Magnetic Motor Starter
TECHNICAL NOTES

MS-T Series Magnetic Contactors and Magnetic Motor Starters

This document introduces the types, characteristics and performances (Type test results) of the magnetic motor starter, for the purpose of being generally utilized as a basic document by all the users including the administrators, designers, and those responsible for construction.

Note a) Note that the described contents are subject to change without notice.

b) The described content is only for reference and it cannot be guaranteed.

The units are described in SI units.

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■ Kinds and Ratings

Type MS-T magnetic motor starter consists of a type S-T magnetic contactor, type TH-T thermal overload relay and an outer case. Type MSO-T magnetic motor starters are also available as a unit for power distributor panels and control panels.

Table 1 Constitutional Elements of Type MS-T Magnetic Motor Starters

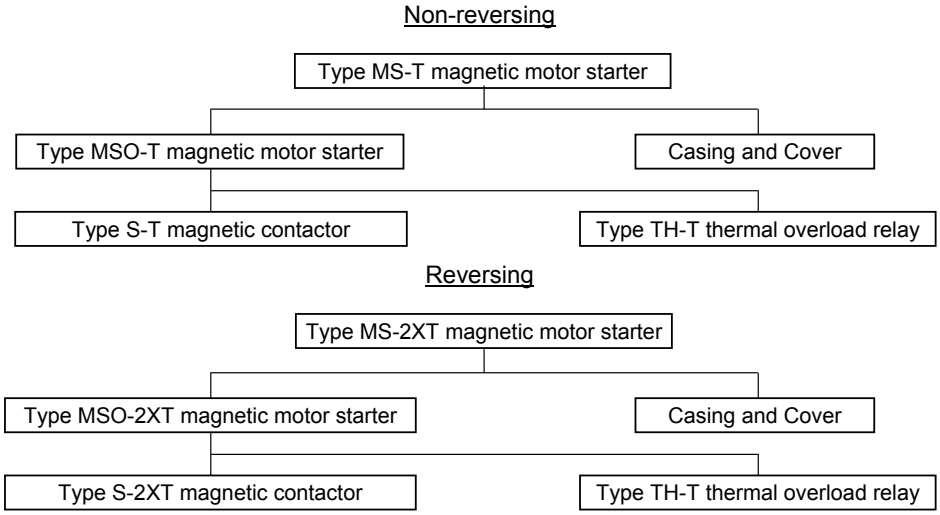


Table 2 Kinds and Composition

Frame	Type				Constituent elements		
	MS-, with enclosure		MSO-, with-out enclosure		S-, magnetic contactor		Thermal overload relay
	Non-reversing	Reversing	Non-reversing	Reversing	Non-reversing	Reversing	
T10	MS-T10 (KP)	-	MSO-T10 (KP)	MSO-2xT10 (KP)	S-T10	S-2xT10	TH-T18(KP)
T12	MS-T12 (KP)	-	MSO-T12 (KP)	MSO-2xT12 (KP)	S-T12	S-2xT12	
T20	-	-	MSO-T20 (KP)	MSO-2xT20 (KP)	S-T20	S-2xT20	
T21	MS-T21 (KP)	MS-2xT21 (KP)	MSO-T21 (KP)	MSO-2xT21 (KP)	S-T21	S-2xT21	TH-T25(KP)
T25	-	-	MSO-T25 (KP)	MSO-2xT25 (KP)	S-T25	S-2xT25	
T32	-	-	-	-	S-T32	S-2xT32	-
T35	MS-T35(KP)		MSO-T35 (KP)	MSO-2xT35 (KP)	S-T35	S-2xT35	TH-T25(KP) (Nominal current of the heater: 22 A or less) TH-T50(KP) (Nominal current of the heater: 29 A)
T50	MS-T50(KP)		MSO-T50 (KP)	MSO-2xT50 (KP)	S-T50	S-2xT50	TH-T25(KP) (Nominal current of the heater: 22 A or less) TH-T50(KP) (Nominal current of the heater: 29 A or higher)
T65	MS-T65(KP)		MSO-T65 (KP)	MSO-2xT65 (KP)	S-T65	S-2xT65	TH-T65(KP)
T80	MS-T80(KP)		MSO-T80 (KP)	MSO-2xT80 (KP)	S-T80	S-2xT80	TH-T65(KP) (Nominal current of the heater: 54 A or less) TH-T100(KP) (Nominal current of the heater: 67 A)
T100	MS-T100(KP)		MSO-T100 (KP)	MSO-2xT100 (KP)	S-T100	S-2xT100	TH-T65(KP) (Nominal current of the heater: 54 A or less) TH-T100(KP) (Nominal current of the heater: 67 A or higher)

Table 3 Rated Capacity

Application / Frame	Motor load					Resistance load	
	Category AC-3 [kW] (Three-phase squirrel-cage motor load standard responsibility)			Category AC-4 [kW] (Three-phase squirrel-cage motor load inching responsibility)		Category AC-1 [kW] (Resistance, heater)	
	220 to 240V	380 to 440V	500V	220 to 240V	500V	220 to 240V	380 to 440V
T10	2.5	4	4	1.5	2.7(2.2)	7.5	7
T12	3.5	5.5	7.5	2.2	5.5(4)	7.5	8.5
T20	4.5	7.5	7.5	3.7	5.5	7.5	8.5
T21	5.5	11	11	3.7	5.5	12	20
T25	7.5	15	15	4.5	7.5	12	20
T32	7.5	15	15	5.5	7.5(11)	12	20
T35	11	18.5	18.5	5.5	11	20	35
T50	15	22	25	7.5	15	30	50
T65	18.5	30	37	11	22	35	65
T80	22	45	45	15	30	45	78
T100	30	55	55	19	37	55	90

Note a) Brackets ( ) in the inching operation indicate the rating of 380V to 440V.

Table 4 Rated Operation Current

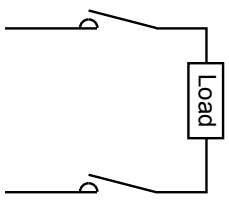
Application / Frame	Motor load						Resistance load		Rated Continuous current I th [A]
	Category AC- 3 [A]			Category AC- 4 [A]			Category AC- 1[A]		
	220 to 240V	380 to 440V	500V	220 to 240V	380 to 440V	500V	220 to 240V	380 to 440V	
T10	11	9	7	8	6	6	20	11	20
T12	13	12	9	11	9	9	20	13	20
T20	18	18	17	18	13	10	20	13	20
T21	25	23	17	18	13	10	32	32	32
T25	30(26)	30(26)	24	20	17	12	32	32	32
T32	32	32	24	26	24	17	32	32	32
T35	40	40	32	26	24	17	60	60	60
T50	55	48	38	35	32	24	80	80	80
T65	65	65	60	50	47	38	100	100	100
T80	85	85	75	65	62	45	120	120	120
T100	105	105	85	80	75	55	150	150	150

Note a) Rated operational current is the maximum applicable current that satisfies the making capacity, breaking capacity, switching frequency, and life at the rated operational voltage.
Note b) Rated Continuous current is a current that can conduct the electricity for 8 hours without raising the temperature above the stated level for all the parts, without switching the magnetic contactor.
Note c) The values of rated operational current in brackets ( ) apply to the magnetic contactor (without thermal overload relay).

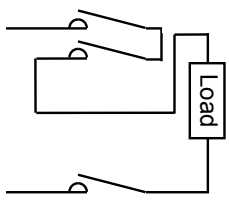
Table 5 DC rated working current

Frame	Rated voltage DC [V]	Category DC2, and DC4 (DC motor load) [A]		Category DC1 (Resistance load) [A]		Category DC-13 (DC coil load) [A]		
		2-pole series	3- pole series	2- pole series	3- pole series	Single pole	2- pole series	3- pole series
T10	24	8	8	10	10	5	8	8
	48	4	6	10	10	3	4	6
	110	2.5	4	6	8	0.6	2	3
	220	0.8	2	3	8	0.2	0.3	0.8
T12	24	12	12	12	12	7	12	12
	48	6	10	12	12	5	6	10
	110	4	8	10	12	1.2	3	5
	220	1.2	4	7	12	0.2	0.5	2
T20	24	18	18	18	18	10	14	15
	48	15	18	18	18	5	7	12
	110	8	15	13	18	1.2	3	5
	220	2	8	8	18	0.2	0.5	2
T21	24	20	20	20	20	12	20	20
	48	15	20	20	20	8	12	15
	110	8	15	15	20	1.5	3	10
	220	2	8	10	20	0.25	1.2	4
T25, T32	24	25	25	25	25	15	25	25
	48	20	25	25	25	10	15	25
	110	10	20	25	25	1.5	4	12
	220	3	10	12	22	0.25	1.2	4
T35	24	35	35	35	35	15	35	35
	48	20	30	35	35	10	15	25
	110	10	20	25	35	1.5	4	12
	220	3	10	12	30	0.25	1.2	4
T50	24	45	50	50	50	-	-	-
	48	25	35	40	50	-	-	-
	110	15	30	35	50	-	-	-
	220	3.5	12	15	40	-	-	-
T65	24	45	50	50	65	-	-	-
	48	25	35	40	65	-	-	-
	110	15	30	35	65	-	-	-
	220	3.5	12	15	50	-	-	-
T80	24	65	80	80	80	-	-	-
	48	40	60	65	80	-	-	-
	110	20	50	50	80	-	-	-
	220	5	20	20	60	-	-	-
T100	24	93	93	93	93	-	-	-
	48	60	90	93	93	-	-	-
	110	40	80	80	93	-	-	-
	220	30	50	50	70	-	-	-

Note a) DC2, DC4, and DC1 are the gradings of JEM1038 that are to be applied for starting and stopping the DC shunt-wound motor, starting and stopping the DC series motor, and resistance load respectively.
Note b) DC- 13 is the grading of IEC60947-5-1 which is to be applied to the induction (coil) load (time constant L/R = 100ms).
Note c) The Switching of the electrical switch can be done up to 500,000 times.
Note d) The closed current capacity of the DC2 and DC4 is four times of the above table while the frequency is 100 times and the breaking current capacity is four times of the above table while the frequency is 25 times.
Note e) The 2-pole series and 3-pole series connections are shown in the following diagram.



2- pole series



3- pole series

■ Characteristics and Performance (Type test results)

1. Structure

It is compatible with JISC8201-4-1, IEC60947-4-1, EN60947-4-1, UL60947-4-1,
CSA C22.2 No.60947-4-1, and GB14048.4.

2. Type Test

Applicable Standard	IEC60947-1	(2011)	Low voltage switchgear and control gear Part 1: General Rule
	IEC60947-4-1	(2012)	Low voltage switchgear and control gear Part 4: Contactor and Motor Starter Section 1: Electro-mechanical Contactor and Motor Starter

2.1 Type Tests and Test Sequences

Test Sequences	Test Name	Test Conditions
a) Sequence I	1) Temperature rise	According to the IEC60947-4-1 9.3.3.3 "Temperature Rise".
	2) Operation and operating limits	According to the IEC60947-4-1 9.3.3.1 "Operation" and 9.3.3.2 "Operating Limits".
	3) Dielectric properties	According to the IEC60947-4-1 9.3.3.4 "Dielectric Properties".
b) Sequence II	1) Rated making breaking capacity Switching capacity and reversibility	According to the IEC60947-4-1 9.3.3.5 "Making and Breaking Capacity".
	2) Conventional operating performance	According to the IEC60947-4-1 9.3.3.6 "Operating Performance Capability".
c) Sequence III	1) Performance under short-circuit conditions	According to the IEC60947-4-1 9.3.4 "Performance under Short-circuit Conditions".
d) Sequence IV	1) Ability of contactors to withstand overload currents	According to the IEC60947-4-1 9.3.5 "Ability of Contactors to Withstand Overload Currents".
e) Sequence V	1) Mechanical properties of terminals	According to the IEC60947-1 8.2.4 "Mechanical Properties of Terminals".

Note a) Tests were conducted with the following coil designation: 200VAC (Rated voltage 200 to 240V 50Hz/60Hz)

2.2 Test Sequence I

2.2.1 Temperature Rise and Dielectric Properties

These tests were conducted according to the test conditions indicated in Table 1 and Note a) to e). The temperature rise of each part met the standard criteria of temperature rise limit. Also the operations and dielectric properties after the temperature tests met the standard criteria.

Table 1

Item / Model Name	Combined Thermal Overload Relay			Test Conditions			Results Note a)								Judgment
	Model Name	Heater designation [A]	Setting Current [A]	Current [A]		Main Circuit Connection Wire Size [mm^2] Note b)	Temperature Rise [K]					Operation	Dielectric Properties		
				Main Circuit	Auxiliary Circuit		Coil [Resistance method]	Terminal		Contact			Impulse Note d)	Power Frequency Note d)	
								Main Circuit	Auxiliary Circuit	Main Circuit	Auxiliary Circuit				
Stan-dard	-	-	-	-	-	-	100 or less	65 or less	65 or less	Note c)		Three times opening and closing thermal No trip	7.3kV 1.2/50 µs x5 times	1890V 5 seconds	
MSO-T10 (KP)	TH-T18 (KP)	9	11	11	10	1.5	47	48	39	50	52	OK	OK	OK	OK
MSO-T12 (KP)	TH-T18 (KP)	11	13	13	10	2.5	47	56	41	55	54	OK	OK	OK	OK
MSO-T20 (KP)	TH-T18 (KP)	15	18	18	10	2.5	53	58	42	72	54	OK	OK	OK	OK
MSO-T21 (KP)	TH-T25 (KP)	15	18	18	10	2.5	43	51	41	43	47	OK	OK	OK	OK
MSO-T25 (KP)	TH-T25 (KP)	22	26	26	10	6	43	53	40	57	47	OK	OK	OK	OK
MSO-T35 (KP)	TH-T50 (KP)	29	34	34	10	10	67	47	30	58	42	OK	OK	OK	OK
MSO-T50 (KP)	TH-T50 (KP)	42	50	50	10	10	67	58	30	68	43	OK	OK	OK	OK
MSO-T65 (KP)	TH-T65 (KP)	54	65	65	10	16	57	49	25	60	42	OK	OK	OK	OK
MSO-T80 (KP)	TH-T100 (KP)	67	80	80	10	25	63	58	25	75	42	OK	OK	OK	OK
MSO-T100 (KP)	TH-T100 (KP)	82	100	100	10	35	51	56	34	70	49	OK	OK	OK	OK
S-T10	-	-	-	20	10	2.5	45	46	38	71	52	-	OK	OK	OK
S-T12	-	-	-	20	10	2.5	41	55	38	76	52	-	OK	OK	OK
S-T20	-	-	-	20	10	2.5	41	55	38	75	52	-	OK	OK	OK
S-T21	-	-	-	32	10	6	31	34	30	46	47	-	OK	OK	OK
S-T25	-	-	-	32	10	6	31	34	30	46	47	-	OK	OK	OK
S-T32	-	-	-	32	-	6	29	33	-	45	-	-	OK	OK	OK
S-T35	-	-	-	60	10	16	62	35	30	45	46	-	OK	OK	OK
S-T50	-	-	-	80	10	25	64	41	29	58	45	-	OK	OK	OK
S-T65	-	-	-	100	10	35	56	39	25	61	42	-	OK	OK	OK
S-T80	-	-	-	120	10	50	62	45	25	71	42	-	OK	OK	OK
S-T100	-	-	-	150	10	50	43	46	34	83	49	-	OK	OK	OK

Note a) The test of temperature rise and operation was conducted by operating at an ambient temperature of 40°C, in open state with the iron plate mounted and by applying a voltage of 240V and a frequency of 60Hz to the operating coil.

Note b) The connection wire size of the auxiliary circuit: 1.5 mm^2

Note c) The temperature rise of the contacts was checked at a temperature that is not harmful to the surrounding components. (In short 100K)

Note d) The application points of the impulse withstand voltage performance and the power frequency withstand voltage performance were as follows. However in the power frequency withstand voltage test, (c) was not implemented.
Measurement Points: (a) Between all terminals of the main circuit and grounded metal body when the contact element was closed.
(b) Between one pole of the main circuit and all other poles connected altogether to the grounded metal body when the contact element was closed.
(c) Between the supply side terminals and the load side terminals of the main circuit when the contact element was opened.
(d) Between one circuit of the operating circuit and auxiliary circuit, and all other circuits/grounded metal body.

Note e) Number of Samples: 1 per machine

2.2.2 Operating Limits

(1) Operating Limits of the Magnetic Contactor

The operating voltage (hot condition) and open-circuit voltage after the temperature test met the standard criteria by operating and opening without hindrance in the set voltage.

Table 2

Item / Standard / Model Name		Test Conditions and Results			Judgment
		Operating Voltage (40°C Hot)		Open-circuit Voltage (-5°C Cold)	
		Operation at 85% (170V or less) of the coil rated voltage	Operation at 110% of the coil rated voltage Note a)	Open at 20 to 75% of the coil rated voltage Note b)	
MSO-T10 (KP)	50Hz	129	OK	90	OK
	60Hz	142	OK	107	OK
MSO-T12 (KP)	50Hz	149	OK	95	OK
	60Hz	164	OK	109	OK
MSO-T20 (KP)	50Hz	151	OK	96	OK
	60Hz	165	OK	112	OK
MSO-T21 (KP)	50Hz	144	OK	104	OK
	60Hz	156	OK	115	OK
MSO-T25 (KP)	50Hz	147	OK	108	OK
	60Hz	159	OK	118	OK
MSO-T35 (KP)	50Hz	137	OK	107	OK
	60Hz	146	OK	117	OK
MSO-T50 (KP)	50Hz	137	OK	107	OK
	60Hz	146	OK	117	OK
MSO-T65 (KP)	50Hz	146	OK	85	OK
	60Hz	148	OK	77	OK
MSO-T80 (KP)	50Hz	146	OK	85	OK
	60Hz	148	OK	77	OK
MSO-T100 (KP)	50Hz	157	OK	100	OK
	60Hz	159	OK	93	OK
S-T10	50Hz	128	OK	89	OK
	60Hz	142	OK	106	OK
S-T12	50Hz	145	OK	90	OK
	60Hz	161	OK	107	OK
S-T20	50Hz	145	OK	90	OK
	60Hz	161	OK	108	OK
S-T21	50Hz	130	OK	103	OK
	60Hz	141	OK	112	OK
S-T25	50Hz	131	OK	104	OK
	60Hz	142	OK	114	OK
S-T32	50Hz	142	OK	96	OK
	60Hz	156	OK	108	OK
S-T35	50Hz	135	OK	107	OK
	60Hz	148	OK	117	OK
S-T50	50Hz	135	OK	107	OK
	60Hz	148	OK	117	OK
S-T65	50Hz	146	OK	85	OK
	60Hz	148	OK	77	OK
S-T80	50Hz	146	OK	85	OK
	60Hz	148	OK	77	OK
S-T100	50Hz	153	OK	98	OK
	60Hz	155	OK	91	OK

Note a) The operation at 110% of the coil rated voltage of standard value was possible at 264V 50Hz/60Hz.
Note b) The operation at 20 to 75% of the coil rated voltage of standard value was possible at 48V to 150V 50Hz/60Hz.
Note c) Number of Samples: 1 per machine

<Reference Test>

Coil characteristics (20°C cold condition)

Model Name	Input [VA]		Con-sumption Power [W]	Operating Voltage [V]		Coil Current [mA]		Operating Time [ms]					
								Coil ON →			Coil OFF →		
	Instant	Usual		Operation	Open	Instant	Usual	Main Contact ON	Auxiliary Contact a ON	Auxiliary Contact b OFF	Main Contact OFF	Auxiliary Contact a OFF	Auxiliary Contact b ON
S-T10	45	7	2.2	120 to 150	75 to 115	200	30	12 to 18	12 to 18	-	5 to 20	5 to 20	-
S-T12	45	7	2.2	120 to 150	75 to 115	200	30	12 to 18	12 to 18	9 to 16	5 to 20	5 to 20	7 to 22
S-T20	45	7	2.2	120 to 150	75 to 115	200	30	12 to 18	12 to 18	9 to 16	5 to 20	5 to 20	7 to 22
S-T21	75	7	2.4	125 to 155	80 to 115	340	30	13 to 20	13 to 20	8 to 14	5 to 15	5 to 15	8 to 18
S-T25	75	7	2.4	125 to 155	80 to 115	340	30	13 to 20	13 to 20	8 to 14	5 to 15	5 to 15	8 to 18
S-T32	55	4.5	1.8	125 to 155	80 to 115	250	20	15 to 22	-	-	5 to 15	-	-
S-T35	110	10	3.8	120 to 150	80 to 115	500	45	10 to 20	10 to 20	8 to 15	5 to 14	5 to 14	8 to 18
S-T50	110	10	3.8	120 to 150	80 to 115	500	45	10 to 20	10 to 20	8 to 15	5 to 14	5 to 14	8 to 18
S-T65	115	20	2.2	110 to 135	60 to 100	520	67	20 to 30	20 to 30	13 to 24	35 to 65	35 to 65	50 to 79
S-T80	115	20	2.2	110 to 135	60 to 100	520	67	20 to 30	20 to 30	13 to 24	35 to 65	35 to 65	50 to 79
S-T100	210	23	2.8	110 to 135	60 to 100	950	85	20 to 35	20 to 35	18 to 28	50 to 100	50 to 100	54 to 104

Note a) The above table shows the standard values of the properties of the 200VAC coil.
Note b) Coil current is the average value when 220V 60Hz was applied.

(2) Operating Charateristics of Thermal Overload Relay

1) Operations in a Balanced Circuit (Ambient Temperature: 20°C)

(a) If the thermal overload relay does not function at 105% of settling current in cold conditions for more than 2 hours, the operation should be performed with 120% of the settling current for less than 2 hours after the constant temperature is maintained.
(b) When 150% of the settling current is passed after the settling current is passed and the constant temperature is maintained, the relay should operate within the limits shown in the table below with respect to the corresponding trip class.
(c) The operation should be performed within the limits shown in the table below with respect to the corresponding trip class, when 720% of the settling current is passed in cold conditions.

Trip Class	150% of the settling current	720% of the settling current
5	Less than 2 minutes	TP≦5 seconds
10A	Less than 2 minutes	2<TP≦10 seconds
10	Less than 4 minutes	4<TP≦10 seconds
20	Less than 8 minutes	6<TP≦20 seconds
30	Less than 12 minutes	9<TP ≦30 seconds

TP：Operating time at the time of constraint

Result: All the frames satisfy the above conditions.

2) Operations in an Unbalanced Circuit (Ambient Temperature: 20°C)

(a) If the open phase detection function does not execute when settling current is passed to all poles at thesame time for 2 hours, the operation should be performed within 2 hours when 1-pole is disconnectedand 132% of settling current is passed to the other 2-pole after the constant temperature is maintained.
(b) If the open phase detection function does not execute when settling current is passed to 2-pole and 90% of settling current to 1 pole for 2 hours, the operation should be performed within 2 hours when 1-pole is disconnected and 115% of settling current is passed to the other 2-pole after the constant temperature is maintained.
(c) The operation should be performed within the limits shown in the table below with respect to the corresponding trip class, when 720% of the settling current is passed in cold conditions.

Result: MSO-T☐KP types satisfy the above conditions.

2.3 Test Sequence II

2.3.1 Test of Making and Breaking Capacities

(1) Test of Making Capacity

These tests were conducted according to the test conditions indicated in Table 4 and Note a) to c). No abnormalities such as welding of contacts were found, and the results met the standard criteria.

Table 4

Item / Standard / Model Name	Rated Value (AC- 3)		Test Conditions (making)						Results	Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage U [V]	Current I [A]	Power Factor cosφ	Operation Cycle [Times] Note b)	ON time [seconds]	OFF time [seconds]		
Standard	-	-	1.05 x Ue	10 x Ie	Ie≦100A: 0.45±0.05 Ie>100A: 0.35±0.05	50	0.05	10	Contact Welding	
S-T10	220	11	231	110	0.45	50	0.05	10	None	OK
	440	9	462	90	0.45	50	0.05	10	None	OK
S-T12	220	13	231	130	0.45	50	0.05	10	None	OK
	440	12	462	120	0.45	50	0.05	10	None	OK
S-T20	220	18	231	180	0.45	50	0.05	10	None	OK
	440	18	462	180	0.45	50	0.05	10	None	OK
S-T21	220	25	231	250	0.45	50	0.05	10	None	OK
	440	23	462	230	0.45	50	0.05	10	None	OK
S-T25	220	30	231	300	0.45	50	0.05	10	None	OK
	440	30	462	300	0.45	50	0.05	10	None	OK
S-T32	220	32	231	320	0.45	50	0.05	10	None	OK
	440	32	462	320	0.45	50	0.05	10	None	OK
S-T35	220	40	231	400	0.45	50	0.05	10	None	OK
	440	40	462	400	0.45	50	0.05	10	None	OK
S-T50	220	55	231	550	0.45	50	0.05	10	None	OK
	440	48	462	480	0.45	50	0.05	10	None	OK
S-T65	220	65	231	650	0.45	50	0.05	10	None	OK
	440	65	462	650	0.45	50	0.05	10	None	OK
S-T80	220	85	231	850	0.45	50	0.05	10	None	OK
	440	85	462	850	0.45	50	0.05	10	None	OK
S-T100	220	105	231	1050	0.35	50	0.05	10	None	OK
	440	105	462	1050	0.35	50	0.05	10	None	OK

Note a) Main circuit frequency: 60Hz

Note b) Among 50 operating cycles, 110% of the rated value (264V 60Hz) was applied to the coil for 25 cycles, and 85% of the rated value (170V 60Hz) was applied to the coil for the other 25 cycles.

Note c) Number of Samples: 1 per machine

(2) Test of Making and Breaking Capacities

These tests were conducted according to the test conditions indicated in Table 5 and Note a) to c) after the making capacity test (1). No abnormalities such as welding of contacts and phase-to-phase short circuits were found, and the results met the standard criteria.

Table 5

Item / Standard / Model Name	Rated Value (AC- 3)		Test Conditions (making and breaking capacity)						Results	Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage Ur [V]	Current Ic [A]	Power Factor cosφ	Operation Cycle [Times]	ON time [seconds]	OFF time [seconds]		
Standard	-	-	1.05 x Ue	8 x Ie	Ie≦100A: 0.45±0.05 Ie>100A: 0.35±0.05	50	0.05	Ic≦100: 10 100<Ic≦200: 20 200<Ic≦300: 30 300<Ic≦400: 40 400<Ic≦600: 60 600<Ic≦800: 80 800<Ic≦1000: 100	Contact Welding and Phase-to-phase Short-circuits	
S-T10	220	11	231	88	0.45	50	0.05	10	None	OK
	440	9	462	72	0.45	50	0.05	10	None	OK
S-T12	220	13	231	104	0.45	50	0.05	20	None	OK
	440	12	462	96	0.45	50	0.05	10	None	OK
S-T20	220	18	231	144	0.45	50	0.05	20	None	OK
	440	18	462	144	0.45	50	0.05	20	None	OK
S-T21	220	25	231	200	0.45	50	0.05	20	None	OK
	440	23	462	184	0.45	50	0.05	20	None	OK
S-T25	220	30	231	240	0.45	50	0.05	30	None	OK
	440	30	462	240	0.45	50	0.05	30	None	OK
S-T32	220	32	231	256	0.45	50	0.05	30	None	OK
	440	32	462	256	0.45	50	0.05	30	None	OK
S-T35	220	40	231	320	0.45	50	0.05	40	None	OK
	440	40	462	320	0.45	50	0.05	40	None	OK
S-T50	220	55	231	440	0.45	50	0.05	60	None	OK
	440	48	462	384	0.45	50	0.05	40	None	OK
S-T65	220	65	231	520	0.45	50	0.05	60	None	OK
	440	65	462	520	0.45	50	0.05	60	None	OK
S-T80	220	85	231	680	0.45	50	0.05	80	None	OK
	440	85	462	680	0.45	50	0.05	80	None	OK
S-T100	220	105	231	840	0.35	50	0.05	100	None	OK
	440	105	462	840	0.35	50	0.05	100	None	OK

Note a) Main circuit frequency: 60Hz

Note b) The operation was conducted by applying a voltage of 240V and a frequency 60Hz to the operating coil.

Note c) Number of Samples: 1 per machine

(3) The Switching Capacity and Reversibility

These tests were conducted according to the test conditions indicated in Table 6, 7 and Note a) to d). No abnormalities such as welding of contacts and phase-to-phase short circuits were found, and the results met the standard criteria.

Table 6

Item / Standard / Model Name	Rated Value (AC- 4)		Test Conditions (making)						Results	Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage Ur [V]	Current Ic [A]	Power Factor cosφ	Operation Cycle [Times]	ON time [seconds]	OFF time [seconds]		
Standard	-	-	1.05 x Ue	12 x Ie	Ie≦100A 0.45±0.05 Ie>100A 0.35±0.05	50	0.05	10	Contact Welding and Phase-to-phase Short-circuits	
S-2 x T10	220	8	231	96	0.45	50	0.05	10	None	OK
	440	6	462	72	0.45	50	0.05	10	None	OK
S-2 x T12	220	11	231	132	0.45	50	0.05	10	None	OK
	440	9	462	108	0.45	50	0.05	10	None	OK
S-2 x T20	220	18	231	216	0.45	50	0.05	10	None	OK
	440	13	462	156	0.45	50	0.05	10	None	OK
S-2 x T21	220	18	231	216	0.45	50	0.05	10	None	OK
	440	13	462	156	0.45	50	0.05	10	None	OK
S-2 x T25	220	20	231	240	0.45	50	0.05	10	None	OK
	440	17	462	204	0.45	50	0.05	10	None	OK
S-2 x T35	220	26	231	312	0.45	50	0.05	10	None	OK
	440	24	462	288	0.45	50	0.05	10	None	OK
S-2 x T50	220	35	231	420	0.45	50	0.05	10	None	OK
	440	32	462	384	0.45	50	0.05	10	None	OK
S-2 x T65	220	50	231	600	0.45	50	0.05	10	None	OK
	440	47	462	564	0.45	50	0.05	10	None	OK
S-2 x T80	220	65	231	780	0.45	50	0.05	10	None	OK
	440	62	462	744	0.45	50	0.05	10	None	OK
S-2 x T100	220	80	231	960	0.45	50	0.05	10	None	OK
	440	75	462	900	0.45	50	0.05	10	None	OK

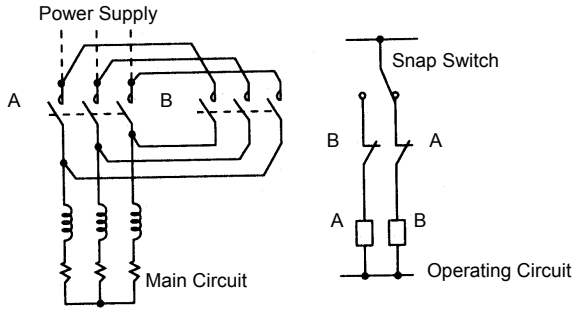
Table 7

Item / Standard / Model Name	Rated Value (AC- 4)		Test Conditions (making and breaking capacity)							Results	Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage Ur [V]	Current Ic [A]	Power Factor cosφ	Operation Cycle [Times]	Simulta-neous Excitation Test	ON time [seconds]	OFF time [seconds]		
Standard	-	-	1.05 x Ue	10 x Ie	Ie≦100A 0.45±0.05 Ie>100A 0.35±0.05	50	10	0.05	Ic≦100: 10 100<Ic≦200: 20 200<Ic≦300: 30 300<Ic≦400: 40 400<Ic≦600: 60 600<Ic≦800: 80	Contact Welding and Phase-to-phase Short-circuits	
S-2 x T10	220	8	231	80	0.45	50	10	0.05	10	None	OK
	440	6	462	60	0.45	50	10	0.05	10	None	OK
S-2 x T12	220	11	231	110	0.45	50	10	0.05	20	None	OK
	440	9	462	90	0.45	50	10	0.05	10	None	OK
S-2 x T20	220	18	231	180	0.45	50	10	0.05	20	None	OK
	440	13	462	130	0.45	50	10	0.05	20	None	OK
S-2 x T21	220	18	231	180	0.45	50	10	0.05	20	None	OK
	440	13	462	130	0.45	50	10	0.05	20	None	OK
S-2 x T25	220	20	231	200	0.45	50	10	0.05	20	None	OK
	440	17	462	170	0.45	50	10	0.05	20	None	OK
S-2 x T35	220	26	231	260	0.45	50	10	0.05	30	None	OK
	440	24	462	240	0.45	50	10	0.05	30	None	OK
S-2 x T50	220	35	231	350	0.45	50	10	0.05	40	None	OK
	440	32	462	320	0.45	50	10	0.05	40	None	OK
S-2 x T65	220	50	231	500	0.45	50	10	0.05	60	None	OK
	440	47	462	470	0.45	50	10	0.05	60	None	OK
S-2 x T80	220	65	231	650	0.45	50	10	0.05	80	None	OK
	440	62	462	620	0.45	50	10	0.05	80	None	OK
S-2 x T100	220	80	231	800	0.45	50	10	0.05	80	None	OK
	440	75	462	750	0.45	50	10	0.05	80	None	OK

Note a) The test was conducted using reversible-type magnetic contactor.

Note b) The operation was conducted at main circuit frequency of 60Hz by applying a voltage of 240V and a frequency of 60Hz to the operating coil.

Note c) Making A → Open circuit A, then immediately making B → Open circuit B → OFF time (above table) pause →Making B → Open circuit B, then immediately making A → Open circuit A → OFF time (above table) pause, this makes 1 cycle. 50 cycles were performed in this way.
Here, (1) "A" shows the forward rotation contactor and "B" shows the reverse rotation contactor.
(2) "Immediately" refers to the shortest reversible exchange time.



Note d) Number of Samples: 1 per machine

2.3.2 The Operating Performance

(1) Non-reversing

These tests were conducted according to the test conditions indicated in Table 8 and Note a) to c). No abnormalities such as welding of contacts and phase-to-phase short circuits were found, and the results met the standard criteria. After the test, the withstand voltage performance was checked by applying a voltage of 1000V and a frequency of 60Hz for 5 seconds. The results were acceptable.

Table 8

Item / Model Name	Rated Value (AC- 3)		Test Conditions (making and breaking capacity)						Results		Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage Ur [V]	Current Ic [A]	Power Factor cosφ	Operation Cycle [Times]	ON time [seconds]	OFF time [seconds]	Making and Breaking Capacity	Withstand Voltage	
Stan-dard	-	-	1.05 x Ue	2 x Ie	Ie≦100A: 0.45±0.05 Ie>100A: 0.35±0.05	6000	0.05	Ic≦100: 10 100<Ic≦200: 20 200<Ic≦300: 30	Contact Welding and Phase-to-phase Short-circuit	2 x Ue provided 1000V or higher 5 seconds	
S-T10	220	11	231	22	0.45	6000	0.05	10	None	OK	OK
	440	9	462	18	0.45	6000	0.05	10	None	OK	OK
S-T12	220	13	231	26	0.45	6000	0.05	10	None	OK	OK
	440	12	462	24	0.45	6000	0.05	10	None	OK	OK
S-T20	220	18	231	36	0.45	6000	0.05	10	None	OK	OK
	440	18	462	36	0.45	6000	0.05	10	None	OK	OK
S-T21	220	25	231	50	0.45	6000	0.05	10	None	OK	OK
	440	23	462	46	0.45	6000	0.05	10	None	OK	OK
S-T25	220	30	231	60	0.45	6000	0.05	10	None	OK	OK
	440	30	462	60	0.45	6000	0.05	10	None	OK	OK
S-T32	220	32	231	64	0.45	6000	0.05	10	None	OK	OK
	440	32	462	64	0.45	6000	0.05	10	None	OK	OK
S-T35	220	40	231	80	0.45	6000	0.05	10	None	OK	OK
	440	40	462	80	0.45	6000	0.05	10	None	OK	OK
S-T50	220	55	231	110	0.45	6000	0.05	20	None	OK	OK
	440	48	462	96	0.45	6000	0.05	10	None	OK	OK
S-T65	220	65	231	130	0.45	6000	0.05	20	None	OK	OK
	440	65	462	130	0.45	6000	0.05	20	None	OK	OK
S-T80	220	85	231	170	0.45	6000	0.05	20	None	OK	OK
	440	85	462	170	0.45	6000	0.05	20	None	OK	OK
S-T100	220	105	231	210	0.35	6000	0.05	30	None	OK	OK
	440	105	462	210	0.35	6000	0.05	30	None	OK	OK

Note a) Main circuit frequency: 60Hz

Note b) The operation was conducted by applying a voltage of 240V and a frequency of 60Hz to the operating coil.

Note c) Number of Samples: 1 per machine

(2) Reversing

These tests were conducted according to the test conditions indicated in Table 9 and Note a) to e). No abnormalities such as welding of contacts and phase-to-phase short circuits were found, and the results met the standard criteria. After the test, the withstand voltage performance was checked by applying a voltage of 1000V and a frequency of 60Hz for 5 seconds. The results were acceptable.

Table 9

Item / Model Name	Rated Value (AC- 4)		Test Conditions (making and breaking capacity)						Results		Judgment
	Voltage Ue [V]	Current Ie [A]	Voltage Ur [V]	Current Ic [A]	Power Factor cosφ	Operation Cycle [Times] Note d)	ON time [seconds]	OFF time [seconds]	Making and Breaking Capacity	Withstand Voltage	
Stan-dard	-	-	1.05 x Ue	6 x Ie	Ie≦100A: 0.45±0.05 Ie>100A: 0.35±0.05	6000	0.05	Ic≦100: 10 100<Ic≦200: 20 200<Ic≦300: 30 300<Ic≦400: 40 400<Ic≦600: 60	Contact Welding and Phase-to-phase Short-circuit	2 x Ue Provided 1000V or higher 5 seconds	
S-2 x T10	220	8	231	48	0.45	6000	0.05	10	None	OK	OK
	440	6	462	36	0.45	6000	0.05	10	None	OK	OK
S-2 x T12	220	11	231	66	0.45	6000	0.05	10	None	OK	OK
	440	9	462	54	0.45	6000	0.05	10	None	OK	OK
S-2 x T20	220	18	231	108	0.45	6000	0.05	20	None	OK	OK
	440	13	462	78	0.45	6000	0.05	10	None	OK	OK
S-2 x T21	220	18	231	108	0.45	6000	0.05	20	None	OK	OK
	440	13	462	78	0.45	6000	0.05	10	None	OK	OK
S-2 x T25	220	20	231	120	0.45	6000	0.05	20	None	OK	OK
	440	17	462	102	0.45	6000	0.05	20	None	OK	OK
S-2 x T32	220	26	231	156	0.45	6000	0.05	20	None	OK	OK
	440	24	462	144	0.45	6000	0.05	20	None	OK	OK
S-2 x T35	220	26	231	156	0.45	6000	0.05	20	None	OK	OK
	440	24	462	144	0.45	6000	0.05	20	None	OK	OK
S-2 x T50	220	35	231	210	0.45	6000	0.05	30	None	OK	OK
	440	32	462	192	0.45	6000	0.05	20	None	OK	OK
S-2 x T65	220	50	231	300	0.45	6000	0.05	30	None	OK	OK
	440	47	462	282	0.45	6000	0.05	30	None	OK	OK
S-2 x T80	220	65	231	390	0.45	6000	0.05	40	None	OK	OK
	440	62	462	372	0.45	6000	0.05	40	None	OK	OK
S-2 x T100	220	80	231	480	0.45	6000	0.05	60	None	OK	OK
	440	75	462	450	0.45	6000	0.05	60	None	OK	OK

Note a) The test was conducted using reversible-type magnetic contactor.
Note b) Main circuit frequency: 60Hz
Note c) The operation was conducted by applying a voltage of 240V and frequency of 60Hz to the operating coil.
Note d) The operation was performed based on the cycle mentioned in Note c) of 2.3.1 (3).
Note e) Number of Samples: 1 per machine

2.4 Test Sequence III

2.4.1 Performance under Short-circuit Conditions

These tests were conducted according to the test conditions indicated in Table 10 and Note a) to d). There was no damage to the conductors and terminals. The leakage detection fuse was not melted, and the results were acceptable.

Table 10

Item / Thermal Overload Relay Model Name and Nominal Current of the Heater / Standard / Model Name		Rated Current of SCPD [A] Note a)	Rated Value (AC- 3)		Test Conditions				Results			Judgment
			Voltage Ue [V]	Current Ie [A]	Voltage [V]	Current I [kA]	Power Factor cosφ	Number of Samples	O or CO Operation	Conductor/ Terminal Damage	Melting of the Leakage Detection Fuse	
		-	-	-	Ue	Note c)	Note d)	[machine]	Note b)	None	None	
MSO-T10 (KP)	TH-T18 9A	20	220/440	11/9	440	1	0.95	1	O	None	None	OK
								1	CO	None	None	
MSO-T12 (KP)	TH-T18 11A	25	220/440	13/12	440	1	0.95	1	O	None	None	OK
								1	CO	None	None	
MSO-T20 (KP)	TH-T18 15A	32	220/440	18/18	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
MSO-T21 (KP)	TH-T25 15A	32	220/440	25/23	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
MSO-T25 (KP)	TH-T25 22A	50	220/440	30/30	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
MSO-T35 (KP)	TH-T50 29A	63	220/440	40/40	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
MSO-T50 (KP)	TH-T50 42A	100	220/440	55/48	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
MSO-T65 (KP)	TH-T65 54A	100	220/440	65/65	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	
MSO-T80 (KP)	TH-T100 67A	125	220/440	85/85	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	
MSO-T100 (KP)	TH-T100 82A	160	220/440	105/105	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	
S-T10	-	40	220/440	11/9	440	1	0.95	1	O	None	None	OK
								1	CO	None	None	
S-T12	-	40	220/440	13/12	440	1	0.95	1	O	None	None	OK
								1	CO	None	None	
S-T20	-	40	220/440	18/18	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T21	-	80	220/440	25/23	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T25	-	80	220/440	30/30	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T32	-	80	220/440	32/32	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T35	-	100	220/440	40/40	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T50	-	100	220/440	55/48	440	3	0.9	1	O	None	None	OK
								1	CO	None	None	
S-T65	-	100	220/440	65/65	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	
S-T80	-	125	220/440	85/85	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	
S-T100	-	160	220/440	105/105	440	5	0.7	1	O	None	None	OK
								1	CO	None	None	

Note a) SCPD: Short Circuit Protection Device

Note b) O operation: Breaking of the circuit by the SCPD resulting from closing the circuit on the equipment under test which is in the closed position.
CO operation: Breaking of the circuit by the SCPD resulting from closing the circuit by the equipment under test.

Note c) The test current specified in the standards for rated operational current was as follows. (Ie indicates the maximum current applied to the motor)
When $1<Ie\leqq16$: 1 kA
When $16<Ie\leqq63$: 3 kA
When $63<Ie\leqq125$: 5 kA

Note d) The power factor specified in the standards for test current was as follows.
When $I\leqq1.5$ kA: 0.95±0.05
When $1.5\ kA<I\leqq3$ kA: 0.9±0.05
When $4.5\ kA<I\leqq6$ kA: 0.7±0.05

2.5 Test Sequence IV

2.5.1 Ability of Contactors to Withstand Overload Currents

The current indicated in Table 11 was applied for 10 seconds in making conditions of the magnetic contactor. All the parts met the standard criteria without abnormality.

Table 11

Item / Standard / Model Name	Rated Current [A]	Test Conditions		Results	Judgment
		Current [A]	Current Passage Time [seconds]		
	Rated Operational Current (AC-3)	Ie≦630A: 8 x Ie Ie>630A: 6 x Ie	10	Abnormality in the part	
S-T10	11	88	10	None	OK
S-T12	13	104	10	None	OK
S-T20	18	144	10	None	OK
S-T21	25	200	10	None	OK
S-T25	30	240	10	None	OK
S-T32	32	256	10	None	OK
S-T35	40	320	10	None	OK
S-T50	55	440	10	None	OK
S-T65	65	520	10	None	OK
S-T80	85	680	10	None	OK
S-T100	105	840	10	None	OK

Note a) The test was conducted only for the magnetic contactor.
Note b) Number of Samples: 1 per machine

2.6 Test Sequence V

2.6.1 Mechanical Properties of Terminals

(1) Tests of Mechanical Strength of Terminals

The crimp terminal indicated in Table 12 was tightened with the following tightening torques, and was tested by connection and disconnection 5 times. All the parts met the standard criteria without looseness or damage.

Table 12

Item / Stan-dard / Model Name	Target Terminal Position	Crimp Terminal Size	Manufacturer Standard Tightening Torque [N・m]	Tested Tightening Torque [N・m]	Results	Judgment
	-	Conductor of the Maximum Cross-Sectional Area	-	110% of the Manufacturer Standard Tightening Torque Note a)	Looseness or Damage to the Part	
MSO-T10(KP)	S-T10: 1/L1	2-3.5	0.9 to 1.5	1.65	None	OK
	TH-T18(KP): 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
MSO-T12(KP)	S-T12: 1/L1	2-3.5	0.9 to 1.5	1.65	None	OK
	TH-T18(KP): 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
MSO-T20(KP)	S-T20: 1/L1	2-3.5	0.9 to 1.5	1.65	None	OK
	TH-T18(KP): 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
MSO-T21(KP)	S-T21: 1/L1	5.5-4	1.2 to 1.9	2.09	None	OK
	TH-T25(KP): 6/T3	5.5-4	1.2 to 1.9	2.09	None	OK
MSO-T25(KP)	S-T25: 1/L1	5.5-4	1.2 to 1.9	2.09	None	OK
	TH-T25(KP): 6/T3	5.5-4	1.2 to 1.9	2.09	None	OK
MSO-T35(KP)	S-T35: 1/L1	22-S5	2.0 to 3.3	3.63	None	OK
	TH-T50(KP): 6/T3	14-5	2.0 to 3.3	3.63	None	OK
MSO-T50(KP)	S-T50: 1/L1	22-S5	2.0 to 3.3	3.63	None	OK
	TH-T50(KP): 6/T3	14-5	2.0 to 3.3	3.63	None	OK
MSO-T65(KP)	S-T65: 1/L1	60-S6	3.5 to 5.7	6.27	None	OK
	TH-T65(KP): 6/T3	22-6	3.5 to 5.7	6.27	None	OK
MSO-T80(KP)	S-T80: 1/L1	60-S6	3.5 to 5.7	6.27	None	OK
	TH-T100(KP): 6/T3	38-S6	3.5 to 5.7	6.27	None	OK
MSO-T100(KP)	S-T100: 1/L1	60-6	3.5 to 5.7	6.27	None	OK
	TH-T100(KP): 6/T3	38-S6	3.5 to 5.7	6.27	None	OK
S-T10	2/T1, 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
S-T12	2/T1, 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
S-T20	2/T1, 6/T3	2-3.5	0.9 to 1.5	1.65	None	OK
S-T21	2/T1, 6/T3	5.5-4	1.2 to 1.9	2.09	None	OK
S-T25	2/T1, 6/T3	5.5-4	1.2 to 1.9	2.09	None	OK
S-T32	2/T1, 6/T3	5.5-4	1.2 to 1.9	2.09	None	OK
S-T35	2/T1, 6/T3	22-S5	2.0 to 3.3	3.63	None	OK
S-T50	2/T1, 6/T3	22-S5	2.0 to 3.3	3.63	None	OK
S-T65	2/T1, 6/T3	60-S6	3.5 to 5.7	6.27	None	OK
S-T80	2/T1, 6/T3	60-S6	3.5 to 5.7	6.27	None	OK
S-T100	2/T1, 6/T3	60-6	3.5 to 5.7	6.27	None	OK

Note a) The test was conducted by applying 110% of the maximum value of the manufacturer standard tightening torque.

Note b) Number of Samples: 1 per machine

(2) Flexion and Pull-out Tests

In the flexion tests, the wire was rotated 135 times continuously by placing weight on its pointed end under the conditions (the following tightening torques were checked by using the minimum value of the manufacturer standard tightening torque) indicated in Table 13-1 and 13-2. The results met the standard criteria without pullout or breaking of the conductor. Then, the pull-out strength indicated in Table 13-1 and 13-2 was applied for 1 minute. The results met the standard criteria without pullout or breaking of the conductor.

Table 13-1

Item / Stan-dard / Model Name	Target Terminal Position	Screw Size	Wire Specifications: Type	Wire Specifications: Size	Number of Connections / Maximum Number of Connections	Manufacturer Standard Tightening Torque [N·m]	Tested Tightening Torque [N·m]	Bushing Hole Diameter [mm]	Height [mm]	Weight [kg]	Pulling Force [N]	Judgment
-	-	-	-	-	Maximum Number of Connections	-	Specified Tightening Torque	0.75mm²: 6.5 1.25mm²: 6.5 2.5mm²: 9.5 4mm²: 9.5 6mm²: 9.5 14mm²: 13.0 16mm²: 13.0 φ1.6: 9.5 φ2: 9.5 φ2.6: 9.5 φ3.6: 13.0	0.75mm²: 260 1.25mm²: 260 2.5mm²: 280 4mm²: 280 6mm²: 280 14mm²: 300 16mm²: 300 φ1.6: 280 φ2: 280 φ2.6: 280 φ3.6: 300	0.75mm²: 0.4 1.25mm²: 0.4 2.5mm²: 0.7 4mm²: 0.9 6mm²: 1.4 14mm²: 2.9 16mm²: 2.9 φ1.6: 0.7 φ2: 0.9 φ2.6: 1.4 φ3.6: 2.9	0.75mm²: 30 1.25mm²: 40 2.5mm²: 50 4mm²: 60 6mm²: 80 14mm²: 100 16mm²: 100 φ1.6: 50 φ2: 60 φ2.6: 80 φ3.6: 100	Pullout or Breaking of Conductor
MSO-T10 (KP)	2/T1 (S-T10)	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3 (TH-T18 (KP))	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
MSO-T12 (KP)	2/T1 (S-T12)	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3 (TH-T18 (KP))	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
MSO-T20 (KP)	2/T1 (S-T20)	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3 (TH-T18 (KP))	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
MSO-T21 (KP)	2/T1 (S-T21)	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
	6/T3 (TH-T25 (KP))	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
MSO-T25 (KP)	2/T1 (S-T25)	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
	6/T3 (TH-T25 (KP))	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
MSO-T35 (KP)	2/T1 (S-T35)	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
	6/T3 (TH-T50 (KP))	M5	Stranded Wire	4mm²	2	2.0 to 3.3	2.0	9.5	280	0.9	60	OK
				14mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ2	2	2.0 to 3.3	2.0	9.5	280	0.9	60	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
MSO-T50 (KP)	2/T1 (S-T50)	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
	6/T3 (TH-T50 (KP))	M5	Stranded Wire	4mm²	2	2.0 to 3.3	2.0	9.5	280	0.9	60	OK
				14mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ2	2	2.0 to 3.3	2.0	9.5	280	0.9	60	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK

Note a) Since MSO-T65(KP) higher models cannot be connected to the unprocessed exposed conductor, this evaluation is not applicable.

Table 13-2

Item / Standard / Model Name	Target Terminal Position	Screw Size	Wire Specification: Type	Wire Specification: Size	Number of Connections / Maximum Number of Connections	Manufacturer Standard Tightening Torque [N·m]	Tested Tightening Torque [N·m]	Bushing Hole Diameter [mm]	Height [mm]	Weight [kg]	Pulling Force [N]	Judgment
-	-	-	-	-	-	-	Specified Tightening Torque	0.75mm²: 6.5 1.25mm²: 6.5 2.5mm²: 9.5 16mm²: 13.0 φ1.6: 9.5 φ3.6: 13.0	0.75mm²: 260 1.25mm²: 260 2.5mm²: 280 16mm²: 300 φ1.6: 280 φ3.6: 300	0.75mm²: 0.4 1.25mm²: 0.4 2.5mm²: 0.7 16mm²: 2.9 φ1.6: 0.7 φ3.6: 2.9	0.75mm²: 30 1.25mm²: 40 2.5mm²: 50 16mm²: 100 φ1.6: 50 φ3.6: 100	Pullout or Breaking of Conductor
S-T10	2/T1	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
S-T12	2/T1	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
S-T20	2/T1	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
	6/T3	M3.5	Stranded Wire	0.75mm²	2	0.9 to 1.5	0.9	6.5	260	0.4	30	OK
				2.5mm²	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
			Single Wire	φ1.6	2	0.9 to 1.5	0.9	9.5	280	0.7	50	OK
S-T21	2/T1	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
	6/T3	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
S-T25	2/T1	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
	6/T3	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
S-T32	2/T1	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
	6/T3	M4	Stranded Wire	1.25mm²	2	1.2 to 1.9	1.2	6.5	260	0.4	40	OK
				6mm²	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
			Single Wire	φ1.6	2	1.2 to 1.9	1.2	9.5	280	0.7	50	OK
				φ2.6	2	1.2 to 1.9	1.2	9.5	280	1.4	80	OK
S-T35	2/T1	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
	6/T3	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
S-T50	2/T1	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
	6/T3	M5	Stranded Wire	1.25mm²	2	2.0 to 3.3	2.0	6.5	260	0.4	40	OK
				16mm²	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK
			Single Wire	φ1.6	2	2.0 to 3.3	2.0	9.5	280	0.7	50	OK
				φ3.6	2	2.0 to 3.3	2.0	13.0	300	2.9	100	OK

Note a) Since S-T65 or higher models cannot be connected to the unprocessed exposed conductor, this evaluation is not applicable.