Diesel Tanks and Plumbing

Diesel fuel tanks must have:

• Fuel fill(s)
• Fuel vent(s)
• Fuel Pick-ups
• Fuel Returns
ABYC Diesel Tank Requirements

Per ABYC, diesel fuel tanks:

- Must accommodate 5% expansion
  - May have a single drain (that cannot be opened inadvertently)
- Provide a means to determine fuel level (sight glasses must have valves top & bottom)
  - May be integral with the hull (KR only recommends integral tanks on metal boats)
- Fills & vents must be self-draining and not spill into the boat.
ABYC Diesel Tank Materials

Per ABYC, diesel fuel tanks can be:

• Copper (internally coated with tin) or galvanized (outside only). *Neither material is usually used.*

• **Aluminum (5052, 5083 or 5086).** *Minimum tank thickness = 0.090”*

• **Stainless Steel (316L or 317L).** *Minimum tank thickness = 0.0747”*

• Cross-linked polyethylene (*XLPE*)
Other Recommended Diesel Tank Design Practices:

Tank baffles:

- Not more than 30” (76 cm) apart.
- Leave room at top for venting and at bottom for fuel flow.
- Open area in baffle should not exceed more than 30% of tank cross-sectional area.
Other Recommended Diesel Tank Design Practices (cont’d.):

Fuel Supply Considerations:

• Consider a specific volume in the tank for a fuel sump/pick-up area.
  • Avoid tanks with large, flat bottoms.
  • Fuel pick-up tubes should be removable.
  • Generator pick-up tubes should be shorter than engine pick-up tubes.
Other Recommended Diesel Tank Design Practices (cont’d.):

Fuel Return Considerations:

• Locate return(s) as far as away from supply point(s) as possible.  
  *(Minimize the possibility of recirculating warm fuel.)*

• Some engine manufacturers require return tubes.  
  Others require the fitting in top of the tank.
  *Go figure!*
  *(Actually it has to do with self-bleeding systems.)*
Other Recommended Diesel System Design Practices:

Plumbing:

• Don’t forget the return!

• Systems with multiple tanks require that the supplies and return be from the same tank.

• Ideally the supply and return are switched together. Not always practical.
Fuel Tank Installation
Pick-ups and Returns
Diesel Fuel Injection Systems:

Components:

• Fuel Tank

• Lift Pump (low pressure)

• Injection Pump (high pressure)

• Injectors
Yanmar Mechanical F.I.
Westerbeke Mechanical F.I.
Lift Pump:

- Low pressure pump

- Moves fuel from tank thru primary and secondary filters to injection pump.

- Mechanical (located on engine) or electrical.
Injection Pump:

- High pressure pump (increases fuel pressure)
  - Meters amount of fuel
- Determines “timing” of fuel delivery to individual injectors.
- Delivers fuel to individual injectors via individual injection (delivery) lines or rails.
- Individual fuel rails must be the same length.
Injectors

- Mechanical valves that open under pressure of fuel.
  - Atomize and spray fuel directly into combustion chamber.
  - Built to very close tolerances (.0002“)
Yanmar Fuel Pumps
Westerbeke Injection Pump
Westerbeke Injector
Westerbeke: Return Lines and Glow Plug
Westerbeke: F.I. System Parts
F.I. HP Pump and Camshaft
F.I. HP Pump Bottom
F.I.: HP Pump Rack
Mechanical Fuel Injector
Mechanical F.I. Nozzle
Common Rail Diesels (CRD)

• The injection pump is replaced with a high pressure pump that supplies a single (common) high pressure fuel manifold (rail) that feeds individual solenoid valves (injectors).

• Timing is determined by the computer controlled injectors, not by the high pressure pump.

• Rail pressures from 14,500 psi (early systems) to 26,000+ psi (current systems).
Common Rail Diesels (CRD) cont’d.

- Multiple injection events during a single power stroke.
- Modern CRDs were developed and introduced during the 1990s.
- Computer control (Electronic Control Module, ECM or Electronic Control Unit, ECU) of the injectors is a fundamental element of current CRDs.
CRD Advantages

• Higher pressures result in better (finer) fuel atomization and more efficient and complete combustion.

• Computer control of individual injectors provides improved timing, reducing exhaust emissions and increasing efficiency.
Common Rail F.I. System
Bosch Common Rail Injector
Diesel Filtration

CLEAN and DRY!

The extremely close tolerances of fuel injection systems make it critical that the fuel used in the engine is clean and dry!
Diesel Filtration

Primary Fuel Filters

• Primary fuel filters are typically located between the tank and the fuel lift pump. (Not on the engine.)
• Primary filters remove larger contaminants. (Typically 10-30 microns)
• Fuel-Water Separators (Raycor and similar)
Raycor Profile
Raycor ¾ View
Raycor Disassembled
Raycor “Spinner”
Dual Raycors with Pressure Gauge
Diesel Filtration

Secondary Fuel Filters

- Secondary fuel filters are typically located on the engine and provided by the engine supplier.
- They are always located before the high pressure injection pump.
- Secondary filters typically have a filter element in the 2 micron range.
Secondary Fuel Filter
Raycor Assembly