YORK®	Refrigerant Shift HCFC-123 to HFC-134a	
MARKETING GUIDE	Supersedes: Nothing	160.00-MG1 (405)

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INTRODUCTION

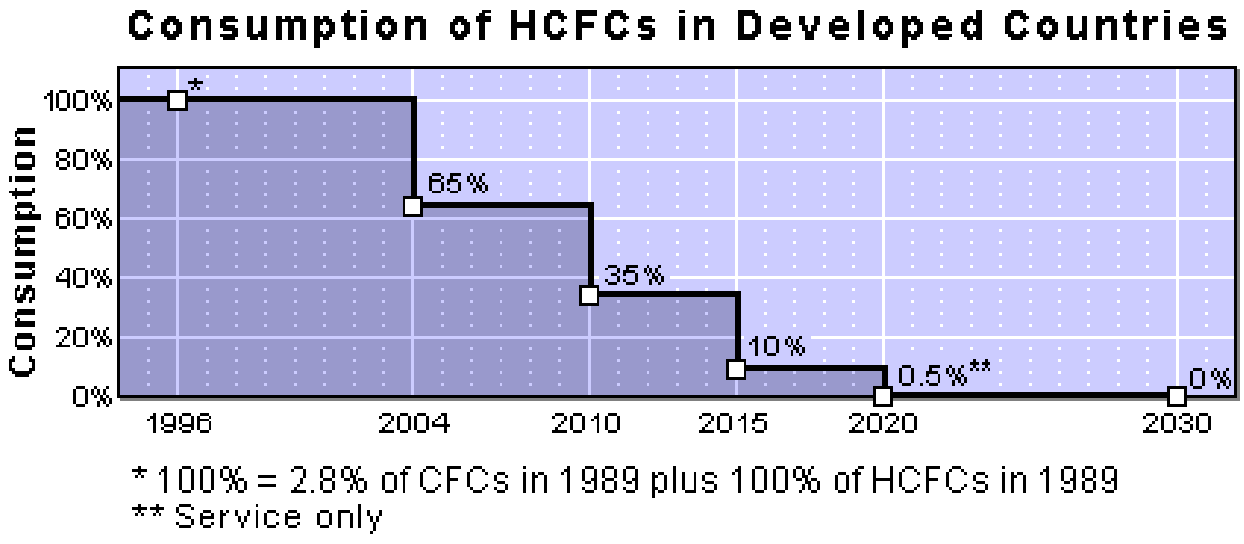
In November 2004, YORK International took the decisive step to transition out of HCFC-123 new chiller production. This action reflects the global refrigerant trend shifting from HCFCs to HFCs. However, in some global markets, including the US, HCFC-123 will remain a competitor. This document presents facts and clarifies perspectives supporting the global shift from HCFCs towards HFC-134a.

MONTREAL PROTOCOL & CLEAN AIR ACT

1. HCFC-123 is one of the many HCFC transitional refrigerants mandated by the Montreal Protocol (ratified by 188 countries) to be phased out by 2020 for new equipment and 2030 for total production (for developed countries).
2. The US Clean Air Act has mirrored this phase-out schedule for HCFC-123.
3. To control and ensure compliance with the Protocol and the Act, the US Environmental Protection Agency (EPA) has established the following reduction schedule for HCFCs:
   - 1/1/2004 35% reduction from the cap
   - 1/1/2010 65% reduction from the cap (no new HCFC-22 products)
   - 1/1/2015 90% reduction from the cap
   - 1/1/2020 99.5% reduction from the cap (no new HCFC-123 products)
   - 1/1/2030 100% reduction from the cap

   (Note: Caps per country were established based on fractions of past consumptions of CFCs and HCFCs in the country)

These reduction mandates apply to all HCFC refrigerants. The phase out schedule is staged and the reduction scheme relies on significant phase-out of some substances early, such as HCFC-22 by 2010. However, availability of HCFCs will be severely limited as time progresses and are intended only for service requirements in the later years.



4. Trane has suggested there may be future exemption for HCFC-123 by the Montreal Protocol. With the very strict language in the Protocol, and the current pressure and desire by most of the Protocol parties to accelerate the phase-out of all ODS (Ozone Depletion Substances), this possibility is rather slim. Many ratifying member countries have accelerated the phase-out of HCFCs – already achieving the 100% reduction final goal. The US Clean Air Act, worded to implement similar or more stringent environmental control than the Montreal Protocol, is another hurdle blocking any attempt to exempt HCFC-123. Changing the Montreal Protocol would not change US law, which specifically phases out HCFC-123.

GLOBAL MARKET

1. Europe has banned the use of all HCFCs, including HCFC-123. Recent actions confirm most of Asia is in the process of phasing it out (well ahead of the Montreal Protocol timelines).
2. While offering only HCFC-123 centrifugals in the US & Canada, Trane is offering HFC-134a centrifugals internationally, citing the CVGF (gear-drive, two-stage compressor) HFC-134a line as using "environmentally responsible refrigerants" in its catalog. CVGF product information is on Trane's website, with a note stating: "currently not available for US and Canada markets".
3. Trane has claimed "nearly two-thirds of new centrifugal chiller installations use HCFC-123". This is absolutely wrong. When challenged, Trane responded by dropping this claim from their website. During 2003 and 2004, global centrifugal-chiller market-share estimates for HCFC-123 were 33% to 30% (mainly in the US), and eroding each year. Our anticipation for 2005 & 2006 is an HCFC-123 global market share of 20%, driven by two factors. 1. YORK no longer offering new HCFC-123 chillers, 2. Trane making more HFC-134a units globally in response to the market demand. HFC-134a centrifugal chiller demand and market share continue to grow globally. Additionally, YORK has seen demand and market share increase for YORK HFC-134a centrifugal and screw products.
4. On the grand scale of all water-cooled chillers (including centrifugal, screw, recip and scroll), HCFC-123 market share is in the single digits.

REFRIGERANT PRODUCTION

1. HCFC-123 production as a refrigerant is less than 1% of all refrigerants produced globally. The majority of HCFC-123 is supplied by a single producer (DuPont) and the continued availability of adequate refrigerant supply presents a significant risk with the imposed cap.
2. While Trane has claimed there "should be" an abundant supply of HCFC-123 available through stockpiled and recycled quantities, these are simply assumptions about the future. YORK believes it is in the *customer's* best interest to avoid this unnecessary risk when investing in capital equipment with a 30 year expected life.

HIGH- vs. LOW-PRESSURE REFRIGERANTS

1. Positive-pressure, HFC-134a chillers can be transported with a complete refrigerant charge, eliminating refrigerant handling on-site. They are also able to store the refrigerant in the heat exchangers during maintenance, reducing potential refrigerant leakage during maintenance.
2. HCFC-123 chillers operate below atmospheric pressure on the cooler side, resulting in air and moisture (non-condensable) entering the system. Purge units are required to remove these non-condensables and reduce the negative impact on chiller performance.
3. Trane claims to have leak-free units, but every one ships with a purge unit. Every purge cycle removes a mixture of non-condensable product *AND refrigerant*. While collection tanks may be applied to capture the purged refrigerant, it is no longer in the chiller. Additional labor is required to recycle the purge canisters and replace refrigerant that has been purged from the chiller.

REFRIGERANT PROPERTIES

1. Based on ASHRAE-15 designation, HCFC-123 is classified as B1 while HFC-134a classified as A1 on toxicity and flammability. (Toxicity rating of A, and B, with A being the lowest toxicity; Flammability rating of 1, 2, or 3 with 1 being non-flammable).
2. International Mechanical Code and ASHRAE Standard 34 (approved by ASHRAE Board of Directors) defined the maximum refrigerant concentration limits (RCLs) for human exposure. The RCL for HFC-134a is 5.5 times that of HCFC-123.

Environmental & safety data for popular refrigerants

	ODP	GWP	Toxicity	RCL (ppm)
HCFC-22	0.055	1700	A1	25000
HCFC-123	0.02	120	**B1**	9100
HFC-134a	0	1300	A1	50000
HFC-410A	0	2000	A1	55000
HFC-407C	0	1700	A1	69000

ENVIRONMENT AND CLIMATE

1. Global warming? HCFC-123 has lower theoretical global warming potential (GWP) compared to HFC-134a. However, current “leak tight” chiller designs result in very small amount of refrigerant escaping the chiller and resulting in an insignificant direct impact (only about 1% of indirect emission impact). Indirect emission, which is the projected global warming impact based on the emissions to produce energy to operate the chillers, depend mainly on chiller efficiency. Considering overall chiller energy consumption, which can be characterized by IPLV, there is virtually no difference between HFC-134a and HCFC-123 chillers. As a result, there is virtually no advantage of HCFC-123 over HFC-134a with regard to GWP. The TEWI (Total Equivalent Warming Impact) between HCFC-123 and HFC-134a chillers are similar (within 1%) and this point is illustrated in table 5-2 of the May 2004 Chiller Task Force Report by TEAP (Technology & Economic Assessment Panel of United Nation Environmental Program).
2. Environment? HCFC-123 is defined by the Montreal Protocol as a *transitional* refrigerant (to replace CFC-11). It is an ODS (Ozone Depleting Substance) on the list to be phased out in efforts to protect the environment.

ENERGY EFFICIENCY

1. There is a theoretical-cycle efficiency advantage for HCFC-123 over HFC-134a (about 5%), which could result in higher design full load efficiency for the HCFC-123 chiller. However, full load at design ECWT conditions account for only 1% of chiller total operating hours. IPLV, which includes the 1% of operating hours spent at full load conditions plus the 99% of operating hours spent at part load/off-design conditions, is the true benchmark for chiller energy efficiency. With HCFC-123 theoretical cycle efficiency partially offset by its heat-transfer disadvantage, HFC-134a IPLVs can exceed those of HCFC-123 in many applications (especially operating with variable-speed drives). We need to convince and encourage our customers to specify IPLV and to use IPLV for chiller energy-efficiency comparisons.
2. In real life, chiller purchases are predominantly driven by the job specifications or governing energy standards. As such, both HCFC-123 and HFC-134a chillers are typically offered with the same efficiency on these applications, which eliminates that argument of a global warming advantage for HCFC-123.

Since late 2004, we have heard owner organizations instructing their engineering personnel to avoid specifying chillers utilizing refrigerants with a phase-out date. One instruction stated: “if you are renovating or building a new facility, make sure that the A/Es or contractors do not spec or offer HVAC equipment that have a limited life because of phase-out of refrigerants with ODP”.

Do your part to protect the environment by choosing high efficiency HFC-134a chillers and avoid the risks associated with HCFC-123.

Select from YORK’s high efficiency HFC-134a products.

- **LOW energy consumption**
- **ZERO ozone depletion**
- **NO phase out**
- **LOW total global warming impact**