




图纸 分发			
分发处		分发数	
汉字	ENGLISH	FW	FC
综合设计	Integrated Design Division	1	
船体构造设计	Hull Structure Team		
船体生产设计	Hull Production Team		
船装设计	Hull Outfitting Design		
船室设计	Accommodation Design		
机装详细设计	Machinery Detail Design		
机装生产设计	Machinery Production Design		
电装设计	Electrical Design		
先行舾装	Preoutfitting Division		2
E/R 舾装	E/R Outfitting		2
船室生产	Accommodation Production		
试航部	Trial Cruise Division		1
采购管理 2	Procurement Team 2		
品质经营	Quality Assurance		2
品质物流(镇海)	Logistics Team (Jinhae)		
轴舵设计(保管)	Shaft & Rudder Design	1	1
合计 (Total)		2	8
<input type="checkbox"/>	For Working		
<input type="checkbox"/>	For Construction		
<input type="checkbox"/>	For Revision		

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HULL NO. 1009~1012, 1031~1032	PROJECT TPC KOREA 33,5K DWT LOG / BULK CARRIER		
APPD BY M. Y Park	TITLE CALCULATION OF TORSIONAL VIBRATION		
CHKD BY J. S Lee			
DWN BY J. H Park (Ext. : 0226)	TEL +86> 0631-538-0204	TOTAL 21 SHEET(S) WITH COVER	
 Samjin Shipbuilding Industries Co.,Ltd.	DEPT RUDDER & SHAFT DESIGN TEAM	DWG NO. RT300M710	SCALE AS SHOWN
		DATE Oct. 08. 2008	REV. NO. 0

PLAN HISTORY					
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
0	2008. 10. 07.	ISSUED & SUBMITTED TO CLASS	H.J. KIM	-	Y.P.KOO
NO. OF PAGES (INCL. COVER) : 19					
YARD	SAMJIN SHIPBUILDING		HULL NO.	H1009/10/11/12/31/32	
VESSEL TYPE	33.5K LOG/BULK CARRIER		CLASS	KR	
PLANT	5S50MC-C MAIN PROPULSION				
APPRD : Y.P.KOO		TITLE : <div style="text-align: center;"> <h2>CALCULATION OF TORSIONAL VIBRATION</h2> </div>			
CHKED : -					
DRAWN : H. J. KIM					
DATE : 2008. 10. 07.					
STX Heavy Industries Co., Ltd. Startower 10F, 73-37, Yongho-dong, Changwon Gyeongsangnam-do, Korea Post. 641-842 Tel: +82-55-278-9489 Fax: +82-55-284-2190			DOCUMENT NO. <div style="text-align: center;"> <h2>TV-0821-LB395</h2> </div>		

PLANT INFORMATION

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1. ENGINE
   MODEL                : 5S50MC-C
   POWER AT MCR (KW)    : 7900.00
   SPEED AT MCR (RPM)   : 127.00

   1.1 CRANK SHAFT      : FSB 242456 / SOLID CRANKPIN
   1.2 VIBRATION DAMPER : N/A
   1.3 TUNING WHEEL     : M.O.I. = 11980.0 KGM2
   1.4 TURNING WHEEL    : M.O.I. = 10000.0 KGM2

2. SHAFTING & PROPELLER
   MANUFACTURER         :
   GENERAL ARRANGEMENT DRAWING :

   2.1 INTER. SHAFT     : D 390.0 / 0.0, UTS = MIN. 590 N/MM2
   2.2 PROPE. SHAFT     : D 460.0 / 0.0, UTS = MIN. 590 N/MM2
   2.3 PROPELLER        : 4-BLADE F.P.PROPELLER
                        : M.O.I. (IN WATER) = 25419.7 KGM2
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OPERATING CONDITIONS

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1. NORMAL FIRING          : PAGE 1 - 11
2. MISFIRING CYL. NO. 5   : PAGE 12 - 18
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CONCLUSION

THERE HAS BEEN FOUND SATISFACTORY TORSIONAL VIBRATION BEHAVIOUR IN BOTH NORMAL AND ONE CYLINDER MISFIRING CONDITION.

MAXIMUM VIBRATORY STRESSES IN THE CRANKSHAFT NEVER EXCEEDS MAN DIESEL CRANKSHAFT LIMITS.

MAXIMUM VIBRATORY STRESSES IN THE INTERMEDIATE AND PROPELLER SHAFT ARE BELOW THE RULE GUIDE LINES.

RESTRICTIONS :

BARRED SPEED RANGE (58 ~ 70 RPM) SHOULD BE PROVIDED AGAINST 1 - 5.0 ORDER UNDER NORMAL AND ONE CYLINDER MISFIRING OPERATION.

IN CASE OF ONE CYLINDER MISFIRING OPERATION THE ENGINE SPEED SHOULD NOT EXCEED 98 RPM (77% OF MCR) IN ORDER TO AVOID THE 3.0 ORDER RESONANCE AND THERMAL OVERLOADING OF THE WORKING CYLINDERS.

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PARTICULARS OF SYSTEM

DESCRIPTION ON SYSTEM

ENGINE : 5S50MC-C : TURNWHL(J=10000.0KGM2) : TUNWHL(J=11980.0KGM2)
 PROPELLER : 4BLADE-FPP : : J(WTR)=25419.7KGM2

ENGINE

MODEL	:	5S50MC-C
2 OR 4 STROKE	:	2.00
ANGLE BETWEEN BANKS	(DEG) :	0.00
OUTPUT AT MCR	(KW) :	7900.00
SPEED AT MCR	(RPM) :	127.00
BORE	(MM) :	500.00
STROKE	(MM) :	2000.00
NO. OF CYLINDER	:	5.00
RECIPROCATING WEIGHT	(KG) :	2721.00
CON-ROD LENGTH	(MM) :	2050.00

DATA FOR MASS ELEMENTS :

MASS NO	NODE NO	DESCRIPTION	RPM RATIO	MASS MOMENT OF INERTIA (KGM2)	DAMPING COEFF (NMS/RAD)	FIRING ANGLE (DEG)	CODE
1	1	TUNWHL+FL	1.000	12080.000	0.000		0
2	2	CYL 1	1.000	4368.000	-58.800	0.0	1
3	3	CYL 2	1.000	4368.000	-58.800	216.0	1
4	4	CYL 3	1.000	4368.000	-58.800	144.0	1
5	5	CYL 4	1.000	4368.000	-58.800	72.0	1
6	6	CYL 5	1.000	4368.000	-58.800	288.0	1
7	7	CAMDRV+MOM.C	1.000	2028.000	-58.800		0
8	8	TURNWHEEL	1.000	10101.600	-100.000		0
9	9	FLANGE	1.000	192.400	0.000		0
10	10	PROPELLER	1.000	25512.100	0.000		4

DATA FOR SHAFT ELEMENTS :

SHAFT NO	NODES	DESCRIPTION	RPM RATIO	TORSIONAL STIFFNESS (MNM/RAD)	DAMPING COEFF (NMS/RAD)	SHAFT DIA (MM)	CODE
1	1 2	CRANK S	1.000	866.551	-100.000	599.9	2
2	2 3	CRANK S	1.000	801.282	-50.000	599.9	1
3	3 4	CRANK S	1.000	791.139	-50.000	599.9	1
4	4 5	CRANK S	1.000	784.929	-50.000	599.9	1
5	5 6	CRANK S	1.000	835.422	-50.000	599.9	1
6	6 7	CRANK S	1.000	1106.195	-100.000	599.9	2
7	7 8	CRANK S	1.000	1626.016	0.000	599.9	3
8	8 9	INTER S	1.000	27.098	0.000	390.0	4
9	9 10	PROP S	1.000	65.099	0.000	460.0	5

NOTE : DAMPINGS WITH NEGATIVE SIGN ARE DYNAMIC MAGNIFIERS.
THE MASS DAMPING FOR THE PROPELLER IS DEPENDENT ON
THE PROPELLER REVOLUTION.

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STX HEAVY INDUSTRIES CO., LTD.
TORSIONAL VIBRATION CALCULATION

Docu. NO. : TV-0821-LB395
DATE : 2008. 10. 07

REV. : 0
PAGE : 4 / 18

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NATURAL FREQUENCIES & MODE SHAPES

MODE NO	1	2	3
FREQUENCY (CPM)	318.6	1308.4	2824.4

MASS NO	MODE SHAPES		
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1	-0.6081	-0.9315	-0.5074
2	-0.5987	-0.6878	0.1114
3	-0.5849	-0.3537	0.7274
4	-0.5672	0.0212	1.0000
5	-0.5460	0.3970	0.7879
6	-0.5228	0.7110	0.2283
7	-0.5030	0.8955	-0.2732
8	-0.4889	1.0000	-0.5846
9	0.5637	0.2742	-0.2049
10	1.0000	-0.0431	0.0062

MODE NO	1	2	3
FREQUENCY (CPM)	318.6	1308.4	2824.4

SHAFT NO	INERTIA TORQUE (KNM)		
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1	-0.818E+04	-0.211E+06	-0.536E+06
2	-0.111E+05	-0.268E+06	-0.494E+06
3	-0.139E+05	-0.297E+06	-0.216E+06
4	-0.167E+05	-0.295E+06	0.166E+06
5	-0.193E+05	-0.262E+06	0.468E+06
6	-0.219E+05	-0.204E+06	0.555E+06
7	-0.230E+05	-0.170E+06	0.506E+06
8	-0.285E+05	0.197E+05	-0.103E+05
9	-0.284E+05	0.207E+05	-0.137E+05

RESONANCE ENGINE SPEED & VECTOR SUMMATION

		NATURAL FREQUENCY (CPM)					
ORDER	*	318.6		1308.4		2824.4	

1.0	*	319/	0.020	1308/	0.154	2824/	1.194
2.0	*	159/	0.159	654/	2.492	1412/	0.190
3.0	*	106/	0.159	436/	2.492	941/	0.190
4.0	*	80/	0.020	327/	0.154	706/	1.194
5.0	*	64/	4.710	262/	0.123	565/	2.855
6.0	*	53/	0.020	218/	0.154	471/	1.194
7.0	*	46/	0.159	187/	2.492	403/	0.190
8.0	*	40/	0.159	164/	2.492	353/	0.190
9.0	*	35/	0.020	145/	0.154	314/	1.194
10.0	*	32/	4.710	131/	0.123	282/	2.855
11.0	*	29/	0.020	119/	0.154	257/	1.194
12.0	*	27/	0.159	109/	2.492	235/	0.190
13.0	*	25/	0.159	101/	2.492	217/	0.190
14.0	*	23/	0.020	93/	0.154	202/	1.193
15.0	*	21/	4.710	87/	0.123	188/	2.855
16.0	*	20/	0.020	82/	0.154	177/	1.194
17.0	*	19/	0.159	77/	2.492	166/	0.190
18.0	*	18/	0.159	73/	2.492	157/	0.190
19.0	*	17/	0.020	69/	0.154	149/	1.193
20.0	*	16/	4.710	65/	0.123	141/	2.855

DATA OF MAX SYNTHESIS STRESS
 STRESS VALUE : 109.9 N/MM2
 SPEED : 63.7 RPM
 SHAFT NO. : 8

TABLE OF MAX TORSIONAL STRESS SYNTHESIS (N/MM2)

SHAFT NO.										
RPM	*	1	2	3	4	5	6	7	8	9
20	*	0.6	4.3	4.1	4.2	4.0	2.3	2.2	6.1	3.7
22	*	0.6	4.4	4.2	4.4	4.2	2.5	2.5	7.2	4.3
24	*	0.6	4.4	4.2	4.3	4.2	2.6	2.5	7.2	4.4
26	*	0.6	4.4	4.3	4.4	4.3	2.7	2.6	7.9	4.8
28	*	0.6	4.5	4.4	4.5	4.4	2.9	2.9	8.9	5.4
30	*	0.8	4.6	4.6	4.8	4.9	3.5	3.4	11.8	7.1
32	*	1.4	5.3	5.5	5.9	6.1	4.0	4.1	16.0	9.7
34	*	1.1	4.9	4.9	5.1	5.2	3.3	3.2	11.6	7.0
36	*	0.9	4.8	4.8	5.0	5.0	3.1	3.1	10.3	6.2
38	*	0.8	4.9	4.9	5.1	5.0	3.3	3.2	10.5	6.4
40	*	0.8	5.0	5.0	5.1	5.0	3.5	3.4	11.6	7.0
42	*	0.7	5.1	5.1	5.2	5.2	3.7	3.6	12.3	7.4
44	*	0.7	5.2	5.3	5.4	5.5	4.0	4.0	13.6	8.3
46	*	0.6	5.3	5.4	5.8	5.8	4.4	4.3	15.1	9.2
48	*	0.5	5.5	5.6	6.1	6.1	4.6	4.6	16.2	9.8
50	*	0.5	5.8	6.0	6.5	6.7	5.1	5.1	18.3	11.1
52	*	0.6	6.2	6.4	7.0	7.4	5.8	5.8	21.3	12.9
54	*	0.7	6.6	7.0	7.7	8.3	6.7	6.8	25.7	15.6
56	*	1.2	7.3	7.9	8.7	9.5	8.0	8.2	32.0	19.4
58	*	2.0	8.3	9.2	10.3	11.5	10.2	10.4	42.4	25.7
60	*	3.6	10.0	11.4	13.0	14.7	13.9	14.4	60.4	36.6
62	*	6.5	12.8	15.3	17.6	20.3	20.2	21.1	91.9	55.7
64	*	9.1	15.0	17.4	20.1	22.9	22.6	23.8	108.4	65.8
66	*	7.7	12.5	14.3	16.3	18.6	15.2	16.2	77.3	46.9
68	*	6.2	10.3	11.5	12.8	14.6	9.8	10.6	53.0	32.2
70	*	5.4	9.2	10.1	10.9	12.3	7.0	7.6	39.4	23.9
72	*	5.5	9.0	9.7	10.5	11.5	5.9	6.3	31.5	19.2
74	*	5.2	8.8	8.8	9.3	9.7	4.7	5.0	26.2	16.0
76	*	5.2	8.9	8.8	9.7	10.0	4.2	4.5	22.8	13.9
78	*	4.8	8.0	8.4	8.9	9.8	3.5	3.8	20.5	12.5

DATA OF MAX SYNTHESIS STRESS
 STRESS VALUE : 109.9 N/MM2
 SPEED : 63.7 RPM
 SHAFT NO. : 8

TABLE OF MAX TORSIONAL STRESS SYNTHESIS (N/MM2)

SHAFT NO.										
RPM	*	1	2	3	4	5	6	7	8	9

80	*	4.2	7.6	7.5	7.8	8.7	2.4	2.8	18.2	11.1
82	*	4.0	7.6	7.2	7.6	8.4	1.9	2.3	16.5	10.0
84	*	4.0	7.7	7.1	7.6	8.3	1.5	1.9	15.3	9.3
86	*	4.1	7.8	7.2	7.6	8.3	1.3	1.6	14.3	8.7
88	*	4.2	8.1	7.3	7.7	8.5	1.1	1.4	13.5	8.2
90	*	4.2	8.3	7.3	7.7	8.8	1.0	1.3	12.9	7.8
92	*	4.4	8.7	7.7	7.7	9.1	1.4	1.2	12.4	7.6
94	*	4.5	9.2	8.1	8.1	9.4	1.6	1.4	12.0	7.3
96	*	4.9	9.6	8.5	8.6	10.1	2.0	1.5	11.8	7.2
98	*	5.5	10.5	9.4	9.6	11.1	2.9	2.2	11.8	7.2
100	*	7.4	13.0	12.3	12.5	13.7	4.5	3.6	12.1	7.4
102	*	7.0	13.2	11.9	12.3	12.8	4.1	3.1	11.6	7.1
104	*	6.2	12.3	10.8	11.1	12.0	3.6	2.7	12.8	7.8
106	*	6.4	12.8	11.2	11.0	12.7	4.0	3.1	13.4	8.2
108	*	7.8	14.4	13.8	13.1	14.8	5.6	4.5	13.2	8.1
110	*	8.2	14.3	14.6	12.2	14.8	5.7	4.6	12.7	7.7
112	*	6.8	13.4	12.3	10.3	12.5	4.3	3.2	12.0	7.3
114	*	6.3	13.4	11.7	10.1	12.3	3.8	2.9	11.4	7.0
116	*	6.1	13.6	11.6	10.4	12.5	3.6	2.7	11.0	6.7
118	*	6.2	13.8	11.7	10.5	13.2	3.6	2.7	10.6	6.5
120	*	6.3	14.0	11.7	10.9	13.9	3.7	2.8	10.3	6.3
122	*	6.3	14.2	12.0	11.5	14.2	3.9	2.9	10.0	6.1
124	*	6.5	14.6	12.4	11.9	14.5	4.1	3.1	9.9	6.0
126	*	6.7	15.0	12.7	12.4	15.1	4.2	3.2	9.8	6.0
128	*	6.9	15.2	12.8	12.5	15.4	4.4	3.4	9.5	5.8
130	*	7.1	15.2	12.7	12.4	15.5	4.6	3.6	9.1	5.6
132	*	7.1	15.2	12.3	12.1	15.7	5.1	4.0	8.7	5.4
134	*	7.3	15.3	12.3	12.0	15.7	5.4	4.2	8.4	5.1
136	*	7.7	15.6	12.3	11.9	15.9	5.8	4.5	8.1	5.0
138	*	8.2	16.0	12.4	11.8	16.1	6.4	5.1	7.8	4.8
140	*	9.1	16.9	12.5	11.6	16.4	7.4	6.0	7.5	4.6

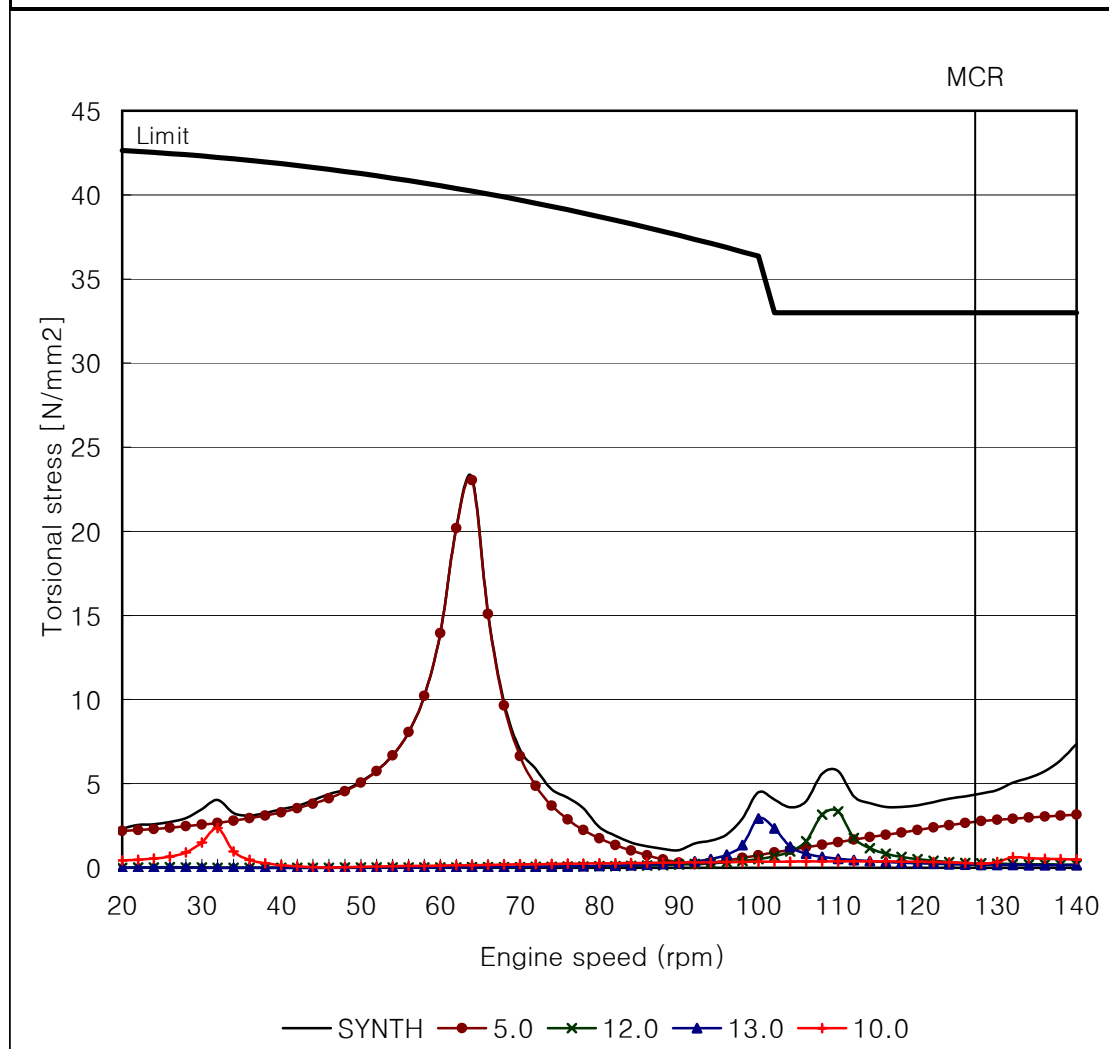
VALUES WITH NEGATIVE SIGN ARE VIBRATORY TORQUES IN (KNM).

Engine type : 5S50MC-C
Rating at MCR : 7900 kW x 127 rpm
Firing condition : Normal firing

Tuning wheel : 11980 kgm²
Turning wheel : 10000 kgm²
Gas harmonics : 242503

BARRED SPEED RANGE : 58 ~ 70 RPM

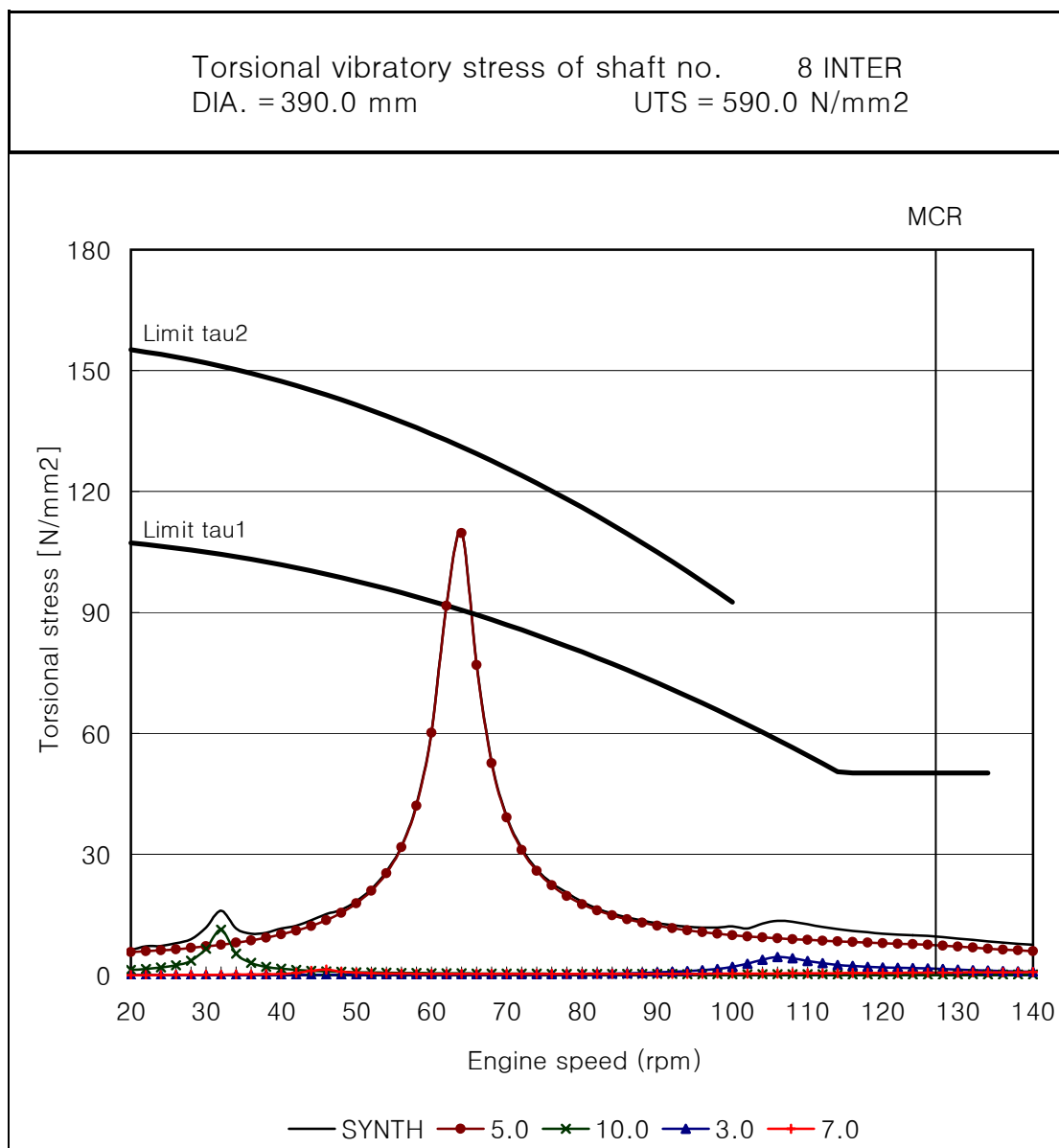
Torsional vibratory stress of shaft no. 6 CRANK
DIA. = 599.9 mm UTS = 610.0 N/mm²



Limit : MAN Diesel Crankshaft Limits
Crankshaft : FSB 242456 / SOLID CRANK PIN

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: Normal firing	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM

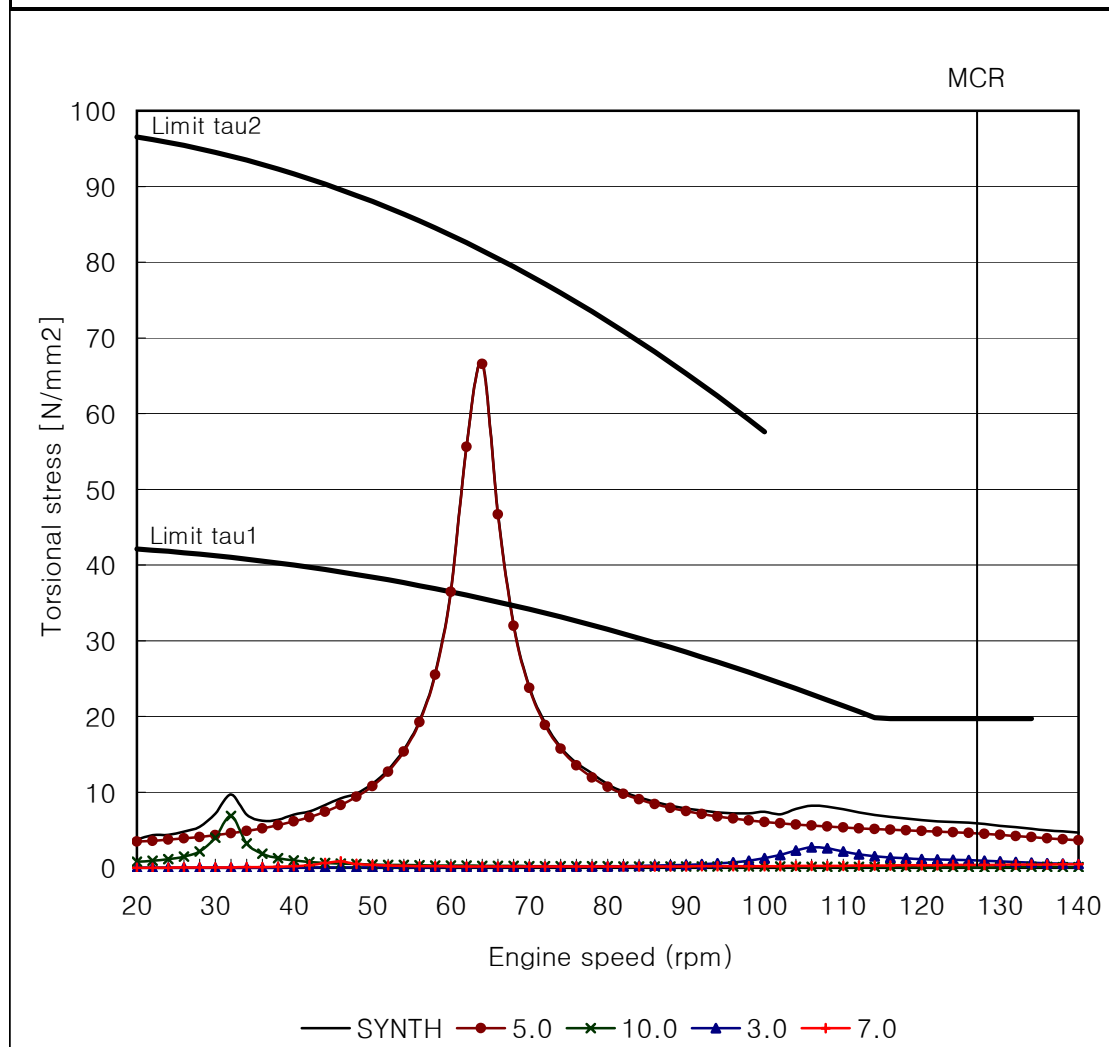


Limit tau1 : Limit for continuous operation with 1.38 Ck factor [Multi-Radius]
Limit tau2 : Limit for transient operation

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: Normal firing	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM

Torsional vibratory stress of shaft no. 9 PROP
DIA. = 460.0 mm UTS = 590.0 N/mm²

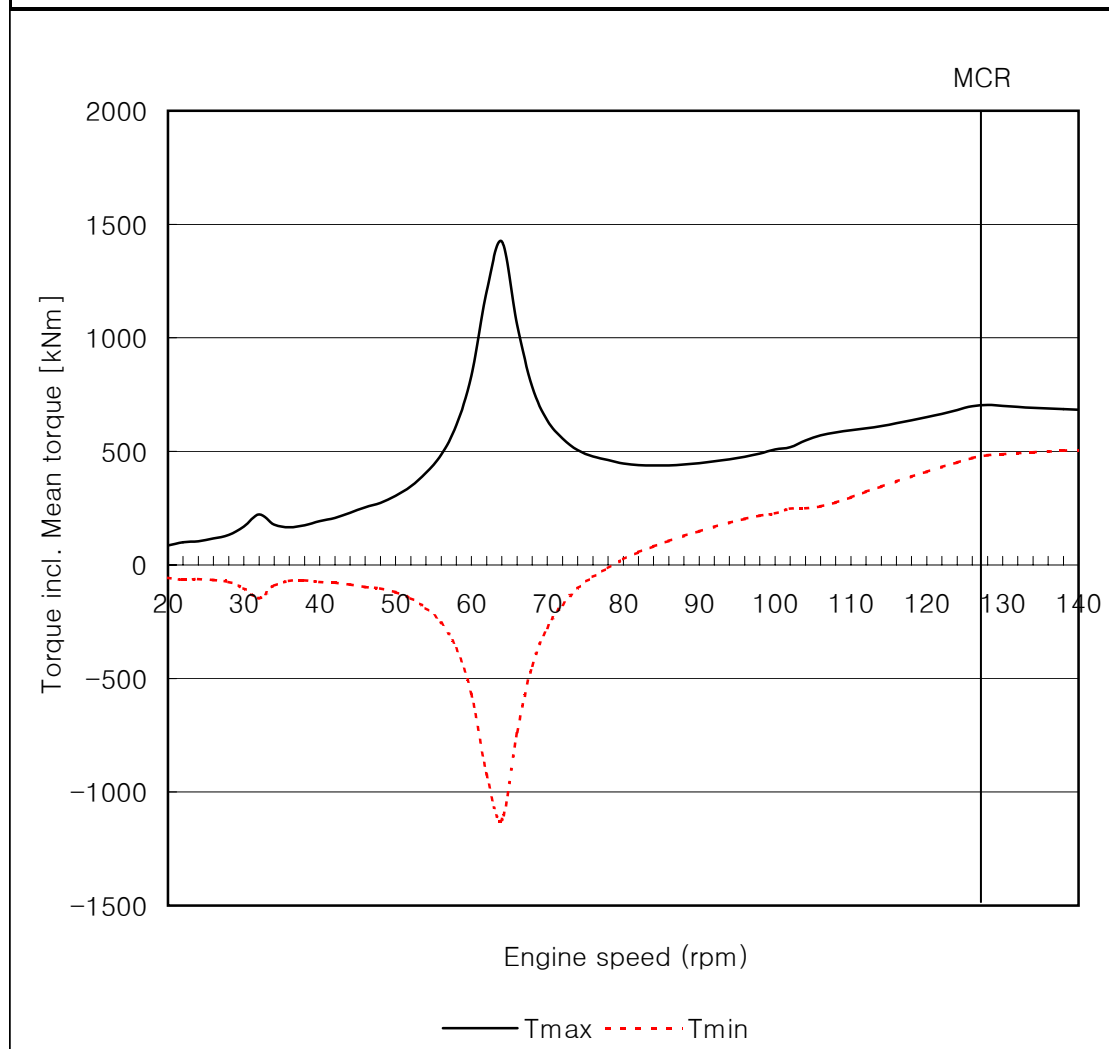


Limit tau1 : Limit for continuous operation with 0.55 Ck factor
Limit tau2 : Limit for transient operation

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: Normal firing	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM

Max and Min torque incl. Mean troque of shaft no. 9 PROP



58 RPM	:	615 kNm
64 RPM	:	1425 kNm
70 RPM	:	638 kNm

RESONANCE ENGINE SPEED & VECTOR SUMMATION

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              NATURAL FREQUENCY (CPM)
ORDER *      318.6      1308.4      2824.4
*****
1.0 *      319/ 0.893   1308/ 0.938   2824/ 1.384
2.0 *      159/ 1.026    654/ 1.573   1412/ 0.204
3.0 *      106/ 1.026    436/ 1.573    941/ 0.204
4.0 *       80/ 0.893    327/ 0.938    706/ 1.384
5.0 *       64/ 3.836    262/ 0.877    565/ 2.627
6.0 *       53/ 0.893    218/ 0.938    471/ 1.384
7.0 *       46/ 1.026    187/ 1.573    403/ 0.204
8.0 *       40/ 1.026    164/ 1.573    353/ 0.204
9.0 *       35/ 0.893    145/ 0.938    314/ 1.384
10.0 *      32/ 3.836    131/ 0.877    282/ 2.627
11.0 *      29/ 0.893    119/ 0.938    257/ 1.384
12.0 *      27/ 1.026    109/ 1.573    235/ 0.204
13.0 *      25/ 1.026    101/ 1.573    217/ 0.204
14.0 *      23/ 0.893     93/ 0.938    202/ 1.384
15.0 *      21/ 3.836     87/ 0.877    188/ 2.627
16.0 *      20/ 0.893     82/ 0.938    177/ 1.384
17.0 *      19/ 1.026     77/ 1.573    166/ 0.204
18.0 *      18/ 1.026     73/ 1.573    157/ 0.204
19.0 *      17/ 0.893     69/ 0.938    149/ 1.384
20.0 *      16/ 3.836     65/ 0.877    141/ 2.627

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DATA OF MAX SYNTHESIS STRESS
 STRESS VALUE : 116.9 N/MM2
 SPEED : 63.7 RPM
 SHAFT NO. : 8

TABLE OF MAX TORSIONAL STRESS SYNTHESIS (N/MM2)

SHAFT NO.										
RPM	*	1	2	3	4	5	6	7	8	9

20	*	0.8	4.3	4.3	4.4	3.9	2.7	2.6	7.4	4.5
22	*	0.8	4.5	4.5	4.6	4.1	2.9	2.8	7.9	4.8
24	*	0.8	4.6	4.6	4.5	4.1	2.9	2.8	7.9	4.8
26	*	0.7	4.6	4.6	4.7	4.3	3.2	3.1	9.1	5.5
28	*	0.8	4.7	4.6	4.7	4.5	3.6	3.5	10.8	6.5
30	*	1.0	4.9	4.9	5.1	5.0	4.1	4.0	13.6	8.2
32	*	1.4	5.3	5.9	6.2	5.8	4.6	4.6	17.2	10.4
34	*	1.1	5.0	5.4	5.6	4.9	3.8	3.7	12.8	7.8
36	*	1.1	5.0	5.4	5.5	4.6	3.5	3.5	12.3	7.5
38	*	1.1	5.1	5.4	5.6	4.8	3.7	3.6	12.9	7.8
40	*	1.1	5.1	5.7	5.4	4.8	4.3	4.2	15.3	9.3
42	*	1.0	5.2	5.8	5.5	4.9	4.3	4.2	14.9	9.0
44	*	1.1	5.2	5.9	6.0	5.5	4.8	4.7	16.4	10.0
46	*	1.1	5.2	5.6	6.6	5.6	5.2	5.2	18.5	11.2
48	*	0.9	5.6	6.0	6.8	6.1	5.5	5.4	19.5	11.8
50	*	0.9	5.9	6.5	7.3	6.8	6.0	5.9	21.6	13.1
52	*	1.1	6.2	7.1	8.0	7.6	6.9	7.0	26.1	15.8
54	*	1.4	7.1	7.8	8.4	8.7	8.3	8.4	31.3	19.0
56	*	1.8	8.0	8.7	9.3	9.7	9.5	9.6	36.8	22.3
58	*	2.6	9.0	10.0	11.0	11.8	11.6	11.8	46.5	28.2
60	*	4.1	10.7	12.3	13.9	15.1	15.3	15.7	64.5	39.1
62	*	7.1	13.5	16.3	18.8	20.6	21.6	22.4	96.8	58.7
64	*	9.6	16.0	18.6	21.3	23.7	24.4	25.6	115.5	70.1
66	*	8.3	13.6	15.6	17.8	18.5	17.4	18.4	84.8	51.5
68	*	6.8	11.5	13.0	14.5	14.0	12.2	13.0	61.0	37.0
70	*	6.0	9.9	10.9	12.7	11.9	9.5	10.2	48.1	29.2
72	*	5.6	9.7	10.5	11.7	10.7	8.1	8.6	41.1	25.0
74	*	5.3	9.7	9.1	10.7	9.5	7.4	7.8	37.4	22.7
76	*	5.4	10.0	9.7	11.0	9.4	6.8	7.2	35.1	21.3
78	*	6.0	10.3	10.8	10.9	9.2	6.8	7.2	35.2	21.4

DATA OF MAX SYNTHESIS STRESS
 STRESS VALUE : 116.9 N/MM2
 SPEED : 63.7 RPM
 SHAFT NO. : 8

TABLE OF MAX TORSIONAL STRESS SYNTHESIS (N/MM2)

SHAFT NO.										
RPM	*	1	2	3	4	5	6	7	8	9

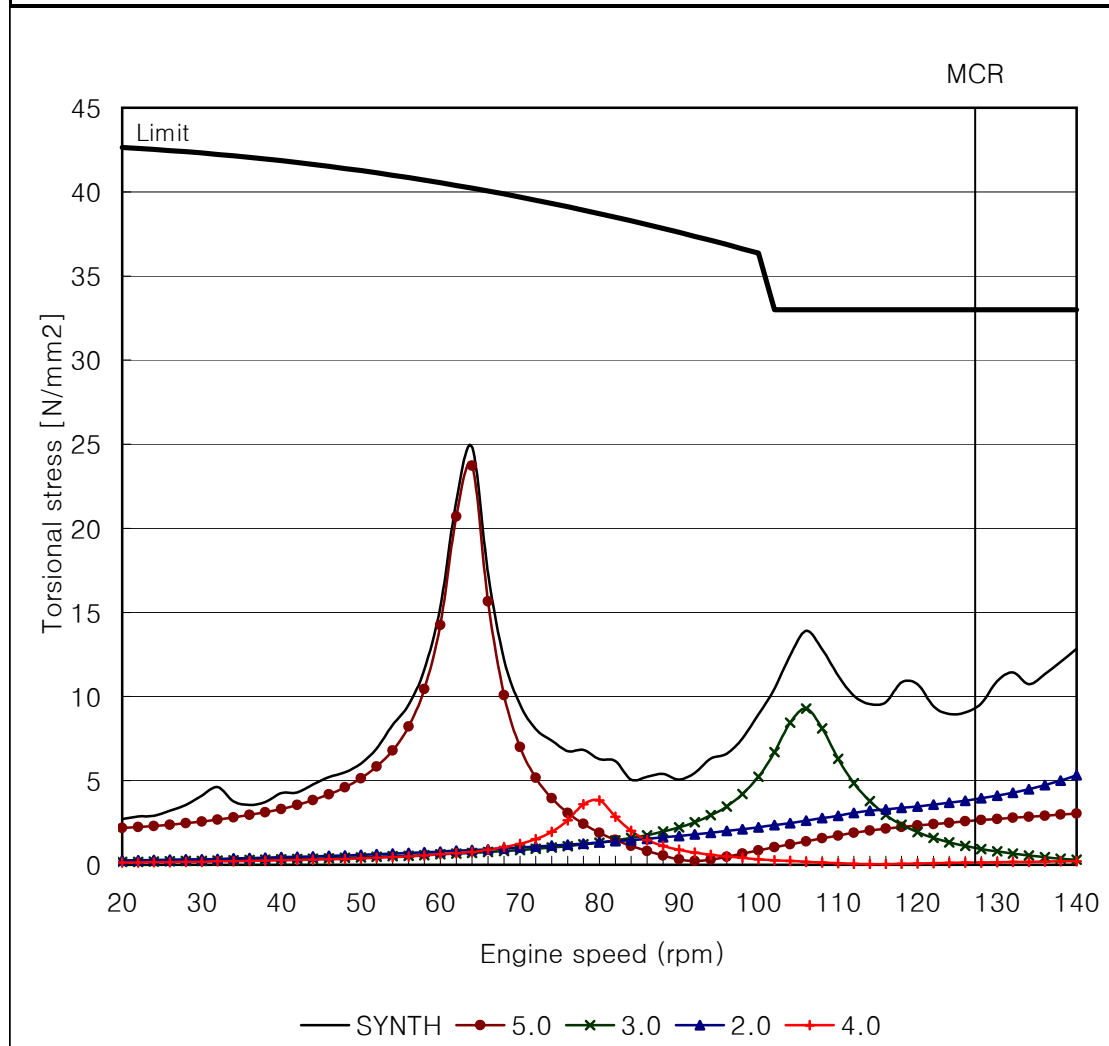
80	*	6.0	10.2	10.8	10.7	6.9	6.3	6.5	36.2	22.0
82	*	6.5	10.5	11.7	10.1	6.4	6.2	6.1	32.9	20.0
84	*	5.3	10.0	10.8	9.7	5.7	5.1	4.9	29.5	18.0
86	*	4.9	10.5	10.4	10.0	6.3	5.2	5.1	26.8	16.3
88	*	5.9	11.1	11.1	11.3	7.8	5.4	5.4	25.2	15.3
90	*	5.9	11.3	11.3	11.4	7.2	5.1	5.1	23.9	14.5
92	*	6.7	11.7	12.0	11.9	7.8	5.5	5.6	23.3	14.2
94	*	7.1	11.7	12.6	13.7	9.7	6.3	6.1	23.8	14.5
96	*	6.3	12.0	11.5	13.4	9.7	6.6	6.2	25.6	15.5
98	*	6.4	13.1	12.1	14.1	10.1	7.5	7.1	28.1	17.1
100	*	7.6	14.6	14.0	16.0	11.3	8.9	8.5	32.2	19.5
102	*	8.1	15.5	15.1	16.9	13.7	10.5	9.8	39.3	23.9
104	*	8.3	16.7	15.9	17.2	15.6	12.4	12.6	49.0	29.7
106	*	8.6	18.0	16.1	16.1	17.5	13.9	14.0	58.3	35.4
108	*	8.3	18.1	16.0	15.5	16.6	12.8	12.7	56.9	34.5
110	*	8.9	17.7	18.1	15.4	14.1	11.3	11.0	48.9	29.7
112	*	8.3	16.3	17.3	13.6	12.4	10.0	9.6	42.3	25.7
114	*	8.0	15.8	17.0	13.7	12.1	9.6	9.0	37.9	23.0
116	*	8.3	16.2	17.3	13.8	12.5	9.7	8.9	34.1	20.8
118	*	9.9	18.6	19.3	14.5	13.9	10.8	9.9	31.7	19.3
120	*	9.5	19.3	18.5	14.1	13.5	10.7	9.3	28.9	17.6
122	*	8.1	17.1	15.7	12.7	11.6	9.4	8.3	26.8	16.3
124	*	7.6	16.4	14.8	12.3	11.2	9.0	7.9	25.3	15.4
126	*	7.7	16.5	14.9	12.3	11.4	9.1	8.0	24.2	14.7
128	*	8.3	17.0	15.7	12.8	12.3	9.6	8.4	23.3	14.2
130	*	10.4	18.5	18.4	14.6	14.3	10.9	9.6	22.2	13.5
132	*	10.3	18.5	17.8	15.2	14.5	11.4	10.4	23.0	14.0
134	*	8.8	16.5	15.8	13.1	13.4	10.7	9.6	23.7	14.4
136	*	8.7	15.9	15.0	12.8	12.9	11.3	10.2	24.2	14.7
138	*	9.0	15.9	14.8	13.3	12.8	12.1	10.9	24.9	15.1
140	*	9.8	16.8	15.0	14.1	13.4	12.8	11.7	25.9	15.7

VALUES WITH NEGATIVE SIGN ARE VIBRATORY TORQUES IN (KNM).

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: No.5 Cylinder misfiring	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM
MAX. SPEED : 98 RPM (misfiring only)

Torsional vibratory stress of shaft no. 6 CRANK
DIA. = 599.9 mm UTS = 610.0 N/mm²

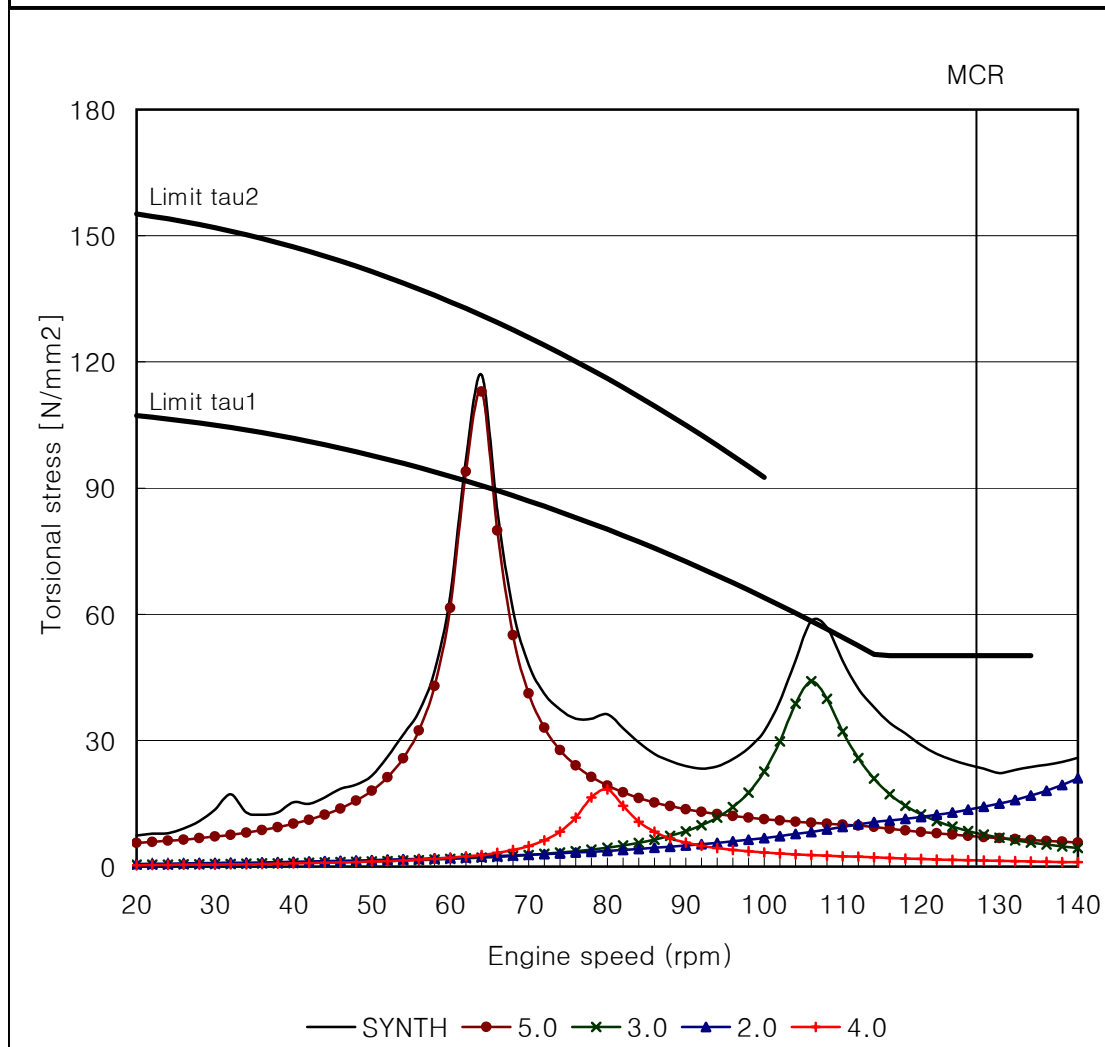


Limit : MAN Diesel Crankshaft Limits
Crankshaft : FSB 242456 / SOLID CRANK PIN

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: No.5 Cylinder misfiring	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM
MAX. SPEED : 98 RPM (misfiring only)

Torsional vibratory stress of shaft no. 8 INTER
DIA. = 390.0 mm UTS = 590.0 N/mm²

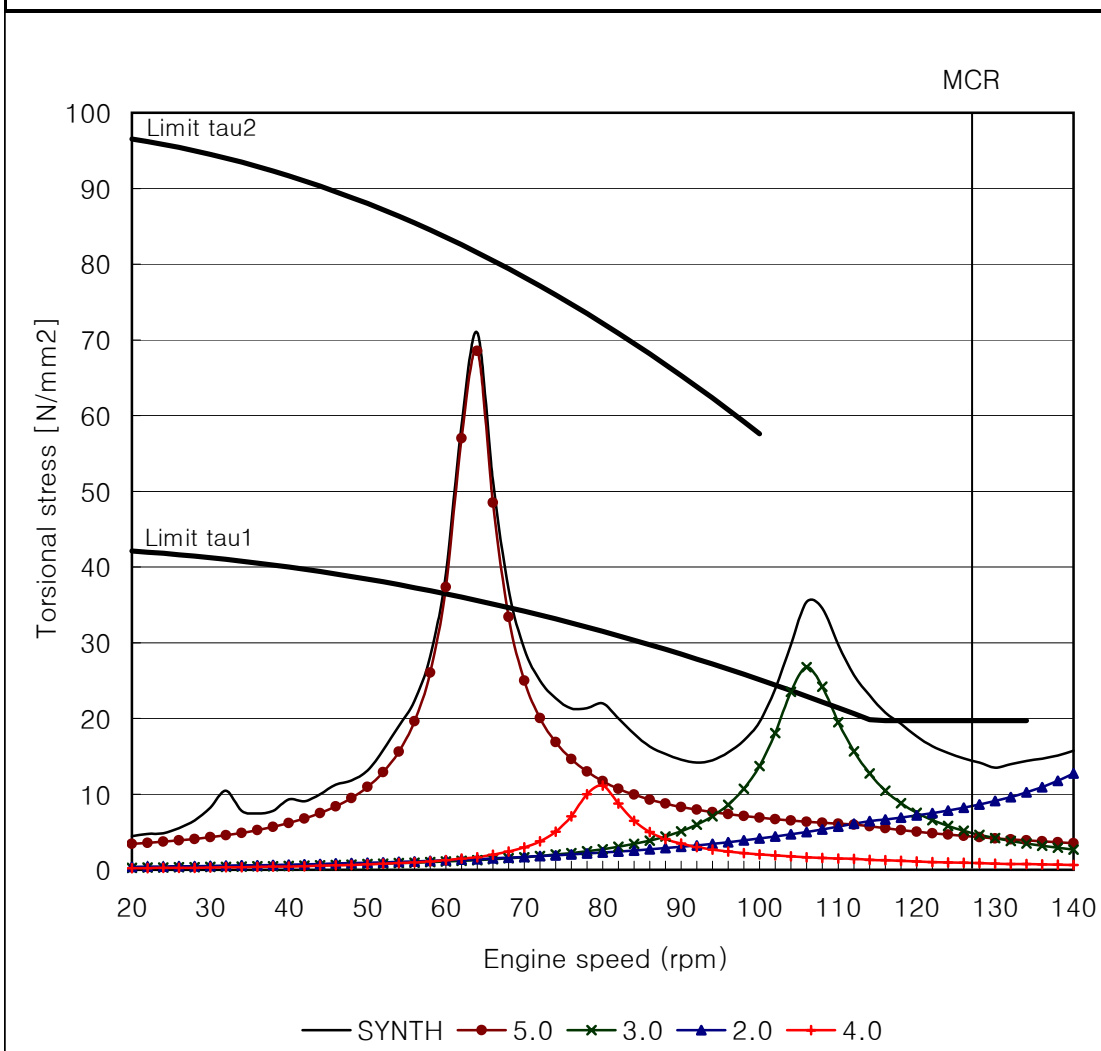


Limit tau1 : Limit for continuous operation with 1.38 Ck factor [Multi-Radius]
Limit tau2 : Limit for transient operation

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: No.5 Cylinder misfiring	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM
MAX. SPEED : 98 RPM (misfiring only)

Torsional vibratory stress of shaft no. 9 PROP
DIA. = 460.0 mm UTS = 590.0 N/mm²

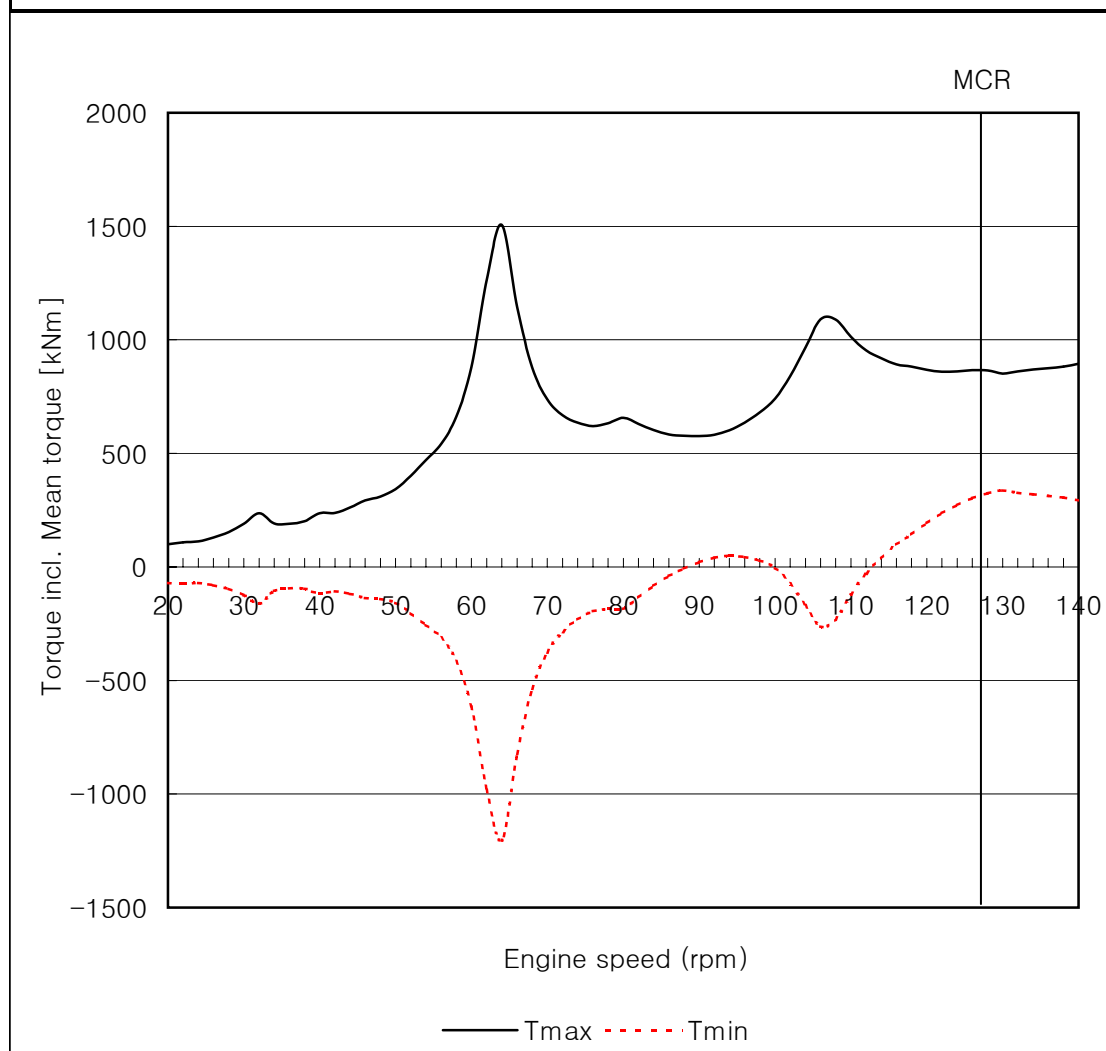


Limit tau1 : Limit for continuous operation with 0.55 Ck factor
Limit tau2 : Limit for transient operation

Engine type	: 5S50MC-C	Tuning wheel	: 11980 kgm ²
Rating at MCR	: 7900 kW x 127 rpm	Turning wheel	: 10000 kgm ²
Firing condition	: No.5 Cylinder misfiring	Gas harmonics	: 242503

BARRED SPEED RANGE : 58 ~ 70 RPM
MAX. SPEED : 98 RPM (misfiring only)

Max and Min torque incl. Mean troque of shaft no. 9 PROP



58 RPM	:	663 kNm
64 RPM	:	1507 kNm
70 RPM	:	738 kNm