Low Temperature Heat and Waste Heat Recovery

While many organizations and industries have been focused on recovering high temperature heat, many are now seeking to recover waste heat from even lower temperature sources (60–300°C), and ORC has been selected as a highly effective technology for recovering this heat and converting it to electrical power.

Genetron 245fa has the most favorable properties for low temperature heat recovery systems. Its thermodynamic properties are different than HFCs typically used in refrigeration.

Safety
Unlike a number of alternative working fluids, e.g. hydrocarbons, Genetron 245fa has low toxicity and is non-flammable. This maximizes the benefits of ORC systems by:

• Driving ORC penetration through better economics than systems containing flammable fluids
• Driving wider acceptability and implementation of ORC across multiple end use environments

Economics
Higher ORC cycle efficiency compared with alternatives increases power generation and improves your payback on investment.

• Genetron 245fa thermodynamic properties reduce ORC size/costs, and lower investment cost to the end user
• Non-flammability can lead to substantial reduction in end user investment costs compared with flammable alternatives – ATEX assessment, renewal safety measures, insurance
• Many end users cannot accept an ORC with a flammable heat transfer fluid

Genetron 245fa minimizes end user investment and maximizes return on investment

Benefits
• Maximizes ORC cycle efficiency and system economics
• Non-flammable
• Favorable toxicological profile

Economical Way of Reducing CO₂ Emissions
Converting low temperature heat to energy is good business and good for the environment. ORC systems:

• Generates power from renewable heat sources, e.g. geothermal and solar, directly increasing the amount of renewable energy and reducing CO₂ emissions
• Generates power from waste heat that offsets grid consumption, reducing CO₂ emissions
• Generates power that is CO₂-free – no fuel consumed in cycle

• Are leak tight, eliminating direct chemical contribution to global warming as a result of working fluid emissions
• Use an organic working fluid to recover heat
• Are built to last, often for decades

Introduction
Companies and organizations of every size, in every industry and on every continent are turning to ORC – Organic Rankine Cycle systems – to both improve the economics of their business and help reduce their CO₂ footprint which can lead to climate change. Honeywell is offering a high-quality working fluid with significant benefits for overall efficiency.
Genetron 245fa Physical Properties

- Chemical Name: 1,1,1,3,3-pentafluoropropane
- Molecular Formula: CHF₃
- Flash Point: 1.0°C
- Boiling Point at 1.01 bar: 15.7°C / 60°F
- Freezing Point: -18°C / 0°F
- Liquid Heat Capacity: 1.36
- Vapor Heat Capacity at constant pressure 1.01 bar kg K: 0.8931

Stability

Laboratory tests indicate Genetron 245fa to have a high degree of thermal and hydrolytic stability. Sealed tube thermal stability tests were conducted at 200°C for four weeks. When tested alone under these conditions, Genetron 245fa purity was relatively unchanged. In sealed tube studies the material showed no signs of decomposition after six weeks of exposure to temperatures ranging from 75°C to 150°C in the presence and absence of moisture. After a period of six to eight weeks at temperatures ranging from 25°C to 100°C. Again, Genetron 245fa did not show any signs of decomposition. The presence of moisture, air, moisture and lubricant can influence stability and, as a result, thermal stability should be evaluated for the conditions of application.

There may be some response and inhibit rubber formulations as well as performaxelane compounds that may be acceptable for specific applications. Electrolube compatibility should be evaluated at the conditions of use.

A separate study was also conducted with cold rolled steel rod exposed to Genetron 245fa in the presence and absence of air and water for a period of six to eight weeks at temperatures ranging from 25°C to 100°C. Again, Genetron 245fa did not show any signs of decomposition. The presence of metals, air, moisture and lubricant can influence stability and, as a result, thermal stability should be evaluated for the conditions of application.

Compatibility

Honeywell has carried out materials testing to evaluate the compatibility of common materials of construction with Genetron 245fa. The evaluations are based on 14-, 30- and 60-day testing results. The evaluations also consider static and dynamic conditions and the intended applications of the materials.

- Plastics Compatibility
  - Polyethylene: Satisfactory
  - Polystyrene: Satisfactory
  - Polyethylene: Satisfactory
  - Polypropylene: Satisfactory
  - TPE: Satisfactory
  - TPR: Satisfactory

- Elastomer Compatibility
  - Perfluorosiloxane: Unsuitable
  - Fluorosilicone: Unsuitable
  - EPDM: Unsuitable
  - Neoprene: Unsuitable
  - Silicone: Unsuitable
  - HNBR: Unsuitable
  - Chloroprene: Unsuitable
  - Buna N: Unsuitable
  - Urethane: Satisfactory
  - VITON: Unsatisfactory

- Materials Compatibility
  - PFA: Unsatisfactory
  - PVDF: Satisfactory
  - PTFE: Satisfactory
  - Polypropylene: Satisfactory
  - Urethane: Satisfactory
  - Butyl rubber: Unsatisfactory
  - Epichlorohydrin: Unsatisfactory
  - Fluoroelastomer: Unsatisfactory
  - Perfluoro-elastomer: Unsatisfactory

- Elastomer Compatibility
  - fluoroelastomers: Unsatisfactory

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