# B52 Information Bulletin

# Use of Hydrocarbon Refrigerants

## In New Equipment and as drop-in replacements for other classes of refrigerants in Existing Systems

CSA Standard B52-99, *Mechanical Refrigeration Code*, establishes requirements for the design, construction, installation and maintenance of mechanical refrigeration systems, so as to minimize the risk of injuries to workers and the general public.

CSA B52 has specific provisions for the use of hydrocarbon refrigerants. Currently, hydrocarbon refrigerants are being promoted as drop-in replacements to refrigeration systems that have been designed for other classes of refrigerants. Substitution of refrigerant type shall not be made without:

(a) permission of the regulatory authority when required;
(b) compliance with this Code; and
(c) verification of design compliance with the requirements of Item (b) by
  (i) the original equipment manufacturer; or
  (ii) a professional engineer.

Before substitution of refrigerants of any kind, and in this case, the use of hydrocarbons refrigerants, all individuals involved must review the following information carefully:

**Note**: *The following is an excerpt from CSA Standard B52 that provides clauses applicable to flammable refrigerants. For a copy of the full Standard, the Standard may be purchased from CSA at 1-800-463-6727 or (416) 747-4044 or shop online at* www.csa.ca

### 1. CSA B52 safety requirements

In addition to the equipment covered by Clause 4.2, equipment with a refrigerant charge not exceeding 3 kg (6.6 lb) and listed by an approved testing laboratory shall be deemed to meet the system application requirements when the equipment is installed in accordance with the listing specification.

CSA Standard B52 permits the use of hydrocarbon refrigerants under the following conditions:

Table 1 (excerpt)

| | | | Quantity of refrigerant per occupied space† | | |
|---|---|---|---|---|---|
| **Refrigerant name** | | **Chemical formula** | **kg/m$^3$**** | **Vol %** | **lb/1000 ft$^3$**** |
| Group A3 | | | | | |
| R-170 | Ethane | $CH_3CH_3$ | 0.0080 | 0.64 | 0.5 |
| R-290 | Propane | $CH_3CH_2CH_3$ | 0.0080 | 0.44 | 0.5 |
| R-1150 | Ethylene | $C_2H_4$ | 0.0061 | 0.52 | 0.4 |

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**Table 2** (excerpt)

| Refrigerant Group | System Leakage Probability | Occupancy | | | |
|---|---|---|---|---|---|
| | | Institutional | Public assembly/ residential | Commercial | Industrial |
| A3 (Hydrocarbons) | High | (i) | (i) | (i) | (c) |
| | Low | (i) | (i) | (i) | (g) |

(c) Rule 3.1 — For refrigeration systems of 75 kW (100 HP) or less, when the quantity of refrigerant in each system exceeds Table 1 quantities, the rules for commercial occupancy shall apply unless all of the following occur:

(i) the area containing the entire refrigeration system is separated from the rest of the building by tight construction with tight-fitting doors;

**Note**: *This area may include multiple rooms, some of which could be refrigerated work areas containing low side components and other rooms that may contain compressors.*

(ii) access is restricted to authorized personnel, and personnel density and means of egress are in compliance with workplace safety and health legislation and building codes where applicable;

(iii) detectors are located in areas where refrigerant vapour from a leak will be concentrated so as to provide warning at a concentration not exceeding the refrigerant(s) TLV® -TWA, except in the case of ammonia where the maximum concentration shall be 300 ppm.

(iv) When the quantity of refrigerant, except refrigerants in Groups A1 and B1, exceeds Table 3 quantities, no flame-producing device or hot surface above 425ºC (800ºF) shall be permitted; and

(v) When the quantity of refrigerant, except Groups A1 and B1 and ammonia, exceeds Table 1 quantities, the area shall be classified as a hazardous location and all electrical equipment shall conform to the requirements of Class 1, Zone 2, of CSA Standard C22.1.

(g) Rule 7 — When the quantity of refrigerant in any system exceeds Table 3 amounts, all refrigerant-containing parts, except piping and those parts outside the building, shall be installed in a machinery room constructed in accordance with the provisions of Clause 5.3 with limitations on refrigerant quantities as follows:

(i) institutional - 250 kg (550 lb);
(ii) public assembly - no limit except Item (h);
(iii) residential - no limit except Item (h);
(iv) commercial - no limit except Item (h); and
(v) industrial - no limit except Item (h);

(h) Rule 8 — When the quantity of refrigerant in any system exceeds Table 1 amounts, all refrigerant-containing parts, except piping, low-side components, condensers, and parts outside the building, shall be installed in a machinery room constructed in accordance with the provisions of Clause 5.2.

In addition, refrigerants of Groups A2, A3, B2, and B3 shall meet the following requirements:

(i) the special machinery room requirements of Clause 5.3 shall apply; and
(ii) except for ammonia systems, amounts of refrigerant exceeding 500 kg (1100 lb) shall be approved by the authority having jurisdiction.

(i) Rule 9 — These refrigerants are prohibited except in laboratories in commercial occupancies. Only unit systems containing not more than 3 kg (6.6 lb) of Group A3 or B3 refrigerant shall be used. If the laboratory is occupied by less than one person per 10 $m^2$ (108 $ft^2$) of floor area, the requirements of industrial occupancies may be applied.

Table 3

| | **Maximum permissible quantities for various occupancies, kg (lb)** | | | |
|---|---|---|---|---|
| **Type of refrigerant system** | **Institutional** | **Public** | **Residential** | **Commercial** |
| Unit systems in other than public hallways or lobbies | 0 (0) | 0* (0) | 3 (6.6) | 10 (220 |

*3 kg *(6.6 lb) allowed when installed in kitchens, laboratories, and mortuaries*.

## 2. Regulatory Requirements

CSA B52 is adopted as part of regulations of all provincial pressure equipment jurisdictions. Users are advised to contact the authorities having jurisdiction for regulatory requirements before modification of pressure equipment or substitution of refrigerants in a refrigeration system to ensure full compliance with the law.

## 3. Warranty and Liability

The use of a hydrocarbon refrigerant as a replacement for the refrigerant in a system, designed for another refrigerant class, voids the approval or certification of the system, and may result in the warranty becoming null and void. As well, there may be resulting liability in doing so.

## 4. Conclusion

Use of hydrocarbon refrigerants, particularly in a drop-in refrigerant replacement situation, will violate the current requirements of B52 and/or the provincial regulatory requirements. For change of refrigerants, in addition to a review of operation effectiveness, a process of verifying their safety in refrigeration systems must be put in place. Organizations promoting hydrocarbon refrigerants as a drop-in replacement and all parties involved may be creating an unnecessary hazard and be held liable for doing so.

*This bulletin is published with the courtesy of the CSA B52 Technical Committee. For more information, please contact:*

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