INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DGF GENERATOR FIELD RELAY

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

APPLICATION

The type DGF relay is used for generator-field protection. This relay will detect most grounds in the generator field regardless of their location. It provides a means of ground detection without the application of additional voltages. The relay, as does other types of field ground relays, depends upon the conductivity of the oil film of the bearing of the generator for the detection of grounds in the generator.

CONSTRUCTION

As seen in Fig. 1, the type DGF relay consists of a d'Arsonval type d-c contact making milliammeter, a linear resistor, and a non-linear resistor or varistor. These components are connected as shown in the internal schematic of Fig. 2.

The d'Arsonval type d-c contact making milliammeter is shown in Fig. 3. It consists of a cylindrical core, a moving coil to which a contact arm is mounted, two adjustable stationary contacts, and a malleable iron frame casting. The cylindrical core consists of an Alnico permanent magnet, two iron pole pieces and two brass spacer blocks.

Electrical connections to the moving coil are made by means of two spiral springs located at the top of the element. A third spiral spring at the bottom of the element provides an electrical connection to the moving contact.

The lower bearing support of the moving element is a sapphire thrust bearing and a ring guide bearing. A guide bearing is the top support of the moving element.

OPERATION

The relay is applied to the field of a generator as shown in the schematic diagram of Fig. 4. Under normal operating conditions, the supply voltage of the generator field is applied to the series connected linear and non-linear resistors. The junction of these two resistors is connected to ground through the d'Arsonval d-c contact making milliammeter. At rated supply voltage, the junction point of the resistors is at the approximate midpoint of the d-c supply. This means that approximately one-half of the field supply voltage is impressed between the junction of the two resistors and the positive side of the supply voltage. The other half of the supply voltage is impressed from the junction point to the negative side of the supply voltage.

When a ground appears in the generator field, the d-c milliammeter unit of the DGF relay is connected to the generator field through the ground. Thus, a bridge is formed which has as its outer legs the non-linear resistor, the linear resistor and the field windings. The d-c contact-making milliammeter forms the center of the bridge. If the ground is not at the null point of the generator field and if the supply voltage is maintained, current will flow in the contact-making milliammeter of the relay, and it will close its contacts.

If the ground is at the null point of the generator and the supply voltage is normal, the voltage applied to the non-linear resistor will not change. As a result, its resistance will not change, and the bridge will not become unbalanced. No current will flow into the contact-making milliammeter, and its contacts will not close. The supply voltage will have to be either raised or lowered before the relay contacts will close.

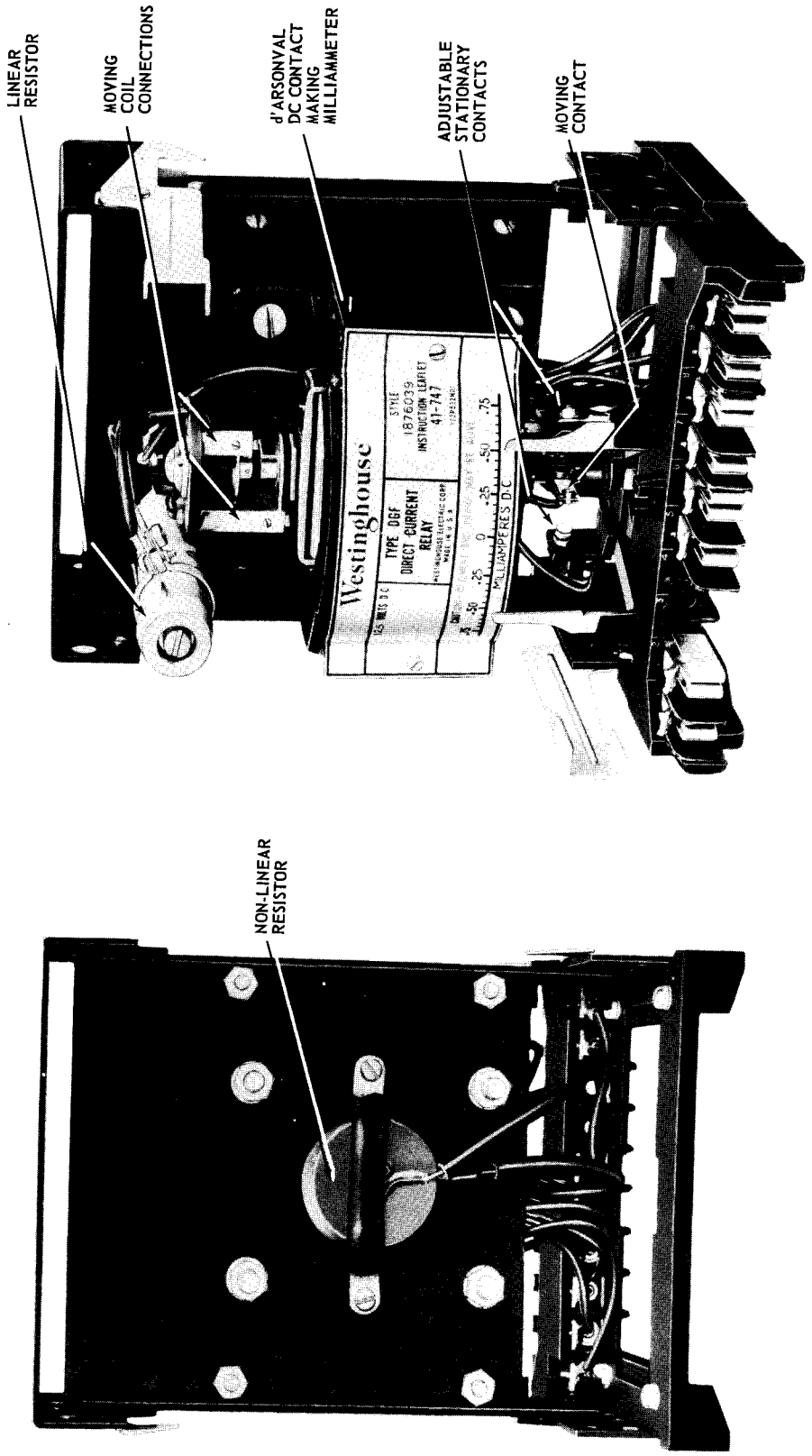


Fig. 1. Type DGF Relay without Case.

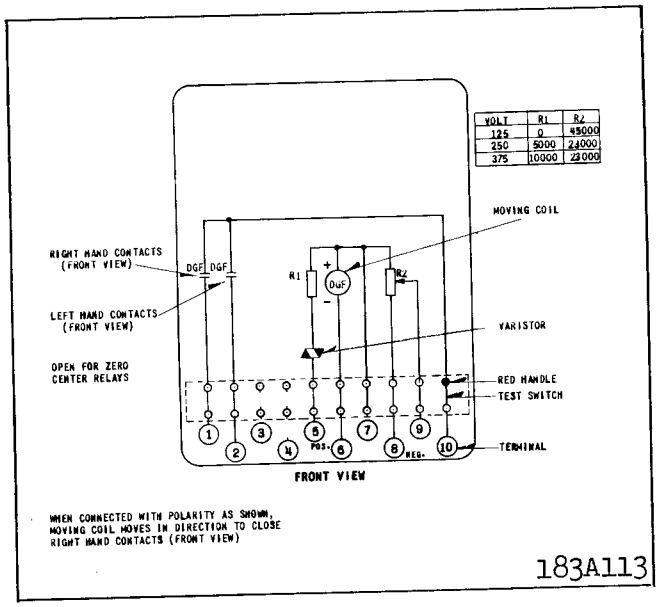


Fig. 2. Internal Schematic of the Type DGF Relay in the FT21 Case.

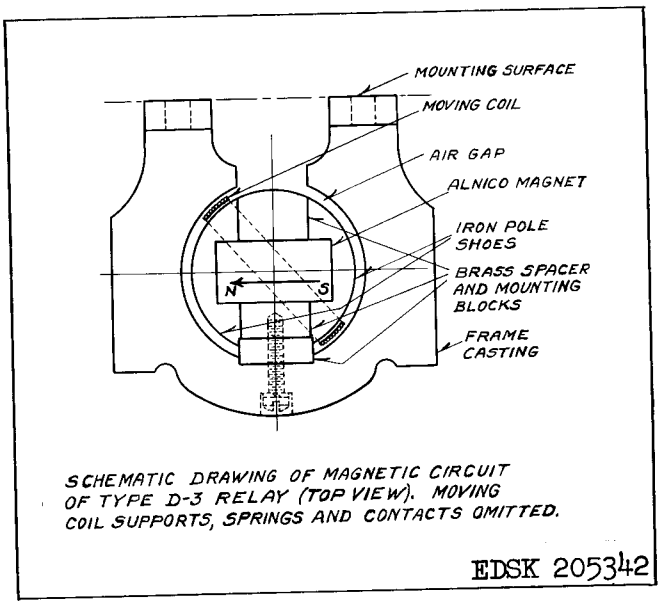


Fig. 3. Magnetic Circuit of d'Arsonval Type dc Contact Making Milliammeter.

The center curve of Figure 5 shows null points position in a grounded generator field for different values of supply voltage. The outer curves of Figure 5 show the amount that the supply voltage must be either raised or lowered before the relay contacts will close for a ground at one of these null points.

A center tap is provided on the linear resistor so that a part of the resistor can be shorted out. By periodically shorting out this resistor by means of a push-button, the DGF will detect grounds at the null points if they exist. In such a case, the bridge is unbalanced by changing the linear resistor, and current will flow into the contact-making milliammeter if a ground exists at the null point.

CHARACTERISTICS

The type DGF relay is generally available for the following field supply voltages:

125 volts d-c
250 volts d-c
375 volts d-c

The non-linear resistor used in the relay has a voltage-resistance characteristic as shown in Fig. 6. The linear resistor used in the 125 volt relay has a value of 45,000 ohms, while it has a value of 23,000 ohms in the other ranges of the DGF relay.

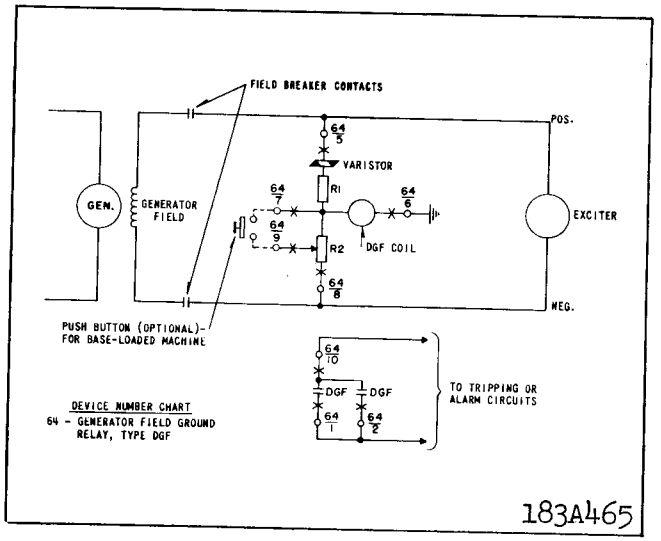
In the 250 volt d-c and 375 volt d-c relay, an additional linear resistor is connected in series with the non-linear resistor to protect the non-linear resistor from overvoltage. This series resistor has a value of 5000 ohms for the 250 volt relay and a value of 10,000 ohms for the 375 volt relay.

The d-c contact-making milliammeter is calibrated to have a zero center. Stationary adjustable contacts may be set to permit the moving contacts to close either to the right or to the left. These contacts will close a circuit carrying one ampere. For larger tripping currents, an auxiliary relay should be used to carry the tripping current. In all cases, an auxiliary contact on the circuit breaker must be provided to open the tripping circuit when the breaker opens.

* The average coil resistance of the contact-making milliammeter at 25° C is 90 ohms. A 1500% overload (22 milliamperes) can be applied continuously to this unit without causing damage.

SETTINGS

The type DGF relay can be set in a range of plus or minus 0.75 milliamperes. By setting the adjustable contacts at a value marked on the scale of d-c contact making milliammeter, the DGF will close its contacts when the current through the milliammeter unit reaches this value. The recommended setting is within .15 milliampere.



* *Fig. 4. External Schematic of the Type DGF Relay.*

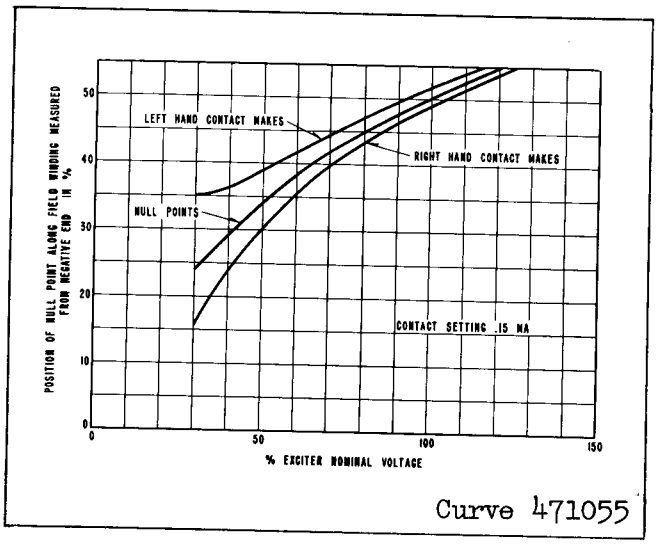


Fig. 5. Null Point Location Characteristic.

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.

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.

Acceptance Tests

The following check is recommended to insure that the relay is in proper working order.

With the stationary contacts of the relay set on .50 milliamperes, apply .50 milliamperes to terminals 6 and 7 of the relay. The moving contact should move to close one of the stationary contacts. Reverse the connection to terminals 6 and 7, the moving contact should move to close the other stationary contact.

* Connect relay in the circuit of Fig. 7. Set the moving contacts on 0.15 milliamperes and apply rated voltage to the relay. Adjust resistor "A" such that the moving contact remains at 0 setting on the scale. Lower d.c. voltage until moving contact makes with the left hand contact. Voltmeter reading should not read less than 90 percent rated voltage.

* Raise d.c. voltage until moving contact makes with the right-hand contact. Voltmeter should not read more than 105 percent of rated voltage.

Routine Maintenance

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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

The core and moving coil assembly should not be removed from the frame casting of the relay unless a

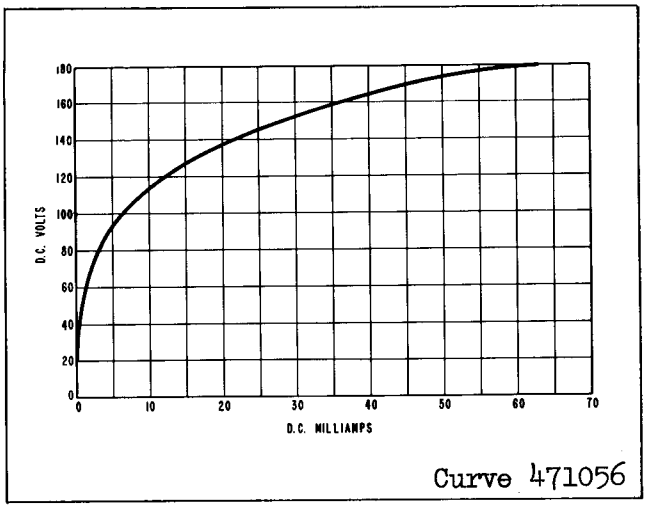
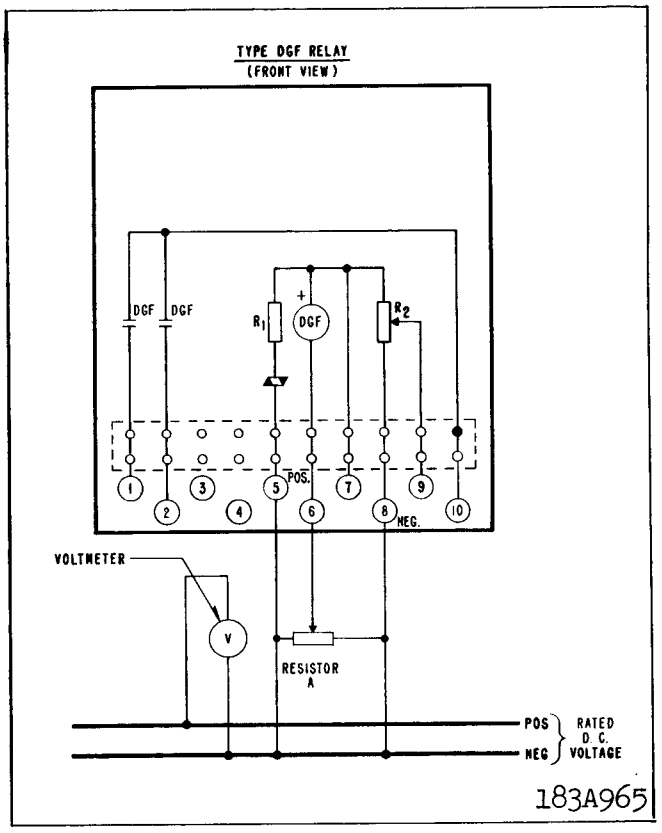


Fig. 6. Typical Voltage Characteristic of Non-Linear Resistor of Type DGF Relay.

keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed. This will prevent possible damaging of the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.



* *Fig. 7. Test Circuit of the Type DGF Relay.*

REPAIRS AND RENEWAL PARTS

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

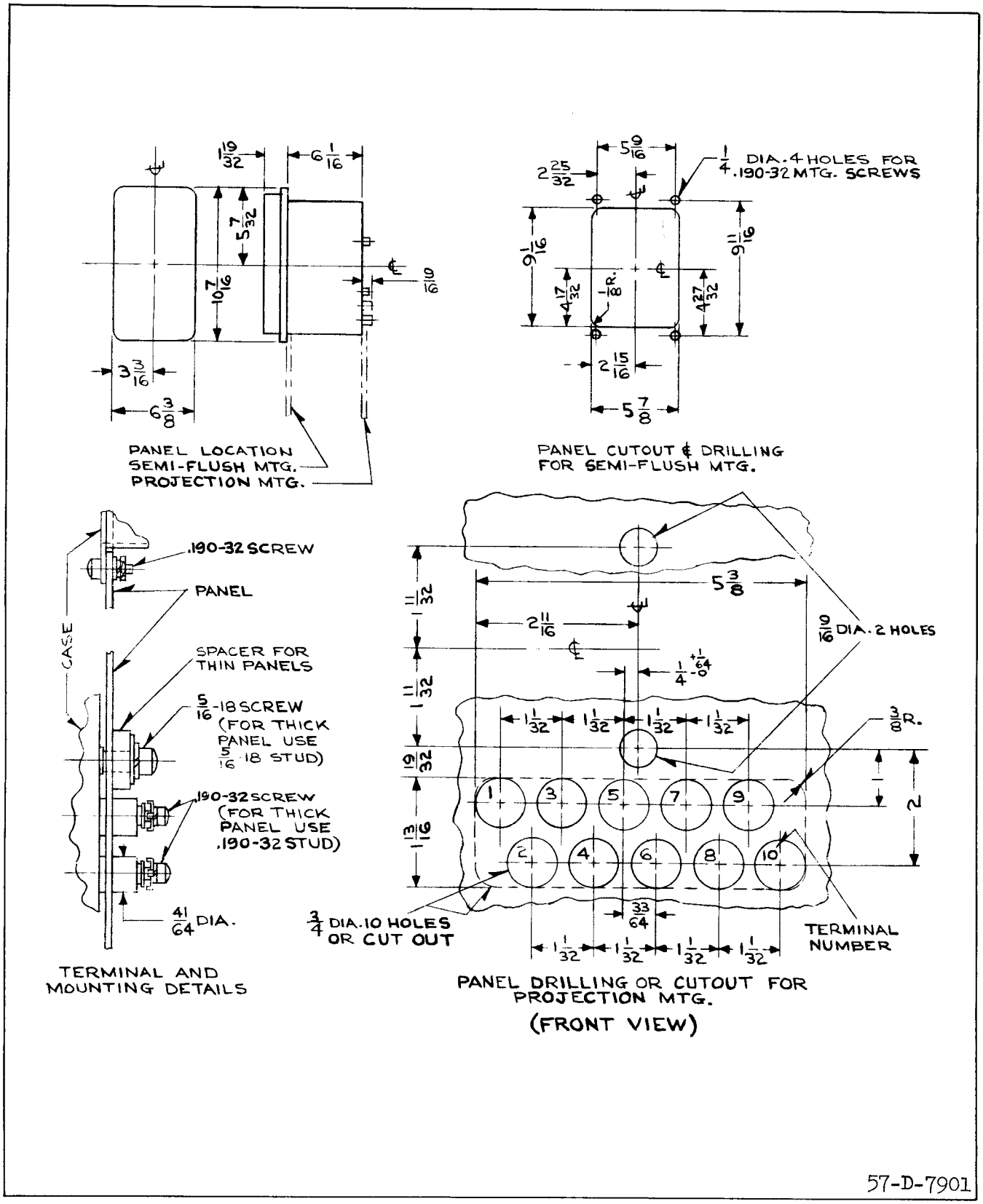


Fig. 8. Outline & Drilling Plan for the DGF Relay in FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
RELAY DEPARTMENT
NEWARK, N. J.
Printed in U. S. A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DGF GENERATOR FIELD RELAY

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

APPLICATION

The type DGF relay is used for generator-field protection. This relay will detect most grounds in the generator field regardless of their location. It provides a means of ground detection without the application of additional voltages. The relay, as does other types of field ground relays, depends upon the conductivity of the oil film of the bearing of the generator for the detection of grounds in the generator.

CONSTRUCTION

As seen in Fig. 1, the type DGF relay consists of a d'Arsonval type d-c contact making milliammeter, a linear resistor, and a non-linear resistor or varistor. These components are connected as shown in the internal schematic of Fig. 2.

The d'Arsonval type d-c contact making milliammeter is shown in Fig. 3. It consists of a cylindrical core, a moving coil to which a contact arm is mounted, two adjustable stationary contacts, and a malleable iron frame casting. The cylindrical core consists of an Alnico permanent magnet, two iron pole pieces and two brass spacer blocks.

Electrical connections to the moving coil are made by means of two spiral springs located at the top of the element. A third spiral spring at the bottom of the element provides an electrical connection to the moving contact.

The lower bearing support of the moving element is a sapphire thrust bearing and a ring guide bearing. A guide bearing is the top support of the moving element.

OPERATION

The relay is applied to the field of a generator as shown in the schematic diagram of Fig. 4. Under normal operating conditions, the supply voltage of the generator field is applied to the series connected linear and non-linear resistors. The junction of these two resistors is connected to ground through the d'Arsonval d-c contact making milliammeter. At rated supply voltage, the junction point of the resistors is at the approximate midpoint of the d-c supply. This means that approximately one-half of the field supply voltage is impressed between the junction of the two resistors and the positive side of the supply voltage. The other half of the supply voltage is impressed from the junction point to the negative side of the supply voltage.

When a ground appears in the generator field, the d-c milliammeter unit of the DGF relay is connected to the generator field through the ground. Thus, a bridge is formed which has as its outer legs the non-linear resistor, the linear resistor and the field windings. The d-c contact-making milliammeter forms the center of the bridge. If the ground is not at the null point of the generator field and if the supply voltage is maintained, current will flow in the contact-making milliammeter of the relay, and it will close its contacts.

If the ground is at the null point of the generator and the supply voltage is normal, the voltage applied to the non-linear resistor will not change. As a result, its resistance will not change, and the bridge will not become unbalanced. No current will flow into the contact-making milliammeter, and its contacts will not close. The supply voltage will have to be either raised or lowered before the relay contacts will close.

SUPERSEDES I.L. 41-747B AND I.L. 41-747.1
*Denotes Change from superseded issue.

EFFECTIVE APRIL 1966

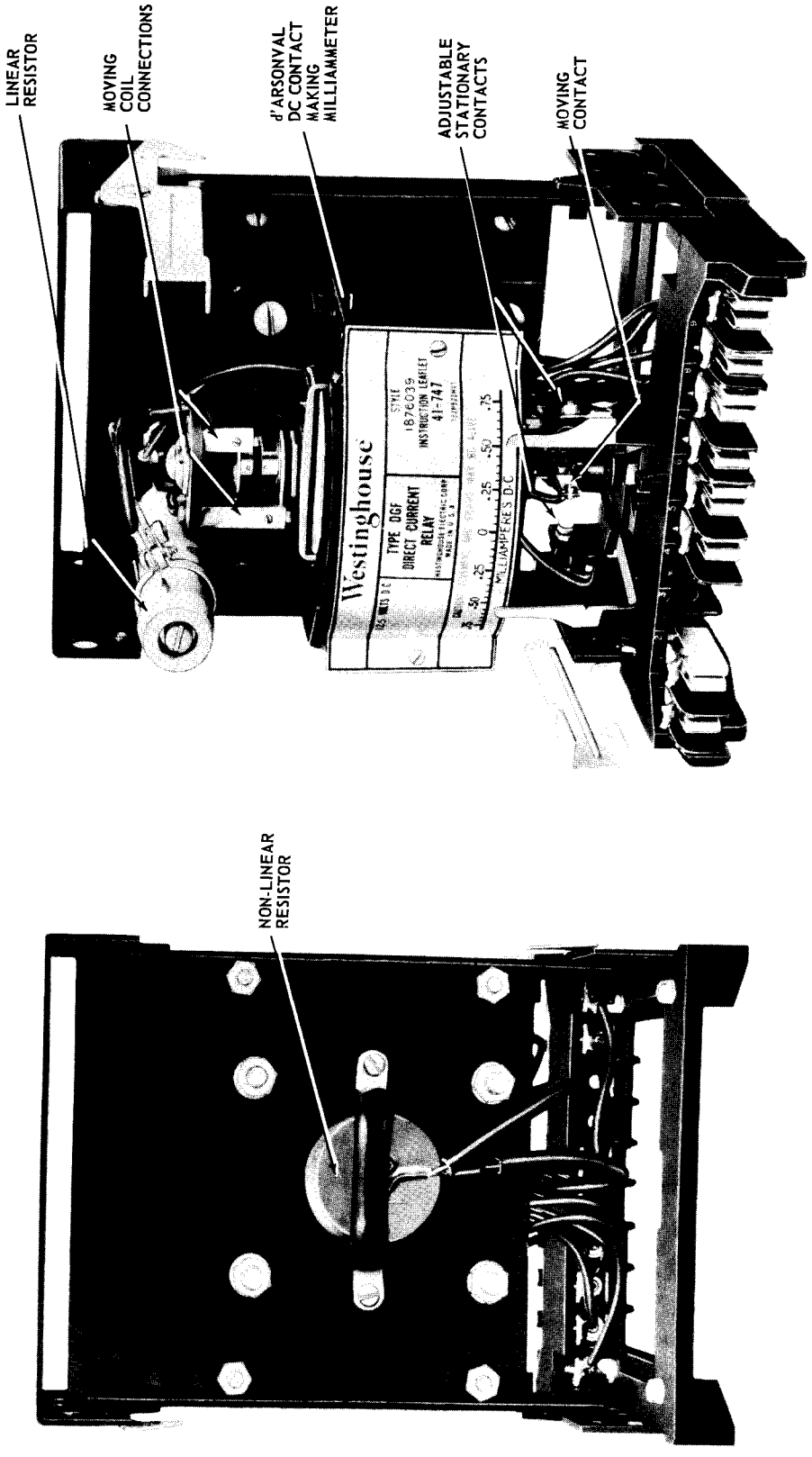
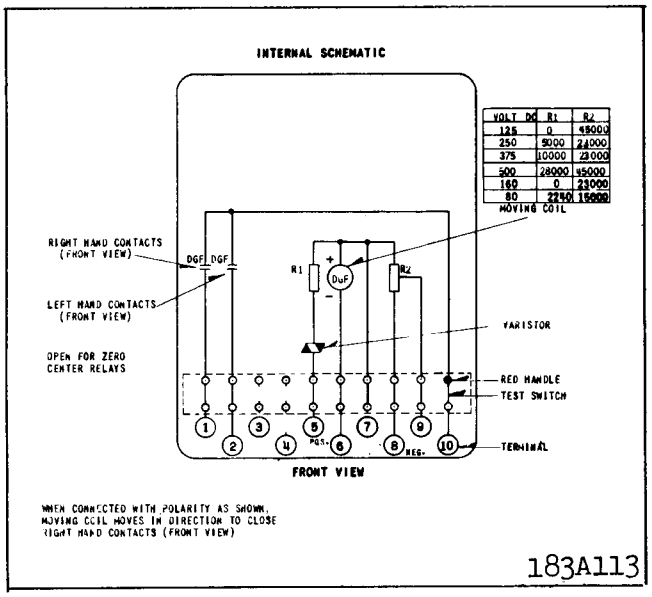


Fig. 1. Type DGF Relay without Case.



* *Fig. 2. Internal Schematic of the Type DGF Relay in the FT21 Case.*

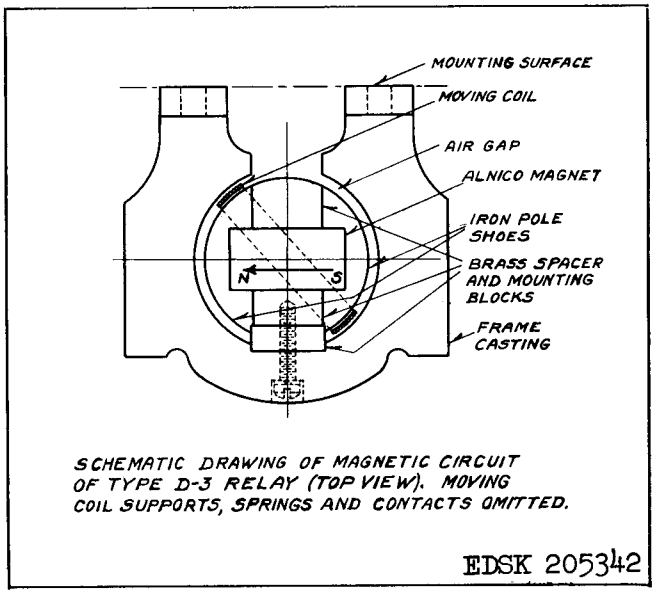


Fig. 3. Magnetic Circuit of d'Arsonval Type dc Contact Making Milliammeter.

The center curve of Figure 5 shows null points position in a grounded generator field for different values of supply voltage. The outer curves of Figure 5 show the amount that the supply voltage must be either raised or lowered before the relay contacts will close for a ground at one of these null points.

A center tap is provided on the linear resistor so that a part of the resistor can be shorted out. By periodically shorting out this resistor by means of a push-button, the DGF will detect grounds at the null points if they exist. In such a case, the bridge is unbalanced by changing the linear resistor, and current will flow into the contact-making milliammeter if a ground exists at the null point.

CHARACTERISTICS

The type DGF relay is generally available for the following field supply voltages:

* 80 volts d-c
125 volts d-c
160 volts d-c
250 volts d-c
375 volts d-c
500 volts d-c

The non-linear resistor used in the relay has a voltage-resistance characteristic as shown in Fig. 6.

* In the 250 volt d-c, 375 volt d-c and 500 volt relay, an additional linear resistor is connected in series with the non-linear resistor to protect the non-linear resistor from overvoltage. (See Fig. 2). The 80 VDC relay has a different varistor (See Fig. 8).

The d-c contact-making milliammeter is calibrated to have a zero center. Stationary adjustable contacts may be set to permit the moving contacts to close either to the right or to the left. These contacts will close a circuit carrying one ampere. For larger tripping currents, an auxiliary relay should be used to carry the tripping current. In all cases, an auxiliary contact on the circuit breaker must be provided to open the tripping circuit when the breaker opens.

* The average coil resistance of the contact-making milliammeter at 25° C is 90 ohms. An overload of 22 milliamperes can be applied continuously to this unit without causing damage.

SETTINGS

The type DGF relay can be set in a range of plus or minus 0.75 milliamperes. By setting the adjustable contacts at a value marked on the scale of d-c contact making milliammeter, the DGF will close its contacts when the current through the milliammeter unit reaches this value. The recommended setting is within .15 milliampere.

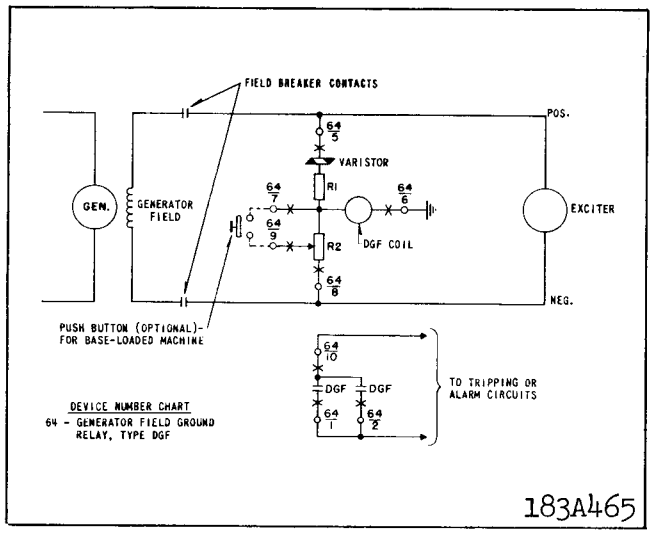


Fig. 4. External Schematic of the Type DGF Relay.

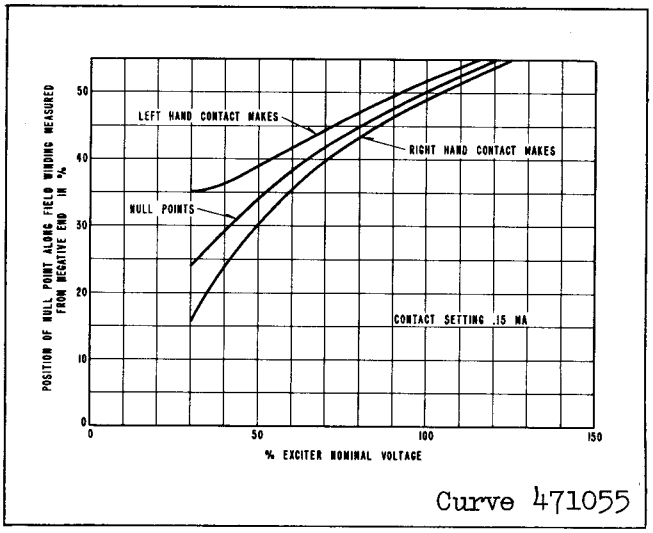


Fig. 5. Null Point Location Characteristic.

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.

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.

Acceptance Tests

The following check is recommended to insure that the relay is in proper working order.

With the stationary contacts of the relay set on .50 milliamperes, apply .50 milliamperes to terminals 6 and 7 of the relay. The moving contact should move to close one of the stationary contacts. Reverse the connection to terminals 6 and 7, the moving contact should move to close the other stationary contact.

Connect relay in the circuit of Fig. 7. Set the moving contacts on 0.15 milliamperes and apply rated voltage to the relay. Adjust resistor "A" such that the moving contact remains at 0 setting on the scale. Lower d.c. voltage until moving contact makes with the left hand contact. Voltmeter reading should not read less than 90 percent rated voltage.

Raise d.c. voltage until moving contact makes with the right-hand contact. Voltmeter should not read more than 105 percent of rated voltage.

Routine Maintenance

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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

The core and moving coil assembly should not be removed from the frame casting of the relay unless a

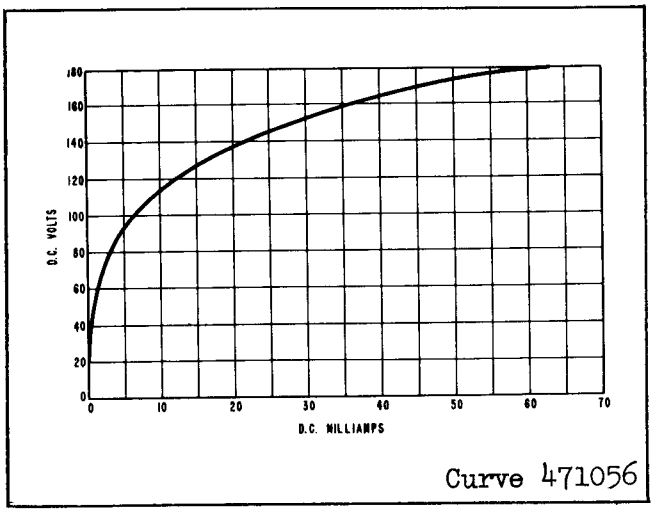
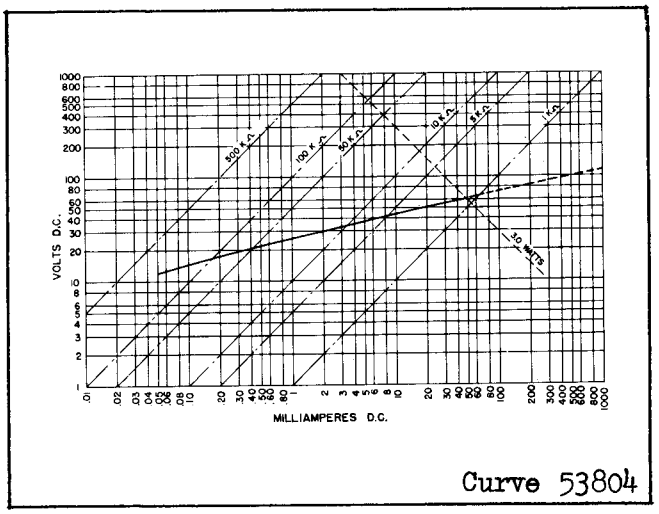


Fig. 6. Typical Voltage Characteristic of Non-Linear Resistor of Type DGF Relay.



** Fig 7. Typical Voltage Characteristic of Non-Linear Resistor of the 80 Volt d-c DGF Relay.*

keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed. This will prevent possible damaging of the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.

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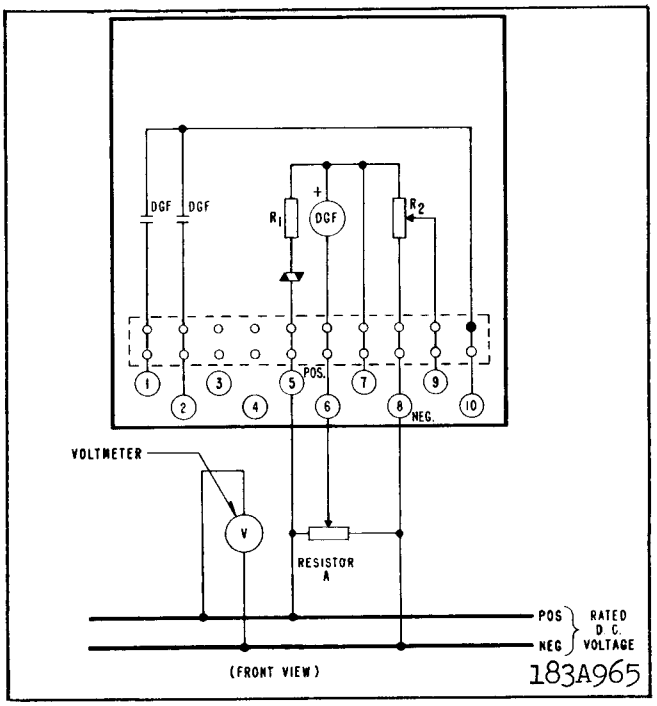
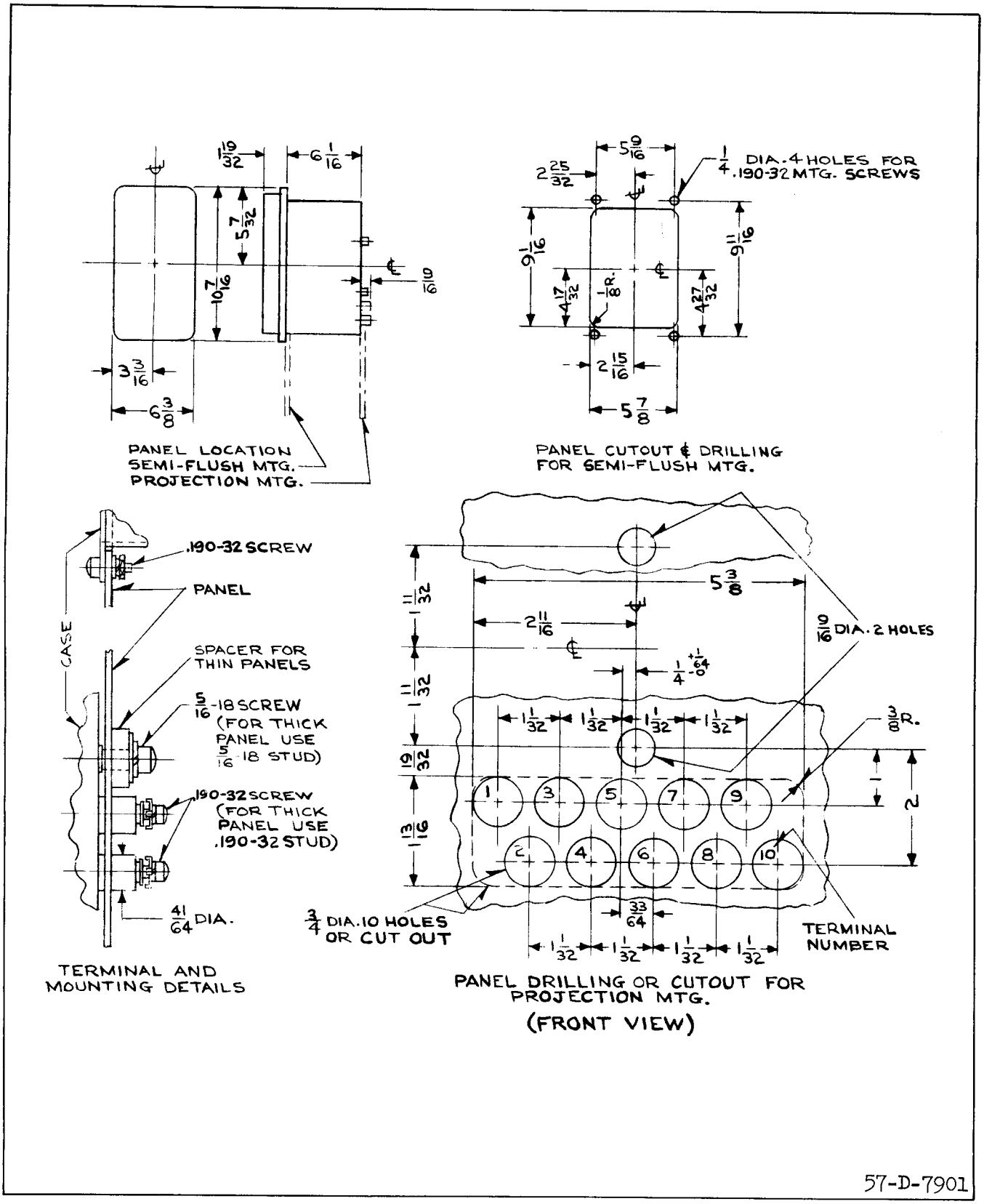
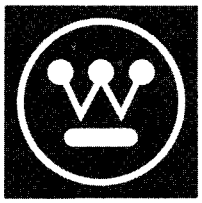


** Fig. 8. Test Circuit of the Type DGF Relay.*



* *Fig. 9. Outline & Drilling Plan for the DGF Relay in FT21 Case.*



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DGF GENERATOR FIELD RELAY

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Electrical connections to the moving coil are made by means of two spiral springs located at the top of the element. A third spiral spring at the bottom of the element provides an electrical connection to the moving contact.

The lower bearing support of the moving element is a sapphire thrust bearing and a ring guide bearing. A guide bearing is the top support of the moving element.

OPERATION

The relay is applied to the field of a generator as shown in the schematic diagram of Fig. 4. Under normal operating conditions, the supply voltage of the generator field is applied to the series connected linear and non-linear resistors. The junction of these two resistors is connected to ground through the d'Arsonval d-c contact making milliammeter. At rated supply voltage, the junction point of the resistors is at the approximate midpoint of the d-c supply. This means that approximately one-half of the field supply voltage is impressed between the junction of the two resistors and the positive side of the supply voltage. The other half of the supply voltage is impressed from the junction point to the negative side of the supply voltage.

When a ground appears in the generator field, the d-c milliammeter unit of the DGF relay is connected to the generator field through the ground. Thus, a bridge is formed which has as its outer legs the non-linear resistor, the linear resistor and the field windings. The d-c contact-making milliammeter forms the center of the bridge. If the ground is not at the null point of the generator field and if the supply voltage is maintained, current will flow in the contact-making milliammeter of the relay, and it will close its contacts.

If the ground is at the null point of the generator and the supply voltage is normal, the voltage applied to the non-linear resistor will not change. As a result, its resistance will not change, and the bridge will not become unbalanced. No current will flow into the contact-making milliammeter, and its contacts will not close. The supply voltage will have to be either raised or lowered before the relay contacts will close.

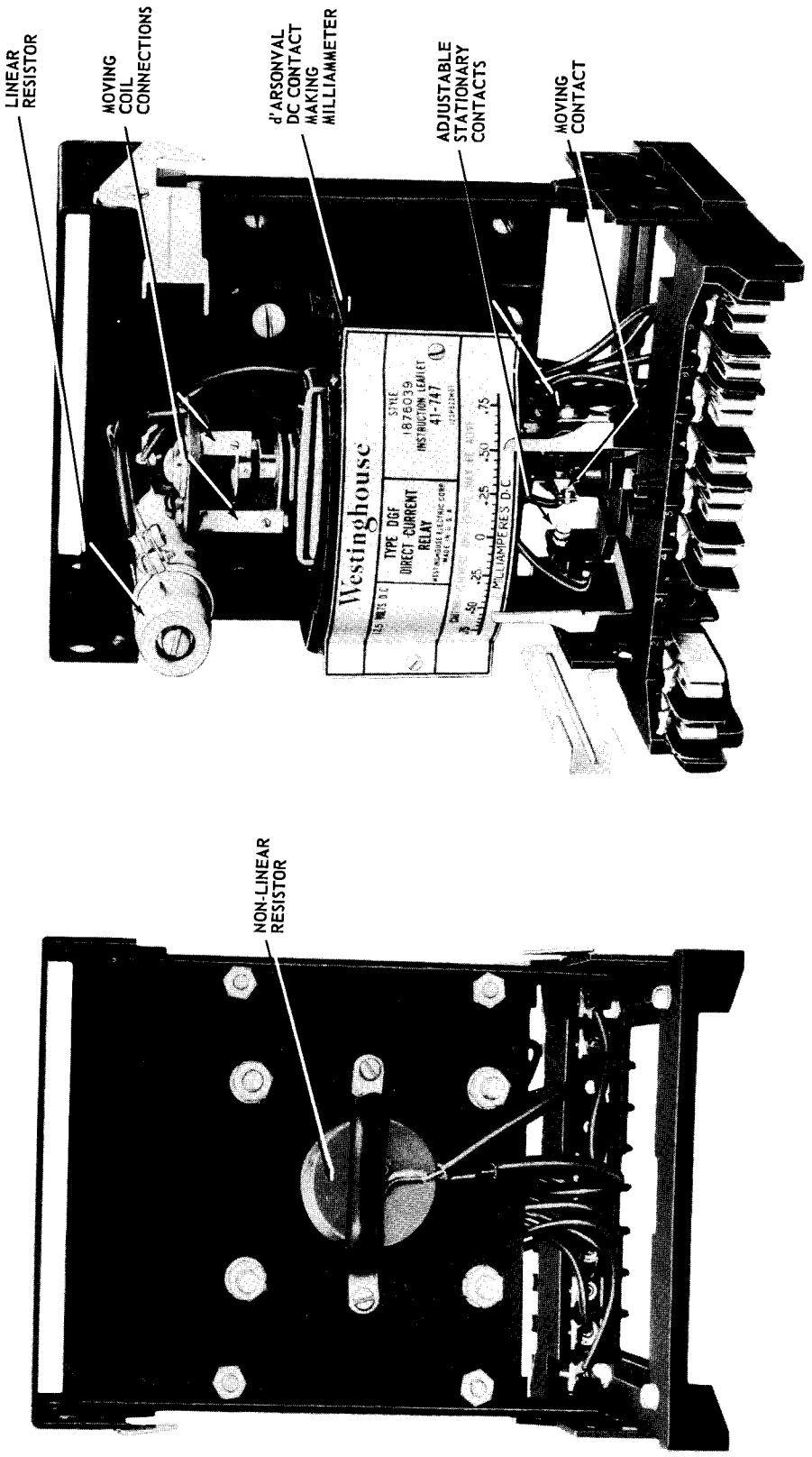


Fig. 1. Type DGF Relay without Case.

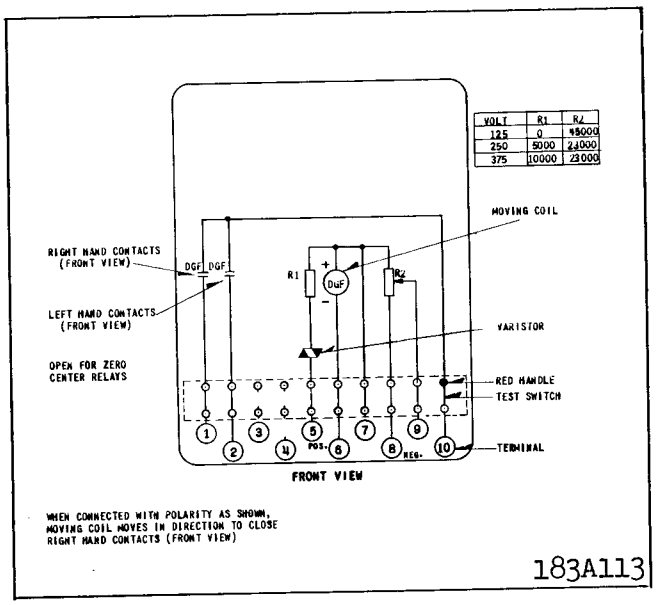


Fig. 2. Internal Schematic of the Type DGF Relay in the FT21 Case.

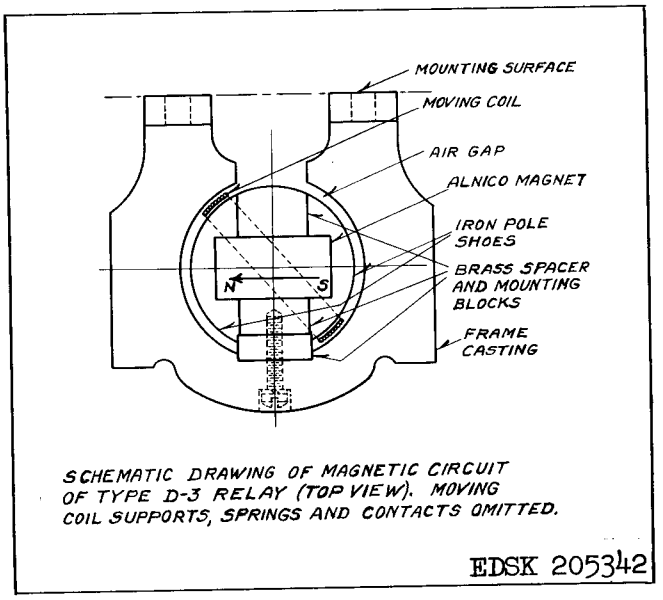


Fig. 3. Magnetic Circuit of d'Arsonval Type dc Contact Making Milliammeter.

The center curve of Figure 5 shows null points position in a grounded generator field for different values of supply voltage. The outer curves of Figure 5 show the amount that the supply voltage must be either raised or lowered before the relay contacts will close for a ground at one of these null points.

A center tap is provided on the linear resistor so that a part of the resistor can be shorted out. By periodically shorting out this resistor by means of a push-button, the DGF will detect grounds at the null points if they exist. In such a case, the bridge is unbalanced by changing the linear resistor, and current will flow into the contact-making milliammeter if a ground exists at the null point.

CHARACTERISTICS

The type DGF relay is generally available for the following field supply voltages:

125 volts d-c
250 volts d-c
375 volts d-c

The non-linear resistor used in the relay has a voltage-resistance characteristic as shown in Fig. 6. The linear resistor used in the 125 volt relay has a value of 45,000 ohms, while it has a value of 23,000 ohms in the other ranges of the DGF relay.

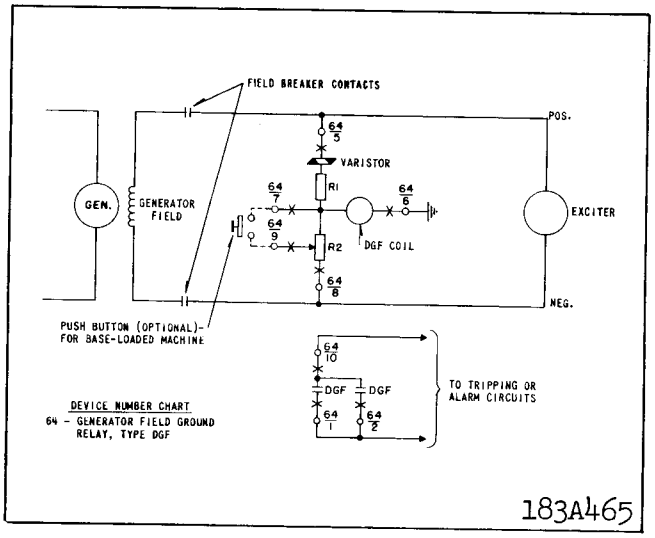
In the 250 volt d-c and 375 volt d-c relay, an additional linear resistor is connected in series with the non-linear resistor to protect the non-linear resistor from overvoltage. This series resistor has a value of 5000 ohms for the 250 volt relay and a value of 10,000 ohms for the 375 volt relay.

The d-c contact-making milliammeter is calibrated to have a zero center. Stationary adjustable contacts may be set to permit the moving contacts to close either to the right or to the left. These contacts will close a circuit carrying one ampere. For larger tripping currents, an auxiliary relay should be used to carry the tripping current. In all cases, an auxiliary contact on the circuit breaker must be provided to open the tripping circuit when the breaker opens.

* The average coil resistance of the contact-making milliammeter at 25° C is 90 ohms. A 1500% overload (22 milliamperes) can be applied continuously to this unit without causing damage.

SETTINGS

The type DGF relay can be set in a range of plus or minus 0.75 milliamperes. By setting the adjustable contacts at a value marked on the scale of d-c contact making milliammeter, the DGF will close its contacts when the current through the milliammeter unit reaches this value. The recommended setting is within .15 milliampere.



* *Fig. 4. External Schematic of the Type DGF Relay.*

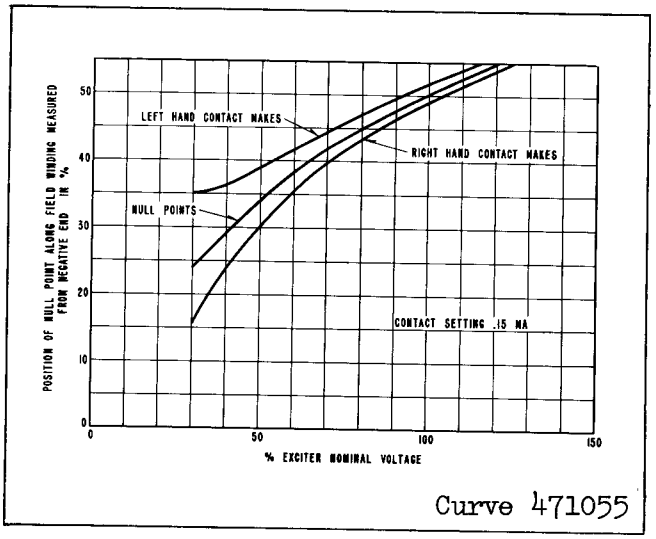


Fig. 5. Null Point Location Characteristic.

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.

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.

Acceptance Tests

The following check is recommended to insure that the relay is in proper working order.

With the stationary contacts of the relay set on .50 milliamperes, apply .50 milliamperes to terminals 6 and 7 of the relay. The moving contact should move to close one of the stationary contacts. Reverse the connection to terminals 6 and 7, the moving contact should move to close the other stationary contact.

* Connect relay in the circuit of Fig. 7. Set the moving contacts on 0.15 milliamperes and apply rated voltage to the relay. Adjust resistor "A" such that the moving contact remains at 0 setting on the scale. Lower d.c. voltage until moving contact makes with the left hand contact. Voltmeter reading should not read less than 90 percent rated voltage.

* Raise d.c. voltage until moving contact makes with the right-hand contact. Voltmeter should not read more than 105 percent of rated voltage.

Routine Maintenance

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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

The core and moving coil assembly should not be removed from the frame casting of the relay unless a

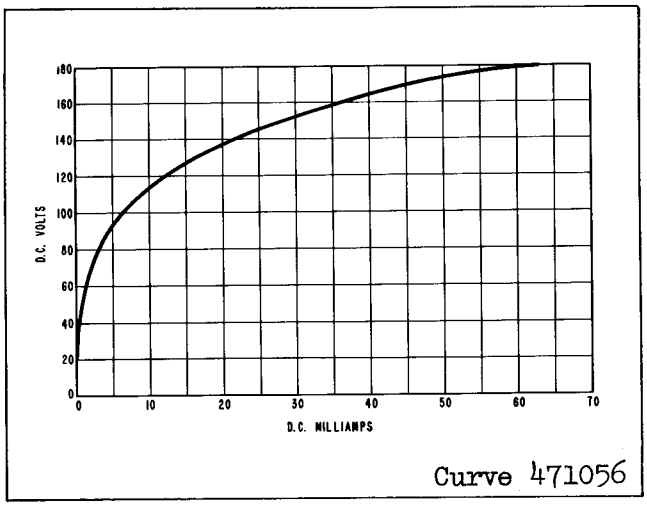
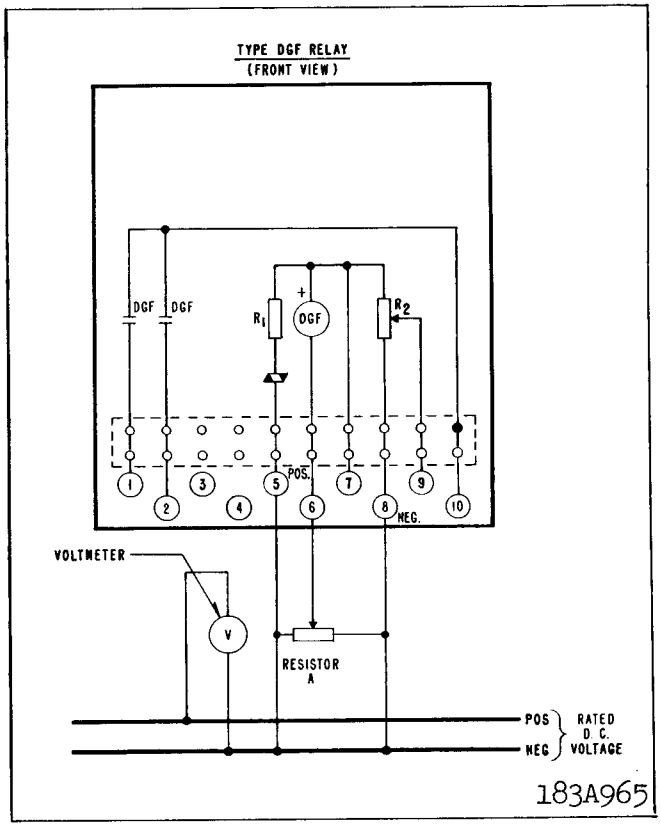


Fig. 6. Typical Voltage Characteristic of Non-Linear Resistor of Type DGF Relay.

keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed. This will prevent possible damaging of the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.



* *Fig. 7. Test Circuit of the Type DGF Relay.*

REPAIRS AND RENEWAL PARTS

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

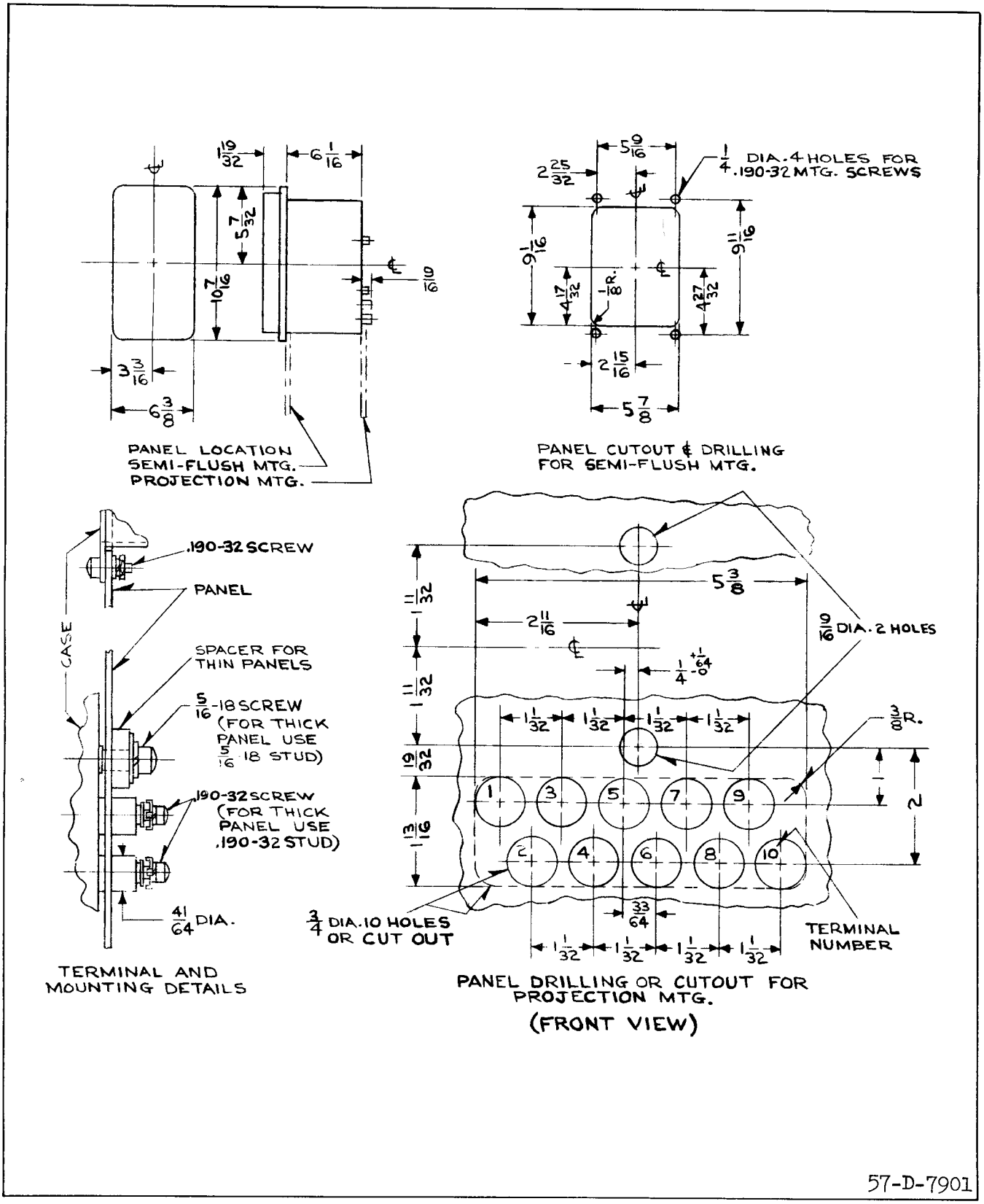


Fig. 8. Outline & Drilling Plan for the DGF Relay in FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
RELAY DEPARTMENT
NEWARK, N. J.
Printed in U. S. A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DGF GENERATOR FIELD RELAY

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

APPLICATION

The type DGF relay is used for generator-field protection. This relay will detect most grounds in the generator field regardless of their location. It provides a means of ground detection without the application of additional voltages. The relay, as does other types of field ground relays, depends upon the conductivity of the oil film of the bearing of the generator for the detection of grounds in the generator.

CONSTRUCTION

As seen in Fig. 1, the type DGF relay consists of a d'Arsonval type d-c contact making milliammeter, a linear resistor, and a non-linear resistor or varistor. These components are connected as shown in the internal schematic of Fig. 2.

The d'Arsonval type d-c contact making milliammeter is shown in Fig. 3. It consists of a cylindrical core, a moving coil to which a contact arm is mounted, two adjustable stationary contacts, and a malleable iron frame casting. The cylindrical core consists of an Alnico permanent magnet, two iron pole pieces and two brass spacer blocks.

Electrical connections to the moving coil are made by means of two spiral springs located at the top of the element. A third spiral spring at the bottom of the element provides an electrical connection to the moving contact.

The lower bearing support of the moving element is a sapphire thrust bearing and a ring guide bearing. A guide bearing is the top support of the moving element.

OPERATION

The relay is applied to the field of a generator as shown in the schematic diagram of Fig. 4. Under normal operating conditions, the supply voltage of the generator field is applied to the series connected linear and non-linear resistors. The junction of these two resistors is connected to ground through the d'Arsonval d-c contact making milliammeter. At rated supply voltage, the junction point of the resistors is at the approximate midpoint of the d-c supply. This means that approximately one-half of the field supply voltage is impressed between the junction of the two resistors and the positive side of the supply voltage. The other half of the supply voltage is impressed from the junction point to the negative side of the supply voltage.

When a ground appears in the generator field, the d-c milliammeter unit of the DGF relay is connected to the generator field through the ground. Thus, a bridge is formed which has as its outer legs the non-linear resistor, the linear resistor and the field windings. The d-c contact-making milliammeter forms the center of the bridge. If the ground is not at the null point of the generator field and if the supply voltage is maintained, current will flow in the contact-making milliammeter of the relay, and it will close its contacts.

If the ground is at the null point of the generator and the supply voltage is normal, the voltage applied to the non-linear resistor will not change. As a result, its resistance will not change, and the bridge will not become unbalanced. No current will flow into the contact-making milliammeter, and its contacts will not close. The supply voltage will have to be either raised or lowered before the relay contacts will close.

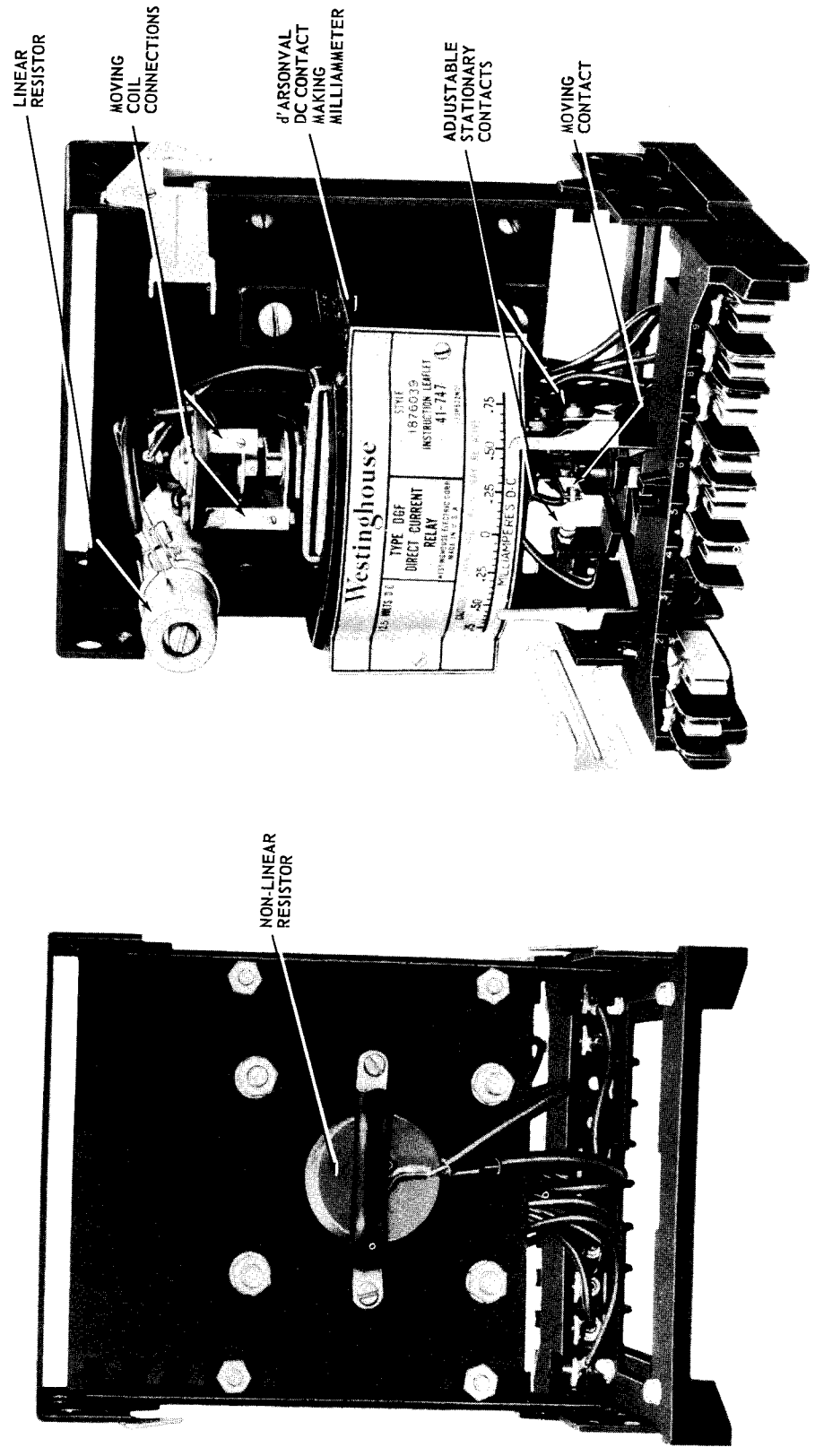


Fig. 1. Type DGF Relay without Case.

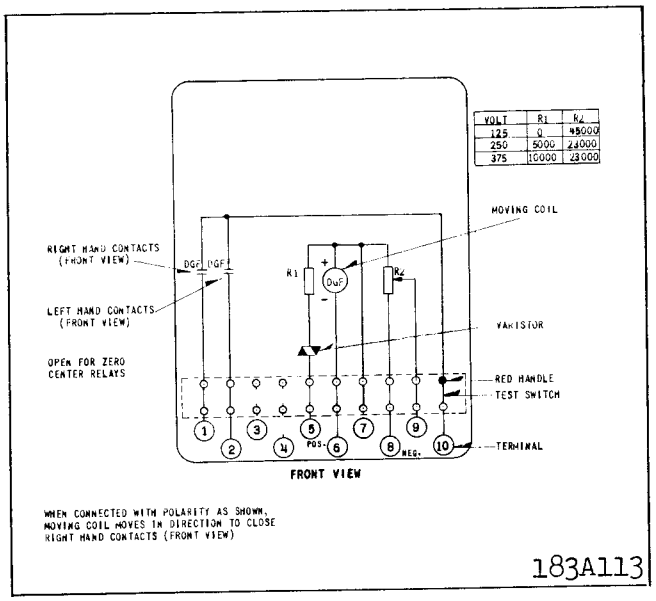


Fig. 2. Internal Schematic of the Type DGF Relay in the FT21 Case.

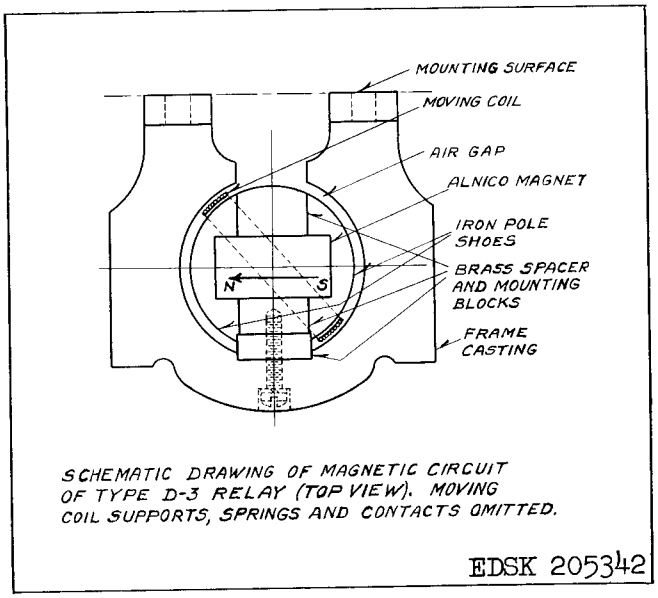


Fig. 3. Magnetic Circuit of d'Arsonval Type dc Contact Making Milliammeter.

The center curve of Figure 5 shows null points position in a grounded generator field for different values of supply voltage. The outer curves of Figure 5 show the amount that the supply voltage must be either raised or lowered before the relay contacts will close for a ground at one of these null points.

A center tap is provided on the linear resistor so that a part of the resistor can be shorted out. By periodically shorting out this resistor by means of a push-button, the DGF will detect grounds at the null points if they exist. In such a case, the bridge is unbalanced by changing the linear resistor, and current will flow into the contact-making milliammeter if a ground exists at the null point.

CHARACTERISTICS

The type DGF relay is generally available for the following field supply voltages:

125 volts d-c
250 volts d-c
375 volts d-c

The non-linear resistor used in the relay has a voltage-resistance characteristic as shown in Fig. 6. The linear resistor used in the 125 volt relay has a value of 45,000 ohms, while it has a value of 23,000 ohms in the other ranges of the DGF relay.

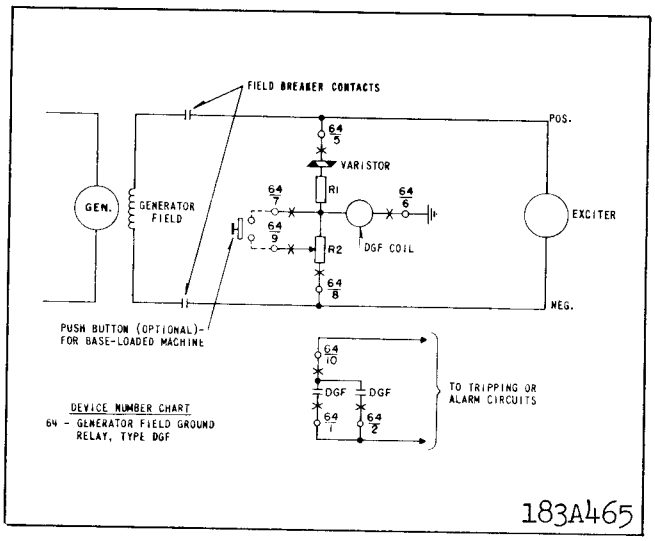
In the 250 volt d-c and 375 volt d-c relay, an additional linear resistor is connected in series with the non-linear resistor to protect the non-linear resistor from overvoltage. This series resistor has a value of 5000 ohms for the 250 volt relay and a value of 10,000 ohms for the 375 volt relay.

The d-c contact-making milliammeter is calibrated to have a zero center. Stationary adjustable contacts may be set to permit the moving contacts to close either to the right or to the left. These contacts will close a circuit carrying one ampere. For larger tripping currents, an auxiliary relay should be used to carry the tripping current. In all cases, an auxiliary contact on the circuit breaker must be provided to open the tripping circuit when the breaker opens.

* The average coil resistance of the contact-making milliammeter at 25°C is 90 ohms. A 150% overload (22 milliamperes) can be applied continuously to this unit without causing damage.

SETTINGS

The type DGF relay can be set in a range of plus or minus 0.75 milliamperes. By setting the adjustable contacts at a value marked on the scale of d-c contact making milliammeter, the DGF will close its contacts when the current through the milliammeter unit reaches this value. The recommended setting is within .15 milliampere.



* *Fig. 4. External Schematic of the Type DGF Relay.*

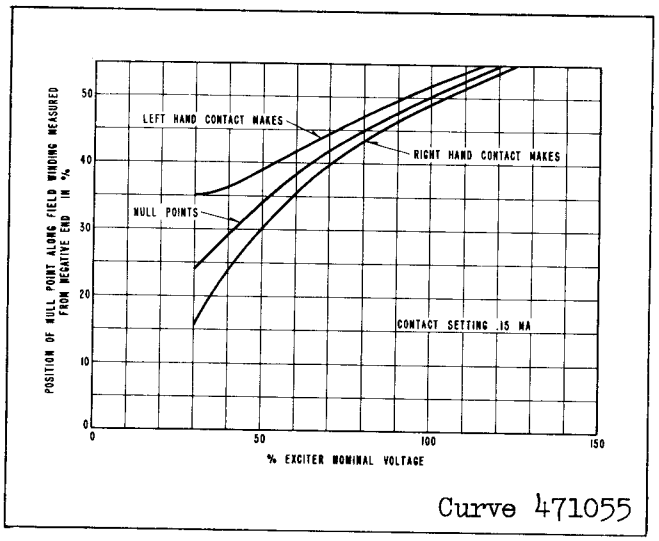


Fig. 5. Null Point Location Characteristic.

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.

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.

Acceptance Tests

The following check is recommended to insure that the relay is in proper working order.

With the stationary contacts of the relay set on .50 milliamperes, apply .50 milliamperes to terminals 6 and 7 of the relay. The moving contact should move to close one of the stationary contacts. Reverse the connection to terminals 6 and 7, the moving contact should move to close the other stationary contact.

Connect relay in the circuit of Fig. 7. Set the moving contacts on 0.15 milliamperes and apply rated voltage to resistor "B". Adjust resistor "A" such that the moving contact remains at 0 setting on the scale. Adjust resistor "B" until moving contact makes with the left hand contact. Voltmeter reading should not read less than 90 percent rated voltage.

Adjust resistor "B" until moving contact makes with the right-hand contact. Voltmeter should not read more than 105 percent of rated voltage.

Routine Maintenance

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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

The core and moving coil assembly should not be removed from the frame casting of the relay unless a

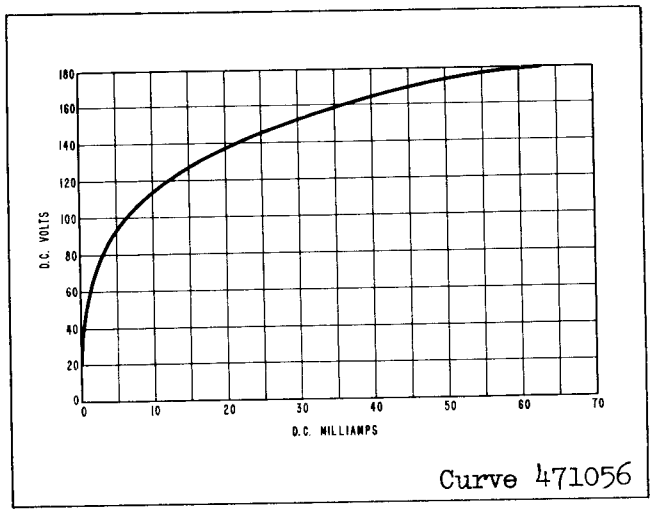


Fig. 6. Typical Voltage Characteristic of Non-Linear Resistor of Type DGF Relay.

keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed. This will prevent possible damaging of the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.

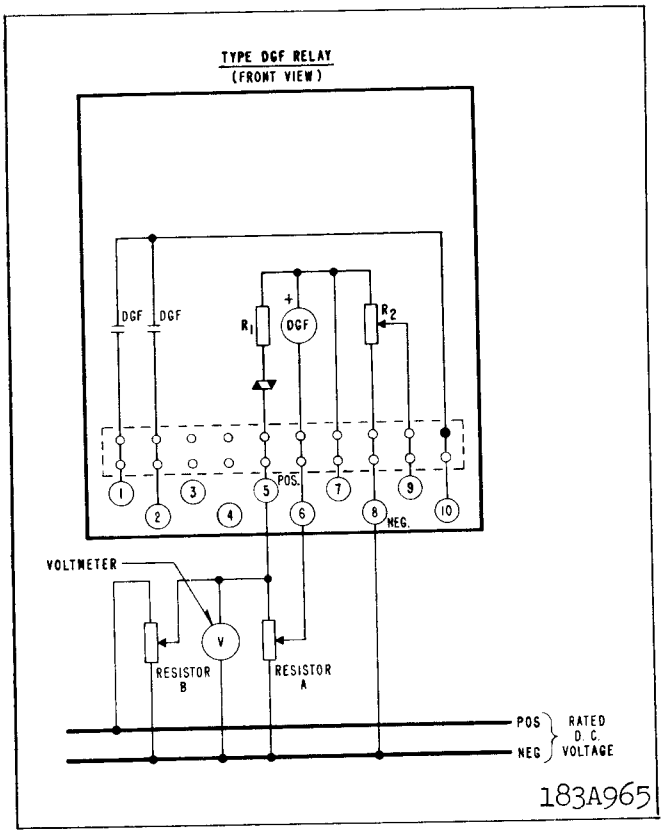


Fig. 7. Test Circuit of the Type DGF Relay.

REPAIRS AND RENEWAL PARTS

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

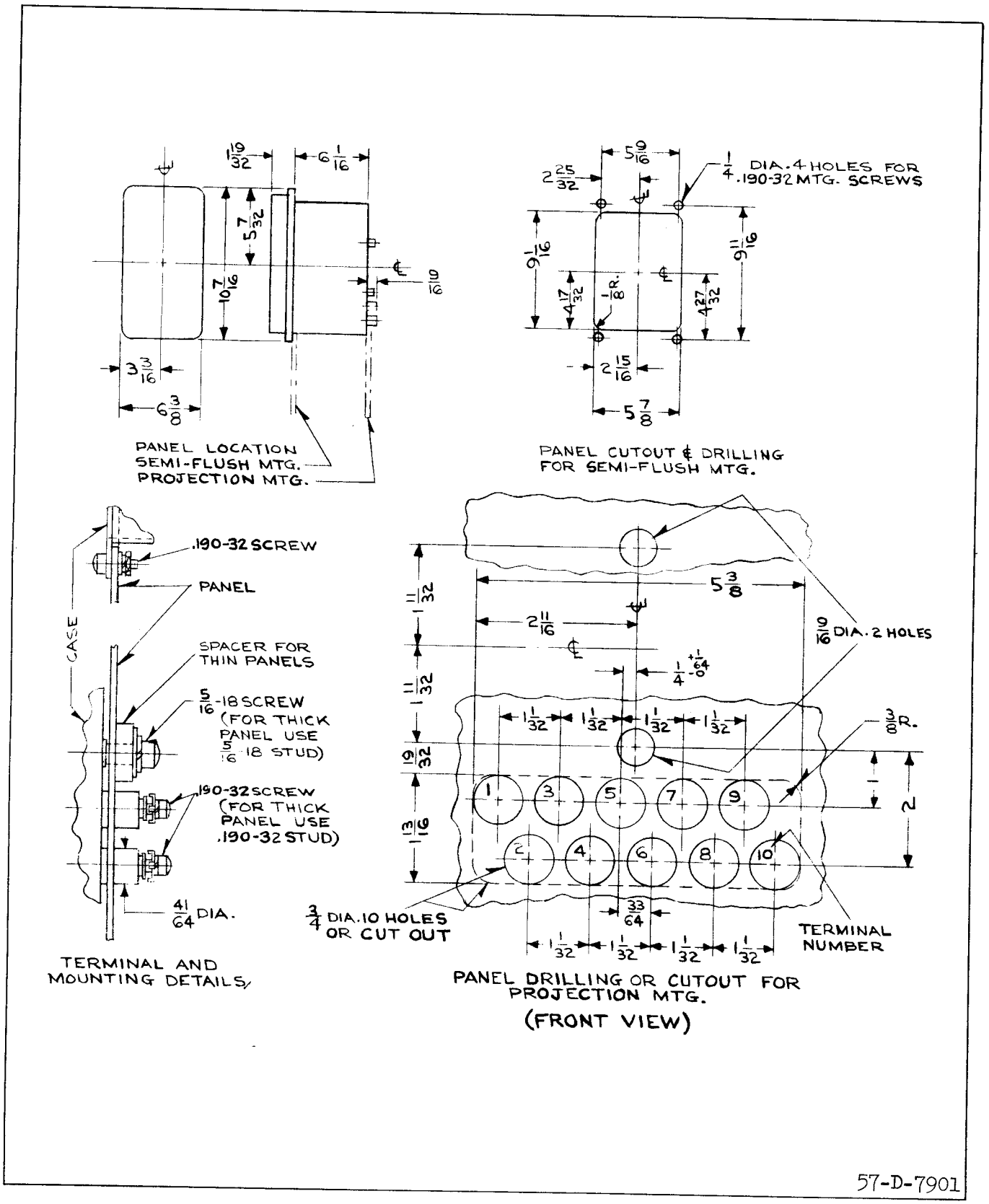


Fig. 8. Outline & Drilling Plan for the DGF Relay in FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
METER DIVISION • **NEWARK, N.J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DGF GENERATOR FIELD RELAY

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

APPLICATION

The type DGF relay is used for generator-field protection. This relay will detect most grounds in the generator field regardless of their location. It provides a means of ground detection without the application of additional voltages. The relay, as does other types of field ground relays, depends upon the conductivity of the oil film of the bearing of the generator for the detection of grounds in the generator.

CONSTRUCTION

As seen in Fig. 1, the type DGF relay consists of a d'Arsonval type d-c contact making milliammeter, a linear resistor, and a non-linear resistor or varistor. These components are connected as shown in the internal schematic of Fig. 2.

The d'Arsonval type d-c contact making milliammeter is shown in Fig. 3. It consists of a cylindrical core, a moving coil to which a contact arm is mounted, two adjustable stationary contacts, and a malleable iron frame casting. The cylindrical core consists of an Alnico permanent magnet, two iron pole pieces and two brass spacer blocks.

Electrical connections to the moving coil are made by means of two spiral springs located at the top of the element. A third spiral spring at the bottom of the element provides an electrical connection to the moving contact.

The lower bearing support of the moving element is a sapphire thrust bearing and a ring guide bearing. A guide bearing is the top support of the moving element.

OPERATION

The relay is applied to the field of a generator as shown in the schematic diagram of Fig. 4. Under normal operating conditions, the supply voltage of the generator field is applied to the series connected linear and non-linear resistors. The junction of these two resistors is connected to ground through the d'Arsonval d-c contact making milliammeter. At rated supply voltage, the junction point of the resistors is at the approximate midpoint of the d-c supply. This means that approximately one-half of the field supply voltage is impressed between the junction of the two resistors and the positive side of the supply voltage. The other half of the supply voltage is impressed from the junction point to the negative side of the supply voltage.

When a ground appears in the generator field, the d-c milliammeter unit of the DGF relay is connected to the generator field through the ground. Thus, a bridge is formed which has as its outer legs the non-linear resistor, the linear resistor and the field windings. The d-c contact making milliammeter forms the center of the bridge.

If the ground is not at the center of the generator field and if the supply voltage is maintained, the voltage across the non-linear resistor will change. This change in voltage will cause a change in the resistance of the non-linear resistor and the bridge will become unbalanced. As a result, current will flow in the contact making milliammeter of the relay, and it will close its contacts.

If the ground is at the center of the generator and the supply voltage is normal, the voltage applied to the non-linear resistor will not change. As a result, its resistance will not change, and the bridge will not become unbalanced. No current will flow into the contact-making milliammeter, and its contacts will not close. Under such a condition, the DGF relay has seen a null point. The supply voltage will have to be either raised or lowered before the relay contacts will close.

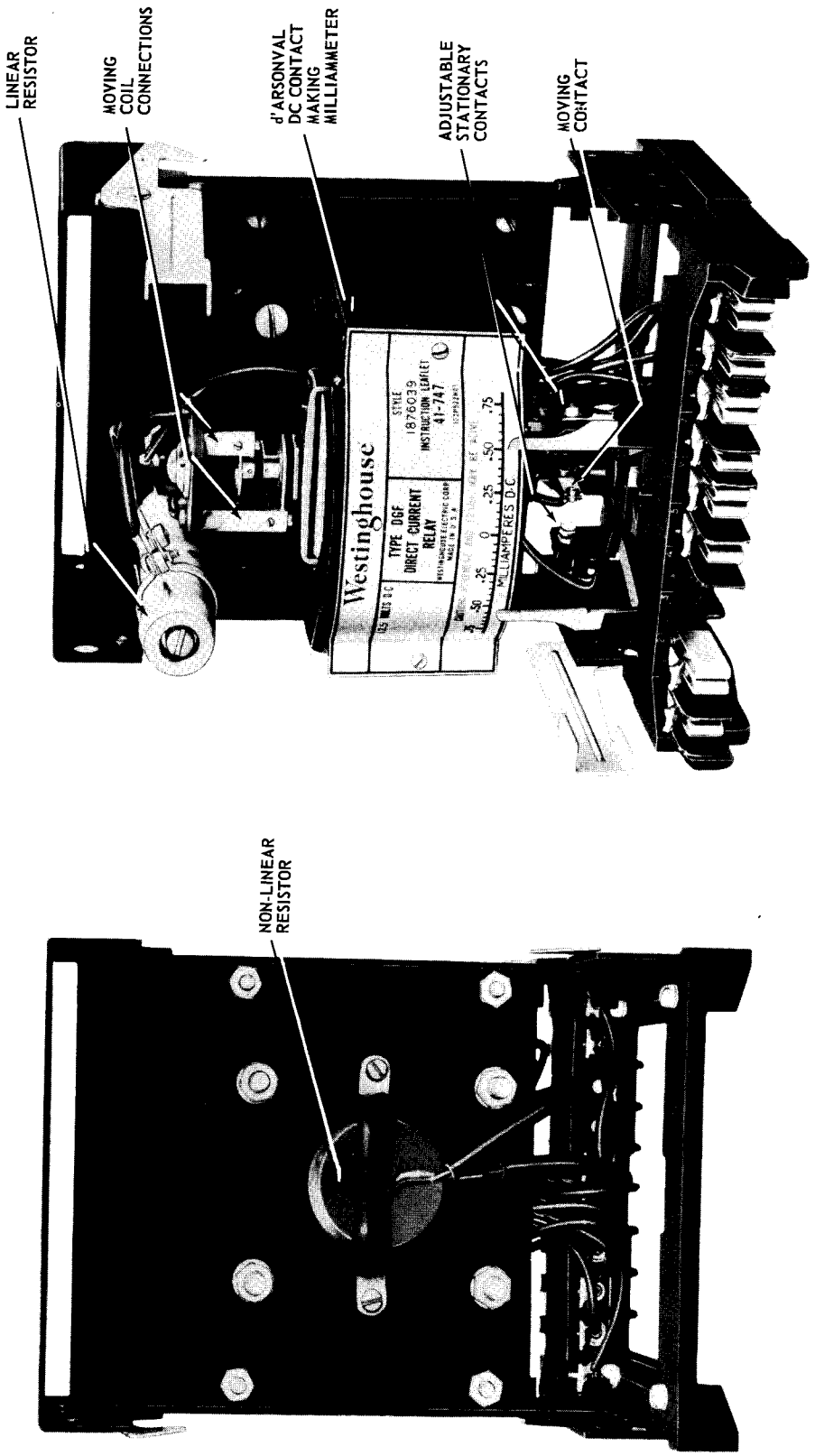


Fig. 1. Type DGF Relay without Case.

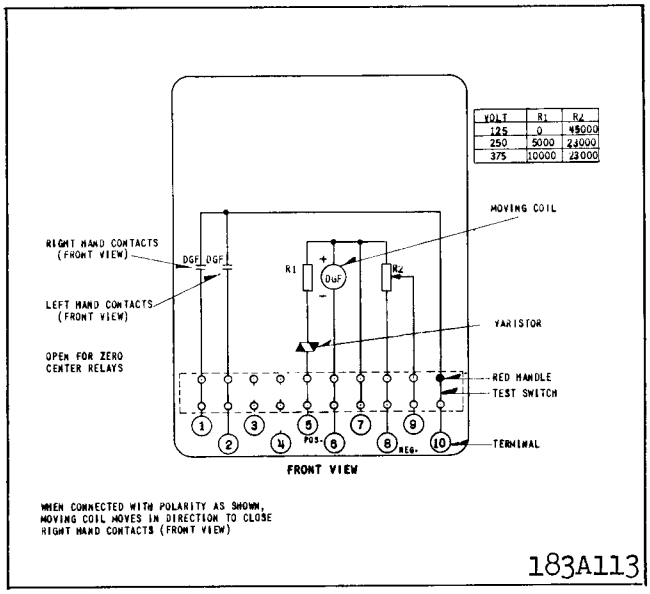


Fig. 2. Internal Schematic of the Type DGF Relay in the FT21 Case.

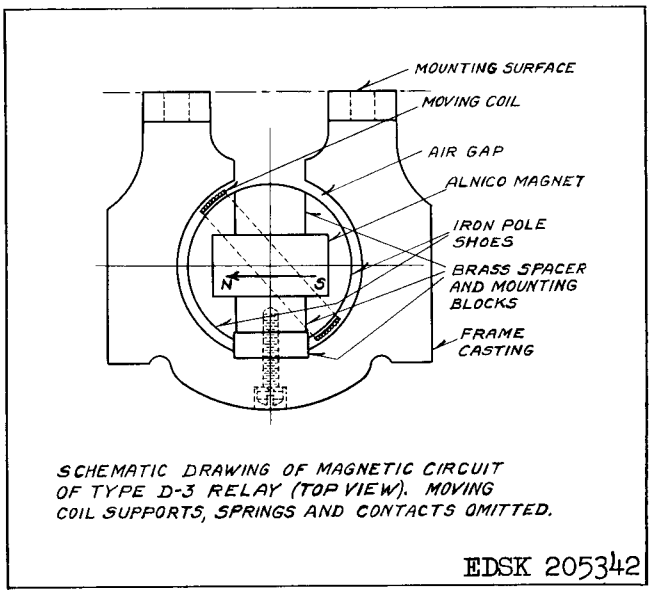


Fig. 3. Magnetic Circuit of d'Arsonval Type dc Contact Making Milliammeter.

The center curve of Figure 5 shows null points position in a grounded generator field for different values of supply voltage. The outer curves of Figure 5 show the amount that the supply voltage must be either raised or lowered before the relay contacts will close for a ground at one of these null points.

A center tap is provided on the linear resistor so that a part of the resistor can be shorted out. By periodically shorting out this resistor by means of a push-button, the DGF will detect grounds at the null points if they exist. In such a case, the bridge is unbalanced by changing the linear resistor, and current will flow into the contact-making milliammeter if a ground exists at the null point.

CHARACTERISTICS

The type DGF relay is generally available for the following field supply voltages:

125 volts d-c
250 volts d-c
375 volts d-c

The non-linear resistor used in the relay has a voltage-resistance characteristic as shown in Fig. 6. The linear resistor used in the 125 volt relay has a value of 45,000 ohms, while it has a value of 23,000 ohms in the other ranges of the DGF relay.

In the 250 volt d-c and 375 volt d-c relay, an additional linear resistor is connected in series with the non-linear resistor to protect the non-linear resistor from overvoltage. This series resistor has a value of 5000 ohms for the 250 volt relay and a value of 10,000 ohms for the 375 volt relay.

The d-c contact-making milliammeter is calibrated to have a zero center. Stationary adjustable contacts may be set to permit the moving contacts to close either to the right or to the left. These contacts will close a circuit carrying one ampere. For larger tripping currents, an auxiliary relay should be used to carry the tripping current. In all cases, an auxiliary contact on the circuit breaker must be provided to open the tripping circuit when the breaker opens.

The average coil resistance of the contact-making milliammeter at 25° C is 90 ohms. A 300% overload (22 milliamperes) can be applied continuously to this unit without causing damage.

SETTINGS

The type DGF relay can be set in a range of plus or minus 0.75 milliamperes. By setting the adjustable contacts at a value marked on the scale of d-c contact making milliammeter, the DGF will close its contacts when the current through the milliammeter unit reaches this value. The recommended setting is within .15 milliampere.

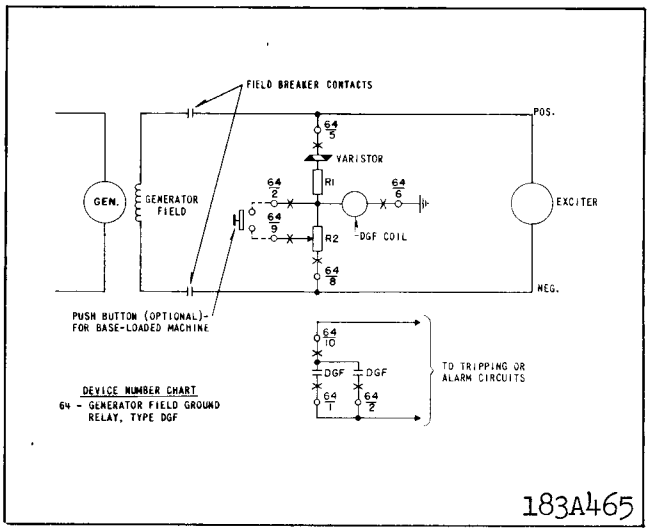


Fig. 4. External Schematic of the Type DGF Relay.

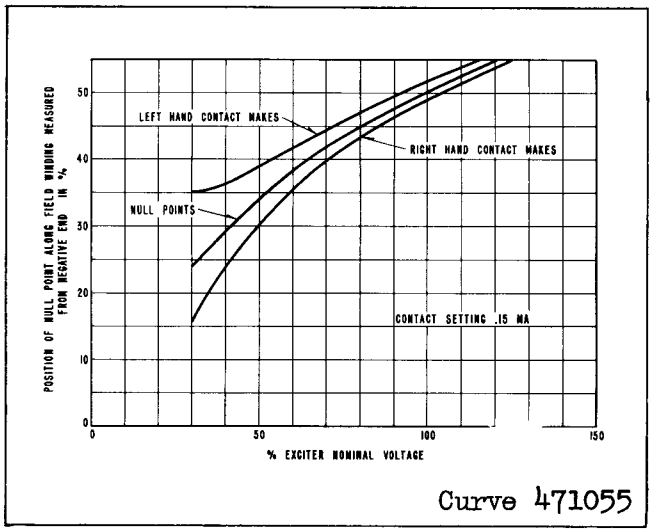


Fig. 5. Null Point Location Characteristic.

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.

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.

Acceptance Tests

The following check is recommended to insure that the relay is in proper working order.

With the stationary contacts of the relay set on .50 milliamperes, apply .50 milliamperes to terminals 6 and 7 of the relay. The moving contact should move to close one of the stationary contacts. Reverse the connection to terminals 6 and 7, the moving contact should move to close the other stationary contact.

Connect relay in the circuit of Fig. 7. Set the moving contacts on 0.15 milliamperes and apply rated voltage to resistor "B". Adjust resistor "A" such that the moving contact remains at 0 setting on the scale. Adjust resistor "B" until moving contact makes with the left hand contact. Voltmeter reading should not read less than 90 percent rated voltage.

Adjust resistor "B" until moving contact makes with the right-hand contact. Voltmeter should not read more than 105 percent of rated voltage.

Routine Maintenance

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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

The core and moving coil assembly should not be removed from the frame casting of the relay unless a

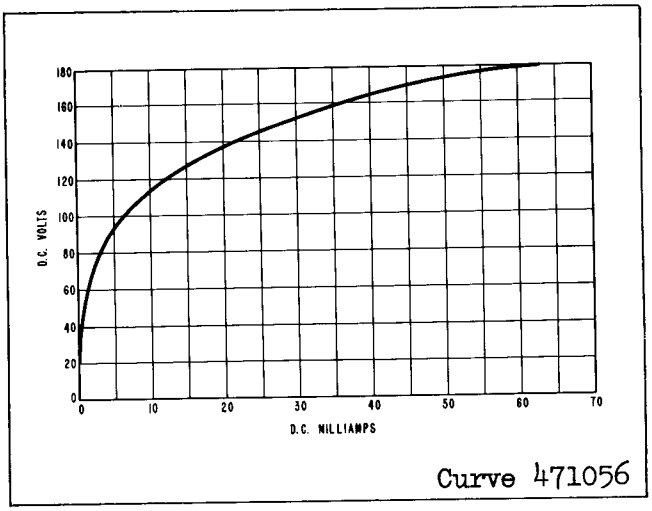


Fig. 6. Typical Voltage Characteristic of Non-Linear Resistor of Type DGF Relay.

keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed. This will prevent possible damaging of the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.

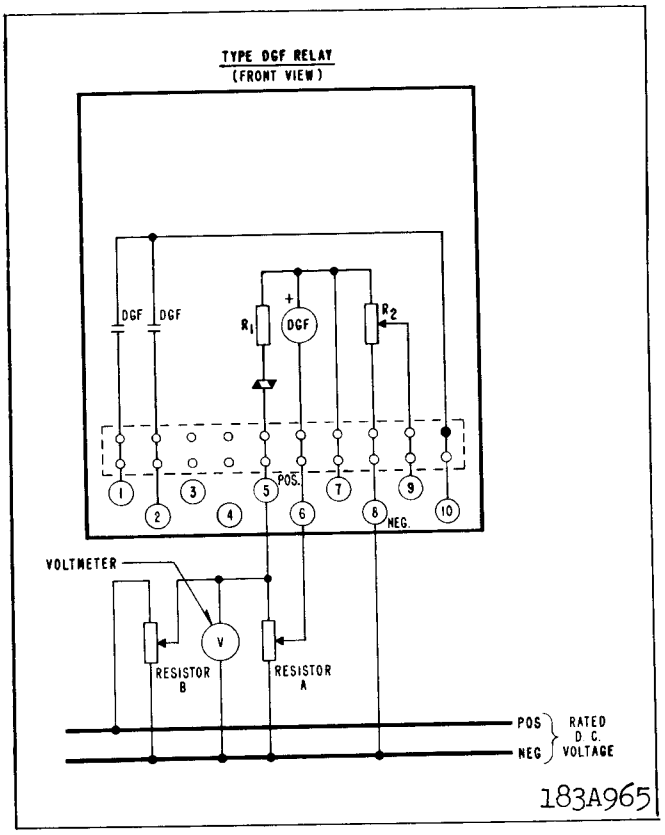


Fig. 7. Test Circuit of the Type DGF Relay.

REPAIRS AND RENEWAL PARTS

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

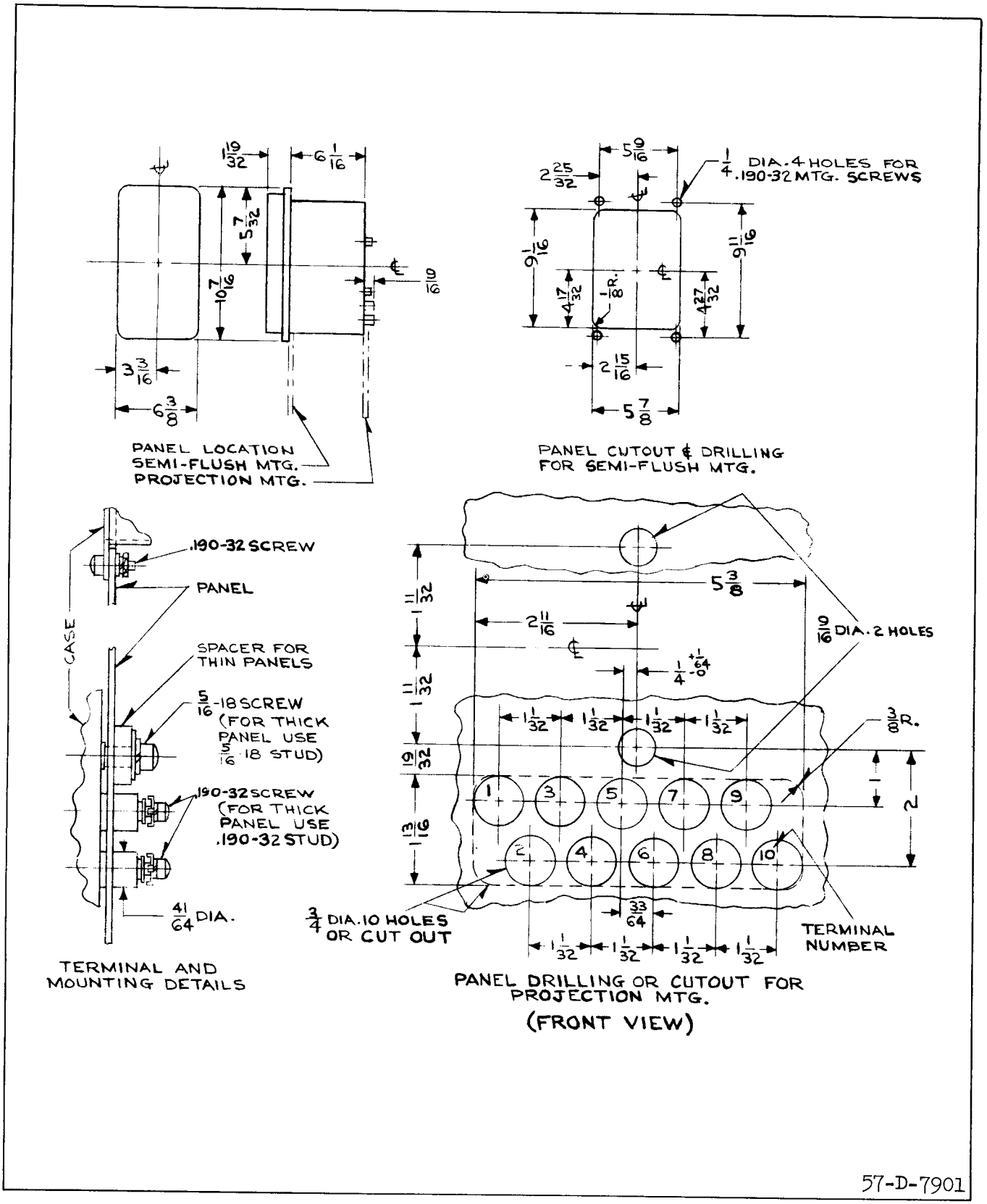


Fig. 8. Outline & Drilling Plan for the DGF Relay in FT21 Case.

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