R22 Phase out of Sabroe & York Marine refrigeration systems

Introduction

Environmental awareness and legislation requirements have increased the request for replacing R22 and ship owners & managers are looking for the best solutions for systems installed.

Questions raised:
- Which refrigerant to choose
- Impact on capacity & power consumption
- Accessibility

This information is our effort to give decision makers an insight to the approach Johnson Controls recommend is taken when considering phase out of R22.

Phase out of R22

Several refrigerants are available as replacement for R22. Some of these refrigerants are known as “direct replacement or drop in refrigerants”, and can in theory replace R22 without any modifications to the original installation.

Other replacements are the new HFC refrigerants like R134a and R404a that as a minimum require oil change and often system modifications as increase of swept volume, motor and starter replacement and change in pipe dimensions.

Commonly for all the replacement refrigerants available, is that a careful evaluation of the systems current design and performance is needed prior to selection.

A straightforward solution is not always available. The best choice depends on the specific equipment and is decided by a number of design criteria.

Evaporator type

The first deciding question for selecting a replacement refrigerant is if the system is equipped with a direct expansion (DX) or a flooded type evaporator.

Where all replacement refrigerants in principle can be used for a DX system, limitations exist when phasing out R22 in flooded systems. In flooded systems zoetrope refrigerant (refrigerants with glide) in general can’t be recommended due to the risk of fractation.

Some of the most common zoetrope refrigerants are known as R407C & ISCEON R417A & R422D.

Design pressure

Design pressure for the systems pressure vessels can limit the available alternatives to R134A and R417A which both have operating pressures that are lower than R22 but also are less effective in capacity.

Re-approval of pressure vessels or dispensation by the applicable authority can open for use of more suitable refrigerants. Basis for this option is that the same construction has been approved for a higher design pressure or has a design that can be documented applicable.

Documenting the design of a pressure vessel for a higher pressure requires many resources. This option should always be carefully considered in a dialog between the ship owner/manager, the applicable authority and the maker of the pressure vessel.

Utilization of design capacity and demand

Using alternative refrigerants in the same system can reduce the systems cooling capacity, especially when the refrigerant alternative is limited by the pressure vessel design and/or the evaporator is of the flooded type.

For some applications, a minor capacity loss can be acceptable. Capacity loss can also be acceptable if the utilization of the systems original design capacity allows it or available backup capacity can be included in the normal operation.

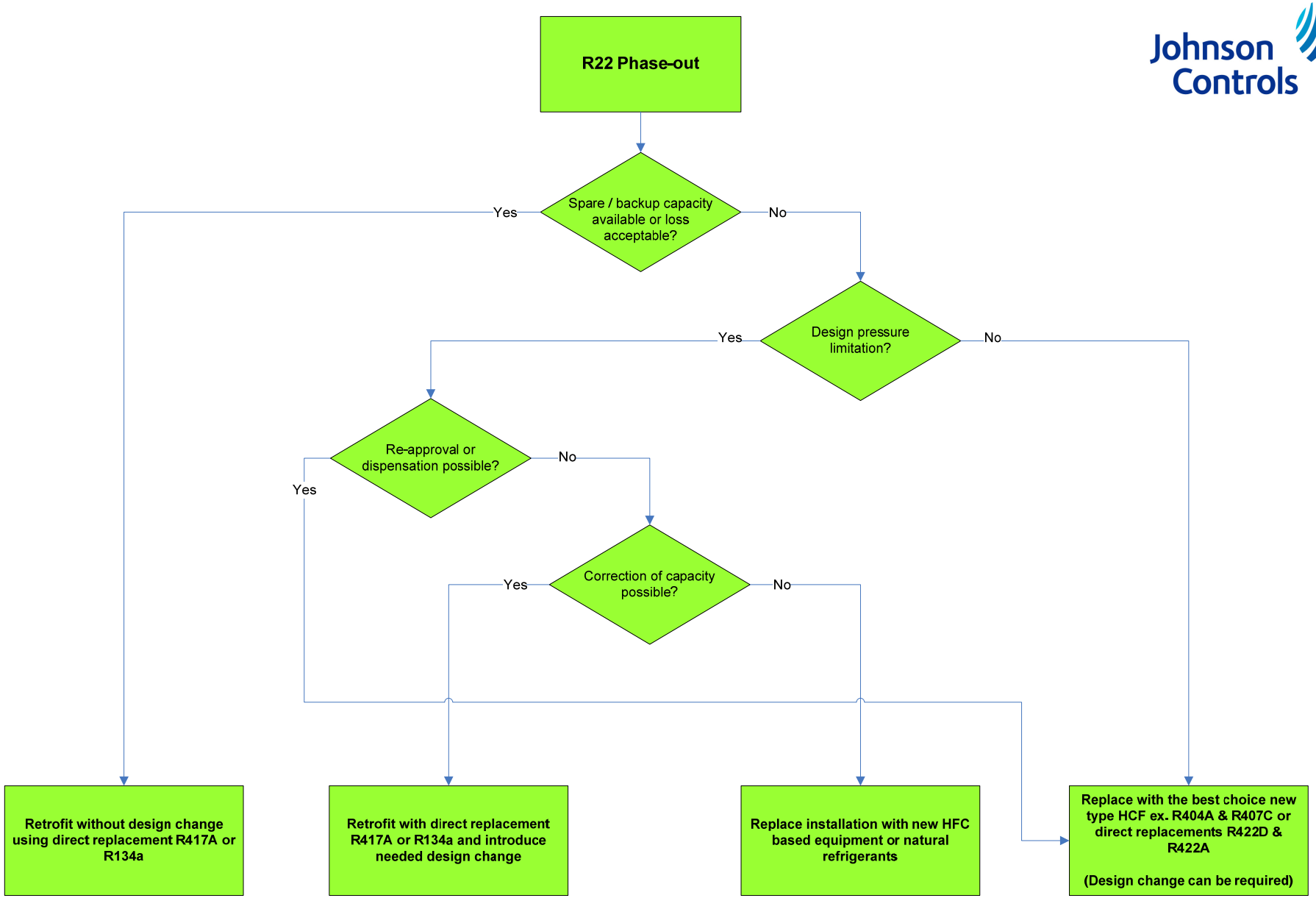
If a capacity reduction is unacceptable, it will in some situations be possible to correct the capacity loss by modifying the system with components that increase the systems capacity. In other situations a replacement of major sections of the system or a total replacement is required.

Approach

When contacting Johnson Controls Marine Service we will be ready to assist you in finding the best solution for your phase out challenge.

We often have most of the information needed to evaluate the system in our files. However, supplementary input on utilization of the installation, acceptable reduction of capacities if any, the general state of the plant as it is, outlook on expected lifetime, etc. will always be required in order to work out the best solution.

We recommend that a qualified engineer from one of our service branches attends the installation for an on site survey.



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