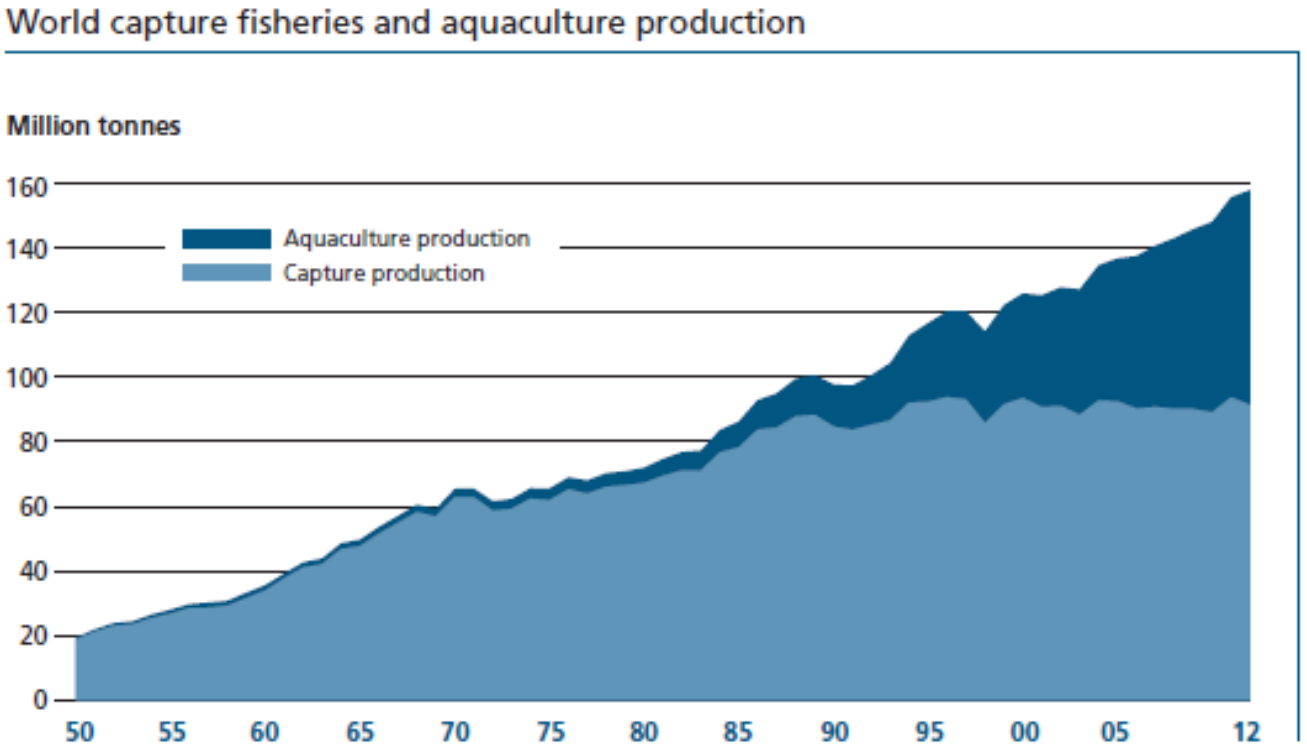
State of the fishing fleets

Current state of the fishing industry in the Indian and Pacific

Land based systems

Marine based systems

Farming becoming more popular



Fishing vessels

Marine Waters	3.230.000	74.08	%
Inland Waters	1.130.000	25.92	%
	4.360.000		

Asia	3.182.800	73	%
Africa	479.600	11	%
Latin America & Carabian	348.800	8	%
North America	130.800	3	%
Europe	130.800	3	%
	4.272.800		

Global motor powered	2.616.000	60	%
Marine Motor powered	2.228.700	69	%
Inland motor powered	406.800	36	%

Less than 12 meter vessels	2.223.600	85	%
More than 100GRT or >24m	52.320	2	%
From 12m to 24	340.080	15	%

EU flagged ships in the Western Pacific

	Vessels	Target fish
Spain	44	Tuna
Portugal	9	Tuna
France	14	Tuna
Lithuania	4	Fish carrier
Netherlands	4	Fish carrier

Ships of many sizes

Ships of many sizes

Current state of the fishing industry in other parts of the world

Fishing vessels

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Inland Waters	1.130.000	25.92	%
	4.360.000		

Asia	3.182.800	73	%
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For many owners the shift to new solutions can be difficult

The table here shows some alternatives to HCFC 22

R-404A here is about 4 times the price of R-22 slighly more expensive than R-717

The average fisher and technician is not properly trained to do much more than the daily monitoring of temperatures and pressures – some cannot read

Their homes do not have electricity and the daily income can just get some food for the family

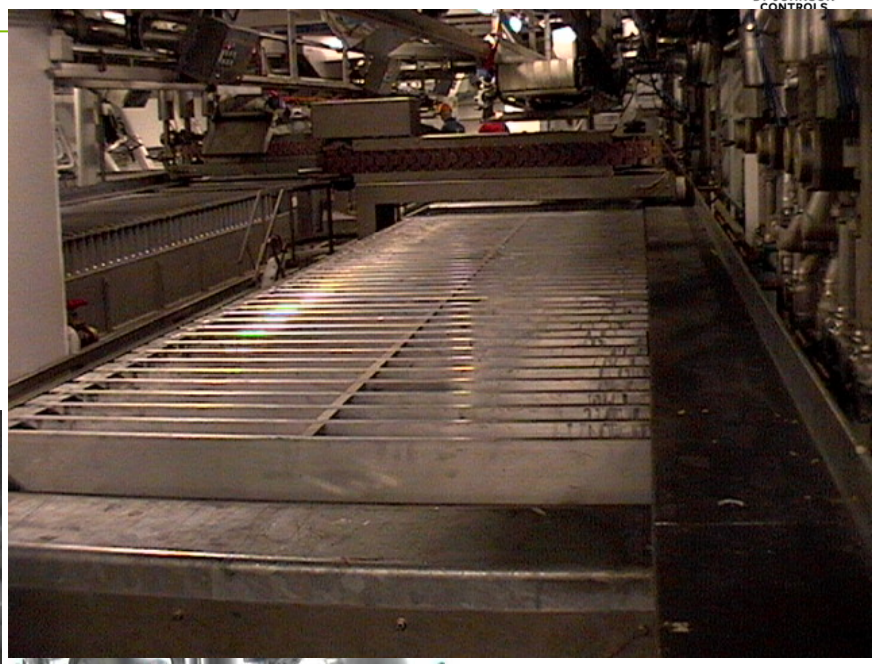
Some of the people working on fishing vessels are kept there in conditions more resembling slavery

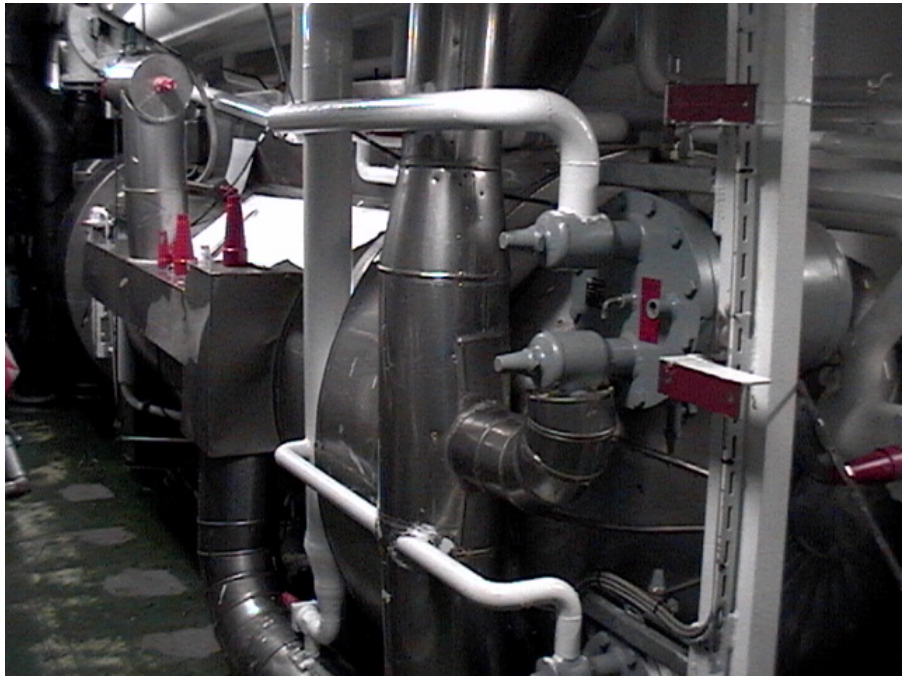
When ships reach time of retrofitting they are disposed on remote islands as big waste

Prices	Relative net price
R404A	1.00
R407F	1.42
R407C	1.03
R452A	3.07
R134a	0.83
R32	1.96
R717	0.21
R290	1.35
R1234ze	3.97
R444B	3.77
R448A	3.41
R449A	3.06
R513A	3.29
R407A	1.00
R600a	1.44
R438A	2.33
R455A	
R410A	1.07

Freezing fish onboard, Kvannøy 2001, Norway

Working on complex and efficient systems can be too difficult for many working in the machine rooms today





M/S Kvannøy

6 reciprocating CO_2 compressors, 3 available for defrosting

2 screw ammonia compressors

11 CO_2 vertical plate freezers, 39 stations each

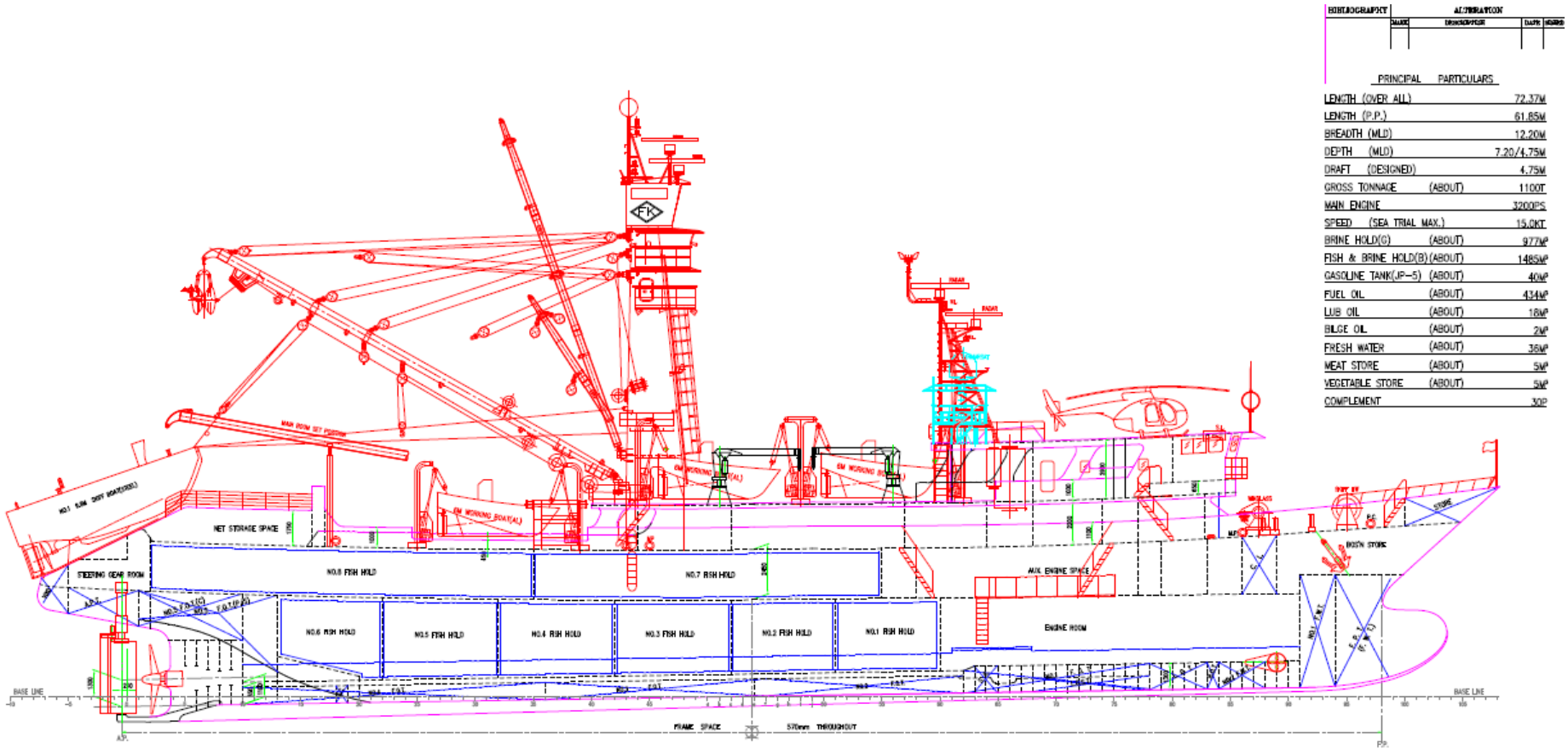
1 CO_2 vertical flake ice machine

Natural air convection CO_2 coils in 3 cargo holds

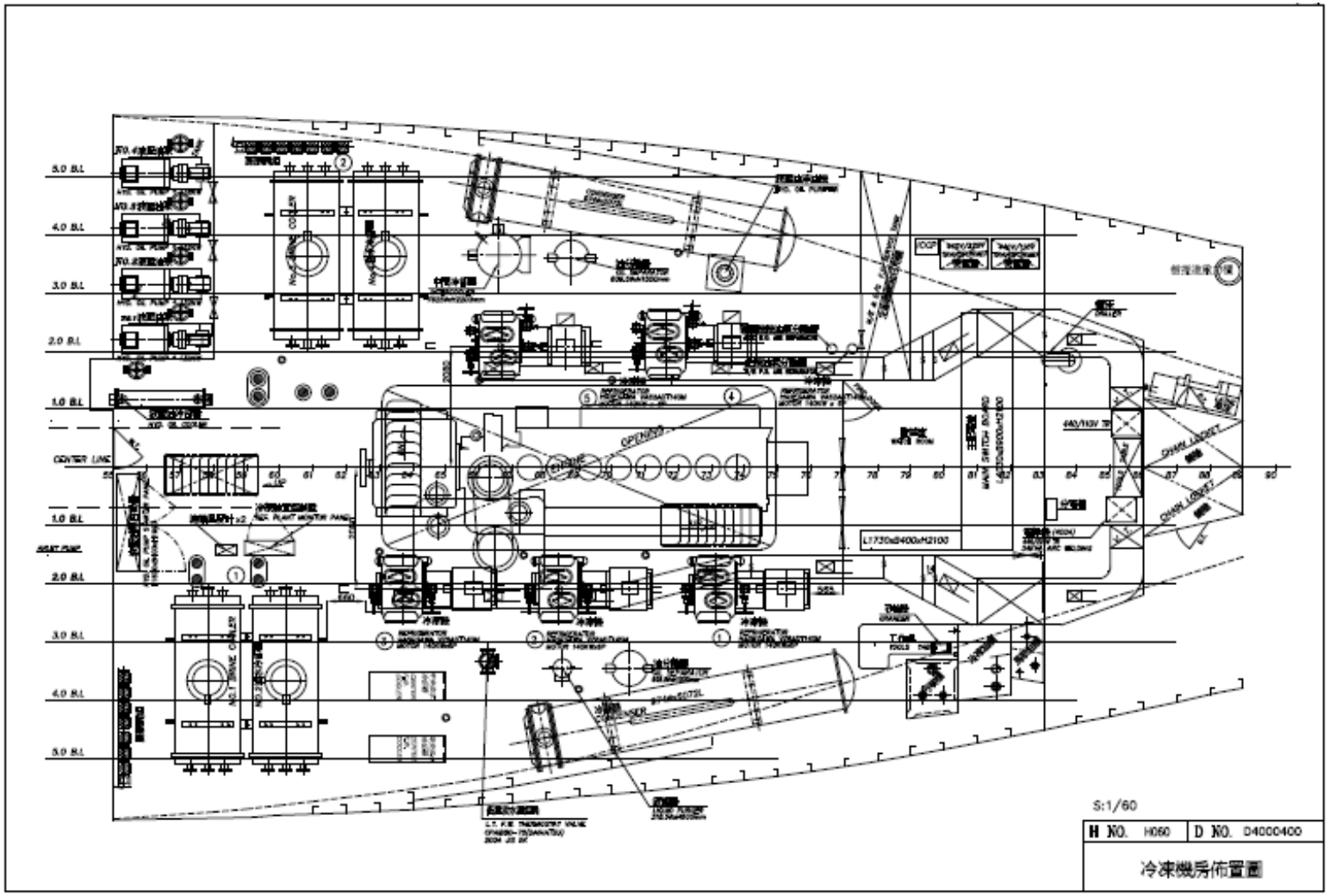
Shell and tube inter stage heat exchanger

Total capacity 1350 kW (4,606 MBH) at –48° C (-54.4° F)

A typical modern boat as used in the Pacific



The machine room onboard



A typical modern boat as used in the Pacific

GENERAL DESCRIPTIONS

1. Freezing

Freezing capacity	:	Approx. 220 tons/24hours -17℃ (Brine freeze)
		Brine immersion system by brine cooler
Cooling system	:	R717 liquid flood expansion and NaCl brine freezing system
Application	:	No.1~6 Fish holds
Volume	:	approx. 966m3
Brine temp.	:	approx. -17℃

2. Dry fish hold

Application	:	No.7~8 Fish holds
Volume	:	approx. 541m3
Cooling temp.	:	approx. -40℃
Cooling system	:	R717 direct expansion and hair-pin coil system

3. Refrigerant : R717 (NH3)

The Compressors

ITEMIZED DESCRIPTIONS

1. R717 Compressor with motor (single stage) 3 sets

Type	:	High-speed multi-cylinder direct coupling type
Model	:	N8WB
		Bore 130mm ϕ × stroke 100mmL (8 cylinders)
Motor	:	140kW×6P ×1,170rpm (AC440V/60Hz×3 ϕ)
Accessories	:	Oil cooler, unloader, safety valve, service valve,
		protection swatches and thermometers

2. R717 Compressor with motor (single / two stage alternative model) 2 sets

Type	:	High-speed multi-cylinder, two stage compression and
		Direct coupling type
Model	:	N62WB
		Bore 130mm ϕ × stroke 100mmL (6 + 2 cylinders)
Motor	:	140kW×6P×1,170rpm (AC440V/60Hz×3 ϕ)
Accessories	:	Oil cooler, unloader, safety valve, service valve,
		protection swatches and thermometers

Advantages

- In large installations for freezing foods, this solution has been used as a way to reduce the inventory of R-717 in plants. Most of European countries and USA have been giving enough focus to reducing ammonia installed in the plants.
- Reduction in the size of equipment in plants for freezing products with temperatures below -45 ^{o}C.
- Adoption of the cascade system R-744/R-717 in commercial refrigeration facilities, where the cost of most refrigerants are higher than 20 R$/kg (with a potential leakage risk).

Refrigerant	Weigth (lb)	Price ($)	R$/kg
R-22	30	398	64
R-134a	30	161	26
R-404A	24	135	27
R-407C	25	132	26
R-410A	25	109	21

Based on USA market, without quantity discount and tax.

Thank you for your kind attention