

DOCUMENT FOR

- ☒ INFORMATION
- ☐ APPROVAL
- ☐ CONSTRUCTION
- ☐ FINAL

INSTALLATION, OPERATING & MAINTENANCE MANUAL

CLIENT :

PROJECT :

ITEM NAME :

SERIAL NO. :

FOR INFORMATION

SHEET 1 OF 127

-	-	ISSUED FOR INFORMATION	K.T.KANG	S.H.LEE	M.S.KAM
NO.	DATE	DESCRIPTION	PRE'D BY	CHK'N BY	APP'D BY

DYNAMIC & SPECIAL COMPANY



Head office & factory :

33, Noksansandan 17ro 78beon-gil, Gangseogu , Busan-si, Korea

Tel : +82 51 973 7895 , Fax : +82 51 973 4894

E-Mail : dasco@dascohex.com



INSTALLATION, OPERATING & MAINTENANCE MANUAL

Table of Contents

1.0	Erection for Forced Draft
2.0	Lubrication Instructions
3.0	Check Up
4.0	Starting Up
5.0	Maintenance and Routine Checking
6.0	Long Time Storage Protection (Over 3 Months)
Appendix A. Fan Installation, Operation & Maintenance Manual	
Appendix B. Motor Installation, Operation & Maintenance Manual	
Appendix C. Belt Tension Value	
Appendix D. Lubricant List	
Appendix E. Tooth Belt Specification & Pulley Drawing	



INSTALLATION, OPERATING & MAINTENANCE MANUAL

These instructions have been prepared to facilitate the erection, installation and maintenance of the equipment supplied by DASCO and to offer the customers the best procurement conditions and delivery time of details.

The equipment dealt with in these instructions should be assembled by qualified and experienced erection personnel with references in the field of air cooler erection according to code API 661, 2013.

Erection and commissioning shall be carried out in strict conformity with the instructions contained in this manual.

Any problem relative to the implantation of these instructions shall be reported in writing (facsimile) to DASCO after sale service specified in this manual, which will answer as soon as possible.

DASCO responsibility cannot be engaged when these clauses are not met.

Furthermore, should you meet any problem, please contact the following

- AFTER SALES DEPARTMENT

DASCO CO., LTD.

33, Noksansandan 17ro 78beon-gil, Gangseogu , Busan-si, Korea

Tel : +82.51.973.7895, E-mail : tsd1@dascohex.com

- THERMAL DESIGN DEPARTMENT

HEAT SOLUTION CORPORATION

Hi Air Korea BLDG 1F, 10, Sasang-ro 181 beon-gil, Sasang-gu, Busan, Korea

Tel : +82.51.715.9981, E-mail: hs@heatsolution.co.kr

- MECHANICAL DESIGN DEPARTMENT

HEAT SOLUTION CORPORATION

Hi Air Korea BLDG 1F, 10, Sasang-ro 181 beon-gil, Sasang-gu, Busan, Korea

Tel : +82.51.715.9981, E-mail: hs@heatsolution.co.kr

- PRODUCTION DEPARTMENT & Q.A. DEPARTMENT

DASCO CO., LTD.

33, Noksansandan 17ro 78beon-gil, Gangseogu , Busan-si, Korea

Tel : +82.51.973.7895, E-mail : tsd1@dascohex.com



INSTALLATION, OPERATING & MAINTENANCE MANUAL

1.0 Erection for Forced Draft Type

1.1 The following documents should be consulted before undertaking erection work :

1.1.1 This instruction manual

1.1.2 General arrangement drawing

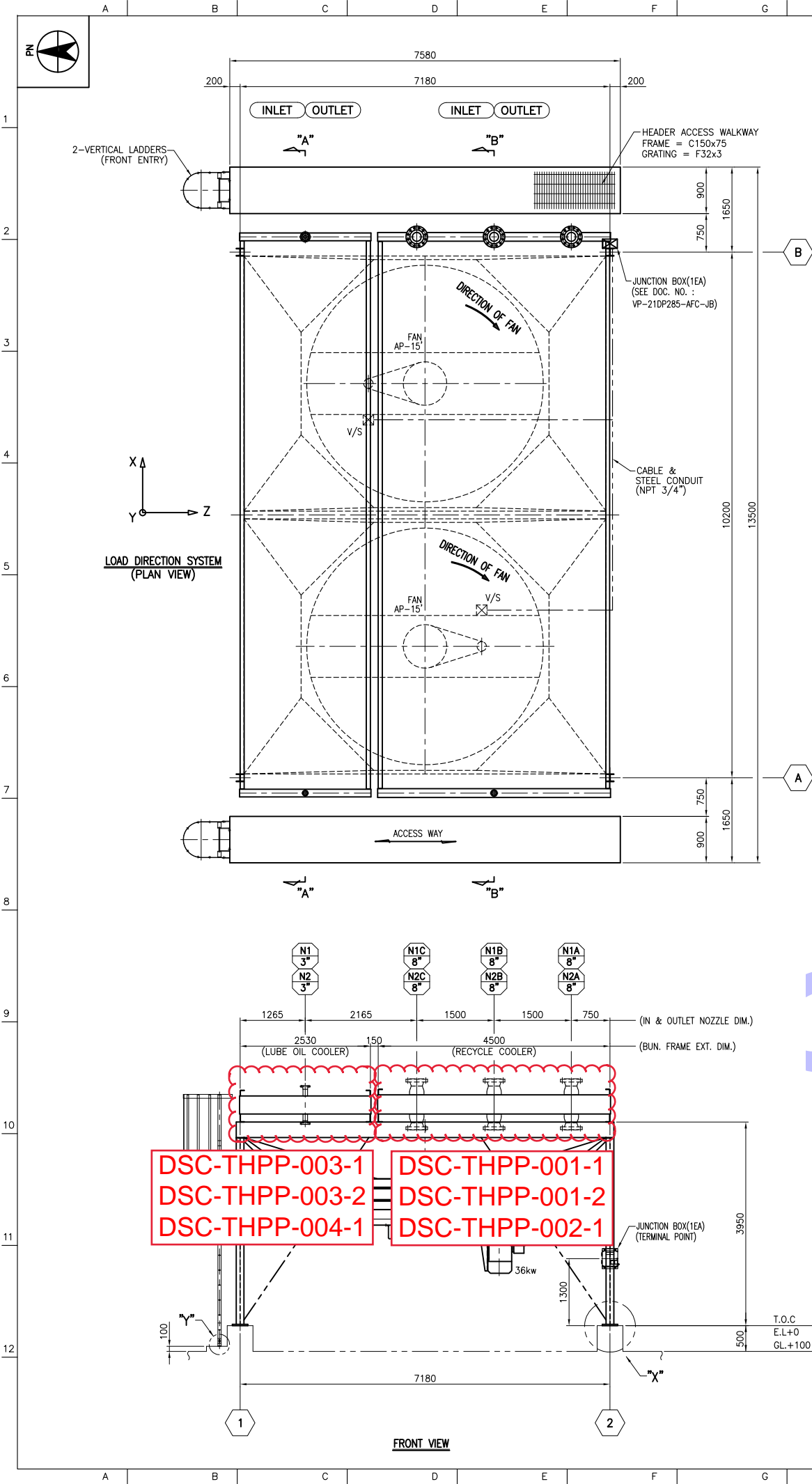
1.1.3 Steel structure outline and steel structure detail drawing

1.1.4 Driving unit assembly and detail drawing

1.1.5 Walkway & ladder details drawing

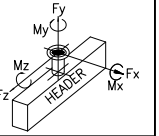
1.1.6 Raceway drawing

SAMPLE



NOTE

1. THE TOTAL OF ALL NOZZLE LOADS ON ONE MULTI-BUNDLE BAY SHALL NOT EXCEED 3 TIMES THAT ALLOWED FOR A SINGLE HEADER (API 661-2013)



* MAXIMUM ALLOWABLE MOMENTS AND FORCES FOR NOZZLES AND HEADERS (2 TIMES OF THE VALUES OF API 661)

ITEM NO.	NOZ. SIZE	MOMENTS (N.m)			FORCES (N)		
		Mx	My	Mz	Fx	Fy	Fz
RECYCLE COOLER	NPS 8"	6100	12200	4480	11380	26680	16020
LUBE OIL COOLER	NPS 3"	820	1220	820	4000	3380	4000

DISPLACEMENT OF HEADERS (Z DIRECTION) INSIDE BUNDLE FRAMES IN RELATION WITH MAXIMUM ALLOWABLE FORCES VALUES ON NOZZLES (mm)

HEADER-INLET/OUTLET	MAXIMUM DISPLACEMENT	ALLOWABLE DISPLACEMENT
RECYCLE COOLER	±6	±6
LUBE OIL COOLER	±6	±6

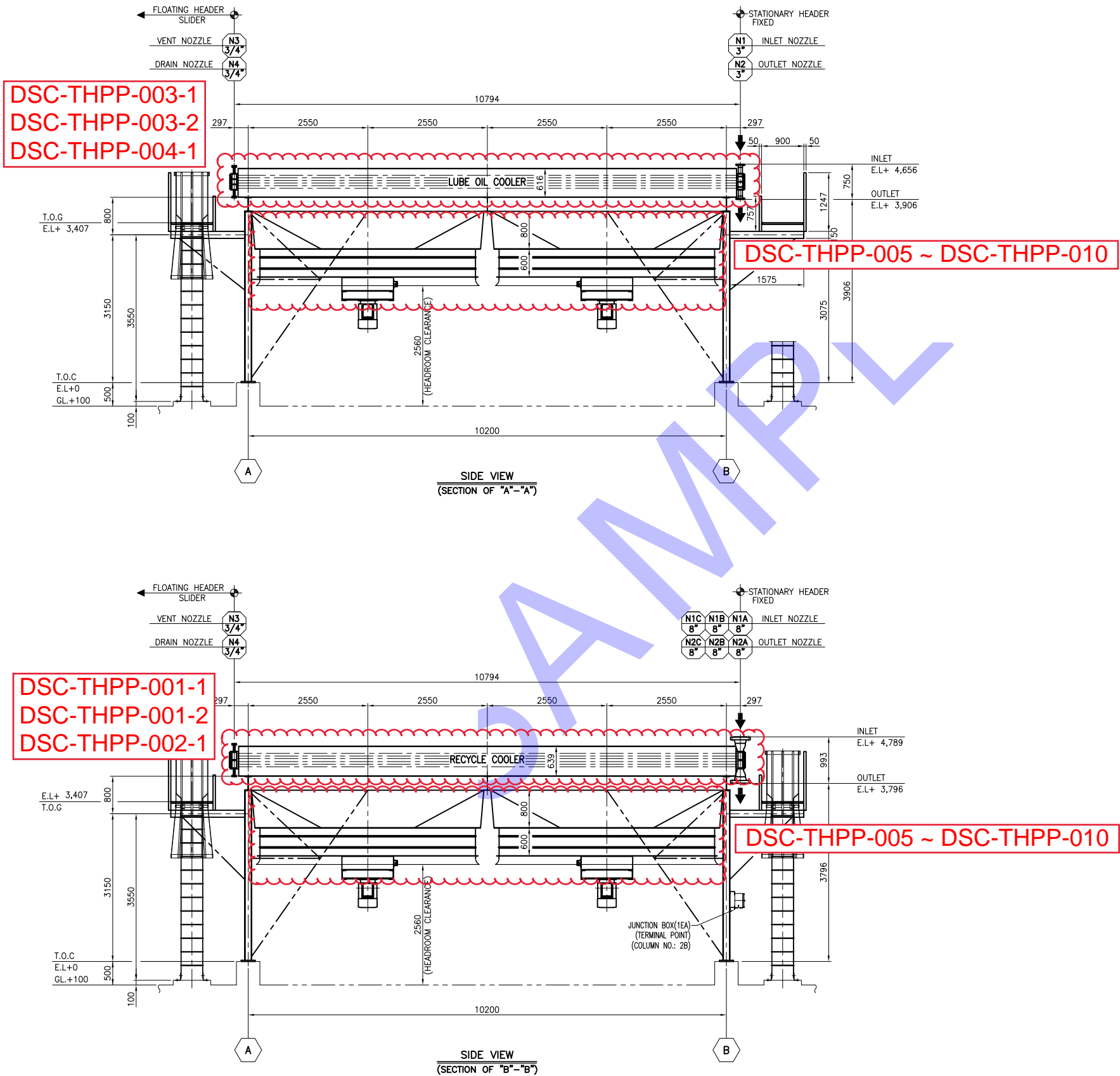
GENERAL NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED.
2. DESIGNED PER API-661 SEVENTH ED. 2013.
- OVERALL TOLERANCES PER API-661, FIG.10 AND APPLICABLE SPECIFICATION.
3. SURFACE PROTECTION : SEE PAINTING PROCEDURE. (DOC. NO. VP-21DP285-AFC-PP)
4. BUNDLES ARE FITTED WITH TEFLON SLIDING PAD.
- AND INLET HEADERS ARE FIXED IN FX DIRECTION (FINTUBE DIRECTION)
5. HEADER STOP BOLTS SHALL BE REMOVED AFTER INSTALLATION. (YELLOW PAINTING) (TRANSPORTATION ONLY) - CAUTION -
6. ALL CARBON STEEL BOLT/NUT/WASHER ARE SUPPLIED HOT DIP GALVANIZED.
7. INTERNAL PROTECTION : N2 (0.3~0.5 barg) WITH PRESSURE GAUGE SHALL BE FURNISHED.

FOR APPROVAL

REV.	DATE	DESCRIPTION	PROPOSED BY	CHECKED BY	APPROVED BY
Δ	2022.05.23	FOR APPROVAL	K.T.KANG	M.S.KIM	S.K.LEE
Δ	2022.02.17	FOR APPROVAL	K.T.KANG	M.S.KIM	S.K.LEE
Δ	2022.01.12	FOR APPROVAL	K.T.KANG	M.S.KIM	S.K.LEE
Δ	2021.11.04	FOR APPROVAL	K.T.KANG	M.S.KIM	S.K.LEE
PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT					
PROJECT Co: MITSUBISHI POWER, LTD.					
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.					
VENDOR: DYNAMIC SPECIAL COMPANY					
DASCO					
AIR COOLED HEAT EXCHANGER GENERAL ARRANGEMENT DRAWING					
PREPARED BY: K.T.KANG	DATE: 2022.05.23	TITLE			
CHECKED BY: M.S.KIM	DATE: 2022.05.23				
APPROVED BY: S.K.LEE	DATE: 2022.05.23				
PAGE: 1/2	SCALE: 1/50	DOCUMENT NUMBER: VP-21DP285-AFC-GA	REV: 3		

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



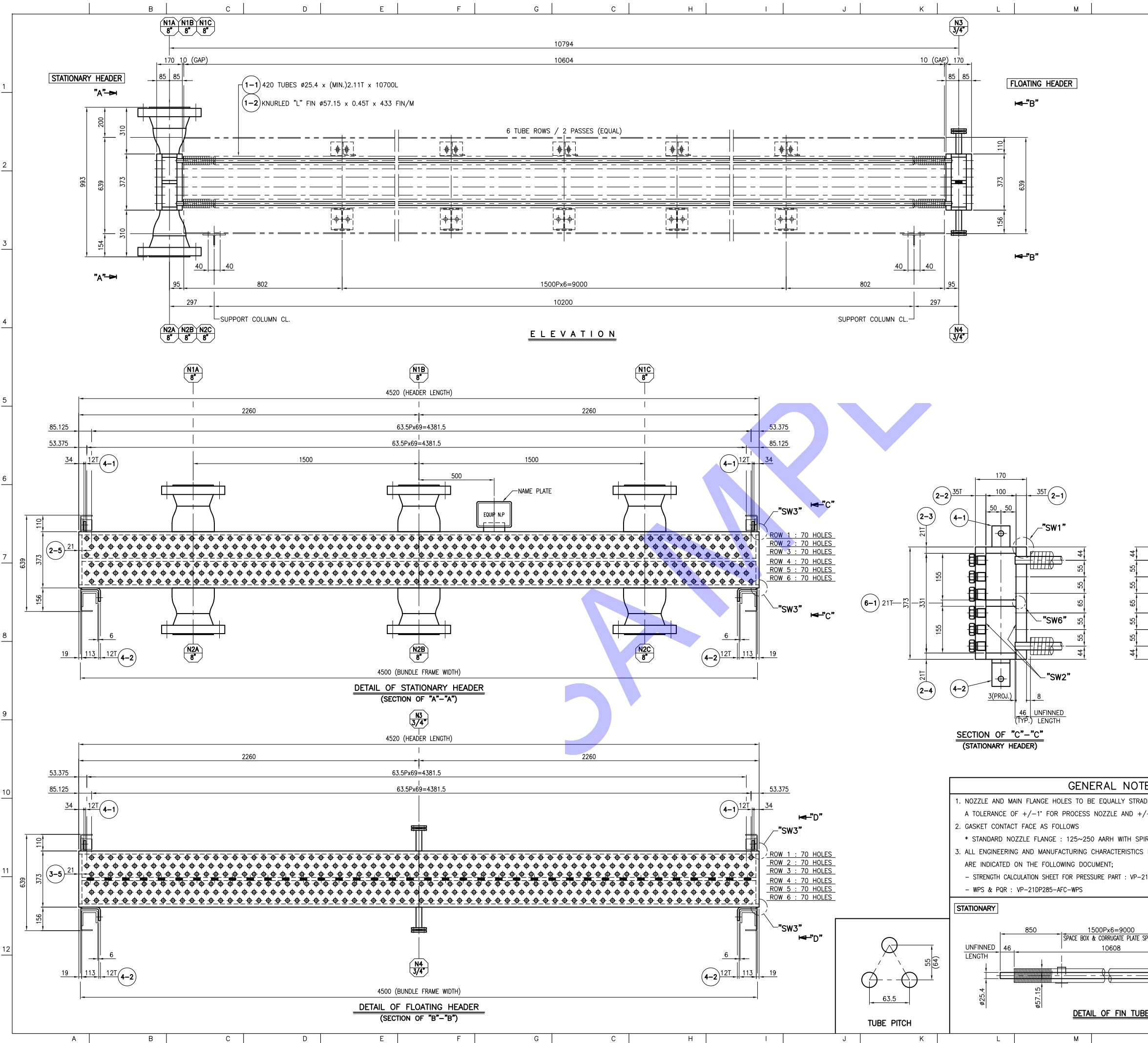
DESIGN & TEST DATA			
CODE	ASME SEC. VIII DIV.1 2019 ED. + API 661 7TH ED.		
CODE STAMP / N.B	NO / NO	ITEM NAME	RECYCLE COOLER
BUNDLE Q'TY	3 BAY(S) / 3 BUNDLE(S)	TYPE	PLUG
SERVICE NAME	RECYCLE COOLER		
DESIGN PRESSURE	barg 59.0	TEST PRESSURE	barg 88.5
DESIGN TEMPERATURE	°C 150 / 12	WEIGHT (PER BUNDLE)	kg 14,600
		WEIGHT (ERECTION)	kg 35,800
FAN DIA. [ø] / BLADE ANGLE [°]	4,572 (15') mm / 12.48°		
FAN TYPE	MANUAL(TWO)		
MOTOR TYPE	100% DOL		
MOTOR OUTPUT	[kw] 36.0		
MOTOR SPECIFICATION (VOLT / PHASE / Hz)	380 x 3 x 50		
MOTORS AND TERMINAL BOXES	IP 55, Exd IIB T4		
HAZARDOUS AREA CLASSIFICATION	ZONE 1, DIVISION 1, GROUP D		

INFORMATION FOR CONNECTION					
ITEM NAME : RECYCLE COOLER					
NO.	NAME	SIZE	Q'TY	SCH.	REMARK
N1A~C	INLET	8"	3	160	ASME B16.5 Cl.600, WN.RF w/COUNT FLANGE, GASKET, BOLT/NUT
N2A~C	OUTLET	8"	3	160	ASME B16.5 Cl.600, WN.RF w/COUNT FLANGE, GASKET, BOLT/NUT
N3	VENT	3/4"	1	13.55T	ASME B16.5 Cl.600, LWN.RF w/B.F
N4	DRAIN	3/4"	1	13.55T	ASME B16.5 Cl.600, LWN.RF w/B.F

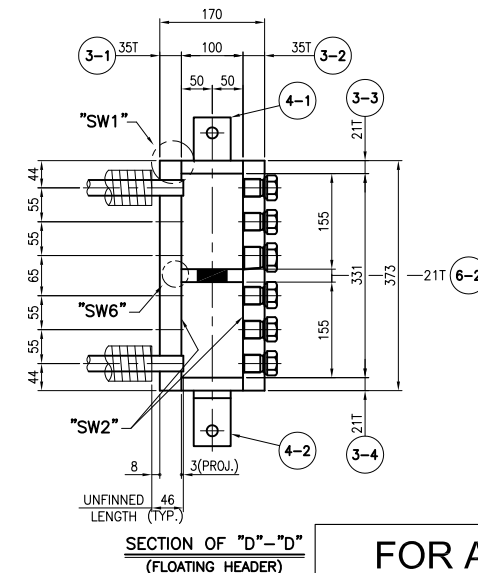
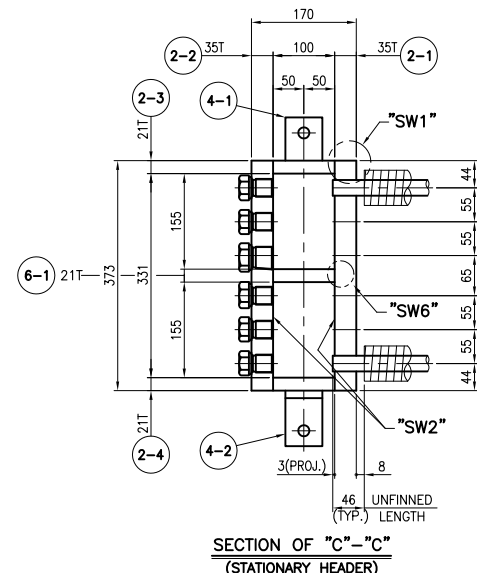
DESIGN & TEST DATA						
CODE	ASME SEC. VIII DIV.1 2019 ED. + API 661 7TH ED.					
CODE STAMP / N/B	NO / NO	ITEM NAME	LUBE OIL COOLER			
BUNDLE Q'TY	- BAY(S) / 3 BUNDLE(S)	TYPE	PLUG			
SERVICE NAME	LUBE OIL COOLER					
DESIGN PRESSURE	barg 11.0	TEST PRESSURE	barg 16.5			
DESIGN TEMPERATURE	°C 100 / 12	WEIGHT (PER BUNDLE)	kg 8,100			
INFORMATION FOR CONNECTION						
ITEM NAME : LUBE OIL COOLER						
NO.	NAME	SIZE	Q'TY	SCH.	DESCRIPTION	REMARK
N1	INLET	3"	1	160	ASME B16.5 Cl.150, WN.RF	w/COUNT FLANGE, GASKET, BOLT/NUT
N2	OUTLET	3"	1	160	ASME B16.5 Cl.150, WN.RF	w/COUNT FLANGE, GASKET, BOLT/NUT
N3	VENT	3/4"	1	8.55T	ASME B16.5 Cl.150, LWN.RF	w/B.F
N4	DRAIN	3/4"	1	8.55T	ASME B16.5 Cl.150, LWN.RF	w/B.F

FOR APPROVAL

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



DESIGN & TEST DATA									
CODE		ASME SEC. VIII DIV.1 2019 ED. + API 661 7TH ED.							
CODE STAMP / N.B		NO / NO		FLUID NAME		NATURAL GAS			
BUNDLE Q'TY		3 BAY(S) / 3 BUNDLE(S)		EQUIPMENT NO.		10/20/30EXH01-AC001			
TYPE		PLUG		DESIGN TEMPERATURE °C		150 / 12			
DESIGN PRESSURE		barG 59.0		OPER. TEMP. (IN./OUT.) °C		109.4 / 52.0			
OPER. PRESSURE		barG 52.52							
TEST PRESSURE				WEIGHT kg (PER BUNDLE)		EMPTY		14,600	
		barG 88.5				FULL OF WATER		16,350	
M.A.W.P. (=DESIGN PRESSURE)		barG 59.0		POST WELD HEAT TREATMENT		YES			
		barG		N.D.E		FULL (UT) + PT			
MDMT °C		12.0		CORR. ALLOWANCE mm		3.0			
NOZZLE SCHEDULE (for ONE BUNDLE)									
MARK	NOM SIZE	NO.	SCH. (mm)	FLANGE				SERVICE	REMARKS
				RATING	TYPE	FACE			
N1A-C	8"	3	160	ASME B16.5 CL600	WN	RF	INLET		w/OUNT FLANGE, GASKET, BOLT/NUT
N2A-C	8"	3	160	ASME B16.5 CL600	WN	RF	OUTLET		w/OUNT FLANGE, GASKET, BOLT/NUT
N3	3/4"	1	13.55T	ASME B16.5 CL600	LWN	RF	VENT		w/B.F
N4	3/4"	1	13.55T	ASME B16.5 CL600	LWN	RF	DRAIN		w/B.F
PART LIST [3 SET(S) TO BE MANUFACTURED]									
PART NO.	PART NAME	MATERIAL	DIMENSIONS	Q'TY		UNIT	WEIGHT (KG)		
				PER 1 SET	INSTAL		SPARE	UNIT	TOTAL
1	1 TUBE	SA179	ø25.4x(MIN.)2.11T-10700L	420		EA	13	5460.0	
	2 KNURLED "L" FIN	ALUMINUM	ø57.15x0.45Tx433 FIN/M	420		EA	7.6	3192.0	
2	1 TUBE SHEET(STATIONARY)	SA516-70	35Tx373x4520	1		EA	463.2		
	2 PLUG SHEET(STATIONARY)	SA516-70	35Tx373x4520	1		EA	463.2		
	3 TOP PLATE(STATIONARY)	SA516-70	21Tx100x4520	1		EA	74.5		
	4 BTM. PLATE(STATIONARY)	SA516-70	21Tx100x4520	1		EA	74.5		
	5 END PLATE(STATIONARY)	SA516-70	21Tx100x330	2		EA	5.4	10.8	
3	1 TUBE SHEET(FLOATING)	SA516-70	35Tx373x4520	1		EA	463.2		
	2 PLUG SHEET(FLOATING)	SA516-70	35Tx373x4520	1		EA	463.2		
	3 TOP PLATE(FLOATING)	SA516-70	21Tx100x4520	1		EA	74.5		
	4 BTM. PLATE(FLOATING)	SA516-70	21Tx100x4520	1		EA	74.5		
	5 END PLATE(FLOATING)	SA516-70	21Tx100x330	2		EA	5.4	10.8	
TOTAL WEIGHT :								10824.4	KG



FOR APPROVAL

GENERAL NOTE

- NOZZLE AND MAIN FLANGE HOLES TO BE EQUALLY STRADDLE OF HEADER MAIN AXIS WITH A TOLERANCE OF +/-1" FOR PROCESS NOZZLE AND +/-2" FOR AUXILIARY CONNECTIONS
- GASKET CONTACT FACE AS FOLLOWS
* STANDARD NOZZLE FLANGE : 125~250 AARH WITH SPIRAL SERRATED.
- ALL ENGINEERING AND MANUFACTURING CHARACTERISTICS NOT MENTIONED ON THIS DWG. ARE INDICATED ON THE FOLLOWING DOCUMENT;
- STRENGTH CALCULATION SHEET FOR PRESSURE PART : VP-21DP285-AFC-STR
- WPS & PQR : VP-21DP285-AFC-WPS

STATIONARY

FLOATING

DETAIL OF FIN TUBE

		</					

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

NOZZLE SCHEDULE (for ONE BUNDLE)									
MARK	NOM SIZE	NO.	SCH. (mm)	FLANGE			SERVICE		REMARKS
				RATING	TYPE	FACING			
N1	3"	1	160	ASME B16.5 Cl.150	WN	RF	INLET		w/COAT FLANGE, GASKET, BOLT/NUT
N2	3"	1	160	ASME B16.5 Cl.150	WN	RF	OUTLET		w/COAT FLANGE, GASKET, BOLT/NUT
N3	3/4"	1	8.55T	ASME B16.5 Cl.150	LWN	RF	VENT		w/B.F
N4	3/4"	1	8.55T	ASME B16.5 Cl.150	LWN	RF	DRAIN		w/B.F

PART LIST [3 SET(S) TO BE MANUFACTURED]

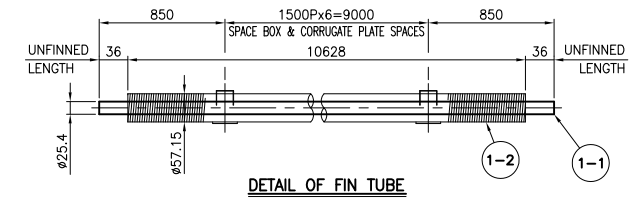
PART NO.	PART NAME	MATERIAL	DIMENSIONS	Q T Y			WEIGHT (KG)	
				PER 1 SET	UNIT	TOTAL		
1	1 TUBE	SA179	ø25.4x(MIN.)2.11T-10700L	234	EA	13	3042.0	
2	2 KNURLED "L" FIN	ALUMINUM	ø57.15x0.45Tx433 FIN/M	234	EA	7.6	1778.4	
	1 TUBE SHEET(STATIONARY)	SA516-70	25Tx350x2550	1	EA		175.2	
	2 PLUG SHEET(STATIONARY)	SA516-70	25Tx350x2550	1	EA		175.2	
	3 TOP PLATE(STATIONARY)	SA516-70	12Tx100x2550	1	EA		24.0	
	4 BTM. PLATE(STATIONARY)	SA516-70	12Tx100x2550	1	EA		24.0	
3	5 END PLATE(STATIONARY)	SA516-70	12Tx100x326	2	EA	3.1	6.2	
	1 TUBE SHEET(FLOATING)	SA516-70	25Tx350x2550	1	EA		175.2	
	2 PLUG SHEET(FLOATING)	SA516-70	25Tx350x2550	1	EA		175.2	
	3 TOP PLATE(FLOATING)	SA516-70	12Tx100x2550	1	EA		24.0	
	4 BTM. PLATE(FLOATING)	SA516-70	12Tx100x2550	1	EA		24.0	
	5 END PLATE(FLOATING)	SA516-70	12Tx100x326	2	EA	3.1	6.2	
	TOTAL WEIGHT :				5629.6	KG		

	2022.05.31	FOR APPROVAL	K.T.XANG	M.S.KAM	S.K.LEE	
	2022.01.12	FOR APPROVAL	K.T.XANG	M.S.KAM	S.K.LEE	
	2021.11.08	FOR APPROVAL	K.T.XANG	M.S.KAM	S.K.LEE	
REV.	DATE	DESCRIPTION	FWPD BY	CMDR BY	APPO BY	

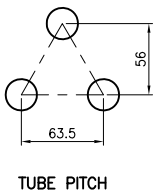
1. NOZZLE AND MAIN FLANGE HOLES TO BE EQUALLY STRADDLE OF HEADER MAIN AXIS WITH A TOLERANCE OF $+/-1'$ FOR PROCESS NOZZLE AND $+/-2'$ FOR AUXILIARY CONNECTIONS
2. GASKET CONTACT FACE AS FOLLOWS
 - * STANDARD NOZZLE FLANGE : 125~250 AARH WITH SPIRAL SERRATED.
3. ALL ENGINEERING AND MANUFACTURING CHARACTERISTICS NOT MENTIONED ON THIS DWG. ARE INDICATED ON THE FOLLOWING DOCUMENT;
 - STRENGTH CALCULATION SHEET FOR PRESSURE PART : VP-21DP285-AFC-STR
 - WPS & POR : VP-21DP285-AFC-WPS

STATIONARY

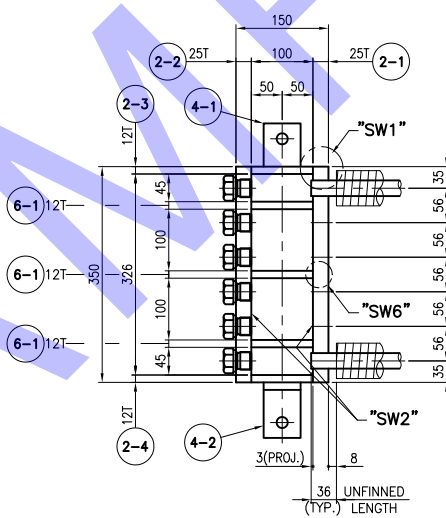
FLOATING



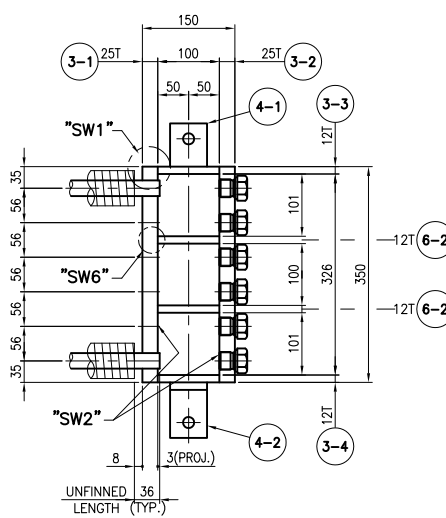
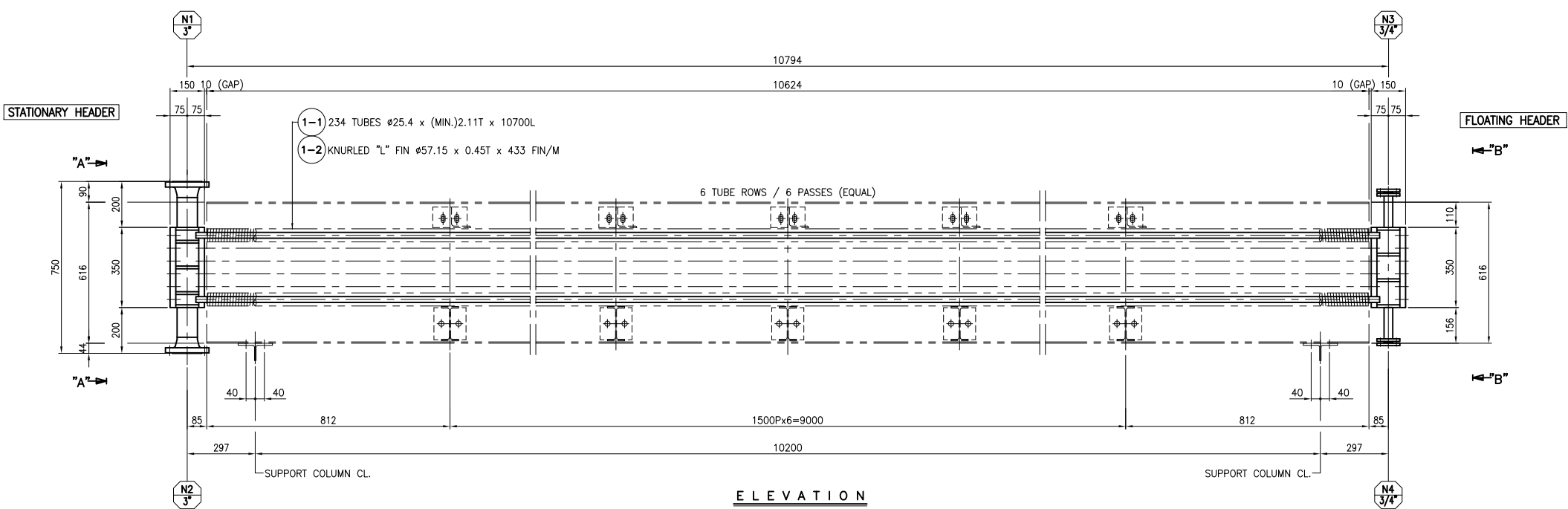
DETAIL OF FIN TUBE



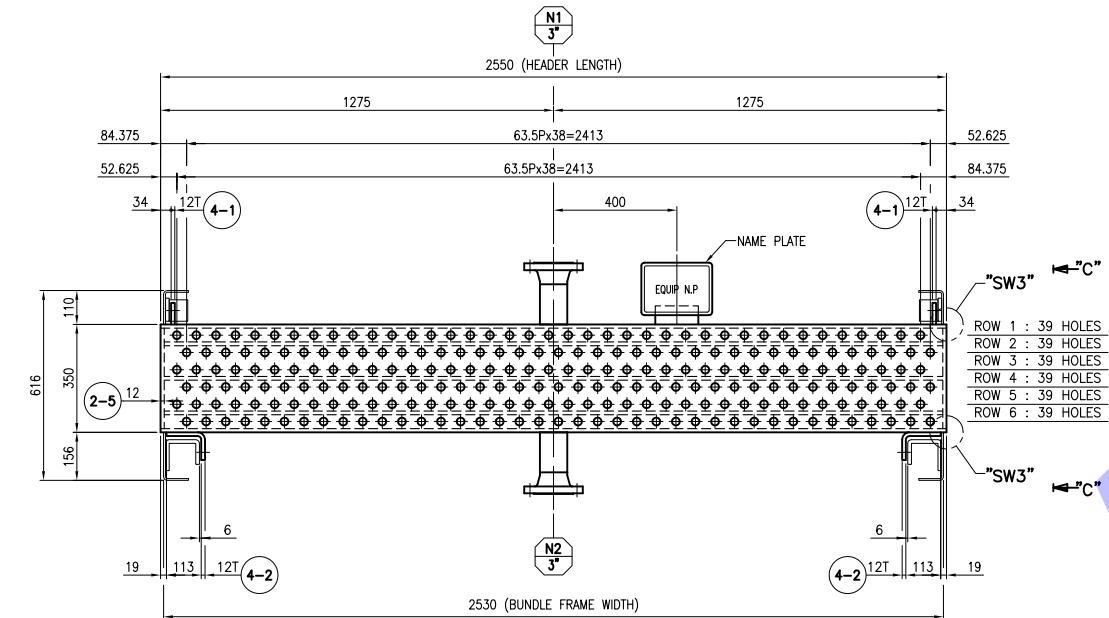
SECTION OF "C"—"C"
(STATIONARY HEADER)



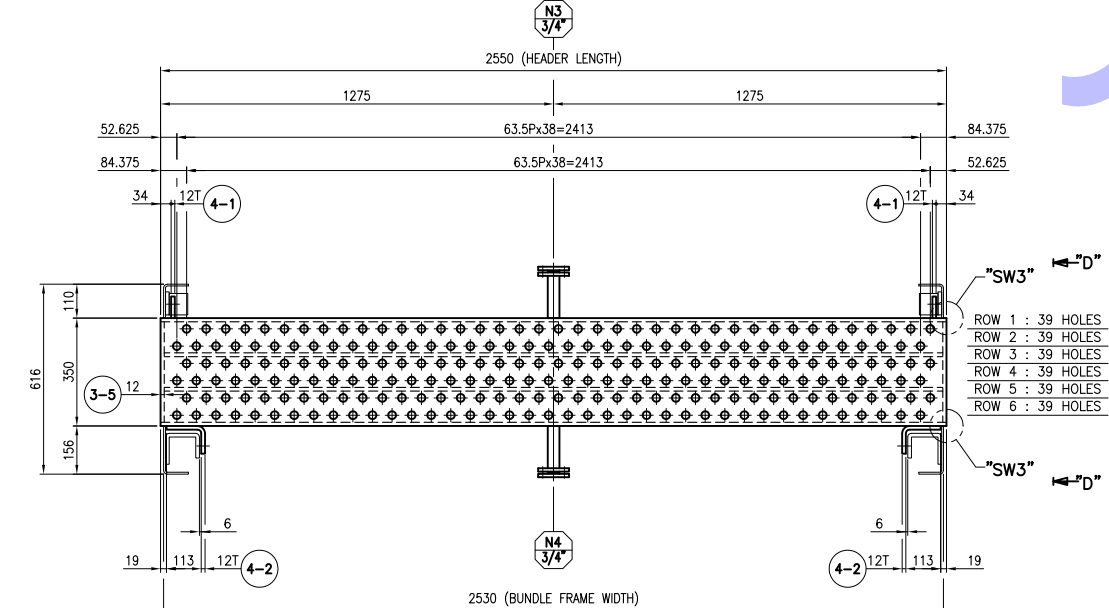
SECTION OF "D"—"D"
(FLOATING HEADER)

E L E V A T I O N

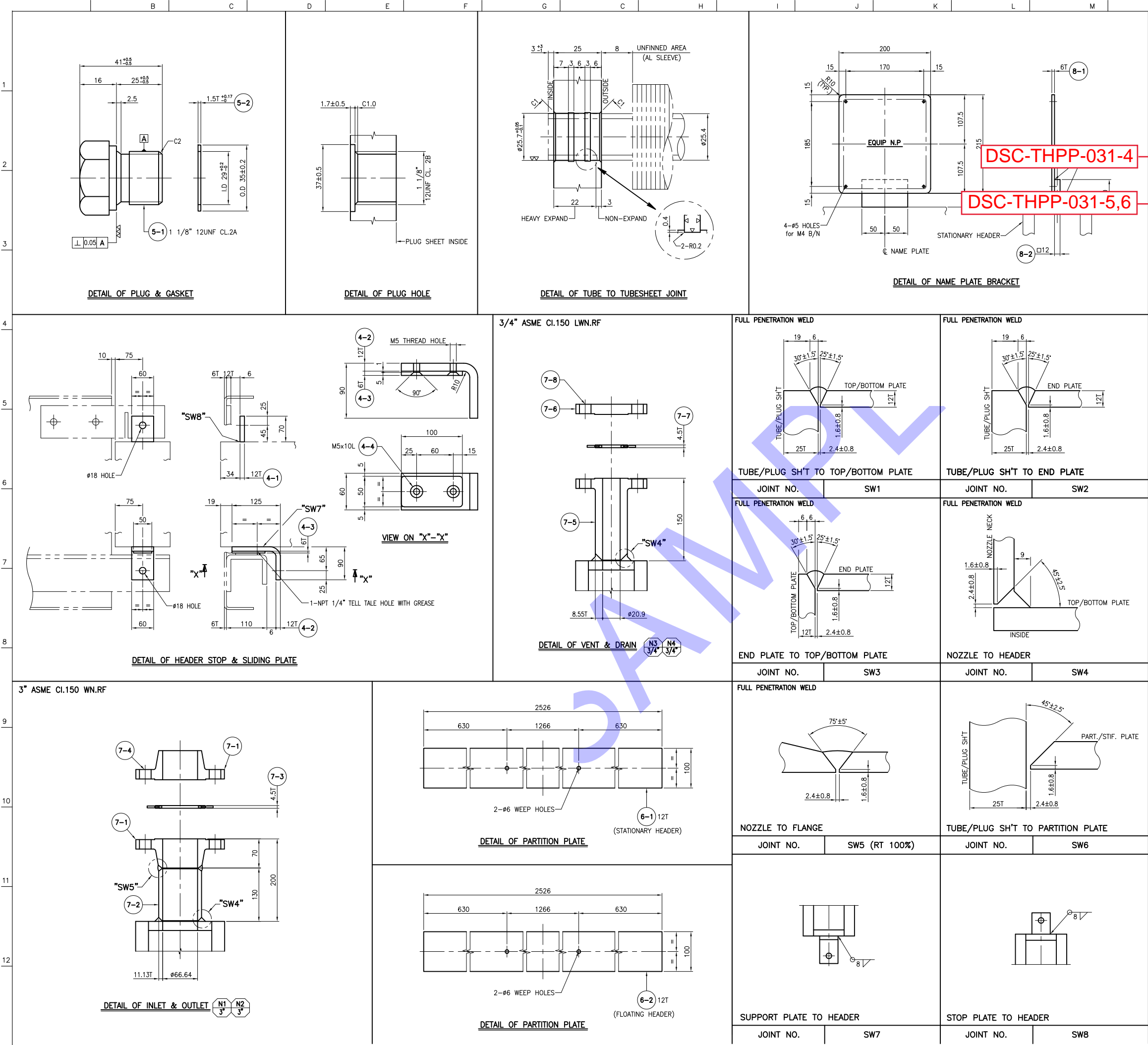
DETAIL OF STATIONARY HEADER
(SECTION OF "A"—"A")



DETAIL OF FLOATING HEADER
(SECTION OF "B"—"B")



CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



PART LIST [3 SET(S) TO BE MANUFACTURED]						
PART NO.	PART NAME	MATERIAL	DIMENSIONS	Q'TY PER 1 SET	WEIGHT (KG)	
4	1 STOP PLATE	SA516-70	12Tx60x70	4	EA	0.4 1.6
	2 SUPPORT PLATE	SA516-70	12Tx60x203	4	EA	1.1 4.4
	3 SLIDING PLATE	TEFLON	6Tx50x100	4	EA	0.1 0.4
	4 FLAT HEAD BOLT	304 S.S.	M5x10L	8	EA	
5	1 PLUG	SA105(N)	1 1/8" 12UNF CL.2A/2B-41L	468	EA	0.3 140.4
	2 PLUG GASKET	SOFT IRON	1.5Tx0.D35xL.D29	468	EA	2
6	1 PARTITION PLATE	SA516-70	12Tx100x2526	3	EA	23.8 71.4
	2 PARTITION PLATE	SA516-70	12Tx100x2526	2	EA	23.8 47.6
	1 FLANGE (SCH.160)	SA105(N)	3" ASME CL.150 WN.RF	2	EA	5.2 20.8
	2 NOZZLE NECK	SA106-B	3" SCH. 160-130L	2	EA	2.8 5.6
	3 GASKET	SEE NOTE 1	4.5Tx3" ASME CL.150 RF	2	EA	
	4 STUD B/2HEX. NUTS(H)	SA193-B7/SA194-2H	5/8"x11UNC-100L	8	SET	0.2 1.6
	5 FLANGE	SA105(N)	3/4" ASME CL.150 LWN.RF	2	EA	1.4 2.8
	6 BLIND FLANGE	SA105(N)	3/4" ASME CL.150 BL.RF	2	EA	0.6 1.2
	7 GASKET	SEE NOTE 1	4.5Tx3/4" ASME CL.150 RF	2	EA	
	8 STUD B/2HEX. NUTS(H)	SA193-B7/SA194-2H	1/2"x13UNC-70L	8	SET	0.8
8	1 NAME PLATE BRACKET	SS275 or EQ.	6Tx200x215	1	EA	2.0
	2 SUPPORT BAR	SA516-70	12Tx60x100	1	EA	0.6
TOTAL WEIGHT :				303.2	KG	

NOTE

- GASKET MATERIAL : SPRIAL WOUND GASKET WITH INNER & OUTER RING TYPE
 - HOOP : 304 S.S., FILLER : GRAPHITE
 - INNER RING : 304 S.S., OUTER RING : 304 S.S.

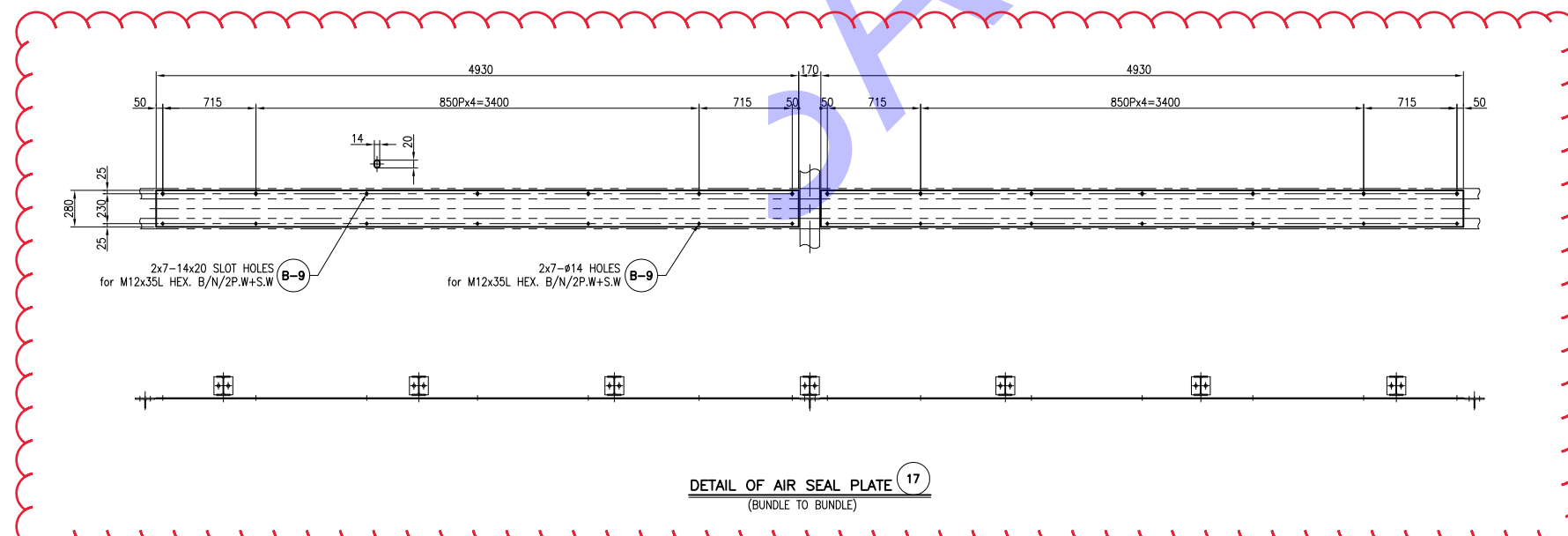
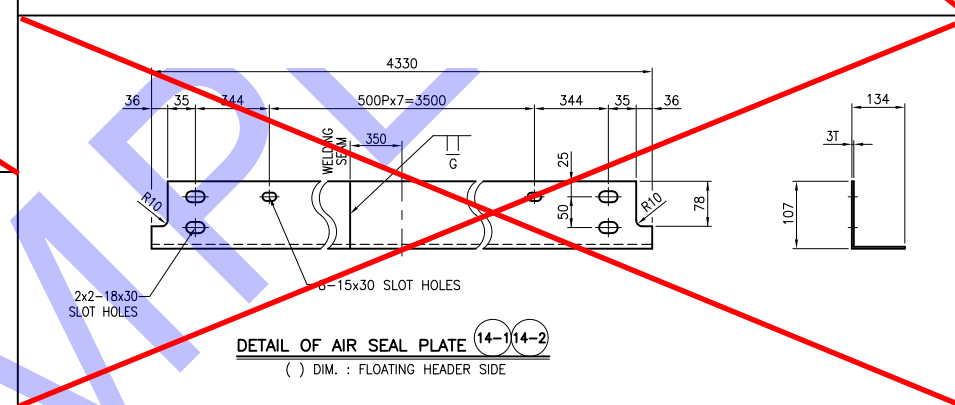
FOR APPROVAL

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



TOTAL WEIGHT : 1222.2 KG						
B	9	HEX. B/N/2P.W+S.W	SA307-A/SAB3-A 7136	M12x35L	44	EA
17	1	AIR SEAL PLATE	SM400A or EQ.	3Tx280x4930	2	EA 32.5
	2	SUP'T CHANNEL	SS275 or EQ.	C100x50x5/7.5-4452L	1	EA 41.
15	1	SUP'T CHANNEL	SS275 or EQ.	C100x50x5/7.5-4452L	1	EA 41.
	2	AIR SEAL PLATE	SM400A or EQ.	3Tx235x4330	1	EA 24
14	1	AIR SEAL PLATE	SM400A or EQ.	3Tx235x4330	1	EA 24
	2	AIR SEAL PLATE	SM400A or EQ.	3Tx177x4478	1	EA 18.
13	1	AIR SEAL PLATE	SM400A or EQ.	3Tx157x4478	1	EA 18.
	2	PLATE	SM400A or EQ.	8Tx138x145	14	EA 1.3
12	1	LOWER TUBE SUP'T	SS275 or EQ.	H148x100x6/9-4472L	7	EA 94.4
	2	PLATE	SM400A or EQ.	8Tx90x150	14	EA 0.8
11	1	UPPER TUBE SUP'T	SS275 or EQ.	L90x90x7T-4472L	7	EA 42.9
					INST. SPARE UNIT	UNIT
PART NO.					Q'TY	TOTAL WEIGHT
PART NAME					PFR 1 SET	(KG)
MATERIAL						
DIMENSIONS						

PART LIST [3 SET(S) TO BE MANUFACTURED]



DETAIL OF AIR SEAL PLATE (17)
(BUNDLE TO BUNDLE)

FOR CONSTRUCTION

	2022.04.04	FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
	2022.02.07	FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
REV.	DATE	DESCRIPTION	PREP BY	CMD BY	APP BY

PROJECT TITLE : THAILAND HINKONG POWER PLANT PROJECT

PROJECT GO. MITSUBISHI POWER, LTD.

EPC CONTRACTOR : HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

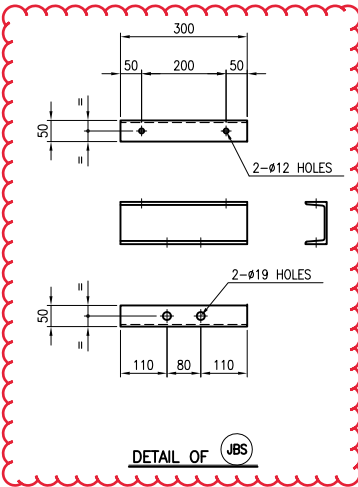
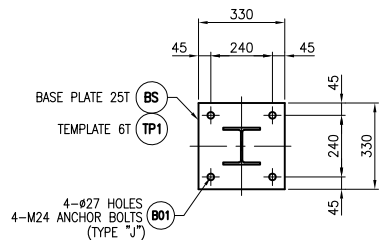
VENDOR : DYNAMIC & SPECIAL COMPANY

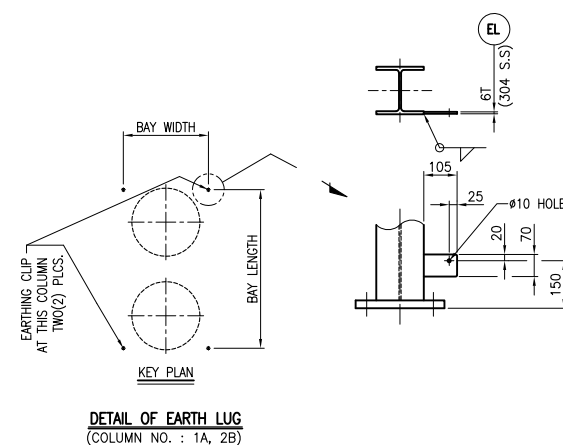
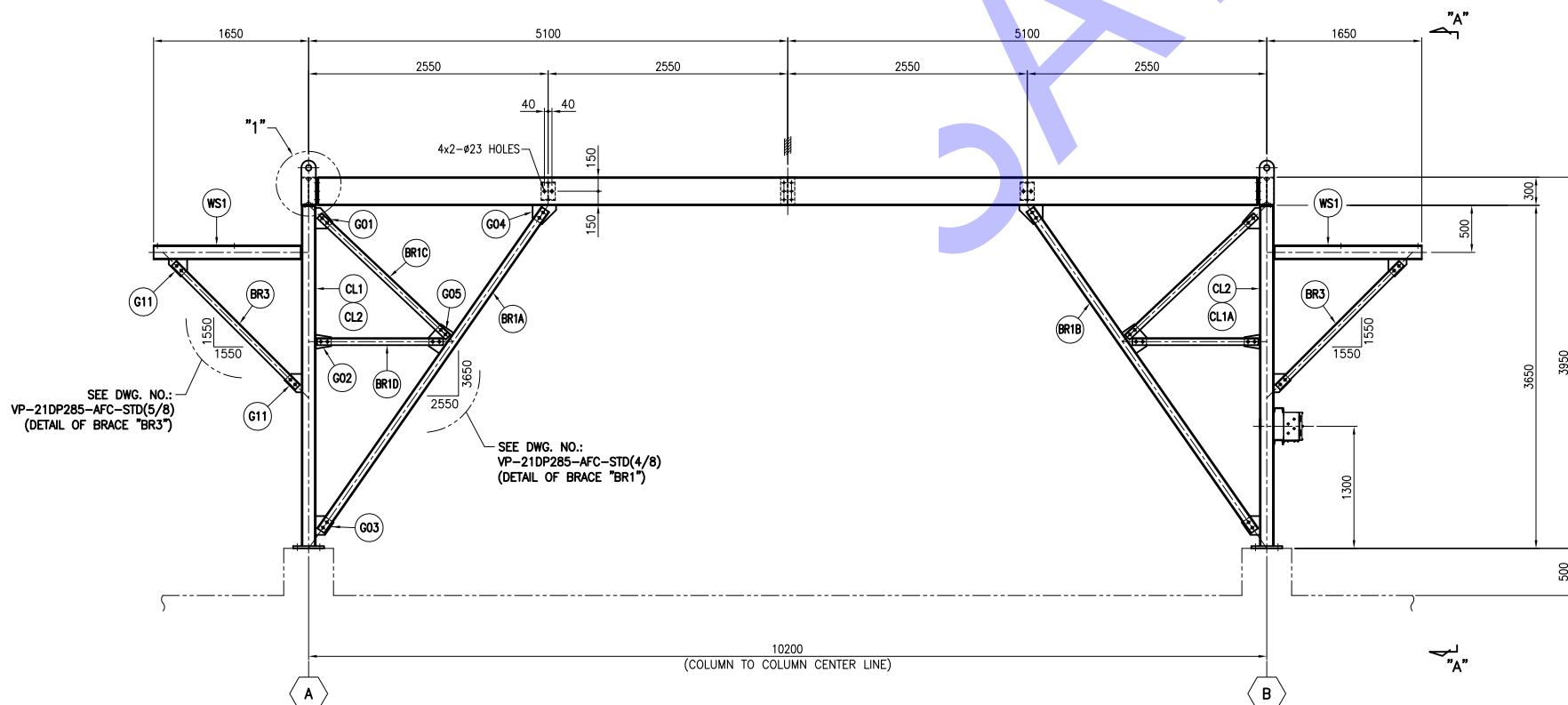
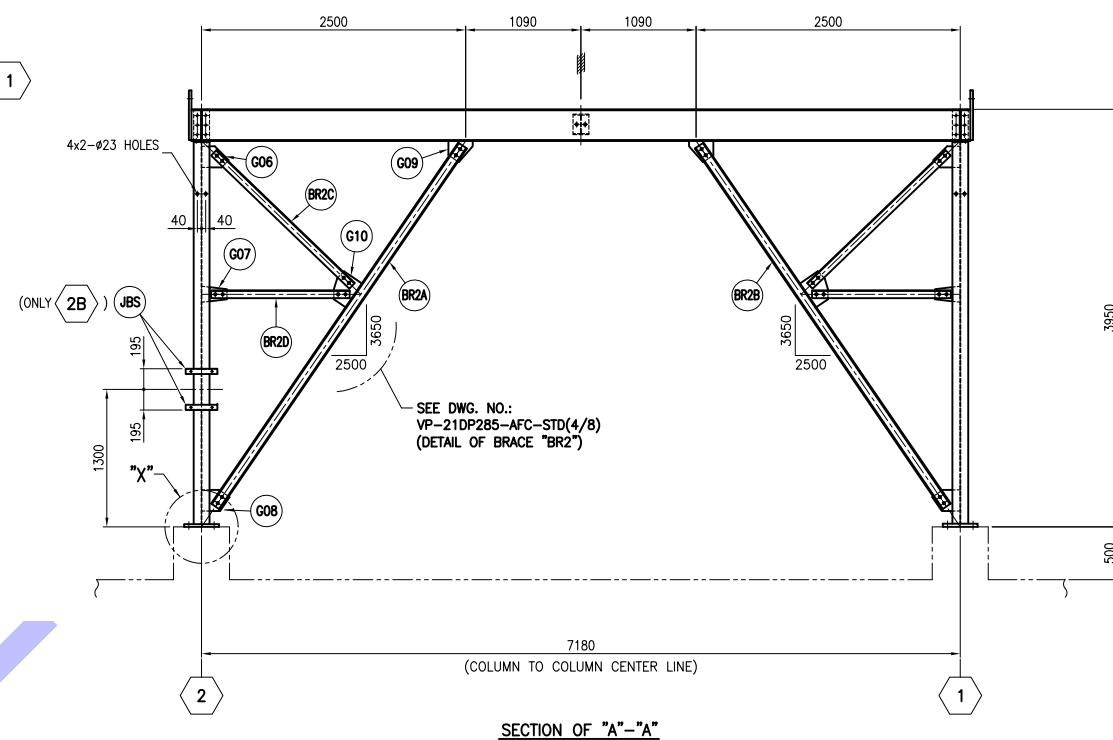
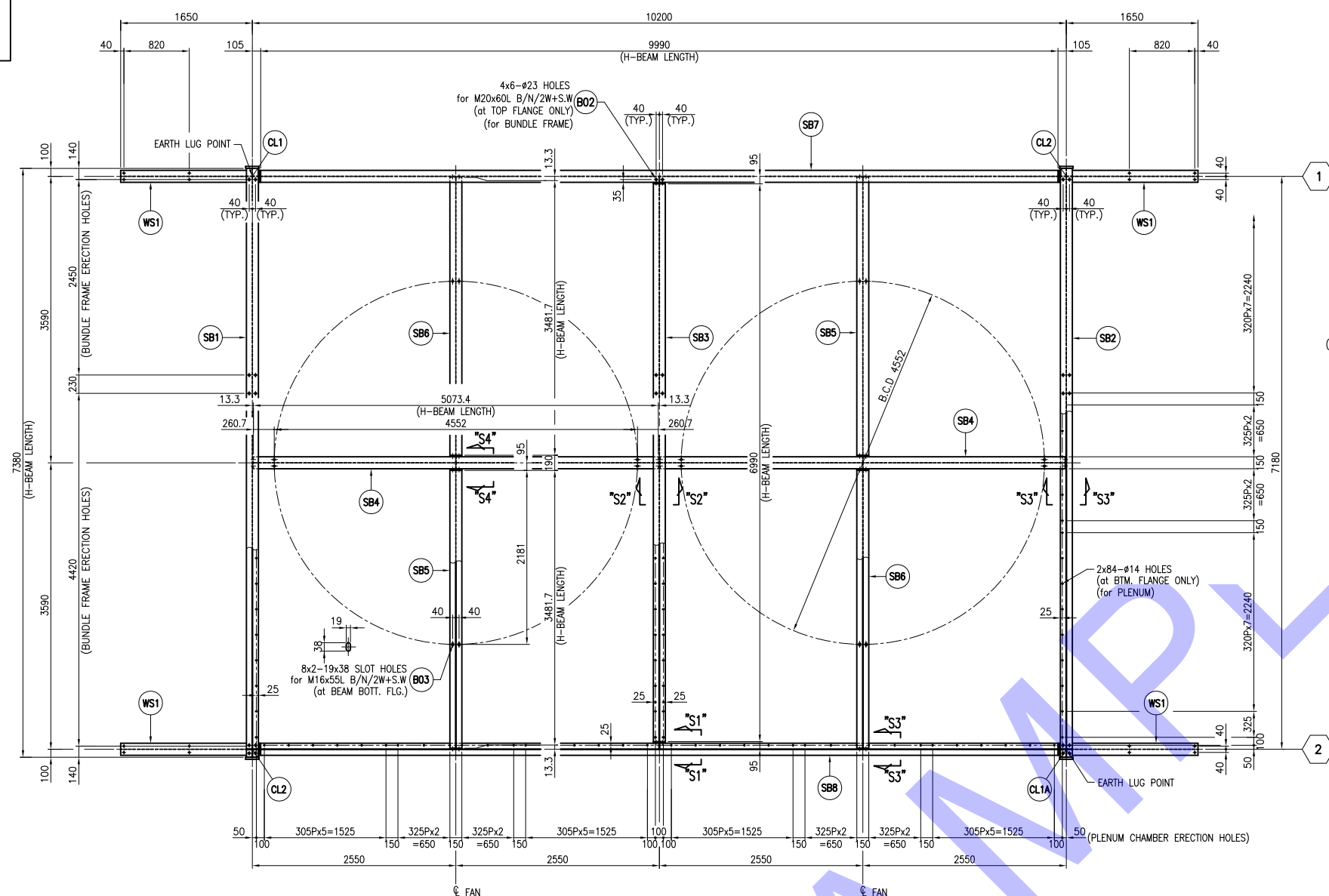
PREPARED BY K.T.KANG CHECKED BY M.S.KAM APPROVED BY S.K.LEE	DATE 2022.02.07 DATE 2022.02.07 DATE 2022.02.07	TITLE SIDE FRAME DETAIL DRAWING for RECYCLE COOLER
---	---	--

PAGE	SCALE	DRAWING NUMBER	REV.
3/8	1/25	VP-21DP285-AFC-BF	1

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

DETAIL OF BASE PLATE

[illegible]

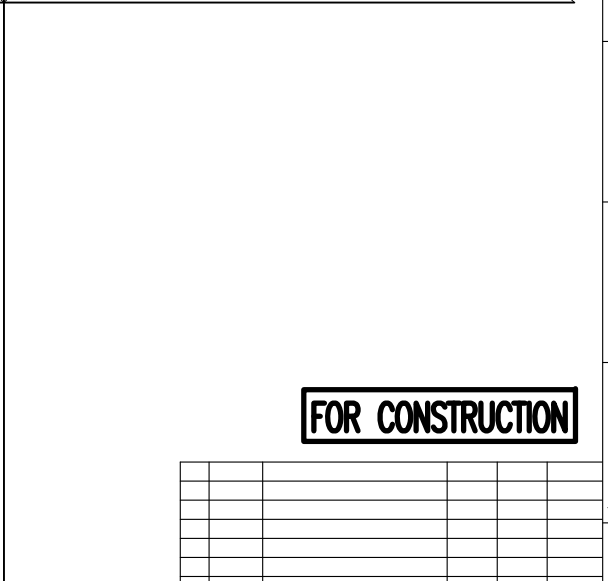
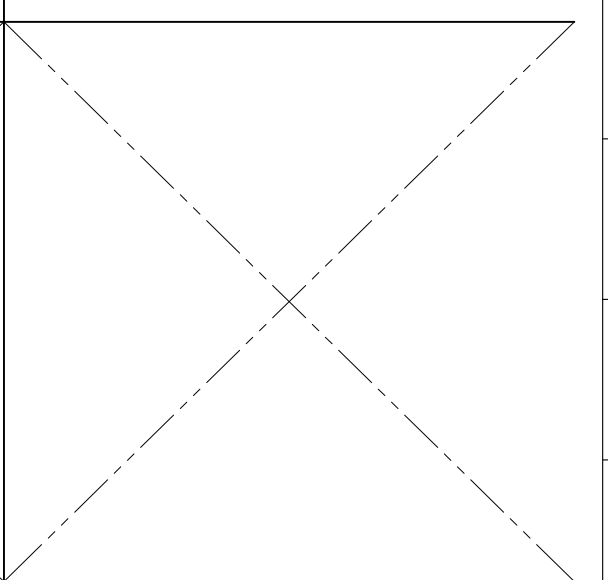
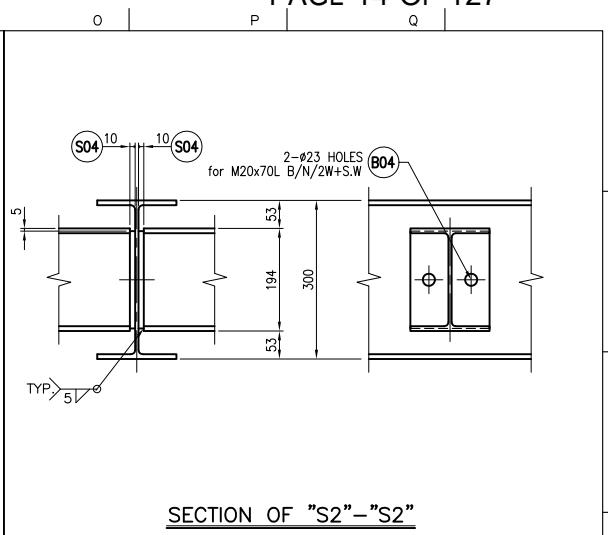


FOR CONSTRUCTION

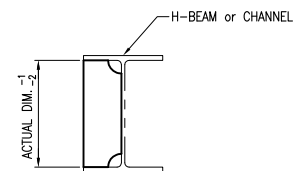
[illegible]

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

	V.
--	----

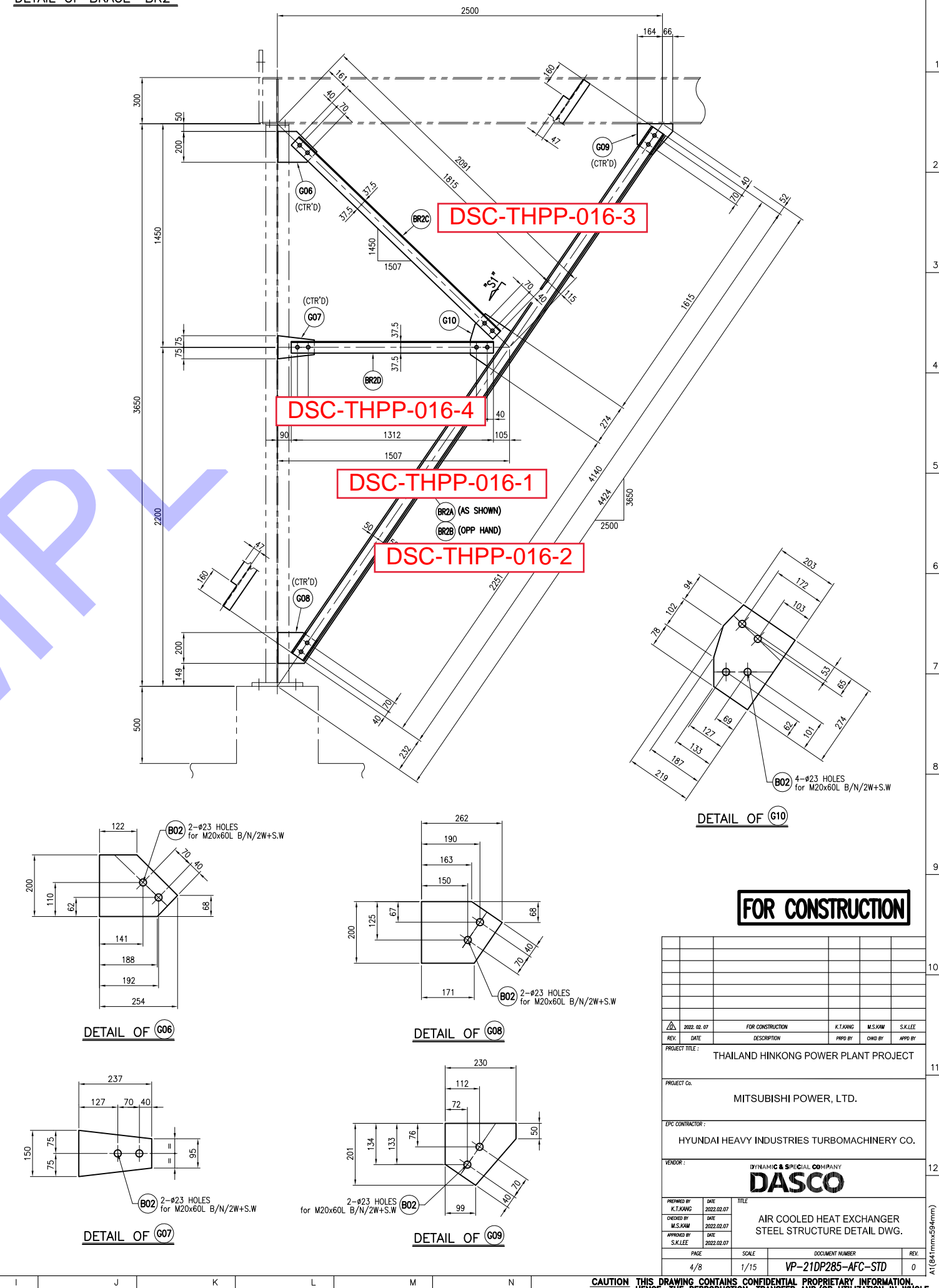


1. UNLESS OTHERWISE CHAMBER : C25
2. UNLESS OTHERWISE ROUND : R25
3. GUSSET PLATE MANUFACTURE TOLERANCE :



FOR CONSTRUCTION

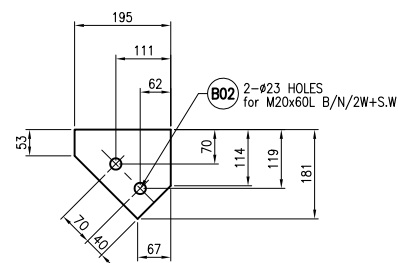
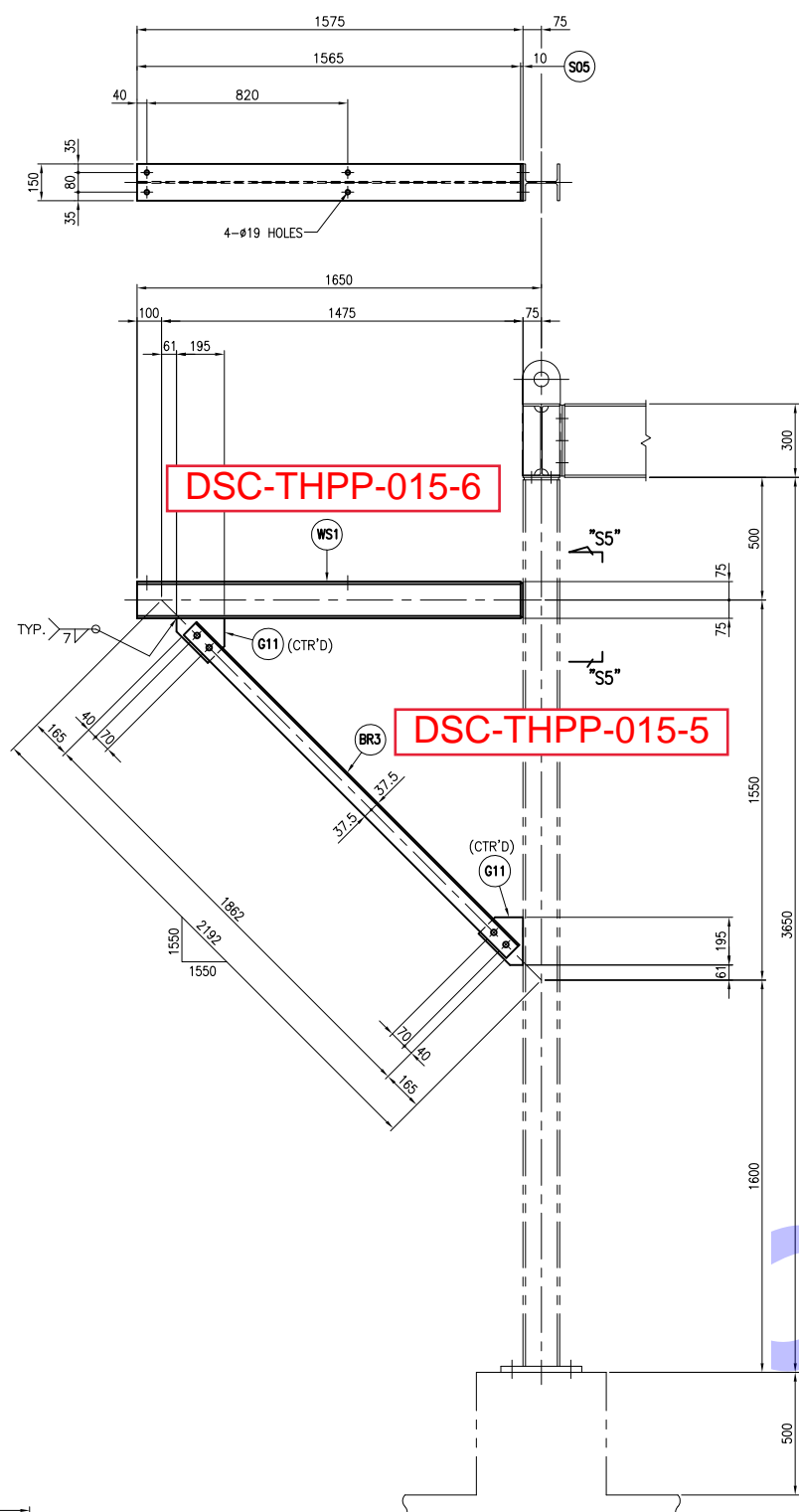
[illegible]



FOR CONSTRUCTION

[illegible]

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



DETAIL OF (G11)

FOR CONSTRUCTION

[illegible]

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

[illegible]



DETAIL OF SB1



DETAIL OF (SB2)

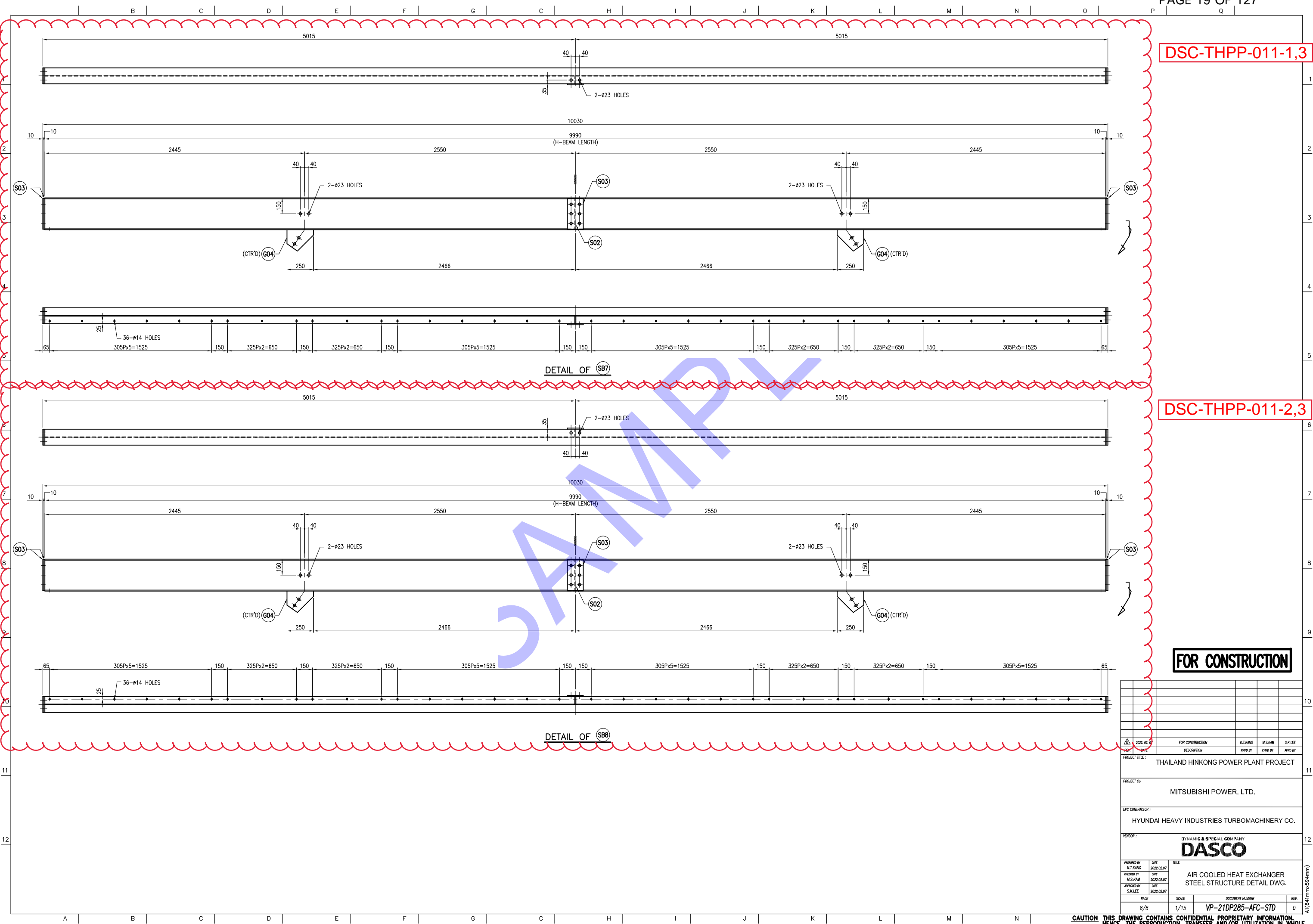
FOR CONSTRUCTION

[illegible]

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

[illegible]

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



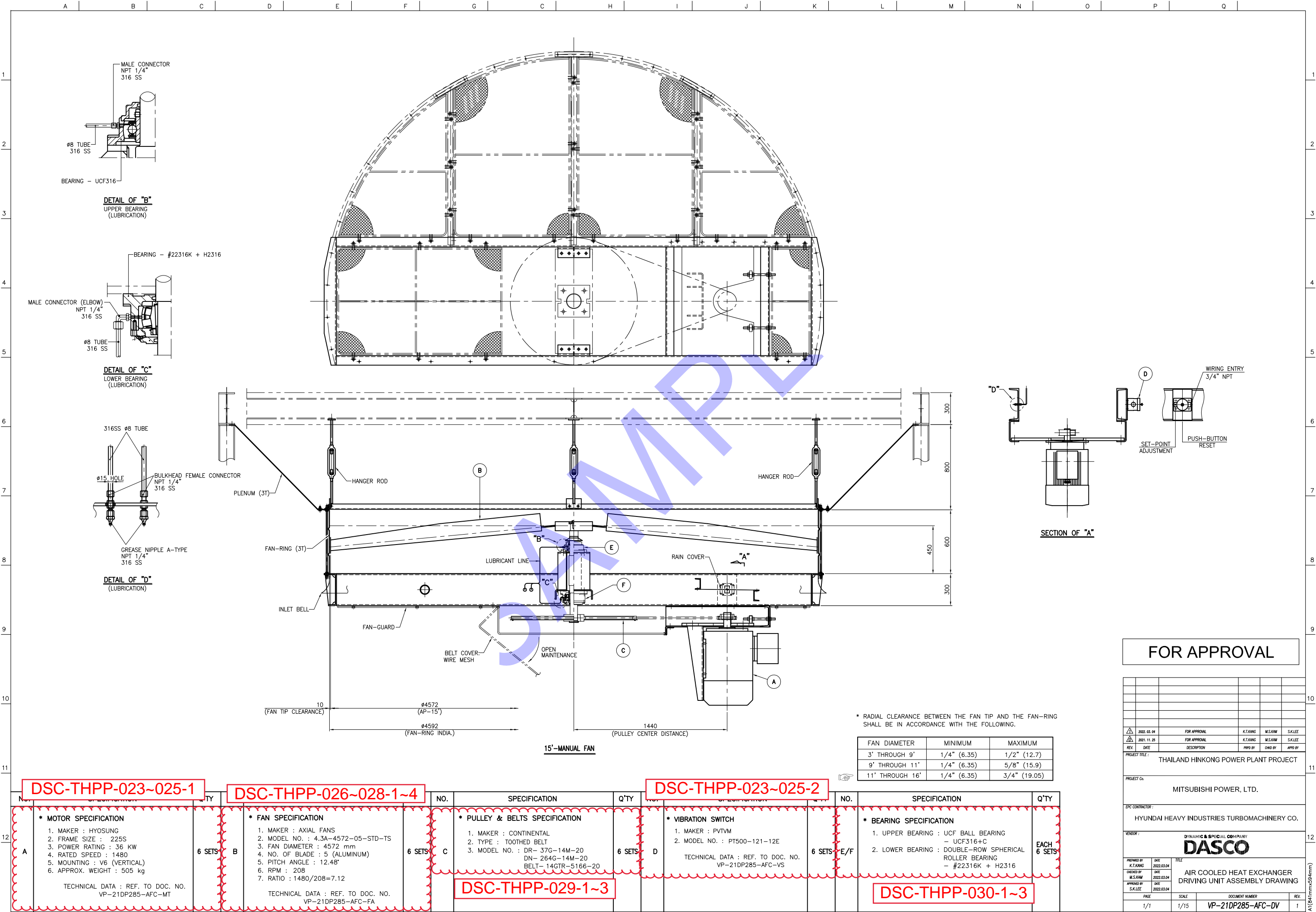
DSC-THPP-011-1,3

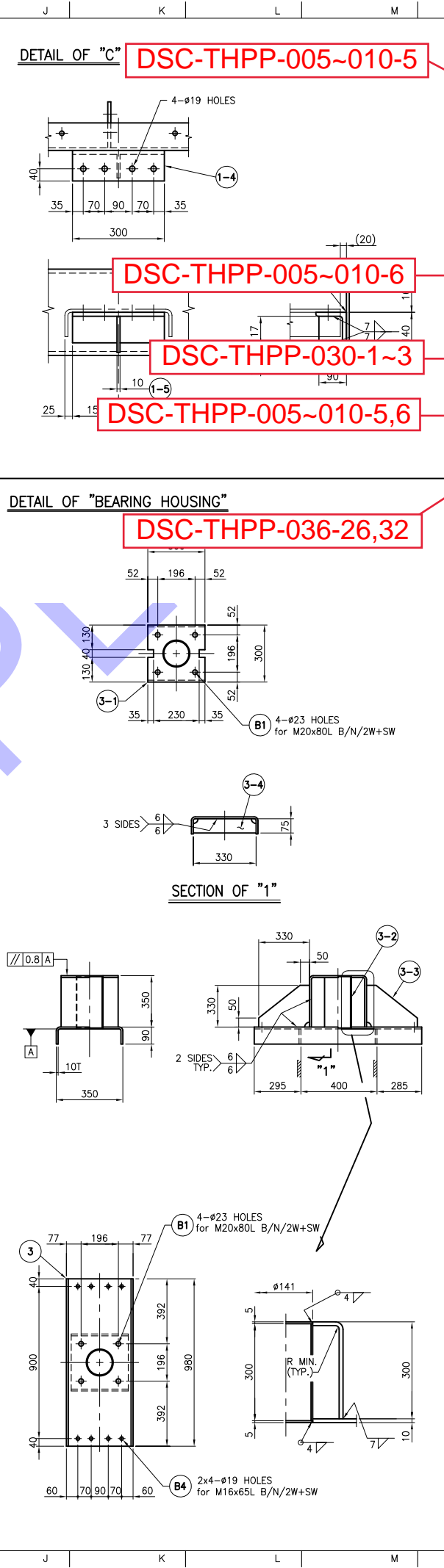
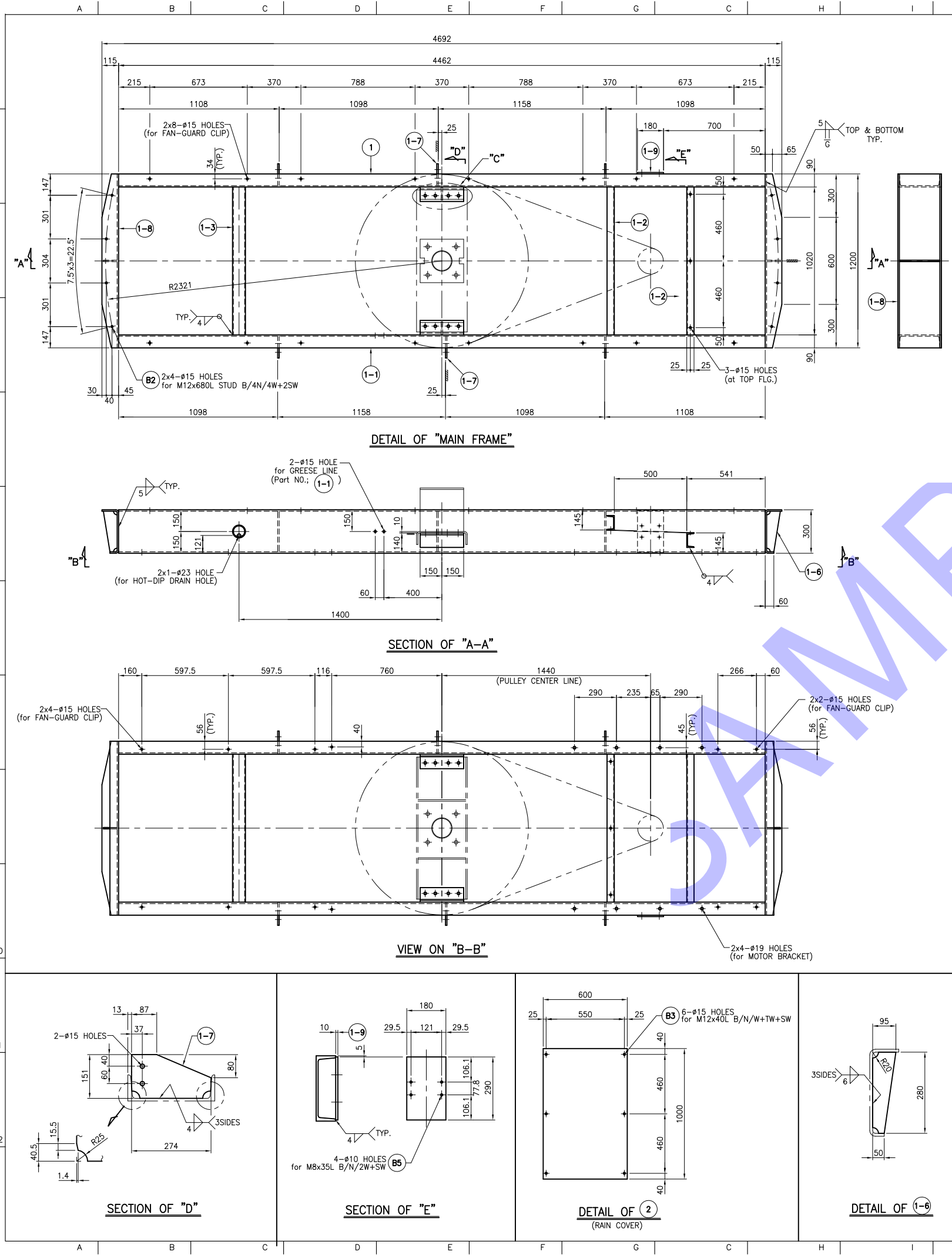
DSC-THPP-011-2,3

FOR CONSTRUCTION

PROJECT TITLE:				THAILAND HINKONG POWER PLANT PROJECT			
PROJECT Co:				MITSUBISHI POWER, LTD.			
EPC CONTRACTOR:				HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.			
VENDOR:				DYNAMIC & SPECIAL COMPANY DASCO			
PREPARED BY	DATE	TITLE		FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
K.T.KANG	2022.02.07	AIR COOLED HEAT EXCHANGER		DESCRIPTION	PROG BY	CHKD BY	APPR BY
CHECKED BY	DATE	STEEL STRUCTURE DETAIL DWG.					
M.S.KAM	2022.02.07						
APPROVED BY	DATE						
S.K.LEE	2022.02.07						
PAGE	SCALE	DOCUMENT NUMBER		REV:			
8/8	1/15	VP-21DP285-AFC-STD		0			

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.





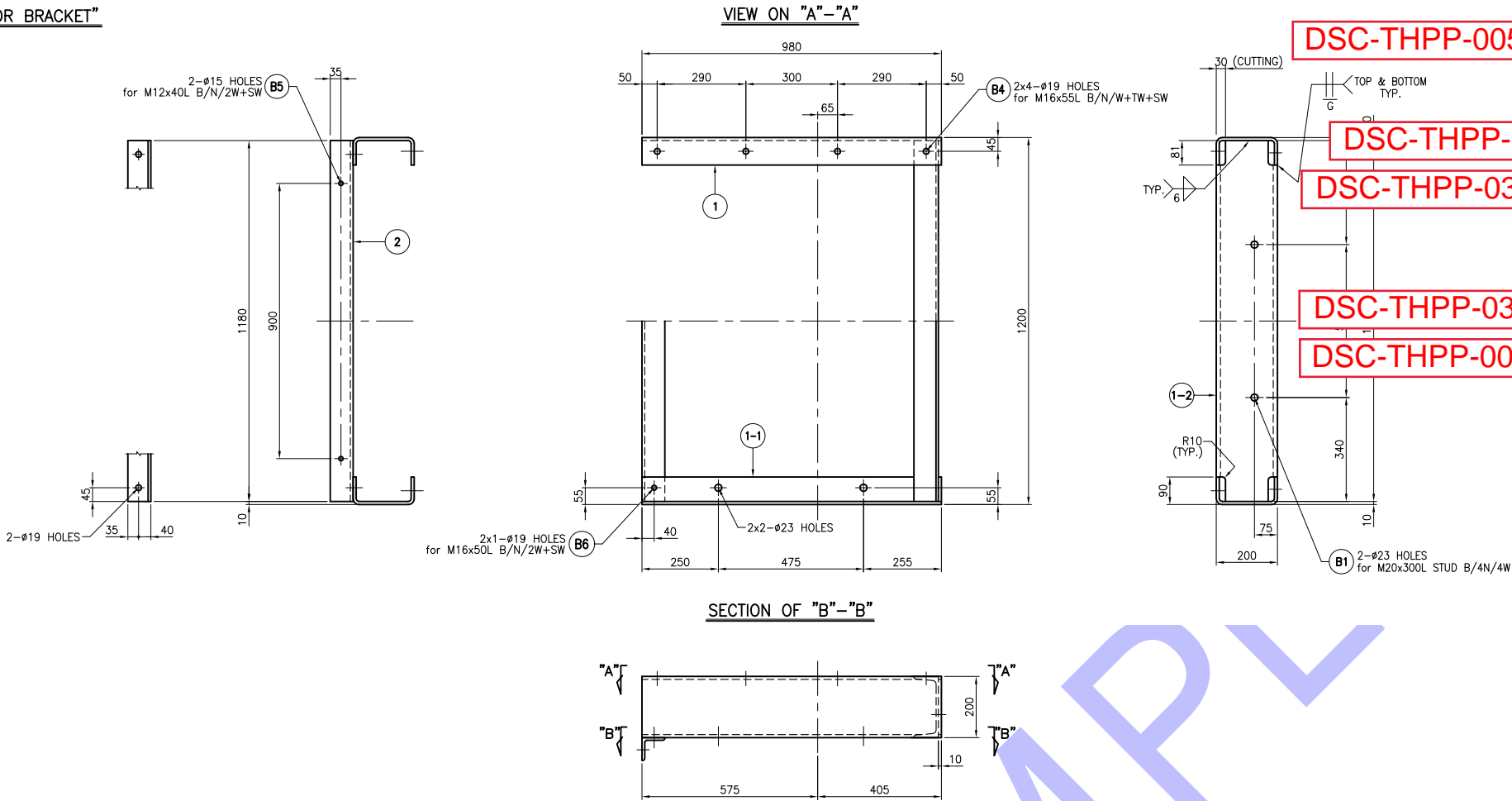
BILL OF MATERIAL							
TAG. NO.	NO	DESCRIPTION	SPECIFICATION	MATERIAL	Q'TY	WEIGHT	REMARKS
MF15-1 1 SETS	1	SUP'T CHANNEL	C300x90x9/13-4462L	SS275 or EQ.	1	170.0	
	1-1	SUP'T CHANNEL	C300x90x9/13-4462L	SS275 or EQ.	1	170.0	
	1-2	SUP'T CHANNEL	C100x50x5/7.5-1020L	SS275 or EQ.	2	19.1	
	1-3	PIPE	PIPE 80A-1020L	SGP	1	9	
	1-4	SUP'T ANGLE	L100x100x13-300L	SS275 or EQ.	2	11.5	
	1-5	RIB PLATE	10Tx90x117	SM400A or EQ.	2	1.7	
	1-6	RIB PLATE	10Tx95x280	SM400A or EQ.	2	4.2	
	1-7	PLATE	10Tx151x274	SM400A or EQ.	6	19.5	
	1-8	SUP'T PLATE	10Tx440x1200	SM400A or EQ.	2	82.8	T/W=
MF15-2	1-9	V/S BRACKET	10Tx180x290	SM400A or EQ.	1	4.1	491.9 KG
	2	RAIN COVER	3Tx600x1000	SM400A or EQ.	1	14.1	
MF15-3 1 SET	3	BENT PLATE	10Tx490x980	SM400A or EQ.	1	37.7	
	3-1	BENT PLATE	10Tx300x950	SM400A or EQ.	1	22.4	
	3-2	SUP'T PIPE	PIPE 125A-350L	SGP	1	5.3	
	3-3	RIB PLATE	10Tx330x330	SM400A or EQ.	2	17.0	T/W=
	3-4	RIB PLATE	10Tx75x330	SM400A or EQ.	2	3.9	86.3 KG
	MF15-B1	B1	HEX. B/N/2W+SW	M20x80L	SA307 Gr.A	8	-
MF15-B2	B2	STUD B/4N/4W+2SW	M12x680L	SA307 Gr.A	8	-	
MF15-B3	B3	HEX. B/N/W+TW+SW	M12x40L	SA307 Gr.A	6	-	
MF15-B4	B4	HEX. B/N/2W+SW	M16x65L	SA307 Gr.A	8	-	
MF15-B5	B5	HEX. B/N/2W+SW	M8x35L	304SS	4	-	
QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.						T/W: 592.3 KG	

FOR CONSTRUCTION

PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT			
PROJECT Co: MITSUBISHI POWER, LTD.			
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.			
VENDOR: DYNAMIC SPECIAL COMPANY			
DASCO			
AIR COOLED HEAT EXCHANGER DRIVING UNIT DETAIL DRAWING			
PREPARED BY: K.T.KANG	DATE: 2022.03.04	TITLE:	
CHECKED BY: M.S.KAM	DATE: 2022.03.04		
APPROVED BY: S.K.LEE	DATE: 2022.03.04		
PAGE: 1/7	SCALE: 1/15	DOCUMENT NUMBER: VP-21DP285-AFC-DVD	REV: 0

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

DETAIL OF "MOTOR BRACKET"



DSC-THPP-005~010-7

DSC-THPP-035-1~6

DSC-THPP-036-27,33

DSC-THPP-036-28,34

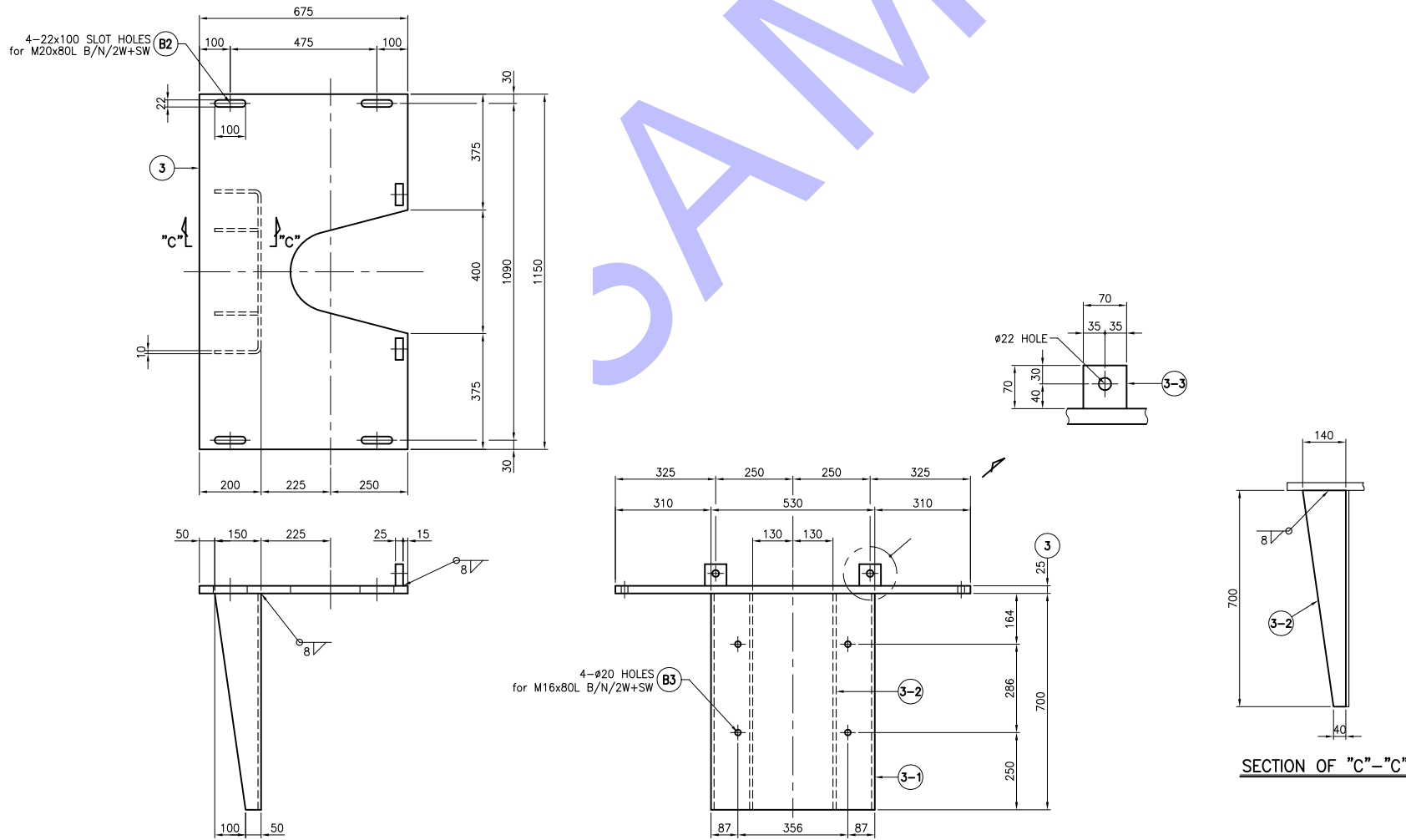
DSC-THPP-005~010-7

BILL OF MATERIAL

TAG NO.	NO	DESCRIPTION	SPECIFICATION	MATERIAL	Q'TY	WEIGHT	REMARKS
MB15-1 SET	1	PLATE	10Tx340x980	SM400A or EQ.	1	26.2	
	1-1	PLATE	10Tx340x980	SM400A or EQ.	1	26.2	T/W=
	1-2	CHANNEL	C200x90x8/13.5-1180L	SM400A or EQ.	1	35.8	88.2 KG
MB15-2	2	SUP'T. ANGLE	L75x75x9-1180L	SS275 or EQ.	1	11.8	
MB15-3 SET	3	PLATE	25Tx675x1150	SM400A or EQ.	1	152.3	
	3-1	PLATE	10Tx700x790	SM400A or EQ.	1	43.4	
	3-2	PLATE	10Tx140x700	SM400A or EQ.	1	7.7	T/W=
MB15-B1	B1	STUD B/4N/4W	M20x300L	SA307 Gr.A	2	1.9	205.3 KG
MB15-B2	B2	HEX. B/N/2W+SW	M20x80L	SA307 Gr.A	4	-	
MB15-B3	B3	HEX. B/N/2W+SW	M16x80L	SA307 Gr.A	4	-	
MB15-B4	B4	HEX. B/N/W+TW+SW	M16x55L	SA307 Gr.A	8	-	
MB15-B5	B5	HEX. B/N/2W+SW	M12x40L	SA307 Gr.A	2	-	
MB15-B6	B6	HEX. B/N/2W+SW	M16x50L	SA307 Gr.A	2	-	

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS. T/W: 305.3 KG

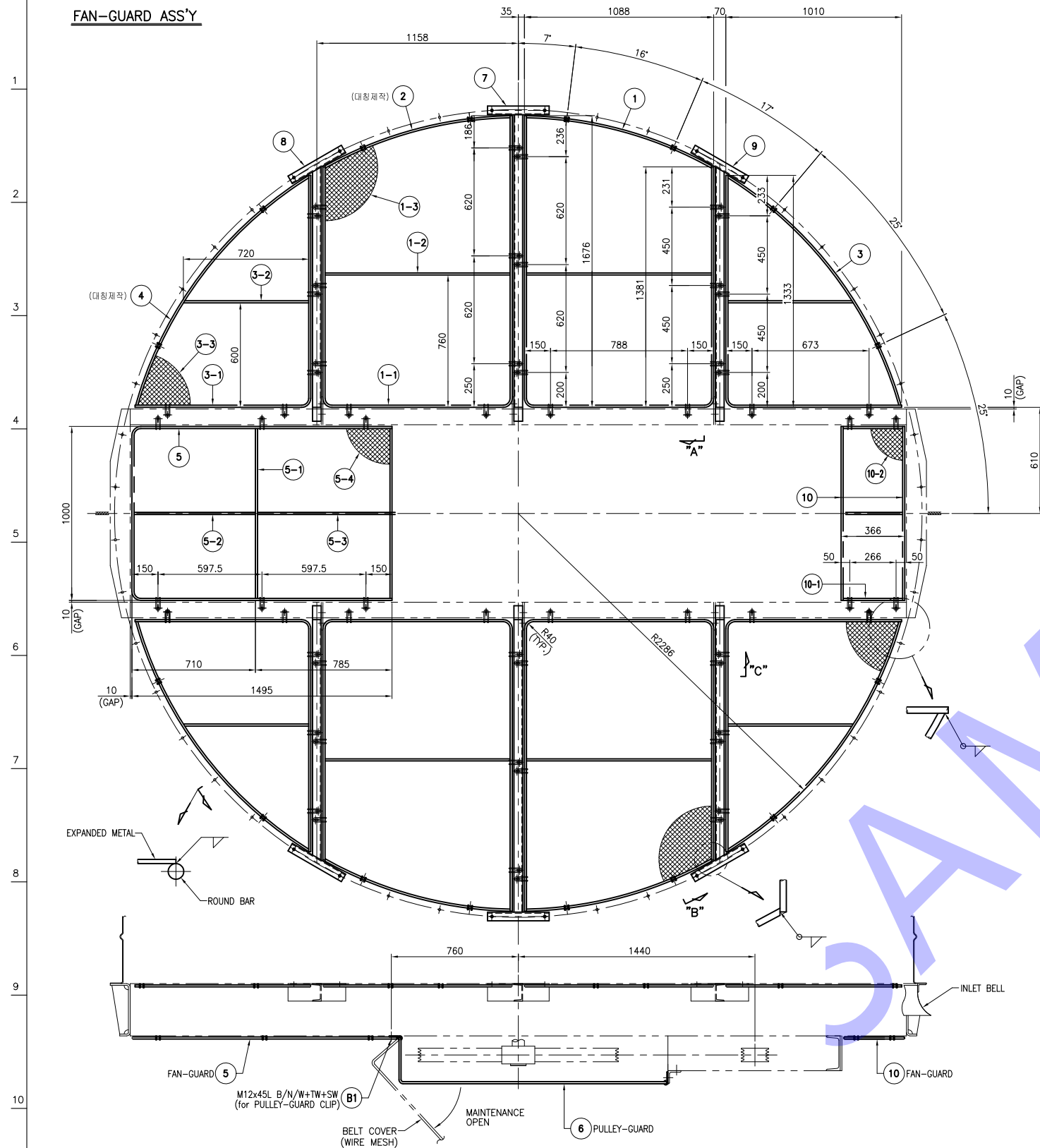
DETAIL OF "MOUNTING PLATE"



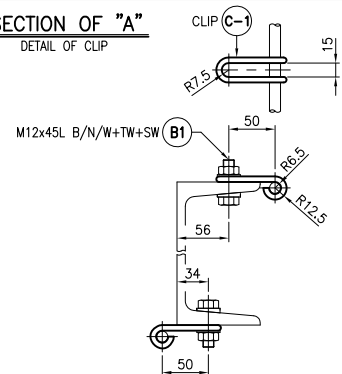
FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	FOR APPROVAL	DATE	DESCRIPTION	FOR APPROVAL	DATE	DESCRIPTION	FOR APPROVAL	DATE	DESCRIPTION
1	2022.03.04		K.T.KANG	2022.03.04	M.S.KIM	2022.03.04	S.K.LEE	2022.03.04			
PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT											
PROJECT Co: MITSUBISHI POWER, LTD.											
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.											
VENDOR: DYNAMIC SPECIAL COMPANY											
DASCO											
AIR COOLED HEAT EXCHANGER DRIVING UNIT DETAIL DRAWING											
PAGE 2/7											
SCALE 1/10											
DOCUMENT NUMBER VP-21DP285-AFC-DVD											
REV. 0											

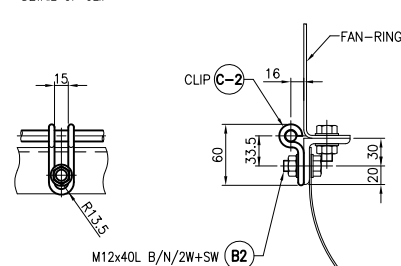
FAN-GUARD ASS'Y



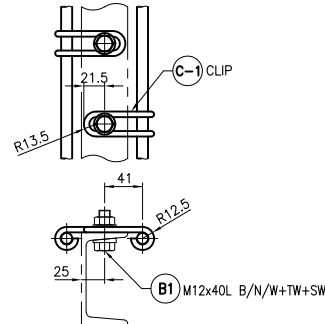
SECTION OF "A"
DETAIL OF CLIP



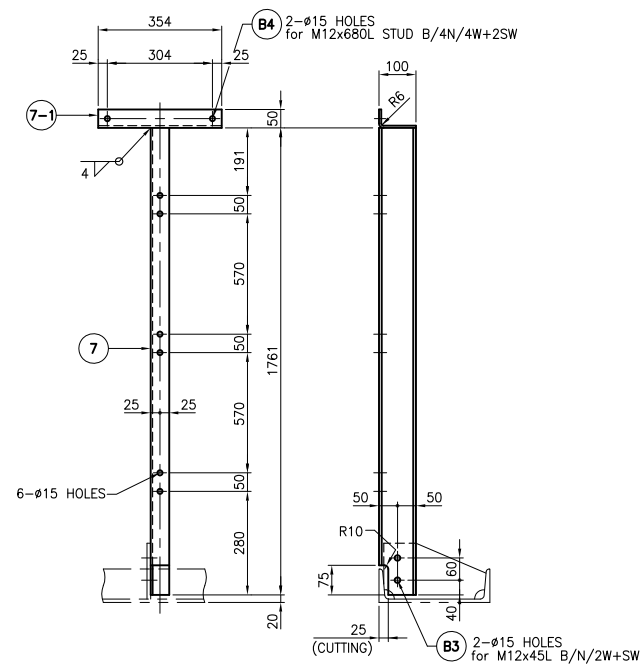
SECTION OF "B"
DETAIL OF CLIP



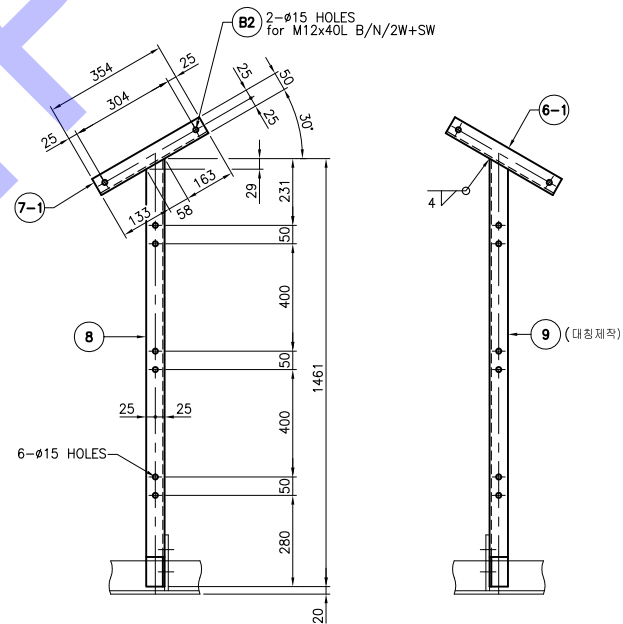
SECTION OF "C"
DETAIL OF CLIP



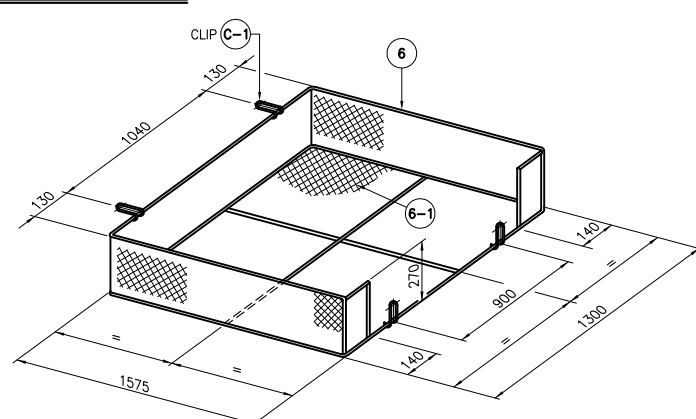
DETAIL OF 7
FAN-GUARD SUP'T



DETAIL OF 8,9
FAN-GUARD SUP'T



PULLEY-GUARD ASS'Y



BILL OF MATERIAL

TAG. NO.	NO	DESCRIPTION	SPECIFICATION	MATERIAL	Q'TY	WEIGHT	REMARKS
FG15-1	1	ROUND BAR	R.B 0.D12-1113L	SS275 or EQ.	2	2.0	
2 SETS	1-1	ROUND BAR	R.B 0.D12-4100L	SS275 or EQ.	2	7.4	
	1-2	ROUND BAR	R.B 0.D12-1064L	SS275 or EQ.	2	1.9	T/W=
	1-3	WIRE MESH	(8 BWG-50x50)x1076x1664	SS275 or EQ.	2	14.3	25.6 KG
FG15-2	2	ROUND BAR	R.B 0.D12-1113L	SS275 or EQ.	2	2.0	
2 SETS	1-1	ROUND BAR	R.B 0.D12-4100L	SS275 or EQ.	2	7.4	
	1-2	ROUND BAR	R.B 0.D12-1064L	SS275 or EQ.	2	1.9	T/W=
	1-3	WIRE MESH	(8 BWG-50x50)x1076x1664	SS275 or EQ.	2	14.3	25.6 KG
FG15-3	3	ROUND BAR	R.B 0.D12-1692L	SS275 or EQ.	2	3.0	
2 SETS	3-1	ROUND BAR	R.B 0.D12-2320L	SS275 or EQ.	2	4.2	
	3-2	ROUND BAR	R.B 0.D12-720L	SS275 or EQ.	2	1.3	T/W=
	3-3	WIRE MESH	(8 BWG-50x50)x998x1321	SS275 or EQ.	2	10.5	19.0 KG
FG15-4	4	ROUND BAR	R.B 0.D12-1692L	SS275 or EQ.	2	3.0	
2 SETS	3-1	ROUND BAR	R.B 0.D12-2320L	SS275 or EQ.	2	4.2	
	3-2	ROUND BAR	R.B 0.D12-720L	SS275 or EQ.	2	1.3	T/W=
	3-3	WIRE MESH	(8 BWG-50x50)x998x1321	SS275 or EQ.	2	10.5	19.0 KG
FG15-5	5	ROUND BAR	R.B 0.D12-3942L	SS275 or EQ.	1	3.5	
1 SET	5-1	ROUND BAR	R.B 0.D12-976L	SS275 or EQ.	2	1.8	
	5-2	ROUND BAR	R.B 0.D12-725L	SS275 or EQ.	1	0.6	
	5-3	ROUND BAR	R.B 0.D12-746L	SS275 or EQ.	1	0.7	T/W=
	5-4	WIRE MESH	(8 BWG-50x50)x988x1483	SS275 or EQ.	1	5.8	12.4 KG
FG15-6	6	ROUND BAR	R.B 0.D12-6000L	SS275 or EQ.	3	16.2	T/W=
1 SET	6-1	WIRE MESH	(8 BWG-50x50)x1840x1845	SS275 or EQ.	1	13.3	29.5 KG
FG15-7	7	SUP'T CHANNEL	C100x50x5/7.5-1761L	SS275 or EQ.	2	33	T/W=
2 SETS	7-1	PLATE	61x138x354	SS275 or EQ.	2	4.6	37.6 KG
FG15-8	8	SUP'T CHANNEL	C100x50x5/7.5-1461L	SS275 or EQ.	2	27.3	T/W=
2 SETS	7-1	PLATE	61x138x354	SS275 or EQ.	2	4.6	31.9 KG
FG15-9	9	SUP'T CHANNEL	C100x50x5/7.5-1461L	SS275 or EQ.	2	27.3	T/W=
2 SETS	7-1	PLATE	61x138x354	SS275 or EQ.	2	4.6	31.9 KG
FG15-10	10	ROUND BAR	R.B 0.D12-1000L	SS275 or EQ.	2	1.8	
1 SETS	10-1	ROUND BAR	R.B 0.D12-342L	SS275 or EQ.	2	0.6	T/W=
	10-2	WIRE MESH	(8 BWG-50x50)x354x988	SS275 or EQ.	1	1.4	3.8 KG
FG-CL1	C-1	CLIP-A	R.B 0.D6-200L	304 S.S	66	6.6	
FG-CL2	C-2	CLIP-B	R.B 0.D6-200L	304 S.S	16	1.6	
FG15-B1	B1	HEX. B/N/W+TW+SW	M12x45L	SA307 Gr.A	64	-	
FG15-B2	B2	HEX. B/N/2W+SW	M12x40L	SA307 Gr.A	24	-	
FG15-B3	B3	HEX. B/N/2W+SW	M12x40L	SA307 Gr.A	12	-	
FG15-B4	B4	STUD B/4N/4W+2SW	M12x680L	SA307 Gr.A	4	-	

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.

T/W: 244.5 KG

FOR CONSTRUCTION

[illegible]

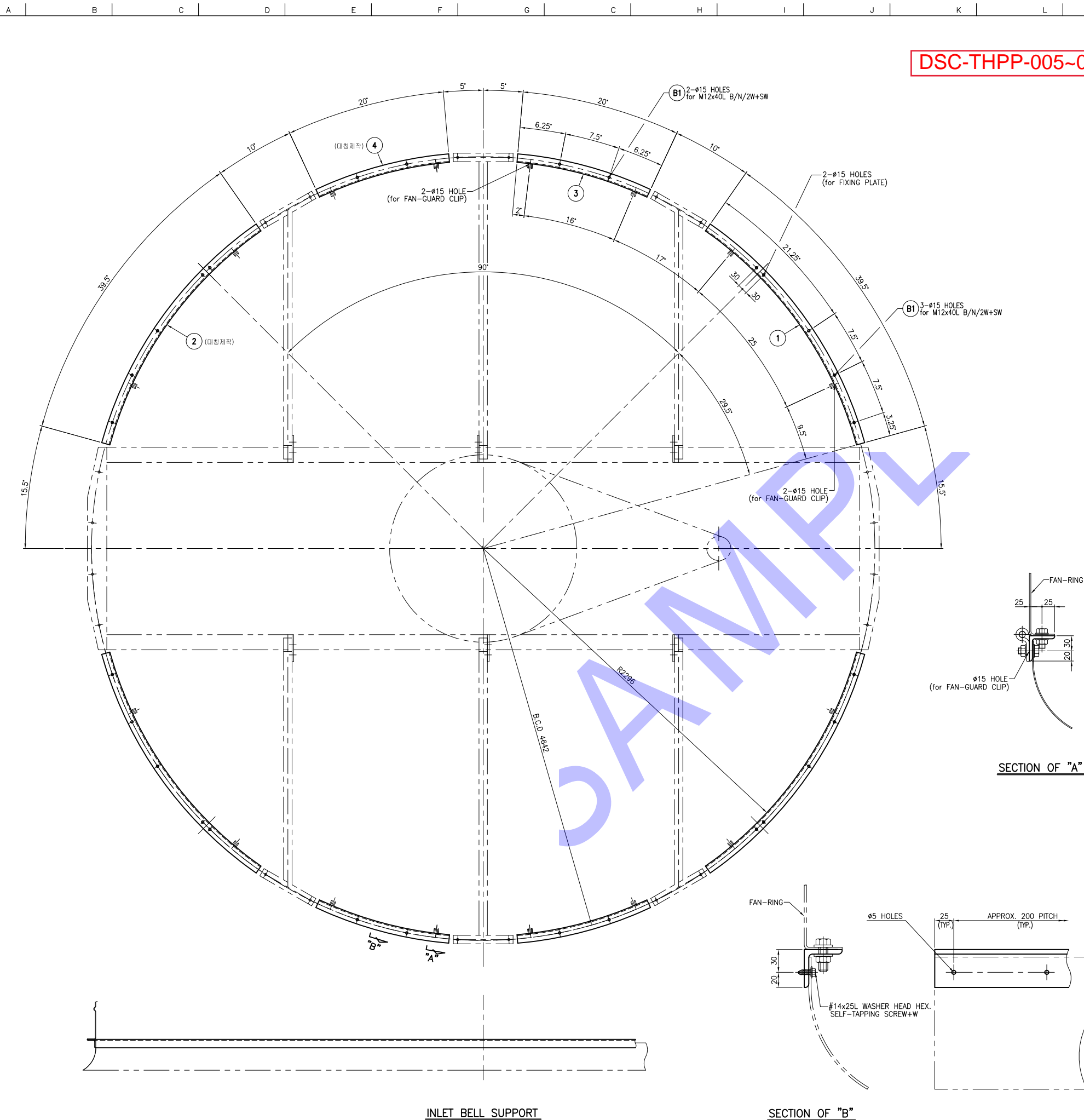
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

A1(841mmx594mm)

[illegible]

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.

T/W: 42.8 KG



SECTION OF "A"

INLET BELL SUPPORT

SECTION OF "B"

FOR CONSTRUCTION

	DATE	FOR APPROVAL	K.T.KANG	M.S.KAM	S.K.LEE
REV.	DATE	DESCRIPTION	PRPD BY	CHD BY	APPD BY

PROJECT TITLE : THAILAND HINKONG POWER PLANT PROJECT

PURPOSE CO. MITSUBISHI POWER, LTD.

EPC CONTRACTOR : HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

VENDOR : DYNAMIC & SPECIAL COMPANY
DASCO

PREPARED BY K.T.KANG	DATE 2022.03.04	TITLE
CHECKED BY M.S.KAM	DATE 2022.03.04	AIR COOLED HEAT EXCHANGER DRIVING UNIT DETAIL DRAWING
APPROVED BY S.K.LEE	DATE 2022.03.04	

PAGE	SCALE	DOCUMENT NUMBER	REV.
4 / 7	1 / 12	VP-21DP285-AFC-DVD	0

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

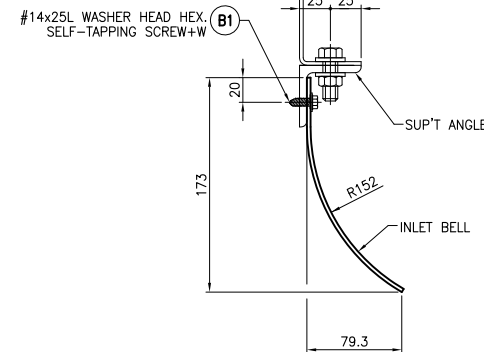
V.

1. Installation

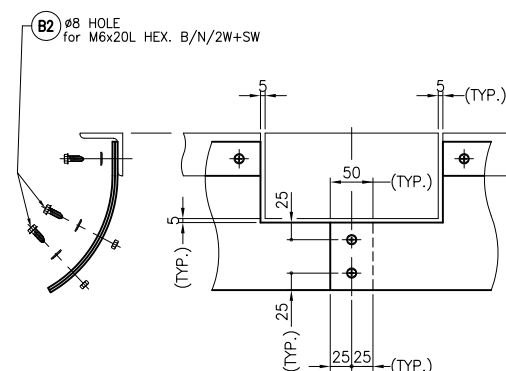
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

[illegible]

1
2
3



TYPICAL INLET BELL SPLICE



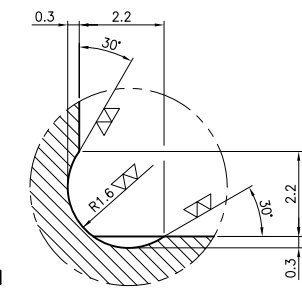
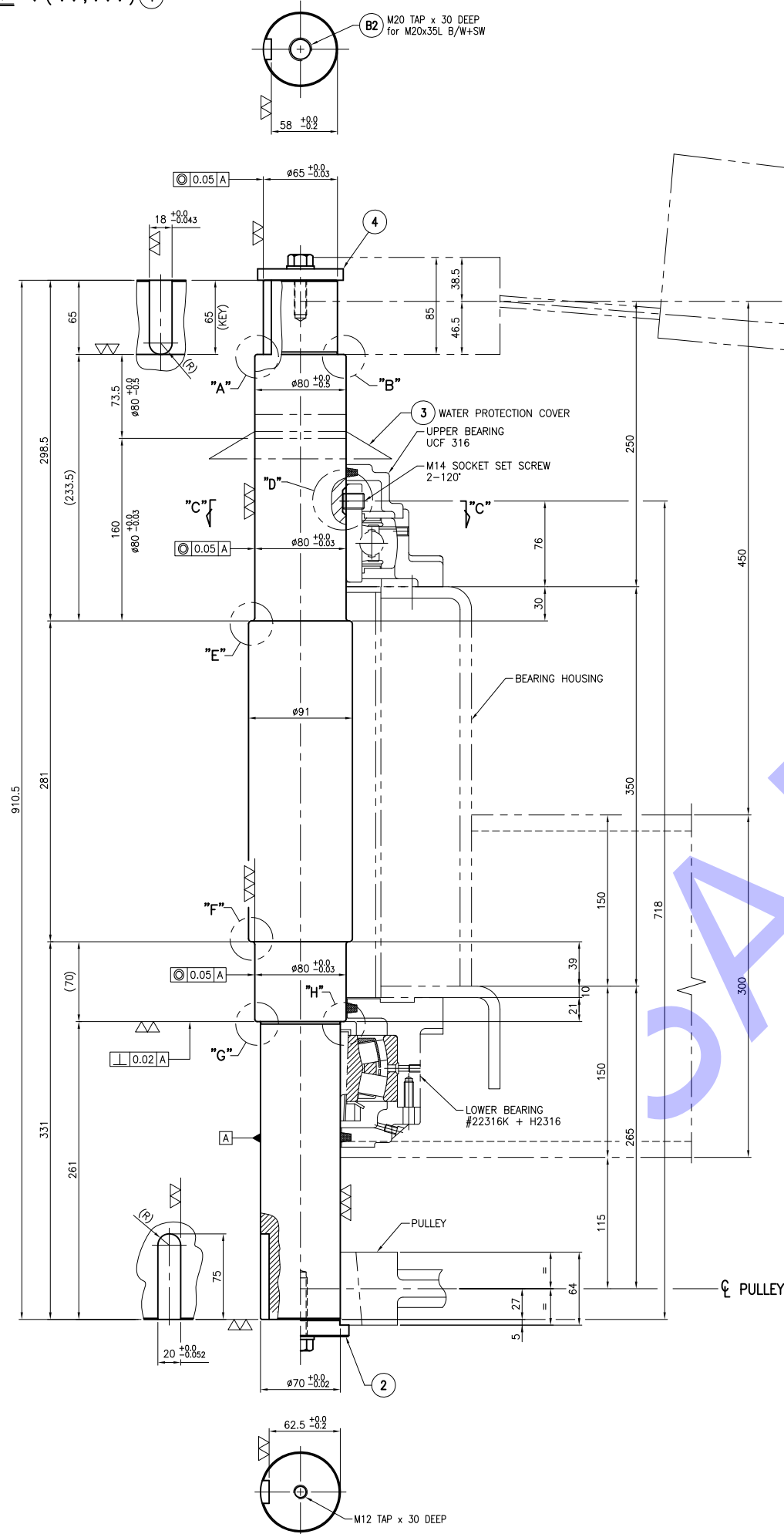
FOR CONSTRUCTION

[illegible]

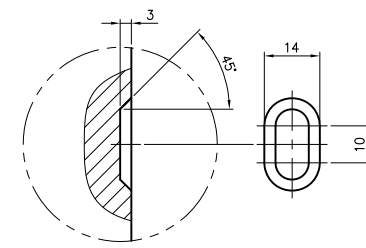
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

A1(841mmx594mm)

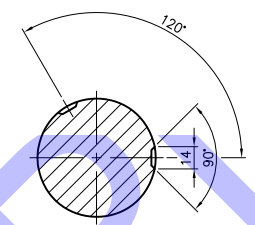
DETAIL OF "FAN SHAFT" ∇ (∇∇, ∇∇∇) ①



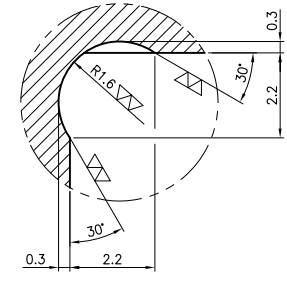
DETAIL - "B"



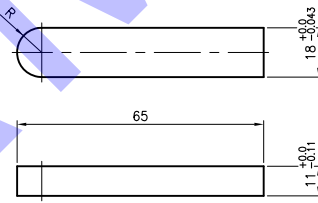
DETAIL - "D"



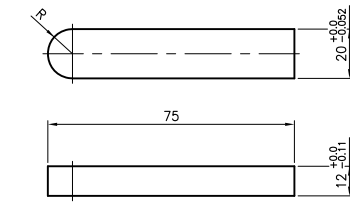
SECTION "C-C"



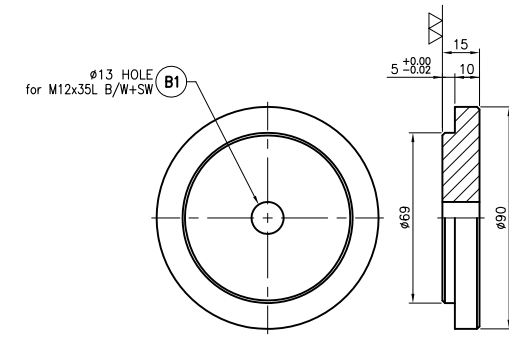
DETAIL - "H"



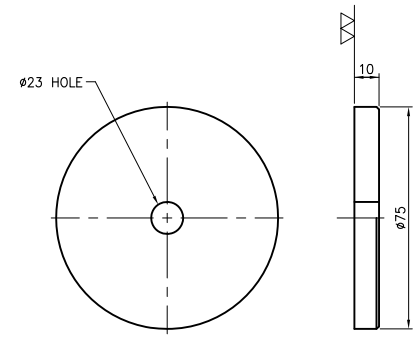
DETAIL OF "FAN SHAFT KEY" ∇∇ (1-1)



DETAIL OF "PULLEY SHAFT KEY" ∇∇ (1-2)



DETAIL OF "PULLEY STOPPER" ∇ (∇∇) ②



DETAIL OF "FAN STOPPER" ∇ (∇∇) ④

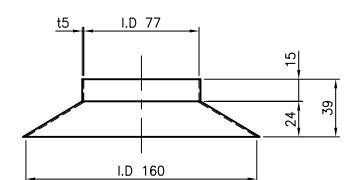
BILL OF MATERIAL

TAG NO.	NO	DESCRIPTION	SPECIFICATION	MATERIAL	Q'TY	WEIGHT	REMARKS
SF15-1	1	FAN SHAFT	R.B 91-910.5L	SM45C	1	45.8	
	1-1	KEY for FAN	11T18x65	SM45C	1	0.1	
	1-2	KEY for PULLEY	12T20x75	SM45C	1	0.1	
SF15-2	2	PULLEY STOPPER	R.B 90-15L	SM45C	1	0.7	
SF15-3	3	WATER PROTECTION COVER	t5xL.D77	SILICONE	1	-	
SF15-4	4	FAN STOPPER	R.B 75-10L	SM45C	1	0.4	
SF15-B1	B1	HEX B/W+SW	M12x35L	SA307 Gr.A	1	-	
SF15-B2	B2	HEX B/W+SW	M20x35L	SA307 Gr.A	1	-	

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.

T/W: 47.1 KG

DSC-THPP-030-1~3



DETAIL OF "WATER PROTECTION COVER" ③

FOR CONSTRUCTION

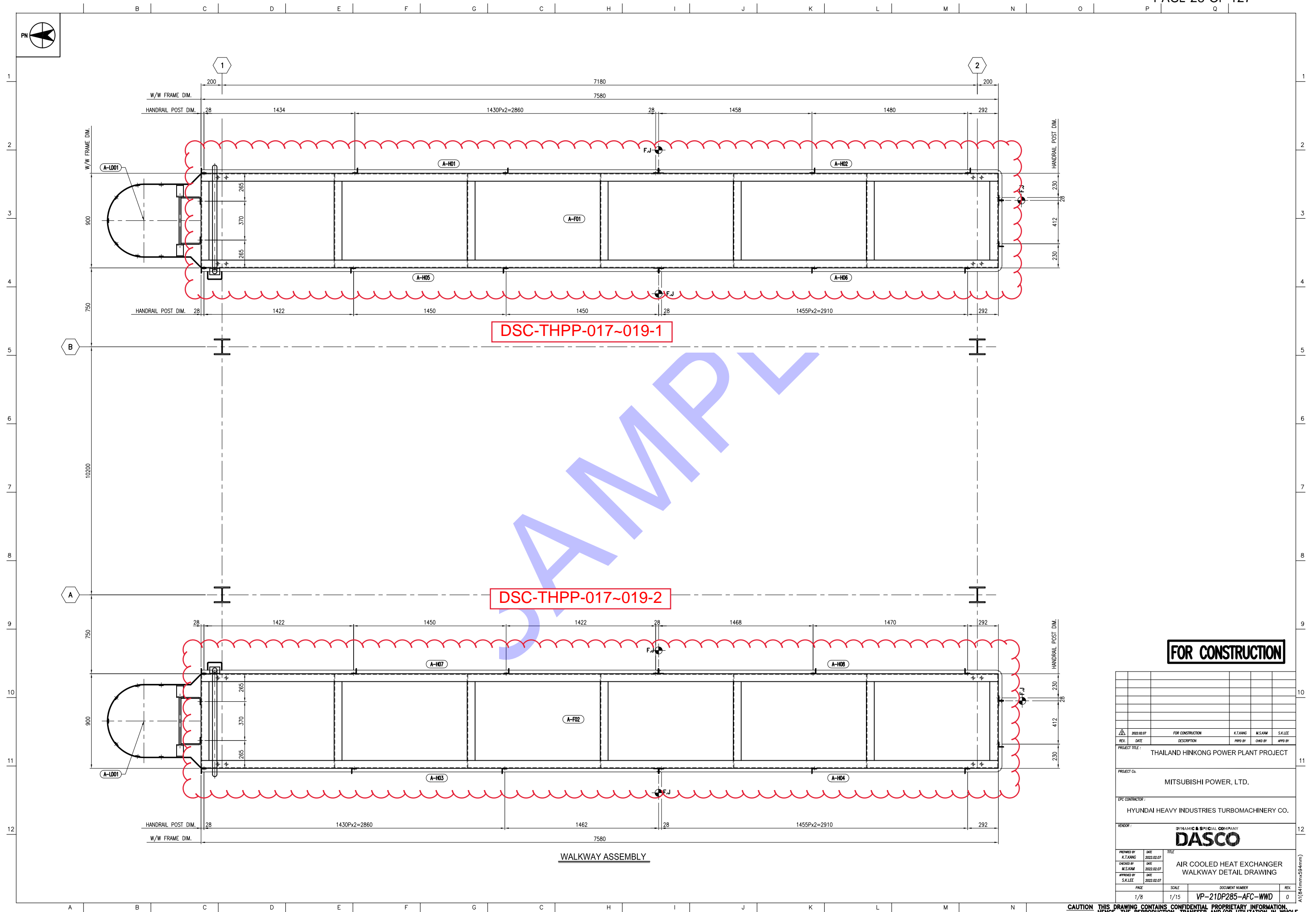
REV.	DATE	DESCRIPTION	FOR APPROVAL	K.T.KANG	M.S.KAM	S.K.LEE
1	2022.03.04		APPROVED			
PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT						
PROJECT Co: MITSUBISHI POWER, LTD.						
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.						
VENDOR: DYNAMIC & SPECIAL COMPANY						
DASCO						
PREPARED BY: K.T.KANG DATE: 2022.03.04						
CHECKED BY: M.S.KAM DATE: 2022.03.04						
APPROVED BY: S.K.LEE DATE: 2022.03.04						
TITLE: AIR COOLED HEAT EXCHANGER DRIVING UNIT DETAIL DRAWING						
PAGE: 6/7	SCALE: 1/25	DOCUMENT NUMBER: VP-21DP205-AFC-010	REV: 0			

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

DSC-THPP-031-9~13



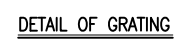
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



FOR CONSTRUCTION

[illegible]

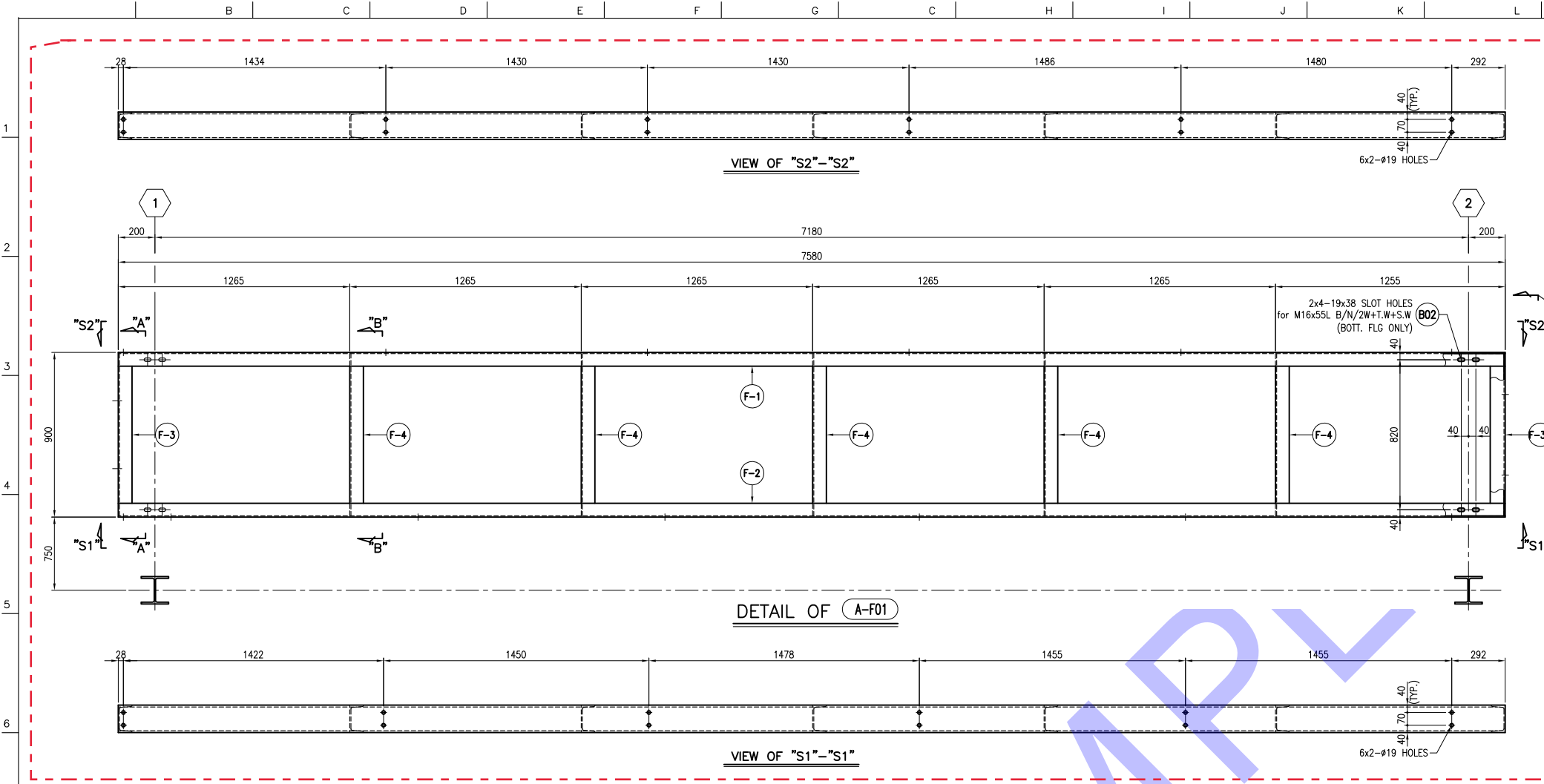
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



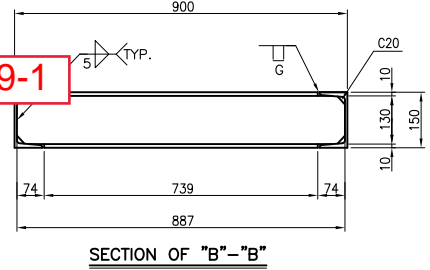
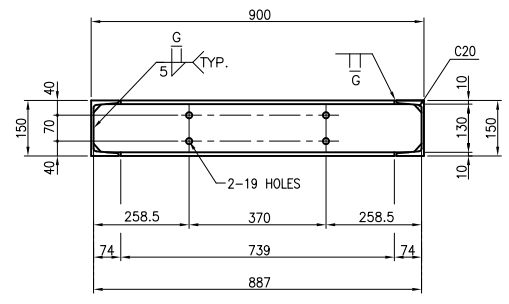
BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-G01	G-1	GRATING (F32x5T)	995Wx880L	SS275 or EQ.	14	463.1	
A-G02	G-2	GRATING (F32x5T)	515Wx880L	SS275 or EQ.	2	43.6	
WW-B05	B05	SADDLE CLIP + BOTTOM KICKER	M8x40L B/N	SS275 or EQ.	64	—	
						TOTAL WEIGHT :	506.7 KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

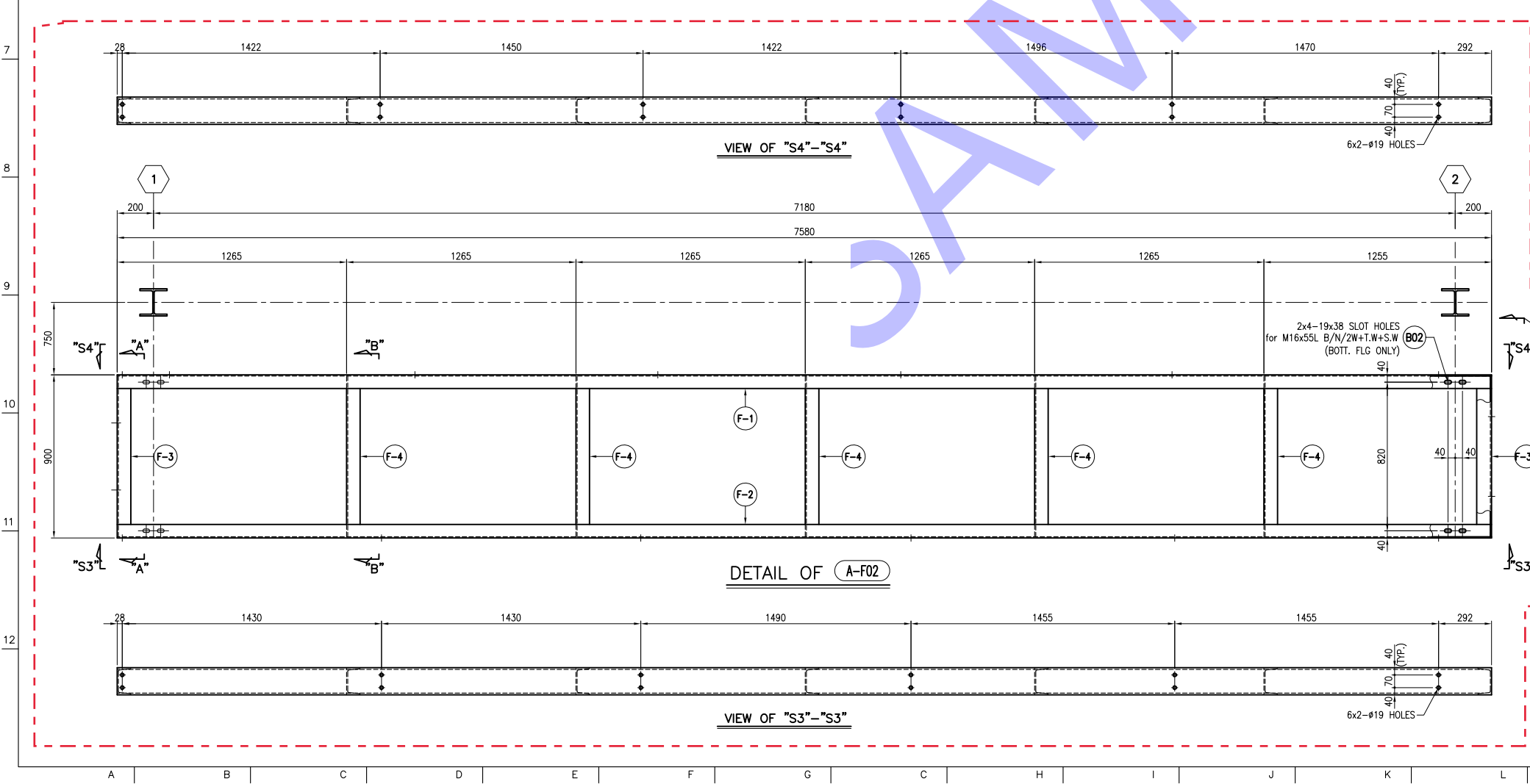
A1(841mmx594mm)



BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-F01 1 SET	F-1	FRAME	C150x75x6.5/10-7580L	SS275 or EQ.	1	141	
	F-2	FRAME	C150x75x6.5/10-7580L	SS275 or EQ.	1	141	
	F-3	FRAME	C150x75x6.5/10-887L	SS275 or EQ.	1	16.5	
	F-3A	FRAME	C150x75x6.5/10-887L	SS275 or EQ.	1	16.5	
					5	82.5	
WW-B02	B02	HEX. B/N/2W+T.W+S.W	M16x55L	SA307 Gr.A	8	-	
						TOTAL WEIGHT :	397.5 KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							



DSC-THPP-017~019-1



BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-F02 1 SET	F-1	FRAME	C150x75x6.5/10-7580L	SS275 or EQ.	1	141	
	F-2	FRAME	C150x75x6.5/10-7580L	SS275 or EQ.	1	141	
	F-3	FRAME	C150x75x6.5/10-887L	SS275 or EQ.	1	16.5	
	F-3A	FRAME	C150x75x6.5/10-887L	SS275 or EQ.	1	16.5	
					5	82.5	
WW-B02	B02	HEX. B/N/2W+T.W+S.W	M16x55L	SA307 Gr.A	8	-	
						TOTAL WEIGHT :	397.5 KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

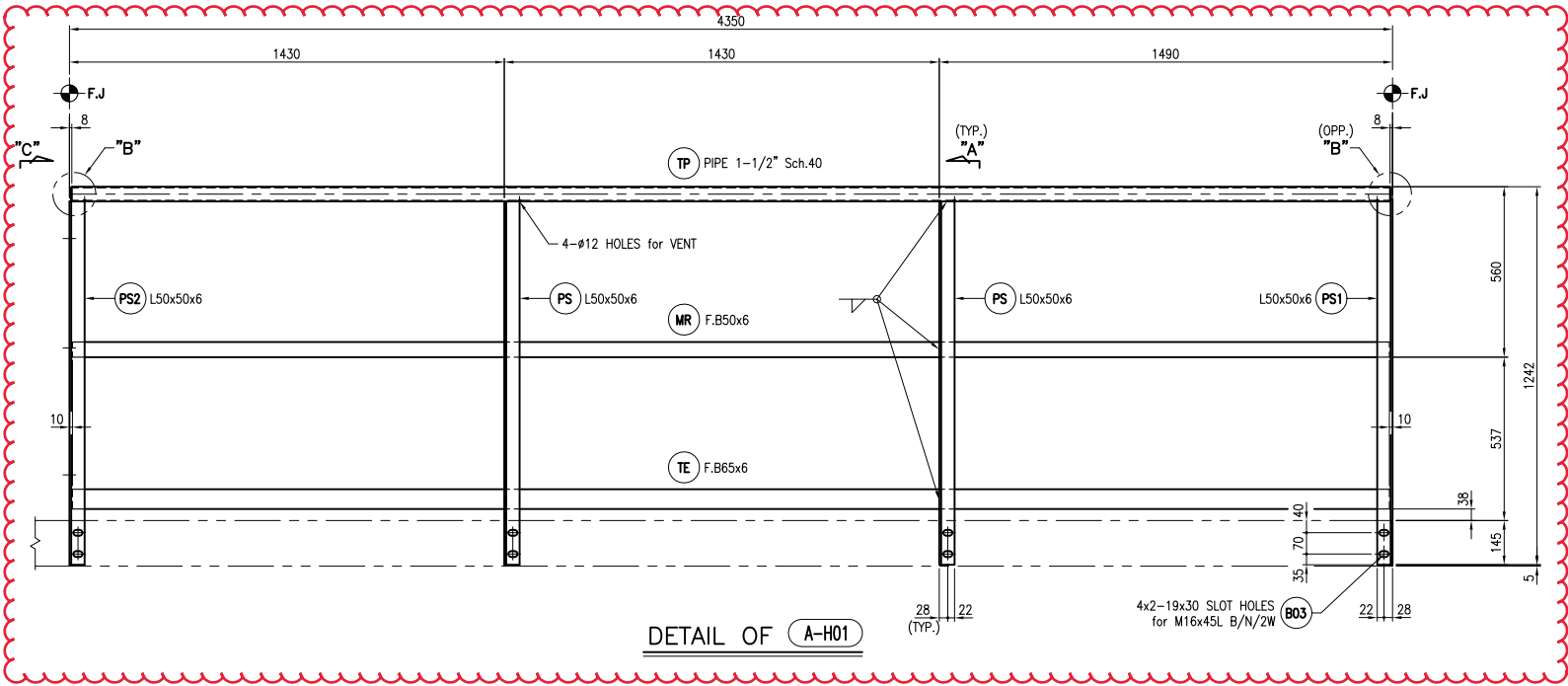
- GENERAL NOTES
- ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
 - UNLESS OTHERWISE ROUND : R10

FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	CHK'D BY	APP'D BY
1	2022.02.07	FOR CONSTRUCTION	K.T.KANG	M.S.KIM
PROJECT TITLE :				
THAILAND HINKONG POWER PLANT PROJECT				
PROJECT Co.				
MITSUBISHI POWER, LTD.				
EPC CONTRACTOR :				
HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.				
VENDOR :				
DYNAMIC SPECIAL COMPANY				
DASCO				
AIR COOLED HEAT EXCHANGER WALKWAY DETAIL DRAWING				
PREPARED BY	DATE	TITLE		
K.T.KANG	2022.02.07			
CHECKED BY	DATE			
M.S.KIM	2022.02.07			
APPROVED BY	DATE			
S.K.LEE	2022.02.07			
PAGE	SCALE	DOCUMENT NUMBER	REV.	
3/8	1/15	VP-21DP285-AFC-WWD	0	

DSC-THPP-017~019-2

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



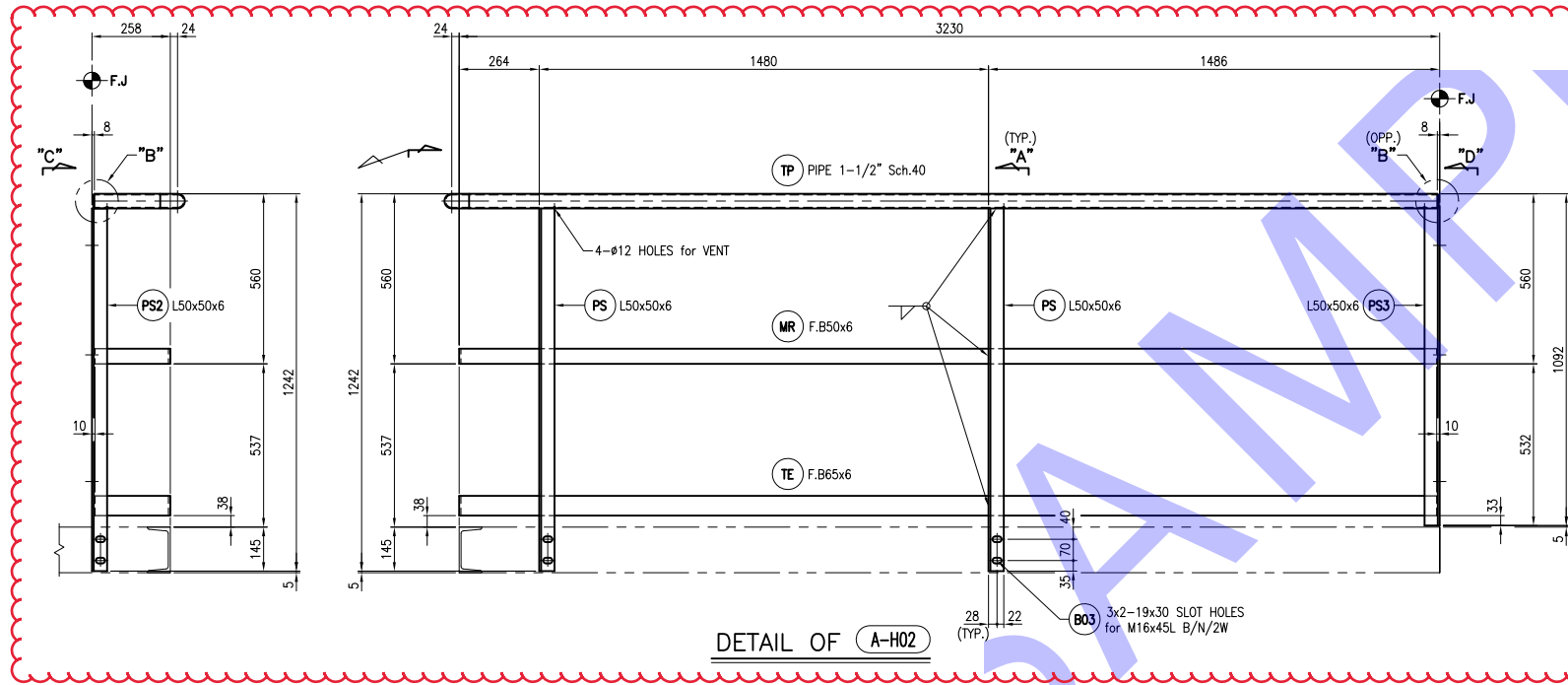
DSC-THPP-017~019-1

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H01 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 4334L	SA53-B	1	17.8	
	MR	MID PLATE	F.B 50x6T - 4330L	SS275 or EQ.	1	10.2	
	TE	TOE PLATE	F.B 65x6T - 4330L	SS275 or EQ.	1	13.2	
	PS	POST	L50x50x6T - 1202L	SS275 or EQ.	2	10.6	
	PS1	POST	L50x50x6T - 1202L	SS275 or EQ.	1	5.3	
	PS2	POST	L50x50x6T - 1202L	SS275 or EQ.	1	5.3	
WW-B03	EP	END PLATE	3Tx#45	SM400A or EQ.	2	0.2	
	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	11	-	
TOTAL WEIGHT :						62.6	KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

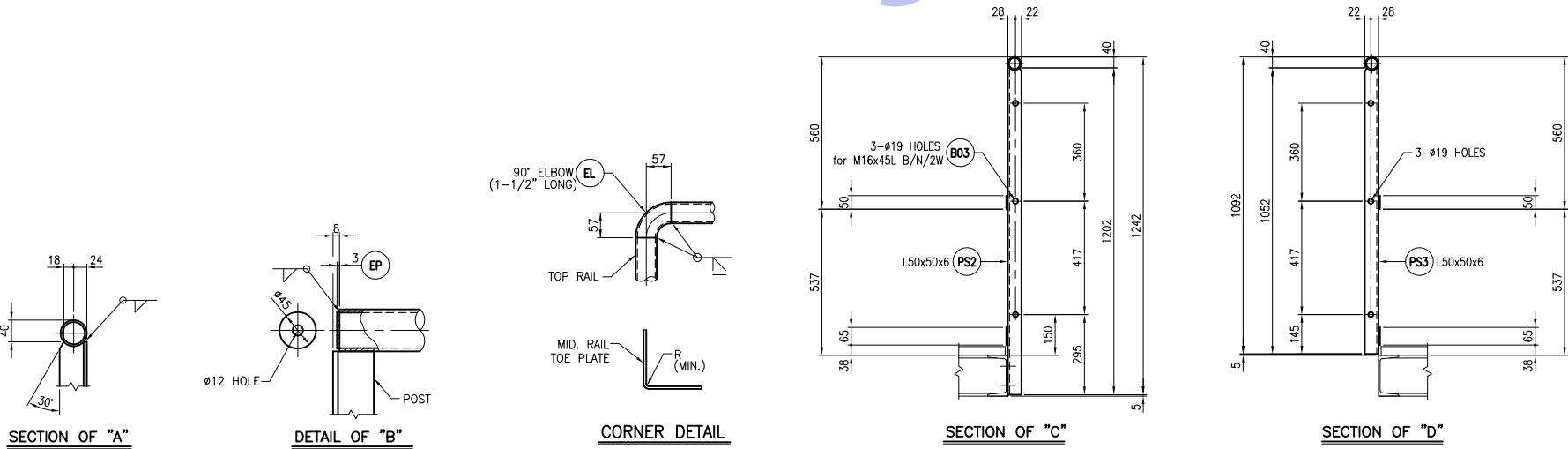
BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H02 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 3406L	SA53-B	1	14	
	MR	MID PLATE	F.B 50x6T - 3468L	SS275 or EQ.	1	8.2	
	TE	TOE PLATE	F.B 65x6T - 3468L	SS275 or EQ.	1	10.6	
	PS	POST	L50x50x6T - 1202L	SS275 or EQ.	2	10.6	
	PS2	POST	L50x50x6T - 1202L	SS275 or EQ.	1	5.3	
	PS3	POST	L50x50x6T - 1052L	SS275 or EQ.	1	4.7	
	EL	ELBOW (90° L.R)	1-1/2" SCH.40	SA234-WPB	1	0.3	
WW-B03	EP	END PLATE	3Tx#45	SM400A or EQ.	2	0.2	
	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	9	-	
TOTAL WEIGHT :						53.9	KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

PART LIST [3 SET(S) TO BE MANUFACTURED]

PART LIST [3 SET(S) TO BE MANUFACTURED]



DSC-THPP-017~019-1



GENERAL NOTES

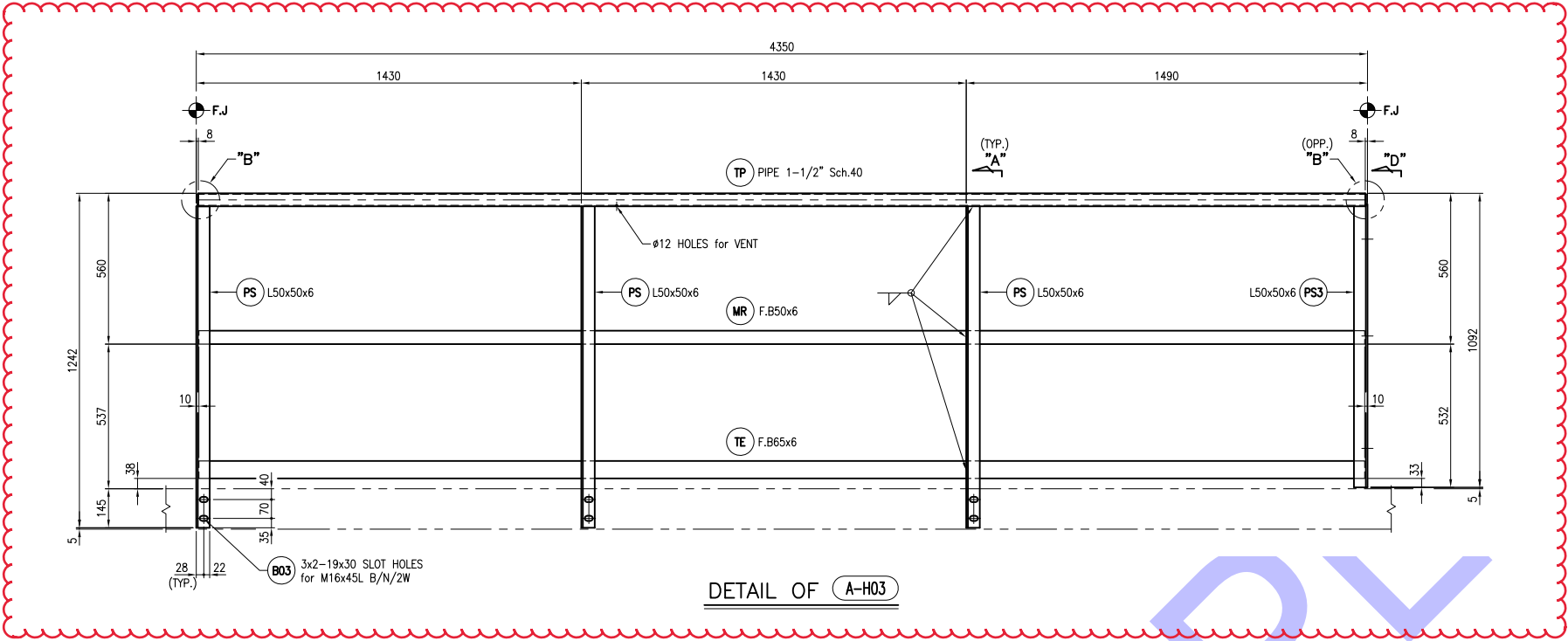
- ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
- UNLESS OTHERWISE ROUND : R10

FOR CONSTRUCTION

REVISION				REVISION			
REV.	DATE	DESCRIPTION	PROJ. NO.	REV.	DATE	DESCRIPTION	PROJ. NO.
1	2022.02.07	FOR CONSTRUCTION	K.T.KANG	1	2022.02.07	FOR CONSTRUCTION	K.T.KANG
PROJECT TITLE :				PROJECT TITLE :			
THAILAND HINKONG POWER PLANT PROJECT				THAILAND HINKONG POWER PLANT PROJECT			
PROJECT Co.				PROJECT Co.			
MITSUBISHI POWER, LTD.				MITSUBISHI POWER, LTD.			
EPC CONTRACTOR :				EPC CONTRACTOR :			
HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.				HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.			
VENDOR :				VENDOR :			
DYNAMIC SPECIAL COMPANY				DYNAMIC SPECIAL COMPANY			
DASCO				DASCO			
PREPARED BY				PREPARED BY			
K.T.KANG				K.T.KANG			
DATE				DATE			
2022.02.07				2022.02.07			
CHECKED BY				CHECKED BY			
M.S.KAM				M.S.KAM			
DATE				DATE			
2022.02.07				2022.02.07			
APPROVED BY				APPROVED BY			
S.K.LEE				S.K.LEE			
DATE				DATE			
2022.02.07				2022.02.07			
PAGE				PAGE			
4/8				4/8			
SCALE				SCALE			
1/12				1/12			
DOCUMENT NUMBER				DOCUMENT NUMBER			
VP-21DP285-AFC-WWD				VP-21DP285-AFC-WWD			
REV.				REV.			
0				0			

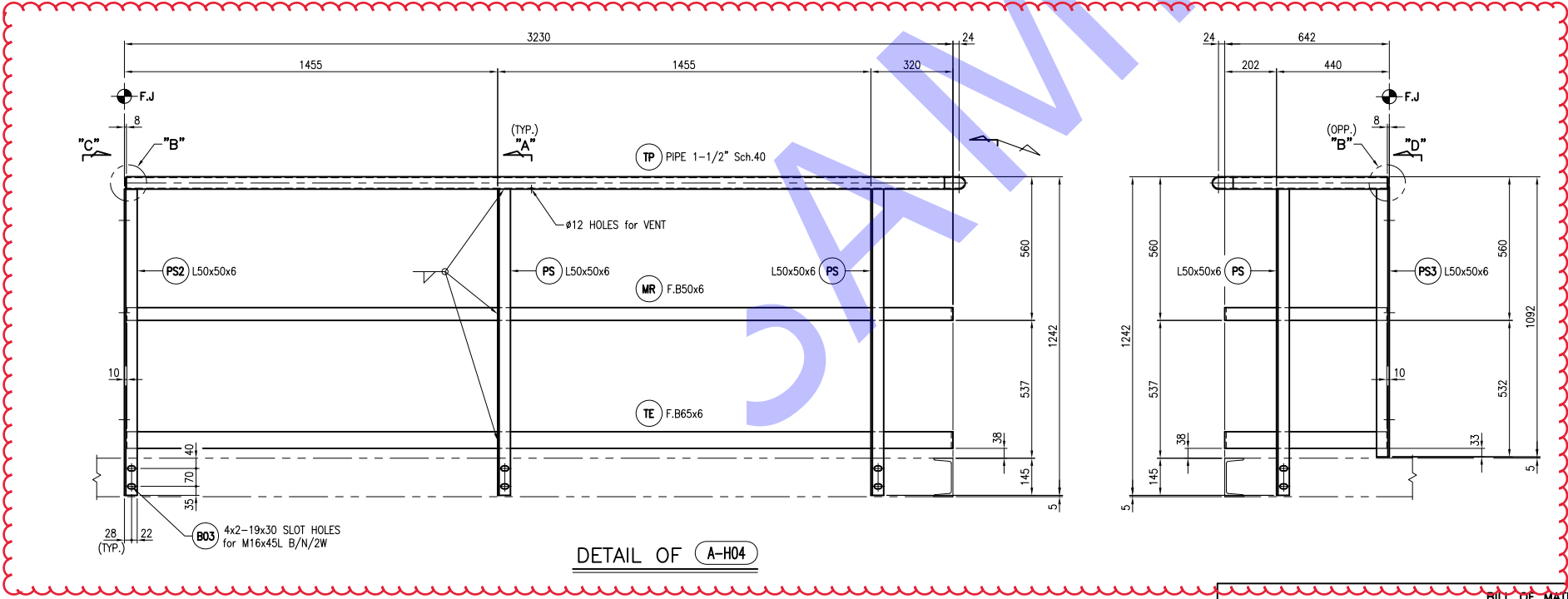
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H03 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 4334L	SA53-B	1	17.8	
	MR	MID PLATE	F.B 50x6T - 4330L	SS275 or EQ.	1	10.2	
	TE	TOE PLATE	F.B 65x6T - 4330L	SS275 or EQ.	1	13.2	
	PS	POST	L50x50x6T - 1202L	SS275 or EQ.	3	16	
	PS3	POST	L50x50x6T - 1052L	SS275 or EQ.	1	4.7	
	EP	END PLATE	3Txø45	SM400A or EQ.	2	0.2	
WW-B03	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	6	-	
					TOTAL WEIGHT : 62.1 KG		
PART LIST [3 SET(S) TO BE MANUFACTURED]							



DETAIL OF A-H03

DSC-THPP-017~019-2



DETAIL OF A-H04


DSC-THPP-017~019-2

GENERAL NOTES

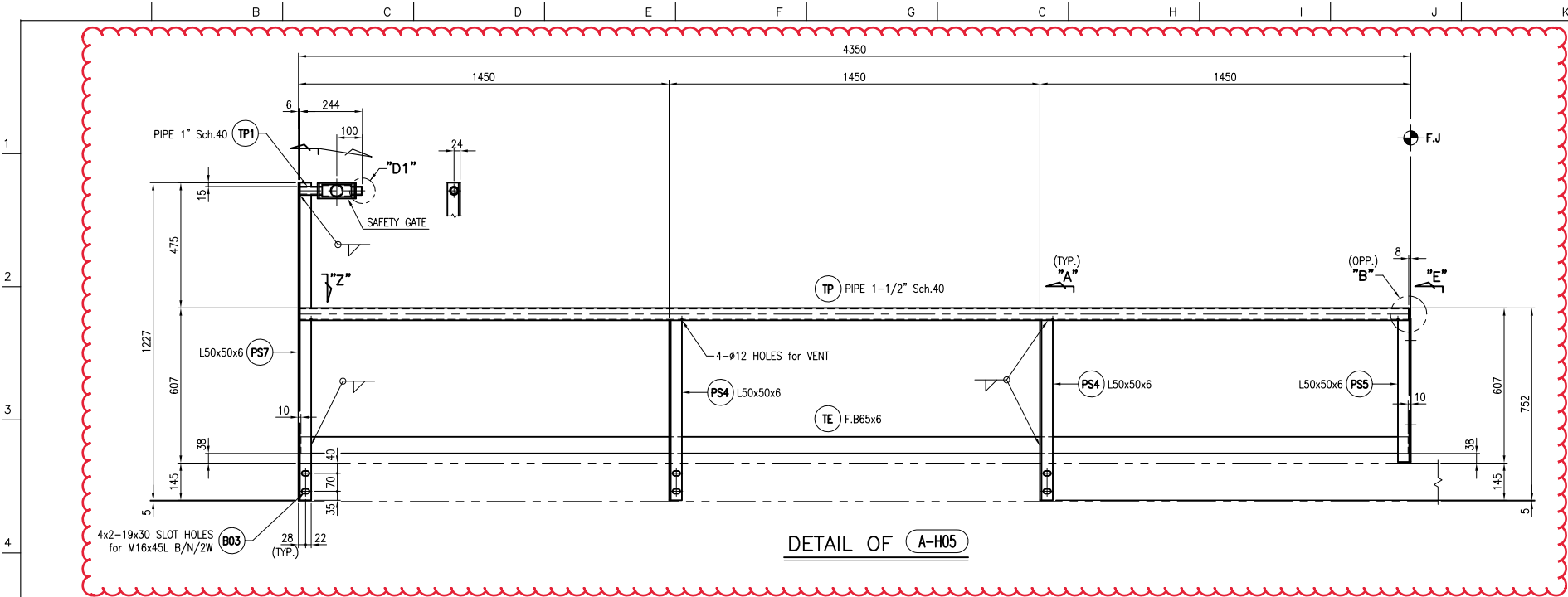
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. UNLESS OTHERWISE ROUND : R10

FOR CONSTRUCTION

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H04 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 3790L	SA53-B	1	15.5	
	MR	MID PLATE	F.B 50x6T - 3852L	SS275 or EQ.	1	9.1	
	TE	TOE PLATE	F.B 65x6T - 3852L	SS275 or EQ.	1	11.8	
	PS	POST	L50x50x6T - 1202L	SS275 or EQ.	3	16	
	PS2	POST	L50x50x6T - 1202L	SS275 or EQ.	1	5.3	
	PS3	POST	L50x50x6T - 1052L	SS275 or EQ.	1	4.7	
	EL	ELBOW (90° L/R)	1-1/2" SCH.40	SA234-WPB	1	0.3	
	EP	END PLATE	3Txø45	SM400A or EQ.	2	0.2	
WW-B03	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	11	-	
					TOTAL WEIGHT : 62.9 KG		
PART LIST [3 SET(S) TO BE MANUFACTURED]							

		2022.02.01		FOR CONSTRUCTION				K.T.KANG		M.S.KAM		S.K.LEE	
REV.	DATE	DESCRIPTION				PROJ BY		CHK BY		APPR BY			
PROJECT TITLE :													
THAILAND HINKONG POWER PLANT PROJECT													
PROJECT Co.													
MITSUBISHI POWER, LTD.													
EPC CONTRACTOR :													
HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.													
VENDOR :													
DYNAMIC & SPECIAL COMPANY													
DASCO													
PREPARED BY : K.T.KANG				DATE : 2022.02.01		TITLE							
CHECKED BY : M.S.KAM				DATE : 2022.02.01		AIR COOLED HEAT EXCHANGER							
APPROVED BY : S.K.LEE				DATE : 2022.02.01		WALKWAY DETAIL DRAWING							
PAGE		SCALE		DOCUMENT NUMBER				REV.					
5/8		1/12		VP-21DP285-AFC-WWD				0					

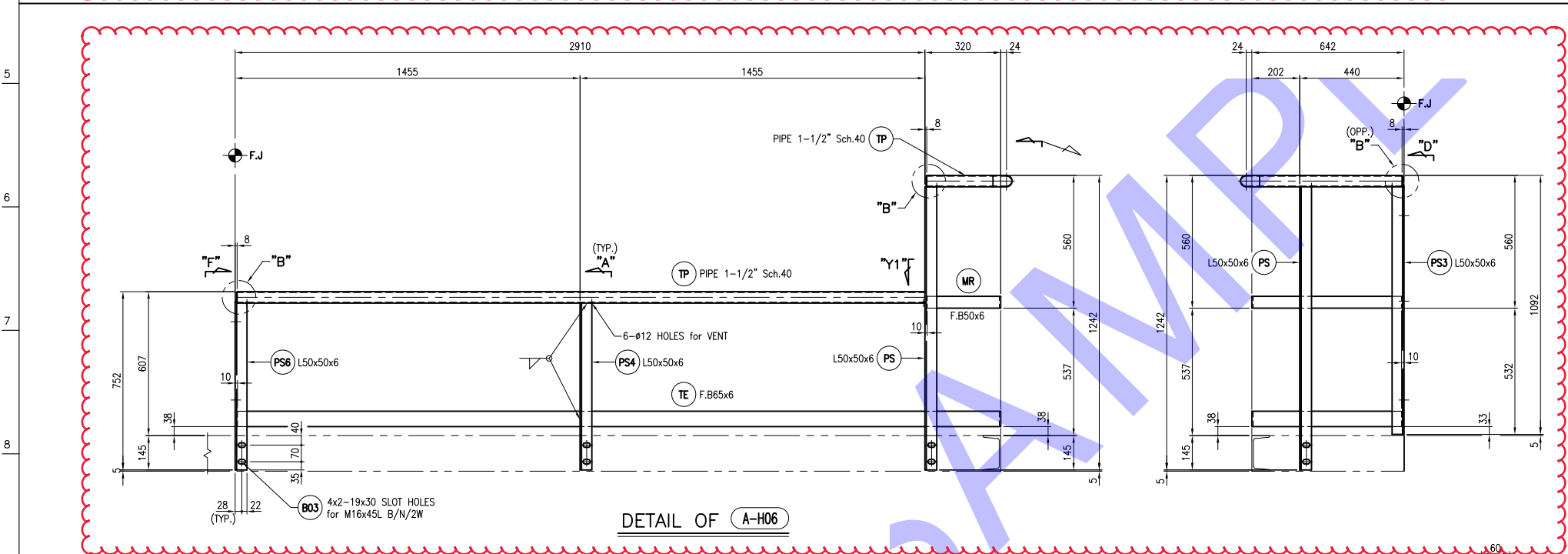
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



DETAIL OF A-H05

DSC-THPP-017~019-1

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H05 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 4336L	SA53-B	1	17.7	
	TP1	HANDRAIL	1" SCH.40 - 241L	SA53-B	1	0.6	
	TE	TOE PLATE	F.B 65x6T - 4330L	SS275 or EQ.	1	13.2	
	PS7	POST	L50x50x6T - 1227L	SS275 or EQ.	1	5.3	
	PS4	POST	L50x50x6T - 712L	SS275 or EQ.	2	6.3	
	PS5	POST	L50x50x6T - 562L	SS275 or EQ.	1	2.5	
	EP	END PLATE	3Tx#45	SS275 or EQ.	1	0.1	
	EP1	END PLATE	3Tx#30	SS275 or EQ.	1	0.1	
	SG1	SAFETY GATE	1-1/2" SCH.40-1098L	SA53-B	1	4.5	
	SG2	CAP	1-1/2" SCH.40	SA234-WPB	1	0.3	
	SG3	TEE	1-1/2" SCH.40	SA234-WPB	1	0.3	
	SG4	STOPPER	6Tx60x378	SM400A or EQ.	1	1.1	
	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	8	-	
TOTAL WEIGHT :						52.0	KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

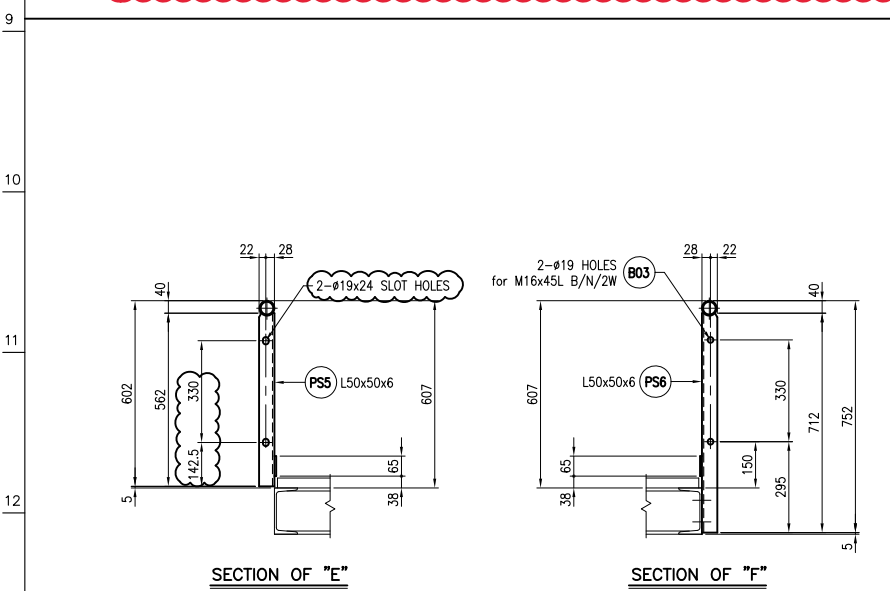


DETAIL OF A-H06

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-H06 1 SET	TP	HANDRAIL	1-1/2" SCH.40 - 3782L	SA53-B	1	15.5	
	MR	MID PLATE	F.B 50x6T - 942L	SS275 or EQ.	1	2.2	
	TE	TOE PLATE	F.B 65x6T - 3852L	SS275 or EQ.	1	11.8	
	PS	POST	L50x50x6T - 1202L	SS275 or EQ.	2	10.6	
	PS3	POST	L50x50x6T - 1052L	SS275 or EQ.	1	4.7	
	PS4	POST	L50x50x6T - 712L	SS275 or EQ.	1	3.2	
	PS6	POST	L50x50x6T - 712L	SS275 or EQ.	1	3.2	
	EL	ELBOW (90° L.R)	1-1/2" SCH.40	SA234-WPB	1	0.3	
	EP	END PLATE	3Tx#45	SM400A or EQ.	3	0.3	
	B03	HEX. B/N/2W	M16x45L	SA307 Gr.A	10	-	
TOTAL WEIGHT :						51.8	KG
PART LIST [3 SET(S) TO BE MANUFACTURED]							

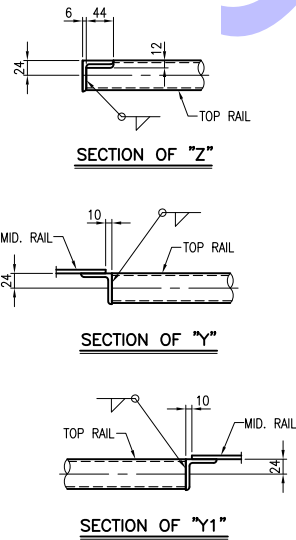
GENERAL NOTES
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. UNLESS OTHERWISE ROUND : R10

DSC-THPP-017~019-1



SECTION OF "E"

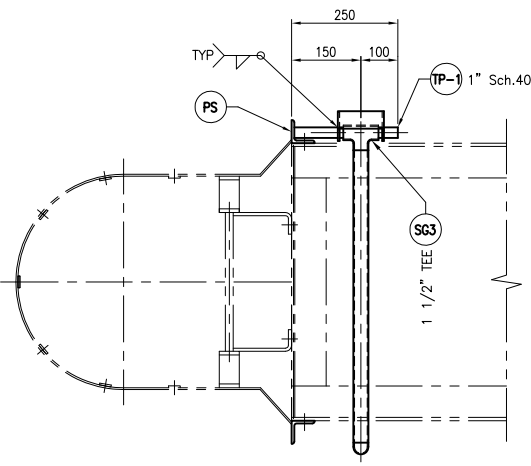
SECTION OF "F"



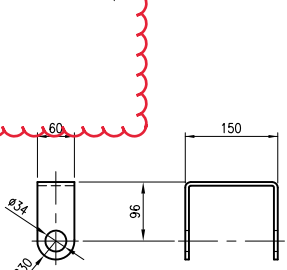
SECTION OF "Z"

SECTION OF "Y"

SECTION OF "Y1"



DETAIL OF SAFETY GATE



DETAIL OF "D1"

FOR CONSTRUCTION

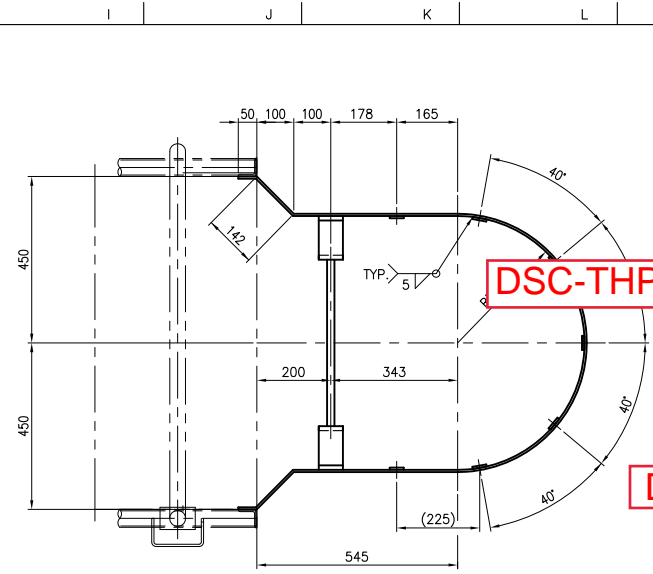
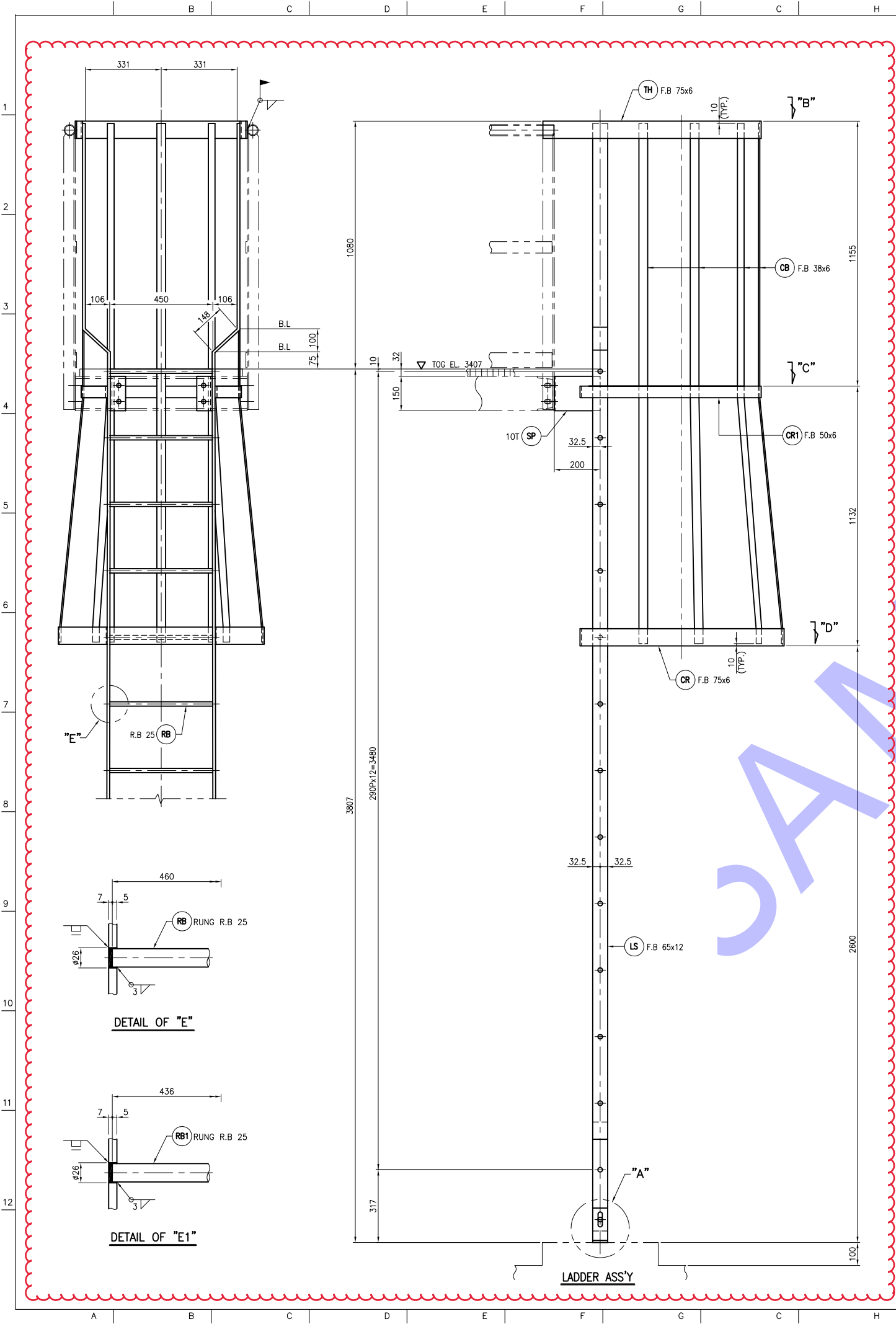
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

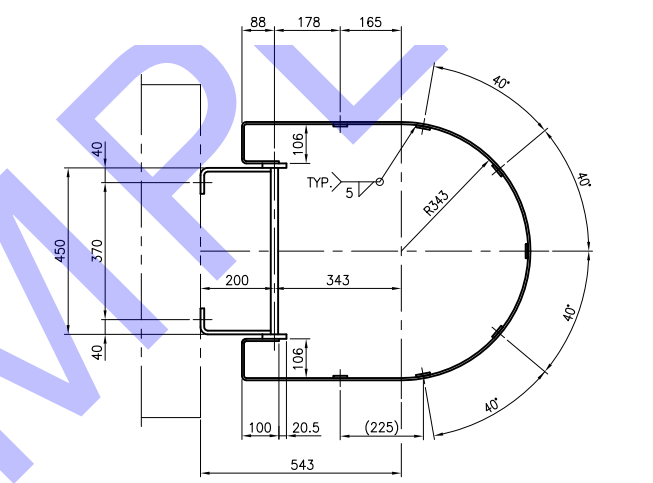
PART LIST [3 SET(S) TO BE MANUFACTURED]PART LIST [3 SET(S) TO BE MANUFACTURED][illegible]

1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. UNLESS OTHERWISE ROUND : R10

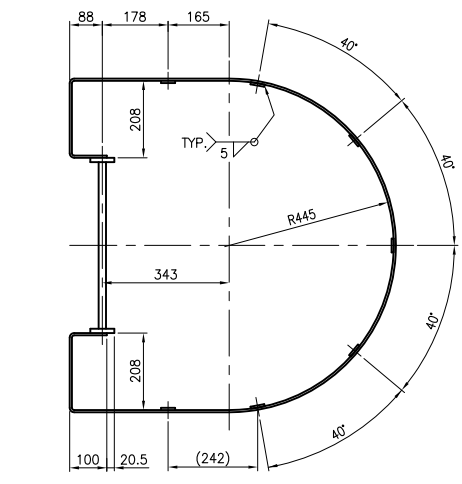
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



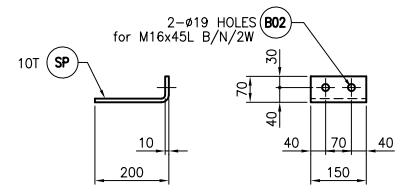
SECTION OF "B"



SECTION OF "C"

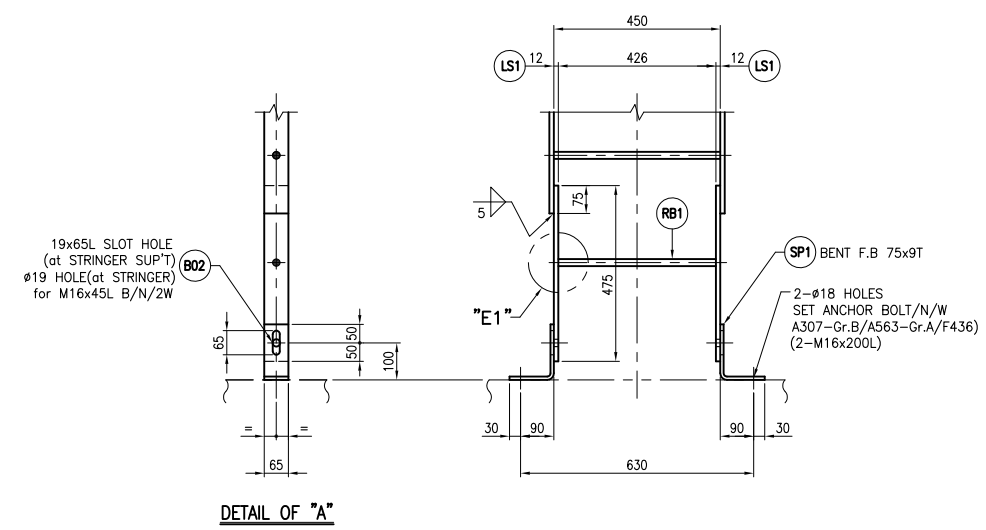


SECTION OF "D"



DETAIL OF SUP'T PLATE

DSC-THPP-020~022-1



DETAIL OF "A"

BILL OF MATERIAL							
TAG NO.	NO	DESCRIPTION	SIZE	MAT'L	Q'TY	WEIGHT	REMARKS
A-LD01 2 SETS	LS	LADDER STRINGER	F.B 65x12T~4475L	SS275 or EQ.	4	109.5	
	CR	CAGE RING	F.B 75x6T~2830L	SS275 or EQ.	2	20	
	CR1	CAGE RING	F.B 50x6T~2306L	SS275 or EQ.	2	10.9	
	TH	TOP HOOP	F.B 75x6T~2351L	SS275 or EQ.	2	16.6	
	CB	CAGE BAR	F.B 38x6T~2272L	SS275 or EQ.	14	56.9	
	RB	RUNG	R.B ø25 - 460L	SS275 or EQ.	24	42.5	
	SP	LADDER CLIP	10T150x252	SS275 or EQ.	4	11.9	
	SP1	LADDER CLIP	F.B 75x9T~270L	SS275 or EQ.	4	4.2	
A-B02	LS1	LADDER STRINGER	F.B 65x12T~475L	SS275 or EQ.	4	11.6	
	RB1	RUNG	R.B ø25 - 436L	SS275 or EQ.	2	3.4	
						TOTAL WEIGHT :	287.5 KG
LIST [3 SET(S) TO BE MANUFACTURED]							

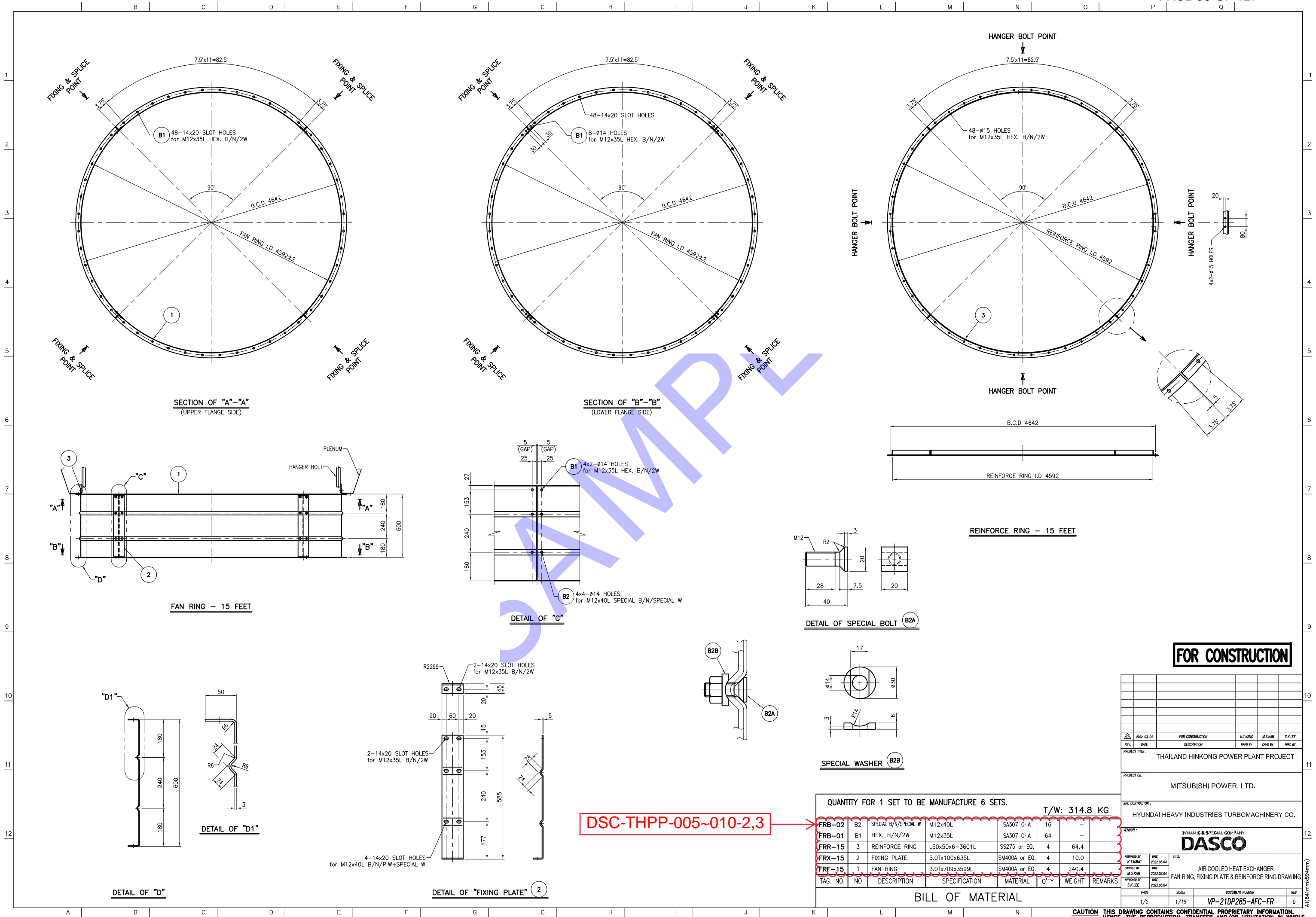
DSC-THPP-036-22~24

- GENERAL NOTES
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
 2. UNLESS OTHERWISE ROUND : R10

FOR CONSTRUCTION

PROJECT TITLE:				THAILAND HINKONG POWER PLANT PROJECT			
PROJECT Co:				MITSUBISHI POWER, LTD.			
EPC CONTRACTOR:				HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.			
VENDOR:				DYNAMIC & SPECIAL COMPANY			
				DASCO			
PREPARED BY				K.T.KANG			
CHECKED BY				M.S.KAM			
APPROVED BY				S.K.LEE			
DATE				2022.05.23			
PROJECT TITLE:				AIR COOLED HEAT EXCHANGER WALKWAY DETAIL DRAWING			
PAGE				8/8			
SCALE				1/10			
DOCUMENT NUMBER				VP-21DP285-AFC-WWD			
REV				1			

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



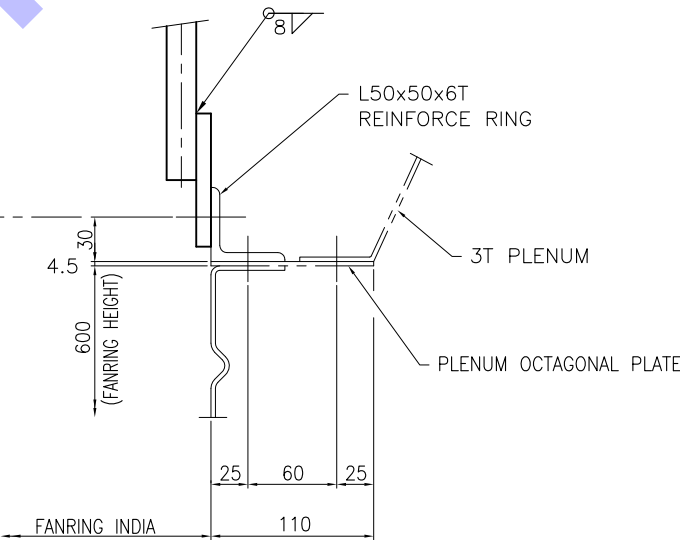
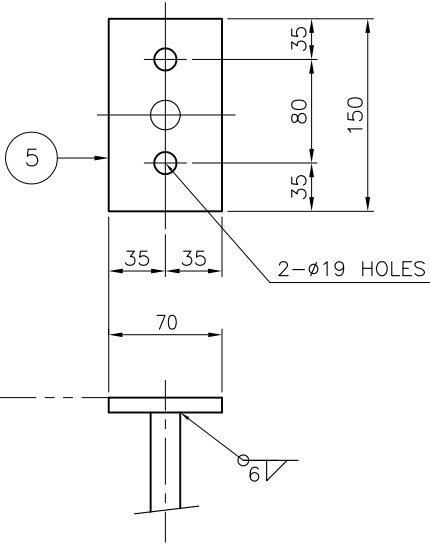
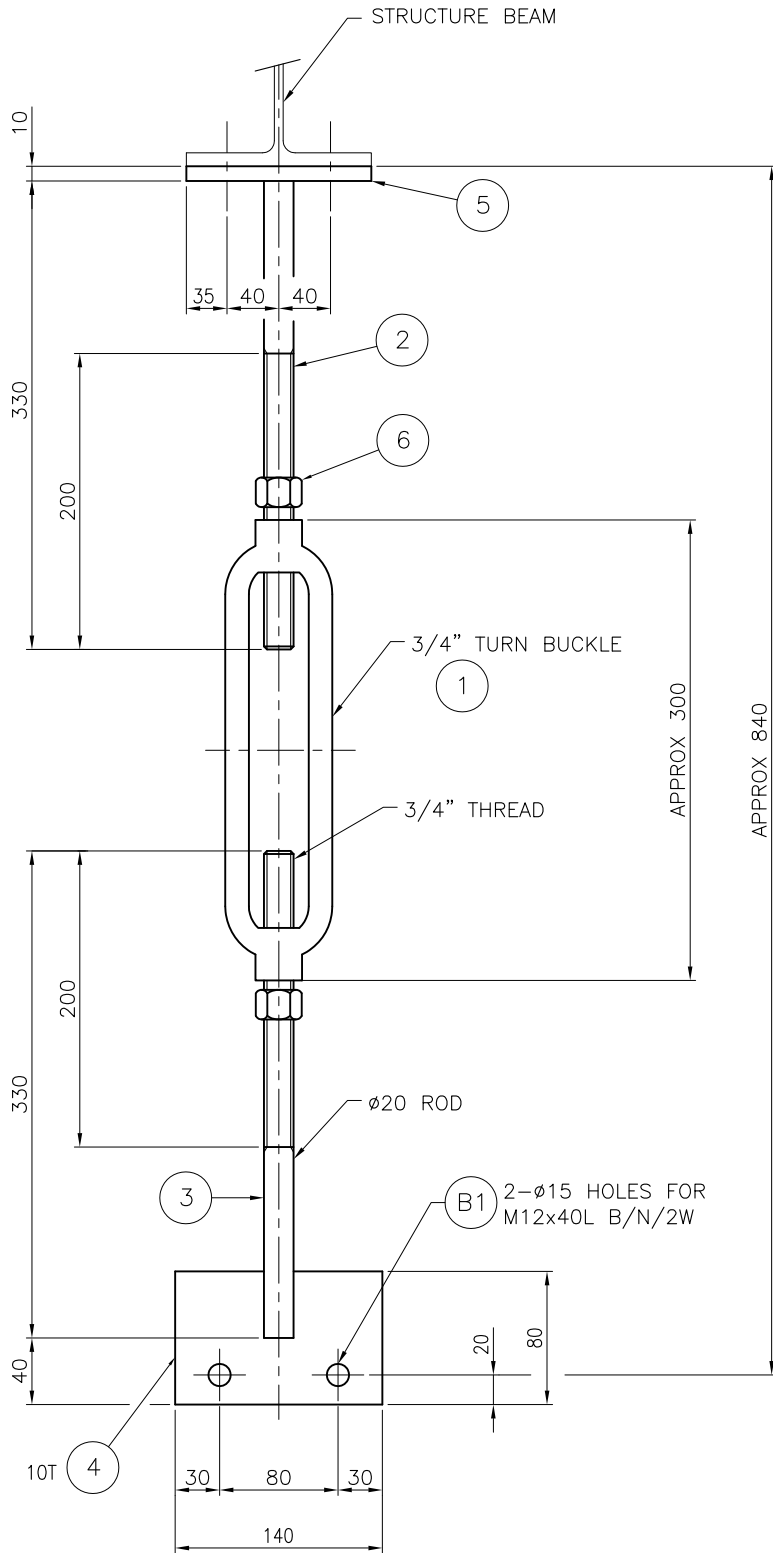
DSC-THPP-005~010-4

BILL OF MATERIAL

TAG. NO.	NO	DESCRIPTION	SPECIFICATION	MATERIAL	Q'TY	WEIGHT	REMARKS
HGR-ROD	1	TURN BUCKLE	FOR 3/4"	S45 or EQ.	1	2.5	
	2	HANGER ROD	RB20 - 330L	SS275 or EQ.	1	0.8	
	3	HANGER ROD	RB20 - 330L	SS275 or EQ.	1	0.8	
	4	PAD	10Tx80x140	SM400A or EQ.	1	0.9	
	5	PAD	10Tx70x150	SM400A or EQ.	1	0.8	
	6	HEX. NUT	M20	SA307 Gr.A	2	-	
HBB-01	B1	HEX B/N/2W	M12x40L	SA307 Gr.A	2	-	

QUANTITY FOR 1 SET TO BE MANUFACTURE 24 SETS.

T/W: 5.8 KG

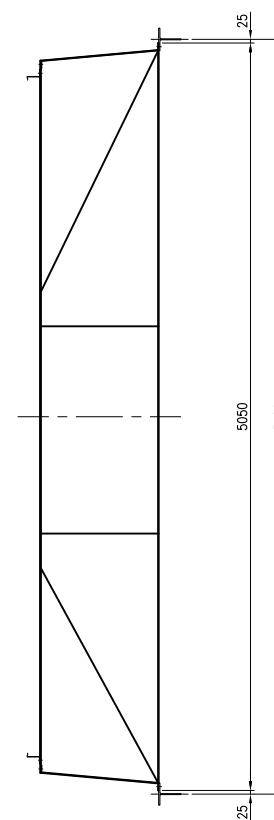


HANGER BOLT DETAIL

FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	PROJ. BY	CHK. BY	APP. BY
1	2022.03.04	FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT					
PROJECT Co. MITSUBISHI POWER, LTD.					
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.					
VENDOR: DYNAMIC & SPECIAL COMPANY					
DASCO					
PREPARED BY	DATE	TITLE			
K.T.KANG	2022.03.04	AIR COOLED HEAT EXCHANGER			
CHECKED BY	DATE				
M.S.KAM	2022.03.04	HANGER BOLT DETAIL DRAWING			
APPROVED BY	DATE				
S.K.LEE	2022.03.04				
PAGE	SCALE	DOCUMENT NUMBER	REV.		
2/2	1/10	VP-21DP285-AFC-FR	0		

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



PLENUM ASSEMBLY
(for 15 FEET)

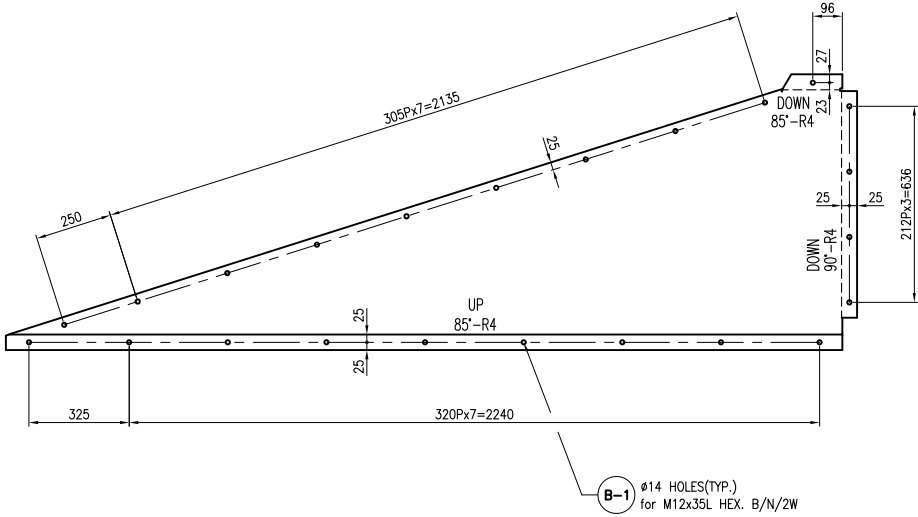
FOR CONSTRUCTION

[illegible]

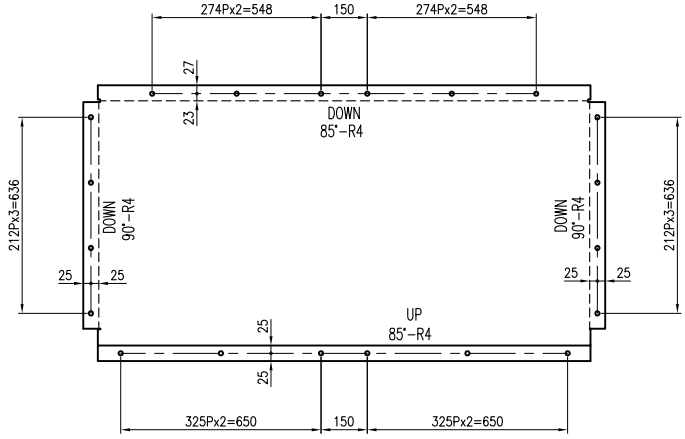
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION.
HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE
OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION
OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

V.	

2-SIDE PANEL-SP1(AS SHOWN)
2-SIDE PANEL-SP2(OPP. HAND)



2-SIDE PANEL-SP3(AS SHOWN)



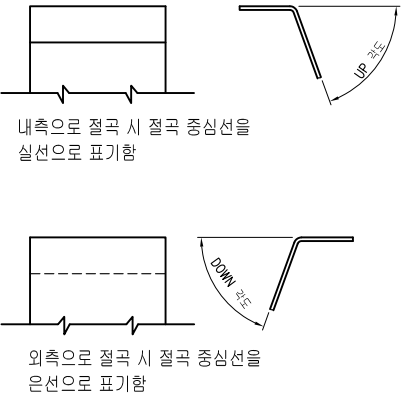
DSC-THPP-036-37

BILL OF MATERIAL

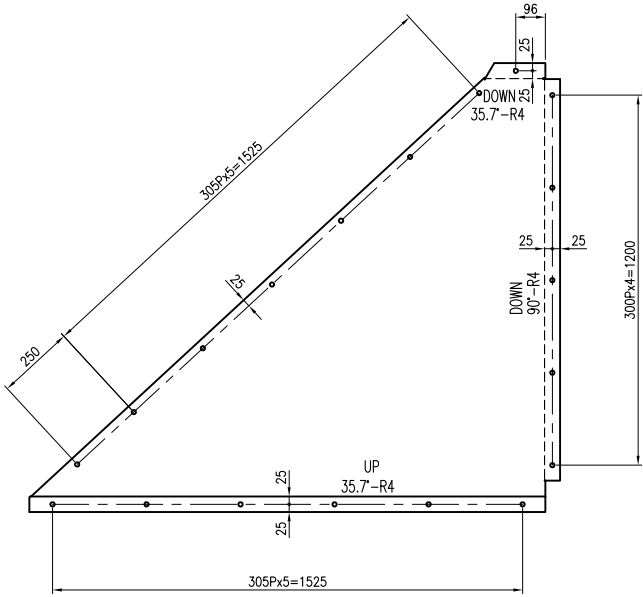
TAG. NO.	PART NO.	PART NAME	MATERIAL	DIMENSIONS	Q'TY PER 1 SET	UNIT	WEIGHT (KG)
SP1	PLENUM	SM400A or EQ.	3T		2	EA	31.4 62.8
SP2	PLENUM	SM400A or EQ.	3T		2	EA	31.4 62.8
SP3	PLENUM	SM400A or EQ.	3T		2	EA	35.3 70.6
SP4	PLENUM	SM400A or EQ.	3T		2	EA	33.5 67.0
SP5	PLENUM	SM400A or EQ.	3T		2	EA	33.5 67.0
DP1	PLENUM	SM400A or EQ.	4.5T		4	EA	23.1 92.4
PL-B01	B	1	HEX. B/N/2W	SA307 Gr.A M12x35L	84	SET	

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.

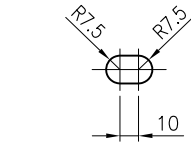
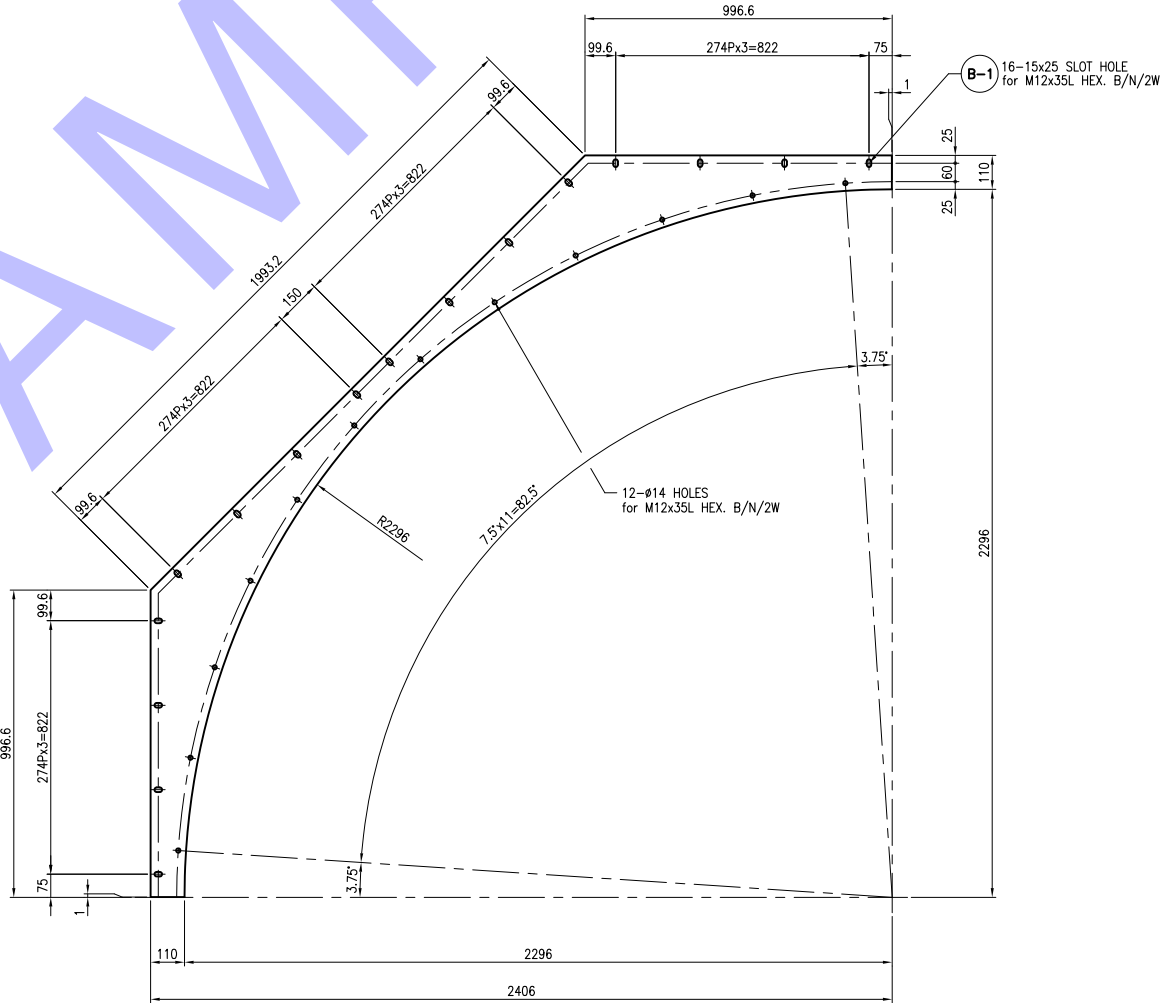
TOTAL WEIGHT : 422.6 KG



2-SIDE PANEL-SP4(AS SHOWN)
2-SIDE PANEL-SP5(OPP. HAND)



4-DECK PLATE-DP1



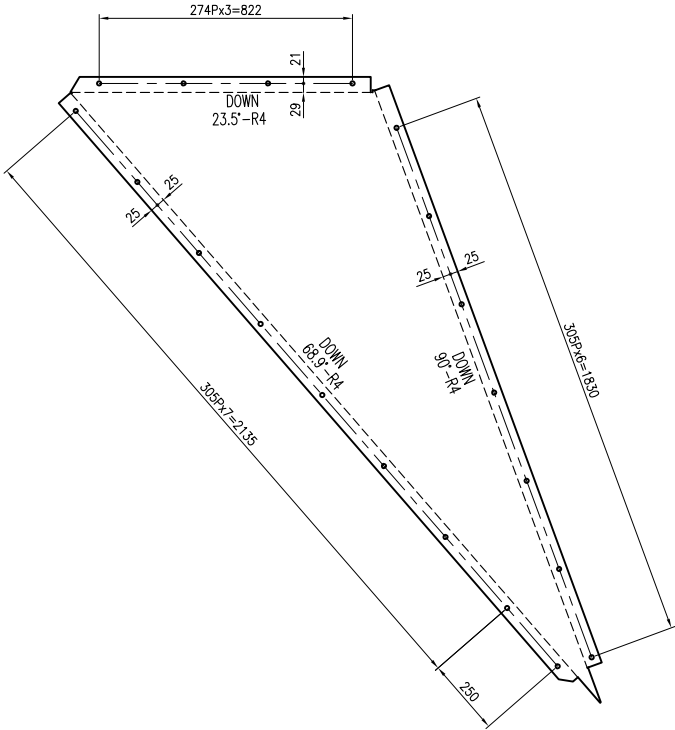
DETAIL OF SLOT HOLE

FOR CONSTRUCTION

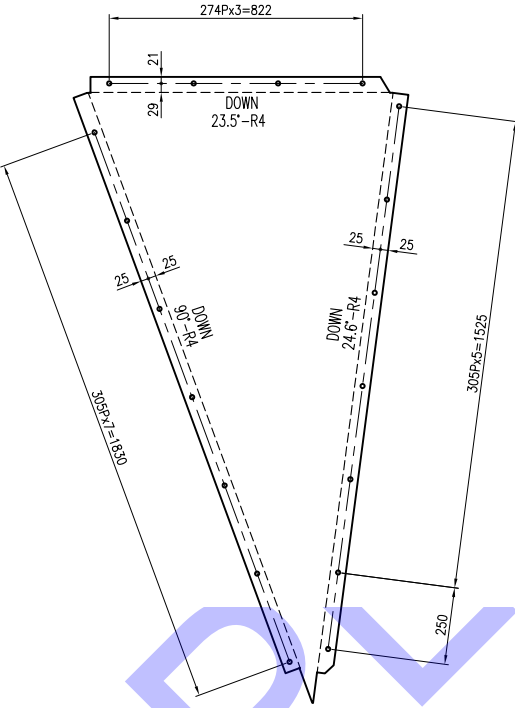
REV.	DATE	DESCRIPTION	PREP BY	CHK BY	APP BY
1	2022.03.11	FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
PROJECT TITLE: THAILAND HINKONG POWER PLANT PROJECT					
PROJECT Co. MITSUBISHI POWER, LTD.					
EPC CONTRACTOR: HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.					
VENDOR: DYNAMIC SPECIAL COMPANY					
DASCO					
AIR COOLED HEAT EXCHANGER PLENUM DETAIL DRAWING					
PAGE	SCALE	DOCUMENT NUMBER	REV.		
2/3	1/12	VP-21DP285-AFC-PL	0		

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.

2-SIDE PANEL-SP8(AS SHOWN)
2-SIDE PANEL-SP9(OPP. HAND)



2-SIDE PANEL-SP7(AS SHOWN)
2-SIDE PANEL-SP10(OPP. HAND)



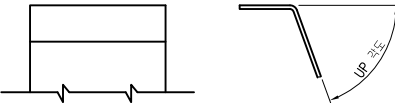
BILL OF MATERIAL

SP6	PLENUM	SM400A or EQ.	3T	2	EA	57.7	115.4
SP7	PLENUM	SM400A or EQ.	3T	2	EA	28.8	57.6
SP8	PLENUM	SM400A or EQ.	3T	2	EA	29.6	59.2
SP9	PLENUM	SM400A or EQ.	3T	2	EA	29.6	59.2
SP10	PLENUM	SM400A or EQ.	3T	2	EA	28.8	57.6

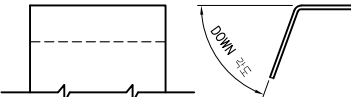
PART NO.	PART NAME	MATERIAL	DIMENSIONS	Q'TY PER 1 SET	UNIT	WEIGHT (KG)
----------	-----------	----------	------------	-------------------	------	----------------

QUANTITY FOR 1 SET TO BE MANUFACTURE 6 SETS.

TOTAL WEIGHT : 349.0 KG

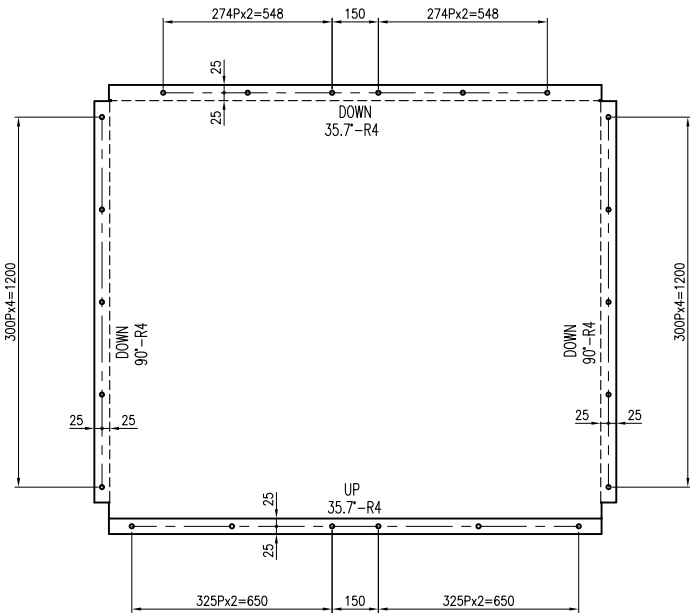


내측으로 절곡 시 절곡 중심선을
실선으로 표기함



외측으로 절곡 시 절곡 중심선을
은선으로 표기함

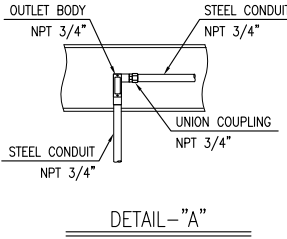
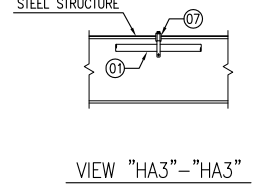
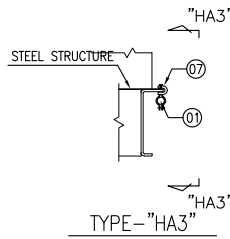
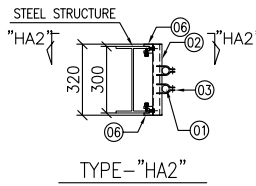
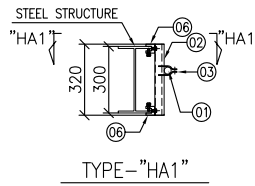
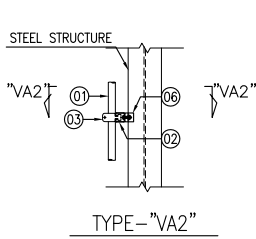
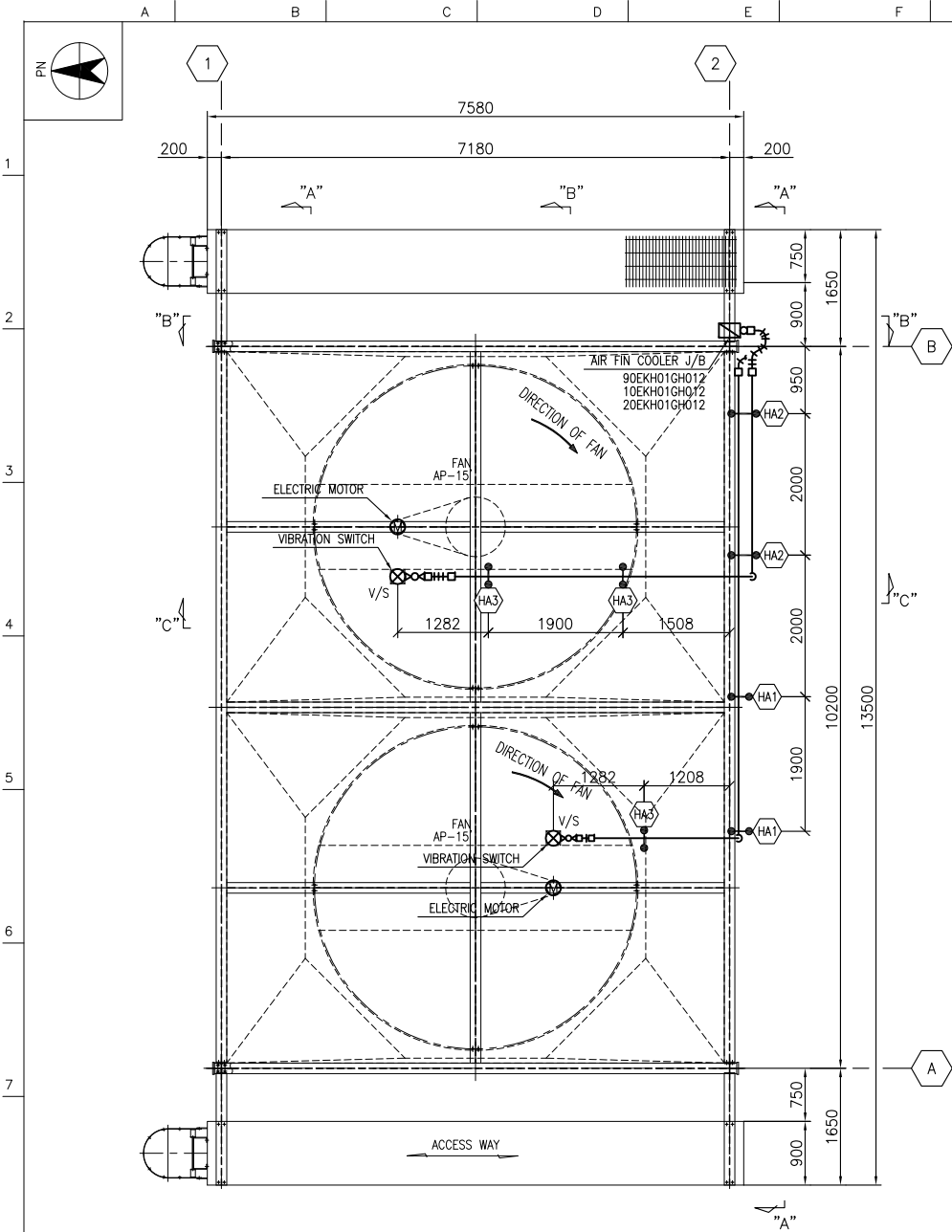
2-SIDE PANEL-SP6(AS SHOWN)



FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	PROG BY	CHKD BY	APPR BY
1	2022.03.11	FOR CONSTRUCTION	K.T.KANG	M.S.KAM	S.K.LEE
PROJECT TITLE :					
THAILAND HINKONG POWER PLANT PROJECT					
PROJECT Co.					
MITSUBISHI POWER, LTD.					
EPC CONTRACTOR :					
HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.					
VENDOR :					
DYNAMIC & SPECIAL COMPANY					
DASCO					
PREPARED BY	DATE	TITLE			
K.T.KANG	2022.03.11	AIR COOLED HEAT EXCHANGER			
CHECKED BY	DATE	PLENUM DETAIL DRAWING			
M.S.KAM	2022.03.11				
APPROVED BY	DATE				
S.K.LEE	2022.03.11				
PAGE	SCALE	DOCUMENT NUMBER		REV.	
3/3	1/12	VP-21DP285-AFC-PL		0	

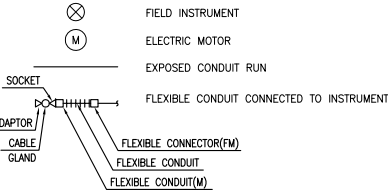
CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



GENERAL NOTES

1. CONDUIT POSITIONS AS SHOWN ARE APPROXIMATE. EXACT LOCATIONS TO AVOID INTERFERENCE WITH PIPING, STRUCTURES, ETC. ARE TO BE DETERMINED IN FIELD EXCEPT WHERE THEIR LOCATIONS ARE FIXED BY DIMENSIONS ON DRAWINGS.
2. ALL EXPOSED CONDUIT SHALL BE USED RIGID GALVANIZED STEEL(R.G.S) CONDUIT.
3. EXPOSED CONDUIT RUNS SHALL BE INSTALLED A NEAT AND WORKMANLIKE MANNER WITH ALL RUNS GENERALLY PARALLEL OR AT RIGHT ANGLE TO WALLS, STRUCTURE MEMBERS AND CEILINGS.
4. ALL CONDUIT SHALL BE SUPPORTED AT EVERY 2M AND WITHIN 900mm OF EACH OUTLET BOX, JUNCTION BOX, CABINET OR FITTINGS.
5. CONDUIT SHALL BE KEPT AT LEAST 300mm FROM STEAM OR OTHER HOT LINES. WHERE CROSSINGS ARE UNAVOIDABLE, CONDUIT SHALL BE KEPT AT LEAST 150mm FROM INSULATION OF SUCH LINES.
6. ALL CONDUIT ENDS SHALL BE PLUGGED OR CAPPED DURING CONSTRUCTION.
7. ALL CONDUIT AND FITTINGS SHALL BE FABRICATED.
8. LOCATIONS AND ELEVATIONS OF INSTRUMENT POINT ARE APPROXIMATE.
9. CONDUITS SHALL BE CONNECTED BY USING THE COUPLING IN ORDER TO PREVENT THE INGRESS OF WATER. CONNECTIONS SHALL BE SEALED BY USING THE ADHESIVE MATERIALS.
10. THIS DRAWING IS SHOWN FOR ONE(1) UNIT. TOTAL REQUIRED ARE 4 UNITS.

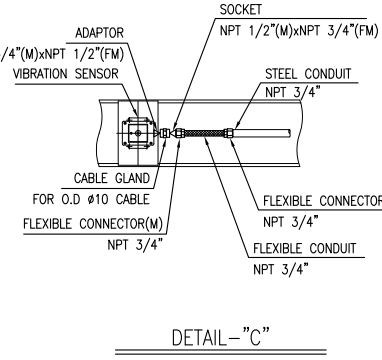
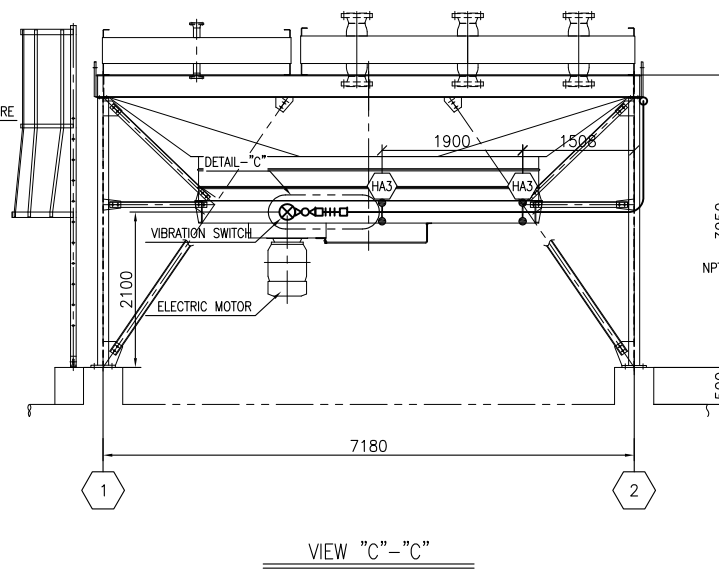
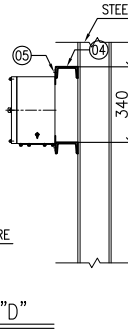
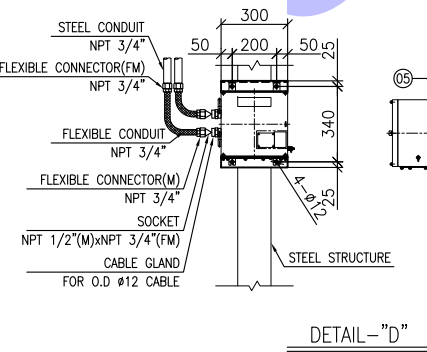
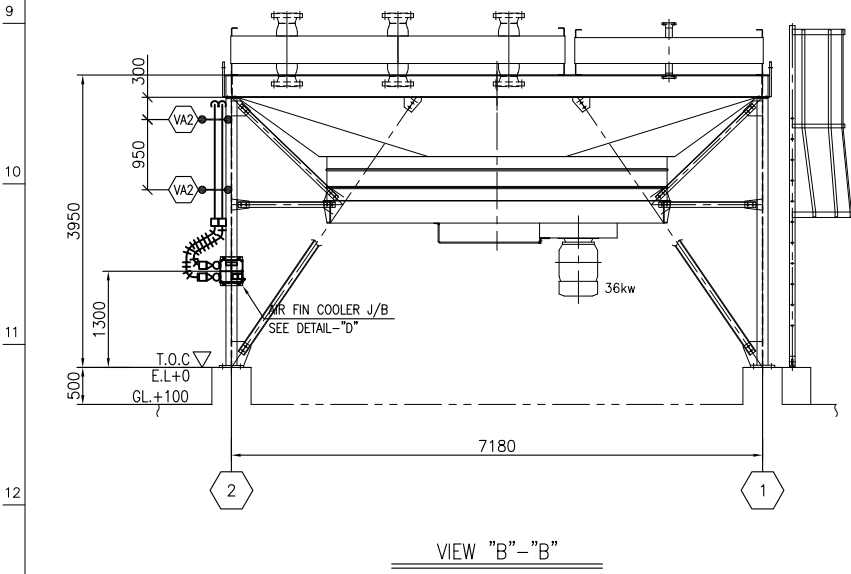
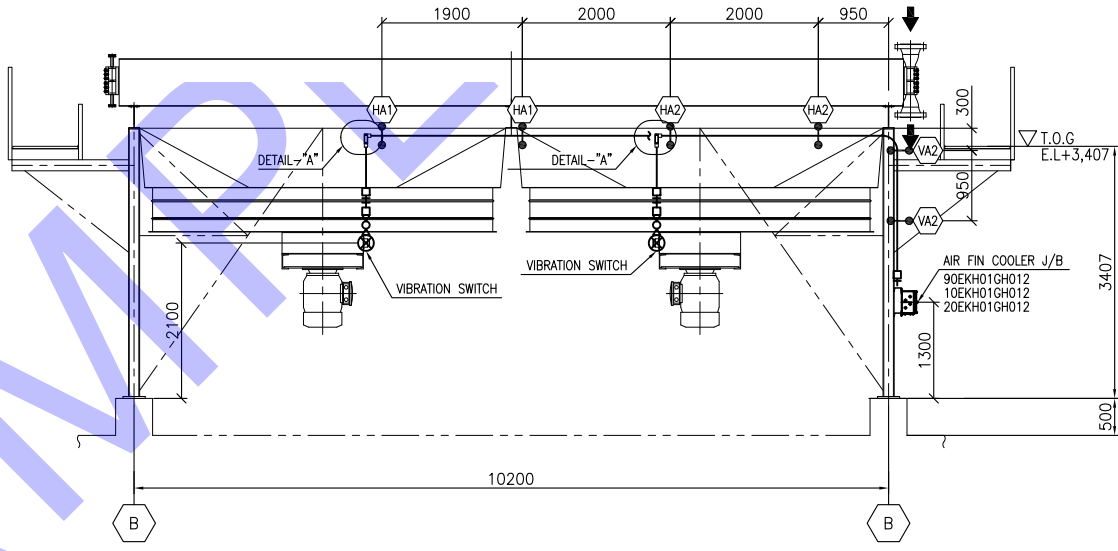
SYMBOLS & LEGENDES



MATERIAL LIST

ITEM NO	DESCRIPTION	REMARK
01	STEEL CONDUIT	STEEL,H.D.G
02	SINGLE UNISTRUT CHANNEL, 41x41x2.6T	STEEL,H.D.G
03	PIPE CLAMP W/BOLT&NUT	STEEL,H.D.G
04	STEEL CHANNEL, 100x50x5	STEEL,H.D.G
05	HEX HEAD BOLT (M10x35L) & HEX NUT & P/W(2), S/W(1)	STAINLESS STEEL 304
06	C TYPE BEAM CLAMP-3TAP W/BOLT	STEEL,ZINC PLATING
07	C TYPE BEAM CLAMP W/SADDLE	STEEL,ZINC PLATING
08	OUTLET BODY W/UNION COUPLING	STEEL

DSC-THPP-033-1~18



FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	ISSUED FOR CONSTRUCTION	K.T.KANG	M.S.KIM	S.K.LEE
PROJECT TITLE:	THAILAND HINKONG POWER PLANT PROJECT					
PROJECT Co:	MITSUBISHI POWER, LTD.					
EPC CONTRACTOR:	HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.					
VENDOR:	DYNAMIC & SPECIAL COMPANY					
DASCO						
PREPARED BY	DATE	TITLE				
K.T.KANG	2022.03.07	AIR COOLED HEAT EXCHANGER RACEWAY DRAWING (1/1)				
CHECKED BY	DATE					
M.S.KIM	2022.03.07					
APPROVED BY	DATE					
S.K.LEE	2022.03.07					
PAGE	SCALE	DOCUMENT NUMBER	REV.			
1/1	1/50	VP-21DP285-AFC-RW	0			

CAUTION THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION. HENCE, THE REPRODUCTION, TRANSFER AND/OR UTILIZATION IN WHOLE OR IN PART ARE PROHIBITED WITHOUT THE WRITTEN PERMISSION OF HYUNDAI HEAVY INDUSTRIES TURBOMACHINERY CO.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

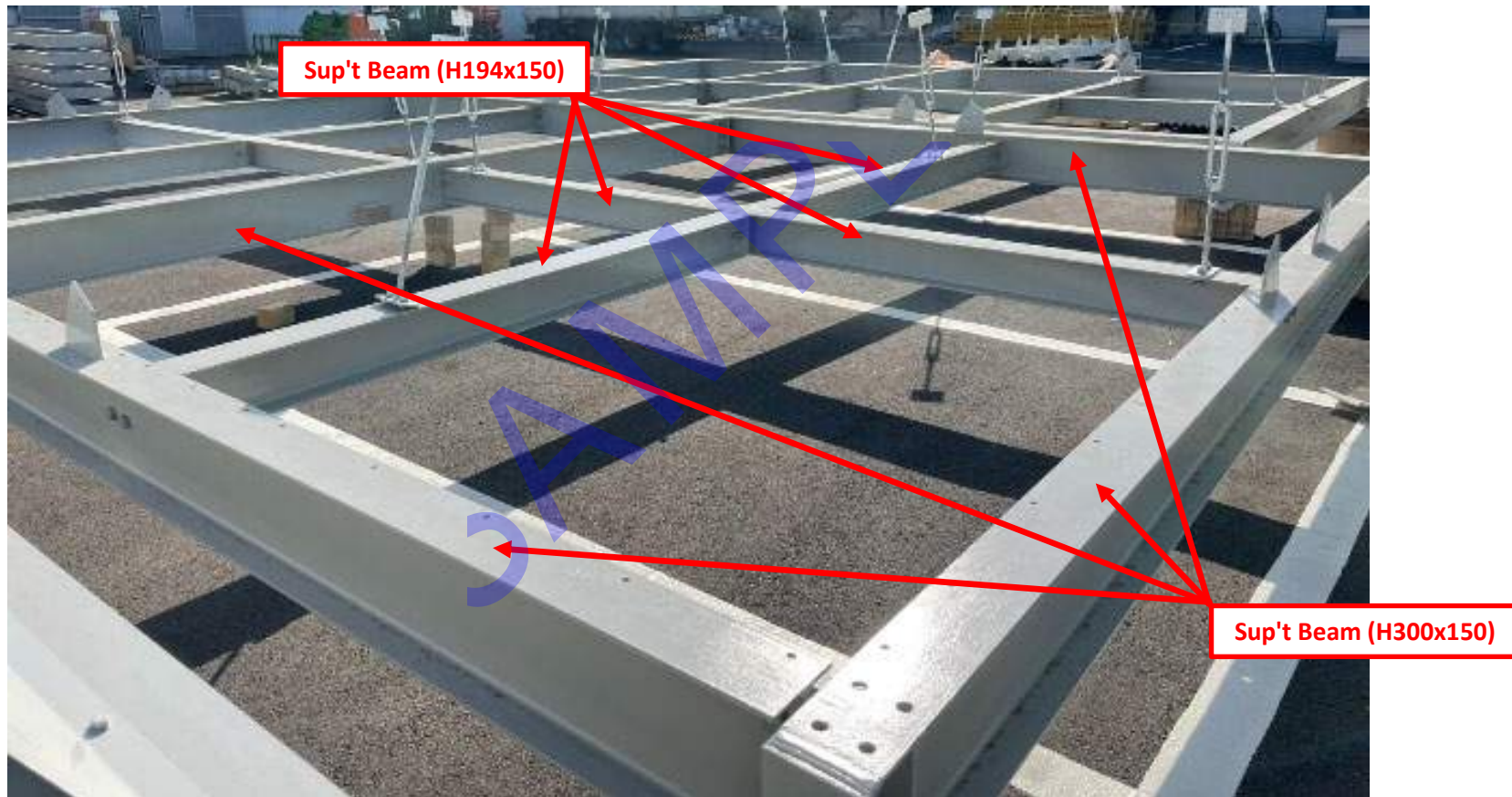
1.2 Erection work diagram - Forced Draft Type :

SAMPLE

INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-1 : Steel Structure - Upper Beam Member Ass'y



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-2 : Steel Structure to Plenum + Fan Ring + Main Frame Ass'y

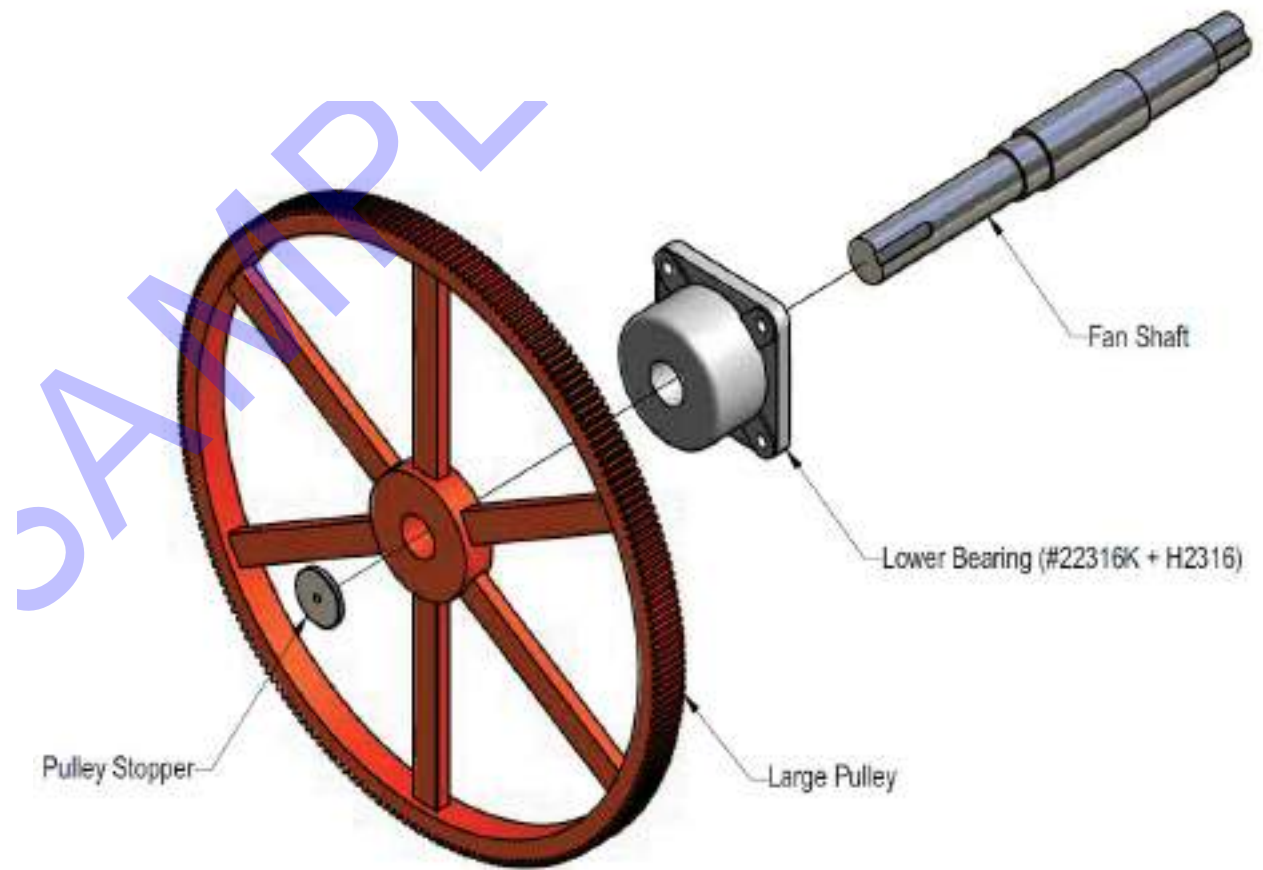


INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-3 : Driving Unit Part - Lower Bearing Ass'y (#22316K+H2316)

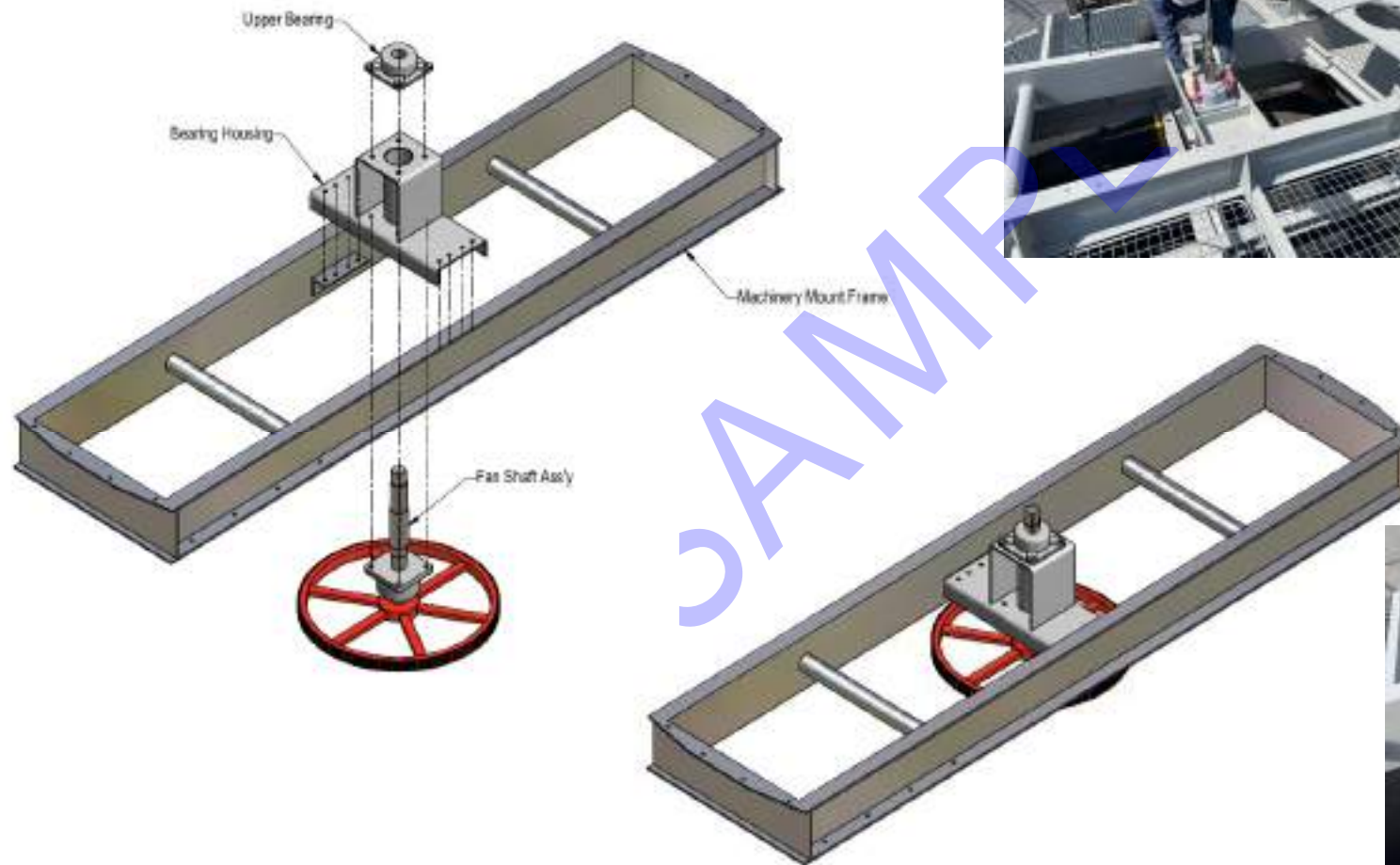
with Initial Charge of Grease & Large Pulley + Lower Bearing + Fan shaft Ass'y



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

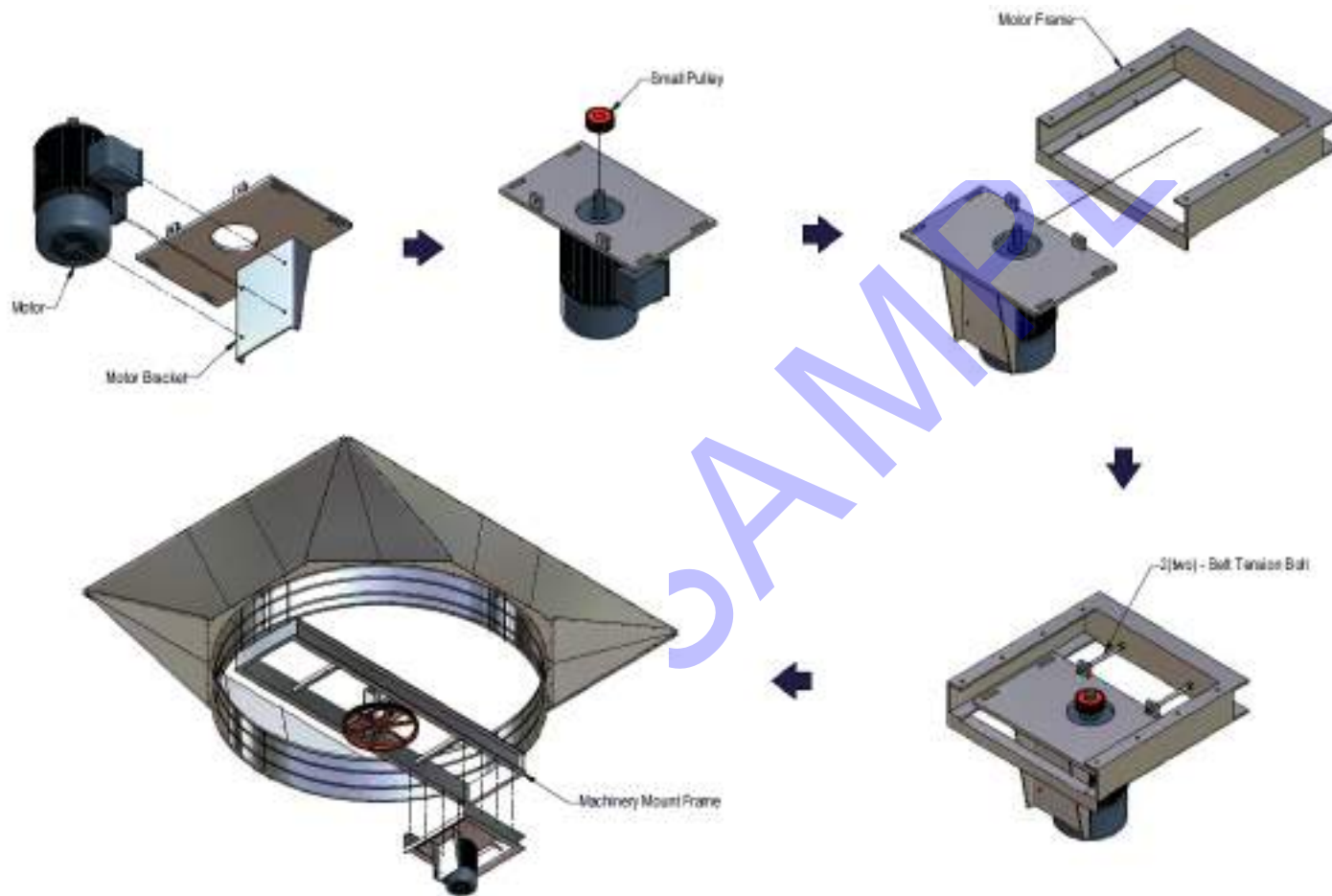
Step-4 : Driving Unit Part - Fan Shaft + Bearing Housing + Upper Bearing Ass'y



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-5 : Driving Unit Part - Motor Frame + Motor + Small Pulley Ass'y



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-6 : Steel Structure - Column Installation



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

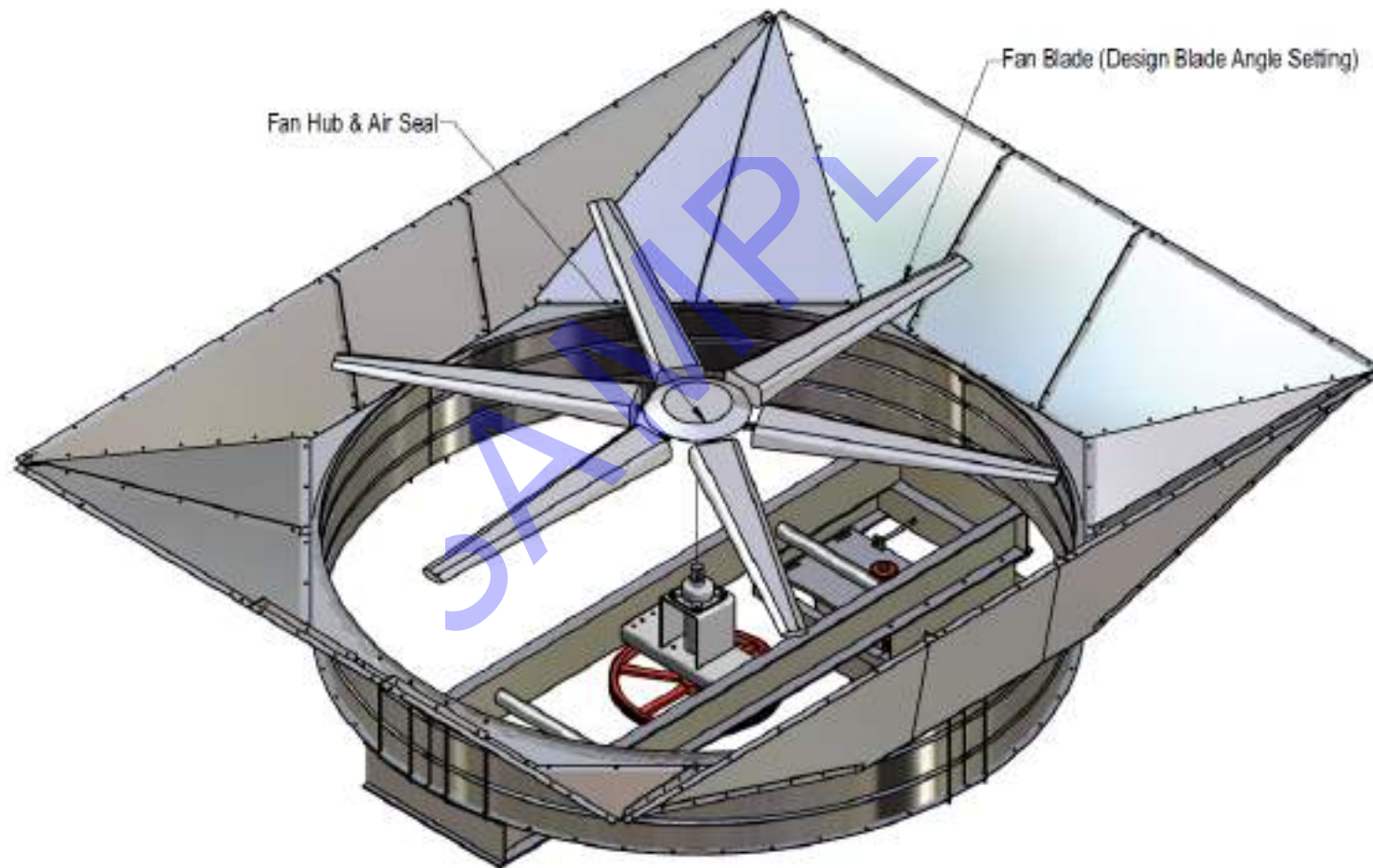
Step-7 : Bay - Turn Over



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

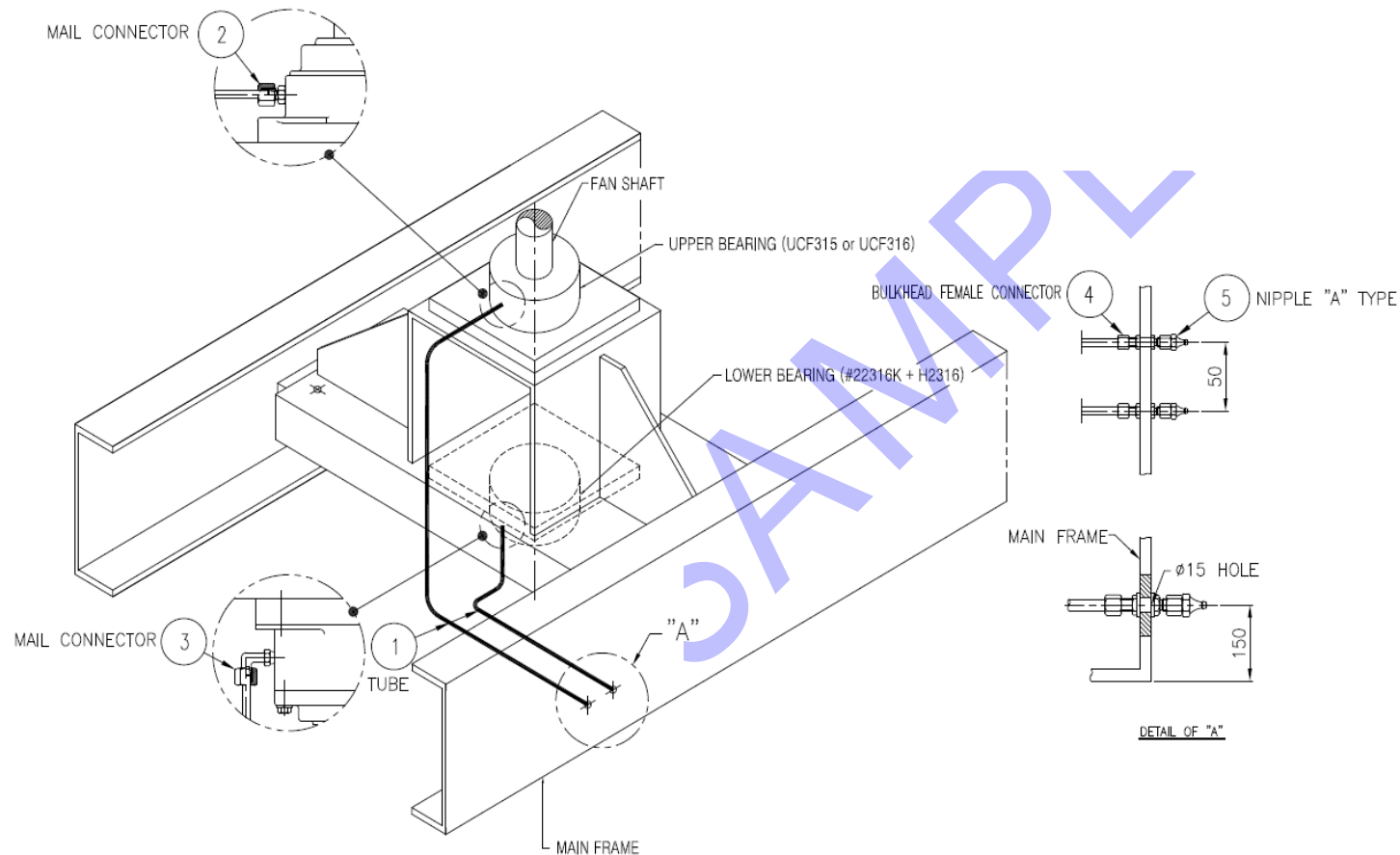
Step-8 : Driving Unit Part - Fan Installation (See Ref. to Attached Fan Installation Manual)



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

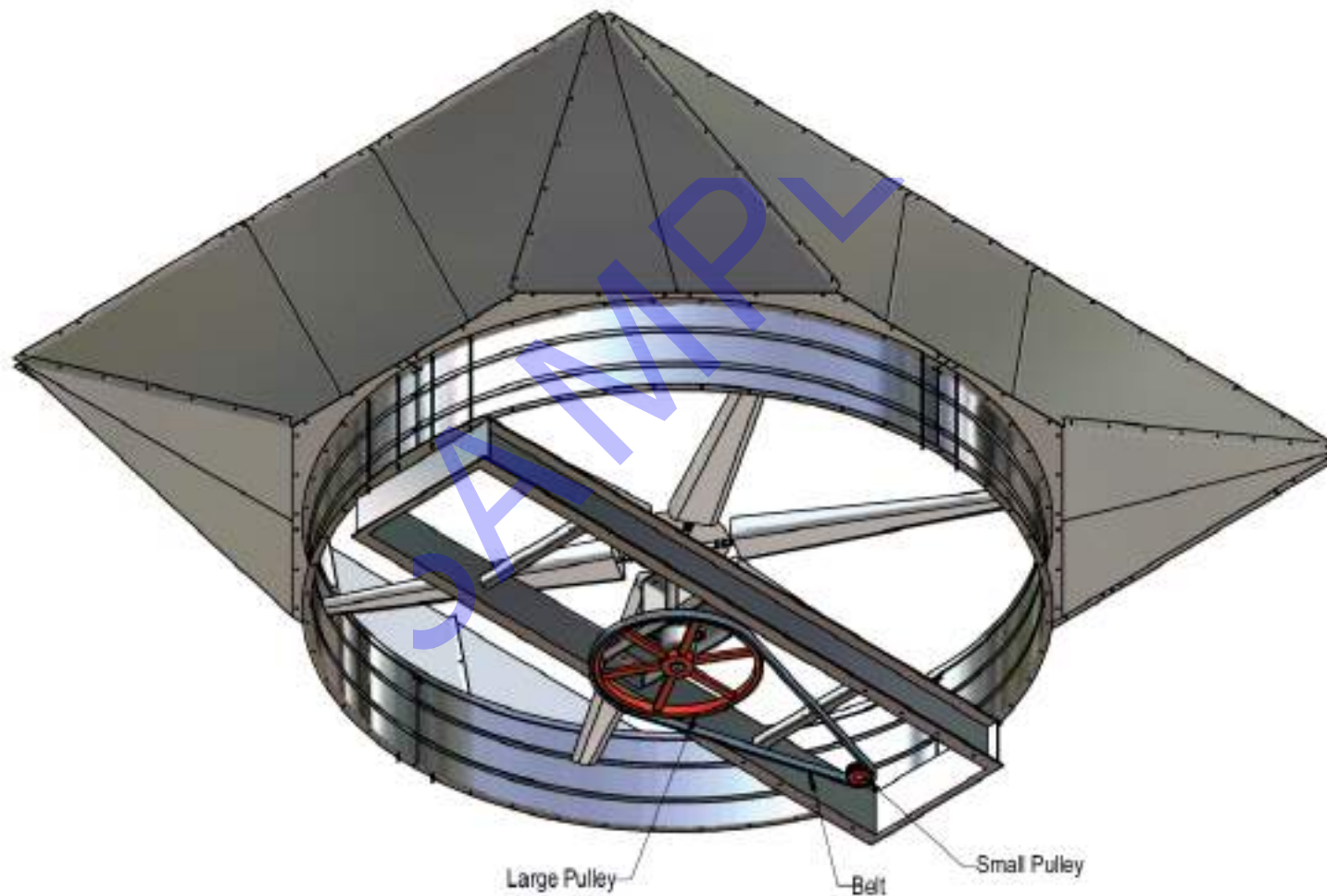
Step-9 : Driving Unit Part - Grease Line Installation (See Ref. to Attached Erection Drawing)



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-10 : Fan Belt Installation (Check-up Belt Tension Value)



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-11 : Junction Box Installation (See Ref. to Attached Erection Drawing)



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-12 : Bundle Lifting Method [Recycle Cooler Bundle Weight (14,600 kg) & Lube Oil Cooler Bundle Weight (8,100 kg)]



INSTALLATION, OPERATING & MAINTENANCE MANUAL

* Forced Draft Air-Cooler Installation Manual

Step-13 : Header Access Walkway & Ladder Ass'y Installation (Complete the AIR COOLED HEAT EXCHANGER)





INSTALLATION, OPERATING & MAINTENANCE MANUAL

1.3 Erection work

1.3.1 Assembly of tube bundle

The tube bundles, plenum + fan-ring + main frame & walkway with handrail are assembled in DASCO work shops. Steel Structure parts, Driving unit parts, ladder, fan, motor, belt, etc. are shipped in knockdown condition and shall erected on site.

1.3.2 Anchoring verification

The supports (ground or pipe rack) are to be supplied by the Purchaser.

They are to be in compliance with the dimensions shown on the DASCO drawings as approved by the Purchaser.

Substructure top surface, which will be used as seating plan for items of equipment, as well as the holes drilled in it for mounting bolts, must exactly comply with the dimensions shown on the DASCO or by the Purchaser (see limit of supply on drawings).

IMPORTANT NOTE

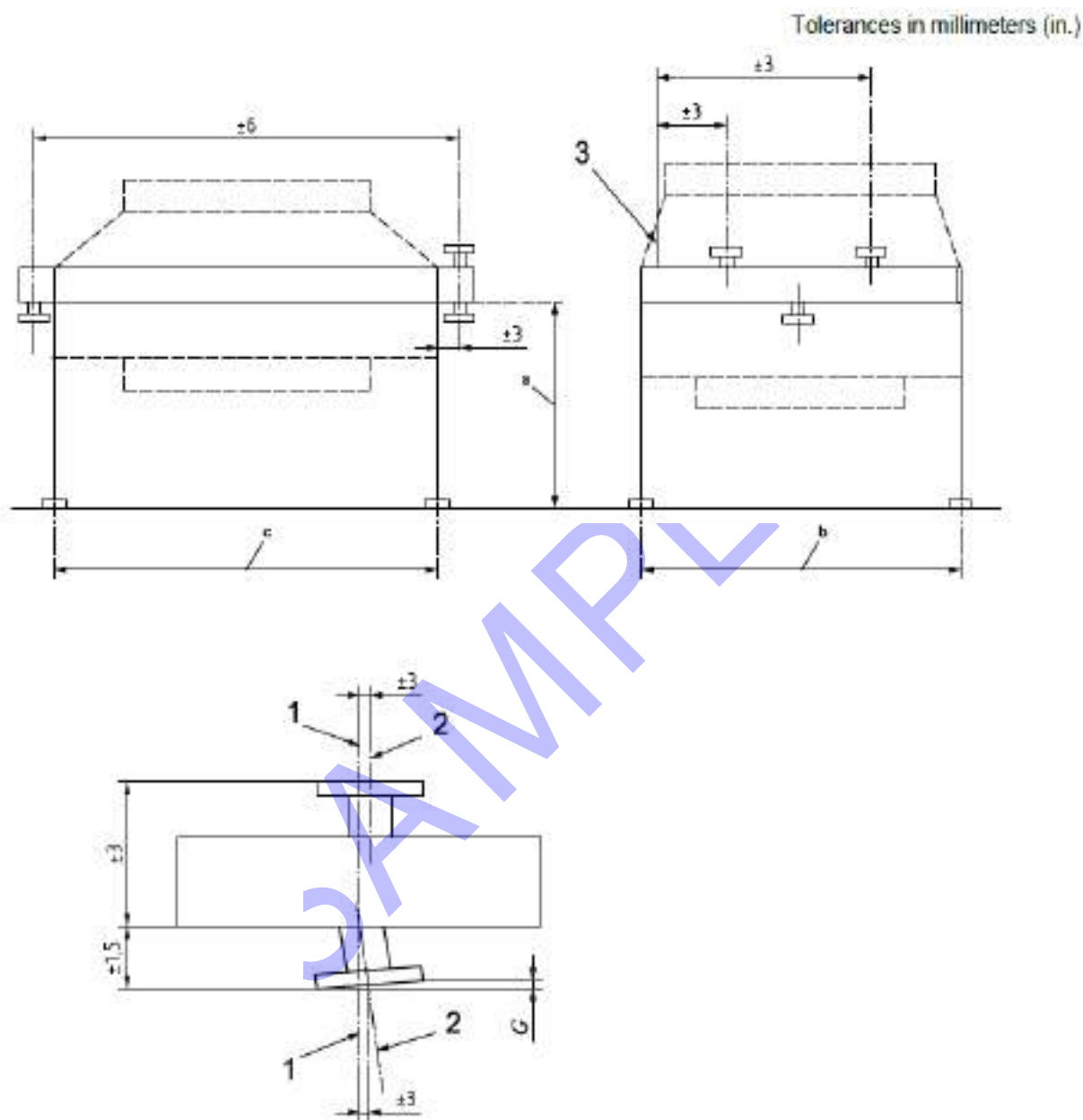
The erector must prior to undertaking erection work- ensure that the substructure top surface is true leveled and flat, and he shall provide for any shims required to obtain a true seating plan.

Standard tolerances for the dimensions of air-cooled heat exchangers and nozzle locations are shown in Figure 10 (API Standard 7th edition).

Refer to diagram in next page

INSTALLATION, OPERATING & MAINTENANCE MANUAL

API Standard 661 : Standard Tolerances



Key

- 1 centerline header
- 2 centerline nozzle
- 3 reference line
- G out-of-plane tolerance, as given below:

Nominal nozzle size DN (NPS)	Maximum out-of-plane tolerance G mm (in)
50 to 100 (2 to 4)	1.6 (1/16)
150 to 300 (6 to 12)	2.4 (3/32)
> 300 (>12)	4.8 (3/16)
stacked, all	0.8 (1/32)

a : +1 & -2 per meter

b : +1 & -1 per meter

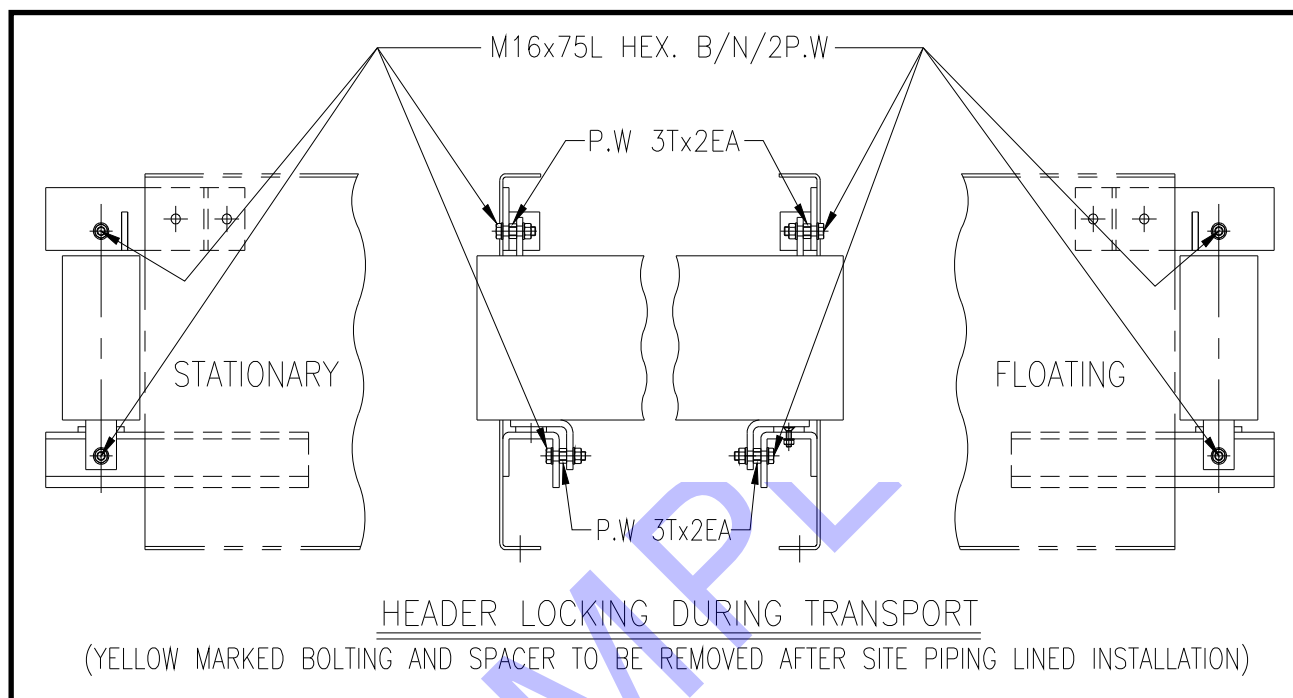
c : +3 & -3 (Wp to 3m; +1 & -2 for each additional meter)

INSTALLATION, OPERATING & MAINTENANCE MANUAL

1.3.3 Remove the transportation bolts

Transportation bolts located in all headers shall be removed after field installation.

These bolts are M16 Hex. Head and marked by yellow paint like follow picture.





INSTALLATION, OPERATING & MAINTENANCE MANUAL

2.0 Lubrication Instructions

2.1 Instructions for lubrication after completing installation

2.1.1 Instruction for lubrication of fan shaft bearings

Initial Charge Quantity

- | | |
|---|----------|
| - Fan shaft bearing UCF 314 & 315 & 316 ball bearing | 380 gram |
| - Fan shaft bearing #22316K + H2316 double-row spherical roller bearing | 700 gram |

The lubrication lines must be filled with lubricant as well, which requires loosening line fittings at bearing housing. Then, using a grease gun, inject lubricant at the lubrication block nipples so that grease will flow out of the other end of line. Now loosen bearing housing fittings and inject again so that grease flows out at the bearings.

Lubricant Chart

Temperature

Shell / Alvania EP2	(-20°C up to + 120°C)
Mobil / Polyrex EM	(-40°C up to + 120°C)
Shell / Alvania RL3	(-20°C up to + 120°C)
SKF / LGHP2	(-40°C up to + 120°C)

2.1.2 Instructions for lubrication of fan drive electric motors

Motor bearings are packed with grease before leaving manufacturer's factory.

When changing over to a new grade/brand of lubricant, it is necessary to take down the bearings, remove the old grease and clean thoroughly before repackaging with new grease.

IMPORTANT NOTE

An excess of grease will be detrimental to bearing life.

2.2 Instructions for lubrication

- See lubricant List (Appendix-D)



INSTALLATION, OPERATING & MAINTENANCE MANUAL

3.0 Check up

3.1 Procedure prior to starting-up

- Check that greasing for mechanical equipment is correct, and make up lubricant if required.

3.2 Verification of bundle installation

- Check that transport fasteners are removed correctly to allow the free expansion of tubing and tube bundles.
- Check that the protection material had been removed and do not keep from air flow.
- If required check that the sealing sheets are set between the bundle of a same bay to avoid the "by pass" of cooling air.

3.3 General verification

- Check that assembling bolting is screwed and locked.
- Every tube-bundle unit has been subjected to a hydrostatic pressure test in manufacturer's shop.
- Nevertheless, in order to check that it has not been damaged during transport or erection, it is advisable to subject the tube-bundle and the associated piping, circulating pumps, etc. to a further hydraulic proof test before starting up the plant.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

4.0 Starting up

4.1 DASCO data sheet

- See attachment data sheet.

SAMPLE

DYNAMIC & SPECIAL COMPANY DASCO		API 661 Air-Cooled Heat Exchanger - Specification Sheet			
1	Job No.			Item No.	RECYCLE COOLER
2	Page	1 OF 2		By	
3	Date	2022-02-17		Revision	1
4	Proposal No	21DP285		Contract No.	
5	Inquiry No.			Order No.	
6					
7	Manufacturer	DASCO		Heat exchanged	(Watts) 4331829
8	Model no.			Surface/Item-Finned tube	(m2) 8095.7
9	Customer	HHI-TMC		Bare tube	(m2) 358.61
10	Plant location	Thailand		MTD, Eff.	(Deg. C) 23.5
11	Service	Recycle Cooler		Transfer rate-Finned	(W/m2-K) 24.039
12	Type draft	FORCED		Bare tube, service	(W/m2-K) 542.69
13	Bay size (WxL)	(m) 7.18 x 10.7	Bare tube, clean	(W/m2-K)	619.02
14	No. of bays/items	1			
15					
16	Basic design data				
17	Pressure design code	ASME VIII DIV.1 + API 661		Structural code	
18	Tube bundle code stamped	NO		Flammable service	NO
19	Heating coil code stamped	N/A		Lethal/toxic service	NO
20	Performance Data - Tube Side				
21	Fluid name	GAS		In	Out
22	Total fluid entering	(kg/h) 119,291	Total flow rate (Liq/Vap)	(kg/s) / 33.136	/ 33.136
23	Dew/bubble point	(Deg. C) /	Water/Steam	(kg/s) / 0.0000	/ 0.0000
24		(Deg. C)	Noncondensables	(kg/s) 0.0000	0.0000
25	Latent heat	(kJ/kg)	Molecular Wt. (Vap/Non-cond)	/	/
26	Inlet pressure	(bar.g) 52.52	Density (Liq/Vap)	(kg/m3) / 30.959	/ 37.303
27	Pressure drop (All/Calc)	(kPa) 55 / 51.436	Specific heat (Liq/Vap)	(kJ/kg-C) / 2.3793	/ 2.1720
28	Velocity (Allow/Calc)	(m/s) / 13.23	Thermal conductivity (Liq/Vap)	(W/m-C) / 0.0493	/ 0.0408
29	Inside fouling resistance	0.000172	Viscosity (Liq/Vap)	(mN-s/m2) / 0.0143	/ 0.0128
30		In Out			
31	Temperature	(Deg. C) 109.40 52.00			
32					
33	Performance Data - Air Side				
34	Air inlet temperature	(Deg. C) 40.50	Face velocity	(m/s)	3.21
35	Air flow rate/item	(m3/s) 154.14	Minimum design ambient tem	(Deg. C)	12
36	Mass velocity	(kg/s-m2)	Altitude	(m)	-
37	Air outlet temperature	(Deg. C) 63.72	Static pressure	(Pa)	160.58
38	Air flow rate/fan	(m3/s) 130.91	Airside fouling resistance	(m2-K/W)	0.000352
39					
40	Design, Material, and Construction				
41	Design pressure	(bar.g) 59	Heating Coil		
42	Test pressure	(bar.g) 88.5	No. of tubes	N/A	
43	Design temperature	(Deg. C) 150	Tube outside diameter	(mm)	
44	Min. design metal temp.	(Deg. C) 12	Tube material		
45	Tube bundle		Fin material and type		
46	Size (WxL)	(m) 4.5 x 10.700	Fin thickness	(mm)	
47	No./Bay	1	ASME Code, Sec. VIII, Div. 1		
48	Number of tube rows	6	Heating fluid		
49	Bundles in parallel	1	Heating fluid flowrate	(kg/hr)	
50	Bundles in series	1	Temperature (In/Out)	(Deg. C) /	
51	Structure mounting	GROUND	Inlet pressure	(bar)	
52	Pipe rack beams		Pressure drop (All/Calc)	(bar) /	
53	Ladders, walkways, platforms	YES	Design temperature	(Deg. C)	
54	Structure surface prep.	H.D.G.	Design pressure	(barG)	
55	Header surface prep.	PAINTING	Inlet/Outlet nozzle	/	
56	Louver		Header		
57	Material	N/A	Type	PLUG	
58	Action control		Material	SA516-70	
59	Action type		Corrosion Allowance	(mm) 3	
60			No. of passes	2	
61			PWHT	YES	
62			Header Split	NO	
63					

DYNAMIC & SPECIAL COMPANY		API 661 Air-Cooled Heat Exchanger - Specification Sheet		Job No.		Item No.		RECYCLE COOLER	
1	DASCO			Page		2 OF 2		By	
2				Date				Revision	
3				Proposal No.				Contract No.	
4				Inquiry No.				Order No.	
5									
6									
7	Design, Material, and Construction (continued)								
8	Header (continued)				No./Bundle 420				
9	Slope			NO	Length	(m)	10.7		
10	Plug material			SA105N	Pitch	(mm)	63.5		
11	Gasket material			SOFT IRON	Layout	Triangular			
12	Nozzle	No.	Size, (mm)	Rating/Facing	Fin				
13	Inlet	3	8"	Cl. 600, WN.RF	Type	KNURLED "L"			
14	Outlet	3	8"	Cl. 600, WN.RF	Material	Aluminum 1100			
15	Vent	1	3/4"	Cl. 600, WN.RF	Thickness	(mm)	0.45		
16	Drain	1	3/4"	Cl. 600, WN.RF	Selection temp.	(C)			
17	Chemical Cleaning				Outside diameter	(mm)	57.15		
18	Min. Wall Thk.				Fin density	(fin/meter)	433.1		
19	Tube				ASME Code, Sec. VIII, Div. 1				
20	Material	SA179			Customer Specifications				
21	Tube outside diameter	(mm)	25.4						
22	Tube wall thickness	(mm)	(MIN.) 2.11						
23	Tube to tubesheet joint	Expanding with Groove							
24									
25	Mechanical Equipment								
26	Fan				RPM	1480			
27	Manufacturer	AXIAL FANS			Service factor	1.0			
28	No./Bay	2			Enclosure	TEFC			
29	RPM	(Revs/min.)	208		Voltage	380			
30	Diameter	(m)	4.572		Phase	3			
31	No. of blades	(ea)	5		Cycle	50			
32	Angle	(degrees)	12.48		Fan noise level	(dB)	85 SPL @ 1M		
33	Pitch adjustment	MANUAL			Speed Reducer				
34	Blade material	AL			Type	TOOTHED BELT			
35	Hub material	CS			Manufacturer	CONTINENTAL			
36	@design temp	(kW)	40.5		No./Bay	2			
37	@min. ambient temp	(kW)			Service factor	1.8			
38	Tip speed	(m/s)	49.8		Speed ratio	7.12			
39	Driver				Support				
40	Manufacturer	HYOSUNG			Vib. switch	MANUAL RESET			
41	Control	100% DOL			Enclosure	Ex d IIB			
42	No./Bay	2							
43	Driver	(kW)	36						
44	Controls - Air Side								
45	Air recirculation	N/A			Louvers				
46	Degree control of outlet process temp.				Positioner				
47	(Max. Cooling), +/-				Signal air pressure (bar)				
48	Action on control signal failure				From		To		
49	Fan pitch				From		To		
50	Louvers				Supply air pressure (bar)				
51	Actuator air supply				From		To		
52	Fan				From		To		
53									
54	Shipping								
55	Plot area (WxL)	(m)	4.597 x 10.700		Total	(kg)	41600		
56	Bundle weight	(kg)	14600		Shipping	(kg)			
57	Bay	(kg)	35800						
58									
59	** REMARK								
60	1) Design for specified Flow & Duty.				4) Combined with LO cooler				
61	2) Cooler has Two(2x50%) Manual Fans.								
62	3) Design for 1 Unit, Total 3 Units Supplied.								
63									

DYNAMIC & SPECIAL COMPANY		API 661 Air-Cooled Heat Exchanger - Specification Sheet	
1	DASCO	Job No.	Item No.
2		Page	1 OF 2
3		Date	2022-02-17
4		Proposal No	21DP285
5		Inquiry No.	
6			
7	Manufacturer	DASCO	Heat exchanged (Watts)
8	Model no.		Surface/Item-Finned tube (m2)
9	Customer	HHI-TMC	Bare tube (m2)
10	Plant location	Thailand	MTD, Eff. (Deg. C)
11	Service	Lube Oil Cooler	Transfer rate-Finned (W/m2-K)
12	Type draft	FORCED	Bare tube, service (W/m2-K)
13	Bay size (WxL) (m)		Bare tube, clean (W/m2-K)
14	No. of bays/Items	1	
15			
16	Basic design data		
17	Pressure design code	ASME VIII DIV.1 + API 661	Structural code
18	Tube bundle code stamped	NO	Flammable service
19	Heating coil code stamped	N/A	Lethal/toxic service
20	Performance Data - Tube Side		
21	Fluid name	ISO VG46	In Out
22	Total fluid entering (L/min)	285	Total flow rate (Liq/Vap) L/min 285 / 285 /
23	Dew/bubble point (Deg. C)	/	Water/Steam (kg/s) 0.00000 / 0.00000 /
24	(Deg. C)		Noncondensables (kg/s)
25	Latent heat (kJ/kg)		Molecular Wt. (Vap/Non-cond) / /
26	Inlet pressure (bar.g)	6.5	Density (Liq/Vap) (kg/m3) 854.00 / 866.00 /
27	Pressure drop (All/Calc) (kPa)	50.000 / 49.783	Specific heat (Liq/Vap) (kJ/kg-C) 2.0290 / 1.9620 /
28	Velocity (Allow/Calc) (m/s)	/ 0.35	Thermal conductivity (Liq/Vap) (W/m-C) 0.1270 / 0.1280 /
29	Inside fouling resistance	0.000172	Viscosity (Liq/Vap) (mN-s/m2) 14.124 / 28.380 /
30		In Out	
31	Temperature (Deg. C)	67.00 48.00	
32			
33	Performance Data - Air Side		
34	Air inlet temperature (Deg. C)	40.50	Face velocity (m/s)
35	Air flow rate/item (m3/s)	91.146	Minimum design ambient tem (Deg. C)
36	Mass velocity (kg/s-m2)		Altitude (m)
37	Air outlet temperature (Deg. C)	41.91	Static pressure (Pa)
38	Air flow rate/fan (m3/s)		Airside fouling resistance (m2-K/W)
39			
40	Design, Material, and Construction		
41	Design pressure (barG)	11	Heating Coil
42	Test pressure (barG)	16.5	No. of tubes
43	Design temperature (Deg. C)	80	Tube outside diameter (mm)
44	Min. design metal temp. (Deg. C)	12	Tube material
45	Tube bundle		Fin material and type
46	Size (WxL) (m)	2.53 x 10.700	Fin thickness (mm)
47	No./Bay	1	ASME Code, Sec. VIII, Div. 1
48	Number of tube rows	6	Heating fluid
49	Bundles in parallel	1	Heating fluid flowrate (kg/hr)
50	Bundles in series	1	Temperature (In/Out) (Deg. C) /
51	Structure mounting		Inlet pressure (bar)
52	Pipe rack beams		Pressure drop (All/Calc) (bar) /
53	Ladders, walkways, platforms		Design temperature (Deg. C)
54	Structure surface prep.		Design pressure (barG)
55	Header surface prep.	PAINTING	Inlet/Outlet nozzle /
56	Louver		Header
57	Material	N/A	Type
58	Action control		Material
59	Action type		Corrosion Allowance (mm)
60			No. of passes
61			PWHT
62			Header Split
63			

DYNAMIC & SPECIAL COMPANY		API 661 Air-Cooled Heat Exchanger - Specification Sheet		Job No.		Item No.		LUBE OIL COOLER		
1	DASCO		Page		2 OF 2		By			
2			Date				Revision		0	
3			Proposal No.				Contract No.			
4			Inquiry No.				Order No.			
5										
6										
7	Design, Material, and Construction (continued)									
8	Header (continued)					No./Bundle 234				
9	Slope NO					Length (m) 10.7				
10	Plug material SA105N					Pitch (mm) 63.500				
11	Gasket material SOFT IRON					Layout Triangular				
12	Nozzle					Fin				
13	No.	Size, (mm)	Rating/Facing		Type	KNURLED "L"				
14	Inlet 1	3"	Cl.150, WN.RF		Material	Aluminum 1100				
15	Outlet 1	3"	Cl.150, WN.RF		Thickness (mm)	0.45				
16	Vent 1	3/4"	Cl.150, WN.RF		Selection temp. (C)					
17	Drain 1	3/4"	Cl.150, WN.RF		Outside diameter (mm)	57.15				
18	Chemical Cleaning				Fin density (fin/meter)	433.1				
19	Min. Wall Thk.				ASME Code, Sec. VIII, Div. 1					
20	Tube				Customer Specifications					
21	Material		SA179							
22	Tube outside diameter (mm)		25.4							
23	Tube wall thickness (mm)		(MIN.) 2.11							
24	Tube to tubesheet joint		Expanding with Groove							
25	Mechanical Equipment									
26	Fan					RPM				
27	Manufacturer	SEE THE "RECYCLE COOLER"			Service factor					
28	No./Bay				Enclosure					
29	RPM (Revs/min.)				Voltage					
30	Diameter (m)				Phase					
31	No. of blades (ea)				Cycle					
32	Angle (degrees)				Fan noise level (dB)					
33	Pitch adjustment				Speed Reducer					
34	Blade material				Type					
35	Hub material				Manufacturer					
36	@design temp (kW)				No./Bay					
37	@min. ambient temp (kW)				Service factor					
38	Tip speed (m/s)				Speed ratio					
39	Driver				Support					
40	Manufacturer				Vib. switch					
41	Control				Enclosure					
42	No./Bay									
43	Driver (kW)									
44	Controls - Air Side									
45	Air recirculation	N/A			Louvers					
46	Degree control of outlet process temp.				Positioner					
47	(Max. Cooling), +/-				Signal air pressure (bar)					
48	Action on control signal failure				From		To			
49	Fan pitch				From		To			
50	Louvers				Supply air pressure (bar)					
51	Actuator air supply				From		To			
52	Fan				From		To			
53										
54	Shipping									
55	Plot area (WxL) (mm)				Total (kg)					
56	Bundle weight (kg)	8100			Shipping (kg)					
57	Bay (kg)									
58										
59	** REMARK									
60	1) Design for specified Flow & Duty.					4) Combined with Recycle cooler				
61	2) Cooler has Two(2x50%) Manual Fans.					5) Tube Insert(Twisted Tape) is excluded.				
62	3) Design for 1 Unit, Total 3 Units Supplied.									
63										



INSTALLATION, OPERATING & MAINTENANCE MANUAL

4.2 Procedure for introduction of the process fluid

Air cooler process fluids may be hot, indeed also very hot.

Risks of burns

- by contact of headers which temperature is higher than 78°C.
- if air flow temperature is higher than 90°C for forced draft bundles.

User should take all precautions to avoid these risks.

- a) During starting up process it is advisable to limit the thermal shock to the tube-bundle and also to avoid too important a cooling during periods of low ambient temperature and low heat load.
- b) It is advisable to take certain special precautions when starting up units intended to release heat from process fluids with the following properties :

- High viscosity fluids,
- Fluids whose pour point is above the ambient air temperature.

In many cases, where fluids with these properties are circulating in air-coolers, the units are equipped with one or more of the following systems, aimed at eliminating such problems in starting and operation

- Manually or automatically controlled louvers,
- Steam-coils,
- Auto-variable pitch fan propellers.

Starting problems are much reduced with units thus equipped. Before introducing the process fluid, close the louvers, start to circulate steam through the coils and switch off fans.

Progressively increase the fluid flow until the normal rate is reached. Then gradually open the louvers, shut off the steam inlet and start the AV fans.

Watch carefully the temperature of the output fluid during all this period and, if there is a risk of excessive cooling, run the heating steam.

For the units without louvers nor steam-coil, the process fluid should be introduced rapidly, in order to avoid excessive cooling of the initial charge of fluid in contact with the cold tubes. It is advisable, however, to avoid any fluid pressure surge.

- c) In order to release heat from a process fluid having a low viscosity and a very low pour point, the starting procedure will be somewhat simplified. First of all, start up the fans, then admit the process fluid, initially with a low rate of flow, but gradually increasing it to the required value.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

5.0 Maintenance and Routine Checking

INTRODUCTION

Adjustment, maintenance, repairing, cleaning and keeping operations must be realized when the machine is shut off.

Before the starting, check the replacing of all protection carters, guards, etc.

5.1 Maintenance and routine checking

(Instructions for maintenance of equipment)

5.1.1 Bearings lubrication

Refer to suppliers' instructions

5.1.2 Mechanical equipment lubricant

Refer to suppliers' instructions on attached manual.

WARNING

This operation must be realized when the equipment is shut off.

5.2 Procedure for maintenance of fin tubes

(Instructions for tube cleaning)

5.2.1 Interior cleaning of fin-tubes

The methods used for the cleaning of the inside of air-cooler tubes are the same as for conventional shell-and-tube heat-exchangers.

There are three methods :

a) Mechanical cleaning

This method consists of drills or wire brushes fitted to long rods which are rotated by a compressed air motor. This method is normally completed with a water rinse or a blowing out. It is not an advised method for the removal of tarry deposits.

b) Chemical cleaning

This method consists in circulating a hot chemical solution through the tubes. Such solutions contain inhibitors against tube wall corrosion.

It is recommended to contact a specialist and to supply him with a sample of the fouling deposit in order to best choose the chemical solution.

Each tube-bundle has to be fitted with inlet and outlet pipe fittings (1 1/2" to 3") to facilitate the passage of the solution.

A circulating pump and a storage tank should also be available.

This method is becoming well known in process plants because it reduces downtime and avoids disassembling the unit. It offers no advantage at all with blocked tubes.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

c) High-pressure flushing equipment

The use of these units (or "Hydro jets") has become widespread in the U.S.A. and Europe during recent years.

The tube cleaning can be accomplished by means of a portable HP pump.

Generally speaking, such pumps have a capacity of 25 gpm with discharge pressures as high as 620 DAN/cm².

The sprinkler head is fitted at the end of a long tube, similar to that used for mechanical cleaning, and it is introduced into each tube individually.

The best pressure is found by trial and error. Generally speaking, the softer the deposit, the lower water pressure needs to be. For example, an amine heat-exchanger can be cleaned with a water pressure of around 140 DAN/cm². A scale deposit left by carbonated water requires a higher pressure ranging about 410 to 620 DAN/cm². Here again, it should be emphasized that this is not suitable for blocked tubes.

These have to be mechanically cleaned.

WARNING

Chemical risks : before using, check the instructions from product manufacturer.

5.2.2 Outside cleaning of fin-tubes

General

The fouling of the extended heat-transfer or fin surfaces depends on the location of the unit, the kind of process, the ground conditions, foliage or other environmental factors (presence of other factories in the area).

The best known sorts of fouling are as follows :

a) Dirt or dust

It accumulates over fins and between fins.

Sometimes, it collects as a fine powder and after being wetted it forms a crusty deposit.

Or alternatively, with oil, it can produce a mixture having the consistency of putty.

b) Lint, poplar seeds, down of cotton wool (or american poplar) etc.

c) Insects

d) Mixtures of dust with oil and corrosive substances

5.2.3 Cleaning methods

Generally speaking, only the two or three lower fin-tube rows will be found to be fouled.

This indicates that the cleaning should be undertaken from the top downwards with the fan at standstill and shut-off valves closed. A preliminary examination should first be made to determine which type of cleaning would be best.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

a) Air nozzle

An air jet from a nozzle, under a pressure of 2.2 DAN/cm², should normally remove dust powder and dry insects. One should ensure that the air jet is always within the plane of the fins to avoid bending them over. The nozzle usually consists of a 1" pipe, 7' or 10' long, flattened at the end to form a tip about 1 1/4" across. The air is supplied via a hose, a control valve and a pressure gage.

b) Water nozzle

A cold water jet, under a pressure of 2.2 DAN/cm², normally allows the removal of agglomerated dust and other impurities. A fire hose with a 1" round-nosed jet should be satisfactory.

As above, the jet should always lie within the fin plane, to avoid bending them over.

c) Hot water or steam jet

If the consistency the fouling is such as to resist both the cold water and the air jet, an atomized spray of hot water or steam should be sufficient to clean the fins.

The steam nozzle can be made in the same manner as the air nozzle.

Hot water can be obtained by means of a proportioning/mixing device fitted at the inlet of the steam nozzle.

d) Chemical cleaning

Normally, in 75 % of cases, methods A, B and C will enable the fins to be cleaned.

Nevertheless there are times when the composition of the fouling is either chemical or organic.

It is then necessary to consult a specialized chemical cleaning firm. With regard to chemical cleaning, great care should be taken. The cleaning fluid should be consistent with the fin material. The chemical cleaning specialist is familiar with these problems and is capable of supplying the proper cleaning solution.

WARNING

before using equipment and cleaning products, the user will check all supplier's instructions.

5.3 Instructions for tube-bundle repair

5.3.1 Instructions for remedying plug tube-bundle leakage observed on start-up or during operation

The tube-bundle units will be delivered perfectly leak-proof after being subjected tightness tests. However, should any leak be found (which may occur where tube-bundle units have been stored for a long period of time) proceed as follows :

a) Leakage at header front plug

First reduce pressure, then slowly tighten the leaky plug and pressurize again.

If seal is not perfect, repeat this operation.

If seal is still not perfect, change the solid ring gasket and also the plug if worn or damaged.

Check that the ring gasket fits exactly into the spot facing provided for it in the header front plate.

NEVER RE-USE A WORN OR COLLAPSED GASKET.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

b) Leakage at tube sheet hole expanded tube joint

Remove plug in way of leaky tube.

Roll in the tube a little further.

Replace plug after changing the ring gasket taking the precautions detailed above.

Re-pressurize. Repeat this procedure if seal is not perfect.

c) Leakage resulting from crack in a faulty tube

In such case, both ends of the faulty tube must be blocked. Proceed as follows :

Remove header front plugs in way of the faulty tube.

Cut through the tube at one end, a few millimeters from the tube sheet before the start of the finned section of the tube, using an inner tube cutter.

This is a must to prevent the tube acting as a tie-rod between the two box headers.

Using the special mandrel provided by the manufacturer, insert a taper plug into each end of the leaky tube.

Gently hammer in the taper plugs.

Replace header front plugs fitted with new ring gaskets as instructed under A.

5.3.2 Instruction for replacement of damaged finned tube

(Partial re-tubing of an air cooler plug bundle)

NOTE :

Upper tubes which interfere with proper operation to be replaced, too.

Operations

1. Upper tube support and air seals plate to be dismantled.
2. Header plugs to be dismantled and steel gaskets to be removed.
3. Tubes to be cut off in way of tube sheet outside the header.
4. Tubes for removal to be taken away.
5. Tube ends remaining in tube sheet to be removed and grooves to be cleaned.
6. New tubes to be set to position.

Required equipment

- Torque wrench or spanner for removing bolt.
- Torque wrench or spanner for removing bolt.
- Inner tube-cutter corresponding to diameter and thickness of tubes + set of blades.
- Crane for bundle lifting.
- Hammer + tube-expander + cleaning brush.
- Tube-expander + hammer.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

- | | |
|---|---|
| 7. Tubes to be expanded inside tube sheet. | Expanding machine + associated equipment (filter and lubricator, expander, cutting tools, rollers). |
| 8. Plug sheet to be tapped. | Tap + wrench. |
| 9. Header to be closed. New gaskets to be fitted. Defective plugs to be changed. | Hexagonal socket wrench. |
| 10. Hydraulic or pneumatic test to be performed, according to equipment specifications. | Conventional testing equipment. |
| 11. Baffle plates to be assembled | <p>Bolted sheets : socket wrench</p> <p>Riveted sheets : riveting machine + rivets or possible replacement by bolts</p> |

SAMPLE



INSTALLATION, OPERATING & MAINTENANCE MANUAL

6.0 Long Time Storage Protection (Over 3 Months)

INSTRUCTIONS FOR PROTECTION OF NON-OPERATING EQUIPMENT FOR MORE THAN THREE MONTHS AFTER FINAL INSTALLATION HAS BEEN COMPLETED

6.1 General

After completion of the operations described in 1.0 and 2.0 related to erection, assembly and installation of plant prepared for starting following the procedures outlined in 5.0, the operational availability of equipment will last for a maximum period of three months.

6.2 Amount of grease for mechanical equipments

See suppliers' instructions on attached manual.

6.3 General protective requirements for fan air cooled heat exchanger

6.3.1 External protection of tube-bundle units

Where the unit is not equipped with control louvers, a canvas or plastic cover should be laid all over the top side of the tube-bundle to prevent the fins from becoming fouled by sand or dust deposits due to wind and/or natural air draft.

Where the unit is equipped with control louvers, the blades of same should be kept in closed position.

6.3.2 Internal protection of tube-bundle and steam coil unit

Internal rust prevention : N₂ charge (0.25 bar G) with pressure gauge

6.3.3 Control louvers(if any)

All blades should be kept in closed position.

6.3.4 Machinery components

Electric motors

First, all drive motors should be taken down to be stored indoors. Then, every month, turn motor shafts by hand to distribute lubricant all over bearing parts.

Drive belts

Summary

The physical properties of correctly stored belts will not change over a period of many years. In poor storage conditions and with incorrect handling, rubber products are, however, subject to changes in their physical properties. These changes can for example, be caused by effects of oxygen, ozone, extreme temperature, light, moisture and solvents.

Storage area

The storage area should be dried, dust free and reasonably well ventilated.

Belts must not be stored close to chemicals, solvents, fuels, lubricants and acids, etc.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

Temperature

The storage temperature should be between + 59°F/ +15°C and 77°F/ 25°C. Normally, lower temperatures are not detrimental to V-belt. Since, however, they become very stiff at low temperatures, before fitting they should be warmed to a temperature of approximately + 68°F/ 20°C to avoid ruptures and cracks. Radiators and their supply lines should be guarded. The distance between a radiator and the stored belts must be at least three feet.

Light

Belts should be protected against light, especially direct sunlight and high ultra violet content (ozone formation) such as naked fluorescent tubes. Illumination utilizing conventional light bulbs is advisable. Where possible windows should be painted a red or orange protective paint. Under no circumstances should blue be used.

Ozone

In order to counteract the harmful effects of ozone, warehouses should not contain any ozone producing appliances, for example fluorescent lights, mercury vapour lights or high voltage electrical equipment. Combustion gases and vapours which may lead to the formation of ozone by photo chemical processes must be avoided or eliminated.

Moisture

Damp store rooms are unsuitable. Care must be taken to ensure that condensation does not occur. The most favourable relative air humidity is below 65%.

Storage

Because stresses can prompt both permanent deformation and the formation of cracks, care must be taken to ensure that belts are stored without stress, i.e. without tension, pressure or any other form of deformation. If belts are stored horizontally and stacked upon each other, it is recommended that the stack height does not exceed 12 inches to avoid deformation. If, to save space, belts are hung, the diameter of the cylinder on which the belts rest should be at least ten times the height of the belt section.

Cleaning

Contaminated belts can be cleaned using a 10 : 1 glycerine-spirit mixture. Benzene, benzole, and turpentine amongst others must not be used.

In addition, sharp edged objects, wire brushes, emery paper etc. must not be used under any circumstances, such action is damaging.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

Pulleys

Thoroughly clean all the pulley grooves, then coat/spray anti-rust compound all over the groove sides.

Fan and drive shafts

Clean all machined or exposed surfaces, then coat/spray anti-rust compound all over.

Ball / roller bearings

Every month, turn the fan propeller and shafting by hand to distribute grease evenly all over the bearing parts. Then, every three months, inject grease to prevent any blocking of the lubrication lines possibly due to grease hardening.

Whenever the fan propeller and shafting have been turned, it is a must to secure them at standstill.

Fan Units

Fixed blade propeller : no particular care is required for blades ;

Self-adjustable pitch angle blade propeller ; every month, operate pneumatic control system to actuate blade control linkage so as to prevent hub internals from sticking.

Fan pitch control system

The pneumatic control system should be supplied with nitrogen and not with air which, even with a very low moisture content, can be detrimental to servo-actuators and controllers.

NOTE:

For protection of equipment, when not operated for long periods of time, the grease used MUST be a long-time non oxidizing preservation grease.



INSTALLATION, OPERATING & MAINTENANCE MANUAL

Appendix A. Fan Installation, Operation & Maintenance Manual

SAMPLE

MANUAL

INSTALLATION AND MAINTENANCE MANUAL FOR FANS SERIES STD

REVISIONI E APPROVAZIONI / REVISIONS AND APPROVALS

REV.	DATA DATE	MOTIVO REVISION DESCRIPTION	REDATTO EDITED	VERIFICATO VERIFIED	APPROVATO APPROVED
0	2019-04-14	General revision of MA 04-06	SC	FC	MR
1	2019-09-25	Modification of tightening torque table	SC	FC	MR

ADOPTION NOTE

Revision "1" of the present manual has been verified by Quality Assurance and Technical and approved by Managing Director on 25/09/19. The formalization of verification and approval is available at Quality Assurance function. The present document is compliant with the original approved, registered and held by Quality Assurance function.

INDEX

1	GENERAL INFORMATION	3
1.1	Introduction	3
1.2	Description	3
1.3	Options / Accessories (at extra cost)	4
1.4	Field Service	4
2	RECEIVING / HANDLING /STORAGE.....	5
2.1	Fan Identification	5
2.2	Receiving and Unloading	5
2.3	Lift procedure.....	6
2.4	Storage (standard packing)	6
2.5	Balancing	6
2.6	Exploded view and part list	7
2.6.1	Supply (S) hub fixing orientation	7
2.6.2	Discharge (D) hub fixing orientation.....	8
3	FAN ASSEMBLY.....	9
3.1	Required Tools	9
3.2	Rotation and flow direction	9
3.3	Preparation	9
3.4	Hub installation	10
3.5	Blade Installation.....	11
3.6	Blade angle adjustment.....	13
3.7	Seal disk installation (if present)	13
3.8	Minimum fan clearance	13
3.9	Tip clearance (gap)	14
3.10	Blade tracking.....	14
4	COMMISSIONING	15
5	PREVENTIVE MAINTENANCE.....	16
6	AXIAL FANS INT CONTACTS.....	18
7	TROUBLE SHOOTING	19
8	TIGHTENING TORQUES	21

1 GENERAL INFORMATION

1.1 Introduction

This manual provides information necessary to install, operate and maintain STD hub series axial flow cooling fans. Maintenance guidelines and procedure are set so that the equipment where the Axial Fans Int fans are installed will operate efficiently, with a minimum of repair or replacement requirements.

This manual refers to installations equipped by:

- Aluminium airfoils model 3.2A, 4.3A, 7.1A
- Fiberglass airfoils model 4.2F, 6.1F

IMPORTANT: for installation of more than one fan, complete the setup of one single fan, and only after ensuring the perfect functioning of this fan (as described in the manual), follow the same mounting procedure with the rest of fans.

IMPORTANT: this entire manual has to be read very intently before proceeding with the installation of the fan. In case of wrong assembly, the warranty is considered void.

The content of this manual cannot be copied, reproduced or printed without written authorization from Axial Fans Int S.r.l., and should a falsification occur, Axial Fans Int S.r.l. will protect itself using whatever means consented by law.

1.2 Description

Axial Fans Int fans combine the most advanced technical solutions with a simple design for an easy installation and operation.

The fan blades profiles are high efficiency airfoils, developed in order to get the maximum aerodynamic efficiency and the lowest noise emission.

Fiberglass (GRP) and aluminium can be used to manufacture the profiles.

The fan blade profiles are connected to the hub with a patented system which significantly reduces the mechanical vibration and the structure noise. The blade to hub connecting system incorporates also the pitch variation device and the fan design allows the installation of the blades one at a time. Blade installation is a simple and quick procedure.

STD series fan blades of the same series, type and diameter are fully interchangeable per order, because they are statically balanced against a master blade.

A one-piece aluminium hub fits to the drive shaft with a tapered bushing connection.

STD series fans are designed to operate at the following conditions.

Allowed temperature for operation				
Minimum		Maximum		
Standard materials	Special materials	Aluminium blades	GRP blades	GRP special arrangements
-50 °C	-56 °C	+120 °C	+80 °C	+110 °C
-56 °F	-69 °F	+248 °F	+176 °F	+230 °F

Table 1 – Allowed temperature for operation

It is forbidden to use the fans outside of the above conditions.

1.3 Options / Accessories (at extra cost)

- Retaining plates to secure the fan to the drive shaft;
- Tools (torque wrench with proper dimensions of the head, torque wrench insert tools, inclinometer for blade pitch adjustment);
- Stainless-steel hardware and shaft.

1.4 Field Service

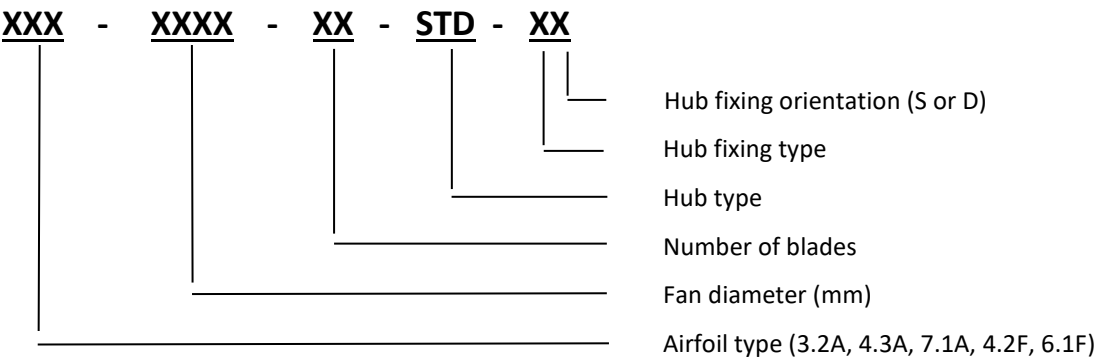
Axial Fans Int S.r.l. maintains a staff of experienced field service personnel. Their expert knowledge may be of great assistance at inspection, installation and start-up of the fans.

SAMPLE

2 RECEIVING / HANDLING /STORAGE

2.1 Fan Identification

The fan identification code allows identification of the main characteristics of the fan. This code can be found on the order acknowledgement and packing list included with the shipment.



The following example:

4.3A-4500-07-STD-TS

Identifies a fan with 4.3A airfoil, 4500 mm fan diameter, 7 blades, STD hub, taper bushing fixing type and supply side hub fixing orientation.

The fans are provided with a product identification code written on the hub. The unique hub number allows future identification of the fan supplied.

2.2 Receiving and Unloading

Upon unloading this equipment, before releasing the carrier, inspect it for damage on box or on the content. If damage has occurred, fill a claim immediately against the carrier and mark the bill of lading accordingly.

All consignments are accompanied by a packing list with the following data:

- Order number of the Customer and of Axial Fans Int S.r.l
- Fan type (fan identification)
- Parts supplied by Axial Fans Int S.r.l

With the fan identification code on the packing list it is easy to know the details of the fan.

The delivered goods should be checked upon arrival for full compliance with the order and/or the parts count and description stated on the packing list.

Shortages should be reported to the Axial Fans Int Contract Engineer within two (2) weeks from receipt of shipment at destination.

NOTE: Axial Fans Int is taking pictures of the content of each box before boxes closing. These pictures are available on request.

2.3 Lift procedure

During the handling operations of all the fan components, pay attention to avoid any contact between these components and metallic tools like chains, hoists, hooks, etc.

It's strictly forbidden to lift the blades in horizontal position (Figure 1a), because this can cause damage on the blade profiles. Blades must be lifted in vertical position (as shown in Figure 1b) to avoid any type of damage or deformation on the profiles.

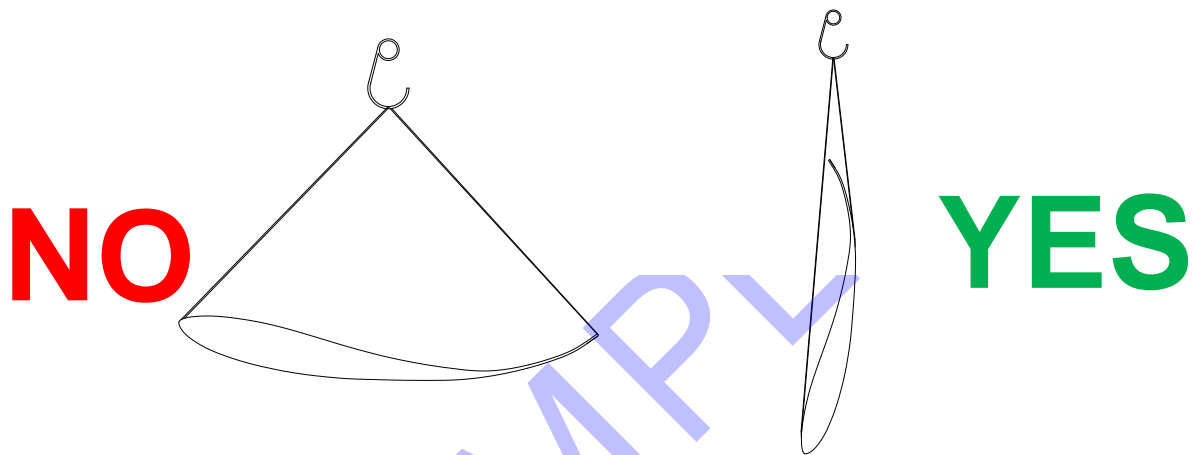


Figure 1a – Wrong lifting position

Figure 1b – Right lifting position

2.4 Storage (standard packing)

The fan should be stored in a dry room. The boxes may be stacked up to a maximum of three (3) high. Do not allow any heavy materials of any kind to be stored on top of the fan.

The fan parts are fixed in the packing to avoid any potential fall or instabilities. It is recommended to handle the crates with trans-pallet and/or fork lift from authorized personnel.

For long-term storage (in excess of 6 months) it is necessary to check the condition of the corrosion preventive coating on all the machined surfaces and the integrity of wooden cages-cases.

Re-apply or repair where necessary.

2.5 Balancing

AFI's STD series fans are balanced in factory with static balancing of hub and static balancing of each blade.

For this reason, there's not a specified order to follow during the assemble of the blades on the hub.

2.6 Exploded view and part list

2.6.1 Supply (S) hub fixing orientation

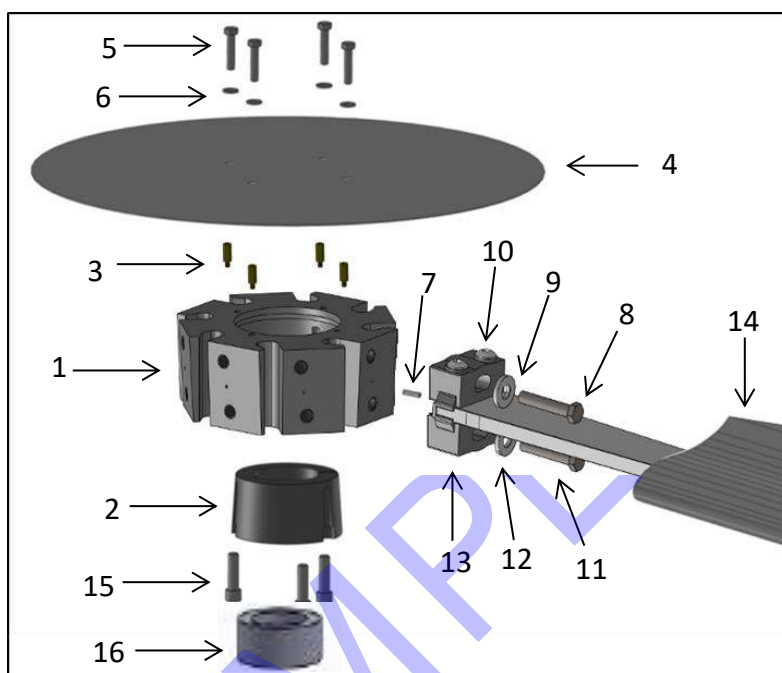


Figure 2a – Hub with taper bushing (S), exploded view

Item	Description	Material (standard model)	Quantity
1	Hub	Aluminium Alloy	1
2	Tapered bushing (Figure 6)	Carbon Steel / Cast Iron	1
3	Disc Spacer (if required by AFI design)	Aluminium Alloy	4*
4	Seal Disk (if required by AFI design)	Aluminium Alloy	1
5	Bolt M8x35 (if required by AFI design)	Galvanized Steel / Stainless Steel	4*
6	Washer M8-16 (if required by AFI design)	Galvanized Steel / Stainless Steel	4*
7	Elastic pin	Galvanized Steel / Stainless Steel	1 / blade
8 - 11	Bolt M14x70	Galvanized Steel / Stainless Steel	2 / blade
9 - 12	Washer M14-33	Galvanized Steel / Stainless Steel	2 / blade
10	Upper Block	Galvanized Steel	1 / blade
13	Lower Block	Galvanized Steel	1 / blade
14	Blade	Aluminium Alloy / GRP	
15	Bolt 1/2"x1" 1/2 BSW (Figure 6)	Carbon Steel	3
16	Spacer (if present)	Carbon Steel	1

* Models with 3 or 6 blades have 3 spacers/washers/bolts instead of 4.

ATTENTION: the exploded view on Figure 2a is only for information. Some elements may be different from the representation.

2.6.2 Discharge (D) hub fixing orientation

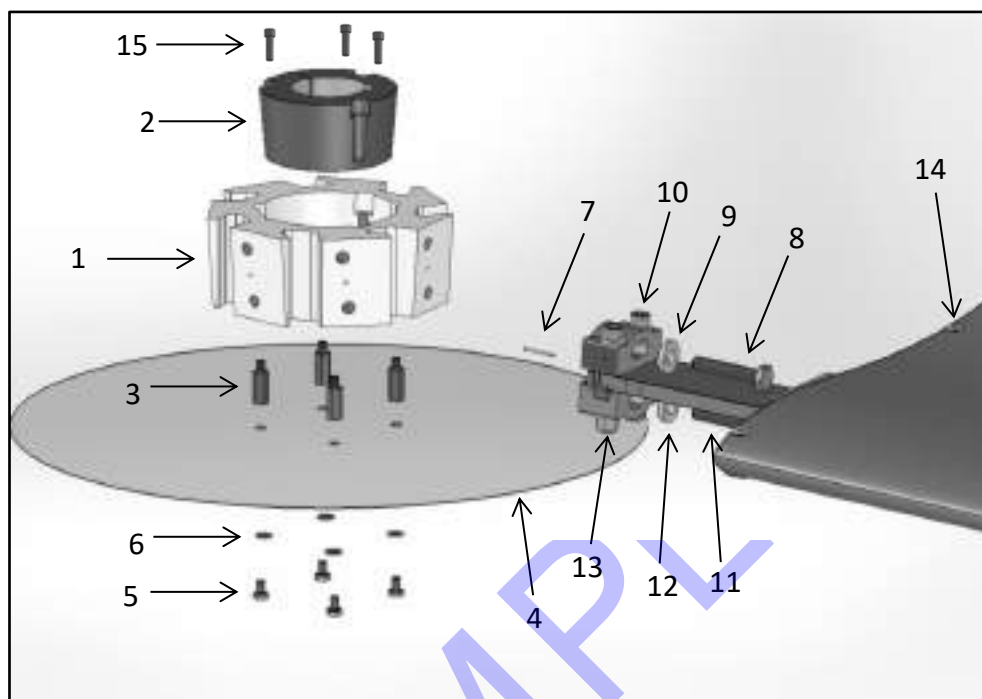


Figure 2b – Hub with taper bushing (D), exploded view

Item	Description	Material (standard model)	Quantity
1	Hub	Aluminium Alloy	1
2	Tapered bushing (Figure 6)	Carbon Steel / Cast Iron	1
3	Disc Spacer (if required by AFI design)	Aluminium Alloy	4*
4	Seal Disk (if required by AFI design)	Aluminium Alloy	1
5	Bolt M8x12 (if required by AFI design)	Galvanized Steel / Stainless Steel	4*
6	Washer M8-16 (if required by AFI design)	Galvanized Steel / Stainless Steel	4*
7	Elastic pin	Galvanized Steel / Stainless Steel	1 / blade
8 - 11	Bolt M14x70	Galvanized Steel / Stainless Steel	2 / blade
9 - 12	Washer M14-33	Galvanized Steel / Stainless Steel	2 / blade
10	Upper Block	Galvanized Steel	1 / blade
13	Lower Block	Galvanized Steel	1 / blade
14	Blade	Aluminium Alloy / GRP	
15	Bolt 1/2"x1"1/2 BSW (Figure 6)	Carbon Steel	3

* Models with 3 or 6 blades have 3 spacers/washers/bolts instead of 4.

ATTENTION: the exploded view on Figure 2b is only for information. Some elements may be different from the representation.

3 FAN ASSEMBLY

3.1 Required Tools

- Torque wrench with proper head dimensions (see figure 7);
- M8 and M14 hexagonal head wrench;
- 1/2"x1"1/2 BSW Allen screw (in case of taper bush);
- Inclinator with accuracy of at least $\pm 0.5^\circ$ (maximum tolerance allowed);

3.2 Rotation and flow direction

Standard rotation is clockwise viewed into the air-system (see figure 3).

Upon request it is also possible to provide fans rotating in counter-clockwise rotating direction.

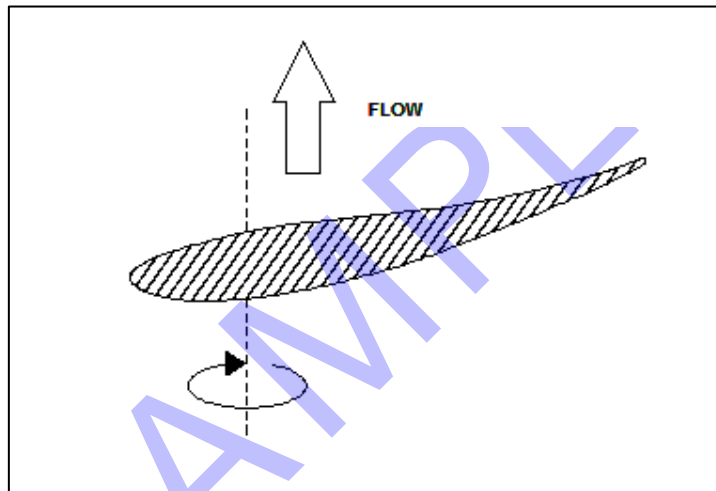


Figure 3 – Standard rotating direction

3.3 Preparation

Clean all mating surfaces between the shaft, hub spacer (if present), and hub. All protective coatings on these surfaces should be removed.

Before assembling the parts, check the following:

- Make sure that the motor cannot be started inadvertently.
- Make sure the drive shaft is properly centred with respect to the fan casing. Also check if the shaft is vertical (or horizontal) within the prescribed tolerance.
- Check the concentricity of the driver shaft before mounting the impeller. Fan shall not be mounted if concentricity gap is greater than 0.02 mm (0.0008 inches).

3.4 Hub installation

ATTENTION: hub (1) lateral faces, used for blade pitch adjustment, may have a small angle with respect to the rotation axis. During hub installation, it is necessary to verify that, if this angle is present, **the lateral faces are tilted towards the direction the air is coming from.**

ATTENTION: if the hub (1) is installed in the wrong way, the inclination angle is in the opposite side respect to the design condition, and this can significantly increase the load applied to the blades. This overload can cause damages on the blades and their components, and for this reason, in case of incorrectly installation of hub (1) or other parts of the fan, the warranty is considered void.

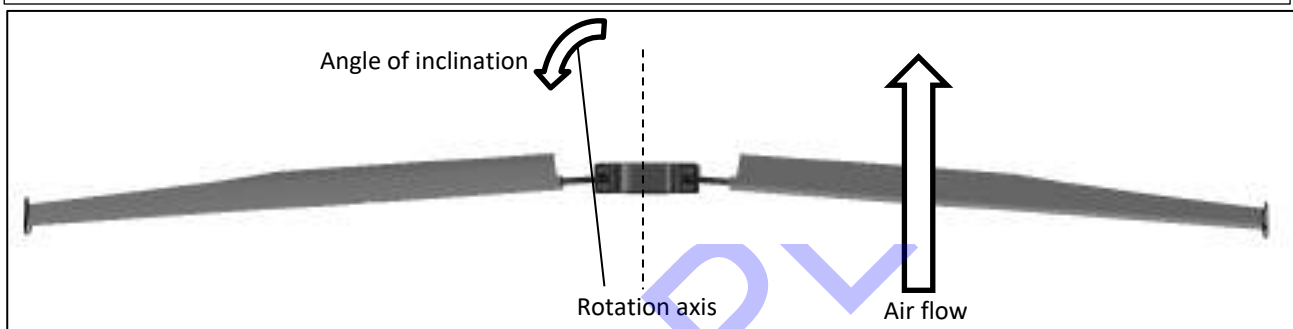


Figure 4 – Airflow from drive to fan

Hub and bushing can be received with anti-rust protective layer, that shall be removed before assembly operations. Do not lubricate bushing, coupling flange bore or hardware. Use of lubricants can cause hub damage.

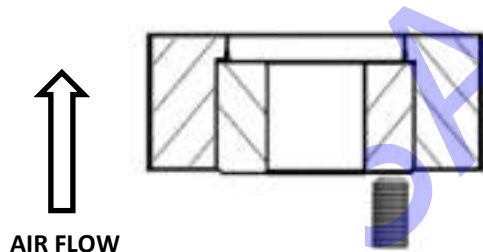


Figure 5a – Supply (S) hub fixing orientation

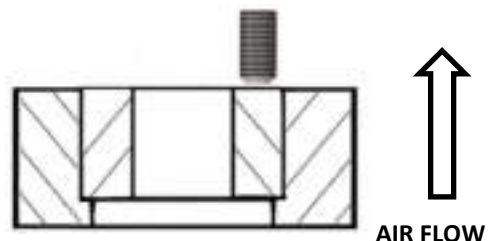


Figure 5b - Discharge (D) hub fixing orientation

1. Slip the spacer (16) (if present) into the shaft, make sure the spacer (if present) is completely through the shaft against the shaft shoulder.
2. Slip the bushing (2) into hub (1) and hold the taper bushing slightly lifted from the hub; slip the bolts (15) in the bushing and hand-tighten them alternating, just enough to keep it in place. Stop holding the taper bushing and keep tightening on all of them as nearly equal as possible, in several steps to prevent going wrong.
3. Slip the hub with the bushing onto the shaft and check the key (not supplied with fan) for proper fit.
4. Be sure the shaft is completely through the bushing. If the spacer (16) is present, make sure that the bushing is completely trough the shaft against the spacer. If the spacer (16) is not present, keep the needed distance between the cap screws and the flange of the drive-in order to correctly tight screws (15) (this distance depends on the torque wrench model).

5. Tighten the bolts (15) alternating, same as per point 1.
6. Tighten the bolts to the torque shown in chapter 8. Do not over-torque. Excessive torque can cause hub or bushing damage.

To remove taper bushing:

1. Unscrew bolts (15).
2. If extractor holes are present on the hub, remove the taper bushing using them; otherwise, apply an extractor to the hub taking care not to hook the taper bushing with the hub.

ATTENTION: the fan is held by the taper bushing or the speed reducer washer; in case of fan mounted with the speed reducer shaft above it, during hub assembly/removal use the necessary means to prevent falls.

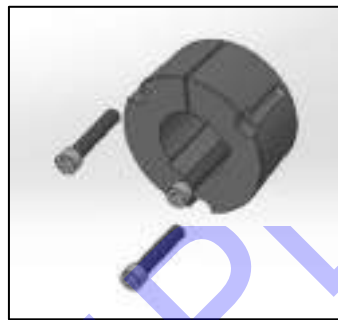


Figure 6 – Example of taper bushing

3.5 Blade Installation

STD hub series fan blades of the same type and diameter are fully interchangeable per order and can be installed at random. Please be aware that the blade droop at stand-still. The centrifugal forces during operation will raise the blades to their equilibrium position.

ATTENTION: During this operation keep the operator and his/her hands not too close to the blade tip to avoid being trapped between the fan tip and the fan casing.

ATTENTION: Bolts connecting blade to hub must be tightened by the use of a proper torque wrench, with reduced dimension of the head as shown in figure 7.

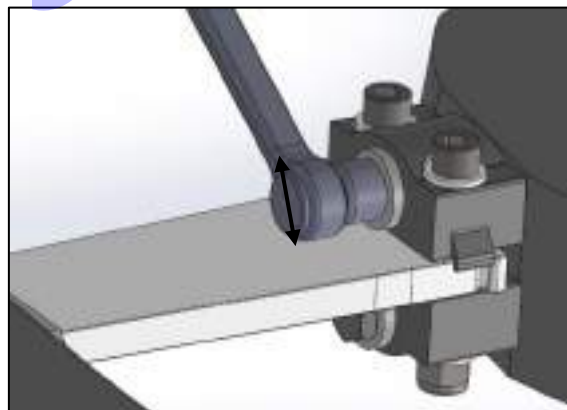


Figure 7 – Bolts tightening with proper wrench

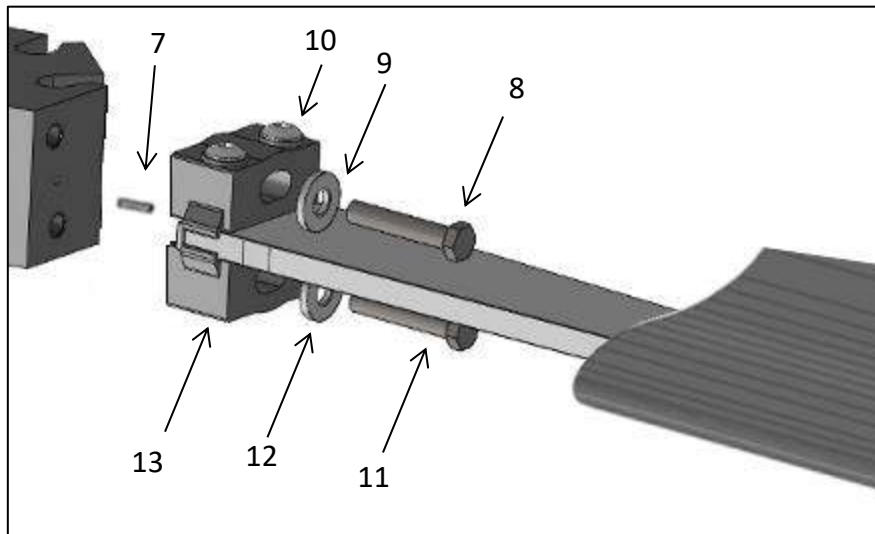


Figure 8 – Blade installation

ATTENTION: if the blades are installed in the wrong way, the warranty is considered void.

1. Before assembling, stainless-steel hardware shall be greased. It is recommended to grease hot-dip galvanized steel hardware. Always be sure to use the correct tightening torque as indicated in the table of Chapter 8.
2. Locate a blade on the upper side of the hub.
3. Centre the blade on the hub using the elastic pin (7).
4. Place the first bolt (8) with the washer (9) through the hole of the upper block (10) in the corresponding upper threaded hole in the hub (1).
5. Hand-tighten the bolt just enough to keep the blade in place; small rotations of the blade in the rotor plane about the elastic pin axis are still allowed to ease the placement of the remaining bolt.
6. Place the second bolt (11) with the washer (12) through the hole of the lower block (13) in the corresponding lower threaded hole in the hub (1) and hand-tighten it; to ease this operation rotate the blade slightly back and forth around the elastic pin axis.
7. Adjust the blade angle (see chapter 3.6).
8. Tighten the bolts to the torque shown in chapter 8.
9. Repeat the above operation for all the blades rotating the hub to have the blade in the same ring position.
10. Double check the tightening torque of the bolts in a clockwise sequence.
11. Re-check blade angle.

ATTENTION: Check that blade slope is opposed to airflow direction (see Figure 9).

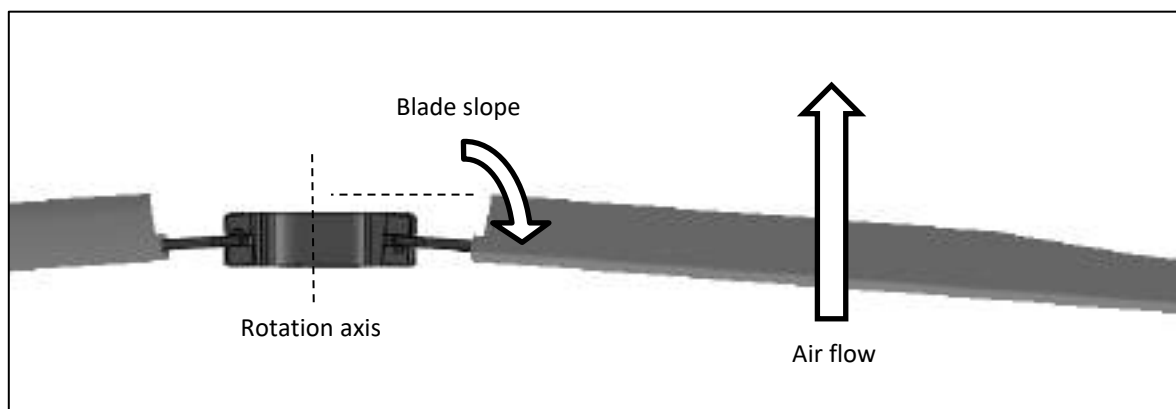


Figure 9 – Blade slope opposite to airflow direction

To disassemble the blades, the reverse process described in paragraph 3.5 can be followed.

3.6 Blade angle adjustment

1. For secondary adjustment only: loosen the two bolts connecting blade to hub (8 and 11) (Figure 8).
2. Place an inclinometer on the steel shaft or on the top of the blades (upper side) at about 50 mm (2 inches) from the blade tip. If the inclinometer is placed at blade tip, it must be long at least as much as the profile width. Refer to the fan datasheet for the design pitch angle at shaft or at tip of the blade.
3. Rotate the blade around the elastic pin axis until the desired angle is set, within a maximum tolerance of ± 0.5 degrees.
4. Tighten the two bolts (8 and 11), not yet to the full torque (see chapter 8).
5. Re-check the angle.
6. Tighten the bolts (8 and 11) to full torque (see chapter 8).
7. Repeat the above operations for all the blades making sure to place the blade to be adjusted in the same ring position.
8. Check the angle of each blade and the torque of the bolts once more.

3.7 Seal disk installation (if present)

After completing blades installation, last operation required is seal disk installation:

1. Place the seal disk spacers (3) and the seal disk (4) to have the respective holes aligned with those of the hub (1).
2. Place the bolts (5) with the washers (6) through the seal disk (4) and the spacer (3) in the corresponding holes present on the upper surface of the hub (1) and hand-tighten them.
3. Tighten the bolts to full torque (see chapter 8).

3.8 Minimum fan clearance

Make sure that in the lowest position at standstill there is still a minimum clearance between the blade tip and the obstacles underneath and beneath the fan.

Refer to the datasheet for the fan positioning and the correct value of clearance.

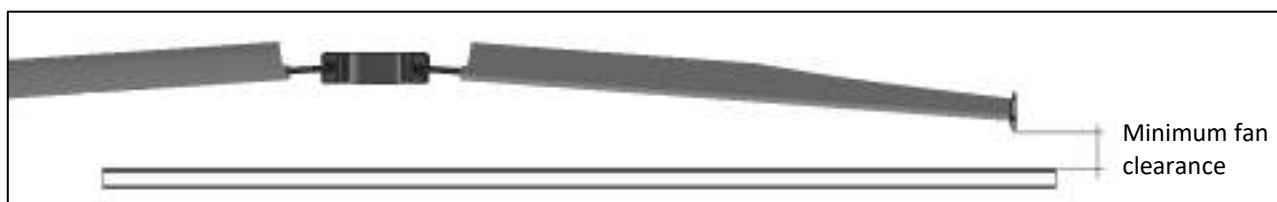


Figure 10 – Minimum fan clearance

3.9 Tip clearance (gap)

Tip clearance is the distance between the blade tip and the fan casing (Figure 11). Due to normal fan casing tolerances, the tip clearance is not constant around the fan casing.

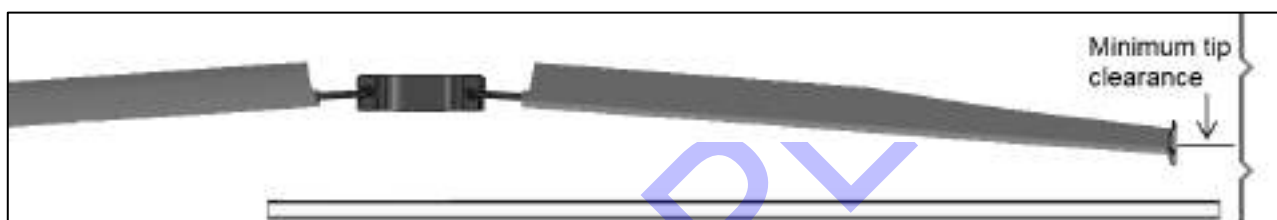


Figure 11 – Tip clearance

Check the minimum tip clearance value placing the longest blade in correspondence of the smallest casing diameter. Refer to the fan datasheet for the correct value.

3.10 Blade tracking

When the fan is at standstill, all the blade tips are not located exactly on the same plane (Figure 12). This behaviour is normal. During the operation, the centrifugal forces on the blades will dominate and will track evenly.

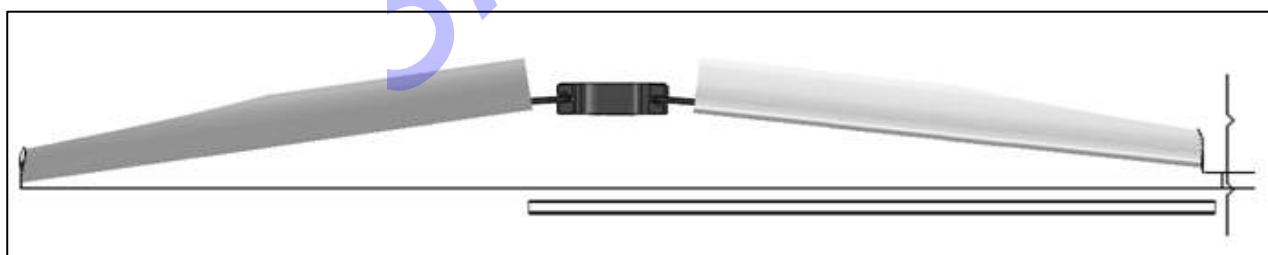


Figure 12 – Blade tracking

4 COMMISSIONING

1. Check all bolts that have been tightened on site for proper tightening (including the fan casing hardware).
2. Turn the fan by hand to check that it runs freely and does not rub or strike the fan housing and minimum clearance is respected.
3. Make sure that all tools and assembly aids like beams, supports, ladders, etc. have been removed. All the required protections must be installed before starting the fan.
4. Make sure that the applicable safety requirements have been met to ensure safe operating conditions.
5. Bump the motor to check for clockwise rotation of the fan, when viewed into the air stream (also see figure 3).
6. Immediately after first start-up check for smooth operation of the fan assembly. Listen for irregular noise/vibrations.

The fan shall never be exposed to a vibration level more than the recommended levels specified in the guideline given in the following table:

Condition	Rigidly mounted [mm/s] *		Flexibly mounted [mm/s] **	
	Peak	R.M.S.	Peak	R.M.S.
Start-up	6.4	4.5	8.8	6.3
Alarm	10.2	7.1	16.5	11.8
Shutdown	12.7	9.0	17.8	12.5

* Rigidly mounted refers to a structure of concrete

**Flexibly mounted refers to a structure of steel or wood

Table 2 – recommended vibration thresholds

ATTENTION: These vibration levels are applicable for translational vibrations along the reference axis of motor-reducer mechanical group (Figure 13a). In case of rotational type vibrations (Figure 13b) these levels are not applicable, because the measured value is not representative of the stress status induced by the vibrations on the fan.

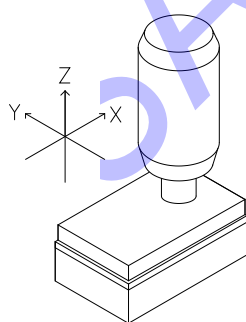


Figure 13a – Translational vibrations along X, Y, Z axis

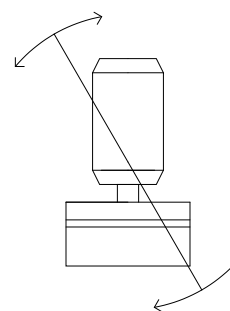


Figure 13b – Rotational vibrations

7. Measure the power absorbed from the motor. In case the fan shaft power (after correction for temperature) is different from that required, adjust the pitch angle accordingly. The variation of some degrees with respect to the design value is to be considered normal.
8. After 48/70 hours from motor start-up check all the bolts tightening.

Warning

Contact with rotating fan blades can cause severe injury or death. Never insert items into the fan to determine movement or direction of rotation. Install fan guards or screens on arrangements with exposed fans. Always use lockout and tag out procedures before performing fan adjustment, maintenance, service or inspection.

The structure shall be properly connected to ground to limit the build-up of static electricity.

IMPORTANT: Fans are used to cool a fluid (water, vapor). It is forbidden to sit or walk on the fan; motors cannot be used for purposes other than those expected. The use of the fan outside temperature range shown in chapter 1.2 is forbidden. Fans are to be used on the surface and in potentially explosive atmospheres, limited to ATEX classification as stated in the fan plate. Every other use is forbidden.

If necessary, consider the means to make sure that the fan can be commanded only from the expected command places. In case of multiple command places, the command system shall be designed so that the use of one of them makes impossible the use from the others, except for stop and emergency commands.

5 PREVENTIVE MAINTENANCE

Though the fan requires little maintenance, it must be inspected at regular intervals, with a minimum of every three (3) months, to check damage due to vibrations, fouling, wear or tear.

Actual recommended maintenance intervals will depend on the use and the application of the complete system installed and shall be determined by the operator.

Important

De-energize the fan and use lock out and tag out procedures prior to performing adjustment, service, inspections or lubrication.

Check for smooth operation of the fan and listen for irregular noise/vibrations

- De-energise the fan and make visual inspection for deposits, and or damages.
- Visually inspect the blade to hub connecting system.
- Replace corroded bolts and washers.
- Check that draining holes are free.
- Deposits shall be removed from impeller and fan housing using brushes and/or a water jet with a maximum water pressure of 3 bar (45 psi).
- Remove snow or ice deposits prior to any start and however at every snowfall depending on snow intensity.
- Check vibration level monthly.
- In case of application with dual speed motor, before switching from high speed to low speed, turn off the motor for a time necessary to make the fan reach a speed lower than the operative one, then restart.
- In case of operation in both rotating directions, before changing sense, stop completely the fan.
- Check protected parts and repair damaged areas, in particular the leading edge in cooling towers being subject to important erosive effects; it is suggested to perform the control every six months.
- In case of GRP blades with anti-static protection painting, every six months check that all the surface is covered with the protecting paint and, in case, re-apply the protection on uncovered areas.
- Randomly check the tightening torque of all blade bolts.

The following table resumes all start-up and maintenance actions and their frequency.

Actions	At start-up	After 48/70 hours	Monthly	Every 3 months	Every 6 months
Check all bolts that have been tightened for proper tightening (including the fan casing hardware).	X				
Turn the fan by hand to check that it runs freely and does not rub or strike the fan housing and minimum clearance is respected.	X				
Check for smooth operation of the fan assembly. Visual inspection for damages and removal of deposits.	X	X		X	
Check all the bolts tightening.		X			<i>random</i>
Replace corroded bolts and washers.				X	
Check that draining holes are free.				X	
Check vibration level.	X	X	X		
Check protected parts and repair damaged areas, in particular the leading edge in cooling towers. In case of GRP blades with anti-static protection painting, check that all the surface is covered with the protecting paint and, in case, re-apply the protection on uncovered areas.					X

Table 3 – frequency of maintenance activities

Axial Fans Int suggests to take photos of every damage that could be possibly present and send them with a description of the problem to Axial Fans Int S.r.l. for evaluations.

6 AXIAL FANS INT CONTACTS

Axial Fans Int S.r.l.
via Leonardo da Vinci snc
21010 Besnate (VA)
Italy

Tel. +39 0331 273315

Fax +39 0331 1855016

Email: info@axialfansint.com

Website: www.axialfansint.com

SAMPLE

7 TROUBLE SHOOTING

In case of any failure, please contact Axial Fans Int S.r.l. stating the fan order number as mentioned on the nameplate located at the hub of the impeller.

Problem	Possible cause	Possible solution
Air volume low	Fouling system	Clean system air-cooler bundles or cooling tower fill
	Obstacles in housing/air stream	Check actual total area of obstacles and impeller housing inlet shape against original selection
		In dry-coolers the minimum required free height of the air inlet area is 1.0 times the fan diameter. This shall be higher in case of multiple row units.
	Decreased blade pitch angle	Reset the angle following scrupulously the instructions indicated on this manual.
	Static pressure higher than specified	Increase blade angle (up to 3 degrees beyond design value)
Power consumption (too) high	Temperature lower than design temperature	-
	Static pressure higher than specified	Decrease blade angle
Impeller is rubbing against fan casing	Bolting of drive-train connection, supporting structure or fan housing is not tight	Tighten all bolts
	Impeller not centred	Centre the impeller
Vibration level high	Bolting of drive-train connection, fan housing and/or fan is not tightened	Tighten all bolts
	Drive alignment incorrect	Realign
	Driver bearing damage	Repair or replace
	Blade unbalance	Contact Axial Fans Int

Problem	Possible cause	Possible solution
	Blades under resonance	Contact Axial Fans Int
	Blade pitch angle not in tolerance $\pm 0.5^\circ$	Correct
	Blades are too close to obstacles	Contact Axial Fans Int
	Resonance between forcing and structure	Contact Axial Fans Int
	Draining holes obstructed	Free holes

SAMPLE

8 TIGHTENING TORQUES

Bolts / Nuts	A4-70 *		A4-80 *		Class 8.8 *				Class 10.9 *			
					Greased		Not greased		Greased		Not greased	
	Nm	Lb ft.	Nm	Lb ft.	Nm	Lb ft.	Nm	Lb ft.	Nm	Lb ft.	Nm	Lb ft.
M4	2	1	2	2	3	2	3	2	4	3	5	3
M6	6	5	8	6	9	7	11	8	13	10	15	11
M8	16	12	22	15	22	16	26	20	31	23	37	27
M10	31	23	42	31	45	33	55	41	65	48	75	55
M12	55	41	70	52	75	56	90	66	105	77	125	92
M14	85	63	110	81	120	88	140	103	170	125	200	148
M16	130	96	170	125	180	133	210	155	250	184	300	221
M20	245	181	330	243	350	258	415	306	490	362	580	428
M22	330	243	435	321	465	342	550	406	655	483	770	568
M24	425	313	570	420	605	446	715	527	850	627	1000	738
M27	620	458	830	612	880	650	1045	771	1240	914	1460	1077
M30	850	627	1135	837	1210	892	1430	1055	1700	1254	2000	1475
M33	1140	841	1520	1121	1620	1195	1920	1416	2280	1682	2685	1980
M36	1480	1092	1970	1453	2100	1549	2490	1837	2950	2176	3470	2559

* Before assembling, stainless steel hardware (AISI 316 – A4.70 and A4.80) must be greased. It is recommended to grease hot-dip galvanized steel hardware.

Application	Screw	Not greased	
		Nm	Lb ft.
Taper bushing fixing	1/2"x1" 1/2 BSW	113	83

SAMPLE

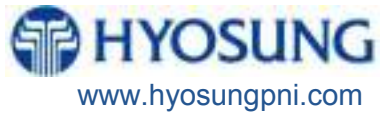


INSTALLATION, OPERATING & MAINTENANCE MANUAL

Appendix B. Motor Installation, Operation & Maintenance Manual

SAMPLE

LVM_OM E-001
Rev.07



Low Voltage Motor Operation & Maintenance Manual

LVM_OM E-001 Rev.07

Contents

1	Safety Guide	3
1.1	Introduction	3
1.2	Definition	3
2	Handling and Installation	3
2.1	Initial check	3
2.2	Transportation	3
2.3	Storage	3
2.4	Installation	3
2.5	Foundation	3
2.6	Connection and alignment of the motor	4
	Direct connection	4
	Belt connection	4
3	Operation	4
3.1	Main connection	4
3.2	Direction of rotation	5
3.3	Insulation resistance	5
3.4	Initial start-up	5
4	Maintenance & Repair	6
4.1	Maintenance	6
4.2	Standby motors	6
4.3	Bearing lubrication	6
5	Disassembly & Assembly	6
5.1	Disassembly sequence	6
5.2	Assembly sequence	7
6	Warranty	7
6.1	Warranty period and coverage	7
6.2	Service after warranty period	7
6.3	After Sales Support	7

1 Safety Guide

1.1 Introduction

A motor can cause serious injury or property damage with its mechanical features such as high voltage, fast speed or hot surface. Thus, the installation, operation and maintenance should be carried out by qualified and trained personnel only under safety regulations and precautions. To prevent possible dangers and accidents, this manual should be thoroughly studied and kept in a place where immediate access is possible.

1.2 Definition

The following markings are used throughout the manual to emphasize certain conditions.

1.2.1 WARNING



Describes potential danger which could lead to death or serious injuries if care not taken.

1.2.2 ATTENTION



Describes potential danger which could lead to injuries or property loss if care not taken.

2 Handling and Installation

2.1 Initial check

Upon the receipt of the motor, check for any damage that might have occurred during transport. Hand-turn the shaft to see that it turns smoothly and also check the basic parts such as flange and painted surface. If there are any issues at all, immediately contact the forwarding agent or Hyosung.

Check the ratings on the nameplate, especially power, voltage, poles, frequency and protection and make sure that they are identical with the ordered item.

2.2 Transportation

Motors with lifting lugs or eyebolts should always be lifted using lifting devices. Make sure that lugs or eyebolts are undamaged and tightened before lifting. When using only one eyebolt to lift, the lifting angle should not be greater than 30° and when using two, not greater than 45°. Take care so that the shaft and main parts do not get damaged during transport. The motor must not be lifted when still coupled to another machine.

2.3 Storage

The motor shall be stored indoors in a dry, clean and well ventilated, vibration- and dust-free environment. If the motor is to be stored for a long period, the below treatments are recommended to keep in good condition:

- Rotate the shaft with hand for more than 1 time every 2 weeks after receiving motor, in order to avoid bearing corrosion.
- Measure the insulation resistance with a Megger tester (500V DC) every 3 months to make sure that the insulation is kept in good condition.
- Check on a regular basis for corrosion. The motor is treated against corrosion at the time of delivery but treatment can weaken depending on the storage environment.
- When the motor is not used for over 1 month or when stored in a place with high humidity subject to debris, the whole motor should be covered with a waterproof cover and sealed with desiccants placed inside. Desiccants should be replaced regularly.

2.4 Installation

The motor should be installed and used in an environment where altitude is less than 1,000m above sea level and ambient temperature between -15°C and 40°C. When installed in other conditions, please contact Hyosung.

When installing the motor, select a place free of dust and humidity and where ventilation and maintenance can easily be done. It should be kept away from oil and external vibration.

Indoor motor must not be installed outdoors as when humidity penetrates into the motor frame it may cause damage and interrupt normal operation.



In a hazardous area, motor of appropriate explosion protection according to relevant standards must be used. Standard motors may cause explosion or fire in hazardous areas.



The air inlet and outlet of the motor must be kept clear at least 20cm from the wall or other objects to allow sufficient cooling.

2.5 Foundation

The user is fully responsible for preparing the foundation of the motor.

The foundation should be designed so that it is sufficiently above ground level, properly drained and rigidly supported on all four feet with no vibration. When height difference is spotted among feet, make use of bolts, studs or shim plates to adjust.



Check the direction of rotation and grounding installations before supplying power to the motor.

2.6 Connection and alignment of the motor

■ Direct connection

Axially and radially align the shaft centers of the motor and the driven machine. When fitting the coupling on to the shaft, apply sufficient lubrication on to the area and press fit by hammering softly with a mallet or a similar tool.

The connection method and tolerance of alignment per type of coupling are as per **Figure 1**.

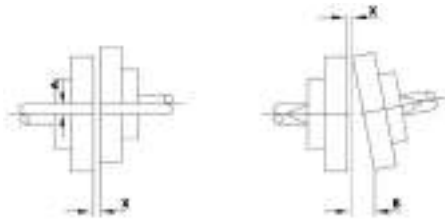


Figure 1: Direct coupling alignment

Tolerance	Rigid Coupling	Flexible Coupling
A	≤0.03mm	≤0.05mm
B	≤0.03mm	≤0.04mm
X	0	Per instruction of the coupling manufacturer

■ Belt connection

Align the shaft ends of the motor and the driven machine so that the centers of the pulleys are in line with each other and in perpendicular with the shafts, as illustrated in **Figure 2**.

When fixing the pulley on to the shaft, apply sufficient lubrication on to the area and press fit by hammering softly with a mallet or a similar tool.

Selection of pulleys and V-belts should be made according to KS C 4202, or other relevant standards. It is important that installation and operation are carried out as per KS C M 6535, or other relevant standards, as the diameter of the pulley and the tension of the belt greatly affect bearing balancing and shaft solidity. For further information, please contact Hyosung.

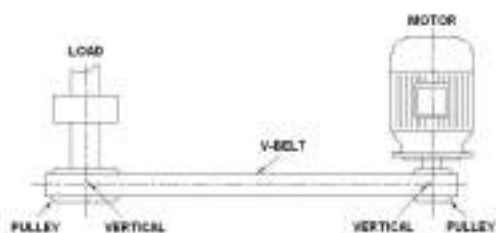
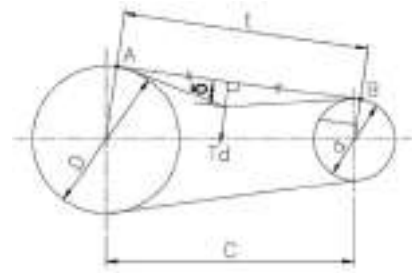


Figure 2: Belt-pulley alignment

The tension of the V-belt drive can be calculated as per **Figure 3**. The principal speed limit is 30m/sec.



whereas, D : Diameter of larger pulley(mm),
 d : Diameter of smaller pulley(mm),
 c : Distance between shafts (mm),
 T_d : tension load (kgf),
 t : Linear distance (mm)

Figure 3: V-belt tension and speed

When the belt tension is too low, it may lower the transmission efficiency by causing vibration or slippage. The permissible range of belt tension when vertical load is applied to the center point of the belt's linear distance can be calculated with the constant 0.016 as per below:

Permissible range of tension (δ) = $0.016 \times t$ (mm)



When using a belt drive, select the right type and specification according to KS or other relevant standards. Refer to **Attachment 1: Recommendation on V-Belt Selection**.

Take special attention to the alignment of the pulleys and tension of the belt. It is necessary to install a protective net around the machine to prevent injuries caused whenever using a belt drive.



Do not use belt drives for 2P motors with power ratings higher than 7.5kW and motors for direct-coupling. It may result in shaft rupture.

3 Operation

3.1 Main connection

The motor control circuit, overload protection device and grounding are to be in accordance to relevant electric standards. Wiring and connection must be done and verified by qualified personnel.

Check that the power and frequency to be supplied are in accordance with the motor nameplate.

When connecting the lead wires in the terminal box, make sure insulation is properly done and always close the cover of the terminal box after each work to avoid electric shocks.



The main connection must be done according to the diagram on the name plate. Do not bend or pull the lead wires by force as it may cause fire or electric shocks from internal short circuit.



- Excessive variation in supply voltage (over $\pm 10\%$) and frequency (over $\pm 5\%$) can cause lack of torque, overheating and other problems in operation.
- Voltage drop can occur in proportion to the distance of distribution cables. Voltage drop should be minimized to under 2%.
- The starting method should be appropriately selected in regards to the load conditions in order to avoid starting failures due to lack of torque.
- Y- Δ Connection must be made at the control panel. Operating for a long time in Y connection can cause winding damage.
- When using a Y- Δ starter, a switch must be installed on the primary circuit and it must be left open when not in use.
- When continuous power is supplied to the motor's primary circuit, creeping discharge may deteriorate and damage the insulation. So be cautious at all times. (Apply 3 contactor method by primary circuit electro-magnetic switch.)

3.2 Direction of rotation

Check the direction of rotation before operating with the motor uncoupled.

To alter the direction, interchange any two connections on the supply cables. If the motor has a unidirectional fan, it needs to be operated only in the specified direction or the fan needs to be reversely installed. For assistance, please contact Hyosung.

3.3 Insulation resistance

Measure insulation resistance of the stator winding with a Megger tester (500V DC) and make sure that the value is above the minimum level which is 5M Ω at 40°C winding temperature. When ambient temperature rises, the minimum level of insulation resistance needs to be corrected in relation to their inverse proportion.

(Refer to IEEE 43)

$$R_C = K_T R_T$$

whereas, R_C : Insulation resistance (M Ω) corrected to 40°C,

R_T : Insulation resistance (M Ω) at temperature T °C.

K_T : Insulation resistance coefficient at temperature T °C

$$(K_T = (0.5)^{(40-T)/10})$$

If the recommended resistance value is not attained, the winding is too damp and needs to be thoroughly dried before commissioning. For further information, please contact Hyosung.



When a motor has been stored for a long time, bearing and insulation resistance must be checked before using.

3.4 Initial start-up

Consecutive starting can overheat the motor or cause other damage. When consecutive starts are required, let the motor have enough time to cool down in between the starts.

Check the direction of rotation on no load and also check the bearing for any abnormal sounds. When excessive noise, vibration or abnormal sounds (clicks or hits) are detected, stop the motor immediately and contact Hyosung.

If overheated during operation, the temperature rise limit needs to be checked once again.

When the motor starts up smoothly, gradually increase the load to full.



- In case of a black out, turn the main power supply off to prevent any unexpected accidents from auto-restarts.
- Do not make physical contact with a running motor whose surface is very hot. It can cause serious injuries and burns.



- Do not operate the motor above the rated current. It may cause damage to the motor from overload.
- Running a standard motor designed to run at standard frequency with a variable speed drive (VSD) may cause damage to insulation and cooling functions depending on operation conditions. When VSD operation is required, the motor must also be rated for such use.
- If the motor does not start operating within 15 seconds (in D.O.L connection), immediately shut off the power supply as overcurrent may damage the motor. For more detailed information, please contact Hyosung.

4 Maintenance & Repair

4.1 Maintenance

Short time duty with consecutive starts generates more heat than continuous duty and affects the lifespan of the rotor as well as winding insulation. Thus, when running on loads that require consecutive starts can cause winding damage to a standard motor designed for continuous duty. If detailed information is needed, please contact Hyosung.

If motor is found to be overheated, immediately stop the operation and inspect the motor according to the **Table 1. Troubleshooting**.

Set up a regular maintenance schedule to check and maintain the condition of the motor with focus on cleanliness, insulation, bearing and vibration.

When excessive noise and vibration are detected, investigation needs to be done to identify and eliminate the root cause.

In case of a flameproof motor whose gaps between joint parts are very tight, re-assembly must be done using a torque wrench. After tightening the bolts with even force, check the gaps with a clearance gauge to allow smooth turning of the shaft. Make sure that there is no interference when turning before connecting the motor to the driven machine.



- The power must be turned off before commencing any maintenance work and opening the terminal box to prevent electric shocks.
- Do not alter any parts without prior instructions from Hyosung. It may cause abnormal operation or serious physical damage. If this was found to have been done, the warranty will not be applied.

4.2 Standby motors

If the motor is in standby for a long time, the following precautions shall be taken to avoid damages to the motors.

- 1) After receiving motor, the shaft must be rotated every 2 weeks for a few minutes by means of starting system or at least 10 rotations by means of hand.
- 2) If motor is stored for a long time more than 6 months, in case the motor has grease nipple, the bearings shall be regreased at least every six month, while rotating the shaft(if there is transport lock, be sure to remove it before rotating).
- 3) If motor is stored more than 2 years, it is recommended to disassemble, wash, inspect and relubricate the bearings(for sealed type

bearings, it is recommended that bearings be replaced).

- 4) All other instructions in this manual shall be followed additionally, if these are not followed, the damages will not be covered by warranty.

4.3 Bearing lubrication

Motors with permanently greased (shield type) bearings come with sufficient grease but regreaseable (open type) bearings may need additional regreasing before the initial use.

Open type anti-friction bearings need regular regreasing to prevent possible accidents that can occur from excessive friction. Regreasing intervals may vary according to the environment and operation conditions. Standard bearing regreasing intervals and amounts can be found in **Table 2 Regreasing standard**

It is also important to keep the bearing housing free of dust and the grease free of contamination.

Avoid mixing different types of grease and, in tough operating conditions, regreasing intervals are recommended to be shorter than standard. In extreme conditions and when the motor is vertically mounted, halve the interval in the table.

If the ambient temperature is too low or too high compared to the standard, please seek consultancy from Hyosung.

Regrease the bearing with the grease outlet plug open and while the motor is at a stop. If it is inevitable to regrease the motor while running, take special care to grease only the appropriate amount as excessive grease may allow leakage into the motor frame damaging the winding and insulation.

5 Disassembly & Assembly

5.1 Disassembly sequence

- 1) Turn the power off.
- 2) Open the terminal box.
- 3) Disconnect all cables connected to the motor.
- 4) Uncouple the motor and the driven machine.
- 5) Undo the bolt on the motor base.
- 6) Transport to work site.
- 7) Disassemble the grease nipple if an open type bearing.
- 8) Disassemble the terminal box.
- 9) Disassemble the fan cover and fan.
- 10) Undo the bolt on the bearing housings of DE and NDE.
- 11) Disassemble the brackets on DE, NDE and the inner bearing cover. (Take care not to damage the core or the winding whilst doing so.)
- 12) Separate the stator and rotor.

5.2 Assembly sequence

Assemble in reverse sequence to disassembly.



- Assembly and disassembly should not be done by a single worker. Always work in more than a pair.
- When disassembling the motor, put aside the parts and components in order they were taken off so that there is no confusion when reassembling.
- Take care that the bearing, winding and other important parts are kept free of dust, contamination and external force.
- Repair and disassembly should be done by qualified personnel in case of dangers from shock, fire and physical injuries.

6.3 After Sales Support

When contacting us for whatever reason, whether it is asking questions, requesting repair works, ordering spare parts, please check the following information beforehand:

- 1) Nameplate
 - A. Serial number:
 - B. Model type:
 - C. Power/Poles/Voltage/Frequency:
- 2) Environment
 - A. Type of driven machine (load):
 - B. Installation site:

6 Warranty

6.1 Warranty period and coverage

The motors, when operated under the conditions recommended by Hyosung in this manual, are warranted for two (2) years from shipment date. When shipment date or start-up date is not clear, the base date shall be the manufacturing date on the nameplate of the motor.

However, this warranty does not apply to products, which have been subject to the following:

- 1) Customer's misuse
- 2) Inadequate installation conditions
- 3) Inadequate ambient temperature (-15°C to +40°C except when designed otherwise)
- 4) Improper installation including obstruction of air flow around the cooling fan and air in/outlets
- 5) Operation at unrated voltage and frequency
- 6) Modification or alteration by those other than authorized Hyosung personnel
- 7) Natural calamities or fire under which manufacturer is at force majeure

Repair or replacement of parts or components carried out by authorized Hyosung personnel does not give extension to the motor's warranty period except for when agreed otherwise.

6.2 Service after warranty period

All investigation and repair works after the warranty period is subject to additional charges. Also, the above-mentioned cases that are not covered by warranty are also subject to additional charges. For detailed information, please contact Hyosung Customer Support center.

Table 1: Troubleshooting

Trouble	Possible causes	What to do
Motor fails to start	Cables have been disconnected.	Re-connect.
	Switch contact failure	Check and repair contact parts of the switch.
	Stator coil failure	Contact Hyosung Customer Support Center.
	Fuse failure	Check the appropriate capacity for the fuse and replace.
	Open circuit in winding	Check for loose wiring or contact Hyosung.
	<i>Overload</i>	<i>Reduce the load to rated level.</i>
	<i>Damaged bearing</i>	<i>Replace bearing or contact Hyosung.</i>
Damaged shaft	Belt connection angle is too small.	Adjust the diameter of the pulley.
	Belt tension is too weak.	Adjust the tension of the pulley.
	Load point is far from the motor.	Adjust the load point closer to the motor.
	<i>The shaft center of motor and driven machine is misaligned when directly connected.</i>	<i>Align the center of motor and the driven machine.</i>
	<i>Motor is too frequently started.</i>	<i>Reduce the frequency of starting.</i>
Noise and vibration	External vibration and shock	Remove external vibration.
	Weak foundation	Fortify the foundation.
	The shaft center of motor and driven machine is misaligned when directly connected.	Align the center of motor and the driven machine.
	Coupling ends are unbalanced.	Balance the coupling ends.
	The centers of the pulleys are misaligned.	Align the centers.
	Foreign particles on the rotating parts	Check and clean the rotating parts for dust or foreign particles
	Single phase operation	Check the connection circuit for proper three phase operation.
	Unbalanced voltage	Check with the grid operator or power supplier.
	Vibration from load	Check the load (driven machine) for the cause of vibration.
	Unbalanced load	Check the load (driven machine) for proper balancing.
	Bearing failure	Contact Hyosung Customer Support Center.
	Belt tension is too weak.	Adjust the tension of the pulley.
	<i>Switch contact failure</i>	<i>Check and repair contact parts of the switch.</i>
	<i>Overload</i>	<i>Reduce the load to rated level.</i>
	<i>Stator coil failure</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>Entry of foreign particles</i>	<i>Contact Hyosung Customer Support Center.</i>
Motor overheat	High ambient temperature	Facilitate ventilation.
	Obstruction	Remove any obstacles within 20cm from the motor.
	Voltage drop	Adjust the thickness and length of the cables and and consult with the grid operator or power supplier.
	Single phase operation	Check the connection circuit for proper three phase operation.
	Overload	Reduce the load to rated level.
	Motor is too frequently started.	Reduce the frequency of starting.
	Moment of inertia of the load is too big.	Contact Hyosung Customer Support Center.
	Cooling fan is damaged.	Contact Hyosung Customer Support Center
	Ventilation inlet or outlet is blocked.	Contact Hyosung Customer Support Center.
	<i>Unbalanced voltage</i>	<i>Check with the grid operator or power supplier.</i>
	<i>Inappropriate relay capacity</i>	<i>Replace with a compatible relay.</i>
	<i>Y-D start was applied to a motor that does not support such.</i>	<i>Use a 3 contactor method.</i>
	<i>Stator coil failure</i>	<i>Contact Hyosung Customer Support Center.</i>
Bearing overheat	Belt tension is too weak.	Adjust the tension of the pulley.
	Bearing failure	Contact Hyosung Customer Support Center.

	Grease has been deteriorated from heat or has been polluted.	Contact Hyosung Customer Support Center.
	<i>High ambient temperature</i>	<i>Facilitate ventilation.</i>
	<i>Environment is high in humidity and very oily.</i>	<i>Protect the motor from moisture and oil.</i>
	<i>Obstruction</i>	<i>Remove any obstacles within 20cm from the motor.</i>
	<i>External vibration and shock</i>	<i>Remove external vibration.</i>
	<i>The shaft center of motor and driven machine is misaligned when directly connected.</i>	<i>Align the center of motor and the driven machine.</i>
	<i>Belt connection angle is too small.</i>	<i>Adjust the diameter of the pulley.</i>
	<i>Load point is far from the motor.</i>	<i>Adjust the load point closer to the motor.</i>
	<i>Foreign particles on the rotating parts</i>	<i>Check and clean the rotating parts for dust or foreign particles</i>
	<i>Thrust is too big.</i>	<i>Reduce the thrust.</i>
	<i>Unbalanced load</i>	<i>Check the load (driven machine) for proper balancing.</i>
	<i>Cooling fan is damaged.</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>Ventilation inlet or outlet is blocked.</i>	<i>Contact Hyosung Customer Support Center.</i>
Irregular rotation	<i>The centers of the pulleys are misaligned.</i>	<i>Align the centers.</i>
	<i>Voltage drop</i>	<i>Adjust the thickness and length of the cables and and consult with the grid operator or power supplier.</i>
Activation of protective relay	<i>Voltage drop</i>	<i>Adjust the thickness and length of the cables and and consult with the grid operator or power supplier.</i>
	<i>Single phase operation</i>	<i>Check the connection circuit for proper three phase operation.</i>
	<i>Inappropriate relay capacity</i>	<i>Replace with a compatible relay.</i>
	<i>Stator coil failure</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>High ambient temperature</i>	<i>Facilitate ventilation.</i>
	<i>Obstruction</i>	<i>Remove any obstacles within 20cm from the motor.</i>
	<i>Pulley interrupts cooling motor</i>	<i>Apply vent to pulley</i>
	<i>Cables have been disconnected.</i>	<i>Re-connect.</i>
	<i>Switch contact failure</i>	<i>Check and repair contact parts of the switch.</i>
	<i>Improper grounding</i>	<i>Check and fix grounding.</i>
	<i>Unbalanced voltage</i>	<i>Check with the grid operator or power supplier.</i>
	<i>Overload</i>	<i>Reduce the load to rated level.</i>
	<i>Motor is too frequently started.</i>	<i>Reduce the frequency of starting.</i>
	<i>Moment of inertia of the load is too big.</i>	<i>Contact Hyosung Customer Support Center.</i>
Short circuit	<i>Bearing failure</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>Improper grounding</i>	<i>Check and fix grounding.</i>
	<i>Stator coil failure</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>High humidity</i>	<i>Contact Hyosung Customer Support Center.</i>
Low insulation resistance	<i>Environment is high in humidity and very oily.</i>	<i>Protect the motor from moisture and oil.</i>
	<i>High humidity</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>Stator coil failure</i>	<i>Contact Hyosung Customer Support Center.</i>
	<i>External vibration and shock</i>	<i>Remove external vibration.</i>
	<i>Y-D start was applied to a motor that does not support such.</i>	<i>Use a 3 contactor method.</i>

ITALIC : CAUSES ARE LESS RELATED THAN NON-ITALIC CAUSES

Table 2: Regreasing standard

Bearing No.	Initial charge(g)	Amount to be regreased while running(g)	Regreasing intervals(hr)			
			2P	4P	6P	8P
6212	65	30	1200	4000	6500	9000
6222	320	70	-	1500	3500	5500
6312	100	40	1200	3500	6000	8000
6313	120	45	1200	3000	5500	7500
6314	150	50	1200	3000	5000	7000
6316	210	60	1200	2500	4500	6500
6317	240	65	-	2500	4000	6000
6319	320	75	-	1500	3500	5500
6311	80	35	1200	3500	6000	8500
6320	370	80	-	1500	3500	5000
6322	510	90	-	1000	3000	4500
NU313		45	-	1500	2500	3500
NU314		50	-	1500	2500	3500
NU315		55	-	1000	2000	3000
NU316		60	-	1000	2000	3000
NU317		65	-	1000	2000	3000
NU318		70	-	1000	2000	2500
NU319		75	-	900	1500	2500
NU320		80	-	800	1500	2500
NU324		100	-	500	1000	2000
NU220		60	-	1000	2000	3000
NU222		70	-	1000	2000	3000
NU224		85	-	800	1500	2000

- Regreasing intervals are subject to change depending on site condition and load condition.
- In case the motor has regreasing information name plate, the name plate has priority.

Attachment 1: Recommendation on V-Belt Selection

MOTOR		STANDARD V-BELT				Narrow width V-belt			
Rated Output (kw)	Pole	Belt Type	Factor of Belt	Diameter of Pulley Pitch (mm)	Width of Pulley (mm)	Belt Type	Factor of Belt	Diameter of Pulley Pitch (mm)	Width of Pulley (mm)
0.2	2	A	1	75	20	3V	1	71	17.4
0.4		A	1	75	20	3V	1	71	17.4
0.75		A	1	80	20	3V	1	71	17.4
1.5		A	2	80	35	3V	1	75	17.4
2.2		A	2	90	35	3V	1	75	17.4
3.7		A	3	90	50	3V	2	75	27.7
5.5		A	3	112	50	3V	3	75	38
7.5		A	3	132	50	3V	4	80	48.3
0.2	4	A	1	75	20	3V	1	71	17.4
0.4		A	1	75	20	3V	1	71	17.4
0.75		A	1	80	20	3V	1	71	17.4
1.5		A	2	90	35	3V	2	75	27.7
2.2		A	2	100	35	3V	2	75	27.7
3.7		A	3	112	50	3V	2	100	27.7
5.5		B	3	125	63	3V	3	100	38
7.5		B	3	150	63	3V	3	125	38
11		B	4	160	82	3V	4	125	48.3
15		B	5	170	101	3V	6	125	68.9
18.5		B	5	200	101	3V	6	140	68.9
22		B	5	224	101	3V	6	160	68.9
30		C	5	224	136	5V	4	180	77.9
37		C	6	224	161.5	5V	4	200	77.9
45		C	6	265	161.5	5V	4	224	77.9
55		C	7	265	187	5V	5	224	95.4
75		C	8	315	212.5	5V	6	250	112.9
90		—	—	—	—	5V	6	250	112.9
0.4	6	A	1	80	20	3V	1	71	17.4
0.75		A	2	80	35	3V	1	75	17.4
1.5		A	2	100	35	3V	2	75	27.7
2.2		A	3	100	50	3V	2	90	27.7
3.7		B	3	125	63	3V	3	100	38
5.5		B	3	150	63	3V	3	140	38
7.5		B	4	150	82	3V	4	140	48.3
11		B	5	170	101	3V	5	140	48.3
15		B	5	224	101	3V	6	160	68.9
18.5		C	4	224	110.5	5V	3	180	60.4
22		C	5	224	136	5V	4	180	77.9
30		C	5	265	136	5V	4	224	77.9
37		C	6	265	161.5	5V	4	224	77.9
45		C	7	280	187	5V	5	224	95.4
55		C	8	300	212.5	5V	6	250	112.9
75		D	6	355	233	5V	6	315	112.9
90		D	6	400	233	5V	6	355	112.9
110		D	7	400	270	8V	4	355	123.8
132		D	7	475	270	8V	4	400	123.8
30	8	C	6	265	161.5	5V	5	224	95.4
37		C	7	280	187	5V	5	250	95.4
45		C	7	315	187	5V	6	250	112.9
55		D	5	355	196	5V	6	280	112.9
75		D	6	400	233	5V	6	355	112.9
90		—	—	—	—	8V	4	355	123.8
110		—	—	—	—	8V	4	400	123.8



Contact us

Homepage

www.hyosungpni.com

Address

303, Gongdan-Ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 642-290 Republic of Korea

Hyosung Customer Support Center

■ Incheon	T: +82-(0)32-887-9527, 6558	F: +82-(0)32-887-9688
■ Changwon	T: +82-(0)55-279-7024	F: +82-(0)55-279-7030
■ Hotline (Toll-free)	T: 080-024-8282 (Domestic only)	

Hyosung Sales Team

■ Global Sales	T: +82-(0)2-707-6584	F: +82-(0)2-707-6444
■ Domestic Sales	T: +82-(0)2-707-6321	F: +82-(0)2-707-6444
■ Domestic Agent Sales	T: +82-(0)2-707-6421	F: +82-(0)2-707-6447
■ Plant & Marine Sales	T: +82-(0)55-268-8571	F: +82-(0)55-268-8579



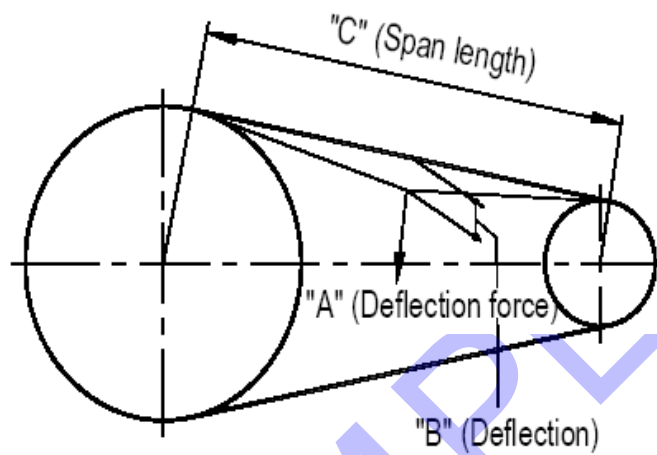
INSTALLATION, OPERATING & MAINTENANCE MANUAL

Appendix C. Belt Tension Value

SAMPLE

BELT TENSION VALUE

NO.	ITEM NO.	FAN SIZE (FEET)	DEFLECTION FORCE (Min.) (NEW BELT)		DEFLECTION FORCE (Max.) (NEW BELT)		BELT DEFLECTION (mm)
			N	KGf	N	KGf	
1	RECYCLE COOLER & LUBE OIL COOLER	15.0	160	16.3	176	18.0	21.1





INSTALLATION, OPERATING & MAINTENANCE MANUAL

Appendix D. Lubricant List

SAMPLE

[illegible]



INSTALLATION, OPERATING & MAINTENANCE MANUAL

Appendix E. Pulley Drawing & Tooth Belt Specification

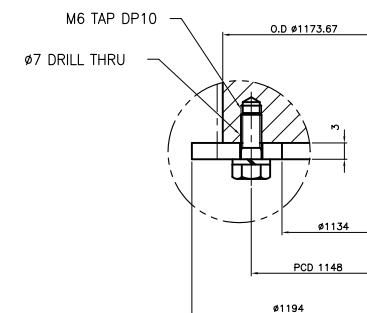
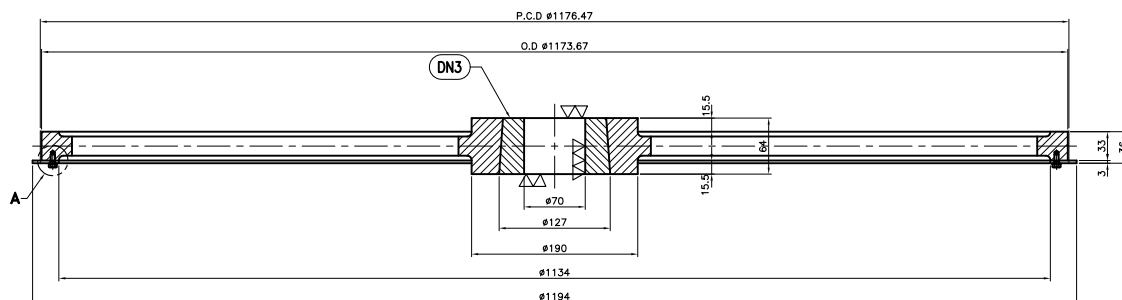
SAMPLE

1

DRIVEN PULLEY

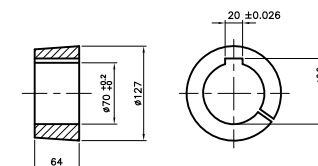
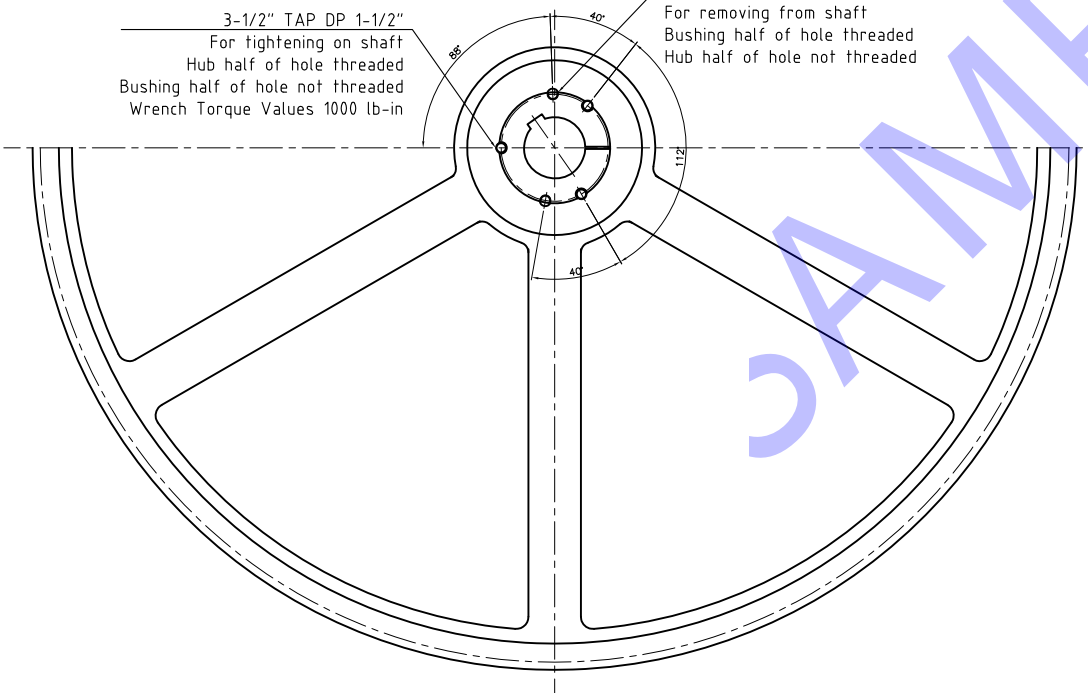
~ (▽, ▽▽▽)

264G-14M-20

DETAIL-"A"

3-1/2" TAP DP 1-1/2"
For tightening on shaft
Hub half of hole threaded
Bushing half of hole not threaded
Wrench Torque Values 1000 lb-in

2-1/2" TAP DP 1-1/2"
For removing from shaft
Bushing half of hole threaded
Hub half of hole not threaded

DETAIL OF "TAPER BUSH" (TB1)

DRAWING TITLE

DRIVEN PULLEY

Hong

DRAWN BY

CHECKED BY

APPROVED BY

Y.M.BATX

Rev 0

REV.

2022.02.23

DATE

REVISION BY

REMARKS

④					
③	SET SCREW	1/2" x 1-1/2"	3	SCM	
②	DN BUSH	#3525- 70	1	S45C	Phosphate coating
①	DN PULLEY	264G-14M-20	1	FC25	Painting
NO	NAME	SPECIFICATION	Q'TY	MATERIAL	REMARKS

THIRD ANGLE
PROJECTION

PTS

GENERAL NOTES
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. NOT MENTIONED DIMENSIONS : ACCORDING TO STANDARD.
3. BALANCING SPEC : ISO 1940 CLASS G16.

DRAWING SCALE : N/S
PURCHASE ORDER QUANTITY : 6 SETS
PROJECT NAME / ITEM NO.

THAILAND HINKONG

1-1

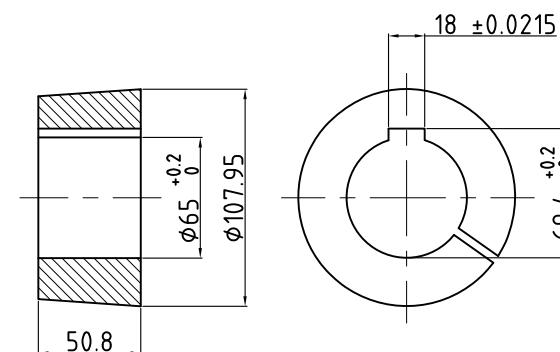
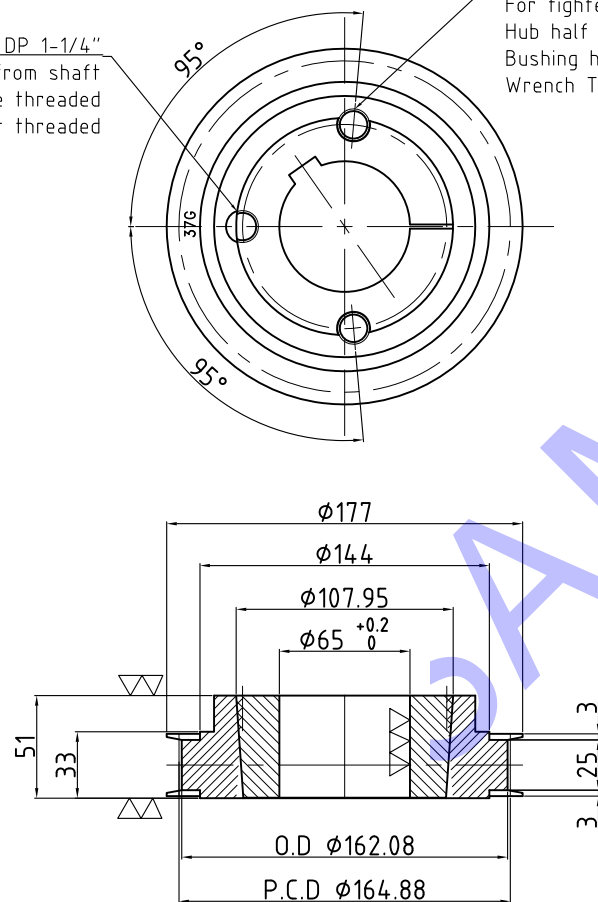
DRIVER PULLEY

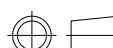
▽ (▽, ▽▽)

37G-14M-20

5/8" TAP DP 1-1/4"
For removing from shaft
Bushing half of hole threaded
Hub half of hole not threaded

2-5/8" TAP DP 1-1/4"
For tightening on shaft
Hub half of hole threaded
Bushing half of hole not threaded
Wrench Torque Values 800 lb-in

DETAIL OF "TAPER BUSH"

④	FLANGE	3t x $\phi 144$ x $\phi 177$	2	SS400		 THIRD ANGLE PROJECTION	PTS GENERAL NOTES 1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED 2. NOT MENTIONED DIMENSIONS : ACCORDING TO STANDARD. 3. BALANCING SPEC' : ISO 1940 CLASS G16.	DRAWING SCALE : N/S
③	SET SCREW	5/8" x 1-1/4"	2	SCM				PURCHASE ORDER QUANTITY : 6 SETS
②	DR BUSH	#3020 - 65	1	S45C	Phosphate Coating			PROJECT NAME / ITEM NO.
①	DR PULLEY	37G-14M-20	1	S45C	Phosphate Coating			THAILAND HINKONG
NO	NAME	SPECIFICATION	Q'TY	MATERIAL	REMARKS			

DRAWING TITLE

DRIVER PULLEY

DRAWN BY

Hong

CHECKED BY

Y.M.BATX

APPROVED BY

REV.

2022.02.23

REVISION BY

REMARKS



Power Transmission Products

2015 Full Line Catalog

The 3 E's of Efficiency

At Continental ContiTech, we are committed to helping you improve your bottom line. That is why we provide a team of drive system specialists, a wide range of products and maintenance tools to help ensure your mechanical belt drive systems run as efficiently as possible. Three simple steps can help you save energy, increase productivity and keep your systems operating at their best:



Evaluate

Competence for facility-wide improvement.

As an industry-leading manufacturer of Continental ContiTech's branded synchronous and V-configured power transmission belts, we will help you enhance productivity and operational savings, reduce noise and lower energy costs.



Empower

Recommendations that deliver value.

With a large selection of industry-leading drive components, we will help you reduce energy consumption and maximize efficiencies.



Educate

Hands-on training to ensure longevity.

Our Continental ContiTech Technical Managers offer a full training curriculum, providing you access to the latest in installation and maintenance best practices.

See how the 3 E's have enhanced efficiencies for operations like yours at realptresults.com.

We Provide Much More than Quality Products

Working with us, you will receive the high level of service and support that is critical to stay ahead in today's business environment. Our branded power transmission products are available through qualified distributors that are carefully selected and trained to provide much more than quality Continental ContiTech products. A complete selection of value-added services are available including cost reduction programs, sales and technical support and inventory control programs.



SilentSync®

Innovative Products

Continental ContiTech is an industry leader with an enviable history of product innovation and power transmission industry firsts, including:

- › **Falcon Pd®** synchronous belts are setting the new standard in synchronous belt drive systems.
- › **SilentSync®** enhanced premium synchronous belts, with a patented Helical Offset Tooth (H.O.T.) design for reduced noise, reduced vibration and increased efficiency have increased horsepower and temperature ratings designed to perform.
- › **MaximizerPro™** Drive Selection Analysis software program for easy, accurate selection of the best money-saving components for your application.
- › **Wedge TLP™** provides an advanced homogeneous construction, allowing unprecedented performance that requires virtually no maintenance.
- › **Torque Team Plus®** belts with the strength and power transmission capacity to replace large chain drives.
- › **Poly-V®** belts with nylon fabric rib facing, fiber-loaded rib compounds and fully machined rib surfaces.



Falcon Pd®

Equally important, the research and development that produced these dramatic improvements is a continuing process. We continue to have a multitude of new innovations that are being developed at our Research and Development Center in Lincoln, Nebraska.

That means our branded Power Transmission Products will continue to meet the increasing demands for improved drive efficiency, long belt life and competitive costs.



Distribution you can count on

Our distributors are committed to providing you the absolute best in products and service. They are thoroughly trained on Continental ContiTech belting and stand ready to meet all your power transmission needs.

These distributors are backed by a staff of sales representatives specially trained and qualified to conduct in-depth studies of your current operations. In addition, sales representatives and our distributors have access to powerful computer programs needed to optimize your current drive/belt applications.

Take comfort in the high level of service, delivery and technical expertise that only comes from a local source backed by a manufacturer with advanced worldwide research and production capabilities.

Cost reduction programs

We can provide you with the tools and services to reduce your operating costs associated with power transmission products. Through training and drive analysis software, we can show you how to eliminate problem drives that are bringing down your productivity.

Customized training

Whenever you need it, wherever you want it, customized training is available for your associates. From maintenance and installation clinics to in-depth training on analyzing failed power transmission products, our distributors and sales representatives can give you the guidance needed to choose, install and maintain your power transmission products.

Installation, maintenance and troubleshooting tools

From initial installation to routine maintenance checks, we offer the tools that make your job easier. Simple to use, reliable and more important, keeping your operations productive and efficient.

Technical assistance

We are proud to offer you the very finest "problem solvers" in the industry. All our distributors are factory-trained in the applications of the products we manufacture. Our professional design engineers are also available for consultation by calling your sales representative. Their combined knowledge and experience are there for you around the clock.

Customer satisfaction

Customer satisfaction is foremost in our guiding principles. It shows in our services. It shows in our products. Most importantly, it shows in the unparalleled customer quality rating our branded power transmission products have received from several key OEMs.

We have determined that the surest route to customer satisfaction is through a constant effort to improve. This commitment guarantees the quality of Continental ContiTech products, our services, deliveries and more – both now and in the years to come.

ISO 9001 certified global sourcing

With state-of-the-art manufacturing facilities around the world, we have the capability of meeting market demands by strategically sourcing product to fill the product supply pipeline. You can also count on the same quality product no matter where in the world our products originate.

ISO 9001 is one of the most widely accepted international standards for quality. Our belt manufacturing plants are all ISO 9001 certified.

Quality service

Our pledge is a simple one: Quality service that you can always depend on. It is a commitment from us and our distributors to you.

DRIVE CHANGESM MAXIMIZING YOUR EFFICIENCY

With Continental ContiTech, you are much more than a customer. You are an integral piece to success. We pledge to support you with quality products, inventory, service, technical help and more.

Continental ContiTech has a tradition of product excellence. Along with our extensive distributor network, Continental ContiTech forms a team second to none in total product and service offerings. Our goal is to supply you with the best products.

We are constantly looking for ways to help you save money on your existing processes, combining your expertise with our knowledge of power transmission products to make every operation as efficient as possible.

Drive ChangeSM is a program we promote to maximize efficiencies, reduce maintenance costs and increase your productivity. We know that it only takes minor improvements in drive efficiency to improve your facility's efficiency with each energy dollar spent. To pinpoint the improvements, we have developed easy-to-use software programs such as MaximizerProTM. With MaximizerProTM, mechanical drive costs can be analyzed, thus identifying the best drive belts for your needs.

In many instances, Drive ChangeSM involves upgrading your drives to the latest innovative belt technology that allows for increased efficiency and reduced cost of operation. For example, upgrading from a standard Classical V-belt to a Narrow V-belt can reduce hardware and maintenance costs while increasing horsepower and load-carrying capabilities. To take it a step further, V-belts could be replaced altogether with a premium synchronous belt like SilentSync[®] or Falcon Pd[®], permitting less maintenance and more efficiency.

MaximizerPro™

Allowing the user to have Continental ContiTech belt specifications and information right at their fingertips

This exciting program is now available in three ways: desktop and web-enabled or a convenient mobile app for popular devices. It makes drive recommendations a snap. With MaximizerPro™ drive requirements specified by the user are matched with available belts, sprockets, pulleys and bushings. Working like an equation for improved performance, MaximizerPro™ takes specific physical data and calculates how the system can be upgraded with multiple options for belt drive designs. These options address the end-user's goals related to energy efficiency, quieter operation, increased output and extended life, to name a few.



The data collection form

Allows you to gather all of the drive specifications required to run the selection program. Specifications include:

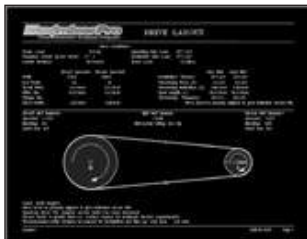
- › Drive operation time
- › Horsepower load
- › DriveR and DriveN rpms
- › Center distance
- › Service factor
- › Energy cost



The maximization screen

Provides an easy way to view, sort and print the resulting selections. From the maximization screen, drive selections can be sorted by:

- › Face width
- › Noise level
- › Energy cost
- › Service factor
- › Belt speed
- › Drive cost index
- › Energy payback feature
- › "Where to Buy" - Distributor locator



The drive design printouts

Provides printable pertinent information for the selected drive. Information available from the detail screen includes:

- › Belt, sprocket and bushing part numbers
- › Engineered drawings on all drive part numbers (where applicable)
- › Drive layout
- › Installation and maintenance tensioning



MaximizerPro™ is available by visiting our website at www.contitech.us/maxpro.

Download mobile App

Power Up the Value

Drive ChangeSM Program

Get the perfect mix of technology, tools and training designed to increase value with each purchase of power transmission products.

With Continental ContiTech and our distributors, we offer an exclusive, all-encompassing Drive ChangeSM program that optimizes the life and performance of your belt drives. Drive ChangeSM is our way of ensuring you are up-to-date on required installation and maintenance tools and procedures necessary to maximize plant operations and optimize output where belt drives are used to transfer power. Schedule an in-plant seminar with your sales representative and dedicated distributor. The next step is yours.



Laser Alignment Tool

Fast, convenient and attaches in a few seconds, delivering a highly visible sight line.

When the laser line lies within the target openings, the pulleys/sprockets are correctly positioned. The result is a fast and precise alignment. Power transmission belts including synchronous, V-belts, flatbelts and more can be aligned equally well. The smart design of the magnetic attachment surface also allows for alignment of both small and large sheaves. For nonmagnetic pulleys, double-sided tape can be used to affix the tool for an added range of applications.



Key features & benefits

- › Mobile version for popular mobile phones and tablets
- › Detects both radial and axial misalignment
- › Easier to use than conventional methods of misalignment detection
- › Affixes to most pulley and sprocket types
- › Also suitable for nonmagnetic pulleys and sprockets
- › Single operator friendly

TensionRite[®] Belt Frequency Meter

Provides a simple, repeatable and reliable method for tensioning belts using optical technology.

TensionRite[®] Belt Frequency Meter displays the natural vibration frequency of a belt so you can closely monitor belt tension. The device calculates the corresponding belt tension in either English or SI units.

Key features & benefits

- › Light optics-based tensioning
- › Quartz crystal-based solid-state circuitry
- › Direct vs. indirect measurement of vibration frequency
- › Meter range matches "real-life" belt installation parameters
- › Can be used with all belt types



Power Up the Value

MaximizerPro™ Drive Selection Analysis Program

Maximize your energy savings.

MaximizerPro™ is the newest and most powerful version of our exclusive drive system analysis software. Still as simple and intuitive to use as ever, MaximizerPro™ has all the features you have come to know, plus some new, powerful upgrades. Data entered into the software is cross-checked against MaximizerPro™'s robust database of available belts, sprockets, pulleys and bushings. The resulting customized report outlines specific products that can help you reach maximum efficiency and energy savings. MaximizerPro™ can enhance your drive systems the first time and every time.



Key features & benefits

- › Mobile version for popular mobile phones and tablets
- › New online version is always up-to-date
- › "Preferred solutions" option for most efficient drive designs
- › Improved screen layouts for quicker navigation
- › Energy consumption displays for specific drives
- › More comprehensive tensioning parameters

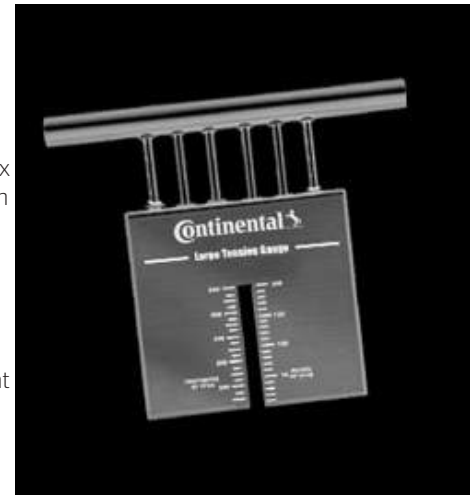
Large Tension Tester

When used with a straight edge or tight string, can be an aid in setting the proper belt tension for a drive system.

The relationship between deflection and belt span has been incorporated in the index scale printed on the face of the gauge. This eliminates one calculation associated with the tensioning operation.

Key features & benefits

- › Quickly helps determine belt tension
- › Compares force measured with recommended values for your application
- › If values are not equal, simply adjust the belt tension and repeat force measurement until measured force matches target value



Synchronous Belts

Continental ContiTech synchronous drive products

Synchronous or Positive Drive (Pd®) belts are a relatively new concept in power transmission belting evolution. These belts combine the advantages of chain and gear with the advantages of V-belts, but without the limitations usually associated with these conventional types of drives. There is minimal elongation, no metal-to-metal contact and no constant lubrication. Synchronous belts are amazingly versatile with possible applications on drives up to 600 horsepower and from speeds under 100 feet per minute to over 6,000 feet per minute.

Pd® is the term applied to our synchronous belts and their method of power transmission. As the name indicates, Pd® belts make possible power transmission that is efficient and accurate to a precise degree.

Pd® belts also make possible important savings in weight, space and construction without the sacrifice of efficiency. They are adaptable to almost any type of power transmission drive from printers to heavy industrial milling machines and grinders.

Engineered and manufactured with extreme care with pitch, tooth depth, width and other measurements accurate to a precise degree, Pd® belts are highly engineered products. The materials used in these remarkable belts consist of high-strength tension members, specially compounded rubber and proven synthetic fabrics. The belts are designed to eliminate excessive heat build-up and operate efficiently.

The evolution of the Pd® belt line

Continental ContiTech manufactures several different designs available as open end constructions and in dual-sided constructions.

Positive Drive Pd® is our trademark line of trapezoidal tooth profile synchronous belts. These belts were the first profile types developed in the continual evolution of synchronous drive belts. This Positive Drive product line includes a stock selection of MXL, XL, L, H, XH, XXH and Metric T pitches. Trapezoidal belts make an excellent means for transmitting power; however, time and technological advances have led to the more advanced product lines mentioned below.

Super Torque Pd® represents the next evolution in synchronous drive belt development in the Continental ContiTech line. The Super Torque Pd® belt has a unique modified round tooth design that minimizes tooth shear and operates quieter than traditional trapezoidal tooth profiles. Super Torque Pd® tooth pitches include S3M, S4.5M, S5M, S8M and S14M and are available as special manufactured parts with minimal runs.

SilentSync® belts and sprockets are a unique technological breakthrough. A patented Helical Offset Tooth (H.O.T.) design provides for continuous rolling tooth engagement, allowing the SilentSync® System to run quieter with less vibration than any other synchronous belt available today. With specialized materials, SilentSync® offers a much higher horsepower and temperature rating than its predecessor. The use of a flange-less sprocket also ensures more compact, lighter drives with precision performance.

SilentSync® belts and sprockets come in a wide variety of stock sizes with custom manufactured sizes being available for specialty drive requirements.

Falcon Pd® is a synchronous belt designed to handle increased horsepower, low torque applications. Falcon Pd® belts feature a high-grade rubber compound. This blended compound handles temperatures much higher than common polyurethane belts used in similar applications. Also, it is formulated to resist tooth deformity and increase tooth rigidity, extending belt life and saving you money. Falcon Pd® belts also feature a patented cord treatment which provides excellent dimensional stability and high-impact strength. Falcon Pd® belts can also be used in applications requiring backside idlers, allowing for greater flexibility in various applications. For ease of ordering, the Falcon Pd® part number interchanges with the Gates counterpart belt, making replacement easy.

Hawk Pd® with its strength and unique construction using our advanced compounding technology, is a line of curvilinear, synchronous belts that offers universal performance that stands alone. Designed to fit the majority of high-capacity synchronous application, Hawk Pd® belts fulfill existing drive requirements, matching industrial standards of belt width and length. With the Universal Profile Design (UPD), Hawk Pd® performs in the GT® and HTD® profiles, replacing Gates PowerGrip® HTD® and PowerGrip® GT® 2 belts.* In addition, Hawk Pd® replaces Carlisle RPP and RPP Plus belts,* running in RPP sprockets, as well as TB Wood's synchronous QD® profile.* The UPD is a simple solution in satisfying the multitude of belt and sprocket combinations in the market. Take universal performance to a higher level with Hawk Pd®.

Blackhawk Pd® is a high-performance, curvilinear belt that offers maximum performance in your 8mm and 14mm synchronous applications. Blackhawk Pd® is precisely designed and can replace existing Carlisle Panther®, Browning® Panther and TB Wood's QT Power Chain® belts, matching competitive offerings of belt width and length. Dynamic testing of Blackhawk Pd® has shown this durable belt actually lasts three to four times longer than Carlisle RPP Panther®. Maximize the performance of your timing belt application with Blackhawk Pd®, designed to deliver longer life and less maintenance. Choose the belt that takes performance to greater heights - Blackhawk Pd®.

*Trademarks of the Gates Corporation, Carlisle and TB Wood's Incorporated respectively.

Falcon Pd® Belts

The star of our reinforced rubber power transmission belt portfolio

Falcon Pd® is quickly setting the new standard in synchronous drive system belting. When compared to conventional polyurethane synchronous belts, the benefits of Falcon Pd® become evident.



Part Number: 8GTR-640-12

8	8mm pitch length
GTR	Falcon Pd® belt
640	640mm pitch
12	12mm width

Specialty compounded materials give this belt superior advantages

The ability to operate continuously in temperatures up to 210°F (98.9°C) and withstand peak temperatures as high as 300°F (148.9°C), along with being static conductive, help Falcon Pd® perform in special applications, providing longer life and higher output to meet your needs.

- › Size for size convenience (example: 8GTR-640-21=Gates 8MGT®-640-21*)
- › Static conductive**
- › Reduced operating noise levels to comparable belt drives
- › Exceptional tensile strength for premium performance
- › Rubber construction provides better resistance to flex fatigue
- › Versatility in a wide range of operating temperatures

Lower maintenance costs reduce the pain

Falcon Pd® synchronous belts do not require lubrication often found in chain drive applications. High-modulus cord members minimize the need for retensioning normally required in standard V-belts, reducing your overall maintenance cost.

Quiet operation

Falcon Pd® runs quieter, up to 6dB in operation for a better environment while offering advanced flex-fatigue resistance to help extend belt life.

Applications

Any application where a chain drive could be used.

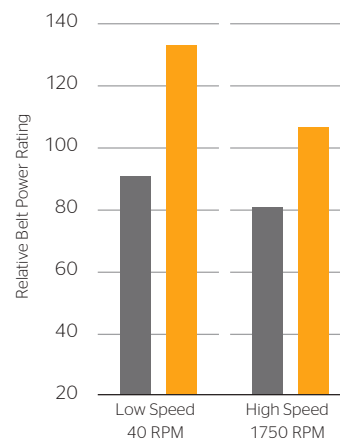
Can also be used with a backside idler when needed, allowing for additional applications.

Suitable for high horsepower, low torque drives.

Key features & benefits

- › Increased horsepower rating up to 36%
- › Increased continuous operating temperature up to 210°F (98.9°C)

Power Rating Comparison



Conditions: 14mm pitch belt, 20mm width belt, 32 tooth sprockets

■ Falcon HTC®
■ Falcon Pd®

*Contact customer service for availability. Gates, Poly Chain and GT are trademarks of the Gates Corporation.

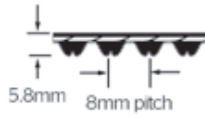
**Drive conditions and service variables in combination with time in operation can result in a loss of static conductivity. It is recommended that a conductivity check be added to drive preventive maintenance programs where belt static conductivity is a requirement.

Falcon Pd® Belts

Available Sizes

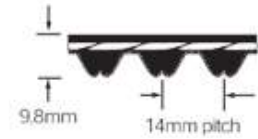
8m

8mm pitch



14m

14mm pitch



Pitch Length (mm)	Pitch Length (mm)	Pitch Length (mm)
640	1224	2520
720	1280	2840
800	1440	3200
896	1600	3600
960	1760	4000
1000	1792	4480
1040	2000	
1120	2240	
1200	2400	

Stock widths: 12mm, 21mm, 36mm, 62mm

Pitch Length (mm)	Pitch Length (mm)	Pitch Length (mm)
994	1960	3500
1120	2100	3850
1190	2240	3920
1260	2380	4326
1400	2520	4410
1568	2660	5166
1610	2800	6496
1750	3136	6636
1890	3304	

Stock widths: 20mm, 37mm, 68mm, 90mm, 125mm