

Isotherm Inc. – Innovating heat transfer solutions

Isotherm, Inc. is a custom manufacturer specializing in the design and fabrication of heat exchangers, pressure vessels, and packaged systems for various industries such as industrial refrigeration, marine refrigeration, chemical & petrochemical, oil & gas, process and renewable energy.

Heat Exchanger World had the opportunity to speak with Adnan Ayub, President at Isotherm Inc. to discuss the company's wide range of enhanced heat transfer technologies & innovative solutions.

By Sarah Bradley

A premium manufacturer of various heat exchangers including shell & tube, plate & frame and shell & plate, Isotherm, Inc. was founded by Dr. Zahid H. Ayub, P.E. in 1999 in Arlington, Texas. A reliable supplier to domestic and international clients, Isotherm continues to be at the forefront in thermal design technology.

"The company was founded by my father, Dr. Zahid H. Ayub. He came to the country in 1980 to pursue his PhD in mechanical engineering and his dissertation involved two phase boiling, under the guidance of the most respected heat transfer professor, Dr. Arthur Bergles. After obtaining his PhD in 1986, he worked at a pressure vessel company in Michigan, E.L. Nickell, and was responsible for creating heat exchanger software, using the most reliable correlations in heat transfer engineering," explained Adnan. "Afterwards, he got a job at a heat exchanger company in Texas in 1990, but decided to do design consulting for heat exchanger fabricators. In 1992, he started his own manufacturing company called Ayub & Associates, the predecessor to Isotherm, which built many heat exchangers for various clients of different industries until it was sold in 1998. A year later, then he started our current company. Although Isotherm has existed for at least 20 years, it was built on more than 30 years of experience in the thermal design of heat exchangers. After all these years of hard work and experience, I am proud to say that my father's hard work in the field resulted in several prestigious awards, such as the ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Louise & Bill Holladay Distinguished Fellow Award and the ASME Heat Transfer Memorial Award."



⚡ Patented thin-film SX ammonia-wine evaporator for a winery plant

Adnan joined the family business in 2005 after obtaining his Bachelor of Science from Rose Hulman Institute of Technology, following in his father's footsteps with a shared passion for thermal design challenges. Currently, the company has approximately 50 employees and continues to be run by professionals with doctoral degrees in engineering, who place a strong emphasis on enhanced heat transfer.

"We are heavily focusing on providing solutions in the heat exchanger industry. For example, in the refrigeration industry, various freons, like R-22 and R-134a, were commonly used in heat transfer, copper tubes was commonly used. Now as ammonia and other natural refrigerants are becoming more prevalent due to the banning of old refrigerants that have impacted the ozone and global warming, we have invested in developing new enhanced tubing technologies," revealed Adnan.



⚡ R-507a-glycol thermosyphon evaporator for petrochemical

through enhanced

“We are heavily focusing on providing solutions in the heat exchanger industry.”

With the extensive technical knowledge the company possesses, Isotherm has focused heavily on new enhanced tubing technologies. This is important in order to be able to provide a more compact design using enhanced tubing instead of plain tubes or the conventional low-fin tubes.

“A plain tube has a smooth surface. Enhanced tubing is a more structured surface which helps facilitate more turbulence and you need turbulent flow for better heat transfer. With very viscous fluids such as propylene glycol, there is high resistance to heat transfer. With enhanced tubing, the turbulence facilitates better heat transfer which enables us to reduce the size of the equipment,” said Adnan. “It is important to have an enhanced tubing technology in order to be able to get the size of the exchanger more compact.



Ammonia liquid recirculator skid packages for solid storage

Although plate & frames and shell & plate heat exchangers are common due to their compactness, there are issues with fouling or more maintenance or replacement of gaskets and plates for the Plate & Frame or the risks of a bad weld for shell & plate in which the whole unit has to be replaced! With a shell & tube design it may last longer, but with plain tubing, size becomes an issue — it will be much bigger and longer. Enhanced tubing results in a more compact design.”

Enhancing Processes Through Enhanced Heat Transfer Solutions

“Our primary industries have been industrial and marine refrigeration, but our solutions are very diverse and dynamic. We are primarily in natural refrigerants like ammonia and CO₂, but we have also done propane and other natural refrigerants and we have also designed our equipment for freon. We have done marine refrigeration skid systems on fishing boats and an Ammonia Sodium Chloride brine chiller package for an Alaskan seafood processing plant,” explained Adnan.



CO₂ Three-stacker gas cooler for heat recovery

“Industrial refrigeration applications include cold storage food & beverage processes, pharmaceutical, as well as chemical & petrochemical process, oil & gas and renewable energies. In the renewable sector we have prepared skid packages for river water heat pumps and district heating and we have also supplied equipment for organic rankine cycle (ORC) projects.”

Isotherm offers various heat exchangers such as shell & tube, plate & frame (gasketed, semi-welded, brazed), shell & plate, pressure vessels, vessel packages, refrigeration skid packages, ORC packages, CNG packages, waste gas process and compression skids and customized special application packaged units based around their heat exchange products. While the company offers these custom manufactured products, they also provide service work, such as, but not limited to, re-tubing or other repair work for the related products, regardless of whether they were built by Isotherm or other manufacturers.

» Custom built, compact, & mobile CNG/RNG refueling unit



The company specializes in enhanced heat transfer for natural refrigerants such as ammonia, carbon dioxide and hydrocarbons, resulting in Isotherm's products being compact with ultra low charge.

"In the refrigeration industry, especially in ammonia, low refrigerant charge is important. The EPA has put regulations in place to where you cannot have more than a certain amount of ammonia in your refrigeration system, because ammonia is toxic and very pungent," said Adnan.

As a solution provider for their customers, Isotherm has been able to combine their immense technical expertise, years of industry experience and a drive to ensure they are providing the customer with the best possible solution for their customer. By developing relationships and listening to their customer's needs, Isotherm has taken customer-driven product development to the next level.

"It is all about being aware of the application that your customer is involved with and being able to provide the right solution. There are situations where an exchanger may have been built to design, but sometimes the design is not necessary for the application," said Adnan. "It may have all the features they think they require, but if the

velocity of the flow is too low it can foul badly and at the same time, if it is too high it could erode. There is much more involved that just simply simulating an exchanger. Our experience has exposed us to so many different scenarios that has helped us become solution providers, because we have learned from witnessing the good and the bad in the industry. You have to really look more in-depth and recognize that in heat transfer, it is not one-size-fits-all. We want to make sure we are finding the best solution for the application for the customer."

Along with their own internal machining shop, Isotherm holds ASME certification for "U" and "UM" stamps and the National Board Repair stamp "R" and is qualified to produce CE marked equipment under the European Pressure Equipment Directive (PED) and Det Norske Veritas (DNV). The designs per TEMA standard are also common.

The company has several capabilities/services that help them stay in line with their approved quality standards such as In-House Quality control personnel with Certified Welding Inspection certificates, ASME approved Non-Destructive Examinations (specifically Liquid Penetrant Testing), Factory Acceptance Testing as required by some of their customers and Client approved Inspection Test Plans.



» Carbon dioxide low pressure receiver for a Canadian food plant



« Refrigerated sea water skid package for a small boat in Pakistan

Dr. Zahid Ayub founded the Natural Fluids Refrigerants Center in collaboration with the Ghulam Ishaq Khan Institute of Engineering Sciences & Technology (GIKI) in Topi, Pakistan. This serves as the company's R&D for new and innovative techniques related to natural refrigerants and its use for refrigeration systems. The center has completed a couple projects and is currently working on some new research in natural refrigerants.

Isotherm's solutions are constructed with various types of materials; most common are carbon steel, stainless steel 304 & 316, titanium, copper & copper alloys. They also have experience in utilizing duplex steel, Alloy 20, and various exotic materials.

Focusing on the Future

Since its establishment, Isotherm Inc. has developed new types of heat exchangers and is committed to working closely with their customers to deliver step-by-step improvement through customer-driven product development. "Our goal is to provide the right solution for our cus-

tomers, we do our best to provide them with service and technology and not just a product. We are not just selling them steel. Our goal is longterm relationships with our customers," said Adnan.

With the goal of providing customers with quality, cost effective and reliable solutions, Isotherm relies on the strength of its highly qualified and experienced engineering department to set the benchmark in enhanced heat treatment technology.

With the main goal of establishing long term partnerships with its customers, the company follows the ISOTHERM way, which stands for: I-Integrity, S-Support, O-Optimism, T-Teamwork, H-Humility, E-Empathy, R-Responsibility and M-Motivation.

Looking forward, the Isotherm team strives daily to be a world class fabrication company that relies on its technological expertise and experience to continue to bring their customers to the forefront in heat transfer. «



« Ethylene/propylene cascade condenser for an LNG plant