
USACE / NAVFAC / AFCEA UFGS-16410N (February 2003)

Preparing Activity: NAVFAC Superseding
UFGS-16410N (August 2000)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Latest change indicated by CHG tags.

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SECTION 16410N

AUTOMATIC TRANSFER SWITCHES 02/03

NOTE: This guide specification covers the requirements for automatic transfer switches intended for use in Emergency Electrical Power Systems meeting requirements of NFPA 70, NFPA 99, and MIL-HDBK-1191.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: The following system design requirements shall be adhered to when providing automatic transfer switches:

1. Provide four-pole transfer switches. The neutral conductor for each source of supply, including the neutral on separately derived systems, shall be switched by the transfer switch.
2. Do not install transfer switches on the supply side of service equipment. When the transfer switch is to be located on the supply side of service loads, provide an independent service overcurrent protection device on the supply side of the transfer switch.

3. Do not use open type transfer switches installed in other equipment such as switchboards, or as part of the service equipment.

NOTE: The following information shall be shown on the project drawings:

1. The available fault current at the bus feeding the automatic transfer switch.

2. The rating of the overcurrent device protecting the automatic transfer switch.

3. Identify automatic transfer switches to be provided with By-pass/Isolation Switches, when applicable.

4. Identify control type, i.e., Utility-Generator, Preferred Utility Source, or Generator-Generator, for each automatic transfer switch.

5. Identify automatic transfer switches to be provided with "transfer time delay" and "time delay transition" or "in-phase monitor" features, where applicable.

6. Identify automatic transfer switches to be used for fire pump service, when applicable.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2003) Acceptance Testing Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1008	(1996; Rev thru Aug 2003) Transfer Switch Equipment
UL 508	(1999; Rev thru Dec 2003) Industrial Control Equipment

1.2 RELATED REQUIREMENTS

Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS, and Section 16081 APPARATUS INSPECTION AND TESTING, apply to this section, with the additions and modifications specified herein.

1.3 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Automatic Transfer Switch Drawings; G

SD-03 Product Data

Automatic Transfer Switches; G

SD-06 Test Reports

Acceptance Checks and Tests; G

Functional Acceptance Tests; G

SD-07 Certificates

Proof of Listing; G

SD-10 Operation and Maintenance Data

Automatic Transfer Switches, Data Package 5; G

Submit in accordance with Section 01781 OPERATION AND
MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Proof of Listing

Submit proof of listing by UL 1008.

1.4.2 Automatic Transfer Switch Drawings

Drawings shall include outline, arrangement, and detail drawings. Detail drawings shall include manufacturer's name and catalog number, electrical ratings, total system transfer statement, reduced normal supply voltage at which transfer to the alternate supply is initiated, transfer delay times, short-circuit current rating, wiring diagram, description of interconnections, testing instructions, acceptable conductor type for terminals, tightening torque for each wire connector, and other required UL 1008 markings.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

NOTE: Select the following options for switches to
be installed in facilities complying with
MIL-HDBK-1191, DOD Medical and Dental Treatment
Facilities Design and Construction Guide: (a)
"Switches utilizing circuit breakers are not
acceptable"; (b) "Automatic Transfer Switches
provided with a by-pass/isolation switch shall be
mounted on a drawout mechanism so that the automatic
transfer switch can be removed from the enclosure".

Provide four-pole, automatic transfer switches for use in emergency systems
in accordance with UL 1008. Each automatic transfer switch shall be rated

for total system transfer and have the current and voltage ratings as indicated. The rating of the switch shall be adequate for withstanding the effects of the indicated RMS symmetrical fault current when protected by the indicated overcurrent device without contact welding. The switch operating mechanism shall be electrically operated from the source to which it is transferring, shall have quick-make, quick-break, load break contacts, and shall be mechanically held in both positions. [Switches utilizing circuit breakers are not acceptable.] Non-fire pump service transfer switches shall have manual operating means provided for maintenance and servicing accessible only by opening the enclosure.

[Transfer switches for fire pump service shall have manual operating means externally operable without opening the enclosure.] The manual operating means shall affect the opening and closing of the switch contacts at the same rate of speed as that caused by the automatic operation of the switch.

[Automatic transfer switches provided with by-pass/isolation switches shall be mounted on a drawout mechanism so that the automatic transfer switch can be removed from the enclosure.] [The switch enclosure shall comply with UL 508, NEMA Type [1], [12], [____], and shall be equipped with an equipment ground lug.]

[2.1.1 By-Pass/Isolation Switches

NOTE: Include by-pass/isolation switches only where the nature of the loads make continuance of power essential when the associated ATS switch is disconnected for repairs, preventive maintenance, or testing. Provide by-pass/isolation switches for automatic transfer switches to be installed in facilities complying with MIL-HDBK-1191, DOD Medical and Dental treatment Facilities Design and Construction Guide.

Include by-pass/isolation switches for the indicated automatic transfer switches. Provide by-pass/isolation switches in accordance with UL 1008 that can be used to manually select an available power source to feed load circuits and to permit total isolation of the automatic transfer switch. The by-pass/isolation switch shall be rated for total system transfer and have the same current rating, voltage rating, number of poles, and withstand and closing rating as the associated automatic transfer switch.

]2.1.2 Automatic Transfer Switch Controls

[2.1.2.1 Controls for Utility-Generator Automatic Transfer Switch

NOTE: The following paragraph is intended for use when the automatic transfer switch is to be used for transferring loads to an emergency generator upon loss of the normal (utility) source.

Provide all necessary controls to start the generator set upon loss of the normal (utility) source, transfer the load to the generator set upon reaching rated voltage and frequency, re-transfer the load when the normal (utility) source returns, and stop the generator set.

The switch shall include the following control features.

- a. Three-phase normal source voltage sensing circuit with adjustable dropout, 75-93 percent of nominal, and pickup, 85-100 percent of nominal.
- b. Engine starting control contacts with adjustable commit-to-start delay circuit, 0.5-6.0 seconds.
- c. Voltage/frequency sensing circuit, set for 80 percent of nominal, for enabling load transfer to emergency source.

NOTE: Provide transfer to emergency source time delay for the transfer switches requiring delayed-automatic operation.

- [d. Transfer to emergency source time delay for transfer switches as indicated, adjustable 0-5 minutes.]
- e. Re-transfer to normal source time delay, adjustable 1-30 minutes.
- f. Programmable exerciser to allow automatic starting of the generator set and subsequent load transfer. Exercise periods shall be selectable for 1 to 24 hours per day for 0 to 7 days a week.

NOTE: When the transferred load includes motors (over 50 HP or over 5 HP without significant resistive loads), select the following option.

- [g. Adjustable time delay transition or in-phase monitor feature for indicated transfer switches to allow safe transfer of highly inductive loads between two non-synchronized sources.]

] [2.1.2.2 Controls for Generator - Generator Source Automatic Transfer Switch

NOTE: The following paragraph is intended for use when a second automatic transfer switch is to be used to select between two generators in a three source (utility-generator-generator) system.

Provide all necessary controls to start both generator sets upon loss of the normal utility source, transfer the load to the first generator set to reach rated voltage and frequency, shutdown the second generator set upon transferring the load to the first generator set, restarting and transferring the load to the second generator if at any time the first generator set fails, re-transfer the load when the normal (utility) source returns, and shut down the generator set. The switch shall include the following control features;

- a. Engine starting control contacts.
- b. Voltage/frequency sensing circuit, set for 80 percent of nominal for enabling load transfer to emergency source.

- c. Programmable exerciser time to allow automatic starting of the generator sets and subsequent load transfer to each generator set. Exercise periods shall be selectable for 1 to 24 hours per day for 0 to 7 days a week.

] [2.1.2.3 Controls for Preferred Utility Source Automatic Transfer Switch

NOTE: The following paragraph is intended for use
when the automatic transfer switch is to be used for
selecting between two utility sources (preferred and
alternate).

Provide all the necessary controls to transfer the load to the alternate utility source upon loss of the preferred utility source and re-transfer the load to the preferred utility source when the preferred utility source returns. The switch shall include the following control features.

- a. Three-phase preferred and alternate source voltage sensing circuit with adjustable dropout, 75-98 percent of nominal, and pick-up, 85-100 percent of nominal.
- b. Re-transfer to normal source time delay, adjustable 1-30 minutes.

NOTE: When the transferred load includes
motors (over 50 HP or over 5 HP without significant
resistive loads) select the following option.

- [c. Adjustable time delay transition or in-phase monitor feature for indicated transfer switches to allow safe transfer of highly inductive loads between two non-synchronized sources.]

] [2.1.2.4 Controls for Fire Pump Service Automatic Transfer Switch

NOTE: The following paragraph is intended for use
when the automatic transfer switch is to be used for
fire pump service.

Provide the following additional controls features:

- a. Phase reversal of the normal source shall initiate transfer to the emergency/alternate source.]

2.1.3 Front Panel Devices

Provide devices mounted on cabinet front consisting of:

- a. Mode selector switch with the following positions and associated functions;
 - 1. TEST - Simulates loss of normal/preferred source system operation.
 - 2. NORMAL - Transfers system to normal/preferred source bypassing

re-transfer time delay.

- b. Lamps for indicating connected source and normal/preferred source is available.
- c. Auxiliary contacts for indicating connected source and normal/preferred source available.

NOTE: Select option for preferred source selector switch when specifying preferred utility source automatic transfer switches.

- [d. Source selector switch with the following positions and associated functions.
 - 1. Source 1 - Selects Source 1 as the source to which the automatic transfer switch will transfer if that source is available.
 - 2. Source 2 - Selects source 2 as the source to which the automatic transfer switch will transfer if that source is available.]

NOTE: Select the following option when specifying by-pass/isolation switches.

- [e. Lamps for indicating that the by-pass/isolation switch is in the "normal by-pass", "alternate by-pass", or "isolated" position.

]PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to the requirements of NFPA 70 and manufacturer's recommendation.

3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the automatic transfer switch.

3.2.1 Performance of Acceptance Checks and tests

Complete as specified in paragraph entitled "Acceptance Checks and Tests". The Acceptance Checks and Tests shall be accomplished by the Testing organization as described in Section 16081 APPARATUS INSPECTION AND TESTING.

3.2.2 Manufacturers O&M Information

The manufacturers O&M information required by the paragraph entitled "SD-10 Operation and Maintenance Data", shall have been submitted to and approved by the Contracting Officer.

3.2.3 Test Equipment

All test equipment and instruments shall be on hand prior to scheduling field tests, or subject to Contracting Officer's approval, evidence shall

be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.3 FIELD QUALITY CONTROL

Give Contracting Officer 15 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The contractor shall be responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The contractor shall provide labor, equipment, apparatus, including test load, and consumables required for the specified tests. Calibration of all measuring devices and indicating devices shall be certified. The test load shall be a cataloged product in accordance with Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS. Perform the following field tests in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.3.1 Automatic Transfer Switch Acceptance Checks and Tests

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Confirm correct application of manufacturer's recommended lubricants.
4. Verify that manual transfer warnings are attached and visible.
5. Verify tightness of all control connections.
6. Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey is not required.
7. Perform manual transfer operation.
8. Verify positive mechanical interlocking between normal and alternate sources.

b. Electrical Tests

1. Measure contact-resistance.
2. Perform insulation-resistance on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole for one minute. Perform tests in both source positions.
3. Verify settings and operations of control devices.
4. Calibrate and set all relays and timers.

3.3.2 Functional Acceptance Tests

Functional Acceptance Tests shall[be coordinated with Section 16237N SINGLE OPERATION GENERATOR SETS and shall] include simulating power failure and demonstrating the following operations for each automatic transfer switch. Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition, and function not less than five times.

- a. Perform automatic transfer tests:
 - 1. Simulate loss of normal/preferred power.
 - 2. Return to normal/preferred power.
 - 3. Simulate loss of emergency power.
 - 4. Simulate all forms of single-phase conditions.
- b. Verify correct operation and timing of the following functions:
 - 1. Normal source voltage-sensing relays.
 - 2. Engine start sequence.
 - 3. Time delay upon transfer.
 - 4. Alternate source voltage-sensing relays.
 - 5. Automatic transfer operation.
 - 6. Interlocks and limit switch function.
 - 7. Time delay and retransfer upon normal power restoration.

-- End of Section --