

1 Introduction

Apart from the normal conventional engine holding down stud used to fasten the engine to the tank top plate, a different design is to be applied for the propeller thrust transmission. The propeller thrust is transmitted from the engine thrust bearing to the bedplate and to the tank top plate which is part of the ship's structure by means of thrust sleeves located adjacent to the engine thrust bearing.

2 Thrust sleeve

2.1 Fitting


The thrust sleeve is fitted in the bottom plate of the engine bedplate and cast in the tank top plate. The diameter of the flame-cut or drilled hole for the thrust sleeve in the tank top plate is larger than the diameter of the sleeve to allow engine alignment without re-machining of the hole. The sleeve in the tank top plate hole is then fixed with epoxy resin material as used for the chocks. The engine holding down stud is inserted in the sleeve and tightened in the same way as the normal holding down studs. This hydraulically tightened holding down stud is of the same design, as the normal holding down stud used to fasten the engine to the tank top plate. Drilling and reaming of the holes in the engine bedplate is carried out by the engine manufacturer. The thrust sleeves with the final tolerance and the holding down studs are supplied by the shipyard.

2.2 Drilling of the holes in the tank top plate

The holes for the thrust sleeves must be drilled or flame-cut in the tank top plate before setting the engine in position. These holes are prepared while observing the dimensions given on the drawing 'Chocking and drilling plan, section B-B'. The holes for the normal holding down studs can be drilled or flame-cut either before or after setting the engine in position.

2.3 Chock thickness

Since the chock thickness cannot be precisely determined before engine alignment is finalized, the standard design of the holding down stud, thrust sleeve and conical socket, allows for the application of chock thicknesses from 25 up to 60 mm. To avoid additional machining of the sleeve to adjust its length, the conical socket is provided with a larger bore compared to the sleeve's external diameter.

Substitute for:								PC	Q-Code	X	X	X	X	X
Modif	A	EAAD084407	16.01.2013	B	7-86.314	01.12.2015	B	EAAD086314	01.12.2015					
		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		
		Product W-2S			Fitting Instruction to engine seating with epoxy resin chocks									
Made	19.01.2011	S.Feuerstein			Main Drw.	Page	Material ID							
Chkd	19.01.2011	M.Hug			Design Group	1 / 4	107.412.130.500							
Appd	19.01.2011	D.Strödercke			9710	Drawing ID	107.412.130					Rev	B	

The sleeve can protrude beyond the top plate more or less, the space in the conical socket allows for this variability.

If chock thickness needs to be more than 60 or less than 25 mm, the length of the thrust sleeve and its corresponding holding down stud as well as the length of the normal holding down stud must be in- or decreased accordingly. Please note: In any case, if the minimum thickness is less than 25 mm, the epoxy resin supplier must be consulted.

3 Pouring of the epoxy resin chocks

3.1 Conditions before pouring


- Engine fully aligned
- All side stoppers welded in place, wedges not fitted
- For thrust sleeves (see figure 1): Thrust sleeves and their accompanying holding down studs inserted into the corresponding holes with the studs/nuts tightened by hand. The bush and the sponge rubber sealing fixed correctly under the tank top plate. Contact surface conical socket/top plate smeared with gasket sealant.
- For normal holding down studs (see figure 2): Sponge rubber plugs or similar inserted into bedplate where normal studs are applied.

3.2 Pouring

Pouring of the epoxy resin chocks together with its preparatory work must be carried out either by experts of the epoxy resin manufacturers or by their representatives. Their instructions must be strictly observed. In particular, no yard work on the engine foundation may proceed before completion of the curing period of the epoxy resin chocks. Epoxy resin material for the thrust sleeve holes is identical to that used for the chocks.

The epoxy resin material applied for the chocking of the engine has to fulfill the following requirements:

- Approved by the major classification societies
- The following materials properties are met:

Substitute for:								PC	Q-Code	X	X	X	X	X
Modif	A	EAAD084407	16.01.2013	B	7-86.314	01.12.2015	B	EAAD086314	01.12.2015					
		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		
		Product W-2S				Fitting Instruction to engine seating with epoxy resin chocks								
Made	19.01.2011	S.Feuerstein			Main Drw.	Page	Material ID 107.412.130.500							
Chkd	19.01.2011	M.Hug			Design Group 9710	2 / 4							Rev	B
Appd	19.01.2011	D.Strödecke				Drawing ID	107.412.130							

Properties	Standard	Values
Ultimate compression strength	ASTM D-695	min. 130 MPa
Compression yield point	ASTM D-695	min. 100 MPa
Compressive modulus of elasticity	ASTM D-695	min. 3100 MPa
Deformation under load: Load 550 N / 70°C Load 1100 N / 70°C	ASTM D-621	max. 0.10 % max. 0.15 %
Curing shrinkage	ASTM D-2566	max. 0.15 %
Coefficient of thermal expansion (0-60 K)	ASTM D-696	max. $50 \cdot 10^{-6}$ 1/K
Coefficient of friction – normal		min. 0.3

Table 1: Required properties of epoxy resin material

4 Tightening the holding down studs

The instructions of the epoxy resin manufacturers or their representatives concerning the curing period must be strictly observed before any work on the engine foundation may proceed. On completion of the curing period, the supporting devices, i.e. jacking screws, jacking wedges, etc., must be removed before the holding down studs are tightened. All engine's holding down studs are tightened by means of a hydraulic pre-tensioning jack. The tightening procedure begins at the driving end and continues alternating from side to side or in parallel on both sides in the direction of the engine free end. After tightening all engine holding down studs, fit the side stopper wedges.


5 Table and figures

5.1 Tightening pressures

Engine type	Pretension force per stud Fv [kN]*1	Hydraulic tightening pressure p [bar] *2	Code-No. of hydr. pre-tensioning jack*3
W-X35, W-X40	280	1500	94145
W-X62, W-X72	700	1500	94145
W-X92	800	1500	94145

Table 2: Foundation bolts tightening data

Remarks: *1) Including an efficiency loss during tightening process
 *2) Tightening procedure: 1st step 1000 bar, 2nd step 1500 bar
 *3) The hydraulic pre-tensioning jack is part of the engine builder's tool kit

Substitute for:								PC	Q-Code	X	X	X	X	X	
Modif	A	EAAD084407	16.01.2013	B	7-86.314	01.12.2015	B	EAAD086314	01.12.2015						
		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date			Number	Drawn Date		
		Product W-2S		Fitting Instruction to engine seating with epoxy resin chocks											
Made	19.01.2011	S.Feuerstein		Main Drw.	Page	3 / 4		Material ID	107.412.130.500						
Chkd	19.01.2011	M.Hug		Design Group	Drawing ID		107.412.130						Rev	B	
Appd	19.01.2011	D.Strödecke		9710											

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5.2 Figures

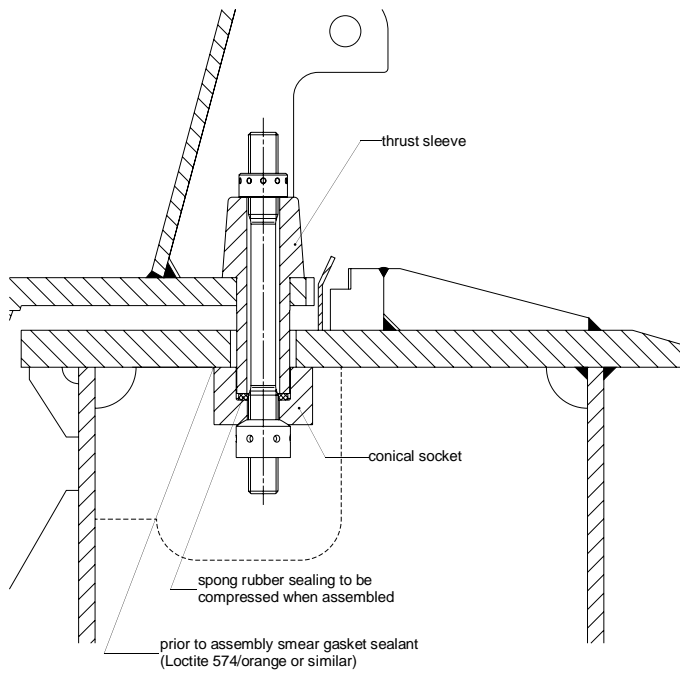


Figure 1: Arrangement of thrust sleeve with stud prior pouring the epoxy resin chocks

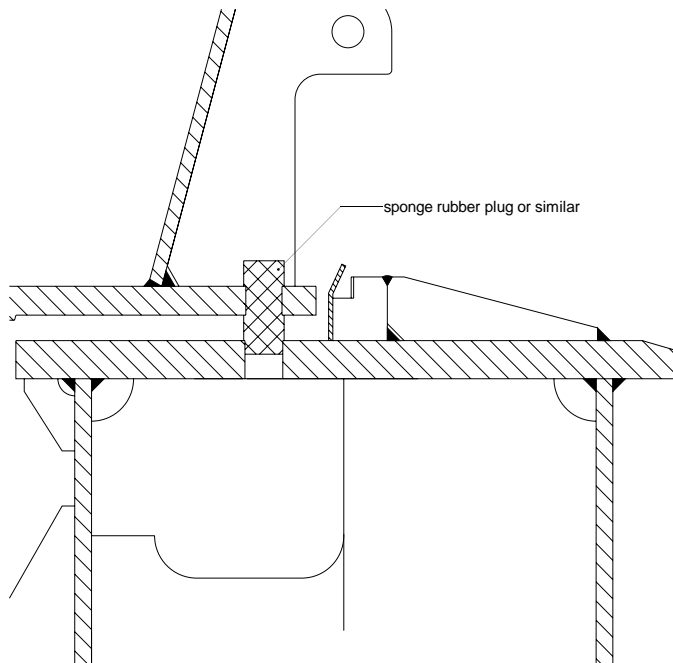


Figure 2: Arrangement prior pouring the epoxy resin chocks for normal stud (proposal)

Substitute for:							PC	Q-Code	X	X	X	X	X
Modif	A	EAAD084407	16.01.2013	B	7-86.314	01.12.2015	B	EAAD086314	01.12.2015				
		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date	
WIN GD Winterthur Gas & Diesel		Product W-2S			Fitting Instruction to engine seating with epoxy resin chocks								
Made	19.01.2011	S.Feuerstein		Main Drw.	Page	4 / 4		Material ID	107.412.130.500				
Chkd	19.01.2011	M.Hug		Design Group	Drawing ID			107.412.130			Rev	B	
Appd	19.01.2011	D.Strödecke		9710									

Fitting of the engine seating and holding down studs.

For engine seating with epoxy resin chocks

1. Introduction

Apart from the normal, conventional engine holding down stud used to fasten the engine to the tank top plate, a different design is to be applied for the propeller thrust transmission. The propeller thrust is transmitted from the engine thrust bearing to the bedplate and to the tank top plate which is part of the ship's structure by means of thrust sleeves located adjacent to the engine thrust bearing.

2. Thrust sleeve

2.1 Fitting

The thrust sleeve is fitted in the bottom plate of the engine bedplate and cast in the tank top plate. The diameter of the flame-cut or drilled hole for the thrust sleeve in the tank top plate is larger than the diameter of the sleeve to allow engine alignment without re-machining of the hole. The sleeve in the tank top plate hole is then fixed with epoxy resin material as used for the chocks. The engine holding down stud is inserted in the sleeve and tightened in the same way as the normal holding down studs. This hydraulically tightened holding down stud is of the same design, as the normal holding down stud used to fasten the engine to the tank top plate. Drilling and reaming of the holes in the engine bedplate is carried out by the engine manufacturer. The thrust sleeves with the final tolerance and the holding down studs are supplied by the shipyard.

2.2 Drilling of the holes in the tank top plate

The holes for the thrust sleeves must be drilled or flame-cut in the tank top plate **before setting the engine in position**. These holes are prepared while observing the dimensions given on the drawing 'Chocking and drilling plan, section B-B'. The holes for the normal holding down studs can be drilled or flame-cut either before or after setting the engine in position.


2.3 Chock thickness

Since the chock thickness cannot be precisely determined before engine alignment is finalized, the standard design of the holding down stud, thrust sleeve and conical washer allows for the application of chock thicknesses from **25 up to 60mm**. To avoid additional machining of the sleeve to adjust its length, the conical washer is provided with a larger bore compared to the sleeve's external diameter. The sleeve can protrude beyond the top plate more or less, the space in the washer allows for this variable. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the thrust sleeve and its corresponding holding down stud as well as the length of the normal holding down stud must be in- or decreased accordingly. **Please note:** In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.

3. Pouring of the epoxy resin chocks

3.1 Conditions before pouring

- Engine fully aligned
- All side stoppers welded in place, wedges not fitted
- **For thrust sleeves (see fig. 1):** Thrust sleeves and their accompanying holding down studs inserted into the corresponding holes with the studs/nuts tightened by hand. The bush and the sponge rubber sealing fixed correctly under the tank top plate. Contact surface washer/top plate smeared with gasket sealant.
- **For normal holding down studs (see fig. 2):** Sponge rubber plugs or similar inserted into bedplate where normal studs are applied.

a	7-53.784	04.05.07						Replaced by:	PC
b	7-59.203	30.01.08						Substitute for:	
 Wärtsilä Switzerland Ltd.		RTA82C/RT-flex82C RTA82T/RT-flex82T		Fitting instructions to engine seating with epoxy resin chocks				Group 9710	
		Drawn: S. Natali Verif: S. Natali		5.12.2006		4-107.379.418			1/4

3.2 Pouring

Pouring of the epoxy resin chocks together with its preparatory work must be carried out either by experts of the epoxy resin manufacturers or by their representatives. Their instructions must be strictly observed. In particular, no yard work on the engine foundation may proceed before completion of the curing period of the epoxy resin chocks. Epoxy resin material for the thrust sleeve holes is identical to that used for the chocks.

The epoxy resin material applied for the chocking of the engine has to fulfill the following requirements:


- Approved by the major classification societies
- The following materials properties are met:

Properties	Standard	Values
Ultimate compression strength	ASTM D-695	min. 130 MPa
Compression yield point	ASTM D-695	min. 100 MPa
Compressive modulus of elasticity	ASTM D-695	min. 3100 MPa
Deformation under load Load 550 N / 70 °C Load 1100 N / 70 °C	ASTM D-621	max. 0.10 % max. 0.15 %
Curing shrinkage	ASTM D-2566	max. 0.15 %
Coefficient of thermal expansion (0-60 K)	ASTM D-696	max. $50 \cdot 10^{-6}$ 1/K
Coefficient of friction	normal	min. 0.3

Required properties of epoxy resin material

4. Tightening the holding down studs

The instructions of the epoxy resin manufacturers or their representatives concerning the curing period must be strictly observed before any work on the engine foundation may proceed. On completion of the curing period the supporting devices, i.e. jacking screws, jacking wedges, etc., must be removed before the holding down studs are tightened. All engine's holding down studs are tightened by means of a hydraulic pre-tensioning jack. The tightening procedure begins at the driving end and continues alternating from side to side in the direction of the engine free end. After tightening all engine holding down studs, fit the side stopper wedges.

a	b					
 WÄRTSILÄ Wärtsilä Switzerland Ltd.		RTA82C/RT-flex82C RTA82T/RT-flex82T Drawn: S. Natali 5.12.2006 Verif.: S. Natali	Fitting instructions to engine seating with epoxy resin chocks			Group 9710
			4-107.379.418		2/4	

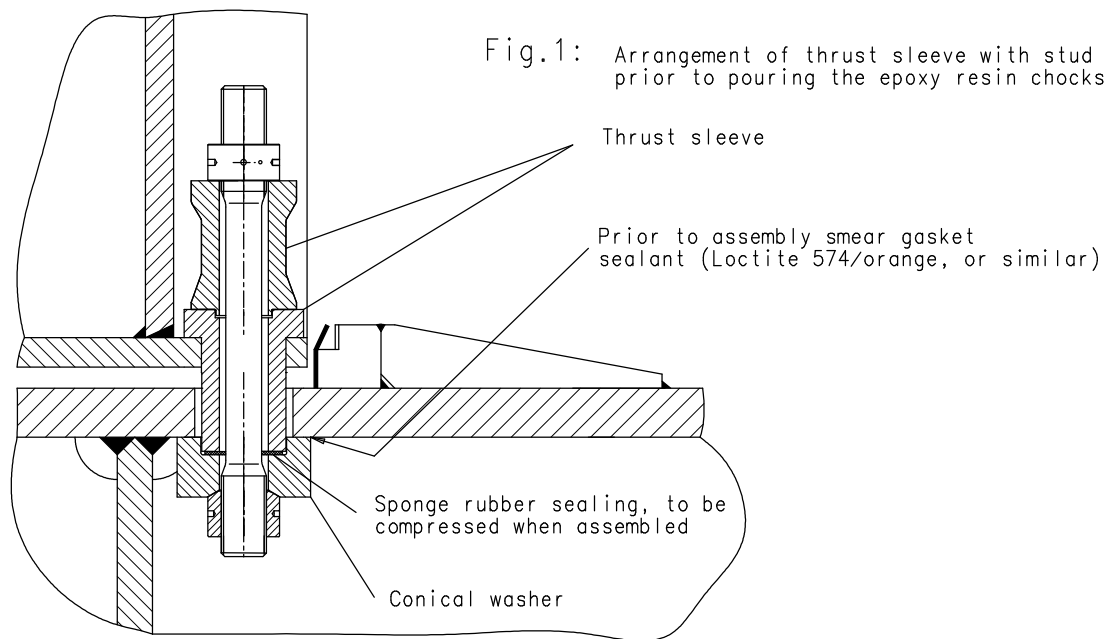
5. Table and figures

5.1 Tightening pressures

Engine type	Pretension force per stud F_v [kN] ^{*1)}	Hydr. tightening pressure p [bar]	Code-No. of hydr. pre-tensioning jack ^{*2)}
RTA82C/RT-flex82C	700	1500	94145
RTA82T/RT-flex82T	700	1500	94145

Remarks: *1) Including an efficiency loss during tightening process
*2) The hydraulic pre-tensioning jack is part of the engine builder's tool kit

5.2 Figures




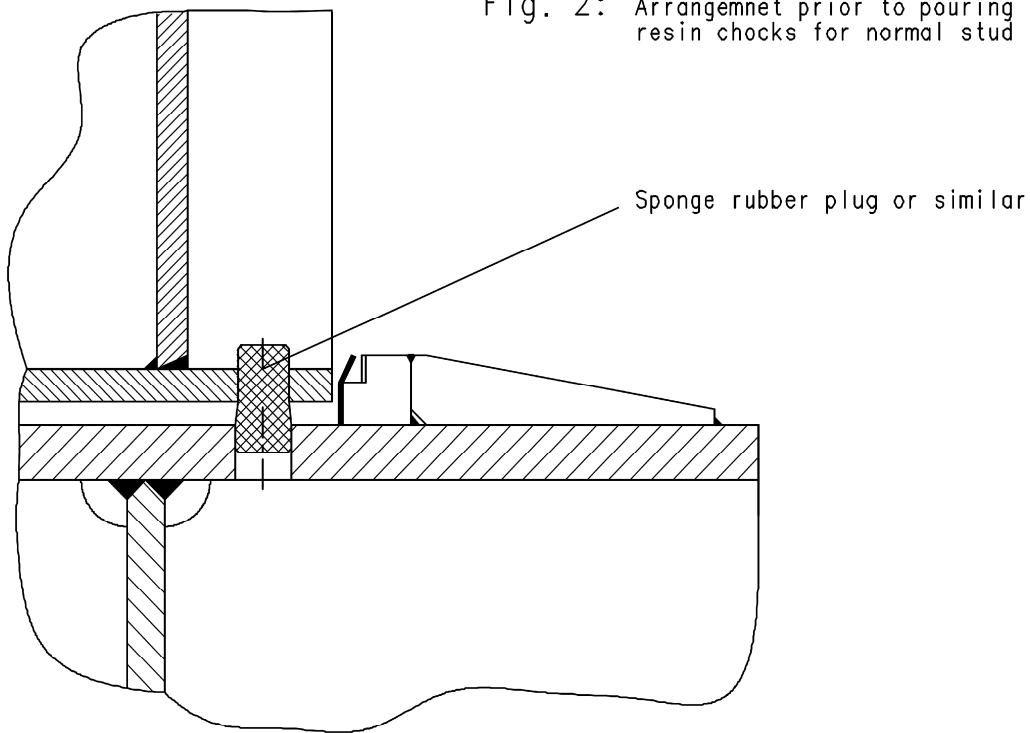

a	b					
 WÄRTSILÄ Wärtsilä Switzerland Ltd.		RTA82C/RT-flex82C RTA82T/RT-flex82T	Fitting instructions to engine seating with epoxy resin chocks	Group 9710		
		Drawn: S. Natali 5.12.2006 Verif.: S. Natali	4-107.379.418			3/4

Fig. 2: Arrangement prior to pouring the epoxy resin chocks for normal stud (proposal)



a	b						
 WÄRTSILÄ Wärtsilä Switzerland Ltd.		RTA82C/RT-flex82C RTA82T/RT-flex82T Drawn: S. Natali 5.12.2006 Verif.: S. Natali	Fitting instructions to engine seating with epoxy resin chocks			Group 9710	
			4-107.379.418		4/4		

Fitting of the engine seating and holding down studs for engine seating with epoxy resin chocks

1. Introduction

Apart from the normal, conventional engine holding down stud used to fasten the engine to the tank top plate, a different design is to be applied for the propeller thrust transmission. The propeller thrust is transmitted from the engine thrust bearing to the bedplate and to the tank top plate which is part of the ship's structure by means of the **a) thrust sleeve** or **b) fitted stud** located adjacent to the engine thrust bearing.

2. Thrust sleeve

2.1 Fitting

The thrust sleeve is fitted in the bottom plate of the engine bedplate and cast in the tank top plate. The diameter of the flame-cut or drilled hole for the thrust sleeve in the tank top plate is larger than the diameter of the sleeve to allow engine alignment without re-machining of the hole. The sleeve in the tank top plate hole is then fixed with epoxy resin material as used for the chocks. The engine holding down stud is inserted in the sleeve and tightened in the same way as the normal holding down studs. This hydraulically tightened holding down stud is of the same design, as the normal holding down stud used to fasten the engine to the tank top plate. Drilling and reaming of the holes in the engine bedplate is carried out by the engine manufacturer. The thrust sleeves with the final tolerance and the holding down studs are supplied by the shipyard.

2.2 Drilling of the holes in the tank top plate

The holes for the thrust sleeves must be drilled or flame-cut in the tank top plate **before setting the engine in position**. These holes are prepared while observing the dimensions given on the drawing 'Chocking and drilling plan, section B-B'. The holes for the normal holding down studs can be drilled or flame-cut either before or after setting the engine in position.

2.3 Chock thickness

Since the chock thickness cannot be precisely determined before engine alignment is finalized, the standard design of the holding down stud, thrust sleeve and conical washer allows for the application of chock thicknesses from **25 up to 60mm**. To avoid additional machining of the sleeve to adjust its length, the conical washer is provided with a larger bore compared to the sleeve's external diameter. The sleeve can protrude beyond the top plate more or less, the space in the washer allows for this variable. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the thrust sleeve and its corresponding holding down stud as well as the length of the normal holding down stud must be in- or decreased accordingly. **Please note:** In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.


3 Fitted stud

3.1 Fitting

The fitted stud is fitted in the bottom plate of the engine bedplate, the epoxy resin chock and the tank top plate. The holes in the bedplate and the top plate are reamed together when the engine is completely aligned. The fitted stud is then inserted and the chocks are poured. The engine bedplate is delivered with pre-drilled holes. The fitted studs with the final tolerance and the holding down studs are supplied by the shipyard.

3.2 Drilling of the holes in the tank top plate

The holes in the tank top plate for the fitted studs are to be pre-drilled when the engine is placed in position. Then drill out and ream the pre-drilled holes in the bedplate together with the holes in the

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									Substitute for:	
 WÄRTSILÄ <small>Wärtsilä Switzerland Ltd.</small>	RT-flex50 <small>Drawn: M. Prstec 01.07.08 Verif: M.Lüthi 03.07.08</small>		Fitting instructions to engine seating with epoxy resin chocks (E)				4-107.401.839		Group 9710	
									1/5	

tank top plate to the foreseen final diameter. The holes for the normal holding down studs are to be drilled according to chocking and drilling plan.

3.3 Chock thickness


Since the chock thickness cannot be precisely determined before the engine alignment is finalised, the standard design of the fitted stud allows for the application of chock thicknesses from **25 up to 60mm**. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the fitted stud and also of the normal holding down stud must be in- or decreased accordingly.

Please note: In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.

4. Pouring of the epoxy resin chocks

4.1 Conditions before pouring

- Engine fully aligned
- All side stoppers welded in place, wedges not fitted
- **When using thrust sleeves (see fig. 1):** Thrust sleeves and their accompanying holding down studs inserted into the corresponding holes with the studs/nuts tightened by hand. The bush and the sponge rubber sealing fixed correctly under the tank top plate. Contact surface washer/top plate smeared with gasket sealant.
- **When using fitted studs (see fig. 2):** Fitted studs inserted into the corresponding holes and tightened by hand. The bush should be fixed correctly under the tank top plate.
- **For normal holding down studs (see fig. 3):** Sponge rubber plugs or similar inserted into bedplate where normal studs are applied.

 WÄRTSILÄ Wärtsilä Switzerland Ltd.	RT-flex50		Fitting instructions to engine seating with epoxy resin chocks		Group 9710
	Drawn: M. Prstec Verif.: M.Lüthi	01.07.08 03.07.08	(E)	4-107.401.839	2/5

4.2 Pouring

Pouring of the epoxy resin chocks together with its preparatory work must be carried out either by experts of the epoxy resin manufacturers or by their representatives. Their instructions must be strictly observed. In particular, no yard work on the engine foundation may proceed before completion of the curing period of the epoxy resin chocks. The filler material for the thrust sleeve holes is identical to that used for the chocks.

The epoxy resin material applied for the chocking of the engine has to fulfill the following requirements:


- Approved by the major classification societies
- The following materials properties are met:

Properties	Standard	Values
Ultimate compression strength	ASTM D-695	min. 130 MPa
Compression yield point	ASTM D-695	min. 100 MPa
Compressive modulus of elasticity	ASTM D-695	min. 3100 MPa
Deformation under load Load 550 N / 70 °C Load 1100 N / 70 °C	ASTM D-621	max. 0.10 % max. 0.15 %
Curing shrinkage	ASTM D-2566	max. 0.15 %
Coefficient of thermal expansion (0-60 K)	ASTM D-696	max. $50 \cdot 10^{-6}$ 1/K
Coefficient of friction	normal	min. 0.3

Required properties of epoxy resin material

5. Tightening the holding down studs

The instructions of the epoxy resin manufacturers or their representatives concerning the curing period must be strictly observed before any work on the engine foundation may proceed. On completion of the curing period the supporting devices, i.e. jacking screws, jacking wedges, etc., must be removed before the holding down studs are tightened. All engine's holding down studs are tightened by means of a hydraulic pre-tensioning jack. The tightening procedure begins at the driving end and continues alternating from side to side in the direction of the engine free end. After tightening all engine holding down studs, fit the side stopper wedges.

 WÄRTSILÄ Wärtsilä Switzerland Ltd.	RT-flex50		Fitting instructions to engine seating with epoxy resin chocks		Group 9710
	Drawn: M. Prstec Verif.: M.Lüthi	01.07.08 03.07.08	(E)	4-107.401.839	3/5

6. Table and figures

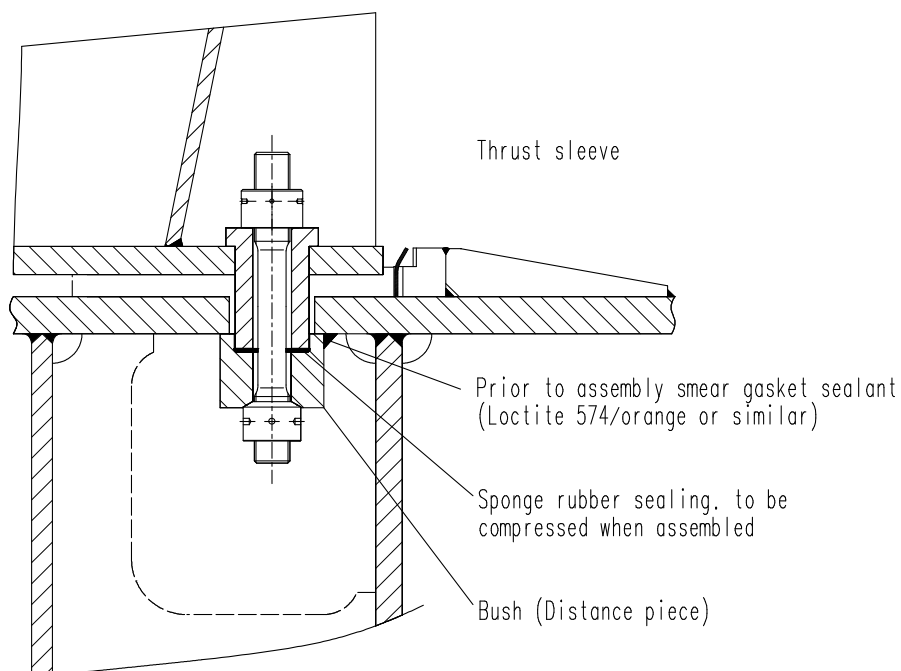
6.1 Tightening pressures

Engine type	Pretension force per stud F_v [kN] ^{*1)}	Hydr. tightening pressure p [bar]	Code-No. of hydr. pre-tensioning jack ^{*2)}
RT-flex50	330	1500	94145
-	-	-	-

Remarks: *1) Including an efficiency loss during tightening process
*2) The hydraulic pre-tensioning jack is part of the engine builder's tool kit

6.2 Figures

Fig. 1: Arrangement of thrust sleeve with stud prior to pouring the epoxy resin chocks




 WÄRTSILÄ Wärtsilä Switzerland Ltd.	RT-flex50	Fitting instructions to engine seating with epoxy resin chocks		Group 9710
	Drawn: M. Prstec 01.07.08 Verif.: M.Lüthi 03.07.08	(E)	4-107.401.839	4/5

Fig. 2: Arrangement of fitted stud prior to pouring the epoxy resin chocks

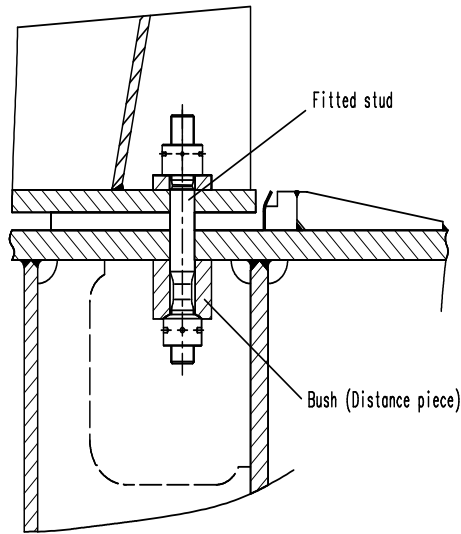
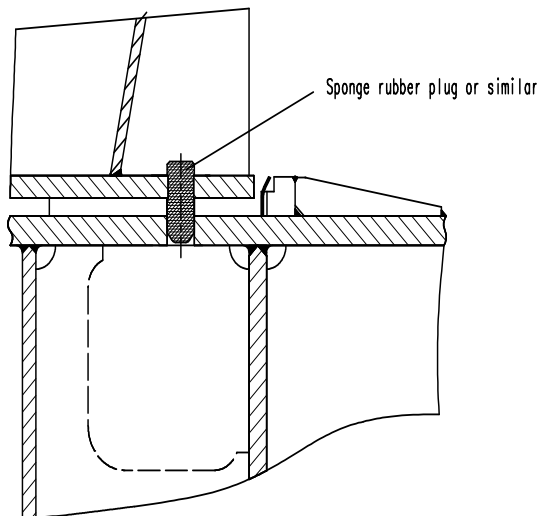



Fig. 3: Arrangement prior to pouring the epoxy resin chocks for normal stud (proposal)



 WÄRTSILÄ Wärtsilä Switzerland Ltd.	RT-flex50		Fitting instructions		Group
			to engine seating with epoxy resin chocks		9710
Drawn: M. Prstec 01.07.08 Verif.: M.Lüthi 03.07.08		(E)	4-107.401.839		5/5

Fitting of the engine seating and holding down studs for engine seating with epoxy resin chocks

1. Introduction

Apart from the normal, conventional engine holding down stud used to fasten the engine to the tank top plate, a different design is to be applied for the propeller thrust transmission. The propeller thrust is transmitted from the engine thrust bearing to the bedplate and to the tank top plate which is part of the ship's structure by means of the **a) thrust sleeve** or **b) fitted stud** located adjacent to the engine thrust bearing.

2. Thrust sleeve

2.1 Fitting

The thrust sleeve is fitted in the bottom plate of the engine bedplate and cast in the tank top plate. The diameter of the flame-cut or drilled hole for the thrust sleeve in the tank top plate is larger than the diameter of the sleeve to allow engine alignment without re-machining of the hole. The sleeve in the tank top plate hole is then fixed with epoxy resin material as used for the chocks. The engine holding down stud is inserted in the sleeve and tightened in the same way as the normal holding down studs. This hydraulically tightened holding down stud is of the same design, except for the length, as the normal holding down stud used to fasten the engine to the tank top plate. Drilling and reaming of the holes in the engine bedplate is carried out by the engine manufacturer. The thrust sleeves with the final tolerance and the holding down studs are supplied by the shipyard.

2.2 Drilling of the holes in the tank top plate

The holes for the thrust sleeves must be drilled or flame-cut in the tank top plate **before setting the engine in position**. These holes are prepared while observing the dimensions given on the drawing '**Chocking and drilling plan, section B-B**'. The holes for the normal holding down studs can be drilled or flame-cut either before or after setting the engine in position.

2.3 Chock thickness


Since the chock thickness cannot be precisely determined before engine alignment is finalized, the standard design of the holding down stud, thrust sleeve and conical washer allows for the application of chock thicknesses from **25 up to 60mm**. To avoid additional machining of the sleeve to adjust its length, the conical washer is provided with a larger bore compared to the sleeve's external diameter. The sleeve can protrude beyond the top plate more or less, the space in the washer allows for this variable. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the thrust sleeve and its corresponding holding down stud as well as the length of the normal holding down stud must be in- or decreased accordingly. **Please note:** In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.

3 Fitted stud

3.1 Fitting

The fitted stud is fitted in the bottom plate of the engine bedplate, the epoxy resin chock and the tank top plate. The holes in the bedplate and the top plate are reamed together when the engine is completely aligned. The fitted stud is then inserted and the chocks are poured. The engine bedplate is delivered with pre-drilled holes. The fitted studs with the final tolerance and the holding down studs are supplied by the shipyard.

3.2 Drilling of the holes in the tank top plate

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										Substitute for:	
 WÄRTSILÄ Wärtsilä Switzerland Ltd.	RT58T-D		Fitting instructions to engine seating with epoxy resin chocks						Group 9710		
	Drawn: M. Prstec 26.02.09 Verif.: D. Strödecke 27.02.09		E	4-107.410.532				1/4			

The holes in the tank top plate for the fitted studs are to be pre-drilled when the engine is placed in position. Then drill out and ream the pre-drilled holes in the bedplate together with the holes in the tank top plate to the foreseen final diameter. The holes for the normal holding down studs are drilled with the same diameter as those in the bedplate.

3.3 Chock thickness


Since the chock thickness cannot be precisely determined before the engine alignment is finalised, the standard design of the fitted stud allows for the application of chock thicknesses from **25 up to 60mm**. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the fitted stud and also of the normal holding down stud must be in- or decreased accordingly.

Please note: In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.

4. Pouring of the epoxy resin chocks

4.1 Conditions before pouring

- Engine fully aligned
- All side stoppers welded in place, wedges not fitted
- **When using thrust sleeves (see fig. 1):** Thrust sleeves and their accompanying holding down studs inserted into the corresponding holes with the studs/nuts tightened by hand. The conical washers and the sponge rubber sealings fixed correctly under the tank top plate. Contact surface washer/top plate smeared with gasket sealant.
- **When using fitted studs (see fig. 2):** Fitted studs inserted into the corresponding holes and tightened by hand. The conical washers fixed correctly under the tank top plate.
- **For normal holding down studs (see fig. 3):** Sponge rubber plugs or similar inserted into bedplate where normal studs are applied.

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	E	4-107.410.532		2/5

4.2 Pouring

Pouring of the epoxy resin chocks together with its preparatory work must be carried out either by experts of the epoxy resin manufacturers or by their representatives. Their instructions must be strictly observed. In particular, no yard work on the engine foundation may proceed before completion of the curing period of the epoxy resin chocks. Epoxy resin material for the thrust sleeve holes is identical to that used for the chocks.

The epoxy resin material applied for the chocking of the engine has to fulfil the following requirements:


- Approved by the major classification societies
- The following materials properties are met:

Properties	Standard	Values
Ultimate compression strength	ASTM D-695	min. 130 MPa
Compression yield point	ASTM D-695	min. 100 MPa
Compressive modulus of elasticity	ASTM D-695	min. 3100 MPa
Deformation under load Load 550 N / 70 °C Load 1100 N / 70 °C	ASTM D-621	max. 0.10 % max. 0.15 %
Curing shrinkage	ASTM D-2566	max. 0.15 %
Coefficient of thermal expansion (0-60 K)	ASTM D-696	max. $50 \cdot 10^{-6}$ 1/K
Coefficient of friction	normal	min. 0.3

Required properties of epoxy resin material

5. Tightening the holding down studs

The instructions of the epoxy resin manufacturers or their representatives concerning the curing period must be strictly observed before any work on the engine foundation may proceed. On completion of the curing period the supporting devices, i.e. jacking screws, jacking wedges, etc., must be removed before the holding down studs are tightened. All engine holding down studs are tightened by means of a hydraulic pre-tensioning jack. The tightening procedure begins at the driving end and continues alternating from side to side in the direction of the engine free end. After tightening all engine holding down studs, fit the side stopper wedges.

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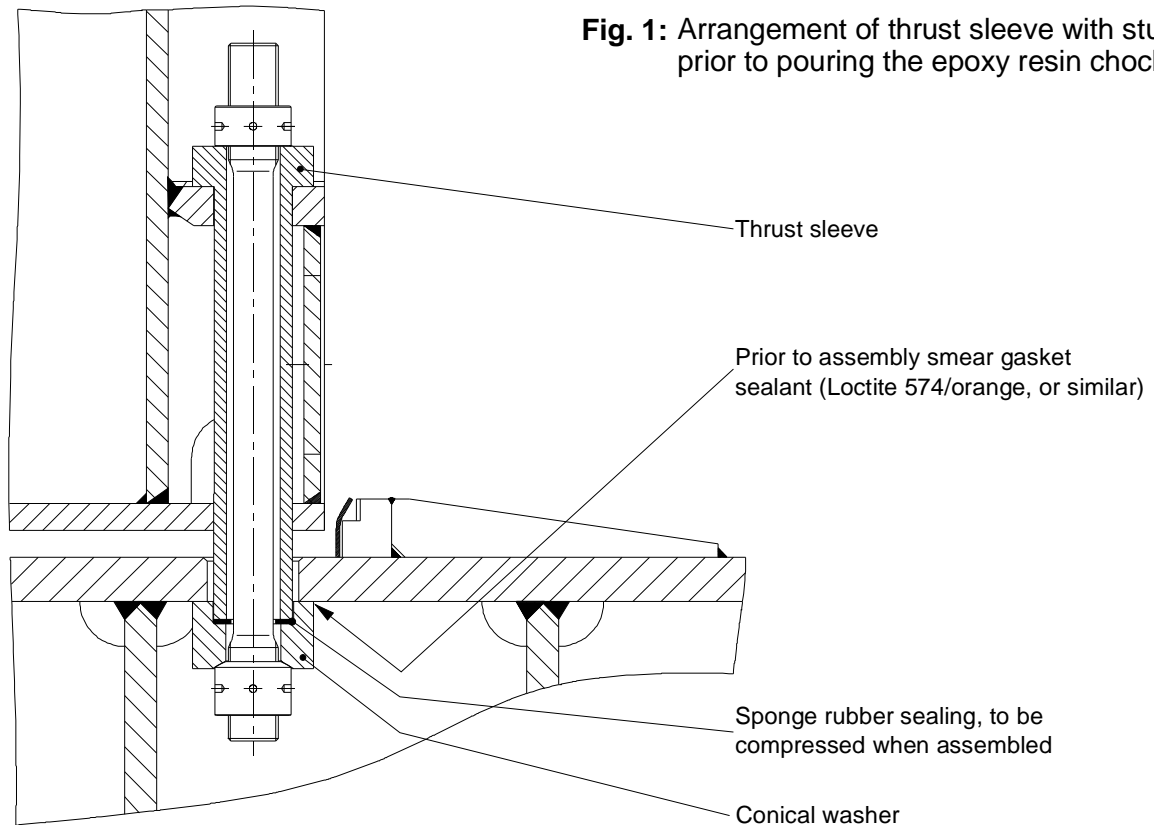
6. Table and figures

6.1 Tightening pressures

Engine type	Pretension force per stud F_v [kN] ^{*1)}	Hydr. tightening pressure p [bar]	Code-No. of hydr. pretensioning jack ^{*2)}
RTA58T	463	1000	94145

Remarks: *1) Including an efficiency loss during tightening process
*2) The hydraulic pretensioning jack is part of the engine builder's tool kit

6.2 Figures




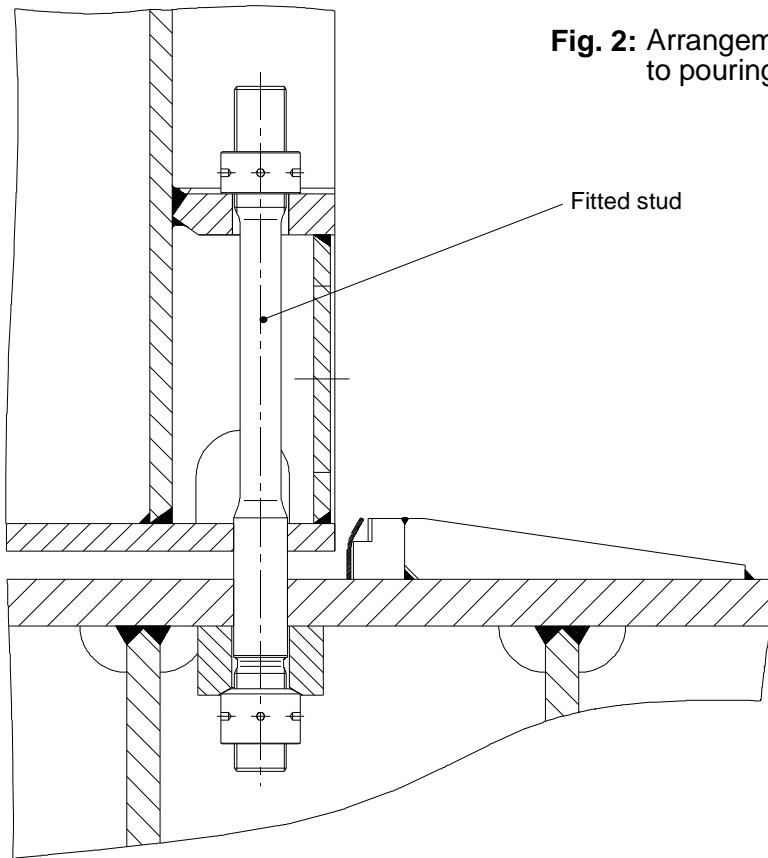
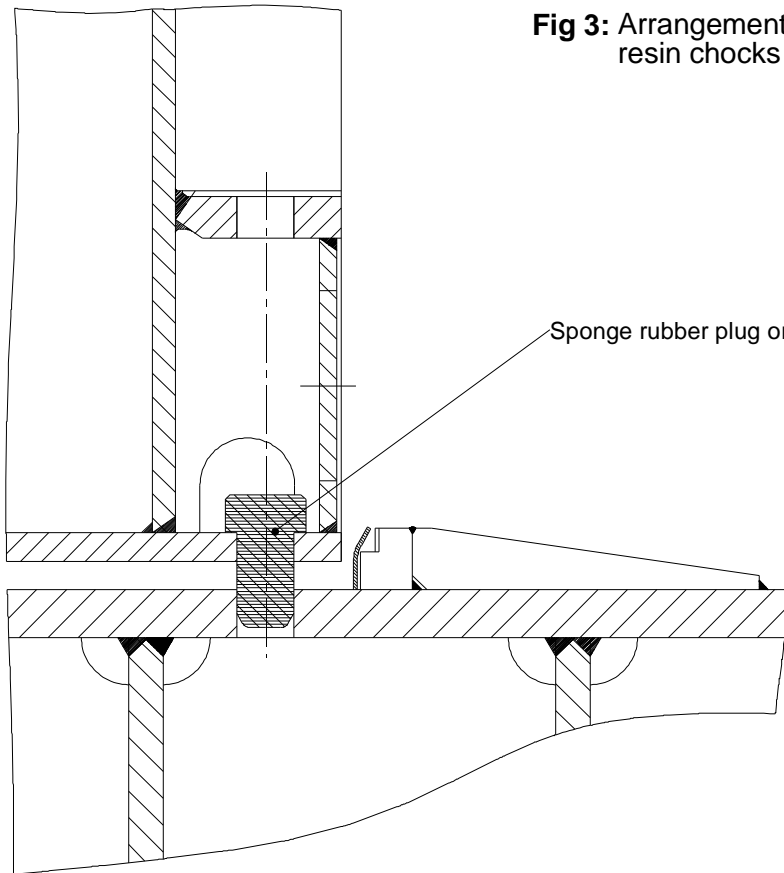
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Fig. 2: Arrangement of fitted stud prior to pouring the epoxy resin chocks




Fitted stud

Fig 3: Arrangement prior to pouring the epoxy resin chocks for normal stud (proposal)



Sponge rubber plug or similar

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Fitting of the engine seating and holding down studs for engine seating with epoxy resin chocks

1. Introduction

Apart from the normal, conventional engine holding down stud used to fasten the engine to the tank top plate, a different design is to be applied for the propeller thrust transmission. The propeller thrust is transmitted from the engine thrust bearing to the bedplate and to the tank top plate which is part of the ship's structure by means of the **a) thrust sleeve** or **b) fitted stud** located adjacent to the engine thrust bearing.

2. Thrust sleeve

2.1 Fitting

The thrust sleeve is fitted in the bottom plate of the engine bedplate and cast in the tank top plate. The diameter of the flame-cut or drilled hole for the thrust sleeve in the tank top plate is larger than the diameter of the sleeve to allow engine alignment without re-machining of the hole. The sleeve in the tank top plate hole is then fixed with epoxy resin material as used for the chocks. The engine holding down stud is inserted in the sleeve and tightened in the same way as the normal holding down studs. This hydraulically tightened holding down stud is of the same design, except for the length, as the normal holding down stud used to fasten the engine to the tank top plate. Drilling and reaming of the holes in the engine bedplate is carried out by the engine manufacturer. The thrust sleeves with the final tolerance and the holding down studs are supplied by the shipyard.

2.2 Drilling of the holes in the tank top plate

The holes for the thrust sleeves must be drilled or flame-cut in the tank top plate **before setting the engine in position**. These holes are prepared while observing the dimensions given on the drawing '**Chocking and drilling plan, section B-B**'. The holes for the normal holding down studs can be drilled or flame-cut either before or after setting the engine in position.

2.3 Chock thickness

Since the chock thickness cannot be precisely determined before engine alignment is finalized, the standard design of the holding down stud, thrust sleeve and conical washer allows for the application of chock thicknesses from **25 up to 60mm**. To avoid additional machining of the sleeve to adjust its length, the conical washer is provided with a larger bore compared to the sleeve's external diameter. The sleeve can protrude beyond the top plate more or less, the space in the washer allows for this variable. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the thrust sleeve and its corresponding holding down stud as well as the length of the normal holding down stud must be in- or decreased accordingly. **Please note:** In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.


3 Fitted stud

3.1 Fitting

The fitted stud is fitted in the bottom plate of the engine bedplate, the epoxy resin chock and the tank top plate. The holes in the bedplate and the top plate are reamed together when the engine is completely aligned. The fitted stud is then inserted and the chocks are poured. The engine bedplate is delivered with pre-drilled holes. The fitted studs with the final tolerance and the holding down studs are supplied by the shipyard.

3.2 Drilling of the holes in the tank top plate

The holes in the tank top plate for the fitted studs are to be pre-drilled when the engine is placed in

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		E		4-DAAD006574		A		1/5	

position. Then drill out and ream the pre-drilled holes in the bedplate together with the holes in the tank top plate to the foreseen final diameter. The holes for the normal holding down studs are drilled with the same diameter as those in the bedplate.

3.3 Chock thickness


Since the chock thickness cannot be precisely determined before the engine alignment is finalised, the standard design of the fitted stud allows for the application of chock thicknesses from **25 up to 60mm**. At the project stage, if chock thicknesses are foreseen to be **more than 60 or less than 25mm**, the length of the fitted stud and also of the normal holding down stud must be in- or decreased accordingly.

Please note: In any case, if the minimum thickness is less than 25mm, the epoxy resin supplier must be consulted.

4. Pouring of the epoxy resin chocks

4.1 Conditions before pouring

- Engine fully aligned
- All side stoppers welded in place, wedges not fitted
- **When using thrust sleeves (see fig. 1):** Thrust sleeves and their accompanying holding down studs inserted into the corresponding holes with the studs/nuts tightened by hand. The conical washers and the sponge rubber sealings fixed correctly under the tank top plate. Contact surface washer/top plate smeared with gasket sealant.
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Curing shrinkage	ASTM D-2566	max. 0.15 %
Coefficient of thermal expansion (0-60 K)	ASTM D-696	max. $50 \cdot 10^{-6}$ 1/K
Coefficient of friction	normal	min. 0.3

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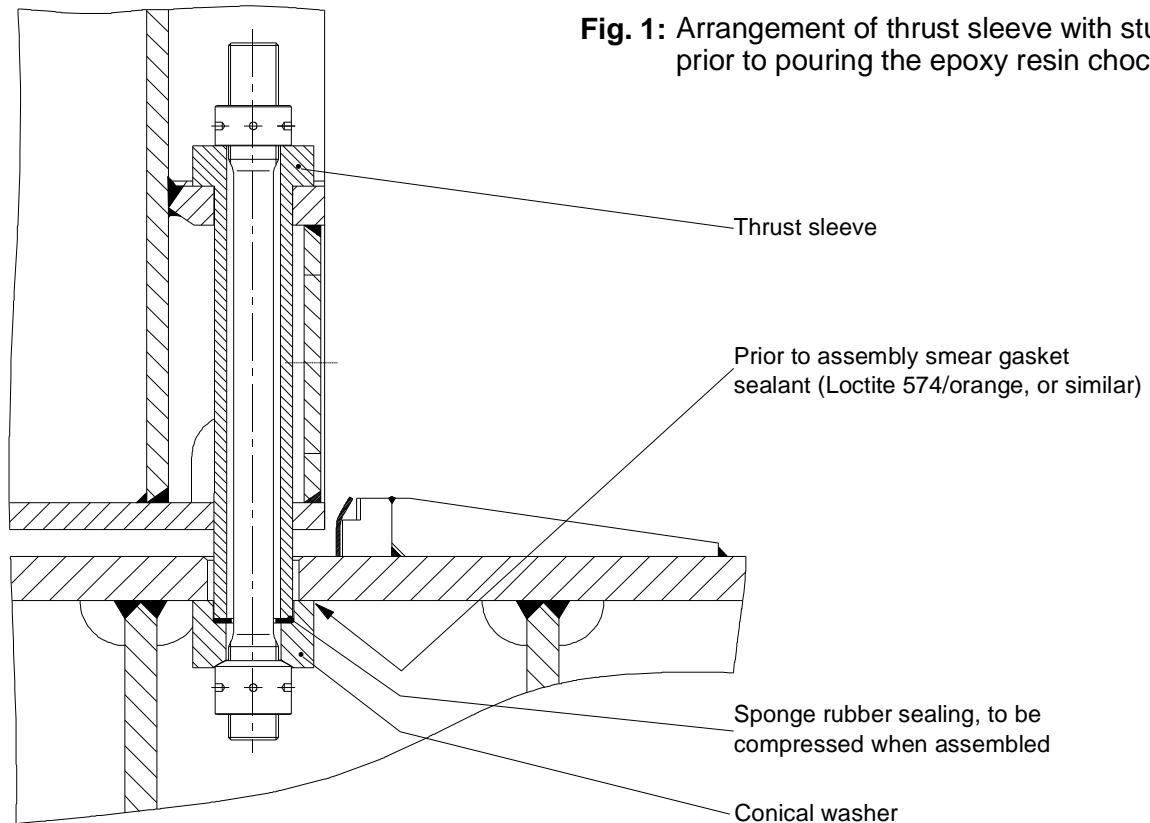
6. Table and figures

6.1 Tightening pressures

Engine type	Pretension force per stud F_v [kN] ^{*1)}	Hydr. tightening pressure p [bar]	Code-No. of hydr. pretensioning jack ^{*2)}
RT-flex48T-D	330	1000	94145

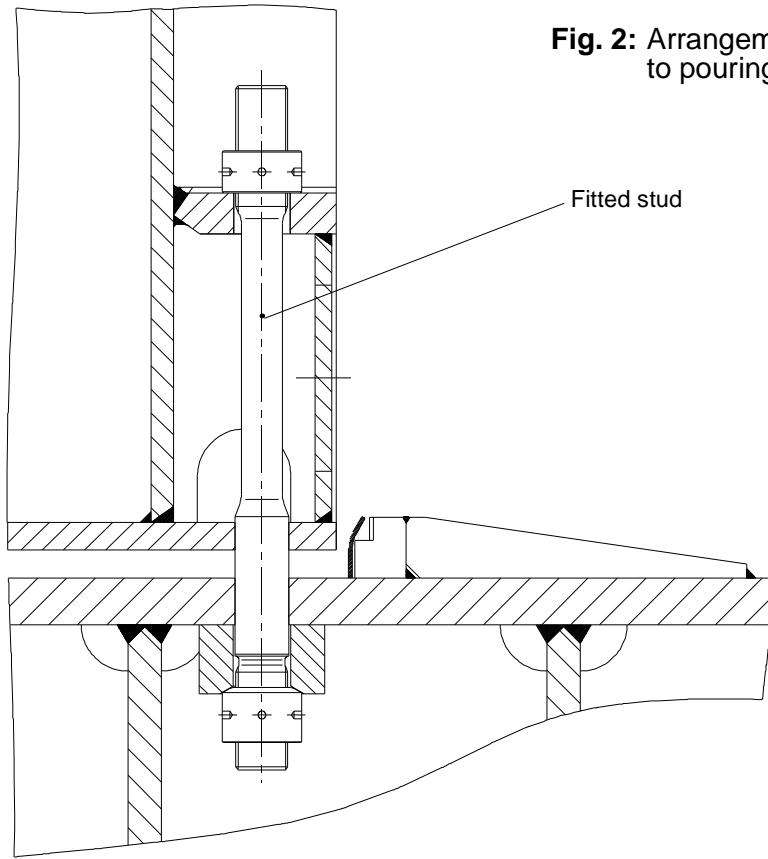
Remarks: *1) Including an efficiency loss during tightening process
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6.2 Figures



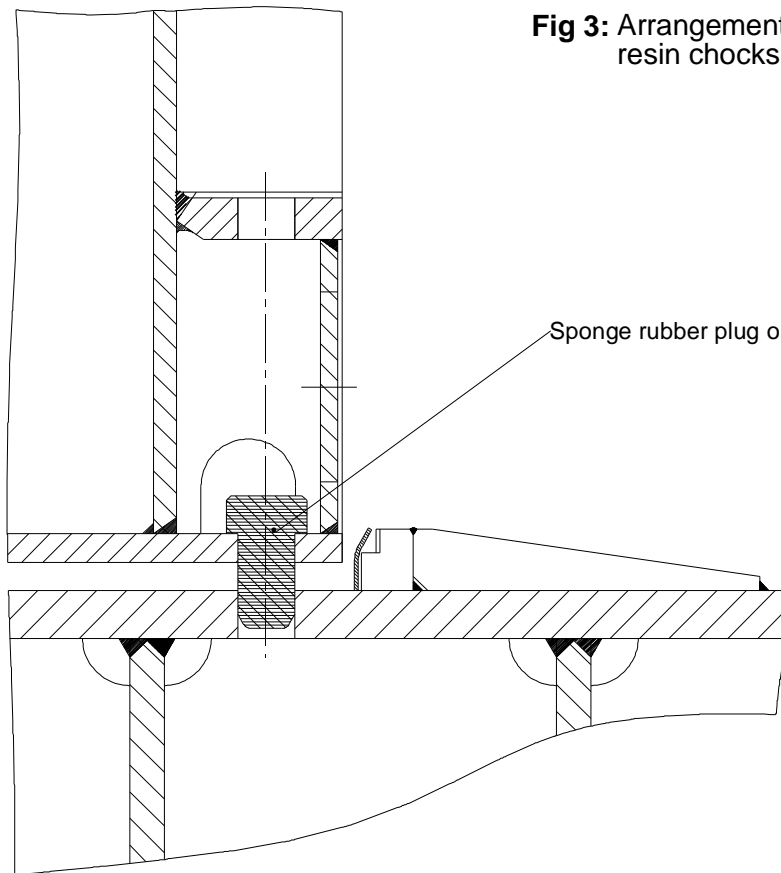
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Fitted stud

Fig 3: Arrangement prior to pouring the epoxy resin chocks for normal stud (proposal)



Sponge rubber plug or similar

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TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2016-10-26	INSTRUCTION	First web upload
2017-02-27	107.379.418 107.401.839 107.410.532 DAAD006574	Instruction and specification for X82/-B/DF, RT-flex50-D/DF, X-52/DF, RT-flex50-D/DF, X-52/DF and RT-flex48T-D added to the documentation set

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