GENERATOR DETAIL

AUGUST 23, 2021

(3FZ04726)-ENGINE (AFE00402)-GENERATOR (9EP02579)-GENSET

For Help Desk Phone Numbers Click here

Selected Model

Engine: 3412	**Generator Frame:** 592	**Genset Rating (kW):** 550.0	**Line Voltage:** 480
Fuel: Diesel	**Generator Arrangement:** 1366634	**Genset Rating (kVA):** 687.0	**Phase Voltage:** 277
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 826.3
Duty: STANDBY	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 39094 /38912 /38261 /2609

Spec Information

Generator Specification

Frame: 592 **Type:** SR4B	**No. of Bearings:** 1
Winding Type: RANDOM WOUND	**Flywheel:** 18.0
Connection: SERIES STAR	**Housing:** 0
Phases: 3	**No. of Leads:** 12
Poles: 4	**Wires per Lead:** 2
Sync Speed: 1800	**Generator Pitch:** 0.8

Generator Efficiency

Per Unit Load	kW	Efficiency %
0.25	137.5	91.9
0.5	275.0	94.3
0.75	412.5	94.4
1.0	550.0	94.0

Reactances	Per Unit	Ohms
SUBTRANSIENT - DIRECT AXIS X''_d	0.2020	0.0677
SUBTRANSIENT - QUADRATURE AXIS X''_q	0.1969	0.0660
TRANSIENT - SATURATED X'_d	0.2888	0.0968
SYNCHRONOUS - DIRECT AXIS X_d	3.7813	1.2672
SYNCHRONOUS - QUADRATURE AXIS X_q	1.9249	0.6451
NEGATIVE SEQUENCE X_2	0.1996	0.0669
ZERO SEQUENCE X_0	0.0919	0.0308

Time Constants	Seconds
OPEN CIRCUIT TRANSIENT - DIRECT AXIS T'_{d0}	2.3980
SHORT CIRCUIT TRANSIENT - DIRECT AXIS T'_d	0.1832
OPEN CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_{d0}	0.0091
SHORT CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_d	0.0069
OPEN CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_{q0}	0.0069
SHORT CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_q	0.0076
EXCITER TIME CONSTANT T_e	0.1400
ARMATURE SHORT CIRCUIT T_a	0.0278

Short Circuit Ratio: 0.34	Stator Resistance = 0.0122 Ohms	Field Resistance = 1.27 Ohms

Voltage Regulation

Voltage level adjustment: +/-	5.0%
Voltage regulation, steady state: +/-	0.5%
Voltage regulation with 3% speed change: +/-	0.5%
Waveform deviation line - line, no load: less than	5.0%
Telephone influence factor: less than	50

Generator Excitation

	No Load	Full Load, (rated) pf	
		Series	Parallel
Excitation voltage:	7.58 Volts	43.85 Volts	Volts
Excitation current	1.68 Amps	8.0 Amps	Amps

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Generator Mechanical Information

Center of Gravity

Dimension X	-646.4 mm	-25.4 IN.
Dimension Y	0.0 mm	0.0 IN.
Dimension Z	0.0 mm	0.0 IN.

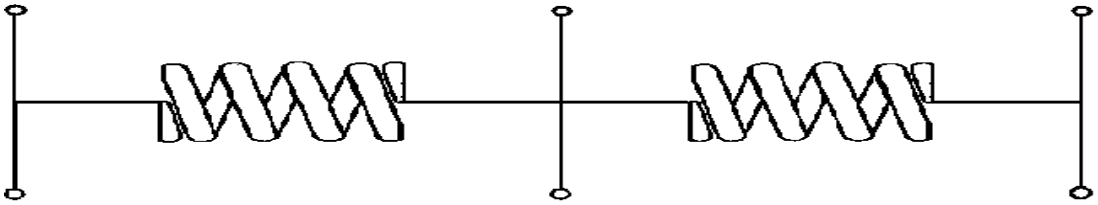
- "X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details
- "Y" is measured vertically from rotor center line. Up is positive.
- "Z" is measured to left and right of rotor center line. To the right is positive.

Generator WT = 1446 kg (3,188 LB) * Rotor WT = 528 kg (1,164 LB) * Stator WT = 918 kg (2,024 LB)

Rotor Balance = 0.0508 mm deflection PTP

Overspeed Capacity = 150% of synchronous speed

Generator Torsional Data



J1 = Coupling and Fan | **J2 = Rotor** | **J3 = Exciter End**

TOTAL J = J1 + J2 + J3

K1 = Shaft Stiffness between J1 + J2 (Diameter 1)

K2 = Shaft Stiffness between J2 + J3 (Diameter 2)

J1	K1	Min Shaft Dia 1	J2	K2	Min Shaft Dia 2	J3
11.8 LB IN. s^2	79.7 MLB IN./rad	5.0 IN.	58.5 LB IN. s^2	9.7 MLB IN./rad	2.5 IN.	1.5 LB IN. s^2
1.336 N m s^2	9.0 MN m/rad	127.0 mm	6.612 N m s^2	1.1 MN m/rad	63.5 mm	0.171 N m s^2

Total J

71.9 LB IN. s^2

8.119 N m s^2

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Generator Cooling Requirements - Temperature - Insulation Data

Cooling Requirements:		**Temperature Data: (Ambient 40 ^{0}C)**	
Heat Dissipated:	35.1 kW	**Stator Rise:**	130.0 ^{0}C
Air Flow:	112.2 m^3/min	**Rotor Rise:**	130.0 ^{0}C

Insulation Class: H

Insulation Reg. as shipped: 100.0 MΩ minimum at 40 ^{0}C

Thermal Limits of Generator

Frequency:	60 Hz
Line to Line Voltage:	480 Volts
B BR 80/40	519.0 kVA
F BR -105/40	625.0 kVA
H BR - 125/40	688.0 kVA
F PR - 130/40	688.0 kVA

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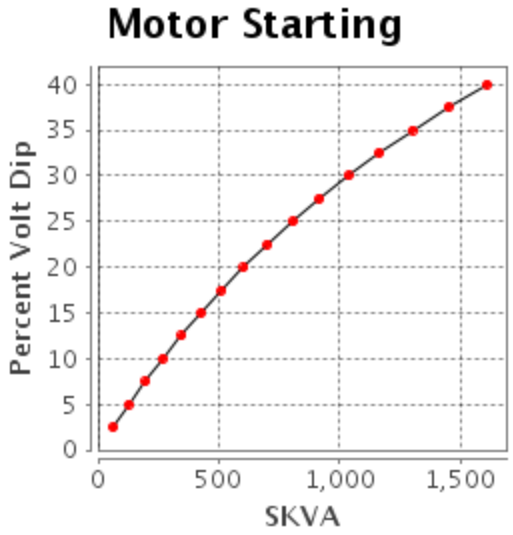
Starting Capability & Current Decrement

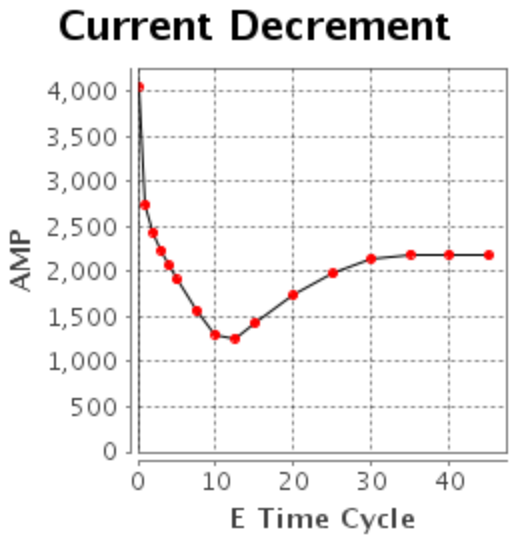
Motor Starting Capability (0.4 pf)

SKVA	Percent Volt Dip
62	2.5
127	5.0
196	7.5
268	10.0
345	12.5
426	15.0
512	17.5
603	20.0
701	22.5
805	25.0
916	27.5
1,034	30.0
1,162	32.5
1,300	35.0
1,448	37.5
1,609	40.0



Current Decrement Data

E Time Cycle	AMP
0.0	4,060
1.0	2,747
2.0	2,439
3.0	2,241
4.0	2,068
5.0	1,910
7.5	1,573
10.0	1,305
12.5	1,262
15.0	1,431
20.0	1,745
25.0	1,979
30.0	2,151
35.0	2,197
40.0	2,194
45.0	2,185



Instantaneous 3 Phase Fault Current: 4060 Amps **Instantaneous Line - Line Fault Current:** 3539 Amps

Instantaneous Line - Neutral Fault Current: 4989 Amps

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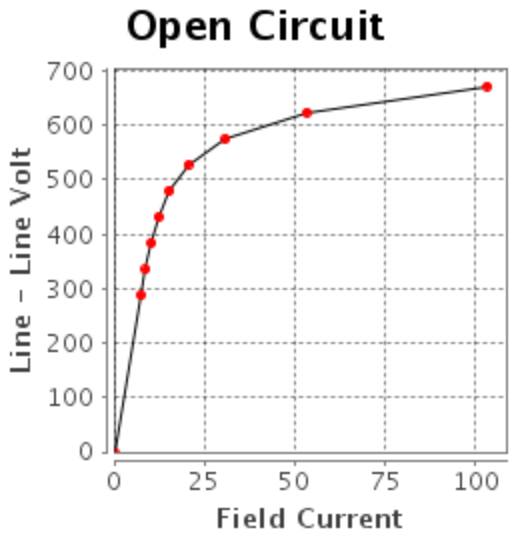
Generator Output Characteristic Curves

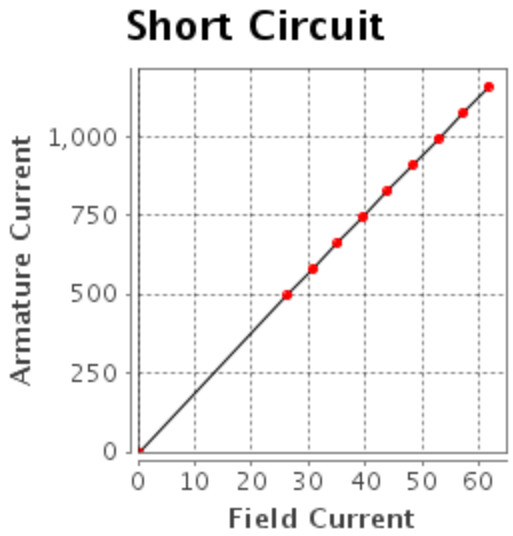
Open Circuit Curve

Field Current	Line - Line Volt
0.0	0
7.4	288
8.8	336
10.3	384
12.3	432
15.3	480
20.5	528
30.9	576
53.3	624
103.2	672



Short Circuit Curve

Field Current	Armature Current
0.0	0
26.4	496
30.8	579
35.2	662
39.6	744
44.0	827
48.4	910
52.9	992
57.3	1,075
61.7	1,158



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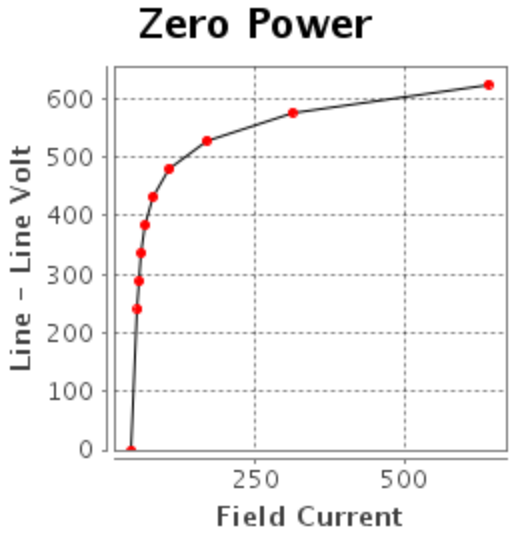
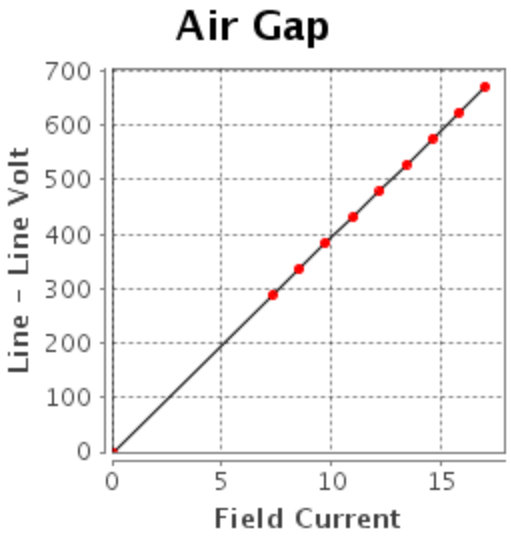
Generator Output Characteristic Curves
Zero Power Factor Curve

Field Current	Line - Line Volt
44.0	0
54.3	240
56.5	288
59.9	336
66.2	384
79.0	432
106.9	480
169.6	528
312.4	576
639.2	624



Air Gap Curve

Field Current	Line - Line Volt
0.0	0
7.3	288
8.5	336
9.7	384
11.0	432
12.2	480
13.4	528
14.6	576
15.8	624
17.0	672



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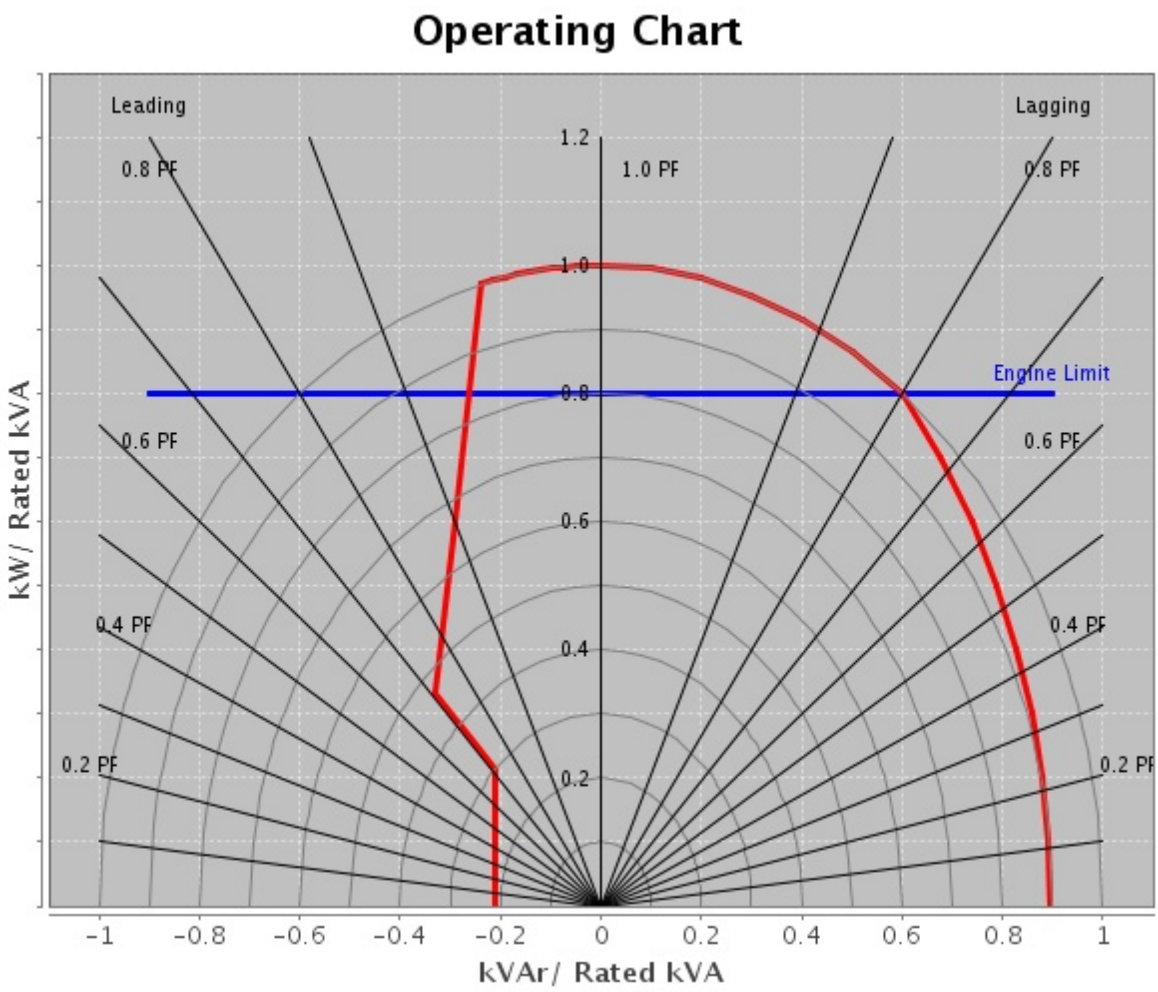
Reactive Capability Curve



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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:
DIP = DIP1 + (SKVA - SKVA1) * 2.5 / (SKVA2 - 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, accross 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 cent er of gravity is measured from the generator/engine flywheel housing i nterface and from the centerline of the rotor shaft.

For two bearing, standalone generators, the center of gravity is measu red from the end of the rotor shaft and from the centerline of the rot or shaft.

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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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