Tools of the Trade

Inspection professionals differed widely on what tools they found indispensable to carry to their work sites. Surprisingly, some toolbox must-haves aren't tools at all

BY HOWARD M. WOODWARD

It is always an education to listen to a welding inspection professional reveal the insider information he or she has gained through experience on the job over the years. Probably no place is more revealing than just checking out an inspector's toolbox to see the items considered must-haves to carry daily to the work site. Read on to learn what several pros had to say when asked, "What's in your toolbox?" You'll be surprised.

Ken Erickson

Ken Erickson, with National Inspection & Consultants, Inc., Fort Myers, Fla., said, "For me, the most important 'tools' in my toolbox are simple organizers to keep all the necessary inspection items at hand. I like to have all the inspection tools and information at my fingertips to more efficiently evaluate a weld and perform my other duties.

"My most valuable tool is a metal organizer. The tri-fold holds a pad of paper, the applicable procedure or specification, the current acceptance criteria for each project application, and a laminated copy of the AWS welding symbols and other pertinent information — Fig. 1.

"Another useful organizing tool is a small pouch attached to my belt that keeps all the necessary small tools within reach. The pouch holds a small flashlight, batteries, extra bulb, marking pens, 6-in. rule, mirror, pit gauge, and other items. The 6-in. rule is a critical item that I use for most all inspections — Fig. 1.

"Another very helpful tool for me is the one-piece fillet weld gauge — Fig. 2. I find this gauge to be more useful than carrying a number of separate fillet gauges. This one-piece gauge can simply tell me if the fillet weld leg sizes are acceptable or not. It is limited to measuring concave throat sizes for fillet welds, but I use a conventional gauge for the questionable welds.

"When I work with the welders on field projects involving numerous fillet welds, I first use my gauge to mark out the required weld leg size on the base materials with a marking tool or soapstone to show the welder the required weld size with a uniform throat dimension. By doing this, the welder will more often make welds of the required sizes. Also, I find it very helpful to show and explain to the welders what I will be inspecting for from a visual standpoint regarding acceptable and unacceptable weld conditions and profiles so they can make better welds the first time.

"So, although a number of inspection tools are necessary for me to do my job, I feel that my ability to communicate and work side by side with the welders is an important tool. By explaining the inspection requirements, the welders tend to do better quality work that results in simplified inspections for me and fewer repairs for them."

Nanette Saminich

Nanette Saminich, AWS District 21 director, is senior inspector with Ninyo & Moore in Las Vegas, Nev. Saminich had no hesitation specifying the bridge cam gauge (Fig. 3) as the most useful item in her toolbox. She explained, "The bridge cam gauge is so versatile it eliminates having to carry fillet weld gauges, high-low gauges, and the VWAC (undercut) gauge. I use a bridge cam gauge to make many measurements, including angle of preparation from 0 to 60 deg, excess weld metal, depth of undercut, weld throat size, fillet weld length, and high-low measurements in either inches or millimeters."

Fig. 1 — Erickson credits these organizers with simplifying his work.

Fig. 2 — A simple one-piece fillet weld gauge can solve a lot of problems.

Clifford "Kip" Mankenberg

Clifford "Kip" Mankenberg is construction supervisor for Shell International Exploration & Production based in Houston, Tex. Mankenberg relies on his unique collection of backgouge gauges, two of which are shown in Fig. 4.

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Fig. 3 — The bridge cam gauge can be a multipurpose godsend for professional inspectors.

Fig. 5 — A few of the dihedral angle gauges Mankenberg often uses in his work.

Fig. 4 — Mankenberg's toolbox includes a number of select backgouge gauges.

Fig. 6 — These well-worn profile gauges attest to their usefulness over the years.

"Some critical structural steel welding procedures for offshore oil and gas projects," he said, "are developed using crack tip opening displacement (CTOD) testing as part of a complicated fracture mechanics approach. One of the keys to successfully meeting the required CTOD values, as required by the project specification, is sufficient removal of the root pass and surrounding heat-affected zone. Simply put, they have a metallurgical structure that will not meet the required CTOD values. During welding procedure specification (WPS) qualification, the depth, width, and radius of the actual backgouge on the test plate is measured. If the CTOD testing passes, this then becomes the minimum depth, width, and radius for backgouging on the WPS.

"During production welding then, it is necessary for me to have a means of measuring the depth, width, and radius of backgouging. The gauges I use serve this purpose. Of course, to be able to measure the depth of backgouging, it is necessary to know the original depth of the bevel using the formula: total depth – bevel depth = backgouge depth. The bevel depth can be measured before backgouging or can be determined from a drawing.

"Also useful are dihedral angle gauges. All of the gauges are essentially the same (a few are shown in Fig. 5), with the exception of one side — the acute angle varies on this side from 15 to 85 deg, and the obtuse angles range from 95 to 155 deg. I primarily use these gauges for measuring the local dihedral angle at tubular TYK joints. They are also useful for measuring dihedral angles in nontubular TYKs. When working with tubular TYKs, it is necessary to measure the local dihedral angle when the joint is in the fitup condition in order to determine the allowable root opening and required weld throat at that area. The measurement of the dihedral angle is also the starting point for any reference point marking that needs to be performed, for determining if an acute angle heel welder qualification is required. (Reference AWS D1.1/D1.1M, *Structural Welding Code — Steel,* 3.12.4 and 3.13.4, Table 3.6, and Figs. 3.5 through 3.10.)

"I also use improved profile gauges — Fig. 6. For fatigue-sensitive structures, it may be necessary to pay particular attention to the finished weld profile in certain cases. Profile improvement can include things like weld toe grinding, peening, and flush grinding of butt joints. For T-joints, a radiused profile can be specified with the required radius based on the material thickness. This radiused profile can be achieved by welding, but oftentimes grinding is required to meet the profile requirements. Each profile gauge shown in the photo has a different radius. In use, the gauge with the required radius is placed on the face of the weld. The requirement is that a 1-mm wire shall not be able to pass between the gauge and the weld." (References AWS D1.1./D1.1M 2.20.6.6 (2) and 2.20.6.7, Commentaries C-2.20.6.6 and C-2.20.6.7, and Fig. C-2.9.)

George D. Fairbanks Jr.

George D. Fairbanks Jr., AWS District 9 director and general manager for Fairbanks Inspection & Testing Services LLC, Donaldsonville, La., responded that when he was asked the question "What is in your tool box?," the first thing that popped into his mind was being prepared and having a good attitude. "No matter when I am called," he said, "I want to be able to respond to the client's needs. To be fully prepared, I routinely keep a number of tools and supplies in my inspection vehicle.

"First of all, I carry all of the safety items specified in the PPE-9 personal protection equipment package: hard hat, safety glasses, steel-toe boots, Nomex® coveralls, and flashlight, plus the fillet weld gauges, pit gauges, and other commonly used inspection measuring tools.

"Most often, I have my laptop loaded with the inspection procedures, individual qualifications, a section on various client specifications, welding procedures, and the forms for field inspection reports. I also carry hard copies of these forms for those times when electronic reporting is not practical.

"In addition, I like to carry a few hand tools for cleaning the welds to assure proper visual inspection and, most of the time, I carry special grinding tools for other services that we provide.

"I keep in mind that the general preparedness changes once you receive specific information pertaining to the job. Before starting out, it is important to gather information about the assignment in order to be properly prepared for the work. These data include what fabrication code is to be used and whether there are any special specifications that are to supersede the code requirements. It is important to clarify the requirements for the inspection, and any additional requirements required beyond the usual visual inspections and tools needed to aid the visual inspection. Likewise, I must determine whether I am qualified to perform the additional requirements and can I perform them without conflict. Finally, if other inspections are to be performed, I must be sure that all of the inspection tools are calibrated as required."

Fairbanks concluded, "I have to be prepared should a task require additional special equipment. Examples are tools for hardness testing, positive material identification (PMI), video probe, monitoring welding procedures or monitoring welding where supplemental essential variables apply, ferrite testing, magnetic particle, and other nondestructive evaluation services."

Last but not least, he said, "Another very useful 'tool' is to maintain an up-to-date checklist of all items taken to the job site. The list aids in my preparation for the work, documentation of equipment on the job, and ensuring that nothing valuable gets left behind!"

Conclusion

It is a simple question to ask someone, "What's in your toolbox?" But as you have read here, the answers can be far-reaching and more revealing than expected about each inspector's personality and his or her approach to the job.❖