




# SSE

## Shunt Static Exciter-Regulator

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*Instruction Manual*

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# INTRODUCTION

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This instruction manual provides information about the operation and installation of the SSE Regulator. To accomplish this, the following information is provided:

- General Information and Specifications
- Controls and Indicators
- Functional Description
- Installation
- Maintenance

## WARNING!

To avoid personal injury or equipment damage, only qualified personnel should perform the procedures in this manual.

## NOTE

Be sure that the device is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal. When the device is configured in a system with other devices, it is recommended to use a separate lead to the ground bus from each unit.

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

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# SECTION 1 • GENERAL INFORMATION

## ***Introduction***

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The Basler Electric Shunt-Static Exciter-Regulator (SSE) controls and regulates the generator output voltage by controlling the generator field voltage. Standard features include underfrequency or volt/hertz operation, manual control, and provisions for paralleling. The capabilities and parameters of each model are detailed in Table 1-1. A power input transformer is supplied as a part of the SSE. Transformer information and ratings are contained in Table 1-2.

## ***Specifications***

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Underfrequency Operational Parameters	See Figures 1-1 and 1-2
Underfrequency Operational Threshold	55 Hz in 60 Hz systems, 45 Hz in 50 Hz systems
Voltage Regulation	Less than $\pm 0.5\%$ for rated generator loading
Regulator Drift	Less than 1% for 50°C (122°F) temperature change
Dimensions (Typical)	See Figures 4-1 and 4-2
Exciter-Regulator Response	Less than 50 milliseconds
Voltage Adjust Range	+10% of nominal* -10% of nominal*
Ambient Operating Temperature	-40°C to +50°C (-40°F to +122°F)
Storage Temperature	-65°C to +85°C (-85°F to +185°F)

\*Factory set at these values. Capable of adjustment between  $\pm 10\%$  from any specific voltage using an internal range adjust potentiometer.

## ***Options***

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The list of options described below contains some of the options that are available on all units and may be on your unit.

- Failed rectifier detector
- Auto / manual nulling meter
- Manual tracking motor operated potentiometer
- Over / under excitation limiting
- AC shut-down contactor
- Field flashing contactor
- Paralleling current transformers
- VAR / power factor controller
- Primary fusing for power transformer when sold in cubicle
- Metering
- Potential transformer
- Cubicles
- MOC potentiometers
- Overexcitation protective relay
- Underexcitation protective relay

Table 1-1. Shunt Exciter Selection Table

SSE Model Number	Power Input			Field Power Requirements				Sensing		Parallel Compensation		Min. Field Resistance (Ohms)	
				Max. Cont.	1 Min. Forcing		kW	VAC	Max. Burden VA / Ø	ADC (Input)	Burden VA Max.		
	VDC	ADC	VDC		ADC								
63-4.5	80	50/60	8	63	72	90	103	4.5	*	10	5	25	0.875
125-4.5	160	50/60	8	125	36	180	52	4.5	*	10	5	25	3.472
63-6.5	80	50/60	12	63	103	90	147	6.5	*	10	5	25	0.611
125-6.5	160	50/60	12	125	52	180	75	6.5	*	10	5	25	2.404
63-9	80	50/60	16	63	143	90	205	9	*	10	5	25	0.440
125-9	160	50/60	16	125	72	180	103	9	*	10	5	25	1.736
63-13	80	50/60	24	63	206	90	295	13	*	10	5	25	0.306
125-13	160	50/60	24	125	104	180	149	13	*	10	5	25	1.202
63-17	80	50/60	31	63	270	90	386	17	*	10	5	25	0.233
125-17	160	50/60	31	125	136	180	196	17	*	10	5	25	0.919
250-17	320	50/60	31	250	68	360	98	17	*	10	5	25	3.676
63-25	80	50/60	45	63	397	90	568	25	*	10	5	25	0.165
125-25	160	50/60	45	125	200	180	288	25	*	10	5	25	0.625
250-25	320	50/60	45	250	100	360	144	25	*	10	5	25	2.500
125-33	160	50/60	59	125	264	180	280	33	*	10	5	25	0.473
250-33	320	50/60	59	250	132	360	190	33	*	10	5	25	1.894
125-50	160	50/60	90	125	400	180	576	50	*	10	5	25	0.313
250-50	320	50/60	90	250	200	360	288	50	*	10	5	25	1.250
125-65	160	50/60	117	125	520	180	750	65	*	10	5	25	0.240
250-65	320	50/60	117	250	260	360	374	65	*	10	5	25	0.963
125-100	160	50/60	180	125	800	180	1152	100	*	10	5	25	0.156
250-100	320	50/60	180	250	400	360	576	100	*	10	5	25	0.625
125-125	160	50/60	225	125	1000	180	1440	125	*	10	5	25	0.125
250-125	320	50/60	225	250	500	360	720	125	*	10	5	25	0.500
250-150	320	50/60	270	250	600	360	864	150	*	10	5	25	0.417

**Notes:**

\*60 Hz: 120-139,208-240, 416-480,520-600, ±10%  
 50 Hz: 100-110, 220-230-240, 380-400-415, 500 ±10%

Table 1-2. Standard Model Power Isolation Transformer Selection

SSE Model No.	225 / 450 **	600	2400 / 4160	13800	Secondary
63-4.5	BE15482001	*	BE21027001	*	80/160
63-6.5	BE18222001	*	*	*	80
63-25	BE15803001	*	BE20221001	*	80
125-4.5	BE15482001	*	BE21027001	*	80/160
125-6.5	BE15201001	BE15202001	BE15203001	BE15205001	160
125-9	BE15206001	BE21439001	BE15208001	BE15210001	160
125-13	BE15211001	BE15212001	BE15213001	BE15205001	160
125-17	BE15221001	BE15222001	BE15223001	BE15225001	160/320
125-25	BE15236001	BE15227001	BE15228001	BE15230001	160/320
125-33	BE15236001	BE15237001	BE15238001	BE15240001	160/320
125-50	BE15241001	BE15247001	BE15243001	BE15250001	160/320
125-65	BE18301001	BE15247001	BE15248001	BE15250001	160/320
125-100	BE15231001	BE15232001	BE15233001	BE15235001	160/320
250-6.5	*	BE18576001	*	*	160/320
250-17	BE15221001	BE15222001	*	*	160/320
250-25	BE15226001	BE15227001	BE15228001	BE15230001	160/320
250-33	BE15236001	BE15237001	BE15238001	BE15240001	160/320
250-50	BE15241001	BE15247001	BE15243001	BE15250001	160/320
250-65	BE18301001	BE15247001	BE15248001	BE15250001	160/320
250-100	BE15231001	BE15232001	BE15233001	*	160/320
250-150	*	*	*	*	160/320

**Notes:**

- \* Consult the factory.
- \*\* All 225 / 440 volt transformers will operate at the following voltages:
  - 60 Hz: 208, 225, 240 / 416, 450, 480 Vac  $\pm$ 10%
  - 50 Hz: 220, 230, 240 / 380, 400, 415 Vac  $\pm$ 10%
  - Nominal exciter forcing levels are based upon 225 / 450 Vac (60 Hz) transformer input. Operation with voltages (transformer primary) other than these will result in a proportional increase or decrease in the exciter forcing.
- Transformers with a 60 or 95 kV BIL rating are available. Consult the factory for data.

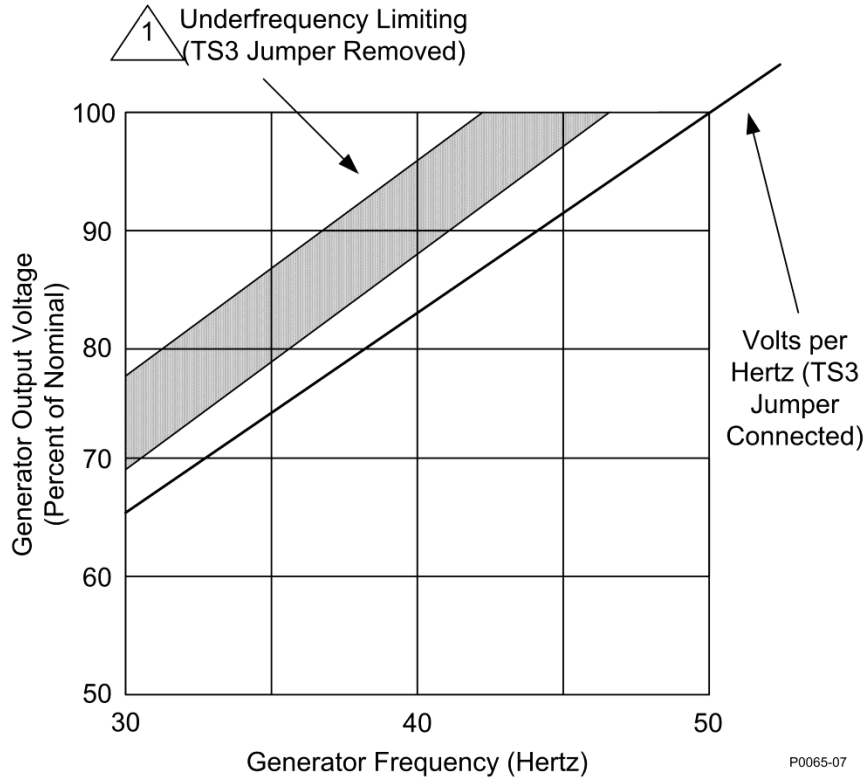


Figure 1-1. Voltage / Frequency Characteristic Curve (50 Hz)

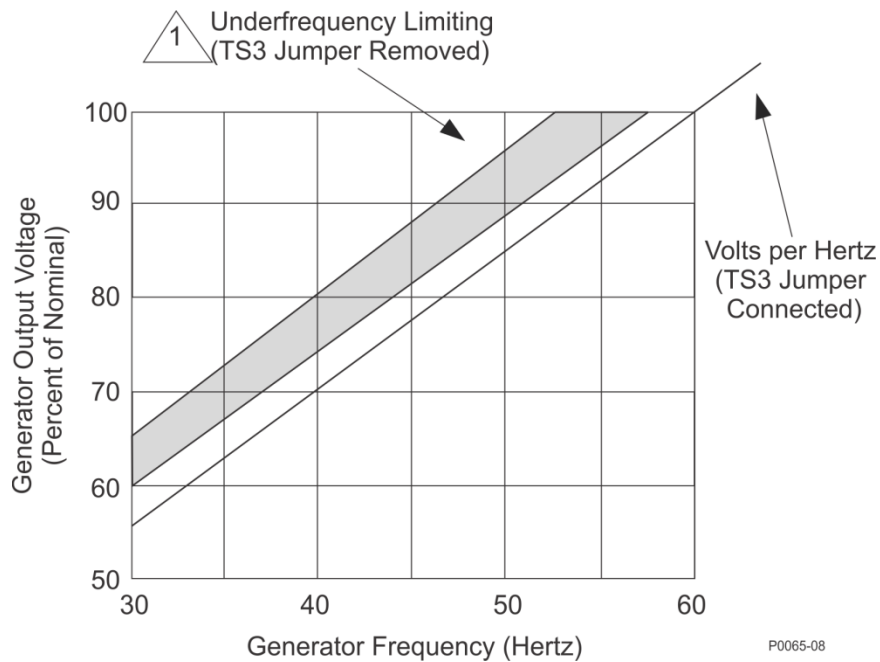


Figure 1-2. Voltage / Frequency Characteristic Curve (60 Hz)



The spread in the envelope (shaded area) is a function of operational temperature and component tolerance.

## SECTION 2 • THEORY OF OPERATION

### ***Operating Power***

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Three-phase ac is applied to the power isolation transformer to provide operating power to the regulated power supply and the semiconverter power rectifier bridge.

When the generator is placed into operation, residual voltage will pass through the normally closed contacts of K1. It is then rectified and applied to the generator field. When the generator output voltage builds up to a sufficient value, K1 (connected across the output of the regulator power supply) energizes, and the contacts open, removing the voltage build-up circuits. Thereafter, the power bridge output is established by the gating pulses from the firing circuits. The minimum residual voltage required for build-up without flashing is approximately 5% of nominal.

### ***Flash and Overflash Protection (SSE 250 Series Only)***

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This circuit provides 125 Vdc to the generator field during start-up. When the generator output voltage rises to 35% of nominal, the flashing voltage is removed and the static exciter regulator takes over. If the output voltage does not build up in 25 seconds, the flashing voltage is removed by the overflash protection circuitry.

### ***Semiconverter Power Rectifier (Power Bridge)***

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The conduction time of the SCRs in the power bridge determines the amount of output current supplied to the generator exciter field. Conduction time is controlled by the timing of gating pulses from the firing circuits. The greater the conduction time of the SCRs, the greater the output current. The less the conduction time, the less the output current.

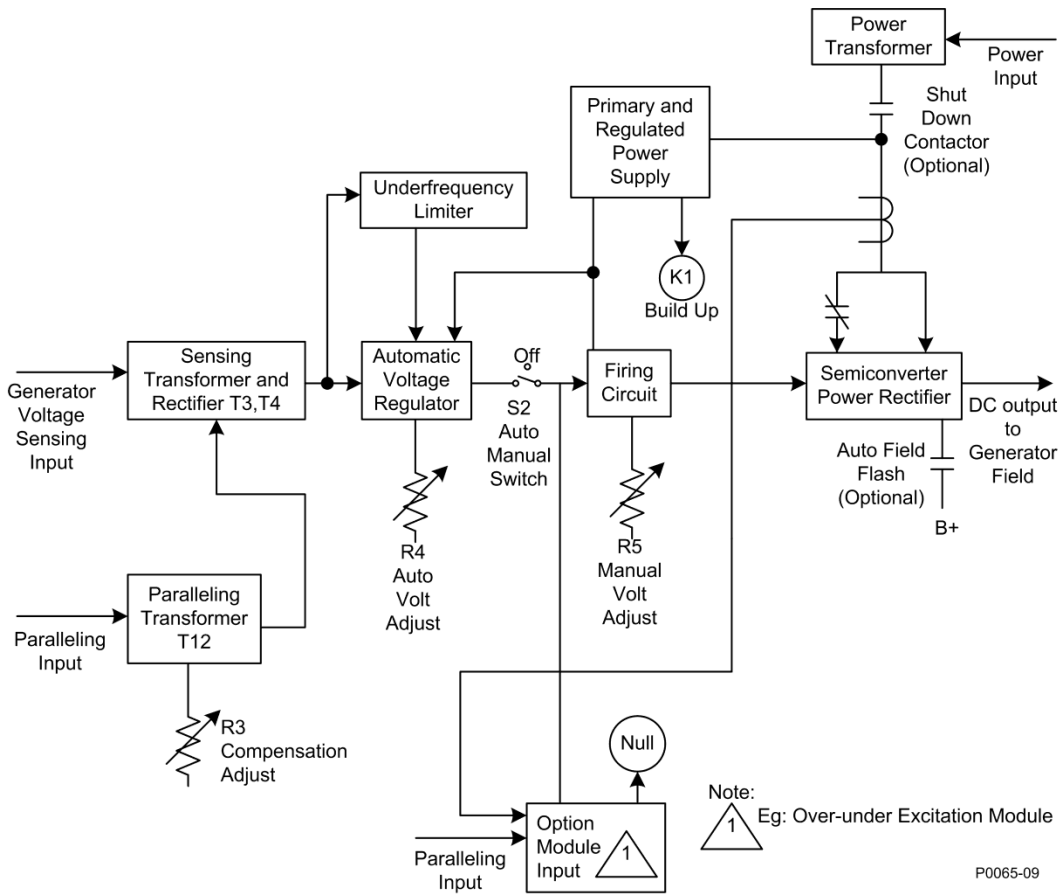


Figure 2-1. Functional Block Diagram (SSE 63 and 125 Series Only)

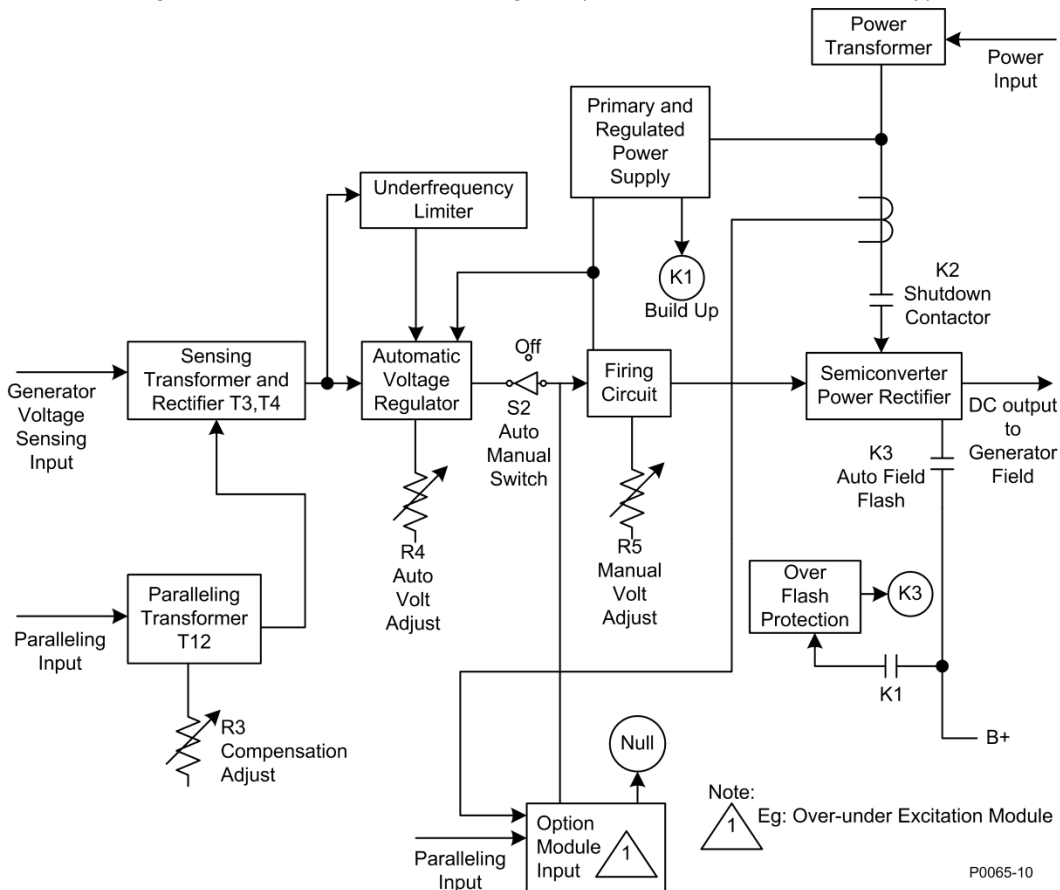


Figure 2-2. Functional Block Diagram (SSE 250 Series Only)

## ***Firing Circuit***

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The circuit compares a dc signal representative of the SCR output with a reference input established by the manual adjust control (R5). Gating pulses to the power bridge are developed as a result of the comparison of the two inputs. As R5 is adjusted to demand a higher or lower nominal generator output, the firing circuits determine whether the gating pulses need to be applied earlier or later in the SCR firing cycle to establish the new operating level. The power bridge responds by providing the correct output to the generator field. When the auto / manual mode switch is in manual, R5 (essentially a manual voltage control) and the firing circuits function independently of the rest of the exciter-regulator and the excitation system does not regulate the system ac voltage. (Refer to Section 3, *Controls*)

## ***Generator Sensing***

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Single-phase generator sensing voltage is connected at TS3-E1 and TS3-E3. Three-phase generator sensing is connected to TS3-E1, TS3-E2, and TS3-E3. The sensing inputs are applied to the primary of sensing transformers T3 and T4. The output voltage from the transformer(s) secondary windings is rectified and a representative sample, taken from a voltage divider network, is applied to the automatic voltage regulator. Selection of single-phase or three-phase sensing is done with a jumper on TS2 (Refer to Section 3, *Jumper Connections*).

## ***Automatic Voltage Regulator (AVR)***

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The AVR senses any change in generator output voltage and translates such changes into a dc error voltage. When the auto / manual mode switch is auto, the dc voltage is sent to the firing circuits where it modifies the gating pulse output originally established by the manual adjust control. When the AVR determines that the generator output voltage is low, the gating pulses are applied to the power bridge SCRs earlier in the cycle to cause a greater dc output. When the generator output voltage is high, the gating pulses are applied later in the cycle causing less current in the generator field.

## ***Underfrequency Limiter***

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The output from one winding of the generator sensing transformer is applied to the underfrequency limiter circuit. It is the function of this circuit to reduce the generator output voltage when the generator is operated at less than rated speed. The percentage of generator output voltage that will be obtained for a specific reduction in frequency is illustrated in Figures 1-1 and 1-2. The horizontal axis of the graph represents generator frequency and the vertical axis represents the percent of nominal generated output voltage. Volts-per-hertz operation is obtained by jumping the terminals located on TS3. Limiting for 50 or 60 Hz is obtained by proper positioning of the jumper on TS4. (Refer to Section 3, *Jumper Connections*)

## ***Parallel Compensation***

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When two generators are operating in parallel, if the field excitation on one generator becomes excessive and causes a circulating current flow between generators, this current will appear as a lagging power factor (inductive) load to the generator with excessive field current and as a leading power factor (capacitive) load to the other. The parallel compensation circuit causes the exciter-regulator to decrease the field excitation on the generator with the lagging power factor load and increases the excitation on the other generator to minimize the circulating currents.

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# SECTION 3 • CONTROLS, INDICATORS, AND JUMPER CONNECTIONS

Exciter-regulator controls, indicators, and connections are illustrated in Figure 3-1 and described in the following paragraphs.

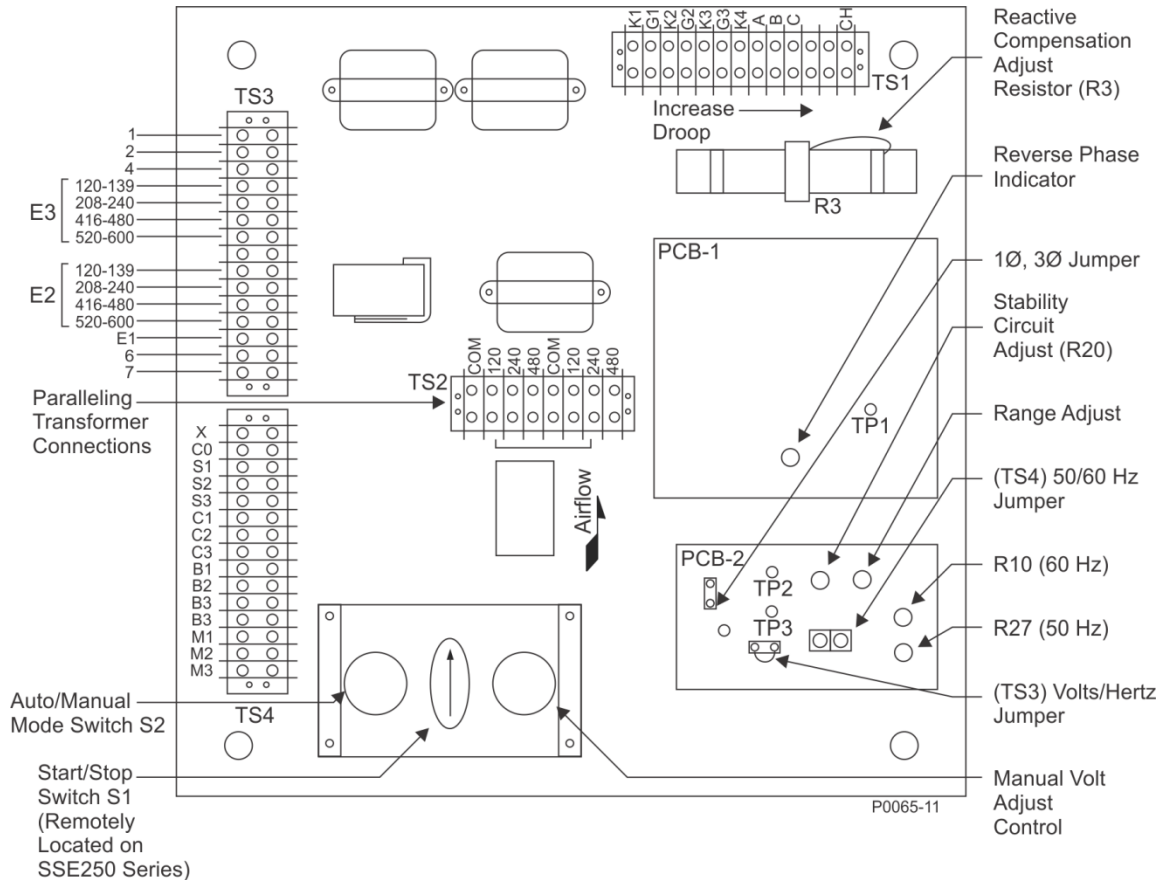


Figure 3-1. Controls, Indicators, Jumpers, and Test Point Locations

## Controls

### Manual Adjust Control (R5)

This control is used to establish nominal generator output when the auto / manual mode switch is in manual. R5 can be remotely located through use of terminals TS4-B1, TS4-B2, and TS4-B3. (Refer to Section 4, *Remotely Located Controls*)

### Voltage Adjust Rheostat (R4)

This rheostat, connected across terminals TS3-6 and TS3-7, is supplied as a separate item for remote panel mounting. It provides adjustment of the regulated generator voltage in the automatic mode of operation. When the control is connected as shown in the interconnection diagram, and R4 is adjusted to its maximum resistance position counterclockwise, minimum generator voltage is obtained. Maximum generator voltage is obtained with minimum resistance (clockwise rotation of R4).

### Stability Circuit Adjustment (R20)

This adjustment provides stable generator voltages by controlling the amount of feedback that is applied to the automatic voltage regulator. Normally it is factory set near the extreme clockwise position. The maximum clockwise setting generally assures good stability but tends to slow the response time of the generator voltage recovery time. If rotated counterclockwise, the system response time becomes faster.

However, if rotated too far counterclockwise the generator voltage may oscillate (hunt). R20 should then be rotated clockwise just above the point where oscillation occurs with no load on the generator. The system voltage stability is most critical at no-load. When a setting is desired that provides the fastest possible response with good generator stability, an oscillator or some voltage recording device should be used.

### **Auto / Manual Mode Switch (S2)**

When this switch is positioned to Manual, the output to the generator field is controlled using the manual adjust control. Generator output is unregulated and machine voltage will vary as a function of generator loading. When the mode switch is in Auto, generator output voltage is regulated automatically and the voltage adjust rheostat (R4) provides adjustment of the regulated voltage level of nominal generator voltage. The mode switch can be remotely located through the use of terminals TS4-C1, TS4-C2, and TS4-C3 (Refer to Section 4, *Remotely Located Controls*). During parallel operation, adjusting the manual control too low to reduce excitation could result in a loss of synchronization.

### **Start/Stop Switch (S1)**

Voltage shutdown is accomplished with the stop/start switch in the stop position. When this switch is in the stop position, field excitation is removed immediately and power generation is inhibited. S1 must be in the start position only during generator start up and running conditions. The switch may be mounted either on the exciter-regulator, or located remotely. (Refer to Section 4, *Remotely Located Controls*)

If field build-up does not occur in 5 to 10 seconds, this switch must be placed in the stop position. (Refer to Table 6-1. *Troubleshooting Chart*)

#### **NOTE**

A user-supplied start/stop switch must be interlocked to prevent simultaneous closing of the start and stop contacts.

### **Reactive Compensation Adjust Resistor (R3)**

This wire wound resistor provides adjustment of the amount of reactive droop compensation when generators are operated in parallel. Minimum reactive droop compensation is obtained when the tap of the resistor is adjusted towards terminal TS3. Maximum droop compensation is accomplished adjusting the tap in the direction as indicated by the arrow on R3.

## ***Indicators***

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### **Reverse Phase Indicator**

A neon indicator is located on the printed circuit board. It illuminates if power applied to rectifier chassis terminals P1, P2, P3 is other than L1, L2, L3 phase rotation. If it illuminates, reverse any two of the leads P1, P2, or P3. The light does *not* respond to incorrect phasing between the sensing voltage and paralleling CT inputs.

## ***Jumper Connections***

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### **One-Phase, Three-Phase Jumper – TS2 (on the printed circuit board)**

If three-phase sensing is used there should be no connection between terminals 1 and 2 on TS2. Install a jumper if one-phase sensing is used.

### **50 / 60 Hertz Jumper**

When 60 Hz operation is required, connect the TS4 jumper lead to the 60 Hz position.

When 50 Hz operation is required, connect the TS4 jumper lead to the 50 Hz position.

### **Volts / Hertz Jumper – TS3**

The SSE is shipped to provide the underfrequency limiting characteristic shown in Figures 1-1 and 1-2. (No jumper on TS3)

If a direct volts / hertz characteristic is desired, perform the following steps:

1. With the SSE in operation, adjust the voltage adjust rheostat R4 for nominal voltage *at rated frequency*.
2. Remove system power.
3. Position R10 fully counterclockwise (R27 in 50 Hz systems)
4. Install a jumper between terminals 1 and 2 on TS3.
5. Place the SSE in operation and adjust R10 (R27 on 50 Hz systems) clockwise until nominal voltage is once again obtained at rated frequency.

### Paralleling Transformer (T2) Tap Selection (on Control Chassis)

Connections for transformer T2 are made on terminal strip TS2. The value selected must be in the same range as the sensing voltage applied to terminals TS3-E1, TS3-E2, and TS3-E3. See Table 3-1.

Table 3-1. Voltage Range Settings for T2

If the sensing voltage applied to terminals TS3-E1, TS3-E2, and TS3-E3 is:		On TS2, connect the red and blue lugs to terminals:	
60 Hz	50 Hz	Red Lug	Blue Lug
120 - 139 Vac	100 - 110 Vac	120	120
208 - 240 Vac	220 - 230 - 240 Vac	240	240
416 - 480 Vac	280 - 400 - 415 Vac	480	480
520 - 600 Vac	500 Vac	480	480

The terminal configuration of terminal strip TS2 is shown in Figure 3-2. This example illustration shows the red and blue lugs connected to the 120 Vac terminals. When making TS2 connections, observe the following:

- The positions (voltage settings) of the red lug and blue lug must match. For example, if the red lug is connected at its 240 Vac terminal, the blue lug must also be connected at its 240 Vac terminal.
- Do not reverse the lug connections; the red lug must be connected to a red lug terminal and the blue lug must be connected to a blue lug terminal.
- The correct TS2 connections must be made even if single-unit (non-parallel) operation is used.

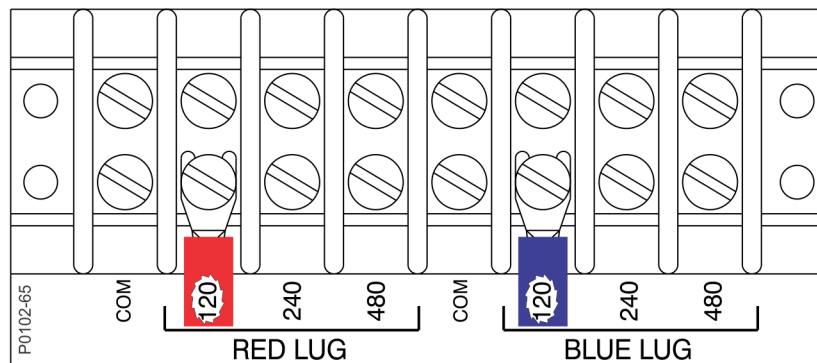


Figure 3-2. Terminal Strip TS2

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# SECTION 4 • INSTALLATION

## Mounting

### Rectifier Chassis

The exciter-regulator chassis must be mounted vertically for maximum cooling. The unit can be mounted anywhere that the ambient temperature does not exceed environmental specifications (Refer to Section 1, *Specifications*). The chassis outline is shown in Figure 4-1 and the dimensions given in Table 4-1.

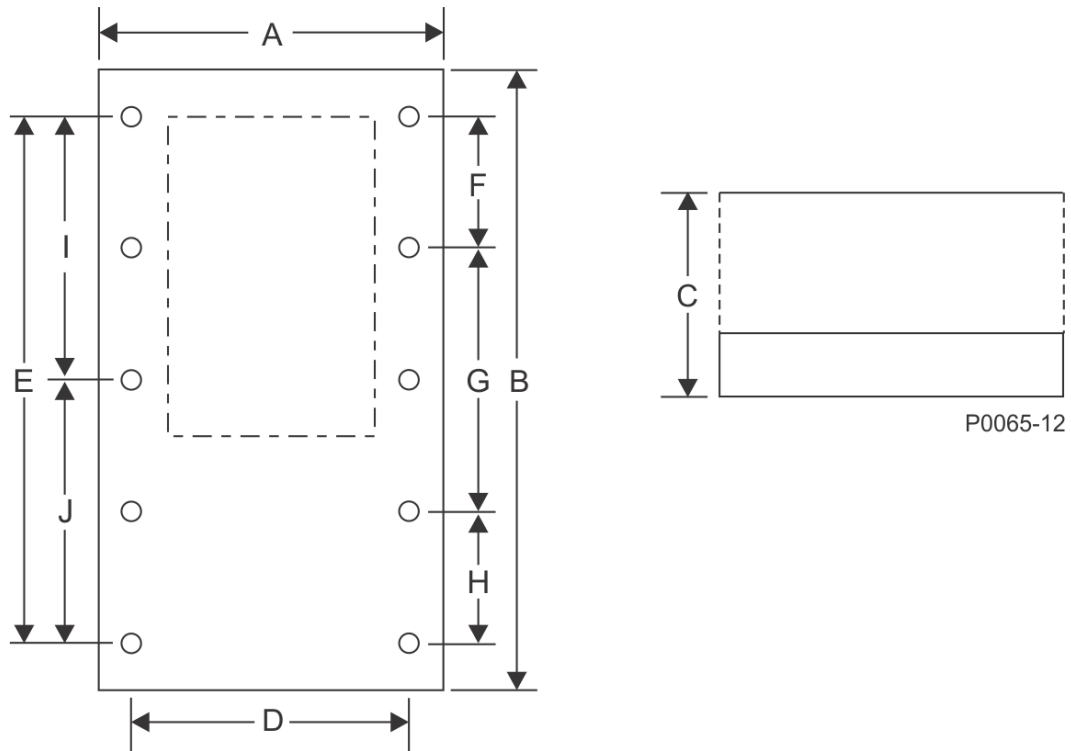


Figure 4-1. Rectifier Chassis Outline

Table 4-1. Rectifier Chassis Dimensions

SSE Model Number	Dimensions										Approx. Weight	
	A	B	C	D	E	F	G	H	I	J		
125-4.5	19.09 (484.8)	18.09 (459.5)	8.70 (221.0)	17.00 (431.8)	16.00 (406.4)	-	-	-	-	-	-	40 lbs. (18.2 kg)
63-4.5												
63-6.5	19.00 (482.6)	23.00 (584.2)	8.62 (218.9)	17.00 (431.8)	21.00 (533.4)	-	-	-	-	-	-	80 lbs. (36.4 kg)
125-6.5												
125-9												
125-13												
125-17	19.00 (482.6)	33.00 (838.2)	8.62 (218.9)	17.00 (431.8)	31.00 (787.4)	-	-	-	-	-	-	80 lbs. (36.4 kg)
125-25	26.00 (482.6)	50.00 (1270.0)	8.75 (222.3)	24.00 (609.6)	48.00 (1219.2)	15.00 (381.0)	16.00 (406.4)	17.00 (431.8)	-	-	-	120 lbs. (54.4 kg)
125-33												
63-25	26.00 (482.6)	55.00 (1397.0)	8.75 (222.3)	24.00 (609.6)	53.00 (1346.2)	15.00 (381.0)	23.00 (584.2)	15.00 (381.0)	-	-	-	120 lbs. (54.4 kg)
125-50												
250-6.5	19.00 (482.6)	36.00 (914.4)	8.50 (215.9)	17.00 (431.8)	34.00 (863.6)	*	*	*	*	*	*	120 lbs. (54.4 kg)
250-13												
250-17	26.00 (482.6)	48.00 (1219.2)	10.50 (266.7)	24.00 (609.6)	46.00 (1168.4)	-	-	-	23.00 (584.2)	23.00 (584.2)	23.00 (584.2)	120 lbs. (54.4 kg)
250-25												
250-33												
250-50	26.00 (482.6)	60.00 (1524.0)	9.75 (247.7)	24.00 (609.6)	58.00 (1473.2)	-	-	-	30.00 (762.0)	30.00 (762.0)	28.00 (711.2)	256 lbs. (120.5 kg)
250-65												
250-100	26.00 (482.6)	72.00 (1828.8)	12.00 (304.8)	24.00 (609.6)	70.00 (1778.0)	-	-	-	28.00 (711.2)	28.00 (711.2)	42.00 (1066.8)	320 lbs. (145.5 kg)
125-150												
125-65	50.00 (1270.0)	60.00 (1524.0)	10.00 (254.0)	49.00 (1244.6)	58.00 (1473.2)	20.00 (508.0)	18.00 (457.2)	70.00 (508.0)	*	*	*	575 lbs. (261.4 kg)
125-100												

Notes: \* Consult factory for further information.  
Dimensions in parentheses are in millimeters.

## Control Chassis

The control chassis must be mounted vertically for maximum cooling. The unit can be mounted anywhere that the ambient temperature does not exceed environmental specifications (Refer to Section 1, *Specifications*). The chassis outline and dimensions are shown in Figure 4-2.

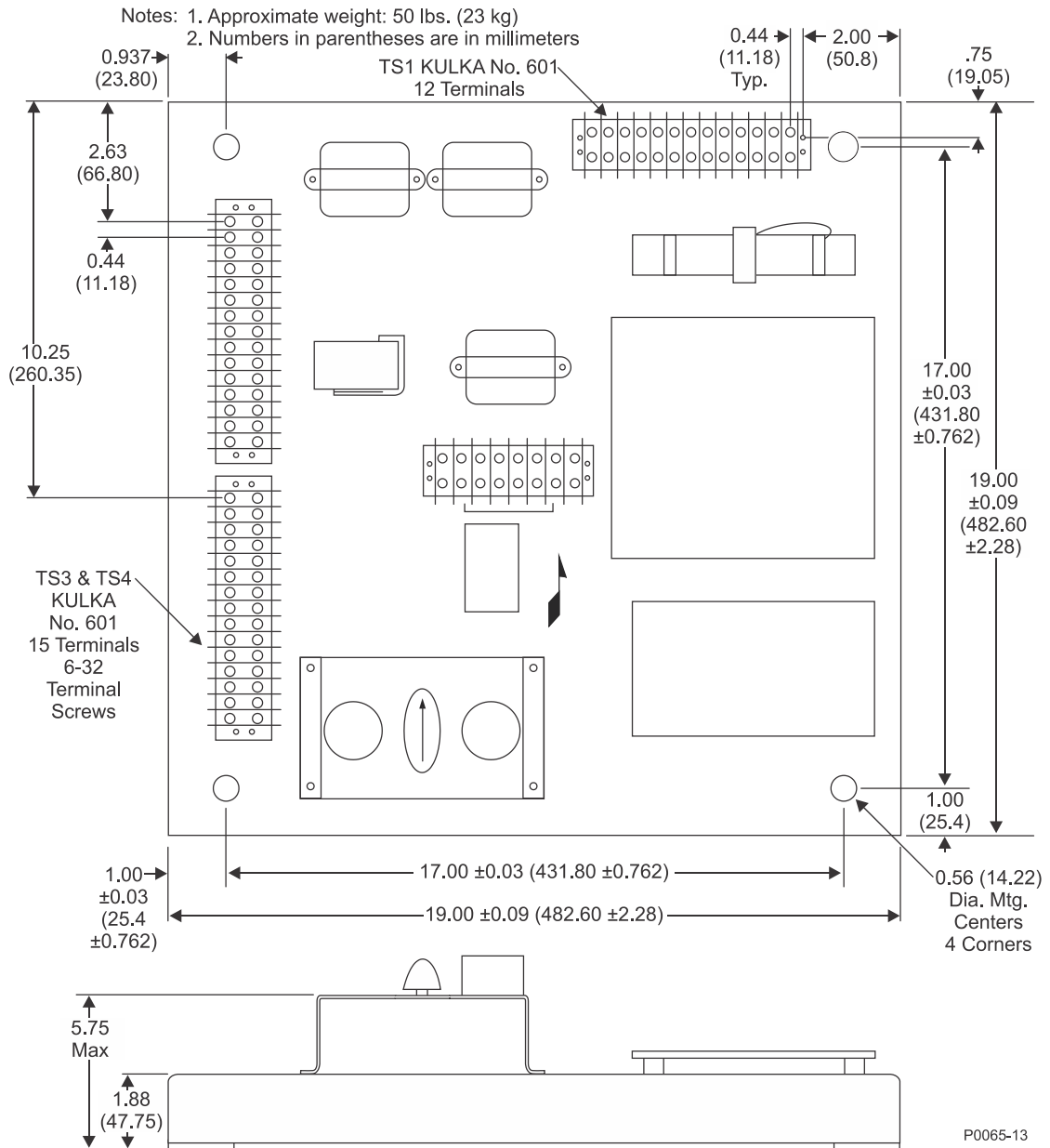


Figure 4-2. Control Chassis Outline

## Power Transformer

The power transformer outline is shown by Figure 4-3 and the dimensions are given in Table 4-2

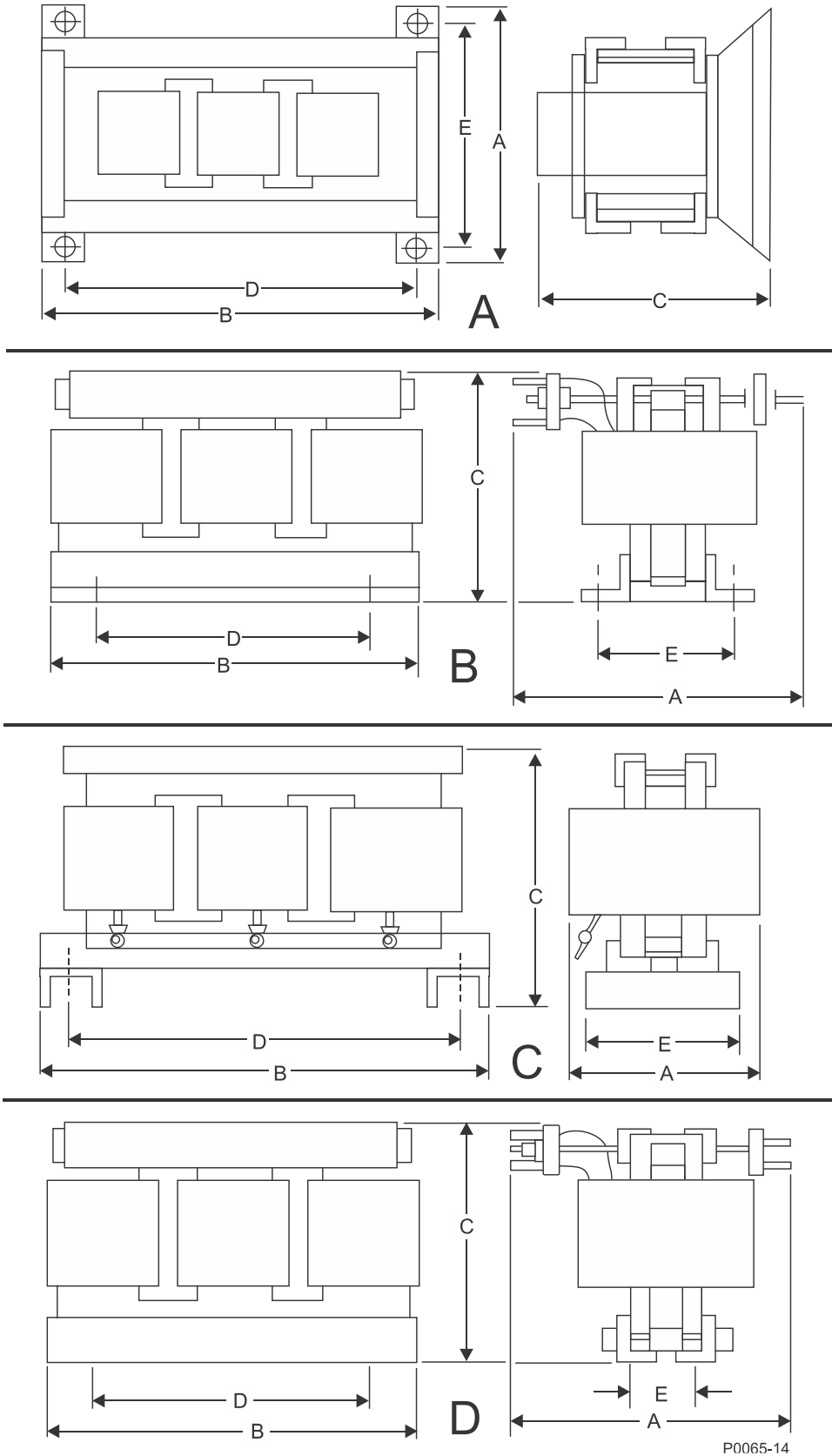


Figure 4-3. Transformer Outline

Table 4-2. Transformer Dimensions

Transformer Part Number	Figure 4-3	Transformer Dimensions					Approx. Weight
		A	B	C	D	E	
BE 15201-001	A	17.25 (438.2)	19.75 (501.7)	7.50 (190.5)	18.75 (476.3)	16.25 (412.8)	250 lbs. (113.6 kg)
BE 15202-001	A	17.25 (438.2)	19.75 (501.7)	7.50 (190.5)	18.75 (476.3)	16.25 (412.8)	250 lbs. (113.6 kg)
BE 15203-001	B	16.75 (426.5)	24.00 (609.6)	10.88 (276.4)	22.00 (558.8)	4.75 (120.7)	230 lbs. (104.5 kg)
BE 15206-001	A	18.25 (463.3)	19.75 (501.7)	8.50 (215.9)	8.75 (476.3)	17.25 (438.2)	330 lbs. (150.0 kg)
BE 15208-001	B	11.88 (301.8)	24.50 (622.3)	17.38 (441.5)	22.50 (571.5)	5.25 (133.4)	290 lbs. (131.8 kg)
BE 15211-001	C	9.25 (235.0)	20.25 (514.4)	18.56 (471.4)	17.75 (450.9)	6.88 (174.8)	340 lbs. (154.5 kg)
BE 15212-001	C	9.00 (228.6)	20.25 (514.4)	18.56 (471.4)	17.75 (450.9)	6.88 (174.8)	300 lbs. (136.4 kg)
BE 15213-001	D	12.63 (320.8)	25.50 (647.7)	12.63 (320.8)	17.75 (450.9)	2.88 (73.2)	380 lbs. (172.7 kg)
BE 15221-001	C	11.00 (279.4)	23.69 (601.7)	19.31 (490.5)	21.19 (538.2)	9.00 (228.6)	440 lbs. (200.0 kg)
BE 15222-001	C	10.50 (266.7)	23.69 (601.7)	17.06 (433.3)	21.19 (538.2)	11.00 (279.4)	350 lbs. (159.1 kg)
BE 15223-001	B	12.88 (327.2)	26.19 (665.2)	18.13 (460.5)	24.19 (614.4)	7.00 (177.8)	420 lbs. (190.9 kg)
BE 15226-001	C	12.63 (320.8)	24.44 (620.8)	19.94 (506.5)	21.94 (557.3)	9.00 (228.6)	640 lbs. (290.9 kg)
BE 15227-001	C	11.81 (300.0)	24.38 (619.3)	20.06 (509.5)	21.88 (555.8)	9.00 (228.6)	560 lbs. (254.5 kg)
BE 15228-001	D	14.25 (362.0)	25.19 (639.8)	21.13 (563.7)	23.19 (589.0)	4.38 (111.3)	560 lbs. (254.5 kg)
BE 15230-001	B	16.00 (406.4)	30.50 (774.7)	36.00 (914.4)	21.00 (533.4)	7.00 (177.8)	590 lbs. (268.2 kg)
BE 15231-001	D	20.50 (520.9)	30.50 (774.7)	22.88 (581.2)	22.00 (558.8)	15.00 (381.0)	1620 lbs. (736.4 kg)
BE 15236-001	C	13.25 (336.6)	24.88 (632.0)	20.19 (512.8)	22.38 (568.5)	9.50 (241.3)	730 lbs. (331.8 kg)
BE 15237-001	C	24.38 (619.1)	11.00 (279.4)	19.75 (501.7)	21.88 (555.6)	9.00 (228.6)	664 lbs. (301.8 kg)
BE 15238-001	D	14.25 (362.0)	25.69 (652.5)	21.75 (552.5)	23.69 (601.7)	4.38 (111.3)	610 lbs. (277.3)
BE 15240-001	B	15.25 (387.4)	36.00 (914.4)	27.75 (704.9)	22.63 (574.7)	9.00 (228.6)	775 lbs. (352.3 kg)
BE 15241-001	C	18.00 (457.2)	31.00 (787.4)	21.25 (539.8)	22.00 (558.8)	9.50 (241.3)	1106 lbs. (502.7 kg)

Transformer Part Number	Figure 4-3	Transformer Dimensions					Approx. Weight
		A	B	C	D	E	
BE 15243-001	D	14.75 (374.7)	29.50 (749.3)	26.81 (671.0)	27.00 (685.8)	3.38 (85.9)	870 lbs. (395.5 kg)
BE 15245-001	B	29.25 (742.9)	43.00 (1092.2)	36.19 (919.2)	30.00 (762.0)	12.50 (317.5)	1235 lbs. (561.4 kg)
BE 15247-001	C	12.44 (316.0)	26.63 (676.4)	28.63 (727.0)	24.13 (612.8)	9.0 (228.6)	1042 lbs. (473.6 kg)
BE 15248-001	D	16.00 (406.4)	30.00 (762.0)	27.50 (698.5)	28.00 (711.2)	4.75 (120.7)	1110 lbs. (504.5 kg)
BE 15250-001	B	19.00 (482.6)	32.94 (836.6)	26.38 (670.0)	35.00 (889.0)	12.00 (304.8)	1216 lbs. (552.7 kg)
BE 15482-001	A	15.25 (387.4)	16.75 (425.5)	8.00 (203.2)	15.75 (400.1)	14.25 (361.9)	173 lbs. (78.6 kg)
BE 15803-001	C	13.25 (336.6)	21.38 (542.9)	20.38 (512.8)	16.88 (428.6)	9.00 (228.6)	615 lbs. (279.5 kg)
BE 16920-001	B	22.13 (562.0)	33.75 (857.3)	23.25 (590.6)	22.00 (558.8)	18.00 (457.2)	1685 lbs. (765.9 kg)
BE 18222-001	B	10.00 (254.0)	18.50 (469.9)	19.94 (506.5)	12.00 (304.8)	6.50 (165.1)	280 lbs. (127.3 kg)
BE 18301-001	B	16.00 (406.4)	25.13 (638.3)	29.88 (759.0)	22.63 (574.8)	9.00 (228.6)	1210 lbs. (550.0 kg)
BE 18576-001	A	17.25 (438.2)	20.75 (527.1)	8.50 (215.9)	19.75 (501.7)	16.25 (412.8)	260 lbs. (118.2 kg)
BE 20221-001	D	15.25 (387.4)	25.50 (647.7)	20.00 (508.0)	23.19 (589.0)	5.13 (130.2)	615 lbs. (279.5 kg)
BE 20932-001	B	19.00 (482.6)	29.50 (749.3)	28.00 (711.2)	20.00 (508.0)	9.50 (241.3)	1165 lbs. (529.5 kg)
BE 21027-001	B	10.88 (276.4)	22.00 (558.8)	14.00 (355.6)	14.50 (368.3)	4.50 (114.3)	310 lbs. (140.9 kg)
BE 21237-001	B	14.50 (368.3)	26.50 (673.1)	15.63 (396.9)	15.00 (381.0)	6.00 (152.4)	195 lbs. (88.6 kg)
BE 21615-001	B	14.69 (373.1)	29.00 (736.6)	20.75 (527.1)	18.00 (457.2)	8.00 (203.2)	235 lbs. (106.8 kg)
BE 21616-001	B	26.00 (660.4)	31.00 (787.4)	32.00 (812.8)	20.00 (508.0)	14.00 (355.6)	350 lbs. (159.1 kg)
BE 21633-001	B	28.63 (727.1)	43.00 (1092.2)	36.19 (919.2)	30.00 (762.0)	12.50 (317.5)	1235 lbs. (561.4 kg)
BE 21278-001	B	23.00 (584.2)	37.25 (946.2)	40.88 (1038.2)	25.00 (635.0)	12.00 (304.8)	2220 lbs. (1009.1 kg)
BE 21439-001	A	18.38 (466.9)	19.88 (505.0)	10.50 (266.7)	18.75 (476.3)	17.25 (438.2)	300 lbs. (136.4 kg)

**Notes:**

\*Consult the factory for 600 Vac and 13 kV transformer connections and dimensions information.

Numbers in parentheses are in millimeters unless otherwise noted.

For transformers not listed, consult the factory.

## Interconnection

### CAUTION

Meggers and high potential test equipment must not be used. Incorrect use of such equipment may result in failure of the semiconductors contained in the exciter-regulator.

### General

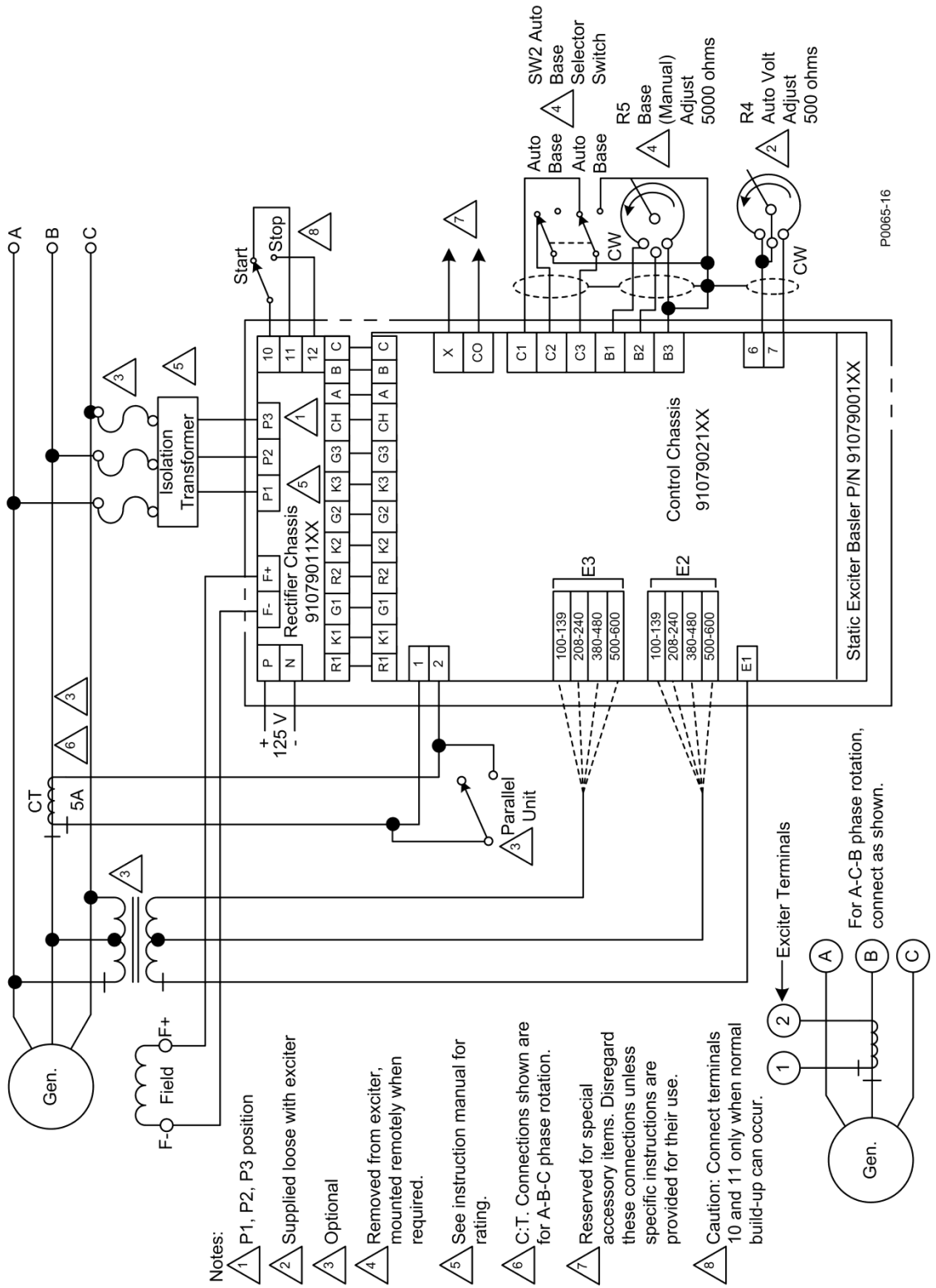
Refer to Figures 4-4 through 4-6 for the interconnection diagrams and to Table 4-3 for wire gauges.

Table 4-3. Interconnection Wire Gauges

Exciter-Regulator Model:	It is recommended that connection be made using wire of the following gauge.			
	To terminals:			
	F+, F-, P1, P2, P3	P, N (SSE 250 only)	F0 (SSE 125 only)	All other terminals
SSE 63-4.5 SSE 125-6.5 SSE 125-9 SSE 250-6.5 SSE 250-13 SSE 250-17	4 gauge	6 gauge	14 gauge	16 gauge
SSE 125-13 SSE 250-25	2 gauge	4 gauge	12 gauge	16 gauge
SSE 125-17 SSE 250-25	0 MCM	3 gauge	10 gauge	16 gauge
SSE 125-25 SSE 125-33 SSE 250-50 SSE 250-65	000 MCM	250 MCM	6 gauge	16 gauge
SSE 125-50	500 MCM	-	1 gauge	16 gauge
SSE 63-25 SSE 250-100	1250 MCM	500 MCM	2 gauge	16 gauge
SSE 63-33 SSE 125-65	750 MCM	-	4 gauge	16 gauge
SSE 125-100	1 – 1500 MCM	-	00 gauge	16 gauge
SSE 250-150	2 – 700 MCM	350 MCM	-	16 gauge
SSE 125-4.5	6 gauge	-	16 gauge	16 gauge
SSE 63-6.5	00 gauge	-	10 gauge	16 gauge

This tabulation is only a guide and does not eliminate the need to consider other operational requirements that relate to wire and cable selection. Recommendations presume use of 90°C (194°F) wire in a 60°C (140°F) ambient environment with not more than 3 conductors in a bundle or raceway.





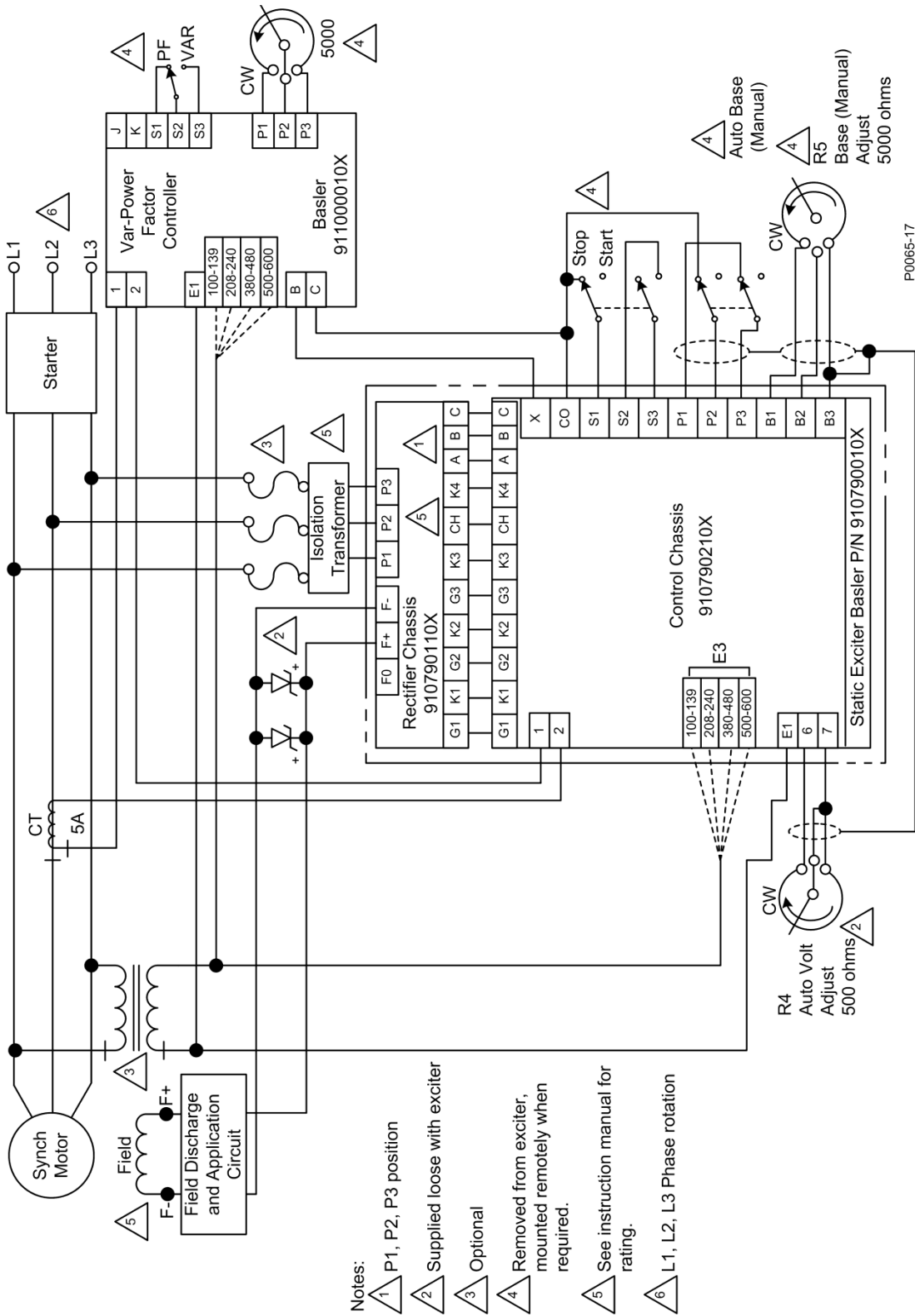


Figure 4-6. Typical Interconnection with a Synchronous Motor

## ***Control Chassis to Rectifier Chassis Interconnection***

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These wires carry critical gating signals which are subject to noise with increased interconnection distance. Therefore, it is recommended that the two chassis be located within the same cubicle or in adjoining cubicles. The interconnection between the control rectifier chassis should be made with 16 gauge wire or larger. If the wire run exceeds three feet (91.44 cm), twisted pair wire must be used. The distance should not exceed five feet (152.4 cm) between the control chassis and the rectifier chassis. If control of the SSE from a greater distance is required, it is recommended that the operation controls be remotely located.

## ***Input Power (Terminals P1, P2, P3)***

---

The input voltage for various SSE models is shown in Table 1-1. A power isolation transformer which delivers the necessary operating voltage is provided as part of the SSE (Refer to Table 1-2). Phase rotation must be P1, P2, P3 at rectifier chassis terminals P1, P2, and P3 respectively.

Table 1-2 lists the power transformers available for use with the SSE line of exciters. Some of the transformers have reconnectable primary windings, others have reconnectable secondary windings and some have both. Figures 4-7 through 4-11 provide information on how to connect the power transformers for the appropriate input and output voltages. On transformers with a reconnectable primary, the correct primary connection is determined by the ac supply voltage. On transformers with a reconnectable secondary, the correct secondary connection is determined by the required voltage input to the SSE (160 Vac or 320 Vac – Refer to Table 1-1).

## ***Sensing Input***

---

When single-phase sensing is used, voltage sensing inputs are connected to terminals TS3-E1 and TS3-E3 and the jumper must be installed. For three-phase sensing, terminals TS3-E1, TS3-E2, and TS3-E3 are used and the TS2 jumper must be removed (See Section 3, *Jumper Connections*) TS3-E1 is connected to phase A, TS3-E2 is connected to phase B and TS3-E3 is connected to the C phase. Terminals are provided for 100-139, 208-240, 380-480, and 500-600 Vac sensing. These four ranges also include the standard 60 Hz nominal voltages of 120, 208, 240, 416, and 520, and the standard 50 Hz nominal voltage of 110, 220, 230, 400, and 415. On generator systems with voltages above 600 Vac, instrument-type potential transformers must be used to step the voltage down to match one of the available voltage inputs. For precise regulation, the sensing leads should be connected as close as possible to the point where regulation is desired. The regulator regulates the voltage applied to its sensing terminals and cannot correct for cable or bus voltage drop that may occur at points other than where the sensing leads are connected. Use of the sensing leads to provide power to other equipment should be limited to low burden devices (as metering).

### 225 / 450 Volt Primary Transformers

BE15201001

BE15206001

BE15211001

BE15221001

BE15226001

BE15231001

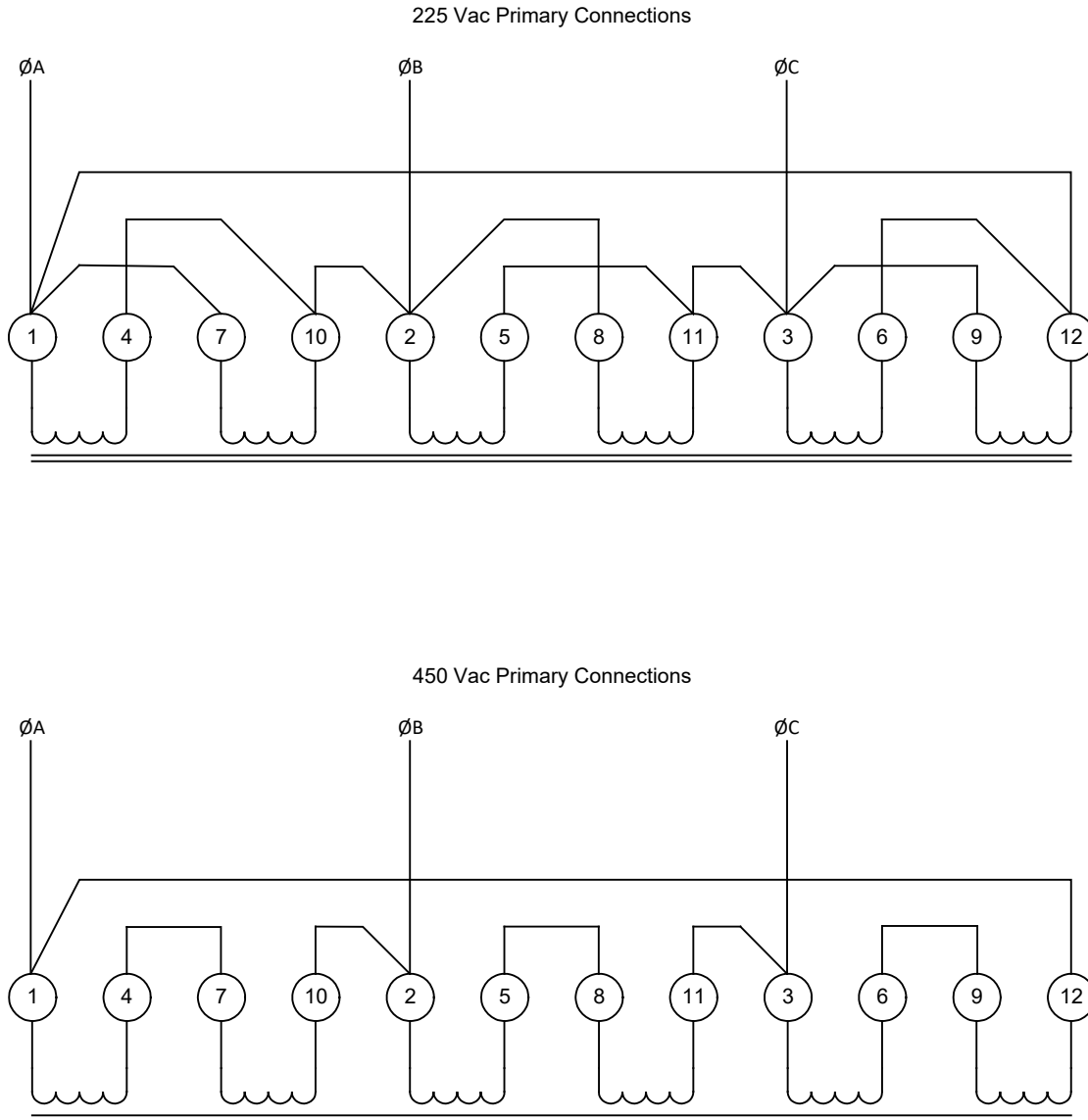
BE15236001

BE15241001

BE15803001

BE18301001

BE18222001



P0065-18

Figure 4-7. Transformer Connection Instructions 225 / 450 Volt Primary

## 2400 / 4160 Volt Primary Transformer

BE15203001

BE15208001

BE15213001

BE15223001

BE15228001

BE15233001

BE15238001

BE15243001

BE15248001

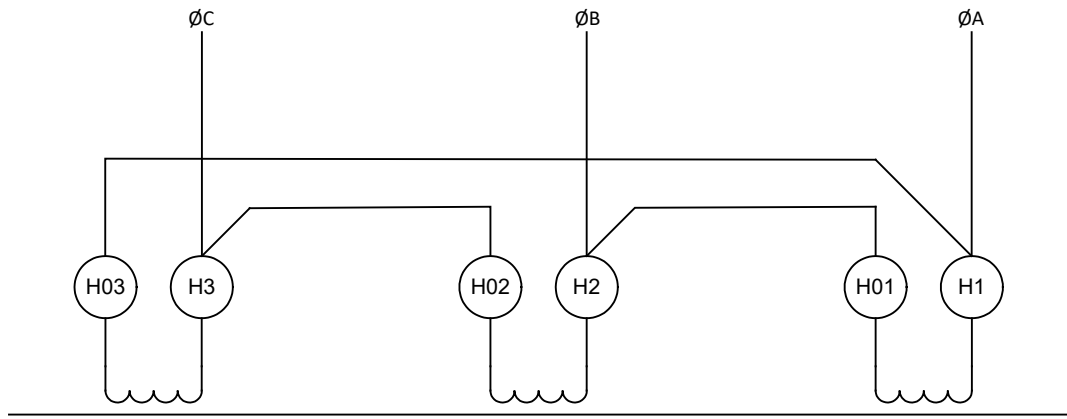
BE21052001

BE20185001

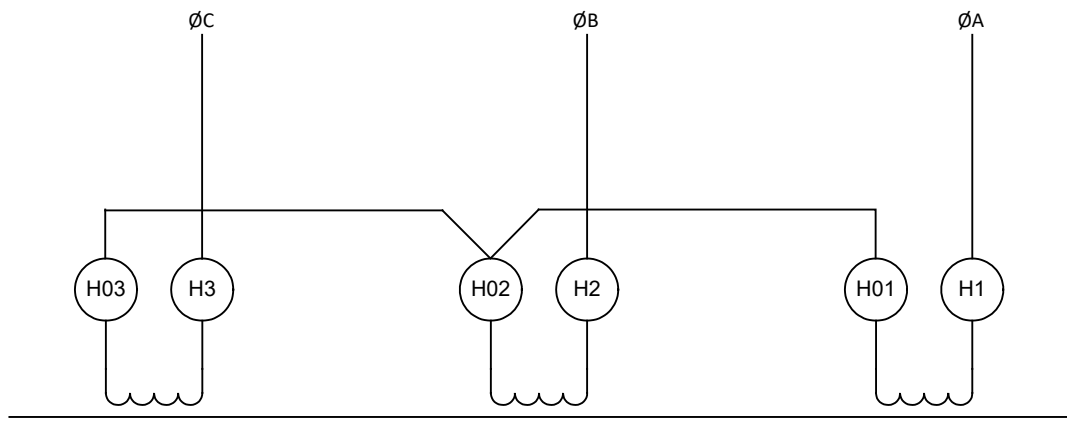
BE20221001

BE21027001

2400 Vac Primary Connections



4160 Vac Primary Connections



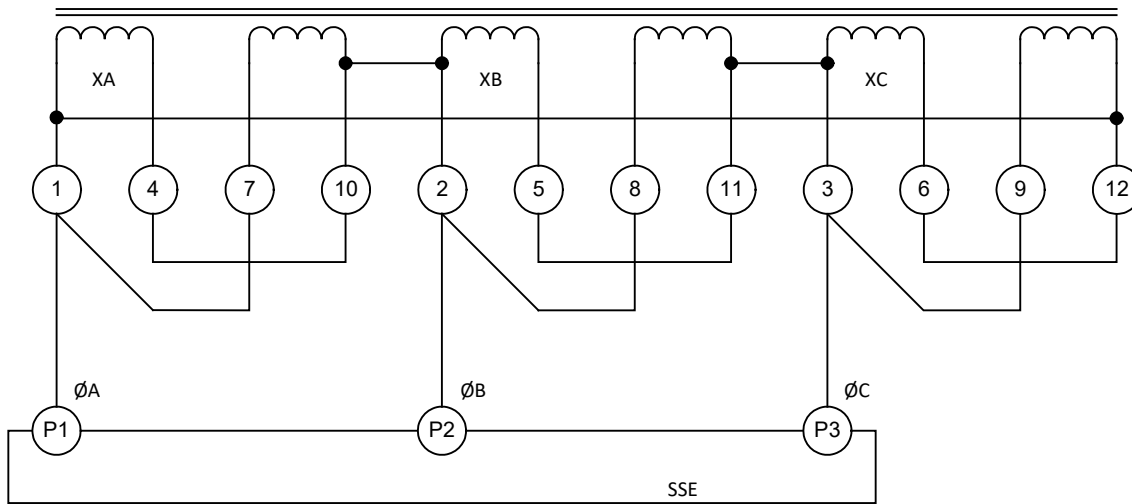
P0065-19

Figure 4-8. Transformer Connection Instructions 2400 / 4160 Volt Primary

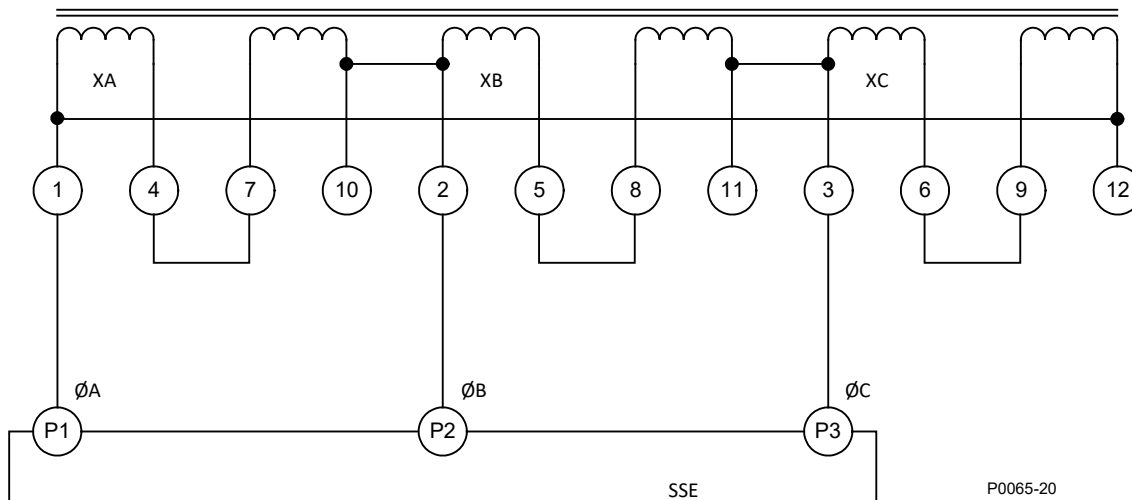
### 160 / 320 Volt Secondary Transformers

BE15221001	BE15222001	BE15223001	BE15225001
BE15226001	BE15227001	BE15228001	BE15230001
BE15231001	BE15232001	BE15233001	BE15240001
BE15236001	BE15237001	BE15238001	BE15245001
BE15241001	BE15242001	BE15243001	BE16920001
BE15247001	BE15248001	BE15250001	BE21633001
BE18301001	BE18576001	BE21052001	BE21085001

160 Vac Secondary Connections



320 Vac Secondary Connections



P0065-20

Figure 4-9. Transformer Connection Instructions 160 / 320 Volt Secondary

## Non-Reconnectable Secondary Transformers

BE15201001  
BE15206001  
BE15212001  
BE18222001  
BE21278001

BE15202001  
BE15208001  
BE15213001  
BE20127001  
BE21237001

BE15203001  
BE15210001  
BE15215001  
BE20221001

BE15205001  
BE15211001  
BE15803001  
BE21439001

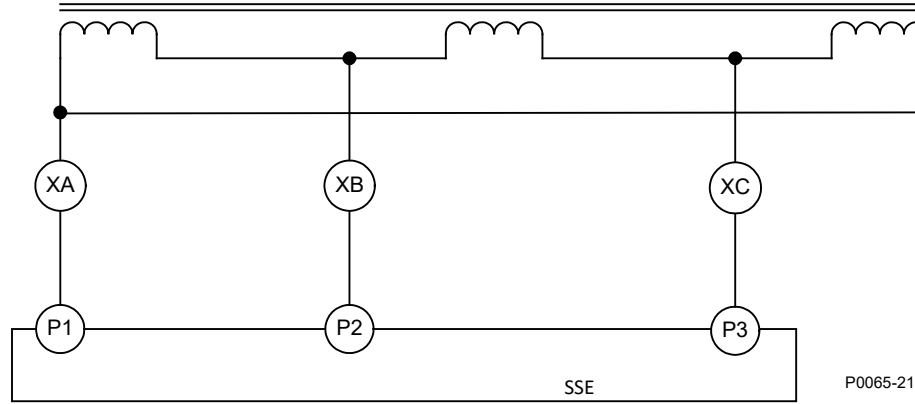


Figure 4-10. Transformer Connection Instructions

## Field Power (Rectifier Chassis Terminals F+ and F-)

### CAUTION

The exciter dc output terminals, F+ and F-, must never be opened during operation. To do so will produce inductive arcing that can possibly destroy the generator field and / or the bridge rectifiers. Therefore, **never** place a voltage shut-down contactor in the field circuit.

When making connections to the generator, polarities should be observed. The regulator F+ terminal connects to the generator field positive terminal and the F- terminal to the negative terminal.

## Voltage Adjust Rheostat

This external rheostat (part number 06847) is rated at 500 ohms, 25 W. It is connected across terminals TS3-6 and TS3-7. The jumper should be connected as shown in the interconnection diagram, so that clockwise rotation results in decreased resistance and increased generator voltage.

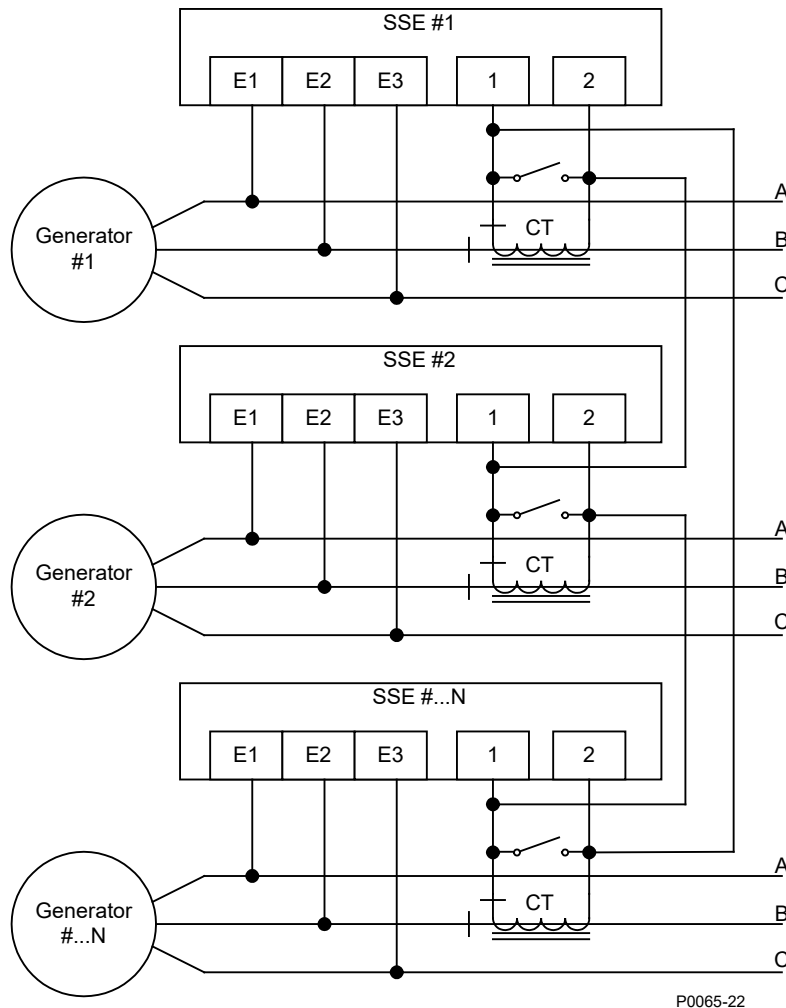
## Parallel Compensation

If paralleling is required, a 5 A, 25 VA current transformer (CT) is required. This CT is connected in the generator line as shown in the interconnection diagram. It should deliver between 3 and 5 Aac secondary current at rated load. The phase relationship of the CT signal to the regulator sensing voltage must be correct or the system will not parallel properly. On three-phase sensing models, the CT must be installed in the line that supplies voltage to regulator terminals TS3-E2. For single-phase models it must be installed in the line that does *not* supply sensing voltage to the regulator. The interconnection diagram shows the correct CT polarity for A-B-C phase rotation. If the phase sequence is A-C-B, the CTs secondary leads must be interchanged. Be certain that the secondary tap selection of paralleling transformer T2 corresponds with the sensing voltage.

For reactive droop compensation connect the CT to its respective regulator as shown in the interconnection diagram. A unit-parallel switch shorts the parallel CT secondary to prevent any reactive droop signal from

being injected into the regulating system during single unit operation, the switch is not required on applications where a voltage drop is not objectionable.

To avoid a droop in generator voltage when there is an inductive load on the paralleled generators, reactive differential (cross-current) compensation should be used. This is obtained by making the connections as shown in Figure 4-12. Reactive differential (cross-current) compensation **should not** be used when the parallel generators are connected to a stiff external bus, such as the utility grid.



P0065-22

Figure 4-11. Reactive Differential (Cross-current) Compensation CTs Interconnection

## Remotely Located Controls

If any or all the following controls are to be remotely located, the internal control(s) must be disconnected. Connect the remotely located control to the same terminals to which the internal control was connected. Shielded wire should be used as shown in the interconnection diagram.

### Control

Auto/Manual Mode Switch (S2)  
 Start/Stop Switch SSE 63 & 125 (S1)  
 Start/Stop Switch SSE 250 (if used)  
 Manual Adjust (R5)

### Terminals (TS4)

C1, C2, C3, C0  
 S1, S2, S3, B3  
 10, 11, 12  
 B1, B2, B3

# SECTION 5 • OPERATION

## General

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It is recommended that Sections 3 and 4 be reviewed before operation of the unit is attempted. All the connections and appropriate jumpers should be verified at this point.

## Field Flashing

---

The regulator contains an internal relay for automatic voltage build-up. Usually there is sufficient residual voltage (approximately 5% of nominal) to allow the generator voltage to build up without an additional flashing circuit. However, if field flashing is required, with the prime mover at rest, apply a dc flashing source (12 Vdc to 125 Vdc) across rectifier chassis terminals F0 and F-. The positive side of the flashing source must be connected to the F0 terminal and the negative side of the flashing source must be connected to the F- terminal. This action remagnetizes the field poles and allows build-up. A diode in the regulator allows the flashing source to be removed from the field without the danger of inductive arcing. After 10 seconds from time of build-up, the flashing source must be removed.

### NOTE

The SSE 125-100, SSE 125-125, and SSE 250 series are automatically flashed with 125 Vdc source when the start/stop switch is in the start position.

## Single-Unit (Non-Parallel) Operation

---

Note: If difficulties are encountered, refer to the troubleshooting procedure in Section 6, *Troubleshooting*.

Steps A through G should be performed without load applied to the generator.

- A) Place the start/stop switch to stop.
- B) Set the exciter voltage rheostat (R4) to mid-range.
- C) Set the manual adjust control to  $\frac{1}{4}$  turn from full counterclockwise position.
- D) Place the auto/manual mode switch to auto. Bring the generator up to rated speed.
- E) Place the start/stop switch to start. The generator output voltage should build up automatically. If it does not, field flashing is required. Refer to Section 5, *Field Flashing*.
- F) Voltage shut-down is accomplished with the start/stop switch in the stop position. Field excitation is removed immediately and ac voltage is no longer generated.

### CAUTION

Before load is applied, ensure that phase rotation is correct.  
Refer to Section 3, *Indicators*.

- G) The generator output voltage may now be controlled using the external voltage rheostat (R4).
- H) Place the auto/manual mode switch to manual. Manual adjust control (R5) is now used to set generator output voltage.
- I) Return the auto/manual mode switch to auto. Verify that the reverse phase indicator is out.
- J) Apply a load to the generator. Verify that voltage regulation is within  $\pm 1\%$ . If it is not within these limits, refer to Section 6, *Troubleshooting*.
- K) Alternately remove and apply the load to determine if the generator output voltage is stable. If it is not stable, adjust R20 as necessary (Refer to Section 3).

#### NOTE

Unstable governors may contribute to generator output voltage instability.

## Parallel Operation

---

### Pre-parallel Operation

It is essential that the paralleling signal at terminals TS3-1 and TS3-2 of the unit have the proper phase relationship with respect to the sensing voltage at terminals TS3-E1, TS3-E2, and TS3-E3. Verify that the connections to these terminals are made exactly as shown in Figures 4-4 and 4-5. If reactive differential (cross-current) compensation is desired, the paralleling CTs must be connected as shown in Figure 4-1. A CT rated at 5 A, 25 VA must be selected to furnish 3 to 5 A at rated generator load current. Prior to operation, the adjustment of resistance R3 (on all exciter-regulators) should be set to identical positions, near its maximum resistance position. This position will provide maximum droop signal. Before attempting to parallel two or more generator sets, it is recommended that individual sets be tested to verify that the paralleling features function properly. The following test should be performed:

- a) Place each set in operation in accordance with Single Unit (Non-Parallel) Operation above.
- b) Verify the paralleling CT secondary is not shorted. (Unit-parallel switch in parallel position).
- c) Apply a 25% to 100% load to the set under test at unity power factor. Generator output voltage should change less than  $\pm 1\%$ .
- d) If generator output voltage changes more than 1%, check that the parallel transformer connection at TS3 match the generator sensing at TS3. Also check that CT is in proper phase and has correct polarity.
- e) Apply a 25% to 100% load (0.8 PF); voltage should droop from 4 to 6% with rated load. If the voltage rises instead of drooping, reverse the CT sensing leads.

During these pre-parallel tests, verify that the voltage and speed does not drift or jump erratically. When the proceeding test has been satisfactorily completed, the sets should parallel properly.

### Parallel Procedure

#### CAUTION

The oncoming generator voltage phase sequence (phase rotation) must be the same as that of the bus to which it is to be paralleled.

- a) Adjust the voltage of the oncoming generator (the generator to be paralleled with bus) to match the bus voltage.
- b) Adjust the oncoming prime mover speed so that its frequency is slightly faster than the load bus.
- c) Observing the synchroscope (or synchronizing lights), close the oncoming generator circuit breaker when the generator is in phase with the bus.
- d) Immediately after closing the breaker, observe the generator line ammeter. It should read well within the rating of the generator. *If not, immediately reopen the circuit breaker and completely review Section 4, Interconnection.*
- e) If operation after paralleling is normal, adjust the prime mover speed control so that the generator takes no load, thereby avoiding the possibility of the reverse power relay tripping the generator off line.
- f) Adjust voltage and speed so that the generator just placed on the bus assumes its share of kW and kvar load.
- g) If two or more generators using the same type of voltage regulators are on a common bus, vary the bus load and make the voltage, speed and parallel compensation (R3) adjustments as necessary to obtain the optimum load sharing.

## Paralleling Problems

If, upon paralleling with the bus, improper operation results, try to determine which control system is at fault, the voltage control or the speed control. A high ammeter reading or circuit breaker opening may occur in either case. Immediately after closing the oncoming generator circuit breaker, observe the kvar and kW meters.

- a) A large kvar reading (incoming or outgoing indicates a faulty voltage regulating system.)
- b) An unbalanced kW reading may indicate a faulty speed regulating system.

Another method of determining which control system is at fault, is to operate the system on base control (standard). If proper operation is obtained on manual voltage control or base control, the voltage regulating system is probably at fault.

Almost all paralleling problems are caused by incorrect system interconnections. If the trouble is isolated to the voltage regulating system, recheck the interconnection diagrams and check for the following during generator parallel operation:

- a) If the vars drift upward when the machine is paralleled to the bus (and does no change), then the CT is not in the paralleling circuit.
- b) If the vars drift downward when the machine is paralleled to the bus (and kW varied from 0 – 100%) by more than 10%, the paralleling CT is in the wrong phase.

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# SECTION 6 • MAINTENANCE AND TROUBLESHOOTING

## ***Preventive Maintenance***

Periodic inspection should be made to insure the unit is clean and free from dirt and moisture. Also, it is recommended that the connection between the exciter-regulator and the system be checked and tightened at this time.

## ***Corrective Maintenance***

Due to a protective, transparent, conformal coating, repair on the printed circuit board is difficult and should be attempted by only qualified personnel. The printed circuit board is easily removed, and replacing the complete PC board assembly is recommended. Replacement printed circuit boards are available from Basler Electric.

## ***Warranty and Repair Service***

The SSE line of static exciters is warranted against defective material and workmanship for 18 months from the date of initial shipment. Contact Basler Electric before returning any item for warranty or non-warranty repair.

## ***Troubleshooting***

The more common generator system malfunctions and the appropriate repair procedures are listed in Table 6-1.

Note: Reference to voltage build-up relay K1 does not apply to the SSE 250 series.

*Table 6-1. Troubleshooting Chart*

Symptom	Probable Cause	Solution
Voltage does not build up to rated value.	Low residual.	Field flashing is required.
	Prime mover not up to rated speed.	Adjust speed to rated.
	No or improper voltage to input power terminals P1, P2 and P3.	Verify wiring.
	Generator output shorted or heavily loaded.	Remove load or short.
	Defective exciter-regulator.	Check SCR-diode bridge, faulty PC board, flashing diode relay or replace regulator.
	Overflash protection circuit not reset (SSE 250 only)	Toggle start/stop switch to stop and back to start.
Voltage builds up until relay actuates, then decays.	Open voltage adjust rheostat R4 or associate circuitry.	Repair open connections or replace rheostat.
	No firing pulse applied to SCR gates.	Replace the PC board.

Voltage high, uncontrollable with voltage adjust rheostat.	No sensing voltage, terminals E1, E2, and E3.	Verify wiring.
	External voltage adjust rheostat shorted.	Verify wiring
	Faulty relay (K1)	Replace.
	Faulty PC board.	Replace.
	Faulty SCRs.	Replace SCRs.
Voltage high, controllable with voltage adjust rheostat.	Sensing transformer set to wrong voltage tap.	Verify tap.
	TS4 jumper on U.F. circuit board (PCB-2) removed with 1 phase sensing.	Install jumper.
	Improper connections of sensing leads to generator.	Verify wiring.
	Voltmeter inaccurate.	Verify operation or replace.
	Faulty PC board.	Replace.
Voltage low, controllable with voltage adjust rheostat.	Prime mover not up to rated speed.	Increase speed.
	TS4 jumper on U.F. circuit board (PCB-1) installed with 3 phase sensing.	Remove jumper.
	Improper connections of sensing leads to generator.	Verify wiring.
	Voltmeter inaccurate.	Verify operation or replace.
Poor regulation.	Generator field voltage requirements at full load in excess of maximum exciter-regulator output capability.	If exciter-regulator application is beyond the limits specified in Table 1-1, consult Basler Electric for available regulators.
	Output voltmeter at different location than regulator sensing (voltage drops in leads or wrong phase).	Connect voltmeter at same point as regulator sensing.
	Waveform distortion due to harmonic content in generator voltage. (Regulator senses average voltage; meter may be indicating RMS values).	Check for saturated load. Consult generator manufacturer.
	Unit-paralleled switch in parallel position.	Verify switch position.
	Unbalanced load with three-phase sensing.	(Unit averages all three-phase voltages)
	Prime mover not up to rated speed.	Bring up to rated.
	Fault in generator.	Verify operation.
	Faulty SCRs or diodes or fuse.	Replace.

Poor voltage stability	Frequency unstable.	Consult governor manual.
	Voltage fluctuates to point where K1 energizes or de-energizes.	See symptom "Voltage builds up, until relay actuates, then decays."
	R20 (stability adjust) improperly adjusted.	Adjust to proper setting.
	Three-phase jumper not connected on AVR board.	Verify jumper.
	Improper supply voltage to P1, P2, P3.	Verify voltage level.
	Faulty PC board.	Replace.
Voltage recovery slow	R20 (stability adjust) improperly adjusted.	Adjust to proper setting.
	Slow prime mover response.	Consult governor manufacturer.
Parallel generators do not divide real (kW) load equally.	Improper setting of power sensing of governor.	Consult generator manufacturer.
No droop compensation can be obtained for parallel generators.	Tap on R3 set to minimum droop position.	Adjust R3 to obtain required droop.
	CT in wrong line.	Verify wiring.
	Parallel CT does not supply the required 3 to 5 A secondary current.	Refer to Section 4 – <i>Parallel Compensation</i> .
Parallel generators do not divide reactive KVAR load equally (circulating reactive current between generators).	Terminals 1 and 2 of regulator shorted by unit-parallel switch.	Place switch in parallel position.
	Tap on R3 set for too low droop.	Adjust for increase droop.
	Parallel CT does not supply the required 3 to 5 A secondary current.	Replace with proper CT.
	Paralleling CTs polarity reversed.	Interchange CT secondary leads.
	Paralleling CT not in correct generator line.	Verify wiring (See Figures 4-4 or 4-5)
	Selected tap on transformer T2 incorrect.	Verify wiring.

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# SECTION 7 • REPLACEMENT PARTS

## General

The following tables (Table 7-1 through 7-16) list the components of the exciter-regulator that have maintenance significance. When ordering parts from Basler Electric, always specify the reference (if applicable), Basler part number, quantity, and description. Be sure to include the complete model number of the SSE.

*Table 7-1. SSE 63-4.5, -6.5 Replacement Parts*

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	08608	1	Diode, 800 V, 70 A
CR2-CR5	10603	4	Diode, 800 V, 150 A
SCR1-SCR3	42079	3	SCR, 800 V, 100 A
VR1	10201	1	Surge Arrestor, 210 V, 65 A
F1-F3	09940	3	Fuse, 250 V, 175 A

*Table 7-2. SSE 63-25 Replacement Parts*

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	42975	1	Diode, 400 V, 125 A
CR2-CR5	10754	4	Diode, 400 V, 500 A
SCR1-SCR3	10753	3	SCR, 400 V, 350 A
VR1	10759	1	Surge Suppressor, 120 V, 195 A
F1-F3	10751	3	Fuse, 130 V, 600 A

Table 7-3, SSE 125-4.5 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1-CR5	08608	5	Diode, 800 V, 70 A
SCR1-SCR3	9095000015	3	SCR, 800 V, 55 A
VR1	03166	1	Surge Supressor, 210 V, 20 A
F1-F3	16401	3	Fuse, 250 V, 50 A

Table 7-4. SSE 125-6.5, -9, -13 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	08608	1	Diode, 800 V, 70 A
CR2-CR5	10603	4	Diode, 800 V, 150 A
SCR1-SCR3	42079	3	SCR, 800 V, 100 A
VR1	10201	1	Surge Supressor, 210 V, 65 A
F1-F3	09940	3	Fuse, 250 V, 175 A

Table 7-5. SSE 125-17 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	08608	1	Diode, 800 V, 70 A
CR2-CR5	10603	4	Diode, 800 V, 150 A
SCR1-SCR3	15760	3	SCR, 800 V, 150 A
VR1	10605	1	Surge Supressor, 240 V, 65 A
F1-F3	10604	3	Fuse, 250 V, 225 A

Table 7-6. SSE 125-25, -33 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	42975	1	Diode, 800 V, 100 A
CR2-CR5	10755	4	Diode, 800 V, 300 A
SCR1-SCR3	10752	3	SCR, 800 V, 250 A
VR1	10758	1	Surge Suppressor, 240 V, 130 A
F1-F3	11291	3	Fuse, 250 V, 400 A

Table 7-7. SSE 125-50 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	10603	1	Diode, 800 V, 150 A
CR2-CR5	11602	4	Diode, 800 V, 400 A
SCR1-SCR3	11604	3	SCR, 800 V, 350 A
VR1	11603	1	Surge Suppressor, 275 V, 200 A
F1-F3	11601	3	Fuse, 250 V, 600 A

Table 7-8. SSE 125-65 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	14375	1	Diode, Heatsink Assembly
CR5	14385	1	Diode, Heatsink Assembly
CR2 / SCR1, CR3 / SCR2, CR4 / SCR3	14383	3	Diode/SCR, Heatsink Assembly
VR1A, VR1B	11603	2	Surge Suppressor, 275 V, 200 A
F1-F3	18285	3	Fuse, 700 V, 800 A

Table 7-9. SSE 125-100 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Board Voltage Regulator and Underfrequency Module Relay, Coil: 24V; Contacts: 10 A at 125 Vac
-	9107904112	1	
K1	02686	1	
Rectifier Chassis Parts			
CR1	14375	1	Diode, Heatsink Assembly
CR5	14385	1	Diode, Heatsink Assembly
CR2 / SCR1, CR3 / SCR2, CR4 / SCR3	14383	3	Diode/SCR, Heatsink Assembly
VR1A, VR1B, VR1C	11603	3	Surge Suppressor, 275 V, 200 A
F1-F3	18285	3	Fuse, 700 V, 800 A

Table 7-10. SSE 250-6.5 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	08606	1	Diode, 1300 V, 65 A
CR2-CR5	11483	4	Diode, 1600 V, 150 A
SCR1-SCR3	11053	3	Silicon Controlled Rectifier, 1600 V, 150 A
VR1	11855	1	Surge Suppressor, 600 V, 37 A
F1-F3	14611	3	Fuse 700 V, 35 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, 3 Pole; Contact: 180 A at 600 Vac, Coil: 125 Vdc
K3	Contact Basler Electric	1	Contact, 3 N.O., 63 A, 600 Vac; 125 Vdc coil.

Table 7-11. SSE 250-13 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	08606	1	Diode, 1300 V, 65 A
CR2-CR5	11483	4	Diode, 1600 V, 150 A
SCR1-SCR3	11053	3	Silicon Controlled Rectifier, 1600 V, 150 A
VR1	11855	1	Surge Suppressor, 600 V, 37 A
F1-F3	14594	3	Fuse 700 V, 35 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, 3 Pole; Contact: 180 A at 600 Vac, Coil: 125 Vdc
K3	Contact Basler Electric	1	Contactor, 3 N.O., 63 A, 600 Vac; 125 Vdc coil.

Table 7-12. SSE 250-17, -25 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	08606	1	Diode, 1300 V, 65 A
CR2-CR5	11054	4	Diode, 1600 V, 300 A
SCR1-SCR3	11053	3	Silicon Controlled Rectifier, 1600 V, 150 A
VR1	11044	1	Surge Suppressor, 550 V, 70 A
F1-F3	11040	3	Fuse 700 V, 175 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, 3 Pole; Contact: 180 A at 600 Vac, Coil: 125 Vdc
K3	9115200006	1	Relay

Table 7-13. SSE 250-33 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	08606	1	Diode, 1300 V, 65 A
CR2-CR5	11054	4	Diode, 1600 V, 300 A
SCR1-SCR3	11053	3	Silicon Controlled Rectifier, 1600 V, 150 A
VR1	11044	1	Surge Suppressor, 550 V, 70 A
F1-F3	11041	3	Fuse 700 V, 250 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, 3 Pole; Contact: 180 A at 600 Vac, Coil: 125 Vdc
K3	9115200006	1	Relay

Table 7-14. SSE 250-50, -65 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	11483	1	Diode, 1300 V, 150 A
CR2-CR5	11054	4	Diode, 1600 V, 300 A
SCR1-SCR3	11050	3	Silicon Controlled Rectifier, 1600 V, 250 A
VR1	11289	1	Surge Suppressor, 550 V, 130 A
F1-F3	11151	3	Fuse 700 V, 400 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, Latching
K3	Contact Basler Electric	1	Relay

Table 7-15. SSE 250-100 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
-	9107916100	1	Overflash Protection Board
-	9107901031	1	Component Board
CR1	11483	1	Diode, 1300 V, 150 A
CR2-CR5	11921	4	Diode, 1600 V, 400 A
SCR1-SCR3	11923	3	Silicon Controlled Rectifier, 1600 V, 350 A
VR1	11924	1	Surge Suppressor, 550 V, 200 A
F1-F3	11151	3	Fuse 700 V, 400 A
F4	18347	1	Fuse 250 V, 10 A
K2	Contact Basler Electric	1	Relay, Latching
K3	Contact Basler Electric	1	Relay, 125 Vdc coil

Table 7-16. SSE 250-150 Replacement Parts

Reference	Basler Part Number	Quantity	Description
Control Chassis Parts			
-	9107903117	1	Firing Circuit Bboard Voltage Regulator and Underfrequency Module Relay Board Assembly
-	9107904112	1	
K1	9107920100	1	
Rectifier Chassis Parts			
CR1	18286	1	Diode Heatsink Assembly
CR5	18287	1	Diode Heatsink Assembly
CR2/SCR1 CR3/SCR2 CR4/SCR3	18305	3	Diode/SCR Heatsink Assembly
F1, F2, F3	18285	3	Fuse, 700 V, 600 A
VR1, VR2	10741	2	Surge Suppressor, 400 VRMS, 500 A

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