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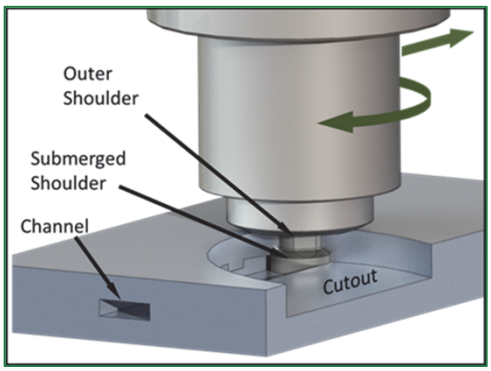
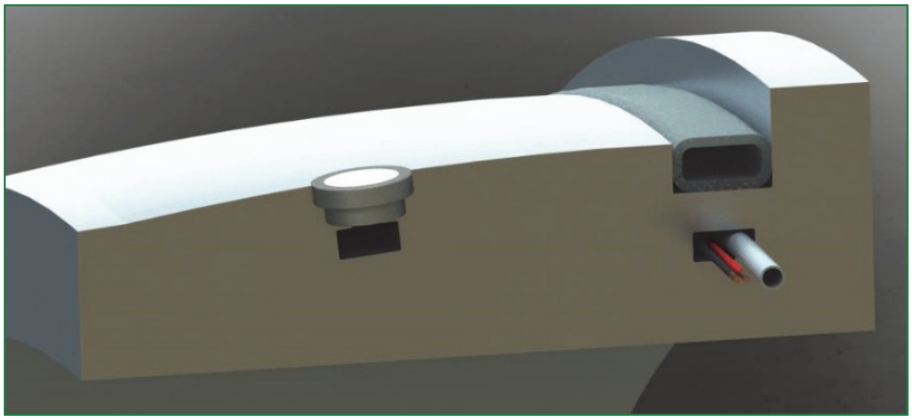
Submerged Bobbin Tool Tunneling Technology

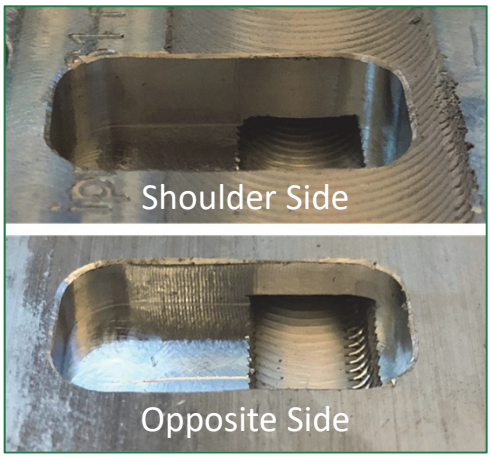
An Agile Approach to Fabricating Enclosed Curvilinear Integral Channels

Submerged bobbin tools, or SBTs, are designed to form integral sub-surface channels (tunnels) within components having internal pathways for wiring, gases, fluids, powders, tubing, composites, etc. Example uses are in heat exchangers, cooling plates, vacuum tools, and structural components. Like a conventional bobbin tool (BT) used in friction stir welding (FSW), an SBT has two opposing shoulders spaced apart along the bobbin or probe section of the tool. Unlike a conventional BT, however, an SBT is used to form enclosed internal channels by the shoulder located at the terminal end of the bobbin being submerged within the workpiece while the opposite shoulder rides along on an outer surface of the workpiece.



Similar to other BT designs, the opposing shoulders of SBT designs serve to contain a portion of stirred material generated during the progression of the process. As a result, a portion of the process forces produced parallel to the tool's axis of rotation are reacted between the opposing shoulders. Compared to single-sided tool designs having one shoulder, SBT tools therefore produce relatively lower out-of-plane forces that must be supported by the fabrication equipment. In turn, SBT fabrication equipment have reduced force and stiffness requirements compared to equipment for single-sided channeling methods. With this innovation, then, new opportunities exist for industrial robots to produce 3-D curvilinear subsurface integral channels in complex-shaped parts.





As a solid state fabrication technology, SBT FSP offers new benefits in the production of components having internal channels to meet internal fluid and gas flow requirements. Due to relatively low out-of-plane force applications, it is ideal for robotic applications, thereby opening up the possibility for producing low cost 5-axis internal pathways for wiring, fluids, gases, powders, etc.

Patent(s) pending

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