



Multilateral Fund

for the Implementation of the Montreal Protocol

OBJECTIVE

To convert a HCFC-22-compressor production line to R-290 compressor technology, in order to validate the use of R-290 as a refrigerant in the manufacture of room AC; and obtain and disseminate experience on redesign and safe conversion

DEMONSTRATION OF CONVERSION OF ROOM AIR-CONDITIONING COMPRESSOR MANUFACTURING FROM HCFC-22 TO R-290

Project title	Demonstration sub-project for conversion of room air-conditioning compressor manufacturing from HCFC-22 to R-290 at Guangdong Meizhi Co.
Country	China
Agency	UNIDO
Sector	Refrigeration and air-conditioning (AC)
Subsector/application	Room AC
Enterprise/systems house	Guangdong Meizhi Co.
Baseline technology	HCFC-22
Alternative technology	Propane (R-290)
GWP (alternative technology)	Negligible
Potential safety issues	Flammable
ODS phase-out (mt)	0
ODS phase-out (ODP tonnes)	0

DESCRIPTION

Guangdong Meizhi Co. produces 18.4 million room AC compressors (2008) in three factories (25% of the domestic market or 20% of the world's market). The demonstration project was conducted in one production line with a production capacity of 1,830,000 HCFC-22-based compressors for split units between 1 and 1.5 hp.

Due to the change of working pressure and temperature and additional ex-proof requirements, the compressor production line needed significant modification and optimization. Therefore, the demonstration included redesign of the compressor to minimise the vapour volume containing R-290; lubricant selection; procurement of necessary equipment and systems for lubricant handling, safety control and enhanced ventilation; modification of tools and parts; installation; debugging and trial of production lines; training; pilot production and performance testing of R-290 compressors; and technology dissemination.

Production equipment was modified in the following lines: assembly, cylinder, roller, bearing, crank shaft, blade, sorting, motor coiling, stator varnish, high-speed press machine and testing tools. Performance testing equipment included calorie meter, life test unit, gas load test, gas concentration alarm system and lubricant viscometer.

The project was implemented in conjunction with the *Demonstration sub-project for conversion from HCFC-22 to propane at Midea (room air conditioner manufacturing enterprise)*.

RESULTS

As a result of the conversion, two types of R-290 compressors (fixed and variable frequency (VF)) with 1 HP and COP of 4.12-4.33 are available for mass production.

The performance of the R-290-based compressor is consistent with national and international standards. The energy efficiency of R-290-based compressors is 2-3% higher than HCFC-22-based compressors.

The main safety measures to be considered in the production of R-290-based compressors are:

- Electric components inside the R-290-based compressor should be sealed. This results in the modification of the electric components and structure of the compressor
- Flammability of R-290 requires special explosion-proof performance testing machines, such as calorimeter, life test units, gas load testing unit and operation testing unit for the compressor.

Based on the outcomes of the demonstration project, other room AC manufacturers have started research and development, and conversion activities using R-290 technology.

COST ANALYSIS

The incremental capital costs were incurred in equipment for the assembly line conversion (89.46 per cent); technical assistance including design, expert consultation and testing (8.39 per cent); and production trials and training of staff (2.15 per cent). The incremental operational cost (IOC) is US \$7.57 per unit.

CONCLUSION

R-290 is considered one of the ideal replacements for HCFC-22 in the room AC manufacturing sector. The converted manufacturing line has maintained the quality and performance of the compressors produced. Significant co-financing efforts from Meizhi contributed to reaching this performance.

In terms of market introduction, the following lessons can be learned:

- 1) Modification of the existing Chinese standards as well as the establishment of new standards will be a key factor for the adoption of alternative technologies
- 2) New policy/financial measures should be considered to help market sales of R-290 air conditioners
- 3) Training in the servicing and installation of the room ACs containing flammable refrigerants is a prerequisite for the market introduction and safe use of the R-290 air conditioners.

FINAL REPORT AND SECRETARIAT'S COMMENTS

<http://www.multilateralfund.org/73/English/1/7317a1.pdf>
(paragraphs 15 to 31 and Annex in page 33)