

# MSPV - Shaft Line Installation / Alignment Drawing


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			Irving Shipbuilding Inc		PROJECT NAME			
					MSPV			
	CUSTOMER		CANADIAN_COAST_GUARD		SCALE	DRG: IN		
					NTS	DATE: 11/16/2011		
					CHKD: JP			
					APPRVD: BF			
				PROJECT NO.	6094			
TITLE		MSPV SHAFT_LINE ALIGNMENT		DRAWING NO.		6094-24300-02		REV: NO. 1

# MSPV Shaft Line - Reference Drawing List

Dwg Number	Dwg Description	Source Document	Dwg Number	Dwg Description	Source Document
ICE Dwg 6094-23300-01	Main Engine Laying & Bolting On Foundation Plan (also includes Gearbox)	ICE Drawing	RR Doc SA1086	Shaft Installation and Alignment Calculation	RR Doc SA1086
ICE Dwg 6094-23300-02	Calculations of ME & GB Laying & Fastening on Foundation	ICE Drawing	RR Dwg 107009	RPM Indicator - Transmitter r - Control System Installation Description	Installation Manual Kamewa CP-A D
ICE Dwg 6094-24400-01	Stern Tube Arrangement Plan	ICE Drawing	RR Dwg 107127	RPM Indicator - Impulse Band Assembly	Installation Manual Kamewa CP-A D
ICE Dwg 6094-O1102-2430-01	Shaft Line Arrangement Details	ICE Drawing	RR Dwg 214740	OD Box Connection to Gear	Installation Manual Kamewa CP-A D
ICE Dwg 6094-O1102-2430-02	Stern Tube Assembly	ICE Drawing	RR Dwg 510800	RPM Indicator - Transmitter - Indication System Installation Description	Installation Manual Kamewa CP-A D
ICE Dwg 6094-O1102-2430-03	Stern Tube Main Construction Dimensions	ICE Drawing	RR Dwg 998174	Instruction for Locking Propeller Screws	Installation Manual Kamewa CP-A D
Kamewa Dwg 144112	Propeller - Plugs for Lifting Holes	Installation Manual Kamewa CP-A D	RR Dwg DMN200000689	CPP Hydraulic System Diagram	Installation Manual Kamewa CP-A D
Kamewa Dwg 214000	OD Box Assembly	Installation Manual Kamewa CP-A D	RR Dwg DMN200000864	Shafting Arrangement	Installation Manual Kamewa CP-A D
Kamewa Dwg 586431	Propeller Hub - Instructions for Tightening Screws	Installation Manual Kamewa CP-A D	RR Dwg R215025A Pressure Cover assy	Pressure Cover Assembly - Twin tube Cover for Launching	Installation Manual Kamewa CP-A D
MTU Dwg 5240002399	Main Engine Resilient Mount Installation (BR4000)	MTU Dwg 5240002399	RR Dwg RRM200005966	Propeller Shaft Assembly	Installation Manual Kamewa CP-A D
MTU Dwg XZ59400000169 Sh.1	Main Engine - Installation	MTU Dwg XZ59400000169	RR Dwg RRM200005969	Rope Guard	Installation Manual Kamewa CP-A D
MTU Dwg XZ59425000006	Flex Coupling ME to Gearbox	MTU Dwg XZ59425000006	RR Dwg RRM200005975 (SKF Dwg 28436)	SKF Coupling	Installation Manual Kamewa CP-A D
MTU Manual : MS150047/01E Pg.168, 169	Engine Mounting, Damper Mounts - Check	MTU Manual : MS150047/01E	RR Dwg RRM200006474 C (Thordon dwg TG-20843 Rev.B)	Thordon Bearing Assembly - Aft	Installation Manual Kamewa CP-A D
RR Doc 48023-E	Fill Oil and Flush Propeller Hub	Installation Manual Kamewa CP-A D	RR Dwg RRM200006475 C (Thordon dwg TG-20844 Rev.B)	Thordon Bearing Assembly - Intermediate	Installation Manual Kamewa CP-A D
RR Doc 48337-E	End Cover and Temporary Gravity Tank Installation	Installation Manual Kamewa CP-A D	RR Dwg RRM200006476 C (Thordon dwg TG-20845 Rev.C)	Thordon Bearing Assembly - Fwd	Installation Manual Kamewa CP-A D
RR Doc 49354-E	Propeller Hub Pressure Test	Installation Manual Kamewa CP-A D	RR Dwg RRM200008623	Twin Tube Drawing	Installation Manual Kamewa CP-A D
RR Doc 49358-E	Maximum Run Out of Shaft and Twin Tube Inspection	Installation Manual Kamewa CP-A D	RR Dwg RRM200009345	Propeller Hub	Installation Manual Kamewa CP-A D
RR Doc 49370-E	OD Box Installation Instructions	Installation Manual Kamewa CP-A D	RR Dwg RRM200011521	Gravity Tank for Propeller Hydraulic System	Installation Manual Kamewa CP-A D
RR Doc 49656-E	Twin Tube Final Installation	Installation Manual Kamewa CP-A D	Simplan Dwg SGC: 3-201-0011-000.0	Stern Tube Cooling Water Diagram	Installation Manual Kamewa CP-A D
RR Doc 49672-E	Fill Hydraulic System with Oil	Installation Manual Kamewa CP-A D	Simplan Dwg SGC: 3-201-0012-000.0	FWD SEAL - Dimensions and Tolerances	Installation Manual Kamewa CP-A D
RR Doc 49680-E	RPM Transmitter Installation Instructions	Installation Manual Kamewa CP-A D	Simplan Dwg SGC:3-217-0008-000.1 - RRM200006480	FWD SEAL, Size 210 (Simplan Seal Type SIC-P)	Installation Manual Kamewa CP-A D
RR Doc 49682-E	Requirements for Lubricating Oil	Installation Manual Kamewa CP-A D	Simplan Installation Doc. Dated 21-03-2002	FWD Seal Installation Document	Installation Manual Kamewa CP-A D
RR Doc 49884-E	Prop Shaft Grounding Instruction Manual	Installation Manual Kamewa CP-A D	Simplan Operating Manual	FWD Seal Operating Manual	Installation Manual Kamewa CP-A D
RR Doc DMN200001323	Propeller Blade Installation	Installation Manual Kamewa CP-A D	SKF Instructions - 81569 Edition B	SKF OKCX Coupling - Mounting and Dismounting Instructions	Installation Manual Kamewa CP-A D
RR Doc DMN200002313	Start up and Flushing of Hydraulic System	Installation Manual Kamewa CP-A D	Wilson Walton Dwg. AM1041	Propeller Shaft Earthing Assembly	Installation Manual Kamewa CP-A D
RR Doc DMN200002315	Start up and Flushing of Hydraulic System (Used when hub is submersed in water)	Installation Manual Kamewa CP-A D	Wilson Walton Dwg. AM1043	Monitoring Brush Assembly - Shaft Earthing Device	Installation Manual Kamewa CP-A D

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No.	REVISION				DATE	DRWN	CHKD	APPR.
PROJECT NAME: MSPV								
 Irving Shipbuilding Inc		SCALE: NTS						
CUSTOMER: CANADIAN_COAST_GUARD		DATE: 11/16/2011		CHKD: JP				
PROJECT NO. 6094		DATE: 11/16/2011		APPRD: SF				
DRAWING NO. 6094-24300-02		REV. NO. 2		SHFT NO. 2				




# MSPV Shaft Line - Equipment List and Material Details

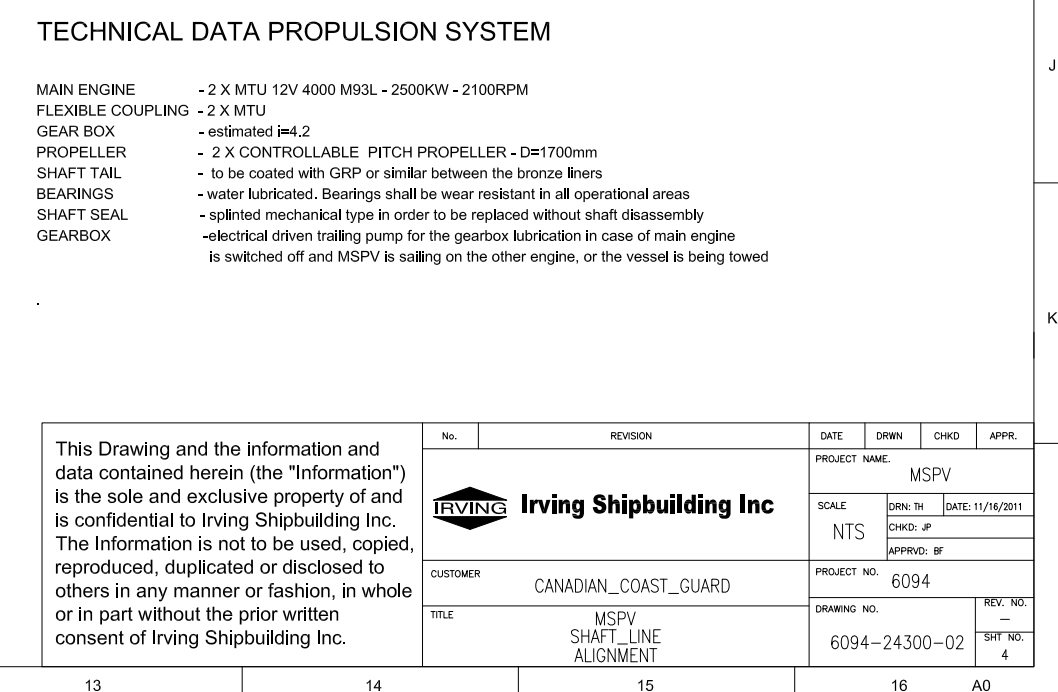
Item No.	Description	Qty	Supplier	Reference Dwg / Doc	Additional Details	Torque Value
01	Main Engine - MTU 12V4000M93L	2	DDACE / MTU - PO.84960	MTU Dwg XZ59400000169		
02	ME Flex Coupling	2	DDACE / MTU - PO.84960	MTU Dwg XZ59425000006		670+50Nm
03	Gear Box - Lufkin HSG17.72HGL	2	DDACE / Lufkin - PO.85744	1. Lufkin Dwg. SK22490_8H 2. Lufkin Dwg. SK22479_8J		
04	SKF Hydraulic Coupling - OKCAX 160	2	Rolls Royce / SKF - PO.85704	1.Dwg RRM200005975 (SKF Dwg 28436) 2.SKF Instructions - 81569 Edition BRR	OKCAX 160	
05	Shaft Earthing Device	2	Rolls Royce / Wilson Walton - PO.85704	1.Wilson Walton Dwg. AM1041 & 1043 2.RR Doc 49884-E		
06	Forward Liner	2	Rolls Royce - PO.85704	RR Dwg DMN200000864		
07	Stern Tube Seal - Simplan SIC-P Size 210	2	Rolls Royce / Simplan - PO.85704	1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Operating Manual	Simplan SIC-P Size 210	
08	Intermediate Liner	2	Rolls Royce - PO.85704	RR Dwg DMN200000864		
09	Sterntube Assembly	2	Halifax Shipyard	1.ICE Dwg 6094-O1102-2430-02_001 2.ICE Dwg 6094-O1102-2430-03_001		
10	Propeller Shaft	2	Rolls Royce - PO.85704	RR Dwg RRM200005966		
11	Aft Liner	2	Rolls Royce - PO.85704	RR Dwg DMN200000864		
12	Propeller Hub	2	Rolls Royce - PO.85704	RR Dwg RRM200009345		
13	Propeller Blade	8	Rolls Royce - PO.85704	RR Doc DMN200001323		
14	Propeller Blade Bolts	12	Rolls Royce - PO.85704	1.Kamewa Dwg 586431 2.RR Doc DMN200001323 3.RR Dwg RRM200009345		1200Nm
15	Bearing Bossing - Aft Sterntube	2	Halifax Shipyard	1.ICE Dwg 6094-O1102-2430-02_001 2.ICE Dwg 6094-O1102-2430-03_001		
16	Twin Tube	2	Rolls Royce - PO.85704	1.RR Doc 49656-E 2.RR Dwg RRM200008623		
17	Bearing Carrier - Aft Sterntube	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Bronze	
18	Bearing - Aft	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Thordon Compac Bearing	
19	Bearing Key - Aft	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Bronze	
20	Bearing Key Screws - Aft	10	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Capscrew, Low profile, bronze C95400, DIN 8912-M12x20	
21	Cap Screw for aft bearing carrier flange	16	Source Atlantic - PO.214795	ICE Dwg 6094-O1102-2430-02_001	Hex socket head capscrews, AISI 316 ST Steel, DIN 912-M12 x 40	101.7Nm
22	Cap screw for aft bearing retaining ring	16	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Capscrew Hex Socket, AISI 316 St Steel, DIN 912 - M10x30	
23	Aft Bearing Retaining Ring	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006474 C (Thordon dwg TG-20843)	Bronze - Split	
24A	Net Cutter	12	Rolls Royce - PO.85704	1.RR Dwg DMN200000864 2.RR Dwg RRM200005969		
24B	Net Cutter Fasteners	24	Rolls Royce - PO.85704	1.RR Dwg DMN200000864 2.RR Dwg RRM200005969	Hex Head Screws (M12 x 30) and Washers (M12) provided by Rolls Royce	76Nm
25	Rope Guard	2	Rolls Royce - PO.85704	1.ICE Dwg 6094-O1102-2430-03, 2.RR Dwg DMN200000864 3.RR Dwg RRM200005969		
26	Screws for Rope Guard	24	Rolls Royce - PO.85704	RR Dwg RRM200005969		
27	Rope Guard Plates	12	Rolls Royce - PO.85704	RR Dwg RRM200005969		
28	Bearing Carrier - Intermediate Sterntube	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Bronze	
29	Bearing - Intermediate	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Thordon Compac Bearing	
30	Bearing Key - Intermediate	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Bronze	
31	Bearing Key Screws - Intermediate	6	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Capscrew, Low profile, bronze C95400, DIN 8912-M12x20	
32	Cap Screw for Intermediate Bearing Carrier Flange	16	Source Atlantic - PO.214795	ICE Dwg 6094-O1102-2430-02_001	Hex socket head capscrews, AISI 316 ST Steel, DIN 912-M12 x 40	101.7Nm
33	Cap Screw for Intermediate Bearing Retaining Ring	16	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Capscrew Hex Socket, AISI 316 St Steel, DIN 912 - M10x30	
34	Intermediate Bearing Retaining Ring	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006475 C (Thordon dwg TG-20844)	Bronze - Split	

Item No.	Description	Qty	Supplier	Reference Dwg / Doc	Additional Details	Torque Value
35	Cover - Stern Tube (intermediate bearing access)	2	Halifax Shipyard	Dwg 6094-O1102-2430-02		
36	Flat Head Screw - for Stern Tube Cover	24	Source Atlantic	Dwg 6094-O1102-2430-02	flat head countersunk socket screws SSA4, DIN 7991, M10 x 30	
37	Bearing Carrier - Fwd Sterntube	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006476 C (Thordon dwg TG-20845)	Bronze	
38	Bearing - Fwd	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006476 C (Thordon dwg TG-20845)	Thordon Compac Bearing	
39	Bearing Key - Fwd	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006476 C (Thordon dwg TG-20845)	Bronze	
40	Bearing Key Screws - Fwd	6	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006476 C (Thordon dwg TG-20845)	Capscrew, Low profile, bronze C95400, DIN 8912-M12x20	
41	Adaptor - Fwd Seal to Stern tube Fwd Boss	2	Rolls Royce / Thordon - PO.85704	RR Dwg RRM200006476 C (Thordon dwg TG-20845)	Supplied attached to Fwd Bearing	
42	Cap Screw - Stern Seal Adaptor to Fwd Boss	16	Source Atlantic - PO.214795	Simplan Dwg SGC: 3-201-0012-000.0	Hex socket head capscrews, AISI 316 ST Steel, DIN 912-M12 x 90	101.7Nm
43	Cap Screw - Fwd Seal to Adaptor	16	Rolls Royce / Simplan - PO.85704	1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002.	Hex socket head capscrews required, A4-70 ST Steel, DIN 912-M16 x 150 (Supplied by Simplan)	120Nm
44	Distance Ring	2	Rolls Royce - PO.85704	RR Dwg DMN200000864		
45	OD-Box	2	Rolls Royce - PO.85704	1.RR Doc 49370-E 2.Kamewa Dwg 214000		
46	Fastener - ME Flex Coupling - Aft	24	DDACE / MTU - PO.84960	MTU Dwg XZ59425000006		670+50Nm
47	Fastener - ME Flex Coupling - Mid	72	DDACE / MTU - PO.84960	MTU Dwg XZ59425000006		22+4Nm
48	Bolt - ME Flex Coupling - Fwd	24	DDACE / MTU - PO.84960	MTU Dwg XZ59425000006		
49	Nut - ME Flex Coupling - Fwd	24	DDACE / MTU - PO.84960	MTU Dwg XZ59425000006		
50	Jacking Apparatus - Main Engine	8	DDACE / MTU - PO.84960	MTU Dwg XZ59400000169 Sh.1		
51	Resilient Mount - Main Engine	8	DDACE / MTU - PO.84960	MTU Dwg 5240002399		
52	Hexagonal Bolt - M16x1.5	32	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN933; Size: M16x1.5; Overall Length: 190mm; Threaded Length:70mm; Material: Steel Grade 8.8	
53	Hexagonal Nut - M16x1.5	64	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN934; Size: M16x1.5; Material: Steel Grade 8	
54	Plain Washer - M16	32	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN125; Size: M16; Material: Steel Grade 8	
55	Main Engine Sleeve	32	Velocity Machining - PO.214874	ICE Dwg# 6094-O1102-2330-04	C60 Steel (AISI 1060). For dimensional details see Dwg# 6094-O1102-2330-04	
56	Resilient Mount - Adjusting Screw	16	DDACE / MTU - PO.84960	MTU Dwg 5240002399		
57	Chockfast Orange	N/A	Altec Marine - PO.99125	Chockfast Orange Installation Instructions - Technical Bulletin No.692A		
58	Damming Foam (for Chockfast)	N/A	Altec Marine - PO.99125	ICE Dwg 6094-23300-01		
59	Stud - M20x2	14	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	DIN 2510; M20x2; Length: 240mm; Threaded Length:70mm each side - 4.5mm dia radial hole with center 8mm from the bottom, Steel Grade10.9	
60	Split/Cotter Pin	14	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN94; Diameter: 4mm; Hole diameter: 4.5mm; Length: 40mm; Material: St.34-1 or equivalent	
61	Castel Nut - M20x2	14	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN 935; Size:M20x2; Material: Steel Grade10	
62	Spherical Washer - M20	14	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN6319; Size: M20; Material: Steel Grade10 or Type G	
63	Gearbox Sleeve	28	Velocity Machining - PO.214874	ICE Dwg# 6094-O1102-2330-02	C60 Steel (AISI 1060). For dimensional details see Dwg# 6094-O1102-2330-02	
64	Plain Washer - M20	28	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN125; Size:M20; Material: Steel Grade 8 or 8.8	
65	Hexagonal Nut - M20x2	28	Barnes Distribution - PO.215646	ICE Dwg 6094-23300-01	Standard: DIN934; Size: M20x2; Material: Steel Grade10	
66	Gearbox Fitted Sleeve	14	Velocity Machining - PO.214874	ICE Dwg# 6094-O1102-2330-03	C60 Steel (AISI 1060). For dimensional details see Dwg# 6094-O1102-2330-03	
67	Damming Foam (for Chockfast)	N/A	Altec Marine - PO.99125	ICE Dwg 6094-23300-01		
68	Chockfast Orange	N/A	Altec Marine - PO.99125	Chockfast Orange Installation Instructions - Technical Bulletin No.692A		

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No.	REVISION				DATE	DRWN	CHCKD	APPR.	
<div> <b>Irving Shipbuilding Inc</b></div>					PROJECT NAME:				MSPV
					SCALE	DRWN: TH	DATE: 11/6/2011		
						CHCKD: JP			
						APPROV: BF			
					CUSTOMER	CANADIAN_COAST_GUARD			
TITLE	MSPV SHAFT ALIGNMENT				DRAWING NO.			REV. NO.	
					6094-24300-02			-	SHEET NO. 3

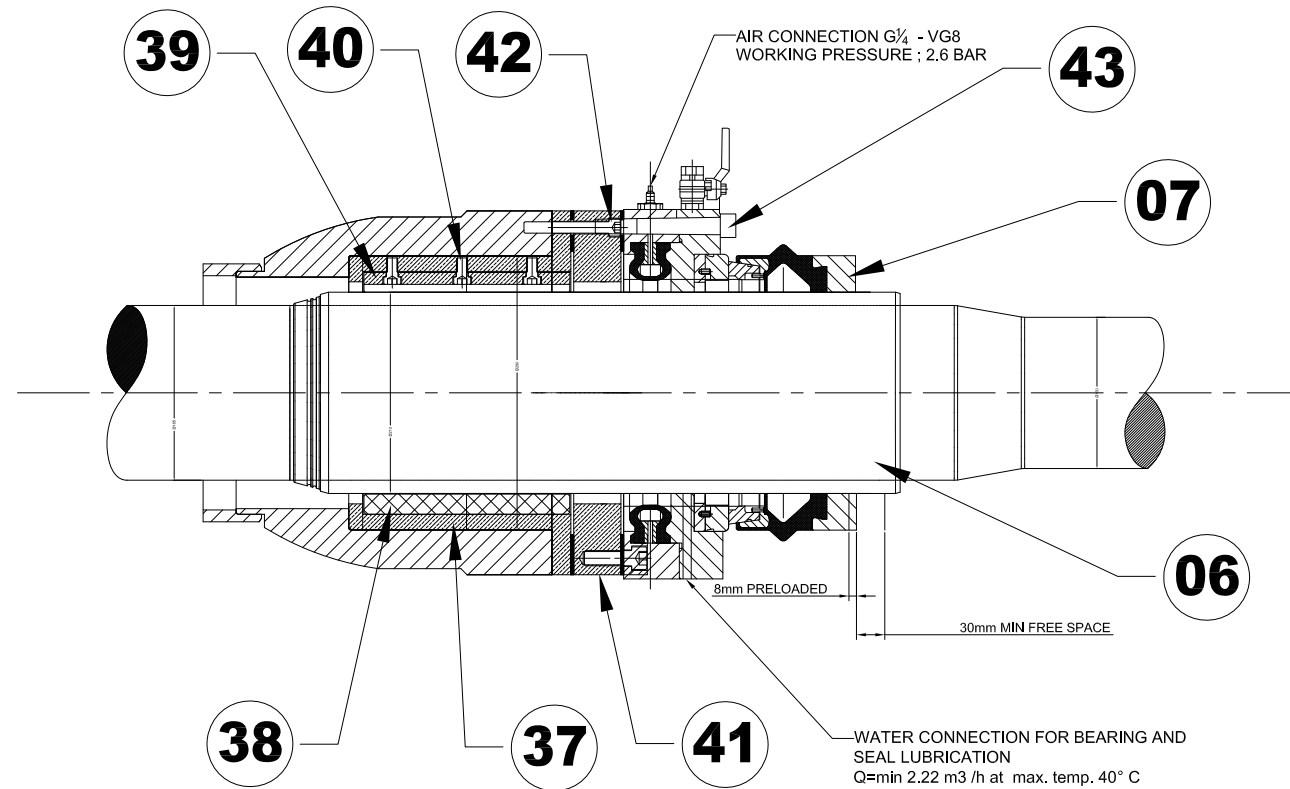
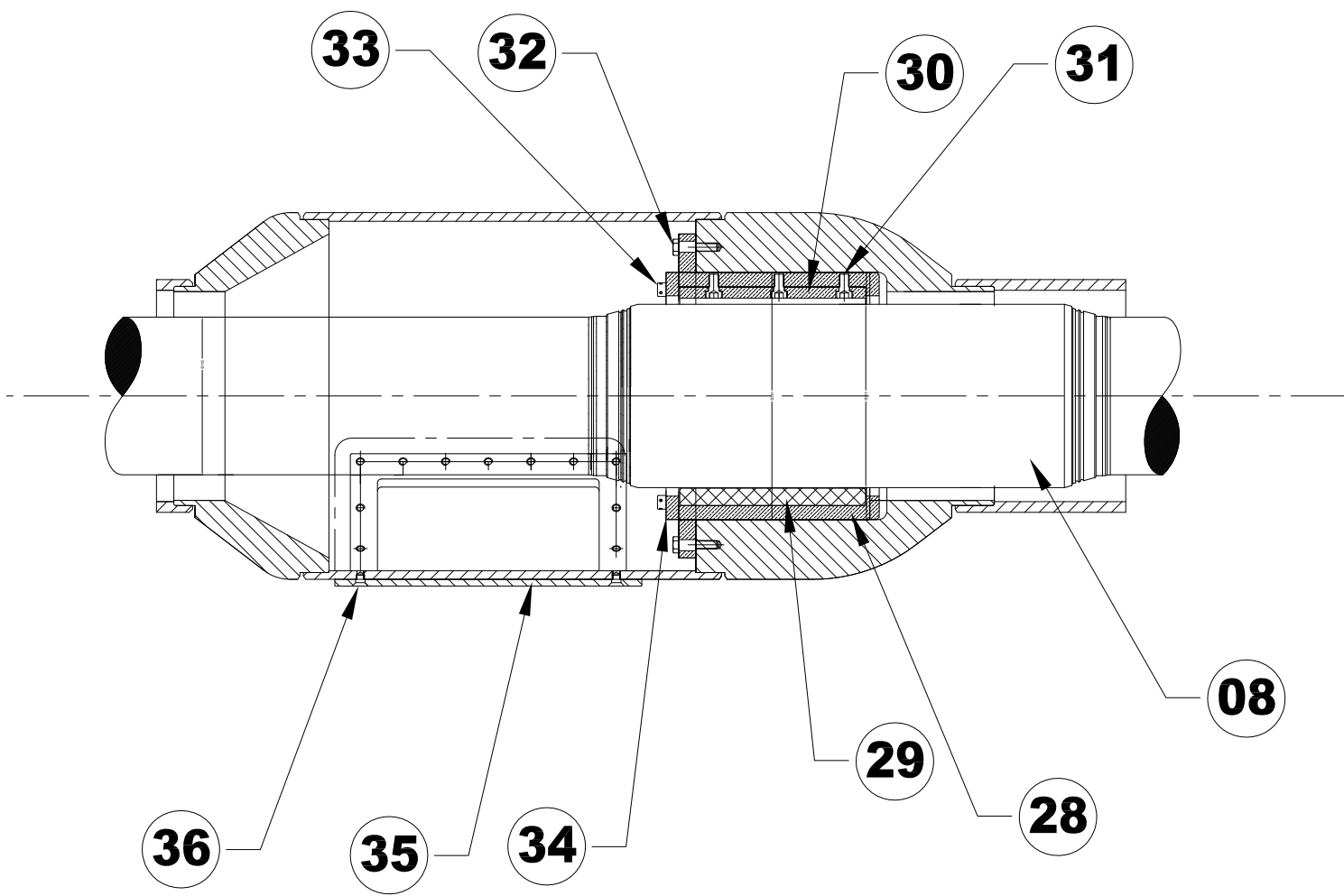
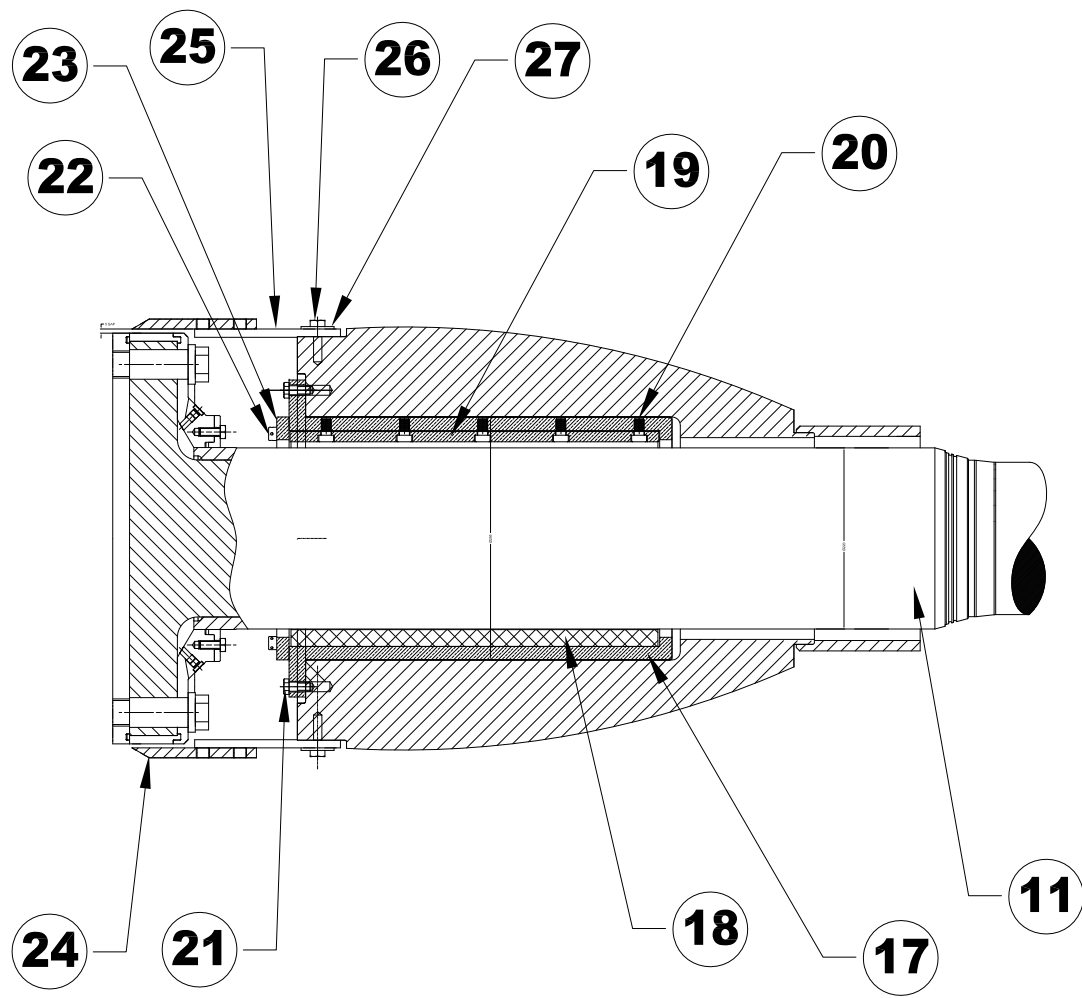




## TECHNICAL DATA PROPULSION SYSTEM


MAIN ENGINE	- 2 X MTU 12V 4000 M93L - 2500KW - 2100RPM
FLEXIBLE COUPLING	- 2 X MTU
GEAR BOX	- estimated #4.2
PROPELLER	- 2 X CONTROLLABLE PITCH PROPELLER - D=1700mm
SHAFT TAIL	- to be coated with GRP or similar between the bronze liners
BEARINGS	- water lubricated. Bearings shall be wear resistant in all operational areas
SHAFT SEAL	- splined mechanical type in order to be replaced without shaft disassembly
GEARBOX	- electrical driven trailing pump for the gearbox lubrication in case of main engine is switched off and MSPV is sailing on the other engine, or the vessel is being towed

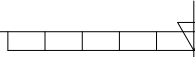




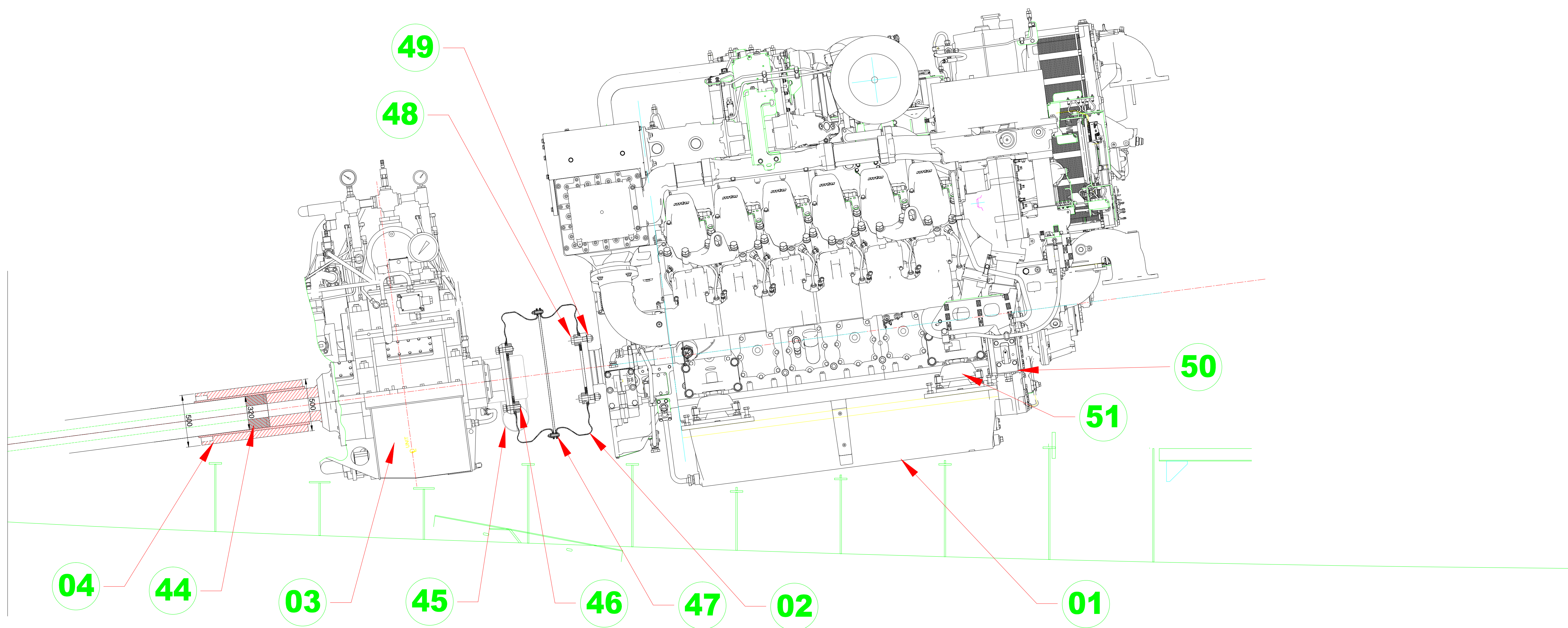
TECHNICAL DATA PROPULSION SYSTEM

- MAIN ENGINE - 2 X MTU 12V 4000 M93L - 2500KW - 2100RPM
- FLEXIBLE COUPLING - 2 X MTU
- GEAR BOX - estimated  $\approx 4.2$
- PROPELLER - 2 X CONTROLLABLE PITCH PROPELLER - D=1700mm
- SHAFT TAIL - to be coated with GRP or similar between the bronze liners
- BEARINGS - water lubricated. Bearings shall be wear resistant in all operational areas
- SHAFT SEAL - splined mechanical type in order to be replaced without shaft disassembly
- GEARBOX - electrical driven trailing pump for the gearbox lubrication in case of main engine is switched off and MSPV is sailing on the other engine, or the vessel is being towed

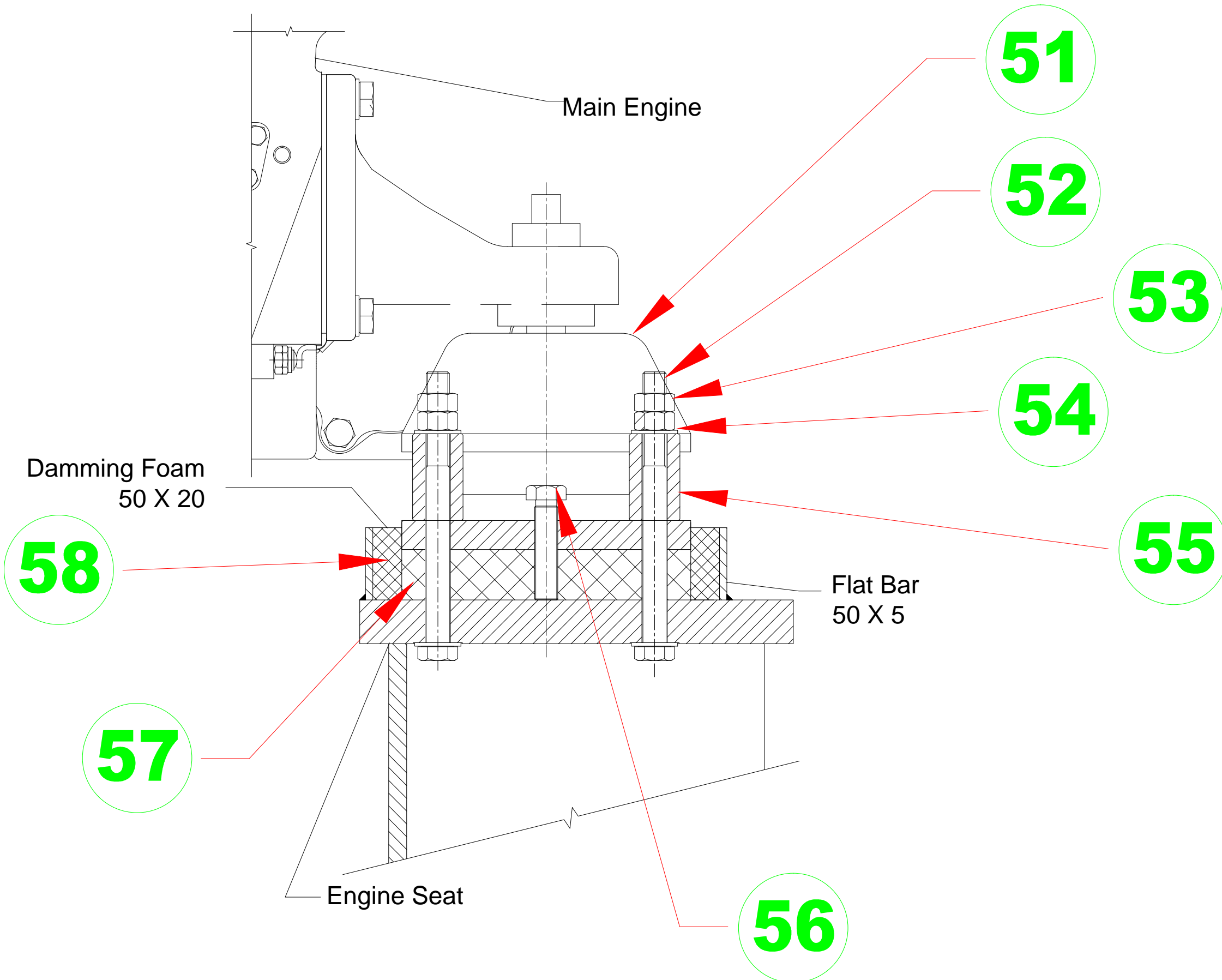
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	 <b>Irving Shipbuilding Inc.</b>			PROJECT NAME:			
				MSPV			
				SCALE	DRN: TH		
				DATE: 11/16/2011			
				NTS	CHKD: JP		
	CUSTOMER			APPRVD: SF			
PROJECT NO.							
6094							
TITLE			MSPV SHAFT_LINE ALIGNMENT		REV. NO.		
			6094-24300-02		SHEET NO. 5		



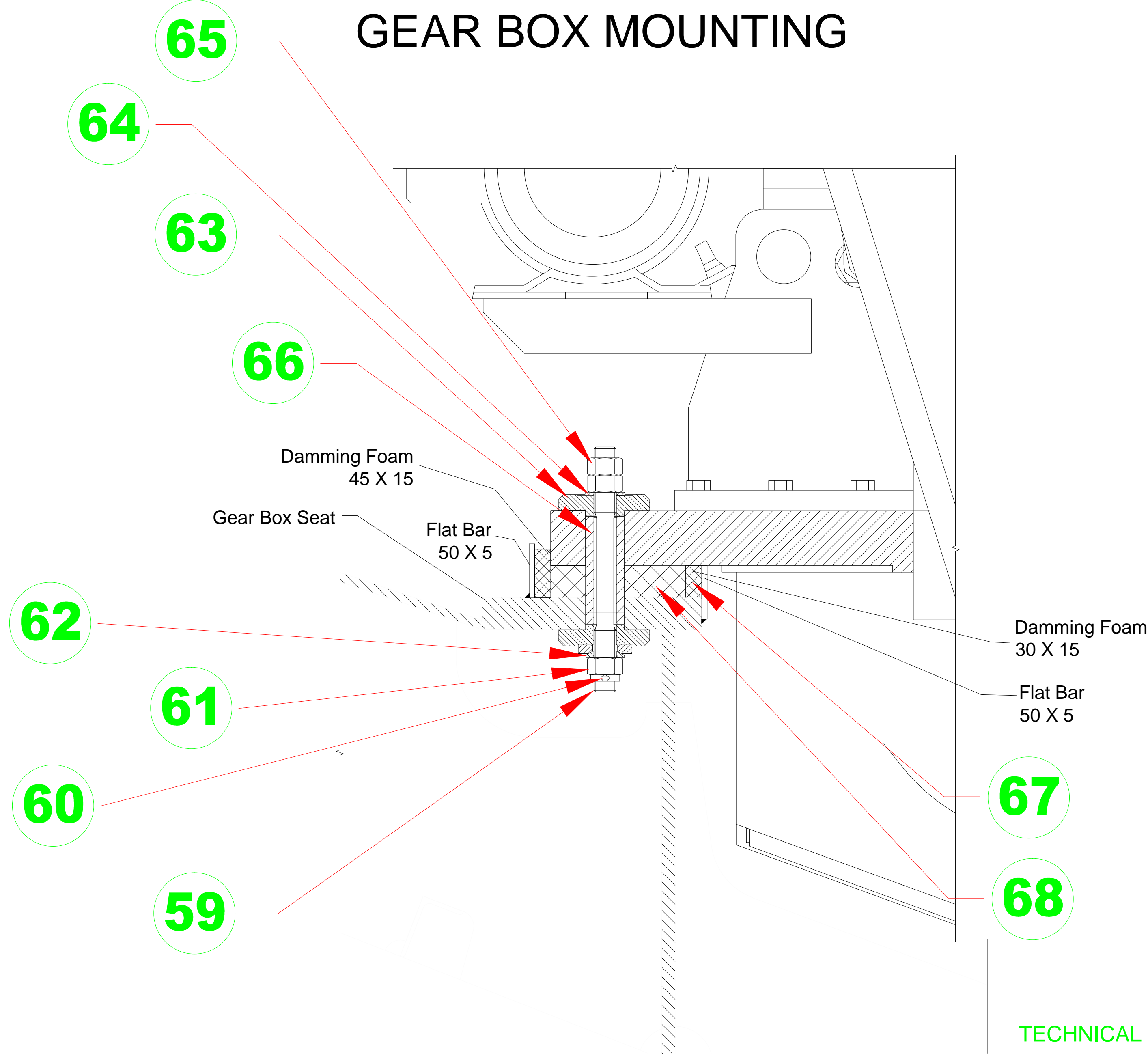




MAIN ENGINE MOUNTING



GEAR BOX MOUNTING



TECHNICAL DATA PROPULSION SYSTEM

- MAIN ENGINE - 2 X MTU 12V 4000 M83L - 2500KW - 2100RPM
- FLEXIBLE COUPLING - 2 X MTU
- GEAR BOX - estimated i=4.2
- PROPELLER - 2 X CONTROLLABLE PITCH PROPELLER - D=1700mm
- SHAFT TAIL - to be coated with GRP or similar between the bronze liners
- BEARINGS - water lubricated. Bearings shall be wear resistant in all operational areas
- SHAFT SEAL - splinted mechanical type in order to be replaced without shaft disassembly
- GEARBOX - electrical driven trailing pump for the gearbox lubrication in case of main engine is switched off and MSPV is sailing on the other engine, or the vessel is being towed

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		PROJECT NAME:		MSPV		SCALE	DATE: 11/16/2011		
		CUSTOMER		CANADIAN_COAST_GUARD		PROJECT NO.	6094		
		TITLE		MSPV SHAFT LINE ALIGNMENT		DRAWING NO.	6094-24300-02	REV. NO.	6



# MSPV - Propulsion Equipment Design Dimensions and Tolerances

Note : Design dimension depicted below, reference the individual ship ITPs for installed dimensions.

## Shaft Related Dimensions

		Aft Bearing	Intermediate Bearing	Fwd Bearing	Between Bearings	Stern Seal	SKF Coupling	Gearbox	
Shaft Dia		220mm	215mm	213mm	185mm	213mm	160mm	160mm	
Stern Tube Final Machined ID		295mm	290mm	290mm					
Stern Tube Pre-machine dimensions		269mm	265mm	262mm					
Bearing ID (Final as received)		221.38mm	216.37mm	214.39mm					
Bearing Carrier OD (Pre machine - as received).		295mm	290mm	290mm					These are increased by 3mm on ships 5 to 9
Gearbox prop shaft connection								160mm	

## Misc Design Tolerances

Shaft rake = 7.5 deg by design

Bearing offsets: A centreline through bearing no. 1, 2 and 3 defines the reference line. The gearbox bearings no 4 and 5 are positioned 0.60 mm below reference line in cold condition.

Clearance between Bearing ID and OD of Propeller Shaft : Aft Brg = 1.38mm, Int Brg = 1.37mm, Fwd Brg = 1.39mm

Bearing Carriers - 1.5mm max can be machined off these (min wall thickness of 15mm)

Extra Stock inside stern tube bosses ranges from 25 to 28mm

Max allowable deviation on vertical face of stern seal adaptor plate = 2.2mm

SKF Coupling:	Max run out =	0.2mm	
Alignment at Coupling Interface:	Gap =	0.04mm	+/-0.05mm tolerance
Alignment at Coupling Interface:	Sag =	-0.30mm	+/-0.08mm tolerance

Max angle of inclination for Gearbox (Lufkin Dwg SK22479-8) : Athwartship; static = 15 deg, dynamic = 22.5 deg. Fore & Aft : static = 7.5 deg, dynamic = 9.5 deg

Thermal expansion of gearbox : The gearbox is rising 0.03 mm between cold (20°C) and warm (60°C) condition.

Chockfast Design Heights : Main Engines = 35mm, Gearboxes = 30mm

Propellers, shafts and gearboxes are all handed - propeller shaft spins otbd at the top.

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	 <b>Irving Shipbuilding Inc</b>					PROJECT NAME			
						MSPV			
						SCALE	DRAWN BY	DATE: 11/NOV2011	
						NTS	CHWD: JP		
	CUSTOMER					PROJECT NO.			
CANADIAN_COAST_GUARD									
TITLE					DRAWING NO.				
MSPV SHAFT LINE ALIGNMENT					6094-24300-02				
					REV. NO.				
					7				




1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	MSPV Shaft Line Alignment Procedure - 1 of 11														
B															
C															
D															
E															
F															
G															
H															
I															
J															
K															
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High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Set up targets and preliminary line of site	Define Datum / Establish preliminary line of sight	Mark location for stern tube pilot hole.					
Set up targets and preliminary line of site	Cut pilot hole for stern tube in hull						
Set up targets and preliminary line of site	Establish formal line of sight	Define LOS between two points; 1) The gearbox outlet flange target center, 2) Theroretical Shaft origin point as defined on Stern Tube Assembly Dwg (drawing 6094-01102-2430-02)				ICE Dwg 6094-01102-2430-02	
Set up targets and preliminary line of site	Set up aft target at theoretical shaft origin point	Shaft origin point as defined on Stern Tube Assembly Dwg (drawing 6094-01102-2430-02)	Port X=1872, Y=1590, Z=264 Stbd X=1872, Y=-1500, Z=264			ICE Dwg 6094-01102-2430-02	
Set up targets and preliminary line of site	Set up fwd target at theoretical gearbox center line along shaft axis.		Port X=11410, Y=1583, Z=1520 Stbd X=11410, Y=-1583, Z=1520			ICE Dwg 6094-01102-2430-02	
Stern Tube - Prep for Welding	Mark and cut hole for stern tube						
Stern Tube - Prep for Welding	Slide sterntube into hull, roughly align and support.						
Stern Tube - Prep for Welding	Run wire between the targets, through the sterntube, as an alignment reference for use during welding.		to be used for guidance while welding the stern tube to the hull				
Stern Tube Install	Align sterntube to reference line.	Using the jacking apparatus align the sterntube to the reference line.					
Stern Tube Install	Weld stern tube and skeg in place	Follow welding procedure. AC to continuously check alignment during welding.					
Gearbox - Prep Before Load Out	Ream Gearbox Bolt Holes	Ream the gearbox mount holding down bolt holes to 36mm, see Lufkin Dwg SK22479-8				Lufkin Dwg. SK22479-8	
Gearbox - LOAD OUT	Load out the gear box and sit loosely on foundation						Gear Box - OIW Part No.1682779 (Stbd), 1682761 (Port)
Gearbox - LOAD OUT	Install gearbox jacking apparatus	Set the reduction gear in place on its foundation, resting on vertical jackscrews. Weld jackscrew clips required for athwartships and fore-aft adjustments of the gearbox.					
Gearbox - Initial Positioning	Jack gearbox to theroretical location along line of sight.	Position the gearbox to the final axial position and to the correct offset given in the alignment calculation (0.60 mm below reference line).	Using the vertical jackscrews, raise or lower the gearbox until the coupling faces are parallel and the rims are roughly inline vertically. Using the athwartships jackscrews, position the gearbox so that the coupling rims are roughly in line athwartships. Using the fore-aft jackscrews position the gearbox so that the gear coupling face is at its design location.	1.Keep in mind that there is a 100mm distance ring to be installed between the gearbox and propeller shafts. 2.CL of gearbox shaft is to be offset 0.6mm below the reference line.		RR Doc SA1086 (Section 4.2.1.2)	
Main Engine - Load Out and Initial Set-Up	Load out Main Engine, move to approx final location on foundation.						
Main Engine - Load Out and Initial Set-Up	Remove Flywheel / Crankshaft transportation Locking Mechanism	Remove the crankshaft ransportation locking mechanisms at the aft end of the engine. Install the main vertical jacking aparatus in their place.	See item 23.142 on MTU Dwg XZ59400000169 Sh.1 Vertical jacking aparatus supplied loose in crate with engine.			MTU Dwg XZ59400000169	
Main Engine - Load Out and Initial Set-Up	Install Horizontal Jacking apparatus for Main Engine	to be fabricated by Shipyard					
Stern Tube Boring	Aft Stern tube bearing boss	Bore the aft stern tube bearing boss to ID approx 0.5mm (20 thousand) less that the measured OD of the bearing carrier.	OD of aft bearing carrier is 295mm for ship 1 thru 4 (298 for ships 5 thru 9). For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	0.05mm coaxially around Q (LOS). See ICE Dwg 6094-01102-2430-03		1.ICE Dwg 6094-01102-2430-03, 2.RRM 200 006 474 C (Thordon dwg TG-20843)	
Stern Tube Boring	Intermediate Stern tube bearing boss	Bore the intermediate stern tube bearing boss to ID approx 0.5mm (20 thousand) less that the measured OD of the bearing carrier.	OD of intermediate bearing carrier is 290mm for ship 1 thru 4 (293 for ships 5 thru 9). For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	0.05mm coaxially around Q (LOS). See ICE Dwg 6094-01102-2430-03		1.ICE Dwg 6094-01102-2430-03, 2.RRM 200 006 475 C (Thordon dwg TG-20844)	
Stern Tube Boring	Fwd Stern tube bearing boss	Bore the fwd stern tube bearing boss to ID approx 0.5mm (20 thousand) less that the measured OD of the bearing carrier.	OD of fwd bearing carrier is 290mm for ship 1 thru 4 (293 for ships 5 thru 9). For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	0.05mm coaxially around Q (LOS). See ICE Dwg 6094-01102-2430-03		1.ICE Dwg 6094-01102-2430-03, 2.RRM 200 006 476 C (Thordon dwg TG-20845)	

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NO.	REVISION				DATE	DRWN	CHWD	APPR.
PROJECT NAME: MSPV								
SCALE: NTS		DRWN: RH	DATE: 11/16/2011					
		CHKD: JP						
		APPRVD: BF						
PROJECT NO: 6094								
TITLE: MSPV SHAFT LINE ALIGNMENT		DRAWING NO: 6094-24300-02		REV: N/A - 8				


No.	REVISION	DATE	DRWN	CHKD	APPR.
 <b>Irving Shipbuilding Inc</b>		PROJECT NAME:			
		MSPV			
		SCALE	DRN TR	DATE: 11/16/2011	
		NTS	CHKD: JP		
CUSTOMER	CANADIAN_COAST_GUARD	APPROV: BF			
TITLE MSPV SHAFT LINE ALIGNMENT		PROJECT NO.		6094	
		DRAWING NO.		REV. NO.	
		6094-24300-02		SHEET NO. 8	



# MSPV Shaft Line Alignment Procedure - 2 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Bearing Carriers - Final Machining	Aft Sterntube Bearing Carrier - Final Machining of carrier outside diameter to suit final stern tube boss machining	Machine OD of carrier to suit bore in sterntube boss. For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	The bearings carriers will be secured to the stern tube via a bolted flange, the interface with the stern tube boss is a transition fit - not an interference fit.	Minimum Installed Clearance between shaft and inner dia of aft thordon bearing is 1.38mm. Machine OD of carrier to best maintain 0.7mm between the shaft and bearing wall around the circumference of the shaft (keep the bearing centered around the shaft).		RR Dwg RRM200006474 C (Thordon dwg TG-20843 )	Fwd bearing supplied by RR (OW Part No. RRM200006474/LR/10S000239)
Bearing Carriers - Final Machining	Intermediate Sterntube Bearing Carrier - Final Machining of carrier outside diameter to suit final stern tube boss machining	Machine OD of carrier to suit bore in sterntube boss. For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	The bearings carriers will be secured to the stern tube via a bolted flange, the interface with the stern tube boss is a transition fit - not an interference fit.	Minimum Installed Clearance between shaft and inner dia of intermediate thordon bearing is 1.37mm. Machine OD of carrier to best maintain 0.7mm between the shaft and bearing wall around the circumference of the shaft (keep the bearing centered around the shaft).		RR Dwg RRM200006475 C (Thordon dwg TG-20844 )	Intermediate bearing supplied by RR (OW Part No. RRM200006475/LR/10S000239)
Bearing Carriers - Final Machining	Fwd Sterntube Bearing Carrier - Final Machining of carrier outside diameter to suit final stern tube boss machining	Machine OD of carrier to suit bore in sterntube boss. For ships 1 - 4; Maximum allowable material to remove off carrier is 1.5mm (minimum wall thickness of 15mm)	The bearings carriers will be secured to the stern tube via a bolted flange, the interface with the stern tube boss is a transition fit - not an interference fit.	Minimum Installed Clearance between shaft and inner dia of fwd thordon bearing is 1.39mm. Machine OD of carrier to best maintain 0.7mm between the shaft and bearing wall around the circumference of the shaft (keep the bearing centered around the shaft).		RR Dwg RRM200006476 C (Thordon dwg TG-20845 )	Aft bearing supplied by RR (OW Part No. RRM200006476/LR/10S000239)
Stern Tube - Machine Face of Bearing Boss - Aft	Machine Aft Face of Aft Sterntube Boss to fit Bearing Carrier Flange	Machine the aft face of the aft sterntube boss so that it is perpendicular to LOS.	Do this only after the sterntube is fully welded into hull and the bearing bosses have been bored,	0.05mm perpendicular to Q (LOS) - See ICE Dwg 6094-O1102-2430-03 (Note that the machining tolerances for the Thordan carrier are +/- 0.5mm.)		1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 474 C (Thordon dwg TG-20843 )	
Stern Tube - Machine Face of Bearing Boss - Aft	Machine Aft Face of Aft Sterntube Boss to fit Bearing Carrier Flange	Mark, drill and tap holes required for bolting the Bearing Carrier Flange to the Aft Sterntube Boss.	Use carrier flange as a template, after machining and trial fit of carrier is complete.			1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 474 C (Thordon dwg TG-20843 )	
Stern Tube - Machine Face of Bearing Boss - Intermediate	Machine Aft Face of Intermediate Sterntube Boss to fit Bearing Carrier Flange	Machine the aft face of the intermediate sterntube boss so that it is perpendicular to LOS.	Do this only after the sterntube is fully welded into hull and the bearing bosses have been bored,	0.05mm perpendicular to Q (LOS) - See ICE Dwg 6094-O1102-2430-03 (Note that the machining tolerances for the Thordan carrier are +/- 0.5mm.)		1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 475 C (Thordon dwg TG-20844 )	
Stern Tube - Machine Face of Bearing Boss - Intermediate	Machine Aft Face of Intermediate Sterntube Boss to fit Bearing Carrier Flange	Mark, drill and tap holes required for bolting the Bearing Carrier Flange to the Intermediate Sterntube Boss.	Use carrier flange as a template, after machining and trial fit of carrier is complete.			1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 475 C (Thordon dwg TG-20844 )	
Stern Tube - Machine Face of Bearing Boss - Fwd	Machine Fwd Face of Fwd Sterntube Boss to fit Bearing Carrier Flange	Machine the fwd face of the fwd sterntube boss so that it is perpendicular to LOS.	Do this only after the sterntube is fully welded into hull and the bearing bosses have been bored,	0.05mm perpendicular to Q (LOS) - See ICE Dwg 6094-O1102-2430-03 Note: Max allowable deviation on vertical face of the flange is 2.2mm (to suit Fwd Seal requirement, see Simplan drawing SGC: 3-201-0012-000)		1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 476 C (Thordon dwg TG-20845 ) 3. SGC: 3-201-0012-000	
Stern Tube - Machine Face of Bearing Boss - Fwd	Machine Fwd Face of Fwd Sterntube Boss to fit Bearing Carrier Flange	Mark, drill and tap holes required for bolting the Bearing Carrier Flange to the fwd Sterntube Boss.	Use carrier flange as a template, after machining and trial fit of carrier is complete.			1.ICE Dwg 6094-O1102-2430-03, 2.RRM 200 006 476 C (Thordon dwg TG-20845 )	
Bearing Installation - Aft	Install Aft bearing	Install aft bearing Carrier - bolt to stern tube boss	8 off bolts / screws required for 13 dia holes (Shipyards Supply) - M12 Stainless steel Bolts		101.7 Nm		OW Part No. 2211389
Bearing Installation - Aft	Install Aft bearing	lock retaining plate cap screws in place.	locking wire supplied by Thordon, comes attached to one of the retaining ring screws.				Vendor Supplied (attached to equipment)
Bearing Installation - Intermediate	Install Intermediate bearing	Install intermediate bearing Carrier - bolt to stern tube boss	8 off bolts / screws required for 13 dia holes (Shipyards Supply) M12 Stainless steel Bolts		101.7 Nm		OW Part No. 2211389
Bearing Installation - Intermediate	Install Intermediate bearing	lock retaining plate cap screws in place.	locking wire supplied by Thordon, comes attached to one of the retaining ring screws.				Vendor Supplied (attached to equipment)
Bearing Installation - Fwd	Install Fwd bearing	Install fwd bearing Carrier - slide in - to be bolted later					
Bearing Installation - Fwd	Install Fwd bearing	install gasket and retaining plate / stern seal adaptor to front face of bearing carrier. bolt in place.	8 off hex socket head capscrews required, AISI 316 ST Steel, DIN 912-M12 x 90 (ISI TO SUPPLY) M12 Stainless steel Bolts	Max allowable deviation on vertical face of the retaining plate / adapter is 2.2mm (to suit Fwd Seal requirement, see Simplan drawing SGC: 3-201-0012-000)	101.7 Nm	Simplan Dwg SGC: 3-201-0012-000.0	OW Part No. 2211397
Fwd Seal Installation - Phase 1 of 5 (Prior to insertion of shaft)	Disassemble the seal to allow for progressive installation as the shaft is inserted (provided fully assembled in packing crate)	See sections A & B of the Simplan Installation Document.				1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	Stern Tube Seal supplied by RR (OW Part No. RRM200006480/LR/10S000239)

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NO.	REVISION			DATE	DRWN	CHKD	APPR.	
 <b>Irving Shipbuilding Inc</b>				PROJECT NAME: MSPV				
				SCALE		DRWN: TM	DATE: 11/16/2011	
						CHKD: JP		
						APPROV: BF		
CUSTOMER: CANADIAN_COAST_GUARD				PROJECT NO. 6094				
TITLE: MSPV SHAFT_LINE ALIGNMENT				DRAWING NO. 6094-24300-02		REV. NO. - SHT NO. 9		



MSPV Shaft Line Alignment Procedure - 3 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Fwd Seal Installation - Phase 1 of 5 (Prior to insertion of shaft)	Fwd Seal Stationary flange c/w gasket to be mounted to the Fwd Bearing Retaining Ring / Adaptor. Secure with cap screws. Secure screws with locktite	See sections C of the Simplan Installation Document.	8 off hex socket head capscrews required, A4-70 ST Steel, DIN 912-M16 x 130 (Supplied by Simplex)		120Nm	1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	Vendor Supplied (bolts and locktite in crate with equipment)
Shaft - Propeller Shaft - Prep	Clean the shaft prior to load out						Shaft OW Part No. 1953743 Left Hand, 2014676 Right Hand.
Shaft - Propeller Shaft - Install	Insert the shaft carefully through the stern tube.	Let the shaft enter the stern tube carefully and then push it almost to its final position.					
Fwd Seal Installation - Phase 2 of 5 (After insertion of shaft)	Prefit Fwd Seal "Boot Assembly" and adjust the pins (do not fit o-rings and stationary rings at this point). Remove Boot after pins are adjusted.	See sections E of the Simplan Installation Document, Also see page 7 of the Simplan Operating Manual		1/16" clearance between pins and shaft		1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	
Fwd Seal Installation - Phase 2 of 5 (After insertion of shaft)	Fit O-rings, stationary rings, and Boot on shaft	See section F of the Simplan Installation Document. Also see page 7 of the Simplan Operating Manual				1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	
SKF Sleeve Coupling - Initial Installation - Load Out	Clean SKF Coupling and Propeller Shaft	Clean and wash the inner sleeve bore and the coupling seatings with white spirit, so that the anticorrosive agent is removed	Remove any burrs on the coupling seating on the shaft.				Coupling supplied by RR (OW Part No. RRM200005975/LR/105000239)
SKF Sleeve Coupling - Initial Installation - Load Out	Release Locking device	Before mounting the coupling, unscrew the four axial screws 1/2 turn to release the locking device.				SKF Instructions - 81569 Edition B - Page 6	
SKF Sleeve Coupling - Initial Installation - Load Out	Slide the SKF coupling loosely on to the propeller shaft	Ensure that the large end of the inner sleeve faces fwd and that the connection holes are at the top of the coupling. Coat the shaft with thin oil before introducing the coupling.	Slide the coupling on so that the propeller shaft protrudes 230mm from the fwd end of the SKF Coupling			1. RR Doc SA1086 (Section 4.2.3) 2. SKF Instructions - 81569	Coupling supplied by RR (OW Part No. RRM200005975/LR/105000239)
Shaft - Propeller Shaft - pull up to final axial position	Pull shaft up to final location	Front face of the propeller hub to be 136mm from the aft face of the sterntube aft boss.	This should be approx 100mm aft of the gearbox out put shaft.	The 100mm distance ring between the propeller shaft and the gearbox output shaft will be installed later in the alignment sequence		1.RR Dwg DMN200000864 2.ICE Dwg 6094-O1102-2430-01	
Gearbox - Preliminary Alignment	Align the gearbox to the propulsion shaft	Position the gear to the final axial position and to the offset given in the alignment calculation, 0.60 mm below reference line	Ensure the twin tubes for CPP are not connected at this time. They are not to be made until the shaft alignment to the gearbox is final.	Offset: 0.60 mm below reference line Gap = 0.04mm (recommended accuracy: +/- 0.05 mm) Sag = -0.36mm (recommended accuracy: +/- 0.05 mm)		RR Doc SA1086 Pg.12, 13 and 14	
Main Engine - Preliminary Alignment	Align the engine to the gearbox (preliminary)	Distance between the Engine Output flange and the Gearbox Input flange is 363mm (+/- 3mm). Allowable Axial Tolerance : 0.05mm. Allowable Radial Tolerance : 0.05mm. As per MTU Dwg XZ59425000036.	For vertical alignment use the vertical jacking devices supplied on the engine. For horizontal alignment use shipside devices fabricated by the shipyard. Note that the Mount Height adjustment devices on the resilient mounts are not to be used for initial alignment. Only use these for fine tuning after the ship is in service.	Allowable Axial Tolerance : 0.05mm. Allowable Radial Tolerance : 0.05mm		1.MTU Dwg XZ59400000169 Sh.1 2.MTU Dwg XZ59425000006	
Fwd Seal Installation - Phase 3 of 5 (After shaft is in final position)	Install the fwd seal's boot assembly - Preliminary fit up.	See sections H and I of the Simplan Installation Document.				1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	
Fwd Seal Installation - Phase 4 of 5 (Pipe fitter work - after boot assembly installed)	Install pipe to fwd seal flushing connection	See section J of the Simplan Installation Document.	If we are not ready to install the pipe before launch, we must install the isolation valve and plug the valve's outlet. Ball valve for vent is supplied by Simplex, it is provided in the package with the seal.			1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	
Fwd Seal Installation - Phase 4 of 5 (Pipe fitter work - after boot assembly installed)	Install compressed air line and isolation valve to the pneumostop outlet on the fwd seal	See section K of the Simplan Installation Document.				1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	
Fwd Seal Installation - Phase 4 of 5 (Pipe fitter work - after boot assembly installed)	Install Fwd seal vent pipe	See section K of the Simplan Installation Document.	If we are not ready to install the pipe before launch, we must install an isolation valve and plug the valve's outlet.			1. Simplan Dwg SGC:3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-03-2002. 3. Simplan Operating Manual	

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PROJECT NAME

MSPV

SCALE

DATE: 11/03/2011

DATE: 11/03/2011

CHWD: JF

APPROV: JF

CUSTOMER

CANADIAN\_COAST\_GUARD

PROJECT NO.

6094

TITLE

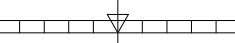
MSPV  
SHAFT LINE  
ALIGNMENT

DRAWING NO.

6094-24300-02

REV. NO.

10






MSPV Shaft Line Alignment Procedure - 4 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Fwd Seal Installation - Phase 4 of 5 ( Pipe fitter work - after boot assembly installed)	Install flushing sys pipe to fwd bearing adaptor plate.	See SIMPLAN Cooling Water Diagram SGC: 3-201-0011-000.0 . Also see Thordon Fwd Bearing Dwg TG-20845 Item 4	Also plug the unused port in the adaptor plate.			1. Simplan Dwg SGC: 3-201-0011-000.0 2. Thordon Dwg TG-20845	
Fwd Seal Installation - Phase 5 of 5 (After shaft is in final position)	Final Assembly (temporary) - Secure fwd seal boot with locking clamp prior to launch.	See Section I of the Simplan Installation Document. Also see Sectio 3.4.1 and 3.4.2 of the Simplan Operating Manual (page 10 and 11).	Note - This is a temporary fit for launch, the seal will need to be re-aligned to suit final alignment of the shaft in a floating condition.	1. Preload = 8mm 2. Distance deviation between rear edge of clamp ring and front edge of housing ring should be no more than +/- 0.2mm 3. Gap between sealing rings = .05mm Max.		1. Simplan Dwg SGC: 3-217-0006-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. 3. Simplan Operating Manual	
Propeller Blades - Install	Propeller Blades - Prep work	Call out Propeller Blade Installation Tools	Propeller Blade Tools OW Part No.s - 1954009, 1954025, 1954033, 1954041, 1954050, 1954066, 1954076, 1954084, 1954092, 1954105, 1954121.			RR Doc RRM200010894	Propeller Blade Tools OW Part No.s - 1954009, 1954025, 1954033, 1954041, 1954050, 1954066, 1954076, 1954084, 1954092, 1954105, 1954121.
Propeller Blades - Install	Propeller Blades - Prep work	Clean the blade flange, screw holes, blade seat and crank pin ring.	Wash the blade screws using a de-greasing solvent.			RR Doc DMN200001323	1. Prop Blades OW Part No.1953751 (Right Hand), 1968700 (Left Hand). 2.Blade Lifting Device - OW Part No.2021761
Propeller Blades - Install	Propeller Blades - Prep work	Inspect that the guide pins are properly secured. If the guide pins are loose, tighten and lock the screws that are keeping the guide pins in place.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Prep work	Apply thread lubricant, according to Hub Assembly drawing, on the blade guide and on the guide pin.				1.RR Dwg RRM200009345 2.RR Doc DMN200001323	Lubricant supplied by shipyard - form stock.
Propeller Blades - Install	Propeller Blades - Prep work	Clean the blade sealing groove.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Prep work	Prepare the flushing equipment (see figure 7). Make sure all hoses are properly connected to the pump and collecting container.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Apply grease or similar (pos 3, figure 1), in the blade sealing groove (pos 2, figure 1) on the blade flange in order to keep the blade sealing ring (pos 4, figure 1) in place when the blade flanges are mounted to the hub. Place the blade sealing ring in its groove (see figure 1) and apply PTFE compound on the top surface of the blade sealing ring (pos 5, figure 1).	1.Teflon grease supplied by shipyard - form stock. 2.PTFE compound supplied by RR - O.W. Part No. 1954076.			RR Doc DMN200001323	1. Blade Seal Ring OW Part No.1953874 2.Teflon grease supplied by shipyard - form stock. 3.PTFE compound supplied by RR - O.W. Part No. 1954076.
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Apply oil (the same as in the hydraulic system) on the bearing surface. Make sure that no grease is applied on the mating surface between the crank pin ring and the blade flange.	NEED ABOUT 20L OF OIL PER SHIP. See 49682-E section of manual for Oil Requirements.			RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Apply sealing compound				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Lift the blade in position.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Use a level to make sure that the foot of the blade and the crank pin ring are absolutely parallel.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Lubricate the blade bolt heads and the threads according to the Hub Assembly drawing.	1.Blade bolt heads - use Kamewa Sealing Compound supplied by RR (OW Part No. 1954084). 2.Threads - use Molycote G-Rapid supplied by RR (OW Part No.1954092).			1.RR Dwg RRM200009345 2.RR Doc DMN200001323	1.Sealing Compound supplied by RR (OW Part No. 1954084). 2.Molycote G-Rapid supplied by RR (OW Part No.1954092).
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Make sure that the holes in the blade bolts are unplugged.				RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Fill the blade bolt holes in the crank pin ring (pos 9, figure 3) up to a third with grease according to the Hub Assembly drawing.				1.RR Dwg RRM200009345 2.RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Mount the blade to the crank pin ring with two blade bolts positioned opposite to each other.	Use a ring key and a hammer to slightly tighten two blade bolts. Tighten the bolts at the same time as a person is "rocking" the blade to assure that the blade will enter its guides.			RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Install the blade and level it with the crank pin ring	Inspect by means of a feeler gauge that the gap between the blade and the crank pin ring is a maximum of 0,05 mm. Measure the gap through one of the empty blade bolt holes.		Gap 0.05 mm		RR Doc DMN200001323	
Propeller Blades - Install	Propeller Blades - Fasten Propeller Blades	Screw in all blade bolts. Excessive grease is evacuated through the hollow bored blade bolts.	Use a hand tool to pre-stress all the blade bolts in a cross pattern.	Screws are to be pre-stressed twice - see dwg Kamewa 586431 for instructions. Lubricant is to be used on the threads of the screw and a sealing compound under the screw head when pre-stressing.		1.Kamewa Dwg 586431 2.RR Doc DMN200001323	Prop Blade Screws OW Part No.1953858

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No.	REVISION				DATE	DRWN	CHWD	APPR.
PROJECT NAME					MSPV			
 <b>Irving Shipbuilding Inc</b>					SCALE	DATE: 11/04/2011		
					NTS	CHWD: JP		
CUSTOMER					PROJECT NO.			
CANADIAN COAST GUARD					6094			
TITLE					DRAWING NO.			
MSPV SHAFT LINE ALIGNMENT					6094-24300-02			
					REV. NO. 11			



MSPV Shaft Line Alignment Procedure - 5 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Propeller Blades - Install	Propeller Blades - Fasten Propeller Blades	Torque the blade bolts	For torque values see Hub Assembly drawing in part Design Drawings. Tighten the blade bolts in a cross pattern to the torque vale stated on the Hub Assembly drawing. For more information on how to tighten the blade bolts see instructions for tightening of screws, 586431.		1200Nm	RR Dwg RRM200009346	
Propeller Blades - Install	Propeller Blades - Flush the Blade Flange	Connect the oil injection pump flushing nipple and hose (pos 2, figure 8) to connection marked "IN". Connect the excessive oil container flushing nipple and hose (pos 1, figure 8) to oil connection marked "OUT".	Pump and hose are supplied by RR - these are in a tool box in the Volvo warehouse.				1.Tool Box - OW Part No. 2021737 2.Pump - OW Part No.2021745 3.Hoses - OW part No.2021763
Propeller Blades - Install	Propeller Blades - Flush the Blade Flange	Start to flush the blade flange with the oil pump unit (pos 1, figure 7). Use minimum pressure value at first. Slowly increase the pressure until grease and then flushing oil starts to evacuate through the open blade bolt holes.					
Propeller Blades - Install	Propeller Blades - Flush the Blade Flange	When only flushing oil evacuates through the blade bolt holes, plug the hole in each blade bolt head using a sealing screw (see position 2, figure 3). Tighten the screws to the torque value stated on the Hub Assembly drawing.	Torque to 16Nm, secure with Loctite 243. Sealing Screw OW part No. 1953882		16Nm	1.RR Dwg RRM200009346 2.RR Doc DMN200001323	Sealing Screw OW Part No.1953882
Propeller Blades - Install	Propeller Blades - Flush the Blade Flange	Disconnect both hoses with nipples at the "IN" and "OUT" connections on the blade flange.					
Propeller Blades - Install	Propeller Blades - Install VSTI Plugs	Install the VSTI plugs (see position 1, figure 3) and tighten to the torque value stated on the Hub Assembly drawing and by using Loctite.	Secure with loctite 243			1.RR Dwg RRM200009346 2.RR Doc DMN200001323	Vendor Supplied (screw attached to prop blade in crate) OW Part No.1953786
Propeller Blades - Install	Propeller Blades - Plug Lifting Holes	Plug the lifting holes in the propeller blades as per instructions on Kamewa drawing 144112	Plug Assembly kit is supplied loose in the shipping crate for the Propeller Blades - OW Part No. 1953760			Kamewa Dwg 144112	Plug Assembly kit - OW Part No. 1953760
Rope Guard - Pre Fit	Pre-fit Rope Guard	With shaft in final position and the propeller hub also in final fit position; fit the pre-fabricated Rope Guard to the aft end of the stern tube.	Ensure there is suitable clearance for Propeller Hub to spin freely, allow for 8mm between the front face of the shaft flange and the aft end of the rope guard. If not achievable them trim the rope guard to suit.	Center line of pre-drilled rope guard bolt holes to be located 25mm fwd of the aft face of the stern tube.		1.ICE Dwg 6094-O1102-2430-03, 2.RR Dwg DMN200000814 3.RR Dwg RRM200005919	Rope Guard OW Part No. 1954383
Rope Guard - Pre Fit	Mark, drill and tap threaded holes in stern tube boss.	Using the rope guard as a template; mark, drill and tap the 12 holes required for securing the rope guard to the stern tube aft hub.	Drill and tap to accommodate M12 x 40 screws. Holes to be 25 to 28 mm deep, trial fit a few to ensure they will work with the rope guard thickness.	Center line of bolt holes to be located 25mm fwd of the aft face of the stern tube.		1.ICE Dwg 6094-O1102-2430-03, 2.RR Dwg DMN200000814 3.RR Dwg RRM200005919	
Rope Guard - Pre Fit	Trial Fit - Secure Rope Guard to Stern Tube	Bolt the rope guard to the aft stern tube boss. The 6 off "1003" bolting plates will require one hole drilled in each at this phase.	12 off M12 x40 Hex Head screws (A4-80) provided by Rolls Royce in the rope guard shipping container.				1.Rope Guard Screws OW Part No. 1954404. 2.Rope Guard Plates OW Part No. 1954391
Net Cutters - Install	Machine The Rope Guard to accommodate fastening of the Net Cutters.	After the rope guard installation has been finalized; pre-fit the net cutters to the rope guard as per RRM drawings DMN200000864 and RRM200005965.	Mark, drill and tap hole to accommodate M12 x 30 screws.			1.RR Dwg DMN200000814 2.RR Dwg RRM200005919	Net Cutter OW Part No. 1954359
Net Cutters - Install	Mount Net Cutters	Fasten the net cutters to the rope guard.	24 off Hex Head Screws (M12 x 30) and Washers (M12) provided by Rolls Royce		76Nm		1.Screws OW Part No. 1954367 2.Washers OW Part No. 1954375
Rope Guard - Final Fit	Final Fit - After net cutters have been fitted, Secure Rope Guard to Stern Tube	Bolt the two halves of the rope guard together using the "1002" plates.	Torque bolts to 76Nm		76Nm	RR Dwg RRM200005965	Supplied with rope guard
Rope Guard - Final Fit	Final Fit - After net cutters have been fitted, Secure Rope Guard to Stern Tube	Bolt the rope guard to the aft stern tube boss utilizing the "1003" plates	12 off M12 x40 Hex Head screws (A4-80) provided by Rolls Royce in the rope guard shipping container. Torque bolts to 76Nm		76Nm	RR Dwg RRM200005965	1.Rope Guard Screws OW Part No. 1954404. 2.Rope Guard Plates OW Part No. 1954391
Rope Guard - Final Fit	Lock Rope Guard Bolts	All rope guard bolts ate to be locked in place by tack weld as per RRM Dwg. RRM200005969				RR Dwg RRM200005965	
Propeller Hub - Fill oil and Flush	Set-up for oil fill of hub	Turn the propeller hub until the forward plug is directed straight downwards and the aft plug is directed straight upwards. see figure 1 of RR Doc. 48023-E.	Remove both plugs.	RR COMMENT :The hub is flushed and tested at workshop before delivery. However, while mounting the blades, dirt will occur so the hub needs to be flushed again after the mounting is finished!		RR Doc 48023-E	
Propeller Hub - Fill oil and Flush	Fill propeller hub with oil	Use an external oil filling unit and filter to purify the oil and to fill the hub. Attach the external oil filling unit and filter according to figure 1 of RR Doc. 48023-E.				RR Doc 48023-E	
Propeller Hub - Fill oil and Flush	Flush propeller hub - set up	Manoeuvre the three way valve (see position 3, figure 1) to enable the oil flow to return directly to the oil container (see position 7, figure 1) without passing through the hub.				RR Doc 48023-E	
Propeller Hub - Fill oil and Flush	Flush propeller hub.	Purify the oil by circulating it until the desired particle value is noted by the particle counter (see position 6, figure 1).	If the SKF coupling and the piping to the O3-box are not installed a pressure of maximum 0.13 Mpa can be used during the flushing procedure.	Max Pressure = 0.13Mpa		RR Doc 48023-E	

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No.	REVISION			DATE	DRWN	CHGD	APPR.
 <b>Irving Shipbuilding Inc</b>				PROJECT NAME: MSPV			
				SCALE: DATE: 11/16/2011			
				NTS DATE: 11/16/2011			
				CHGD: JF APPROV: BF			
CUSTOMER	CANADIAN_COAST_GUARD			PROJECT NO.	6094		
TITLE	MSPV SHAFT_LINE ALIGNMENT			DRAWING NO.	6094-24300-02		REV. NO. -- SHEET NO. 12

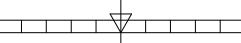


MSPV Shaft Line Alignment Procedure - 6 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Propeller Hub - Fill oil and Flush	Flush propeller hub.	Manoeuvre the three way valve to enable the oil flow to fill the hub from bottom to top. The air trapped inside the hub is allowed to evacuate through the aft plug hole (see position 1 in figure 1).				RR Doc 48023-E	
Propeller Hub - Fill oil and Flush	Flush propeller hub.	Start the filling unit again and turn the propeller hub half a turn (180o) (see figure 2).				RR Doc 48023-E	
Propeller Hub - Fill oil and Flush	Flush propeller hub.	Flush the propeller hub. Let the oil circulate inside the propeller hub and through the external filter. Use the particle counter to make sure that the oil meets the recommendations in section Requirements for Lubricating Oil.	New gear oil must be filtered before filling. The desired cleanliness grade will normally be obtained when using a 6 to 8 micron filling filter.	Rolls-Royce AB recommends as a minimum requirement a cleanliness level of 18/16/13, according to ISO 4406:1999. This is an approximate equivalent of contamination classes NAS 1638 class 7 and SAE AS 4059 class 8.		RR Doc 49682-E	
Propeller Hub - Fill oil and Flush	Flush propeller hub.	Turn the propeller hub until the text "Hole" (stamped into the forward part of the hub) is directed straight downwards (6 o'clock position).				RR Doc 48023-E	
Propeller Hub - Pressure Test	Propeller Hub - Pressure Test General Info	Prior to launching the propeller hub is to be filled with oil and a pressure test must be performed to verify that no leakage occurs.	RR COMMENT : The hub is flushed and tested at workshop before delivery. However, while mounting the blades, dirt will occur so the hub needs to be flushed and pressure tested again after the mounting is finished!			RR Doc 48023-E	
Propeller Hub - Pressure Test	Install End Cover	Install the end cover in the propeller shaft and insert a plug in the hole in the blanking flange.	The end cover was installed by RR before shipment, the Hub should already be full of oil from the flushing procedure.			RR Doc 48023-E	
Propeller Hub - Pressure Test	Connect Flushing / Pressure Unit	Leave the external filling unit used during the flush connected to the forward venting/filling hole.				RR Doc 48023-E	
Propeller Hub - Pressure Test	Pressure test propeller hub	Insert a plug in the aft venting/filling hole and start the external pump. Let the pressure rise to 0.10 to 0.15 MPa. Retain the pressure for 1 hour.		1 hour at 0.10 to 0.15MPa		RR Doc 48023-E	
Propeller Hub - Pressure Test	Inspect Blades and Hub	Inspect the blade seal seats, the bolt head seats and the shaft flange screws for leakage.				RR Doc 48023-E	
Propeller Blades - Install	Propeller Blades - Lock the Blade Bolts	Fit stainless steel locking pins between the hexagon part of the blade bolt and the hub. Spot weld the locking pin to the recess on the propeller blade according to figure 6 on page 5 of DMN200001323. Make sure to leave a space between the locking pin and the screw (see position 2, figure 6).	Lock with steel rod and spot weld. <u>Do only after the hub has been flushed and pressure tested.</u>			RR Doc DMN200001323 Page 5 (Propeller Blade Installation Doc).	Lock Pin OW Part No. 1953866
Gravity Tank - Hub Seal	Install Gravity tank	Mount the Gravity Tank in its final location	The propeller hub and propeller shaft must be filled with oil and connected to a gravity tank via an end cover installed on the propeller shaft end (see figure 1 of RR Doc 48337-E). The gravity tank will maintain an oil pressure in the hub and prevent water ingress.	The gravity tank must be located 1.3 times higher than the distance between the centre of the shaft and water line, or minimum 2 m above the water line, in order to keep the oil pressure in the hub.		1.RR Dwg DMN200000689 2.RR Dwg RRM200011521	Gravity Tank - OW Part No. 2021850
Gravity Tank - Hub Seal	Pipe work to gravity tank	Connect a pipe or hose between the cover (item 5 on Fig.1, 48337-E) and the valve connected to the gravity tank line.				1.RR Dwg R215025A 2.RR Doc 48337-E	
Gravity Tank - Hub Seal	Fill Gravity Tank	Fill the gravity tank with specified oil	The tank valve must be secured in the open position after oil filling.				
Stern Tube - Install Cover for Intermediate Bearing		Install the cover for the stern tube intermediate bearing access hole. Use liquid sealant on cover and loctite on the screws	24 off flat head countersunk socket screws required. SSA4, DIN 7991, M10 x 30				
Main Engine - Load Out and Initial Set-Up	De - Preserve Engine	Flush the preservation fluid from the engine's oil system.					
Main Engine - Load Out and Initial Set-Up	Establish recommended wet condition for Engine	Use appropriate fluid and / or weight to compensate for fluids not able to install.	required by resilient mount supplier to pre-load mounts. Also required by flex coupling supplier during engine alignment (MTU dwg X00011408 see note 1.2)				
Main Engine - Load Out and Initial Set-Up	Fill Main Engine sump with Oil and calibrate dip stick	Pour 160L oil in the engine, then mark dipstick for "Low". Pour another 40L (to have 200L total) of oil in the engine, then mark dipstick for "High"	Dipstick is not calibrated at factory because calibration depends on angle of inclination.	Oil Pan Capacity: Minimum – 160L Maximum – 200L			
Main Engine - Resilient Mounts	Pre-load Resilient Mounts	Remove the resilient mount blocking screws (Pos.1 on MTU dwg 5240002399) and allow the engine to stand on the mounts for 48 hours	Allow mounting elements to settle into final position			MTU Dwg 5240002399	mounts supplied attached to engine.

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NO.		REVISION		DATE	DRAWN	CHECK	APPR.
 <b>Irving Shipbuilding Inc</b>				PROJECT NAME: MSPV			
				SCALE	DRAWN DATE	DATE 11/06/2011	
				NTS	CHG'D BY	APPROV: BF	
				PROJECT NO. 6094			
				CUSTOMER CANADIAN_COAST_GUARD			
TITLE		MSPV SHAFT_LINE ALIGNMENT		DRAWING NO. 6094-24300-02		REV. NO. 13	





MSPV Shaft Line Alignment Procedure - 7 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Main Engine - Resilient Mounts	Pre-load Resilient Mounts	After 48 hours re-install the blocking screw to suit the settled position.	The blocking screws may only be removed once the alignment has been complete and the mounts are loaded by the engine weight (AFTER LAUNCH and Chocking is complete)			MTU Dwg 5240002399	
Main Engine - Resilient Mounts	Height Adjustment Nut Check / set up	The Height adjustment nut is to be pre-set for dimension H=5mm +/-0.3mm	Note that the Mount Height adjustment devices on the resilient mounts are not to be used for initial alignment. Only use these for fine tuning after the ship is in service.	H=5mm +/-0.3mm		MTU Dwg 5240002399	
Main Engine - Resilient Mounts	Buffer Clearance of Resilient Mounts	For each resilient mount check the buffer clearance and if necessary adjust. See Page 169 from MTU manual MS150047/01E	Adjustment of buffer to mid-span to allow for fine tuning of mount after bolted to engine bed.	Tolerances dependant upon marking on Mount; 1. "30" mark corresponds to a=3 + 0.3mm 2. "40" mark corresponds to a=4 + 0.3mm		1.MTU Manual : MS150047/01E Pg.169 2.MTU Dwg 5240002399	
Main Engine - Resilient Mounts	Torque locking nuts on resilient mounts	Tighten each resilient mount's locking nut (Item 3 in Manual except) to the specified tightening torque, securing the central buffer from turning.			580Nm + 50Nm	1.MTU Manual : MS150047/01E Pg.169 2.MTU Dwg 5240002399	
Launch Vessel							
Stern Tube - fill with water	Stern tube to be filled with water prior to final alignment of shaft	Vent stern tube until full of water.	Should do this before the Inclining Test.				
Load Ship - Achieve Alignment Condition	Ship brought to final design draft. RR Pre-requisites prior to final alignment.	Before the final alignment starts. The vessel must be afloat in sheltered waters and all heavy sections, modules and equipment must be placed in their final position. All essential welding works must be finished.	For best result of the alignment the loading condition of the vessel should be similar to the most frequent sailing condition, the design condition. Fill stern tube with water. Put ballast in the tanks that simulate RIB on board.			RR Doc SA1086 : Section 4.1	
Shaft Securing Device - Remove	Remove shaft securing device.	The shaft securing device is to be removed just prior to final alignment and fit up of SKF coupling.	The shaft securing device should be kept in place as long as possible to stop the shaft from sliding aft in the stern tube, moving away from the final alignment condition.				
Loosen Fwd Seal	Loosen Fwd Seal to allow shaft to float freely		Note - The seal will later need to be re-aligned to suit final alignment of the shaft in a floating condition.				
Gearbox - Final Alignment to Propeller Shaft	Final Alignment prep	Position the SKF OKCX coupling at the correct position for gap and sag measurement (200mm aft of shaft face). See page 12 of RR Doc. SA1086	Make sure that it is only the bearings that are in contact with the shaft line. The twin tube is still to be disconnected at this time.			RR Doc SA1086 Pg.12	
Gearbox - Final Alignment to Propeller Shaft	Gap and sag between Gearbox and Prop Shaft	Check the gap and sag on the shafts where the SKF OKCX coupling is to be installed. Adjust the gearbox until the offset, gap and sag values are achieved.	Keep in mind that there is a 100mm distance ring to be installed between the gearbox and propeller shafts.	Offset: 0.60 mm below reference line Gap = 0.04mm (recommended accuracy: +/- 0.05 mm) Sag +/- 0.30mm (recommended accuracy: +/- 0.08 mm)		RR Doc SA1086 Pg.13, 14 and 33	
Gearbox - Final Alignment to Propeller Shaft	Lock Jack screws	When completed, check that all the jackscrews are locked in location to preserve the alignment settings					
Twin Tube - Installation	Load Twin Tube in Location	Slide twin tube through gear box	The twin tube installation procedure is completed after the vessel has been launched. The twin tube joint at the sleeve coupling must be connected before the SKF sleeve coupling is mounted.			1.RR Doc 49656-E 2.RR Dwg RRM200008623	Twin Tube OW Part No. 1953794
Twin Tube - Installation	Disconnect Gravity Tank	Disconnect the temporary connection from gravity tank to end cover on shaft CPP tube.	Close valve from oil tank, relocate temporary line to OD Box location in preparation for hook up to OD box.				
Twin Tube - Installation	Attach Twin Tube to Propeller Shaft	Twin tube screwed joint must be cleaned and tightened until the set screw can be installed in the predrilled holes, see figure 2 and figure 3 of RR Doc 49656-E.	Do not over tighten the threaded twin tube joints. If the twin tube joints are over-tighten the sealing capacity will be reduced. Tighten only until the set screw can be inserted.			1.RR Doc 49656-E 2.RR Dwg RRM200008623	
Twin Tube - Installation	Install Set Screw	Lock twin tube joint into position using the set screw. Use loctite to secure the set screw.	Set screw is supplied in the crate with the twin tube OW Part No. 1953831. Torque to 15Nm.		15Nm	1.RR Doc 49656-E 2.RR Dwg RRM200008623	Set screw OW Part No. 1953831
Distance Ring - Install	Install the distance ring between the propeller shaft and the gear box output shaft.	Fit the distance ring around the twin tube at the interface to the propeller shaft.	This must be installed prior to installing the sleeve coupling.			RR Dwg DMN20000864	Distance Ring OW Part No. 1953840
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Coupling Pump, coupling ejectors and coupling wrenches are in a tool box supplied by Rolls Royce. OW Part No.s 2021702, 2021711, 2021729					1.Coupling Pump OW Part No. 2021702 2.Coupling Ejector (2 off) OW Part No. 2021711 3.Coupling Wrenches (2 off) OW Part No. 2021729
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Support the shafts and the coupling during the mounting process so that no misalignment appears.	Make sure that the shafts are aligned and concentric before mounting the sleeve coupling.			SKF Instructions - 81569 Edition B	SKF Coupling OW Part No. RRM200005975/LR105000239

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No.		REVISION				DATE	DRAWN	CHWD	APPR.
		PROJECT NAME:				MSPV			
		SCALE				DATE: 11/NOV/2011			
		CUSTOMER				CANADIAN_COAST_GUARD			
		PROJECT NO.				6094			
		DRAWING NO.				6094-24300-02			
		TITLE				MSPV SHAFT LINE ALIGNMENT			
						REV. NO. 14			



MSPV Shaft Line Alignment Procedure - 8 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Mark the final resting position "A2" on the gearbox output shaft. This indicates the final location of the front face of the couplings inner sleeve.	A2 is to be 188 +/- 1.5mm forward of the aft face of the gearbox output flange (see SKF dwg 28436)			1.RR Dwg RRM200005975 (SKF Dwg 28436) 2.SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Slide the coupling back along the shafts until the large end face of the inner sleeve coincides with the A2 mark on the gearbox output shaft.	Coat the sealing on the shaft with thin oil to prevent scrapes on the shafts when sliding the coupling in position (SAE20W Motor Oil for ambient temp between 8 - 18 deg C, SAE 30 Motor Oil for Temp between 18 - 27 deg C.)			1.RR Dwg RRM200005975 (SKF Dwg 28436) 2.SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	When the coupling is in the correct position and before mounting, measure the outside diameter of coupling and record it.	The location for measuring is marked on the outside of the coupling with a shallow groove.			SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Connect the low pressure pump to the lower 1/4" hole. Connect the high pressure injectors to the 1/8" holes on the coupling hub.	Start pumping oil into the hydraulic chamber (B) until oil free from air bubbles escapes through the open 1/4" hole. Then close that hole with the plug.			SKF Instructions - 81569	1.Coupling Pump OW Part No. 2021702 2.Coupling Ejector (2 off) OW Part No. 2021711
SKF Sleeve Coupling - Final Installation	Prep for Coupling Drive Up	Begin working the high pressure injector connected to the 1/4" hole A1. Work the high pressure pump with even strokes until oil emerges around the periphery at the large end of the inner sleeve. Continue pumping for a couple of minutes.				SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Drive Up Outer Sleeve	Start the pump connected to the oil chamber (B) to begin the drive up of the outer sleeve. It is important to continue working the high pressure injectors with even strokes during the entire drive up operation. Continue the drive up procedure until the diameter of the outer sleeve has increased by the dimension Δ (0.252mm).	If it is necessary to refill the container of the injector during the drive up procedure, always stop the pump connected to the oil chamber first. After refilling, work the injectors first until oil emerges again around the periphery at the large end of the inner sleeve.	Δ before draining oil = 0.252mm Δ after draining oil = 0.24mm.		1.RR Dwg RRM200005975 (SKF Dwg 28436) 2.SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Confirm Drive up Measurements	Stop the pump connected to the hydraulic chamber B, but keep the pressure. Open the return valves on the injectors A1 and A2. Keep the pressure (B) in the hydraulic chamber. After 10 minutes, measure the Δ value again, to confirm the correct diameter increase.		Δ before draining oil = 0.252mm Δ after draining oil = 0.24mm.		1.RR Dwg RRM200005975 (SKF Dwg 28436) 2.SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Disconnect injectors and Pump	Open the return valve on the pump connected to the oil chamber (B) slowly to release the pressure, make sure the outer sleeve is not moving. Remove the injectors, disconnect the pump and refit the plugs when the oil has drained.				SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Reference Measurement	On completion of mounting, the distance A3 (distance from the end of the inner sleeve to the end of the outer sleeve) should be measured and recorded.	This is used as a confirmation during any future mounting of the coupling.			SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Protect Ends	Protect the ends of the coupling at the shaft and the clearance between the nut and the outer sleeve using silicon or similar protective.				SKF Instructions - 81569	
SKF Sleeve Coupling - Final Installation	Tighten Locking device	After mounting, retighten the four axial locking screws to secure the locking device.	The gap between the nut and the hydraulic chamber can be inspected with a feeler gauge to make sure that the locking devices are activated.	Torque to 5Nm	5Nm	SKF Instructions - 81569	SKF Instructions - 81569 - Page 6
Shaft - Propeller Shaft - Inspect Maximum Run Out	Inspect and record the maximum run out of the Propeller Shaft.	Place an indicating dial gauge on the propeller shaft as per figure 1 of RR Doc 49358-E	Slowly rotate the shaft 360 degrees, inspect and record the values given by the indicator gauge. The value may differ maximum 0.2 mm.	less than or equal to 0.2mm deviation on a dial gauge		RR Doc 49358-E Page.1 & 2	
SKF Sleeve Coupling - Inspect Maximum Run Out	Inspect and record the maximum run out of the SKF Sleeve Coupling.	Place an indicating dial gauge on the SKF Sleeve Coupling as per figure 1 of RR Doc 49358-E	Slowly rotate the shaft 360 degrees, inspect and record the values given by the indicator gauge. The value may differ maximum 0.2 mm.	less than or equal to 0.2mm deviation on a dial gauge		1.RR Doc 49358-E Page.1 & 2 2.RR Doc SA1086 Pg.12	
Twin Tube - Inspect Maximum Run Out	Set up Pitch	It is preferable that the pitch is set as close as possible to the mechanical end position ahead. If not possible the pitch can remain in its position close to zero pitch.				RR Doc 49358-E Page 3 (Alternative 3)	
Twin Tube - Inspect Maximum Run Out	Measure Run Out	Place an indicating gauge on the oil transfer tube, see position 3, in figure 2 of RR Doc 49358-E	Slowly rotate the shaft 360 degrees, inspect and record the values given by the indicator gauge. The value may differ maximum 0.2 mm.	less than or equal to 0.2mm deviation on a dial gauge		RR Doc 49358-E Page 3 (Alternative 3)	
Jack Load Test	Jack Load Test - Set up	Place a jack on the prop shaft 300mm aft of the SKF coupling as per page 16 of RR Doc SA1086. Use a manometer or a load cell to measure the load.	Jack load measurement is performed to verify the final alignment. The jack load test must be carried out with the whole shaftline coupled.			RR Doc SA1086 Pg.15	
Jack Load Test	Jack Load Test - Set up	Put a dial gauge at a frame above the shaft and point it on the shaft straight above the jack.				RR Doc SA1086 Pg.15	

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No.		REVISION			DATE	DRWN	CHGD	APPR.	
 <b>Irving Shipbuilding Inc</b>					PROJECT NAME: MSPV				
					SCALE		DATE: 11/16/2011		
					NTS		CHGD: JP		
							APPROVD: BF		
					CUSTOMER		PROJECT NO. 6094		
		CANADIAN_COAST_GUARD							
TITLE		MSPV SHAFT_LINE ALIGNMENT			DRAWING NO. 6094-24300-02		REV. NO. — SHEET NO. 15		



# MSPV Shaft Line Alignment Procedure - 9 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Jack Load Test	Jack Load Test - Reduce Hysteresis	Before the jack load measurement is started the shaft should be jacked to the highest measure point and lowered again. This is to reduce the hysteresis in the shaft and to check the jacking equipment.		Max bearing play in the gearbox output shaft / bearing is 0.80mm (see RR Dwg. 214740)		RR Doc SA1086 Pg.15	
Jack Load Test	Jack Load test - Measure	Lift the shaft slowly and carefully and note down the loads for every 0.01 mm from 0.00 to 0.10. Then measure every 0.05 mm to 0.5 mm or if the top of the bearing is reached. If the load is increasing much in relation to the dial gauge reading it indicates that the top of the bearing is reached. Measure the steps on the way down as well.	Use the jack up protocol on page 19 of RR Doc SA1086 to record results.	Max bearing play in the gearbox output shaft / bearing is 0.80mm (see RR Dwg. 214740)		RR Doc SA1086 Pg. 17, 18,19	
Jack Load Test	Jack Load Test - Approval	Draw a jack load graph as per section 4.4.2 of RRM Doc - SA1086. Compare the measured jack load with the calculated values in the alignment report. The recommended tolerance for jack load is +/- 10%.					
Jack Load Test	Jack Load Test - Approval	Submit Jack load protocol to Rolls Royce for approval.	Also record conditions in all tanks at the time of this test for future reference.				
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Prep OD Box for Installation	Remove the reduction nipple on top of the OD box and replace with the RR supplied plug.	The plug is in the bag of misc parts inside the crate with the OD Box			1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	1.OD Box Right Hand OW Part No. 1953891 2.OD Box Left Hand OW Part No. 1969227 3.Plug supplied loose in crate with OD Box - no individual OW Part No (Item 57 on packing slip)
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Prep work at Gear Box	Mount the bushing (see position 3, figure 1 of RR Doc 49370-E) complete with O-Rings (Items 32 and 33 on dwg 214000). Then mount the Sleeve (position 4, figure 1) in the gear shaft (position 1, figure 1).	8 off M5 x 25mm screws required. Torque screws to 5Nm		5Nm	1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box 3.RR Dwg 214740 - OD Box Connection to Gear	Socket Screws, Bushing, Sleeve and O-Rings supplied loose in crate with OD Box - no individual OW Part No.s (Bushing is item 19 on packing slip, sleeve is item 20, screws are item 53, o-rings are Items 32 and 33)
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Mount the OD-box housing	Mount the OD-box housing (see position 16, figure 1 of RR Doc 49370-E).	Make sure that the diameter and the drilled holes in the gear housing are in accordance with the OD-box ring.			1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box 3.RR Dwg 214740 - OD Box Connection to Gear	
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Mount the sealing package	Mount the sealing package (see position 5, figure 1) on the twin tube forward end. The outside liner and the inside of the sealing rings must be greased with Lithium grease before mounting.	Make sure that the sealing package is held in line with the liner during mounting, or the seals might get damaged.			1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	Supplied with OD Box
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Fit OD-Box Ring	Fit the two O-rings (see position 2, figure 1) in their groove on the forward twin tube. Lift the stub shaft and OD-box ring (see position 6 and 15, figure 1) and mount them on the forward twin tube.				1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	O-Rings supplied loose in crate with OD Box - no individual OW Part No (O-rings are item 35 on packing slip)
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Connect the guide rod to the OD-box ring.	Connect the guide rod to the OD-box ring.				1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	Supplied with OD Box
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Assemble the OD-box covers.	Put the cover back on the OD Box	Bolts to be torqued to 9Nm		9Nm	1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	
OD-Box - Install (Phase 1 of 2 - ISI Scope)	Fill OD Box	Fill the OD-box housing with filtered oil through the plug (pos 8, figure 1).				1.RR Doc 49370-E 2.Kamewa Dwg 214000 - OD Box	
Gravity Tank - Connect to OD Box	Gravity Tank - Connect to OD Box	Connect the temporary line from the gravity tank to the OD Box (port SP). To maintain oil pressure in the propeller hub and prevent water egress.	If the entire CPP Hydraulic system is finished and charged by this point there is no need to hook up the gravity tank. Instead hook up the hydraulic system in its final configuration.			1.RR Dwg DMN260000689 2.RR Dwg RRM260011521	
Gearbox - Check and Secure	Mark and drill Gearbox Foundation	Holes to be 36mm dia to suit fitted sleeves.	See View D-D of ICE Dwg 6094-23300-01			ICE Dwg 6094-23300-01	
Gearbox - Check and Secure	Drill Chockfast Vent Hole	10mm dia hole to be drilled in Gear Box footprint for epoxy venting.	See View A-A of ICE Dwg 6094-23300-01			ICE Dwg 6094-23300-01	
Gearbox - Check and Secure	Install Chockfast dams and pour chockfast.	Take a sample of each chockfast pour and deliver to QA.				Chockfast Orange Installation Instructions - Technical Bulletin No.692A	OW Part No.s: Chockfast Orange - 1955773. Foam damming - 1955781, Release Agent - 1955802, Impax 1XT59 Solvent - 1955802, Jiffy Mixer - 1955811, Non Metal Grease - 1955829, Sealing Putty - 1955837
Gearbox - Check and Secure	Allow Chockfast to cure	Suggested curing period; 48 hours (13 - 18 deg C), 24 hours (19 - 21 deg C), 18 hours (above 21 deg C)				Chockfast Orange Installation Instructions - Technical Bulletin No.692A	
Gearbox - Check and Secure	Bolt gearbox to foundation	Bolt the gearbox to its foundation using items 5 through 12 on ICE Dwg 6094-23300-01	See View D-D of ICE Dwg 6094-23300-01		264Nm ICE Calc Value	1.ICE Dwg 6094-23300-02 Pg.12 2.ICE Dwg 6094-23300-01	OW Part No.s: 2218054, 2218100, 2212120, 2212138, 2218089, 2218071, 2218046, 2218097

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NO.	REVISION			DATE	DRWN	CHKD	APPR.
 <b>Irving Shipbuilding Inc</b>				PROJECT NAME:			
				MSPV			
				SCALE		DATE: 11/16/2011	
				NTS		CHKD: JP	
						APPROV: BF	
CUSTOMER				PROJECT NO.			
CANADIAN_COAST_GUARD				6094			
TITLE				DRAWING NO.		REV. NO.	
MSPV SHAFT_LINE ALIGNMENT				6094-24300-02		SHEET NO. 16	



MSPV Shaft Line Alignment Procedure - 10 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
Main Engine - Final Alignment	Check the Flange to Flange run out between Engine and Gearbox after the resilient mounts have been set up. Re-adjust alignment if necessary.	Distance between the Engine Output flange and the Gearbox Input flange is 363mm (+/- 3mm). Allowable Axial Tolerance : 0.05mm. Allowable Radial Tolerance : 0.05mm. As per MTU Dwg XZ59425000006.	For vertical alignment use the vertical jacking devices supplied on the engine. For horizontal alignment use shipside devices fabricated by the shipyard. Note that the Mount Height adjustment devices on the resilient mounts are not to be used for initial alignment. Only use these for fine tuning after the ship is in service.	Allowable Axial Tolerance : 0.05mm. Allowable Radial Tolerance : 0.05mm		1.MTU Dwg XZ59400000169 Sh.1 2.MTU Dwg XZ59425000006	
Main Engine - Chock and Secure	Mark and drill Engine foundation	Drill holes in foundation to suit M16 bolts.	See View C-C of ICE Dwg 6094-23300-01			ICE Dwg 6094-23300-01	
Main Engine - Chock and Secure	Install Chockfast dams and pour chockfast.	Take a sample of each chockfast pour and deliver to QA.				Chockfast Orange Installation Instructions - Technical Bulletin No.692A	OW Part No.s: Chockfast Orange - 1955773, Foam damming - 1955781, Release Agent - 1955802, Impax 4XT59 Solvent - 1955802, Jiffy Micer - 1955811, Non Metal Grease - 1955829, Sealing Putty - 1955837
Main Engine - Chock and Secure	Allow Chockfast to cure	Suggested curing period; 48 hours (13 - 18 deg C), 24 hours (19 - 21 deg C), 18 hours (above 21 deg C)				Chockfast Orange Installation Instructions - Technical Bulletin No.692A	
Main Engine - Chock and Secure	Remove blocking screws on resilient mounts	The blocking screws may only be removed once the alignment has been complete and the mounts are loaded by the engine weight.					
Main Engine - Chock and Secure	Remove jacking screws for the resilient mount base plates						
Main Engine - Chock and Secure	Re-check the Flange to Flange run out between Engine and Gearbox after the resilient mounts have been set up.	Re-adjust alignment if necessary.					
Main Engine - Chock and Secure	Bolt Engine to foundation	Bolt the engine to its foundation using items 2, 3, 4 and 14 on ICE Dwg 6094-23300-01	See View C-C of ICE Dwg 6094-23300-01		114Nm ICE Calc Value	1.ICE Dwg 6094-23300-02 Pg.7 2.ICE Dwg 6094-23300-01	OW Part No.s: 2218118, 2218126, 2218134, 2212144
Flexible Coupling Installation - Gearbox to Engine	Mount fwd half of coupling to Engine	Mount the fwd half of the coupling to the engine flywheel flange. Secure with bolt (754), washer (810) and nuts (801).	Torque to 670+50 Nm as per table on dwg XZ59425000006. Coat bolts with engine oil prior to torquing.		670+50Nm	MTU Dwg XZ59425000006	ME Flex Coupling OW Part No.X00039215 Dwg indicates the fasteners are supplied handtight with the coupling
Flexible Coupling Installation - Gearbox to Engine	Mount aft half of coupling to Gearbox	Mount the aft half of the coupling to the Gearbox input flange. Secure with bolt (754) and washer (810).	Torque to 670+50 Nm as per table on dwg XZ59425000006. Coat bolts with engine oil prior to torquing.		670+50Nm	MTU Dwg XZ59425000006	Dwg indicates the fasteners are supplied handtight with the coupling
Flexible Coupling Installation - Gearbox to Engine	Determine Clearance "X"	Determine Clearance "X" by measuring 3 equally offset points and taking the average. Spacer configuration in Detail Z is defined by final measured flange distance.	Install Spacers as per Instruction 2.3 and Detail Z of Dwg.XZ59425000006			MTU Dwg XZ59425000006	
Flexible Coupling Installation - Gearbox to Engine	Attach coupling halves	Join the two halves of the coupling as per detail Z on Dwg.XZ59425000006.	Torque to 22+4 Nm as per table on Dwg XZ59425000006. Coat bolts with engine oil prior to torquing.		22+4Nm	MTU Dwg XZ59425000006	Dwg indicates the fasteners are supplied handtight with the coupling
Fwd Seal Final Alignment	Final Assembly - Secure fwd seal boot with locking clamp.	See Section I of the Simplan Installation Document. Also see Secto 3.4.1 and 3.4.2 of the Simplan Operating Manual (page 10 and 11).	Note - Do not perform final alignment of boot / below assembly to the shaft by the clamp ring until the shaft is coupled.	1. Preload = 8mm 2. Distance deviation between rear edge of clamp ring and front edge of housing ring should be no more than +/- 0.2mm 3. Gap between sealing rings = .05mm Max.		1. Simplan Dwg SGC-3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-01-2002. 3. Simplan Operating Manual	
Fwd Seal Commissioning	Before turning shaft open the fwd seal vent valve to fill the seal completely with water, removing all air.	See Section L of the Simplan Installation Document.				1. Simplan Dwg SGC-3-217-0008-000.1 (RRM 200 006 480). 2. Simplan Installation Doc. Dated 21-01-2002. 3. Simplan Operating Manual	
Rolls Royce FSR On-Site							
RRM Service Rep.	Fill hydraulic system with oil	must be performed by authorized Rolls-Royce service personnel.	Note ; pipe aspects of the system are to be pre-flushed and pressure tested by Halifax Shipyard prior to RR FSR's arrival.			RR Doc 49672-E	
RRM Service Rep.	Start up and flush hydraulic system	must be performed by authorized Rolls-Royce service personnel.				1.RR Doc DMN200002313 2.RR Doc DMN200002315	
RRM Service Rep.	Inspect twin tube axial movement ratio	must be performed by authorized Rolls-Royce service personnel.				RR Doc 49362-E	
RRM Service Rep.	Install OD-box and feed back system (Phase 2 of 2 - RRM Scope)	Assemble the linkage in the feed back box	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49370-E	
RRM Service Rep.	Install OD-box and feed back system (Phase 2 of 2 - RRM Scope)	Adjustment of the pointer on OD-box scale.	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49370-E	

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No.	REVISION				DATE	DRWN	CHD	APPR.	
 <b>Irving Shipbuilding Inc</b>					PROJECT NAME: MSPV				
					SCALE NTS		DRN T: 11/03/2011	DATE: 11/03/2011	
					CHD: IF		APPROV: IF		
					PROJECT NO. 6094				
CUSTOMER CANADIAN_COAST_GUARD					DRAWING NO. 6094-24300-02			REV. NO. —	
TITLE MSPV SHAFT_LINE ALIGNMENT					SHT NO. 17				



# MSPV Shaft Line Alignment Procedure - 11 of 11

High Level Activity	Activity Description	Activity Details	Additional information	Applicable Tolerances	Torque Values	Associated Documents	Material Info
RRM Service Rep.	Install OD-box and feed back system (Phase 2 of 2 - RRM Scope)	Adjustment of the cams and micro switches	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49370-E	
RRM Service Rep.	Install OD-box and feed back system (Phase 2 of 2 - RRM Scope)	Adjustment of the feed back potentiometer.	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49370-E	
RRM Service Rep.	Adjust OD-box scale	Adjust OD-box scale	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49363-E	
RRM Service Rep.	Adjust OD-box scale	Inspect the OD-box ring axial play (applicable for OD-box type F0 and FA)	must be performed by authorized Rolls-Royce service personnel.			RR Doc 49364-E	

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		PROJECT NAME:		MSPV					
		SCALE:		DRG: IT	DATE: 11/16/2011				
				CHKD: JP					
				APPRVD: BF					
CUSTOMER		CANADIAN_COAST_GUARD		PROJECT NO.		6094		REV: NO	
TITLE		MSPV SHAFT_LINE ALIGNMENT		DRAWING NO.		6094-24300-02		SHEET NO. 18	