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Programmable Motor Protection
Device No. 38, 46, 49, 50, 50N, 51, 86, 87

Type MPR Motor Protective Relay

APPLICATION

The MPR programmable protective relay is designed to provide multifunction protection of 3 phase ac induction motors as follows:

Overload/Overtemperature
Locked Rotor/Jam
Instantaneous Overcurrent
Instantaneous Ground Overcurrent
Phase Differential
Phase Unbalance
Phase Reversal
Motor Winding Overtemperature
Motor Bearing Overtemperature
Load Bearing Overtemperature
Load Case Overtemperature
Load Loss

FEATURES

Trip indication and reset
Alarm indication and reset
Field settable:
- -- RTD Type and Quantity
- -- Alarm Levels
- -- Trip levels and time delays
- -- Trip mode
- -- Motor constants

Selective Digital Display
- -- Alarm values
- -- Relay Trip Data

Monitoring Data
- -- Phase currents
- -- RTD temperature
- -- Ground current
- -- Differential current
- -- Settings

Non Volatile Memory
- -- Settings
- -- Target Data

Self Diagnostic Display

OPERATION

Large motor protection requires a number of distinct functions which have been provided by up to 9 seperate relays. Westinghouse has combined the experience gained in applying and manufacturing these seperate relays with the flexibility of a microprocessor to provide a single multi-function relay for total integrated motor protection.

The protective functions are based on motor currents and up to 11 RTD inputs. These inputs are scanned continually by microprocessor con trolled circuitry providing the digital equivalent to continuous protection.

The principal concern of the relay is the present and projected temperature of the motor. The temperature measured by the RTD's is monitored directly for alarm and trip.

In addition, current measure ments are combined with temperature in the microprocessor to modify response time. This allows a longer period of over load on a cold motor while protecting against too frequent starts. The combination increases the life and use of the motor.

An operator interface panel is used for field input of values associated with each of the protective functions, and trip and alarm settings. The same push buttons on the panel are used to enter motor and RTD data and ct ratio. The microprocessor is programmed with algorithms that process these inputs.

TRIP INDICATION:

When the trip relay is energized a trip indication LED will turn ON. The legend for each LED identifies the protective function involved.

Trip indication will remain ON until manually reset by an operator. This is accomplished by pressing the RESET button.

ALARM INDICATION

In case of an alarm an LED will FLASH, corresponding to the condition(s) in alarm.

DISPLAY OF MOTOR OPERATING PARAMETERS:

The Input/Output panel provides three functions: Display of motor operating parameters; input facility for settings and characteristic data; and monitoring lights.

The motor operating parameters that can be viewed are given in Table 1.

Each parameter is identified by a function number. The following procedure will cause the VALUE display to read the current operating value of a given function.

1. Using Table 1, determine the function number of the parameter to be displayed.
2. Press the SELECT button. The LED below the button will come ON indicating that the relay is in the FUNCTION SELECT mode.
3. Press the RAISE or LOWER buttons to change the function number selection in the FUNCTION display. Each time the button is pressed the number displayed will increment up or down one digit. Holding the button depressed will cause the display to change in a fast mode. The relay is programmed to display only those functions contained in that particular relay. Functions not available are bypassed.
4. When the function is selected the VALUE display will show the present operating value after an approximate 1 to 3 second delay. When the SELECT button is pressed again, the SELECT LED will turn off and the I/O panel will revert to a stand-by mode.

If a trip indication is present, the operating values displayed are the values at the time the trip occurred. Pressing the RESET button returns the relay to displaying the present operating values.

Table 1

FUNCTION	VALUE DISPLAY	UNITS
00	LOAD CURRENT	% FLC
01	PHASE A CURRENT	AMPS
02	PHASE B CURRENT	AMPS
03	PHASE C CURRENT	AMPS
04	MAX, RTD TEMP	°C
05	RTD 1 WINDING TEMP	°C
06	RTD 2 WINDING TEMP	°C
07	RTD 3 WINDING TEMP	°C
08	RTD 4 WINDING TEMP	°C
09	RTD 5 WINDING TEMP	°C
10	RTD 6 WINDING TEMP	°C
11	RTD 7 MOTOR BEARING TEMP	°C
12	RTD 8 MOTOR BEARING TEMP	°C
13	RTD 9 LOAD BEARING TEMP	°C
14	RTD 10 LOAD BEARING TEMP	°C
15	RTD 11 LOAD CASE TEMP	°C
16	GROUND FAULT CURRENT	% TRIP
17	PHASE A DIFF CURRENT	% TRIP
18	PHASE B DIFF CURRENT	% TRIP
19	PHASE C DIFF CURRENT	% TRIP

SOFTWARE CAUTION NOTICE
The operation of this relay is based on Westinghouse proprietary software, resident in a built-in microprocessor. Purchase of this relay includes a restricted license for the use of any and all programs solely as part of the protective functions. Westinghouse reserves the right to request return of the microprocessor should the relay no longer be used as a protective device. The programs may not be copied, transferred or applied to any other device.

SETTINGS AND DISPLAY

MOTOR AND TRIP PARAMETERS

Table 2 lists the motor and system parameters that must be input before the relay will operate and which are used in the relay calculations and operation. Table 3 lists the various trip values and trip time delays which determine the trip and alarm operating modes of the relay. Any of these may be displayed using the selection procedure outlined above and the function number given in the table.

MPR Setting Procedure

1. Press the "SELECT" button.
2. FUNCTION display will read "0". VALUE display will show phase A current as a percent of full load current setting.
3. Press RAISE or LOWER button until the desired FUNCTION number appears in the FUNCTION display. Functions not in a given relay will be bypassed.
4. The VALUE display will show the existing setting or value of the FUNCTION selected.
5. To enter or change the reading press the SET button. The SET LED will turn on and the SELECT LED will turn off.
6. Use the RAISE or LOWER button to choose the proper value. The relay is programmed so that an invalid setting may not be entered.
7. When the desired reading shows, press the SET button. 0000 will appear in the VALUE display.
8. Press the SET button again and the setting chosen will appear. If this is incorrect, press the SELECT button and start over. If correct, press the SET button again, and the new value will be entered in non-volatile memory and used in the relay operation.
9. The SET LED will now turn off and the SELECT LED will turn on. The new setting now in memory will be read out on the VALUE display.

Table 2

FUNCTION	DATA	SET POINT	UNITS
20	TYPE & QTY OF WINDING RTD'S	0 TO 46	NUMBER
21	TYPE & QTY OF MOTOR BEARING RTD'S	0 TO 42	NUMBER
22	TYPE & QTY OF LOAD BEARING RTD'S	0 TO 42	NUMBER
23	TYPE & QTY OF LOAD CASE RTD'S	0 TO 41	NUMBER
24	MOTOR FACTOR K	2 TO 10	NUMBER
25	C T RATIO	2 TO 800	RATIO
26	PRIMARY FULL LOAD CURRENT	1 TO 9999	AMPS
27	FREQUENCY OF MOTOR CURRENT	50 OR 60	HERTZ

Table 3

FUNCTION	TRIPS AND TIME DELAY	SET POINT	UNITS
28	LOCKED ROTOR CURRENT TRIP	3 TO 12	X FLC
29	LOCKED ROTOR RELAY	1 TO 99	SEC
30	INST OVERCURRENT TRIP	3 TO 15	X FLC
31	INST OVERCURRENT DELAY	0.04 TO 0.2	SEC
32	OVERLOAD TRIP	100 TO 190	% FLC
33	RTD WINDING TEMP TRIP	10 TO 190	°c
34	RTD MOTOR BEARING TEMP TRIP	10 TO 190	°c
35	RTD LOAD BEARING TEMP TRIP	10 TO 190	°c
36	RTD LOAD CASE TEMP TRIP	10 TO 190	°c
37	PHASE REVERSAL TRIP	1	--
38	GROUND FAULT TRIP	0.1 TO 1.0	AMPS
39	GROUND FAULT DELAY	0.1 TO 1.0	SEC
40	LOAD LOSS TRIP	20 TO 95	% FLC
41	LOAD LOSS DELAY	1 TO 16	SEC
42	PHASE DIFF TRIP	0.1 TO 1.0	AMPS
43	PHASE DIFF DELAY	0.04 TO 0.2	SEC
44	LOAD JAM TRIP	0.7 TO 12.0	X FLC
45	LOAD JAM DELAY	1 TO 10	SEC

ALARMS

46	WINDING TEMP	2 TO 20	°c BELOW TRIP
47	MOTOR BEARING TEMP	2 TO 20	°c BELOW TRIP
48	LOAD BEARING TEMP	2 TO 20	°c BELOW TRIP
49	LOAD CASE TEMP	2 TO 20	°c BELOW TRIP
50	PHASE UNBALANCE	5 TO 30	I2 % of I1
51	GROUND FAULT	30 TO 100	% TRIP
52	LOAD LOSS	20 TO 95	% FLC
53	LOAD LOSS ALARM DELAY	1 TO 16	SEC
54	PHASE DIFF	30 TO 100	% TRIP

FEATURES

56	RESET MODE SELECTION	1 TO 3

TO DISABLE ANY TRIP, DELAY OR ALARM FUNCTION ENTER 9999

TYPE MPR RELAY

OPERATION AND CONNECTIONS

The external and simplified internal connections of the MPR relay are shown in figure 1. The ct's shown in the upper left are used to bring in phase and ground currents.

Internal ct's and loading resistors convert the current signals to voltages which are multiplexed and then fed to an A/D converter. These digital signals are used by the microprocessor in a series of calculations to monitor and display motor conditions. Trip and alarm decisions are based on this information in addition to settings and other inputs to the relay.

The ct's in the lower left are connected differentially by phase. These are also multiplexed and converted to digital signals which are stored and processed in the microprocessor.

The RTD's are connected and wired as shown. This wiring arrangement is used to compensate for temperature effects in the wiring run. The RTD connected to each terminal must match the function listing in the tables so that the relay will correctly interpret the various readings.

The Output and Display elements provide the various displays discussed elsewhere and drive the alarm and trip relays.

FUNCTIONAL DESCRIPTION

The MPR relay is designed to protect a motor by sensing that any one or combination of operating conditions are in a range where damage and/or reduced operating life may result. The following sections detail the protection functions available, the protection concept involved and the operating conditions that each function considers.

Overtemperature Protection -- RTD Sensing Only

This function measures winding temperature utilizing embedded winding RTD's. A trip output is provided when the measured resistance of any one of the active RTD's indicates that its temperature has reached or exceeds the trip setting.

Overload -- Without RTD's

Measurement of overload where RTD's are not available is accomplished by using the expression $I_H^2 = I_1^2 + KI_2^2$, where I_1, is the positive sequence component of the three phase input currents, I_2 is the negative sequence component and K is a weighting factor to accomodate the increased influence on heating produced by negative sequence current. The relay is given a locked rotor (full voltage) current setting and a "cold" permissible locked rotor time setting. This establishes a point on the I_H^2t curve. This curve is an inverse squared curve with a cutoff at the pickup level setting. The motor is protected for all currents, from moderate overload to locked rotor levels, assuming the ambient and ventilating conditions are in accordance with the design limits.

Overtemperature -- With RTD's

Temperature conditions may be examined in a more refined way when RTD's are available. The RTD is located between windings in the motor stator slot, and is therefore subjected to all of the same influences of heating as the stator insulation, including ambient and ventilation. The RTD has an appreciable deviation from winding temperature when the motor is subjected to a large change in current, such as during starting or upon a jam occurrence. The RTD is also a poor indicator of rotor temperature. Because of these limitations, I_H sensing is also required to complement the RTD behavior.

Excessive temperature of the RTD will cause tripping without additional time delay. Time delay is inherent in the increase in temperature of the motor itself.

For large currents in excess of the I_H pickup setting, the need for tripping is sensed by a combination of RTD and current influences. Effective rotor temperature is calculated by this means. When the motor is removed from service, a linear decay of rotor temperature is assumed by the relay at a rate estimated from locked rotor current and permissible time. A restart, prior to complete reset of temperature to ambient level, will correctly produce a shorter tripping time than that which would occur for a "cold" start.

Figure 2 details the protection algorithm that is programmed into the relay to provide an inverse time overcurrent function with respect to the calculated current I_H. The inverse time function becomes active anytime the current I_H is above the full load current setting (function 26) multiplied by the overload trip setting (function 32).

Locked Rotor Protection without RTD's

Locked rotor current value (as a multiple of full load current) and locked rotor delay time are settings that are provided as inputs to the MPR relay. A "cold" motor is identified through a retention of information regarding previous loading.

"Hot" is identified by whether or not the motor has recently been running. It is assumed to be running if current in excess of 20% of full load current is present for a time in excess of twice the locked rotor delay setting. The MPR trip characteristic will remain in the "hot" condition following reduction of current to zero for a period determined by the time constant which is calculated from locked rotor current and time. With terminal voltage at values different from rated, locked rotor current will vary accordingly. The shape of the I_H-time curve is such that the actual trip time varies with I_H in the same way as permissible locked rotor time varies with I_H. The reduction in trip time for a "hot" motor is influenced by the calculated time constant.

Type MPR Motor Protective Relay

Locked Rotor Protection with RTD's

An approximation of rotor temperature is calculated based on RTD temperature (to indicate previous loading history) and on I_H level.

The time to trip at a given value of current will be modified by the relay so that the total temperature of the limiting element in the rotor circuit will be essentially the same as for a "cold" start trip.

Instantaneous Overcurrent

Detection of faults is achieved by the measurement of individual phase current levels. When the highest phase current magnitude exceeds the instantaneous overcurrent trip level setting for a period of time in excess of the instantaneous overcurrent delay setting, immediate tripping and indication will occur. This function is set, with margin, to allow for maximum locked rotor current with dc offset. Any current in excess of this setting is clearly fault current, contributed by the power system, and not starting current, not jam current nor contribution from the motor to a fault elsewhere in the system.

The instantaneous overcurrent trip, (function 30) may be set between 3 and 15 times full load current. Trip delay may be set between 40 and 200 milliseconds (function 31). The relay is designed to trip correctly on high fault currents even with saturated ct's.

Ground Overcurrent

Motors are generally ungrounded. By using with the MPR relay a "through-type" ct (such as the BYZ-S 50:5) with all three phaseconductors routed through it, sensitive detection of ground faults in the motor or motor supply cables can be obtained by measuring the ct secondary current. The ground fault trip (function 38) can be set between 0.1 and 1.0 amperes. Ground fault trip delay tripping may be selected from 0.1 to 1.0 seconds (function 39). This delay is necessary to override such phenomenon as discharge and energization of surge protective capacitors that are often connected from phase-to-ground at the motor terminals.

Jam

A sudden large increase in current after the motor is running is indicative of a jam condition on the motor. A jam is sensed when the magnitude of I_H is above the load jam trip trip delay setting (function 45). The resultant trip time is less than would be expected from the time curves of figure 2.

Load Loss

A sudden decrease in current is indicative of a loss of load (shaft breakage or a driven load problem). If the motor is running, load loss is sensed by a drop in the magnitude of IH below Load Loss setting (function 40) and remaining there for a period greater than the Load Loss delay setting (function 41). After this delay a trip signal is generated and Load Loss is indicated. Reduction of current to zero is recognized as removal of the motor from the line and no tripping or indication function will occur.

Phase Differential

Additional protection for motor windings is provided by sensing the current from 3 ct's connected to measure the differential current in each winding. Phase differential trip may be set between 0.1 and 1.0 amps (function 42). Trip may be delayed from 0.04 to 0.2 seconds with the phase differential delay setting (function 43).

Phase Reversal

The phase sequence of the input currents is sensed. If two sequential checks indicate an ACB sequence instead of ABC an immediate trip is generated. This protection function (function 37) disabled if the motor is to be run with phases reversed.

Phase Unbalance

Unbalanced phase currents contain I_2 (negative sequence components). Abnormal I_2, causes an alarm to sound. Excessive heating caused by I_2 produces tripping with "Phase Unbalance" indication.

Loss of phase represents an extreme case of phase unbalance. Loss of phase is identified when I_2 is very nearly equal to I_1. Loss of phase tripping causes "Phase Unbalance" indication.

Motor and Load Bearings

This function senses bearing temperature, as measured by bearing RTD's. A trip output is provided when the measured resistance of any one of the active RTD's indicates that its temperature has reached or exceeds the trip setting.

ALARM INDICATION

The relay provides alarm indication whenever certain of the protective functions reach the preset percentage of the trip setting. Alarms are also provided in case of problems within the relay itself.

In case of motor protection alarms, the LED corresponding to that function will flash as long as the alarm condition exists.

In the case of relay problems, the self diagnostic function within the relay detects various problem. The LEDs that indicate these are located in the bottom row of the display panel.

Typical relay problems are listed below.

1. If power to the relay is lost, the "POWER ON" LED turns off.
2. *If the microprocessor stops functioning or the memory is corrupted, the "MONITOR ON" LED stops flashing.*

All alarm conditions produce a change in contact position of the alarm relay for external alarm supervision.

SETTINGS

Functions 20-23 --A two digit setting is chosen to identify the type and quantity of RTD (resistance temperature detectors) in use for a particular function. The first digit identifies the type as follows:

1 -- 10 ohm copper

2 -- 100 ohm nickel

3 -- 120 ohm nickel

4 -- 100 ohm platinum

The second digit identifies the number of RTD's in use. A setting, for example, of 26 would represent 100 ohm nickel with a quantity of 6.

All RTD's for a given Function must be the same.

Function 24 --The K factor in $I_1^2 + KI_2^2$ provides a weighting influence for negative sequence current heating compared to that for positive sequence. Using ANSI/NEMA MG1-1978, MG1-14.34, K can be estimated conservatively by: $K = 175/(ILR)^2$. For a motor having a per unit locked rotor current ILR of 6, $K = 175/(6)^2 = 4.86$. The setting on the MPR for function 24 would be 5.0.

When more explicit heating data is available on the particular motor being protected, a different value may be selected.

Function 25 --The ct ratio is entered directly. For example a 200:5 ct would require an entry of 40. A 200:1 ct would require an entry of 200.

Function 26 --The motor rated load amperes are entered.

Function 27 --Enter the appropriate frequency for the application. Either 50 or 60 hertz will be accepted.

Function 28 -- Locked rotor current is entered as a multiple of full load current. In the absence of a specific, full voltage, locked rotor value an estimate of the value may be obtained from the code letter on the nameplate (See MG-1-10.36). For example, code letter G corresponds to 5.6-6.3 KVA per Horsepower. The setting would be chosen in this case to be 6, the nearest even multiple.

Function 29 -- Locked rotor delay is the maximum permissible time in seconds, with full voltage applied and the rotor rotate. This time, in conjunction with Function 28, establishes the motor heating curve.

Function 30 -- Instantaneous overcurrent trip setting is selected as a multiple of full load current. This element must be set to ignore maximum locked rotor current, including the effect of the maximum dc offset. This requires a setting of 1.5 times the maximum symmetrical locked rotor current. For the example of Function 28, a value of 1.5x6.3 = 9.45 is required. Enter a setting of 10.

Function 31 -- Occasionally a delay is necessary in tripping with the "instantaneous" unit to avoid possible misoperation due to such phenomenon as surge protective capacitor inrush. A setting of 0.04 seconds will usually suffice.

Function 32 -- Overload trip is selectable from 100 to 190 percent of full load current. This is the level of current above which tripping will eventually occur unless other elements, such as instantaneous trip or jam, cause earlier tripping. In general, it would be set at 105 to 115% of full load current where RTD's (resistance temperature detectors) are not available and at 190% where they are available.

Function 33-36 -- The trip temperature is dependent on the temperature class of the particular motor insulation or expected operating temperature of bearings or case. See ANSI/NEMA MG-1-20.40 for insulation limitations. A motor rated over 1500 HP and less than 7000 volts with class B insulation may use a setting (°C) of 125 for the winding RTD trip level. Knowledge of the normal bearing or casing operating termperature may be used to select a trip temperature for these functions. The same level is applicable to all RTD's in a group. The groups are winding, motor bearing, load bearing and load case. Each group requires a setting, and each group may be set independently.

Function 37 -- Phase reversal trip is not dependent on a level setting. It is made operative by entering 1. To incapacitate phase reversal trip and allow reversal of motor rotation, enter 9999.

Function 38 -- Ground fault trip is generally set at its lowest value, 0.1 amperes, when it is supplied by a "doughnut" type ct. Where this type ct is not available, the "residual" return circuit for the phase ct's may be used to supply this circuit. A setting as high as 1.0 amperes may be required to override the [illegible] current where this alternative

Function 39 -- A ground fault delay setting of 0.1 seconds will usually suffice to override those phenomenon which must be ignored where a "doughnut" ct scheme is used. A much longer setting, up to 1.0 seconds, may be required where the "residual" circuit supplies the ground current.

Function 40 -- Load loss trip setting must be set below the lowest load level expected and below the alarm level set in Function 52. A minimum load level of 80% would allow an alarm level of 75% and a 70% load loss trip setting. Sudden reduction to a current level less than 20% of full load signifies removal of the motor from the line by other means, (such as a manual trip) and no MPR action takes place.

Function 41 -- A load loss delay of 1 second will usually suffice. Reduction of load below the load loss trip level for a period of time in excess of the load loss delay will cause tripping and "load-loss" indication.

Function 42-43 -- The phase differential trip and phase differential delay settings, generally, may be set at 0.1 amperes and 0.04 seconds where any surge protective capacitors are outside the protected zone. Longer time delays up to 0.2 seconds may be required.

Function 44 -- Following the presence of current greater than 20% of full load current, for a time in excess of two times the locked rotor delay that was set in Function 29, a sudden overcurrent will cause "load jam" tripping and indication of "locked rotor/jam". A typical jam setting is 1.5 times full load but may be increased to 3.0 or more where RTD's are supplied.

Function 45 -- The motor will contribute to a fault on the supply system and this current can approach locked rotor value. To avoid misoperation, the jam delay setting must be set to override this fault contribution. Generally, a setting of 1 second will suffice.

Functions 46-49 -- This alarm level (°C below trip) will serve to warn an operator of impending shutdown. A setting of 5 will generally be satisfactory for each of these functions.

Function 50 -- The lowest setting compatible with normal unbalance conditions should be used. A setting of 5% will normally be useable. A negative sequence current in excess of 5% of the positive sequence current will cause the alarm relay to dropout. A trip caused by excessive $I_1^2 + KI_2^2$, that is accompanied by a "Phase Unbalance" alarm will indicate "Phase Unbalance" only.

Function 51 -- Any ct secondary current flow when the "doughnut" ct scheme is applied is abnormal and may be used to sense that a more serious problem is impending. A setting of 30% of the trip value may be used.

Function 52 -- The load loss alarm must be set below the lowest expected load level and above the trip level of Function 40. This function will either be set at 5% below the minimum load level or will be incapacitated by setting 9999.

Function 53 -- A load loss alarm delay setting of 1 second will usually be adequate.

Function 54 -- The phase differential scheme uses "doughnut" ct's to sense the sum of current in and out of individual phase windings of the motor. These ct's will, under normal conditions, have no secondary current flow. An alarm setting of 30% (of trip setting) will be useable, provided any surge protective equipment is outside the protected zone.

Function 55 -- not assigned

Function 56 -- Tripping Mode Trip operation is selected by a number as outlined below:

1. Trip output and indication sealed in until reset. This is the factory set condition. This setting should be selected when "two-wire" ac control is used and automatic restart is not desired.
2. Trip is sealed in for all conditions except winding RTD overtemperature. An overtemperature trip will remain operative only as long as any winding RTD temperature is above the set point. All other trip conditions will seal in. This setting is used with "two-wire" ac control when automatic restart can be accomplished safely.
3. No trip seal-in. All trip signals will be maintained only as long as a trip condition exists. This setting is selected when a switchgear type motor controller is used.

Any alarm or trip function may be made inoperative by entering 9999 for the setting for that function.

Technical Specifications

General

Rated Current	1A	5A
Maximum Permissable Current		
Continuous	10A	10A
Two Second	200A	200A

Frequency	50Hz / 60Hz
Supply Voltage	70 - 132 Vac and 93.5 - 144 Vdc
Burden	
Phase Current CT's	.075VA @ 5A
Ground & Phase Diff. CT's	.020VA @ 1A
Power Supply	25 VA max
R T D Types Accommodated	
10 ohm copper	
100 ohm nickel and platinum	Selectable
120 ohm nickel	
Ambient Temperature	-20 to +55 deg C (ANSI C37.90)

Environmental Influences

± 10% timing variation ± 5% pickup level	due to rated temperature or PS voltage variation
Insulation Test Voltage	1.5kV, 50/60 Hz, 1 minute (ANSI C37.90)
Impulse Voltage Withstand	5kV peak, 1.2/50us, 0.5 joule (IEC 255-5)
Fast Transient Voltage	5kV, 10/100 ns (Proposed ANSI C37.90a)
SWC	ANSI C37.90, IEC 255.5

Contact Data

Trip	2 form C	30A make and carry, 15 sec 5A interrupting, 120 VAC resistive
Alarm	2 form C	5A interrupting, 120VAC resistive

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