Assessing Retrofit Options

Factors to Consider

- Capacity
- Efficiency
- Resultant Mass Flow
- Equipment Changes
- Lubricant Compatibility
- Compressor Manufacturer Approval
- Global Warming Impact
- Disruptions to Store operations

Capacity

- The capacity of an existing refrigeration system is determined by the selected refrigerants (R22) refrigerating effect per lb circulated and the weight of refrigerant circulated per unit time.
  - The compressor(s) displacement was selected on R22 values resulting in the systems capacity at selected conditions.
  - Retrofit fluids with characteristics different that those of R22 will deliver different capacity values.
    - Gas volume at suction conditions
    - Enthalpy
    - Pressure drop effects
- Moderate capacity shortfalls of alternative refrigerants may be addressed with system modifications.
  - Modify operating conditions
  - sub cooling
- A thorough analysis of the thermodynamics, the existing system and compressor manufacturers data is warranted to predict a replacement refrigerants performance in **your** system.
  - Review compressor manufacturers data carefully , often the printed capacity is the result of standardized testing using high return gas temperatures and all superheat is calculated as useful cooling.

Efficiency

- COP – The coefficient of performance of a refrigeration cycle is the ratio of the heat absorbed to the heat energy equivalent of the energy supplied to the compressor.
  - Simple thermodynamic calculations can be and indicator of cycle efficiency.
  - System efficiency is the result of minimizing loses in the cycle by utilizing efficient compressors, narrowing compression ratios, minimizing pressure drop etc.
  - R22 is a good refrigerant , retrofitting to a refrigerant with properties as close to those of R22 may maintain system efficiency.
    - Some retrofit candidates benefit significantly by applying sub cooling which can help the low temperature system efficiency.

Mass Flow

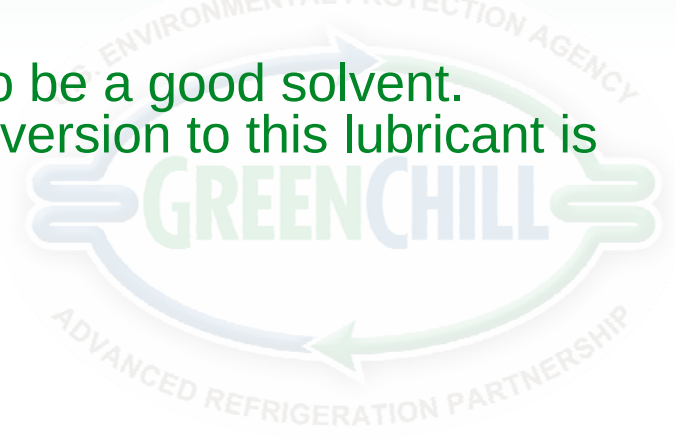
- A better expression would be “resultant mass flow”.
  - In a retrofit situation we are working with established compressor displacement selected to “pump” the proper amount of R22 to satisfy the refrigeration load.
    - Retrofit refrigerant selections with suction vapor volumes different than R22 will produce higher or lower resultant mass flows.
  - Significantly higher or lower mass flows can affect system performance.
    - TXV’s in particular may require changing if the mass flow varies significantly. (+ - 30%)
    - High mass flows may increase piping pressure losses and degrade system efficiency.

Equipment Change

- There is no “drop in” for R22 and the systems components must be evaluated when considering a retrofit fluid.
  - Consult compressor manufacturers for suitability of replacements in their units both from a materials compatibility and capacity standpoint. Motors and starters should also be evaluated.
  - Valve manufacturers should be consulted for operation suitability and materials of construction compatibility.
  - Pressure drop in evaporator distributors should be evaluated.
  - Elastomers-seals and gaskets must be changed during a retrofit.
  - While not a “change”. Retrofit candidates with high glide may require TXV adjustment.

Lubricant Compatibility

- In general, R22 systems utilize mineral oil and the oil /refrigerant relationship is well understood and system piping practices and oil separation technology is well established.
- HFC's and Synthetic lubricants were engineered to reproduce the HCFC/mineral oil relationship.
- HFC/HC Blends offer the possibility of using mineral oil with HFC's. This approach should be evaluated carefully and many supermarkets have successfully used various HFC/HC blends with mineral oil. In some cases the addition of synthetic lubricants to the mineral oil may be required to obtain adequate oil return.
- Compressor and system manufactures should be consulted when selecting lubricants.
- Synthetic lubricants (POE) have proven to be a good solvent. Monitoring system cleanliness after a conversion to this lubricant is warranted.



Compressor Manufacturers Approval

- Compressor manufacturers have established guidelines for retrofit fluids.
  - Warranties can be void if unapproved refrigerants or lubricants are used.
  - Some older compressor models are not suitable for HFC/synthetic lubricants.
  - Compressor manufacturers extensive reliability and capacity analysis is extremely useful in selecting a retrofit fluid.
    - Revised electrical data
    - Capacity tables
    - Lubricant recommendations

GWP

- While not a design or operational consideration the GWP of a replacement refrigerant should be considered when evaluating prospective retrofit candidates.
  - Possible regulatory action around the GWP of refrigerants in the future make the selection of fluids with lower values a prudent choice.
  - Reduction in carbon footprint
  - Commercial LEED certification is evolving
  - Opportunity to achieve GreenChill Certification with low GWP refrigerants

Disruption to Store Operations

- A refrigerant only retrofit could minimize sales floor disruption provided:
  - Retrofit fluid mass flow and pressures are close enough to those of R22 to avoid TXV changes.
  - Seal and gasket replacement is back room work.
  - Minimal or no re-piping is necessary