INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE TSI MAGNETIZING INRUSH TRIPPING SUPPRESSOR FOR INDUCTION TYPE PERCENTAGE DIFFERENTIAL RELAYS

INSTRUCTIONS FOR 60 CYCLE MODELS

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

The type TSI suppressor provides a time delay to prevent unnecessary tripping of transformer bank breakers upon the occurrence of a magnetizing inrush or recovery surge, but does not interfere with the prompt operation of the differential relay when a fault exists in the transformer bank, either during normal operation or when it is initially energized.

The suppressor described in this leaflet is intended for use with types CA, CA-4 and CA-6 relays and not with the type HCB relays. The type TSP tripping suppressor is for use with the type HCB relay and is covered in I.L. 41-972.1. The types CA and CA-4 relays are normally wired for use with or without this suppressor. When the type CA-6 relay is used with the suppressor, a transformer differential type CA-6 relay should be used. This type CA-6 relay should be equipped with a stronger spring to give a minimum trip of 0.75 to 1.25 amperes on the No. 19 Tap.

CONSTRUCTION

The type TSI relay consists of three Type SV voltage units, a synchronous timer, four auxiliary contactor switches, and a seal-in contactor switch. The construction of the units are described below.

TYPE SV VOLTAGE UNITS

These units, designated S1, S2, S3 are solenoid types with a U-shaped iron frame that supports the coil and serves as the external magnetic path for the coil. The coil surrounds a core and an adjustable flux shunt by which calibration is obtained. The plunger moves in the core and is guided by two bearings, one at the top of the assembly, and one at the bottom of a bronze guide tube for the flux shunt.

Make and break contacts are required. The moving contacts are assembled on a Micarta insulation plate attached to the upper end of the moving plunger. The electrical connections are made by means of coiled flexible wire. The stationary contacts are attached to the end of a slotted bracket. The bracket is held in place by screws to which the electrical connections are made.

SYNCHRONOUS TIMER

The timer designated T_2, is a small synchronous motor operating on voltage and driving a moving contact arm thru a gear train. The contact arm terminates in a short flat spring with contacts on the opposite outer ends. When the arm travel time elapses, the moving contacts strike two rigid stationary contacts to stall the motor. Contact travel is obtained by the deflection of the moving contact spring.

The synchronous motor has a floating rotor which is in mesh with the gear train only when energized. The rotor falls out instantly when the motor is de-energized and permits a coil spring to reset the moving arm quickly.

AUXILIARY CONTACTOR SWITCHES

The switch designated as T_1, is a small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts, only two of which are used in this relay. A small threaded stud

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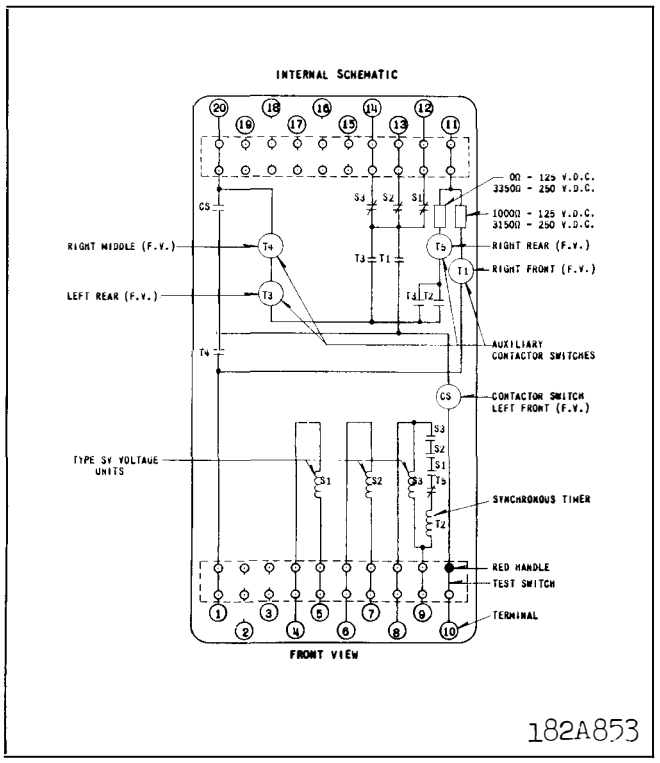

Fig. 1. Internal Schematic of the Type TSI Relay in the Type FT42 Case.

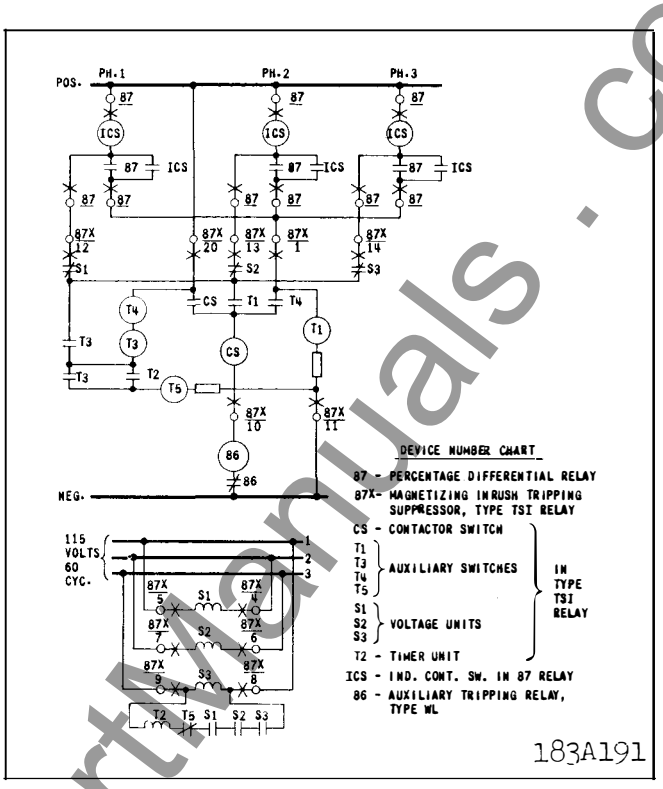

Fig. 2. External Schematic of the Type TSI Relay with Induction Type Percentage Differential Relays.

projects below the plunger which supports the silver disc and carries the adjusting nuts. A weight is used on the plunger assembly to improve the drop-out characteristics of the switch.

The switches designated as T3 and T4 are similar in construction to T1, except that the weighted plunger is not required.

The solenoid type contactor switch designated as T5 differs from the others. The plunger of this contactor switch operates a spring leaf arm which has a silver contact surface on one end and is rigidly fixed to the frame at the other end. The stationary contact is also fastened to the frame, and in the deenergized position the contacts are held closed by the leaf spring. When the coil is energized, the plunger travels upward breaking the contacts.

SEAL-IN CONTACTOR SWITCH

This switch, designated as CS, is similar in construction to the auxiliary contactor switch T1 above except that the weighted plunger is not required.

OPERATION

The operation of the tripping suppressor in conjunction with three differential relays is as follows with reference to the schematic diagram of Fig. 2. There are two trip circuit paths thru the type TSI. One is thru the contacts of the differential relays and T4. The other is thru the back contacts S1, S2, or S3 and T1. Tripping thru either of these paths will operate the indicating contactor switch in the particular differential relay involved, and will energize the auxiliary tripping relay type WL. The type WL relay contacts are used to trip the necessary number of circuit breakers.

The voltage switches S1, S2, and S3 are energized by potential transformers. These transformers should be energized at the same time the power transofrmer is energized. (An alternate method, using bus potential transformers, is described under "Installation"). When all three switches are energized at normal voltage, their front contacts close a series circuit to energize the synchronous timer T_2 connected in parallel with S_3 coil.

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When the timer contacts T2 close, they energize a d-c circuit and pick up the three auxiliary contactor switches, T3, T4, and T5. The T3 switch seals in around the timer contacts. The contacts on the T4 switch complete the main trip circuit to the differential relay contacts. The T5 switch opens the timer circuit so that the synchronous timer T2 is deenergized immediately after it makes contact.

Assume that a circuit breaker is closed to energize a power transformer bank and that the transformer is normal, but that the magnetizing inrush closes one or more of the differential relay contacts. Auxiliary switch T1 of the suppressor will be picked up, but no tripping will result because the magnetizing inrush will not reduce the voltage below the pick-up point of the type SV units S1, S2 and S3. If on the other hand, there is a short circuit in the bank, the voltage will be reduced on the affected phase so that one or more of the back contacts S1, S2 and S3 will not open and prompt tripping will result through the voltage switch back contacts and T1. If there is no fault in the power transformer, the timer contacts T_2, will close at the end of a suitable time up to 5 seconds, picking up T3, T4, and T5, and will then reset. By this time, however, the differential relay contacts will have reset because of the decay of the magnetizing inrush. If now, during normal operation, a short circuit in the bank should occur, tripping will result by one or the other of the described paths. If the voltage is not reduced below the drop out point of the type SV unit by the short-circuit, tripping results through the differential relay contacts and the T4 contacts as described for the first tripping path. On the other hand, if the short circuit is severe, the auxiliary contactor switches T3 and T4 will be short-circuited by one or more of the back contacts S1, S2, and S3. In the event that the T4 contacts open before the differential relay contacts close, tripping will still result thru the SV back contacts and the T1 contact. An indicating contactor switch shows in the differential relay for a tripping operation whether the trip circuit is set up through the first or second path.

In the event of a severe external fault, which reduces the system voltage to such an extent that the power bank will suffer another magnetizing inrush, or recovery surge, when the fault is cleared, then the suppressor will act in the same way as for an initial inrush. This is because the low voltage during the short-circuit will cause one or more of the SV units to drop out, thus dropping out T3, T4, and T5, which in turn resets the timer circuit so that the synchronous timer will have to time out again when the external short-circuit is cleared and the voltage goes back to normal.

CHARACTERISTICS

The type TSI tripping suppressor is rated 120 volts, 60 cycles and separate models are available for 125 or 250 volt d-c trip circuits. The type SV voltage units pick-up at approximately 100 volts and drop out at approximately 90 volts or more. The pick-up setting is adjustable, however, and the drop out is from 90-98 percent of the pick-up. The synchronous timer scale is marked in 30 cycle divisions and is adjustable up to 5 seconds. The seal-in contactor switch will safely carry 30 amperes d-c long enough to trip a breaker.

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 four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

The potential transformers used to energize the type TSI tripping suppressor should be located within the differential zone so that they are energized at the same time that the power transformer is energized. An alternate method is to use bus potential transformers, in which case auxiliary switches on the breakers must be used so that the voltage units of the tripping suppressor are deenergized when the power transformer is deenergized. In this case, it is preferable that the breaker auxiliary switch contacts close after the main contacts close.

The multi-contact auxiliary tripping relays should have suitable contacts to open the trip circuit after the breaker trip circuits are energized and sealed in.

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SETTINGS

The settings to be made are the pick-up values on the voltage units, and the time setting on the synchronous timer. The drop-out voltage of the SV voltage units should always be higher than the drop out of the synchronous timer.

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 cleaned periodically. A contact burnisher S#182A836H01 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.

TYPE SV VOLTAGE UNITS

Adjust the make contact for 9/64 inch contact separation with the break contact out of the way. In other words, when the plunger rises from the de-energized position it should travel 9/64 inch before the make contacts touch.

Adjust the magnetic shunt on each unit so that the elements pick-up at 100 volts, 60 cycles. When moving the shunt be sure that the locking lever is pushed out to free the shunt. Energize all three units at once, and make sure that all three make contacts maintain a steady circuit to the motor with 100 to 130 volts on the type SV units. This is indicated by uniform operation of the motor without flutter.

The drop out of the units should be 90 volts or more when the pick-up setting is 100 volts, 60 cycles.

A setting of 100 volts has been described as Typical. Other values may be used as required by the application.

SYNCHRONOUS TIMER

The moving contacts should have approximately 1/16 inch follow after the motor stalls. Make sure that the spiral spring returns the contact arm to the full open position quickly when the motor is de-energized. The motor should pick-up and run in synchronism at 100 volts, 60 cycles, and drop out at below 90 volts.

AUXILIARY CONTACTOR SWITCH T1

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked up. This can be most conveniently done by turning the relay up-side-down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point where the moving core just separates from the stationary core screw. Back off the stationary core screw 1/2 turn beyond this point and lock in place with the locknut provided. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 3/32 inch by means of the two small nuts on either side of Micarta disc. The switch in the 125 volt relays should pick-up on not less than 75 volts d-c. Test for sticking when 125 volts d-c is removed. The coil resistance is approximately 1160 ohms. For the 250 volt relays, double the voltage values above.

AUXILIARY CONTACTOR SWITCHES T3 AND T4

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core as described above for the T1 switch. Adjust the contact clearance for 1/16 inch.

AUXILIARY CONTACTOR SWITCH T5

Adjust the core screw so that the plunger strikes it just as the moving contact strikes the upper contact and then back the screw off one turn and lock. Adjust the lock nuts below the plunger so that the plunger drops below the contact spring 1/8 inch when the lower contact is made. The T3, T4 and T5 auxiliary switches are all connected in series thru the timer contacts, T2. Each coil resistance is approximately 1160 ohms. The switches in the 125 volt relays should pick up on not less than 75 volts d-c across all three switches. They should not stick when 125 volts d-c is removed. For the 250 volt relays, double the voltage values shown.

SEAL-IN CONTACTOR SWITCH

Adjust this switch the same as described above

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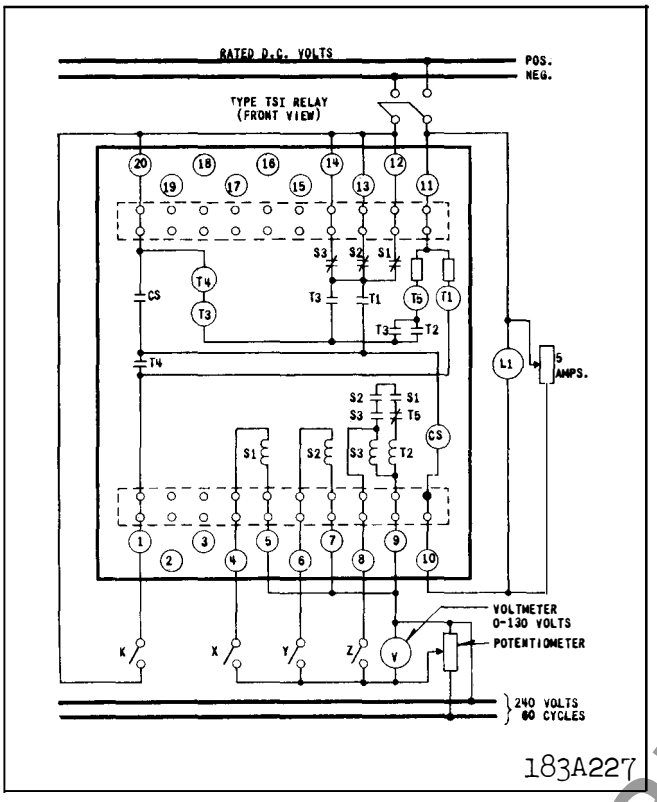

Fig. 3. Diagram of Test Connections for the Type TSI Relay in the Type FT42 Case.

for the auxiliary contactor switch T1. The switch should pick-up at 2 amperes d-c. Test for sticking after 30 amperes d-c have been passed thru the coil. The coil resistance is approximately 0.23 ohm.

OVERALL TEST

Connect the relay per Fig. 3 with switches x, y, z closed. All three SV units should pick up and the timer motor should run at all voltages from 100 to 130 volts, with the SV units set for 100 volts pick-up. The timer should reset after its contacts close.

Block the T1 switch open.

Close switches x, y, z, with voltage adjusted for 115 volts. After the SV units pick-up, close switch K. The trip circuit should be completed the instant the timer, T_2, closes contact. The trip circuit should seal in, and lamp L_1 should light. The timer should reset. Remove blocking from the T1 switch.

Apply 115 volts 60 cycles through switches x, y, z, then close switch K, then open switch x before the timer closes. The trip circuit should be established thru T_1 and SV back contacts. Repeat, except open switch y. Repeat again, except open switch z. In each case the timer should reset.

ENERGY REQUIREMENTS

The burdens of the type TSI Tripping Suppressor are as follows:

Element	Watts at 125 V. d-c.	Voltamperes at 120 Volts, 60 cycles	P. F. Angle Degrees Lag
Auxiliary Switch T1	Δ7.25	----------	----------
Auxiliary Switches T3, T4 and T5	4.5	----------	----------
Synchronous Timer T2	---------	2.72	56.6
Type Sv, S1, S2, S3 (each)	---------	7.95	62.2

Δ For Intermittent duty. At 250 volts d-c, the burden is 14.5 watts intermittent duty.

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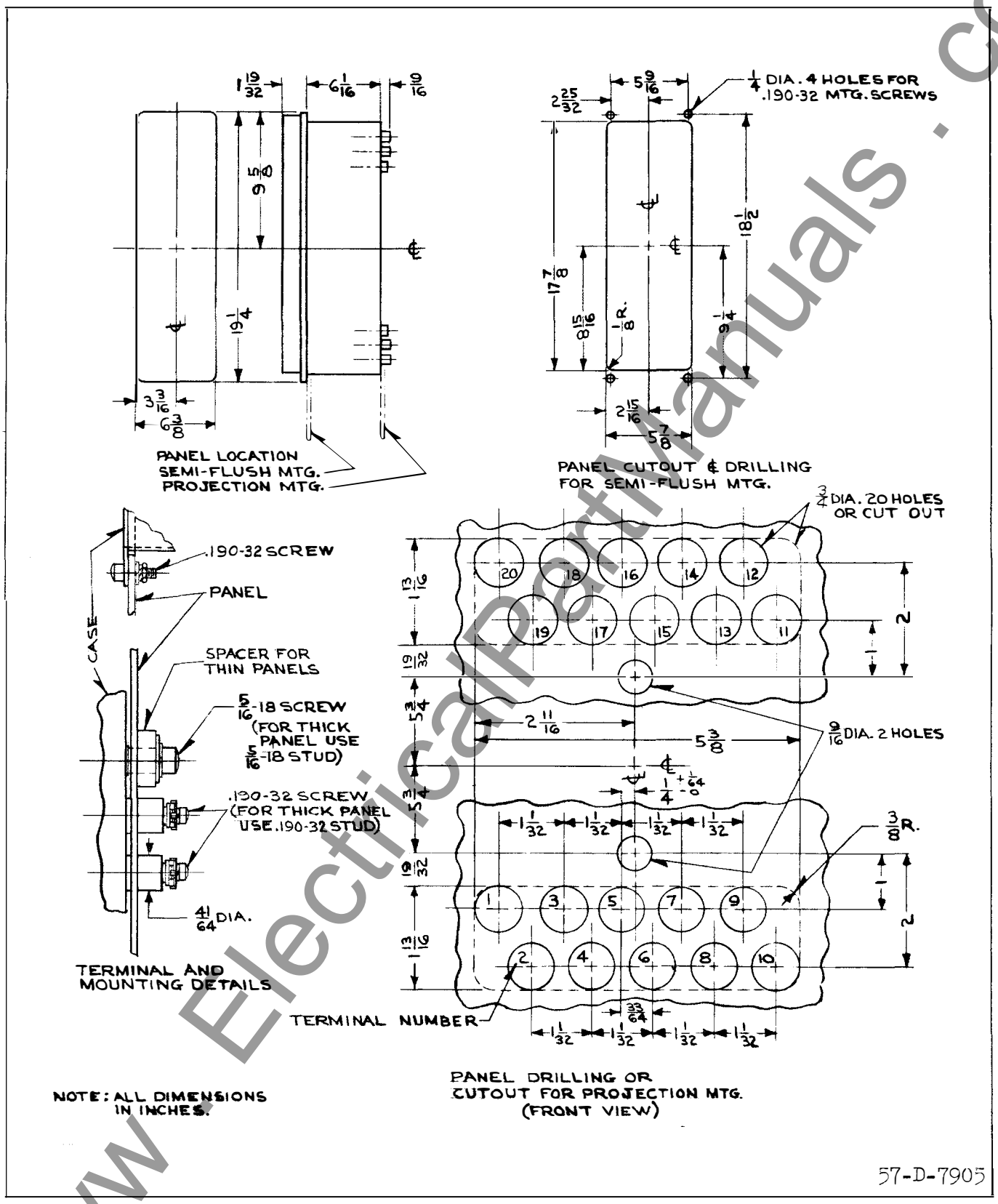

Fig. 4. Outline and Drilling Plan for the Type TSI Relay in the Type FT42 Case.

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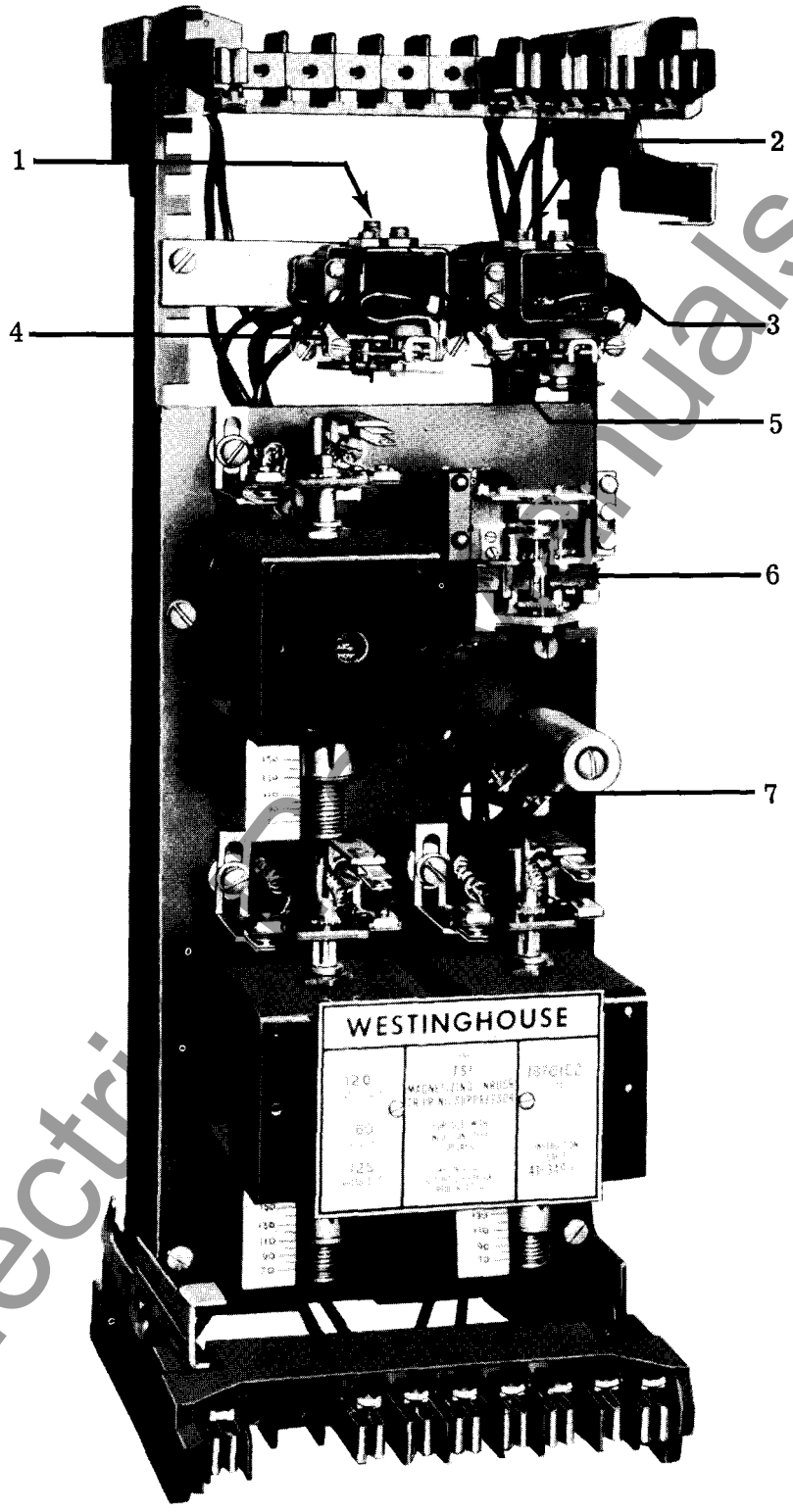

* *Fig. 5. Type TSI Supressor 1 – T5 Auxiliary Switch. 2 – T4 Auxiliary Switch. 3 – T1 Auxiliary Switch. 4 – T3 Auxiliary Switch. 5 – Seal-in Contactor Switch CS. 6 – T2 Synchronous Timer. 7 – SV Voltage Units.*

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RELAY DEPARTMENT **NEWARK, N. J.**

Printed in U. S. A.

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INSTRUCTIONS FOR 60 CYCLE MODELS

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

The type TSI suppressor provides a time delay to prevent unnecessary tripping of transformer bank breakers upon the occurrence of a magnetizing inrush or recovery surge, but does not interfere with the prompt operation of the differential relay when a fault exists in the transformer bank, either during normal operation or when it is initially energized.

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CONSTRUCTION

The type TSI relay consists of three Type SV voltage units, a synchronous timer, four auxiliary contactor switches, and a seal-in contactor switch. The construction of the units are described below.

TYPE SV VOLTAGE UNITS

These units, designated S1, S2, S3 are solenoid types with a U-shaped iron frame that supports the coil and serves as the external magnetic path for the coil. The coil surrounds a core and an adjustable flux shunt by which calibration is obtained. The plunger moves in the core and is guided by two bearings, one at the top of the assembly, and one at the bottom of a bronze guide tube for the flux shunt.

Make and break contacts are required. The moving contacts are assembled on a Micarta insulation plate attached to the upper end of the moving plunger. The electrical connections are made by means of coiled flexible wire. The stationary contacts are attached to the end of a slotted bracket. The bracket is held in place by screws to which the electrical connections are made.

SYNCHRONOUS TIMER

The timer designated T_2, is a small synchronous motor operating on voltage and driving a moving contact arm thru a gear train. The contact arm terminates in a short flat spring with contacts on the opposite outer ends. When the arm travel time elapses, the moving contacts strike two rigid stationary contacts to stall the motor. Contact travel is obtained by the deflection of the moving contact spring.

The synchronous motor has a floating rotor which is in mesh with the gear train only when energized. The rotor falls out instantly when the motor is de-energized and permits a coil spring to reset the moving arm quickly.

AUXILIARY CONTACTOR SWITCHES

The switch designated as T_1, is a small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts, only two of which are used in this relay. A small threaded stud

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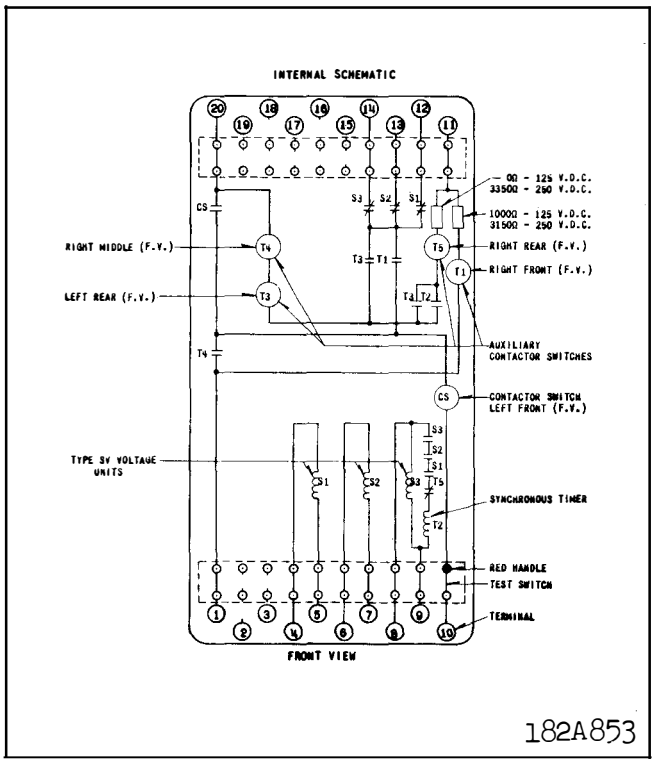

Fig. 1. Internal Schematic of the Type TSI Relay in the Type FT42 Case.

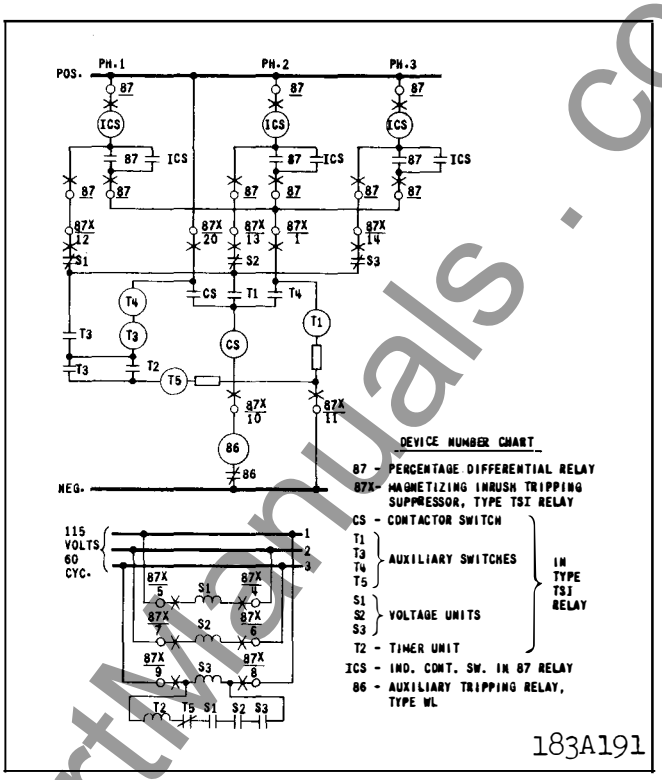

Fig. 2. External Schematic of the Type TSI Relay with Induction Type Percentage Differential Relays.

projects below the plunger which supports the silver disc and carries the adjusting nuts. A weight is used on the plunger assembly to improve the drop-out characteristics of the switch.

The switches designated as T3 and T4 are similar in construction to T1, except that the weighted plunger is not required.

The solenoid type contactor switch designated as T5 differs from the others. The plunger of this contactor switch operates a spring leaf arm which has a silver contact surface on one end and is rigidly fixed to the frame at the other end. The stationary contact is also fastened to the frame, and in the deenergized position the contacts are held closed by the leaf spring. When the coil is energized, the plunger travels upward breaking the contacts.

SEAL-IN CONTACTOR SWITCH

This switch, designated as CS, is similar in construction to the auxiliary contactor switch T1 above except that the weighted plunger is not required.

OPERATION

The operation of the tripping suppressor in conjunction with three differential relays is as follows with reference to the schematic diagram of Fig. 2. There are two trip circuit paths thru the type TSI. One is thru the contacts of the differential relays and T4. The other is thru the back contacts S1, S2, or S3 and T1. Tripping thru either of these paths will operate the indicating contactor switch in the particular differential relay involved, and will energize the auxiliary tripping relay type WL. The type WL relay contacts are used to trip the necessary number of circuit breakers.

The voltage switches S1, S2, and S3 are energized by potential transformers. These transformers should be energized at the same time the power transofrmer is energized. (An alternate method, using bus potential transformers, is described under "Installation"). When all three switches are energized at normal voltage, their front contacts close a series circuit to energize the synchronous timer T_2 connected in parallel with S_3 coil.

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When the timer contacts T2 close, they energize a d-c circuit and pick up the three auxiliary contactor switches, T3, T4, and T5. The T3 switch seals in around the timer contacts. The contacts on the T4 switch complete the main trip circuit to the differential relay contacts. The T5 switch opens the timer circuit so that the synchronous timer T2 is deenergized immediately after it makes contact.

Assume that a circuit breaker is closed to energize a power transformer bank and that the transformer is normal, but that the magnetizing inrush closes one or more of the differential relay contacts. Auxiliary switch T1 of the suppressor will be picked up, but no tripping will result because the magnetizing inrush will not reduce the voltage below the pick-up point of the type SV units S1, S2 and S3. If on the other hand, there is a short circuit in the bank, the voltage will be reduced on the affected phase so that one or more of the back contacts S1, S2 and S3 will not open and prompt tripping will result through the voltage switch back contacts and T1. If there is no fault in the power transformer, the timer contacts T_2, will close at the end of a suitable time up to 5 seconds, picking up T3, T4, and T5, and will then reset. By this time, however, the differential relay contacts will have reset because of the decay of the magnetizing inrush. If now, during normal operation, a short circuit in the bank should occur, tripping will result by one or the other of the described paths. If the voltage is not reduced below the drop out point of the type SV unit by the short-circuit, tripping results through the differential relay contacts and the T4 contacts as described for the first tripping path. On the other hand, if the short circuit is severe, the auxiliary contactor switches T3 and T4 will be short-circuited by one or more of the back contacts S1, S2, and S3. In the event that the T4 contacts open before the differential relay contacts close, tripping will still result thru the SV back contacts and the T1 contact. An indicating contactor switch shows in the differential relay for a tripping operation whether the trip circuit is set up through the first or second path.

In the event of a severe external fault, which reduces the system voltage to such an extent that the power bank will suffer another magnetizing inrush, or recovery surge, when the fault is cleared, then the suppressor will act in the same way as for an initial inrush. This is because the low voltage during the short-circuit will cause one or more of the SV units to drop out, thus dropping out T3, T4, and T5, which in turn resets the timer circuit so that the synchronous timer will have to time out again when the external short-circuit is cleared and the voltage goes back to normal.

CHARACTERISTICS

The type TSI tripping suppressor is rated 120 volts, 60 cycles and separate models are available for 125 or 250 volt d-c trip circuits. The type SV voltage units pick-up at approximately 100 volts and drop out at approximately 90 volts or more. The pick-up setting is adjustable, however, and the drop out is from 90-98 percent of the pick-up. The synchronous timer scale is marked in 30 cycle divisions and is adjustable up to 5 seconds. The seal-in contactor switch will safely carry 30 amperes d-c long enough to trip a breaker.

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 four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

The potential transformers used to energize the type TSI tripping suppressor should be located within the differential zone so that they are energized at the same time that the power transformer is energized. An alternate method is to use bus potential transformers, in which case auxiliary switches on the breakers must be used so that the voltage units of the tripping suppressor are deenergized when the power transformer is deenergized. In this case, it is preferable that the breaker auxiliary switch contacts close after the main contacts close.

The multi-contact auxiliary tripping relays should have suitable contacts to open the trip circuit after the breaker trip circuits are energized and sealed in.

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SETTINGS

The settings to be made are the pick-up values on the voltage units, and the time setting on the synchronous timer. The drop-out voltage of the SV voltage units should always be higher than the drop out of the synchronous timer.

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 cleaned periodically. A contact burnisher S#182A836H01 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.

TYPE SV VOLTAGE UNITS

Adjust the make contact for 9/64 inch contact separation with the break contact out of the way. In other words, when the plunger rises from the de-energized position it should travel 9/64 inch before the make contacts touch.

Adjust the magnetic shunt on each unit so that the elements pick-up at 100 volts, 60 cycles. When moving the shunt be sure that the locking lever is pushed out to free the shunt. Energize all three units at once, and make sure that all three make contacts maintain a steady circuit to the motor with 100 to 130 volts on the type SV units. This is indicated by uniform operation of the motor without flutter.

The drop out of the units should be 90 volts or more when the pick-up setting is 100 volts, 60 cycles.

A setting of 100 volts has been described as Typical. Other values may be used as required by the application.

SYNCHRONOUS TIMER

The moving contacts should have approximately 1/16 inch follow after the motor stalls. Make sure that the spiral spring returns the contact arm to the full open position quickly when the motor is de-energized. The motor should pick-up and run in synchronism at 100 volts, 60 cycles, and drop out at below 90 volts.

AUXILIARY CONTACTOR SWITCH T1

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked up. This can be most conveniently done by turning the relay up-side-down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point where the moving core just separates from the stationary core screw. Back off the stationary core screw 1/2 turn beyond this point and lock in place with the locknut provided. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 3/32 inch by means of the two small nuts on either side of Micarta disc. The switch in the 125 volt relays should pick-up on not less than 75 volts d-c. Test for sticking when 125 volts d-c is removed. The coil resistance is approximately 1160 ohms. For the 250 volt relays, double the voltage values above.

AUXILIARY CONTACTOR SWITCHES T3 AND T4

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core as described above for the T1 switch. Adjust the contact clearance for 1/16 inch.

AUXILIARY CONTACTOR SWITCH T5

Adjust the core screw so that the plunger strikes it just as the moving contact strikes the upper contact and then back the screw off one turn and lock. Adjust the lock nuts below the plunger so that the plunger drops below the contact spring 1/8 inch when the lower contact is made. The T3, T4 and T5 auxiliary switches are all connected in series thru the timer contacts, T2. Each coil resistance is approximately 1160 ohms. The switches in the 125 volt relays should pick up on not less than 75 volts d-c across all three switches. They should not stick when 125 volts d-c is removed. For the 250 volt relays, double the voltage values shown.

SEAL-IN CONTACTOR SWITCH

Adjust this switch the same as described above

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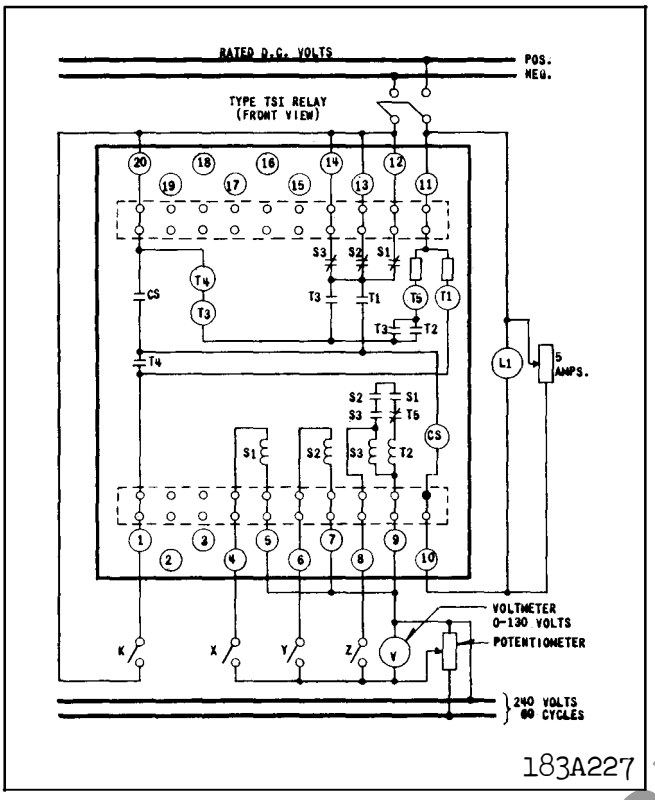

Fig. 3. Diagram of Test Connections for the Type TSI Relay in the Type FT42 Case.

for the auxiliary contactor switch T1. The switch should pick-up at 2 amperes d-c. Test for sticking after 30 amperes d-c have been passed thru the coil. The coil resistance is approximately 0.23 ohm.

OVERALL TEST

Connect the relay per Fig. 3 with switches x, y, z closed. All three SV units should pick up and the timer motor should run at all voltages from 100 to 130 volts, with the SV units set for 100 volts pick-up. The timer should reset after its contacts close.

Block the T1 switch open.

Close switches x, y, z, with voltage adjusted for 115 volts. After the SV units pick-up, close switch K. The trip circuit should be completed the instant the timer, T_2, closes contact. The trip circuit should seal in, and lamp L_1 should light. The timer should reset. Remove blocking from the T1 switch.

Apply 115 volts 60 cycles through switches x, y, z, then close switch K, then open switch x before the timer closes. The trip circuit should be established thru T_1 and SV back contacts. Repeat, except open switch y. Repeat again, except open switch z. In each case the timer should reset.

ENERGY REQUIREMENTS

The burdens of the type TSI Tripping Suppressor are as follows:

Element	Watts at 125 V. d-c.	Voltamperes at 120 Volts, 60 cycles	P. F. Angle Degrees Lag
Auxiliary Switch T1	Δ7.25	----------	----------
Auxiliary Switches T3, T4 and T5	4.5	----------	----------
Synchronous Timer T2	---------	2.72	56.6
Type Sv, S1, S2, S3 (each)	---------	7.95	62.2

Δ For Intermittent duty. At 250 volts d-c, the burden is 14.5 watts intermittent duty.

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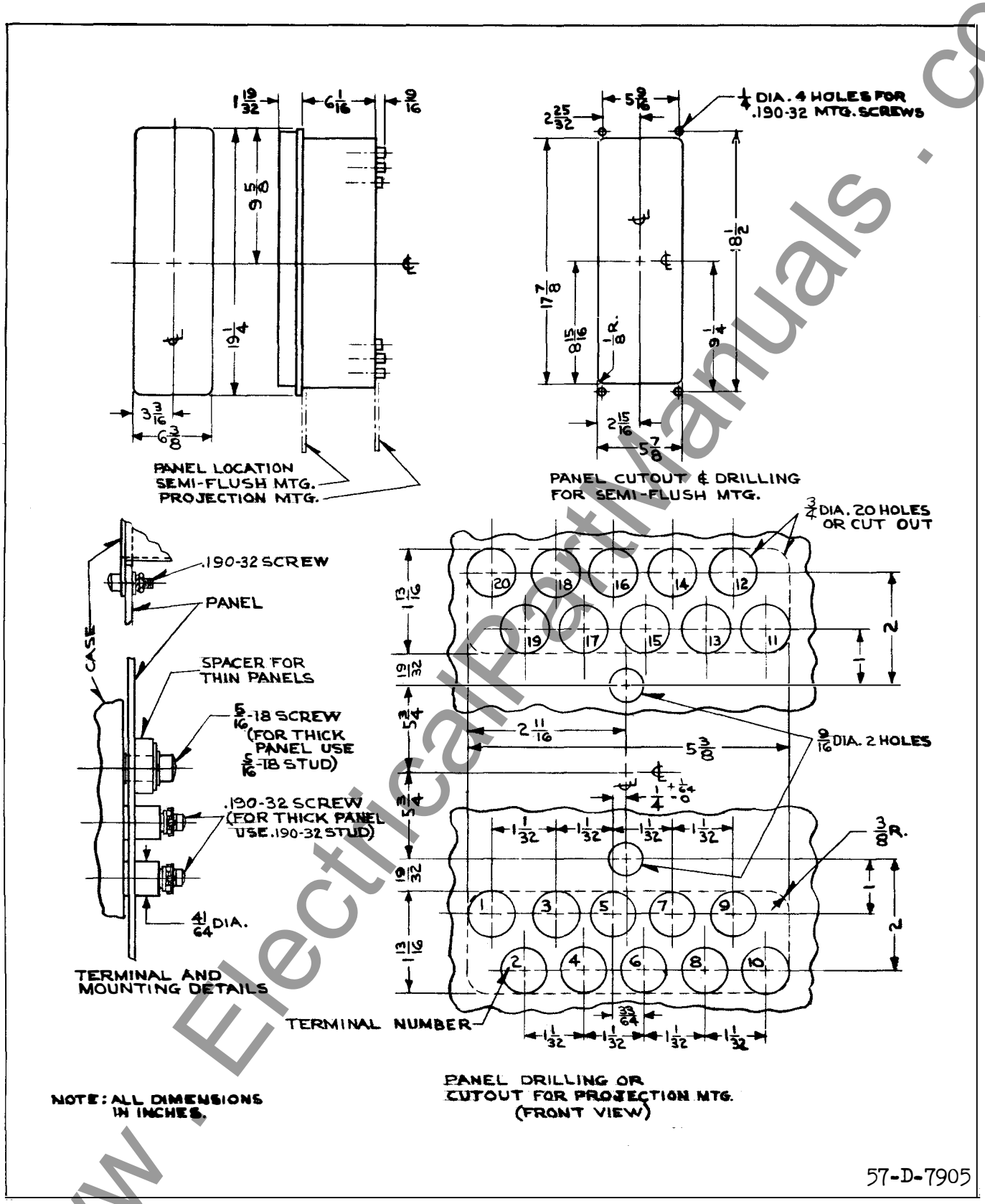

Fig. 4. Outline and Drilling Plan for the Type TSI Relay in the Type FT42 Case.

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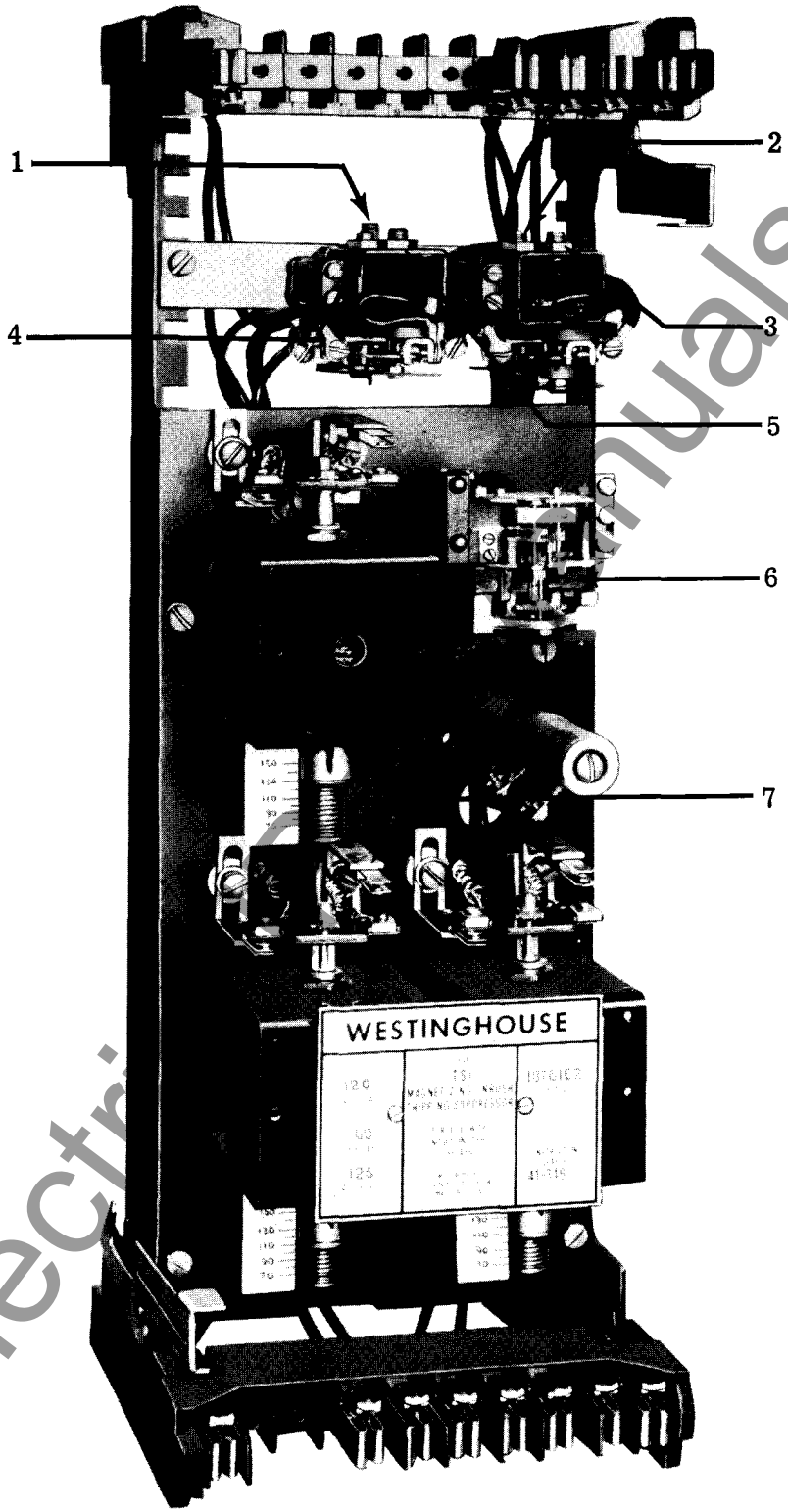

** Fig. 5. Type TSI Supressor 1 – T5 Auxiliary Switch. 2 – T4 Auxiliary Switch. 3 – T1 Auxiliary Switch. 4 – T3 Auxiliary Switch. 5 – Seal-in Contactor Switch CS. 6 – T2 Synchronous Timer. 7 – SV Voltage Units.*

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Printed in U. S. A.