

DEH-41473 Installation and Maintenance Manual

AKD-20 AR / Entellisys AR Low-voltage Switchgear



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General Information


Hazard Classifications

The following important highlighted information appears throughout this document to warn of potential hazards or to call attention to information that clarifies a procedure.

Carefully read all instructions and become familiar with the devices before trying to install, operate, service or maintain this equipment.

 **DANGER:** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING:** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **CAUTION:** Indicates that if the hazard is not avoided could result in minor or moderate injury.

NOTICE: Is used to notify of practices not related to personal injury.

Trademarks

Entellisys*

EntelliGuard* G

EntelliGuard* E

EntelliGuard* TU

Arc Vault* Protection System

Warranty

This document is based on information available at the time of its publication. While efforts have been made to ensure accuracy, the information contained herein does not cover all details or variations in hardware and software, nor does it provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein that are not present in all hardware and software systems. GE Industrial Solutions assumes no obligation of notice to holders of this document with respect to changes subsequently made. GE Industrial Solutions makes no representation or warranty, expressed, implied, or statutory, with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

Contact your local sales office if further information is required concerning any aspect of AKD-20 AR or Entellisys AR switchgear and EntelliGuard G or EntelliGuard E breaker operation or maintenance.

Section 1. Introduction

General Information

NOTICE: These instructions convey information that pertain to both AKD-20 AR and Entellisys AR low-voltage switchgear products. Information that is applicable only to AKD-20 AR will be marked as (AKD-20 AR Only) and information that is applicable to Entellisys AR will be marked as (Entellisys AR Only). Unless marked otherwise, information provided in this document is applicable to both products.

NOTICE: These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with the installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purposes, the matter should be referred to the General Electric Company. These instructions are intended for use by qualified personnel only.

This manual contains procedures for receiving, handling, storage, installation, operation, maintenance, and service of AKD-20 AR and Entellisys AR low-voltage switchgear.

NOTICE: The personnel responsible for installing, operating, and servicing this equipment should be thoroughly familiar with the contents of this manual.

Before any installation work is performed, thoroughly read and understand the material in this instruction manual and the drawings furnished with the equipment. The documentation shipped with the equipment includes the Summary, Front View, Elementary Diagram, Connection Diagram and Instruction Books. This material is located in a forward compartment tagged "INSTRUCTIONS IN THIS COMPARTMENT." The documentation provides all of the information necessary for installation of the switchgear. When requesting information from the General Electric Company, include the complete data appearing on the equipment nameplate, requisition number, summary number, and elementary diagram number. The nameplate is located in the lower left, front corner of the lineup.

When requesting information concerning any specific item furnished with the switchgear, refer to that item by description, part number, its location within this manual, and any applicable drawing number. Any material external to the equipment, which may be required to meet local codes (such as mats, screens, railings, etc.), is not furnished by the General Electric Company.

If there are any questions or requirements not covered in this manual or in the accompanying drawings, please contact the local sales office of the General Electric Company.

Instruction Manual Arrangement

Information and procedures in this instruction manual are divided into sections as follows:

Section 1, Introduction

Gives a brief account of the equipment's function and provides for general information, and applicable data for the equipment and its components.

Section 2, Receiving, Handling, and Storage

Describes procedures required for receiving and handling the equipment and how to prepare it for short- or long-term storage.

Section 3, Switchgear Description

Describes the AKD-20 AR and Entellisys AR low-voltage switchgear and its various components. Included are the section enclosure, breaker compartments, circuit breakers, instrument panels and instrument compartments, bus bar arrangement, incoming cable, ground and neutral bus, and auxiliary sections. This section also explains how the electrical and mechanical components perform their assigned functions.

Section 4, Equipment Installation

Provides the information needed prior to installation, site location and foundation requirements, and how to anchor the equipment properly and safely. It also covers installation of peripheral equipment and includes information on electrical connections and mechanical construction.

Section 5, Exhaust Plenum Installation

Describes the procedure for installing the exhaust plenum across the top of the switchgear and provides details for assembly of the end of the plenum exhaust system.

Section 6, Installing and Removing Circuit Breakers

Gives a step-by-step procedure for lifting the breaker from the floor, installing it on draw-out rails, and moving it into the connected position. A further procedure is given to withdraw a breaker, remove it from the draw-out rails, and lower it to the floor. Also included is a description of the rejection system provided to avoid the inadvertent use of an incorrect breaker in a breaker compartment.

Section 7, Testing and Inspecting

Reviews items which should be tested or inspected prior to energizing and operating the switchgear.

Section 8, Operating the Switchgear

Covers how to operate the circuit breaker, and contains information concerning draw-out provisions, doors, and various accessories.

Section 9, Energizing the Switchgear

Outlines the steps to be taken before and during the electrical energization of the equipment.

Section 10, Maintaining the Switchgear

Provides instructions for all preventive maintenance, servicing, and lubrication information for the switchgear equipment. Included is service and maintenance data for the circuit breakers, instrument compartments, instruments, bus bar joints, and cable connections. This section also includes paint refinishing requirements.

Section 11, Common Switchgear Accessories and Kits

Outlines a listing of common accessory and kit items available from the factory.

Appendices A, B, C, D, E, F, and G

Contains information concerning screw and bolt torque values, circuit breaker rejection features, circuit breaker information, exhaust plenum system component details, and a open space for taking notes.

Related Publications

Addendum's to this instruction manual are the available service and maintenance publications supplied separately for circuit breakers, relays and other devices not described in this instruction manual.

In addition to instruction manuals, the following drawings will be supplied as required for each order of AKD-20 AR and Entellisys AR switchgear equipment.

These are all the documents necessary to install, operate, and maintain the equipment. One complete set of drawings and instruction manuals is shipped with the equipment.

General Arrangement Drawings

Drawings which Include front view and floor plan details.

Elementary and Connection Drawings

Drawings (or wiring routing tables) which indicate and identify test and connection points including terminal blocks, device studs, switch contact developments, and remote connections.

Summary of Switchgear Equipment

Documents which list of all the components furnished with the switchgear, including the breakers, identified by catalog number.

Figure 1.1 AKD-20 AR low-voltage switchgear



Section 2. Receiving, Handling, and Storage

Receiving

Equipment Packaging

Every package leaving the factory is plainly marked with the case number, requisition number, and customer's order number. If the equipment has been split for shipment, the section numbers of the equipment enclosed in each shipping package are identified.

NOTICE: To avoid the loss of any parts when unpacking, the contents of each container should be carefully checked against the packing list before discarding the packing material.

The contents of each shipping package are listed on the Master Packing List. In addition, this list includes the number of the shipping crate in which miscellaneous parts needed to install and operate the equipment (such as hardware, contact lubricant, touch-up paint, breaker closing devices, etc.) are located. Normally, such devices are packed in a cardboard carton and the carton secured in an empty switchgear compartment (Figure 2.1). If such items are packed in a switchgear section instead of a separate crate, the list will indicate the appropriate section number in which they are stored. Large items (such as breaker lifting devices and dollies used with indoor equipment) will always be shipped in separate crates or cartons (Figure 2.2 and Figure 2.3).

Inspecting for Damage

All equipment leaving the factory is carefully inspected and packed by personnel experienced in the proper handling and packing of electrical equipment. Upon receipt of any equipment, immediately perform a visual inspection to ascertain if any damage has been sustained in shipping or if there are any loose parts.

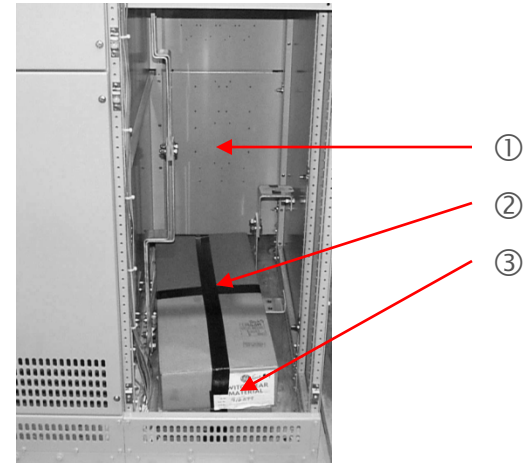
Circuit breakers may be shipped separately in individual containers with the breaker in the open position. Circuit breakers should be unpacked and visually inspected for damage or loose parts as soon as possible after they have been received.

Be sure to inspect all devices mounted or packed inside compartments of each section to see if any have been dislodged or damaged.

Filing a Claim

If any damage is evident, or indication of rough handling is visible, file a claim for damage at once with the transportation company and notify the nearest General Electric Company Sales Office immediately. Information on damaged parts, part number, case number, requisition number, etc., should accompany the claim.

Figure 2.1 Packaging of loose material for shipment



- (1) Spare Compartment
- (2) Carton Containing Loose Material
- (3) Shipping Label Listing Contents of Carton

Figure 2.2 Carton containing breaker lifting device



Figure 2.3 Carton containing exhaust plenum components



Handling

NOTICE: It is preferable to leave the shipping skids in place under the switchgear until it reaches its final location. The equipment should be installed in its final location prior to installing the circuit breakers.

Indoor Enclosure Lifting

The indoor switchgear sections are best handled by lifting with a crane (Figure 2.4). Removable lifting plates are provided, as standard equipment, on the top of each switchgear section. To preserve the external appearance of the equipment, it is suggested that the lifting plates be left in place except where adjacent equipment must be bolted together, i.e. shipping splits, etc.

Utilize four equal length cables and an overhead crane, each with a minimum load rating of twice the weight of the switchgear.

Estimated weights for shipping splits appear on the Front View drawings.

Example: Switchgear Section Weight = 5,000 pounds. The crane and the four lift cables must have a minimum load lifting capacity of 10,000 pounds.

⚠ WARNING: The angle between the cables and the top of the equipment must be at least 45 degrees. If this is not possible because of lack of headspace, spreader bars must be used. Also, lift cables with greater load capability may be necessary, depending upon the angle between the cables and the crane hook.

Connect a cable from the crane to the four lifting plates located on the top-front and rear of the switchgear (Figure 2.4).

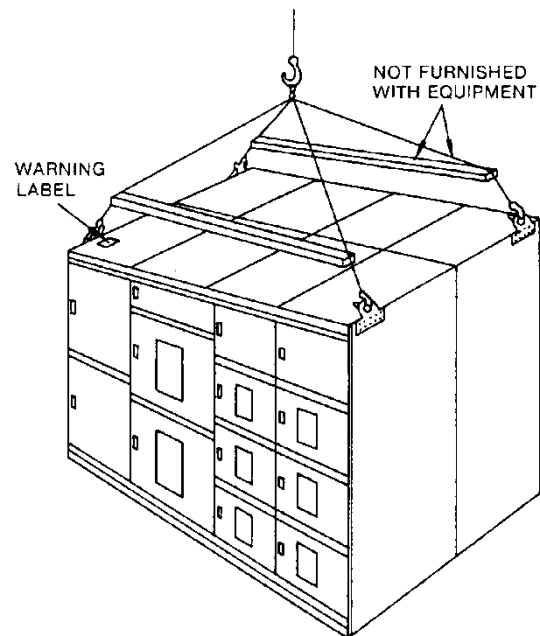
Take up the slack in the lifting device very carefully and manually stabilize the switchgear to prevent it from rotating.

⚠ DANGER: Do not stand under switchgear while it is being moved. Serious injury may occur if the cables or lifting device fail.

⚠ CAUTION: Gently lower the switchgear section onto the level site location. If the switchgear is roughly handled or jarred, it is possible to damage or misalign internal components.

⚠ WARNING: Be sure to remove all circuit breakers from their compartments prior to lifting. Failure to remove the circuit breakers prior to lifting will result in a center of gravity toward the front of the switchgear assembly and may require additional rigging and stabilization.

Figure 2.4 Recommended lifting of indoor enclosure



WARNING LABEL BY EACH LIFTING PLATE

⚠ WARNING

When lifting this equipment, use lifting holes provided. Angle of sling must not be less than 45 degrees. If head space is insufficient, use a spreader bar. Refer to Instructions and Operations Manual.

⚠ AVERTISSEMENT

Lorsque vous soulevez cet équipement, utilisez les trous de levage fournis.

L'angle de l'élingue ne doit pas être inférieur à 45 degrés.

Si l'espace de tête est insuffisant, utilisez une barre d'écartement.

Reportez-vous au Manuel d'Instructions et Opérations.

⚠ ADVERTENCIA

Cuando levante el equipo, utilice los agujeros de transporte proveídos.

El ángulo de la eslinga no debe ser inferior a 45 grados.

Si el espacio de cabeza es insuficiente, utilice una barra separadora.

Consulte el Manual de Instrucciones y Operaciones.



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Rollers

If crane facilities are not available, the equipment may be moved into position by means of construction rollers placed under the shipping skids. The switchgear may be raised enough for the placement of rollers by means of a forklift.

There should never be less than four rollers under the equipment unless the lineup is less than five feet long. Use one roller for each 18 inches of equipment length.

Forklifts

When using a forklift to raise the lineup to position rollers underneath, proceed as follows:

1. Expand forklift tines to their maximum (widest) extension.
2. Carefully insert tines of forklift below one side of the switchgear lineup at the approximate center of the panel. Raise equipment and position one roller under the skids close to the raised end of the lineup (Figure 2.5).
3. Carefully lower the gear until it rests on the roller (Figure 2.6).
4. Repeat the lifting process at the other end and place the appropriate number of rollers under the skids spacing them evenly across the width of the lineup (Figure 2.7).
5. Carefully lower the gear until it rests on the roller (Figure 2.6).
6. While carefully pushing the switchgear to its final site position, the rollers that are freed from the rear of the switchgear are then repositioned at the forward end. This procedure should be continued until the switchgear is in its final location (Figure 2.7).
7. When the switchgear is in its final position, remove all lug bolts holding the shipping skids to the switchgear lineup.
8. Insert the tines of the forklift at one end of the lineup, raise slightly, and remove the loose rollers.
9. Lower the end of the gear carefully to the floor.
10. Raise the other end of the lineup slightly and remove the remaining roller at that end.

⚠ CAUTION: Do not attempt to lift or move the equipment with a forklift positioned in the front or rear of the equipment. It is possible to damage internal components and/or the shipping skid.

NOTICE: If the shipping skids are removed prior to final placement of the equipment, rollers may only be used to move the equipment in a direction parallel to the front.

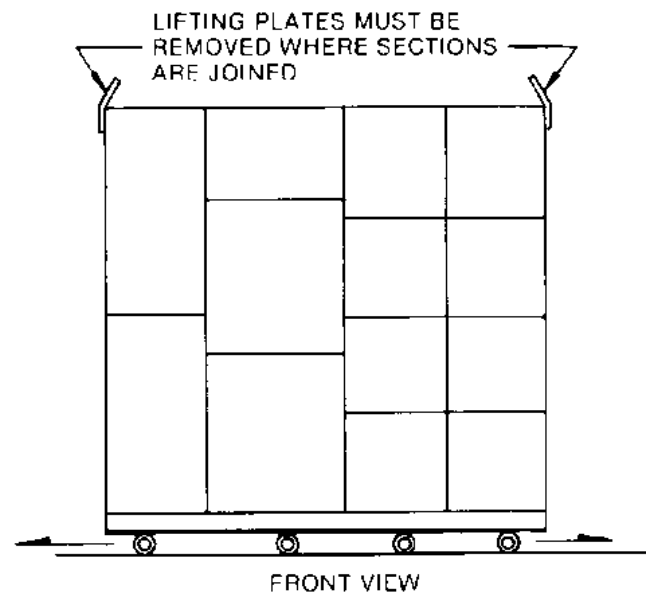
Figure 2.5 Positioning forklift tines



Figure 2.6 Placement of construction rollers



Figure 2.7 Method of rolling equipment



Storage

Switchgear

If it is necessary to store the switchgear equipment for any length of time, the following precautions should be taken to prevent corrosion or deterioration.

1. Remove protective covering. Check thoroughly for damage.
2. Store in a clean, dry, rodent-free location with moderate temperature and provide coverings to prevent dirt, water, or other foreign substances from entering the switchgear.
3. If dampness or condensation may be encountered in the storage location, heaters must be placed inside the switchgear sections to prevent moisture damage. Approximately 250 watts of heat in each section is required. On outdoor switchgear equipment, this may be accomplished by making a temporary power supply connection to the heaters already installed in the equipment. On indoor switchgear, factory installed heaters are available as an option.
4. If the switchgear is to be used with an external exhaust plenum system, be sure that the factory installed temporary covers are in place for storage. Equipment shipped from the factory without the external exhaust plenum will have covers located on each vertical section on the top of the plenum flange assembly (Figure 2.8).

⚠ CAUTION: Remove all cartons, containers and any other miscellaneous packaging and packing material from inside the switchgear sections before energizing any internal heaters. To prevent fire, remove any plastic or polyethylene shrouding from the switchgear sections before energizing any internal heaters.

⚠ CAUTION: If the space heaters are to be temporarily energized from an external source, it is important to remove the fuses on the secondary side of the control power transformer. This precaution is to prevent a feedback of higher voltage to other portions of the equipment through the control power transformer primary circuit.

Circuit Breakers

If circuit breakers are not to be placed into service at once, remove them from their shipping cartons and thoroughly inspect them for damage. If the breakers are in satisfactory condition, replace the breakers in their shipping cartons for storage. Do not remove the circuit breaker shipping members at this time.

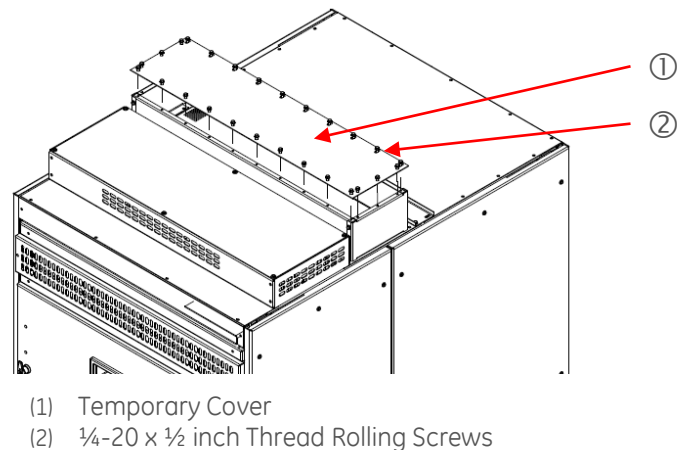
Store the circuit breakers in a clean, dry location in an upright position. They must be properly supported to prevent bending of the studs or damage to any of the breaker parts. Do not remove any protective grease until the circuit breakers are ready to be installed. A plastic or canvas-type cover should be provided to reduce the possibility of damage to the breakers due to dust and water.

Exhaust Plenum Components

If it is necessary to store the exhaust plenum system for any length of time, the following precautions should be taken to prevent corrosion or deterioration.

1. Remove protective covering. Check thoroughly for damage.
2. Store in a clean, dry, rodent-free location with moderate temperature and provide coverings to prevent dirt, water, or other foreign substances from entering the individual components.

Figure 2.8 Plenum flange temporary cover



Section 3. Switchgear Description

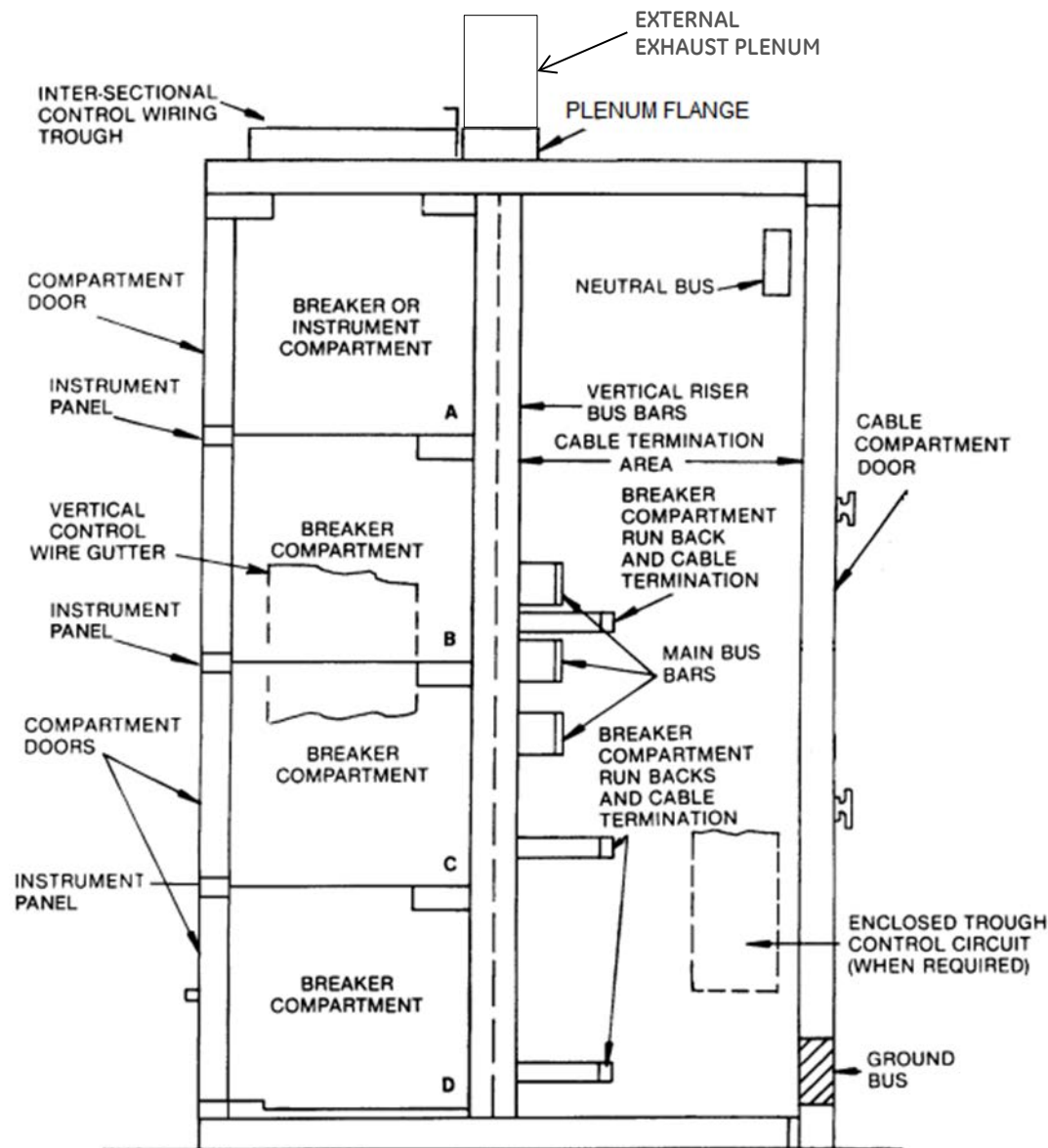
General

This section contains a description of the General Electric low-voltage switchgear. It also describes the functions of the electrical and mechanical systems.

Figure 3.1 is a side view of a typical section showing compartmentation.

Compartmentation is identical for Entellisis AR equipment with the exception that an Entellisis Messenger is provided in lieu of an Instrument Panel for each breaker compartment.

Figure 3.1 Side view section of AKD-20 AR low-voltage switchgear



Summary Description

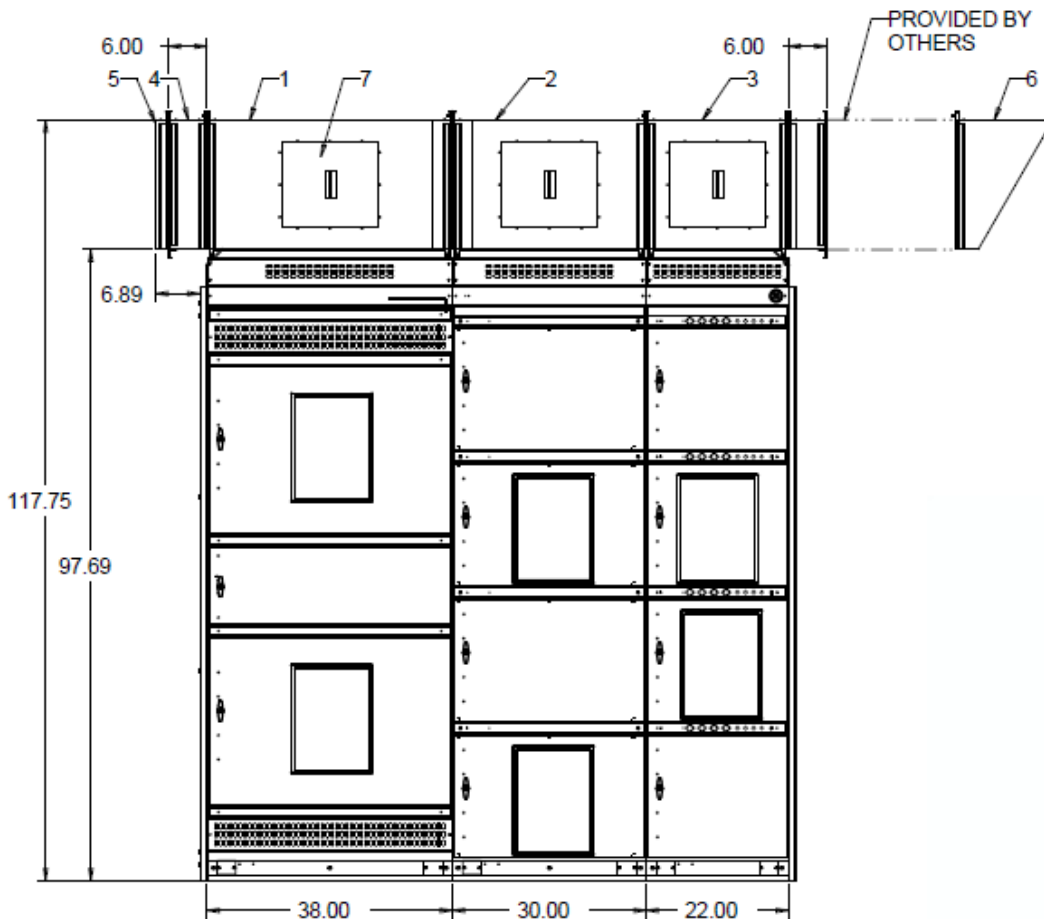
General Electric low-voltage switchgear is a freestanding assembly of metal-enclosed sections containing low-voltage power circuit breakers, bus bars, cable termination provisions, auxiliary power circuit protective devices, controls, and instrumentation.

All of the primary circuit switching and protective devices, secondary control and metering devices, control fuses, instrument transformers, and instrumentation are mounted in the enclosure.

The minimum ceiling space required for an assembly of arc resistant low-voltage switchgear is 10 feet from the base of the assembly.

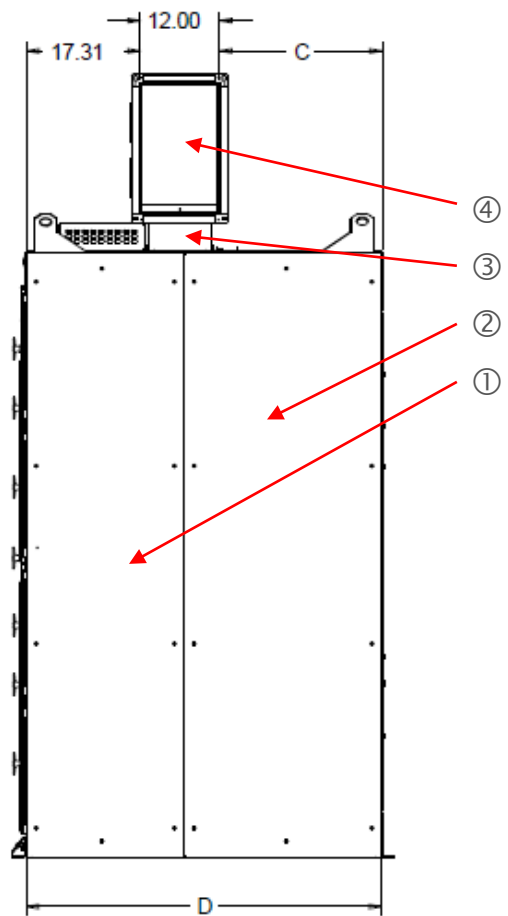
The breaker compartments include draw-out rails, stationary breaker contacts, interlocks, and necessary control and indicating devices. The breakers are provided with self-aligning primary and secondary disconnecting contacts, breaker locking mechanism, and integral trip unit. The individual sections, compartments, and devices are described in the following paragraphs. Figure 3.2 and Figure 3.3 provide an outline of a typical single-ended load center illustrating the nomenclature used for all equipment.

Figure 3.2 Outline of typical arc resistant low-voltage switchgear (front view)



- (1) Exhaust Plenum Section, 38" Stack
- (2) Exhaust Plenum Section, 30" Stack
- (3) Exhaust Plenum Section, 22" Stack
- (4) Transition Adaptor Section (Typical)
- (5) End Cap
- (6) Exhaust Plenum End Portal
- (7) Exhaust Plenum Access Cover (Typical)

Figure 3.3 Outline of typical arc resistant low-voltage switchgear (side view)



- (1) Front Compartments & Breaker Compartments
- (2) Bus and Cable Compartment
- (3) Plenum Flange
- (4) Exhaust Plenum System

Table 3.1 Arc resistant low-voltage switchgear assembly depths

Dimension	Depth (inches)			
C	24.74	30.74	37.74	44.74
D	54	60	67	74

Front Compartments

The front enclosure of each section is divided into individual compartments. These compartments house either a low-voltage power circuit breaker or are used to mount instruments, control components and other ancillary devices.

Instrument Panel (AKD-20 AR Only)

A standard instrument panel is located above each breaker compartment eliminating cross-hinge wiring (Figure 3.4). When required, optional devices may be included and mounted on the front face of the panel such as breaker control circuit fuses, pilot lights, and a RELT switch.

Fuses for the charge, close, and trip circuits of the electrically operated EntelliGuard G breakers are mounted on the panel. Routine wiring inspections and fuse checks or fuse replacements can be performed with the breaker compartment door in the closed position so that operators are protected from the energized primary circuits.

Circuit Breaker Control Fuse Panel (Entellisys AR Only)

Control fuses for the charge, close, and trip circuit of electrically operated EntelliGuard E circuit breakers are located on the lower left panel of the circuit breaker escutcheon cover (Figure 3.5). Control fuses for the SET and RESET coils of the optional Network Interlock accessory are located similarly.

EntelliGuard Messenger (Entellisys AR Only)

An EntelliGuard Messenger is located above each breaker compartment (Figure 3.6). The Messenger provides an interface between the circuit breaker, the breaker compartment, and the Entellisys system. For additional information and instructions, reference DEH-501.

Instrument/Auxiliary Compartment

An instrument/auxiliary compartment is available as a standard feature (Figure 3.7).

Relays, fuse cutouts, and similar devices may be installed in the instrument compartment or in adjacent compartments.

CAUTION: The instrument/auxiliary compartment may contain devices that operate at a variety of different control voltages including both primary and secondary sources. Review all equipment drawings, elementary, remote connection drawings and the summary of equipment prior to working inside.

Figure 3.4 AKD-20 AR instrument panel



- (1) Circuit Breaker Control Fuses
- (2) RELT Switch & Indicator
- (3) Pilot Indicating Lights

Figure 3.5 Entellisys AR circuit breaker fuse panel



Figure 3.6 EntelliGuard messenger



Figure 3.7 Instrument/auxiliary compartment



Entellisys Instrument/Auxiliary Compartment (Entellisys AR Only)

Each Entellisys AR low-voltage switchgear lineup contains standard devices housed within the instrument compartments (Figure 3.8). Two CPUs (Central Processing Units) provide the processing capability to support all switchgear functions. At least one HMI (Human-Machine Interface) provides user access to the Entellisys system. Network switches provide communication links between the CPU, the HMI, the EntelliGuard Messengers, and the external world. A pair of uninterruptible power supplies (UPS's) and control power throw-over relays supply highly reliable control power to these system devices. For additional information and instructions, reference DEH-501.

⚠ CAUTION: The instrument/auxiliary compartment may contain devices that operate at a variety of different control voltages including both primary and secondary sources. Review all equipment drawings, elementary, remote connection drawings and the summary of equipment prior to working inside.

Auxiliary/Transition Sections

Sections may be provided for any one or more of several reasons including:

- Incoming cable when a main breaker section is not provided
- Mounting and wiring of additional metering, relaying, and control devices requiring more space than available in a standard instrument panel or instrumentation compartment (transition or auxiliary)
- Mounting and wiring of purchaser specified and/or furnished devices.

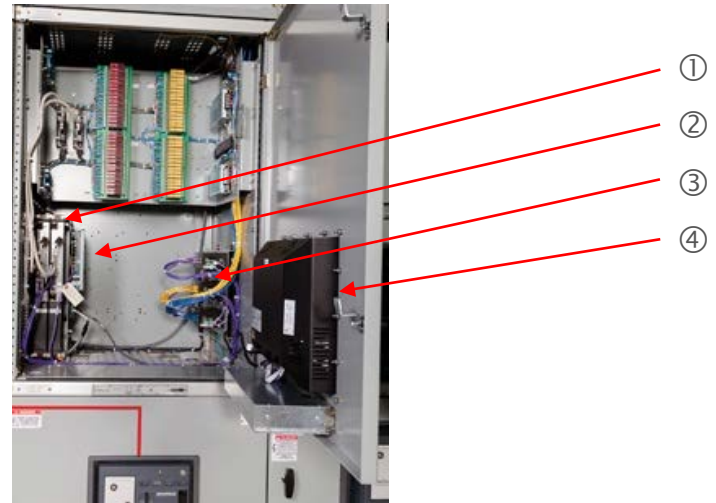
Auxiliary sections may be 22-inch, 30-inch, or 38-inch wide as required to accommodate the space requirements. The compartment doors on the front of the sections are hinged and latched in the same manner as breaker compartment doors.

Figure 3.9 is a front view of a typical instrumentation compartment.

Figure 3.10 shows examples of primary and secondary control protection in the instrument compartment.

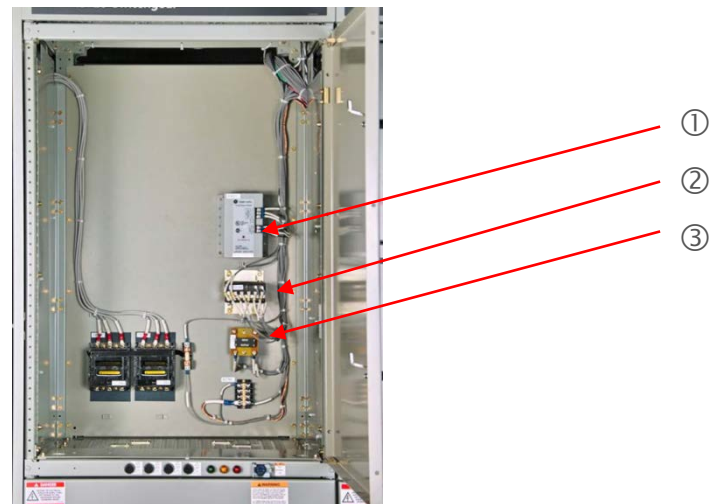
⚠ CAUTION: The instrument/transition compartment may contain devices that operate at a variety of different control voltages including both primary and secondary sources. Review all equipment drawings, elementary, remote connection drawings and the summary of equipment prior to working inside.

Figure 3.8 Entellisys instrument/auxiliary compartment



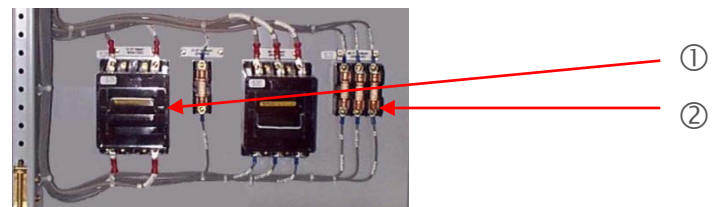
- (1) CPU's (Central Processing Units)
- (2) Firewall Security Device
- (3) Network Switches
- (4) HMI (Human Machine Interface)

Figure 3.9 Auxiliary/transition section



- (1) 24V Power Supply
- (2) Auxiliary Summing CT
- (3) Voltage Conditioners

Figure 3.10 Primary and secondary fusing



- (1) Enclosed Fuse Block (Primary Circuits)
- (2) Open Fuse Block (Secondary Circuits)

Circuit Breaker Compartments

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

Closed door draw-out circuit breaker compartments are standard construction with all switchgear equipment (Figure 3.12). The circuit breaker compartment doors remain closed and latched while the breaker is racked out from the CONNECTED position, through TEST, to the DISCONNECTED position.

Breaker compartment doors do not have any ventilation slots, thus protecting operators from hot ionized gases which may be vented by the breaker during circuit interruption. Additionally, the breaker compartment is enclosed by grounded steel barriers on the top, sides, bottom, and front (Figure 3.13 and Figure 3.14). In the back, a flame-retardant, track resistant, glass-filled polyester base minimizes the possibility of fault communication between compartments or to the bus.

A circuit breaker racking handle is provided in the right most pocket of the breaker compartment fascia (Figure 3.11).

Up to two key interlocks may be provided in the breaker compartment fascia (Figure 3.12). If the application does not require a key interlock(s), metallic key interlock plug(s), GE #GM2KIP, are provided.

⚠ WARNING: The EntelliGuard racking handle must be returned to its compartment to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: Either the key interlock(s) or the metallic key interlock plug must be installed to maintain the integrity of the arc resistant enclosure.

An optional position switch may be provided in the left side frame of the circuit breaker compartment (Figure 3.14). If the application does not require a position switch, a metallic position switch cover, GE #GM2PSC, is provided.

⚠ WARNING: Either the position switch or the metallic position switch cover must be installed to maintain the integrity of the arc resistant enclosure.

Figure 3.11 EntelliGuard racking handle



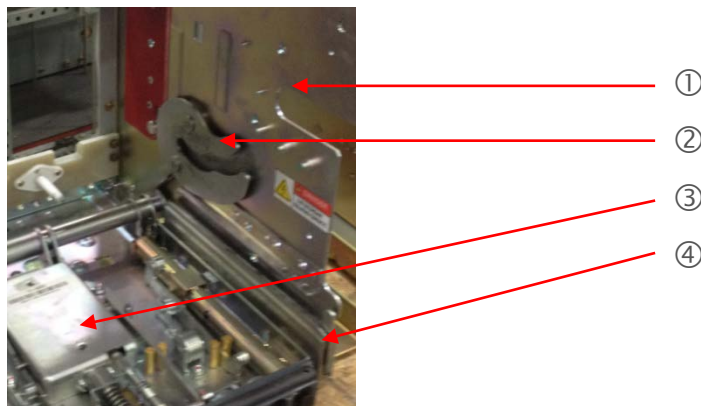
(1) EntelliGuard Racking Handle

Figure 3.12 EntelliGuard breaker compartment fascia



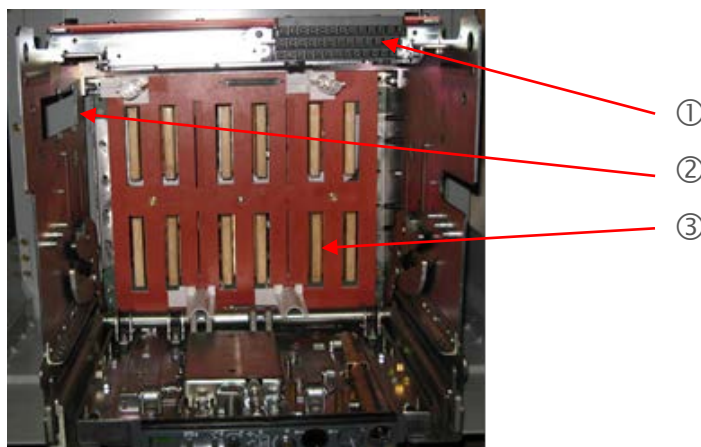
- (1) Circuit Breaker Door and Gasket
- (2) Breaker Position Indicator
- (3) Key Interlocks (Optional)
- (4) Access Port to Racking Mechanism
- (5) Racking Handle

Figure 3.13 EntelliGuard circuit breaker compartment



- (1) Cassette Side Barrier
- (2) Racking Arm
- (3) Cassette Bottom and Racking Box
- (4) Draw-out Rails

Figure 3.14 EntelliGuard circuit breaker compartment



- (1) Secondary Disconnects (Optional)
- (2) Position Switch Location (Pos. Switch not Shown)
- (3) Primary Disconnect Stab Tip (Typical)

Installing and removing of the circuit breaker from the compartment is covered in SECTION 6 of this instruction manual.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

The racking arm (Figure 3.13) engages fixed racking anchor pins on the sides of the circuit breaker. As the racking arms are rotated by the operation of the racking handle (Figure 3.12), the circuit breaker is pulled into or out of the compartment, and locked in its final position.

The circuit breaker should always be OPEN when it is moved into or out of the CONNECTED position. As a safeguard, a draw-out interlock will prevent access to the racking mechanism unless the circuit breaker is OPEN.

Each circuit breaker compartment has four positions as described in Table 3.2.

Movement of the breaker between the CONNECTED, TEST, and DISCONNECTED positions is performed by the use of a racking handle (Figure 3.12) which engages the racking mechanism mounted on the cassette. An optional remote racking device is also available. Movement to the WITHDRAWN position is manually performed after opening the compartment door. These positions are illustrated and described more fully in SECTION 6 of this manual.

All EntelliGuard circuit breakers are provided with a factory installed mechanical rejection feature. See SECTION 6 of this manual for additional details.

Depending on the equipment specified, items such as position switch, key interlock(s) and secondary disconnects are optional and may appear in any compartment or not be included at all.

Although the breaker compartment door may be opened in any position, it is recommended that the door only be opened when the breaker is in the DISCONNECTED or WITHDRAWN position.

Table 3.2 Circuit breaker positions

Circuit Breaker Position	Primary Disconnects	Secondary Disconnects	Shutter Assembly	Circuit Breaker Door	Circuit Breaker Functionality
CONNECTED	Engaged	Engaged	Opened	Closed	Can be operated mechanically or electrically. Ready for serving intended load.
TEST	Disengaged	Engaged	Closed	Closed	Can be operated mechanically or electrically. Control circuit operations can be tested & verified.
DISCONNECTED	Disengaged	Disengaged	Closed	Closed	Can be operated mechanically only. Cannot be removed from the compartment.
WITHDRAWN	Disengaged	Disengaged	Closed	Opened	Can be operated mechanically only. Can be removed from the compartment.

Primary Disconnect Shutter

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

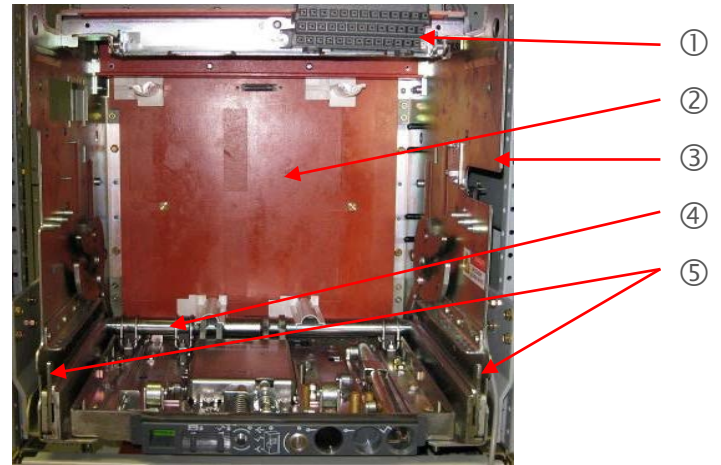
Primary disconnect shutters (Figure 3.15) are available as a standard to provide protection against contact with the energized stationary primary disconnects when the breaker is removed from its compartment. Shutters are supplied as standard component on all breaker compartments and future breaker compartments. The shutters are constructed from glass-reinforced polyester insulating material.

The shutters (movable barriers) prevent frontal access to the primary disconnect line and load stationary disconnects.

The shutters are closed when the breaker is in the DISCONNECTED Position. As the circuit breaker is racked from the DISCONNECTED Position to the TEST Position the shutters remain fully closed. As the breaker is racked from the TEST Position to the CONNECTED Position, the shutters open allowing the breaker to connect to the primary disconnects.

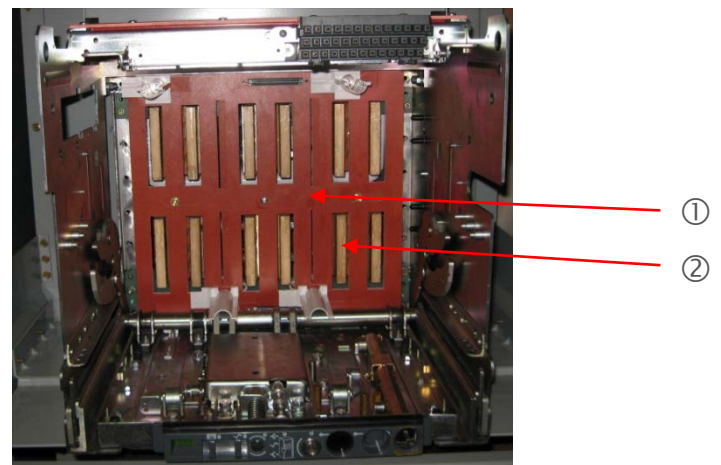
Figure 3.16 shows the shutter assembly with the shutter in the open position.

Figure 3.15 Primary disconnect shutter (closed)



- (1) Secondary Disconnect (Optional)
- (2) Shutter Assembly (Closed)
- (3) Cassette Side Barrier
- (4) Racking Shaft
- (5) Draw-out Rails

Figure 3.16 Primary disconnect shutter (opened)



- (1) Shutter Assembly (Opened)
- (2) Primary Disconnect Stab Tip (Typical)

Breaker Compartment Door

Each circuit breaker compartment door is provided with two self-latching mechanisms with a single “T”-shaped door handle (Figure 3.18).

To open the door, rotate the handle clockwise to release the latch mechanisms and pull the door outward.

Operating the handle is not necessary to close the door. Simply close the door and push on the door directly behind each latching mechanism (Figure 3.18). Confirmation of the door being latched can be achieved by pulling on the “T”-shaped handle while not rotating the handle.

If a circuit breaker is to be removed from its compartment for an extended period of time, it is strongly recommended that a future breaker cassette barrier (Figure 3.17) and future breaker door cover (Figure 3.18) be installed to keep any potential electrical arcing events contained within the equipment. Refer to Table 6-2 for future cassette and door covers.

Behind the circuit breaker compartment door is a dead front gasket (Figure 3.17). When the compartment door is closed, the combination of the dead front gasket and the breaker door gasket (Figure 3.17) provides the necessary sealing for the arc resistant rating.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

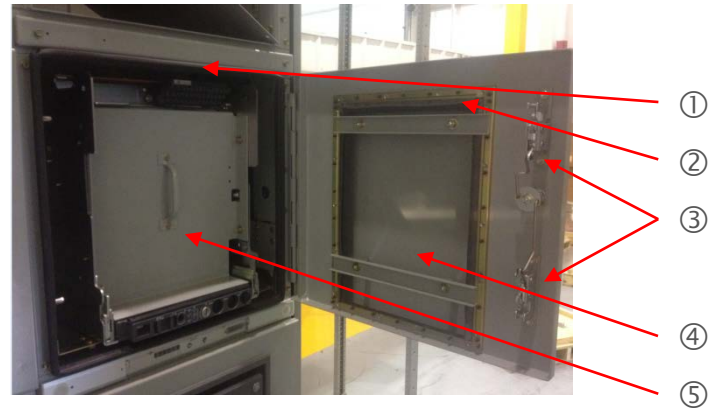
⚠ CAUTION: If the dead front gasket of the breaker door gasket is damaged, these components should be replaced to ensure the integrity of the arc resistant enclosure.

Future Circuit Breaker Compartment

When specified, compartments may be supplied for future addition of circuit breaker elements. These compartments are fully equipped with draw-out rails, primary disconnects, and ancillary devices as required (i.e. secondary disconnects, accessory devices, etc.).

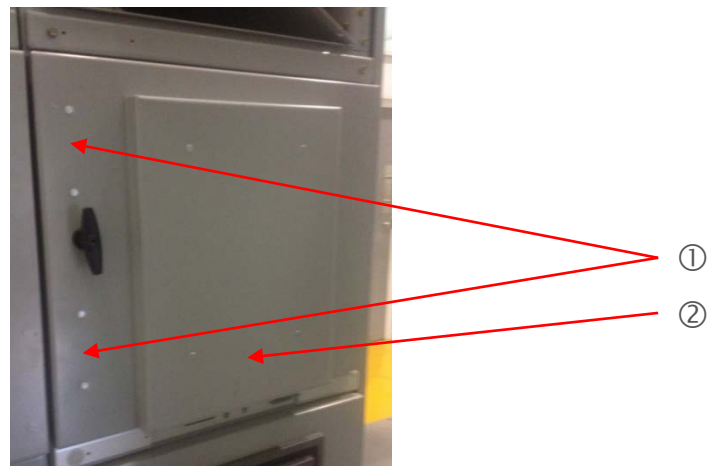
The opening in the breaker compartment door and the opening in the cassette of the compartment are closed with bolted-on steel plates to deter accidental contact with energized electrical circuits (i.e. primary disconnect stab tips) and provide the necessary closing to achieve the arc resistant rating (Figure 3.17 and Figure 3.18).

Figure 3.17 Breaker compartment door (opened)



- (1) Dead Front Gasket
- (2) Breaker Door Gasket
- (3) Self-latching Mechanism
- (4) Future Breaker Door Cover
- (5) Future Breaker Cassette Barrier

Figure 3.18 Breaker compartment door (closed)



- (1) Push to Latch Area
- (2) Future Breaker Door Cover

Circuit Breakers

The General Electric EntelliGuard low-voltage power circuit breaker includes spring-operated, stored energy, close and trip mechanisms for either manual or electrical operation.

General Electric EntelliGuard circuit breakers form the complete family of breakers used in the AKD-20 AR and Entellisys AR switchgear. Each type of breaker listed in Table 3.3 describes the breaker interrupting rating which corresponds to the 5th digit of the breaker catalog number. These circuit breakers range from 400 to 5,000 ampere frame size.

Envelope 1 EntelliGuard Circuit Breakers

- 2,000 ampere frame size
- Up to 100kAIC interrupting rating
- Four high stacking ; 22-inch wide sections

Envelope 2 EntelliGuard Circuit Breakers

- 2,000 ampere frame size
- Up to 100kAIC interrupting rating
- Four high stacking ; 22-inch wide sections

Envelope 2 EntelliGuard Circuit Breakers

- 3,200 ampere frame size
- Up to 100kAIC interrupting rating
- Available in 22-inch wide sections

Envelope 3 EntelliGuard Circuit Breakers

- 5,000 ampere frame size
- Up to 200kAIC interrupting rating
- Available in 38-inch wide sections

Figure 3.19 EntelliGuard E circuit breaker



Figure 3.20 EntelliGuard G circuit breaker



Table 3.3 ANSI/UL 1066 Low-voltage power circuit breaker interruption ratings

Interruption Rating Tier (I _{cu})					Circuit Breaker/Cassette Sizes					
Type	240 Vac	480 Vac	600 Vac	Withstand (I _{cw}) 0.5 sec.	Envelope 1 ²		Envelope 2 ²		Envelope 3	
	254 Vac Max.	508 Vac Max.	635 Vac Max.		Continuous Current	Close & Latch	Continuous Current	Close & Latch	Continuous Current	Close & Latch
S	65,000A	65,000A	50,000A	50,000A	400-1,200A	42,000A				
N	65,000A	65,000A	65,000A	65,000A	400-2,000A					
H	85,000A	85,000A	65,000A	65,000A	400-2,000A					
P	100,000A	100,000A	65,000A	65,000A	400-2,000A					
E	85,000A	85,000A	85,000A	85,000A			400-3,200A	65,000A		
M	100,000A	100,000A	100,000A	85,000A			400-3,200A		4,000-5,000A	100,000A
B	100,000A	100,000A	100,000A	100,000A					3,200-5,000A	
L	150,000A	150,000A	100,000A	100,000A					3,200-5,000A	
W ¹	200,000A	200,000A	100,000A	100,000A					3,200-5,000A	

1 – Contact Factory

2 – EntelliGuard E Circuit Breakers exclude 400A and 1,200A ratings

Bus Area

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

The bus area (Figure 3.21) contains the main horizontal bus and vertical riser bus bars for the particular section. The vertical bus bars are supported at the breaker run-ins which are bolted to the molded bases that form the rear wall of the breaker compartment. The horizontal bus bars are supported by the power connectors which are bolted to the vertical bus bars. All bolted supports and connections are accessible from the rear for maintenance. The bus area is fully isolated from the breaker, instrument and auxiliary compartments by the molded bases or glass polyester sheet.

Busing System

Bus bars are fully tin-plated copper with bolted joints and silver plating is optional. The standard construction is a barrier system (Bus Compartmentation) that isolates the main and vertical bus bars from the cable area. All run-backs (load-side power conductors) from the breaker compartment to the cable termination area are covered with non-PVC insulated tubing.

The typical arrangement is shown in Figure 3.22 and Figure 3.24.

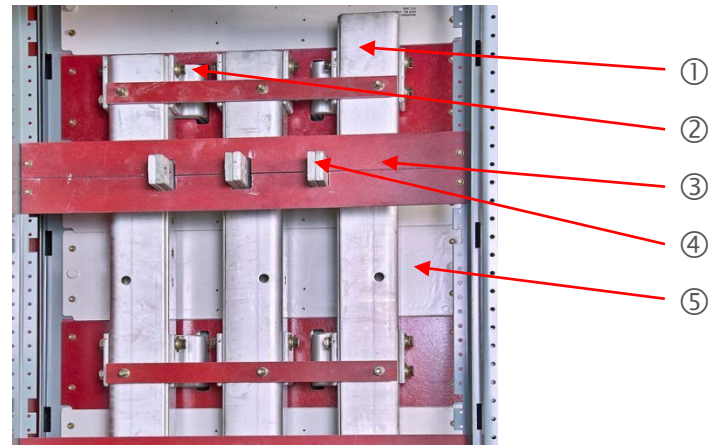
The standard bracing is 65,000 amperes, RMS symmetrical. Bracing for 100,000, 150,000 and 200,000 amperes, RMS symmetrical is available as an option.

In general, when the switchgear equipment has no more than four sections or does not exceed 10 feet in length, it will be shipped as one complete lineup. In such cases, the only field assembly would be to a close-coupled transformer if, the switchgear were part of a Load Center Unit Substation. If, because of shipping and/or handling considerations, the equipment cannot be handled in one piece, it can be split into two or more shipping sections at the factory. The individual shipping splits require both mechanical and electrical connections between sections to be made in the field.

At these shipping splits, provisions are made for bolting all buses and making the necessary electrical and mechanical connections. These are described in SECTION 4 of this instruction manual.

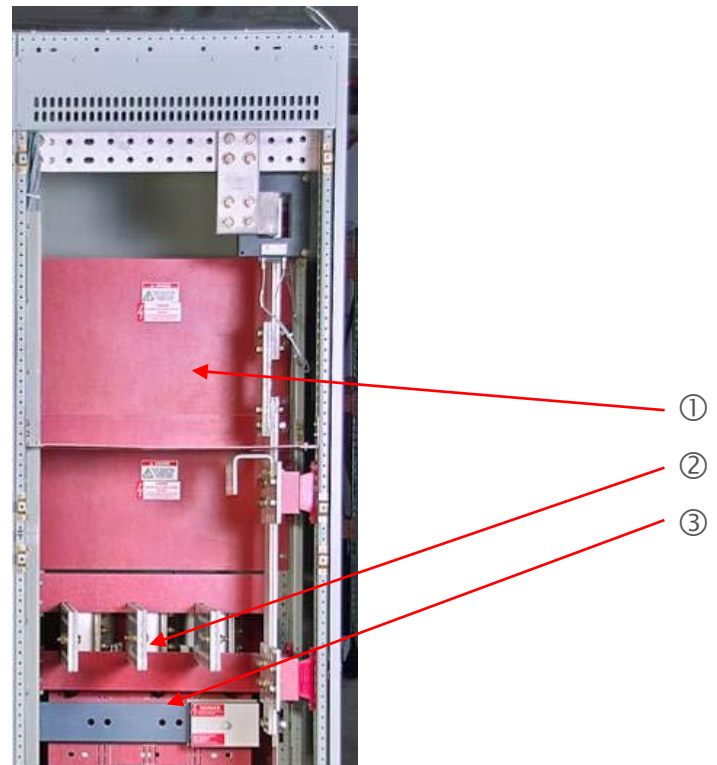
On main and tie breakers, the bus area is divided into an upper and lower section by a glass reinforced polyester isolation barrier. For typical unit substation main circuit breakers, the upper section contains the incoming line bus. The lower section of the bus area contains the load side main bus (protected by the main breaker) which feeds all sections of the switchgear equipment. Similarly, barriers at tie breakers isolate the two main bus sections from each other.

Figure 3.21 Bus construction



- (1) Vertical Riser Bus
- (2) Run-ins to Breaker Compartment
- (3) Short-circuit Brace
- (4) Run-backs from Breaker Compartment
- (5) Molded Base

Figure 3.22 Main breaker arrangement



- (1) Isolation Barrier
- (2) Incoming Cable Connection
- (3) Main Horizontal Bus

Insulated/Isolated Bus System

A bus insulation system (Figure 3.24) that fully insulates and isolates each phase of the horizontal main bus and isolates each phase of the vertical bus, is available for AKD-20 AR and Entellisys AR switchgear as standard construction. With the INSULATED/ISOLATED BUS system, there are no live connections accessible in the rear of each section except the cable lugs.

Insulation and isolation of the vertical riser bus bars (Figure 3.21) is provided by installing phase isolation barriers (not shown) between the bus bars and by the vertical bus barrier which covers over the bus bars.

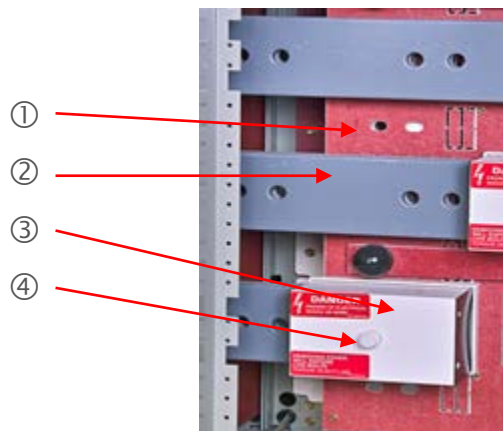
The phase isolation barriers and riser bus covers are constructed from insulating material. Insulation of the horizontal main bus bars is achieved by an oven cured coating of epoxy.

The vertical/horizontal bus bar joints are covered with collars and caps (Joint Cap) held in place with nylon thumb screws. The collars and caps are constructed from insulating material.

A vertical section barrier (Figure 3.25) between adjacent sections of equipment is always furnished. The section barrier provides a separating barrier system between adjacent bus and cable compartments while allowing the horizontal main bus to progress through adjacent sections.

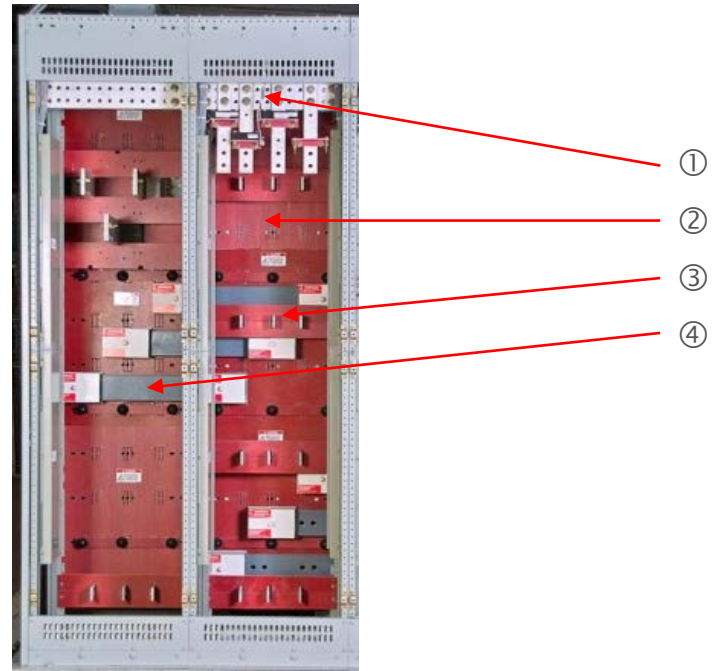
Figure 3.23 illustrates the various components comprising the vertical main bus bars. Bus bars are supported by molded or machined barriers. Vertical bus can be braced depending on the interrupting rating of the switchgear. Conductors that provide current to the breaker compartments are called run-in bars and are bolted to the riser bus bars. Insulated run-back bars are for connecting load conductor cabling.

Figure 3.23 Insulated horizontal bus system



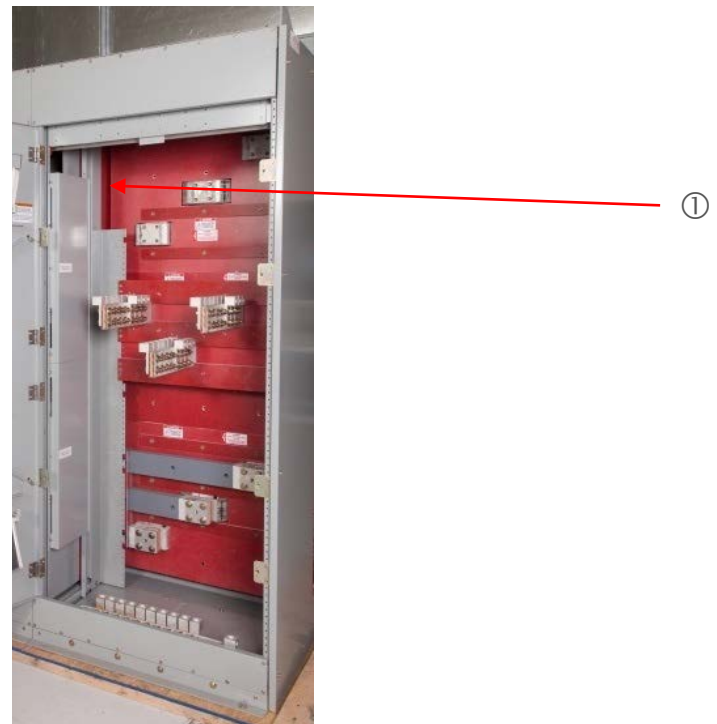
- (1) Vertical Bus Cover
- (2) Insulated Bus Bar (Epoxy Coated)
- (3) Joint Cap
- (4) Nylon Thumb Screw

Figure 3.24 Insulated/Isolated bus system



- (1) Upper Neutral Bus with 4th Wire Sensors
- (2) Vertical Riser Bus Covers
- (3) Run-backs to Feeder Cable Connections
- (4) Horizontal Main Bus

Figure 3.25 Section barrier system



- (1) Section Barrier

Cable Compartment

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

The rear cable and terminal compartment (Figure 3.26) provides for cable installation and terminations. The cable bending space meets the requirements of the National Electric Code. Various arrangements of single or double cable terminals are provided, depending upon the purchaser's requirements.

When specified, racks for the support of feeder cables are located in the cable compartment. The actual support of the cables is provided by lashing them to these racks.

Also located in the cable compartment are provisions for terminating control wires between external devices and control circuits within the switchgear equipment. Figure 3.27 shows this typical arrangement.

When furnished, the terminal boards (Figure 3.27) for such connections are located in an enclosed vertical wiring trough mounted on the side of the cable compartment. The trough is of steel construction with bolted covers to provide an isolation barrier between the control wiring and the adjacent power cables.

A neutral bus, insulated from ground, is provided in the bus area on switchgear designed for four-wire systems. The neutral bus is located either near the top or near the bottom of the cable compartment. It includes provisions for terminating the neutral conductor of four-wire feeder cables and also direct mounting of the neutral CT or neutral Rogowski as required for those feeder system circuit breakers having a ground fault trip function.

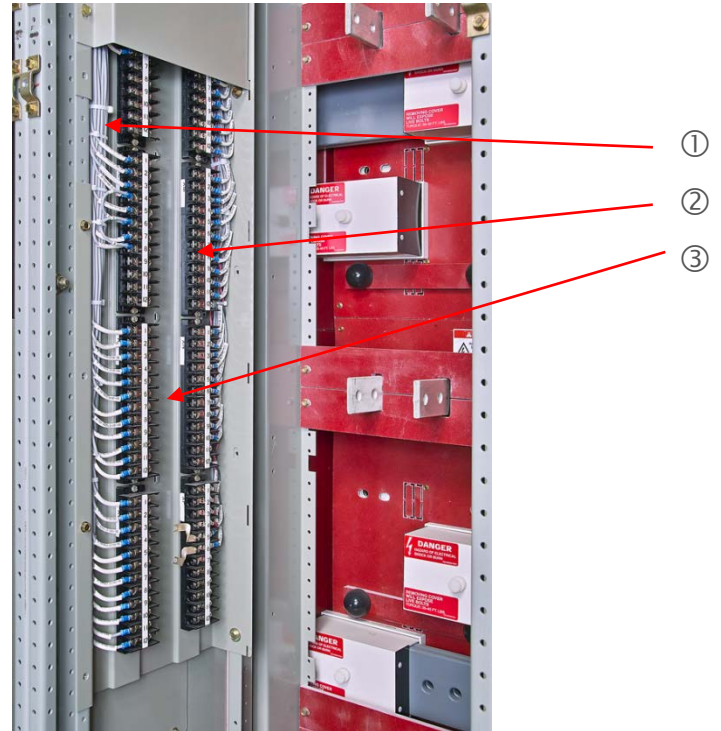
Cable Compartment Floor Plates

Bolted-on steel floor plates (Figure 3.28) are furnished in each cable compartment.

Figure 3.26 Cable termination provisions



Figure 3.27 Control wiring termination trough



- (1) Internal Equipment Control Wiring
- (2) Terminal Boards
- (3) Space for Purchaser's Field Control Wiring

Figure 3.28 Cable compartment floor plates



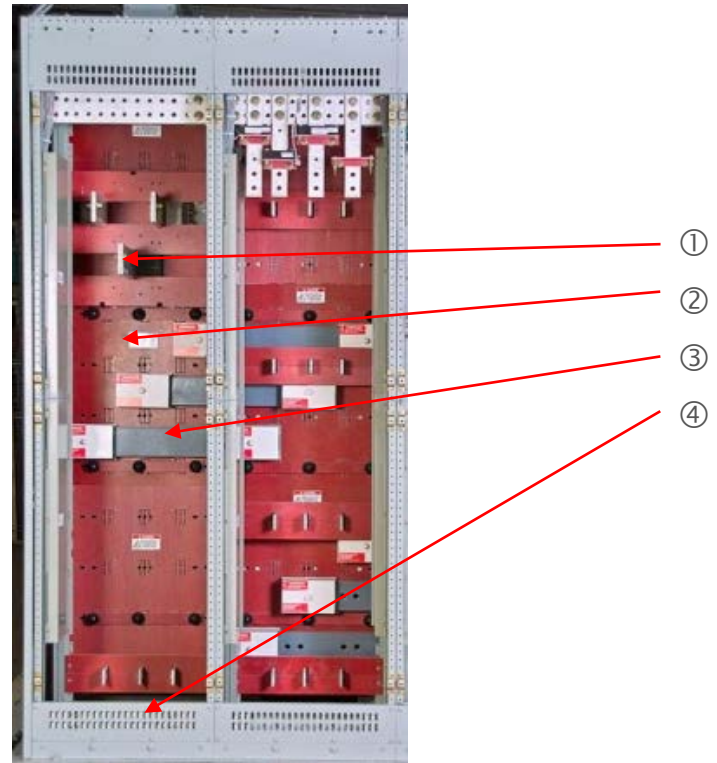
Ground Bus

All General Electric AKD-20 AR and Entellisys AR switchgear sections are grounded to the internal equipment ground bus (Figure 3.29) located at the bottom or the top of the cable compartment

Heaters

If the switchgear will be stored for an extended period of time prior to energization, space heaters (Figure 3.30) are provided as an option for indoor equipment. They provide protection against condensation of moisture that could, in combination with air-borne contaminants, deteriorate insulation or cause corrosion. One 1000-watt, 240-volt, operating at 120V (250-watts) ac heater is located on the floor of the bus compartment of each switchgear section. The heaters should be energized at all times to prevent condensation within the switchgear.

Figure 3.29 Ground bus



- (1) Feeder Cable Connections
- (2) Vertical Bus Cover
- (3) Horizontal Main Bus
- (4) Ground Bus (Behind Steel Cover)

Figure 3.30 Internal equipment heater (optional)



- (1) Internal Heater (Optional)

Section 4. Equipment Installation

General

This section contains complete instructions for installing General Electric AKD-20 AR and Entellisys AR low-voltage switchgear.

All expendable hardware for shipping purposes only, is painted yellow or tagged with yellow adhesive tape and may be discarded at completion of the installation phase.

CAUTION: Personnel installing this equipment must be thoroughly familiar with this instruction manual and all articles of the National Electrical Code applicable to the installation of this switchgear. In addition, all drawings, both mechanical installation and electrical, must be understood and strictly followed to prevent damage to the switchgear or equipment being protected by the switchgear.

NOTICE: Before installation work is started, it is important to review all of the drawings provided, including the General Electric equipment arrangement drawings, site installation drawings, elementary and remote connection drawings, mechanical connection drawings, and the summary of equipment list.

Site Location

In general, the location of the switchgear equipment will have been predetermined during the specification and/or procurement of equipment phases. Indoor locations within buildings impose certain requirements which must be met so that the switchgear may operate efficiently with a minimum of maintenance.

In locating the switchgear, adequate aisle space must be provided at the front and rear of the equipment to ensure proper ventilation of the equipment and to allow service and maintenance of the equipment with the front and rear doors open. The recommended aisle space is shown on the floor plan supplied with the equipment drawings.

The switchgear equipment should be placed in an area where clean, dry air is free to circulate around and above it. Since air is taken into the equipment at the bottom of each section and exhausted at the top, a location with good airflow must be provided for efficient operation. A minimum of 30 inches of clear space above the equipment is recommended.

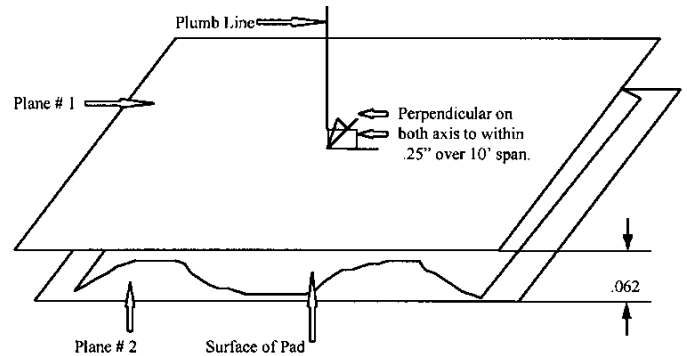
Foundation Requirements

For optimum performance of your General Electric switchgear equipment, the foundation requirements expressed in this section should be strictly adhered to.

The foundation must be strong enough to prevent sagging due to the weight of the switchgear structure and to withstand the shock stress caused by the opening of the breakers under fault conditions. The shock loading is approximately 1-1/2 times the static load.

The foundation must be flat and level in all planes. Refer to Figure 4.1 for definition of flat and level.

Figure 4.1 Definition of flat and level



Foundation Preparation

Indoor Equipment

Refer to Figure 4.2 along with the owner's foundation construction drawings and the General Electric supplemental installation drawings. Although the indoor switchgear equipment can be mounted directly on a smooth, level floor, it is recommended that recessed steel channels be installed for supporting the equipment. Anchor bolts and channels are to be provided by the purchaser.

NOTICE: When the equipment is installed on a surface subject to impact (shock) loads due to operating conditions or environmental seismic (earthquake) conditions, the anchor bolts should be fabricated of medium carbon steel (grade 5 load rating).

The floor channels under the front and rear switchgear anchor points (Figure 4.2) should be embedded in a level concrete slab with their top surfaces flush with the finished floor. It is essential that these steel channels be level and aligned with each other prior to final anchoring, to prevent distortion of the switchgear structure, to assure proper mechanical and electrical connections between shipping splits, and to assure proper interfacing to other close-coupled equipment.

NOTICE: The embedded steel floor channel in the floor pad is the preferred anchoring method for the switchgear assembly. Alternate anchoring methods should be reviewed and approved by the customer and/or their authorized representative. When the equipment is subject to impact (shock) due to operating conditions or environmental seismic (earthquake) conditions, alternate anchoring methods must be approved by the customer's certified structural engineer.

As an option, the General Electric switchgear assembly can be provided as certified for seismic applications. Samples of the most seismically significant construction were shake table tested to qualify the various constructions available. Refer to DET-463 for further information.

General Electric Switchgear and Load Center Substations are frequently mounted on steel floors and/or structural steel in industrial installations (such as a mezzanine) to minimize usage of production floor space. Regardless of the type of mounting surface, the requirement for a smooth level surface remains.

If studs or anchor bolts are to be used, they should be installed in the foundation as it is poured. It is important that the studs or bolts are spaced to agree with dimensions given on the General Electric job drawings. The dimensions between anchor bolts for a particular installation are dependent upon the configuration of equipment ordered. The dimensions shown on Figure 4.2 cover the entire standard enclosures available for AKD-20 AR and Entellisys AR switchgear.

Figure 4.3 and Table 4.1 illustrates the space available for conduit and/or cable entrance through the bottom or top of each equipment section. The space required for control wiring entry to the optional wiring trough is also shown.

Figure 4.2 Indoor enclosure anchor locations

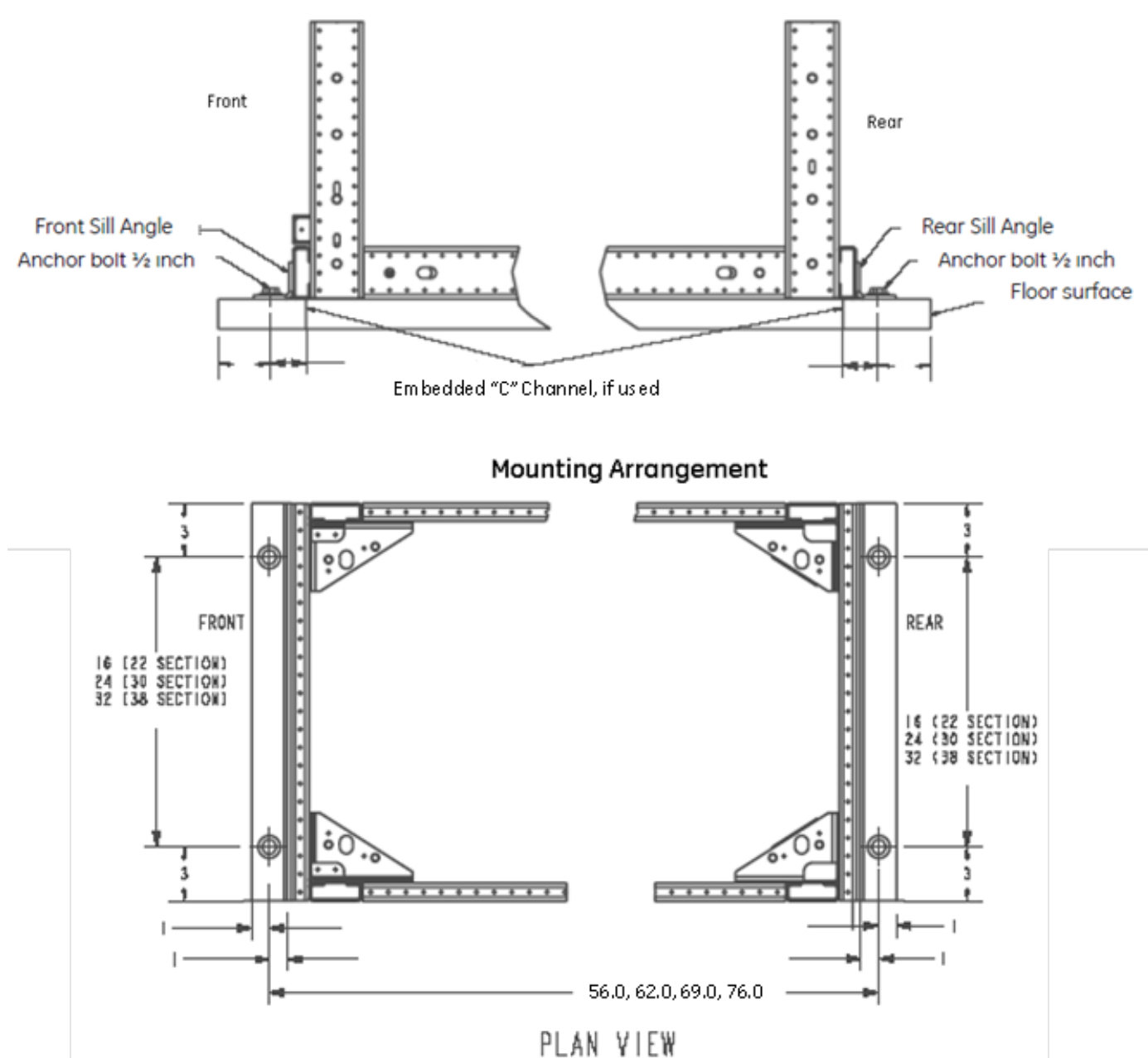
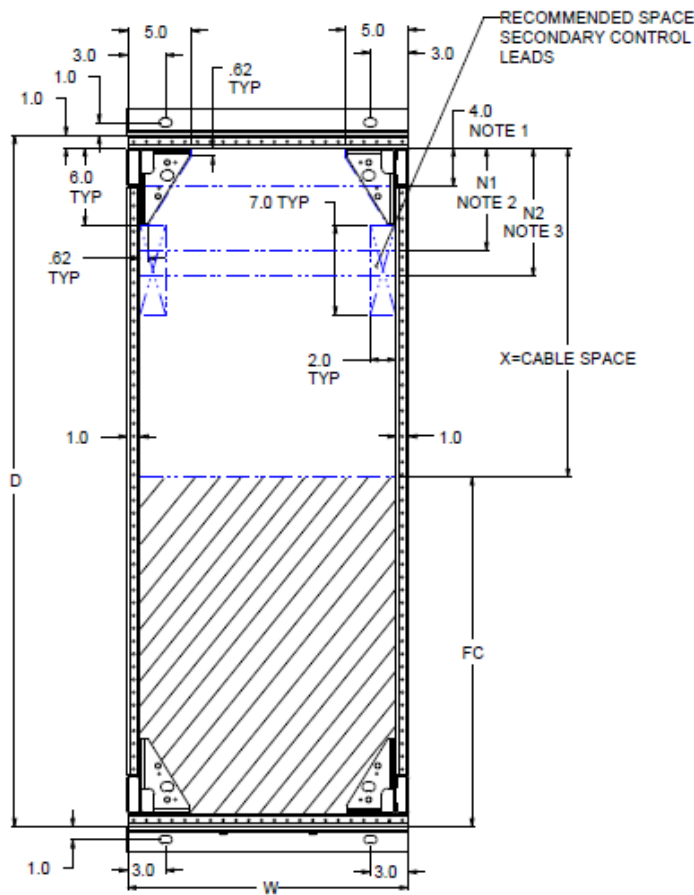


Figure 4.3 Indoor enclosure floor plan and cable entry space (inches)

**Note 1: Offset ground bus.**

If greater than 6 ground lugs are required in the same section, an offset ground bus is provided. When the offset ground bus and cable entry is located both bottom or above, it will reduce the available cable space.

Note 2: Neutral Bus (Optional) (AKD-20 AR Only).

When this option is provided and the neutral bus and cable entry is located both bottom or top, it will reduce the available cable space.

Note 3: Neutral Bus (Optional) (Entellisys AR Only).

When this option is provided and the neutral bus and cable entry is located both bottom or top, it will reduce the available cable space.

Note 4: Cable Direction Below.

If the section does not have a circuit breaker in the "D" compartment, an additional 4 inches of cable space is available.

General: Secondary control lead space may be required on left, right, or both sides of cable compartment. Consult factory drawings for details.

Table 4.1 Indoor enclosure depth, cable direction, and cable space (inches)

Section Width "W"	Section Depth "D"	Front Compartment "FC"	Horizontal Bus Rating (Amperes)	Cable Direction (Note 4)	Cable Space "X"	AKD-20 AR Only "N1"	Entellisys AR Only "N2"
22, 30, 38	54	33	4,000 & Below	Below	16	9	10.25
				Above	20		
	60	33	4,000 & Below	Below	22		
				Above	26		
		40	5,000 & Below	Below	15		
				Above	19		
	67	33	4,000 & Below	Below	29		
				Above	33		
		40	5,000 & Below	Below	22		
				Above	26		
	74	33	4,000 & Below	Below	36		
				Above	40		
		40	5,000 & Below	Below	29		
				Above	33		

Assembly and Installation of Switchgear

General

Before assembling or installing the switchgear equipment, all components should be available at the site location. This will facilitate switchgear component identification as well as installation. The foundation should be prepared in accordance with the instructions in Foundation Requirements and Foundation Preparation and all embedded conduits installed and capped.

If a transformer is not part of the installation, and/or the equipment has been split for shipment, place the center section on the foundation first. Assemble the remaining sections outward from the center section, in each direction.

If the switchgear equipment is part of a Load Center Unit Substation, the transformer section should be set on its pad first in accordance with the instructions furnished with the transformer. All remaining sections of the switchgear should then be installed.

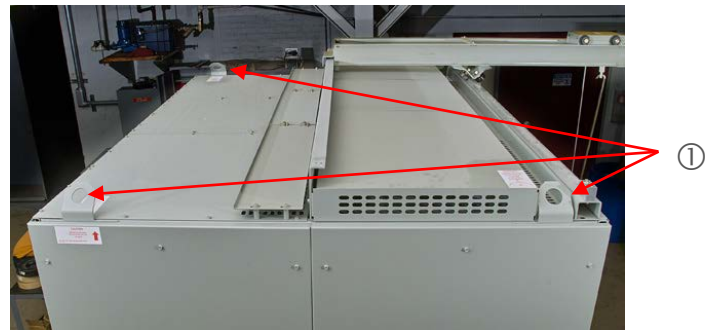
NOTICE: If rollers are to be used for movement of the equipment to its permanent installation, it is recommended that the shipping skid not be removed until the equipment is placed in position over the anchor bolts.

NOTICE: Before assembling and installing the switchgear equipment, the foundation must be absolutely level and clear of debris to prevent damage and possible misoperation of the switchgear equipment.

NOTICE: In the event the lifting plates must be reassembled on the equipment for lifting purposes, they must be moved to locations where unused screw holes are available. Generally achieved by shifting the plate horizontally on the mounting surface one bolt hole from its previous location. When remounting the lifting plates, torque the mounting bolts to 7-9 ft.-lbs.

NOTICE: All mating sections of the equipment lineup (including transformer, if applicable) must be securely fastened together prior to tightening the anchor bolts fastening the equipment to the mounting surface.

Figure 4.4 Indoor lifting plate locations



(1) Lifting Plates (One Plate not Shown)

Detailed Assembly and Installation Instructions

Indoor Equipment

The recommended procedure for installation of an indoor switchgear or Load Center Unit Substation is as follows:

Position the Equipment

Position the equipment or sections of the complete equipment in their final location.

Remove any lifting plates (Figure 4.4) on the sides of adjacent joining equipment sections.

Once the lifting plates have been removed, they may be discarded.

NOTICE: If the equipment lineup was split into shipping sections, the lifting plates on corners of adjacent sections (Figure 4.4) must be removed. Failure to remove these plates will interfere with mating adjacent sections and prevent installation of bus splice plates, structure tie plates, etc.

Remove the Shipping Skids

The equipment is fastened to the shipping skids with ½ inch lag bolts through the equipment anchoring holes (Figure 4.5).

Equipment shipping sections up to 10 feet long will be fastened to the skids with four lag screws and/or carriage bolts, along the front and rear of the assembly. The shipping skid and screws/bolts are expendable material and may be disposed of at the purchaser's discretion.

Fasten Sections Together

After placement of the equipment and installing the anchor bolts loosely, the various shipping sections must be rigidly fastened together. Through-bolts fasten each section of the switchgear equipment to the adjacent section. Figure 4.6 shows the location of the through-bolts.

Figure 4.7 illustrates the installation of the through-bolts. The through-bolts are in the front and rear compartments. The nut and bolt assembly should be tightened with a torque of 25-30 ft.-lbs.

All of the hardware required for assembling the equipment across the shipping splits is furnished with the equipment. If a transformer is included in the lineup of equipment, the transformer flange should be aligned with the opening in the side of the transition section and fastened together using the 3/8-16 bolts, nuts and washers supplied with switchgear. The fastener assembly should be tightened with a torque of 25-30 ft.-lbs.

Figure 4.5 Attachment method to shipping skids



- (1) ½ inch Carriage Bolt
- (2) ½ inch Lag Screw

Figure 4.6 Location of through bolts

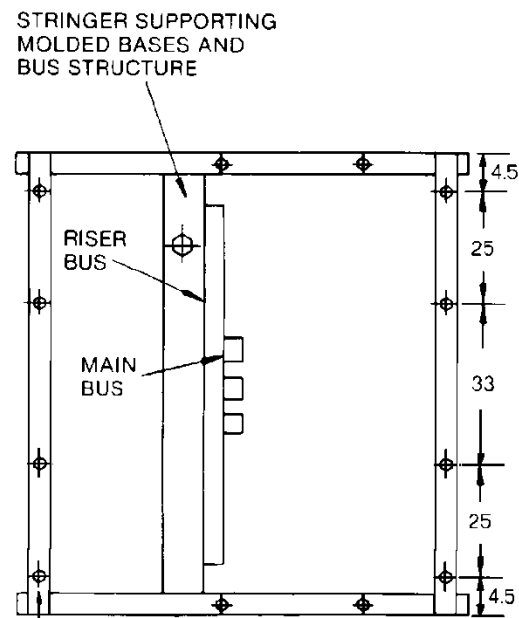
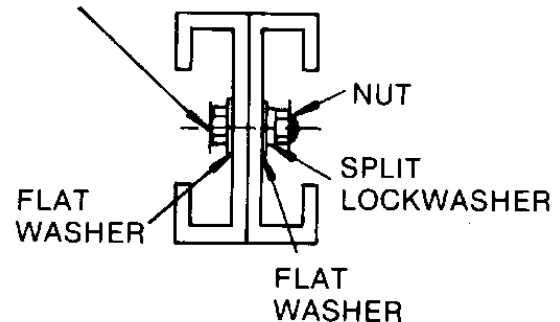


Figure 4.7 Through bolt installation

THROUGH BOLT
(3/8-16 x 1'')



Complete the Electrical Interconnections

After completing the mechanical connections between the several sections of equipment, the electrical interconnections should be completed. This includes the installation of splice plates for the main bus bars, the neutral bus, and the ground bus in addition to the control and metering circuits.

Figure 4.8 illustrates the general location of the buses that must be spliced across the shipping splits.

⚠ WARNING: All switchgear equipment must be adequately grounded for safety. Failure to ground the equipment properly may result in serious injury.

Ground Bus Interconnections

The ground bus is mounted directly on the rear upright channels in each vertical section. The ground bus is commonly located in lower position but can be alternately located near the upper portion of the upright channels.

A 4/0 AWG cable connector is located in the bottom of the transition section (or in the incoming line compartment if a transition section is not included) for terminating the purchaser's cable connection to ground. The specific location of the station ground connection is shown on the site floor plan drawing and in the electrical drawings supplied with the equipment. All grounding of the switchgear should be in accordance with National Electrical Code.

Figure 4.9 illustrates the installation of the ground bus splice plate across a shipping split. In addition to the bolted fastening of the splice plate to the two ends of the ground bus, self-tapping 1/4-20 bolts pass through the splice plate and ground bus stubs, and thread into the equipment frame. These bolts should be fastened with a torque of 7-9 ft.-lbs.

All bolted bus joints should be made using the proper torque shown in Table A-1 in Appendix A. Torque Values of this instruction manual.

⚠ WARNING: It is particularly important that the ground bus be connected first since it provides an integral ground for all the equipment. It must also be connected to the station ground prior to proceeding with the installation. Failure to provide an adequate ground prior to energizing the equipment may result in serious injury and misoperation of the equipment.

Figure 4.8 Typical locations of buses at shipping splits

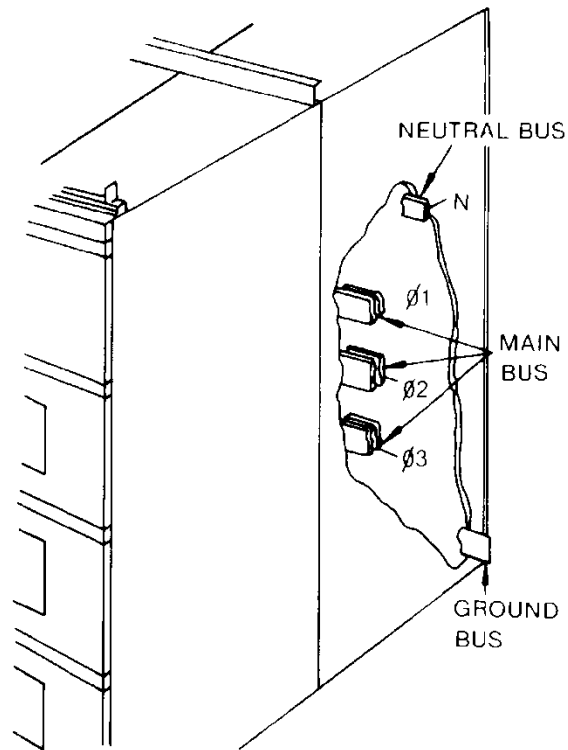
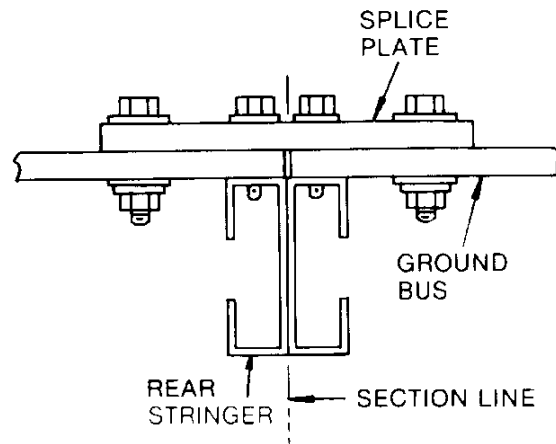


Figure 4.9 Ground bus splice installation (plan view)



Neutral Bus Interconnections (Optional)

The neutral bus is insulated from the grounded frame of the switchgear equipment; thus, it is mounted on insulators throughout the equipment. Installation of the neutral bus splice plate across a shipping split is similar to the ground bar splice except that the splice plate is not bolted to the equipment frame. Figure 4.10 illustrates the installation of the neutral splice plate.

The neutral bus may be located either in the lower position or the upper position on the rear upright channels.

A neutral bus may be provided for 4-wire electrical systems. The neutral bus may or may not extend the length of the equipment construction. Consult the factory drawings for details.

Horizontal Main Bus

The installation of the horizontal bus splice bars is with bolted joints.

Figure 4.11 and Figure 4.12 illustrate the assembly of the main bus splice plates on the bolted bus system. Copper bus systems are normally supplied with flat washers and lock washers.

Figure 4.11 shows the rear view of the main bus area with the installed splice plates indicated with cross-hatching.

Figure 4.12 shows that a spacer is used both between the bus bars when more than one bar is used per phase (normally the 2,500 ampere and larger main bus ratings).

The factory drawings provided with the equipment will detail the assembly for each main bus rating.

After assembly of the splice bars and spacers, the 1/2-13 bolts should be tightened to a torque of 35-40 ft.-lbs.

After completing the installation of the main bus splice bars, the joint covers may be mounted and secured by a 3/8-16 nylon bolt and polyester flat washer if the bus insulation option has been supplied with the equipment.

Figure 4.10 Neutral bus splice installation (plan view)

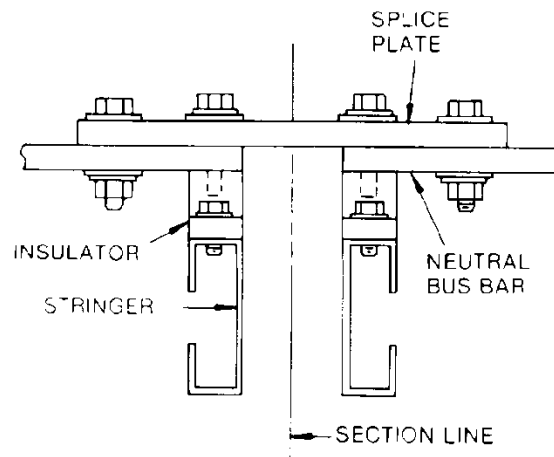


Figure 4.11 Main bus at shipping split (rear view)

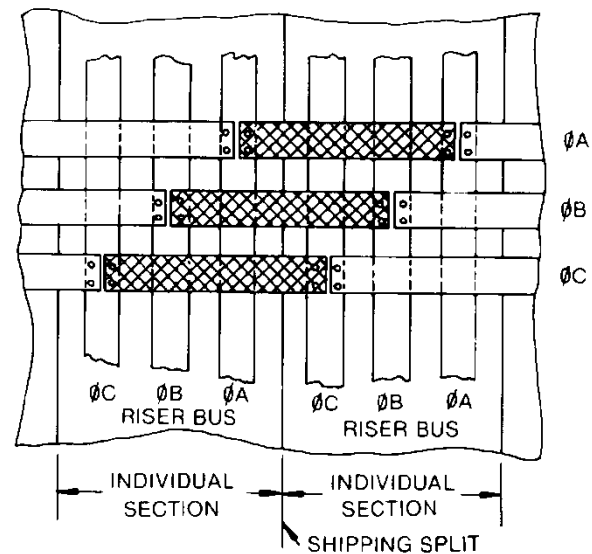
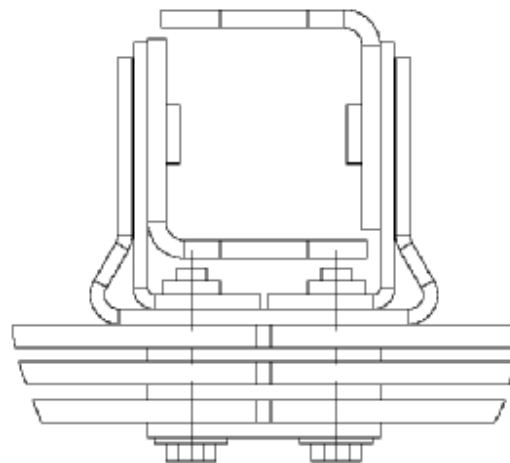


Figure 4.12 Horizontal bus splice installation (plan view)



Connect the Interconnect Control Wiring

Interconnect control wiring is located in the wire trough at the top front side of the equipment and runs the length of the lineup.

Interconnection of control wiring across shipping splits is accomplished by connecting to terminal blocks located in the cross-section wiring trough on top of the equipment (Figure 4.13).

If terminal blocks are provided, each wire must be attached to the correct point on the terminal block, following the circuit identification number attached to each wire.

Ethernet or other communication wiring is connected by similar methods.

Switchgear Anchoring

Indoor Equipment

The switchgear assembly can be anchored to the foundation by two methods. Use of anchor bolts or by welding.

Anchoring by Anchor Bolts

Indoor equipment is normally secured to their final mounting surface by anchor bolts threaded into the embedded channel sills (Figure 4.2). The bolts were loosely threaded into place before reassembling the equipment shipping splits and connecting to the close-coupled transformer, if appropriate. The anchor bolts should now be tightened with a torque of 35-40 ft.-lbs.

Anchor by Weld

An alternate method of anchoring the equipment to its foundation is to weld the equipment to floor sills (or the floor itself if constructed of steel). Several methods (Figure 4.14) are available to the purchaser for welding the equipment to the channel sills.

Anchoring by Weld (Front Lag Sill)

The front of the equipment is attached to the embedded channel sills (Figure 4.14) by two 3/16-inch fillet welds. It is recommended that two welds, each 2-1/2 inches long (min.), be used for each section to firmly tie the bottom width post to the channel sill.

Anchoring by Weld (Rear Lag Sill)

The rear of the equipment may be anchored by weld using one of three procedures.

The first method is by plug welds (Figure 4.14) using the anchor bolt holes in the rear sill angle. The plug weld should receive a minimum 1/2-inch bead around the entire circumference of the anchor bolt hole.

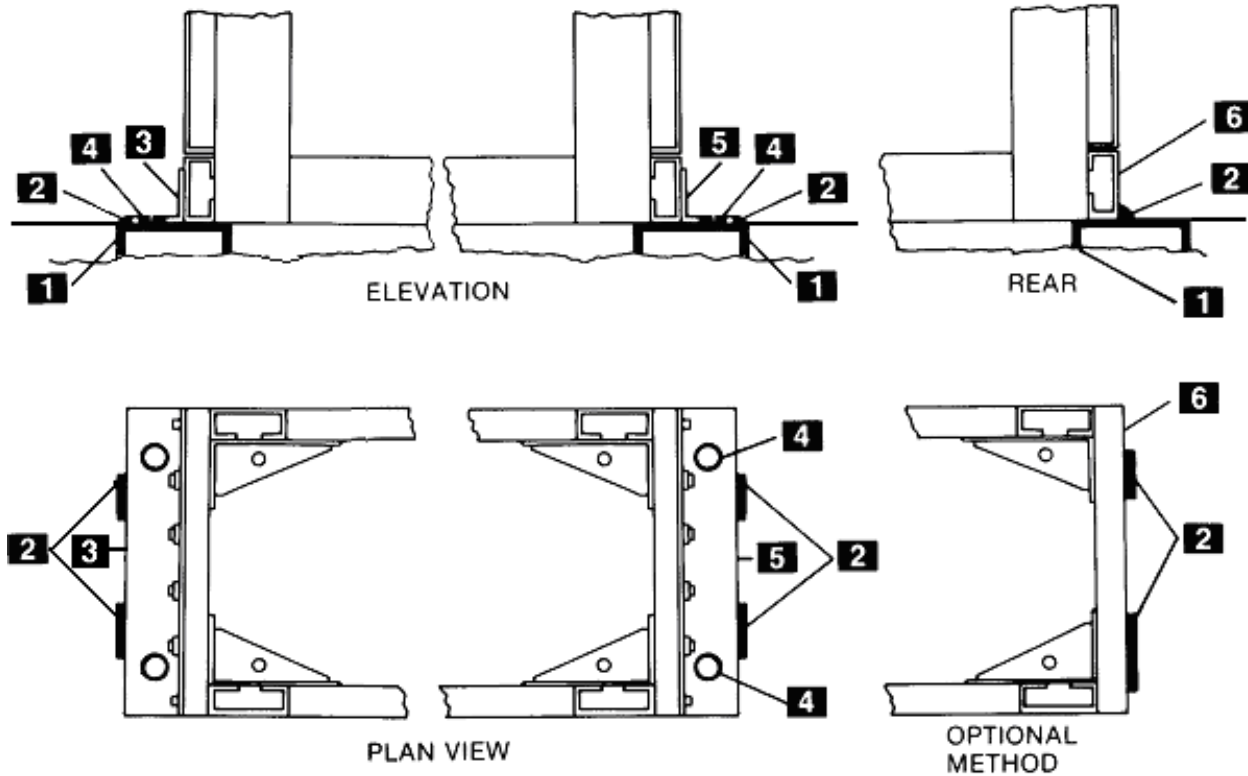
A second method of securing the front and rear sill angles to the channel sill is the use of two linear fillet welds for each section. It is recommended that each weld be 2-1/2 inches long (min.) with a 3/16-inch fillet (min.).

A third method for anchoring the rear of the equipment is to remove the rear sill angle from the switchgear and weld the rear bottom width post to the channel sill. These welds should, like the front welds, have a 3/16-inch (min.) fillet and each have a minimum length of 2-1/2 inches.

NOTICE: The installation drawings provided with the switchgear will convey requirements for certified seismic weld anchoring methods. Alternate anchoring methods should be reviewed and approved by the customer and/or their authorized representative. When the equipment is subject to impact (shock) due to operating conditions or environmental seismic (earthquake) conditions, alternate anchoring methods must be approved by the customer's certified structural engineer.

Figure 4.13 Interconnect control wiring



Figure 4.14 Indoor equipment weld anchoring

- (1) Channel Sills
- (2) 3/16 inch Fillet Weld
- (3) Front Lag Sill Angle
- (4) Plug Weld in Anchor Bolt Hole
- (5) Rear Sill Angle
- (6) Rear Width Post

External Control Wire Connections

All wires entering or exiting the switchgear assembly must be enclosed in a conduit. Sealing compound may be used, if desired. Floor plates are provided as standard.

For external control wiring (Figure 4.3) connection point locations, reference the GE drawings provided for the specific section and location within the equipment. Each section of switchgear can be provided with up to two control wire termination troughs (Figure 3.27). Figure 4.3 depicts a typical location for the cable entry of these control cables. Connect the control wires to the switchgear section as follows:

1. When control conduits enter the switchgear from below, they should not extend more than one inch above the floor. The control wires may be pulled through the conduits before or after the switchgear is installed.
2. Route the control wires from the conduits through the wiring trough (cross-hatched area- 2" x 7"-shown on Figure 4.3) at the side of the cable compartment. Connect the cables to the terminal blocks in accordance with the connection diagrams for the equipment.
3. If the control conduits enter from above, drill the top cover within the available space indicated (Figure 4.3). Control wires should be routed to the wiring trough and connected to the terminal blocks as described previously.

Power Cable Connections

All cables entering or exiting the switchgear assembly must be enclosed in a conduit. Sealing compound may be used, if desired. Floor plates are provided as standard.

Connect the main cables to the main lugs. Before any main cable connections are made, the cables should be identified to indicate their phase relationship with the equipment. Adequate electrical and mechanical clearances must be provided between conduit, cables, and bus. Where the cables enter the section, they can be lashed to optional cable supports at the rear of the cable compartment as required.

Mechanical cable terminals are normally included with the switchgear (compression terminals are supplied when ordered) and are mounted at the ends of the breaker runbacks in the cable compartment. Carefully follow the cable manufacturer's recommendations for installation of cable.

Install the cables in the proper path to the terminals, using temporary lashing if required. Cut the cables to the proper length. Strip the insulation to the desired dimension, being careful not to damage any strands.

For copper cables, coat the wires with GE lubricating grease D6A15A2, insert the cables into the terminals, and tighten the set screws in accordance with torque values shown in the torque value table for cable terminals in the addendum of this manual. See Appendix A. Torque Values, Table A-2.

For aluminum cables, wire brush the wire strands thoroughly. Immediately after wire brushing, coat the cable strands with a quality oxide inhibiting compound such as Penetrox A. Insert exposed wires into the terminals and tighten the set screws in accordance with values shown in the Table A-2 in Appendix A. Torque Values of this instruction manual.

CAUTION: The torque values shown in the table are for dry threads only. Do not grease or otherwise lubricate the threads on the cable terminals as this will permit over tightening of the screw and possible damage to the terminal or cable.

This should result in the oozing of compound material from between individual strands. Wipe off any excess compound.

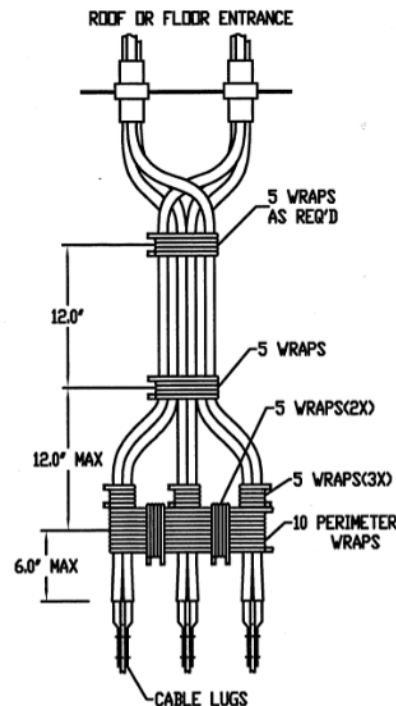
Bolt the cable terminal connectors to the ends of the bars in the cable compartment. A non-oxidizing grease, such as GE lubricating grease D6A15A2 furnished with each equipment, should be used at these connection surfaces. The bolts should be tightened in accordance with values shown in Table A-2 in Appendix A – Torque Values of this instruction manual.

Lash the cables securely to the optional cable support, if present, to take their weight off the runbacks and to brace

them against short circuit forces in the event of a fault. Cable supports can be optionally ordered from the factory.

The following instructions for cable lashing should be used as a guide and Figure 4.15 details a typical cable lashing diagram. Run and bend the main cable in a most convenient orientation, making sure the main cable has been located directly up against any cable braces (if present) before it connects to the main cable terminals. Using a 3/8 inch diameter continuous nylon rope or equivalent (minimum 2000 pounds tensile strength) at 6 inches from the main cable terminals, make five revolutions around the "A" and "B" phase main cables, making sure the rope does not overlap. Make five revolutions around the "B" and "C" phase main cables. With the remaining rope, wrap around the main cable lashing between the "B" and "C" phase and the cable brace (if present) with a minimum of 5 revolutions getting as much revolutions as possible between the phases. Continue wrapping between the "A" and "B" phase around the main cable lashing and the cable brace (if present) with a minimum of 5 revolutions getting as much revolutions as possible between the phases. Securely tie off the remaining rope. Repeat this lashing at every 6-inch interval.

Figure 4.15 Typical cable lashing



Relay and Control Devices

Remove all blocking on relays and devices as shown in the instructions accompanying the devices. Protective relays, devices, trip units and control devices should be set in accordance with the associated short-circuit coordination and/or project specifications provided by the customer.

Breaker Lifting Device

Indoor Equipment

Figure 4.16 depicts the breaker lifting device assembled on indoor equipment. When supplied with indoor equipment, the breaker lifting device is shipped in a separate carton completely assembled, Figure 4.17.

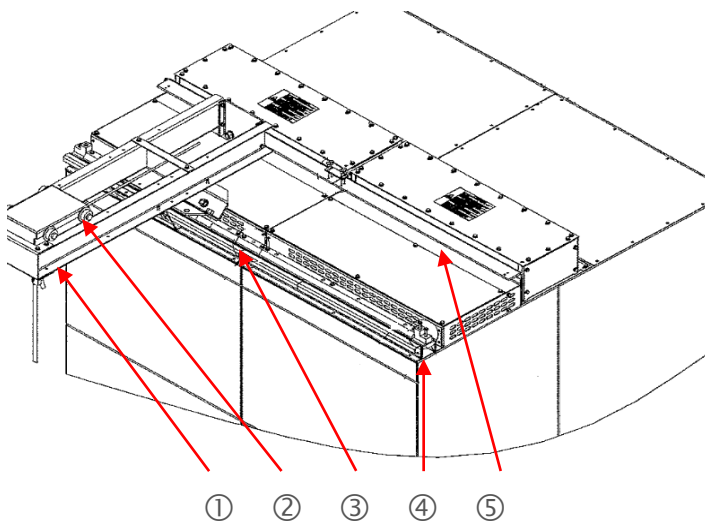
⚠ WARNING: The maximum lifting capacity of the breaker lifting device is 500 pounds. The breaker lifting device is design specifically to raise or lower EntelliGuard circuit breakers with an EntelliGuard circuit breaker lifting beam referenced in Table 6.1. Use of the circuit breaker lifting device for other functions is not recommended.

Before attempting to install the breaker lifting device assembly onto the switchgear equipment, it is necessary to remove the runner guide from the breaker lifting device carriage as shown in Figure 4.18. Do not dispose of this guide and mounting hardware.

NOTICE: Be sure to retain the breaker lifting guide and mounting hardware for reinstallation after mounting the breaker lifting device on the equipment.

The breaker lifting device can be lifted into position on top of the switchgear so that the end with two rollers is toward the rear of the equipment, Figure 4.19.

Figure 4.16 Breaker lifting device assembly (Indoor Equipment)



- (1) Breaker Lifting Device
- (2) Dolly
- (3) Front Rail
- (4) End Stop
- (5) Rear Runner

Figure 4.17 Carton containing breaker lifting device



Figure 4.18 Breaker lifting device runner guide

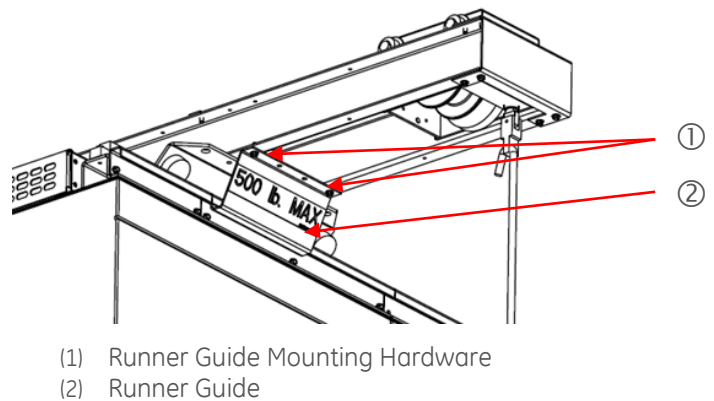
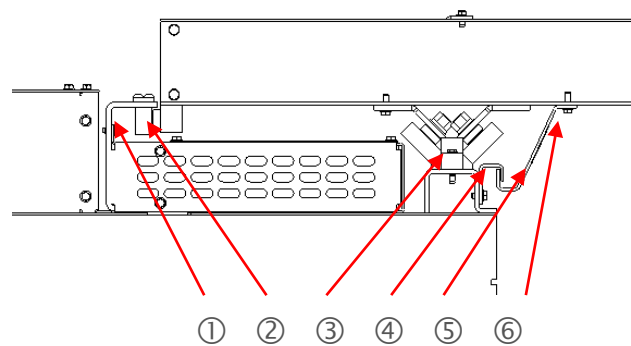


Figure 4.19 Location of breaker lifting device rear rollers



- (3) Rear Runner
- (4) Rear Rollers
- (5) Stop Block
- (6) Front Runner Bracket
- (7) Runner Guide
- (8) Runner Guide Mounting Hardware

The rear rollers can then be hooked under the rear runner and the front rollers can be positioned on the front rail. Refer to Figure 4.19 and Figure 4.20. The runner guide should be reassembled to the breaker lifting device using the hardware retained earlier (Figure 4.19).

⚠ WARNING: Failure to install properly or failure to reinstall the breaker lifting device runner guide may allow an operator to inadvertently lift the breaker lifting device off its rail system and fall unexpectedly.

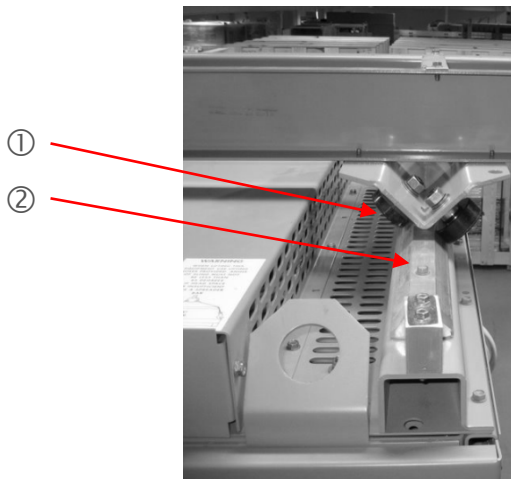
Stop blocks are provided at each of the front runner to prevent the breaker lifting device from rolling off the ends of the rail system.

If the equipment has been shipped in sections, Figure 4.21 and Figure 4.22, there are splice plates for the rear runner and the front rail attached to each respective part.

NOTICE: Prior to installing the front rail splice plate(s) and rear runner splice plate(s), the switchgear must be assembled and anchored to its foundation. Failure to follow this sequence may result in a misalignment of the breaker lifting device components.

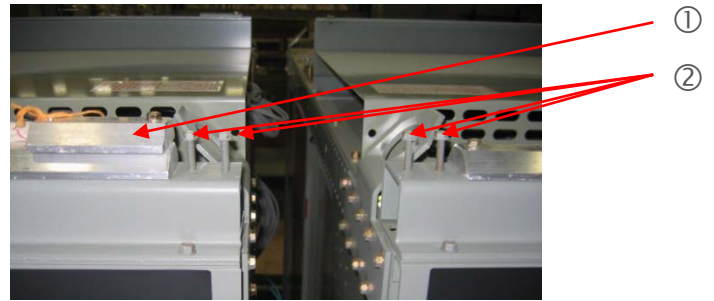
On each shipping split section, remove the bolt holding the front rail shipping splice plate in place. Retain the front rail shipping splice plate and remove the front rail shipping splice plate mounting hardware (Figure 4.21). Install the front rail shipping splice plate using the mounting hardware. Figure 4.23 depicts a typical front rail shipping splice plate installed.

Figure 4.20 Location of breaker lifting device front rollers



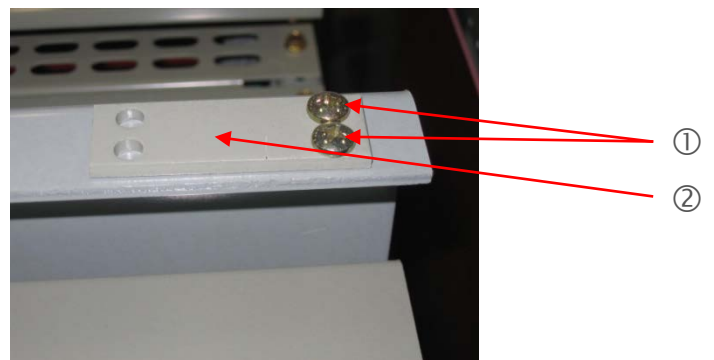
- (1) Front Rollers
- (2) Front Rail

Figure 4.21 Front rail shipping splice plate



- (1) Front Rail Shipping Splice Plate
- (2) Front Rail Shipping Splice Plate Mounting Hardware

Figure 4.22 Rear runner shipping splice plate



- (3) Rear Runner Shipping Splice Plate Mounting Hardware
- (4) Rear Runner Shipping Splice Plate

Figure 4.23 Front rail shipping splice installed



On the rear runner, there is also a splice plate held in place with two screws, Figure 4.22 show a typical example. After the front rail shipping splice plate(s) have been installed, remove and retain the two screws holding the rear runner splice plate. Remove the two screws that are on the rear runner on the other side of the shipping split. Place the rear runner shipping splice plate over both sections and on top of the rear runner. Align the four mounting holes and install the four screws that were previously retained.

After the splice plates have been installed, run the breaker lifting device over the assembled shipping splits to check the alignment of the front rail and rear runner. If necessary, adjust the front rail and/or rear runner for smooth operation of the rollers on the breaker lifting device.

On seismic rated equipment, it is necessary to remove the bracket locking the dolly on the breaker lifting device before the breaker lifting device can be used, refer to Figure 4.24. Replace the bracket after breaker installation or removal is complete.

Figure 4.24 Bracket locking dolly



Rear Door Ventilation

After the primary and secondary wiring has been installed within the cable compartments of the switchgear assembly and prior to energization of the equipment, the shipping wire, on each rear door ventilation, must be removed (Figure 4.25).

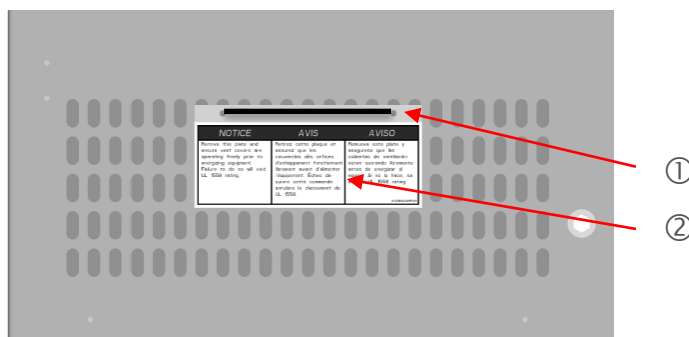
Each rear door has a ventilation opening near the top and bottom of the door and each ventilation opening flap must free moving for proper ventilation of the equipment during normal operation.

Each ventilation flap can be freed by cutting the retaining wire holding the system in the closed position. The notice placard and shipping wire can be discarded after removal.

NOTICE: Ensure the vent covers are operating freely prior to the energizing the equipment. Failure to do so will prohibit proper ventilation of the equipment during normal operation.

WARNING: The rear compartment door must be closed and bolted to maintain the integrity of the arc resistant enclosure. The rear compartment door should not be opened when the equipment is energized.

Figure 4.25 Rear door ventilation shipping wire



Wall Mounted HMI (Entellisys AR Only)

General

The Entellisys switchgear can be optionally provided with a wall mounted HMI (Human Machine Interface) unit (Figure 4.26). Before installation of the HMI unit, ensure that the surface to which the enclosure will be mounted is capable of supporting 85 pounds.

Installation

The recommended procedure for installation of the Entellisys wall mounted HMI unit is as follows:

1. Add two conduit connection holes in either the top or bottom surface of the HMI unit enclosure. Do not position the holes less than 1-1/2 inches from the edges of the enclosure (Figure 4.27).
2. Four mounting holes are provided in the back of the enclosure. Drill an identically spaced pattern of holes in the surface to which the enclosure will be mounted to according to the drawing supplied with the enclosure.
3. Attach the enclosure to the wall or other structure using 3/8 inch bolts, flat washers, and, if the bolts are not self-threading, lock washers and nuts. To ensure proper sealing and enclosure protection rating, use the provided sealing washers. Installing the sealing washers inside the enclosure with the tapered cone against the enclosure and then add the flat washers as shown in Figure 4.28 and Figure 4.29.
4. Attach suitable conduit fittings to the holes from step 1. Run the conduit to the enclosure as necessary.

Wiring

The recommended procedure for connecting the Entellisys HMI power and communication cables is as follows:

1. Connect the 120V ac line, neutral, and ground wires to the terminal block as shown in the wiring diagram included with the assembly.
2. Connect the incoming Ethernet cable to the port on the side of the HMI display. Secure the wires to the HMI and the enclosure with cable ties.
3. If the enclosure is equipped with a power supply and RS232/RS485 converter, connect the incoming RS485 cable to the converter terminals labeled RX+ and RX-.

Figure 4.26 Entellisys wall mounted HMI unit

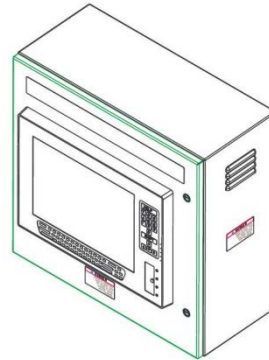


Figure 4.27 Entellisys wall mounted HMI unit and devices

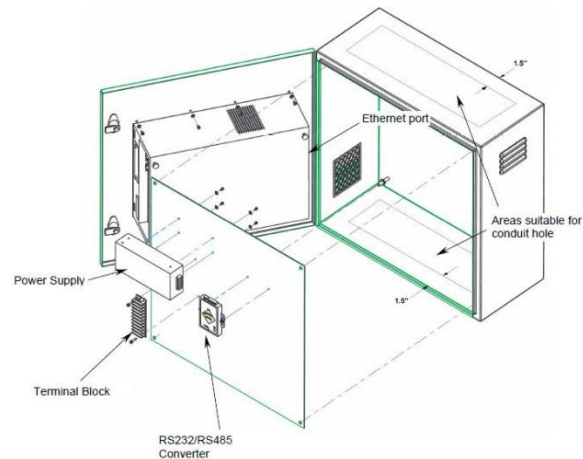


Figure 4.28 Enclosure mounting using nuts and bolts

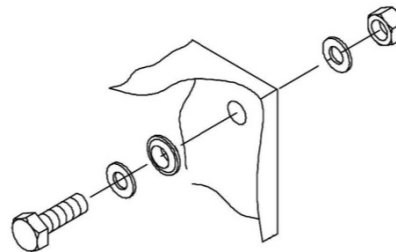
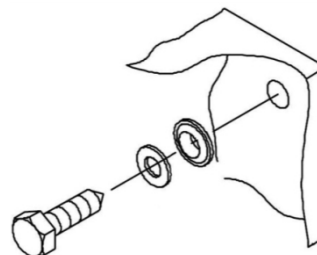


Figure 4.29 Enclosure mounting using self-threading bolts



Section 5. Exhaust Plenum Installation

General

The exhaust plenum system (Figure 5.1) is a metallic duct that is attached to the plenum flange located on the top of the switchgear. The exhaust plenum will run across the entire length of the equipment and is attached to a plenum flange for each individual section (Figure 5.2).

NOTICE: The minimum unobstructed ceiling height from the base of the switchgear is 10 feet to install the exhaust plenum system.

The exhaust plenum duct is shipped separately for installation at the customer's site.

The instructions here pertain to how the exhaust plenum system is installed on top of the switchgear and requirements for the end duct installation. Refer to the customer's specification/construction drawings for routing, installation and requirements for the exhaust plenum system between the end flange on the equipment and the end exhaust portal.

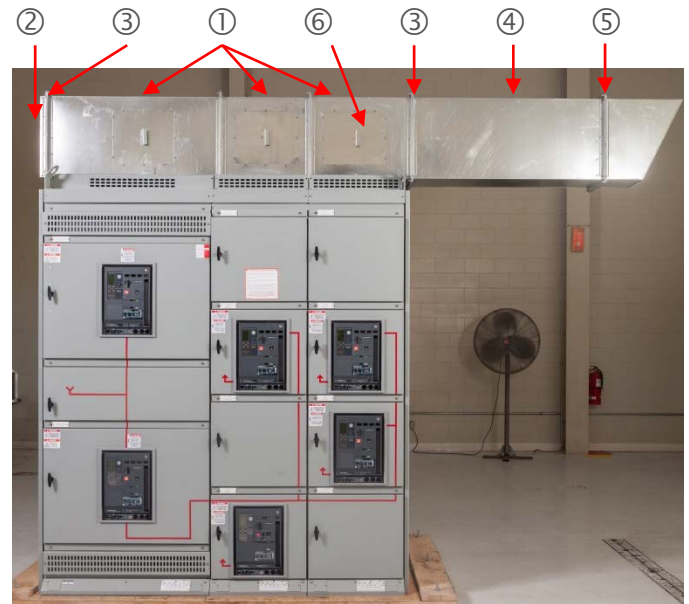
The portion of exhaust plenum system between the transition adapter and the end exhaust portal (Figure 5.1) may or may not be provided by the General Electric Company. Adherence to the design requirements in this manual is required when constructing this area of the exhaust plenum system.

⚠ WARNING: The exhaust plenum system is an integral component of the arc resistant rating of the equipment. Energizing and operating the equipment without a properly installed exhaust plenum system will negate the arc resistant rating.

The exhaust plenum above each section of equipment will match the width of that specific section. An access cover (Figure 5.1) is provided in each exhaust plenum above the switchgear to facilitate the installation.

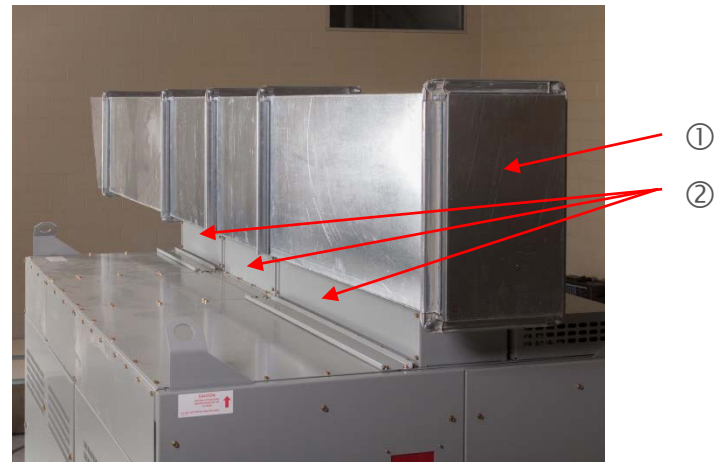
NOTICE: Prior to installing the exhaust plenum system, the switchgear shipping splits must be assembled and anchored to its foundation. Failure to follow this sequence may result in a misalignment of the exhaust plenum system.

Figure 5.1 Exhaust plenum system (front view)



- (1) Exhaust Plenum Section (above equipment)
- (2) End Cap
- (3) Exhaust Plenum Transition Adapter
- (4) Exhaust Plenum Duct (provided by others)
- (5) Exhaust Plenum End Portal
- (6) Access Cover (typical)

Figure 5.2 Exhaust plenum system (rear view)



- (1) End Cap
- (2) Plenum Flange (typical for each section)

Installation

Exhaust Plenum above Switchgear

The recommend procedure to install the exhaust plenum above the switchgear is as follows:

1. Prior to installing the individual sections of the exhaust plenum system, it is important to identify the different sections for each stack width and transition adapters to be installed on the very left end section and the very right end section of the equipment lineup (Figure 3.2). The exhaust plenum sections above each section of the switchgear will have an external flange on three sides (Figure 5.4). The left and right end sections of the transition adapters will have an end flange as shown in Figure 5.3.
2. Remove the #10-32 x ¼ inch hardware attaching the access cover to the exhaust plenum section (Figure 5.6). Be sure to retain the hardware and the access cover for re-installation later in this instruction manual.
3. Remove and discard the temporary cover that is attached to the top of the plenum flange at the top of the switchgear section (Figure 5.5). Be sure to retain the mounting hardware for in step 4.
4. Raise the exhaust plenum section to the top of the switchgear and align the opening and hole pattern in the bottom of the exhaust plenum with the opening and hole pattern on the plenum flange (Figure 4.7). Attach the exhaust plenum section to the plenum flange using the hardware retained in Step 3. Torque the hardware to 7-9 ft.-lbs. Be sure that the access cover opening is facing toward the front of the switchgear.

Figure 5.3 Left and right end flange detail of transition adapter

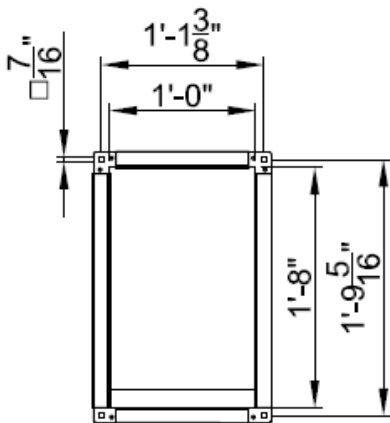


Figure 5.4 Flange detail above switchgear

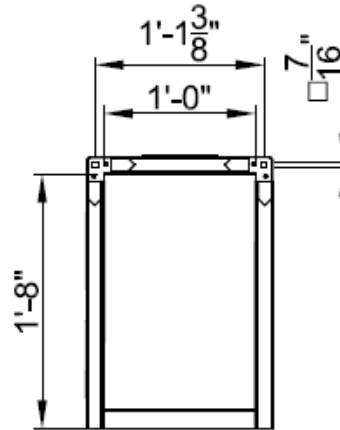
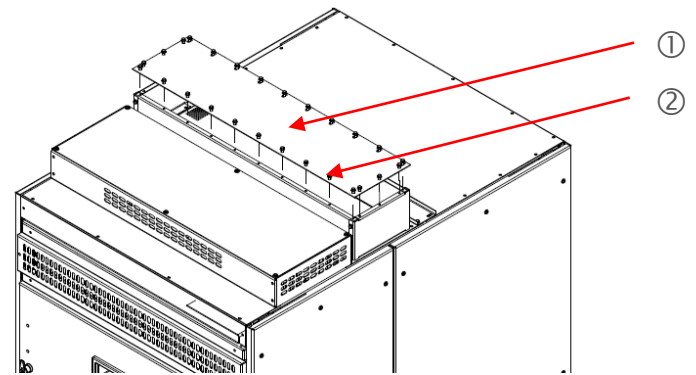
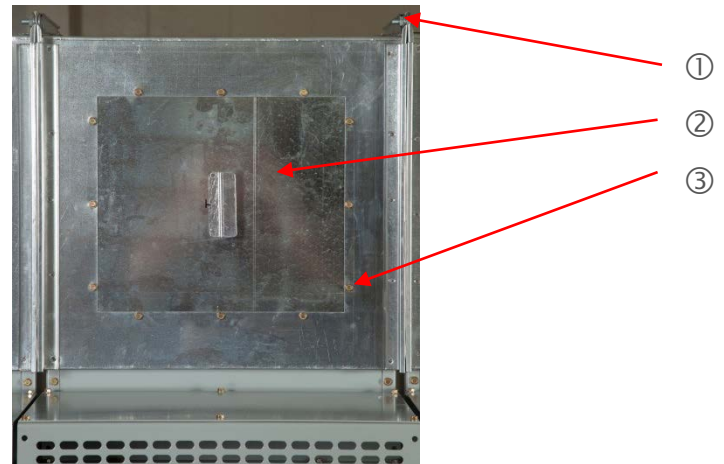


Figure 5.5 Plenum flange temporary cover



- (1) Temporary Cover
- (2) ¼-20 x ½ inch Self-Thread Rolling Screws

Figure 5.6 Access cover hardware



- (1) 3/8-16 x 1 inch Carriage Bolts
- (2) Exhaust Plenum Access Cover
- (3) #10-32 x ¼ inch Access Cover Mounting Screws

5. Repeat steps 3 and 4 for the adjacent exhaust plenum section on the adjoining section of equipment
6. Using the 3/8-16 x 1 inch carriage bolts, lock washers and hex nuts provided, attach the upper two corners of the middle flanges together and torque to 25-30 ft.-lbs. (Figure 5.6).
7. Using the #12-24 x 7/8 inch self-thread forming screws (Figure 5.8), complete attaching the two middle flanges together. Torque the screws to 4-5 ft.-lbs. Optional flange clips may be used in lieu of the #12-24 x 7/8 inch hardware.

CAUTION: If properly aligned, there should be no air gap between the exhaust plenum and the plenum flange on top of the switchgear. There should be no air gap between the individual exhaust plenum sections.

NOTICE: As an option, a fire rated 440 butyl sealing compound may be applied between exhaust plenum flanges.

8. Repeat steps 2 through 7 until all exhaust plenum sections are installed above each section of the switchgear lineup.
9. After all exhaust plenum sections are installed above each section of the switchgear. The left and right side transition adapters can be installed at each end of the plenum system. Using the 3/8-16 x 1 inch carriage bolts, lock washers and hex nuts provided, attach the upper two corners of the transition adapters to the plenum flange and torque to 25-30 ft.-lbs. (Figure 5.6).
10. Using the #12-24 x 7/8 inch self-thread forming screws (Figure 5.8), complete attaching the transition adapter to the exhaust plenum flange. Torque the screws to 4-5 ft.-lbs. Optional flange clips may be used in lieu of the #12-24 x 7/8 inch hardware.

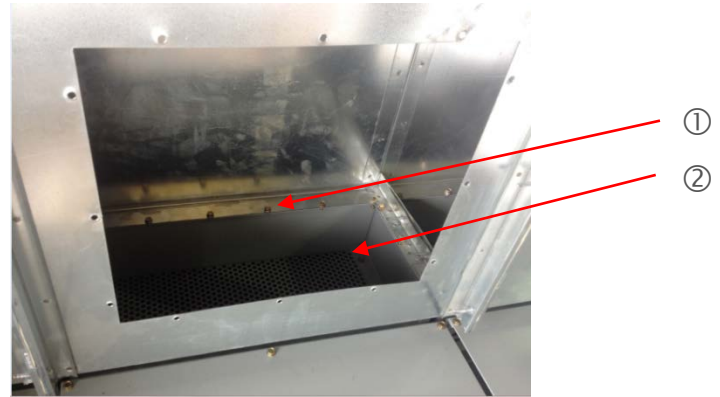
CAUTION: If properly aligned, there should be no air gap between the transition adapter and the exhaust plenum flange.

NOTICE: As an option, a fire rated 440 butyl sealing compound may be applied between exhaust plenum flanges.

11. Using the hardware and access cover retained from step 2, re-install the access cover to each exhaust plenum section. Be sure that the access cover is located internally to the exhaust plenum (Figure 5.6) and torque the hardware to 4-5 ft.-lbs.

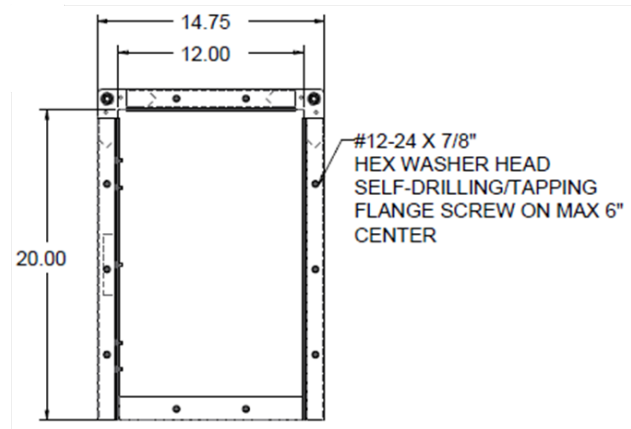
CAUTION: Over-tightening of the access cover mounting screws could damage the exhaust plenum itself. Care should be taken while performing this task.

Figure 5.7 Plenum flange mounting hardware



- (1) Plenum Flange Mounting Hardware
- (2) Plenum Flange Opening

Figure 5.8 Attaching exhaust plenum flange (hardware)



Exhaust Plenum End Cap

If one end of the exhaust plenum system above the switchgear is required to be closed, an end cap (Figure 5.9) can be installed as follows:

1. Using the 3/8-16 x 1 inch carriage bolts, lock washers and hex nuts provided, attach the upper and lower two corners of the flanges together and torque to 25-30 ft.-lbs. (Figure 5.9).
2. Using the #12-24 x 7/8 inch self-thread forming screws (Figure 5.10), complete attaching the end cap to the end flange. Torque the screws to 4-5 ft.-lbs.

CAUTION: If properly aligned, there should be no air gap between the transition adapter and the exhaust plenum flange.

NOTICE: As an option, a fire rated 440 butyl sealing compound may be applied between exhaust plenum flanges.

Exhaust Plenum End Portal

The exhaust plenum end portal should be located on an exit wall (Figure 5.11) from the equipment room and secured to this structure.

If the exit point of the equipment room is an exterior wall, the securing of the exhaust end portal must include methods to prevent water ingress between the exhaust end portal and the structure wall.

Care and consideration should be taken when selecting the exhaust end portal location. An area of at least 10 feet in all directions from the exhaust end portal needs to be clear of obstruction and access to this area should be restricted to ensure the safety of personnel.

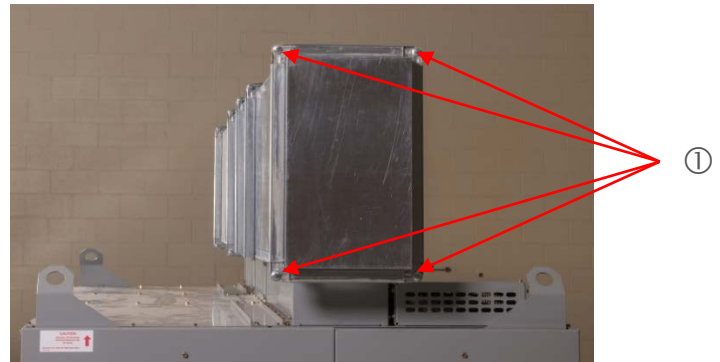
Recommended attachment means are identical to those shown in Figure 5.10.

The exhaust end portal hinged flap is secured in place with a self-thread forming screw. Behind the hinged flap, a standard rodent screen is provided. An optional moisture absorbent foam material may be located between the rodent screen and hinged flap.

Care should be taken to ensure the flap is secured, closed and flat against the exhaust portal assembly.

WARNING: An area of at least 10 feet in all directions from the exhaust end portal should be free and clear of personnel and obstructions to allow safe passage of exhaust gases during an internal arcing fault within the equipment. Failure to do so may result in serious injury or death.

Figure 5.9 Exhaust plenum end cap



(1) 3/8-16 x 1 inch Carriage Bolts

Figure 5.10 Attaching end flange (hardware)

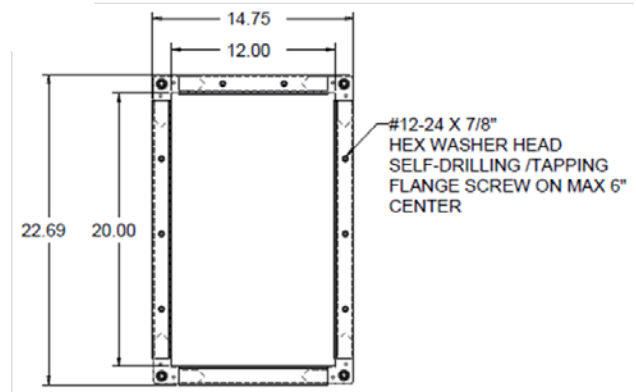
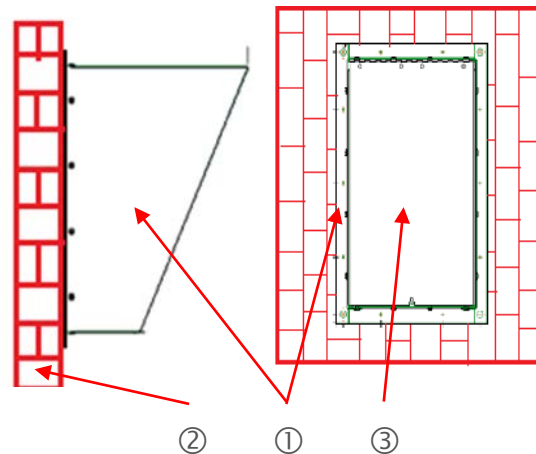


Figure 5.11 Typical exhaust portal assembly



- (1) Exhaust Plenum End Portal Assembly
- (2) Structural Wall
- (3) Exhaust Plenum End Portal Hinged Flap

Plenum System between Equipment and End Portal

Construction of the exhaust plenum between the end flange on the switchgear and the exhaust end portal can vary upon the customer's construction requirements.

Care should be taken to ensure that minimum cross-sectional area of the exhaust plenum interior volume measure no less than 12 inches by 20 inches.

The exhaust plenum should be constructed of a corrosion resistant metal with a material thickness of no less than 23 gauge.

Attaching the exhaust plenum should adhere to the details shown in Figure 5.10.

Total length of the plenum has no restriction. Elevation changes and turns of no greater than 90 degrees are acceptable but should be kept to a minimum.

The exhaust plenum should be anchored in such a method that it will support the weight of the system itself and adhere to the customer's construction/specification requirements.

Section 6. Installing and Removing Circuit Breakers

General

Before installing, operating, or removing a circuit breaker, refer to the breaker instruction manual for preparation, inspection, and test. Check thoroughly for damaged or loose parts and for any dirt or foreign matter which may be in the breaker. Be sure that a thin film of GE lubricating grease D6A15A2 is present on primary disconnects of the switchgear before installing the breaker.

Circuit Breaker Identification

To select a circuit breaker for installation, proceed as follows:

1. Before installing check the contact areas on each primary disconnect bar or cluster of fingers for foreign matter that may have accumulated. Clean these areas if necessary. Be sure that a thin film of GE lubricating grease D6A15A2 covers the contact areas before putting a breaker in the compartment.
2. Check to see that the breakers match their respective compartments. Each breaker is assigned a part or mark number. This number is shown on the breaker sheets of the summary, the front view drawings, and on the identification card on the breaker shipping carton. The breaker may also be identified using the 20 digit catalog number (AKD-20 AR Only) or using the 10 digit catalog number (Entellisys AR Only).
3. To locate the breaker in the proper compartment, refer to the breaker location list on the front view drawing. Find the proper breaker by the identification card on the breaker carton. All identical breakers will have the same mark and catalog number.

Rejection Feature

Draw-out breakers of the same type and ratings are interchangeable in their equipment compartments. Draw-out breakers of different type or short-circuit rating are intentionally made non-interchangeable to prevent inserting the wrong type breaker into a draw-out compartment; Unique "rejection hardware" is affixed to each breaker (Figure 6-1) and its cassette (Figure 6-2). When the wrong type breaker is inserted into a compartment, the pins on the breaker and the blocks in the cassette interfere, thus preventing the wrong breaker from being racked onto the primary stabs.

The complete rejection pattern code is included in Appendix C (AKD-20 AR Only) and Appendix D (Entellisys AR Only).

Figure 6.1 EntelliGuard circuit breaker rejection pins



Figure 6.2 EntelliGuard circuit breaker rejection blocks



NOTICE: Breakers with a higher short circuit rating will fit into a compartment for a lower short circuit rating. For example, a GA08H* breaker can be inserted into a GA08N* compartment. A GA08N* breaker, however, will be rejected by a GA08H* compartment.

NOTICE: If a circuit breaker is rejected by the rejection feature, check the breaker type and rating against the equipment drawings.

Installing a Circuit Breaker

General

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

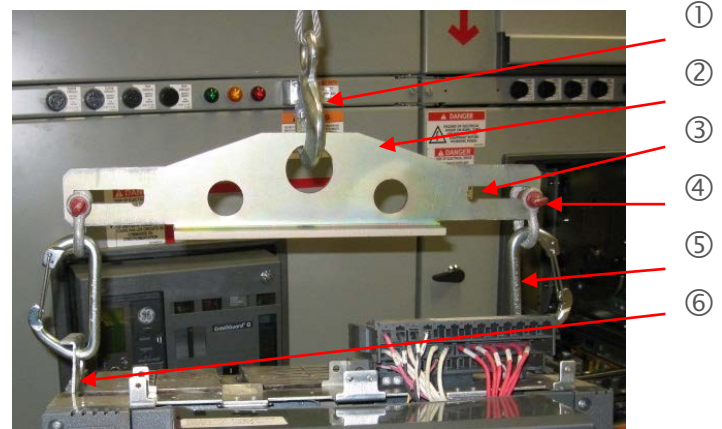
1. Prior to lifting a breaker to its intended compartment location, observe the following precautions:
2. Check the compartment to ensure that it is free of foreign objects.
3. Verify that the breaker is the correct type for that compartment.
4. Ensure that the breaker is open.
5. Apply a thin fresh coat of GE lubricating grease D6A15A2 to the breaker's primary disconnect assemblies.
6. Ensure that the position indicator on the compartment is in the DISCONNECTED position and is correctly positioned for initial engagement. To do this, open the racking handle door, insert the racking handle and rotate it fully counter-clockwise.

Installation Procedure

To install the EntelliGuard circuit breaker, proceed as follows:

1. Carefully place the breaker in front of the section in which it is to be installed with the primary disconnects parallel and facing toward the front.
2. Open the breaker compartment door by rotating the door latch assembly clockwise.
3. Attach the appropriate lifting beam (Table 6.1) to the circuit breaker and breaker lifting device as shown in Figure 6.3. The carabineers of the lifting beam should be securely closed on the circuit breaker lifting tabs.
4. Using the switchgear breaker lifting device or a suitable lifting mechanism and the appropriate lifting beam, raise the breaker above the elevation of the breaker compartment rails.
5. Fully withdraw the rails to their stops.
6. Slowly lower and guide the circuit breaker to align with the breaker compartment. Prior to lowering the circuit breaker onto the rails, be sure the breaker metallic side frames (Figure 6.4 and Figure 6.6) are aligned with the grooves in the cassette.

Figure 6.3 EntelliGuard lifting beam



- (1) Breaker Lifting Beam Hook
- (2) Lifting Beam
- (3) Envelope 1 Carabineer Position
- (4) Envelope 2 Carabineer Position
- (5) Carabineers
- (6) Circuit Breaker Lifting Tabs

Table 6.1 EntelliGuard circuit breaker lifting beams

Catalog Number	Poles	Envelope Size
GLD3F12	3	Envelope 1 or 2
GLD3F3		Envelope 3
GLD4F12	4	Envelope 1 or 2
GLD4F3		Envelope 3

⚠ WARNING: Do not stand under the circuit breaker during the lifting or lowering operation.

⚠ CAUTION: When using the switchgear breaker lifting device, do not unwind the cable completely from the drum. To lift the breaker, turn the device operating crank clockwise. To lower the breaker, turn the device operating crank counter-clockwise.

⚠ CAUTION: When lifting or lowering a circuit breaker, take care to prevent the circuit breaker from rotating and hitting components on the front of the equipment.

NOTICE: Envelope 1 and Envelope 2 circuit breakers share a common lifting beam. The lifting beam has two unique positions for the carabineers to properly lift each Envelope size circuit breaker (Figure 6-3).

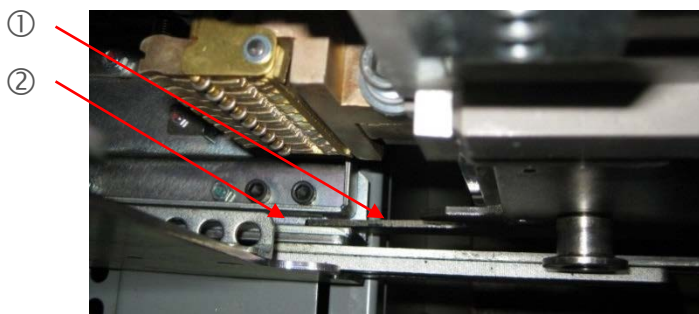
7. With both sides of the circuit breaker aligned with the grooves in the cassette, slowly lower and guide the breaker to allow the 4 breaker wheels to align with the rails (Figure 6.5). Remove the lifting beam. The breaker is now positioned on the draw-out rails.
8. Roll the breaker into the compartment until the racking forks meet the racking pin, this is the DISCONNECTED position. If an incorrect breaker has been installed, the interference pins on the breaker will interfere with the rejection blocks in the compartment prior to reaching the disconnect position. At this point, the racking forks on the cassette are contacting the fixed racking pins on the breaker.
9. Slide rails back into compartment. Close the compartment door and latch (Figure 3.18).

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

10. Engage the racking handle (Figure 6.7) by using a slot screwdriver to open the racking shaft door by rotating it clockwise, then insert hex manual racking handle.
11. Rotate the handle clockwise as far as it will go. As you rotate the handle clockwise, the breaker will travel from the DISCONNECTED, through the TEST position (you will notice an audible click), and then into the CONNECTED position. The breaker position can be seen on the indicator barrel, located on the cassette escutcheon (Figure 6.7).
12. Return the racking handle to the right most pocket in the breaker compartment (Figure 6.8).

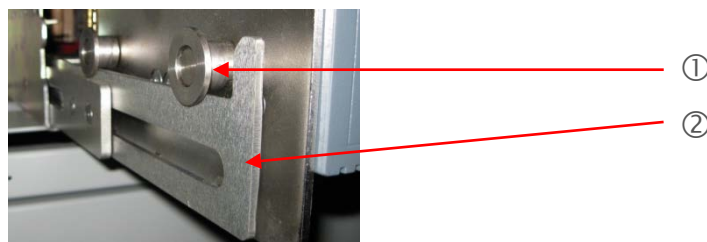
⚠ WARNING: The EntelliGuard racking handle must be returned to its compartment to maintain the integrity of the arc resistant enclosure.

Figure 6.4 EntelliGuard lifting beam



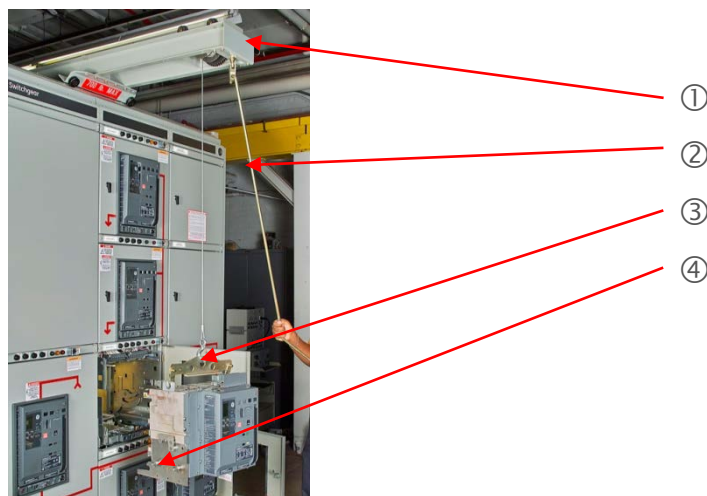
- (1) Circuit Breaker Side Frame
- (2) Cassette Groove

Figure 6.5 EntelliGuard circuit breaker on draw-out rails



- (1) Circuit Breaker Wheels
- (2) Cassette Draw-out Rails

Figure 6.6 Circuit breaker lifting device



- (1) Switchgear Breaker Lifting Device
- (2) Operating Crank
- (3) Lifting Beam
- (4) Circuit Breaker Side Frame

Figure 6.7 EntelliGuard racking handle



- (1) Circuit Breaker Position Indicator
- (2) Racking Shaft Access
- (3) Racking Handle

Figure 6.8 EntelliGuard racking handle storage



- (1) EntelliGuard Racking Handle

Removing a Circuit Breaker

To remove the EntelliGuard circuit breaker, proceed as follows:

1. Open the breaker by pressing the OFF/OPEN button.
2. Use a slot screwdriver to open the racking shaft door by turning clockwise (Figure 6-7). Insert the racking handle and rotate it counterclockwise until the breaker travels from CONNECTED through TEST to the DISCONNECTED position, as shown by the position indicator. This operation should be performed with the door closed. If the breaker closing spring is fully charged, it will be automatically discharged when the breaker is moved to the WITHDRAWN position.
3. Open the compartment door and fully extend the draw-out rails. Roll breaker out to rail stops. This is the WITHDRAWN position.
4. Before proceeding, visually check the breaker's spring charge and close indicators to verify that breaker is open and the springs are discharged.
5. Attach the lifting device (Table 6.1) and raise breaker off draw-out rails.
6. Push the draw-out rails back into the compartment.
7. Pull the breaker forward until the primary disconnects clear the compartment.
8. Lower the breaker onto a flat surface free of protrusions that could damage the breaker's internal parts.
9. Close the breaker compartment door. If the circuit breaker will be removed from the compartment for an extended period of time. An optional future cassette barrier and future front cover (Table 6.2) should be ordered and installed to prevent access to live conductor parts and maintain the integrity of the arc resistant enclosure.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

10. Return the racking handle to the right most pocket in the breaker compartment (Figure 6.8).

⚠ WARNING: The EntelliGuard racking handle must be returned to its compartment to maintain the integrity of the arc resistant enclosure.

Table 6.2 Future cassette barriers and future door covers

Catalog Number	Poles	Envelope Size
GM2ARF1FC	Future Cassette Barrier	Envelope 1
GM2ARF2FC		Envelope 2
GM2ARF3FC		Envelope 3
GM2ARFDC	Future Door Cover	Env. 1, 2 & 3

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: Do not stand under the circuit breaker during the lifting or lowering operation.

⚠ CAUTION: When using the switchgear breaker lifting device, do not unwind the cable completely from the drum. To lift the breaker, turn the device operating crank clockwise. To lower the breaker, turn the device operating crank counter-clockwise.

⚠ CAUTION: When lifting or lowering a circuit breaker, take care to prevent the circuit breaker from rotating and hitting components on the front of the equipment.

NOTICE: Envelope 1 and Envelope 2 circuit breakers share a common lifting beam. The lifting beam has two unique positions for the carabineers to properly lift each Envelope size circuit breaker (Figure 6-3).

Section 7. Testing and Inspecting

General

After the equipment has been installed and all connections made, it must be tested and inspected before it is put in service. Although the equipment and devices have been tested at the factory, a final field test must be made to be sure that the equipment has been properly installed and that all connections are correct.

⚠ WARNING: The equipment must be completely de-energized while the tests are in progress.

Directions for testing relays, instruments, and meters are given in the instruction manual furnished for each device. The proper settings of the protective relays and circuit breaker trip units or EntelliGuard Messengers are normally determined from a complete power system coordination study performed by the purchaser or their consultant; therefore, the settings of these devices must be made by the purchaser. When the equipment is shipped from the factory, the time dial of all inverse-time induction disc relays (i.e., IFC types) is set to zero to prevent contact bounce during transportation.

⚠ WARNING: The trip setting adjustments of the trip unit or EntelliGuard Messenger for each circuit breaker may be at any setting when shipped from the factory and must be correctly set prior to energization of the equipment.

General instructions for setting the relays are given in the applicable relay or trip unit instruction manual. Directions for Entellisys instrumentation is provided in DEH-501.

The extent of the tests on the equipment as a whole will depend on the type and function of the equipment. Tests which should be performed, however, include circuit breaker operation, and switchgear meggering, phasing, and grounding checks.

High-potential tests to check the integrity of the insulation are not necessary if the installation instructions are carefully followed. If local codes demand this test, or the purchaser wishes to make high-potential tests, the voltage should not exceed 75 percent of the IEEE factory test voltage.

For the power circuit, the IEEE factory test voltage is two times switchgear rating plus 1,000 volts. See Table 7.1. Potential and control power transformers must be disconnected during high-voltage testing.

Table 7.1 High potential test values

Switchgear Voltage Rating	ANSI Test Voltage, ac RMS	Field Test Voltage, ac RMS
600 V ac	2,200 V	1,650 V
480 V ac	1,960 V	1,470 V
240 V ac	1,480 V	1,110 V

Key Interlocks

After initial installation of the switchgear equipment, all necessary interlock keys should be inserted into the appropriate locks and all spare keys should be stored in a location in accordance with the owner's established procedures.

⚠ CAUTION: Refer to the key interlock schematic included in the summary furnished with the equipment to determine the sequence of operation and the correct number of operating keys required. This precaution is necessary since the improper use of spare keys will defeat the interlocking scheme.

Breaker Operation Test

All compartments housing EntelliGuard circuit breakers have a TEST position in which the breaker primary contacts are disconnected while the secondary contacts are still engaged. This TEST position permits complete testing of the electrical control circuit without energizing the primary power circuit. When the breaker is first put into service, its control circuit must be thoroughly tested while in this position to make sure that all closing and tripping circuits are complete and functioning properly.

The TEST position is not suitable for inspection and maintenance of the breaker and should therefore be used only for testing breaker operation.

Refer to the appropriate breaker instruction manual for other pre-operational checks on the breakers. See DEH-41304 (AKD-20 AR Only) or DEH-41526 (Entellisys AR Only).

EntelliGuard Trip Units (AKD-20 AR Only)

The calibration of the EntelliGuard trip unit should be checked with the Type GTUTK20 test kit, a portable instrument designed for the field-testing of EntelliGuard trip units. The complete trip system is comprised of the following components:

1. Solid-state Trip Unit with Rating Plug
2. Phase Current Sensors
3. Flux Shift Magnetic Trip Device
4. When applicable, a Neutral Sensor for units containing a Ground Fault Trip Element.

All components, except the Neutral Sensor, are integrally mounted in the circuit breaker. When used, the Neutral Sensor is separately mounted in the bus or cable compartment of the switchgear. In draw-out construction, it

is automatically connected to the trip unit in the breaker via a draw-out secondary disconnect block.

Complete Instructions for testing the trip units are included with the test set. The trip unit user manuals are DEH-4567 (EntelliGuard trip unit) and DEH-4568 (GTUTK20).

⚠ CAUTION: Never disengage the trip unit on a circuit breaker that is energized and carrying load current. This will open circuit the current sensors, allowing dangerous and damaging voltages to develop.

Entellisys System Test Kit (Entellisys AR Only)

The Entellisys system can be tested with the Type ETSTESTKIT03 test kit, a portable instrument designed for field-testing of the Entellisys system functionality. The test kit user manual is DEH-503.

Final Steps to be taken Before Energizing Equipment

The following steps should be taken before energizing the equipment:

1. Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they are properly aligned and operate freely.
2. Conduct an electrical insulation resistance test to make sure the switchgear is free from short circuits and grounds. This should be done both phase-to-ground and phase-to-phase with the switches or circuit breakers both opened and closed. This test should be performed with a 1000 volt meggar. Disconnect all control circuits before checking resistance.
3. Check any electrical relays, meters, or instrumentation to determine that connections are made properly and the devices function properly.
4. Electrically exercise all electrically operated circuit breakers, and other mechanisms (but not under load), to determine that the devices operate properly. An auxiliary source of control power may be necessary to provide power to the electrical operators.
 - a. (Entellisys AR Only): Using the Entellisys HMI, exercise all EntelliGuard circuit breakers to determine all devices are functioning correctly. For Entellisys HMI instructions, reference DEH-501.
5. Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions.
 - a. (Entellisys AR Only): Test all protective functions using the Entellisys Test Kit

(ETSTESTKIT03). Reference DEH-503 for instructions.

6. Set the adjustable current and voltage trip mechanisms to the proper values. Experience has indicated that damage from faults can be reduced if the devices used for overload and short circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.
7. Make certain that field wiring is clear of live bus and, where necessary, physically secured to withstand the effects of fault currents.
8. Check to determine that all grounding connections are made properly.
9. Remove all debris, scrap wire, etc., from the switchgear interior before closing the enclosure.
10. Install covers, close doors, and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.

⚠ WARNING: The following must be adhered to ensure the integrity of the arc resistant enclosure:

- EntelliGuard racking handle(s) must be returned to all breaker compartment(s).
- Key interlock(s) or the metallic key interlock plug(s) must be installed to all breaker compartments
- Position switch(es) or the metallic position switch covers(s) must be installed to all breaker compartments.
- Breaker compartment door(s) must be closed and latched.
- Breaker compartment(s) without a circuit breaker(s) must have a future door cover(s) and future cassette barrier(s) installed.
- Exhaust plenum system must be properly installed.
- Rear compartment door(s) must be closed and bolted.
- IR window cover(s) must be closed and secured.

Section 8. Operating the Switchgear

General

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: The EntelliGuard racking handle must be returned to its compartment to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: Either the key interlock(s) or the metallic key interlock plug(s) must be installed to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: Either the position switch or the metallic position switch cover must be installed to maintain the integrity of the arc resistant enclosure.

⚠ CAUTION: If the dead front gasket of the breaker door gasket is damaged, these components should be replaced to ensure the integrity of the arc resistant enclosure.

Included below are abbreviated operating instructions for EntelliGuard circuit breakers. Before activation of the circuit breakers or operation of the switchgear equipment, thoroughly read, and be familiar with the circuit breaker manuals which will be supplied as supplementary information to this manual. Publication number is DEH-41304 (AKD-20 AR Only) or DEH-41526 (Entellisys AR Only).

Manually Operated Circuit Breakers

Closing Operation

Manually operated EntelliGuard circuit breakers are equipped with an integral charging handle and a push button marked CLOSE on the front of the escutcheon. The spring must be charged first.

A complete charge is accomplished by pulling the handle down about 90° (until it stops) ten times to fully charge the closing springs. *This will not close the breaker contacts.* The charge indicator will show CHARGED on a yellow background.

Opening Operation

A mechanically operated OPEN button mounted on the breaker escutcheon, operates the trip shaft to open the breaker.

The Entellisys HMI may also be used to electrically open the breaker (Entellisys AR Only).

Electrically Operated Circuit Breakers

Closing Operation

Electrically operated breakers may be closed by ac control power, or dc (normally station or standby battery) control power. Refer to the provided elementary diagrams for information on control circuitry.

The Entellisys HMI may be used to electrically close the breaker (Entellisys AR Only).

Opening Operation

A shunt trip device is used for electrical tripping and each breaker can have up to two shunt trip accessories installed.

The Entellisys HMI may also be used to electrically open the breaker (Entellisys AR Only).

Circuit Breaker Draw-out Operation

The circuit breaker compartment is constructed to offer four unique positions of CONNECTED, TEST, DISCONNECTED, and WITHDRAWN.

CONNECTED Position

In the CONNECTED position (Figure 8.1), the primary and secondary disconnects are fully engaged. The breaker must be tripped before it can be racked out of this position.

TEST Position

When in the TEST position (Figure 8.2), the primary contacts are disconnected, but the secondary contacts remain engaged. This allows complete breaker operation without energizing the primary circuit.

DISCONNECTED Position

In the DISCONNECTED position (Figure 8.3), neither primary nor secondary contacts are made. Breakers may be racked between these three positions with the compartment door closed and latched.

WITHDRAWN Position

With the door open, the breaker can be rolled out manually from the DISCONNECTED to the WITHDRAWN position. Here, the breaker is completely out of its compartment, ready for removal.

WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

Draw-out Operation

All breakers are supported on the draw-out rails mounted on the side walls of the cassette. On EntelliGuard breakers, two wheels on each side of the breaker rest on each draw-out rail.

Motion is provided by a mechanism mounted on the bottom of the cassette. This mechanism drives racking cams which engage pins anchored to each side of the breaker.

The cams are driven by a removable racking handle or remote racking device, catalog #EGGRLV, which engages the mechanism. The handle is inserted through an opening in the cassette escutcheon below the breaker.

Turning the handle in a clockwise direction drives the breaker into the compartment. As the breaker disconnect fingers engage the stab tips, a high force will be felt. Turn the racking handle until the indicator barrel clearly shows CONNECTED.

The position of the breaker is given by the position indicator in the cassette escutcheon as it moves through the door cutout.

Figure 8.1 Circuit breaker in CONNECTED position



Figure 8.2 Circuit breaker in TEST position



Figure 8.3 Circuit breaker in DISCONNECTED position



Front Doors

The front access doors, auxiliary and circuit breaker doors, on all AR switchgear are hinged and equipped with a self-latching system (Figure 8.4). To open the door, rotate the handle clockwise. To close the door, push on the outside of the door directly behind the self-latching mechanism (Figure 8.6).

To verify that the front door has latched, pull on the door handle without rotating the handle. Both the upper and lower door latches should keep the door in place.

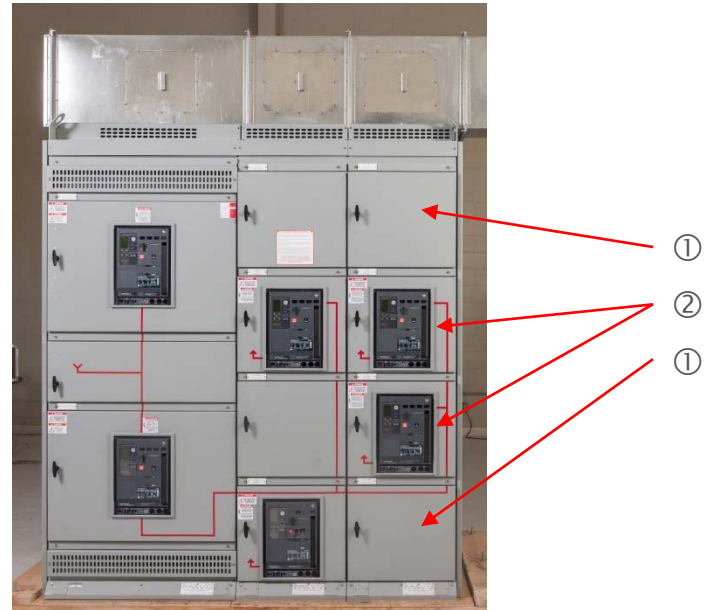
Any front access door that is required to be closed to maintain the integrity of the arc resistant enclosure is marked with a warning label (Figure 8.5).

The AR switchgear is rated per IEEE standards for a type 2B class rating. The type 2B classification allows the auxiliary door, unless otherwise marked, to be opened without impacting the arc resistant rating of the enclosure.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

Figure 8.4 AR switchgear front access doors



- (1) Auxiliary Compartment Front Access Door
- (2) Circuit Breaker Compartment Front Access Door

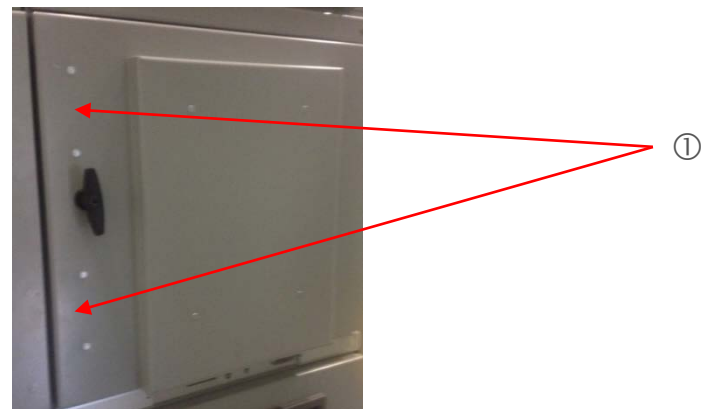
Figure 8.5 AR front access door warning label



Arc Flash Hazard

Door must be closed and latched to maintain the integrity of the arc resistant enclosure refer to DEH-41473 for details.

Figure 8.6 AR front access door latching



- (1) Push to Latch (Future Door Cover Shown)

Front Door Removal and Installation

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

Refer to Figure 8.7, Figure 8.8, and Figure 8.9 for the removal and installation of the switchgear front access doors.

Front Door Removal

To remove the switchgear front access door, proceed as follows:

1. Open the door by rotating the handle clock-wise.
2. If the door is an auxiliary compartment door, remove the mounting hardware attaching the ground wire from the door to the frame (Figure 8.9).
3. Loosen and remove the four ¼-20 x 5/8 inch self-thread forming screws holding the door hinge to the compartment dead front.

⚠ CAUTION: Prepare to support the weight of the front access door prior to removing the last of the four mounting screws.

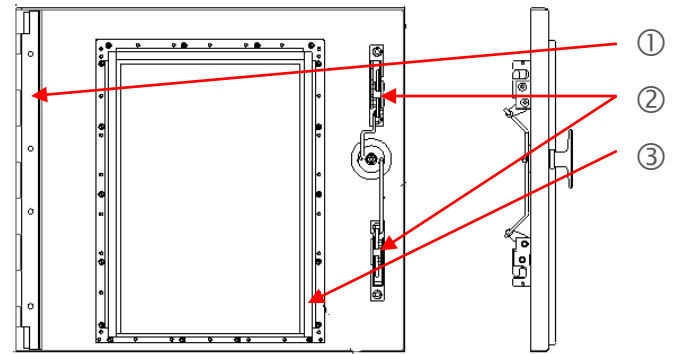
4. The door is now free to remove.

Front Door Installation

To install the switchgear front access door, proceed as follows:

1. With the door in the open position, align the mounting holes on the door hinge with the mounting holes on the compartment dead front.
2. Insert the four ¼-20 x 5/8 inch self-thread forming screws and tighten to 7-9 ft.-lbs.
3. If the door is an auxiliary compartment door, attach the ground wire from the door to the frame using the ¼-20 self-thread rolling screw, hex nut, flat washers and external star lock washers (Figure 8.9).
4. Close and latch the door.

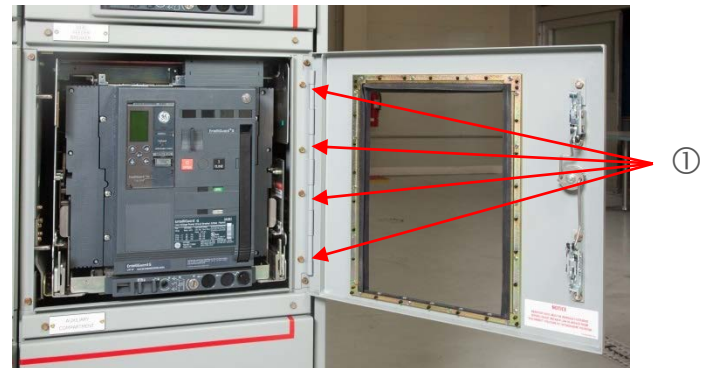
Figure 8.7 AR front access door details



- (1) Full Height Front Door Hinge
- (2) Self-latching Mechanism
- (3) Escutcheon Breaker Gasket (Breaker Door Only)

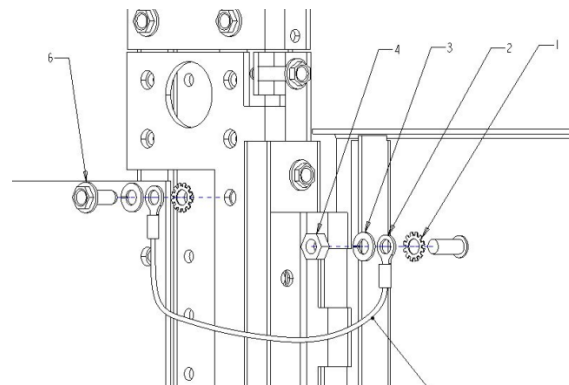
Figure 8.8 AR front access door mounting hardware

(Dead Front Gasket Not Shown)



- (1) ¼-20 x 5/8 inch Thread Rolling Screws

Figure 8.9 AR front access door details



Future Circuit Breaker Compartments

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

Breaker compartments designed for future use are complete and ready to use from the factory. These breaker compartments have a steel panel, future door cover, to cover the door cutout (Figure 8.10) and a steel panel, future cassette barrier, to cover the cassette opening (Figure 8.11).

To remove the future cassette barrier and future door cover, proceed as follows:

1. Open the breaker door by rotating the handle clockwise.
2. Remove the four ¼ inch hex nuts attached the two retaining bars for the door cut-out cover (Figure 8.11). Retain the hardware, retaining bars and steel cover for future use.
3. Remove the four ¼-20 self-thread forming screws holding the cassette steel cover plate in place (Figure 8.11). Retain the hardware and steel cover for future use.

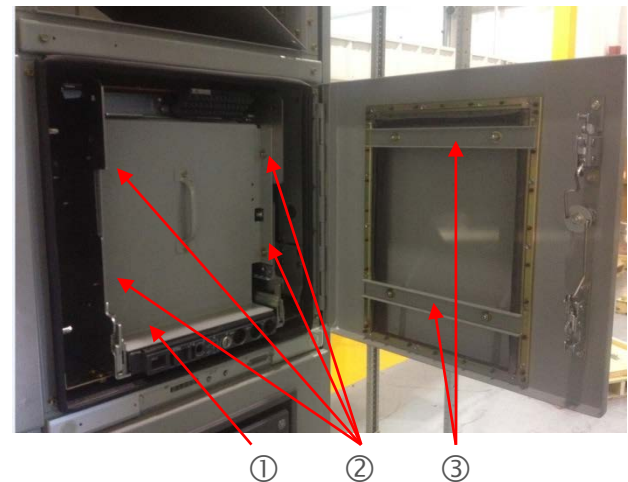
Refer to DEH-41697 for ordering or further information for a future cassette barrier and future door cover.

Figure 8.10 Future circuit breaker compartment



1. Future Door Cover

Figure 8.11 Future cassette barrier and future door cover



- (1) Cassette Barrier Cover
- (2) Cassette Barrier Cover Mounting Hardware
- (3) Future Door Cover Retainer Bars & Mounting Hardware

Circuit Breaker Compartment Features

Key Interlocks

⚠ CAUTION: Refer to the key interlock schematic included in the summary furnished with the equipment to determine the sequence of operation and the correct number of operating keys required. This precaution is necessary since the improper use of spare keys will defeat the interlocking scheme.

A circuit breaker key interlock is optionally available to provide protection against unauthorized operation (Figure 8.12). The key interlock is mounted on the right on escutcheon of the cassette below the breaker.

The typical interlock system is designed so that the key may be removed from the lock only when the breaker is tripped. The key actuates a cam that elevates the trip bar on the cassette and the breaker is rendered trip free.

The operation of the key interlock should be checked as follows:

1. With the breaker in the CONNECTED position, manually trip the breaker. This then allows the key interlock to elevate the trip bar. When the trip bar is elevated, the breaker cannot be closed but the key can be removed. The breaker will remain trip free until the key is returned and the trip bar is lowered.
2. If desired, the breaker may be moved to either the TEST or DISCONNECTED position while the key is removed from the lock. In these positions, the breaker cannot be operated for checking or maintenance

Figure 8.12 Circuit breaker key interlocks



Padlocking Features

The circuit breaker compartment is provided with several padlocking features as a standard. Optional padlocking front access and rear access doors are also available.

Padlocking the Racking Access Door

The racking access door can be padlocked to prevent access to the racking mechanism. The cassette can be padlocked with the breaker in any position or without the breaker installed. Up to three padlocks can be placed on a cassette. A padlock with a hasp thickness of at least 0.120 inches should be used to padlock the racking shaft door. To padlock cassette racking door, pull out the racking door locking tab and insert padlock (Figure 8.13).

Padlocking the Draw-out Rails

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The breaker compartment door must be closed and latched to maintain the integrity of the arc resistant enclosure. The breaker compartment door should not be opened when the circuit breaker is closed and in the connected position when the equipment is energized.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

The circuit breaker compartment door must be opened to put the padlock on; however, there is no interference with the door after the padlock has been placed in position.

Padlocks will prevent the acceptance of breakers in the compartment.

The padlock device on the draw-out rails will accept up to three padlocks on both the left and right sides of the compartment (Figure 8.14).

Padlocking the Shutter Assembly

The shutter on each cubicle can be padlocked to prevent access to the live primary conductors. The shutter can be padlocked without the breaker installed. One padlock can be placed on a cassette. To padlock the shutter, pull out the shutter locking tab and insert padlock (Figure 8.15). Pulling out the shutter locking tab actuates a rod that goes through moving shutter parts that prevents it from opening.

Shutters are provided as a standard for circuit breaker compartments in both AKD-20 AR and Entellisys AR equipment. Refer to DEH-41696 for ordering or further information for a shutter assembly.

Figure 8.13 Circuit breaker racking door padlock device



Figure 8.14 Circuit breaker draw-out rail padlock device

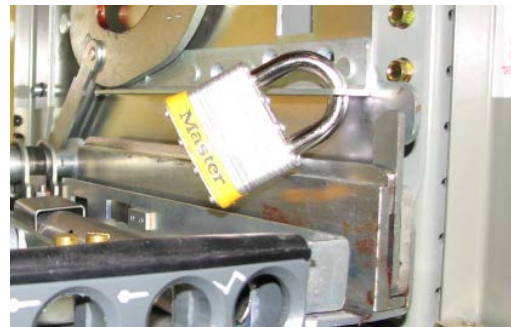


Figure 8.15 Circuit breaker shutter padlock device



Cooling Fan Control Module

General

AKD-20 AR and Entellisys AR switchgear may be provided with a front mounted auxiliary ventilation compartment, Figure 8.16.

The GA50 (AKD-20 AR) and EE50 (Entellisys AR) circuit breaker compartment is provided with an integrally mounted cooling fan system. The cooling fan system, when provided, is contained within the front mounted auxiliary ventilation compartment. When a front mounted auxiliary ventilation compartment contains a fan cooling system, the instrument tray directly above the front mounted ventilation compartment will be provided with the components shown in Figure 8.17.

In AKD-20 AR applications, the fan control is initiated by the “Current Alarm 2” feature of the trip unit which signals a fan control circuit to turn the fans on or off. Refer to Figure 8.18 for a typical fan cooling circuit diagram.

In Entellisys AR applications, the fan control is initiated by the Entellisys Messenger which signals a fan control circuit to turn the fans on or off. Refer to Figure 8.19 for a typical fan cooling diagram.

The fan control circuit requires 120Vac control power which is normally provided by the switchgear control power transformer. The power requirements for each fan is 0.3 amps @ 120Vac (2 fans installed).

Remote monitoring of the fan control circuit is optionally available.

NOTICE: Variations of the fan control circuit may be provided. Operators should review and understand the shop order drawings and documents provided with the equipment from the factory to confirm final fan control circuitry.

Table 8.1 provides the current threshold values that the circuit breaker trip unit’s “Current Alarm 2” function (AKD-20 AR) should be programmed to initiate the fan cooling system. Refer to DEH-4567 for details on programming the circuit breaker trip unit. For Entellisys AR circuit breaker compartments, the initiation of the fan cooling system will be automatically managed by the Entellisys Messenger. Refer to DEH-551 for additional information.

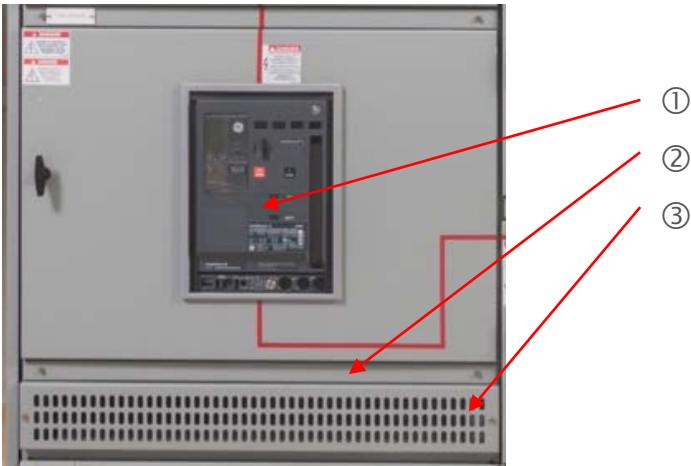
Operation of the switchgear, for an extended period of time, above the threshold limits shown in Table 8.1 without a properly working fan cooling system will not create an unsafe condition but is not recommended.

Table 8.1 Current Alarm 2 Settings for Cooling Fan System

Circuit Breaker	Section Width (inches)	Current Alarm 2 (Amperes)	
		ON Set Point	OFF Set Point
GA50	38	4,500	4,500

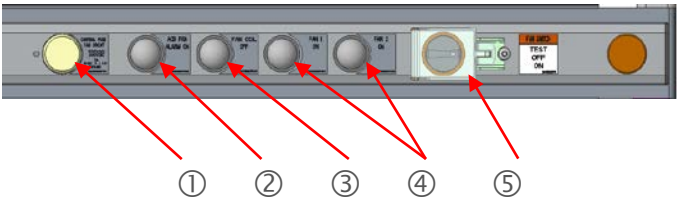
NOTICE: The circuit breaker(s) referenced in Table 8.1 must be configured with the “Current Alarm 2” trip unit option and this function must be set per Table 8.1 for proper operation of the fan cooling system.

Figure 8.16 Front mounted auxiliary ventilation compartment



- (1) EntelliGuard Circuit Breaker
- (2) Instrument Tray Panel
- (3) Front Mounted Auxiliary Ventilation Compartment

Figure 8.17 Fan control instrument tray panel



- (1) Fan Control Power Fuse
- (2) EntelliGuard Breaker Current Alarm Indicating Light
- (3) Fan Relay “On” Indicating Light
- (4) Fan “On” Indicating Light(s)
- (5) Illuminating Fan Control Switch

Figure 8.18 AKD-20 AR cooling fan control circuit

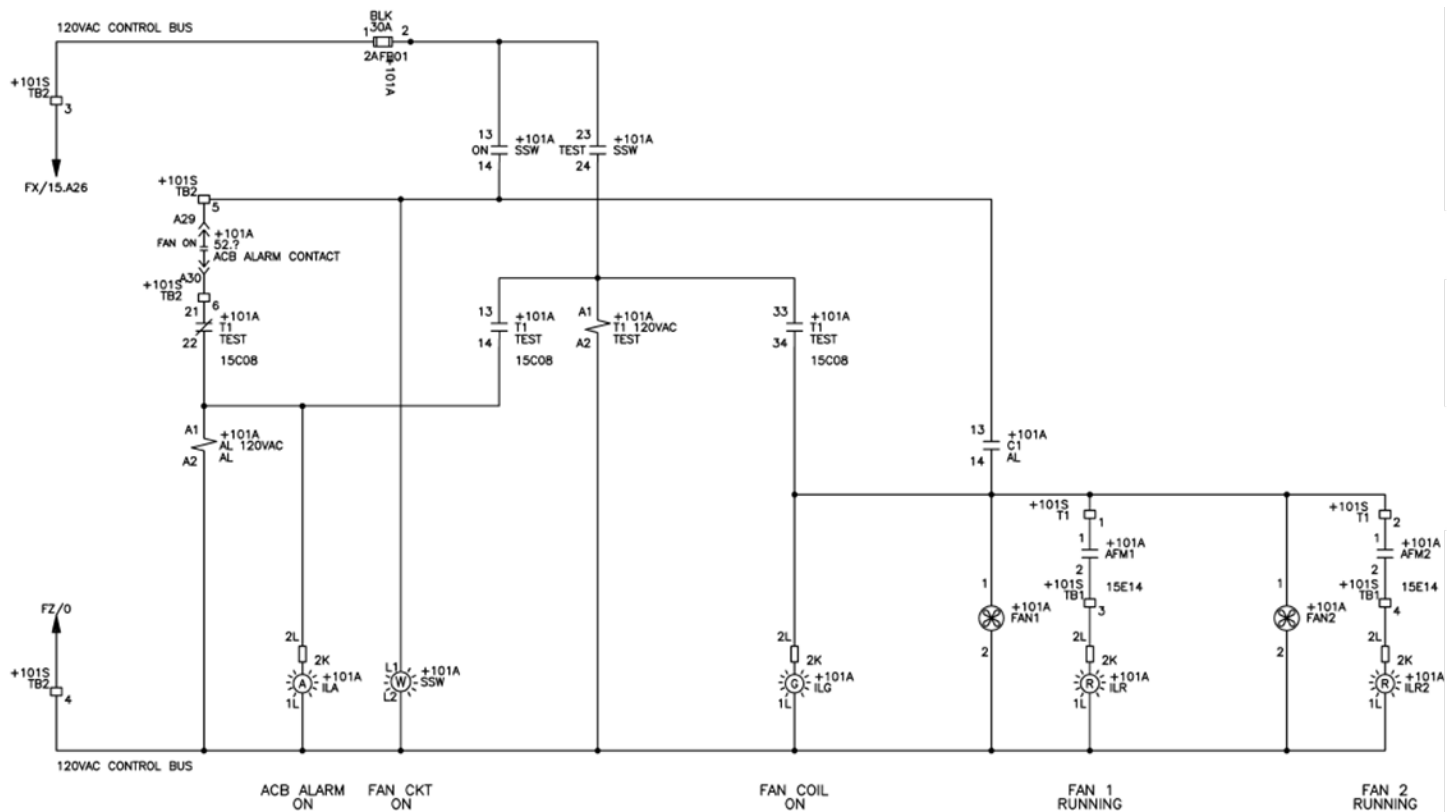
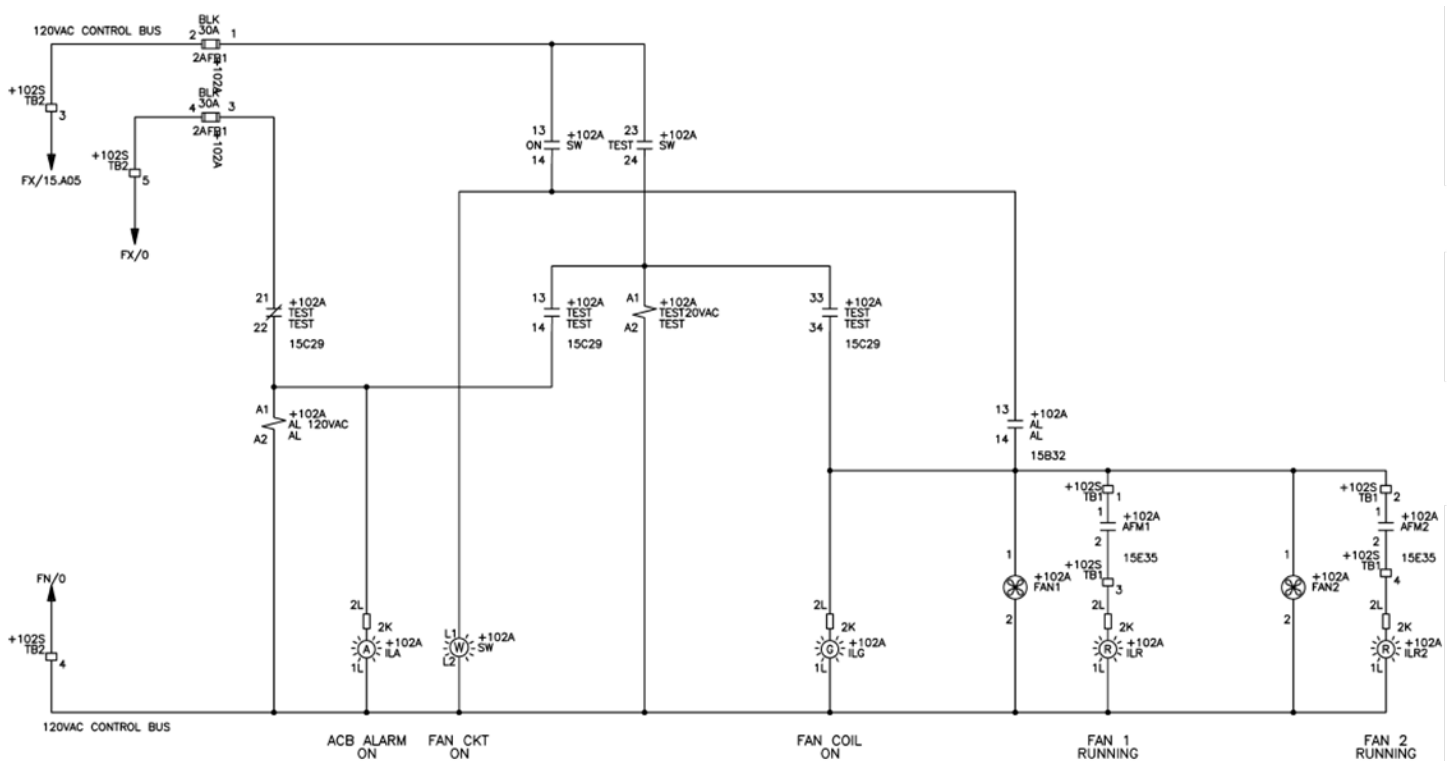


Figure 8.19 Entellisys AR cooling fan control circuit



Operation

A three position Illuminated Fan Control Switch, Figure 8.17, is provided to allow an operator to select the mode of operation for the cooling fan system. The fan control switch is provided with a pad-lockable hasp to allow an operator to lock-out/tag-out the fan control switch. The three positions of the fan control switch is "OFF", "ON" and "TEST". The "TEST" position of the fan control switch is a momentary position.

OFF Operating Mode

With the Illuminated Fan Control Switch in the "OFF" position, the 120Vac control power to the fan cooling system is not available except for the line side of the Fan Control Power Fuse and the Illuminated Fan Control Switch. All indicating lights will be off. This operating mode may assist with an operator trouble-shoot or perform maintenance on the fan cooling system.

ON Operating Mode

With the Illuminated Fan Control Switch in the "ON" position, the 120Vac control power to the fan cooling system is available. The fan control switch itself will be illuminated and the fan cooling system is ready to respond as necessary. This is the normal operating mode for the fan cooling system.

If the current exceeds the values shown in Table 8.1 for 60 seconds, the amber Current Alarm Indicating Light will be illuminated. The green Fan Relay On Indicating Light and each red Fan On Indicating Light will be illuminated.

If the current drop below the values shown in Table 8.1 for 60 seconds, the amber Current Alarm Indicating Light, the green Fan Relay On Indicating Light and each red Fan On Indicating Light will be off.

TEST Operating Mode

With the Illuminated Fan Control Switch held in the "TEST" position, an operator can perform a functional test on the fan cooling system without having to exceed the values shown in Table 8.1.

While the Illuminated Fan Control Switch is held in the "TEST" position, the following events will indicate a healthy fan cooling system.

- Amber Current Alarm Indicating Light illuminated
- Green Fan Relay On Indicating Light illuminated
- Each Red Fan On Indicating Light Illuminated

If the amber Current Alarm Indicating Light did not illuminate, check to see if the 120Vac control power is available, the Fan Control Power Fuse is not blown, or the indicating lamp is not burned out.

If the green Fan Relay On Indicating Lamp did not illuminate, check to see if the Fan Relay is operating properly.

If any of the red Fan On Indicating Lamps did not illuminate, check to see if either the fan air flow monitor or the fan itself has failed. Refer to DEH-41475 for instructions on how to replace either a cooling fan or its air flow monitor.

NOTICE: Each cooling fan is provided with an air flow monitor. The air flow monitor will only change state and illuminate the red Fan On Indicating Light once the cooling fan is energized and is operating at an acceptable air flow rate.

Rear Access Doors

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: The rear compartment door(s) must be closed and bolted to maintain the integrity of the arc resistant enclosure. If provided with IR viewing windows, the IR window cover must be closed and secured to maintain the integrity of the arc resistant enclosure.

The rear access doors on all AR switchgear are full height hinged doors (Figure 8.20).

Each door is provided with a six 3/8-16 bolts to secure the door in the closed position. Two of these bolts are located on the hinge side of the door.

Optional non-locking, key lock-able and padlock-able door handles, and 3-point latching are available.

IR viewing windows are also available.

With any combination of door options, the rear door must be secured in the closed position by all six bolts tighten to 6-8 ft.-lbs.

NOTICE: Take care when tightening the rear door bolts. Over-tightening can lead to bowing of the door surface.

Figure 8.20 Rear access doors



(1) Rear Access Door Closure Bolts (Typical)

Section 9. Energizing the Switchgear

Before Energizing

Before switchgear is energized, a thorough final check should be made using the following checklist: Refer to section Final Steps to be taken Before Energizing Equipment for additional information.

- Breakers and other operating mechanisms exercised
- Electrical insulation resistance tested phase-to-phase and phase-to-ground
- Relays, meters and instruments properly connected
- Electrically operated breakers and operating mechanisms exercised
- Ground fault protection system tested
- Adjustable trips properly set
- Field wiring secured and free of live bus
- Grounding connections made
- All debris, scrap wire, etc. removed
- All covers installed, doors closed and latched

⚠ WARNING: The following must be adhered to ensure the integrity of the arc resistant enclosure:

- EntelliGuard racking handle(s) must be returned to all breaker compartment(s).
- Key interlock(s) or the metallic key interlock plug(s) must be installed to all breaker compartments
- Position switch(es) or the metallic position switch covers(s) must be installed to all breaker compartments.
- Breaker compartment door(s) must be closed and latched.
- Breaker compartment(s) without a circuit breaker(s) must have a future door cover(s) and future cassette barrier(s) installed.
- Exhaust plenum system must be properly installed.
- Rear compartment door(s) must be closed and bolted.
- IR window cover(s) must be closed and secured.

Energizing Procedures

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: Energizing the switchgear for the first time is potentially dangerous. Therefore, qualified electrical personnel should be present when the equipment is energized. If problems caused by damage or poor installation practices have not been detected in the checkout procedure described previously, serious damage can result when the power is turned on.

There should be no load on the switchgear when it is energized.

Turn off all of the downstream loads, including those such as motor control centers and other devices which are remote from the switchgear.

The equipment should be energized in sequence by starting at the source end of the system and working toward the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices.

Turn the devices on with a firm positive motion.

Using the Entellisys HMI, turn on the devices (Entellisys AR Only).

Section 10. Maintaining the Switchgear

General

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ DANGER: Solid insulation surrounding an energized conductor and power apparatus must never be relied upon to provide protection to personnel.

A periodic maintenance schedule must be established to obtain the best service from the switchgear. An annual check of the switchgear devices and all connections should be made as a minimum requirement. Equipment subject to highly repetitive operation may require more frequent maintenance.

A permanent record of all maintenance work should be kept. The record should include a list of periodic checks and tests made, the date they were made, the condition of the equipment, and any repairs or adjustments that were performed. Maintenance employees must follow all recognized safety practices, such as those contained in NFPA 70B: Electrical Equipment Maintenance, and NFPA 70E: Standard for Electrical Safety in the Workplace and in company or other safety regulations.

For specific information regarding the maintenance of devices, such as circuit breakers, relays, meters, etc., refer to the separate instruction manual furnished for each device.

Circuit Breaker and Instrument Compartments

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: Primary equipment must be completely de-energized while tests on control circuits, etc. are being conducted. Be sure that all areas of feedback from secondary circuits, as well as outside power sources, are disconnected.

Periodic inspection of the circuit breaker is recommended at least once a year. More frequent inspections are recommended where severe load conditions, dust, moisture or other unfavorable conditions exist, or if the vital nature of the load warrants it. Always inspect the breaker after a short-circuit current has been interrupted.

Circuit Breaker

Test for Proper Operation

Test and inspect all circuit breakers for proper operation as follows:

1. Operate each breaker while in the TEST position and check all functions. This is particularly important for breakers that normally remain in either the opened or closed positions for long periods of time.
2. Remove the breakers from their compartments to a clean maintenance area. Close compartment door and cover the breaker cutout to prevent access to live parts.

⚠ WARNING: When a circuit breaker is removed from its compartment. The future cassette barrier and the future breaker door cover must be installed and the circuit breaker compartment door closed and latched to maintain the integrity of the arc resistant enclosure.

⚠ WARNING: De-energize the equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

Checks after Circuit Breaker is De-Energized

At the time of inspection, the following checks should be made after the breaker has been de-energized.

1. Manually operate the breaker several times, checking for obstructions or excessive friction. Manual closing of an electrically operated breaker may be performed by the following two steps:
 - a. To charge the mechanism springs, pull the operating handle down until it stops (about 90°) ten times for the EntelliGuard breaker. The charge indicator will show CHARGED on a yellow background.
 - b. Depress the CLOSE button on the front of the breaker. The springs should discharge and, if the latch is properly reset, the breaker will close.
2. Electrically operate the breaker several times to check performance of the electrical accessories.
3. Visually check the breaker for loose hardware on the breaker; also, check the bottom of the compartment for any hardware that has fallen from the breaker.
4. Remove and inspect the arc quenchers and contacts for breakage or excessive burning.
5. The performance of the solid-state current trip devices may be checked with a suitable test set. Check electro-mechanical devices for positive trip in accordance with the instructions in the proper instruction manual.
6. Check insulating parts for evidence of overheating and for cracks that indicate excessive thermal aging.

Refer to circuit breaker instruction manuals for detailed maintenance instructions and information for replacement of parts. See DEH-41304 (AKD-20 AR Only) or DEH-41526 (Entellisys AR Only).

Lubrication

In general, the circuit breaker requires moderate lubrication. Bearing points and sliding surfaces should be lubricated at the regular inspection periods with a thin film of GE lubricant D6A15A2. Before lubricating, remove any hardened grease and dirt from latch and bearing surfaces with mineral spirits then wipe with a clean rag.

On draw-out breakers, the contact surface of the disconnect fingers should be cleaned and greased with GE lubricant D6A15A2.

NOTICE: All excess lubricant should be removed with a clean cloth to avoid accumulation of dirt or dust.

Instruments, Instrument Transformers, and Relays

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: De-energize the equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

Check and inspect all devices to see that they are functioning properly. Check that all electrical connections are tight. Check mounting of the device.

Under normal conditions, the protective relays do not operate; therefore, it is important to check the operation of these devices regularly. Refer to relay instruction manuals for detailed instructions.

Circuit Breaker Compartment Interiors

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: De-energize the equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

Thoroughly clean the interior of the breaker and instrument compartments. Use a vacuum cleaner and clean rags only. Do not use steel wool or oxide papers. Blowing with compressed air is not recommended.

Check indicating devices, mechanical and key interlocks.

Check primary disconnecting device contacts for signs of abnormal wear or overheating. Discoloration of the silvered surfaces is not ordinarily harmful. These contacts should be cleaned only by wiping with a lint-free cloth.

Clean the racking mechanism and lubricate with GE lubricant D6A15A2.

Before replacing the breaker, wipe off the primary disconnecting device contacts. Apply a thin coat of GE lubricant D6A15A2 to the stationary studs and to the primary disconnects on the breaker.

Bus Area

⚠ DANGER: Electrical arc flash hazard. Personal protection equipment required. Turn off power to the equipment before working inside.

⚠ WARNING: De-energize the equipment completely before doing maintenance work on any devices, connections, bus work, breaker or feeder cable compartments. This includes de-energizing any connections to outside primary or secondary sources, such as transformers, tie lines, etc.

⚠ WARNING: The rear compartment door(s) must be closed and bolted to maintain the integrity of the arc resistant enclosure. If provided with IR viewing windows, the IR window cover must be closed and secured to maintain the integrity of the arc resistant enclosure.

Inspect and check the bus area as follows:

1. Inspect the buses and connections carefully for evidence of overheating or weakening of the insulating supports. If bus insulation is present, remove the molded covers over the main bus connection to expose joints for inspection.
2. Check all connection bolts in the bus compartment and all bracing bolts for tightness. See the Table A-1 in Appendix – Torque Values.
3. Vacuum and, with a clean rag, wipe the buses and supports.
4. Visually inspect the insulation on the bars that run from the breaker studs through the bus structure to the cable area.
5. After cleaning, megger and record the resistance to ground and between phases of all insulated bars and all buses and connections. Disconnect all control circuits before checking resistance. Do not use over a 1,500-volt megger. Since definite limits cannot be given for satisfactory insulation resistance values, a record must be kept of the readings.

Weakening of the insulation from one maintenance period to the next can be recognized from the recorded readings. The readings should be taken under similar conditions each time, if possible, and the record should include the ambient temperature and humidity.

Circuit Breaker Lifting Mechanism

Under normal conditions, no special maintenance procedures or lubrication is required for this device. If the cable is abraded under any condition, it should be inspected for broken strands or other damage and replaced if necessary.

Overall Switchgear

Make the following checks on the complete switchgear equipment.

- Clean and inspect all painted surfaces and retouch where necessary.
- Check to see that all anchor bolts and other structural bolts are tight.
- Check that all breaker and instrument compartment door latches operate properly.
- If the switchgear is equipped with heaters, check to see that all heaters are energized and operating.
- For exterior vent openings in equipment furnished with air filters, the foam filter elements should be removed and washed in warm soapy water, rinsed, and reassembled at least annually. Elements should be inspected before re-assembly and replaced if any signs of deterioration are evident.

Paint Refinishing

Indoor switchgear is finished with ANSI-61 gray acrylic enamel paint (PPG W42713, GE part number 21525032650). To refinish damaged areas, remove all loose paint, rust, scale, oil or grease. Sand any scratches smooth using 220 grit paper or finer.

Apply a coat of good acrylic enamel primer (Sherman-Williams E61 A 60, -GE part number 21525025200) with a viscosity of approximately 24-32 seconds using a #2 Zahn cup. Reduce with D5B9 Xylol (GE part number 21525038000) if needed. Air dry the primer for a minimum of 30 minutes, then apply the finish color coat of acrylic enamel. The top coat should be applied within 24 hours for best adhesion.

If the area is to be spray-coated, thin the acrylic enamel with D5B9 Xylol (GE part number 21525038000). This thinning should only be necessary if the paint was received in a five gallon drum or more. The recommended viscosity for the W42713 topcoat should be 24-32 seconds with a #2 Zahn cup. The curing schedule for PPG W42713 is dust free in 5 minutes, touch in 30 minutes, handle in 60 minutes, full cure in 7 days. Both the primer (Sherwin-Williams E61 A 60) and paint (PPG W42713) should be applied only when temperature is above 55 degrees Fahrenheit.

Application of special paint will be per the manufacturer's Product Data Sheet which includes instructions on thinning and application.

Section 11. Common Switchgear Accessories and Kits

The following tables list common accessories and kits available for ordering for the AKD-20 AR or Entellisys AR equipment.

Table 11.1 EntelliGuard breaker compartment accessories and kits

Description	Catalog Number
Future Cassette Barrier, Envelope 1	GM2ARF1FC
Future Cassette Barrier, Envelope 2	GM2ARF2FC
Future Cassette Barrier, Envelope 3	GM2ARF3FC
Future Door Cover, Envelope 1, 2 & 3	GM2FDC
Key Interlock Plug	GM2KIP
Key Interlock, Kirk style lock (lock not included)	GCKRKR
Key Interlock, Profalux style lock (lock not included)	GCPROR
Key Interlock, Ronis style lock (lock not included)	GCRONR
Position Switch Cover, Envelope 1, 2 & 3	GM2PSC
Position Switch Kit – 3 N.O., 3 N.C. Contacts (1 N.O./1 N.C. per position)	GCPS1R
Position Switch Kit – 6 N.O., 6 N.C. Contacts (2 N.O./2N.C. per position)	GCPS2R
Position Switch Kit – 6 N.O., 6 N.C. Contacts (Connect Position Only)	GCPS3R
Racking Handle, Telescoping for Cassette (OEM Style)	GRHN
Shutter Kit, Envelope 1, 3 Pole	GM2F120H2SSL
Shutter Kit, Envelope 2, (2,000A or below), 3 Pole	GM2F220H2SSL
Shutter Kit, Envelope 2, (Above 2,000A), 3 Pole	GM2F232M2SSL
Shutter Kit, Envelope 3, 3 Pole	GM2F350M2SSL

Table 11.2 Switchgear accessories and kits

Description	Catalog Number
Circuit Breaker Lifting Cart (Beech Eng. #B-1000)	GE-1000
Circuit Breaker Test Cabinet, EntelliGuard E	ETC-120
Circuit Breaker Test Cabinet, EntelliGuard G	GTC-250
Entellisys System Test Kit	ETSTESTKIT03
Lifting Beam, Envelope 1 or 2, 3 Pole	GLD3F12
Lifting Beam, Envelope 1 or 2, 4 Pole	GLD4F12
Lifting Beam, Envelope 3, 3 Pole	GLD3F3
Lifting Beam, Envelope 3, 4 Pole	GLD4F3
Overhead Circuit Breaker Lifting Device Crank	GAKDLDC
Racking Handle (AKD Style)	GRHAKD
Remote Circuit Breaker Racking Device	EGGRRLV
Time Delay Module (110~130V dc)	GTDM120D
Time Delay Module (120~130V ac)	GTDM120A
Time Delay Module (208V ac)	GTDM208A
Time Delay Module (220~240V ac)	GTDM240A
Time Delay Module (220~240V dc)	GTDM240D
Time Delay Module (250V dc)	GTDM250D
Time Delay Module (277V ac)	GTDM277A
Time Delay Module (48V ac)	GTDM048A
Time Delay Module (48V dc)	GTDM048D
Time Delay Module (60V dc)	GTDM060D
Trip Unit Test Kit, EntelliGuard G	GTUTK20

Table 11.3 Exhaust plenum accessories and kits

Description	Catalog Number
440 Butyl Sealing Compound, Exhaust Plenum Flange	440BUTYL
Exhaust Plenum Section, 22" Wide	GM2AR22EPS
Exhaust Plenum Section, 30" Wide	GM2AR30EPS
Exhaust Plenum Section, 38" Wide	GM2AR38EPS
Exhaust Plenum Section, T-Section, 22" Wide	GM2AR22EPTS
Exhaust Plenum Section, T-Section, 30" Wide	GM2AR30EPTS
Exhaust Plenum Section, T-Section, 38" Wide	GM2AR38EPTS
Exhaust Plenum Section, V-Section, 30" Wide	GM2AR30EPVS
Exhaust Plenum Section, V-Section, 38" Wide	GM2AR38EPVS
Exhaust Plenum, Access Cover	GM2ARAC
Exhaust Plenum, End Cap	GM2AREC
Exhaust Plenum, Exhaust End Portal	GM2AREP
Exhaust Plenum, Exhaust End Portal w/ Moisture Absorbent Foam	GM2AREPMAF
Exhaust Plenum, Flange Clip	GM2ARTFC
Exhaust Plenum, Transition Adapter	GM2ARTAS
Exhaust Plenum Section, Extension (36")	GM2AREP3
Exhaust Plenum Section, 90 Degree Elbow – Vertical	GM2AREP90V
Exhaust Plenum Section, 90 Degree Elbow – Horizontal	GM2AREP90H

Appendix A. Torque Values

Table A.1 Torque values for electrical hardware other than cable terminals (Copper, Tin or Silver Plated)

Hardware Size	Torque (1)(2) (ft.-lbs.)
#10-32	4-5
#12-24	4-5
¼-20	7-10
3/8-16	25-30
½-13	35-40
5/8-11	45-55

- (1) These torque values are for non-lubricating threads
 (2) Standard nut with conical spring washer or lock washer

NOTICE: When installing parts or components to the compartment molded base, torque ¼ inch screws slowly and do not exceed nine ft.-lbs.

Table A.2 Torque values for cable terminals

Wire Size	Torque (1)(2) (in.-lbs.)
6	100
5	
4	
3	
3	125
2	
1	
0	
00	150
000	
0000	
200,000	
250,000	200
300,000	
350,000	
400,000	
500,000	250
600,000	
700,000	
750,000	
800,000	300
900,000	
1,000,000	
1,250,000	
1,500,000	400
1,750,000	
2,000,000	

- (1) These torque values are for non-lubricating threads
 (2) Torque values provided for reference only. Follow cable terminal manufacturer's recommended torque values.

Appendix B. Circuit Breaker Rejection Feature

General

In general, draw-out breakers of the same type and rating are interchangeable in their equipment compartments; draw-out breakers of different types or short circuit ratings are intentionally made non-interchangeable. To prevent inserting the wrong type breaker into a draw-out compartment, unique "rejection hardware" is affixed to each breaker and its cassette. The rejection is accomplished by pins on the sides of the breaker and the blocks on the sides of the cassette.

Rejection Feature

This factory-installed, pin and gate device prevents the insertion of a circuit breaker into a cassette if the nominal rating of the breaker is incompatible with that of the cassette and its ancillary equipment.

The information in the following appendices lists the available rejection scheme combinations for the rejection feature. AKD-20 AR rejection combinations are in Appendix C and Entellisys AR rejection combinations are in Appendix D.

Figure B.1 EntelliGuard circuit breaker rejection pins



Figure B.2 EntelliGuard compartment rejection blocks



Appendix C. EntelliGuard G Rejection Features (AKD-20 AR Only)

Envelope 1 Rejection Features

Table C.1 EntelliGuard G envelope 1 circuit breaker logic

800A								1,200A								1,600A								2,000A																
P Tier 100kA	ANSI GE Breaker																ANSI GE Breaker								ANSI GE Breaker															
	Left				Right												Left				Right				Left				Right											
	Block		ACB				Block										Block		ACB				Block		Block		ACB				Block									
	1				1	1												1				1	1				1	1				1								
	2				2	2												2				2	2				2	2				2								
	3				3	3												3				3	3				3	3				3								
4				4	4				4				4	4				4	4				4																	
5				5	5				5				5	5				5	5				5																	
H Tier 85kA	ANSI GE Breaker																ANSI GE Breaker								ANSI GE Breaker															
	Left				Right												Left				Right				Left				Right											
	Block		ACB				Block										Block		ACB				Block		Block		ACB				Block									
	1				1	1												1				1	1				1	1				1								
	2				2	2												2				2	2				2	2				2								
	3				3	3												3				3	3				3	3				3								
4				4	4				4				4	4				4	4				4																	
5				5	5				5				5	5				5	5				5																	
N Tier 65kA SQ	ANSI GE Breaker																ANSI GE Breaker								ANSI GE Breaker															
	Left				Right												Left				Right				Left				Right											
	Block		ACB				Block										Block		ACB				Block		Block		ACB				Block									
	1				1	1												1				1	1				1	1				1								
	2				2	2												2				2	2				2	2				2								
	3				3	3												3				3	3				3	3				3								
4				4	4				4				4	4				4	4				4																	
5				5	5				5				5	5				5	5				5																	
S Tier 65kA	ANSI GE Breaker								ANSI GE Breaker																															
	Left				Right				Left				Right																											
	Block		ACB				Block		Block		ACB				Block																									
	1				1	1				1				1	1																				1	1				1
	2				2	2				2				2	2																				2	2				2
	3				3	3				3				3	3																				3	3				3
4				4	4				4				4	4				4	4				4																	
5				5	5				5				5	5				5	5				5																	

Table C.2 EntelliGuard G envelope 1 non-automatic switch logic

	800A						1,200A						1,600A						2,000A					
	ANSI GE Switch												ANSI GE Switch						ANSI GE Switch					
H Tier 85kA	Left			Right			Left			Right			Left			Right			Left			Right		
	Block	ACB		Block			Block	ACB		Block			Block	ACB		Block			Block	ACB		Block		
1				1	1		1			1	1		1			1	1		1			1	1	
2				2	2		2			2	2		2			2	2		2			2	2	
3				3	3		3			3	3		3			3	3		3			3	3	
4				4	4		4			4	4		4			4	4		4			4	4	
5				5	5		5			5	5		5			5	5		5			5	5	
S Tier 65kA	ANSI GE Switch						ANSI GE Switch																	
	Left			Right			Left			Right			Left			Right			Left			Right		
	Block	ACB		Block			Block	ACB		Block			Block	ACB		Block			Block	ACB		Block		
1				1	1		1			1	1		1			1	1		1			1	1	
2				2	2		2			2	2		2			2	2		2			2	2	
3				3	3		3			3	3		3			3	3		3			3	3	
4				4	4		4			4	4		4			4	4		4			4	4	
5				5	5		5			5	5		5			5	5		5			5	5	

Envelope 2 Rejection Features

Table C.3 EntelliGuard G envelope 2 (single cluster) circuit breaker logic

	800A						1,600A						2,000A					
	ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker					
M Tier 100kA	Left			Right			Left			Right			Left			Right		
	Block	ACB		Block			Block	ACB		Block			Block	ACB		Block		
1				1	1		1			1	1		1			1	1	
2				2	2		2			2	2		2			2	2	
3				3	3		3			3	3		3			3	3	
4				4	4		4			4	4		4			4	4	
5				5	5		5			5	5		5			5	5	
E Tier 85kA SQ	ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker					
	Left			Right			Left			Right			Left			Right		
	Block	ACB		Block			Block	ACB		Block			Block	ACB		Block		
1				1	1		1			1	1		1			1	1	
2				2	2		2			2	2		2			2	2	
3				3	3		3			3	3		3			3	3	
4				4	4		4			4	4		4			4	4	
5				5	5		5			5	5		5			5	5	

Table C.4 EntelliGuard G envelope 2 (single cluster) non-automatic switch logic

	800A						1,600A						2,000A					
	ANSI GE Switch						ANSI GE Switch						ANSI GE Switch					
M Tier 65kA	Left			Right			Left			Right			Left			Right		
	Block	ACB		Block			Block	ACB		Block			Block	ACB		Block		
1				1	1		1			1	1		1			1	1	
2				2	2		2			2	2		2			2	2	
3				3	3		3			3	3		3			3	3	
4				4	4		4			4	4		4			4	4	
5				5	5		5			5	5		5			5	5	

Table C.5 EntelliGuard G envelope 2 (double cluster) circuit breaker logic

	800A						1,600A						2,000A						3,200A					
	ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker					
	Left			Right			Left			Right			Left			Right			Left			Right		
	Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB	
M Tier 100kA	1			1	1		1			1	1		1	1		1	1		1	1		1	1	
	2			2	2		2			2	2		2	2		2	2		2	2		2	2	
	3			3	3		3			3	3		3	3		3	3		3	3		3	3	
	4			4	4		4			4	4		4	4		4	4		4	4		4	4	
	5			5	5		5			5	5		5	5		5	5		5	5		5	5	
E Tier 85kA SQ	ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker						ANSI GE Breaker					
	Left			Right			Left			Right			Left			Right			Left			Right		
	Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB	
	1			1	1		1			1	1		1	1		1	1		1	1		1	1	
	2			2	2		2			2	2		2	2		2	2		2	2		2	2	
N Tier 65kA SQ	3			3	3		3			3	3		3	3		3	3		3	3		3	3	
	4			4	4		4			4	4		4	4		4	4		4	4		4	4	
	5			5	5		5			5	5		5	5		5	5		5	5		5	5	
																			ANSI GE Breaker					
																			Left			Right		
																			Block	ACB		Block	ACB	
																			1			1	1	
																			2			2	2	
																			3			3	3	
																			4			4	4	
																			5			5	5	

Table C.6 EntelliGuard G envelope 2 (double cluster) non-automatic switch logic

	800A						1,600A						2,000A						3,200A					
	ANSI GE Switch						ANSI GE Switch						ANSI GE Switch						ANSI GE Switch					
	Left			Right			Left			Right			Left			Right			Left			Right		
	Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB	
M Tier 65kA	1			1	1		1			1	1		1	1		1	1		1	1		1	1	
	2			2	2		2			2	2		2	2		2	2		2	2		2	2	
	3			3	3		3			3	3		3	3		3	3		3	3		3	3	
	4			4	4		4			4	4		4	4		4	4		4	4		4	4	
	5			5	5		5			5	5		5	5		5	5		5	5		5	5	

Envelope 3 Rejection Features

Table C.7 EntelliGuard G envelope 3 circuit breaker logic

3,200A										4,000A										5,000A										6,000A														
W Tier 200kA	ANSI GE Breaker										ANSI GE Breaker										ANSI GE Breaker																							
	Left					Right					Left					Right					Left					Right																		
	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block																				
	1			1	1		1	1			1	1			1	1			1	1			1																					
	2			2	2			2	2			2	2			2	2			2	2			2																				
	3			3	3			3	3			3	3			3	3			3	3			3																				
	4			4	4			4	4			4	4			4	4			4	4			4																				
5			5	5			5	5			5	5			5	5			5	5			5																					
L Tier 150kA	ANSI GE Breaker										ANSI GE Breaker										ANSI GE Breaker																							
	Left					Right					Left					Right					Left					Right																		
	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block																				
	1			1	1		1	1			1	1			1	1			1	1			1																					
	2			2	2			2	2			2	2			2	2			2	2			2																				
	3			3	3			3	3			3	3			3	3			3	3			3																				
	4			4	4			4	4			4	4			4	4			4	4			4																				
5			5	5			5	5			5	5			5	5			5	5			5																					
B Tier 100kA SQ	ANSI GE Breaker										ANSI GE Breaker										ANSI GE Breaker																							
	Left					Right					Left					Right					Left					Right																		
	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block	Block	ACB				Block																				
	1			1	1		1	1			1	1			1	1			1	1			1																					
	2			2	2			2	2			2	2			2	2			2	2			2																				
	3			3	3			3	3			3	3			3	3			3	3			3																				
	4			4	4			4	4			4	4			4	4			4	4			4																				
5			5	5			5	5			5	5			5	5			5	5			5																					
M Tier 100kA											ANSI GE Breaker										ANSI GE Breaker																							
											Left					Right					Left					Right																		
											Block	ACB				Block	Block	ACB				Block	Block	ACB				Block																
											1			1	1		1	1			1	1			1	1			1	1													1	
											2			2	2			2	2			2	2			2	2			2											2			2
											3			3	3			3	3			3	3			3	3			3											3			3
											4			4	4			4	4			4	4			4	4			4											4			4
5			5	5			5	5			5	5			5	5			5	5			5																					
E Tier 85kA SQ											ANSI GE Breaker										ANSI GE Breaker																							
											Left					Right					Left					Right																		
											Block	ACB				Block	Block	ACB				Block	Block	ACB				Block																
											1			1	1		1	1			1	1			1	1			1	1													1	
											2			2	2			2	2			2	2			2	2			2											2			2
											3			3	3			3	3			3	3			3	3			3											3			3
											4			4	4			4	4			4	4			4	4			4											4			4
5			5	5			5	5			5	5			5	5			5	5			5																					

Table C.8 EntelliGuard G envelope 3 non-automatic switch logic

		3,200A						4,000A						5,000A						6,000A					
		ANSI GE Switch						ANSI GE Switch						ANSI GE Switch											
		Left			Right			Left			Right			Left			Right								
		Block		ACB				Block		Block		ACB				Block		Block		ACB				Block	
M Tier 65kA		1			1	1			1	1			1	1			1	1			1	1			1
		2			2	2			2	2			2	2			2	2			2	2			2
		3			3	3			3	3			3	3			3	3			3	3			3
		4			4	4			4	4			4	4			4	4			4	4			4
		5			5	5			5	5			5	5			5	5			5	5			5

Appendix D. EntelliGuard E Rejection Features (Entellisys AR Only)

Envelope 1 Rejection Features

Table D.1 EntelliGuard E envelope 1 circuit breaker logic

	2,000A						1,600A						1,200A						800A					
	ANSI GE Entellisys						ANSI GE Entellisys												ANSI GE Entellisys					
	Left			Right			Left			Right									Left			Right		
	Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB	
P Tier 100kA	1			1	1		1	1		1	1		1			1			1	1			1	
	2			2	2		2	2		2	2		2			2			2	2			2	
	3			3	3		3	3		3	3		3			3			3	3			3	
	4			4	4		4	4		4	4		4			4			4	4			4	
	5			5	5		5	5		5	5		5			5			5	5			5	
H Tier 85kA	1			1	1		1	1		1	1		1			1			1	1			1	
	2			2	2		2	2		2	2		2			2			2	2			2	
	3			3	3		3	3		3	3		3			3			3	3			3	
	4			4	4		4	4		4	4		4			4			4	4			4	
	5			5	5		5	5		5	5		5			5			5	5			5	
N Tier 65kA SQ	1			1	1		1	1		1	1		1			1			1	1			1	
	2			2	2		2	2		2	2		2			2			2	2			2	
	3			3	3		3	3		3	3		3			3			3	3			3	
	4			4	4		4	4		4	4		4			4			4	4			4	
	5			5	5		5	5		5	5		5			5			5	5			5	
S Tier 65kA													ANSI GE Entellisys						ANSI GE Entellisys					
													Left			Right			Left			Right		
	Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB		Block	ACB	
	1			1	1		1	1		1	1		1			1			1	1			1	
	2			2	2		2	2		2	2		2			2			2	2			2	

Envelope 2 Rejection Features

Table D.2 EntelliGuard E envelope 2 circuit breaker logic

3,200A												2,000A												1,600A												800A												
M Tier 100kA	ANSI GE Entellisys												ANSI GE Entellisys												ANSI GE Entellisys												ANSI GE Entellisys											
	Left						Right						Left						Right						Left						Right						Left						Right					
	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block								
	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1							
	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2							
	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3							
4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4								
5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5								
E Tier 85kA SQ	ANSI GE Entellisys												ANSI GE Entellisys												ANSI GE Entellisys												ANSI GE Entellisys											
	Left						Right						Left						Right						Left						Right						Left						Right					
	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block	Block	ACB						Block								
	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1			1	1							
	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2			2	2							
	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3			3	3							
4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4			4	4								
5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5								
N Tier 65kA SQ	ANSI GE Entellisys																																															
	Left						Right																																									
	Block	ACB						Block																																								
	1			1	1			1																																								
	2			2	2			2																																								
	3			3	3			3																																								
4			4	4			4																																									
5			5	5			5																																									

Envelope 3 Rejection Features

Table D.3 EntelliGuard E envelope 3 circuit breaker logic

6,000A		5,000A						4,000A						3,200A					
W Tier 200kA		ANSI GE Entellisys						ANSI GE Entellisys						ANSI GE Entellisys					
		Left			Right			Left			Right			Left			Right		
		Block		ACB		Block		Block		ACB		Block		Block		ACB		Block	
		1			1	1		1	1			1	1		1	1			1
		2			2	2		2	2			2	2		2	2			2
		3			3	3		3	3			3	3		3	3			3
		4			4	4		4	4			4	4		4	4			4
		5			5	5		5	5			5	5		5	5			5
L Tier 150kA		ANSI GE Entellisys						ANSI GE Entellisys						ANSI GE Entellisys					
		Left			Right			Left			Right			Left			Right		
		Block		ACB		Block		Block		ACB		Block		Block		ACB		Block	
		1			1	1		1	1			1	1		1	1			1
		2			2	2		2	2			2	2		2	2			2
		3			3	3		3	3			3	3		3	3			3
		4			4	4		4	4			4	4		4	4			4
		5			5	5		5	5			5	5		5	5			5
B Tier 100kA SQ		ANSI GE Entellisys						ANSI GE Entellisys						ANSI GE Entellisys					
		Left			Right			Left			Right			Left			Right		
		Block		ACB		Block		Block		ACB		Block		Block		ACB		Block	
		1			1	1		1	1			1	1		1	1			1
		2			2	2		2	2			2	2		2	2			2
		3			3	3		3	3			3	3		3	3			3
		4			4	4		4	4			4	4		4	4			4
		5			5	5		5	5			5	5		5	5			5
M Tier 100kA		ANSI GE Entellisys						ANSI GE Entellisys											
		Left			Right			Left			Right								
		Block		ACB		Block		Block		ACB		Block							
		1			1	1		1	1			1	1						
		2			2	2		2	2			2	2						
		3			3	3		3	3			3	3						
		4			4	4		4	4			4	4						
		5			5	5		5	5			5	5						
E Tier 85kA SQ		ANSI GE Entellisys						ANSI GE Entellisys											
		Left			Right			Left			Right								
		Block		ACB		Block		Block		ACB		Block							
		1			1	1		1	1			1	1						
		2			2	2		2	2			2	2						
		3			3	3		3	3			3	3						
		4			4	4		4	4			4	4						
		5			5	5		5	5			5	5						

Appendix E. Circuit Breaker Information

For all circuit breaker information including ratings, weights, accessories, etc., reference DEH-41304 (AKD-20 AR Only) or DEH-41526 (Entellisys AR Only) at www.industrial.com. In Publication Library, select publication number type in this DEH number and click Go.

Appendix F. Exhaust Plenum System Details

General

The exhaust plenum system will be attached to the top of the switchgear assembly (Figure 3.2 and Figure 3.3). The exhaust plenum section above each stack of the equipment will match the stack width of the equipment and be supplied with three external flanges and one internal flange (Figure F.1).

An optional T-Section exhaust plenum (Figure F.2) may be provided per the customer's requirements. The rear facing flange of the exhaust plenum t-section is provided with four external flanges.

NOTICE: Use of the exhaust t-section plenum will require routing the exhaust plenum system over the top rear section of the equipment stack which will limit the entrance of power cables and/or busway from above.

An optional V-Section exhaust plenum (Figure F.3) may be provided per the customer's requirements. The vertical facing flange of the exhaust plenum v-section is provided with four external flanges. The V-Section exhaust plenum is not available for 22 inch wide stack widths.

The very left and right end of the exhaust plenum system is provided with an exhaust plenum transition adapter which has four external flanges (Figure F.4). The four sided external flange pattern are used for all exhaust plenum connections not directly above the equipment plenum flange.

Figure F.1 Exhaust plenum section

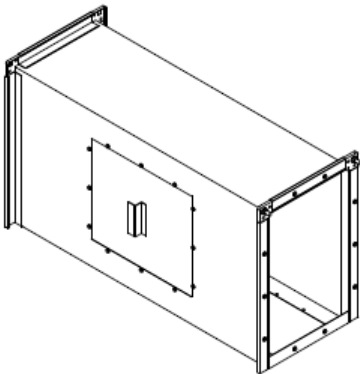


Figure F.2 Exhaust plenum t-section

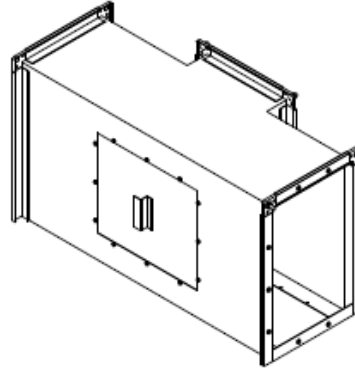


Figure F.3 Exhaust plenum v-section

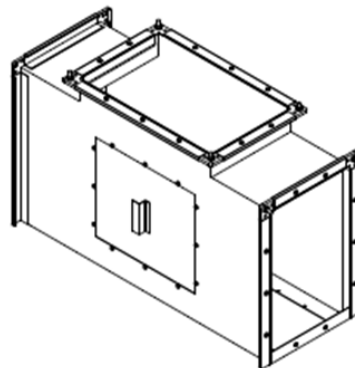
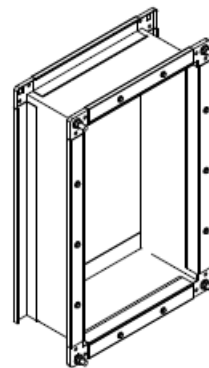


Figure F.4 Exhaust plenum transition adapter



If one end of the exhaust plenum system is required to be closed, an exhaust plenum end cap can be provided (Figure F.5). The exhaust plenum end cap is attached to the exhaust plenum transition adapter.

An exhaust plenum end portal is provided as an egress point for the exhaust plenum system (Figure F.6).

An optional exhaust plenum extension (Figure F.7) may be provided per the customer requirements. The exhaust plenum extension is 36 inches in length and is provided with four external flanges on each side.

An optional exhaust plenum 90 degree vertical elbow (Figure F.8) may be provided per the customer requirements. The exhaust plenum vertical elbow is provided with four external flanges on each side and enables the exhaust plenum to be directed in a vertical orientation.

An optional exhaust plenum 90 degree horizontal elbow (Figure F.9) may be provided per the customer requirements. The exhaust plenum horizontal elbow is provided with four external flanges on each side and enables the exhaust plenum to be directed in a horizontal orientation.

An optional exhaust plenum flange clip (Figure 7.10) may be provided to attach the exterior flanges of the exhaust plenum system. Two flange clips can be used on each of the long axis and one flange clip can be used on each of the shorter axis of the exterior flange.

Figure F.5 Exhaust plenum end cap

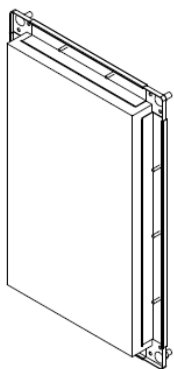


Figure F.6 Exhaust plenum end portal

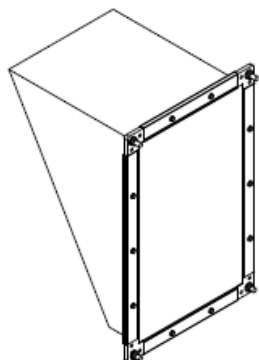


Figure F.7 Exhaust plenum extension

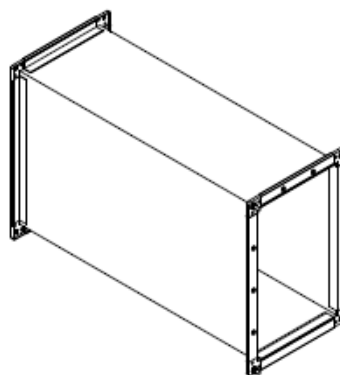


Figure F.8 Exhaust plenum vertical elbow

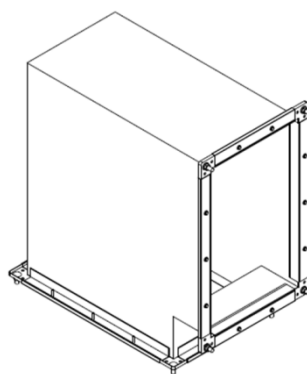


Figure F.9 Exhaust plenum horizontal elbow

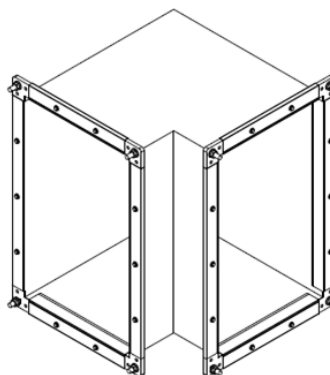


Figure F.10 Exhaust plenum flange clip



Exhaust Plenum Section

The exhaust plenum sections may be provided in widths of 22, 30, and 38 inches (Figure F.10).

Figure F.11 Exhaust plenum section details

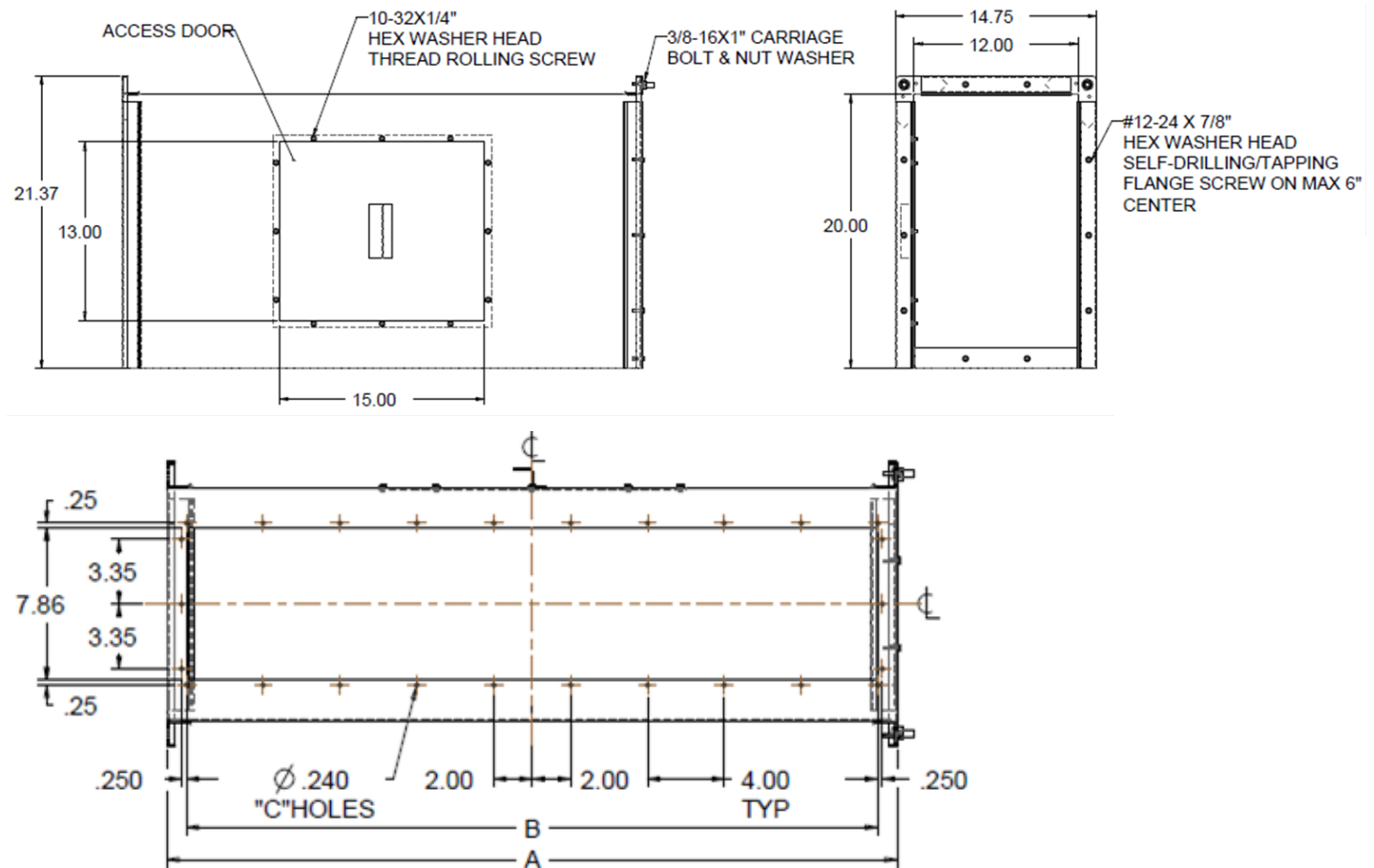


Table F.1 Exhaust plenum section widths (inches)

Stack Width	Dimension "A"	Dimension "B"	Qty. of "C" Holes
22	22	20	18
30	30	28	22
38	38	36	26

NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum T-Section

The exhaust plenum t-sections may be provided in widths of 22, 30, and 38 inches (Figure F.12).

Figure F.12 Exhaust plenum t-section details

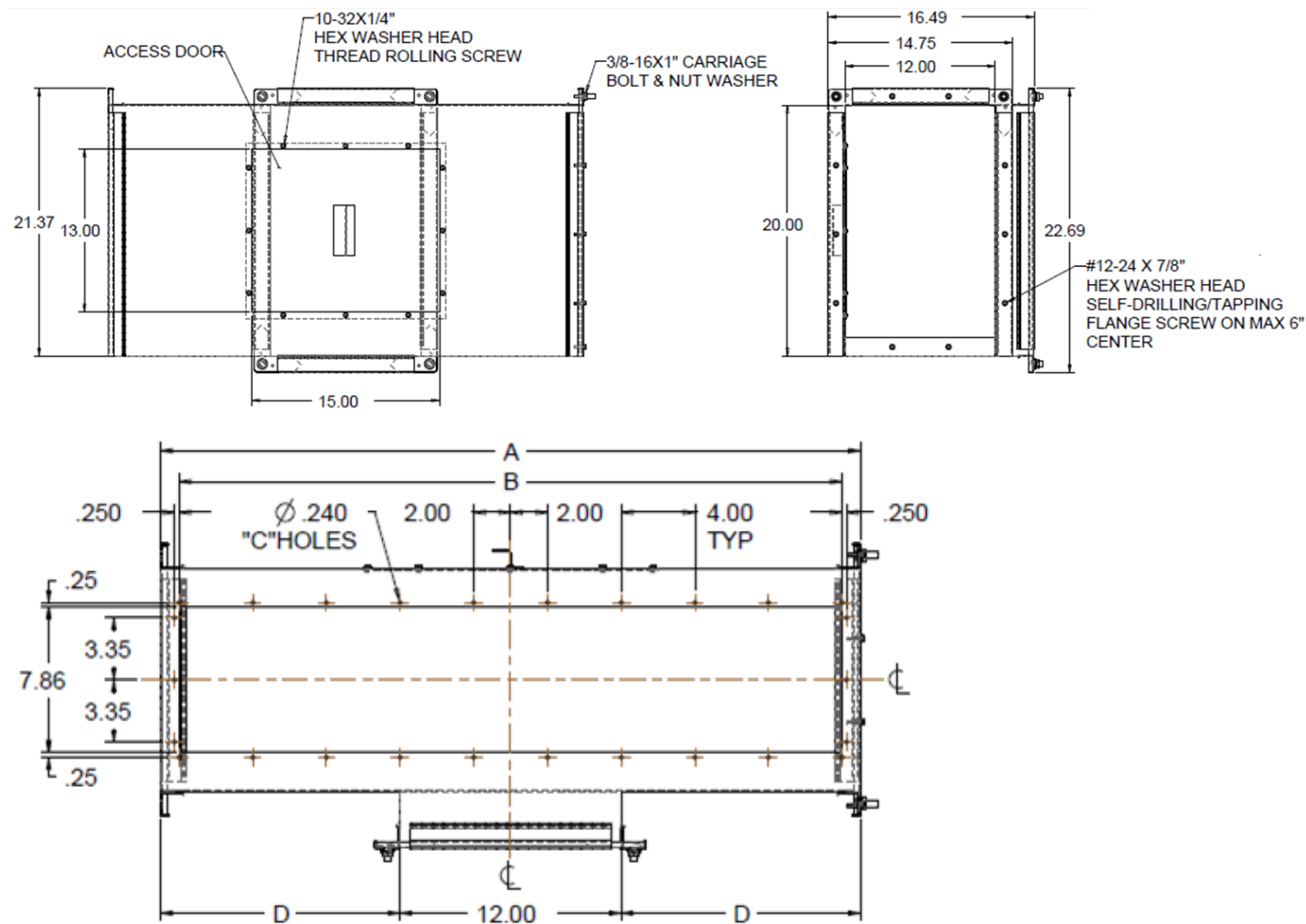


Table F.2 Exhaust plenum t-section widths (inches)

Stack Width	Dimension "A"	Dimension "B"	Qty. of "C" Holes	Dimension "D"
22	22	20	18	5
30	30	28	22	9
38	38	36	26	13

NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum V-Section

The exhaust plenum t-sections may be provided in widths of 30 and 38 inches (Figure F.13).

Figure F.13 Exhaust plenum v-section details

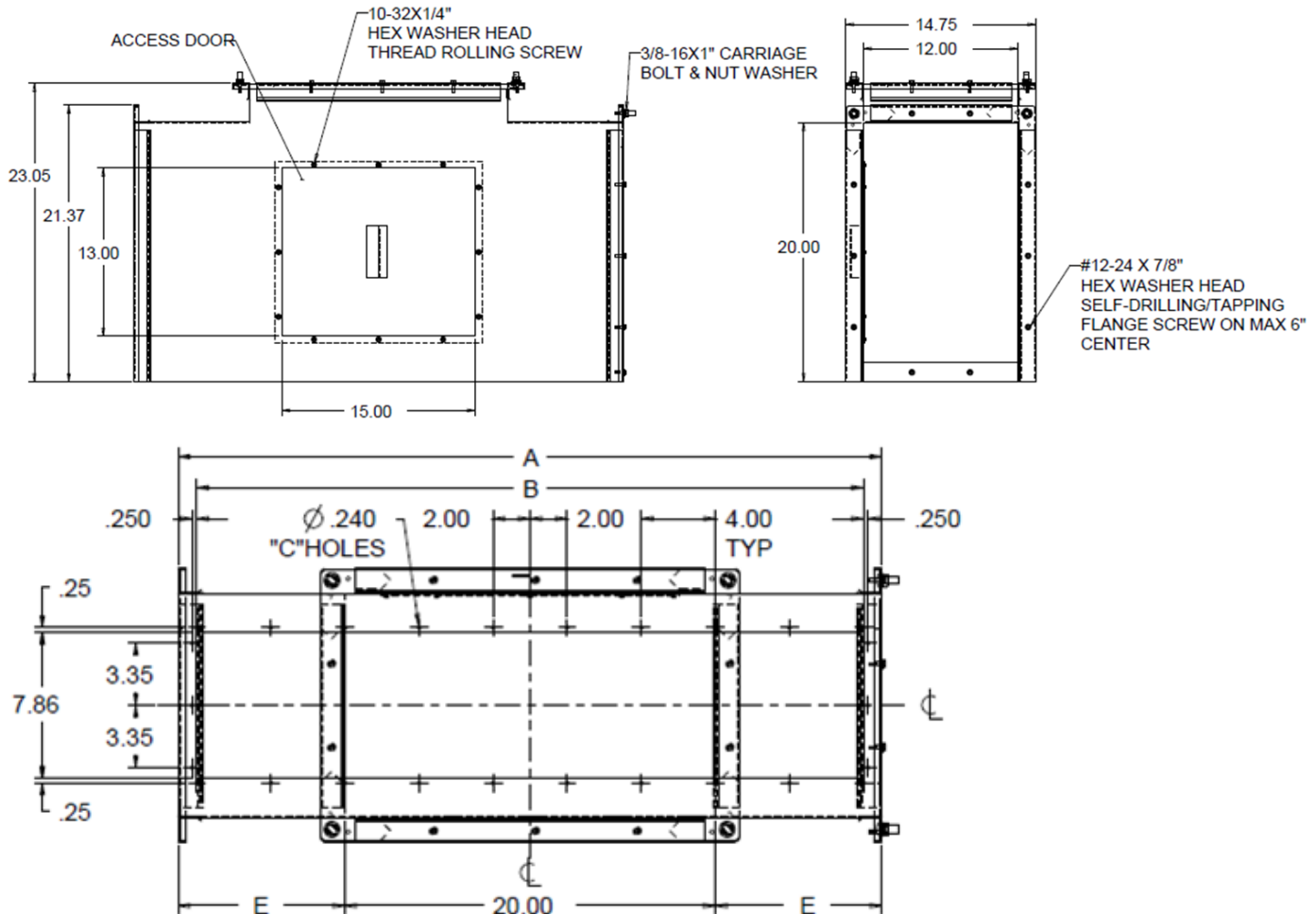


Table F.3 Exhaust plenum v-section widths (inches)

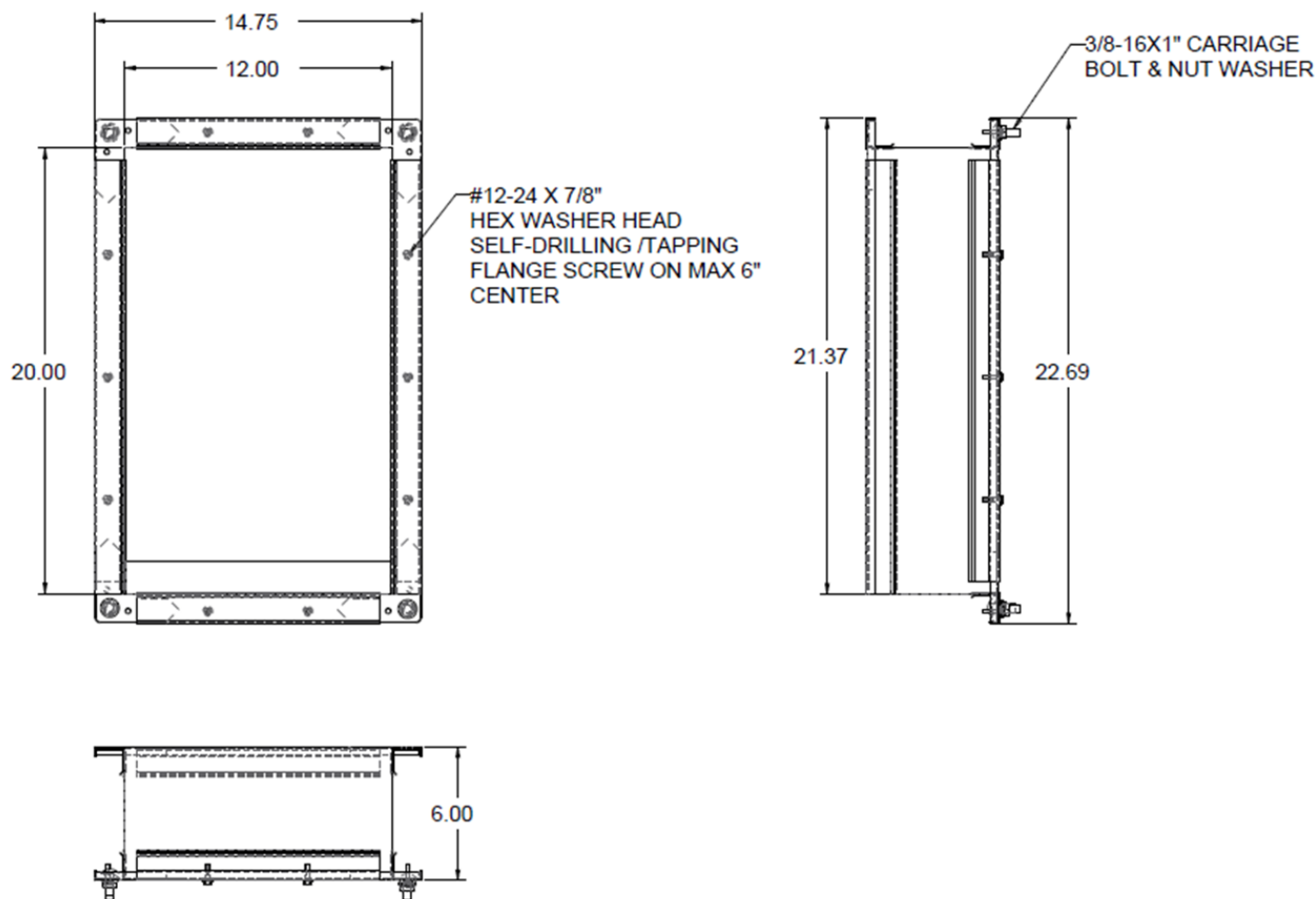
Stack Width	Dimension "A"	Dimension "B"	Qty. of "C" Holes	Dimension "E"
30	30	28	22	5
38	38	36	26	9

NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum Transition Adapter

The exhaust plenum transition adapter is attached to the left and right most plenum sections at the end of the equipment assembly (Figure F.14).

Figure F.14 Exhaust plenum transition adapter details

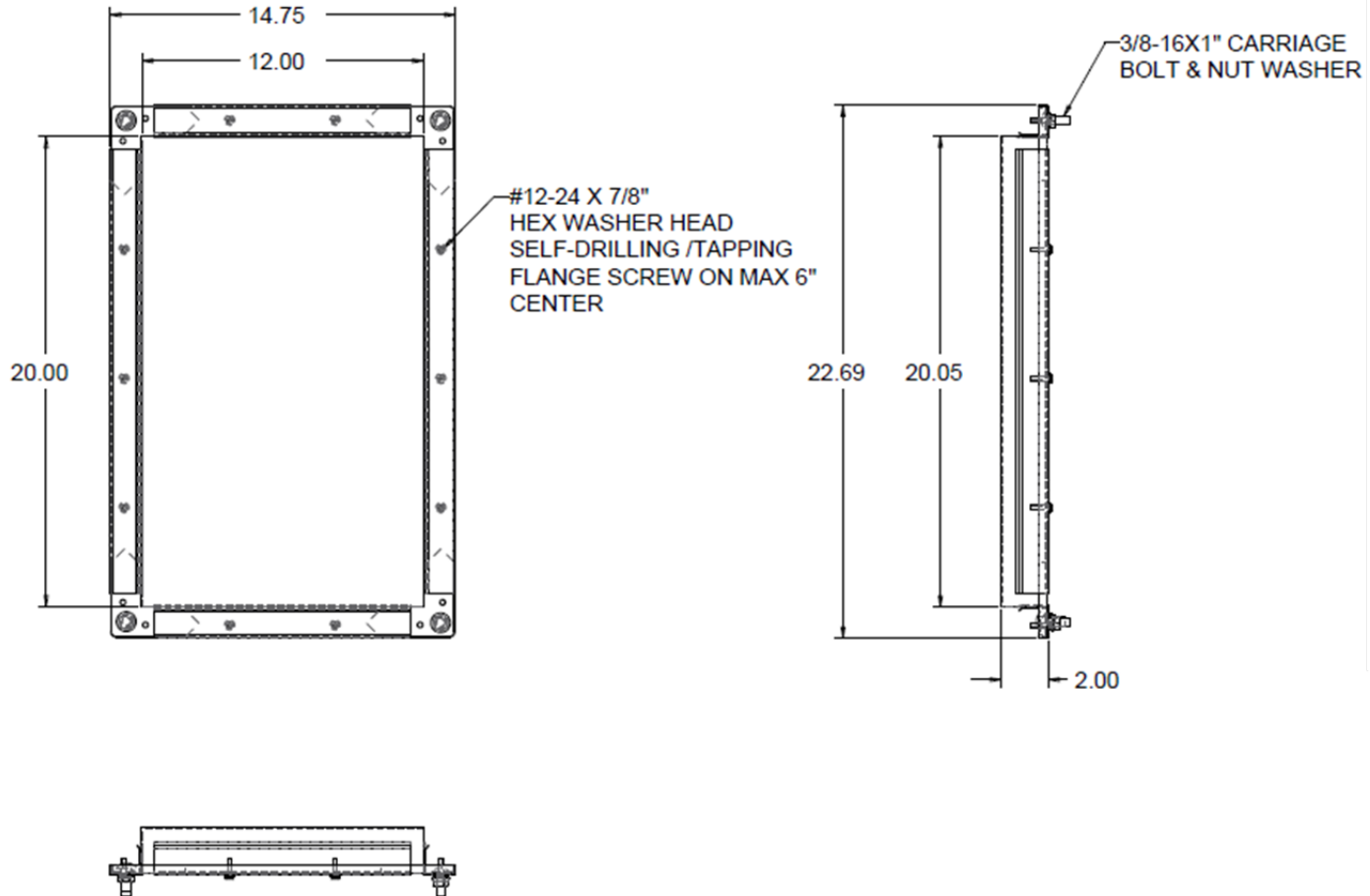


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum End Cap

The exhaust plenum end cap is attached to the left or right most plenum sections at the end of the equipment assembly (Figure F.15). The exhaust plenum end cap must be installed on the exhaust plenum transition adapter (Figure F.14).

Figure F.15 Exhaust plenum end cap details

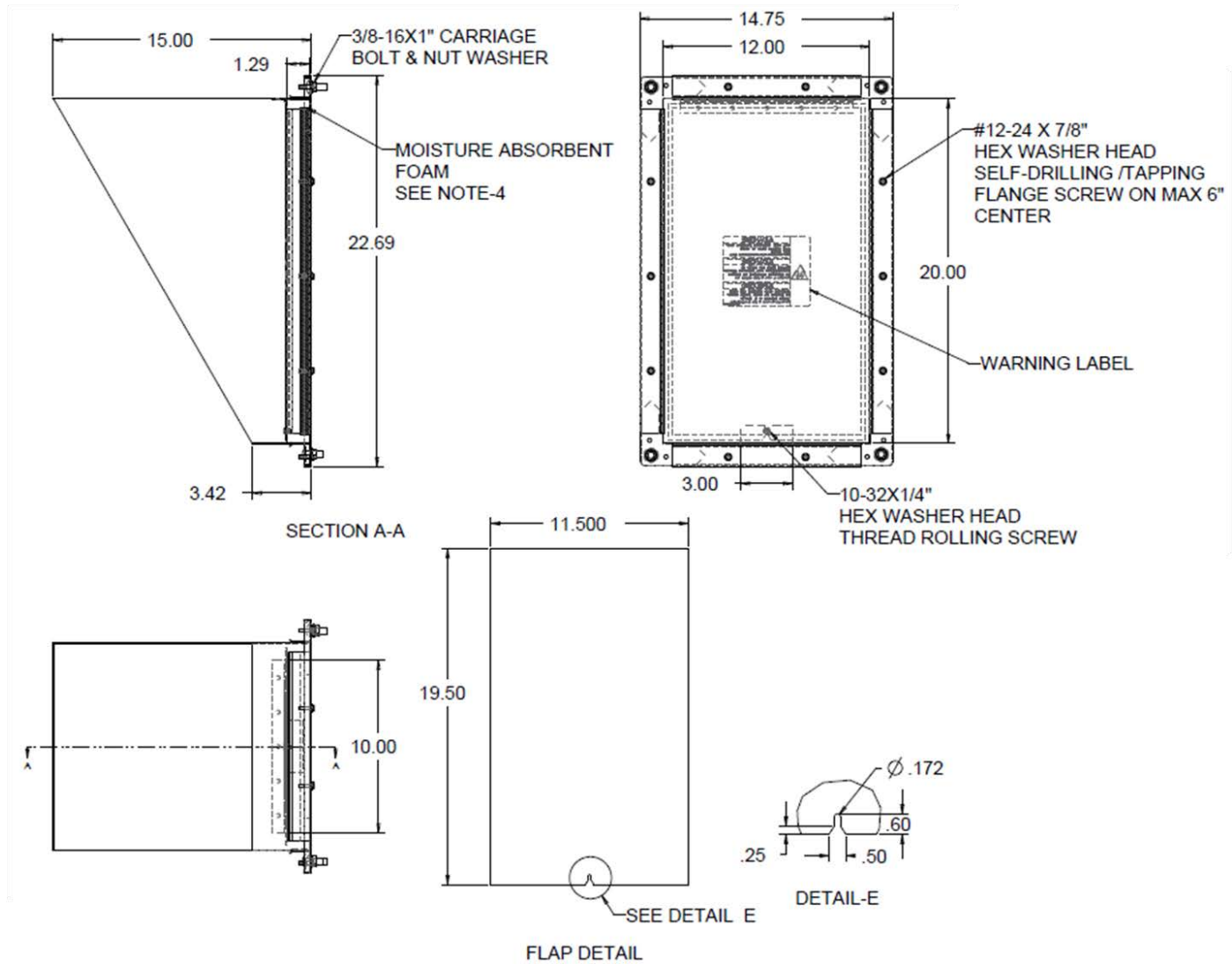


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum End Portal

The exhaust plenum end portal provides an egress point for the exhaust plenum system (Figure F.16).

Figure F.16 Exhaust plenum end portal details

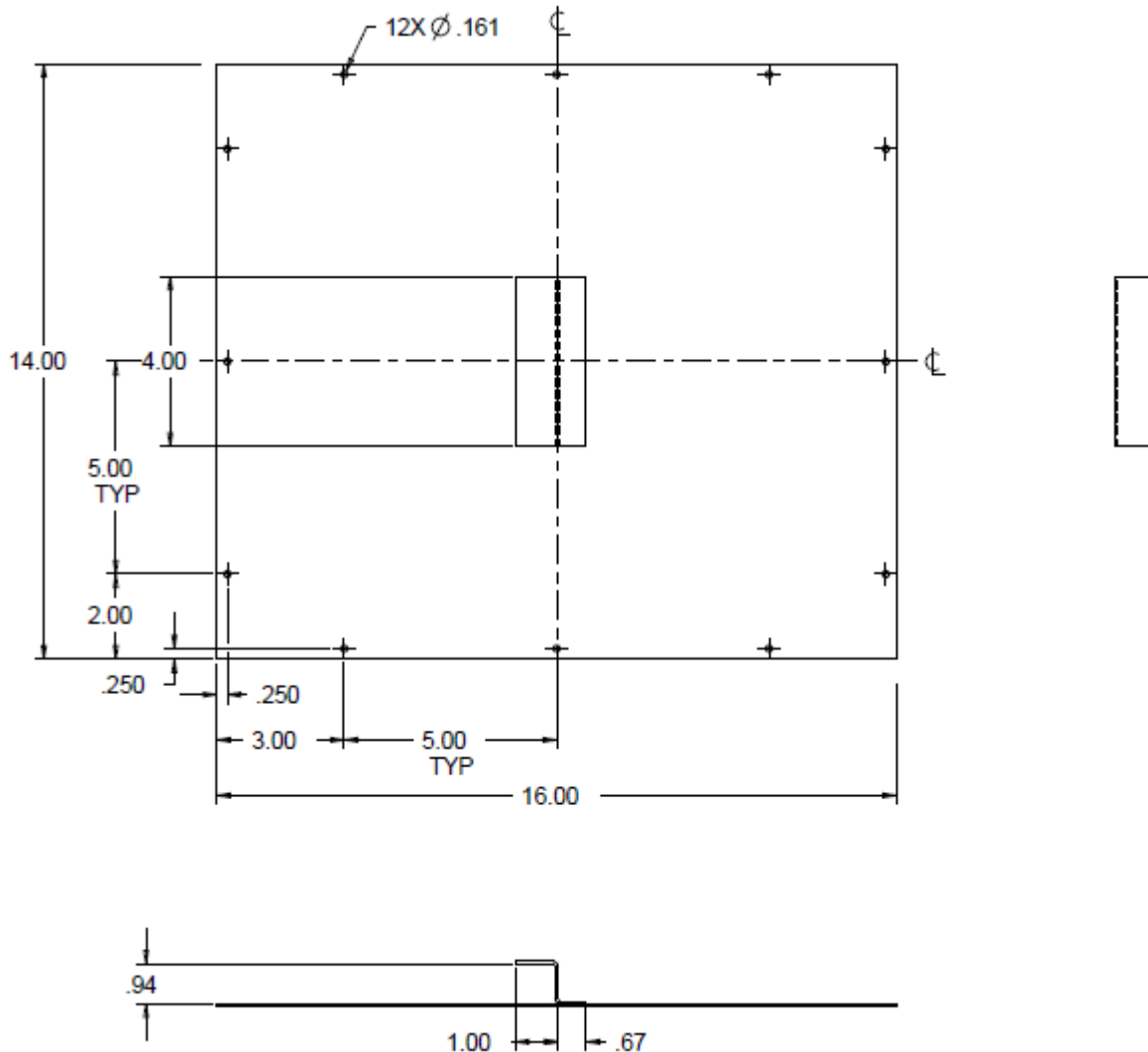


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum Access Cover

The exhaust plenum access cover is provided on each exhaust plenum above the switchgear assembly to ease with the installation of the exhaust plenum system (Figure F.17).

Figure F.17 Exhaust plenum access cover details

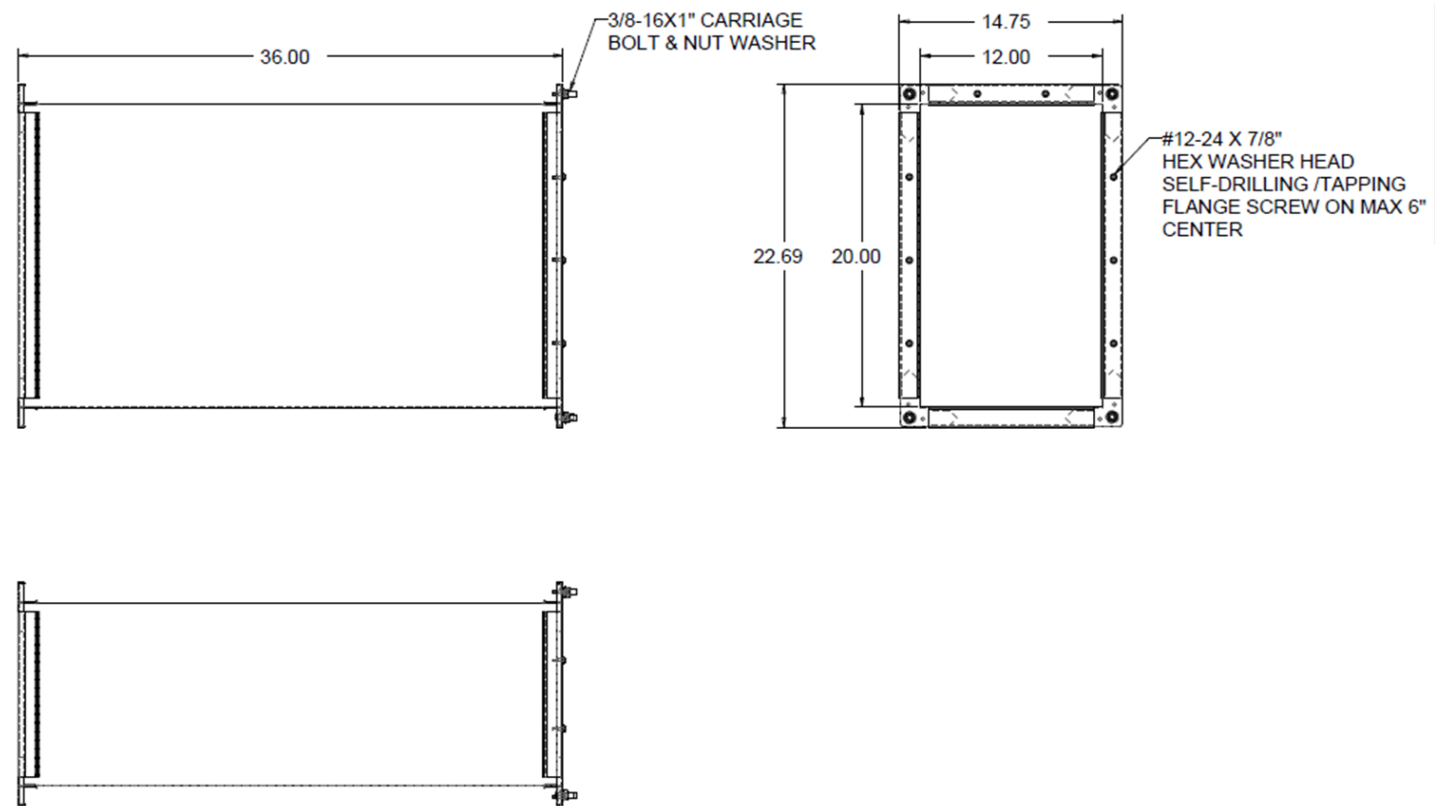


⚠ CAUTION: Over-tightening of the access cover mounting screws could damage the exhaust plenum itself. Care should be taken while performing this task.

Exhaust Plenum Extension

The exhaust plenum extension is an optional item that can be used to extend the exhaust plenum above the switchgear further in the equipment room (Figure F.18). The exhaust plenum extension is provided in 36 inch lengths.

Figure F.18 Exhaust plenum extension details

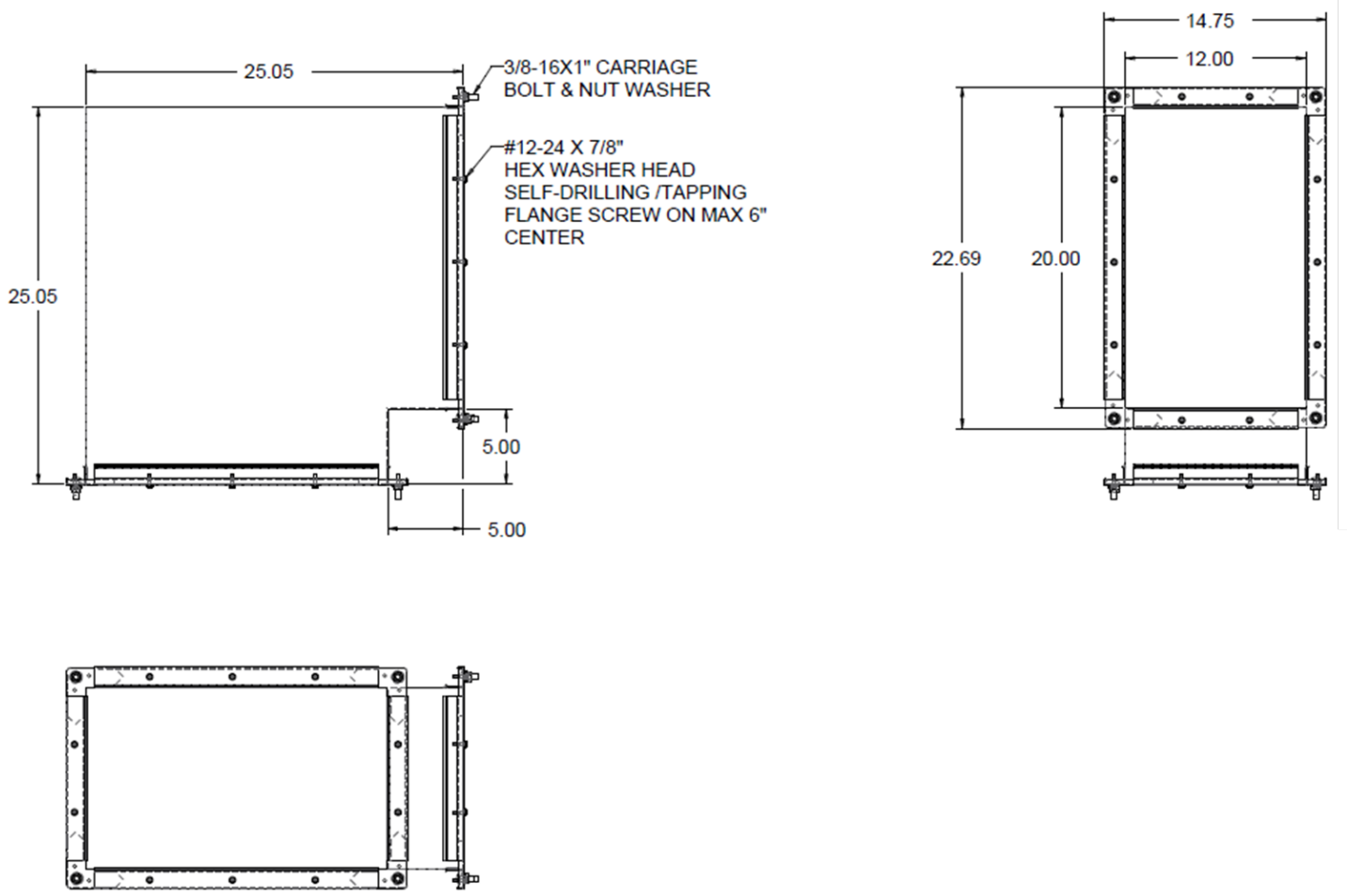


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum 90 Degree Vertical Elbow

The exhaust plenum vertical elbow is an optional item that can be used to extend the exhaust plenum above the switchgear further in the equipment room (Figure F.19). The exhaust plenum vertical elbow can be oriented in either an upward or downward orientation.

Figure F.19 Exhaust plenum 90 degree vertical elbow details

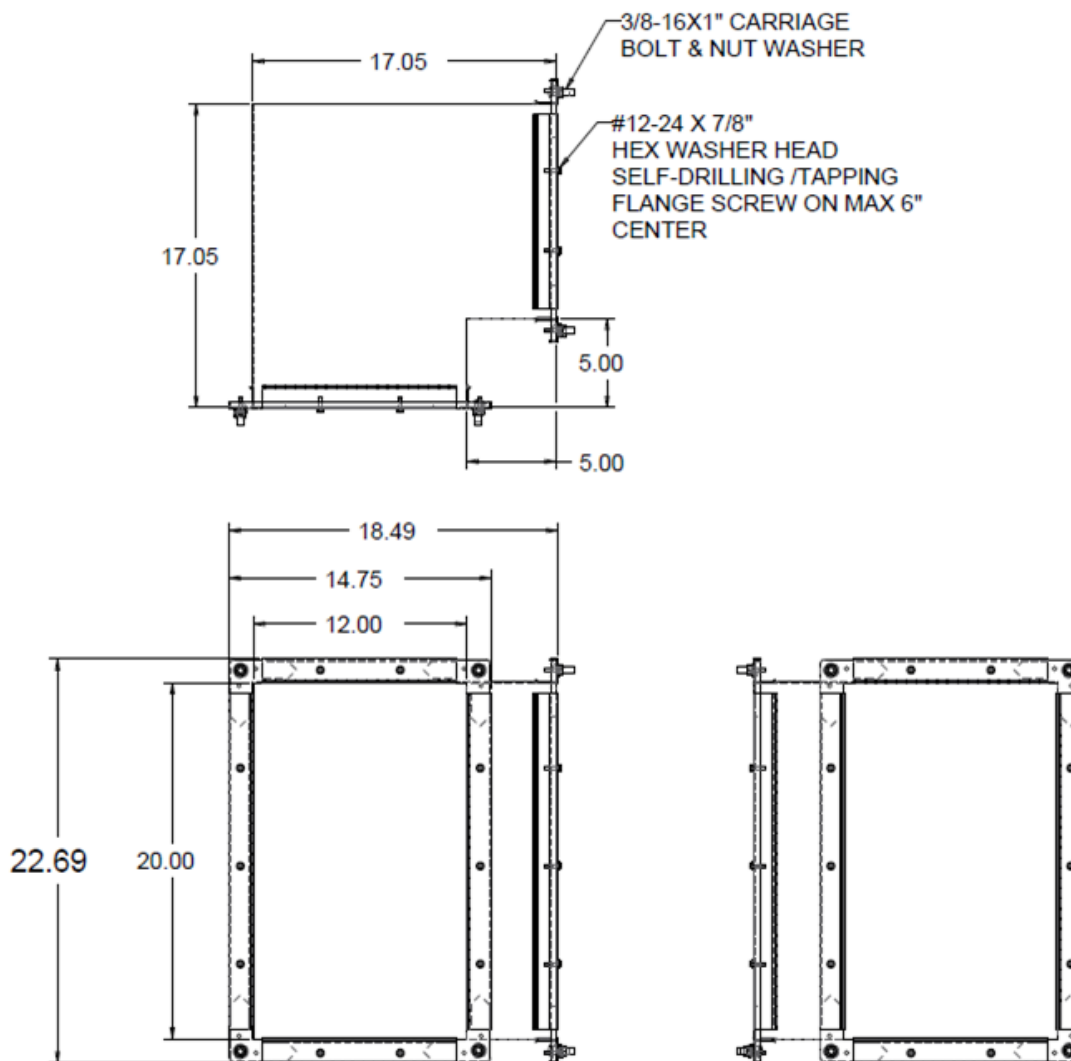


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum 90 Degree Horizontal Elbow

The exhaust plenum horizontal elbow is an optional item that can be used to extend the exhaust plenum above the switchgear further in the equipment room (Figure F.20). The exhaust plenum horizontal elbow can be oriented in either a left or right orientation.

Figure F.20 Exhaust plenum 90 degree horizontal elbow details

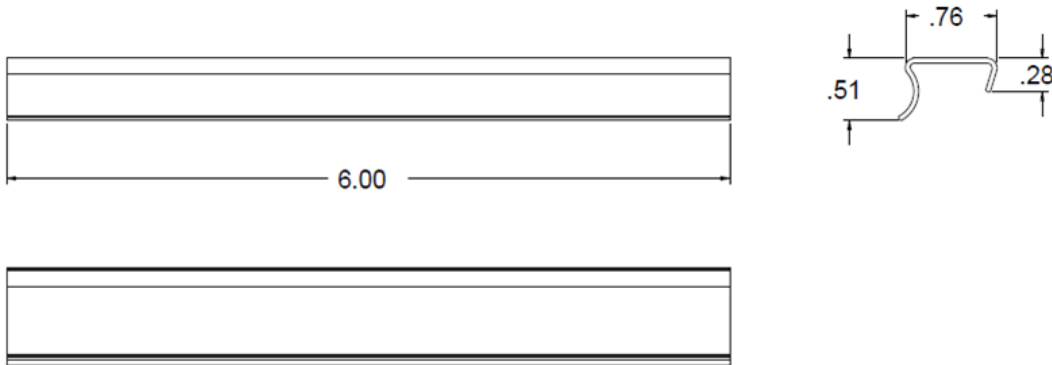


NOTICE: Use of optional flange clips (Figure F.10) may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips may be installed on each long exterior flange and one flange clip may be installed on each short exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Exhaust Plenum Flange Clip

The exhaust plenum flange clip is an optional item that can be used to attach the exterior flanges of the individual exhaust plenum components to adjacent exterior flanges (Figure F.21). The exhaust plenum flange may be used in lieu of the #12-24 x 7/8 inch hardware. Two flange clips shall be used on each long axis exterior flange and one flange clip shall be used on each short axis exterior flange. Use of the optional flange clips will still require the installation of the 3/8-16 x 1 inch carriage bolts at each exterior flange corner.

Figure F.21 Exhaust plenum flange clip details



Appendix G. Notes



Imagination at work

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West Burlington, IA 52655
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To contact GE Industrial Solutions post sales service team, call 888-437-3765

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