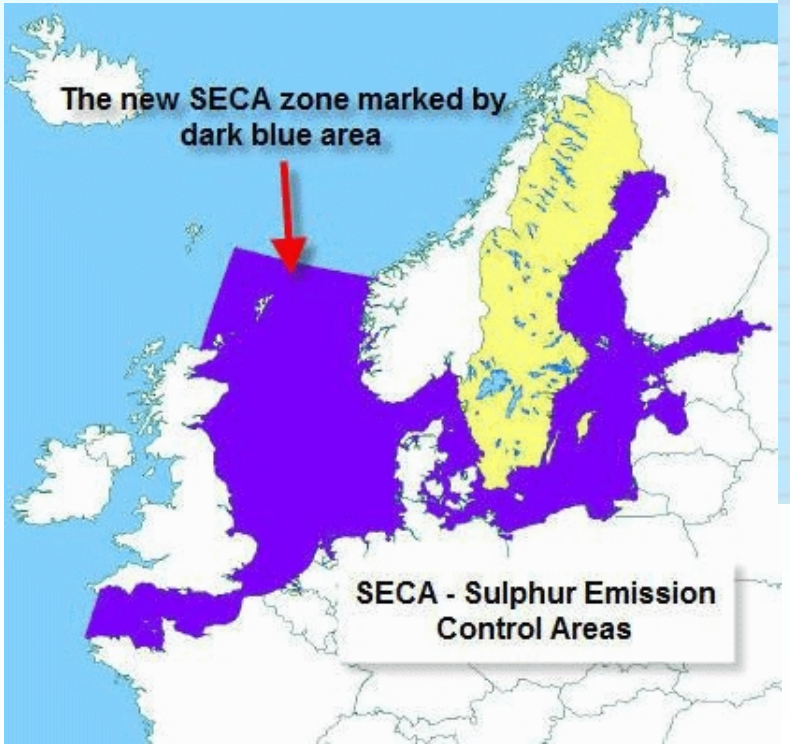
MGO Cooling

Current and Upcoming Legislation

Sulphur limits of marine fuels				
Enforcement date	Sulphur limit (% m/m)	Grade	Operating area	Reference
Already in force	4.5	All grades	Global limit	MARPOL Annex VI
	0.1	MGO	EC Territory and waters	Directive 1999/32/EC as ammended by Regulation 1882/2003 and Directive 2005/33
	1.5	All grades	Baltic / North sea SECA	Directive 1999/32/EC as ammended by Regulation 1882/2003 and Directive 2005/33 + MARPOL Annex VI
Early 2009	1.5	MGO (DMA)	California waters and 24 NM of the California baseline	CARB (mandatory use of either MGO or MDO with the set maximum sulphur limits to auxiliary engines
	0.5	MDO (DMB)		
1 July 2009	1.5	MGO (DMA)		CARB (mandatory use of either MGO or MDO with the set maximum sulphur limits to main propulsion engines and boilers)
	0.5	MDO (DMB)		
1 January 2010	0.1	All grades	EC inland waterways and at berth for > 2 hours	Directive 1999/32/EC as ammended by Regulation 1882/2003 and Directive 2005/33
1 July 2010	1.0	All grades	Baltic / North sea SECA	Revised MARPOL Annex VI adopted by resolution MEPC.176(58)
1 January 2012	3.5	All grades	Global limit	Revised MARPOL Annex VI adopted by resolution MEPC.176(58)
1 January 2012	0.1	MGO (DMA) MDO (DMB)	California waters and 24 NM of the California baseline	CARB (mandatory use of either MGO or MDO with the set maximum sulphur limits to all engines)
1 January 2015	0.1	All grades	Baltic / North sea SECA	Revised MARPOL Annex VI adopted by resolution MEPC.176(58)
1 January 2020	0.5	All grades	Global limit	Revised MARPOL Annex VI adopted by resolution MEPC.176(58)

IMO have ratified 200 NM of the North American coastline as a SECA area by the Aug. 2012 – 0.1% Sulphur effective from January 1st 2015

The SECA areas



MGO Cooling
Technical Background

- The distillation process of fuels to remove sulphur causes:
  - Lubricity to fall below set standards
  - Viscosity to fall below an acceptable level

- Lubricity can be raised by additives and is being positively affected by cooling

- Viscosity can be raised by cooling the fuel
  - 3 cSt is recommended to ensure safe operation of ME fuel pumps
  - 2 cSt is requried by most booster pump makers

- Cooling is required to avoid gasification of MGO due to high temperature
  - When operating ME for prolonged periods of time at low load recirculation will continuously raise the fuel temperature

MDO / MGO Cooling
Technical Precautions

- Presumptions
  - System must be designed to allow operation from 0 – 100% load
    - » Primary operation will be at low load!
  - Temperature control must be able to ensure 2ºC / Min drop rate
    - » To avoid thermal shock to fuel system components
  - Surface temperature of coolers must be kept above pour point
    - » If pour point is reached coolers will be blocked !
  - Necessary attention to system design to ensure correct capacity
    - » Design temperatures
    - » Fuel tank location
    - » Fuel system type

System Layout
ME Location of Coolers

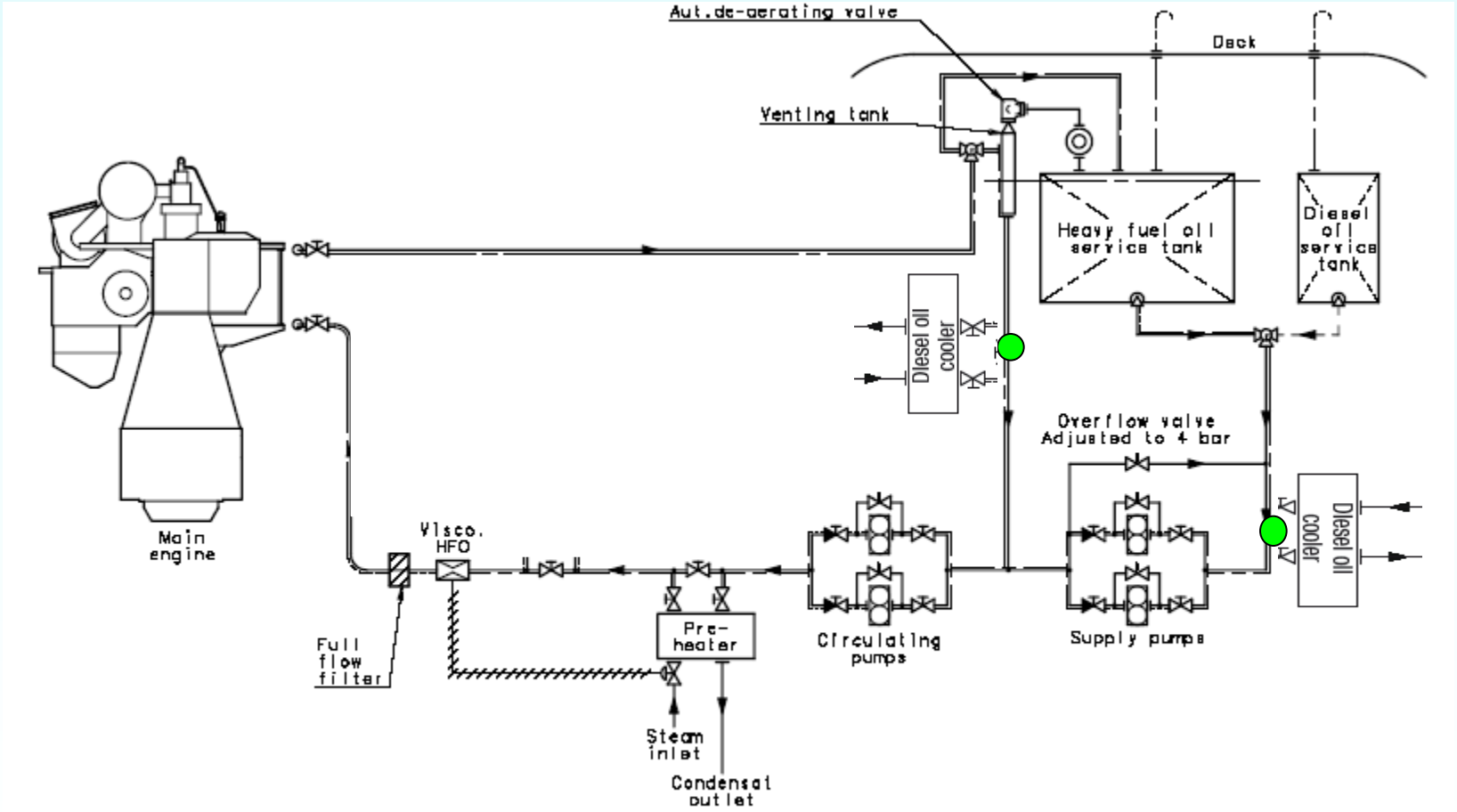
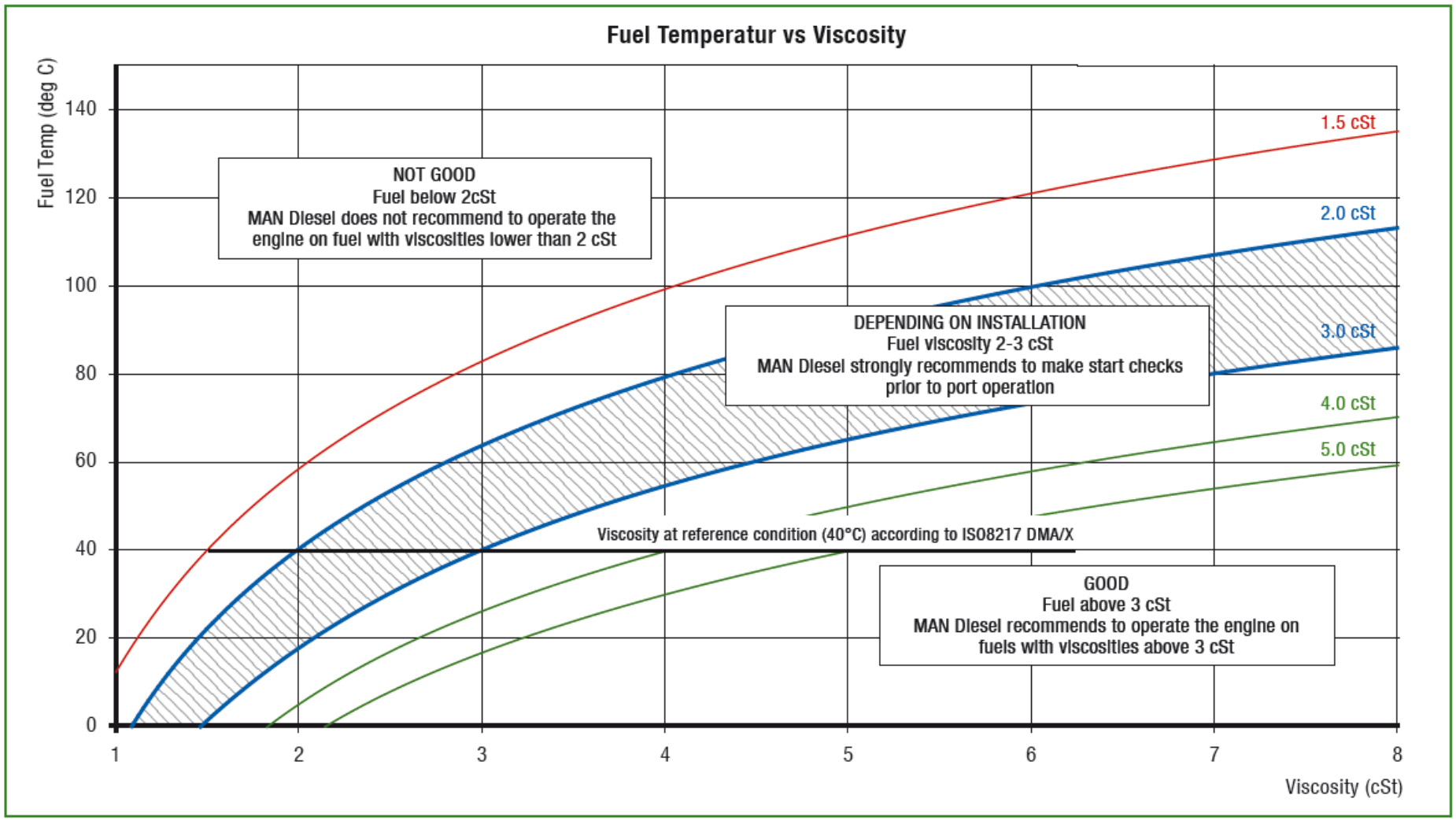


Figure 1: Fuel system (cooler installed after the circulating pumps)

Viscosity Chart

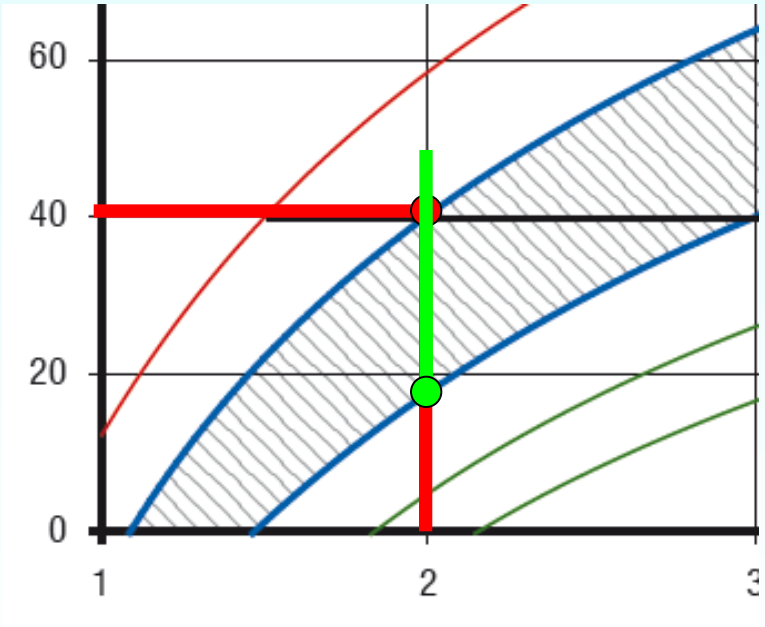


Viscosity Chart

- Specific example

- MGO is bunkered with
  - 2 cSt
  - 40ºC
  - ISO 8217 DMA/X

- To reach 3 cSt at engine inlet the MGO needs cooling from tank temperature 45ºC to 18ºC



System Layout

- Installation
  - Compact skid mounted equipment
  - Access to the ER through the service hatch
  - Installation on voyage possible
  - Piping is simple 1 – 2” steel piping
  - Fully commissioned and tested before connecting to the fuel lines
  - Vessel down time at an absolute minimum