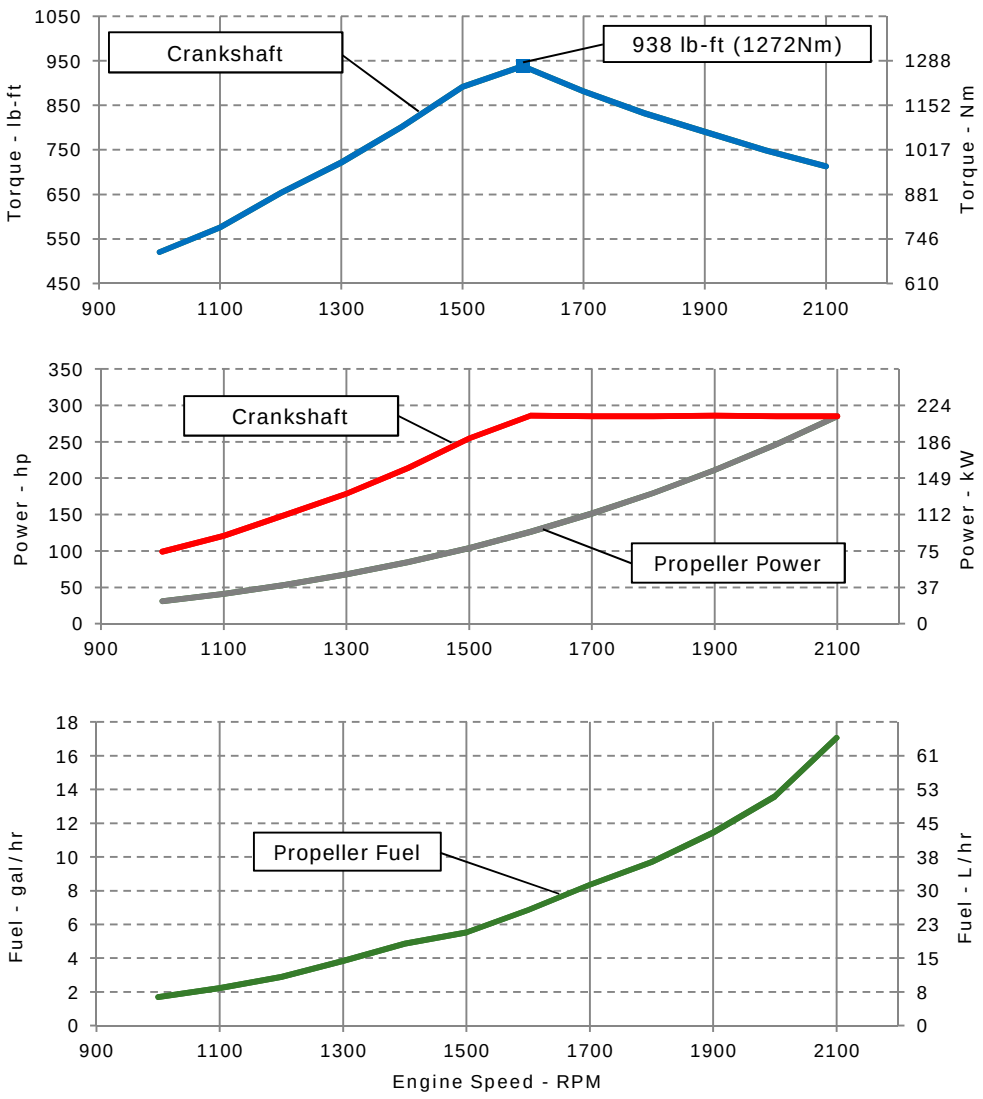
# ENGINE PERFORMANCE CURVE

Rating: M1 - 285hp (213kW) @ 2100 RPM
Application: Marine

PowerTech™ 9.0L Engine
Model: 6090AFM85




## REFERENCE CONDITIONS

Air Intake Restriction.....12 in.$H_2O$ (3 kPa)
Exhaust Back Pressure..... 30 in.$H_2O$ (7.5 kPa)

Rated speed and power
Gross power guaranteed within ±5% at SAE J1995 and ISO 3046
J1995 and ISO 3046 conditions:
77 °F (25 °C) air inlet temperature
29.31 in.Hg (99 kPa) barometric pressure
104 °F (40 °C) fuel inlet temperature
0.853 fuel specific gravity @ 60 °F (15.5 °C)

Ambient air temperature is defined to be the temperature of ambient air close to operating vessel that is not influenced in any manner by operating characteristics of the vessel (free field temp).

Conversion factors:
Power: kW = hp x 0.746
Fuel: 1 gal = 7.1 lb, 1 L = 0.85 kg
Torque: N·m = lb-ft x 1.356

All values from currently available data. Subject to manufacturing and measurement variations and to change without notice.
Actual performance is subject to application and operation conditions outside of John Deere control.

*Notes:*

*M1:* The M1 rating is for marine propulsion applications that may operate up to 24 hours per day at uninterrupted full power and have load factors greater than 65 percent.

*Possible applications:* Line hauls tugs and towboats, fish and shrimp trawlers/draggers, and displacement hull fishing boats.

| Designed/Calibrated to meet: | Certified by: |
|---|---|
| • EPA Commercial Marine Tier 3<br>• IMO MARPOL Annex VI Compliant<br>• NRMM (97/68/EC), as amended<br>Ref: Engine Emission Label | 9-Mar-14 |

Performance Curve: 6090AFM85_A

All values at rated speed, power, and standard conditions, per SAE J1995 unless otherwise noted.

# Engine Installation Criteria

## General Data

| | | | | |
|---|---|---|---|---|
| Model | 6090AFM85 | | | |
| Number of Cylinders | 6 | | | |
| Bore | 118 | mm | 4.65 | in |
| Stroke | 136 | mm | 5.35 | in |
| Displacement | 9.0 | L | 549 | $in^3$ |
| Compression Ratio | 16.3:1 | | | |
| Valves per Cylinder, Intake/Exhaust | 2/2 | | | |
| Combustion System | Direct injection | | | |
| Firing Order | 1-5-3-6-2-4 | | | |
| Engine Type | In line, 4 Cycle | | | |
| Aspiration | Turbocharged and Aftercooled | | | |
| Aftercooling System | Engine coolant | | | |
| Engine Crankcase Vent System | Closed | | | |

## Cooling System*

| | | | | |
|---|---|---|---|---|
| Engine Coolant Heat Rejection** | 237 | kW | 13479 | BTU/min |
| Max. Pressure Drop Across Keel Cooler | 40 | kPa | 5.8 | psi |
| Coolant Flow | 315 | L/min | 83 | gal/min |
| Seawater Flow (heat exchanged) | 397 | L/min | 105 | gal/min |
| Thermostat Start to Open | 71 | °C | 155 | °F |
| Thermostat Fully Open | 84 | °C | 182 | °F |
| Engine Coolant Capacity, HE | 30 | L | 7.9 | gal |
| Engine Coolant Capacity, KC | 26 | L | 6.9 | gal |
| Min. Coolant Fill Rate | 12 | L/min | 3.2 | gal/min |
| Min. Pressure Cap | 110.3 | kPa | 16 | psi |
| Min. Pump Inlet Pressure | 30 | kPa | 4.4 | psi |
| Max. External Coolant Restriction | 40 | kPa | 5.8 | psi |
| Normal Operation Max Top Tank Temperature | 100 | °C | 212 | °F |
| ≤ 5% of Total Operating Time Top Tank Temperature | 100-110 | °C | 212-230 | °F |
| Absolute Max Top Tank Temperature | 110 | °C | 230 | °F |
| Recommended Fuel Cooler | 13 | kW | 743 | BTU/min |
| Engine Radiated Heat | 32 | kW | 1845 | BTU/min |

* The cooling system should be capable of typical at ambient up to the maximum conditions in which the vessel will operate.

Typical operation is defined as the average load sustainable in the vessel over 10 min.

** Reference 32 ˚C Sea Water Temperature

## Physical Data

| | | | | |
|---|---|---|---|---|
| Length to rear face of block | 1293 | mm | 50.9 | in |
| Length maximum | 1714 | mm | 67.5 | in |
| Width maximum | 938 | mm | 36.9 | in |
| Height, crank centerline to top | 665 | mm | 26.2 | in |
| Height, crank centerline to bottom | 319 | mm | 319 | in |
| Weight, with oil, no coolant (includes engine, flywheel housing, flywheel, and electronics) | 1055 | kg | 2325 | lb |
| Center of Gravity Location, X-axis From Rear Face of Block | 408 | mm | 16.1 | in |
| Center of Gravity Location, Y-axis Right of Crankshaft | 38 | mm | 1.5 | in |
| Center of Gravity Location, Z-axis Above Crankshaft | 200 | mm | 7.9 | in |
| Max. Allowable Static Bending Moment At Rear Face of Flywheel Housing with 5-G Load | 814 | Nm | 600 | lb-ft |
| Thrust Bearing Load Limit, Forward Continuous | 8.6 | kN | 1933 | lbf |
| Thrust Bearing Load Limit, Forward Intermittent | 13 | kN | 2923 | lbf |
| Thrust Bearing Load Limit, Rearward Continuous | 4 | kN | 899 | lbf |
| Thrust Bearing Load Limit, Rearward Intermittent | 6 | kN | 1349 | lbf |

## Electrical System

| | | |
|---|---|---|
| Min. Recommended Battery Capacity, 12V @32 °F (0 °C) | 1100 | amps |
| Min. Recommended Battery Capacity, 24V @32 °F (0 °C) | 750 | amps |
| Starter Rolling Current, 12V @32 °F (0 °C) | 920 | amps |
| Starter Rolling Current, 24V @32 °F (0 °C) | 600 | amps |
| Min. Voltage at ECU during Cranking, 12V | 6 | volts |
| Min. Voltage at ECU during Cranking, 24V | 10 | volts |
| Max. Allowable Start Circuit Resistance, 12V | 0.0012 | ohms |
| Max. Allowable Start Circuit Resistance, 24V | 0.002 | ohms |
| Recommended Starter Cable, 12V 100" | #00 | |
| Recommended Starter Cable, 24V 100" | #2 | |
| Recommended Starter Cable, 12V 200" | #0000 or 2#00 | |
| Recommended Starter Cable, 24V 200" | #0 | |
| Electrical Component Maximum Temperature Limit | 125 °C | 257 °F |

Performance Curve: 6090AFM85_A

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# Engine Installation Criteria

## Fuel System

| | | | | |
|---|---|---|---|---|
| ECU Description | | | L14 | |
| Fuel Injection Pump | | | Denso HP4 | |
| Governor Type | | | Electronic | |
| Volumetric Fuel Consumption | 64.6 | L/hr | 17.1 | gal/hr |
| Mass Fuel Consumption | 54.9 | kg/hr | 121 | lb/hr |
| Total Fuel Volumetric Flow | 240 | L/hr | 63.4 | gal/hr |
| Total Fuel Mass Flow | 204 | kg/hr | 450 | lb/hr |
| Max. Fuel Inlet Restriction* | 20 | kPa | 80 | in.H2O |
| Max. Fuel Inlet Pressure | 20 | kPa | 80 | in.H2O |
| Max Fuel Return Pressure | 20 | kPa | 80 | in.H2O |
| Max. Fuel Height Above Transfer Pump | 2.4 | m | 7.9 | ft |
| Max. Leak-off Return Height | 2.4 | m | 7.9 | ft |
| Max. Fuel Inlet Height Above Fuel Tank Supply | 2.4 | m | 7.9 | ft |
| Normal Operation Fuel Temperature | 40 | °C | 104 | °F |
| Max. Fuel Inlet Temperature | 100 | °C | 212 | °F |
| Min. Recommended Fuel Line Inside Diameter | 8.34 | mm | 0.33 | in |
| Min. Recommended Fuel Line Size | | | 6 (-) AN | |
| Primary Fuel Filter | | | 10 mic | |
| Secondary Fuel Filter | | | 2 mic | |

## Lubrication System

| | | | | |
|---|---|---|---|---|
| Oil Pressure at Rated Speed | 300 | kPa | 44 | psi |
| Oil Pressure at Low Idle (650rpm)** | 141 | kPa | 20 | psi |
| Max. Crankcase Pressure | 2 | kPa | 8 | in.H2O |
| Maximum Installed Angle, Front Down | | | 0 deg | |
| Maximum Installed Angle, Front Up | | | 12 deg | |
| Engine Angularity Limits Any Direction, Continuous*** | | | 20 deg | |
| Engine Angularity Limits Any Direction, Intermittent*** | | | 30 deg | |

* With clean filters

** With John Deere Plus-50 II™ 15w-40, not applicable with break in oil.

*** With 1932 option

## Air Intake System

| | | | | |
|---|---|---|---|---|
| Engine Air Flow | 20.8 | $m^3$/min | 735 | $ft^3$/min |
| Intake Manifold Pressure | 176.4 | kPa | 25.6 | psi |
| Manifold Air Temperature | 83 | °C | 181 | °F |
| Maximum Manifold Air Temperature | 130 | °C | 266 | °F |
| Max. Allowable Temperature Rise, Ambient Air to Engine Inlet | 17 | °C | 30 | °F |
| Max. Air Intake Restriction, Clean Air Cleaner | 3 | kPa | 12 | in.$H_2O$ |
| Max. Air Intake Restriction, Dirty Air Cleaner | 6.25 | kPa | 25 | in.$H_2O$ |
| Min. Ventilation Area | 0.128 | $m^2$ | 198 | $in^2$ |

## Performance Data

| | | | | |
|---|---|---|---|---|
| Rated Power | 213 | kW | 285 | hp |
| Rated Speed | | 2100 | RPM | |
| Peak Torque Speed | | 1600 | RPM | |
| Low Idle Speed | | 650 | RPM | |
| Rated Torque | 967 | Nm | 713 | ft-lb |
| Peak Torque | 1272 | Nm | 938 | ft-lb |
| BMEP, Rated | 1350 | kPa | 196 | psi |
| Rated Pferdestärke (metric hp) | | 289 | ps | |
| Front Drive Capacity, Intermittent | 955 | Nm | 704 | lb-ft |
| Front Drive Capacity, Continuous | 955 | Nm | 704 | lb-ft |

## Exhaust System

| | | | | |
|---|---|---|---|---|
| Exhaust Flow | 49 | $m^3$/min | 1730 | $ft^3$/min |
| Exhaust Flow @ gas STP | 20.3 | $m^3$/min | 717 | $ft^3$/min |
| Exhaust Temperature | 448 | °C | 838 | °F |
| Max. Allowable Exhaust Restriction | 7.5 | kPa | 30 | in.$H_2O$ |
| Max. Shear on Turbocharger Exhaust Outlet | 11 | kg | 24.3 | lb |
| Max. Bending Moment on Turbocharger Exhaust Outlet | 7 | Nm | 15.4 | lb-ft |
| Min. Exhaust Pipe Diameter, Dry | 114.3 | mm | 4.5 | in |
| Min. Exhaust Pipe Diameter, Wet | 127 | mm | 5.0 | in |

Performance Curve: 6090AFM85_A

All values at rated speed, power, and standard conditions, per SAE J1995 unless otherwise noted.

## Engine Performance Data Table

| Engine Speed | Crank Power | | Crank Torque | | * Prop Power | | * Prop Fuel | | * Prop BSFC |
|---|---|---|---|---|---|---|---|---|---|
| RPM | kW | hp | Nm | lb-ft | kW | hp | L/hr | gal/hr | g/kW-hr |
| 2100 | 213 | 285 | 967 | 713 | 213 | 285 | 64.6 | 17.1 | 258 |
| 2000 | 213 | 285 | 1015 | 749 | 184 | 246 | 51.4 | 13.6 | 238 |
| 1900 | 213 | 286 | 1072 | 791 | 158 | 211 | 43.3 | 11.4 | 234 |
| 1800 | 213 | 285 | 1128 | 832 | 134 | 180 | 36.7 | 9.7 | 233 |
| 1700 | 213 | 285 | 1195 | 881 | 113 | 151 | 31.6 | 8.3 | 238 |
| 1600 | 213 | 286 | 1272 | 938 | 94 | 126 | 25.9 | 6.9 | 234 |
| 1500 | 190 | 255 | 1208 | 891 | 78 | 104 | 20.9 | 5.5 | 229 |
| 1400 | 159 | 214 | 1087 | 802 | 63 | 84 | 18.4 | 4.9 | 248 |
| 1300 | 133 | 179 | 978 | 721 | 50 | 68 | 14.5 | 3.8 | 244 |
| 1200 | 111 | 149 | 886 | 653 | 40 | 53 | 11.0 | 2.9 | 235 |
| 1100 | 90 | 121 | 781 | 576 | 31 | 41 | 8.4 | 2.2 | 235 |
| 1000 | 74 | 99 | 705 | 520 | 23 | 31 | 6.4 | 1.7 | 238 |

* Theoretical 3.0 exponent propeller curve , measured at flywheel

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