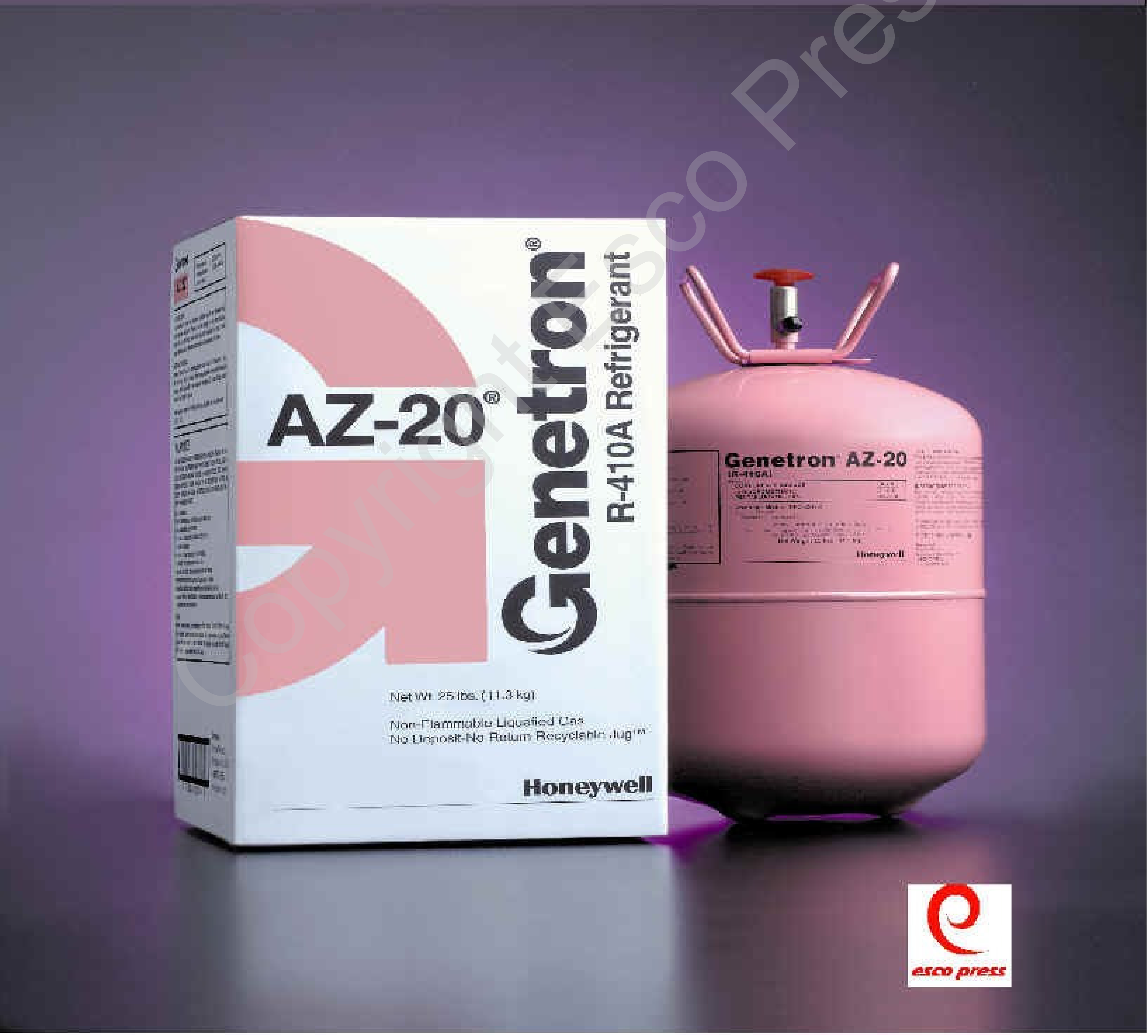
AC&R Safety Coalition

Universal R-410A Safety & Training



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The HVAC/R Professional's Field Guide to

Universal R-410A Safety & Training

Delta-T Solutions

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Published by:

esco press

UNION CWA LABEL PRINTING SECTOR CHICAGO, IL

ISBN 1-930044-12-7

Cover photo supplied by **Honeywell International**.

Printed in the United States of America
7 6 5 4 3 2 1

AC&R Safety Coalition

The AC&R Safety Coalition develops and establishes safe work practices and paradigms for Heating, Ventilation, Air Conditioning, and Refrigeration” personnel. This is accomplished through education, training and certification programs that address the safety needs of our industry.

Founding Members:

RSES
Refrigeration Service Engineers Society

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Universal R-410A Safety

Preface

This certification manual was written to assist in the training and certification of HVACR technicians for proper safety, handling and application of R-410A refrigerant. The manual was written by two current and one Emeriti faculty members of the HVACR Department of Ferris State University.

The program is written on the belief that the solution to transition to environmentally safer refrigerants and oils, while keeping the public and technicians out of harms way, is education and training. This value-added program contains practical applications of refrigeration and air conditioning system technology, fundamentals of refrigerants and oils, and the characteristics of R-410A, a refrigerant that deserves safety consideration.

This project was conducted in cooperation with numerous manufacturers and associations, most of which are listed with the acknowledgments to this manual. Their assistance made the solutions and safety portions of this manual possible. At the time of printing, the information on refrigerants and oils was the current technology.

Bibliographical Acknowledgments

We wish to thank the following organizations for whose material used in research made this project possible.

Air Conditioning Contractors of America (ACCA)
Air Conditioning and Refrigeration Institute (ARI)
Amana
The Air Conditioning, Heating and Refrigeration News
American Society of Heating, Refrigeration & Air Conditioning Engineers, Inc. (ASHRAE)
Blissfield Manufacturing Company
Bohn Heat Transfer Company
BVA Oils
Carlyle
Carrier
Castrol
Chevron
Copeland
Danfoss, Inc.
The Delfield Company
Department of Transportation
DuPont Chemicals
Environmental Protection Agency (EPA)
ESCO Institute (Educational Standards Corp)
Frigidaire Company
General Motors
Goodman Manufacturing
Honeywell
HVAC Excellence
Industrial Technology Excellence (ITE)
Johnson Controls
Lennox
Merit Mechanical Systems, Inc.
Mobil
National Refrigerants
Newsweek
Plumbing Heating and Cooling Contractors (PHCC)
Refrigeration Research, Inc.
Refrigeration Service Engineers Society (RSES)
Rheem
Rhuud
Ritchie Engineering
Robinair (SPX)
Scientific American
Tecumseh Corporation
Thermal Engineering Company
TIF Corporation (SPX)
Time
Trane
York

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R-410A and the R-22 Phase-Out

Background:

It is widely accepted that chlorine based refrigerants contribute to the depletion of the earth's stratospheric ozone. In recent years, the air conditioning and refrigeration industry has supported global efforts to transition to safer non-chlorine based refrigerants. In the developing countries of the world, CFC-12 (R-12) refrigerant, which was widely used since the 1930's, is today phased out and replaced with non-ozone depleting refrigerants. HCFCs, (including R-22) that have been widely used in air conditioning and refrigeration applications since the 1940's, are also being phased out. The technological changes that continue to evolve with refrigerants, compressor design, highly refined refrigeration oils and increased efficiency is truly revolutionary. The challenges confronting the refrigeration and air conditioning industry continue to unfold as we provide industrial cooling, comfort, food preservation and the "quality of life" needed for our society. This manual addresses one of these challenges; the transition from R-22 to R-410A.

Based on the 1974 Molina-Rowland theory that chlorine and bromine were responsible for depleting the earth's ozone layer that protects us from ultraviolet radiation, numerous global actions have taken place to reverse this environmental problem. Let's look at some of these significant actions:

- 1978 U.S. bans all non-essential aerosols containing chlorine or bromine.
- 1978 global warming concerns come into view.
- 1987 the U.S. and 22 other countries sign the original Montreal Protocol establishing timetables and phase-out schedules for CFCs and HCFCs.
- 1990 The Clean Air Act (CAA) signed in the U.S. calling for refrigerant, production reductions, recycling and emission reduction and the eventual phase-out of CFCs and HCFCs.
- 1992 unlawful to vent CFCs and HCFCs into the atmosphere.
- 1994 technician certification required for purchasing and handling of CFCs and HCFCs.
- 1995 unlawful to vent alternate (substitute) refrigerants such as HFCs, into the atmosphere.
- 1996 phase-out of CFC refrigerant production in the U.S.
- 1996 cap HCFC production levels.
- 1997 Kyoto Protocol established in response to global warming concerns.
- 2010 phase-out HCFC-22 (R-22) for new equipment.
- 2020 Phase-out HCFC-22 production.

HCFC Phaseout Schedule

The following italicized statements are condensed
and reprinted from the U. S. EPA web site.

All developed countries that are Parties to the Montreal Protocol are subject to a cap on their consumption of hydrochlorofluorocarbons (HCFCs).

Consumption is calculated by the following formula:

consumption = production plus imports minus exports.

The cap is set at 2.8% of that country's 1989 chlorofluorocarbon consumption + 100% of that country's 1989 HCFC consumption. (Quantities of chemicals measured under the cap are ODP-weighted, which means that each chemical's relative contribution to ozone depletion is taken into account.)

Under the Montreal Protocol, the U.S. and other developed nations are obligated to achieve a certain percentage of progress towards the total phaseout of HCFCs, by certain dates. These nations use the cap as a baseline to measure their progress towards achieving these percentage goals.

The following table shows the U.S. schedule for phasing out its use of HCFCs in accordance with the terms of the Protocol. The Agency intends to meet the limits set under the Protocol by accelerating the phaseout of HCFC-141b, HCFC-142b and HCFC-22. These are the most damaging of the HCFCs. By eliminating these chemicals by the specified dates, the Agency believes that it will meet the requirements set by the Parties to the Protocol. The third and fourth columns of the table show how the United States will meet the international obligations described in the first two columns.

Since the production levels are based on caps, rising production levels of HCFCs has triggered an accelerated phase-out of some HCFCs by manufacturers of new air conditioning equipment, prior to the established phase-out schedule.

See Phase-out chart

PHASE-OUT CHART			
Montreal Protocol		United States	
Year by which Developed Countries Must Achieve % Reduction in Consumption	% Reduction in Consumption, Using the Cap as a Baseline	Year to be Implemented	Implementation of HCFC Phaseout through Clean Air Act Regulations
2004	35.0%	2003	No production and no importing of HCFC-141b
2010	65%	2010	No production and no importing of HCFC-142b and HCFC-22, except for use in equipment manufactured before 1/1/2010 (so no production or importing for NEW equipment that uses these refrigerants)
2015	90%	2015	No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before 1/1/2020
2020	99.5%	2020	No production and no importing of HCFC-142b and HCFC-22
2030	100%	2030	No production and no importing of any HCFCs

Due to environmental and competitive pressure, HCFCs are being phased-out. In response, many manufacturers are building air conditioning equipment using HFC based R-410A. It is important that contractors and technicians understand the safety, safe handling, proper charging, operating characteristics and proper applications of this refrigerant blend.

As we approach the next stage and comply with these global and national provisions and regulations calling for the elimination of all ozone depleting substances, we need to prepare ourselves.

Regulation and Change:

Public pressures that resulted in the Montreal Protocol and regulations imposed by the CAA have resulted in our industry's transition to safer refrigerants. Numerous other factors such as global warming, energy utilization, developments in compressor design and refrigeration oils also continue to create change.

Global warming is a challenge that may see increased attention as our industry phases into newer refrigerants and more efficient equipment. The Kyoto Protocol that was established in 1997 calls for the reduction of greenhouse gases by an average of 5.23% from 1990 levels in developing countries. While only a few nations have ratified the Kyoto Protocol, many countries are reacting strongly and our industry may be challenged to look to alternate refrigerants that reduce global warming. Measurements of global warming such as the Total Equivalent Warming Impact (TEWI) take into consideration the direct and indirect effects of global warming, and can play an increased part in the selection of new refrigerants and system performance.

The development of the scroll compressor and the rapid adoption from the reciprocating compressor has opened the door to new refrigerants and made our industry's challenge easier. The scroll compressor not only is more efficient; it also is able to accommodate considerably higher pressures that are inherent in R-410A.

In 2006 the U.S. Department of Energy is scheduled to require that air conditioner efficiencies be raised from 10 SEER (Seasonal Energy Efficiency Ratio) to 12 SEER or higher. ASHRAE 90.1 standard is calling for increased efficiency level in commercial equipment to be increased by as much as 20%.

The direct and indirect impact of R-410A on global warming must be considered. The direct impact of R-410A is that it has a slightly higher global warming potential (GWP) than R-22. The indirect impact of R -410A is that because of its increased efficiency, R-410A systems use less energy, thereby reducing carbon dioxide emissions from power plants. The TEWI should be lower. There will likely be increased pressure on our industry to not only transition to safer refrigerants, but to further reduce refrigerant emissions, produce higher efficient equipment and maintain these systems at their optimum level of efficiency. That is our challenge.