



# ИПО® ООД

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ISO 14001  
OHSAS 18001  
BUREAU VERITAS  
Certification



BG19607Q/1 / BG19607E/1 / CZE-130001



**BOSCH YANMAR**



**Power Generation**



**HOUCHIN**

До : "АЕЦ КОЗЛОДУЙ" ЕАД  
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От : Карел Райчев  
Наш факс : 02/971 9548  
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Брой страници : 6+27 (вкл. челната)  
Дата : 31.01.2022 год.

**Относно: Ваше запитване за доставка на дизелова генераторна система за резервно захранване на ваш обект, производство на Cummins Power Generation.**

**Уважаеми госпожи и господа,**

Във връзка с покана за пазарна консултация с Ваш №48258, относно доставка на мобилен дизелов генератор с номинална мощност 1100 kW, монтиран в 40" ISO контейнер за Ваш обект, предоставям на Вашето внимание нашата:

## БЮДЖЕТНА ОФЕРТА

**Дизелов генератор Cummins Power Generation**



# 1. Техническа спецификация на предложеното оборудване

## 1.1. Техническа спецификация на дизелов генератор C1675D5



### Дизелов генератор C1675D5 (Шумозаглушен тип)

#### Генератор, Модел C1675D5

Мощност 1675 kVA (1340 kW) Резервно захранване – Максимална мощност

**Мощност 1400 kVA (1120 kW) Основно захранване – Номинална мощност**

Регулиране на напрежението – ISO 8528 compliant

Регулиране на напрежението, без натоварване до пълно натоварване:  $\pm 1\%$

Случайно изменение /толеранс/ на напрежението:  $\pm 1\%$

Случайно изменение /толеранс/ на честотата:  $\pm 1\%$

Работен температурен диапазон: от  $-25^{\circ}\text{C}$  до  $+40,4^{\circ}\text{C}$

Надморска височина: до 1000m

Време за стартиране на дизеловия генератор след отпадане на ел. захранването от 0 сек. до 3 600 сек.

Време за пълно натоварване на дизеловия генератор при отпадане на ел. захранването: от 5 сек. до 15 сек.

#### Шумозаглушен тип

Приложение Резервно захранване (Standby)

Изходящо напрежение, 6,300 - 6,600V

CE сертификат

#### Антивибрационни демпфери

Стандартни антивибрационни демпфери

#### Двигател

Cummins KTA50G8, дизелов в съответствие с **ISO 3046**

Горивна система с директно впръскване

Работен обем на двигателя: 50 л.

Диаметър на буталото: 159 мм.

Ход на буталото: 159 мм.

Обороти: 1500 rpm

Скорост на буталото: 7,9 m/s

Брой цилиндри: 16 цилиндъра

Капацитет на смазочната течност: 178л.

Степен на съгъстяване: 14.9:1

Заряден алтернатор 1800 amps

#### Управление на двигателя - Електронно

Електрическа инсталация на двигателя - 24V

Въздушен филтър на двигателя с нормална замърсеност

#### Нагревател на охлаждащата течност, 240V

**Горивен филтър: Dual spin-on paper element fuel filters with standard water separator**

Гъвкава връзка между изхода на турбината и шумозаглушителя

#### Алтернатор

**P80HVR, 50 Hertz (Hz), 6,300 - 6,600V, 125C, Резервно захранване)**

Безчетков, 4 полюса, въртящи се полета

Статор Стъпка 2/3

Директно куплиран с гъвкав диск

**Система на изолация Клас H****Защита IP23**

Стандартно повишаване на температурата 163°C в режим резервно  
захранване при околна температура 27°C

Възбудител / Регулатор на напрежението AVR

**Система за възбуждане с Постоянно магнитен генератор – PMG****Нагревател на алтернатора против конденз и влага****Допълнителна изолация против влажност****Охлаждане: Центробежен вентилатор за директно задвижване****Съотношение на късо съединение: 1/Xd****Шумозаглушаване**

40' контейнер, оборудван с входящи и изходящи жалузийни решетки, вътрешно и  
аварийно осветление, резидентални Шумозаглушители

**Охлаждаща система**

Радиатор за охлаждащата течност на двигателя, 40°C околна температура

Охлаждаща течност, 50% Антифриз, 50% Вода

**Токов прекъсвач**

-

**Табло за входни кабели**

Табло за входни кабели, позиционирано в ляво

Вход на кабелите - отдолу

**Опции на контролната система**

Контролна система Power Command Control 3.3

Дисплей контролен, LCD

Paralleling Isolated Bus

Език на контролната система – Английски

Предупреждение – ниско ниво на стартовите акумулатори

**Изключване на генератора при ниско ниво на охлаждащата течност**

Звукова аларма при изключване на генератора

Control Network Communication Interface

**Стартов акумулатор**

**Фабрично монтирани акумулатори, гарантиращи стартиране до 7 пъти  
последователно**

**Зареждане на акумулаторите**

Подзаряд на акумулаторите 10A, 240V – за монтаж на стена

**Тестове и сертификати**

Стандартен заводски тест

"CE" сертификат

Сертификат за заводски тестове

**Език на техническата документация**

Английски

**Гаранция**

**Две (2) години в режим на работа „Резервно захранване“ или 1000 м.ч.,  
което настъпи първо.**

➤ **Предлаганите дизелови генератори са производство на Cummins Power Generation.**

➤ **Дизеловият генератор C1675D5 шумозаглушен тип е предназначен за монтаж на открито. Шумозаглушаването се осъществява с 40' ISO HC контейнер**

оборудван с входящи и изходящи жалузийни решетки, шумозаглушители, горивен резервоар, вътрешно и аварийно осветление и двустранни входни врати за достъп.

➤ Специфицираната номинална мощност на трифазния дизелов генератор е в режим на резервно захранване ( $\cos \varphi = 0.8$ ).

➤ Дизеловият генератор представлява единна конструкция, състояща се от дизелов двигател и генератор за променлив ток, монтирани на обща стоманена рама. Двигателят и алтернаторът (синхронният генератор) са свързани помежду си с фланец, изключващ възможността от осево отклонение (даже и след продължителното му използване) и са закрепени на металната рама с помощни виброизолаторни тампони, осигуряващи пълно редуциране на вибрациите на рамата.

➤ Дизеловите генератори отговарят на всички изисквания, гарантиращи **автономност на резервното захранване:**

- Система за подгрев на охлаждащата течност (антифриза);
- Монтирано на системата зарядно устройство, осигуряващо постоянен подзаряд на стартовия акумулатор. При работа на генератора същия се дозарежда от заряден алтернатор, монтиран на двигателя.
- **Автоматично регулиране на изходящото напрежение (Automatic voltage regulator).**
- **Система за възбуждане с Постоянно магнитен генератор (Permanent Magnet Generator).**
- **Микропроцесорно базирана контролна система с цифров дисплей PowerComamnd 3.3 производство на Cummins Power Generation,** отчитаща всички параметри свързани с двигателя и алтернатора: напрежение във  $V_{DC}$  на стартовия акумулатор, налягане на маслото, температура на охлаждаща течност, отработени моточасове, електрически параметри: изходящи напрежения, честота, натоварване по фази; обработка и визуализация на грешки в системата, **ModBus протокол за комуникация с BMS;**
- **Контролната система PowerComamnd 3.3** има възможност за контролиране и работа с няколко генератора в паралел, както и възможността за работа на генератор и мрежа в паралел за целта е необходимо токовете прекъсвачи, които ще бъдат командвани от контролната система да имат VT (PT) и СТ.

➤ **Оферирания дизелов генератор е с дизелов двигател производство на Cummins.**

➤ **Алтернатора на дизеловия генератор е производство на Cummins Technologies ("Newage" - Stamford)**

➤ **Филтрите (въздушен, горивен, маслен) на дизеловия генератор са производство на Cummins Filtration – "Fleetguard".**

➤ Радиаторите за охлаждането на двигателите са съобразени с околна температура до 50°C и подгрева на охлаждащата течност на дизеловия генератор Cummins Power Generation позволява безотказната му работа при всякакви атмосферни условия.

➤

## 2. Ценово предложение

### 2.1. Цена на дизелов генератор C1675D5 Шумозаглушен тип

| Модел                       | Описание                                                                                                                                                           | Кол. | Ед. Цена   | Общо              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|-------------------|
| C1675D5                     | Дизелов генератор трифазен, 50Hz, номинална мощност <b>1400 kVA (1120 kW) 6,300 - 6,600V</b> в режим резервно, монтиран в контейнер и кабелна макара с 20м. кабели | 1    | 485 370,00 | 485 370,00        |
| <b>Общо в Евро без ДДС:</b> |                                                                                                                                                                    |      |            | <b>485 370,00</b> |

### 2.2. Цена на полуремарке с теглич за дизелов генератор

| №                           | Описание                                  | Кол. | Ед. Цена  | Общо             |
|-----------------------------|-------------------------------------------|------|-----------|------------------|
| 1                           | Полуремарке с теглич за дизелов генератор | 1    | 70 000,00 | 70 000,00        |
| <b>Общо в Евро без ДДС:</b> |                                           |      |           | <b>70 000,00</b> |

Горепосочените цени на оборудването по т.2.1. и 2.2. са **в ЕВРО, без включен ДДС.**

В цената на оборудването е включен транспорт на оборудването до Ваш обект в гр. Козлодуй.

## 3. Начин на плащане

По договаряне

## 4. Срокове за доставка

**4.1.** Дизелов генератор C1675D5 Шумозаглушен тип – до 52 седмици след извършена заявка и авансово плащане по т.4, в зависимост от складовите наличности в завода-производител.

## 5. Гаранция

**5.1.** Дизелов генератор C1675D5 - Две (2) години международна гаранция в режим на работа „Резервно хранване“ до 1000 м.ч.

## 6. Валидност на офертата

**6.1.** Офертата е валидна до 31.03.2022 година

## 7. Сервиз и обслужване на генераторни системи Cummins Power Generation

ИПО ООД е официален дистрибутор и оторизиран сервиз (от завода производител) на Cummins Power Generation за България и изпълнява гаранционните и извънгаранционните ремонти на генераторните системи. ИПО

ООД предлага и извършване на техническите обслужвания през Гаранционния период и след него.

Фирма ИПО ООД разполага с 4 сервизни бази – София, Карлово, Панагюрище и Варна. Сервизните бази на фирмата са оборудвани с необходимите оригинални стендове и инструменти, за извършване на пълни основни ремонт. В сервизната база има голям склад с богато разнообразие от налични резервни части за всички модели генератори и двигатели на Cummins, както и на възли за тях и консумативи. Фирмата разполага с квалифицирани и правоспособни механици и сервизни автомобили, с които извършва ремонти и обслужвания на място. Всеки механик и ел. техник във фирма ИПО ООД притежава сертификати издадени от Cummins за преминали успешно курсове на обучение за ремонт и поддръжка на дизеловите генераторни системи.

**Фирмата предлага 24 часово дежурство на механик със сервизен автомобил и на практика в рамките на 4 часа след повикване, сервизен екип може да бъдат на площадката, където е монтиран агрегата.**

Фирма ИПО ООД притежава собствена мобилна товарна банка с капацитет 300 kW, с която може да извършва тестове на генератори под товар на място на площадката където са монтирани генераторите.

**ИПО ООД притежава следните сертификати:**

- Сертификат ISO 9001;
- Сертификат ISO 14001;
- Сертификат OHSAS 18001;

## **8. Приложения**

### **8.1. Технически спецификации**

- 27 стр.

С уважение,

Карел Райчев - Мениджър Дизелови Генератори „Cummins Power Generation“  
ИПО ООД, Моб: 0888 127 116, e-mail: [raytchev@ipo-bg.com](mailto:raytchev@ipo-bg.com), web: [www.ipo-bg.com](http://www.ipo-bg.com)



# Diesel generator set KTA50 series engine

1250 kVA - 1675 kVA 50 Hz  
1120 kW - 1545 kW 60 Hz



## Description

This Cummins® commercial generator set is a fully integrated power generation system, providing optimum power performance, reliability, and versatility for stationary Standby, Prime Power, and Continuous duty applications.

## Features

**Cummins heavy-duty engine** - Rugged 4-cycle industrial diesel delivers reliable power, low emissions and fast response to load changes.

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

**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-circuits capability, and class F or H insulation.

**Control system** - Standard PowerCommand® electronic control provides total system integration including remote start/stop, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown.

**Cooling system** - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

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

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

**ISO8528-5 G3 Capable** – Refer to factory for site and configuration specific transient performance specification.

| Model            | Standby rating    |                   | Prime rating      |                   | Emissions compliance<br>TA Luft – EU Stage | Data sheets |           |
|------------------|-------------------|-------------------|-------------------|-------------------|--------------------------------------------|-------------|-----------|
|                  | 50 Hz<br>kVA (kW) | 60 Hz<br>kW (kVA) | 50 Hz<br>kVA (kW) | 60 Hz<br>kW (kVA) |                                            | 50 Hz       | 60 Hz     |
| <b>C1400 D5</b>  | 1400 (1120)       |                   | 1250 (1000)       |                   |                                            | DS44-CPGK   |           |
| <b>C1675 D5</b>  | 1675 (1340)       |                   | 1400 (1120)       |                   |                                            | DS46-CPGK   |           |
| <b>C1675 D5A</b> | 1675 (1340)       |                   | 1500 (1200)       |                   |                                            | DS47-CPGK   |           |
| <b>C1250 D6</b>  |                   | 1270 (1588)       |                   | 1120 (1400)       |                                            |             | DS84-CPGK |
| <b>C1500 D6</b>  |                   | 1545 (1931)       |                   | 1286 (1608)       |                                            |             | DS85-CPGK |

## Generator set specifications

|                                          |                                 |
|------------------------------------------|---------------------------------|
| Governor regulation                      | ISO 8528 part 1                 |
| Voltage regulation, no load to full load | ± 1%                            |
| Random voltage variation                 | ± 1%                            |
| Frequency regulation                     | Isochronous                     |
| Random frequency variation               | ± 0.25%                         |
| EMC compatibility                        | BS EN61000-6-4 / BS EN61000-6-2 |

## Engine specifications

|                             |                                                                       |
|-----------------------------|-----------------------------------------------------------------------|
| Design                      | 4 cycle, V-block, turbocharged and after-cooled                       |
| Bore                        | 158.8 mm (6.25 in.)                                                   |
| Stroke                      | 158.8 mm (6.25 in.)                                                   |
| Displacement                | 50 L (3067 in <sup>3</sup> )                                          |
| Cylinder block engine       | Sixteen-cylinder vee formation, direct injection, four-cycle diesel   |
| Battery capacity            | 1800 amps at ambient temperature 32 °F (0 °C)                         |
| Battery charging alternator | 55 amps                                                               |
| Starting voltage            | 24 Volts, negative ground                                             |
| Fuel system                 | Direct injection                                                      |
| Fuel filter                 | Dual spin on paper element fuel filters with standard water separator |
| Air cleaner type            | Dry replaceable element                                               |
| Lube oil filter type(s)     | Spin-on paper element full flow and bypass lube oil filters           |
| Standard cooling system     | 104 °F (40 °C) ambient radiator                                       |

## Alternator specifications

|                                              |                                                          |
|----------------------------------------------|----------------------------------------------------------|
| Design                                       | Brushless, 4 pole, drip proof revolving field            |
| Stator                                       | 2/3 pitch                                                |
| Rotor                                        | Direct coupled by flexible disc                          |
| Insulation system                            | Class H                                                  |
| Standard temperature rise                    |                                                          |
| Exciter type                                 | Permanent Magnet Generator (PMG)                         |
| Phase rotation                               | A (U), B (V), C (W)                                      |
| Alternator cooling                           | Direct drive centrifugal blower fan                      |
| AC waveform Total Harmonic Distortion (THDV) | No load < 1.5%. Non distorting balanced linear load < 5% |
| Telephone Influence Factor (TIF)             | < 50% per NEMA MG1-22.43                                 |
| Telephone Harmonic Factor (THF)              | No load < 1.5%. Non distorting balanced linear load < 5% |

## Available voltages

| 50 Hz Line – Neutral/Line – Line |              | 60 Hz Line – Neutral/Line – Line |              |
|----------------------------------|--------------|----------------------------------|--------------|
| • 220/380*                       | • 1905/3300  | • 219/380                        | • 2400/4160  |
| • 230/400                        | • 3640/6300  | • 254/440                        | • 7200/12470 |
| • 240/415                        | • 3810/6600  | • 277/480                        | • 7620/13200 |
| • 254/440                        | • 6350/11000 | • 347/600                        | • 7970/13800 |

\*Derate may be applicable at this voltage. Please consult the factory for details.

## Generator set options

### Engine

- Heavy duty air filter
- Water jacket heater 220/240 V
- Oil sampling valve
- UK built engine and alternator

### Enclosure

- High-cube 40ft container

### Alternator

- Alternator heater
- High humidity isolation
- Exciter voltage regulator (PMG)
- Hardened Bearing Cartridge

### Control panel

- 3 pole main circuit breaker
- 4 pole main circuit breaker

### Warranty

- 5 years for Standby application
- 2 years for Prime application

### Silencer

- 9 dB attenuation critical silencer
- 25 dB residential – delivered loose

### Cooling

- Antifreeze 50/50 (Ethylene glycol)

\*Note: Some options may not be available on all models - consult factory for availability.

**Our energy working for you.™**

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[power.cummins.com](http://power.cummins.com)



## PowerCommand 3.3 control system



The PowerCommand 3.3 control system is an integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing.

**AmpSentry** – Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

**Power management** – Control function provides battery monitoring and testing features and smart starting control system.

**Advanced control methodology** – Three phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

**Communications interface** – Control comes standard with PCCNet and Modbus interface.

**Regulation compliant** – Prototype tested: UL, CSA and CE compliant.

**Service** – InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

**Reliable design** – The control system is designed for reliable operation in harsh environment.

### Multi-language support

### Operator panel features

**Operator panel features** – The operator panel, in addition to the alternator, displays the Utility/AC Bus data.

### Operator/display functions

- 320 x 240 pixels graphic LED backlight LCD
- Auto, manual, start, stop, fault reset and lamp test/panel lamp switches
- Alpha-numeric display with pushbuttons
- LED lamps indicating genset running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop

### Paralleling control functions

- Digital frequency synchronization and voltage matching
- Isochronous kW and kVar load sharing controls
- Droop kW and kVar control
- Sync check
- Extended paralleling (peak shave/base load)
- Digital power transfer control (AMF) provides load transfer operation in open or closed transition or soft (ramping) transfer mode

### Alternator data

- Line-to-Neutral and Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kW, kVar, power factor kVA (three phase and total)

### Engine data

- DC voltage
- Engine speed
- Lube oil pressure and temperature
- Coolant temperature
- Comprehensive FAE data (where applicable)

### Other data

- Genset model data
- Start attempts, starts, running hours, kW hours
- Load profile (operating hours at % load in 5% increments)
- Fault history
- Data logging and fault simulation (requires InPower)

### Standard control functions

#### Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

#### Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase, 4-wire Line-to-Line sensing
- Configurable torque matching

#### AmpSentry AC protection

- AmpSentry protective relay
- Over current and short circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field overload

#### Engine protection

- Battery voltage monitoring, protection and testing
- Over speed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- Fail to start (over crank) shutdown
- Fail to crank shutdown
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown
- Full authority electronic engine protection

#### Control functions

- Time delay start and cool down
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop
- Data logging
- Cycle cranking
- Load shed
- Configurable inputs and outputs (4)
- Remote emergency stop

#### Options

- Auxiliary output relays (2)

**Emergency Standby Power (ESP):**

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP):**

Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.

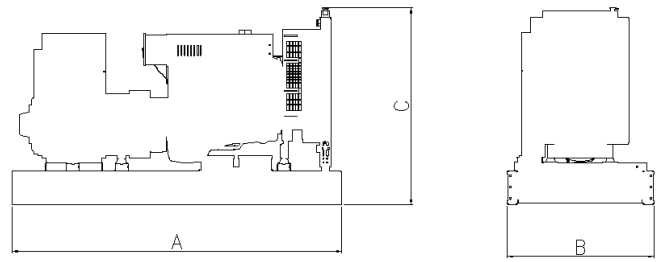
**Prime Power (PRP):**

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP):**

Applicable for supplying power continuously to a constant electrical load for unlimited hours.

Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is to provide representative configuration details for model series only.



See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

| Model     | Dim 'A' (mm) | Dim 'B' (mm) | Dim 'C' (mm) | Set weight* dry (kg) | Set weight* wet (kg) |
|-----------|--------------|--------------|--------------|----------------------|----------------------|
| C1400 D5  | 5105         | 2000         | 2238         | 9190                 | 9613                 |
| C1675 D5  | 5811         | 2033         | 2330         | 10348                | 10967                |
| C1675 D5A | 5811         | 2033         | 2330         | 10348                | 10967                |
| C1250 D6  | 5105         | 2000         | 2238         | 9190                 | 9613                 |
| C1500 D6  | 5811         | 2033         | 2330         | 10348                | 10967                |

\* Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

## Codes and standards

|                                                                                     |                                                                                                                                      |                                                                                      |                                                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. |  | This generator set is available with CE certification subject to EU RoHS exclusion per EU 2011/65. |
| 2000/14/EC                                                                          | All enclosed products are designed to meet or exceed EU noise legislation 2000/14/EC step 2006.                                      | ISO 8528                                                                             | This generator set has been designed to comply with ISO 8528 regulation.                           |

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## Generator set data sheet



**Model:** C1675 D5  
**Frequency:** 50 Hz  
**Fuel type:** Diesel

|             |           |
|-------------|-----------|
| Spec sheet: | SS16-CPGK |
|-------------|-----------|

| Fuel consumption | Standby     |      |      |      | Prime       |      |      |      |
|------------------|-------------|------|------|------|-------------|------|------|------|
|                  | kVA (kW)    |      |      |      | kVA (kW)    |      |      |      |
| Ratings          | 1675 (1340) |      |      |      | 1400 (1120) |      |      |      |
| Load             | 1/4         | 1/2  | 3/4  | Full | 1/4         | 1/2  | 3/4  | Full |
| US gph           | 24.3        | 43.7 | 66.8 | 91.2 | 21.7        | 40.9 | 58.7 | 76.3 |
| L/hr             | 92          | 165  | 253  | 345  | 82          | 155  | 222  | 289  |

| Engine                         | Standby rating                                | Prime rating |
|--------------------------------|-----------------------------------------------|--------------|
| Engine manufacturer            | Cummins                                       |              |
| Engine model                   | KTA50 G8                                      |              |
| Configuration                  | Cast iron, 60 ° V16 cylinder                  |              |
| Aspiration                     | Turbocharged and low temperature after-cooled |              |
| Gross engine power output, kWm | 1429                                          | 1200         |
| BMEP at set rated load, kPa    | 2275                                          | 1910         |
| Bore, mm                       | 159                                           |              |
| Stroke, mm                     | 159                                           |              |
| Rated speed, rpm               | 1500                                          |              |
| Piston speed, m/s              | 7.9                                           |              |
| Compression ratio              | 14.9:1                                        |              |
| Lube oil capacity, L           | 178                                           |              |
| Overspeed limit, rpm           | 1725 ±50                                      |              |
| Regenerative power, kW         | 116                                           |              |
| Governor type                  | Electronic                                    |              |
| Starting voltage               | 24 Volts DC                                   |              |

| Fuel flow                             |     |
|---------------------------------------|-----|
| Maximum fuel flow, L/hr               | 570 |
| Maximum fuel inlet restriction, mm Hg | 203 |
| Maximum fuel inlet temperature, °C    | 70  |

| <b>Air</b>                           | <b>Standby rating</b> | <b>Prime rating</b> |
|--------------------------------------|-----------------------|---------------------|
| Combustion air, m <sup>3</sup> /min  | 99.3                  | 90.0                |
| Maximum air cleaner restriction, kPa | 6.2                   |                     |

| <b>Exhaust</b>                                          |     |     |
|---------------------------------------------------------|-----|-----|
| Exhaust gas flow at set rated load, m <sup>3</sup> /min | 261 | 231 |
| Exhaust gas temperature, °C                             | 510 | 485 |
| Maximum exhaust back pressure, kPa                      | 6.7 |     |

| <b>Standard set-mounted radiator cooling</b>                            |       |       |
|-------------------------------------------------------------------------|-------|-------|
| Ambient design, °C                                                      | 40    |       |
| Fan load, kWm                                                           | 30.0  |       |
| Coolant capacity (with radiator), L                                     | 496   |       |
| Cooling system air flow, m <sup>3</sup> /sec @ 12.7 mm H <sub>2</sub> O | 21.7  |       |
| Total heat rejection, Btu/min                                           | 52430 | 42210 |
| Maximum cooling air flow static restriction mm H <sub>2</sub> O         | 12.7  |       |

| <b>Optional set-mounted radiator cooling</b>                            |       |       |
|-------------------------------------------------------------------------|-------|-------|
| Ambient design, °C                                                      | 50    |       |
| Fan load, kWm                                                           | 30.0  |       |
| Coolant capacity (with radiator), L                                     | 501   |       |
| Cooling system air flow, m <sup>3</sup> /sec @ 12.7 mm H <sub>2</sub> O | 28.8  |       |
| Total heat rejection, Btu/min                                           | 62600 | 51850 |
| Maximum cooling air flow static restriction mm H <sub>2</sub> O         | 12.7  |       |

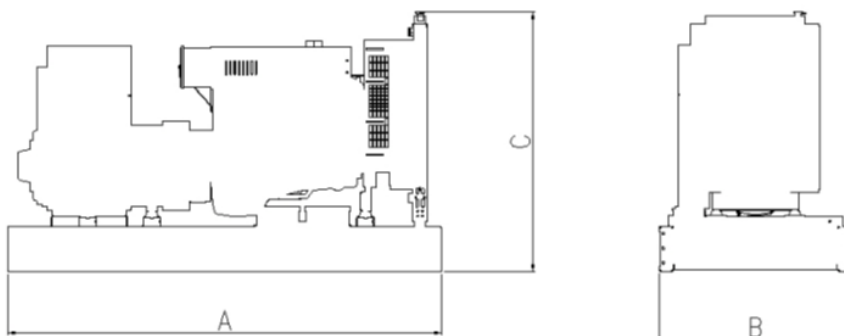
| <b>Weights*</b>     | <b>Open</b> | <b>Enclosed</b> |
|---------------------|-------------|-----------------|
| Unit dry weight kgs | 10348       | 18199           |
| Unit wet weight kgs | 10967       | 18818           |

\* Weights represent a set with standard features. See outline drawing for weights of other configurations.

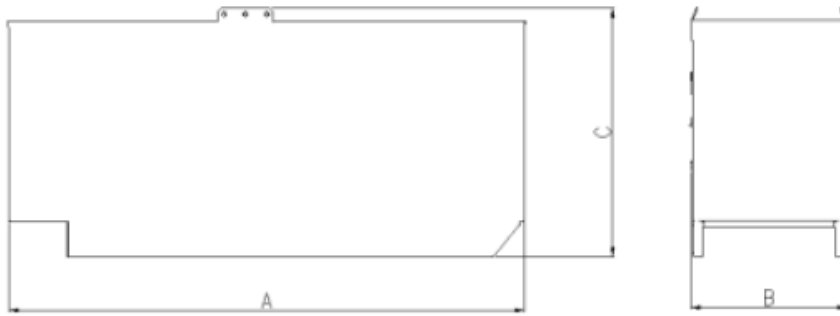
| <b>Dimensions</b>                                        | <b>Length</b> | <b>Width</b> | <b>Height</b> |
|----------------------------------------------------------|---------------|--------------|---------------|
| Standard open set dimensions mm                          | 5811          | 2033         | 2330          |
| Enclosed set standard dimensions (with exhaust stack) mm | 12192         | 2438         | 2896 (3233)   |

## Genset outline

### Open set



## Enclosed set



Outlines are for illustrative purposes only. Please refer to the genset outline drawing for an exact representation of this model.

## Alternator data

| Connection   | Temp rise °C | Duty | Alternator | Voltage        |
|--------------|--------------|------|------------|----------------|
| Wye, 3-phase | 150/125      | S/P  | PI734D     | 380 – 440 V    |
| Wye, 3-phase | 125/105      | S/P  | MVSI804R   | 3300 V         |
| Wye, 3-phase | 125/105      | S/P  | HVSI804R   | 6300 – 6600 V  |
| Wye, 3-phase | 125/105      | S/P  | HVSI804R   | 10000 V        |
| Wye, 3-phase | 125/105      | S/P  | HVSI804R   | 10500 –11000 V |

## Ratings definitions

| Emergency Standby Power (ESP):                                                                                                                                                                                                                                           | Limited-Time Running Power (LTP):                                                                                                                | Prime Power (PRP):                                                                                                                                                                                                                        | Base Load (Continuous) Power (COP):                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

## Formulas for calculating full load currents:

### Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

### Single phase output

$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$

### See your distributor for more information.

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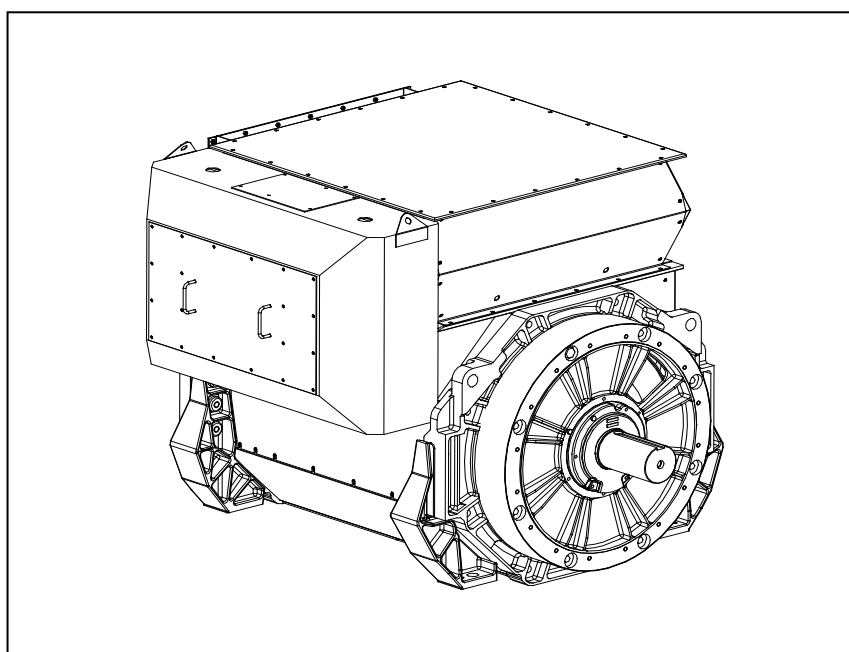
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DS46-CPGK (07/19)



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# STAMFORD®

## HV 804 R WDG 61 - Technical Data Sheet



# FRAME HV 804 R

## SPECIFICATIONS & OPTIONS

**STAMFORD**

### STANDARDS

STAMFORD AC generators are designed to meet the performance requirements of IEC EN 60034-1. Other international standards, including BS5000, VDE 0530, NEMA MG1-32, AS1359, CSA C22.2, UL and CE; as well as a wide range of international Marine Certification Approvals, can be met on request. For clarification regarding compliance please contact Cummins Generator Technologies.

### DESCRIPTION

The STAMFORD PI range of synchronous ac generators are brushless with a rotating field. They are separately excited by the STAMFORD Permanent Magnet Generator (PMG). This is a shaft mounted, high frequency, pilot exciter which provides a constant supply of clean power via the Automatic Voltage Regulator (AVR) to the main exciter. The main exciter output is fed to the main rotor, through a full wave bridge rectifier, protected by surge suppression.

### VOLTAGE REGULATORS

The P range generators complete with a PMG are available with one AVR. The AVR has soft start voltage build up and built in protection against sustained over-excitation, which will de-excite the generator after a minimum of 8 seconds. Underspeed protection (UFRO) is also provided on both AVRs. The UFRO will reduce the generator output voltage proportional to the speed of the generator below a pre-settable level.

The **MA330 AVR** is 3 phase rms sensed with a voltage regulation of 0.5% rms (see the note on regulation). The UFRO circuit has adjustable slope and dwell for controlled recovery from step loads. An over voltage protection circuit will shutdown the output device of the AVR, it can also trip an optional excitation circuit breaker if required. As an option, short circuit current limiting is available with the addition of current transformers.

The MA330 AVR needs a generator mounted current transformer to provide quadrature droop characteristics for load sharing during parallel operation. Provision is also made for the connection of the STAMFORD power factor controller, for embedded applications, and a remote voltage trimmer.

### WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low levels of voltage waveform distortion.

### TERMINALS & TERMINAL BOX

Standard generators feature a main stator with 6 ends brought out to the terminals, which are mounted on the frame at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

### SHAFT & KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.

### INSULATION/IMPREGNATION

The insulation system is class 'F'. All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

### QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

### NOTE ON REGULATION

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing is typical of the product range.

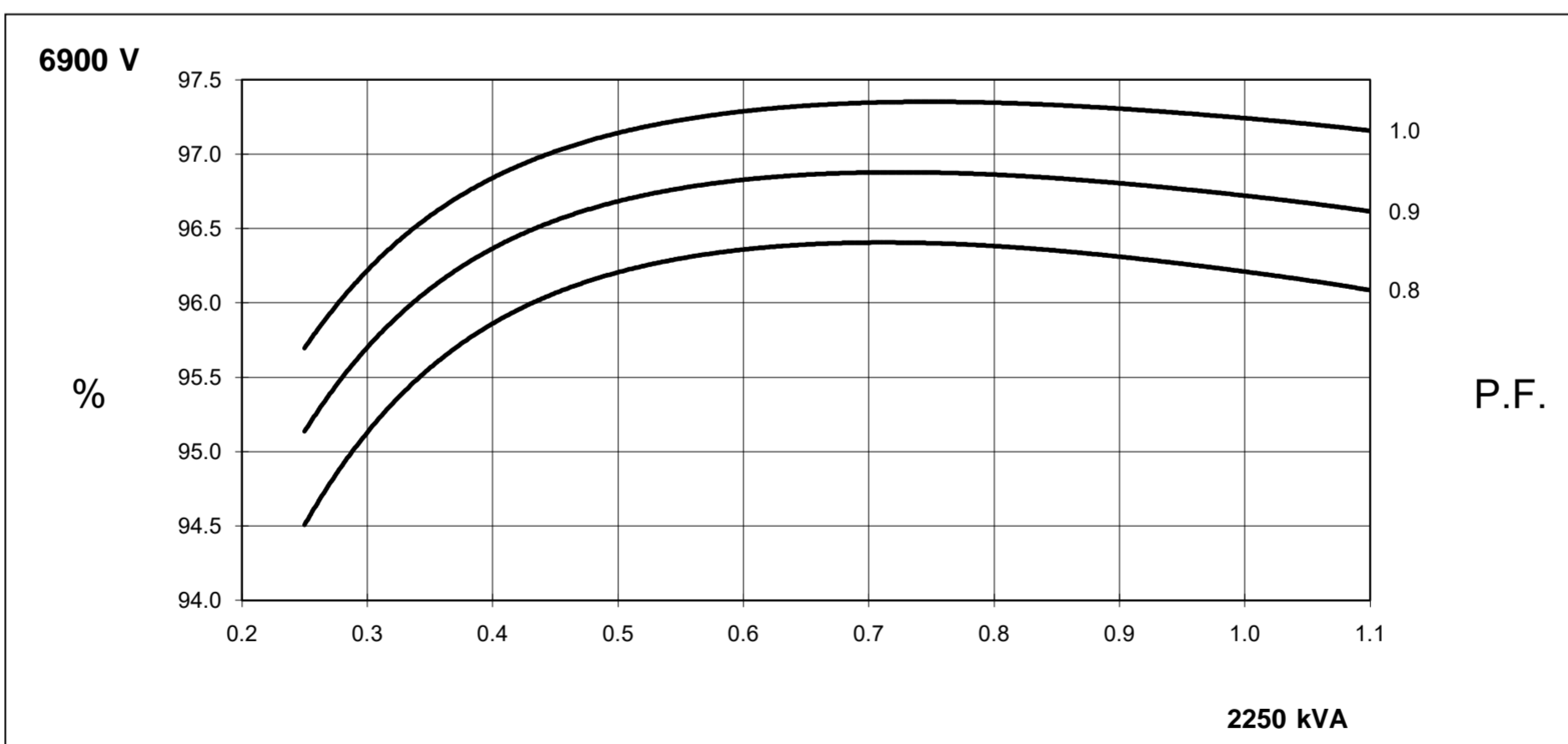
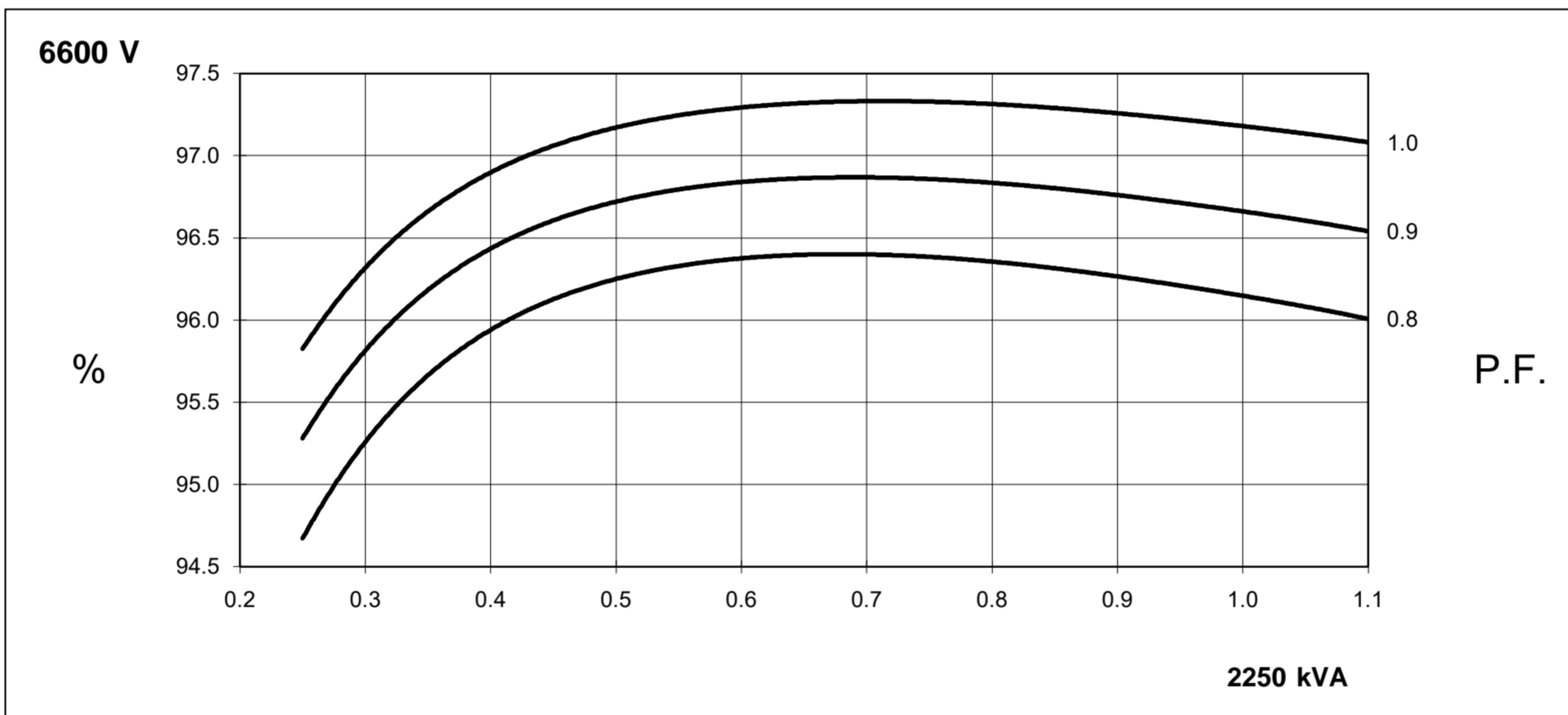
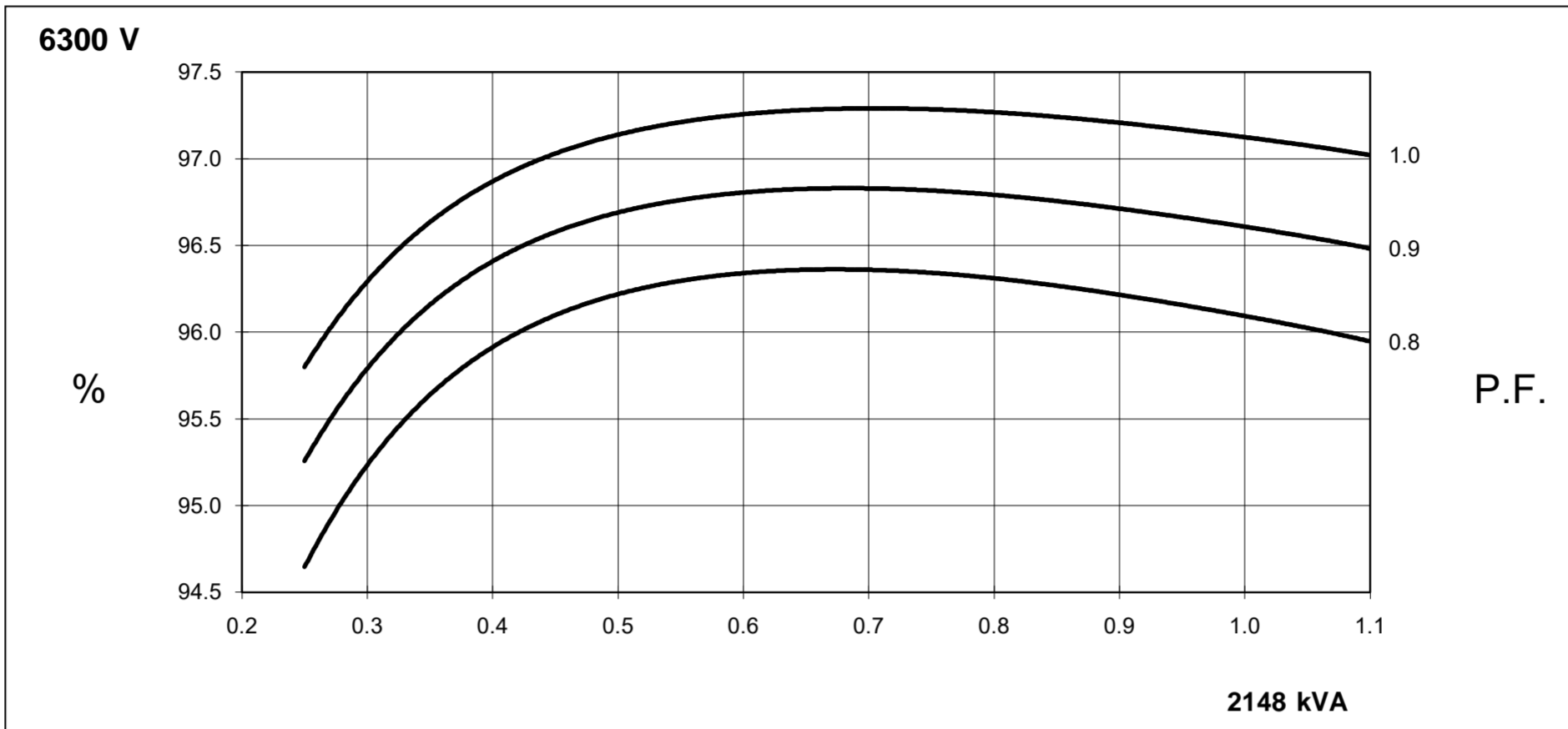


**FRAME HV 804 R  
WINDING 61**

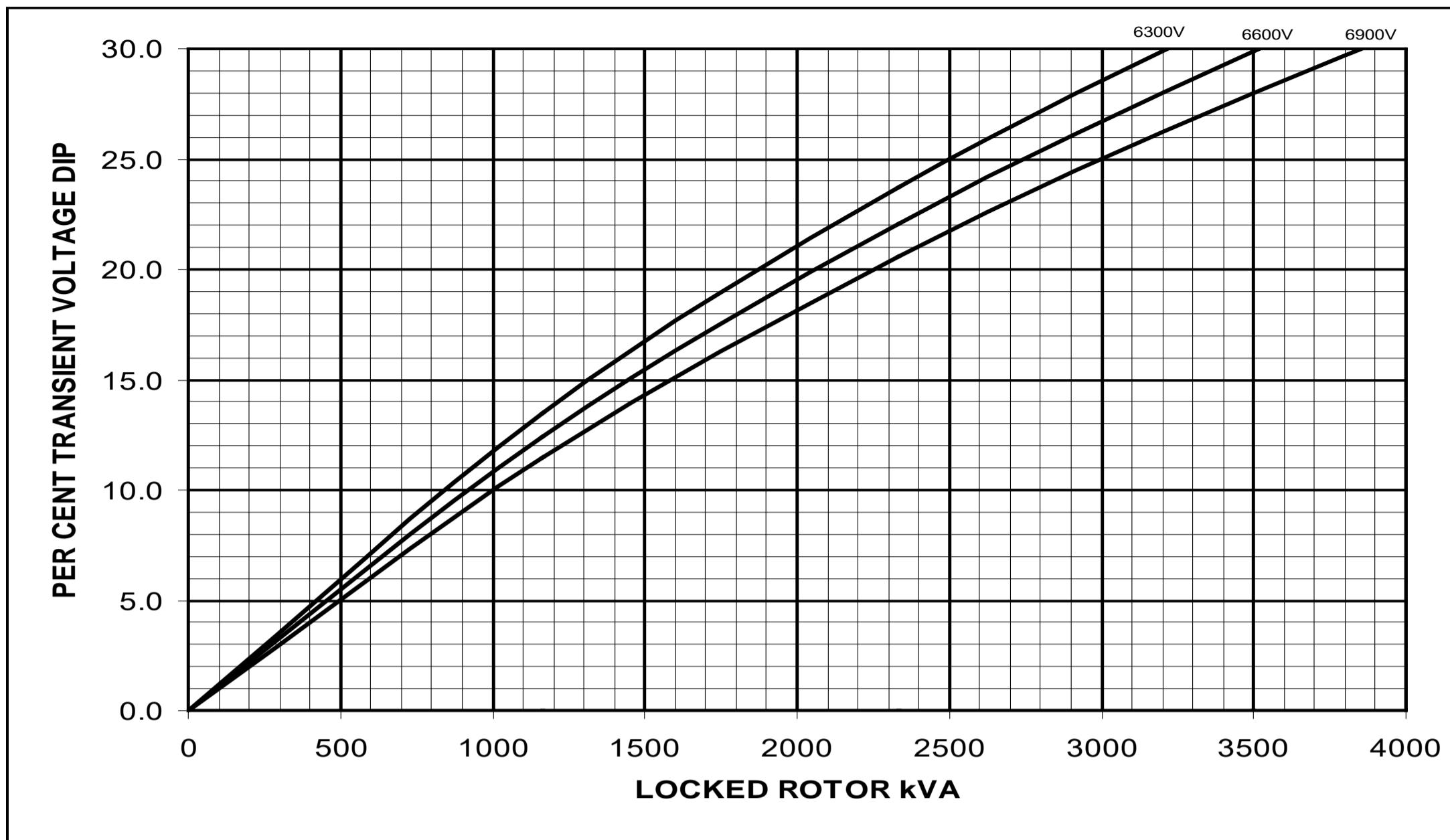
|                                              |                                                                                |                          |       |
|----------------------------------------------|--------------------------------------------------------------------------------|--------------------------|-------|
| MAXIMUM ALTITUDE                             | 1000 METRES ABOVE SEA LEVEL                                                    |                          |       |
| MAXIMUM AMBIENT TEMPERATURE                  | 40° C                                                                          |                          |       |
| CONTROL SYSTEM SERIES 3                      | SEPARATELY EXCITED BY P.M.G.                                                   |                          |       |
| A.V.R.                                       | FULL WAVE RECTIFIED                                                            |                          |       |
| VOLTAGE REGULATION                           | ± 0.5%                                                                         | WITH 4% ENGINE GOVERNING |       |
| SUSTAINED SHORT CIRCUIT                      | REFER TO SHORT CIRCUIT DECREMENT CURVES OF THIS SECTION                        |                          |       |
| INSULATION SYSTEM                            | CLASS F                                                                        |                          |       |
| PROTECTION                                   | IP23 STANDARD                                                                  |                          |       |
| RATED POWER FACTOR                           | 0.8                                                                            |                          |       |
| STATOR WINDING                               | DOUBLE LAYER LAP                                                               |                          |       |
| WINDING PITCH                                | 2/3                                                                            |                          |       |
| WINDING LEADS                                | 6                                                                              |                          |       |
| R.F.I. SUPPRESSION                           | BS EN 50081/2-1/2 VDE 0875G VDE 0875N For other standards apply to the factory |                          |       |
| WAVEFORM DISTORTION                          | NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 3.0%                      |                          |       |
| MAXIMUM OVERSPEED                            | 2250 Rev/Min                                                                   |                          |       |
| BEARING DRIVE END                            | ISO 6232 C3                                                                    |                          |       |
| BEARING NON DRIVE END                        | ISO 6324 C3                                                                    |                          |       |
| EFFICIENCY                                   | REFER TO EFFICIENCY CURVES OF THIS SECTION                                     |                          |       |
| FREQUENCY                                    | 50Hz                                                                           |                          |       |
| TELEPHONE INTERFERENCE                       | THF < 2%                                                                       |                          |       |
| COOLING AIR                                  | 3 m <sup>3</sup> /sec                                                          |                          |       |
| VOLTAGE STAR (Y)                             | 6300                                                                           | 6600                     | 6900  |
| KVA BASE RATING FOR REACTANCE VALUES         | 2148                                                                           | 2250                     | 2250  |
| X <sub>d</sub> DIRECT AXIS SYNCHRONOUS       | 2.51                                                                           | 2.40                     | 2.20  |
| X' <sub>d</sub> DIRECT AXIS TRANSIENT        | 0.215                                                                          | 0.205                    | 0.188 |
| X'' <sub>d</sub> DIRECT AXIS SUB-TRANSIENT   | 0.160                                                                          | 0.153                    | 0.140 |
| X <sub>q</sub> QUADRATURE AXIS REACTANCE     | 1.77                                                                           | 1.690                    | 1.55  |
| X'' <sub>q</sub> QUAD. AXIS SUB-TRANSIENT    | 0.299                                                                          | 0.285                    | 0.261 |
| X <sub>L</sub> LEAKAGE REACTANCE             | 0.118                                                                          | 0.113                    | 0.103 |
| X <sub>2</sub> NEGATIVE PHASE SEQUENCE       | 0.231                                                                          | 0.220                    | 0.201 |
| X <sub>0</sub> ZERO PHASE SEQUENCE           | 0.035                                                                          | 0.033                    | 0.030 |
| REACTANCES ARE SATURATED                     | VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED                            |                          |       |
| T' <sub>d</sub> TRANSIENT TIME CONSTANT      | 0.200                                                                          |                          |       |
| T'' <sub>d</sub> SUB-TRANSIENT TIME CONSTANT | 0.015                                                                          |                          |       |
| T' <sub>do</sub> O.C. FIELD TIME CONSTANT    | 4.00                                                                           |                          |       |
| T <sub>a</sub> ARMATURE TIME CONSTANT        | 0.07                                                                           |                          |       |
| SHORT CIRCUIT RATIO                          | 1/X <sub>d</sub>                                                               |                          |       |
| STATOR WINDING RESISTANCE (L-N)              | 0.1818                                                                         |                          |       |
| ROTOR WINDING RESISTANCE                     | 1.320                                                                          |                          |       |
| EXCITER STATOR FIELD RESISTANCE              | 17.50                                                                          |                          |       |
| EXCITER ROTOR RESISTANCE (L-L)               | 0.076                                                                          |                          |       |
| PMG STATOR RESISTANCE (L-L)                  | 3.800                                                                          |                          |       |
|                                              | RESISTANCE VALUES ARE IN OHMS AT 20° C                                         |                          |       |
| NO LOAD EXCITATION VOLTAGE                   | 15.0                                                                           |                          |       |
| FULL LOAD EXCITATION VOLTAGE                 | 63.0                                                                           |                          |       |

Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

**THREE PHASE EFFICIENCY CURVES**



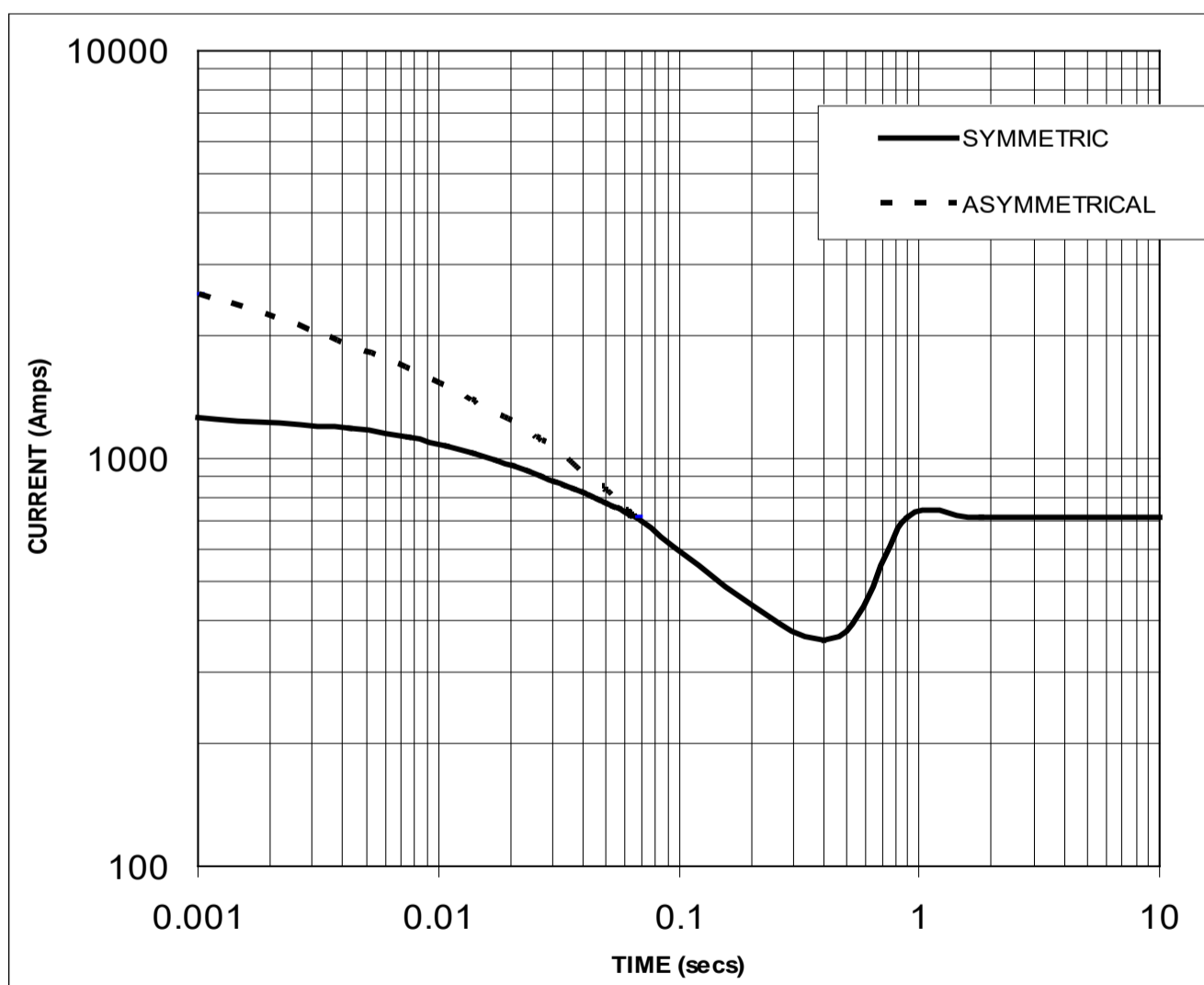
FULL WAVE RECTIFIED AVR  
 LOCKED ROTOR MOTOR STARTING CURVE



FRAME HV 804 R WDG 61 50Hz

Three Phase Short Circuit Decrement Curve  
 No- Load Excitation at Rated Speed

Based on series star (wye) connection



NOTE 1  
 THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO ADJUST THE VALUES FROM CURVES BETWEEN THE 0.001 SECONDS AND THE MINIMUM CURRENT POINT IN RESPECT OF NOMINAL OPERATING VOLTAGE

| VOLTAGE | FACTOR |
|---------|--------|
| 6300V   | X 0.95 |
| 6600V   | X 1.00 |
| 6900V   | X 1.05 |

THE SUSTAINED CURRENT VALUE IS CONSTANT IRRESPECTIVE OF VOLTAGE LEVEL

NOTE 2  
 THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO CONVERT THE VALUES CALCULATED IN ACCORDANCE WITH NOTE 1 TO THOSE APPLICABLE TO THE VARIOUS TYPES OF SHORT CIRCUIT

|                               | 3 PHASE | 2 PHASE L-L | 1 PHASE L-N |
|-------------------------------|---------|-------------|-------------|
| INSTANTANEOUS                 | X 1.0   | X 0.87      | X 1.30      |
| MINIMUM                       | X 1.0   | X 1.80      | X 3.20      |
| SUSTAINED                     | X 1.0   | X 1.50      | X 2.50      |
| MAX SUSTAINED DURATION        | 10 SEC  | 5 SEC       | 2 SEC       |
| ALL OTHER TIMES ARE UNCHANGED |         |             |             |

SUSTAINED SHORT CIRCUIT = 718 Amps

FRAME HV 804 R  
WINDING 61                      0.8 Power Factor

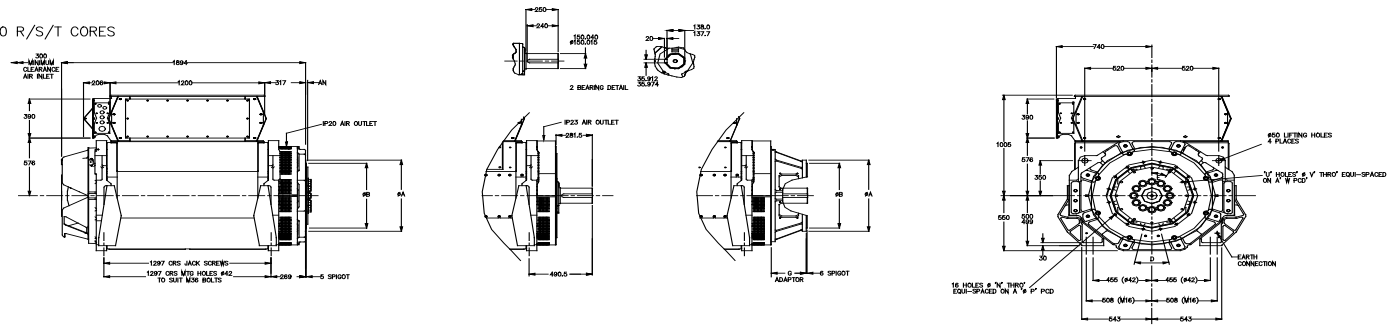


**RATINGS**

| Class - Temp Rise |                | Cont. F - 105/40°C |      |      | Cont. H - 125/40°C |      |      | Class F Standby - 125/40°C |      |      | Class F Standby - 138/27°C |      |      |
|-------------------|----------------|--------------------|------|------|--------------------|------|------|----------------------------|------|------|----------------------------|------|------|
| <b>50Hz</b>       | Star (V)       | 6300               | 6600 | 6900 | 6300               | 6600 | 6900 | 6300                       | 6600 | 6900 | 6300                       | 6600 | 6900 |
|                   | kVA            | 2148               | 2250 | 2250 | N/A                | N/A  | N/A  | 2291                       | 2400 | 2400 | 2386                       | 2500 | 2500 |
|                   | kW             | 1718               | 1800 | 1800 | N/A                | N/A  | N/A  | 1833                       | 1920 | 1920 | 1909                       | 2000 | 2000 |
|                   | Efficiency (%) | 96.1               | 96.1 | 96.2 | N/A                | N/A  | N/A  | 96.0                       | 96.0 | 96.1 | 95.9                       | 96.0 | 96.1 |
|                   | kW Input       | 1788               | 1872 | 1871 | N/A                | N/A  | N/A  | 1909                       | 1999 | 1998 | 1989                       | 2083 | 2081 |
| <b>60Hz</b>       | Star (V)       | N/A                | N/A  | N/A  | N/A                | N/A  | N/A  | N/A                        | N/A  | N/A  | N/A                        | N/A  | N/A  |
|                   | kVA            | N/A                | N/A  | N/A  | N/A                | N/A  | N/A  | N/A                        | N/A  | N/A  | N/A                        | N/A  | N/A  |
|                   | kW             | N/A                | N/A  | N/A  | N/A                | N/A  | N/A  | N/A                        | N/A  | N/A  | N/A                        | N/A  | N/A  |
|                   | Efficiency (%) | N/A                | N/A  | N/A  | N/A                | N/A  | N/A  | N/A                        | N/A  | N/A  | N/A                        | N/A  | N/A  |
|                   | kW Input       | N/A                | N/A  | N/A  | N/A                | N/A  | N/A  | N/A                        | N/A  | N/A  | N/A                        | N/A  | N/A  |

**TYPICAL DIMENSIONS - Further arrangements available - please refer to factory**

P80 R/S/T CORES



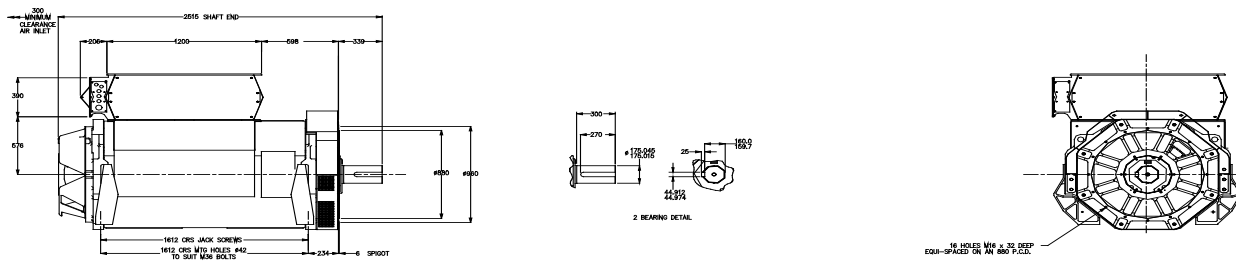
| P80 R/S/T CORES<br>1-BRG ADAPTORS |     |       |    |       |       |
|-----------------------------------|-----|-------|----|-------|-------|
| SAE                               | A   | B     | N  | P     | D     |
| SAE 0                             | 711 | 647.7 | 14 | 679.5 | 22.5" |
| SAE 00                            | 883 | 787.4 | 14 | 851.0 | 22.5" |

| P80 R/S/T/W/X CORES<br>1-BRG COUPLING DISC |      |       |    |      |       |     |
|--------------------------------------------|------|-------|----|------|-------|-----|
| SAE                                        | AN   | C     | U  | V    | W     | E   |
| 18                                         | 15.9 | 571.4 | 12 | 16.7 | 543.0 | 30° |
| 21                                         | 0    | 673.0 | 12 | 16.7 | 641.3 | 30° |
| 24                                         | 0    | 733.3 | 12 | 20.7 | 692.0 | 30° |

| P80 R/S/T/W/X CORES<br>2-BRG ADAPTORS |     |       |
|---------------------------------------|-----|-------|
|                                       | SAE | G     |
| P80 R/S/T                             | 0   | 271.5 |
| P80 R/S/T                             | 00  | 271.5 |
| P80 W/X                               | 0   | 271.5 |
| P80 W/X                               | 00  | 329.0 |

| P80 R/S/T/W/X CORES<br>2-BRG ADAPTORS |     |       |    |       |       |
|---------------------------------------|-----|-------|----|-------|-------|
| SAE                                   | A   | B     | N  | P     | D     |
| SAE 0                                 | 711 | 647.7 | 14 | 679.5 | 22.5" |
| SAE 00                                | 883 | 787.4 | 14 | 851.0 | 22.5" |

P80 W/X CORES



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# PowerCommand® 3.3 Generator Set Digital Integrated Control System



Bargraph Optional

## Introduction

The PowerCommand® 3.3 control system is a microprocessor-based generator set monitoring, metering, and control system, which is comprised of PowerCommand® Control 3300 and the Human Machine Interface 320. PCC3300 supports multiple operation modes including:

- Standalone,
- Synchronization only,
- Isolated bus paralleling,
- Utility single generator set paralleling,
- Utility multiple generator set paralleling,
- Utility single generator set paralleling with power transfer control (automatic mains failure),
- Isolated bus paralleling with Masterless Load Demand

PowerCommand® Control 3300 is designed to meet the exacting demands of the harsh and diverse environments of today's typical power generation applications for Full Authority Electronic or Hydromechanical engine power generator sets.

Offering enhanced reliability and performance over more conventional generator set controls via the integration of all generator control functions into a single system, PCC3300 is your Power of One generator set control solution.

## Benefits and Features

- 320 x 240 pixels graphical LED backlit LCD
- Multiple languages supported
- AmpSentry™ protection provides industry-leading generator overcurrent protection
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes

- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr control
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing is provided on applicable platforms
- Generator set monitoring (including metering) and protection with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- 12 V (DC) and 24 V (DC) battery operation
- RS-485 Modbus® interface for interconnecting to customer equipment
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards

# PowerCommand® Generator Set Digital Control System PCC 3300



## Introduction

PCC3300 is an industry-leading digital generator set control suitable for usage on a wide range of diesel and lean burn natural gas generator sets in both standalone as well as paralleling applications.

PowerCommand® is compatible with either shunt or PMG excitation, and is suitable for usage with reconnectable or non-reconnectable generators. Configuration for any frequency, voltage and power connection from 120 V (AC) to 600 V (AC) line-to-line or 601 V (AC) to 45k V (AC) with an external PT is supported. The PCC3300 derives its own power from the generator set starting batteries and functions over a voltage range of 8 V (DC) to 30 V (DC).

## Features

- PCC3300 supports configurable control features via software download using InPower PC-compatible software
- 12 V (DC) and 24 V (DC) battery operation
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing on applicable platform is provided, which is capable of providing isochronous frequency regulation
- Full authority J1939 CANBus® prime mover communications and control is provided for platforms with an Engine Control Module (ECM)
- AmpSentry™ protection provides industry-leading alternator overcurrent protection:
  - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
  - Reduces the risk of Arc Flash due to thermal overload or electrical faults by inverse time protection

- Generator set monitoring offers status information for all critical prime mover and generator functions
- AC and DC digital generator set metering is provided. AC measurements are configurable for single or three phase sensing with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Battery monitoring system continually monitors the battery output and warns of the potential occurrence of a weak battery condition
- Relay drivers for prime mover starter, fuel shutoff (FSO), glow plug/spark ignition power and switched B+ applications are provided
- Integrated generator set protection is offered to protect the prime mover and generator
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes
- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr Control
- The synchronization check function provides adjustments for phase angle window, voltage window, frequency window and time delay
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Advanced serviceability is offered via InPower™, a PC-based software service tool
- PCC3300 is designed for reliable operation in harsh environments with the unit itself being a fully encapsulated module
- RS-485 ModBus interface for interconnecting to customer equipment
- Native on PCC3300: Four discrete inputs, two dry contact relay outputs and two low-side driver outputs are provided and are all configurable.
  - Optional extra PCC3300 input and output capability available via AUX101
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards

## Base Control Functions

### HMI capability

Options: Local and remote HMI320 options are available

Operator adjustments: The HMI320 includes provisions for many set up and adjustment functions.

Genset hardware data: Access to the control and software part number, genset rating in kVA and genset model number is provided from the HMI320 or InPower.

Data logs: Information concerning all of the following parameters is periodically logged and available for viewing; engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history: Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

### Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

For Lean Burn Natural Gas Engine applications:

- Alternator heater status
- Alternator winding temperature (per phase) as well as alternator drive end and non-drive end bearing

### Utility/AC bus data

- Voltage (three phase line-to-line and line-to-neutral)
- Current (three phase and total)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

AmpSentry: 3x current regulation for downstream tripping/motor inrush management. Thermal damage curve (3-phase short) or fixed timer (2 sec for 1-Phase Short or 5 sec for 2-Phase short).

### Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Coolant temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Lean Burn Natural Gas (LBNG) application parameters include:

- Safety shutoff valve status
- Valve proving status
- Downstream gas pressure
- Gas inlet pressure
- Gas mass flow rate
- Control valve position
- Gas outlet pressure
- Manifold pressure and temperature
- Throttle position
- Compressor outlet pressure
- Turbo speed
- Compressor bypass position
- Cylinder configuration (e.g., drive end and non-drive end configurations)
- Coolant pressure 1 and 2 as well as coolant temperature 1 and 2 for both HT/LT respectively
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- Parent ECM internal temperature and isolated battery voltage
- Speed bias
- Child ECM internal temperature and isolated battery voltage
- Knock level, spark advance, and knock count (for up to 18 cylinders)
- Auxiliary supply disconnect status
- Engine heater status
- Coolant circulating pump status
- Lube oil priming pump status
- Lube oil status
- Oil heater status
- Derate authorization status
- Start system status
- Ventilator fan status
- Ventilation louvre status
- Radiator fan status
- DC PSU status
- Start inhibit/enable status and setup

Service adjustments – The HMI320 includes provisions for adjustment and calibration of genset control functions. Adjustments are protected by a password. Functions include:

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable input and output set up
- Meter calibration
- Paralleling setup
- Display language and units of measurement

## Prime Mover Control

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data transfer between genset and engine controller for control, metering and diagnostics.

12 V (DC) or 24 V (DC) nominal battery voltage is supported by PCC3300 for normal operation.

Temperature dependant prime mover governing dynamics: This function is supported enabling the engine to be responsive when warm and more stable when operating at lower temperature via providing control and modification over electronic governing parameters as a function of engine temperature.

Isochronous governing is provided in order to control prime mover speed within  $\pm 0.25\%$  of nominal rated speed for any steady state load from no load to full load. During operation frequency drift should not exceed  $\pm 0.5\%$  of nominal frequency given a 33°C (or 60°F) change in ambient temperature within an eight-hour period.

Droop electronic speed is governing capability is natively offered by PCC3300 to permit droop from 0% to 10% between no load to full load.

Remote start capability is built into the PCC3300 as the unit accepts a ground signal from remote devices to automatically command the starting of the generator set as well as the reaching of rated speed, voltage and frequency or otherwise run at idle speed until prime mover temperature is adequate. The presence of a remote start signal shall cause the PCC3300 to leave sleep mode and return to normal power mode. PCC3300 supports an option for delayed start or stop.

Remote Start Integrity: In compliance with NEC2017 Start Signal Integrity standard – NFPA70 Article 700.10(D)(3), the remote start circuit from ATS to PCC3300 is continuously monitored for signal disturbance due to broken, disconnected or shorted wires via a configurable input. Loss of signal integrity results in activation of a remote start signal.

Remote and local emergency stopping capability: PCC3300 accepts ground signal from a locally or remotely mounted emergency stop switch to cause the generator set to immediately shutdown. The generator set is prevented from either running or cranking with the emergency stop switch engaged. If PCC3300 is in sleep mode, then the activation of any emergency stop switch shall return PCC3300 to normal powered state along with the activation of the corresponding shutdown and run-prevention states.

Sleep mode: PowerCommand 3.3 supports a configurable low current draw state, which is designed with consideration to the needs of prime applications or other applications without a battery charger (in order to minimize battery current drain).

Automatic prime mover starting: Any generator set controlled by PCC3300 is capable of automatic starting achieved via either magnetic pickup or main alternator output frequency. PCC3300 additionally supports

configurable glow plug control where applicable.

Prime mover cycle cranking: PCC3300 supports configurable starting cycles and rest periods. Built-in starter protection is incorporated to prevent the operator from specifying a starting sequence that may be damaging.

Configurable time delay functionality: PCC3300 supports time delayed generator set starting and stopping (for cooldown). Permissible time delays are as follows (noting a default setting is 0 seconds):

1. Start delay: 0 seconds to 300 seconds prior to starting after receiving a remote start signal.
2. Stop delay: 0 seconds to 600 seconds prior to shut down after receiving a signal to stop in normal operation modes.

Lean Burn Natural Gas application specific parameters

PCC3300 supports prime mover inhibiting in order to permit application-specific processes (i.e. Auxiliaries) to be started first.

## Generator Control

PCC3300 performs both Genset voltage sensing and Genset voltage regulation as follows:

- Voltage sensing is integrated into PCC3300 via three phase line-to-line sensing that is compatible with shunt or PMG excitation systems
- Automatic voltage regulation is accomplished by using a three phase fully rectified input and has a FET output for good motor starting capability.

Major features of generator control include:

Digital output voltage regulation - Capable of regulating output voltage to within  $\pm 1.0\%$  for any loads between no load and full load. Voltage drift will not exceed  $\pm 1.5\%$  for a 40 °C (104 °F) change in temperature in an eight-hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand® will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

Cylinder Cut-off System (CCS): PCC 3300 supports Cylinder Cut-off System which is used to operate the engines on half bank at no load and light load conditions. CCS has the following benefits on engine



performance- improved emission standards, improved fuel efficiency, reduced hydrocarbons, reduced white smoke, reduced wet stacking and higher exhaust temperature at light loads to improve turbocharger operations and catalyst performance.

**Step Timing Control (STC):** PCC 3300 supports STC functionality which is used to advance the engine timing of a hydro-mechanical engine during start up and light load conditions. During ADVANCED injection timing, it:

- Improves cold weather idling characteristics
- Reduces cold weather white smoke
- Improves light load fuel economy
- Reduces injector carboning

## Paralleling Functions

**First Start Sensor™ system** – PowerCommand® provides a unique control function that positively prevents multiple gensets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between the gensets that allows the gensets to work together to determine which genset is a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

**Synchronizing** – Control incorporates a digital synchronizing function to force the genset to match the frequency, phase and voltage of another source such as a utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer can match other sources over a range of 60-110% of nominal voltage and -24 to +6 hertz. The synchronizer function is configurable for slip frequency synchronizing for applications requiring a known direction of power flow at instant of breaker closure or for applications where phase synchronization performance is otherwise inadequate.

**Load sharing control** – The genset control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the genset(s) are operating on an isolated bus. The control system determines kW load on the engine and kVar load on the alternator as a percent of genset capacity, and then regulates fuel and excitation systems to maintain system and genset at the same percent of load without impacting voltage or frequency regulation. The control can also be configured for operation in droop mode for kW or Kvar load sharing.

**Load govern control**– When PowerCommand® receives a signal indicating that the genset is paralleled with an infinite source such as a utility (mains) service, the genset will operate in load govern mode. In this mode the genset will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW

values from 0-100% of standby rating, and 0.7-1.0 power factor (lagging). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control. In addition, the control can be configured for operation in kW or kVAR load govern droop.

**Load demand control** – The control system includes the ability to respond to an external signal to initiate load demand operation. On command, the genset will ramp to no load, open its paralleling breaker, cool down, and shut down. On removal of the command, the genset will immediately start, synchronize, connect, and ramp to its share of the total load on the system.

**Sync check** – The sync check function decides when permissive conditions have been met to allow breaker closure. Adjustable criteria are: phase difference from 0.1-20 deg, frequency difference from 0.001-1.0 Hz, voltage difference from 0.5-10%, and a dwell time from 0.5-5.0 sec. Internally the sync check is used to perform closed transition operations. An external sync check output is also available.

**Genset and utility/AC bus source AC metering** – The control provides comprehensive three phase AC metering functions for both monitored sources, including: 3-phase voltage (L-L and L-N) and current, frequency, phase rotation, individual phase and totalized values of kW, kVAR, kVA and Power Factor; totalized positive and negative kW-hours, kVAR-hours, and kVA-hours. Three wire or four wire voltage connection with direct sensing of voltages to 600V, and up to 45kV with external transformers. Current sensing is accomplished with either 5 amp or 1 CT secondaries and with up to 10,000 amp primary. Maximum power readings are 32,000kW/kVAR/kVA.

**Power transfer control** – provides integrated automatic power transfer functions including source availability sensing, genset start/stop and transfer pair monitoring and control. The transfer/retransfer is configurable for open transition, fast closed transition (less than 100msec interconnect time), or soft closed transition (load ramping) sequences of operation. Utility source failure will automatically start genset and transfer load, retransferring when utility source returns. Test will start gensets and transfer load if test with load is enabled. Sensors and timers include:

**Under voltage sensor:** 3-phase L-N or L-L under voltage sensing adjustable for pickup from 85-100% of nominal. Dropout adjustable from 75-98% of pickup. Dropout delay adjustable from 0.1-30 sec.

**Over voltage sensor:** 3-phase L-N or L-L over voltage sensing adjustable for pickup from 95-99% of dropout. Dropout adjustable from 105-135% of nominal. Dropout delay adjustable from 0.5-120 sec. Standard configuration is disabled and is configurable to enabled in the field using the HMI or InPower service tools.

Over/Under frequency sensor: Center frequency adjustable from 45-65 Hz. Dropout bandwidth adjustable from 0.3-5% of center frequency beyond pickup bandwidth. Pickup bandwidth adjustable from 0.3-20% of center frequency. Field configurable to enable.

Loss of phase sensor: Detects out of range voltage phase angle relationship. Field configurable to enable.

Phase rotation sensor: Checks for valid phase rotation of source. Field configurable to enable.

Breaker tripped: If the breaker tripped input is active, the associated source will be considered as unavailable.

Timers: Control provides adjustable start delay from 0 - 300sec, stop delay from 0 - 800sec, transfer delay from 0-120sec, retransfer delay from 0-1800sec, programmed transition delay from 0-60sec, and maximum parallel time from 0-1800sec.

Negative Sequence Current Protection: PCC3300 supports this protection natively in order to determine if the generator is at any point was running subject to negative phase sequencing.

**Breaker control** – Utility and Genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include Contact Failure, Fail to Close, Fail to Open, Fail to Disconnect, and Tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

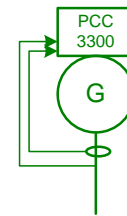
**Exerciser clock** –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A Real Time Clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval, and mode. For example, a test with load for 1 hour every Tuesday at 2AM can be programmed. Up to 6 different exceptions can also be set up to block a program from running during a specific date and time period.

**Extended paralleling** – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for either the genset metering point ("Base Load") or the utility metering point ("Peak Shave"). The control point for the reactive power (kVAR or Power Factor) can also be independently configured for either the genset metering point or the utility metering point. This flexibility would allow base kW load from the genset while maintaining the utility power factor at a reasonable value to avoid

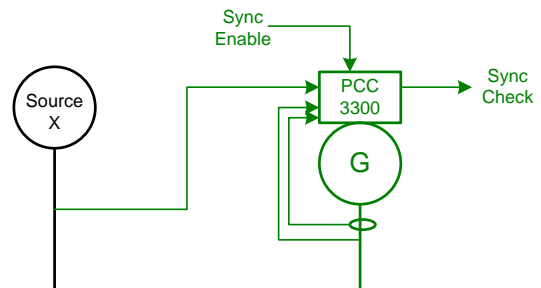
penalties due to low power factor. The System always operates within genset ratings. The control point can be changed while the system is in operation. Set points can be adjusted via hardwired analog input or adjusted through an operator panel display or service tool.

**Application types** – Controller is configured to operating in one of six possible application types. These topologies are often used in combinations in larger systems, with coordination of the controllers in the system either by external device or by interlocks provided in the control. Topologies that may be selected in the control include:

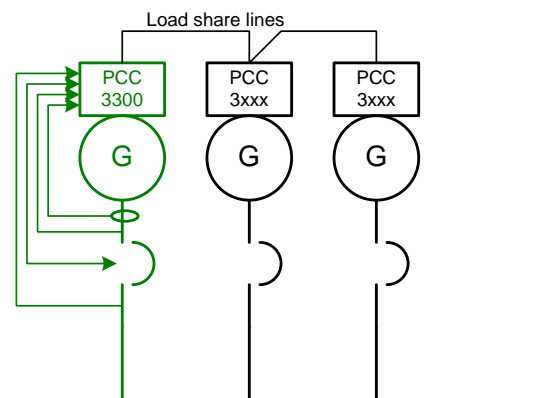
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



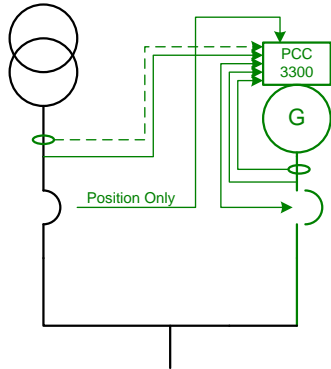
Synchronizer only: control will synchronize the genset to other source when commanded to either via a hardwired or Modbus driven input.



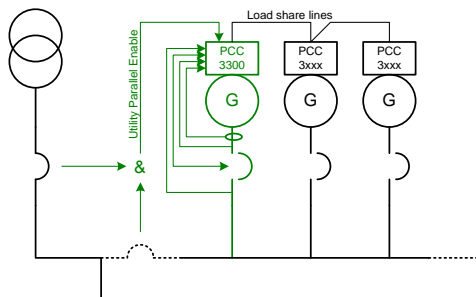
Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.



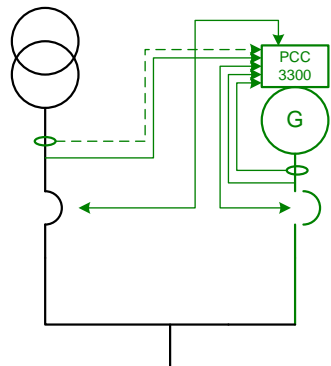
**Utility Single:** Control monitors one genset and utility. The control will automatically start and provide power to a load if the utility fails. The control will also resynchronize the genset back to the utility and provides extended paralleling capabilities.



**Utility Multiple:** Supports all functionality of Isolated Bus and provides extended paralleling to the utility. Extended paralleling load set points follow a constant setting; dynamically follow an analog input, Modbus register or HMI.

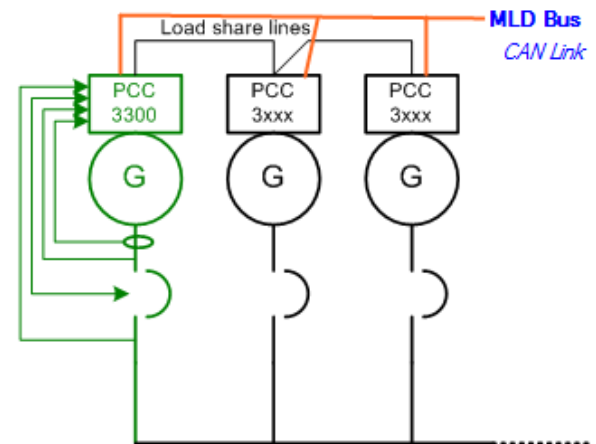
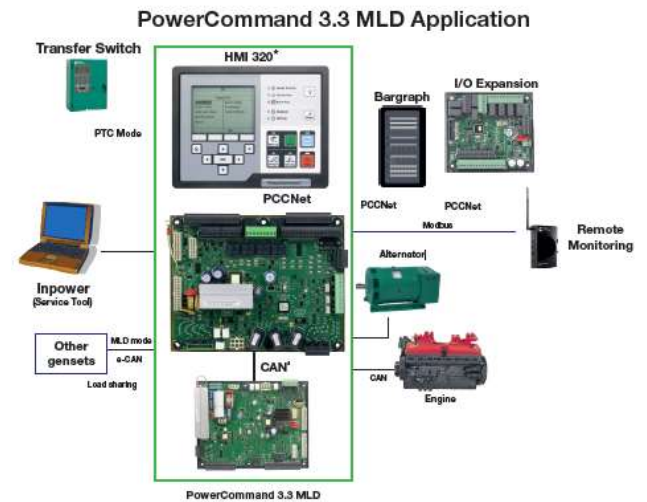


**Power Transfer Control:** Control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



**Masterless Load Demand (Optional Feature):**

PowerCommand® 3.3 with Masterless Load Demand (MLD) technology enables generator sets to start/stop automatically based on load demand. Masterless Load Demand-capable generators are equipped with an additional s-CAN network connection that allows sharing of information amongst paralleled generator sets. MLD has been designed for hassle-free installation, commissioning and operation. MLD functionality. Integrated on-board system logic provides the MLD topology control without the need for any additional system.



**PCC3300 External Voltage and Frequency Biasing Inputs**

PCC3300 supports externally driven voltage and frequency biasing capability in order to permit external paralleling (if intending to use this feature please contact your local distributor for further information).

## Protective Functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

### Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation (or are handled by the engine ECM) are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

### Derate

The Derate function reduces output power of the genset in response to a fault condition. If a Derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or Modbus. If a Derate command occurs while in utility parallel mode, the control will actively reduce power by lowering the base load kW to the derated target kW.

### Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition.

The control is programmable for warning, derate, shutdown, shutdown with cooldown or status indication and for labeling the input.

### Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

### General prime mover protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery each time the genset is signaled to start and indicate a warning if the battery indicates impending failure.

Low coolant level warning – Can be set up to be a warning or shutdown.

Low coolant temperature warning – Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

Fail to start (overcrank) shutdown - The control system will indicate a fault if the genset fails to start by the completion of the engine crank sequence.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Fault simulation –The control in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of the control and its interface by simulating failure modes or by forcing the control to operate outside of its normal operating ranges. InPower also provides a complete list of faults and settings for the protective functions provided by the controller.

### For Lean Burn Natural Gas Engine applications:

Off load running (protection) – This feature protects the engine in the event the genset is being called to go off load for too long.

### Hydro Mechanical fuel system engine protection:

Overspeed shutdown – Default setting is 115% of nominal

Low lube oil pressure warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High lube oil temperature warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High engine temperature warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

Low coolant temperature warning – Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

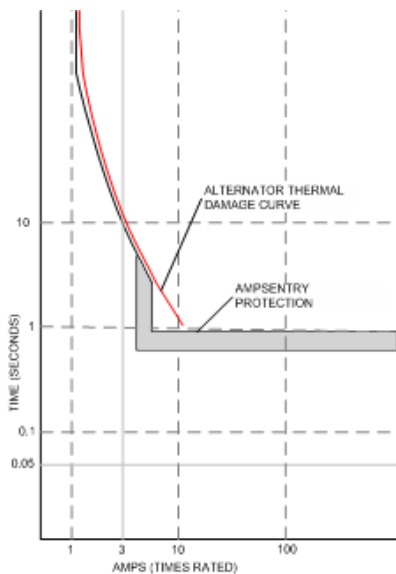
High intake manifold temperature shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

### Full authority electronic engine protection:

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

## Alternator Protection

AmpSentry protective relay - A comprehensive monitoring and control system integral to the PowerCommand® Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the genset or in the load. It also provides single and three phase fault current regulation (3x Current) so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3 phase short) or fixed timer (2sec for 1P short, 5sec for 2P short). See document R1053 for a full-size time over current curve. The control does not include protection required for interconnection to a utility (mains) service.



AmpSentry Maintenance Mode (AMM) - Instantaneous tripping, if AmpSentry Maintenance mode is active (50mS response to turn off AVR excitation/shutdown genset) for arc flash reduction when personnel are near genset.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off or synchronizing.

Under frequency shutdown (81 u) - Genset output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

Over frequency shutdown/warning (81o) - Genset is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

Overcurrent warning/shutdown (51) - Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of genset will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown genset when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Default: 10%, 3 seconds.

Reverse Var shutdown (40) - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

Short circuit protection - Output current on any phase is more than 175% of rating and approaching the thermal damage point of the alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

Negative sequence overcurrent warning (46) - Control protects the generator from damage due to excessive imbalances in the three phase load currents and/or power factors.

Custom overcurrent warning/shutdown (51) - Control provides the ability to have a custom time overcurrent protection curve in addition to the AmpSentry protective relay function.

Ground fault overcurrent (51G) - Control detects a ground fault either by an external ground fault relay via a contact input or the control can measure the ground current from an external current transformer. Associated time delays and thresholds are adjustable via InPower or HMI.

## Paralleling Protection

**Breaker fail to close Warning:** When the control signals a circuit breaker to close, it will monitor the breaker auxiliary contacts and verify that the breaker has closed. If the control does not sense a breaker closure within an adjustable time period after the close signal, the fail to close warning will be initiated.

**Breaker fail to open warning:** The control system monitors the operation of breakers that have been signaled to open. If the breaker does not open within an adjustable time delay, a Breaker Fail to Open warning is initiated.

**Breaker position contact warning:** The controller will monitor both 'a' and 'b' position contacts from the breaker. If the contacts disagree as to the breaker position, the breaker position contact warning will be initiated.

**Breaker tripped warning:** The control accepts inputs to monitor breaker trip / bell alarm contact and will initiate a breaker tripped warning if it should activate.

**Fail to disconnect warning:** In the controller is unable to open either breaker, a fail to disconnect warning is initiated. Typically, this would be mapped to a configurable output, allowing an external device to trip a breaker.

**Fail to synchronize warning:** Indicates that the genset could not be brought to synchronization with the bus. Configurable for adjustable time delay of 10 -900 seconds, 120 default.

**Phase sequence sensing warning:** Verifies that the genset phase sequence matches the bus prior to allowing the paralleling breaker to close.

**Maximum parallel time warning (power transfer control mode only):** During closed transition load transfers, control independently monitors paralleled time. If time is exceeded, warning is initiated and genset is disconnected.

**Bus or genset PT input calibration warning:** The control system monitors the sensed voltage from the bus and genset output voltage potential transformers. When the paralleling breaker is closed, it will indicate a warning condition if the read values are different.

## Field Control Interface

**Input signals to the PowerCommand® control include:**

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Rupture basin
- Start type signal
- Battle short
- Load demand stop
- Synchronize enable
- Genset circuit breaker inhibit
- Utility circuit breaker inhibit
- Single mode verify
- Transfer inhibit – prevent transfer to utility (in power transfer control mode)
- Retransfer inhibit – prevent retransfer to genset (in power transfer control mode)
- kW and kVAR load setpoints

Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

**Input signals for Lean Burn Natural Gas Engine applications:**

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault support as a discrete input via an appropriate secondary detection device
- Differential fault
- DC power supply fault
- Genset Interface Box (GIB) isolator open fault
- Start inhibit/enable (x3)
- Radiator fan trip
- Ventilator fan trip
- Ventilation louvers closed
- Start system trip
- Alternator heater trip
- Alternator heater status
- Alternator winding temperature (PT100 RTDx3)
- Alternator drive end bearing temperature (PT100 RTD)
- Alternator non-drive end bearing temperature (PT100 RTD)

**Output signals from the PowerCommand® control include:**

- Load dump signal: Operates when the genset is in an overload condition.
- Delayed off signal: Time delay-based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (genset running) signal: Operates when the genset has reached 90% of rated speed and voltage and latches until genset is switched to off or idle mode.
- Paralleling circuit breaker relays outputs: Control includes (4) relay output contacts (3.5A, 30 VDC) for opening and closing of the genset and utility breakers.

**Output Signals for Lean Burn Natural Gas Engine applications:**

- Start inhibit/enable event
- Emergency stop event
- Ventilator fan run control
- Louvre control
- Radiator fan control
- Alternator heater control
- Engine at idle speed event

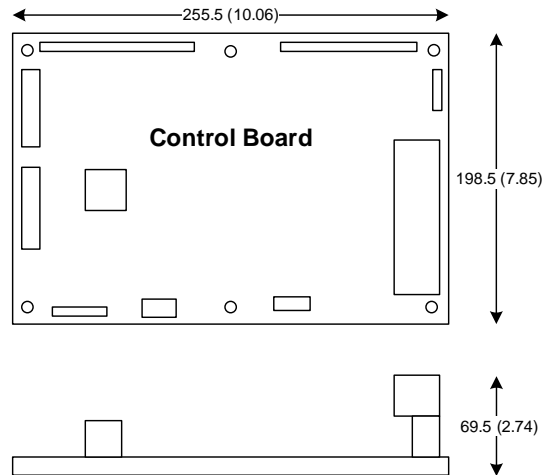
**Communications connections include:**

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

**Mechanical Drawing**



# PowerCommand® Human Machine Interface HMI320



## Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

## Features:

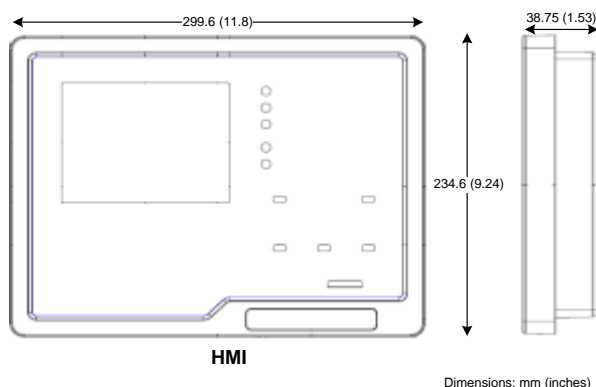
- LED indicating lamps
  - genset running
  - remote start
  - not in auto
  - shutdown
  - warning
  - auto
  - manual and stop
  - Circuit breaker open (if equipped)
  - Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.

- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std. and CE standards.
- Languages supported: English, Spanish, French, German, Italian, Greek, Portuguese, Finnish, Norwegian, Danish, Russian (Cyrillic), Chinese, Hungarian, Japanese, Polish, Korean, Romanian, Brazilian Portuguese, Turkish, Dutch, and Czech

## Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

## Mechanical Drawing



## Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand® gensets and transfer switches, to facilitate service and monitoring of these products.



## Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C (-40 °F) to +70° C (158 °F), and for storage from -55 °C (-67 °F) to +80 °C (176 °F). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 °C (-4 °F) to +70 °C (158 °F), and for storage from -30 °C (-22 °F) to +80 °C (176 °F).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a genset. The control includes transient voltage surge suppression to provide compliance to referenced standards.

## Certifications

PowerCommand® meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4:2005 compliance, controls and switchgear (second edition)
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized, suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand® control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.
- ROHS (Restriction of Hazardous substance) complaint both for HMI 320 & PCC3300v2.

## Reference Documents

Please refer to the following reference documents available in the PowerSuite library:

- PowerCommand™ 3.3. Application Guide
- T-037: PowerCommand Control Application Manual (ANSI Protective Functions)
- T-040: PowerCommand 3.3 Paralleling Application Guide

Please refer to the following reference documents available on Cummins Quickserve:

- Service Manuals for PC3.3 (non-MLD) and PC3.3 (MLD)
- Modbus Register Mapping

## 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.

