

ASSOCIATION OF
AMMONIA REFRIGERATION

Energy & Sustainability of Refrigerant Plant

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Today on World Refrigeration Day, we thank the engineers, technicians, plant teams & all stake holder who keep the refrigeration system running 24x7.

Your work reduces waste, saves energy, and protects lives.

Let's keep innovating for sustainable, low-GWP cooling.

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Happy World Refrigeration Day 2026

This World Refrigeration Day :-
Take step forward towards

- :- Better design,
- :- Smarter operation,
- :- promote / pledge to use / shift to natural refrigerants,
- :- energy recovery : cut carbon and cost.


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Refrigeration system consumes almost 75 to 80% of total power requirement of cold storage contributing to operating cost.

Sr. No	Industry	Typical percentage of site energy cost spent on refrigeration
1	Ice cream	70%
2	Meat, poultry and fish	50%
3	Frozen fruit and vegetables.	70%
4	Chocolate and sugar confectionery	30%
5	Beer and other brewing	20%
6	Cold storage	90%
	Milk and Milk Products	30%


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Criteria of selection of refrigerant

- ▶ Low cost.
- ▶ Easy availability
- ▶ Easy to use.
- ▶ Energy efficient.
- ▶ Gives less pressure drop.
- ▶ Eco friendly.

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Facts about Ammonia as a refrigerant.

- ▶ Ammonia is produced in India.
- ▶ Low-cost refrigerant.
- ▶ lighter than air. Hence air ventilation is sufficient.
- ▶ Oil Heavier than refrigerant
- ▶ Extremely Stable compound under normal condition.
- ▶ Extremely hard to ignite. does not ignite below 651°C
- ▶ Ammonia is classified in B2L category by ANSI and ASHRAE standard 34.

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Facts about Ammonia as a refrigerant.

› GWP level

Refrigerant	ODP	GWP
Ammonia	0	< 1
R-22	0.055	1810
R-134a	0	1430
R-404A	0	3900
R-407 c	0	1650
R-410A	0	2100

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Facts about Ammonia as a refrigerant.

› Acute Exposure Guide Line (AEGL) levels for ammonia (ppmv) 2008

	Description of Guideline level	10 min	30 min	60 min	4 hr	8hr
AEGL 1	Would not cause discomfort	30	30	30	30	30
AEGL 2	Would not cause disability	220	220	160	110	110
AEGL 3	Would not cause death	2700	1600	1100	550	390

Source Table 14 page 38 IIF –IIR ammonia as refrigerant

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Anhydrous Ammonia refrigerant purity requirement

- › Ammonia purity requirement: IS 17773 – 2022
- › Ammonia content: 99.95% min.
- › Water : 33 PPM max
- › Oil : 2 PPM
- › Ammonia readily dissolves in water

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› The comparative refrigerant performance for 100 kW capacity @ -5 Deg. C EVP temp.

Ref.	Shaft power kW@ 40 Deg C cond. (Water cooled)	Diff. in shaft power w.r.t Ammonia	extra energy bill for 15 year s of plant life (RS)	Shaft power kW@ 52 Deg C cond. (Air cooled)	Diff. in shaft power w.r.t Ammonia	extra energy bill for 15 year s of plant life (RS)
R-717	26.5	0		26.5*	0	
R-407c	30.92	4.42	8,95,050	43.17	16.67	33,75,675
R-404a	45	6.56	13,28,400	45.11	18.61	37,68,525

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Improving sustainability , energy efficiency & Safety of existing plant

- › I already have a refrigeration system
- › Can I make my existing refrigeration system more sustainable , energy efficient and safe?

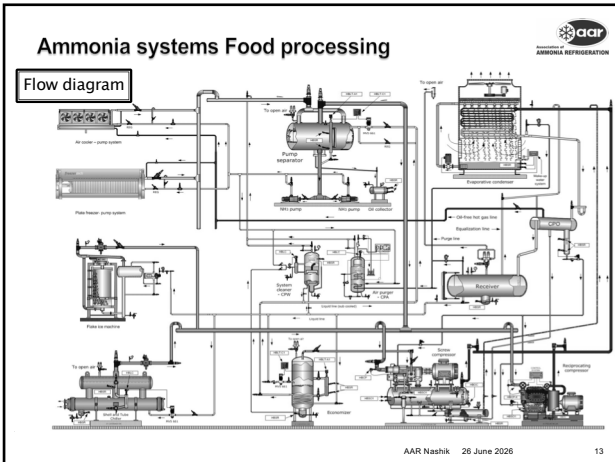
Yes , we can

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Let us begin with Main component in ammonia system

TYPICAL SINGLE-STAGE VAPOR COMPRESSION REFRIGERATION

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Systematic approach

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Collect documentation

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Formulate basis of design based on present load.

S. No	Item	Unit	Chamber 1
1	Room Size (Out to out)		
	L	m	
	B	m	
	H	m	
2	PUF / EPS thickness	mm	
3	Product to be cool		
4	Type of packing		
5	kg/packing	kg/packing	
6	Total product storage capacity/Daily loading	MT	
7	Ambient Temp	° C	

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Carry out detailed study of existing Plant

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Understanding Energy Efficiency

COP

Each equipment :-
design

construction and

data mentioned on name plate.

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Understanding Energy Efficiency



Refrigeration load requirement

Recorded data

Electrical load list

COP

Part load and full load operating data

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Further .



- ▶ Automation for Monitoring and controlling using Digital Tools , SCADA for :-----
- ▶ Real-time COP tracking,
- ▶ Calculation of power kWh/ton of refrigeration
- ▶ Detect refrigerant leaks,
- ▶ Defrosting of ACU

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Further .



- ▶ Reduce water usage by selecting/replacing proper type of condenser
- ▶ Heat recovery

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▶ Improving plant safety



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Improving Plant Safety



- ▶ **BELIVING THAT “ HUMAN LIFE IS ABOVE ALL ”**
- ▶ **AND**
- ▶ **“PROTECTING HUMAN LIFE IS OUR PARAMOUNT OBJECTIVE.”**

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▶ Study carefully existing installed safety system:



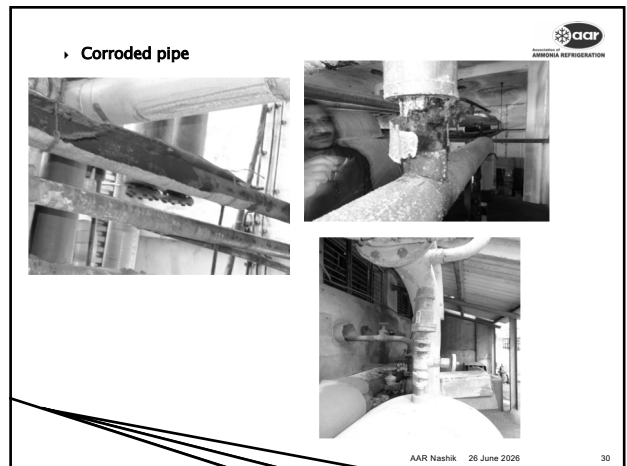
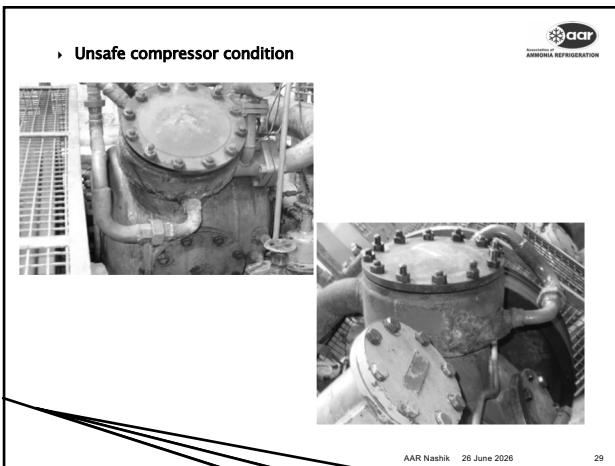
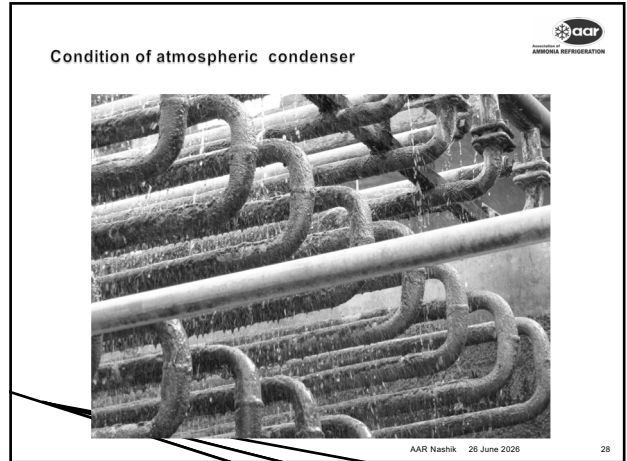
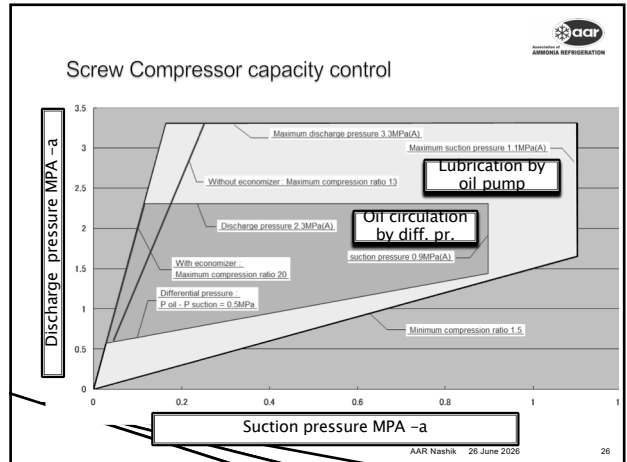
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Operating limits for ammonia refrigerant

		Min	Max
Comp speed	rpm		1000 to 1500
Line frequency	Hz	50	50
Suction pressure= evap. Pr.=Crank case pr.	Bar a	1.5	8.5
Suction super heat	Deg C	> 0	5
Discharge Pr.	Bar a	26	
Discharge Temp	Deg C	155	
Pr. Ratio		10	

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› Condition of pipe insulation in ante room



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› House keeping in plant room



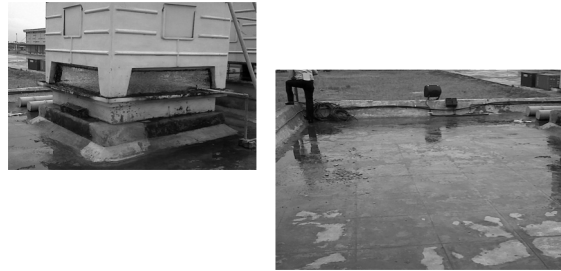
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› Condition of surge drum , piping and controls



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No proper water drain



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PUF panel protection



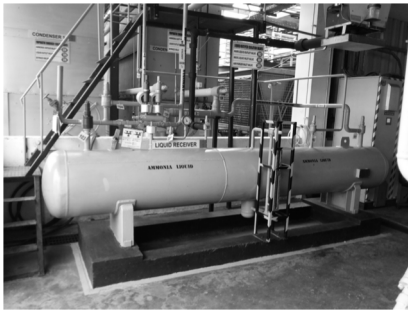
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Arrangement of safety for ammonia charging station



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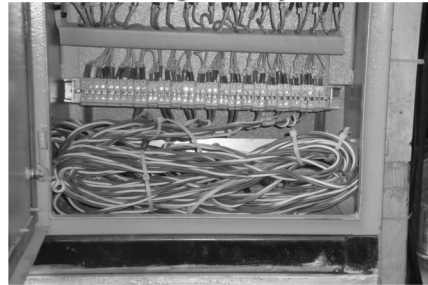
Bund below Pr. Vessel



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Electrical safety precautions while designing and installation of the refrigeration system.



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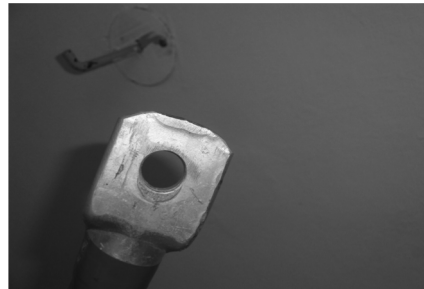
House keeping behind MCC



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Electrical safety precautions while designing and installation of the refrigeration system.



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Electrical safety precautions while designing and installation of the refrigeration system.



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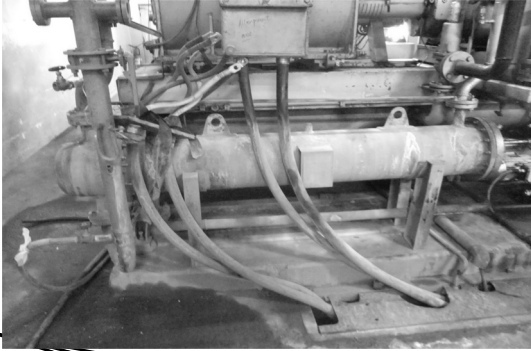
Electrical safety precautions while designing and installation of the refrigeration system.



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▶ House keeping near compressor



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Electrical safety precautions while designing and installation of the refrigeration system.



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PPE

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Eye and face wash station



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▶ Ammonia Safety equipment
▶ Full face mask



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▶ Storage of safety equipments



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Arrangement for ammonia suit



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Experience sharing



Receiver shell thickness at two pints observed below acceptable limit.

- Receiver was 20-Year-old.
- Major accident was avoided due to regular Audit and monitoring.

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Conclusion



- Improvement is – continuous
- Today on World refrigeration day occasion , let us decide make our plant Sustainable, Energy Efficient and safe.

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THANK YOU



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