



ASTFE

American Society of Thermal and Fluids Engineers

11TH THERMAL AND FLUIDS
ENGINEERING CONFERENCE (Hybrid)
Arizona State University, Tempe, AZ, USA

9-12
MARCH
2026

2nd Annual ASTFE Thermal Hydraulics Competition: Heat Exchanger Design

Sponsored by Heat Transfer Research, Inc.

The 11th Thermal and Fluids Engineering Conference is set for March 2026 at Arizona State University. All students currently enrolled in a university degree program are invited to complete a heat exchanger design according to the specifications outlined in Design a Compressor Intercooler.

A panel of international heat exchanger experts in industry will evaluate the merits of each submission. Six submissions—the top three designs from undergraduate-led teams and from graduate-led teams—will be awarded cash prizes: first place, US\$1000; second place, US\$850; and third place, US\$650.

TO ENTER:

By October 18, 2025:

- eMail kevin.farrell@htri.net with the subject **Intercooler for ASTFE Design Competition** stating your intention to participate.
- Submit a brief abstract via the ASTFE conference portal, selecting the subject area of **Intercooler for ASTFE Design Competition**.
- Register and pay for conference attendance at the student rate according to stated ASTFE deadlines.

By 11:59 pm US Central Time **on December 31, 2025**, submit final entry to kevin.farrell@htri.net.

Our ASTFE community looks forward to seeing your designs. Thank you for your consideration.

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Design a Compressor Intercooler

Effective heat exchanger design is essential for energy-efficient processes that lower the carbon footprint. While different applications may require different approaches, a design for a compressor intercooler requires high effectiveness and low pressure drop. Consider the following process conditions for a typical intercooler design:

Fluid	Dry air*	Water
Inlet temperature, °C	158	32
Outlet temperature, °C	39	<i>TBD by designer</i>
Flow rate, kg/s	7	<i>TBD by designer</i>
Inlet pressure, absolute, kPa	244	451
Allowable pressure drop, kPa	5	70

*Air is typically moist for intercoolers. For this competition, dry air is assumed for simplicity.

The temperature effectiveness is calculated as $(T_{hot,in} - T_{hot,out}) / (T_{hot,in} - T_{cold,in}) = 0.94$.

For this competition, propose a commercially viable exchanger design which meets this effectiveness value without exceeding the allowable pressure drops of either fluid. You may complete CFD results to support the performance claims. The exchanger designs can be of various configurations, including shell-and-tube, plate-type, or other compact types and should consider fouling of both the dry air and water streams. For novel systems, reference to installed applications or experimental data is required.

A panel of industrial experts will evaluate and rank the heat exchanger designs for commercial use with emphasis on the following attributes, in priority order:

- Use of temperature profile.** Effective designs use countercurrent flow to the extent possible which maximizes the mean temperature difference over the heat transfer surface. The effectiveness, NTU (number of transfer units), and heat capacity rate ratio values in your design should match expectations from theory for the flow arrangement used in the exchanger.
- Water usage.** Water is a scarce and valued resource. Lower water usage is preferred.
- Compactness.** Compactness is defined as the heat transfer area divided by exchanger volume. Constraints of the compressor skid limit the exchanger size to 5 m³. The exchanger you design must fit onto the compressor skid, which is 5 m long by 2 m wide by 2 m high. Limit the dry weight to less than 1800 kg.
- Flow distribution.** Maldistribution degrades performance. Uniform flow through parallel flow passages generally ensures that the heat transfer coefficient and mean temperature difference are maximized.
- Second law efficiency.** Reduce the net availability destruction to achieve a high second law efficiency and reduced emissions. The hot stream gives up availability to the cold stream, but a portion of the hot stream availability is destroyed by irreversibilities, such as heat transfer over a finite temperature difference and frictional pressure drop. The second law efficiency is defined here as one minus the net availability destruction normalized by the heat duty of the exchanger. The dead state is taken as 25 °C and 101325 Pa.

Document the design in a technical report (PDF) of ten standard letter-sized, single-sided pages or less, including scope, summary, and discussion sections. Use 1-in. margins and 11-pt sans serif font. The report should address the design rationale, technical approach, fluids and solid(s) properties, and the principal attributes of the design with clarity and concision. Well-labeled layout drawings and tabularized data are preferred.

The evaluation rubric will be 45% technical design and calculations, 40% design justification and optimization, and 15% documentation. **Note:** *Although students may ask generalized questions to faculty members and outside experts, the effort is to be student-led.*