

## 26 36 00 TRANSFER SWITCHES: SIGNIFICANT (OR TOTAL) DELETION OF EXISTING TEXT

Delete the following current section in its entirety (deletions are shown struck through).

### ~~.01 General~~

- ~~A. Transfer switch shall contain SPDT contacts for central control system, and a sufficient number of poles to switch phase wires plus a neutral wire where necessary. Transfer switch shall include capabilities for monitoring “normal source acceptable”, “emergency source acceptable” and “switch status”. Monitoring points shall be connected to the building automation system. Transfer switch shall include provisions to accept two remote inputs; “transfer/exercise” and “engine exercise”. Refer to BAS Specification for complete requirements.~~
- ~~B. Transfer switch shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. Data logging capability to show total number of transfers, number of transfers caused by power failures and total days controller has been energized.~~
- ~~C. Transfer switch shall be similar to ASCO 4000 series or ASCO 7000 series. Discuss the following options with Engineering Services:~~
- ~~1. Overlapping neutrals on systems with ground fault protection~~
  - ~~2. Closed transition (for generator systems only)~~
  - ~~3. Paralleling (for large generator systems only)~~
  - ~~4. Delayed transition~~
  - ~~5. Bypass Isolation (for building standby loads requiring maintenance without interruption, not typical for Emergency or Elevator ATS's)~~
  - ~~6. Additional auxiliary contact sets to indicate switch position~~
  - ~~7. Two Pole, double-throw contacts operate when normal source voltage is present at transfer switch terminals~~
  - ~~8. Two Pole, double-throw contacts operate when emergency source voltage is present at transfer switch terminals~~
  - ~~9. One Form C contact for each of the following:~~
    - ~~a. Normal Source Acceptability~~
    - ~~b. Emergency Source Acceptability~~
    - ~~c. Fourth contact can be set to mimic the acceptability contacts or annunciate any combination of the acceptability contacts and/or any switch alarm conditions available:~~
      - ~~1. Extended Parallel Time (closed transition)~~
      - ~~2. Failure to Synchronize (Closed Transition)~~
      - ~~3. Transfer Switch Locked Out (Closed Transition)~~
      - ~~4. Load Disconnected (Delayed transition)~~

Replace with following text.

**.01 General**

A. Transfer switch shall be similar to ASCO 4000 series or ASCO 7000 series. Discuss the following options with Engineering Services:

1. Overlapping neutrals on systems with ground fault protection
2. Closed transition (for generator systems only)
3. Paralleling (for large generator systems only)
4. Delayed transition
5. Bypass Isolation (for building standby loads requiring maintenance without interruption, not typical for Emergency or Elevator ATS's)

**.02 Guide Specifications**

A. Design Professional shall carefully review and edit the guideline specifications below, adapting them as needed to achieve application-specific, fully developed specifications for each project.

B. These shall be edited using the process described in the instructions contained at the beginning of the document. Proposed modifications shall be reviewed with OPP Engineering Services.

C. Finalized version shall be included in the project contract documents. Use of other specifications is not acceptable.

<u>Document</u>	<u>Version Date</u>	<u>Description</u>
<u>Transfer Switches Guide Specification.docx</u>	<u>June 2016</u>	<u>University's guide specification for Transfer Switches to be used by the design professional.</u>
<u>Transfer Switches Datasheet.docx</u>	<u>June 2016</u>	<u>Typical University Transfer Switches Datasheet for the Professionals use. The datasheet instructions are found in the guide specification and a sample is found in</u>

<u>Document</u>	<u>Version Date</u>	<u>Description</u>
		Division 26 00 00.

**END of revision**

**Update Commentary:**

Section was updated primarily for the following reasons:

- 1) Deleted old section and replaced with new section, which includes a new guide specification section and new additional datasheet.*

<b>DATA SHEETS TRANSFER SWITCH</b>		<b>Equipment Name:</b>	
<b>DESCRIPTION</b>	<b>UNITS</b>	<b>SPEC DATA</b>	<b>VENDOR DATA</b>
Manufacturer	N/A	By Manufacturer	
Model/Catalog No.	N/A	By Manufacturer	
<b>SITE CONDITIONS</b>			
Minimum Ambient Temperature	°C		
Maximum Ambient Temperature	°C		
<b>TRANSFER SWITCH RATINGS</b>			
Nominal System Voltage	V		
Maximum Operating Voltage	V		
No. Phases / No. Wires	Ph/W		
Frequency	Hz		
Continuous Current Rating	A		
Number of Poles	Qty.		
Automatic/Non-Automatic	N/A		
Two-Position/Closed Transition/Delayed Transition	N/A		
No Neutral/ Solid Neutral/Switched Neutral	N/A		
Bypass/Isolation Switch	N/A		
# of Auxiliary Contacts			
Short-time Withstand Capability	Cycles		
Ground Fault Protection	Type		
Main and Neutral lugs	Size		
<b>ENCLOSURE</b>			
NEMA Type	NEMA		
Weight as Installed	Lb	By Manufacturer	
Color	ANSI	61 Gray	
<b>ACCESSORIES</b>			
Operation Counter	Y/N		
<b>SPECIAL REQUIREMENTS</b>			

**SECTION 263600 - TRANSFER SWITCHES**

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

*General Notes:*

1. *This guide specification is intended to provide the Design Professional with a basic guideline of minimum OPP requirements.*
2. *The guide specification shall be carefully reviewed and edited with respect to application-specific project requirements. Proposed modifications shall be reviewed with OPP Staff.*
3. *Finalized version shall be included in the project contract documents.*

*Editing Notes*

1. *This OPP Guide specification must only be altered by notation (i.e. deleted text with strikethrough and additional text with double underline). This shall be accomplished by using Tools /Track Changes / Highlight Changes, and select "Track changes while editing" in MS Word or equivalent.*
2. *The Review Submittal Specification section shall be provided in electronic form for OPP Review.*
3. *Leave the following Note ("For Construction Document Review, Design Submittal") as part of the Review Submittal, to aid any Reviewer to understand WHY there are strikeouts and underlines. Also, leave any "DESIGNER NOTE" placed in this Guide Spec.*
4. *AFTER comments are received from PSU and incorporated, the strikeouts and underlines shall be removed, and the REVIEWER NOTES deleted, before the spec is issued for Bidding.*
5. *Data Sheet Instructions:*
  - a. *Engineer completes "SPEC DATA" column with information about equipment including but not limited to ratings, features and options. The data sheet is then submitted with completed specifications for bid.*
  - b. *Manufacturer completes "VENDOR DATA" column and returns completed data sheet with bid or submittal.*
6. *Engineer verifies that design specifications have been met by checking that specified features match submitted features.*

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All sections of the project manual are directly applicable to this specification section. Should a conflict arise between specification sections or between specifications and drawings and/or code requirements, the contractor shall notify the Architect/Engineer of the conflict in writing. If direction is not provided prior to the submission of the bid, the contractor shall price the more extensive system.

## 1.2 SUMMARY

- A. Section includes **[automatic]** **[and]** **[nonautomatic]** transfer switches rated 600 V and less, including the following:
  - 1. Bypass/isolation switches.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
  - 2. Include material lists for each switch specified.

Discuss with owner the preference for bypass/isolation switch during design phase.

- 3. Single-Line Diagram: Show connections between transfer switch, **[bypass/isolation switch,]** power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch. Indicate lug sizes for all electrical connections.

Retain and revise, if necessary, "Riser Diagram" Subparagraph below if retaining remote annunciators, control panels, or bypass/isolation switches.

- 4. Riser Diagram: Show interconnection wiring between transfer switches and bypass/isolation switches.

#### 1.4 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

- A. Qualification Data: For [manufacturer-authorized service representative] [testing agency].

Retain "Seismic Qualification Certificates" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 260548.16 "Seismic Controls for Electrical Systems."

- B. Seismic Qualification Certificates: For transfer switches, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

- C. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Features and operating sequences, both automatic and manual.
    - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

#### 1.6 QUALITY ASSURANCE

Retain "Testing Agency Qualifications" Paragraph below if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 014000 "Quality Requirements." See the Evaluations for discussion of NETA ATS and manufacturer's testing procedures.

- A. Testing Agency Qualifications to be approved by Owner:
1. Member company of NETA.
    - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## 1.7 FIELD CONDITIONS

Retain this article if interruption of existing electrical service is required.

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
  - 1. Notify [**Construction Manager**] [**Owner**] no fewer than [**two**] <**Insert number**> weeks in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without [**Construction Manager's**] [**Owner's**] written permission.

## 1.8 WARRANTY

When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

- 1. Warranty Period: [**Two years**] <**Insert time**> from date of Substantial Completion.

## PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or ARCOM. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

## 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.

Retain one of first two paragraphs below, or both, if applicable to Project.

- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.



Coordinate "Indicated Current Ratings" Paragraph below with Drawings and indicate percentage of tungsten filament lamp load for switches where it exceeds 30 percent. This percentage may affect switch selection. Some manufacturers' ratings for some switch lines apply to all classes of load, including tungsten lamps.

- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

Indicate required ratings on Drawings. See the Evaluations.

- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

Retain first subparagraph below if this Section includes automatic transfer switches based on molded-case-switch or circuit-breaker products or if design includes fault-current protection internal to transfer switch.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

Retain subparagraph and first option below for standard UL 1008 withstand ratings. If this Section includes automatic transfer switches, which must have extended short-time withstand rating to selectively coordinate with overcurrent protection devices, verify availability with manufacturer and insert number of cycles. This may be of value for service-rated switches or large generator units. Selective coordination is required for some emergency-generator-backed, life-safety systems.

2. Short-time withstand capability for [three] <Insert number> cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
  - I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
  - J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

Service-rated switches have a circuit breaker. Some may be contactor-style switches with a breaker ahead of the switches; others may use breakers as the switching devices. The breaker is needed to provide the overcurrent protection required for service conductors by NFPA 70. A service rated transfer switch will be application dependent and is a special installation on campus.

- K. Service-Rated Transfer Switch:
  1. Comply with UL 869A and UL 489.
  2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.

3. In systems with a neutral, the bonding connection shall be on the neutral bus.
4. Provide removable link for temporary separation of the service and load grounded conductors.

Retain first subparagraph below unless a service-rated surge protective device is installed on service equipment between the transfer switch and the utility power connection. Surge protective devices are specified in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

5. Surge Protective Device: Service rated.

Ground-fault protection is not permitted for some emergency alternative power sources. See NFPA 70 for requirements.

6. Ground-Fault Protection: Comply with UL 1008 for [**normal bus**] [**normal and alternative buses**].
7. Service Disconnecting Means: Externally operated, manual [**mechanically**] [**electrically**] actuated.

Retain "Neutral Switching" Paragraph and appropriate option below, if application is 480V or greater four-pole transfer switches are required. Discuss with owner option for overlapping or switched neutral application. See discussion of neutral switching in the Evaluations. Coordinate with Drawings.

- L. Neutral Switching: Where four-pole switches are indicated, provide [**neutral pole switched simultaneously with phase poles**] [**overlapping neutral contacts**].

Retain "Neutral Terminal" Paragraph below for single-phase, three-wire systems or three-phase, four-wire systems without neutral switching. Neutral switching is not required for 208V or lower applications. Coordinate with Drawings.

- M. Neutral Terminal: Solid and equal rating as power terminals unless otherwise indicated.

Retain "Oversize Neutral" Paragraph below if required for heavy nonlinear loads. This requirement may result in some suppliers oversizing certain switches to provide an oversize neutral. Coordinate with Drawings.

Retain "Heater" Paragraph below if one or more switches are exposed to outdoor temperatures and humidity. Coordinate with Drawings.

- N. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

Retain "Annunciation, Control, and Programming Interface Components" Paragraph below if provisions for communication capability are required. Coordinate with Drawings.

- O. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- P. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable [**with printed**] [**shrinkable sleeve**] markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Accessible via [**rear**] [**and front**] access.

Use NEMA 250, Type 12 enclosure if environment is generally dusty. NEMA 250, Type 12 enclosure may be larger due to heat dissipation requirements within the sealed enclosure. If more than one type of enclosure is used, include a table listing enclosure type for each switch or indicate type on Drawings. PSU will typically use Type 1 or 3R.

- Q. Enclosures: General-purpose NEMA 250, [**Type 1**] [**Type 3R**] [**Type 12**], complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

[<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

1. ASCO by Emerson
2. GE Zenith Controls
3. Owner Approved Equal

Revise first paragraph below to coordinate terminology for sources, such as "normal," "preferred," "emergency," and "alternative," if such terms are used elsewhere in the Construction Documents. Coordinate requirements for bypass/isolation switches with Drawings.

- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

If transfer switches are required to have service entrance rating, consider use of a breaker-type transfer switch because most service-entrance-rated transfer switches are of the breaker type.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.

Transfer switches used in emergency systems must have mechanically held contacts.

2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
4. Conductor Connectors: Suitable for use with conductor material and sizes.
5. Material: Hard-drawn copper, 98 percent conductivity.

Compression lugs are considered more permanent than mechanical because once applied, they are not removable and it is less likely for the conductor to become loose in the connector. However, because they

are not removable, if the conductor must be removed from the connector then the connector will need to be cut off and discarded. The conductor can be removed and reinstalled in a mechanical lug as many times as needed.

6. Main and Neutral Lugs: Mechanical type.

Retain one of first two subparagraphs below.

7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
8. Ground bar.
9. Connectors shall be marked for conductor size and type according to UL 1008.
10. <Insert features>.

Retain one of first two paragraphs below to represent the basic switching arrangement: open, delayed, or closed transition. Some manufacturers have variations of one or two types intended for particular uses. Consult manufacturer's literature for information on specific types. Discuss with owner during design.

Retain "Automatic Open-Transition Transfer Switches" Paragraph below for loads that can be interrupted during transfer of power. Open transition transfer switches are the most common on PSU campus.

- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
  1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

Retain "Automatic Closed-Transition Transfer Switches" Paragraph below for loads intolerant of interruptions or for switching large-motor loads. Closed-Transition is for generator applications only and for data center applications. Coordinate with "Large-Motor-Load Power Transfer" Paragraph and with Drawings. See the Evaluations.

- E. Automatic Closed-Transition Transfer Switches: Connect both sources to load momentarily. Transition is controlled by programming in the automatic transfer-switch controller.
  1. Fully automatic make-before-break operation when transferring between two available power sources.
  2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
  3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.

Retain one of first two subparagraphs below to specify the method of synchronizing the two power sources prior to closing both sources to the load. Consult manufacturer to determine availability of the active control of the generator.

- a. Initiation occurs without active control of generator.
  - b. Automatic transfer-switch controller takes active control of generator to match frequency, phase angle, and voltage.
  - c. Controls ensure that closed-transition load transfer closure occurs only when the two sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
4. Failure of power source serving load initiates automatic break-before-make transfer.

5. Ensure soft load/unload during transitions.

Retain one of first three paragraphs below to include nonautomatic switching operation. First paragraph includes optional features with some manufacturers.

- F. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- G. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- H. Electric [**Nonautomatic**] Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

Retain "Signal-Before-Transfer Contacts" Paragraph below if required for control to minimize elevator disruption or for other purposes.

- I. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- J. Automatic Transfer-Switch Controller Features:

Revise pickup, dropout, and time-delay settings in first four subparagraphs below to suit application, and retain required features. Delete delay requirements if only closed-transition switches are included.

1. Controller operates through a period of loss of control power.

First subparagraph below specifies three-phase undervoltage monitor. Retain if loss of one phase of normal source is a problem for loads downstream from transfer switch. Similar option is available for emergency source.

2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
  - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

- b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Voltage Availability Contacts:
- a. Two-pole, double-throw contacts that operate when normal source voltage is present at transfer switch terminals.
  - b. Two-pole, double-throw contacts that operate when emergency source voltage is present at transfer switch terminals.
9. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position(normal and emergency), rated 10 A at 240-V ac.
10. Additional Form C contacts for each of the following:
- a. Normal Source Acceptability
  - b. Emergency Source Acceptability
  - c. Spare contact can be set to mimic acceptability contacts or annunciate any combination of the acceptability contacts and/or any alarm conditions available:
    - 1) Extended Parallel Time
    - 2) Failure to Synchronize
    - 3) Transfer Switch Locked Out
    - 4) Load Disconnected

Retain any of the below subparagraphs for the fourth contact. Contact can be set to mimic the acceptability contacts or annunciate any combination of the acceptability contacts and/or any switch alarm conditions available.

11. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

Retain "Engine Starting Contacts" Subparagraph below if needed to coordinate with engine generator. Do not duplicate control features furnished with generator. Coordinate contacts with engine generator. See the Evaluations.

12. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

Retain one of two "Engine Shutdown Contacts" subparagraphs below.

13. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
14. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
15. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
- a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
  - b. Push-button programming control with digital display of settings.

- c. Integral battery operation of time switch when normal control power is unavailable.
- 16. Transfer switch shall include provisions to accept two remote inputs:
  - a. Transfer/Excercise
  - b. Engine Excercise

### 2.3 NONAUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ASCO by Emerson
  - 2. GE Zenith Controls
  - 3. Russelectric, Inc

Retain "Electrically Operated" or "Manual and Electrically Operated" Paragraph below for basic switch type. First is less costly and complies with most manual transfer requirements.

- B. Electrically Operated: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- C. Manual and Electrically Operated: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.
- D. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.
- E. Pilot Lights: Indicate source to which load is connected.
- F. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternative-source sensing circuits.
  - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
  - 2. Emergency Power Supervision: Red light with nameplate engraved "Alternative Source Available."
- G. Unassigned Auxiliary Contacts: Switch shall have one set of normally closed contacts for each switch position, rated 10 A at 240-V ac.
- H. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switch Action: Double throw; mechanically held in both directions.
  - 2. Contacts: Silver composition or silver alloy for load-current switching.
  - 3. Conductor Connectors: Suitable for use with conductor material and sizes.

4. Material: Hard-drawn copper, 98 percent conductivity.

Compression lugs are considered more permanent than mechanical because once applied, they are not removable and it is less likely for the conductor to become loose in the connector. However, because they are not removable, if the conductor must be removed from the connector then the connector will need to be cut off and discarded. The conductor can be removed and reinstalled in a mechanical lug as many times as needed.

5. Main and Neutral Lugs: Mechanical type.

Retain one of first two subparagraphs below.

6. Ground Lugs and Bus-Configured Terminators: Mechanical type.
7. Ground bar.
8. Connectors shall be marked for conductor size and type according to UL 1008.
9. <Insert features>.

## 2.4 TRANSFER SWITCH ACCESSORIES

Retain Bypass/Isolation switch paragraph if application is for building standby loads requiring maintenance without interruption, not typical for Emergency or Elevator ATS's Discuss with PSU as this is dependent on the project.

### A. Bypass/Isolation Switches:

1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Comply with requirements for Level 1 equipment according to NFPA 110.
3. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
  - a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. Interlocks shall prevent transfer-switch operation, except for testing or maintenance, while automatic transfer switch is isolated.
  - b. Provide means to make power available to transfer-switch control circuit for testing and maintenance purposes.

Drawout arrangement is dependent on the size of the switch. Retain one of two "Transition" subparagraphs below.

- c. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations. Transfer switch and bypass/isolation switch shall be in isolated compartments.
- d. Transition: Provide closed-transition operation when transferring from main transfer switch to bypass/isolation switch on the same power source.
- e. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
- f. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.



Retain "Manual Control" or "Automatic and Nonautomatic Control" Subparagraph below, or both.

- g. Manual Control: Constructed so load bypass and transfer-switch isolation can be performed by one person in no more than two operations in 15 seconds or less. Operating handles shall be externally operated.
  - h. Automatic and Nonautomatic Control: Automatic transfer-switch controller shall also control the bypass/isolation switch.
  - i. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
  - j. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
4. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

B. Data Recording:

- 1. Switch shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss.
- 2. Data logging capability to show total number of transfers, number of transfers caused by power failures and total days controller has been energized.

C. Nameplate

- 1. Switch shall have duplicate nameplate mounted on the front door of the switch.

Delete "Remote Annunciator System" or "Remote Annunciator and Control System" Paragraph below, or both. Coordinate location of equipment and wiring with Drawings. Coordinate with transfer-switch description and with Section 263213 "Engine Generators" and Section 260913 "Electrical Power Monitoring and Control." Revise to specify required system features and functions. See "Annunciation and Control" Article in the Evaluations.

## 2.5 SOURCE QUALITY CONTROL

Retain "Factory Tests" Paragraph below for factory-assembled transfer switches. Factory tests are an added cost option and may not be available from some manufacturers. Verify requirement with Owner.

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
  - 1. For each of the tests required by UL 1008, performed on representative devices, for **[emergency] [legally required]** systems. Include results of test for the following conditions:
    - a. Overvoltage.
    - b. Undervoltage.

- c. Loss of supply voltage.
- d. Reduction of supply voltage.
- e. Alternative supply voltage or frequency is at minimum acceptable values.
- f. Temperature rise.
- g. Dielectric voltage-withstand; before and after short-circuit test.
- h. Overload.
- i. Contact opening.
- j. Endurance.
- k. Short circuit.
- l. Short-time current capability.
- m. Receptacle withstand capability.
- n. Insulating base and supports damage.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

Coordinate location of switches, annunciators, control panels, and associated equipment on Drawings.

Retain first paragraph below for floor-mounting switches. Majority of switches will be floor mounted, the smaller switches will be wall mounted. Coordinate with Drawings.

- A. Floor-Mounting Switch: Anchor to floor by bolting.

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

- 1. Install transfer switches on cast-in-place concrete equipment base(s).

Retain first subparagraph below if seismic controls are a project requirement. Coordinate with Drawings.

- 2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- 3. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- 4. Provide workspace and clearances required by NFPA 70.

- B. Identify components according to Section 260553 "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- D. Comply with NECA 1.

### 3.2 CONNECTIONS

Retain "Wiring to Remote Components" Paragraph below if connections are to remote annunciator, control panel, or motor controller. Discuss with PSU on I/O junction box details and wiring. Coordinate with Drawings.

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, [**motor controls**,]control, and communication requirements of transfer switches as

recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

- B. Provide wiring to I/O junction box external to transfer switch.

Retain "Wiring Method" or "Wiring within Enclosures" Paragraph below and coordinate with Drawings. Delete both if wiring method for system is indicated on Drawings.

- C. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 271500 "Communications Horizontal Cabling."
- G. Route and brace conductors according to manufacturer's written instructions[.][ **and Section 260529 "Hangers and Supports for Electrical Systems."**] Do not obscure manufacturer's markings and labels.
- H. Brace and support equipment according to Section 260548.16 "Seismic Controls for Electrical Systems."
- I. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than **18 inches (457 mm)** in length.

### 3.3 FIELD QUALITY CONTROL

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" Paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" Paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

- A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections. Retain all tests listed unless waived by owner.

- C. Perform the following tests and inspections[ **with the assistance of a factory-authorized service representative**]:
1. After installing equipment, test for compliance with requirements according to NETA ATS including all optional tests unless waived by Owner.
  2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with Drawings and Specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and required clearances.
    - d. Verify that the unit is clean.
    - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
    - f. Verify that manual transfer warnings are attached and visible.
    - g. Verify tightness of all control connections.
    - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
      - 1) Use of low-resistance ohmmeter.
      - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
    - i. Perform manual transfer operation.
    - j. Verify positive mechanical interlocking between normal and alternate sources.
    - k. Perform visual and mechanical inspection of surge arresters.
    - l. Inspect control power transformers.
      - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
      - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
      - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
  3. Electrical Tests:
    - a. Perform insulation-resistance tests on all control wiring with respect to ground.

[See the Evaluations for discussion of contact/pole resistance test.](#)

- b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
- c. Verify settings and operation of control devices.
- d. Calibrate and set all relays and timers.
- e. Verify phase rotation, phasing, and synchronized operation.
- f. Perform automatic transfer tests.
- g. Verify correct operation and timing of the following functions:
  - 1) Normal source voltage-sensing and frequency-sensing relays.

- 2) Engine start sequence.
  - 3) Time delay on transfer.
  - 4) Alternative source voltage-sensing and frequency-sensing relays.
  - 5) Automatic transfer operation.
  - 6) Interlocks and limit switch function.
  - 7) Time delay and retransfer on normal power restoration.
  - 8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    - a. Check for electrical continuity of circuits and for short circuits.
    - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    - c. Verify that manual transfer warnings are properly placed.
    - d. Perform manual transfer operation.
  5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.

Retain test in first subparagraph below if three-phase undervoltage sensing is specified in Part 2. Test requires advance preparation by testing agency.

- b. Simulate loss of phase-to-ground voltage for each phase of normal source.
- c. Verify time-delay settings.
- d. Verify pickup and dropout voltages by data readout or inspection of control settings.
- e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

Usually require test in first subparagraph below only for critical and extensive installations and for switches rated 1600 A and more in other installations.

- f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
- g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

Retain "Ground-Fault Tests" Subparagraph below if protective devices for circuits connected to transfer switches include ground-fault protection.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
  - a. Verify grounding connections and locations and ratings of sensors.

Observe reaction of circuit-interrupting devices when simulated fault current is applied at sensors. Retain first paragraph below if automatic transfer switch is associated with generator.

- D. Coordinate tests with tests of generator and run them concurrently.
- E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

- F. Transfer switches will be considered defective if they do not pass tests and inspections.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Prepare test and inspection reports.

Revise "Infrared Scanning" Paragraph below to suit types of switches specified.

- I. Infrared Scanning: After Substantial Completion and building occupancy, perform an infrared scan of switch connections.
  - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Perform two follow-up infrared scans of switch, one at four months and the other at 11 months after Substantial Completion.
  - 3. Prepare a certified report identifying switch checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

### 3.4 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.

Retain paragraph below if generators are in Project.

- C. Coordinate this training with that for generator equipment.

END OF SECTION 263600