



Service Bulletin

CTV-SB-82E

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Product	Centrifugal Liquid Chillers
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Literature Changes:

- CTV-SB-82 (4/91)--Original issue of bulletin.
- CTV-SB-82A (5/91)--Bulletin revised to incorporate cautionary statement on mixing of refrigerants.
- CTV-SB-82B (7/91)--Bulletin revised to incorporate changes required due to revised AEL for HCFC-123.
- CTV-SB-82C (1/92)--Bulletin revised to warn the effects of using other types refrigerants which may affect motor winding, insulation or varnish and will render refrigerant charge unsalvageable.
- CTV-SB-82D (4/94)--Revised to incorporate new information regarding safe handling of CFC-11 and HCFC-123 and additional guidelines.
- CTV-SB-82E (7/01)--Revised to incorporate new information regarding AEL of 50 parts-per-million for HCFC-123.

Subject: HCFC-123 For Centrifugal Chillers

Introduction:

HCFC-123 is the acceptable alternative refrigerant to CFC-11 for application in low-pressure centrifugal water chillers which have been designed or retrofitted for use with this refrigerant. There are a great number of similarities and some differences between HCFC-123 and CFC-11. This service bulletin will discuss these similarities and differences so personnel conducting start-up and service work on HCFC-123 chillers are familiar with the proper procedures for handling HCFC-123.

Discussion:

A comparison of Material Safety Data Sheets (MSDS) for HCFC-123 and CFC-11 will show many similarities. Obtain and review the MSDS for HCFC-123 prior to handling this new refrigerant. All Trane Commercial Sales Offices have copies of the MSDS for HCFC-123 and CFC-11. A comparison of some of the characteristics of HCFC-123 and CFC-11 is made in Table 1 on the next page.

Table 1
Physical Data Comparison for HCFC-123 and CFC 11

Physical Data	HCFC-123	CFC-11
Boiling Point	27.6 C (81.7 F) @ 760mm Hg	23.9 C (75 F) @ 760mm Hg
Vapor Pressure	13 psia @ 25C (77F)	15.3 psia @ 25 C (77 F)
pH Information	Neutral	Neutral
Color	Colorless	Colorless
Odor	Slight E thereal	Slight E thereal
Flash Point	Will Not Burn	Will Not Burn

Hazardous Reactivity:

Both HCFC-123 and CFC-11, as well as many other commonly used fluorocarbon-based refrigerants, can be decomposed by high temperature (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids, and possibly, carbonyl halides.

Health Hazard Information:

Exposure Limits

Safe handling is essential for all refrigerants. The specific requirements for HCFC-123 are provided in "Refrigerant Handling Guidelines" (CFC-GUIDE-2). A consideration in using HCFC-123, is the AEL (Allowable Exposure Level) of 50 parts-per-million. The AEL for HCFC-123 dictates specific handling requirements and practices when using HCFC-123 in centrifugal water chillers, to insure safe and environmentally sound operation. In the case of a major spill, resulting in accidental exposures above the AEL, the short-term toxicological effects of HCFC-123 are quite comparable to those seen with CFC-11. See Table 2 for a safe handling comparison of CFC-11 and HCFC-123. Present agency-established and manufacturer-recommended personal exposure levels to HCFC-123 and CFC-11 are given in Table 3.

Table 2
Shows Safe Handling Table comparing CFC-11 and HCFC-123

Safe Handling For the HVAC Industry the Danger is Acute not Chronic			
		CFC-11	HCFC-123
Chronic	AEL	1,000 ppm	50 ppm
	EEL	1,000 ppm	1,000 ppm
Accute	LC50	26,000 ppm	32,000 ppm
	Cardiac Sensitization	5,000 ppm	20,000 ppm
	Anesthetic Effect (10 Min)	35,000 ppm	40,000 ppm

Table 3
Allowable Personal Exposure Levels for HCFC-123 and CFC-11

Exposure Level Acronym	Source	HCFC-123	CFC-11
PEL (1)	OSHA (5)	Not Established	Not Established
Ceiling (2)	OSHA (6)	Not Established	1,000 ppm
AEL (3)	DuPont (6)	50 ppm	1,000
EEL (4)	DuPont (6)	1,000 ppm	1,000

Notes:

1. PEL = Permissible Exposure Limit. OSHA time-weighted average. The employee's average airborne exposure in any 8-hour workshift of a 40-hour workweek, which shall not be exceeded.
2. Ceiling = The employee's exposure level which shall not be exceeded for any time period.
3. AEL = Acceptable Exposure Level. An employee's average, airborne exposure in any in any 8-hour workshift of a 40-hour workweek, which shall not be exceeded.
4. EEL = Emergency Exposure Level. Maximum exposure-level ceiling during emergency situations, such as a spill or accidental chemical release. Exposure duration shall not exceed one hour. Escape is feasible without suffering any escape-impairing or irreversible effects on employee health.
5. OSHA = Occupational Safety and Health Administration.
6. DuPont = DuPont Chemicals.
7. ppm = Parts-per-million.

Personal Protection Requirements:

The minimum personal respiratory protection equipment requirements at various exposure levels are listed in Table 4.

Table 4
Minimum Respirator Protection for HCFC-123

PPM	Exposure Time	Minimum Equip. Required
Less than 50 as a TWA*	8 or 12 Hours per day	None
In the event of unusual/non-routine tasks or when work place levels may exceed 50-PPM for other than the above exception:		
50-100		1/2 Mask - Organic Vapor Cartridge or Canister
100-500		Full Mask - Organic Vapor Cartridge or Canister
Greater than 500		SCBA or Full Face Air Line

* Instantaneous Spikes may occur during breaking of charge lines, tapping of drums etc. When factored into the Timed Weighted Average, these excursions have not resulted in exceeding the AEL during ROUTINE servicing.

Service Requirements:

The refrigerant handling guidelines detailed in Trane's "CTV-SB-81B", in "CFC-Guide-2" and in DuPont's "PUSH-123", must be followed. Particular attention must be given to the purge system and the unit relief vent lines. HCFC-123 can collect in these locations in a liquid state and must be properly drained prior to servicing. Do not open the unit to atmosphere for service work until the refrigerant charge is fully removed or recovered. Avoid spills while charging and removing charge from machines. Drain refrigerant from hoses and charging equipment into acceptable containers. Seal all containers after use. As with any fluorocarbon-based refrigerant, a self-contained breathing apparatus (SCBA) is highly recommended in the event of a large spill.

CAUTION: When adding refrigerant to a chiller operating on HCFC-123, use HCFC-123 only. Use of other types of refrigerant (i.e., CFC-11, CFC-113) may affect unit performance, deteriorate gaskets, seals, motor winding insulation or varnish, and will render the refrigerant charge unsalvageable.

All personnel performing service work on an HCFC-123 centrifugal water chiller must:

- ù Before performing service, activate customer's equipment room ventilation system and maintain ventilation flow at highest possible level during service procedures.
- ù Verify the presence and proper calibration of the customer's equipment room refrigerant monitor. It is possible to release traces of refrigerant gas during normal service procedures (i.e., refrigerant charging, removing or reclaiming refrigerant, opening the chiller to atmosphere, etc.). This device must detect levels of HCFC-123 that insures the AEL of 50 ppm is not exceeded. Above 50 ppm concentration, the monitor must activate an automatic alarm.

Air Monitors For Service Personnel:

A refrigerant monitor must be installed that has the capability of detecting HCFC-123 in the range of 0-200 ppm and activate an alarm above 50 ppm. Since HCFC-123 vapor is heavier than air, the air monitor sensing device should be located 12"-18" above the floor, and in close proximity to the HCFC-123 chiller location, to provide adequate sensing and early warning indications for safety. Typically, an equipment room refrigerant concentration level of 50 ppm during normal unit operation would indicate a leak condition that requires corrective service procedures. Long-term exposures (continuous 8 hrs/day; 5 days/wk; for an entire working career) to levels over 50 ppm could provide the potential for health hazards. For additional protective directives refer to Trane manual RF-AM-3. Contact the CenTraVac Technical Service Department in La Crosse to identify a recommended air monitor. Additional sources of refrigerant monitoring devices are listed in various HVAC-industry publications and in the Thomas Register.

Typical refrigerant levels present in equipment rooms with HCFC-123 chillers have been reported below one part-per-million during normal operation and up to 8 ppm during normal maintenance, after all refrigerant has been properly removed or recovered from the machine.

Safe Application of HCFC-123:

Trane, York, DuPont, Allied Signal, and even the United States Environmental Protection Agency (EPA) have publicly stated that HCFC-123 can be used safely in centrifugal chillers with equipment room concentrations being held well below one part-per-million during normal operation, providing a margin of safety of at least 100-to-1, as long as the equipment room guidelines established in ASHRAE "Standard 15" are followed.¹ Refrigerant vapor concentrations found during servicing of equipment are normally held below two ppm, on a time-weighted average, as long as the recommended refrigerant handling procedures in Trane's "Refrigerant Handling Guidelines" (CFC-GUIDE-2) are followed.² Now that all the facts are known, the primary concern over the safety of HCFC-123 is a matter that can easily be handled through proper design of the equipment room and by adherence to established refrigerant handling practices.

1. Data supported by two detailed reports: a Trane/DuPont HCFC-123 equipment room concentration report "CFC-Report-1", October 1991, and the United States EPA equipment room concentration report (both available from The Trane Company).
2. For a report relating actual measured HCFC-123 concentration levels in various equipment rooms, contact the CenTraVac Technical Service Department of the La Crosse Business Unit at (608) 787-3943.