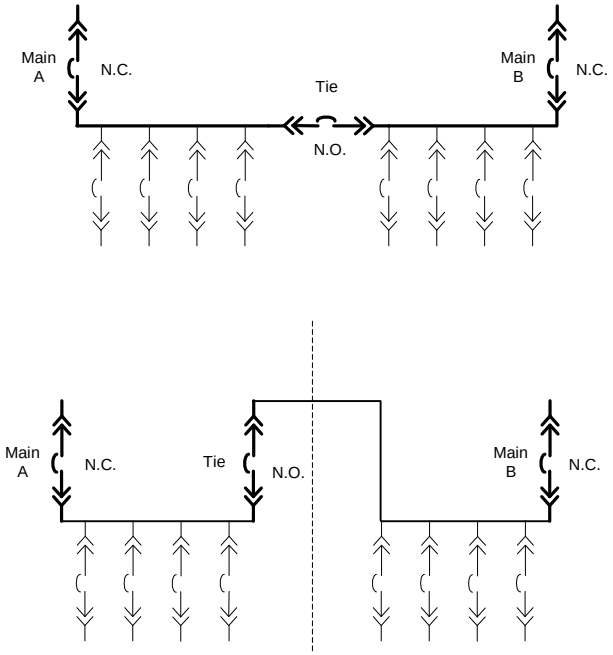
A case for the Separated Double Tie

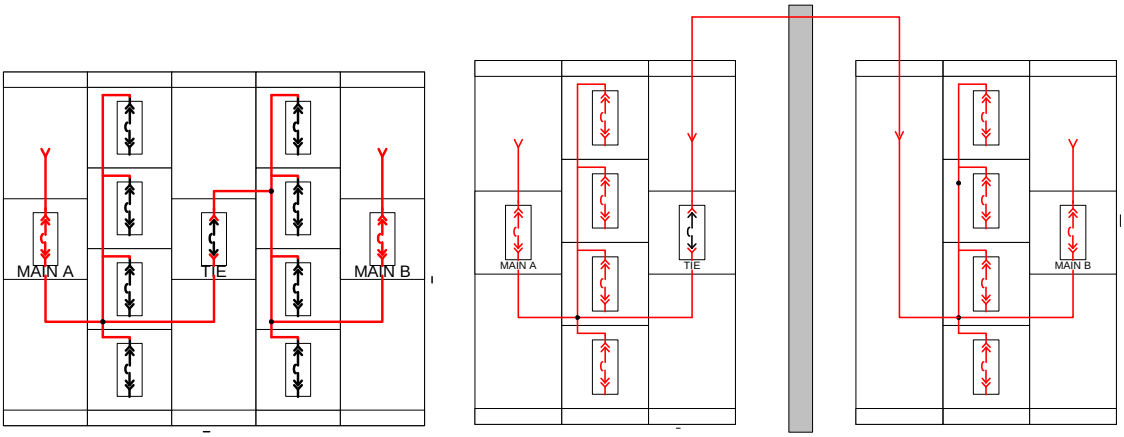
By: Rick Schlobohm, PE
GE Senior Specification Engineer

Redundant source electrical systems with bus ties between the sources are a very popular design for reliable electrical systems. Many systems utilize a tie breaker, which is normally open so that if one source fails, the tie can be closed and the other source utilized for the entire load. Other uses of the main-tie-main arrangement include redundant service to each load from two different sources and also splitting loads between the two sources so that the main electrical distribution equipment can be serviced without disruption of service to the critical load. This paper will discuss the use of single tie breakers versus double tie breakers and the safety aspects associated with each scenario.

The following one-lines depict typical main-tie-main scenarios. The first scenario is one continuous lineup while the second one-line depicts the same functionality but with the two sources split in different lineups with the tie between the two boards. This is a popular arrangement to give added separation between the two services and the service equipment in the case of failure of one of the service entrance boards.

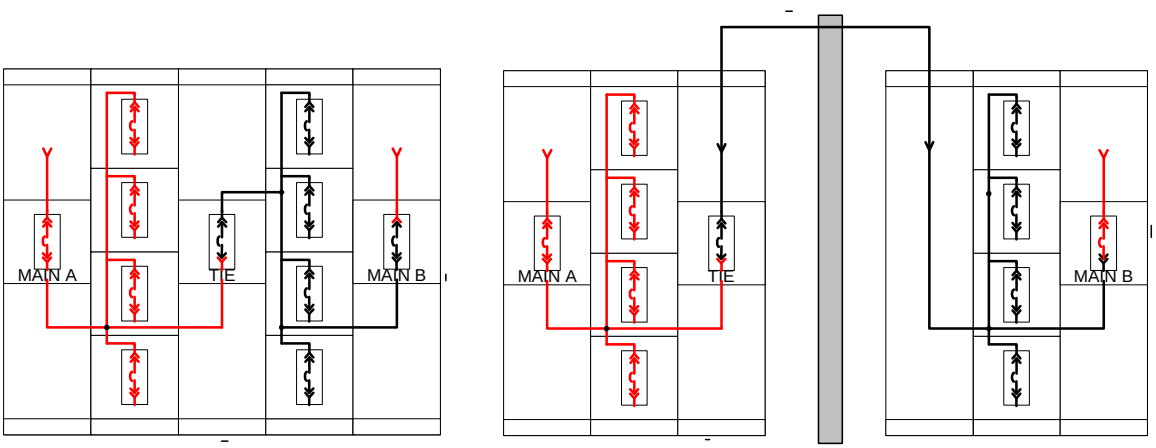


The following diagrams depict the above distribution one-lines as an elevation in equipment. The red bussing indicates which bussing segments would be energized in normal operation. Normal operation defined as Normally open tie breaker with Normally Closed incoming breaker.



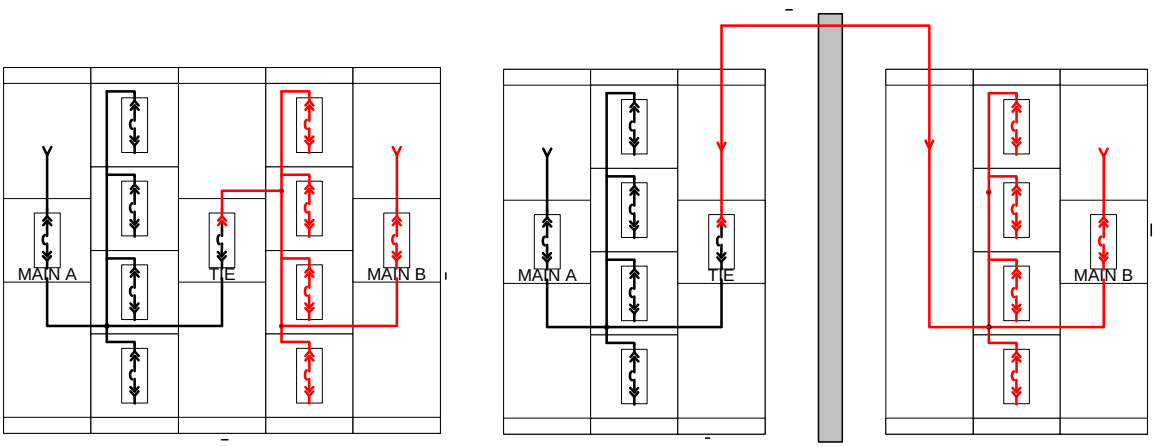
The above scenarios have live bus in each and every section during normal operation with tie open and both mains closed.

Using the front views for clarity, we will show all live bus within the boards for scenario where all loads are shifted to source A with the Tie and source B main breaker open for maintenance on B side of the board. The red lines will indicate live bussing while the black lines will indicate de-energized bussing.



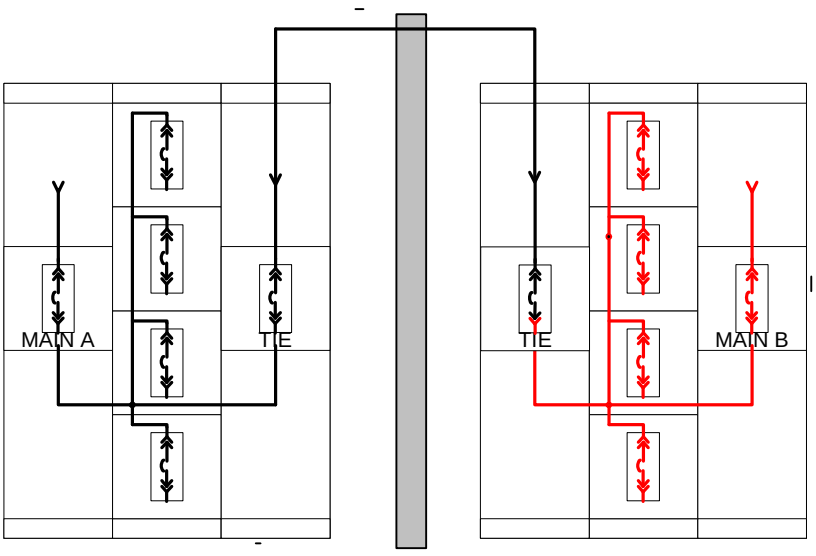
The maintenance personnel should clearly understand that the line side of source B breaker is live bus while everything between the load side of Main B and the Tie is de-energized. Prudent maintenance technicians will even go the extra step and remove the source to the line side of Main B so that for lineup 2, the entire board is dead and they can safely work on de-energized equipment.

The situation changes when using the same load shift scenario and all of the load is shifted from A side of the board to the B side of the board. The depictions below assume that the operator de-energized the source to Main A for service of that lineup.



Looking at the above scenarios, the customer went to the extra trouble and expense to separate the two sides of the service board. However, even if the source to Main A was de-energized as depicted there is still live bus in side A. The technician in this case cannot work on a de-energized lineup and must still be concerned about shock hazards and must still wear the appropriate PPE for the present hazard risk category.

Looking at the below diagram, we will add a second tie breaker. The previous scenario will be analyzed again with the entire load shifted to Main B and the source to Main A removed.



By separating the two sources and by employing double tie breakers, each side of the board can be truly de-energized for maintenance and an operator can remove himself from the dangers of shock hazards and arc flash.

There are other items, which need to be recognized when utilizing this scheme to make the maintenance procedure, as safe as possible. The number one technique to prevent shock or arc flash hazards is to remove the source of the hazard. When eliminating various source power you must consider all sources. For example, the source of control power for any electrically operated breakers, meters and communicating trip units. This can include control power transformers (cpt) at each source with or without auto-throwover for the control power. It also could include remote AC or DC control power. External disconnects must be provided in the system design for any external control power with proper labeling at the distribution equipment. If cpts are connected on the source side of the main devices, this also should be labeled. And if an automatic throw-over for the control power is utilized, a disconnect must be provided in each board similar to the double tie for the distribution power.