14 Water / Waste (ATA 38)

14.1 Definition

Those fixed units and components which store and deliver for use, fresh water, and those fixed components which store and furnish a means of removal of water and waste. Includes wash basins, toilet assemblies, tanks, valves, etc. (**ATA 100**)

14.2 System Classification

The water / waste system may be divided into three subsystems:

1. The *potable water system* is used to store and deliver fresh drinking water.
2. The *wastewater drain system* disposes the wastewater from lavatory washbasins and galley sinks.
3. The *toilet system* gives sanitary facilities to passengers and crew.

14.3 Potable Water Systems

The potable water system delivers drinking water

- to faucets and coffee makers in the *galleys*
- to faucets and (in some cases) toilet bowls in the *lavatories*.

The water is stored in *tanks* made from composite material. *Sensors* on the tank measure the water quantity. The distribution system delivers the water through *lines* to the consumers. In critical areas, lines and valves are protected against freezing by *insulation* material and electrical *heating elements.* Nevertheless, water must be drained from the potable water system, if the aircraft is parked overnight at temperatures below freezing.

If water left the tank just by *gravity*, the exit pressure would be very low. For this reason, gravity dispensing is applied only on small aircraft. On most aircraft, **potable water tanks** located below the cabin floor **are pressurized** with air. The pressurized air exerts a pressure on the water surface in the tank and thus enables water distribution at a higher pressure. The tanks may be pressurized with bleed air from the *engines* or the *APU*. Alternatively, air could be pressurized with a dedicated *compressor*. On the ground it is also possible to pressurize the tanks from an *external pressure source*.

In-service measurements have shown an average **water consumption** of about 0.2 l per passenger (pax) per hour in aircraft with a vacuum toilet system. This amount is made up of:

- 0.11 l/pax/h consumed in the wash basin
- 0.07 l/pax/h used for toilet rinsing
- 0.02 l/pax/h consumed in the galley.

14.4 Wastewater Systems

The wastewater system disposes the wastewater from lavatory washbasins and galley sinks. Commonly, wastewater is drained overboard through *drain valves* via *drain lines* to *drain masts* on the lower side of the fuselage. The drain masts are electrically heated to prevent water from freezing on exit. The drain valve in the drain line prevents leakage of cabin air through the drain line. Note: toilet waste is never drained overboard.

Principally, the wastewater could also be disposed into the waste tanks together with toilet waste. This technique, however, would increase aircraft weight compared with draining the wastewater. The wastewater could also be reused on board for flushing of vacuum toilets. This would save potable water taken on board and would therefore reduce aircraft weight.

14.5 Toilet Systems

Two types of toilet systems are in use: the *chemical toilet system* and the *vacuum toilet system*.

Waste *tanks* of recirculating liquid **chemical toilet systems** are precharged with a dye-deodorant-disinfectant chemical flushing liquid. *Sensors* on the tank measure the waste quantity. A tank-mounted *motor/pump/filter assembly* develops pressure to flush the toilets. A flush signal is generated when the *flush control lever* on a toilet is pressed. This signal is electronically processed and opens the *flush valve.* Subsequently, pressurized and filtered flushing liquid rinses the *toilet bowl.* The waste and the flushing liquid enter the waste tank. The waste tanks are vented overboard.

Simpler chemical toilet systems are operated with a toilet-mounted foot pedal that is connected to a mechanical pump.

The **vacuum toilet system** (Figure 14.2) is described in the Airbus example.

14.6 Example: Airbus A321

The **potable water system** supplies water from a water tank (200 l) through a distribution system. Potable water is supplied to water faucets in the galleys and lavatories. The system also supplies potable water to the water heaters, which are located below the lavatory washbasins, and to the toilet bowls for rinsing. Water lines in cold areas of the aircraft are insulated and heated to avoid freezing. Air pressure is used to pressurize the potable water system. The air is supplied from the bleed air system or the ground pressure connection.

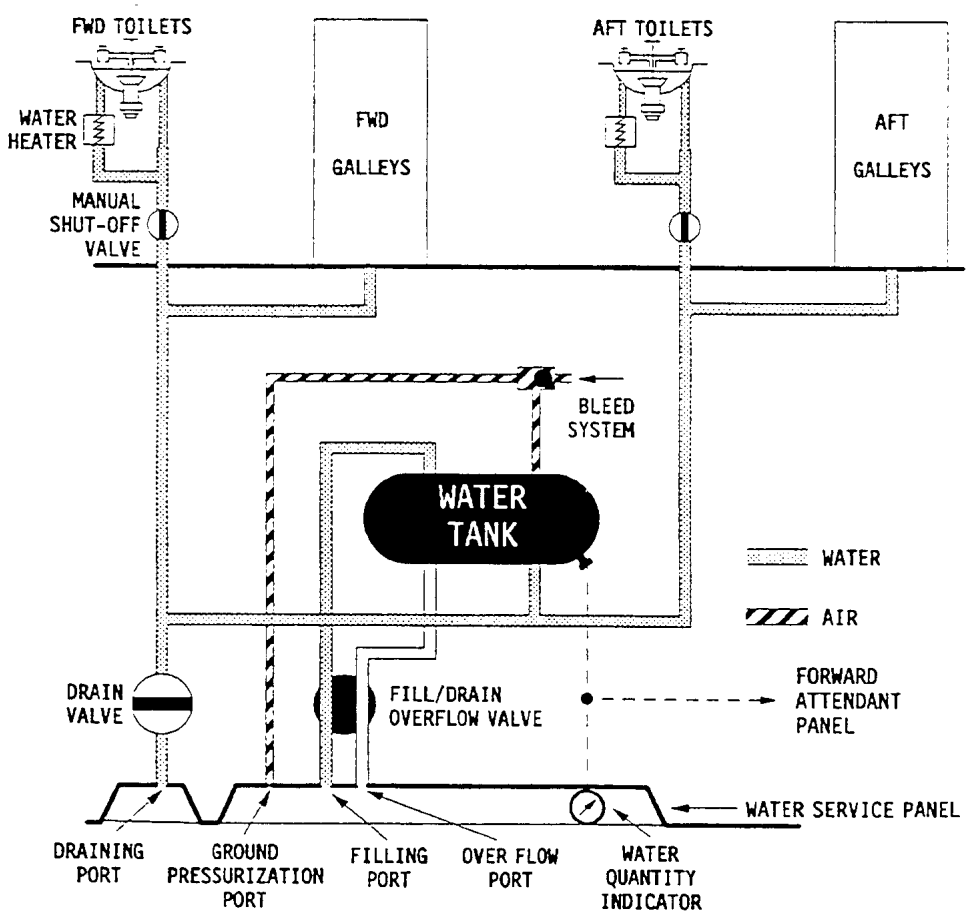

Figure 14.1 A321 potable water system

The A321 is equipped with a **vacuum toilet system**. It removes waste from the toilet bowls through a vacuum drain to an under floor waste *tank* (170 l). Toilet wastes are flushed to the waste storage tank under the effect of differential pressure between the cabin and the waste tank. On ground and at low altitudes (below 16000 ft) a *vacuum generator* produces the necessary differential pressure. At high altitudes (above 16000 ft), ambient pressure alone ensures the differential pressure. A *vacuum system controller* (VSC) controls the operation of the vacuum generator. The system uses water from the aircraft potable water system to flush the toilet. A *flush control unit* (FCU) in each toilet controls the flush process. During ground

service, the waste holding tank is emptied, cleaned, and filled with a prescribed quantity of sanitary fluid.

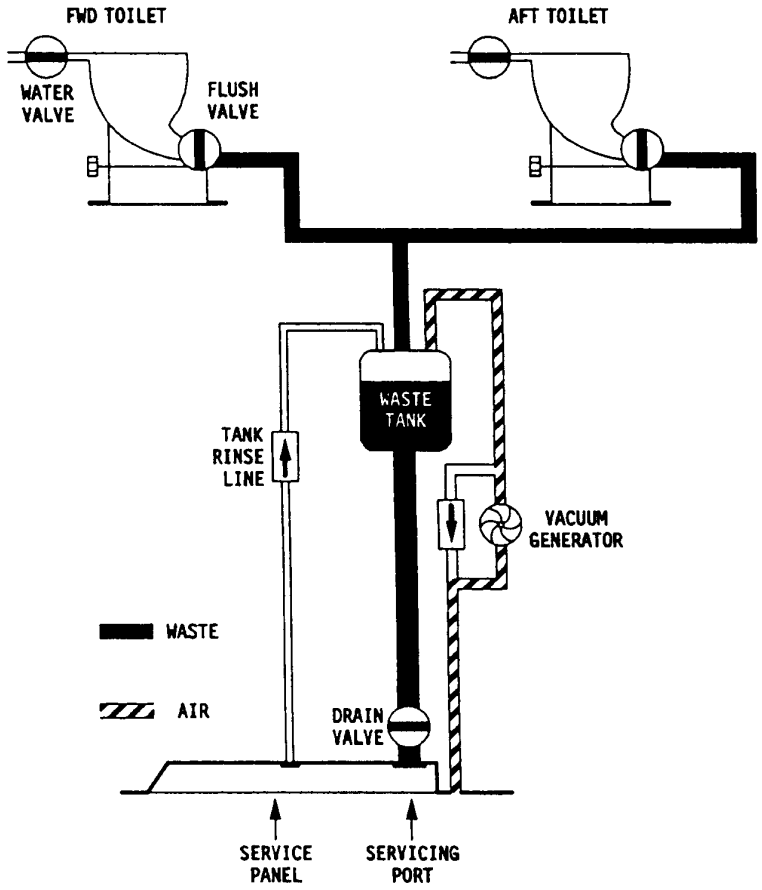

Figure 14.2 A321 vacuum toilet system