

<b>Engine:</b> 3306	<b>Generator Frame:</b> 448	<b>Selected Model</b>	<b>Genset Rating (kW):</b> 220.0	<b>Line Voltage:</b> 400
<b>Fuel:</b> Diesel	<b>Generator Arrangement:</b> 1415532		<b>Genset Rating (kVA):</b> 275.0	<b>Phase Voltage:</b> 230
<b>Frequency:</b> 50	<b>Excitation Type:</b> Self Excited		<b>Pwr. Factor:</b> 0.8	<b>Rated Current:</b> 396.9
<b>Duty:</b> PRIME	<b>Connection:</b> SERIES STAR		<b>Application:</b> EPG	<b>Status:</b> Current

Version: 39094 /38912 /38261 /2788

**Spec Information**

Generator Specification			Generator Efficiency		
			Per Unit Load	kW	Efficiency %
<b>Frame:</b> 448	<b>Type:</b> SR4	<b>No. of Bearings:</b> 1	0.25	55.0	91.2
<b>Winding Type:</b> RANDOM WOUND	<b>Flywheel:</b> 14.0		0.5	110.0	93.8
<b>Connection:</b> SERIES STAR	<b>Housing:</b> 1		0.75	165.0	93.9
<b>Phases:</b> 3	<b>No. of Leads:</b> 12		1.0	220.0	93.2
<b>Poles:</b> 4	<b>Wires per Lead:</b> 1		1.1	242.0	92.7
<b>Sync Speed:</b> 1500	<b>Generator Pitch:</b> 0.75				

Reactances	Per Unit	Ohms
SUBTRANSIENT - DIRECT AXIS X" <sub>d</sub>	0.1287	0.0749
SUBTRANSIENT - QUADRATURE AXIS X" <sub>q</sub>	0.1513	0.0880
TRANSIENT - SATURATED X' <sub>d</sub>	0.2315	0.1347
SYNCHRONOUS - DIRECT AXIS X <sub>d</sub>	2.5030	1.4563
SYNCHRONOUS - QUADRATURE AXIS X <sub>q</sub>	1.4829	0.8628
NEGATIVE SEQUENCE X <sub>2</sub>	0.1401	0.0815
ZERO SEQUENCE X <sub>0</sub>	0.0493	0.0287

Time Constants	Seconds
OPEN CIRCUIT TRANSIENT - DIRECT AXIS T' <sub>d0</sub>	1.8690
SHORT CIRCUIT TRANSIENT - DIRECT AXIS T' <sub>d</sub>	0.1729
OPEN CIRCUIT SUBTRANSIENT - DIRECT AXIS T" <sub>d0</sub>	0.0044
SHORT CIRCUIT SUBTRANSIENT - DIRECT AXIS T" <sub>d</sub>	0.0036
OPEN CIRCUIT SUBTRANSIENT - QUADRATURE AXIS T" <sub>q0</sub>	0.0047
SHORT CIRCUIT SUBTRANSIENT - QUADRATURE AXIS T" <sub>q</sub>	0.0039
EXCITER TIME CONSTANT T <sub>e</sub>	0.1144
ARMATURE SHORT CIRCUIT T <sub>a</sub>	0.0223

Short Circuit Ratio: 0.55	Stator Resistance = 0.023 Ohms	Field Resistance = 1.115 Ohms
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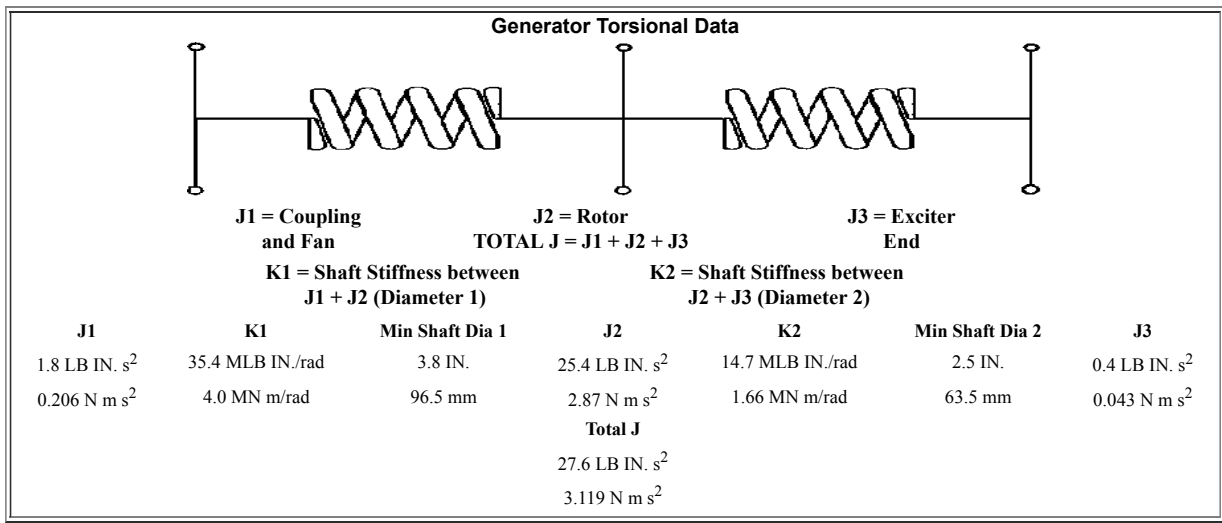
Voltage Regulation		Generator Excitation		
		No Load	Full Load, (rated) pf	
			Series	Parallel
<b>Voltage level adjustment:</b> +/-	5.0%			
<b>Voltage regulation, steady state:</b> +/-	0.5%			
<b>Voltage regulation with 3% speed change:</b> +/-	0.5%			
<b>Waveform deviation line - line, no load:</b> less than	5.0%	<b>Excitation voltage:</b> 9.51 Volts	38.83 Volts	Volts
<b>Telephone influence factor:</b> less than	50	<b>Excitation current</b> 2.11 Amps	7.09 Amps	Amps

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<b>Duty:</b> PRIME	<b>Connection:</b> SERIES STAR		<b>Application:</b> EPG	<b>Status:</b> Current

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**Generator Mechanical Information**

Center of Gravity		
Dimension X	-609.6 mm	-24.0 IN.
Dimension Y	0.0 mm	0.0 IN.
Dimension Z	0.0 mm	0.0 IN.
<ul style="list-style-type: none"> <li>"X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details</li> <li>"Y" is measured vertically from rotor center line. Up is positive.</li> <li>"Z" is measured to left and right of rotor center line. To the right is positive.</li> </ul>		
Generator WT = 915 kg * Rotor WT = 319 kg * Stator WT = 596 kg 2,017 LB                      703 LB                      1,314 LB		
Rotor Balance = 0.0508 mm deflection PTP Overspeed Capacity = 180% of synchronous speed		



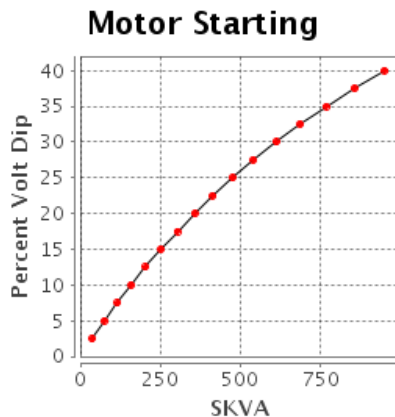
<b>Selected Model</b>			
Engine: 3306	Generator Frame: 448	Genset Rating (kW): 220.0	Line Voltage: 400
Fuel: Diesel	Generator Arrangement: 1415532	Genset Rating (kVA): 275.0	Phase Voltage: 230
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Duty: PRIME	Connection: SERIES STAR	Application: EPG	Status: Current
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Generator Cooling Requirements - Temperature - Insulation Data	
<b>Cooling Requirements:</b>	<b>Temperature Data: (Ambient 40 °C)</b>
Heat Dissipated: 16.1 kW	Stator Rise: 105.0 °C
Air Flow: 53.4 m <sup>3</sup> /min	Rotor Rise: 105.0 °C
<b>Insulation Class: H</b>	
<b>Insulation Reg. as shipped: 100.0 MΩ minimum at 40 °C</b>	
Thermal Limits of Generator	
Frequency:	50 Hz
Line to Line Voltage:	400 Volts
<b>B BR 80/40</b>	228.0 kVA
<b>F BR -105/40</b>	275.0 kVA
<b>H BR - 125/40</b>	300.0 kVA
<b>F PR - 130/40</b>	300.0 kVA

<b>Selected Model</b>			
Engine: 3306	Generator Frame: 448	Genset Rating (kW): 220.0	Line Voltage: 400
Fuel: Diesel	Generator Arrangement: 1415532	Genset Rating (kVA): 275.0	Phase Voltage: 230
Frequency: 50	Excitation Type: Self Excited	Pwr. Factor: 0.8	Rated Current: 396.9
Duty: PRIME	Connection: SERIES STAR	Application: EPG	Status: Current
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**Starting Capability & Current Decrement  
Motor Starting Capability (0.4 pf)**

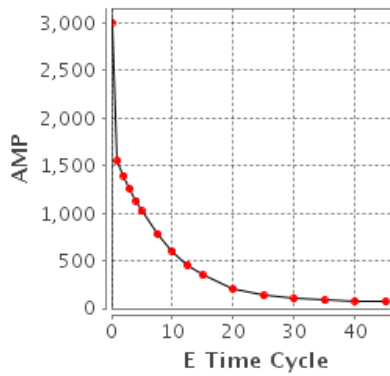
SKVA	Percent Volt Dip
37	2.5
75	5.0
116	7.5
159	10.0
204	12.5
252	15.0
303	17.5
357	20.0
414	22.5
476	25.0
541	27.5
612	30.0
687	32.5
768	35.0
856	37.5
951	40.0



**Current Decrement Data**

E Time Cycle	AMP
0.0	3,006
1.0	1,552
2.0	1,395
3.0	1,257
4.0	1,132
5.0	1,020
7.5	783
10.0	600
12.5	459
15.0	350
20.0	202
25.0	133
30.0	101
35.0	85
40.0	77
45.0	72

**Current Decrement**



**Instantaneous 3 Phase Fault Current: 3006 Amps**

**Instantaneous Line - Line Fault Current: 2494 Amps**

**Instantaneous Line - Neutral Fault Current: 3649 Amps**

**Engine: 3306**  
**Fuel: Diesel**  
**Frequency: 50**  
**Duty: PRIME**

**Generator Frame: 448**  
**Generator Arrangement: 1415532**  
**Excitation Type: Self Excited**  
**Connection: SERIES STAR**

**Selected Model**

**Genset Rating (kW): 220.0**  
**Genset Rating (kVA): 275.0**  
**Pwr. Factor: 0.8**  
**Application: EPG**

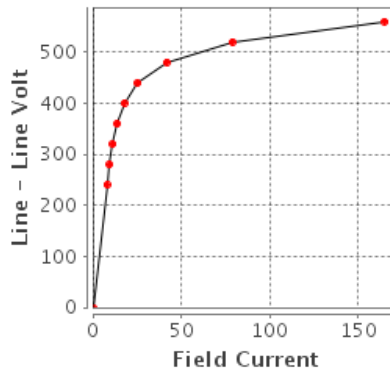
**Line Voltage: 400**  
**Phase Voltage: 230**  
**Rated Current: 396.9**  
**Status: Current**

Version: 39094 /38912 /38261 /2788

**Generator Output Characteristic Curves**  
**Open Circuit Curve**

Field Current	Line - Line Volt
0.0	0
8.0	240
9.5	280
11.3	320
13.7	360
17.7	400
25.4	440
41.8	480
78.9	520
165.1	560

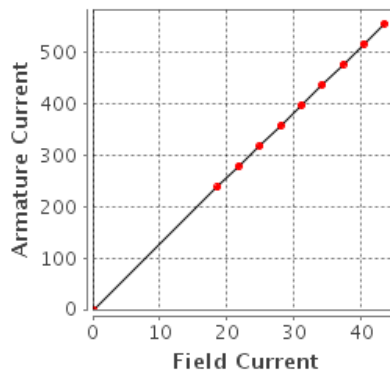
**Open Circuit**



**Short Circuit Curve**

Field Current	Armature Current
0.0	0
18.6	238
21.7	278
24.9	318
28.0	357
31.1	397
34.2	437
37.3	476
40.4	516
43.5	556

**Short Circuit**



**Engine: 3306**  
**Fuel: Diesel**  
**Frequency: 50**  
**Duty: PRIME**

**Generator Frame: 448**  
**Generator Arrangement: 1415532**  
**Excitation Type: Self Excited**  
**Connection: SERIES STAR**

**Selected Model**

**Genset Rating (kW): 220.0**  
**Genset Rating (kVA): 275.0**  
**Pwr. Factor: 0.8**  
**Application: EPG**

**Line Voltage: 400**  
**Phase Voltage: 230**  
**Rated Current: 396.9**  
**Status: Current**

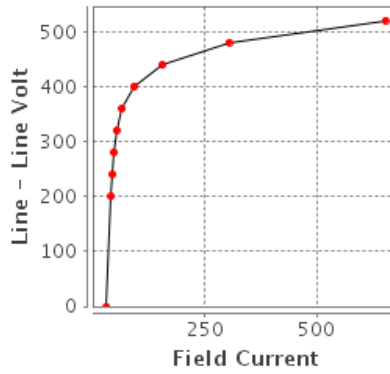
Version: 39094 /38912 /38261 /2788

**Generator Output Characteristic Curves**

**Zero Power Factor Curve**

**Zero Power**

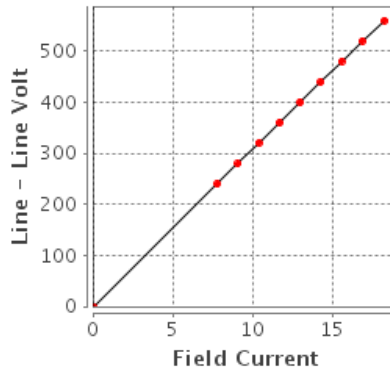
Field Current	Line - Line Volt
31.1	0
41.2	200
43.4	240
46.7	280
52.6	320
64.9	360
92.3	400
155.5	440
303.4	480
652.1	520



**Air Gap Curve**

**Air Gap**

Field Current	Line - Line Volt
0.0	0
7.8	240
9.1	280
10.4	320
11.7	360
13.0	400
14.3	440
15.6	480
16.9	520
18.3	560



**Engine:** 3306  
**Fuel:** Diesel  
**Frequency:** 50  
**Duty:** PRIME

**Generator Frame:** 448  
**Generator Arrangement:** 1415532  
**Excitation Type:** Self Excited  
**Connection:** SERIES STAR

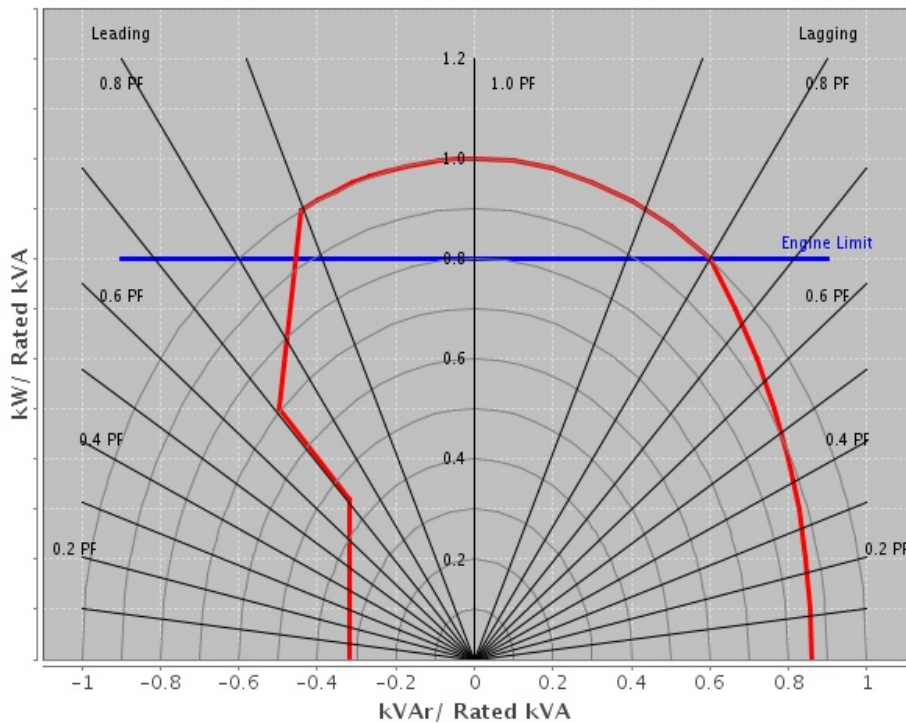
**Selected Model**

**Genset Rating (kW):** 220.0  
**Genset Rating (kVA):** 275.0  
**Pwr. Factor:** 0.8  
**Application:** EPG

**Line Voltage:** 400  
**Phase Voltage:** 230  
**Rated Current:** 396.9  
**Status:** Current

Version: 39094 /38912 /38261 /2788

**Reactive Capability Curve  
 Operating Chart**



**Engine:** 3306  
**Fuel:** Diesel  
**Frequency:** 50  
**Duty:** PRIME

**Generator Frame:** 448  
**Generator Arrangement:** 1415532  
**Excitation Type:** Self Excited  
**Connection:** SERIES STAR

**Selected Model**

**Genset Rating (kW):** 220.0  
**Genset Rating (kVA):** 275.0  
**Pwr. Factor:** 0.8  
**Application:** EPG

**Line Voltage:** 400  
**Phase Voltage:** 230  
**Rated Current:** 396.9  
**Status:** Current

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Version: 39094 /38912 /38261 /2788

## General Information

DM7802

### GENERATOR GENERAL INFORMATION

#### I. GENERATOR MOTOR STARTING CAPABILITY CURVES

A. THE MOTOR STARTING CURVES ARE REPRESENTATIVE OF THE DATA OBTAINED BY THE FOLLOWING PROCEDURE:

1. THE CATERPILLAR GENERATOR IS DRIVEN BY A SYNCHRONOUS DRIVER.
2. VARIOUS SIZE THREE PHASE INDUCTION MOTORS (NEMA CODE F) ARE STARTED ACROSS THE LINE LEADS OF THE UNLOADED GENERATOR.
3. THE RESULTING VOLTAGE DIPS ARE RECORDED WITH AN OSCILLOSCOPE.
4. MOTOR HORSEPOWER HAS BEEN CONVERTED TO STARTING KILOVOLT AMPERES (SKVA).
5. RECORDED VOLTAGE DIPS HAVE BEEN EXPRESSED AS A OF GENERATOR RATED VOLTAGE.

#### II. USE OF THE MOTOR STARTING CAPABILITY CURVES.

A. CALCULATE THE SKVA REQUIRED BY THE MOTOR FOR FULL VOLTAGE STARTING ACROSS THE LINE IF THE VALUE IS NOT LISTED ON THE MOTOR DATA PLATE.

1. MOTORS CONFORMING TO NEMA STANDARDS  
MULTIPLY THE MOTOR HORSEPOWER BY THE NEMA SKVA/HP FIGURE. FOR NEMA CODE F, USE 5.3 SKVA/HP; FOR NEMA CODE G, USE 6.0 SKVA/HP.

2. ALL OTHER MOTORS:  
MULTIPLY THE RATED VOLTAGE BY THE LOCKED ROTOR AMPERE AND BY 0.001732. (IF THE LOCKED ROTOR AMPERES ARE NOT LISTED, MULTIPLY THE FULL LOAD (RUNNING) AMPERES BY B. USE THE ABOVE SKVA WITH THE MOTOR STARTING TABLE.

1. ACROSS LINE STARTING:

READ ACROSS THE ROW OF "ACROSS THE LINE STARTING SKVA IF THE DESIRED VALUE OF SKVA IS NOT GIVEN, CALCULATE THE DIP BY FINDING THE PROPER SKVA INTERVAL AND INTERPOLATING AS FOLLOWS:

SKVA1 IS THE SKVA TABLE ENTRY JUST SMALLER THAN THE DESIRED SKVA, DIP1 IS THE DIP FOR SKVA2, AND SKVA2 IS THE SKVA TABLE ENTRY JUST GREATER THAN THE DESIRED SKVA. THE DIP (IN PERCENT) AT THE DESIRED SKVA IS:

$$\text{DIP} = \text{DIP1} + (\text{SKVA} - \text{SKVA1}) * 2.5 / (\text{SKVA2} - \text{SKVA1})$$

NOTE: VOLTAGE DIPS GREATER THAN 35% MAY CAUSE MAGNETIC CONTACTORS TO DROP OUT.

2. REDUCED VOLTAGE STARTING:

REFER TO THE FOLLOWING TABLE. MULTIPLY THE CALCULATE ACROSS LINE SKVA BY THE MULTIPLIER LISTED FOR THE SPECIFIC STARTING METHOD. APPLY THE RESULT TO THE STARTING TABLE AS IN II A, TO CALCULATE THE EXPECTED VOLTAGE DIP:

TYPE OF REDUCED VOLTAGE STARTING	MULTIPLY LINE SKVA BY
80% TAP	.80
65% TAP	.65
50% TAP	.50
45% TAP	.45
Wye start, delta run	.33

#### AUTOTRANSFORMER

80% TAP	.68
65% TAP	.46
50% TAP	.29

NOTE: REDUCE VOLTAGE STARTING LOWERS THE MAXIMUM REQUIRED MOTOR skVA.

3. Part winding starting:

Most common is half-winding start, full-winding run.

Multiply the full motor, across line starting skVA by 0.6. Apply the result to the selected curve as in ii. A above. Read the expected voltage dip, for the required skVA.

#### III. DEFINITION:

##### A. GENERATOR TERMS

MODEL: Engine Sales model

ENG TYPE: DI = Direct Injection,

NA = Naturally aspirated, etc

HZ: Running frequency, hertz

RATING TYPE: PP, SB (prime power or standby)

KW: Base rating electrical kilowatts (ekW)

VOLTS: Rating terminal, line to line

GEN ARR: Cat generator arrangement part number

GEN FRAME: Generator frame size designation

CONN: Generator output connection  
(star, wye, delta, ect.)

POLES: Number of pole pieces on rotor.  
(eg. A 4 pole generator run at 1800)

RPM will produce 60 Hz alternating current. A 6 pole generator run at 1200 RPM will produce 60 Hz alternating current.)

#### B. GENERATOR TEMPERATURE RISE:

The indicated temperature rise indicated the NEMA limits for standby or prime power applications. These rises are used for calculating the losses and efficiencies and are not necessarily indicative of the actual temperature rise of a given machine.

#### C. CENTER OF GRAVITY

The specified center of gravity is for the generator only. For single bearing, and two bearing close coupled generators, the center of gravity is measured from the generator/engine flywheel housing interface and from the centerline of the rotor shaft.

For two bearing, standalone generators, the center of gravity is measured from the end of the rotor shaft and from the centerline of the rotor shaft.

For two bearing, standalone generators, the center of gravity is measured from the end of the rotor shaft and from the centerline of the rotor shaft.

#### D. GENERATOR DECREMENT CURRENT CURVES

The generator decrement current curve gives the symmetrical current supplied by the generator for a three phase bolted fault at the generator terminals. Generators equipped with the series boost attachment or generators with PM excitation system will supply 300% of rated current for at least 10 seconds.

#### E. GENERATOR EFFICIENCY CURVES

The efficiency curve is representative of the overall generator efficiency over the normal range of the electrical load and at the specified parameters. This is not the overall engine generator set efficiency curve.

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