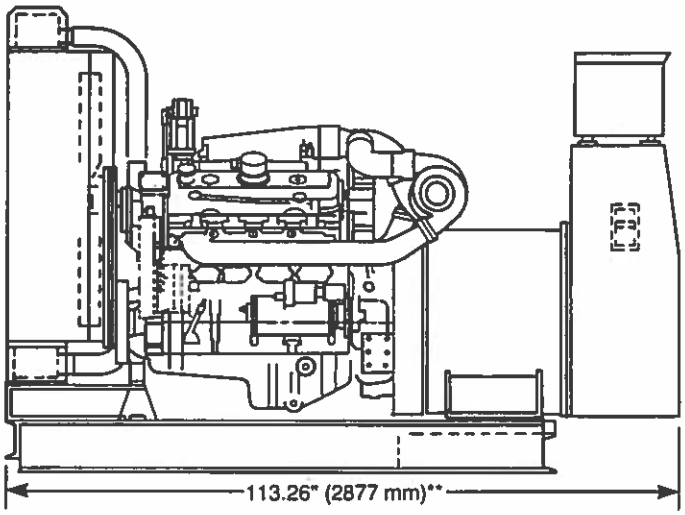
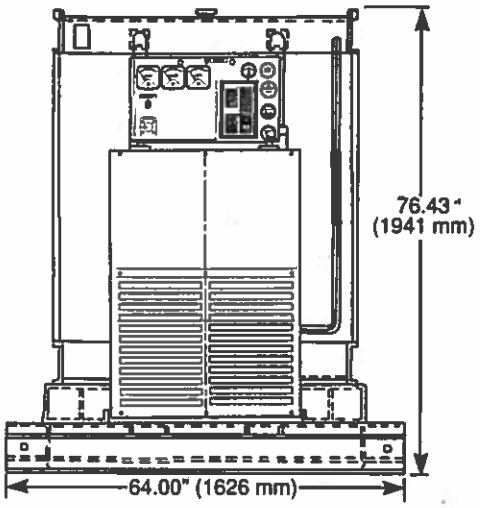
DETROIT DIESEL

Diesel Generator Set Model DDC 400

405 kW @ 60 Hz 353 kW @ 50 Hz





Weight (Net with lube oil) 6431 lbs (2917 kg)

The standard generator set comes complete with the following features:

- Reliable Detroit Diesel engine
- Reconnectable Generator with PMG excitation
- NFPA Level 2 Control System*
- 600V Molded Case U.L./CSA Approved Circuit Breaker
- Electronic Governor
- ±0.5% Voltage Regulation
- Prototype Tested with Factory Torsional and Bending Vibration Analysis
- Production Tested and Ready for Installation
- Wide Range of Factory Options and Performance-matched Power System Components
- Supported by DDC Distributors Worldwide

Generator Set Ratings and Performance

Model		60 Hz Ratings[1]		50 Hz Ratings[2]	
DDC 400		(kW)	(kVA)	(kW)	(kVA)
Standby Rating with Fan[3]		405	506	353	441
Prime Rating with Fan[4]		366	458	305	381
Standby Rating without Fan[3]		423	529	363	454
Prime Rating without Fan[4]		384	480	315	394
Application Data					
(at Standby Rating)[3]		1800 RPM		1500 RPM	
Combustion Air Flow, acfm (M³/min)		1770	(50.1)	1480	(41.9)
Cooling Fan Air Flow, acfm (M³/min)		26882	(761.1)	22472	(636.2)
Exhaust Gas Flow, cfm (M³/min)		4370	(123.7)	3720	(105.3)
Exhaust Gas Temperature, °F (°C)		865	(463)	890	(477)
Heat Rejected to Exhaust, BTU/min (kW)		22,117	(390)	19,821	(350)
Heat Rejected to Coolant, BTU/min (kW)		19,933	(352)	16,306	(288)
Heat Radiated from Engine, BTU/min (kW)		3,280	(57.9)	3,080	(54.3)
Heat Radiated from Generator, BTU/min (kW)		1,876	(33.1)	1,590	(28.1)
Fuel Consumption	**Load**				
gph (lph)	100%	31.7	(120.1)	28.3	(107.1)
	75%	24.1	(91.2)	21.3	(80.6)
	50%	17.2	(65.0)	14.7	(55.6)

[1] Rating Conditions are 86°F ambient temperature at 503 ft. above sea level, based on generator model 23506257 with a 480/277 volt connection.
[2] Rating Conditions are 86°F ambient temperature at 503 ft. above sea level, based on generator model 23506258 with a 415/240 volt connection.
[3] Standby Ratings are guaranteed within ±5% and are equivalent to ISO 3046 Fuel Stop Power.
[4] Prime Ratings are guaranteed as shown and are equivalent to ISO 3046 Continuous Power.
* NOTE: Requires the addition of optional jacket water heater.
** NOTE: Unit is shown with standard 60 Hz generator P/N 23506257

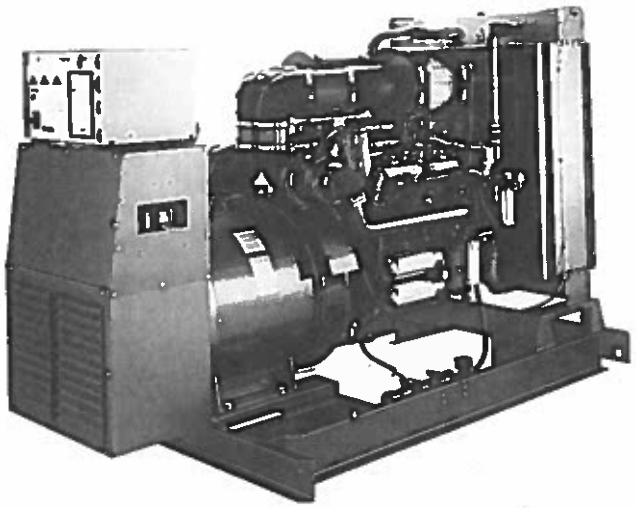
- One Step Load Acceptance: 100% of nameplate rating per NFPA 110
- Voltage regulation under varying loads from 0% to 100% is ±0.5% maximum
- Random voltage variation will not exceed ±0.5% of its mean value for constant loads from 0% to 100%
- Frequency regulation under varying loads from 0% to 100%—Isochronous
- Random frequency variation will not exceed ±0.25% of its mean value for constant loads from 0% to 100%
- Waveform Deviation is less than 4% measured line to line at full rated load
- TIF factor is less than 50
- THF is less than 2%

Standby Rating at Alternate Voltages[3]								
Voltage	Connection P/N	Connection	Amps	Phase	Hz	Generator Model	Exciter	Standby Rating (kW/kVA)
139/240	23506207	12 LEAD LO-WYE	1,218	3	60	23506257	PM100	405/506
127/220	23506208	10 LEAD LO-WYE	1,400	3	60	23506258	PM100	427/533
220/380	23506211	4 LEAD WYE	760	3	60	23508659	PM100	400/500
120/208	23506208	10 LEAD LO-WYE	1,480	3	60	23506258	PM100	427/533
347/600	23506211	4 LEAD WYE	481	3	60	23506273	PM100	400/500
110/190	23506208	10 LEAD LO-WYE	1,342	3	50	23506258	PM100	353/442
220/380	23506206	10 LEAD HI-WYE	671	3	50	23506258	PM100	353/442
120/208	23506208	10 LEAD LO-WYE	1,226	3	50	23506258	PM100	353/442

Standard Equipment

Generator sets are assembled to meet the specifications of the user. A wide range of Factory options and performance-matched power system components are described in the Optional Equipment section. The standard unit includes:

- Proven, dependable Detroit Diesel 2-stroke engine providing unsurpassed block loading capability and transient load response in a compact, durable package
- Electronic isochronous governor
- Single bearing A.C. brushless generator including AVR (0.5% regulation) with Permanent Magnet Excitation, Volts per Hertz Regulation and 3 phase RMS sensing
- Autostart control panel in vibration isolated steel enclosure
- 104° (40°C) cooling system including radiator with cowling, OSHA approved belt guard and radiator guard
- 600 Volt, molded case, U.L./CSA listed main line circuit breaker
- Dry-type air filter
- Flexible fuel lines
- Flexible stainless steel bellows-type, exhaust connection
- All mounted on a rigid, structural steel base
- Literature and Warranty
- Open Unit Installation Drawing Number: 23509037
- Enclosed Unit Installation Drawing Number: 23509038
- Engine Performance Curve, Standby Rating: E4-8085-32-10
- Engine Performance Curve, Prime Rating: E4-8085-32-12



Typical Detroit Diesel Power Systems Generator Set

Application/Operation Information

Baseframe: Generator Set components are mounted on a heavy-duty fabricated structural steel base and 3 point mounting system for ease of installation.

Coupling and Mounts: The engine flywheel is flexibly coupled to the alternator rotor by means of an SAE flange preventing misalignment of the engine and generator under a variety of conditions. The engine and generator are affixed to the baseframe by means of a self aligning vibration isolation system.

Cooling System: Heavy-duty industrial radiator with engine driven fan complete with OSHA approved fan and belt guards. Standard radiator is designed to cool engine at rated output in ambient temperatures up to 104°F (40°C). Optional cooling systems for 122°F (50°C) ambient temperatures as well as heat exchanger cooling are available.

Engine Filtration System: Heavy duty dry type air filters, with replaceable elements suitable for use in dusty conditions, are supplied with each unit. Fuel filter and lubricating oil filters also have replaceable elements.

Exhaust System: Heavy-duty, stainless-steel flexible exhaust connection (bellows-type) is standard. A variety of silencers are described in the Optional Equipment section.

Electric System: 24 volt negative ground electric starting system is standard. Engine-mounted battery charging alternators, static battery chargers and optional air starters are described in the Optional Equipment section.

Factory Testing: Each generator set is load tested at the factory before shipment. During the testing the generator set and its systems are tested as a complete unit. Control functions, site load conditions and system faults are simulated and a test certificate, indicating final results, is provided with each unit.

Generator Set and Components meet or exceed the following specifications: AS 1359, AS2 789, ABGSM TM3, BS 4999, DIN 6271, DIN 6280, EGSA 101P etc. etc.

Alternator Details

Permanent Magnet Generator (PMG) excitation, single piece four pole rotor with die-cast rotor core, amortiseur winding, and regreasable bearings with a minimum B-10 life of 40,000 hours. Reconnectable stator winding provides dual voltage for either 60 hertz or 50 hertz operation.

Insulation: Standard insulation system is Class H and uses multiple dips of a thermosetting polyester varnish with an overcoat of epoxy.

On medium voltage machines (5kV range) the standard insulation system is a vacuum pressure impregnated system using 100% solid epoxy with an epoxy overcoat. This system is also available as an option on random wound, low voltage generators.

Design: Electrical design is in accordance with IEC34-1, VDE0530, UTE100, NEMA MG1-22 CEMA, BS5000 part 99 and CSA 22.2.

Voltage Regulator: Solid-state encapsulated regulator provides 1/2% regulation. Includes volts/hertz underspeed protection adjustable from 40 to 70 Hertz, 3 phase RMS sensing, and paralleling and over excitation protection.

Standard regulators also provide loss of sensing protection, regulator current limit, temperature protection, and an engine unloading circuit. EMI suppression meets MIL-STD-461B, part 9 on standard DDC generator sets.

Waveform Deviation: Less than 4% measured line-to-line at full rated load. TIF factors less than 50. THF less than 2%.

Control Details

Autostart Control Panel: Set mounted autostart control panel in a vibration isolated steel enclosure with hinged cover to allow easy access for inspection and maintenance. Control panel contains the following:

Instruments: Voltmeter, Ammeter, Frequency Meter, Hour Meter, Coolant Temperature Gauge, Oil Pressure Gauge, Battery Condition Voltmeter, Battery Charging Ammeter.

Controls: Off/Auto/Test/Manual Switch, Phase Selector Switch, Lamp Test Button, Alarm Silencer Switch, Selectable Cooldown Timer, Voltage Adjust Rheostat, Selectable Crank Rest Periods, Selectable Cranking Cycles.

Shutdown Protection Devices: High Coolant Temperature, Low Water Level, Low Oil Pressure, Overspeed, Overcrank Remote Shutdown.

A broad range of additional control systems are available and are described in the Optional Equipment section.

Circuit Breaker: A three pole molded case circuit breaker is mounted in the generator terminal box or in a vibration isolated steel box with access ports for incoming and outgoing cables.

Wiring Harnesses: Conduit enclosed industrial type, with multi-pin connectors for fast trouble shooting and simple retrofitting of alternative or remote control systems.

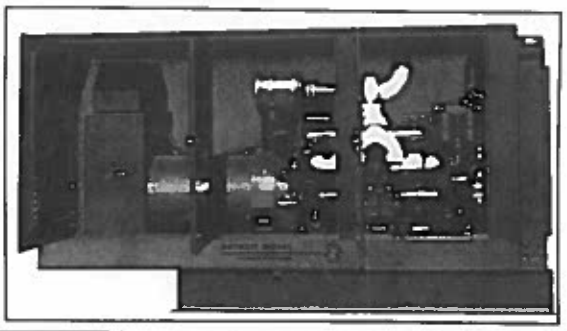
Optional Equipment

The ultimate selection of instrumentation and control equipment lies with the user and is dependent on jobsite application and installation factors. Options include:

- NFPA Level 1 Control Panel
- Audible Alarms
- Shutdown Protection Equipment
- Remote Annunciator Panels
- Optional Governors
- Static Battery Chargers
- Engine driven battery charging alternator
- Voltage Options for both 60Hz and 50Hz
- Alternator Heater to prevent condensation
- High Ambient Cooling System
- Heat Exchanger Cooling
- Engine Water Jacket Heater
- Base Fuel Tanks
- Day Tanks
- Manual and Electrical Fuel Transfer Systems
- Residential and Critical Grade Exhaust Silencers
- Weatherproof and Acoustically Insulated Enclosures
- Special Requirements Testing
- Transfer Switches and Bypass/Isolation Switches

Optional Control Panels

Optional Enclosures



The Detroit Diesel Generator Set Line - 20 kW through 1,635 kW

Gen Set Model	Engine Model	60 Hz Standby Rating kW	60 Hz Standby Rating kVA	60 Hz Prime Power Rating kW	60 Hz Prime Power Rating kVA	50 Hz Standby Rating kW	50 Hz Standby Rating kVA	50 Hz Prime Power Rating kW	50 Hz Prime Power Rating kVA
DDC 20	3.152	20.0	25.0	20.0	25.0	17.6	22.0	17.6	22.0
DDC 25	3.1524	25.0	31.3	24.5	30.6	21.6	27.0	21.6	27.0
DDC 40	4.236	40.0	50.0	37.7	47.1	32.0	40.0	32.0	40.0
DDC 50	T4.236	50.0	62.5	50.0	62.5	46.4	58.0	46.4	58.0
DDC 60	T4.236	60.0	75.0	55.0	68.8	51.0	63.7	46.4	58.0
DDC 70	T6.3544	70.0	87.5	70.0	87.5	68.0	85.0	68.0	85.0
DDC 85	T6.3544	85.0	106.3	85.0	106.3	76.0	95.0	68.0	85.0
DDC 100	1006.6TG	100	125	92	115	88	110	80	100
DDC 135	1043-7305	135	169	122	153	116	145	105	132
DDC 150*	1043-7305	150	188	132	165	130	163	112	140
DDC 200	1063-7305	215	269	185	232	191	239	164	205
DDC 240	8063-7305	240	300	205	256	210	263	180	225
DDC 275	8063-7405	275	344	243	303	240	300	206	258
DDC 300	8063-7416	300	375	266	332	265	331	225	281
DDC 375	8083-7405	375	467	322	402	335	419	288	360
DDC 400	8083-7416	405	506	366	457	353	442	305	381
DDC 500*	7123-7405	500	625	425	531	430	538	370	463
DDC 550	8123-7405	550	688	500	625	470	588	425	531
DDC 600	8123-7416	600	750	545	681	505	631	435	543
DDC 655	8163-7305	655	819	560	700	565	706	480	600
DDC 750	8163-7405	750	938	675	844	650	813	585	731
DDC 825	8163-7416	825	1,031	720	901	705	881	605	756
DDC 1050	9123-7306	1,050	1,313	940	1,175	860	1,075	780	975
DDC 1200	9123-7416	1,200	1,500	1,030	1,288	975	1,219	840	1,050
DDC 1400	9163-7316	1,400	1,750	1,200	1,500	1,200	1,500	1,025	1,281
DDC 1585	9163-7416	1,585	1,981	1,365	1,707	1,360	1,700	1,170	1,462
DDC 1635	9163-7416	1,635	2,044	1,365	1,707	1,400	1,750	1,170	1,462

Standby Ratings are ±5% and are equivalent to ISO 3046 Fuel Stop Power
Prime Ratings are ±0% and are equivalent to ISO 3046 Continuous Power

* Available 1991

DETROIT DIESEL ®
POWER SYSTEMS

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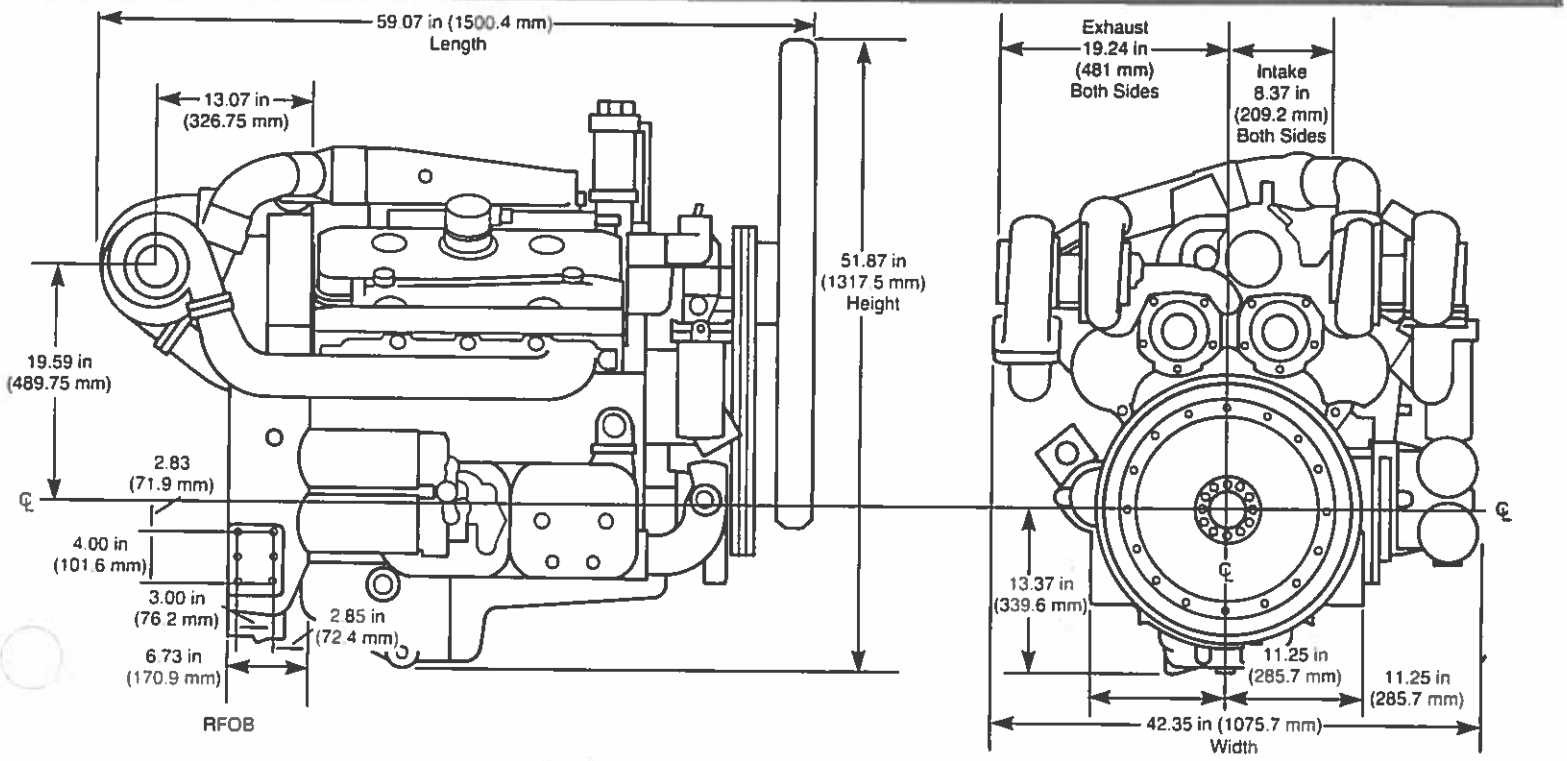
DETROIT DIESEL Series 92

Diesel Generator Engine Model 8083-7416

643 HP @ 1800 rpm 526 HP @ 1500 rpm



Basic Technical Data

Number of Cylinders: 8.
Cylinder Arrangement: Vee.
Cycle: 2 stroke.
Induction System: Turbocharged.
Combustion System: Direct Injection
Bore: 4.84 in (123 mm).
Stroke: 5.0 in (127.0 mm).
Compression Ratio: 15.0:1.
Cubic Capacity: 736 in^3 (12.1 liters).
Direction of Rotation: Clockwise viewed from the front.
Firing Order: 1L, 3R, 3L, 4R, 4L, 2R, 2L, 1R.
Total Weight (dry): 2465 lbs (1118 kg).
Total Weight (wet): 2660 lbs (1207 kg).
Overall Dimensions: Height 53.0 in (1346 mm); Length 50.7 in (1287 mm); Width 40.0 in (1016 mm).
Moment of Inertia (wr^2): Engine 5.77 lb-in-s^2 (0.65 kg m^2); Flywheel 28.74 lb-in-s^2 (3.25 kg m^2).
Speed Variation at Constant Load: ±0.25%
Engine Performance Curve, Standby Rating: E4-8085-32-14.
Prime Rating: E4-8085-32-15.
Engine Installation Drawing: 2SA665 (23504836).

Performance

Maximum Overspeed Limit: 2300 rpm.
Average Sound Pressure Level for Bare Engine (Without Inlet and Exhaust) at 1 meter: 1800 rpm 102 dBA; 1500 rpm 100 dBA.
Note: All data based on operation under ISO 3046, BS 5514 or SAE J1349.
Test Conditions: Rated prime power output shown represents engine performance capabilities at ambient conditions equivalent to ISO 3046, BS 5514: 77°F (25°C) air inlet temperature; 29.5 in. Hg (100 kPa) total barometric pressure; 30% relative humidity. Rated standby power shown represents engine performance capabilities at ambient conditions equivalent to SAE J1349: 77°F (25°C) air inlet temperature; 29.31 in. Hg (99 kPa) dry barometer.
Indicated performance is based on minimum intake and exhaust restrictions.
All ratings certified within ±5%.
If the engine is to operate in ambient conditions other than the test conditions then suitable adjustments must be made for any change in inlet air temperature, barometric pressure or humidity. For details refer to Detroit Diesel.
Diesel Fuel: To conform to ASTM D975 66T Number 2D or BS 2869: 1983 Class A2.
Lubricating Oil: A monograde SAE 40 lubricating oil must be used which conforms with specification MIL-L-2104D or API-CD-II.

Technical Data

Item	Units	Type of operation and application			
		Prime[1]		Standby [2, 5]	
		50 Hz	60 Hz	50 Hz	60 Hz
Engine speed	rpm	1500	1800	1500	1800
Rated engine power	bhp (kW)	454 (339)	555 (414)	526 (392)	643 (480)
Brake mean effective pressure	lbf in^2 (kPa)	133 (1124)	166 (1145)	189 (1301)	192 (1325)
Piston speed	ft min (m min)	1250 (381)	1500 (457)	1250 (381)	1500 (457)
Engine coolant flow	US gal min (Liter min)	133 (503)	160 (606)	133 (503)	160 (606)
Engine air flow	ft^3 min (m^3 min)	1290 (36 5)	1600 (45 3)	1480 (41 9)	1770 (50 1)
Exhaust gas flow	ft^3 min (m^3 min)	3180 (90)	3810 (108)	3720 (105)	4370 (124)
Exhaust gas temperature	°F (°C)	865 (463)	820 (438)	890 (477)	865 (463)
Fan Loss[3]	bhp (kW)	14 5 (10 8)	25 (18 7)	14 5 (10 8)	25 (18 7)
Cooling fan airflow[3]	ft^3 min (m^3 min)	19125 (542)	22300 (632)	19125 (542)	22300 (632)
Heat from fuel[4]	Btu min (kW)	52970 (931)	62520 (1099)	61510 (1081)	72650 (1277)
Heat to power	Btu min (kW)	19250 (338)	23530 (414)	22300 (392)	27260 (479)
Heat to water	Btu min (kW)	14074 (247)	17205 (302)	16306 (287)	19933 (350)
Heat to exhaust	Btu min (kW)	16966 (298)	18875 (332)	19824 (349)	22177 (390)
Heat to radiation	Btu min (kW)	2680 (47 1)	2910 (51.2)	3080 (54.1)	3280 (57 7)

[1] Equivalent to ISO-3046 Continuous Power
[2] Equivalent to ISO-3046 Fuel Stop Power
[3] With standard option fan
[4] Based on LHV of Fuel = 18370 BTU lb
[5] It is recommended that all ancillary engine systems be designed for maximum engine capability

Cooling System

Coolant:
Maximum static pressure head at pump: 50 ft. H^2O (149 kPa).

Minimum temperature to engine: 160°F (71°C).

Temperature rise across engine: 10°F (5.5°C).

Maximum permissible external system resistance: 5 psi (3.4 kPa).

Standard Option Fan:
Diameter: 40" (1016 mm).
Drive Ratio: 0.82:1
Number of Blades: 8

Thermostat:
Operation range: 177-197°F (81-92°C).

Electrical System

Battery Charging System:

Type: Negative ground.

Alternator: Delco-Remy.

Starter motor: Delco-Remy.

Recommended Battery Capacity		
Temperature		SAE J537 Cold cranking amperes 24V
°F	°C	
Over 32	Over 0	950
Under 32	Under 0	1250

Mountings

Maximum Bending Moment at Rear Face of Engine Block: 0 lbf-ft (0 Nm).

Position of Center of Gravity (dry engine):
Forward from rear face of block, 11.8 in (300 mm);
Above crankshaft center line, 8.5 (216 mm).
Right of crankshaft center line, 0.4 (10.2 mm)

Fuel System

Type of Injection System: Direct.

Fuel Injection Pump: Not Applicable.

Fuel Injector:

Type: Unit Injector.

Fuel Lift Pump:

Delivery/hour:
1800 rpm 97.0 gal. (367 liters);
1500 rpm 91.8 gal. (347 liters).

Maximum pump suction:
Clean System 6.0 in Hg (20 kPa);
Dirty System 12.0 in Hg (41 kPa).

Maximum static pressure head: 0 ft (0 m)

Governor Type: Barber Colman 8000, Electronic.

Induction System

Maximum Air Intake Restriction at Engine:
1800 rpm, Clean filter 8.7 in H_2O (2.2 kPa);
Dirty filter 14.4 in H_2O (3.6 kPa).
1500 rpm, Clean filter 6.2 in H_2O (1.5 kPa);
Dirty filter 10.3 in H_2O (2.6 kPa).

Recommended Inside Diameter of Intake Pipe:
6.0 in. (152 mm)

Exhaust System

Maximum Back Pressure for Total System:
1800 rpm, 2.0 in Hg (6.8 kPa).
1500 rpm, 1.4 in Hg (4.7 kPa).

Recommended Inside Diameter of Engine Exhaust Outlet:
6.0 in (152 mm).

Lubrication System

Lubricating Oil Capacity: Total system 25 qt (24 litres); Sump only 23 qt (22 litres).

Normal Operation Angles: Front up 17°, Front down 17°, Side to side, 17°.

Pressure at Which Oil Relief Valve Opens:

Lubricating Oil Pressure: At rated speed
1800 rpm 49-70 psi (338-483 kPa);
1500 rpm 41-62 psi (283-427 kPa)

Lubricating Oil Temperature:
At normal operation 200°F (93°C).
Maximum 250°F (121°C).

Lubricating Oil Consumption as a Percentage of Fuel Consumption: 0.5% maximum.

Recommended SAE viscosity grades:

API Symbol:

SAE Viscosity Grade: 40.
API Classification: CD-II
Military Spec.: Mil-L-2104D
Sulfated Ash: Less Than 1.0%

Certain engine operating conditions may require exceptions to this recommendation:

1. For continuous high temperature operation (over 100°F ambient or 200°F Coolant Out) the use of an SAE grade 50 lubricant in all series, two-cycle DDC engines is recommended.
2. At ambient temperatures below freezing where starting aids are not available or at very cold temperatures (0 to −25°F), the use of multiviscosity grade 15W-40 or monograde SAE 30 lubricants will improve startability. **Exception: Do not use these lubricants in two-cycle marine engines or DDC Series 149 engines under any circumstances.**

DETROIT DIESEL ®
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5SA562 9007 As technical advancements continue, specifications will change. Litho in U.S.A.