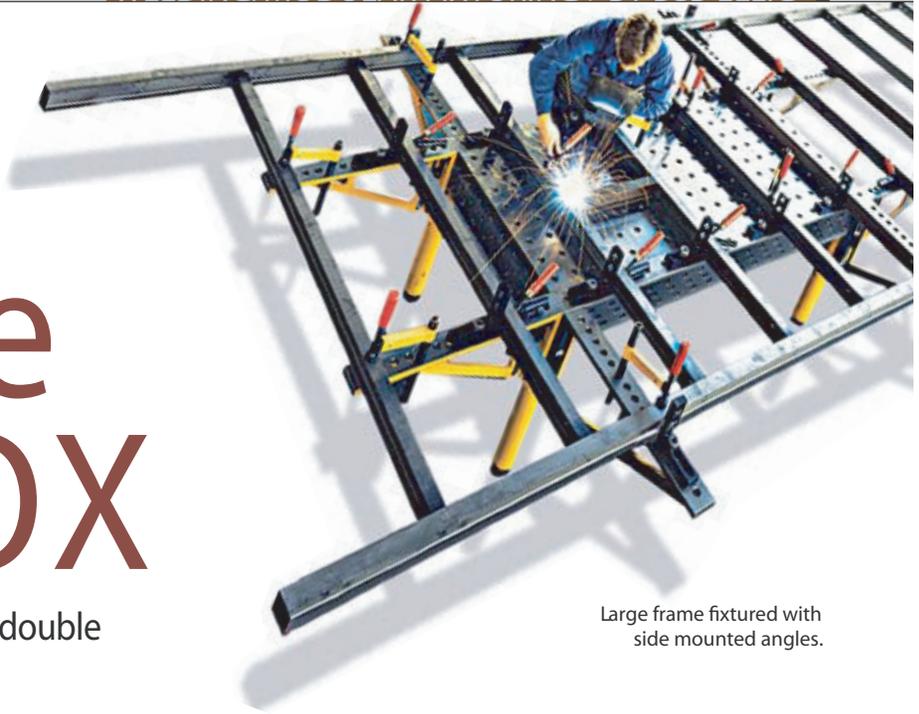


Think Outside the BOX

Modular fixturing for welding can double production and boost quality



Large frame fixtured with side mounted angles.

The concept of modular fixturing for welding is not new. Framing squares, chalk, tape measures, levels, piano wire and a stout hammer are the basic tools for an experienced welder. The good welders have amassed a collection of special tools gathered over the years that make their jobs easier. It is the evolution of these special tools into a logical system of table-based components, all designed to interface with each other that makes a modular fixturing system practical.

Here's some of what's been said about modular fixturing. "It's neat stuff but my boss will never go for it; it's too expensive." When compared to a single dedicated fixture, a modular fixturing package can be "too expensive." However, out of this package any number of fixtures can be built. When comparing the costs of dedicated against modular fixtures, typical break-even points are reached within six fixtures. In many cases, the system will pay for itself on the first job.

"Modular fixturing is for production and all my work is short run." The opposite is true. Where volume is high and the mix is low, a dedicated fixture is usually the best solution. With short runs and constant change of part mix, dedicated fixtures can become a very expensive habit. Lead times suffer, prime manufacturing space is consumed storing fixtures, and keeping up with engineering changes becomes almost impossible. With a modular fixturing package, you can build your fixtures when you need them, run your job and then re-assemble the fixture for the next job in a matter of minutes, not days, weeks or months.

"Modular fixturing is for short runs and all my work is high volume production." There was a time when this was true. However, it has been proven that using modular elements in a dedicated fixture can reduce lead times, improve quality, reduce fixture costs and minimize the impact that changes have on the fixture.

Modular elements have far more precise features machined into them than may be required in a dedicated fixture. However, these same precise features provide an attachment point for smaller, simpler adapters. When an engineering

change hits, instead of sending the entire fixture back to the tool room to be re-machined, simply toss the small adapter and replace it with another simple adapter. Down the road, when the product has reached the end of its life, disassemble the fixture and reuse the major elements in another fixture.

"We make our own fixtures for every part." This makes sense where production runs and the product life is long, where engineering changes are rare and where you don't have to produce specials in short order to compete in your market. A case can also be made for using base elements of a modular fixture to provide quick, easy and accurate points to attach special part-specific fixturing elements. This eliminates the need, on large fixtures of having to make a special base for every fixture. You save storage space, time and money.

"We hard-tool our prototypes." With engineers now working with six gigahertz erasers, changes come fast and furious and there is a need to modify the hard tool to accommodate the latest part design. The need for prototypes and their changes are clear. With modular fixturing, these changes are easily implemented. Also, with prototypes, where the part goes during the welding process is not always predictable. Locators and clamps are often shifted to compensate for weld draw. With a modular fixtures, the changes are fast and easy. And, when a



Outside storage of dedicated fixtures.



Kits help first time users select modular fixturing packages.

good part is produced, the modular fixture can be measured.

“Welding robots can only be used for high volume jobs.” Conventional wisdom says that you cannot use a robot for short run welding jobs. But, the robot doesn’t know that. Put a part in front of a robot where it expects it to be and it will weld a perfect part every time. The benefits of robots in welding have been well documented. Typically they weld parts four times faster with highly repeatable accuracies. They never take a coffee break and never call in sick when the weather is perfect for a round of golf. Because of the high costs of tooling, robots often sit idle when there are no high runs jobs to be done. Programming costs can also drive a robot into an early retirement. Modular fixturing can place the parts exactly where the robot expects to see them, every time. Fixtures can be easily and quickly rebuilt to within +/- 0.005 in. With all of the component geometries available in 3D solid models, computer based programming can be done off-line. It is also possible for a setup operator to physically build the fixture and then teach the robot the part. When he is happy with the program, he turns the robot over to the machine operator who completes the rest of the short run. In a two-station robot, these two guys trade places all day setting up and running parts with lot sizes as low as four pieces.

“I’m a job shop and I have to put the cost of fixturing in my price.” This is true. Fixturing has historically been viewed as part-specific and therefore charged to the job. However, modular fixturing has to be considered an investment in capital equipment. When you buy a press brake, shear or an iron worker, the full cost of that tool is never thrown into a quoted job. To overcome the initial sticker shock, it is possible to rent a system. Try it before you buy it. The rental costs can be charged to the customer. Then, at the end of the job, the rental can be converted to a purchase with credit being given for a portion of rental payments. Rent-to-own, rent and return or purchase a system, outright. Once a system is installed, it will become a manufacturing life-changing event.

MODULAR FIXTURING SYSTEM OVERVIEW

Like all good things in life, a true modular fixturing system for welding starts with a good base. The table is a five-sided weldment made from 25 mm (1 in.) thick high tensile strength, low carbon steel, ribbed and gusseted for strength. The surfaces are milled flat 0.004 in. over all with bores on 100 mm (4 in.) centers across the top and around all four sides located +/- 0.001 in. The tables can be hardened to 55 Rc using the nitriding process which prevents spatter from sticking to it. Table sizes range from 1000 x 1000 mm (40 in. x 40 in.) to 2000 x 4000 mm (6 ½ ft x 13 ft). Where larger surfaces are needed, standard cast steel angles can be mounted to the sides and serve as outriggers. Tables can also be joined together.



A setup operator builds a modular fixture and teaches a robot the program.

The device that connects all system components together is the Positioning & Clamping Bolt. The body of the bolt has a bullet nose for easy insertion into the system bores and a pair of O-rings which hold the body from turning while the bolt is being tightened from above. Turning the knurled knob at the top of the PC Bolt extends five locking balls into the chamfer at the back side of all system bores. The head of the bolt has a double hex in the centre. Once snugged up, one eighth of a turn on a hex key generates three tons of clamping force.”



Positioning and clamping bolt quickly and firmly secures the locator to the table.

“How do you get started with modular fixturing?” The best way to get started is to choose the area in the welding department that has the greatest problems. Getting the jobs done on time, finished goods quality, part rework, excessive costs, lack of fixture storage, keeping up with engineering changes, loss of welding skills as older welders retire and maintaining the competitive edge in the marketplace are problem areas that modular fixturing can address. Contact the experts in the field and have a CAD design done for one or more of your parts.

From this, a kit can be considered which will get you started. Compared to older methods, modular fixturing can double your production and double your quality. Where the need is great but the budget is not planned, systems can be rented. You can expect on-site training with your system that will ease the transition. Once a system has been installed, you will wonder how you got along without one for so long. **CM**

Bob Ellig is president of Bluco Corp, Aurora, IL.