Critical Facilities Applications Using Transfer Switches

Presented by: Muzaffar Zaman – Midwest Area Sales Manager
Critical Power Product Overview Road Map

- Critical Power Market Segments/Applications
- 7000 SERIES Product Features
- 7000 SERIES Product Platforms
- Critical Power ATS Controller
- Withstand And Close On Ratings
- 7000 SERIES Optional Accessories
- Custom-Engineered Transfer Switches
- Review
Critical Power Market Segments /Applications

- Data Centers
- Healthcare
- Government
- Transportation
- Telecom

Diverse Market Segments
Critical Power Market Segments – ASCO Offerings

1. Automatic Transfer Switch
2. Power Control System
3. Load Bank
4. EcoStruxure Power (Critical Power Management Appliance)
5. Critical Power Services

ASCO Products Portfolio For Critical Facilities
Critical Power Market Segments - Healthcare

The Top US Hospitals Choose ASCO

100% Of Top Hospitals Have At Least Some ASCO
70% Of Top Hospitals Are Mostly or All ASCO
30% Of Top Hospitals Have Only ASCO

<table>
<thead>
<tr>
<th>Rank</th>
<th>The 2018-2019 Honor Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mayo Clinic (Rochester, MN)</td>
</tr>
<tr>
<td>2</td>
<td>Cleveland Clinic (Cleveland, OH)</td>
</tr>
<tr>
<td>3</td>
<td>Johns Hopkins Hospital (Baltimore, MD)</td>
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<tr>
<td>4</td>
<td>Massachusetts General Hospital (Boston, MA)</td>
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<tr>
<td>5</td>
<td>Michigan Medicine (Ann Arbor, MI)</td>
</tr>
<tr>
<td>6</td>
<td>UCSF Medical Center (San Francisco, CA)</td>
</tr>
<tr>
<td>7</td>
<td>UCLA Medical Center (Los Angeles, CA)</td>
</tr>
<tr>
<td>8</td>
<td>Cedars-Sinai Medical Center (Los Angeles, CA)</td>
</tr>
<tr>
<td>9</td>
<td>Stanford Health Care, Stanford Hospital (Stanford, CA)</td>
</tr>
<tr>
<td>10</td>
<td>New York Presbyterian Hospital (New York, NY)</td>
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<tr>
<td>11</td>
<td>Barnes-Jewish Hospital (St. Louis, MO)</td>
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<tr>
<td>12</td>
<td>Mayo Clinic Hospital (Phoenix, AZ)</td>
</tr>
<tr>
<td>13</td>
<td>Northwestern Memorial Hospital (Chicago, IL)</td>
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<tr>
<td>14</td>
<td>Penn Presbyterian Medical Center (Philadelphia, PA)</td>
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<td>15</td>
<td>NYU Langone Hospital (New York, NY)</td>
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<td>16</td>
<td>UPMC Presbyterian Shadyside (Pittsburgh, PA)</td>
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<td>17</td>
<td>Vanderbilt University Medical Center (Nashville, TN)</td>
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<tr>
<td>18</td>
<td>The Mount Sinai Hospital (New York, NY)</td>
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<tr>
<td>19</td>
<td>Duke University Hospital (Durham, NC)</td>
</tr>
<tr>
<td>20</td>
<td>Brigham and Women’s Hospital (Boston, MA)</td>
</tr>
</tbody>
</table>
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• Custom-Engineered Transfer Switches
• Review
7000 SERIES Product Features

Conventional Two Position Transfer Configuration, Plus Closed And Delayed Transition. Also Available In Bypass Isolation And Service Entrance (SEATS) Configurations

- Automatic And Non – Automatic Open Transition Transfer Switches (7ATS, 7MTS, & 7NTS)
- Closed Transition Transfer Switches (7ACTS, & 7NCTS)
- Delayed Transition Transfer Switches (7ADTS, & 7NDTS)
- Bypass Isolation Transfer Switches (7ATB, 7ACTB, & 7ADTB)
- Service Entrance Transfer Switches (SEATS) (7AUS, 7AUB, 7ACUS, 7ACUB, 7ADUS, & 7ADUB)
7000 SERIES Product Features

- UL Listed To 1008 Transfer Switch Equipment
- SEATS Also Listed To UL 891 (Switchboard Construction) For 250 – 4000 Amps
- CSA Certified To CSA 22.2 No 178 - 1978
- 2, 3, 4, (Switched Or Overlap Neutral) Pole Configurations
- Voltages to 600 V
- Group 5 Controller
- High Withstand And Close On Ratings Including New Short Time Ratings
- Optional Type 3R, 3RX, 4, 12, 4X Enclosures (Non – Secure And Secure)

D Frame
30 – 230A

J Frame
150 – 600A

H Frame
600 – 1200A

G Frame
1600 – 3000A

G Frame 4000A
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7000 SERIES Transfer Switch Product Platform

- Electrically Operated
- Mechanically Held
- Simple
- Reliable
- Repeatable
- Fast
7000 SERIES Transfer Switch Product Platform

Dual Solenoid Assembly

Allows Dual Contactors to Operate Independently enabling:
- Delayed Transition
- Load Shed to a Center Off Position
- Closed Transition (Limited Parallel)
- Soft Load (Extended Parallel)
7000 SERIES Open Transition Transfer Switch 7ATS

Figure 4: Open Transition Sequence

Available 30 – 4000 Amperes
What could happen if the 2 sources are not in synch?

In-phase Transfer

- Engine-Generator
- Emergency Power
- Normal Voltage
- Emergency Voltage
- 7000 SERIES Open Transition Transfer Switch 7ATS
- Motor Load
- Normal Power
- V Motor
- Power Plant
- Transfer Switch
7000 SERIES Open Transition Transfer Switch 7ATS

**In-phase Transfer**

Normal-to-Emergency usually has an outage time for generator start, so in-phase is not used/needed.

- **Emergency Voltage**
- **Normal Voltage**
- **Emergency Power**
- **Normal Power**
- **Engine-Generator**
- **Transfer Switch**
- **Power Plant**
- **Motor Load**
- **V Motor**
Emergency-to-Normal may have very short time delay between the 2 sources with possible catastrophic consequences.

Controller Algorithm

Speed

Consistency

Engine-Generator

Emergency Power

Transfer Switch

Normal Power

Motor Load

Normal Voltage

Emergency Voltage

V Motor

7000 SERIES Open Transition Transfer Switch 7ATS
7000 SERIES Closed Transition Transfer Switch 7ACTS

Figure 6: Closed Transition Sequence

Passive Synchronization

Available 150 – 4000 Amperes
7000 SERIES Closed Transition Transfer Switch 7ACTS

- Both Sources Must Be Present
- Sources Must be in Synchronism
- Overlap Shall Not Exceed 100 msec.
- Isochronous Type Governor
7000 SERIES Delayed Transition Transfer Switch 7ADTS

Available 150 – 4000 Amperes
7000 SERIES Delayed Transition Transfer Switch 7ADTS

- Time Delayed Neutral Position to Allow Motor Voltage to Decay
- **Mechanical Interlock**
- Configurable Time Delay via Control Panel Settings
  - Password Protected
  - Readily Adjustable Through Key Pad or Dip Switches
Specifying Bypass Isolation Transfer Switches

NEC 2020

Essential Electrical Systems (517, 700-702)
- Article 700.5(B) specifies the capability “to bypass and isolate the transfer equipment.”
- NFPA 99, 101 & 110

Critical Operations Power Systems (708.24 (D))
- Bypass Isolation ATS required where COPs loads are supplied by only one transfer switch
- Goal is to facilitate system maintenance 708.6(C)

Examples of Facilities that are Designated as Mission Critical Facilities are:
- Data Processing Centers; 911 Call Centers; Hospitals; Transportation and Municipal Infrastructure; Police, Fire, and Civil Defense Stations; Telecommunications Centers; Cell Sites; Air Traffic Control Towers; Water Pumping Stations and Petrochemical Plants.
7000 SERIES Bypass Isolation Transfer Switches

Available 150 – 4000 Amperes
I do not specify it because, facility managers are not using it…

They might be intimidated by it?

- **Fixed** vs. Removable Handles
- **Dead Front Design** (Why open the door?)
- Load-break vs. No Load-break Design
7000 SERIES – Maintenance Bypass Isolation Operation

1. Normal State with ATS Connected to Normal Source
   - Bypass Switch in Open Position
   - Sliding "Stab and Finger" Contacts

2. Bypass Switch Connected to Normal Source
   - From Emergency
   - To Load
   - From Normal

3. ATS in Test Position with Control Contacts Connected
   - Bypass Switch Open (Manual Operation)
   - Transfer Switch Normal Position
   - Bypass Switch Connected to Normal (Manual Operation)

4. ATS Withdrawn and Available for Maintenance
   - Bypass Switch Closed to Normal
   - Transfer Switch Normal Position
7000 SERIES Service Entrance Transfer Switches 7AUS

- Available 100 – 4000 Amperes
- UL 1008 Listed, And UL 891 Listed (Switchboard Construction) 250 – 4000 Amps
- Meets NEC Requirements For Use As Service Entrance Equipment
- 100% Rated Breakers For 1000 Amps And Above; 80% below 1000 Amps With Optional 100% Rated Breaker
- Ground Fault Protection Provided On Sizes Of 1000 Amperes And Above
- Type 1, 3R, 4, 4X, 12 Secure Enclosures

Circuit Breaker Mounted In Separate Compartment For 250 – 4000 Amperes Can Be Operated Without Opening Enclosure Door
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Critical Power ATS Controller

Group 5 Controller
Standard Display

Advanced Touch Display Interface (TDI)
Accessory 150 Tech. Package (see page 16)
Easy-To-Read Display Indicates System State, Source Voltages, Active Time Delays and Event Log

- Open, Closed or Delayed Transition
- 3-phase Normal and Emergency Monitoring
- Operator Adjustable Time Delays
- Operator Adjustable Frequency and Voltage Pickup and Dropout Settings
- Standard Engine Exerciser

System Status

- Normal OK
- Load on Normal

Source Status

- Normal Source
- Load on Normal

Time Delay Status

- Normal OK
- TD, Source, Fault

Inphase Transfer Status

- Inphase OK
- Waiting for In-Phase Delay

Voltage and Frequency Settings

- Normal Voltage
- Trip
- Undervoltage
- Overvoltage
- Output

Feature Settings

- Shed Load
- Feature

Time Delay Settings

- TD Time
- Phase
- Port Time

Indication Lights for Connected Source

- Indication Lights for Source Acceptability

- Selector Switch for Transfer Test and Retransfer Time Delay Bypass

Group 5 Controller
Premium User-Friendly Experience

Touch Display Interface

Controller Expanded Options

Hot-Swappable Screen

- Expanded Options
- Friendly Experience
- Touch Display Interface
- Hot-Swappable Screen
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- Warranty Review
Circuit Breakers (AIC) vs. Transfer Switches (WCR)?

**Ampere Interrupting Capacity (AIC)** - Capability to **safely interrupt or break** short circuit currents and disconnect the power source from the load under overcurrent conditions.

**Withstand Closing Rating (WCR)** - Capability to **safely endure and close-on** short circuit currents until overcurrent conditions are interrupted. These WCR ratings are based on either:

- Specific time durations (time based)
- Coordination with specific circuit breaker or fuse types (series rating)

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**Interrupt Current**

**Maintain Current**
Qualifying Specific Breakers Post UL1008, 7th Edition

- Problem: Prior to 7th edition there was **no guarantee** that all listed breakers would coordinate with the ATS WCR rating to clear the short circuit safely.

- **Method for listing specific breakers was not defined in the standard** and was based on a comparison of the **“published” instantaneous clearing time** between the tested breaker and non-tested circuit breakers.

- **If the non-tested circuit breaker’s published clearing time was equal to or less than the tested circuit breaker’s published clearing time, the non tested breaker could be listed.**

- Most switch manufacturers then documented a **formidable list of specific breaker manufacturers and types** on their WCR label at that time.

- The **most significant change in the 7th Edition** requires **comparing the publish trip time of the new breaker with actual breaker trip time from a previous short circuit test.**
### NEW LABEL

#### Instantaneous Trip Response

**SHORT-CIRCUIT WITHSTAND AND CLOSING RATING**

When protected by a circuit breaker, this transfer switch is suitable for use in a circuit capable of delivering the short-circuit current for the maximum time duration and voltage marked below.

The circuit breaker must include an instantaneous trip response and shall not include a short-time trip response.

The maximum clearing time of the instantaneous trip response must be equal to or less than the time duration shown for the marked short-circuit current.

**Short-Circuit Current**

<table>
<thead>
<tr>
<th>RMS Sym Amps (x 1000)</th>
<th>Voltage (Volts AC)</th>
<th>Time Duration (Sec)</th>
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<tbody>
<tr>
<td>65</td>
<td>240</td>
<td>0.050</td>
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<tr>
<td>42</td>
<td>480</td>
<td>0.050</td>
</tr>
<tr>
<td>35</td>
<td>600</td>
<td>0.050</td>
</tr>
</tbody>
</table>

**NEW LABEL**

Short-Time Trip Response

When protected by a circuit breaker, this transfer switch is suitable for use in a circuit capable of delivering the short-circuit current for the maximum time duration and voltage marked below.

The circuit breaker must include an instantaneous trip response unless the available short-circuit current is less than or equal to the time duration shown.

The maximum clearing time of the instantaneous trip response must be less than or equal to the time duration shown for the marked short-circuit current.
Critical Power Design/Strive for Excellence

What should happen when the following occurs:

- Fault A – Downstream of Optional ATS
- Fault B – Downstream of Optional ATS

Why Short Time Ratings? Selective Co-ordination!!!
Localization of an overcurrent condition to restrict outages to the circuit or equipment affected
### 7000 SERIES - UL 1008 Withstand And Close - On Ratings

<table>
<thead>
<tr>
<th>Frame</th>
<th>Switch rating (Amps)</th>
<th>Current Limiting Fuses</th>
<th>Specific Breaker</th>
<th>Time Based</th>
<th>Short Time Ratings1 (sec)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>480V Max.</td>
<td>600V Max.</td>
<td>Max. Size, A</td>
<td>Class</td>
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<tr>
<td>D</td>
<td>30</td>
<td>300</td>
<td>200</td>
<td>J</td>
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<tr>
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<td>200</td>
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<td>150kA</td>
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<td>35kA</td>
<td>200</td>
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<td>300</td>
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<td>E</td>
<td>260, 400</td>
<td>100kA</td>
<td>600</td>
<td>J</td>
<td>65kA</td>
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<tr>
<td>J</td>
<td>150, 200, 260</td>
<td>200kA</td>
<td>800</td>
<td>L</td>
<td>200kA</td>
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<tr>
<td>J</td>
<td>400</td>
<td>200kA</td>
<td>800</td>
<td>L</td>
<td>65kA</td>
</tr>
<tr>
<td>J</td>
<td>600</td>
<td>200kA</td>
<td>800</td>
<td>L</td>
<td>65kA</td>
</tr>
<tr>
<td>H#</td>
<td>600</td>
<td>600</td>
<td>200kA</td>
<td>1600</td>
<td>65kA</td>
</tr>
<tr>
<td>P#</td>
<td>600</td>
<td>600</td>
<td>200kA</td>
<td>1600</td>
<td>65kA</td>
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<td>1600</td>
<td>65kA</td>
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<td>800 - 1200</td>
<td>200kA</td>
<td>2500</td>
<td>L</td>
<td>100kA</td>
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</tbody>
</table>

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1. Short Time Ratings refer to the maximum current that a device can withstand for a specific duration without permanent damage.
Specifying Short Time Ratings – 26 36 00

2.04 TRANSFER-SWITCH TYPE ELECTRICAL CHARACTERISTICS AND OPTIONS

A. Manual, Automatic, Open-Transition, Closed-Transition, or Bypass/Isolation type as indicated on the Drawings.

2.05 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. 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 amperne rating, unless otherwise indicated.

B. Tested Fault-CURRENT closing and Withstand 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.
   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.
   2. Short-time withstand capability:
      a. Three cycles, minimum for all equipment under 600 amperes.
      b. 15 cycles, minimum for all equipment 600 amperes or greater.

B. Tested Fault-CURRENT Closing and Withstand 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.
   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.
   2. Short-time withstand capability:
      a. 18 cycles, minimum for all equipment.
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7000 SERIES Optional Accessories

- **Indicators**
  - 1A/14B – Additional Aux Contacts To Indicate Switch Position
  - 18B, 18G – Form C 2P D/T Throw Contacts For Source Availability

- **Customer Control Circuits**
  - 17AL – Preferred Source Selector Switch (Peak Shave)
  - 30* – Load Shedding Circuit (Non-essential Loads)
  - 31Z – Selective Load Disconnect Control Contacts (Elevator)
  - 43R – Terminal Block for all Customer Control Connections

- **Surge Protection**
  - 73* – ASCO TVSS, rated 50kA to 100kA Per Mode – Can be Connected to Normal, Emergency, or Load Terminals

- **Strip Heater**
  - 44G – Strip Heater With Thermostat

- **Extension Harness**
  - 37B – Six Foot (6’) Extension Harness to Increase Distance Between Transfer Switch and Control Panel

- **Bypass-Isolation Switch Options**
  - 14* - Aux Contact for various Positions
  - 82C – Automatic Shutters for Bus Isolation with Switch Withdrawn

- **Time Delay**
  - 1G – External 24 VDC Input Signal To Controller To Maintain Power When Both Power Sources Are De-Energized
  - 1PS1 – Provides Backup Power For Communications When Power Is Lost Terminal Block For External 24 VDC
  - 2C – Extended Time Delay On Engine Start

- **Manual Controls For Automatic Transfer Switches**
  - 6C – Reset Switch For Manual Retransfer To Normal With Automatic Retransfer In The Event Of Emergency Source Failure
  - 6D – Selector Switch For Automatic/Manual Retransfer To Normal. Automatic Bypass If Emergency Fails

- **Special Applications**
  - 29A – Priority Source Selector Switch Between Two Utility Sources
  - 63 – Special Lug Configurations – Crimp Lugs, Bus Risers etc.
  - 111A – Controls For Gen to Gen for Standby Applications
  - 111B – Controls For Gen to Gen for Prime Power Applications
  - 125A – Seismic Certification – IBC
  - 131 – Certification Of Compliance With ARRA (Buy American)
7000 SERIES Optional Accessories - Metering

Optional Accessory – 135* (Load Metering)
7000 SERIES Optional Accessories – Tech Package

Optional Accessory – 150*

- **Graphical Color Touch Interface**: Simplifies transfer switch and engine-generator operation and management.
- **24-Months of power load demand data**
- **Logs 1000 Events**:
  - Transfer Switch
  - Bypass transfer switch
  - Engine-generator
  - Download all logs to your USB drive
- **Sends Out Real-Time Alarms** through E-Mail and Text Messages
- **4 Weeks** of historical energy trending data with ability to zoom in to 1-second resolution.
- **Enhances Security** using NIST compliant AES 128-bit Encryption and Multi-level Authentication
- **25 Seconds** of power outage ride-through for ATS controller and communications.
- **Mobile Web App** allows you to monitor your transfer switch and engine-generator on-the-go.
- **Increase Efficiency** by increasing operational effectiveness and energy efficiency.
- **Compatible** with building, monitoring, and IT monitoring systems using OPEN MODBUS and SNMP PROTOCOLS.
- **Enables Regulatory Reporting** for ASCO 5700 Series automated NFPA, Joint Commission, and CALEA compliance reporting tools.
7000 SERIES Optional Accessories – 5101

Compliance with New Requirement requires:

1. Continuous Monitoring of Gen Signaling Circuits
2. Visual and Audible Annunciation of Changes in State
3. Automatic Transmission of an Engine Start Signal and Alarm when a Problem is Detected
Monitoring of EPSS

Simplify NFPA 110

Email and Text Alarms and Event Conditions

Simplify BMS Integration

Joint Commission Compliance

Modbus TCP/IP BACnet IP

Optional Accessory – 107G
7000 SERIES Optional Accessories - Annunciators

- 5350 8-ATS Annunciator
- 5705 8-Device Annunciator
Specifying Advanced Annunciator – 26 36 00

BMS Compatibility

NFPA 110 Compliant

Email & Text Alerts

EPSS Reporting

B. Annunciator Panel: Graphical touch screen with the following capabilities:

1. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
2. Digital Communication Capability: Matched to that of transfer switches supervised.
4. ATS and Generator reporting with Settings, Energy, Testing and Outage reports.
5. NFPA 110 Generator Information.
6. Generator real-time performance dashboard, including, but not limited to, engine speed, oil pressure, coolant temperature, and fuel level.
7. Alarm reporting via email and text.
8. Web-based remote access capability and remote testing of power generators and transfer switches.

2.05 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

b. Adjustable time-delay for transferring to “emergency” and to “normal.”
c. Adjustable time-delay for engine cool down.
d. Manual bypass button to allow bypass of time-delay back to normal power.
e. Engine start adjustable time-delay.
f. AC metering for amperes, voltage, frequency, running time, KVA/PF loads on each side.
g. Programmable Microprocessor Controlled.
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Custom Transfer Switches – Full Capability

Figure 5: This ASCO 3,000 Amp 7000 SERIES Automatic Isolation-Bypass Switch lineup includes power distribution circuit breakers in Sections 1 & 2, a Continuous Power Monitoring System (Section 3), circuit breakers for the Normal and Emergency sources (Section 5), and current transformer and utility termination compartments in Section 6.
Benefits of Custom-Engineered Transfer Switches

- **Reduced Space**
  - Equipment provided by different vendors will typically be mounted in a separated location, often in a separate enclosure for each component

- **Reduced Lead and Construction Times**
  - Instead of purchasing through separate multiple channels, multiplying the effort required to procure

- **Reduced Installation Labor**
  - Simplified installation

- **Lower Overall Installed Cost**
  - Integrated solutions typically cost less than installing separate power devices

- **Enhanced Quality Control**
  - Factory-assembled, tested and provided as a single deliverable

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Single Source – A Unified Solution from a Single Manufacturer Streamlines Equipment Design, Procurement, and Installation because all the Related Services can be Undertaken through a Single Source
Custom Transfer Switches – Case Study

WWTP Southwest Minnesota
Custom Applications – Smart Power Transfer Board

ASCO 5700 Power Management Gateway
Continuously monitors, aggregates and enables consolidated local & remote management wirelessly.

Touchscreen HMI
Centralized consolidated 10inch capacitive touchscreen interface.

Easergy TH110 & CL110 Wireless Thermal Sensors
Continuously thermal and humidity monitoring of sources and load connections.

ASCO 5401 Multi-circuit Monitoring with IO
Monitors status, energy-usage, power quality and demand of distribution circuit breakers.

PowerLogic PM8000 with ION Technology
Analyze power quality of utility, generator and loads.

ASCO 5112 Ethernet IO Module
Enables bypass transfer switch monitoring.

ASCO SERIES 400 Surge Protection w/ Active Surge Monitoring
All-in-one surge protection device & active surge monitoring.

From Reactive to Proactive
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Concurrent Maintainability
Maximize Uptime
Fault Tolerance

CRITICAL FACILITIES

ALERTS & NOTIFICATIONS

CPMS USER INTERFACE

EPSS

GENERATOR
POWER CONTROL SYSTEMS
TRANSFER SWITCH
SWITCHBOARDS & PANEL BOARDS
LOAD BANKS
UTILITY
POWER DISTRIBUTION UNITS
SURGE MONITORING SYSTEM
POWER METERS
COMPUTER ROOM AIR CONDITIONERS
UPS