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# HEAT PUMP TRAINING PROGRAM

## Course 10 – Safety, Refrigerants and Standards

One of ten vendor-neutral courses, with worked examples, P&IDs, a quiz and a glossary, written for Indian conditions.

Values marked "typical", "approximate" or "illustrative" are not test data; check them against manufacturers' manuals and current standards before use.

# Contents

## 10 Safety, Refrigerants and Standards

Level 3 · Field Practice

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# Course 10 — Safety, Refrigerants and Standards

Powered by Sunniva. This Level 3 course is for everyone who works in the field: installers, service technicians, commissioning engineers and supervisors. After it you will be able to (1) isolate and lock out a heat pump safely before work, (2) handle pressure, brazing and flammable or high-pressure refrigerants without putting yourself or the site at risk, (3) read a refrigerant's safety class and choose the right handling rules, and (4) explain the phase-down rules and the test standards behind a heat pump's rated figures.

## 10.1 Electrical safety and lock-out/tag-out

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**Key idea: Never trust a switch — isolate, lock, tag and prove the circuit dead before you touch it.**

A heat pump runs on 230 V single-phase or 415 V three-phase supply. Both can kill. Current through the chest of only tens of milliamps can stop the heart.

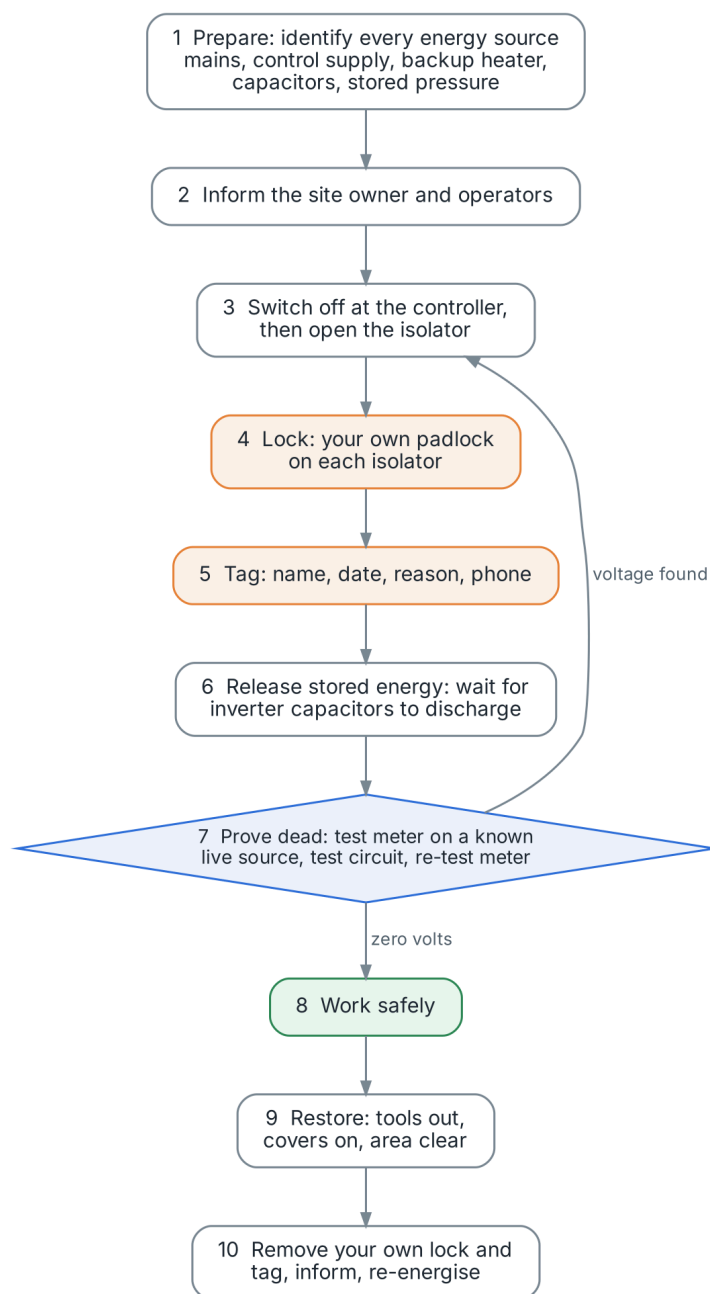
Lock-out/tag-out (LOTO) is a written routine that keeps a machine switched off while someone works on it. "Lock-out" means a personal padlock on the isolator. "Tag-out" means a label saying who is working and why.

Think of LOTO like keeping the gas cylinder valve shut and the regulator removed while you repair the stove. Turning the knob off is not enough.

Inverter drives add one more hazard. Their DC bus capacitors (energy-storing parts inside the drive) can hold a lethal charge for several minutes after power-off. Wait the time printed on the drive label, then measure.



## Lock-out / tag-out in ten steps



Lock-out / tag-out in ten steps

| Hazard           | Where in a heat pump                       | Control                                |
|------------------|--------------------------------------------|----------------------------------------|
| Mains voltage    | Terminal block, contactors, inverter input | Isolate, lock, test                    |
| Stored DC charge | Inverter / VFD capacitors                  | Wait the labelled time, measure DC bus |
| Backfeed         | Second supply for backup heater or pump    | Isolate every source                   |
| Earth fault      | Damaged cable, wet panel                   | RCD/RCCB, earth continuity test        |
| Moving parts     | Fan blades, pump couplings                 | Lock out before reaching in            |

### Remember

- Every person working fits their own lock; one lock per person.

- "Test before touch": prove your meter works before and after testing the circuit.
- Inverter capacitors stay live after switch-off; wait and measure.
- Check for second supplies such as backup heaters and external pumps.
- Only the person who fitted a lock removes it.

**Common mistake:** Trusting the controller "OFF" button — it stops the compressor but the control board and terminals stay live.



## 10.2 Pressure, brazing and fire safety

**Key idea: Refrigerant circuits store energy as pressure, and brazing adds open flame — control both before you start.**

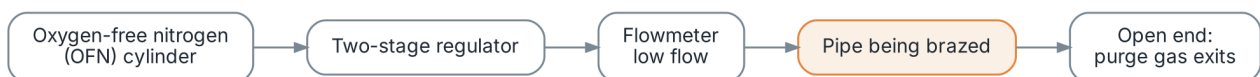
A refrigerant circuit is a sealed pressure vessel. High-side pressure is typically 15–25 bar on R134a systems and 25–40 bar on R410A/R32 heat pumps and can exceed 100 bar on CO<sub>2</sub> systems. A loose flare or a cut pipe under pressure can whip, freeze skin or blow oil into eyes.

A pressure cooker is a good comparison. You never open the lid while it is whistling; you let pressure fall first. Treat every circuit the same way.

Brazing joins copper pipes with a filler rod at roughly 600–800 °C (typical). Blow dry nitrogen (oxygen-free nitrogen, OFN) through the pipe at low flow while brazing. This stops black copper oxide forming inside, which later blocks filters and expansion valves.

Never braise a circuit that still holds refrigerant or oil. Heat can raise pressure, and some refrigerants break down into toxic acids in a flame.

### Nitrogen purge while brazing



Nitrogen purge while brazing

| Test                     | Purpose                           | Typical medium                         | Note                                                           |
|--------------------------|-----------------------------------|----------------------------------------|----------------------------------------------------------------|
| Strength / pressure test | Prove joints hold design pressure | Dry nitrogen                           | Use regulator and relief valve; never oxygen or compressed air |
| Leak test (standing)     | Find leaks                        | Dry nitrogen, sometimes with trace gas | Hold for a set time, correct for temperature                   |
| Evacuation               | Remove air and moisture           | Vacuum pump                            | Typical target below 500 micron                                |

### Worked example — pressure change with temperature during a standing test

A circuit is filled with nitrogen to 30 bar(g) at 25 °C in Chennai. Next morning it reads 29.2 bar(g) at 20 °C. Is it leaking?

$$\frac{P_2}{T_2} = \frac{P_1}{T_1} \quad (\text{absolute pressure, kelvin})$$

- $P_1 = 30 + 1 = 31 \text{ bar(a)}$ ;  $T_1 = 298 \text{ K}$ ;  $T_2 = 293 \text{ K}$ .
- Expected  $P_2 = 31 \times 293 / 298 = 30.48 \text{ bar(a)} = 29.48 \text{ bar(g)}$ .
- Measured 29.2 bar(g) is 0.28 bar lower than expected — a small leak is likely. Re-check joints with soap solution.

### Fire safety on site

- Hot-work permit where the site requires it.
- Keep a dry-powder or CO<sub>2</sub> extinguisher within reach.

- Remove or shield combustibles; use a heat mat.
- Stay 30 minutes after brazing to watch for smouldering (typical site rule).

**Remember**

- Recover refrigerant and depressurise before cutting or brazing.
- Always flow nitrogen while brazing; never use oxygen to pressure test.
- Use a regulator on every nitrogen cylinder.
- Correct standing-test readings for temperature.

**Field tip:** Wear safety glasses and gloves for all refrigerant work — liquid refrigerant flashing on skin causes frostbite in seconds.



## 10.3 Refrigerant safety classes: A1, A2L, A3

**Key idea: A refrigerant's safety class — a letter for toxicity and a number for flammability — tells you how carefully to handle it.**

ISO 817 and ASHRAE Standard 34 classify refrigerants with a two-part code. The letter shows toxicity: A is lower toxicity, B is higher toxicity. The number shows flammability: 1 no flame propagation, 2L lower flammability with slow burning speed, 2 flammable, 3 higher flammability.

So R32 is "A2L": low toxicity, mildly flammable. R717 (ammonia) is "B2L": higher toxicity, mildly flammable.

GWP (global warming potential) compares how much heat a gas traps over 100 years with CO<sub>2</sub>, which is 1. AR4 and AR5 are two IPCC assessment reports; they give slightly different values.

### Refrigerant safety classes (ISO 817 / ASHRAE 34)

Flammability ↓ / Toxicity →

**A lower toxicity**

**B higher toxicity**

**3 higher flammability**

R290 (propane)  
R600a (isobutane)

—

**2 flammable**

R152a

—

**2L lower flammability**

R32, R1234yf,  
R1234ze(E)

R717 (ammonia)

**1 no flame propagation**

R134a, R410A, R407C,  
R513A, R744 (CO<sub>2</sub>)

R123

Refrigerant safety classes

| Flammability \ Toxicity  | A — lower toxicity                                  | B — higher toxicity |
|--------------------------|-----------------------------------------------------|---------------------|
| 3 — higher flammability  | R290 (propane), R600a                               | —                   |
| 2 — flammable            | R152a                                               | —                   |
| 2L — lower flammability  | R32, R1234yf, R1234ze(E)                            | R717 (ammonia)      |
| 1 — no flame propagation | R134a, R410A, R407C, R513A, R744 (CO <sub>2</sub> ) | R123                |

Read the class as two parts: the letter is toxicity, the number is flammability.

**Refrigerant comparison (GWP values approximate, 100-year)**

| Refrigerant             | Type          | GWP AR4 (approx.) | GWP AR5 (approx.) | Safety class | Typical use                                           |
|-------------------------|---------------|-------------------|-------------------|--------------|-------------------------------------------------------|
| R134a                   | HFC           | 1430              | 1300              | A1           | Chillers, high-temperature heat pumps, car AC (older) |
| R410A                   | HFC blend     | 2090              | 1920              | A1           | Split AC, air-to-water heat pumps (older designs)     |
| R407C                   | HFC blend     | 1770              | 1620              | A1           | Retrofit of R22 systems, water chillers               |
| R32                     | HFC           | 675               | 677               | A2L          | Split AC, modern air-to-water heat pumps              |
| R513A                   | HFO/HFC blend | ~630              | ~570              | A1           | R134a replacement in chillers                         |
| R1234yf                 | HFO           | ~4                | <1                | A2L          | Car AC, some chillers                                 |
| R1234ze(E)              | HFO           | ~7                | <1                | A2L          | Chillers, high-temperature heat pumps                 |
| R290                    | Hydrocarbon   | 3                 | ~3                | A3           | Monobloc heat pumps, small commercial units           |
| R744 (CO <sub>2</sub> ) | Natural       | 1                 | 1                 | A1           | Hot water heat pumps, supermarket refrigeration       |
| R717 (ammonia)          | Natural       | 0                 | 0                 | B2L          | Industrial refrigeration, large heat pumps            |

### Remember

- Letter = toxicity (A lower, B higher); number = flammability (1, 2L, 2, 3).
- A2L refrigerants burn slowly but still need ignition control.
- Low GWP often means some flammability or high pressure — a trade-off.
- Check the nameplate class before you choose tools or work method.

**Common mistake:** Assuming "A1" means harmless — any refrigerant displaces oxygen in a small closed room.

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## 10.4 Working with flammable refrigerants (R290 and others)

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**Key idea: With A3 and A2L refrigerants, keep gas below its lower flammable limit and keep every ignition source away.**

R290 is propane, the same gas family as LPG. It has excellent efficiency and very low GWP. But a leak can form a burnable mixture with air.

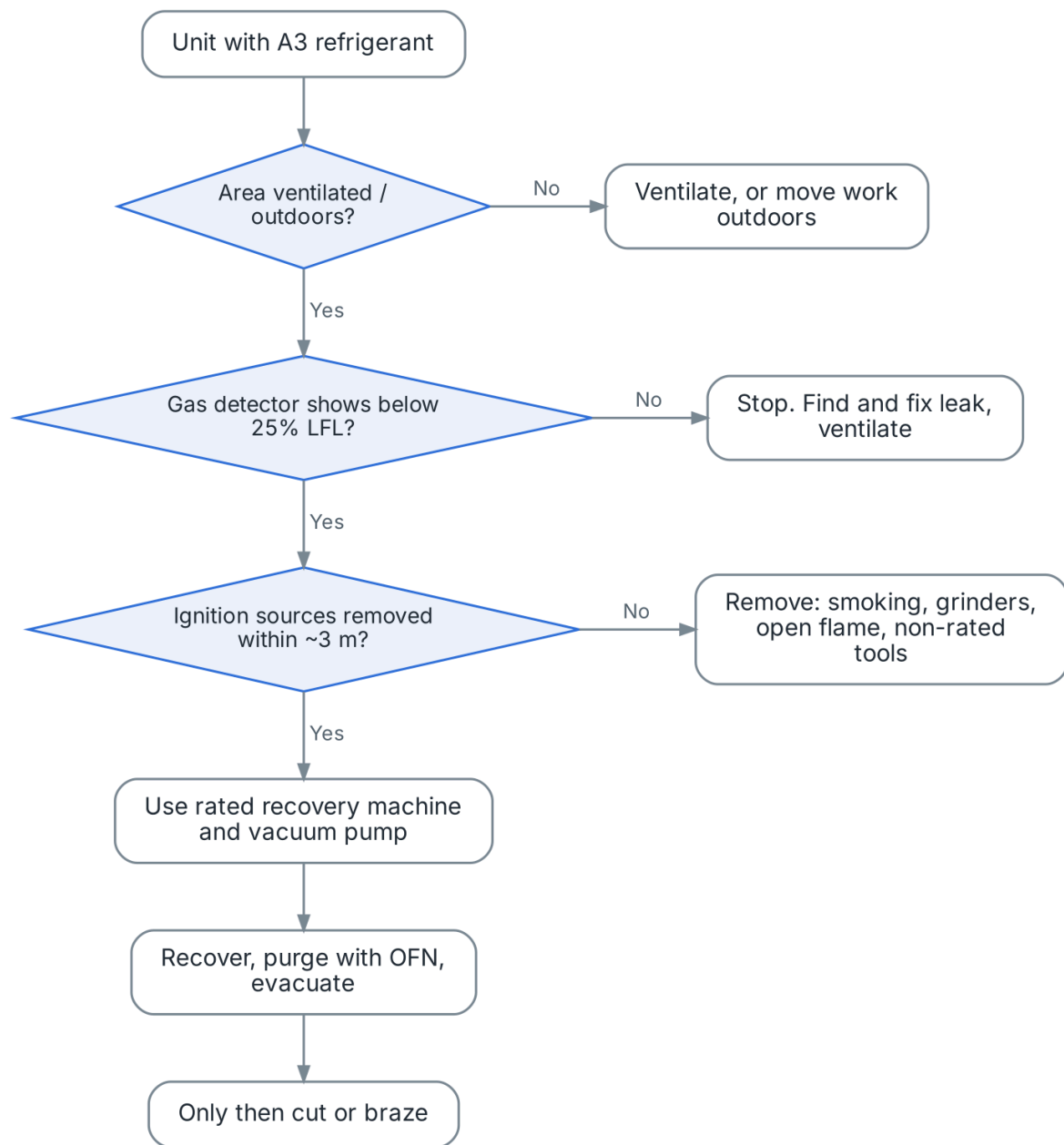
The lower flammability limit (LFL) is the lowest gas-in-air concentration that can burn. For R290 it is about 2.1 % by volume (typical value). Below LFL the mix is too lean to burn.

Propane is heavier than air. Like LPG from a leaking cylinder, it collects at floor level and in pits.

Charge size limits exist in product and installation standards. Indoor parts usually carry small charges; larger charges sit outdoors in monobloc units. Follow the manufacturer's limits.



## Before opening an R290 (A3) circuit



Before opening an R290 (A3) circuit

| Rule         | R290 (A3)                                   | R32 (A2L)               |
|--------------|---------------------------------------------|-------------------------|
| Gas detector | Always, set for hydrocarbons                | Always, suitable sensor |
| Tools        | Spark-free recovery unit and vacuum pump    | Rated for A2L           |
| Ventilation  | Essential; gas sinks to floor               | Essential               |
| Brazing      | Only after recovery and nitrogen purge      | Same                    |
| Cylinder     | Marked for flammable gas, red band or label | Flammable label         |

### Remember

- Use a calibrated gas detector before and during work.

- No smoking, no open flame, no sparking tools in the work zone.
- Recover and purge with nitrogen before any hot work.
- Store and transport cylinders upright, ventilated, away from heat.
- Respect the manufacturer's charge limits.

**Field tip:** Keep the gas detector at ankle height — propane settles low.



## 10.5 CO<sub>2</sub> (R744) systems

**Key idea: CO<sub>2</sub> is non-flammable and has GWP 1, but it runs at very high pressure and often above its critical point.**

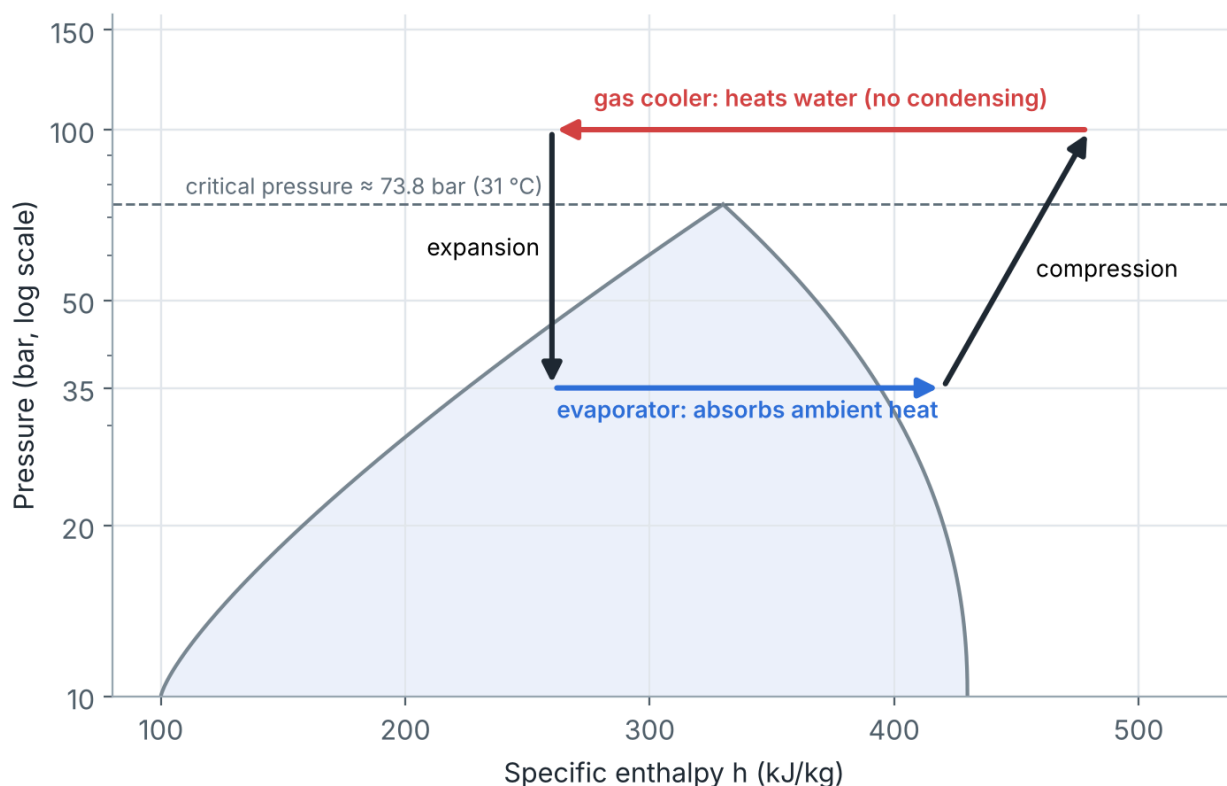
CO<sub>2</sub>'s critical point is about 31 °C and 73.8 bar. Above this point there is no separate liquid and vapour. Heat is rejected in a "gas cooler" instead of a condenser.

This is called a transcritical cycle. Because the hot gas cools over a wide temperature glide, CO<sub>2</sub> heats water very well from a cold inlet to 65–90 °C. That suits sanitary hot water.

Typical pressures (approximate): gas cooler side 80–130 bar, evaporator side 25–45 bar. Standstill pressure on a warm Indian day can exceed 60 bar.

### CO<sub>2</sub> (R744) transcritical cycle

Sketch, not to scale. Heat rejection happens above the critical point, in a gas cooler.



CO<sub>2</sub> transcritical cycle

| Property             | R744 (CO <sub>2</sub> )                 | R410A (for comparison, typical) |
|----------------------|-----------------------------------------|---------------------------------|
| Safety class         | A1                                      | A1                              |
| GWP                  | 1                                       | ~2000                           |
| High-side pressure   | 80–130 bar                              | 25–35 bar                       |
| Critical temperature | ~31 °C                                  | ~71 °C                          |
| Best use             | Hot water, large water temperature lift | Space heating and cooling       |

Safety: high pressure needs rated pipes, fittings and gauges. CO<sub>2</sub> is heavier than air and displaces oxygen in pits and plant rooms. Dry ice can form when liquid CO<sub>2</sub> is vented quickly, blocking lines.

**Remember**

- Use gauges and hoses rated for CO<sub>2</sub> pressures.
- Vent CO<sub>2</sub> slowly to avoid dry ice formation.
- Fit a CO<sub>2</sub> detector in enclosed plant rooms.
- Efficiency depends strongly on cold water inlet temperature.

**Common mistake:** Using a standard HFC manifold on a CO<sub>2</sub> system — it is not rated for the pressure.



## 10.6 Recovery, recycling and disposal of refrigerants

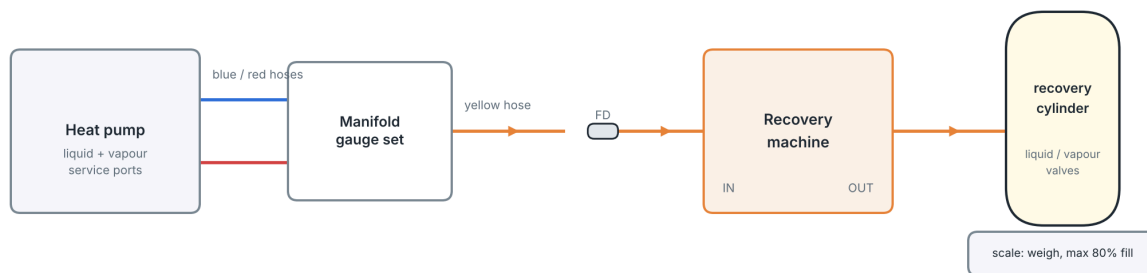
**Key idea: Refrigerant is never vented — it is recovered into a rated cylinder, then recycled, reclaimed or destroyed.**

Recovery means removing refrigerant from a system into a cylinder. Recycling means cleaning it on site (oil and moisture removal) for reuse in the same owner's system. Reclaim means reprocessing it at a facility to new-product purity. Destruction means breaking it down in an approved plant.

Venting HFCs harms the climate. Venting hydrocarbons creates a fire risk. Recover everything except where a procedure specifically permits controlled venting of hydrocarbons outdoors.

### Connecting a recovery machine

Recover into a dedicated cylinder on a scale; never fill above 80%



### Connecting a recovery machine

Recover liquid first (faster), then vapour. The cylinder sits on a scale. Use a cylinder rated and labelled for the refrigerant.

#### Worked example — maximum safe fill of a recovery cylinder

A recovery cylinder has a water capacity of 12 L. You recover R32 with liquid density about 0.96 kg/L (typical at room temperature). Use the 80 % fill rule.

$$m_{max} = V_{water} \times \rho_{liquid} \times 0.8$$

- $m_{max} = 12 \times 0.96 \times 0.8 = 9.2$  kg (approximately).
- If the empty cylinder (tare) weighs 9 kg, stop recovery at 18.2 kg gross on the scale.

| Step | Action                                                               |
|------|----------------------------------------------------------------------|
| 1    | Identify refrigerant from nameplate; never mix types in one cylinder |
| 2    | Weigh empty cylinder, evacuate it                                    |
| 3    | Connect as diagram; purge hose air                                   |
| 4    | Recover liquid, then vapour, to the target vacuum                    |
| 5    | Close valves, label cylinder: refrigerant, weight, date, site        |
| 6    | Record in service log; send for reclaim or destruction               |

### Remember

- One refrigerant per cylinder; label it.
- Never fill beyond 80 % of liquid capacity.
- Use a recovery machine rated for the refrigerant class (A2L/A3).
- Keep records of quantities recovered.

**Field tip:** Chill the recovery cylinder (shade, wet cloth) in Indian summers — a cooler cylinder speeds recovery.



## 10.7 The Kigali Amendment, HFC phase-down and the India Cooling Action Plan

**Key idea: World rules now cut HFC use step by step, so low-GWP and natural refrigerants are the long-term direction.**

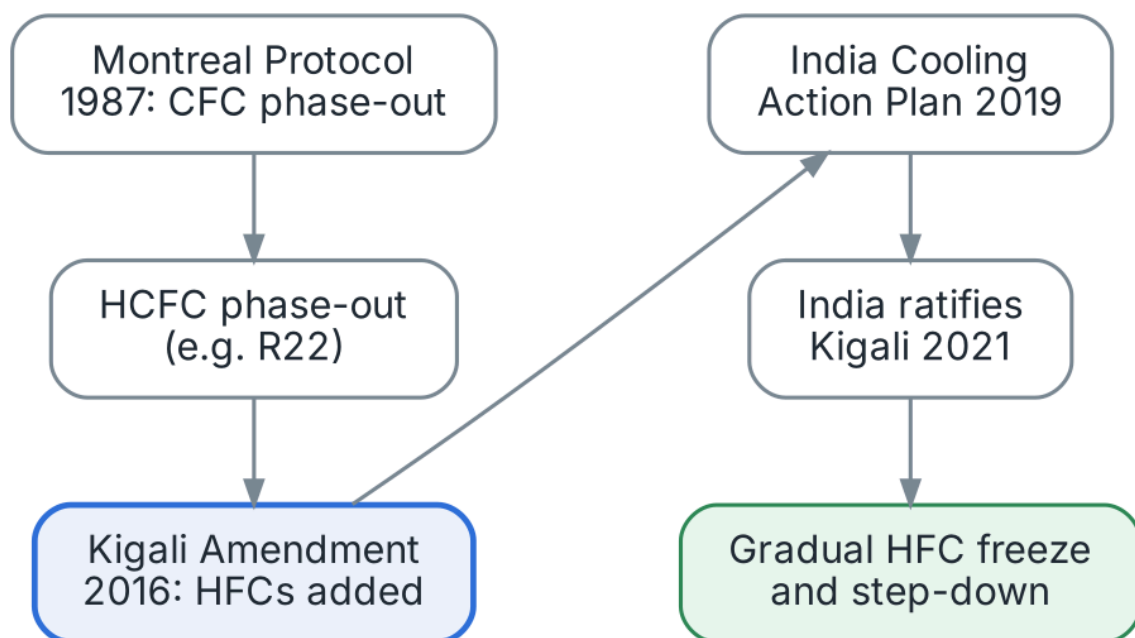
The Montreal Protocol (1987) is the treaty that phased out ozone-depleting gases like CFCs and HCFCs (e.g. R22). It is often called the most successful environmental treaty.

The Kigali Amendment (agreed in 2016 in Kigali, Rwanda) added HFCs to the Montreal Protocol. HFCs do not harm ozone but are strong greenhouse gases. Countries agreed to freeze, then gradually reduce, HFC production and use.

Countries are grouped with different timelines. Developed countries started first. India is in a group of developing countries with a later freeze and slower reduction. India ratified the amendment in 2021.

The India Cooling Action Plan (ICAP), released by the Ministry of Environment, Forest and Climate Change in 2019, looks 20 years ahead. It aims to reduce cooling demand and refrigerant demand, improve efficiency, and train and certify service technicians.

### From ozone to climate: the refrigerant rules



From ozone to climate: the refrigerant rules

| Gas family | Example          | Ozone harm | Climate impact | Status direction        |
|------------|------------------|------------|----------------|-------------------------|
| CFC        | R12              | High       | Very high      | Phased out              |
| HCFC       | R22              | Moderate   | High           | Being phased out        |
| HFC        | R134a, R410A     | None       | High           | Phase-down under Kigali |
| HFO        | R1234yf          | None       | Very low       | Growing                 |
| Natural    | R290, R744, R717 | None       | Very low       | Growing                 |

### Remember

- Montreal handled ozone; Kigali extended it to HFCs for climate.
- India follows a later, gradual HFC timeline.
- ICAP stresses efficiency, lower demand and technician training.
- Skills for A2L, A3 and CO<sub>2</sub> will be in steady demand.

**Field tip:** Good recovery and leak-free installation are the technician's direct contribution to the phase-down.



## 10.8 Test and rating standards: BIS, EN 14511, EN 16147, ISO 13256, AHRI

**Key idea: A rated capacity or COP only means something if you know which standard and which test conditions produced it.**

A test standard fixes how a unit is measured: air and water temperatures, flow, tolerance and instruments. Two units can only be compared fairly when tested to the same standard at the same conditions.

Think of a car's fuel mileage. A highway figure and a city figure differ for the same car. Heat pump COP changes the same way with source and sink temperatures.

### How a standard becomes a datasheet number



How a standard becomes a datasheet number

| Standard               | Body / region                                               | What it covers (general)                                                                                                                    |
|------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| BIS (Indian Standards) | Bureau of Indian Standards, India                           | Indian standards for safety and performance of air conditioners, heat pumps and electrical appliances; some products need BIS certification |
| EN 14511               | European (CEN)                                              | Rating of capacity and COP/EER of air conditioners, chillers and heat pumps (air and water sources) at defined conditions                   |
| EN 16147               | European (CEN)                                              | Testing of heat pumps for domestic hot water, including tapping cycles and water heating COP                                                |
| ISO 13256              | International (ISO)                                         | Rating of water-source and ground-source (brine) heat pumps                                                                                 |
| AHRI standards         | Air-Conditioning, Heating, and Refrigeration Institute, USA | Performance rating of HVAC and heat pump equipment; certification directory in North America                                                |
| ISO 817 / ASHRAE 34    | ISO / ASHRAE                                                | Refrigerant designation and safety classification (from 10.3)                                                                               |
| ISO 5149 / EN 378      | ISO / CEN                                                   | Safety and environmental requirements for refrigerating systems and heat pumps                                                              |

Condition shorthand: "A7/W35" means outdoor air 7 °C, water leaving at 35 °C. "W10/W35" means source water 10 °C, leaving water 35 °C. "B0/W35" means brine 0 °C.

### Worked example — reading a rating

A datasheet says: heating capacity 10 kW, power input 2.5 kW at A7/W35, and 9 kW, 3.2 kW at A7/W55.

$$COP = \frac{Q_{heat}}{P_{electric}}$$

- At A7/W35:  $COP = 10 / 2.5 = 4.0$ .

- At A7/W55:  $\text{COP} = 9 / 3.2 = 2.8$ .
- For hot water at 55 °C in Pune, use COP 2.8, not 4.0. At ₹9/kWh (example rate), 100 kWh of heat costs  $100 / 2.8 \times 9 = ₹321$ , not ₹225.

#### Remember

- Always quote the test condition with any COP.
- EN 14511 for space heating/cooling ratings; EN 16147 for domestic hot water.
- ISO 13256 for water- and ground-source units.
- Check whether BIS certification applies to the product in India.

**Common mistake:** Comparing one unit's A7/W35 COP with another unit's A7/W55 COP.



## Quiz 10

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1. What is the correct order in LOTO? A) Lock, isolate, test, tag B) Isolate, lock, tag, prove dead C) Test, tag, isolate, lock D) Tag, isolate, work, lock
2. Why wait after switching off an inverter heat pump? A) Fan must stop cooling B) DC bus capacitors hold charge C) Refrigerant must settle D) Controller must save data
3. Which gas is used to pressure test a refrigerant circuit? A) Oxygen B) Compressed air C) Dry nitrogen D) LPG
4. In "A2L", what does "A" mean? A) Approved B) Lower toxicity C) Air-cooled D) High flammability
5. Which refrigerant is class A3? A) R32 B) R744 C) R290 D) R134a
6. Which refrigerant is B2L? A) R717 B) R410A C) R1234yf D) R513A
7. Where does leaked R290 collect? A) Ceiling B) Evenly in room C) Floor level and pits D) Outside only
8. Approximate critical temperature of CO<sub>2</sub>? A) 0 °C B) 31 °C C) 71 °C D) 100 °C
9. Maximum liquid fill of a recovery cylinder? A) 50 % B) 80 % C) 95 % D) 100 %
10. Which standard covers domestic hot water heat pump testing? A) EN 16147 B) ISO 13256 C) ISO 817 D) EN 378

### Answer key

1. B — isolate first, then lock, tag and prove dead before work.
2. B — inverter capacitors stay charged after power-off.
3. C — dry nitrogen is inert and dry; oxygen and air are dangerous.
4. B — A = lower toxicity class.
5. C — R290 (propane) is higher flammability, A3.
6. A — ammonia is higher toxicity and lower flammability.
7. C — propane is heavier than air.
8. B — about 31 °C (at about 73.8 bar).
9. B — 80 % leaves room for liquid expansion with heat.
10. A — EN 16147 covers domestic hot water heat pumps.

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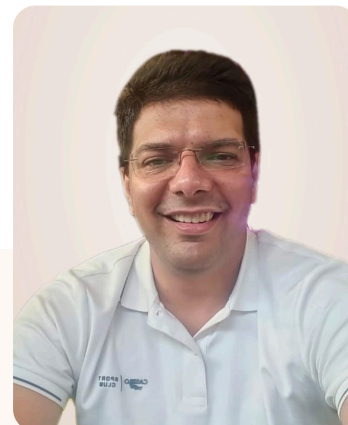
## Glossary

| Term             | Meaning                                                                            |
|------------------|------------------------------------------------------------------------------------|
| LOTO             | Lock-out/tag-out: personal lock and label that keep equipment isolated during work |
| DC bus capacitor | Energy-storing part in an inverter drive that stays charged after power-off        |
| RCD / RCCB       | Device that trips when current leaks to earth                                      |
| OFN              | Oxygen-free (dry) nitrogen used for purging and pressure testing                   |
| Brazing          | Joining metals with a filler rod above about 450 °C                                |
| Safety class     | ISO 817 / ASHRAE 34 code: toxicity letter plus flammability number                 |
| A2L              | Lower toxicity, lower flammability with slow burning speed                         |
| LFL              | Lower flammability limit: lowest gas-in-air concentration that can burn            |
| GWP              | Global warming potential, compared with CO <sub>2</sub> = 1 over 100 years         |
| AR4 / AR5        | IPCC assessment reports giving GWP values                                          |
| Transcritical    | Cycle with heat rejection above the critical point                                 |
| Gas cooler       | Heat exchanger replacing the condenser in a transcritical CO <sub>2</sub> cycle    |
| Critical point   | Temperature/pressure above which liquid and vapour cannot be told apart            |
| Recovery         | Removing refrigerant from a system into a cylinder                                 |
| Recycling        | On-site cleaning of recovered refrigerant for reuse                                |
| Reclaim          | Reprocessing refrigerant at a facility to new-product purity                       |
| Kigali Amendment | 2016 addition to the Montreal Protocol to phase down HFCs                          |
| ICAP             | India Cooling Action Plan, 20-year national cooling roadmap                        |
| EN 14511         | European standard for rating heat pump and AC capacity and efficiency              |
| EN 16147         | European standard for testing domestic hot water heat pumps                        |
| ISO 13256        | International standard for rating water- and ground-source heat pumps              |
| COP              | Coefficient of performance: heat output divided by electrical input                |

## ABOUT THE AUTHOR

# Kashyap Anandpara

Founder Director, Sunniva Encon LLP



*It started as an instinct. In 2012 I wanted to do something in energy conservation. That was the whole of it. There was no plan to build machines, and no plan to build them in India. Both came later.*

Kashyap founded Sunniva Encon in 2012 to work on energy conservation. The company now designs and builds heat pumps at its own factory in Asangaon, Maharashtra, with its office in Mumbai, and supplies hot water, space heating and process heat systems across India, including remote, high-altitude sites.

Over these years he has seen heat pumps chosen, sized, installed and serviced in every kind of Indian condition, and seen how often good machines are let down by poor selection, rushed installation or missing maintenance. Most of those problems come from knowledge that is not widely taught.

This program is his answer: an open, vendor-neutral course that shares that knowledge with students, technicians, installers, consultants and facility teams. It teaches the technology, not a brand. The lessons carry no product names or sales claims; Sunniva's part is only to make the material available.

- Founder Director, Sunniva Encon LLP, since 2012
- More than 5,000 heat pump installations across India
- Own heat pump factory in Asangaon, Maharashtra, built for 2,000 machines a year
- Nationwide service network reaching sites as remote as Leh

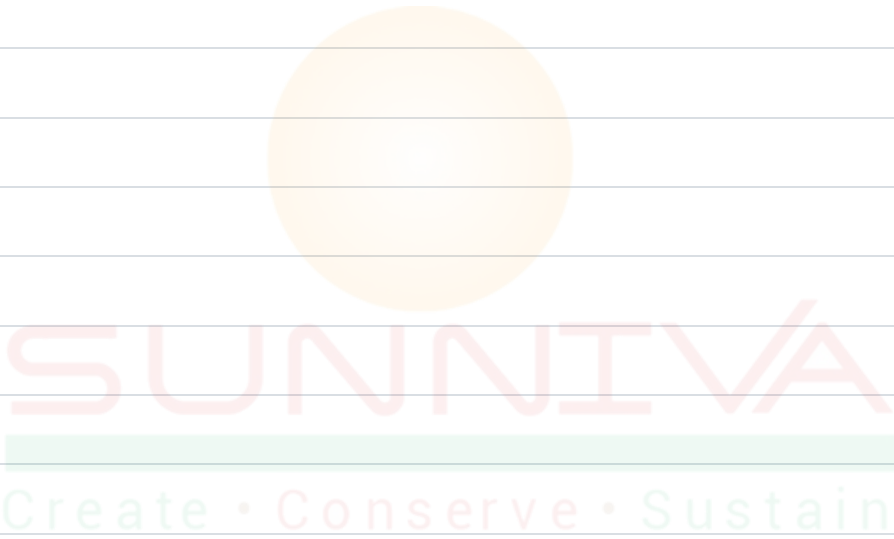
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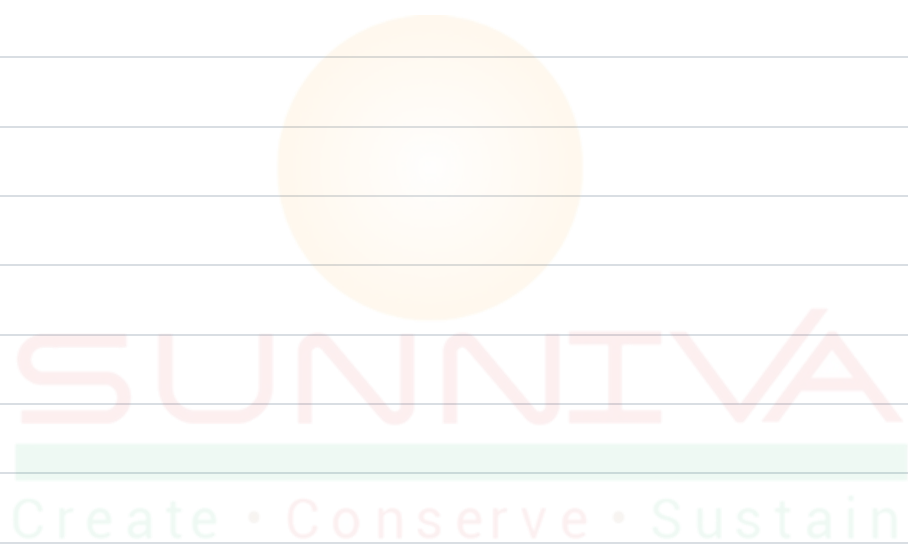
### Website

[sunnivaencon.com](https://sunnivaencon.com)

NOTES



NOTES





# THANK YOU.

Thank you for learning with us. Questions, corrections and suggestions for the next edition are welcome.

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