

Table of contents

Introduction	1
Abbreviations	1
1 General.....	2
2 Limits for testbed	3
3 Limits before chocking.....	5
4 Limits for commissioning / ship delivery	8
5 Limits for normal ship service	11

Introduction

The 2nd priority - after “all bearings need to be statically loaded under all conditions” - is that **all crankweb deflections should be within the service limits when the engine is stopped and the ship is in any normal service condition, i.e.:**

- the ship draught is between ballast and maximum draught
- the ship is at normal trim
- the engine is in cold-stopped or hot-stopped condition

According to general engineering practice, the crankweb deflection limits are increasing from the strictest limits valid for testbed reference measurements, to the limits valid for normal ship service condition.


Abbreviations

The following abbreviations are used in this document:

DG	design group (Wärtsilä drawing set structure)
cyl.	cylinder
cyl.1	aftmost cylinder #1
cyl.(n)	foremost cylinder
cyl.(n-1)	second foremost cylinder
TV damper	torsional vibration damper
PTO	power take off

Substitute for:							PC	Q-Code	X	X	X	X	X
-----------------	--	--	--	--	--	--	----	--------	---	---	---	---	---

Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date

		Product W-2S		Engine alignment Crankweb deflection - limits			
Made	14.10.2013	J.Bergande	Main Drw.	Page	Material ID		
Chkd	18.10.2013	W.Schiffer	Design Group	1 / 12	PAAD128847		
Appd	21.10.2013	B.Haag	9709	Drawing ID	DAAD040466		Rev

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

1 General

The information provided in this section has to be considered for all crankweb deflection measurements, i.e. on testbed, before chocking, at commissioning and in normal service.

1.1 Turning direction during crankweb deflection measurement

Wärtsilä recommends the following turning directions:

- **Counter-clockwise** rotation for engines with **turning gear on fuel pump side**:
e.g. RTA48T-D, RTA58T-D, RT-flex60C-B, RTA68-D, RTA82C, RTA82T/T-B, RTA/RT-flex84T-D, RTA/RT-flex96C-B
- **Clockwise** rotation for engines with **turning gear on exhaust side**:
e.g. W-X35, W-X40, W-X62, W-X72, W-X82, W-X92, RT-flex48T-D, RT-flex50-B/-D, RT-flex82C/T

During a measurement session, the same turning direction has to be used for all cranks, i.e. either clockwise for all cranks or counter-clockwise for all cranks.


1.2 Measurement accuracy

The **dial gauge must be fully functional** and **with a smoothly sliding rod**. **Good experience and great care is essential** for measuring crankweb deflections. The deflection of a crankweb is measured at five angular positions. The first and the last reading values need to be measured when **the dial gauge is very close to the connecting rod** (for details see DG9709 - "Engine alignment – Guideline for measurements"). **Right after reading the fifth deflection value of each crank, the difference between the first and the fifth crankweb deflection reading value needs to be checked. Their difference should not exceed the engine specific permissible deviation listed in table 1.** **If the permissible deviation is exceeded, then the measurement of relevant crank needs to be repeated** – otherwise it might not be possible to judge the measurement results.

Table 1	Permissible deviation between first and last deflection reading value of a crankweb [mm]
W-X35 W-X40	0.03
W-X62	0.04
W-X72	0.05
W-X82 W-X92	0.06
RT-flex48T-D & RTA48T-D RT-flex50 / -B / -D & RT-flex50DF RT-flex58T-D / -E & RTA58T-D RT-flex60C-B	0.04
RT-flex68-D & RTA68-D	0.05
RT-flex82C & RTA82C RT-flex82T / T-B & RTA82T / T-B RT-flex84T-D & RTA84T-D RT-flex96C-B & RTA96C-B	0.06

Substitute for: PC Q-Code X X X X X

Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date
-------	--------	------------	--------	------------	--------	------------	--------	------------

		Product W-2S		Engine alignment Crankweb deflection - limits			
		Made 14.10.2013 J.Bergande	Main Drw.	Page 2 / 12	Material ID PAAD128847		
Chkd 18.10.2013 W.Schiffer	Design Group		9709	Drawing ID DAAD040466			Rev
Appd 21.10.2013 B.Haag							

Copyright Wärtsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wärtsilä.

1.3 Recording of crankweb deflection measurement results incl. essential additional information

Careful recording of crankweb measurement results is essential for a reliable analyse of the alignment condition. In addition to the measurement results, also further information about the measurement conditions and the measurement tools need to be included in the records for a clear understanding and a comprehensive judgement of the alignment measurement results.

See DG9709 - "Engine alignment – Guidelines for measurements" - section "Recording of crankweb deflection measurements".

Wärtsilä provides data record sheets in Microsoft Excel file format free of charge. See DG9707 - "Engine alignment – record sheets". Please contact Wärtsilä, e.g. by email to: application.engineering.ch@wartsila.com or contact the local Wärtsilä office.

2 Limits for testbed

The crankweb deflections measured on testbed are a binding requirement for engine approval. They are referred to as a reference for subsequent installation in the ship.

2.1 Validity


The crankweb deflections limits for testbed (see table 2) are valid for measurements of the completely assembled engine on the testbed, i.e. the flywheel is installed and the tie rods are correctly tightened according to DG0351 - "Assembly instructions". The engine is cold and uncoupled from the connecting shaft to the water break.

These limits are not valid for any additional optional measurement on the testbed, e.g. before tightening of the tie rods or with pistons or running gears removed etc.


For the **cold engine coupled to the cold water break**, the same limits have to be considered - except for aftmost cyl. 1. Just in this case, the limits for aftmost cyl. 1 are the same as for cyl. 2 to the second foremost cyl.(n-1).

2.2 WCH case specific limits

If final measurements exceed the limits, then Wärtsilä should be contacted.

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande	Main Drw.		Page	Material ID					PAAD128847					
Chkd	18.10.2013	W.Schiffer	Design Group		3 / 12											
Appd	21.10.2013	B.Haag	9709		Drawing ID	DAAD040466					Rev					


Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

Table 2		Testbed crankweb deflection limits [mm]			
		vertical			horizontal
Reading convention:		cyl.1	cyl.2 to cyl.(n-1) cyl.(n) ^{*1}	cyl.(n) ^{*2}	cyl.1 to cyl.(n)
					
W-X35		0.11 -0.25	0.11 -0.11	0.11 -0.27	0.06 -0.06
W-X40		0.13 -0.29	0.13 -0.13	0.13 -0.32	0.07 -0.07
W-X62		0.22 -0.51	0.22 -0.22	0.22 -0.56	0.12 -0.12
W-X72		0.32 -0.74	0.32 -0.32	0.32 -0.82	0.17 -0.17
W-X82		0.35 -0.82	0.35 -0.35	0.35 -0.90	0.18 -0.18
W-X92		0.42 -0.98	0.42 -0.42	0.42 -1.08	0.22 -0.22
RT-flex48T-D RTA48T-D		0.17 -0.38	0.17 -0.17	0.17 -0.42	0.09 -0.09
RT-flex50 / -B / -D RT-flex50DF		0.17 -0.38	0.17 -0.17	0.17 -0.42	0.09 -0.09
RT-flex58T-D / -E ^{*3} RTA58T-D		0.23 -0.53	0.23 -0.23	0.23 -0.58	0.12 -0.12
RT-flex60C-B		0.22 -0.49	0.22 -0.22	0.22 -0.54	0.11 -0.11
RT-flex68-D RTA68-D		0.23 -0.53	0.23 -0.23	0.23 -0.58	0.12 -0.12
RT-flex82C RTA82C		0.24 -0.55	0.24 -0.24	0.24 -0.60	0.12 -0.12
RT-flex82T / T-B RTA82T / T-B		0.35 -0.82	0.35 -0.35	0.35 -0.90	0.18 -0.18
RT-flex84T-D RTA84T-D		0.33 -0.75	0.33 -0.33	0.33 -0.83	0.17 -0.17
RT-flex96C-B RTA96C-B		0.30 -0.69	0.30 -0.30	0.30 -0.76	0.16 -0.16

*1 For engines without TV damper or front disc or free end PTO.

*2 For engines with TV damper or front disc or free end PTO.

*3 Also valid for RT-flex58T-ER-3.

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande	Main Drw.	Page	4 / 12	Material ID	PAAD128847									
Chkd	18.10.2013	W.Schiffer	Design Group	9709		Drawing ID	DAAD040466			Rev						
Appd	21.10.2013	B.Haag														

Copyright Wärtsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wärtsilä.

3 Limits before chocking

3.1 Validity

The crankweb deflection limits before chocking (see table 3) are valid for the completely assembled engine¹ on board the new built vessel in continuous fully floating condition.

The engine is cold and all propulsion shafts and the main engine are coupled. All temporary supports and all jack-down forces are removed. Any heat supply to the double bottom inside the engine room has to be out of operation at least 8 hours prior to the measurement until it is completed, i.e. the heating of the main lubricating oil sump tank below the main engine, the pre-heater of the main lubricating oil separator, etc.

These limits are not valid for any other measurement, e.g. for measurements with partly or fully loosened tie rods or with pistons or running gears removed etc.

3.2 Re-alignment after repair

In case of an engine re-alignment on board of vessels which already were in regular service, values between 'before chocking' and 'ship delivery' can be applied. Wärtsilä should be contacted for assistance.

3.3 Crankweb deflection max. deviation indicator

Huge differences in vertical crankweb deflections of adjacent cranks can indicate deficiencies such as a lack of static load. For this reason the deviations of vertical crankweb deflections among adjacent cranks have to be checked carefully:

- If a difference in vertical crankweb deflections of adjacent cranks exceeds the maximum deviation indicator value provided in table 3, then the static loads of the main bearings in way of relevant cranks need to be measured.

It can be exceeded between the two foremost cranks if a heavy external load, e.g. a TV damper or a front disc or a free end PTO gear drive is attached at the crankshaft forward end. In such a case the static loads for the two foremost main bearings need to be measured.


However, if the maximum deviation indicator for vertical crankweb deflections between two adjacent cranks is exceeded in way of cyl.2 to the second foremost cyl.(n-1), then Wärtsilä needs to be contacted.

- If the static loads of adjacent main bearings can be accepted, then also the increased difference in vertical crankweb deflections of adjacent cranks can be accepted.

The indicator values for the maximum deviation of vertical crankweb deflections among adjacent cranks should just indicate if the static loads of adjacent main bearings need to be checked additionally.

The indicator values are no final acceptance criteria.


¹ The tie rods are correctly tightened according to DG0351 - "Assembly instructions".

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande	Main Drw.	Page	5 / 12	Material ID	PAAD128847									
Chkd	18.10.2013	W.Schiffer	Design Group	9709		Drawing ID	DAAD040466			Rev						
Appd	21.10.2013	B.Haag														


3.4 WCH case specific limits

If final measurements exceed the limits, then Wärtsilä should be contacted.


Copyright Wärtsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wärtsilä.

Substitute for:								PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
			Product W-2S		Engine alignment Crankweb deflection - limits									
Made	14.10.2013	J.Bergande	Main Drw.		Page	Material ID								
Chkd	18.10.2013	W.Schiffer	Design Group		6 / 12	PAAD128847								
Appd	21.10.2013	B.Haag	9709		Drawing ID	DAAD040466							Rev	

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

Table 3					
Before Chocking – Newbuilding					
crankweb deflection limits [mm]					
Reading convention: 	vertical				horizontal
	cyl.1	cyl.2 to cyl.(n-1) cyl.(n) ^{*1}	cyl.(n) ^{*2}	max. deviation indicator ^{*3}	cyl.1 to cyl.(n)
W-X35	0.20	0.15	0.15	0.13	0.07
	-0.15	-0.15	-0.27		-0.07
W-X40	0.24	0.18	0.18	0.15	0.08
	-0.18	-0.18	-0.32		-0.08
W-X62	0.40	0.30	0.30	0.25	0.14
	-0.30	-0.30	-0.56		-0.14
W-X72	0.59	0.44	0.44	0.36	0.20
	-0.44	-0.44	-0.82		-0.20
W-X82	0.64	0.48	0.48	0.39	0.22
	-0.48	-0.48	-0.90		-0.22
W-X92	0.77	0.58	0.58	0.47	0.26
	-0.58	-0.58	-1.08		-0.26
RT-flex48T-D RTA48T-D	0.31	0.23	0.23	0.19	0.11
	-0.23	-0.23	-0.42		-0.11
RT-flex50 / -B / -D RT-flex50DF	0.31	0.23	0.23	0.19	0.11
	-0.23	-0.23	-0.42		-0.11
RT-flex58T-D / -E^{*4} RTA58T-D	0.42	0.31	0.31	0.26	0.15
	-0.31	-0.31	-0.58		-0.15
RT-flex60C-B	0.39	0.29	0.29	0.24	0.14
	-0.29	-0.29	-0.54		-0.14
RT-flex68-D RTA68-D	0.42	0.31	0.31	0.26	0.15
	-0.31	-0.31	-0.58		-0.15
RT-flex82C RTA82C	0.43	0.32	0.32	0.26	0.15
	-0.32	-0.32	-0.60		-0.15
RT-flex82T RTA82T	0.64	0.48	0.48	0.39	0.22
	-0.48	-0.48	-0.90		-0.22
RT-flex84T-D RTA84T-D	0.59	0.44	0.44	0.36	0.21
	-0.44	-0.44	-0.83		-0.21
RT-flex96C-B RTA96C-B	0.54	0.41	0.41	0.33	0.19
	-0.41	-0.41	-0.76		-0.19

- *1 For engines without TV damper or front disc or free end PTO.
- *2 For engines with TV damper or front disc or free end PTO.
- *3 This value is not a limit for final acceptance, but it is used to indicate if further investigations are required.
- *4 Also valid for RT-flex58T-ER-3

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande	Main Drw.	Page	7 / 12	Material ID	PAAD128847									
Chkd	18.10.2013	W.Schiffer	Design Group	9709		Drawing ID	DAAD040466					Rev				
Appd	21.10.2013	B.Haag														

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose without the previous written consent of Wartsilä.

4 Limits for commissioning / ship delivery

4.1 Validity

The limits for commissioning / ship delivery (see table 4) are valid for the completely assembled engine² which is fully fixed to its foundation on board the new built vessel which is in continuous fully floating condition at commissioning / delivery of the ship to the owner, i.e. usually directly before, during or after the sea trial.

- The draught and trim is within the normal ship operation limits.
- The engine is stopped.
- Depending on the engine temperature condition, any heat supply to the double bottom inside the engine room has to be out of operation prior to the measurement until it is completed, i.e. the heating of the main lubricating oil sump tank below the main engine, the pre-heater of the main lubricating oil separator, etc.:
 - at least 8 hours for measurements at cold conditions
 - at least 4 hours for measurements at warm conditions
 - at least 1 hour for measurements at hot conditions

The limits for commissioning / ship delivery can be applied for additional measurements after chocking and fixation of the engine. However, if the ship has not yet been in operation, then the limits should not be maxed out, as influences by settling effects and welding stress release in ship hull cannot be predicted exactly.

These limits are not valid for the condition before chocking of a new built ship, or for measurements with partly or fully loosened tie rods or with pistons or running gears removed etc.


4.2 Crankweb deflection max. deviation indicator

Huge differences in vertical crankweb deflections of adjacent cranks can indicate deficiencies such as a lack of static load. For this reason the deviations of vertical crankweb deflections among adjacent cranks have to be checked carefully:

- If a difference in vertical crankweb deflections of adjacent cranks exceeds the maximum deviation indicator value provided in table 4, then the static loads of the main bearings in way of relevant crank needs to be measured.

It can be exceeded between the two foremost cranks if a heavy external load, e.g. a TV damper or a front disc or a free end PTO gear drive is attached at the crankshaft forward end. In such a case the static loads for the two foremost main bearings need to be measured.

² The tie rods are correctly tightened according to DG0351 - "Assembly instructions".

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
		Made	14.10.2013	J.Bergande	Main Drw.	Page	8 / 12	Material ID	PAAD128847							
Chkd	18.10.2013	W.Schiffer	Design Group		9709		Drawing ID	DAAD040466			Rev					
Appd	21.10.2013	B.Haag														

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

However, if the maximum deviation indicator for vertical crankweb deflections between two adjacent cranks is exceeded in way of cyl.2 to the second foremost cyl.(n-1), then Wärtsilä needs to be contacted.


- If the static loads of adjacent main bearings can be accepted, then also the increased difference in vertical crankweb deflections of adjacent cranks can be accepted.

The indicator values for the maximum deviation of vertical crankweb deflections among adjacent cranks should just indicate if the static loads of adjacent main bearings need to be checked additionally.


The indicator values are no final acceptance criteria.

4.3 WCH case specific limits


If final measurements exceed the limits, then Wärtsilä should be contacted.

Substitute for:								PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits									
Made	14.10.2013	J.Bergande	Main Drw.	Page	Material ID PAAD128847									
Chkd	18.10.2013	W.Schiffer	Design Group	9 / 12									Rev	
Appd	21.10.2013	B.Haag	9709	Drawing ID	DAAD040466									

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

Table 4 Ship Delivery / Commissioning crankweb deflection limits [mm]					
Reading convention: 	vertical				horizontal
	cyl.1	cyl.2 to cyl.(n-1) cyl.(n) ^{*1}	cyl.(n) ^{*2}	max. deviation indicator ^{*3}	cyl.1 to cyl.(n)
W-X35	0.24 -0.27	0.18 -0.18	0.18 -0.27	0.15	0.09 -0.09
W-X40	0.28 -0.32	0.21 -0.21	0.21 -0.32	0.17	0.10 -0.10
W-X62	0.48 -0.56	0.36 -0.36	0.36 -0.56	0.29	0.17 -0.17
W-X72	0.70 -0.82	0.53 -0.53	0.53 -0.82	0.43	0.24 -0.24
W-X82	0.77 -0.90	0.58 -0.58	0.58 -0.90	0.47	0.26 -0.26
W-X92	0.92 -1.08	0.69 -0.69	0.69 -1.08	0.56	0.32 -0.32
RT-flex48T-D RTA48T-D	0.37 -0.42	0.27 -0.27	0.27 -0.42	0.22	0.13 -0.13
RT-flex50 / -B / -D RT-flex50DF	0.37 -0.42	0.27 -0.27	0.27 -0.42	0.22	0.13 -0.13
RT-flex58T-D / -E^{*4} RTA58T-D	0.50 -0.58	0.37 -0.37	0.37 -0.58	0.30	0.17 -0.17
RT-flex60C-B	0.47 -0.54	0.35 -0.35	0.35 -0.54	0.28	0.16 -0.16
RT-flex68-D RTA68-D	0.50 -0.58	0.37 -0.37	0.37 -0.58	0.30	0.17 -0.17
RT-flex82C RTA82C	0.52 -0.60	0.39 -0.39	0.39 -0.60	0.32	0.18 -0.18
RT-flex82T RTA82T	0.77 -0.90	0.58 -0.58	0.58 -0.90	0.47	0.26 -0.26
RT-flex84T-D RTA84T-D	0.71 -0.83	0.53 -0.53	0.53 -0.83	0.43	0.24 -0.24
RT-flex96C-B RTA96C-B	0.65 -0.76	0.49 -0.49	0.49 -0.76	0.40	0.22 -0.22

- *1 For engines without TV damper or front disc or free end PTO.
- *2 For engines with TV damper or front disc or free end PTO.
- *3 This value is not a limit for final acceptance, but it is used to indicate if further investigations are required.
- *4 Also valid for RT-flex58T-ER-3.

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande	Main Drw.	Page	10 / 12	Material ID	PAAD128847									
Chkd	18.10.2013	W.Schiffer	Design Group	9709		Drawing ID	DAAD040466			Rev						
Appd	21.10.2013	B.Haag														

5 Limits for normal ship service

Normally it is sufficient to measure crankweb deflections regularly according to the intervals defined by the maintenance manual of the main engine or by the class rules – whatever is stricter.

Only in case of abnormalities, like significant change of crankweb deflection measurement results compared to the set of previous measurements, it is recommended to inspect the crankcase and to measure crankweb deflections more frequently.

If signs of damage are found or in case of bearing temperature alarms or even bearing damage, then detailed alignment measurements might become necessary. Wärtsilä should be contacted for support and to coordinate necessary investigations in advance. When judging crankweb deflections, it needs to be considered that they are affected by the influences listed below. Consequently it is recommended to include these influences in the records:

- the forward and aft ship draught
- the temperature in the lubricating oil sump tank
- the temperature of seawater
- the engine temperature


5.1 Validity

The limits for normal ship service (see table 5) are valid for any normal ship service condition after ship delivery, i.e.:


- The ship's **draught and trim** are within the limits for normal operation.
- The **engine is stopped**.
- Depending on the engine temperature condition, any **heat supply to the double bottom inside the engine room has to be out of operation prior to the measurement** until it is completed, i.e. the heating of the main lubricating oil sump tank below the main engine, the pre-heater of the main lubricating oil separator, etc.:
 - **at least 8 hours** for measurements **at cold conditions**
 - **at least 4 hours** for measurements **at warm conditions**
 - **at least 1 hour** for measurements **at hot conditions**

5.2 WCH case specific limits

If final measurements exceed the limits, then Wärtsilä should be contacted.

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date						
		Product W-2S			Engine alignment Crankweb deflection - limits											
Made	14.10.2013	J.Bergande		Main Drw.	Page	Material ID					PAAD128847					
Chkd	18.10.2013	W.Schiffer		Design Group	11 / 12											
Appd	21.10.2013	B.Haag		9709	Drawing ID	DAAD040466					Rev					

Copyright Wartsilä. All rights reserved. By taking possession of the drawing, the recipient recognizes and honors these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wartsilä.

Table 5 Normal ship service crankweb deflection limits [mm]				
Reading convention: 	vertical			horizontal
	cyl.1	cyl.2 to cyl.(n-1) cyl.(n) ^{*1}	cyl.(n) ^{*2}	cyl.1 to cyl.(n)
W-X35	0.27	0.19	0.19	0.09
	-0.27	-0.19	-0.27	-0.09
W-X40	0.32	0.23	0.23	0.11
	-0.32	-0.23	-0.32	-0.11
W-X62	0.56	0.40	0.40	0.18
	-0.56	-0.40	-0.56	-0.18
W-X72	0.82	0.58	0.58	0.27
	-0.82	-0.58	-0.82	-0.27
W-X82	0.90	0.64	0.64	0.29
	-0.90	-0.64	-0.90	-0.29
W-X92	1.08	0.76	0.76	0.35
	-1.08	-0.76	-1.08	-0.35
RT-flex48T-D RTA48T-D	0.42	0.30	0.30	0.14
	-0.42	-0.30	-0.42	-0.14
RT-flex50 / -B / -D RT-flex50DF	0.42	0.30	0.30	0.14
	-0.42	-0.30	-0.42	-0.14
RT-flex58T-D / -E^{*3} RTA58T-D	0.58	0.41	0.41	0.19
	-0.58	-0.41	-0.58	-0.19
RT-flex60C-B	0.54	0.38	0.38	0.18
	-0.54	-0.38	-0.54	-0.18
RT-flex68-D RTA68-D	0.58	0.41	0.41	0.19
	-0.58	-0.41	-0.58	-0.19
RT-flex82C RTA82C	0.60	0.43	0.43	0.20
	-0.60	-0.43	-0.60	-0.20
RT-flex82T RTA82T	0.90	0.64	0.64	0.29
	-0.90	-0.64	-0.90	-0.29
RT-flex84T-D RTA84T-D	0.83	0.59	0.59	0.27
	-0.83	-0.59	-0.83	-0.27
RT-flex96C-B RTA96C-B	0.76	0.54	0.54	0.25
	-0.76	-0.54	-0.76	-0.25


*1 For engines without TV damper or front disc or free end PTO.

*2 For engines with TV damper or front disc or free end PTO.

*3 Also valid for RT-flex58T-ER-3.

Substitute for: PC Q-Code X X X X X

Modif	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date	Number	Drawn Date

		Product W-2S		Engine alignment Crankweb deflection - limits			
		Made 14.10.2013 J.Bergande	Main Drw.	Page 12 / 12	Material ID PAAD128847		
Chkd 18.10.2013 W.Schiffer	Design Group		Drawing ID DAAD040466			Rev	
Appd 21.10.2013 B.Haag	9709						

WinGD-2S – Alignment_crankweb deflection limit

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2016-10-25	DOCUMENT	First web upload

DISCLAIMER

© Copyright by Winterthur Gas & Diesel Ltd.

All rights reserved. No part of this document may be reproduced or copied in any form or by any means (electronic, mechanical, graphic, photocopying, recording, taping or other information retrieval systems) without the prior written permission of the copyright owner.

THIS PUBLICATION IS DESIGNED TO PROVIDE AN ACCURATE AND AUTHORITATIVE INFORMATION WITH REGARD TO THE SUBJECT-MATTER COVERED AS WAS AVAILABLE AT THE TIME OF PRINTING. HOWEVER, THE PUBLICATION DEALS WITH COMPLICATED TECHNICAL MATTERS SUITED ONLY FOR SPECIALISTS IN THE AREA, AND THE DESIGN OF THE SUBJECT-PRODUCTS IS SUBJECT TO REGULAR IMPROVEMENTS, MODIFICATIONS AND CHANGES. CONSEQUENTLY, THE PUBLISHER AND COPYRIGHT OWNER OF THIS PUBLICATION CAN NOT ACCEPT ANY RESPONSIBILITY OR LIABILITY FOR ANY EVENTUAL ERRORS OR OMISSIONS IN THIS BOOKLET OR FOR DISCREPANCIES ARISING FROM THE FEATURES OF ANY ACTUAL ITEM IN THE RESPECTIVE PRODUCT BEING DIFFERENT FROM THOSE SHOWN IN THIS PUBLICATION. THE PUBLISHER AND COPYRIGHT OWNER SHALL UNDER NO CIRCUMSTANCES BE HELD LIABLE FOR ANY FINANCIAL CONSEQUENTIAL DAMAGES OR OTHER LOSS, OR ANY OTHER DAMAGE OR INJURY, SUFFERED BY ANY PARTY MAKING USE OF THIS PUBLICATION OR THE INFORMATION CONTAINED HEREIN.