

Multiple Guns For Efficient Resistance Spot Welding

Sheetmetal fabricators increase productivity and cut welding costs with series-type multiple-gun resistance welding machines.

The distance current travels to make resistance-spot welds determines the amount of impedance, resistance to current flow in the circuit. The longer the current path, the higher the impedance or power loss, in the circuit. In multiple-direct spot-welding machines, which use weld guns with large throats, current paths are long; setups have high impedances that require large transformers. Throat depth on these machines is typically 24 to 36 inches. The deeper the throat, the higher the power loss and the larger and more costly the transformer.

Reducing losses

To minimize the length of the secondary circuit and the amount of lost power, which allows use of smaller transformers, manufacturers use, for large complex parts, multiple-gun machines that position electrodes from only one side of the joint, making two or more spot welds by one current path. Current travels from electrode through the work to a second electrode on the same side of the work. This arrangement reduces the total length of the current path needed to make all of the welds. This process is known as series welding.

Multiple-gun resistance-welding machines perform spot, projection and seam welding. Circuits can be wired for four processes multiple direct, push-pull, series and indirect welding. Multiple-direct and push-pull require electrodes on both sides of the joint; push-pull circuitry uses current more efficiently than does direct-machine circuitry, by keeping guns close to transformers. In series and indirect machines, electrodes and contact blocks meet the work from only one side of the joint.

For series welding, the most productive of the multiple-gun processes, electrodes line up next to each other. Current flows from a positively charged electrode through the joint, along the work, and through the joint at the second electrode, negatively charged. Spot welds form at both contact points. Indirect welding substitutes a contact block for one of the electrodes both top and bottom work pieces contact the electrical elements, electrode and contact block. During series welding, only one of the work pieces meets the electrode.

Series and indirect welding, working from one side of the joint only, promote good weld appearance. Both processes use a flat backup bar under the part. The bar draws heat away from the joint and serves as a rigid backing, only a small amount of current flows through it. Welds are flat with no indentations or dimples on the backside.

Going to work

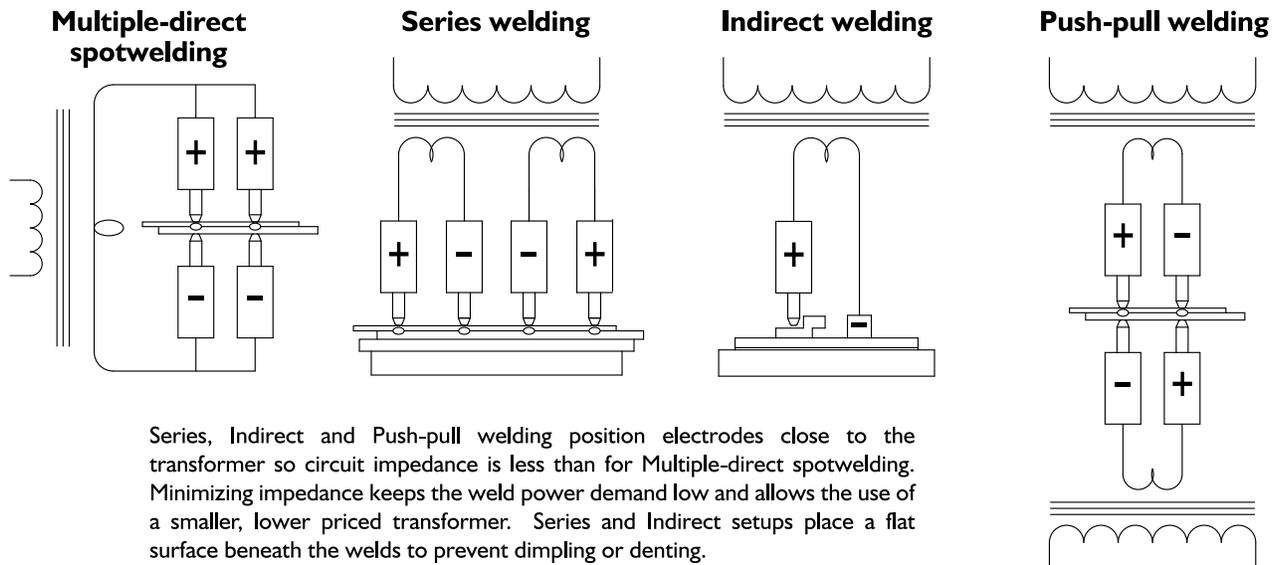
Implementing multiple-gun processes, fabricators can retrofit two or more guns to an existing rocker-arm or press-welding machine or purchase a new machine designed to accept several weld guns. Retrofitting is costly: to keep distance from transformer to electrodes short, it may entail removal of the entire front of the machine, leaving only the transformer intact. The machine manufacturer then redesigns the machine to hold the guns close to the transformer for series or indirect welding. Purchase of a machine designed for multi-gun welding may allow the user to add more guns easily and economically.

Multiple-gun welding machines come with one or more transformers, some with dual secondary output. Each transformer powers two or four weld guns. The transformers can fire the weld guns simultaneously if enough power is available, or in cascading sequence to smooth out power demand. Cascading also gives good weld-quality control, since operators can set time and current individually for each weld sequence.

HOW SPOT SPACING AFFECTS SHUNT LOSSES

SPOT SPACING (Inches)	Shunt Loss, Percent	
	Base-metal	Thickness, In.
	0.035	0.06
1	55	85
1 ½	33	67
2	22	50
2 ½	20	40
3	15	32
4	11	24
6	8	16
8	5	11

THE MULTI-SPOT PROCESSES:



Some pointers

Series welders are used by manufacturers of sheetmetal doors, automobiles and consumer products such as barbecue grills and lawn mowers. The process joins sheet as thick as 16 gauge, 0.059 inch. Direct welding machines join work of any suitable thickness with a properly sized transformer.

Using series-type multiple-gun machines, designers should space welds at least 2 inches apart to minimize shunt losses-current wander from the spot-weld location. High shunt-current loss requires larger KVA rated transformers with greater weld-current output to supply sufficient current to the welds.

To assure that all series welds in the circuit are of equal size and strength, the electrical secondary circuit-current path from the transformer secondary through both electrodes and the workpiece-must be balanced. The machine manufacturer will balance secondary circuits by selecting cables of specific lengths. Users should assure that electrodes, cables, and connections are kept secure and clean.

Keep electrodes properly and similarly shaped. This rule is clear when we consider a machine making four spot welds simultaneously using one transformer and electrodes of 1/4 inch diameter face. If the faces mushroom to 5/16 inch, the welds require 55 percent more current; 3/8 inch, 125 percent more.

Fit the machine to the job

Before purchasing a multiple-gun machine, fabricators should know production requirements, plant power supply capabilities & limitations, amount of floor space & personnel available and weld quality & strength requirements. Underestimating production requirements leads to a machine that will never produce properly, while overestimates result in excessively high investment costs.

