HC-290 in Split Air Conditioner

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Commitment to the Environment

- Godrej introduced Hydrcarbons technology in Refrigerator (Yr 2000) and Air Conditioner (Yr 2012).
- In 2010 – Tripartite agreement between GIZ, Ozone Cell (MoEF) and Godrej is signed, for working on **HC 290 Air-conditioner Project.**
- In 2012 - equipment of HC 290 AC manufacturing line frozen and installed at Godrej Manufacturing Plant near Pune, India.
- GIZ consultants helped with safety aspects.
- Safety inspection of equipment and installation by TuV, Germany.

Product Research

- Test methodology
  - Published data on performance of HC-290 vis-à-vis HCFC-22
  - Drop-in performance
    - 3~15% drop in cooling capacity
    - 2~8% improvement in COP
    - Charge quantity 45~50% drop by weight
- Charge limit followed as per European Standard (EN 378)

  $m_{max} = 2.5 \times LFL^{5/4} \times h_0 \times A^{1/2}$
- Challenge to get smaller diameter condenser tube
- Micro-channel heat exchangers (brazed aluminium) – the game changer

Manufacturing Project

- Tripartite agreement, Ozone Cell/GIZ/Godrej in 2010 – to set up manufacturing facility for annual output of 180,000 Air-conditioners.
- Safety Measures on Manufacturing Line
  - Gas Sensors and Alarm Systems
    - Refrigerant Storage Area
    - Refrigerant Charging system
    - Product Performance Test Chamber
    - Product Repair Area
  - Ex-proof electrical hardware in areas handling refrigerant
    - Product Performance Test Chamber
  - Ventilation System in areas handling refrigerant
    - Refrigerant Charging system
    - Product Performance Test Chamber
    - Product Repair Area

Service Training & Network

- All master technicians trained by a team of GIZ and Godrej experts
  - Dissemination of this knowledge to all Godrej technicians
  - Comprehensive training manual prepared
- Only certified technicians are permitted to install and service the HC 290 AC
- For Split ACs, flaring of connecting pipe ends not permitted in the field
  - Only Factory flared connections used

High Ambient Performance of R290

- Evident that HC-290 is well suited to high ambient regions.
- Global results show
  - Cooling capacity of R-290 model is 7% lower at rating conditions; gets marginally greater at higher temp by 3%
  - Improvement in COP of R-290 over R-22 also declines

Parameter		Outdoor temperature				
		35°C	**48°C**	**50°C**	**52°C**	**54°C**
Cooling capacity (kW)	HC-290	4.84	4.08	3.90	3.74	3.64
	HCFC-22	5.19	4.43	4.20	4.12	–
	Difference	7%	8%	8%	10%	–
COP (kW/kW)	HC-290	3.60	2.38	2.21	2.04	1.91
	HCFC-22	3.08	2.11	1.93	1.86	–
	Difference	16%	12%	13%	10%	–

Current R-290 Line up

- In 2020, Godrej expanded production line to increase Manufacturing capacity from 180,000 to 400,000.
- Developed new R-290 charged models as per upgrade Energy norms of India.
- Moved from PFC to Copper condenser.
- Used 5mm smaller diameter copper tubes in condenser.

Success Factor

- Focused on use of HC-290 as committed to Green
- Installed Safety equipment's on Manufacturing line. Arrangement for Leak detection, ventilation, alarm is placed on line.
- Provided adequate Service Training for Installation of HC-290 models and servicing on field.
- No Single customer complaint received from field about Flammability of HC-290 till date.
- Government and GIZ support to promote Green refrigerant.

R290
REFRIGERANT
LOWEST GLOBAL WARMING POTENTIAL

Feature Plan

- Development of HC-290 models as per India's new upgraded energy star rating (from 1st Jan 2022)
- Research and development work started to produce own Godrej R290 compressors with improved efficiency for Air Conditioner.
- Use of smaller diameter copper tubes in Heat Exchangers.

Thank you for your attention!

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