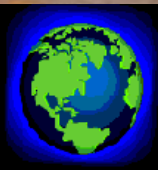




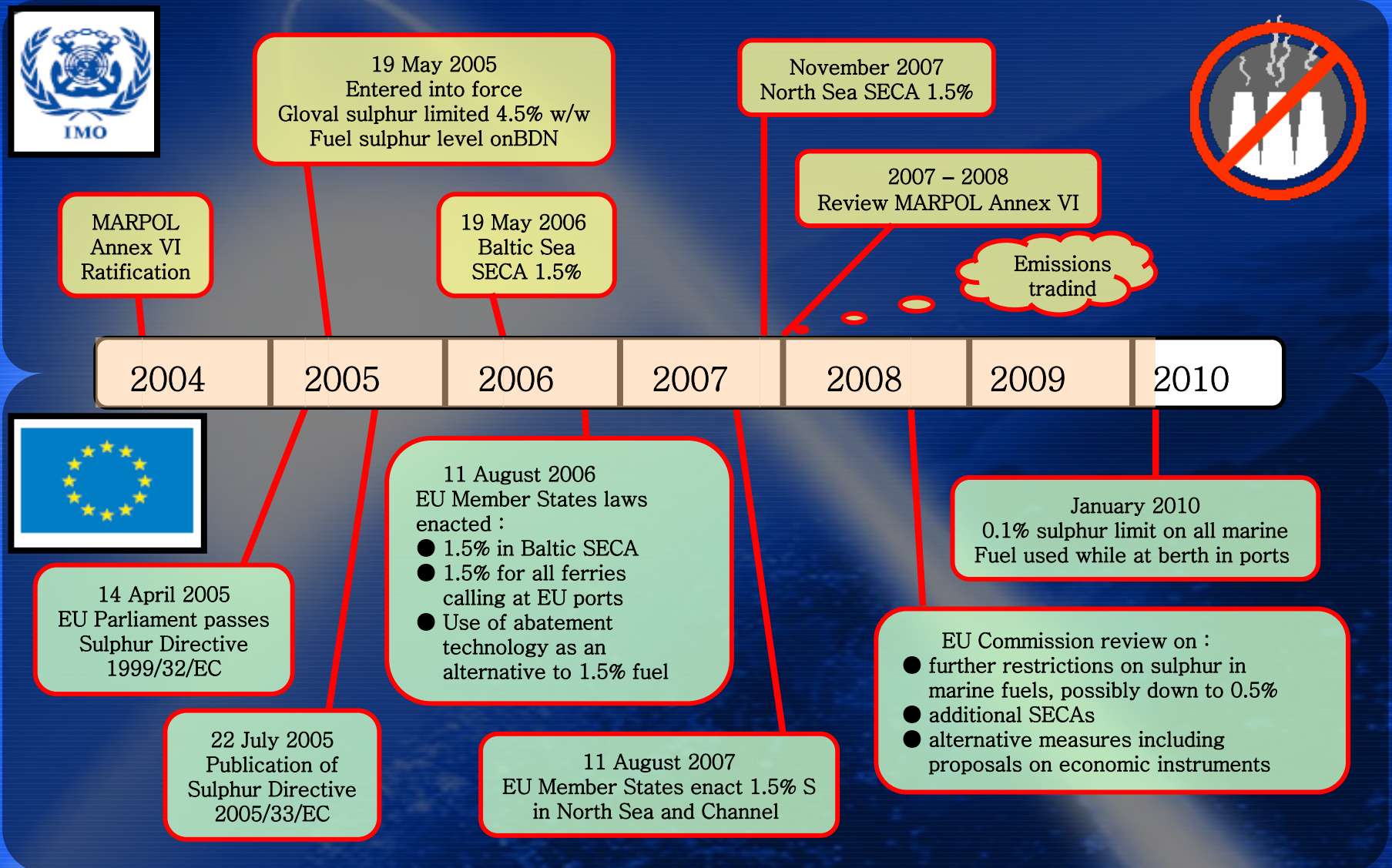
MGO COOLING UNIT



Heat Exchanger
Solution Partner

1. Regulation – IMO & EU

Legislative overview and timeline – IMO and European Union



1. Regulation

MARPOL 73/78 Annex VI

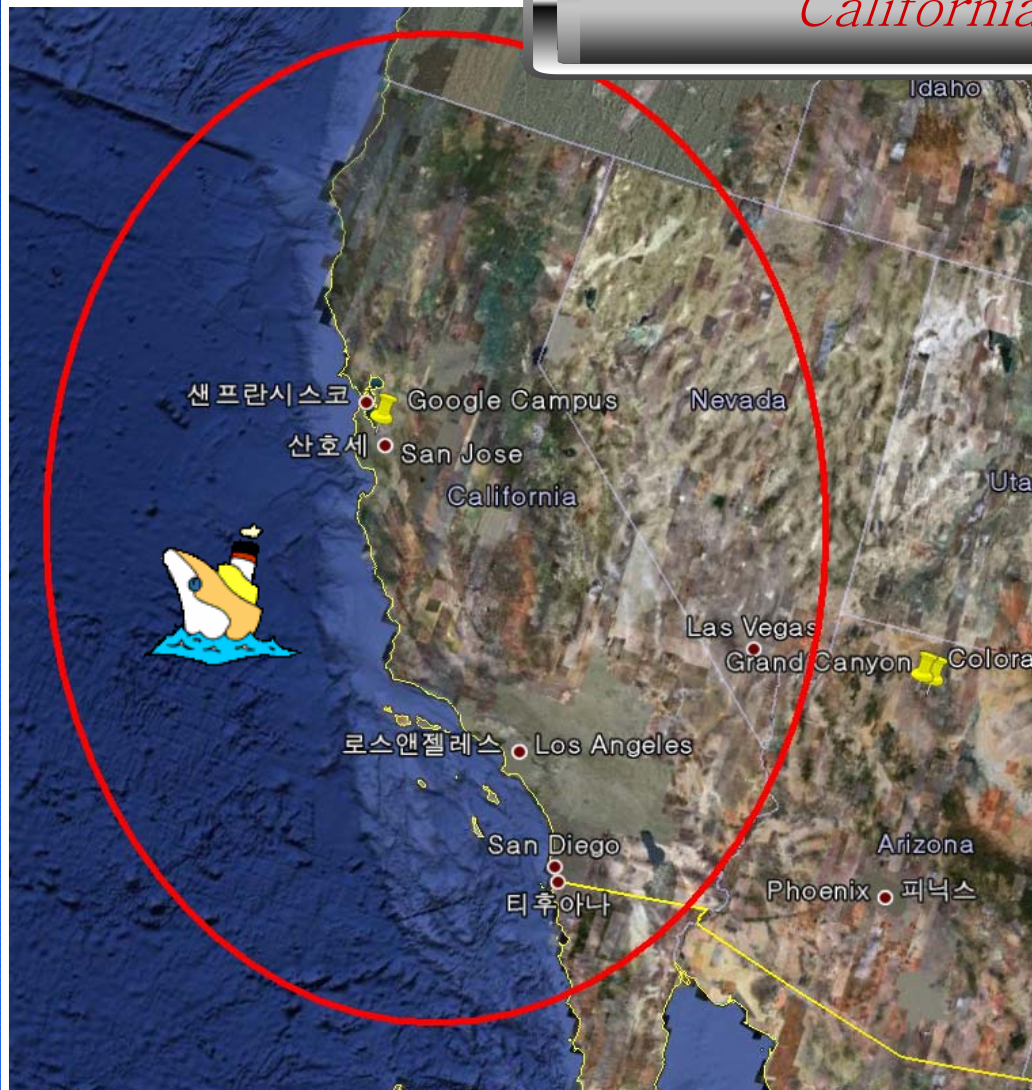
Application Time	Regulation	Area	Application	Sulfur Content
2005. 05. 19 ~	MARPOL Annex VI	Global	All Ships	Below 4.5 %m/m
2006. 05. 19 ~	MARPOL Annex VI	Baltic Sea (SECA)	All Ships	Below 1.5 %m/m
2007. 11. 22 ~	MARPOL Annex VI	North Sea (SECA)	All Ships	Below 1.5 %m/m

EU Directive 2005/33/EC

Application Time	Regulation	Area	Application	Sulfur Content
2006. 08. 11 ~	2005/33/EC	EU Ports	Passenger Ship (>12people)	Below 1.5 %m/m
2006. 08. 11 ~	2005/33/EC	Baltic Sea (SECA)	All Ships	Below 1.5 %m/m
2007. 08. 11 ~	2005/33/EC	North Sea (SECA)	All Ships	Below 1.5 %m/m
2008. 01. 01 ~	2005/33/EC 2005/33/EC	EU Ports	All Ships	Below 0.1 %m/m for Marine Gas Oil
2010. 01. 01 ~	2005/33/EC	EU Ports	All Ships	Below 0.1 %m/m

1. Regulation

California



CARB				
Application Time	Reg.	Area	App.	Sulfur Content
2007. 01. 01 ~	CARB	CARB Area	All Ships	Below 0.5 %m/m for MDO
2009. 07. 01 ~	CARB	CARB Area	All Ships	Below 0.5 %m/m for MDO or Below 1.5 %m/m for MGO
2012. 01. 01 ~	CARB	CARB Area	All Ships	Below 0.1 %m/m for MDO & MGO

CARB
(California Air Resources Board)
- Within 24 miles (39Km) from California sea coast

1. Regulation

EU Ports



Available Application at SECA (SOx Emission Control Areas)

1. MGO Cooling-Unit
2. Exhaust Gas-Sox Cleaning Systems (e.g. Sox scrubbers)
3. Distillate Fuel (Low-Sulfur)

2. Function of MGO Cooling Unit

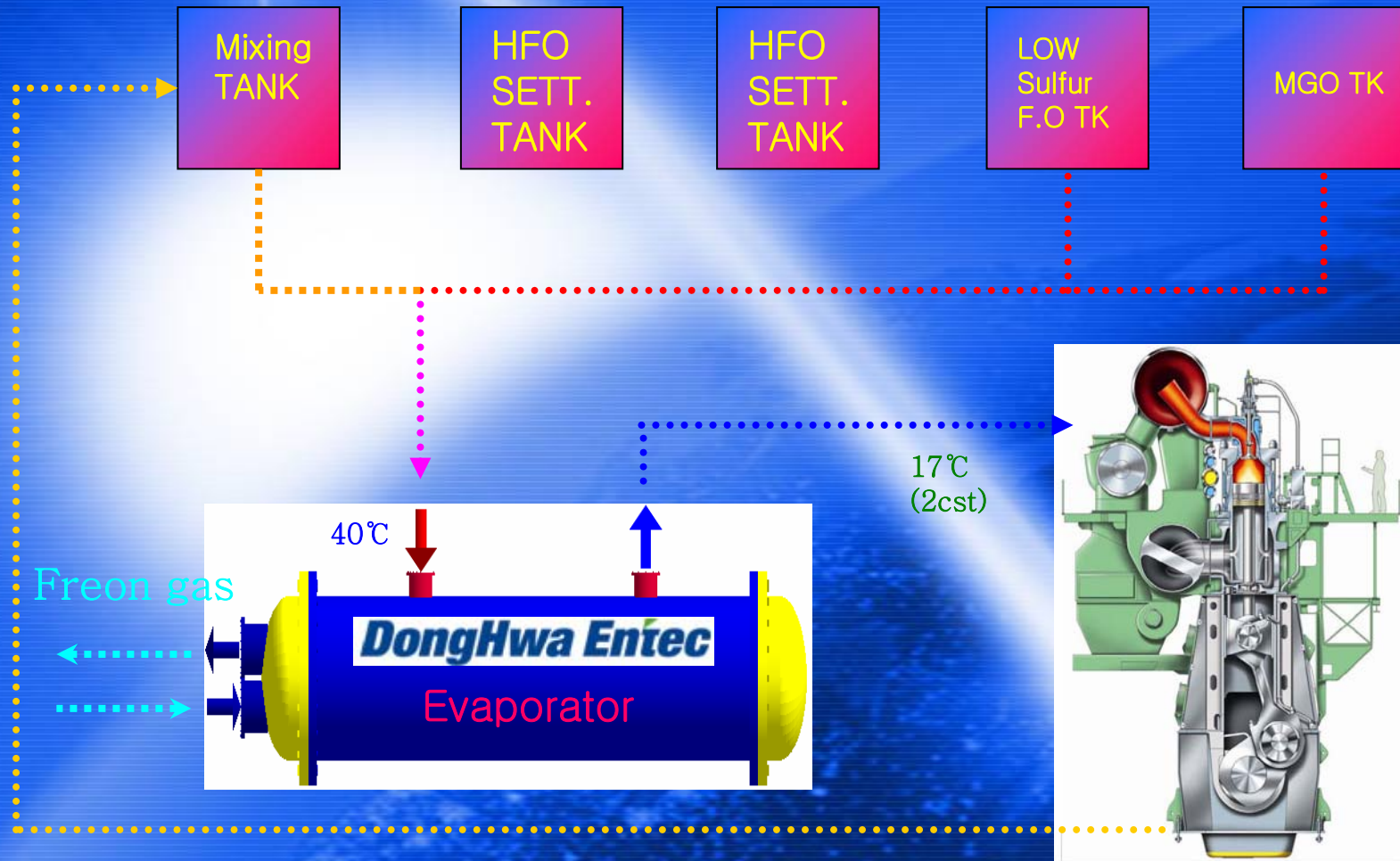
Freon gas

- Features of Freon Gas
 1. Developed by DuPont Co.,Ltd. for the use of refrigerator.
 2. Safe from corrosion.
 3. Applicable to food due to non-toxic characteristic and handy use.
 4. High thermal efficiency under low pressure.
 5. Applied to Refrigerator and Air Conditioner.
 6. Destroy ozone layer through split of chlorine by ultraviolet rays.
(Prohibition from 2040 by Montreal Protocol)
- Representative Freon Gas : R12, R22, R502(No use)
- Carbonization Hydrogen System Freon gas is used for marine : R134A, R404A/R507A, R407C, R410A
- Expected to be replaced from Freon to Halogen Gas.
; Bromine instead of Chlorine is used for Halogen Gas.

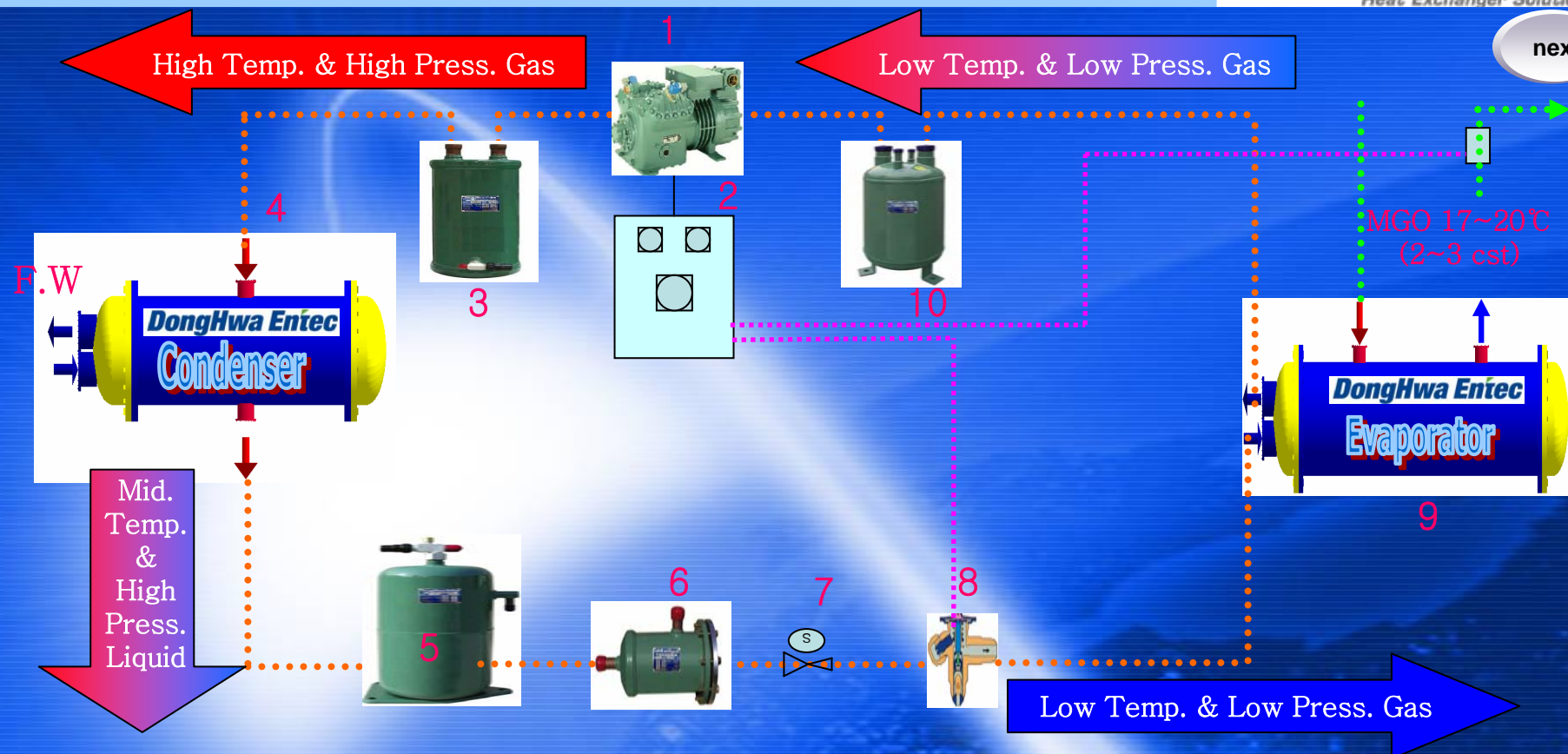
2. Function of MGO Cooling Unit

It's composed with Compressor, Condenser, and Evaporator and Freon Gas as refrigerant is used to keep the viscosity of Marine Gas Oil to 2 cst(17°C).

Ambient air temp. : 45°C



4. P&ID and Diagram

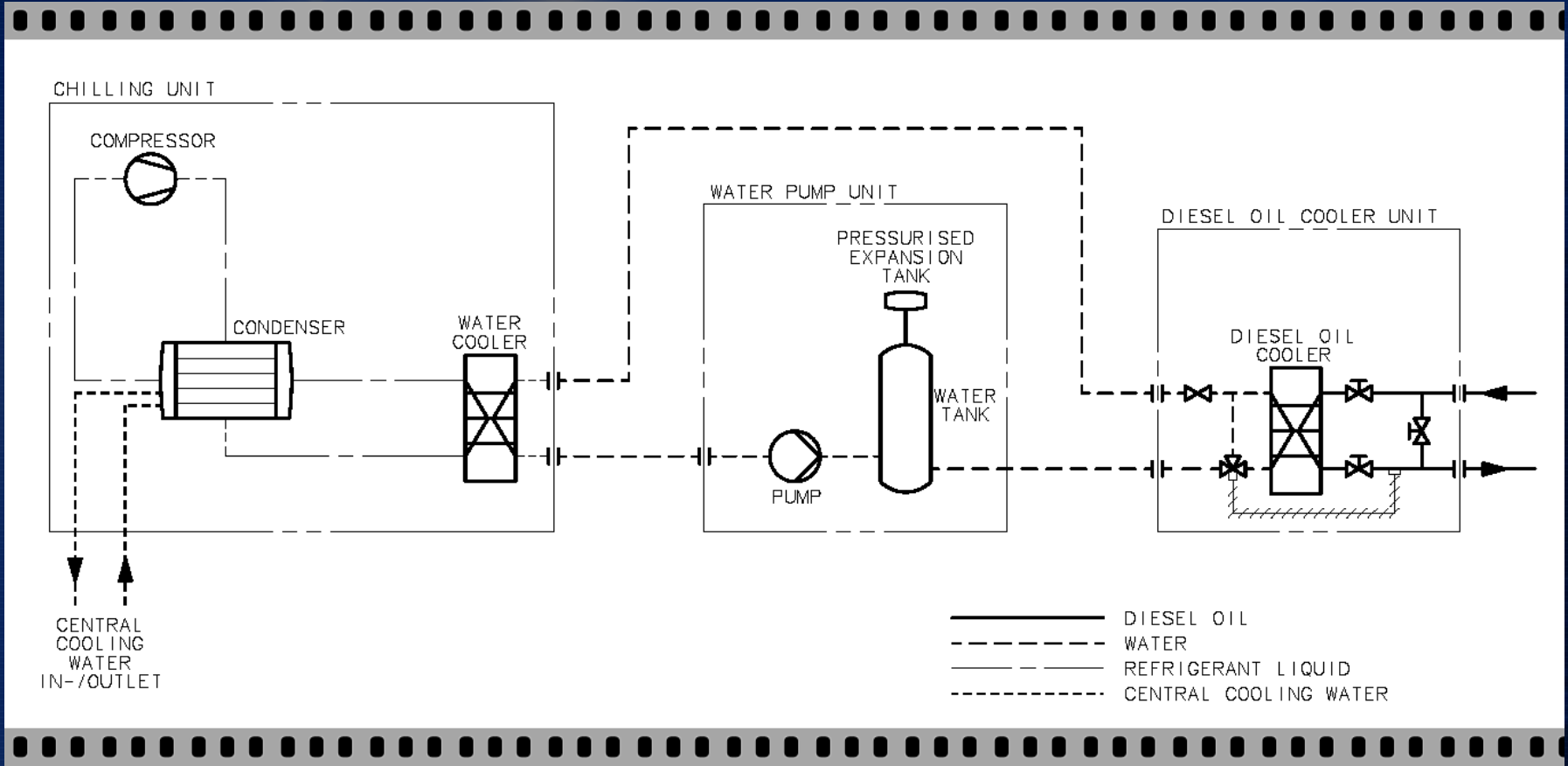


next

No.	Item	No.	Item
1	Compressor	6	Strainer
2	Control Panel	7	Solenoid Valve
3	Oil Separator	8	Thermal Expansion Valve
4	Condenser	9	MGO Evaporator
5	Receiver	10	Accumulator

4. P&ID and Diagram

MAN DIESEL



4. P&ID and Diagram

