
Energy Efficient Technology for Cold Chain

For India Japan Environment Week

13, Jan., 2023

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Mayekawa Mfg. Co., Ltd.

● About Speaker



Mr. Hiroyuki Egashira

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Worked in India from 2006 to 2016.

Currently, working as the Senior Advisor, South Asia Region Operation and Business Development for Mayekawa Mfg. Co., Ltd.

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MAYEKAWA MFG. CO.,LTD.

- ❑ Established 1924
- ❑ Head Office Tokyo, Japan
- ❑ Annual Turnover 150 billion JPY
(Group)
- ❑ Employees 4,700 (Global)



● Existing System



Frick India Limited

A Leader in Industrial
Refrigeration Equipment
Manufacturer and
Turnkey Solution Provider,
Since 1962



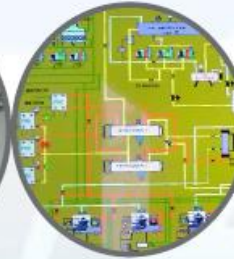
DESIGNING



MANUFACTURING



INSTALLATIONS



AUTOMATION



COMMISSIONING



SERVICING

You still can't beat the system when it's all FRICK INDIA

● MEMORANDUM OF COLABORATION



MAYEKAWA-FRICK INDIA EXCLUSIVE TECHNICAL
SUPPORT FOR ENERGY EFFICIENT AND ENVIROMENT
FRIEDNLY SOLUTIONS SINCE 2018

● Global Environment Issues

Ozone Depletion

Montreal Protocol

CFC : banned in 1996

HCFC : Limited from 2004

Totally Banned in 2020

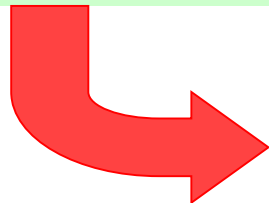
Freon Recycling Law:

CFC, HCFC, HFC

PRTR Law (chemical gas):

HCFC22, HCFC123, Ethylene glycol, etc.

Introduction of Environment Tax, Freon Tax to industries



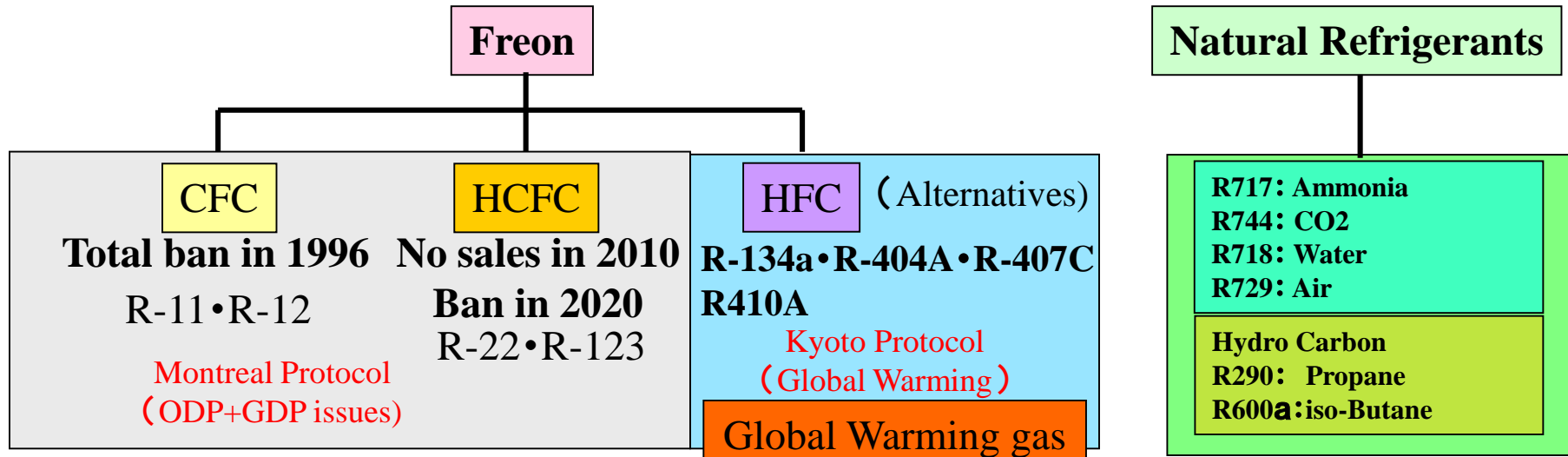
Demand for use of Natural Refrigerant has increased

Global Warming

Kyoto Protocol

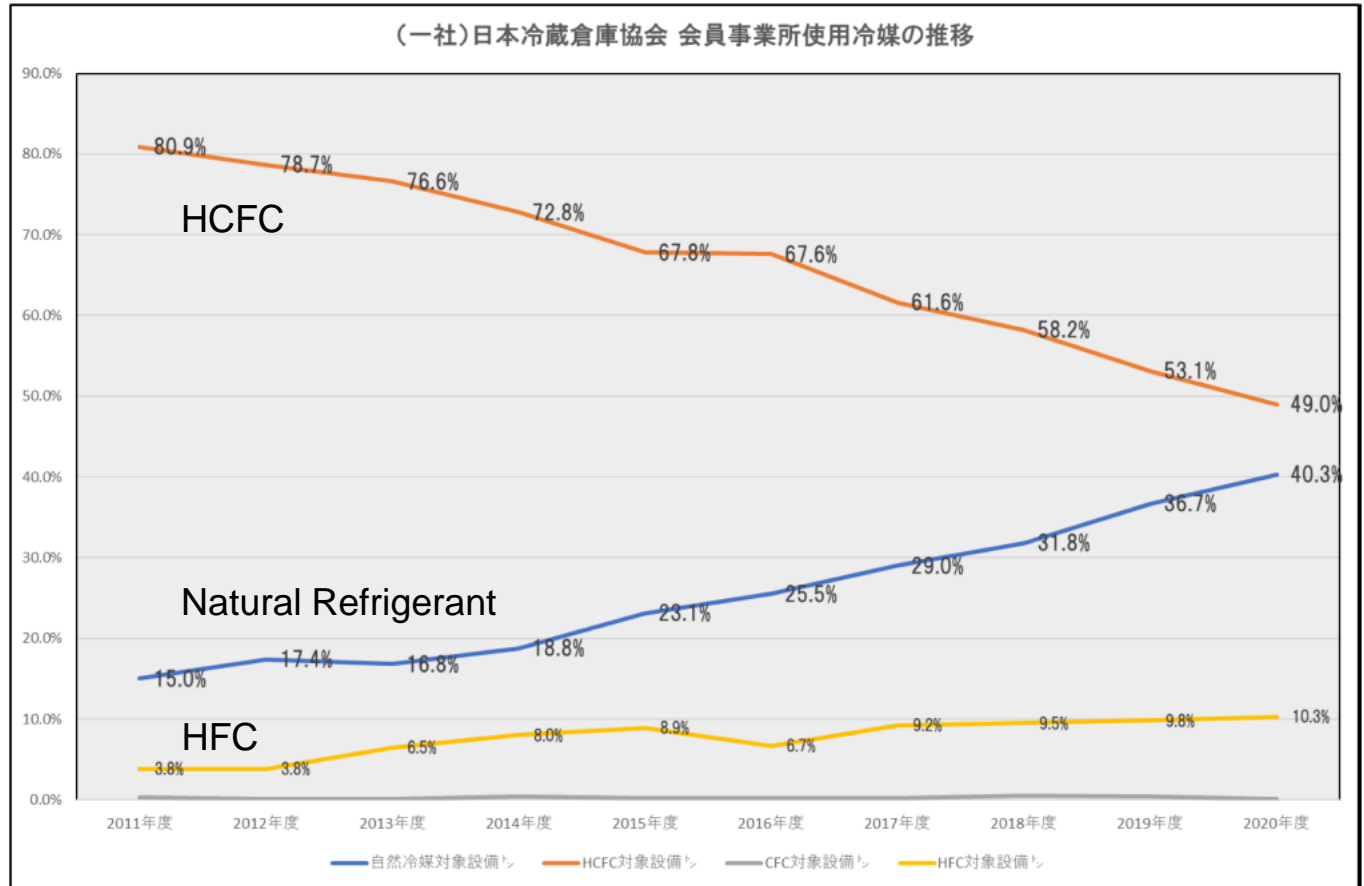
Reduction of global warming gas by 6% from 1990 level in the first period of 2008 ~2012). **HFC are the target**

● Future of refrigerants



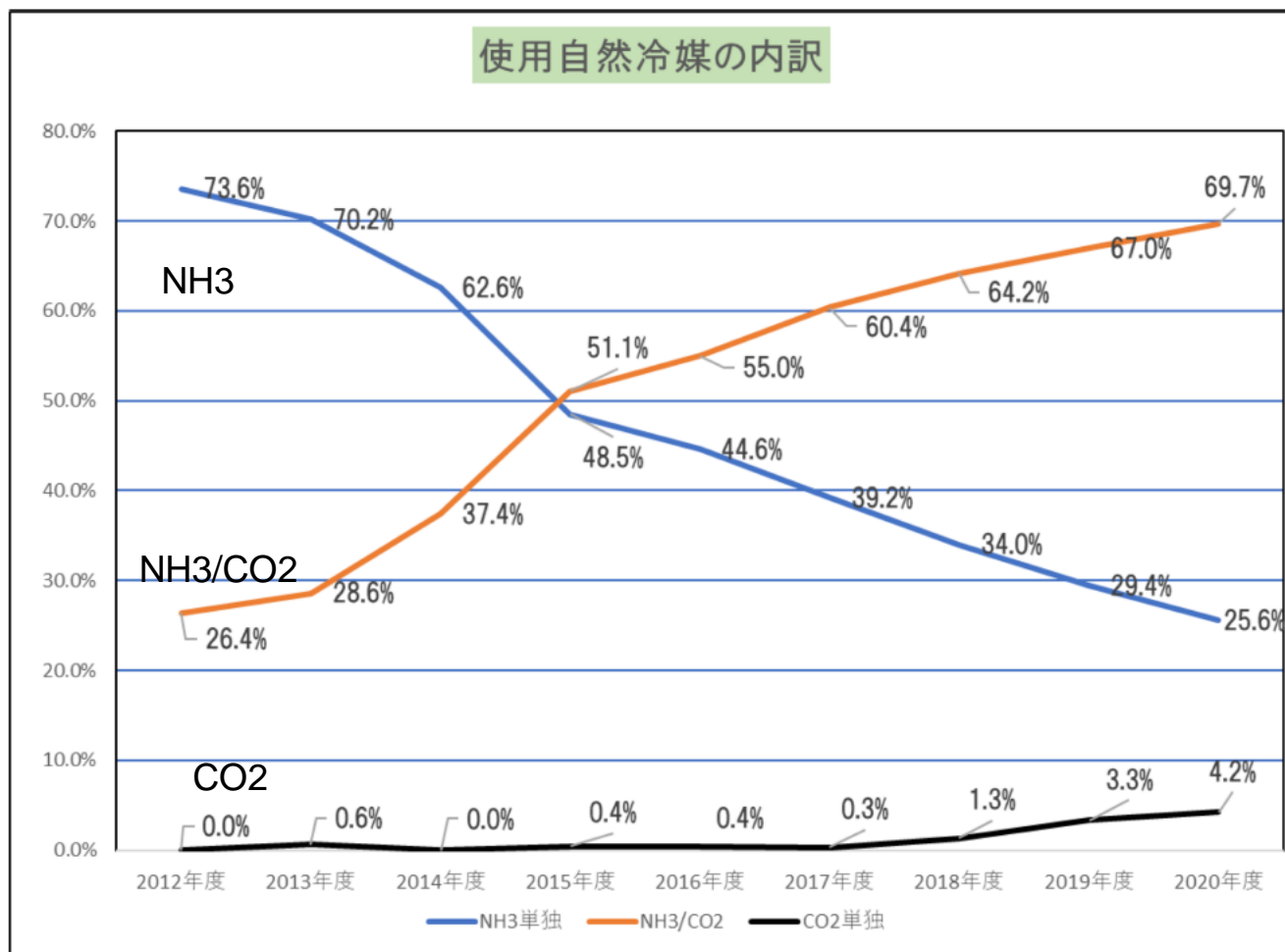
Refrigerant Groups	Banned Freon CFC			Limited Freon HCFC	Alternative Freon HFC				Natural Refrigerant Natural Fives		
	R11	R12	R502	R22	R134a	R404A	R407C	R410A	R717 NH3	R744 CO2	R600a Iso-Butane
Refrigerants	R11	R12	R502	R22	R134a	R404A	R407C	R410A	R717 NH3	R744 CO2	R600a Iso-Butane
ODP	1.0	1.0	0.33	0.055	0	0	0	0	0	0	0
GWP	4000	8100	5800	1700	1300	3780	1650	1980	<1	1	3
Characters	<ul style="list-style-type: none"> •Big ODP •Use by refrigerator, car air conditioning •Banned in 1995 			<ul style="list-style-type: none"> •Per Montreal Protocol •will be banned in 2020 •Price will go up 	<ul style="list-style-type: none"> •Instable gas •No ODP •Specified as GDP gas by Kyoto Protocol •Anticipated to be regulated by authority 				<ul style="list-style-type: none"> •Natural •No worry to be regulated 		

Trend of Refrigerants in Japan/Cold Storage



27/06/2022 - TOKYO
28/06/2022 - ONLINE

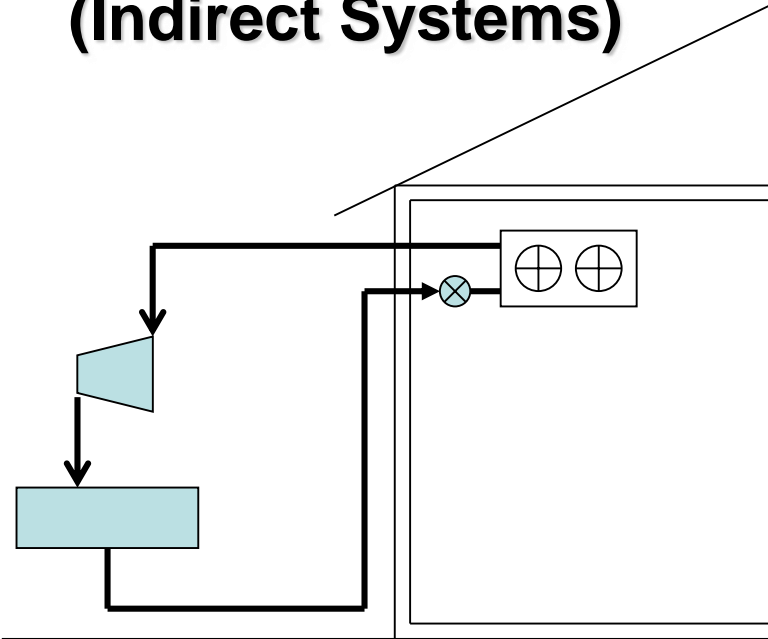
● Trend of Natural Refrigerant systems in Japan/Cold Storage



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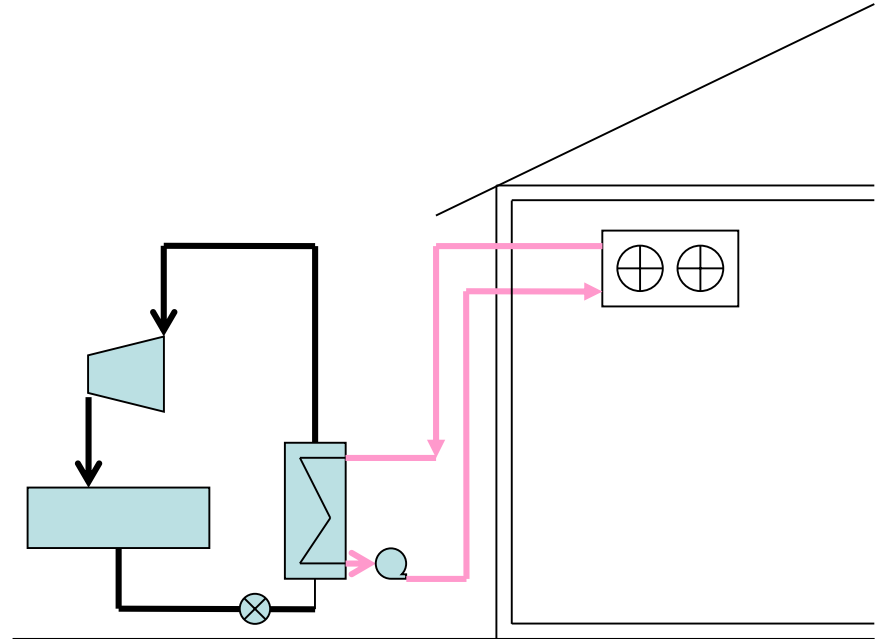
● NH3-CO2 system

Safest Approach of NH3 Refrigeration Systems (Indirect Systems)



Direct method

- Potential leak in storage room
- Requires large amount of ammonia
- Simple system



Indirect method

- Least potential of leakage in storage room
- uses very small amount of ammonia
- A bit more complicated system

● NewTon: NH3-CO2 System



● Energy Saving compared with R-22 Systems

Customer	Volume	Age	Refrigerant formerly used		Power reduction
	(m3)	(year)	Refrig.	Comp.	(%)
Tokyo Toyomi	45,000	29	HCFC-22	Screw	31.1
Niigata Reizo	10,000	33	HCFC-22	Recip.	41.2
QP “Kewpie”	16,250	27	HCFC-22	Recip.	24.9
Sensui Reizo	6,125	38	HCFC-22	Screw	29.3
Ajinomoto	7,500	25	HCFC-22	Recip.	28.0
Gliko	30,000	30	HCFC-22	Screw	19.8
Showa Reizo	32,500	22	HCFC-22	Recip.	28.0
AMB Funabashi	30,000	25	NH3/Brine	Recip.	34.0



Do they really have to be the systems from Japan?

● A case study in Krishnapatnam, Andhra Pradesh

System Outline

Freezer			
Room Temp:	-18deg.C.		
No. of Room	7Rooms		
Room Size (m)	L	W	H
	8.5	20.5	12.5
Pallte Per Room	350pallet		
Estimated Capacity	28.8kW		
Compressor			
Carlyle 06CC899F200	8sets (1set stand-by)		
Chilled and Loading Area			
Room Temp:	5deg.C.		
No. of Room	3Rooms		
Room Size	L	W	H
	8.5	20.5	12.5
Pallte Per Room	350pallet		
Compressor			
Carlyle 06EM799601	4sets (1set stand-by)		

● Comparison

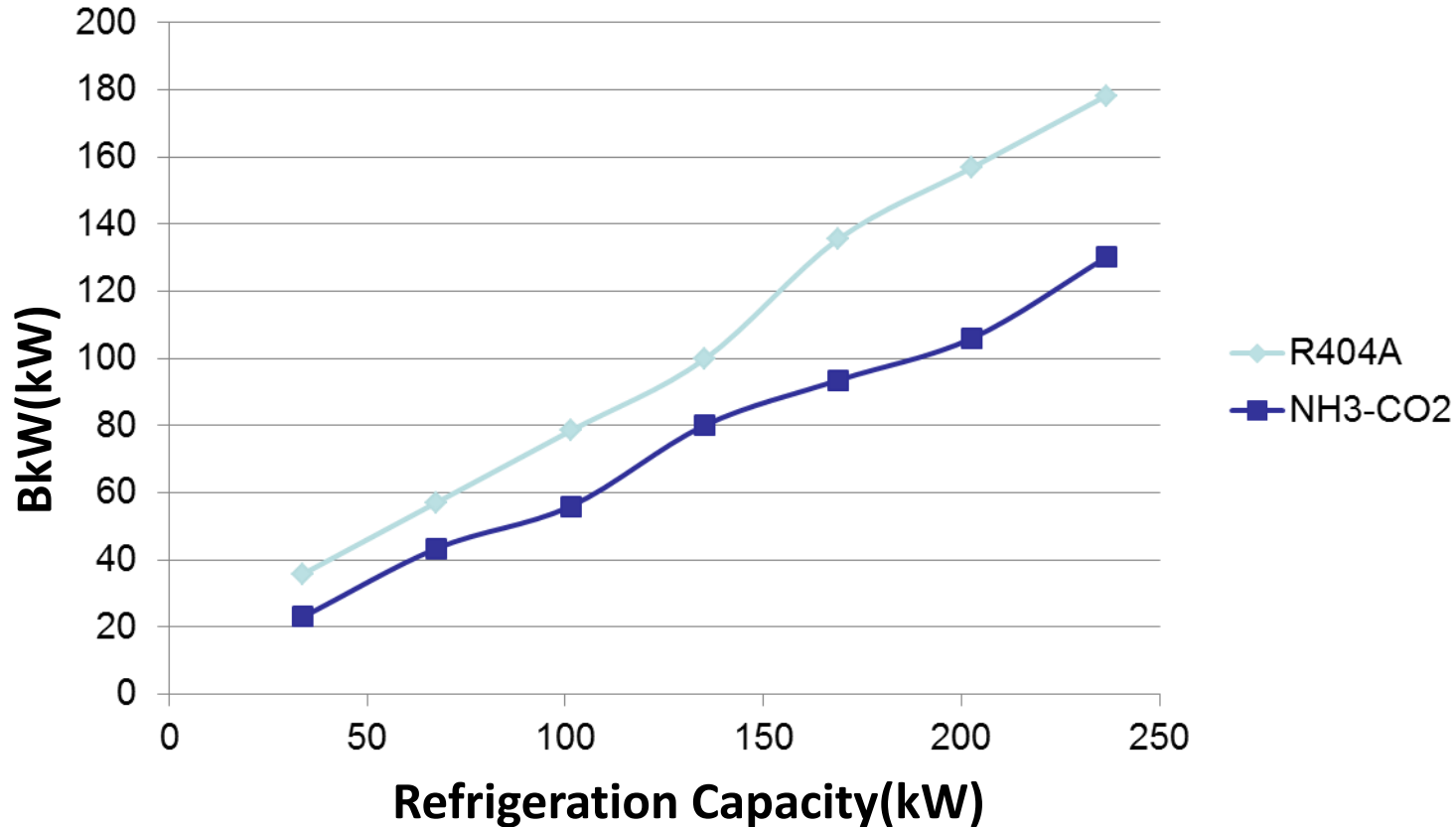
Comparison of Installed Power

Capacity	236.7kW			240.5kW			
Existing				NH3-CO2 System N62K x 5 sets			
Equipment	Q'ty	Motor	Total	Equipment	Q'ty	Motor	Total
Condensing Unit	8	22.5	180	Compressor	5	30	150
Unit Cooler	7	2.48	17.36	Unit Cooler	7	2.48	17.36
Air Cooled Condenser	2	22.4	44.8	CO2 pump	1	2.2	2.2
				Eva. Condenser	1	5.15	5.15
Installed motor kW	242.16			174.7			


Comparison of BkW at full load operations

Capacity	236.7kW			240.5kW			
Existing				NH3-CO2 System N62K x 5sets			
Equipment	Q'ty	BkW	Total	Equipment	Q'ty	BkW	Total
Condensing Unit	7	19.38	135.66	Compressor	5	22.1	110.5
Unit Cooler	7	1.96	13.72	Unit Cooler	7	1.96	13.72
Air Cooled Condenser	2	14.4	28.8	CO2 pump	1	1.76	1.76
				Eva. Condenser	1	4.12	4.12
Total BkW at full load	178.18			130.1			

BkW comparison at partial load



NH3-CO2 system gives better performance at all load.



By changing the refrigerant from R404A to NH₃/CO₂, 27% power reduction at full load is possible. In partial load conditions, the power reduction may be less, still some 20% reduction is achievable.



Japan is working toward the natural refrigerant cold chain.

Major shift is taking place through the governmental encouragements and the efforts of Individuals, industries and the professional and industrial associations.



For the use of natural refrigerant, India is in a good position.

India can be a leader of the world by

- A) Encourage and Promote use of Ammonia in refrigeration application through incentives**
- B) Guidance for the use of Ammonia refrigeration system through BIS standard**

भारतीय मानक
Indian Standard

IS 17773 : 2022

संवृत-परिपथ अमोनिया प्रशीतन प्रणाली —
डिजाइन और संस्थापन की रीति संहिता
(एएनएसआई/आईआईएआर 2 : 2014, एनईक्यू)

**Closed-Circuit Ammonia
Refrigeration System — Code of
Practice for Design and Installation
(ANSI/IIAR 2 : 2014, NEQ)**

ICS 71.060; 13.300; 27.200

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

September 2022

Price Group 16

**BIS standard for Closed
Circuit Ammonia
Refrigeration System-Code of
Practice for Design and
installation.**

**It is compiled by the
professionals of Association
of Ammonia Refrigeration,
and adopted as National
Standard by the Bureau of
India Standard**



**Association of
AMMONIA REFRIGERATION**

Established in **2012**

[not-for-profit organization registered in Pune
, Maharashtra, India]

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Kothrud, Pune 411038

Phone : 7447454586

Email: ammoniaindia@gmail.org

Website : www.ammoniaindia.org

Aim >> To promote safe use of ammonia as refrigerant through education, training, information and standards.

Purpose >> To provide a platform for professionals, industry, technicians, end-users to meet, interact and work towards advance technology and safe practices with ammonia and other natural refrigerants.

This Purpose is achieved through >>

- ✓ *Technical Seminars – Advantage Ammonia*
- ✓ *Quarterly Newsletter*
- ✓ *Annual Event & Expo – ARCON*
- ✓ *Technical Publications*
- ✓ *Skill Up gradation through Standards*

AAR Achievements



55
Corporate
Members



350
Individual
Members



16000+
Delegates
Trained



75
Advantage Ammonia
Training Programs



40
Tech Presentations
Other Forums



17
Webinars



7 ARC
Asia's Only Ammonia
Convention
ARCON



35
AAR Member
Networking
Events



6 Publications
Newsletter, Posters
Pocket Guide Ind Ref Standards,
Tech Reference books

Members are manufacturers, consultants, contractors, Technical Professionals and End-Users of various organizations who are involved directly or indirectly with Ammonia as a Refrigerant. Apart from India we have members from countries like China, Singapore, Germany, UAE, Japan, USA, Sri Lanka and Vietnam.