



RESISTORS

| | TYPE | PAGE |
|------------------------------------------|-------------|-------------|
| High Resistance Grounding Equipment | | 6-2 |
| Low Voltage (wall mtd) | DS9181W | 6-7 |
| Low Voltage (floor mtd) | DS9181L | 6-8 |
| High Voltage (floor mtd) | DS9181H | 6-8 |
| Ground Current Detector Cat # 245A2006P1 | | 6-8 |
| Neutral Grounding Resistors—Type DS300C | DS300C | 6-8 |
| Neutral Grounding Resistors—Type 85A | 85A | 6-16 |

Wye or Delta Systems—DS9181 (CSA Approved)

240, 480, 600 Volts

WHERE TO USE

The function of a high-resistance grounding equipment is:

1. To provide a ground for neutral of an ungrounded three-phase power system, utilizing the high-resistance method. Using this equipment allows the system to operate basically as an ungrounded system. The equipment is designed to eliminate the danger of high transient over-voltages during certain types of ground faults.

NOTE: The use of high-resistance grounding on 600-volt maximum systems precludes line-to-neutral loading.

2. To provide an immediate warning when the first ground fault occurs through an alarm system.
3. To provide a method for quickly locating and removing the fault before another fault develops on another phase, thereby preventing circuit outages due to double line-to-ground faults. This is done by using the pulsing ground current feature and portable detector.

Equipment Range

Taps are provided on the standard DS9181 grounding resistor to adjust for a system charging current maximum of 3.5 amps or less. Since the normal charging current for most 600-volt or less systems is usually below one ampere, our standard equipment is adequate; however, for systems with greater charging currents refer to the Company. Data for estimating the system charging current is shown in GEI-100010.

DESCRIPTION OF OPERATION OF STANDARD EQUIPMENT—LOW VOLTAGE

The circuits used for low-voltage systems are shown in Fig. 1 and Fig. 2.

During normal conditions, with no ground fault on the system, only a small magnetizing current (capacitance-charging current) flows in the grounding transformers and no voltage appears across the resistor.

When a ground fault occurs, the resistor limits the ground current to a low value.

Taps are provided on the resistor to adjust the magnitude of the ground current in the range of 0.9 to 3.6 amperes, depending on the size of the system, so that the current supplied by the resistor to a ground fault will be slightly greater than the system's natural capacitance-charging current.

The voltage appearing across the resistor will be sensed by the meter relay. Auxiliary contacts in the control, operated by the meter relay, are available for remote indication and annunciation of a ground.

A green indicating light on the equipment indicates the control voltage is available and that the system is normal. When a fault develops, a red indicating light on the equipment will light and remain lighted until the ground fault is removed.

To trace the ground fault, the operator turns the selector switch to the "pulse" position. This initiates cycle timing, alternately energizing and de-energizing a shorting contactor at the secondary resistor, resulting in a rhythmic fluctuation in the magnitude of the ground current.

The portable hook-on detector is then used to trace the fluctuations in ground current through the system to the point of fault. After the ground point has been located and removed from the system, the operator then resets the selector switch to de-energize the pulse-cycle timing circuits.

The grounding transformer for delta systems will consist of three single-phase transformers connected wye-delta. For wye systems, where system neutral is available, these grounding transformers are not needed.

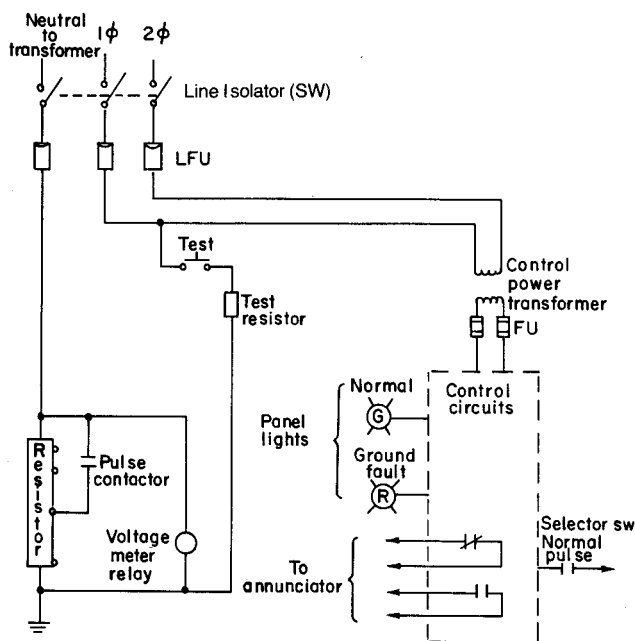


Fig. 1. 600 volts maximum wye systems

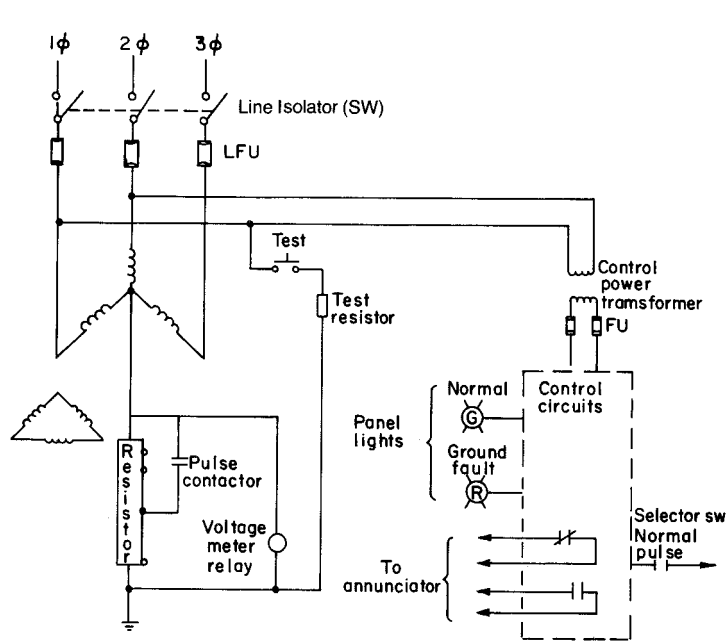


Fig. 2. 600 volts maximum delta systems

Wye or Delta Systems—DS9181

240, 480, 600 Volts

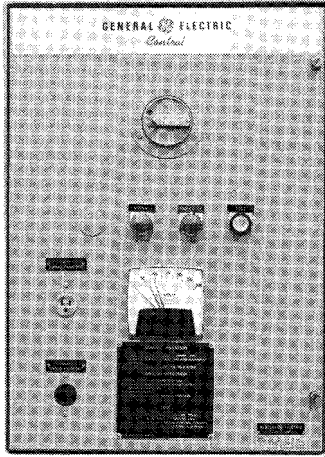


Fig. 3. DS9181WB Type 1 wall-mounted panel for 600-volt (max) wye or delta systems

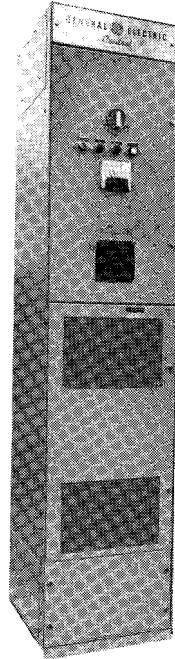


Fig. 4. DS9181 Type 1CV floor-mounted panel for 600-volt (max) wye or delta systems

SPECIFICATIONS

Equipment Included in Standard 240-, 480-, or 600-volt Wye and Delta Systems

- 1—Line Isolator, three phase, interlocked with the door
 - 3—Line fuses, 600 volts, 10 amp, interrupt 200,000 amps RMS symmetrical
 - 3—Neutral deriving transformers, dry-type (delta system only)
 - 1—Control power transformer (CPT)
 - 1—Meter relay (double set point)
 - 1—Pulsing contactor, set to produce approximately 40 current pulsations per minute
 - 1—Neutral-grounding resistor (separately mounted)†, cont. rated
 - 1—Relay for pulsing contactor
 - 1—Control relay, with interlocks for remote alarm
 - 1—“Ground Fault” red indicating light
 - 1—“Normal” green indicating light
 - 1—“Normal-Pulse” selector switch
 - 1—TEST resistor
 - 1—TEST pushbutton (momentary type)
 - 1—Instruction plate on door
 - 1—Wall-mounted enclosure (floor mounted is optional)
 - 1—Portable ground-current detector with carrying case. (Optional—must be ordered as a separate item.)
 - X—Control circuit operates from 120 volts supplied by secondary of CPT.
 - X—All connections to control and annunciator circuits wired to terminal boards
 - X—Cable entry from top or bottom
 - X—Optional Modifications (See page 6-7.)
- † Resistor is mounted inside DS9181L floor-mounted panel.

DIMENSIONS

All dimensions in inches.

Type 1 (outline 273A3617 Sh. 1)

Approximate Weight
Wye - 225 pounds
Delta - 300 pounds

Type 3 (outline 273A3617 Sh. 2)

Approximate Weight
Wye - 275 pounds
Delta - 350 pounds

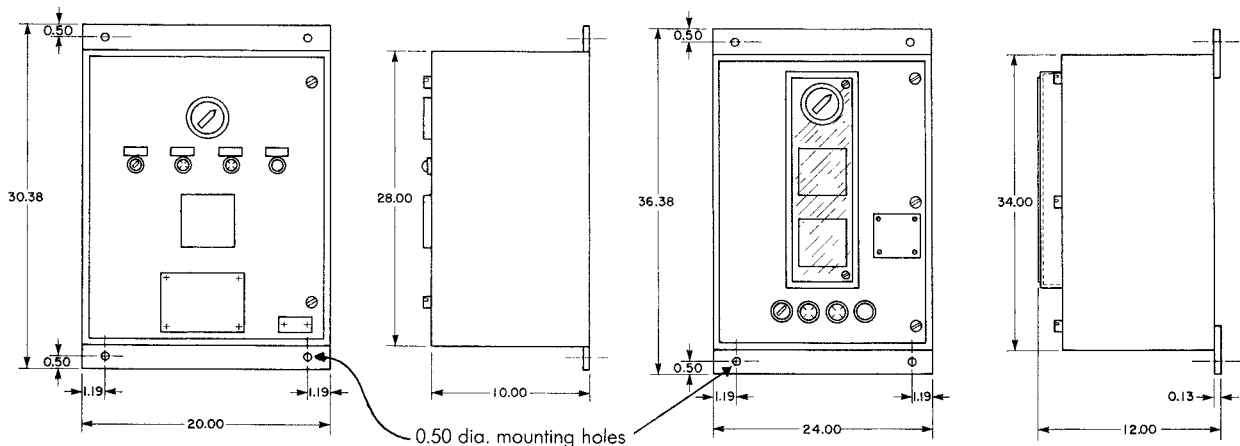


Fig. 5. Dimensions and weights of DS9181W (240-, 480- or 600 volt, wye or delta systems) in wall-mounted enclosure

Data subject to change without notice

Wye or Delta Systems—DS9181

2400, 4160 Volts

Equipment Range

Taps are provided on the standard DS9181 grounding resistor to adjust for a system charging current maximum of 5.8 amps or less (maximum 3.3 amps or less for 4160 volts delta). Since the normal charging current for most 4160-volt or less systems is

usually below this, our standard equipment is adequate; however, for systems with greater charging currents refer to Company. Data for estimating the system charging current is shown in GEI-100010.

DESCRIPTION OF OPERATION OF STANDARD EQUIPMENT—HIGH VOLTAGE

The system operation is the same as was described for the 600-volt (max) systems. One line diagrams for 2400- or 4160-volt systems are as shown in Fig. 9 and 10.

Taps are provided on the secondary resistor to adjust the magnitude of the ground current, in the range of 2 to 6 amperes (1.2 to 3.5 amperes on 4160-volt delta). The re-

sistor tap value should be set slightly higher than the system's natural capacitance-charging current. For example, if the system capacitance-charging current is measured at 1.9 amperes, the resistor taps should be set for approximately 2 amperes ground current, with a periodic increase during pulsing to 4 amperes.

SPECIFICATIONS

Equipment included in standard 2400- or 4160-volt wye and delta systems: 1—Draw-out line isolator with 1 line fuse (3 fuses for delta system)

1—Grounding transformer, dry-type (3 for delta system)

1—Meter relay

1—Door switch (DSW)

1—Pulsing contactor, set to produce approximately 40 current pulsations per minute

1—Neutral-grounding resistor (mounted on top of panel or separately mounted), cont. rated

1—Relay for pulsing contactor

1—Control relay, with interlocks for remote alarm

1—Control-power disconnect switch

2—Control fuses

1—"Ground Fault" red indicating light

1—"Normal" green indicating light

1—"Normal-Pulse" selector switch

1—"TEST" pushbutton (momentary type)

1—Instruction plate on door

1—Floor-mounted enclosure (wall mounted not available)

1—Portable ground-current detector with carrying case. (Optional—must be ordered as a separate item.)

X—Control circuit operates from remote source supplied by purchaser

X—All connections to control and annunciator circuits wired to terminal boards

X—Cable entry from top or bottom

X—Optional modifications (See Table 6, page 6-8 for description.)

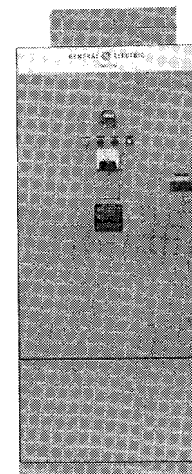


Fig. 6. DS9181, 4160-volt delta system in Type 1 floor-mounted enclosure with resistors mounted on top

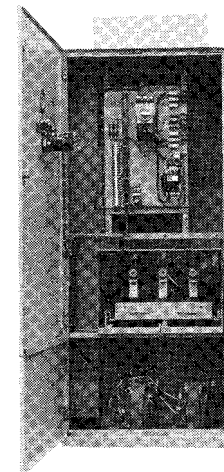


Fig. 7. DS9181, 4160-volt delta system, panel doors open, with resistors mounted on top

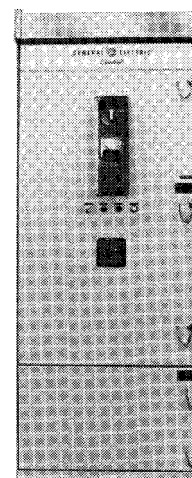


Fig. 8. DS9181, 4160-volt delta system, in Type 3 floor-mounted enclosure

Data subject to change without notice

Wye or Delta Systems—DS9181

2400, 4160 Volts

DESCRIPTION OF OPERATION (Cont'd)

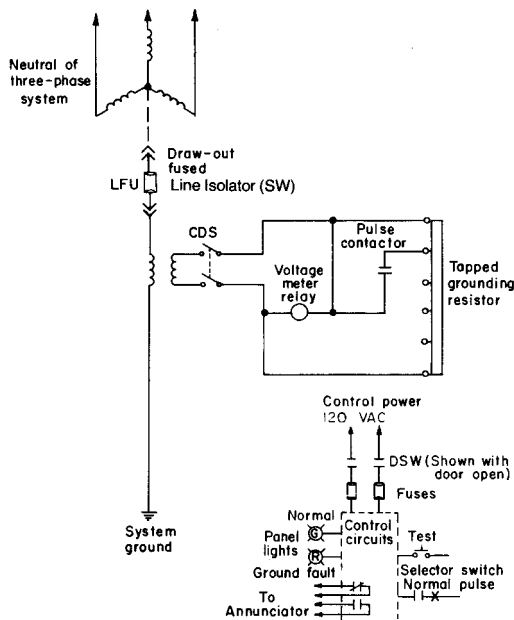


Fig. 9. 2400- or 4160-volt wye systems

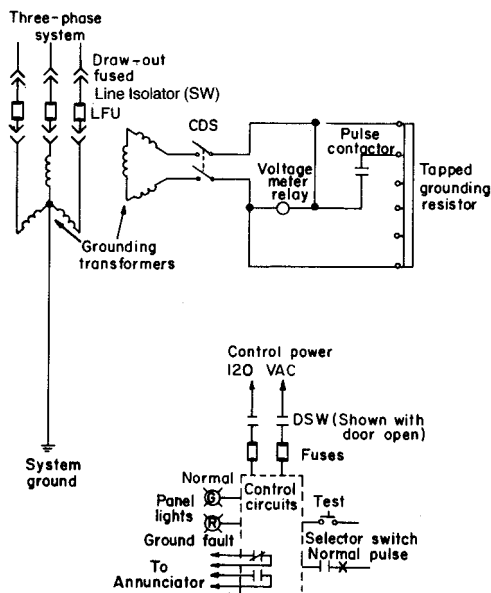
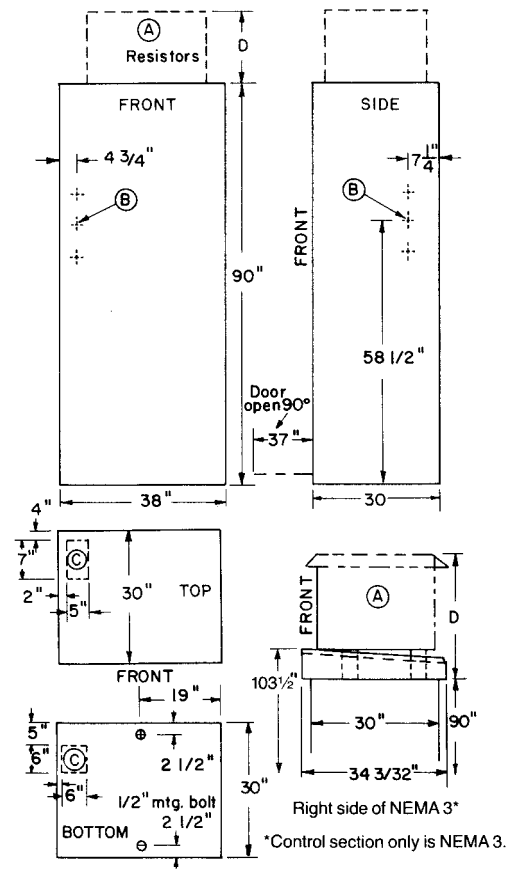


Fig. 10. 2400- or 4160-volt delta systems

DIMENSIONS



| Voltage | Encl Type | D (In Inches) | | Net Weight (lbs) | |
|---------|-----------|---------------|--------|------------------|-------|
| | | Wye | Delta | Wye | Delta |
| 2400, | 1 | 13.375 | 13.375 | 1800 | 2300 |
| 4160 | 1 | 18.50 | 13.375 | 2000 | 2500 |
| 2400, | 3 | 22.06 | 22.06 | 2400 | 2900 |
| 4160 | 3 | 27.18 | 22.06 | 2600 | 3100 |

A Resistors may be mounted separate. See Table 3, page 6-7.

B Incoming terminal connection

C Recommended position for incoming power conduit

Fig. 11. Dimensions of DS9181HA or HC (2400- or 4160-volt wye or delta systems)

Wye or Delta Systems—DS9181

240, 480, 600, 2400, 4160 Volts

Ground-current Detector* (Cat # 245A2006P1)

The ground-current detector is a modified portable hook-on type ammeter and includes the following special features:

- Multi-range switch.
- Large window, suitable for conduits up to 5 inches nominal diameter.
- Removable arm to facilitate use in limited spaces where conduits are closely adjacent.
- Shorting switch to provide transient protection while detector is being positioned around conductors.
- Closed magnetic core to minimize effects of stray fields.
- For use on systems rated up to 4160 volts nominal, the handle is insulated making it suitable for use where cables are not in conduit.

* Minimum quantity one (1) required at the installation site.

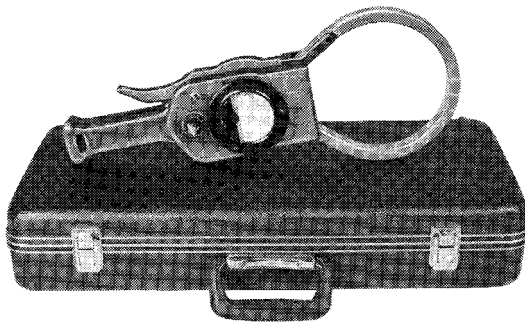


Fig. 12. Portable detector with carrying case

HOW TO ORDER DS9181 SYSTEMS (See TABLES 1-6)

Order by complete DS9181 catalog number.

EXAMPLE: Quantity 1—Type 1 wall-mounted panel with pulser for 480-volt wye, 60-Hertz system.

Order 1—DS9181WAY108B1XX1 (from TABLE 1) (includes grounding resistor in NEMA 1 enclosure for separate mounting) and order 1—DS9181 Cat. No. 245A2006P1 ground-current detector with carrying case each from TABLE 4).

TABLE 1—240-, 480-, and 600-volt systems
Standard wall-mounted panels

| Description | | | | | | |
|---------------------------------------------------------------------------------------------|-----------------------|---|---|---|---|-----------|
| Catalog Number DS9181W | | — | — | — | — | — |
| PANEL TYPE | | A | — | — | — | — |
| Standard, with pulser | B-Use A form | ↑ | ↑ | ↑ | ↑ | ↑ |
| Standard, without pulser | | | | | | |
| NEC/Calif Code, with pulser † | C | | | | | |
| NEC/Calif Code, without pulser † | D-Use C form | | | | | |
| SYSTEM TYPE | | | | | | |
| Delta, 60 Hertz | DO | | | | | |
| Wye, 60 Hertz | Y1 | | | | | |
| Delta, 50 Hertz | OBS | | | | | |
| Wye, 50 Hertz | OBS | | | | | |
| SYSTEM VOLTAGE AND RELAY MODIFICATIONS † | | | | | | |
| 240-volt, Standard | 01 | | | | | |
| 240-volt + UV | 02-Use 04 form | | | | | |
| 240-volt + TR | 03-Use 04 form | | | | | |
| 240-volt + UV + TR | 04 | | | | | |
| 480-volt, Standard | 08 | | | | | |
| 480-volt + UV | 09-Use 11 form | | | | | |
| 480-volt + TR | 10-Use 11 form | | | | | |
| 480-volt + UV + TR | 11 | | | | | |
| 600-volt, Standard | 15 | | | | | |
| 600-volt + UV | 16-Use 18 form | | | | | |
| 600-volt + TR | 17-Use 18 form | | | | | |
| 600-volt + UV + TR | 18 | | | | | |
| GROUNDING RESISTOR MOUNTING | | | | | | |
| For separate mounting and wiring by Customer. (Cannot be mounted inside or on top of Panel) | | | | | | B |
| TYPE OF ENCLOSURE FOR GROUNDING RESISTOR ‡ | | | | | | |
| Open (no enclosure) | | | | | | X |
| Indoor Cover | | | | | | 1 |
| Outdoor Weatherproof | | | | | | 3 |
| MODIFICATIONS † | | | | | | |
| None (standard) | | | | | | XX |
| AM & separate mounted CT (Delta form only) | | | | | | AM |
| Holding relay, reset push button, AM, CT (Wye form only) | | | | | | HM |
| EQUIPMENT ENCLOSURES § | | | | | | |
| Type 1 | | | | | | 1 |
| Type 3 | | | | | | 3 |
| Type 12 | | | | | | C |

† See TABLE 6 for description of Modifications.

§ For dimensions of wall-mounted panels see Fig. 5, page 6-3.

‡ Approximate dimensions of resistor:

| | W | D | H |
|----------------------|-----|-----|--------------------------------------------|
| Open | 21" | 19" | 5" (Fig. 23, Part 24, page 3-2) |
| Indoor Cover | 22" | 21" | 7" (Fig. 23, Part 24, + Note 1, page 3-10) |
| Outdoor Weatherproof | 28" | 27" | 11" (Fig. 24, Part 25, Page 3-11) |

Wye or Delta Systems—DS9181

240, 480, 600, 2400, 4160 Volts

HOW TO ORDER (Cont'd)

**TABLE 2—240-, 480-, and 600-volt systems
Optional floor-mounted panels**

| Description | | | | | |
|---------------------------------------------------------------|-----------------------|---|---|-----------|-----------|
| Catalog Number DS9181L | | | | | |
| PANEL TYPE | ▲ | ▲ | ▲ | ▲ | ▲ |
| Standard, with pulser | A | | | | |
| Standard, without pulser | B-OBSOLETE | | | | |
| NEC/Calif Code, with pulser* | C | | | | |
| NEC/Calif Code, without pulser* | D-OBSOLETE | | | | |
| SYSTEM TYPE | | | | | |
| Delta, 60 Hertz | D0 | | | | |
| Wye, 60 Hertz | Y1 | | | | |
| Delta, 50 Hertz | D2-OBSOLETE | | | | |
| Wye, 50 Hertz | Y3-OBSOLETE | | | | |
| SYSTEM VOLTAGE AND RELAY MODIFICATIONS* | | | | | |
| 240-volt, Standard | 01 | | | | |
| 240-volt + UV | 02-Use 04 form | | | | |
| 240-volt + TR | 03-Use 04 form | | | | |
| 240-volt + UV + TR | 04 | | | | |
| 480-volt, Standard | 08 | | | | |
| 480-volt + UV | 09-Use 11 form | | | | |
| 480-volt + TR | 10-Use 11 form | | | | |
| 480-volt + UV + TR | 11 | | | | |
| 600-volt, Standard | 15 | | | | |
| 600-volt + UV | 16-Use 18 form | | | | |
| 600-volt + TR | 17-Use 18 form | | | | |
| 600-volt + UV + TR | 18 | | | | |
| GROUNDING RESISTOR MOUNTING | | | | | |
| Mounted and wired inside equipment enclosure | | | | AX | |
| MODIFICATIONS* | | | | | |
| None (standard) | | | | | XX |
| CT and AM | | | | | AM |
| Holding Relay, Reset push button, Ammeter, CT (Wye form only) | | | | | HM |
| EQUIPMENT ENCLOSURES | | | | | |
| Type 1 CV† | | | | | 1 |
| Type 3 CV | | | | | 3 |
| Type 12 CV | | | | | C |

Approximate Dimensions and Weights

| Equipment Enclosure | W × D × H (In Inches) | With Pulser | | Without Pulser | |
|---------------------|--------------------------|-------------|-------|----------------|-------|
| | | In Pounds | | In Pounds | |
| | | Wye | Delta | Wye | Delta |
| Type 1CV | 20 × 20 × 90 | 600 | 700 | 575 | 675 |
| Type 3CV | 20 × 20 × 100 | 1000 | 1100 | 975 | 1075 |
| Type 12CV | 20 × 20¾ × 93 | 650 | 750 | 625 | 725 |

FOOTNOTES FOR TABLES 2 & 3

- * See TABLE 6 for description of modifications.
- † CV is convection cooled.
- ‡ Wall-mounted enclosure not available for 2400- and 4160-volt applications.
- ¶ Refer to Company for dimensions. Resistor is for separate mounting and wiring by Customer.
- λ Refer to Fig. 11, page 6-5, for dimensions and weights.

**TABLE 3—2400- and 4160-volt systems
Standard floor-mounted‡ panels with pulser**

| Description | | | | | |
|----------------------------------------------------|-----------------------|---|---|----------|-----------|
| Catalog Number DS9181H | | | | | |
| PANEL TYPE | ▲ | ▲ | ▲ | ▲ | ▲ |
| Standard, with pulser | A | | | | |
| NEC/Calif Code, with pulser | C | | | | |
| SYSTEM TYPE | | | | | |
| Delta, 60 Hertz | D0 | | | | |
| Wye, 60 Hertz | Y1 | | | | |
| Delta, 50 Hertz | D2-OBSOLETE | | | | |
| Wye, 50 Hertz | Y3-OBSOLETE | | | | |
| SYSTEM VOLTAGE AND RELAY MODIFICATIONS* | | | | | |
| 2400-volt, Standard | 01 | | | | |
| 2400-volt + UV | 02-Use 04 form | | | | |
| 2400-volt + TR | 03-Use 04 form | | | | |
| 2400-volt + UV + TR | 04 | | | | |
| 4160-volt, Standard | 08 | | | | |
| 4160-volt + UV | 09-Use 11 form | | | | |
| 4160-volt + TR | 10-Use 11 form | | | | |
| 4160-volt + UV + TR | 11 | | | | |
| 3300-volt, Standard | 15-OBSOLETE | | | | |
| 3300-volt + UV | 16-OBSOLETE | | | | |
| 3300-volt + TR | 17-OBSOLETE | | | | |
| 3300-volt + UV + TR | 18-OBSOLETE | | | | |
| GROUNDING RESISTOR MOUNTING | | | | | |
| Panel mounted (on top in own enclosure) | | | | A | |
| Shipped separate in own enclosure¶ | | | | B | |
| TYPE OF ENCLOSURE FOR GROUNDING RESISTOR | | | | | |
| Open (no enclosure—all systems) | | | | 0 | |
| Type 1 (4160 volts wye) | | | | 1 | |
| Type 3 (4160 volts wye) | | | | 2 | |
| Type 1 (4160 volts delta, 2400 volts wye or delta) | | | | 3 | |
| Type 3 (4160 volts delta, 2400 volts wye or delta) | | | | 4 | |
| MODIFICATIONS* | | | | | |
| Holding Relay, Reset push button, Ammeter, CT | | | | | HM |
| None (standard) | | | | | XX |
| CT and AM | | | | | AM |
| EQUIPMENT ENCLOSURES λ | | | | | |
| Type 1 | | | | | 1 |
| Type 3 | | | | | 3 |
| Type 12 | | | | | C |

TABLE 4—Ground-current detector (modified portable hook-on type ammeter) and carrying case

| Cat. No. | Maximum System Voltage |
|-------------------|------------------------|
| 245A2006P1 | 4160 |

TABLE 5—(Description of modifications applicable to all panels)

| Mod. | Item | Function |
|-----------------|---------------------|------------------------------------------------------------------------------------------------|
| UV | Undervoltage Relay | Drops out on low voltage and provides auxiliary contacts for meter relay failure remote alarm. |
| TR | Timing Relay | Prevents nuisance tripping on temporary transient faults. |
| NEC/Calif. Code | Door Switches | Allows panel to meet California Code and NEC. |
| CT | Current Transformer | Detects ground current |
| AM | Ammeter | Indicates ground current |

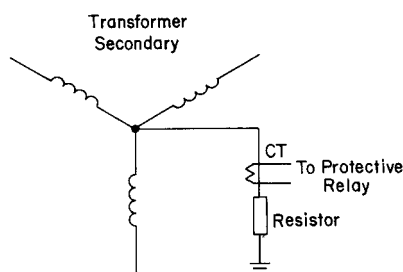
Type DS300C Stainless-steel Neutral Grounding Resistors

WHERE TO USE

Use for resistance grounding of industrial power systems. Connect between ground and neutral of wye-wound transformers or generators.

Neutral grounding resistors are rated in line-to-neutral voltage, initial current amperes and allowable-time-on. The line-to-neutral voltage corresponds to the system's voltage divided by 1.732. The initial current is the current which would flow if rated voltage were present and resistance not affected by temperature rise.

Listed neutral grounding resistors are designed, tested, and rated in accordance with IEEE Standards No. 32-1972.



Typical grounding resistor schematic

SERVICE REQUIREMENTS

The two classes of service requirements for neutral grounding resistors, as established by IEEE Standard 32-1972, are "steady state" and "rated time."

RATED TIME

Ten-second Rating—This is the shortest time rating applied to neutral grounding devices which are used to reduce the ground current that may flow through a piece of equipment. The current permitted is usually considerably greater than the full-load current, so that dependence must be placed upon the relay operation to prevent damage not only to the neutral device but also to the main equipment.

One-minute Rating—A common use of neutral grounding devices has been to limit ground currents on outgoing feeders during faults to ground in order to reduce damage at the fault, limit overvoltages between sound phases and ground, and improve voltage regulation.

Extended-time Rating—For all applications where a ground fault is permitted to persist for longer than ten minutes, the grounding device should have a rating based upon the temperature reaching a constant maximum value, but selected on the basis that such operation will be infrequent. The temperature rise permitted may be higher than the standard temperature rise for steady-state service, assuming that operations at maximum temperature will not be required for more than an average of

90 days per year with an average ambient not exceeding 30 C.

STEADY STATE

The IEEE standards have established for the continuous-current-rated neutral grounding resistors an allowable temperature rise of 385 C under steady-state conditions. For the extended-time rating, a temperature rise of 610 C is permitted for stainless-steel resistors. Thus, if the lower temperature rise is desired for stainless-steel-type resistors or if the resistor is to be on for an average above 90 days per year, a steady-state rating should be specified.

Mine Service Requirements

Where neutral grounding resistors have been specified for mining service applications, the Department of the Interior, Bureau of Mines-Mandatory Safety Standards for Coal Mines, sections 77.80-1 and 77.90-1, specifies that "the ground fault current rating of grounding resistors shall meet the extended time rating" set forth in AIEE #32 (IEEE #32-1972). Therefore, an extended time rating should be specified for such applications.

Seismic Shock Requirements

Where the application requires the neutral grounding resistor to be rated for seismic shock, specific requirements in terms of magnitude and frequency of the vibration should be obtained.

Hazardous Location Requirements

In areas where fire or explosion hazards may exist, the temperature rises allowed by IEEE-32-1972 are likely to exceed the ignition temperature of the gas or vapor involved. It will be necessary to refer requests for neutral grounding resistors for hazardous locations to the company for a quotation, specifying the ignition temperature in degrees celsius of the gas or vapor involved. Resistors will be designed for a maximum operating temperature of the resistive element not to exceed 80 percent of the ignition temperature.

Altitudes above 3300 Ft (1000 M)

Resistors listed in this section are designed and rated for use at altitudes not exceeding 3300 ft (1000 M). For applications at higher altitudes, it will be necessary to refer to the company for a quotation.

Resistance Tolerance

The listed 85A and DS300C resistors are manufactured to a resistance tolerance of plus or minus 10 percent of the nominal furnished value.

Rated Current

The rated current for a neutral grounding resistor is the initial value of current, assuming a constant voltage is applied to the resistor. Resistors with ten-second, 60-sec-

ond or extended-time rating have zero (0) continuous-duty-current rating.

Tests

Standard factory tests performed on the 85A and DS300C resistor consist of resistance measurement and applied potential tests only in accordance with routine tests as defined by IEEE-32-1972, Sections 10.1.4 and 10.3.2 (second paragraph), respectively.

EQUIPMENT DESCRIPTION

DS300C Stainless-steel Resistors (Open frame)

DS300C neutral grounding resistors consist of ceramic-core ribbon-wound units arranged in tiers within an open frame. (Fig. 1). Each unit is insulated from the tier structure. For systems above 600 volts, the frame assembly is supported on ANSI-70 gray insulators rated 7.5 kV or higher to provide insulation from ground. The standard frame is constructed of hot dipped galvanized steel with zinc plated hardware. (Optional frame constructions available are aluminum or stainless steel, each with stainless-steel hardware. Refer to company for quotation.)

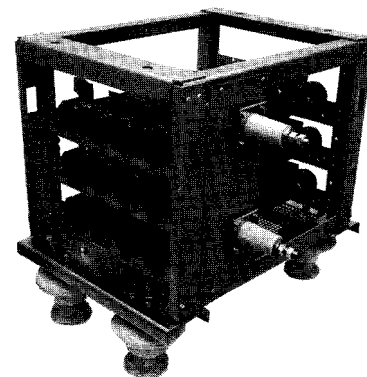


Fig. 17. DS300C stainless-steel resistor in open frame with support insulators

DS300C Stainless-steel Resistors (Open Frame) (Cont'd)

Line and ground connections on DS300C resistor are external to frame and consist of through-stud-type entrance bushings with 5/8-inch - 11 stud.

For systems with line-to-neutral, voltages greater than 4160 volts, resistor will consist of two or more frames. Frames may be stacked (2-high frames maximum) for most 10- and 60-second ratings.

DS300C open resistors can be installed indoors or outdoors. No weather-protective enclosure is required. Support insulators are shipped separately to prevent breakage in transit. See page 4-13 for principal characteristics.

Data subject to change without notice

Type DS300C Stainless-steel Neutral Grounding Resistors (Cont'd)

EQUIPMENT DESCRIPTION (Cont'd)

DS300C Resistor with Bolt-on Ventilated Covers

Bolt-on ventilated covers (attached to all six sides of the resistor frame) are intended to protect the resistor from falling objects, and prevent entry of birds and rodents. Cover plates are furnished for the lifting holes in the resistor frame. The ventilated covers are constructed of hot dipped galvanized steel with 0.25-inch \times 1.50-inch rectangular openings spaced 0.2-inch apart, providing approximately 49-percent opening for ventilation. Refer to Fig. 18.

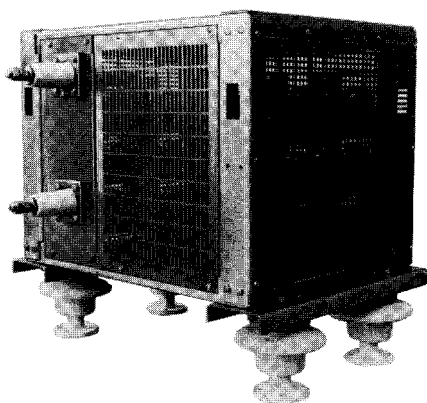


Fig. 18. DS300C neutral-grounding resistor with ventilated covers attached to frame

DS300C Resistor with Grounded Safety-screen Enclosures

For indoor or outdoor pad-mounted applications on systems rated greater than 600 volts line-to-line, the DS300C open frame resistor with grounded safety-screen enclosure should be used to provide for personnel safety (Refer to Fig. 19).

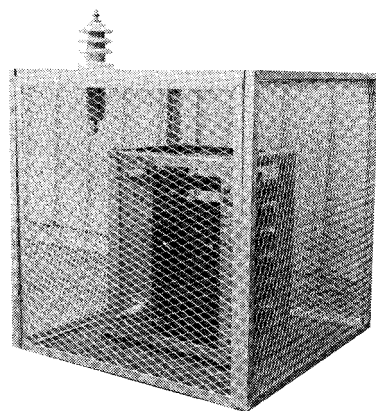


Fig. 19. DS300C resistor in grounded safety-screen enclosure

The open frame resistor is then surrounded at top and 4 sides by a self-supporting screen enclosure that provides adequate electrical clearance from the resistor frame based on system voltage. The safety enclosure is bolted to the floor (on concrete pad) by purchaser. There is no bottom screen. Sides are removable for customer access. The screens are constructed of galvanized expanded metal with 1.2-inch by 2.6-inch diamond-shaped openings.

Entrance of the purchaser's incoming neutral connection is normally made through the top screen utilizing an optional stud-type entrance bushing. (Refer to TABLE 1, page 4-20.)

Stands

DS300C Resistor Stand

Resistor mounting stands are structures which elevate the resistor frame (frames) above ground level and can be used to provide personnel safety (refer to Fig. 20). The stand provides support for the resistor and is available with either 4-foot or optional 8-foot legs.

The standard offering is a stand assembly made with steel angle legs and support members which are hot dipped galvanized steel for outdoor service. The top of the stand is covered with galvanized welded-wire screening.

The stand includes a grounded safety-screen enclosure. Standard enclosure is galvanized expanded-metal construction (as previously described).

All stands with the grounded safety enclosure include mounting provisions on the top screen for one entrance bushing, one stand-off insulator and one JKW current transformer, each rated up to 15 kV. The current transformer may be mounted outside on the top screen or suspended from the top screen inside the enclosure (Refer to Fig. 31 and 32).

Stands with 4-foot legs always include the grounded safety enclosure to provide personnel protection, because the closest electrical live point would be a maximum of 4 feet 9 inches above ground level.

All stands and safety enclosures are bolted construction.

All stands are shipped partially assembled. Safety enclosures used with the stands may be shipped completely unassembled or assembled (depending on size).

DS300C Entrance Bushing

Entrance bushings are available for mounting on top screen of pad-mounted or stand-mounted safety enclosures to allow

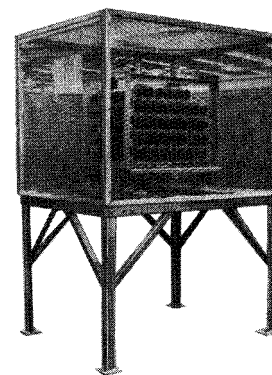


Fig. 20. Stand with 4-foot legs and grounded galvanized safety-screen enclosure

for means of connecting customer's incoming neutral conductor to the resistor. These ANSI-70 light gray bushings are "assembled through stud" type rated 400 amperes continuous, which is adequate for use with all catalog-listed DS300C resistors.

Optional universal clamp-type terminal assembly for entrance bushing is available for use with copper or aluminum cable from Size #2 to 600 MCM.

DS300C Current Transformers (CT)

JKW wound-type current transformers are available for applications up to 15 kV maximum with a maximum ratio of 800:5 for JKW-3 (5 kV) and JKW-4 (8.7 kV) and 1200:5 for JKW-5 (15 kV). These current transformers may be used indoors or outdoors without a weather-protective enclosure.

The bottom insulators for resistor frame are commonly referred to as "stand-off insulators" or "support insulators" and are included in the price of the resistor.

DS300C Resistor Terminations

Type DS300C resistors are supplied with line and ground connection points external to the frame consisting of through stud type entrance bushings with 5/8-inch - 11 copper studs.

DS300C Cabling

Where the resistor rating requires two frames or more and the frames are stacked, the connection between frames is included. Where the rating requires two or more frames that are not stackable (such as extended time ratings), the connection between frames must be supplied by purchaser. Cabling to and from entrance bushing and current transformer must also be supplied by the purchaser.

Type DS300C Stainless-steel Neutral Grounding Resistors (Cont'd)**Specifications—DS300C Stainless-steel Resistors**

| Characteristic or Property | DS300C Stainless-steel Type |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RESISTANCE MATERIAL a. Short time rating 10 minutes or below b. Extended time ratings | a. AISI-430 chrome stainless steel or AISI-406 iron, chromium, stainless steel as determined by rating b. AISI-406 iron, chromium, aluminum, stainless steel |
| TEMPERATURE RISE (in accordance with IEEE-32 Standards). 30 C ambient a. Short time ratings b. Extended time ratings* c. Continuous ratings | a. 760 C rise b. 610 C rise c. 385 C rise |
| TEMPERATURE COEFFICIENT OF RESISTANCE | a. AISI-430 .00103 b. AISI-406 .00016 |
| CHANGE IN RESISTANCE WITH TEMPERATURE (over the Operating Temperature Range) a. Short time ratings b. Extended time ratings—Per IEEE-32 | a. 90% increase b. 13% increase |
| CORROSION RESISTANCE | The stainless-steel type resistors are inherently corrosion resistant and virtually immune to progressive pitting and rusting. The ceramic insulators are not appreciably affected by exposure to condensation, dust and other foreign materials. These resistors may be used outdoors completely exposed to the weather without an enclosure. |
| RESISTANCE TOLERANCE | ± 10 percent |

Type DS300C Stainless-steel Neutral Grounding Resistors—10-second Rating for Indoor or Outdoor Service

| Initial Current in Amperes | Total Resistance—Ohms | | Resistor Catalog Number DS300C | Number of Frames | Dimensions | | Enclosure or Stand Group Number |
|-------------------------------------------------------------------------|-----------------------|-------------------|--------------------------------|------------------|------------|----------|---------------------------------|
| | Calculated | Nominal Furnished | | | Fig. No. | Part No. | |
| 139 VOLTS LINE-TO-NEUTRAL (240-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 100 | 1.390 | 1.33 | 139A100*714A | 1 | 23 | 1 | 44 |
| 200 | .695 | .69 | 139A200*702A | 1 | 23 | 1 | 44 |
| 277 VOLTS LINE-TO-NEUTRAL (480-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 100 | 2.77 | 2.76 | 277A100*744A | 1 | 23 | 2 | 44 |
| 200 | 1.39 | 1.39 | 277A200*633A | 1 | 23 | 1 | 44 |
| 400 | .69 | .69 | 277A400*702A | 1 | 23 | 1 | 44 |
| 1390 VOLTS LINE-TO-NEUTRAL (2400-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 100 | 13.9 | 14.4 | 1390A100*312B | 1 | 24 | 4 | 46 |
| 200 | 6.95 | 7.20 | 1390A200*161B | 1 | 24 | 4 | 46 |
| 300 | 4.63 | 4.60 | 1390A300*110B | 1 | 24 | 4 | 46 |
| 400 | 3.48 | 3.68 | 1390A400*108B | 1 | 24 | 3 | 44 |
| 500 | 2.78 | 2.96 | 1390A500*160B | 1 | 24 | 3 | 44 |
| 600 | 2.32 | 2.48 | 1390A600*212B | 1 | | 3 | 44 |
| 2400 VOLTS LINE-TO-NEUTRAL (4160-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 25 | 96 | 96.6 | 2400A25*435C | 1 | 24 | 10 | 46 |
| 50 | 48 | 47.5 | 2400A50*423C | 1 | 24 | 7 | 46 |
| 100 | 24 | 24 | 2400A100*317C | 1 | 24 | 6 | 44 |
| 200 | 12 | 12 | 2400A200*167C | 1 | 24 | 6 | 44 |
| 300 | 8 | 7.82 | 2400A300*117C | 1 | 24 | 7 | 46 |
| 400 | 6 | 5.98 | 2400A400*113C | 1 | 24 | 6 | 44 |
| 500 | 4.8 | 4.81 | 2400A500*165C | 1 | 24 | 6 | 44 |
| 600 | 4.0 | 4.03 | 2400A600*217C | 1 | 24 | 6 | 44 |
| 800 | 3.0 | 3.06 | 2400A800*274C | 1 | 24 | 7 | 46 |
| 1000 | 2.4 | 2.38 | 2400A1000*325C | 1 | 24 | 7 | 46 |
| 1200 | 2.0 | 2.04 | 2400A1200*377C | 1 | 24 | 7 | 46 |
| 1600 | 1.5 | 1.53 | 2400A1600*430C | 1 | | 10 | 46 |
| 2000 | 1.2 | 1.19 | 2400A2000*469C | 1 | 24 | 10 | 46 |
| 4160 VOLTS LINE-TO-NEUTRAL (7200-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 25 | 166.4 | 165 | 4160A25*449C | 1 | 24 | 14 | 47 |
| 50 | 83.2 | 85 | 4160A50*433C | 1 | 24 | 10 | 46 |
| 100 | 41.6 | 41.5 | 4160A100*327C | 1 | 24 | 9 | 45 |
| 200 | 20.8 | 20.8 | 4160A200*177C | 1 | 24 | 9 | 45 |
| 300 | 13.87 | 13.8 | 4160A300*127C | 1 | 24 | 9 | 45 |
| 400 | 10.4 | 10.6 | 4160A400*123C | 1 | 24 | 8 | 46 |
| 500 | 8.32 | 8.51 | 4160A500*175C | 1 | 24 | 8 | 46 |
| 600 | 6.93 | 7.13 | 4160A600*227C | 1 | 24 | 8 | 46 |
| 7200 VOLTS LINE-TO-NEUTRAL (12,470-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 100 | 72 | 73.6 | 7200A100*325G | 2 | 25 | 108 | 49 |
| 200 | 36 | 36.8 | 7200A200*175G | 2 | 25 | 108 | 49 |
| 300 | 24 | 23.9 | 7200A300*125G | 2 | 25 | 109 | 48 |
| 400 | 18 | 18.4 | 7200A400*120G | 2 | 25 | 107 | 48 |
| 500 | 14.4 | 14.8 | 7200A500*172G | 2 | 25 | 107 | 48 |
| 600 | 12 | 12.4 | 7200A600*224G | 2 | 25 | 107 | 48 |
| 800 | 9.0 | 8.96 | 7200A800*336G | 2 | 25 | 109 | 48 |
| 1000 | 7.2 | 7.28 | 7200A1000*333G | 2 | 25 | 109 | 48 |
| 8000 VOLTS LINE-TO-NEUTRAL (13,900-VOLT SYSTEM) 10-SECOND RATING | | | | | | | |
| 100 | 80 | 83 | 8000A100*327G | 2 | 25 | 109 | 48 |
| 200 | 40 | 41.6 | 8000A200*177G | 2 | 25 | 109 | 48 |
| 300 | 26.7 | 27.6 | 8000A300*127G | 2 | 25 | 109 | 48 |
| 400 | 20 | 20.2 | 8000A400*122G | 2 | 25 | 108 | 49 |
| 500 | 16 | 16.3 | 8000A500*174G | 2 | 25 | 108 | 49 |
| 600 | 13.3 | 13.0 | 8000A600*225G | 2 | 25 | 108 | 49 |
| 800 | 10.0 | 10.2 | 8000A800*283G | 2 | 25 | 109 | 48 |
| 1000 | 8.0 | 8.40 | 8000A1000*335G | 2 | 25 | 109 | 48 |
| 1200 | 6.67 | 6.72 | 8000A1200*386G | 2 | 25 | 109 | 48 |
| 1600 | 5.0 | 5.10 | 8000A1600*442G | 2 | 25 | 113 | 49 |
| 2000 | 4.0 | 4.06 | 8000A2000*481G | 2 | 25 | 113 | 49 |

* If resistor open frame, insert "A" in this space.

If resistor with bolt-on covers, insert "B" in this space.

Type DS300C Stainless-steel Neutral Grounding Resistors

MODIFICATIONS—DS310 Enclosures and/or Stands and Accessories

Using TABLE 1 below, select complete DS310 catalog number for enclosure and/or stand assembly and accessories required for the application. (When an enclosure and/or stand assembly is selected from TABLE 1, a complete DS310 catalog number is required. Refer to pricing example on page 4-13.)

TABLE 1—Enclosures, Stands and Accessories

| Catalog Number DS310 | | — | — | — | — | — | — | — | — |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---|---|---|---|---|---|---|---|
| TYPE OF ENCLOSURE OR STAND | | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |
| Galvanized safety-screen enclosure | A | | | | | | | | |
| Aluminum louvered safety enclosure | B | | | | | | | | |
| Galvanized-steel stand with 4 ft legs and galvanized safety screen enclosure | | | | | | | | | |
| For resistor - one frame or two frames stacked | E | | | | | | | | |
| For resistor - two frames side by side | M | | | | | | | | |
| Galvanized-steel stand with 8 ft. legs, and galvanized safety screen enclosure. | | | | | | | | | |
| For resistor - one frame or 2 frames stacked..... | K | | | | | | | | |
| Galvanized-steel stand with 8 ft. legs, no enclosure | | | | | | | | | |
| For resistor - one frame or 2 frames stacked..... | H | | | | | | | | |
| No enclosure, no stand..... | N | | | | | | | | |
| CURRENT TRANSFORMER FUNCTION | | | | | | | | | |
| Without CT mounting provisions..... | | 0 | | | | | | | |
| With CT mounting provisions | | 1 | | | | | | | |
| ENCLOSURE OR STAND GROUP NUMBER | | | | | | | | | |
| Insert group number from last column of resistor pricing tables, pages 4-14 to 4-18 here | | | | | | | | | |
| (Note: Price adder per group no. depends on type of enclosure or stand.) | | | | | | | | | |
| GROUP NUMBER | TYPE OF ENCLOSURE OR STAND | | | | | | | | |
| 00 | N or H | | | | | | | | |
| 44 | A, E or K | | | | | | | | |
| 46 | A, E or K | | | | | | | | |
| 47, 48, 49..... | A, E or K | | | | | | | | |
| 30, 32 | A or M | | | | | | | | |
| 33, 41 | A or M | | | | | | | | |
| 35, 37, 39..... | A or M | | | | | | | | |
| 44 | B | | | | | | | | |
| 46 | B | | | | | | | | |
| 47, 48, 49..... | B | | | | | | | | |
| ENTRANCE BUSHING AND STAND OFF INSULATORS | | | | | | | | | |
| None..... | | | | | | N | | | |
| Entrance bushing only: | 7.5 kV | | | | | A | | | |
| | 15.0 kV | | | | | B | | | |
| | 23.0 kV | | | | | C | | | |
| | 34.5 kV | | | | | D | | | |
| Stand-off Insulator only:..... | 7.5 kV | | | | | F | | | |
| | 15.0 kV | | | | | G | | | |
| | 23.0 kV | | | | | H | | | |
| | 34.5 kV | | | | | J | | | |
| Entrance bushing and Stand-off Insulator: | 7.5 kV | | | | | L | | | |
| | 15.0 kV | | | | | M | | | |
| | 23.0 kV | | | | | P | | | |
| | 34.5 kV | | | | | R | | | |
| TERMINALS | | | | | | | | | |
| Cable lugs for resistors for Size #2 to 600 MCM cable† | | | | | | | | | |
| None required..... | | | | | | | 0 | | |
| 1 lug..... | | | | | | | 1 | | |
| 2 lugs..... | | | | | | | 2 | | |
| 4 lugs..... | | | | | | | 4 | | |
| 6 lugs..... | | | | | | | 6 | | |
| Cable or tube clamp for stand-off insulator | | | | | | | | | |
| None required..... | | | | | | | 0 | | |
| 1 - for cable size #6-500 MCM or tube 1/8"-1/2" IPS | | | | | | | 1 | | |
| 1 - for cable size #4/0-1250 MCM or tube 1/4"-1 IPS..... | | | | | | | 2 | | |
| Entrance bushing terminal assembly for #2-600 MCM cable | | | | | | | | | |
| None required..... | | | | | | | | 0 | |
| 1 Asm | | | | | | | | 1 | |
| 2 Asm | | | | | | | | 2 | |
| Ground clamp for leg of stand | | | | | | | | | |
| None required | | | | | | | | | 0 |
| 1-for cable size #8 solid to #4 stranded | | | | | | | | | 1 |
| 1-for cable size #4 solid to #2/0 stranded..... | | | | | | | | | 2 |
| 1-for cable size #2/0 solid to #250 MCM | | | | | | | | | 3 |
| 1-for cable size 300 MCM to 500 MCM | | | | | | | | | 4 |
| 1-Ground lug for enclosure or stand (for cable size #2 to 600 MCM) | | | | | | | | | 5 |
| CURRENT TRANSFORMER (1 only) | | | | | | | | | |
| (Refer to TABLE 2 for Form Letters. Selection of CT based on voltage and ratio.) | | | | | | | | | |
| None required (Form NN)..... | | | | | | | | | * |
| 5.0 kV class Type JKW-3 (Forms AA-AR)..... | | | | | | | | | * |
| 8.7 kV class Type JKW-4 (Forms BB-BR)..... | | | | | | | | | * |
| 15.0 kV class Type JKW-5 (Forms CA-CT)..... | | | | | | | | | * |
| *Insert TWO letter form. | | | | | | | | | |
| † When ordering resistors only (open frame or with bolt-on cover) cable lugs may be ordered as a separate item. by Cat. No. 259A5970G1. | | | | | | | | | |

RESISTORS

Type DS300C Stainless-steel Neutral Grounding Resistors

DIMENSIONS (FOR ESTIMATING ONLY)

All dimensions in inches.

Outlines: 273A4742-open frame
273A4733-with covers (600V)

| Part No. | Dimensions in Inches | | | | Front View | Max. Weight (Lb) | |
|----------|----------------------|-----|--------|--------|------------|------------------|-------------|
| | Width | B | Height | D | | Open Frame | With Covers |
| 1* | ... | ... | 17 5/8 | 21 3/4 | E | 160 | 175 |
| 2* | ... | ... | 22 5/8 | 9 1/2 | E | 190 | 205 |
| 3* | ... | ... | 27 5/8 | 9 1/2 | E | 220 | 240 |
| 4* | ... | ... | 32 5/8 | 9 1/2 | E | 250 | 270 |
| 5 | 22 1/2 | 12 | 22 5/8 | 9 1/2 | F | 275 | 300 |
| 6 | 22 1/2 | 12 | 27 5/8 | 9 1/2 | F | 340 | 370 |
| 7 | 22 1/2 | 12 | 32 5/8 | 9 1/2 | F | 390 | 420 |
| 8 | 22 1/2 | 12 | 37 5/8 | 9 1/2 | F | 450 | 480 |
| 9 | 37 1/2 | 27 | 27 5/8 | 9 1/2 | F | 520 | 565 |
| 10 | 37 1/2 | 27 | 32 5/8 | 9 1/2 | F | 620 | 665 |
| 11 | 37 1/2 | 27 | 37 5/8 | 9 1/2 | F | 720 | 765 |
| 12 | 37 1/2 | 27 | 42 5/8 | 9 1/2 | F | 820 | 865 |
| 13 | 37 1/2 | 27 | 47 5/8 | 9 1/2 | F | 920 | 970 |
| 14 | 37 1/2 | 27 | 52 5/8 | 9 1/2 | F | 1020 | 1070 |
| 15 | 37 1/2 | 27 | 57 5/8 | 9 1/2 | F | 1120 | 1175 |

* These parts furnished with only 2 mounting locations. Refer to Front View "E".
Insulation Class: 600 volts (max).

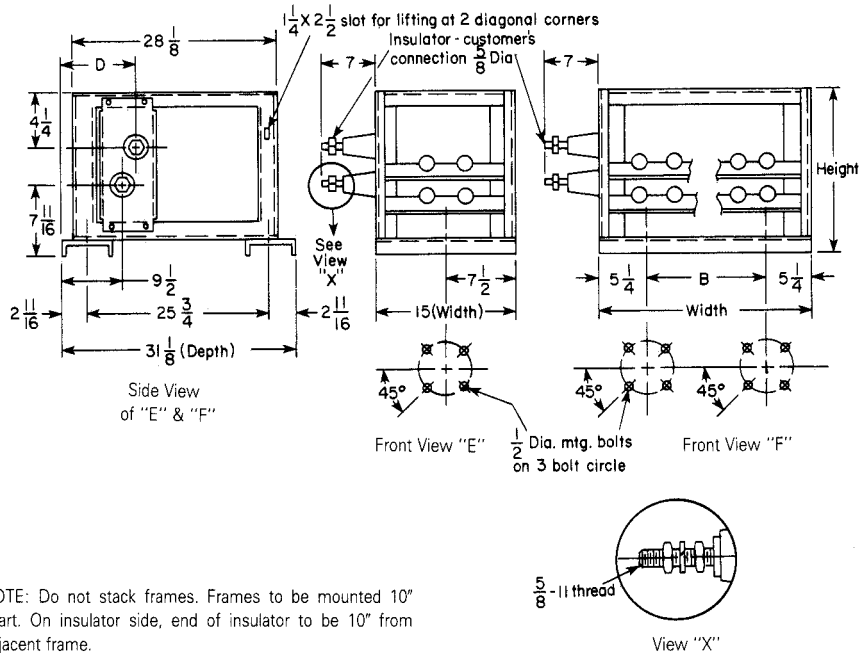
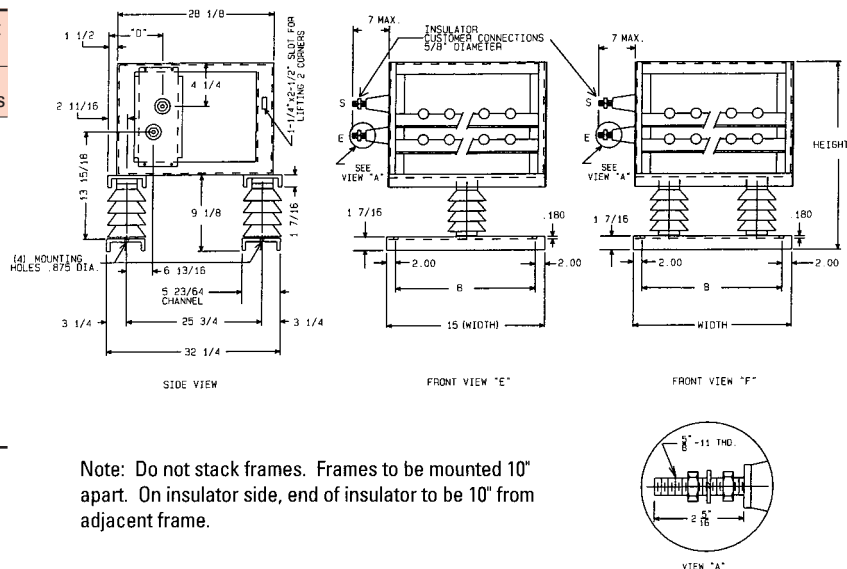


Fig. 23. Dimensions and weights of DS300B 600-volt (maximum) resistors (open or with bolt-on covers)

Outlines: open frame with covers (7.5KV)

| Part No. | Dimension in Inches | | | | Front View | Max. Weight (Lb) | |
|----------|---------------------|--------|--------|--------|------------|------------------|-------------|
| | Width | B | Height | D | | Open Frame | With Covers |
| 1† | ... | ... | 23 7/8 | 21 3/4 | E | 185 | 200 |
| 2† | ... | ... | 28 7/8 | 9 1/2 | E | 215 | 230 |
| 3† | ... | ... | 33 7/8 | 9 1/2 | E | 245 | 260 |
| 4† | ... | ... | 38 7/8 | 9 1/2 | E | 275 | 290 |
| 5 | 22 1/2 | 18 1/2 | 28 7/8 | 9 1/2 | F | 330 | 350 |
| 6 | 22 1/2 | 18 1/2 | 33 7/8 | 9 1/2 | F | 385 | 415 |
| 7 | 22 1/2 | 18 1/2 | 38 7/8 | 9 1/2 | F | 440 | 460 |
| 8 | 22 1/2 | 18 1/2 | 43 7/8 | 9 1/2 | F | 500 | 520 |
| 9 | 37 1/2 | 33 1/2 | 33 7/8 | 9 1/2 | F | 580 | 600 |
| 10 | 37 1/2 | 33 1/2 | 38 7/8 | 9 1/2 | F | 680 | 700 |
| 11 | 37 1/2 | 33 1/2 | 43 7/8 | 9 1/2 | F | 780 | 805 |
| 12 | 37 1/2 | 33 1/2 | 48 7/8 | 9 1/2 | F | 880 | 905 |
| 13 | 37 1/2 | 33 1/2 | 53 7/8 | 9 1/2 | F | 980 | 1010 |
| 14 | 37 1/2 | 33 1/2 | 58 7/8 | 9 1/2 | F | 1080 | 1125 |
| 15 | 37 1/2 | 33 1/2 | 63 7/8 | 9 1/2 | F | 1185 | 1225 |

† These parts furnished with only 2 support insulators. Refer to front view "E".
Insulation class: 7.5 kV (max).



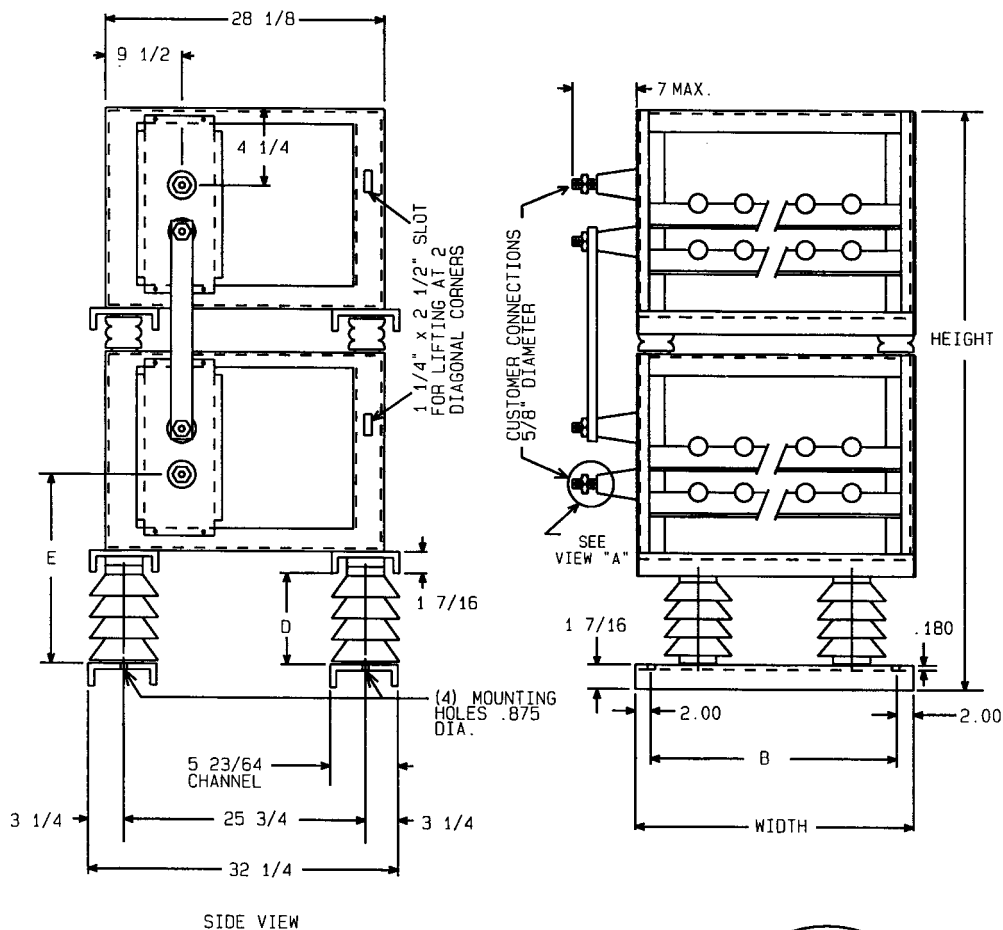
Note: Do not stack frames. Frames to be mounted 10" apart. On insulator side, end of insulator to be 10" from adjacent frame.

Fig. 24. Dimensions and weights of DS300C 7.5 kV single-frame resistors (open or with bolt-on covers)

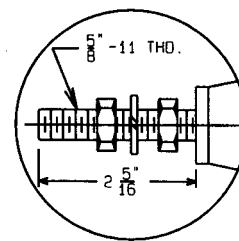
Type DS300C Stainless-steel Neutral Ground Resistors

DIMENSIONS (For Estimating Only)

All dimensions in inches.



Insulation Class (max)
 Pts 5-15, 7.5 kV
 Pts 105-115, 15 kV



VIEW "A"

RESISTORS

| Outlines: 273A4728 - open frame (7.5KV) 273A4736 - with covers | | | | | | | | Outlines: 273A4729 - open frame (15KV) 273A4737 - with covers | | | | | | | | | |
|-------------------------------------------------------------------|----------------------|--------|--------|-------|----------|-------|-------------------|------------------------------------------------------------------|-----------|----------------------|--------|---------|-------|---------|-------|-------------------|-------------|
| Part. No. | Dimensions in Inches | | | | | | Max. Weight (Lb)* | | Part. No. | Dimensions in Inches | | | | | | Max. Weight (Lb)* | |
| | Width | B | Height | D | E | F | Open Frame | With Covers | | Width | B | Height | D | E | F | Open Frame | With Covers |
| 5 | 22 1/2 | 18 1/2 | 55 | 6 1/4 | 13 15/16 | 3 5/8 | 620 | 650 | 105 | 22 1/2 | 18 1/2 | 57 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 665 | 695 |
| 6 | 22 1/2 | 18 1/2 | 65 | 6 1/4 | 13 15/16 | 3 5/8 | 730 | 760 | 106 | 22 1/2 | 18 1/2 | 67 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 775 | 805 |
| 7 | 22 1/2 | 18 1/2 | 75 | 6 1/4 | 13 15/16 | 3 5/8 | 840 | 910 | 107 | 22 1/2 | 18 1/2 | 77 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 885 | 915 |
| 8 | 22 1/2 | 18 1/2 | 85 | 6 1/4 | 13 15/16 | 3 5/8 | 960 | 1030 | 108 | 22 1/2 | 18 1/2 | 87 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 1000 | 1035 |
| 9 | 37 1/2 | 33 1/2 | 65 | 6 1/4 | 13 15/16 | 3 5/8 | 1110 | 1190 | 109 | 37 1/2 | 33 1/2 | 67 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 1200 | 1235 |
| 10 | 37 1/2 | 33 1/2 | 75 | 6 1/4 | 13 15/16 | 3 5/8 | 1315 | 1395 | 110 | 37 1/2 | 33 1/2 | 77 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 1400 | 1440 |
| 11 | 37 1/2 | 33 1/2 | 85 | 6 1/4 | 13 15/16 | 3 5/8 | 1515 | 1595 | 111 | 37 1/2 | 33 1/2 | 87 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 1600 | 1640 |
| 12 | 37 1/2 | 33 1/2 | 95 | 6 1/4 | 13 15/16 | 3 5/8 | 1720 | 1810 | 112 | 37 1/2 | 33 1/2 | 97 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 1800 | 1845 |
| 13 | 37 1/2 | 33 1/2 | 105 | 6 1/4 | 13 15/16 | 3 5/8 | 1920 | 2010 | 113 | 37 1/2 | 33 1/2 | 107 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 2010 | 2060 |
| 14 | 37 1/2 | 33 1/2 | 115 | 6 1/4 | 13 15/16 | 3 5/8 | 2120 | 2220 | 114 | 37 1/2 | 33 1/2 | 117 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 2210 | 2260 |
| 15 | 37 1/2 | 33 1/2 | 125 | 6 1/4 | 13 15/16 | 3 5/8 | 2320 | 2430 | 115 | 37 1/2 | 33 1/2 | 127 1/2 | 8 3/4 | 16 7/16 | 4 1/8 | 2420 | 2520 |

Fig. 25. Dimensions and weights of IC300B two-frame (stacked) 7.5 kV and 15 kV resistors (open or with bolt-on covers)

* Weight of 2 frame stack

Type DS300C Stainless-steel Neutral Grounding Resistors

DIMENSIONS—DS310 SAFETY-SCREEN ENCLOSURE Hot-dipped Galvanized Construction (A)

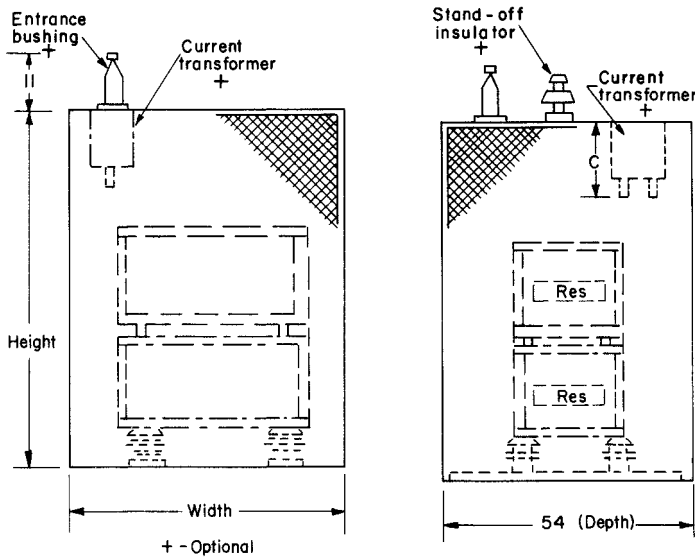
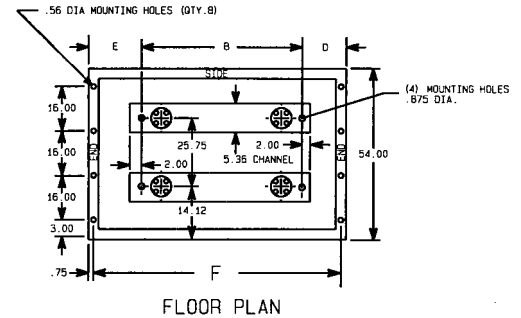


Fig. 26. Dimensions of grounded safety-screen enclosure for one- or two-frame (stacked) resistors

| Enclosure Part No. DS310 | Dimensions in Inches | | | | Max. Weight (Lb.) |
|--------------------------|----------------------|--------|----------|--------|-------------------|
| | Width | Height | C | | |
| A044 A144 | 54 | 54 | JKW-3, 4 | JKW-5 | 200 |
| A045 A145 | 68 | 54 | 12 3/8 | 15 3/4 | 225 |
| A046 A146 | 68 | 64 | 12 3/8 | 15 3/4 | 250 |
| A047 A147 | 68 | 80 | 12 3/8 | 15 3/4 | 300 |
| A048 A148 | 68 | 100 | 12 3/8 | 15 3/4 | 350 |
| A049 A149 | 68 | 120 | 12 3/8 | 15 3/4 | 425 |



(Fig. 27)

DIMENSIONS—DS310 GALVANIZED-STEEL STAND With Hot-dipped Galvanized Safety-screen Enclosure All dimensions in inches.

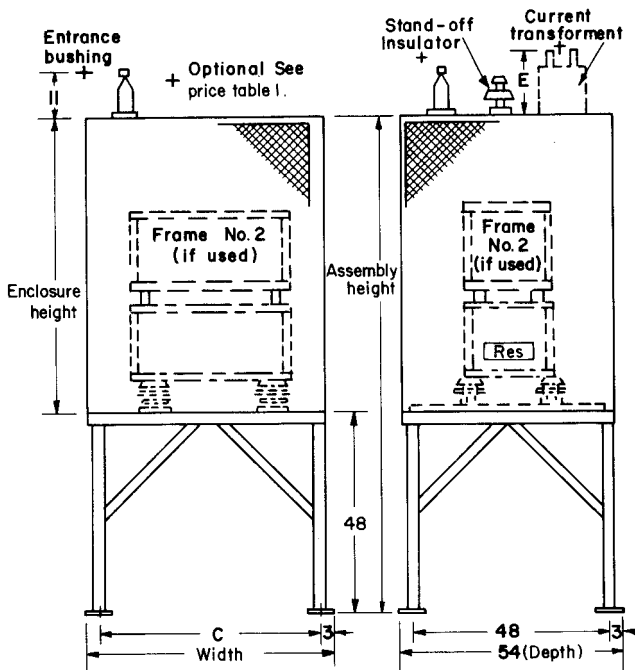


Fig. 31. Dimensions of stand with grounded safety-screen enclosure for one-frame resistors and two-frame (stacked) resistors

| Enclosure Part No. DS310 A or B | Dimensions in Inches | | | |
|---------------------------------|----------------------|------|-------|------|
| | B* | D | E | F |
| 044, 144 | 11 | 15.5 | 27.5 | 52.5 |
| 045, 145 | 18.5 | 9.75 | 25.75 | 52.5 |
| 046, 146 | 33.5 | 9.75 | 24.75 | 66.5 |
| 047, 147 | 11 | 9.5 | 47.5 | 66.5 |
| 048, 148 | 18.5 | 9.75 | 39.75 | 66.5 |
| 049, 149 | 33.5 | 9.75 | 24.75 | 66.5 |

* Refer to Figures 24 and 25. Refer to company for DS300B mounting dimensions.

| Stand Assembly Part No. DS310 | Dimensions in Inches | | | | | | | | |
|-------------------------------|----------------------|-----|-------|----|------------------|----------|--------|----------------------|-----|
| | Assembly Height | | Width | | Enclosure Height | E | | Maximum Weight (Lb.) | |
| | E | K | Width | C | | JKW-3, 4 | JKW-5 | E | K |
| E044, E144 K044, K144 | 102 | 150 | 54 | 48 | 54 | 12 3/8 | 15 3/4 | 550 | 730 |
| E045, E145 K045, K145 | 102 | 150 | 68 | 62 | 54 | 12 3/8 | 15 3/4 | 585 | 765 |
| E046, E146 K046, K146 | 112 | 160 | 68 | 62 | 64 | 12 3/8 | 15 3/4 | 610 | 790 |
| E047, E147 K047, K147 | 128 | 176 | 68 | 62 | 80 | 12 3/8 | 15 3/4 | 660 | 840 |
| E048, E148 K048, K148 | 148 | 196 | 68 | 62 | 100 | 12 3/8 | 15 3/4 | 710 | 890 |
| E049, E149 K049, K149 | 168 | 216 | 68 | 62 | 120 | 12 3/8 | 15 3/4 | 760 | 940 |

Type 85A Stainless-steel Neutral Grounding Resistors

Type 85A neutral grounding resistors are used for resistance grounding of industrial power systems. They are connected between the neutral of wye-wound transformer or generator and ground. The current rating of the resistor is selected to allow sufficient fault current to flow to operate protective ground fault relays and yet not be greater than necessary to limit the fault current.

Ratings

The 85A neutral grounding resistor is selected based on (1) rated line to neutral voltage, (2) initial current in amps and (3) allowable "time on", as defined by IEEE standards. The time ratings are: 10 seconds, 60 seconds, extended time and continuous. Current ratings range from 50 amps to 1000 amps, with higher rating up to 2000 amps. Line to neutral voltage ratings are 480/277 and 600/347 for low voltage systems, and high voltage rating from 1390 volts up to 20KV line to neutral.

Construction

The 85A neutral grounding resistor is a stainless steel grounding resistor box in a protective metal enclosure, suitable for indoor or outdoor applications. The resistor elements are stainless steel, and are mounted with steel box end frames. The standard enclosure is made from mill galvanized steel and includes a solid top, screened or louvered side panels, a galvanized steel screened bottom. Cable connections include a top mounted high voltage entrance bushing and a bottom insulated cable hub for through cable connection to the resistor. Each resistor enclosure includes eye bolts for easy lifting.

Options

Optional items for the 85A resistor include side mounted entrance bushings, two top mounted entrance bushings, two bot-

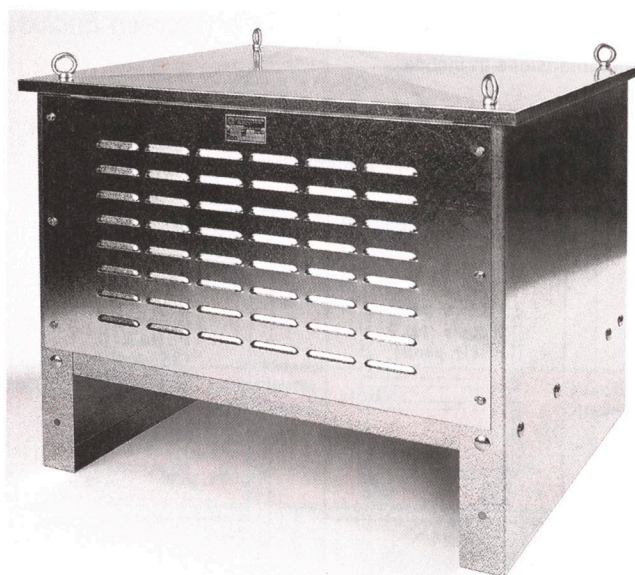
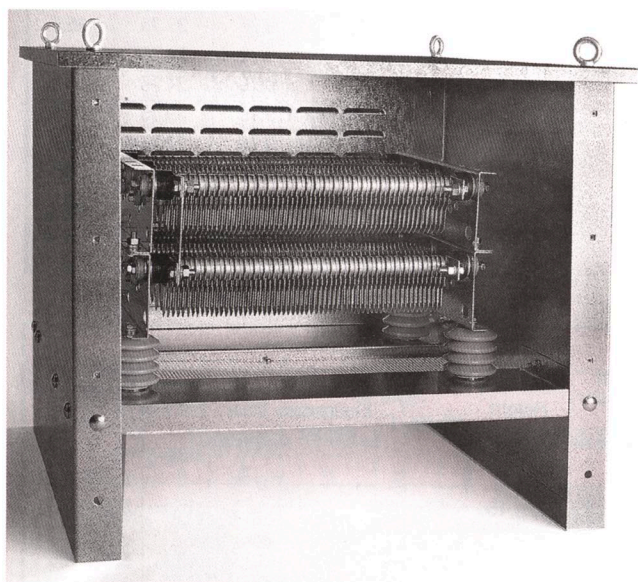
tom mounted entrance hubs, current transformers, potential transformers, elevated stand with 4' or 8' legs, and various custom enclosures. Several optional finishes and materials, such as aluminum and stainless steel, are available for the resistor enclosure.

Low Voltage Indoor Grounding Resistors

For indoor low voltage applications, either 277 or 347 volts, the IC9133 type resistor assembly is supplied. The IC9133 uses wire or ribbon wound elements, mounted on ceramic cores. The assembly may be supplied with a protective metal enclosure.

High Resistance Grounding

For resistors to limit the fault current to less than 5 amps, refer to pages 6-2 to 6-7 on HIGH RESISTANCE GROUNDING EQUIPMENT, type DS9181.



Type 85A Stainless-steel Neutral Grounding Resistors

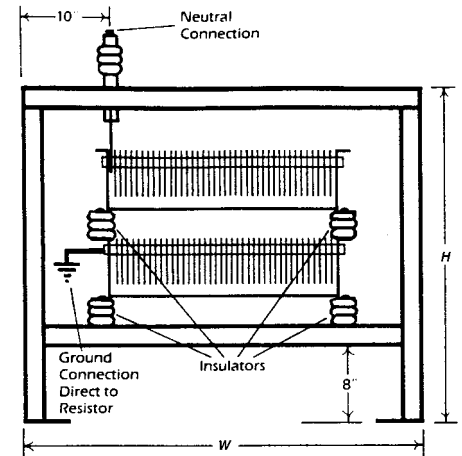
| Catalog Number | 85A | - | - | - | - | - | - | - |
|--------------------------------------------|-----|-----|---|------|----|---|----|------|
| Description | | | | | | | | |
| SYSTEM VOLTAGE L-N | | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| 1300 volts | | 13 | | | | | | |
| 2400 volts | | 24 | | | | | | |
| 4160 volts | | 41 | | | | | | |
| 6600 volts | | 66 | | | | | | |
| 7200 volts | | 72 | | | | | | |
| 8000 volts | | 80 | | | | | | |
| 9950 volts | | 100 | | | | | | |
| TIME RATING | | | | | | | | |
| 10 sec on time | | | A | | | | | |
| extended time | | | E | | | | | |
| continuous | | | C | | | | | |
| 60 sec | | | B | | | | | |
| 30 sec | | | D | | | | | |
| CURRENT RATING | | | | | | | | |
| 50 amps | | | | 50 | | | | |
| 100 amps | | | | 100 | | | | |
| 200 amps | | | | 200 | | | | |
| 400 amps | | | | 400 | | | | |
| 500 amps | | | | 500 | | | | |
| 600 amps | | | | 600 | | | | |
| 800 amps | | | | 800 | | | | |
| 1000 amps | | | | 1000 | | | | |
| 1200 amps | | | | 1200 | | | | |
| 1600 amps | | | | 1600 | | | | |
| 2000 amps | | | | 2000 | | | | |
| ENCLOSURE TYPE | | | | | | | | |
| Mill finish | | | | | Mx | | | |
| Painted finish | | | | | Px | | | |
| Hot dip galvanized finish | | | | | Hx | | | |
| Aluminum | | | | | Ax | | | |
| Stainless steel | | | | | Sx | | | |
| Standard enclosure | | | | | xA | | | |
| Std enclosure with 4 ft stand | | | | | xE | | | |
| Std enclosure with 6 ft stand | | | | | xF | | | |
| Std enclosure with 8 ft stand | | | | | xG | | | |
| BUSHINGS | | | | | | | | |
| top bushing and bottom hub (basic version) | | | | | | 1 | | |
| top bushing and bottom hub (w/terminals) | | | | | | 2 | | |
| top and bottom bushings w/terminals | | | | | | 4 | | |
| bottom entrance and exit with hubs | | | | | | 3 | | |
| special per specifications | | | | | | 9 | | |
| CURRENT TRANSFORMERS | | | | | | | | |
| none | | | | | | | NN | |
| 5kv CT | | | | | | | Ax | |
| 8.5kv ct | | | | | | | Bx | |
| 15kv ct | | | | | | | Cx | |
| 100:5 | | | | | | | xK | |
| 200:5 | | | | | | | xM | |
| 300:5 | | | | | | | xN | |
| 400:5 | | | | | | | xP | |
| 600:5 | | | | | | | xQ | |
| 800:5 | | | | | | | xR | |
| 1000:5 | | | | | | | xS | |
| 1200:5 | | | | | | | xT | |
| heater, anti-condensation | | | | | | | Hx | |
| special per specification | | | | | | | Yx | |
| OTHER MODIFICATIONS | | | | | | | | |
| none | | | | | | | | none |
| Special Customer Nameplate | | | | | | | | 2 |
| Special Customer Drawings | | | | | | | | 3 |

RESISTORS

Type 85A Stainless-steel Neutral Grounding Resistors

| Rating | | CATALOG NUMBER | DIMENSIONS | | | | | |
|-------------------------------------------------------------------------|------|----------------------|------------|----|----|---------|----|----|
| AMPS | OHMS | | without CT | | | with CT | | |
| | | | W | D | H | W | D | H |
| 1390 Volts line to neutral (2,400 volt system) 10 second rating | | | | | | | | |
| 50 | 27.5 | 85A 13 A 50 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 100 | 14 | 85A 13 A 100 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 200 | 7 | 85A 13 A 200 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 300 | 4.6 | 85A 13 A 300 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 400 | 4 | 85A 13 A 400 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 500 | 3 | 85A 13 A 500 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 600 | 2.3 | 85A 13 A 600 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 800 | 1.7 | 85A 13 A 800 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 1000 | 1.4 | 85A 13 A 1000 MA 1NN | 36 | 32 | 24 | 36 | 36 | 24 |
| 2400 Volts line to neutral (4,160 volt system) 10 second rating | | | | | | | | |
| 50 | 48 | 85A 24 A 50 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 100 | 24 | 85A 24 A 100 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 200 | 12 | 85A 24 A 200 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 300 | 8 | 85A 24 A 300 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 400 | 6 | 85A 24 A 400 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 500 | 5 | 85A 24 A 500 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 600 | 4 | 85A 24 A 600 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 800 | 3 | 85A 24 A 800 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 1000 | 2.4 | 85A 24 A 1000 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 1200 | 2 | 85A 24 A 1200 MA 1NN | 36 | 32 | 32 | 36 | 36 | 32 |
| 4160 Volts line to neutral (7,200 volt system) 10 second rating | | | | | | | | |
| 50 | 83.2 | 85A 41 A 50 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 100 | 41.6 | 85A 41 A 100 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 200 | 20.8 | 85A 41 A 200 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 300 | 13.9 | 85A 41 A 300 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 400 | 10.4 | 85A 41 A 400 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 500 | 10.4 | 85A 41 A 500 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 600 | 8.3 | 85A 41 A 600 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 800 | 5.2 | 85A 41 A 800 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 1000 | 4.2 | 85A 41 A 1000 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 1200 | 3.5 | 85A 41 A 1200 MA 1NN | 36 | 36 | 36 | 36 | 42 | 36 |
| 8000 Volts line to neutral (13,900 volt system) 10 second rating | | | | | | | | |
| 50 | 160 | 85A 80 A 50 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 100 | 80 | 85A 80 A 100 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 200 | 40 | 85A 80 A 200 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 300 | 27 | 85A 80 A 300 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 400 | 20 | 85A 80 A 400 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 500 | 16 | 85A 80 A 500 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 600 | 13 | 85A 80 A 600 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 800 | 10 | 85A 80 A 800 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 1000 | 8 | 85A 80 A 1000 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |
| 1200 | 6.7 | 85A 80 A 1200 MA 1NN | 42 | 42 | 60 | 42 | 52 | 60 |

FRONT VIEW



LEFT SIDE VIEW

