

# **ASCO Power Technologies**

## **Engineering Application Information**

### **WITHSTAND AND CLOSING RATINGS FOR TRANSFER SWITCH EQUIPMENT**

*ASCO products comply with all mandatory UL 1008 withstand and closing ratings.*

*By using the information in this publication and calculating available short circuit currents, the system designer can be assured the transfer switches will be properly rated for the electrical system.*

## **Guidelines for using the information in this publication to verify suitability of switches for specific applications based on withstand current ratings**

1. Determine the prospective fault current available (from each source) at the location of the switch.
2. Determine the overcurrent protective devices (OPDs) that will be located ahead of the switch.
3. If the OPD is a circuit breaker, refer to Table II on page 3. Select the switch rating necessary to handle the full load current. Compare the fault current available at the switch to the withstand current rating (WCR) shown in Table II for the applicable switch ampere size and voltage. If the prospective fault current is equal to or less than the WCR from Table II, the switch selected is suitable for the application.
4. If the prospective fault current is greater than the WCR obtained from Table II, refer to Table IV on pages 3-7. Compare the fault current to the WCR shown in Table IV. If the fault current is equal to or less than the WCR shown in Table IV, the switch is suitable for the application when protected by any of the circuit breakers shown. If the specific circuit breaker being used is not shown in the table, contact ASCO Power Technologies.
5. If the prospective fault current is greater than the WCR listed in Table IV, refer to *Special Application Considerations* on page 8.
6. When the overcurrent protective devices are current limiting fuses refer to Table III on page 3. If there are any questions about the suitability of the switch when protected by current limiting fuses contact ASCO Power Technologies.

## **Introduction**

This publication provides information on withstand current ratings (WCRs) for ASCO transfer switches and related products, including compliance with the optional 1½ and 3 cycle “any breaker” WCRs and other revisions to UL 1008. Also included are guidelines for special WCR applications and typical methods for specifying WCR requirements.

## The Importance of Proper Ratings

The transfer switch is a unique and critical part of the power system. It is the last distribution device feeding the critical loads of a facility. For that reason, the transfer switch should be located as close as possible to the protected loads. In addition, after a fault (short circuit) is cleared, the transfer switch must remain operable so that it can restore power to the critical loads from the alternate power source.

In the design of an electrical power distribution system, a coordination study should be conducted to determine the trip settings required for all circuit breakers. Proper trip settings will assure that a fault is cleared as close to its location as practical. The coordination study considers conductor sizes, quantities and lengths as well as any other relevant circuit impedance. The farther from the source a device is located, the lower the fault current will be. Referring to Figure 1, a fault at point A should be cleared by the switchgear feeder breaker  $F_2$  and not by M. This would leave the other feeder circuits ( $F_1$  &  $F_3 - F_7$ ) in operation. A coordination study will determine the magnitude of fault current at the load side of the transfer switch and indicate the settings for  $F_2$ .

Consider a fault at point B on the load side of the breaker feeding  $L_1$  as shown in Figure 1. If the system

breakers have been coordinated properly, the breaker feeding  $L_1$  will trip before the upstream breaker or fuse. The transfer switch must withstand this fault current until the circuit breaker or fuse clears the fault. Most automatic transfer switches available today have a standard control circuit time delay of 0.5 seconds or more to override any momentary voltage transients. This is ample time for any over current device to clear the fault, allowing system voltage to return to normal and avoiding any unnecessary operation of the transfer switch.

Now consider a fault at point A of Figure 1. The circuit breakers on the load side of the transfer switch would not see the fault current, but the upstream breaker ( $F_2$ ) would and the instantaneous trip element would be actuated. The transfer switch controller senses there is no voltage from the utility, signals a transfer operation and the transfer switch is now required to close on the fault condition until the generator over current device clears the fault.

If a transfer switch does not have a sufficient with-stand current rating, severe damage and a potential fire hazard could result from the fault current. Over-rating the transfer switch to achieve a sufficient withstand current rating leads to a less cost-effective design. Good engineering practice requires adequately rated devices in the power distribution system. Therefore, the specified WCR for the transfer switch should be the available fault current at the location of the transfer switch. Some recommended engineering practices to assist in fault current calculations are referenced at the end of this publication.

## How Codes Impact Ratings

Codes often require equipment to be approved for its intended use. For example, one of the most common applications for automatic transfer switches is in Emergency Systems per Article 700 of the National Electrical Code (NEC) ANSI/NFPA 70. Section 700-3 and 700-6 require that all transfer equipment be approved for use on Emergency Systems. How does a manufacturer obtain approval? There are several ways, but perhaps the most common is via a third party certification acceptable to the authority having jurisdiction.

## The Role of Underwriters Laboratories

Underwriters Laboratories (UL) is one of several independent testing agencies and is perhaps the most well-known third party certifier. The Standard for Safety under which Underwriters Laboratories tests Transfer Switch Equipment is UL 1008. Equipment which meets UL requirements is listed in UL's *Electrical Construction Materials List*. This list is frequently used by electrical inspectors and other authorities having

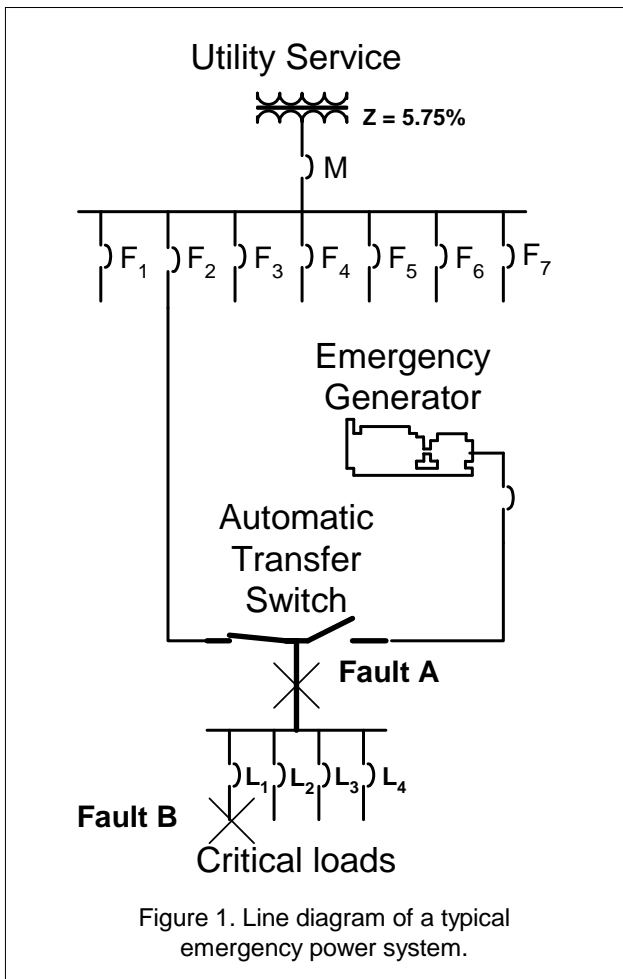


Figure 1. Line diagram of a typical emergency power system.

jurisdiction in conjunction with the device markings and rating label to approve an electrical installation.

UL has issued several revisions to the UL 1008 Standard, which redefine how a transfer switch is to be tested and marked for fault current withstand and closing ratings. A major revision introduced in the 1989 version of UL 1008 allowed an optional rating category for WCR and closing tests. Its purpose was to permit transfer switch manufacturers to conduct tests without overcurrent protective devices. For transfer switches rated 400A and below for use on 10 kA circuit maximum, the on time of the fault current must be at least 25 ms (1½ cycles). For transfer switches rated above 400A or for use on circuits with available fault currents above 10 kA, the on time of the fault current must be at least 50 ms (3 cycles). When this test is successful, the manufacturer may mark the switch for use with any manufacturer’s circuit breaker within its rating. Such *umbrella* ratings give the application engineer more flexibility when specifying and coordinating the transfer switch with overcurrent devices.

Where a transfer switch manufacturer does not opt for this test, the switch can only be marked to show the specific manufacturer’s circuit breaker with which the switch was tested, or circuit breakers approved by UL through extension from the original test data. The specific breaker marking can limit the product’s application and acceptance by the inspecting authority.

Other issues may develop when the transfer switch WCR is limited to use with specific circuit breakers. Even though a specific breaker is coordinated with the transfer switch upon initial installation, the breaker could possibly be replaced at a later date with another type and/or rating which is not one of the breakers approved by UL. Circuit breakers also change trip characteristics as they age and the tripping time may become slower, allowing the transfer switch to be subjected to energy above the original short circuit testing values. These issues would not be a concern to the specifying engineer if a transfer switch rated for use with “any breaker” were selected.

## ASCO Switches Meet and Exceed UL 1008 Requirements

ASCO Power Technologies provides withstand current ratings on its products to provide maximum flexibility to the electrical consultant when specifying these products. The ratings apply to the ASCO products shown in Table I and are specified in Tables II, III, and IV. The ratings apply to single phase and three phase switches. The withstand current ratings of the overlapping neutral transfer pole is identical to the WCR of the phase switching poles.

See page 8, *Special Application Considerations*, if ratings beyond those listed are required. Contact ASCO Power Technologies to determine if ratings have been increased or for ratings beyond three cycles which may not be UL Listed, but which are based on other tests.

Table I. Applicable Products (Refer to Specific Rating Tables for Each Products Rating)

ASCO Product	Typical Applications	Product Description	
		Automatic Transfer Switch	Non-Automatic Transfer Switch
Series 165, 185	Residential	Automatic	Manual
Series 300 / 386	Industrial / Light Commercial	Automatic Transfer Switch (Light Commercial Applications)	Non-Automatic – Electrically Operated Transfer Switch
4000 TS 4000 Series Power Transfer Switches	Industrial, Commercial, Institutional	4ATS – Automatic Transfer Switch 4ACTS – Automatic Closed Transition Switch 4ADTS – Automatic Delayed Transition Switch	4NTS – Non-Automatic Transfer Switch 4NCTS – Non-Automatic Closed Transition Switch 4NDTS – Non-Automatic Delayed Transition Switch
7000 TS 7000 Series Power Transfer Switches	Health Care, Critical Power Facilities	7ATS – Automatic Transfer Switch 7ACTS – Automatic Closed Transition Switch 7ADTS – Automatic Delayed Transition Switch 7ASLS – Automatic Soft Load Transfer Switch	7NTS – Non-Automatic Transfer Switch 7NCTS – Non-Automatic Closed Transition Switch 7NDTS – Non-Automatic Delayed Transition Switch 7MTS – Manually Operated Transfer Switch
7000 TB 7000 Series Transfer Switches with Bypass-Isolation Feature	Health Care, Critical Power Facilities, Mission Critical	7ATB – Automatic Transfer Switch with Bypass-Isolation 7ACTB – Automatic Closed Transition Switch with Bypass-Isolation 7ADTB – Automatic Delayed Transition Transfer Switch with Bypass-Isolation 7ASLB – Automatic Soft Load Transfer Switch with Bypass-Isolation	7NTB – Non-Automatic Transfer Switch with Bypass-Isolation 7NCTB – Non-Automatic Closed Transition Transfer Switch with Bypass-Isolation 7NDTB – Non-Automatic Delayed Transition Transfer Switch with Bypass-Isolation

Table II. Withstand / Closing Ratings for ASCO Transfer Switches used with “Any Circuit Breaker”<sup>1</sup>

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Ratings (RMS Symmetrical Amps)		
			When Protected With Any Circuit Breaker <sup>3</sup>		
			Volts max.	KA max.	Time Cycles @ 60Hz
165 TS, 185 TS	D	100, 200, 230	240	10	1.5
4000 TS 7000 TS 7000 TB 4ATS, 7ATS 4NTS, 7NTS 7MTS	D	30	600	10	1.5
		70, 100, 125, 150			
		200	480		
		230			
	J	150 <sup>2</sup> , 260, 400, 600 <sup>2</sup>	600	35	3
			480	42 <sup>5</sup>	
			240	65	
	H	800, 1000, 1200	600	50	3
36				18 <sup>4</sup>	
4000 TS 7000 TS 7000 TB	G	1600, 2000 front connected	600	85	3
		1600, 2000		100	
		2600, 3000		100	
7000 TB	F	4000	600	100	3
4000 TS 7000 TS	G	4000	600	100	4
			480	65	18

<sup>1</sup> Any breaker ratings based on 3 cycle duration for 260-4000 amp continuous ratings and 1-1/2 cycles for 30-230 amp.

<sup>2</sup> J 150 amp is 4ACTS, 4ADTS, 7ACTS, 7ADTS, 7ASLS, & 7000 TB only.

<sup>3</sup> When protected by any circuit breaker without an adjustable short-time response only.

<sup>4</sup> When protected by any circuit breaker with an adjustable short-time setting.

<sup>5</sup> Applicable to 2 pole, 3 pole, & conventional 4 pole switches only.

Table III. Withstand / Closing Ratings for ASCO Transfer Switches used with Current Limiting Fuses

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Ratings (RMS Symmetrical Amps)			
			When Protected With Current Limiting Fuses			
			kA	Volts max.	Max. Fuse Size (amps)	Fuse Class
165 TS	D	100, 200, 230	—			
300 386 4000 TS 7000 TS 7000 TB 4ATS, 7ATS 4NTS, 7NTS 7MTS	D	30	100	480	60	J
		70, 100, 125, 150	200		200	
		200	100		300	
		230	100		300	
	J	150 <sup>1</sup> , 260 <sup>2</sup> , 400 <sup>2</sup> , 600 <sup>1</sup>	200	600	600	J
			200	600	800	L
H	800, 1000, 1200	200	600	1600	L	
300 386 4000 TS 7000 TS 7000 TB	G	1600, 2000 front connected	200	600	3000	L
		1600, 2000			4000	
		2600, 3000			4000	
4000 TS 7000 TS	G	4000	200	600	5000	L
7000 TB	F		200	480	6000	

<sup>1</sup> J 150 amp is 4ACTS, 4ADTS, 7ACTS, 7ADTS, 7ASLS, & 7000 TB only.

<sup>2</sup> Series 300 & 386, 260 A & 400 A are E-frame prefix and current limiting fuse rating is limited to 480 V.

Table IV. Withstand / Closing Ratings for Transfer Switches  
Used with Specific Manufacturer's Molded Case Circuit Breakers

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Rating kA RMS Symmetrical amps	Volts max.	Circuit Breaker Manufacturer	Circuit Breaker Type or Class	Circuit Breaker Rating (amps max.) Per NEC
300	D	30	10	600	Any	Any Breaker	
300 386 4000 TS 7000 TS	D	70	22	480	GE	TB1	100
						TEL, THED, THLC1, THLC2	150
						TFL	225
					SIEMENS / I-T-E	CED6, ED6, HED4, HED6	125
						CFD6	150
						FD6, FXD6, HLD6	250
					Square-D	FH	80
						FC, FI	100
						KA, KC, KH, KI, LA, LH	250
					Cutler-Hammer	FCL, TRI-PAC FB	100
						FD, FDC, HFD	150
						HJD, JD, JDB, JDC	250
					ABB	HKD, KD, KDB, KDC, LCL, TRI-PAC LA	400
						S1	125
S3	150						
Merlin Gerin	CE104, CE106	100					
300 386 4000 TS 7000 TS	D	100	22	480	GE	TB1	100
						TEL, THED, THLC1, THLC2	150
						TFL	225
					SIEMENS / I-T-E	CED6, ED6, HED4, HED6	125
						CFD6	150
						FD6, XD6, HLD6	250
					Square-D	FC, FI	100
						KA, KC, KH, KI, LA, LH	250
						FCL, TRI-PAC FB	100
					Cutler-Hammer	FD, FDC, HFD	150
						HJD, JD, JDB, JDC	250
						HKD, KD, KDB, KDC, LCL, TRI-PAC LA	400
					ABB	S1	125
						S3	150
Merlin Gerin	CE104, CE106	100					
						CF250	250
4000 TS 7000 TS	D	125	22	480	GE	TEL, THED, THLC1	150
						TFL, THFK, THLC2	225
						SFL, SFP, TFJ, TFK	250
						SGL4, SGP4, TLB4	400
					SIEMENS / I-T-E	CFD6	200
						FD6, FXD6, HFD6	250
					Square-D	KA, KC, KH, KI	250
						FD, FDC, HFD	150
					Cutler-Hammer	HJD, JD, JDB, JDC	250
						HKD, KD, KDB, KDC, LCL, TRI-PAC LA	400
ABB	S3	150					
Merlin Gerin	CF250	250					
300 386 4000 TS 7000 TS	D	150 200 230	22	480	GE	TEL, THED, THLC1	150
						TFL, THFK, THLC2	225
						SFL, SFP, TFJ, TFK	250
						SGL4, SGP4, TLB4	400
					SIEMENS / I-T-E	CFD6, FD6, FXD6, HFD6	250
						CJD6, HHJD6, HHJXD6, HJD6, JD6, JXD6, SCJD6	400
						SHJD6, SJD6	400
					Square-D	KA, KC, KH, KI	250
						LC, LI	300
						LA, LH	400
					Cutler-Hammer	FD, FDC, HFD	150
						JD, JDB, JDC, HJD	250
						HKD, KD, KDB, KDC, LCL, TRI-PAC LA	400
					ABB	S3	150
Merlin Gerin	CF250	250					
						CJ400	400

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Rating kA RMS Symmetrical amps	Volts max.	Circuit Breaker Manufacturer	Circuit Breaker Type or Class	Circuit Breaker Rating (amps max.) Per NEC					
300, 386 4000 TS 7000 TS	D	150 200 230	42	240	Square-D	JG	250					
4000 CTS 4000 DTS 7000 CTS 7000 DTS 7000 TB	J	150	50	480	Cutler-Hammer	HJD, JDC, JGH, JGC	250					
						HKD, CHKD, KDC	400					
						HLD, CHLD, LDC, CLDC	600					
					GE	SFL, SFP	250					
						TJL4V, TJL1S-6S, TBC6	600					
						SGL1, SGL4, SGP1, SGP4	600					
					SIEMENS / I-T-E	HFD, HFXD	250					
						HJD, HJXD, SHJD	400					
			Square-D	KC	250							
				CK400N, CK400NN, CM1250HH	400							
			42	600	Cutler-Hammer	JGC	250					
						KDC	400					
						LDC, CLDC	600					
						SGL1, SGL4, SGP1, SGP4	600					
300 386	E	260	42	480	GE	TFL, THLC2	225					
						SFL, SFLA, SFP	250					
						SGL4, SGP4, TB4, THLC4, TLB4	400					
						SGLA, SGL6, SGP6, TB6	600					
						SKHA, SKLB, SKP8, TKL	800					
						CFD6, FD6, FXD6	250					
						SIEMENS / I-T-E	CJD6, HHJD6, HHJXD6, HJD6, JD6, JXD6, SCJD6	400				
							SHJD6, SJD6	400				
							CLD6, HHL6, HHLXD6, HLD6, SCLD6, SHLD6	600				
							CMD6, HMD6, HND6, MD6, MXD6, SCMD6, SHMD6	800				
							SMD6, SND6	800				
							KC, KI	250				
					Square-D	LC, LI	600					
						MH	800					
						HJD, JDC	250					
					Cutler-Hammer	HKD, KDC, LCL, TRI-PAC LA	400					
						HLD	600					
						TRI-PAC NB	800					
					ABB	S5	400					
						S6	800					
					Merlin Gerin	CF250	250					
						CJ400	400					
					4000 TS 7000 TS 7000 TB	J	260	50	480	Cutler-Hammer	HJD, JDC, JGH, JGC	250
											HKD, CHKD, KDC	400
											HLD, CHLD, LDC, CLDC	600
											MDL, CMDL, HMDL, CHMDL, NGS, NGH, NGC	800
										GE	SFL, SFP	250
											TBC4	400
TBC6, TJL4V, TJL1S-6S	600											
SGL1, SGL4, SGL6, SGP1, SGP4, SGP6	600											
TBC8, TKL4V, TKH8S-12S, TKL8S-12S	800											
SKH8, SKL8, SKP8	800											
SIEMENS / I-T-E	HFD, HFXD	250										
	HJD, HJXD, SHJD	400										
	HLD, HLXD, SHLD	600										
	LMD, LMXD, HLMD, HLMXD, HMG	800										
	MD, MXD, HMD, HMXD, SMD, SHMD	800										
Square-D	KC	250										
	CK400N, CK400NN, CM1250HH	400										
	LC	600										
	CK800N, CK800NN, CM1600HH	800										
42	600	Cutler-Hammer	HJD, JGC	250								
			KDC	400								
			LDC, CLDC	600								
			TBC4	400								
GE	TBC6, SGL1, SGL4, SGL6, SGP1, SGP4, SGP6	600										
	TBC8, TKL4V, TKL8S-12S, SKL8, SKP8	800										
	Siemens / I-T-E	HLMXD, HLMXD, HMD, HMXD, SHMD	800									

Table IV. continued

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Rating kA RMS Symmetrical amps	Volts max.	Circuit Breaker Manufacturer	Circuit Breaker Type or Class	Circuit Breaker Rating (amps max.) Per NEC		
4000 TS 7000 TS 7000 TB	J	400	50	480	Cutler-Hammer	HKD, CHKD, KDC	400		
						HLD, CHLD, LDC, CLDC	600		
						MDL, CMDL, HMDL, CHMDL, NGS, NGH, NGC	800		
					GE	TBC4	400		
						TBC6, TJL4V, TJL1S-6S	600		
						SGL1, SGL4, SGL6, SGP1, SGP4, SGP6	600		
						TBC8, TKL4V, TKH8S-12S, TKL8S-12S	800		
						SKH8, SKL8, SKP8	800		
					SIEMENS / I-T-E	HJD, HJXD, SHJD	400		
			HLD, HLXD, SHLD	600					
			LMD, LMXD, HLMD, HLMXD, HMG	800					
			Square-D	MD, MXD, HMD, HMXD, SMD, SHMD	800				
				CK400N, CK400NN, CM1250HH	400				
				LC	600				
			42	600	Cutler-Hammer	CK800N, CK800NN, CM1600HH	800		
						KDC	400		
						LDC, CLDC	600		
					GE	TBC4	400		
TBC6, SGL1, SGL4, SGL6, SGP1, SGP4, SGP6	600								
TBC8, TKL4V, TKL8S-12S, SK8L, SK8P	800								
SIEMENS / I-T-E	HLMD, HLMXD, HMD, HMXD, SHMD	800							
300 386	E	400			42	480	GE	SGL4, SGP4, TB4, THLC4, TLB4	400
								SGLA, SGL6, SGP6, TB6	600
			SKHA, SKL8, SKP8, TKL	800					
			SIEMENS / I-T-E	CJD6, HHJD6, HHJXD6, HJD6, SCJD6, SHJD6			400		
				CLD6, HHL6, HHLXD6, HLD6, SCLD6, SHLD6			600		
				CMD6, HMD6, HND6, MD6, MXD6, SCMD6, SHMD6			800		
				SMD6, SND6			800		
			Square-D	LC, LI			600		
				MH			800		
			Cutler-Hammer	HKD, KDC, LCL, TRI-PAC LA			400		
				HLD			600		
				TRI-PAC NB			800		
			ABB	S5			400		
				S6			800		
			Merlin Gerin	CJ600			600		

Table IV. continued

ASCO Transfer Switch Product	Transfer Switch Frame Prefix	Transfer Switch Rating (amps)	Withstand / Closing Rating kA RMS Symmetrical amps	Volts max.	Circuit Breaker Manufacturer	Circuit Breaker Type or Class	Circuit Breaker Rating (amps max.) Per NEC		
300 386 4000 TS 7000 TS 7000 TB	J	600	50	480	Cutler-Hammer	HLD, CHLD, LDC, CLDC	600		
						MDL, CMDL, HMDL, CHMDL, NGS, NGH, NGC	800		
					GE	TBC6, TJL4V, TJL1S-6S	600		
						SGL1, SGL4, SGL6, SGP1, SGP4, SGP6	600		
						TBC8, TKL4V, TKH8S-12S, TKL8S-12S	800		
						SKH8, SKL8, SKP8	800		
					SIEMENS / I-T-E	HL6, HLXD, SHLD	600		
						LMD, LMXD, HLMD, HLMXD, HMG	800		
			MD, MXD, HMD, HMXD, SMD, SHMD	800					
			ND, NXD, HND, HNXD, HNG, SND, SHND	1200					
			Square-D	CK400N, CK400NN, CM1250HH	400				
				LC	600				
				CK800N, CK800NN, CM1600HH	800				
				CM2000HH	1000				
			42	600	Cutler-Hammer	LDC, CLDC	600		
GE	TBC6, SGL1, SGL4, SGL6, SGP1, SGP4, SGP6, TBC4, TBC8, TKL4V, TKL8S-12S, SKL8, SKP8	600							
	TBC8, TKL4V, TKL8S-12S, SKL8, SKP8	800							
SIEMENS / I-T-E	HLMD, HLMXD, HMD, HMXD, SHMD	800							
	HND, HNXD, HNG, SHND	1200							
300 386 4000 TS 7000 TS 7000 TB	H	600 800 1000 1200			65	480	GE	TB8	800
								MICROVERSATRIP TKL	1200
			SIEMENS / I-T-E	CLD6, HHL6, HHLXD6, HLD6, SCLD6, SHLD6			600		
				CMD6, HMD6, SCMD6, SHMD6			800		
				CND6, HND6, SCND6, SHND6			1200		
				CPD6			1600		
			Square-D	MH SERIES 2			1000		
				PJ			1200		
				RJ	1600				
				SE (LS TRIP), SEH (LS TRIP)	2500				
			42	480	Cutler-Hammer	TRI-PAC NB	800		
						TRI-PAC PB	1600		
					RDC	2500			
					ABB	S6	800		
			S7	1200					
			Merlin Gerin	CJ600	600				
CK1200	1200								
7000TB	G	1600 2000	125	480	Square-D	Master Pact NW-L	3000		

## Marking Requirements

UL requires markings on each switch listing the approved short circuit ratings for each product and its ampacity. ASCO switches display rating labels similar to the one shown in Figure 2.

## Special Application Considerations

ASCO Power Technologies provides a line of switches which are highly reliable, utilize latest technology, include features most frequently used by the consulting engineer, and which are rated to meet a wide variety of requirements. For special applications, such as when higher ratings or longer withstand times are needed, the system designer can consider several rating alternatives:

1. Consider relocating the switch closer to the load where the added impedance of the feeder conductors will reduce the available fault current to an acceptable level. This is consistent with good engineering practice of locating transfer switches as close to the load as possible in order to minimize the risk of conductor failures between the load side of the switch and the utilization equipment.
2. Use current limiting fuses or current limiting circuit breakers to reduce fault currents.
3. Use a larger ampacity switch with a higher withstand/closing rating.
4. When the overcurrent protective device ahead of the transfer switch has a clearing time exceeding three cycles, a zone selective interlocking scheme may be considered. Such a scheme permits intentional delays to be over-ridden and the breaker to trip instantaneously whenever the fault is within the breaker's zone of primary protection.
5. Contact ASCO Power Technologies to determine if additional ratings are available.

SUITABLE FOR CONTROL OF MOTORS, ELECTRIC DISCHARGE AND TUNGSTEN LAMPS, ELECTRICAL HEATING EQUIP, WHERE THE SUM OF MOTOR FULL LOAD AMPS AND AMPS OF OTHER LOADS DOES NOT EXCEED THE SWITCH AMP RATING AND THE TUNGSTEN LOAD DOES NOT EXCEED 30% OF SWITCH RATING, 240V MAX. WHEN PROTECTED BY A CIRCUIT BREAKER WITHOUT AN ADJUSTABLE SHORT-TIME RESPONSE ONLY OR BY FUSES THIS TRANSFER SWITCH IS RATED FOR USE ON A CIRCUIT CAPABLE OF DELIVERING NOT MORE THAN THE RMS SYMMETRICAL AMPS AT THE VOLTAGE SHOWN.

These are the "any breaker" ratings for the transfer switch. For this switch the rating is 65,000 RMS amps symmetrical at 240 volts and 35,000 amps at 600 volts.

RMS SYMM AMPS X1000	VOLTS MAX	CIRCUIT BREAKER MANUFACTURER / TYPE	AMPS MAX
65	240	ANY	PER NEC
35	600	ANY	PER NEC
50	480	CUTLER HAMMER / HKD,CHKD,KDC HLD,CHLD,LDC,CLDC MDL,CMDL,HMDL,CHMDL,NGS,NGH,NGC	400 600 800
50	480	GENERAL ELECTRIC / TBC4 TBC6,TJL4V,TJL1S-6S SGL1,SGL4,SGL6,SGP1,SGP4,SGP6 TBC8,TKL4V,TKH8S-12S,TKL8S-12S SKH8,SKL8,SKP8	400 600 600 800
50	480	SIEMENS / HJD,HXD,SHJD HLD,HLXD,SHLD LMD,LMXD,HLMD,HLMXD,HMG MD,MXD,HMD,HMXD,SMD,SHMD	400 600 800
50	480	SQUARE D / CK400N,CK400NN,CM1250HH LC CK800N,CK800NN,CM1600HH	400 600 800
42	600	CUTLER HAMMER / KDC LDC,CLDC	400 600
42	600	GENERAL ELECTRIC / TBC4 TBC6,SGL1,SGL4,SGL6,SGP1,SGP4,SGP6 TBC8,TKL4V,TKL8S-12S,SKL8,SKP8	400 600 800
42	600	SIEMENS / HLMD,HLMXD,HMD,HMXD,SHMD	800

This area indicates the "specific breaker" ratings, maximum voltage, breaker manufacturer, breaker type, and maximum frame size. This switch is rated either 50,000 or 42,000 RMS amps symmetrical for the specific breakers listed.

RMS SYMM AMPS X1000	VOLTS MAX	FUSE MANUFACTURER / TYPE	AMPS MAX
200	600	ANY / CLASS J	600
200	600	ANY / CLASS L	800

MANUFACTURER'S ADDITIONAL RATING INFORMATION  
WHEN PROTECTED BY A CIRCUIT BREAKER WITHOUT AN ADJUSTABLE SHORT-TIME RESPONSE ONLY, THIS TRANSFER SWITCH IS RATED FOR USE ON A CIRCUIT CAPABLE OF DELIVERING NOT MORE THAN THE RMS SYMMETRICAL AMPS AT THE VOLTAGE SHOWN FOR NO LONGER THAN THE TIME DURATION SHOWN.

RMS SYMM AMPS X1000	VOLTS MAX	TIME DURATION MAX (mSEC)
50	480	31
42	600	29

USE 75°C MIN CU/AL WIRE FOR POWER CONNECTIONS.  
USE 60°C MIN CU WIRE FOR CONTROLS

**USE COPPER OR ALUMINUM WIRE FOR POWER TERMINALS**

RECOMMENDED TIGHTENING TORQUE 375 IN-LBS 483500-266  
REV B

There is also a rating when used with current limiting fuses of the Class J maximum size indicated on the label. This switch is rated for 200,000 RMS amps when used with Class J fuses 600 amps or less.

Figure 2. Typical rating label for ASCO 400 amp Transfer Switch.

## How To Specify Withstand and Closing Ratings

Calculated values of available fault current should be specified for each transfer switch based on its location in the electrical system. This will assure that a properly rated switch will be applied and avoid specified ratings which are too low for the actual location (resulting in an

unsafe practice or ratings which are too high (resulting in unnecessarily higher costs).

A growing number of specifiers are adding fault current withstand and closing current tables to the electrical plans showing the calculated values for each switch. A typical arrangement is shown in Table V.

Table V. Typical Listings of Transfer Switch Fault Current Ratings on an Electrical Plan

Transfer Switch Ident. No.	No. of Poles	Switched Neutral Y/N	Transfer Switch Ampacity	System Voltage	Calculated Fault Currents		Type of OCD
					RMS Sym. Amperes	X/R Ratio	
ATS-E8	4	Y	260	480/277	29,000	2.3	MCCB
ATS-E9	3	N	400	480	33,000	2.3	MCCB
ATS-LS1	4	Y	100	480/277	7,300	2.1	MCCB
ATS-LS2	4	Y	150	480/277	8,900	2.4	MCCB
ATS-EQ1	3	N	1000	480	48,000	3.2	MCCB

## Importance of X/R Ratio

The circuit reactance to resistance ratio (X/R) is a determinant in preparing fault current studies. Consideration should be given to the X/R ratio at each transfer switch location. The actual X/R ratio should not exceed the X/R ratio at which the transfer switch was tested. Table VI shows the power factor test requirements of UL 1008 with equivalent X/R ratios. If an application requires higher X/R ratios, consider the *Special Application Considerations* previously discussed or consult ASCO Power Technologies for a recommendation. By using the information in this

publication and calculating short circuit currents, the system designer can be assured that the transfer switches will be properly rated for the electrical system.

Table VI. UL Maximum Test Factor with Equivalent X/R Ratio

Available Fault Current (amperes)	Maximum Test Power Factor	Equivalent X/R Ratio
10,000 or less	0.50	1.73
10,001 – 20,000	0.30	3.18
greater than 20,000	0.20	4.90

## Suggested Fault Current Study Reference Guides

1. The Institute of Electrical and Electronics Engineers, Inc., *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, IEEE Buff Book, ANSI/IEEE Std. 242-1986, New York, N.Y., pp. 45-113.
2. The Institute of Electrical and Electronics Engineers, Inc., *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants*, IEEE Red Book, ANSI/IEEE Std. 141-1993, New York, N.Y., pp. 109-184.
3. The Institute of Electrical and Electronics Engineers, Inc., *IEEE Recommended Practice for Power System Analysis*, IEEE Brown Book, ANSI/IEEE Std. 399-1990, New York, N.Y., pp. 171-194.
4. The Institute of Electrical and Electronics Engineers, Inc., *IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*, IEEE Orange Book, ANSI/IEEE Std. 446-1995, New York, N.Y., pp. 175-196.
5. The Institute of Electrical and Electronics Engineers, Inc., *IEEE Recommended Practice for Electric Systems in Health Care Facilities*, IEEE White Book, ANSI/IEEE Std. 602-1996, New York, N.Y., pp. 50-51; 72-74.
6. Frank W. Kussy and Jack L. Warren, *Design Fundamentals for Low-Voltage Distribution and Control*, Marcel Dekker Inc., pp. 104-117, 1987.
7. Hermann W. Reichenstein, *Applying Low-Voltage Fuses—Classes and Characteristics*, McGraw-Hill Inc., 1979.

In addition to the above, most manufacturers of overcurrent protective devices can provide application data on calculating short circuit currents. Various software packages are also available to assist the application engineer in performing calculations by computer.

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