

# HOW TO SELECT A RESISTANCE WELDER

Despite the fact that resistance welding is one of the most widely used joining processes in the sheet metal fabricating industry, the proper selection of a resistance welder is a concern shared by many engineers and managers. The correct choice will cut costs and increase production, but will otherwise probably go unnoticed. On the other hand, the wrong choice is almost guaranteed to be noticed by everyone.

The selection of the right welder is based on an understanding of the resistance welding process and of the types and performance of available welders, controls and options.

There are five basic types of resistance welders commonly used for sheet metal fabrication work. These types are: rocker arm, press type, projection type, portable gun type and multiple gun welders.

The rocker-arm spot welder is sometimes considered a general-purpose spotwelder. It is versatile in terms of its ability to reach into some difficult access areas, but should not be considered an all-purpose spotwelder. That designation would be more accurately applied to a vertical press type resistance welder. The reasons for this choice of designations will become apparent as the advantages and disadvantages of each type are examined.

## Rocker-Arm

Rocker-arm spot welders use pivoting motion to apply electrode force. They can be manually foot operated or powered by an air cylinder. The electrode force decreases as the throat depth (arm length) increases. The electrode clearance opening will increase as the throat depth increases.

If not properly aligned, rocker-arm welders can “skid” upon contact with the workpiece, causing irregularly-shaped weld nuggets. Excessive skidding can cause unacceptable surface indentation of the workpiece. As the electrodes wear, surface marking will increase.

Due to this pivoting motion, setting up for projection welding can be difficult. In the case of two or more projections to be welded simultaneously, such as a three-projection weld bolt, uneven set-down of individual projections can cause misalignment of the weld bolt and possible rejection of the assembly.

The principal advantages of the rocker-arm are:

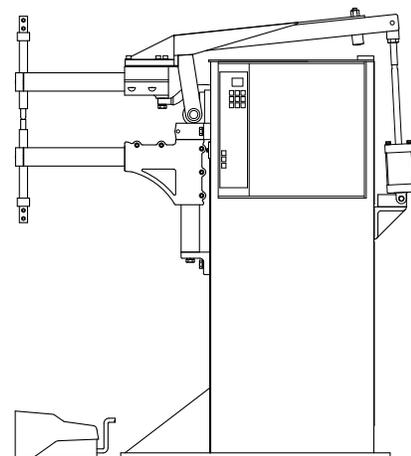
1. Clearance over upper arms
2. Wide electrode opening
3. Interchangeable or adjustable arms to permit a change in throat depth.

Disadvantages include:

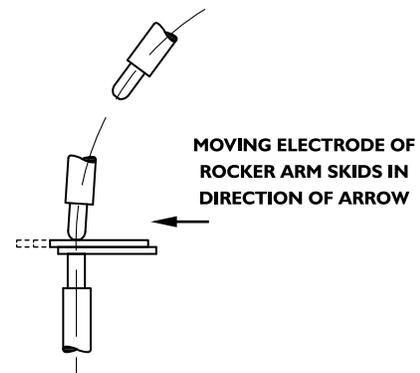
1. Electrode skidding
2. Electrode force decreases as throat depth increases, unless conditions permit fitting of a larger air cylinder.

## Press-Type Welder

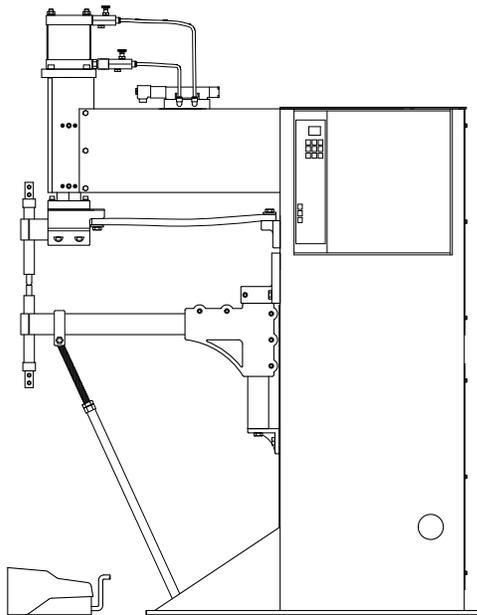
Press-type welders operate in a straight-line motion. They can be manually foot operated or air operated. Modern press welders have air cylinders mounted directly over the ram head, eliminating skidding of the electrode.



**AIR ROCKER**



**ELECTRODE SKIDDING**



**AIR PRESS**

This vertical descent action is desirable for projection welding, as force can be applied evenly to all projections of a weld bolt or nut. The throat depth of a press welder is a fixed factor. If a larger than standard electrode clearance is required, either a retraction stroke or an adjustable stroke feature must be added.

Press welder advantages are:

1. No electrode skidding
2. Easily set up for projection welding

Disadvantages are:

1. Limited clearance over upper arm and ram head
2. Smaller electrode opening
3. Fixed throat depth

## **Projection Welder**

Projection welders share the same basic design features as press welders. In place of arms, however, projection welders are fitted with a rigid lower platen support of fabricated steel and an upper platen mounted directly under the ram head.

These platens are designed with T-slots to accept custom-made, bolt-on projection weld dies. The T-slots of the upper and lower platens are arranged at a 90-degree angle to each other to permit X axis adjustment of one die and Y axis adjustment of the other to assure proper alignment.

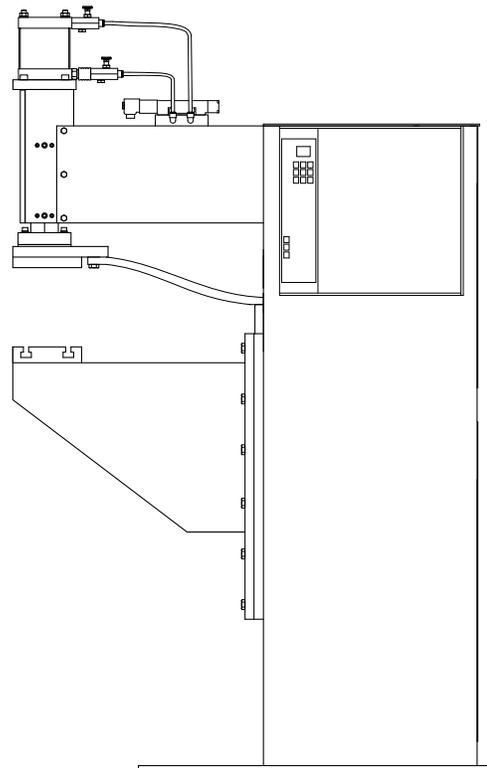
Projection welders are usually equipped with transformers which produce more secondary amperage than press or rocker-arm welders of equal KVA rating.

Projection welders may also be specified in a combination configuration. Short spot weld arms with conventional electrode holders can be bolted onto the platens. Since the spot weld arms extend beyond the ram head, combination welders are usually designated as having two throat depths.

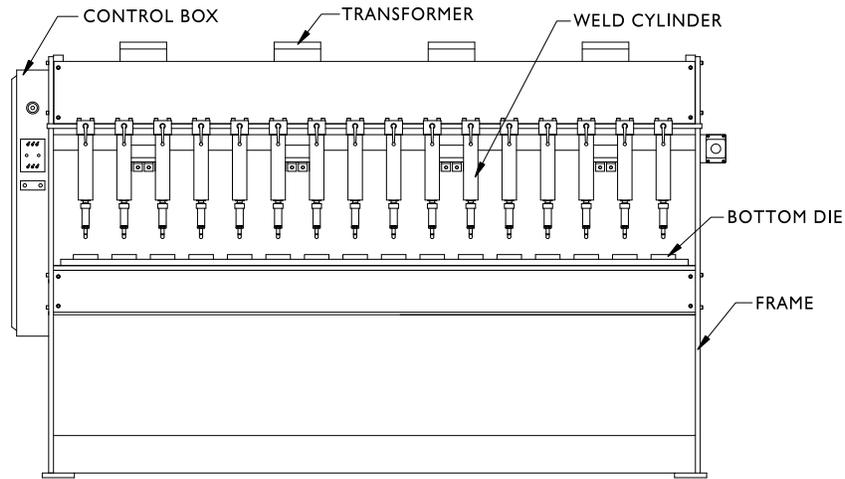
## **Multiple Welders**

Multiple gun welders can be furnished in many forms. Their design may vary according to the application to be welded and the rate of production required. Most multiple gun welders are dedicated to a specific application, but some may be capable of welding more than one size of a similar configuration workpiece.

It is usually not practical to design a multi-gun welder as a “sponge” to accommodate many applications. Depending upon the original application, however, the OEM may be able to design the welder so that it can be retrofitted for other applications.



**AIR PROJECTION WELDER**



(16) HEAD MULTIPLE RESISTANCE WELDER  
(4) TRANSFORMERS FOR SERIES WELD TYPE

## MULTI-HEAD WELDER

Such retrofits may entail a change in the quantity and size of transformers and weld guns and may necessitate a different welder control.

### Portable Gun

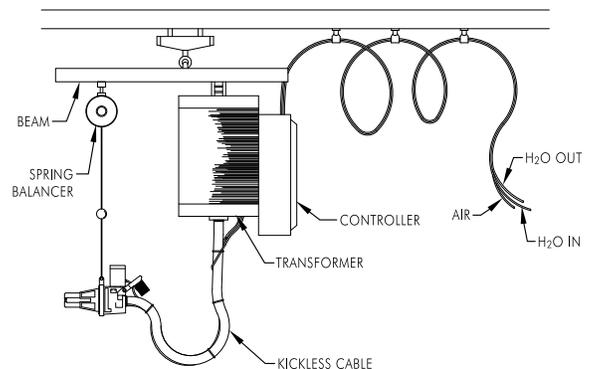
Portable gun welders are available in two types: the old-style remote transformer cable gun and the more efficient integral transformer type. Both types have been produced in Hand-Held and suspended versions. Hand held units are usually manually operated but, could be pneumatically operated. Hand held spotwelding guns may lack water cooling and are normally employed for light duty welding.

Suspended Portable Gun Welders are normally pneumatically operated although some manually operated and hydraulically operated units have been produced.

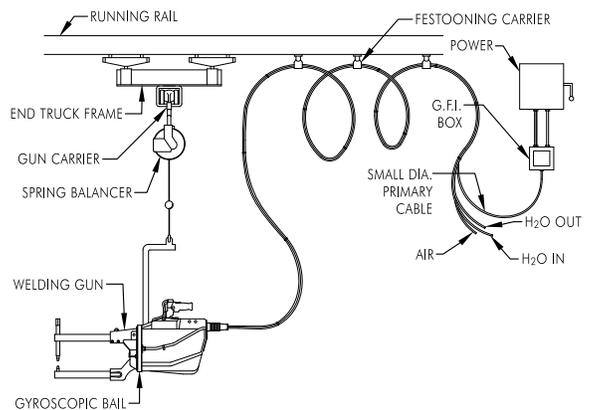
The remote transfer cable gun places a higher demand on a plant primary power system. The newer integral transformer guns are electrically more efficient and may reduce primary power demand by 50 percent or more compared to old-style cable guns. For this reason, many of the robotics spotwelders are based on integral transformer technology.

Both types of portable guns are available in "C" type or scissor (rocker) type configuration. The new generation suspended portable gun welders feature a self-contained design with built-in transformer, encapsulated SCR welding contactor, and a miniaturized microprocessor-based welder control built into the operating handle assembly. An important safety feature is the use of ground leakage detectors (ground fault interrupters).

### REMOTE TRANSFORMER TYPE (Old Style)



### SELF CONTAINED PORTABLE





### **TYPICAL WELDER CONTROL**

## **Controls**

Most resistance welder OEMs offer a variety of welder controls. Controls may be either non-synchronous or synchronous. Some basic controls do not provide the timing accuracy and consistency needed for critical applications.

The most popular and widely used control seems to be the synchronous four-sequence type which features adjustable squeeze, weld, hold, and off times. It can be used for either single spot or automatic repeat operation and is generally suitable for welding mild steel, stainless steels, nickel alloys, and some copper alloys.

The welder control OEM has worked closely with the resistance welder OEM to improve and advance the range of controls currently available. Many controls offer additional features such as slope control, forge delay, pulsation and quench/temper. These features are useful when welding to standards specified by quality control or certified welding.

Microprocessor-based controls have done much to popularize multiple weld schedules which can be retained in

the control memory and recalled when necessary, reducing the time and cost of changeover and setup.

The control OEM has made available other features which are important to today's fabricators. These include automatic voltage compensation and load distribution controls.

The load distribution feature is extremely important to the plant power system. Some controls offer monitoring capabilities to alert the user of poor weld conditions and/or bad welds. Under closely controlled conditions, such devices can be helpful.

It is important to provide the welder OEM with all the specifications and information about the application to assure that the monitor is suitable. Welder OEMs should be contacted for guidance. Their experiences with the different controls and monitors could be very helpful.

## **What to Consider**

Knowledge of the types of welders and controls which are available is only part of the precaution process in selecting a resistance welder. It is important to consider all factors so that a suitable choice may be made without incurring unnecessary costs. Some of these factors are:

- ◆ Material type and thickness
- ◆ Type of material coating, if any
- ◆ Throat depth required to place the weld where needed
- ◆ Configuration of workpiece assemblies
- ◆ Weld standards
- ◆ Weld cosmetic requirements
- ◆ Production rate
- ◆ Available plant power supply voltage and amperage capacity
- ◆ Available compressed air and water supplies

A common error in selecting a resistance welder is to base the selection solely on the KVA rating. One welding engineer has compared such a selection process to buying a pick-up truck based only on the size of the gas tank.

A quick check of published weld schedules will show that critical factors in making a weld are weld force, current expressed in secondary amperage and time expressed in cycles per second. KVA ratings are never mentioned in those welding schedules.

It must be determined if a given welder produces the weld force and secondary amperage necessary to weld the material type and thickness used in the workpiece at the throat depth required to place the weld where it is needed. Since the majority of resistance welders are of the single-phase alternating current (AC) type, it is important to consider the effects of electrical impedance when selecting a resistance welder. Due to reduced efficiency caused by impedance, a single phase AC-type welder with a long throat depth or a wide throat gap may not have the same capacity as a short throat/short gap welder of equal KVA rating.

The number of welds to be made per minute or hour (production rate) will help determine the KVA needed to produce the required welding current without overheating the transformer. Resistance Welding Manufacturers Association standards specify that KVA ratings should be rated at 50 percent duty cycle, (seam welders excepted).

Where resistance welders are used to weld suitable materials within the capacity of the welder using optimum weld schedules, it would be difficult to exceed the duty cycle of a properly sized welder. However, a combination of excessively long weld times and a high rate of welds per minute or hour may exceed the allowable duty cycle.

For this reason, it is important to consult a **RWC** technical sales representative and discuss all aspects of the application with particular attention to the nine selection factors mentioned above. Failure to do this could result in getting a welder which is inadequate for the job.

If the buyer furnishes the right information, the welder OEM will offer a welder which is suitable for the application. Welder OEMs are usually able to make studies and, if necessary, may submit welded samples for an evaluation. The OEM may also offer recommended welder and/or control options to consider which may make a new welder more versatile without excessive "overkill". The buyer controls which welder he will get, so he should examine his needs closely, discuss them with a **RWC** technical sales consultant to ensure he will not try to buy more welder than he really needs.

