Electrical panel design calculations pdf

Daniel LightseyABB Ability (TM), Smart Power—Marcelo E. ValdesPE, IEEE Fellow Applications Eng. ManagerABB Electrification Products Industrial Solutions Short circuit current ratings (SCCR) are an important specification when designing industrial dashboards. Determining the appropriate SCCR really does not require calculation. Instead, there is a simple, four-step process to follow. The UL standard for industrial panel safety, the UL 508A, includes guidelines for calculating the panel's short-circuit current rating (SCCR), but many have difficulty working through that process. Identifying an accurate SCCR is essential to ensure the safety of those working on or around electrical equipment. A panel with an incorrectly calculated SCCR can fail or cause an arc flash, with the potential to cause serious injury or death, as well as significant damage to the facility. People refer to the SCCR calculation of a panel, but there is really no necessary calculation. Instead, identifying a SCCR only requires you to investigate the possibility of errors of components in the dashboard circuit. With the list of values in hand, you need to identify the components with the lowest power, which is literally the weakest link in the circuit. SCCR of the entire board is the capacity of that component. Tables must be evaluated for existing errors available at the time they are installed and for potential future needs, if they can be higher on some future dates. What is SCCR? Instead of calculating a dashboard's SCCR, it really just asks you to investigate the possibility of errors of the components involved and then identify the components with the lowest power... weakest link in the circuit. SCCR's component is the SCCR of the entire board. Prior to 2005, nec required industrial machinery electrical panels to be marked only by interruption ratings of over-mainstream protective equipment. This, however, does not guarantee the electrical panel is adequately protected against short circuits. The new standard includes the entire combined circuitry in determining SCCR requirements. Determining the SCCR of the dashboardHow is the SCCR calculated? There are three steps in the process: Step 1 - Determine the short circuit current rating (SCCR) of each component or combination in the circuit. (SB4.2) Step 2 – Determine if the load circuit components are limited to faulty circuit protection devices (SB4.3), such as fuses. Step 3 – Determines the overall short circuit current rating for industrial control panel (SB4.4.). Step 4 – List the SCCR mark on the dashboard name table (SB5.1). Here's more detailed information on each step. Step 1 – Determine the short circuit current rating of each component in the circuit The first step is to determine the SCCR of each component or combination of components, usually located on the component label or its manual. You need to include SCCR for power changers. A SCCR information source is assumptiond to the current short circuit evaluation for unmarked components, table SB4.1 in standard UL 508A. All components must have a standard current error rating, and it is usually very low. There are resources available that provide device ratings for recognized components, including component UL files and manufacturer installation instructions. In addition, the UL site includes a short-circuit current chart for combined motor control components. These components usually have to be used with another component to get the ratin feeder-circuit components desired to modify faulty current including: Circuit breaker limit current You need to locate these parts and include them in the SCCR review. On the branch circuit, you need to consider the variable rating. For substations rated 10kVA or less, a 5kA-assigned substation of current is available, and all sub-components in the circuit must have a SCCR of 5kA or more. On the main side, only over-mainstream protection is related to the sccr overall dashboard. One example is the Class CC fuse used on the main side of the pressure machine, which has a SCCR of 100kA. The branch circuits must have SCCR equal to or higher than the current for the passing of the intake circuit. If they do not, the overall rating for the panel is the lower rating of the control panel or branch circuit. Step 2 – Determine if the load circuit components limit the faulty current when you have defined SCCR for the components, the next step is to determine whether the load circuit components, namely circuit protection devices such as fuses, limit fault current or not. The circuit breaker must be marked current limit to use SB4.3.2. The breaker allowed through the current will not exceed a specified value. One of two conditions applies:1. If the devices on the load side of this breaker have a SCCR higher than the breaker power of the breaker, then you can use the breaker power of the circuit breaker. This can also be a combination that has been tested by the manufacturer or dashboard store.2. If the device has a SCCR lower than the breaker power of the circuit breaker, sccr for this circuit is the lower value. The maximum permission for a circuit breaker is determined by the manufacturer. For fuses it is defined by a standard, which allows you to use an SB4 table, peak allows through flow, IP and I2T clearing for fuses. In determining the SCCR panel, the SCCR on the side of the road of any current limit circuit breaker cannot exceed the SCCR of any branch circuit protection or the breaker power of the circuit breaker. The peak current cannot exceed the SCCR for any branch circuit on the load side. This basically says that the device is on the loading side of the can withstand the energy of the breaker over and current. For fuses, using the values in Table SB4.2 Current allows peak, IP and clearing, I2T for fuses to get I2T and IP for fuses used in combined circuits. Any fuse of lower value for both I2T and IP can be used. If your fuse size isn't displayed, use the next larger value in the table. Step 3 – Determine the overall short-circuit current ratingWith the completion component study, you have the necessary information to determine the SCCR of the panel. You do this by identifying three different SCCRs. The lowest of the three is the SCCR panel. The three values to determine are: For each branch circuit protected in the control panel, determine the smallest SCCR for the circuit components on the load side of the branch circuit protection device. (SB4.4.1) Identify the lowest SCCR of all feeder components. If the current limit components are supplied in the feed circuit, specify the modified SCCR for the load component and all branch circuit (s) (from A) above] connected to the load side. (SB4.3), see step 2 above. Compare these values from this dashboard. SCCR is the lowest of the three. Step 4 – List the SCCR mark on the dashboard name table (SB5.1) The value from step 3 above must be listed on the chart or name table label. The marking of the name plate must include SCCR in the symmetrical rms kAmps, at the rated voltage. Know your dashboard People who design and build industrial electrical panels need to understand the level of short-circuit current protection required for those who own, operate and maintain those panels. Short-circuit current ratings provide an important portion of the information in ensuring the appropriate level of protection. Panel manufacturers rely on the steps set out in the UL 508A standard to calculate/identify the SCCR of their product and provide this information. References[1] 2008, Short Circuit Current Panel and Rating, Underwriters Labratories, 2] UL 508A, Third Edition, Standard for Industrial Control Panels Related Content The SACE Tmax XT Series of Molded Case Circuit Breakers (MCCBs) are designed to maximize ease of use, integration and connectivity while providing reliable safety and quality. Read more, SACE Tmax XT: Breaking new ground design calculations establish guidelines and minimum requirements for generating electrical calculations on projects. Electrical calculations should be performed for all projects including electrical components and should be lodged in project laptops. Calculation of electrical design required for the projectThe calculation design can be done manually or by computer programs. At a minimum, the following types of calculations should be performed when applying:Load calculationThe size indusingsMotor branch sizeThe improvement factorsThe variables main circuit size and subVoltage subVoltage dipShort voltage circuit analysisLighting levelsGrounding in substations (where step potentials are of concern)Harmonic distortion analysisCable pulling calculationsGenerator capability/motor starting. LoadLoad calculations should be performed using the applicable sections of NEC Article 220, 430, and other parts of the NEC. The following load calculations should often be used for dimensions: Feeder conductors andTransformersPanelboard protection devices and bussesMotor component control center ComponentService component entrance and transmission transmission wires must include all loads. They should be done by a combination of all loads (using the appropriate diverse elements allowed by NEC Article 220) that are connected to each control panel, switchboard and engine control center. A grant must be made for future load growth. The load for each branch of the distribution system can then be re-synthesized for the service entrance equipment. Generator SizingThe following information aims to acquaint design engineers with the terminology used by software size generators and basic form formulas. Single or multi-set generators must be sized to provide maximum start (SkVA), stable state running (RkVA) and non-linear (GkW) needs of connected electrical equipment and in the future. Important information for the size and selection of single generators or multiple sets including: Environmental conditions: altitude, temperature, indoors or outdoorsNo discount requirements: silencers, enclosures, silent modelsFuel: diesel, gasoline, natural gasfuel Storage: skid mounted tanks, day and remote tank: liquid-cooled radiator, forced airVoltage regulation: maximum voltage dips allowed Operation: main, standbyVoltage rating: voltage, 3 phases, 1-stage, solid base, delta, wyeConnected load: linear, non-linear, electrical element Load operation: Motor start method, single step , single step with variety, multiple load stepsThe future size procedure for single or multi-ministry generatorThe following procedure is the size process for single generators or multiple sets: Prepare a loading schedule. Enter individual load characteristics in the software. Enter the load in a step order in the software. There is software that calculates and selects a generator. It is a good practice to require a verification calculation from preferred genset manufacturers. Calculation of electricity design required for projects

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