DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

SUDDEN PRESSURE RELAY

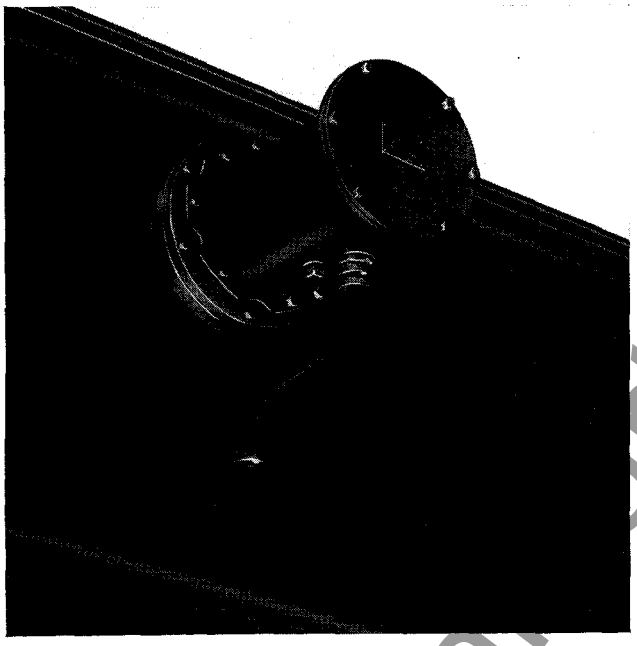

FIG. 1. Sudden Pressure Relay Installed.

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1 shows the relay mounted on the side of the transformer tank close to the cover, and wired into the conduit-type tank bracing rib. It is designed for alarm-trip circuit opening and/or circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure actuated switch housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and to thus operate the pressure actuated switch.

It is well known that the break-down of transformer oil due to electric arcs results in the evolution of a gas. The amount of gas formed and the rate of pressure increase resulting from such an arc are functions of the arc current and time.

As the gas is evolved in a gas-cushioned transformer the oil, being non-compressible, is displaced upward, compressing the gas in that gas cushion. This sudden displacement of oil causes an equally sudden increase in gas pressure. Even for such low current intermittent arcs as may be experienced in faulty terminal boards or tap changers in which the amount of gas evolved is small and the total resultant increase in pressure is only perhaps in the magnitude of 3/4 to 1 1/2 pounds per square inch, the rate of gas pressure increase may be greater than that due to the thermal expansion experienced in normal transformer operation. It is this principle on which the Westinghouse Sudden Pressure Relay is designed to operate.

The relay consists of a pressure-tight case (see Fig. 2) in which is mounted a pressure sensitive

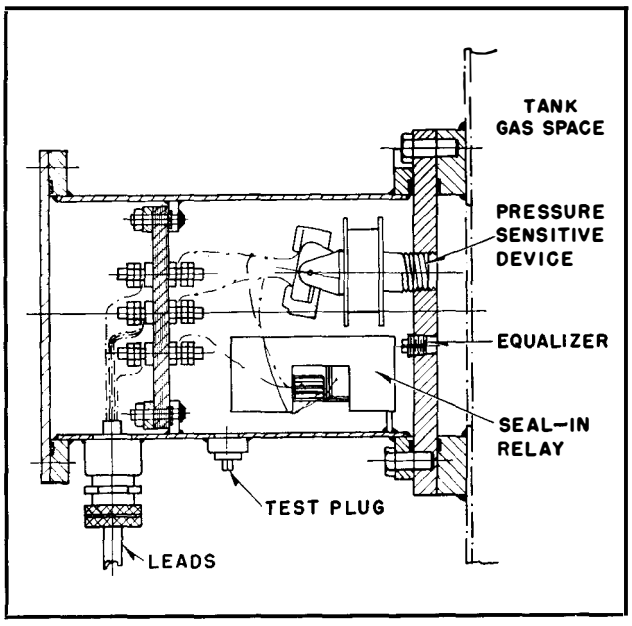

FIG. 2. Internal View of Relay.

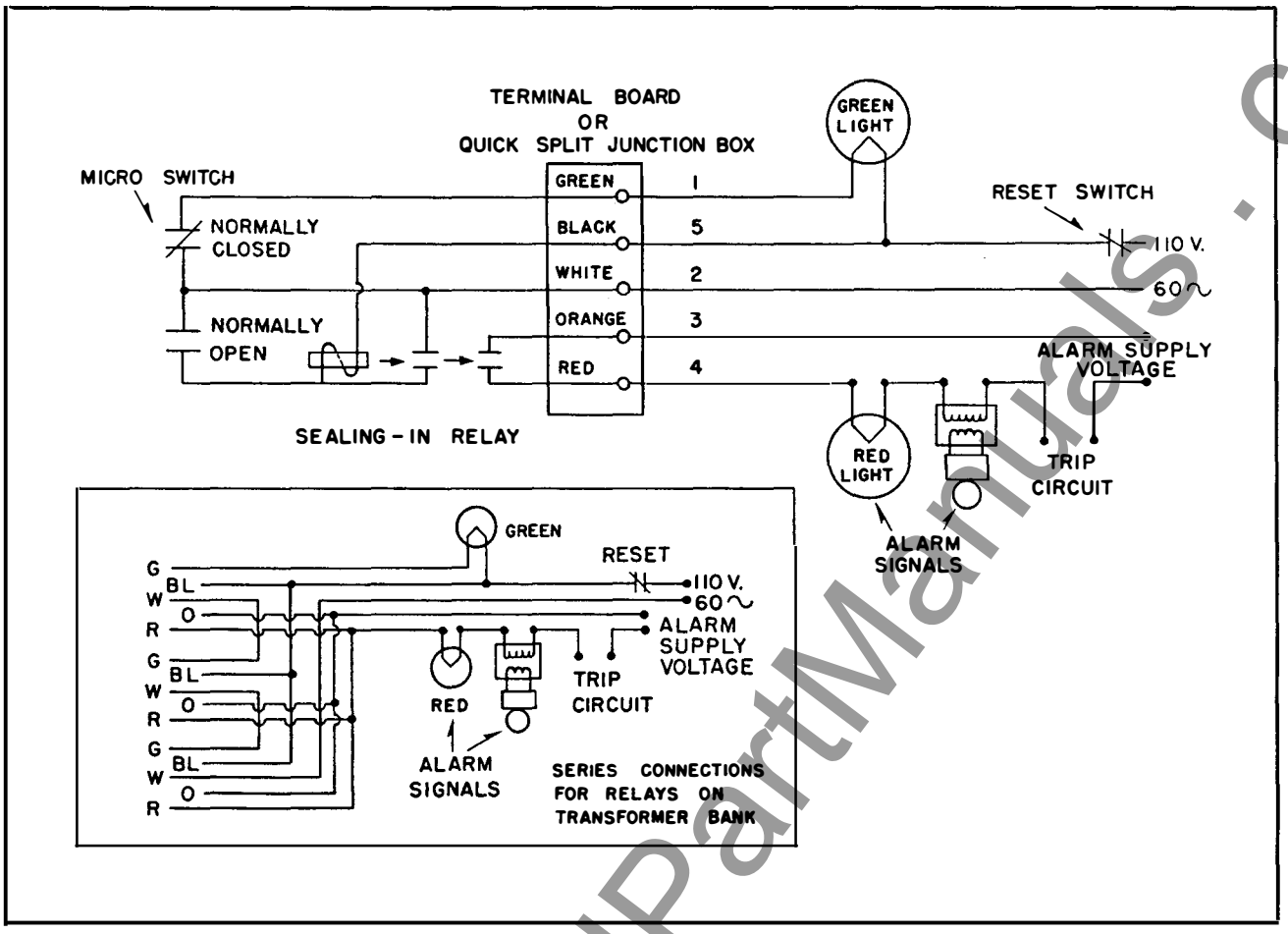

FIG. 3. Sudden Pressure Relay Connection Diagram.

device, a seal-in relay, equalizer and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch, mounted thereon, energize a seal-in relay. This seal-in relay is a double-pole, single-throw relay. It will operate on the first ¼ cycle of impressed voltage starting at zero voltage. One set of contacts is used to lock the coil of the seal-in relay itself, into the power circuit. The second set of contacts, thus locked in by the other contacts, may be used for an alarm and/or trip circuit. See diagram of connections, Fig. 3.

The standard relay operates on 110 V—60 cycle, however, it is also available for 230 V—60 cycle.

The contact rating for the microswitch is 15 amperes at 125-460 volts a-c and the rating of the sealing-in relay is 5 amperes at 110 volts a-c non-inductive load.

The red and green lights and the bell alarm with transformer (all shown in the diagram of connections) are not an integral part of the sudden pressure relay and must be ordered or supplied separately by the purchaser. The reset switch will be supplied with the relay.

INSTALLATION

The Sudden Pressure Relay is mounted as high in the gas space as physically possible when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

Each relay is calibrated at the factory. Adjustment of the relay in the field is not recommended.

OPERATION

The Sudden Pressure Relay as developed and tested, will accomplish the following: (See Fig 4).

1. It will operate on changes in gas pressure, regardless of the operating pressure of the transformer.

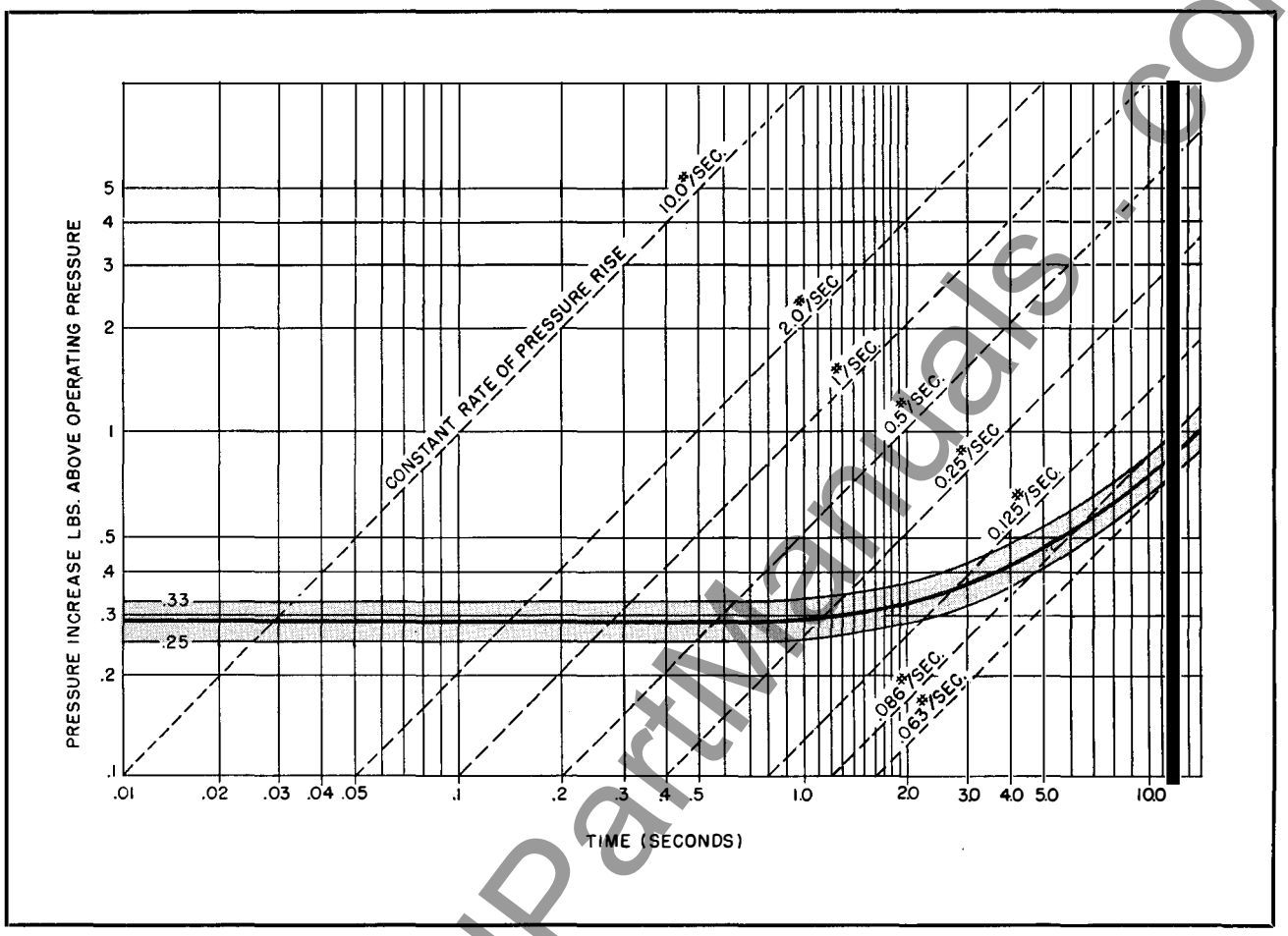

FIG. 4. Operating Characteristics of Sudden Pressure Relay.

2. It will operate on a minimum average rate of rise in pressure of .07 pounds per sq. inch per second as shown in Fig. 4 by the median line (provided the total pressure increase in the tank is at least 0.3 pounds per square inch). The shaded areas above and below the solid median line represent the operating range found in practice because of the tolerance on the pressure sensitive device setting. Fig. 4 shows the time required to operate, for rates of pressure rise from .07 pounds per sq. inch per second to 10 pounds per sq. inch per second.

Referring to Fig. 4, showing the operating characteristics of the sudden pressure relay, note that there are three variables: The rise in pressure in the tank (above operating pressure), the rate of pressure increase (per second), and the length of time required for the relay to operate.

Following the median line of the curve, it will be seen that pressure rising at the rate of 10 pounds per second, with tank pressure increased by 0.3 pounds per sq. inch, will cause the relay to operate in an average time of .03 seconds. Similarly, the relay will operate in an average time of 2.75 seconds when the pressure is rising at a rate of 0.125 pounds per second with the tank pressure 0.35 pounds above normal operating pressure.

3. At high rates of pressure increase—30 to 40 pounds per square inch per second—it will operate in a half cycle on a 60-cycle circuit.

4. It will protect the transformer against disturbances which are insufficient to operate the conventional pressure relief device.

5. It will not operate on changes in pressure common to normal transformer operation.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock, such as that resulting from striking the transformer tank with a sledge hammer, will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the

reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will open the alarm and trip circuits and will restore the circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

MAINTENANCE

It is desirable to check the operation of the relay when it is installed, and every six months or a year afterwards. These tests can be made while the transformer is in service.

The relay is tested by opening and closing the test plug on the bottom of the case, when the steady pressure inside the tank is 3/4 pound per square inch or higher. Opening the plug under these conditions will lower the pressure in the relay chamber, thus causing a differential sufficient to operate the relay. Closing the plug will permit the pressure inside the relay case to build up to the pressure inside the transformer, through the small hole in the equalizing plug. It is necessary to open the reset switch after each operation in order to open the seal-in relay and restore the circuits to their original condition.

Close the test plug after testing; otherwise the transformer will leak gas slowly through the equalizing plug, and the relay may give a continuous fault indication.

Caution: If the trip circuit is arranged to disconnect the transformer from the line, care should be taken to open this trip circuit if the test plug is operated while the transformer is carrying load.

Inspect the equalizing plug hole after the first year of service. This is done by removing the cover of the relay. The plug is mounted in the base plate of the relay. It is made of non-corrosive metal with a small diameter hole in the center. This hole may be cleaned if necessary with a small stiff bristle. Subsequent inspections should be made every one or two years. Removal of the relay case can be made while the transformer is in service, provided the test plug is first opened. It should be realized that the transformer will lose gas pressure through the equalizing hole while the case is removed.

If it is necessary to remove the entire relay from the transformer, this should be done only after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the stock order and serial number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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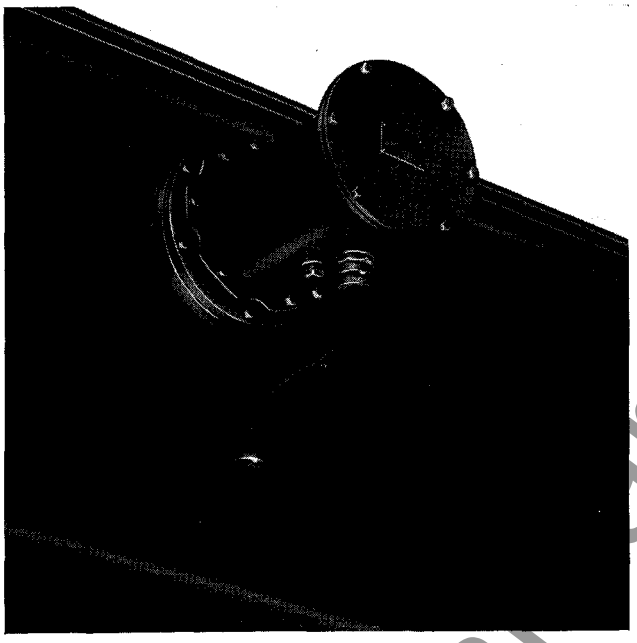

FIG. 1. Sudden Pressure Relay Installed.

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1 shows the relay mounted on the side of the transformer tank close to the cover, and wired into the conduit-type tank bracing rib. It is designed for alarm-trip circuit closing or occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and to thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case (see Fig. 2) in which is mounted a pressure sensitive device, a seal-in relay, equalizer and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch, mounted thereon, energize a seal-in relay. This seal-in relay is a double-pole, single-throw relay. It will operate on the first 1/4 cycle of impressed voltage starting at zero voltage. One set of contacts is used to lock the coil of the seal-in relay itself, into the power circuit. The second set of contacts, thus locked in by the other contacts, may be used for an alarm and/or trip circuit. See diagram of connections, Fig. 3.

The standard relay operates on 110 v.—60 cycle, however, it is also available for 230 v.—60 cycle or 125 v. d-c.

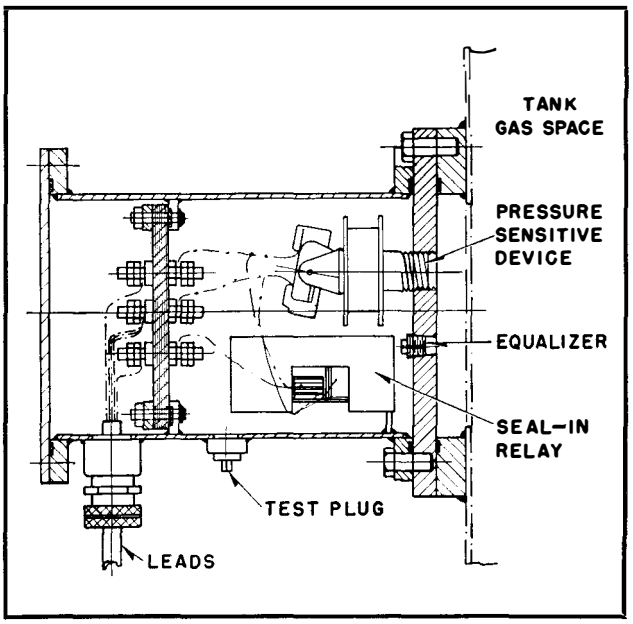

FIG. 2. Internal View of Relay.

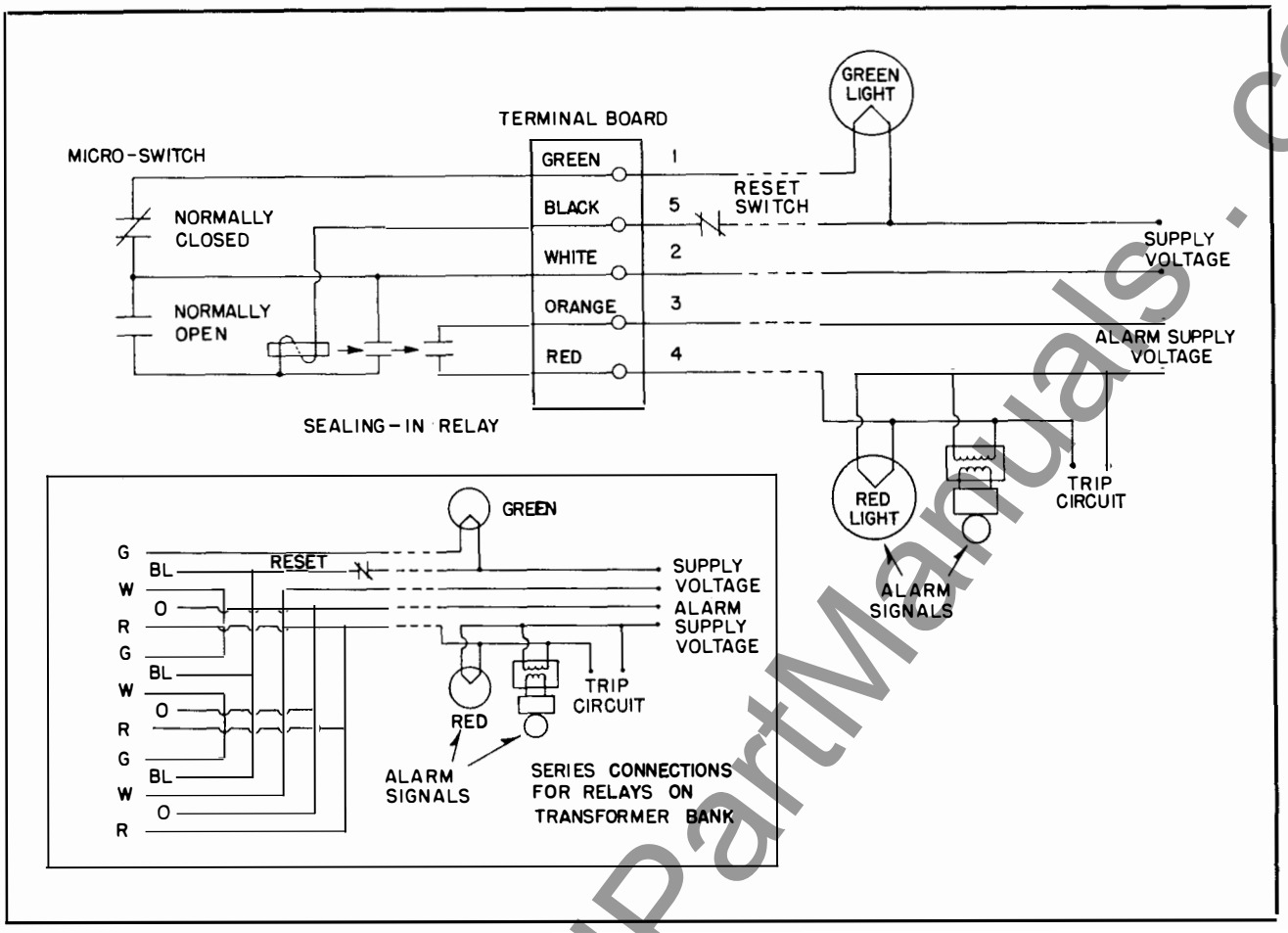

FIG. 3. Sudden Pressure Relay Connection Diagram.

Table No. 1—ALARM CIRCUIT RATINGS

RELAY STYLE NO.	RELAY SUPPLY VOLTS	NORMALLY OPEN ALARM CIRCUIT		
		Load	Amps.	Voltage
1609 786	115 A-C	Non-Inductive	4.25	115 Volts A-C
1646 249	230 A-C		2.12	230 Volts A-C
1646 248	125 D-C		0.2	125 Volts D-C

The all clear signal operated from the normally closed circuit on the microswitch is good for a 6 watt lamp load maximum on 125 volt d-c or 15 amps. maximum at 115 or 230 volts a-c.

The red and green lights and the bell alarm with transformer (all shown in the diagram of connections) are not an integral part of the Sudden Pressure Relay and must be ordered or supplied separately by the purchaser. The reset switch is supplied with the relay.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil.

Each relay is calibrated at the factory. Adjustment of the relay in the field is not recommended.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 4).

1. It will operate on changes in gas pressure, regardless of the operating pressure of the transformer.

2. It will operate on a minimum average rate of rise in pressure of .07 pounds per sq. inch per

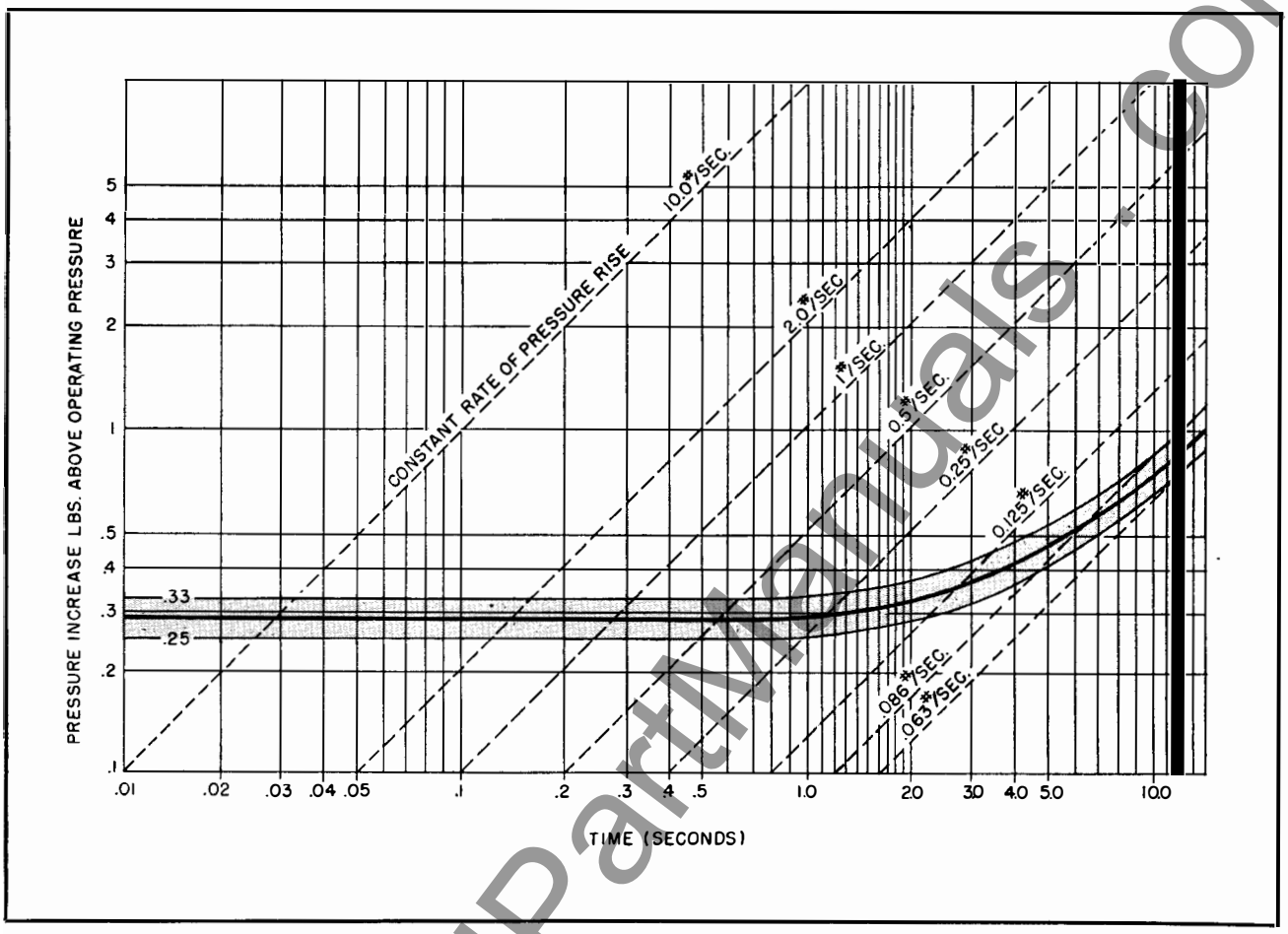

FIG. 4. Operating Characteristics of Sudden Pressure Relay.

second as shown in Fig. 4 by the median line. The shaded areas above and below the solid median line represent the operating range found in practice because of the tolerance on the pressure-sensitive device setting. Fig. 4 shows the time required to operate, for rates of pressure rise from .07 pounds per sq. inch per second to 10 pounds per sq. inch per second.

Referring to Fig. 4, showing the operating characteristics of the sudden pressure relay, note that there are three variables: The rise in pressure in the tank (above operating pressure), the rate of pressure increase (per second), and the length of time required for the relay to operate.

Following the median line of the curve, it will be seen that pressure rising at the rate of 10 pounds per second, with tank pressure increased by 0.3 pounds per sq. inch, will cause the relay to operate in an average time of .03 seconds. Similarly, the relay will operate in an average time of 2.75 seconds when the pressure is rising at a rate of 0.125 pounds per second with the tank pressure 0.35 pounds above normal operating pressure.

3. At high rates of pressure increase—30 to 40 pounds per square inch per second—it will operate in a half cycle on a 60-cycle circuit.

4. It will protect the transformer against disturbances which are insufficient to operate the conventional pressure relief device.

5. It will not operate on changes in pressure common to normal transformer operation.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock, such as that resulting from striking the transformer tank with a sledge hammer, will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually

operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will open the alarm and trip circuits and will restore the circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of ¾ pound per square inch.

There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Fig. 5 and is the basis for checking the operation of the relay.

Test Procedure.

1. Disconnect the relay trip circuit.

2. Record the transformer operating pressure.

3. Connect an audio or visual system such as the green light in Fig. 3 across terminals 1 and 5 either at the relay or the control cabinet.

4. Remove the test plug from the relay case. The relay will then operate and the green light will go out.

5. Replace the plug after five seconds and record the time required for the green light to come back on after the plug has been replaced.

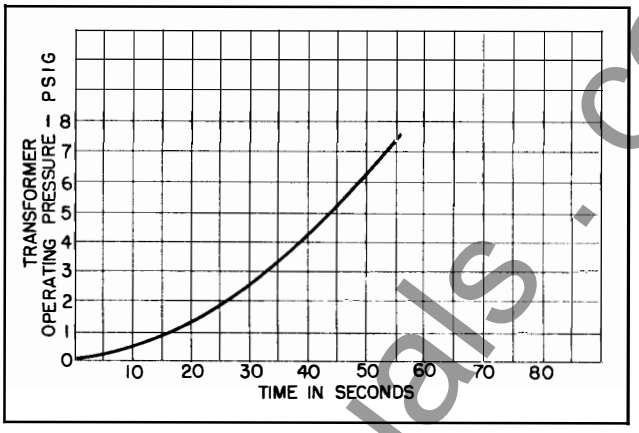

FIG. 5. Relay Operation Comparison Curve.

6. Compare time (5) and transformer pressure (2) to Fig. 5. Any wide deviation of field test points should be referred to the nearest Westinghouse Office.

7. Replace the test plug using cement S# 1150 419 to prevent gas leakage which may cause false relay operation.

If it is necessary to remove the entire relay from the transformer, this should be done only after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the stock order and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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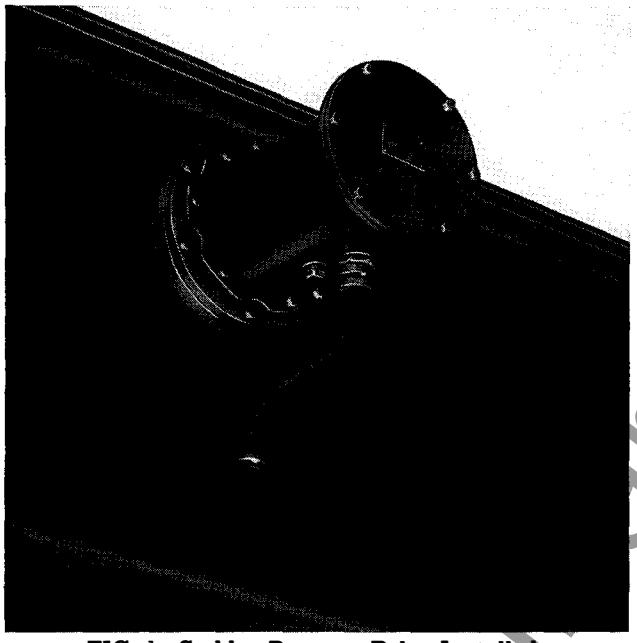

FIG. 1. Sudden Pressure Relay Installed.

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1 shows the relay mounted on the side of the transformer tank close to the cover, and wired into the conduit-type tank bracing rib. It is designed for alarm-trip circuit closing or occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and to thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case (see Fig. 2) in which is mounted a pressure sensitive device, a seal-in relay, equalizer and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch, mounted, thereon, energize a seal-in relay.

The seal-in relay will operate on the first ¼ cycle of impressed voltage starting at zero voltage. The seal-in relay used on all a-c applications has a double pole, single-throw set of contacts, whereas the relay used for d-c applications has two such sets. One pair of contacts is used to lock the coil of the seal-in relay itself, into the power circuit. The remaining contacts thus locked in maybe used for alarm and/or trip circuits. See diagram of connections, Figure 3.

The relay is available for operation on 110 volt or 230 volt a-c or 125 volt d-c.

The all clear signal operated from the normally closed circuit on the microswitch is good for a 6 watt lamp load maximum on 125 volt d-c or 15 amps. maximum at 115 or 230 volts a-c.

The red and green lights and the bell alarm with transformer (all shown in the diagram of connections) are not an integral part of the Sudden Pressure Relay and must be ordered or supplied separately by the purchaser. The reset switch is supplied with the relay.

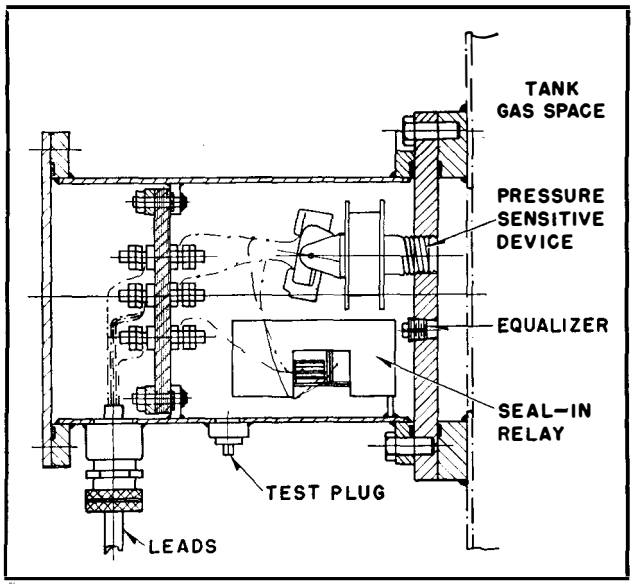

FIG. 2. Internal View of Relay.

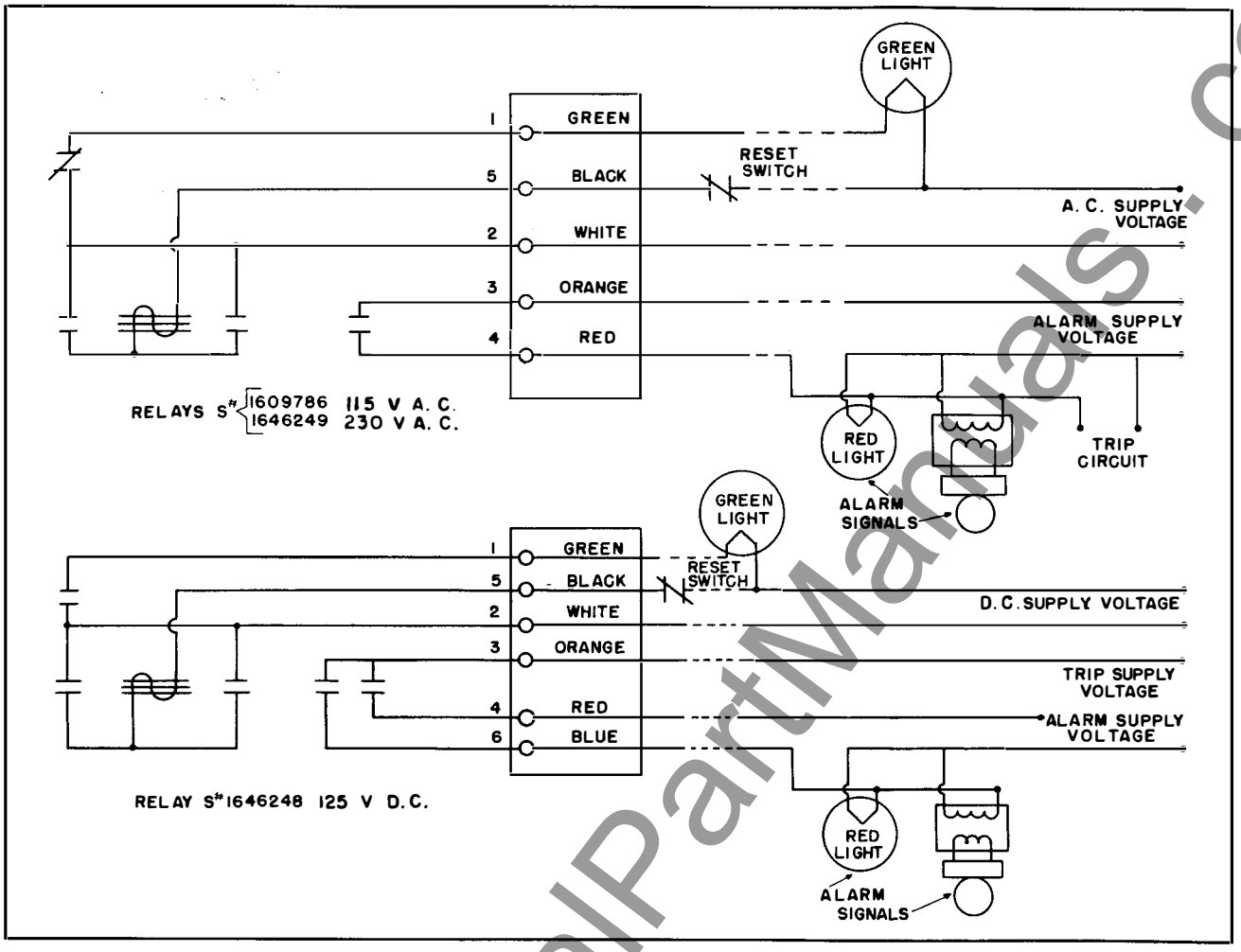

FIG. 3. Sudden Pressure Relay Connection Diagram.

Table No. 1—ALARM CIRCUIT RATINGS

NORMALLY OPEN ALARM CIRCUIT

CONTACT RATING			TYPE OF LOAD		VOLTAGE
Make (Inrush)	Break	Carry	Non-Inductive	Inductive	
4.25	4.25	5	X	X	115 Volts A-C
2.12	2.12	5	X	X	230 Volts A-C
2.12	2.12	5	X	..	48 Volts D-C
1.00	1.00	5	..	Max. L/R 0.026	48 Volts D-C
⅓	2.12	5	Lamp Load	..	48 Volts D-C
0.20	0.20	5	X	..	125 Volts D-C
0.10	0.10	5	..	Max. L/R 0.026	....
0.06	0.20	5	Lamp Load	..	125 Volts D-C
0.10	0.10	5	X	..	250 Volts D-C
0.05	0.10	5	..	Max. L/R 0.026	250 Volts D-C
0.015	0.10	5	Lamp Load	..	250 Volts D-C

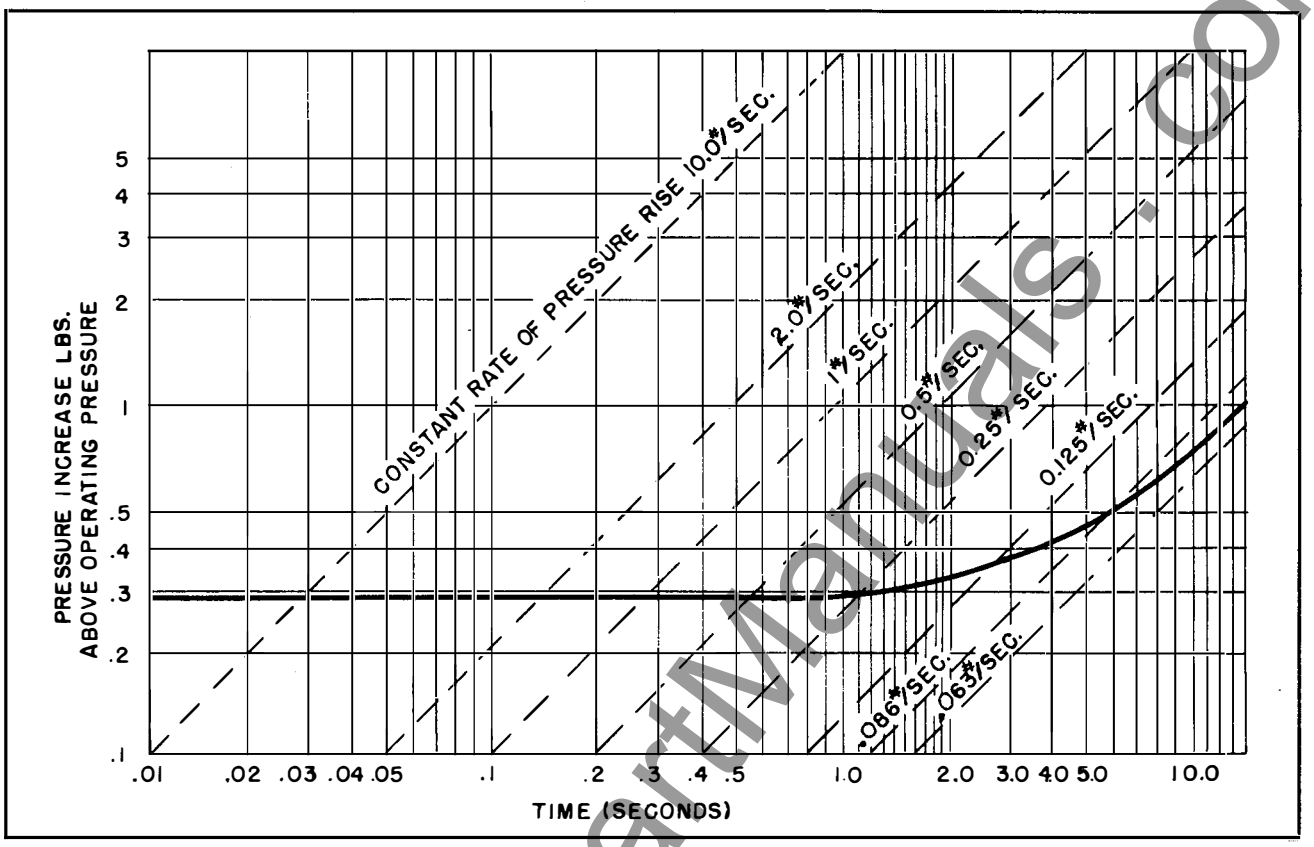

FIG. 4. Operating Characteristics of Sudden Pressure Relay.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil.

Each relay is calibrated at the factory. Adjustment of the relay in the field is not recommended.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 4).

1. It will operate on changes in gas pressure, regardless of the operating pressure of the transformer.

2. It will operate on a minimum average rate of rise in pressure of .07 pounds per sq. inch per second as shown in Fig. 4 by the median line. The shaded areas above and below the solid median line represent the operating range found in practice because of the tolerance on the pressure-sensitive device setting. Fig. 4 shows the time required to operate, for rates of pressure rise from .07 pounds per sq. inch per second to 10 pounds per sq. inch per second.

Referring to Fig. 4, showing the operating characteristics of the sudden pressure relay, note that there are three variables: The rise in pressure in the tank (above operating pressure), the rate of pressure increase (per second), and the length of time required for the relay to operate.

Following the median line of the curve, it will be seen that pressure rising at the rate of 10 pounds per second, with tank pressure increased by 0.3 pounds per sq. inch, will cause the relay to operate in an average time of .03 seconds. Similarly, the relay will operate in an average time of 2.75 seconds when the pressure is rising at a rate of 0.125 pounds per second with the tank pressure 0.35 pounds above normal operating pressure.

3. At high rates of pressure increase—30 to 40 pounds per square inch per second—it will operate in a half cycle on a 60-cycle circuit.

4. It will protect the transformer against disturbances which are insufficient to operate the conventional pressure relief device.

5. It will not operate on changes in pressure common to normal transformer operation.

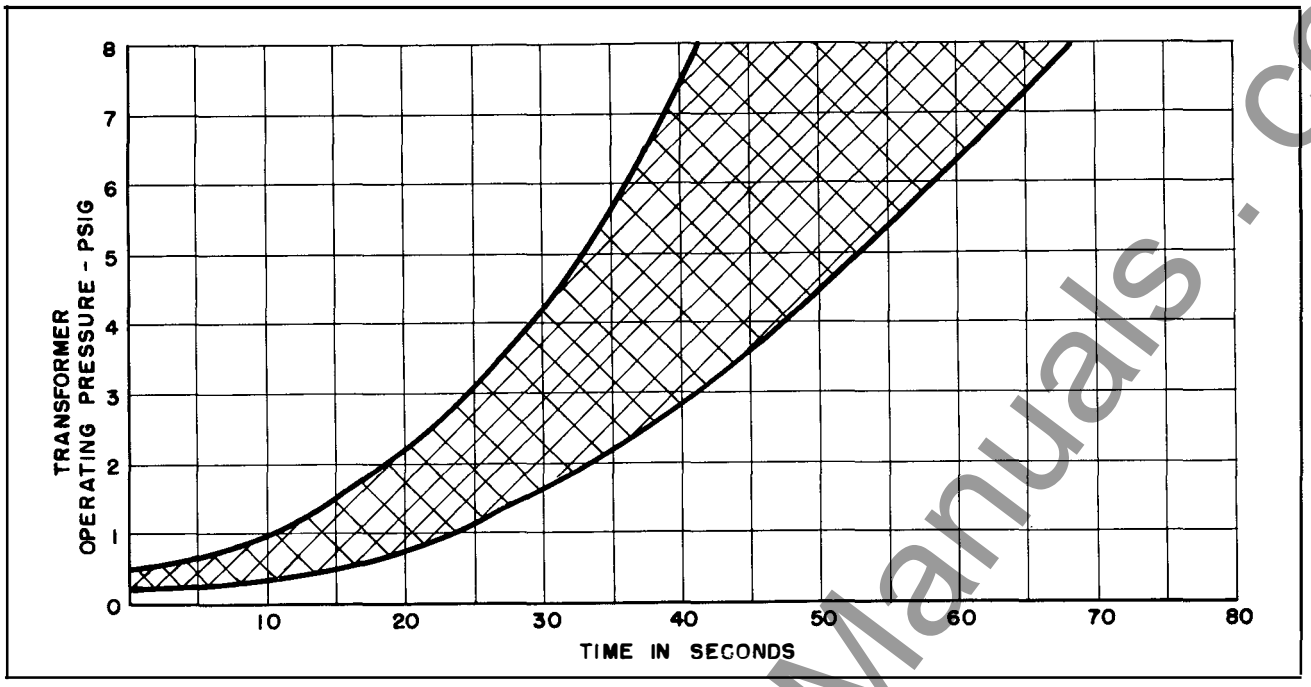

FIG. 5. Relay Operation Comparison Curve.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock, such as that resulting from striking the transformer tank with a sledge hammer, will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will open the alarm and trip circuits and will restore the circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of ¾ pound per square inch.

There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Fig. 5 and is the basis for checking the operation of the relay.

Test Procedure.

1. Disconnect the relay trip circuit.

2. Record the transformer operating pressure.

3. Connect an audio or visual system such as the green light in Fig. 3 across terminals 1 and 5 either at the relay or the control cabinet.

4. Remove the test plug from the relay case. The relay will then operate and the green light will go out.

5. Replace the plug after five seconds and record the time required for the green light to come back on after the plug has been replaced.

6. Compare time (5) and transformer pressure (2) to Fig. 5. Any wide deviation of field test points should be referred to the nearest Westinghouse Office.

7. Replace the test plug using cement S# 1150 419 to prevent gas leakage which may cause false relay operation.

If it is necessary to remove the entire relay from the transformer, this should be done only after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the stock order and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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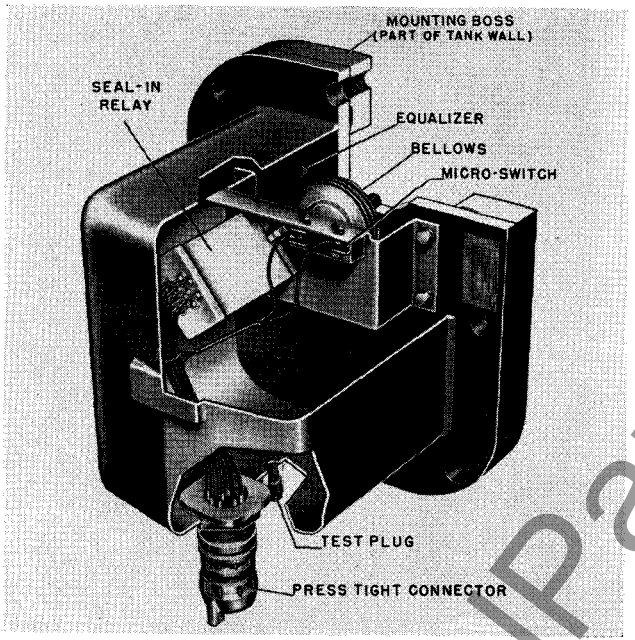

FIG. 1. Cutaway of Relay

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1, shows a cutaway of the relay. It is designed for alarm-trip circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case in which is mounted a pressure sensitive device, a seal-in relay, equalizer, and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch energize the seal-in relay.

The seal-in relay will operate on the first ½ cycle of positive or negative increasing current. The relay has two single pole single-throw contacts and two single pole double-throw contacts. See Table 1 for current rating of contacts. One of the single pole single-throw contacts is used to lock the coil of the seal-in relay into the power circuit. One of the leads of this seal-in circuit is brought out of the case to facilitate field tests. (See Fig. 2). This lead must be externally connected as shown for proper operation of the relay. The remaining contacts may be used for alarm and/or trip circuits.

The relay is available from stock for operation on 110 volts a-c, 230 volts a-c and 125 volts d-c. It may also be obtained for 48 volts d-c operation. The reset switch shown in Fig. 2 is supplied with the relay.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 3).

1. It will operate on changes in gas pressure regardless of the operating pressure on the transformer.

2. A rate of rise of pressure of 5.5 pounds per square inch per second will operate the relay in three cycles on a 60 cycle circuit.

3. At high rates of rise, 30 to 40 pounds per square inch per second, it will operate in a half cycle.

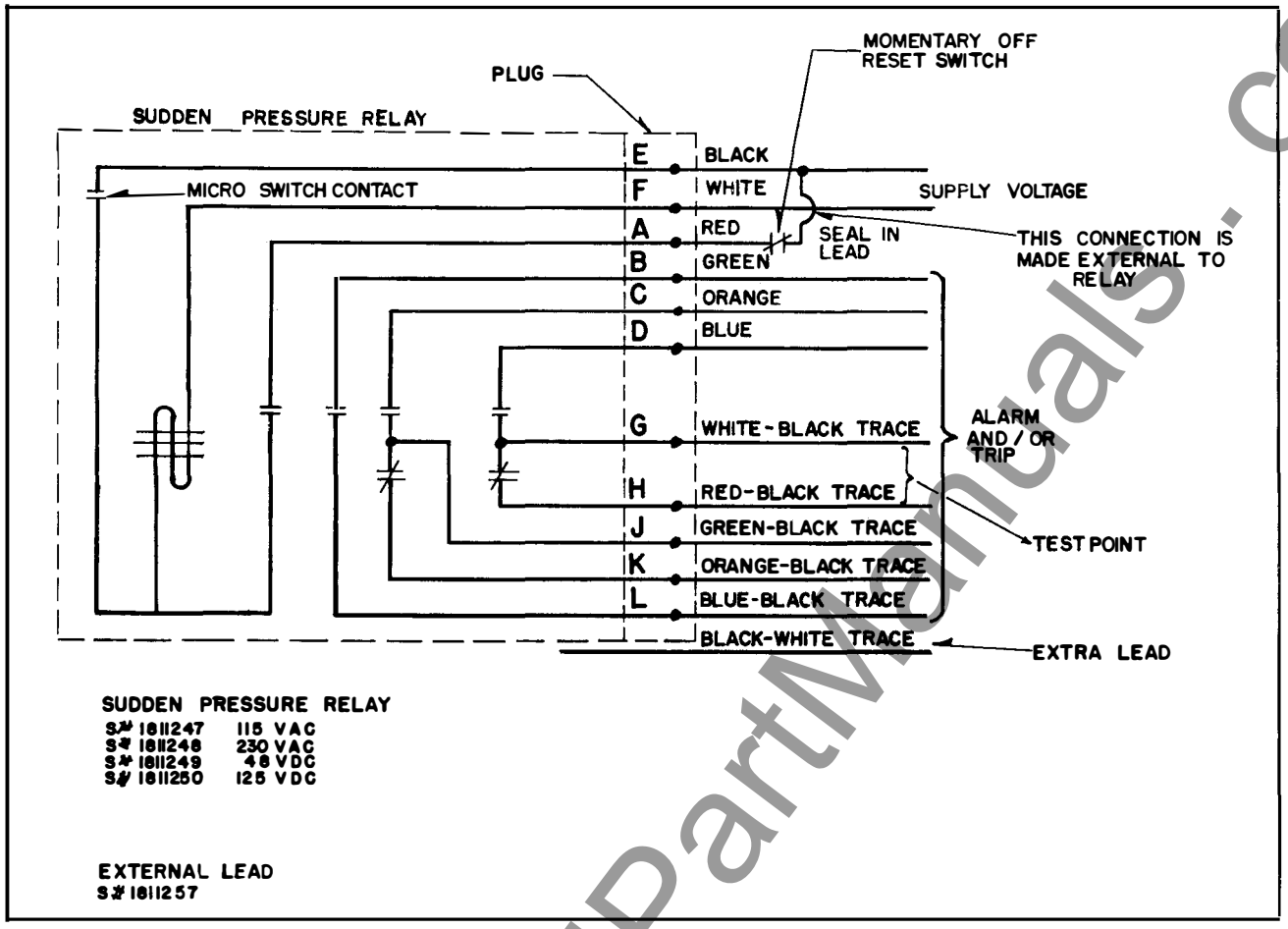

FIG. 2. Reset Switch

4. It will not operate on changes in pressure common to normal transformer operation.

5. It will detect abnormal disturbances which are insufficient to operate the conventional pressure relief device.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will restore the alarm and trip circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

Table No. I

CONTACT RATING (AMPS)

Voltage	Make (All Loads)	Carry (All Loads)	BREAK TYPE OF LOAD		
			Resistive	Inductive Max. L/R—0.026	Lamp
115 Volts A-C	20	10	10	5	2
230 Volts A-C	20	10	5	2.5	2
48 Volts D-C	20	10	2	1	2
125 Volts D-C	20	10	.5	.25	.5
250 Volts D-C	20	10	.1	.05	.1

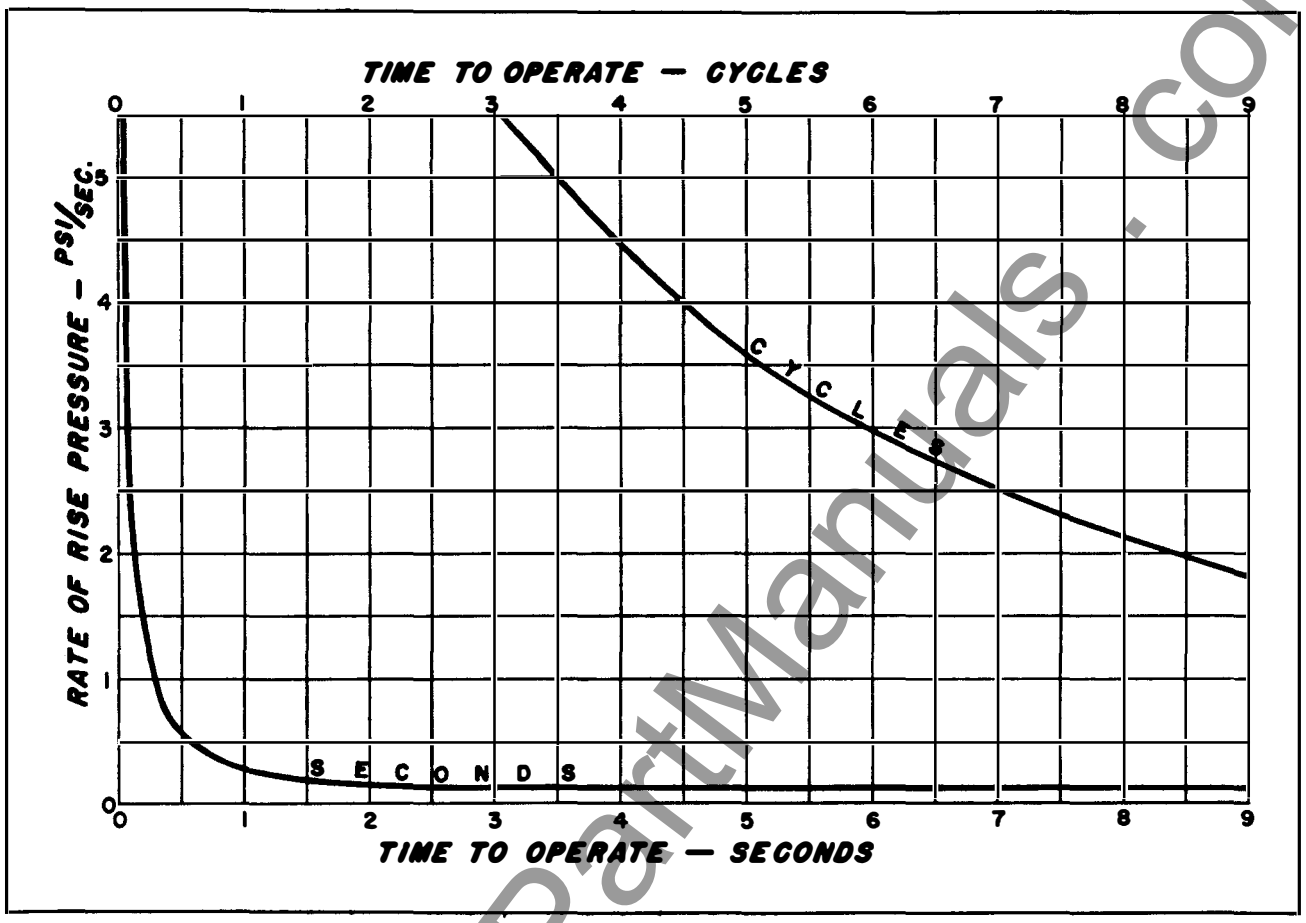

FIG. 3. Operating Characteristics of Sudden Pressure Relay

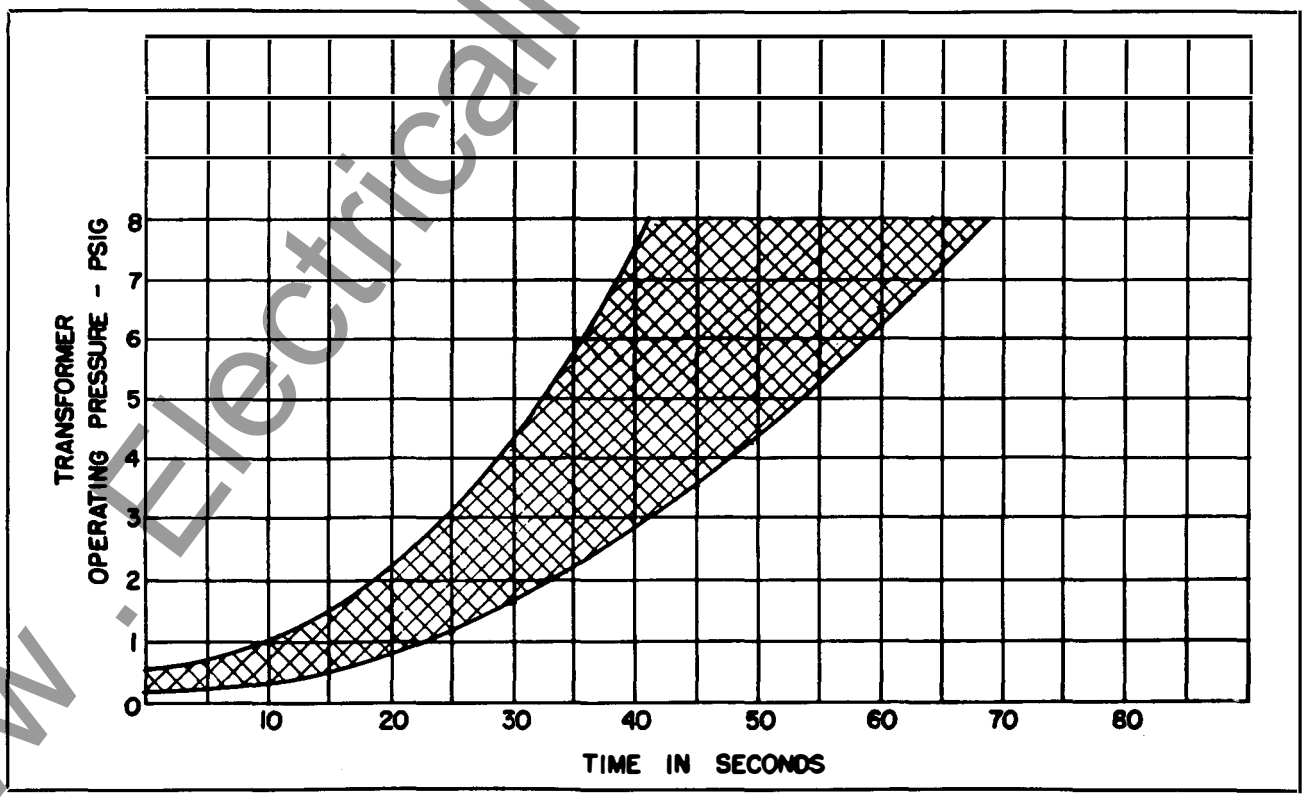

FIG. 4. Time and Pressure Curves

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Fig. 4 and is the basis for checking the operation of the relay. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of ¾ pound per square inch.

Test Procedure

1. Disconnect the relay trip circuit.

2. Open the reset switch.

3. Record the transformer operating pressure.

4. Connect an audio or visual system across terminals G and H at the control cabinet.

5. Remove the test plug from the relay case. The relay will then operate and the audio or visual system will indicate.

6. Replace the plug after five seconds and record the time required for the contacts to reclose after the plug has been replaced.

7. Compare time (6) and transformer pressure (3) to Fig. 4. Any wide deviation of field test points should be referred to the nearest Westinghouse Office.

8. Replace the test plug using cement style 1150419 to prevent gas leakage which may cause false relay operation.

9. Reconnect the seal-in lead.

If it is necessary to remove the entire relay from the transformer, it should be done after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the serial number and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

SUDDEN PRESSURE RELAY

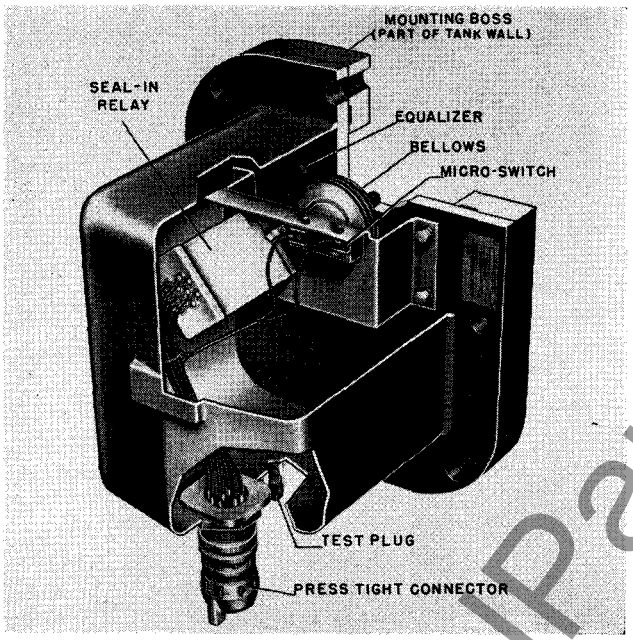

FIG. 1. Cutaway of Relay

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1, shows a cutaway of the relay. It is designed for alarm-trip circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case in which is mounted a pressure sensitive device, a seal-in relay, equalizer, and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch energize the seal-in relay.

The seal-in relay will operate on the first ½ cycle of positive or negative increasing current. The relay has two single pole single-throw contacts and two single pole double-throw contacts. See Table 1 for current rating of contacts. One of the single pole single-throw contacts is used to lock the coil of the seal-in relay into the power circuit. One of the leads of this seal-in circuit is brought out of the case to facilitate field tests. (See Fig. 2). This lead must be externally connected as shown for proper operation of the relay. The remaining contacts may be used for alarm and/or trip circuits.

The relay is available from stock for operation on 110 volts a-c, 230 volts a-c and 125 volts d-c. It may also be obtained for 48 volts d-c operation. The reset switch shown in Fig. 2 is supplied with the relay.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 3).

1. It will operate on changes in gas pressure regardless of the operating pressure on the transformer.

2. A rate of rise of pressure of 5.5 pounds per square inch per second will operate the relay in three cycles on a 60 cycle circuit.

3. At high rates of rise, 30 to 40 pounds per square inch per second, it will operate in a half cycle.

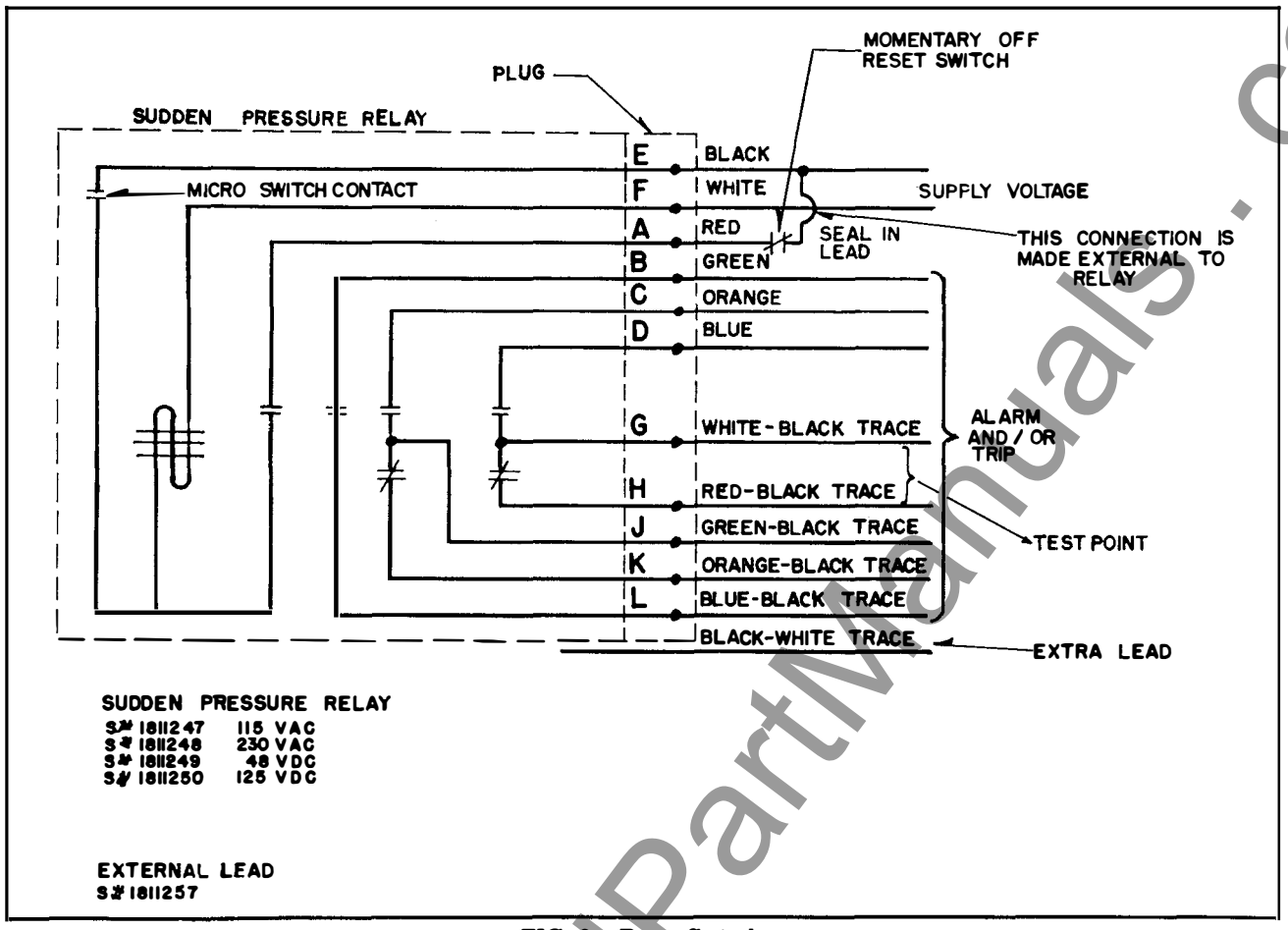

FIG. 2. Reset Switch

4. It will not operate on changes in pressure common to normal transformer operation.

5. It will detect abnormal disturbances which are insufficient to operate the conventional pressure relief device.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will restore the alarm and trip circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

Table No. I

CONTACT RATING (AMPS)

Voltage	Make (All Loads)	Carry (All Loads)	BREAK TYPE OF LOAD		
			Resistive	Inductive Max. L/R—0.026	Lamp
115 Volts A-C	20	10	10	5	2
230 Volts A-C	20	10	5	2.5	2
48 Volts D-C	20	10	2	1	2
125 Volts D-C	20	10	.5	.25	.5
250 Volts D-C	20	10	.1	.05	.1

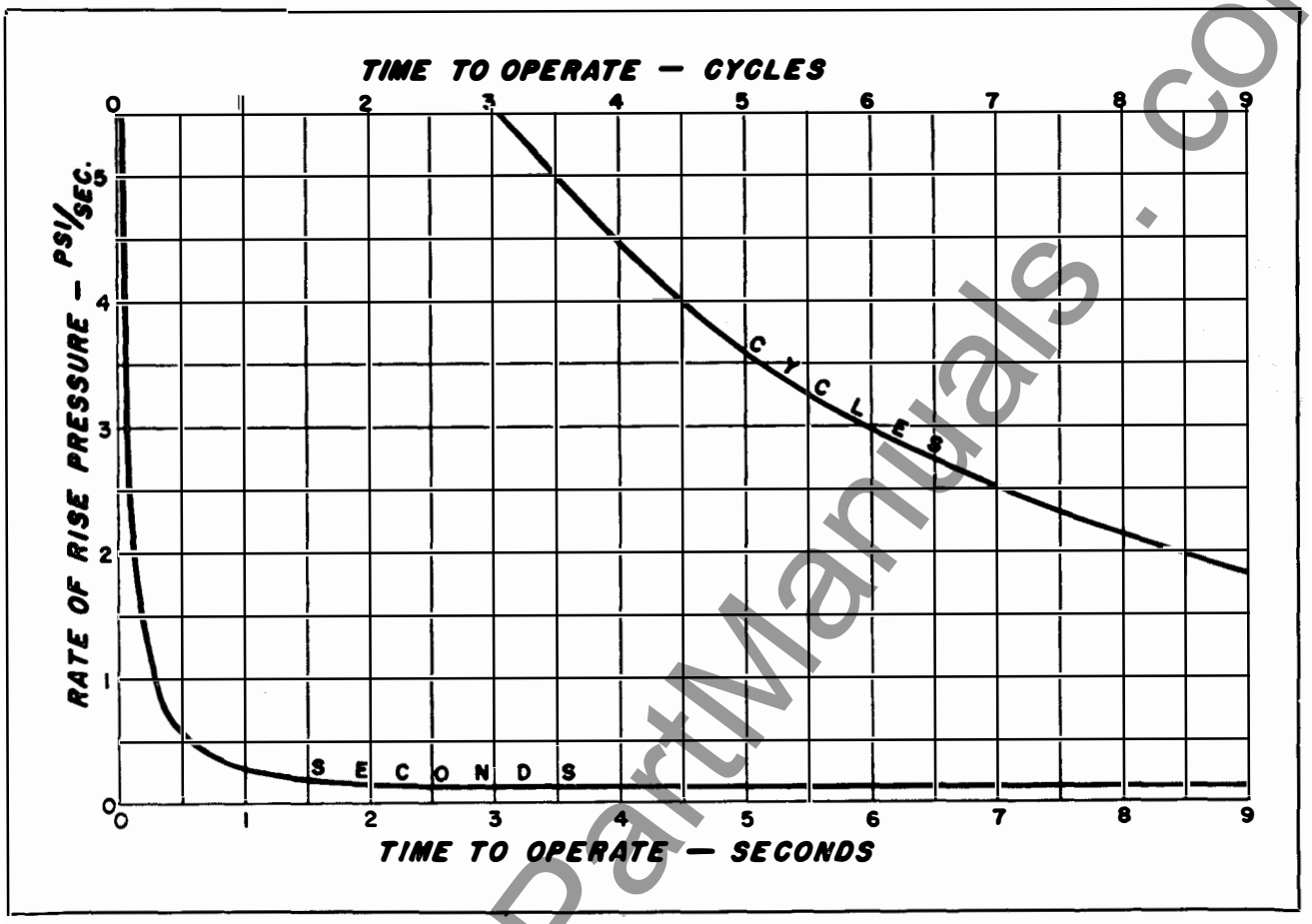

FIG. 3. Operating Characteristics of Sudden Pressure Relay

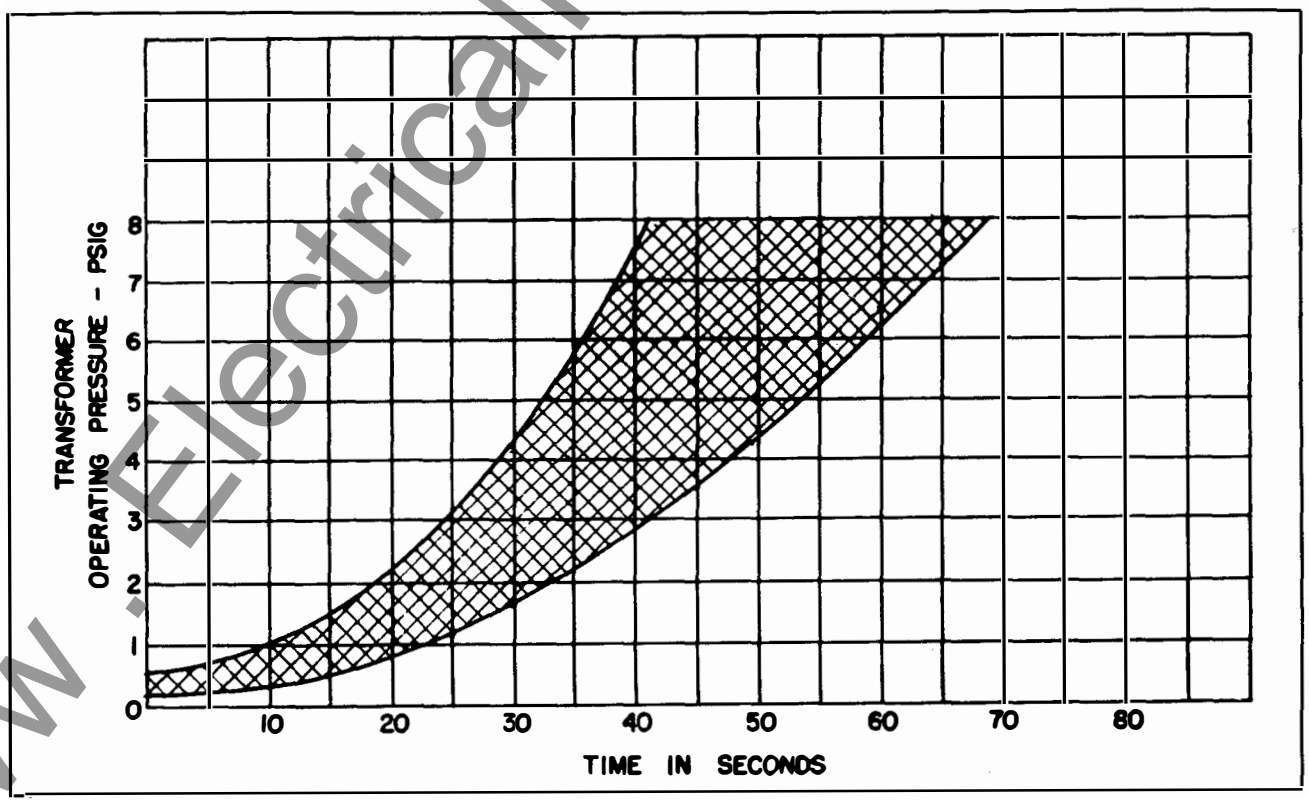

FIG. 4. Time and Pressure Curves

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Figure 4 and is the basis for checking the operation of the relay. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of 3/4 pound per square inch.

TEST PROCEDURE

1. Disconnect the relay trip circuit.
2. Disconnect relay supply voltage.
3. Open the reset switch.
4. Record the transformer operating pressure.
5. Connect a circuit tester across terminals E and F at the control cabinet. The current must be limited to:

   39 milliamperes for 125 V DC

   96 milliamperes for 48 V DC

   15 amperes up to 250 V AC

6. Remove the test plug from the relay case. The relay will operate and the circuit tester will indicate the resistance of the seal-in relay coil that is in series with the micro-switch contact.
7. Close the test plug and record the time required for the contacts to open.
8. Compare time (7) and transformer pressure (4) to Fig. 4. Wide deviations of field test points should be referred to the nearest Westinghouse Office.
9. Close reset switch.
10. Connect relay supply voltage.
11. Connect a circuit tester across terminals G & H .
12. Remove the test plug from the relay case. The relay will operate and the circuit tester indicate an open circuit.
13. Replace the plug and allow sufficient time (see 7 above) for relay to equalize.
14. Operate reset switch and note that the circuit between G & H recloses.
15. Following correct operation of the relay, reconnect the trip circuit.

If it is necessary to remove the relay from the transformer, it should be done after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the serial number and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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INSTRUCTIONS

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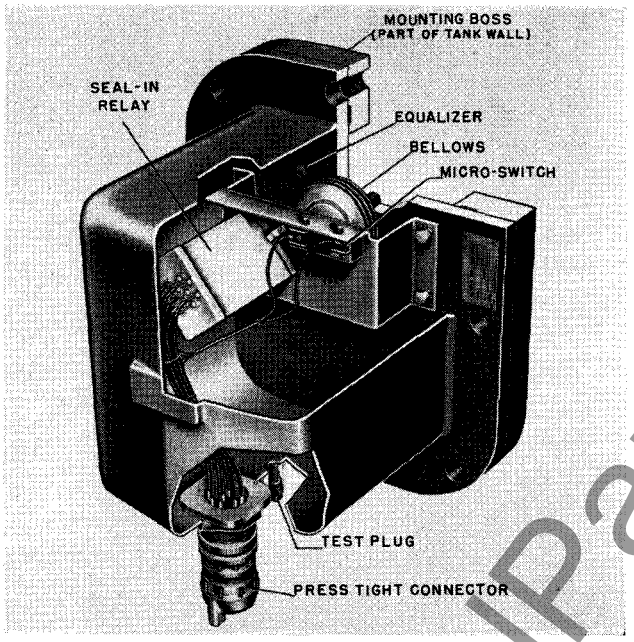

FIG. 1. Cutaway of Relay

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1, shows a cutaway of the relay. It is designed for alarm-trip circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case in which is mounted a pressure sensitive device, a seal-in relay, equalizer, and a test plug. The pressure sensitive device will detect the pressure differential and through a microswitch energize the seal-in relay.

The seal-in relay will operate on the first ½ cycle of positive or negative increasing current. The relay has two single pole single-throw contacts and two single pole double-throw contacts. See Table 1 for current rating of contacts. One of the single pole single-throw contacts is used to lock the coil of the seal-in relay into the power circuit. One of the leads of this seal-in circuit is brought out of the case to facilitate field tests. (See Fig. 2). This lead must be externally connected as shown for proper operation of the relay. The remaining contacts may be used for alarm and/or trip circuits.

The relay is available from stock for operation on 110 volts a-c, 230 volts a-c and 125 volts d-c. It may also be obtained for 48 volts d-c operation. The reset switch shown in Fig. 2 is supplied with the relay.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mountings on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 3).

1. It will operate on changes in gas pressure regardless of the operating pressure on the transformer.

2. A rate of rise of pressure of 5.5 pounds per square inch per second will operate the relay in three cycles on a 60 cycle circuit.

3. At high rates of rise, 30 to 40 pounds per square inch per second, it will operate in a half cycle.

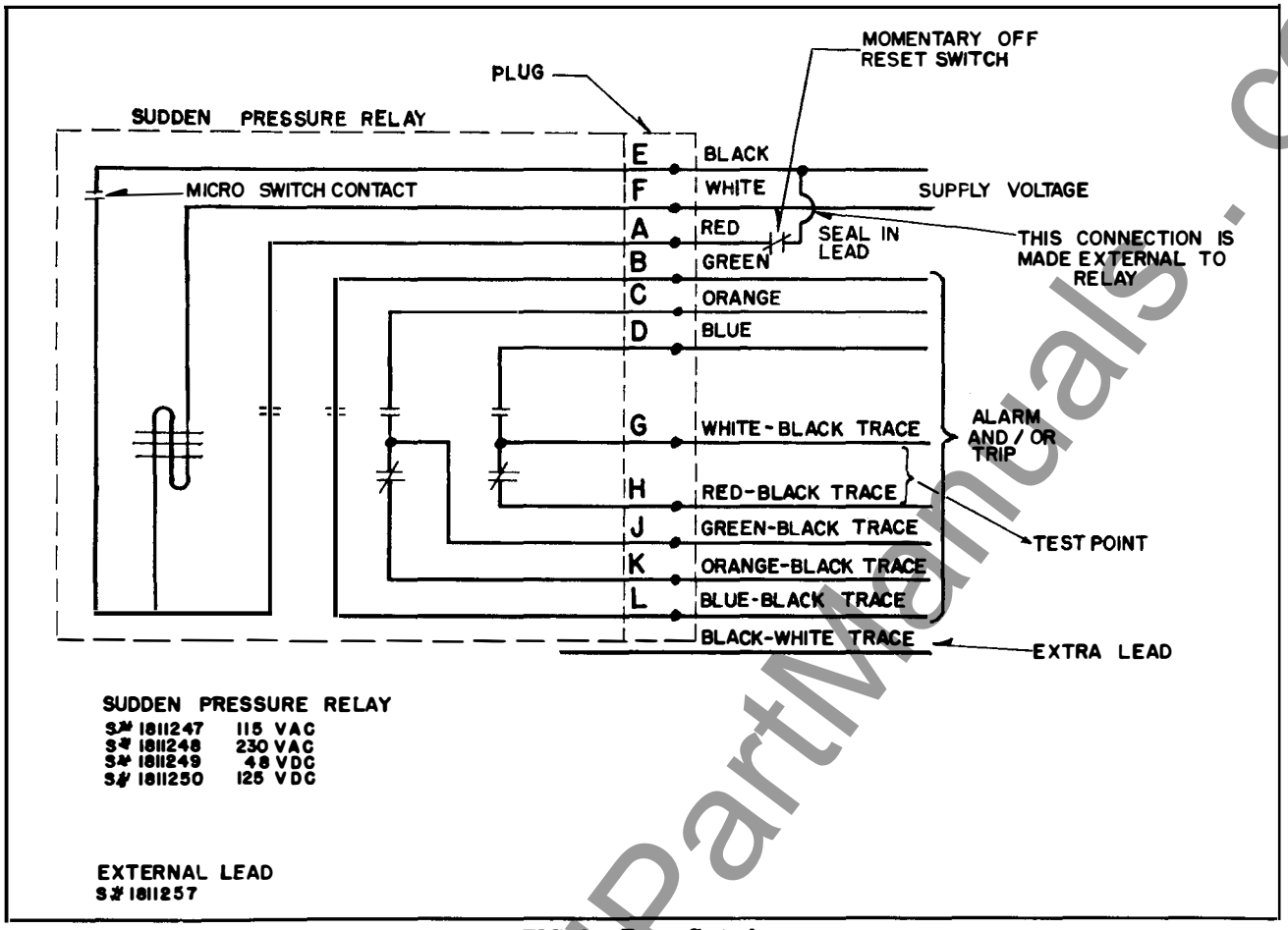

FIG. 2. Reset Switch

4. It will not operate on changes in pressure common to normal transformer operation.

5. It will detect abnormal disturbances which are insufficient to operate the conventional pressure relief device.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will restore the alarm and trip circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

Table No. I

CONTACT RATING (AMPS)

Voltage	Make (All Loads)	Carry (All Loads)	BREAK TYPE OF LOAD		
			Resistive	Inductive Max. L/R—0.026	Lamp
115 Volts A-C	20	10	10	5	2
230 Volts A-C	20	10	5	2.5	2
48 Volts D-C	20	10	2	1	2
125 Volts D-C	20	10	.5	.25	.5
250 Volts D-C	20	10	.1	.05	.1

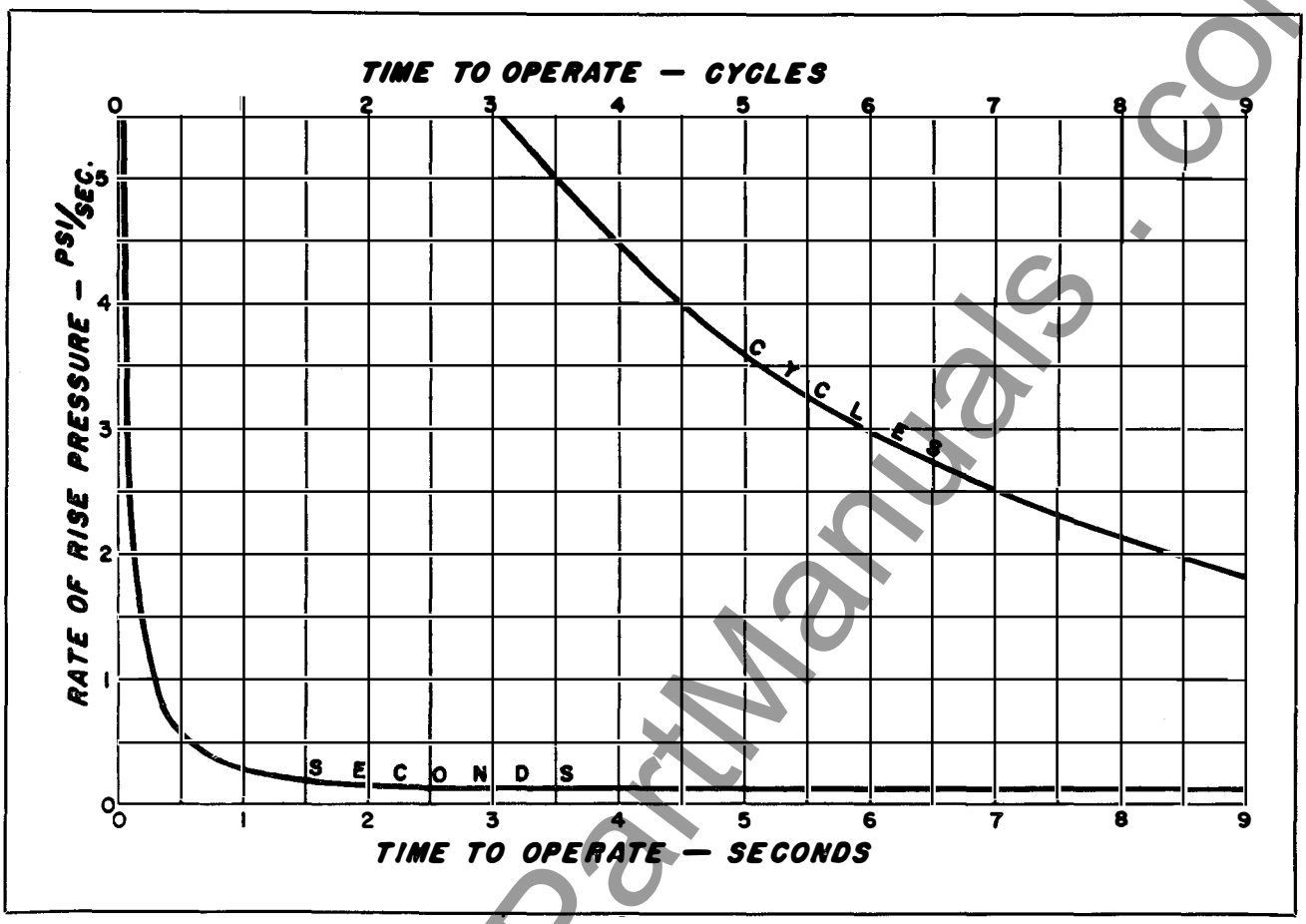

FIG. 3. Operating Characteristics of Sudden Pressure Relay

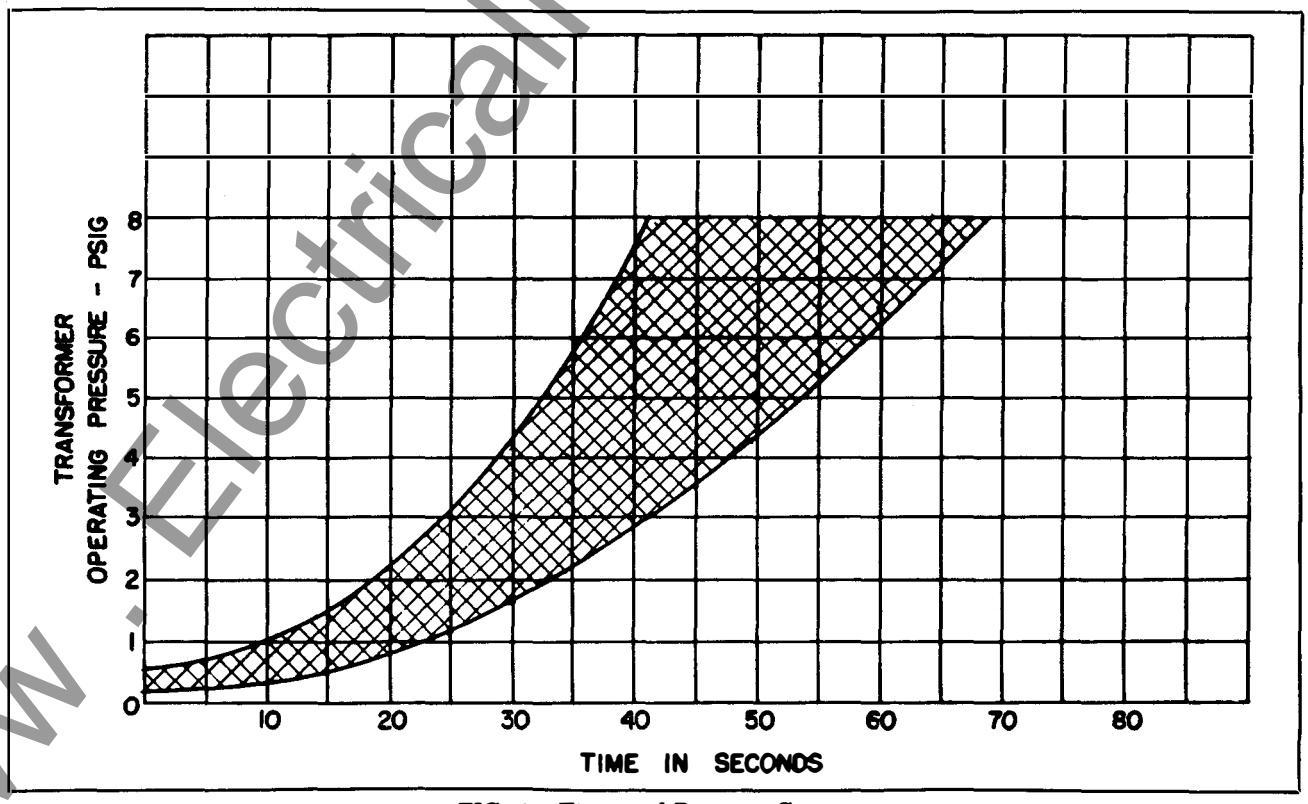

FIG. 4. Time and Pressure Curves

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Figure 4 and is the basis for checking the operation of the relay. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of 3/4 pound per square inch.

TEST PROCEDURE

1. Disconnect the relay trip circuit.
2. Disconnect relay supply voltage.
3. Open the reset switch.
4. Record the transformer operating pressure.
5. Connect a circuit tester across terminals E and F at the control cabinet. The current must be limited to:

   39 milliamperes for 125 V DC

   96 milliamperes for 48 V DC

   15 amperes up to 250 V AC

6. Remove the test plug from the relay case. The relay will operate and the circuit tester will indicate the resistance of the seal-in relay coil that is in series with the micro-switch contact.
7. Close the test plug and record the time required for the contacts to open.
8. Compare time (7) and transformer pressure (4) to Fig. 4. Wide deviations of field test points should be referred to the nearest Westinghouse Office.
9. Close reset switch.
10. Connect relay supply voltage.
11. Connect a circuit tester across terminals G & H .
12. Remove the test plug from the relay case. The relay will operate and the circuit tester indicate an open circuit.
13. Replace the plug and allow sufficient time (see 7 above) for relay to equalize.
14. Operate reset switch and note that the circuit between G & H recloses.
15. Following correct operation of the relay, reconnect the trip circuit.

If it is necessary to remove the relay from the transformer, it should be done after the gas pressure in the transformer is brought to atmospheric level.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the serial number and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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INSTRUCTIONS

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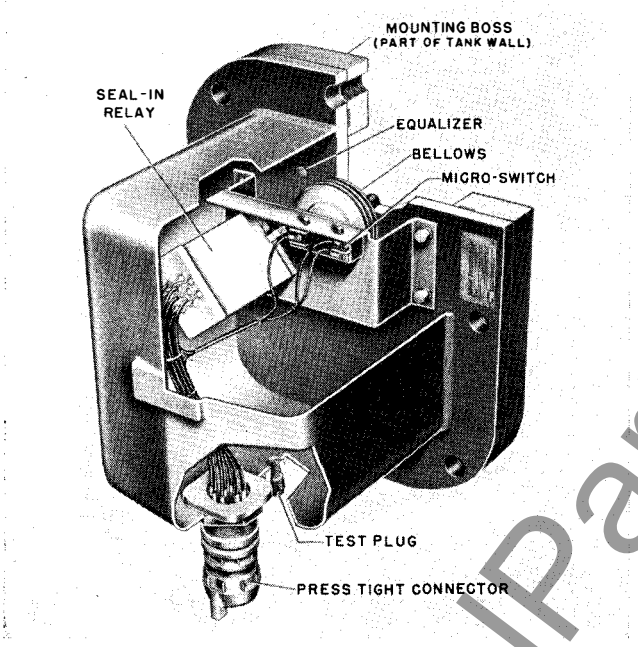

FIG. 1. Cutaway of Relay

GENERAL DESCRIPTION

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1, shows a cutaway of the relay. It is designed for alarm-trip circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case in which is mounted a bellows operated micro-switch, a seal-in relay, equalizer, and a test plug. The pressure operated micro-switch will close at a small pressure differential and energize the seal-in relay. It is also possible to bypass the seal-in relay and use the micro-switch to actuate an external relay.

The seal-in relay will operate on the first ½ cycle of positive or negative increasing current. The relay has one single pole single-throw contact and two single pole double-throw contacts. See Table I for current rating of contacts. The single pole single-throw contact is used to lock the coil of the seal-in relay into the power circuit. One of the leads of this seal-in circuit is brought out of the case to facilitate field tests. (See Fig. 2.) This lead must be externally connected as shown for proper operation of the relay. The remaining contacts may be used for alarm and/or trip circuit.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mounting on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil. The normal procedure is to ship all new transformers with a dummy plate mounted in place of the Sudden Pressure Relay. Whenever possible the transformer should be filled with oil before the dummy plate is removed.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 3).

1. It will operate on changes in gas pressure regardless of the operating pressure on the transformer.

2. A rate of rise of pressure of 5.5 pounds per square inch per second will operate the relay in three cycles on a 60 cycle circuit.

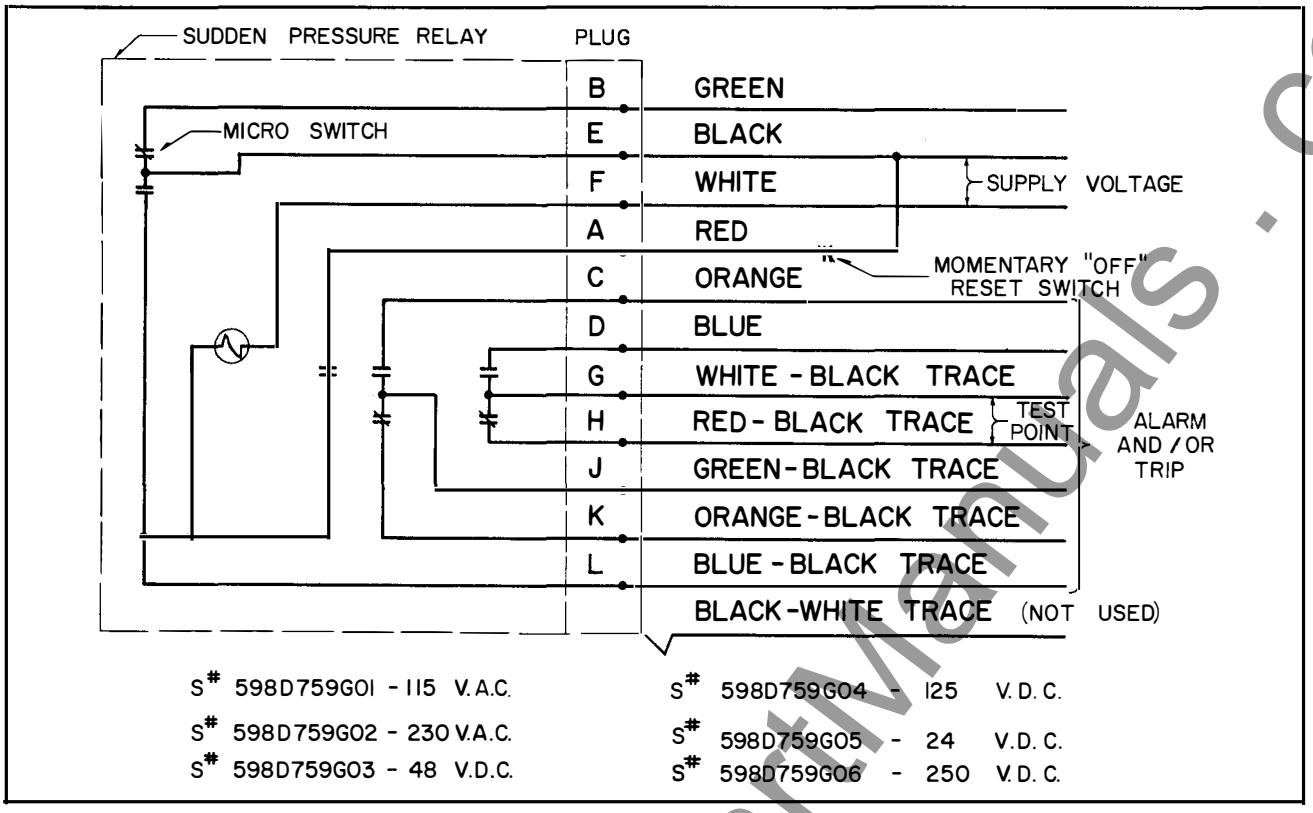

FIG. 2. Wiring Diagram

3. At high rates of rise, 30 to 40 pounds per square inch per second, it will operate in a half cycle.

4. It will not operate on changes in pressure common to normal transformer operation.

5. It will detect abnormal disturbances which are insufficient to operate the conventional pressure relief device.

6. Disturbances, such as short circuits, in-rush currents and impulse voltages, will not operate the relay unless the transformer is damaged internally.

7. Mechanical shock will not operate the relay.

When an operation occurs, the seal-in relay will keep the alarm and trip circuits closed until the reset switch is opened. The reset switch is manually operated. It is necessary to open this switch for a fraction of a second only to interrupt the circuit and release the seal-in relay. Opening and closing the reset switch will restore the alarm and trip circuits to their original condition, ready for detection of further sudden pressure rises in the transformer.

Table No. 1
SEAL-IN RELAY CHARACTERISTICS

SEAL-IN RELAY COIL			
Style Number	Coil Current (MA)		Coil Voltage
	In-Rush	Continuous	
598D759G01	120	62	115 V. A.C.
598D759G02	62	27	230 V. A.C.
598D759G03	...	96	48 V. D.C.
598D759G04	...	39	125 V. D.C.
598D759G05	...	170	24 V. D.C.
598D759G06	...	39	250 V. D.C.

SEAL-IN RELAY CONTACT RATINGS				
Make (All Loads) Amps	Carry (All Loads) Amps	Break Type of Load For N.O. and N.C. Contacts (Amps)		Contact Voltage
		Resistive	*Inductive	
20	10	10	5	115 V. A.C.
20	10	5	2.5	230 V. A.C.
20	10	5	3.0	24 V. D.C.
20	10	2	1	48 V. D.C.
20	10	.5	.25	125 V. D.C.
20	10	.1	.05	250 V. D.C.

* L/R equal or less than 0.026, where
L = Inductance in henrys and
R = Resistance in ohms.

IMPORTANT: Relays, solenoids and motors are inductive loads. When an inductive circuit is opened, a voltage is induced which tends to maintain current flow. The resultant arcing causes severe contact duty and may result in failure of the contacts to interrupt current.

Table No. 2

BZ-RD MICRO-SWITCH RATING

VOLTAGE	RATED CAPACITY OF CONTACTS (AMPS)				
	Carry (All Loads)	Break Type of Load for N.O. and N.C. Contacts		Lamp Load for Max. Heated Filament	
		Resistive	* Inductive	N.O. Contact	N.C. Contact
125 V. A.C.	15	15	15	1.5	3.0
250 V. A.C.	15	15	15	1.25	2.5
24 V. D.C.	15	2	1	1.5	2.0
48 V. D.C.	15	.8	.05	0.8	0.8
125 V. D.C.	15	.3	.03	0.3	0.3
250 V. D.C.	15	.2	.02	0.2	0.2

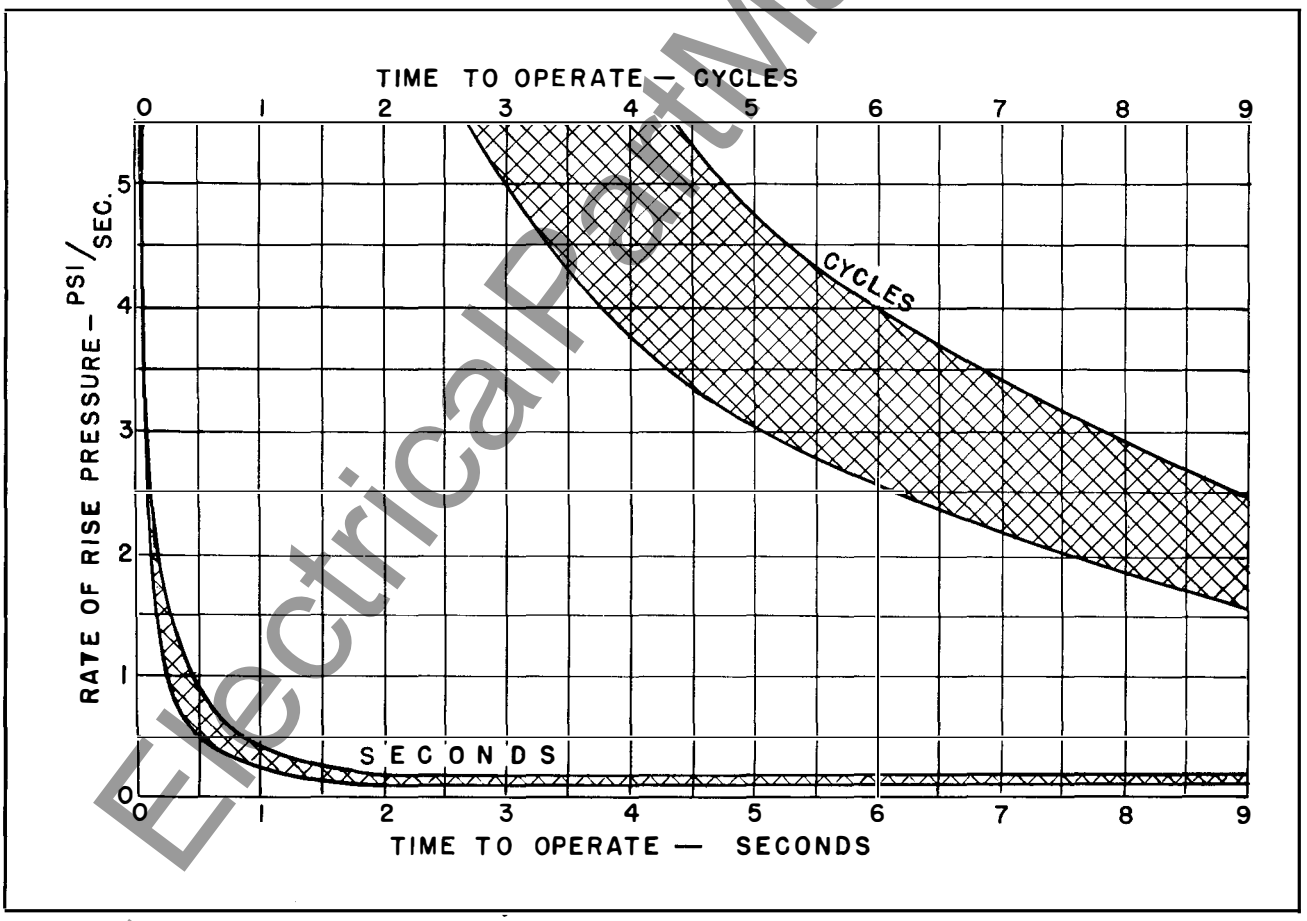

FIG. 3. Operating Characteristics of Sudden Pressure Relay

MAINTENANCE

It is desirable to check the operation of the relay when it is installed and every six months or a year afterwards. There is a definite relationship between the transformer gas pressure and the time required to equalize the pressures between the transformer and the relay. This relationship is shown graphically in Figure 4 and is the basis for checking the oper-

2. Remove the manhole cover to see what can be observed visually. Sometimes the odor of burning is quite obvious.

3. Make the regular insulation power factor and insulation resistance tests together with a check on the ratio of the transformer.

4. Any other tests which might be desirable after these first tests have been made.

5. Check the operation of the Sudden Pressure Relay as outlined in the "Field Test Procedure" section.

DETECTION OF ACETYLENE GAS

Acetylene is one of the primary products of decomposition due to any arc under oil, and its presence is an indication that a fault has occurred. The Westinghouse Acetylene Gas Detector is an elementary form of gas analyzer which detects acetylene gas in the gas space by bubbling gas from the transformer through a solution of ammonia and Cuprous Chloride. If acetylene is present a brick red precipitate will be formed which will indicate that a fault has occurred.

The Gas Detector may be connected directly to the test plug of the Sudden Pressure Relay by means of plastic tubing and the flow of gas through the ammonia solution can be controlled by pinching the tubing.

A complete set of Operating Instructions is included with each Westinghouse Acetylene Gas Detector.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the serial number and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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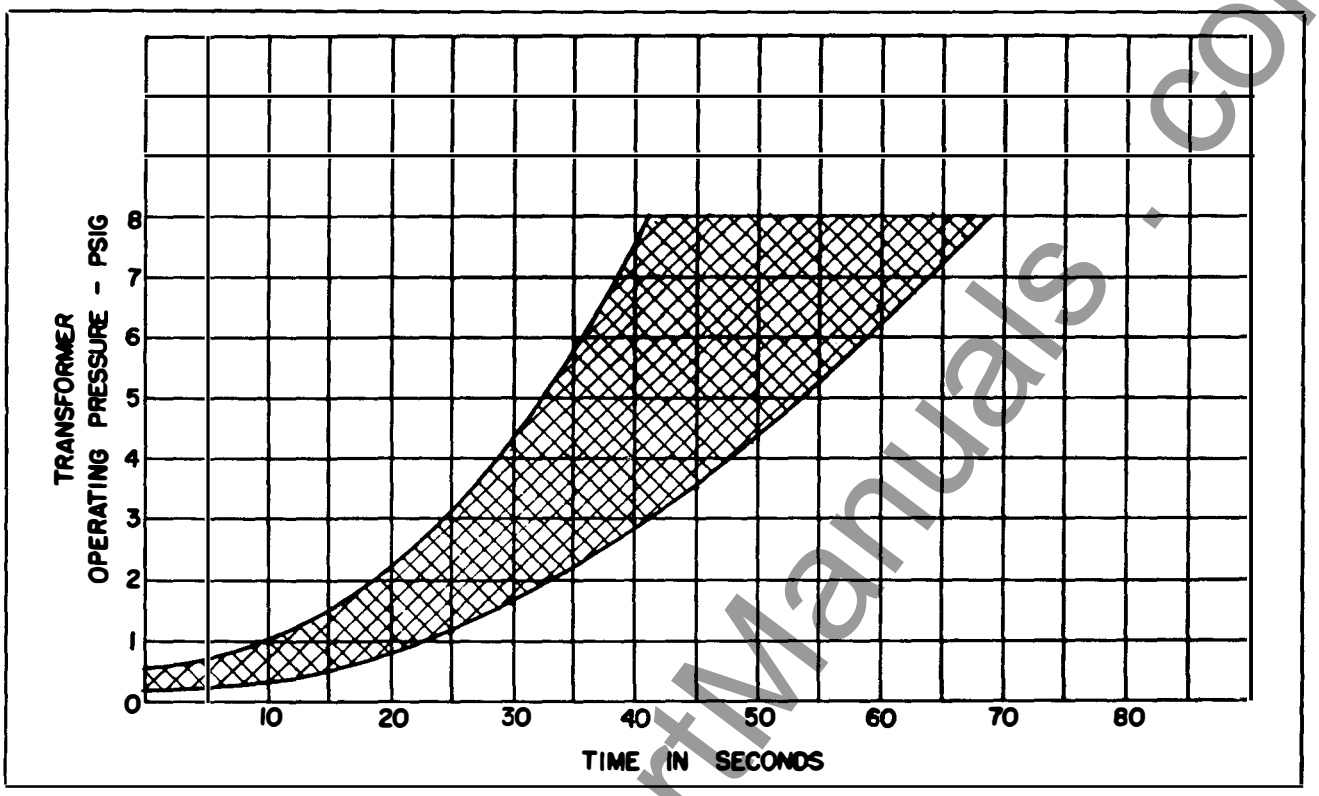

FIG. 4. Time and Pressure Curves

ation of the relay. The following test may be made on the relay while the transformer is in service, providing the transformer is operating at a positive tank pressure in excess of 3/4 pound per square inch.

FIELD TEST PROCEDURE

1. Disconnect the relay trip circuit.
2. Disconnect relay supply voltage.
3. Open the reset switch.
4. Record the transformer operating pressure.
5. Connect a circuit tester across terminals E and F at the control cabinet.
6. Remove the test plug from the relay case. The relay will operate and the circuit tester will indicate the resistance of the seal-in relay coil that is in series with the micro-switch contact.
7. Close the test plug and record the time required for the contacts to open.
8. Compare time (7) and transformer pressure (4) to Fig. 4. Wide deviations of field test points should be referred to the nearest Westinghouse Office.
9. Close reset switch.
10. Connect relay supply voltage.
11. Connect a circuit tester across terminals G & H .
12. Remove the test plug from the relay case. The relay will operate and the circuit tester indicate an open circuit.
13. Replace the plug and allow sufficient time (see 7 above) for relay to equalize.
14. Operate reset switch and note that the circuit between G & H recloses.
15. Following correct operation of the relay, reconnect the trip circuit.

If it is necessary to remove the relay from the transformer, it should be done after the gas pressure in the transformer is brought to atmospheric level.

FACTORY TESTS

The factory tests made on the Sudden Pressure Relay are more conclusive than is necessary for field testing to ensure the Sudden Pressure Relay is in operating condition.

All electrical parts of the Sudden Pressure Relay receive a 1500 Volt insulation test for a period of one minute at 60 cycles. The seal-in relay must operate at 80% of rated voltage within 12 milli-

seconds. The bellows is tested at 15 pounds pressure while positioned in a fixture to limit its travel to a maximum of 1/16" from free length. When the pressure is released the bellows must return to its original free length plus or minus .005 inches. The maximum pressure which is applied to the bellows in the completed Sudden Pressure Relay should be limited to 8 psi.

The following tests are made on all completed Sudden Pressure Relays with the relay mounted on a vertical mounting plate.

1. A 1500 Volt 60 cycle insulation test is made on the electrical circuit of the Sudden Pressure Relay to ground for a period of one minute.

2. An operation test is made to determine the "make" and "break" pressure of the microswitch.

(a) The maximum "make" pressure at which point the normally-open contacts of the microswitch close is 0.4 psi or 11 inches of water.

(b) The minimum "break" pressure at which point the normally-open contacts of the microswitch reopens is .15 psi or 4.15 inches of water.

3. An orifice test is made in the same manner as outlined under Field Test Procedure. This gives the operating characteristics of the Sudden Pressure Relay without actually making a rate-of-rise pressure test.

4. A 20 pound pressure test is made to ensure that the relay is pressure tight. During this test it is necessary to apply pressure to both the tank side and the relay case itself so as not to damage the bellows.

OPERATING PROCEDURE AFTER A RELAY OPERATION

What to do after the transformer bank is tripped out due to a relay operation is a difficult question. Theoretically a fault has occurred and the bank should be taken out of service until the trouble has been repaired. In actual practice a number of faults within a transformer can be self-clearing. Sparkovers can occur between turns or even between taps or terminal connections which normally operate at relatively low voltage between points and these sparkovers will be cleared because the normal operating voltage simply is not sufficient to maintain an arc through the oil. While such impulse sparkovers should never occur with modern transformers and modern lightning arresters, they can and do occur because of defects in the transformer or in the arrester protection. In addition, there is the possibility of incorrect breaker tripping resulting from difficulties in the relays, wiring, and circuit breakers or some unforeseen combination of circumstances which can cause an outage where there is no fault.

After a transformer has been disconnected as a result of relay operation it is always desirable to get it back into service as soon as possible. It is, of course, desirable to make certain that the transformer is not faulted, but in many instances the necessity of getting the transformer bank into service outweighs the risk of additional consequential damage which may be incurred by putting a faulted transformer bank on the line, and the risk of reconnecting the transformer immediately without making additional tests to determine the nature of the fault is justified. In fact, even though it may be known that a sparkover has occurred inside the transformer, it is still true that if the transformer can be reconnected even temporarily and will carry the load for even a short period the risk of reconnecting a damaged transformer can be justified. The penalty for reconnecting a damaged transformer is, of course, that if a second fault occurs the damage to the transformer and possibly to associated equipment will be larger than it would be after only one fault.

However, with the most modern relay protection and especially the Sudden Pressure Relay, the sensitivity to a fault is such that very little consequential damage can occur without causing relay operation. This will be true even for single turn shorts in the winding for the fault current in these faults will be in the order of full load current. The relay will operate, in the first place, before appreciable consequential damage can occur and if the transformer is reclosed it is fairly certain that the relay will operate again before serious consequential damage is done in addition to that caused by the first fault. Accordingly, it seems that it is generally good policy to reclose after operation of relays if the transformer is protected with sensitive relay protection.

As soon as the transformer can be taken out of service for additional inspection and test the following procedure should be followed.

1. Connect the Westinghouse Acetylene Gas Detector to the test plug of the Sudden Pressure Relay as outlined in the section for "Detection of Acetylene Gas." If this is not available take samples of the gas from the gas space for analysis to determine whether there are present excessive products of decomposition.

DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

SUDDEN PRESSURE RELAY

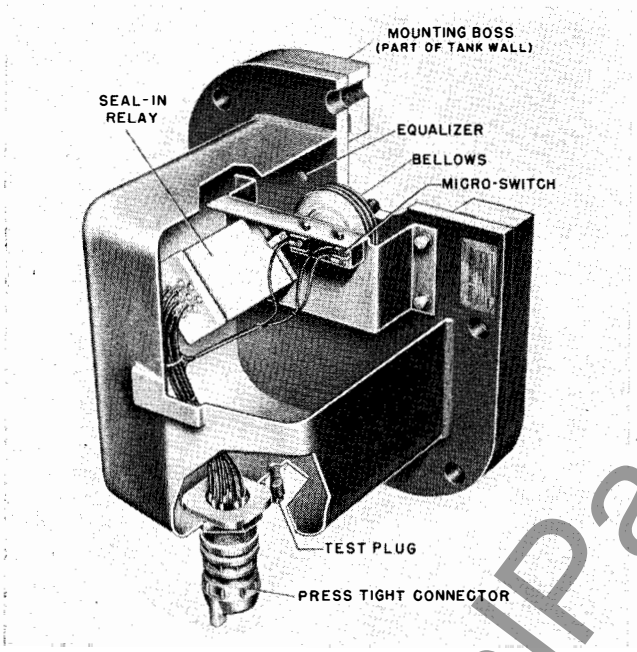

FIG. 1. Cutaway of Relay

GENERAL DESCRIPTION

THE WESTINGHOUSE SUDDEN PRESSURE RELAY is a protective device mounted on the side of gas-cushioned liquid-immersed transformers in the region of the gas space. Fig. 1, shows a cutaway of the relay. It is designed for alarm-trip circuit closing on occurrence of a fault in the transformer which produces an abnormal rise of pressure. This is accomplished by means of a pressure-actuated switch, housed in a hermetically sealed case and isolated from the transformer gas space except for a pressure equalizer. This equalizer, consisting of a non-corrosive plug with a small hole, permits normal transformer operation over its entire pressure range without giving a false alarm. It will act to throttle any pressure change of greater magnitude than that experienced in normal operation so as to effect a pressure differential between the relay case and the transformer case, and thus operate the pressure-actuated switch.

The relay consists of a pressure-tight case in which is mounted a bellows operated micro-switch, a seal-in relay, equalizer, and a test plug. The pressure operated micro-switch will close at a small pressure differential and energize the seal-in relay. It is also possible to bypass the seal-in relay and use the micro-switch to actuate an external relay.

The seal-in relay will operate on the first ½ cycle of positive or negative increasing current. The relay has one single pole single-throw contact and two single pole double-throw contacts. See Table I for current rating of contacts. The single pole single-throw contact is used to lock the coil of the seal-in relay into the power circuit. One of the leads of this seal-in circuit is brought out of the case to facilitate field tests. (See Fig. 2.) This lead must be externally connected as shown for proper operation of the relay. The remaining contacts may be used for alarm and/or trip circuit.

INSTALLATION

The Sudden Pressure Relay is mounted above the maximum oil level in the gas space when applied on transformers at the factory. This is the preferred mounting. Vertical mounting on the transformer cover can be made satisfactorily for applications to transformers in the field.

When vacuum filling a transformer on which a Sudden Pressure Relay is mounted, care must be taken that the relay is not filled with oil. The normal procedure is to ship all new transformers with a dummy plate mounted in place of the Sudden Pressure Relay. Whenever possible the transformer should be filled with oil before the dummy plate is removed.

OPERATION

The Sudden Pressure Relay will accomplish the following: (See Fig. 3).

1. It will operate on changes in gas pressure regardless of the operating pressure on the transformer.

2. A rate of rise of pressure of 5.5 pounds per square inch per second will operate the relay in three cycles on a 60 cycle circuit.

2. Remove the manhole cover to see what can be observed visually. Sometimes the odor of burning is quite obvious.

3. Make the regular insulation power factor and insulation resistance tests together with a check on the ratio of the transformer.

4. Any other tests which might be desirable after these first tests have been made.

5. Check the operation of the Sudden Pressure Relay as outlined in the "Field Test Procedure" section.

DETECTION OF ACETYLENE GAS

Acetylene is one of the primary products of decomposition due to any arc under oil, and its presence is an indication that a fault has occurred. The Westinghouse Acetylene Gas Detector is an elementary form of gas analyzer which detects acetylene gas in the gas space by bubbling gas from the transformer through a solution of ammonia and Cuprous Chloride. If acetylene is present a brick red precipitate will be formed which will indicate that a fault has occurred.

The Gas Detector may be connected directly to the test plug of the Sudden Pressure Relay by means of plastic tubing and the flow of gas through the ammonia solution can be controlled by pinching the tubing.

A complete set of Operating Instructions is included with each Westinghouse Acetylene Gas Detector.

REPLACEMENT

In the event it becomes necessary to replace the relay, give the serial number and style number of the relay along with the stock order and serial number of the transformer. Address all correspondence to the nearest Westinghouse Office.

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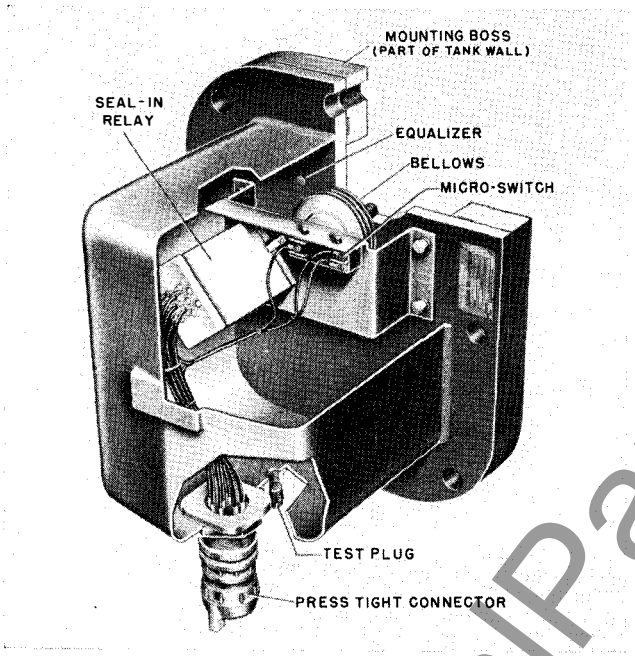

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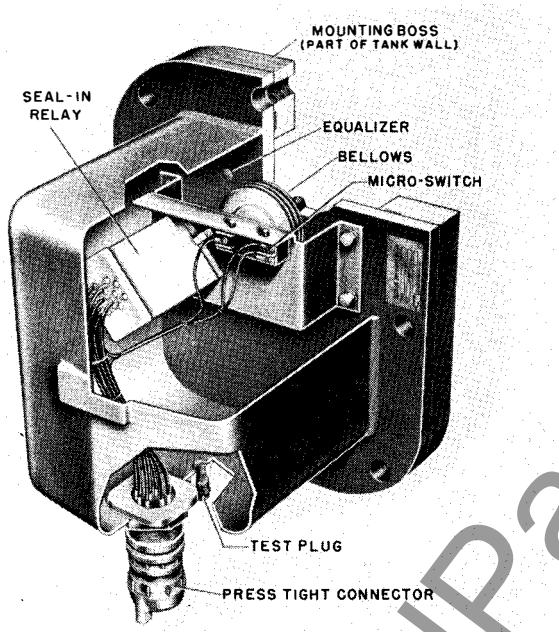

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