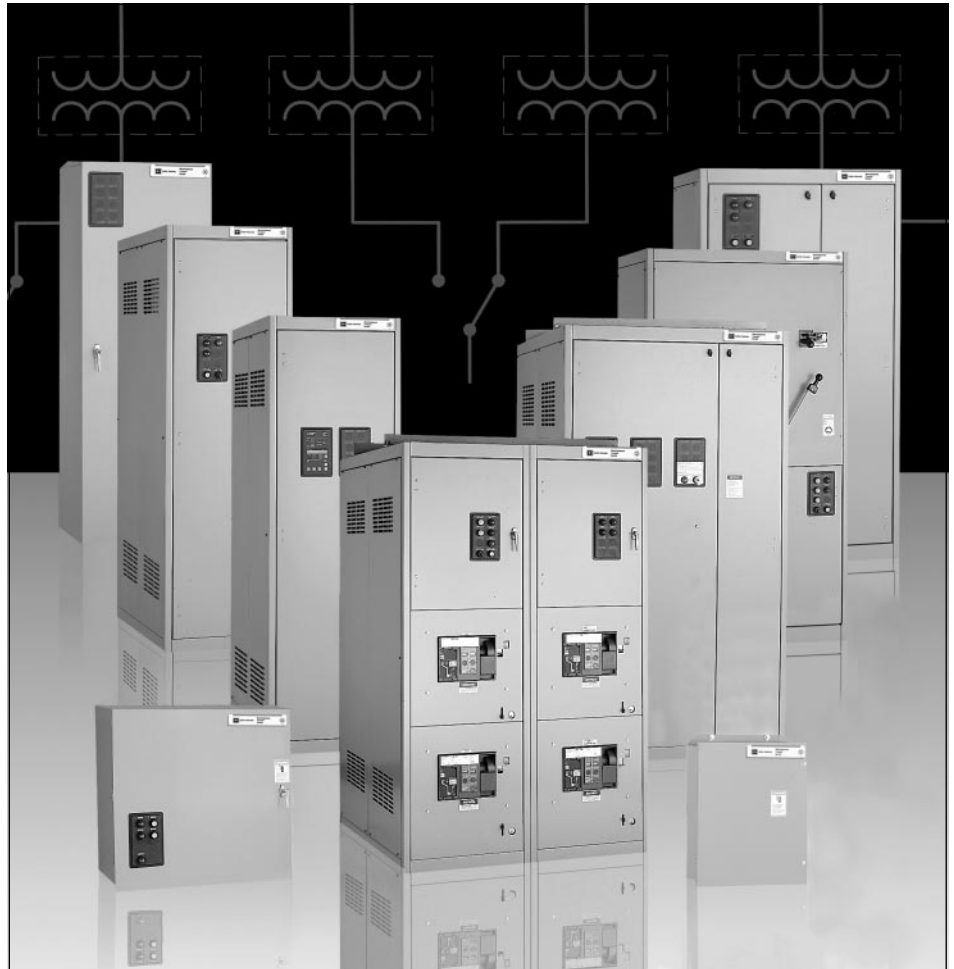


General Description

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Cutler-Hammer Automatic Transfer Switches are reliable, rugged, versatile and compact assemblies for transferring essential loads and electrical distribution systems from one power source to another.

Transfer switches can be supplied in separate enclosures for stand-alone applications or can be supplied as an integral component in the following equipment:

Product Type	Section Ref.
Magnum DS Switchgear	E1
DSII Switchgear	E2
Pow-R-Line Switchboards	E3
Motor Control Centers	I2

Types of Transfer Switches Available:

- **Automatic Solid-State Logic**
ATHSFD 100-150 amperes 2, 3 or 4 poles
ATVS 225-1000 amperes 2, 3, or 4 poles
- **Automatic Microprocessor (IQ Transfer) Logic**
ATHIFD 100-150 amperes 2, 3, or 4 poles
ATVI 225-1000 amperes 2, 3, or 4 poles
ATVISP 600-4000 amperes 3 or 4 poles
CTVISP 600-4000 amperes 3 or 4 poles
Closed Transition
- **Automatic Transfer Switch with Bypass Isolation (IQ Transfer)**
BIHI 100-1000 amperes 2, 3, or 4 poles
BIVISP 800-3000 amperes
3 or 4 poles
CBVISP 800-3000 amperes 3 or 4 poles
Closed Transition
- **Automatic Residential/Light Commercial Transfer Switches**
RTHEFD 30-200 amperes, 2-pole 240 volt, or 3-pole 208 volt only

- **Maintenance Bypass Switch**
MBHE 100-1000 amperes 2, 3, or 4 poles
MBVE 600-4000 amperes 2, 3, or 4 poles
- **Manual Non-Automatic Transfer Switches**
MTHXFD, MT2XFD, and NTHSFD 100-150 amperes 2, 3, or 4 poles
MTVX, MTDX, and NTVS 225-1000 amperes 2, 3, or 4 poles
NTVS 600-4000 amperes 3 or 4 poles (Fixed or Drawout)
- **Medium Voltage Automatic Transfer Switches (2.4-38 kV)** are available with the IQ Transfer Logic, using VCP-W or WLI/WVB technology. Contact your local Cutler-Hammer sales representative for details.
- **Automatic Soft Load/Closed Transition Transfer Switches**
CTVCSP 600-4000 amperes 3 or 4 poles



Further Information

CAT.73.01.T.E

General Description

100-1000 Amperes Automatic Transfer Switches – Types ATHSFD and ATVS Solid-State Logic



Type ATVS Automatic Transfer Switch
(Dead Front panel removed)

Features

- Complies with UL 1008, and UL 489 standards.
- Seismic qualified for UBC and BOCA Zone 4.
- Meets American Bureau of Shipping approval.
- Solid-State Logic Panel.
- Molded case switch power contact assemblies.
- Permanently affixed safe manual operating handle.
- Transfer switch position indicator for visual contact position indication on the face of the power switching device contact assemblies.

- Auxiliary contacts provide indication of switch position for each source.
- Quick keyed disconnect plug between power switching panel and logic panel.
- Three levels of interlocking; two mechanical interlocks and one electrical interlock
- High withstand, closing and interrupting ratings.
- Fully Rated Neutral - A fully rated solid neutral is supplied on all two- and three-pole Cutler-Hammer Automatic transfer switches. All four-pole switches are supplied with switched neutral contacts of identical construction and rating as the power poles and are mounted on the power contact shaft integral to the completely enclosed contact assemblies.
- High pressure, silver alloy weld resistant contact structures.
- Air Break De-ion arc quenching.
- Complete 3-phase, close differential undervoltage sensing of normal source is standard. Normally set at 80% dropout, 90% pickup and field adjustable for alternate settings.
- Multi-tap transformer package permits line voltage selection of 208, 220, 240, 380, 415, 480, or 600 volts ac, 50 to 60 Hz simply by proper insertion of voltage selection plug.
- Test pushbutton for testing of transfer switch operation.
- Engine starting contacts that provide a 10A, 30 Vdc contact closure to initiate engine starting upon failure of normal power source.
- Transfer motor disconnect plug to allow testing of control logic circuitry without initiating load transfer.

- Designed in an ISO 9001 facility.
- Manufactured in an ISO 9002 facility.
- Optionally available as Service Equipment rated. See page K1-10 for detailed description.

Benefits

- Reliable and versatile systems monitoring and interaction with all transfer switch functions. Offers wide array of options for customer design flexibility.
- High withstand switching devices, totally enclosed for maximum arc suppression and isolation during power transfer. Optional trip units offer system overcurrent protection.
- Permits true quick-break, quick-make manual operation under full load. Operation under load is completely safe to personnel and equipment.
- Provides safe, positive disconnection for electrical isolation of the logic circuits for maintenance or manual operation.
- Redundant interlocking affords the safest possible installation to positively prevent paralleling of two sources of power.
- Flexible adjustable settings for ease of applying to specific application needs.
- Modular design eases preventive maintenance and adapting to new application requirements.
- Provides the ultimate in transient isolation protection and versatility in application set-up. Meet IEEE surge withstand requirements.

100-1000 Amperes Automatic Transfer Switches – Types ATHIFD and ATVI with Microprocessor (IQ Transfer) Logic



IQ Transfer on an ATS (ATVI)

These transfer switches include the features, benefits, and ratings of the design above. They also include the advantage of microprocessor-based technology for the ATS logic by utilizing the IQ Transfer product described on page K1-3.

General Description

600-4000 Amperes SPB Fixed Mounted Transfer Switches – Types ATVISP, CTVISP (Closed Transition) with Microprocessor (IQ Transfer) Logic



Mini-SPB Fixed Transfer Switch Front Accessible

Features

- Complies with UL 1008 and UL 489 standards.
- High withstand, totally enclosed SPB switches.
- High speed, stored energy switching mechanism.

- Mechanical and electrical interlocking.
- Fully rated true 4th pole on common shaft.
- Cutler-Hammer IQ Transfer microprocessor. See page K1-3 for detailed description.
- Optionally available as Service Equipment rated. See page K1-10 for detailed description.
- Closed transition operation (≤ 100 msec) available. See page K1-5 for detailed description of Closed Transition IQ Transfer.

Benefits

- The endurance and interrupting requirements of the combined standards provide the engineer with the assurance of safe and reliable operation.
- Provides the maximum arc suppression and isolation during power transfer.
- Provides the fastest switching times available, (less than 5 cycles).



Full Size SPB Fixed Transfer Switch Rear Accessible

- Ensures that the sources will not be paralleled.
- Provides 4-pole switching for systems where switching the neutral is required.
- Closed transition minimizes outages during intentional transfer.

800-4000 Amperes SPB Draw-out Transfer Switches – Types ATVISP, CTVISP (Closed Transition) with Microprocessor (IQ Transfer) Logic



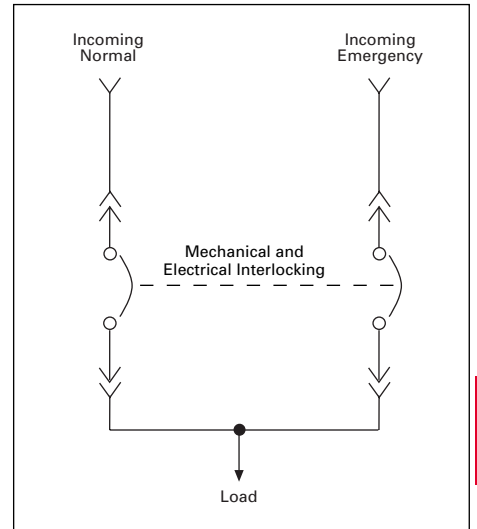
Draw-out SPB Transfer Switch

Features

- Same reliable power contact and logic design as the fixed mounted SPB switch Type ATVISP.
- Draw-out power contacts permit true maintainability.
- Substantial cost and space savings.
- Optionally available as Service Equipment rated. See page K1-10 for detailed description.
- Closed transition (≤ 100 msec) operation available. See page K1-5 for detailed description of Closed Transition IQ Transfer.

Benefits

- Draw-out power contact cassettes allow for safe and fast isolation for inspection or maintenance.
- Critical loads can be supplied by opposing power source during maintenance of draw-out contacts for minimal disruption of power.
- Reduced cost and space relative to conventional bypass isolation equipment.
- Closed transition minimizes outages during intentional transfer.



Draw-out Transfer Switch Single Line Diagram



General Description

100-1000 Amperes Automatic Transfer Switch with Bypass Isolation and Microprocessor (IQ Transfer) Logic – Type BIHI



Bypass Isolation Transfer Switch

Features

- Complies with UL 1008 and UL 489 standards
- Superior Main Contact Structure
- Reliable IQ Transfer Microprocessor Logic
- Ease of Operation
- Simple Test Circuit
- Designed to safely withstand fault currents
- Eliminates need for complex interlocks
- Optionally available as Service Equipment rated

Benefits

Cutler-Hammer requires all power contacts of the Bypass Isolation Transfer Switch to meet UL 1008, and UL 489 standards. This added measure of safety and reliability ensures the integrity of the contact assemblies and eliminates the need for periodic maintenance of the contacts, reducing downtime and maintenance cost.

The Transfer Switch section of the Cutler-Hammer BIHI Bypass Isolation Switch utilizes the Cutler-Hammer IQ Transfer Microprocessor logic package. This provides the opportunity to tailor the product to a particular application as well as providing the capability of upgrading logic functions as needed in the field. See page K1-3 for detailed description.

The Cutler-Hammer BIHI Bypass Isolation Switch utilizes foolproof mechanical Kirk Key interlocking and a positive isolation mechanism. The result is the safest, easiest to

operate Bypass Isolation Switch available in the marketplace today.

When the Transfer Switch is in the "Isolated" position, complete testing of the Automatic Transfer Switch can be accomplished via a special insulated keyed connector. This allows the operator to completely test the entire operating sequence of the ATS while maintaining power to the connected load.

The BIHI Bypass Isolation Switch utilizes modified molded case switches, designed specifically for high duty repetitive load transfer, as a means to bypass and isolate the transfer switch. These devices provide for a reliable, rugged installation that can withstand very high level short circuits.

Switch Operation Type BIHI

A major advantage of the Cutler-Hammer Bypass Isolation Switch is it utilizes **load-break** isolation and bypass transfer power contacts. Thus, should voltage be lost on the line to which the ATS is connected, and should a manual bypass be required to the other line, this can be accomplished safely and quickly as described below. With contactor designs utilizing **non-loadbreak** isolation and bypass switches, manual bypass to the other line is hindered by mechanical or electrical safety interlocking.

Bypass to Normal

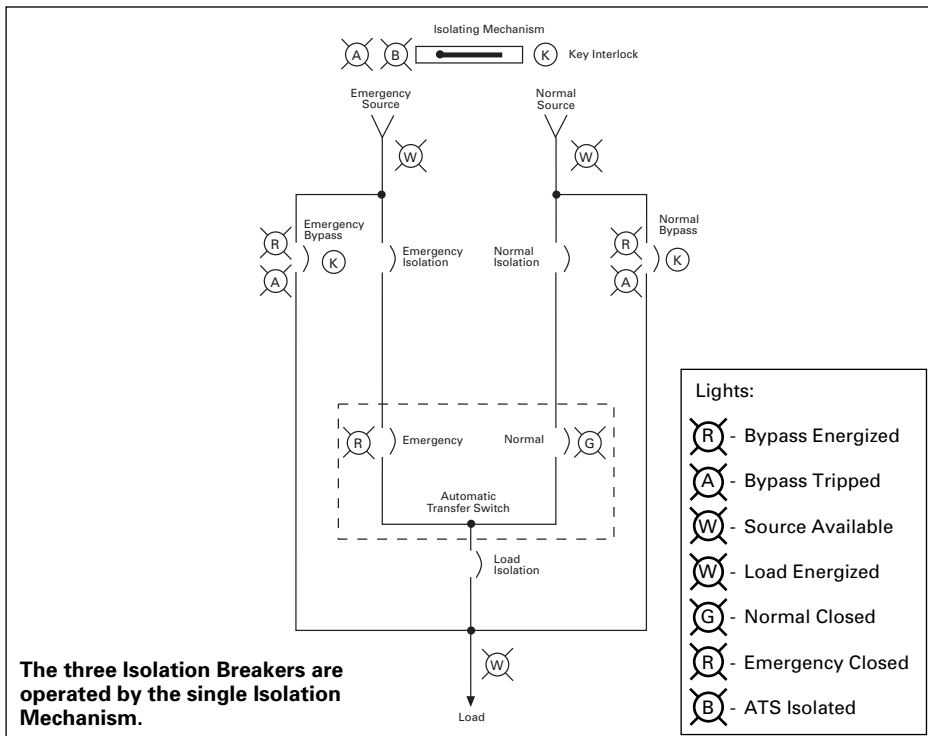
1. Turn "Generator" switch to "Off".
2. Place isolating mechanism handle in "Off" position.
3. Turn and remove key.
4. Place key in "Normal Bypass" lock.
5. Turn "Normal Bypass" "On".

Bypass to Emergency

1. Turn "Generator" switch to "Run".
2. Place isolating mechanism handle in "Off" position.
3. Turn and remove key.
4. Place key in "Emergency Bypass" lock.
5. Turn "Emergency Bypass" "On".

Return to Normal Operation

1. Place appropriate bypass in "Off" position.
2. Turn and remove key.
3. Place key in isolating mechanism lock.
4. Place isolating mechanism handle in "On" position.
5. Turn "Generator" switch to "Auto".



The three Isolation Breakers are operated by the single Isolation Mechanism.

Single Line Diagram – Bypass Isolation ATS

General Description

800-3000 Amperes SPB Draw-out Automatic Transfer Switch with Bypass Isolation and Microprocessor (IQ Transfer) Logic – Types BIVISP, CBVISP (Closed Transition)



Draw-out SPB Bypass Isolation Transfer Switch

- Ease of Operation.
- Designed to safely withstand fault currents.
- Eliminates need for complex interlocks.
- Most versatile Bypass Isolation Transfer Switch available.
- Cutler-Hammer Draw-out Cassette Design.
- Overcurrent protection available.
- Optionally available as Service Equipment Rated. See page K1-10 for detailed description.
- No Loadbreak when bypassing to the same source.
- Draw-out capabilities on both ATS and Bypass portions.
- Compact design.
- Ability to test Power Switching Elements during draw-out process.
- Power Switching Devices completely interchangeable between ATS and Bypass portions.

Benefits

The Cutler-Hammer BIVISP Bypass Isolation Transfer Switch offers many of the same benefits as the Type BIHI design, and more.

The BIVISP Bypass Isolation Transfer Switch features draw-out SPB molded case switches, providing the ultimate in coordination flexibility and maintainability, making the BIVI the most versatile switch available.

Features

- Complies with UL 1008 and UL 489 standards.
- Superior SPB Main Contact Structure.
- Reliable IQ Transfer Microprocessor logic. See pages K1-3 and K1-5 for detailed description.

Switch Operation — Types BIVISP, CBVISP

Bypass to Normal with ATS in Normal (No Load Interruption)

1. Turn "Generator" selector switch to "Off".
2. Lift K2 lock release lever on ATS Emergency ②, turn and remove key.
3. Insert key in K2 on Normal Bypass ③, unlock and close Normal Bypass.
4. Isolate ATS Normal ① via draw-out handle.

Bypass to Emergency with ATS in Normal (Load Interruption)

1. Turn "Generator" selector switch to "Run".
2. Lift K1 lock release lever on ATS Normal ①, turn and remove key (ATS Normal ① will open when lock engages).
3. Insert key in K1 on Emergency Bypass ④, unlock and close Emergency Bypass.
4. Isolate ATS Normal ① via draw-out handle.

Return to Normal Operation When Bypassed to Normal (No Load Interruption)

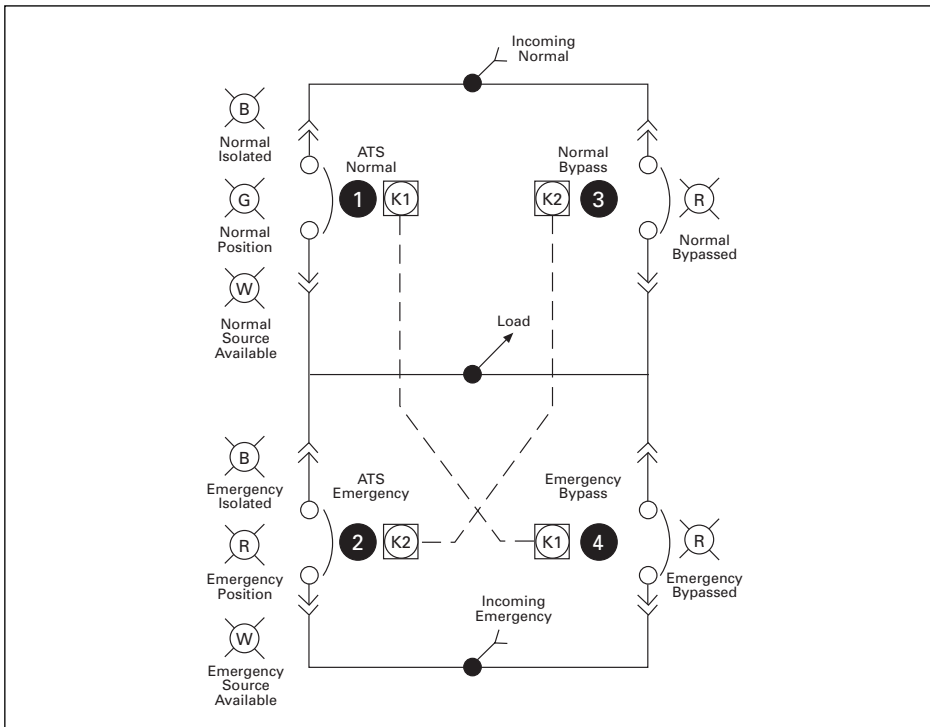
1. If isolated, return ATS Normal ① to connected position and close same.
2. Open Normal Bypass ③.
3. Lift K2 lock release lever on Normal Bypass ③, turn and remove key.
4. Insert key in K2 on ATS Emergency ②, and unlock.
5. Return "Generator" selector switch to "Auto" position.

Return to Normal Operation When Bypassed to Emergency (Load Interruption)

1. If isolated, return ATS Normal ① to connected position (do not attempt to close yet).
2. Lift K1 lock release lever on Emergency Bypass ④, turn and remove key (Emergency Bypass ④ will open when lock engages).
3. Insert key in K1 on ATS Normal ①, unlock and close ATS Normal ①.
4. Return "Generator" selector switch to "Auto" position.

Use of Bypass Switch as Manual Transfer Switch

1. Removal of K1 and K2 lock keys from ATS and placement of lock keys in appropriate Bypass devices (as described above) will permit the Bypass Switch to be operated as a true Manual Transfer Switch.



Single Line Diagram of SPB Draw-out Bypass Isolation Automatic Transfer Switch

General Description

IQ Transfer
Microprocessor-Based Logic

The IQ Transfer is a microprocessor-based logic controller to be used with Cutler-Hammer transfer switches. This device is door-mounted and provides the operator with an at-a-glance overview of switch status and parameters, as well as key diagnostic data. Real time values for volts and frequency can be viewed via the front panel LED display, along with an indication of the power source currently in use.

The IQ Transfer continuously monitors either single-phase or three-phase voltages for Source 1, Source 2, and the Load. When the Source 1 voltage or frequency is detected to be below the customer programmed setpoints, transfer to Source 2 is initiated. When the Source 2 voltage and frequency are detected to be within the programmed parameters, the transfer occurs. While the Load is connected to Source 2, the IQ Transfer continues to monitor Source 1. As soon as the Source 1 voltage and frequency return to within the programmed limits, and after a programmed time delay, the load transfer back to Source 1 is initiated.

The IQ Transfer uses microprocessor technology to provide the operator with a vast array of selections. Depending on the application, the user can "customize" the IQ Transfer to meet his particular need. A summary of several key selections is listed in Table 1:

Table 1: Programming Selections

Parameters	Setpoints
TDNE	0 Sec to 1800 Sec
TDEN	0 Sec to 1800 Sec
TDEC	0 Sec to 1800 Sec
TDES	0 Sec to 120 Sec
TDN ^①	0 Sec to 120 Sec or Based on Load Voltage Decay (10-30% of Nominal Voltage)
Load Sequencing ^①	0 to 10 Devices
Pre-Transfer Signal Device ^①	0 to 120 Sec (Up To 10 Devices)
Plant Exerciser ^①	Load or No Load Transfer (Selectable)
Preferred Source Selector ^①	Source 1 or Source 2 or None
Sensing	3-Phase or 1-Phase
System Selection	Utility/Generator or Dual Utility or Dual Generator

Table 2: Specifications

Input Control Power Range:	65 Vac rms to 160 Vac rms (50/60 Hz)		
Voltage Measurements of:	Source 1 V _{AB}	Source 2 V _{AB}	Load V _{AB}
	Source 1 V _{BC}	Source 2 V _{BC}	Load V _{BC}
	Source 1 V _{CA}	Source 2 V _{CA}	Load V _{CA}
Voltage Measurement Range:	0 to 790 Vac rms (50/60 Hz)		
Voltage Measurement Accuracy:	±2% of nominal input voltage		
Frequency Measurement for:	Source 1 and Source 2		
Frequency Measurement Range:	40 Hz to 80 Hz		
Frequency Measurement Accuracy:	±0.1 Hz		
Undervoltage Sensing:	Source 1 and Source 2		
Undervoltage Dropout Range:	50% to 90% of nominal voltage		
Overvoltage Dropout Range ^① :	105% to 120% of nominal voltage		
Under Frequency Dropout Range ^① :	90% to 100% of nominal frequency		
Over Frequency Dropout Range ^① :	100% to 120% of nominal frequency		
Contact Outputs:			
Two Form A Contacts for Generator start:	5A 250 Vac	5A 30 Vdc	
Four Form A Contacts for Control Functions:	10A 250 Vac	10A 30 Vdc	
Three Form C Contacts for Control Functions:	10A 250 Vac	10A 30 Vdc	
Communications Output Over IMPACC/PowerNet: (Optional)	PONI (Product Operated Network Interface)		
Front Panel Indications:			
Automatic Mode:	Blinking LED indicates Automatic operation		
Test Mode:	LED illuminated indicating the unit is in the TEST mode		
Program Mode:	LED illuminated indicating the unit is in the Program mode		
	Blinking LED indicates user is viewing setpoints in Program mode		
LED Lights to Indicate:	Source 1 Available (Amber)	Source 2 Available (Amber)	
	Source 1 Connected (Green)	Source 2 Connected (Red)	
	Source 1 Preferred (Red)	Source 2 Preferred (Red)	
	Load Energized (Red)		
LED Display to Indicate:	History Information		
	Setpoints		
	Real Time Clock		
Environmental Temperature Range:			
Operation:	-20°C to +70°C		
Storage:	-30°C to +85°C		
Applicable Standards:			
	UL 1008		
	UBC and BOCA for Seismic Zone 4		

The IQ Transfer is equipped to display history information either via the front panel or over IMPACC/PowerNet. Source 1 and Source 2 Run Time, Available time, and Connect time are available as well as Load Energized Time, Number of Transfers, and the Date, Time and Reason for the Last 16 Transfers.

For communications capability, the IQ Transfer can be equipped with a PONI card which will allow the user to communicate with the unit via Series III software. All settings for purchased options can be set from the faceplate of the unit or downloaded over IMPACC/PowerNet. Series III software allows for charting of key historical data as well as provides the capability to monitor and control the transfer switch from a remote location.

For further information on IMPACC/PowerNet products and software see section B.

^① Optional features.

General Description

Closed Transition IQ Transfer Microprocessor-Based Logic



Introduction

The Closed Transition IQ Transfer (CTIQ Transfer) is a programmable, microprocessor-based monitoring device designed for use in Cutler-Hammer Closed Transition Transfer Switches (CTVI/CBVI). By using the Cutler-Hammer CTIQ Transfer, the user may avoid intentional interruption of power when both sources of power are available. This make-before-break mode of operation is useful during testing of the engine generator under load and where a predetermined transfer to the generator is desired. Source paralleling duration is limited to less than 100 msec.

Passive Closed Transition

The Closed Transition mode of operation requires that both power sources be synchronized in voltage, frequency and phase angle within prescribed limits. Cutler-Hammer's CTIQ Transfer utilizes a technique that involves waiting for synchronization of the two sources without actively controlling the generator's voltage or frequency. The mode of operation is anticipatory in that the switch close command is initiated before the sources are exactly in phase. Utilizing the phase angle and frequency difference between the two sources, a calculation is made to predict when both sources would be in phase. The response time of the switch is then factored in to determine when the switch close signal should be given to assure optimal closure of the two sources in phase.

Application Considerations

- The generator used with a closed transition transfer switch must be equipped with an isochronous governor.
- When paralleling sources, fault current contributions from both sources should be considered in the system design.

① Optional features.

Table 1: Programming Selections

Parameters	Setpoints
TDNE	0 to 1800 Seconds
TDEN	0 to 1800 Seconds
TDEC	0 to 1800 Seconds
TDES	0 to 120 Seconds
TDN①	0 to 120 Seconds or Based on Load Voltage Decay (10-30% of Nominal Voltage)
Closed	Enabled or Disabled
CTFD	0.0 to 0.3 Hz
CTVD	1 to 5% (voltage)
I Phase	Enabled or Disabled
IPFD	0.0 to 3.0 Hz
SYNC	1 to 60 Minutes
Load Sequencing①	0 to 10 Devices
Pre-Transfer Signal Device①	0 to 120 Seconds (Up to 10 Devices)
Plant Exerciser①	Load or No Load Transfer (Selectable)
Preferred Source Selector①	Source 1 or Source 2 or None
Sensing	3-Phase or 1-Phase
System Selection	Utility/Generator or Dual Utility or Dual Generator

- Closed Transition (make before break) Technology causes paralleling with the utility. It is the user's responsibility to comply with any requirements regarding protective relaying. Protective relaying is not supplied with the standard transfer switch, but is available.

The IQ Transfer is equipped to display history information either via the front panel or over IMPACC/PowerNet. Source 1 and Source 2 Run Time, Available Time, and Connect Time are available as well as Load Energized Time, Number of Transfers, and the Date, Time and Reason for the Last 16 Transfers.

For communications capability, the IQ Transfer can be equipped with a PONI card which will allow the user to communicate with the unit via Series III software. All settings for purchased options can be set from the faceplate of the unit or downloaded over IMPACC/PowerNet. Series III software allows for charting of key historical data as well as provides the capability to monitor and control the transfer switch from a remote location.

For further information on IMPACC/PowerNet products and software see section B.

Table 2: Specifications

Input Control Power Range:	65 Vac rms to 160 Vac rms (50/60 Hz)
Voltage Measurements of:	Source 1 V_{AB} Source 2 V_{AB} Load V_{AB} Source 1 V_{BC} Source 2 V_{BC} Load V_{BC} Source 1 V_{CA} Source 2 V_{CA} Load V_{CA}
Voltage Measurement Range:	0 to 790 Vac rms (50/60 Hz)
Voltage Measurement Accuracy:	±2% of nominal input voltage
Frequency Measurement for:	Source 1 and Source 2
Frequency Measurement Range:	40 Hz to 80 Hz
Frequency Measurement Accuracy:	±0.1 Hz
Undervoltage Sensing:	Source 1 and Source 2
Undervoltage Dropout Range:	50% to 90% of nominal voltage
Overvoltage Dropout Range①:	105% to 120% of nominal voltage
Under Frequency Dropout Range①:	90% to 100% of nominal frequency
Over Frequency Dropout Range①:	100% to 120% of nominal frequency
Contact Outputs:	
Two Form A Contacts for Generator start:	5A 250 Vac; 5A 30 Vdc
Four Form A Contacts for Control Functions:	10A 250 Vac; 10A 30 Vdc
Three Form C Contacts for Control Functions:	10A 250 Vac; 10A 30 Vdc
Communications Output Over IMPACC/PowerNet: (Optional)	
PONI (Product Operated Network Interface)	
Front Panel Indications:	
Automatic Mode:	Blinking LED indicates Automatic operation
Test Mode:	LED illuminated indicating the unit is in the TEST mode
Program Mode:	LED illuminated indicating the unit is in the Program mode
	Blinking LED indicates user is viewing setpoints in Program mode
LED Lights to Indicate:	Source 1 Available (Amber) Source 2 Available (Amber) Source 1 Connected (Green) Source 2 Connected (Red) Source 1 Preferred (Red) Source 2 Preferred (Red) Load Energized (Red)
LED Display to Indicate:	History Information Setpoints Real Time Clock
Environmental Temperature Range:	
Operation:	-20°C to +70°C Storage: -30°C to +85°C
Applicable Standards:	
UL 1008	UBC and BOCA for Seismic Zone 4

General Description

30-150 Amperes Automatic Residential/Light Commercial Transfer Switches – Type RTHEFD



Residential/Light Commercial Transfer Switch



Panel Interior

Features

- UL 1008 listed
- NEC Article 700 conformance
- Normal/standby source monitoring
- Molded case switch contacts
- Engine start contacts
- Transfer mechanism
- Logic panel
- Fully automatic operation
- NEMA 1 enclosure
- NEMA 3R enclosure optional

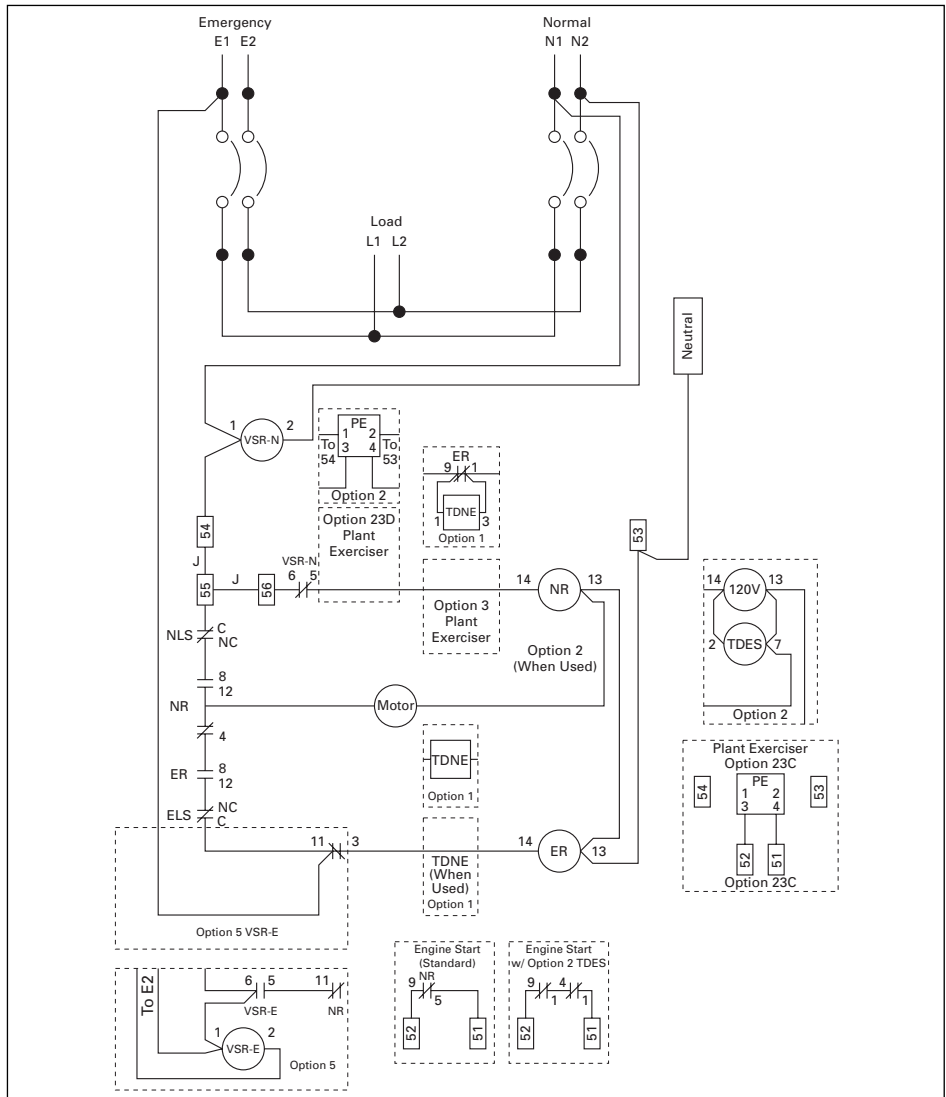
Product Description

A compact line of Residential/Light Commercial Automatic Transfer Switches available for application on 120, 120/208, 120/240 volt systems; 30, 70, and 100 Amperes; 2- or 3-pole.

Available Options

In addition to the standard features and accessories, the following optional features and accessories are also available to match your application requirements:

- 1 Time delay normal to emergency (3-60 seconds)
- 2B Time delay engine start (.5-15 seconds)
- 2C Time delay engine start (4-120 seconds)
- 3 Time delay emergency to normal (24-480 seconds)
- 5D Single phase undervoltage sensing on standby
- 13B 3-wire start circuit
- 23C Plant exerciser without load
- 23D Plant exerciser with load

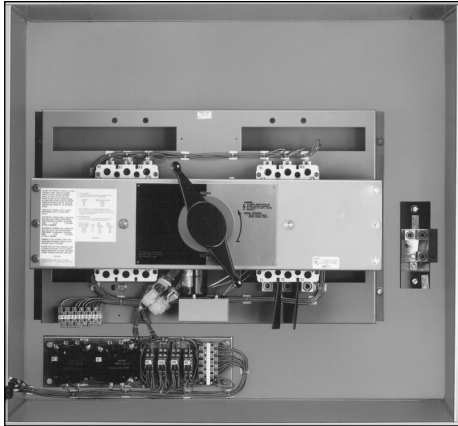


Typical Wiring Diagram

K

General Description

Maintenance Bypass Switches
Type MBHE 100-1000 Amperes
Type MBVE 1200-4000 Amperes



Type MBHE Maintenance Bypass Switch

The Cutler-Hammer Maintenance Bypass Switch is a UL 1008 listed device that provides a simple and effective means for

bypassing uninterruptable power supplies while maintaining continuity of power to the critical computer loads. A maintenance bypass switch is a requirement on every UPS installation in order to accommodate the maintenance and testing of the UPS System.

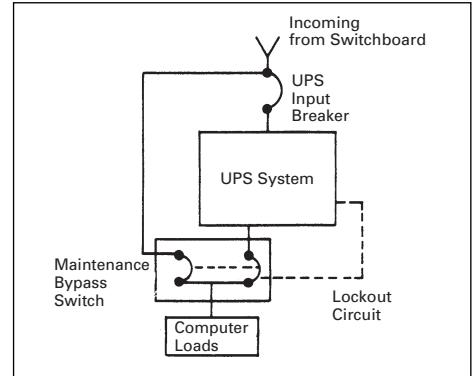
Features

- UL 1008 Listing – File E61639.
- Make before break electrical operation.
- Lockout circuit to be wired into the UPS bypass authorization.
- Pilot devices to show UPS position “Normal” and “Bypassed”.
- Pilot device to show “Lockout” enabled.
- Reliable manually initiated electrical operation.
- High interrupting ratings are standard.
- Molded case switch or circuit breaker designs are available.
- Solid neutral connections are standard.

Benefits

- Safe and reliable operation is ensured due to the simple and durable switching design.
- Unauthorized bypass is prevented by the need of UPS System to send the bypass authorized signal.

- 100% current ratings makes selection to the UPS kVA ratings easy to accomplish.
- Use of interrupting rating switches or breakers makes the maintenance bypass switches adaptable to systems with high levels of available fault current.



Single Line Diagram of Maintenance Bypass Switch

Manual/Non-Automatic Transfer Switches

Features

- Molded case switch power contact assemblies.
- Positive mechanical interlocking.
- Permanently affixed manual operating handle (MTHXFD and MTVX).
- Pushbutton operation (NTHSFD and NTVS).

Benefits

- High withstand, totally enclosed for maximum arc suppression and isolation during power transfer. Optional trip units offer system overcurrent protection.
- Prevents the paralleling of two sources of power. Types NTHSFD and NTVS are also electrically interlocked.
- Permits safe and convenient manual transfer of power.
- Allows transfer of power under load via external push button (NTHSFD and NTVS only) initiated operation.
- Type NTHSFD and NTVS can be easily upgraded to fully automatic operation.

Manual Single Handle Operated Transfer Switches

Engineered for those applications requiring manual transfer of power.



Type MTHXFD 100-150 Amperes

Manual Electrically Operated Non-Automatic Transfer Switches

Manually initiated, electrically operated switches for use in applications where an automatic load transfer is not necessary.



Type NTHSFD 100-150 Amperes



General Description

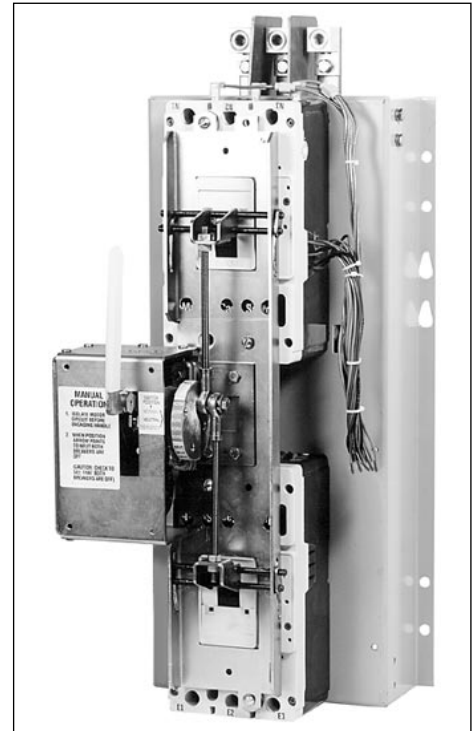
Manual/Non-Automatic Transfer Switches



Mechanical Interlock (Rear View, Power Panel)



Type NTVS 225-1000 Amperes
(1200-4000A Not Shown)



Type MTVX 225-1000 Amperes
(Dead Front Panel Removed)

Service Equipment Rated Transfer Switches

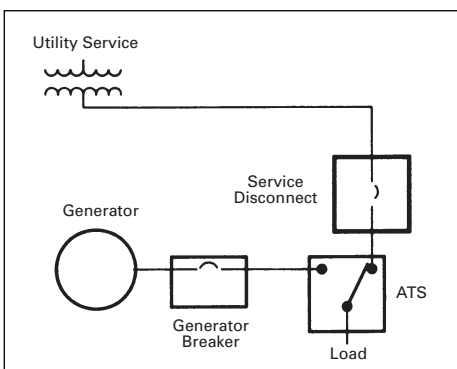


Service Entrance Control Panel

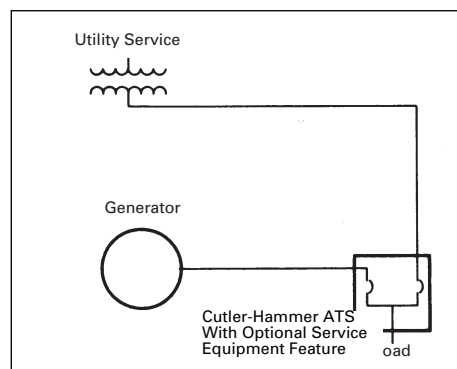
Cutler-Hammer Service Equipment Transfer Switches (Option 37) are the same as other transfer switch products with the addition of a service disconnect function accessible externally on the enclosure door. A two-position selector switch with padlockable cover permits load disconnecting with opening the enclosure door. The service equipment transfer switch is also equipped with external visual indication of the service disconnect position. Integral overcurrent protection (Option 16B) is also included with the service equipment transfer switch thereby eliminating the need for separate upstream protective devices.

Features

- Service disconnect function.
- Integral overcurrent protection.
- Totally integrated design.
- Increased system reliability.
- Solid-state IQ Transfer microprocessor logic design.
- Visible indication of service disconnected.
- Lockout in disconnected position.
- Ground fault protection available on all switch ratings – required by code on ratings 1000 amperes and above at 480V.
- Disconnecting neutral assembly.
- Molded case circuit breaker transfer switch.



Typical ATS Application



ATS Application with Optional Service Equipment Feature

Benefits

- Lockable disconnect permits safe downstream maintenance.
- Eliminates the need for separate upstream protective devices.
- Combined service disconnect, overcurrent protection, and transfer switch functions substantially reduce overall equipment and installation costs and saves space.
- Fewer components and power interconnections maximize circuit integrity and minimize maintenance requirements.
- Same rugged, time-proven design utilized on other Cutler-Hammer transfer switch products.

General Description

Style Number Selection Guide

The Style Selection Guide permits at-a-glance specification of custom Transfer Switch configurations to meet all application requirements.

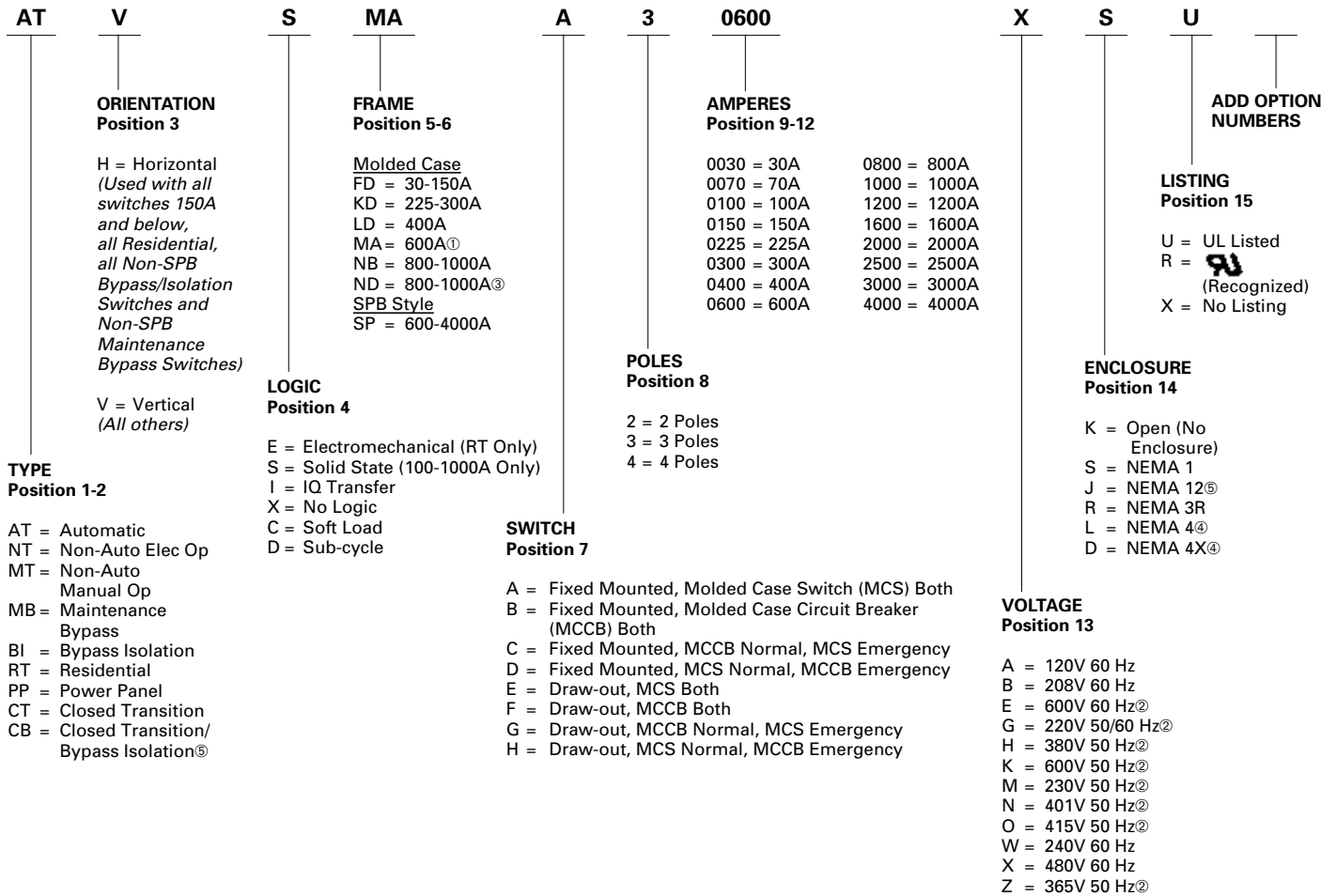
The Style Selection Guide allows the specifier to generate a 15-digit catalog number which represents ten basic style/feature categories:

- Type
- Orientation
- Logic
- Frame
- Switch
- Poles
- Ampere Rating
- Voltage
- Enclosure Type
- Listing

Each category is associated with a selection menu. By choosing the appropriate selection from the menu for each category in sequence and incorporating the associated selection code into the catalog number, the specifier constructs a unique catalog number which describes the desired switch configuration.

The catalog number can then be modified through the addition of appropriate option codes.

<p>Example 1:</p> <p>Solid-State Logic Automatic Transfer Switch, 480/277 V, 60 Hz, 3-Phase, 4-Wire, 3-Pole, 600-Ampere, UL 1008 listed, NEMA 3R enclosure with Options 1, 2B, 3, 4 and 5B.</p> <p>Specify Number: ATVSMAA30600XSU with Options 1, 2B, 3, 4 and 5B.</p>	<p>Example 2:</p> <p>Solid-State Logic Automatic Transfer Switch, 480/277V, 60 Hz, 3-Phase, 4-Wire, 3-Pole, 3000-Ampere UL 1008 Listed, NEMA 1 enclosure with Options 2B, 3, 4, 5B, 12C, 12D and 23J.</p> <p>Specify Number: ATVISPA33000XRU with Options 2B, 3, 4, 5B, 12C, 12D and 23J.</p>
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① With 4-pole, 600 amperes use NB.
 ② Not available with Relay Logic.
 ③ Contact factory for availability.
 ④ Not available on 100 kAIC rated SPB type switches.
 ⑤ Available with SPB style only.

Note: Standard generator option package 0G9 includes Options 1, 2b, 3, 4, 5b, 12C, 14C, 14D.

General Description

Optional Features for Automatic Transfer Switches

Optional Features/Accessories - Listed below are Optional Features/Accessories that will allow you to customize a Cutler-Hammer Automatic Transfer Switch to your particular application. All Features/Accessories are Underwriters Laboratories, Inc. listed unless noted otherwise.

1. **Time Delay Normal to Emergency (TDNE)** - Provides a time delay when transferring from the Normal Power Source to the Emergency/Standby Power Source. Timing begins when the source voltage of the emergency/standby power source appears. Adjustable 1 second - 64 minutes.
2. **Time Delay Engine Start (TDES)** - This option is for use when the Emergency/Standby Source is an engine generator. It delays initiation of the engine start circuit in order to override momentary power outages or voltage fluctuations of the normal power source.
 - B. Adjustable .5-15 seconds
 - C. Adjustable 4-120 seconds
3. **Time Delay Emergency to Normal (TDEN)** - Delays the transfer from the Emergency/Standby Power Source to the Normal Power Source to permit stabilization of the normal power source before retransfer is made. Timing begins when the Normal Power Source appears. If the Emergency/Standby Source fails during timing, transfer to the normal power source is immediate, overriding the time delay. Adjustable 1 second - 64 minutes.
4. **Time Delay Engine Cooldown (TDEC)** - Permits the generator to continue to run unloaded after retransfer to normal has occurred. Timing begins when transfer is made. Adjustable 1 second - 64 minutes.
5. **Emergency/Standby Source Monitoring** - Provides more precise voltage and/or frequency monitoring of the Emergency/Standby Power Source. Relay prevents transfer from the Normal Power Source to the Emergency/Standby Power Source until that source is within a pre-selected range. In addition, when the switch is in the Emergency/Standby position and that source falls outside the monitored parameters, a load transfer is initiated to the Normal Power Source if it is present.
 - B. Single-Phase Undervoltage/Under Frequency Monitor - Provides single-phase voltage/frequency sensing. Frequency sensing is set at 56 Hz Dropout and 58 Hz Pickup (60 Hz applications). Voltage sensing is set at 80% Dropout and 90% Pickup of nominal voltage.
 - C. Single-Phase Overvoltage/Over Frequency Monitor - Provides single-phase

voltage/frequency sensing. Frequency sensing is set at 64 Hz Dropout and 62 Hz Pickup (60 Hz applications). Voltage sensing is set at 115% Dropout and 110% Pickup of nominal voltage.

- D. Undervoltage Monitor - Provides adjustable single-phase voltage sensing, nominally set at 90% pickup, 80% dropout.
 - E. Overvoltage Monitor - Provides adjustable single-phase voltage sensing, nominally set at 115% pickup, 110% pickup.
 - F. Undervoltage Monitor - Provides adjustable three-phase voltage sensing, nominally set at 90% pickup, 80% dropout.
 - G. Overvoltage Monitor - Provides adjustable three-phase voltage sensing, nominally set at 115% pickup, 110% pickup.
 - H. Phase Reversal - Provides protection from reversal of phases on the Emergency side.
 - J. Three-Phase Undervoltage/Under Frequency - Provides three-phase voltage/frequency sensing. Frequency sensing is set at 56 Hz Dropout and 58 Hz Pickup (60 Hz applications). Voltage sensing is set at 80% Dropout and 90% Pickup of nominal voltage.
 - K. Three-Phase Overvoltage/Over Frequency - Provides three-phase voltage/frequency sensing. Frequency sensing is set at 64 Hz Dropout and 62 Hz Pickup (60 Hz applications). Voltage sensing is set at 115% Dropout and 110% Pickup of nominal voltage.
6. **Alternate Test Operators** All Cutler-Hammer Automatic Transfer Switches are supplied with a Test Pushbutton as a standard Feature/Accessory. When one of the following alternatives is selected, the Test Push Button is omitted.
- D. Test Selector Switch (TSS) - Provides a two-position maintained contact marked "AUTO", "TEST". Test operation of the Automatic Transfer Switch by simulating a loss of the Normal Power Source, causing the engine to start and initiate a load transfer to the Emergency/Standby Power Source.
 - H. Four-Position Test Selector Switch (FPSS) - Marked "Test", "Auto", "Engine Start", and "Off". Permits four modes of Transfer Switch operation. The "Test" position simulates a failure of the Normal Power Source and functions like the standard Test Selector Switch. The "Auto" position is the regular operational mode. The "Off" position de-energizes the control logic relays and opens the engine start circuit.

A white pilot light is provided to indicate that the FPSS is in the "Off" position. The "Engine Start" position provides testing of the engine start circuit by closing the engine starting contacts and allowing the engine to run unloaded.

8. **Transfer Time Delay Bypass** - Provides a manual pushbutton operated bypass on the TDNE (Optional Accessory 1) and/or the TDEN (Optional Accessory 3) function permitting the switch to be transferred to either Power Source without a time delay.
 - C. Bypass TDEN pushbutton (PBEN)
 - D. Bypass TDNE pushbutton (PBNE)
9. **Maintenance Selector Switch (MSS)** - Marked "OFF", "ON". Provides selector switch disconnection of control power to the Transfer Motor circuit thus allowing testing of the Transfer Switch Control logic circuitry without initiating load transfer. (Manual disconnection is standard on all Automatic Transfer Switches.) Positioning the MSS in the "Off" position isolates the control logic circuit from the Transfer Motor, permitting manual operation of the Transfer Switch or testing of logic circuitry without load transfer.
 - B. Maintained Contact MSS
10. **Preferred Source Selector Switch (PSSS)** - Permits the selection of either source as the "Preferred" source. Marked "SOURCE 1", "SOURCE 2".
 - B. PSSS for use on systems comprised of Dual Utility or Utility/Engine Generator power sources.
 - D. PSSS for use on systems comprised of Dual Engine Generator power sources. (Dual Engine starting circuits are provided when option/accessory 10D is selected.)

12. Indicating Lights

Switch Positions

- C. Green Pilot Light (NL) indicates that the load is connected to the Normal Power Source. Marked "NORMAL".
- D. Red Pilot Light (EL) indicates that the load is connected to the Emergency/Standby Power Source. Marked "EMERGENCY".

Source Availability

- G. White Pilot Light (SN) indicates voltage is present on the line side of the Normal Power Source. Marked "NORMAL SOURCE".
- H. White Pilot Light (SE) indicates voltage is present on the line side of the Emergency/Standby Power Source. Marked "EMERGENCY SOURCE".

General Description

Tripped Condition (Available only when integral overcurrent protection selected – Option 16). A common trip indicator light is provided as standard on SPB type switches (ATVISP, CTVISP, BIVISP, CBVISP, NTVSSP) when supplied with Option 16.

- L. Amber Pilot Light (TN) indicates overcurrent trip condition on normal side main contacts.
 - M. Amber Pilot Light (TE) indicates overcurrent trip condition on emergency side main contacts.
- 14. Relay Auxiliary Contacts** – Three Form C contacts are provided on all Automatic Transfer Switches utilizing solid-state logic sensing.
- C. Normal Source Relay Auxiliary Contacts (NRA) – Energized when the load is connected to the Normal Power Source Power Supply and Normal voltage is present.
 - D. Emergency/Standby Source Relay Auxiliary Contacts (ERA) – Energized whenever Emergency/Standby Source voltage is present.
- 16. Integral Overcurrent Protection** – Provides overcurrent protection integral to the Power Switching Device(s). Use of the option/accessory can, in many cases, eliminate the need for separate upstream, overcurrent/short circuit protection. In addition to overcurrent protection, for safety purposes, selection of this optional accessory also includes a lock-out function that prevents further automatic transfer operation until the appropriate source is manually reset. Units rated 1200 Amps and greater will also be supplied with an amber indicating light marked “Tripped Condition” indicating an overcurrent trip status. (See Options 12 L and M for trip lights on units 1000 Amps and below.)
- Thermal Magnetic Overcurrent Protection**
- B. Overcurrent Protection on Both Power Sources.
 - E. Overcurrent Protection on the Emergency/Standby Power Source only.
 - N. Overcurrent Protection on the Normal Power Source supply only.
- 17. Alternate High Withstand Power Switch**
- C. Increases withstand from 65 kA to 100 kA @ 480V for 600 through 1200 Amps. (Available on SPB type switches only.)
- 18. Metering and Communications**
- The IQ Family of microprocessor-based digital meters offers the latest technological advances in metering and communications functions for today’s complex

system designs. Line side voltage is monitored phase-to-phase and phase-to-neutral with 1% accuracy, and current is monitored from each phase of the connected load with 1% accuracy. Frequency is monitored from the line side of the source with .5% accuracy. The entire IQ Family is also available with remote monitoring and communications capabilities via the Cutler-Hammer Type IMPACC/PowerNet System. (For additional information, please refer to section B5).

IQ Generator – The IQ Generator is a microprocessor-based monitoring device that provides simultaneous current, voltage and frequency metering. Includes CTs, PTs and power module required for operation and can be supplied on the Normal Power Source, the Emergency/Standby Power Source, or with a selector switch allowing reading for both power sources.

- I. Normal
- J. Emergency
- K. Both N and E

IQDP4000 – The IQDP4000 is a microprocessor-based monitoring device that provides ammeters, voltmeter, wattmeter, watt-hour meters, and more. The IQDP4000 includes the CTs, PTs and power module required for operation and can be supplied on the normal or emergency/standby power.

- L. Normal
- M. Emergency
- N. Both N and E

P. IMPACC/PowerNet Communications – For applications requiring remote monitoring and/or communications capabilities

20. Rear Bus Provisions – Standard 30 – 1000 Ampere Cutler-Hammer Transfer Switches are assembled with front connected solderless lugs. Standard 1200-4000 Ampere Switches are assembled with rear connected solderless lugs.

- A. Rear Bus Provisions – Provide separate bus stabs extending to the rear from the line side of the Normal and Emergency/Standby Power Switching Devices as well as common load stabs, allowing the installer to connect his bus to the transfer switch.

21. Optional Terminals

- A. Refer to Wire Terminal Data, Page 307, to make the appropriate selection for your applications.

23. Plant Exerciser (PE)

Solid-state, digital clock timer provides means for automatic testing of the Emer-

gency/Standby Power Plant. This device is programmable to allow a maximum of 10 programs of automatic testing per week. Run time is fully adjustable with set points from 1 second to 168 hours.

- C. Engine Start/Run Only – Starts Emergency/Standby Power Plant and runs engine without load transfer. However, if the Normal Power Supply fails during the exercise period, load transfer will occur.
- D. Exercise With Load Transfer – Starts Emergency/Standby Power Plant and initiates load transfer. Automatically transfers back to the Normal Power Source at the end of the Exercise period.
- G. Exercise With or Without Load Transfer – Programmable to allow selection of Engine Start/Run only. Exercise with Load Transfer, or a complete bypass of the Exercise system. Includes selector switch marked “Engine Run”, “Bypass”, “Load Transfer”.
- I. Exercise with Load Transfer and Failsafe Feature – Similar to Optional Accessory 23D except with Failsafe Feature. This feature provides an immediate transfer to the Normal Power Source if Emergency/Standby Power Source fails during exercising period.
- J. Exercise With or Without Load Transfer and Failsafe Feature – Similar to Optional Accessory 23G except with Failsafe Feature. If the Emergency/Standby Power Source should fail while Exercising in the “Load Transfer” mode, an immediate retransfer to the Normal Power Supply will occur.

24. Battery Charger (BC)

Fully automatic 5-ampere float battery charger for engine cranking batteries. Uses ferroresonant transformer technology which is self-regulating and completely devoid of any complicated switching circuits. The charger comes in its own #304 stainless steel housing for separate mounting and includes a DC Ammeter allowing instant visual identification of charger output status. Unit requires a separate 100-135 VAC/60 Hz power supply for hookup.

- C. Battery Charger with 12 Vdc output
- D. Battery Charger with 24 Vdc output

26. Type of Protection (Normal Source)

Full phase protection is standard. A voltage sensing relay monitors each phase of the normal power supply. Normally set at 80% dropout and 90% pickup.

- C. Overvoltage Monitor – Provides three-phase voltage sensing. Set at 115% Dropout and 110% Pickup of nominal voltage. Adjustable over a wide range of settings.

General Description

- D. Area Protection (Interruptible Rate) Connections With Override Circuit – Provides two terminal blocks for connection of one or more NO (open when there is no voltage) area protection contacts; these terminal blocks are wired in the same manner as the test switch and when the NO area protection contact opens, the switch initiates engine start and will transfer to Emergency Power Source. In the event that the NO area protection contact remains open and the Emergency Source fails when the switch is in the Emergency position, an override circuit will retransfer the switch to the Normal Source if it is available.
- E. Under frequency, adjustable 45-60 Hz (drops out 2 Hz lower than setting). A frequency sensing relay is connected to 1 phase only of the Normal Source, constantly monitoring that phase.
- F. Over frequency, adjustable 50-65 Hz (Drops out 2 Hz above setting). A frequency sensing relay is connected to 1 phase only of the Normal Source, constantly monitoring that phase.
- G. Phase Reversal – Provides protection from reversal of phases on the Normal side.

29. Type of Operation

- A. Automatic operation is standard. Provides for automatic transfer and retransfer from source to source as dictated by the reset values of the transfer switch intelligence circuits.
- E. Push button to return to normal. Automatic operation Normal to Emergency. Pushbutton operation Emergency to Normal. Includes failsafe feature providing immediate retransfer to Normal if Emergency fails while in that position.
- * G. Automatic/Manual Operation. Two-position selector switch (marked Auto/Manual) permits selection of Automatic or Manual operation. Includes pushbuttons for manual operation when selector switch is in the manual position.
- J. Automatic/Pushbutton Operation Return to Normal. Two-position selector (marked Auto/Manual) permits selection of automatic or pushbutton operation Emergency to Normal, automatic Normal to Emergency. Includes Option 29E which only operates to return to Normal when the switch is in the manual mode.

*ATS must be labeled as non-automatic-transfer switch equipment.

30. Cranking Limiter

- A. Adjustable 0-120 seconds. Interrupts engine start circuit if voltage does not appear within preselected time.

32. Inductive Load Transfer

- A. Delayed transition – Time Delay provides a time delay in the Neutral (OFF) position when the load is transferred in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads. Utilizes one normally open breaker contact.
- B. Delayed Transition – Load Voltage Decay Provides a delay in the neutral (OFF) position based on measured load voltage (adjustable between 10 and 30% of nominal system voltage) when the load is transferred in either direction to prevent excessive inrush currents due to out of phase switching of large inductive loads.

Note: Only available on transfer switches with IQ Transfer logic.

- C. In-Phase Monitor minimizes the possibility of excessive inrush currents caused by an out-of-phase transfer by only allowing a transfer when the two sources are in synchronization. This option does not control the generator governor or regulator, and therefore depends on the coincidental synchronization of the sources.

Note: Only available on transfer switches with IQ Transfer logic.

- D. In-Phase/Time Delay Neutral. In-phase transition is a feature that will allow a transfer between two live sources only when the phase difference between the two sources is near zero. This is an open transition transfer that prevents inrush currents from exceeding normal starting currents in the case where motor loads are being transferred.

Time Delay Neutral provides a time delay in the transfer switch Neutral position when both breakers are open. This delay takes place when the load is transferred in either direction to prevent excessive inrush currents due to out-of-phase switching of large motor loads. This feature is not available with the Time Delay Neutral Load (TDNLD) feature.

33. Shunt Trip

Wired to terminal blocks for customer connection.

- A. Supplied in normal side
- B. Supplied in emergency side

34. Extender Cable

Permits remote mounting of intelligence circuitry to accommodate limited space applications.

- A. 48 inches
- B. 72 inches
- C. 96 inches
- D. 120 inches
- E. 144 inches

35. Pre-Transfer Signal Device

Contacts open/close on a timed basis (adjustable 0-120 seconds) to allow the load to be de-energized prior to transfer in either direction. (Typically used in conjunction with elevator controls.)

- A. Form C contacts (2NO, 2NC)

36. Load Shed From Emergency – Provides for accepting customer supplied external dry contact closure which will initiate a transfer operation from the connected emergency position to a both off position for as long as customer signal is present. If normal returns, transfer to the normal position is permitted. This option is often desirable where multiple engines are feeding a common emergency bus.

37. Service Equipment Rated Transfer Switches

See page 302 for detailed description.

- A. SE, rated without GFP
- B. SE, rated with GFP

41. Space Heater with Thermostat

- A. 100W
- B. 200W
- C. 400W

42. Seismic Certification

Unit is certified for application in seismic Zone 4 under both the California Building Code, the Uniform Building Code and BOCA. Transfer Switches shipped to those Zip Codes in the United States of America, and possessions, which are located in Zone 4 areas are automatically certified, and are furnished with any special installation instructions to meet the requirements. Customers desiring seismic certification that are not in these pre-determined areas may request this option on order entry.

45. Load Sequencing After Transfer

Provides time sequenced contacts to start individual loads following transfer to a source in order to step load the source, and minimize the effects of high starting currents.

General Description

47. Closed Transition

C. Closed/In-phase Transition/Time Delay Neutral Load Sense. Closed Transition is a feature that will temporarily parallel two live sources in a make-before-break scheme when performing a transfer. This achieves a transfer between sources with no power interruption. Both sources must be synchronized in frequency, phase, and voltage before the transfer is initiated.

In-phase Transition is a feature that will allow a transfer between two live sources only when the phase difference between the two sources is near zero. This is an open transition transfer that prevents inrush currents from exceeding normal starting currents in the case where motor loads are being transferred.

Time Delay Load Voltage Decay utilizes the load voltage measurements to sense back EMF that is generated when the transfer switch is in the Neutral position. It provides a delay in transfer in either

direction if an unacceptable level is sensed as established by a customer programmed level. The transfer will not take place until the back EMF decays below the acceptable programmed level. This feature has a separate setting of enabling or disabling the operation. If disabled, the transfer switch will not delay in the Neutral position and will transfer between the sources as fast as possible. This feature is not available with the Time Delay Neutral Optional Feature 32A.

D. Closed Transition. Closed Transition is a feature that will temporarily parallel two live sources in a make-before-break scheme when performing a transfer. This achieves a transfer between sources with no power interruption. Both sources must be synchronized in frequency, phase, and voltage before the transfer is initiated.

If the logic is forced into a fail safe mode (i.e., loss of connected source), the logic will perform a load voltage decay open transfer.

E. Closed/In-phase Transition/Time Delay Neutral. Closed Transition is a feature that will temporarily parallel two live sources in a make-before-break scheme when performing a transfer. This achieves a transfer between sources with no power interruption. Both sources must be synchronized in frequency, phase, and voltage before the transfer is initiated.

In-phase Transition is a feature that will allow a transfer between two live sources only when the phase difference between the two sources is near zero. This is an open transition transfer that prevents inrush currents from exceeding normal starting currents in the case where motor loads are being transferred.

Time Delay Neutral provides a time delay in the transfer switch neutral position when both breakers are open. This delay takes place when the load is transferred in either direction to prevent excessive inrush currents due to out-of-phase switching of large motor loads.

Technical Data

Coordinated Withstand, Closing and Interrupting Ratings for Cutler-Hammer Transfer Switch Equipment

Series Equipment Rating – Symmetrical Amperes

Chart shows upstream breaker type that can be applied to attain rating. Size in accordance with the NEC.

Table 1: 208-240 Vac

Transfer Switch Rating	65 kA	85 kA	100 kA	200 kA
30-100	FD JD		HFD HJD	FDC JDC KDC
150-300	JD KD		HJD HKD NB Tri-pac ^①	FDC JDC KDC
400	KD LD		HKD HLD NB Tri-pac ^①	
600	HLC HMC		HLD NB Tri-pac ^②	
800-1000	HMC, PB-P ^③ HNC RD			
1200-1600	DS ^④		SPB ^④	
1600-3000	DS ^④ 1600-2000A	DS ^④ 2500-3000A	SPB ^④	
4000			SPB ^④ DS ^④	

- ① With P12 Limiter.
- ② With P20 Limiter.
- ③ With PR20 Limiter.
- ④ Can coordinate with a Power Breaker short time rating for up to 30 cycles (1200-3000A-50 kA) (4000A-85 kA).

Table 2: 480 Vac

Transfer Switch Rating	35	50	65	85	100	150	200
30-100			HFD HJD HKD		FDC JDC KDC	FCL LCL	FB Tri-pac ^①
150-300			HFD HJD HKD		FDC JDC KDC	FLC LCL	LA Tri-pac ^②
400	KD/LD	HMC	HKD/HLD		KDC/LDC		
600	HLC	HMC			NB Tri-pac ^③		
800-1000		HNC RD			PB Tri-pac ^④		
1200-1600		DS ^⑤			SPB ^⑤ PC		PB Tri-pac ^④
1600-3000			DS ^⑤		SPB ^⑤ PC		
4000				DS ^⑤	SPB ^⑤		

- ① With P06 Limiter.
- ② With P10 Limiter.
- ③ With P12 Limiter.
- ④ With PR20 Limiter.
- ⑤ Can coordinate with a Power Breaker short time rating for up to 30 cycles (1200-3000A-50 kA) (4000A-85 kA).

Table 3: UL 1008 Maximum Withstand, Closing and Interrupting Ratings – All Products ①②

Transfer Switch Amp Rating	Rating When Used With Upstream Circuit Breaker			Rating When Used With Upstream Fuse		
	240V (kA)	480V (kA)	600V (kA)	Maximum Fuse Rating	Fuse Type	600V max. (kA)
30	100	65	25	200	J, T, R ^④	200
70	100	65	25	200	J, T, R ^④	200
100	100	65	25	200	J, T, R ^④	200
150	100	65	25	400	J, T, R ^④	200
225	100	65	25	400	J, T, R ^④	200
300	100	65	25	400	J, T, R ^④	200
400	100	65	25	600	J, T	200
600	65	50 ^{③⑤⑥}	25	800/1200	L	100/200
800	65	50 ^{③⑤⑥}	25	1200/1600	L	100/200
1000	65	50 ^{③⑤⑥}	25	1600	L	200
1200	85	65 ^⑥	85	2000	L	200
1600	100	100	85	3000	L	200
2000	100	100	85	3000	L	200
2500	100	100	85	4000	L	200
3000	100	100	85	4000	L	200
4000	100	100	85	5000 ^⑦	L	200

- ① Tested in accordance with UL 1008.
- ② For maximum breaker rating in circuits where the transfer switch is evaluated as a "motor branch circuit conductor" refer to the NEC Section 430-25 for sizing.
- ③ 4-pole units are rated 35 kA.
- ④ 100 kA @ 480V.
- ⑤ 65 kAIC for mini-SPB.
- ⑥ 100 kAIC for SPB with Option 17C.
- ⑦ Cutler-Hammer Class L Fuse only for 5000A rating.

Table 4: Wire Size Data for Power Cable Connections

Switch Rating (Amps)	Cables Per Phase	Range of Wiring Size ①	Type of Conductor
30-100	1	#4-1/0	Cu/Al
150	1	#4-4/0	Cu/Al
225-300	1	#3-350 kcmil	Cu/Al
400	2	250-350 kcmil	Cu/Al
600 ^{①②}	2	#1-500 kcmil	Cu/Al
800	3	3/0-400 kcmil	Cu/Al
1000	4	4/0-500 kcmil	Cu/Al
1200	4	4/0-500 kcmil	Cu/Al
1600-2000	8	4/0-500 kcmil	Cu/Al
2500-3000	12	4/0-500 kcmil	Cu/Al
4000	16	4/0-500 kcmil	Cu/Al

- ① For alternative lugs, please contact Cutler-Hammer.
- ② Standard wire size for 4-pole is 3/0-400 kcmil.

Layout Dimensions, Enclosed Units

Automatic and Manual/Non-Automatic Transfer Switches

Types ATVS, ATVI Automatic
Types MTVX and NTVS Manual
225-1000 Amperes

Types ATHSFD, ATHIFD Automatic
Type NTHSFD Non-Automatic
30-150 Amperes

Logic Panel	38 in. H x 11 in. W x 6.5 in. D
Transformer Panel	22 in. H x 16.5 in. W x 6.5 in. D (30-150A) 28.63 in. H x 8.25 in. W x 5.5 in. D (225-1000A)

	Approximate Shipping Weight (Lbs.)	
30-150A	210	
225-300A	380	
400A	430	
600A	525	
800-1000A	610	

Breaker Type	Power Panel			Enclosure			Conduit Area			Bolt Pattern	
	Height (In.)	Width (In.)	Depth (In.) ^③	Height (In.)	Width (In.)	Depth (In.) ^④	Width (In.)	Depth (In.)	Bending (In.)	Horizontal (In.)	Vertical (In.)
				A	B	C	D	E	F	G	H
FD (30-150A)	11.00	17.00	6.81	44	21	18.13	21	14.5	4	11.00	42.86
KD (225A)	24.50	11.88	17.5	44	21	19.63	8	4.00	6	11.00	42.86
KD (300A)	24.50	11.88	17.5	52	21	19.63	8	4.00	9	11.00	50.86
LD (400A)	26.00	16.88	17.5	61	26	19.63	8	4.00	11	16.00	59.86
MA (600A)	36.25	16.88	17.5	73	26	20.63	8	4.75	12	16.00	71.86
NB (800A)	36.25	16.88	19.0	79	26	20.63	8	4.75	15	16.00	77.86
NB (1000A)	36.25	16.88	19.0	79	26	20.63	8	4.75	15	16.00	77.86
ND (800A)	36.25	16.88	19.0	79	26	20.63	8	4.75	15	16.00	77.86
ND (1000A)	36.25	16.88	19.0	79	26	20.63	8	4.75	15	16.00	77.86

① Device panel supplied to house required pilot control devices (lights, selector switches, etc.).
② Manual (except 100-150A, top of page) and non-automatic switch enclosure dimensions same as automatic.
③ Depth includes the interior handle extended.
④ Enclosure depth includes the exterior (or door) handle.

Automatic and Non-Automatic Transfer Switches

Type ATVISP Mini-SPB Automatic
Type NTVSSP Mini-SPB Non-Automatic
600-1200 Amperes

Transfer Switch Rating	Approximate Shipping Weight (Lbs.)
3-Pole, 600-1200A	850
4-Pole, 600-1200A	950

Dimensions are in inches.

Layout Dimensions, Enclosed Units

Automatic and Non-Automatic Transfer Switches

Type ATVISP SPB Automatic
 Type NTVSSP SPB Non-Automatic
 1600-4000 Amperes (Fixed Mounted)®
 800-4000 Amperes (Draw-out)

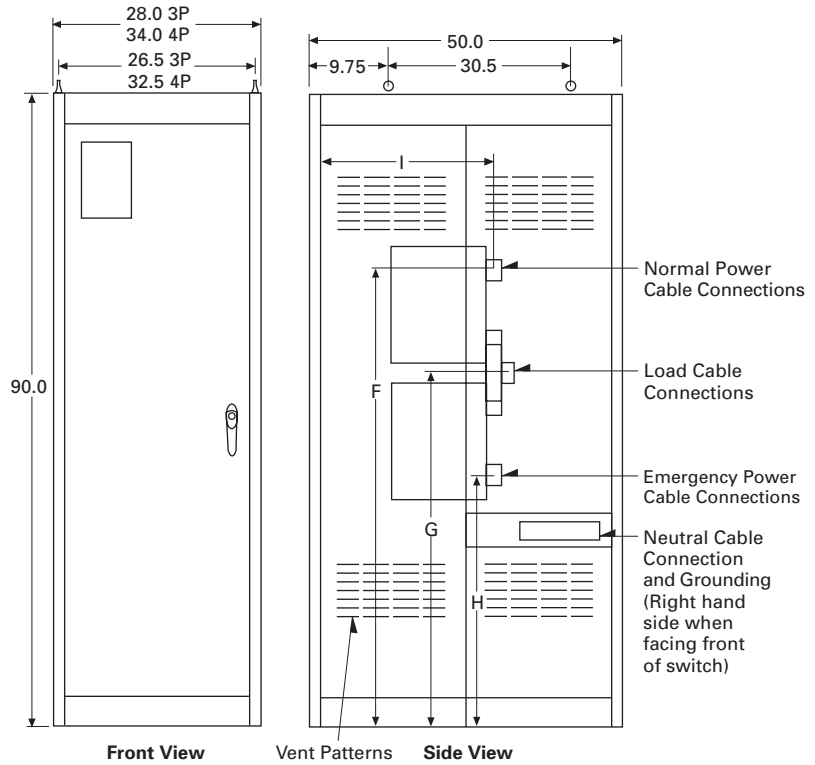
Maintenance Bypass Switches

Type MBVE
 1200-4000 Amperes (Fixed Mounted)

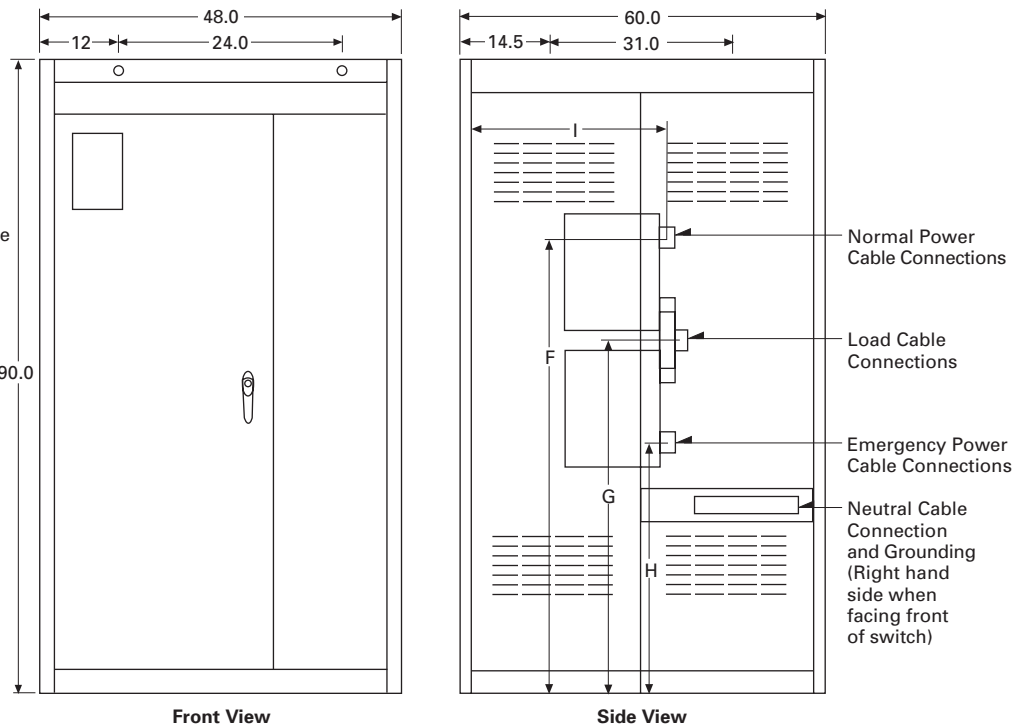
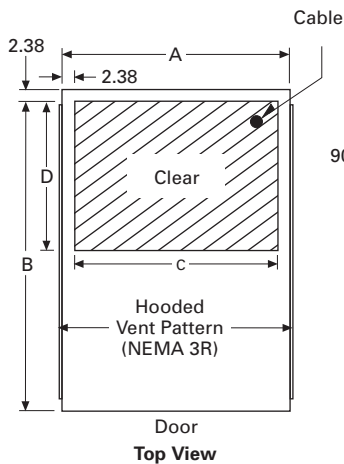
Transfer Switch Rating	Dimensions and Conduit Opening in Inches	Dimensions and Conduit Opening in Inches				Weight Lbs.
		A	B	C	D	
3-Pole 800-1200①	Fixed	28.00	50.00	23.50	22.00	1300
4-Pole 800-1200①	Fixed	34.00	50.00	29.50	22.00	1400
3-Pole 2500-4000A	Fixed	40.00	60.00	43.25	22.00	1900
4-Pole 2500-4000A	Fixed	48.00	60.00	43.25	22.00	2100

Transfer Switch Rating	Dimensions in Inches	Dimensions in Inches			
		F	G	H	I
2000A	Fixed	71.00	54.50	38.00	29.54
3000A	Fixed	67.00	47.00	27.00	36.09
4000A	Fixed	69.12	45.12	21.12	33.16

800-2000 amperes, 3- or 4-poles
 800-1200 only if Option 17C is selected



2500-4000 amperes, 3-poles
 2500-3000 amperes, 4-poles



① 800-1200 ampere supplied with Option 17C.

Dimensions are in inches.

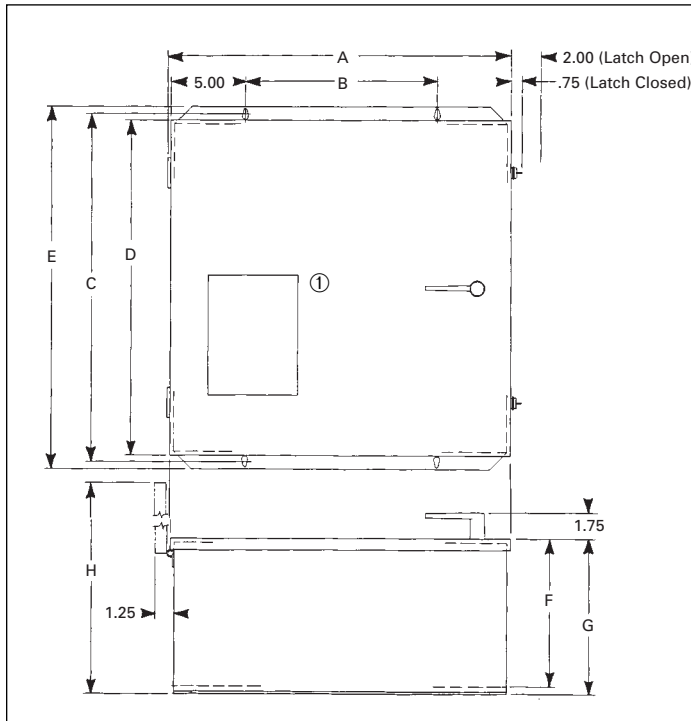
Layout Dimensions, Enclosed Units

Manual Transfer Switches

Type MTHXFD
100-150 Amperes

Maintenance Bypass Switches

Type MBHE
100-1000 Amperes

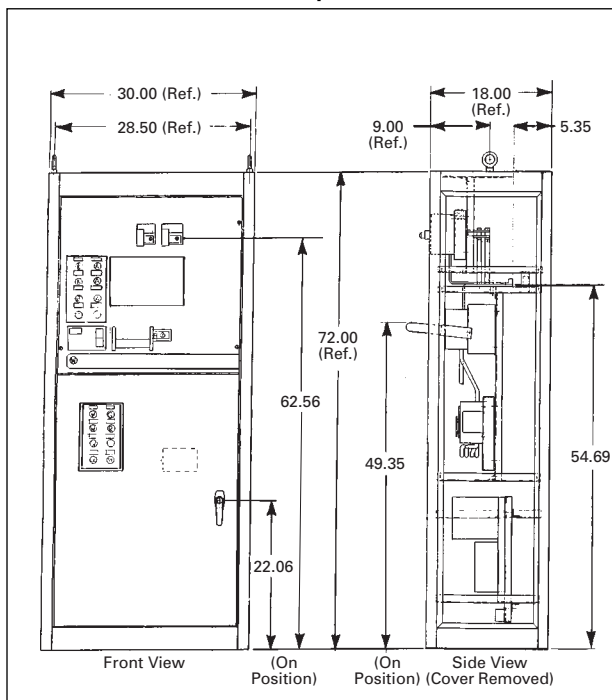


	A	B	C	D	E	F	G	H
100-150 Amps	22.88	13.13	22.74	22.62	24.50	9.78	10.28	32.31
225-300 Amps	38.88	29.13	35.74	35.62	37.50	17.28	17.78	55.81
400 Amps	38.88	29.13	35.74	35.62	37.50	17.28	17.78	55.81
600 Amps	38.88	29.13	49.74	49.62	51.50	17.28	17.78	55.81
800 Amps	38.88	29.13	49.74	49.62	51.50	17.28	17.78	55.81
1000 Amps	38.88	29.13	59.74	59.62	61.50	17.28	17.78	55.81

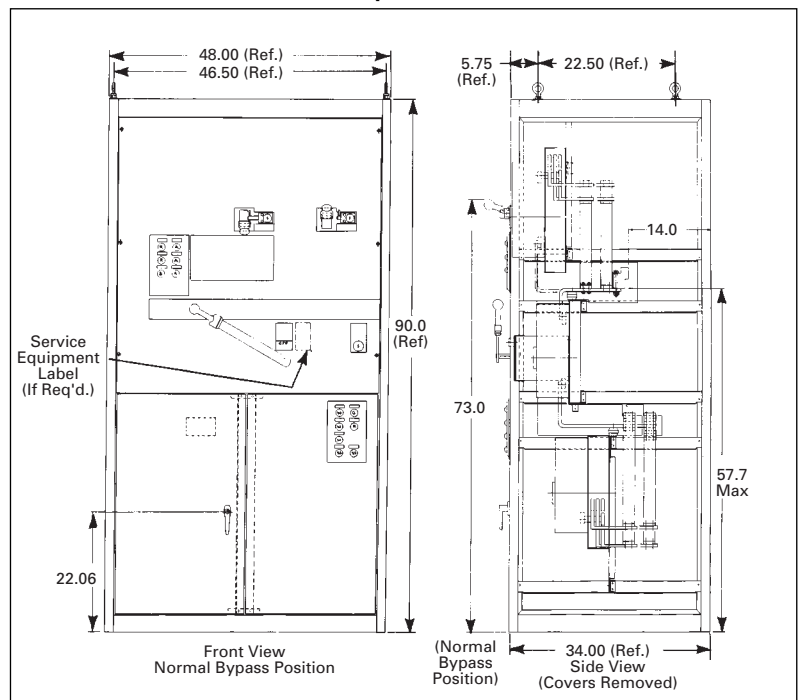
Bypass Isolation Automatic Transfer Switches

Type BIHI
100-1000 Amperes

Enclosure Dimensions 100 Amperes



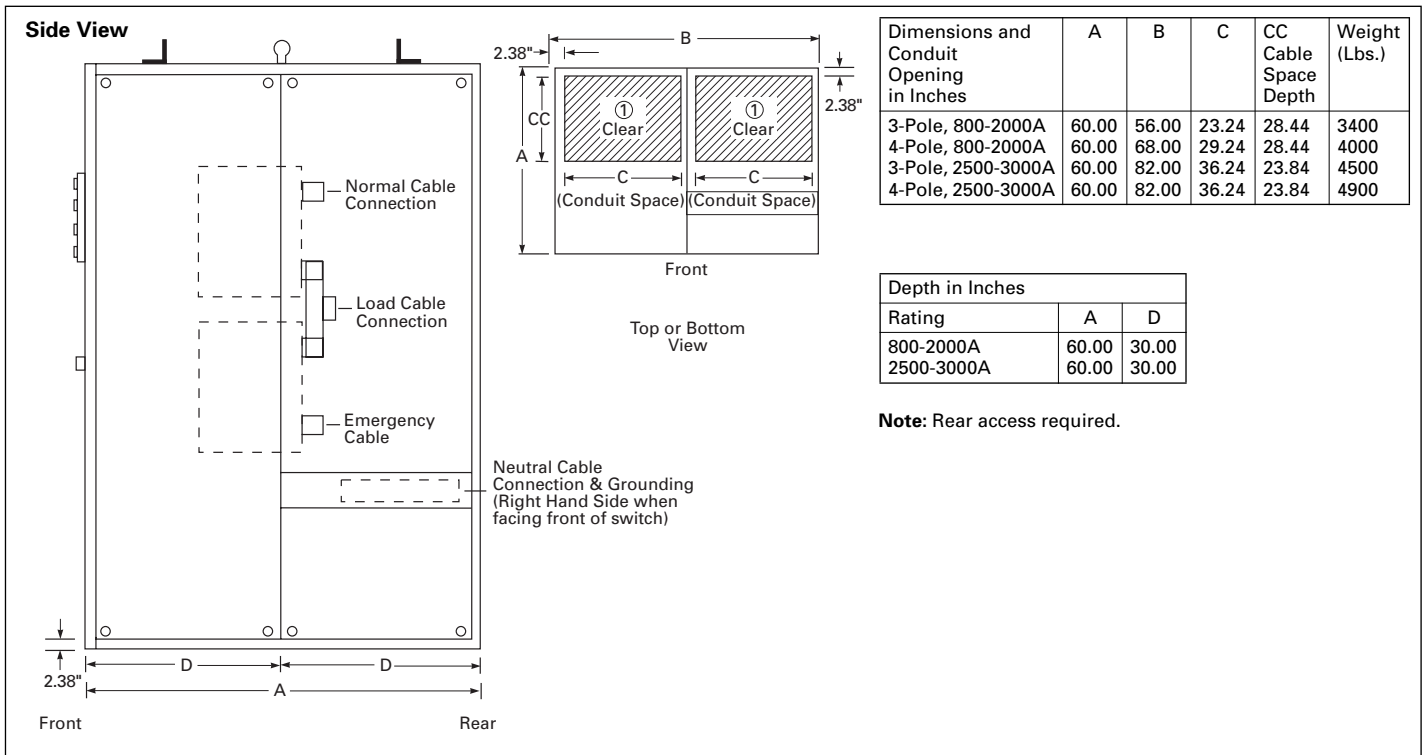
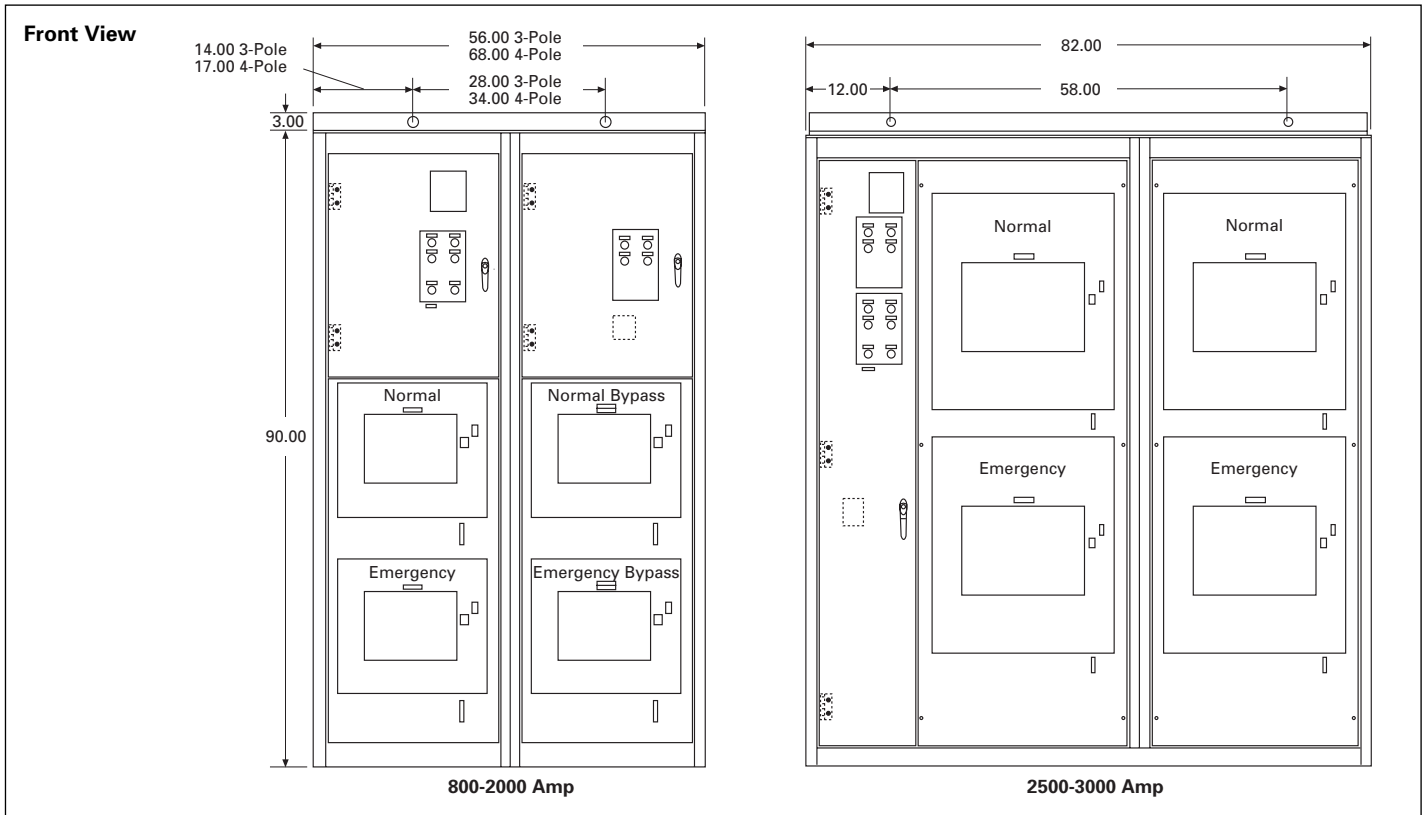
Enclosure Dimensions 150-1000 Amperes



Layout Dimensions, Enclosed Units

Bypass Isolation Automatic Transfer Switches

Type BIVISP SPB Draw-out
800-3000 Amperes



K

Low-Voltage Automatic Transfer Switches – Typical Specifications (Open Transition)

Ratings

- A. The transfer switch shall have withstand, closing and interrupting ratings of _____ amperes.
- B. The voltage rating of the transfer switch shall be no less than the system voltage rating. The continuous current rating of the transfer switch shall be no less than the maximum continuous current requirements of the system.
- C. The transfer switch shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL 1008 for emergency system total load.
- D. All pilot devices and relays shall be of the industrial type with self-cleaning contacts and rated 10 amperes.
- E. The automatic transfer switches shall be fully rated to protect all types of loads, inductive and resistive, from loss of continuity of power, without derating, either open or enclosed. (Optional)
- F. Transfer switches shall have a minimum 60-cycle withstand rating of 51 kA. The transfer switch shall be rated for application with upstream power circuit breakers and insulated case circuit breakers having short-time delay settings of up to 30 cycles. Contacts shall not weld when used with upstream overcurrent protective devices that do not incorporate instantaneous trip units.

Construction

- A. The transfer switches shall consist of completely enclosed contact assemblies and a separate control logic panel. The contact assemblies shall be operated by a non-fused motor operator or stored energy mechanism and be energized only momentarily during transfer, providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.
- B. Transfer switches shall be capable of being operated manually under full load conditions. Manual operation shall be accomplished via a permanently affixed manual operator or integrally mounted pushbutton operators located on the face of the contact assemblies. Removable manual operating handles and handles which move in the event that electrical operators should suddenly become energized while performing a manual transfer operation are not acceptable. The manual operator shall provide the same contact-to-contact transfer time as provided under normal automatic operation to prevent possible flashovers from switching the main contacts slowly. In addition, provisions shall be made to allow disengagement of the electrical operator during manual operation.

- C. Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. Main contacts shall be mechanically locked in position in both normal and emergency positions. A neutral position shall not be possible under normal electrical operation unless a delayed transition accessory is required for switching highly inductive loads. Each transfer switch shall have a manual neutral position for load circuit maintenance. A transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.
- D. All three-phase four-wire transfer switches used on systems with ground fault equipment shall be true four-pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft. The fourth (neutral) pole contacts shall be of identical construction as, and operate simultaneously with, the main power contacts. Add-on or overlapping neutral contacts are not acceptable.
- E. An electronic sensing and control logic panel shall be separately mounted from the power switching portion of the transfer switch. The two sections shall be connected by control cables with plug-in connectors. The control section shall be capable of being disconnected from the power section for maintenance purposes.
- F. The logic circuit shall utilize electronic components mounted on printed circuit boards to accomplish functions such as timing, time delays, and voltage and frequency monitoring. LEDs shall be furnished to indicate the operation of each solid-state function. Modifications shall be available for field installation without voiding the UL label.
- G. The transfer switch shall be equipped with a voltage selection plug making it suitable for operation on standard voltages from 208 through 600 volts ac, 50 or 60 Hertz, by placing the voltage selection plug in the proper voltage receptacle.
- H. Where shown on the drawings, transfer switches applied as service entrance switches shall be provided with overcurrent trip units and a service entrance label. An external key-operated selector switch shall be provided to disconnect the power supplies. Indicators shall be provided to show the availability of each source as well as breakers in a tripped or disconnected position. Provide a neutral disconnect link for three-pole solid neutral switches, and a neutral-to-ground main bonding jumper for all switches to meet UL service entrance requirements. Ground fault protection shall be provided for all switches

rated 1000 amperes or more applied on 480Y/277-volts ac systems in accordance with NEC Article 230-95.

Drawout Design

- A. Where indicated on the drawings, the transfer switches shall be provided with a drawout mechanism to allow easy access to the molded case switches (insulated case breakers) for preventive maintenance, testing or inspection. The drawout mechanism shall provide visual indicators as to position of the switch/breaker during the drawout operation.

Wiring/Terminations

- A. Terminal blocks shall conform to NEMA ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. The main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.

Sequence of Operation

- A. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of its normal or preferred source.
- B. Upon loss of phase-to-phase voltage of the normal source to 80% of nominal, and after a time delay, adjustable from 0.5 to 15 seconds, to override momentary dips and/or outages, a 10-ampere, 30-Vdc contact shall close to initiate starting of the emergency or standby source power plant. Transfer to the alternate source shall take place immediately upon attainment of 90% of rated voltage and frequency of that source. For switches not involving engine generator sets as power plants, transfer shall occur after an adjustable time delay of 1 to 60 seconds to override momentary dips and outages.
- C. When the normal source has been restored to 90% of rated voltage, and after a time delay, adjustable from 0.5 to 32 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.
- D. A time delay, adjustable from 0.5 to 32 minutes, shall delay shutdown of the emergency or standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.
- E. If the emergency or standby power should fail while carrying the load, transfer to the normal power supply shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

Low-Voltage Automatic Transfer Switches – Typical Specifications (Open Transition)

Customer Metering

A. Where indicated on the drawings, provide a separate customer metering compartment with front hinged door and include the following:

1. Current transformers where shown on the drawings or elsewhere specified shall be wired to shorting-type terminal blocks.
2. [Potential transformers including primary and secondary fuses with disconnecting means] [Fused potential taps as the potential source] for metering as shown on the drawings.

Select devices as required for item B. Refer to section B for detailed specification for metering as follows:

IQ Generator

IQ DP-4000

IQ Analyzer

B. Microprocessor-Based Metering System

Enclosure

A. Each transfer switch shall be provided in enclosures suitable for locations as indicated on the drawings and as described below.

1. NEMA 1 surface or flush mounted general purpose enclosures primarily intended for indoor use.
2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping noncorrosive liquids.
3. NEMA 3R raintight enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
4. NEMA 4 and NEMA 4X (stainless steel) watertight enclosures intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation.

Finish

A. NEMA 1, 12 or 3R enclosures shall be painted with the manufacturer's standard painting procedures to ensure suitability for environmental conditions as referenced in the plans. Color shall be light gray ANSI 61. NEMA 4 or 4X shall be stainless steel, non-painted.

Accessories

A. The following logic and options shall be supplied:

1. The logic of the transfer switch shall function via a microprocessor. Where shown on the drawings provide electronic transfer device equal to Cutler-Hammer type IQ Transfer. The set points shall be field adjustable without the use of special tools. The switch shall have a multi-tap voltage selection plug for ease of voltage adjustment in the field. LED lights shall be included on the exterior of the switch to show:

Normal Source Available
Emergency Source Available
Normal Source Connected
Emergency Source Connected
Load Energized.

A digital readout shall display each option as it is functioning. Readouts shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the microprocessor shall display the timer counting down. All set points can be reprogrammed from the front of the switch when the switch is in the program mode. A test pushbutton shall be included as part of the microprocessor. The microprocessor shall be compatible with a Cutler-Hammer IMPACC/PowerNet communications system. The switch shall include the following:

- a. Provide a time delay transfer from the normal power source to the emergency power source (0 seconds to 30 minutes). This option does not affect the engine start circuit.
- b. Provide a timer to override a momentary power outage or voltage fluctuation (0 seconds to 120 seconds).
- c. Provide a time delay transfer from the emergency power source to the normal power source (0 seconds to 30 minutes).
- d. Provide a timer to allow the generator to run unloaded after retransfer to the normal power supply (1 second to 30 minutes).
- e. Provide single-phase undervoltage and underfrequency sensing on the emergency power source. Voltage shall be factory set at 90% pickup and 80% dropout. Frequency sensing shall be set at 58-hertz pickup and 56-hertz dropout.
- f. Provide a pilot light to indicate that the switch is in the normal position as an integral part of the microprocessor.

g. Provide a pilot light to indicate that the switch is in the emergency position as an integral part of the microprocessor.

h. Provide a pilot light to indicate that the normal power is available as an integral part of the microprocessor.

i. Provide a pilot light to indicate that the emergency power is available as an integral part of the microprocessor.

j. Provide auxiliary relay contacts that are energized when the power is available on the normal source.

k. Provide auxiliary relay contacts that are energized when the power is available on the emergency source.

B. The following features shall be provided:

1. Time delay normal to emergency, adjustable
2. Time delay emergency to normal, adjustable
3. Green pilot light to indicate switch in normal position and red pilot light to indicate switch in emergency position
4. White pilot lights marked "Normal Source" and "Emergency Source" to indicate that respective source voltages are available
5. Tripped position indicating lights for both sources
6. Relay auxiliary contacts (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.

C. When the alternate source is an engine generator, the following features shall also be provided:

1. Time delay engine start, adjustable
2. Time delay engine cool off, adjustable
3. Engine start contact
4. Frequency/voltage relay for emergency source, frequency adjustable from 45 to 60 Hz and voltage fixed at 90% pickup, 70% dropout
5. Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads

Low-Voltage Automatic Transfer Switches – Typical Specifications (Open Transition)

- 6. Four-position selector switch permitting four (4) modes of transfer switch operation: TEST (simulates normal power outage), AUTO (standard automatic operation), OFF (de-energizes control relays and opens the engine start circuit for maintenance purposes), ENGINE START (retains transfer switch in normal position and initiates a testing of the engine start circuit). Furnish white pilot light for OFF indication.
 - D. A transfer switch position indicator shall be visible from the front of the switch.
 - E. Provide load sequencing (0 to 10 devices).
 - F. Provide plant exerciser (selectable load no-load transfer).
 - G. Provide preferred source selector (source 1 or source 2, or none).
- Communications**
- A. Where shown on the drawings, provide in the transfer switch a microprocessor-based unit capable of communicating phase and ground current, peak demand, present demand, energy consumption, contact status, and mode of trip. The transfer switch shall respond to open and close commands from a master control unit via a communications network. Communication network shall be Cutler-Hammer IMPACC/PowerNet.
 - B. Provide communications capability to monitor the normal and emergency switch position and normal and emergency source availability. Additional communications capability shall be provided to bypass time delays during transfer or retransfer, and to initiate engine start for no-load or load testing of the transfer switch from a remote master computer.

Low-Voltage Automatic Transfer Switches – Typical Specifications (Closed Transition)

Products**Mechanically Held Transfer Switch**

- A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a stored energy mechanism, with a non-fused motor used for charging the mechanism.
- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contact assemblies shall be completely enclosed, of silver composition and shall not weld when used with the upstream overcurrent protective device shown on the plans and with the available fault current as specified.
- D. Main contact assemblies shall have published extended withstand, closing and interrupting ratings for maximum system coordination, so that the transfer switch may be applied with an upstream protective device having a short-time interrupting rating. Transfer switches having three-cycle only withstand ratings shall not be acceptable.
- E. The transfer switch shall be capable of being safely operated manually under load. Provisions shall be provided to allow disengagement of the electrical operator during manual operation. Manual operation shall not allow “teasing” of the contacts which may result in welding, or flashover from switching the contacts slowly. CTTS designs not capable of manual transfer under load shall not be acceptable.
- F. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor terminal plate with fully-rated Al-Cu pressure connectors shall be provided.
- G. Four-pole transfer switches with fully rated neutrals shall be provided for separately derived systems. A non-load-break overlapping neutral shall not be acceptable.
- H. Where indicated on the drawings, the transfer switches shall be provided with a drawout mechanism. The mechanism shall provide visual indicators as to position of the switch during the drawout operation. Each contact assembly shall be individually removable without interrupting the current-carrying capability of the alternate source contact assembly.

Microprocessor Control Panel

- A. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability,

minimum maintenance, and inherent communications capability. The control panel shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance. The microprocessor control panel shall be the Cutler-Hammer IQ Transfer Closed Transition controller or approved equal.

- B. The control panel shall be self-enclosed and be mounted separately from the transfer switch unit for safety and ease of maintenance. Both sensing and control logic shall be provided on the controller. True RMS voltage sensing shall be based on actual frequency measurement, not derived from an assumed system frequency. Use of external interface relays to operate the switching devices shall not be permitted.
- C. An LED digital readout shall display each option as it is functioning. The display shall be capable of showing actual line-to-line voltages (both sources and load), frequencies (both sources), and timer values. User setpoints and parameters shall be stored in non-volatile RAM. Use of replaceable batteries for the purpose of maintaining setpoints shall not be acceptable.
- D. The control panel shall be equipped to display historical information either via the front panel LED digital readout or over a communication network such as the Cutler-Hammer IMPACC/PowerNet system. Historical data shall include: Source 1 and Source 2 Run Time, Available Time, Connect Time, Load Energized Time, Number of Transfers, and Date, Time and Reason for the Last 16 Transfers.
- E. The control panel shall be rated for an operating temperature range of -20°C to +70°C, and a storage temperature range of -30°C to +85°C.
- F. The microprocessor control panel shall be capable of operating with control input power available within the range of 55% to 133% of nominal voltage indefinitely. Connection to any external battery, or to the engine battery to permit correct operation of any microprocessor function, is not permissible. The controller shall not in any way be adversely affected by line voltage or frequency fluctuations during the course of transferring heavy electrical loads from one source to another. Adverse effects may include, but are not limited to, an unintended retransfer to the original source.

Transformer Panel

- A. The CTTS shall be equipped with a transformer panel containing a line voltage selector making the CTTS suitable for

operation on standard system voltages from 208 through 600 volts ac, 50 or 60 Hz, without the necessity of changing parts. The transformer panel shall be connected to the transfer switch and microprocessor control panel by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance.

Enclosure

- A. The CTTS shall be supplied in the appropriate enclosure as shown on the plans. The enclosure shall be painted with the manufacturer's standard painting procedures to ensure suitability for environmental conditions as referenced in the plans.
- B. The enclosure and all parts subject to corrosion, other than copper bus or electrical connections, shall be coated with the manufacturer's standard corrosion protection procedure.
- C. The contractor's field wiring terminating within the enclosure shall comply with NFPA-70. Wires shall be permanently marked near the terminal at each end with the wire number on the approved shop drawings. Terminal blocks shall conform to NEMA Standard ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. Main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.
- D. The CTTS assembly shall be seismic qualified under the Uniform Building Code (and California Building Code) for Seismic Zone 4 earthquake application. Seismic qualification shall include factory certification and equipment labeling of structural integrity for Seismic Zone 4 applications.

Voltage and Frequency Sensing

- A. The voltage of each phase of the normal source shall be monitored, with dropout adjustable from 50% to 90% of nominal and pickup adjustable from [dropout setting + 2%] to 100% of nominal.
- B. The voltage of each phase of the emergency source shall be monitored, with dropout adjustable from 50% to 90% of nominal and pickup adjustable from [dropout setting + 2%] to 100% of nominal.
- C. The frequency of the emergency source shall be monitored, with dropout adjustable from 90% to 100% of nominal and pickup adjustable from [dropout setting + 1 Hz] to 110% of nominal.

Low-Voltage Automatic Transfer Switches – Typical Specifications (Closed Transition)

- D. Repetitive accuracy of all settings shall be within $\pm 2\%$.
- E. Voltage settings shall be field adjustable in 1 volt increments from the front of the CTTS without the use of dip switches, tools, meters or power supplies. Actual settings shall be clearly defined in the operator's manual.
- F. Frequency settings shall be field adjustable in 1 Hz increments from the front of the CTTS without the use of dip switches, tools, meters or power supplies. Actual settings shall be clearly defined in the operator's manual.
- G. A source differential sensor shall be provided for the closed transition operating mode. The sensor shall enable transfer from normal to emergency and retransfer to normal between live sources in the closed transition mode only when the two sources have a maximum voltage differential of 5%, frequency differential of 0.3 Hz and are within 10 electrical degrees.
- H. A shunt trip shall be integrally mounted into each switching mechanism in the transfer switch panel and each wired to the control panel. These shall instantaneously open the switching mechanism (connected to the source to which the load is being transferred) if and when the opposing switching mechanism has not opened within 100 milliseconds of source paralleling time. Shunt trips mounted externally to the transfer switch mechanism shall not be acceptable.
- I. Close transition transfer shall be accomplished with no power interruption and without altering or actively controlling the standby generator set.

Time Delays

- A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine start signals. Adjustable from 0 to 120 seconds.
- B. A time delay shall be provided on transfer from normal to emergency for controlled timing of transfer of loads to emergency. Adjustable from 0 to 30 minutes.
- C. A time delay shall be provided on retransfer from emergency to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is within user definable limits.
- D. A time delay shall be provided on shutdown of engine generator for cooldown. Adjustable from 0 to 30 minutes.
- E. All time delays shall be fully field adjustable in 1 second increments from the front of the CTTS without the use of dip switches, tools, meters or power supplies.

Additional Features

- A. A silver cadmium contact rated 10 amperes, 30 Vdc shall be provided for a low-voltage engine start signal.
- B. A momentary-type test pushbutton shall be provided to simulate a normal source failure. It shall be possible, using the set-point programming, to disable the test switch on the front panel to prevent tampering of the CTTS.
- C. Terminals shall be provided for a remote contact which opens to signal the CTTS to transfer to emergency.
- D. Indicating lights shall be provided, one to indicate when the CTTS is connected to the normal source (green) and one to indicate when the CTTS is connected to the emergency source (red). Lights shall also be provided to indicate source availability (amber), preferred source selection (red), and load energization status (red).
- E. Indicating lights shall be configured in a mimic bus format for intuitive display.
- F. Provide 4 NO/NC auxiliary contacts per source to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

Optional Accessories

- G. Engine Exerciser – An engine generator exercising timer shall be provided, selectable for exercise with or without load transfer. The exerciser shall be programmable to enable exercise for 1 minute to 24 hours per day in 1 minute increments for 1 to 7 days per week.
- H. In-phase Monitor – An in-phase monitor shall be inherently built into the controls. The monitor shall control transfer in the "open-transition" mode so that motor load inrush currents do not exceed normal starting currents.

Select metering devices as required. Refer to section B for detailed specification for metering as follows:

- IQ Generator
- IQ DP-4000
- IQ Analyzer

- I. Communications Capability – The IQ Transfer control panel shall be provided with a Cutler-Hammer IPONI communication network interface to enable communication over the Cutler-Hammer IMPACC/PowerNet network with remotely located annunciators and/or network supervisors using a standard PC platform.

- J. The transfer switch mechanism shall include integral overcurrent protection in one or both switching mechanisms, thereby eliminating one or two separate upstream circuit breakers.
- K. The CTTS shall be service entrance rated. The required overcurrent protection shall be integral to the transfer switch mechanism. Separately mounted and wired overcurrent protection devices shall not be acceptable.

Withstand, Closing and Interrupting Ratings

- A. The CTTS shall be rated to close on, withstand and interrupt 65 kA fault current (600 through 1200 amperes continuous) or 100 kA fault current (1600 through 4000 amperes continuous) with any upstream protective device. CTTS without identical withstand, closing and interrupting ratings shall not be acceptable.
- B. The CTTS shall be rated for use with an upstream protective device which has a short-time trip unit. Ratings on the CTTS shall be consistent with the short-time ratings shown on the plans for the upstream device for optimal system coordination, and be no less than 60 cycle withstand, or 30 cycles withstand when equipped with integral overcurrent protection.
- C. The CTTS shall be 100% rated for continuous duty, and shall be UL listed through 600 volts ac in accordance with UL 1008 and be labeled in accordance with that standard's withstand ratings. CTTS's which are not tested and labeled with 3-cycle "any breaker" ratings and have series, or specific breaker ratings only, are not acceptable.
- D. The voltage rating of the CTTS shall be no less than the system nominal voltage.
- E. The continuous current rating of the CTTS shall be no less than the maximum continuous current requirement as shown in the plans.

Bypass/Isolation Automatic Transfer Switches – Typical Specifications

Ratings

- A. The transfer switch shall have withstand, closing and interrupting ratings of _____ amperes.
- B. The voltage rating of the transfer switch shall be no less than the system voltage rating. The continuous current rating of the transfer switch shall be no less than the maximum continuous current requirements of the system.
- C. The transfer switch shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL 1008 for emergency system total load.
- D. All pilot devices and relays shall be of the industrial type with self-cleaning contacts and rated 10 amperes.
- E. The automatic transfer switches shall be fully rated to protect all types of loads, inductive and resistive, from loss of continuity of power, without derating, either open or enclosed.
- F. The isolation and bypass devices shall meet all rating requirements of the automatic transfer switch including full-load current, withstand, closing, interrupting, and mechanical endurance ratings.
- G. Transfer switches shall have a minimum 60-cycle withstand rating of 51 kA. The transfer switch shall be rated for application with upstream power circuit breakers and insulated case circuit breakers having short-time delay settings of up to 30 cycles. Contacts shall not weld when used with upstream overcurrent protective devices that do not incorporate instantaneous trip units.

Construction

- A. The transfer switches shall consist of completely enclosed contact assemblies and a separate control logic panel. The contact assemblies shall be operated by a non-fused motor operator or stored energy mechanism and be energized only momentarily during transfer, providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.
- B. Transfer switches shall be capable of being operated manually under full load conditions. Manual operation shall be accomplished via a permanently affixed manual operator or integrally mounted pushbutton operators located on the face of the contact assemblies. Removable manual operating handles and handles which move in the event that electrical operators should suddenly become energized while performing a manual transfer operation are not acceptable. The manual operator shall provide the same contact-to-contact transfer time

as provided under normal automatic operation to prevent possible flashovers from switching the main contacts slowly. In addition, provisions shall be made to allow disengagement of the electrical operator during manual operation.

- C. Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. Main contacts shall be mechanically locked in position in both normal and emergency positions. A neutral position shall not be possible under normal electrical operation unless a delayed transition accessory is required for switching highly inductive loads. Each transfer switch shall have a manual neutral position for load circuit maintenance. A transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.
- D. All three-phase four-wire transfer switches used on systems with ground fault equipment shall be true four-pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft. The fourth (neutral) pole contacts shall be of identical construction as, and operate simultaneously with, the main power contacts. Add-on or overlapping neutral contacts are not acceptable.
- E. Inspection and replacement of all separate arcing contacts (moving and stationary) shall be possible from the front of the transfer switch.
- F. An electronic sensing and control logic panel shall be separately mounted from the power switching portion of the transfer switch. The two sections shall be connected by control cables with plug-in connectors. The control section shall be capable of being disconnected from the power section for maintenance purposes.
- G. The logic circuit shall utilize electronic components mounted on printed circuit boards to accomplish functions such as timing, time delays, and voltage and frequency monitoring. LEDs shall be furnished to indicate the operation of each solid-state function. Modifications shall be available for field installation without voiding the UL label.
- H. The transfer switch shall be equipped with a voltage selection plug making it suitable for operation on standard voltages from 208 through 600 volts ac, 50 or 60 Hertz, by placing the voltage selection plug in the proper voltage receptacle.
- I. Bypass and isolation switches shall consist of completely enclosed contact assemblies with dead-front operation. Positive mechanical key interlocks shall

be provided for the bypass and isolation switches to prevent simultaneous closing of the normal and emergency power sources when in the bypass and/or isolated mode. Bypass and isolation switches utilizing only electrical interlocking to prevent simultaneous closing of both power sources are not acceptable.

- J. Operating handles for the bypass and isolation switches shall be externally operable. A maximum of two (2) handles shall be required to bypass and isolate the automatic transfer switch. Operating instructions shall be permanently affixed to the outside of the enclosure.
- K. The automatic transfer switch and the bypass and isolation switch sections shall be connected together via copper bus or cable.
- L. Where shown on the drawings, the transfer switches applied as service entrance switches shall be provided with overcurrent trip units and a service entrance label. An external key-operated selector switch shall be provided to disconnect the power supplies. Indicators shall be provided to show availability of each source as well as breakers in a tripped or disconnected position. Provide a neutral disconnect link for three-pole solid neutral switches, and a neutral-to-ground main bonding jumper for all switches to meet UL service entrance requirements. Ground fault protection shall be provided for all switches rated 1000 amperes or more applied on 480Y/277-volt systems in accordance with NEC Article 230-95.

Drawout Designs

- A. Where indicated on the drawings, the transfer switches shall be provided with a drawout mechanism to allow easy access to the molded case switches (insulated case breakers) for preventive maintenance, testing or inspection. The drawout mechanism shall provide visual indicators as to position of the switch/breaker during the drawout operation.
- B. Inspection and replacement of all separate arcing contacts (moving and stationary) shall be possible from the front of the transfer switch.

Wiring/Terminations

- A. Terminal blocks shall conform to NEMA ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. The main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.

Sequence of Operation

- A. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of its normal or preferred source.

Bypass/Isolation Automatic Transfer Switches – Typical Specifications

- B. Upon loss of phase-to-phase voltage of the normal source to 80% of nominal, and after a time delay, adjustable from 0.5 to 15 seconds, to override momentary dips and/or outages, a 10-ampere, 30-Vdc contact shall close to initiate starting of the emergency or standby source power plant. Transfer to the alternate source shall take place immediately upon attainment of 90% of rated voltage and frequency of that source. For switches not involving engine generator sets as power plants, transfer shall occur after an adjustable time delay of 1 to 60 seconds to override momentary dips and outages.
- C. When the normal source has been restored to 90% of rated voltage, and after a time delay, adjustable from 0.5 to 32 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.
- D. A time delay, adjustable from 0.5 to 32 minutes, shall delay shutdown of the emergency or standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.
- E. If the emergency or standby power plant should fail while carrying the load, transfer to the normal power supply shall be made instantaneously upon restoration of the normal source to satisfactory conditions.
- F. Total isolation of all line and load connections of the automatic transfer switch shall be performed with the turn of a single handle opening of the load-break isolation devices. A key interlock shall then be released locking the switch in the "isolated position." The isolation devices shall meet all rating requirements of the automatic transfer switch and bypass switches including full load current ratings, withstand, closing, and interrupting ratings, and mechanical endurance ratings.
- G. The key interlock on the "normal bypass" or "emergency bypass" shall then be released to allow bypassing to the appropriate power source. Key interlocking shall not allow simultaneous closing of both power sources in the "bypass" mode, but shall allow for manual transfer of the load from one power source to the other when necessary.
- H. Reversal of the above procedures shall allow reconnection of the automatic transfer switch.

Customer Metering

- A. Where indicated on the drawings, provide a separate customer metering compartment with front hinged door and include the following:

- 1. Current transformers where shown on the drawings or elsewhere specified shall be wired to shorting-type terminal blocks.
- 2. [Potential transformers including primary and secondary fuses with disconnecting means] [Fused potential taps as the potential source] for metering as shown on the drawings.

Select devices as required for item B. Refer to section B for detailed specification for metering as follows:

- IQ Analyzer
- IQ DP-4000
- IQ Generator
- IQ 200

B. Microprocessor-Based Metering System

Enclosure

- A. Each transfer switch shall be provided in enclosures suitable for locations as indicated on the drawings and as described below.
 - 1. NEMA 1 surface or flush mounted general purpose enclosures primarily intended for indoor use.
 - 2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping noncorrosive liquids.
 - 3. NEMA 3R raintight enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
 - 4. NEMA 4 and NEMA 4X (stainless steel) watertight enclosures intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation.

Finish

- A. NEMA 1, 12 or 3R enclosures shall be painted with the manufacturer's standard painting procedures to ensure suitability for environmental conditions as referenced in the plans. Color shall be light gray ANSI 61. NEMA 4 or 4X shall be stainless steel, non-painted.

Accessories

- A. The following logic and options shall be supplied:
 - 1. The logic of the transfer switch shall function via a microprocessor. Where shown on the drawings provide

electronic transfer device equal to Cutler-Hammer type IQ Transfer. The set points shall be field adjustable without the use of special tools. The switch shall have a multi-tap voltage selection plug for ease of voltage adjustment in the field. LED lights shall be included on the exterior of the switch to show:

Normal Source Available
 Emergency Source Available
 Normal Source Connected
 Emergency Source Connected
 Load Energized.

A digital readout shall display each option as it is functioning. Readouts shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the microprocessor shall display the timer counting down. All set points can be reprogrammed from the front of the switch when the switch is in the program mode. A test pushbutton shall be included as part of the microprocessor. The microprocessor shall be compatible with a Cutler-Hammer IMPACC/PowerNet communications system. The switch shall include the following:

- a. Provide a time delay transfer from the normal power source to the emergency power source (0 seconds to 30 minutes). This option does not affect the engine start circuit.
- b. Provide a timer to override a momentary power outage or voltage fluctuation (0 seconds to 120 seconds).
- c. Provide a time delay transfer from the emergency power source to the normal power source (0 seconds to 30 minutes).
- d. Provide a timer to allow the generator to run unloaded after retransfer to the normal power supply (1 second to 30 minutes).
- e. Provide single-phase undervoltage and underfrequency sensing on the emergency power source. Voltage shall be factory set at 90% pickup and 80% dropout. Frequency sensing shall be set at 58-hertz pickup and 56-hertz dropout.
- f. Provide a pilot light to indicate that the switch is in the normal position as an integral part of the microprocessor.
- g. Provide a pilot light to indicate that the switch is in the emergency position as an integral part of the microprocessor.



Bypass/Isolation Automatic Transfer Switches – Typical Specifications

- h. Provide a pilot light to indicate that the normal power is available as an integral part of the microprocessor.
 - i. Provide a pilot light to indicate that the emergency power is available as an integral part of the microprocessor.
 - j. Provide auxiliary relay contacts that are energized when the power is available on the normal source.
 - k. Provide auxiliary relay contacts that are energized when the power is available on the emergency source.
- B. The following features shall be provided:
1. Time delay normal to emergency, adjustable
 2. Time delay emergency to normal, adjustable
 3. Green pilot light to indicate switch in normal position and red pilot light to indicate switch in emergency position
 4. White pilot lights marked "Normal Source" and "Emergency Source" to indicate that respective source voltages are available
 5. Tripped position indicating lights for both sources
 6. Relay auxiliary contacts (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.
- C. When the alternate source is an engine generator, the following features shall also be provided:
1. Time delay engine start, adjustable
 2. Time delay engine cool off, adjustable
 3. Engine start contact
 4. Frequency/voltage relay for emergency source, frequency adjustable from 45 to 60 Hz and voltage fixed at 90% pickup, 70% dropout
 5. Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads
 6. Four-position selector switch permitting four (4) modes of transfer switch operation: TEST (simulates normal power outage), AUTO (standard automatic operation), OFF (de-energizes control relays and opens the engine start circuit for maintenance purposes), ENGINE START (retains transfer switch in normal position and initiates a testing of the engine start circuit). Furnish white pilot light for OFF indication.
- D. A transfer switch position indicator shall be visible from the front of the switch.
- E. Provide load sequencing (0 to 10 devices).
- F. Provide plant exerciser (selectable load no-load transfer).
- G. Provide preferred source selector (source 1 or source 2, or none).

Communications

- A. Where shown on the drawings, provide in the transfer switch a microprocessor-based unit capable of communicating phase and ground current, peak demand, present demand, energy consumption, contact status, and mode of trip. The transfer switch shall respond to open and close commands from a master control unit via a communications network. Communication network shall be Cutler-Hammer IMPACC/PowerNet.
- B. Provide communications capability to monitor the normal and emergency switch position and normal and emergency source availability. Additional communications capability shall be provided to bypass time delays during transfer or retransfer, and to initiate engine start for no-load or load testing of the transfer switch from a remote master computer.

Low-Voltage Maintenance Bypass Switches – Typical Specifications

Ratings

- A. The transfer switch shall have withstand, closing and interrupting ratings of _____.
- B. The voltage rating of the transfer switch shall be no less than the system voltage rating. The continuous current rating of the transfer switch shall be no less than the maximum continuous current requirements of the system.
- C. The transfer switch shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL 1008 for emergency system total load.
- D. The transfer switches shall be fully rated for all types of loads, inductive and resistive, without derating, either open or enclosed.
- E. The transfer switch shall be rated for application with upstream power circuit breakers and insulated case circuit breakers having short time delay settings of up to 30 cycles. Contacts shall not weld when used with upstream overcurrent protective devices that do not incorporate instantaneous trip units.

Construction

- A. The transfer switches shall consist of completely enclosed contact assemblies. The contact assemblies shall be equipped with a single operating handle in an arrangement to provide inherently double throw switching action.
- B. Transfer switches shall be capable of being operated manually under full load conditions. The manual operator shall provide true quick-make, quick-break operation to prevent possible flashovers from switching the contacts slowly.

- C. Each transfer switch shall be positively interlocked via means of the operating mechanism, and shall also be equipped with a walking beam interlock to prevent simultaneous closing of both sources during manual operation. Each transfer switch shall be capable of achieving a neutral position for systems maintenance purposes. A transfer switch position indicator shall be included on the face of the transfer mechanism to display the switch position.
- D. Main contacts shall be designed to withstand multiple fault currents and shall meet UL 489 and/or UL 1087 requirements.
- E. All three-phase four-wire transfer switches used on systems with ground fault equipment shall be true four-pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft. The fourth (neutral) pole contacts shall be of identical construction as, and operate simultaneously with, the main power contacts. Add-on or overlapping neutral contacts are not acceptable.

Wiring/Terminations

- A. Terminal blocks shall conform to NEMA ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. The main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.

Enclosure

- A. Each transfer switch shall be provided in enclosures suitable for locations as indicated on the drawings and as described below:
 1. NEMA 1 surface or flush mounted general purpose enclosures primarily intended for indoor use.

2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping noncorrosive liquids.
3. NEMA 3R raintight enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
4. NEMA 4 and NEMA 4X (stainless steel) watertight enclosures intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation.

Finish

- A. The enclosure shall be painted with the manufacturer's standard painting procedures to ensure suitability for environmental conditions as referenced in the plans. Color shall be light gray ANSI 61.

Accessories

- A. The following accessories shall be provided:
 1. Main contact assemblies shall be equipped with thermal magnetic or electronic trip units and AB De-ion arc extinguishers. Trip units shall have adjustable instantaneous trip values for each pole. Tripping mechanisms shall be designed "trip-free" so that the contacts cannot be held closed against an abnormal circuit condition.
 2. Auxiliary contacts (2 NO and 2 NC) for each source to indicate transfer switch position
 3. Pilot lights to indicate source position and/or availability of voltage.

For a complete product specification in CSI format, see **Cutler-Hammer Product Specification Guide**, section 16498.

Low-Voltage Manual Transfer Switches – Typical Specifications

Ratings

- A. Manual transfer switches shall be non-automatic, electrically operated with control transformers in a common enclosure.
- B. The transfer switch shall have withstand, closing and interrupting ratings of _____ amperes.
- C. The transfer switch shall be rated for application with upstream power circuit breakers and insulated case circuit breakers having short-time delay settings of up to 30 cycles. Contacts shall not weld when used with upstream overcurrent protective devices that do not incorporate instantaneous trip units.
- D. The voltage rating of the transfer switch shall be no less than the system voltage rating. The continuous current rating of the transfer switch shall be no less than the maximum continuous current requirements of the system.
- E. The transfer switch shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL 1008 for emergency system total load.
- F. The manual transfer switches shall be fully rated for all types of loads, inductive and resistive, without derating, either open or enclosed.

Construction

- A. The transfer switches shall consist of completely enclosed contact assemblies. The contact assemblies shall be equipped with a single operating handle in an arrangement to provide inherently double throw switching action.
- B. Transfer switches shall be capable of being operated manually under full load conditions. The manual operator shall provide true quick-make/quick-break operation to prevent possible flashovers from switching the contacts slowly.

- C. Each transfer switch shall be positively interlocked via means of the operating mechanism, and shall also be equipped with a walking beam interlock to prevent simultaneous closing of both sources during manual operation. Each transfer switch shall be capable of achieving a neutral position for systems maintenance purposes. A transfer switch position indicator shall be included on the face of the transfer mechanism to display the switch position.
- D. Main contacts shall be designed to withstand multiple fault currents and shall meet UL 489 and/or UL 1087 requirements.
- E. All three-phase four-wire transfer switches used on systems with ground fault equipment shall be true four-pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft. The fourth (neutral) pole contacts shall be of identical construction as, and operate simultaneously with, the main power contacts. Add-on or overlapping neutral contacts are not acceptable.

Wiring/Terminations

- A. Terminal blocks shall conform to NEMA ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. The main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.

Enclosure

- A. Each transfer switch shall be provided in enclosures suitable for locations as indicated on the drawings and as described below:
 1. NEMA 1 general purpose enclosure.
 2. NEMA 1 surface or flush mounted general purpose enclosures primarily intended for indoor use.

3. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping noncorrosive liquids.
4. NEMA 3R raintight enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
5. NEMA 4 and NEMA 4X (stainless steel) watertight enclosures intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation.

Finish

- A. NEMA 1, 12 and 3R enclosures shall be painted with the manufacturer's standard painting procedures to ensure suitability for environmental conditions as referenced in the plans. Color shall be light gray ANSI 61. NEMA 4 or 4X shall be stainless steel non-painted.

Accessories

- A. The following accessories shall be provided:
 1. Main contact assemblies shall be equipped with thermal magnetic or electronic trip units and AB De-ion arc extinguishers. Trip units shall have adjustable instantaneous trip values for each pole. Tripping mechanisms shall be designed "trip-free" so that the contacts cannot be held closed against an abnormal circuit condition.
 2. Auxiliary contacts (2 NO and 2 NC) for each source to indicate transfer switch position.
 3. Pilot lights to indicate source position and/or availability of voltage.

For a complete product specification in CSI format, see **Cutler-Hammer Product Specification Guide**, section 16499.