

GE Marine 8L250 EPA Tier 3 Development

Task #8 Report

for:

New Technology Research and Development Program

582-11-13470-2019

Submitted by:

GE Transportation

Principal Investigators:

Jason Strode

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Bradley Hamm

April 19, 2013

Updated June 18, 2013

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by the State of Texas
through a Grant from the Texas Commission on Environmental Quality*

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Abstract/Executive Summary

This project involves the prototype build and engine performance testing of a marine compression-ignition engine that meets US Environmental Protection Agency (EPA) Tier 3 emissions standards under 40 Code of Federal Regulations (CFR) Part 1042. In particular, it is a goal of this project to manufacture and certify an engine that meets Tier 3 emissions standards ahead of the January 1, 2014, compliance deadline.

This task in particular consisted of the necessary certification testing and official submittal preparation for the 8L250 engine configuration. In particular, this task was focused on the American Bureau of Shipping (ABS) and EPA compliance submittals. The EPA submittal consisted of emissions certification testing and verification. The ABS submittal included design reviews and analysis of the modified engine components.

Introduction/Background

The GE family of inline engines is EPA Tier 2 certified under 40 CFR Part 94. This project seeks to modify the current inline engine design such that it is capable of meeting the more stringent EPA Tier 3 emissions standards under 40 CFR Part 1042. Given that the EPA guidelines on Tier 3 marine engines only apply to engines with a rated load of less than 2000 kilowatts, the inline engines in GE's portfolio will be subject to the Tier 3 standards starting in January 2014.

Project Objectives / Technical Approach

From the Grant Activities (Scope of Work):

"1.1. The objectives for this work are:

1.1.1. Certify a marine 4-stroke six and eight cylinder engine rebuild kit to American Bureau of Shipping (ABS) class standards and EPA Tier 3 marine emission standards ahead of the 2014 EPA regulatory deadline."

This report in particular is in regards to the submittals to EPA and ABS for the purposes of receiving an EPA Certificate of Conformity and ABS Product Design Assessment.

Tasks

Task 8: 8L250 Certification Testing

From the Grant Activities (Scope of Work):

"2.8. Task Statement: The PERFORMING PARTY will obtain all final product certification and compliance approvals from the EPA and ABS for release to manufacturing of a Tier 2 certified 8L250 engine family operating at US EPA Tier 3 emissions levels."

EPA Certification

From the Grant Activities (Scope of Work):

"2.8.1. The PERFORMING PARTY will complete EPA certification testing of the prototype engine. The PERFORMING PARTY will submit all necessary documentation to the EPA and respond to all EPA questions as necessary to receive Tier 3 certification for the prototype engine."

"2.8.1.1. All EPA certification testing will be completed using the 8L250 test engine and be completed in the engine test cells in Erie, Pennsylvania"

Engine testing was completed in the engine test cell in Erie, Pennsylvania during the month of February, 2013. The 8L250 model was submitted for addition to the US EPA certification on March 28, 2013. This application included all required test data and supplemental documentation. The following ratings were submitted for EPA compliance approval for the entire engine family, by engine model, engine speed in revolutions per minute (RPM), and engine horsepower (hp):

- 6L250, 900RPM, 2035 hp
- 6L250, 1000RPM, 2261 hp
- 6L250, 1050RPM, 2374 hp
- 8L250, 900RPM, 2679 hp

To date all open questions from the EPA have been addressed, and official confirmation has been received from the EPA showing regulatory compliance of the engine family. Shown in Appendix A is the EPA Certificate of Conformity.

ABS Certification

From the Grant Activities (Scope of Work):

“2.8.2. The PERFORMING PARTY will submit all necessary documentation to the ABS and respond to all ABS questions as necessary to receive ABS certification for the prototype engine.”

“2.8.2.1. All ABS certification testing will be completed using the 8L250 test engine and be completed in the engine test cells in Erie, Pennsylvania”

All necessary steps to submit for engine level ABS type approval have been completed. Since the L250 Tier 3 engine has been deemed similar to the L250 Tier 2 engine, a request has been submitted to ABS to ask for an addition to the existing type approval certificate. ABS has responded to the request for the 6L250 with the letter shown in Appendix B. ABS has given conditional design approval for the 6L250, however has asked for a three hour engine test on a production engine during emission testing, with a surveyor present. Due to production release design status, this test has been planned and will be completed on the first series production engine for the first commercial order. The product's entry will be in ABS Program Database.

Both the 6L250 design assessment and the 8L250 design assessment were conditionally approved. The 8L250 assessment request was submitted April 8, 2013, and approval received June 3, 2013 (Appendix D).

System Design Reviews

From the Grant Activities (Scope of Work):

“2.8.3. The PERFORMING PARTY will complete all necessary design review closure and design tasks to finalize the Tier 3 system component designs per internal practices.”

All necessary design reviews to approve of the compliance submittal have been completed. Per task 7 of this grant, all engine level performance reviews have been completed. All engine component level

analysis and design reviews have been completed up to a point where all internal requirements have been met for compliance submittal.

Schedule

From the Grant Activities (Scope of Work):

“2.8.4. Schedule: The PERFORMING PARTY shall complete this task within 20 months of the signed Notice to Proceed Date as issued by TCEQ.”

The Notice to Proceed Date was signed July 14, 2011. All compliance submittals occurred during the months of December 2012 for the initial submittal, and March and April 2013 for the final EPA and ABS submittals.

Deliverables

From the Grant Activities (Scope of Work):

“2.8.5. Deliverables: The PERFORMING PARTY shall submit a report to the TCEQ upon completion of this task. This report will include but is not limited to copies of the EPA Tier 3 and ABS certifications approvals.”

The EPA Certificate of Conformity has been received and is shown above in Appendix A.

The 6L250 design assessment has received a conditional design approval from ABS (Appendix B). To obtain a complete approval, a three hour surveyed engine test will be required, however due to production design readiness, this test will not occur until the first production engine is built. The 8L250 design assessment has also received a conditional design approval from ABS (Appendix D).

Discussion/Observations

Objectives vs. Results

All desired objectives have been met for this portion of the grant objectives.

Critical issues

The only critical issue encountered thus far has been with regard to schedule, due to test lab resource availability. Constraints on resources resulted in the certification testing not taking place as early as originally planned.

Technical and commercial viability of the proposed approach

All aspects of this project to date are deemed achievable and technically viable. Some activity is still to be undertaken to finalize the serial production design of the engine, however this activity is within the allowances of the noted agencies.

Scope for future work

Future planned work includes the follow through from any questions from ABS regarding the noted 8L250 submission, and required witnessed engine testing. Additionally, all engineering aspects of this project will be completed with the expectation of receiving a commercial order.

Commercialization

The newly certified Tier 3 engines can be applied to all vessel newbuilds and repowers (depending on engine room space) requiring medium speed engines in the 2000 to 2600 hp range not only in the US, but globally. The commercialization process of the Tier 3 L250 engine has begun in the fourth quarter of 2012. The new brochure, released in 2012, is provided in Appendix C. The brochure was widely distributed at the International Workboat Show in New Orleans last year. GE Transportation will use its extensive sales, marketing and distribution network currently in place to support efforts for adoption of this product in the marine both in the US and globally, as well as any adjacent markets where the technology could be applied. In the state of Texas specifically, the GE Transportation sales leader responsible for that region is working closely with Texas ship owners to identify candidate repower and newbuild vessels into which this engine can be applied. GE Transportation is confident that this engine will be broadly applicable to the marine workboats in the state of Texas within the power and speed range. The repower of the old harbor vessels that are currently equipped with the legacy polluting diesel engines will reduce the Houston-Galveston-Brazoria non-attainment area NO_x emission inventory.

There are no known issues with intellectual property rights, nor are there any planned institutional alliances necessary to implement for the commercialization.

Intellectual Properties/Publications/Presentations

All information provided in this Task Deliverable Report is the property of GE Transportation. It has been supplied in accordance with the agreed upon terms of the NTRD contract as proof of Task completeness.

Regarding potentially patentable designs, concepts and ideas generated during the engine verification and certification, several are being evaluated, or are in the application process to acquire patent protection. TCEQ will be notified when corresponding patent applications issue as patents.

Summary/Conclusions

The elements of this part of the grant activity focused on American Bureau of Shipping and U.S. Environmental Protection Agency compliance certifications. All tasks specified in this deliverable report have been completed with the noted exception of the necessary ABS witnessed engine testing. The remaining scope of this grant activity includes the follow up with ABS.

Contact Information

For further information about this project please contact:

Ed Lu
GE Transportation
814-875-5961
ed.lu@ge.com

Appendices

Appendix A: EPA Certificate of Conformity for GE Tier 3 engine family

	<p>UNITED STATES ENVIRONMENTAL PROTECTION AGENCY OFFICE OF TRANSPORTATION AND AIR QUALITY WASHINGTON, DC 20460</p> <p>CERTIFICATE OF CONFORMITY 2013 MODEL YEAR</p>	
-----------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------

Manufacturer:	TRANSPORTATION SYSTEMS BUS. OPS. OF GENERAL ELECTRIC CO.		
Engine Family:	DGETN15.7EMF		
Certificate Number:	GET-MCI-13-04		
Intended Service:	PROPULSION AND AUXILIARY		
Intended Service Fuel:	DISTILLATE DIESEL [1065.703(B)]		
FELs:	NOx: N/A	THC+NOx: 7.0	PM: 0.34
Effective Date:	3/28/2013		
Date Issued:	3/28/2013		


Byron J. Bunker, Director
Compliance Division
Office of Transportation and Air Quality

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. § 7547) and 40 CFR Part 1042, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following marine engines, by engine family, more fully described in the documentation required by 40 CFR Part 1042 and produced in the stated model year.

This certificate of conformity covers only those new marine compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 1042 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1042.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR Part 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 1042. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void ab initio for other reasons specified in 40 CFR Part 1042.

This certificate does not cover marine engines sold, offered for sale, introduced, or delivered for introduction into commerce in the U.S. prior to the effective date of the certificate.

This certificate of conformity is conditional upon compliance of said manufacturer with the averaging, banking and trading provisions of 40 CFR Part 1042, Subpart H. Failure to comply with these provisions may render this certificate void ab initio.

Appendix B: ABS response to 6L250 design assessment request

Electronically published by ABS Houston.
Reference 978321, dated 18-FEB-2013.



18 February 2013
GE Transportation
2901 East Lake Road
BLDG. 14-350
Erie, PA 16531

Project No. 2917738
Task No.: 978321 / EG

Attention: Mr. Jason D. Ozolins

Subject: **Type Approval – Product Design Assessment – Revalidation & Revision**
Model: 6L250B Tier 3 Engine
Max Ratings: 1517 kW @ 900 RPM
1686 kW @ 1000 RPM
1770 kW @ 1050 RPM
Drawings as per the Attached List

Gentlemen:

We have your Application for ABS Type Approval dated February 2013 together with the appropriate enclosures and are pleased to advise that we have completed the Design Assessment phase of the Type Approval process with the exception of prototype testing, as described below:

The subject plan has been design reviewed in compliance with the ABS Rules for Building and Classing Steel Vessels, 2013 (the Rules).

Please note that these modifications are considered as significant changes and therefore, we would require a 3 hour test which shall include 1 hour of operation at 100%, 1 hour of operation at 110%, and 20 minutes each at 25%, 50%, and 75% of rated power in the presence of our Surveyor. This testing may be performed when the Tier 3 emission testing is performed.

Upon notification to this office by the attending Surveyor of successful completion of the above component testing and submission of satisfactory test reports signed by the ABS Surveyor, the Certificate of Design Assessment will be issued.

Please contact your local ABS Erie Office at Tel: 814-838-1848, Fax 814-838-1287 to arrange for the necessary component testing. To find another office, use the directory of ABS offices on the ABS website at www.eagle.org. You may also speak with the ABS Program Staff at Tel: 281-877-6018, Fax: 281-877-6001 or email type.approval@eagle.org.

An invoice to cover the cost of our design review on the above subject will be forwarded under separate cover. Please forward your remittance as per instructions on the invoice.

Attached, please find a preliminary copy of the product's entry into the ABS Program Database

Page 1 of 3

Electronically published by ABS Houston.
Reference 978321, dated 18-FEB-2013.



18 February 2013
GE Transportation

Project No. 2917738
Task No.: 978321 / EG

One (1) copy of the submitted drawings, appropriately stamped to indicate our review, is being returned electronically through the ABS FTP system.

We appreciate your confidence in ABS Type Approval. If you should have any comments relative to the scope and conditions of the assessment of your product, or if we can be of any further assistance, please do not hesitate to contact Elizabeth Gardner at 281-877-6413 or 281-877-6795 by telefax. Please refer to O2E Task No.: 978321, when responding to this correspondence.

Very truly yours,

Matthew D. Tremblay
Vice President of Engineering
ABS Americas

By: *Prasad Mantravadi*
Prasad Mantravadi
Principal Engineer
Ship Engineering Department

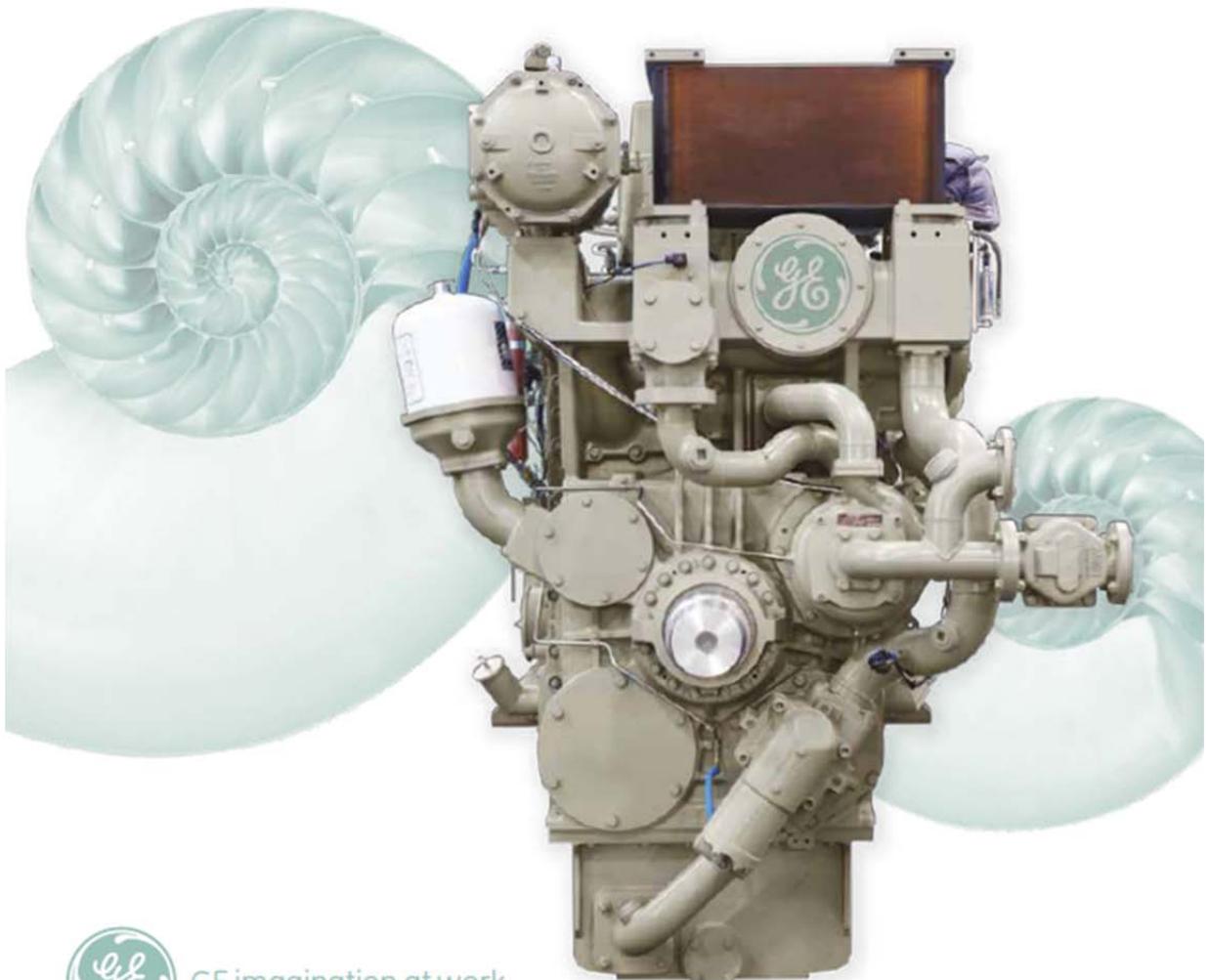
cc.: ABS Erie w/p & inv.

Appendix C: GE Tier 3 Engine Brochure

GE Marine

Clean, lean marine

GE's L250 EPA Tier 3 inline diesel engine



GE imagination at work

GE's marine-class engines

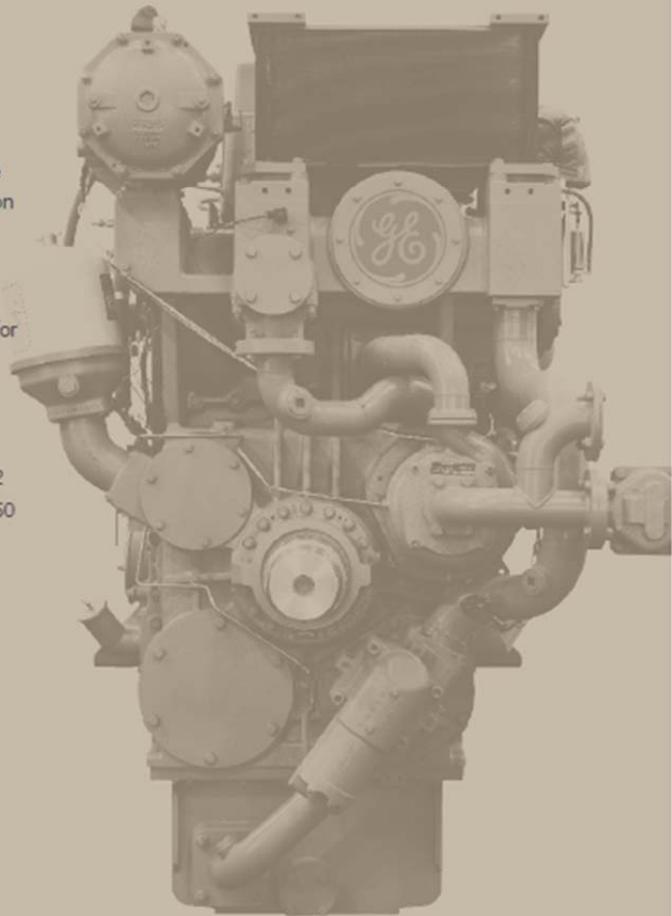
A history of proven performance

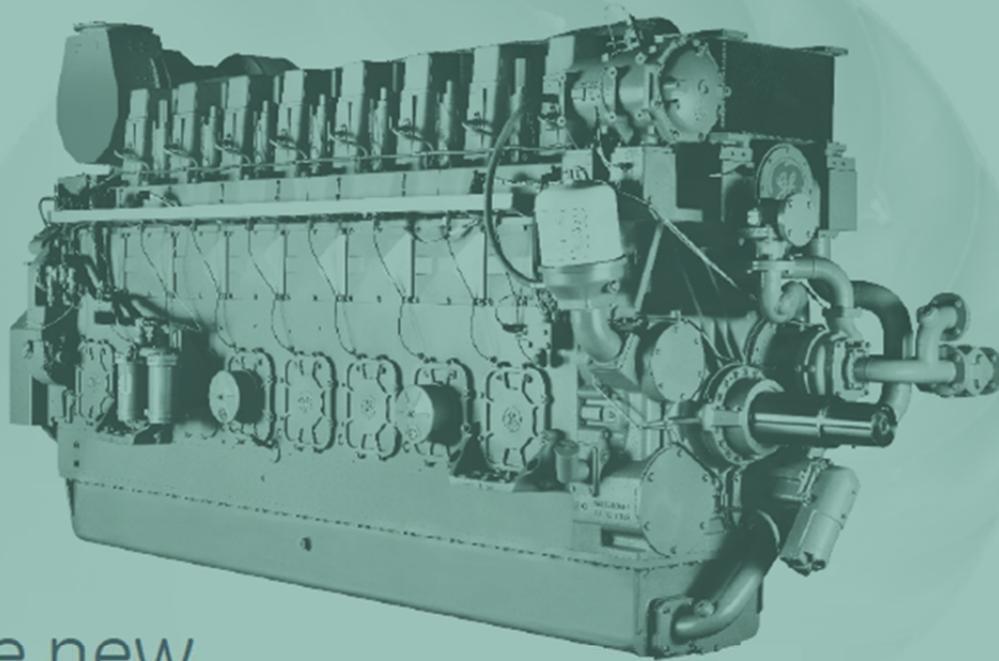
GE Transportation has been serving the transportation industry for more than a century. For nearly 50 years, we have designed and built high-performance diesel engines and have become one of the largest manufacturers of medium-speed engines in the world.

GE Marine, a division of GE Transportation, is one of the world's leading manufacturers of marine products that help tackle the most important challenges facing the marine industry today through integrated solutions, breakthrough technologies and process innovations. You can rely on GE's experience, innovation and proven performance to help you succeed. We've invested millions to ensure our engines comply with the latest emission standards through technological advancements that will exceed your expectations. The L250 engine series is just one example of our dedication to a sustainable environment and supporting our customers with GE's efficient, reliable and economic diesel engines. Where applicable, the L250 engines meet EPA Tier 3 emission standards without the need for exhaust after treatment.

Along with the new L250 EPA Tier 3 engine, GE's family of medium-speed engines include 8-, 12- and 16-cylinder V configurations, all of which are EPA Tier 2 and/or IMO Tier II certified with future plans for our L250 and V250 engines to meet EPA Tier 4 and IMO Tier III emission levels.

With more than 15,000 engines operating worldwide in some of the most challenging industrial environments, GE's medium-speed engines are dependable, long-lasting, durable and efficient. From tugboats in Turkey and fishing vessels in Peru to offshore construction vessels in Norway and ferries in Texas, GE's marine engines are supported by an extensive global parts, distribution and service network.





The new L250 EPA Tier 3 inline diesel engine

GE's new L250 inline diesel engine offers a streamlined design that is fuel-efficient and delivers continuous power from 1,518 to 1,999 kW. The L250 is specifically engineered for marine applications with its accessories mounted on the engine for maintenance ease and offers a full-power PTO option.

The L250 is marine-class compliant and meets U.S. EPA Tier 3 emission requirements (certified to EPA Tier 2 during 2013) — a proactive approach to fuel savings and emissions reduction natural to GE. Depending on the application and duty cycle, the L250 offers an average 12% fuel savings when compared to the V228 engine.

The engine, available in 6- and 8-cylinder models, also offers ease of re-power as its narrow inline footprint takes in mind marine engine room constraints where space is at a premium. The narrower frame uses a similar footprint as competitive engines for minimum design change.

GE designed the L250 engine based on the successful V250 engine platform using the Six Sigma Quality design process. Together, with flexible installation and maintenance options, proven parts performance and support from GE's worldwide distribution network, the L250 offers customers reliability and limited downtime.

→ FUEL-EFFICIENT

→ EPA TIER 3 EMISSIONS-COMPLIANT

→ COMPACT POWER

→ NARROW FOOTPRINT

→ EASY TO MAINTAIN

L250 components — Marine class. Inline design.

Sturdy mainframe

The L250's mainframe is a rugged one-piece iron casting which provides excellent vibration-dampening characteristics and long-term stability to minimize line bore distortion. Further strength and rigidity are added by bolting main bearing caps both vertically and horizontally. The lube oil gallery and passages are cast or drilled into the frame to provide lubrication to all vital engine areas with no pipe or hose connections within the frame, to help eliminate leaks or loss of lubrication.



Turbocharger

The L250 uses a new, high-efficiency, radial flow and water-cooled turbocharger to achieve EPA Tier 3 emissions without sacrificing engine performance. Depending on duty cycle and application, response time and fuel efficiency have improved over the L250 Tier 2 engines and fuel consumption improved 5% to 6% at 85% of MCR.



Crankshaft and engine drive train

The crankshaft is press-forged, high-quality alloy steel. Oil passages drilled in the crankshaft allow oil delivery to connecting rod bearings and pistons. A flywheel with ring gear for the starting motor is bolted directly to the crankshaft flange.

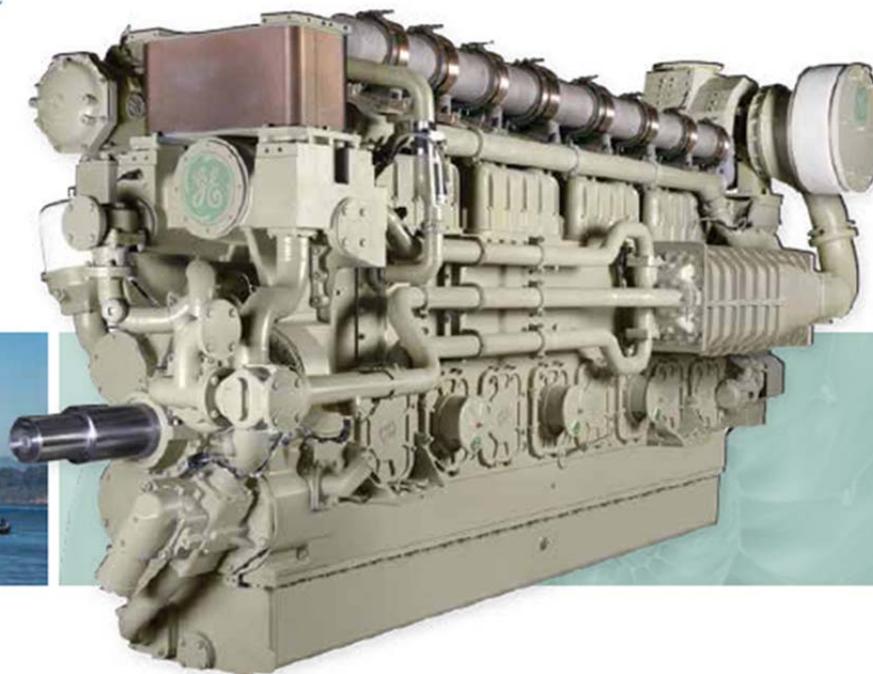
One-piece liners

The stiff, one-piece, mid-stop liner has an integral external water jacket that removes the possibility of water leaks. An anti-polishing ring provides a durable running surface, improving lube oil consumption and liner life. The top one-third of the liner is cooled.



Power assemblies

The L250's power assemblies are designed to meet the high-pressure demands of the engine while adhering to strict reliability requirements and an easy-to-maintain assembly concept. Unitized cylinder assembly enables quick change-outs and increased engine uptime. Each assembly is mounted directly to the mainframe and includes liner assembly, cylinder head, intake and exhaust valves, valve linkage and a high-pressure fuel-injection pump and nozzle. This design enables excellent flow paths for combustion, lower fuel consumption and reduced emissions. Design improvements will result in a significant reduction in lube oil consumption over L250 Tier 2 engines.



Exhaust manifold

The exhaust manifold provides increased transient response and better efficiency under pulse and constant pressure operation. It is modularized with identical piping and bellows sections for all of the cylinder assemblies. The bellows sections help lower the thermal and vibration-induced stresses on the exhaust system.

Intercooler and air-intake manifold

The L250's combustion air-intake system includes one intercooler mounted on the mainframe between the turbo outlet and air manifold inlet. This allows for lower fuel consumption, emissions and exhaust temperatures. For servicing, the intercooler can be removed without dismantling other engine components.

Pistons

Our pistons are ruggedly designed to accommodate the high-peak firing pressure requirements of L250 engines. The pin and skirt components are also designed to yield better piston lubrication and guidance as it travels



within the liner. The design helps minimize oil consumption and blow-by as well as lengthen oil life.

Connecting rod assembly

The forged-steel connecting rods are exceptionally strong and exhibit high stiffness, which is beneficial during the engine's lifetime. Large bearing widths with optimized oil grooves also help improve oil-film thickness and pressure, allowing for optimum performance and lower friction losses.

Advanced EFI

Designed for greater efficiency at varying speeds and loads, the L250's electronic fuel injection features precise fuel control, increased pressure capability and refined timing. Optimization of the cam profile, injection start, injection volumes and flows, and control algorithms have produced a relatively simple system, proven reliable through extensive validation.



Camshafts

The camshafts on the L250 are made of sectional carbon steel forgings joined by dowel-bolted flanges, a design that simplifies component removal and replacement. Individual sections of the camshaft, rather than the entire camshaft, can be serviced or replaced.



L250 EPA Tier 3 inline diesel engine specifications

	6L250	8L250
Engine data		
Number of cylinders	6	8
Stroke cycle	4	4
Cylinder arrangement	inline	inline
Bore	250 mm (9.84 in)	250 mm (9.84 in)
Stroke	320 mm (12.60 in)	320 mm (12.60 in)
Compression ratio	15.7	15.7
Power output at 900 rpm		
Maximum continuous rating*	1,518 kw (2035 hp)	1,998 kw (2679 hp)
Power output at 1,000 rpm		
Maximum continuous rating*	1,687 kw (2261 hp)	N/A
Power output at 1,050 rpm		
Maximum continuous rating*	1,771 kw (2374 hp)	N/A
Engine dimensions		
Length	5,095 mm (200 in)	5,985 mm (235 in)
Width	2,032 mm (80 in)	2,032 mm (80 in)
Height including sump	2,962 mm (116 in)	2,962 mm (116 in)
Crankshaft center line to sump	940 mm (37 in)	940 mm (37 in)
Crankshaft center line to mounting feet	308 mm (12 in)	308 mm (12 in)
Exhaust diameter	457 mm (18 in)	457 mm (18 in)
Dry weight	15,909 kg (35,000 lbs)	19,090 kg (42,000 lbs)

*Maximum continuous rating (MCR):

Maximum speed and load conditions at which the engine is capable of operating continuously for an unlimited number of hours per year: between the normal maintenance intervals stated by GE, under standard ambient conditions and with the maintenance prescribed by GE having been carried out. Engine overload is limited for U.S. EPA Tier 3 (40 CFR Part 1042) regulations.

Dimensions and weights are approximate and include all engine mounted accessories.

GE Marine

To learn more,
visit www.getransportation.com.



GE imagination at work

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20266-A

Appendix D: ABS response to 8L250 design assessment request



3 June 2013

Project No. 2981307
Task No.: T1007338_2/EC

GE Transportation
2901 East Lake Road
BLDG. 14-350
Erie, PA 16531

Attention: Mr. Jason D. Ozolins

Subject: **Type Approval – Product Design Assessment – Revalidation & Revision**
Model: 8L250B Tier 3 Engine
Max Ratings: 2679 HP (1997 kW) @ 900 RPM
Drawings as per the Attached List

Gentlemen:

We have your Application for ABS Type Approval dated 1 March 2013 together with the appropriate enclosures and are pleased to advise that we have completed the Design Assessment phase of the Type Approval process with the exception of prototype testing, as described below:

The subject plan has been design reviewed in compliance with the ABS Rules for Building and Classing Steel Vessels, 2013 (the Rules).

We note that for the 8L250B model engine the camshaft is slightly modified and the piston and piston ring design is also changed which is the same as the 6L250 engine currently waiting to be type tested. We note that the 8L250B model utilizes a new turbocharger and that this modification is considered as a significant change and therefore, we would require a 3 hour test which shall include 1 hour of operation at 100%, 1 hour of operation at 110%, and 20 minutes each at 25%, 50%, and 75% of rated power in the presence of our Surveyor. This testing may be performed when the Tier 3 emission testing is performed.

Upon notification to this office by the attending Surveyor of successful completion of the above component testing and submission of satisfactory test reports signed by the ABS Surveyor, the Certificate of Design Assessment will be issued.

Please contact your local ABS Erie Office at Tel: 814-838-1848, Fax 814-838-1287 to arrange for the necessary component testing. To find another office, use the directory of ABS offices on the ABS website at www.eagle.org. You may also speak with the ABS Program Staff at Tel: 281-877-6018, Fax: 281-877-6001 or email type.approval@eagle.org.

An invoice to cover the cost of our design review on the above subject will be forwarded under separate cover. Please forward your remittance as per instructions on the invoice.

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3 June 2013
GE Transportation

Project No. 2981307
Task No.: T1007338_2/EG

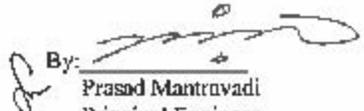
Attached, please find a preliminary copy of the product's entry into the ABS Program Database

One (1) copy of the submitted drawings, appropriately stamped to indicate our review, is being returned electronically through the ABS FTP system.

We appreciate your confidence in ABS Type Approval. If you should have any comments relative to the scope and conditions of the assessment of your product, or if we can be of any further assistance, please do not hesitate to contact Elizabeth Gardner at 281-877-6413 or 281-877-6795 by telefax. Please refer to O2E Task No.: T1007338_2, when responding to this correspondence.

Very truly yours,

Matthew D. Tremblay
Vice President of Engineering
ABS Americas

By: 
Prasad Mantravadi
Principal Engineer
Ship Engineering Department

cc.: ABS Eric w/p & inv.



3 June 2013
GE Transportation

Project No. 2981307
Task No.: T1007338_2/EG

Drawing List

Engineering Office:	Americas Engineering Admin	
Submitter:	GE TRANSPORTATION PARTS, LLC	
Drawing No	Revision No	Drawing Title
09-HS329980-14DA	-	GE L250 Product Design Assessment
84c636695	-	Exhaust Manifold Adapter
84E903192G3	•	Camshaft Section for CW Rotation Engine
84E904301AN	•	8L250 T3 Outline Drawing of L250B with New Turbocharger
84E905793P1	•	Turbocharger Mounting Adapter
84E934152K3	•	Camshaft Section for CCW Rotation Engine
8L250	-	Turbocharger Turbocharger Outline Drawing
RR 978321 72870013	•	ABS Response letter to task no 978321 EQ
Turbo Design Assessment Cert	•	Turbocharger Design Assessment Certificate