

COST-EFFECTIVE REFRIGERATION

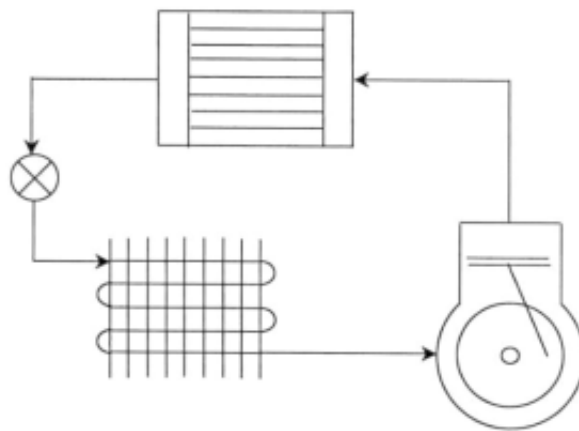
A FIVE DAY TEACHING WORKSHOP
Monday 1st July 2024 to Friday 5th July 2024

London, UK

www.cost-effective-refrigeration.org

www.cost-effective-refrigeration.com

Presented by
Professor Don Cleland



Optimize your food refrigeration designs and operations
Enhance your understanding of food refrigeration systems
Learn new methods to predict system performance
Minimize energy use while maintaining product quality

In collaboration with



INTRODUCTION

Refrigeration continues to be a key technology for the global food industry and industrial heat pump use is increasing. The workshop will bring together users of industrial refrigeration and heat pump equipment, suppliers of industrial and large commercial refrigeration equipment, refrigeration and heat pump contractors, energy suppliers, consultants, researchers, and those involved in refrigeration education at tertiary level to upgrade their refrigeration and heat pump knowledge. It is particularly important that technical, commercial and environmental aspects of refrigeration and heat pumping are addressed:

- Climate change responses mean that mechanisms to limit greenhouse gas emissions (decarbonise) including improved energy efficiency are becoming important business practices.
- Heat pumps are increasingly being used to reduce dependence on fossil fuels and systems for temperatures greater than 90°C are starting to emerge.
- The Kigali and Paris agreements on refrigerants and climate change are likely to have increasing impact on businesses using refrigerants and consuming large amounts of energy.
- Businesses are facing on-going electricity prices increases and greater risks related to security of supply.
- Processing and storage conditions for food products are becoming progressively more exacting yet varied as we seek to extract greater value from agricultural activities yet maintain food safety.
- Increasingly provision of refrigerated services is being contracted out to third parties.
- Considerable expenditure on replacement of old and creation of new refrigeration equipment is ongoing, and engineers and owners need to ensure that capital is wisely spent.

This is the first offering in the United Kingdom of this teaching workshop entitled “Cost-Effective Refrigeration”. The workshop has been delivered more than 30 times in NZ and Australia to more than 700 industry participants.

PRESENTER

Don Cleland is Professor of Process Engineering at Massey University in New Zealand. He has more than 40 years research, consultancy and training experience in refrigeration, heat pumping, system design, food processing and preservation, energy management and energy efficiency. He has worked mainly in New Zealand but also has significant experience in the US, the UK and Australia. He is a Fellow of American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), the NZ Institute of Food Science and Technology (NZIFST), the NZ Institute of Refrigeration, Heating and Air-Conditioning Engineers (IRHACE), and a Distinguished Fellow of Engineers New Zealand (EngNZ). He holds Honorary memberships of the Australian Institute of Refrigeration, Air-conditioning and Heating (AIRAH) and the Science & Technology Council of the International Institute of Refrigeration (IIR). He is also a winner of the Institute of Refrigeration J&E Hall Gold Medal, the IIR Clarence Birdseye Award, the Scott Medal from the Royal Society of NZ, the Furkert Award and 1992 Young Engineer of the Year from EngNZ, and the Ian Syminton Prize and Tony Barnard Award from the NZ National Committee of the IIR.

WORKSHOP DESCRIPTION

There will be about 20 workshop sessions each of about 60 to 90 minutes. The material covered has been selected to be relevant to designers and suppliers of heavy and light industrial refrigeration equipment, commercial equipment suppliers and contractors, industrial and commercial refrigeration owners and operators, and consultants. The workshop encompasses several broad themes:

- Refrigeration and psychrometric basics. The vapour compression cycle and use of Mollier diagrams to understand, design, analyse and troubleshoot refrigeration systems. Introduction to jargon and system analysis tools. The psychrometric chart and its use for understanding air properties and humidity.
- The customer/contractor interface when new equipment is being purchased, or old plant being modified. The technical specification as the basis of expenditure of capital including common faults within specifications leading to unsatisfactory contracts, tendering and contract management.
- Heat load determination. Calculations for plant sizing and design. Monitoring and control of heat loads to ensure they are minimised, thus controlling refrigeration and energy costs.
- Chilling and freezing calculations. Simple methods for prediction of chilling and freezing times, prediction of the effect of making changes on freezer or chiller performance. Methods for estimating thermal property and the effect of product voidage or air spaces in packaged products.
- Refrigeration plant layout and design. Selection of compressors, use of liquid subcooling, multi-stage compression, cascade systems, flooded and pump circulation as well as direct expansion systems, types of control systems, modes of operation for maximum energy efficiency, refrigerant piping design rationale etc. Evaporator and condenser selection. The impact of new refrigerants, use of cryogenic refrigeration and the use of speed controllers. Heat recovery and heat pumping opportunities.

- Absorption refrigeration. Principles of operation, types of system, performance characteristics, guidelines for application and economics.
- Operational efficiency of refrigeration systems. Performance of evaporators, condensers, compressors, control systems etc in practice. Impact on energy efficiency of making changes to designs, operations and controls. Effect of pipeline pressure drop on performance and efficiency.
- Water vapour and its effect on refrigeration system performance. Control of relative humidity, vapour barriers, control of condensation in refrigerated rooms, evaporator frosting and defrosting etc.
- Heat pumping for process heating. Process heating using heat pumps including refrigerant and cycle design and selection, matching of heat pump cycles with process requirements, and development of high temperature heat pumps.
- Environmental issues - global warming, ozone depletion and safety. Policy, legislation and regulations now and future, and the impacts on the refrigeration and food industries including choice of refrigerants.

The teaching methods used will be suited to a wide variety of educational backgrounds and will cover both the design and operation of refrigeration systems and refrigerated applications. A combination of simple but effective hand calculation methodologies and computer analysis software will be presented, and participants will have the opportunity to try out these in several practical sessions. Participants will be given access to some non-proprietary calculation software tools.

PROGRAMME

Monday, 1st July 2024

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| 8.45 - 9.00 | Workshop Registration |
| 9.00 – 9.30 | Introductions |
| 9.30-11.00 | Session 1 Specifications; Examination of the purpose of specifications in the contractor/customer relationship. Preparation and interpretation of specifications. Technical detail for customers, consultants and contractors. Case studies. |
| 11.30 - 1.00 | Session 2 Refrigeration basics. Review of basic refrigeration cycles. Introduction to system analysis tools and refrigeration jargon. Introduction to psychrometrics. |
| 1.30 - 3.00 | Session 3 The CFC issue and global warming - implications for refrigeration. |
| 3.30 - 5.00 | Session 4 Heat load calculations. Techniques for estimation of loads and identification of excessive heat loads. Methods for load reduction. Hand calculations and computer analysis. |
| 5.15 - 8.00 | Introductory Social (venue to be confirmed at workshop) |

Tuesday, 2nd July 2024

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| 8.30 - 10.00 | Session 5 Heat load calculations continued. |
| 10.30 - 12.00 | Session 6 Heat load calculations. A “hands-on” session for participants to use the techniques on typical industrial problems. |
| 12.30 - 2.00 | Session 7 Air cooling systems (evaporators) and defrost systems. Discussion and quantitative techniques for ensuring that maximum efficiency is obtained. |
| 2.30 - 4.00 | Session 8 Water vapour and refrigeration. Vapour barriers, condensation on cold surfaces, humidity control. |
| 4.00 - 5.30 | Session 9 Estimation of chilling times and means for predicting the effect of changing conditions on chiller performance. Hand calculations and computer analysis. |

Wednesday, 3rd July 2024

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| 8.00 - 9.30 | Session 10 Estimation of freezing times and means for predicting the effect of changing conditions on freezer performance. Cryogenics. Hand calculations and computer analysis. A “hands-on” session for participants to use the techniques on a typical industrial problem. |
| 10.00 -11.30 | Session 11 Product weight loss. Theory and practical techniques to minimise product shrinkage in refrigerated facilities. |

- 11.30 - 12.30 **Session 12** Refrigeration plant design and energy efficiency calculations. Review basic techniques and analyse simple single stage cycles.
- 1.30 - 3.00 **Session 13** Refrigeration plant design and energy efficiency calculations. More complex plant arrangements, plant variations to save energy.
- 3.30 - 5.00 **Session 14** Heat pump cycle designs and energy efficiency calculations for process heating. Matching heat pumps to process requirements. High temperature heat pumps.
- 6.00 - 10.00 Workshop Dinner (venue to be confirmed at workshop)

Thursday, 4th July 2024

- 8.30 – 10.00 **Session 15** Refrigeration and heat pump plant and energy calculations. A “hands-on” session for participants to use the techniques on a typical industrial problem.
- 10.30 – 12.00 **Session 16** Absorption refrigeration. Principles of operation, system types and layouts, performance characteristics and efficiency, applications and economics.
- 1.00 - 2.30 **Session 17** Operational aspects of refrigeration plant performance - performance of evaporators, condensers and compressor and effect of pipeline pressure drop.
- 3.00 - 4.30 **Session 18** Operational aspects of refrigeration plant performance - measurement of performance, trouble-shooting guidelines, effects of operational practices on energy efficiency.

Friday, 5th July 2024 (optional)

- 8.30 – 10.00 **Session 19** Introduction to and use of spreadsheet calculation tools – prediction of applications heat loads and prediction of freezing and chilling times.
- 10.30 – 12.00 **Session 20** Introduction to and use of spreadsheet calculation tools –use of CoolProps to get refrigerant and psychrometric properties and to analysis simple cycles.
- 1.00 – 2.30 **Session 21** Introduction to and use of spreadsheet calculation tools – analysis of complex cycles and heat pumps.

WORKSHOP FEE AND REGISTRATION

The workshop attendance fee is £1495 (the workshop is VAT exempt). There are two options for enrolling and paying:

- 1) On-line registration and payment at www.cost-effective-refrigeration.org
- 2) Alternatively register on-line at www.cost-effective-refrigeration.org and request that an invoice is sent.

The workshop fees covers:

- attendance at all five days of the workshop
- a full set of printed workshop notes (approximately 720 pages)
- an electronic version of workshop power-point slides
- spreadsheet-based calculation tools using the methods covered in the workshop
- morning and afternoon teas and lunches during the workshop
- the Monday social and the Wednesday dinner at the workshop

Registrants are responsible for organising their own travel and accommodation to enable them to attend the venue.

There is no closing date for applications but only the first 30 applicants will be accepted.

If there are fewer than 10 registrations the workshop may not be delivered. If so, all registrations fees will be fully refunded.

If you find it necessary to cancel your registration, there will be a refund of fees paid less a cancellation fee of £100.00. Participants from the same company can be freely substituted at any time prior to the workshop.

VENUE

The workshop will be held at The Chocolate Studio, 52 Chocolate Studios, 7 Shepherdess Place, London N1 7LJ.