FLOWSERVE

ASHUGANJ 450 MW CCPP (NORTH)

CIRCULATING WATER PUMP DATA SHEET

KKS No: 20PAC10AP001

Rev: 5

Issue Date: 27.03.2015

Rev

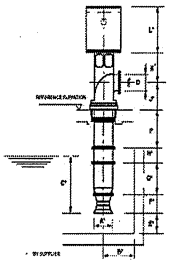
INSPECTION ANS TESTING: (5)

	Required	Witnessed	Test Code	Requirements
Hydrostatic Test:		X		Hydrostatic Pressure Test / Test time: 1,5 MAWP / 30 minutes
Performance Test - Run test:		X		At least 5 points
Submergence test		X		
Vibration measurements		X		During Performance Test
Bearing temp. measurements		X		During Performance Test
Noise measurements		X		During Performance Test
Motor Routine Test		X		
Motor Type Test	X			

OTHER REQUIREMENTS:

Painting according to the aplicable specification. Painting reports shall be delivered.

ARRANGEMENT AND DIMENSIONS:



ELEVATION DATA	
REFERENCE	9,2 m (PWD) El 99550mm
MAXIMUM LIQUID LEVEL	7,4 m (PWD) El 97730mm (11)
NORMAL LIQUID LEVEL	6,2 m (PWD) El 96530mm (11)
MINIMUM LIQUID LEVEL	0,76 m (El 91110mm) (11)
SUMP BOTTOM	-5,9 (2) (El 84450mm)

	A	B	C	D	E	F	G	H	I	J	K	L	M	Notes
Specification														
Seller	2534	1900	5815	1676	845		14255			1676	3474	3260		

REMARKS

(1) For cooling water quality refer to technical specification: Document No 07485-20-PAC-MIP-TRE-008

(2) Deleted

(3) Elevation of the baseplate is +9,2m

(4) Plant elevation 100000 corresponds to ground level elevation +9,65m MSL (PWD)

(5) According to IAP and Specification applicable

(6) Flange Class: AWWA C207

(7) Viewed from the drive to the pump

(8) The first criticalspeed of pumps and motors shall be at least 125% the operating nominal speed.

(9) The instrument and control equipment shall be designed in accordance with Instrumentation and Control Requirements for Package Units (07485-20-YY_-YR_-TRE-007) and thecnical specification

(10) Operational conditions can add a maximum of 3°C to the peak temperature,

(11) Deleted

(12) TDH has been calculated referred to minimum water level, taking into account the diference between sucion and discharge elevation. TDH is the total dynamic head calculated as discharge - suction pressure referred to the same elevation.

(13) Operatng point for maximum water level and minimum water level in accordance with the resistant curves attached to this data sheet.

(14) Deleted

ASHUGANJ 450 MW CCPP (NORTH)

CIRCULATING WATER PUMP DATA SHEET

KKS No: 20PAC10AP001

Rev: 5

Issue Date: 27.03.2015

FLOWSERVE

Rev: 5

GENERAL

Applicable to:	Bid		Purchase		As Built		
Project:	ASHUGANJ 450 MW CCPP (NORTH)	Location:	Ashuganj, Bangladesh	Customer:	Ashuganj Power Station Company (APSCL)		
KKS:	20PAC10AP001	Service:	Circulating Water Pump	Quantity:	1X 100%		
Mfr:	FLOWSERVE	Model:	57 APM	Size & Type:	Vertical Wet Pit		
Stages:	1	Driver supplied by:	Pump Seller	Driver Mounted by:	Pump Seller		

DESIGN CONDITIONS:

Pumped Fluid:	Raw water *(1)*			Environmental Conditions			
	Min / Normal (NT) / Max Temperature	°C	15 / 32.2 / 36 (10)		Barometric pressure nom	Pa	101300
	Vapor Pressure at NT	bara	0.048		Ambient temperature Min / Norm / Max	°C	8 / 35 / 40
	Density at NT	kg/m3	994.967		Min / Normal / Max. Relative Humidity	%	35 / 98 / 100
	Viscosity at NT	mm2/s	0.765	System design conditions			
	pH		(1)		Pressure (2)	barg	4.8/-1
Seismic Factor:	Bangladesh National Buiding Code Seismic zone 3				Temperature (2)	°C	42
Design Codes:	Hydraulic Institute (HI)			Liquid level min / norm / max (PWD) (4)		m	7,38 / 6,2 / 0,76
Location:	Indoor	Outdoor	X	Sump depth (PWD) (3) (4)		m	-5,9

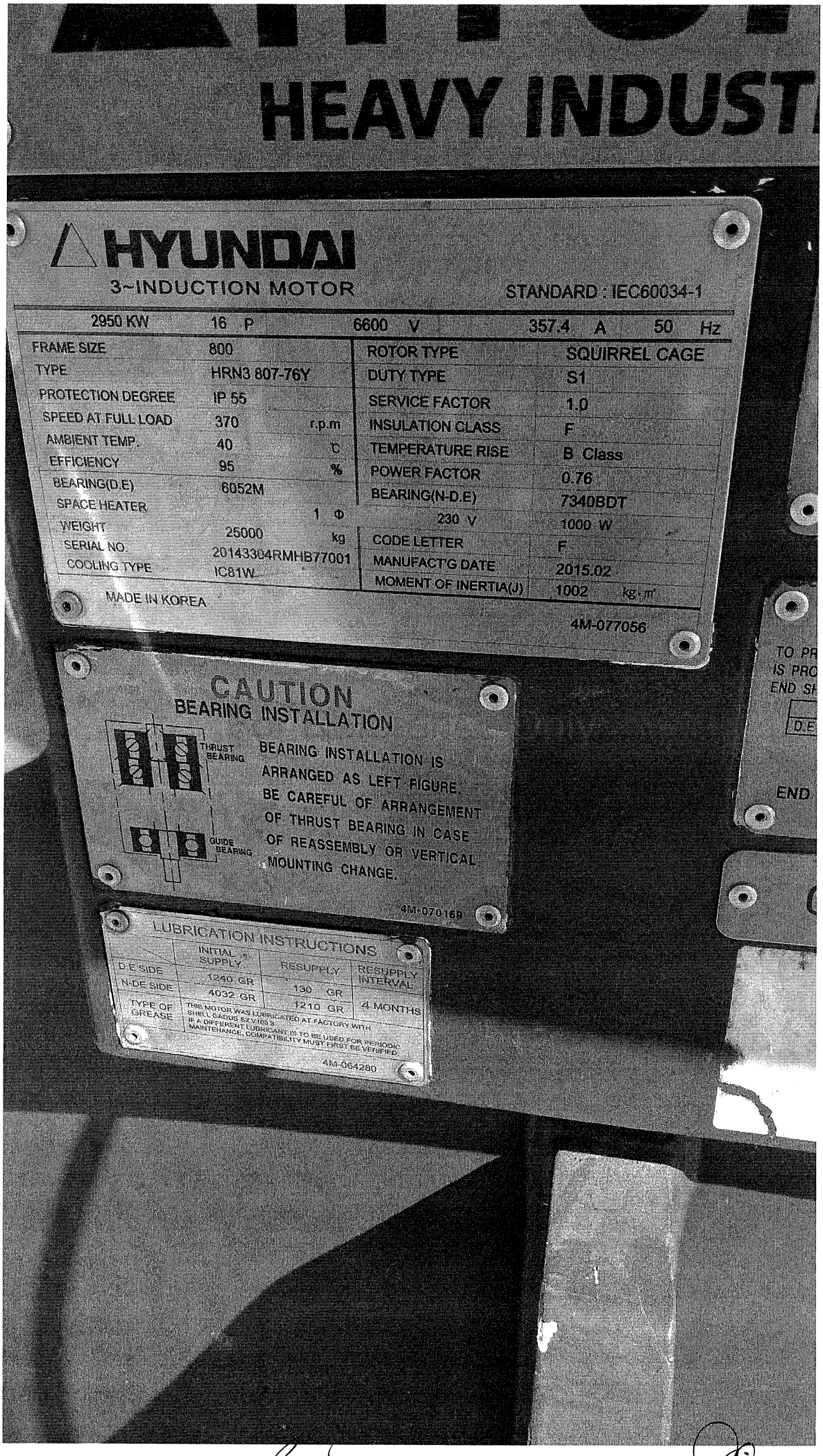
OPERATING AND PERFORMANCE CONDITIONS:

			Minimum Flow	Operating Point min water level (13)	Operating Point max water level (13)	Design Point	Runout
4	Flow	m3/h	28000	35080	39300	35820	43000
5	TDH (12)	m	26.6	23.1	19.3	22.3	15.8
3	Discharge Pressure	barg	1.61 at LWL	1.26 at LWL	0.89 at LWL	1.19 at LWL	0.56 at LWL
4	Pump Efficiency	%	76	84.5	83.2	85	77.2
4	NPSH required	m	8.7	9.5	10.4	8.8	13.3
4	Submergence required	m	3.1	3.1	3.2	3.1	4.5
4	Brake Horsepower	kW	2657	2600	2472	2548	2394
2	NPSH available at minimum liquid level	m	14.7 (at LWL)	14.7 (at LWL)	21.3 (at HWL)	14,7 (at LWL)	14,7 (at LWL)
2	Submergence available from the minimum liquid level to inlet	m	5.81 (at LWL)	5.81 (at LWL)	5.81 (at LWL)	5.81 (at LWL)	5.81 (at LWL)
3	TDH at shut off condition	m	40,1				
1	Discharge pressure at shut-off condition	barg	3.6 at HWL				
3	Flow at BEP / Efficiency	m3/h / %	36975				
	Speed	rpm	371				
	Critical speed (8)	rpm	> 464				
	Maximum allowable reverse speed	rpm	556.5				
	Maximum achievable reverse speed	rpm	556.5				
	Maximum operation time at shut-off conditions	s	30				
	Rotation viewing the pump from the driver end	CW/CCW	CCW				
	Noise level 1 m away from the pump	dBA	<85				

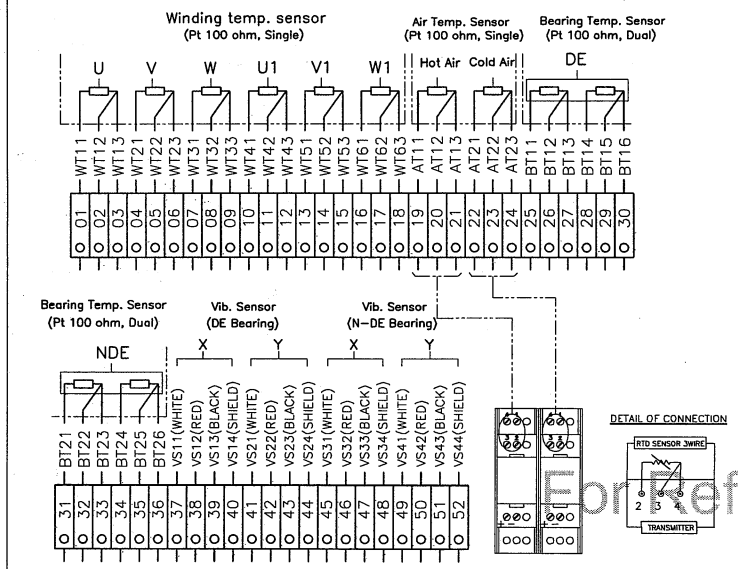
CONSTRUCTION DATA:

	Pump lenght measured from baseplate (m)				**Arrangement**				
	L (pump):	NA	L (pump+bell):	14255	Pull out construction		Non Pullout Construction		X
	Pump intake dimensions				**Impeller diameter**				
3	Distance from the back wall to the pump bell centerline (mm)			1900	Rated (mm)	1175	Min (mm)	1018	Max 1258
	Distance between the inlet bell and floor (mm)			845	**Impeller type**		Enclosed	Semiopen	Open
	Inlet bell outside diameter (mm)			2534	**Bearings**		Lineshaft		Thrust
	Nozzle Connections				Type		Sleeve		Ball
		Size	Rating	Facing (6) Location	Quantity		6		1
	Discharge	66"	AWWA C207 Table 2 Class B	Flanged End Above soleplate	Lubrication type		Product Water		Oil Bath
	Auxiliary connections				Expected life		40000h		40000 h
		Quantity	Size	Type	**Shaft Sealing**				
1	Vent connection	1	6"	ANSI 16.5 Cl.150 RF	Type		Mechanical seal X		Packing
2	Discharge pres. Gauge	1	1/2"	NPT	Manufacturer / Model		Flowserve / ALLPAC 480		
2	**Coupling**				Material		As per Bill of Material in Seal GA drawing		
	Type	Flexible	Rigid	Spacer Guard OSHA	Sealing fluid		Pumped Fluid X		External
5	Manufacturer	JAURE	Model:	MTV-0275, B01, B01	Sealing flushing plan		API Plan 13		
	Anchor bolts	Information		Supply					
	Baseplate	Driver pedestal / Head		Soleplate					

	PUMP MATERIALS (14):				**DRIVER:**				
	Inlet Bell	ASTM A36			Manufacturer:	HYUNDAI	Power:		2950
	Casing	ASTM A36			Speed:	371	Efficiency:		95%
	Bowls	NA			Voltage:	6,6 kV	Phase/Frecuency:		3/50 Hz
	Impellers	ASTM A743 CA6NM			Insulation:	Class F	Temperature rise:		Class B
	Difussers	NA			Applicable spec:	07485-20-BBX-EIP-TRE-001	IP:		55
	Shaft	ASTM A276 Ty 410 Cond. T			**MECHANICAL DATA:**				
	Column	ASTM A36			**Moment of Inertia WR2:**	460 Kg.m2			
	Discharge elbow/head	ASTM A36			**Torque**				
1	Casing wear rings	ASTM A743/A743M CA15			5	Nominal Pump Torque	65900		N.m
1	Impeller wear rings	ASTM A743/A743M CA15			5	Maximum torque required during starting	68300		N.m
	Shaft sleeves	ASTM A276 Ty 410			5	Maximum torque which pump is able to withstand	68300		N.m
	Radial Bearings	RUBBER - Bronze Backed			5	Maximum torque in runout conditions	61400		N.m
	Bolting	ASTM A307 Gr. B				Max. applic. transient taking into account safety	NA		N.m
	Wet Boltimg	AISI 410			**Forces (N) and moments (N.m)**	Fx	Fy	Fz	Mx My Mz
	Auxiliary piping	316L			Inlet Nozzle	NA	NA	NA	NA NA NA
	Soleplate	ASTM A36			Outlet Nozzle	30110	27152	33500	34496 42651 29241
					Thrust (at the coupling)	Maximum (N)			Continuos (N)
					Downward	261100			250850
2	**WEIGHTS:**	Pump (kg): 30800		Motor (kg): 25000	Upward	87040			83620
2		Soleplate (kg): 995 (Included in 30800 kg)		Total (kg): 55800					


HEAVY INDUST
HYUNDAI
3~INDUCTION MOTOR
STANDARD : IEC60034-1
2950 KW 16 P 6600 V 357.4 A 50 Hz
FRAME SIZE 800
TYPE HRN3 807-76Y
PROTECTION DEGREE IP 55
SPEED AT FULL LOAD 370 r.p.m
AMBIENT TEMP. 40 ℃
EFFICIENCY 95 %
BEARING(D.E) 6052M
SPACE HEATER 1 Φ 230 V 1000 W
WEIGHT 25000 kg
SERIAL NO. 20143304RMHB77001
COOLING TYPE IC81W
ROTOR TYPE SQUIRREL CAGE
DUTY TYPE S1
SERVICE FACTOR 1.0
INSULATION CLASS F
TEMPERATURE RISE B Class
POWER FACTOR 0.76
BEARING(N-D.E) 7340BDT
CODE LETTER F
MANUFACTG DATE 2015.02
MOMENT OF INERTIA(J) 1002 kg-m²
MADE IN KOREA
4M-077056
CAUTION
BEARING INSTALLATION
THRUST BEARING
GUIDE BEARING
BEARING INSTALLATION IS ARRANGED AS LEFT FIGURE. BE CAREFUL OF ARRANGEMENT OF THRUST BEARING IN CASE OF REASSEMBLY OR VERTICAL MOUNTING CHANGE.
4M-070169
LUBRICATION INSTRUCTIONS
INITIAL SUPPLY
RESUPPLY
RESUPPLY INTERVAL
D.E SIDE 1240 GR 130 GR
N-DE SIDE 4032 GR 1210 GR 4 MONTHS
TYPE OF GREASE THIS MOTOR WAS LUBRICATED AT FACTORY WITH SHELL GADUS S2 V100 3 IF A DIFFERENT LUBRICANT IS TO BE USED FOR PERIODIC MAINTENANCE, COMPATIBILITY MUST FIRST BE VERIFIED.
4M-064280
TO PR
IS PRO
END SH
D.E
END

ACC'Y T/BOX WIRING DIAGRAM



NOTE

1) WT11, 12, 13 ; Winding temp. sensor (U)
2) WT41, 42, 43 ; Winding temp. sensor (U1)
3) WT21, 22, 23 ; Winding temp. sensor (V)
4) WT51, 52, 53 ; Winding temp. sensor (V1)
5) WT31, 32, 33 ; Winding temp. sensor (W)
6) WT61, 62, 63 ; Winding temp. sensor (W1)

→ Pt 100 ohm at 0 °C, Single

7) BT11,12,13,14,15,16 ; Bearing Temp. Sensor(DE)
8) BT21,22,23,24,25,26 ; Bearing Temp. Sensor(N-DE)

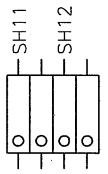
→ Pt 100 ohm at 0 °C, Dual

9) AT11,12,13 ; Air Temp. Sensor(Hot air)
10) AT21,22,23 ; Air Temp. Sensor(Cold air)

→ Pt 100 ohm at 0 °C, Single

11) VS11-14,VS21-24 ; Vib. Sensor(DE X,Y)
12) VS31-34,VS41-44 ; Vib. Sensor(N-DE X,Y)

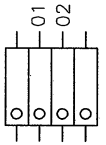
HEATER T/BOX WIRING DIAGRAM



NOTE

1) SH11,12 ; Space Heater

LEAKAGE DETECTOR WIRING DIAGRAM



NOTE

1) 01,02 ; Leakage detector

* TAG NO.

DE BEARING TEMP.	20PAC10AP001JT12A
NDE BEARING TEMP.	20PAC10AP001JT13A
LEAKAGE DETECTOR	20PAC10AP001JH82A
ATD (COLD AIR TEMP.)	20PAC10AP001JT27A
ATD (HOT AIR TEMP.)	20PAC10AP001JT28A
WINDING TEMP. (U)	20PAC10AP001JT21R
WINDING TEMP. (V)	20PAC10AP001JT22S
WINDING TEMP. (W)	20PAC10AP001JT23T
WINDING TEMP. (U1)	20PAC10AP001JT31R
WINDING TEMP. (V1)	20PAC10AP001JT32S
WINDING TEMP. (W1)	20PAC10AP001JT33T
VIBRATION NDE X	20PAC10AP001JT60A
VIBRATION NDE Y	20PAC10AP001JT70A
VIBRATION DE X	20PAC10AP001JT66A
VIBRATION DE Y	20PAC10AP001JT67A

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
1	'15.02.13	Revised as mark	H.K.LEE	S.H.Park	J.B.Kim	H.C.Kim

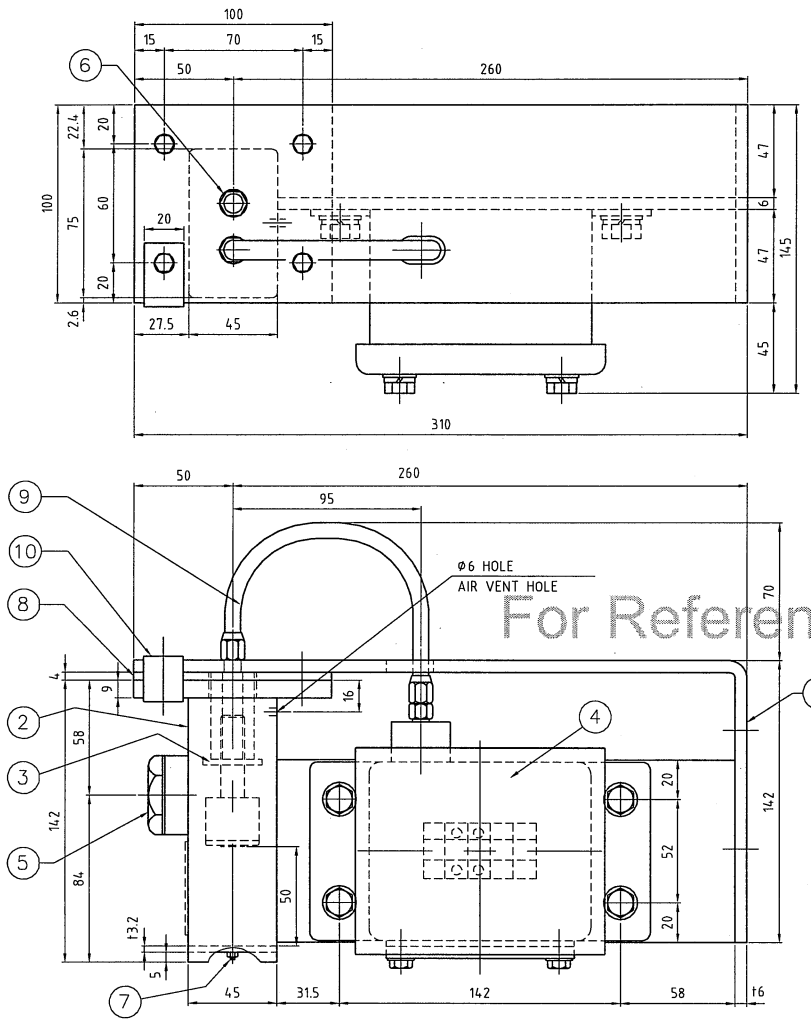
Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.

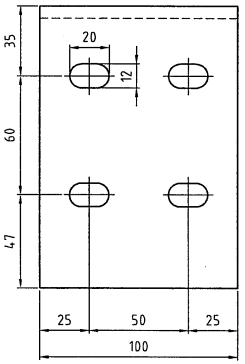
APPD BY	Y.S.Joo	UNIT	mm
CHKD BY	Y.G.Kwon	SCALE	NON SCALE
CHKD BY		PROJEC'N	3 면각(3rd Angle)
DSND BY	Y.S.Cha	DATE	2014-10-24

SUBJECT
DWG SIZE A3 (1:6)
TITLE WIRING DIAGRAM
REF. NO
Sheet No. of
DWG NO 3M-133804
Revision No. 1

HYUNDAI HEAVY INDUSTRIES CO., LTD.

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
1	SUPPORT	SS400					1
1	SQ. TUBE(HOUSING)	SS400					2
1	SENSOR ASS'Y	–	FLOAT TYPE(RSF54Y100R1/8)-GYNERGY		3M-175865		3
1	JUCTION BOX	SUS316					4
1	SIGHT GLASS	SUS316					5
1	WATER IN CONDUCTOR	SUS316					6
1	DRAIN HEX. PLUG	SUS316	PT 1/4"				7
1	PACKING	NBR					8
1	SENSOR CABLE GUARD PIPE	SUS316	T2 x ø13				9
1	EARTH PLATE	SUS316	T1 x 20				10





1

* TAG NO.

20143304RMHB77001	20PAC10AP001GA003

CONTACT : NO

CONTACT RATING ;
DC Max.120V, 0.6A

PROTECTION DEGREE : IP65

▽	50S
▽▽	12.5S
▽▽▽	3.2S
▽▽▽▽	0.4S

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
1	2015.02.13	REVISION OF MARK 1	H.K.LEE	Y.G.KWON	---	H.C.KIM

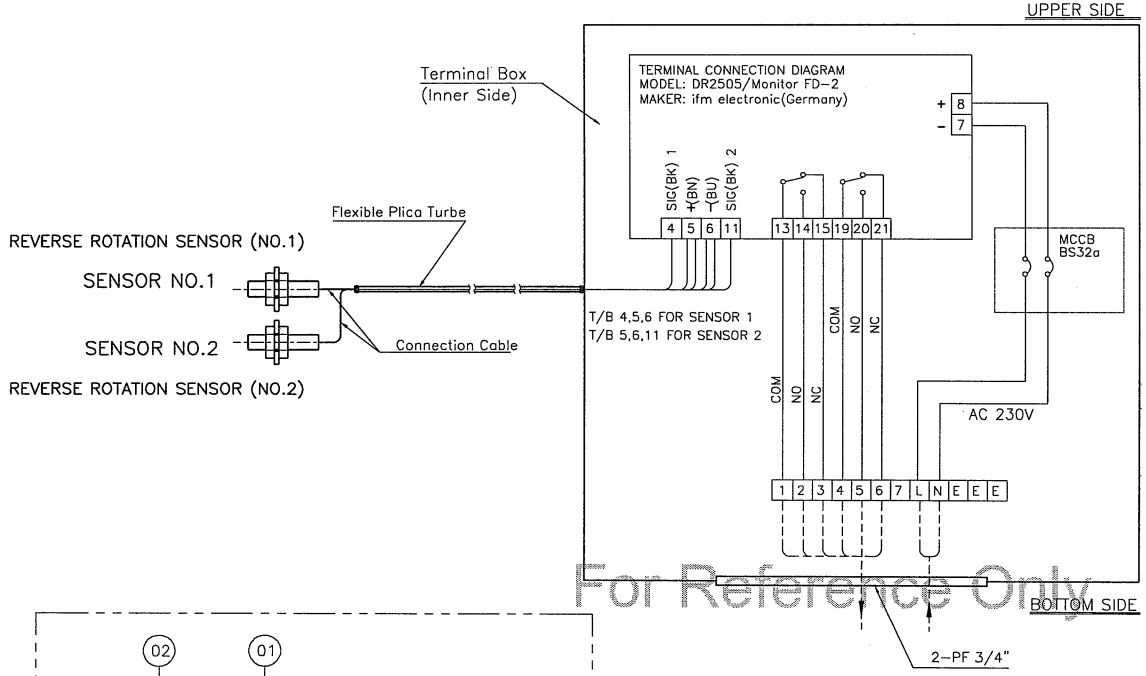
일반기공공차		일반재관공차	
1-4	±0.1	6-30	±0.5
4-18	±0.2	30-120	±0.8
18-63	±0.3	120-315	±1.2
63-250	±0.5	315-1000	±2.0
250-	±0.8	1000-	±3.0

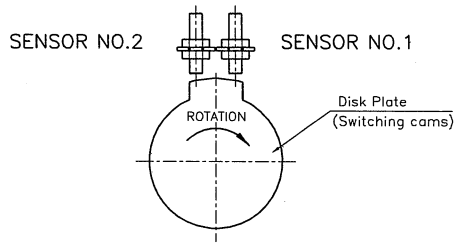
Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.

APPD BY	Y.S, Joo	UNIT	mm
CHKD BY	Y.S, Cha	SCALE	Non Scale
CHKD BY	---	PROJEC'N	3 면법(3rd Angle)
DSND BY	Y.G,Kwon	DATE	2014-10-10

HYUNDAI HEAVY INDUSTRIES CO., LTD.

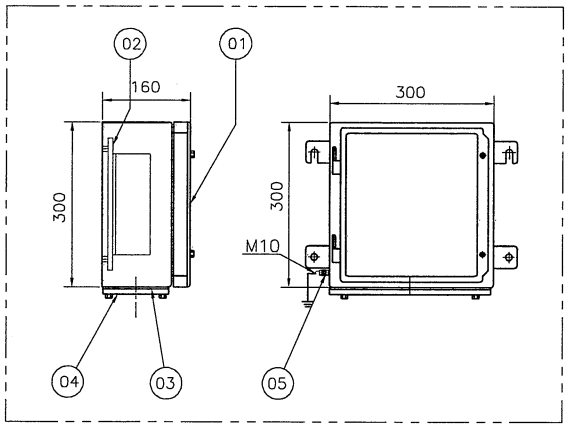
SUBJECT	NONE	DWG SIZE	A3 (1:2)
TITLE	LEAKAGE DETECTOR		
REF. NO	3M-098713	Sheet No.	of
DWG NO	3M-185935	Revision No.	1





Typical Sensors Location(VIEW FROM DE SIDE)

CABLE CONNECTION SCOPE
-----Not in HHI scope
———HYUNDAI Scope



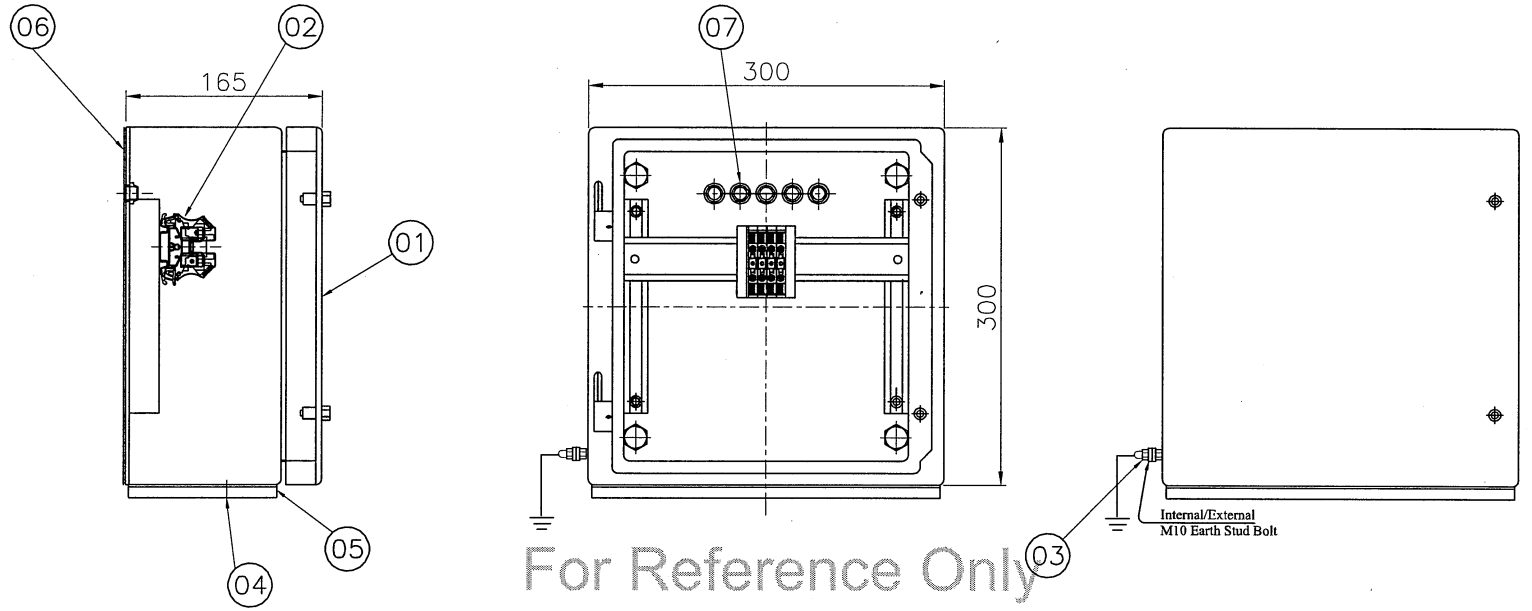
Reverse Rotation sensor Box

NO.	DESCRIPTION	MATERIAL	Q'TY
05	EARTH STUD	–	1
04	CABLE GLAND PLATE	SUS316L	1
03	GASKET	SILICONE	1
02	PLATE	–	1
01	TERMINAL BOX	SUS316L	1

PROTECTION DEGREE : IP65

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	Y.S.JOO	UNIT	mm	SUBJECT			DWG SIZE A2 (1:1)
CHKD BY	J.B.KIM	SCALE	1/6				
CHKD BY	H.K.LEE	PROJEC'N	3각법(3rd Angle)	TITLE	REVERSE ROTA. SENSOR BOX & WIRING DIAGRAM		
DSND BY	J.Y.Kim	DATE	2013-06-25				
HYUNDAI HEAVY INDUSTRIES CO., LTD.				REF. NO			Sheet No. of
				DWG NO	2M-090244		Revision No. 0



△1

* TAG NO.	
20143304RMHB77001	20PAC10AP001GH001

PROTECTION DEGREE : IP65

NO	DESCRIPTION	QTY	MATERIAL	DIMENSION	WEIGHT	PART-NO	REMARK
7	GROMMET	5	N.B.R				
6	PACKING	1	SILICONE				
5	PACKING	1	SILICONE				
4	CABLE GLAND PLATE	1	SUS316L				
3	EARTH STUD	1	–				
2	RAIL + TERMINAL BLOCK	1	–	WDU-6			WEIDMULLER
1	TERMINAL BOX	1	SUS316L				

▽	50S
▽▽	12.5S
▽▽▽	3.2S
▽▽▽▽	0.4S

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
△1	2015.02.13	REVISION OF MARK △1	H.K.LEE		Y.G.KWON	H.C.KIM

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

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.

APPD BY	Y.S, Kim	UNIT	mm
CHKD BY	K.S, Kim	SCALE	1/4
CHKD BY	--	PROJEC'N	3각법 (3rd Angle)
DSND BY	Y.G,Kwon	DATE	2011-05-25

SUBJECT

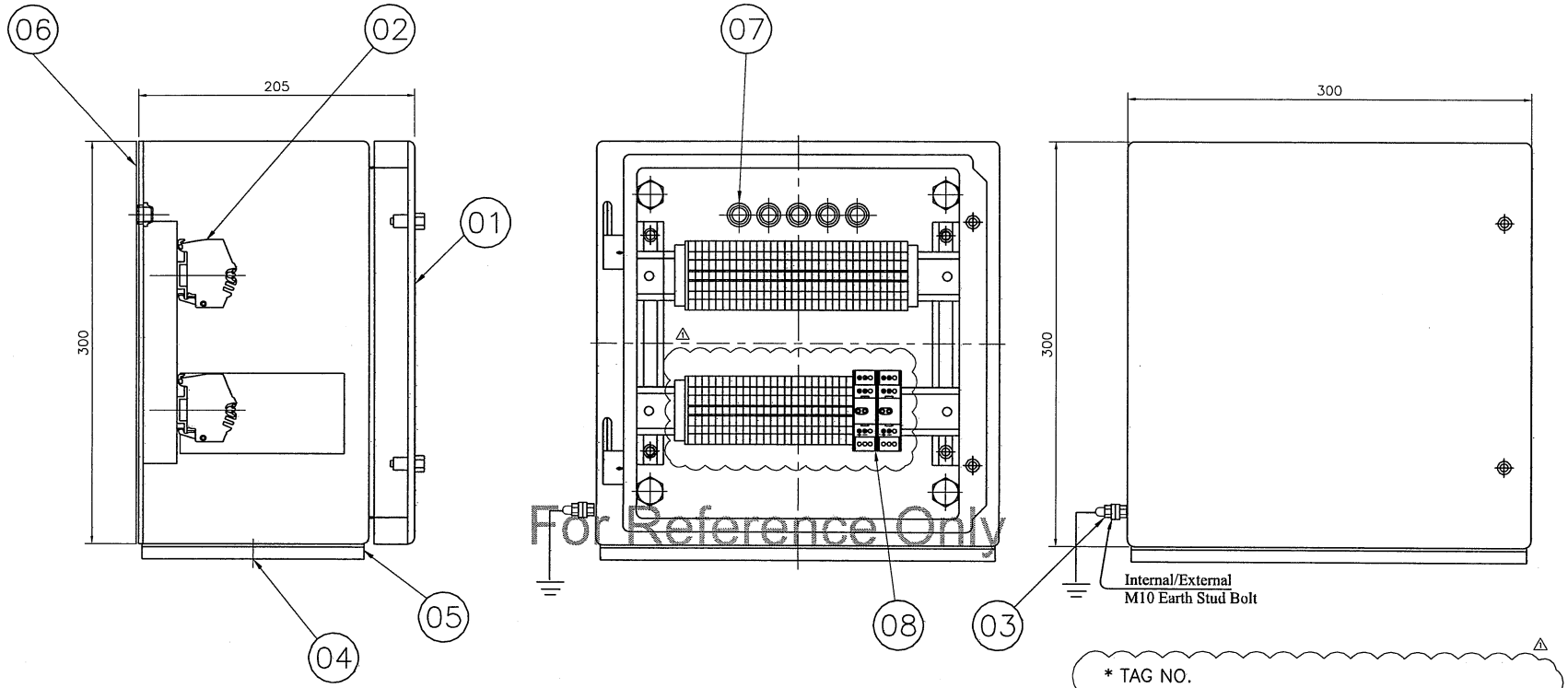
DWG SIZE A3 (1:4)

TITLE

HEATER T/BOX ASS'Y

HYUNDAI HEAVY INDUSTRIES CO., LTD.

REF. NO		Sheet No. of
DWG NO	3M-141343	Revision No. 1



* TAG NO.

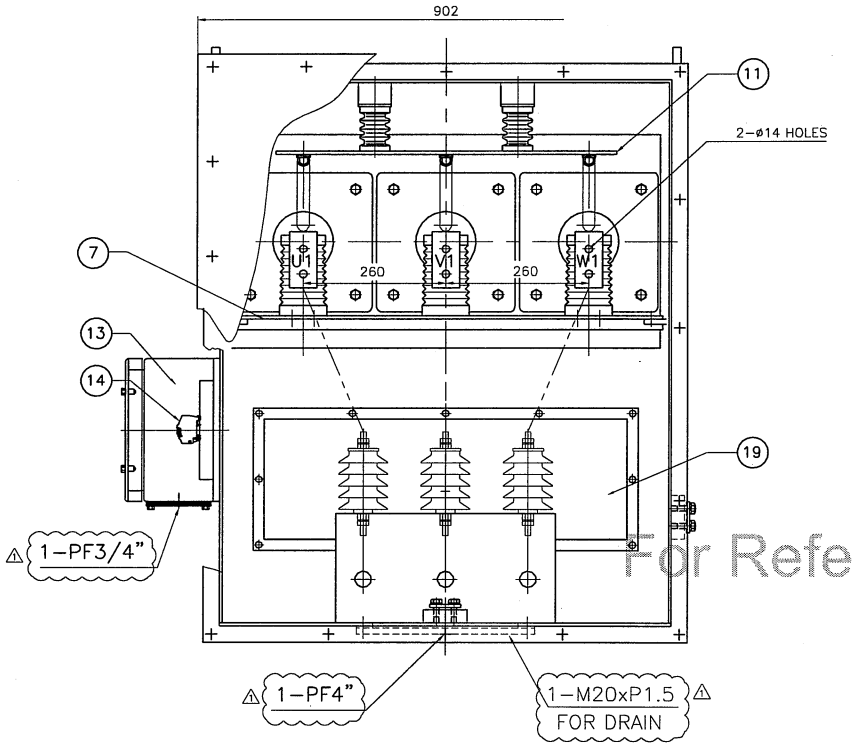
20143304RMHB77001	20PAC10AP001GA001

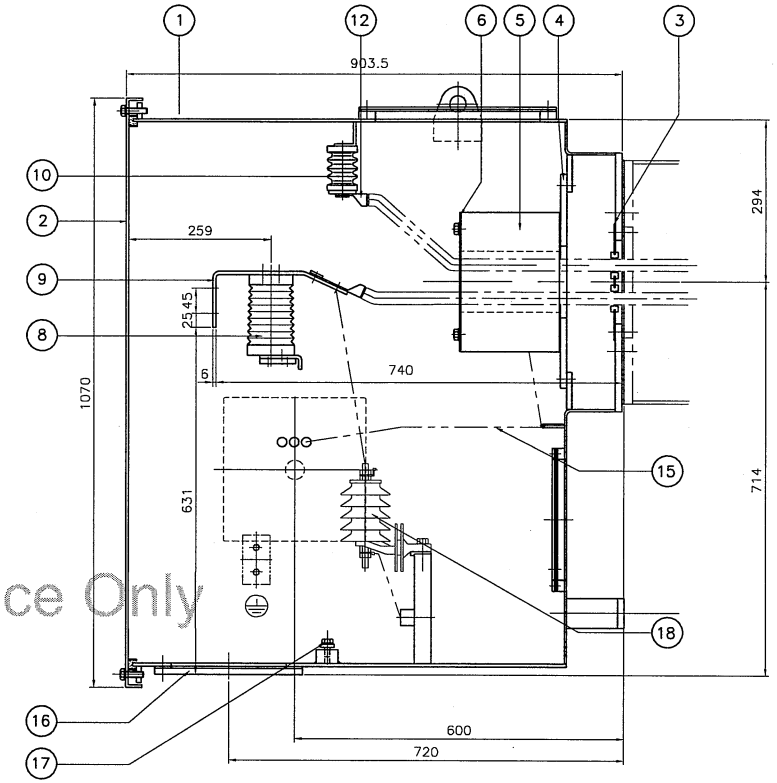
PROTECTION DEGREE : IP65

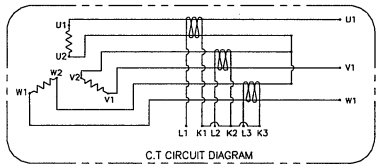
NO	DESCRIPTION	QTY	MATERIAL	DIMENSION	WEIGHT	PART-NO	REMARK
⚠8	TEMP. TRANSMITTER	2	–				
7	GROMMET	5	N.B.R				
6	PACKING	1	SILICONE				
5	PACKING	1	SILICONE				
4	CABLE GLAND PLATE	1	SUS316L				
3	EARTH STUD	1	–				
2	RAIL + TERMINAL BLOCK	1	–				
1	TERMINAL BOX	1	SUS316L				

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
⚠	2015.02.13	REVISION OF MARK ⚠	H.K.LEE		Y.G.KWON	H.C.KIM

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	Y. S. JOO	UNIT	mm	SUBJECT	NONE		DWG SIZE A3 (1:2.5)
CHKD BY	Y. D. KIM	SCALE	1/2.5	TITLE	ACC'Y T/B ASS'Y		
CHKD BY	——	PROJEC'N	3 (3rd Angle)				
DSND BY	K. S. KIM	DATE	2012-11-20				
HYUNDAI HEAVY INDUSTRIES CO., LTD.				REF. NO		Sheet No. of	
				DWG NO	3M-141595	Revision No. 1	







TAG NO.

	MAIN TERMINAL BOX	CT TERMINAL BOX
20143304RMHB77001	20PAC10AP001GH001	20PAC10AP001GH003

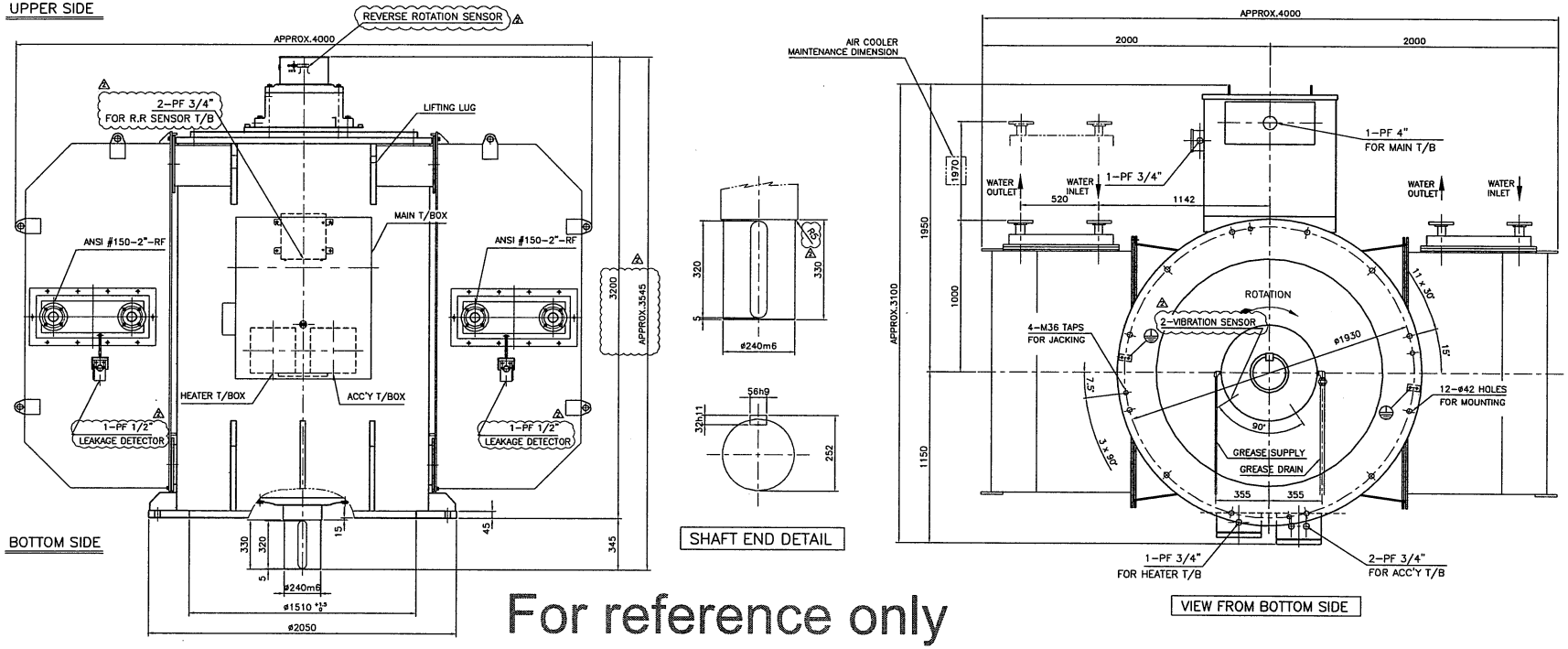
				2	INSULATOR	EPOXY	10
1	PRESSURE DIAPHRAGM	–	19	3	CONNECTION BAR	CU	9
1	SURGE ARRESTER (Ohio Brass,214008)	STANDARD	18	3	INSULATOR	EPOXY	8
2	EARTH TERMINAL	SS400	17	1	SUPPORT RAIL	SS400	7
1	CABLE GLAND PLATE	SS400	16	3	SUPPORT	E.G.P	6
6	C.T CABLE	SILICON	15	3	C.T FOR SELF BLANCING (100:1A,10P5,10VA)	–	5
1	TER-BLOCK	–	14	1	C.T SUPPORT	SS400	4
1	C.T BOX ASS'Y	SS400	13	1	GUIDE PLATE	E.G.P	3
6	TERMINAL LUG	CU	12	1	COVER	SS400	2
1	COMMON BAR	CU	11	1	TERMINAL BOX BODY	SS400	1
Q'TY	DESCRIPTION	MATEREIAL	NO.	Q'TY	DESCRIPTION	MATEREIAL	NO.

PROTECTION DEGREE : IP55

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
1	2015.02.13	REVISION OF MARK 1	H.K.LEE		Y.G.KWON	H.C.KIM

Q'TY	DESCRIPTION	MATERIAL	DIMENSION	WEIGHT	PART NO.	REMARK	NO.
APPD BY	J.W.LIM	UNIT	mm	SUBJECT	NONE	DWG SIZE	A2 (1:8)
CHKD BY	K.S.KIM	SCALE	1/6				
CHKD BY	---	PROJECT'N	3 (3rd Angle)	TITLE	MAIN T/BOX ASS'Y		
DSND BY	H.T.Kwak	DATE	2012-02-23				
HYUNDAI HEAVY INDUSTRIES CO., LTD.				REF. NO		Sheet No.	of
				DWG NO	2M-107624	Revision No.	1

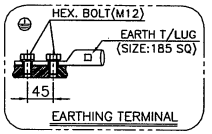
HYUNDAI HEAVY INDUSTRIES CO., LTD.



For reference only

THREE PHASE INDUCTION SQUIRREL CAGE ROTOR MOTOR ; IC611

TYPE	OUTPUT	POLES	VOLT.	FREQ.	PROT.	INSUL. CLASS	MOUNT.	BEARING		TOTAL WEIGHT (APPROX.)
								D.E SIDE	N-D.E SIDE	
HRN3 807-76Y	2950 kW	16 P	6600 V	50 Hz	IP 55	F	V 10	6052M	7340BDT	25000 kg



CAUTION

To maintain the water cooler of motor in good condition, cooling water shall be provided into the water cooler less than maximum allowable flowrate.
In addition, cooling water shall be provided in accordance with cooling water inlet pressure.
Otherwise, the water cooler will be seriously damaged.

TECHNICAL INFORMATION

1) BEARING

BEARING		D.E SIDE	N-D.E SIDE
Bearing Type		#6052M (Ball)	7340BDT (Angular Contact Ball)
Lubricant Type		GREASE	GREASE
Grease Type		SHELL(Gadus S2 V100 3)	
Initial Charge Quantity		1240 g	4032 g
Refilling -Charge	Quantity	130 g	1210 g
	Interval	4 MONTHS	4 MONTHS

2) WINDING TEMPERATURE DETECTOR
A) Number and Type : 2EA/Phase, Pt 100 ohm at 0°C-Single

3) BEARING TEMPERATURE DETECTOR
A) Number and Type : 1EA/Bearing, Pt 100 ohm at 0°C-Dual

4) AIR TEMPERATURE DETECTOR
A) Number and Type : 2EA/Motor, Pt 100 ohm at 0°C-Single

5) CONTROL SETTING(Included Ambient Temp.):

	Winding(W.T.D)	Bearing(B.T.D)
Alarm	130 °C	100 °C
Trip	150 °C	105 °C

6) SPACE HEATER : 1 PHASE, 230 V, 1000W

7) WATER LEAKAGE DETECTOR : 2EA/MOTOR

8) REVERSE ROTATION SENSOR : 1EA/MOTOR (IFM, DR2505)

9) VIBRATION SENSOR (Seismic Transmitter)
A) Number and Type : 2EA/Bearing, Bently Nevada 177230

10) COOLING WATER FOR MOTOR

Quality	Fresh Water
Flow rate	17.0 m^3/hr
Max. allowable Flow rate	22.1 m^3/hr
Operating Pressure	Max. 10 barg
Inlet Temp.	37.2°C
Max. allowable Inlet Temp.	39°C

11) CURRENT TRANSFORMER (SELF BALANCE TYPE)
A) Number and Type : 3EA/MOTOR, CT-eTech, 100/1A, 10P20

KKS NO.: 20PAC10AP001

NOTE

1. THIS MOTOR IS DESIGNED TO BE OPERATED IN ARROW DIRECTION.
2. THE NON-DRIVE END SHIELD IS INSULATED TO PREVENT BEARING DAMAGE FROM SHAFT CURRENT.
3. THIS MOTOR CANNOT WITHSTAND THE UP AND DOWN THRUST OF PUMP.
4. WHILE A MOTOR IS NOT IN ITS OPERATION, AND IF THE AMBIENT TEMPERATURE GOES BELOW THE WATER FREEZING POINTS, PLEASE DRAIN COOLING WATER COMPLETELY TO PREVENT COOLER PIPE DAMAGE FROM WATER FREEZING.
5. THE TEMPERATURE OF THE COOLING WATER MUST BE OVER 5°C (41°F)

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
4	2015.05.21	REVISION OF MARK 4	M.W.SEO	S.H.PARK	J.B.KIM	H.C.KIM
3	2015.03.24	REVISION OF MARK 3	H.K.LEE		Y.G.KWON	H.C.KIM
2	2015.01.26	REVISION OF MARK 2	H.K.LEE		Y.G.KWON	H.C.KIM
1	2014.10.24	REVISION OF MARK 1	H.K.LEE		Y.G.KWON	Y.S.JOO

APPD BY	Y.S.JOO	UNIT	mm
CHKD BY	Y.G.KWON	SCALE	1/14
CHKD BY		PROJEC'N	3RD(3rd Angle)
DSND BY	H.K.LEE	DATE	2014-10-09

HYUNDAI HEAVY INDUSTRIES CO., LTD.

SUBJECT
TITLE: OUTLINE DIMENSION
REF. NO
DWG NO: HM-092841
2ND SIZE A1 (1:14)
Sheet No. of
Revision No. 4

CHARACTERISTICS	REQUIRED	PROPOSED
Establishment of speed-torque, speed-current and speed-power factor curves, as per declared standard test procedure (see above) and at 70%, 85%, 100% and 110% of the rated voltage.	Yes, Witnessed	We would like to submit test report for speed-torque, speed-current curve at rated load condition only. Speed power factor curve can be submitted by a calculation sheet instead of measuremen t.

CHARACTERISTICS	REQUIRED	PROPOSED
Inspection of the motor auxiliary device wiring to the terminal strips	Yes, Witnessed	Comply.
Determination of the magnetic centering	Yes, Witnessed	Comply. Included No-Load test.
Operating inspection of the RTDs of windings and bearings	Yes, Witnessed	Comply.
Overspeed test	Yes, Witnessed	Comply.
Type tests		
Determination of losses, efficiency and power factor, as per declared standard test procedure (see above)	Yes, Witnessed	Comply.
Temperature rise test	Yes, Witnessed	Comply.
Cooling water system performance test to check flow rate and heat transfer.	Yes, Witnessed	Comply But Cooling water system performance test will be conducted in-process test So, reviewed not witness
Sound pressure level at 1 m	Yes, Witnessed	Comply.

CHARACTERISTICS	REQUIRED	PROPOSED
- Rated voltage (kV rms)	7.2	9
- Continuous operating voltage (kV rms)	6,6	7.65
6 Tests		
Routine tests:		
Visual inspection (motor rating plate, ID plate, terminal boxes, CT´s, RTD´s, documentation, paint, cooling, etc)	Yes	Comply
No-load test as per declared standard test procedure (see motor characteristics above)	Yes, Witnessed	Comply
Locked-rotor test as per declared standard test procedure (see above)	Yes, Witnessed	Comply
Dielectric strength test at power frequency for 1 minute as per declared standard test procedure (see motor characteristics above)	Required, Witnessed	Comply
Insulation resistance test before and after the dielectric test as per declared standard test procedure (see above)	Yes, Witnessed	Comply
Winding resistance measurement	Yes, Witnessed	Comply
Rotation test and phase-sequence test	Yes, Witnessed	Comply. Included No-Load test
Rotor vibration test and balance test	Yes, Witnessed	Comply. But balance test will be conducted in-process test So, reviewed not witness.
Phase-earth capacity and tg δ of the insulation	Yes, Witnessed	Comply. But phase-earth capacity and delta tangent test will be conducted in-process test So, reviewed not witness.
Dimensional check and verification of finish	Yes, Witnessed	Comply.

CHARACTERISTICS	REQUIRED	PROPOSED
- Type	Pt-100	Pt-100
- Number of terminals	3	3
c. Bearing temperature detectors (RTDs):		
- Quantity per bearing	2	2
- Manufacturer		Sentech
- Type	Pt-100	Pt-100
- Number of terminals	3	3
d. Temperature detectors (RTDs) to measure heat exchanger inlet and outlet air, in case of air/water cooling:		
- Quantity	2	2
- Manufacturer		Sentech
- Type	Pt-100	Pt-100
- Number of terminals	3	3
e. Heat exchanger water leakage detector for air/water cooling:		
- Quantity	1	1
- Manufacturer		Hanbit KSE
- Type		Floating
- Contact rated current (A)		120VDC, 0.6A
- Breaking current of the contact at 125 V dc in inductive circuit (A)	0.5	
f. Current transformers for differential protection:		
- Quantity	3	3
- Manufacturer		CT-eTech
- Type		Self Balance
- Connection		
- Transformation ratio		100/1A
- Rated output		
- Accuracy class and rated accuracy limit factor		10P20
g. Surge arresters :		
- Quantity	3	3
- Manufacturer		Ohio-Brass
- Type		
- Connection type	Phase-earth	Phase-earth

CHARACTERISTICS	REQUIRED	PROPOSED
- Minimum pressure (kg/cm^2)	6	0.5 (Cooler required)
c. Pressure loss in the air/water heat exchanger (kg/cm^2)		Air side: 0.0003 /Water side: 0.31
d. Temperature rise of the water flowing through the air/water heat exchanger (°C)		4
e. Heat loss to be dissipated (W)		400
f. Heat exchanger tube material		90/10 copper Nickel
g. Design pressure (kg/cm^2)		6
h. Design temperature (°C)		39
i Air relieve valve	Yes	Yes
4 Cables		
External power cable terminals		
a. Maximum permissible cross-section (mm^2)		2x(3x185 mm^2)
Earthing terminals		
a. Number	2	2
b. Maximum permissible cross-section (mm^2)	185	182
5 Terminal Boxes		
Number of boxes	Min 3	3
Type		
Minimum IP protection degree of the terminal boxes	IP65	IP65
Accessories:		
a. Space heaters:		
- Quantity	1	1
- Manufacturer		Youngkwang
- Type		
- Connection		Parallel
- Supply voltage (V)	230	230
- Total power consumed at supply voltage (W)		1000
b. Stator temperature detectors (RTDs):		
- Quantity	6	6
- Manufacturer		Sungsil

CHARACTERISTICS	REQUIRED	PROPOSED
2 Bearings		
Bearing type (ball, sleeve, etc.):		Ball
a. Horizontal motor		
b. Vertical motor		
- Thrust bearing		7340BDT
- Guide bearing		6052M
Maximum allowable bearing temperature:		
a. Horizontal motor (°C)		N/A
b. Vertical motor		
- Thrust bearing (°C)		105
- Guide bearing (°C)		105
Type of bearing lubricant (oil, grease):		
a. Horizontal motor		
b. Vertical motor		
- Thrust bearing		Grease
- Guide bearing		Grease
Motors with forced bearing lubrication:		N/A
a. Oil flow required for forced bearing lubrication (l/min)		
b. Viscosity of the oil		
c. Oil pressure at bearing inlet:		
- Maximum pressure (kg/cm^2)		
- Minimum pressure (kg/cm^2)		
d. Pressure loss in the bearings (kg/cm^2)		
e. Temperature rise of the oil flowing around the bearings (°C)		
f. Heat losses to be dissipated (W)		
Construction of sleeve bearing, supports and shields (split, one-piece, etc)		N/A
Bearing Size (diameter by length)		ø260/200
3 Motor Cooling		
Motor cooling method		IC81W
Motors with air-water cooling:		
a. Required water flow rate (l/min)		283
b. Cooling water pressure at the air/water heat exchanger inlet:		
- Maximum pressure (kg/cm^2)		10

For reference only

CHARACTERISTICS	REQUIRED	PROPOSED
Motor designed to restart with 110% reapplied voltage and 40% residual voltage at opposite phase angle	Yes	Yes
Maximum accumulated time withstand with an overvoltage caused by an earth fault	≥ 4 moths	
Direction of rotation (looking at the motor from the side opposite the coupling)	CW or CCW	CW
Permissible over-speed	20%	20% for 2min.
Maximum reverse speed motor can withstand in pump turbinisation when motor is disconnected from power supply (vertical motors with no device to prevent reverse rotation) (rpm)		444rpm during 2min.
Sound pressure level (weighted value, radiated sound pressure at 1 m) (dB(A))	80	80dB(A) No-load, Mean value
Class of stator winding insulation Class of stator winding temperature rise	40°C+105k+10k=155 40°C+80k+10k=130	F (155°C) B (130°C)
Insulation system of the stator winding	VPI	VPI
Ohmic resistance per phase (at 20°C) (Ω)		0.0728
Stator winding single-phase grounding capacity (μF)		0.2303
Rotor axial clearance (mm)		N/A
Shaft type (horizontal, solid vertical, hollow vertical)		Vertical
Enclosure classification (IP Number)	IP55	IP55
Weights: a. Weight of the rotor (kg) b. Total weight of the motor (kg)		 6100 25000
Erection		
Calorific value dissipated into the environment (Air)		6.0 kW
Frequency of starting cycles per year	≥ 1000	≥ 1000
Number of successive complete starts a. Hot b. Cold	 2 3	 2 3

For reference only

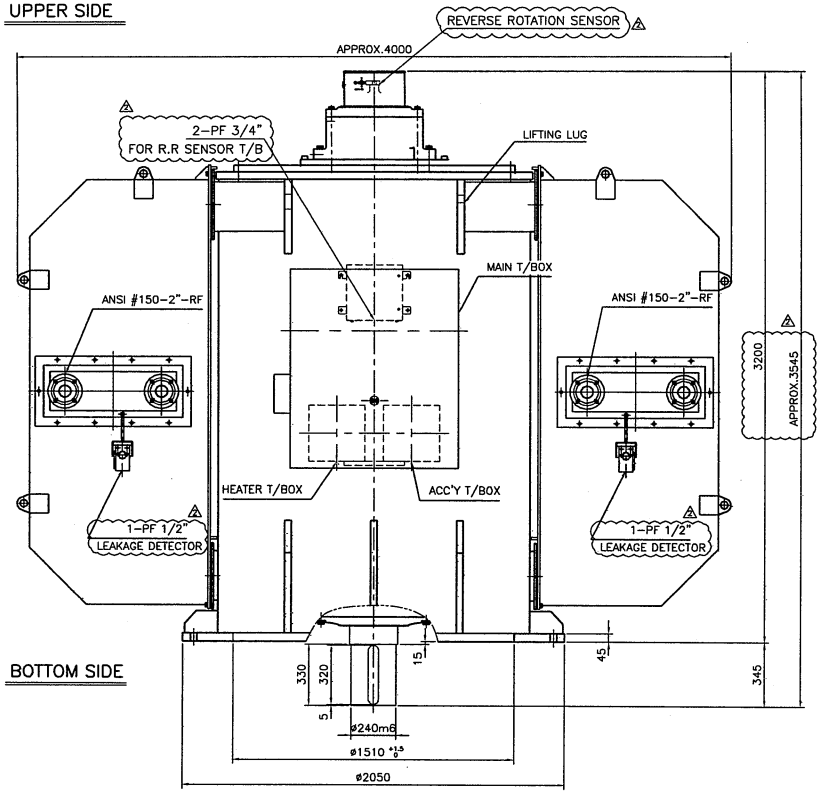
CHARACTERISTICS	REQUIRED	PROPOSED
Motor thermal limit curve (Drawing no.)		TLC-1405-663-2
- Thermal time constant of motor heating (min)		20
- Thermal time constant of motor cooling (min)		60
Guaranteed power factor at rated voltage and frequency:		
a. At full load		0.76
b. At 75% full load		0.71
c. At 50% full load		0.61
Guaranteed efficiency at rated voltage and frequency:		
a. At full load		95.0
b. At 75% full load		95.0
c. At 50% full load		94.0
Motor equivalent circuit parameters in respect of the stator		
R_1 (at 20°C) (p.u.)		0.00683
X_1 (p.u.)		0.16147
R_2		
- When S = 0 (p.u.)		0.01829
- When S = 1 (p.u.)		0.03188
X_2		
- When S = 0 (p.u.)		0.08925
- When S = 1 (p.u.)		0.06293
X_M (p.u.)		1.604
Subtransient reactance, X" (p.u.)		0.2104
Time constants of the motor current contributing to a 3-phase short-circuit at terminals		
a. AC component Tac ~ X"/2 π fR2 (s)		0.0352
b. DC component Tdc ~ X"/2 π fR1 (s)		0.0523
Time constant with open circuit		
Toc ~ Xm/2 π fR2 (s)		0.2947

CHARACTERISTICS	REQUIRED	PROPOSED
Maximum starting current, A		1787.0
Maximum starting voltage, V		6600
Maximum starting torque, %FLT		75
Locked-rotor current at rated voltage and frequency (guaranteed maximum value) (p.u.)	≤ 5,5 +20% tol.	≤ 5.0 + 20% tol.
Power-frequency withstand voltage (kV)	23	14.2
Impulse withstand voltage of the interturn insulation (kV)	32	20
Lightning impulse withstand voltage (kV)	49	31
No-load current at rated voltage and frequency (A)		175.0
Power factor at rated output		0.76
Minimum torque at rated voltage and frequency (%)		75
Speed at which minimum torque is produced (rpm)		0
Pull-up torque at rated voltage and frequency (%)		75
Breakdown torque at rated voltage and frequency (p.u)	≥ 2.1	≥2.1
Speed at which breakdown torque is produced (rpm)		348
Guaranteed minimum startup voltage (% U_N)	80	80
Inertia moment (GD^2) (kg/m^2)		4008
Acceleration time (full load)		
a. At rated voltage (s)		1.2
b. At minimum specified startup voltage (80%) (s)		2.5
Maximum allowable time with locked rotor at rated voltage:		
a. With the motor initially at maximum ambient temperature (s)	≥125% the accel. time at U_N	26.8
b. With the motor initially at operating temperature (s)	≥125% the accel. time at U_N	19.9
Maximum allowable time with locked rotor at the minimum start up voltage specified:		
a. With the motor initially at maximum ambient temperature (s)	≥125% the accel. time at U_N	42.7
b. With the motor initially at operating temperature (s)	≥125% the accel. time at U_N	31.6

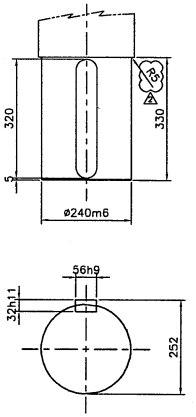
CHARACTERISTICS	REQUIRED	PROPOSED
1. Motor Characteristics		
Driven equipment		CWP
Manufacturer		HHI
Number of units		1 EA
Type	Induction	Induction
Rated Power (kW)		2950
Designed, manufactured and tested according to the following standard		IEC
Stator winding connection (star, star with accessible neutral, delta, etc)		Star with accessible neutral
Type of rotor	Squirrel cage	Squirrel cage
Guaranteed power rating at site conditions (kW)		2950
Duty type	S1	S1
Rated useful life	30 years	30 years
Frame size		800 Frame
Stator winding temperature rise above ambient temperature: • Measured by resistance variation (K) • Measured by resistance sensors housed in the winding (K)	 ≤ 80 ≤ 90	 <78.2 <88.2
Temperature rise after 1 hour operating with a load of the highest torque at 85% of rated voltage and between 48.5 and 50Hz (K)		Temperature saturation + about 43K
Temperature rise after 1 minute operating at a voltage of 70% of rated voltage and at 47.5 Hz (K)		Temperature saturation + about 2K
Temperature rise after 15 minutes running at 85% of the nominal voltage (K)		Temperature saturation + about 8K
Maximum ambient temperature (°C)	40	40
Rated voltage (kV)	6.6 ± 10%	6.6 ± 10%
Number of phases	3	3
Rated frequency (Hz)	50	50
Speed at full load (rpm)		370
Slip at full load (%)		1.33
Full load current at rated voltage and frequency (A)		357.4

HYUNDAI HEAVY INDUSTRIES CO., LTD.

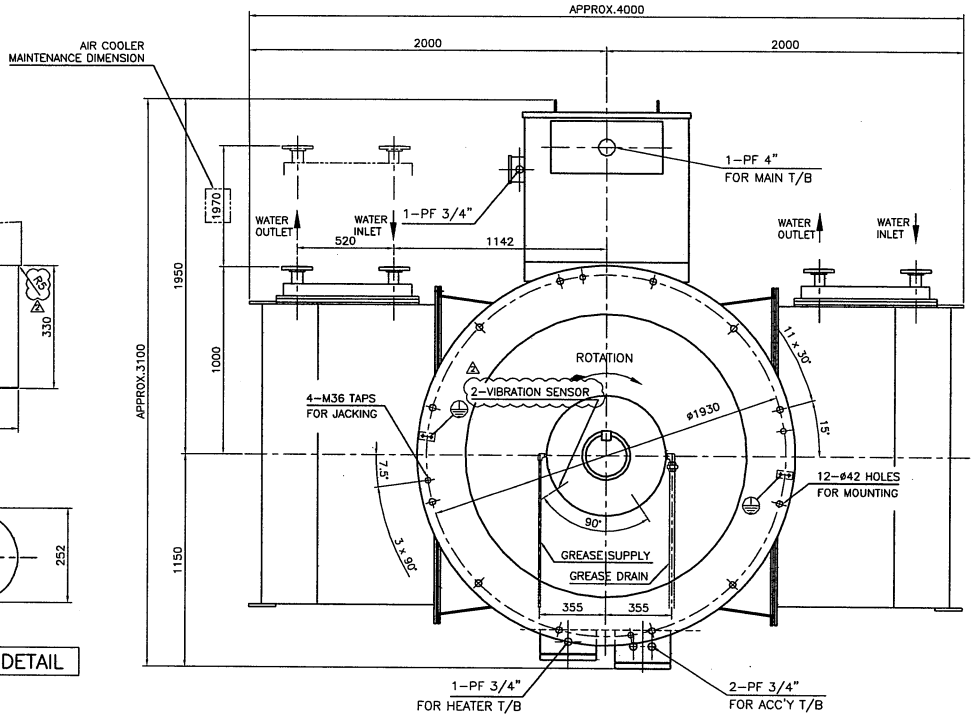
UPPER SIDE



BOTTOM SIDE



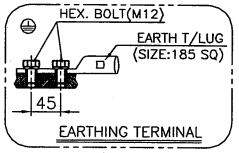
SHAFT END DETAIL



VIEW FROM BOTTOM SIDE

THREE PHASE INDUCTION SQUIRREL CAGE ROTOR MOTOR ; IC611

TYPE	OUTPUT	POLES	VOLT.	FREQ.	PROT.	INSUL. CLASS	MOUNT.	BEARING		TOTAL WEIGHT (APPROX.)
								D.E SIDE	N-D.E SIDE	
HRN3 807-76Y	2950 kW	16 P	6600 V	50 Hz	IP 55	F	V 10	6052M	7340BDT	25000 kg



CAUTION

To maintain the water cooler of motor in good condition, cooling water shall be provided into the water cooler less than maximum allowable flowrate.
In addition, cooling water shall be provided in accordance with cooling water inlet pressure.
Otherwise, the water cooler will be seriously damaged.

TECHNICAL INFORMATION

1) BEARING

BEARING		D.E SIDE	N-D.E SIDE
Bearing Type		#6052M (Ball)	7340BDT (Angular Contact Ball)
Lubricant Type		GREASE	GREASE
Grease Type		SHELL(Gadus S2 V100 3)	
Initial Charge Quantity		1240 g	4032 g
Refilling -Charge	Quantity	130 g	1210 g
	Interval	4 MONTHS	4 MONTHS

2) WINDING TEMPERATURE DETECTOR
A) Number and Type : 2EA/Phase, Pt 100 ohm at 0°C-Single

3) BEARING TEMPERATURE DETECTOR
A) Number and Type : 1EA/Bearing, Pt 100 ohm at 0°C-Dual

4) AIR TEMPERATURE DETECTOR
A) Number and Type : 2EA/Motor, Pt 100 ohm at 0°C-Single

5) CONTROL SETTING(Included Ambient Temp.):

	Winding(W.T.D)	Bearing(B.T.D)
Alarm	130 °C	100 °C
Trip	150 °C	105 °C

6) SPACE HEATER : 1 PHASE, 230 V, 1000W

7) WATER LEAKAGE DETECTOR : 2EA/MOTOR

8) REVERSE ROTATION SENSOR : 1EA/MOTOR (IFM, DR2505)

9) VIBRATION SENSOR (Seismic Transmitter)
A) Number and Type : 2EA/Bearing, Bently Nevada 177230

10) COOLING WATER FOR MOTOR

Quality	Fresh Water
Flow rate	17.0 m^3/hr
Max. allowable Flow rate	22.1 m^3/hr
Operating Pressure	Max. 10 barg
Inlet Temp.	37.2°C
Max. allowable Inlet Temp.	39°C

11) CURRENT TRANSFORMER (SELF BALANCE TYPE)
A) Number and Type : 3EA/MOTOR, CT-eTech, 100/1A, 10P20

KKS NO.: 20PAC10AP001

NOTE
1. THIS MOTOR IS DESIGNED TO BE OPERATED IN ARROW DIRECTION.
2. THE NON-DRIVE END SHIELD IS INSULATED TO PREVENT BEARING DAMAGE FROM SHAFT CURRENT.
3. THIS MOTOR CANNOT WITHSTAND THE UP AND DOWN THRUST OF PUMP.
4. WHILE A MOTOR IS NOT IN ITS OPERATION, AND IF THE AMBIENT TEMPERATURE GOES BELOW THE WATER FREEZING POINTS, PLEASE DRAIN COOLING WATER COMPLETELY TO PREVENT COOLER PIPE DAMAGE FROM WATER FREEZING.
5. THE TEMPERATURE OF THE COOLING WATER MUST BE OVER 5°C (41°F)

REV	DATE	CONTENTS	REVD BY	CHKD BY	CHKD BY	APPD BY
5	2015.05.21	REVISION OF MARK 5	M.W.SEO	S.H.PARK	J.B.KIM	H.C.KIM
4	2015.03.24	REVISION OF MARK 4	H.K.LEE		Y.G.KWON	H.C.KIM
3	2015.01.06	REVISION OF MARK 3	H.K.LEE		Y.G.KWON	H.C.KIM
2	2014.10.24	REVISION OF MARK 2	H.K.LEE		Y.G.KWON	Y.S.JOO

APPD BY	Y.S.JOO	UNIT	mm	SUBJECT	
CHKD BY	Y.G.KWON	SCALE	1/14	TITLE	OUTLINE DIMENSION
CHKD BY		PROJEC'N	3차법(3rd Angle)		
DSND BY	H.K.LEE	DATE	2014-10-09		
HYUNDAI HEAVY INDUSTRIES CO., LTD.		REF. NO		DWG SIZE	A1 (594)
		DWG NO	HM-092841	Sheet No.	of
				Revision No.	4

TSK TECNICAS REUNIDAS UTE TSK TÉCNICAS REUNIDAS ASHUGANJ NORTH	**Ashuganj Power Station Company Ltd. (APSCL)**	

ASHUGANJ COMBINED CYCLE POWER PLANT PROJECT (NORTH)

UTS PROJECT NO. 7485	**UNIT: CIRCULATING WATER PUMP**
PURCHASE ORDER NUMBER (P.O.R) 074850505 / F557	**EQUIPMENT : 20PAC10AP001**

REVIEW RESPONSE BY PURCHASER:

Purchaser review and comments do not indicate either responsibility or liability for accuracy and completeness of this document or alter any contractual terms and conditions:

☐ REJECTED	☐ Reviewed With Comments	☒ Review. Without Comments
☐ COMMENTS AS NOTED	☐ REVIEWED AS BUILT	☐ FOR INFORMATION

DATE: 29/05/15

DOCUMENT VENDOR IDENTIFICATION: FLOWSERVE

DOCUMENT TITLE: **Motor General Arragement**

VENDOR DOCUMENT No: COS-14-10P40399-6004	REV: 5	CODE: PLD-0001
UTS DOCUMENT No: V-0748505050-0002	REV: 5	
KKS DOCUMENT No.: 07485-20-PAC-EDP-FLS-003	REV: 5	

Section 8. Drawings/Layout