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**Bid Receiving - PWGSC / Réception des soumissions  
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**11 Laurier St. / 11, rue Laurier  
Place du Portage , Phase III  
Core 0B2 / Noyau 0B2**

**Gatineau  
Québec**

**K1A 0S5**

**Bid Fax: (819) 997-9776**

**Revision to a Request for a Standing Offer**

**Révision à une demande d'offre à commandes**

National Individual Standing Offer (NISO)

Offre à commandes individuelle nationale (OCIN)

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Offer remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'offre demeurent les mêmes.

**Comments - Commentaires**

**Vendor/Firm Name and Address**

**Raison sociale et adresse du  
fournisseur/de l'entrepreneur**

**Issuing Office - Bureau de distribution**

Marine Machinery and Services / Machineries et services maritimes

11 Laurier St. / 11, rue Laurier

6C2, Place du Portage

Gatineau

Québec

K1A 0S5

<b>Title - Sujet</b> MARINE VESSEL FUEL MANAGEMENT SYS		
<b>Solicitation No. - N° de l'invitation</b> F7044-150030/A	<b>Date</b> 2015-12-16	
<b>Client Reference No. - N° de référence du client</b> F7044-150030	<b>Amendment No. - N° modif.</b> 003	
<b>File No. - N° de dossier</b> 025ml.F7044-150030	<b>CCC No./N° CCC - FMS No./N° VME</b>	
<b>GETS Reference No. - N° de référence de SEAG</b> PW-\$\$ML-025-25455		
<b>Date of Original Request for Standing Offer</b>		2015-11-06
<b>Date de la demande de l'offre à commandes originale</b>		
<b>Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2015-12-22</b>		<b>Time Zone</b> Fuseau horaire Eastern Standard Time EST
<b>Address Enquiries to: - Adresser toutes questions à:</b> Girard, Luc J.		<b>Buyer Id - Id de l'acheteur</b> 025ml
<b>Telephone No. - N° de téléphone</b> (819) 956-0652 ( )	<b>FAX No. - N° de FAX</b> (819) 956-0897	
<b>Delivery Required - Livraison exigée</b>		
<b>Destination - of Goods, Services, and Construction:</b> <b>Destination - des biens, services et construction:</b>		
<b>Security - Sécurité</b> This revision does not change the security requirements of the Offer. Cette révision ne change pas les besoins en matière de sécurité de la présente offre.		

**Instructions: See Herein**

**Instructions: Voir aux présentes**

<b>Acknowledgement copy required</b>	<b>Yes - Oui</b>	<b>No - Non</b>
<b>Accusé de réception requis</b>	<input type="checkbox"/>	<input type="checkbox"/>
<b>The Offeror hereby acknowledges this revision to its Offer.</b> <b>Le proposant constate, par la présente, cette révision à son offre.</b>		
<b>Signature</b>	<b>Date</b>	
Name and title of person authorized to sign on behalf of offeror. (type or print) Nom et titre de la personne autorisée à signer au nom du proposant. (taper ou écrire en caractères d'imprimerie)		
<b>For the Minister - Pour le Ministre</b>		

Solicitation amendment 003 is raised to add a Limitation of Liability in the Resulting Contract Clause section, to answer Question and Answer Set 3 and to provide amended Appendix 1 to reflect clarifications provided.

1. Under PART 6, B – RESULTING CONTRACT CLAUSES, insert new Limitation of Liability clause as follows;

**INSERT:**

**6.9 Limitation of Contractor's Liability for Damages to Canada**

1. This section applies despite any other provision of the Contract and replaces the section of the general conditions entitled "Liability". Any reference in this section to damages caused by the Contractor also includes damages caused by its employees, as well as its subcontractors, agents, and representatives, and any of their employees.
2. Whether the claim is based in contract, tort, or another cause of action, the Contractor's liability for all damages suffered by Canada caused by the Contractor's performance of or failure to perform the Contract is limited to **Contract value**. This limitation of the Contractor's liability does not apply to:
  - a. any infringement of intellectual property rights; or
  - b. any breach of warranty obligations.
3. Each Party agrees that it is fully liable for any damages that it causes to any third party in connection with the Contract, regardless of whether the third party makes its claim against Canada or the Contractor. If Canada is required, as a result of joint and several liability, to pay a third party in respect of damages caused by the Contractor, the Contractor must reimburse Canada for that amount.

2. Answers to Question and Answer Set 3 are included below.

3. Amended Appendix 1 to Annex A is attached to reflect clarifications provided in Question and Answer Sets.

**Keys for Interpretation of Answers:**

No Highlight = Questions not answered

Green Highlight = Answers already provided

Yellow Highlight = Current answers

Item #	Ref.	Statements	Questions	Answers
1	SOW	Annex A, Appendix 1, Table 1, line 29	Does the vessel Captain Goddard have three ship service engines or is it two?	The Captain Goddard vessel only has two (2) Ship Service Generators. Amended Table 1 attached.
2	SOW	Annex A, Appendix 1, Table 1, Line 34	The indicated shaft size of 850mm for the Alfred Needler seems high, is this shaft size correct?	The indicated shaft size is incorrect. The correct shaft size is 262.6mm. Amended Table 1 attached.
3	RFP	Annex E, section 2, IM1	Is the 'Evaluation Factor' in section IM1 to be calculated as follows? Number of vessels (34) multiplied by the number of average days to perform the work per vessel multiplied by the number of FSR's performing the work for each day?	The bidder is to provide the FSR per diem rate and this rate will be multiplied by the stated Evaluation Factor of 34. As outlined in section 1.3 Government Furnished Equipment and Services of Annex A, Canada is performing the installation of the equipment and the FSR will monitor and finalize the installation and set-up.
4	SOW	Annex A, section 4.4.2	Is the Canadian Coast Guard looking to	CCG plans to monitor performance, have the

Item #	Ref.	Statements	Questions	Answers
			profile the energy performance for each platform and rank the fleet e.g. fuel/speed, torque/fuel, service load/propulsive load fuel/nm per knot, to enable the platform to operate at peak efficiency when schedules allow and maximize endurance?	ability to plan for future years, and schedule maintenance plans based on performance.
5	SOW	Annex A, section 4.4.4	Is there a requirement for a shore-side element to the data collection – planning, estimating?	Not as part of this Statement of Work (SOW).
6	SOW	Annex A, section 4.4.2	Is the ability to detect abnormal fuel consumption required?	No.
7	SOW	Annex A, section 4.2.4	a) Will the system have to deal with multiple fuel types? b) Do all vessels have the same fuel delivery system – fuel line bores, fuel types?	a) Fuel type is as per SOW section 4.2. b) Fuel delivery system and line bores as per SOW. These could differ from Class to Class.
8	SOW	Annex A, section 1.4	Will the system need to be calibrated against sea state and environmental conditions?	No.
9	SOW	Annex A, section 4.2.3	a) Is the software to be focused on data logging of fuel flow in isolation of other parameters? b) Are there any other sensors to be integrated?	a) Standalone system as per SOW. b) There are no other CCG supplied sensors to be integrated.
10	SOW	Annex A, section 4.3	Is it allowed to propose a torque measurement system based on the optical measuring principle?	CCG will accept an optical torque measurement as long as it does not require the removal or relocation of guards and equipment currently fitted to the shaft or in way of.
11	RFP	Limitation of Liability	Can a Limitation of Liability be included in the Contract such as SACC manual clause N0001C?	A Limitation of Liability to the Contract value will be implemented in the Solicitation by adding SACC Manual clause N0001C under new article 6.9 Limitation of Liability under B. RESULTING CONTRACT CLAUSES.
12	SOW	Annex A, Appendix 1	If the piping size is a direct correlation to a US measurement 25.4 = 1 "do the mounting flanges need to be ANSI type flanges? If the piping size is a direct correlation to DN pipe 25mm should we use DN flanges?	All supplied piping, flanges and fittings must meet Transport Canada and/or Class requirements for fuel oil.  CCG has no preference for flange types.
13	SOW	Annex A, Appendix 1	Are the Power Output readings for the Generator Engine the kw/hp rating of the engine or the genset kW?	Power ratings may not match manufacturer specifications because diesel alternator set has been de-rated for specific installations.
14	SOW	Annex A, Appendix 1	<b>Louis S. St-Laurent:</b> Stated Power Output KW 5872 doesn't match vessel spec sheet at 4028kW per engine for a total power of 20142kW. Which is correct?  Is the indicated Fuel supply line of 12.7 mm (1/2") correct for the Kw rating?	5872 kw is correct.  1" is correct size.

Item #	Ref.	Statements	Questions	Answers
			The indicated fuel consumption of 4.5Lph seems low for kW Rating, what is the correct consumption?	233.17 LPH is consumption.
15	SOW	Annex A, Appendix 1	<b>Terry Fox vessel:</b> Can you confirm Supply line diameter at DN50 of 2" ANSI?	For bidding purposes, use 2" diameter a 1 1/2" return
16	SOW	Annex A, Appendix 1	<b>Amundsen:</b> Can you confirm the # of cylinders for Main Engine (V-16) and Genset (either V-16 or V-12)? Please note that no Alco 251F are listed in the bid spec Table 2 under the generator heading.  Bid Spec Sheet shows 2 listings for the Alco 251F, one with a supply line of 25mm (900 rpm engine) the other with a supply line of 12.7mm (1/2") (1000 rpm engine), which size is correct?  Bid Spec Sheet shows 2 listings for the Alco 251F, one with a return line of 22 - Jan the other with a return line of 19.525mm, what is the correct sizing?	This is corrected in Table 1 to MTU 4000, Alco 251 engines replaced this year.  16 cylinder engines operating at 1000 RPM . Use supplied dimensions for bid purposes.  20 mm, Note that both listings have been changed for bid purposes.
17	SOW	Annex A, Appendix 1	<b>Des Groseilliers:</b> Same questions as in Item 16.	See answers in Item 16.
18	SOW	Annex A, Appendix 1	<b>Henry Larson</b> What is the correct engine RPM on the Genset engine Wartsila 6L22?	1200 RPM.
19	SOW	Annex A, Appendix 1	<b>Pierre Radisson</b> Can you confirm the # of cylinders for Main Engine (V-16) and Genset (either V-16 or V-12)? Please note that no Alco 251F are listed in the bid spec Table 2 under the generator heading.  Bid Spec Sheet shows 2 listings for the Alco 251F, one with a supply line of 25mm (900 rpm engine) the other with a supply line of 12.7mm (1/2") (1000 rpm engine), which size is correct?  Bid Spec Sheet shows 2 listings for the Alco 251F, one with a return line of 22 - Jan the other with a return line of 19.525mm, what is the correct sizing?  For the return line on Genset Engine 8V4000 M23S, supply is indicated at 25.4 and return is indicated at 12.7 (1/2"), is this data correct?	As per answer in Item 16.  As per answer in Item 16.  As per answer in Item 16.  Use supplied dimensions.
20	SOW	Annex A, Appendix 1	<b>Ann Harvey:</b> Can you please confirm # of Cylinder for Main Engine (V-16) or ( V-12) - 1000 or 900 rpm engines?	16 Cylinder "E" engines operating at 900 RPM

Item #	Ref.	Statements	Questions	Answers
			<p>Bid Spec Sheet shows 2 listings for the Alco 251F, one with a supply line of 25mm (900 rpm engine) the other with a supply line of 12.7mm (1/2") (1000 rpm engine), which size is correct?</p> <p>Bid Spec Sheet shows 2 listings for the Alco 251F, one with a return line of 22 - Jan the other with a return line of 19.525mm, what is the correct sizing?</p>	<p>Use 25mm for bid purposes</p> <p>Use 20mm for bid purposes</p>
21	SOW	Annex A, Appendix 1	<b>Edward Cornwallis:</b> Same questions as in Item 20.	See answers in Item 20.
22	SOW	Annex A, Appendix 1	<b>George R Pearkes:</b> Same questions as in Item 20.	See answers in Item 20.
23	Sow	Annex A, Appendix 1	<b>Martha L Black:</b> Same questions as in Item 20.	See answers in Item 20.
24	Sow	Annex A, Appendix 1	<b>Sir Wilfred Laurier:</b> Same questions as in Item 20.	See answers in Item 20.
25	SOW	Annex A, Appendix 1	<b>Sir Williams Alexander:</b> Same questions as in Item 20.	See answers in Item 20.
26	SOW	Annex A, Appendix 1	<p><b>Samuel Risley:</b> Can you confirm both supply and return line size 28mm for propulsion engines?</p> <p>The Detroit 6-71 engine is not listed in the generator section of table 2 in the bid specs, can you please confirm the Supply and Return line sizes?</p>	<p>For bidding purposes use 25 mm.</p> <p>Replaced with Caterpillar C18.</p>
27	SOW	Annex A, Appendix 1	<b>Telost:</b> Is the stated fuel consumption on 3512 Mechanical Genset engine correct as it is much higher (more than twice) than the 3512B (344lph vs 160 lph)?	Electrical loading on two different ships. Use numbers provided for bid purpose.
28	SOW	Annex A, Appendix 1	<b>John P Tully:</b> Can you confirm that the Duetz SBV 8M628 has fuel booster pump rated at 1800lph and that this is not an engine suction pump?	Engine driven Fuel booster pump rated 1800 lph @5bar
29	SOW	Annex A, Appendix 1	<p><b>Cape Roger:</b> Can you confirm size of indicated Fuel Return line to be 12.7mm (1/2") where they are using a 25.4 mm line for the supply fuel?</p> <p>Genset fuel line indicates a size of 11mm that is not a common piping size, can you confirm correct dimension of return fuel line?</p>	<p>Use supplied sizes for bid purposes</p> <p>12.7 mm is correct size.</p>
30	SOW	Annex A, Appendix 1	<p><b>Leonard Crowley:</b> Can you confirm fuel consumption rate, Table 2 in the bid spec which indicates that the consumption is 750LPH?</p> <p>That is over 7 times higher than the other Nohab engine and the F312V is also indicated to have a lower power output than the F212V.</p>	<p>Correct to 350LPH</p> <p>Use provided numbers for bidding purposes considering reply above.</p>
31	SOW	Annex A, Appendix 1	<b>Gordon Reid:</b>	

Item #	Ref.	Statements	Questions	Answers
			Are flange ends ANSI or DN25 on the main engine?	For bidding purpose use ANSI.
32	SOW	Annex A, Appendix 1	For vessels 19-27 (Caporal Kaeble, Corporal McLaren, Corporal Teather, G Peddle, A. LeBlanc, M.Charles MB, Constable Carriere, Captain Goddard, Private Robertson), can you confirm the stated Supply and Return Fuel Line size as the indicated 10mm (3/8") does not seem correct?	22mm is correct size.
33	SOW	Annex A, Appendix 1	<b>Sir Wilfred Grenfell:</b> As the indicated piping sizes are 25mm and 25.4mm, are the flanges for the piping metric or US?	For bidding purpose use 1" pipe flanges.
34	Sow	Annex A, Appendix 1	<b>Tanu:</b> Is it ¾" ANSI or DN20 flanges?  What is the eKw rating & hertz on the genset so we can figure fuel consumption rate?	For bidding purposes, use ANSI.  215KW 60hz.
35	SOW	Annex A, Appendix 1	<b>Hudson:</b> The Alco 251D is listed on Table 1 of the bid spec but not on Table 2, table two indicates a higher kw Alco 251B, what is the correct engine and piping size?	Alco B, as per table 2.
36	SOW	Annex A, Appendix 1	<b>Alfred Needler:</b> What is the proper piping size on the 3306 Gen set as 11mm is not a recognized size?	12.7 mm
37	SOW	Annex A, Appendix 1	<b>Eckaloo:</b> What is the proper piping size on the 3306 Gen set as 11mm is not a recognized size?	12.7 mm
38	SOW	Annex A, Appendix 1	<b>Griffon:</b> Engine is listed on table #1 but not Table #2 for piping size, what is the piping size for the D353 Genset on this vessel?	Replace with Caterpillar 3406 DITA.
39	SOW	Annex A, Appendix 1	<b>Limnos:</b> Engine is listed on table #1 but not Table #2 for piping size, what is the piping size for the Cat C6.6 Genset on this vessel?  What is the eKw for the genset?	½ " Supply ½ " Return  150kw
40	SOW	Annex A	Why is the speed over the ground being used with no reference to the environmental conditions e.g. sea state, effects of wind etc?  a. Misleading performance indicators will result if these dominating factors are not taken into account. b. We would strongly recommend that a reference of Speed through Water vs	CCG is not concerned primarily with the performance indicators are outlined here given the type of operations we run as identified above. Performance is a non-issue in emergency situations. The measurements determined as consumption per nautical mile is not a true performance indicator for the CCG as it would be for a commercial ship. Primary concern will be with consumption per hour or

Item #	Ref.	Statements	Questions	Answers
			log speed be used instead. As the Coast Guard are more likely to be operating in poorer sea states on rescue missions this factor is even more important and any fuel performance and energy management system needs to be calibrated for different conditions.	with specific fuel consumption.
41	SOW	Annex A	<p>Why is there such as focus and extra detail provided for shaft dimensions?</p> <p>a. We believe this is missing the point – the key point for any system of this type to be reliable is that SOG needs to be used as the reference (GPS derived). For example, the speed through water could be 0 against the tide and rough sea state, and the ship will look really poor fuel efficiency wise – this is where the effort/technology needs to be focused in greater detail, not so much torque measurements per se. Speed Through Water and sea state inputs give a more true picture of ship fuel performance.</p>	<p>See answer item 39. CCG does not operate as a commercial entity and cannot focus performance on consumption per nautical mile for standard operations in which we are engaged, i.e. Conservation and protection patrol, aids to navigation, icebreaking, search and rescue, etc. These operations do not exist on a port of call to port of call type transit in which this information is relevant and usable. By supplying shaft dimensions for a torsion meter, CCG will be able to determine the fuel consumed versus output power to deliver the specific fuel consumption (SFC) for the ship. SFC is the true data required to determine the efficiency of the plant.</p>
42	SOW	Annex A	<p>Is the service load assumed to be constant for the vessels?</p> <p>There is no mention of generator service load variations or means of measuring it, which at slow speeds have a dominating impact on overall vessel fuel consumption – versus propulsive load. Thus, if service load varies then this can make true vessel performance look abnormally poor or good. Some means of measuring deviations in service load and subtracting this from the total power (and fuel consumed) needs to be added to give a true picture of fuel/energy performance of the vessel.</p>	<p>All vessels of the CCG operate on different platforms, with different power plants, and with different mandates. Service load does vary for the ships and will constitute some of the fuel consumption for the ship. Fuel consumption for electrical generating equipment not supplying propulsive power should not contributing to the overall SFC of the propulsion plant. This should be accommodated by the software application provided for integration.</p>
43	SOW	Annex A	<p>Can the fuel capacities and number of tanks on each boat for the correct equipment be provided in order to complete the bid?</p>	<p>This is not required to complete the bid. Fuel flow rates have been provided for the necessary equipment. Fuel capacities and numbers of tanks fitted to each ship have no bearing on the supply as outlined in this procurement.</p>

A		B		C		D		E		F		G		H	
1				Appendix 1 to Annex "A"											
TABLE 1		Vessel Location position du navire		Main Engines Moteurs principaux		Ship Service Génératrices		Shafts l'arbre porte-hélice							
CCGS NGCC				Number Fitted Nombre installé		Manufacturer/modèle		Number Fitted Nombre installé		Manufacturer/modèle		Number Fitted Nombre installé		Diameter	
2	Louis S. St-Laurent	St-John's, NL	5	Krupp Makk 16M453C	3	Krupp Mak 6M282	3	2 of 26" 1 of 25.5"							
3	Terry Fox	St-John's, NL	4	Stork-Werkspoor 8TM410	2	Caterpillar 3512B	2	775mm							
4	Amundsen	Québec, QC	6	Alco M251F	3	<b>MTU 4000</b>	2	24"							
5	Des Groseilliers	Québec, QC	6	Alco M251F	3	<b>MTU 4000</b>	2	24"							
6	Henry Larsen	St-John's, NL	3	Wartsilla Vasa 16V32	1	Wartsila 6L22 Caterpillar 3512B	2	662mm							
7	Pierre Radisson	Québec, QC	6	Alco M251F	3	MTU 4000	2	24"							
8	Ann Harvey	St-John's, NL	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
9	Edward Cornwallis	Dartmouth, NS	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
10	George R. Pearkes	St-John's, NL	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
11	Martha L. Black	Québec, QC	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
12	Sir Wilfrid Laurier	Victoria, BC	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
13	Sir Williams Alexander	Dartmouth, NS	3	Alco 251F	1	Caterpillar 3508	2	510 mm							
14	Samuel Risley	Parry Sound, ON	4	Wartsilla Vasa 12V22	2	<b>Caterpillar C18</b>	2	200mm							
15	Teleost	St-John's, NL	1	Caterpillar 3612	1	Caterpillar 3512	1	340mm							
16	John P. Tully	Victoria, BC	2	Deutz/ 5/BV8M628	3	Caterpillar C18	1	290mm							
17	Cape Roger	St-John's, NL	2	Polar Nohab F212V	2	Caterpillar 3406	1	310							
18	Leonard J. Cowley	St-John's, NL	2	Polar Nohab F312V	3	Caterpillar 3412	1	13.5"							
19	Gordon Reid	Victoria, BC	4	Deutz 6BVM 628	3	Caterpillar 3406	2	125mm							
20	Caporal Kaebble V.C.	Quebec	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
21	Corporal McLaren M.M.V.	Dartmouth, NS	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
22	Corporal Teather C.V.	Burlington, ON	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
23	G. Peddle S.C.	St-John's, NL	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
24	A LeBlanc	Quebec	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
25	M Charles M.B.	Victoria BC	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
26	Constable Carrière	Burlington, ON	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
27	Captain Goddard	Victoria BC	2	MTU 4000M 93L	3	Northern Lights M1066A3	2	152mm							
28	Private Robertson V.C.	Burlington, ON	2	MTU 4000M 93L	2	Northern Lights M1066A3	2	152mm							
29	Sir Wilfred Grenfell	St-John's, NL	2	Deutz BVM 628 V16	2	Caterpillar C18	2	320mm							
30	Tanu	Victoria, BC	2	Deutz BVM 628 L9	3	Caterpillar C9	1	253mm							
31	Hudson	Dartmouth, NS	2	Alco 251 <b>B</b>	2	Caterpillar 398	2	14.78"							
32	Alfred Needler	Dartmouth, NS	1	Caterpillar 3606	2	Caterpillar 3306	1	<b>262.6mm</b>							
33	Eckaloo	Mackenzie River	2	Caterpillar 3512B	2	Caterpillar 3306	2	6"							
34	Griffon	Prescott, ON	4	Fairbanks Morse 38D8	3	<b>Caterpillar 3406 DITA</b>	2	7 "							
35	Limnos	Burlington, ON	2	Caterpillar C18	2	Caterpillar C6.6	2	Not applicable							

TABLE 2 MAIN PROPULSION ENGINE DATA

Manufacturers	Marque	Moteurs principaux	MKK	ALCO	ALCO	ALCO	ALCO	MTU	WARTSILA VASA	WARTSILA VASA	WARTSILA VASA	CATERPILLER	STORK	Deutz	Deutz	Deutz	Fairbanks Morse	Nohab	Nohab
Quantity	18	18	18	4	18	4	18	4	3	4	4	6	4	4	2	6	6	2	2
Power Output (kw)	5872	2200	2200	2980	2496	1650	902	2984	1657	916	1150	1652	3052	1150	1652	3052	995	1560	1640
Revolutions/minute (max)	600	1000	1000	1200	2100	1260	1800	850	1000	1800	600	750	900	900	900	900	750	750	750
Fuel Temperature	Ambient	Ambient	Ambient	Ambient	55	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient
Estimated Fuel Consumption 95% MCR (Maximum Continuous Rating) LPH	1100	475	500	430	550	208	644	250	208	350	1000	250	410	737	200	350	200	100	100
Booster Pump Capacity LPH, Pressure en L/H, Pression	2800	1800, 3-4 bar		1800LPH 1800bar		12,000	4 BAR				6000, 3 BAR	3,6AR	1800, 5 BAR	3000, 3 BAR					
Supply Line Diameter (mm)	25.4	25	25*	19.1	22	25	25.4	25.4	25.4	25	19.1	25	19	25	25.4	19	19	25.4	25.4
Return Line Diameter (mm)	25.4	20*	20*	19.1	22	25	25.4	25.4	25.4	25	19.1	25	19	25	25.4	19	19	25.4	25.4
Mechanical/Electronic Injection		M	M	M	E	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Engine Fuel Pp capacity	1800			1800	3780	400	4770							1800 5BAR	600				
Electrical power meter (fitted)	Y	Y	Y	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N
Fuel Consumption (theoretical) [L/(kw*hr)]	0.236	0.293	0.293	0.292	0.261	0.227	0.233	0.232	0.231	0.218	0.229	0.247	0.233	0.231	0.228	0.321	0.321	0.228	0.246

TABLE 3 SHIP SERVICE AUXILIARY ENGINE DATA

Manufacturers	Marque	Généralités	MKK	Volvo Penta	MTU*	Northern Lights/ Luggar	WARTSILA VASA	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER	CATERPILLER
Quantity	3	2	9	18	1	2	3	3	10	5	6	1	2	2	2	3	3	3
Power Output (kw)	950.0	500	750	160	925	200	120	320	357.425	1030	600	1070	1030	660	660	450	450	450
Revolutions/minute (max)	900	1800	1800	1800	1800	120	1800	1800	1800	1800	1800	1800	1200	1200	1200	1800	1800	1800
Fuel Temperature**	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient
Estimated Fuel Consumption 95% MCR LPH	233.17*	83	450	16.8 @ 33%	40	13.5	80	28	344	140	344	160	80	50				
Booster Pump Capacity LPH, Pressure	9.9			-0.261					680, 3.6 bar									
Supply Line Diameter (mm)	19.1	19.1	25.4	6	20	12.7	11	11	19.13	12.7	19.1	25.4	19	19	19	19	19	
Return Line Diameter (mm)	12.7	19.1	12.7	E	20	12.7	11	11	19.1	12.7	19.1	25.4	19	19	19	19	19	
Mechanical/Electronic Injection	M	E	E	M	M	M	M	M	E	M	M	M	E	M	M	M	M	
Engine Fuel Pp capacity	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Electrical power meter (fitted)	Y	Y	Y	F	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Fuel Consumption (theoretical) [L/(kw*hr)]	0.237	0.256	0.254	0.245	0.239	0.213	0.235	0.232	0.231	0.229	0.232	0.232	0.232	0.232	0.232	0.385	0.385	

\*Density of fuel = 832 g/L

\*\*Ambient temperature range in ER

spaces: 10°C to 50°C