

NEW FUJI SERIES MAGNETIC SWITCHES

APPROVED BY UL AND CSA

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1. INTRODUCTION

It is well known that internationalization of various industries has increased in recent years. Products are being exported and overseas factories are being built and conformance and listing of the electric devices used to overseas standards is demanded.

The UL and CSA standards introduced here are United States and Canada safety standards. That electrical devices exported be approved products of these standards has become an essential condition.

2. OUTLINE OF UL AND CSA STANDARDS

2.1 Outline of UL standards

UL was founded in 1894 by William Henry Merrill to test products against the risks of electric and fire accidents for American insurance companies. Later, with the support of the American Insurance Association, the Laboratories came to conduct tests on materials, equipment, products, instruments, buildings, and systems for risks that may damage lives and property, but now the Laboratories have no direct connection and are managed as an independent non-profit organization and are considered one of the largest and most authoritative safety testing organizations.

The main missions of the UL, from the standpoint of

consumers, with an aim of protecting life and property against the risks of equipment fire and electric shock, are to:

- (1) Establish standards regarding safety
- (2) Conduct tests on various products based on the established standards
- (3) Publish the test results to insurance companies, government organizations, associated entities, and general consumers.

2.2 UL indication

UL conducts tests according to the principles mentioned above, and gives approval to successful products and publishes the fact. There are two indication methods as shown in *Table 1*: listing service and recognition service.



(1) Listing service

This is commonly called "listing", and is aimed at products and their parts manufactured to be safe whatever the conditions and methods they were to be used. Considering the fact that general consumers may use the product, investigations and tests are conducted on their safety over a wide range of use. When the products pass the test, a "Listing Mark" is given and the fact is published to the public in a product-classified list (Green Book) by UL.

(2) Recognition Service

This is aimed mainly at parts and materials to be incorporated into end products at factories by producers. When a product passes the examination, it is listed in a "Registered Parts List" (Yellow Book).

Table 1 Indication of UL approval

Indication of UL approval		Safety	Publishing method		
			Indication attached to product	Publishing by UL	
Listing	Products and parts manufactured to ensure safety of end users.	Unconditional safety	Listing mark 	Product classified list (Green Book)	White card
Recognition	Parts and materials chiefly incorporated in equipment or devices at manufacturer's factories.	Conditional safety	Recognition mark 	Registered parts list (Yellow Book)	Yellow card

2.3 Outline of CSA standards

CSA is a semi-governmental organization established in Canada to guarantee the safety of electric goods, electric machinery, electric wire, electric parts, materials, and gas equipment and oil burning equipment to humans (electric shock for electric goods) and against fire (short circuit, leakage, fire for electric goods). The sale and use of products which do not meet CSA standards or are not approved by state inspection authorities are prohibited in all the states of Canada.

These standards also apply to magnetic switches, push-buttons, selector switches, and other control devices. When exporting these control devices alone, they must meet CSA standards.

On the other hand, when exporting these devices as a part of panels and equipment, because there is the possibility that the assembly method may create danger at the assembled product, and there are standards separate from those of the individual parts regarding the construction, wiring, insulation distance in narrow places, mounting method, etc. of panels and equipment, they must conform to them.

2.4 CSA approval indication

When a product passes the CSA approval tests, it is allowed to display the CSA monogram shown in Fig. 1.

Fig. 1 CSA monogram



The CSA monogram corresponds to the UL Listing mark. CSA does not have anything corresponding to the UL Recognition mark.






3. NEW SC SERIES APPROVED BY UL AND CSA

The new SC series approved by UL and CSA are 240V, 5HP and less magnetic switches, magnetic contactors, thermal overload relays, industrial relays, and option units. They are listed in Table 2.

The ratings of the magnetic switches and magnetic contactors of the new SC series are shown in Table 3. Typical exterior views are shown in Fig. 2. The auxiliary contact ratings of the magnetic contactors thermal overload relays and the ratings of the industrial relays are shown in Table 4.

New SC series standard products conform to UL and CSA standards. For thermal relays for 3-phase circuits, UL and CSA standards do not allow 2 heat elements, and

Table 2 Table of types approved by UL and CSA

Type		Type designation	Approval classification		
			UL	CSA	
Magnetic switch	Standard type (with 3-element)	SW-□/3H			
	With open-phase protective device	SW-□/2E			
	Reversing (with 3-element)	SW-□RM/3H			
	Reversing (2E)	SW-□RM/2E			
Magnetic contactor	Standard type	SC-□			
	Reversing	SC-□RM			
	DC operated	SC-□/G			
Thermal overload relay	Standard type (with 3-element)	TR-□/3			
	With open-phase protective device	TK-□			
Industrial relay	Standard type	SH-□			
	DC operated	SH-□/G			
Option units	Auxiliary contact block (front mounting)	SZ-A□			
	Auxiliary contact block (side mounting)	SZ-AL, AR			
	Mechanical interlock unit	SZ-RM			
	Coil surge suppression unit	SZ-Z□			
	Main circuit surge suppression unit	SZ-ZM□			
	Base unit for separate mounting	SZ-HB, HC			
	Reset release button	SZ-R□			
	Dial cover	SZ-DA			
	Terminal cover	SZ-T□			

[Notes] : Listed by UL : Recognized by UL : Certified by CSA

Table 3 Ratings of UL and CSA listed magnetic contactors and magnetic switches

Size	Type			Maximum horsepower ratings [HP]						Rated thermal current [A]
	Contactor	Starter		Single phase			3-phase			
		Standard (*1)	2E (*2)	110~120V	220~240V	200V	220~240V	440~480V	550~600V	
00+	SC-03	SW-03/3H	SW-03/2E	1/3	1	2	2	5	5	11
0	SC-0	SW-0/3H	SW-0/2E	1/3	1	3	3	5	5	13
	SC-05	SW-05/3H	SW-05/2E	1/3	1	3	3	5	5	13
0+	SC-4-0	SW-4-0/3H	SW-4-0/2E	1	2	5	5	7.5	7.5	20
	SC-4-1	SW-4-1/3H	SW-4-1/2E	1	2	5	5	10	10	20
	SC-5-1	SW-5-1/3H	SW-5-1/2E	1	2	5	5	10	10	20

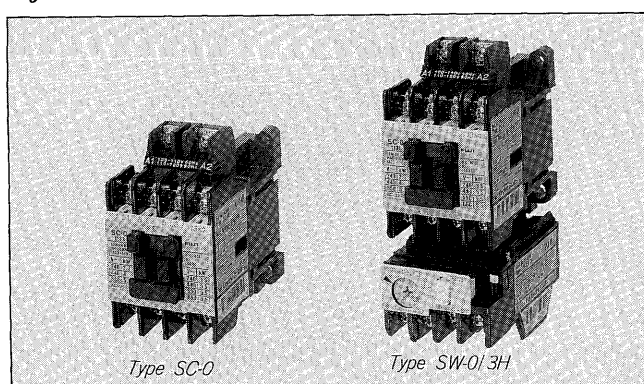
(*1) with 3-element thermal overload relay (*2) with open-phase protective device

Table 4 Auxiliary contact ratings and thermal overload relay contact ratings

Description	Type	Contact Rating Code Designation	Continuous Ampere Ratings	Ratings									
				Maximum Current [A]								Maximum Volt-Amperes	
				120V*1		240V*2		480V		600V		Make	Break
				Make	Break	Make	Break	Make	Break	Make	Break		
Contactor Auxiliary Contacts	SC-03 SC-0 SC-05 SC-4-0 SC-4-1 SC-5-1	A600	10	60	6	30	3	15	1.5	12	1.2	7200	720
		Q300	2.5	0.55	0.55	0.27	0.27	—	—	—	—	69	69
Industrial Relays	SH-4 SH-5	A600	10	60	6	30	3	15	1.5	12	1.2	7200	720
		Q300	2.5	0.55	0.55	0.27	0.27	—	—	—	—	69	69
Overload Relay Contacts	TR-0N/3 TK-0N TR-5-1N/3 TK-5-1N	C600	2.5	15	1.5	7.5	0.75	3.75	0.375	3	0.3	1800	180

(*1) Q300 = DC125V (*2) Q300 = DC250V

Fig. 2 New SC Series listed by UL and CSA



3 heat elements are applied. For the many features and construction of the new SC series, see the separate article in this special issue.

4. PERFORMANCE AND TESTS

4.1 Performance

The new SC series conform to the main foreign

standards (IEC, BS, VED, LR, BV, etc.), to say nothing of domestic standards. They are, of course, certified based on these standards and actual application is considered and evaluation of endurance against long use and cases considered from the standpoint and actual use are assumed and verification tests are conducted.

4.2 Differences and main standards of UL and CSA standards

The main UL and CSA standards which are applied to control devices are:

- UL508 Industrial Control Equipment
- CSA22.2 No. 14 Industrial Control Equipment

The differences between these standards and JIS, IEC, and other standards for magnetic switches are shown in Table 5.

4.2.1 Temperature test

The temperature rise limit of the terminals is 65°C for JIS and JEM and 50°C for UL and CSA. The rated thermal current was decided by considering this.

4.2.2 Thermal relay calibration test

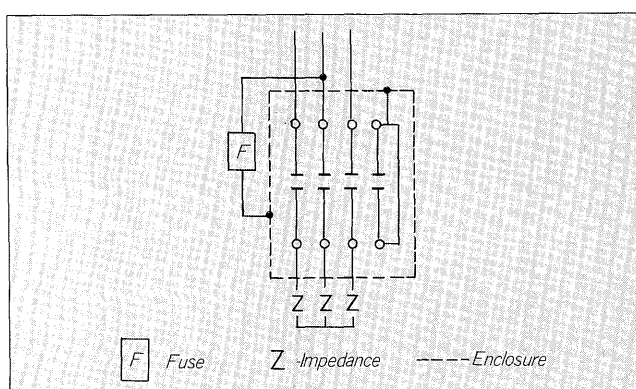
The operating characteristics of the thermal relays of this series are UL and CSA class 10 (class which trips within 10 seconds at 600% of the rated current). Protection

Table 5 Main differences of UL and CSA standards and JIS and IEC standards magnetic switches

Test Item	UL 508 CSA C22.2 No. 14	JIS C8325	IEC 158-1 IEC 292-1
Temperature test	Terminal: Less than 50°C	Terminal: Less than 65°C	Terminal: Less than 70°C
Operation test	Operate at AC 85%Ee or less Operate at DC 80%Ee or less	Operate at 85%Ee or less	Operate at 85%Ee or less
Catibration test	600%Ie, 10 secs or less: Class 10 600%Ie, 20 secs or less: Class 20 600%Ie, 30 secs or less: Class 30	600%Ie: 2~30 secs 125%Ie: within 2 hours	120%Ie: within 2 hours
Overload test	6Ie 50 switchings (reversing type, simultaneous energizing, additional 10 cycles)	10Ie 100 makes 8Ie 25 breaks	10Ie 100 makes 8Ie 25 breaks
Endurance test	2Ie 6000 switchings	Ie 1,000,000 times: class 0	2Ee+1000V, 1 min
Dielectric test	2Ee+1000V, 1 min	2500V, 1 min	2500V, 1 min
Short circuit test	Combined with fuse or MCCB at 5000A, 600V or 480V	—	—

Ie: Rated current Ee: Rated voltage

Fig. 3 Overload test connection diagram



of small motors with a short starting time is possible.

In Europe, etc., the dial setting is displayed by general FLA (Full-Load Motor-Running Currents in Amperes). The tripping current is 120%FLA.

4.2.3 Overload and endurance tests

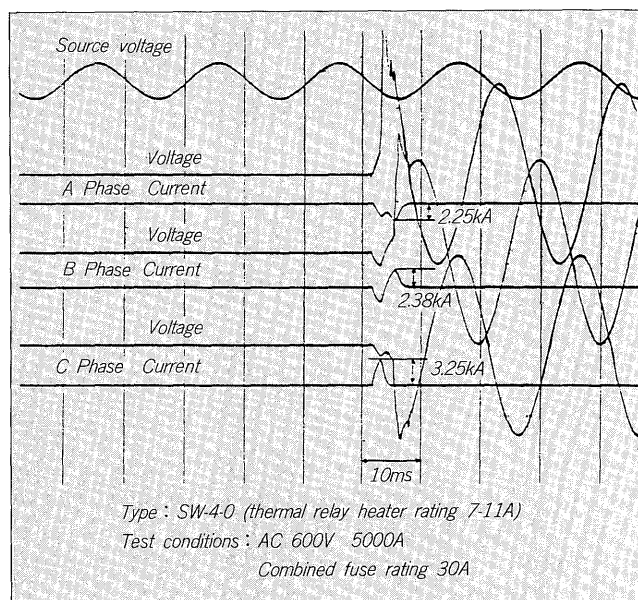
For motor use, the overload test of magnetic switches six times the full load current 50 times at the rated voltage. For the reversing type, ten addition cycles are to be conducted with both coils energized. The overload test connection diagram is shown in Fig. 3. For the endurance test, it is specified that double the full load current be switched 6000 times. It was confirmed that there were no hindrances for both. Since the specified intermittent duty is high, this endurance test is a stringent test condition for equipment.

4.2.4 Short circuit test

This test combines the magnetic switch, magnetic contactor, and thermal relay with the specified protective device (fuse or MCCB). Damage connected to burnout must not be generated.

For this series, short circuit tests were conducted at 480V or 600V and 5000A conditions and harmonized with protective devices and their safety was confirmed. Oscillograms of typical types are shown in Fig. 4. The

Fig. 4 Short circuit test oscillogram



ratings of the fuse or MCCB combined at the short circuit test are decided by thermal overload relay heat element rating. Fuses are combination of 225% or more of the heat element ratings and MCB are combination of 115 to 400%. Refer to the instruction manual, etc.

5. CONCLUSION

An outline of the new SC series magnetic switches listed by UL and CSA was introduced above. There is also a series of magnetic switches from 240V 7.5HP to 150HP that have already been approved by UL and CSA, in addition to the above. Refer to the catalog. The authors will be happy if this article serves as reference in application and selection by machinery manufacturers and concerned parties who export to the United States and Canada.