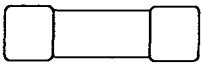
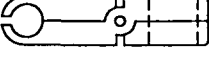


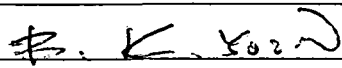
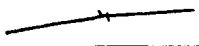
NAME PLATE TYPE : 2A

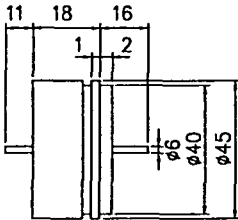
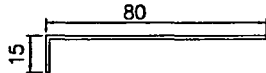
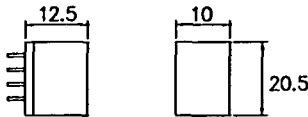
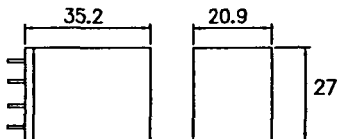
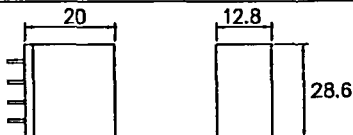
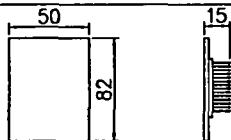
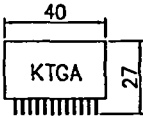


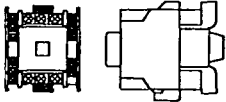
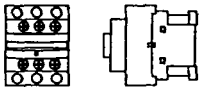
No.	SYM.	NAME	SETS	CABLE GLAND	CONN. DIA.	P.B W/LAMP		LOCK P.B		ENCLOS. PROTEC.
						GREEN	Q'T	RED	Q'T	
1	SNP	EM'CY STOP FOR BOW THRUSTER	1	20C	#1			XB5-AH45	1	IP56
2	SNP	EM'CY STOP FOR STERN THRUSTER	1	20C	#2			XB5-AH45	1	IP56

R E V	△	2004.12.15	TITLE EM'CY STOP BUSH BUTTON BOX FOR FORWARD AND AFT MOORING DECK	DRAW No. KTM-0038-15-1		
			KTE	DISK No. D4437ES		SHEET 15

HYD.PUMP STARTER & LOCAL CONTROL BOX SPARE FOR BOW/STERN THRUSTER (COMMON USE)					PAGE NO.	
					BOX No.	
No.	NAME	S K E T C H	SUPPLY PER SHIP			REMARKS
			WORKING	SPARE		
1	MAGNETIC CONTACTOR		2	1		SC-5-1, AC220V
			4	1		SC-05, AC220V
2	CONTROL RELAY		16	2	3a2b	CAD-326M7, AC220V
3	AUX. RELAY	"	8	1	2a2b	CAD-N226, AC220V
4	TIME RELAY		4	1		H3BA-N, AC220V
5	BULB FOR SIGNAL LAMP		18	18		BA9S 24V 2W
6	FUSE		8	8		SB-C1, 1A
			6	6		SB-C1, 3A
7	LAMP TONGS		-	1		
8	FUSE PULLER		-	1		
9	SPARE PARTS BOX		-	1		STEEL BOX 350x200x200(WxDxH)
10						
R E V			TITLE			DRAW No.
			SPARE PARTS LIST.			KTM-0038-16-0
						DISK No.
						D4437SPL1
						16

BIBLIOGRAPHY		
OWNER	A.P.MOLLER	
SNO.	H-4437/38/41	DNV
SHIPYARD	DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.	
BOW THRUSTER (TCT-220) STERN THRUSTER (TCT-200) ELECTRIC PART - REMOTE CONTROL SYSTEM - HYD. PUMP STARTER / LOCAL CONTROL BOX SPARE PARTS & TOOLS LIST		
KTE KTE Co.,Ltd. MECHATRONICS DIVISION - BUSAN. KOREA -		
APPROVED		
CHECKED		
DRAWN	P. S. KIM	
TRACED	P. S. KIM	
DATE	Dec. 15, 2004	
DWG. NO.	KJ9630-001-0	

HNO		4437/4438/4441						
U S E		BOW/STERN THRUSTER REMOTE CONTROL SYSTEM						
ITEM NO	NAME OF PART	OUTLINE	QUANTITY			REMARKS		
			WORKING		SPARE			
			PER SET	PER VESS				
1	POTENTIOMETER		6	6	1	MIDORI CPP-45B 4TAP		
2	1.5mm HEXAGON RENCH				1			
3	CONTROL RELAY		24	24	3	⚠ NAIS DS2E-M-DC24V		
4	CONTROL RELAY		4	4	1	HANKUK RELAY HR705-4PL. DC24V		
5	CONTROL RELAY		18	18	2	NAIS JW2SN-DC24V		
6	COMMON CARD		2	2	2	KT COMM. CARD		
7	HYBRID IC		20	20	2	KT ALARM. CARD		
8								
9								
R E V	⚠	2004.12.15	TITLE SPARE PARTS LIST			DRAW No.		
						KTM-0037-26-1		
							DISK No. D4437SP1	SHEET No.

HYD.PUMP STARTER & LOCAL CONTROL BOX SPARE FOR BOW/STERN THRUSTER (COMMON USE)					PAGE NO.		
					BOX No.		
No.	NAME	S K E T C H	SUPPLY PER SHIP			REMARKS	
			WORKING	SPARE			
1	MAGNETIC CONTACTOR		2	1		SC-5-1, AC220V	
			4	1		SC-05, AC220V	
2	CONTROL RELAY		16	2	3a2b	CAD-326M7, AC220V	
3	AUX. RELAY	"	8	1	2a2b	CAD-N226, AC220V	
4	TIME RELAY		4	1		H3BA-N, AC220V	
5	BULB FOR SIGNAL LAMP		18	18		BA9S 24V 2W	
6	FUSE		8	8		SB-C1, 1A	
			6	6		SB-C1, 3A	
7	LAMP TONGS		-	1			
8	FUSE PULLER		-	1			
9	SPARE PARTS BOX		-	1		STEEL BOX 350x200x200(WxDxH)	
10							
R E V			TITLE SPARE PARTS LIST			DRAW No. KTM-0038-16-0	
						DISK No.	
						D4437SPL1	
						16	

