Improving the performance of booster heat pumps using zeotropic mixtures - DTU Orbit (01/12/2018)

Improving the performance of booster heat pumps using zeotropic mixtures

Abstract This study demonstrated an increase in the thermodynamic performance of a booster heat pump, which was achieved by choosing the working fluid among pure and mixed fluids. The booster heat pump was integrated in an ultra-low-temperature district heating network with a forward temperature of 40°C to produce domestic hot water, by heating part of the forward stream to 60°C, while cooling the remaining part to the return temperature of 25°C. The screening of working fluids considered 18 pure working fluids and all possible binary mixtures of these fluids. The most promising solutions were analysed with respect to their performance under off-design conditions and their economic potential. The best-performing mixture showed a coefficient of performance (COP) of 9.0 and thereby outperformed R134a by 47%. Although the mixed working fluids resulted in higher investment cost, the economic performance was comparable to the pure fluids. The mixtures showed similar performance as the pure fluids at off-design conditions. It was concluded that the mixtures 50% Propylene/50% Butane and 50% R1234yf/50% R1233zd(E) could considerably improve the thermodynamic performance of the overall heat supply system while being economically competitive to pure fluids.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Danfoss AS
Contributors: Zühlsdorf, B., Meesenburg, W., Ommen, T. S., Thorsen, J. E., Markussen, W. B., Elmegaard, B.
Pages: 390-402
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Energy
Volume: 154
ISSN (Print): 0360-5442
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.6 SJR 1.99 SNIP 1.923
Web of Science (2017): Impact factor 4.968
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.974 SNIP 1.823
Web of Science (2016): Impact factor 4.52
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.03 SJR 2.22 SNIP 2.037
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.7 SJR 2.575 SNIP 2.602
Web of Science (2014): Impact factor 4.844
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.02 SJR 2.456 SNIP 2.556
Web of Science (2013): Impact factor 4.159
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.25 SJR 1.935 SNIP 2.214
Web of Science (2012): Impact factor 3.651
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4 SJR 1.566 SNIP 2.01
Web of Science (2011): Impact factor 3.487
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.712 SNIP 2.46
Web of Science (2010): Impact factor 3.597
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.663 SNIP 2.357
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.103 SNIP 1.438
Scopus rating (2007): SJR 0.902 SNIP 1.434
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.851 SNIP 1.315
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.942 SNIP 1.153
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.703 SNIP 1.105
Scopus rating (2003): SJR 1.024 SNIP 1.45
Scopus rating (2002): SJR 0.806 SNIP 1.257
Scopus rating (2001): SJR 1.079 SNIP 1.089
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.698 SNIP 0.962
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.624 SNIP 0.687
Original language: English
Keywords: Ultra-low-temperature district heating, Zeotropic mixture, Working fluid selection, Economic analysis, Off-design, System performance
DOIs:
10.1016/j.energy.2018.04.137
Source: RIS
Source-ID: urn:02E6C886B38122A3980B3E21AC540393
Research output: Research - peer-review ; Journal article – Annual report year: 2018