Diesel Engine Series 60®

for Pleasurecraft Marine Applications

“Since 1990, I’ve owned over 15,000 Series 60’s.
During That Time Our Company Has Grown Over 600%.
I’m Building A New Yacht And Specified Series 60’s.
After Running So Many Of Them For So Long In Trucks,
I Wouldn’t Have Anything Else.”

Jerry Moyes
President and CEO
Swift Transportation

The Most Popular Heavy-Duty Diesel Engine In North America

1992 Only five years after introduction, The Series 60 becomes the most popular heavy duty diesel engine in North America.

1997 The Series 60 becomes the best selling high horsepower diesel engine in North America.

1998 The Series 60 is the most popular diesel engine in North America for the seventh year in a row.

1999 The Series 60 engine outsold its two closest competitors, combined... making it the best selling engine eight years in a row.

2002 Proven, popular, and certified for new emissions regulations, more than 700,000 Series 60 engines are in operation.

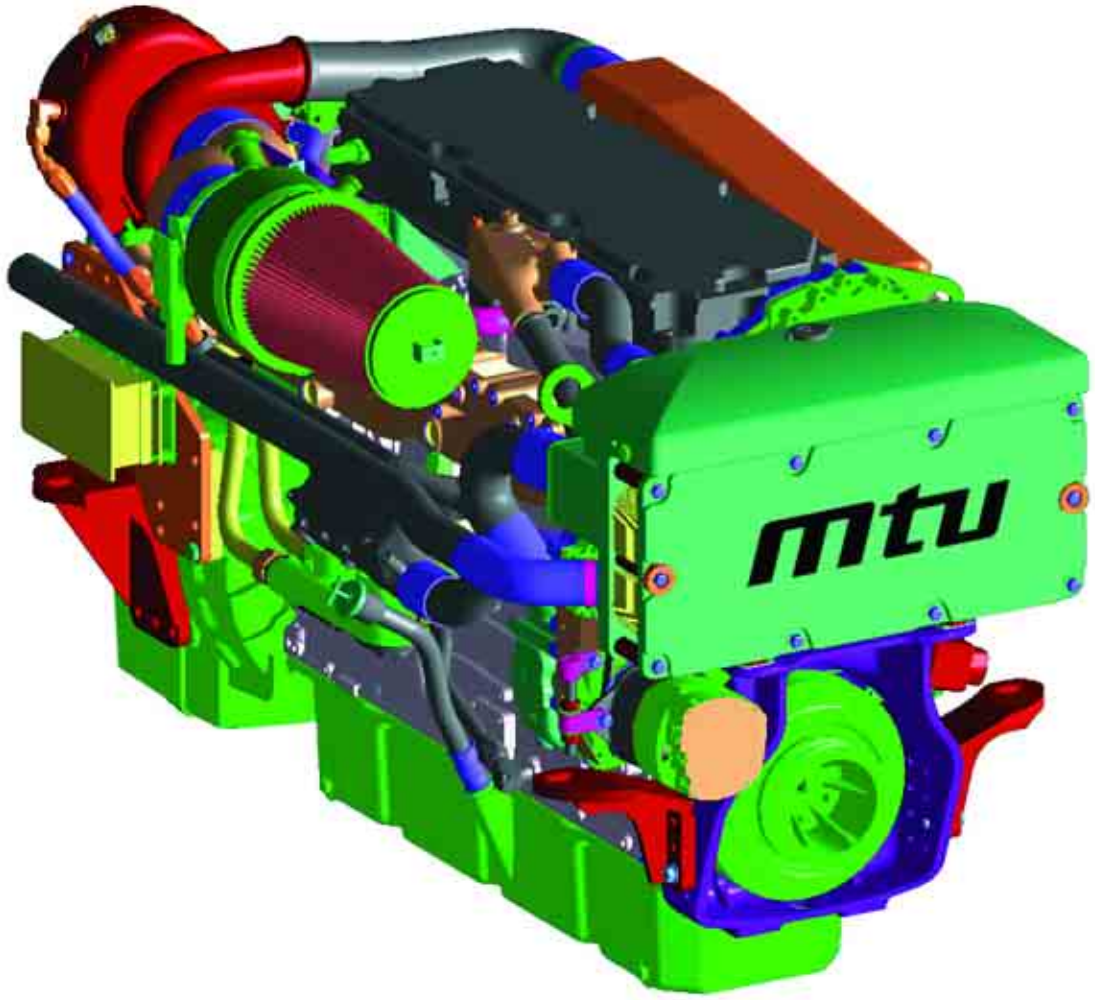
How Has This Engine Gained Such **Popularity So Quickly?**

We're Glad You Asked!

Almost All Diesel Engines Available In Boats Between 30 And 60 Feet Are Derived From On-Highway Truck Engines.

The Owners Of On-Highway Truck Engines Depend On Them To Make Money.

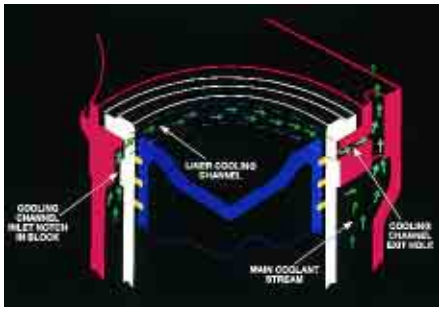
- **They know what performs**
- **They know what they can count on**
- **They know what works... and what doesn't**
- **And they buy more Series 60 engines than any other**



Why?

It All Starts With The Design.

The cylinder block of the Series 60 is rugged and simple. Cast in ribs provide strength and reduce overall weight. These ribs reduce noise transmittal from the block, one of the reasons the Series 60 engine is so quiet.

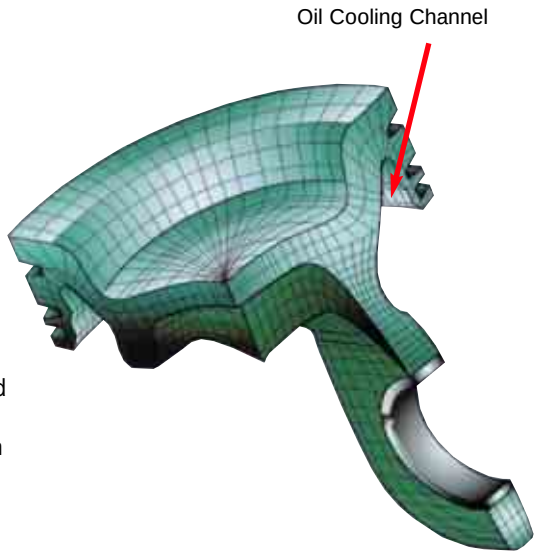


The patented “Top Liner Cooling” feature allows engine coolant to circulate all the way to the top of the cylinder liner.

This feature continuously draws heat away from the hottest part of the cylinder. The result is reduced temperature of the oil, piston, liner and ring, which means long life even at prolonged high speeds.

The crankshaft is drop forged for strength, heat treated to relieve internal stress, induction hardened for long life and statically and dynamically balanced for vibration free operation, even at maximum RPM.

The piston of the Series 60 engine is a two piece design. The forged steel dome provides the structure to harness high horsepower and a strong surface for the piston rings to seal against. The top ring of the Series 60 marine engine is lowered to protect it from high cylinder temperatures. Ring thickness is increased by 20% to increase strength. The most durable ring material available, ceramic chrome, is used for long life, low friction and high output. Pistons are kept cool by a unique combination of a drilled passage in the connecting rod and a spray nozzle mounted to the block. The oil carries heat away from the back side of the piston rings to the high capacity oil cooler, ensuring long life even at sustained maximum output.

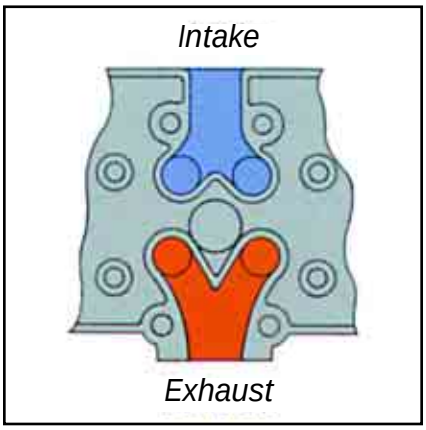


If There Is A Secret To The Engine's Success, **It Is The Combination Of The Overhead Camshaft And Unit Fuel Injectors.**

The camshaft features roller lifters, advanced timing, high lift and long duration for maximum performance. Ceramic cam follower rollers are used for extremely long life at high RPM and high injection pressure.

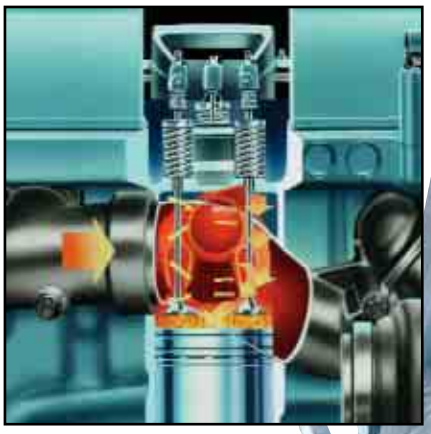
The overhead cam is able to operate each unit fuel injector directly, via a rigid rocker arm. Other engines, with the camshaft located in the block, use pushrods. This overhead system provides excellent stiffness for high injection pressures. The overhead cam in the Series 60 is capable of injection pressures over 30,000 PSI. High injection pressure means rapid start up, high power output, low smoke and emissions, instant throttle response and excellent fuel economy.

Eight evenly spaced head bolts surround every cylinder, with a combined clamp load of over 1,000,000 lbs. The result is a stable head to block joint and an extremely durable head gasket for thousands of hours of trouble free running. The evenly spaced bolts ensure the block is not distorted after torquing. This maintains liner circularity for good piston ring seal under all conditions. The result is more power and long ring life.

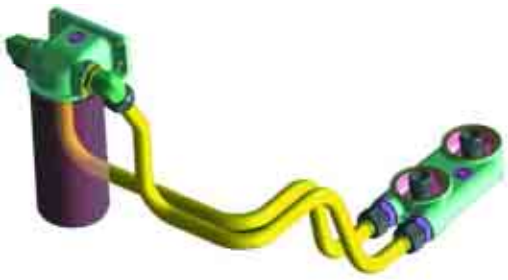


The intake and exhaust passages are short and straight for maximum airflow at all RPM's providing for high power output and no smoke. The short intake ports don't add heat to the incoming air charge, improving performance. The short exhaust ports allow the engine to maintain heat energy. Maximum exhaust heat is needed for maximum turbocharger performance and maximum boat performance. Pyromet exhaust valves, Stellite 1 valve seats and powdered metal valve guides are used for long, reliable life, even at high temperatures.

The overhead camshaft makes service a snap. Removing the rocker cover reveals the entire injection system and valve train. After a simple one-time check of valve lash, the Series 60 does not require tune-ups.



The aluminum oil pan helps reduce oil temperature and further reduces engine weight. The oil pans 38 quart capacity, combined with spin-on oil filters and the high capacity 45 gpm oil pump, allows for up to 250 hours of boating between oil changes.

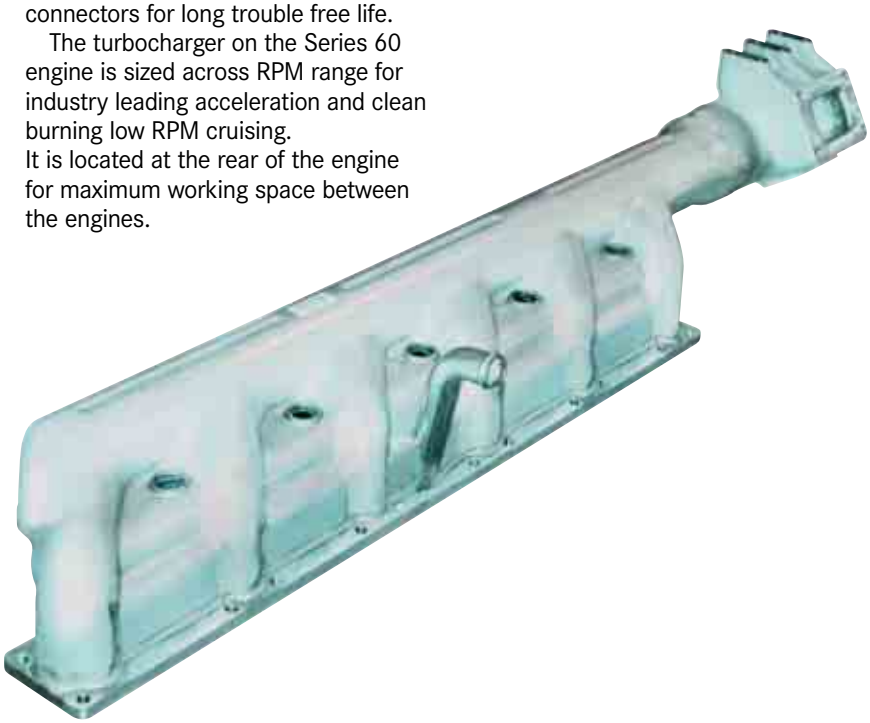


The rocker cover is a two piece design for ease of removal even in tight quarters.

US Coast Guard approved FC234 hoses are used throughout.

Silicone hoses and stainless steel hose Breeze clamps are used on all water connectors for long trouble free life.

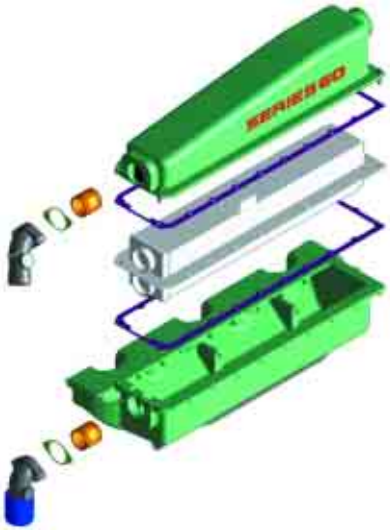
The turbocharger on the Series 60 engine is sized across RPM range for industry leading acceleration and clean burning low RPM cruising.
It is located at the rear of the engine for maximum working space between the engines.

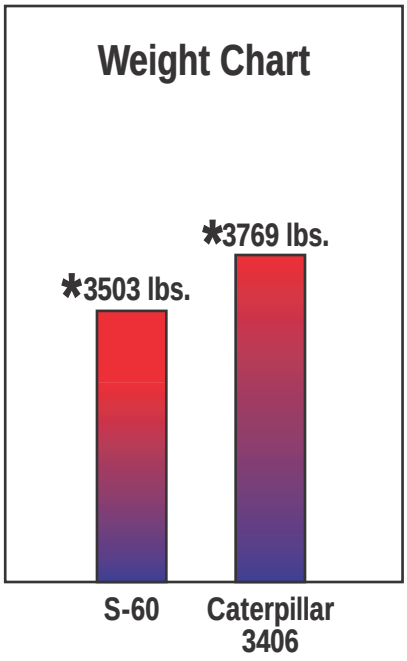


The exhaust manifold uses a pulse design, similar to Formula One and CART designs, for maximum performance. The manifold is water cooled for safety and a comfortable engine room temperature.

The copper - nickel intercooler cools the air from the turbocharger before it enters the cylinder. Cool air improves performance and reduces stress on cylinder components. The intercooler of the Series 60 uses sea or lake water for maximum cooling. The intercooler is integrated into the intake manifold to eliminate unnecessary parts, reduce weight and provide more space around the engine.

Less weight means better performance, maneuverability, and reduced fuel consumption.

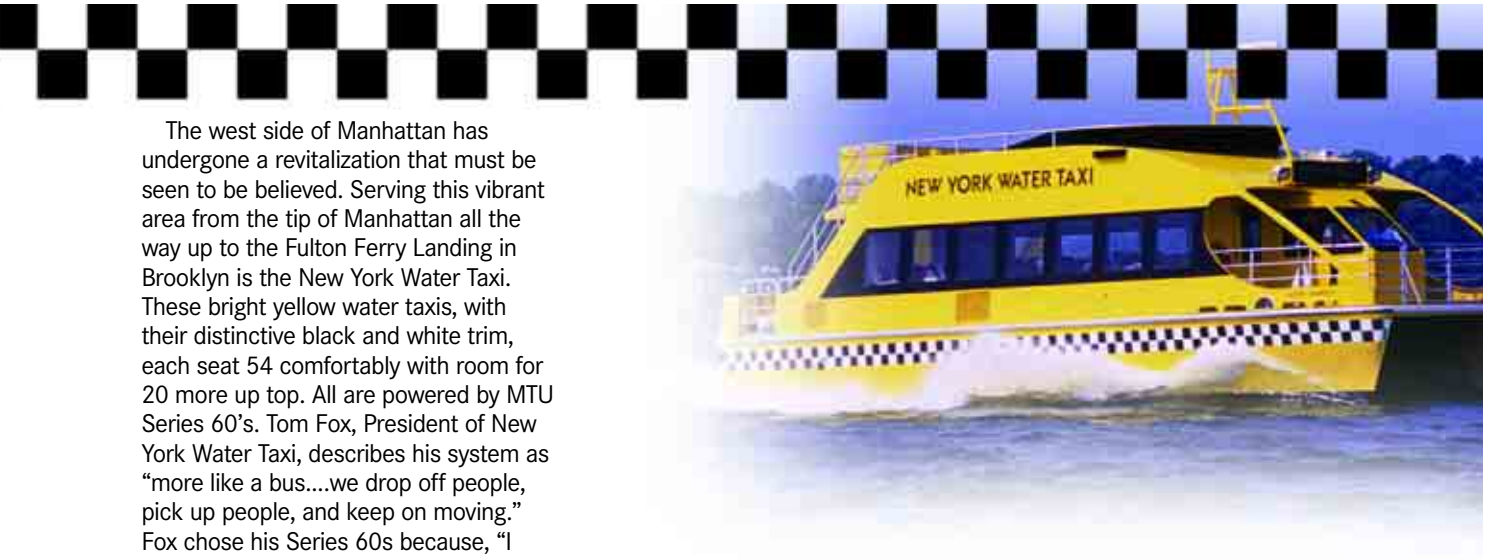




*Installed weight without gear.

All Reasons Why The Series 60 Is Number One.
But That's Only The Beginning.

Proven Reliability



The west side of Manhattan has undergone a revitalization that must be seen to be believed. Serving this vibrant area from the tip of Manhattan all the way up to the Fulton Ferry Landing in Brooklyn is the New York Water Taxi. These bright yellow water taxis, with their distinctive black and white trim, each seat 54 comfortably with room for 20 more up top. All are powered by MTU Series 60's. Tom Fox, President of New York Water Taxi, describes his system as "more like a bus....we drop off people, pick up people, and keep on moving." Fox chose his Series 60s because, "I wanted something with low emissions, was less polluting, and was reliable."

The year 2003 marks the introduction of Carver Yachts' luxury cruising flagship, the Marquis. At 59', the Marquis "introduces a unique fusion of European styling and American sensibility," says Mike Murawski, Carver VP of Sales and Marketing. "It features a sleek low-profile design and a very accommodating cockpit," notes Murawski. It also features twin MTU Series 60 engines. "The MTUs were chosen because they're a very credible brand and they have a huge network for service," adds Carver President Robert Van Grunsven.

If you want a high end "lobster boat" you go to San Juan. That's San Juan Composites in Anacotes, Washington. Located on Fildago Island in the San Juan Islands, founders Donald Campbell and Randy McCurdy offer full service and repair in Ft. Lauderdale, Florida, and Norwalk, Connecticut, and their technicians will travel worldwide if needed. Utilizing MTU Series 60 engines, these 36 to 50 ft. yachts represent cutting edge technology with traditional craftsmanship. "We've been extremely happy with the MTUs and have high expectations for MTU products," commented Campbell.

What Owners Are Saying **About Their Series 60 Engines**

Surveys were recently sent to 13,000 owners of heavy-duty diesel engines. They rely on their engines to make their living. Each of these owners run their engines an average 2,200 hours a year. They know engines. In the charts on the right are two key questions we asked and the results we found.

OVERALL ENGINE QUALITY

Please rate engine manufacturers based on your opinion of overall quality:

	Poor Quality 1	2	Average 3	4	High Quality 5
Detroit Diesel	1.1 %	2.3 %	7.6 %	28.2 %	60.7 %
Competition A	4.1 %	9.1 %	42.7 %	35.4 %	8.8 %
Competition B	9.3 %	13.7 %	37.2 %	28.5 %	11.3 %

ENGINE PERFORMANCE VS. COST

Please rate these engine manufacturers on how well their performance justifies their cost:

	Not Worth It 1	2	Fair Price 3	4	I'd Even Pay More 5
Detroit Diesel	1.7 %	5.5 %	34.8 %	42.2 %	15.8 %
Competition A	8.3 %	21.1 %	52.4 %	16.1 %	2.1 %
Competition B	21.0 %	28.1 %	35.2 %	13.6 %	2.1 %

And More Reasons The Series 60 Engine Is **Number One...**

Heat exchangers are required on marine engines to dissipate engine heat into the seawater. Temperature extremes are common. The environment is harsh. Frequent maintenance is the norm. Heavy materials are used.

The Series 60 Engine Solution?

- **A modular design**
- **Includes an integrated fuel cooler for simplicity and fewer components to service and maintain**
- **Easy to disassemble for cleaning**
- **The heat exchanger is constructed of titanium plates**
- **Withstands harsh environments**
- **Increased efficiency for reduced size**
- **Reduces weight, making it easy to handle during maintenance**
- **Eliminates troublesome "anti-corrosion" devices**
- **A high output water pump is used for increased flow through the heat exchanger**

What all these features mean to you are lower maintenance costs and less downtime spent dockside for maintenance.

IN A RECENT SURVEY BY *HEAVY DUTY TRUCKING*, 45% OF COMPANY DRIVERS PREFER SERIES 60 ENGINES.

■ June, 1999 *Heavy Duty Trucking*

Titanium Heat Exchangers

And That's Only The Beginning Of The Story...

What Is DDEC®?

Diesel Engine Electronic Controls

A fully electronic control system, in use in over 700,000 Detroit Diesel engines. DDEC is:

- ***Simple***
- ***Proven***
- ***Reliable***

And packed with features you will enjoy.

The heart of DDEC is a powerful, engine mounted electronic control unit (ECU).

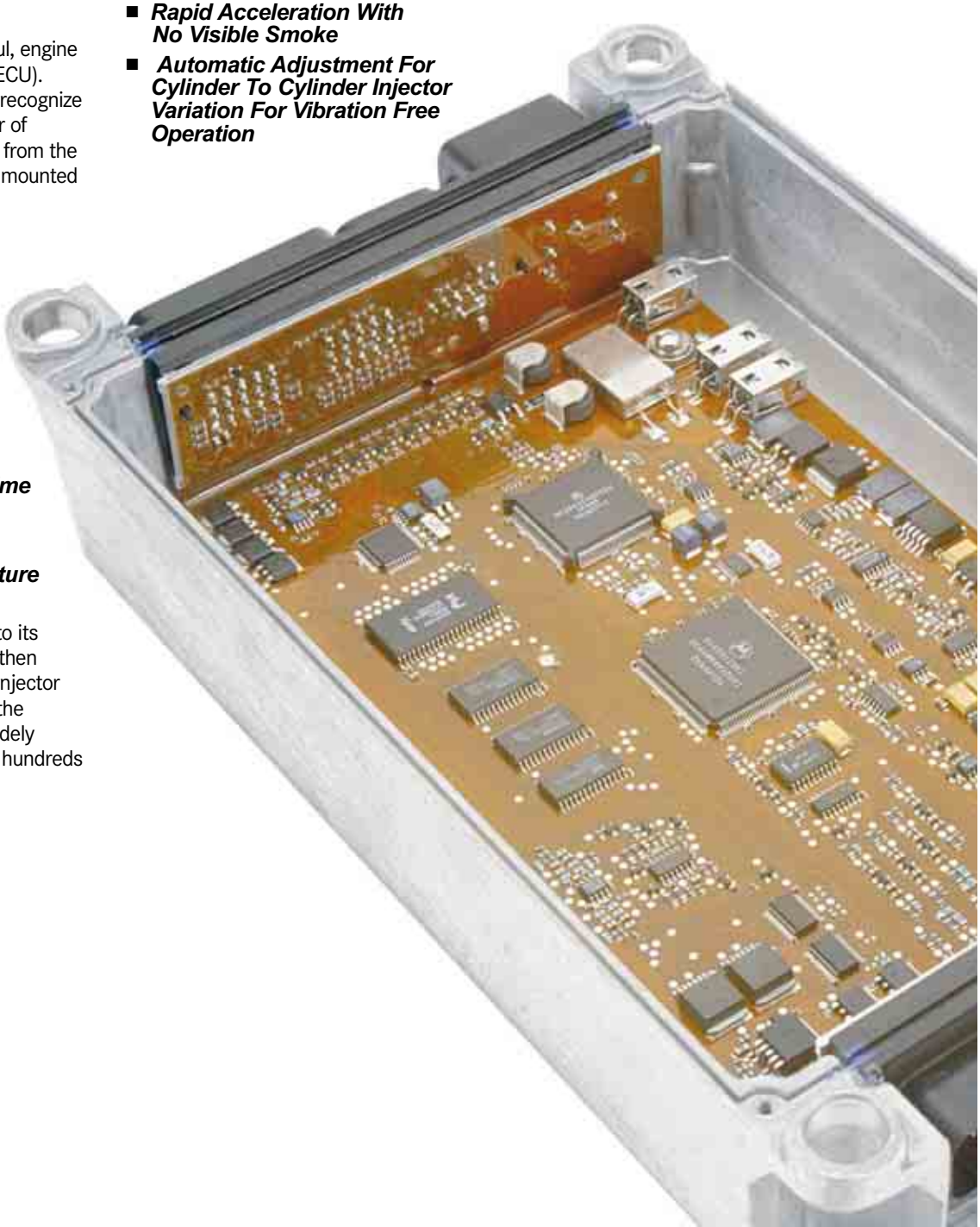
The ECU is preprogrammed to recognize and respond to an infinite number of variables. The ECU receives input from the throttle and a number of sensors mounted on the engine.

- ***Oil pressure***
- ***Oil temperature***
- ***Engine speed***
- ***Coolant pressure***
- ***Coolant temperature***
- ***Fuel pressure***
- ***Fuel temperature***
- ***Engine timing***
- ***Fuel injector response time***
- ***Battery voltage***
- ***Turbo boost***
- ***Intake manifold temperature***

The ECU compares the inputs to its preprogrammed parameters and then electronically operates each fuel injector accordingly. Injection timing and the amount of fuel injected can be widely varied. The ECU is able to do this hundreds of times per second.

What Does All This Mean To You?

- ***No White Smoke At Start-Up and Warm-Up***
- ***Variable Idle Speeds Programmed And Pre-Selected By The Owner***
- ***Ultra Low Idle Speed For Low Boat Speeds When Maneuvering In Tight Quarters***
- ***Rapid Acceleration With No Visible Smoke***
- ***Automatic Adjustment For Cylinder To Cylinder Injector Variation For Vibration Free Operation***



The Simplicity Of **Electronic Fuel Injection**

The Injectors Are Operated By The Camshaft And Rocker Arms And Controlled By The ECU

The rocker arm, operated by the overhead camshaft, depresses the plunger. The cavity below the plunger is continuously filled with diesel fuel by the fuel pump. In addition to being the fuel for the engine, diesel fuel also cools and lubricates the internal components in the injector.
A drilled passage connects the cavity below the plunger to the poppet control valve.

When the poppet control valve is open, no pressure is created below the plunger and no fuel is injected into the cylinder.

When the poppet control valve is closed, diesel fuel is trapped in the cavity and the downward motion of the plunger pressurizes the fuel and injection takes place through the injector tip.

The poppet valve is controlled by a simple solenoid, which in turn is controlled by the DDEC Electronic Control Unit (ECU).

The poppet valve can be opened and/or closed at any time. Therefore, engine timing can be varied over a wide range, improving start-up, smoke control and overall performance.

The length of time the poppet valve is opened determines the amount of fuel injected and therefore the power level of the engine.

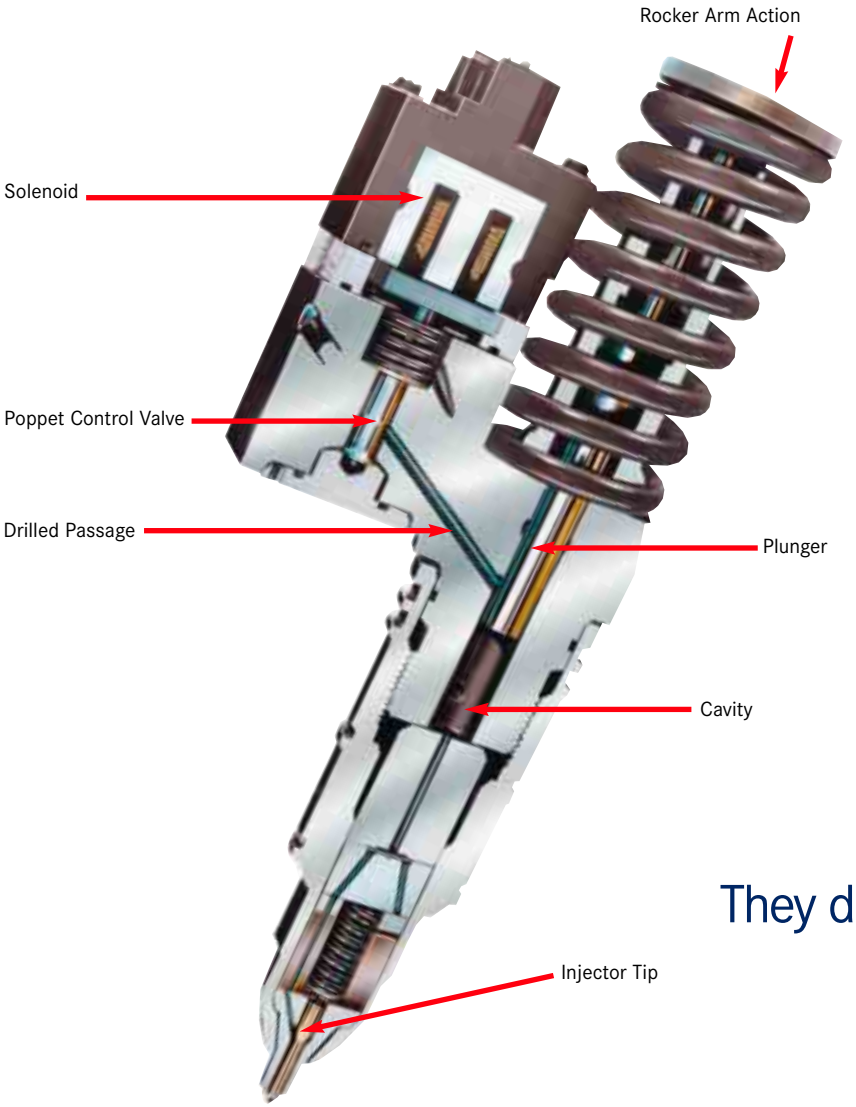
The poppet valve is responsive enough to open and close twice in milliseconds.

Since the poppet valves are controlled electronically, one or more injectors can be turned “off” by the ECU.

Turning individual injectors “on & off” is a technique used by service technicians to quickly isolate a problem.

Turning half the injectors “off” allows the half engine idle feature to operate. Half engine idle quickly warms the engine during cold ambient conditions as three cylinders must do the work of six. Once engine temperatures rise, the remaining three cylinders are automatically added with no embarrassing dockside smoke.

Electronic injectors are simple, reliable and proven. Over 4,000,000 electronic injectors are currently in use in modern Detroit Diesel Engines. The U.S. Military uses Detroit Diesel Electronic Injectors in a variety of vehicles, as does the U.S. Coast Guard and Fire Departments around the world.



They depend on DDEC...
You Can Too!

Engine Protection

Detailed and descriptive warnings are displayed on the module anytime DDEC senses a problem. The system is intelligent enough to sense the difference between a disconnected wire and a true problem. The system guards against all these:

- **Low Coolant Level**
- **Engine Coolant Temperature – High**
- **Oil Temperature – High**
- **Fuel Pressure – Low**
- **Injector Response Time – Long Or Short**
- **Battery Voltage – High And Low**
- **Engine Overspeed Protection**
- **Low Oil Pressure**

DDEC records such events in its memory for later retrieval by the owner or technician, proving what actually took place.

Print outs from DDEC offer proof of the engines past operation, including hours run, total fuel used, time spent at idle and numerous other parameters. When it's time to sell your vessel, printouts from DDEC will help you sell it for top dollar.

DDEC

- **Fewer Parts – Fewer Things To Go Wrong And Higher Reliability**
- **No Adjustments – For Reduced Maintenance Expense**
- **Self Protecting – To Avoid Accidental Damage To The Engine, Marine Transmission And Propeller Shaft**
- **Self Diagnosing – Eliminates Guesswork If Something Goes Wrong**
- **Easy To Trouble-Shoot – Even in Far Away Places**
- **No Tune-Ups – To Reduce Downtime**
- **Modular Components Are Easy To Replace**

How Does The Series 60 Engine Stack-Up To Competition?

Excellent

In Terms Of Fuel Efficiency,
Acceleration, Noise And Smoke,
It Is No Competition...
Series 60 Is The Clear Winner.

High Efficiency Means Better Fuel Economy

High efficiency means more power for every gallon of fuel used. High efficiency means better fuel economy. And better fuel economy means more than saving money. It means all of the following:

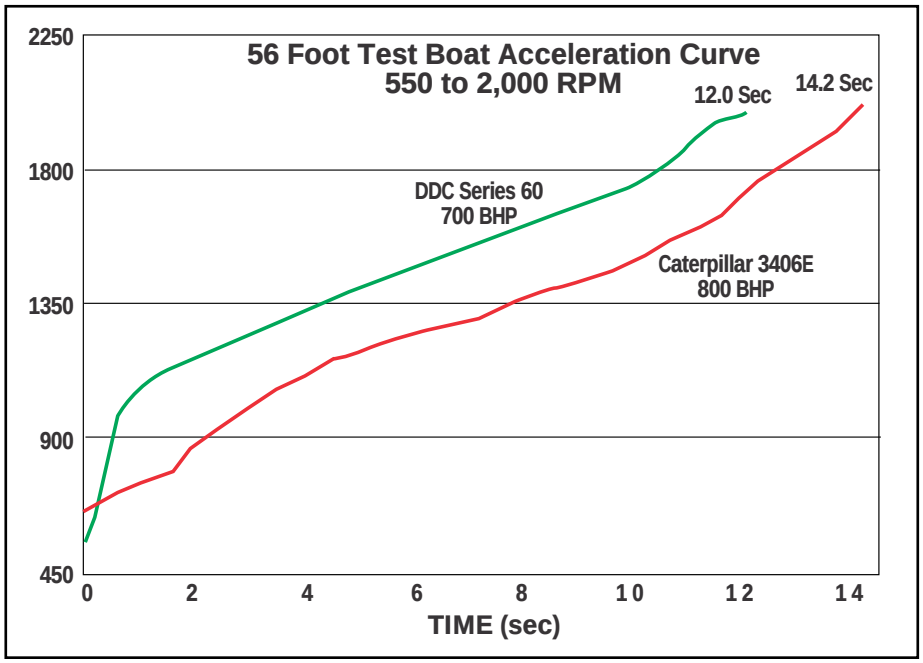
- **Less time spent waiting in line for fuel on a busy weekend**
- **Longer cruising range, with less need to plan a trip based on fuel stops along the way**
- **An increased margin of safety when plans change or weather threatens**
- **Less need to cut an enjoyable trip short "just to be safe"**
- **Less need to buy fuel of questionable quality when far from home-port**

If The Series 60 Is More Efficient, How Does That Translate Into Boat Performance?

That's A Good Question.

Professional race drivers will tell you that overall driveability, throttle response and torque management throughout the RPM range are much more important than horsepower at a particular point. The same holds true for the Series 60, rated at up to 825 BHP. The following acceleration curve is a clear indication that advertised horsepower is not the key to maximum performance. The Series 60, with its advanced DDEC electronic controls, was able to reach 2000 RPM 2.2 seconds faster than the CAT 3406.

This Series 60 performance advantage helps in emergency situations, as well. In another test, while fully loaded, the Series 60 accelerated the boat from a standing stop to 1950 rpm with only one engine. This is a remarkable accomplishment for any engine on a 56 foot boat. This translates into superior handling and the ability to get home safely, even with just one engine.



How Does That Translate **Into Boat Noise?**

Noise is something you need to experience yourself. We suggest a visit to your local dealer and ask for your own demonstration. During your demonstration, in addition to the performance of the Series 60, you will notice something else...it's extremely quiet even at high speed.

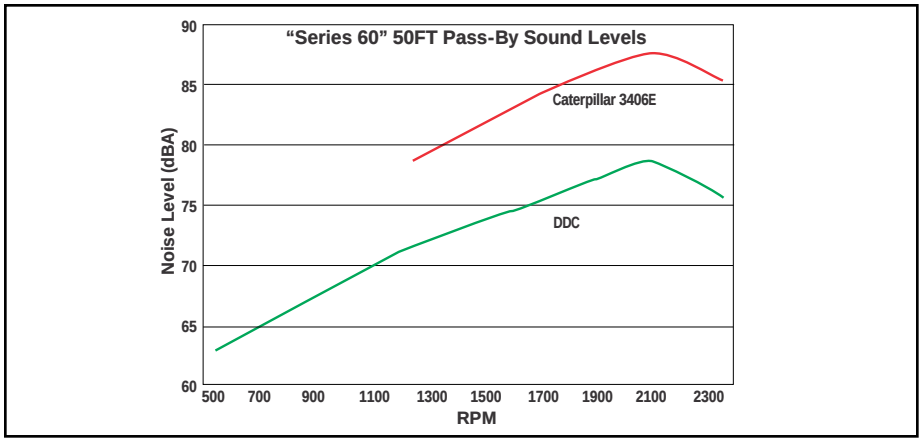
The following chart compares the pass-by noise of the same boat when equipped with two different engines.

The Series 60 is about 10 dBA quieter throughout the operating range. Since the dBA scale progresses exponentially, 10 dBA is a significant difference in noise level. For comparison, consider the following noise levels.*

Normal conversation	**= 60 dBA**
Average TV Volume	**= 70 dBA**
Ringing telephone	**= 80 dBA**
Handsaw	**= 85 dBA**
Subway	**= 90 dBA**

Interestingly the League for the Hard-Of-Hearing says, “Motorboats emit sound levels ranging from 85-115 dBA.”

The Series 60 is significantly quieter than their example.



Another way to equate the level of noise: According to a recent advertisement by Caterpillar**, they stated the interior noise level of a Cadillac STS is 72 dBA. You can see how well Series 60 engines measure up.

*Source Noise Center of the League for the Hard of Hearing
**_Forbes_, July 26, 1999

Low Noise - High Performance - Low Emissions

Great Fuel Economy - Extended Range

Low Maintenance - Advanced Controls

The Series 60 has it ALL

And There Is More...**Worldwide Technical Support**

MTU distributors provide a Pilot Installation Description to every boat builder to ensure the quality and integrity of the installation. Torsional Analysis are made for every installation. Marine transmissions are engineered as part of the entire package, including customized torsional couplings and optimized integrated cooling. We worry about the installation so you won't have to.

Factory trained technicians offer application engineering support and conduct personalized on board commission inspections on every new Series 60 powered yacht.

Should service be required, it is readily available, worldwide. Simply call **1-877-DDC-BOAT** (NAFTA) and try it yourself. You'll find MTU's Worldwide parts and service support is a fact, not a slogan. And it's available 24 hours a day, 365 days a year.

Training for the Captain and crew is available at a number of convenient locations. To find the location most convenient for you, call **1-877-DDC-BOAT** (NAFTA), the same number used for Parts and Service support. One number, one call.

All Series 60 pleasurecraft engines are covered by MTU's 5 year limited warranty. Warranties which are easily transferable to subsequent owners.

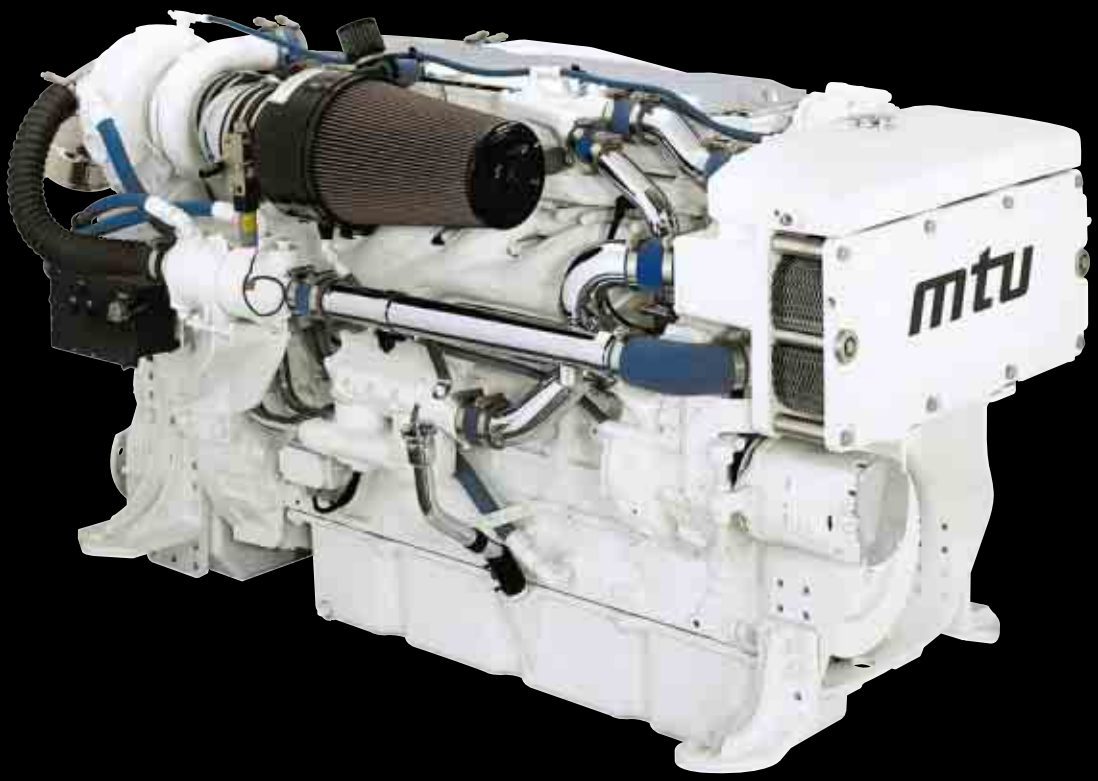
The Series 60 marine engine is currently available from 350 BHP @ 1800 RPM to 825 BHP @ 2300 RPM.

Internet Based Troubleshooting

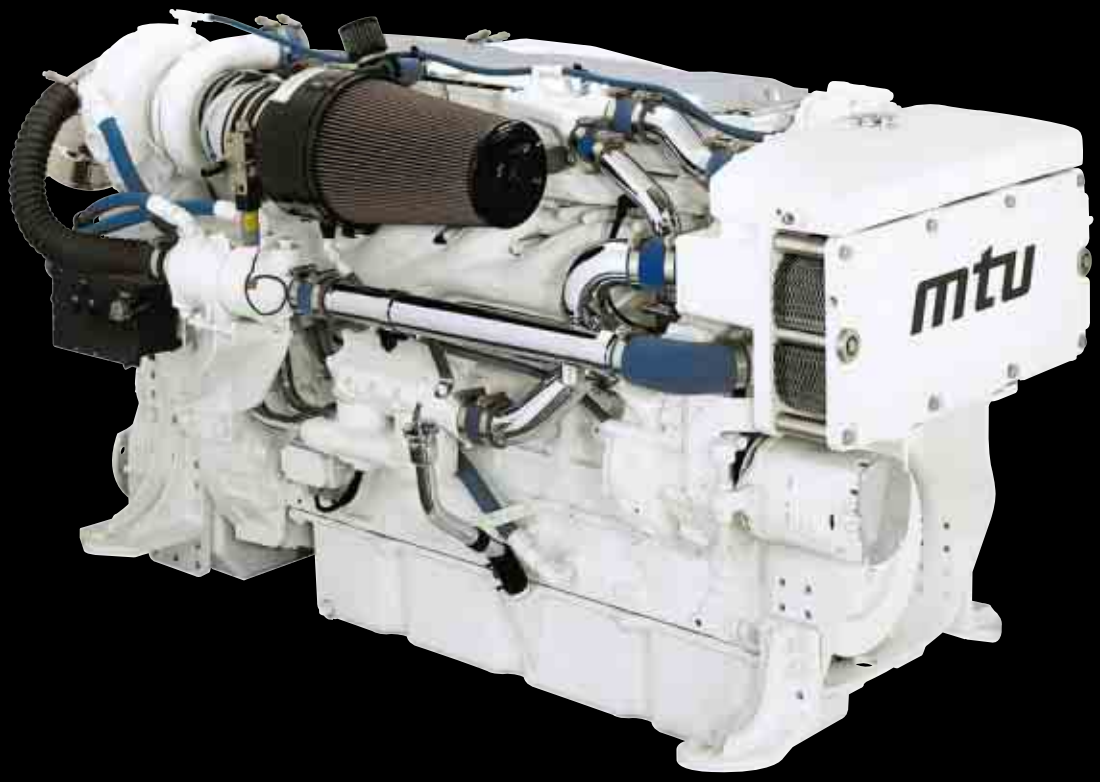
Description:	
low power, high rpm, not temperature related	
Questions:	**Answers (list):**
Has the check engine light come on?	No
Does the problem only occur at certain outside temperatures?	No
When does the engine performance problem occur?	High Speeds
What type of engine performance problem is occurring?	Low power
What type of engine problem is occurring?	Performance
Actions:	
97 Check turbo boost pressure.	
97 Check air intake system for restrictions.	
97 Check air intake system for low boost pressure.	

Why Should You Consider The MTU Series 60 Engine...
Why Would You Consider Anything Else?

We Invite You To:
Contact Your Local MTU Distributor
Arrange A Plant Tour In Detroit Or Friedrichshafen
Watch Us Build 350 Series 60s Every Day
Find Out Why We Should Build ...



... A Pair For You.



More Reasons Why The Series 60
Is The Best Choice For Today's Yachts.

Comfort And Convenience

- **Excellent fuel economy for extended range and safety**
- **Cleaner engine room with the closed crankcase breather system**
- **Compact size allows additional cabin space**
- **Easy starting in cool temperatures**
- **Owner/Captain/Crew training available at a number of locations**
- **1-877-DDC-BOAT** (NAFTA) **365 days a year**
- **True worldwide parts and service support**

Reliability And Durability

- **Pilot Installation Description assures proper engine installation**
- **Two piece steel piston for long life**
- **Corrosion resistant valves and valve seats**
- **Modular titanium heat exchanger for long life and easy cleaning**
- **Block heaters for cold weather starting**
- **Ceramic chrome piston rings for long life at high RPM**
- **High capacity oil pump for maximum piston cooling and bearing life**
- **Endurance tested in heavy-duty commercial applications**
- **Well over 200 billion miles of experience**
- **Cylinder liners are water cooled all the way to the top for reduced ring temperature**
- **Production dyno tested**
- **Five-year limited warranty with no limit on engine hours**
- **Designed, built and tested in the USA, on an assembly line designed for off-highway engines**

Performance

- **Electronic unit injectors for maximum performance**
- **Pulse tuned manifold for low end performance**
- **DDEC electronic control system manages multiple systems for maximum output, low smoke and precise control**
- **Overhead cam with ceramic rollers for high RPM operation**
- **Four valve cylinder heads for high RPM performance**

High Value At Time Of Resale

- **MTU has been building Marine Engines since 1937**
- **Printed reports from the engines DDEC system verify the history of the engines operation**
- **The Series 60 is at the beginning of its design life and will be state-of-the-art for years to come**
- **MTU is committed to the Marine industry. Has been, is, and will be**
- **Easily transferable warranties**
- **Worldwide parts and service**
- **It's a Series 60...**

MTU Marine Power.

SERIES 60®

The Most Popular Heavy Duty Engine In North America

The Difference Is The Details.

For additional information, contact your local distributor or dealer

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6SA160 0302 As technical advancements continue, specifications will change. Printed in U.S.A.