

# Diesel Generator Set

## Model DFEH 60 Hz

### EPA Emissions

**400 kW, 500 kVA Standby**  
**350 kW, 438 kVA Prime**



### Description

The Cummins Power Generation DF-series commercial generator set is a fully integrated power generation system providing optimum performance, reliability, and versatility for stationary standby or prime power applications.

A primary feature of the DF GenSet is strong motor-starting capability and fast recovery from transient load changes. The torque-matched system includes a heavy-duty Cummins 4-cycle diesel engine, an AC alternator with high motor-starting kVA capacity, and an electronic voltage regulator with three-phase sensing for precise regulation under steady-state or transient loads. The DF GenSet accepts 100% of the nameplate standby rating in one step, in compliance with NFPA 110 requirements.

The standard PowerCommand<sup>®</sup> digital electronic control is an integrated system that combines engine and alternator controls for high reliability and optimum GenSet performance.

Optional weather-protective enclosures and coolant heaters shield the generator set from extreme operating conditions. Environmental concerns are addressed by low exhaust emission engines, sound-attenuated enclosures, exhaust silencers, and dual-wall fuel tanks. A wide range of options, accessories, and services are available, allowing configuration to your specific power generation needs.

Every production unit is factory tested at rated load and power factor. This testing includes demonstration of rated power and single-step rated load pickup. Cummins Power Generation manufacturing facilities are registered to ISO9001 quality standards, emphasizing our commitment to high quality in the design, manufacture, and support of our products. The generator set is CSA certified and is available as UL2200 Listed. The PowerCommand control is UL508 Listed.

All Cummins Power Generation systems are backed by a comprehensive warranty program and supported by a worldwide network of 170 distributors and service branches to assist with warranty, service, parts, and planned maintenance support.

### Features

**UL Listed Generator Set** - The complete generator set assembly is available Listed to UL 2200.

**Low Exhaust Emissions** - Engine certified to U.S. EPA Nonroad Source Emission Standards, 40 CFR 89, Tier 2.

**Cummins Heavy-Duty Engine** - Rugged 4-cycle industrial diesel delivers reliable power, low emissions, and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings; low waveform distortion with non-linear loads, fault clearing short-circuit capability, and class H insulation. The alternator electrical insulation system is UL1446 Recognized.

**Permanent Magnet Generator (PMG)** - Offers enhanced motor starting and fault clearing short circuit capability.

**Control System** - The PowerCommand electronic control is standard equipment and provides total genset system integration, including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry<sup>™</sup> protection, output metering, auto-shutdown at fault detection, and NFPA 110 compliance. PowerCommand control is Listed to UL508.

**Cooling System** - Provides reliable running at the rated power level, at up to 50°C ambient temperature.

**Integral Vibration Isolation** - Robust skid base supports the engine, alternator, and radiator on isolators, minimizing transmitted vibration.

**E-Coat Finish** - Dual electro-deposition paint system provides high resistance to scratches, corrosion, or fading.

**Enclosures** - Optional weather-protective and sound-attenuated enclosures are available.

**Fuel Tanks** - Dual wall sub-base fuel tanks are also offered.

**Certifications** - Generator sets are designed, manufactured, tested, and certified to relevant UL, NFPA, ISO, IEC, and CSA standards.

**Warranty and Service** - Backed by a comprehensive warranty and worldwide distributor network.

# Generator Set

The general specifications provide representative configuration details. Consult the outline drawing for installation design.

## Specifications – General

See outline drawing 500-4227 for installation design specifications.

<b>Unit Width, in (mm)</b>	60.0 (1524)
<b>Unit Height, in (mm)</b>	71.3 (1812)
<b>Unit Length, in (mm)</b>	152.1 (3864)
<b>Unit Dry Weight, lb (kg)</b>	8500 (3856)
<b>Unit Wet Weight, lb (kg)</b>	8800 (3992)
<b>Rated Speed, rpm</b>	1800
<b>Voltage Regulation, No Load to Full Load</b>	±0.5%
<b>Random Voltage Variation</b>	±0.25%
<b>Frequency Regulation</b>	Isochronous
<b>Random Frequency Variation</b>	±0.25%
<b>Radio Frequency Interference</b>	IEC 801.2, Level 4 Electrostatic Discharge IEC 801.3, Level 3 Radiated Susceptibility

<b>Cooling</b>	<b>Standby</b>	<b>Prime</b>
<b>Standard Set-Mounted Radiator Cooling (Dwg. 500-3326)</b>		
Set Coolant Capacity, US Gal (L)	15.3 (57.9)	15.3 (57.9)
Total Heat Rejected from Cooling System, BTU/min (MJ/min)	12770.0 (13.5)	11700.0 (12.4)
Heat Radiated to Room, BTU/min (MJ/min)	3905.0 (4.1)	3720.0 (3.9)

<b>Air</b>		
Combustion Air, scfm (m <sup>3</sup> /min)	1290.0 (36.5)	1180.0 (33.4)
Alternator Cooling Air, scfm (m <sup>3</sup> /min)	2190.0 (62.0)	2190.0 (62.0)
Radiator Cooling Air, scfm (m <sup>3</sup> /min)	25000.0 (707.5)	25000.0 (707.5)
Max. Static Restriction, in H <sub>2</sub> O (Pa)	0.5 (124.5)	0.5 (124.5)

## Rating Definitions

**Standby Rating based on:** Applicable for supplying emergency power for the duration of normal power interruption. No sustained overload capability is available for this rating. (Equivalent to Fuel Stop Power in accordance with ISO3046, AS2789, DIN6271 and BS5514). Nominally rated.

**Prime (Unlimited Running Time) Rating based on:** Applicable for supplying power in lieu of commercially purchased power. Prime power is the maximum power available at a variable load for an unlimited number of hours. A 10% overload capability is available for limited time. (Equivalent to Prime Power in accordance with ISO8528 and Overload Power in accordance with ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.

## Site Derating Factors

Genset may be operated up to 2540 m (8325 ft) and 40°C (104°F) without power deration. For sustained operation above these conditions up to 3000 m (9840 ft), derate by 4.3% per 305 m (1000 ft) and 5.7% per 10°C (3.2% per 10°F). Above 3000 m (9840 ft), derate 6.4% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) and 10% per 10°C (5.6% per 10°F).

# Engine

Cummins heavy duty diesel engines use advanced combustion technology for reliable and stable power, low emissions, and fast response to sudden load changes.

Electronic governing provides precise speed regulation, especially useful for applications requiring constant (isochronous) frequency regulation such as Uninterruptible Power Supply (UPS) systems, non-linear loads, or sensitive electronic loads. Optional coolant heaters are recommended for all emergency standby installations or for any application requiring fast load acceptance after start-up.

**Note:** Features included with the engine: battery charging alternator, fuel/water separator, shutdown low coolant and bypass oil filtration.

## Specifications – Engine

<b>Base Engine</b>	Cummins Model QSX15-G9 Nonroad 2, Turbo-charged with air-to-air charge air cooling, diesel-fueled
<b>Displacement in<sup>3</sup> (L)</b>	912.0 (14.9)
<b>Overspeed Limit, rpm</b>	2150 ±50
<b>Regenerative Power, kW</b>	52.00
<b>Cylinder Block Configuration</b>	Cast iron with replaceable wet liners, In-Line 6 cylinder
<b>Battery Capacity</b>	900 amps minimum at ambient temperature of 32°F (0°C)
<b>Battery Charging Alternator</b>	35 amps
<b>Starting Voltage</b>	24-volt, negative ground
<b>Lube Oil Filter Types</b>	Single spin-on combination element with full flow and bypass filtration
<b>Standard Cooling System</b>	104° F (40° C) ambient radiator

Power Output		Standby				Prime			
Gross Engine Power Output, bhp (kWm)		755.0 (563.0)				680.0 (507.3)			
BMEP at Rated Load, psi (kPa)		287.0 (1978.8)				261.0 (1799.5)			
Bore, in. (mm)		5.39 (136.9)				5.39 (136.9)			
Stroke, in. (mm)		6.65 (168.9)				6.65 (168.9)			
Piston Speed, ft/min (m/s)		1995.0 (10.1)				1995.0 (10.1)			
Compression Ratio		17.0:1				17.0:1			
Lube Oil Capacity, qt. (L)		88.0 (83.3)				88.0 (83.3)			
Fuel Flow									
Fuel Flow at Rated Load, US Gal/hr (L/hr)		112.0 (423.9)				112.0 (423.9)			
Maximum Inlet Restriction, in. Hg (mm Hg)		5.0 (127.0)				5.0 (127.0)			
Maximum Return Restriction, in. Hg (mm Hg)		6.5 (165.1)				6.5 (165.1)			
Air Cleaner									
Maximum Air Cleaner Restriction, in. H <sub>2</sub> O (kPa)		25.0 (6.2)				25.0 (6.2)			
Exhaust									
Exhaust Flow at Rated Load, cfm (m <sup>3</sup> /min)		2875.0 (81.4)				2685.0 (76.0)			
Exhaust Temperature, °F (°C)		825.0 (440.6)				815.0 (435.0)			
Max Back Pressure, in. H <sub>2</sub> O (kPa)		41.0 (10.2)				41.0 (10.2)			
Fuel System		Full Authority Electronic (FAE) Cummins HPI-TP							
Fuel Consumption		Standby				Prime			
60 Hz Ratings, kW (kVA)		400 (500)				350 (438)			
	Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full
	US Gal/hr	10.0	16.0	21.5	27.3	9.4	14.9	20.0	25.2
	L/hr	38	61	81	103	36	56	76	95

## Alternator

Single-bearing alternators couple directly to the engine flywheel with flexible discs for drivetrain reliability and durability. No gear reducers or speed changers are used. Two-thirds pitch windings eliminate third-order harmonic content of the AC voltage waveform and provide the standardization desired for paralleling of generator sets.

A Permanent Magnet Generator (PMG) excitation system limits voltage dip during transient load application, sustains 3-phase short circuit current at approximately three times rated for up to 10 seconds, and is resistant to harmful effects of harmonics generated by non-linear loads. The alternator delivers excellent performance in applications containing large motors or sensitive electronics.

Various alternator sizes are available to meet individual application needs. Alternator sizes are differentiated by maximum winding temperature rise at the generator set standby or prime rating when operated in a 40°C ambient environment. Available temperature rises range from 80°C to 150°C. Not all temperature rise selections are available on all models. Lower temperature rise is accomplished using larger alternators at lower current density. Lower temperature rise alternators have high motor starting kVA, lower voltage dip upon load application, and they are generally recommended to limit voltage distortion and heating due to harmonics induced by non-linear loads.

## Alternator Application Notes

**Alternator Space Heater** - is recommended to inhibit condensation.

## Available Output Voltages

### Three Phase

- [ ] 110/190
- [ ] 110/220
- [ ] 115/200
- [ ] 115/230
- [ ] 120/208
- [ ] 127/220
- [ ] 139/240
- [ ] 220/380
- [ ] 230/400
- [ ] 240/416
- [ ] 255/440
- [ ] 277/480
- [ ] 347/600

# Specifications – Alternator

<b>Design</b>	Brushless, 4-pole, drip-proof revolving field
<b>Stator</b>	2/3 pitch
<b>Rotor</b>	Direct-coupled by flexible disc
<b>Insulation System</b>	Class H per NEMA MG1-1.65 and BS2757
<b>Standard Temperature Rise</b>	125°C standby
<b>Exciter Type</b>	Permanent Magnet Generator (PMG)
<b>Phase Rotation</b>	A (U), B (V), C (W)
<b>Alternator Cooling</b>	Direct-drive centrifugal blower
<b>AC Waveform Total Harmonic Distortion</b>	<5% total no load to full linear load <3% for any single harmonic <50 per NEMA MG1-22.43.
<b>Telephone Influence Factor (TIF)</b>	<3
<b>Telephone Harmonic Factor (THF)</b>	<3

Three Phase Table <sup>1</sup>		105° C	105° C	125° C	125° C	125° C	125° C	125° C	150° C	150° C	150° C	150° C	
Feature Code		B259	B301	B258	B252	B414	B246	B300	B426	B413	B424	B419	
Alternator Data Sheet Number		307	306	306	305	307	305	305	305	305	305	305	
Voltage Ranges		110/190 Thru 139/240 220/380 Thru 277/480	347/600	110/190 Thru 139/240 220/380 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	277/480	347/600	110/190 Thru 139/240 220/380 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	277/480	347/600	
Surge kW		514	517	511	509	516	514	513	508	509	514	513	
Motor Starting kVA (at 90% sustained voltage)	PMG	2208	1896	1896	1749	2208	1749	1749	1749	1749	1749	1749	
Full Load Current - Amps at Standby Rating		<u>110/190</u> 1521	<u>120/208</u> 1390	<u>110/220</u> 1314	<u>115/230</u> 1257	<u>139/240</u> 1204	<u>220/380</u> 761	<u>230/400</u> 723	<u>240/416</u> 695	<u>255/440</u> 657	<u>277/480</u> 602	<u>347/600</u> 482	

**Notes:**

**1. Single Phase Capability:** Single phase power can be taken from a three phase generator set at up to 40% of the generator set nameplate kW rating at unity power factor.

# Control System



**PowerCommand (2100) Control**



**PowerCommand (3200) Control**

## PowerCommand Control with AmpSentry™ Protection

- The PowerCommand Control is an integrated generator set control system providing governing, voltage regulation, engine protection, and operator interface functions.
- PowerCommand Controls include integral AmpSentry protection. AmpSentry provides a full range of alternator protection functions that are matched to the alternator provided.
- Controls provided include Battery monitoring and testing features, and Smart-Starting control system.
- InPower PC-based service tool available for detailed diagnostics
- Standard PCCNet interface. Available with Echelon LonWorks network interface
- NEMA 3R enclosure (2100 only)
- Suitable for operation in ambient temperatures from -40C to +70C, and altitudes to 13,000 feet (5000 meters)
- Prototype tested; UL, CSA, and CE compliant

AmpSentry AC Protection	Engine Protection	Operator Interface
<ul style="list-style-type: none"> <li>• Overcurrent and short circuit shutdown</li> <li>• Overcurrent warning</li> <li>• Single &amp; 3-phase fault regulation</li> <li>• Over and under voltage shutdown</li> <li>• Over and under frequency shutdown</li> <li>• Overload warning with alarm contact</li> <li>• Reverse power and reverse Var</li> <li>• Excitation fault (2100 only)</li> </ul>	<ul style="list-style-type: none"> <li>• Overspeed shutdown</li> <li>• Low oil pressure warning and shutdown</li> <li>• High coolant temperature warning and shutdown</li> <li>• High oil temperature warning</li> <li>• Low coolant level warning or shutdown</li> <li>• Low coolant temperature warning</li> <li>• High and low battery voltage</li> <li>• Weak battery</li> <li>• Dead battery</li> <li>• Fail to start (overcrank) shutdown</li> <li>• Fail to crank shutdown</li> <li>• Redundant start disconnect</li> <li>• Cranking lockout</li> <li>• Sensor failure indication</li> </ul>	<ul style="list-style-type: none"> <li>• OFF/MANUAL/AUTO mode switch</li> <li>• MANUAL RUN/STOP switch</li> <li>• Panel lamp/reset switch</li> <li>• Emergency Stop switch</li> <li>• Alpha-numeric display with pushbutton access, for viewing engine and alternator data and providing setup, controls, and adjustments</li> <li>• LED lamps indicating genset running, not in auto, common warning, common shutdown</li> <li>• (5) configurable LED lamps (2100 only)</li> <li>• LED Bargraph AC data display</li> <li>• Panel Lighting with switch and timer</li> </ul>
Alternator Data	Engine Data	Other Data
<ul style="list-style-type: none"> <li>• Line to Line and Line to Neutral AC volts</li> <li>• 3-phase AC current</li> <li>• Frequency</li> <li>• Total and individual phase kW and kVA</li> </ul>	<ul style="list-style-type: none"> <li>• DC voltage</li> <li>• Lube oil pressure</li> <li>• Coolant temperature</li> <li>• Lube oil temperature</li> <li>• FAE engine data (varies with engine)</li> </ul>	<ul style="list-style-type: none"> <li>• Genset model data</li> <li>• Start attempts, Starts, running hours</li> <li>• KW hours (total and since reset)</li> <li>• Fault history</li> <li>• Load Profile (Hours less than 30% and hours more than 90% load)</li> <li>• System Data Display (optional with network and other PowerCommand gensets or transfer switches)</li> </ul>
Governing	Voltage Regulation	Control Functions
<ul style="list-style-type: none"> <li>• Integrated digital electronic isochronous governor</li> <li>• Temperature dynamic governing</li> <li>• Smart idle speed mode</li> <li>• Glow plug control (some models)</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated digital electronic voltage regulator</li> <li>• 3-phase line to neutral sensing</li> <li>• PMG Control Interface</li> <li>• Single and three phase fault regulation</li> <li>• Configurable Torque Matching</li> </ul>	<ul style="list-style-type: none"> <li>• Data logging on faults</li> <li>• Fault simulation (requires InPower)</li> <li>• Time delay start and cooldown</li> <li>• PCCNet Interface</li> <li>• Cycle cranking</li> <li>• (4) Configurable inputs</li> <li>• (4) Configurable outputs (2100 only)</li> </ul>
Options		
<ul style="list-style-type: none"> <li><input type="checkbox"/> Open Transition Power Transfer Control</li> <li><input type="checkbox"/> Fast Closed Transition Power Transfer Control (3200 Control)</li> <li><input type="checkbox"/> Ramping Closed Transition Power Transfer (3200 Control)</li> <li><input type="checkbox"/> Paralleling (3200 Control)</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Key-type mode switch</li> <li><input type="checkbox"/> Ground fault module</li> <li><input type="checkbox"/> Exhaust Temperature Monitor</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Echelon LonWorks interface</li> <li><input type="checkbox"/> Digital input and output module(s) (loose)</li> <li><input type="checkbox"/> Remote Annunciator (loose)</li> <li><input type="checkbox"/> (8) configurable network inputs and (16) outputs</li> </ul>

## Generator Set Options

### Engine

- 208/240/480 V thermostatically controlled coolant heater for ambient above 40°F (4.5°C)
- 208/240/480 V thermostatically controlled coolant heater for ambient below 40°F (4.5°C)
- 120 V 300 W lube oil heater
- Heavy-duty air cleaner with safety element

### Cooling System

- 131°F (55°C) ambient radiator

### Fuel System

- 300 Gal (1136 L) Sub-base tank
- 400 Gal (1514 L) Sub-base tank
- 500 Gal (1893 L) Sub-base tank
- 600 Gal (2271 L) Sub-base tank
- 660 Gal (2498 L) Sub-base tank
- 850 Gal (3218 L) Sub-base tank
- 1700 Gal (6435 L) Sub-base tank

### Alternator

- 80°C rise alternator
- 105°C rise alternator
- 150°C rise alternator
- 120/240 V, 300 W anti-condensation heater

### Control Panel

- 120/240 V, 150 W control anti-condensation space heater
- Ground fault alarm
- Paralleling configuration
- Power transfer control
- Remote fault signal package
- Run relay package

### Exhaust System

- Critical grade exhaust silencer
- Exhaust packages
- Industrial grade exhaust silencer
- Residential grade exhaust silencer

### Generator Set

- AC entrance box
- Batteries
- Battery charger
- Export box packaging
- UL2200 Listed
- Main line circuit breaker
- Paralleling accessories
- Remote annunciator panel
- Sound-attenuated enclosure (2 levels) with internal silencers
- Spring isolators
- Weather-protective enclosure with internal silencer
- 2 year prime power warranty
- 2 year standby warranty
- 5 year basic power warranty
- 10 year major components warranty

## Available Products and Services

A wide range of products and services is available to match your power generation system requirements. Cummins Power Generation products and services include:

Diesel and Spark-Ignited Generator Sets

Transfer Switches

Bypass Switches

Parallel Load Transfer Equipment

Digital Paralleling Switchgear

PowerCommand Network and Software

Distributor Application Support

Planned Maintenance Agreements

## Warranty

All components and subsystems are covered by an express limited one-year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available. Contact your distributor/dealer for more information.

## Certifications



**ISO9001** - This generator set was designed and manufactured in facilities certified to ISO9001.



**CSA** - This generator set is CSA certified to product class 4215-01.



**PTS** - The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Products bearing the PTS symbol have been subjected to demanding tests in accordance to NFPA 110 to verify the design integrity and performance under both normal and abnormal operating conditions including short circuit, endurance, temperature rise, torsional vibration, and transient response, including full load pickup.



**UL** - The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage.

## See your distributor for more information



**Cummins Power Generation**  
1400 73rd Avenue N.E.  
Minneapolis, MN 55432  
763.574.5000  
Fax: 763.574.5298  
[www.cumminspower.com](http://www.cumminspower.com)

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Detector and AmpSentry are trademarks of Cummins Inc.

**Important:** Backfeed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.