McPherson Voltage Regulators
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To avoid of possible personal injury or equipment damage read and understand this manual before installation.

SS42-7 (A.V.R)

208 / 380 / 480VAC 50/60HZ
OUTPUT: 42VDC 7A

DESCRIPTION

The SS42-7 voltage regulator is designed for use on 50/60 Hz brushless generators that have internal auxiliary power winding. This regulator includes frequency compensation, over excitation shutdown, a solid-state build-up circuit, and EMI filtering.

1-1 SPECIFICATIONS

Refer to Table 1-1 for the electrical specifications of the SS42-7 and to Table 1-2 for the physical specifications.

Table 1-1. Electrical Specifications.

Dc Output Power:	7 Adc at 42 Vdc maximum continuous. 15 Adc at 90 Vdc forcing for 10 seconds. (At 240 Vac supply voltage)
Exciter Field Dc Resistance:	6 Ohms minimum, 105 Ohms maximum.
Ac Power Input:	Operating rang 220 Vac to 260 Vac, 1-Phase, 50/60 Hz
Sensing Input:	200-252 Vac ± 10%, 2-Phase, 50/60 Hz < 1 VA Burden.
Voltage Adjust Range:	180-277 Vac.
Regulation Accuracy:	< 1% No-load to Full-load, Average Sensing.
Paralleling:	Input for 5 Vac from External C.T./Burden to allow 10% Droop.
Response Time:	Less than 1.5 cycles for ± 5% change in sensing voltage. Link (T C) and Adjustable Stability to optimize response.
EMI Suppression:	Internal EMI filter.
Frequency compensation:	Twice Volts per Hertz (See Paragraph 1-3 for curve).
Over-excitation Shutdown:	Inverse Time delayed, fixed setting. Trip range from no trip @ 50. Vdc to instantaneous at 100 Vdc. (See Paragraph 1-4 for curve). Disable link terminals (N D) provided for parallel operation.
Voltage build-up:	Internal provision for automatic build-up from 6 Vac, “Soft Start”

Power Dissipation:	20 Watts typically.

Table 1-2. Physical Specifications.

Operating Temperature:	-20°C (-4°F.) to 60°C. (140°F.)
Storage Temperature:	-40°C (-40°F.) to 85°C. (185°F.)
Vibration:	Withstands 1.3 G's at 2 to 27 Hz; 0.036 " double amplitude at 27 to 52 Hz; and 5 G's at 52 to 1000 Hz.
Shock:	Withstands up to 20 G's in each of three mutually perpendicular axes.
Weight:	0.68 kg (1.5 lbs).

1-3 FREQUENCY COMPENATION (See Figure 1-1)

a. The frequency compensation characteristic of Figure 1-1 used to improve system load pickup performance by restraining voltage recovery until frequency has also started to recover.

b. The regulator is shipped from the factory set at a 47 Hz "corner frequency" for 50 Hz systems. For 60 Hz systems, a 57 Hz corner frequency is achieved by removing the "50-50" external link.

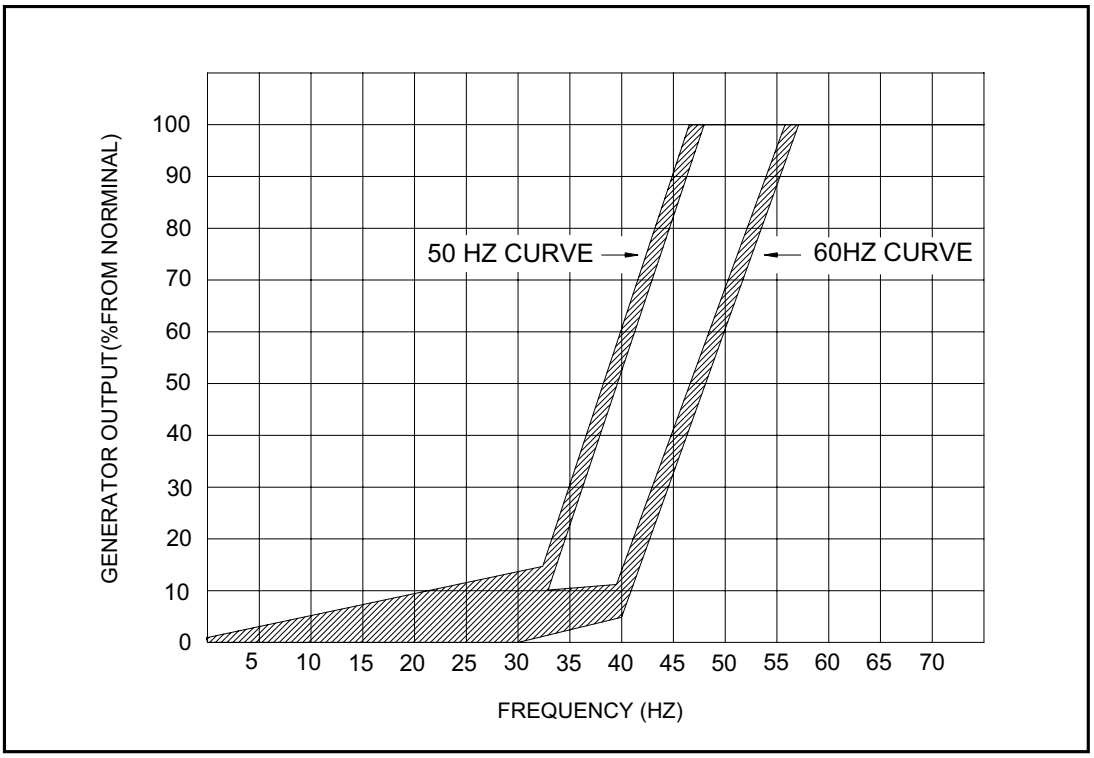


Figure 1-1 Frequency Compensation Curves.

1-4 OVER-EXCITATION TIME DELAY

If exciter voltage exceeds 52 ± 2 Vdc, the regulator automatically removes the field current, after a time delay. The time delay is inversely proportional to the magnitude of the detected field in over voltage condition up to 95 ± 5 Vdc point. Beyond 95 ± 5 Vdc, the field voltage is removed at a much faster rate. This shutdown function may be disabled for parallel operation by linking terminals N and D together.

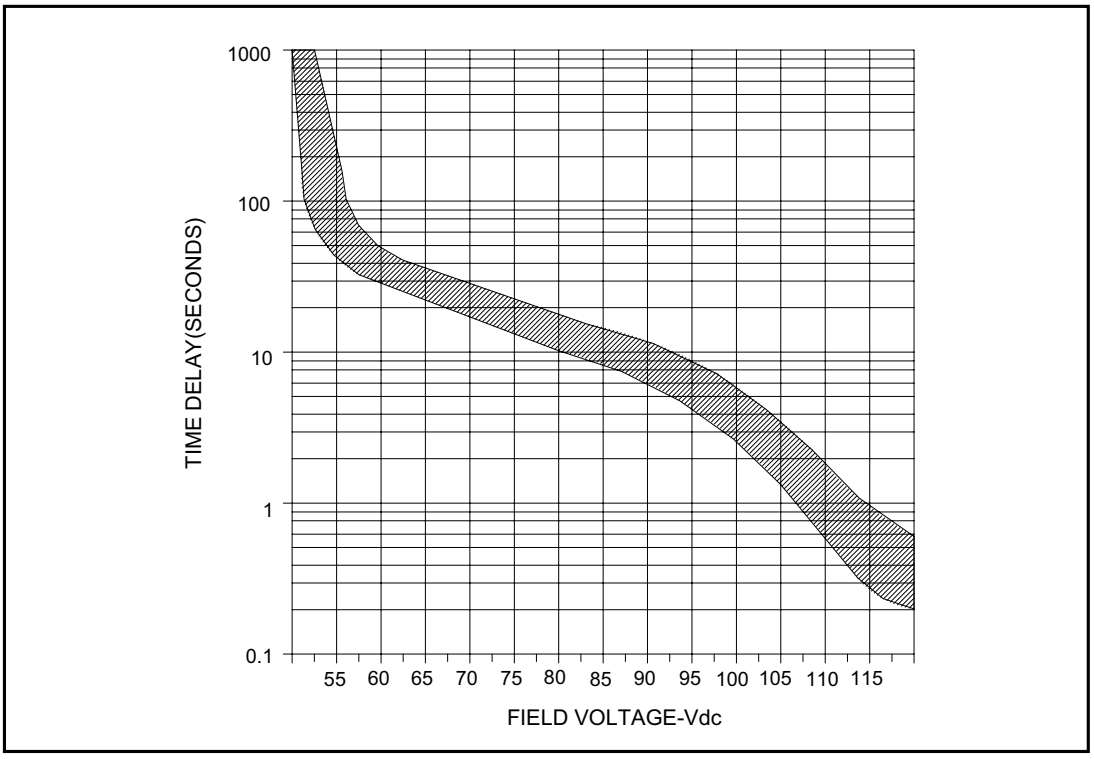


Figure 1-2 Typical Inverse Time Delay Characteristic Curve.

2-1 MOUNTING

The regulator may be mounted on the generator in any convenient position. Refer to outline drawing Figure 2-1. Figure 2-2 provides the drilling template.

> NOTE
>
> The ground terminal must be bonded either to a metal ground by the mounting screw or by means of a cable to the most suitable earthing point available close to the regulator.

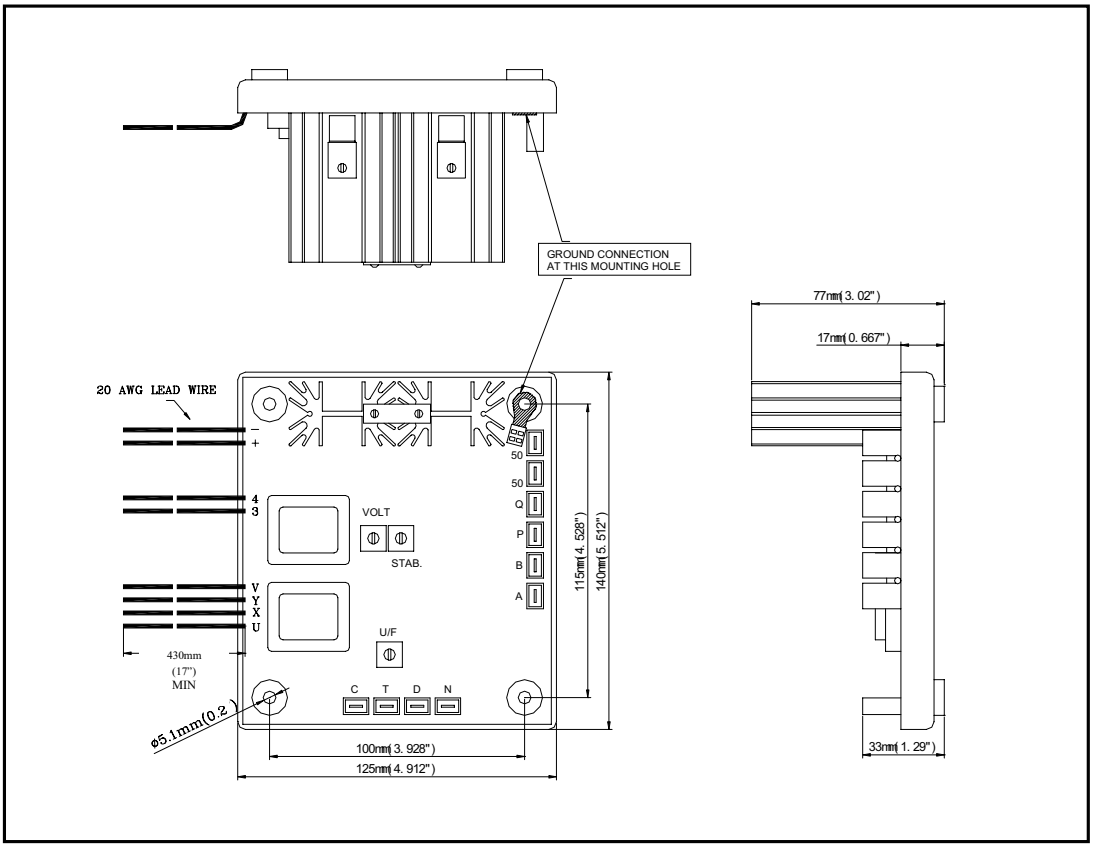


Figure 2-1 SS42-7 Outlined Diagram.

2-2 EXCITER FILELD POWER CIRCUIT

a. Connect regulator + wire to the brushless exciter field F+ terminal, and the – wire to the field F- terminal. Refer to Figure 2-3.

> CAUTION
>
> The DC resistance of the exciter field must be equal to or greater than 6 ohms and less than 100 ohms.

b. If the exciter field resistance is less than 6 ohms, and if the full-load field current does not exceed the maximum continuous current rating of the regulator (7 Adc), a resistor of sufficient wattage must be added in series with the field to bring the total resistance to 6 ohms.

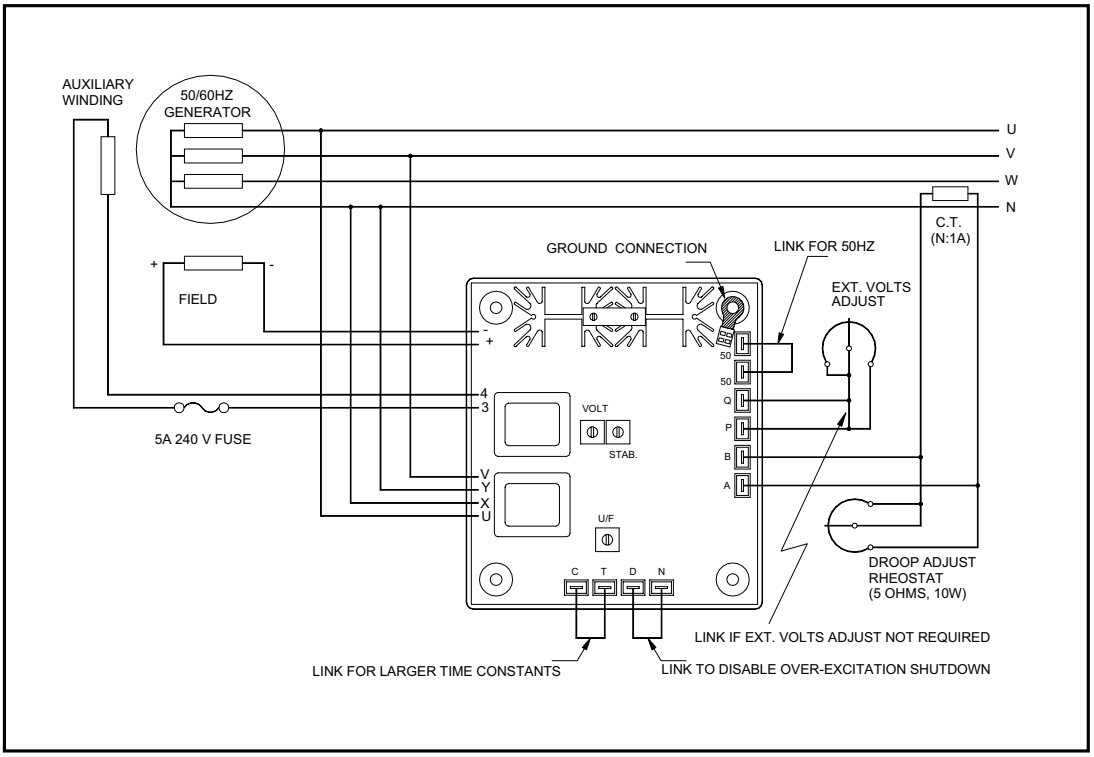


Figure 2-2 Interconnection Diagram, 480 Vac High Y Generator.

2-3 POWER INPUT

Connect wiring as shown in Figure 2-3. Power for the regulator is derived from the generator auxiliary winding, connected to wires 3 and 4. The operable power input range is 171 – 264 Vac.

2-4 SENSING INPUT

For sensing, wires U and V are connected to the generator phase U and Phase V respectively. Wires X and Y are connected to the opposite ends of the U and V phase coils, or connected together at the Neutral (star) point.

2-5 QUADRATURE DROOP INPUT

When paralleling is required, a current transformer (C.T.) and variable burden resistor (rheostat) should be connected to terminals A and B. The ratio of the C.T. and the maximum value of the burden must be chosen so that at maximum current the voltage applied to terminals A and B does not exceed 5 Vac rms. A suitable value of burden would be a rheostat adjustable from 0-5 ohms (10 Watts) for a C.T. with a 1 Aac secondary current at full load. These terminals may either be linked or left open when paralleling is not required.

2-6 FUSES

It is recommended that a fuse or fuses with high interruption capability be installed per the interconnection diagram. A suitable fuse type would be Littlefuse™ type 3AG, rated 250 Vac, 6,3 A, "SLOBLO". Dimensions are 6.3 mm × 32 mm ($1_{1/4}^{M} \times {}_{1/4}^{M}$).

NOTE
Fuse(s) MUST be installed per interconnection diagram avoid interrupting field current.

2-7 VOLTAGE ADJUST RHEOSTAT (V)

a. An internal screwdriver pre-set (V) provides coarse adjustment of generator output voltage. Moving the rheostat clockwise increases voltage.

b. The voltage regulator is shipped from the factory with a link across terminals P and Q. If a remote voltage adjusts rheostat is used, the link should be removed and the Rheostat connected to P and Q. A 1 Kilo-Ohm, 0.5W. Potentiometer will provide a "fine" voltage range adjustment of approximately ± 10% over most of the coarse range of adjustment. See Figure 2-2 interconnection diagram.

2-8 V/Hz " CORNER FREQUENCY " SELECTION

For 50 Hz systems, the regulator is pre-set at the factory for a 47 Hz " corner frequency ", and a link fitted across terminals "50". If operation at 60 Hz is required, this link should be removed; the " corner frequency " is now set to 57 Hz. do not operate the system at 60 Hz with the 50 Hz link in place.

2-9 OVER-EXCITATION SHUTDOWN

a. Over-excitation shutdown is provided by removing output excitation should the regulator's output voltage exceeds 52 ± 2 Vdc for a sufficient time. The inverse-time delay curve is shown in Figure 1-2. For voltage above 95 ± 5 Vdc, there is a second and much shorter inverse time curve.

b. After output power is removed, the regulator can be reset by decreasing the input voltage to less than 6 Vac for a minimum of 2 seconds; stopping the prime mover or interrupting the regulator input by means of a reset switch accomplishes this.

c. In cases where the generator is operating in a parallel mode, it is sometimes considered undesirable to allow the regulator to shut down, which may cause the generator to be " motored". The regulator is provided with terminals N and D, which may be linked together to prevent over-excitation shutdown. Note however that continuous running at output levels greater than the continuous rating may result in eventual regulator failure, and that other means should be employed to protect the system.

3-1 GENERAL

> CAUTION
>
> Meggers and high-potential test equipment must not be used. Incorrect use of such equipment could damage the semiconductors used inside this regulator.

a. The following operation procedures provide instructions for adjusting the SS42-7 voltage regulator. Symptoms resulting form a faulty regulator and certain generator system problems are included, together with suggested remedies.

b. Complete the following steps before proceeding with system start-up.

3-2 PRELIMINARY SET-UP

a. Verify that the voltage regulator specifications conform to the generator system requirements.

b. Ensure that the regulator links are fitted correctly where required, as follows:

(1) If the remote voltage adjust rheostat is not required, ensure terminals P and Q are linked together.

(2) If a 57 Hz corner frequency for 60 Hz systems desired, ensure the " 50-50 " link is removed. If a 47 Hz corner frequency for 50 Hz systems is desired, ensure the " 50-50 " link is connected.

(3) If the system is to be run in parallel, consider whether shutdown of the generator's excitation is acceptable. If not, ensure that the link between terminals N and D is in place.

c. Confirm that the voltage regulator is correctly connected to the generator; F+ to field positive, F- to field negative, and terminals 3 and 4 to the auxiliary winding supply. It is vital that the sensing connections are correctly made to all 4 wires U, V, X, and Y. Confirm that the metal ring tag at one mounting hole is bonded to ground via either a metal screw or shout length of cable.

d. Install the fuses as per paragraph 2-6.

e. Set the regulator and external voltage adjust, if used, as follows:

Regulator Volts Adjust "V"	Fully CCW
Remote Volts Adjust	Centered
Stability Adjust "S"	Centered

3-3 SYSTEM START-UP

a. Perform preliminary set-up, per paragraph 3-2, checking wiring carefully.

> NOTE
> All AC voltage readings are to be taken with an " RMS average " reading voltmeter.

b. Start the Prime mover and bring it up to rated speed.
RESULT：Voltage should build up to less than nominal value. If not, proceed to paragraph 3-4.

c. Slowly adjust the regulator voltage adjust V until the generator output voltage reaches the nominal value. Should a low frequency oscillation or hunting be present on the generator output voltage, adjust stability control S to cause this to be damped out. In general, " Clockwise " increases the stability but in some cases, too far CW may start to reduce stability again, and will invariably slow the response of the generator to load changes. An optimum method of setting is to adjust S slowly CCW until the generator voltage just starts to become unstable, then back off 1/4 turn CW from that position.

d. If used, adjust the external voltage adjust rheostat to fine trim the voltage to the exact value desired.
RESULT：Voltage should now have built up and be stable at the desired value. If voltage does not build to rated value, check that there is no short circuit or excessive load present on the generator lines. If a minimum residual of 6 Vac is not present, perform " field flashing " per paragraph 3-4.

e. Check regulator under normal operating and loading conditions.
RESULT：Voltage regulation should be better than ± 1.0% no-load to full-load. If regulation is not within this range, check the following:

(1) Voltage reduction under loads of $\cos\theta > 0.0$ may be due to speed reduction due to loading of the prime mover. This may be causing the frequency compensation (V/Hz) circuit to reduce voltage at a speed that is less than the "corner frequency".
(2) Replace voltage regulator.

3-4 FIELD FLASHING

When the regulator is operated with the generator for the first time, the polarity of residual magnetism may be reversed or too small to achieve the necessary build-up voltage for the regulator. If reversing the field connections does not make build-up voltage, and if the residual voltage is less than 6 Vac, shut down the Prime mover and proceed with the following steps:

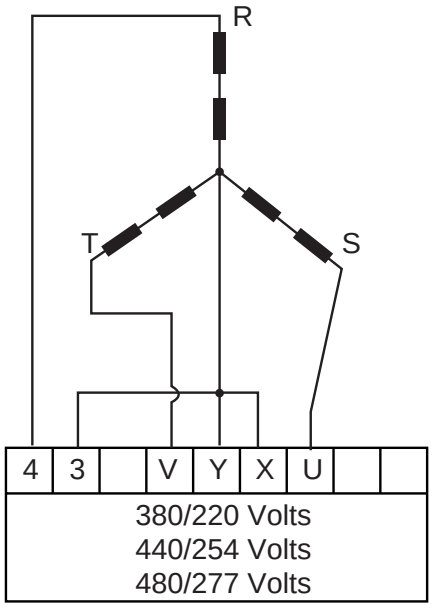
a. With the Prime-mover at rest and the regulator's field output wires disconnected, apply a DC source (NOT grounded) of not more than 24 Vdc with Positive to F+ and Negative to F-.

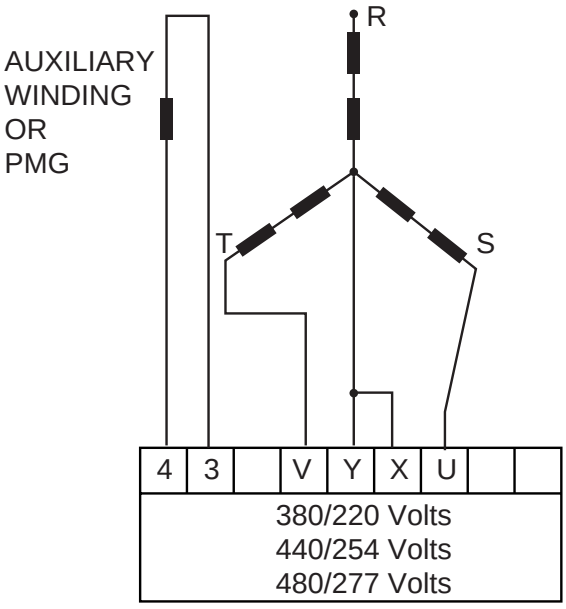
b.

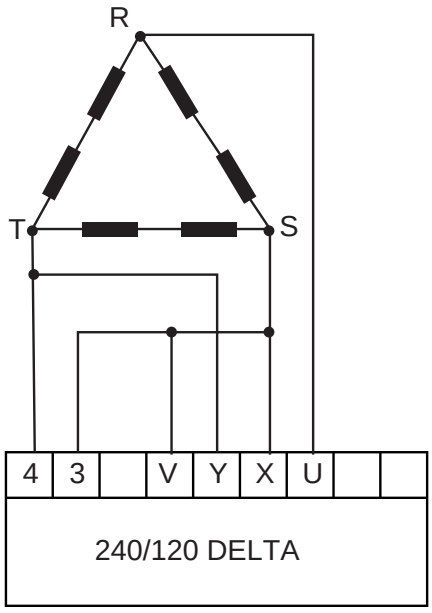
c. Allow approximately 3 seconds before removing the DC source.

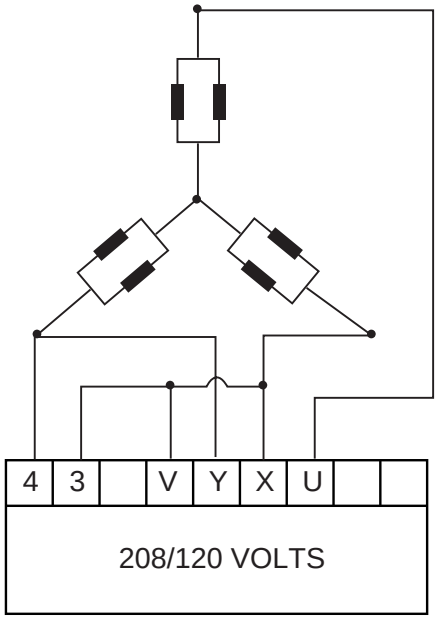
d. With the voltage regulator disconnected (wires 3 and 4), start the prime mover and measure the "residual" voltage available at the auxiliary winding. If this voltage is greater than 6 Vac, reconnect voltage regulator, and voltage build-up should be successful. If less than 6 Vac is measured, repeat field flashing procedure.

e. If repeating steps a. and b. does not result in generator voltage build-up, and residual is greater than 6 Vac, replace voltage regulator.





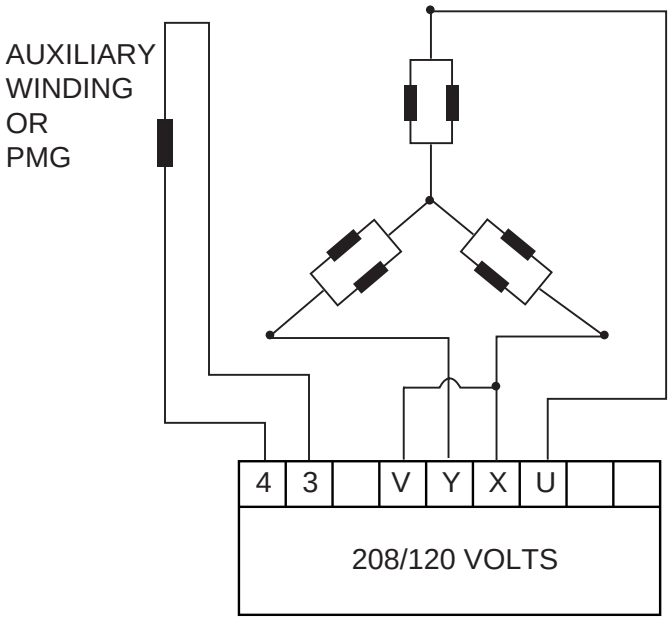




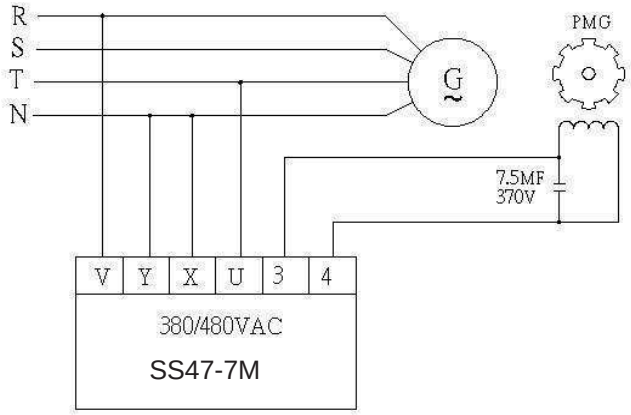
INPUT TERMINALS 3 & 4 CAN BE POWERED USING THE GENERATOR ITSELF, AN AUXILIARY WINDING OR A PMG.

THE INPUT OF 3 & 4 MUST BE FROM 60 TO 277 Vac and from 60 to 400 HERTZ

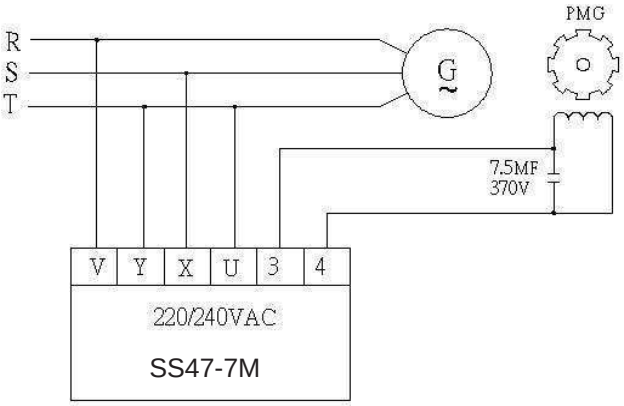
See Regulator instructions for more information



Use SS47-7M in place of PM100 AVR



PM100A		EA42-7(M)	
E1	=	U	INPUT MAX 277VAC
E2	=	X	
E2	=	Y	INPUT MAX 277VAC
E3	=	V	



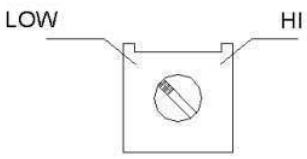
Original PM100 is used in 1 or 3 phase alternators.
If used with 3 phase sensing voltage feed lines into E1, E2, E3 (one E2 lead is null)
If used with 1 phase sensing voltage feed lines into E1, E2 and connect jumper between E2,E3
--See Marathon drawing at http://www.marathonelectric.com/generators/connect/PM1001.pdf

To replace the PM100 with the SS42-7M

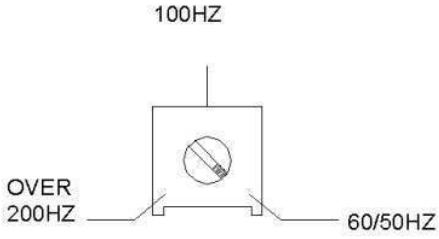
1) If 3 phase 200~240V (R,S,T)
wiring R-->U, S-->Y, T-->X & V
= E1-->U, E2--Y, E3-->X & V

2) If 3 phase 380 ~ 480V
The alternator must have neutral point N
Interwiring R-->U, T-->V, N-->Y & X
= E1-->U, E3-->V, N-->Y & X
E2 must be isolated avoid E2 conducting to any metal.

3) PMG is wired to lead 3 and 4 of SS42-7M
Keep original capacitor connected to the 2 wire of PMG output.
The capacitor is a big (5~7.5MF 370V) and it is connected to leads 3 & 4 of PM100
The SS42-7M has no additional lead to connect capacitor therefore move connection to terminal 3 & 4
4) Add one 3A 600V fuse ahead of either lead 3 or 4 wiring



U/F



HF

fig-2

Set HF to Max CCW for PM100 Use