

OPERATING INSTRUCTIONS

for GANGED VARIACS

TYPES V-5G2, V-5HG2, V-5G3, V-5HG3, V-10G2, V-10HG2,
V-10G3, V-10HG3, V-20G2, V-20HG2 V-20G3, V-20HG3

Where operating requirements cannot be met by individual Variac® autotransformers, ganged units controlled by a single shaft, will usually provide a satisfactory solution. Two- and three-gang standard assemblies are available for the Type V-5, V-10, and V-20 models. These can be used in both single-

phase and three-phase circuits to meet a variety of specialized requirements.

Single-phase combinations are listed below, and three-phase combinations on page 4. Similar combinations can be devised for the little-used two-phase circuits.

Single-Phase Series Circuits

When Variacs are operated in series, they can be used on circuits whose voltages are twice the normal voltage ranges of the Variacs. This circuit is particularly useful on 460-volt, single-phase supply, which would otherwise require auxiliary transformers for Variac® control. When the 115-volt models

are used in series, they have power ratings intermediate between the various H-models used singly. Ratings and other data are listed in Table I below.

Because there is no common connection between input and output, DO NOT GROUND LOAD.

TABLE I SINGLE-PHASE VARIACS AND VARIAC® ASSEMBLIES

	TYPE	INPUT			OUTPUT							
		CONNECTION	See Fig.	LINE INPUT VOLTS	K V A		VOLTS		AMPERES		MINIMUM LOAD OHMS	
					AT LINE INPUT VOLTS	AT MAX. VOLTS	LINE	MAX	RATED	MAX.	AT LINE VOLTS	AT MAX. VOLTS
115-VOLT CIRCUITS	V-5 V-10 V-20			115 115 115	.862 1.5 3.0	.675 1.35 2.70	0-115 0-115 0-115	0-135 0-135 0-135	5 10 20	7.5 13 26	15.3 8.85 4.43	27 13.5 6.75
115- TO 230-VOLT CIRCUITS	V-5H V-10H V-5G2 V-20H V-10G2 V-20G2	Series Series Series	1c 1c 1c	115 115 115 115 115 115	.300 .600 .862 1.2 1.5 3.0	.270 .540 .675 1.08 1.35 2.70		0-270 0-270 0-270 0-270 0-270 0-270	1 2 2.5 4 5 10	2.6 5.2 7.5 10.4 13 26		270 135 108 67.5 54 27
230-VOLT CIRCUITS	V-5H V-10H V-5G2 V-20H V-10G2 V-20G2	Series Series Series	1b, 1a 1b, 1a 1b, 1a	230 230 230 230 230 230	.600 1.15 1.72 2.3 3.0 6.0	.540 1.08 1.35 2.16 2.70 5.40	0-230 0-230 0-230 0-230 0-230 0-230	0-270 0-270 0-270 0-270 0-270 0-270	2 4 5 8 10 20	2.6 5.2 7.5 10.4 13 26	88.5 44.2 30.7 22.1 17.7 8.85	135 67.5 54 33.8 27 13.5
230- TO 460-VOLT CIRCUITS	V-5HG2 V-10HG2 V-20HG2	Series Series Series	1c 1c 1c	230 230 230	.575 1.15 2.30	.540 1.08 2.16		0-540 0-540 0-540	1 2 4	2.6 5.2 10.4		540 270 135
460-VOLT CIRCUITS	V-5HG2 V-10HG2 V-20HG2	Series Series Series	1b, 1a 1b, 1a 1b, 1a	460 460 460	1.15 2.30 4.6	1.08 2.16 4.32	0-460 0-460 0-460	0-540 0-540 0-540	2 4 8	2.6 5.2 10.4	177 88.5 44.2	270 135 67.5

For connection diagrams, see page 2.

For three-phase assemblies, see pages 3 and 4.

For parallel operation of ganged Type V-20, see page 5.

For dimension drawings, see pages 6 and 7.

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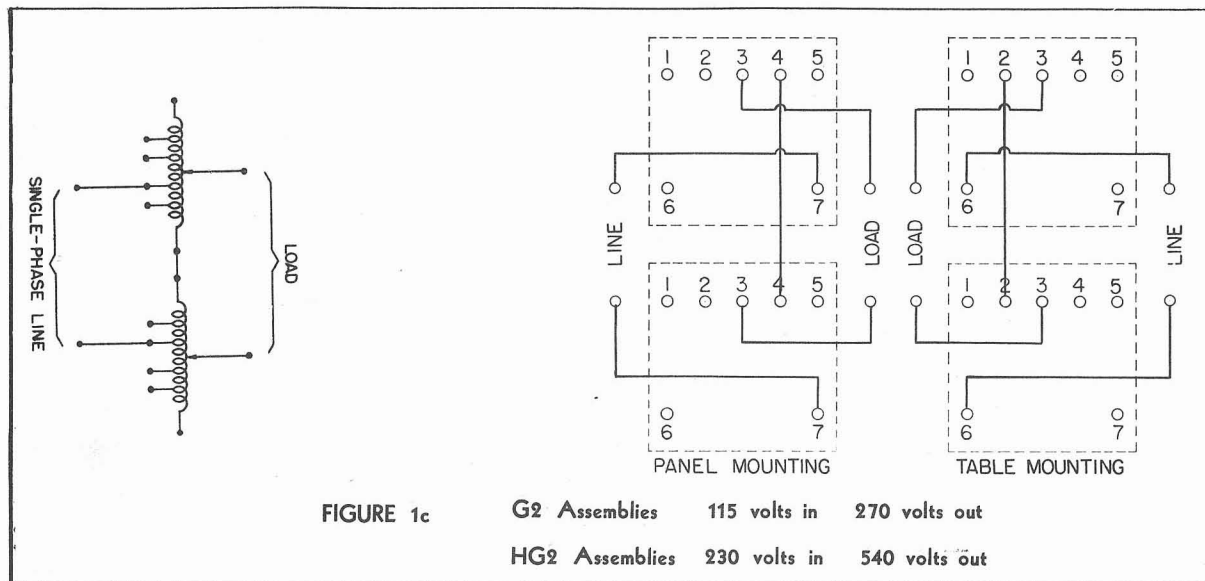
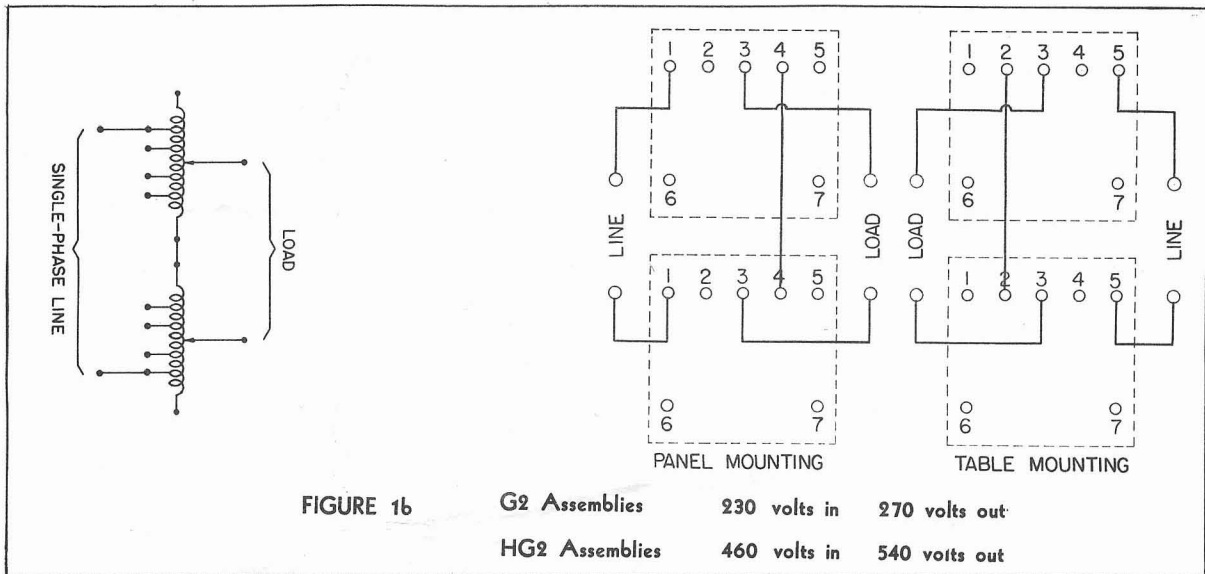
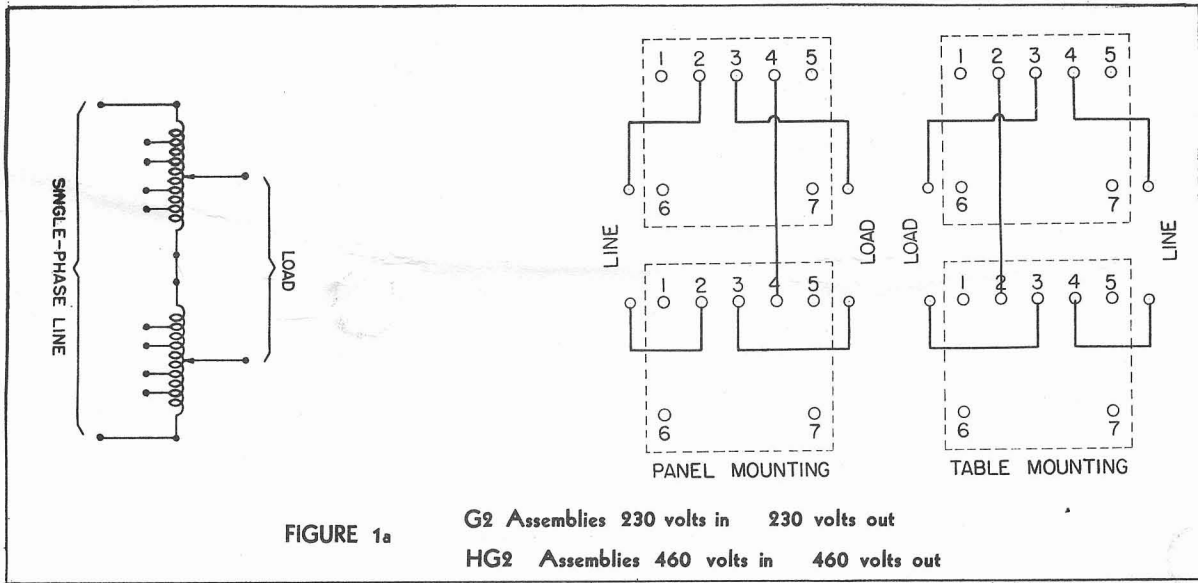
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CONNECTIONS FOR VARIACS OPERATED IN SERIES



Three-Phase Circuits

Variacs connected in open delta and wye circuits can be used directly on three phase lines. The open delta connection of Figure 2a normally permits operation either to line voltage or to 117% of line voltage. With the H-models, output voltages of more than double the supply voltage can be obtained, although current and power ratings are halved.

Figure 3 shows one of the most useful Variac® connections. Because the voltage across each leg of a wye-connected assembly is line volts divided by $\sqrt{3}$, and since 115-volt Variacs are wound to 135 volts, and 230-volt Variacs to 270 volts, it is possible to operate wye-connected Variacs from three-phase lines of twice the Variac® voltage rating. With this connection,

the voltage across the Variac® on a 460-volt line is 266 volts, and for a 230-volt line is 133 volts. The overvoltage feature is sacrificed in this circuit, but KVA rating is increased by the ratio of 133:115.

The two common types of three-phase load are shown in Figure 4. For equal load on the supply Variac®, $R_{\Delta} = 3R_Y$.

The relation of R_{Δ} and R_Y to the single-phase impedance, R , is given by $\frac{R_{\Delta}}{\sqrt{3}} = R = R_Y\sqrt{3}$.

Voltages and circuits as well as minimum load impedances are given in Table II below. Note that $V_{\Delta} = V_Y\sqrt{3}$ and $I_{\Delta} = \frac{I_Y}{\sqrt{3}}$

PANEL MOUNTING versus TABLE MOUNTING

The term "panel mounting" refers to the operation of a Variac® with its base mounted to the rear of a panel and the shaft extending through the base into the knob on the panel face. "Table mounting" assumes that the Variac is operated on top of a table (or other surface) with the shaft extending up from the brush radiator into the knob. Since it is desirable that voltage increase with clockwise rotation, the connections for these two operating conditions are different.

TABLE II
THREE-PHASE ASSEMBLIES

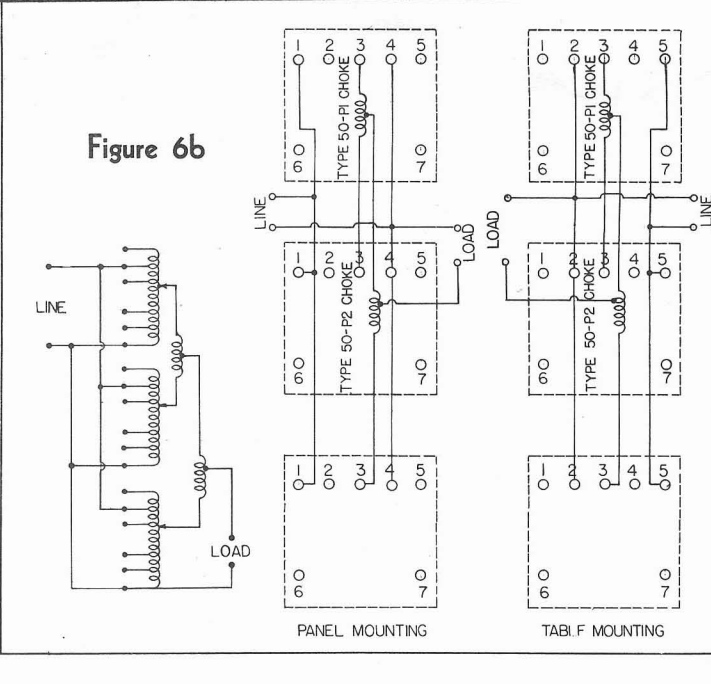
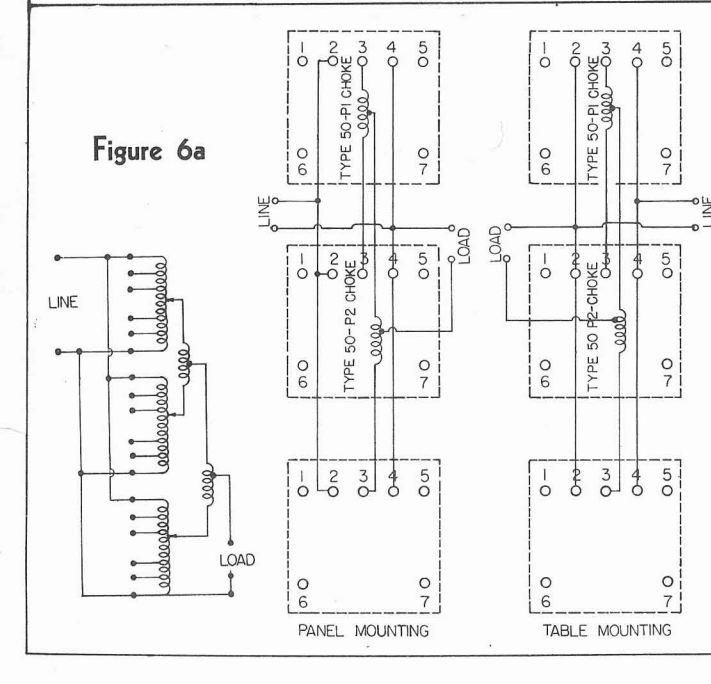
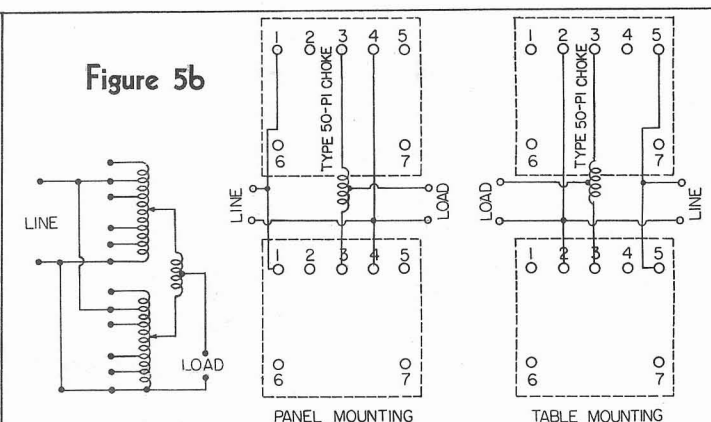
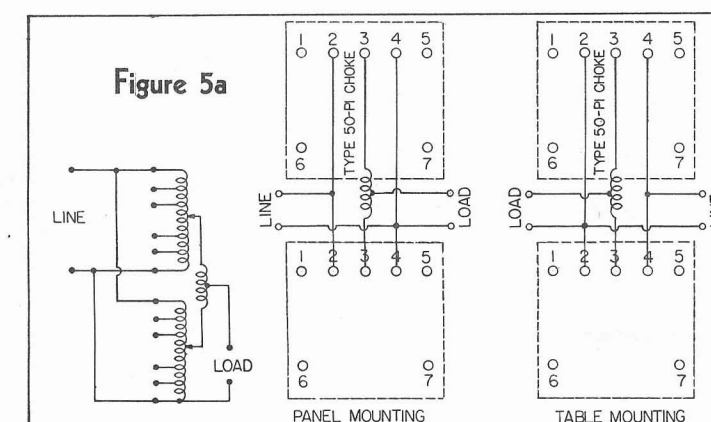
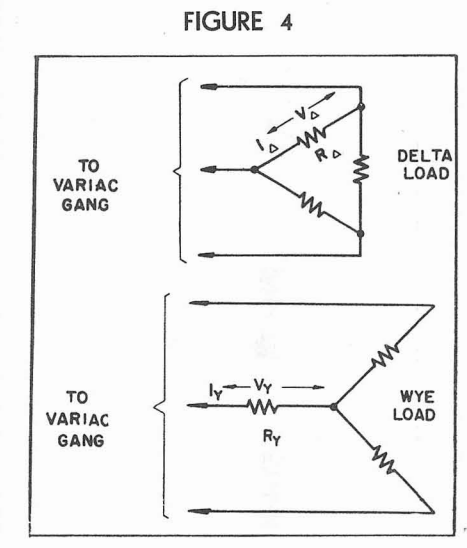
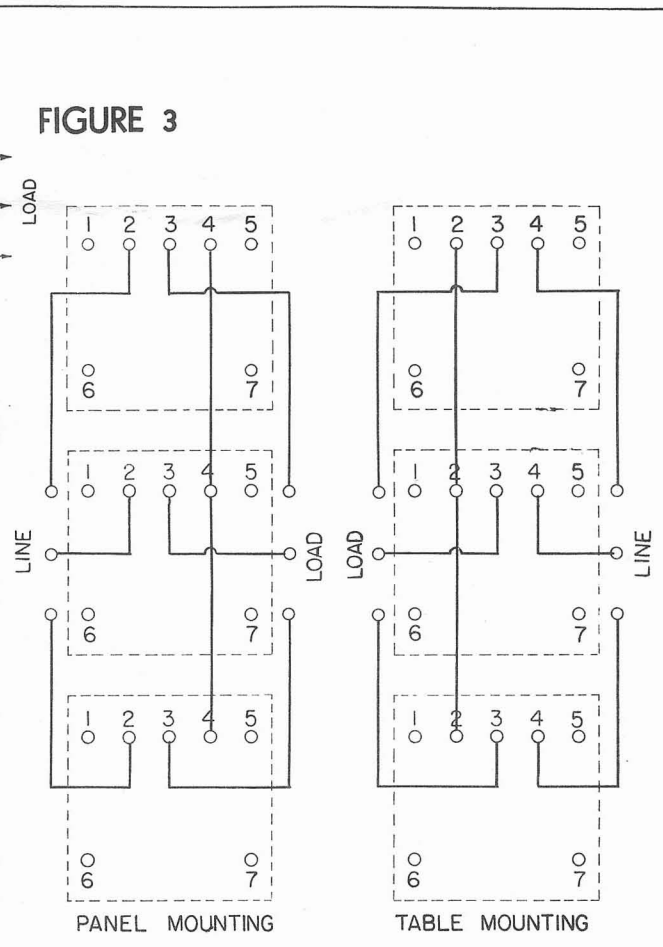
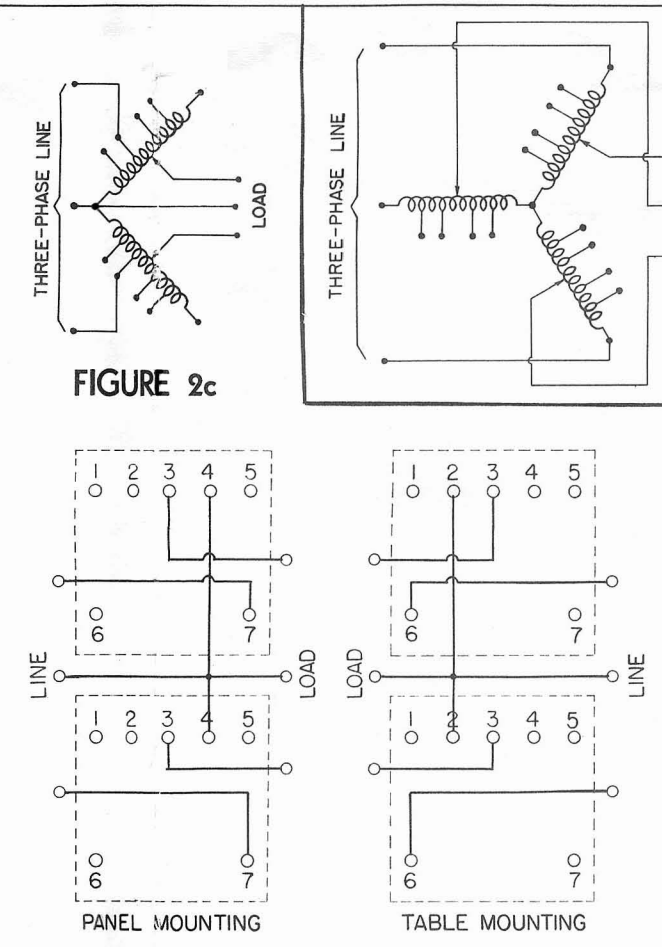
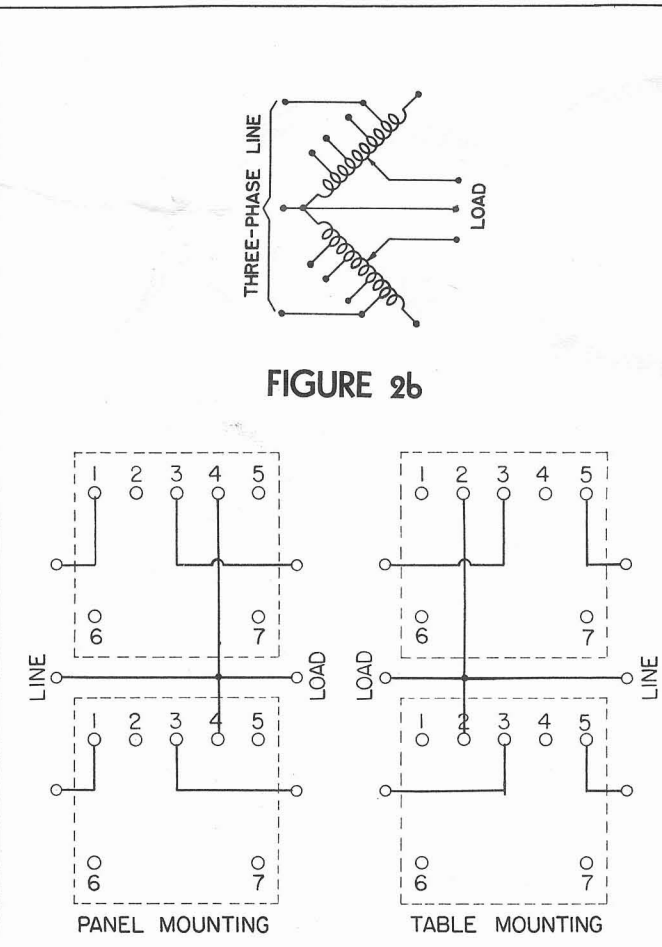
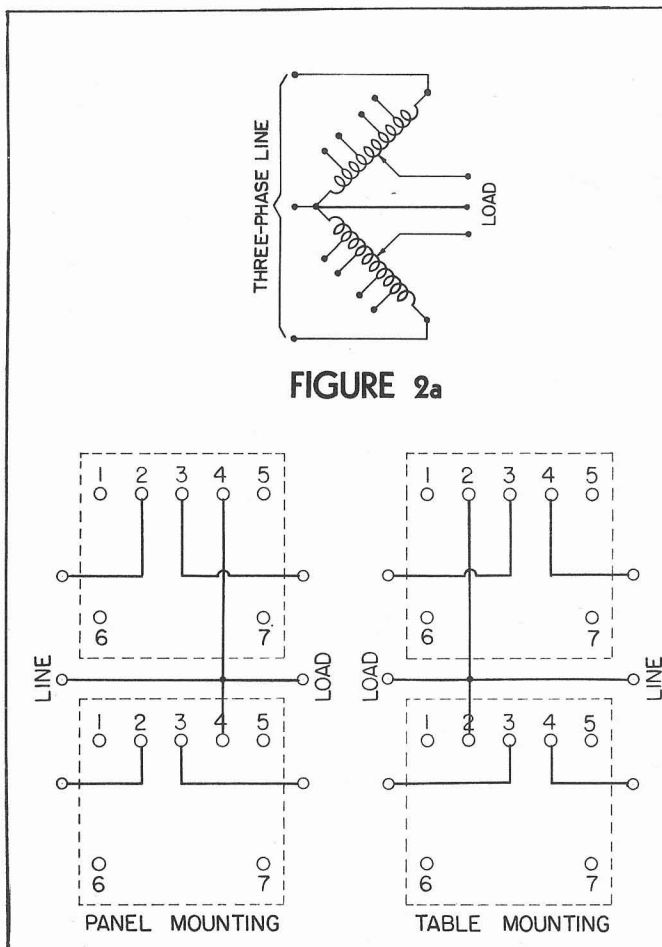
TYPE	LINE VOLTS	CONNecTION	See Fig.	KVA		DELTA LOAD						WYE LOAD						
				AT LINE VOLTS	AT MAX. VOLTS	OUTPUT VOLTS		AMPERES		MINIMUM OHMS		OUTPUT VOLTS		AMPERES		MINIMUM OHMS		
				LINE CONNec.	OVERVOLT. CONNec.	RATED	MAX.	AT LINE V.	AT MAX. V.	LINE CONNec.	OVERVOLT. CONNec.	RATED	MAX.	AT LINE V.	AT MAX. V.			
115-VOLT CIRCUITS	V5G2	115	Delta	2a, 2b	1.5	1.17	0-115	0-135	2.89	4.33	26.6	46.7	0-66.5	0-78	5	7.5	8.87	15.6
	V10G2	115	Delta	2a, 2b	3	2.34	0-115	0-135	5.78	7.5	15.3	23.4	0-66.5	0-78	10	13	5.12	7.8
	V20G2	115	Delta	2a, 2b	6	4.7	0-115	0-135	11.5	15.0	7.65	11.8	0-66.5	0-78	20	26	2.56	3.9
115- TO 230-VOLT CIRCUITS	V5HG2	115	Delta	2c	.5	.47	0-270		.577	1.44		467	0-66.5	0-156	1	2.6		156
	V10HG2	115	Delta	2c	1	.94	0-270		1.16	2.89		233	0-66.5	0-156	2	5.2		78
	V20HG2	115	Delta	2c	2	1.88	0-270		2.31	5.78		117	0-66.5	0-156	4	10.4		39
230-VOLT CIRCUITS	V5HG2	230	Delta	2a, 2b	1	.94	0-230	0-270	1.16	1.44	160	233	0-133	0-156	2	2.6	51	78
	V10HG2	230	Delta	2a, 2b	2	1.88	0-230	0-270	2.31	2.89	79.7	117	0-133	0-156	4	5.2	25.5	39
	V5G3	230	Wye	3	3		0-230		2.89	4.33	53.2		0-133		5	7.5	17.8	
	V20HG2	230	Delta	2a, 2b	4	3.7	0-230	0-270	4.62	5.78	39.8	58.4	0-133	0-156	8	10.4	12.8	19.5
	V10G3	230	Wye	3	3		0-230		5.78	7.5	30.7		0-133		10	13	10.24	
	V20G3	230	Wye	3	10.4		0-230		11.6	15.0	15.4		0-133		20	26	5.12	
460-VOLT CIRCUITS	V5HG3	460	Wye	3	2		0-460		1.16	1.44	319		0-266		2	2.6	102	
	V10HG3	460	Wye	3	4		0-460		2.31	2.89	159		0-266		4	5.2	51	
	V20HG3	460	Wye	3	8		0-460		4.62	5.78	79.5		0-266		8	10.4	25.5	

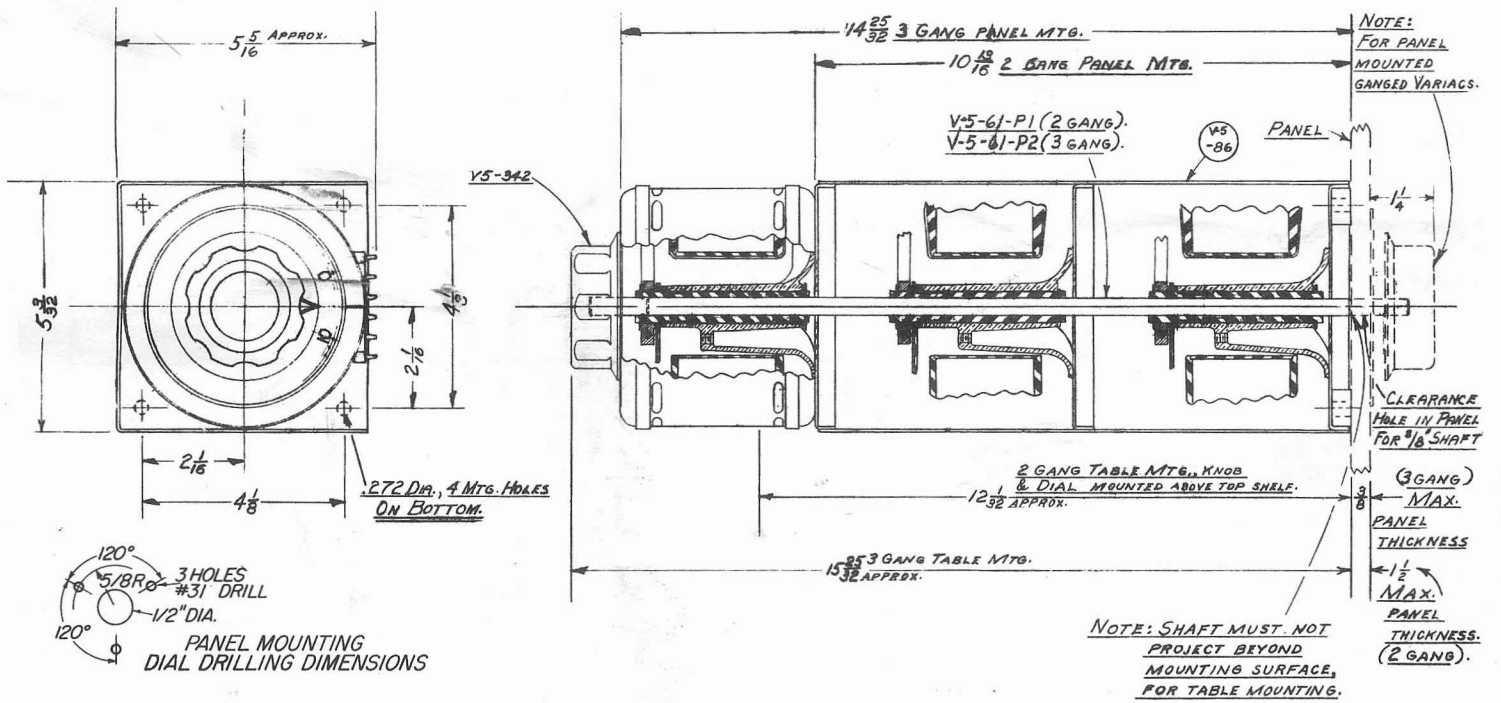
PARALLEL OPERATION OF GANGED TYPE V-20 VARIACS

Parallel operation of two or three Type V-20 Variacs makes it possible to control loads two or three times the maximum load of a single unit. The following table lists the ratings and pertinent data for these connections.

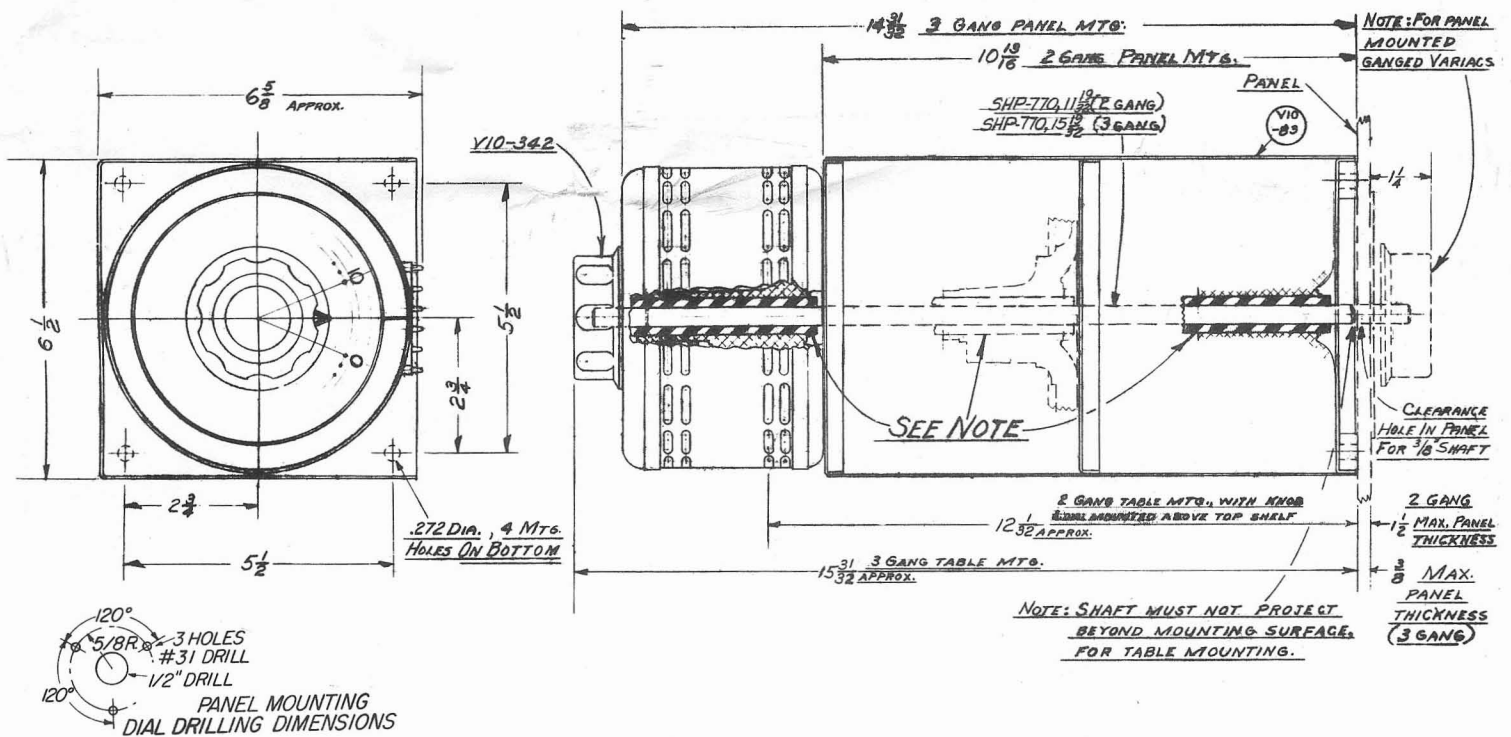
Type	Connection	See Fig.	Line Input Volts	Rated Output Amps.	Output							
					Line-Voltage Connection			Overvoltage Connection		Minimum Load Ohms		
					Output Voltage Range	Max. Output Amps.	KVA at Max. Volts	Output Voltage Range	Rated Output Amps.	Line-Voltage Connection	Over-Voltage Connection	
115-Volt Circuits	V-20M V-20G2 V-20G3	Parallel* Parallel**	5a, 5b 6a, 6b	115	20	0-115	26	3.0	0-135	20	4.42	6.75
				115	40	0-115	52	6.0	0-135	40	2.21	3.38
				115	60	0-115	78	9.0	0-135	60	1.47	2.25
230-Volt Circuits	V-20HM V-20HG2	Parallel*	5a, 5b	230	8	0-230	10.4	2.4	0-270	8	22.00	33.80
				230	16	0-230	20.8	4.8	0-270	16	11.00	16.90

*One Type 50-P1 Choke required.
**One Type 50-P1 and one Type 50-P2 Choke required.

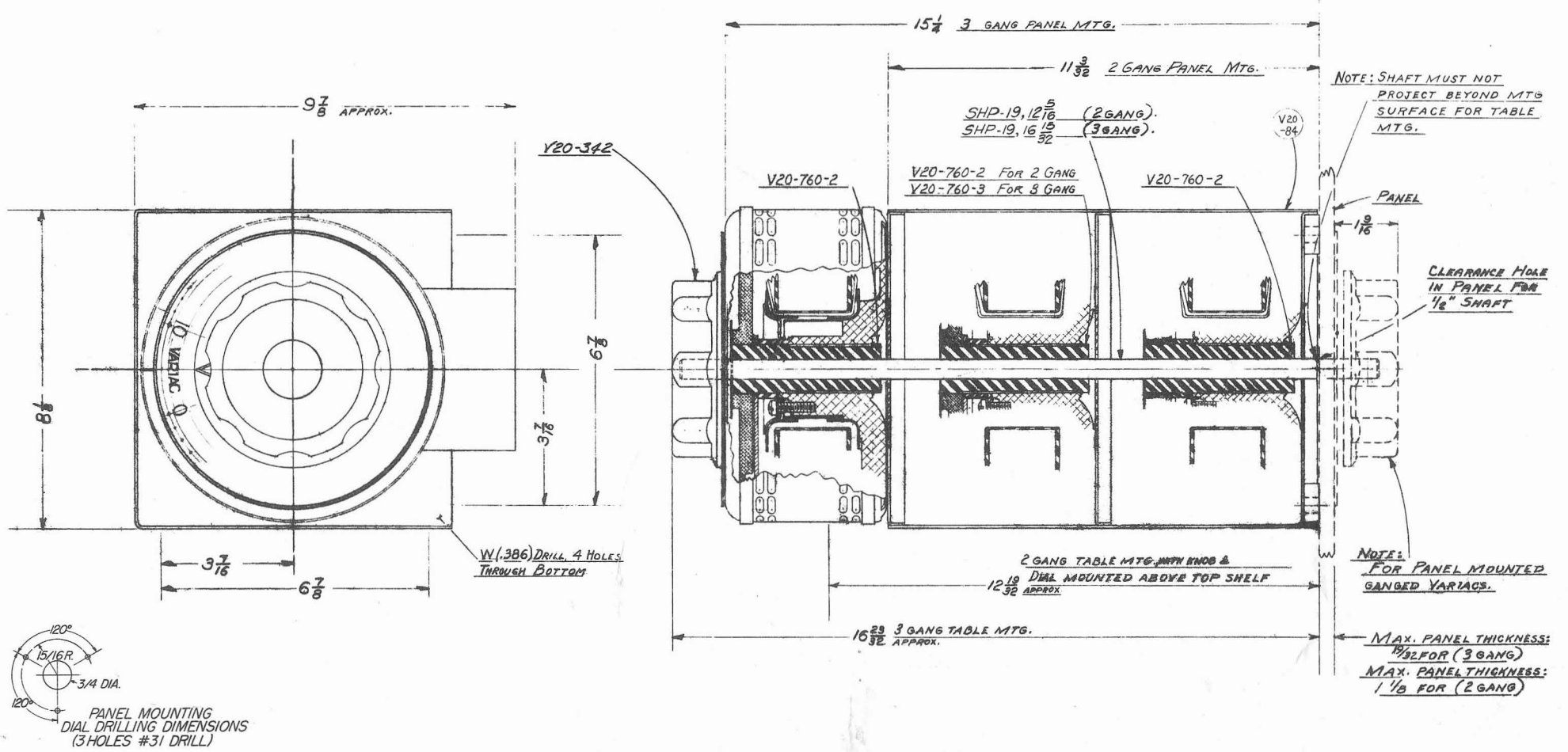




Dimension drawing of Ganged Type V-5 Variacs.



Dimension drawing of Ganged Type V-10 Variacs.



Dimension drawing of Ganged Type V-20 Variacs.