U-3ARC TRAINING WEBINAR Nº 3

GOOD PRACTICES IN RAC

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SEPTEMBER 12TH 2021

INTRODUCTION

We are all part of the RAC sector

We design, install, maintain, service, repair, or use refrigeration appliances

But have we ever taken a step back, paused for a moment, and thought about just how IMPORATNT is refrigeration in our day-to-day life?

Let’s get started

OVERWIEW

- Refrigeration and Air Conditioning are essentials to Modern Life
- Indeed, refrigeration is fundamental to business, health, food, comfortable living
- It's one of the pillars of modernity.
- Refrigeration is vital for the food, chemical, plastic and building industries.
- Other advanced industries (such as electronic-data processing or biotechnologies) could not operate without refrigeration.
- Air conditioning is not only important for human health and well-being, and work efficiency, but it also has a major influence in the industrial area, in particular in the high-tech sectors, including Information Technology.
- However, there are adverse effects of refrigeration that must also be addressed.

FACTS I

➢ Environnemental Impact

1) Refrigeration equipment impact the environment through refrigerant leakage by using the most common refrigerants CFCs, HCFCs, HFCs with high ozone-depleting potential (ODP) and / or global warming potential (GWP).

- ❖ Direct emissions.

2) Refrigeration equipment uses electricity to operate.
Electricity consumption can be increased by many factors: Incorrect charge

- ❖ Indirect emissions.

FACTS II

- **RAC sector consumes about 19% of the overall electricity used worldwide. (IIR)**
- With all this in mind, it's crucial to employ RAC best practices
- Have the right approach throughout the lifecycle of your equipment
- From design, through install to service and maintenance
- That's what we are going to look at.

AREAS OF FOCUS

- Design
- Installation
- Service & Maintenance

DESIGN

- Carefully select the right components
- System should provide maximum efficiency
- Avoid leakage.
- Consider life cycle cost and not capital cost
- New systems should last up to 20 years

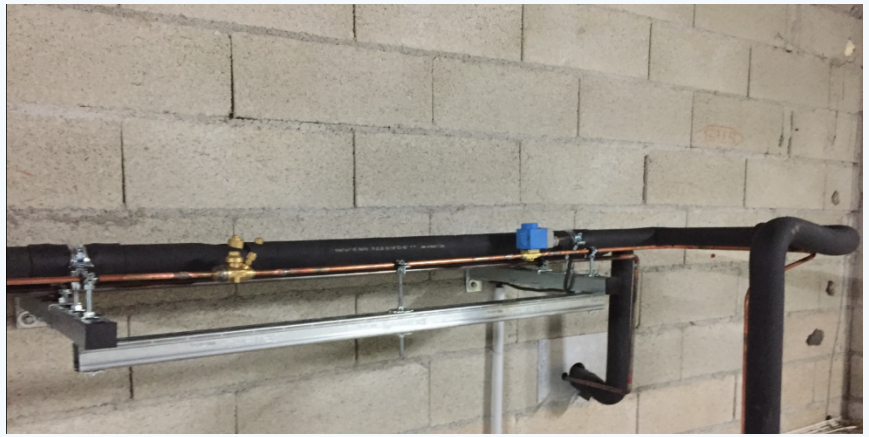
DESIGN

DESIGN OUT LEAK

- Avoiding leakages should be considered a high priority
- Follow good design standards
- Easy access to pipework
- Pipework joints (consider brazing instead of flares)
- Eliminate or reduce vibration and stress
- Fixed leak detection for large systems

INSTALLATION & COMMISSIONING

- Beside the installation of the main refrigeration system components, the refrigerant pipe work has to be carried out in a perfect clean and proper manner
- Consider the shortest pipe run possible
- Use adequate pipe fixations
- Avoid long risers
- Consider trap for good oil return



INSTALLATION & COMMISSIONING

- Use good brazing method
- Introduction Nitrogen (OFN) as protective gas (very low flow rate inside the pipe assembly during brazing process) to avoid oxidation.
- Purging refrigerant pipelines whilst brazing with dry Nitrogen.

INSTALLATION & COMMISSIONING

- Pressure tests:
-
- Refer to the correct standards

  - Strength test 1,3 Maximum Operating Pressure (1 H)
  - Leak test 1,1 Maximum Operating Pressure (24 H)

  Ex: A system that has 10 Bar as maximum pressure
  Strength test 10 X 1.3 = 13 Bars for 1H
  Leak test 10 X 1.1 = 11 Bars for 24H

- Use OFN for pressure test with correct accessories

- **Do not use compressed air of Refrigerant to pressure test a system (moisture)**

INSTALLATION & COMMISSIONING

- Evacuation : Why do we need to evacuate an air conditioning system or a refrigeration system?

  - All the refrigeration systems are designed to run without moisture and non-condensable gases; else it may not work as designed and is likely to fail prematurely.

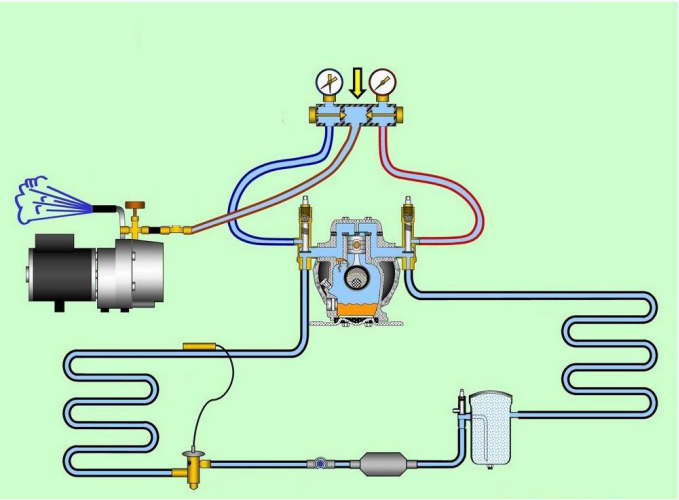
  - It may cause restrictions on various places like expansion valves, evaporator coils, reducing the overall cooling effect.

  - In case of a hermetic compressor it may cause deterioration of the insulation winding, leading to a short circuit and compressor motor burnout.

INSTALLATION & COMMISSIONING

- Evacuation :

  Use vacuum pump (two stage is possible)
  Do not use refrigeration compressor



- If possible, evacuate on both (high and low pressure) sides.

- Measure the pressure with a vacuum gauge in the system and not at the vacuum pump

- Refer to the chart for the correct pressure after vacuum

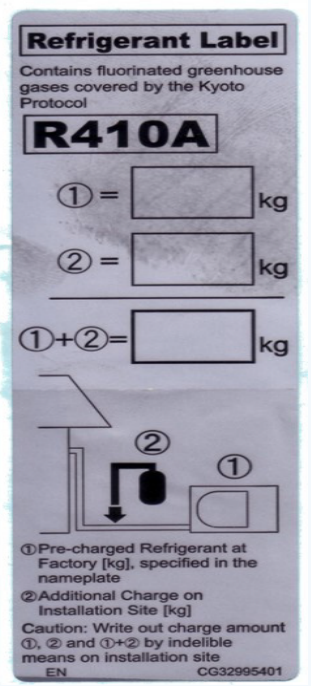
Température (°C)	Pression de vapeur saturante (mbar)	Pression de vapeur saturante (Pascals)
-60	0,001	0,1
-40	0,13	13
-20	1,03	103
-10	2,6	260
0	6,1	610
5	8,72	872
10	12,3	1230
15	17	1700
20	23,4	2340
25	31,7	3170
30	42,4	4240
40	73,8	7380
50	123	12300
60	199	19900
100	1013	101300

INSTALLATION & COMMISSIONING

➢ Charging refrigerants :

- Break the final vacuum by charging liquid refrigerant into the receiver outlet valve access or the area of liquid line downstream from the receiver outlet.
- Charge the exact amount of refrigerant(use weighing scale)
- Follow the correct charging procedures
- Some refrigerant (Blend) need to be charged in liquid state

➢ Different refrigerants = different working pressures



SERVICE & MAINTENACE

- A system is only as good as the new if it is maintained correctly
- The servicing and maintenance of refrigeration systems is as important as the initial design of the system.
- This activity plays a crucial role in ensuring that systems operate:
  - At their design efficiency
  - Remain leak tight.

SERVICE & MAINTENANCE

Good Practices:

➢Adapt the required operating conditions :

(up to 3% reduction in power consumption for 1°K increase in evaporating temperature)

➢Good maintenance
(10 to 20 % capacity loss due to blocked condenser)

SERVICE & MAINTENANCE

Good Practices:

- ➢Alaways check the operating data of a system
- ➢Adapt the condensing temperature depending on the season (Variable HP can lead to 25% saving on power consumption)
- ➢Use free cooling whenever is possible.

SERVICE & MAINTENANCE

➢ **The true cost of leakage (Consequences):**

❖ **Direct cost**

- Labor to fix the repair.
- The cost of new refrigerant.
- System down time
- Loss of products

SERVICE & MAINTENANCE

➢ **The true cost of leakage (Consequences):**

❖ **Indirect costs**

- Increased energy use
- Dammage to the equipment
- Shorter life cycle
- Reputation damage

A small action can have big consequences

RECOMMENDATIONS

We all have a part to play in reducing carbon emissions from refrigerating systems by:

- ➢ Regular leak testing
- ➢ Maintaining records
- ➢ Refrigerant recovery
- ➢ Labelling
- ➢ Training and certification
- ➢ Obtain the correct tooling

THE ENVIRONMENTAL IMPACT OF LEAKING REFRIGERANT FROM A SYSTEM

Take a look at what happens when just 1 kg of R404A is released.

1 kg R404A is equivalent released to driving a van about 20,000 km.

This is based on the following assumptions and conversion factors from the UK Carbon Trust website (www.carbontrust.co.uk):
14 km per litre fuel consumption (about right for a small van) .

1 litre of diesel is equivalent to 2.67 kg CO2.

R404A GWP = 3922, i.e. 1 kg R404A has the same effect as 3,922 kg CO2.

So… 1 kg R404A = 3,922 kg CO2 = 20,565 km.

THANK YOU

ANY QUESTIONS

UNION OF ASSOCIATION OF AFRICAN ACTORS IN REFRIGERATION & AIR-CONDITIONING

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COOLING: THE KEY TO SUSTAINABLE DEVELOPMENT