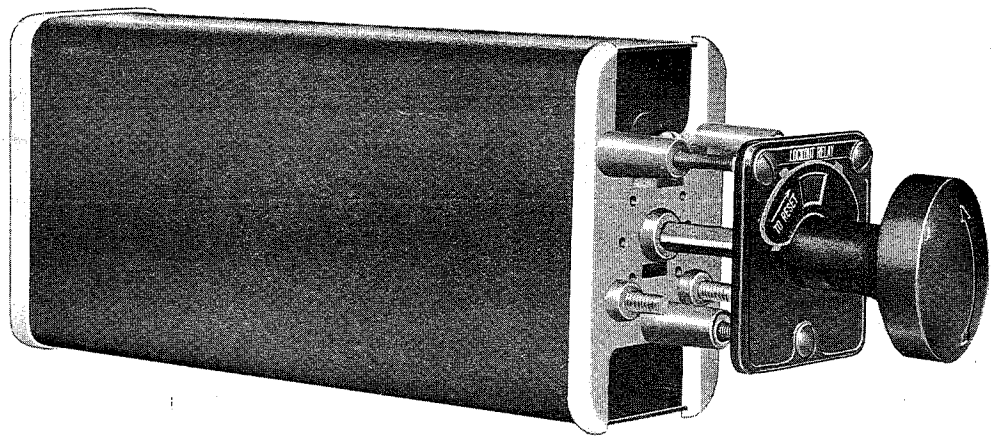
INSTRUCTIONS

GEH-2036

HANDBOOK REFERENCE • 7293

AUXILIARY RELAYS

Hand Reset with Target



Type HEA51

LOW VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

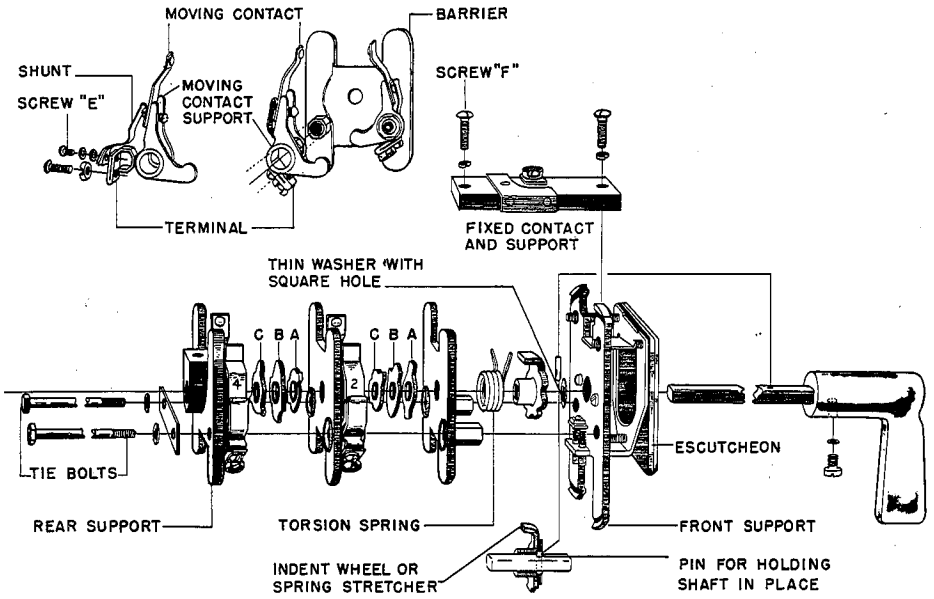


Fig. 1 Exploded View of Contact Section of Type HEA Relay

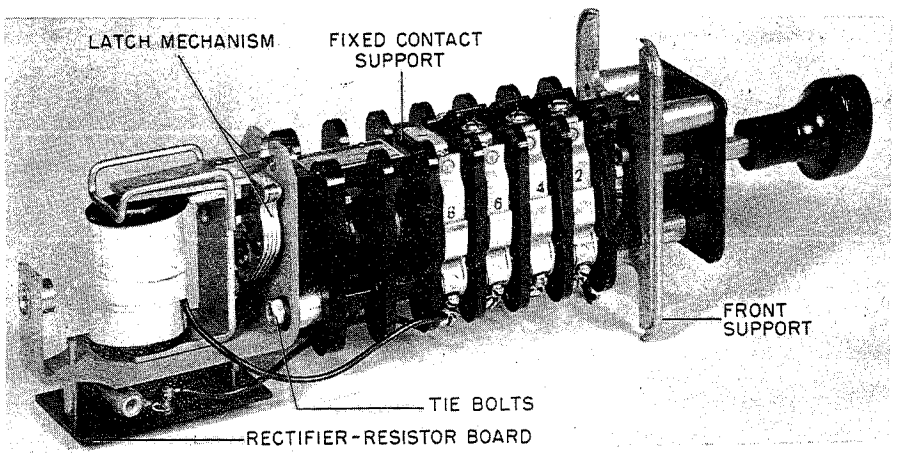


Fig. 2 6 Contact HEA Relay in Tripped Position, with Cover Removed

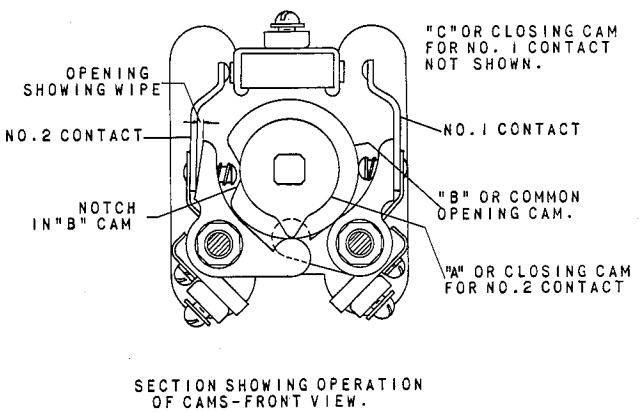


Fig. 3 Typical Section Showing Operation of Cams - Front View

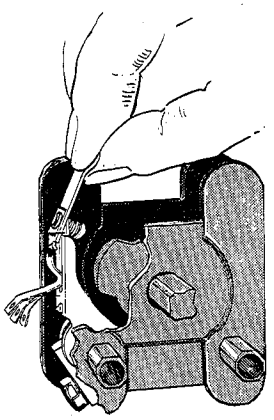


Fig. 4 Removing and Replacing Moving Contact

Fig. 1 (8009283) Fig. 3 (6507946) Fig. 4 (From Fig. 8 of GEH-908M) Cover (8004493)

AUXILIARY RELAYS - HAND RESET
TYPE HEA

DESCRIPTION

INTRODUCTION

The Type HEA relay is a high speed, multi-contact, hand reset, auxiliary relay provided with a mechanical target which indicates whether it is in the tripped or reset position. Table I lists the differences among the various relays covered by these instructions.

APPLICATION

The Type HEA relays are applicable where it is desired that a number of operations be performed simultaneously. Some of the functions that can be performed by these relays are: trip the main circuit breaker of a system, operate an auxiliary breaker, open a neutral line breaker, trip main and auxiliary-field discharge breakers, and operate other relays which in turn perform various functions. Another important use of the Type HEA relay is in conjunction with differential relays which protect transformers, rotating apparatus, buses, etc. A typical application is illustrated in Fig. 7.

OPERATING CHARACTERISTICS

The time required to trip the relay from the point of energization of the coil to the closing of the normally-open contacts is shown in Fig. 5. The opening time of the normally closed contacts is approximately the same as the closing time of the normally open contacts.

RATINGS

The Type HEA relays are available for all standard voltage ratings (intermittent) up to 250 volts, DC and 230 volts, AC.

The current-closing rating of the contacts is 50 amperes for voltages not exceeding 600 volts. The contacts have a current-carrying capacity of 20 amperes continuously or 50 amperes for one minute. The interrupting rating of the contacts varies with the inductance of the circuit. The values (in amperes) given in Table II, for DC inductive circuits, are based on the average trip coil currents.

TABLE I

TYPE	FIGURE	NO. OF CONTACTS	OVERLAPPING CONTACTS †	REMARKS
HEA51A	8	6 + 2 For trip coil	No	
HEA51B	9	10 + 2 For trip coil	No	
HEA51C	10	16 + 2 For trip coil	No	
HEA51E	11	10 + 2 For trip coil	Yes	
HEA51J	12	6 + 2 For Trip coil	Yes	Explosion Proof Housing
HEA51K	13	10 + 2 For trip coil	No	
HEA51M	14	2 + 2 For trip coil	No	
HEA51N	15	10 + 2 For trip coil	No	Special Contact Arrangement
HEA51R	16	6 + 2 For trip coil	No	Explosion Proof Housing

† All normally-closed contacts overlap all normally-open contacts

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

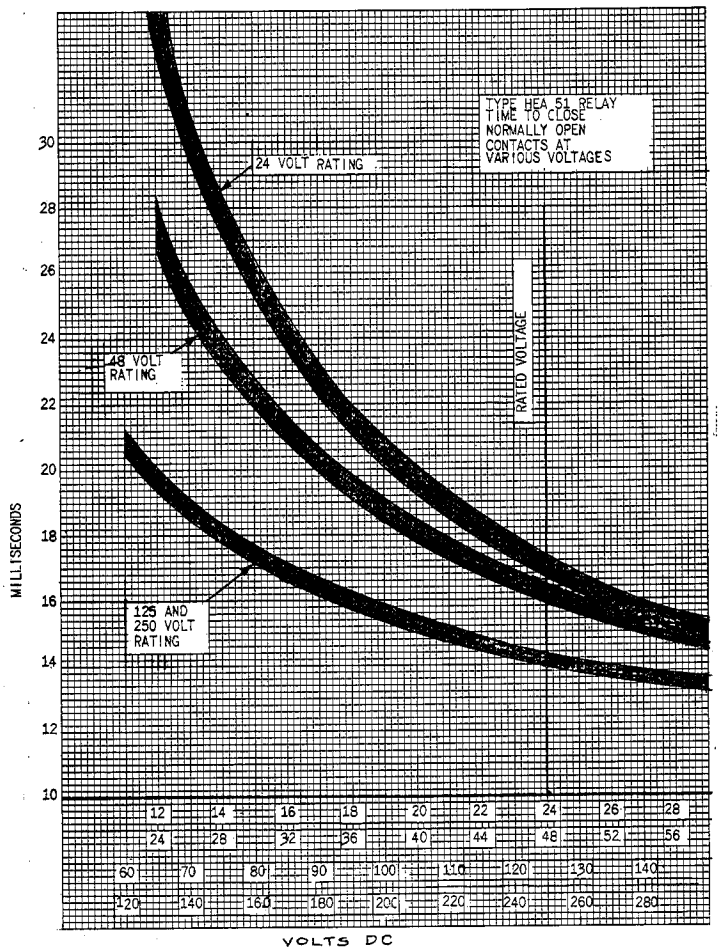


Fig. 5 (0127A9510-0)

Fig. 5 Typical Time-Voltage Characteristics of Type HEA51 Relay

TABLE II

CONTACT INTERRUPTION RATING

Circuit Volts	Non-Inductive Circuit			Inductive Circuit		
	Number of Contacts			Number of Contacts		
	1	2 in series	4 in series	1	2 in series	4 in series
24 DC	6.0	30.0		4.0	20.00	30.0
48 DC	5.0	25.0	40.0	3.0	15.00	25.0
125 DC	2.5	11.0	25.0	2.0	6.25	9.5
250 DC	0.75	2.0	8.0	0.7	1.75	6.5
600 DC	0.25	0.45	1.35	0.15	0.35	1.25
115 AC	40.00	50.0		24.0	50.0	
220 AC	25.00	50.0		12.0	25.0	40.0
440 AC	12.00	25.0		5.0	12.0	20.0
550 AC	6.00	12.0		4.0	10.0	15.0

TABLE III

BURDENS

Intermittent Rating	Freq.	Res. Ohms 25° C	AC Inrush Current Amps	Rating of Protective Relay Target Coil Amps	
				Universal Target Seal-in	Separate Target & Seal-in
12	DC	0.4		2.0	
24	DC	1.2		2.0	1.0
32	DC	2.4		2.0	
48	DC	4.5		2.0	1.0
60	DC	4.5		2.0	
125	DC	17.3		0.2	1.0
250	DC	69.0		0.2	0.2
115	60 Cyc.		25	2.0	
230	60 Cyc.		14	2.0	
230	25 Cyc.		6.0	0.2	

BURDENS

The burden data of the Type HEA relay is listed in Table III.

CONSTRUCTION AND CIRCUITRY

The contact section of this relay is built from parts of the Type SB-1 control and transfer switch (See Fig. 1 and 2).

The operating shaft is held in the reset position by a positive latch. It is released through the action of the operating coil when it attracts the hinged-armature element.

The mechanical target on the escutcheon plate assembly indicates black when the relay is in the reset position and yellow when in the tripped position. To reset the relay after being tripped, the handle is turned clockwise as indicated by the arrow on the escutcheon plate.

In addition to the 2, 6, 10 or 16 sets of contacts as provided each relay is equipped with two normally-closed contacts connected in series for opening the operating coil circuit. All DC rated relays are supplied with a rectifier-resistor board connected across the coil to reduce arcing of the coil circuit contacts and to limit the voltage surge created by the opening of the coil circuit.

INSTALLATION

RECEIVING

These relays, when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips.

MOUNTING

The relay should be mounted on a vertical surface. The relay may be mounted on panels, having thickness of 2 inches, 1-1/2 inches, 1 inch, or 1/8 inch. The shaft has tapped holes provided to secure the handle to it, the holes being properly located to accommodate the various panel thicknesses. For a 1/8 inch panel mounting, the shaft must be shortened by cutting through the hole used for one inch panels. For intermediate thicknesses of panels, spacers are furnished to fill the excess space between the front support and panel. Two sets of mounting screws are provided for securing the relay to any of the above mentioned panel sizes.

The outline and panel drilling diagrams for the various types of HEA relays are shown in Figs. 8 to 16, inclusive.

CONNECTIONS

The internal connection diagrams for the various types of HEA relays are shown in Figs. 8 to 16, inclusive. NOTE THAT RECTIFIER END OF COIL CIRCUIT MUST BE CONNECTED TO NEGATIVE. When connecting switchboard wires to the coil circuit be sure, they are kept away from the arc path which occurs when the relay contacts interrupt the coil circuit.

MAINTENANCE

PERIODIC TESTS

During any scheduled outage of the equipment and preferably at yearly intervals, the relay should be tripped electrically to insure that it is in good operating condition, and that all the circuits are complete so that the breakers can be tripped.

This test may be performed at 70 per cent of rated voltage by inserting the proper value of series resistance in the coil circuit as listed in Table IV being careful to apply the test voltage only long enough to trip the relay.

TABLE IV

Volts (DC)	12	24	32	48	60	125	250
Ex. Ohms For Test	0.2	0.5	1.0	2.0	2.0	7.5	30.0

SERVICING

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched roughened surface, resembling in effect a superfine file.

The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact.

The burnishing tool described is included in the standard relay tool kit obtainable from the factory.

RENEWAL PART INSTALLATION

To remove the moving contact, position the relay so that the contact is open. Remove screw E, (Fig. 1) which holds the shunt to the terminal, press in, on the top of the contact, to release the torque at its lower end (Fig. 4) and pull the contact upward and off.

The moving contact has a shoe that is assembled between the contact spring and the contact. When assembling a new moving contact, the end of the moving contact support must be inserted between the shoe and the moving contact. Then the contact may be slide down into place and screw (E) replaced. When replacing screw (E) be sure the lockwasher is replaced and be careful to avoid creasing the thin metal strips of the shunt. Operate the relay and observe whether the contacts meet squarely and simultaneously. The contacts can be adjusted by bending slightly with smooth faced pliers. After adjustment there should be an appreciable gap, with the contacts closed, between the moving contact and the moving support.

Damage to a fixed contact requires replacement of the complete assembly of fixed contacts and support. Remove screws F (Fig. 1) change assemblies and replace screws. Check alignment of contacts.

When cams, barriers, moving-contact supports, etc. need to be replaced the relay should be removed from the panel and disassembled on a bench.

Disassembly

With the relay in the tripped position, remove the handle and the fixed contact support. Disconnect the rectifier-resistor board and coil leads from the terminals. Remove rectifier-resistor board, then the coil and polepiece. The frame and armature assembly can now be removed. Unscrew the tie bolts from the front support but leave them in the relay. Remove cotter pin from rear end of shaft and slide off roller arm assembly. Slip the front support off the shaft being careful to hold the shaft in the relay so as not to pull it out of the cams in the rear stage. Slide the shaft out just enough to remove the pin, through the shaft, which rests in the counterbore in the spring stretcher. Push the shaft back into the relay and remove the spring stretcher, spring and thin washer that is assembled between the spring stretcher and front support. Remove the first barrier to expose the cams for contacts No. 1-2.

The cams and barriers may now be removed until the damaged part is reached.

CAUTION:

The parts of the last contact stage adjacent to the latch mechanism should not be removed, as they are formed differently from the others in order to facilitate operation of series targets in the coil circuit, and therefore are not interchangeable.

When converting from two normally open to two normally closed contacts three new cams, 6015923P7 for A and C and 6015923P5 for B are required, (See Fig. 6). When changing from two normally closed to two normally open contacts three new cams, 6015923P5 for A and C and 6015923P19 for B are required. When converting from two normally open contacts to one normally open and one normally closed two new cams 6015923P7 for A and 6015923P14 for B are required. The C cam is not changed. Note that this conversion makes the even numbered contact normally closed which is standard practice for the relay. When converting from two normally closed contacts to one normally open and one normally closed two new cams, 6015923P5 for C and 6015923P14 for B are required. The A cam is not changed.

Note: The preceeding description of contact conversion does not apply to relay types HEA51E and HEA51J. These relays are designed for overlap

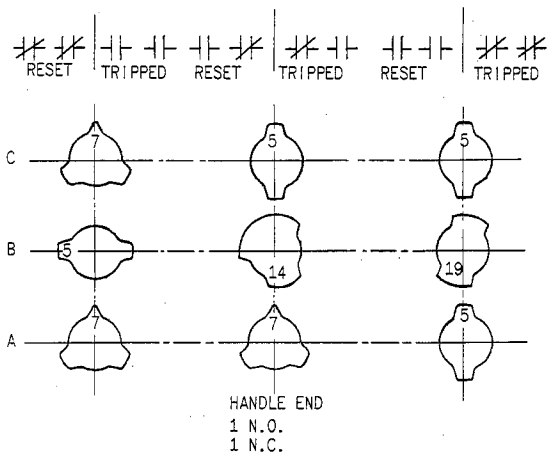


Fig. 6 (0127A7989-0)

Fig. 6 Cam Arrangement (Front View)

between the normally-open and normally-closed contacts. It is recommended that these relays be returned to the factory if contact conversion is necessary.

Assembly

Place the end of the shaft in the rear support with the relay in the tripped position (spring spreader toward top of switch), assemble the cams for each stage in the order C-B-A and in the positions shown in Fig. 6, depending on the contact arrangement desired for the individual stage. Assemble first all the stages that are to have two normally-closed contacts; then the one stage (if any) that is to have one normally open and one normally closed contacts; and finally all stages that are to have two normally open contacts.

When the front barrier, which carries no contacts is in place, assemble the spring spreader and torsion spring with the counterbored end toward the front support. Pull the shaft out just enough to permit the locking pin to be inserted through the shaft. Then push the shaft back into relay so that the locking pin seats in the counterbore and slide the thin washer over the shaft. Slide the front support into place. Tighten the tie bolts, after making sure that all barriers are properly nested. Replace roller arm assembly and cotter pin at rear end of shaft. Reassemble frame and armature asembly to the relay. Replace coil and polepiece. Then fasten rectifier-resistor board in position and reconnect leads to correct terminals. (See CONNECTIONS Section). Finally, remount fixed contact support and handle.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specifying the quantity required and describing the parts by catalogue numbers as shown in Renewal Parts Bulletin No. GEF-3325.

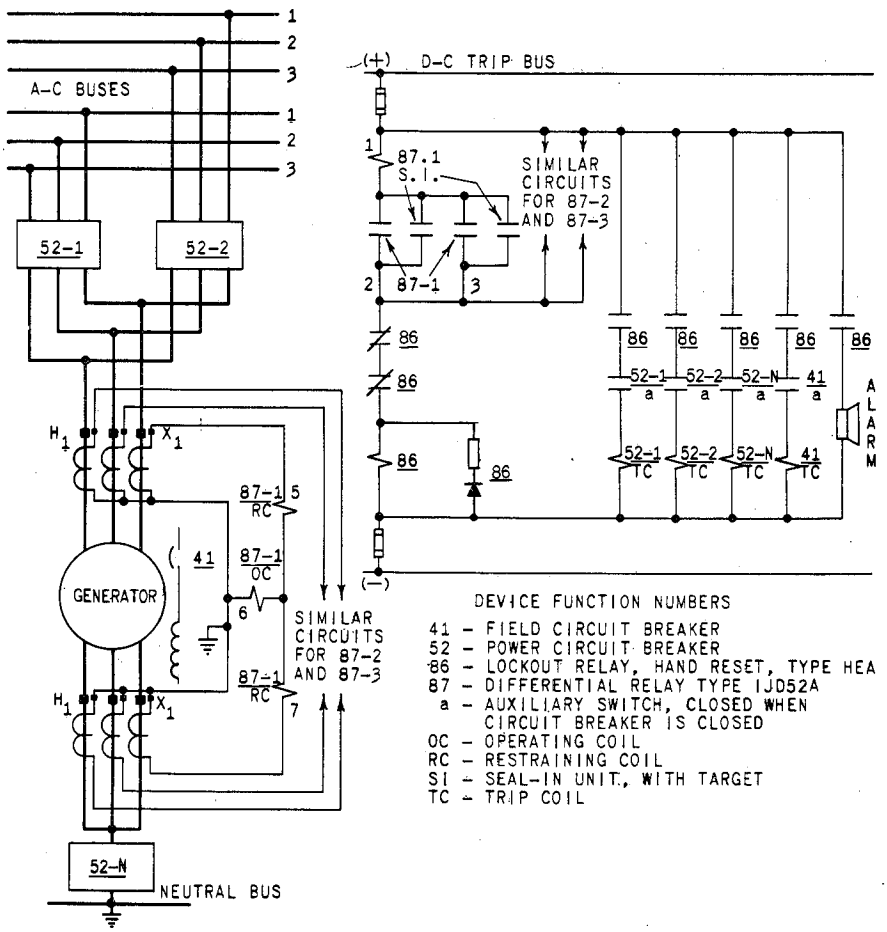
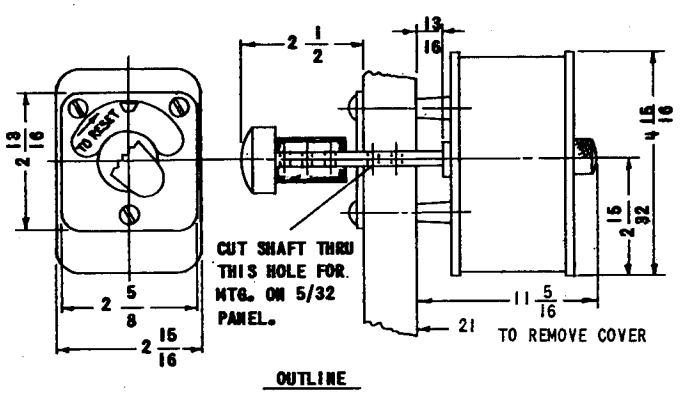
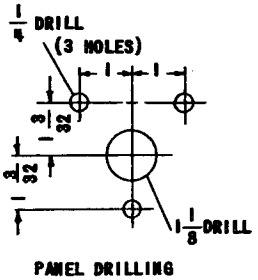
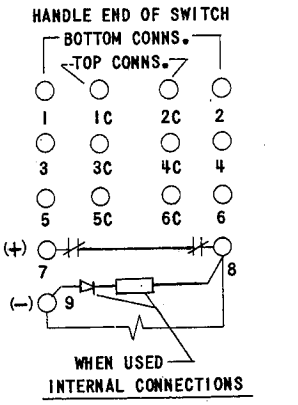


Fig. 7 (K-6174073-4)

Fig. 7 Typical Application of Type HEA Relays as Auxiliary Device in the Differential Protection of a Generator





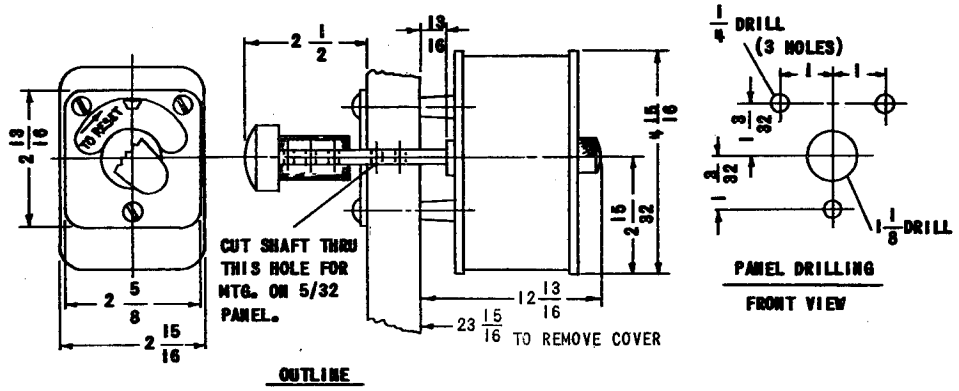


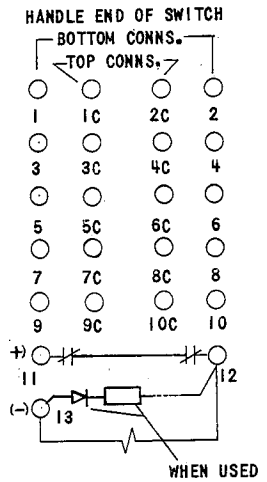
NOTE - CONTACTS 7 & 8 SHOWN IN RESET POSITION.

CYCLES	RELAY FORM NUMERAL															CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	DC	DC	DC	50/60		25	DC	50/60	25	50/60	RESET	POSITION
VOLTS	250	125	48	24	60	32	12	220	115	230	230	110	460	115	208	OPEN	CLOSED
MODEL 12HEA51A	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	NONE	1 TO 6
	211	221	231	241	251	261	271	281	291	301	311	321	331	341	351	1	2 TO 6
	212	222	232	242	252	262	272	282	292	302	312	322	332	342	352	1 & 2	3 TO 6
	213	223	233	243	253	263	273	283	293	303	313	323	333	343	353	1 TO 3	4 TO 6
	214	224	234	244	254	264	274	284	294	304	314	324	334	344	354	1 TO 4	5 TO 6
	215	225	235	245	255	265	275	285	295	305	315	325	335	345	355	1 TO 5	6
	216	226	236	246	256	266	276	286	296	306	316	326	336	346	356	1 TO 6	NONE

Fig. 8 (104A8931-2)

Fig. 8 Outline, Panel Drilling and Internal Connection Diagram for HEA51A Relay





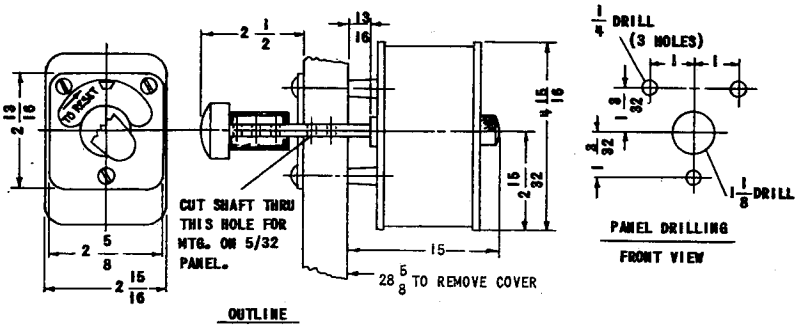
NOTE - CONTACTS 11 & 12 SHOWN IN RESET POSITION.

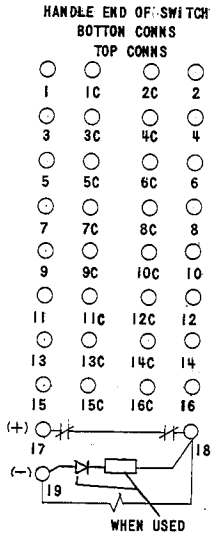
CYCLES	RELAY FORM NUMERAL										CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	DC	DC	50/60	DC	50/60	RESET	POSITION
VOLTS	250	125	48	24	32	230	220	115	230	460	OPEN	CLOSED
MODEL 12HEA51B	210	230	250	270	290	310	330	350	370	390	410	NONE	1 TO 10
	211	231	251	271	291	311	331	351	371	391	411	1	2 TO 10
	212	232	252	272	292	312	332	352	372	392	412	1 & 2	3 TO 10
	213	233	253	273	293	313	333	353	373	393	413	1 TO 3	4 TO 10
	214	234	254	274	294	314	334	354	374	394	414	1 TO 4	5 TO 10
	215	235	255	275	295	315	335	355	375	395	415	1 TO 5	6 TO 10
	216	236	256	276	296	316	336	356	376	396	416	1 TO 6	7 TO 10
	217	237	257	277	297	317	337	357	377	397	417	1 TO 7	8 TO 10
	218	238	258	278	298	318	338	358	378	398	418	1 TO 8	9 TO 10
	219	239	259	279	299	319	339	359	379	399	419	1 TO 9	10
	220	240	260	280	300	320	340	360	380	400	420	1 TO 10	NONE

Fig. 9 (104A8932-2)

Fig. 9 Outline, Panel Drilling and Internal Connection Diagram for HEA51B Relay

Fig. 10 (104A8933-2)



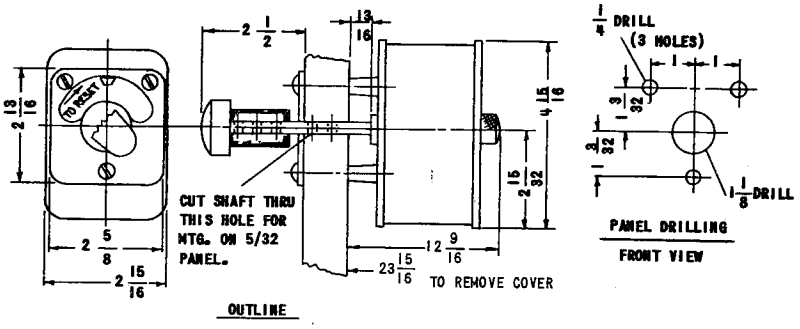


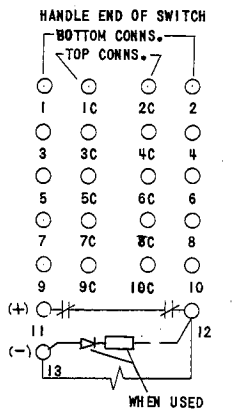
NOTE-CONTACTS 17 & 18 SHOWN IN RESET POSITION.

CYCLES	RELAY FORM NUMERAL												CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	50/60							RESET	POSITION
VOLTS	250	125	48	24	220	115	460						OPEN	CLOSED
MODEL 12HEA51C	210	230	250	270	290	310	330						NONE	1 TO 16
	211	231	251	271	291	311	331						1	2 TO 16
	212	232	252	272	292	312	332						1 & 2	3 TO 16
	213	233	253	273	293	313	333						1 TO 3	4 TO 16
	214	234	254	274	294	314	334						1 TO 4	5 TO 16
	215	235	255	275	295	315	335						1 TO 5	6 TO 16
	216	236	256	276	296	316	336						1 TO 6	7 TO 16
	217	237	257	277	297	317	337						1 TO 7	8 TO 16
	218	238	258	278	298	318	338						1 TO 8	9 TO 16
	219	239	259	279	299	319	339						1 TO 9	10 TO 16
	220	240	260	280	300	320	340						1 TO 10	11 TO 16
	221	241	261	281	301	321	341						1 TO 11	12 TO 16
	222	242	262	282	302	322	342						1 TO 12	13 TO 16
	223	243	263	283	303	323	343						1 TO 13	14 TO 16
	224	244	264	284	304	324	344						1 TO 14	15 TO 16
	225	245	265	285	305	325	345						1 TO 15	16
	226	246	266	286	306	326	346						1 TO 16	NONE

Fig. 10 Outline, Panel Drilling and Internal Connection Diagram for HEA51C Relay

Fig. 11 (104A8935-2)

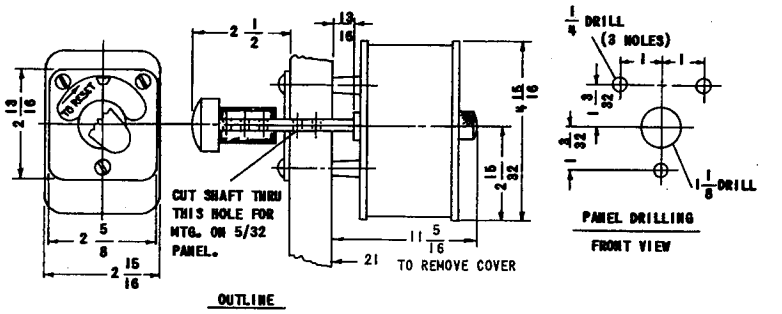




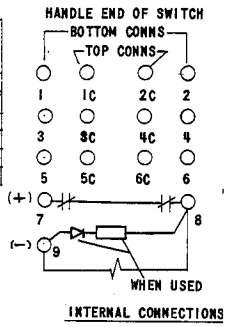
NOTE: CONTACTS 11 & 12 SHOWN IN RESET POSITION. NORMALLY CLOSED CONTACTS OVERLAP ALL NORMALLY OPEN CONTACTS FOR POSITIONS 1 THRU 10.

CYCLES	RELAY FORM NUMERAL												CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	DC	DC	50/60					RESET	POSITION
VOLTS	250	125	48	24	32	250	220	115	230				OPEN	CLOSED
MODEL 12HEA51E	211	231	241	251	261	271	281	291	301				1	2 TO 10
	212	232	242	252	262	272	282	292	302				1 & 2	3 TO 10
	213	233	243	253	263	273	283	293	303				1 TO 3	4 TO 10
	214	234	244	254	264	274	284	294	304				1 TO 4	5 TO 10
	215	235	245	255	265	275	285	295	305				1 TO 5	6 TO 10
	216	236	246	256	266	276	286	296	306				1 TO 6	7 TO 10
	217	237	247	257	267	277	287	297	307				1 TO 7	8 TO 10
	218	238	248	258	268	278	288	298	308				1 TO 8	9 TO 10
	219	239	249	259	269	279	289	299	309				1 TO 9	10

Fig. 11 Outline, Panel Drilling and Internal Connection Diagram for HEA51E Relay

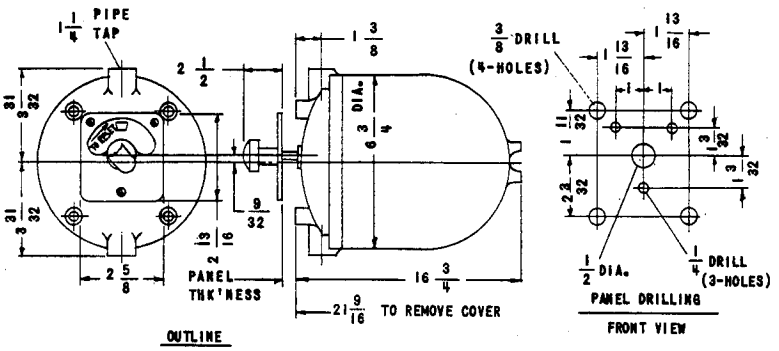


CYCLES	RELAY FORM NUMERAL DC	DC	DC	DC	DC		DC	50/60				CONTACT ARRANGEMENT RESET	POSITION
VOLTS	250	125	48	24	32		220	115	230			OPEN	CLOSED
MODEL 12HEA51J	211	221	231	241	251		271	281	291			1	2 TO 6
	212	222	232	242	252		272	282	292			1 & 2	3 TO 6
	213	223	233	243	253		273	283	293			1 TO 3	4 TO 6
	214	224	234	244	254		274	284	294			1 TO 4	5 TO 6
	215	225	235	245	255		275	285	295			1 TO 5	6

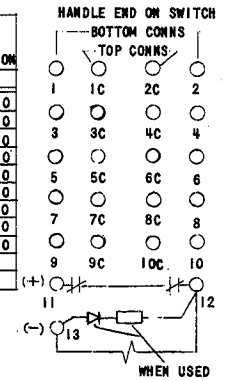


NOTE - CONTACTS 7 & 8 SHOWN IN RESET POSITION. NORMALLY CLOSED CONTACTS OVERLAP NORMALLY OPEN CONTACTS IN POSITIONS 1 THRU 6.

Fig. 12 Outline, Panel Drilling and Internal Connection Diagram for HEA51J Relay



CYCLES	RELAY FORM NUMERAL 50/60	25	25	50/60	DC	DC	DC	DC	DC			CONTACT ARRANGEMENT RESET	POSITION
VOLTS	115	230	115	230	460	12	24	48	125	250		OPEN	CLOSED
MODEL 12HEA51K	210	230	250	270	290	310	330	350	370	390		NONE	1 TO 10
	211	231	251	271	291	311	331	351	371	391		1	2 TO 10
	212	232	252	272	292	312	332	352	372	392		1 & 2	3 TO 10
	213	233	253	273	293	313	333	353	373	393		1 TO 3	4 TO 10
	214	234	254	274	294	314	334	354	374	394		1 TO 4	5 TO 10
	215	235	255	275	295	315	335	355	375	395		1 TO 5	6 TO 10
	216	236	256	276	296	316	336	356	376	396		1 TO 6	7 TO 10
	217	237	257	277	297	317	337	357	377	397		1 TO 7	8 TO 10
	218	238	258	278	298	318	338	358	378	398		1 TO 8	9 TO 10
	219	239	259	279	299	319	339	359	379	399		1 TO 9	10
	220	240	260	280	300	320	340	360	380	400		1 TO 10	NONE

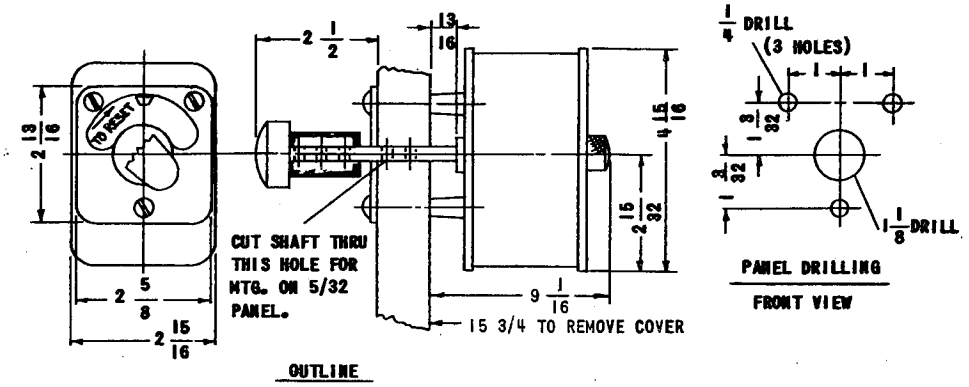


NOTE - CONTACT 11 & 12 SHOWN IN RESET POSITION.

Fig. 13 Outline, Panel Drilling and Interconnection Diagram for HEA51K Relay

Fig. 12 (104A8936-2)

Fig. 13 (104A8937-2)

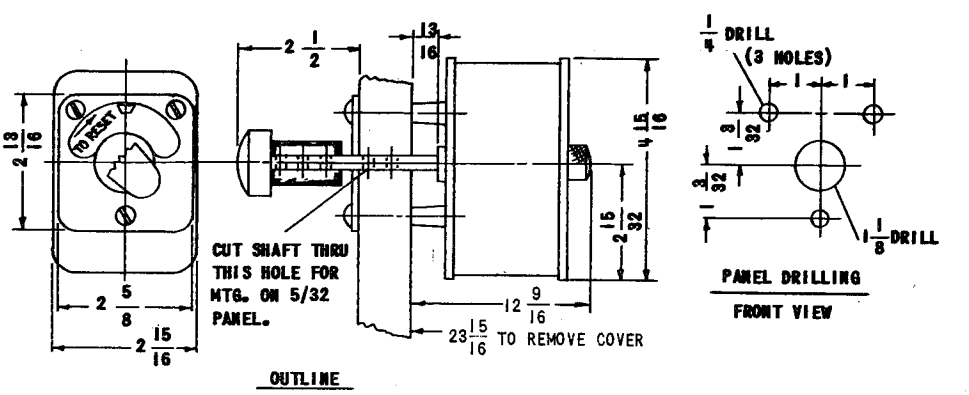


CYCLES	RELAY FORM NUMERAL												CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	DC	DC	DC	50/60	25	DC	50/60	RESET	POSITION
VOLTS	250	125	48	24	60	32	12	220	115	230	230	110	OPEN	CLOSED
MODEL 12HEA5IM	10	20	30	40	50	60	70	80	90	100	110	120	3 & 4	NONE
	11	21	31	41	51	61	71	81	91	101	111	121	3	4
	12	22	32	42	52	62	72	82	92	102	112	122	NONE	3 & 4

NOTE-CONTACTS 5 & 6 SHOWN IN RESET POSITIONS

Fig. 14 (104A8938-2)

Fig. 14 Outline, Panel Drilling and Internal Connection Diagram for HEA5IM Relay

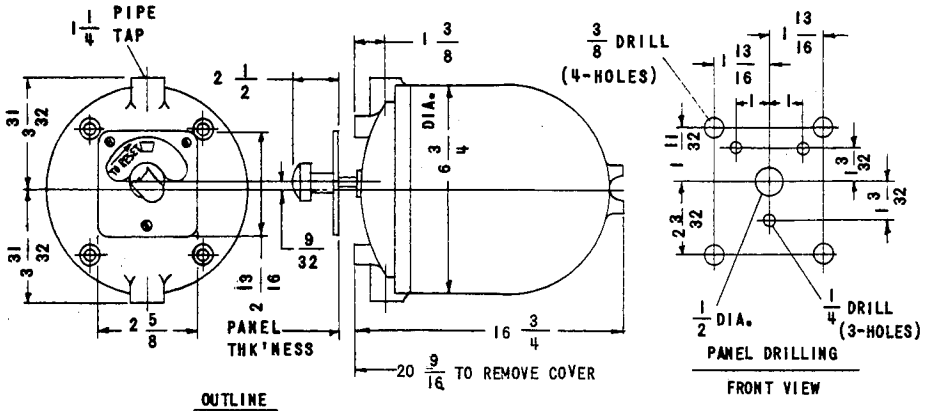


CYCLES	RELAY FORM NUMBER					CONTACT ARRANGEMENT	
	DC	DC	DC	DC	DC	RESET	POSITION
VOLTS	250	125	48	24	32	OPEN	CLOSED
MODEL 12HEA5IN	10	20	30	40	50	1-3-5-7-9	2-4-6-8-10
	11	21	31	41	51	1-3-5-7-9-10	2-4-6-8

NOTE-CONTACTS 11 & 12 SHOWN IN RESET POSITION.

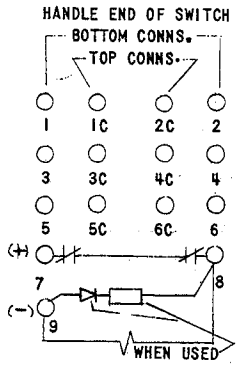
Fig. 15 (104A8939-2)

Fig. 15 Outline, Panel Drilling and Internal Connection Diagram for HEA5IN Relay



OUTLINE

	RELAY FORM NUMERAL														CONTACT ARRANGEMENT	
CYCLES	DC	DC	DC	DC	DC	DC	DC	DC	50/60	25	50/60	25	50/60		RESET	POSITION
VOLTS	250	125	48	24	60	32	12	220	115	230	230	460	115	208	OPEN	CLOSED
MODEL 12 HEA51R	210	220	230	240	250	260	270	280	290	300	310	330	340	350	NONE	1 to 6
	211	221	231	241	251	261	271	281	291	301	311	331	341	351	1	2 to 6
	212	222	232	242	252	262	272	282	292	302	312	332	342	352	1 & 2	3 to 6
	213	223	333	243	253	263	273	283	293	303	313	333	343	353	1 to 3	4 to 6
	214	224	234	244	254	264	274	284	294	304	314	334	344	354	1 to 4	5 to 6
	215	225	235	245	255	265	275	285	295	305	315	335	345	355	1 to 5	6
	216	226	236	246	256	266	276	286	296	306	316	336	346	356	1 to 6	NONE



INTERNAL CONNECTIONS

NOTE-CONTACT 7 & 8 SHOWN IN RESET POSITION

Fig. 16 (104A8940-2)

Fig. 16 Outline, Panel Drilling and Internal Connection Diagram for HFA51R Relay