

Zebec Inflatable Boats

by Herm Hoops ~ 2016

Founded in 1983, Zebec is fast becoming one of the largest whitewater inflatable boat manufacturers in the world. Woosung I.B., under its own in-house brand Zebec, is a Korean manufacturer that annually exports inflatable boats worth \$20 million in 60 countries. The founder of Woosang, Mr. Lee Hee-jae, started the inflatable boat company with \$100,000 in 1992 when the Korean water sports industry was still in its early stages of development.

Currently, the company is doing business with buyers in global markets, including Northwest River Supplies (NRS), Hobie Cat, Sea Eagle, Naish, Tohatsu, Boardworks and Star.(1,2)(#a.) Besides whitewater inflatables the company manufacturers stand up paddleboards (SUP), sports boats, fishing boats, rescue boats, race boats, water park systems and inflatable systems. Their lifeboats and military boats are used in 13 countries including the Indonesian military.(1)

The company established an in-house boat technology research center, the only institution of its kind, in South Korea in 2007. Zebec has developed more than 100 types of inflatable boats that are produced using cold gluing, hot air welding construction, and a production system using auto-cutting machines.(#c.) Woosung has an annual production capability of 40,000 units for inflatable boats, which requires a hand-made process by skilled employees. Zebec has four manufacturing plants in China and plants in Viet Nam, Taiwan and the United States. Although Zebec has a manufacturing plant in Ohio, most of its river inflatables are manufactured in China because of lower labor and material costs.(1,2)

Woosung, and thus Zebec, manufacturers everything from Hypalon and PVC fabrics, coatings and fabric, D-rings, valves and other accessories to the completed inflatable boat. Their Plastomer fabric, known for its special polymer coating, is strong, and wear resistant.(1) Zebec inflatable boats use a high pressure material to give extra rigidity and the tear strength necessary to handle motors, run whitewater rivers, or paddle on open seas. Because this material is highly resistant to stretching, it allows a working pressure of 3.2 PSI, making the inflatable tubes a solid, rigid structure.(2) Zebec Hypalon fabric consists of four layers of calendared sheets offering guaranteed air retention (no porosity) and optimal adhesion to rubber. This combination of material provides improved resistance against fading and aging due to weather, as well as resistance to fuel, oil and everyday abrasion. The tubes are bonded using a three-layer gluing process with all seams internally and externally butted for maximum reliability.(1,2)(#f. #g. #h.)

Most cutting is performed on computer controlled vacuum tables with multiple tools including rotary blades, drag knives, hole punches, notch punches, ink pens and air ink sprayers. Projects are cut directly from CAD files with automated nesting to provide quick and accurate cutting.(#d.) They use manual, computer controlled, small throat, large throat and portable hot air welding machines capable of welding just about any project and they use Radio Frequency welding machines to handle larger projects.(#e.)

{Numbers in parenthesis (1) are REFERENCES; letters in parenthesis (#a) are described in SIGNIFICANT NOTES.}

For certain projects they use pattern sewing with automated programmable pattern sewing machines that can use light and heavy weight threads. Lockstitch sewing machines in different configurations can handle most any sewing project.(#b.)

Because Zebec manufactures rafts in their own facility they can provide custom options on any order. Some of the options include: color selection, number of handles or special webbing colors, extra reinforcement to prevent wear, custom logo printing, and custom designs.(2) Because they develop designs with CAD, which can digitize intricate patterns, they can be modified in a CAD program or sent directly to an automated cutter that can produce unique, individual prototypes and finished designs.(2)

Rafts can be constructed with welded seams or cold gluing. On welded Zebec boats each seam is reinforced with extra seam tape creating a more positive seal. All Zebec rafts are made with 1000 denier reinforced fabric and that can be upgraded to 2000 denier fabric. They include a wide wear strip which completely encircles the raft to protect sides of the tubes.

Raft floors are constructed with reinforced fabric and can be ordered with a standard (non-self bailing - ST) or self-bailing floor. The standard floor is made of 0.07 inch thick (1.8mm), 4000 denier material that is wrapped up the side tubes 2-3 inches. The self bailing I-beam floor is 5" thick, protected by a leaflet PRV and permanently installed to the side tubes. Zebec can custom manufacture any drop-stitch floor design. The standard river boat drop stitch floor options are 6" and 8" thick and it can be as a rigid inflatable floor or inserted into the floor through a zipper opening. The air bladder floor is made of an unsupported fabric cell made of heat-welded poly-urethane and inserted into the floor with a zipper opening. Zebec rafts include heavy-duty individual webbing strap handles and D-rings. All Zebec rafts carry a lifetime warranty on air holding seams.(2)

The company also expects that the growing demand for inflatable stand up paddle (SUP) boards, sold in 60 countries, will boost its sales revenues. Woosung's sports boat, for leisure and racing boating on the lakes, rivers or ocean is designed to be sturdy, easy to disassemble and assemble, and it can be easily transported or stored in a small area.(1) Besides manufacturing inflatables for other purveyors Zebec's inflatable boats are being used by private and commercial outfitters in the Grand Canyon and other whitewater rivers. Zebec's quality whitewater rafting boat was designated as an official racing boat and was supplied for the 10th worldwide International Rafting Tournament.

Basically these inexpensive boats appear to model other higher quality designs. Working with foreign manufacturers, especially those in Asia, provide challenges to overcome complex cultural and management norms. Just ask Hyside's Richard DeChant who has spent an inordinate amount of time and energy training his production team and understanding those cultural intricacies. In general with Zebec manufactured boats, you get what you pay for!

REFERENCES

- University of Utah, J. Willard Marriott Library, Special River Archive, Herm Hoops Collection
- (1) Woosung I.B. website;
- (2) Zebec 29th Anniversary Catalog; 2015; Herm Hoops Collection;
- (3) Zebec Home Page; www.zebec.com; 2015;

MISCELLANEOUS

- U.S. Coast Guard Hull Code: SII (Zebec of North America)
- Woosung I.B. Co., Ltd.; 331-10, Hyosung-dong, Gyeyang-gu, Incheon, Korea
E-mail : zebec@zebec.co.kr; eddie@zebec.co.kr
- U.S.A. Address: 232 Banks Road Travelers Rest, SC 29690; Tel : (864) 835-0057
- U.S.A. Manufacturing: Zebec of North America, Inc.; 210 Donald Drive; Fairfield, OH, 45014 (513) 829-5533

SIGNIFICANT NOTES:

(#a.) Other Manufacturers:

For information on inflatable whitewater boats manufactured by Zebec (Northwest River Supplies (NRS), Sea Eagle, and Star) see individual histories at University of Utah, J. Willard Marriott Library, Special River Archive, Herm Hoops Collection;

(#b.) Lockstitch Sewing:

Lockstitch is so named because two threads, an upper and lower, "lock" (entwine) together in the hole in the fabric which they pass through. The upper thread runs from a spool kept on a spindle on top of or next to the machine, through a tension mechanism, through the take-up arm, and finally through the hole in the needle. Meanwhile the lower thread is wound onto a bobbin, which is inserted into a case in the lower section of the machine below the material. To make one stitch, the machine lowers the threaded needle through the cloth into the bobbin area, where a rotating hook catches the upper thread at the point just after it goes through the needle. The hook mechanism carries the upper thread entirely around the bobbin case, so that it has made one wrap of the bobbin thread. Then the take-up arm pulls the excess upper thread (from the bobbin) back to the top, forming the lockstitch. The feed then pulls the material along one stitch length, and the cycle repeats.

(#c.) Hot Air Welding:

Hot air welding, is a plastic welding technique using heat. A specially designed heat gun, called a hot air welder, produces a jet of hot air that softens both the parts to be joined and a plastic filler rod, all of which must be of the same or a very similar plastic.

(#d.) CAD (Computer Aided Design):

Computer-aided design (CAD) is the use of computer systems to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. In mechanical design it is known as mechanical design automation (MDA) or computer-aided design (CAD), which includes the process of creating a technical drawing with the use of computer software.

CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space. The design of geometric models for object shapes, in particular, is occasionally called computer-aided geometric design (CAGD).

(#e.) Radio Frequency welding:

Radio frequency welding or (high frequency welding) is the process of bonding together materials through the use of electromagnetic energy. Two electrodes create an oscillating electric field that begins to shift and move polar molecules within the materials in order to orient themselves in accordance with the electromagnetic field. The movement of these molecules releases energy in the form of heat. When enough energy is applied, the molecules begin to melt and bond to one another. No external heat is applied. The weld is completed by applying pressure to the bonded area, ensuring a successful seal. PVC thermoplastic polyurethanes, and open celled polyurethanes are the most common fabrics using this method in raft construction.

(#f.) Hypalon:

Hypalon is a trademark for chlorosulfonated polyethylene (CSPE) synthetic rubber (CSM) noted for its resistance to chemicals, temperature extremes, and ultraviolet light. It was a product of Dupont Performance Elastomers, a subsidiary of Dupont. Along with PVC, CSM is one of the most common materials used to make inflatable boats and folding kayaks. It is also used in roofing materials and as a surface coat material on radomes owing to its radar-transparent quality. Dupont Performance Elastomers announced on May 7, 2009, that it intended to close its manufacturing plant in Beaumont, Texas, by June 30, 2009. This was Dupont's sole plant for CSM materials. The company was therefore exiting the business for Hypalon and its related product, Acsium. The Hypalon trademark has become the common name for all kinds of CSM regardless of manufacturer.

(#g.) Polyurethanes:

Polyurethane (PUR and PU) is a “plastic” polymer composed of organic units joined by carbamate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available. Some recent efforts have been dedicated to minimize the use of isocyanates to synthesize polyurethanes, because they raise severe toxicity issues. Non-isocyanate based polyurethanes (NIPUs) have recently been developed as a new class of polyurethane polymers to mitigate health and environmental concerns. Polyurethane products often are simply called “urethanes”, but should not be confused with ethyl carbamate, which is also called urethane. Polyurethanes neither contain nor are produced from ethyl carbamate.

(#h.) PVC:

Polyvinyl chloride (PVC) is the third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene. PVC comes in two basic forms: rigid and flexible. The rigid form of PVC is used in construction for pipe and in profile applications such as doors and windows, bottles, other non-food packaging, and bank or membership cards. It can be made softer and more flexible by the addition of plasticizers, the most widely used being phthalates. In this form, it is also used in insulation, imitation leather, inflatable products, and other applications where it replaces rubber.

SPECIAL APPRECIATION:

- Partial funding and support from the University of Utah, Marriott Library, Utah River Running Archives, Salt Lake City, UT
- Funding by Val & Herm Hoops, oneway boatworks, P.O. Box 163, Jensen, UT 84035

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{ 1st draft: Dec. 15 2015 - 2028 words; 4th draft: Jan 12 2016 - 2017 }