Breakers vs Contactor Type Transfer Switches

The many technological advances realised in the electrical power industry over the past couple of decades have provided specifying engineers with an almost limitless list of products that will satisfy the needs of the most challenging user installation. The availability of this vast array of products has created a greater choice for the engineer, but has simultaneously placed a greater burden on the design engineer to select those components which best provide his customers with superior product quality and performance at a reasonable, competitive cost. Quite often, the best product choices are not always completely obvious due to the parity found in competitive product offerings. When this is the case, the engineer must look for that "extra" something that clearly demonstrates a greater degree of reliability and thus added value to the product in question.

The automatic transfer switch industry has kept pace with the technological advances in electrical distribution products by offering seemingly equal competitive products from a standpoint of function and performance. However, a distinct design differentiation continues to exist between ATS manufacturers with regard to the type of construction used in the power transfer contacts. This product difference is often expressed by the phrase "Breaker versus Contactor" type designs. Cutler-Hammer has adopted the "Breaker Type" design for many obvious reasons. Of course, it is natural for a manufacturer to embrace a design concept for which they have secured international recognition as the technological leader. Decades of continuing research and development, new product innovations and improvements, and excellent field performance leaves no doubts about the superior viability of a breaker type design in a power switching application. The conscientious engineer will, however, require more tangible evidence of superior performance and value than just a manufacturer's opinion of his product.

The Canadian Standards Association (CSA) has developed a comprehensive test standard for automatic transfer switches (C22.2 #178). In order to list an ATS under C22.2 #178, an ATS manufacturer must subject a sample unit of each rating and configuration to a battery of sequential performance tests. As is the case with any product standard, CSA #178 defines only the minimum performance requirements for Automatic Transfer Switches. While any CSA #178 listed ATS will assure a specifying engineer and user a minimum quality level of performance, CSA approval falls well short of certifying any

extra degree of performance. Any validity in a manufacturer's claims for additional performance levels above these minimum values can only be accepted as demonstrated by actual field performance experience or by additionally required testing mandated by other clearly defined standards.

Since Cutler-Hammer uses specially designed moulded case circuit breakers and/or moulded case switches as the ATS main power switching contacts, these devices must be also approved under a second CSA standard C22.2 #5. The Canadian Standards Association uses two basic types of approval programs: Label service and re-examination. CSA C22.2 #5 employs a label service approval program that requires an extensive follow-up testing program for listed devices. Standard CSA C22.2 #178 for ATS approves product under the re-examination program, which only requires a continual physical re-examination of the components used in the product to ensure consistency with the originally submitted device. No follow-up testing is required under CSA C22.2 #178.

Representative production samples of circuit breakers used in Cutler-Hammer Transfer Switches are subjected to a complete test program identical to the originally submitted devices on an ongoing periodical basis per C22.2 #5. The frequency of such re-submittal can be as often as every quarter for a 100 Amp device. Any failure during one of these periodic re-submittals could result in a loss of the valued CSA approval.

These re-submittals include tests such as: 200%, 135% Calibration at 25°C; 100% Calibration at 40°C; Calibration of Instantaneous Trip; Overload Tests (at 6 X rating); Endurance; Low Level Interrupting Capacity (after endurance); Standard Interrupting Capacity (typically 14KA @ 600V minimum); and Dielectric Voltage-Withstand. High interrupting capacity test (at marked I/C ratings) are conducted on a less frequent basis. These periodic follow-up tests serve as ample proof that the quality of the main power switching contacts in the Cutler-Hammer ATS is maintained.

Cutler-Hammer ATS main power switching contacts must also comply with the test requirement of CSA C22.2 #178. A comparison of the two specifications will point out the lower severity of the C22.2 #178 tests. This fact, coupled with the absence of any requirements for a follow-up re-test program in C22.2 #178 can only emphasise the advantages of a combination of both C22.2 #178 and #5 compliance inherent in the Cutler-Hammer ATS. This re-certification process ensures a continuing high level of performance that a customer and user should expect over and above any stated or implied quality commitment that the manufacturer states.

In manufacturing a "Breaker Type" Automatic Transfer Switch, Cutler-Hammer must of necessity subject our product to more extensive testing than comparable "Contactor Type" ATS products. Not only is such testing more demanding, but the periodic re-testing of the Cutler-Hammer ATS power switching contacts per C22.2 #5 provides the user with an additional measure of reliability that will allow the design engineer to specify Cutler-Hammer with confidence on his next Automatic Transfer Switch application.

COMPARISON OF CSA REQUIREMENTS

Moulded Case Circuit Breakers
CSA C22.2 No. 5.1
CANADIAN STANDARDS ASSOCIATION

TEST REQUIREMENTS
Standard Tests

1. The tripping mechanism shall be enclosed to prevent tampering.
2. The mechanism shall trip free of the handle on overload.
3. All breakers shall be calibrated to carry their continuous rating in an ambient temperature of 4O'C.
4. 200% calibration check.
5. 125% calibration check.
6. Overload test at 600% normal current at rated voltage. Up to 1600 Amps, 50 operations; 1601 - 2500 amps, 25 operations; 2501 to 6000 Amps, 28 operations.
7. Temperature rise check at 100% rated load continuously without exceeding specified temperature limits.
8. Endurance test:

	Operations		
Ampere Rating	With Current	Without Current	Per Minute
0-100	6000	4000	6
101-225	4000	4000	5
226-600	1000	5000	4
601-800	500	3000	1
801-2500	500	2000	1
2501-6000	400	1100	1

9. After endurance test, the breaker must again pass a calibration test at the 200% and 135% ratings.
10. It must next pass short circuit tests at the value shown in the following chart.

Breaker Rating		Test Circuit		
Volts	Amps	Common Pole Amps	Ind. Pole Amps	No. of Tests
250 & Below	100 & Below	4330	5000	7
Above 250	100 & Below	8660	10000	7
Any	101-800	8660	10000	7
Any	801-1200	12120	14000	7
Any	1201-1600	14000	20000	8
Any	1601-2000	14000	25000	8
Any	2001-2500	20000	30000	8
Any	2501-3000	25000	35000	8

11. After the short circuit test, the breaker again pass a calibration test at 200% of its rating.
12. Insulation test consisting of 1,000 volt plus twice the rated voltage between live parts and ground; between poles with the breaker closed; and between line and load terminals with the breaker open and in tripped position.

Moulded Case Switches
CSA C22.2 No. 5.2
CANADIAN STANDARDS ASSOCIATION

TEST REQUIREMENTS
Standard Tests

1. The instantaneous response release mechanism shall be enclosed to prevent tampering.
2. The instantaneous response release mechanism shall automatically open free of the handle on short circuit.
3. All breakers shall be calibrated to carry their continuous rating in an ambient temperature of 40°C.
4. N/A.
5. N/A.
6. Overload test at 600% normal current at rated voltage.Up to 1600 Amps, 50 operations; 1601 - 2500 Amps, 25 operations; 2501 – 6000 Amps, 28 operations.
7. Temperature rise check at 100% rated load continuously without exceeding specified temperature limits.
8. Endurance test:

	Operations		
Ampere Rating	With Current	Without Current	Per Minute
0-100	6000	4000	6
101-225	4000	4000	5
226-600	1000	5000	4
601-800	500	3000	1
801-2500	500	2000	1
2501-6000	400	1100	1

9. N/A.
10. It must next pass short circuit tests at the value shown in the following chart.

Breaker Rating		Test Circuit		
Volts	Amps	Common Pole Amps	Ind. Pole Amps	No. of Tests
250 & Below	100 & Below	4330	5000	7
Above 250	100 & Below	8660	10000	7
Any	101-800	8660	10000	7
Any	801-1200	12120	14000	7
Any	1201-1600	14000	20000	8
Any	1601-2000	14000	25000	8
Any	2001-2500	20000	30000	8
Any	2501-3000	25000	35000	8

11. N/A.
12. Insulation test consisting of 1,000 volt plus twice the rated voltage between live parts and ground; between poles with the breaker closed; and between line and load terminals with the breaker open and in tripped position.

Transfer Switches
CSA C22.2 No. 178
CANADIAN STANDARDS ASSOCIATION

TEST REQUIREMENTS
Standard Tests

1. Not applicable. (N/A)
2. N/A.
3. N/A.
4. N/A
5. N/A
6. Overload test at 600% normal current at rated voltage. Up to 1600 amps 50 operations; 1601 - 2500 amps 25 operations; 2501 and up, 30 operations.
7. Temperature rise check at 100% rated load continuously without exceeding specified temperature limits.
8. Endurance test:

	Operations			
Ampere Rating	With Current		Without Current	
	100%	200%		
0-300	3000	3000	---	1
301-400	2000	2000	---	1
401-800	1000	1000	1000	1
801-1600	750	750	1500	½
1601 & Above	500	500	2000	¼

9. N/A
10. Withstand and Closing Test.

Switch Rating (Amperes)	Test Circuit Amperes	No. Of Tests
100 or less	5000	2
101-400	10000	2
401 & Greater	20 times rating but not less than 10,000 Amperes	2

11. N/A
12. Insulation test consisting of 1,000 volt plus twice the rated voltage between live parts and ground; between poles with the breaker closed; and between line and load terminals with the breaker open and in tripped position.