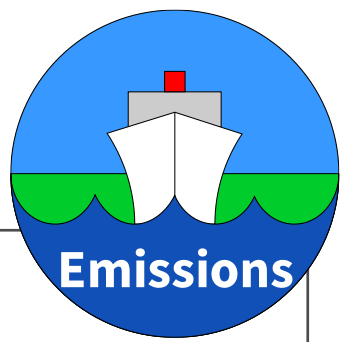


# ShipEF: : CHEAT SHEET



## Engine Characteristics

**calcShipCategory:** This function determines the EPA regulatory category of the ship based on the cylinder displacement of its main engine.

**calcEngineType:** Assigns a standardized engine type descriptor using engine stroke and engine rpm data.

**calcEngineTier:** Estimates a ship's regulatory tier for NOx emissions based on its category and keelLaidYear. Currently this function only outputs values for category 3 vessels, and NA for vessels of category 1 or 2.

```
calcShipCategory(mainEngineBore,  
mainEngineStroke)
```

```
calcEngineType(propulsionType,  
mainEngineStrokeType,  
mainEngineRPM,  
main_aux_boiler)
```

```
calcEngineTier(engineType,  
keelLaidYear,  
shipCategory)
```

## Emission Factors

**calcEF:** Calculates the emission factor to assign to an engine given its characteristics and operating conditions. Emission factors for the following pollutants can be calculated with this function: CO, HC, CO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>. By default, a low-load adjustment factor is applied if applicable.

**calcLLAF :** Calculates stand-alone low-load adjustment factors given an engine's operating conditions

```
calcEF(engineType,  
tier,  
Location,  
loadFactor,  
main_aux_boiler)
```

```
calcLLAF(engineType,  
location,  
loadFactor)
```

## About this Beta Version

This package is designed to select the appropriate set of emission factors for commercial marine vessels given information about their engines and operating conditions. Emission factors are provided for main engines, auxiliary engines, and boilers. Currently this package only provides emission factors for category 3 vessels. Future versions may also include emission factors for category 1 and 2 vessels.

## Variable Definitions

**engineType:** A standardized descriptor of engine type.

- "SSD": Slow speed diesel engine
- "MSD": Medium speed diesel engine
- "GT": Gas turbine engine
- "ST": Steam turbine engine
- "MSD-ED": Medium speed diesel engine with electric drive
- "GT-ED": Gas turbine engine with electric drive
- "LNG": Liquefied Natural Gas burning engine
- "HSD": high speed diesel engine (Auxiliary engines only)
- "Boiler": (Boilers only)

**keelLaidYear:** The year the ship's keel was laid; this may be different from the year the ship was built.

**loadFactor:** Fractional percentage (between 0 and 1) of main engine required to propel vessel at given speed.

**location:** Geographic flag used to determine fuel type most likely to be used.

- "ECA": The ship is operating within an emissions control area.
- "OutsideECA": The ship is operating outside an emissions control area.
- "GreatLakes": the ship is operating on the Great Lakes.

**main\_aux\_boiler:** Indicates the type of engine to calculate emission factors for.

- "main": The main engine used to propel the ship.
- "aux": Auxiliary engines used to provide electricity on the ship.
- "boiler": Boilers used to supply process heat on the ship.

**mainEngineBore:** Main engine cylinder diameter given in mm.

**mainEngineRPM:** Maximum operating speed of the main engine in revolutions per second.

**mainEngineStroke:** Stroke length of main engine cylinder given in mm.

**mainEngineStrokeType:** Does the engine use a 2 or 4 stroke combustion cycle (NA for non-piston engine types).

**propulsionType:** A string describing the drivetrain of the ship (may be "NA").

**shipCategory:** EPA regulatory ship category from engine displacement

**tier:** Engine NOx tier based on the vessel's keel-laid year for C3 vessels

- "Tier 0" (used for marine engines not covered by C3 NOx regulations)
- "Tier 1"
- "Tier 2"
- "Tier 3"

