INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE SX TOGGLE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

Type SX relay is a toggle type relay intended for auxiliary service where the relay contacts should operate and not reset until reset coil is energized.

In a typical application, the type SX relays are used to provide selective reclosing where the breaker is instantaneously reclosed only after it is tripped by the carrier or instantaneous trip relays. The typical connections of this scheme is shown in Fig. 1. The instantaneous or carrier trip circuit is trip circuit No. 1, and operates the series operating coil of the type SX relay. This closes the type SX relay contact to initiate reclosing. All of the other trip circuit paths are combined in trip circuit No. 2 which by-pass the type SX relay operating coil.

The advantage of this toggle relay is its high operating speed and its positive toggle action. If the trip current is well above the operating value of the relay, the relay contacts will close positively even though its coil is immediately shorted out by the seal-in contactor switch.

Where an instantaneous back-up element such as type HZ or HZM relay first impedance element or instantaneous trip attachments are used and not included in the selective reclosing circuit thru the type SX relay, the back-up trip circuit should include a suitable resistor to prevent shorting the type SX relay before the other trip circuit operates.

One type SX relay is required in each instantaneous trip path. For the type HKB Carrier Relays and the type HZ or HZM Carrier Relays using type RS Relay, one type SX relay is required and connected in series in the carrier trip path as shown in Fig. 1.

For the type HZ Carrier Relays with out-of-step blocking using the type RSN relay two *type SX relays or a two element relay (Figs. 5 and 6) are required, one in the phase carrier trip circuit and one in the ground carrier trip circuit as shown in Fig. 2. In this scheme reclosing is initiated whenever the trip coil is energized by the directional element thru the second impedance element and carrier (RRP) for phase faults, or by the directional, ground overcurrent and carrier elements (RRG) for ground faults. The operating coil of one type SX Relay is connected in the Z1 and RRP phase trip circuit, and of the other in the D_o, I_o and RRG ground trip circuit. Energizing the trip coil through any of these paths picks-up the type SX relays and the seal-in switches. The latter immediately shorts out the type SX relays but not before these contacts close the reclosing circuit. The back-up trip circuits by-pass the type SX operating coils.

An alternate method for selective reclosing is to use a third point of the seal-in contactor switch to energize a voltage type operating coil of the type SX relay. This is particularly applicable to the type HKB Carrier Relay where the extra point of the contactor switch is brought out to a base terminal.

*Denotes change from superseded issue.

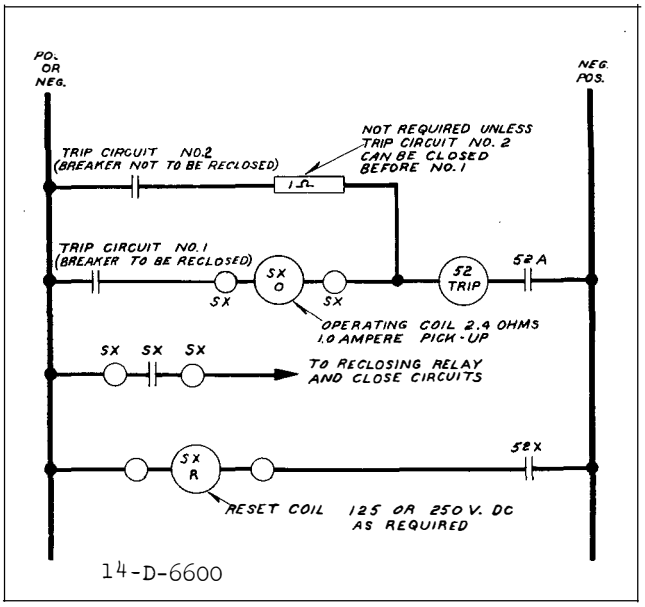


Fig. 1—Typical Schematic Connections for Selective Reclosing Using the Type SX Relay.

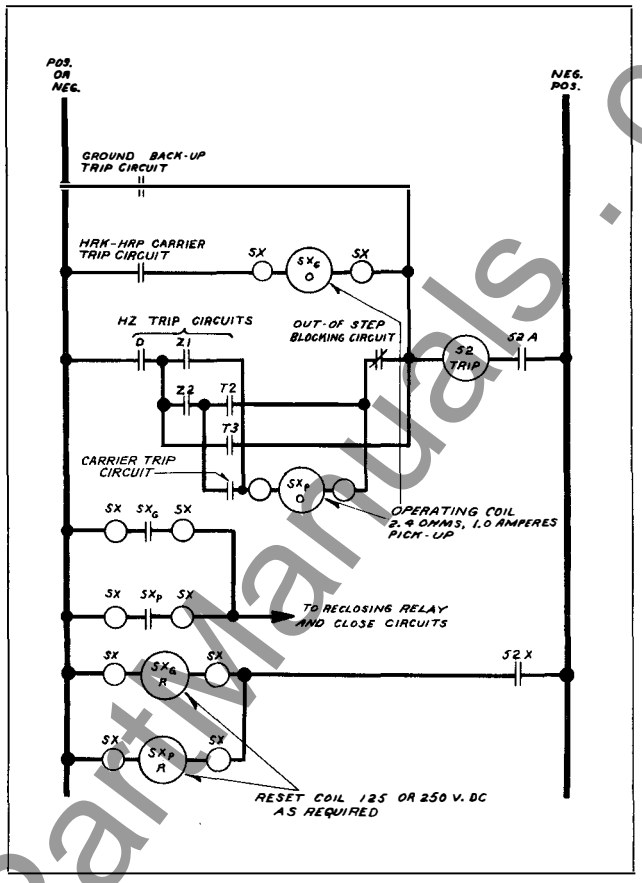
The type SX relays stay operated until the reset coil is energized. After the reclosure is completed, a switch on the breaker auxiliary contactor energized the reset coil for subsequent operations.

CONSTRUCTION AND OPERATION

The type SX relay consists of two electromagnets with a common armature. The armature is constructed with a toggle joint, and the spring mounted on one of the pole pieces provides pressure on the end of the armature so that it will remain against that pole piece to which it is moved, either electrically or mechanically, after the operating force is removed. The moving contact or contacts are mounted at the top of the armature, and the stationary contacts are mounted above the two pole pieces.

CHARACTERISTICS

The type SX relay usually is supplied with either a single contact or with two contacts closed in one position of the armature and one contact closed in the other position, with one of the moving contacts common to two stationary contacts. In the latter design of the relay the double-throw contact is normally used to interrupt the coil circuits after the relay has operated.



*** Fig. 2—Typical Schematic Connections for Selective Reclosing Using the Type SX Relays with the Type HZ-RSN Carrier Relays.**

Special modifications have been supplied with two single-throw electrically independent contacts. These may be arranged so that both contacts are closed in one position of the armature, or one contact may be closed and one open in each position of the armature.

The relay is available for 115 or 230 volts, 25, 50 or 60 cycles, for 125 or 250 volts d-c service, or for 1, 5 or 10 amperes d-c. These ratings are for intermittent service only. The relay operates at 80 percent of its rated voltage. The relay is supplied with the operating and reset coils in any combination of the above ratings as desired.

Relays used for selective reclosing are frequently provided with a one-ampere operating coil having a lower power consumption and which requires special adjustment of the toggle spring. This coil is used in order to keep the resistance in series with the trip

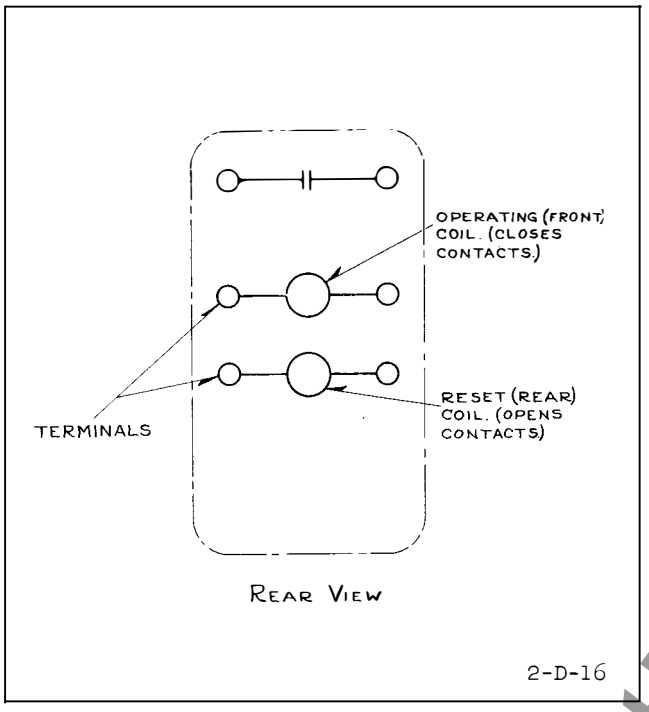


Fig. 3—Internal Schematic Connections of the Single Contact Type SX Relay in the Small Glass Case.

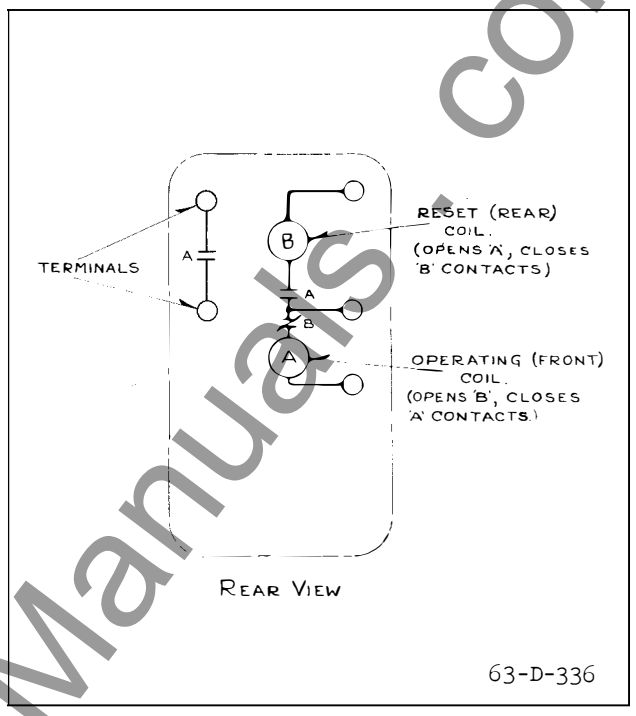


Fig. 4—Internal Schematic Connections of the Type SX Relay with Cut-off Contacts in the Small Glass Case.

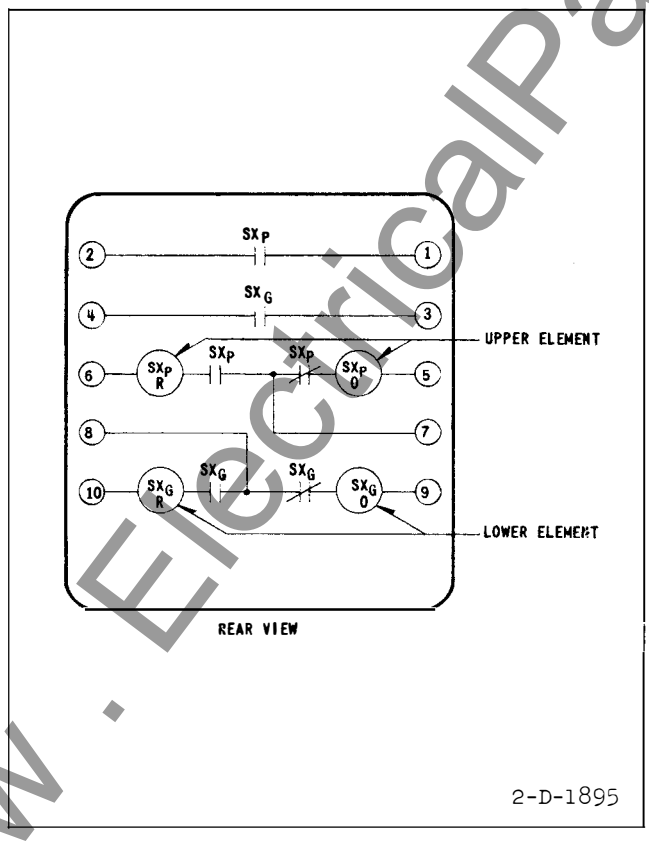


Fig. 5—Internal Connections of the Two-Element Type SX Relay with Cut-off Contacts in the Standard Case.

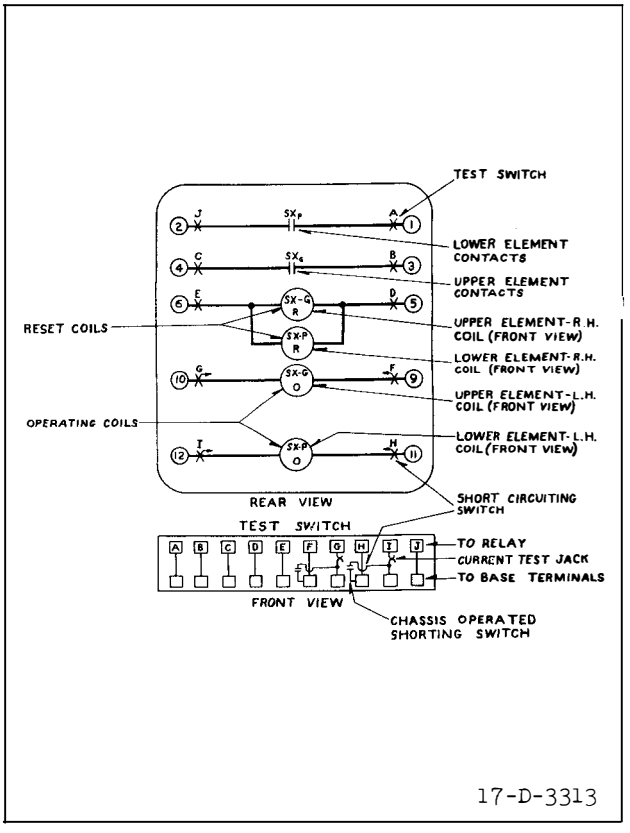


Fig. 6—Internal Schematic of the Two-Element Single Contact Type SX Relay in the Type FT Case.

coil to as low a value as possible. Its use should be restricted to such applications as necessitate a minimum value of coil resistance

The resistances of standard 1, 5 and 10 ampere coils are 15, 0.75 and 0.2 ohms respectively. The resistance of the special one-ampere coil is 2.4 ohms.

The relay contacts will carry 5 amperes continuously. They will interrupt non-inductive circuits carrying 20 amperes at 115 volts a-c, 10 amperes at 230 volts a-c, 2 amperes at 125 volts d-c, or 0.75 amperes at 250 volts d-c.

The operating time of the type SX relay, when energized from a d-c source through a resistance load and when using the special low resistance one-ampere coil, is approximately .027 seconds at rated current, .008 seconds at 300 percent and .005 at 2000 percent of rated current. At 2000 percent of rated current in a circuit having approximately the same ratio of inductance to resistance as a typical trip coil, the operating time is approximatley .007 seconds.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be periodically cleaned with a fine file. S #1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

If the relay has been dismantled, it is necessary to check the toggle action and the contact follow after reassembling it. The clearance hole for the mounting screw in the pole piece under the toggle spring is large enough to permit some variation in the pole piece position. The gap between the two pole pieces should be 1/4". The thickness of the armature measured over the copper rivets which serve as anti-residual spacers in the air gap is 5/32" to 11/64", so that the movement of the armature at this point is about 5/64" to 3/32".

When the armature is at dead center with respect to the toggle action, it should have equal travel to either pole piece if the relay closes contacts in both positions. If the relay has a single contact, the travel from dead center to the contact side may be slightly greater than the travel to the opposite side. The position of the armature at dead center, and also the force required to transfer the armature from one side to the other, is controlled by the shape of the toggle spring and can be adjusted by bending the spring as required. In all relays except those having a single contact, a screw is provided to assist in adjusting the pressure of the spring on the toggle member and consequently the force required to move the armature from one position to the other. The bends in the spring should be approximately correct initially, however. A set screw in the side of the pole piece locks the screw after the adjustment is made.

The standard adjustment is such that an operating force of 3 ounces or more applied close to the toggle hinge will transfer the

armature from one position to the other. The force required can be greater than 3 ounces but should be low enough to permit the relay to operate at 80 percent of its rating. On relays having the special one-ampere low energy coil, the operating force must be considerably less, and it is particularly important that the spring be shaped so that the armature has equal travel on both sides of the dead center position.

The stationary contacts should be adjusted (by bending) so that there is a small gap to the moving contacts when the armature is at dead center, and the contact follow should not be such as to prevent the armature from touching the pole piece when the operating coil is de-energized. Even with the low energy operating coil, the resulting follow will be sufficient to insure positive contact if the armature position in the gap is correct at dead center. If the armature does not rest against the pole piece with the operating coil de-energized, it is possible that the contacts may close but bounce to the permanently open position when the coil is de-energized. This will not occur on a correctly adjusted relay.

REPAIR AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The 115 volt 60 cycle SX relay takes approximately 60 v.a. at rated voltage. The 125 volt d-c relay takes approximately 20 watts.

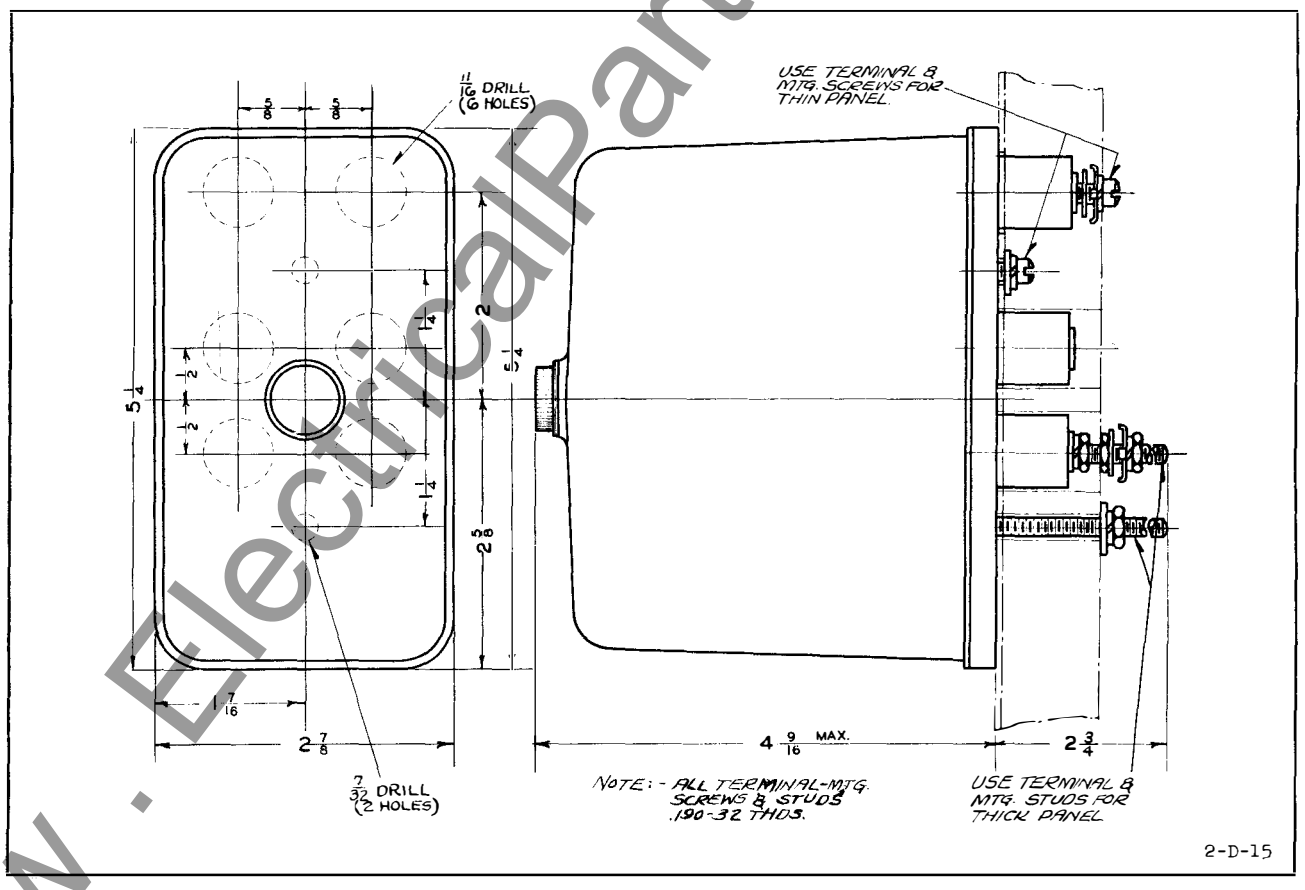


Fig. 7—Outline and Drilling Plan for the Small Projection Glass Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

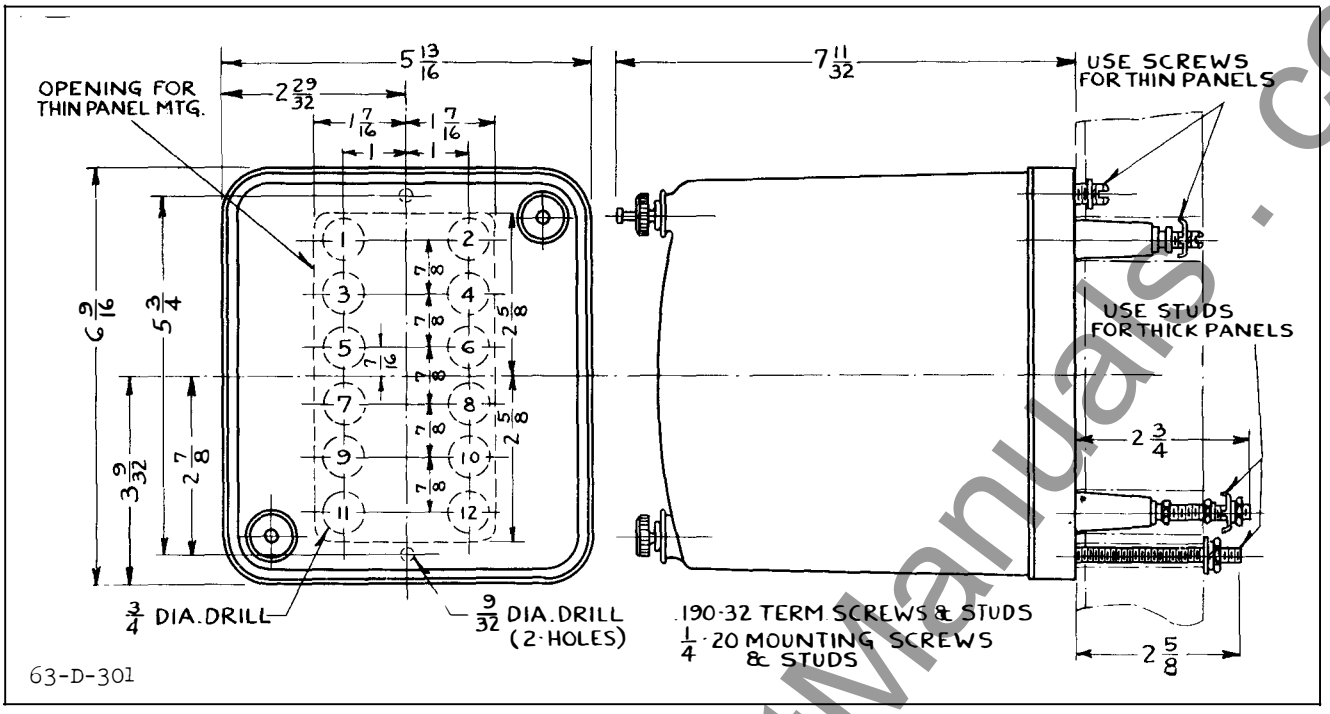


Fig. 8—Outline and Drilling Plan for the Standard Projection Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

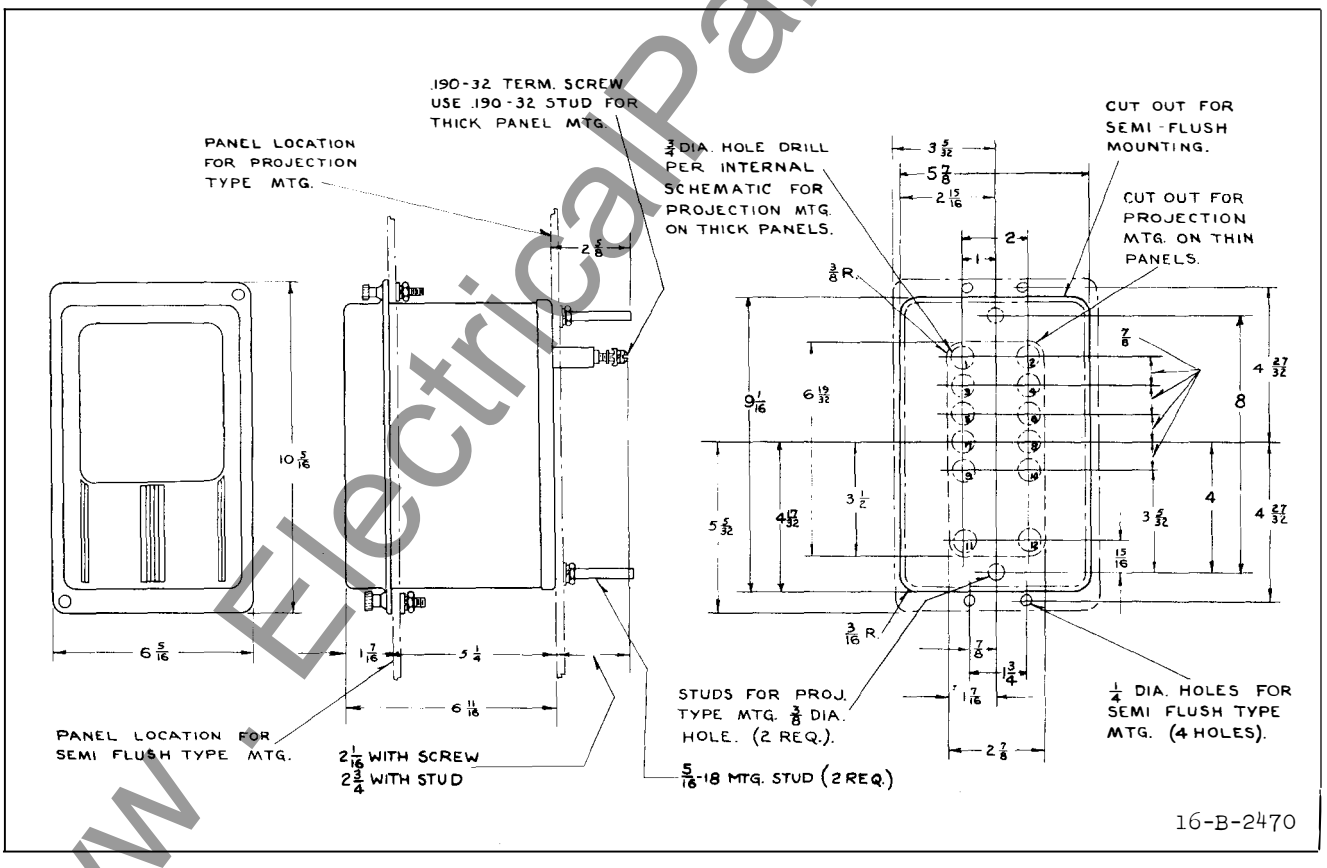


Fig. 9—Outline and Drilling Plan for the Semi-flush or Projection Type FT Flexitest Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE SX TOGGLE RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

Type SX relay is a toggle type relay intended for auxiliary service where the relay contacts should operate and not reset until reset coil is energized.

In a typical application, the type SX relays are used to provide selective reclosing where the breaker is instantaneously reclosed only after it is tripped by the carrier or instantaneous trip relays. The typical connections of this scheme is shown in Fig. 1. The instantaneous or carrier trip circuit is trip circuit No. 1, and operates the series operating coil of the type SX relay. This closes the type SX relay contact to initiate reclosing. All of the other trip circuit paths are combined in trip circuit No. 2 which by-pass the type SX relay operating coil.

The advantage of this toggle relay is its high operating speed and its positive toggle action. If the trip current is well above the operating value of the relay, the relay contacts will close positively even though its coil is immediately shorted out by the seal-in contactor switch.

Where an instantaneous back-up element such as type HZ or HZM relay first impedance element or instantaneous trip attachments are used and not included in the selective reclosing circuit thru the type SX relay, the back-up trip circuit should include a suitable resistor to prevent shorting the type SX relay before the other trip circuit operates.

One type SX relay is required in each instantaneous trip path. For the type HKB Carrier Relays and the type HZ or HZM Carrier Relays using type RS Relay, one type SX relay is required and connected in series in the carrier trip path as shown in Fig. 1.

For the type HZ Carrier Relays with out-of-step blocking using the type RSN relay two type SX relays or a two element relay (Figs. 5 and 6) are required, one in the phase carrier trip circuit and one in the ground carrier trip circuit as shown in Fig. 2. In this scheme reclosing is initiated whenever the trip coil is energized by the directional element thru the second impedance element and carrier (RRP) for phase faults, or by the directional, ground overcurrent and carrier elements (RRG) for ground faults. The operating coil of one type SX Relay is connected in the Z1 and RRP phase trip circuit, and of the other in the D_o, I_o and RRG ground trip circuit. Energizing the trip coil through any of these paths picks-up the type SX relays and the seal-in switches. The latter immediately shorts out the type SX relays but not before these contacts close the reclosing circuit. The back-up trip circuits by-pass the type SX operating coils.

An alternate method for selective reclosing is to use a third point of the seal-in contactor switch to energize a voltage type operating coil of the type SX relay. This is particularly applicable to the type HKB Carrier Relay where the extra point of the contactor switch is brought out to a base terminal.

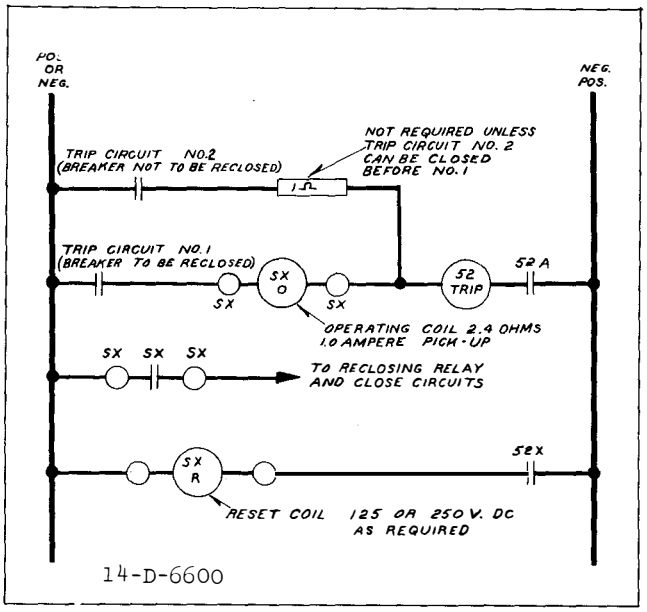


Fig. 1—Typical Schematic Connections for Selective Reclosing Using the Type SX Relay.

The type SX relays stay operated until the reset coil is energized. After the reclosure is completed, a switch on the breaker auxiliary contactor energized the reset coil for subsequent operations.

CONSTRUCTION AND OPERATION

The type SX relay consists of two electromagnets with a common armature. The armature is constructed with a toggle joint, and the spring mounted on one of the pole pieces provides pressure on the end of the armature so that it will remain against that pole piece to which it is moved, either electrically or mechanically, after the operating force is removed. The moving contact or contacts are mounted at the top of the armature, and the stationary contacts are mounted above the two pole pieces.

CHARACTERISTICS

The type SX relay usually is supplied with either a single contact or with two contacts closed in one position of the armature and one contact closed in the other position, with one of the moving contacts common to two stationary contacts. In the latter design of the relay the double-throw contact is normally used to interrupt the coil circuits after the relay has operated.

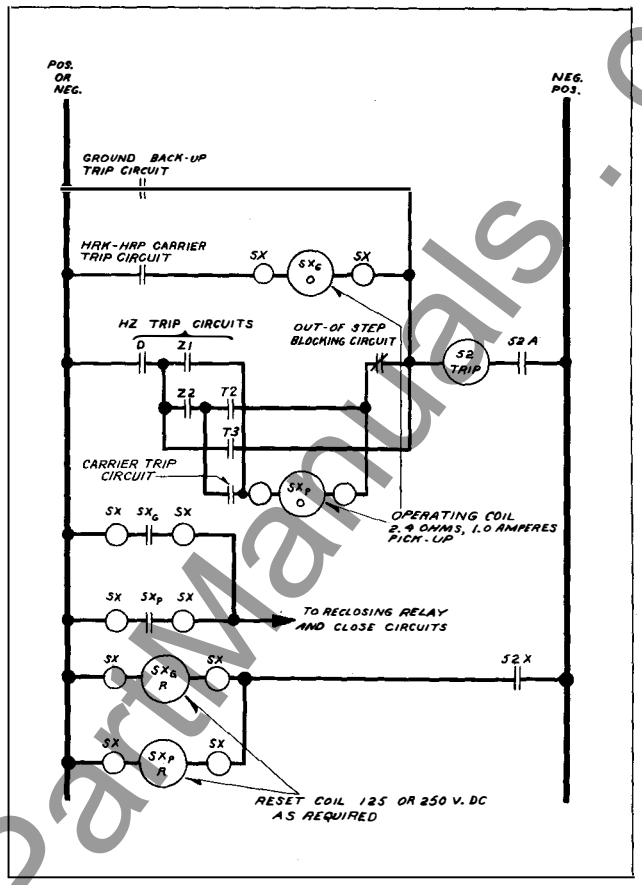


Fig. 2—Typical Schematic Connections for Selective Reclosing Using the Type SX Relays with the Type HZ-RSN Carrier Relays.

Special modifications have been supplied with two single-throw electrically independent contacts. These may be arranged so that both contacts are closed in one position of the armature, or one contact may be closed and one open in each position of the armature.

The relay is available for 115 or 230 volts, 25, 50 or 60 cycles, for 125 or 250 volts d-c service, or for 1, 5 or 10 amperes d-c. These ratings are for intermittent service only. The relay operates at 80 percent of its rated voltage. The relay is supplied with the operating and reset coils in any combination of the above ratings as desired.

Relays used for selective reclosing are frequently provided with a one-ampere operating coil having a lower power consumption and which requires special adjustment of the toggle spring. This coil is used in order to keep the resistance in series with the trip

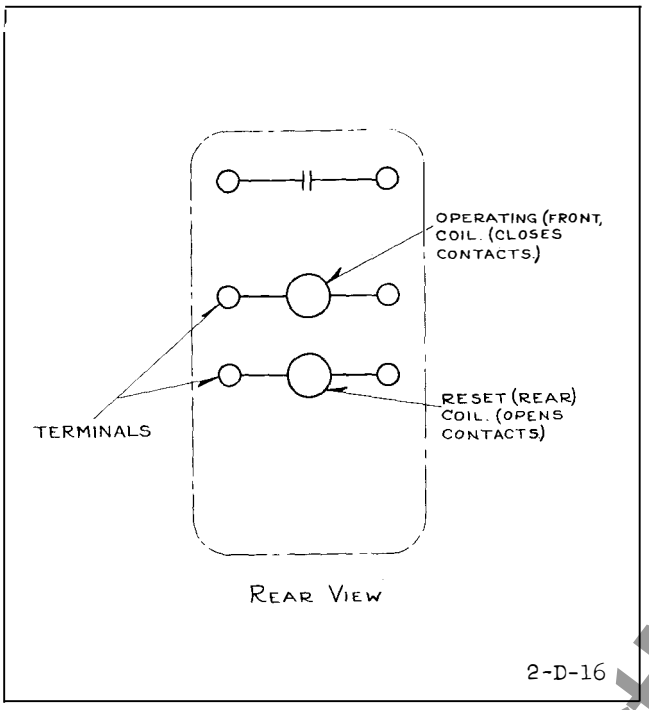


Fig. 3—Internal Schematic Connections of the Single Contact Type SX Relay in the Small Glass Case.

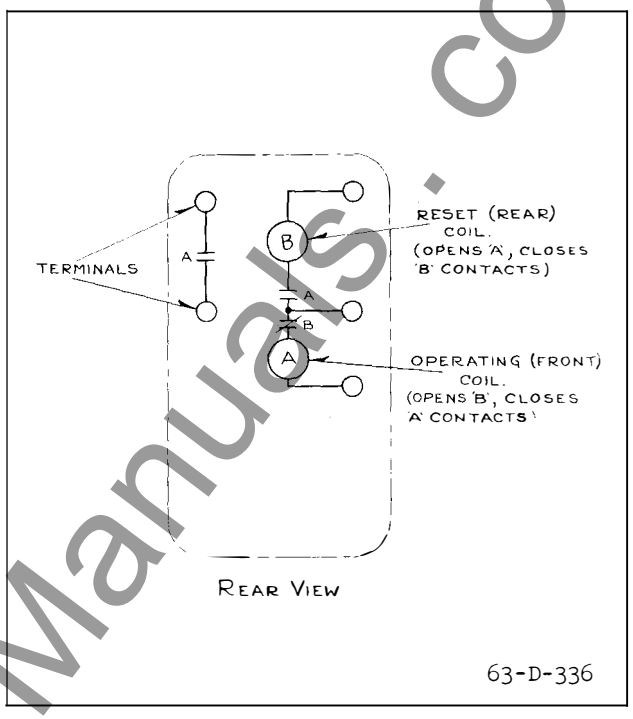


Fig. 4—Internal Schematic Connections of the Type SX Relay with Cut-off Contacts in the Small Glass Case.

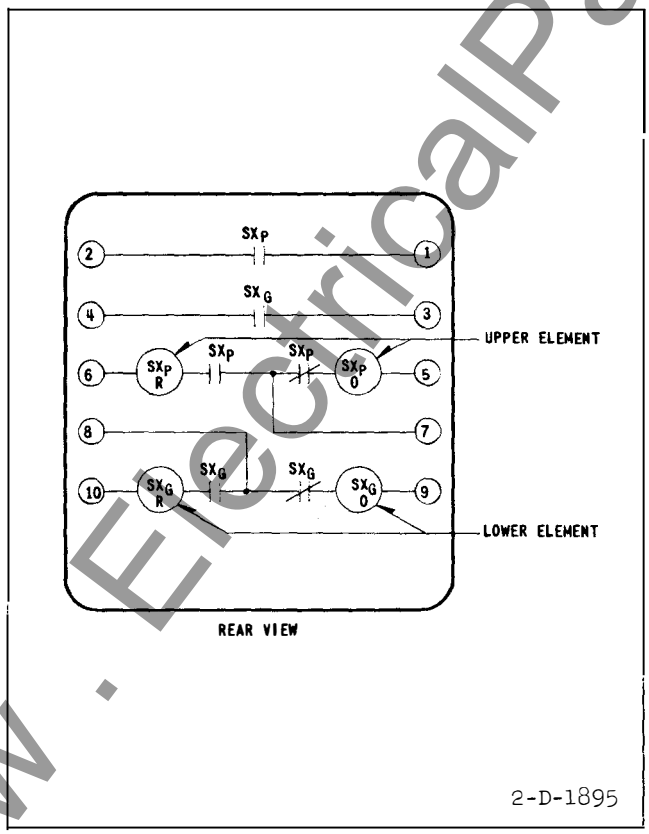
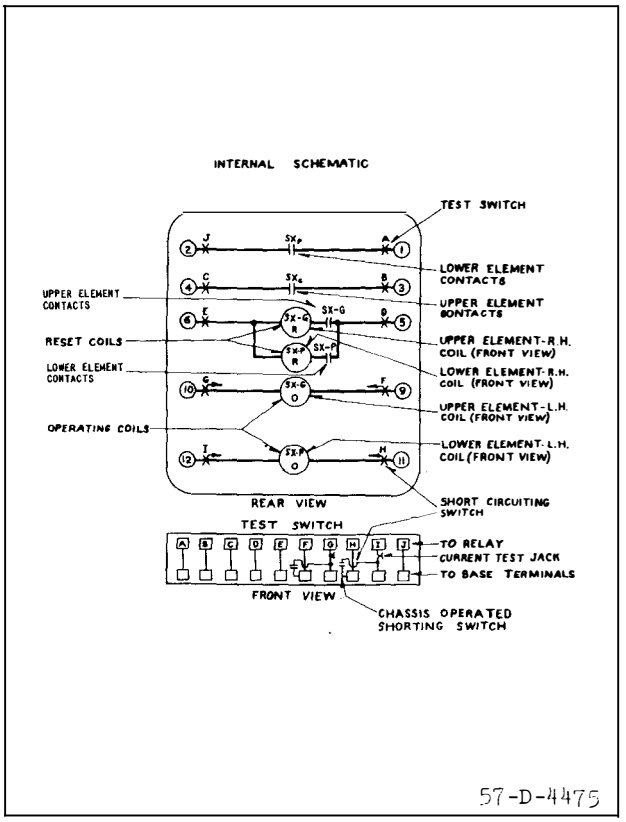


Fig. 5—Internal Connections of the Two-Element Type SX Relay with Cut-off Contacts in the Standard Case.



* Fig. 6—Internal Schematic of the Two-Element Type SX relay with Coil Interrupting Contacts in the Type FT Case.

coil to as low a value as possible. Its use should be restricted to such applications as necessitate a minimum value of coil resistance

The resistances of standard 1, 5 and 10 ampere coils are 15, 0.75 and 0.2 ohms respectively. The resistance of the special one-ampere coil is 2.4 ohms.

The relay contacts will carry 5 amperes continuously. They will interrupt non-inductive circuits carrying 20 amperes at 115 volts a-c, 10 amperes at 230 volts a-c, 2 amperes at 125 volts d-c, or 0.75 amperes at 250 volts d-c.

The operating time of the type SX relay, when energized from a d-c source through a resistance load and when using the special low resistance one-ampere coil, is approximately .027 seconds at rated current, .008 seconds at 300 percent and .005 at 2000 percent of rated current. At 2000 percent of rated current in a circuit having approximately the same ratio of inductance to resistance as a typical trip coil, the operating time is approximatley .007 seconds.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be periodically cleaned with a fine file. S #1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

If the relay has been dismantled, it is necessary to check the toggle action and the contact follow after reassembling it. The clearance hole for the mounting screw in the pole piece under the toggle spring is large enough to permit some variation in the pole piece position. The gap between the two pole pieces should be 1/4". The thickness of the armature measured over the copper rivets which serve as anti-residual spacers in the air gap is 5/32" to 11/64", so that the movement of the armature at this point is about 5/64" to 3/32".

When the armature is at dead center with respect to the toggle action, it should have equal travel to either pole piece if the relay closes contacts in both positions. If the relay has a single contact, the travel from dead center to the contact side may be slightly greater than the travel to the opposite side. The position of the armature at dead center, and also the force required to transfer the armature from one side to the other, is controlled by the shape of the toggle spring and can be adjusted by bending the spring as required. In all relays except those having a single contact, a screw is provided to assist in adjusting the pressure of the spring on the toggle member and consequently the force required to move the armature from one position to the other. The bends in the spring should be approximately correct initially, however. A set screw in the side of the pole piece locks the screw after the adjustment is made.

The standard adjustment is such that an operating force of 3 ounces or more applied close to the toggle hinge will transfer the

armature from one position to the other. The force required can be greater than 3 ounces but should be low enough to permit the relay to operate at 80 percent of its rating. On relays having the special one-ampere low energy coil, the operating force must be considerably less, and it is particularly important that the spring be shaped so that the armature has equal travel on both sides of the dead center position.

The stationary contacts should be adjusted (by bending) so that there is a small gap to the moving contacts when the armature is at dead center, and the contact follow should not be such as to prevent the armature from touching the pole piece when the operating coil is de-energized. Even with the low energy operating coil, the resulting follow will be sufficient to insure positive contact if the armature position in the gap is correct at dead center. If the armature does not rest against the pole piece with the operating coil de-energized, it is possible that the contacts may close but bounce to the permanently open position when the coil is de-energized. This will not occur on a correctly adjusted relay.

REPAIR AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The 115 volt 60 cycle SX relay takes approximately 60 v.a. at rated voltage. The 125 volt d-c relay takes approximately 20 watts.

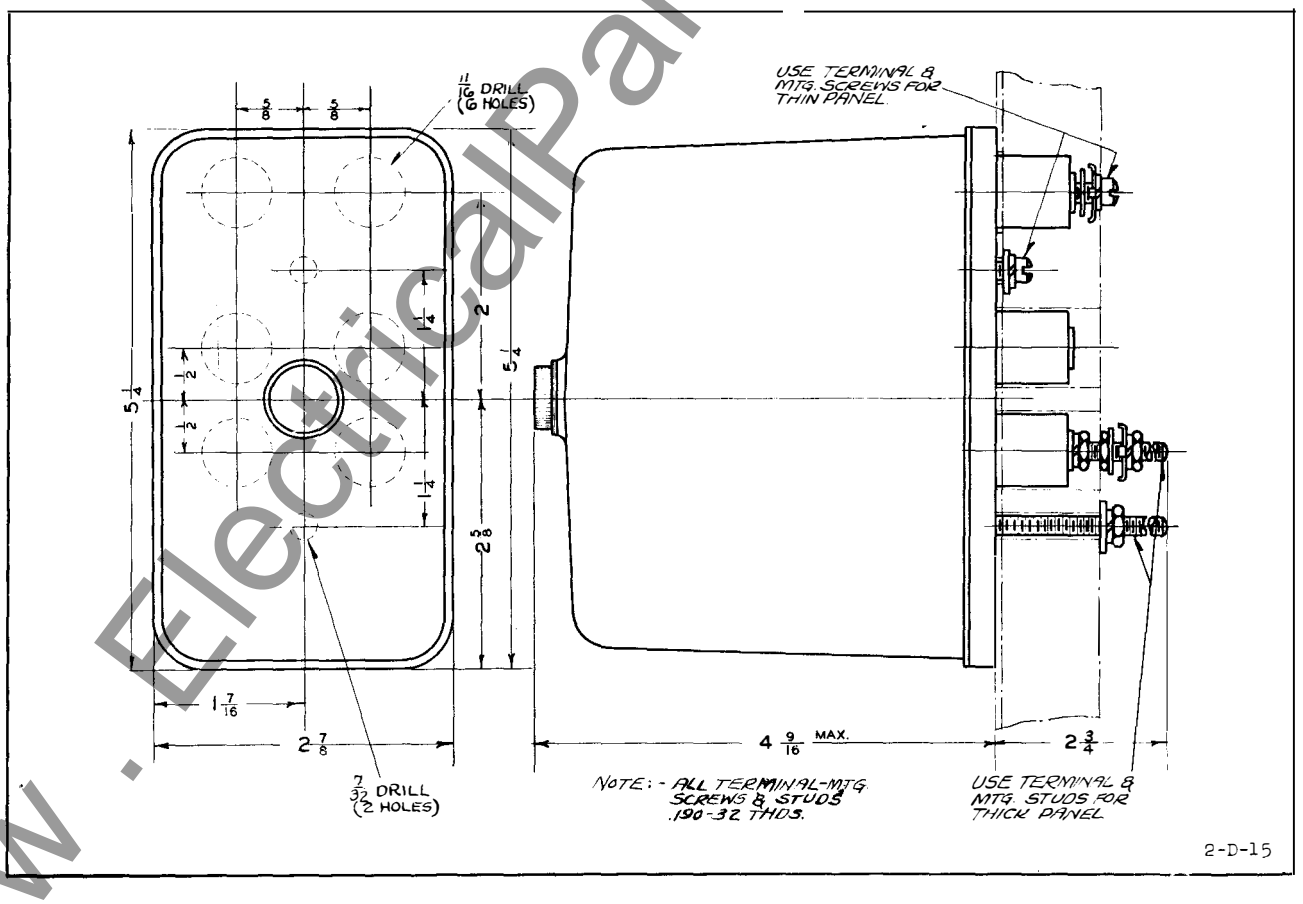


Fig. 7—Outline and Drilling Plan for the Small Projection Glass Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

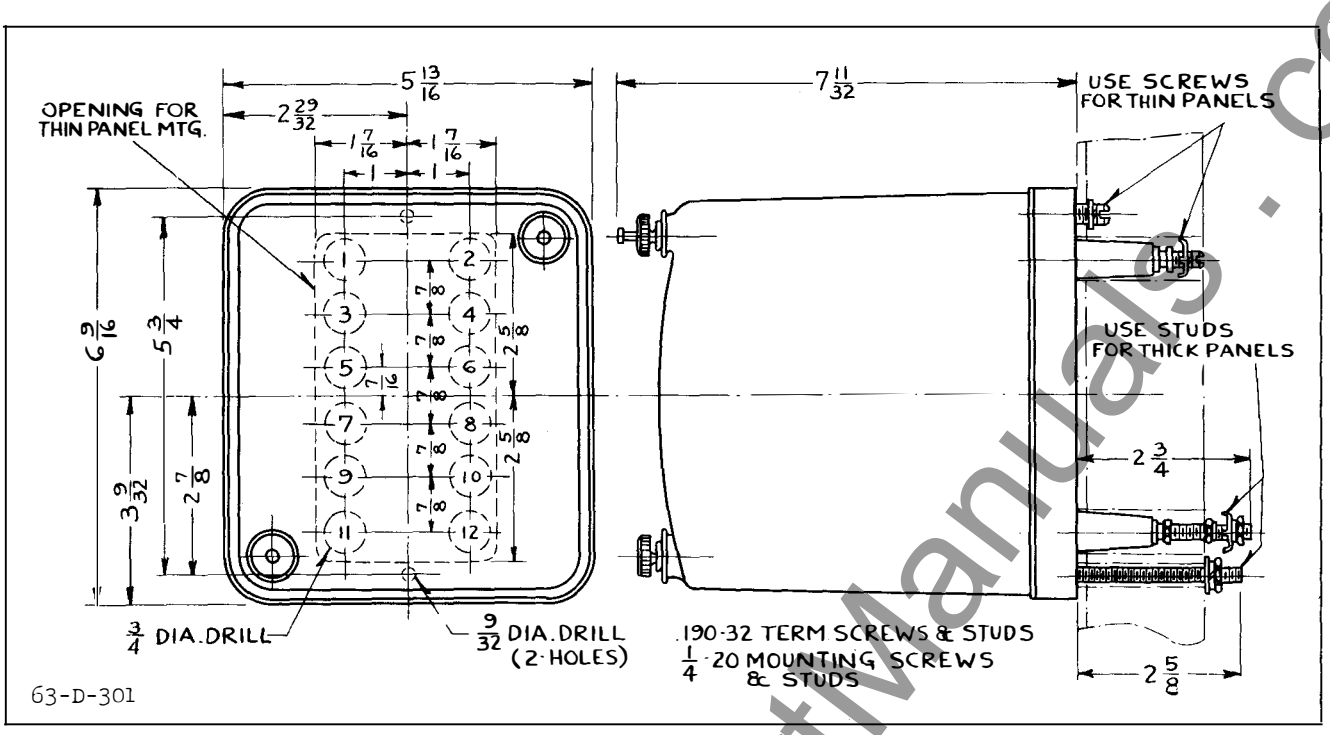


Fig. 8—Outline and Drilling Plan for the Standard Projection Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

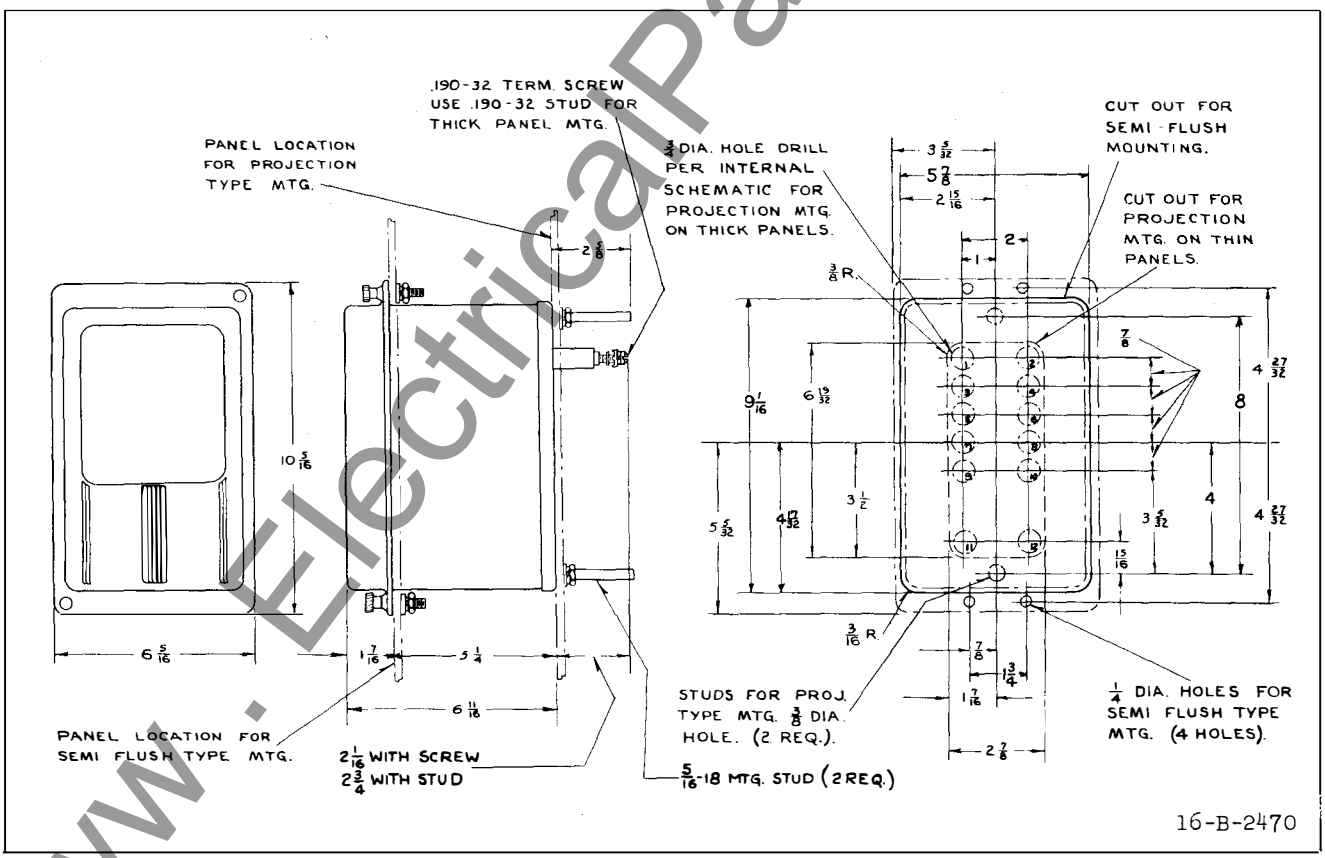


Fig. 9—Outline and Drilling Plan for the Semi-flush or Projection Type FT Flexitest Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

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METER DIVISION • **NEWARK, N.J.**

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