INSTRUCTION MANUAL
FOR
VOLTAGE REGULATOR
Model: APR 125-5X
Part Number: 9 1688 00 102

Basler Electric

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Warning

To prevent personal injury or equipment damage, only qualified technicians/operators should install, operate, or service this device.

Caution

Meggers and high potential test equipment should be used with extreme care. Incorrect use of such equipment could damage components contained in the device.

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It is not the intention of this manual to cover all details and variations in equipment, nor does it provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to change without notice. Should further information be required, call Basler Electric Company, Highland, IL.

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SECTION 1

GENERAL INFORMATION

1-1. GENERAL

a. The Basler APR 125-5X Voltage Regulator is an encapsulated unit contained in a metal case. The regulator controls the dc exciter field power of medium-sized, 50 or 60 Hz brushless generators that have a 63 Vdc field to regulate the output voltage.

b. Regulation is provided by sensing the generator output voltage, converting it to a dc signal and comparing the signal to a reference voltage signal. An error signal is developed and used to control the dc field power in order to maintain a constant generator output.

1-2. SPECIFICATIONS

Refer to Table 1-1 for the electrical specifications and to Table 1-2 for the physical specifications of the APR 125-5X.

Table 1-1. Electrical Specifications.

Output Power (with a 120 Vac Input):	5 Adc @ 63 Vdc (315 W) maximum continuous. 8 Adc @ 100 Vdc (800 W) forcing for one minute.
Exciter Field Dc Resistance:	13 W minimum to 100 W maximum.
Ac Input Power:	95 to 139 Vac, ±10%, single-phase, 50/60 Hz.
Input Burden:	500 VA maximum.
Ac Sensing Voltage: **120 Vac:** **240 Vac:**	 95/110 Vac at 50 Hz nominal; 104/120 Vac at 60 Hz nominal. 190/200/208 Vac at 50 Hz nominal; 208/425/240 Vac at 60 Hz nominal.
Sensing Burden:	1 VA.
Voltage Adjust Range:	85 to 132 Vac or 170 to 240 Vac using the internal voltage adjust. The external voltage adjust provides a ±10% adjustment of the nominal value determined by the internal voltage adjust.
External Voltage Adjust Rheostat:	A 5000 W, 2 W, locking-shaft potentiometer with a screwdriver slotted shaft is supplied with the regulator for remote mounting.
Regulation Accuracy:	±0.25%.
Voltage Drift:	<±1% voltage variation for a 50°C (90°F) change.
Response Time:	<1.0 cycle.
Frequency Compensation:	Refer to Figure 1-1.
EMI Suppression:	Internal electromagnetic filter (EMI filter).

Table 1-1. Electrical Specifications - Continued.

Voltage Build-up:	Internal provisions for automatic voltage build-up from generator residual voltages as low as 6 Vac.
Overexcitation Shut-down:	Refer to paragraph 1-3.
Power Dissipation:	25 W maximum.

Table 1-2. Physical Specifications.

Operating Temperature:	-40°C (-40°F) to +60°C (+140°F).
Storage Temperature:	-65°C (-85°F) to +85°C (+185°F).
Shock:	Withstands up to 15 G's in each of three mutually perpendicular axes.
Vibration:	Withstands the following accelerations at the stated frequency: 1.2 G's at 5 to 26 Hz, 0.036" double amplitude at 27 to 53 Hz, 5.0 G's at 53 to 1000 Hz.
Weight:	5.1 lbs. (2.3 kg) net, 6.1 lbs. (2.8 kg) shipping.

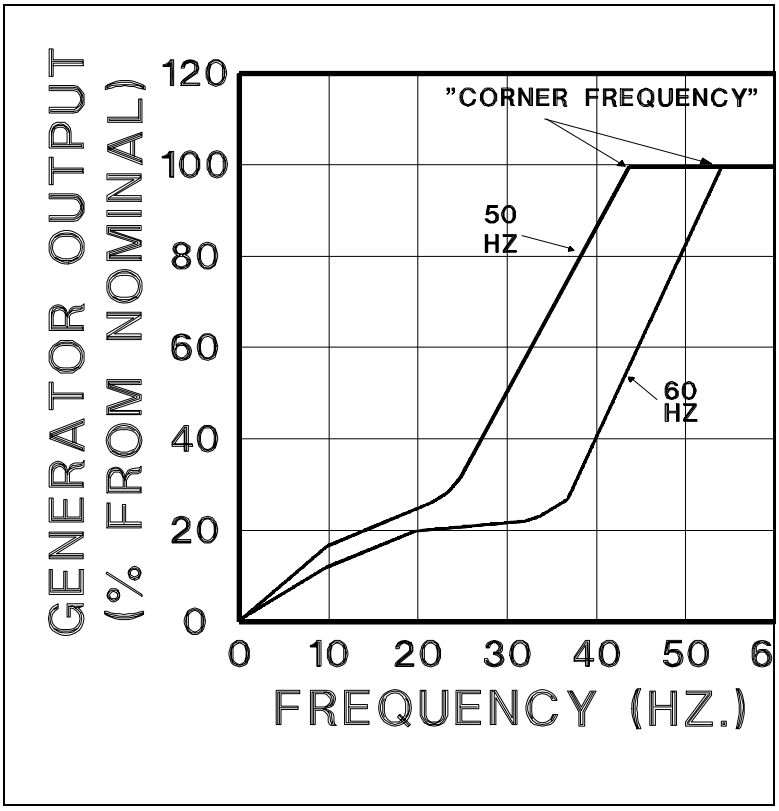

Figure 1-1. Typical APR 125-5 Frequency Compensation Curves.

1-3. OVEREXCITATION SHUTDOWN

a. Refer to Figure 1-2. If the exciter field voltage exceeds 95 Vdc, the regulator automatically removes the field current after a time delay. The time delay is inversely proportional to the magnitude of the detected overvoltage condition. At approximately 140 Vdc, the field voltage is removed instantaneously. Overexcitation shutdown will not operate below 80 Vdc.

b. Upon detection of overexcitation and the resulting field voltage shutdown, the regulator will not reset or return to an operational condition until the generator output drops to less than 6 Vac for ten (10) seconds minimum.

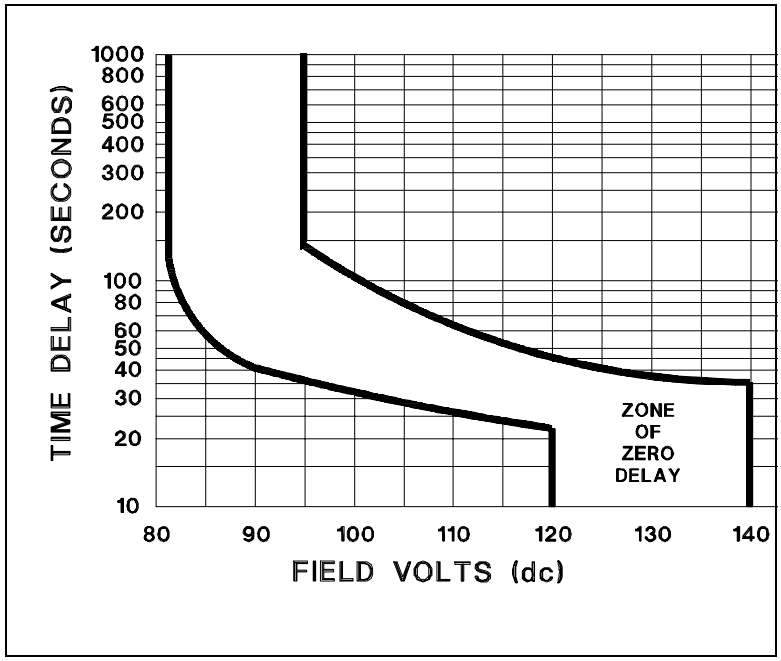

Figure 1-2. Typical Inverse Time Delay Characteristic Curves.

1-4. ACCESSORY ITEMS

a. Power Isolation Transformer. A low voltage power isolation can be used to provide electrical isolation and to match voltages from the generator to the regulator. To obtain maximum regulator output power (exciter field resistance of 13 to 15 W), select a power isolation transformer of 0.5 kVA or greater. For field resistances of 15 W or more, the transformer may be derated (300 VA at 50 W, 150 VA at 100 W).

b. Paralleling Module (APM 2000). To parallel two or more generators using droop or cross-current compensation, use this module and a current transformer with a 5 A nominal secondary such as the Basler CT series.

c. Manual Voltage Control (MVC 300). This control offers back-up excitation for the regulator in critical applications. The regulated output of this electronic manual control improves the performance of a generator using traditional types of manual control.

d. Current Boost System (CBS 305). Using the electronics built into the APR 125-5X, and a current transformer to tap the generator's line current, the CBS 305 boosts the field current during short circuit or large motor starting.

SECTION 2

INSTALLATION

2-1. MOUNTING

The regulator may be mounted in any position. Refer to the outline drawing (Figures 2-1 and 2-2). The regulator may be mounted directly on the generator set using 1/4" hardware. Select the proper hardware to withstand any expected shipping/transportation and operating conditions.

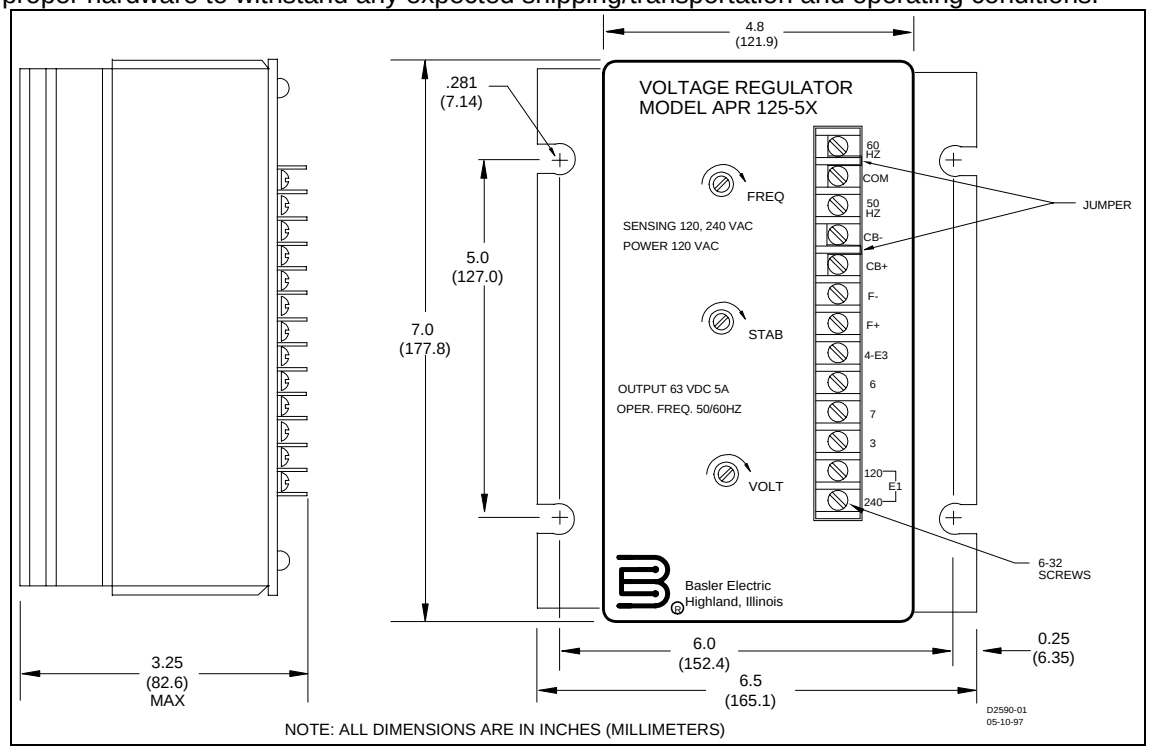

Figure 2-1. APR 125-5X Outline Drawing.

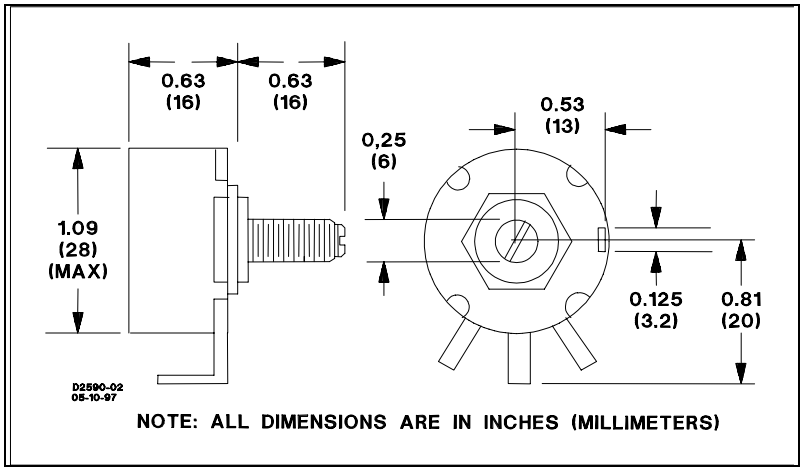

Figure 2-2. External Voltage Adjust Potentiometer, Basler P/N 06390.

2-2. INTERCONNECTION (Refer to Figures 2-3 through 2-5.)

a. Connect the jumper from **COM** to either the **50 Hz** or **60 Hz** terminal depending upon the generator frequency.

b. Remove the jumper and connect terminals **CB-** and **CB+** to the CBS 305 inputs (if used). If the CBS 305 is not being used, leave the jumper in place.

c. If an external voltage adjust control is being used, connect the potentiometer to terminals **6** and **7** as shown. If not, connect a jumper between terminals **6** and **7**.

d. Connect the exciter field to terminals **F+** and **F-**. Be sure to observe polarity.

e. Connect the input power to the generator stator to provide power to terminals **3** and **4-E3** within the voltage range of 95 to 139 Vac nominal. Fuse both leads. Install the optional shutdown switch, if desired.

f. Connect the sensing input to either **120 (E1)** or **240 (E1)** and to terminal **4-E3** depending on voltage. The sensing should be connected "line-to-line".

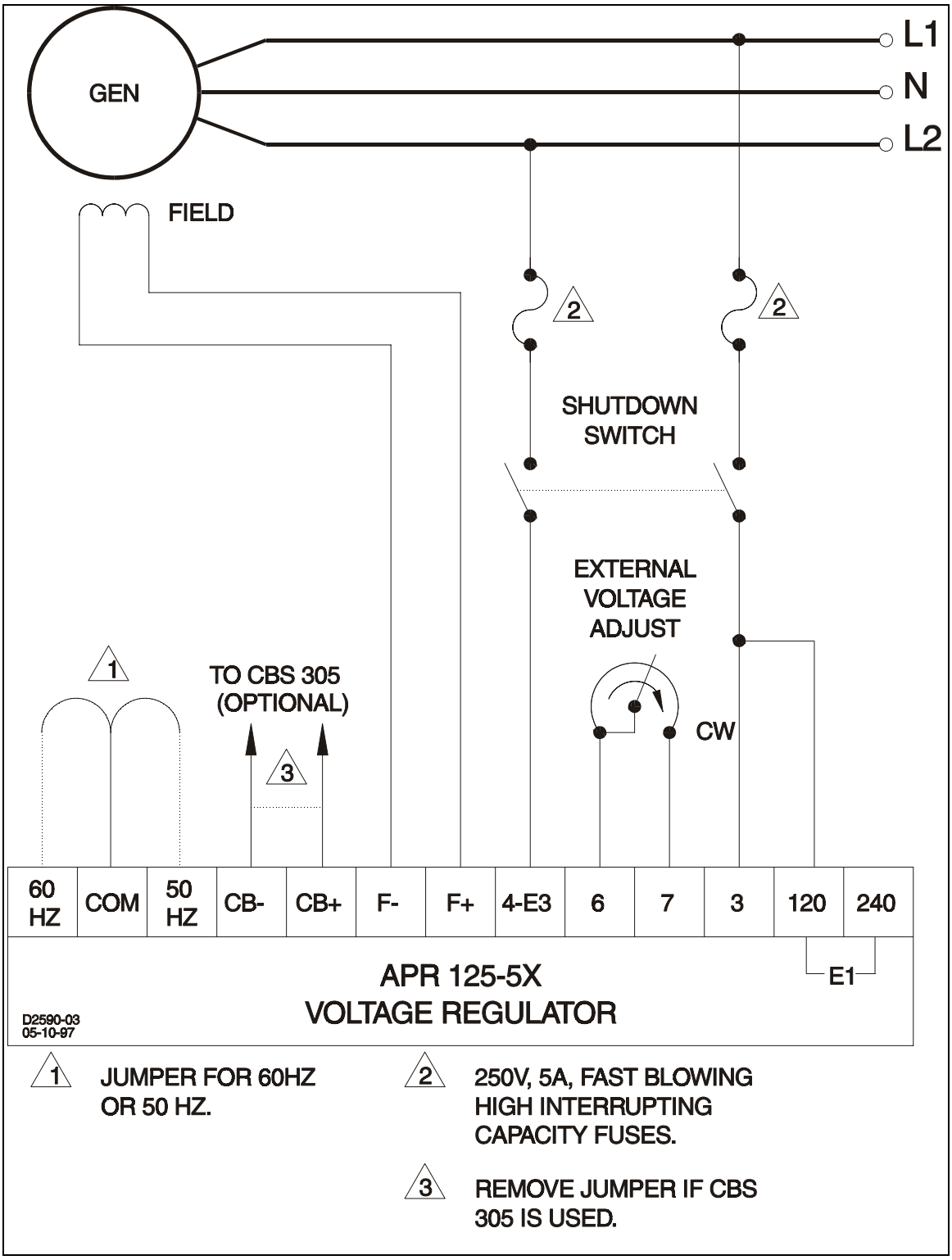

Figure 2-3. 120/240 Vac, Single-Phase, Interconnection Diagram.

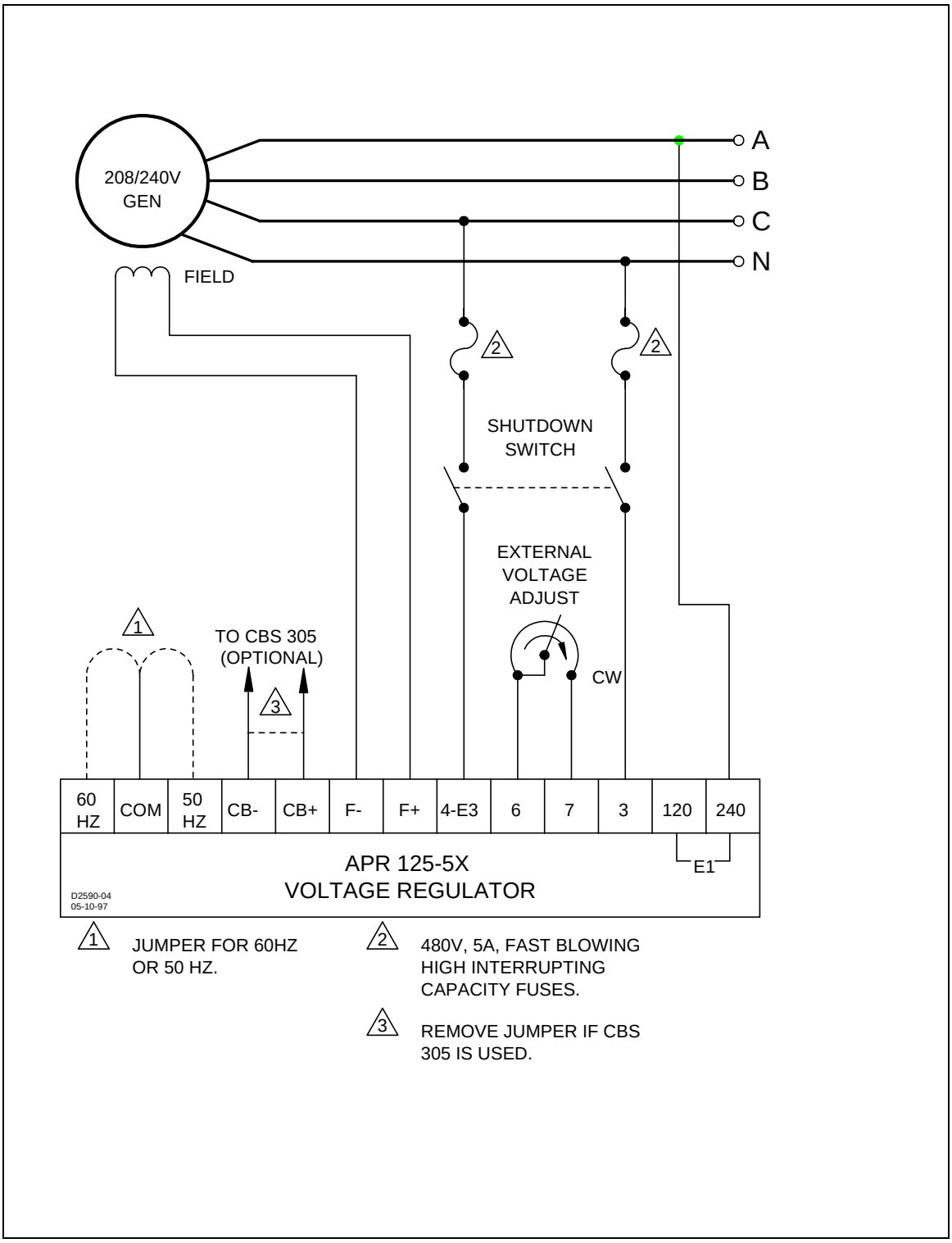

Figure 2-4. 208/240 Vac Interconnection Diagram.

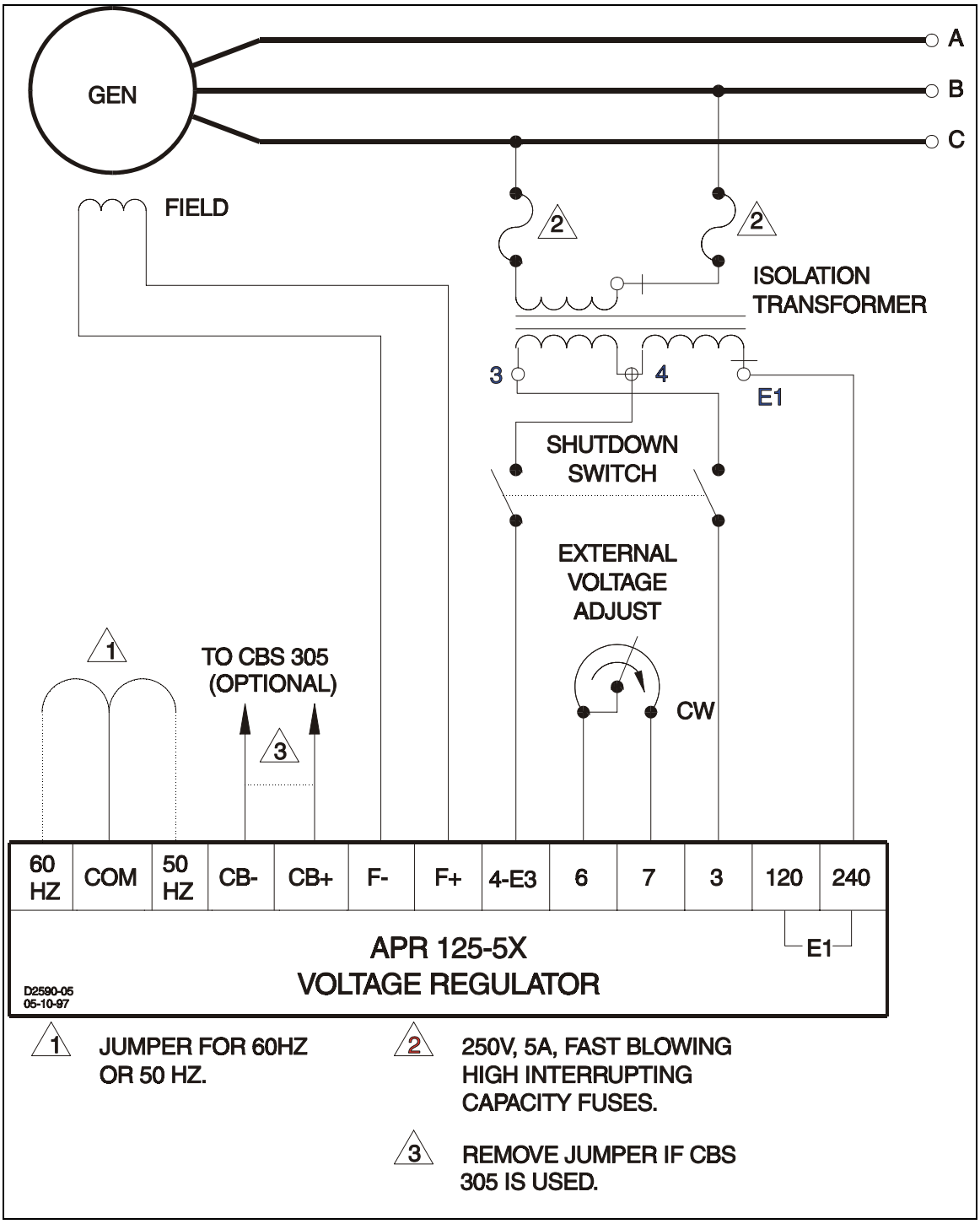

Figure 2-5. Isolation Transformer Interconnection Diagram.

SECTION 3

OPERATION

3-1. GENERAL

The below procedures provide instructions for setting up, starting, operating, and adjusting the APR 125-5X Voltage Regulator. Symptoms of problems occurring during start-up that result from incorrect regulator adjustment and certain generator system problems that resemble faulty regulation, are included together with possible solutions.

3-2. PRELIMINARY SET-UP

To prevent damage to the regulator, complete the following steps before proceeding with system start-up:

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

b. Ensure that the regulator has been installed and connected in accordance with Section 2.

3-3. OPERATION AT REDUCED SPEEDS

During periods of prime mover idling, use the shutdown switch to remove power from the regulator.

3-4. SYSTEM START-UP

Refer to Table 3-1 for starting up the system.

Table 3-1. System Start-up.

Procedure	Symptom	Remedy
1. Perform the preliminary set-up per paragraph 3-2.	N/A	N/A
2. Start prime mover and bring up to rated speed.	a. Voltage does not build-up.	a. Flash field. b. Troubleshoot.
	b. Voltage builds up and then decays.	Troubleshoot.
3. Slowly adjust **VOLT** adjustment or external voltage adjust rheostat until voltage reaches nominal.	a. Voltage does not build up to rated value.	a. Check generator output for shorted or excessive load. b. Troubleshoot.
	b. Voltage high and uncontrollable.	Troubleshoot.

Table 3-1. System Start-up - Continued.

Procedure	Symptom	Remedy
4. Apply and remove load to check stability.	Generator response too slow or is hunting (oscillating).	a. Check generator output for shorted or excessive load. b. Troubleshoot.
5. Check regulation under normal operating conditions.	Poor regulation.	a. Check that prime mover is up to speed. b. Check that voltmeter is connected at the same point as the regulator sensing. c. Use an average sensing voltmeter (not an RMS sensing). d. Troubleshoot.
6. Reduce generator frequency to approximately 5 Hz below nominal. Generator output should decrease from this point.	Generator output voltage does not decrease at desired frequency.	a. Check that all wiring is in accordance with section 2. b. Adjust FREQ control.

3-5. OVEREXCITATION SHUTDOWN

a. The overexcitation shutdown is included to remove the regulator output power if the exciter field voltage exceeds 95 Vdc. Refer to paragraph 1-3 for details.

b. After regulator output power is shutdown, the regulator can be reset by decreasing the input voltage to less than 6 Vac for a minimum of 10 seconds. This may be accomplished by stopping the prime mover or by interrupting the regulator input with the shutdown switch.

3-6. ADJUSTMENTS

a. Field Flashing. When the regulator is operated with the generator for the first time, the polarity of the residual magnetism may not be correct or of sufficient magnitude. If the residual voltage at terminals **3** and **4-E3** is greater than 6 Vac, replace the regulator. If generator residual voltage is less than 6 Vac at terminals **3** and **4-E3**, shut down the prime mover and proceed with the following steps:

CAUTION

Do not flash the field with the generator in motion. The regulator may be damaged.

(1) With the prime mover at rest, apply a dc source (ungrounded), of not more than 48 Vdc, to terminals **F+** (positive) and **F-** (negative) in series with a limiting resistor. Use one (1) ohm of resistance for each volt from the dc power source with a power rating of least one (1) watt per ohm.
EXAMPLE: If using a 24 Vdc source, use a 24 ohm, 24 watt resistor.

(2) Allow the field to be flashed for approximately ten seconds before removing the dc source.

(3) If voltage build-up does not occur after performing steps (1) and (2), verify the polarity of the dc source used in steps (1) and (2) and re-perform.

b. Frequency Roll-Off Adjustment. The APR 125-5X underfrequency adjust is factory preset to cause an average 2 V drop in the generator's line input voltage to the regulator when the frequency is between 55 and 55.6 Hz (for 60 Hz applications). For 50 Hz applications, the frequency "roll-off" is factory preset to between 45.75 and 47.75 Hz. To reset the frequency roll-off, proceed as follows:

(1) Adjust the prime mover RPM to the desired frequency compensation (corner frequency roll-off) point.

(2) Adjust the front panel **FREQ** control until the output voltage starts to drop off.

(3) Bring the prime mover up to rated speed. The output voltage should return to normal.

c. Stability Adjustment. An oscilloscope or other voltage recording device should be used if a stability setting is desired that will provide the fastest possible voltage response with good generator stability.

(1) Rotation of the front panel **STAB** control in the clockwise (CW) direction will slow response time.

(2) Rotation of the front panel **STAB** control in the counter-clockwise (CCW) direction will speed response time. If rotated too far CCW, the generator voltage may oscillate (hunt).

(3) Rotate the front panel **STAB** control CCW until the system starts oscillating and then rotate CW just past the point where oscillation occurred.

d. Voltage Adjustment.

(1) Installation of a jumper across terminals **6** and **7** allows the internal (front panel) **VOLT** adjustment to vary the generator nominal voltage over the range shown in Table 1-1.

(2) The 5000 ohm external potentiometer (supplied with the regulator) may be connected in place of the jumper and will allow for a ±10% adjustment of the voltage range. The nominal value of this range is set by the front panel **VOLT** control.

(3) If a range less than or greater than that provided by the 5000 ohm potentiometer is desired, a 2 Watt potentiometer of any value from 1000 ohms to 10000 ohms may be substituted.

3-7. OPERATIONAL TEST

To operationally test any APR 125-5X, refer to Figure 3-1 and perform the following steps in the order given:

a. Connect the voltage regulator as shown by Figure 3-1 and apply 120 Vac as shown.

b. Adjust the front panel **VOLT** control fully counter-clockwise (CCW).

RESULT: Observe that the lamp does not light.

c. Adjust the front panel **VOLT** control fully clockwise (CW).

RESULT: Observe that the lamp is now lit.

d. Adjust the front panel **VOLT** control until the lamp just goes out.

Regulator operation is satisfactory if the above results are obtained. Stability, however, must be tested with the generator and regulator operating.

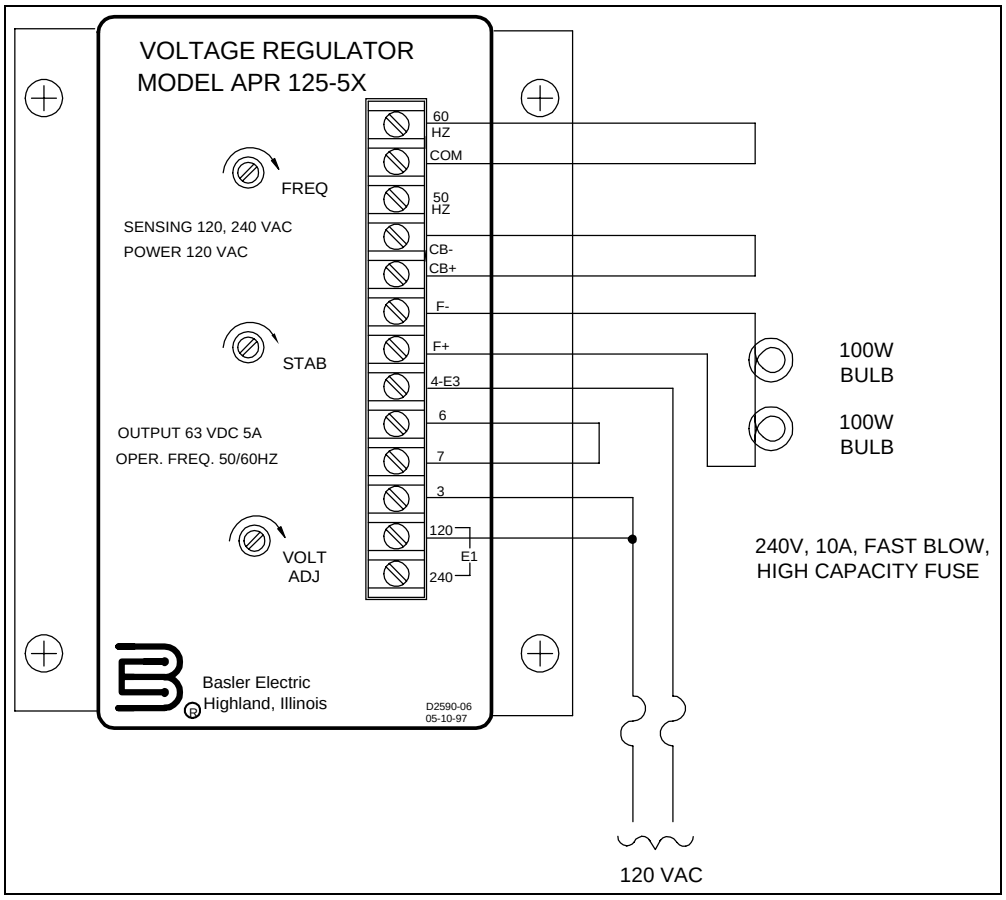

Figure 3-1. Operational Test.

SECTION 4

MAINTENANCE

4-1. PREVENTIVE MAINTENANCE

A periodic inspection should be made of the voltage regulator to ensure that it is clean and free from accumulations of dust and moisture. Be sure that all terminal connections are clean and tight.

4-2. TROUBLESHOOTING

In case of failure/defective operation of the unit, the following table (Table 4-1) is provided to aid in the determination of the cause and the possible solution.

Table 4-1. Troubleshooting.

Symptom	Possible Cause	Remedy
Voltage does not build up.	a. No voltage or incorrect voltage to power input at terminals **3** and **4-E3**.	a. Flash field. b. Verify wiring. c. Check fuses. d. Check shutdown switch. e. Replace regulator.
	b. Overexcitation circuit is shutting off regulator.	Shutdown prime mover then restart. Watch for high voltage.
Voltage builds up and then decays.	a. Open external voltage adjust rheostat or no connection between terminals **6** and **7**.	Replace external voltage adjust rheostat or the jumper across terminals **6** and **7**.
	b. Defective regulator.	Replace regulator.
Voltage does not build up to rated value.	a. Terminals **CB+** and **CB-** are not jumpered.	Install jumper across terminals **CB+** and **CB-**.
	b. Wrong sensing tap selected.	Check sensing tap.
	c. Internal or external voltage adjustments are improperly set.	Adjust front panel **VOLT** control and/or external voltage adjust rheostat.
	d. Faulty regulator.	Replace regulator.

Table 4-1. Troubleshooting - Continued.

Symptom	Possible Cause	Remedy
Voltage high and uncontrollable.	a. No sensing input.	Verify wiring.
	b. Wrong sensing tap.	Check sensing tap.
	c. Faulty regulator.	Replace regulator.
Generator response too slow or hunting.	a. Improper front panel **STAB** adjustment.	Re-adjust front panel **STAB** adjustment.
	b. Faulty regulator.	Replace regulator.
Poor regulation.	a. Field resistance not matched to regulator capability or regulator output rating too low for generator requirements.	Verify specifications.
	b. Incorrect jumper selection for 50 Hz or 60 Hz operation.	Check for improper frequency jumper installation.
	c. Low prime mover speed.	Verify prime mover speed.