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# The Rise and Rise of Low Charge NH<sub>3</sub> Refrigeration Systems

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# THE PAST

- Hand expansion valves
- Liquid flood-backs
- Manual control
- Moisture problems
- Non-condensables ingress
- Corrosion
- Accidents
- Specialized maintenance
- “Industrial”
- “Dangerous”
- “Smelly”

- Leaky
- Manual oil drainage
- Big and bulky
- Noisy
- Maintenance intensive
- “Agricultural”
- “Old fashioned”



# SOME RECENT MILESTONES

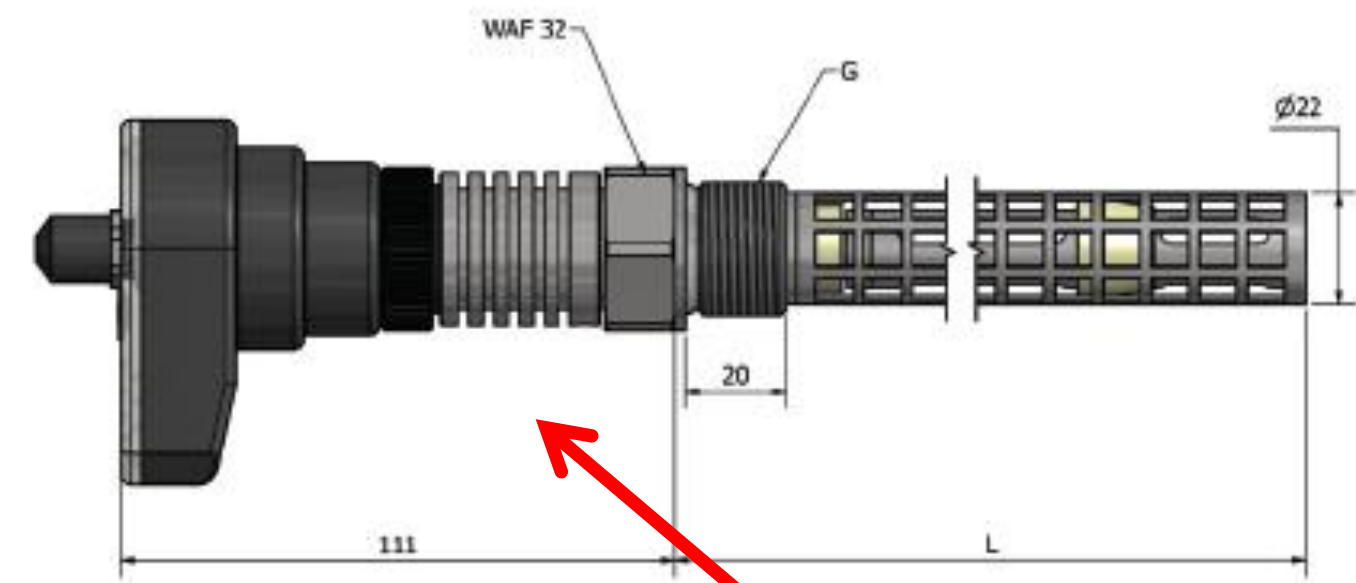
NH<sub>3</sub> based air conditioning retrofit (QLD)

Ultra low NH<sub>3</sub> inventory packages (USA)

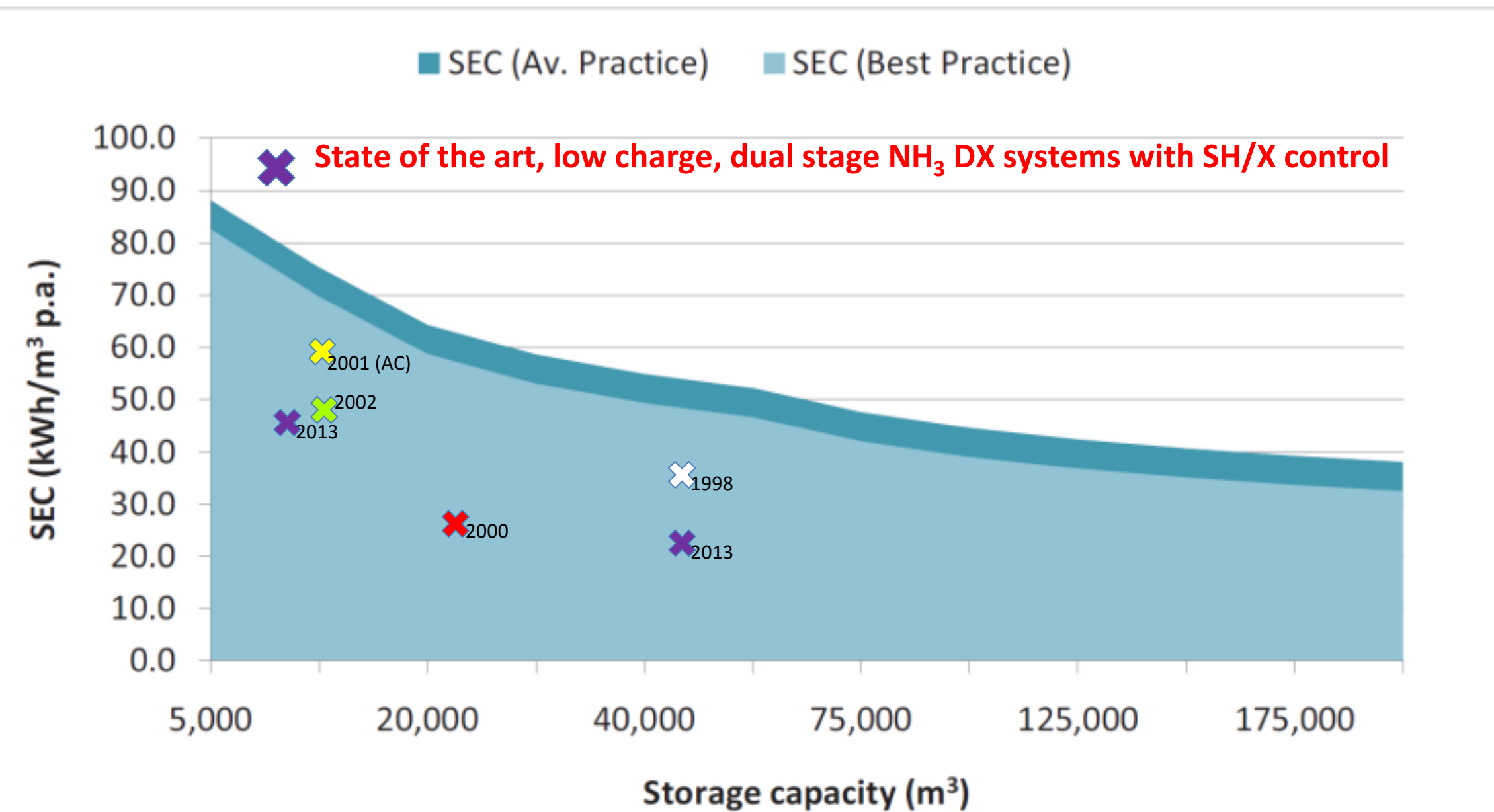


NH<sub>3</sub> entered the HFC capacity territory

Energy performance improvements of 40-70%



Quality or "X" sensor

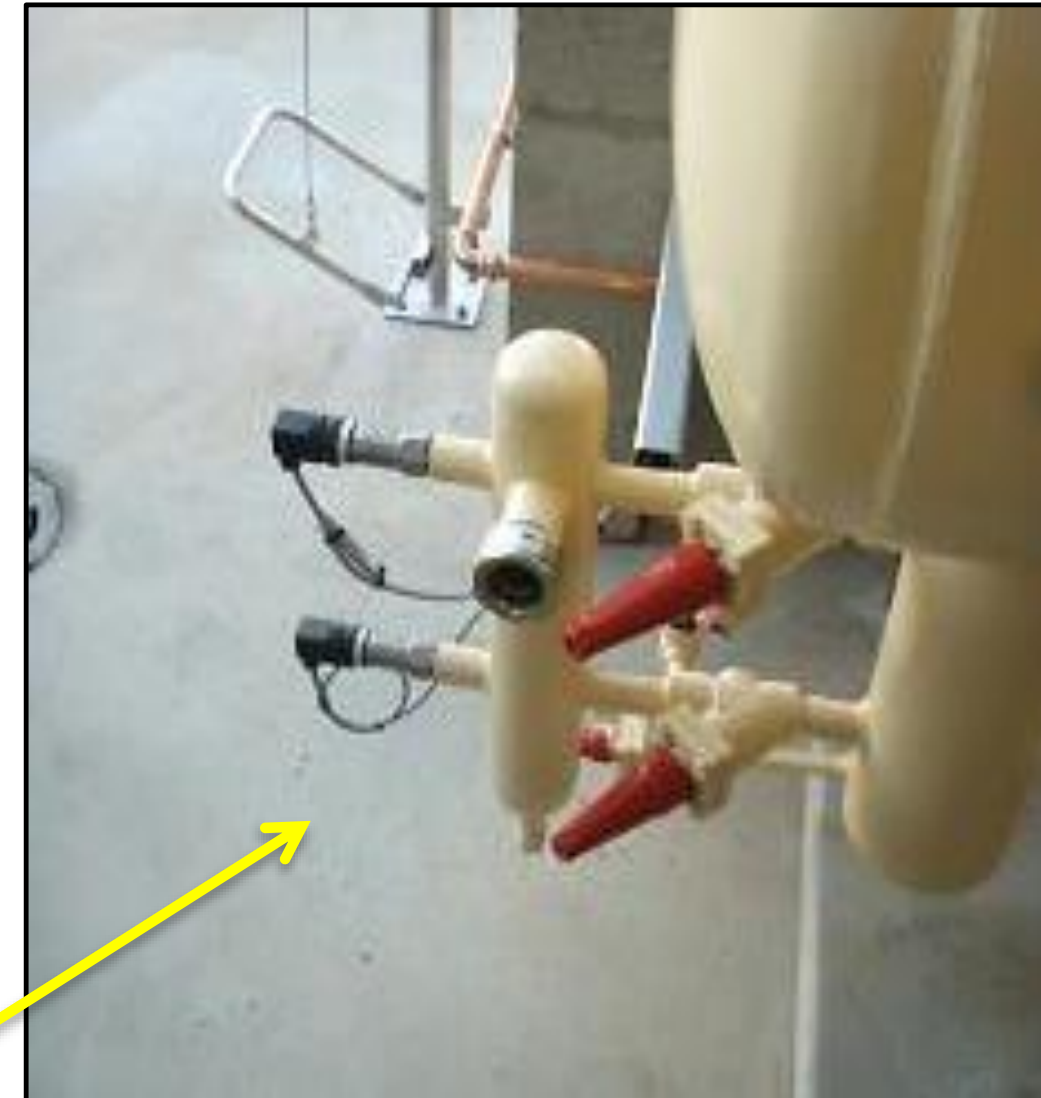


Source: California Energy Commission 2008

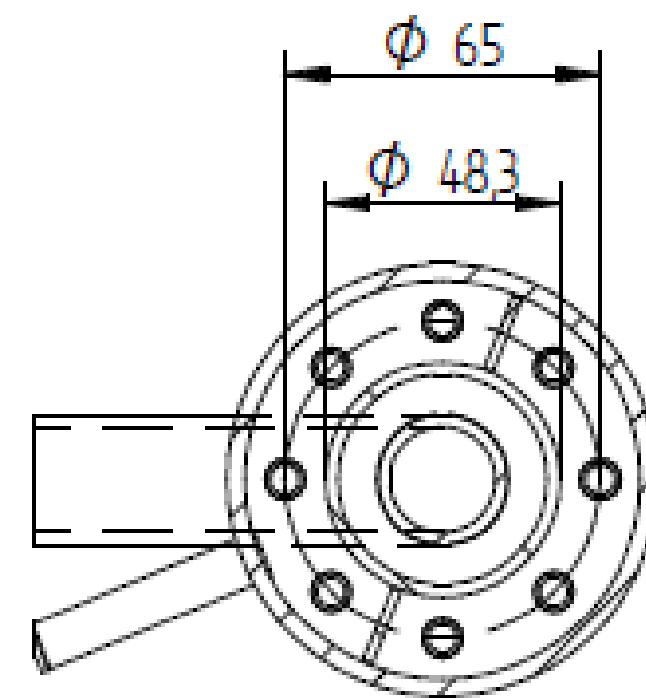
# SOME RECENT MILESTONES



Oil carry-over <1 ppm

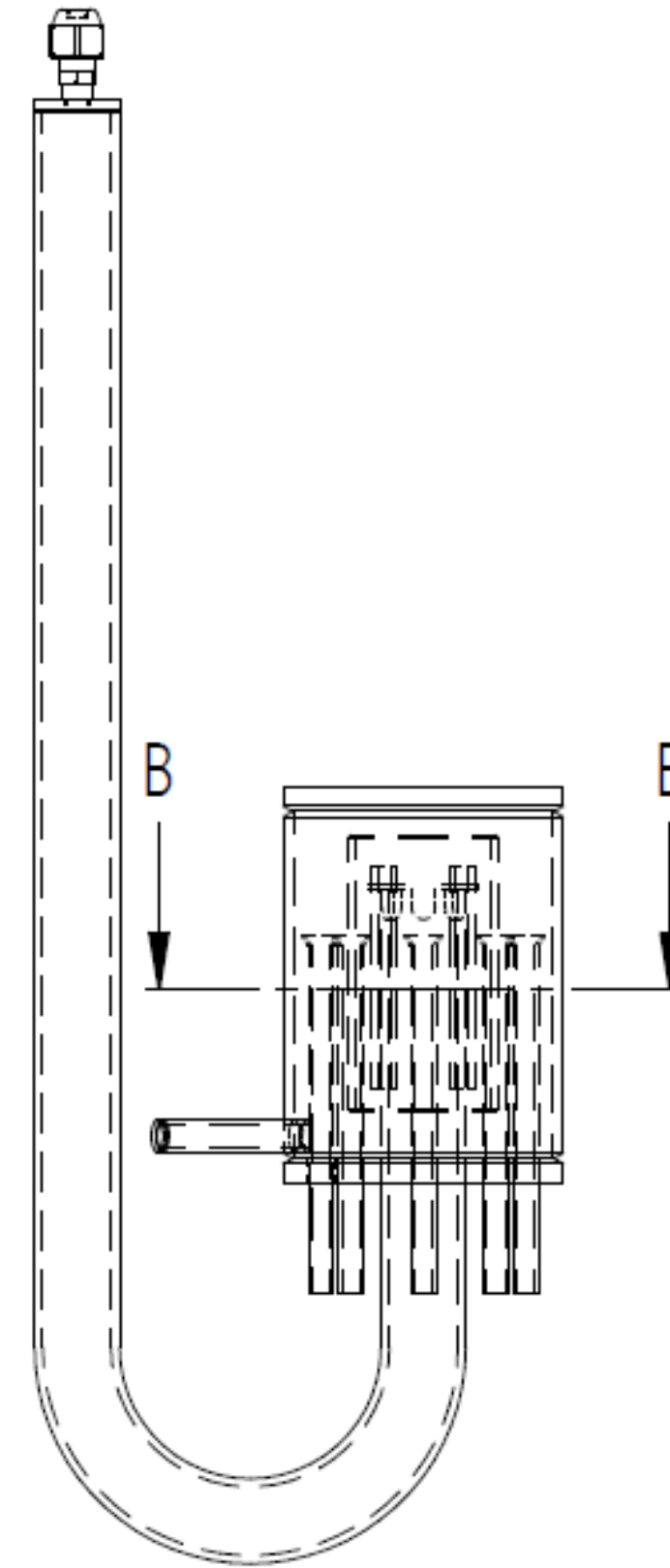


Automatic oil return

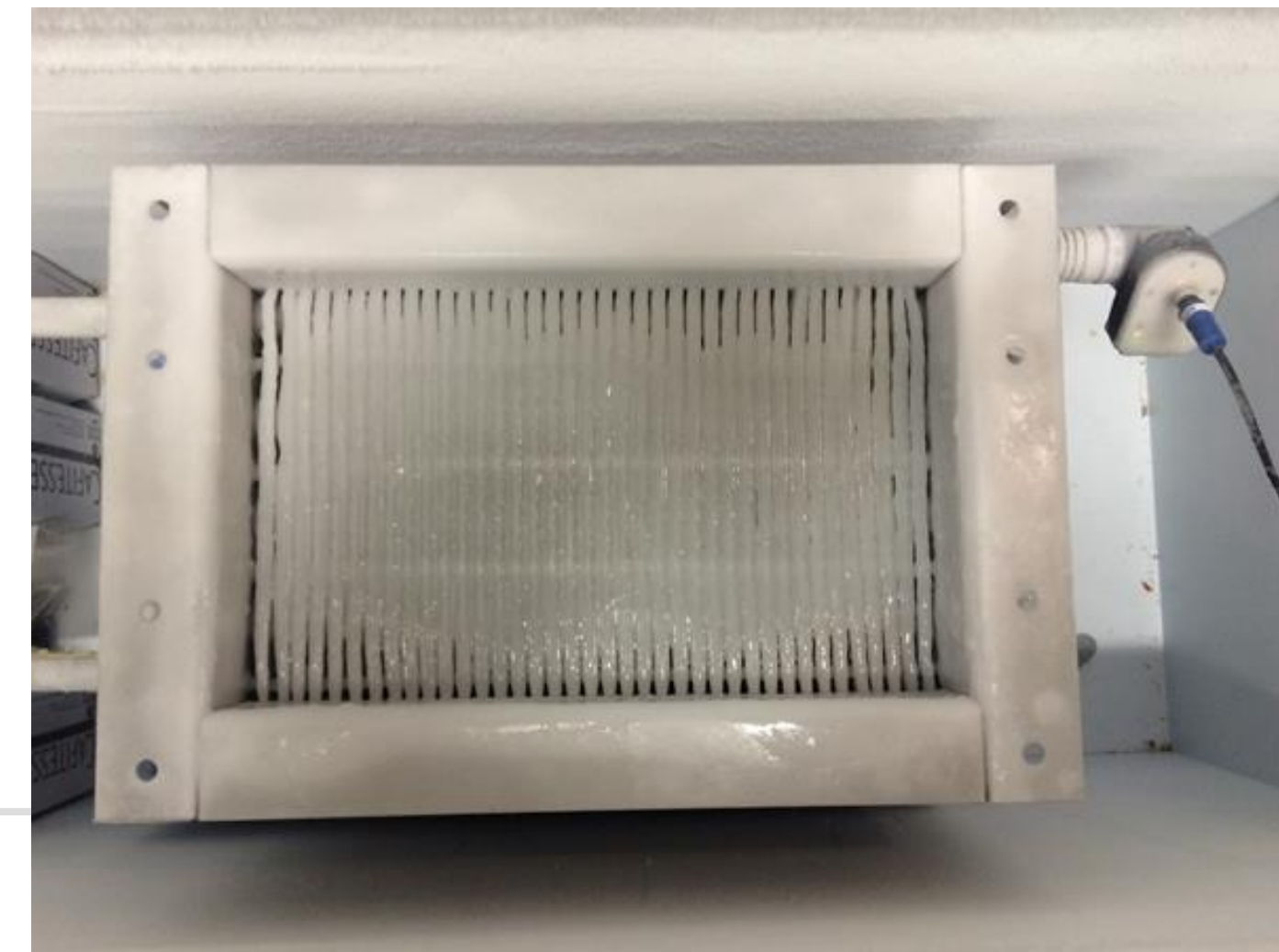


Schnitt B-B

New distributors



Demand defrost by means of frost thickness sensors



# WHERE ARE WE GOING?

Central low charge NH<sub>3</sub> plants <0.7 kg/kW

Smaller evaporator tubes for even lower NH<sub>3</sub> inventories

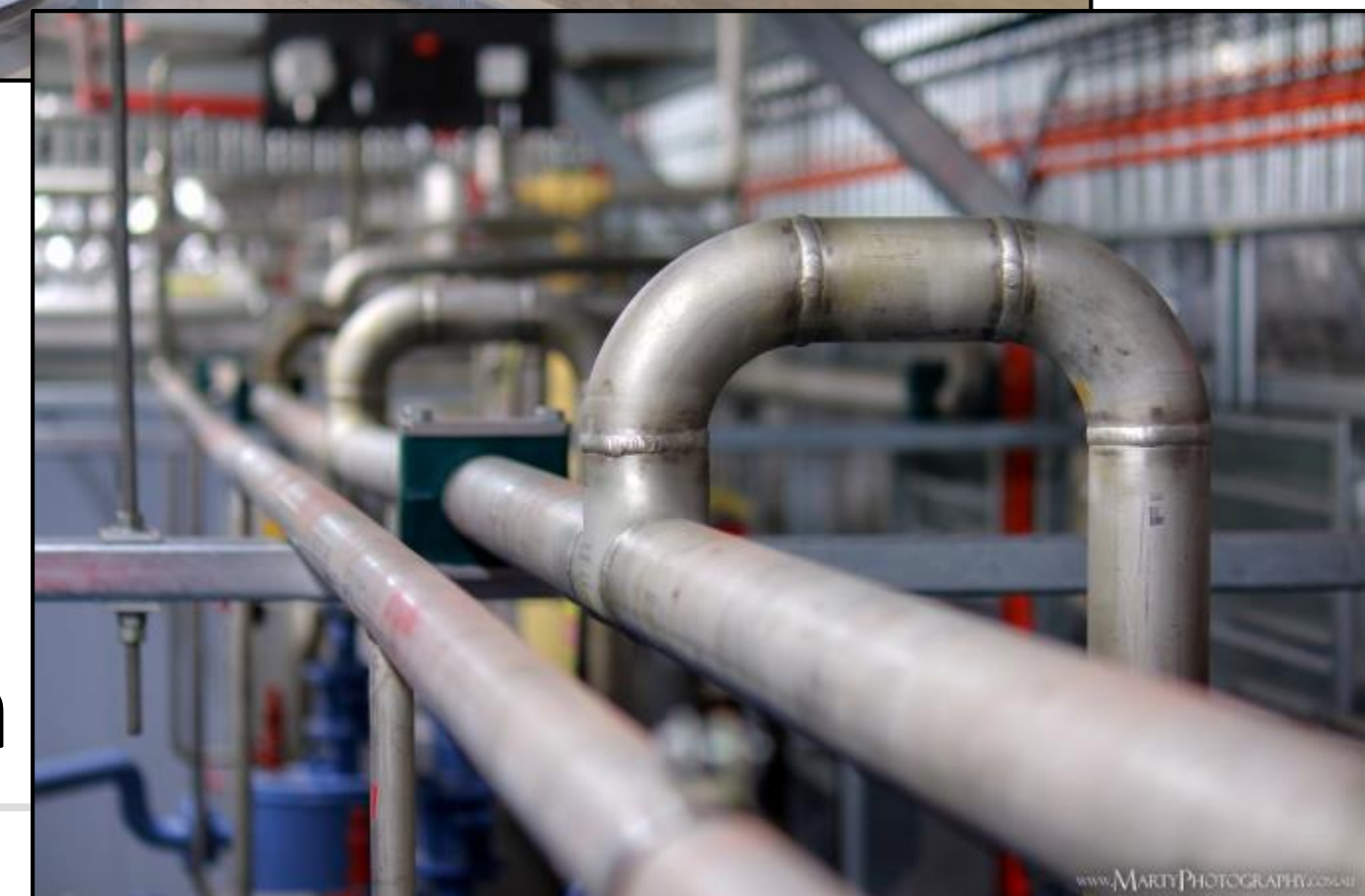


NH<sub>3</sub>  
DX  
PHE's



Factory packaging for mobility and safety

304SS for low friction



# WHERE ARE WE GOING?

Low charge plate freezers

“LOGAS” hot gas defrost minimizing intercooler NH<sub>3</sub> inventory

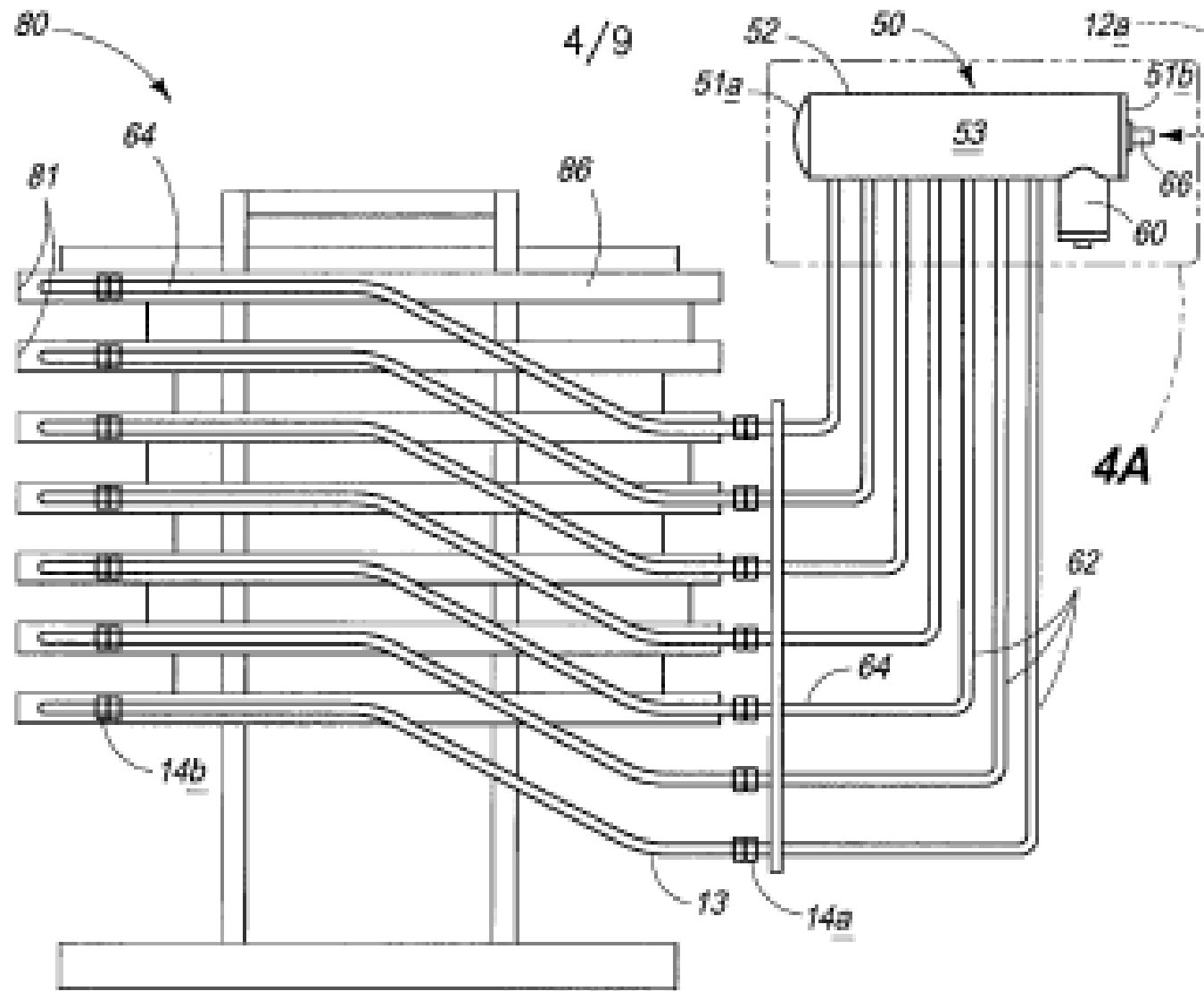


FIG. 4

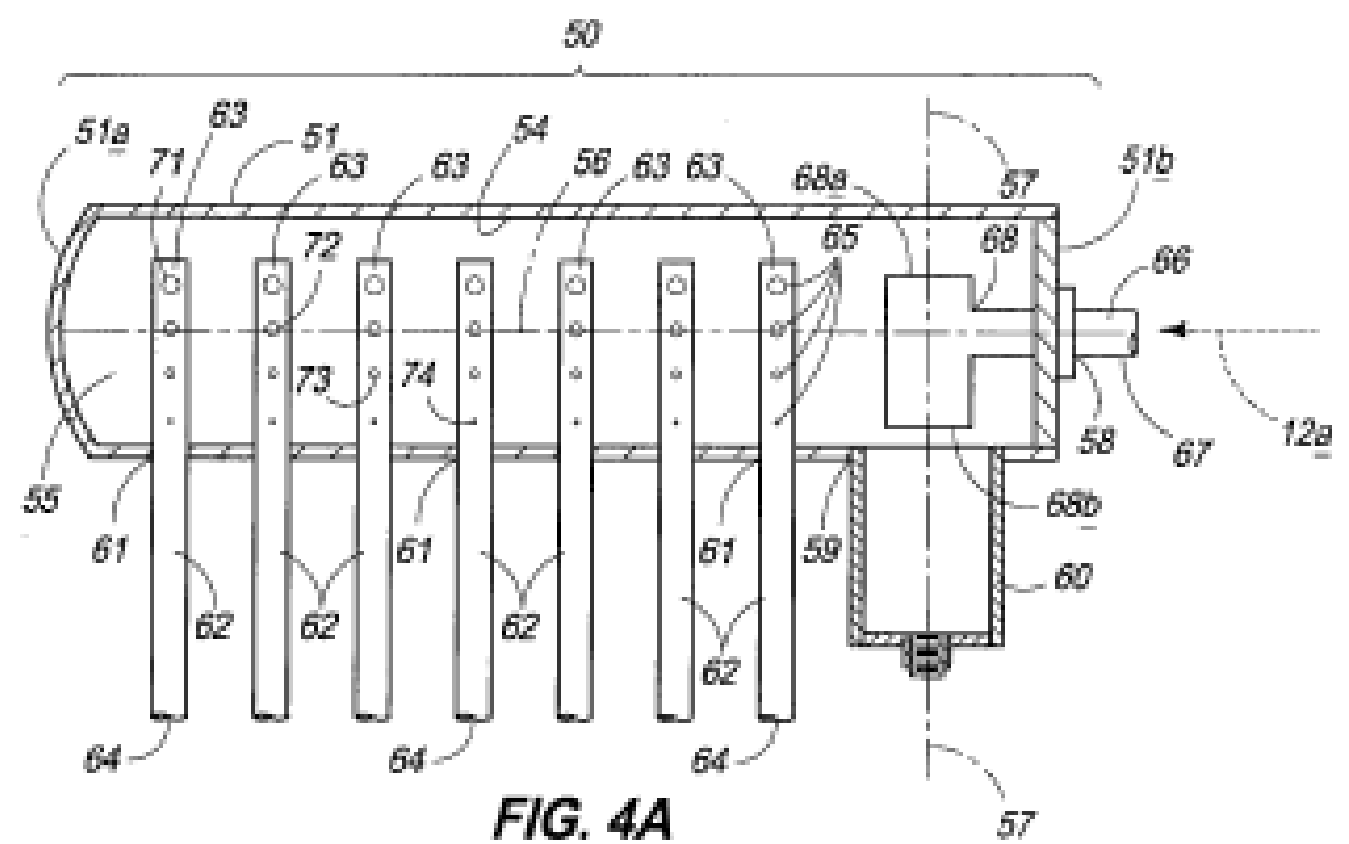
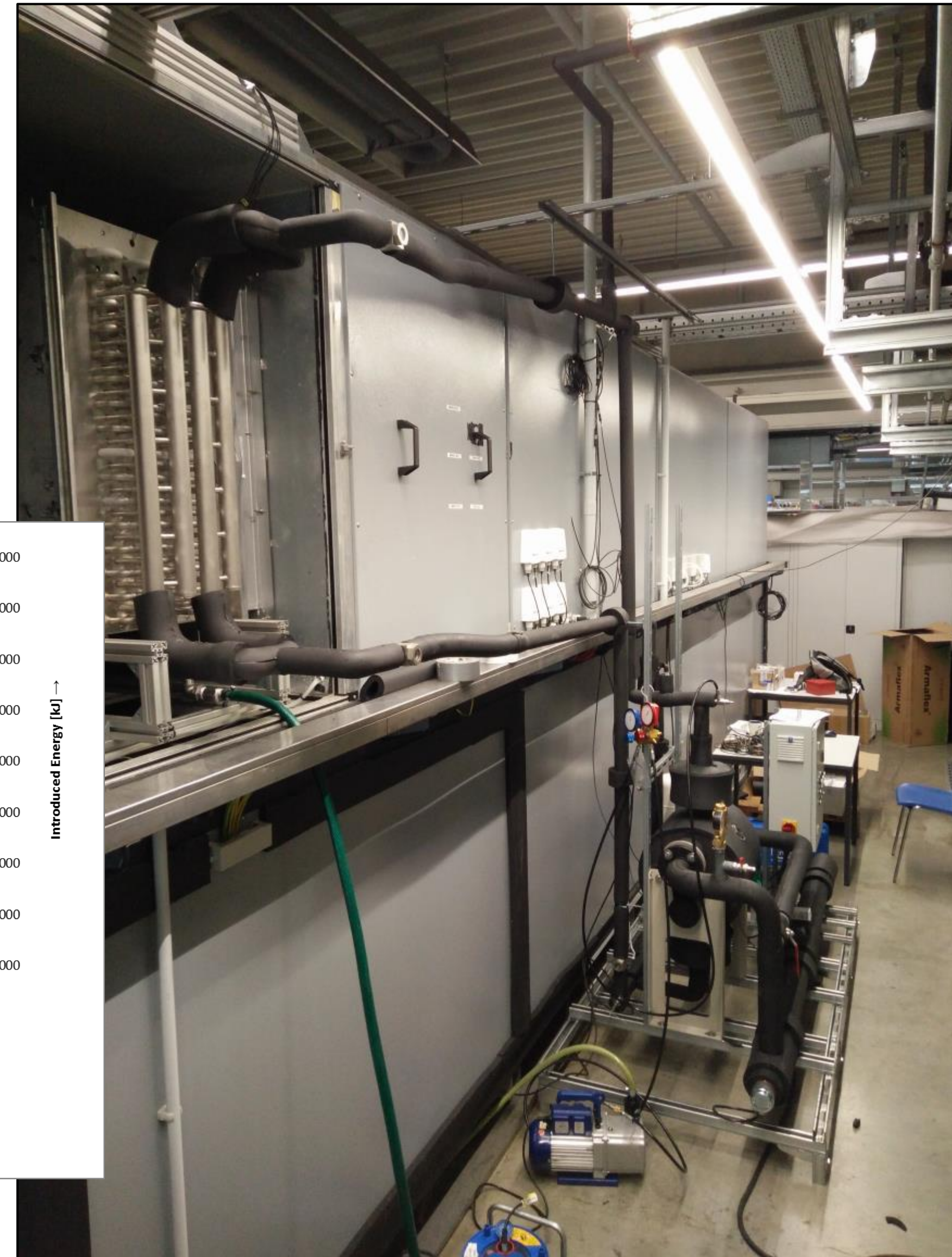
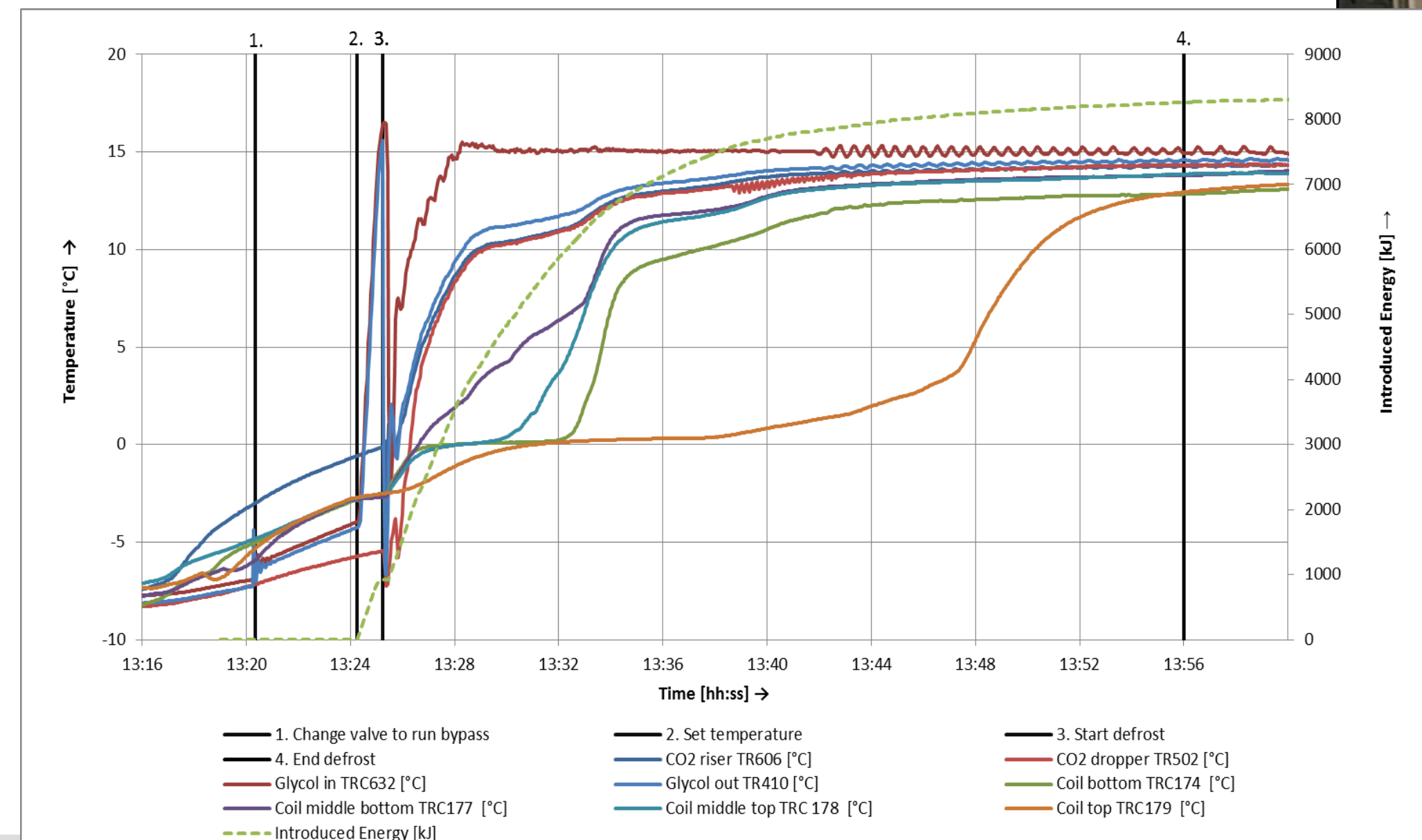


FIG. 4A



# WHERE ARE WE GOING?

Office A/C with chilled water supplied from low charge NH<sub>3</sub> system



Larger systems

Cold store evaporator, 7 meters long, 160 kW cooling capacity



# WHERE ARE WE GOING?

- Towards reducing  $\text{NH}_3$  inventories further and therefore towards safer systems
- Towards more widespread use of semi-hermetic compressors for  $\text{NH}_3$
- Towards more compact air coolers for medium temperature applications
- Towards significantly improved energy efficiency with multiple sources of drive energy
- Towards new applications in air conditioning, supermarkets and commercial refrigeration
- Towards  $\text{NH}_3$  based, low charge liquid chilling systems for a wider range of purposes



# WHERE ARE WE GOING?

- Towards greater mechanical system simplicity with a much wider range of applications
- Towards non-welded systems employing press-fit tubing with metal to metal seals
- Towards more compact, mass produced injection controls
- Towards total solutions where buyers pay for all services (energy, depreciation, maintenance) via fixed regular payments
- Towards the emergence of low charge  $\text{NH}_3$  technology as mainstream



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Thank you very much!

