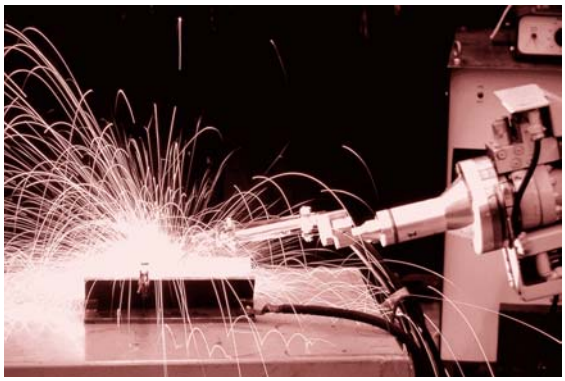
GE Zenith Controls

Engineering Application Information Withstand and Closing Ratings

The Purpose of Testing and Unit Ratings

GE Zenith ZTS series automatic transfer switches have been subjected to an extensive test program to show that they comply with and exceed UL 1008 standards as well as the various performance specifications used by most government agencies and major electrical engineers throughout the world. The primary test to assure the dependability of an automatic transfer switch is its ability to close into and withstand high fault currents. The purpose of this publication is to provide basic information on withstand ratings and to document the ratings that GE Zenith currently holds under UL 1008.

NFPA 110 Standard for Emergency and Standby Power Systems, Section 4-2.2, requires that the capacity and rating of automatic transfer switches be adequate to withstand the thermal and electromagnetic effects of short circuit currents that may arise in the electrical system. It is important to be able to compare properly the withstand current rating (WCR) of the switch to the available short circuit (fault) current of the system until the protective device clears the fault.



If a transfer switch does not have adequate withstand capability—system failure, fire, injury to personnel or equipment damage may result. A clear understanding of the interrelationship between the protective device, transfer switch and system needs is necessary for a well designed installation. Some basic information on withstand rating terms and calculations follows the enclosed rating charts.

Underwriters Laboratories (UL) is the independent testing body that has developed the standard UL 1008 which all major transfer switch manufacturers test to. UL lists products which have successfully passed a battery of witnessed tests including the withstand and close into fault tests described herein. Manufacturers that complete these tests are then permitted to label their products with the UL mark.

UL made significant changes in April of 1989 regarding the labeling requirements of transfer switches. Prior to that date there had been concern over coordination with some protective devices. UL clarified the labeling procedure and now allows for three rating categories.

- Current limiting fuse
- Specific class (trip time) of molded case breaker
- "Umbrella" or "Any Breaker" ratings that take into account all types of molded and insulated case circuit breakers; these tests are performed for a duration of 3 cycles on units 225 amps and greater, and for 1.5 cycles on 40-150 amp units (with an optional 3 cycle duration for units up to 150 amps; note the three cycle rating on 150 amp and below units is optional as UL has determined that all breakers in this size clear in less than 1.5 cycles). The "Umbrella" or "Any Breaker" rating is therefore the actual UL requirement and definition of the ATS industry 3 cycle (or 1.5 as noted) withstand and closing rating, and should not to be confused with additional, non UL 1008 labeled "withstand only" tests.

GE Zenith Product Ratings

The ZTS family of transfer switches has maintained an industry-leading role in ratings from the time of its introduction. Today all ZTS products are labeled with an "umbrella" (any molded case breaker) rating as well as some higher specific breaker levels giving the consultant a free hand with system design. The following pages include the UL certified ratings and specific breaker coordination charts, withstand rating data and additional specific information.

The consulting engineer must keep in mind that unless a transfer switch bears an umbrella breaker approval for use with any molded case breaker, care must be taken to assure that the breaker specified for the installation have an equal or shorter trip time when compared to the listed devices. This would limit the application of the switch to projects within the scope of its specific breaker listing.

In addition to this factor, many transfer switch manufacturers perform additional withstand tests on selected products. These additional tests may be either for a higher current valve or a longer duration than their standard UL listed ratings. The consultant must determine the applicability of these tests and take careful note of the fact that these levels are normally not UL labeled ratings.

THE ZTS SWITCH FAMILY

- ***ZTS*** *Automatic Transfer Switches 40 - 4000 amps*
- ***ZTSD*** *Delayed Transition Switches 40 - 4000 amps*
- ***ZTSCT*** *Closed Transition Switches 100 - 4000 amps*
- ***ZBTS*** *Transfer/Bypass Switches 100 - 4000 amps*
- ***ZBTSD*** *Delayed Transfer/Bypass Switches 100 - 4000 amps*
- ***ZBTSCT*** *Closed Transition Transfer/Bypass Switches 100 - 4000 amps*
- ***ZTG*** *Automatic Transfer Switches 40 - 3000 amps*
- ***ZTGD*** *Delayed Transition Switches 40 - 3000 amps*
- ***ZTX*** *Automatic Transition Switches 40 - 400 amps*

Underwriters Laboratories Inc.®

333 Pfingsten Road
Northbrook, Illinois 60062–2096
(847) 272–8800
FAX No. (847) 272–8129
MCI Mail No. 254–3343
Telex No. 6502543343

100 a century of public safety est. 1894

December 3, 1997

Zenith Controls, Inc.
Mr. Paul Stephan
830 West 40th Street
Chicago, IL 60609

Our Reference: E23911, E67544

Subject: Automatic Transfer Switches, Bypass/Isolation Switches

Dear Paul:

This letter summarizes Zenith Control's Listing of Automatic Transfer Switches and Bypass/Isolation Switches per UL 1008 for use on emergency or standby systems. See attached Appendix.

Each Zenith Automatic Transfer Switch and Bypass Isolation Switch is UL Listed for use in 480 V maximum applications provided the total current is within the ATS rating and the withstand current rating is suitable for the application.

The Zenith ATS rating is based on total system or motor load application. Thus, they are suitable for control of motors, electric discharge lamps, tungsten filament lamps and electric heating equipment where the sum of motor full-load ampere ratings and the ampere ratings of the other loads do not exceed the ampere rating of the switch and the tungsten load does not exceed 30 percent of the switch rating. Additional 100 percent tungsten ratings are noted on Chart A.

A Zenith Automatic Transfer Switch for each ATS rating (Appendix) completed successfully the overload, heat rise, endurance and dielectric withstand as required by UL 1008. The heat rise test was performed after the endurance test at the request of the manufacturer. Each ATS (WCR) withstand closing test (Appendix) was performed on a previously untested sample.

If you should have any questions of the above, please do not hesitate to contact us.

Very truly yours,

MICHAEL J. MAHER (Ext. 42980)
Senior Project Engineer
Engineering Services, 418D

Reviewed by:

R. G. Hames (Ext. 42973)
Associate Managing Engineer
Engineering Services, 418D

MJM:rv
97save10maher2.nov

A not-for-profit organization dedicated to public safety and committed to quality service

Rating Summary Chart –

Certified Withstand and Closing Ratings in Symmetrical RMS Amperes at 480 Volts AC –

GE Zenith Transfer Switches Rated for Total Systems or Motor Loads (1)	Withstand and Closing Current Ratings per UL 1008						
GE Zenith Model No.	UL 1008 ZTS Switch Rating	Withstand and Closing Ratings when Coordinated with Current Limiting Fuse		Specific Coordinated Breaker Rating (3)		Any Molded Case Breaker Rating	Minimum UL 1008 Ratings
		Maximum Fuse Size Amps	Maximum Circuit Amps	Maximum Circuit Breaker Size Amps	Maximum Circuit Amps	Maximum Circuit Amps	
ZTS3 (2) (6)	30	40	200,000	400	30,000	10,000	5,000
ZTS4 (2) (6)	40	50	200,000	400	30,000	10,000	5,000
ZTS7 (2) (6)	70	100	200,000	400	30,000	10,000	5,000
ZTS8 (2) (6)	80	100	200,000	400	30,000	10,000	5,000
ZTS10 (2) (6)	100	125	200,000	400	30,000	10,000	5,000
ZTS11 (2) (6)	104	150	200,000	400	30,000	10,000	5,000
ZTS15 (2) (6)	150	200	200,000	400	30,000	10,000	10,000
ZTS20	200	300	200,000	400	30,000	10,000	10,000
ZTS22 (2) (6)	225	300	200,000	800	50,000	35,000	10,000
ZTS25 (2) (6)	250	350	200,000	800	50,000	35,000	10,000
ZTS26 (2) (6)	260	350	200,000	800	50,000	35,000	10,000
ZTS30 (2) (6)	300	400	200,000	800	50,000	35,000	10,000
ZTS40 (2) (6)	400	600	200,000	800	50,000	35,000	10,000
ZTS60	600	750	200,000	800	65,000	50,000	12,000
ZTS80	800	1200	200,000	1200	65,000	50,000	16,000
ZTS100	1000	1250	200,000	1600	85,000	50,000	20,000
ZTS120	1200	1500	200,000	1600	85,000	50,000	24,000
ZTS160	1600	2000	200,000	2500	100,000	100,000	32,000
ZTS200	2000	2500	200,000	2500	100,000	100,000	40,000
ZTS260	2600	4000	200,000	4000	100,000	100,000	60,000
ZTS300	3000	4000	200,000	4000	100,000	100,000	60,000
ZTS400 (7)	4000	6000	200,000	5000	100,000	100,000	80,000
ZTSD4 (2)	40	50	200,000	150	50,000	35,000	5,000
ZTSD8 (2)	80	100	200,000	150	50,000	35,000	5,000
ZTSD10 (2)	100	125	200,000	150	50,000	35,000	5,000
ZTSD15 (2)	150	200	200,000	400	50,000	35,000	10,000
ZTSD22 (2)	225	300	200,000	400	50,000	35,000	10,000
ZTSD25 (2)	250	350	200,000	400	50,000	35,000	10,000
ZTSD26 (2)	260	350	200,000	400	50,000	35,000	10,000
ZTSD30 (2)	300	600	200,000	800	50,000	35,000	10,000
ZTSD40 (2)	400	600	200,000	800	50,000	35,000	10,000
ZBTS10 (2)	100	125	200,000	800	50,000	35,000	5,000
ZBTS15 (2)	150	200	200,000	800	50,000	35,000	10,000
ZBTS22 (2)	225	300	200,000	800	50,000	35,000	10,000
ZBTS26 (2)	260	350	200,000	800	50,000	35,000	10,000
ZBTS40 (2)	400	600	200,000	800	50,000	35,000	10,000
ZBTS60	600	750	200,000	800	65,000	50,000	12,000
ZBTS80	800	1000	200,000	1600	85,000	50,000	16,000
ZBTS100	1000	1250	200,000	1600	85,000	50,000	20,000
ZBTS120	1200	1500	200,000	1600	85,000	50,000	24,000
ZBTS160	1600	2500	200,000	2500	100,000	100,000	32,000
ZBTS200	2000	2500	200,000	2500	100,000	100,000	40,000
ZBTS260	3000	4000	200,000	4000	100,000	100,000	60,000
ZBTS300	3000	4000	200,000	4000	100,000	100,000	60,000
ZBTS400 (7)	4000	6000	200,000	5000	100,000	100,000	80,000

UL Appendix, Page 1 – Chart A

Rating Summary Chart –

Certified Withstand and Closing Ratings in Symmetrical RMS Amperes at 480 Volts AC –

GE Zenith Transfer Switches Rated for Total Systems or Motor Loads (1)		Withstand and Closing Current Ratings per UL 1008				
GE Zenith Model No.	UL 1008 ZTS Switch Rating	Withstand and Closing Ratings when Coordinated with Current Limiting Fuse		Specific Coordinated Breaker Rating (3)		Minimum UL 1008 Ratings
		Maximum Fuse Size Amps	Maximum Circuit Amps	Maximum Circuit Breaker Size Amps	Maximum Circuit Amps	
ZTG3 (2) (6)	30	40	200,000	400	30,000	5,000
ZTG4 (2) (6)	40	50	200,000	400	30,000	5,000
ZTG7 (2) (6)	70	100	200,000	400	30,000	5,000
ZTG8 (2) (6)	80	100	200,000	400	30,000	5,000
ZTG10 (2) (6)	100	125	200,000	400	30,000	5,000
ZTG11 (2) (6)	104	150	200,000	400	30,000	5,000
ZTG15 (2) (6)	150	200	200,000	400	30,000	10,000
ZTG20	200	300	200,000	400	30,000	10,000
ZTG22	225	300	200,000	400	30,000	10,000
ZTG26 (2) (6)	260	350	200,000	800	50,000	10,000
ZTG30 (2) (6)	300	400	200,000	800	50,000	10,000
ZTG40 (2) (6)	400	500	200,000	800	50,000	10,000
ZTG60	600	750	200,000	800	65,000	12,000
ZTG80	800	1200	200,000	1200	65,000	16,000
ZTG100	1000	1250	200,000	1600	85,000	20,000
ZTG120	1200	1500	200,000	1600	85,000	24,000
ZTG160	1600	2000	200,000	2500	100,000	32,000
ZTG200	2000	2500	200,000	2500	100,000	40,000
ZTG260	2600	4000	200,000	4000	100,000	60,000
ZTG300	3000	4000	200,000	4000	100,000	60,000
ZTG400	4000	6000	200,000	5000	100,000	80,000
ZTGD4 (2)	40	50	200,000	150	50,000	5,000
ZTGD8 (2)	80	100	200,000	150	50,000	5,000
ZTGD10 (2)	100	125	200,000	150	50,000	5,000
ZTGD15 (2)	150	200	200,000	400	50,000	10,000
ZTGD22 (2)	225	300	200,000	400	50,000	10,000
ZTGD26 (2)	260	350	200,000	400	50,000	10,000
ZTSD30 (2)	300	350	200,000	400	50,000	10,000
ZTGD40 (2)	400	600	200,000	800	50,000	10,000
ZTX4 (2) (6)	40	50	200,000	400	30,000	5,000
ZTX8 (2) (6)	80	100	200,000	400	30,000	5,000
ZTX10 (2) (6)	100	125	200,000	400	30,000	5,000
ZTX15 (2) (6)	150	200	200,000	400	30,000	10,000
ZTX20	200	300	200,000	400	22,000	10,000
ZTX22	225	300	200,000	400	30,000	10,000
ZTX30 (2) (6)	300	400	200,000	800	50,000	10,000
ZTX40 (2) (6)	400	500	200,000	800	50,000	10,000

Notes:

1. For each rating attained in above table, heat run was performed after the overload and endurance tests.
2. These models also listed for 100% tungsten lamp loads.
3. Consult factory for coordinated breaker types and ratings.
4. All transfer switches are rated in coordination with the protective device installed. Lower rated devices than those shown may be utilized and the system rated accordingly.
5. Consult factory for CSA and IEC ratings.
6. These units are also UL listed at 600VAC.

UL Appendix, Page 2 – Chart A

ZTS Series

Amp	Any Breaker	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types	Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200	10,000	22,000	**480V** Cutler-Hammer/ Westinghouse: 150A, FD, FDC, HFD; 250A, HJD, JD, JDB, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FC, FH, FI; 250A, KA, KC, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6, ED6, HED4, HED6; 250A, CFD6, FD6, FXD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THED, THLC1; 225A, TFK, TFL, THFK, THLC2; 250A, SFL, SFP, TFJ; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4	200,000	J	(Max. 400A)	(Max. 400A)
		30,000	**480V** Cutler-Hammer/ Westinghouse: 150A, FDC, HFD; 250A, HJD, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FC, FI; 250A, KC, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6, HED4, HED6; 250A, CFD6, FD6, FXD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THLC1; 225A, TFL, THLC2; 250A, SFL, SFP; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
		22,000	**600V** Cutler-Hammer/ Westinghouse: 150A, FDC, HFD; 250A, HJD, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FI; 250A, KA, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6; 250A, CFD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THLC1; 225A, TFL, THLC2; 250A, SFL, SFP; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4				

(1) ZTG2 and ZTX Frame F17 – Z1

ZTS Series *(continued)*

Amp	Any Breaker	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200	10,000	30,000	**240V**		200,000	J	(Max. 350A)	200A 300A, 350A respectively
			Cutler-Hammer/ Westinghouse	100A, FCL, FB TRI-PAC 150A, FD, FDC, HFD 250A, HJD, JD, JDB, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, DK				
			Square D	100A, FC, FH, FI 250A, KA, KC, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
			Siemens/ITE	125A, CED6, ED6, ED4, HED4, HED6 250A, CFD6, FD6, FXD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
			General Electric	100A, TB1 150A, SEL, SEP, TEL, THED, THLC1 225A, TFL, THFK, THLC2 250A, SFL, SFP 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
480V								
225 260 300 350 400	35,000	50,000	General Electric	SFL, SFP, TFL, THLC2, SGL4, SGP4, TB4, THLC4, TLB4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8	200,000	T, J, RK5	(Max. 800A)	600A
			Siemens/ITE	CFD6, HFD6, CJD6, SCJD6, HHJD6, HHJXD6, SHJD6, HJD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6				
			Square D	KI, KC, LI, LXI, LX, LE, LC, MX, ME, MH				
			Cutler-Hammer/ Westinghouse	HJD, JDC, HKD, CHKD, KDC, LCL, LA TRI-PAC, HLD, CHLD, LDC, CLDC, NB TRI-PAC				
			Merlin Gerin	CF250L, CF250H, CJ400L, CK400H, CJ400H, CK400N, CJ600H, CK800H, CK800N				
600 800	50,000	65,000	Cutler-Hammer/ Westinghouse	NB TRI-PAC, DSL206, HMDL, CHMDL, HND, NDC, CHND, CNDC, HLD, CHLD, LDC, CLDC	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
			General Electric	TB8, SKL8, SKP8, SGL6, SGP6, TB6, TJL, SKL12, SKP12, TKL8S, TKL12S, TP, THP, TC, THC				
			Siemens/ITE	CMD6, SCMD6, HMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6, CND6, SCND6, HND6, SHND6				
			Square D	LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX				
1000 1200	50,000	85,000	General Electric	THP, THC, TRP, SKP12, SKP8, TB8	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
			Square D	NC, NE, NX, PCF, PEF, PHF, PXF				
			Cutler-Hammer/ Westinghouse	PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC				
			Merlin Gerin	CK1000L, CM1600				
			Siemens/ITE	CND6, SCND6, CPD6, CMD6, SCMD6				
1600, 2000 2600 3000 4000	100,000	100,000	Any (Max. rated 2000, 2500, 4000, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A, 4000A 4000A, 5000A respectively)	2000A, 2500A 4000A, 4000A 6000A respectively

ZTSD Series

Amp	Any Breaker	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
40 80 100 150 225 260 400	35,000	50,000	General Electric Siemens/ITE Square D Cutler-Hammer/Westinghouse ABB Merlin Gerin	TB4, TJL, TLB4, THLC4, THLC1, THLC2, SEL, SEP, SFL, SFP, SGL, SGP, TFL, THLC2, SGL4, SGP4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8 CJD6, SCJD6, HJD6, SHJD6, HFD6, CFD6, HHJD6, HHJXD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6 KC, KI, LC, LI, LX, LXI, LE, MX, ME, MH HKD, KDC, LCL, LA TRI-PAC, HFD, FDC, HJD, JDC, , CHKD, HLD, CHLD, LDC, CLDC, NB TRI-PAC JHB CJ400L, CK400H, CF250L, CF250H, CJ400H, CK400N, CJ600H, CK800H, CK800N	200,000	T, J, RK5	(Max. 800A)	50A, 100A, 125A, 200A 300A, 350A, 600A respectively
600 800	50,000	65,000	Cutler-Hammer/ Westinghouse General Electric Siemens/ITE Square D	NB TRI-PAC, DSL206, HMDL, CHMDL, HND, NDC, CHND, CNDC, CNDC, HLD, CHLD, LDC, CLDC TB8, SKL8, SKP8, SGL6, SGP6, TB6, TJL, SKL12, SKP12, TKL8S, TKL12S, TP, THP, TC, THC CMD6, SCMD6, HMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6, CND6, SCND6, HND6, SHND6 LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
1000 1200	50,000	85,000	General Electric Square D Cutler-Hammer/Westinghouse Merlin Gerin Siemens/ITE	THP, THC, TRP, SKP12, SKP8, TB8 NC, NE, NX, PCF, PEF, PHF, PXF PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC CK1000L, CM1600 CND6, SCND6, CPD6, CMD6, SCMD6	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
1600 2000 2600 3000 4000	100,000	100,000	Any (Max. rated 2000, 2500, 4000, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A 4000A 4000A 5000A respectively)	2000A 2500A 4000A 4000A 6000A respectively

ZTG Series

Amp	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200 225 (1)	22,000	**480V**		200,000	J	(Max. 400A)	(Max. 400A)
		Cutler-Hammer/ Westinghouse	150A, FD, FDC, HFD 250A, HJD, JD, JDB, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL				
		Square D	100A, FC, FH, FI 250A, KA, KC, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
		Siemens/ITE	125A, CED6, ED6, HED4, HED6 250A, CFD6, FD6, FXD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
		General Electric	100A, TB1 150A, SEL, SEP, TEL, THED, THLC1 225A, TFK, TFL, THFK, THLC2 250A, SFL, SFP, TFJ 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
	30,000	**480V**					
		Cutler-Hammer/ Westinghouse	150A, FDC, HFD 250A, HJD, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL				
		Square D	100A, FC, FI 250A, KC, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
		Siemens/ITE	125A, CED6, HED4, HED6 250A, CFD6, FD6, FXD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
		General Electric	100A, TB1 150A, SEL, SEP, TEL, THLC1 225A, TFL, THLC2 250A, SFL, SFP 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
	22,000	**600V**					
		Cutler-Hammer/ Westinghouse	150A, FDC, HFD 250A, HJD, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL				
		Square D	100A, FI 250A, KA, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
		Siemens/ITE	125A, CED6 250A, CFD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
		General Electric	100A, TB1 150A, SEL, SEP, TEL, THLC1 225A, TFL, THLC2 250A, SFL, SFP 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4				

(1) ZTG3 Frame

ZTG Series *(continued)*

Amp	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200 225 (1)	30,000	**240V**		200,000	J (600V)	(Max. 350A)	200A 300A, 350A respectively
		Cutler-Hammer/ Westinghouse	100A, FCL, FB TRI-PAC 150A, FD, FDC, HFD 250A, HJD, JD, JDB, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, DK				
		Square D	100A, FC, FH, FI 250A, KA, KC, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
		Siemens/ITE	125A, CED6, ED6, ED4, HED4, HED6 250A, CFD6, FD6, FXD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
		General Electric	100A, TB1 150A, SEL, SEP, TEL, THED, THLC1 225A, TFL, THFK, THLC2 250A, SFL, SFP 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
		480V					
225 (2) 260 300 350 400	50,000	General Electric	SFL, SFP, TFL, THLC2, SGL4, SGP4, TB4, THLC4, TLB4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8	200,000 100,000	J (600V) RK/RK5 (480V)	(Max. 800A)	600A
		Siemens/ITE	CFD6, HFD6, CJD6, SCJD6, HHJD6, HHJXD6, SHJD6, HJD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6				
		Square D	KI, KC, LI, LXI, LX, LE, LC, MX, ME, MH				
		Cutler-Hammer/ Westinghouse	HJD, JDC, HKD, CHKD, KDC, LCL, LA TRI-PAC, HLD, CHLD, LDC, CLDC, NB TRI-PAC				
		Merlin Gerin	CF250L, CF250H, CJ400L, CK400H, CJ400H, CK400N, CJ600H, CK800H, CK800N				
600 800	65,000	Cutler-Hammer/ Westinghouse	NB TRI-PAC, DSL206, HMDL, CHMDL, HND, NDC, CHND, CNDC, HLD, CHLD, LDC, CLDC	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
		General Electric	TB8, SKL8, SKP8, SGL6, SGP6, TB6, TJL, SKL12, SKP12, TKL8S, TKL12S, TP, THP, TC, THC				
		Siemens/ITE	CMD6, SCMD6, HMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6, CND6, SCND6, HND6, SHND6				
		Square D	LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX				
1000 1200	85,000	General Electric	THP, THC, TRP, SKP12, SKP8, TB8	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
		Square D	NC, NE, NX, PCF, PEF, PHF, PXF				
		Cutler-Hammer/Westinghouse	PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC				
		Merlin Gerin	CK1000L, CM1600				
		Siemens/ITE	CND6, SCND6, CPD6, CMD6, SCMD6				
1600, 2000 2600, 3000 4000	100,000	Any (Max. rated 2000, 2500, 4000, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A, 4000A 4000A, 5000A respectively)	2000A, 2500A 4000A, 4000A 6000A respectively

(1) ZTG3 Frame, Effective 01/01/01; (2) ZTG1/2 Frame Discontinued 01/01/01

ZTGD Series

Amp	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
40 80 100 150 225 260 400	50,000	General Electric	TB4, TJL, TLB4, THLC4, THLC1, THLC2, SEL, SEP, SFL, SFP, SGL, SGP, TFL, THLC2, SGL4, SGP4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8	200,000	T, J, RK5	(Max. 800A)	50A, 100A, 125A, 200A 300A, 350A, 600A respectively
		Siemens/ITE	CJD6, SCJD6, HJD6, SHJD6, HFD6, CFD6, HHJD6, HHJXD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6				
		Square D	KC, KI, LC, LI, LX, LXI, LE, MX, ME, MH				
		Cutler-Hammer/Westinghouse	HKD, KDC, LCL, LA TRI-PAC, HFD, FDC, HJD, JDC, , CHKD, HLD, CHLD, LDC, CLDC, NB TRI-PAC				
		ABB	JHB				
		Merlin Gerin	CJ400L, CK400H, CF250L, CF250H, CJ400H, CK400N, CJ600H, CK800H, CK800N				
600 800	65,000	Cutler-Hammer/ Westinghouse	NB TRI-PAC, DSL206, HMDL, CHMDL, HND, NDC, CHND, CNDC, CNDC, HLD, CHLD, LDC, CLDC	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
		General Electric	TB8, SKL8, SKP8, SGL6, SGP6, TB6, TJL, SKL12, SKP12, TKL8S, TKL12S, TP, THP, TC, THC				
		Siemens/ITE	CMD6, SCMD6, HMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6, CND6, SCND6, HND6, SHND6				
		Square D	LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX				
1000 1200	85,000	General Electric	THP, THC, TRP, SKP12, SKP8, TB8	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
		Square D	NC, NE, NX, PCF, PEF, PHF, PXF				
		Cutler-Hammer/Westinghouse	PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC				
		Merlin Gerin	CK1000L, CM1600				
		Siemens/ITE	CND6, SCND6, CPD6, CMD6, SCMD6				
1600 2000 2600 3000 4000	100,000	Any (Max. rated 2000, 2500, 4000, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A 4000A 4000A 5000A respectively)	2000A 2500A 4000A 4000A 6000A respectively

ZTX Series

Amp	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types	Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200 225	22,000	**480V** Cutler-Hammer/ Westinghouse: 150A, FD, FDC, HFD; 250A, HJD, JD, JDB, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FC, FH, FI; 250A, KA, KC, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6, ED6, HED4, HED6; 250A, CFD6, FD6, FXD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THED, THLC1; 225A, TFK, TFL, THFK, THLC2; 250A, SFL, SFP, TFJ; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4	200,000	J	(Max. 400A)	(Max. 200A)
	30,000	**480V** Cutler-Hammer/ Westinghouse: 150A, FDC, HFD; 250A, HJD, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FC, FI; 250A, KC, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6, HED4, HED6; 250A, CFD6, FD6, FXD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THLC1; 225A, TFL, THLC2; 250A, SFL, SFP; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
	22,000	**600V** Cutler-Hammer/ Westinghouse: 150A, FDC, HFD; 250A, HJD, JDC; 400A, HKD, KD, KDB, KDC, LA TRI-PAC, LCL Square D: 100A, FI; 250A, KA, KH, KI; 400A, LA, LC, LE, LH, LI, LX, LXI Siemens/ITE: 125A, CED6; 250A, CFD6, HFD6; 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6 General Electric: 100A, TB1; 150A, SEL, SEP, TEL, THLC1; 225A, TFL, THLC2; 250A, SFL, SFP; 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4				

ZTX Series *(continued)*

Amp	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
30 40 70 80 100 104 150 200 225	30,000	**240V**		200,000	T, J, RK5, RK1	(Max. 350A)	200A 300A, 350A respectively
		Cutler-Hammer/ Westinghouse	100A, FCL, FB TRI-PAC 150A, FD, FDC, HFD 250A, HJD, JD, JDB, JDC 400A, HKD, KD, KDB, KDC, LA TRI-PAC, DK				
		Square D	100A, FC, FH, FI 250A, KA, KC, KH, KI 400A, LA, LC, LE, LH, LI, LX, LXI				
		Siemens/ITE	125A, CED6, ED6, ED4, HED4, HED6 250A, CFD6, FD6, FXD6, HFD6 400A, CJD6, HJD6, HHJD6, HHJXD6, JD6, JXD6, SCJD6, SHJD6, SJD6				
		General Electric	100A, TB1 150A, SEL, SEP, TEL, THED, THLC1 225A, TFL, THFK, THLC2 250A, SFL, SFP 400A, SGL4, SGP4, TB4, THJK4, THLC4, TJJ, TJK4, TLB4				
480V							
225 250 260 300 350 400	50,000	General Electric	SFL, SFP, TFL, THLC2, SGL4, SGP4, TB4, THLC4, TLB4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8	200,000	T, J, RK5	(Max. 800A)	600A
		Siemens/ITE	CFD6, HFD6, CJD6, SCJD6, HHJD6, HHJXD6, SHJD6, HJD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6				
		Square D	KI, KC, LI, LXI, LX, LE, LC, MX, ME, MH				
		Cutler-Hammer/ Westinghouse	HJD, JDC, HKD, CHKD, KDC, LCL, LA TRI-PAC, HLD, CHLD, LDC, CLDC, NB TRI-PAC				
		Merlin Gerin	CF250L, CF250H, CJ400L, CK400H, CJ400H, CK400N, CJ600H, CK800H, CK800N				

ZTSCT Series

Amp	Any Breaker	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
100 150 225 260 400	35,000	50,000	General Electric Merlin Gerin Siemens/ITE Square D Cutler-Hammer/ Westinghouse	SFL, SFP, TFL, THLC2, SGL4, SGP4, TB4, THLC4, TLB4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8 CF250L, CF250H, CJ400L, CK400H, CJ400H, CK400N, CJ600H, CK800H, CK800N CFD6, HFD6, CJD6, SCJD6, HHJD6, HHJXD6, SHJD6, HJD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6 KI, KC, LI, LXI, LX, LE, LC, MX, ME, MH HJD, JDC, HKD, CHKD, KDC, LCL, LA TRI-PAC, HLD, CHLD, LDC, CLDC, NB TRI-PAC	200,000	T, J, RK5	(Max. 800A)	200A, 300A 350A, 600A respectively
600 800	50,000	65,000	Cutler-Hammer/ Westinghouse General Electric Siemens/ITE Square D	NB TRI-PAC, DSL206, HMDL, CHMDL, HND, NDC, CHND, CNDC, HLD, CHLD, LOC, CLDC TB8, SKL8, SKP8, SGL6, TB6, TJL, SKL12, SKP12, TKL8S, TKL12S, TP, THP, TC, THC CMD6, SCMD6, HMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6, CND6, SCND6, HND6, SHND6 LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
1000 1200	50,000	85,000	General Electric Square D Cutler-Hammer/ Westinghouse Merlin Gerin Siemens/ITE	THP, THC, TRP, SKP12, SKP8, TB8 NC, NE, NX, PCF, PEF, PHF, PXF PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC CK1000L, CM1600 CND6, SCND6, CPD6, CMD6, SCMD6	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
1600 2000 2600 3000 4000	100,000	100,000	Any (Max. rated 2000, 2500, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A 4000A 5000A respectively)	2000A 2500A 4000A 6000A respectively

ZBTS, ZBTSD and ZBTSCT Series

Amp	Any Breaker	Maximum Coordinated Breaker Rating	Coordinated Breaker Model Types		Current Limiting Fuse Rating	Fuse Class	Breaker Ampere Size	Fuse Size
100 150 225 260 400	35,000	50,000	General Electric Merlin Gerin Siemens/ITE Square D Cutler-Hammer/ Westinghouse	SFL, SFP, TFL, THLC2, SGL4, SGP4, TB4, THLC4, TLB4, SGL6, SGP6, TB6, TJL4V, TKL4V, TJL1S-6S, SKL8, SKP8, TB8, SKH8 CF250L, CF250H, CJ400L, CK400H, CJ400H, CK400N, CJ600H, CK800H, CK800N CFD6, HFD6, CJD6, SCJD6, HHJD6, HHJXD6, SHJD6, HJD6, CLD6, SCLD6, HHLD6, HHLXD6, SHLD6, HLD6, CMD6, SCMD6, HMD6, SHMD6, HMXD6, MD6, MXD6, SMD6 KI, KC, LI, LXI, LX, LE, LC, MX, ME, MH HJD, JDC, HKD, CHKD, KDC, LCL, LA TRI-PAC, HLD, CHLD, LDC, CLDC, NB TRI-PAC	200,000	T, J, RK5	(Max. 800A)	125A 200A 300A 350A 600A respectively
600	50,000	65,000	Cutler-Hammer/ Westinghouse General Electric Siemens/ITE Square D	NB TRI-PAC, DSL206, HMDL, CHMDL, HLD, CHLD, LDC, CLDC TB8, SKL8, SKP8, SGL6, SGP6, TB6, TJL, TP, THP, TC, THC CMD6, SCMD6, HMD6, SHMD6, SHMD6, HLD6, SHLD6, CLD6, SCLD6 LC, LE, LI, LX, LXI, ME, MH, MX, NC, NE, NX	200,000	T, J, RK5 RK1, L	(Max. 800A)	750A
800 1000 1200	50,000	85,000	General Electric Square D Cutler-Hammer/ Westinghouse Merlin Gerin Siemens/ITE	THP, THC, TRP, SKP12, SKP8, TB8 NC, NE, NX, PCF, PEF, PHF, PXF PC, PCC, PB TRI-PAC, NDC, CNDC, RDC, CRDC, NB TRI-PAC CK1000L, CM1600 CND6, SCND6, CPD6, CMD6, SCMD6	200,000	L	(Max. 1600A)	1000A 1250A 1500A respectively
1600 2000 2600 3000 4000	100,000	100,000	Any (Max. rated 2000, 2500, 4000, 5000 respectively)		200,000	L	(Max. 2000A 2500A 4000A 5000A respectively)	2000A 2500A 4000A 6000A respectively

Purpose

Many questions arise when comparing WCR to the system fault current rating. Too often a switch is rated by a manufacturer in one set of WCR terms and the available system fault currents described with a different set of terms. The purpose of this paper is to outline the different ways switches may be rated (WCR) and systems are measured.

Basic Definitions

a. *RMS Current* – The Root Mean Square which is the effective value of an alternating current. It is equal to .707 of the peak current for a sine wave. This is the value referred to when people say "current."
b. *Peak Current* – The instantaneous maximum value of current—the peak current of a sine wave is 1.414 times its RMS value.
c. *Symmetrical Current* – The alternating current which is symmetrical around the zero axis of the sine wave.
d. *Asymmetrical Current* – The alternating current which is not symmetrical around the zero axis.
e. Peak Fault Current – The instantaneous maximum current value that occurs after the start of a fault in any phase.
f. *Available Peak Current* – Maximum possible short circuit current that may exist in a system without protective devices.
g. *Peak Let Through Current* – Maximum instantaneous current through the protective device during the total clearing time.
h. *Withstand Current Rating* – The rating that defines the ability of the switch to withstand the thermal and electromagnetic effects of short circuit currents for a set period of time.
i. *Withstand and Closing Rating* – UL 1008 test for a transfer switch's ability to close into and withstand a fault current. These are the ratings which will actually appear on the UL label of the product.

NOTE: *For diagrams of typical current wave forms, see* ***Figure 1*** *and* ***Figure 2****.*

Comparison of Terms

The following values have all been used to describe identical circuit conditions:

a.	Available Short Circuit Current RMS	120,000 amps
b.	Peak Let Through Current (½ cycle)	30,000 amps
c.	Peak Asymmetrical Current	56,000 amps
d.	Peak Symmetrical Current	40,000 amps
e.	Withstand Rating 3 Cycles RMS	28,000 amps

What do these numbers mean? They mean that a switch was tested at 28,000 amps RMS Sym for 3 cycles; the switch also had a projected peak symmetrical current of 40,000 amps for less than ½ cycle and a peak asymmetrical current of 56,000 amps for less than ½ cycle. The switch has been tested in a system that has an available capacity of 120,000 amps RMS.

How should a manufacturer rate a switch? Preferably by submitting test data which is reported as outlined by UL 1008 specifications. This data calls for RMS symmetrical readings based on specific test parameters. Other figures may be misleading.

Test Documents

As fault currents can occur at any level, a transfer switch must be capable of withstanding any fault current up to its maximum rating. This rating is based on the rating of the protective device in front of the unit and must be considered on that basis.

GE Zenith tests show results based on various current values and time durations, and include additional high current tests with fuses. By considering this range of values, it is possible to predict performance with different fuse characteristics or specific circuit breaker current-time curves with a given available short circuit current.

Interrupting Ratings

Some manufacturers of circuit breaker type automatic transfer switches list interrupting current (IC) ratings in lieu of WCR. These switches will then open on faults instead of withstanding the fault until the external protective device clears. As the transfer switch is then used to open the fault current in place of a protective device—this may leave the transfer switch with both normal and emergency open which then requires manual resetting of the breakers within the transfer switch enclosure. The circuit breakers may require factory inspection after high current interruption in accordance with common circuit breaker procedures.

WCR ratings, as opposed to IC ratings appear to offer a better choice to the system designer as he attempts to coordinate the protection of the entire system. Knowing the maximum amount and duration of fault current a switch will withstand gives the designer the information necessary for complete coordinated system design.

Advantage of RMS Symmetrical Ratings

a. Date is consistently reported based on UL test procedures.
b. Where time beyond the first ½ cycle is given suitable decisions can be made to use circuit breakers or fuses.
c. "Trick" reporting is eliminated.

Blow-On Effects of Short Circuit Currents on Contacts

Some switch designers analyze "blow-on" and "blow-off" effects and force vectors (due to electromagnetic repulsion) to claim increased WCR capability of their product. Such calculations are very rough approximations because of inherent errors in estimating "domain" size and number, current "pinch" effect and the problem of complex geometry of actual contact structures when compared to idealized models. The only proof of a successful design are tests, uniformly performed and consistently reported all to the same criterion such as UL 1008.

Available Fault Current

Available fault current information can often be supplied by the utility company. If this information is not available, approximate fault current can be calculated by knowing the transformer impedance (usually 2 to 5% of full load ampere rating of the transformer).

For a single phase system, transformer let through current is: (*where Z is transformer impedance in percent divided by 100)*

$$I = \frac{\text{kVA (of trans) x 1000}}{\text{Z x Line Volts}}$$

For three phase systems:

$$I = \frac{\text{kVA x 1000}}{\text{1.73 Z x Line Volts}}$$

EXAMPLE:
500 kVA transformer
2.5% Impedance
480 Volts, 3 phase

$$\frac{500 \times 1000}{1.73\ (.025)\ (480)} = 24{,}085 \text{ amps}$$

This figure is somewhat lower if a long run of cable introduces a substantial volt drop.

Available fault current determine the rating that a transfer must meet.

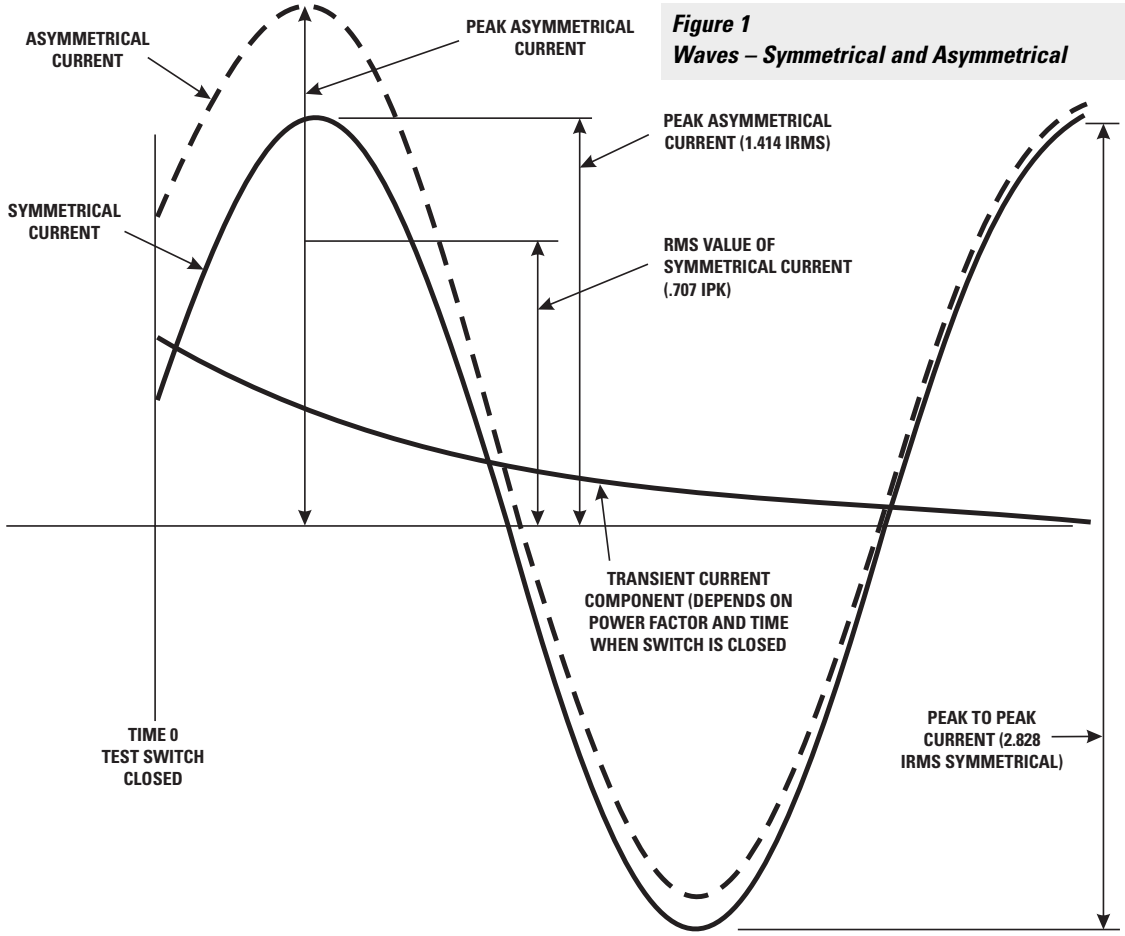


Figure 1
Waves – Symmetrical and Asymmetrical

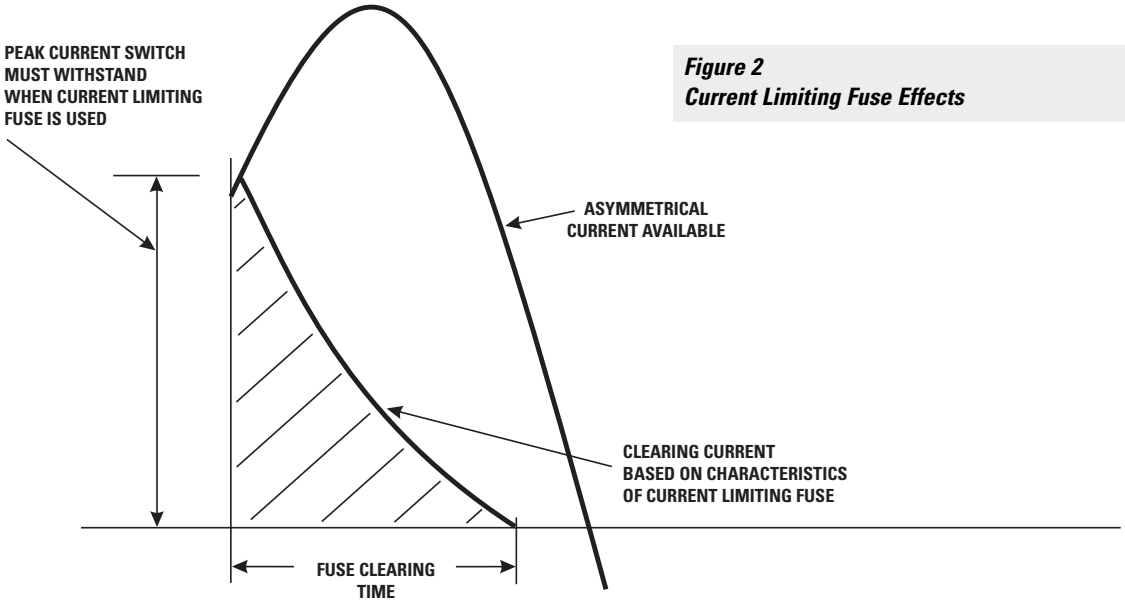


Figure 2
Current Limiting Fuse Effects

Application Worksheet

Item Number	Available Fault Current	Ampere Rating	Circuit Protection Type	GE Zenith Transfer Switch Rating
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 630 850-6899
www.geindustrial.com