RULES FOR SIZING ISOLATION CONTACTORS

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FOR WTC RESISTANCE WELDING CONTROLS

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The purpose of this document is to assist in selecting the proper size isolation contactor for a given welding application. This document does not constitute any recommendation, warranty or obligation on the part of Welding Technology Corporation or any of its employees, representatives or distributors. The user of this information assumes all responsibility for proper use of the information. The information in this document is presented as-is; no warranty of correctness or suitability for any application is given or implied.

The calculations in this document have been simplified and are designed for the most common situations. If the application is very unusual, for example a system with large welding transformers above 400 KVA, a system with more than six welding transformers, or a system with a very low welding duty cycle (below 1%), competent engineering help should be sought to size the isolation contactor.

ASSUMPTIONS:

The process to select the correct size of an isolation contactor consists of two parts. Part 1 calculates the average primary current draw of each welding transformer in the system. Given the average primary current draw of each welding transformer in the system and how they are connected, Part 2 selects the appropriate size isolation contactor.

This selection guide assumes the following things:

The isolation contactors are rated in amperes by UL general purpose current, which is a continuous-duty current.

The isolation contactors are not opened or closed while weld current is flowing.

The KVA ratings on the nameplates of the welding transformers are in accordance with the RWMA standards for resistance welding transformers.

The power line voltage is between 420 and 500 VAC nominal.

All calculations here apply to SINGLE-PHASE AC welding transformers only.

PART 1:CALCULATION OF AVERAGE CURRENT DRAW PER WELDING TRANSFORMER

There are three classes of duty cycle to consider:

A HIGH duty cycle application is seam welding. For HIGH DUTY CYCLE applications, the average primary current draw per transformer is:

AVERAGE CURRENT DRAW (amps) = TRANSFORMER NAMEPLATE KVA x 2

A MEDIUM duty cycle application is defined as 7 or more spot-welds in any 30-second time interval. This corresponds to a duty cycle of more than 5%. Robot applications, portable gun welders, or systems, which use multiple welding guns on each transformer usually, fall into this category. For MEDIUM DUTY CYCLE applications, the average primary current draw per transformer is:

AVERAGE CURRENT DRAW (amps) = TRANSFORMER NAMEPLATE KVA X 1.6

A LOW duty cycle application is defined as 6 or fewer spot-welds in any 30-second time interval. This corresponds to a duty cycle of 5% or less. Manually operated pedestal welders, welders on fixtures or hard automation welders usually fall into this category. For LOW DUTY CYCLE applications, the average primary current draw per transformer is:

AVERAGE CURRENT DRAW (amps) = TRANSFORMER NAMEPLATE KVA X 1.3

The result of the calculation of PART 1 determines the average current per welding transformer. Depending on how the transformer(s) are connected to the isolation contactor, PART 2 selects the appropriate isolation contactor rating in amperes.

PART 2: ISOLATION CONTACTOR CURRENT RATING SELECTION BASED ON TRANSFORMER CONNECTION.

CASE 1: (simplest)

If just one single-phase transformer is connected to an isolation contactor, the required isolation contactor current rating is the value of average current calculated for that transformer from Part 1.

CASE 2:

If two or more transformers are connected in parallel on the same two poles of an isolation contactor and are welding simultaneously, the required isolation contactor current rating is simply the sum of the average currents calculated for each transformer (from Part 1).

For example if three 50 KVA welding transformers, welding simultaneously in a fixture application are connected to the same two poles of an isolation contactor, the required current rating for the isolation contactor is:
65 + 65 + 65 = 195 amperes.

CASE 3:

If two or more transformers are connected in parallel on the same two poles of an isolation contactor and ARE NOT welding simultaneously (cascade operation), the required isolation contactor current rating is equal to the average current for the largest transformer (from Part 1) times the square root of the number of transformers.

For example, if a 100 KVA and a 75 KVA transformer are connected in parallel to the same two poles of an isolation contactor and are operated in cascade in a fixture welding application, the required current rating for the isolation contactor is:
130 * sqrt(2) = 184 amperes.

CASE 4:

If two or more transformers are connected to different poles of the isolation contactor (three-phase operation), whether the transformers are welding simultaneously or not, the required isolation contactor current rating is the highest sum of average currents for the all the transformers on one phase, times 1.7 (the approximate square root of 3).

For example, four 75 KVA fixture welding transformers are connected to all three poles of an isolation contactor. Two transformers are connected to poles 1 and 2, one transformer is connected to poles 2 and 3, and the last transformer is connected to poles 1 and 3. All transformers weld simultaneously:

The largest load is the two 75 KVA transformers on poles 1 and 2. The computed average current (from Part 1) for these two transformers is 98 + 98 = 196 amperes.

The required current rating for the isolation contactor is:
196 * 1.7 = 333 amperes

Once the required current rating is computed, select the isolation contactor with the next-higher current rating value. The circuit breaker above the isolation contactor(s) and any upstream fuses must be sized appropriately to handle the required current ratings computed above. The magnetic trip of the circuit breaker should be set no higher than ten times the current rating of the smallest isolation contactor below it.