

Part-load controlling systems, refrigerant selection and sustainability

H. F. T. Meffert and *C. A. Infante Ferreira¹

Refrigeration Engineering and Indoor Climate Technology
Delft University of Technology
Mekelweg 2, 2628 CD Delft, the Netherlands
Tel. ++31.15.2784894 Fax. ++31.15.2782460
E-mail: hmeffert@xs4all.nl c.a.infanteferreira@wbmt.tudelft.nl

Abstract

Refrigerated container units work most of the time under part-load conditions. Several controlling methods maybe applied: on / off, piston valve lifting, suction line control, speed control and hot-gas by-pass. The choice of the controlling method has a large impact in the yearly total equivalent warming impact of the system and this value substantially differs from what would be expected from full-load calculations. With regard to the conditioning quality, stepwise control methods should be used with care for sensitive cargoes under chilling conditions.

This paper investigates, for a number of control strategies and refrigerants, the yearly system COP variation. This allows the calculation of the yearly mean total equivalent warming impact of the alternatives. For the GWP contribution due to direct refrigerant emissions, the operating pressure level of the specific refrigerant has been taken into account. The sustainability of different part-load options in combination with refrigerant selection is discussed. Ammonia and isobutane / propane mixtures appear to be most sustainable options while carbon dioxide on the opposite appears to be the less sustainable refrigerant for these applications. Piston valve lifting gives a very sustainable part-load control while hot-gas by-pass is a less sustainable method.

¹ Corresponding author