

This drawing with the supplements is the property of SILLA METAL Co., Ltd.. The drawing, therefore, shall not be copied, reproduced or transferred to any third party, without the prior consent from SILLA METAL Co., Ltd..

이 도면은 신라금속의 자산이므로, 제 3자가 당사의 사전 승인 없이 본 도면을 복사, 판매, 양도하거나, 도면에 따라 부품을 제작·생산하는 것을 금합니다.

KIND OF SHIP :	33,500 DWT LOG / BULK CARRIER
OWNER :	
HULL NO. :	H-1009/10/11/12/31/32
SHIPYARD :	SAMJIN SHIPBUILDING INDUSTRIES CO., LTD.
ENG. MODEL :	STX-MAN B&W 5S50MC-C(MK7)
INSPECTION :	K R

BIBLIOGRAPHY :

SIL LA METAL CO., LTD.

1489-2, Songjung-Dong, Gangseo-Gu,
BUSAN, KOREA

Phone : (051) 831 - 5991 ~ 8

F a x : (051) 831 - 5990

TOTAL NO. OF SHEETS : PAGE 1/30

MANAGER

CHIEF OF SEC.

EXAMINED BY

DRAWN BY

DATE

DRAWING NO.

J. Y. LEE

2008. 11.

08 - P - 19

DRAWING & DATA LIST

<u>NO.</u>	<u>DESCRIPTION</u>	<u>DWG. NO.</u>	<u>SHEETS</u>
A)	PROPELLER	08-P-19	13
1.	PROPELLER DRAWING	08-P-19-01	1
2.	PROPELLER BOSS DRAWING	08-P-19-02	1
3.	PLUG FOR EYE BOLT DRAWING	08-P-19-03	1
4.	DETAIL OF EYE BOLT DRAWING	08-P-19-04	1
5.	PROPELLER CAP DRAWING	08-P-19-05	1
6.	ANTI-SINGING TREATMENT		1
7.	PROPELLER OFFSET DATA		1
B)	INSTRUCTION MANUAL FOR PUSH-UP KEYLESS PROPELLER		9
C)	HYD. NUT	08-S-19	6
1.	HYD. NUT DRAWING	08-S-19-01	1
2.	LIST OF TOOLS FOR HYD.NUT		3
3.	LIST OF TOOLS FOR SHAFTING		1
D)	SHAFTING	DA500M104	10

BIBLIOGRAPHY

KIND OF SHIP

33,500 DWT LOG / BULK CARRIER

OWNER

HULL NO.

H-1009/10/11/12/31/32

KR

SHIPYARD

SAMJIN SHIPBUILDING INDUSTRIES
CO., LTD.

PROPELLER

SIL LA METAL CO., LTD.

DESIGN DEPT.

1489-2, Songjung-Dong, Gangseo-Gu,
BUSAN, KOREA

Phone : (051) 831 - 5991 ~ 8

F a x : (051) 831 - 5990

MANAGER

CHIEF OF SEC.

EXAMINED BY

DRAWN BY

J. Y. LEE

DATE

2008. 11.

DRAWING NO.

08 - P - 19

1. MAIN ENGINE

MODEL	STX-MAN B&W 5S50MC-C(MK7)
MAX. CONTINUOUS OUTPUT	10,740 BHP
REVOLUTION PER MINUTE	127.0 RPM

2. PROPELLER PARTICULARS

DIAMETER	D = 5.600 M
PITCH AT 0.7R	P _{0.7} = 4.0115 M
PITCH RATIO AT 0.7R	P _{0.7} /D = 0.7163
MEAN PITCH	P _{MEAN} = 3.9194 M
MEAN PITCH RATIO	P _{MEAN} /D = 0.6999
NO. OF BLADE	Z = 4 EA
EXPANDED AREA	A _e = 15.517 M ²
EXPANDED AREA RATIO	A _e /A _o = 0.6300
BOSS RATIO	D _{hub} /D = 0.170
RAKE	RK = 0.0 DEG
SKEW	SK = 24.5 DEG
TURNING DIRECTION	R.H(LOOKING FROM STERN)
MATERIAL	Ni-Al-Br (CU3)
SECTION	NACA 66, a=0.8
PROPELLER WEIGHT	abt. 14030 kg
M.O.I IN WATER	abt. 259,200 kg · cm · sec ²

3. INSPECTION GUIDANCE OF PROPELLER (ISO R 484/1 - 1981)
SPECIFICATION CLASS I.

INSPECTION ITEMS		TOLERANCE	REMARK
PITCH	LOCAL PITCH	$\pm 2 \%$	
	MEAN PITCH OF EACH RADIUS OF EACH BLADE	$\pm 1.5 \%$	
	MEAN PITCH PER BLADE	$\pm 1 \%$	
	MEAN PITCH FOR PROPELLER	$\pm 0.75 \%$	
RADIUS OF EACH BLADE		$\pm 0.3 \%$	
THICKNESS	PLUS TOLERANCE WITH A MINIMUM OF	+ 2.5 % 2.5 mm	MAX. THICKNESS OF THE CORRESPONDING BLADE SECTION
	MINUS TOLERANCE WITH A MINIMUM OF	- 1.5 % - 1.5 mm	
LENGTH OF BLADE SECTION	TOLERANCE WITH A MINIMUM OF	$\pm 2.0 \%$ 10.0 mm	
BLADE INCLINATION (RAKE)		$\pm 1.0 \%$	
ANGULAR DEVIATION BETWEEN TWO CONSECUTIVE BLADES		$\pm 1 \text{ DEG.}$	
STATIC BALANCING (P VALUE)		$P = \frac{C_m}{R_n^2}$	m = MASS OF PROPELLER
FINISHED ROUGHNESS OF SURFACE FOR BLADE FROM 0.3 R		MIN. 6Ra	

JOB NO. : H-1009/10/11/12/31/32

```
*****
*
*          CALCULATION FOR PROPELLER BLADE THICKNESS          *
*          ACCORDING TO KR RULES                               *
*
*          ( SOLID PROPELLER )                                  *
*
*****
```

```
REQUIRED THICKNESS AT 0.25 R =    177.008  MM
ACTUAL  THICKNESS AT 0.25 R =    187.280  MM
K1  =    33.054      K2  =    1.177      SATISFACTORY
=====
```

```
-----
REQUIRED THICKNESS AT 0.60 R =    82.725  MM
ACTUAL  THICKNESS AT 0.60 R =    97.490  MM
K1  =    10.302      K2  =    1.235      SATISFACTORY
=====
```

INPUT PARTICULARS

=====

```
1. OUTPUT OF ENGINE AT MCR ( PS ) :    10740.0  PS
2. REVOLUTION AT MCR      ( RPM ) :     127.0  RPM
3. NUMBER OF BLADE        ( Z ) :         4    EA
4. DIAMETER OF PROPELLER  ( D ) :     5600.0  MM
5. BLADE PITCH AT 0.25R   ( P25 ) :     3714.5  MM
6. BLADE PITCH AT 0.60R   ( P60 ) :     4000.0  MM
7. BLADE PITCH AT 0.70R   ( P70 ) :     4011.5  MM
8. RAKE                    ( E ) :         0.0  MM
9. SKEW ANGLE              ( THETA ) :      24.5  DEG
10. WIDTH OF BLADE AT 0.25R ( L25 ) :     1393.0  MM
11. WIDTH OD BLADE AT 0.60R ( L60 ) :     1894.5  MM
12. MATERIAL FACTORS       ( K ) :         1.30
    MATERIAL                :         CU3
13. EXPANDED AREA RATIO    ( AE ) :         0.6300
14. ACT. SEC MOD RATIO 0.25R( CN25 ) :         0.1000
15. ACT. SEC MOD RATIO 0.60R( CN60 ) :         0.1000
```

5. MATERIAL LIST

NO.	DESCRIPTION	MATERIAL	Q'TY		WEIGHT	REMARK
			WORK	SPARE		
1	PROPELLER	Ni-Al-Br	1		14,030 Kg	CU3
2	PLUG	C2700BD	2			PF 7/8
3	PLUG	C2700BD	2			PT 3/8
4	PACKING	C1100P-0	2	2		φ26 x φ18 x 1t
5	JOINT PLUG	SUS304	2			PT 3/8
6	O-RING	NBR	1	1		φ698 x φ8.4
7	PLUG	C2700BD	3			M42
8	PLUG	C2700BD	1			M72 x P6
9	PACKING	C1100P-0	1	1		φ85 x φ74 x 1t
10	EYE BOLT FOR PROPELLER	SF590A	1		10 kg	M72 x P6
11	PROPELLER CAP	Mn-Br	1		245Kg	
12	WIRING BOLT FOR CAP	SUS304	12			M24 x 65L
13	WIRE FOR CAP	SUS304	1			φ2.6 x 3000L
14	PLUG FOR CAP	C2700BD	2			M20
15	PACKING	C1100P-0	2	2		φ32 x φ22 x 1t
16	EYE BOLT FOR PROP. CAP	SS41	1		0.2kg	M20

6. INSPECTION ITEMS OF PROPELLER

SHIP NO. : H-1009/10/11/12/31/32

NO.	I T E M	KIND OF INSPECTION	WITNESS	REMARK
1	PROPELLER	MATERIAL TEST	CLASS	REPORT
		P-T CHECK	CLASS	REPORT
		CONTACT CHECK	CLASS	RECORD
		DIMENSION CHECK	CLASS , OWNER	REPORT
		BALANCING CHECK	CLASS , OWNER	REPORT
		WEIGHT CHECK	CLASS , OWNER	REPORT

1

DIRECTION OF TURNING
RIGHT HANDED

RADIUS

PITCH

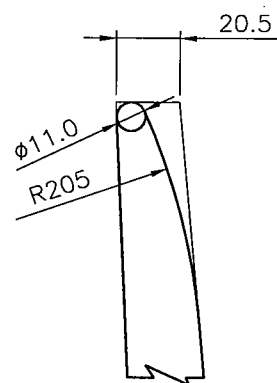
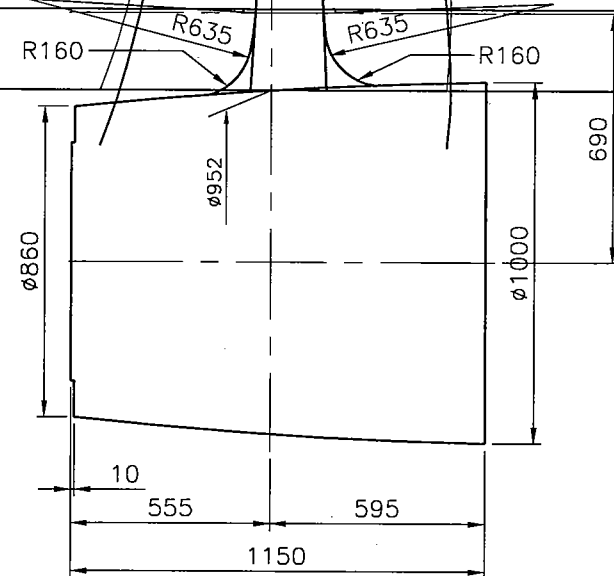
PITCH RATIO

MAX-T

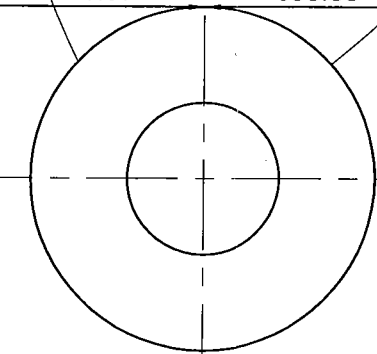
LENGTH


r/R

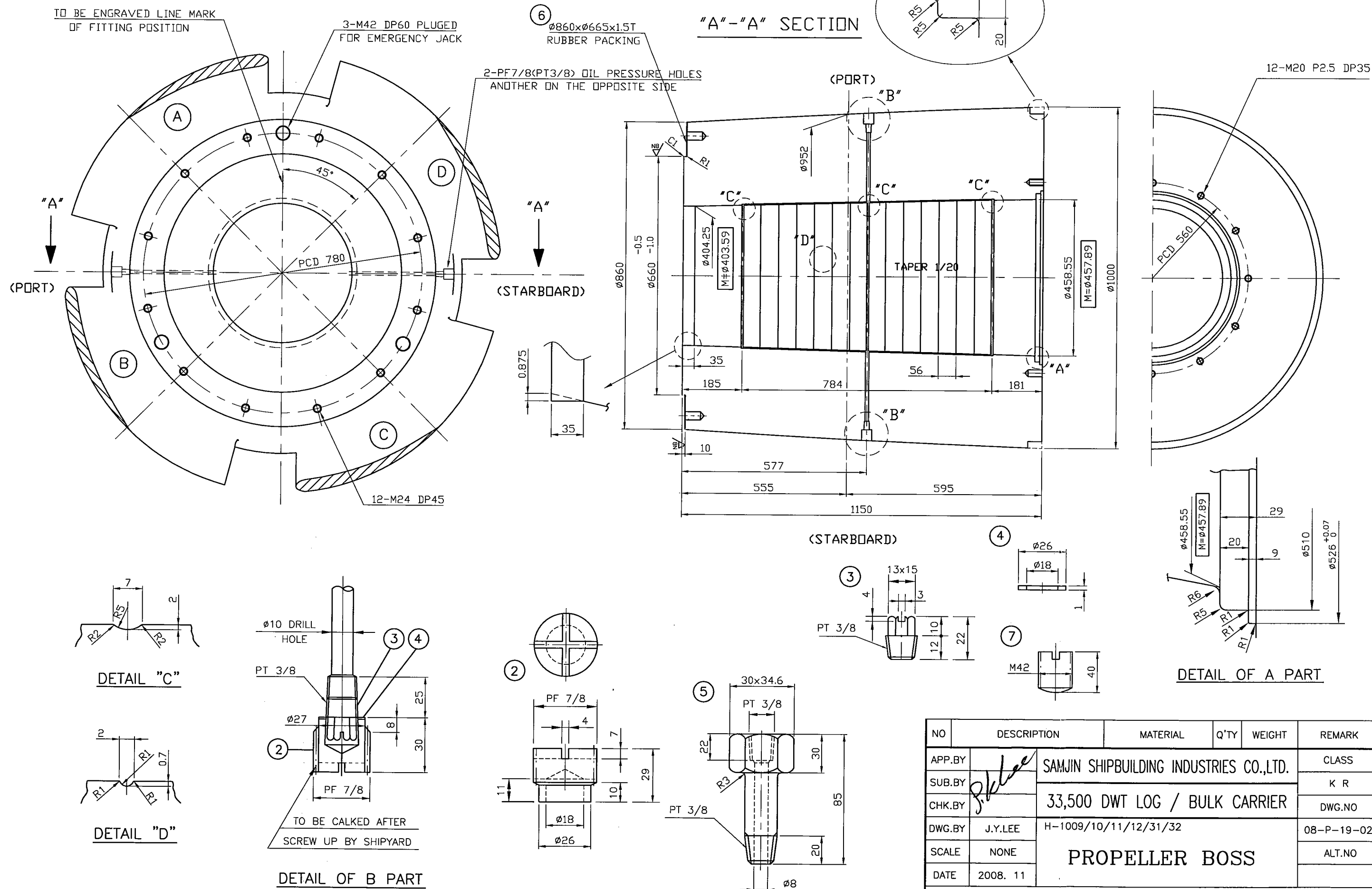
2800	3792.0	0.6771	20.50	0.6	0.6	857.05	1.0 R
2730	3821.5	0.6824	24.50	1105.1	1105.10	215.81	0.975 R
2660	3849.3	0.6874	28.60	1389.9	1379.08	10.82	0.95 R
2520	3901.3	0.6967	37.27	1673.8	1362.35	311.45	0.9 R
2240	3980.7	0.7108	55.45	1898.3	1201.05	697.25	0.8 R
1960	4011.5	0.7163	75.46	1945.0	1014.23	930.77	0.7 R
1680	4000.0	0.7143	97.49	1894.5	844.72	1049.78	0.6 R
1400	3948.0	0.7050	121.14	1787.1	724.82	1062.28	0.5 R
1120	3866.5	0.6904	146.23	1644.8	658.47	986.33	0.4 R
840	3767.7	0.6728	173.27	1480.1	630.89	849.21	0.3 R
700	3714.5	0.6633	187.28	1393.0	623.58	769.42	0.25 R
476	3624.0	0.6471	210.80	1247.0	616.97	630.03	0.17 R

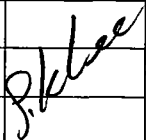



DETAIL OF TIP



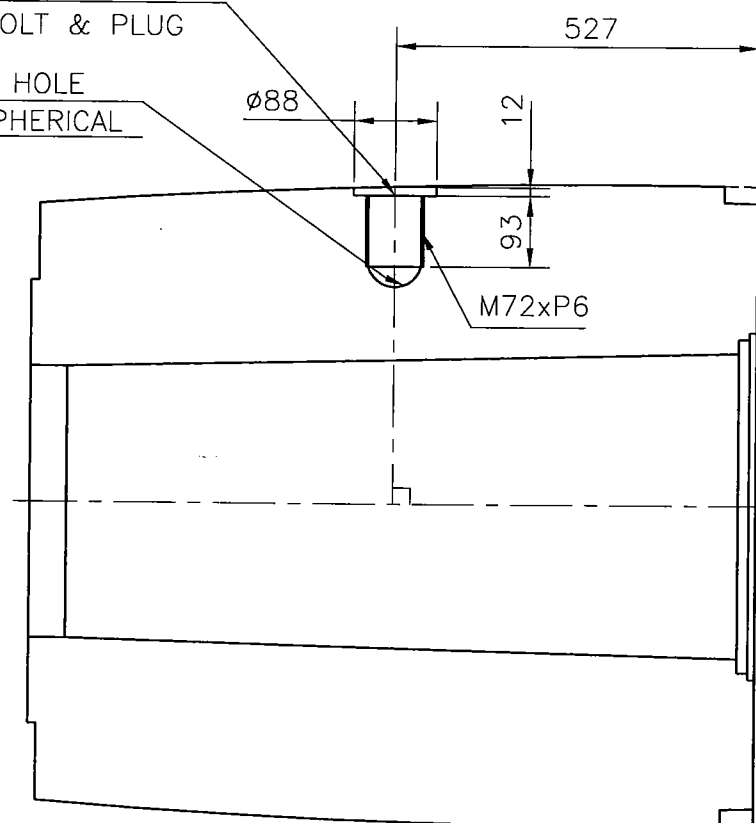
1	PROPELLER	Ni-Al-Br (CU3)	1	14030 Kg	
NO	DESCRIPTION	MATERIAL	Q'TY	WEIGHT	REMARK
APP.BY	SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.				CLASS
SUB.BY	33,500 DWT LOG / BULK CARRIER				K R
CHK.BY					DWG.NO
DWG.BY	J.Y.LEE	H-1009/10/11/12/31/32			08-P-19-01
SCALE	NONE	PROPELLER			ALT.NO
DATE	2008. 11				
 SIL LA METAL CO., LTD					BUSAN KOREA



NO	DESCRIPTION		MATERIAL	Q'TY	WEIGHT	REMARK	
APP.BY		SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.				CLASS	
SUB.BY		33,500 DWT LOG / BULK CARRIER				K R	
CHK.BY						DWG.NO	
DWG.BY		J.Y.LEE	H-1009/10/11/12/31/32				08-P-19-02
SCALE		NONE	PROPELLER BOSS				ALT.NO
DATE	2008. 11						
 SIL LA METAL CO., LTD						BUSAN KOREA	

⑧⑨⑩ LIFTING HOLE FOR
EYE BOLT & PLUG

BOTTOM OF THREAD HOLE
TO BE MACHINED SPHERICAL



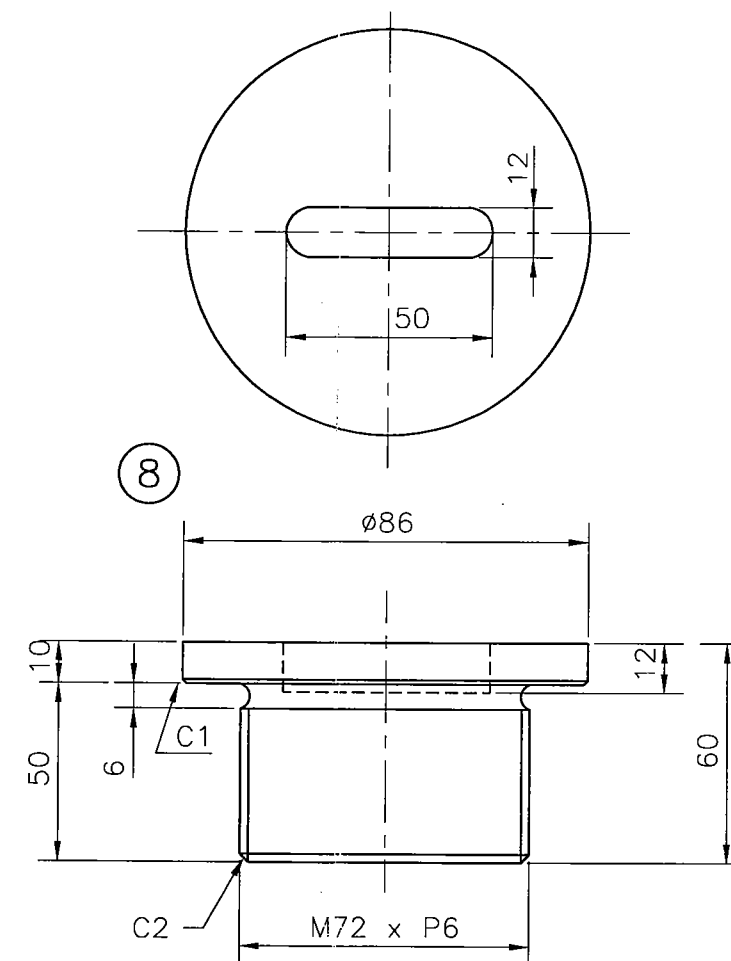
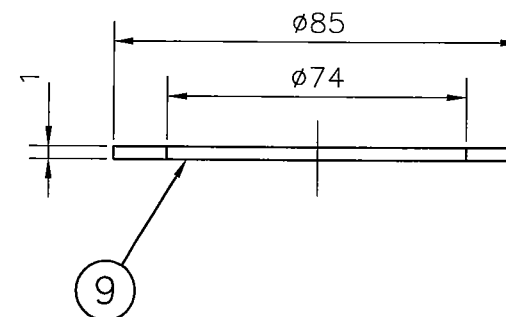
OIL PRESSURE HOLE
"B" PART

LIFTING EYE HOLE

BLADE "D"

BLADE "A"

OIL PRESSURE HOLE
"B" PART

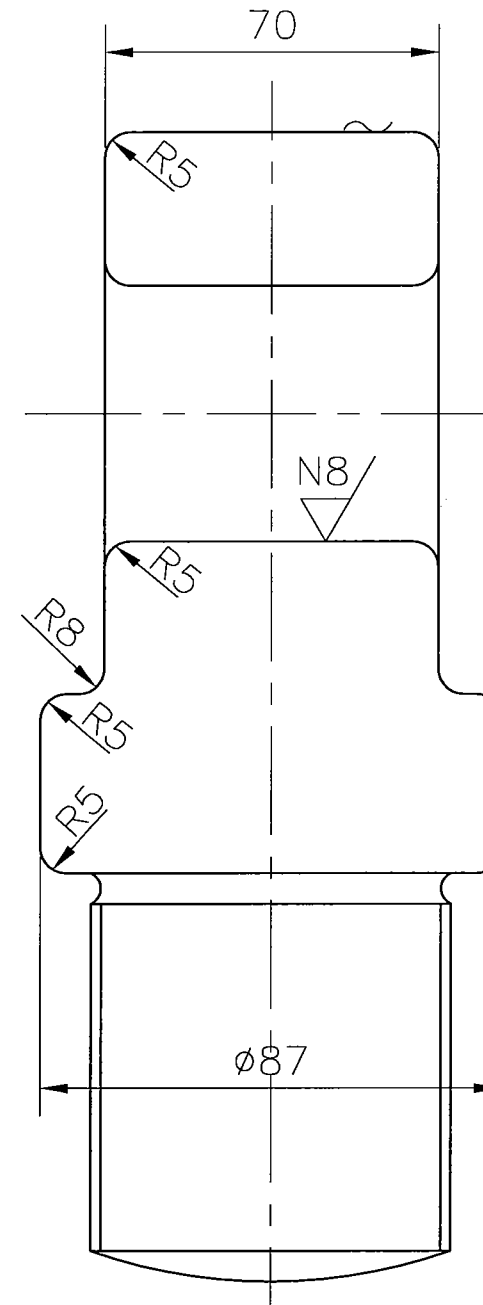
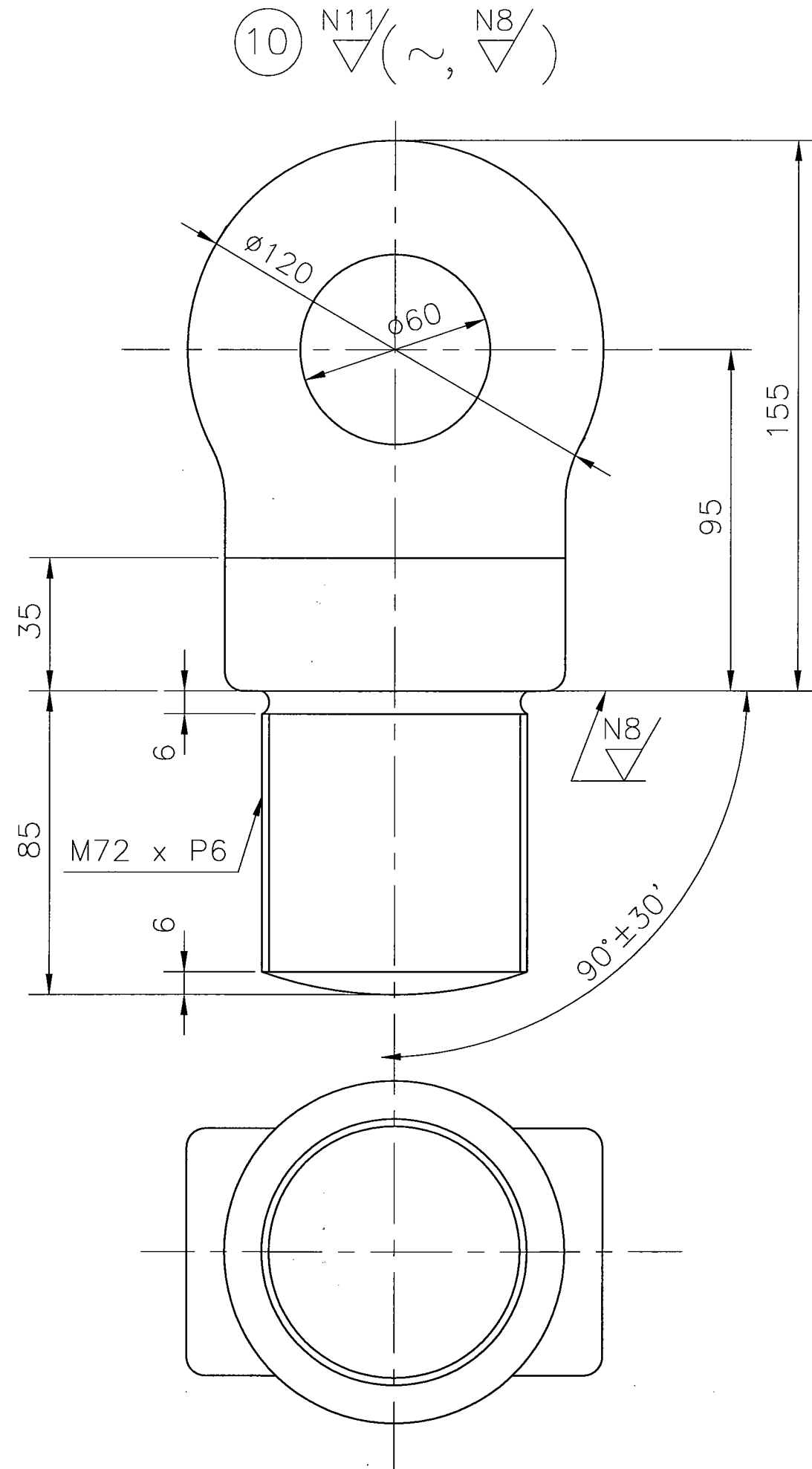


10	EYE BOLT	SF590A	1	10 Kg	M72xP6
9	PACKING	C1100P-0	1		ø85xø74x1t
8	PLUG	C2700BD	1		M72xP6
NO	DESCRIPTION	MATERIAL	Q'TY	WEIGHT	REMARK
APP.BY	SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.				CLASS
SUB.BY					K R
CHK.BY	33,500 DWT LOG / BULK CARRIER				DWG.NO
DWG.BY	J.Y.LEE	H-1009/10/11/12/31/32			08-P-19-03
SCALE	NONE	PLUG FOR EYE BOLT			ALT.NO
DATE	2008. 11				



SIL LA METAL CO., LTD

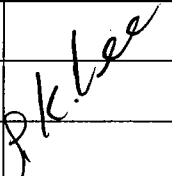

BUSAN
KOREA

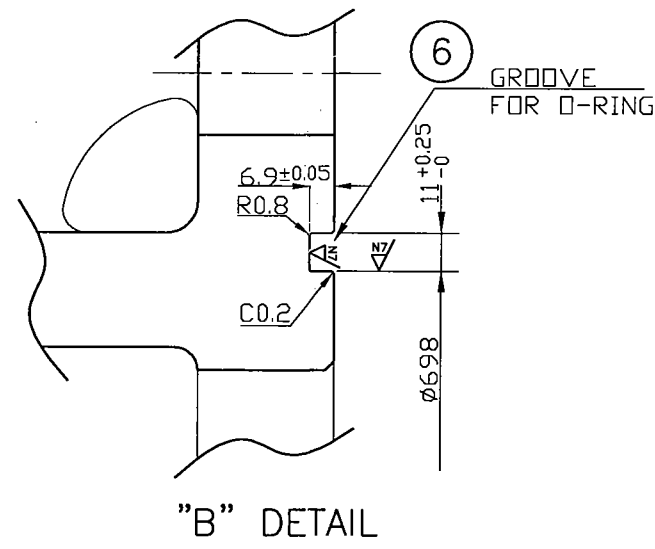
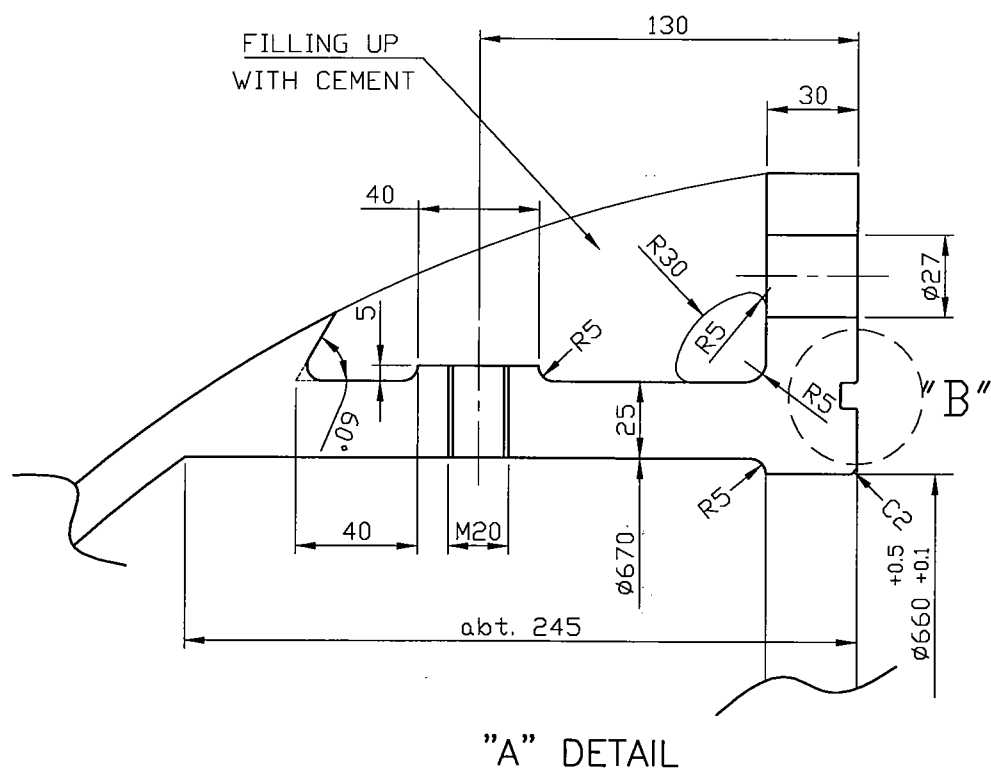
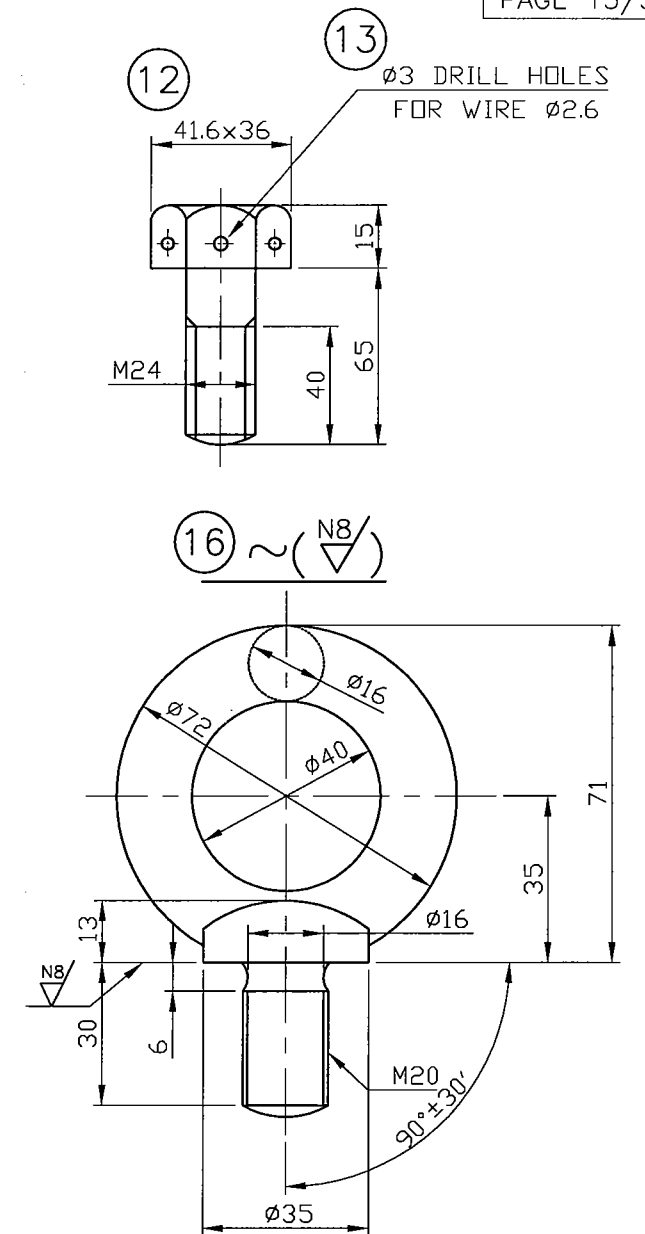
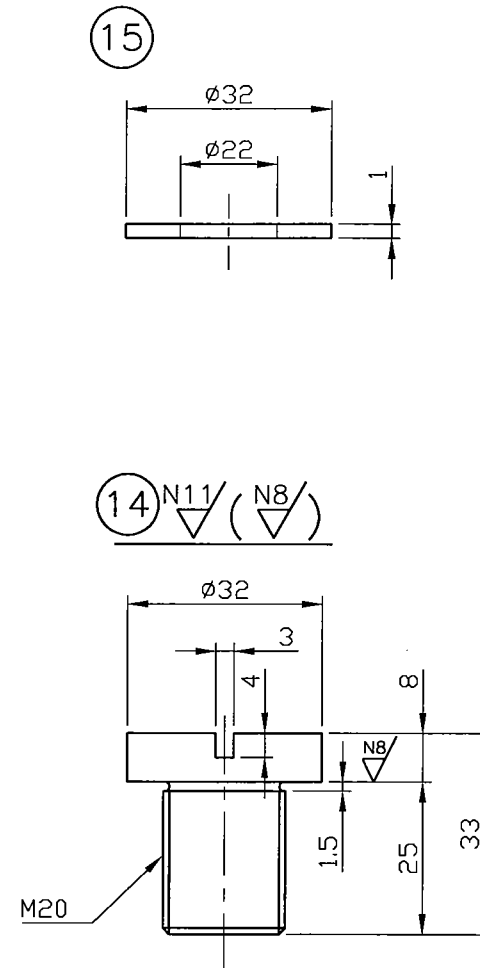
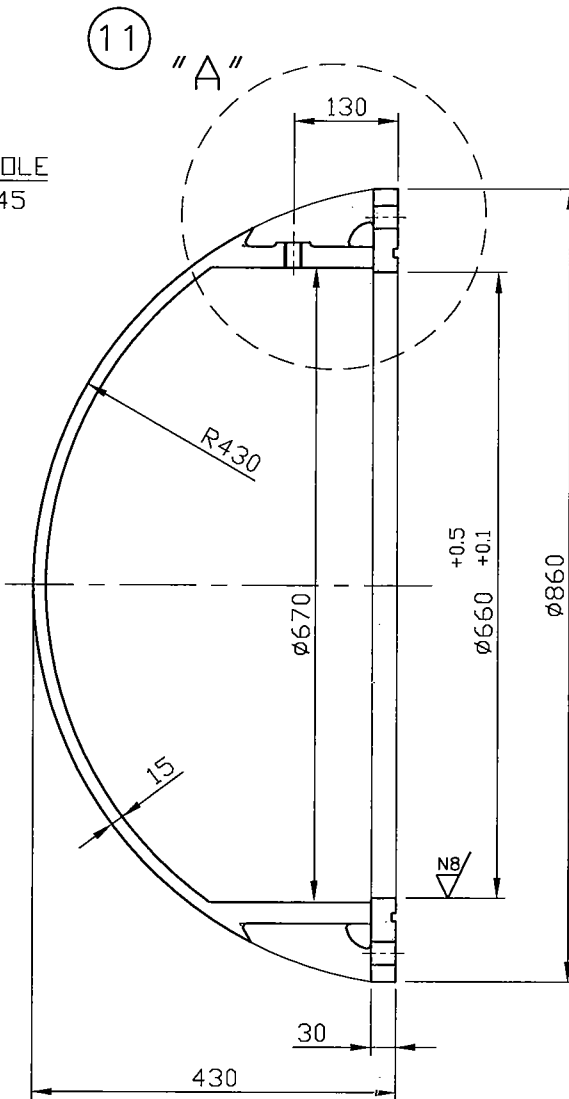
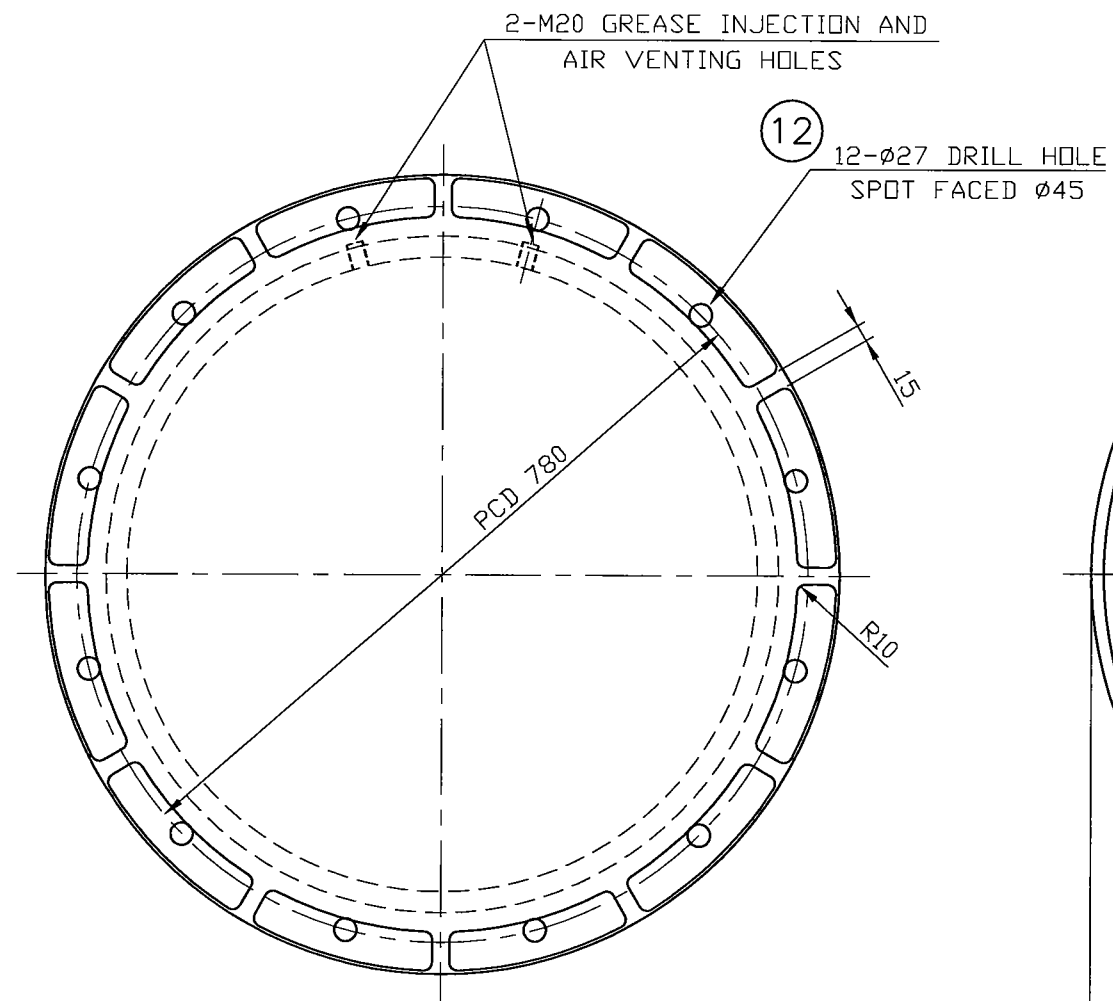



NOTE

1. EYE BOLTS ARE TO BE FORGED AND NORMALIZED.
2. TEST COUPON FORGED INTEGRAL WITH EYE BOLT IS TO MEET.

T.S = 590 N/MM²
 ELONGATION = 18 %
 YIELD = 295 N/MM²

10	EYE BOLT	SF590A	1	10 kg	JIS G 3201-1988
NO	DESCRIPTION	MATERIAL	Q'TY	WEIGHT	REMARK
APP.BY		SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.			CLASS
SUB.BY		33,500 DWT LOG / BULK CARRIER			K R
CHK.BY					DWG.NO
DWG.BY		J.Y.LEE	H-1009/10/11/12/31/32	08-P-19-04	
SCALE		NONE			DETAIL OF EYE BOLT
DATE	2008. 11				
 SIL LA METAL CO., LTD					BUSAN KOREA



16	EYE BOLT	SS41	1		M20
15	PACKING	C1100P-0	2		
14	PLUG FOR CAP	C2700BD	2		M20
13	WIRE FOR CAP	SUS304	1		ø2.6 x 3m
12	WIRING BOLT FOR CAP	SUS304	12		M24x65L
11	PROPELLER CAP	Mn-Br	1	245 Kg	
NO	DESCRIPTION	MATERIAL	Q'TY	WEIGHT	REMARK
APP.BY	SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.				CLASS
SUB.BY	33,500 DWT LOG / BULK CARRIER				K R
CHK.BY					DWG.NO
DWG.BY	J.Y.LEE	H-1009/10/11/12/31/32			08-P-19-05
SCALE	NONE	PROPELLER CAP			ALT.NO
DATE	2008. 11				
 SIL LA METAL CO., LTD					BUSAN KOREA

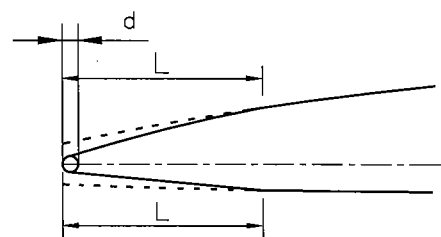
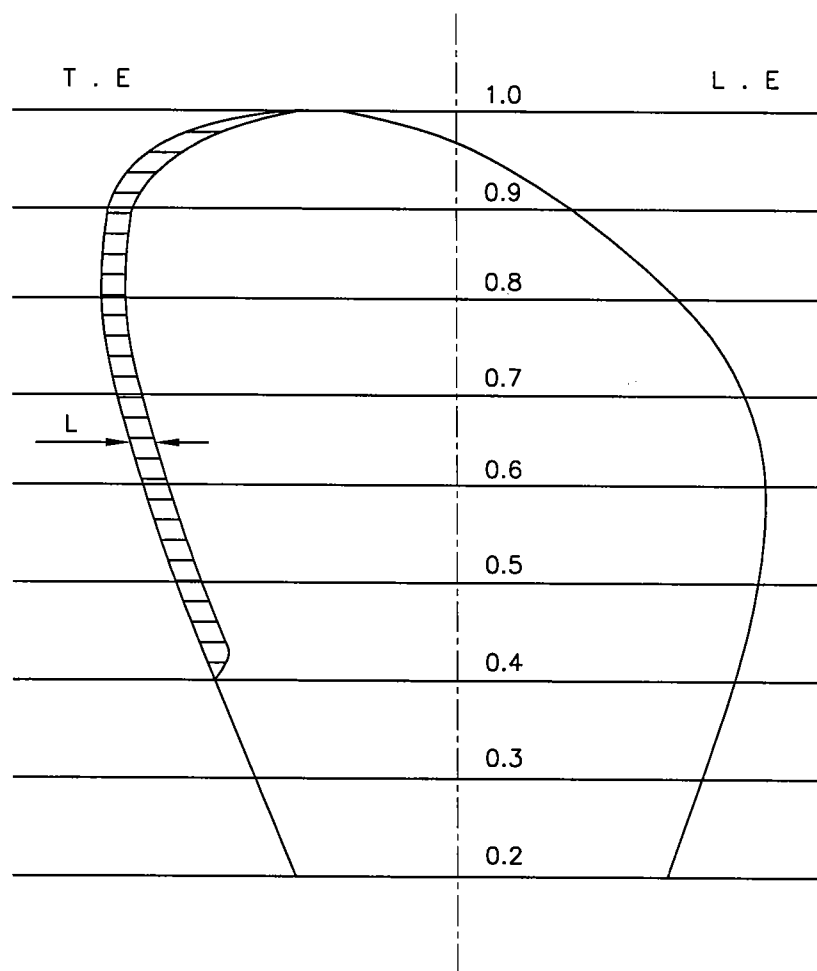
ANTI-SINGING TREATMENT

YARD : SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD.

DATE : 2008. 11

SHIP NO : H-1009/10/11/12/31/32

PROP' DIA : 5600 MM



ANTISINGING AT THE T.E BETWEEN
0.5 ~ 0.975R

UNIT : MM

r/R	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.975
L	-	25	25	25	25	20	20	20
d	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Section Profile: NACA66

Unit: mm

ORDER OF OFFSETS-(1)-DISTANCE FROM LE (2)-SUCTION SIDE

(3)-CAMBER LINE (4)-PRESSURE SIDE. ALL DIMENSIONS IN MM

PERT L	1.0	2.5	5.0	10.0	20.0	30.0	40.0	45.0	50.0	60.0	70.0	80.0	90.0	95.0	97.5	99.0	100.0
R/R0	12.5	31.2	62.4	124.7	249.4	374.1	498.8	561.1	623.5	748.2	872.9	997.6	1122.3	1184.7	1215.8	1234.5	1247.0
0.170	27.6	41.8	59.3	84.7	118.8	139.3	150.3	152.5	152.2	144.8	128.0	100.5	58.5	33.4	20.6	12.7	7.3
	3.6	7.6	12.9	21.3	33.3	41.1	45.8	47.0	47.6	46.6	42.3	33.5	17.1	8.2	3.9	1.5	0.0
	-13.0	-21.1	-28.8	-38.6	-50.3	-56.4	-58.6	-58.4	-57.0	-51.4	-42.3	-31.2	-21.6	-15.3	-11.6	-8.9	-6.8
R/R0	13.9	34.8	69.7	139.3	278.6	417.9	557.2	626.8	696.5	835.8	975.1	1114.4	1253.7	1323.3	1358.2	1379.1	1393.0
0.250	24.3	37.7	54.3	78.4	110.7	130.4	141.0	143.1	143.0	136.3	120.5	94.5	54.4	30.8	18.8	11.4	6.4
	3.8	7.9	13.6	22.4	35.0	43.2	48.1	49.5	50.1	49.0	44.5	35.2	18.0	8.6	4.1	1.5	0.0
	-11.7	-18.1	-24.0	-31.2	-39.5	-43.4	-44.6	-44.2	-42.9	-38.0	-30.8	-22.5	-16.6	-12.4	-9.8	-7.7	-6.1
R/R0	14.8	37.0	74.0	148.0	296.0	444.0	592.0	666.0	740.0	888.1	1036.1	1184.1	1332.1	1406.1	1443.1	1465.3	1480.1
0.300	22.4	35.3	51.2	74.3	105.5	124.6	134.8	137.0	136.9	130.5	115.5	90.5	51.8	29.1	17.7	10.7	5.9
	3.8	8.1	13.8	22.8	35.6	44.0	49.0	50.3	50.9	49.8	45.3	35.8	18.3	8.7	4.2	1.6	0.0
	-10.8	-16.3	-21.1	-26.9	-33.4	-36.3	-36.8	-36.3	-35.1	-30.7	-24.4	-17.7	-13.9	-10.8	-8.7	-7.0	-5.7
R/R0	16.4	41.1	82.2	164.5	329.0	493.4	657.9	740.2	822.4	986.9	1151.4	1315.8	1480.3	1562.6	1603.7	1628.4	1644.8
0.400	18.9	30.5	44.9	65.9	94.3	111.7	121.2	123.2	123.3	117.7	104.3	81.6	46.2	25.8	15.4	9.2	5.0
	3.8	8.0	13.7	22.7	35.5	43.8	48.7	50.1	50.7	49.6	45.1	35.6	18.2	8.7	4.2	1.6	0.0
	-9.0	-12.8	-16.0	-19.5	-22.9	-24.0	-23.7	-23.0	-21.9	-18.4	-13.8	-9.6	-9.1	-7.9	-6.8	-5.7	-4.8
R/R0	17.9	44.7	89.4	178.7	357.4	536.1	714.8	804.2	893.6	1072.3	1251.0	1429.7	1608.4	1697.7	1742.4	1769.2	1787.1
0.500	15.7	25.9	38.4	56.9	81.9	97.3	105.6	107.5	107.6	102.8	91.2	71.3	40.1	22.2	13.2	7.7	4.1
	3.6	7.5	12.9	21.3	33.2	41.0	45.6	46.9	47.5	46.4	42.2	33.4	17.0	8.1	3.9	1.5	0.0
	-7.3	-9.9	-11.9	-13.8	-15.2	-15.2	-14.3	-13.7	-12.6	-9.9	-6.6	-4.2	-5.6	-5.6	-5.2	-4.6	-4.0
R/R0	18.9	47.4	94.7	189.5	378.9	568.4	757.8	852.5	947.3	1136.7	1326.2	1515.6	1705.1	1799.8	1847.1	1875.6	1894.5
0.600	12.7	21.2	31.6	47.1	68.1	81.0	88.1	89.7	89.8	85.9	76.2	59.6	33.3	18.3	10.8	6.3	3.3
	3.1	6.6	11.2	18.6	29.0	35.8	39.8	40.9	41.4	40.5	36.8	29.1	14.9	7.1	3.4	1.3	0.0
	-5.8	-7.6	-8.8	-9.7	-10.0	-9.4	-8.4	-7.8	-6.9	-4.8	-2.5	-1.2	-3.4	-4.0	-3.9	-3.6	-3.2
R/R0	19.5	48.6	97.2	194.5	389.0	583.5	778.0	875.2	972.5	1167.0	1361.5	1556.0	1750.5	1847.8	1896.4	1925.6	1945.0
0.700	9.8	16.6	25.0	37.4	54.2	64.6	70.3	71.5	71.7	68.6	60.9	47.6	26.5	14.5	8.5	4.9	2.5
	2.6	5.4	9.3	15.3	23.9	29.5	32.9	33.8	34.2	33.5	30.4	24.0	12.3	5.9	2.8	1.1	0.0
	-4.4	-5.6	-6.3	-6.6	-6.2	-5.4	-4.5	-3.9	-3.2	-1.6	0.0	0.6	-1.9	-2.7	-2.9	-2.7	-2.5
R/R0	19.0	47.5	94.9	189.8	379.7	569.5	759.3	854.2	949.2	1139.0	1328.8	1518.6	1708.5	1803.4	1850.8	1879.3	1898.3
0.800	7.3	12.5	18.8	28.3	41.1	49.0	53.4	54.4	54.6	52.4	46.7	36.7	20.7	11.6	7.1	4.3	2.5
	2.0	4.3	7.3	12.1	18.9	23.3	26.0	26.7	27.0	26.4	24.0	19.0	9.7	4.6	2.2	0.8	0.0
	-3.1	-3.8	-4.1	-4.0	-3.3	-2.4	-1.5	-1.0	-0.6	0.4	1.3	1.3	-1.3	-2.3	-2.6	-2.6	-2.5
R/R0	16.7	41.8	83.7	167.4	334.8	502.1	669.5	753.2	836.9	1004.3	1171.7	1339.0	1506.4	1590.1	1632.0	1657.1	1673.8
0.900	5.0	8.6	13.0	19.5	28.4	34.0	37.0	37.7	37.9	36.6	32.8	26.0	15.0	8.7	5.6	3.8	2.5
	1.5	3.1	5.2	8.7	13.5	16.7	18.6	19.1	19.3	18.9	17.2	13.6	6.9	3.3	1.6	0.6	0.0
	-2.0	-2.4	-2.5	-2.2	-1.4	-0.6	0.1	0.4	0.7	1.2	1.5	1.2	-1.1	-2.1	-2.4	-2.5	-2.5
R/R0	13.9	34.7	69.5	139.0	278.0	417.0	556.0	625.5	695.0	833.9	972.9	1111.9	1250.9	1320.4	1355.2	1376.0	1389.9
0.950	3.8	6.5	9.8	14.7	21.3	25.5	27.8	28.3	28.5	27.6	24.8	19.8	11.7	7.1	4.8	3.4	2.5
	1.1	2.2	3.8	6.3	9.9	12.2	13.6	14.0	14.1	13.8	12.6	9.9	5.1	2.4	1.2	0.4	0.0
	-1.6	-1.9	-2.1	-2.0	-1.6	-1.1	-0.6	-0.3	-0.2	0.1	0.3	0.0	-1.6	-2.3	-2.5	-2.5	-2.5
R/R0	11.1	27.6	55.3	110.5	221.0	331.5	442.0	497.3	552.5	663.1	773.6	884.1	994.6	1049.8	1077.5	1094.0	1105.1
0.975	3.0	5.2	7.7	11.5	16.7	19.8	21.5	21.9	22.1	21.4	19.4	15.6	9.5	6.0	4.3	3.2	2.5
	0.7	1.6	2.7	4.4	6.8	8.5	9.4	9.7	9.8	9.6	8.7	6.9	3.5	1.7	0.8	0.3	0.0
	-1.5	-2.0	-2.4	-2.7	-3.0	-2.9	-2.7	-2.6	-2.5	-2.3	-2.0	-1.8	-2.5	-2.7	-2.7	-2.6	-2.5
R/R0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6
1.000	1.9	3.0	4.2	6.0	8.2	9.5	10.2	10.2	10.3	10.0	9.1	7.5	5.3	4.0	3.3	2.8	2.5
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	-1.9	-3.0	-4.2	-6.0	-8.2	-9.5	-10.2	-10.2	-10.3	-10.0	-9.1	-7.5	-5.3	-4.0	-3.3	-2.8	-2.5

BIBLIOGRAPHY

KIND OF SHIP

33,500 DWT LOG / BULK CARRIER

OWNER

HULL NO.

H-1009/10/11/12/31/32

KR

SHIPYARD

SAMJIN SHIPBUILDING INDUSTRIES
CO., LTD.**INSTRUCTION MANUAL
FOR PUSH-UP KEYLESS
PROPELLER****SIL LA METAL CO., LTD.****DESIGN DEPT.**# 1489-2, Songjung-Dong, Gangseo-Gu,
BUSAN, KOREA

Phone : (051) 831 - 5991 ~ 8

F a x : (051) 831 - 5990

MANAGER

CHIEF OF SEC.

EXAMINED BY

DRAWN BY

J. Y. LEE

DATE

2008. 11.

DRAWING NO.

08 - P - 19

OPERATION INSTRUCTION MANUAL FOR PUSH-UP OF WET-TYPE KEYLESS PROPELLER WITH OIL PRESSURE

1. INTRODUCTION

THE REQUIRED CARE AND THE PREPARATION IN FITTING THE WET-TYPE KEYLESS PROPELLER TO TAIL SHAFT ARE DESCRIBED IN THIS INSTRUCTION MANUAL.

REGARDING TO THE SAFETY OF GRIPPING FORCE BETWEEN BOSS AND SHAFT, THE PUSH-UP CALCULATION FOR WET-TYPE KEYLESS PROPELLER WAS SUBMITTED.

2. APPARATUS FOR PUSH-UP WITH OIL PRESSURE AND MEASUREMENT INSTRUMENT

ITEM	NAME	NO (SET)	REMARKS
APPARATUS FOR PUSH-UP	SUPPLIES HYDRAULIC NUT ACCESSORIES TOOLS SPARES	1	
MEASUREMENT INSTRUMENT	THERMOMETER DIAL GAUGE	2 1	WITH A MAGNET HOLDER
OTHERS	ACETONE OR THINNER ADHESION GENERAL TOOLS	1	ALON ALPHA

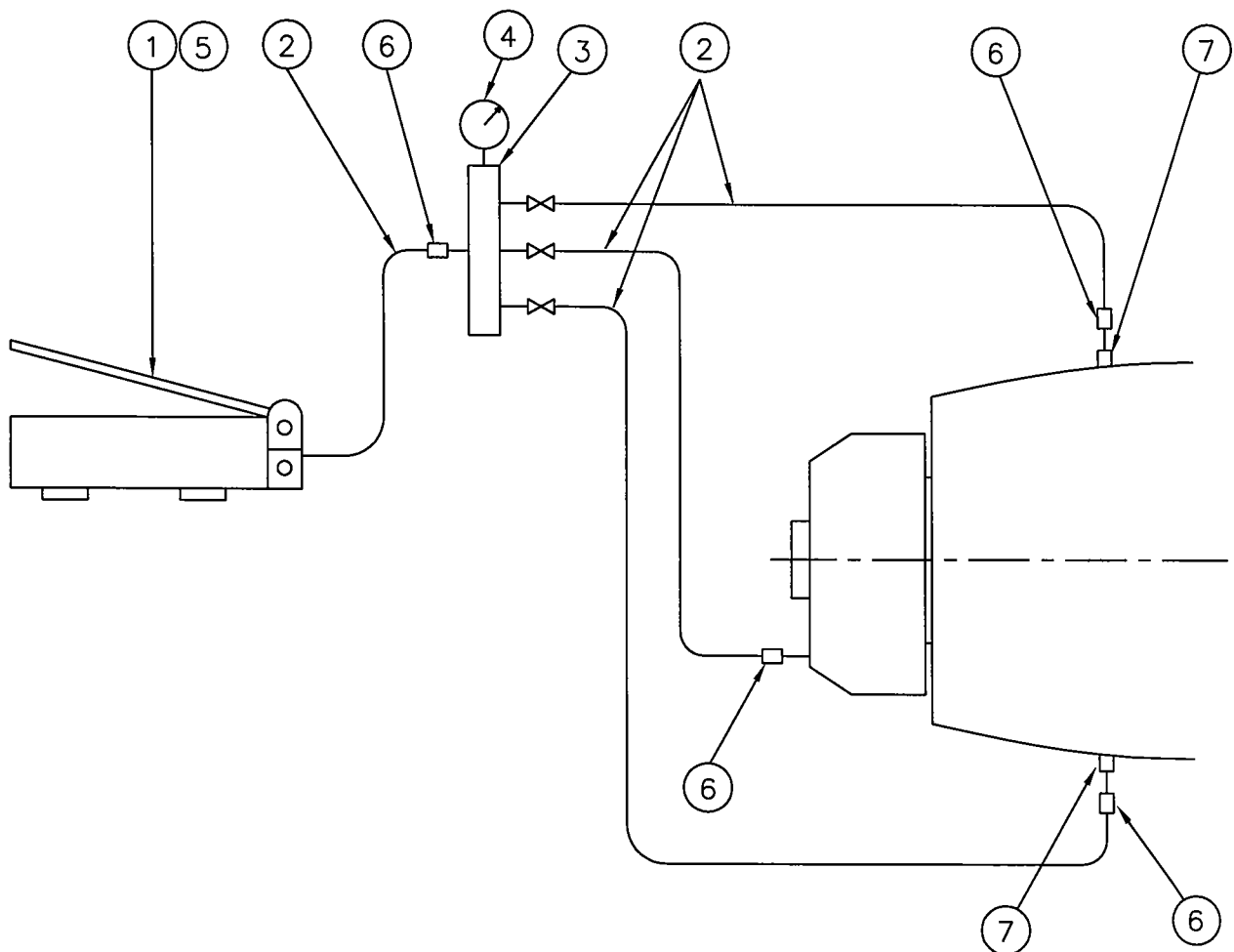
3. PROCEDURE FOR WORKING OF PUSH-UP PROPELLER WITH OIL PRESSURE

ITEM	SUMMARY	REMARKS
PREPARATIONS FOR PUSH-UP	(1) CLEAN THE INSIDE OF THE PROPELLER BOSS AND SURFACE OF THE SHAFT WITH ACETONE AND SMEAR OIL.	OIL : MOBIL OIL DTE LIGHT OR EQUIVALENT.

ITEM	SUMMARY	REMARKS
PREPARATIONS FOR PUSH-UP	<p>(2) ADJUST THE MARK ON THE CIRCUMFERENTIAL DIRECTION.</p> <p>(3) READ THE TEMPERATURE OF THE SHAFT AND THE PROPELLER BOSS.</p> <p>(4) SECURE THE HYDRAULIC NUT TO SHAFT.</p> <p>(5) VENT OUT AIR IN THE HYDRAULIC NUT.</p> <p>(6) VENT OUT AIR IN THE PROPELLER BOSS USING INJECTION HOLE OF BOSS.</p>	<p>WITHIN 5.0MM IN RIGHT AND LEFT.</p> <p>LOCATIONS ARE TO BE BETWEEN EACH BLADE ROOT AND ON THE SHAFT.</p> <p>ADJUST THE LOADING RING TO THE FACE OF HYDRAULIC NUT BODY.</p>
PUSH-UP	<p>(1) RAISE UP OIL PRESSURE OF THE HYDRAULIC NUT ONLY, READ OIL PRESSURE IN STEP WITH PUSH-UP DISTANCE AND PLOT IT.</p> <p>(2) TAKE DOWN THE OIL PRESSURE OF THE HYDRAULIC NUT GRADUALLY.</p> <p>(3) DETERMINE 0(ZERO) POINT FROM THE POINT MEASURED IN (1), AND RESET THE DIAL GAUGE.</p> <p>(4) RAISE PRESSURE TO THE HYDRAULIC NUT AND PROPELLER BOSS INTERFACE AND PLOT IT INTO FITTING DIAGRAM.</p> <p>(5) PUSH-UP TO A DESIGNED PUSH-UP DISTANCE CORRESPONDING TO THE MEASURED TEMPERATURE.</p> <p>(6) TAKE DOWN THE PRESSURE GRADUALLY.</p>	<p>IF THE CLASSIFICATION OF SHIP'S ADVISES THE CONDITION OF 0(ZERO) POINT, SHOULD BE TAKEN.</p> <p>TAKE DOWN THE OIL PRESSURE GRADUALLY AFTER SHUTTING OFF THE VALVE CONNECTION TO THE HYDRAULIC NUT.</p> <p>ALLOW THE PROPELLER TO SETTLE FOR A PERIOD OF 10 MINUTES.</p>

ITEM	SUMMARY	REMARKS
PUSH-UP	<p>(7) RELEASE THE RING PRESSURE OF HYDRAULIC NUT BY OPENING THE VALVE SLOWLY, DISCONNECT THE SUPPLY HOSE.</p> <p>(8) MAKE MARKING OF THE CIRCUMFERENTIAL DIRECTION OF THE TAIL SHAFT TO THE PROPELLER BOSS.</p> <p>(9) SCREW UP THE HYDRAULIC NUT AND SECURELY LOCK TO THE SHAFT.</p>	
DRAW-OUT	<p>(1) LOOSEN THE HYDRAULIC NUT AND PUT A WOODEN PIECE BETWEEN THE PROPELLER BOSS AND THE HYDRAULIC NUT.</p> <p>(2) SET OIL PRESSURE EQUIPMENT ON THE PROPELLER BOSS.</p> <p>(3) RAISE OIL PRESSURE INTO THE PROPELLER BOSS INTERFACE GRADUALLY.</p> <p>(4) AFTER DRAW-OUT, REMOVE THE HYDRAULIC NUT FROM TAIL SHAFT.</p>	<p>GAP IS TO BE APPROX. 40MM.</p> <p>REQUESTED OIL PRESSURE WILL BE ABOUT 10% HIGHER THAN INTERFACE PRESSURE AS SHOWN IN FITTING DIAGRAM CORRESPONDING TO THE TEMPERATURE.</p>

HYD. PIPING SYSTEM



1. HYDRAULIC POWER PUMP
2. FLEXIBLE HOSE
3. 3-WAY BRANCH WITH SHUT OFF VALVE
4. PRESSURE GAUGE
5. OIL
6. COUPLER
7. JOINT PLUG

```

*****
*
*          CALCULATION FOR PROPELLER FITTING
*
*          VERSION 4.0 / 1 JULY 2000
*
*****
*          JOB ID NO. : H-1009/10/11/12/31/32
*
*****
Shipyard      =      SAMJIN
Ship No.      =      H-1009/10/11/12/31/32
Propeller Maker =      SILLAMETAL

```

I. INPUT PARTICULARS

```

1. Material of Shaft      =      FORGED STEEL
2. Material of Boss      =      CU3
3. Output of Engine [MCR] =      10740.0 [PS]
4. Revolution at MCR     =      127.0 [rpm]
5. Ship Speed at MCR     =      15.2 [Kt]
6. Shaft Taper           =      1/20.0
7. Mean Dia. of Prop. Shaft (Ds) =      430.25[mm]
8. Mean Dia. of Propeller Boss (Dp) =      952.0 [mm]
9. Mean Dia. of Hollow Shaft (Di) =      0.0 [mm]
10. Boss Length          =      1150.0 [mm]
11. Contact Area between Shaft & Boss =      1463654.0 [mm2]
12. K1=Dp/Ds            =      2.2
13. K2=Di/Ds            =      0.0

```

** Remark : Friction Coef. = 0.13 for Dry/0.015 for Wet

II. OUTPUT

```

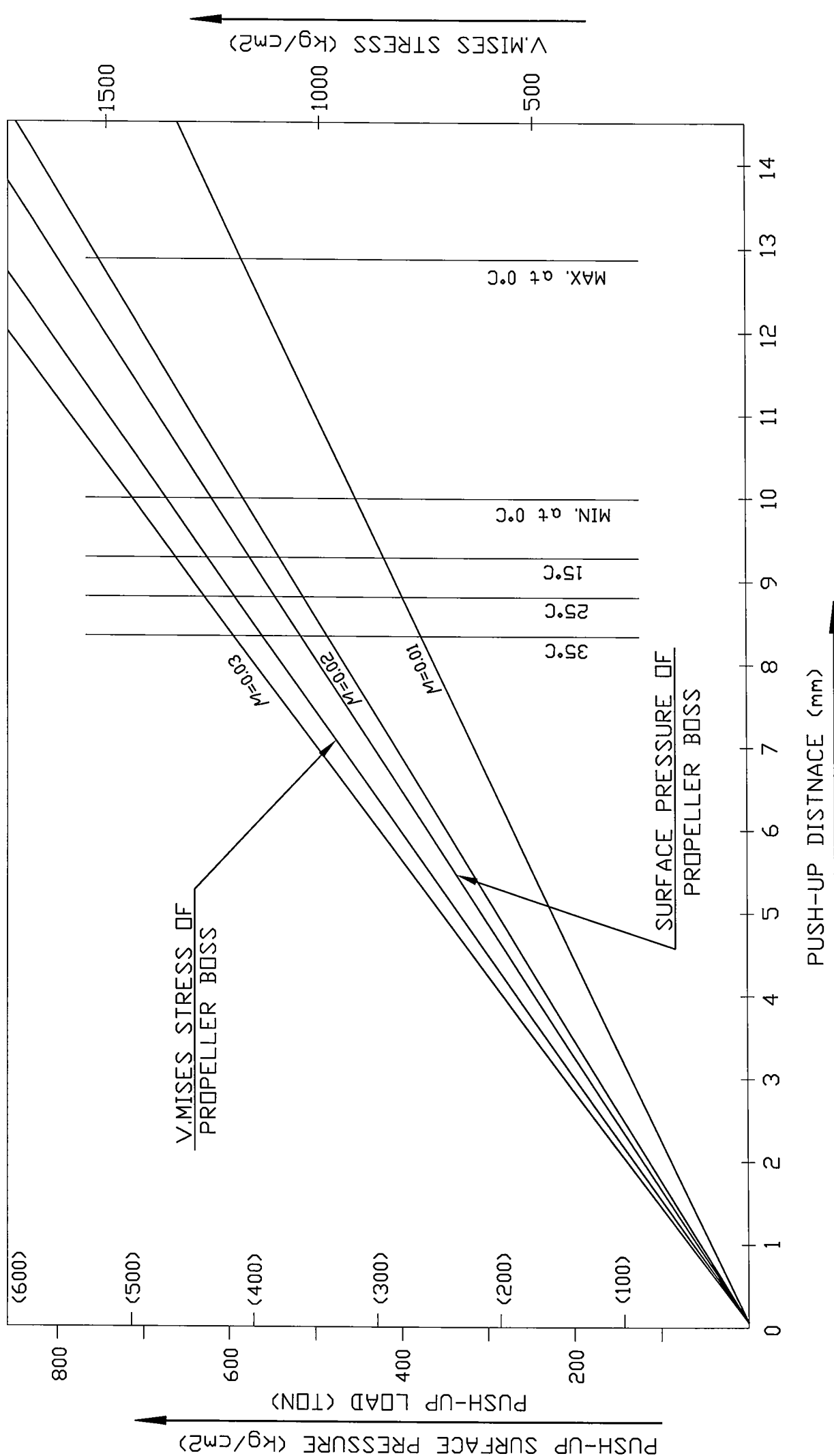
Min. Req. Surface Pressure at 35 deg.      =      5.17 [kg/mm2]
Max. Permissible Surface Pres. at 0 deg.    =      7.98 [kg/mm2]
Min. Pull-up Length at 35 deg.             =      8.34 [mm]
Max. Pull-up Length at 0 deg.              =      12.87 [mm]

```

Rated Thrust = 92778.0 [kgf] Shear Force = 337851.0 [kgf]

Temp. [C]	Travel. Length[mm]		Min. Surface P. [kgf/mm2]	Push-up Load[ton]	
	Min	Max		Dry	Wet
35.0	8.34	11.21	5.17	1172.9	302.7
30.0	8.57	11.45	5.32	1206.2	311.3
25.0	8.81	11.68	5.46	1239.5	319.9
20.0	9.05	11.92	5.61	1272.8	328.5
15.0	9.28	12.16	5.76	1306.1	337.1
10.0	9.52	12.39	5.90	1339.4	345.6
5.0	9.76	12.63	6.05	1372.6	354.2
0.0	9.99	12.87	6.20	1405.9	362.8

FITTING DIAGRAM (H-1009/10/11/12/31/32)



Design Calculation of Keyless Bore Propeller (Wet Type)

1. Intruduction

This design calculation was carried out in accordance with numerical analysis method for WET TYPE Keyless bore propeller.

2. Calculations according to Numerical analysis method

The design should be complied with factor of safety , two point eight (2.8) times.

The factor of safety shall be given at full power against slipping of the propeller boss on the shaft for ahead condition at 35 °C which is assumed to be the working temperature.

The stress condition is determined for 0 °C assumed for the purpose of the calculation to be the working temperature.

As the results, push-up distances and stresses where calculated by using computer as follows.

2-1) In-put data for Computer

(1) Particulars

Break Horse Power	BHP	10740.0
Revolution og Propeller	rpm	127.0
Diameter of propeller shaft	mm	460.00
Diameter of propeller	mm	5600.00
Taper of the bore		1 : 20
Factor of Safety at 35 °C		2.80
Coefficient of Friction		0.13
Diameter of tail shaft at the midpoint of taper	mm	430.25
Mean diameter of propeller boss	mm	952.00

(2) Propeller

Material	CU3	Ni-Al-Br
Ultimate Tensile Strength	kgf/mm ²	60.00
Yield Stress	kgf/mm ²	25.00
Elongation	%	16.00
Modulus of elasticity	kgf/mm ²	12000
Poisson's Ratio		0.33
Coefficient of linear expansion (x 10 ⁻⁶)	mm/mm °C	17.50

(3) Shaft

Material		Forged steel
Ultimate Tensile Strength	kgf/mm ²	60.00
Yield Stress	kgf/mm ²	31.00
Elongation	%	18.00
Modulus of elasticity	kgf/mm ²	21000
Poisson's Ratio		0.29
Coefficient of linear expansion (x 10 ⁻⁶)	mm/mm °C	12.00

2-2) Out-put data from computer

Push-up distance – Surface Pressure

Temp.	0 °C	35 °C	unit
δt	9.99	8.34	(mm)
Pt	6.20	5.17	(kgf/mm ²)

Max. stress (V.Mises)

Temp.	0 °C	35 °C	unit
f h	9.38	7.82	(kgf/mm ²)
f r	3.18	2.65	(kgf/mm ²)
f v	13.59	11.33	(kgf/mm ²)

Nomenclature

δt = Push-up distance

Pt = Interface pressure of Boss / Shaft

f h = Hoop Stress

$$= Pt \cdot (Ds^2 + Db^2) / (Db^2 - Ds^2)$$

f r = Radial Stress

$$= 2 \cdot Pt \cdot Ds^2 / (Db^2 - Ds^2)$$

f v = V. Mises Stress

$$= \text{SQRT}(f h^2 + f h \times Pt + Pt^2)$$

3. Results

- V.Mises is the computation of the " Von Mises Equivalent" uniaxial stress.
- The max. equivalent uniaxial stress in the boss bore based on "V.Mises" Criterion at the greatest interference fits of the assembly should not exceed 70 percents of the yield stress for propeller material ($25.0 \times 0.70 = 17.5 \text{ kgf/mm}^2$).
- The value of "V.Mises" is **13.59 kgf/mm²** as above table.
- Therefore, the result of the computer calculations are sufficiently satisfied with the numerical analysis.

BIBLIOGRAPHY

KIND OF SHIP

33,500 DWT LOG / BULK CARRIER

OWNER

HULL NO.

H-1009/10/11/12/31/32

KR

SHIPYARD

SAMJIN SHIPBUILDING INDUSTRIES
CO., LTD.

HYD. NUT

SIL LA METAL CO., LTD.**DESIGN DEPT.**# 1489-2, Songjung-Dong, Gangseo-Gu,
BUSAN, KOREA

Phone : (051) 831 - 5991 ~ 8

F a x : (051) 831 - 5990

MANAGER

CHIEF OF SEC.

EXAMINED BY

DRAWN BY

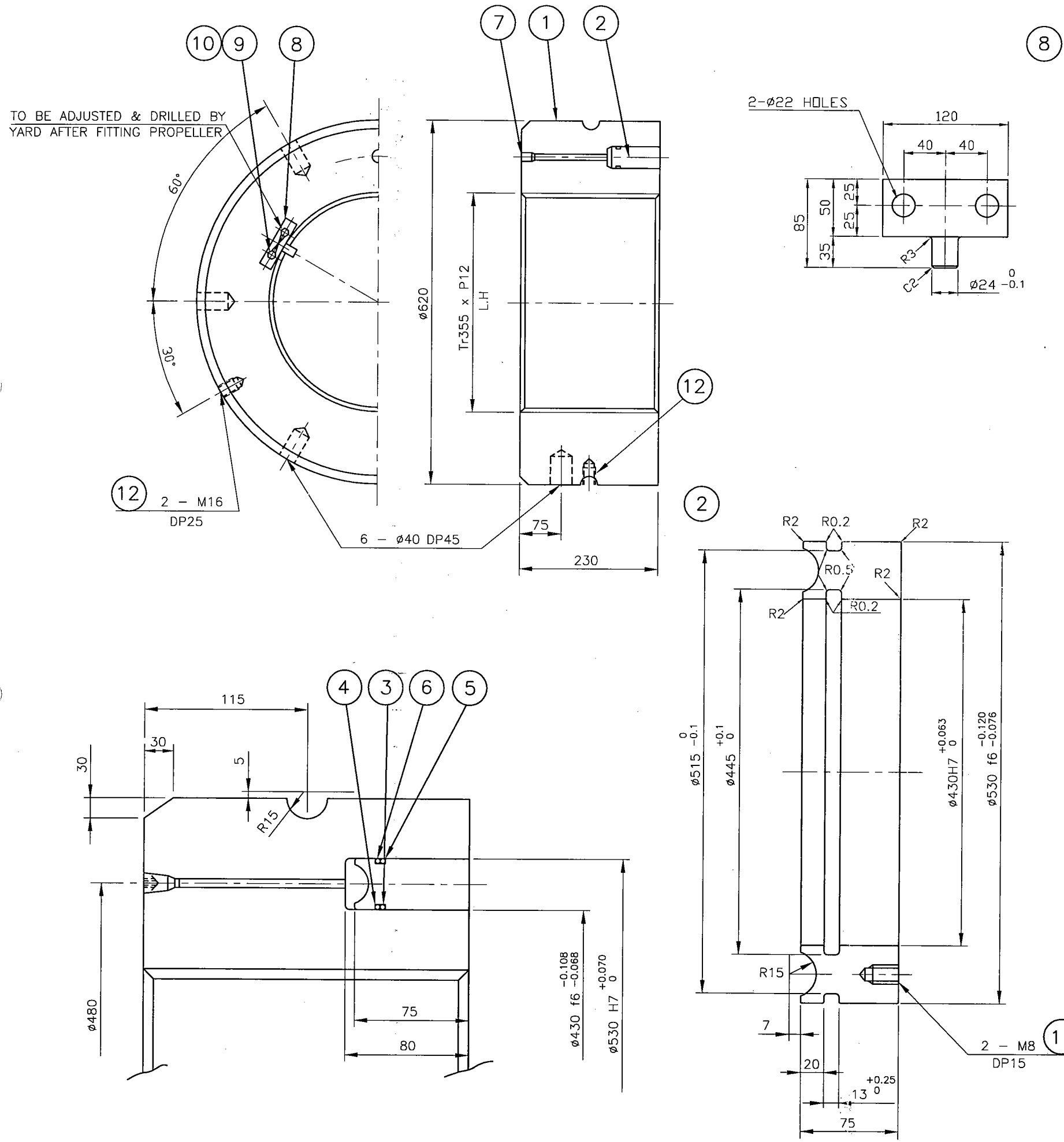
J. Y. LEE

DATE

2008. 11.

DRAWING NO.

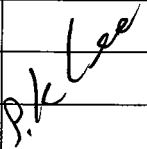

08 - S - 19



STRENGTH OF NUT

MAX. PRESSURE	:	900 kg/cm ²
RAM AREA	:	754.0 cm ²
MAX. THRUST POWER	:	678.6 TON
STROKE	:	18 MM
WEIGHT	:	360 KG

1. OIL : MOBIL OIL DTE LIGHT OR EQUIVALENT.

12	EYE BOLT	SS41	2		JIS B1168 M16	
11	EYE BOLT	SS41	2		JIS B1168 M8	
10	WIRE	SWRM3	1		ø2.6 x 300 ^l	
9	WIRING BOLT ø3 HOLES	SS41	2		M20 x 55 ^l	
8	LOCKING PLATE	SS41	1			
7	PLUG	C2700BD	1		PT 3/8	
6	"O" — RING	NBR	1		JIS B 2401 ø515 x ø8.4	
5	BACK—UP RING	SYNTHETIC RESIN	1		JIS B 2407 T2.75 P515	
4	"O" — RING	NBR	1		JIS B 2401 ø430 x ø8.4	
3	BACK—UP RING	SYNTHETIC RESIN	1		JIS B 2407 T2.75 P430	
2	LOADING RING	SF590A	1	45 kg	T.S (JIS G 3201) MIN590N/mm2	
1	NUT BODY	SF590A	1	315 kg	T.S (JIS G 3201) MIN590N/mm2	
NO	DESCRIPTION	MATERIAL	Q'TY	WEIGHT	REMARK	
APP.BY		SAMJIN SHIPBUILDING INDUSTRIES CO.,LTD. 33,500 DWT LOG / BULK CARRIER H-1003/10/11/12/31/32 HYD. NUT			CLASS	
SUB.BY					K R	
CHK.BY					DWG.NO	
DWG.BY					J.Y.LEE	08-S-19-01
SCALE					NONE	ALT.NO
DATE					2008. 11	
					BUSAN KOREA	

TOOLS

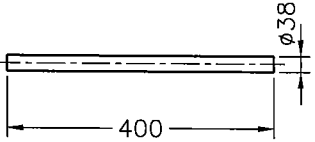
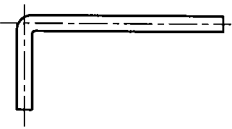
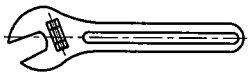
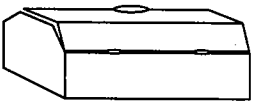
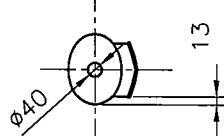
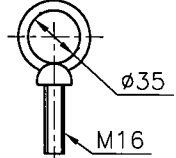
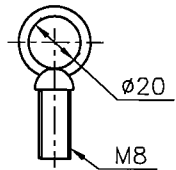
LIST OF TOOLS FOR HYD.NUT

PAGE

27/30

SHIP No.

H-1009/10/11/12
31/32

No.	NAME	SKETCH	MATERIAL	WORK-ING	SPARE	DRAWING No.	REMARK
1.	BAR SPANNER		SS41	2			FOR NUT BODY
2.	SOCKET HEAD SPANNER		STEEL	1			FOR PT 3/8 PLUG
3.	MONKEY WRENCH		STEEL	1			
4.	STEEL TOOL BOX WITH KEY&LOCKER		STEEL	1			
5.	TAPE SEAL		PTFE	1			
6.	EYE BOLT		SS41	2			FOR NUT BODY
7.	EYE BOLT		SS41	2			FOR LOADING RING
8.							

SIL LA METAL CO., LTD.

SPARES

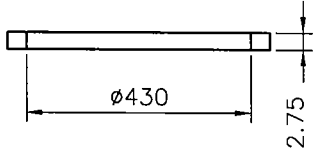
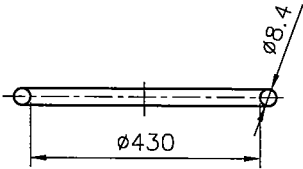
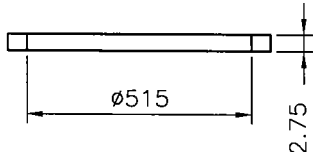
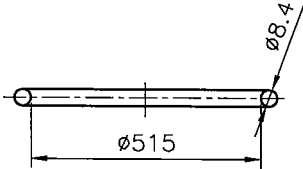
LIST OF SPARES FOR HYD NUT

PAGE

28/30

SHIP No.

H-1009/10/11/12
31/32

No.	NAME	SKETCH	MATERIAL	WORK -ING	SPARE	DRAWING No.	REMARK
1.	BACK UP RING		PTEE	1	1		
2.	O - RING		NBR	1	1		
3.	BACK UP RING		PTEE	1	1		
4.	O - RING		NBR	1	1		

SIL LA METAL CO., LTD.

ACCESSORIES

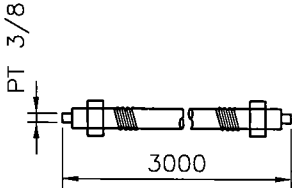
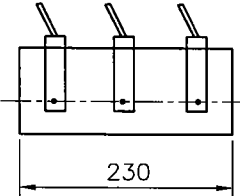
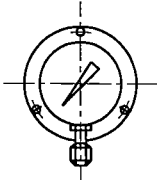
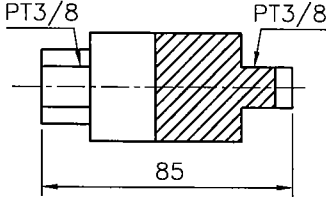
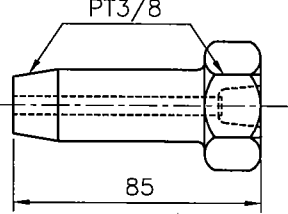
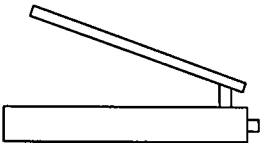
LIST OF ACCESSORIES FOR HYD. NUT

PAGE

29/30

SHIP No.

H-1009/10/11/12
31/32

No.	NAME	SKETCH	MATERIAL	WORK -ING	SPARE	DRAWING No.	REMARK
1.	FLEXIBLE HOSE			4			
2.	3WAY BRANCH WITH SHUT OFF VALVE			1			
3.	PIPE LINE PRESSURE GAUGE			1			SCALE 1000 Kg/cm ²
4.	COUPLER			4			
5.	JOINT PLUG		SUS304	2			
6.	HYDRAURIC POWER PUMP			1			

SIL LA METAL CO., LTD.

TOOLS

LIST OF TOOLS FOR SHAFTING

PAGE

30/30

SHIP No.

H-1009/10/11/12
31/32

[illegible]